ColorCheck Reference Guide

Onyx Graphics Inc.

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ColorCheck provides an integrated tool set within Onyx Rip-Queue for evaluating various aspects of printing. With these tools in place a printer operator can easily assess print accuracy as well as ensure that printed results are consistent day after day for multiple printer devices of the same make and model.

ColorCheck simplifies the implementation and maintenance of Process Control within a printing environment which can improve efficiency and reduce waste - thus saving time and money.

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1. Process Control and ColorCheck

Process control involves setting up processes in a print environment to ensure that printing (and finishing) is performed consistently and correctly

The ColorCheck tools in RIP-Queue only provide one part needed to assess and implement process control within a printing environment.
Process control requires a mindset of excellence and understanding by everyone involved in the printing process.

As such, process control in a print environment involves:

> Maintenance of Equipment
> Maintaining a stable printing environment
> Proper profiling and calibration printers
> Quality control of media and inks
> Ensuring that printed output is correct
> Regular evaluation of printed results
> Lots of details (like processes, forms, and checklists) ...

1.1. Maintenance of Equipment

Equipment must be maintained to ensure that printing is done consistently.

Questions to consider when setting up process controls related to equipment maintenance may include:

- What is being done to ensure equipment is working correctly (nozzle checks, self diagnostics, repairs, etc.)?
- Are finishing devices (laminators, calendars, heat presses) maintained and operated consistently?
- What is the maintenance schedule for the equipment (daily, weekly, etc.)?
- Are color measurement devices properly calibrated, maintained, and serviced?

1.2. Maintaining a stable printing environment

The physical environment where printing is performed and where materials are stored can dramatically impact the final printed output.

Questions to consider when setting up process controls related to the printing material storage environment may include:

- Are physical conditions consistent?
- How is temperature and humidity controlled?
- What factors of air quality are maintained (dust, fumes, air flow, etc.)?
- How stable are the print modes being used?

1.3. Proper profiling and calibration of printers

Properly setting up and maintaining color management for the printers, media, ink configurations, and print modes is essential to getting consistent and predicable output.

Questions to consider when setting up process controls related to proper profiling and calibration of printers may include:

- Was the printer in a stable printing condition when profiling was performed?
- Has calibration been performed?
- Is the color device used for profiling/calibration properly maintained and used?
- Has profiling been correctly performed for the printer, media, inks, ink configuration and print mode?
- Is the printer printing the same as when profile was performed?
- When is re-calibration performed?
- What processes are put in place when things change (ie media or ink)?

1.4. Quality control of media and inks

Ensuring consistency in the media, ink and materials used for image reproduction is essential for getting consistent and predictable output.

Questions to consider when setting up process controls related to quality control of media and inks may include:

- How is stability of inks in printers maintained?
- How does the media and ink change over time?
- What is the age of media or ink being used?
- Are you using the same media and ink, and are they consistent with the profiles that you are using?
- What processes are in place to ensure that media is consistent when replaced/restocked?
- What processes are in place to ensure that ink is consistent when replaced/restocked?
- If other materials are used what processes are in place to ensure that they are consistent when replaced/restocked?

1.5. Ensuring that printed output is correct

G7, Standards Simulation, and Print Gamut Verification ColorCheck verification tools provides a means of determining that printing is performed correctly after profiling is performed. This ensures that a standard level of output quality is achieved.

1.6. Regular evaluation of printed results

After standards and a level of quality has been established then regular reassessment using the Baseline ColorCheck verification tool provides a means of evaluate how consistently printing is being performed. The Baseline tool can also be used to assess how similar output is from multiple printers that share the same profiles.

1.7. ColorCheck verification processes

In the cases when ColorCheck verification fