Color iQC and Color iMatch
Software Installation Guide

Version 8.0 | July 2012

Installation on Windows XP SP3:

1. Login with full local administrator permissions.
2. Insert the CD and it should Auto Run or use Windows Explorer and double click the installation EXE file. (see installation steps below)
3. Once installation is completed and while still logged in as administrator start the software. The software will run for up to 30 days in demo mode until fully licensed. While in demo mode you must always log into the computer with full local administrator permissions. If you run the software without administrator permissions it the demo mode will expire.
4. Each time you start the software in demo mode the licenses dialog will appear. At the top it will indicate how many days are left in the demo period. In the middle is a link to the website to register and receive your license key. At the bottom of the license dialog will be a registration code and a place for the license key. If you do not have internet access on the installed computer you may go to http://www.xrite.com/registration.aspx from any computer. Make note of the registration code in the software. If the registration code is zero or blank you do not have full administrator permissions or did not choose “Run as administrator”.
5. You can license the software or click Continue to continue on in demo mode. The software will automatically guide you through setting up the instrument and your default settings.

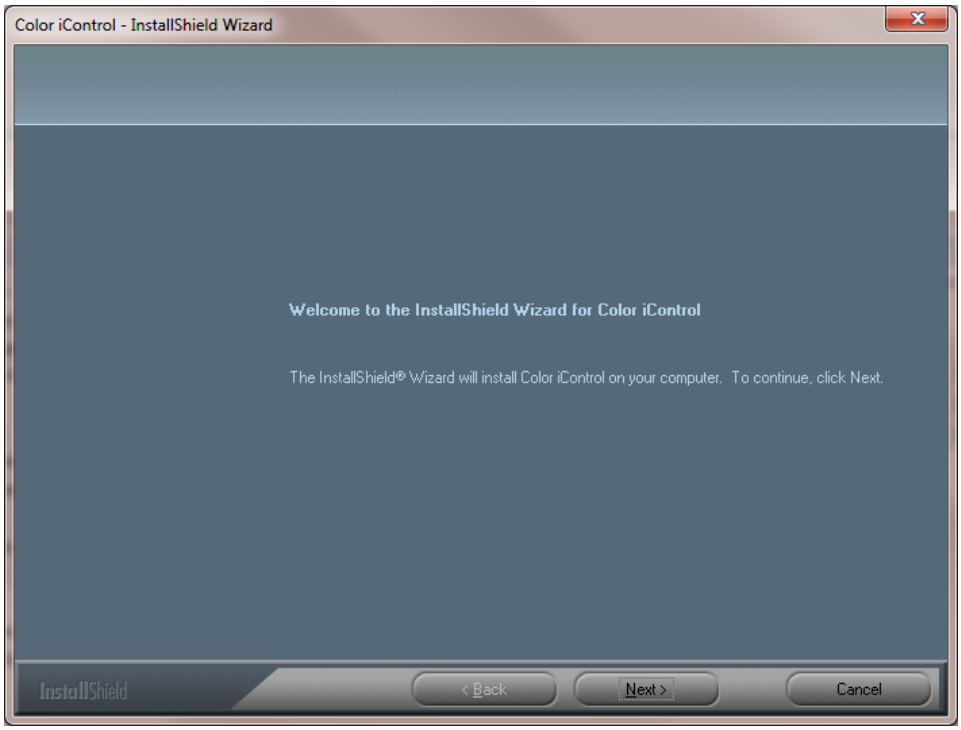
6. Each time you start Color iQC or Color iMatch the license page will appear until fully licensed. Click Continue if you do not have the permanent license key yet.
7. Once registered and you receive your license key, enter it in the box provided and click the License button. You will get a message that your product is now licensed.
8. Once fully licensed you will no longer have the license dialog box show up when you start the software and may log into the computer with normal user permissions.

Installation on Windows 7 (32 or 64 bit):

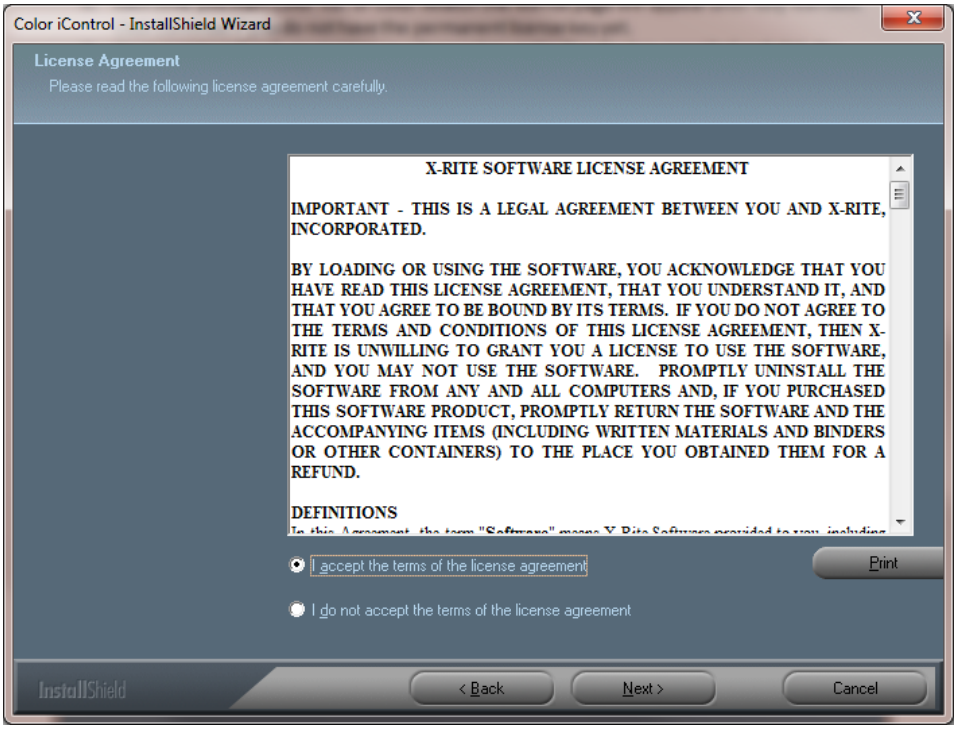
1. Login with full local administrator permissions.
2. Insert the CD and it should Auto Run or use Windows Explorer and double click the installation EXE file. (see installation steps below)
3. Once installation is completed and while still logged in as administrator, right click on the Color iControl desktop icon and choose "Run as administrator". The software will run for up to 30 days in demo mode until fully licensed. While in demo mode you must always log into the computer with full local administrator permissions and "Run as administrator". If you run the software without administrator permissions and "Run as administrator" the demo mode will expire.
4. In demo mode each time you start the software you will have the license dialog appear. At the top it will show the number of days left in the demo period. In the middle is a link to the website to register and receive your license key. At the bottom of the license dialog will be a registration code and a place for the license key. If you do not have internet access on the installed computer you may go to http://www.xrite.com/registration.aspx from any computer. Make note of the registration code in the software. If the registration code is zero or blank you do not have full administrator permissions or did not "Run as administrator.
5. You can license the software or click Continue button to continue on in demo mode. The software will automatically guide you through setting up the instrument and your default settings.
6. Each time you start Color iQC or Color iMatch the license page will appear until fully licensed. Click Continue if you do not have the permanent license key yet.
7. Once registered and you receive your license key, enter it in the box provided and click the License button. You will get a message that your product is now licensed.
8. Once fully licensed you will no longer have the license dialog box show up when you start the software and may log into the computer with normal user permissions and do not need to "Run as administrator".

Color iQC and Color iMatch Installation Screens:

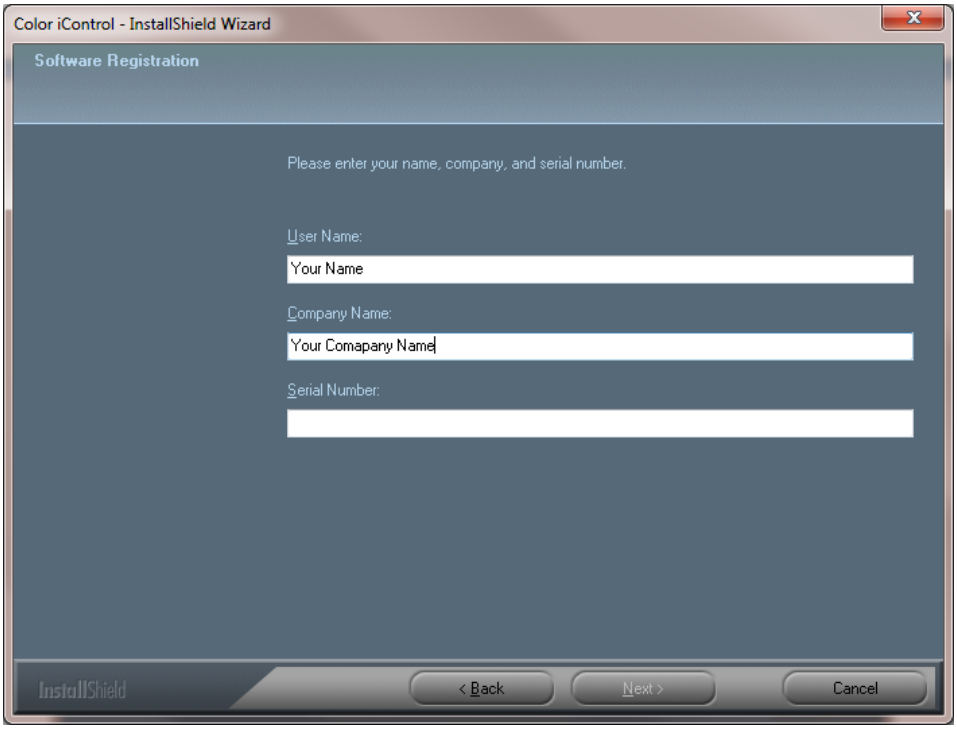
1. Run the installation executable described in step 2 above. Click **Next** to continue:



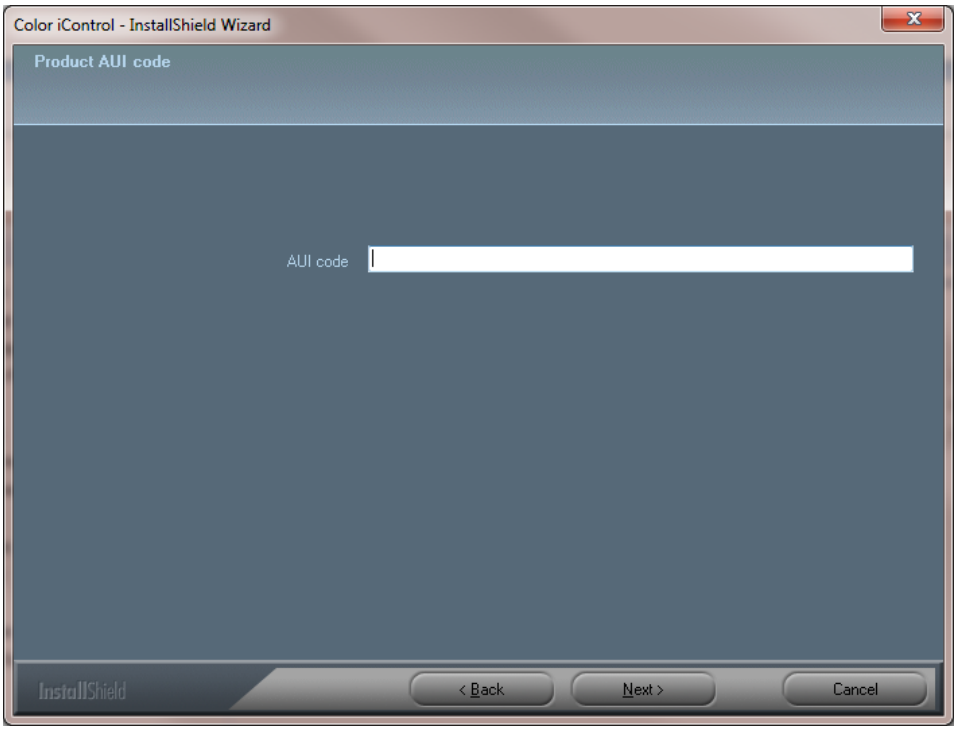
2. Select I accept on the license agreement and click **Next** to continue:



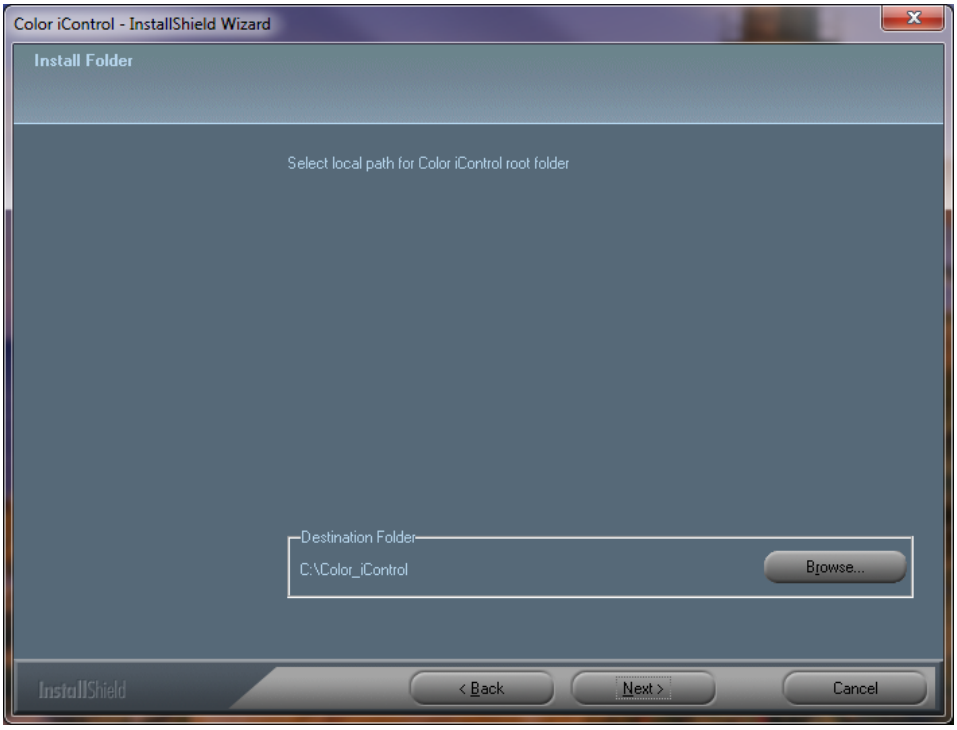
3. Enter in your User name, company name and software serial number from label on the CD case. Click Next to continue:



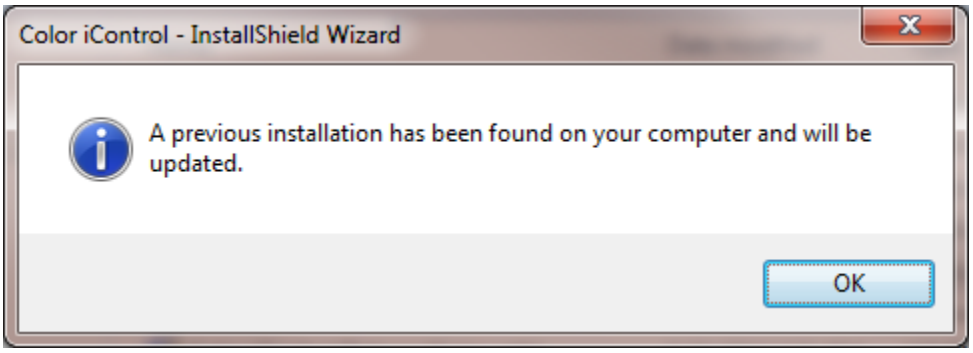
4. Enter your software AUI (Application Unique Identifier) number from the label on the CD case. Click **Next** to continue:



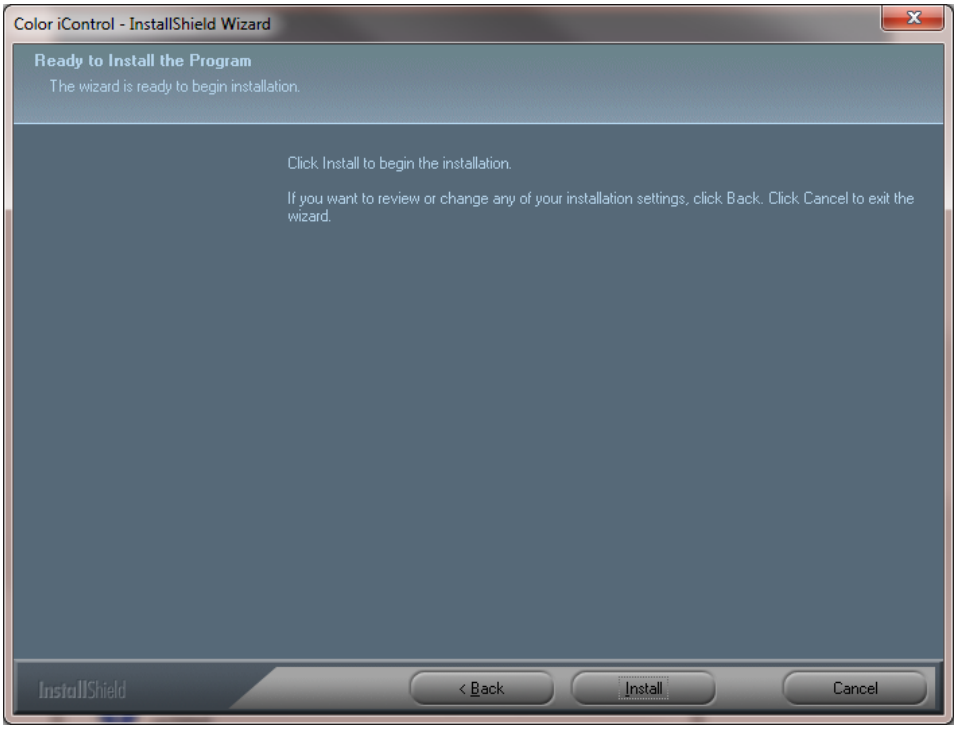
5. If this is a new installation you will be prompted to select a location for the software user data file folders to be located at. The program files will be installed in the C:\Program Files\GretagMacbeth\ or C:\Program Files(x86)\GretagMacbeth\ folders. For more information on user data files please see *Color iControl Folders and Files* document under Color iMatch and Color iQC common helpdesk Questions on www.XRite.com.



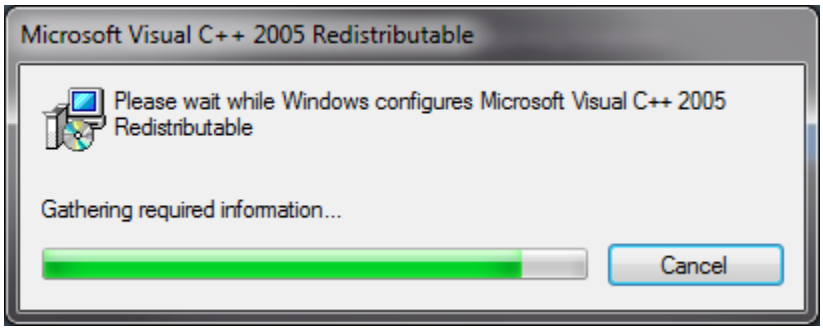
6. If this is an update the software will install to the same folders and upgrade your current version:



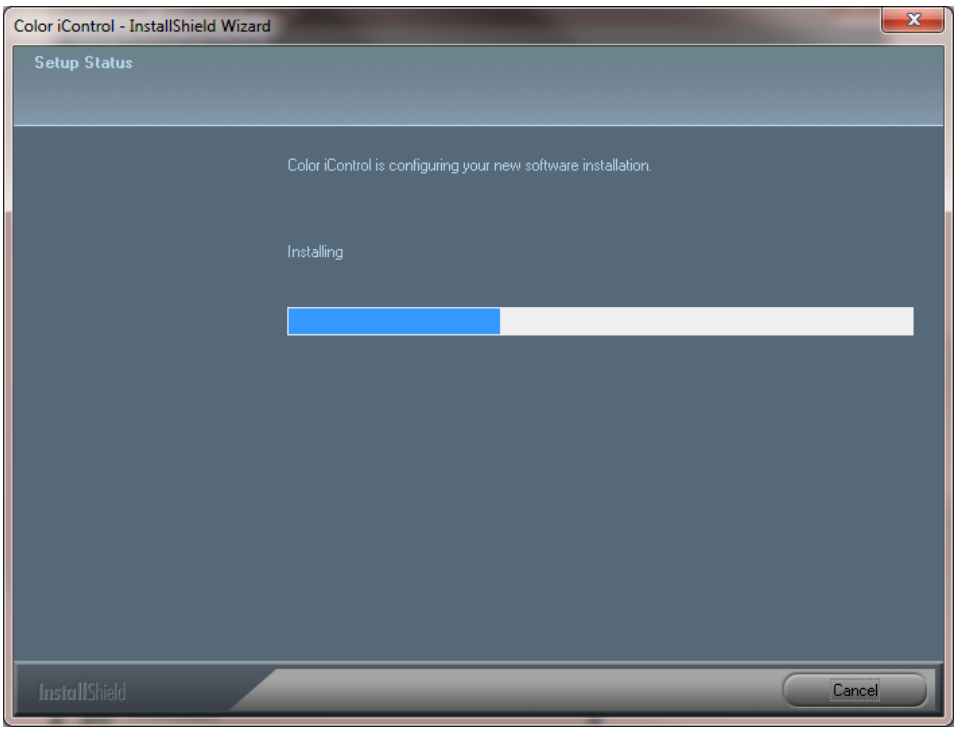
7. Click Install to begin software installation:



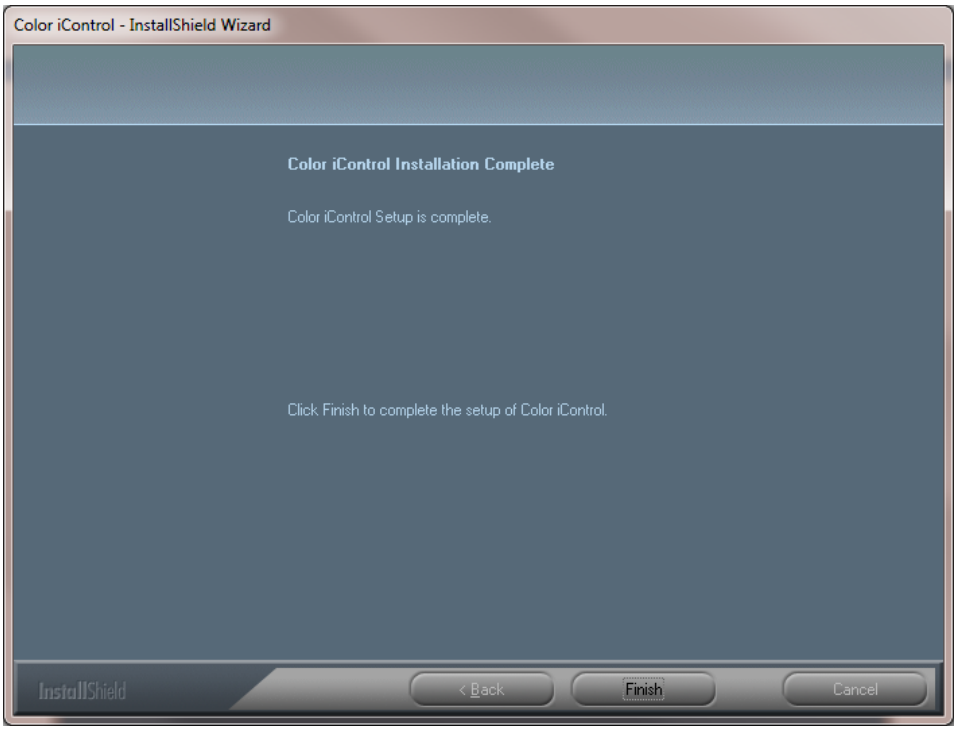
8. Two boxes will appear automatically during software installation. One is the Visual C++ 2005.



9. The other is Setup Status. This will show you the status of the software installation.



10. Once the installation is completed click the Finish button:



Color iQC and Color iMatch
Getting Started and Spectrophotometer Setup Guide

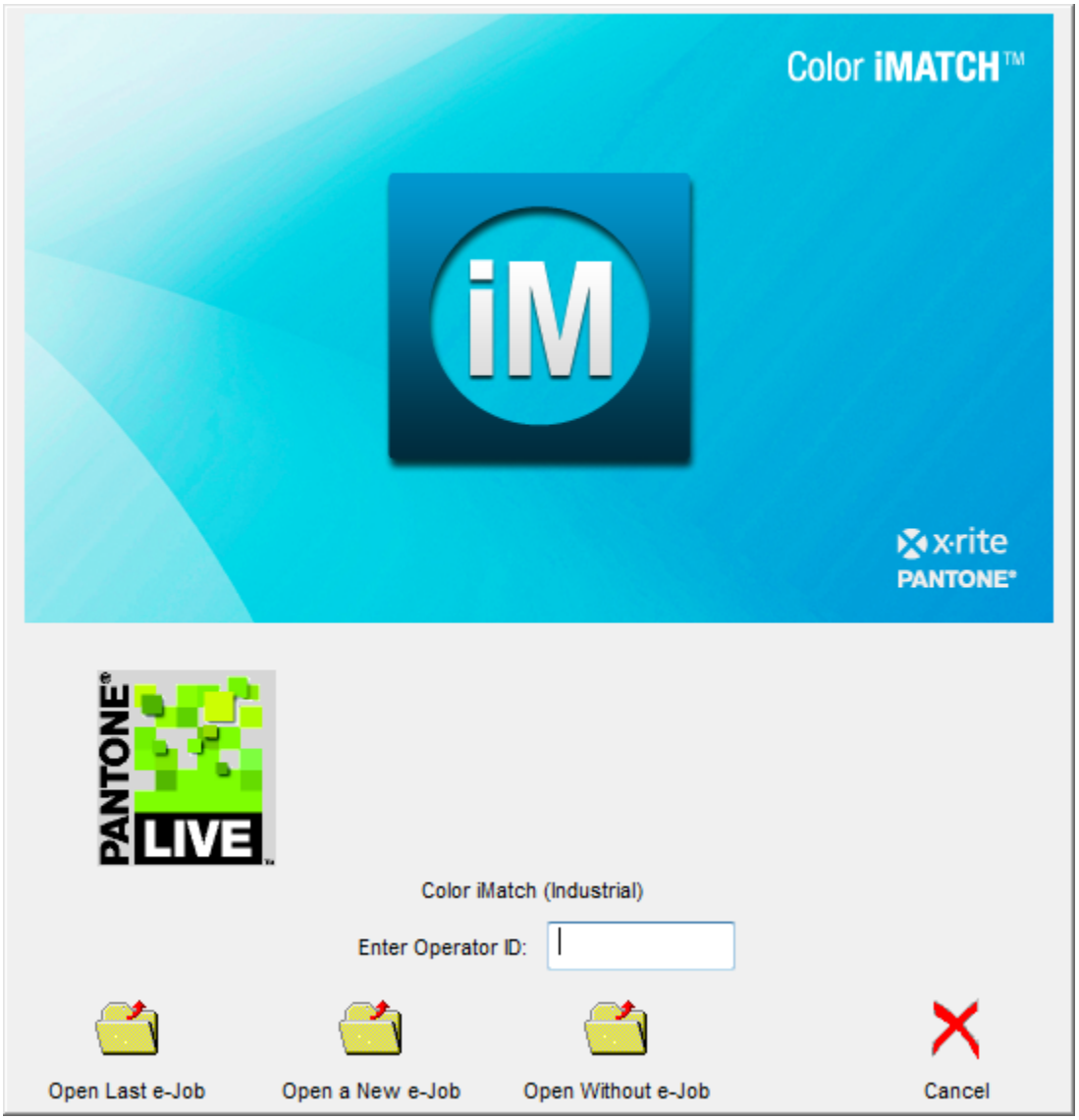
Version 8.0 | July 2012

Color iControl Getting Started

Once Color iControl is installed on your system, there are still a few preliminary actions you must perform prior to being able to run the software fully. Each of these is explained below.

Initial Logon for Color iControl

Double-click the program icon installed to your desktop. The opening splash screen and log-on screen will be displayed. The image displayed here will vary depending on your software configuration: Color iQC, Color iMatch, etc. Type your initials into the Operator ID field in the log-on screen and then click on one of the "Open" icons in the lower left. (Operator ID's are limited to six characters maximum.)



Installing an Instrument

Prior to beginning this operation, be sure that the spectrophotometer is connected to the computer via a communication port and that you know the ID for that port. In addition, check to make sure the instrument is plugged into the power outlet and powered up.

Once the instrument is physically connected to your computer, you must install it in terms of the software. To do this, follow the steps provided below:

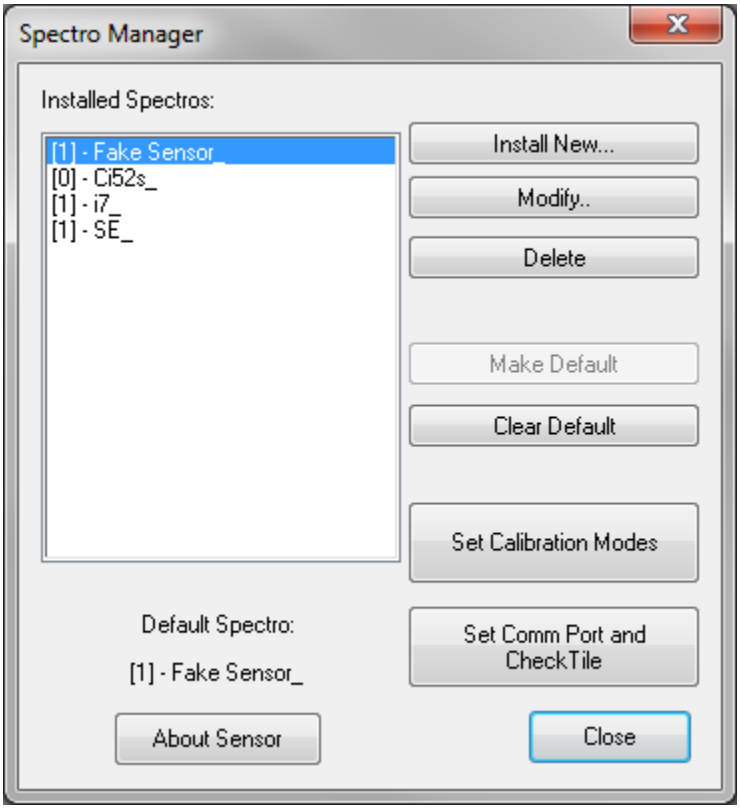


Figure 1 —Spectro Manager Dialog

1. From the main menu select “Spectro” then “Install or configure…”
2. A dialog box titled “Spectro Manager” (See Figure 1) will be displayed.
3. Click on the “Install New...” button. A second dialog titled “New Spectro” will appear with a list of available instruments for Color iControl (See Figure 2).

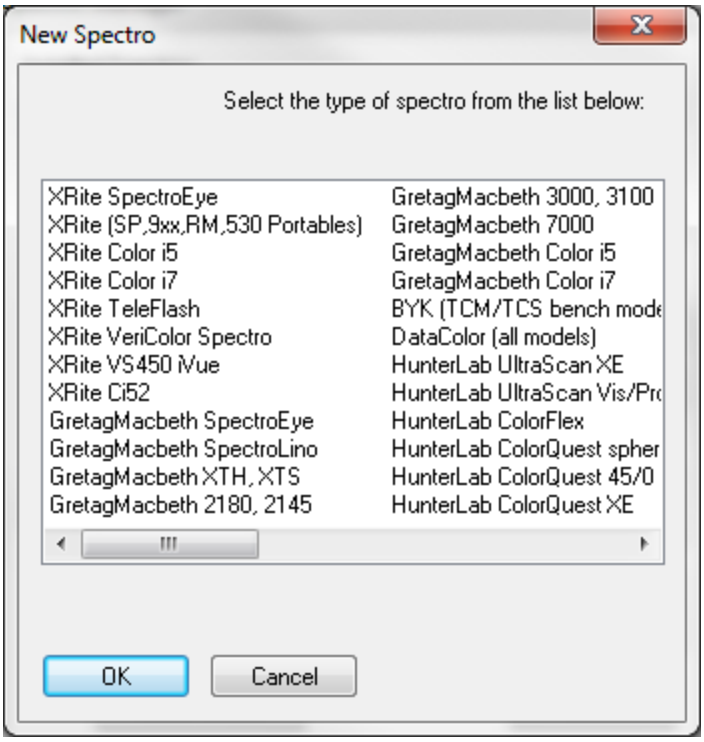


Figure 2 —New Spectro

4. Select the instrument you wish to install by clicking once on the instrument name (or manufacturer) and clicking "OK." (You may also at this point be asked for a calibration disk(s) that should have been provided with your instrument. If this is the case, follow the instructions that appear onscreen.)
5. The Spectrophotometer Installation Wizard dialog box will appear.
6. Depending on the type of sensor you are installing, the Choose Sensor Model dialog box may appear (See Figure 3). If it does, select your instrument's model type from the drop-down list and click <Next>.

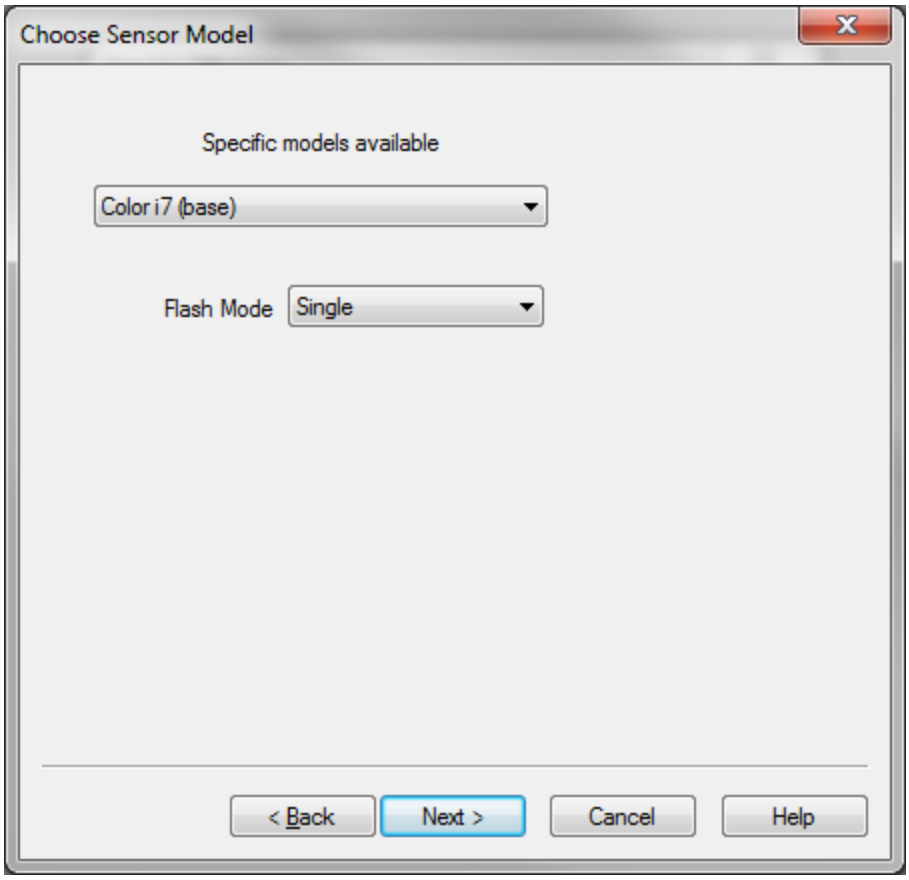


Figure 3 —Choose Sensor Model

7. On the next dialog (see Figure 4), enter the name of your spectrophotometer into the space provided. Depending on your instrument make and model, you may need to enter the serial number of your instrument and click <Next>.

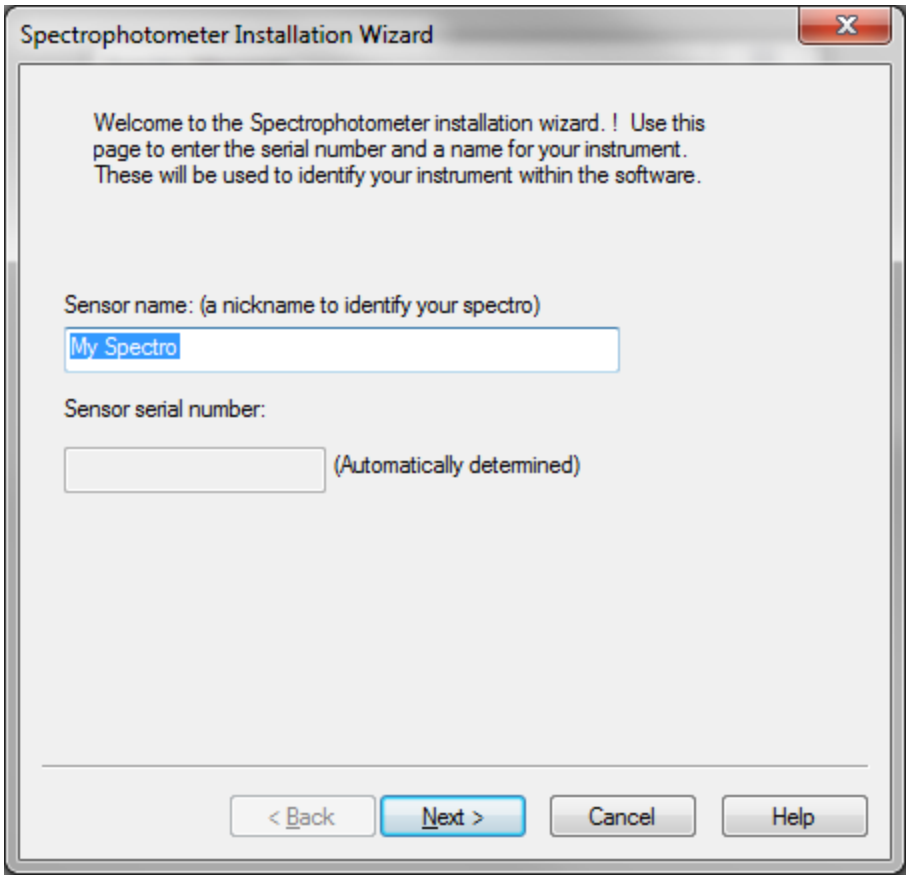


Figure 4 —Sensor Name

8. Again, depending on the type of sensor you are installing, the Instrument Wavelength Range dialog may appear at this point (also not pictured). This dialog allows you to select the default wavelength range for taking measurements.

9. A dialog box allowing you to select the communications port and the baud rate of the instrument will appear next (see Figure 5).

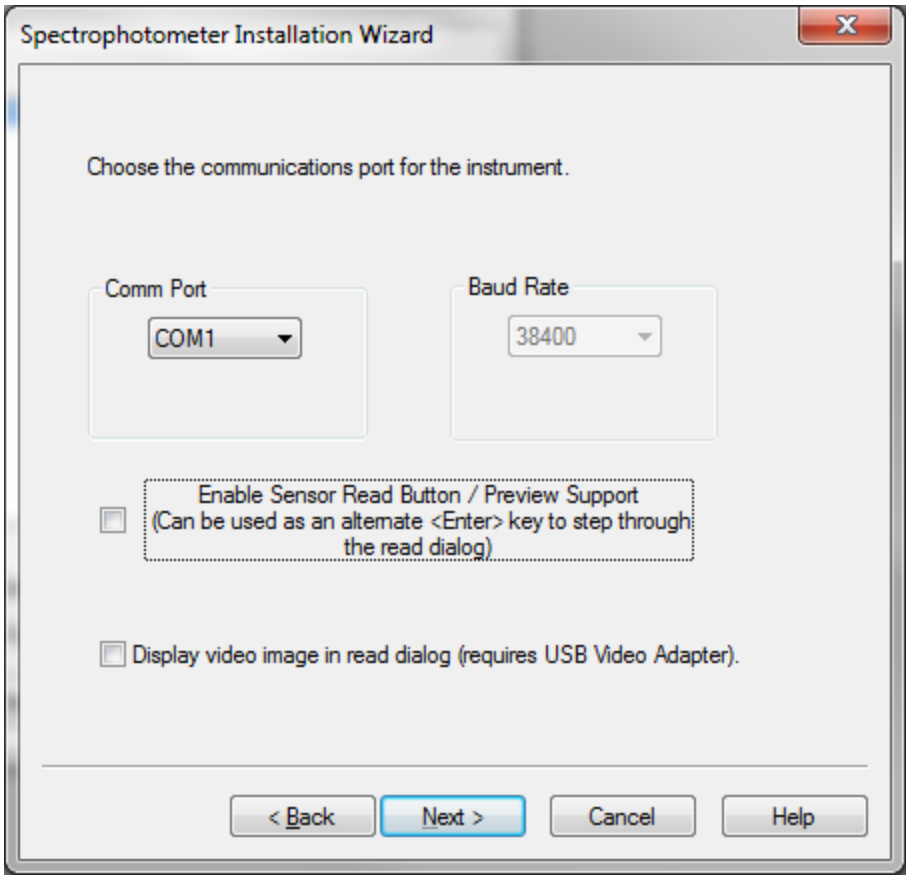


Figure 5 —Communication Port and Baud Rate

10. Click on the drop down to identify the communication port where you have the instrument connected. The default is to have your instrument connected to comm. port one. The baud rate should default to the correct setting. If your instrument is incapable of communicating at multiple baud rates, this section of the dialog will be unavailable. You may also enable the Read button on the sensor if you wish. Click <Next> once you have selected the comm. port and baud rate.

11. The next dialog (see Figure 6) will appear and prompt you to select a pre-defined calibration mode for your instrument. This dialog allows you to create an initial calibration mode for the instrument just installed. The mode contains such information as the size of the sample port, the type of illumination the instrument uses, whether or not you are taking reflectance or transmittance data, etc.

12. Click the <Finish> button to accept the current settings as the default initial mode.

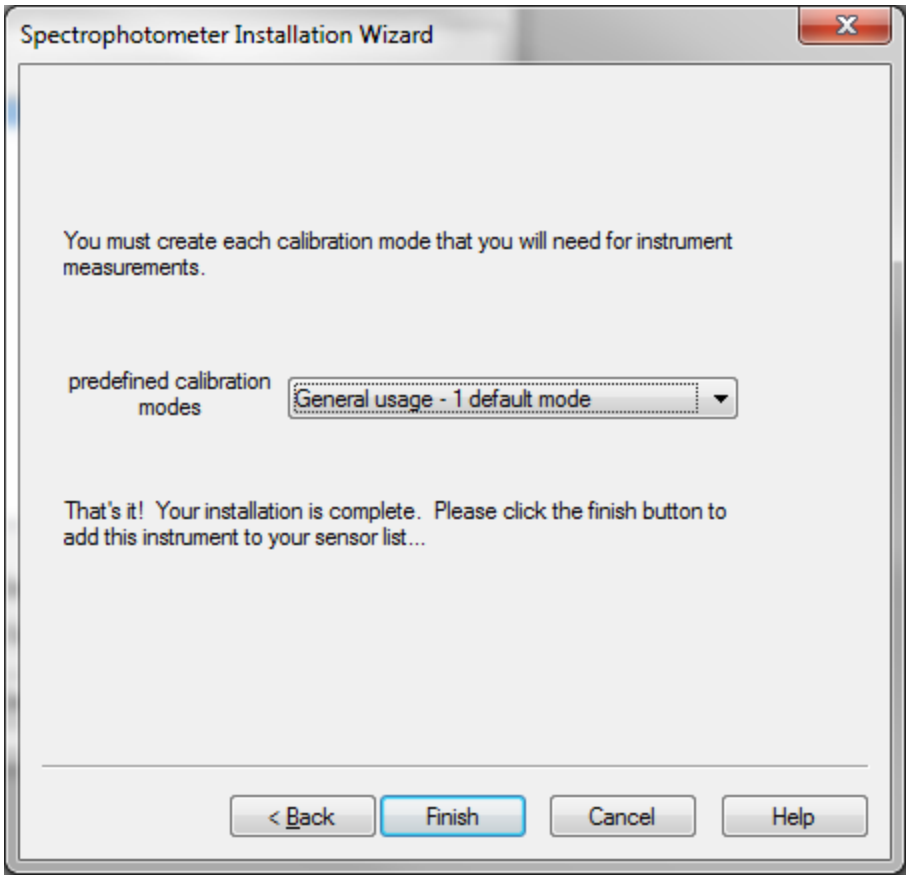


Figure 6 —Calibration Modes

13. Once you have closed the Calibration Mode, the Choose Calibration Mode dialog box will appear, allowing you to create more calibration modes for that instrument (see Figure 7). The default mode just defined should be listed as the only mode. You may define an entirely new mode by clicking on the "Define New" button. You should refer to the documentation provided with your instrument to determine what capabilities your sensor has and what variety of calibration modes you may want to define. (See Spectro under Menu Commands in the Help file for more information about setting the various sensor modes in Color iControl.)

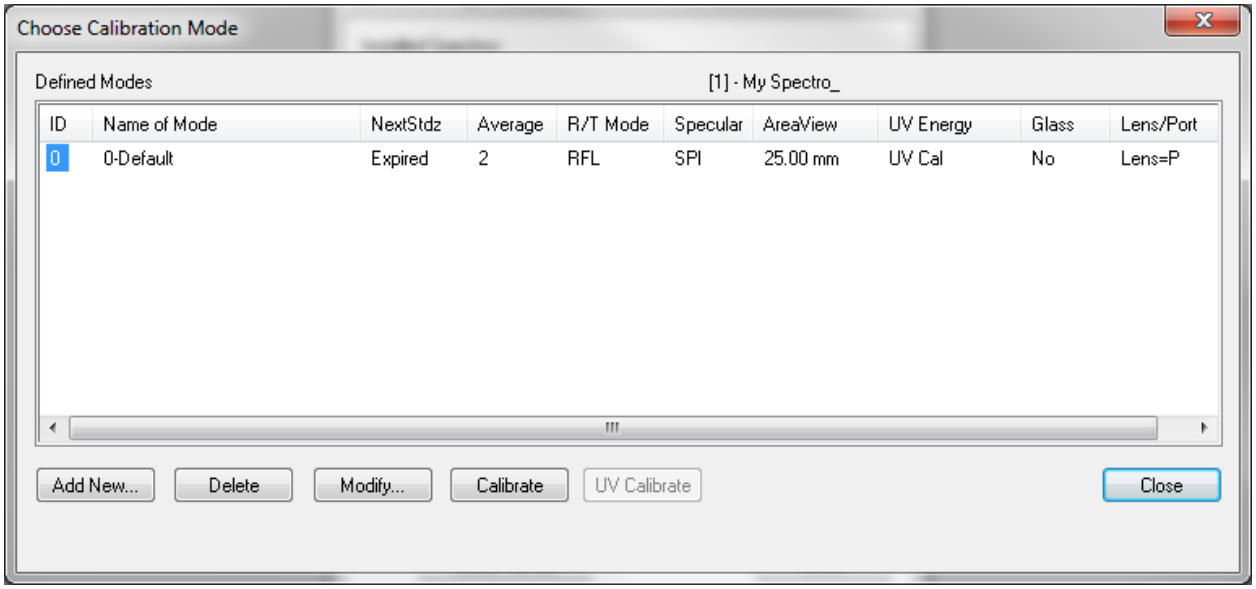


Figure 7 —Choose Calibration Modes

14. Once you have selected the sensor, its communication port, and the mode in which it will operate, all that remains to do is to calibrate the instrument. Do this by clicking on the "Calibrate" command under the "Spectro" menu and following the instructions on the screen. You must have a job opened in order for the "Calibrate" command to appear as one of the options under the Spectro menu. Calibration generally consists of taking readings of one or more tiles. These tiles should be supplied with your instrument; refer to your instrument's documentation for more information. The next section guides you through this process.

Calibrating the Sensor / Taking a Measurement

The next action to take is to calibrate the sensor and to take a measurement in order to be sure that the instrument installation has been successful. Obtain a standard and three trial samples prior to starting (we will use the trials in the Color iControl Tutorial which is included as a Adobe PDF file along with this document and the Installation instructions.)

Important Note: These instructions use the menu commands as the main method of accessing Color iControl's various functions. However, buttons on the toolbar as well as keyboard shortcuts exist for most of the commonly used menu commands, such as taking measurements and calibrating the spectrophotometer.

1. Click on the Spectro menu.

2. Click on "Calibrate"

3. Depending upon your instrument model, the system will prompt you to read the light trap/black tile. Place the light trap or black tile on the instrument port and click <OK>.

4. The system will prompt you to read the white tile. Place the white tile on the instrument port and click <OK>.

5. The system should report that the sensor has been successfully standardized.

6. Place the standard you obtained on the sensor port.

7. Open a new job. [By selecting "New e-Job" from the "e-Job" menu item on the main system menu.]

8. Click on Data menu.

9. Click on "Measure with Spectro..." A sub-menu will appear. Click on "Measure Standard."

10. A dialog box will appear allowing you to name the standard. Enter a name and click <Next>. Instructions for continuing will be displayed under the field where you entered the name. Follow those instructions until the system prompts you to enter another name for a measurement.

11. The Standard should appear as the first item in the Tree View at the upper left of the open job.

12. Click on e-Job menu item.

13. Click on “Close Current Job” from the drop down menu. A standard Windows “Save As...” dialog box will open.

14. Enter a name and click <OK>. The system will automatically append the extension to the job when it is saved.

15. Click on e-Job menu item

16. Click on “Exit” from the drop down menu. The program should close.

17. The sensor is now installed and correctly functioning.

Editing the Default Job Settings File

Once the instrument has been configured, you should edit the default settings file. Color iControl originally ships with two default settings files, one for screen resolution set at 800x600 and one for screen resolution set at 1024x768. One of these settings files will be the basis for any job opened in Color iControl without specifying an alternative (i.e., another settings file or template). Which one gets used depends on the resolution of your monitor. This will be true even if you select to store your settings in the job and not in a settings file, because even if you select to store the settings in each individual job, the program has to have some settings to include when each job is initially created. Editing the default job settings file is described below.

Editing the Default Settings File

1. To edit the default settings, first click once on "Edit Default Job Settings" under the File menu. (This option will only appear when there are no open jobs. If a blank job appeared when you started running the program, you must close it before you can use this option. Use the "Close Current Job" command under the e-Job menu or click once on the Windows close button in the upper right corner of the job window.)

2. A job window will open with the title "_800.st3" or "_1024.st3," depending on your monitor's resolution. Click once on the "Settings" option under the Application menu.

3. The Settings dialog box will appear. Click on the General tab. (For now, we will only set up the most basic settings needed. You may need to edit this file again once your familiarity with the software has increased.)

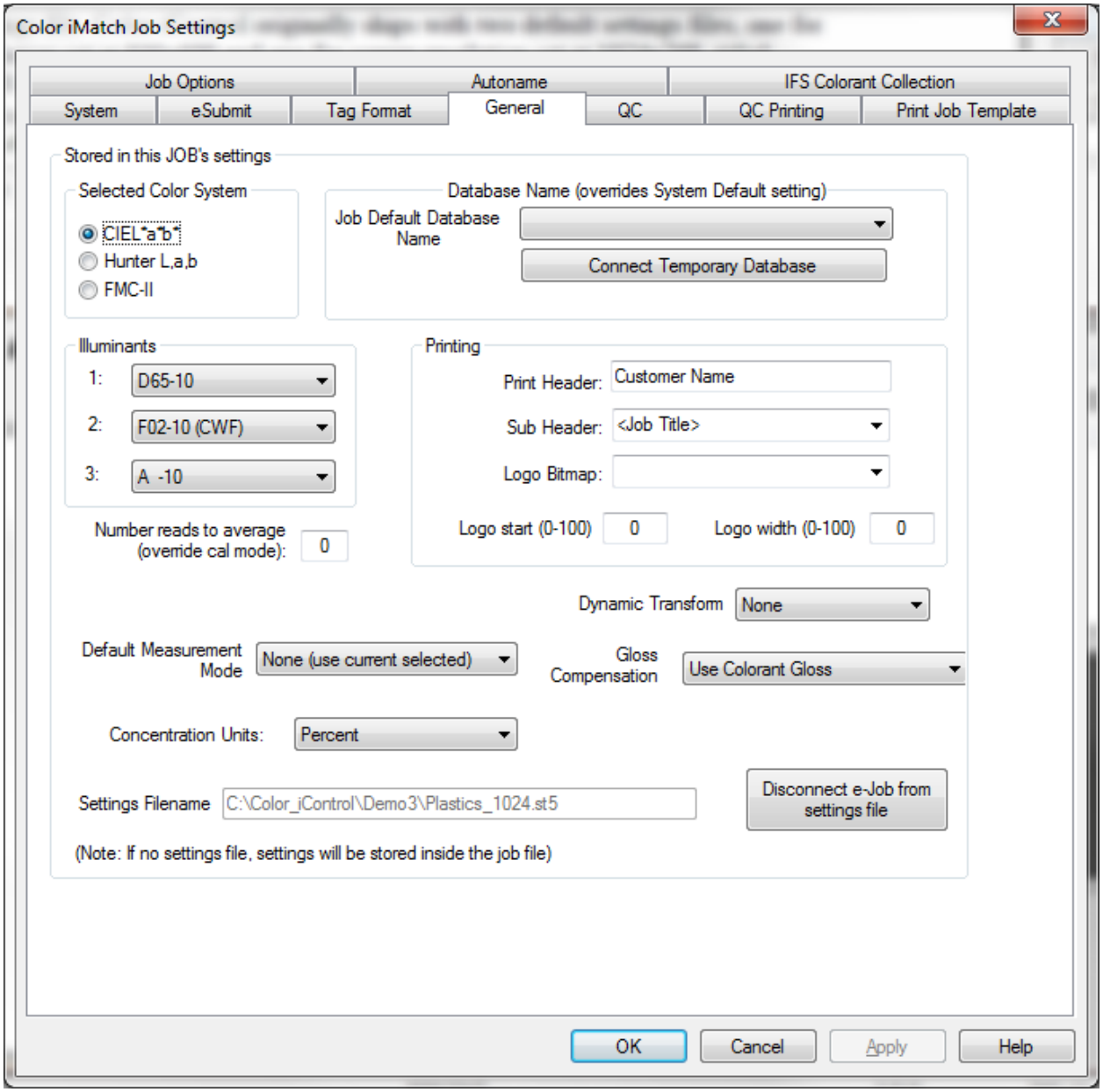


Figure 8 —Settings | General Tab

4. At the top left of the dialog are three radio buttons for selecting the desired color space. The options are: CIEL*a*b*, Hunter, or FMCII. The system will default to CIEL*a*b*. Select an option or leave the system set to CIEL*a*b*.

5. In the center left of the dialog are three drop-down lists allowing you to select the primary, secondary, and tertiary illuminants for the system. The defaults are: D6510, F02-10, and A-10. The appended 10 on the end of the illuminant means that it is using the ten-degree observer. Two-degree observer illuminants are available and designated with a “-02". Select your illuminants from the drop-down lists.

6. Once you have selected these settings, click on the "Close Current Job" command under the Job menu. The default settings you selected will be stored into the file. These settings will be in place for every new job you open without specifying a template. Of course, there are many other settings, both in the General tab and in the Quality Control tab. Once you gain more familiarity with the software, you may want to return to re-edit the settings stored in the default settings file.

Color iQC and Color iMatch
Distinguishing Concepts Guide

Version 8.0 | July 2012

1. **Document ["Job"] Based Architecture [similar to Word]**
   Jobs are containers that contain all the items a user needs to perform a specific job or function. Sending the document to another user on a different system allows communication, since all the contents, including the settings used, the views, the layouts, and the data are preserved in the job exactly they way they were on the sending system. Easy to model the user's actual workflow in a production operation, since this type of work normally involves files and folders that contain specific objects they are working on [for example – the standard , the tolerances required, and all sample measurements to date for a lot running on a specific dye machine].

2. **Multiple Database Storage/Retrieval**
   Important information that is likely to be required in multiple jobs, or needs to be preserved for safekeeping, or organized for retrieval at a later date can be stored and retrieved from whichever database is appropriate. Both Access and SQL Server databases are supported, and users can connect different jobs to different databases as required.

3. **Multi-user, Networkable, Terminal Server Aware, Network Licensing, Security**
   Most systems today must operate within a network [both LAN and WAN] of users. Information needs to be shared and distributed while maintaining control of the data and user rights. Color iQC/iMatch contains an account management system that allows supervisory control over user rights and permissions, allows supervisors to hide

controls and functions for specific users, and manages access to a global SQL Server database with Regional / Local group read and modify access.

4. **Measurement**
   A measurement is a "container" that has multiple spectral data, user defined tags, security settings, measurement properties, procedures, and colorimetric data. Extended data [such as OL/OD, R/T, or Haze data] are all treated as a single "measurement". Trials can be "associated" with a specific standard [by its UUID].

5. **Unique GUID**
   Every measurement, colorant, and collection in Color iQC/iMatch is created with a unique GUID that identifies that specific object for its entire life. This allows Jobs to be circulated around the world and specific items to be "recognized" by the system as they come back. Attempting to add a "new" item to the database which is actually a "renamed" copy of the original will flag the attempt and either "update" the item in the database or create a new object with a new GUID. Each measurement contains a "signature" that validates the instrument conditions used to measure it, the type of instrument, the procedures used, and any NetProfiling and/or model transforms applied to the data.

6. **Templates and Settings Files**
   Jobs and their contents, settings, and layouts can be derived from templates and settings files, allowing a customer to create many tailored "job types" that are preset for particular functions they routinely do. A requirement to change a tolerance for a specific customer only requires changing it in a settings file, and all relevant jobs derive that new setting.

7. **Connected Views**
   All views are connected within a document, so actions taken in one view cause updates in all other views. Views inherit their settings from the job settings. If a user needs to select specific items by using a color space plot, while other users prefer to use a list view, and some want to use a combination – then each can operate in their most efficient manner. Having all views connected enhances the understanding of what the "job contents" are since graphic views and data views and job contents views are all displaying the same connected information – just from different aspects.

8. **Multiple samples compared to a standard**
   Color iQC/iMatch views and reports are tailored to be able to display large numbers of samples compared to a standard, can automatically adjust views to show the appropriate samples with the current standard, but allow the user to quickly show alternate selections of any samples compared to any other measurement as a standard. The user is not "locked into" any specific relationship of samples to a specific standard.

9. **Tolerances**
   The most difficult part of a QC system is establishing and controlling what the "tolerance" for color variation is and what it means. Graphics must be used in a way that enhances a users "impression" of the relationship of a sample to a standard, and

of many samples to each other through the use of meaningful tolerances. Tolerances in Color iQC/iMatch can be automatically generated using the CMC equation, specified by the user on a specific standard, specified for a particular job, or specified for the entire system. In Color iQC/iMatch, the source of the tolerance is a hierarchy [that can be specified by the user], that allows a cascade of the tolerance source … if the tolerance is not specified in the current standard, it is derived from the job, if not in the job, then from the default system settings, if not in the default settings, it will be calculated automatically. Color iQC/iMatch also contains methods of generating tolerances based on historical information, and can generate tolerances based on statistical control limits. Tolerances are always generated for L, a, b, c, and h information – not just L, a, b or L, c, and h. LCH is **not** a separate color space from LAB – users should be free to mix or combine color differencing within CIELab color space in whichever metric color difference descriptor is most effective – so displaying dL, da, db, dC, and dH values and tolerances at the same time is possible and often done.

10. **Import/Export**
    Color iQC/iMatch can import and export a wide range of competitive file formats [EXP, QTX, MIF, SMP, XML, CxF, PAL, TXT, DAT, MDB…]. In most cases these files can be important as a "native" format by simply double clicking on the file and launching Color iQC/iMatch … the user doesn't have to know that the file type is a foreign file type. Communications between many types of color systems is becoming mandatory in the business world. This feature has been instrumental in capturing DataColor customers – since we can click on an email attachment with a QTX file and run it directly within Color iQC/iMatch.

11. **Remote Output**
    Integrating information from a QC Color system into manufacturing systems often involves IT Support and special software modifications. Color iQC/iMatch contains a remote output feature that allows the user to tailor and format an output stream of any information in Color iQC/iMatch and direct it to serial ports or network file locations. This information can be sent automatically as a sample is measured, making it ideal for automatic integration into manufacturing systems. Remote Output feature is also used for output of formulas to dispensers, allowing customers to create specific output streams for whatever dispenser they have – including the ability to export all formulas to a "text file" for import into mainframe databases.

12. **Drag and Drop / Cut and Paste / Multiple documents**
    Users can display multiple jobs within the Color iQC/iMatch frame, and drag and drop contents between the jobs to help analyze data. Users can cut and paste information or entire measurements into an Excel spreadsheet, then paste from a spreadsheet back into Color iQC/iMatch to create new measurements.

13. **Printed reports**
    Users can easily format a printed report style from existing views and create a report style that looks good without having to be a designer, or without simply printing out multiple views one at a time.

Color iQC and Color iMatch
Settings and Templates Guide

Version 8.0 | July 2012

Jobs and their contents, settings, and layouts can be derived from templates and settings files, allowing a customer to create many tailored "job types" that are preset for particular functions they routinely do.

Understanding Jobs, Settings Files, and Templates

A job in Color iQC and Color iMatch is basically a file or document. Multiple jobs can be opened at the same time and managed through the software. Jobs can be stand-alone with their settings self-contained or they can store their settings in a file that they point to and can share with other jobs. Jobs can also be created using templates.

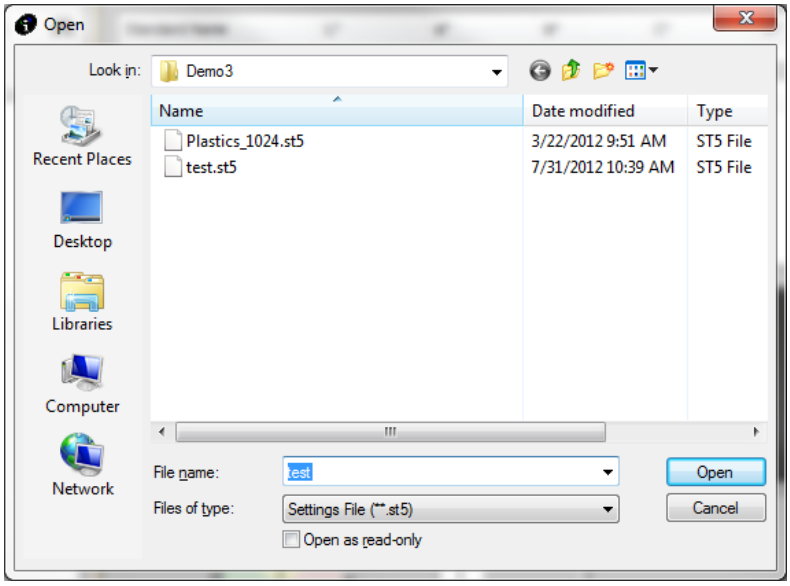
Creating a New Settings File

1. To create new "settings files," open a new, blank job by clicking once on the "New Job" command under the e-Job / File menu. *The File menu will appear when no jobs are open; the e-Job menu will be available when there is at least one job open.*

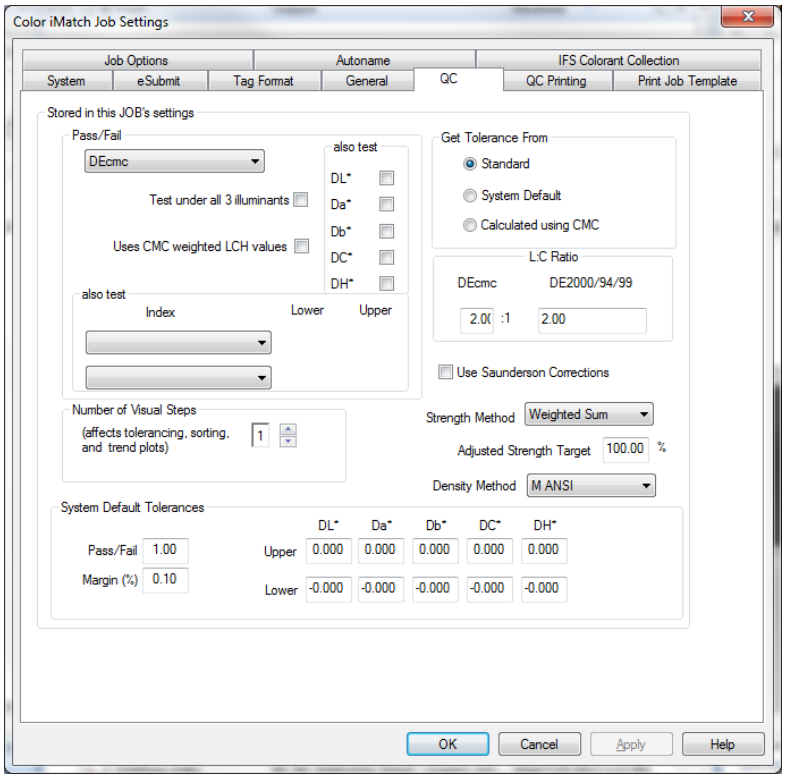
2. The new job will open. Click once on the "Change settings file reference" command under the Job menu.

3. The Open dialog box will appear with the available settings files listed, except for the defaults which are stored in a different place. (If you want to edit the default settings

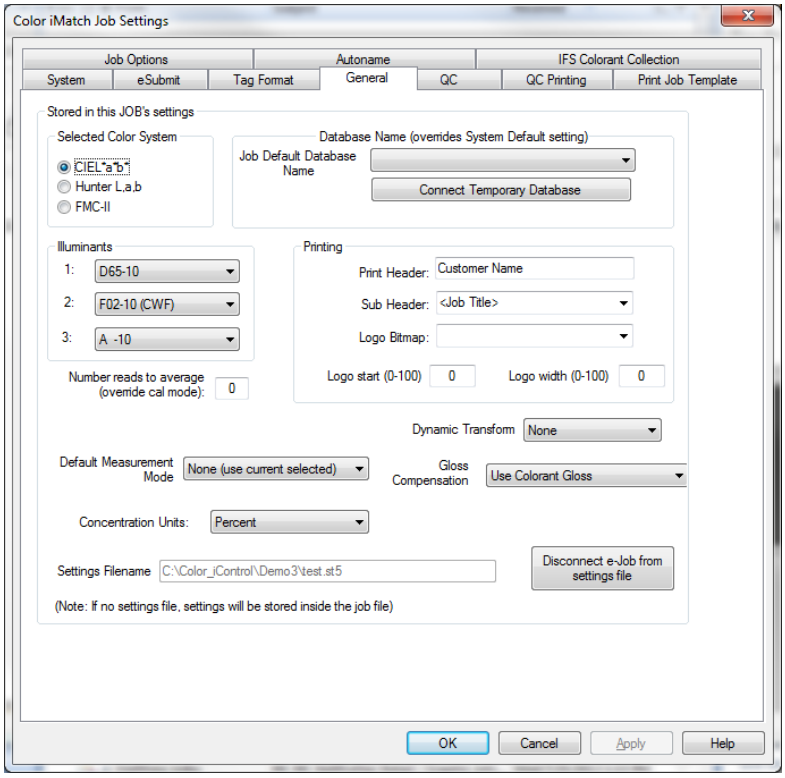
file, you must use the Edit Default Job Settings under the File menu.) Enter a name “in the “Filename” field and click on the <Open> button.



4. The program will automatically create a new settings file using the name you entered and associate it to the current job. At this point, click on Application | Settings in the main program menu. The Settings dialog box will open.



5. Click on the General tab of the Settings dialog box to make choices with regards to the selected color system, illuminants, printing, and other default parameters. Click on <OK> when finished.



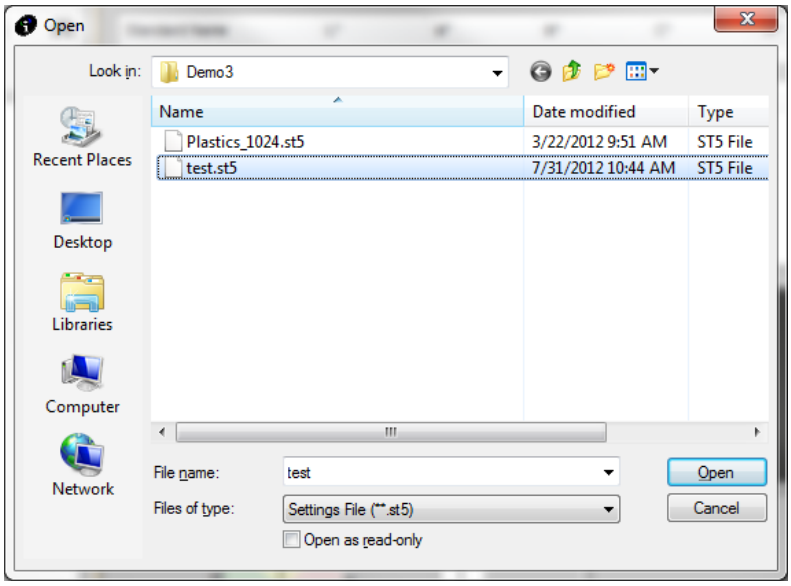
6. Click once on the "Save Settings" command under the e-Job menu. This will save the settings you selected into the file you created. Once you save the settings, the new "settings file" is complete and ready for use. (Note: The blank job you opened in order to create the file may be closed without saving.)

Using Alternate Settings/Creating a Template

You can associate any job with a settings file. However, an easier way exists to create jobs associated with a setting file is to create a template that automatically points to that settings file. Any jobs created using a template will automatically be associated with the correct settings file.

1. Open a new, blank job by using the "New e-Job" command under the e-Job menu.

2. 2. Click on the "Change settings file reference" command under the e-Job menu. Select a settings file to use for this template by clicking on it once to highlight it and then clicking on the <Open> button.



3. Save the Job by clicking on the "Save As..." command under the e-Job menu. Note that you must save the job before you can save it as a template. Name the job appropriately.

4. Once the job has been saved, click on the "Save as template" command under the e-Job menu.

5. 5. Enter in a name for the template. Templates are saved using a "*.jt5" extension.

6. You may now open new jobs using the template you have created by clicking on the "New from Template" command under the e-Job/File menu. Those jobs will automatically be associated with the selected settings file.

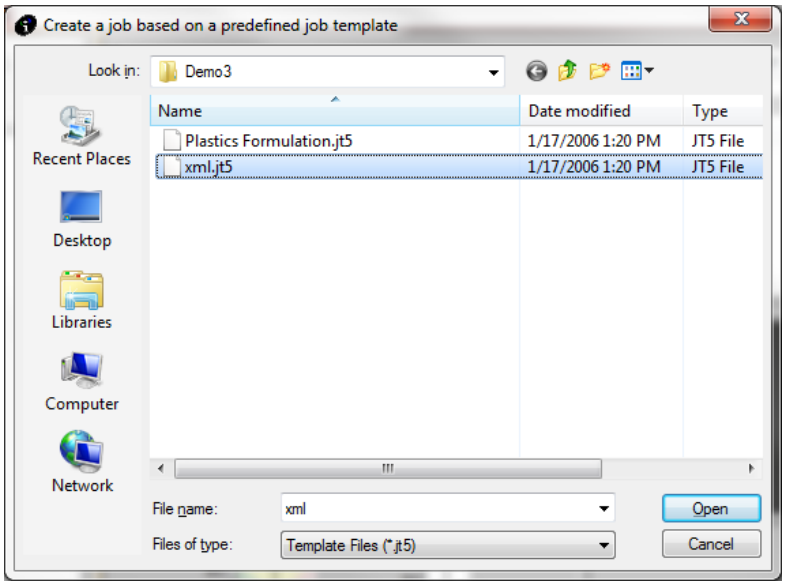
Creating a Job from Template

You may create new jobs from the templates you create by using the "New from Template" command under the e-Job menu.

1. Click on e-Job in the main program menu.

2. Click on "New e-Job from Template" menu item

3. The Open dialog will appear with the available templates listed. Click once on a template name to select it.



4. Click on <Open>. You now have a new job that points to the settings file.

Disconnecting a Job from Its Settings File

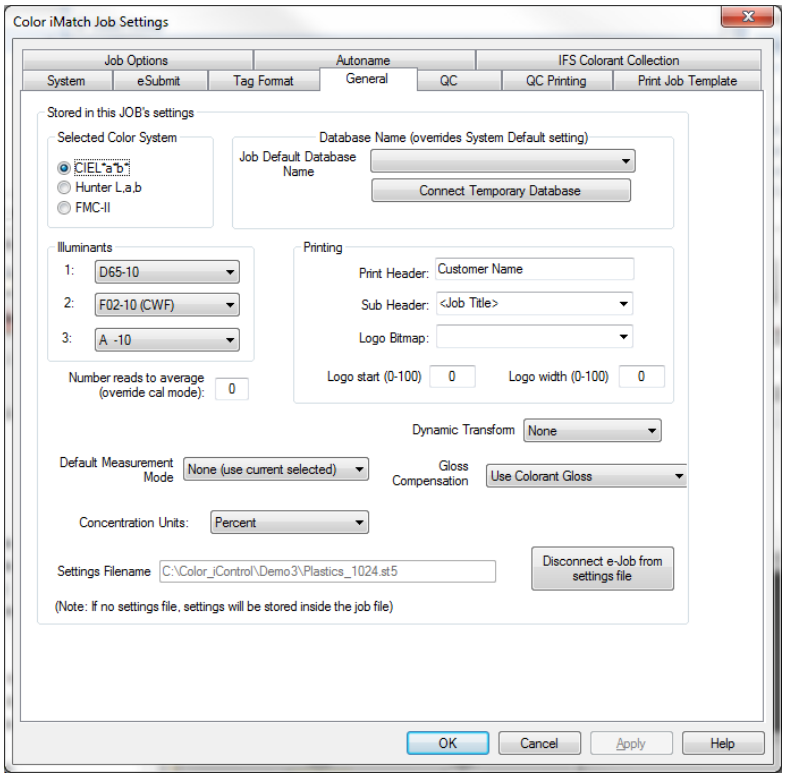
If you have selected to use settings files as the default method of storing settings for your jobs, you may still create jobs that are self-contained by disconnecting the job from its settings file. When you do this, the settings that are stored in the settings file will automatically be copied from the file into the job. Follow the instructions below to disconnect a job from its settings file and turn it into a self contained job. These instructions assume that the job is already open in the main program window and is the active job.

1. Click on the Application menu and select the “Settings” menu item.

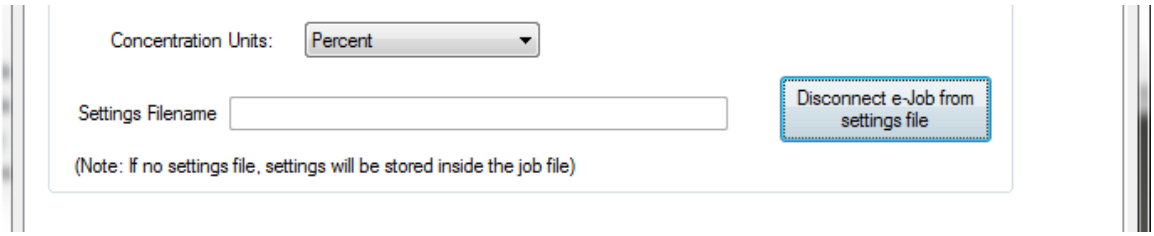
2. The Settings dialog will open. Go to the General settings tab.

3. At the bottom of the General settings tab is a button marked “Disconnect this job from settings file.”

4. Click once on that button.



5. The settings file listed in the "Settings Filename" field should disappear.



6. The job is disconnected from its original settings file and that information is now stored in the job itself. Click on <Apply>.

7. Click on <OK>.

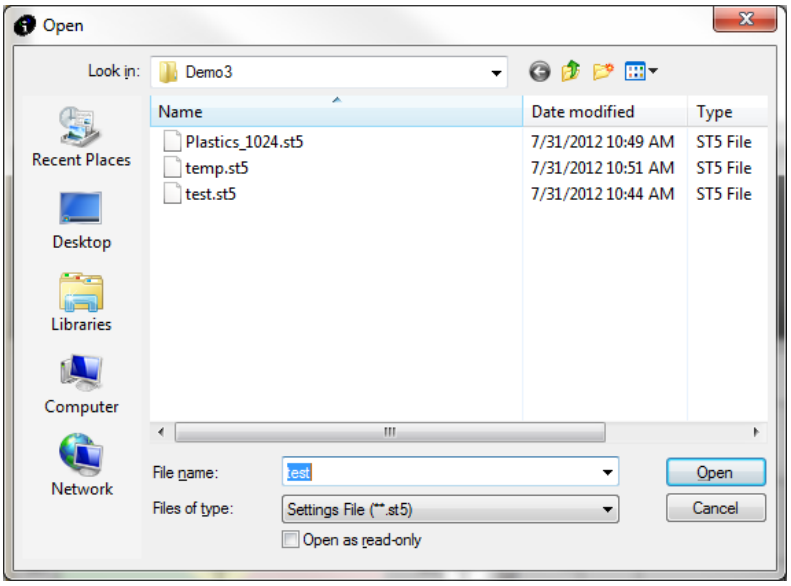
Connecting a Job to a Settings File

This section describes how to connect a job to a different settings file. This will overwrite the settings stored in a standalone job with the new settings from the file.

1. Click on the e-Job menu.

2. Click on "Change Settings File Reference."

3. The Open dialog box will open displaying the available settings files.



4. Click on the appropriate settings file name.

5. Click on the <Open> button.

6. The current job's settings are now coming from the selected file. You can check this by opening the Settings dialog (Application | Settings...) and looking in the General tab.

Establishing the Default System Settings

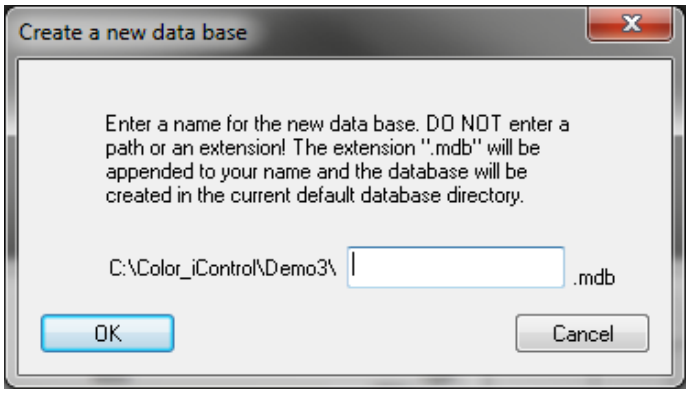
The next step in setting up the program is to establish the default system settings. Double-click on the Color iQC or Color iMatch desktop icon to re-start the program. Click on the <Open without e-Job> button. At this point, you will need to decide if you want to store your data in a database as well as in jobs. If you wish to store your data in a database, you will need to create it. Follow the steps below to create a database for use with Color iQC or Color iMatch.

Creating the Database

1. Click on the blank document button to open a new job (or you may click on File | New Job).

2. Once a blank job is open, click on Data | Create an empty Data Base…

3. A small dialog box will open allowing you to name the database. Enter a name for the database. The program will automatically append the *.mdb extension to the name you enter. The path where the program will place the database will be displayed.



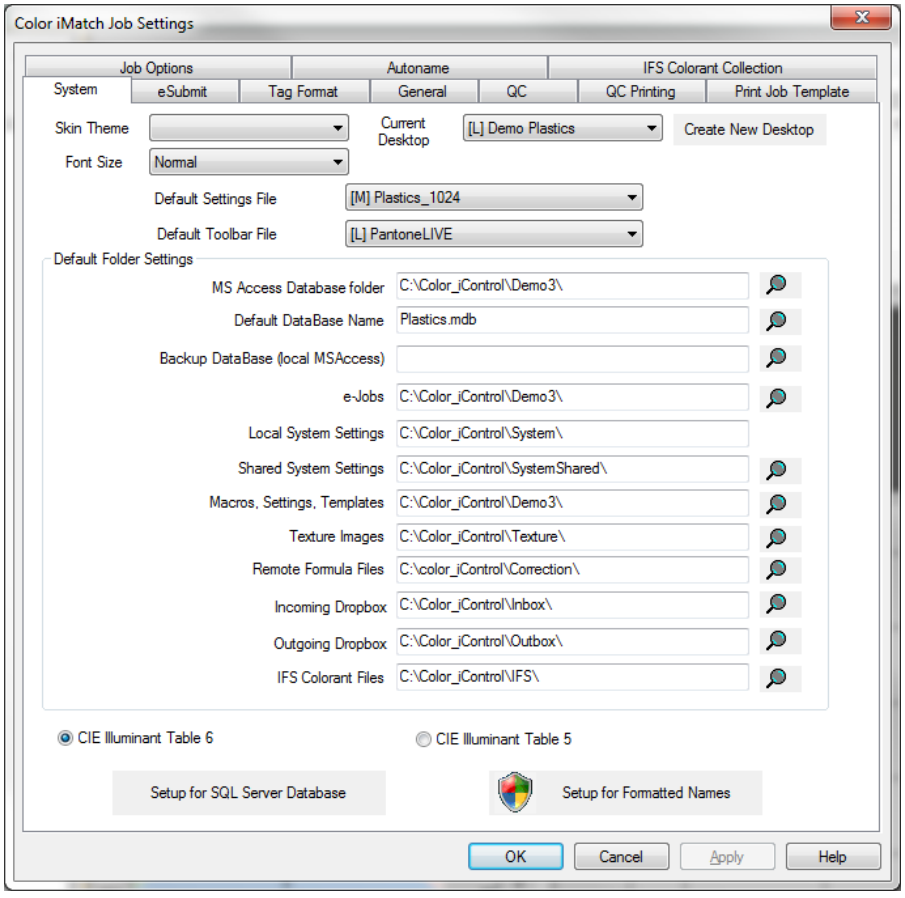
4. Click <OK>.

Editing the Default System Settings

1. Click on the Application menu followed by the "Settings..." command (or you may use the "pencil and pad" button on the toolbar).

2. Click on "System" tab.

3. The Default System Settings tab will be displayed.



4. Inspect the path settings as they are shown in the various fields. (See the table below for a description of each path/field.) The database you created and named should be displayed as the default database. Generally, you should let the path settings remain set to their defaults unless you have a good reason to change them. For example, you may want to set up your system to have the database located on a network drive so that others can access it. In that case, you will need to change the database path to point to the correct drive and directory where you will be storing your data. (These path definitions may be specified using UNC conventions. See your network administrator for help with that.)

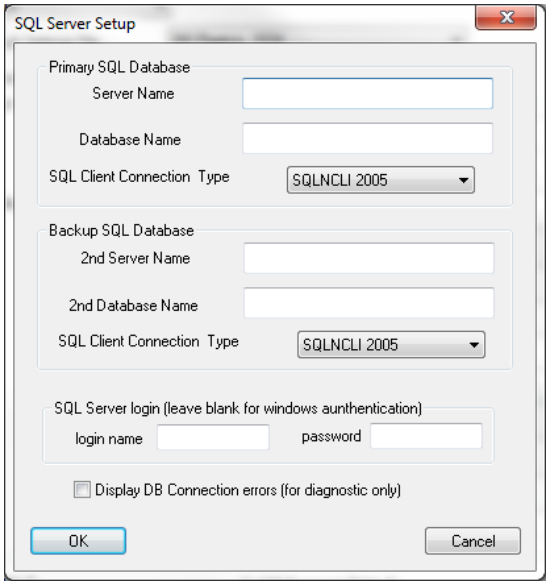
5. Click on <OK> when you have finished defining the paths for storing the various types of files associated with Color iQC and Color iMatch.

System Settings	
Setting	**Description**
Skin Theme	Choose from a selection of predefined windows skin themes to enhance software appearance.
Current Desktop	This field allows you to select a desktop. Color iControl allows the creation of desktop layouts that can affect many of the software's operating parameters, including such global settings as the default database folder or default jobs folder. In addition, a desktop can be associated with a user ID so that as soon as a user logs on to the system (even if passwords are disable), the correct desktop will instantly be applied to the program.
Default Settings File	This field will display the settings file associated with the current desktop. Click on the magnifying glass button to the right of the field to select a different settings file.
Default Toolbar File	This field will display the toolbar file associated with the current desktop. Click on the magnifying glass button to the right of the field to select a different toolbar file.
MS Access Database Folder	Default folder location for any databases needed by the system.
Default Database Name	Name of a default database for use with Color iControl. Enter in full name of the database including "*.mdb" extension. This database will be used if a database specified in the job being opened cannot be located or opened, or if the job does not contain a database name.
e-Jobs	Default location for the storage of Jobs.
Local System Settings	This field displays the location for the storage of local user settings; it cannot be modified (unless system is on-line version). These settings are private to a user and should not be shared between users.
Shared System Settings	This field displays the location for the storage of shareable user settings. These settings are typically shared between all users of a network system, and can reference a shared network drive.
Macros, Settings, Templates	Default location for macros, templates, and settings files.
Texture Images	Default location for the storage of images and texture images.
Remote Formula Files	Specifies location where formula output files will be written to... can be the network path for a dispenser folder.
Incoming Dropbox	Default location to store incoming submits.
Outgoing Dropbox	Default location to store outgoing submits.
IFS Colorant Files	Location where all IFS files (and .samples files) will be located .
Illuminant File	these radio buttons allow you to select from either of the 2 standard CIE illuminant tables. Table 6 is the current CIE recommendation and should be used unless you are trying to agree with actual raw color values from old systems that used Table 5.

There are two additional setup options available:

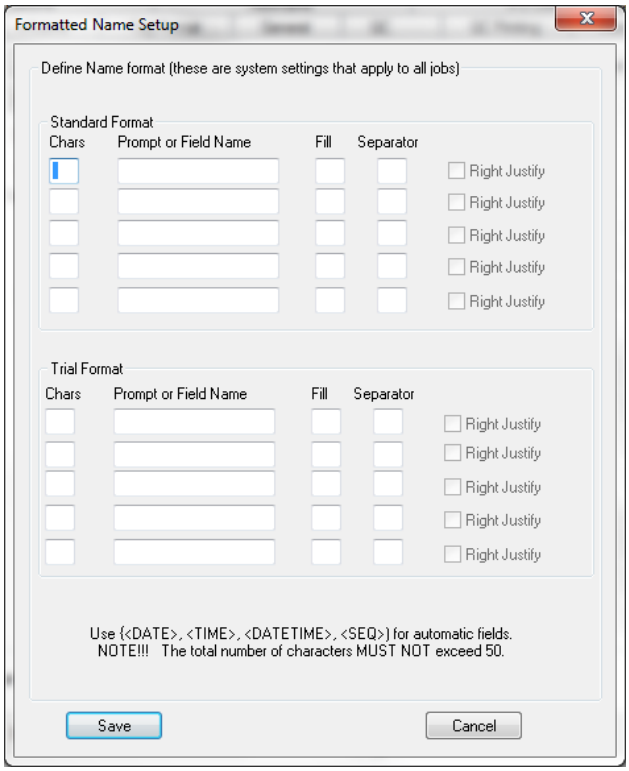
Setup for SQL Server Database

This option allows you to enter the information required to connect to a MS SQL Server database. Information from you IT department will be required to make this connection.



Setup for Formatted Names

This option allows you to configure the software to use formatted naming when taking measurements.



Color iQC and Color iMatch
How to Guide

Version 8.0 | July 2012

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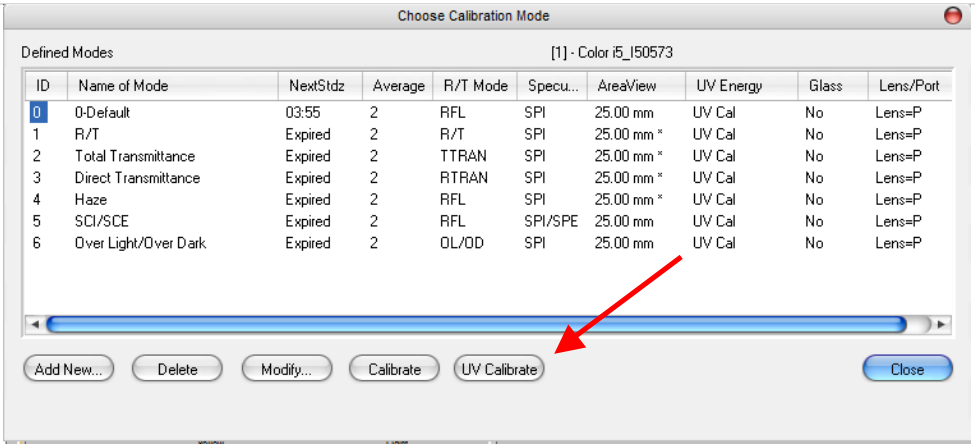
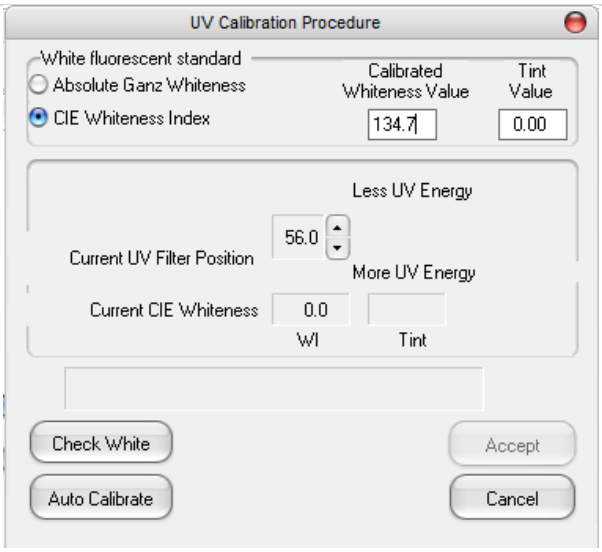
Calibration

How can I calibrate the UV?

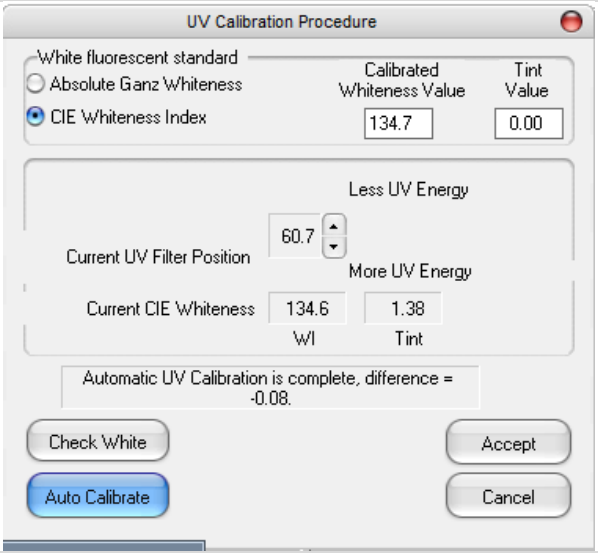


Select the measurement mode and perform a normal calibration. Once this is finished you can select within the Calibration Mode selection – the option UV-Calibrate.



With the i5 or i7 instrument a white plastic chip with a defined CIE Whiteness value is provided.

Enter the Calibrated Whiteness Value in the proper information field, place the chip in front of the spectro and press [Auto Calibrate]



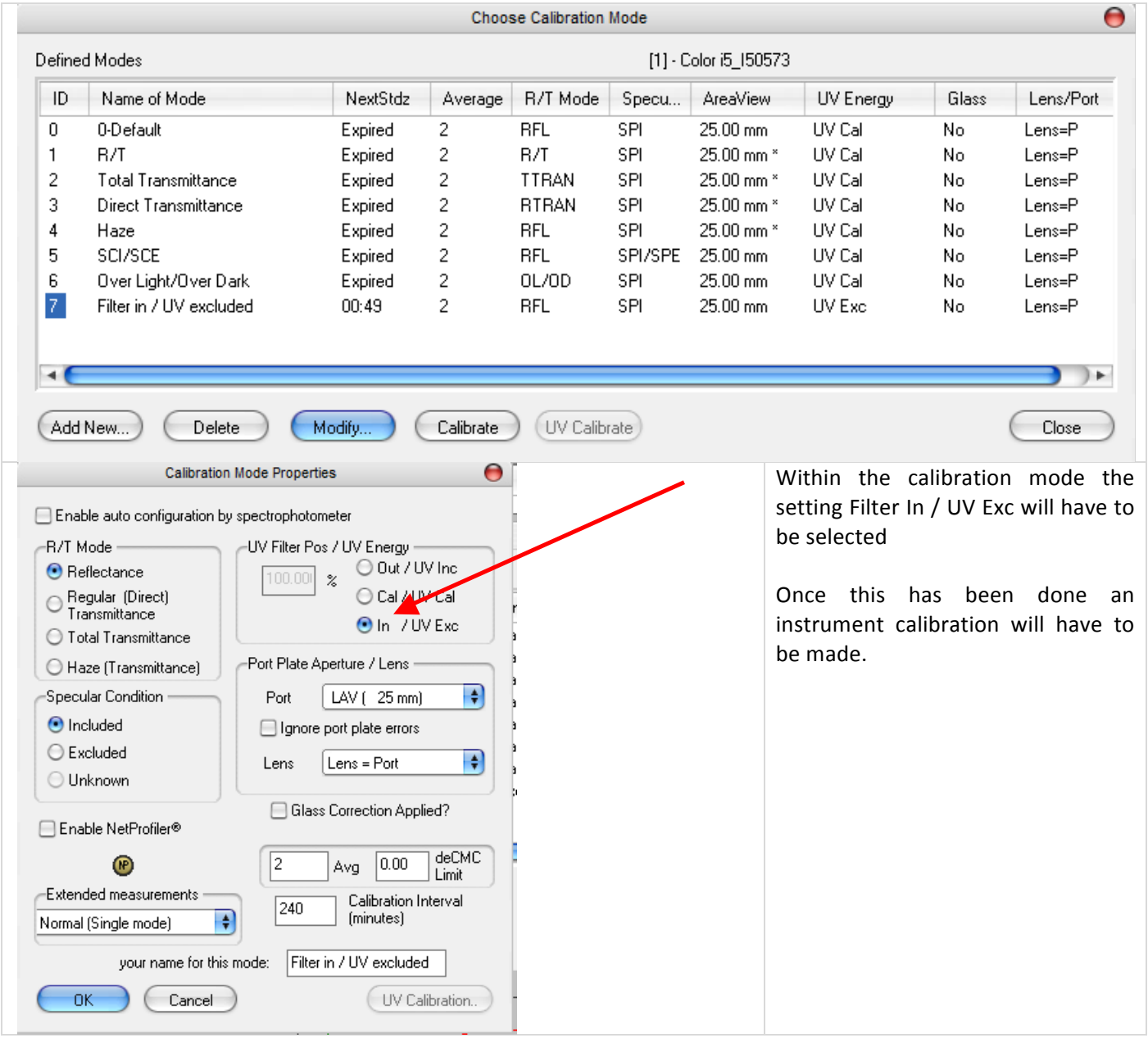
At the end of the Calibration procedure the Current UV Filter Position, the Current UV Whiteness and the Automatic UV Calibration Difference is reported.

Typically result will be within 0.2

Accept the UV calibration and repeat a regular calibration procedure.

How can exclude the complete UV?

In order to exclude the UV completely a calibration mode will have to be set up



Within the calibration mode the setting Filter In / UV Exc will have to be selected

Once this has been done an instrument calibration will have to be made.

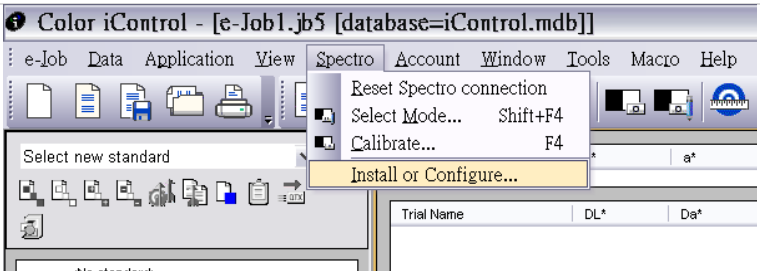
How can include the complete UV?

Color iQC does not offer the option include complete UV. Whenever this option is selected the instrument will automatically use UV cal. There is a reason for it.

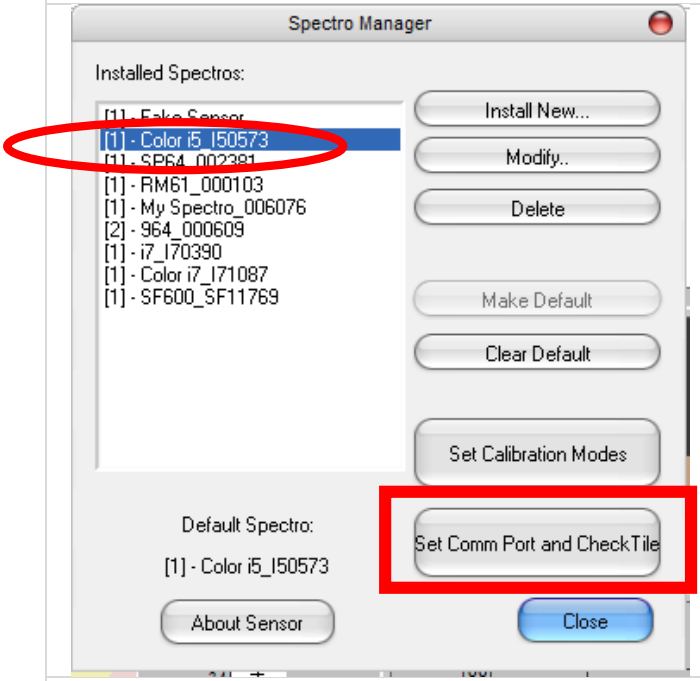
The UV content of a Xenon lamp has an impact on the reflectance data, if samples such as textiles or paper contain optical brighteners.

If the instrument works without the UV filer (or calibrated UV) the UV content of the Xenon Lamp will depend on the age of the lamp. Since UV content has an impact on the reflectance data, different reflectance data would be achieved depending on the age of the lamp. It would be nearly impossible to achieve a good inter instrument agreement.

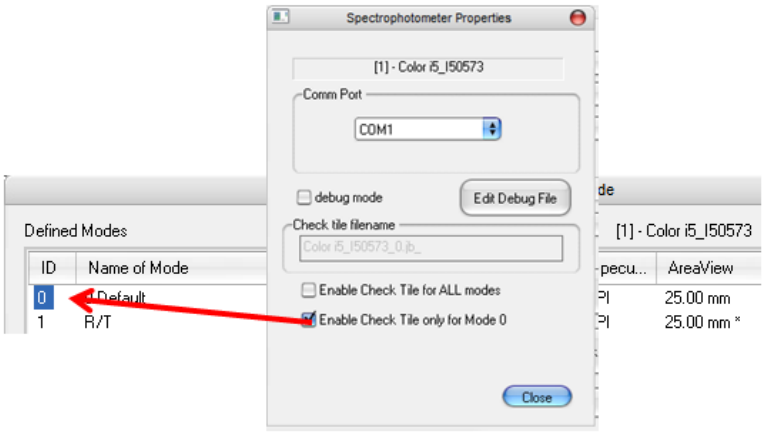
How can I activate a green tile test after the calibration?



1. Main menu, select spectro, and install or configure.



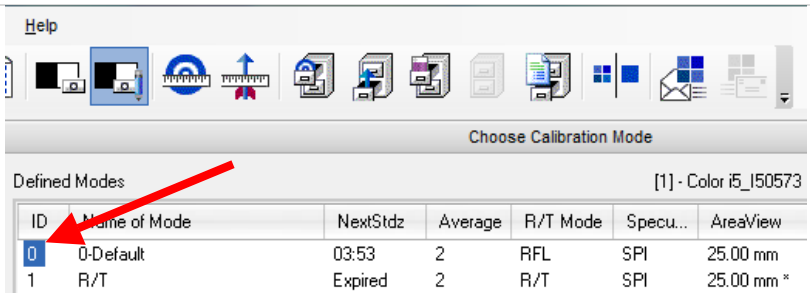
2. Select your spectro, eg color i5; and then click "**set Comm Port and check tile**" button.



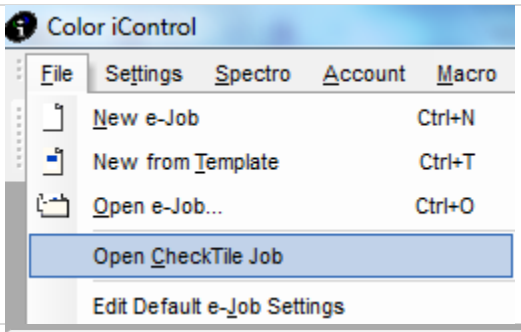
3. Select which mode you need to do green tile check.

   Mode 0, means only the first cal. Mode, which mode ID is 0.

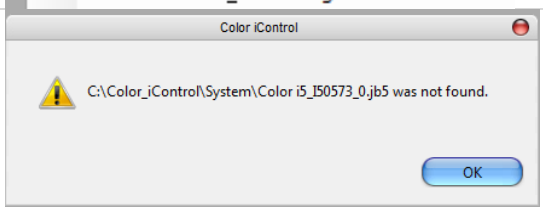
   All modes, means all cal. Mode ID need to do green diagnostic test.



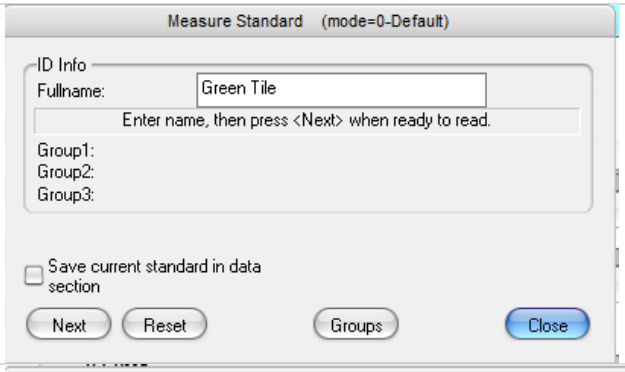
4. Open a new job, go to "Select Mode" and select a cal. mode that you want to set green tile diagnostic test.
   (Make sure you had done calibration on each mode before you come to this step, if not, switch off the check tile and go calibrate your spectrophotometer first.)



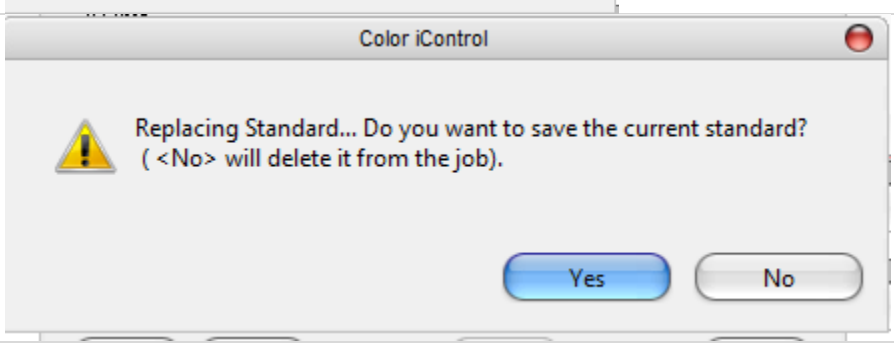
5. Then close job…
6. Go to File, and select "Open Check Tile Job".



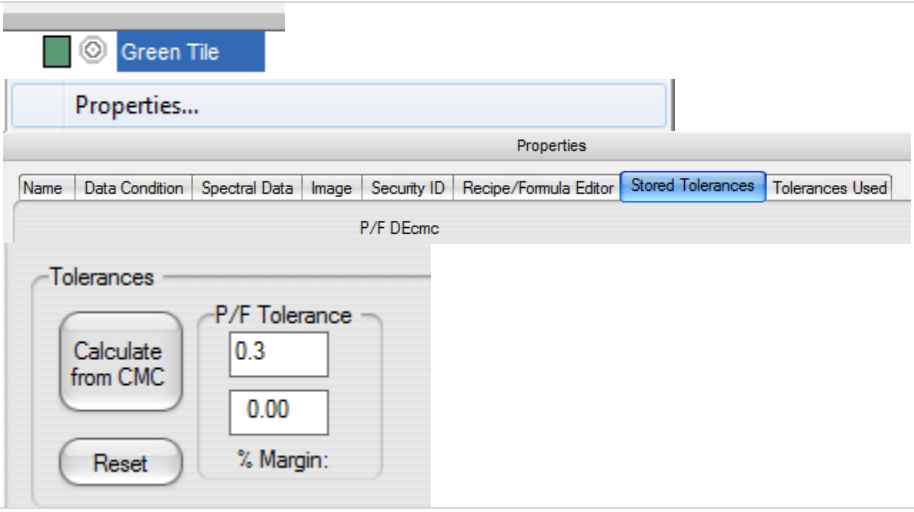
7. Color iQC and Color iMatch realizes, that the proper job is not yet available and places the warning on the screen. It will automatically create a Green Tile test job.



8. Enter the name and go through the measurement sequence Uncheck the "Save current standard in the data segment"

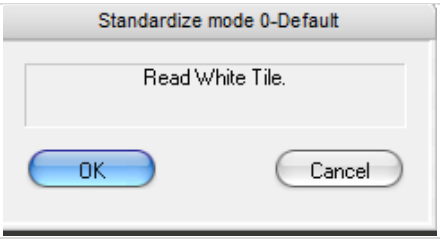


9. At the end confirm, that the standard should be saved.

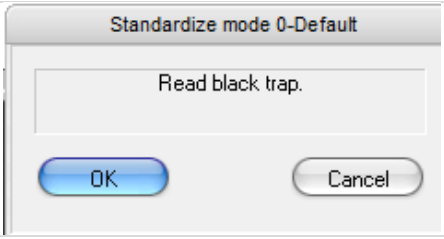


10. It is recommended to enter Pass/Fail Tolerance to the standard.
    Mark the tile in the data Selection Windows selects the properties.
    In the standard properties select Stored Tolerances and enter a tolerance of 0.3

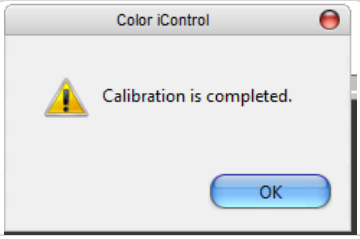
When a calibration for the calibration mode 0 is done automatically a read check will be imitated



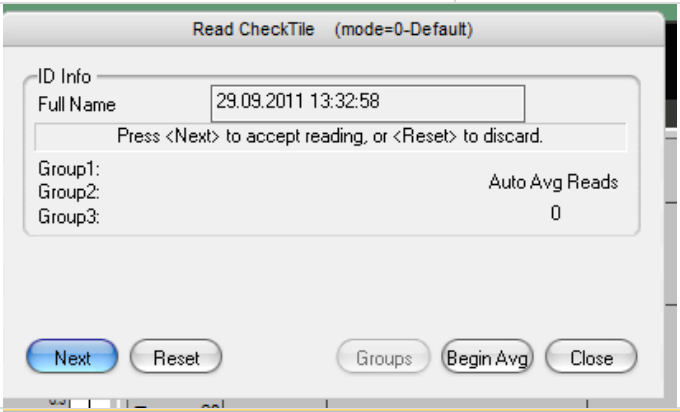
White Calibration



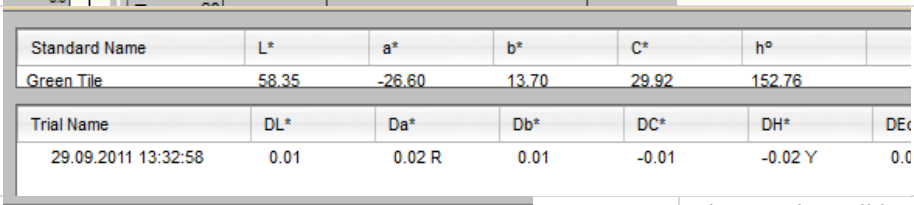
Black Calibration



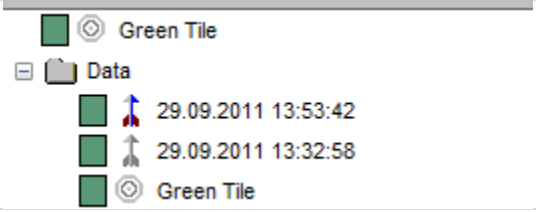
Calibration is finished



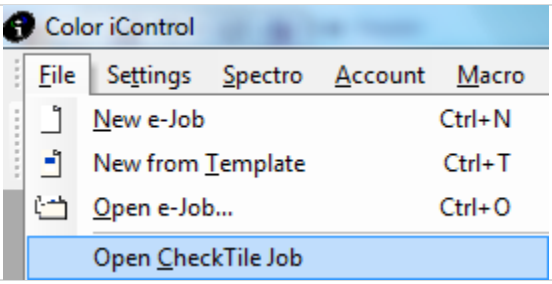
11. Once the calibration is finished the check tile test will come up. Place the green tile in front of the spectro and start a normal measurement routine.



12. Once the calibration is finished the results will be shown. If outside of tolerance the calibration will be rejected.



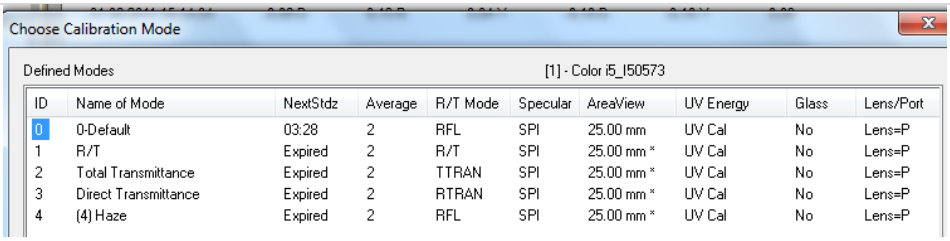
The results will be saved in the job.



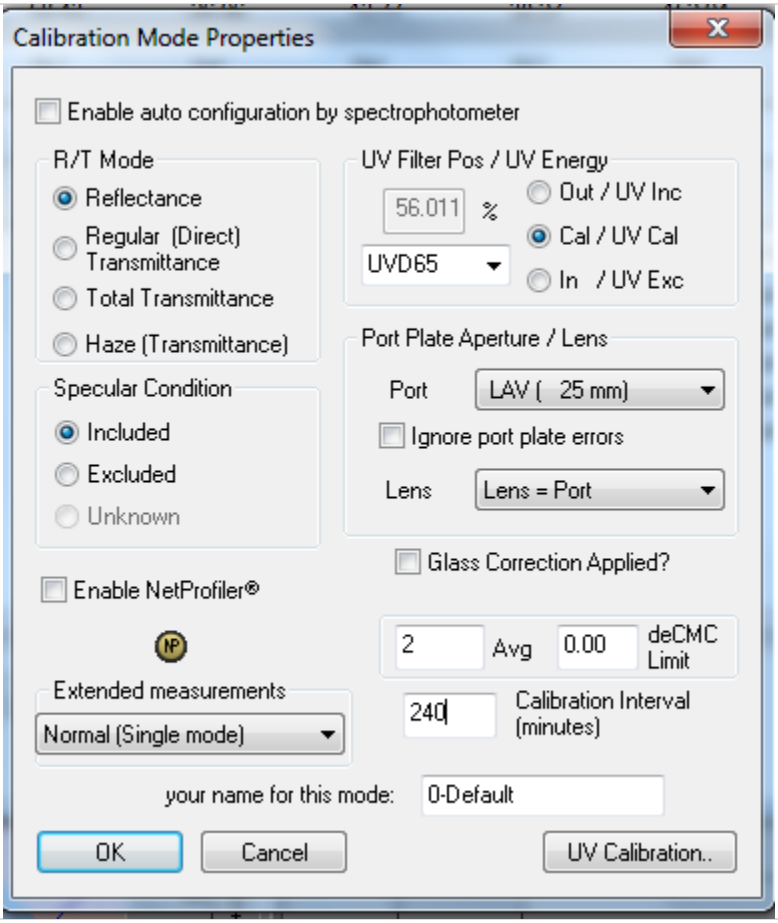
In order to evaluate the results of the CheckTile Job close all jobs.
Select File –
Select Open CheckTile Job
Now you can analyze the data.

How can I set the calibration time control?

Most customers like a automatic reminder to calibrate the instrument when it`s reqired



For each of the calibration modes there is a timer for the next calibration. This can be changed using the modify option



In the Calibration Mode Properties the calibration Interval can be set.
The typical recommendation is 240 Minutes.

Attention: if the time is set to “0” there will be **NO** time control.
This can be useful, if you do want to do long term measurements and do not want to have any interruption by the calibration.

This can be useful, if you use self calibrating instruments portable spectrophotometers like the Spectro Eye or other portable devices like the SP or 900 series, which do have their own internal time control.

Measurement

How can I measure Gloss with my instrument?

Color iQC | Color iMatch Gloss and SRR Gloss

Gloss in Color iQC and Color iMatch applies to measurements made on a sphere instrument where SPI and SPE are possible, and uses an equation developed by X-Rite for each instrument that is correlated to a 60 degree gloss meter for paint samples on paper. It is generally pretty close to an actual gloss meter within the normal ranges of 20-80 but may be different somewhat at the low or high ends of the range. Every spectro has a different form of the equation to account for differences in sphere size, number of holes, size of specular port, etc. X-Rite has a specific equation for CE7000, Color i5/i7, XTH, and SP62/64. All other sphere spectrophotometers use a general equation and may not agree as well. The ASTM method that applies to this is D523. However the type of equipment required by D523 does NOT include sphere instruments. Therefore the equation gives us a "correlated gloss" value rather than a "60 degree gloss" value.

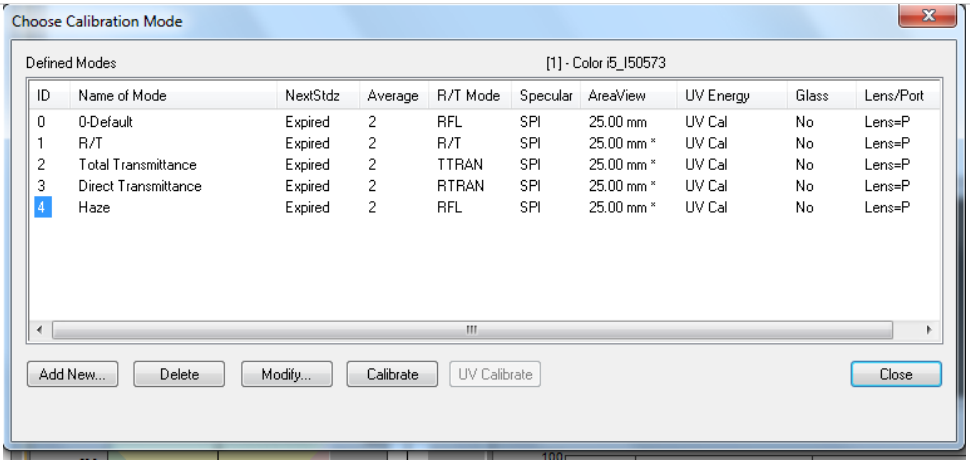
SRR Gloss in Color iQC and Color iMatch is "Specular Reflectance Ratio" and is defined as ASTM method E429 (not E463). This method is titled "Measurement and Calculation of Reflecting Characteristics of Metallic Surfaces Using Integrating Sphere Instruments" , and in general is useful for describing the specular reflectance from surfaces that are somewhat glossy. An inverse value called "diffuse reflectance ratio" is normally calculated for comparing metallic surfaces which are matte however the DRR value is NOT contained in color iQC or Color iMatch.

The methods will give similar relative comparative results between several samples – but the values themselves will be different.

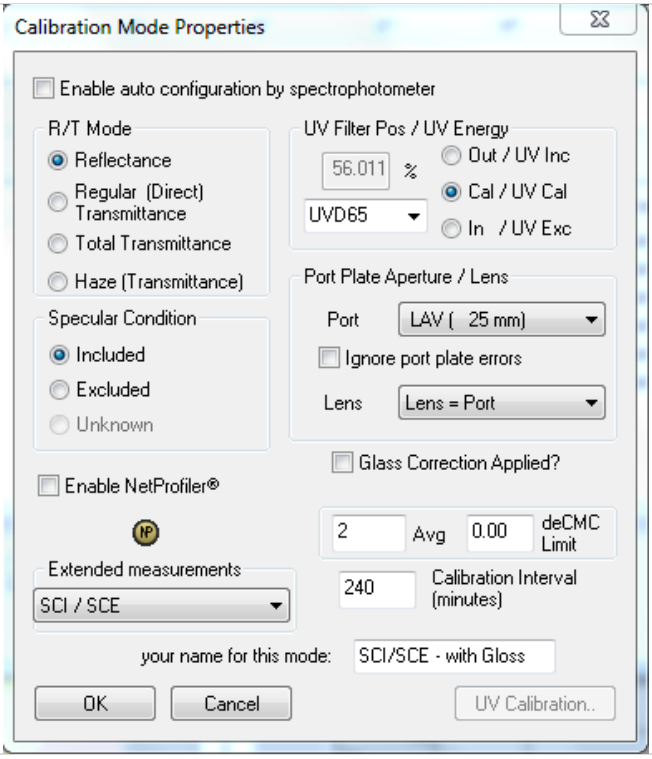
Additional Notes: RFW 2Dec2010

- GLOSS60 calculation can be performed in the Color i5 (if it has firmware 2.0 or higher) and transferred to the software during any measurement – otherwise the GLOSS60 value can ONLY be calculated if the measurement is extended SCI/SCE.
- SRR Gloss can only be calculated from an extended SCI/SCE measurement.
- Gloss60 is a "correlated" equation using an instrument model specific equation developed by X-Rite to correlate a sphere measurement to a 60 degree gloss meter. The equation has been improved in version 6.2 for most sphere instrument models.
- SRR_Gloss is an ISO method of calculating gloss (Specular Reflectance Ratio) that is typically used when measuring materials that are highly glossy (such as metals).

- First step - prepare the calibration mode for the gloss measurement



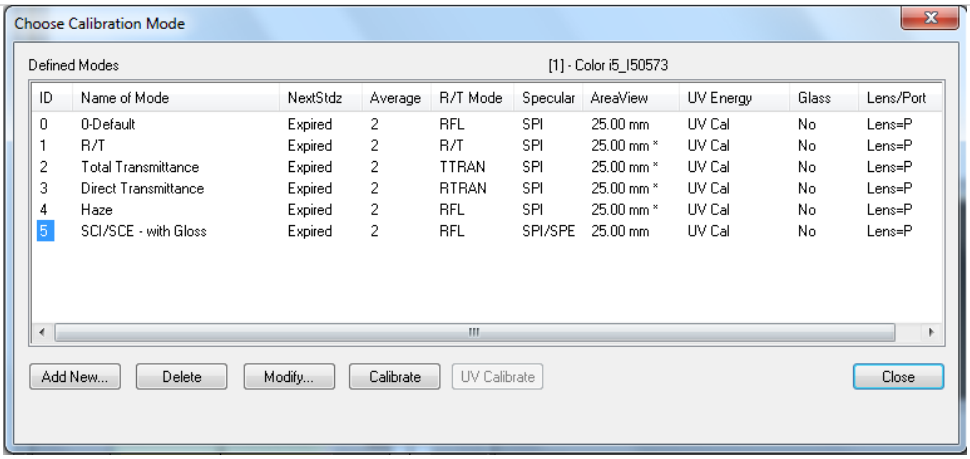
Open the Calibration Mode Windows [Shift] + [F4] - and click [Add New]



Select the following settings:
Remove the check next to "Enable auto configuration by spectrophotometer"
R/T Mode = Reflectance
Specular Condition = Included
Extended Measurements = SCI/SCE
UV Filer Pos/UV Energy = UVD65/Cal/UVCal

Enter a name for this calibration mode

Press [OK] to leave the Calibration mode properties.



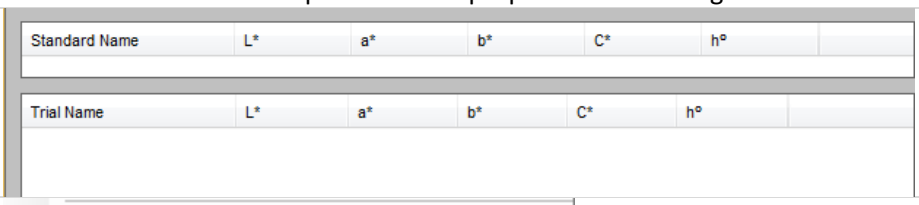
A new calibration mode has been added now.

Select mode 5 and calibrate it with the normal calibration procedure.

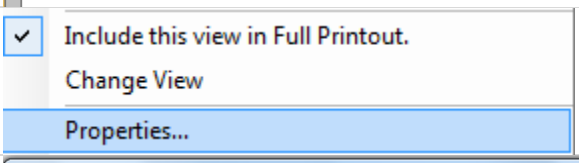
The calibration will include SCI and SCE

Click [Close] to leave the box

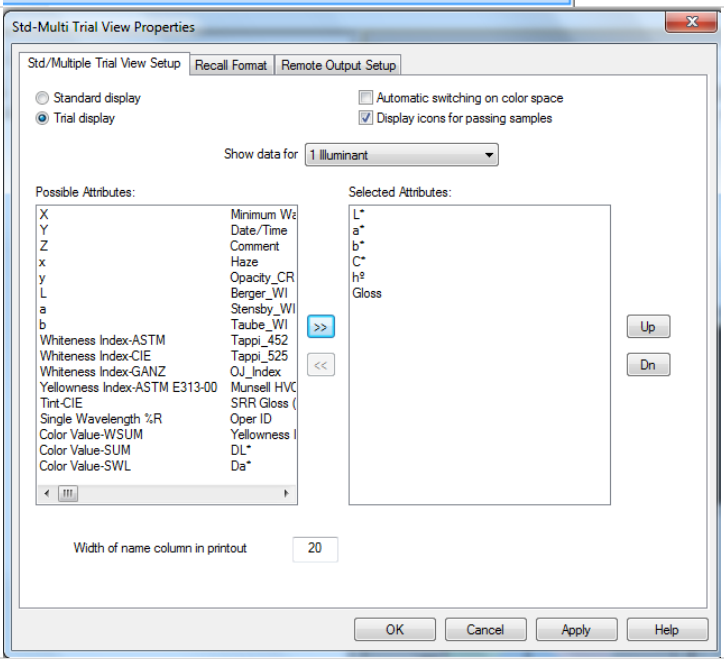
- Next the data output has to be prepared to include gloss



Make a right mouse click into the multi trial data view



From the right mouse key mouse key menu - select properties



From the possible Attributes (left side) select Gloss and press the button facing to the right side and include the Gloss into the list of Selected Attributes.

If you want you can move it to a different position within the list.

Press [Apply] and press [OK].

Next - take measurements using the measurement routines for trails and measure

Trial Name	L*	a*	b*	C*	h°	Gloss
X-Rite Gloss Chart 1	25,19	0,09	-0,92	0,93	275,56	4,99
X-Rite Gloss Chart 2	24,74	0,14	-0,98	0,99	278,25	13,37
X-Rite Gloss Chart 3	24,65	0,04	-0,87	0,88	272,71	32,36
X-Rite Gloss Chart 4	24,65	-0,00	-0,84	0,84	269,96	32,90
X-Rite Gloss Chart 5	24,94	0,07	-0,96	0,97	273,93	57,48
X-Rite Gloss Chart 6	25,25	0,07	-1,13	1,13	273,32	92,62

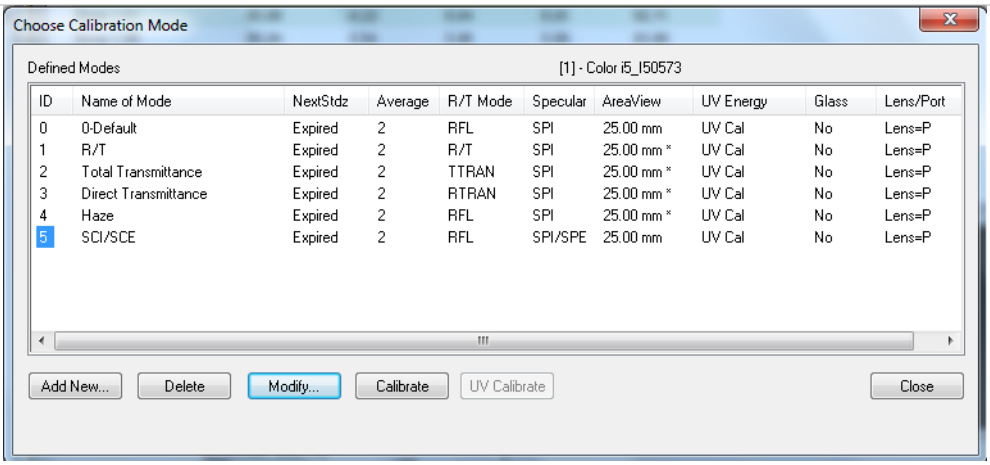
The results will be shown in the multi trial data display

The correlated gloss data will be included.

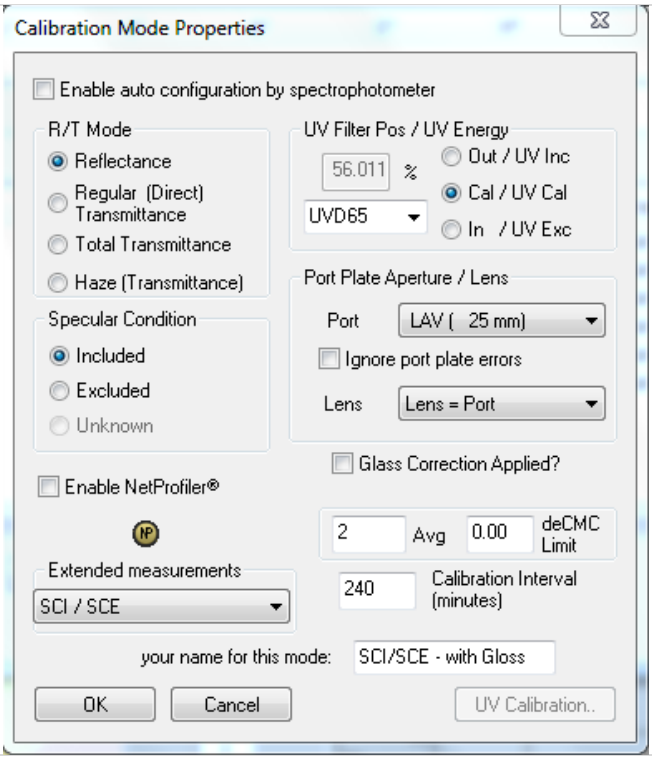
How can I measure SCI and SCE?

This measurement option is available with the Color-Eye XTH, Color i5, and Color i7, 7000-instruments SP-Series. For SP-Series Instruments all measurements must be made with SCI/SCE to be able to use the automatic standard definition in the instrument.

- First step - prepare the calibration mode for the gloss measurement



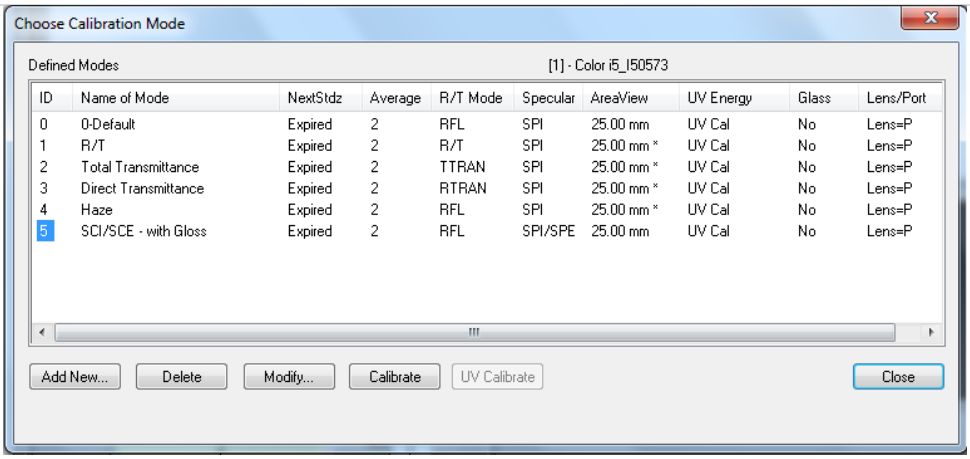
Select a calibration mode for SCI/SCE measurement. If it is not yet available to you have to create one.



Select the following settings:
Remove the check next to "Enable auto configuration by spectrophotometer"
R/T Mode = Reflectance
Specular Condition = Included
Extended Measurements = SCI/SCE
UV Filer Pos/UV Energy = UVD65/Cal/UVCal

Enter a name for this calibration mode

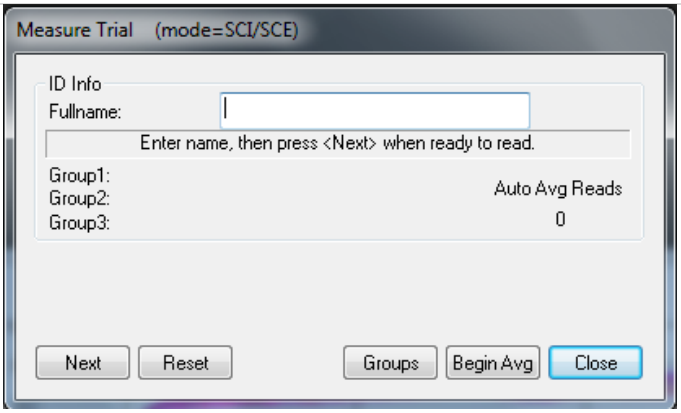
Press [OK] to leave the Calibration Mode Properties Window.



Select mode 5 and calibrate it with the normal calibration procedure.

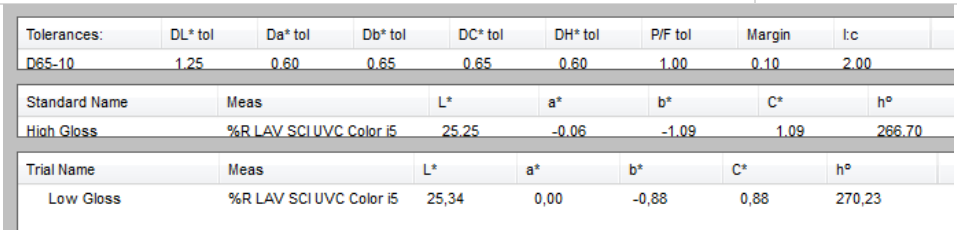
The calibration will include SCI and SCE

Click [Close] to leave the box

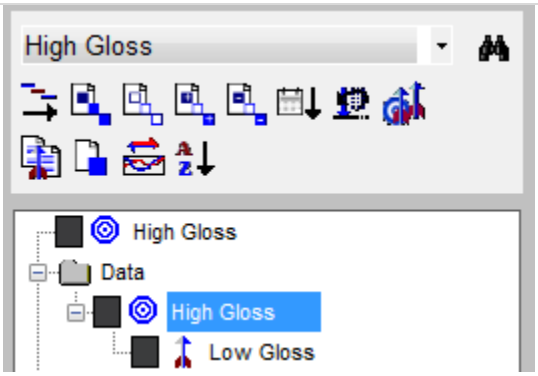


Take measurements in the known way.

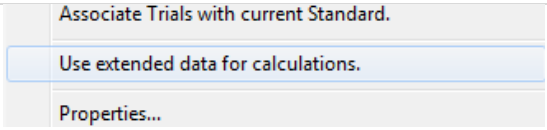
The Measure Trial Windows will have the information mode (SCI/SCE) in the header.



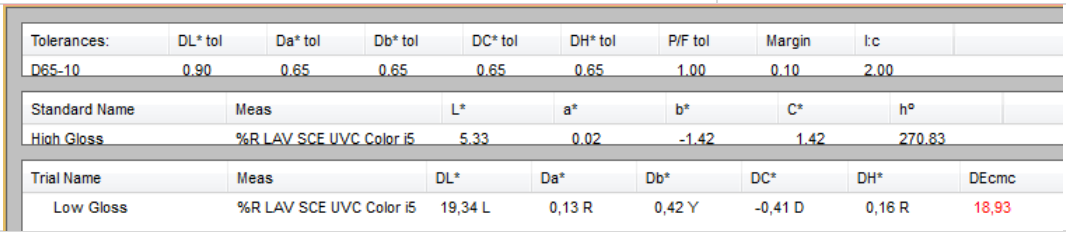
The data will be shown in the multi-trial data view.
To provide more clearance the measurement condition has been added to the view.



In order to change the display of data to SCE mode, do a right mouse key click into the data section of tree view.



Select “Use extended data for calculation”



Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	l:c
D65-10	0.90	0.65	0.65	0.65	0.65	1.00	0.10	2.00

Standard Name	Meas	L*	a*	b*	C*	h°
High Gloss	%R LAV SCE UVC Color i5	5.33	0.02	-1.42	1.42	270.83

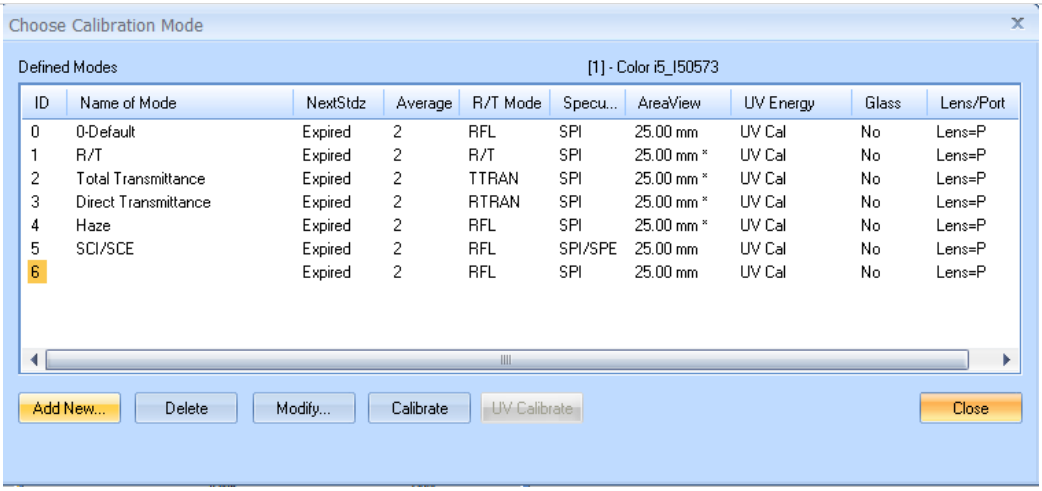
Trial Name	Meas	DL*	Da*	Db*	DC*	DH*	DEcmc
Low Gloss	%R LAV SCE UVC Color i5	19,34 L	0,13 R	0,42 Y	-0,41 D	0,16 R	18,93

This will display the results for SCE condition.

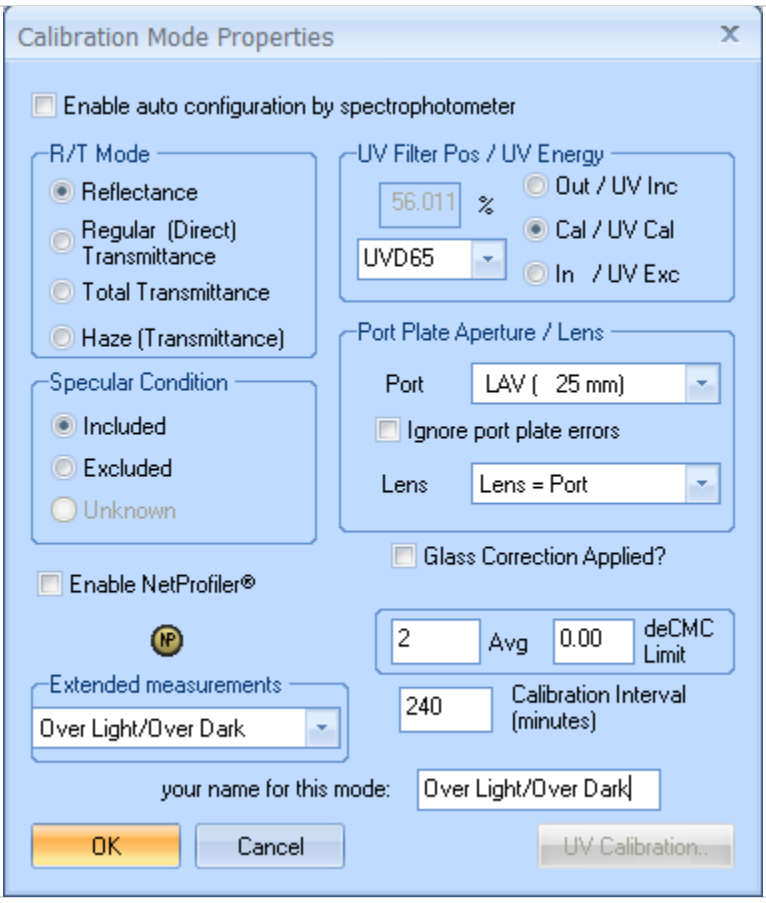
How to measure the contrast ratio from OL/OD measurements?

Within iQC the contrast ratio can be calculated from over light and over dark measurements

- First step - prepare the calibration mode for the OverLight and OverDark measurements



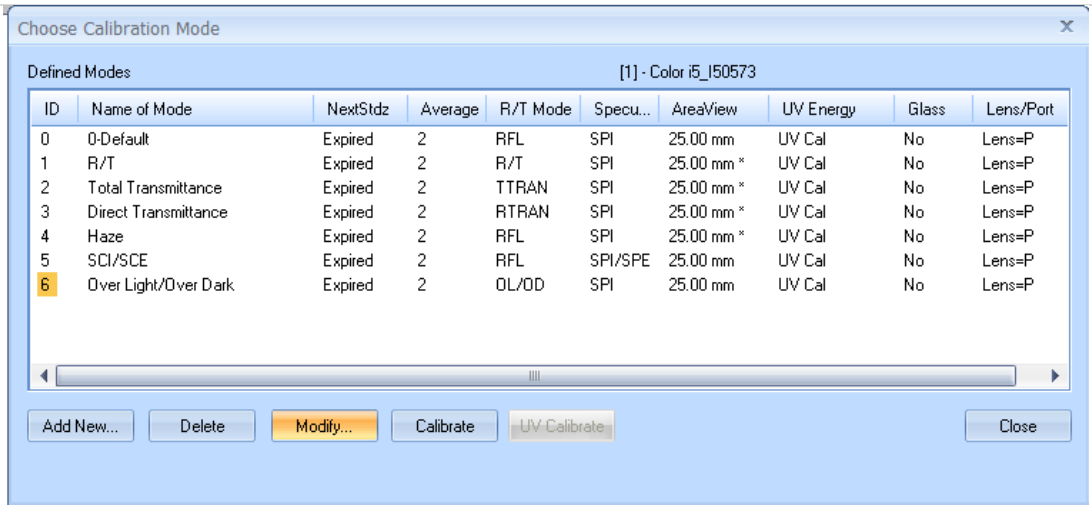
Select a calibration mode for OL/OD measurement. If it is not yet available to you have to [Add New] one.



Select the following settings:
Remove the check next to "Enable auto configuration by spectrophotometer"
R/T Mode = Reflectance
Specular Condition = Included
UV Filer Pos/UV Energy = UVD65/Cal/UVCal
Extended Measurements = OverLight/Over Dark

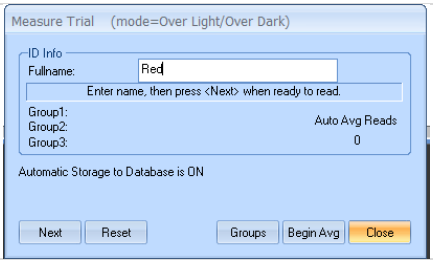
Enter a name for this calibration mode

Press [OK] to leave the Calibration Mode Properties Window.

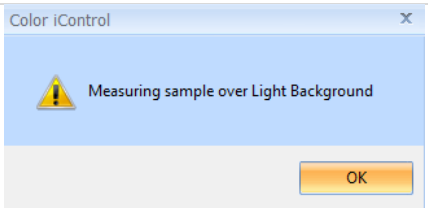


Select mode 6 and calibrate it with the normal calibration procedure.

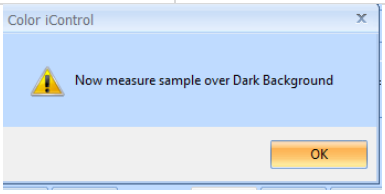
Click [Close] to leave the box



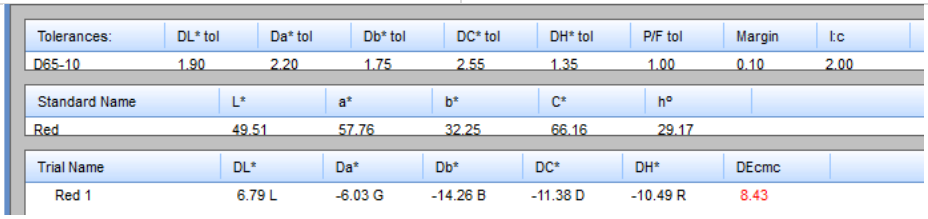
The measurement windows will show in the header which measurement mode is used



Within the measurement sequence you will be asked to present the samle over white

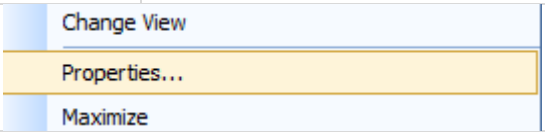


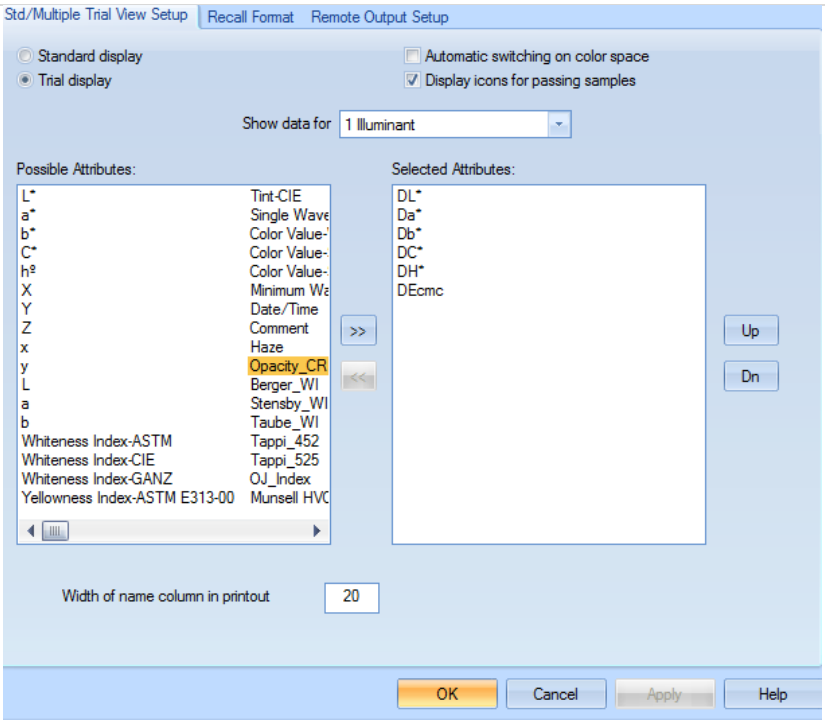
and over black background



The data for the over light measurements will be shown in the multi-trial data view.
To provide the Opacity_CR information the opacity information has been added to the view.

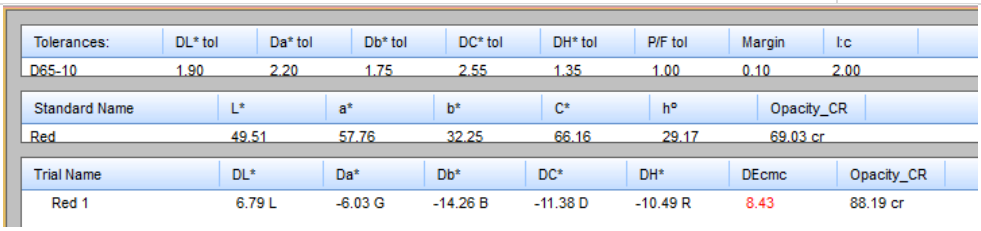
In order to change the information in the multi-trial data view – do a right mouse click into the multitrial data view and select the properties… from the menu





In the Properties Windows for the Multi-trial setup select Opacity_CR and press the key facing to the right.

This should be done for standard and trial

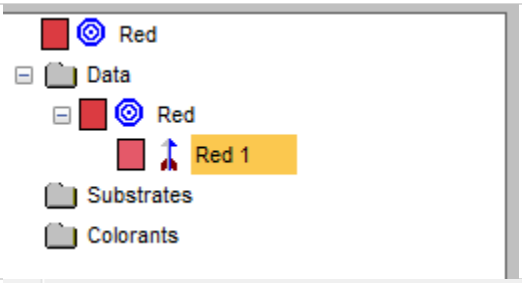


Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	I:c
D65-10	1.90	2.20	1.75	2.55	1.35	1.00	0.10	2.00

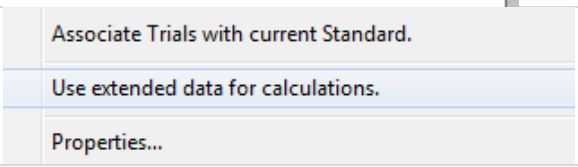
Standard Name	L*	a*	b*	C*	h°	Opacity_CR
Red	49.51	57.76	32.25	66.16	29.17	69.03 cr

Trial Name	DL*	Da*	Db*	DC*	DH*	DEcmc	Opacity_CR
Red 1	6.79 L	-6.03 G	-14.26 B	-11.38 D	-10.49 R	8.43	88.19 cr

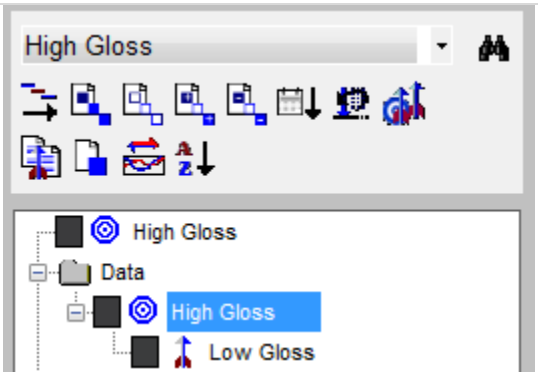
Now the data mutitrial data view will include the Opacity_CR information along with with the Over Light data. If the Over Dark data are desired the output must be changed



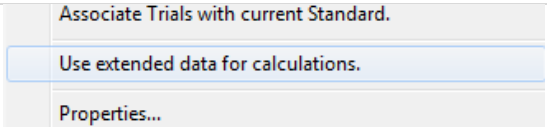
Mark the standard or sample in the tree view and press the right mouse key.



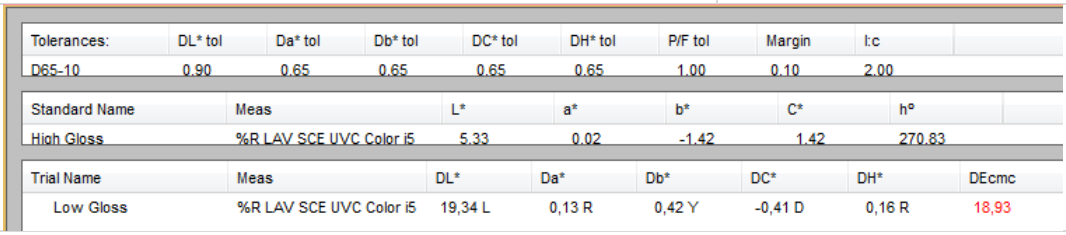
Select to use the extended data for calculation



In order to change the display of data to SCE mode, do a right mouse key click into the data section of tree view.



Select “Use extended data for calculation”



Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	l:c
D65-10	0.90	0.65	0.65	0.65	0.65	1.00	0.10	2.00

Standard Name	Meas	L*	a*	b*	C*	h°
High Gloss	%R LAV SCE UVC Color i5	5.33	0.02	-1.42	1.42	270.83

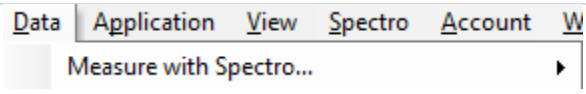
Trial Name	Meas	DL*	Da*	Db*	DC*	DH*	DEcmc
Low Gloss	%R LAV SCE UVC Color i5	19,34 L	0,13 R	0,42 Y	-0,41 D	0,16 R	18,93

This will display the results for SCE condition.

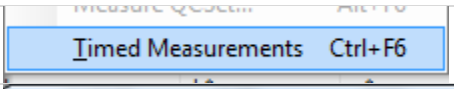
How can I start a timed measurement to take automatic readings?

For some application, there is need to measure the changes of samples with the time.
Also, when long time performance tests of the instruments have to be done, an automatic measurement is very useful. There is a function build into the program which allows to perform these measurements automatically

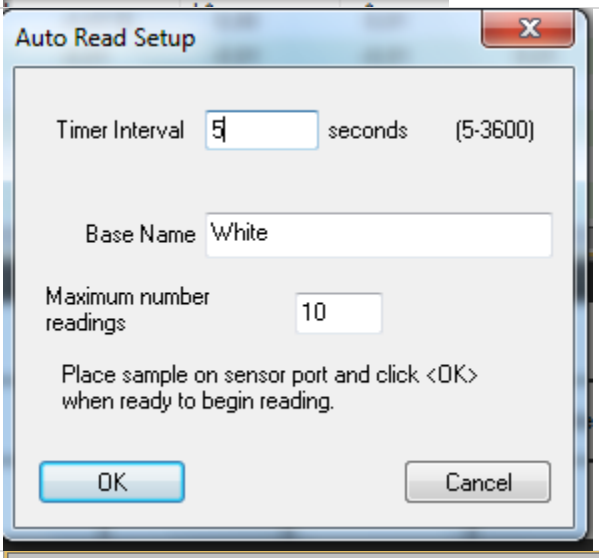
- Step 1 – open a new job
- Step 2 - Select the desired calibration mode for the spectro
- Step 3 – Calibrate if required
- Step 4 - measure the standard – if trial measurements in relation to a standard need to be made
- Step 5 – Setup the timed measurement in the following way



From the main menu – select Data - there you select Measure with your Spectro

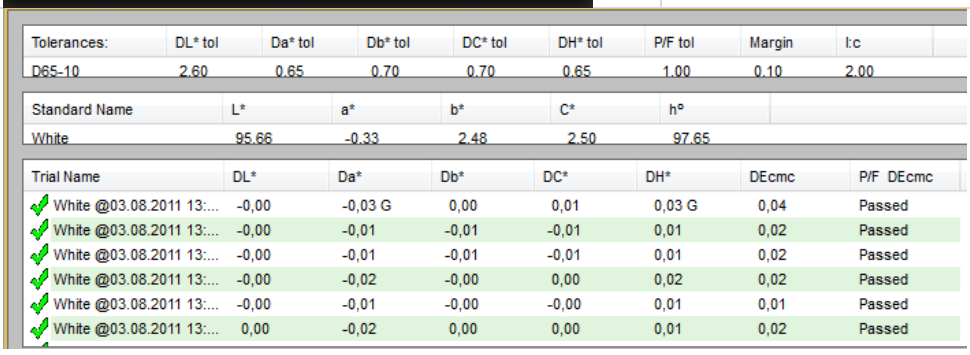


Next you select Timed Measurements
(alternately you can do the same with [CTRL] + [F6]



Within the Auto Read Setup – you can enter

- the timer interval
- Sample Name
- Maximum number of readings to be done



Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	I:c
D65-10	2.60	0.65	0.70	0.70	0.65	1.00	0.10	2.00

Standard Name	L*	a*	b*	C*	h°
White	95.66	-0.33	2.48	2.50	97.65

Trial Name	DL*	Da*	Db*	DC*	DH*	DEcmc	P/F DEcmc
White @03.08.2011 13:...	-0,00	-0,03 G	0,00	0,01	0,03 G	0,04	Passed
White @03.08.2011 13:...	-0,00	-0,01	-0,01	-0,01	0,01	0,02	Passed
White @03.08.2011 13:...	-0,00	-0,01	-0,01	-0,01	0,01	0,02	Passed
White @03.08.2011 13:...	-0,00	-0,02	-0,00	0,00	0,02	0,02	Passed
White @03.08.2011 13:...	-0,00	-0,01	-0,00	-0,00	0,01	0,01	Passed
White @03.08.2011 13:...	0,00	-0,02	0,00	0,00	0,01	0,02	Passed

As soon as you press [OK] the measurement starts

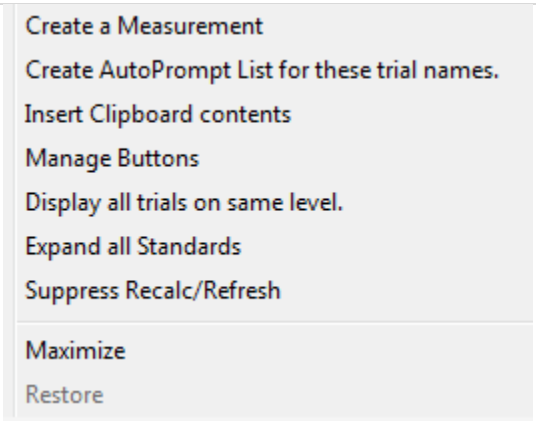
Make sure, that you have placed the sample before

Attention: To avoid, that the time frame for the total number of measurements exceeds the calibration time – either adapt the timer there or enter a 0 to exclude the calibration timer control.

How can I enter a new standard with color metric data only?

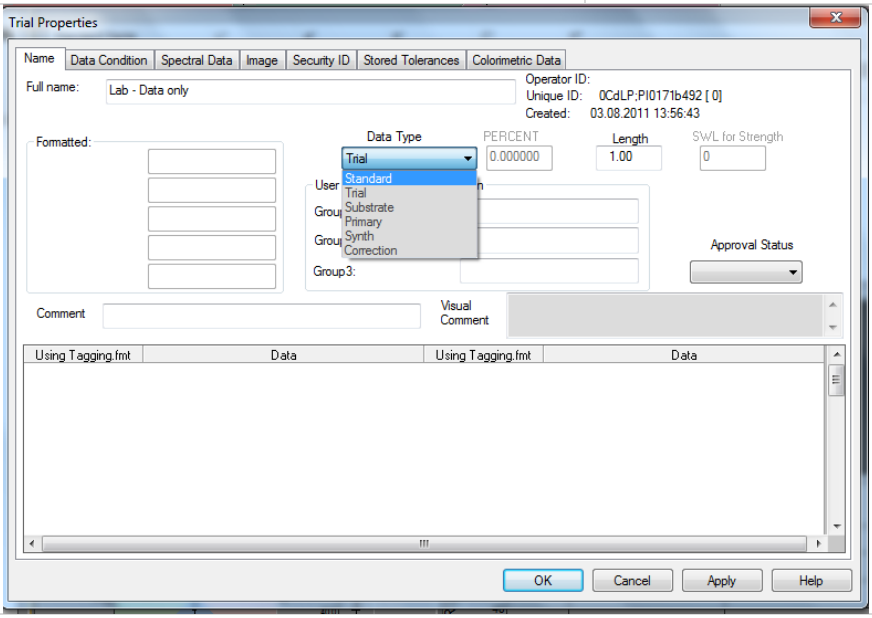
Sometimes customers provide standard specification in terms of L*a*b* - data only. The question is – how can these be entered into the system?

- Step 1 – Choose the job – in which you want to store the new standard
- Step 2 – Do a right mouse click into the Tree-View Data section (alternately press the [insert] button on your keyboard



The right mouse menu will provide you a list of options

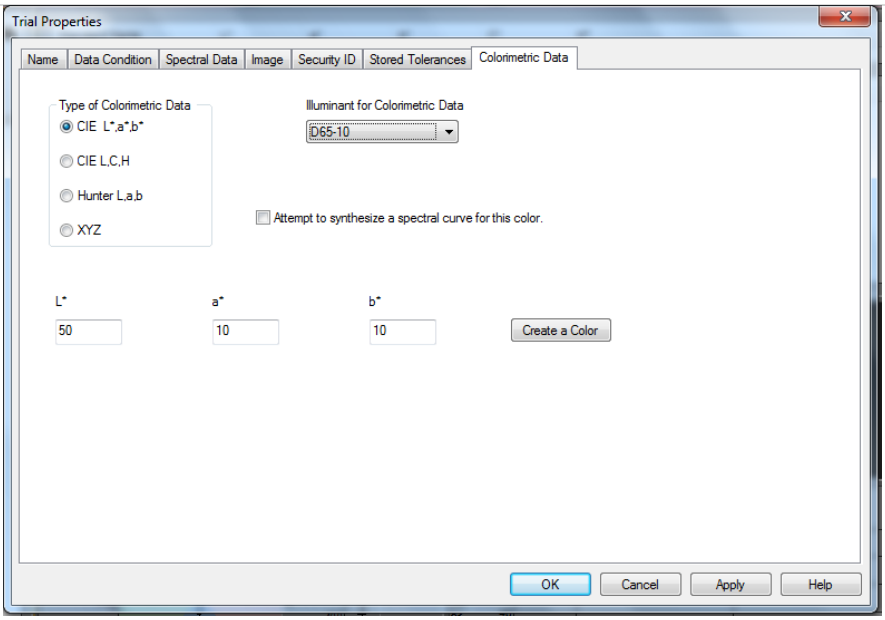
Select the Create a Measurement



- Step 3

This opens the Trial Properties Windows

On the Tab Name – you can enter the name of the sample for which you want to enter the lab-data and the Data Type . If you want to enter Standard Data select Standard



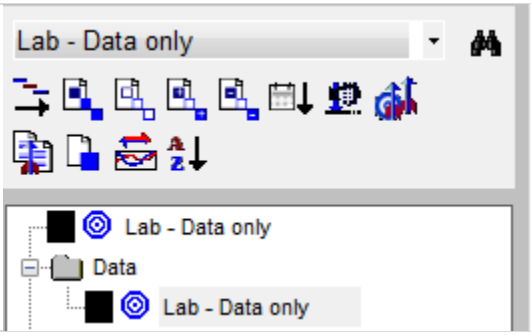
Step 4

Select the type of color metric data

Select the illuminant observer condition of the color metric data

Enter the color metric data

Press [Apply]
Press [OK]



This standard is now available for comparison like any other standard

Attention – It always has to be kept in mind that this standard is only valid for those data entered.

Transmission Measurement

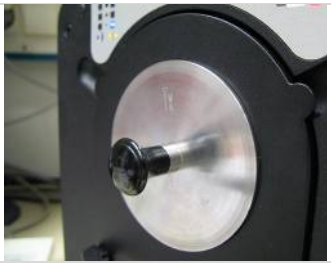
The color or the transmission spectrum of colored liquids or colored solid materials such as foils can be measured with the Color_i7 or Color_i5.
Principally the user can measure the direct (for clear samples) or the total (for turbid sample) Transmission.
Measuring the direct transmission only the direct light beam transmitted by the sample will be considered. Since there is lot of scattering in turbid samples the recommendation is to collect all light transmitted through the sample.

How to prepare for Transmission measurement and how to calibrate

White Standard

The sphere has to be closed with the Calibration White Standard (i5) or with TX-cover (i7).

- The Tx-Cover (see picture) is made from steel and will fixed to the front through the magnetic behavior. It is needed to complete the Ulbricht sphere and it needs to be kept all the time in front of the sphere..
- If the transmission white standard is used this should stay all the time in the position.

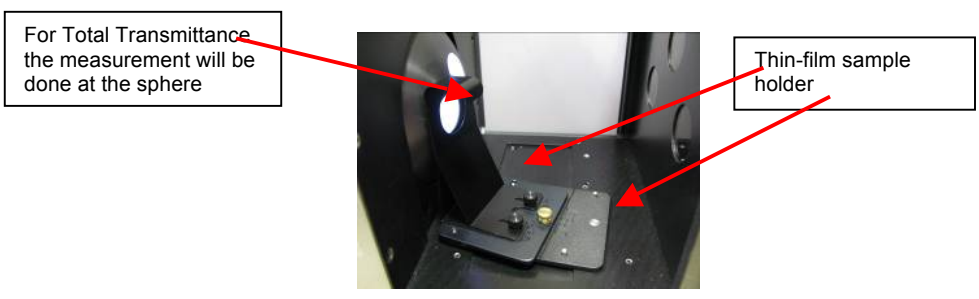


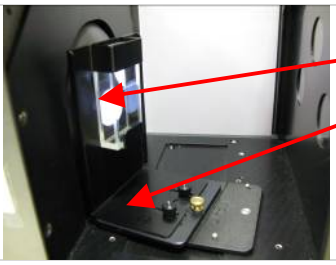
Tx-Cover with integrated white (i7)

Transmission White Standard for Calibration

Sample Holder

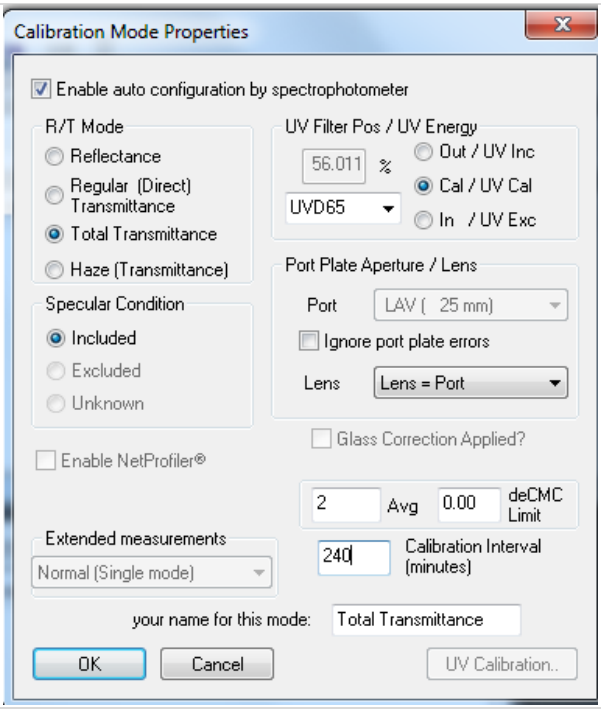
- The thin-film-sample holder or the liquid cell holder can be mounted in the transmission part of the instrument, prior to the calibration. This is decision of the user.
- In case of measurement of liquids, we would recommend to include the empty and cleaned cuvette (quartz) into the calibration process.

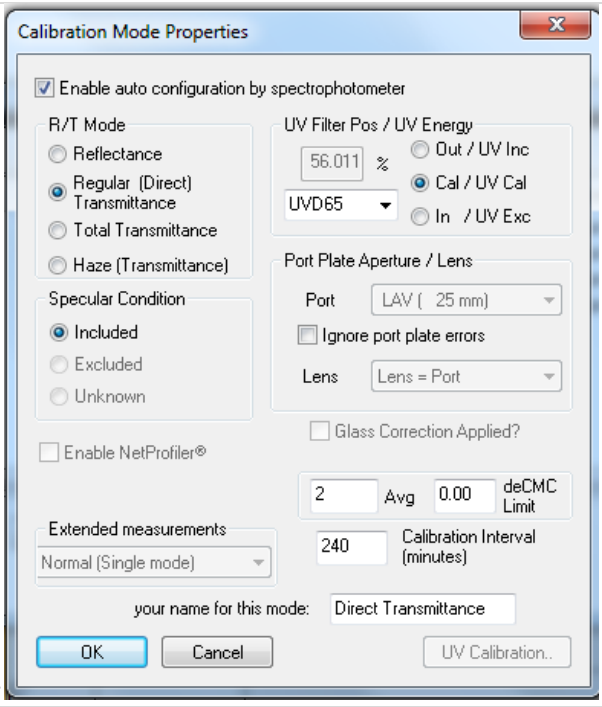




Calibration Mode

In order to do any measurement in iQC a proper measurement mode has to be selected. If it is not yet available it has to be created.





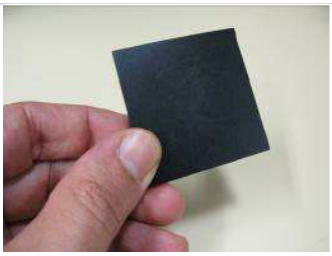
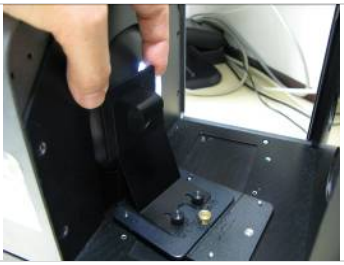
ID	Name of Mode	NextStdz	Average	R/T Mode	Specular	AreaView	UV Energy	Glass	Lens/Port
0	0-Default	Expired	2	RFL	SPI	25.00 mm	UV Cal	No	Lens=P
1	R/T	Expired	2	R/T	SPI	10.00 mm *	UV Cal	No	Lens=P
2	Total Transmittance	Expired	2	TTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
3	Direct Transmittance	Expired	2	RTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
4	(4) Haze	Expired	2	HAZE	SPI	25.00 mm	UV Cal	No	Lens=P

Calibration

Once all preparation have been made and the desired calibration mode has to be selected and the calibration has to be started. (press F4 or the proper icon)

- The calibration will be guided by the Color iQC.
  - Step1 – White calibration
    In the first step the white calibration has to be made. Either the TX sphere cover with integrated white or the White Transmission Standard has to be placed in front of the instrument. It has to be kept all the time in this position.

- Step 2 – Black calibrations
  In the second step the black standard (black plastic chip) – has to be placed next to the sphere opening. The easiest will be to fix the sample between thin-film-holder and the sphere. The sphere opening should be completely covered.

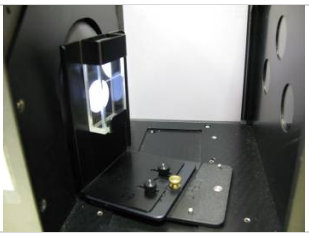
	A black standard (is provided as part of the Transmission Package) will be placed in the cell holder	

How to do Color Measurement in Transmission mode – Total Transmittance

- To do a color measurement in transmission mode the following a job has to be opened/created
- The correct type of calibration mode for the transmission measurement has to be selected

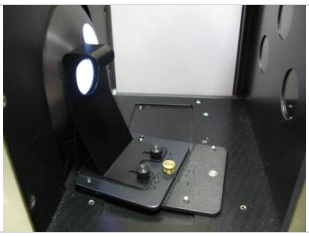
ID	Name of Mode	NextStdz	Average	R/T Mode	Specular	AreaView	UV Energy	Glass	Lens/Port
0	0-Default	Expired	2	RFL	SPI	25.00 mm	UV Cal	No	Lens=P
1	R/T	Expired	2	R/T	SPI	10.00 mm *	UV Cal	No	Lens=P
2	Total Transmittance	Expired	2	TTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
3	Direct Transmittance	Expired	2	RTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
4	(4) Haze	Expired	2	HAZE	SPI	25.00 mm	UV Cal	No	Lens=P

- If calibration expired – calibration has to be made



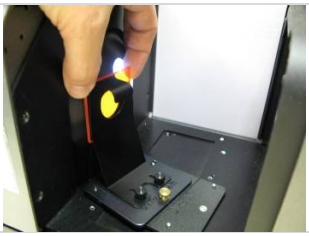
Transparent liquid samples

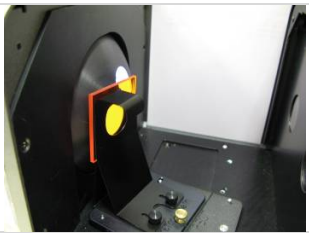
- For liquid samples the cell holder has to be mounted to the base panel. This will fix direct into the wholes on the ground of the instrument. The cell holder should be placed very close to the sphere whole.
- The liquid sample will be entered into the cuvette and this will be placed into the cell holder.



Transparent plastic chips

- The thin-foils-sample-holder will be mounted to the base panel. This will fix directly into the wholes on the ground of the instrument. The sample holder should be placed very close to the sphere whole.
- The liquid sample will be entered into the sample holder.





- Once the sample has been presented correctly the measurement can be activated (F6) or  within the iQC program.
- The iQC program works for transmission samples in the same way as it would with opaque samples – standards and trials can be measured, evaluations can be done afterwards and reports can be generated

How to do Color Measurement in Transmission mode – Direct Transmittance

- To do a color measurement in transmission mode the following a job has to be opened/created
- The correct type of calibration mode for the transmission measurement has to be selected

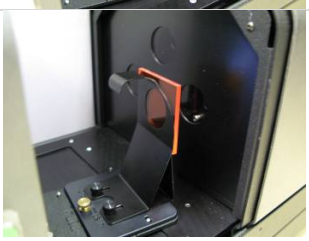
ID	Name of Mode	NextStdz	Average	R/T Mode	Specular	AreaView	UV Energy	Glass	Lens/Port
0	0-Default	Expired	2	RFL	SPI	25.00 mm	UV Cal	No	Lens=P
1	R/T	Expired	2	R/T	SPI	10.00 mm *	UV Cal	No	Lens=P
2	Total Transmittance	Expired	2	TTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
3	Direct Transmittance	Expired	2	RTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
4	(4) Haze	Expired	2	HAZE	SPI	25.00 mm	UV Cal	No	Lens=P

- If calibration expired – calibration has to be made

Transparent plastic chips

- The thin-foils-sample-holder will be mounted to the base panel. The base panel will fix directly into the wholes on the ground of the instrument. The sample holder should be placed very close to the lens.
- The plastic chip sample will be entered into the thin-foils-sample-holder

- Once the sample has been presented correctly the measurement can be activated (F6)  within the iQC program.
- The iQC program works for transmission samples in the same way as it would with opaque samples – standards and trials can be measured, evaluations can be done afterwards and reports can be generated

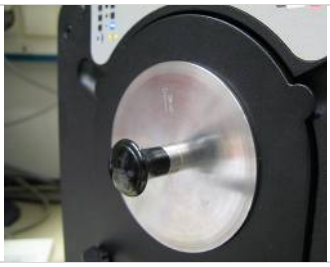


Color Measurement in Transmission mode – Haze

With the i5 or i7 instrument the haze of samples can be measured. To measure haze two single measurements have to be made one with a white calibration standard in place and one with a black (Black Standard) in place. Only those samples with a good dispersion and good resistance of sedimentation should be measured.

How to prepare for Haze Calibration?

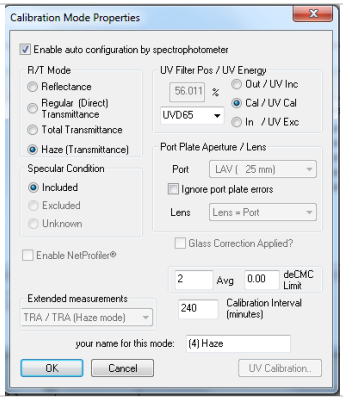
- First of all the sphere has to be closed with the Calibration White Standard or with TX-cover.
  - The Tx-Cover (see picture) is made from steel and will fixed to the front through the magnetic behavior. It is needed to complete the Ulbricht sphere.
  - If the other option is to use the white standard



Tx-Cover with integrated white

Transmission White Standard for Calibration

  - The thin-film-sample holder or the liquid cell holder can be mounted in the transmission part of the instrument, prior to the calibration. This is decision of the user.
  - In case of measurement of liquids, we would recommend to include the empty and cleaned cuvette (quartz) into the calibration process.



ID	Name of Mode	NextStdz	Average	R/T Mode	Specular	AreaView	UV Energy	Glass	Lens/Port
0	0-Default	Expired	2	RFL	SPI	25.00 mm	UV Cal	No	Lens=P
1	R/T	Expired	2	R/T	SPI	10.00 mm *	UV Cal	No	Lens=P
2	Total Transmittance	Expired	2	TTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
3	Direct Transmittance	Expired	2	RTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
4	(4) Haze	Expired	2	HAZE	SPI	25.00 mm *	UV Cal	No	Lens=P

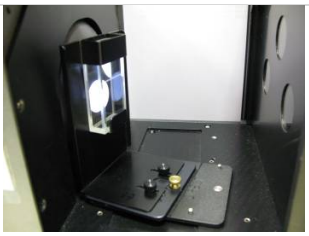
- Once the preparation has been made the desired calibration mode has to be selected and the calibration has to be started. (press F4 or the proper icon)
- The calibration will be guided by the Color iQC.
  - Step1 – White calibration
    In the first step the white calibration has to be made. Either the TX sphere cover with integrated white or the white transmission standard has to be placed in front of the instrument.
  - Step 2 – Black calibration with the black trap
    In the second step the black trap will be requested. Place it in front of the spectro and do a measurement.

How to do Haze Measurement?

- To do a haze measurement a job has to be opened/created
- The correct type of calibration mode for the transmission measurement has to be selected

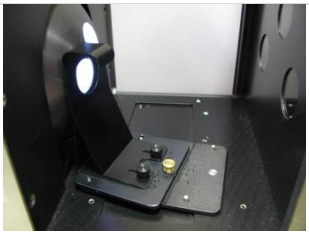
ID	Name of Mode	NextStdz	Average	R/T Mode	Specular	AreaView	UV Energy	Glass	Lens/Port
0	0-Default	Expired	2	RFL	SPI	25.00 mm	UV Cal	No	Lens=P
1	R/T	Expired	2	R/T	SPI	10.00 mm *	UV Cal	No	Lens=P
2	Total Transmittance	Expired	2	TTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
3	Direct Transmittance	Expired	2	RTRAN	SPI	25.00 mm *	UV Cal	No	Lens=P
4	(4) Haze	Expired	2	HAZE	SPI	25.00 mm *	UV Cal	No	Lens=P

- If calibration expired – calibration has to be made



Liquid samples

- For liquid samples the cell holder has to be mounted to the base panel. This will fix direct into the wholes on the ground of the instrument. The cell holder should be placed very close to the sphere whole.
- The liquid sample will be entered into the cuvette and this will be placed into the cell holder.
- The measurement will be done in two steps
    - over the white transmission standard
    - over the black trap
- Once the measurement has been done evaluations can be done and reports can be generated

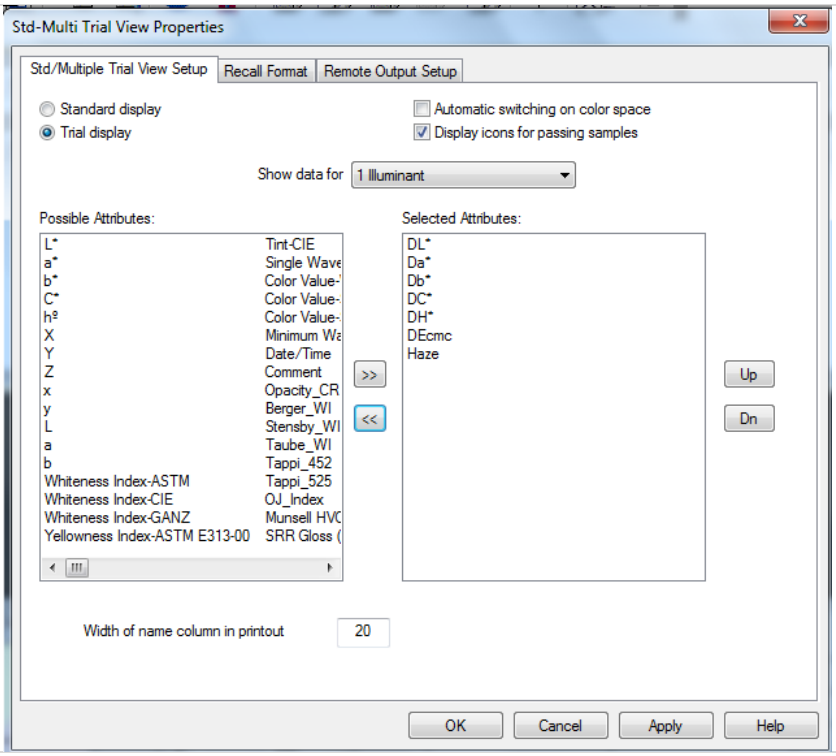


Plastic chips and foils

- The thin-foils-sample-holder will be mounted to the base panel. This will fix directly into the wholes on the ground of the instrument. The sample holder should be placed very close to the sphere whole.
- The liquid sample will be entered into the sample holder.
- The measurement will be done in two steps
    - over the white transmission standard
    - over the black trap

Once the measurement has been done evaluations can be done and reports can be generated

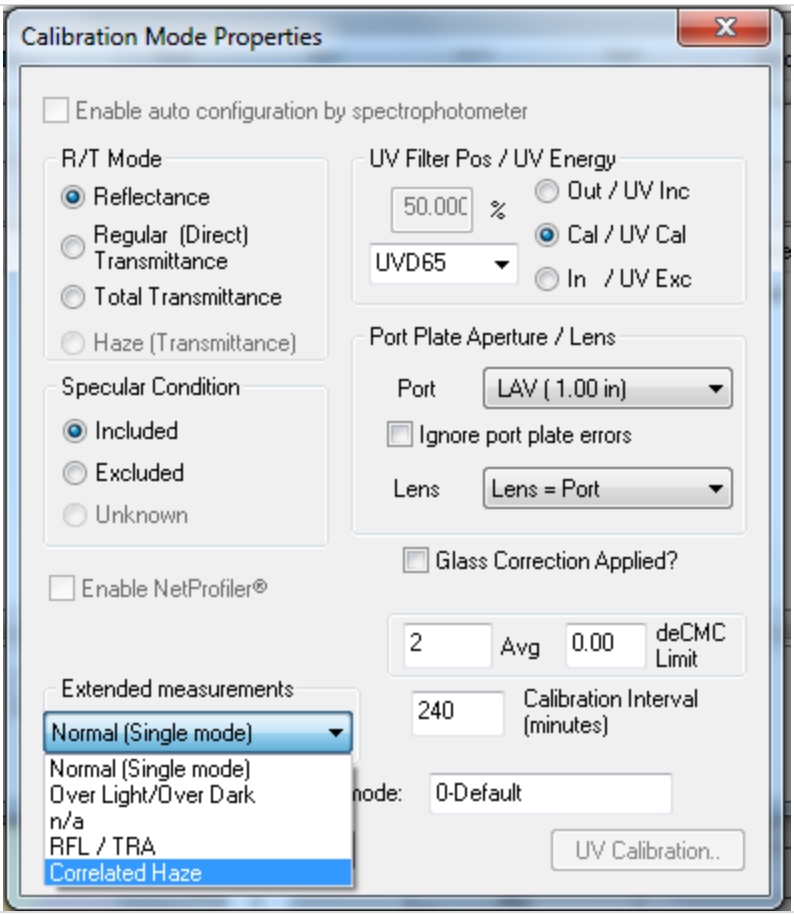
How to set up the Multi Trial view to see the Haze Data?



In order to show the measured haze data the haze information has to be added to the multi trial view.
You can do this by clicking into the multi trial and press the right mouse key. Then select properties and the Multi Trial View Windows will open.
Select the Haze information in the box of possible attributes and press the double arrow key facing to the right. This will move the haze to the right box.

How to measure correlated Haze on a 7000A instrument

Also with the 7000A instrument the haze of samples can be measured. However there is the little difference to the above information on the i5 and i7 instrument. Due to the fact, that the 7000A instrument doesn´t require a black calibration in the transmission mode, the Haze function cannot be done in this mode. For the 7000A instrument you will have to use the correlated haze.

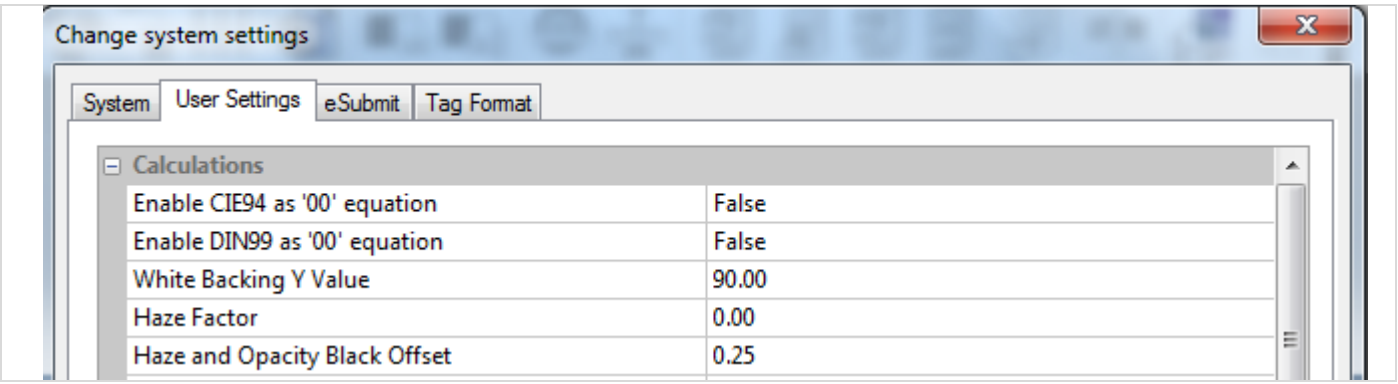


On the 7000A instrument a correlated haze measurement can be done, when in the R/T Mode with the activated Reflectance the option correlated haze is selected

Calibrate the instrument in the Reflectance Mode.
Place the samples within transmission chamber – place them close to the sphere and follow the instruction to place the black and white standard for the measurement.

Haze Correlation

Even a sphere based spectrophotometer can be used to measure a correlated Haze – it is not really build up like a Haze Meter. Therefore it might well be, that the results achieved by the sphere based spectrophotometer do not agree to those of the Haze meter. If a series of samples with a haze value available – the results from the spectrophotometer might be adjustable to the target results. Within the user settings (F2 if no job is loaded) of the iQC program – there are two sets data, which can be used to influence the results.
The Haze factor is a linear factor (default value = 0)
The Haze and Opacity Black Offset factor is an offset from 0.



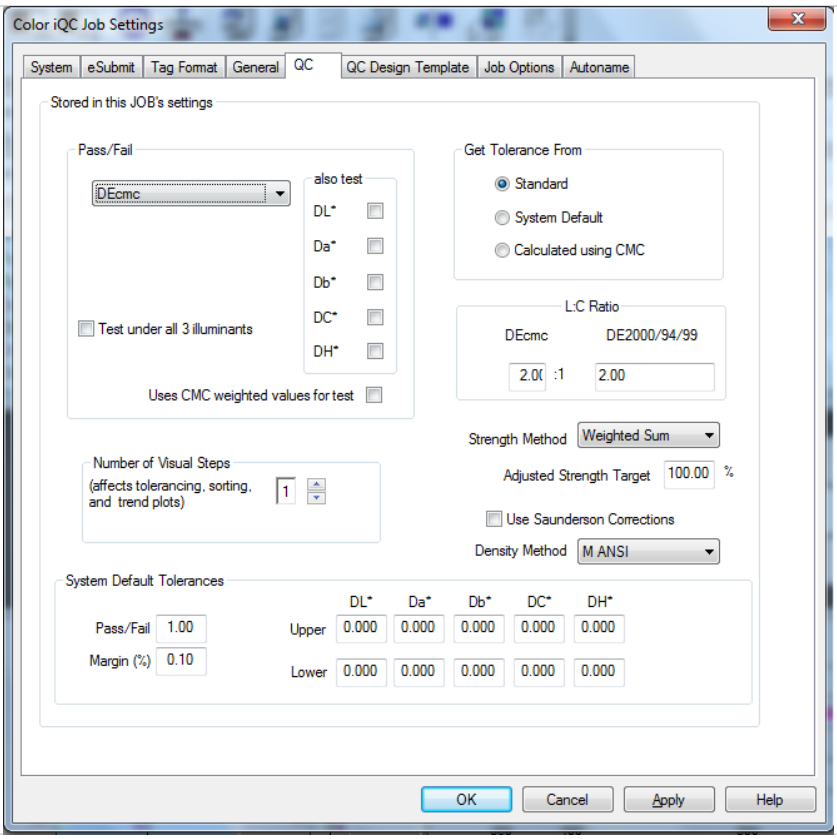
Tolerances

Program workflow for tolerance settings

Color iQC and Color iMatch supports 3 different types of general tolerance handling.

- Individual standard settings
- The same tolerances for all standards
- Automatic CMC tolerancing

This general tolerance setting is defined in the QC-Setting

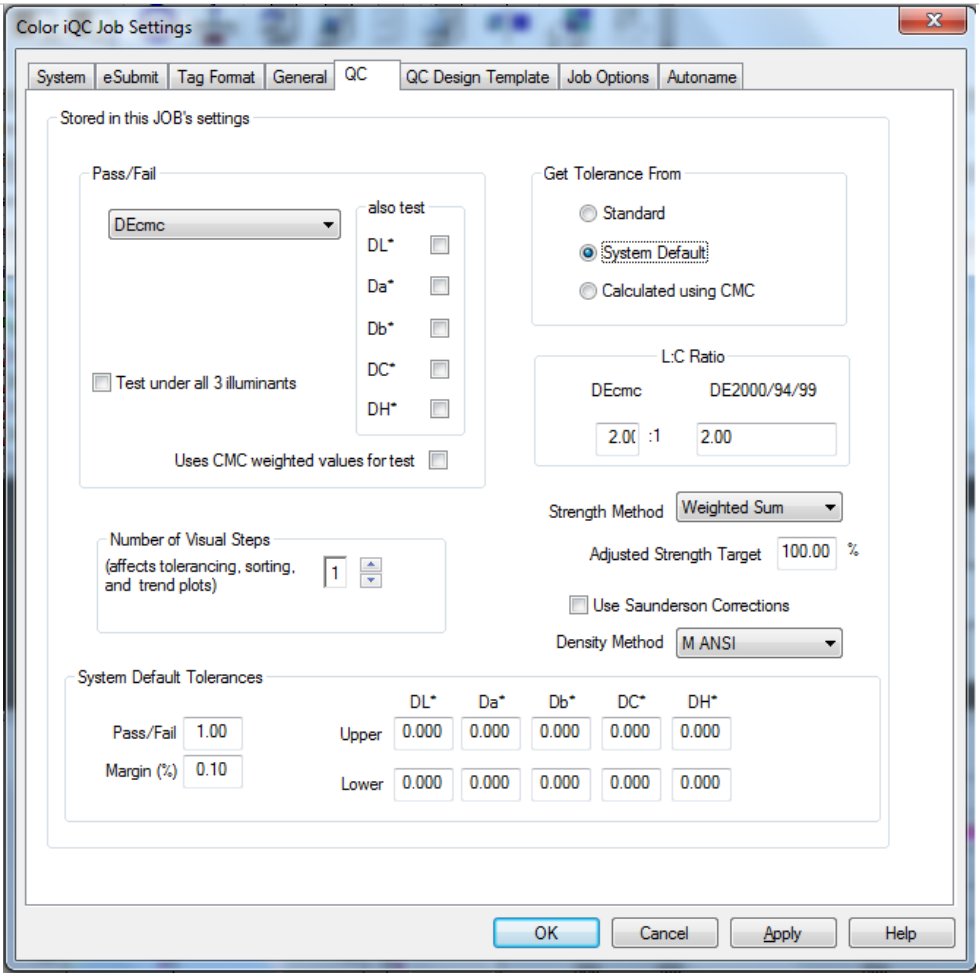


In the Color iQC Job settings - on the tab QC - the user can decide which type of tolerance handling he wants to use.

In case the option "Get Tolerance From" Standard is activated - the program workflow will check first at the selected standard, whether individual tolerances are stored along with the standard. If this is not the case the program workflow will use the system default settings as defined in this window.
In case the system default is activated the program logic will use the tolerance settings as defined in this screen

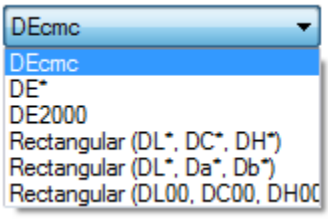
When and how to use system tolerances?

For companies, which do not yet have any experience with individual tolerances and do not have specific customers with individual tolerances for individual standards the use of system tolerance is very often used. Only at one location 1 tolerance setting has to be defined and this will work for all standards



In order to set the program workflow in such way, that no individual tolerances should be considered the “Get Tolerance From System Default” has to be activated.

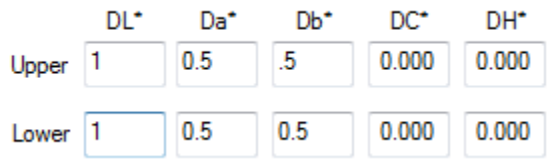
In this case the tolerance data as defined in this screen will be used.



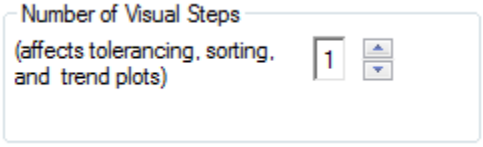
There is a choice of 6 different tolerance systems.
This includes

- DE*
- DEcmc
- DE2000
- Rectangular (DL*, DC*, DH*)
- Rectangular (DL*,Da*,Db*)
- Rectangular (DL00, DC00, DH00)

In the System Default Tolerances the Pass/Fail-Value for the selected tolerance system is defined with a margin value for warning information.



If either the Rectangular (DL*,Da*,Db*) system or the Rectangular (DL*, DC*, DH*) is selected individual tolerances can be defined for each parameter.

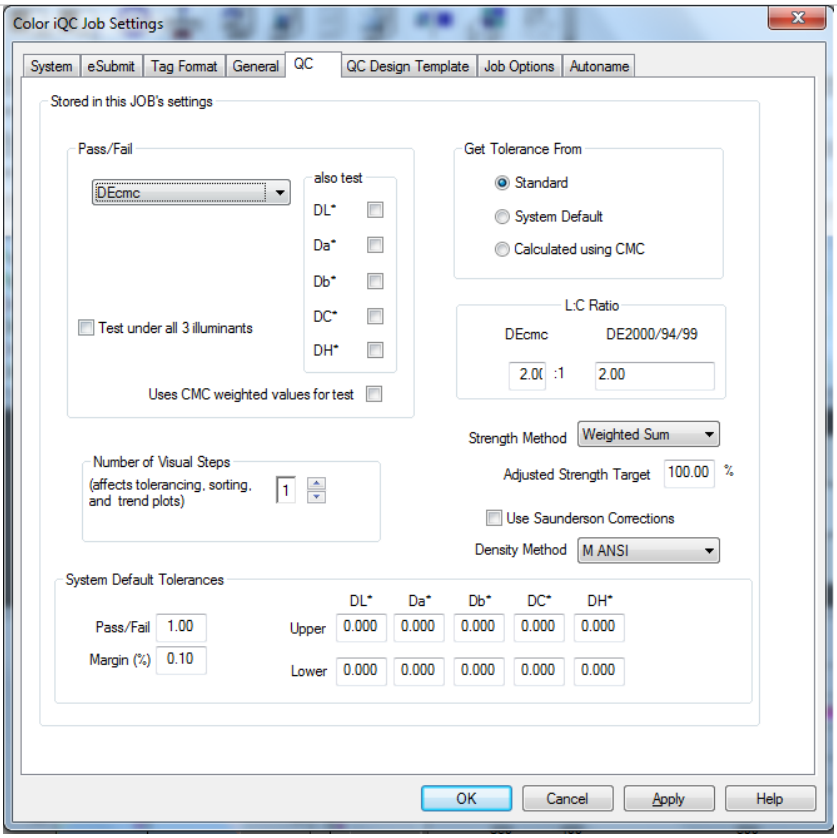


Attention: For the above tolerance setting with de-central tolerances data is only available – if the number of visual sorting steps has been set to 1.

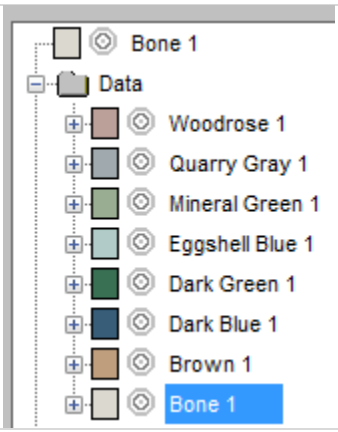
If the function Test under all 3 illuminants (as defined on the Color iQC-Setting Tab General) – for each of the 3 illuminants tolerances can be provided.

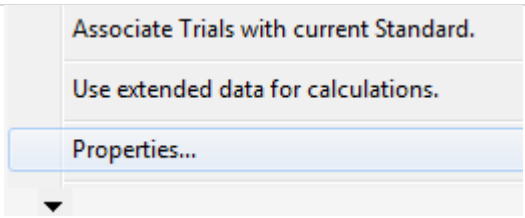
When and how to use individual tolerances for each standard?

The use of individual tolerances for each standard is recommended, if you are working with customers which have individual tolerances for each standard. IQC provides a lot of flexibility to handle such cases. For each standard individual tolerance systems (DE*, DE_{CMC}, DE_{00}, …) as well as individual tolerance values can be used.

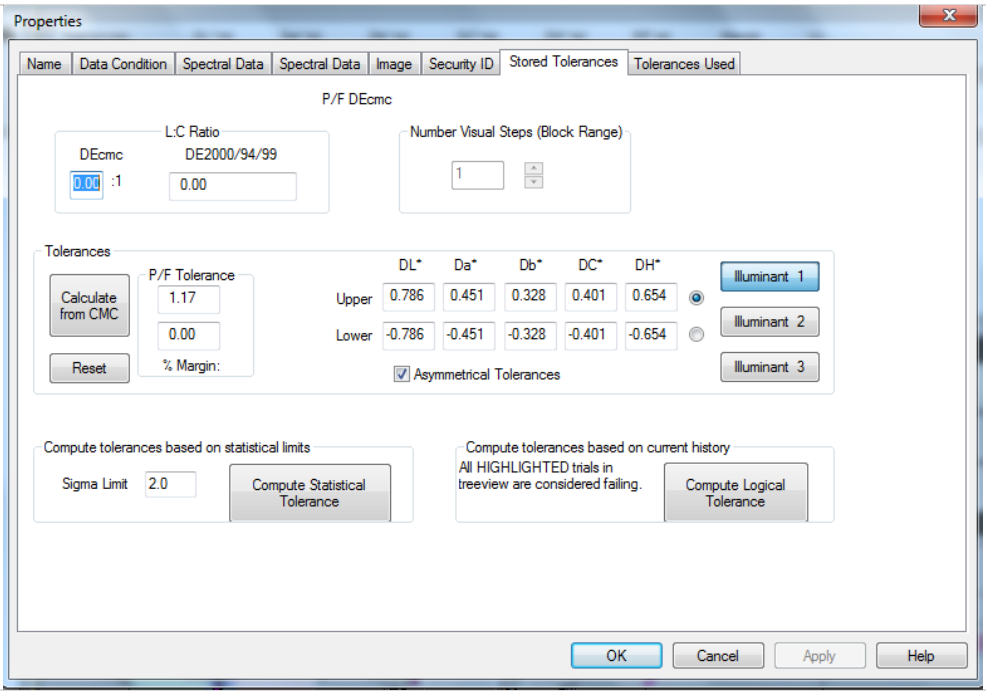


In order to allow individual tolerances for each standard, the selection "Get Tolerance From" Standard has to be activated. In this case the program workflow will check first at the selected standard, whether individual tolerances are stored along with the standard. If this is not the case the program workflow will use the system default settings as defined in this window.
In case the system default is activated the program logic will use the tolerance settings as defined in this screen.





In order to provide individual tolerances to a standard the standard will be have to be marked in the tree view windows and the right mouse key has to be used.
From the option menu the "Properties" function option has to be selected.



In the properties for the selected standard on the tab "Stored Standard" the tolerances for the standard can be set.
The choice includes

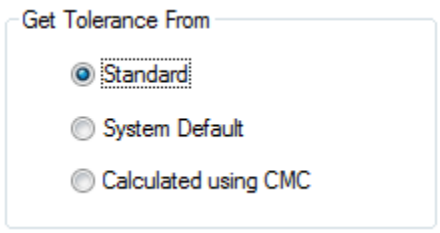
- DE_{CMC}
- Rectangular DL*Da*Db*DC*DH*
- DE2000/94/99

Individual tolerances' for different illuminants can be defined.

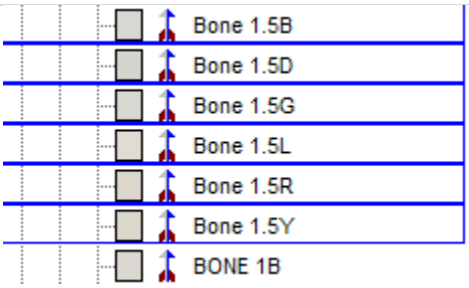
Special functions can be used to calculate tolerances based on existing trail data.

LC-Ratio	If a different ratio of L:C than defined in the system setting should be used it can be set at this point
Number of steps for sorting	In this box the number of sorting steps within the 555 sorting can be defined here
Tolerances	Within this section the tolerances can be defined
Calculate from CMC	The Tolerances DL*, Da* … as shown can be calculated from the manual entered P/F-Tolerance value

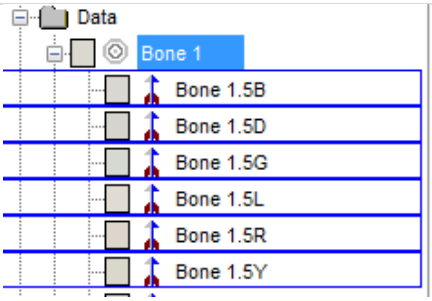
How to calculate individual standard tolerances based on statistical data?

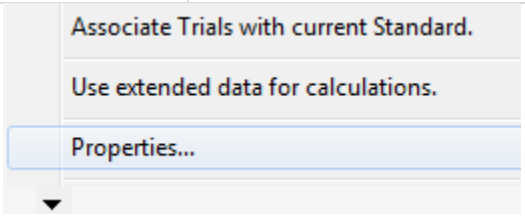


In order to allow use individual tolerances for each standard, the selection "Get Tolerance From" Standard has to be activated. In this case the program workflow will check first at the selected standard, whether individual tolerances are stored along with the standard. If this is not the case the program workflow will use the system default settings as defined in this window.
In case the system default is activated the program logic will use the tolerance settings as defined in this screen.

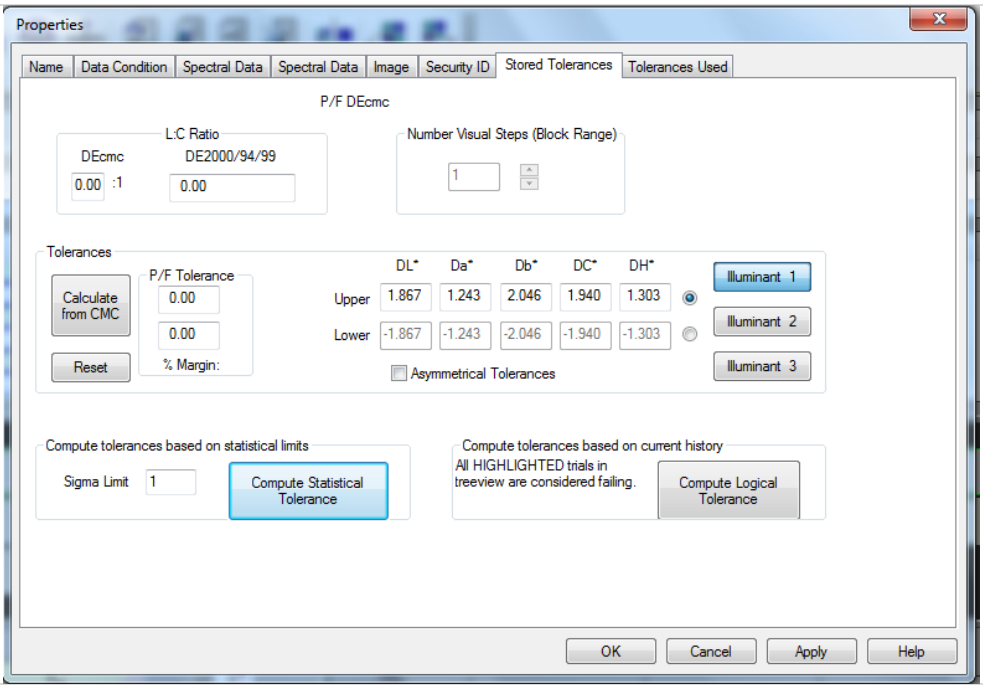


Minimum 10 acceptable trials have to be associated with the standard. There is no difference whether the sample have been marked/selected or not marked/selected.



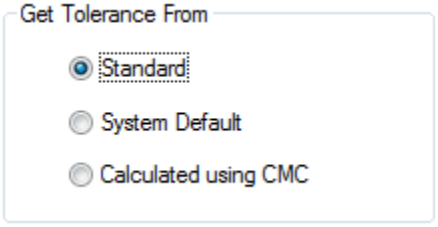


In order to provide individual tolerances to a standard the standard will be have to be marked in the tree view windows and the right mouse key has to be used.
From the option menu the "Properties" function option has to be selected.

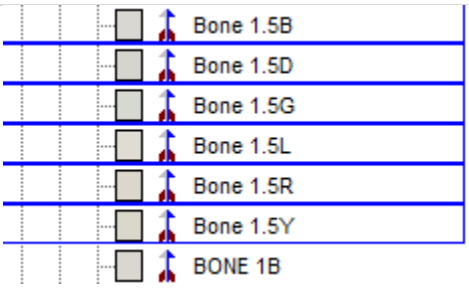


Within the properties of the standard the Tab “Standard Tolerances” has to be selected.
Once a sigma limit has been entered the button “Compute Statistical Tolerances” has to be clicked. A set of DL*, Da*, Db*, DC* and DH* will be provided.

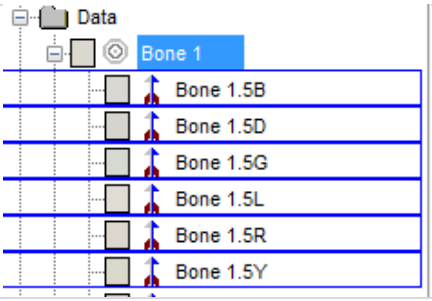
How to calculate logical CMC tolerances for a standard?

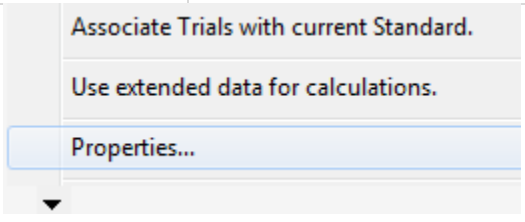


In order to allow using individual tolerances for each standard, the selection "Get Tolerance From" Standard has to be activated. In this case the program workflow will check first at the selected standard, whether individual tolerances are stored along with the standard. If this is not the case the program workflow will use the system default settings as defined in this window.
In case the system default is activated the program logic will use the tolerance settings as defined in this screen.



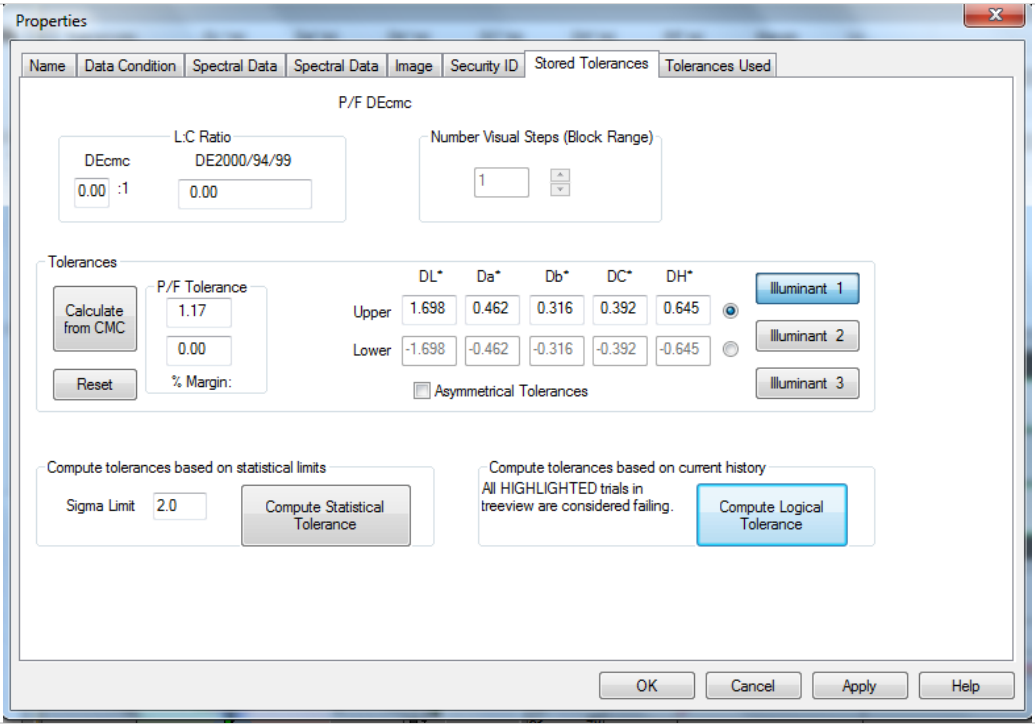
A minimum of 10 samples/trials and at least one selected (fail) in order to compute logical tolerances for a standard. The more samples the better the tolerance generation.





In order to provide individual tolerances to a standard the standard will be have to be marked in the tree view windows and the right mouse key has to be used.
From the option menu the

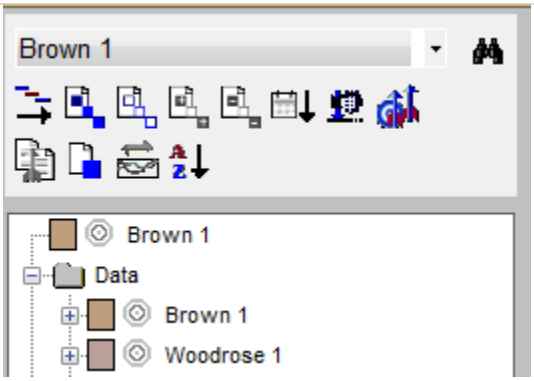
		"Properties" function option has to be selected.



Within the properties of the standard the Tab "Standard Tolerances" has to be selected. Once a sigma limit has been entered the button "Compute Logical Tolerances" has to be clicked. A set of DL*, Da*, Db*, DC* and DH* and the CMC P/F tolerance will be provided.

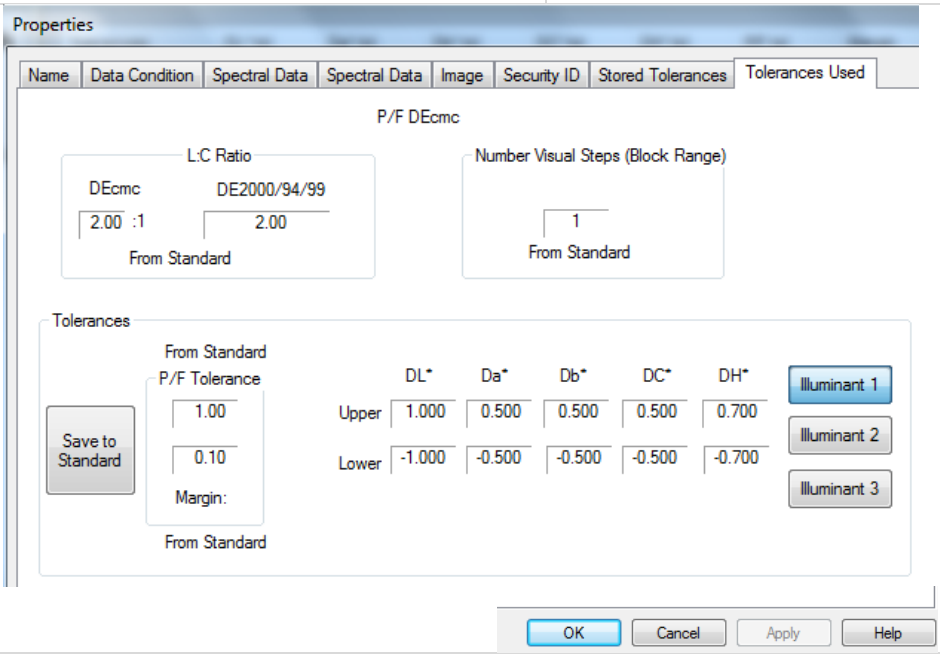
How to transfer tolerances from one standard to another standard?

Sometime it is useful to transfer the tolerances from one standard to another standard. This can easily be done.



Let's assume that the standard Brown 1 contains the tolerances, DL* 1, Da* 0.5, Db* 0.5, DC* 0.5 DH* 0.7 which need to be transferred to Woodrose 1 – the following way of operation should be used.

- Select Brown 1 (the standard, which provides the tolerances) as the current standard
- Mark Woodrose 1 (the standard, which should receive the tolerances)
- Press right mouse key and select Properties



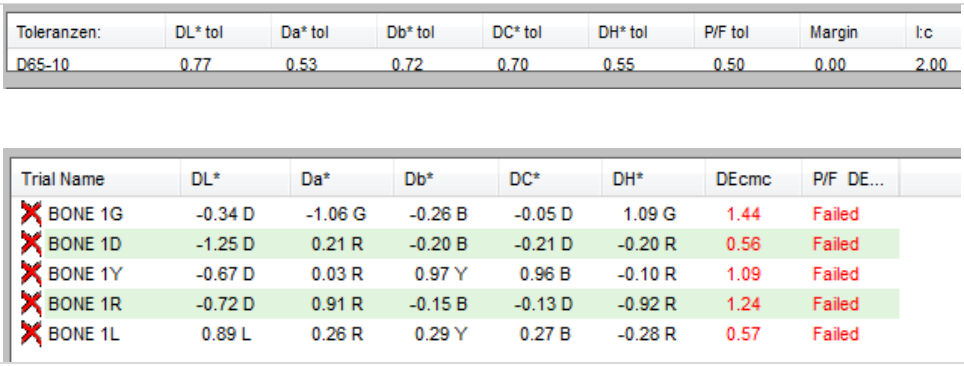
In the tolerance used the last used tolerances will be shown – by pressing Save to Standard – these tolerances will be stored to the standard.

Which tolerances are shown and used?

As indicated earlier iQC a very complex and flexible way to handle tolerances. Which tolerances are shown and used for Pass/Fail – depends on the several settings in the System Defaults and in the standard properties.

Information about System settings you will find here: When and how to use system tolerances?
Information about Standard properties: When and how to use individual tolerances for each standard?

In the iQC program tolerances and Pass/Fail-Decisions will be shown in the Standard/Multi Trial View.



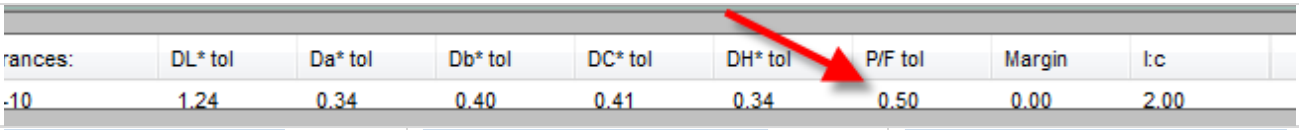
Toleranzen:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	l:c
D65-10	0.77	0.53	0.72	0.70	0.55	0.50	0.00	2.00

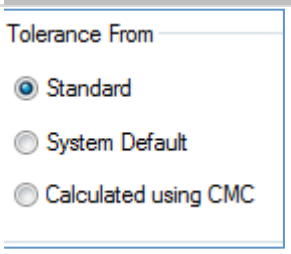
Trial Name	DL*	Da*	Db*	DC*	DH*	DEcmc	P/F DE...
BONE 1G	-0.34 D	-1.06 G	-0.26 B	-0.05 D	1.09 G	1.44	Failed
BONE 1D	-1.25 D	0.21 R	-0.20 B	-0.21 D	-0.20 R	0.56	Failed
BONE 1Y	-0.67 D	0.03 R	0.97 Y	0.96 B	-0.10 R	1.09	Failed
BONE 1R	-0.72 D	0.91 R	-0.15 B	-0.13 D	-0.92 R	1.24	Failed
BONE 1L	0.89 L	0.26 R	0.29 Y	0.27 B	-0.28 R	0.57	Failed

Tolerances are shown in the Standard/Multi Trial View, if the option is activated.

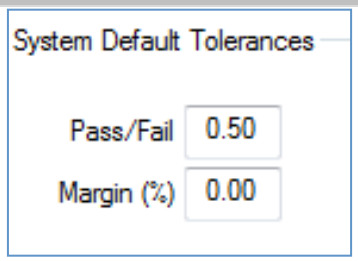
Decisions about P/F are based on the displayed tolerances and the system settings.

Tolerances – P/F on Total difference only

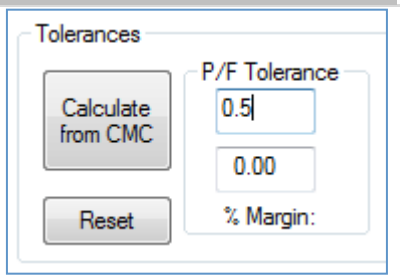




System Settings

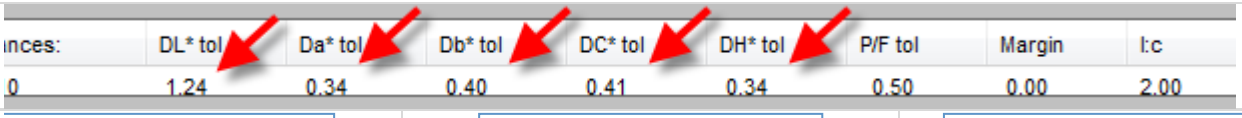


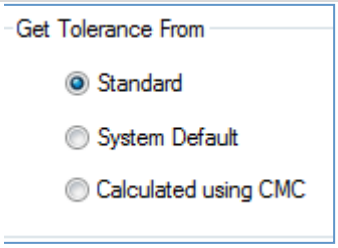
System Default Tolerances



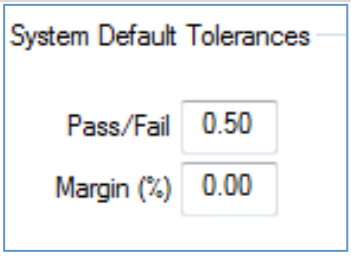
Standard Tolerances

- In the Systemsettings (F2-Tab:QC) it is defined where to get the tolerances from
- Additional the System Tolerance is defined at the this location
- The Tolerance for the standard is defined for each standard in its properties
- Whats shown in the tolerance display in the iQC depends on the settings according to the following decision flow.
  - 1
    - "Get Tolerance From" = Standard
    - P/F-value for the Standard = available
    - Show: P/F tolerances from Standard
  - 2
    - "Get Tolerance From" = Standard
    - P/F-value for the standard = 0
    - P/F-value for System Default Tolerances = available
    - Show: P/F of System Default Tolerances
  - 3
    - "Get Tolerance From" = Standard
    - P/F-value for the standard = 0
    - P/F-value for System Default Tolerances = 0
    - Show: 0
      - Attention: A Pass/Fail decision is still done on CMC=1
  - 4
    - "Get Tolerance From" = Systemstandard
    - P/F-value for System Default Tolerances = available
    - Show: P/F of System Default Tolerances
  - 5
    - "Get Tolerance From" = Calculated using CMC
    - Show = 0
      - Attention: A Pass/Fail deicision is still done on CMC=1

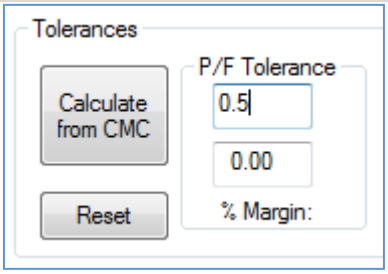




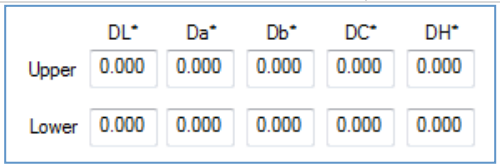
System-Einstellungen



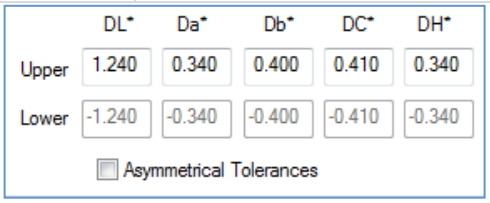
Systemstandard



Standard Toleranz



Systemstandard Attribute Toleranzen

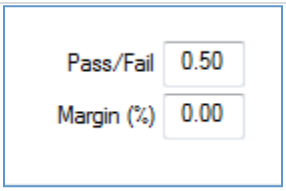


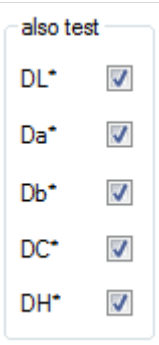
Standard Attribute Toleranzen

- In the Systemsettings (F2-Tab:QC) it is defined where to get the tolerances from
- Additional the System Tolerance is defined at the this location
- The Tolerance for the standard is defined for each standard in its properties
- What' s shown in the DL* Da" Db" tolerance display in the iQC depends on the settings according to the following decision flow.
  - 1
    - Get Tolerance From = Standard
    - Standard Attribute Tolerances (dL* da* db" dC" DH*) = available
    - Show: Attribute Tolerance from Standard
  - 2
    - Get Tolerance From = Standard
    - Standard Attribute Tolerances (dL* da* db" dC" DH*) = 0
    - Standard P/F-Tolerance = available
    - Show: Attribute Tolerances calculated based on P/F-value from Standard
  - 3
    - Get Tolerance From = Standard
    - Standard Attribute Tolerances (dL* da* db" dC" DH*) = 0
    - Standard P/F-Tolerance = 0
    - System Default Attribute Tolerances (dL* da* db" dC" DH*) = available
    - Show: Attribute Tolerances from System
  - 4
    - Get Tolerance From = Standard
    - Standard Attribute Tolerances (dL* da* db" dC" DH*) = 0
    - Standard P/F-Tolerance = 0
    - System Default Attribute Tolerances (dL* da* db" dC" DH*) = 0
    - System Default P/F-Tolerances = available
    - Show: Attribute Tolerances based on calculation of P/F-Tolerances from System
  - 5

        - Get Tolerance From = Standard
        - Standard Attribute Tolerances (dL* da* db” dC” DH*) = 0
        - Standard P/F-Tolerance = 0
        - System Default Attribute Tolerances (dL* da* db” dC” DH*) = 0
        - System Default P/F-Tolerances = 0
        - Show: Attribute Tolerances based on calculation of Default Tolerance of 1
    - 6
        - Get Tolerance From = System Default
        - System Default Attribute Tolerances (dL* da* db” dC” DH*) = available
        - Show: Attribute Tolerances from System Default
    - 7
        - Get Tolerance From = System Default
        - System Default Attribute Tolerances (dL* da* db” dC” DH*) = 0
        - System Default P/F-Tolerance = available
        - Show: Attribute Tolerances calculated from System P/F-Default
    - 8
        - Get Tolerance From = System Default
        - System Default Attribute Tolerances (dL* da* db” dC” DH*) = 0
        - System Default P/F-Tolerance = 0
        - Show: Attribute Tolerances calculated from Default Tolerance of 1
    - 9
        - Get Tolerance From = Calculated from CMC
        - Show: Attribute Tolerances calculated from Default Tolerance of 1

Which decision will be taken?

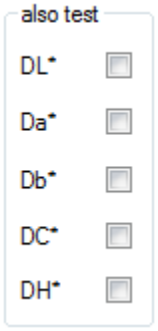




Pass/Fail-value (Standard or System) and the whether or not attributes should be considered for P/F will influence Pass/Fail decision

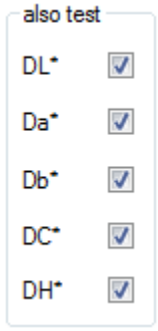
Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	l:c
D65-10	1.24	0.34	0.40	0.41	0.34	0.50	0.00	2.00

Trial Name	DL*	Da*	Db*	DC*	DH*	DEcmc	P/F DE...
BONE 1G	-0.34 D	-1.06 G	-0.26 B	-0.05 D	1.09 G	1.44	Failed
BONE 1D	-1.25 D	0.21 R	-0.20 B	-0.21 D	-0.20 R	0.56	Failed
BONE 1Y	-0.67 D	0.03 R	0.97 Y	0.96 B	-0.10 R	1.09	Failed
BONE 1R	-0.72 D	0.91 R	-0.15 B	-0.13 D	-0.92 R	1.24	Failed
BONE 1L	0.89 L	0.26 R	0.29 Y	0.27 B	-0.28 R	0.57	Failed



In this case a P/F will be done on the P/F-value only – since attributes are not checked. All samples, which exceed a DEcmc 0.5 will be be failed. All fails will be shown in red color

Trial Name	DL*	Da*	Db*	DC*	DH*	DEcmc	P/F DE...
BONE 1G	-0.34 D	-1.06 G	-0.26 B	-0.05 D	1.09 G	1.44	Failed
BONE 1D	-1.25 D	0.21 R	-0.20 B	-0.21 D	-0.20 R	0.56	Failed
BONE 1Y	-0.67 D	0.03 R	0.97 Y	0.96 B	-0.10 R	1.09	Failed
BONE 1R	-0.72 D	0.91 R	-0.15 B	-0.13 D	-0.92 R	1.24	Failed
BONE 1L	0.89 L	0.26 R	0.29 Y	0.27 B	-0.28 R	0.57	Failed

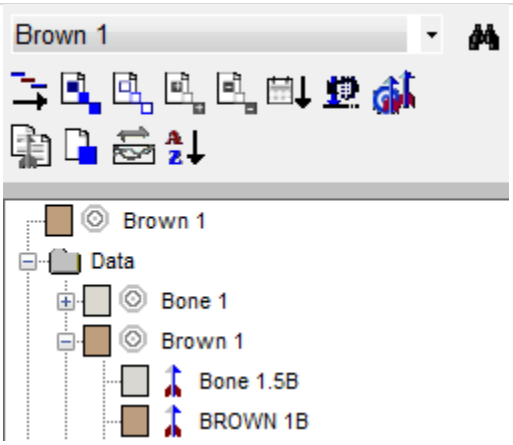


In this case also the color attributes will be used for P/F. All trials, which exceed the tlerances as show in the tolerance window will be failed. All fails will be shown in red color.

QC Tree View - operation

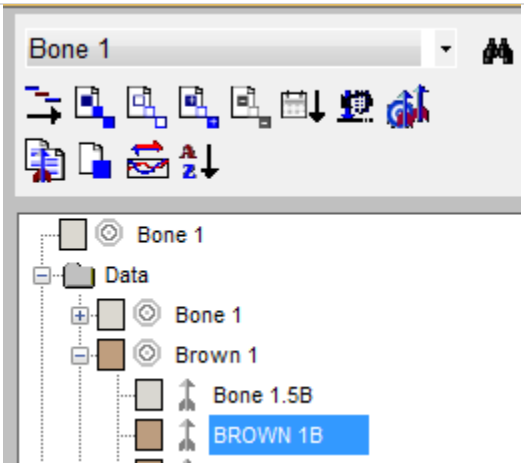
How to change the association of trial to a standard?

Within the operation it can happen, that a trial will by mistake linked to the wrong standard



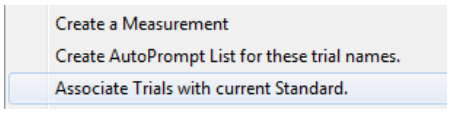
In this example the trial Bone 1.5B has been associated to the standard Brown 1.

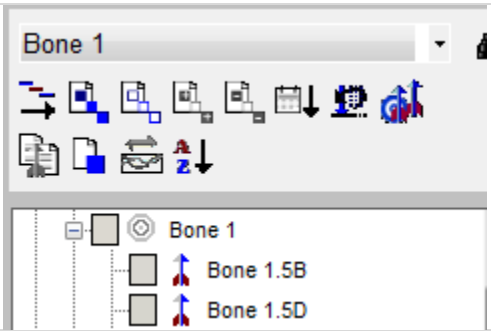
In order to change it the following procedure has to be used.



Within the standard selection field the target standard Bone 1 has to be selected.
Next the trial, which needs to be transferred, has to be marked and right mouse key has to be pressed.

Next the function Associate Trial with current Standard has to be selected

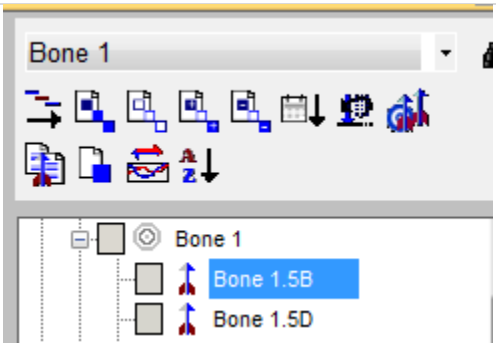




The trial Bone 1.5B has been associated to standard Bone 1

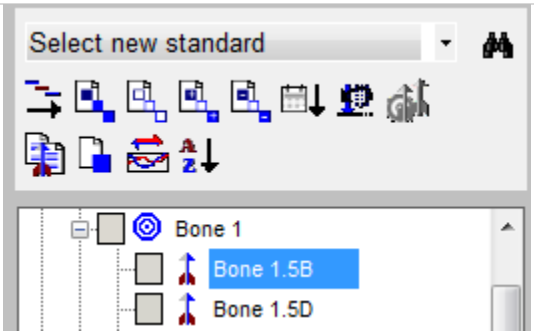
How to remove the association of trial to a standard?

Within the operation it sometimes can be required to completely remove a association to a standard



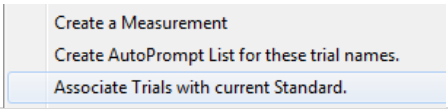
In this example the trial Bone 1.5B has been associated to the standard Bone 1.

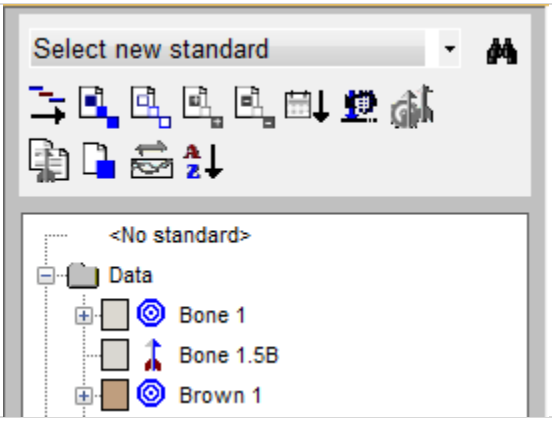
If this association should be completely removed, the following can be done



Within the standard selection field the target standard <no standard> has to be selected.
Next the trial, which needs to be transferred, has to be marked and right mouse key has to be pressed.

Next the function Associate Trial with current Standard has to be selected

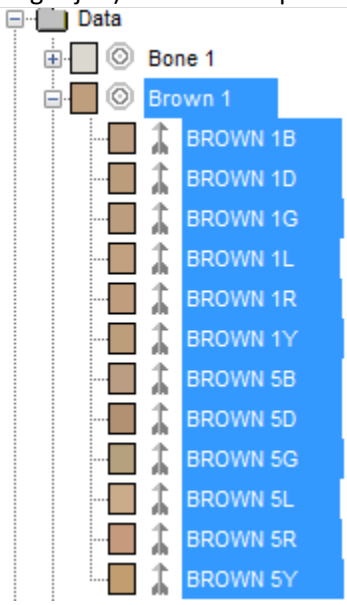
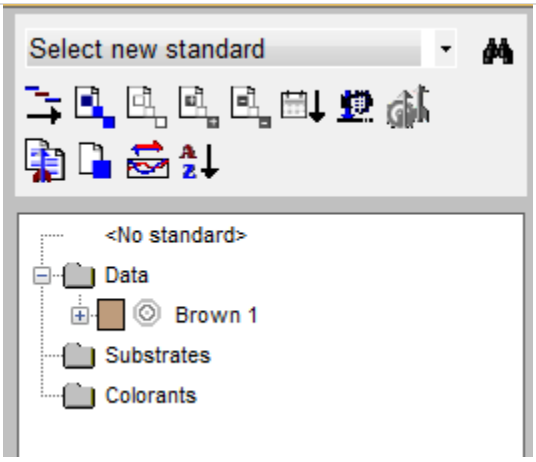




The trail Bone 1.5B is now without any association.

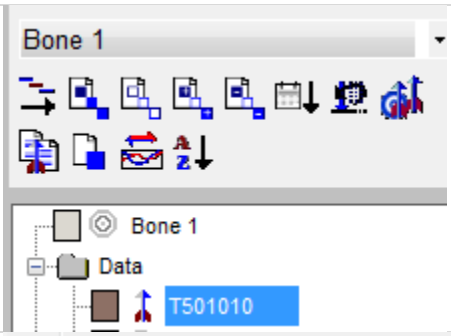
How to copy a series of measurements from one job to another job?

Within the operation it sometimes can be necessary to copy a series of samples from one job to another job.

Both jobs (job with data to be copied and the target job) need to be opend	
	All data to be copied need to be marked. Keeping the mouse pressed the mouse pointer has to be moved to the header of the target job and as soon the target job opens the mouse pointer has to be moved into the data section of the target job. Here the mouse will be released. This copies all the data.
	All data have been transferred to the new job
The same functionality can be reached by masking all samples to be copied – then use [Ctrl] + [C] – then go to the target job and use [Ctrl] + [V]	

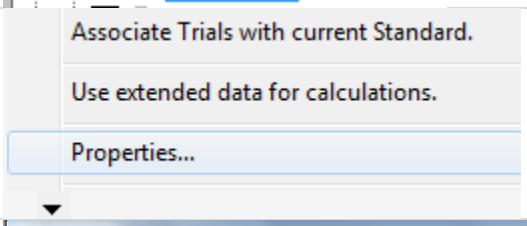
How can I edit a standard or trial?

Sometimes it is required to do some changes to the record of a standard or sample. F.e. change the name or change the type of record or ….

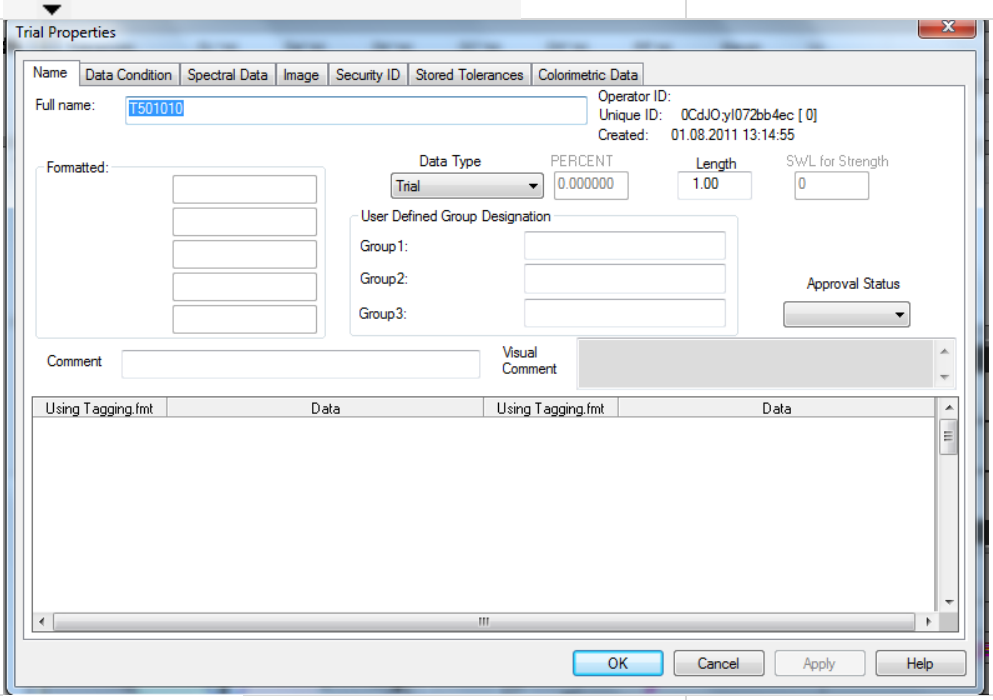


Example:
The trial 501010 has been measured like a trail – it needs to become a standard and a different name has to be applied

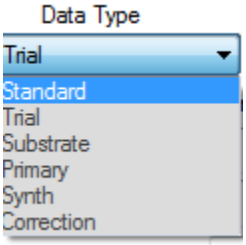
Click the trial – then press the right mouse key



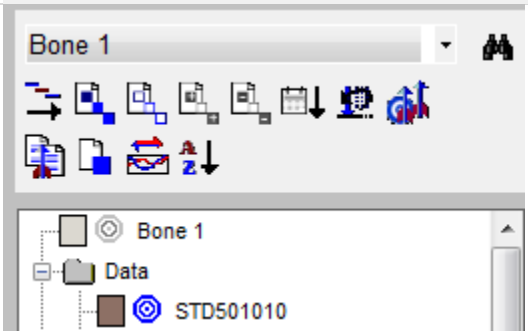
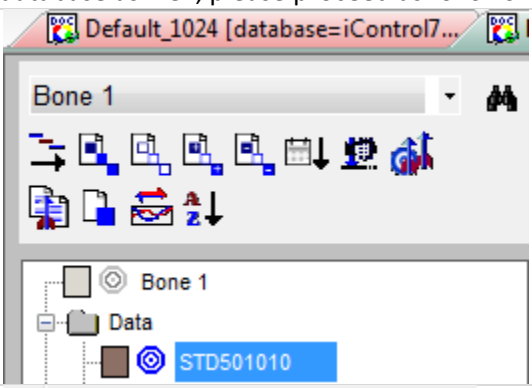
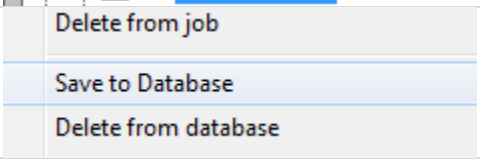
Select the properties function



First we select the Tab Name and do the modification to the Full-Name



Next click on the arrow underneath the Data Type and we select the Standard

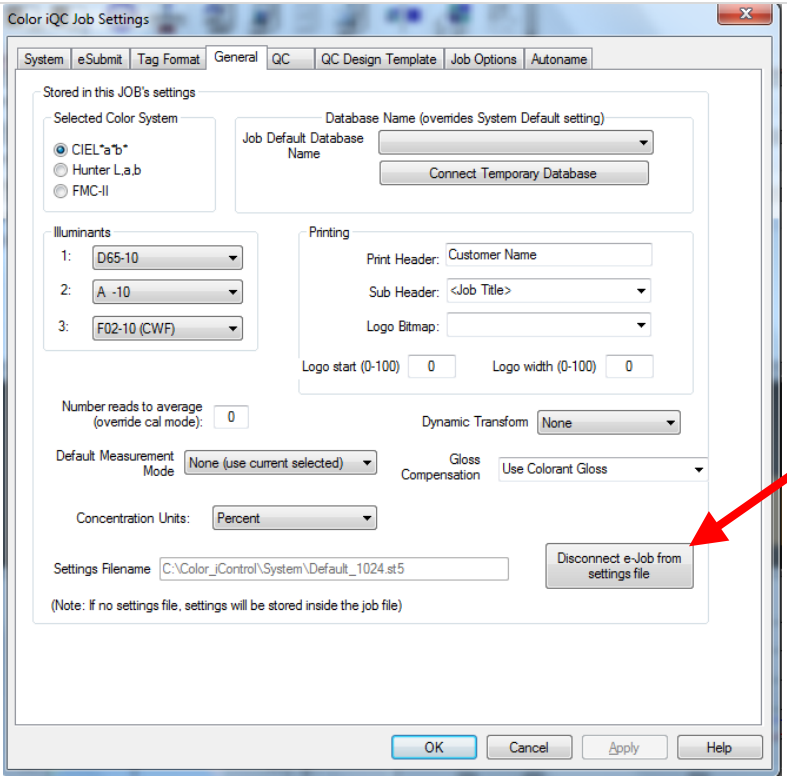
	Finally we press apply and ok
	The previous trail T501010 is now a standard with the name STD501010
These changes will be made to the data in the job only. If you want to make them apply to the data in the database as well, please proceed as follows	
	Click the desired sample
	Select save to database

e-Job's

How can I make sure, that changes, which have been made to a job will still be the same, if I start the job the next time again?

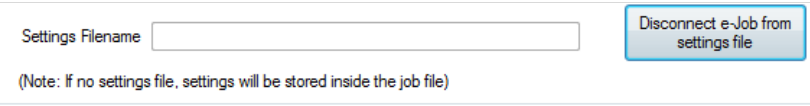
Situation:
I have modified a job to give me very specific display of data and I experience, that anytime i start the job again, that I am back to the old settings.

Solution:
Your job is linked to a setting file which contains a different data display. Anytime you start the job – it will use the settings as defined in this setting. If you want, that the job will keep use your modified settings, you will have disconnect the job from the setting file.



If you want to disconnect the e-job from the default setting – do the following:

- Go to the Color iQC Settings [F2].
- Choose the TAB General
- Here you will find which settings file your job is connected to.
- Click the button [Disconnect e-job from settings file].



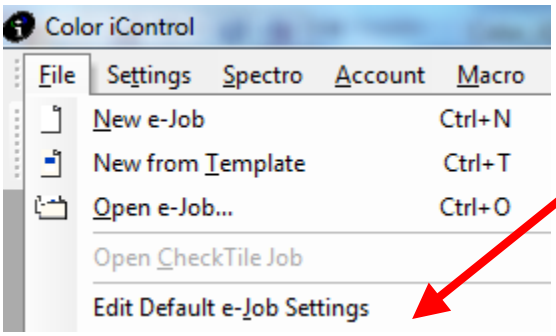
Now the job has been disconnected all settings will be stored within the job now.

How can I make sure, that changes will apply to new jobs?

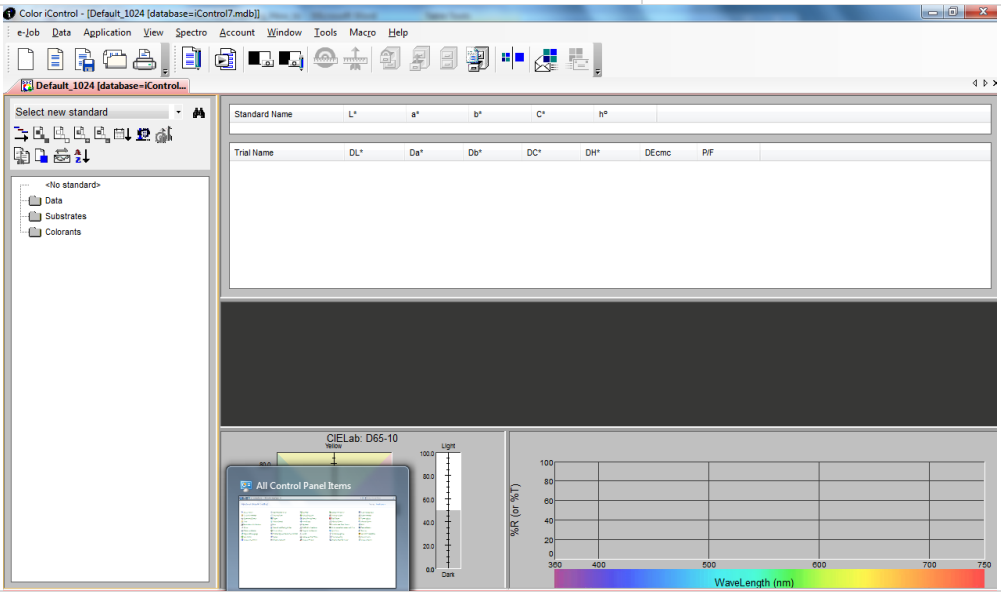
Situation:
Changes have been made to the jobs for example – a new logo is used - or a new selection of illuminants has been applied - or a change in the job options has applied. How can these changes be applied to new jobs?

Solution:
All new jobs, which are started from the default job will use the default job setting. In order to make changes to the appearance of new jobs – the default job has to be edited.
Please proceed in the following way.

- Close any open job (this will give a access to the default job



Open the Menu File and select the option Edit default e-Job Settings

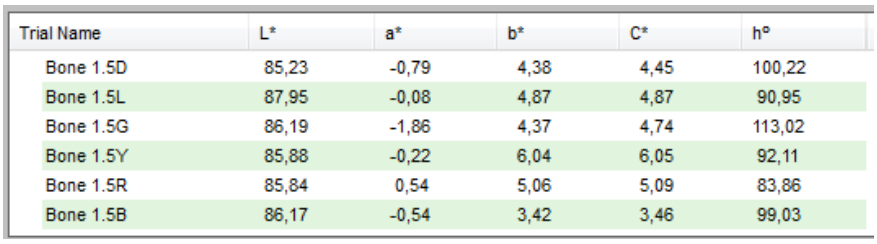


In the Color iQC windows or in the [F2] Color iQC settings make all modifications to match up the desired functions.

Once all modifications have been made save the default job and close it.

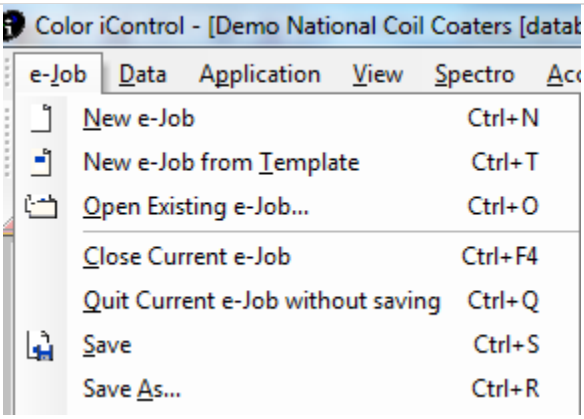
How can I easily get a different view of data for the same standard and trial

Situation:
A customer desired a solution, which does allow to easily switch between an LabCH* display of data and and an display of XYZxy - data

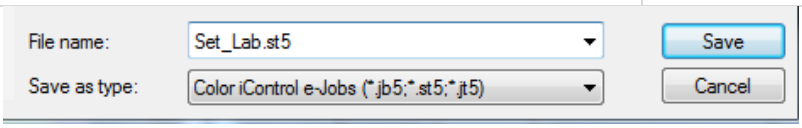


Trial Name	L*	a*	b*	C*	h°
Bone 1.5D	85,23	-0,79	4,38	4,45	100,22
Bone 1.5L	87,95	-0,08	4,87	4,87	90,95
Bone 1.5G	86,19	-1,86	4,37	4,74	113,02
Bone 1.5Y	85,88	-0,22	6,04	6,05	92,11
Bone 1.5R	85,84	0,54	5,06	5,09	83,86
Bone 1.5B	86,17	-0,54	3,42	3,46	99,03

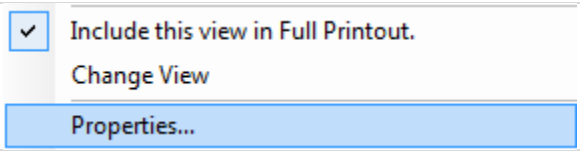
Situation – customer has already an L*a*b* display and wants to change to an XYZxy display



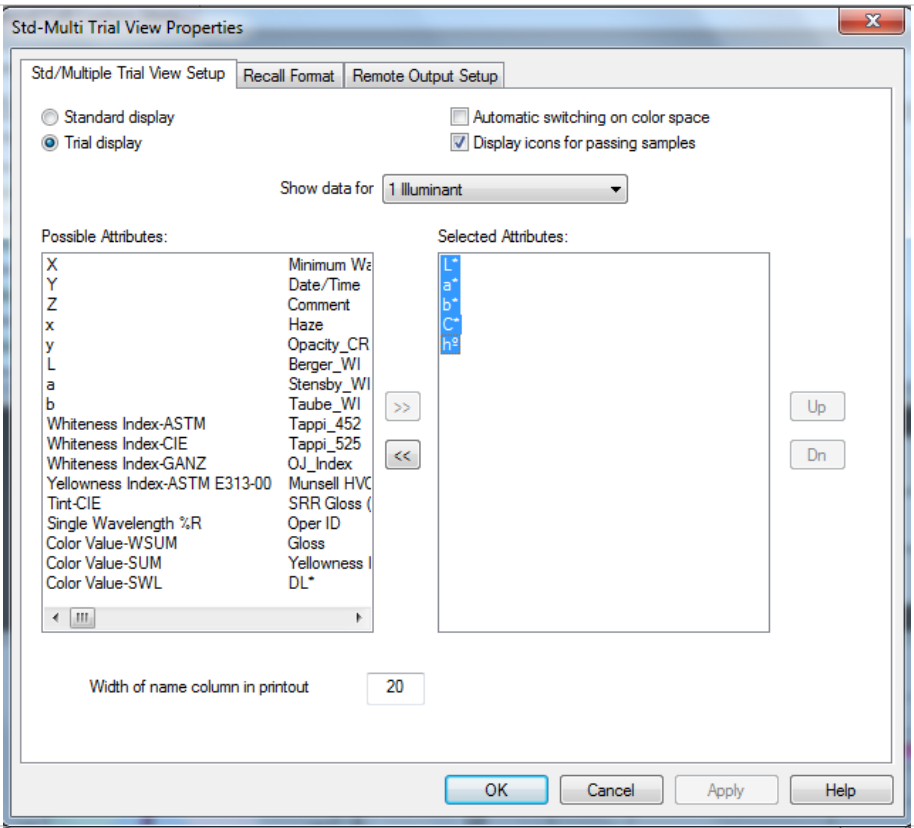
With the function Save As.. ([CTRL]+[R]) the actual settings can be saved



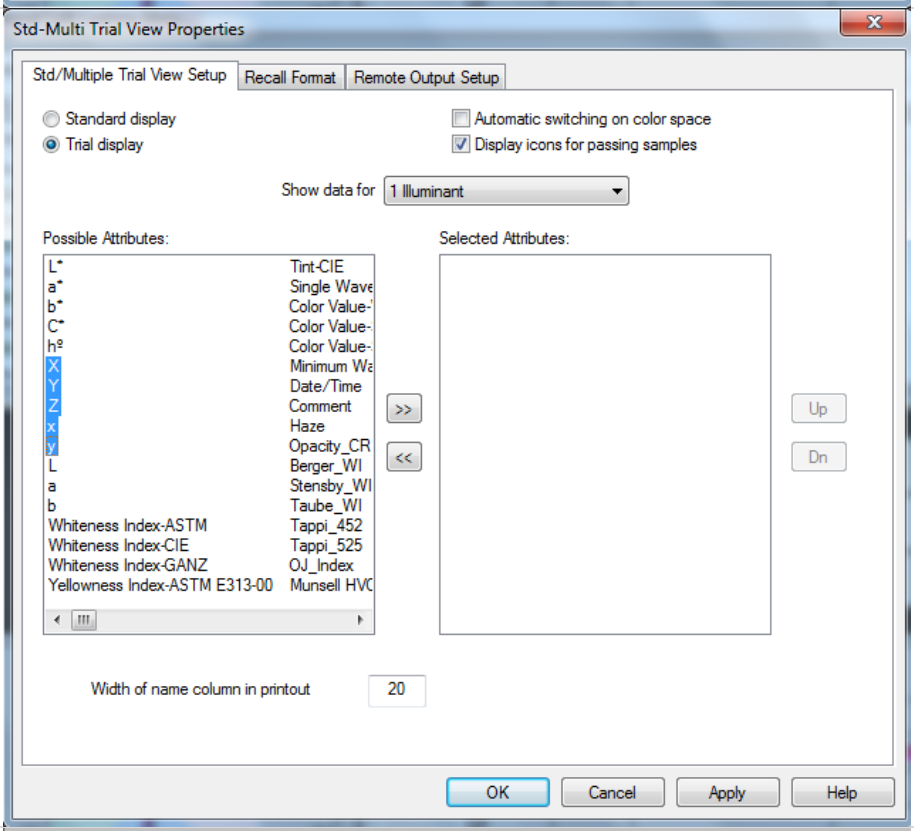
We save this as Set_Lab.st5 (st5 stands for settings_type 5)



Next with the right mouse key in the multi_data_view and select the option Properties

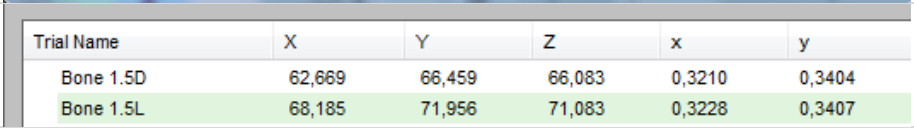


We mark the content of the right box (which we want to be replaced) and press the key facing to the left



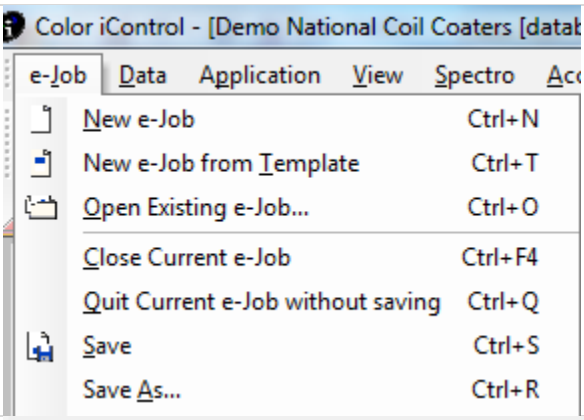
We mark the desired attributes in the left box and press the key facing to the right.

Once the new attributes have been listed in the right box we press Apply and OK

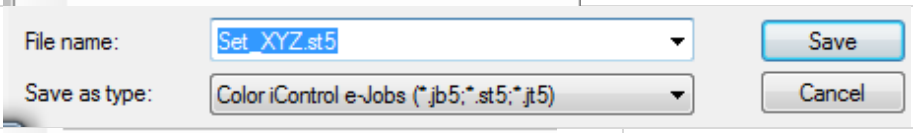


Trial Name	X	Y	Z	x	y
Bone 1.5D	62,669	66,459	66,083	0,3210	0,3404
Bone 1.5L	68,185	71,956	71,083	0,3228	0,3407

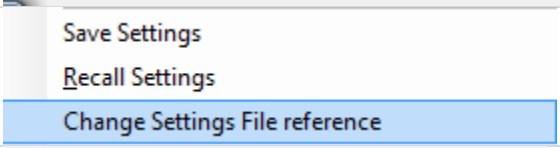
The changes have now been applied in the job



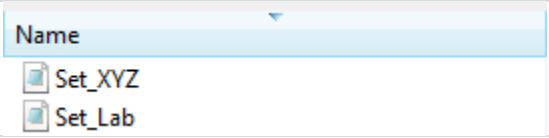
With the function Save As.. ([CTRL]+[R]) we save now the actual settings.



We save this as Set_XYZ.st5 (st5 stands for settings type 5)



In the future you can easily select the function Change Settings File reference from the e-job menu

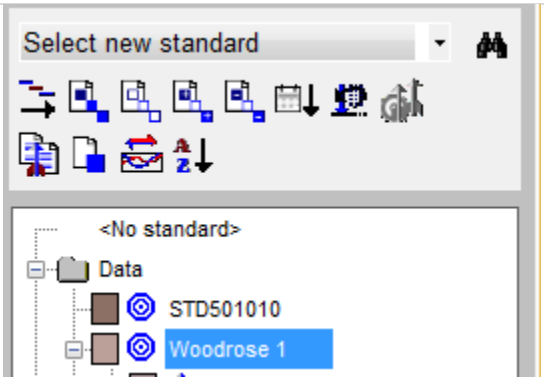


Select the desired setting and your Multi-Trial View Data will change immediately.

Color Search

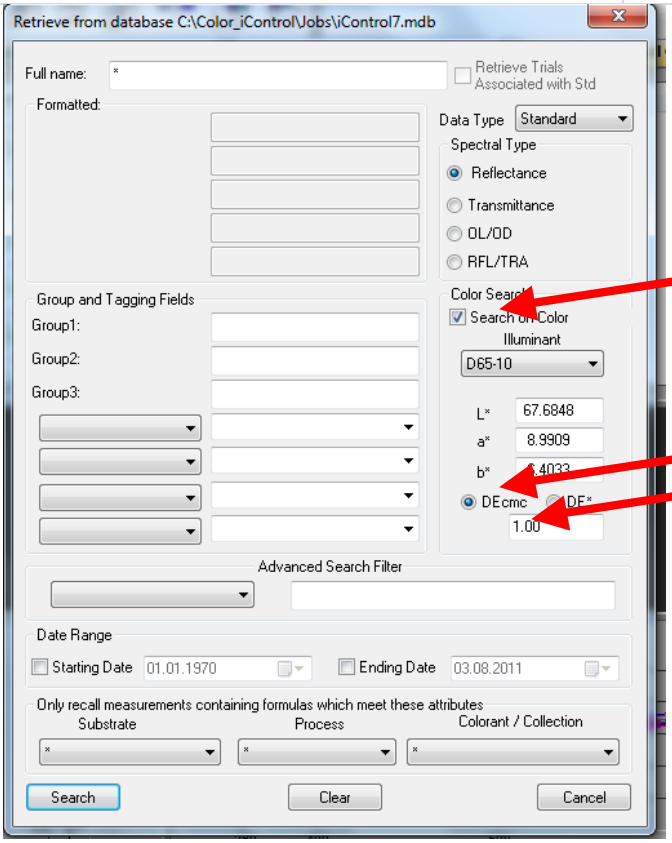
How can I do a color search in the database?

- Step 1 – Decide what you want to search for? Standard or trial?



Have the Standard Selection box "Select New Standard" – If a standard is selected, this will be sample which is used in the color search
Mark the sample for which you want to get the closest match.

Press [Shift] + [F5] – or the proper icon  on the Icon bar



This will open up the "Retrieve from Database" window.

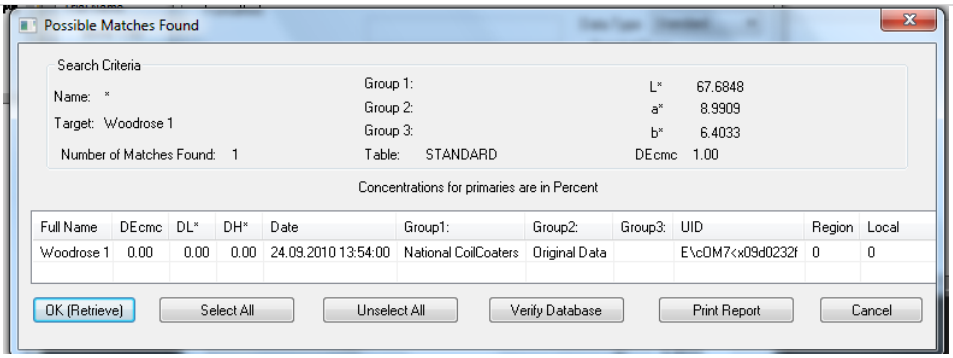
If you want to search the Trials instead of standards you can change the Data Type

Activate the Search on Color Function

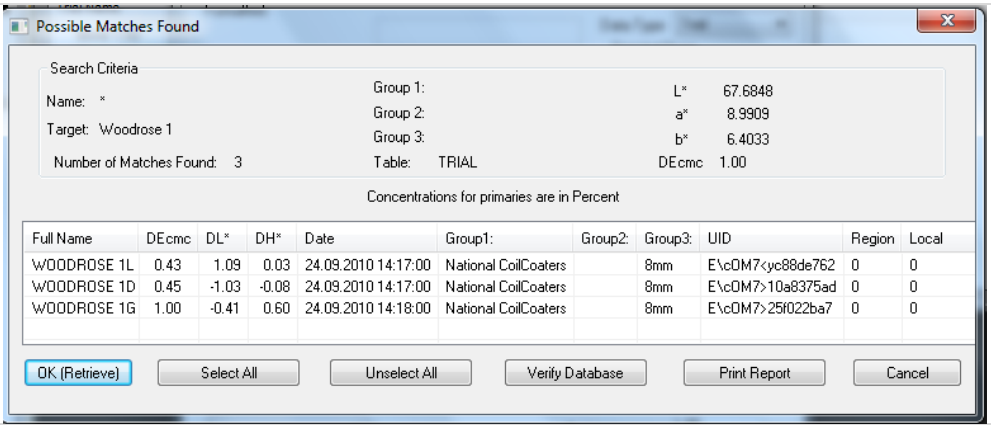
The L*a*b*-data of the current sample have been transferred into this box already.

Define the DEcmc or DE* and the limit.

Press [Search] to start the Search Process



All standards within the tolerance will be shown. Select either individually or [Select All] and press [ok] to transfer them into the job.

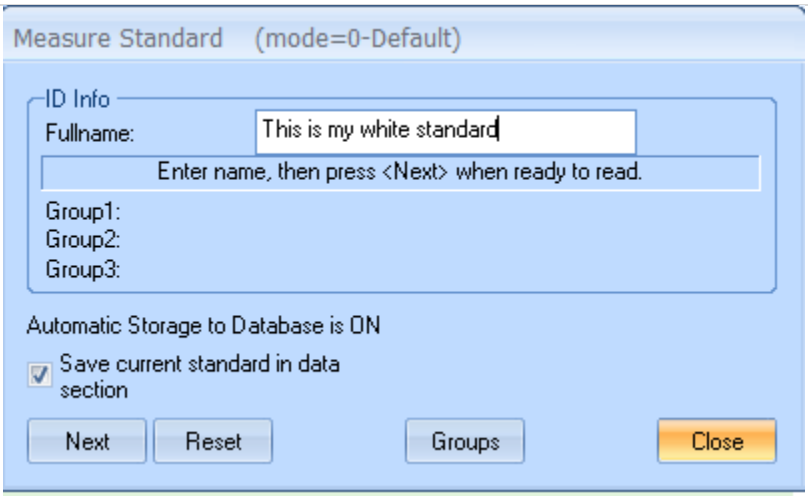


In the Trial database even more samples within tolerances have been found. Select either individually or [Select All] and press [ok] to transfer them into the job.

Naming options

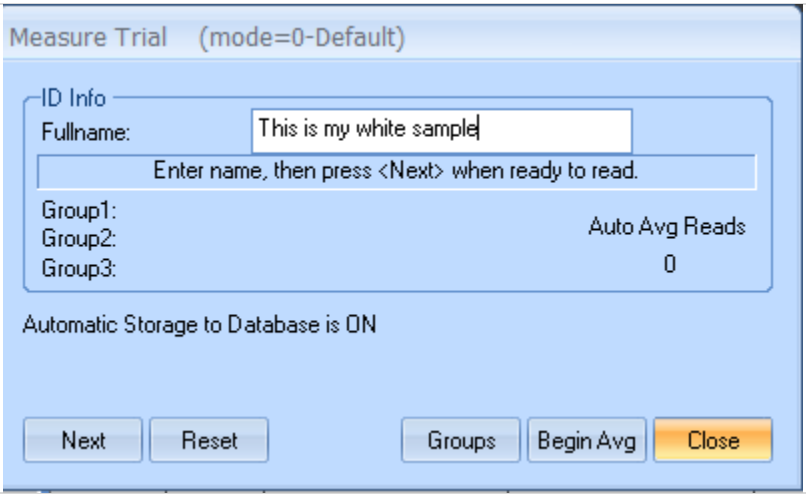
Being able to give the right name to standard and sample is sometimes a challenge since there are customers who desire maximum flexibility and others have a very restricted concept. X-Rite iQC can support almost all these wishes by different methods.

How to use a flexible name?



Up to 50 characters can be used to describe the standard.

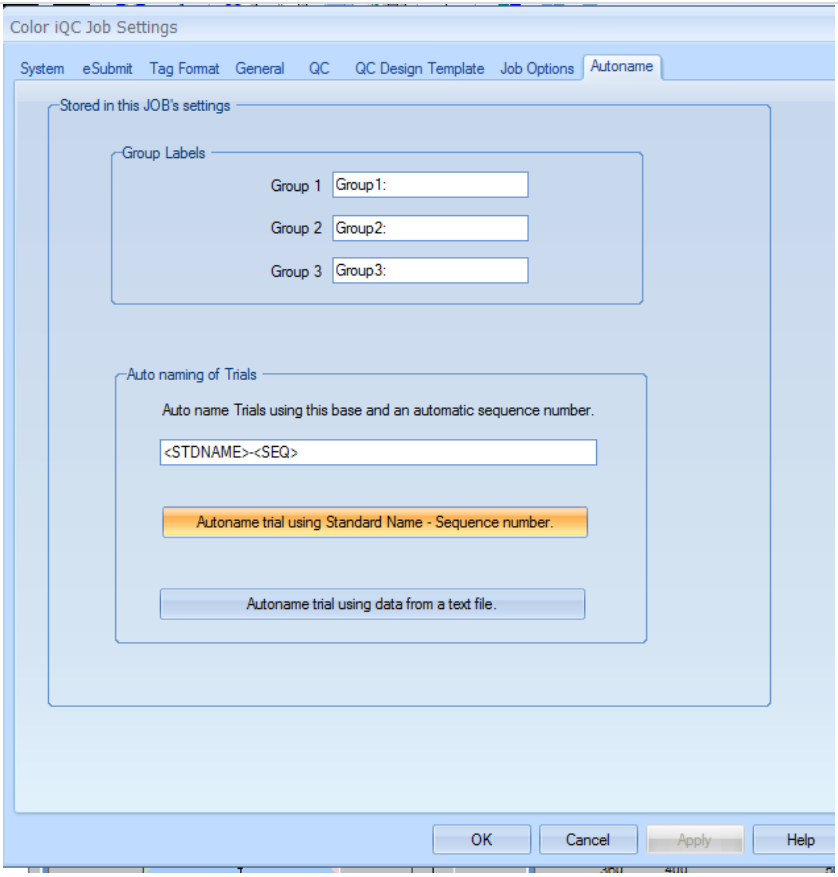
There is no automatism except – as long you stay in the Measure Standard Window the entry box will default with the last Fullname



Up to 50 characters can be used to describe the standard.

There is no automatism except – as long you stay in the Measure Trial Window the entry box will default with the last Fullname

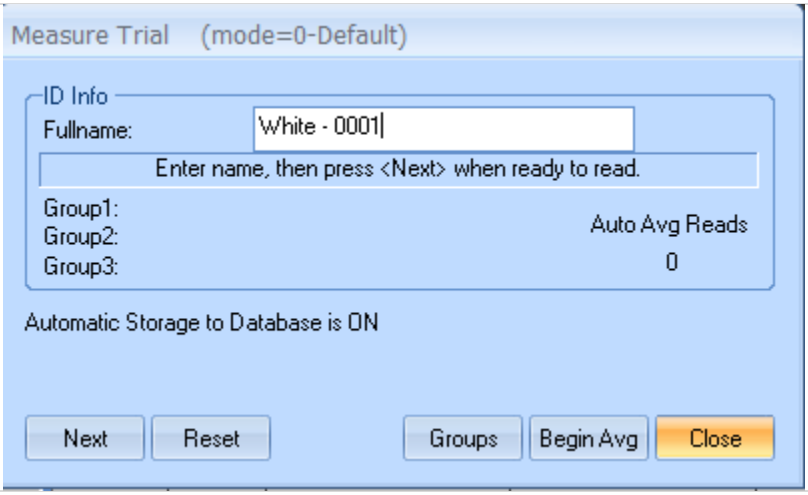
How to use automatically a standard name with a sequence number?



To activate the automatic Sample counting - the option Autoname trial using Standard Name – Sequence Number has to be activated in the Color iQC setting on the tab Autoname.

This will write the following text into the "Auto name Trials…." Entry box

You can replace the <StdName> with a fixed text which would be used for all samples



iQC will automatically suggest in the Measure Trial Windows the Name of the standard – with the sequence Number.

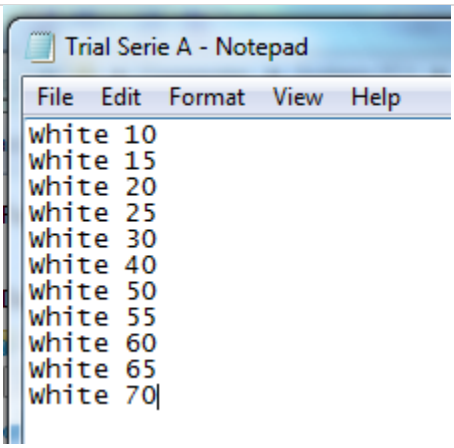
If there is already a series of measurements done the program will automatically suggest the next number

For the trial in a sequence you can overwrite this number.

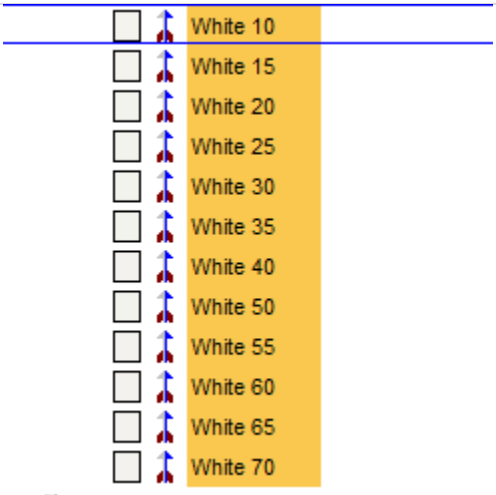
Start the measurement process with next

How to work with predefined trial names from a list?

In some application hundreds of measurements have be made, which all follow the same concept. Instead of entering the name with any sample a list can be provided and the program will automatically take names from the list – exactly in the order.

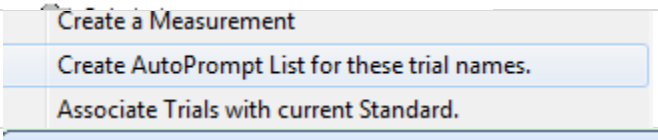


With the notepad program a list of sample name as to be used by iQC has to be generated.
This list can be long as you want

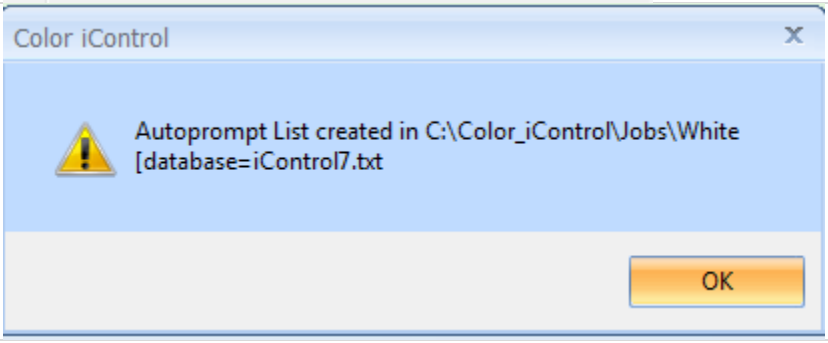


iQC allows to generate such a list directly out of the program

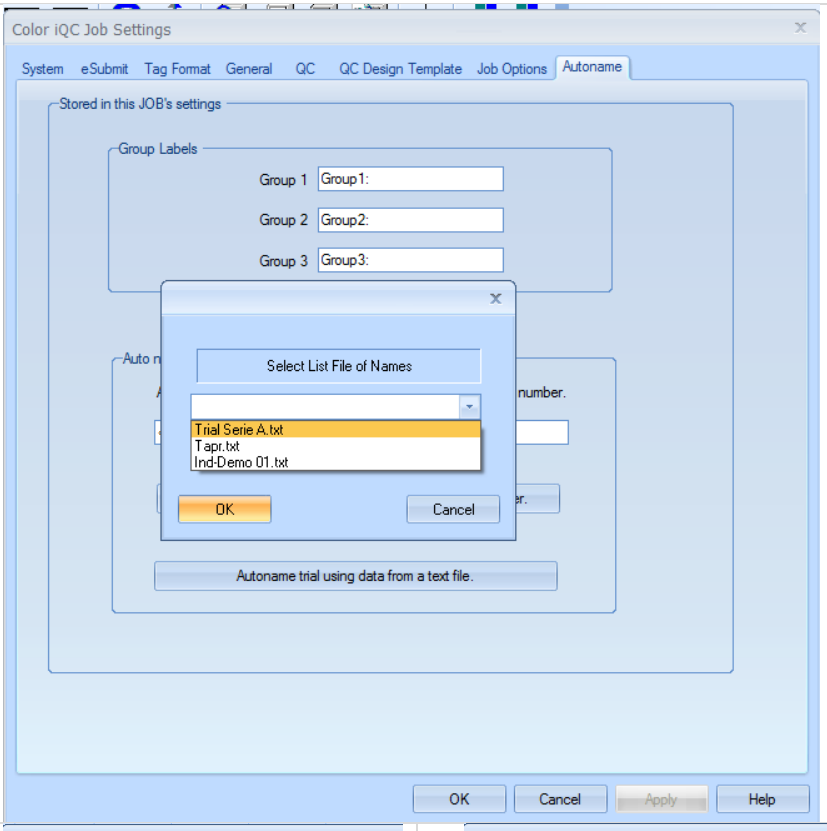
if a series of samples with the target name has been measured already, mark the series of samples and press the right mouse key.



Select the option to “Create AutoPrompt List for these trial names”

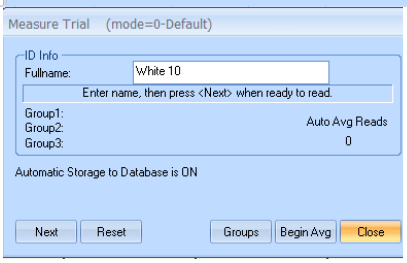


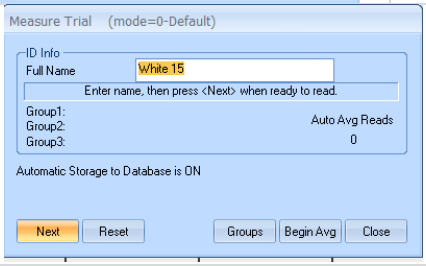
A new list will be AutoPrompt List will be generated in the Jobs Directory

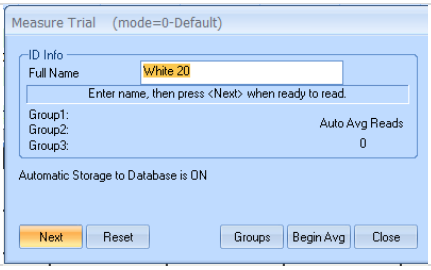


To activate the Autoname trial data from a text file - the option Autoname trial date using a text file has to be activated. As soon the button is clicked a selection box with the active text files in the Color_iContol/Jobs – Directory is listed and the correct file can be selected.
In this case Trials Series A. txt has been defined

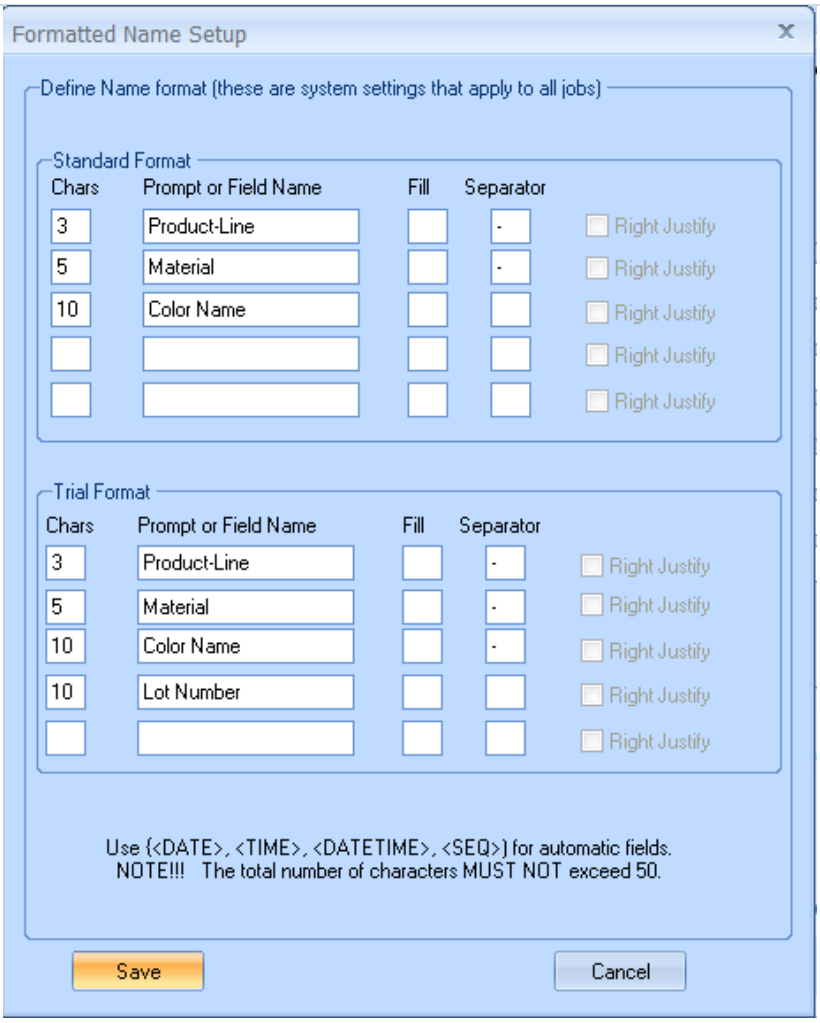
In the following measurement example the measurement routine will ask one sample name after the other one.







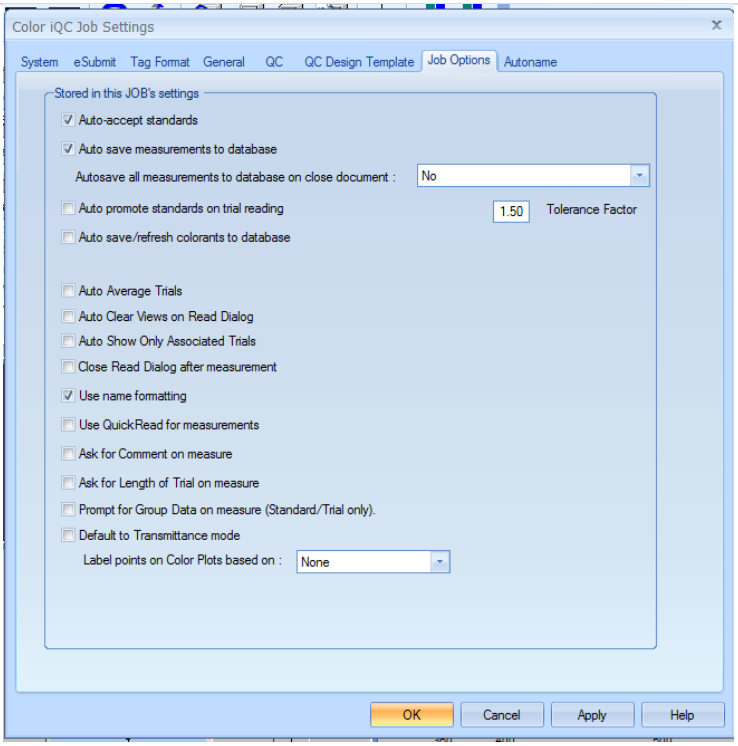
How to use a Formatted Name Setup?



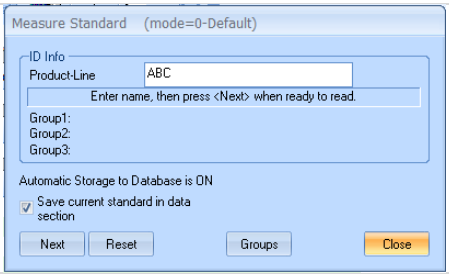
In this example the standard name is an addition of 3 different information the product line (3 digits), the material code (5 digits) and the color name (10) digits

The Trial has an additional Lot Number information with 10 digits

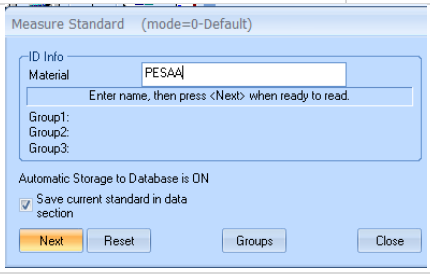
Once the setup has been finalized, the IQC will call for the input item by item.



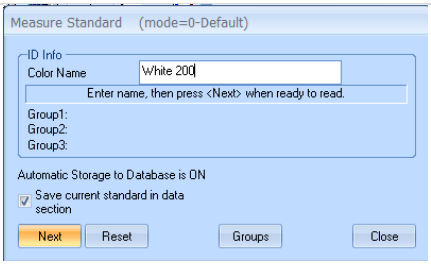
Activate the Use name formatting



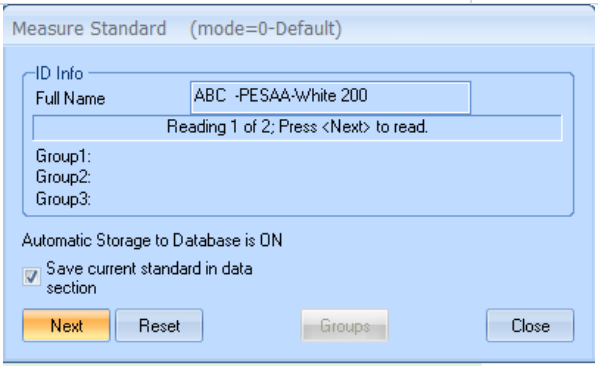
Input Product Line



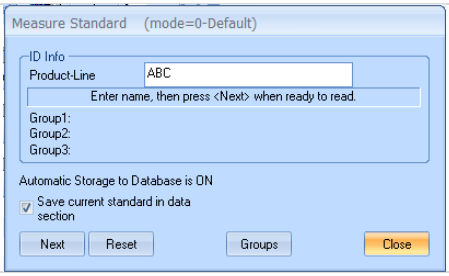
Input Material ID



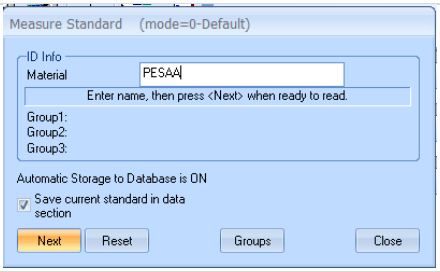
Input Color Name



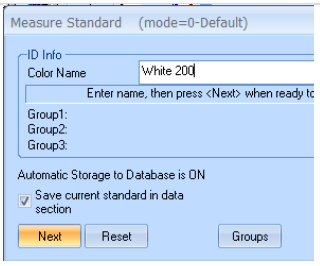
Measurement Windows with the complete name



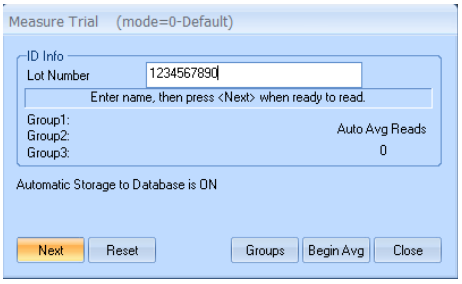
Input Product Line



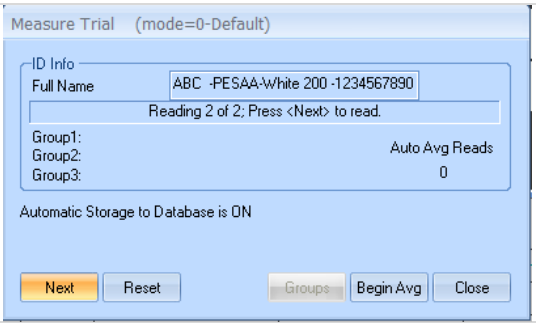
Input Material ID



Input Color Name

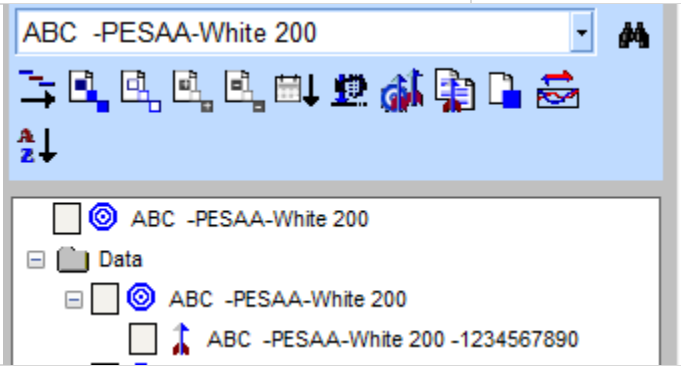


Input Lot Number



Measurement Windows

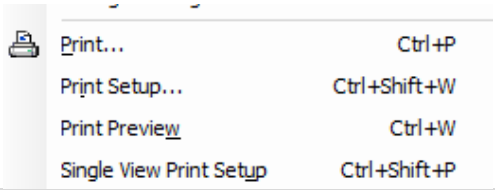
In the measurement window the sample will have the complete name



Results in the tree view

Printer Output

How to start a printout?



A printout can be started on different ways

Click  Button on the iQC-Button-Tab

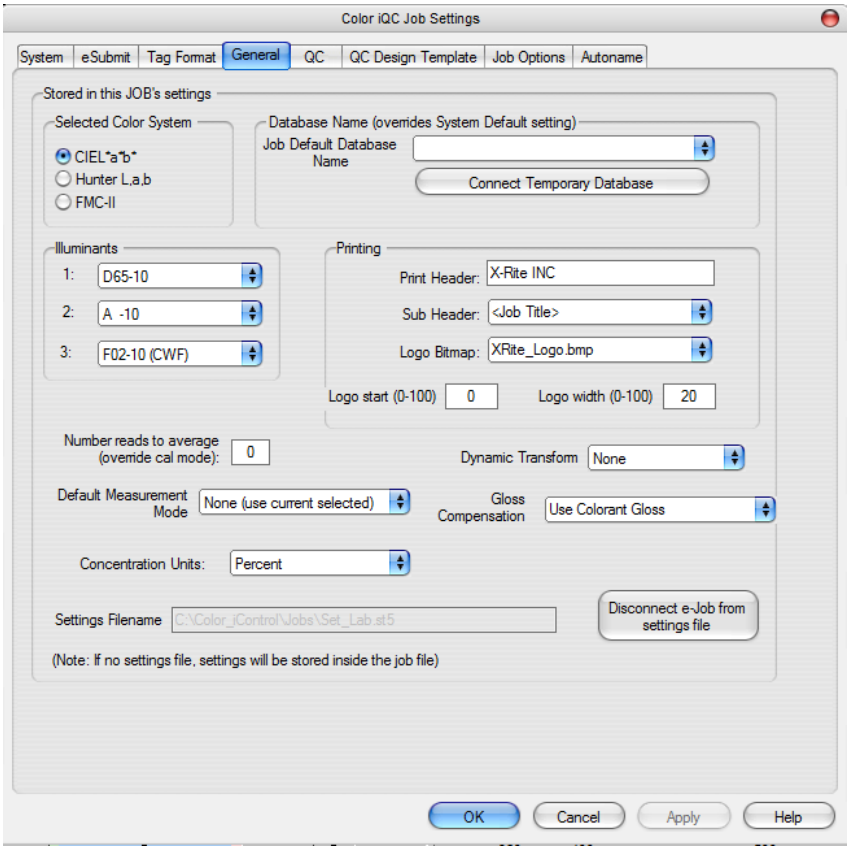
or

Open the e-job menu and select “Print”

Or

Enter [CTRL]+[P]

How to define the header of the printout?

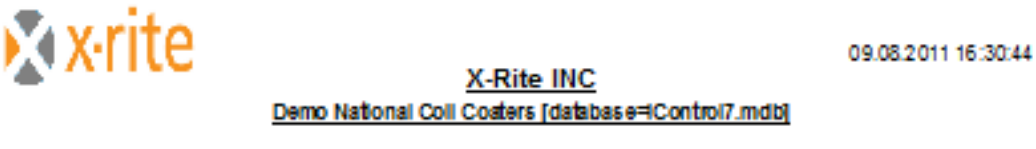


The header of the printout will be defined in the Color iQC Job settings. (Press the button [F2] to enter the Color iQC Job setting)

In the area Printing you can define the Print Header, the Sub Header and can enter a Logo Bitmap with position and size

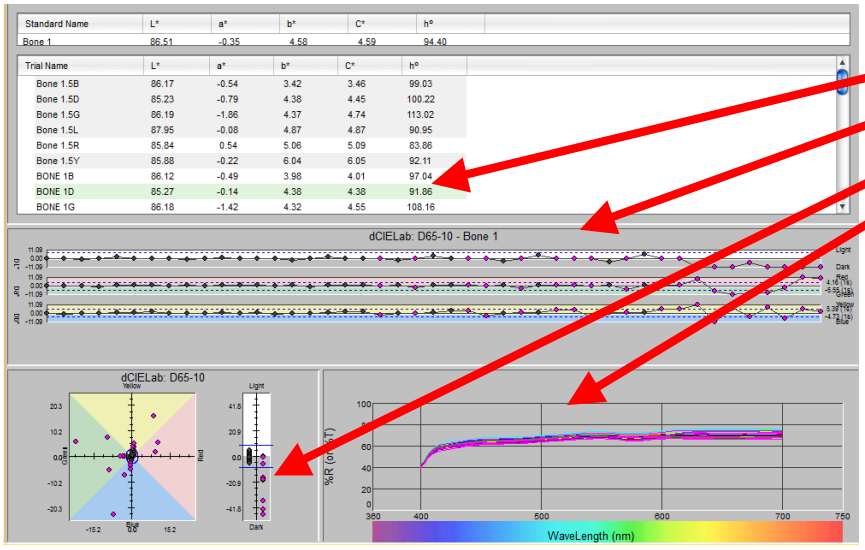
The Print Header can be defined in each job differently.
Print Headers should be saved in the Job-Templates to make sure, that all new jobs created from them will have the correct header.

If all jobs should have the same printer header, the changes should be made in the systems settings (your can enter system settings with [F2] if no job is open.

Print Header	Most people enter the company name into the print header
Sub Header	The choices are: Job Title Name of Standard Comment of Standard Blank
Logo	A bmp-file can be positioned in the printer header. JPG and other formats can not be used.
Logo-start	A value between 0 and 100 for the location of the left edge of the bitmap, 0 being the left margin and 100 being the right margin.
Logo-width	Requires a value between 0 and 100 as well, representing the size of the image in percent.
	Result of above settings

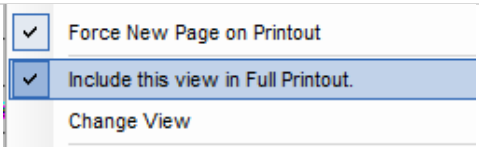
How to define the items of the printout?

Color iQC and Color iMatch allows you to define which items (color data, CIELab-Plot, Trend, Reflectances) should be placed into the printout. The content of printed information is defined by the information in the views.

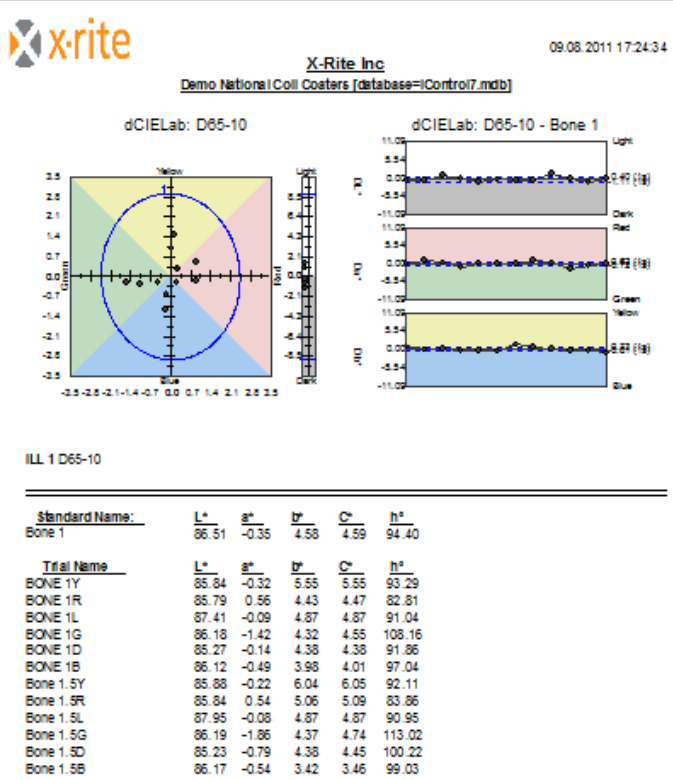


- Each of the views has it´s properties.
- "MultiTrialData",
- "Trendplot",
- "Lab-Graph,
- "Reflectance-Graph"

With a right mouse click in any of the view areas you can open the right mouse menue connected to it. There you can also define wheter the item should be included in the Printout.



If the checkmark in front of "Include this in Full Printout" is set, this item will be included.



09.08.2011 17:24:34

X-Rite Inc

Demo National Coil Coaters [database=IControl7.mdb]

dCIELab: D65-10

dCIELab: D65-10 - Bone 1

ILL 1 D65-10

Standard Name:	L*	a*	b*	C*	h°
Bone 1	86.51	-0.35	4.58	4.59	94.40

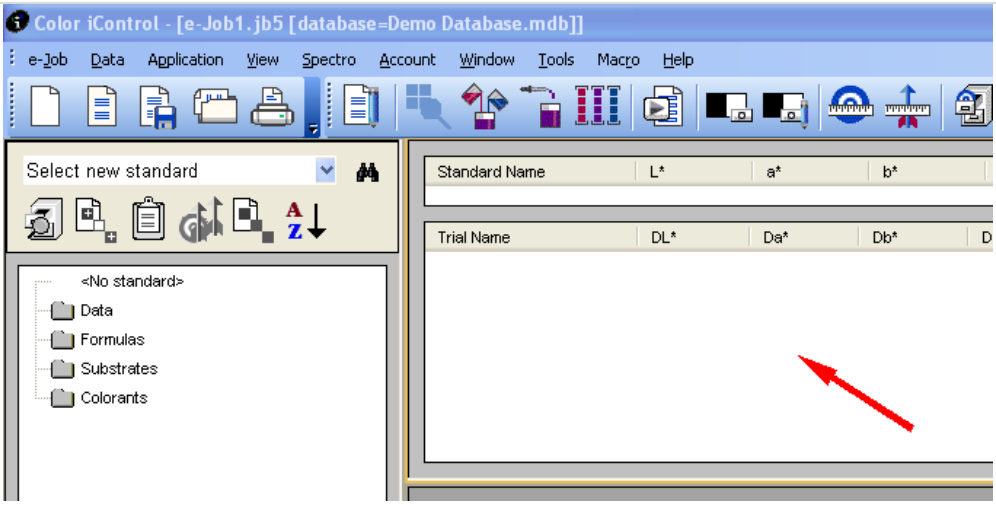
Trial Name	L*	a*	b*	C*	h°
BONE 1Y	85.84	-0.32	5.55	5.55	93.29
BONE 1R	85.79	0.56	4.43	4.47	82.81
BONE 1L	87.41	-0.09	4.87	4.87	91.04
BONE 1G	86.18	-1.42	4.32	4.55	108.16
BONE 1D	85.27	-0.14	4.38	4.38	91.86
BONE 1B	86.12	-0.49	3.98	4.01	97.04
Bone 1.5Y	85.88	-0.22	6.04	6.05	92.11
Bone 1.5R	85.84	0.54	5.06	5.09	83.86
Bone 1.5L	87.95	-0.08	4.87	4.87	90.95
Bone 1.5G	86.19	-1.86	4.37	4.74	113.02
Bone 1.5D	85.23	-0.79	4.38	4.45	100.22
Bone 1.5B	86.17	-0.54	3.42	3.46	99.03

Print out, with header (logo, headline, subheader, date) Cielab, Trendplot and L*a*b*-Data for one illuminant.

Remote Output

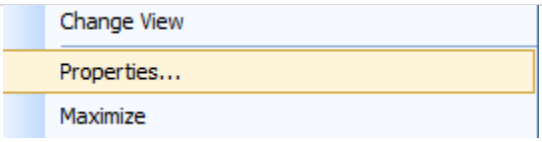
How to set up for Remote Output?

Color iQC and Color iMatch have the option of sending data to a serial communication port or to an ASCII text file. This “Remote Output” is generally used to export colorimetric data to a file which is then sent to a serial printer or imported into other programs such as inventory tracking systems or Excel for custom analysis.

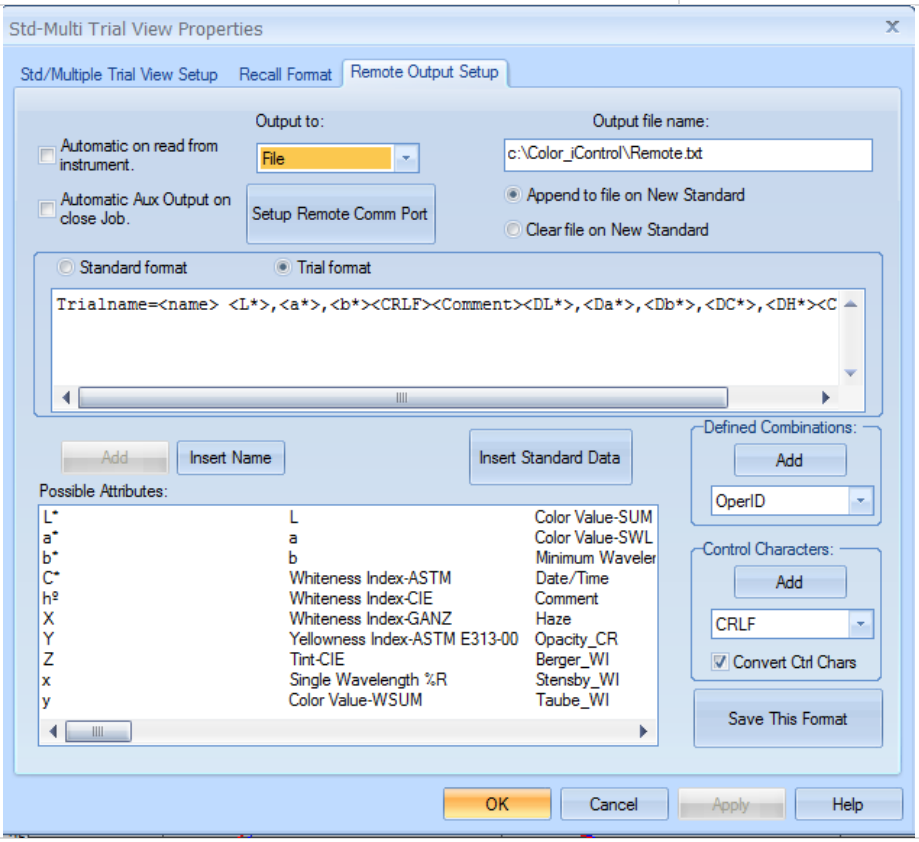


Remote Output is configured from the Standard Muli-Trial view in QC.

Right Click



Select Properties



Within the Std Multi Trial View Properties there is a tab for Remote Output Setup.

There is a setup for the Standard and the Trial output.

Use this tool to setup the output for each section.

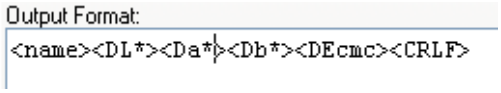
Output To:	You have the option to direct the ASCII data to a serial communication port (COM1, COM2 etc.) or to a File.
Output File Name:	If outputting to a file you can specify the name of the file and location. You can use mapped drive letters or UNC (network Universal Naming Convention) to specify a location. (example \\server\foldername\remote.txt).
Setup Remote Comm Port:	If using the COM port you should select Setup Remote Comm Port to set Baud rate, data bits, stop bits and parity.
Automatic on Read from Instrument:	This option will send out the selected data to the com port or file as soon as it is measured from the instrument. Other option is to manually select Remote Output or Aux Output which is discussed later.
Append to file on New Standard or Clear file on New Standard:	These options give you the ability to add to an existing file even when the standard is changed or to clear out any existing data in a file when the standard is changed.
Output Format:	This area is where you will construct the output of data for your standard , trial or both.

Insert Name:	This will add "<name>" to the output format section. This will output the name of the trial or standard depending on if you are working in the Standard Output or Trial output.
Insert Standard Data:	This is used when setting up the Trail output and will add <<stdinfo>> to the output format section. When changing or adding a new standard the standard data is output only once then the trail data will follow. If multiple system or multiple standards are being added to a single output file you may want some standard information on each line with the trail information. Any data such as the name and L*, a*, b* setup for the Standard Output will then be inserted for each trial data.
Add:	This button will become active when an attribute is selected from the Possible Attributes section. You can add any of the data available in the Standard/ Multi Trial view such as DL*, Da* and Db*.
Defined Combinations:	You have a drop down list of additional data available to export that is not in the Standard Multi Trial view. • OperID: ID entered when starting Color iQC or iMatch. This is tagged on each measurement. • FileName: Name of the e-job being used during remote output. • Path: The computer location / path of the e-job. • Group 1, Group 2, Group 3: Data from Group 1, 2 or 3. • PFtol: Pass/Fail Tolerance. L:C Ratio, P/F and Margin (2.00:1;P/F=1.00;10.00) • MeasCond: Condition of measurement such as reflectance, large area view, Specular included. • Signature: Digital signature of measurement. • SerialNum: Serial number of spectrophotometer used to measure. • Model: Type of spectrophotometer used to measure • SWL-EWL: Starting wavelength and ending wavelength of measurement • SpectralData: Spectral data • ExtSpectralData: Extended spectral data such as over dark. • IllObs1, IllObs2, IllObs3: Illuminant and observer 1, 2 and 3. • BlockRange: 555 sort block Range • LABtol: L*a*b* tolerances (0.25; 0.19; 0.26) • LCHtol: L*C*h tolerances (0.25; 0.19; 0.26) • OperID: ID entered when starting Color iQC or iMatch. This is tagged on each measurement. • FileName: Name of the e-job being used during remote output. • Path: The computer location / path of the e-job. • Group 1, Group 2, Group 3: Data from Group 1, 2 or 3. • PFtol: Pass/Fail Tolerance. L:C Ratio, P/F and Margin (2.00:1;P/F=1.00;10.00) • MeasCond: Condition of measurement such as reflectance, large area view, Specular included. • Signature: Digital signature of measurement. • SerialNum: Serial number of spectrophotometer used to measure. • Model: Type of spectrophotometer used to measure • SWL-EWL: Starting wavelength and ending wavelength of measurement • SpectralData: Spectral data • ExtSpectralData: Extended spectral data such as over dark.

	• IllObs1, IllObs2, IllObs3: Illuminant and observer 1, 2 and 3. • BlockRange: 555 sort block range • LABtol: L*a*b* tolerances (0.25; 0.19; 0.26) • LCHtol: L*C*h tolerances (0.25; 0.19; 0.26) • TaperTol: Taper tolerances, Standard, average, roll and range (1.00 1.00 0.50 5.00) • idL*, ida*, idb*: Integer(no decimal points) DL*, Da*, Db* (-0.13 D, 0.12 R, 0.05 Y, would be -013, 012, 005) • TagLabel_***xx***: Tag label 01 through 30 • TagData_***xx***: Tag data 01 through 30.
Control Characters:	These can help format the data. • CRLF: Carriage return and line feed • CR: Carriage return • LF: Line feed • TAB: Tab • FF: Form Feed • ETX: End of Transmission • EOT: End of Tape • Bell: Bell • ACK: Acknowledge
Convert Ctrl Chars:	This will convert the control characters text into the ASCII codes. Unchecked the control characters such as <CRLF> will be passed through for the end device like a serial printer to interpret.
Save This Format:	You can save the setups for the remote output to an external file. This allows you to have multiple remote output setups and the ability to send this remote output setup to another Color iQC or Color iMatch system for them to use. In the Output Format area you can add to this directly from your keyboard by clicking in box at the position you want to add something then type. Items between brackets < > will be decoded by the software at the time of export. Anything not in brackets will be passed directly out the export. Some examples follow.

Examples

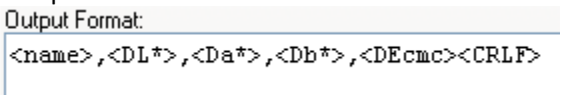
Example 1:



Exported:
Blue Batch 1 -0.13 D 0.12 R 0.05 Y 0.16
Blue Batch 2 -1.21 D 1.93 R -0.31 B 2.18
Blue Batch 3 0.23 L -0.19 G -0.05 B 0.25

The above export will include the trail name, the DL*, Da*, Db*, DEcmc and return to the beginning of the next line for the next trial output. No user typing was added.

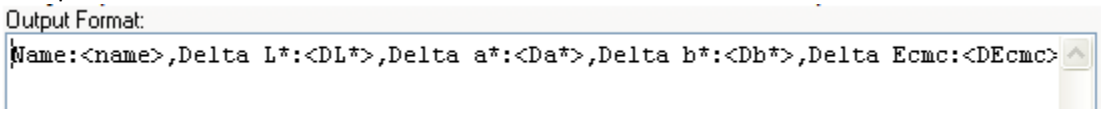
Example 2:



Exported:
Blue Batch 1 , -0.13 D, 0.12 R, 0.05 Y, 0.16
Blue Batch 2 , -1.21 D, 1.93 R, -0.31 B, 2.18
Blue Batch 3 , 0.23 L, -0.19 G, -0.05 B, 0.25

The above export will include the trial name, the DL*, Da*, Db*, DEcmc and return to the beginning of the next line for the next trial output. Commas were added to have a delimited file for easy import into Excel.

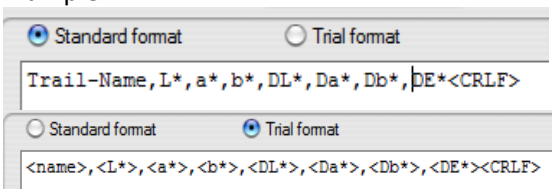
Example 3



Exported:
Name:Blue Batch 1 ,Delta L*: -0.13 D,Delta a*: 0.12 R,Delta b*: 0.05 Y,Delta Ecmc: 0.16
Name:Blue Batch 2 ,Delta L*: -1.21 D,Delta a*: 1.93 R,Delta b*: -0.31 B,Delta Ecmc: 2.18
Name:Blue Batch 3 ,Delta L*: 0.23 L,Delta a*: -0.19 G,Delta b*: -0.05 B,Delta Ecmc: 0.25

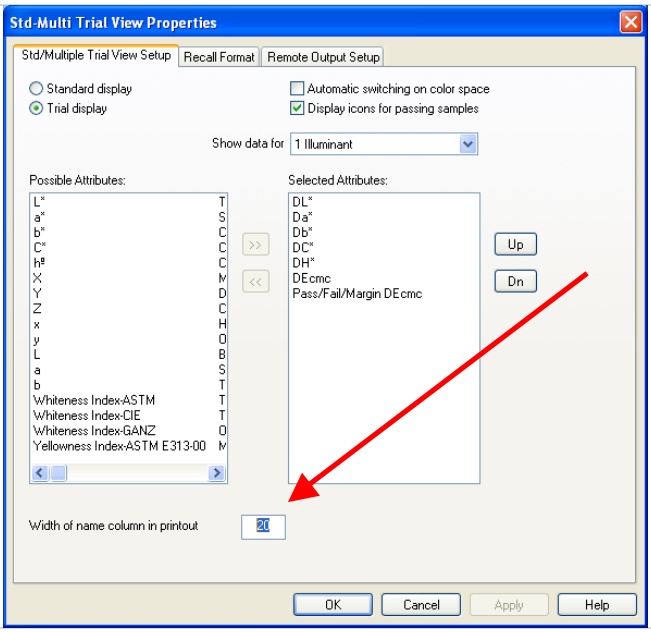
The following will export the name of the trail, the DL*, Da*, Db*, DEcmc and return to the beginning of the next line for the next trial output. Commas were added to have a delimited file for easy import into Excel. And text was added to describe the output.

Example 4



Trial-Name, L*,a*,b*,DL*,Da*,Db*,DE*
Bone 1.5D , 85.23 , -0.79 , 4.38 , -1.29 D, -0.44 G, -0.20 B, 1.37
Bone 1.5L, 87.95 , -0.08 , 4.87 , 1.43 L, 0.27 R, 0.29 Y, 1.49

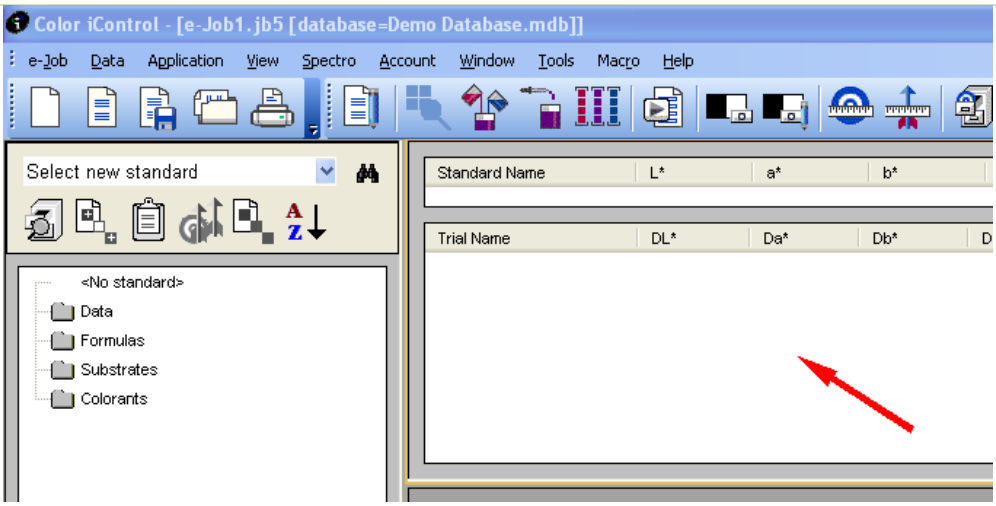
In this example a header has been added (instead of the standard name) and comma separated information have been provided



Attention:
The name of standards and trials can be up to 55 characters in length. The software defaults to exporting only the first 20 characters. If needed you can increase this to the maximum of 55 by going to the settings of the Standard Multi-Trial view and on the setup tab you can change the Width of name column on Printout.

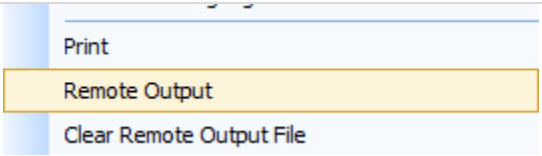
The remote output setup is saved with the e-Job or settings file.

How to utilize a Remote Output in Color iQC?



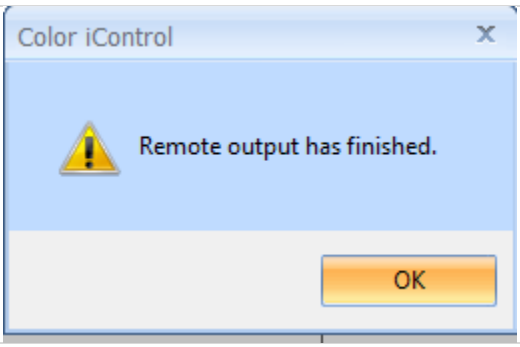
Remote Output is started from the Standard Muli-Trial view in QC.

Right Click



Select Remote Output

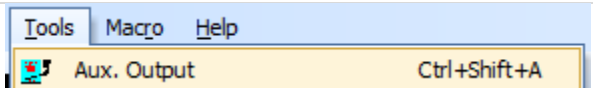
The data of all trials in the view will be exported



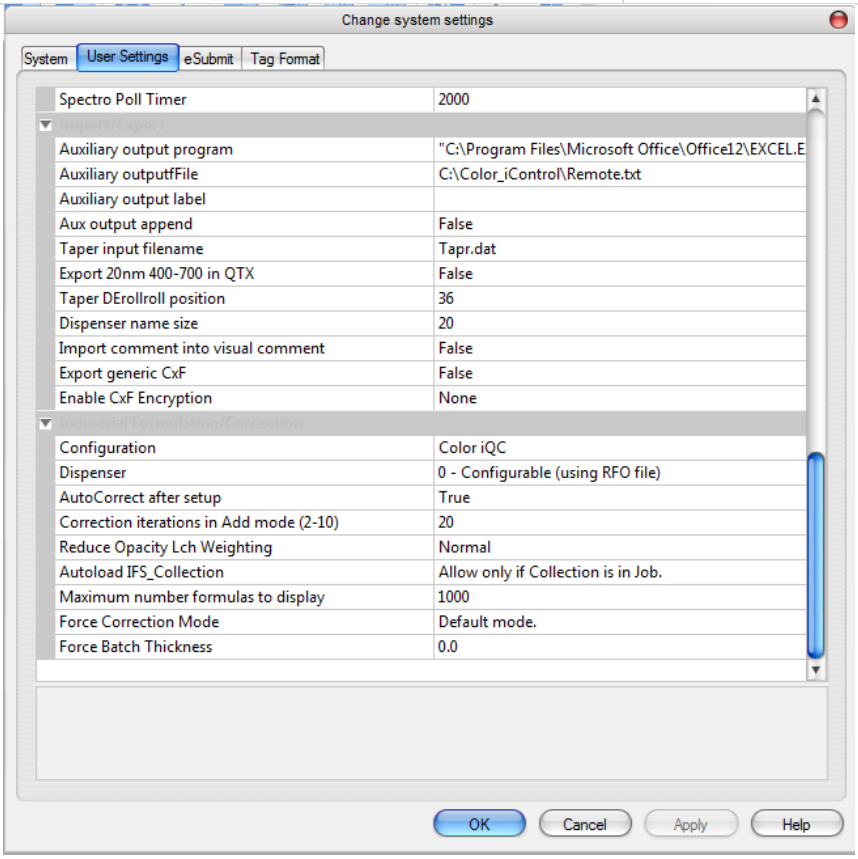
You will receive a message that Remote Output has been finished.

How to export from Color iQC directly into an Excel Application?

Another way to export is to use the Aux Output feature. Under the Tools menu is Aux. Output. This stands for Auxiliary output. It will use the remote output setup defined in the Standard Multi-Trial view but you have the option of having a separate file name and location along with a launching program. You can also customize your toolbar and add the Aux. Output button to make this a one click feature.



Within the Menu item Tools – there is the function Aux. Output. It will use the remote output as it is defined in the Standard Multi-Trial view. You combine this with an automatic action – f.e. has Excel started automatically with the data provided.



In order to prepare the Aux.Output and combine with an application – you will have to change the system Settings. (No – Job opened – press [F2])

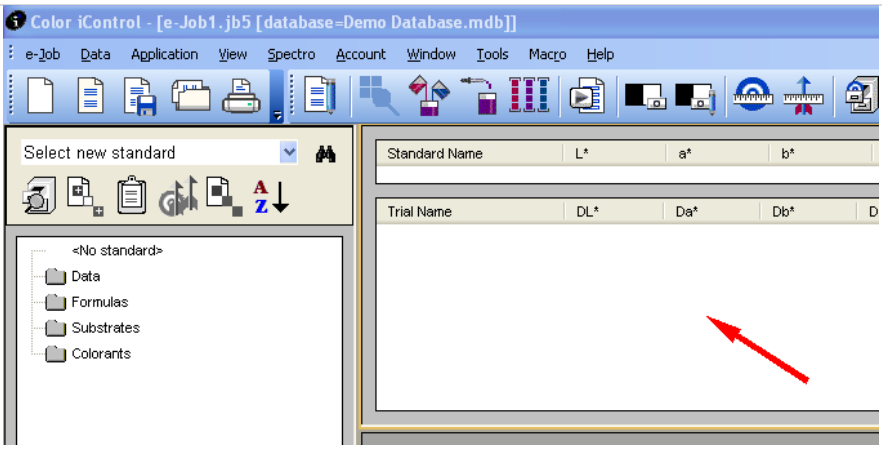
Go to the Tab “User Settings”

Go to the item Auxiliary Output Program and enter the path of the application program
“C:\Program Files\Microsoft…\.EXE”

Attention: It is important to have the path it in quotes.

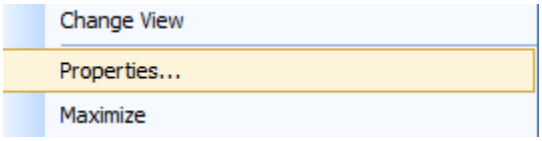
Go to the item Auxiliary output file and enter the name which corresponds to the Remote Output file.

Press [Apply]
Press [Ok]

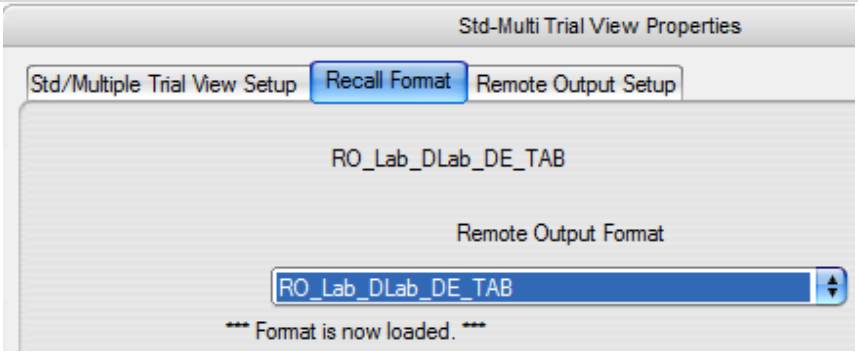


Activate the Remote Output with the correct Remote Output File

Right mouse key into the Multi Trial Data View

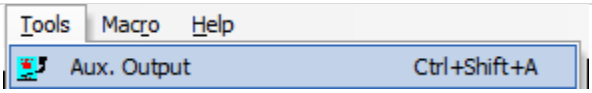


Select Properties

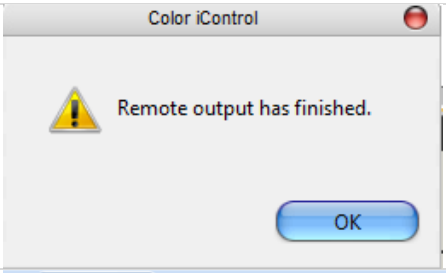


Within the properties select the desired Remote Output Format

In this case the RO_LAB_DLab_DE with tabbed separation has been selected, with the output file C:\Color_icontro\Remote.txt has been selected

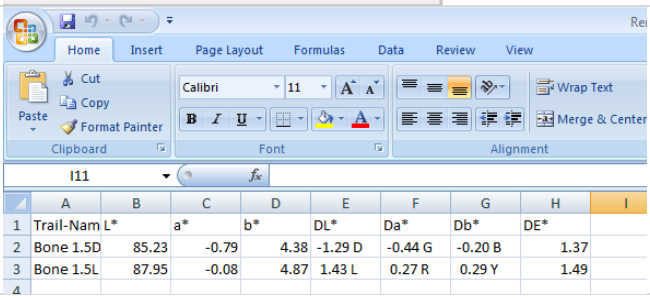


In the iQC application the Aux. Output has been selected



Directly the message comes up, that Remote output has finished

Press [OK] to continue



Directly the excel program starts up to with the content of the Remote Text – File

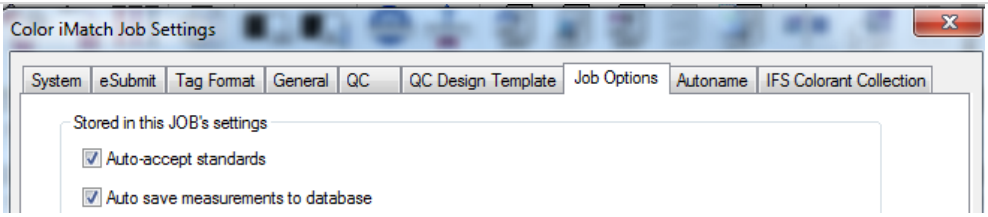
Attention: There is only one Aux. Output Program – but it can work with different jobs. Since each job can have its own Remote-Output-Format (ROF) – to refer to at the same standard Remote output file (f.e. REMOTE.TEXT) – this tool can be used for different exports.

Data Import

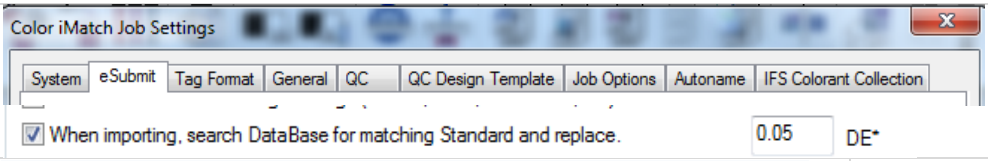
Semi-Automatic QTX-Data-Import

For some our customers it is important to automatically import data from a customer or supplier. If f.e. data are retrieved by mail they will (after double click on the data file) automatically find their way into the iQC-software.

The behavior of the qtx-import and the settings within the job will be controlled by a QTX.JT5 – Job-Template file. The QTX.JT5 can be created/modified in the known way.



If the data should be stored in the database upon closing, the option “Auto save” should be selected.



To avoid multiple standards with the same name this option should be selected

```
[STANDARD_DATA 0]
STD_NAME=H64850136,
STD_GUID=
STD_DATETIME=1152031721,
STD_REFLPOINTS=38,
STD_REFLINTERVAL=10,
STD_REFLLOW=360,
STD_VIEWING=%R LAV SCI UV CAL,
STD_R=5.11,5.96,7.43,10.14,13.04,14.33,15.11,16.17
[BATCH_DATA 0]
STD_NAME=H64850136,
BAT_NAME=100182382-D.36/596-Fi-Pr-(M)-3
BAT_GUID=
BAT_DATETIME=1322711781,
BAT_REFLPOINTS=38,
BAT_REFLINTERVAL=10,
BAT_REFLLOW=360,
BAT_VIEWING=%R LAV SCI UV CAL,
BAT_R=5.50,6.34,7.90,10.61,13.29,14.50,15.15,16.16
[BATCH_DATA 1]
```

It is important, that both the Standard_ Data and the Batch_Data are defined in the Data.QTX-file.

If only BATCH_DATA defined (even with the STD_Name=Standard is available it will not be saved correctly into the database

Color iQC and Color iMatch
Multi Flux Matching Guide

Version 8.0 | July 2012

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Abstract

Advanced Color Formulation

Traditionally, color formulation software has been based on theories whose mathematics cannot adequately address the complete needs of the color industry. The intention is to provide a solution that will address these needs and be a valuable tool for the beginner as well as the experienced colorist.

Unlike most commercially available color matching packages, solutions presented through the X-Rite® Color iMatch™ software are not based on Kubelka-Munk theory. All calculations are done in absolute units, and the same database can be used for matching samples that are opaque, transparent, or translucent. When used with a X-Rite Color i7™ or Color i5™ spectrophotometer, the same database can also be used to match samples in both reflectance and transmittance modes. Color iMatch flexibility means that a single package can be used for a wide variety of applications that include, but are not limited to: printing inks (offset, screen, gravure, and flexographic), coatings, and plastics. In addition to a new mathematical model, there are multiple features within Color iMatch that differentiate it from other color matching packages.

Due to the proprietary nature of the mathematics used in Color iMatch, not all features will be covered in complete detail.

Traditional Color Matching

Visual Color Evaluation

Color matching is still as much an art as it is a science, and the importance of visual evaluation must not be taken for granted. There still is no substitute for the visual evaluation of color, though it is used more in the quality control function and less in the determination of initial formulas.

Traditionally initial matches required significant trial and error, even with a highly skilled color matcher. In most organizations the color matcher is aided by instrumental and computational methods to supplement visual evaluation. Besides more accurate formulations, the most important advantage to the use of a computer formulation system is the amount of time that it takes to obtain an initial match. By significantly decreasing the amount of time it takes to obtain an acceptable match the profitability of the end product can increase dramatically.

Visual Evaluation Requirements

For successful visual evaluation of color, there are three important criteria that must be met. The most important requirement is normal color vision. However, the cases where thorough color vision testing is employed are far and few between. By using a test method such as the Farnsworth-Munsell 100 Hue Test, the level of color deficiency can easily be determined. A controlled viewing environment, with standard light sources like the X-Rite SpectraLight® III, is also an important part of visual evaluation. Finally, there is no substitute for experience. Today it is becoming more difficult to find sufficiently experienced personnel. Instrumental methods help to reduce the amount of experience required and decrease the learning curve when developing visual evaluation skills.

Additivity Principle

The additivity principle means that if two pigments are mixed in a sample, the total absorption can be found by adding up the individual absorption's of the pigments. Both pigments behave as if the other one was not there. An example of this behavior is described in the following equation using K/S.

(K/S)a+b = (K/S)a + (K/S)b

Experimental data has shown that the additivity principle is not generally valid for a mix of two or more pigments.[4]

K/S *versus* Wavelength

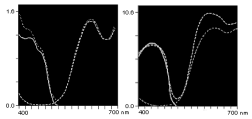


Figure 1a Figure 1b

In Figure 1a it can be seen that the additivity theory is valid in some cases; but it does not always hold true, as can be seen in Figure 1b.

Kubelka-Munk

The Kubelka-Munk theory is used for reflectance measurements and calculations. The original Kubelka-Munk theory described the propagation of light in a stellar system. The same equations have been used for the interaction of light with pigment particles in paint, plastic, and ink mediums. Although these applications are considering the same visible light; the distance between, and the dimensions of, pigment particles versus those of the stars are quite different.[4]

Originally published in the1930's by Paul Kubelka and Franz Munk, the Kubelka-Munk equations described the reflectance and transmittance of the sample as a function of absorption and scatter (K and S respectively). The Kubelka-Munk theory is a two-flux version of the many-flux method of solving radiation transfer problems.[6] Given that the sample must have the same refractive index as air these equations were not practical for industrial color matching. In the 1940's the Saunderson correction factors were introduced and the Kubelka-Munk equations became more practical for the use in opaque systems. Simplifications and assumptions have been made to the original equations, though these simplified formulas have many limitations they are the dominant algorithms used in color matching systems today.

Single and Two Constant

Depending on the application, the Kubelka-Munk equations can be divided into two different cases; single constant systems and two constant systems.

Single Constant

Single constant theory assumes that the individual pigments do not significantly contribute to the total scattering of the sample. An example of this theory is the exhausting of transparent dyes into a textile substrate.

Two Constant

If the scatter is assumed to occur from two sources, the colorant(s) and the substrate, it is considered two constant theory. An example of this theory is the formulation of opaque coatings where titanium dioxide is blended with other pigments to achieve color. In this case the titanium dioxide becomes the second source of scatter.

Saunderson Correction

Given the limitations of Kubelka-Munk a more complex equation was developed by J.L. Saunderson that contrasted the refractive index of the sample to that of air. With the addition of surface or specular (K1) and internal (K2) correction factors the equation became more practical for use in opaque systems.

Deficiencies of Kubelka-Munk Theory

Though the Kubelka-Munk theory has proven to be adequate in many applications it has significant deficiencies that prevent it from being a total solution for color matching. Kubelka-Munk theory continues to be popular because it provides simple analytical equations and reasonable predictions.[6]

Assumptions of Kubelka-Munk

It is assumed that the colorant layer is sufficient in extent for there to be no light lost from the edges of the layer and that it has uniform composition.[6]

Kubelka-Munk reflectances arise from the assumption that the coefficients K and S are the same for forward and reverse flux. From a many-flux analysis it can be concluded that the angular distribution of the forward and reverse flux is not the same.[6]

The Kubelka-Munk theory assumes a linear relation between the colorant characteristic K/S and the colorant concentration. In general it is found that the K/S ratio of a component colorant is a nonlinear function of the concentration.[7] This means that it will not be possible to adequately describe the colorant behavior by using a linear relation.

K/S *versus* Concentration

420 nm 520 nm

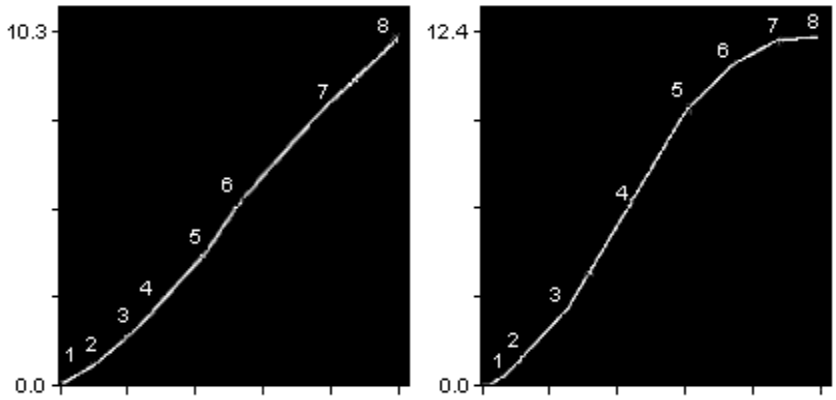


Figure 2a Figure 2b

Figure 2a shows the linear relation that results between K/S and concentration. In figure 2b the plot shows a typical non-linear relationship between K/S and concentration at 520 nanometers for a series of calibration samples.

For the Kubelka-Munk theory to work it is assumed that the pigment particles act independently of each other. The net result is obtained simply by adding up the individual actions.[4]

Lambert-Beer

The Lambert-Beer theory is reserved for transmittance calculations for very transparent samples. Dating back to the 18th and 19th centuries, the Lambert-Beer law states that the absorbence (Log 1/*T*) for a transparent sample is proportional to the thickness and the concentration of the colorant. [1]

Beer's law has been found to be valid at low and moderate concentrations in transparent applications but it may prove to be inaccurate at higher concentrations. In order for Beer's law to be valid the absorption coefficient must be a constant independent of the concentration.[3] Since all colorant layers scatter some light; these equations, even in cases of slightly turbid-media, are generally not valid.

Advanced Color Matching

Turbid-Medium Theory

Though Kubelka-Munk is a turbid-medium theory, it is limited in its application. It is important to note the advancements that have been made in other areas of turbid-media theory. This will help to determine which will best accommodate the different types of samples we see in today's color industry.

Turbid-Media

There are three kinds of optical systems that define turbid-media; optically thin, intermediate, and optically thick. Each of these systems can be seen throughout our everyday lives and each one is significantly different from the other. Of all the theories that have been developed to handle the turbid-mediums, only one can successfully handle all three optical systems.

Optically Thin

The scattered light that is observed is scattered only once; much unscattered light emerges from the sample.[2] An example of an optically thin application would be transparent *dyes* being exhausted into a textile substrate.

Intermediate

Most of the scattered light has been scattered many times, but some unscattered light emerges from the sample.[2] A typical intermediate application would be a plastics operation that works with pigments and general purpose polystyrene. Most systems that are typically assumed to fall into the optically thin and optically thick areas are actually intermediate media. Classically, offset printing inks are assumed to be optically thin and screen printing inks to be optically thick. In most cases both of these applications fall into the intermediate media classification.

Optically Thick

All the light has been multiply scattered.[2] A paint manufacturer preparing opaque coatings, where titanium dioxide is blended with other scattering pigments to create a color, would be considered an optically thick system.

Application of Turbid-Medium Theories[2]

Theory	Optically Thin	Intermediate	Optically Thick

Kubelka-Munk .....No .....No .....Yes
Four-Flux..... Yes ..... Limited.....Yes
Many-Flux..... Yes.....Yes ..... Yes
Doubling ..... Yes .....Yes .....Limited
Monte Carlo..... Yes ..... Limited..... No
Scattering Order ..... Yes ..... Limited..... No
Diffusion .....No .....No .....Yes

Billmeyer and Richards examined various turbid-medium theories for their applicability in the three levels of optical behavior.[2] Of all the theories shown only the Many-Flux method accommodates all three turbid-media classifications.

Many-Flux

The many-flux theory covers applications with all levels of optical thickness from one mathematical model. By using this model to determine absolute K and S values, the software does not have to define whether white is present in the formulation. All matching is done in one database. There is no need for separate packages that would use Kubelka-Munk single constant, Kubelka-Munk two constant or Lambert-Beer mathematics.

Color iMatch System

Color iMatch

Color iMatch is a sophisticated and intuitive color formulation and quality control tool that is easily learned and used by the expert as well as the novice color matcher.

Color iMatch automatically determines the best formula for your application based on the parameters you select, such as lowest cost or least number of colorants. It will automatically formulate with or without white, at all levels of opacity, from a single database. In addition Color iMatch Satellite Systems can offer added value by providing the same high quality formulation results as a full Color iMatch system, with a low cost and feature limited satellite.

With the continuing advancement of the personal computer, more complicated calculations can be done in less time.

These advancements in personal computers have given Color iMatch the ability to perform many complicated algorithms, such as computing many-flux calculations and spectral matching routines.

Kubelka-Munk Comparison with Color iMatch

Color iMatch is *not* based on Kubelka-Munk

Two Constant Always Used

Although a number of colorants can have very low absorption (extenders, resins, etc.) or a very low scattering (several pigments, colorants, etc.), there is no such thing as zero absorption or zero scattering. There is no single constant behavior in the real world, nature is always two constant. Because all samples show two constant behavior, the calculations in are based on two constant mathematics.[4] Though Kubelka-Munk used two-constant theory in some cases, it is limited due to the simplified equations and the assumptions about sample and colorant characteristics.

All Calculations in Absolute Units

K and S[4]

Due to the mathematical restrictions of the Kubelka-Munk equations, the pigment K and S data are calculated relative to a reference component (generally the white pigment). Typically the K and S of the white can be determined with a double measurement (reflectance and transmittance or over white and over black). This is performed on an individual sample or series of samples at constant thickness and varying white pigment

volume concentrations. This does allow for the optimization of white pigment loading, though it can result in inaccurate calculations of opacity and/or pigment loading when considered in combination with other colorants.

From the beginning Color iMatch calculates pigment K and S in absolute units. In addition the calculation of K and S goes beyond the white pigment to *all colorants* providing accurate opacity and pigment loading predictions.

K and S *versus* Wavelength

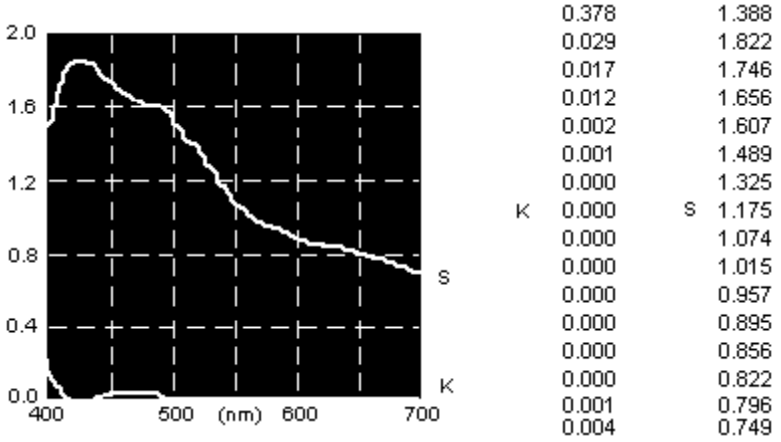


Figure 3

The data in figure 3 shows calculated K and S data, where both K and S are variable across the visible spectrum.

K1 and K2

The Kubelka-Munk equation is founded on the premise that once you disperse a pigment in a resin system, there is no further development. The determination of how much light enters a sample and how much exits after diffusion, relates directly to the Saunderson correction factors, K1 and K2.[5] However, most available software uses a fixed value for K1 and/or K2. In many cases these values are not calculated, they are input by the user. For example, default values of 4% for K1 and 60% for K2. These values are fixed for all wavelengths or they can be a calculated value limited to a single wavelength. These methods are not valid because K1 and K2 are dependent on the refractive index of the material which is wavelength dependent (see figure 4). Depending on the sample set, using a fixed K1, K2 value can lead to inaccurate calculation of absolute K and S. Color iMatch calculates and takes advantage of K1 and K2 values at each wavelength.

K1 and K2 *versus* Wavelength

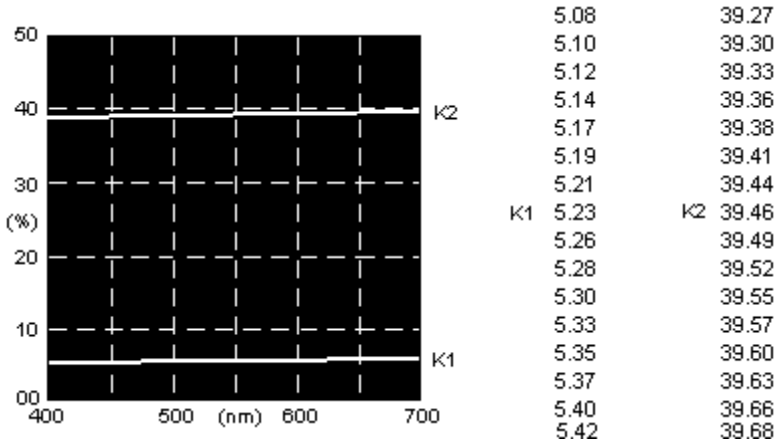


Figure 4

Figure 4 shows the variation that can occur in the determination of the K1 and K2 values at individual wavelengths across the spectrum.

As colorants are added to a Color iMatch database the K1 and K2 values will change. This implies that other samples added to the database can influence the K1 and K2 values. This occurs because the added samples will give better characterization. The system can then calculate more accurate values. In many cases other formulation packages will base its K1 and K2 calculations solely on the resin, white and black.

Non-Linear Relationships

Kubelka-Munk assumes linear relationships for K/S versus concentration and K/S versus thickness as well as the validity of the additive theory.

1. K (Concentration)
2. S (Concentration)
3. K (Thickness)
4. S (Thickness)
5. “Additivity”

Color iMatch treats all functions as completely non-linear; it does not try to approach non-linear functions through a piece by piece linear approximation.

Calibration Uses All Selected Samples

Because Color iMatch works from a single database, all selected samples are used in the calibration process. Calibration samples can consist of opaque, translucent, and transparent samples as well as samples at multiple film thicknesses. Measurements can be reflectance only, reflectance and

transmittance, over white and over black, or any combination of these measurements.

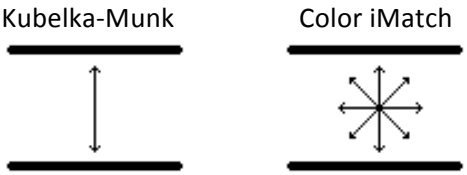
Additivity Principle Not Used

Color iMatch uses a non-linear function for the relationship between both K and S and the pigment concentration. When two or more pigments are mixed into a sample, an interaction is calculated.[4]

Many-Flux

The many-flux theory can be applied to applications that have samples at any level of optical thickness. All the calculations can be done in a single formulation package.

Two-Flux *versus* Many-Flux



Opaque Samples	Any Samples - Transparent - Translucent - Opaque

Figure 5

The physics that takes place within the colorant/resin matrix demands that directional flux be determined. Color iMatch considers light flux within the colorant/resin matrix in both an up and down flux (Kubelka-Munk) as well as directional flux.

Spectral *versus* Tristimulus Matching

Tristimulus Match

The typical approach for color formulation uses tristimulus matching routines.

Match Routine

Match standard X, Y, Z
Three equations to be solved
3 Unknowns = 3 Concentrations = 3 Pigments

Disadvantages

Because there are three unknowns there needs to be at least three pigments in the formula.

2 Pigments: impossible

1 Pigment: impossible

Spectral Match -- Color iMatch

In Color iMatch the computations are completed through an iteration process. There is no exact tristimulus match, but a best fit spectral curve match is calculated. This is not a selective spectral match; all Color iMatch formulations are done using its spectral matching routine.

Match Routine

Match standard spectral data R_i
Iteration to achieve best fit

Advantages

1. Better pigment selection due to more points of reference.
2. No limitation on the number of pigments (minimum or maximum)
3. Metamerism is minimized in calculations (spectral matching ensures quality under all lighting conditions, not just default conditions)
4. More accurate formulations in general.

Dynamic Database

Color iMatch has the capability to continually add more samples to the calibration database in order to increase performance. In addition, the sample set is variable for each individual colorant. An application may require only five samples for a yellow colorant, but twelve samples for a reflex blue to achieve optimum performance. Note that additional samples, including mixtures of multiple colorants, are used in the calculation of the absolute K and S data. These samples are *not* a function in a "search and correct" calculation.

Complete file calibration uses all selected samples and optimizes the K and S data for all colorants. The results for *all* matches will improve, not just matches that are close in color or formula to the added samples.

Sample Set

In some cases the sample set may appear to be more extensive than what is requested for other formulation packages. However the amount of work and time involved may actually be less. If a typical sample set requires two individual samples at opacity and each sample must be cross-coated five times to reach opacity, the number of drawdowns that must be made is ten (with time to dry between each cross-coat). If Color iMatch requires eight individual samples there are only eight drawdowns at process thickness, with no drying time in between.

Samples for Color iMatch Database

1. Mathematical Minimum: 2
   (2 unknowns --- 2 knowns)
   Linear relation is always correct (straight line, one sample)
   Sample validity can not be determined
   Concentration dependent
2. Non-Linear Relation (More Than Two Samples)
   samples that are not correct can be easily identified.
   More samples, better characterization
3. Types of Samples for Each Colorant
   Different concentrations with resin
   Mixes with white (help to define white using “non gray” samples)
   Mixes with black (lower reflectance values help to define K1)
4. Number of Samples
   Application dependent
   Typically 7-10 samples per colorant
5. Additional Samples
   Once the database is complete it is possible to add more calibration samples to improve performance if necessary.
   All that is required the measuring of the new sample(s) and re-calibrating the database.
6. Known Mixtures
   Mixtures of multiple colorants may also be used to characterize the database.

Sample Characteristics

In many Kubelka-Munk based color matching systems the user is required to present an opaque sample to the spectrophotometer. Depending on the application this can be done a number of ways. For coatings the technique of cross-coating several layers of colorant until opacity is achieved is commonly used. The generated sample then has become inconsistent with the typical process thickness. Although this

can add error to the formulation it will still adhere to the limitations of the Kubelka-Munk equation. [5]

The samples required for the Color iMatch system must be at process thickness for the most accurate characterization of each colorant. Unlike Kubelka-Munk samples, Color iMatch can benefit from samples that have not reached complete opacity. The sample's colorant thickness is also used in the calibration process. This enables the user to enter the same sample at different thicknesses into the database. This is important for applications that continually produce samples at varying film thicknesses.

Effect of Sample Set

Full *versus* Limited Sample Set

		Resin	White	Black	Yellow	Red	Green	Blue
1.	Actual	90	300	30	60	0	60	60
	Full	90	302	37	61	0	67	46
	Limited	90	301	0	77	24	40	69
2.	Actual	60	120	120	0	60	0	240
	Full	60	118	125	0	53	0	244
	Limited	60	106	155	0	13	0	266
3.	Actual	120	0	0	180	240	0	60
	Full	120	1	0	192	242	0	45
	Limited	120	0	82	199	197	2	0
4.	Actual	300	30	30	0	180	60	0
	Full	300	27	33	0	189	52	0
	Limited	300	25	39	27	168	442	0

Figure 6

Figure 6 shows how the number of samples used to characterize a database can affect the initial formulation. In this example the full set uses nine samples (six masstone letdowns, one with white, one with black, and one with white and black) per colorant and the limited uses three samples (one masstone, one with white, and one with black). The nine sample database provides initial predictions that are much closer to the actual formula.

Applications

Because basic pigment properties are calculated using absolute units, how they are applied in the matching algorithm add versatility to the Color iMatch system

Single Database

The same database can be used for samples at all levels of opacity; transparent, translucent, and opaque. The quality of the predicted recipes will be the same for all degrees of opacity.

Multiple Mediums

It is not necessary to characterize the pigment behavior in all mediums. Multiple resin systems (different bases, extenders, clears, etc.) can be calibrated into one database. This process only requires samples mixed with white and black for each additional resin that is added.

Reflectance and Transmission

Both reflectance and transmittance measurements can be applied to the same database. For plastics, translucent liquids, and for printing or coating on non-opaque substrates this is a very important feature. In these applications it is not sufficient to match a standard in reflectance only, a transmission match is equally important. Color iMatch can combine both types of matches in one calculation, using only one database. In order to use this capability it is necessary that the spectrophotometer can measure both the reflectance and total transmission of the sample (i.e., X-Rite Color-Eye 7000).

Contrast Measurements

Just as the reflectance and transmittance measurements can be used in one database, contrast measurements can also be applied to a single database (or even combined with R/T measurements for the calibration of the database). In this case the two measurements that would be combined are the over white and over black measurements. Typically this technique is applied to coatings and printing inks on paper or screen inks on textiles (white and black cloth).

Summary

Advanced Color Formulation

In practice there are many sources of error apart from the inaccuracies of theory. In addition there is human error, measurement error, batch variation of the colorants, and the non-reproducibility of the coloration process itself.[6] Once a process is under control, the next step is to apply color formulation software. It has been shown that many of the past methods have not proven to be completely viable for the variety of color applications that we encounter today.

The solutions presented through the X-Rite Color iMatch software are not based on Kubelka-Munk theory. All calculations are done in absolute units, and the same database can be used for matching samples that are opaque, transparent, or translucent. The database can be calibrated using samples measured in reflectance, reflectance and transmittance, or contrast modes. Color iMatch uses a single mathematical model that can be used for a wide variety of applications. There are many features within Color iMatch that can differentiate it from other color matching packages.

Considering the full scope of many applications, other commercially available packages have not been able to provide a total solution for color matching. With the addition of the many-flux theory, variable K1 and K2 values, and spectral matching Color iMatch is the next step in providing the color industry with a *total* solution for color formulation.

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Color iQC and Color iMatch
Paint Database Guide

Version 8.0 | July 2012

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Database Preparation

Refer to the X-Rite Database preparation and prepare all requested samples
Before starting the measurement process, it is good to inspect all samples

- Make sure, that the samples are complete
- Make sure, that all samples are in good surface quality

Step 1 – Review General Requirements

Homogeneity

Primary samples must be homogeny. No matter at which location of the sample the measurement is taken, the measurements should provide the same result. If samples are non-homogeneous, multiple measurements could be taken to achieve a statistical homogeneity.

Reproducibility

Primary samples must be reproducible. No matter, which person under which condition the samples produced, the same recipe should produce the same sample.
In the process of the sample preparation it is strongly recommended, that the reproducibility will be tested. 3 persons should produce at 3 days 3 recipes – these will be compared to define the reproducibility.
Experiences have shown, that ideally all calibration samples should be produced by the same person.

Representative

Primary samples must represent the application and the condition under which later on tests will be done.
Example: Film thickness If the typical paint applications will tested at 100 my film thickness it is recommended to produce the primary samples at the same film thickness.
Example: Pigment load For each pigment the maximum concentration in a given product should be defined and should not be exceeded, when producing the calibration samples. Surface changes like gloss changes or orange peel effects are indications, that the maximum pigmentation has been exceeded.

Accuracy

The highest available accuracy is required in each step of the calibration sample preparation process.
Example: Scaling It is not important, that you scale exactly the amount, which is recommended by X-Rite for a defined sample, but it is absolutely important, that the exact scaled amount will be documented. We recommend to use a scale with minimum 3digit accuracy.
Example: Film thickness: Film thickness can be defined using different methods (wet, dry). Whatever method is chosen, it is important that the correct film thickness will be provided. It is recommended, that the film thickness within a colorant calibration file should stay within +-5%

Sample preparation process

The same sample preparation process should be used for all samples

Example: mixing - The same mixing equipment with the same settings for time and speed must be used for all calibration samples.

Example: application – The same application equipment with the same settings must be used for all calibration samples.

Substrate

Calibration samples should ideally be applied over non fluorescing black and white contrast cards. These must provide areas of coat over black and white of at least 25mm * 25mm. This allows taking good measurements over contrast background and provides a good base for load calculations. Our customers have collected good experience with Form 5DX from Leneta.

Filler (f.e. Blancfix)

Filling additives have very often a color contribution. There are methods to define this and take this into account, when formulating.

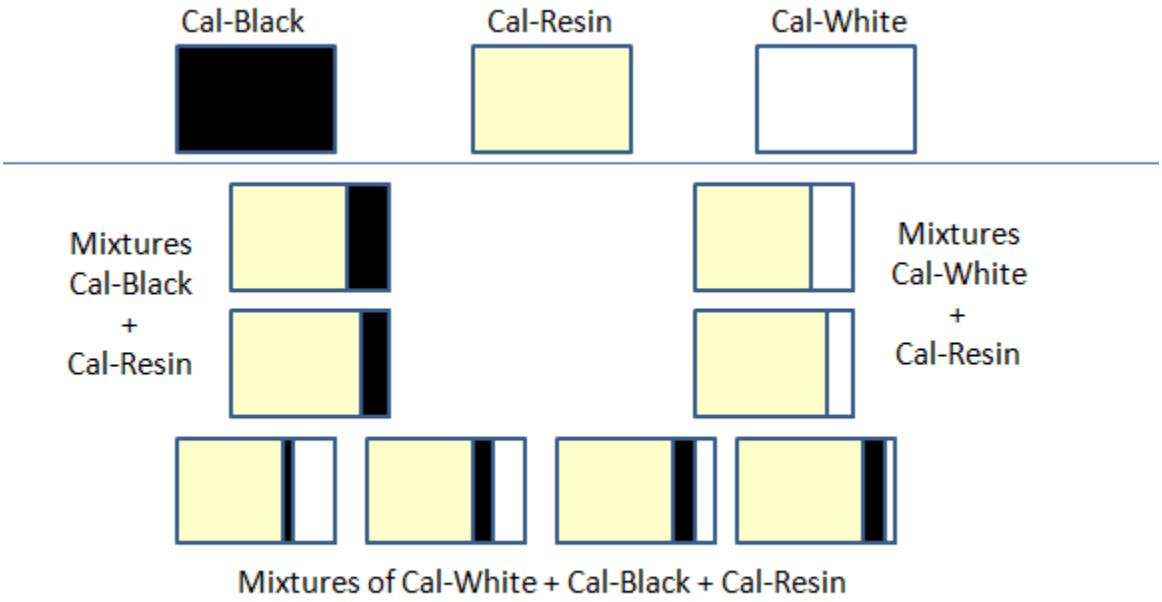
Calibration Components

The calibration pigments, white and black as well as the calibration Resin are base materials for any new calibration. Mixtures of colorant with white and mixtures of colorant with black are made for any new colorant. That's why it is important, that enough of these materials is stocked.

Calibration Mixtures

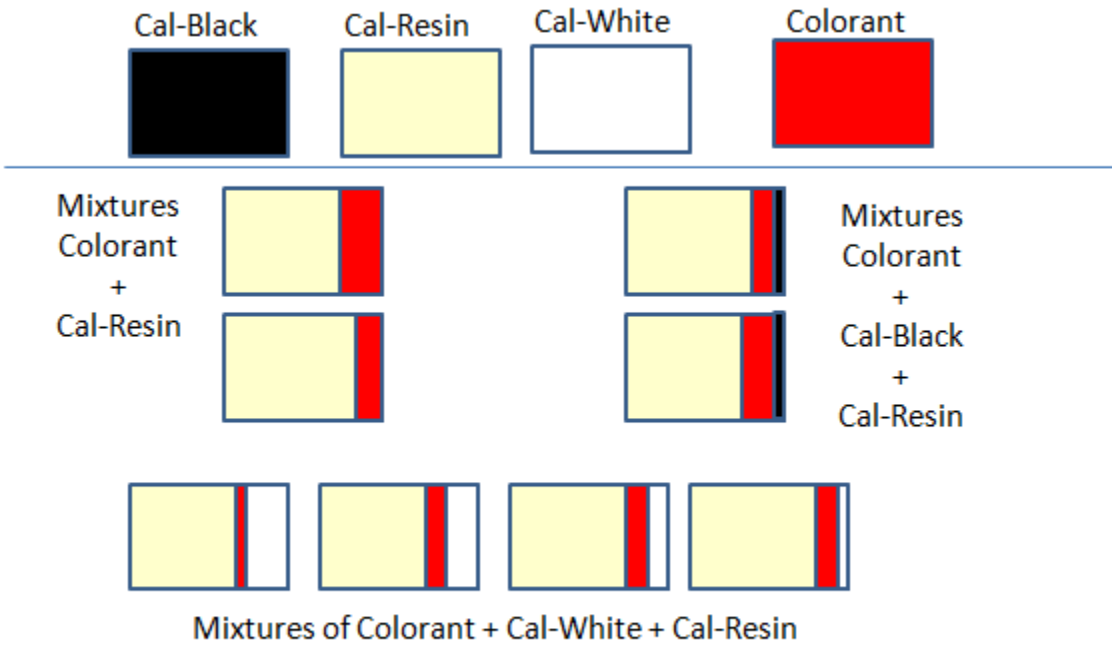
The ideal mixtures of colorant with white, black and resin depend on the individual condition in a given system. An excel table is available to calculate the ratios depending on the condition.

Base Calibration – Black white and Resin



Attention: All samples must be applied at constant film thickness over contrast card

Requirements for each colorant



Attention: All samples must be applied at constant film thickness over contrast card

Step 2 – Verification of samples and tools

Part of the sample preparation process is to define the process and scaling conditions.
For this purpose we would like you to completely prepare 3 different recipes from beginning to the end (scaling, mixing, application, drying) at 3 days by 3 persons. This will produce 3 sets with each 9 samples. This will give you some idea about the reproduce ability within the given working condition.

Visual verification of sample & process repeatability

Visually compare the 3 sets of 9 samples. Are these visually acceptable?

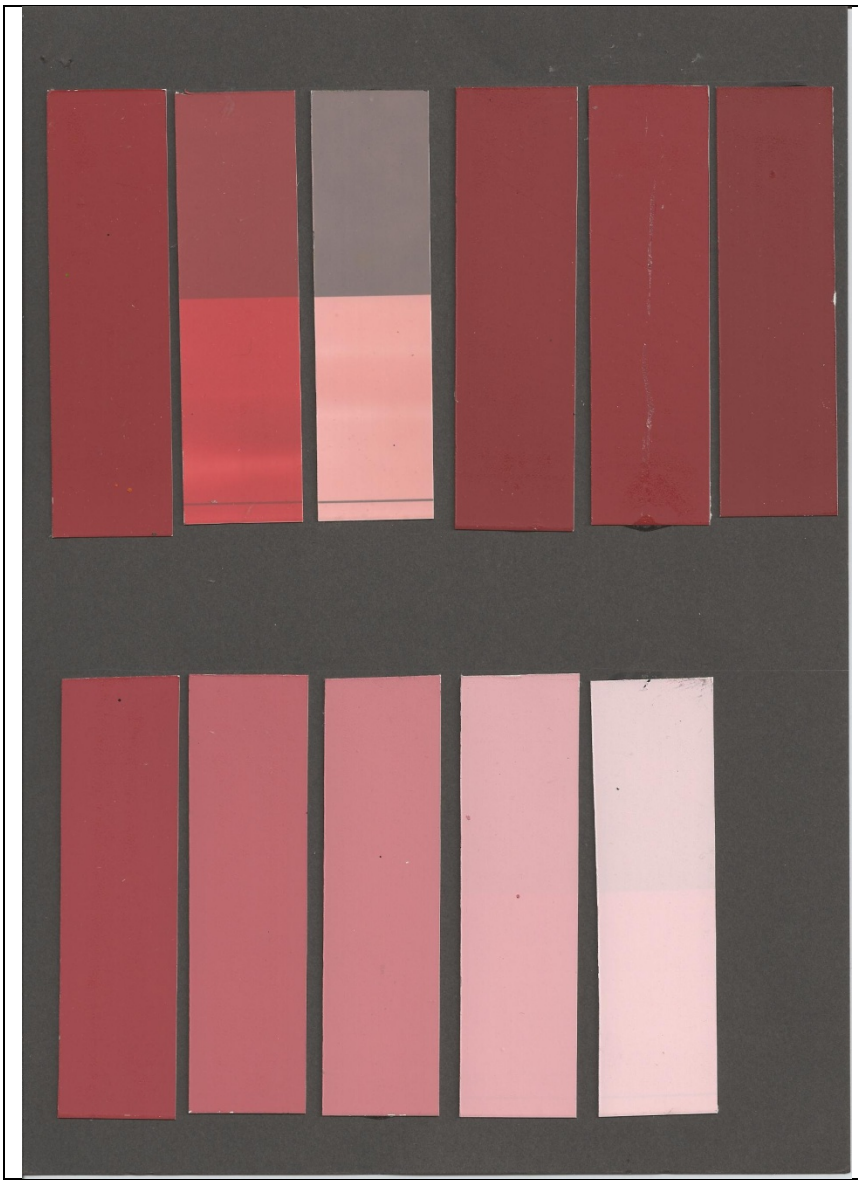
Visual verification of calibration mixtures

Visually check all calibration samples

- Are the surfaces ok?
  - Do you recognize surface effects like bronzing, gloss variations, orange peel
  - Are the samples homogeneous
- Is the build-up logical?
  - Increasing concentrations should lead to samples with increased color strength?

Sample Set for Base calibration with the following samples

- Resin,
- the substrate,
- 3 mixtures of white with Resin,
- 3 mixtures of colorant with black
- 3 mixtures of colorant with white and black.

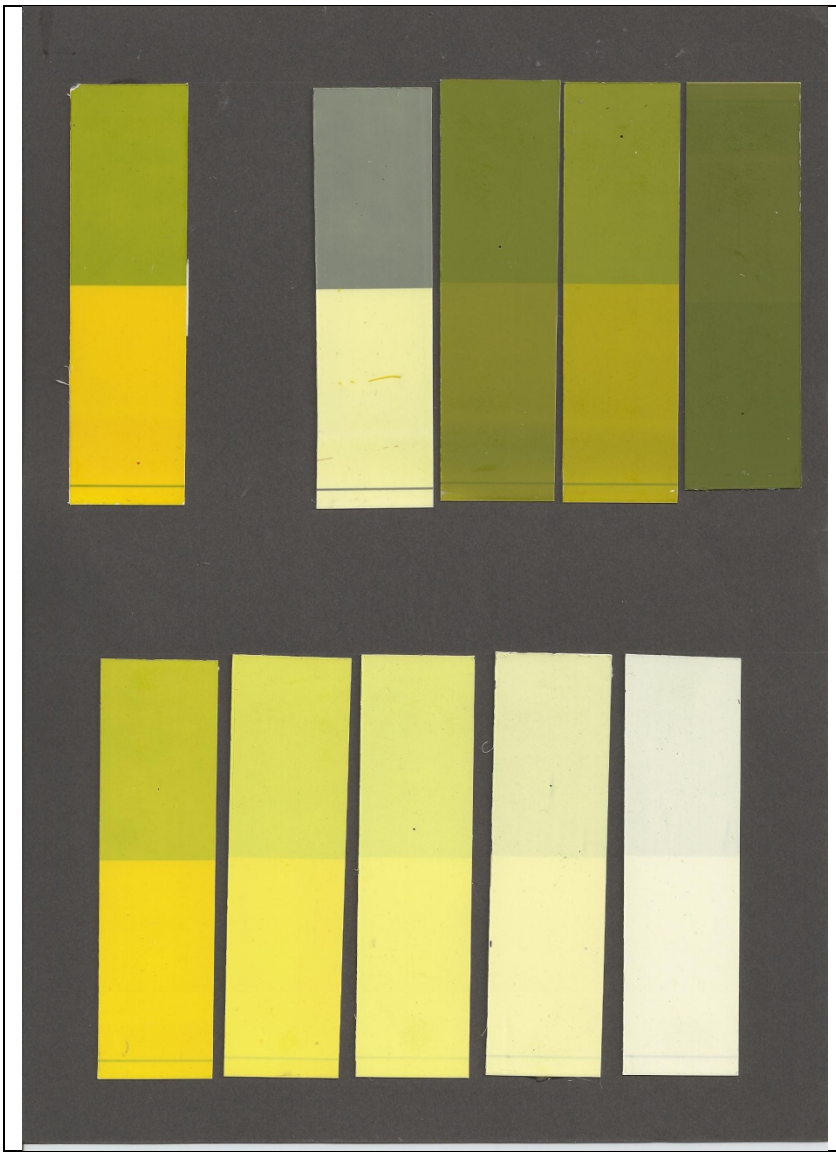


Sample Set for Oxide Red calibration with the following samples

- 3 mixtures of colorant with resin
- 3 mixtures of colorant with black and resin
- 5 mixtures of colorant with white and resin

It is easily to be seen that the samples with transparent are cloudy

On the mixtures colorants with white a good build from right to left is seen.

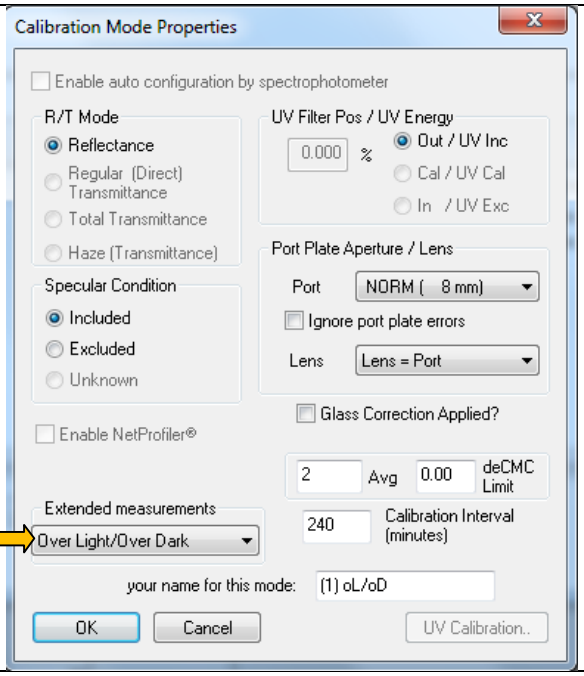


Measurement verification of sample & process repeatability

Compare the 3 set`s of each 9 samples.

Measurement verification of homogeneity of calibration samples

Especially, when we build up a paint data file with based on non hiding samples, we often experienced, in homogeneity within the samples. One of the reasons could be thickness variations.
Whatever the reason for in homogeneity is, it is recommended to define the repeatability on those samples. This helps to define, whether single measurements are ok for the measurement of calibration samples or multiple readings have to be taken.



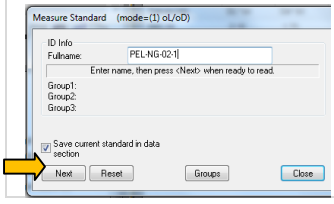
From the job button choose the [select calibration] mode option.

Select the Calibration mode Over Light/Over Dark – if it is not yet available create a new calibration mode.

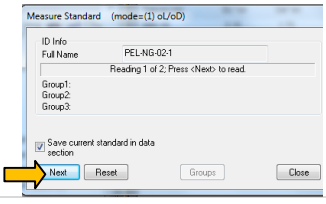
Within the properties of the calibration mode select in the extended measurement mode the Over Light/Over Dark option

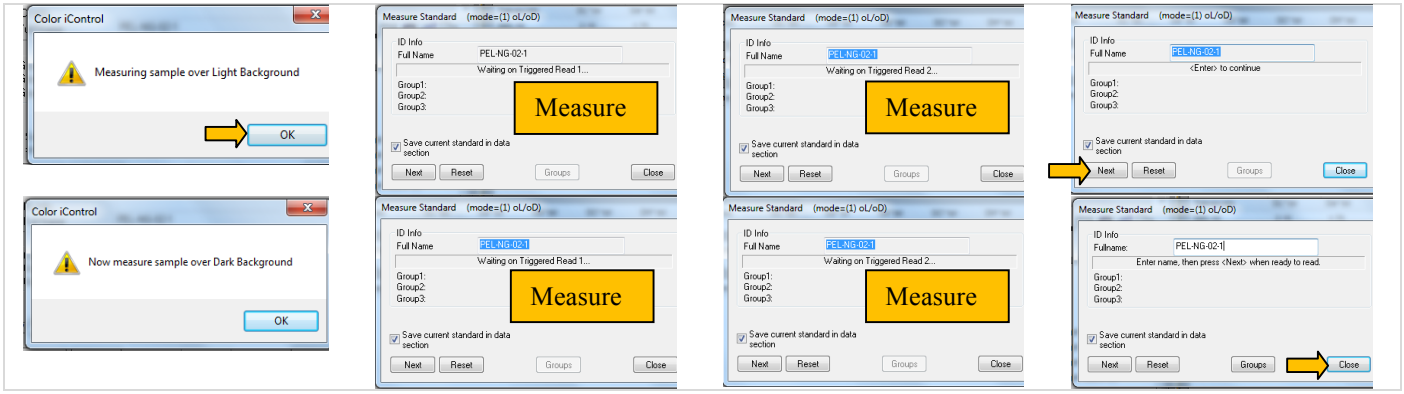
Measurement sequence for non hiding samples (over OL/OD)

Measurement sequence to measure a standard (or trial) over black and white. In this example for an average of two measurements



Enter Name and Group data and continue with next





With the above measurement sequence a few measurement comparisons have been made. Results are shown underneath

Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	I:c
D65-10	2.30	2.30	1.80	2.35	1.75	1.00	0.10	2.00

Standard Name	L*	a*	b*	C*	h°
Test 1 - Average of 2	71.43	-53.74	4.76	53.95	174.94

Trial Name	DL*	Da*	Db*	DC*	DH*	DE*	Opacity_CR
Test Sample - Repeat 2	0.67 L	0.42 R	-0.14 B	-0.43 D	0.11 B	0.80	46.08 cr
Test Sample - Repeat 1	0.59 L	0.30 R	-0.09 B	-0.31 D	0.06 B	0.67	46.24 cr
Test Sample - Repeat	-0.22 D	-0.11 G	0.03 Y	0.11 B	-0.02	0.24	47.39 cr

Example: Average of 2 – measurement at random positions created differences of about 0.5 DE and variations of about +- 0.5 in CR as well. In the following example an averaging of 3 showed differences of about 0.1 DE*

Tolerances:	DL* tol	Da* tol	Db* tol	DC* tol	DH* tol	P/F tol	Margin	I:c
D65-10	2.30	2.30	1.80	2.35	1.75	1.00	0.10	2.00

Standard Name	L*	a*	b*	C*	h°
Test 2 - Average of 3	72.04	-53.38	4.62	53.58	175.05

Trial Name	DL*	Da*	Db*	DC*	DH*	DE*	Opacity_CR
Test 2 - Repeat 3	-0.04 D	0.01	-0.00	-0.01	0.00	0.04	45.72 cr
Test 2 - Repeat 2	-0.01	0.03 R	0.01	-0.03 D	-0.01	0.03	45.77 cr
Test 2 - Repeat	-0.03 D	0.00	0.02	-0.00	-0.02	0.04	45.84 cr

Step 3 – Measurement of all Calibration samples

For this function a job will be created to store all calibration samples in this job.

Certainly all measurements could be done directly in the Pigment Calibration routine, but there are some advantages, if all samples have been measured before in a separate process.

- All measurements are made at the same time with more focus and less interruptions
- If something goes wrong with the calibration – the samples can be recalled any time
- Easy to do additional tests, if there are doubts about the measurement for difficult samples

Typically all mixtures would be measured and sample identifications would be provided, which makes it easy to recall the correct sample

A measure routine for OverLight/OverDark would be defined and all samples will be measured.

Trial Name	L*	a*	b*	C*	h°	Opacity_CR
Sheen Contrast	94.28	0.21	0.31	0.37	56.53	6.95 cr
PEL-BWR-00	91.86	-0.54	5.71	5.73	95.43	26.87 cr
PEL-BWR-01	95.04	-0.67	3.15	3.22	101.99	92.18 cr
PEL-BWR-02	92.87	-0.88	6.12	6.18	98.19	56.07 cr
PEL-BWR-03	92.28	-0.72	6.01	6.05	96.87	29.98 cr
PEL-BWR-04	26.56	-0.01	-0.45	0.45	268.23	100.00 cr
PEL-BWR-05	41.83	0.03	-0.33	0.33	275.61	81.06 cr
PEL-BWR-06	76.33	-0.12	3.78	3.78	91.79	41.78 cr
PEL-BWR-07	35.39	-0.69	-3.58	3.64	259.14	100.00 cr
PEL-BWR-08	51.60	-1.25	-4.75	4.91	255.24	100.00 cr
PEL-BWR-09	88.25	-0.89	0.16	0.90	169.79	98.93 cr
Pel-Red-01	49.45	58.10	32.73	66.68	29.39	67.80 cr
Pel-Red-02	66.20	45.19	13.28	47.10	16.37	46.21 cr
Pel-Red-02a	86.44	10.57	4.40	11.45	22.61	32.91 cr
Pel-Red-03	56.35	52.00	18.36	55.15	19.45	87.33 cr
Pel-Red-04	67.82	39.61	7.77	40.36	11.10	95.08 cr

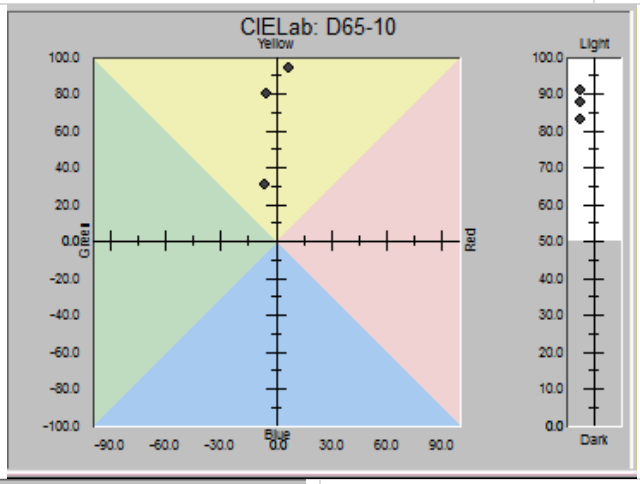
At the end all samples have been measured and stored in the job file. The display (printer) form contains the information about CR as well.

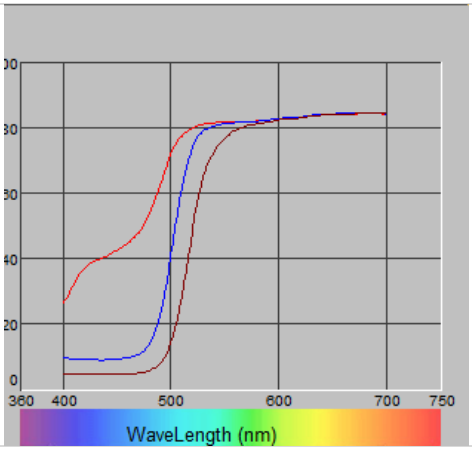
Mixtures of colorant with Resin

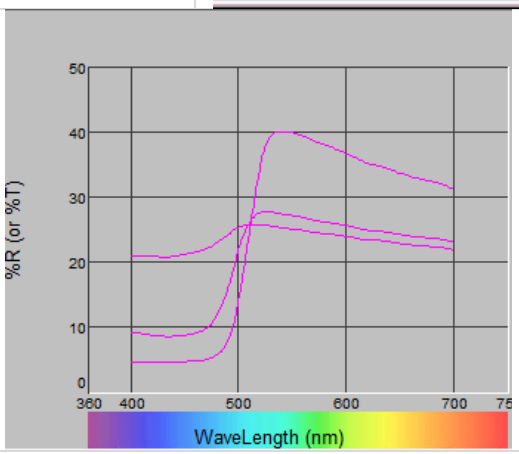
ame	Meas	L*	a*	b*	C*	h°	Opacity_CR
Y-02a	%R MAV SCI UVI XRite SP62/SP...	90.73	-6.12	30.96	31.56	101.18	30.96 cr
Y-02	%R MAV SCI UVI XRite SP62/SP...	87.44	-5.36	79.84	80.02	93.84	34.11 cr
Y-01	%R MAV SCI UVI XRite SP62/SP...	83.23	7.14	93.64	93.91	85.64	51.36 cr

Each group of colorants can be analyzed. In this case 3 mixtures of yellow color with resin viewed. 1 = highest concentration 2a is the lowest concentration.
In the above data group we can see, that the concentration line is represented by the Contrast ratio 1=51 / 2=34 / 2a = 31.

On the right side, we see that the samples have more or less the same hue angle,







Reflectance data over white and black

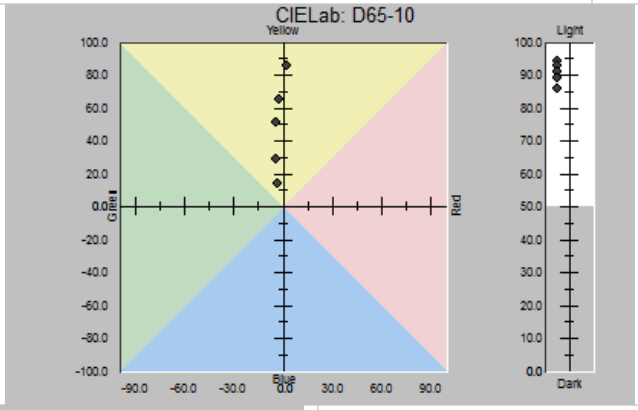
The measurements over white show a good separation
The measurements over black show strange behaviour for the lowest concentration

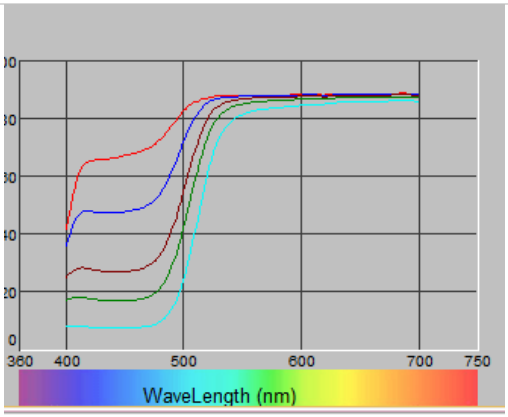
Mixtures of colorant with white

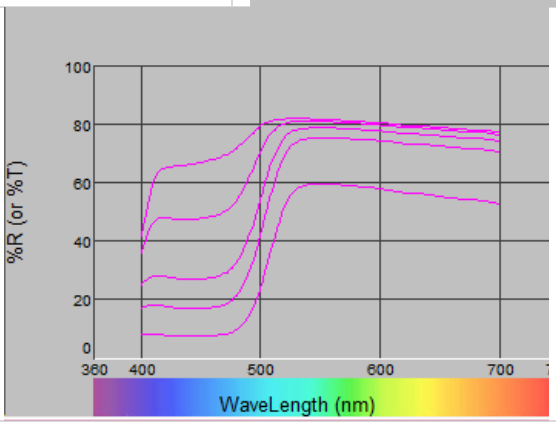
ame	Meas	L*	a*	b*	C*	h°	Opacity_CR
Y-07	%R MAV SCI UVI XRite SP62/SP...	94.18	-3.20	14.00	14.37	102.86	92.77 cr
Y-06	%R MAV SCI UVI XRite SP62/SP...	92.86	-4.65	29.11	29.48	99.07	92.45 cr
Y-05	%R MAV SCI UVI XRite SP62/SP...	90.78	-4.40	50.72	50.91	94.96	91.00 cr
Y-04	%R MAV SCI UVI XRite SP62/SP...	88.95	-2.61	65.32	65.37	92.29	88.82 cr
Y-03	%R MAV SCI UVI XRite SP62/SP...	85.82	2.31	85.22	85.25	88.45	73.51 cr

Here we have 4 mixtures of the yellow with white.
The increasing yellow concentration from 7 (lowest) to 3 (highest) can be seen on the b-value.
The higher contrast ration of sample 7 (higher white content) agrees with the expectation.

On the right side, we see that the samples have more or less the same hue angle,







Reflectance data over white and black
There is a good separation between the concentration

Each of the calibration sets should be analyzed and any anomalies should be noted.

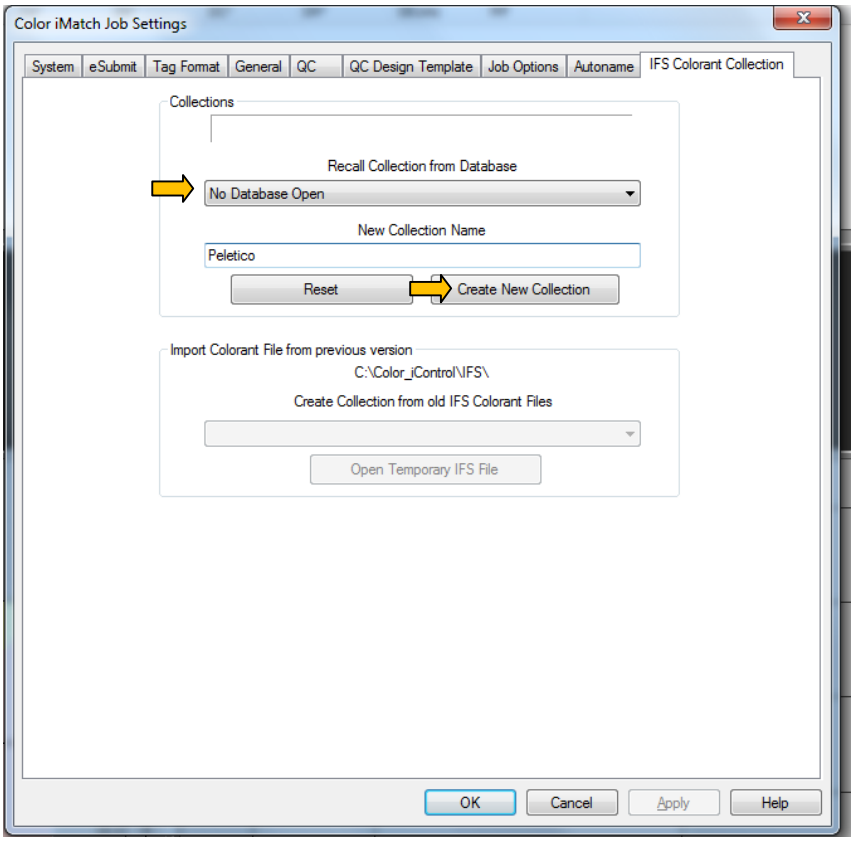
Step 4 – Prepare all data for the creation of the Colorant Collection

Within the process of a Colorant Collection the following information are required:

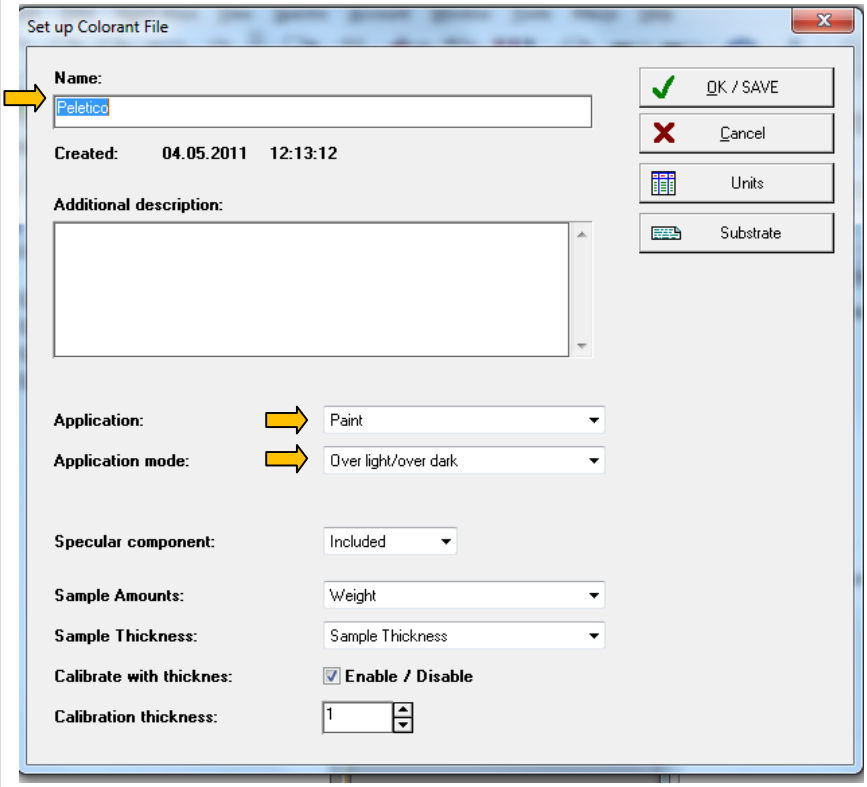
1. Job with all reflectance data
2. All concentrations of the calibration samples
3. All Specific Gravities, Colorant Prices,

Step 5 –Creation of the Paint Data File and storage of Base Data

Create a data base



With F2 the SET-UP will be called. On the Tab IFS Colorant Collection – a new collection name will be provided and the Create New Collection button will be clicked.



The Set Colorant File windows will come up and file definitions have to be made.

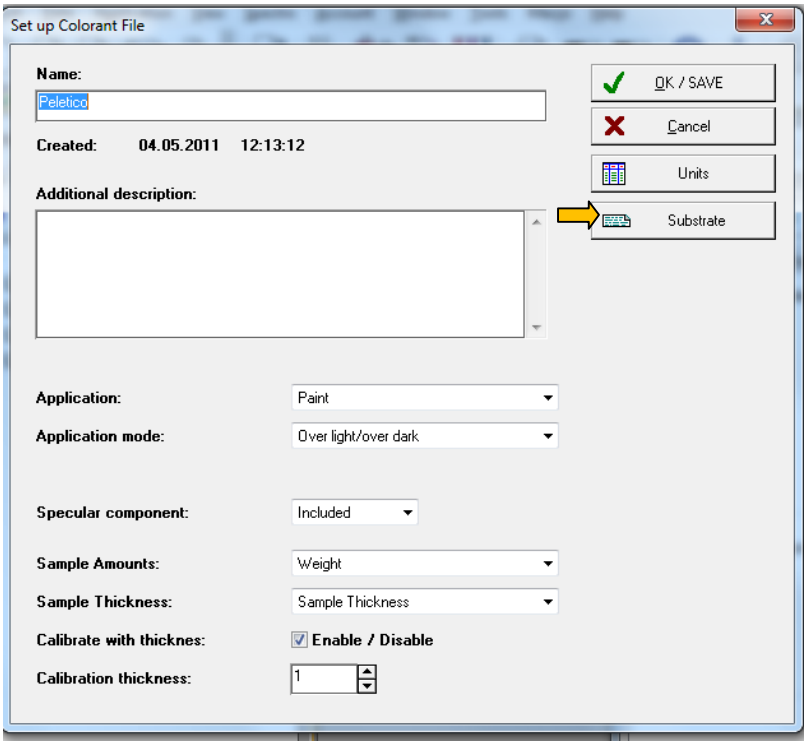
For Paint Application with non hiding samples the OverLight/OverDark application mode will be selected.

Typically the Specular component included mode will be selected

Typically the Sample Amount method – weight will be selected, since scaling of calibration samples is typically done by weight.

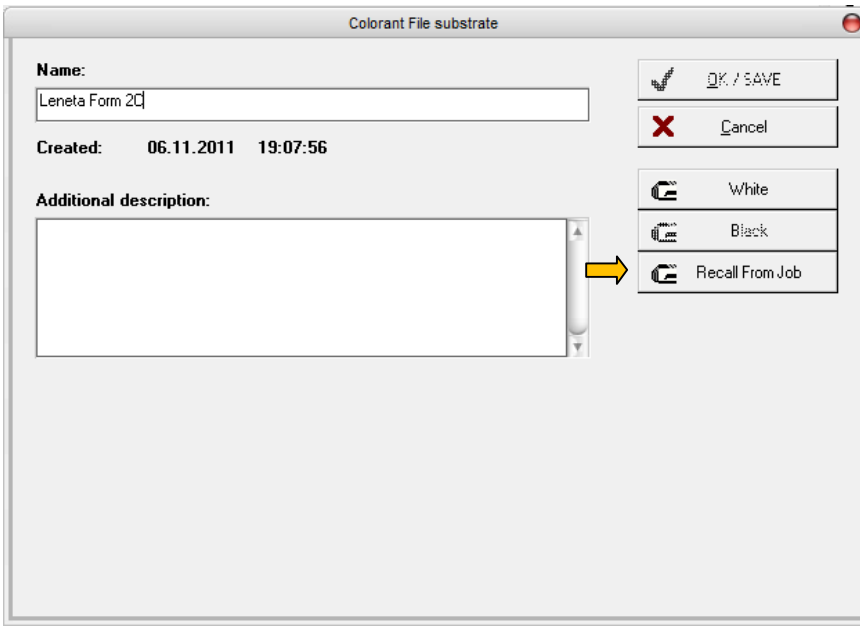
Typically the Sample thickness will be defined in the sample thickness.

If the calibrate Enable is activated, the film thickness will be part of the calibration



Next the substrate has to be measured or called from Job
This is done by clicking the substrate button.

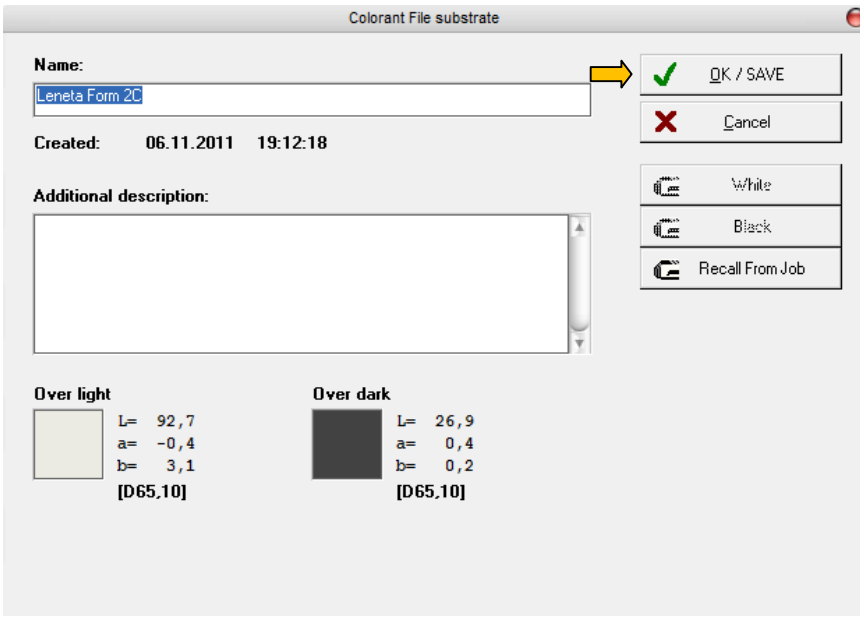
Enter substrate data



This is done by clicking the substrate button.
By pressing the [White] button the measurement of the white background would be initiated.

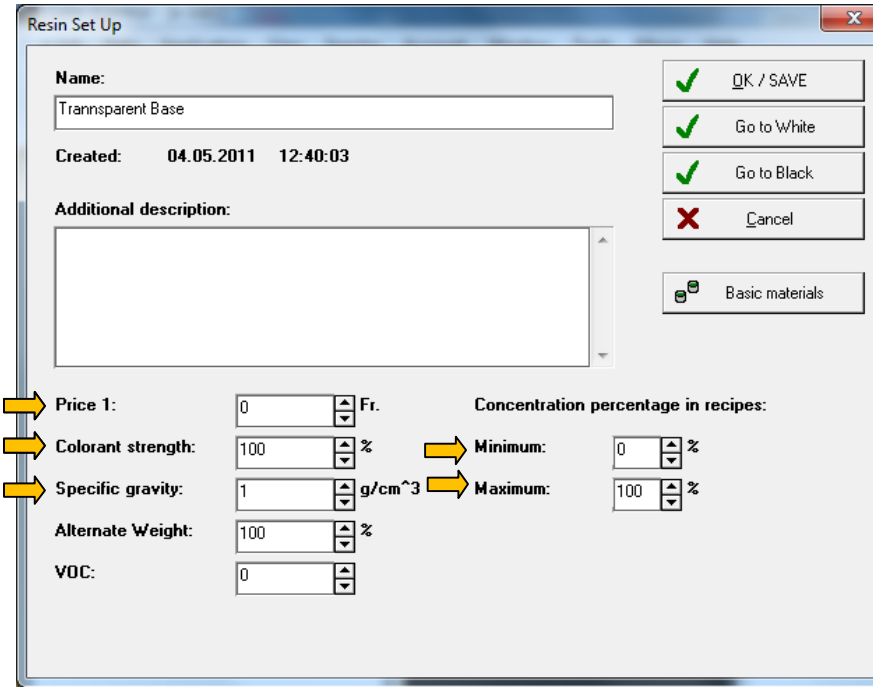
By pressing the [Black] button the measurement of the white background would be initiated.

Since all measurements have been done in the job we press [Recall from Job].
This allows to retrieve the measurement data from the job.



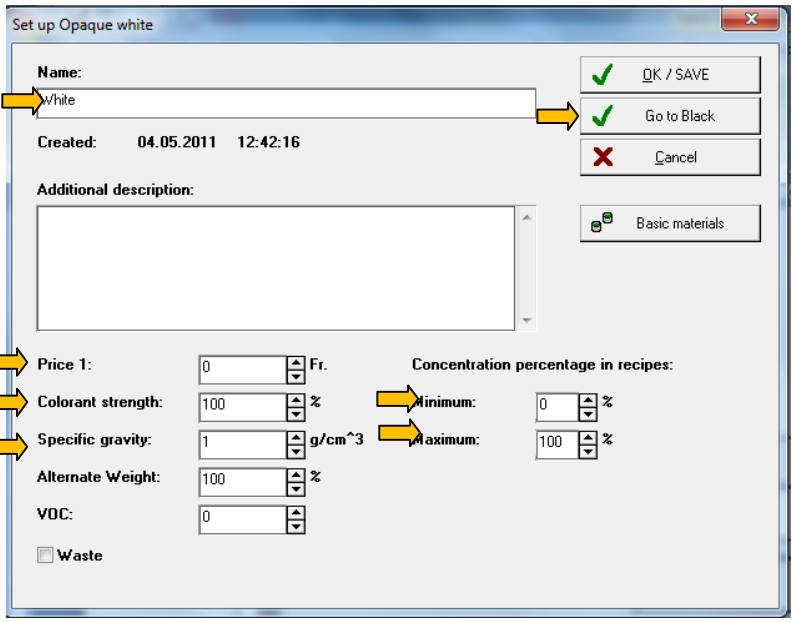
As soon the measurement data have been retrieved the lab – values for the over light and over dark will be shown.

Enter the Name, Price, Colorant Strength, SG,.. for Base, White and Black

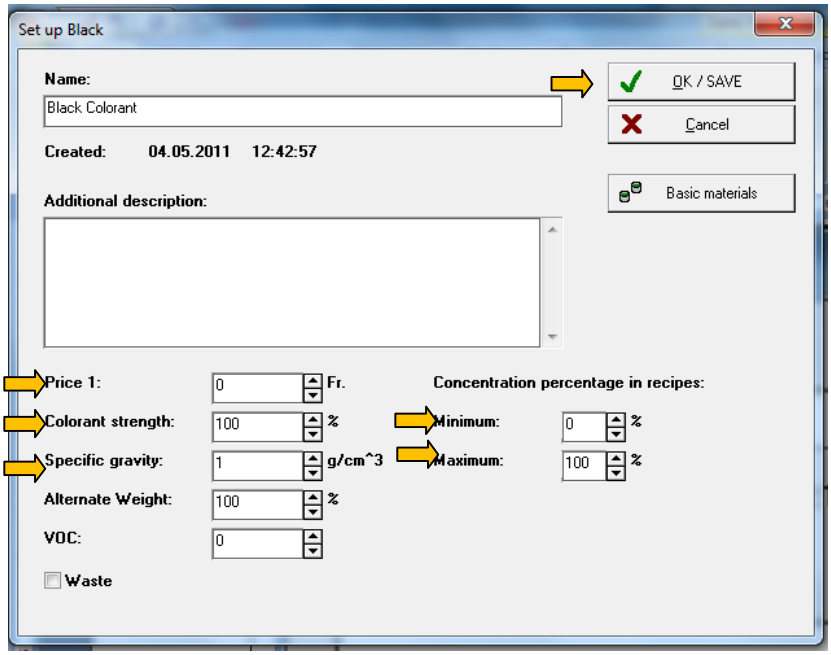


In the next step enter the Name and data of the transparent base.
As soon this is done press the [Go to White] button.

This switch to the windows to enter the White Colorant Data.

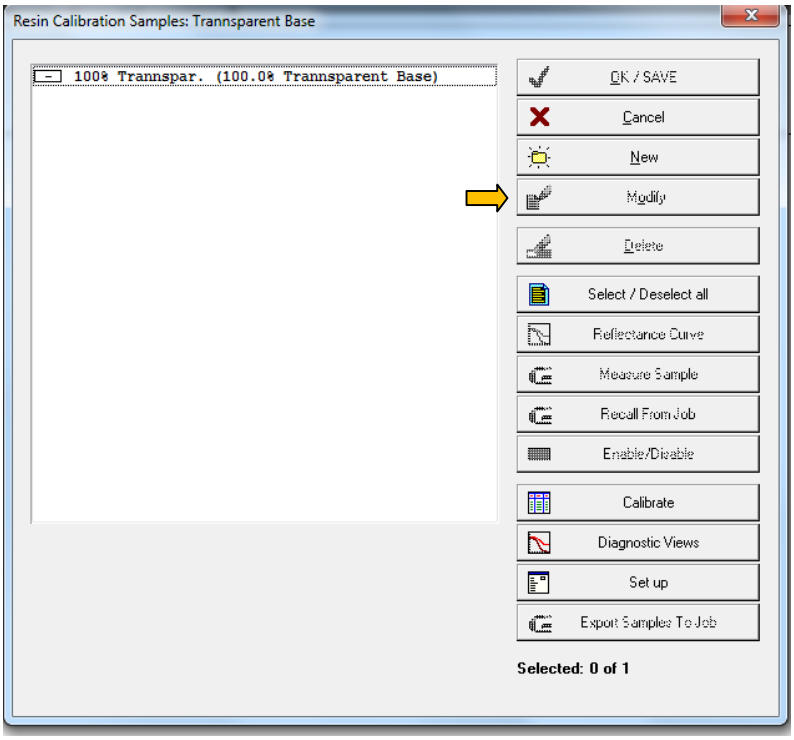


In the next step enter the Name and data of the white.
As soon this is done press the [Go to Black] button.
This switch to the windows to enter the Black Colorant Data.



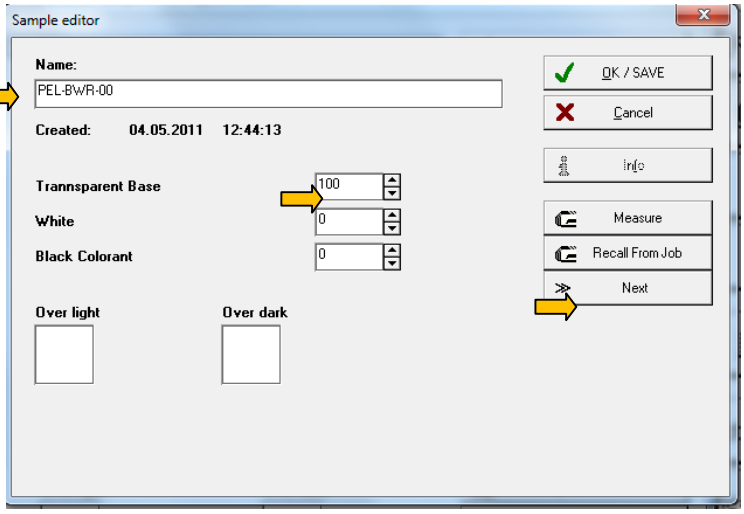
In the next step enter the Name and data of the Black.
As soon this is done press the [OK Save] button.
All technical data and prices for the Base, the White and the Black have been entered now.

Insert Calibration samples



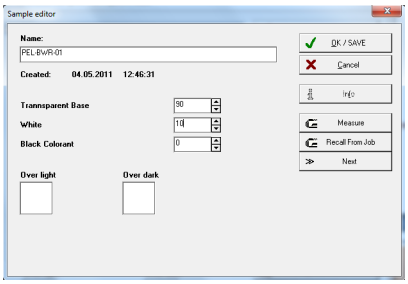
In list of calibration data a sample with 100 % Transparent is already listed. The – sign in the sample indicates that no reflectance measurements have been stored yet.

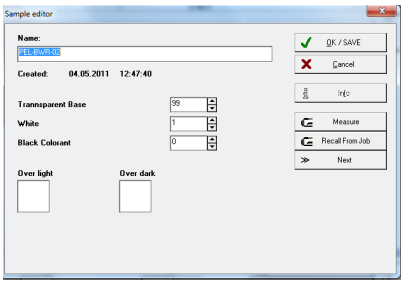
If we mark this sample and press modify, we can view the details of this input

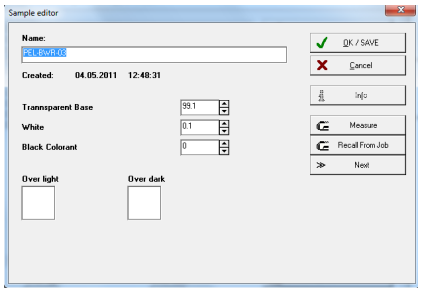


We change the Name to agree – to the name we used in the job for the 100 % Transparent
PEL-BWR-00
Pressing next will allow to enter the next concentration

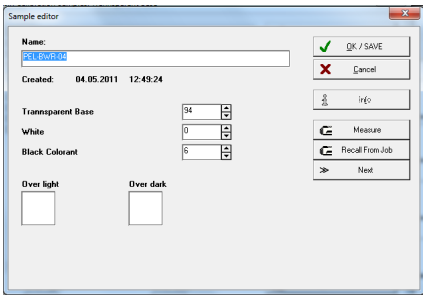
For the next series of samples – the mixtures of White with Resin - the name and concentration will be entered.

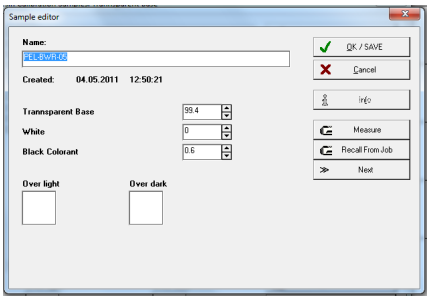


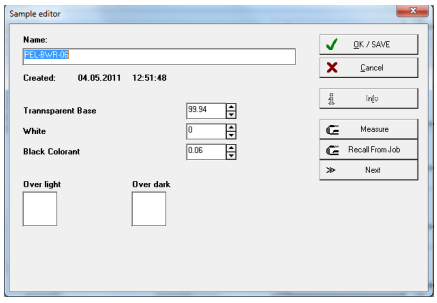




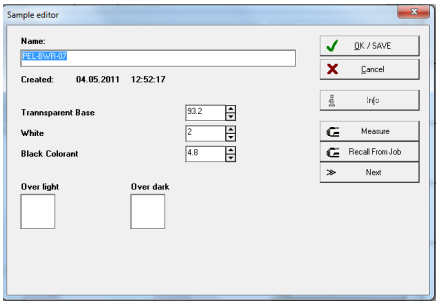
For the next series of samples – the mixtures of Black with Resin will be entered

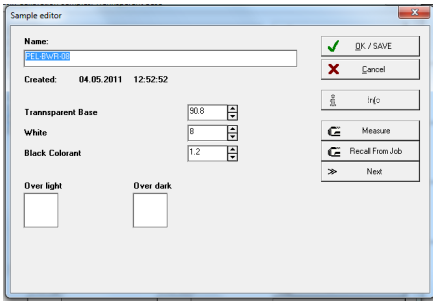


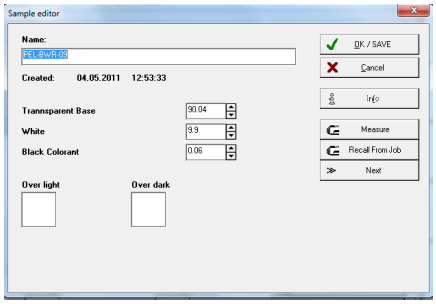




For the next series of samples – the mixtures of White and Black and Resin will be entered

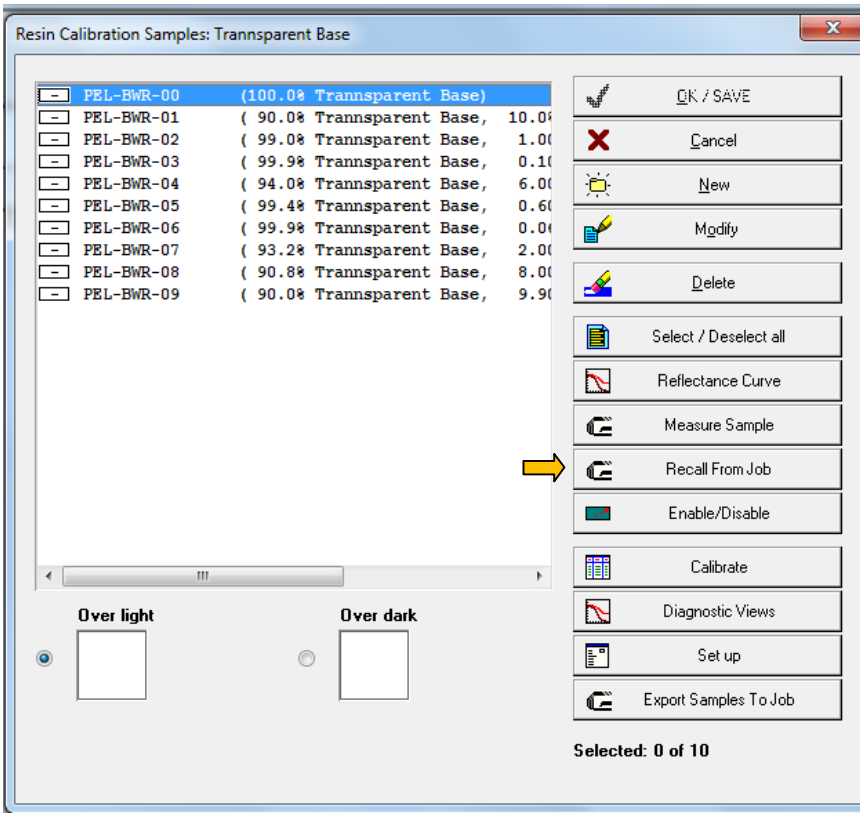




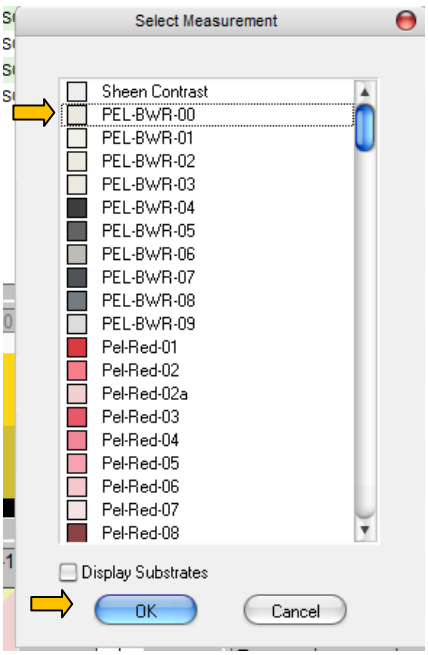


Recall reflectance data for the calibration mixtures

As soon all concentrations have been entered press the ok button

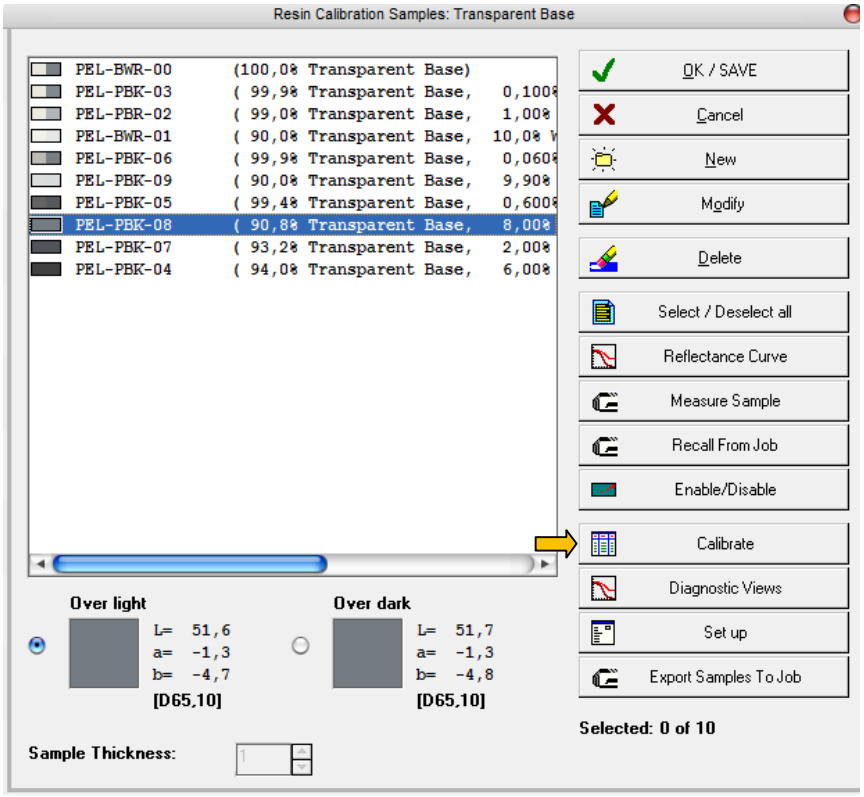


When all concentrations have been entered a list of all samples will be shown. The – sign will indicate, that no reflectance readings are available. Mark the first sample and press the [Recall from Job] button.



Select from the job the sample which contains the reflectance for this concentrations

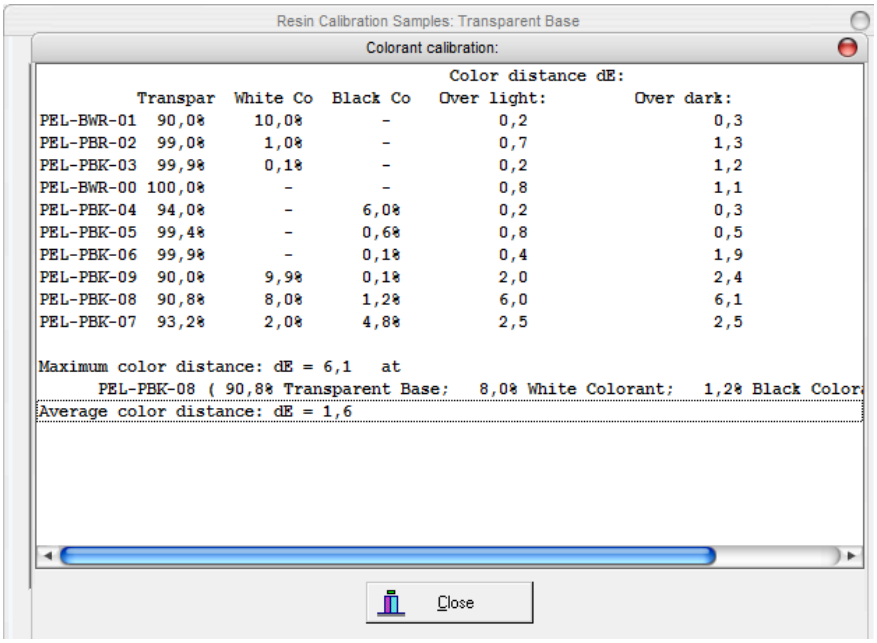
Repeat this for all samples in the list.



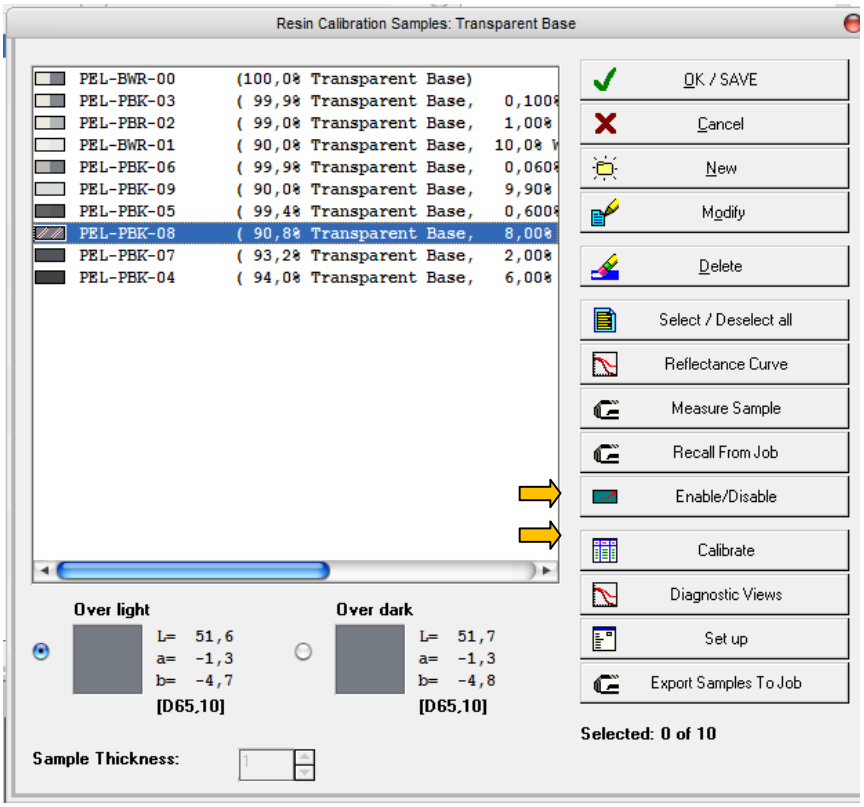
As soon all for samples a reflectance curve has been added the listing would like this.
Instead of a – there is a sample icon with a measurement over white and black background for the non hiding samples and a solid icon with the color of the sample for the hiding samples.

For whatever sample is selected detailed information will be provided underneath.

Analysis of data – with the Calibrate and Diagnostic Views

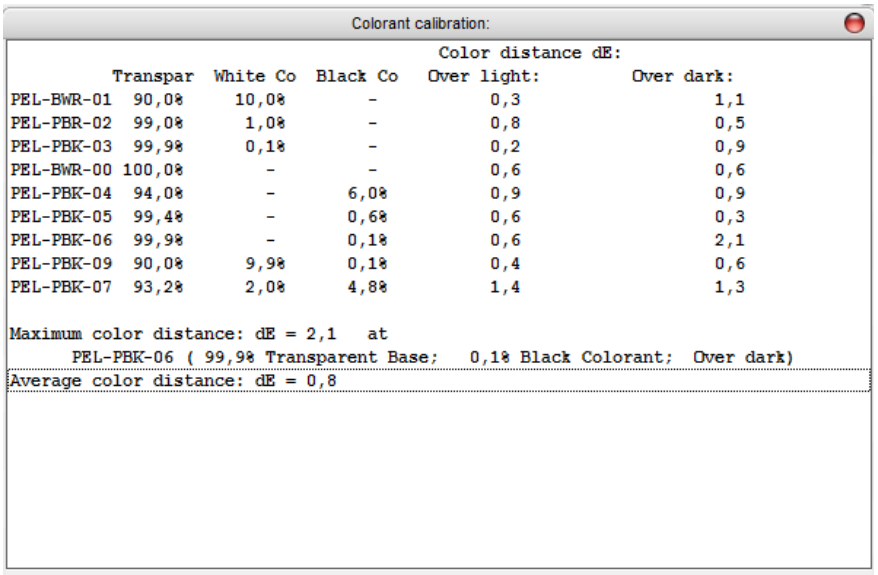


In this example of the calibration view there is a quite good back calculation of all samples over white except for sample 8 which shows a difference of 6 DE over light and 6.1 over black.



The program allows to disable easily the questionable samples

Once the questionable sample has been disabled – the calibrated function will be used again.



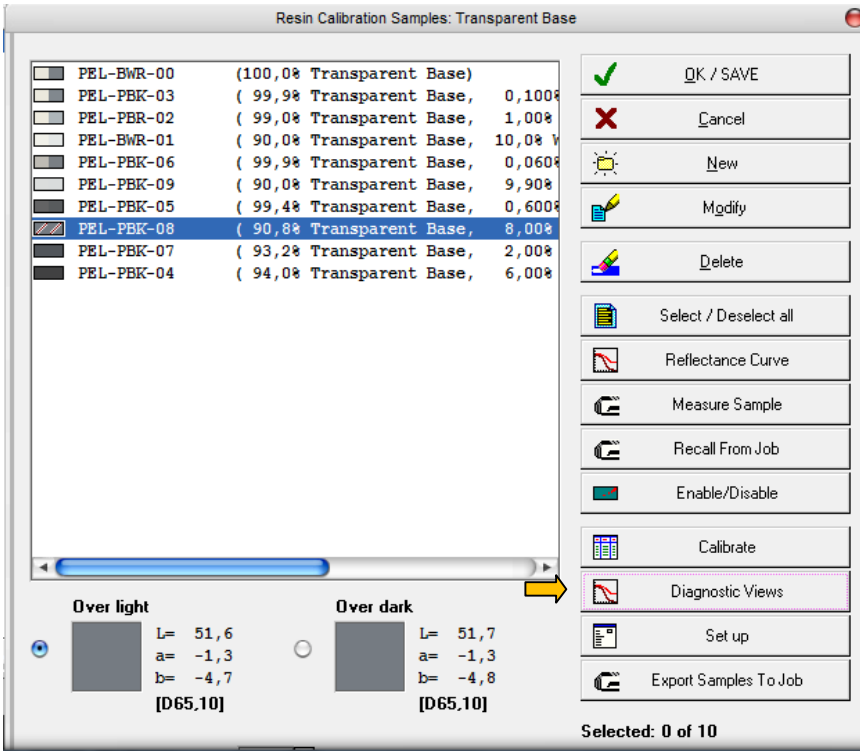
After disabling the sample 08 the average color difference has dropped down from 1.6 down to 0.8.

As better the average dE is, as better the agreement of the samples to each other is (as better the process control) in the sample preparation.

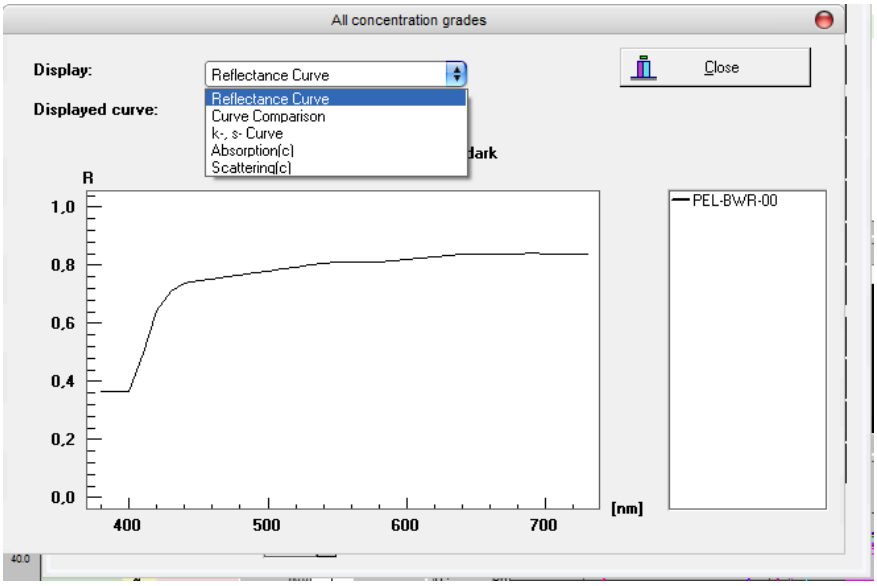
General Rules for evaluation of concentration samples, which do not fit

If there are samples, which do not fit to the rest of the samples proceed in the following way:

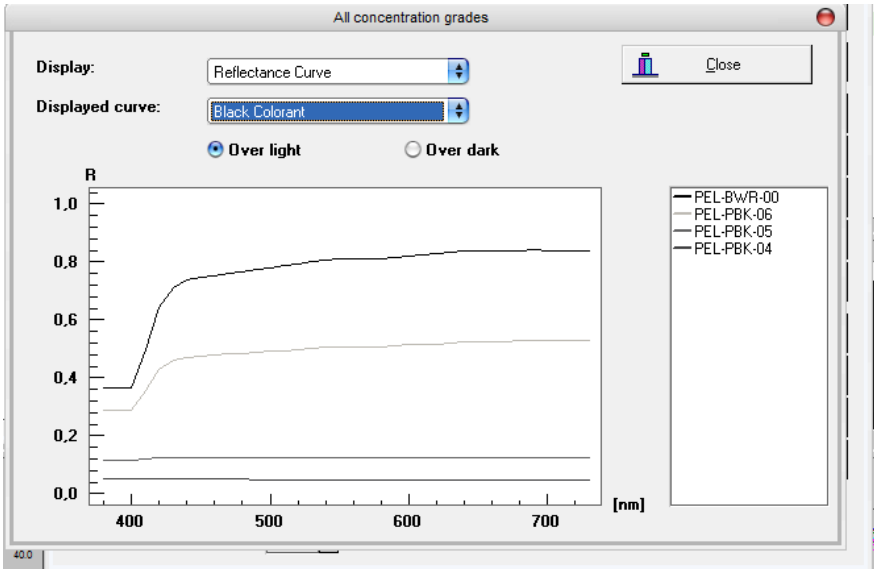
- Check the concentration – is the right concentration entered
- Check the film thickness entry
- Recall the sample once again (to avoid that a wrong sample has been used)
- Remeasure the sample
- Remake the sample



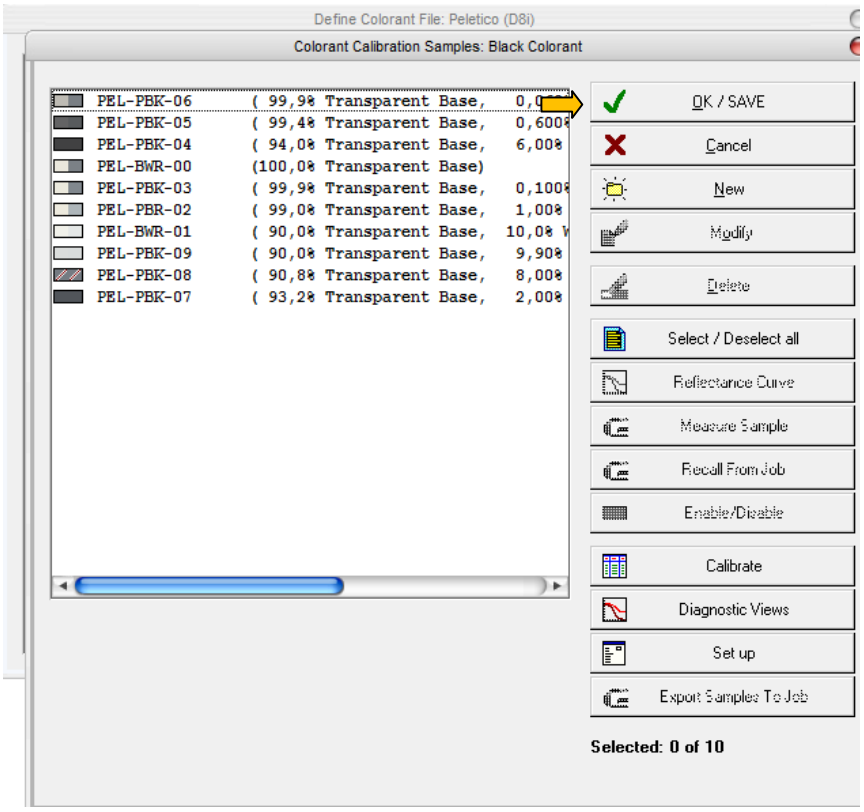
With the diagnostic views further information can be received.



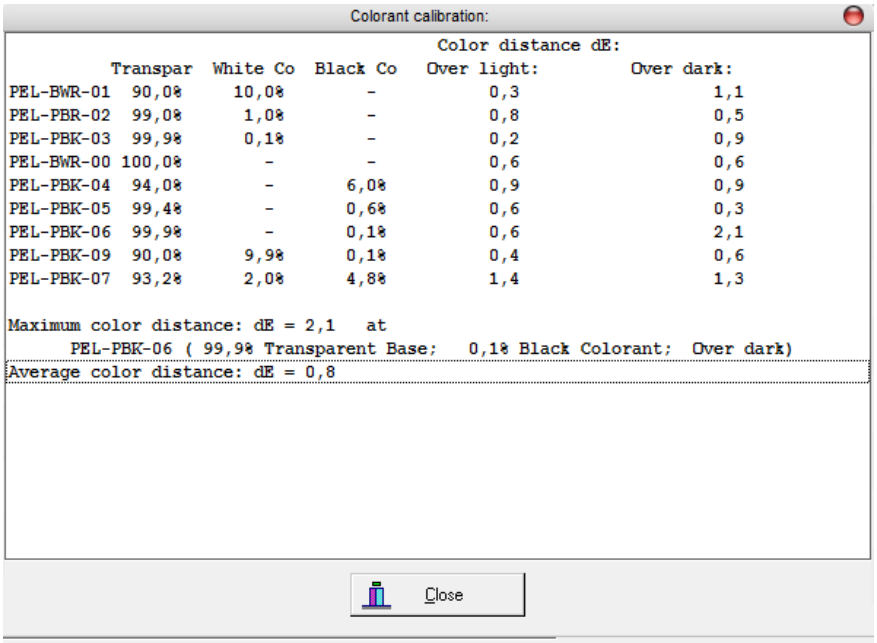
In the diagnostic views the reflectance curves, Absorption, Scattering and K vs. S curves and Curve comparisons can be made.



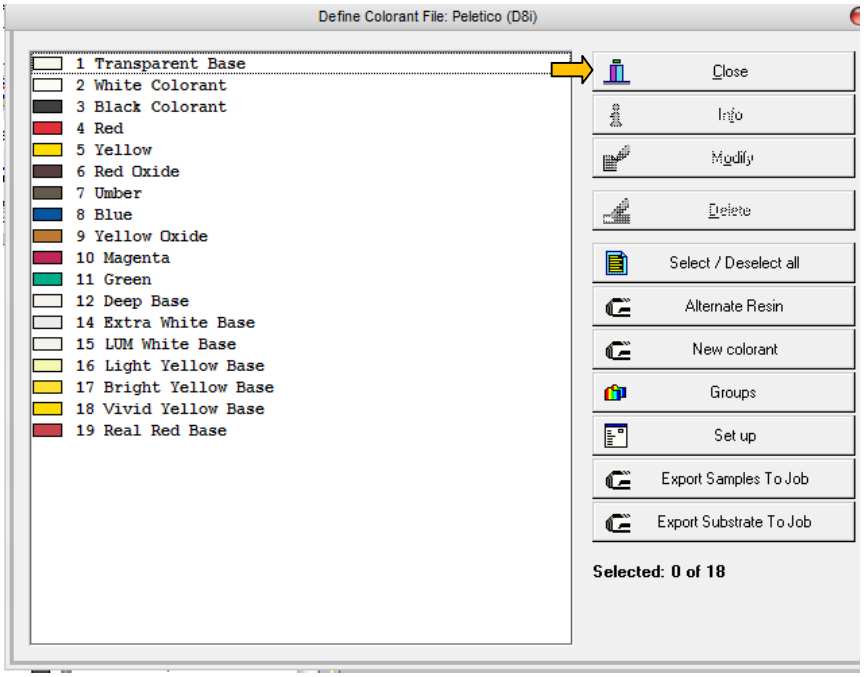
One of the items you should look for is a good representation over the total reflectance area.



Once the samples have been approved press OK / Save



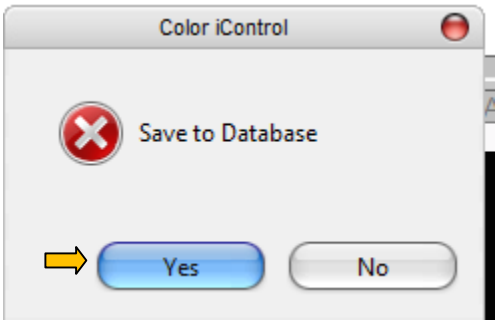
This will review the calibration of the samples



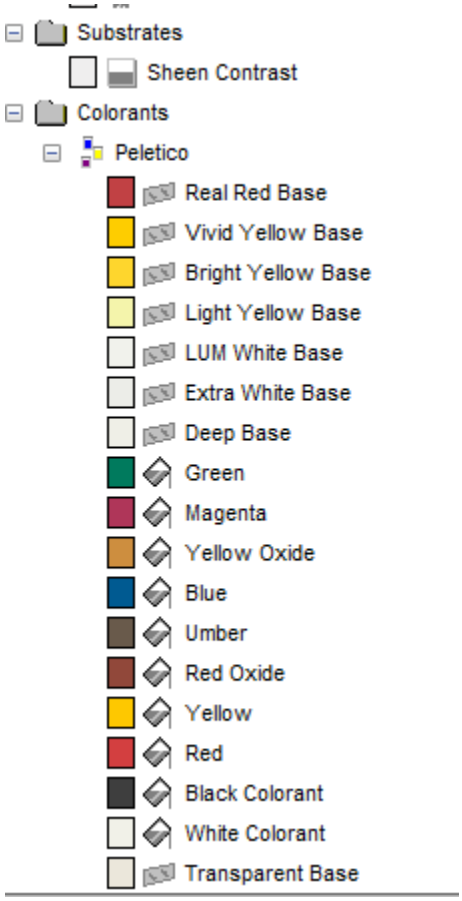
Repeat the procedure for all colorants

- Enter data (price, SG, …)
- Enter Data (Price, SG, min max, ….)
- Recipes
- Recall samples
- Evaluate samples

From to time close the colorant file



Save to Database and save job afterwards



The colorant set is now available in the data base and can be used for formulation,

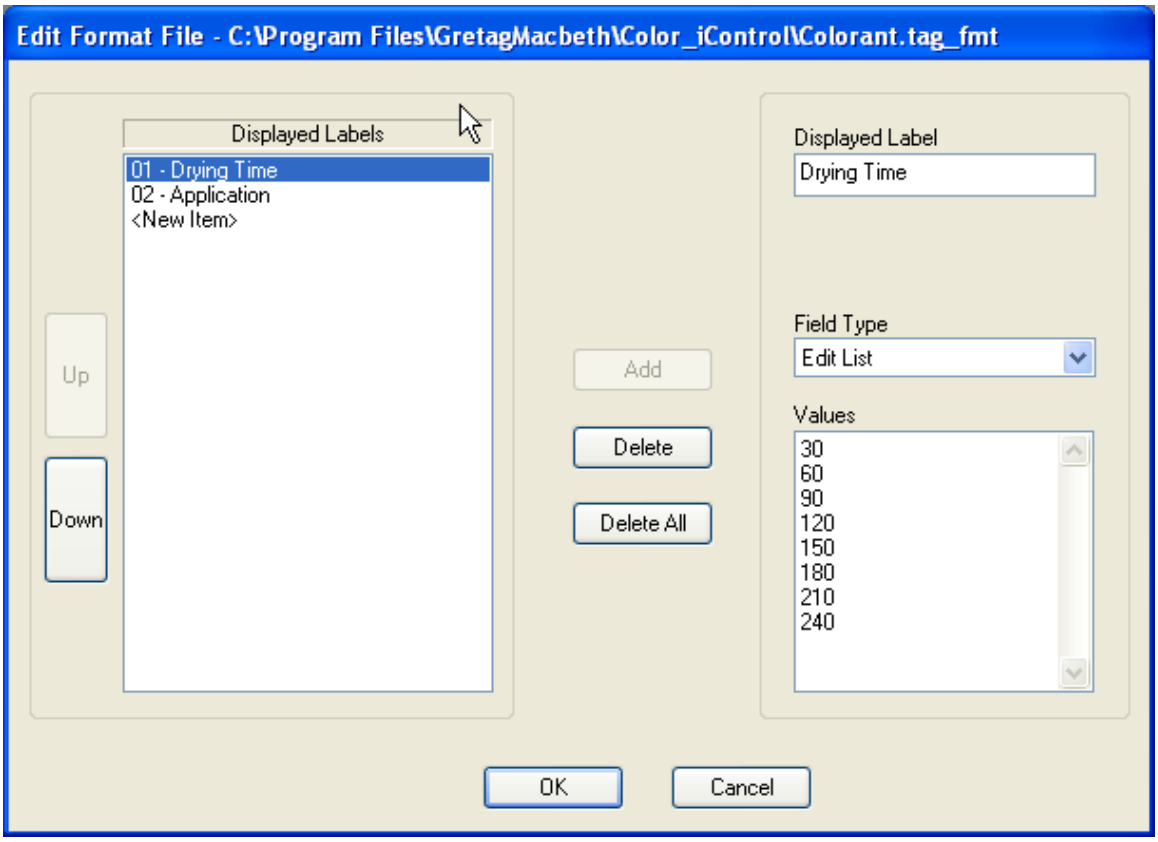
The next step would be to create a job template with the colorant collection.

Color iQC and Color iMatch
Colorant Rules Guide

Version 8.0 | July 2012

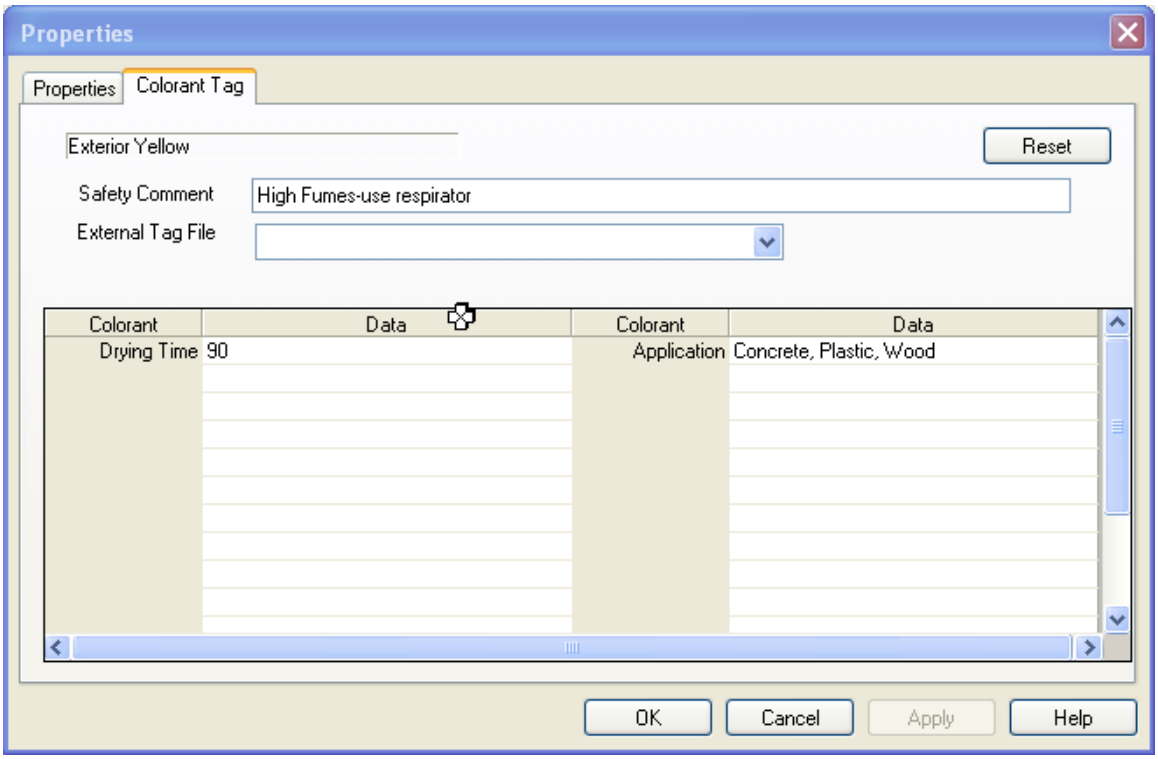
Colorant Rules in formulation is used to select a set of colorants out of all the current colorants available to be used for formulation. It is like creating a group of colorants on the fly. For example if you need to match a shade with paint but need it to dry quickly they you can specify a rule for drying time to be equal to or shorter that 30 minutes. When you choose this rule in formulation it will look through the colorants available and select only those that you have set to have drying times of 30 minutes or less. To use Colorant Rules you can define up to 30 tags / information you want to track or group by, enter the actual information into each colorant, then create a rule for use in formulation.

First you will need to setup Colorant Tags. This is a onetime setup and will be used for all colorants in the system. To setup colorant tags you will enter Color iMatch and close all e-Jobs. Then go to the Settings menu and choose Setup Colorant Tagging.



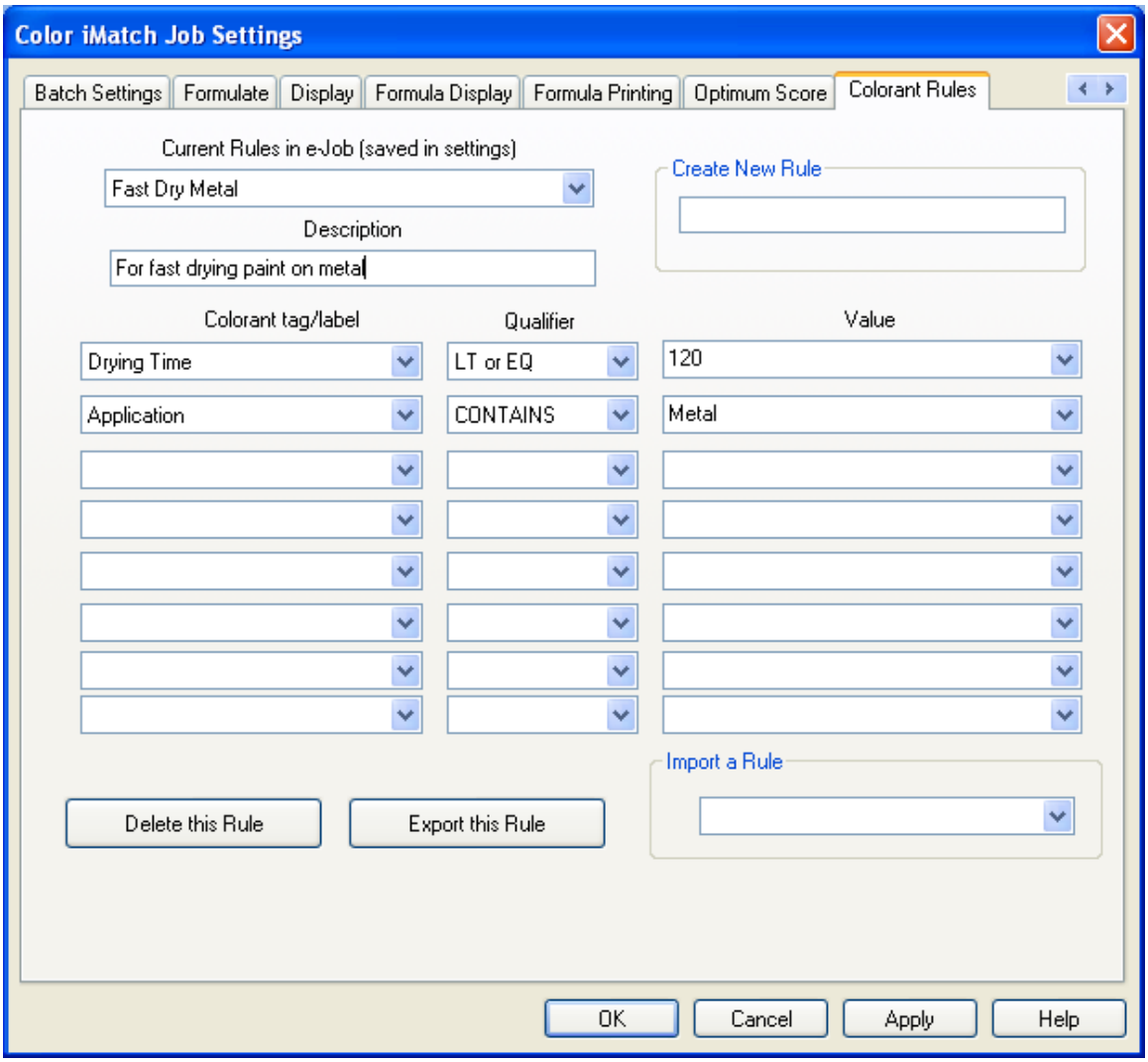
To create tags, click on <New Item> in the left box and then enter a name for the label under Displayed Label on the right. Then choose the type of entry you would like for this type of tag. Field Types are Text Edit [free entry], Drop List [will be presented with a drop down list and much choose from the list], Edit List [will be presented with a drop down list but can type in data], MultiSelect [will be presented with a drop down list and can select more than on item]. For the above example there are only two tags named Drying Time with an edit list and Application with a multi select. I added values to each list that will appear in the drop down on each colorant. Once you have created all the tags you wish to use then click OK and it will save the colorant tagging information.

Next you will need to edit each colorant and put the correct values in for each of the tags. To do this, open an e-Job that has colorants in it or import colorants from an IFS file or from the database. Then from the List View right click on one of the colorants and go to Properties. On the properties of a colorant there will be a Colorant Tagging tab that will have the tags you setup and blank values. Enter in the values needed for each tag using the drop down or hand entering.

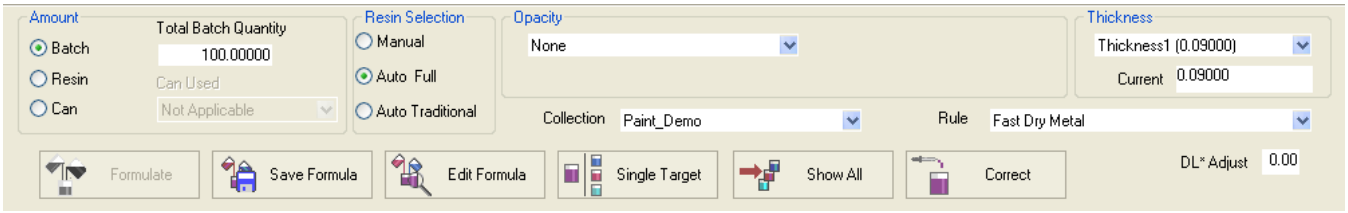


There is also a space for a Safety Comment. In formulation a formula will have an exclamation point to the right of the formula number indicating that at least one of the colorants has a safety comment. If you right click on the formula number you have an option to "View Safety warnings associated with this formula".

The last thing is to create a rule to use. For example you have 30 colorants available. Of these 30 colorants the drying times vary and the application varies for each. You want to do a formulation but use only colorants that can dry within 120 minutes and can be applied to metal. So you create a rule. With an e-Job open go into the formulation mode. Then go to Settings [Pencil and paper icon]. The last tab will be Colorant Rules. The number of tabs and what is on those tabs in settings will depend on how your system is configured. Under the Colorant Rules tab you can enter in a name for your rule in the Create New Rule block. This will be in the drop down in formulation as a rule to choose. You can add a description for your own notes. Then you can create up to eight filters. In the example below we have drying time is equal to or less than 120 and Application contains metal. The qualifiers are abbreviations for EQ is Equals can be text or number, LT is Less Than and must be number, GT is Greater Than and must be number, LT or EQ is Less than or equal to and must be a number, GT or EQ is Greater Than or Equal To and must be a number, NOT EQ is Not Equal and must be a number, CONTAINS is Contains and can be text or number, NOT CONTAIN is Not Contains and can be text or number. Contains and Not Contains should be used especially on multi select fields.



Then in formulation you will have a drop down box on the right side containing all the colorant rules you have created. When you select one of the rules such as Fast Dry Metal then only the colorants meeting those requirements will be used for formulation. So out of the 30 colorants only 12 meet the fast dry metal rule and will be used for formulation.



When using a rule you will not be able to select or deselect individually colorants. You will need to select no rule to manually select colorants.

Color iQC and Color iMatch
Account Management Guide

Version 8.0 | July 2012

Color iQC / Color iMatch contains an account management system that allows an administrator to create, modify, and mange groups of users and control what permissions and features each group has access to. When enabled, Color iQC / Color iMatch requires a logon during startup that prompts the user for an operator ID [OPERID] and password. The PASSWORD entered must match an existing password for an existing group account in order to proceed with operating Color iQC / Color iMatch. By design, multiple users may operate under the same group account settings. The OPERID is not a required part of the group account [it is ONLY the password that determines which group account is selected], however the OPERID is used for identifying the individual – each measurement made contains this OPERID whether account management is enabled or not.

Each group account that is created contains settings to enable/disable actions and controls that are defined as “permissions”. Disabling a particular permission or control for a user group will prevent those users from taking that action, or accessing that control.

Each group account can designate a “default desktop” to be used for that user group. Desktops contain settings that determine path settings, databases, default settings files, and toolbars – so are a great way to modify program appearance and behavior based on different uses. An example would be desktops for “Production”, “Lab”, and “Manager” which could be used to

easily tailor operation for each department, and each department may run 3 shifts – each shift operator using the same group account for their department.

It is important to note that Group accounts are independent of the actual windows user accounts, and more than one user may use the same group account. This makes it possible to have only a few group accounts that determine levels of permissions for many actual users.

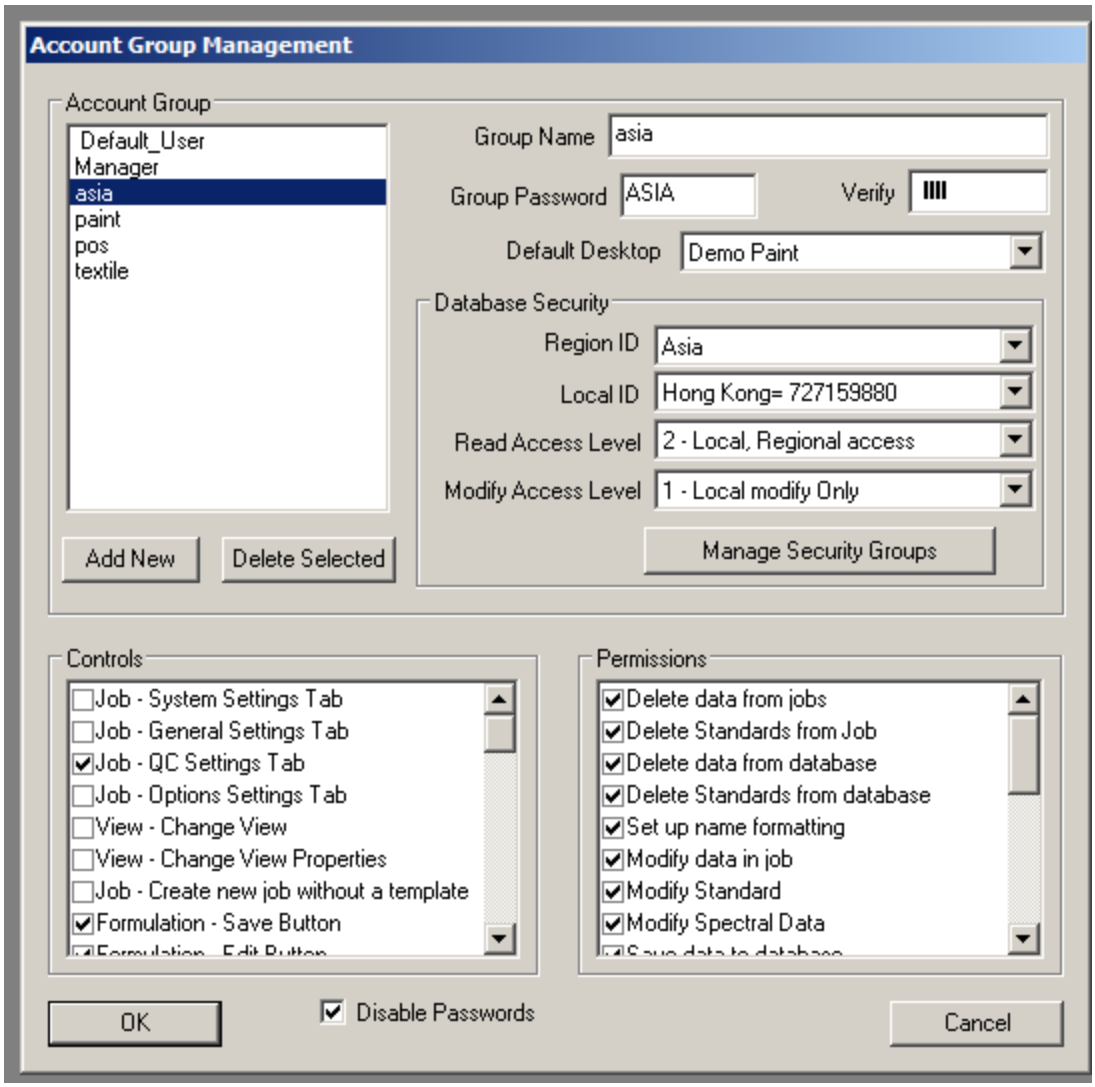
The account management system also includes the ability of assigning read/write permissions to data stored in the database based on security groups. Security groups are defined by regions [regional] and each region contains user defined locales [local]. Each group account can be assigned to a specific Region and Locale. When a measurement object is created, it is assigned to the Region and Locale of the creating user group. When recalling data from the database, or writing data to the database, the user groups permissions to "Read from database" and "modify/write measurements" can be set to allow "access to all data", "access to your Region", "access only your Region/Locale". This allows administrators to have a single large database but restrict access to the data by user groups. A user assigned to the "Asia, HongKong" region/locale would not be able to see or retrieve data that was stored by the "USA, New York" office unless they had the permission to retrieve data "from all regions".

Objects by default are assigned the REGION/LOCAL ID of the creating user, however this may be changed by editing the properties of the object if the current user has "modify" rights to that object [see security tab]. It is also possible to set the ownership of objects so that they can be read by anyone within a specific REGION, or by everyone [in any region], by setting either the LOCAL_ID=none [to allow anyone within that region to have access], or REGION and LOCAL=none [to allow everyone access].

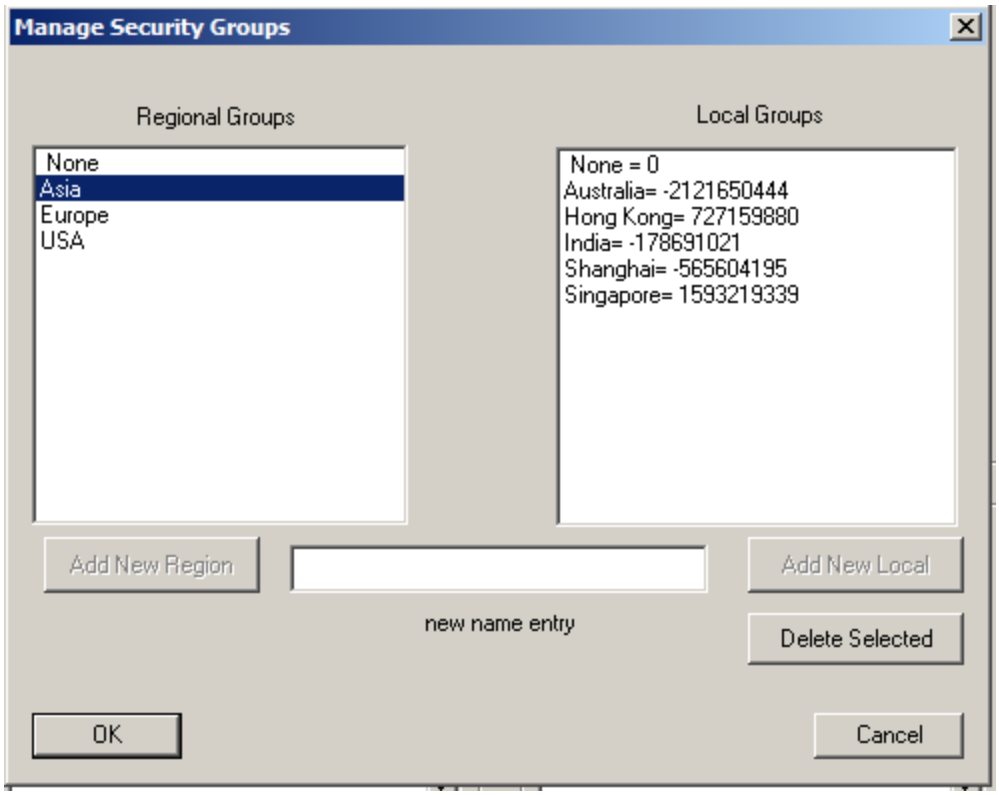
The accounts, regions, and locales that are created in Color iQC / Color iMatch are stored in a file called "proxy.archive" normally kept in the "System Shared Settings Path" [default is the application's Program Files folder "C:\Program Files\GretagMacbeth\Color_iControl\"], but this can be located on a network drive and shared with multiple network users. If the location is changed, the registry variable:

> *HKEY_CURRENT_USER\Software\GretagMacbeth\Color_iControl\Preferences\Job Defaults\System Shared Settings Path*

must be set by the administrator for each user. Note that is ***ABSOLUTELY CRITICAL*** that this file **proxy.archive** be backed up, since it contains all the account information and security ID's and cannot be recreated with the same security IDs [you can recreate the REGION and LOCAL names, but they would have new randomly assigned security IDs and would not match the existing database objects].



The Account Management dialog allows administrators to create user groups and set their permissions. It also allows the administrator to assign each account to a security group and set its read/write permissions for database access. See table in appendix for full list of permissions and controls.



Once security groups have been defined, security tagging is automatically enabled with all database and job read/write functions. There are no limits to the number of regions and locales/region that can be set. Please note that if a security group is DELETED, it CANNOT be recreated. Creating another group of the same NAME will NOT associate that new security group with existing measurements owned by the earlier [deleted] group. Those measurements will have to be recalled [by an account that can access them], then reassigned to ownership by the new group [see properties of a measurement].

Special features of Account Management:

1) By default, a new system always has a "default_user" account, with no password. **You cannot delete this account**. If you launch Color iQC / Color iMatch using OLE methods [by double clicking on an attachment and having Windows launch Color iQC / Color iMatch automatically], this is the account that will be used to run from. In addition, since it contains no password, any user who attempts to run Color iQC / Color iMatch and does not enter a password will get this account by default. If you DO NOT want to allow this type of access, then either disable all permissions in this account, or set a password in it to prevent unauthorized access.

2) It is not necessary to enable full security account management and passwords to gain the benefit of accounts…. If you have created user groups with short “names” [less than 10 characters], and have “disable passwords” checked in Account Management, then any user entering an OPERID that matches an existing account name will run under that account.

Appendix

Permissions List:

Delete Data from Job
Delete Standards from Job
Delete Data from Database
Delete Standards from Database
Change Name formatting settings
Modify Properties of Data in a Job
Modify Properties of Standards
Save Data to Database
Save Standards to Database
Access Formulation mode
Access Correction mode
Create Colorants or Collections
Modify System or Job Settings
Access Account Management
Read or Calibrate the spectrophotometer
Read Standards from spectrophotometer
Change current database path
Access items on special tools menu
Modify security tag ownership of data
Recall colorants or collections from Database

Controls List:

Access System Settings Page
Access Job-General Settings page
Access Job-QC settings page
Access Job-Options settings page
Allow user to change views to a different View
Allow user to modify the properties of Views
Allow user to open new jobs without using predefined templates.
Show “Save Formula” button in Formulation mode
Show “Edit Formula” button in Formulation mode
Show “Multi-Target/Single Target” button in Formulation mode
Show “Show All” button in Formulation mode
Show “Dispense Formula” button in Formulation mode
Show “Opacity Control” in Formulation mode header
Show “Can ID” control in Formulation header

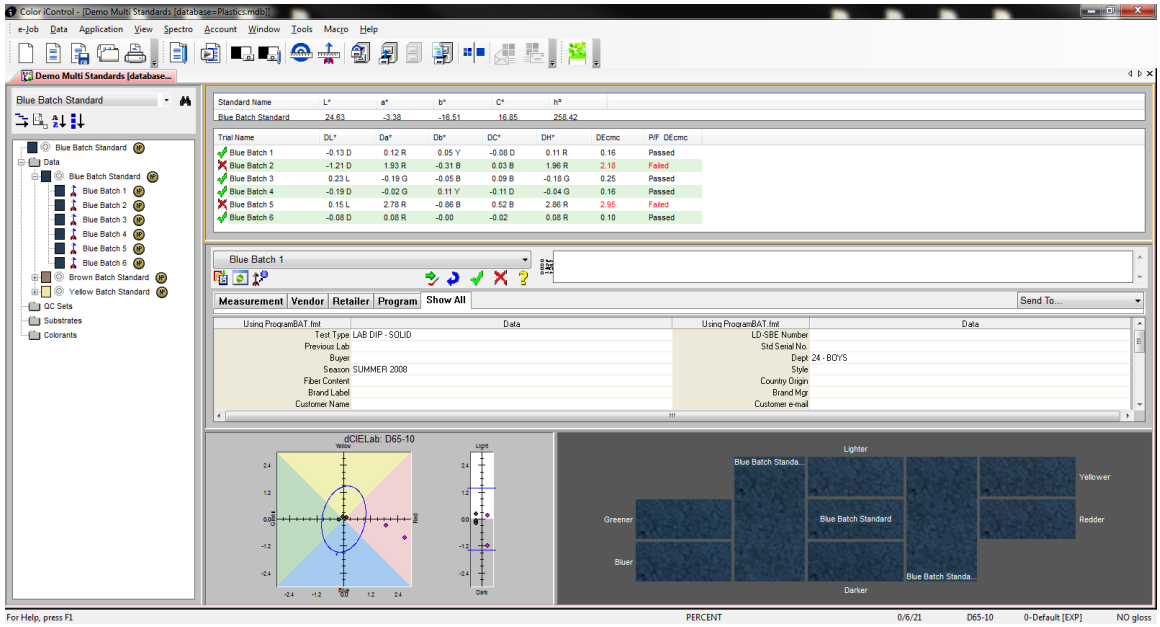
Show “Batch” radio control in Formulation header
Show “Can” radio control in Formulation header
Show “Resin” radio control in Formulation header
Show “Resin Manual” radio control in Formulation header
Show “Resin Full” radio control in Formulation header
Show “Resin Traditional” radio control in Formulation header
Show “Quantity” Edit control in Formulation header
Show “DL Adjust” control in formulation header
Show “Thickness” combo control in formulation header
Show “Rules” combo control in Formulation header
Show “Process type” combo control in formulation header
Show “Fiber Type” combo control in Formulation header
Show “Dye Class Type” combo control in Formulation header
Show “Preference” combo control in Formulation header;
Access Formulation-Batch Settings page
Access Formulation-Formulate settings page
Access Formulation-Display settings page
Access Formulation-Printing settings page
Access Formulation-Score settings page
Access Formulation-Rules settings page
Access Formulation-Printing settings page
Show “Save” button in Correction mode
Show “Edit” button in Correction mode
Show “Batch-As-Waste” button in Correction mode
Show “Show Last Batch” button in Correction mode
Show “Setup” button in Correction mode
Show “Dispense” button in Correction mode
Show “IFS_Collection” combo in Correction header

Color iQC and Color iMatch
Managing Electronic Submissions Guide

Version 8.0 | July 2012

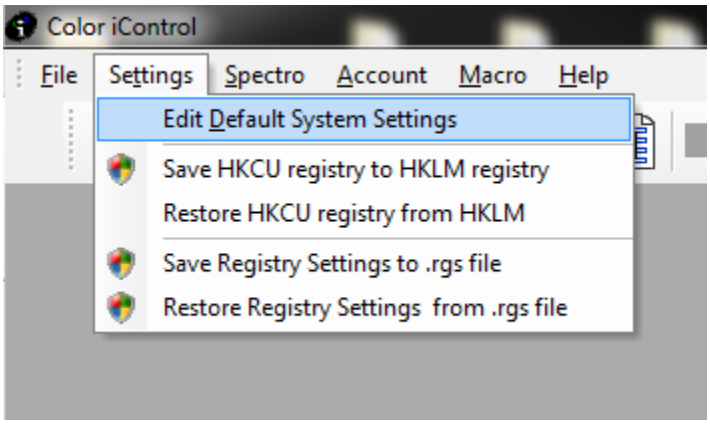
Color iQC contains many features designed to help you manage and participate in any electronic supply chain management [aka electronic submissions] program. The core of these features is known as “e-Submit” within Color iQC, and can easily integrate with the rest of your submit tools. The e-Submit option, along with Extended Tagging, allows users to enter information which is useful for customers working with their suppliers to electronically communicate color data throughout their supply chain; this is done through a set of fields included as part of the information stored with the measurement. Usually this is done for the standard or target colors specified by the designer which needs to be reproduced in the color matching process. These "tagged" fields can be viewed in a special e-Submit View in the Quality Control mode [listed as just "Submit View" in the Change View dialog]. Information included in the tagged fields may be printed out in the form of a report or transmitted electronically in the *.CXF [or *.QTX] file format through your computer's e-mail system, ftp site, or exported into other electronic submission software. The tag data is key when recalling items from the database. Using the Dynamic Database Viewer feature the user is able to display the database contents in an infinite number of user definable hierarchies arranged in tree fashion. In fact, the tagging/organize function is useful even if you do not need to employ the e-Submit color communications features. Note that while extended tagging is an e-Submit feature, you do not have to be participating in an electronic submission program to take advantage of extended tagging features.

Most communication in the submission process currently uses e-mail attachments to pass color information between systems, although some systems are used that are internally coupled to the same database and exchange information directly. Color iQC can operate in both environments, although the e-mail format is the most straightforward and easiest to implement.

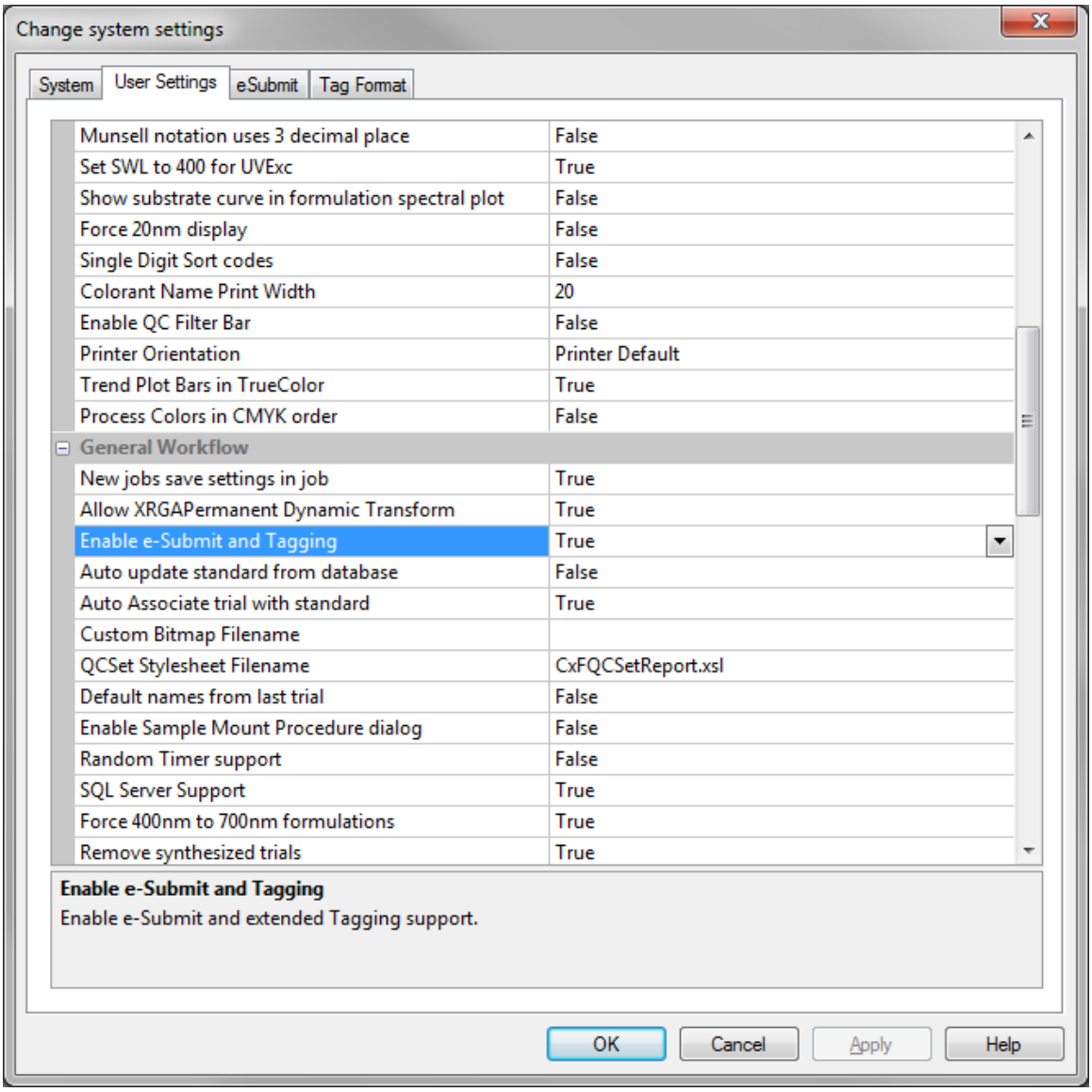


Setting up e-Submit:

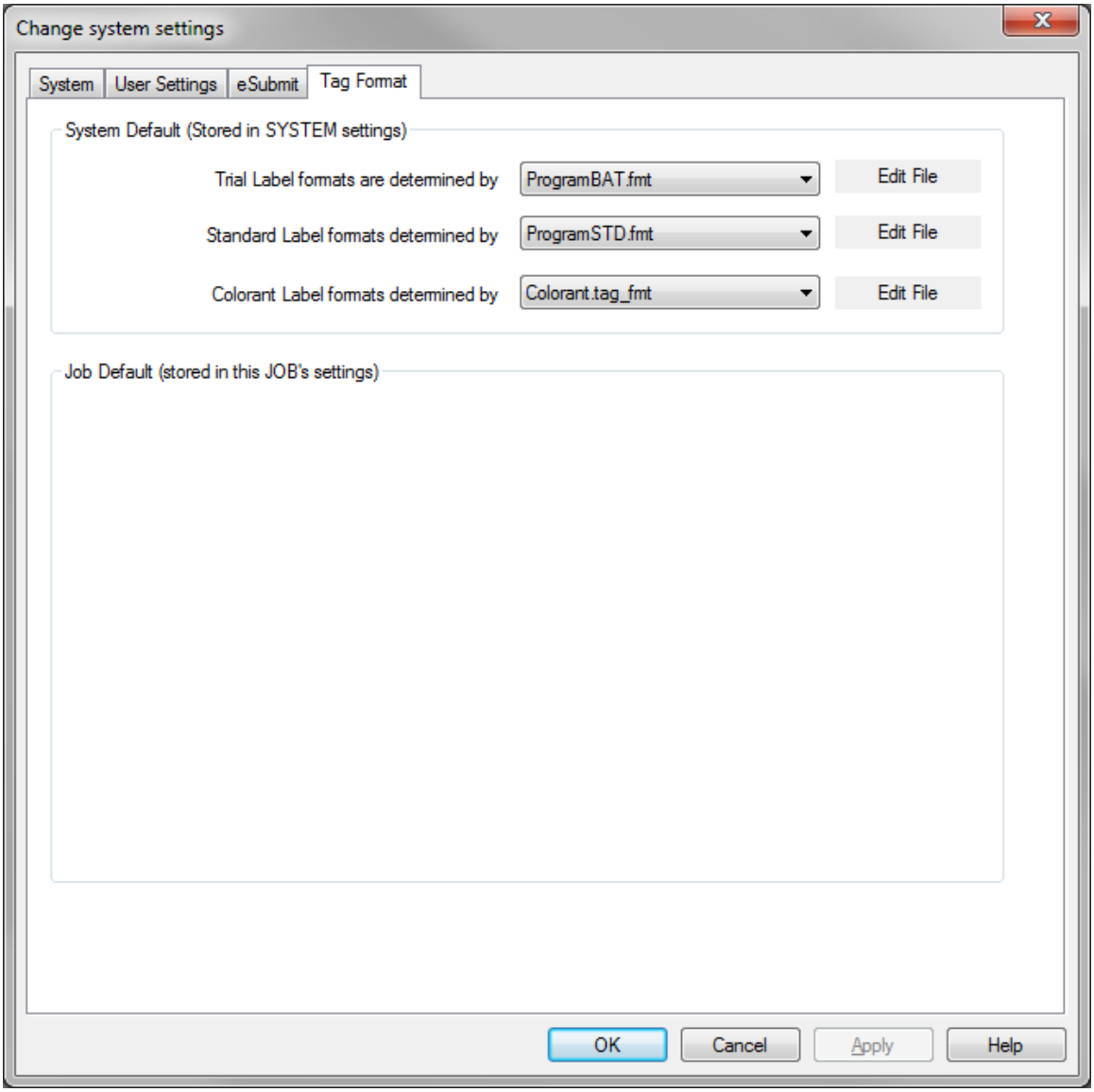
In order to begin with e-Submit, you must first enable e-Submit and Tagging support. This is done from the “Settings” menu by selecting “Edit Default System Settings” when no jobs are open:



This will display the “Change System Settings” dialog box. Go to the “User Settings” tab and scroll down to the “General Workflow” section and set “Enable e-Submit and Tagging” to True.



In addition, you will have to set up the system parameters that are to be used when you are working with e-Submits. The tabs “Tag Format” and “eSubmit” allow you to set these parameters.



Under "Tag Format", the first two settings are the Format Files that you want to use to define your tag labels and choices. Any *Trial Label Format* or *Standard Label Format* files you specify here are ***system defaults*** that may be overridden by individual job or template file settings.

The Format Files that you use may come from one or more Customers, be downloaded from a web-site, or they can be created from examples included with Color iQC. The format files define what label/tag pairs you want each trial [and standard] to get when they are measured, what type of data field it is [edit box, dropdown list, multi-select], what the transfer label is, which tag group it is in, and what the possible choices for it are [if any are defined]. In addition, the position of the label/tag pair in the list is important in terms of database storage – each item is linked to a specific database column in the TAGS table, so do not change the order of the tags once determined.

Editing Format Files:

You may edit or create a new eSubmit format file from the "Settings → Tag Format" dialog box. To edit an existing file, select it from the drop-down list and click once on the <Edit this file> button below the list display field. To create a new format file, type in a new name in the list field, deleting the name displayed if necessary, and click on the <Edit this file> button. The Edit Format File dialog will open (see figure below). This dialog allows you to define the various data fields for use with the eSubmit and extended tagging functions.

Enter the first item you want into the field at the upper right titled "Displayed Label". The field below allows you to enter in the "Transfer Label" (usually UPPER CASE). The Transfer Label is the label actually used in the QTX file to transmit the TAG information; the displayed field is what is used in your jobs and database to display and store the information. To add a NEW tag, you must click on the <new item> entry in the list before entering any information.

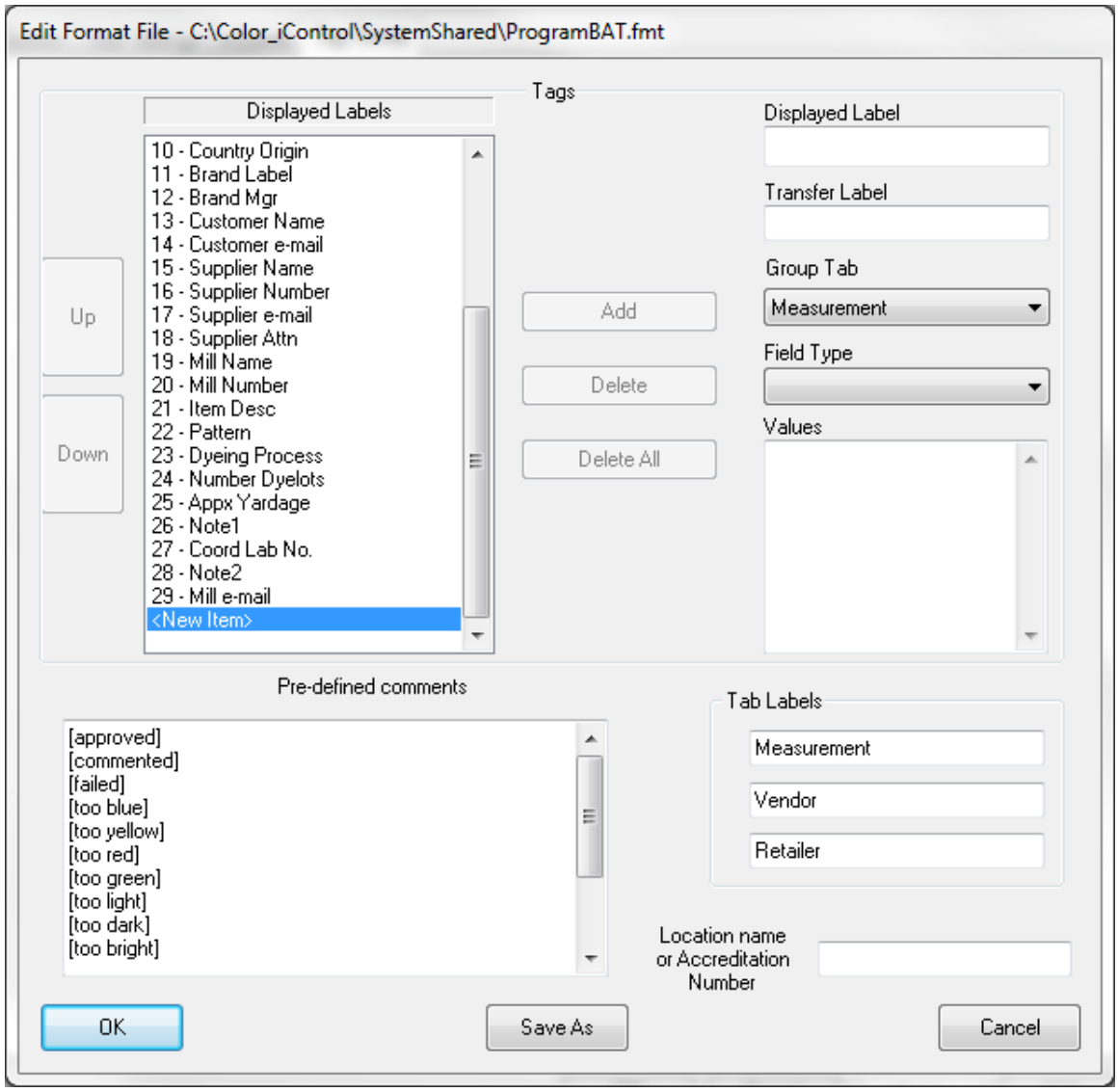
The Group Tab allows you to designate the TAG as belonging to one of 3 predetermined groups to help distinguish what the information is related to.

The Field Type allows you to select the type of field the item will be: an editable text field, a drop-down list of predetermined options, a multiple select list, or an editable drop-down list.

The Values box below the list will become active if you select either the Drop-down List or the Edit List option for the field. You may enter the values you wish displayed in the eSubmit field on separate lines by pressing the <Enter> key after each item.

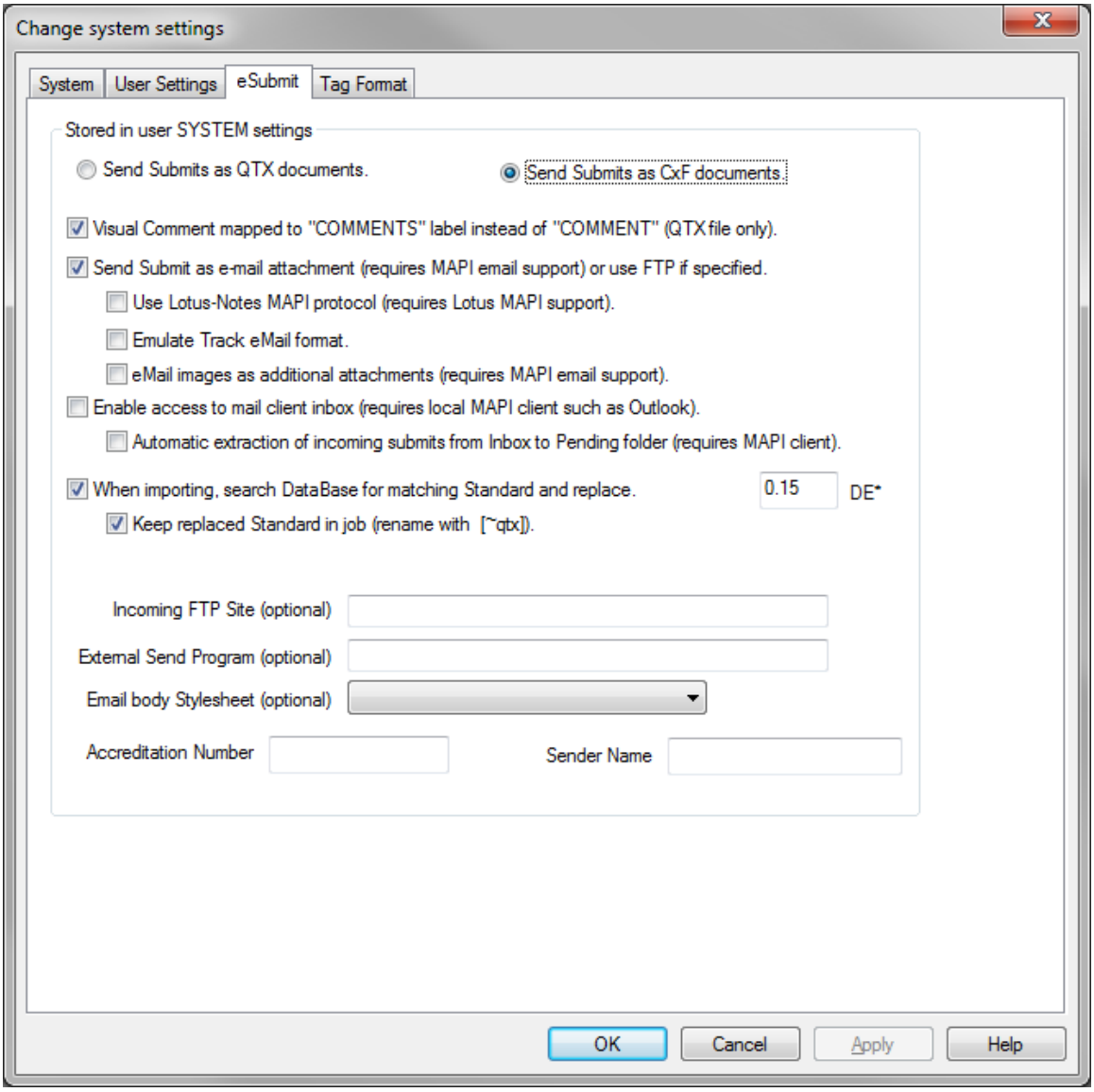
Once you have the fields on the right side of the dialog filled in, click once on the <Add> button. The new item will be listed in the "Displayed Labels" box. The system will automatically increment the number of the field as items are added. You may change the order of the items by selecting one and using the <Up> and <Down> buttons to the left of the box.

Click <OK> to finalize the modification or create the new file.



You may have a maximum of 30 labels in each format file. The size of the label cannot exceed 20 characters, and the size of the data you enter for each label cannot exceed 120 characters. Additional submission options are available on the “eSubmit” tab. Items here include transfer format [CxF or QTX], options for how to connect to your MAPI compliant email system, and option for automatic database search and replace.

The remaining parameters are set from the "Settings → eSubmit" tab:



The two radio buttons in the center of the dialog are mutually exclusive. You must choose whether you are using the QTX format or the CXF format for your outgoing eSubmit files. CXF is the new XML standard based on CXF3 and is currently being considered for ISO adoption as the international standard for communicating color.

Visual Comment: "Comment" mapping allows you to map comments into either the QTX "COMMENTS" field, or map to the field "COMMENT" for support of alternate systems.

Send as email attachment: Software automatically creates a MAPI text message with the QTX or CXF file attached and launches customers email client with the MAPI message:

- Use Lotus Notes sets system to use Lotus Notes style MAPI support.
- Emulate Track sets system to use DCI Track style headers and formats when sending electronic submissions by email.
- Email images sets system to automatically attach a JPG image file for each sent measurement that has an associated image. The image(s) will be automatically retrieved into a receiving iQC system's image library.

Enable Access to Mail Client Inbox: Allows iQC to scan the users email inbox and display new incoming e-submit or Track messages:

- Automatic extraction of incoming submits. – If checked, performs an automatic scan of the users inbox every 5 minutes and moves new submits into the specified incoming submits folder.

When importing, search database for matching standard: When a submit file (QTX or CXF) is opened, iQC can recall the local matching standard from its own database and replace the standard(s) in the incoming submit. This maintains trial associations with the local standard and confirms that the correct standard was sent with the submission:

- Keep replaced standard in job – allows any replaced standard to be kept for review, or deleted automatically.
-

Incoming FTP site: Color iQC can optionally monitor and retrieve e-Submits through a shared FTP site.

External Send program: Color iQC can optionally launch a program or command file to handle the e-submit file (QTX or CXF) that was created. The name of the created file will be included as a parameter on the command line.

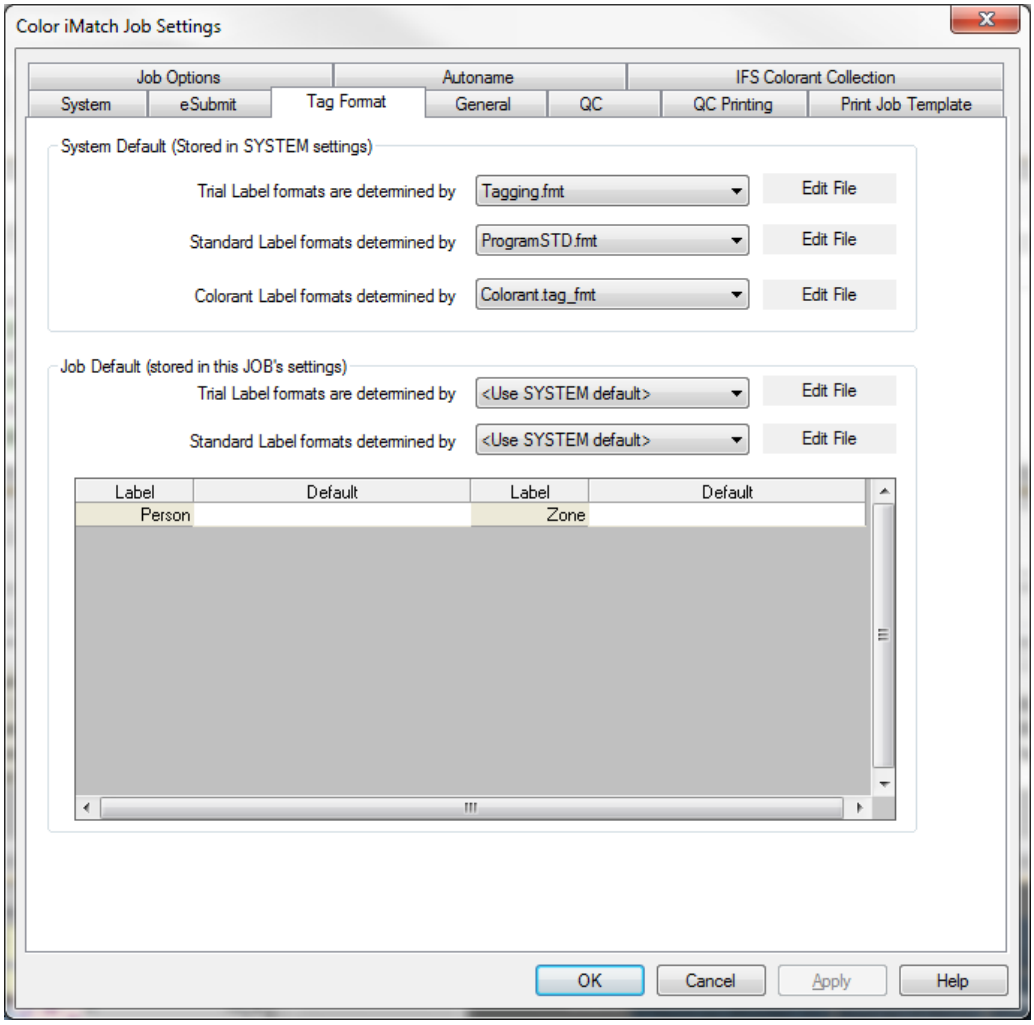
The supplier accreditation number: Required for submissions to some specifiers, if you have one you should enter it here for automatic inclusion in the submission. This is a system setting that can be overridden by the specific FMT file being used.

Sender Name: If ftp transfer is being used to send e-submits, enter a name here to tag the ftp file with the name of the sender.

Using Format Files:

Each time you open a job, the job reads in the definitions of the format files for standards and for trials. If the format file is specified in the job settings [including settings file or template], then it is used – otherwise the system specified default format files will be used. Each time a measurement is created, it acquires the labels from the current format file [either standard or trial – whichever is appropriate]. From that point on, regardless of what format file is used, that measurement already contains the labels it was given "at birth". This makes it possible to work with and display trials from a variety of sources within the same job. Changing labels in a measurement after creation can be done from within the Submit View.

To define a format file to be used for a particular job or settings file, first open the job and from the "Settings" icon select the "Tag Format" tab. This brings up a dialog similar to the one shown earlier, but in this case there are additional options to select tag format files that ONLY apply to this job.

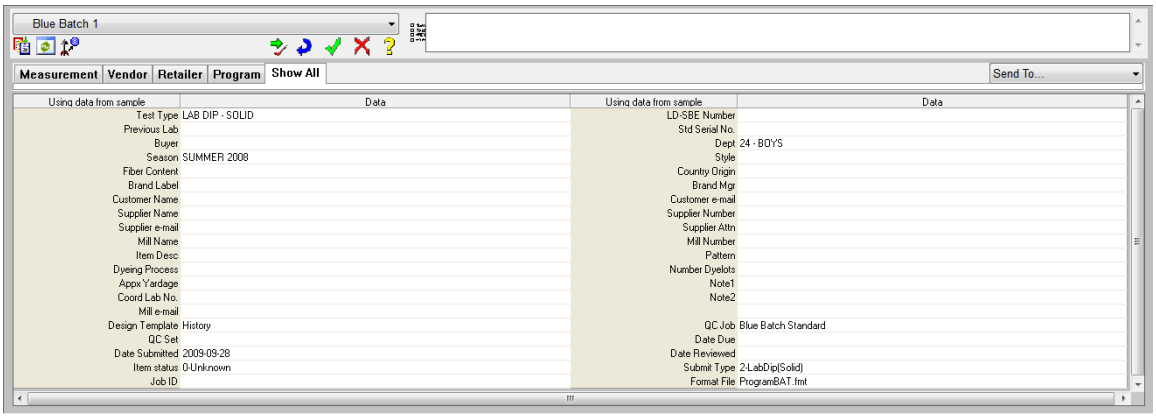


If the format file fields are left blank, it indicates this job will use the default system format files you specified earlier.

In the e-mail submission process, the action of submitting from a supplier to a customer uses the email address associated with the CUSTOMER_EMAIL tag in the Standard. When a customer reply's to a Submit, they are using the SUPPLIER_EMAIL field in the submit [trial] being sent. If no email addresses are found, then the user will be prompted for an email address before sending.

Submit View:

The submit view is available as a view from within the QC frame in a job. It is designed to let you work with Standards and Trials while viewing and modifying their tag data, and perform actions related to submitting and approving samples.



The Submit view works with all the measurements currently "shown in views". The Submit view can show tag information for the current standard and each trial that is currently enabled. Select the item shown in the Submit view by using the combo selector at the top left. The combo selector also indicates the current status of each trial using icons for "Submitted", "Rejected", "Commented", and "Approved".

Tags can be divided into categories. Click on the appropriate TAB to view/edit tag information related to that category. The names of these tabs can be modified by the user using the Format File editor. You may move from field to field using the arrow keys or TAB key on your keyboard. To activate a field for editing, it may be necessary to click the <Enter> key. How you edit each field depends on the type of field it is. After you edit the field be sure to press <Enter> or click on another field. If you do not press <Enter> the arrow keys will not work as navigational keys.
The **Text Edit** type of field simply allows you to click within the field and place a text cursor into the field. Enter the desired text and then select the next field.

The **Drop List** type of field will open the list when you double-click it. Each item will be displayed; scroll through the list and double-click your selection.

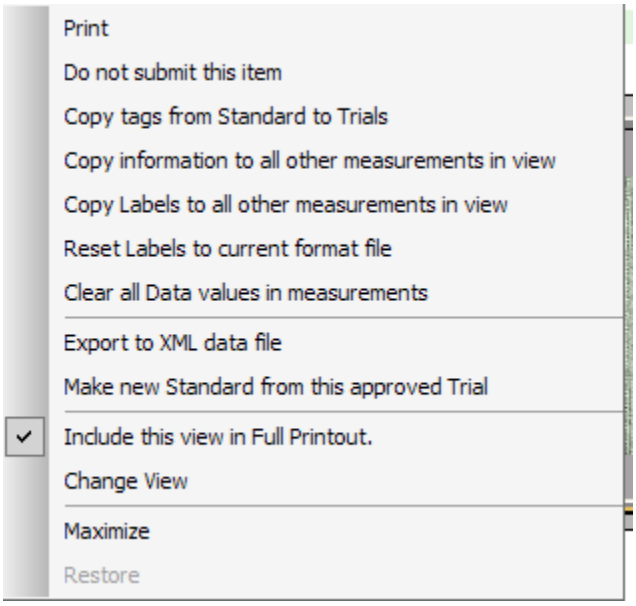
The **Edit List** type of field opens that item's Properties… dialog box where you may enter in your data directly into the submit fields for that item.

The **Multi Select** type of field allows you to choose multiple items from a checkbox list of choices defined in the FMT file and includes your choices in the Tag separated by commas.

The **Date Field** allows you to enter a date in any valid format, and double clicking on the arrow launches a date time picker calendar control for easier entry.

The **AutoAssign** field type allows the user to define and maintain multiple "auto-increment" fields in the database to support fields (like LD numbers) which automatically increment to the next numerical value.

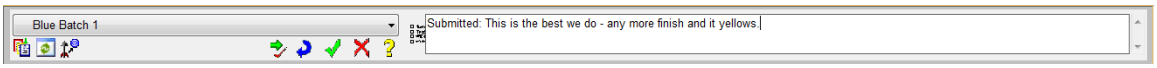
The easiest way to enter trial information is fill out the Submit fields for the standard prior to measuring the samples (appropriate information from matching display labels are automatically copied to the trial during measurement), or by using the right click menu "Copy Tags from Standard to Trials". There are other menu items available which allow you to perform similar actions, including resetting the labels to the current format file, clearing all data, and copying data from the current measurement to other measurements [of the same type].



The buttons on the submit view control panel allow you to mark each item as Submitted (arrow/check), not done (blue curved arrow), accept (green checkmark), rejected (red X), and

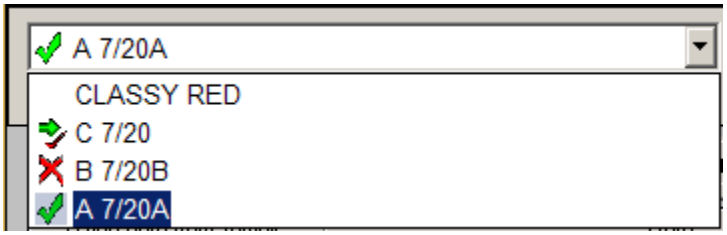
commented (yellow question mark) once a determination has been made regarding that item's disposition. Marking a submit status with anything other than "Not Done" will cause that item to be included and sent in the Submission process. To prevent an item from being sent, either mark it "Not Done", remove it from views, or use the menu item "Do not submit this item".

The Visual comment field to the right top of the view allows simple text entry in multiple lines of information. Please note that some software packages cannot accept more than 30 characters in the comment field, so when submitting comments it may be necessary to limit the size of the information sent. To the left of this field is a button that allows entry of predefined comments as contained in the current FMT file.



- copy tag data from current measurement to all other trials shown in view.
- change status of current measurement to Submitted.
- make a new standard from this approved trial.
- change status of current measurement to Not Done.
- change status of current measurement to Approved.
- change status of current measurement to Rejected.
- change status of current measurement to Commented.
- show associated image.

The dropdown control at the top left of the control panel is used to select the current measurement as well as to review the status of all the current items:



Sending e-Submits:

The main toolbar in Color iQC contains a button for "e-Submit Selected items". If this button is pressed **while the Submit View has focus**, then it will create a QTX file containing the standard and the shown in views items that have a status of Submitted, Approved, or Rejected, and save it to the designated QTX location.

If the user has a MAPI compliant email system [ex: Outlook, Outlook express, Lotus with MAPI option], and has selected "e-mail as an attachment" in their e-Submit settings, the software will

automatically create an email message, determine whether the desired action is to send to customer or send to supplier, place the appropriate email address in the “send-to” box of the mail message, place appropriate information in the subject line, include information in the message body related to the items being sent, and attach the proper QTX file to the mail message as an attachment. The determination of the action to be taken is based on what status button was last clicked in the Submit View - if the user clicks on “Approved”, “Rejected”, or “Commented”, the action is to send the response to the ***Supplier*** using the email address for Supplier in the first **Submit**. If the user last clicked on “Submitted”, then the action is to send the Submission to the ***Customer*** using the Customer email address specified in the **Standard**.

If MAPI compliant software is not being used, or the user needs to manually direct the submission for other reasons, then the QTX file is created and placed in the outgoing Mailbox folder.

If the user needs to specifically select items to be submitted from the tree view, then the QC Tree View will have focus, and the behavior of the “send e-Submit button” in the main toolbar will be slightly different, instead sending the items **selected** in the tree view regardless of their submit status.

Step-by-Step: Sending an e-Submit file via e-mail

1. Make sure that the Submit View is active and that the Submit view fields for the standard and each target have been properly filled out.

2. Select each trial to be submitted by changing its status to “submitted” from the Submit View. You can use the leftmost button to copy the status to all other measurements if you need to submit all items.

3. Once the desired items are selected, click on the "Send To" control in the Submit View. You may select “send to customer”, “send to supplier”, “send to mill” to automatically send to the appropriate email address [as specified in the current standard]. You may also select “Send To:” and choose the recipient from your Outlook Contacts later.

4. A dialog box will appear prompting you to name the file. The default behavior is preset depending on your settings - However, you may alter that to any file name that you wish.

5. Once you have name the file, the system will automatically open your e-mail utility, create a new e-mail, and attach the file you just created.

6. Address the e-mail if not already addressed and click <Send>.

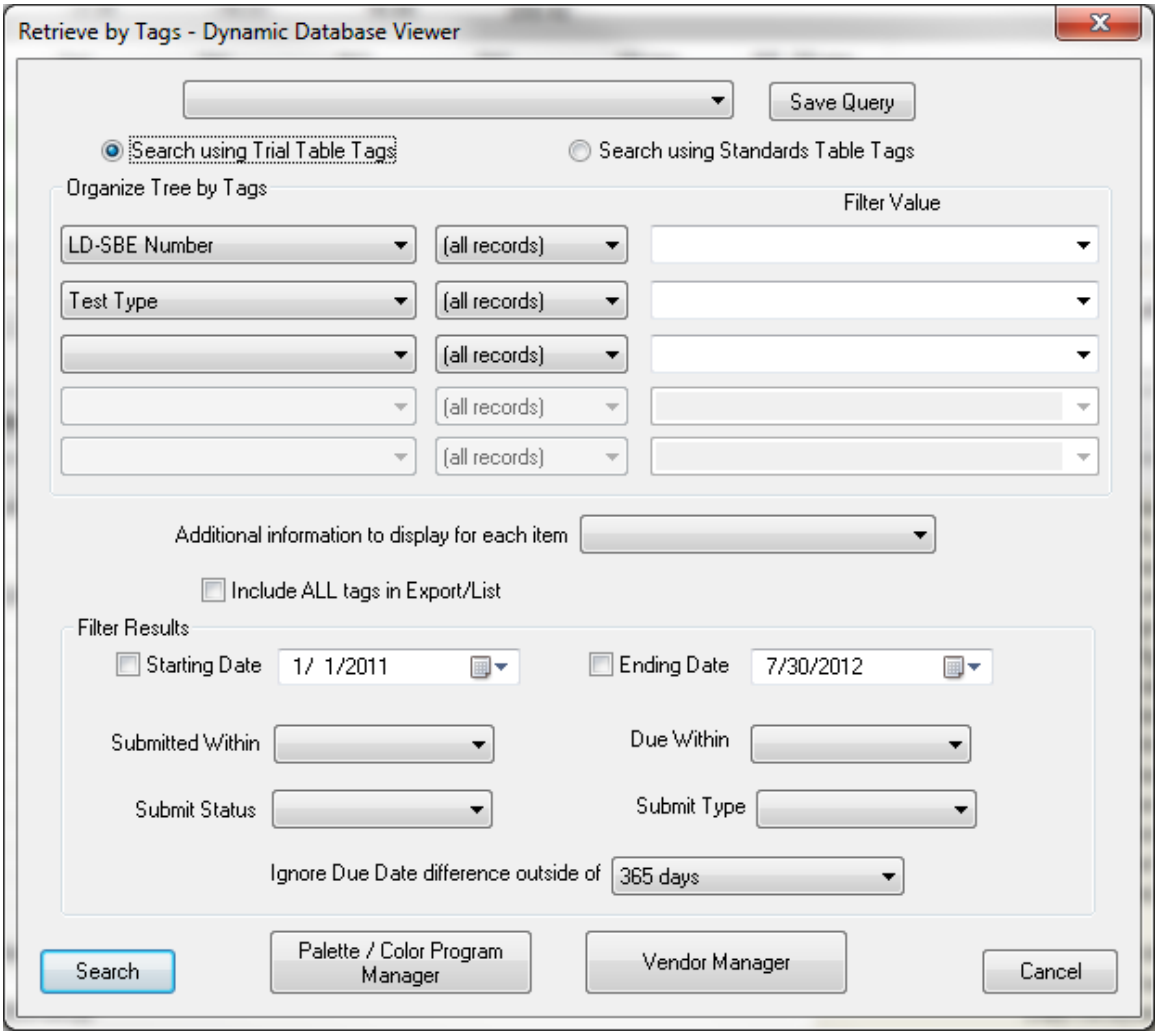
Receiving e-Submits:

"Import e-Submit file" button, or double click directly on the QTX or CXF attachment in the email message. If prompted for an “Import Template”, choose the proper template (.jt5) to use to import this type of QTX file. The import templates must be configured by you to specify the appropriate views for the new job you are creating, and most importantly, which FORMAT files are to be used for mapping the TAG data from the QTX file into your TAG fields. If importing a QTX attachment, the system checks for a template called qtx.jt5 in your shared system settings folder…. If not found than the system will prompt you for the template to use. Similar behavior exists for all import file types (QTX, CXF, MIF, EXP).

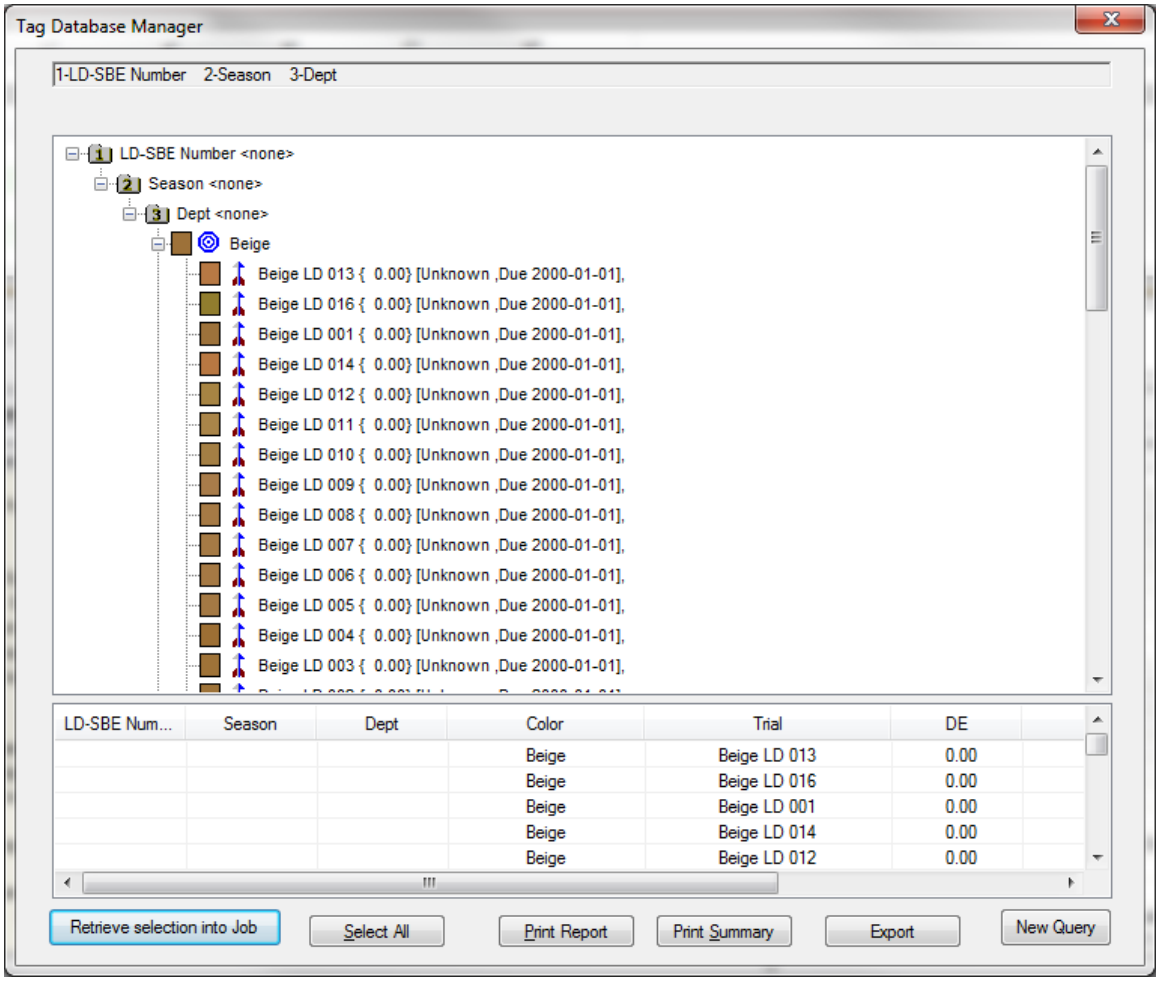
Organizing the Submit Process:

The e-Submit process can involve a large amount of data consisting of Standards and associated trials for a variety of colors, products, seasons, customers, and suppliers. While e-Submit is primarily a job based function, it is obviously important to maintain this data in a database capable of organizing and analyzing the state of the submit process. Color iQC contains two features designed to assist you with this process.

The function “*Recall from Database by Tags*” [available from the <Data> menu] allows the user to recall trials and standards from the database using up to 4 tag filters, Date Range, and submit status. The 4 tags can be selected from any of the currently defined tag labels, are persistent from last usage, and can be changed at anytime. The qualifier allows the user to specify the value as either “contains”, “begins with”, “equals”, or “not contains”.



The date range allows the user to specify data added to the database within the last day, 2 days, week, month, or year. Submit status can filter submits that are submitted, accepted, rejected, commented, or still open [not done].



The potential matches are then displayed in a tree view, organized by the specified tags. The user can then select the specific data to be retrieved from the database into the job to be worked on. The user can click on a single item folder to recall everything within that branch, including trials and associated standards, into the job to be worked on. A print report button allows the tree view to be printed on the printer, giving the user a way of creating a database contents report organized by any 4 tags that they choose.

The function "*Store to DB and Clear Job*" [available from the <Data> menu] will automatically return all the data from the job into the database [updating existing measurements and adding any new measurements], then delete the standards and trials from the job [any existing substrates, colorants, and Collections will remain in the job]. This allows the user to quickly update any changes back to the database after the submission process and return the job to an empty status in preparation for the next action. This method of operation is a more "database oriented" approach than the "job based" operations normally used in color iQC. With this approach, users can have a single job always open that becomes a temporary workspace container and use only the database as their primary storage media.

Color iQC and Color iMatch
Color Calculations Guide

Version 8.0 | July 2012

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Attributes for Standard/Multi-Trial View Display

Color iControl has a wide variety of possible attributes available for display for either the standard or any trial data loaded into a job. Following is a complete list, with brief definitions, of each of those attributes. This list is comprehensive and includes attributes for both Standard and Trial display; however, not all of these attributes will be applicable to the standard (delta values, for example).

General Attributes

Date/Time	Displays the day and time that the measurement was taken.
Comment	This option allows you to display any comments entered into the Comment field in the measurement's Name tab of its Properties... dialog box
Oper ID	This attribute displays the operator ID for the measurement, ie, the person who took the reading.
Group/Sequence	This attribute will only be available if you have purchased the SLI-Taper/W32 option with your Color iControl system. It identifies each sample's place in a set(s) of tapered samples. If more than one group was tapered with a data set, then the groups will be identified as well as the sequence.
Group_1, Group_2, Group_3	These attributes allow you to display any User Groups that the sample has been included within. See User Groups for more information.
Visual Comment	The comment entered for the e-Submit visual comment field.
ILL-Observer	The name for the current primary illuminant / observer combination used for the colorimetric calculations.
Meas Conditions	Displays spectrophotometer settings used for this measurement
Length	This attribute displays the length of the fabric in whatever units have been selected by the user. You can set the program to prompt for a length value whenever you do an instrument read in the Options tab of the Settings dialog box.

Pass Fail Decisions

Pass/Fail/Margin	This item displays a pass, fail, or marginal indicator for samples measured against the standard. It must be selected in order for the pass/fail/marginal icons (green ball, stop sign, yellow question mark, respectively) to be displayed in the Standard/Multi-Trial view. **Color iControl - Color iQC / Color iMatch Color Difference/How To · 135**
Roll-Roll DEcmc	This item displays the DE_{cmc} from roll to roll when the SLI-Taper software is used to sequence a set of measurements depicting rolls of fabric.
Ext DE*	DE* value using the extended (alternate) spectral data. Typically used to display the DE* comparison of the transmittance spectral data between a standard and a sample in an extended R/T measurement type.

Summary Count, Summary DE, Summary Cluster	Values that are calculated and displayed by the statistics summary view. Count is the number of samples, DE is the average DE_{cmc} or DE* for the selected samples, and Cluster is the average DE_{cmc} for the samples compared to the average (rather than the standard).

Opacity Indices

Opacity_CR	This value is the opacity using the contrast ratio method. To use this value, the calibration mode of the spectro must include extended measurements for over light and over dark. Samples must then be measured using both a light backing and a dark backing. See Extended Measurements in Setting Up the Measurement Process and Additional Elements of the Measure Dialog for more information. See also Calibration Mode Properties Dialog in Select Mode. Opacity=100.0 * ($DarkY_{C2}$/$LightY_{C2}$)
Tappi_Opacity	This index is a measure of opacity (sometimes called hiding power or contrast ratio). It is the ratio of Y tristimulus for the sample measured over a black substrate divided by the Y tristimulus for the sample measured over a white substrate, expressed as a percentage. This calculation is based on the 1931 standard observer (2 degree) and Illuminant A.
DIN Transparency D53-147	Displays transparency of a semi-transparent material using DIN D53-147 equation.

Transmittances Indices

Haze	Calculation requiring extended measurements TRA/TRA. Correlated Haze requires measurement of transmission using a white then a black trap. See Extended Measurements in Setting Up the Measurement Process and Additional Elements of the Measure Dialog for more information. See also Calibration Mode Properties Dialog in Select Mode. **Color iControl - Color iQC / Color iMatch Color Difference/How To · 133**
APHA	This attribute is defined by the American Public Health Association for determining color (clarity) of water.
OJ_Index	This index was developed by the U.S. Department of Agriculture for use with the GretagMacbeth Color-Eye 2020+ or GretagMacbeth Color-Eye 3000 spectrophotometers equipped with an orange juice test tube holder accessory.

Gloss Indices

SRR Gloss	ASTM method E429 Specular Reflectance Ratio gloss calculation for sphere spectrophotometers using Specular included versus Specular excluded measurements. SRR Gloss requires Extended Measurements.
Gloss 60*	This attribute displays a correlated 60 degree gloss method using SCI/SCE measurement and an equation that correlates the differences to measurements taken on a true 60 degree gloss meter. Gloss 60* requires Extended Measurements. See Extended Measurements in Setting Up the Measurement Process and Additional Elements of the Measure Dialog for more information. See also Calibration Mode Properties Dialog in Select Mode.

Sorting Codes

Sort Codes (DL*C*H*, DL*a*b*, DLab)	This attribute displays the 555 Sort Codes for the selected samples compared to the standard. You may select Sort Codes for DL*C*H*, DL*a*b*, or DLab. Also available in Strength Adjusted form for the DL*C*H* and DL*a*b* sort codes..

Density Indices

% Density_1, _2, _3	% strength calculation between a standard and a sample using the density values for each.
Density_1,_2,_3	**–** Provides density calculation using the selected Density equation (as specified in the general settings tab). Density values are given for 3 “filters” (cyan, magenta, yellow) based on weighting s provided for that method in the Density.table. Users can add to this table to create custom density functions. **136 · Color Difference/How To Color iControl - Color iQC / Color iMatch**

Yellowness Index

Yellowness is defined as "the attribute by which an object color is judged to depart from a preferred white towards yellow'.

The Yellowness Index is a number calculated from spectral data that describes the change in color of a test sample from clear or white toward yellow. This test is most commonly used to evaluate color changes in a material caused by real or simulated outdoor exposure.

Yellowness Indices are limited to specimens having dominant wavelength in the range 570 to 580 nm. For Samples, which do not fulfill this criteria the results have no value.

Typically the Yellowness index is measured for a reference, which represents the ideal white. Samples (or changes) are compared to the reference and differences are calculated. Positive values will indicate, that then sample will be more yellow. Negative will indicate that the sample is more blue.

ASTM D 1925 Yellowness Index for Plastics

ASTM D1925 has been specifically developed for the definition of the Yellowness of homogeneous, non-fluorescent, almost neutral-transparent, white-scattering or opaque plastics as they will be reviewed under daylight condition. It can be other materials as well, as long as they fit into this description.

The calculation for ASTM D1925 is:	$YI = \left[\frac{100 \times (1.28X - 1.06Z)}{Y}\right]$
X, Y and Z are the tri-stimulus values for the calculated for illuminant C	

ASTM E 313 Yellowness index

ASTM E313 has successfully been used for a variety of white or near white materials. This includes coatings, Plastics, Textiles.

The calculation for ASTM E313 is:	$YI = 100 \times \left[1 - \frac{0.847Z}{Y}\right]$
X, Y and Z are the tri-stimulus values for the calculated for illuminant C	

Whiteness Indices

Certain industries, such as paint, textiles and paper manufacturing, evaluate their materials and products based on standards of whiteness. Typically, this whiteness index is a preference rating for how white a material should appear, be it photographic and printing paper or plastics. Thus Whiteness Index is a measure which correlates the visual ratings of whiteness for certain white and near-white surfaces.

According to ASTM (American Society for Testing and Materials) as "the attribute, by which an object color is judged to approach some preferred white" . There is a number of different indices available. No matter which index you choose you have to verify how this relates to your visual observation. If you communicate any whiteness data with some partners in your supply chain, you will always have to clearly identify which index you selected.

ASTM E313 Whiteness

The calculation for ASTM E313 is	$WI = 3.388 \cdot Z - 3 \cdot Y$

- Y and Z are the tri-stimulus values for the sample

CIE Whiteness

The CIE Whiteness index is quite wide spread in the industry.
It will strictly be used for D65 for 2 or 10 deg observer

The calculation for CIE Whiteness is:	$W_{CIE} = Y + 800 \cdot (x_0 - x) + 1700 \cdot (y_0 - y)$

- Y is the tri-stimulus value for the sample
- x and y the color coordinates for the sample as this calculated using the illuminant/observer condition
- x_0 and y_0 are the color coordinates of the achromatic point

Interpretation of data

- Values bigger than 100 indicate a bluish white
- Values smaller than 100 indicate a yellowish white

Berger (59) Whiteness

This formula was developed by A. Berger (formerly employee of Bayer AG, Germany and was presented in 1959. Whiteness values calculated after the formula of Berger was very popular during the sixties until beginning of the eighties mainly in the paper and also in Textile areas

Berger Whiteness is defined for illuminant C and the 2° Observer. However it is used for other illuminant observer condition as well.

The calculation for Berger Whiteness is:	$WI_{Berger(59)} = 0.333Y + 125\frac{Z}{Z_0} - 125\frac{X}{X_0}$

- X,Y and Z is the tri-stimulus value for the sample
- X_0 and Z_0 are the tri-stimulus values of the illuminant Observer

Interpretation:
· Values bigger than 33.33 indicate a bluish white
· Values smaller than 33.33 indicate a yellowish white

Stensby Whiteness

This formula was developed by Mr. P. Stensby (formerly employee of J.R. Geigy AG in US.) It was presented in 1968.
Whiteness values calculated after the formula of Stensby found its use in the detergent area, especially in the USA. Today it is rarely seen.

The calculation for Stensby Whiteness is:	$WI_{Stensby} = L - 3b + 3a$

- L, a and b are Hunter Color Coordinates

Interpretation:
· Values bigger than 100 indicate a bluish white
· Values smaller than 100 indicate a yellowish white

Taube Whiteness

This Formula was developed by Mr. Taube (formerly an employee of BASF AG, Germany). It was presented in 1960 and has found it's application mainly in the plastic sector.

The calculation for Taube Whiteness is:	$WI_{Taube} = 400\frac{Z}{Z_0} - 3Y$

- X,Y and Z is the Tri-stimulus value for the sample
- Z_0 is the Tri-stimulus value of the illuminant observer

Interpretation:

· Values bigger than 100 indicate a bluish white

· Values smaller than 100 indicate a yellowish white

Hunter (60) Whiteness-Index

This Formula was developed by Mr. Hunter. It was presented in 1960.

The calculation for Hunter Whiteness is:	$WI_{Hunter} = L - 3b$

- L, a and b are Hunter Color Coordinates

Interpretation:

· Values bigger than 100 indicate a bluish white

· Values smaller than 100 indicate a yellowish white

Ganz and Grieser Whiteness

Dr. E. Ganz (formerly employee of Ciba AG, Switzerland) and Mr.R. Griesser (formerly employee of J.R.Geigy) developed the Ganz Grieser Whiteness Method. It is the first formula which referred to a neutral white and in order to take the difference to the preferred whites it used a second dimension the tint or shade deviation.

The calculation for Ganz Whiteness is:	$W_{Ganz} = Y + P \cdot x + Q \cdot y + C$
The calculation for Ganz Grieser Tint is	$T_{Ganz-Griesser} = m \cdot x + n \cdot y + k$

- Where nominal coefficients are given for $D_{65/10}$ as
- P=- 1868.322
- Q=-3695.690
- C= 1809.441
- m= -1001.223
- n= 748.366
- k = 68.261

Interpretation

- Tint >0 = white has a greenish shade
- Tint <0 = white has a reddish shade
- Whiteness differences of less than 5 Ganz units appear to be undistinguishable to the human eye
- Tint differences of less than 05 Ganz-Grieser units appear to be undistinguishable to the human eye

Strength calculations

Color strength is defined as a pigments or dyes ability to change the color of a otherwise color less material. Strength indices are used to compare Standard and Sample and define the ratio of the sample strength in relation to the standard. Strength indices allow you to define how strong or weak a sample is in comparison to the reference standard. Different lots of the same colorant material are prepared in the same way and the difference between the two samples is measured.
A strength correction based on spectral data will adjust the spectral data of the sample to those of the standard. The corrected data afterwards will be used for color comparisons. With this method color comparison can done on the bases of equivalent color strength.

Strength calculations will be done on the base of a color value. This is a numerical value related to the amount of light-absorbing material (colorant) contained in a sample. The calculation is done based on spectral data by one of three acceptable methods (SWL, SUM, WSUM). The results of the different methods may not agree with any other method. The choice of method usually depends on the nature of sample and the need to obtain a color value.

Color Value SWL

The Color Value SWL is calculated as the sum of K/S values for the sample read across the spectrum for reflectance measurements and from the sum of absorbance's for the sample read across the spectrum for transmittance measurements.
There are several ways to define the color strength indices.

% (Color) Strength SWL

This strength is also known as the chromatic color strength. It describes the ratio based on the (K/S-value) of the Sample in relation to the (K/S-value) of the Standard at a single wavelength and will be expressed in percent. This calculation typically is meaningful, if it will be made at the wavelength of maximum absorption (lowest reflectance). In daily application often it will be made at other wavelength, but results have to be evaluated very carefully. If standard and sample have different wavelengths of maximum of absorption this method will not deliver correct results.

The calculation for SWL color strength based on Reflectance is	$Strength\% = 100 \times \frac{(K/S)_{trial}}{(K/S)_{std}}$ using $(K/S) = \frac{(1-R)^2}{2R}$
• R is the reflectance at the wavelength of maximum absorption in a decimal way (20%R = 0.20R)	

The calculation for SWL color strength based on Transmission is	$R = \log_{10}(1/T)$
• T is the Transmission in a decimal way (20%T = 0.20T)	

Interpretation

- Percent color strength >100 = sample is more strong in color than the standard
- Percent color strength >100 = sample is weaker in color than the standard
- Percent color strength =100 = sample and standard have the same color strength

% (Color) Strength SUM (DIN55986)

This strength method is sometimes listed as apparent strength

The % strength SUM represents the ratio of (K/S) data between sample and standard at all visual wavelength (400-700nm) and will be expressed in % . The selection of different illuminant observer condition has no influence on the result.

The calculation for SUM strength based on reflectance is	$Strength\% = 100 \times \frac{\sum_{400}^{700}(K/S)_{trial}}{\sum_{400}^{700}(K/S)_{std}}$ using $(K/S) = \frac{(1-R)^2}{2R}$
• R is the reflectance at the wavelength of maximum absorption in a decimal way (20%R = 0.20R)	

The calculation for SUM strength based on Transmission is	$R = \log_{10}(1/T)$
• T is the Transmission in a decimal way (20%T = 0.20T)	

Interpretation

- Percent color strength >100 = sample is more strong in color than the standard
- Percent color strength >100 = sample is weaker in color than the standard
- Percent color strength =100 = sample and standard have the same color strength

% (color) Strength WSUM

This strength method is sometimes listed as integrated strength.
The strength WSUM represents the ration of sums of (K/S) data multiplied by the sum of weighted observer/illumination at all wavelengths for the sample in relation to the standard. It will be expressed in percent. The result is illuminant/observer depending.
F.e. If a red color is evaluated for strength difference this method will show for D65 illumination a smaller color strength difference than for illuminant A.

The calculation for WSUM color strength based on reflectance is	$Strength\% = 100 \times \frac{\sum_{400}^{700}(K/S)(f_x + f_y + f_z)_{trial}}{\sum_{400}^{700}(K/S)(f_x + f_y + f_z)_{std}}$ using $(K/S) = \frac{(1-R)^2}{2R}$

- R is the reflectance at the wavelength of maximum absorption in a decimal way (20%R = 0.20R)

The calculation for WSUM strength based on Transmission is	$R = \log_{10}(1/T)$

Interpretation

- Percent color strength >100 = sample is more strong in color than the standard
- Percent color strength >100 = sample is weaker in color than the standard
- Percent color strength =100 = sample and standard have the same color strength

Color Value

The Color value as used in calculating colorant strength, is a single numerical value related to the amount of light-absorbing material (colorant) contained in the sample and is usually based on spectral data. Color value may be calculated by any of the three acceptable methods (SWL, SUM, WSUM). The color value which results from the one method might not agree with any other method. The choice is usually dependent on the nature of the sample and the need to obtain a color value.

The color value is normally calculated based on the spectral data.

Reflectance Methods

The calculation of color value of a sample is based on the reflectance values of the sample and uses the K/S calculation either at one (SWL) or multiple wavelength (SUM, WSUM)	$\frac{K}{S} = \frac{(1.0-\beta)^2}{2.0\beta}$

- β = percentage reflectance at each wavelength

Color Value SWL

The calculation of the Color Value SWL is calculated as the K/S values for the sample at **one** wavelength (typically at the wavelength of maximum absorption) for reflectance measurements.	$CV_{swl} = \left(\frac{K}{S}\right)_{\lambda}$

Color Value SUM

The calculation of the Color Value SUM is calculated as the sum of K/S values for the sample read across the spectrum for reflectance measurements	$CV_{sum} = \sum_{\lambda} \left(\frac{K}{S}\right)_{\lambda} d\lambda$

- λ = wavelength within across the spectrum

Color Value WSUM

The calculation of the Color Value WSUM is calculated as the sum of K/S values weighted by illuminant and observer for the sample read across the spectrum for reflectance measurements.	$CV_{wsum} = \sum_{\lambda} \left(\frac{K}{S}\right)_{\lambda} \cdot E_{\lambda} \cdot S_{\lambda} \, d\lambda$

- λ = wavelength within across the spectrum / E = Energy distribution of the selected illuminant / S = Observer function

Transmission Method

The calculation of color value of a sample is based on the transmission values of the sample and uses the absorbance calculation either at one (SWL) or multiple wavelength (SUM, WSUM)	$A_\lambda = \log_{10}\left(\frac{1.0}{T_\lambda}\right)$
T8= internal Transmittance – normally measured with a spectrophotometer (100 % T = 1.0)	

Color Value SWL

The calculation of the Color Value SWL is calculated as the absorbance value for the sample at **one** wavelength (typically at the wavelength of maximum absorption = minimum transmittance)	$CV_{swl} = (A_\lambda)_\lambda$

Relative Strength

The relative strength between a standard and a sample can be calculated from the color values. It will be expressed as a % of the sample in relation to 100% of the standards

The relative strength is	$\%strength = \left(\frac{ColorValue_{specimen}}{ColorValue_{standard}}\right) \cdot 100.0$

Strength Adjusted

This attribute appears before many of the colorimetric terms previously listed and allows you to display those terms in their strength adjusted form. That is, Color iControl corrects the sample(s) so that its strength is equal to the standard. Then color difference data is calculated again. Strength adjusted data is helpful in determining whether or not correcting only for strength differences will result in a hue shift. Terms that are available in Strength Adjusted form are so indicated.

X, _Y, _Z - Ratio

% Strength calculation between a standard and a sample using the X,Y,or Z values of each. Normally used in Paints evaluation and in conjunction with Saunderson Corrections.

% Strength (current method)

Used to display the %strength value by whatever calculation method is currently selected in the general settings tab as the current %strength method.

DIN 53235 Tint % Strength

A percent strength value is calculated for a sample relative to a standard for different apparent strength levels and used by colorant manufacturers to help determine and adjust for strength differences.

DIN 53235 Tint B Value

The actual Tint B value for the measurement and used in the DIN Strength method for calculating the %strength of a standard/sample pair.

http://www.beuth.de/langanzeige/DIN-53235-1/de/80457684.html

http://www.beuth.de/langanzeige/DIN-53235-2/de/80457913.html

TAPPI-Indices

You will be able to receive each of the following Standards directly at the TAPPI (Technical Association of Pulp and Paper Industries) in the US :
Phone (USA): +1-800-332-8686
address: TAPPI, Technology Park/Atlanta, PO Box 105113, Atlanta, GA 30348-5113
http://www.tappi.org/

T 452 TAPPI Brightness for Pulp Paper and Paperboard (1977)

This will be used in the paper industry to evaluate the quality of non-processed pulp, paper and board.
This TAPPI T 452 (1977) is not recommended to be used to evaluate the appearance of white. Especially if fluorescent material is used you better should use a whiteness index.
Further information at:
http://www.tappi.org/Downloads/unsorted/UNTITLED---0104T452pdf.aspx

T 452 TAPPI - Brightness for Pulp Paper and Paperboard *(1987)*

This will deliver the same results as described in the official method TAPPI T 452 as published in 1977.
This will be used in the paper industry to evaluate the quality of non-processed pulp, paper and board.
This TAPPI T 452 (1977) is not recommended to be used to evaluate the appearance of white. Especially if fluorescent material is used you better should use a whiteness index.
Further information at:
http://www.tappi.org/Downloads/unsorted/UNTITLED---0104T452pdf.aspx

T 525 TAPPI - Diffuse brightness of paper, paperboard and pulp

This method will provide the diffuse brightness of pulp based on reflectance (d/0°) measurement at 457 nm. It is used to evaluate the diffuse blue reflectance factor (diffuse brightness) of pulp, in which samples prepared according to T218 (“Forming Hand sheets for Reflectance samples of Pulp”)
This TAPPI T 452 (1977) is not recommended to be used to evaluate the appearance of white. Especially if fluorescent material is used you better should use a whiteness index.
Further information at:
http://www.tappi.org/Downloads/unsorted/UNTITLED---0104T525pdf.aspx

TAPPI T 425 Opacity

Opacity of paper (15°/Diffuse illuminant A/2Deg, 89% Reflectance Backing and Paper backing

This is an empiric measurement oft the optical properties of paper, the quantity and type of filler, the degree of bleaching. This method will measure paper over a black and white backing. The measurement of paper over black will let the light pass through non opaque paper. The measurement over black backing will compared with the over white backing. .

Two alternate methods of opacity measurements are used:

· Opacity (89% Reflectance backing)
· Opacity (Paper backing)

Further information about Tappi Methods at:
http://engineers.ihs.com/document/abstract/LMXBJBAAAAAAAAAA

TAPPI T 519 - Diffuse Opacity of paper (D/0-Backing)

This method provides a measure of diffuse opacity (paper backing) of white and near-white papers, previously known as “printing opacity.”

The method may be employed for colored papers on condition that their reflectance (paper backing) is greater than 20% and their diffuse opacity (paper backing) is greater than 45% (1).

The method is not suitable for highly transparent papers such as glassine.

This method employs d/0 geometry, illuminant C, and paper backing whereas TAPPI T 425 “Opacity of Paper” employs 15/d geometry, illuminant A, both 89% reflectance backing and paper backing.

This method is similar to ISO 2471.

Further information about Tappi T519i Method at:
http://engineers.ihs.com/document/abstract/ERNRJBAAAAAAAAAA

AATCC Gray-Scales

AATCC Gray-Scale-Tests for assessing changes in color

(equivalent to ISO 105-A02-1978 (E)

Describes the gray scale for determining changes in color of textiles in color fastness tests, and its use. A precise colorimetric specification of the scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be compared. The essential scale (5 steps) consists of pairs of non-glossy grey color chips (or swatches of grey cloth). In addition, an augmented scale includes four half-steps and, thus, 9 steps.
Further information you will find here:
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=3785

AATCC Gray Scale for assessing staining

(equivalent to ISO 105-A02-1978 (E)

Describes the grey scale for determining staining of adjacent fabrics in color fastness tests, and its use. A precise colorimetric specification of the scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be compared.

The essential, or 5-step, scale consists of five pairs of non-glossy grey or white color chips (or swatches of grey or white cloth), which illustrate the perceived color differences corresponding to fastness ratings 5, 4, 3, 2 and 1. This essential scale may be augmented by the provision of similar chips or swatches illustrating the perceived color differences corresponding to the half-step fastness ratings 4–5, 3–4, 2–3 and 1–2, such scales being termed 9-step scales. The first member of each pair is white in color and the second member of the pair illustrating fastness rating 5 is identical with the first member. The second members of the remaining pairs are increasingly darker in color so that each pair illustrates increasing contrasts or perceived color differences which are defined color metrically. The full colorimetric specification is given below.
Further information you will find here:
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=3787

Metamerism-Index

The Metamerism-Index (MI) will show the probability that two samples will show the same color difference under two different illuminants (represented by the first and second illuminant)

MI =	$MI = \sqrt{(\Delta L^*_1 - \Delta L^*_2)^2 + (\Delta a^*_1 - \Delta a^*_2)^2 + (\Delta b^*_1 - \Delta b^*_2)^2}$

- DL^*_1 Da^*_1 Db^*_1 are the Delta CIELab* color coordinates between Standard and Sample for the first illuminant
- DL^*_2 Da^*_2 Db^*_2 are the Delta CIELab* color coordinates between Standard and Sample for the second illuminant

Interpretation:

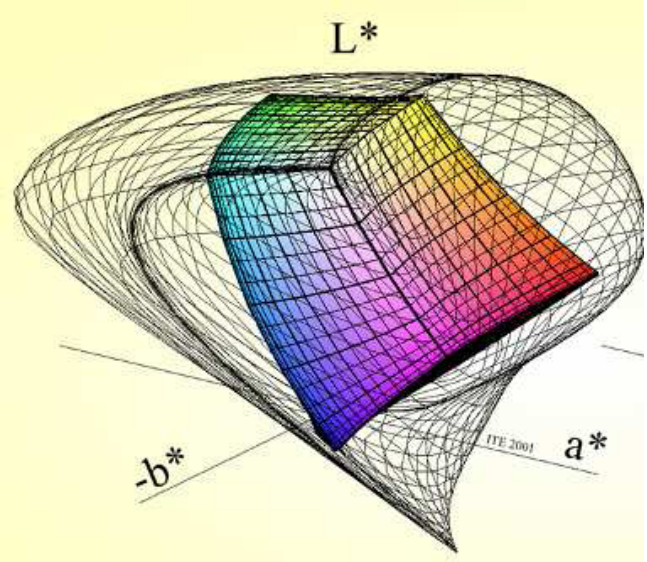
- If MI is low the color difference between the sample pair is the same for both illuminants. This does not mean that the two samples match, it means, that the two samples show the same difference for both illuminants
- If MI his high there is a different color difference between the two samples at two different illuminants. The samples might match under one illuminant, but not under the second. Or the sample 1 might to be red under illuminant 1 and to green under illuminant 2

Color Inconsistency

This attribute indicates a color change in the sample (without any reference to the standard) under different illuminants. This property is sometimes known as **"flare."** You may select to display a Color Inconstancy value for samples for the first and second illuminants, the second and third illuminants, and the first and third illuminants. This is a new index for which experimental data has not been gathered and therefore no hard and fast rules on acceptable tolerances have been established. Higher values of Color Inconstancy (over 1.0) probably indicate an unacceptable color difference; however, it would be wise to also examine the trial measurement in question in the Color Rendering View with the Multiple Illuminants option turned on to examine the color change visually rather than depending purely on the numeric value listed in the Multi-Trial View. Color Inconstancy is also an attribute on which you may sort formulas when in Color iControl's formulation mode and can be selected from that mode's Settings dialog.

CIE 1976 (L*, a*, b*) color space (CIELAB)

CIE L*a*b* (CIELAB) is color space specified by the CIE International Commission on Illumination (French *Commission internationale de l'éclairage)*. It describes all the colors visible to the human eye and was created to serve as a device independent model to be used as a reference.

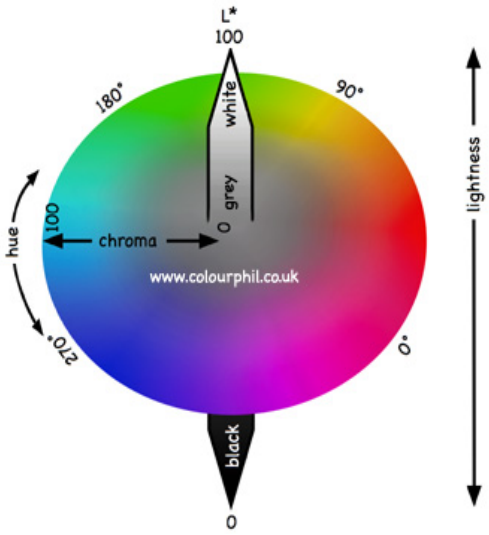


The three coordinates of CIELAB represent the lightness of the color (***L**** = 0 yields black and ***L**** = 100 indicates diffuse white; specular white may be higher), its position between red/magenta and green (***a****, negative values indicate green while positive values indicate magenta) and its position between yellow and blue (***b****, negative values indicate blue and positive values indicate yellow).

The asterisk (*) after *L*, *a* and *b* are part of the full name, since they represent *L**, *a** and *b**, to distinguish them from Hunter's *L*, *a*, and *b*, described below. Since the *L*a*b** model is a three-dimensional model, it can only be represented properly in a three-dimensional space.

Because the red/green and yellow/blue opponent channels are computed as differences of lightness transformations of (putative) cone responses, CIELAB is a chromatic value color space.

CIE L*C*H*



The L* axis represents *Lightness*.
It ranges from ***L**** = 0 yields black and ***L**** = 100 indicates diffuse white. The C* axis represents *Chroma* or "saturation". This ranges from 0 at the centre of the circle, which is completely unsaturated (i.e. a neutral grey, black or white) to 100 or more at the edge of the circle for very high Chroma (saturation) or "color purity". h* describes the hue angle. It ranges from 0 to 360 – h=0° = red / h=90° = yellow / h=180°=green / h=270° = blue

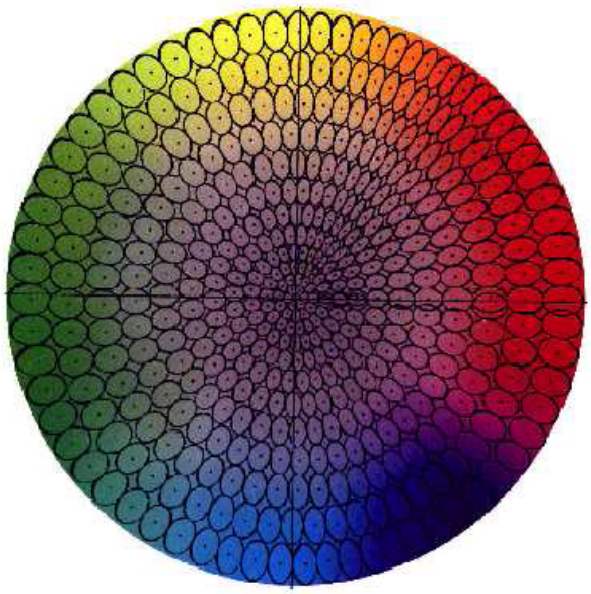
CieLab* Color Attributes

L*	Represents a standard or sample's position on the lightness axis in either CIELAB or CIELCH color space. This attribute is also available in Strength Adjusted form.
a*	Represents a standard or sample's position on the green/red axis in CIELAB color space, green being in the negative direction and red being in the positive direction. This attribute is also available in Strength Adjusted form.
b*	Represents a standard or sample's position on the blue/yellow axis in CIELAB color space, blue being in the negative direction and yellow being in the positive direction. This attribute is also available in Strength Adjusted form.
C*	Represents a standard or sample's chroma value in CIELCH color space. This attribute is also available in Strength Adjusted form.
h*	Represents a standard or sample's hue value in CIELCH color space. This attribute is also available in Strength Adjusted form.

CieLab* Color Difference Attributes

DL*	The delta value for the L* attribute. This attribute is also available in Strength Adjusted form.
Da*	The delta value for the a* attribute. This attribute is also available in Strength Adjusted form.
Db*	The delta value for the b* attribute. This attribute is also available in Strength Adjusted form.
DC*	The delta value for the C* attribute. This attribute is also available in Strength Adjusted form
Dh*	The delta value for the h* attribute. This attribute is also available in Strength Adjusted form.
DE*	The distance a sample falls from the standard in CIE* color space using a simple, straight-line calculation. This attribute is also available in Strength Adjusted form.

CMC l:c (1984)



In 1984, the Colour Measurement Committee of the Society of Dyers and Colorists defined a difference measure, also based on the L*C*h color model. Named after the developing committee, their metric is called **CMC l:c**.

The quasimetric has two parameters: lightness (l) and chroma (c), allowing the users to weight the difference based on the ratio of l:c that is deemed appropriate for the application. Commonly-used values are 2:1 for acceptability and 1:1 for the threshold of imperceptibility.

$$\Delta E_{CMC} = \sqrt{\left(\frac{\Delta L^*}{l \cdot S_L}\right)^2 + \left(\frac{\Delta C^*}{c \cdot S_C}\right)^2 + \left(\frac{\Delta H^*}{H_L}\right)^2}$$

SL = Funktion von L

- SL is a function of L
- Sc is a function of C
- l:c is the defined ratio of Lightness and Chroma

CMC* Color Difference Attributes

DL*cmc	The delta L* weighted by the CMC equation. This attribute is also available in Strength Adjusted form.
DC*cmc	The delta C* weighted by the CMC equation. This attribute is also available in Strength Adjusted form.
Dh*cmc	delta H* weighted by the CMC equation. This attribute is also available in Strength Adjusted form.
DEcmc (2.0:1)	This value also represents the distance in color space that a sample falls from the standard but is calculated using the CIE DEcmc equation which includes weighting functions that predict visual acceptability more accurately than the simpler DE* calculation. This attribute is also available in Strength Adjusted form.

CIE94

The 1976 definition was extended to address perceptual non-uniformities, while retaining the L*a*b* color space, by the introduction of application-specific weights derived from an automotive paint test's tolerance data.[7]

Δ*E* (1994) is defined in the L*C*h* color space with differences in lightness, chroma and hue calculated from L*a*b* coordinates. Given a reference color[8] (L_1^*, a_1^*, b_1^*) and another color (L_2^*, a_2^*, b_2^*), the difference is:[9][10][11]

$$\Delta E_{94}^* = \sqrt{\left(\frac{\Delta L^*}{K_L}\right)^2 + \left(\frac{\Delta C_{ab}^*}{1 + K_1 C_1^*}\right)^2 + \left(\frac{\Delta H_{ab}^*}{1 + K_2 C_1^*}\right)^2}$$

Where the K-values depend on the application

	graphic arts	textiles
K_L	1	2
K_1	0.045	0.048
K_2	0.015	0.014

CIE DE 2000* Color Difference Attributes

DE2000	DE value using CIE DE2000 evaluation equation (this equation was not formerly adopted and is provided here only for reference).
DL*00	The delta value for the L* attribute from a proposed new color space. This attribute is also available in Strength Adjusted form.
DC*00	The delta value for the C* attribute from a proposed new color space. This attribute is also available in Strength Adjusted form
DH*00	The delta value for the H* attribute from a proposed new color space. This attribute is also available in Strength Adjusted form.

Hunter Lab

The Hunter Lab color scale was developed in the 50´s and 60's. There were several permutations of the Hunter Lab color scale until the current formulas were released in 1966.

The Hunter Lab color space is organized in a cube form. The L axis runs from the top to the bottem. The maximum for L is 100 (for a perfect reflecting diffuser) while the minumum is 0. The a and b axes have no speficic numeric limits. Positive a is red and negative a is green. Positive b is yellow and negative b is blue.

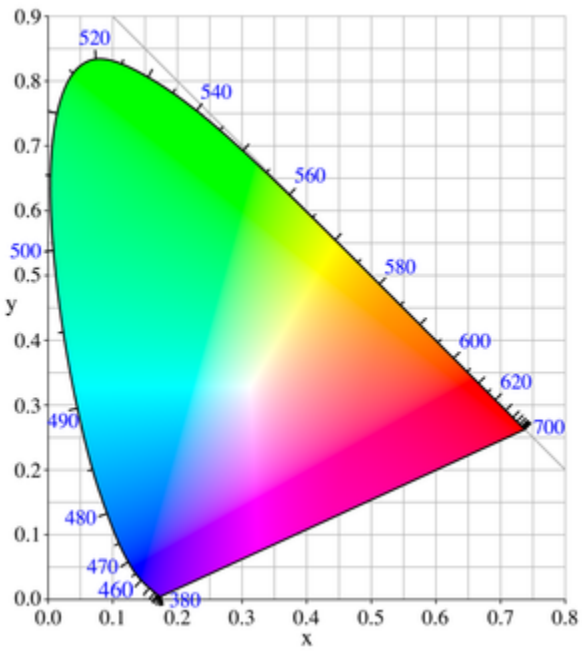
Hunter Lab Color Space attributes

L	Represents a standard or sample's position on the lightness axis in Hunter color space. This attribute is also available in Strength Adjusted form.
a	Represents a standard or sample's position on the green/red axis in Hunter color space. This attribute is also available in Strength Adjusted form
b	Represents a standard or sample's position on the blue/yellow axis in Hunter color space. This attribute is also available in Strength Adjusted form.

Hunter Lab Color Difference attributes

DL	The delta value for the L component of Hunter color space.
Da	The delta value for the a component of Hunter color space.
Db	The delta value for the b component of Hunter color space
DEh	The distance a sample falls from the standard in Hunter color space

CIE xyY Color space



The CIE 1931 color space chromaticity diagram. The outer curved boundary is the spectral (or monochromatic) locus, with wavelengths shown in nanometers.

CIE XYZ Color Coordinates

X	Represents a standard or sample's X tri-stimulus value for the 1931 CIE XYZ color space
Y	Represents a standard or sample's Y tri-stimulus value for the 1931 CIE XYZ color space
Z	Represents a standard or sample's Z tri-stimulus value for the 1931 CIE XYZ color space.
sx	Represents a standard or sample's position on the horizontal axis in the chromaticity diagram
sy	Represents a standard or sample's position on the vertical axis in the chromaticity diagram

CIE XYZ Differences

DY	The delta value for the Y element of the chromaticity diagram.
Dx	The delta value for the x element of the chromaticity diagram
Dy	The delta value for the y element of the chromaticity diagram.

FMCII (Friele - MacAdam - Chickering) Color Difference

The FMCII unit of color difference is based on just noticeable, or threshold, color difference data.
It has been published in 1942. Friele used the data in his suggested color-difference formula, which was modified later by MacAdam, and then by Chickering. The FMC-2 Scale is a color difference scale only and was designed for Illuminant C and 2° standard observer conditions only. It has been successfully used for non-saturated colors under illuminants D65 and A as well as 10° standard observer conditions.

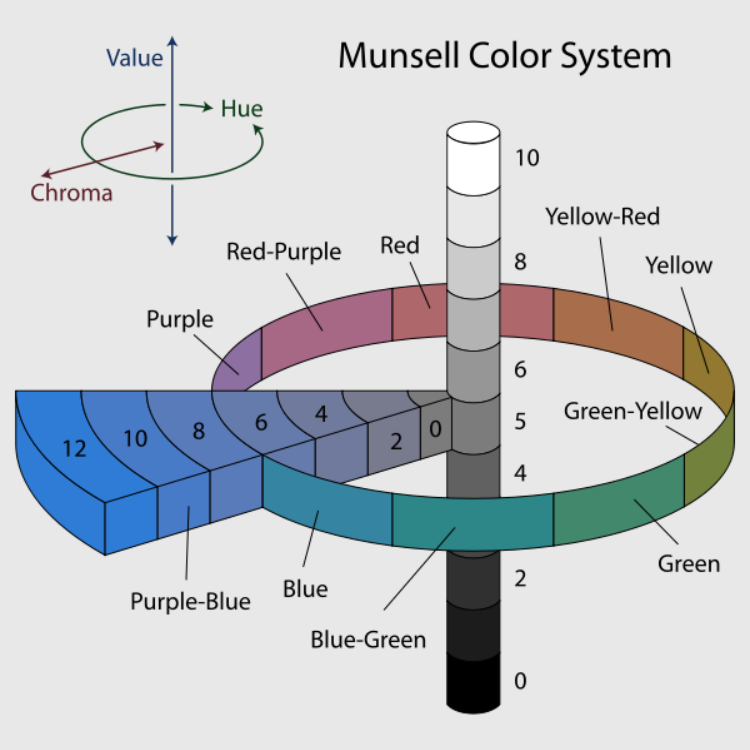
Red-green (dRG FMCII) differences, yellow-blue (dYB FMCII) differences, total lightness differences (dL), and total color differences (dE FMCII) between standard and sample are computed according to the Friele-MacAdam-Chickering metric (*JOSA*, February 1968, p. 292 and August 1969, p. 986).

FMC-II Color Difference attributes

DLf	The delta value for lightness in FMC-II color space.
DRGf	The delta value for the red/green value in FMC-II color space.
DYBf	The delta value for the yellow/blue value in FMC-II color space.
Def	The delta E value for the FMC-II color space.

Color Notations

Munsell



In colormetry, the **Munsell color system** is a color space that specifies colors based on three color dimensions: hue, value (lightness), and chroma. (color purity). It was created by Professor Albert H. Munsell in the first decade of the 20th century and adopted by the USDA as the official color system for soil research in the 1930s.

Munsell HVC Notation	This will display the Munsell Hue Value Chroma notation for the sample.

sRGB Color Notation

sRGB is a standard RGB color space created cooperatively by HP and Microsoft in 1996 for use on monitors, printers, and the Internet.
sRGB uses the ITU-R BT.709 primaries, the same as are used in studio monitors and HDTV,[1] and a transfer function (gamma curve) typical of CRTs. This specification allowed sRGB to be directly displayed on typical CRT monitors of the time, a factor which greatly aided its acceptance.

sR, sG, sB	These attributes allow you to display RGB values as given in SRGB color space.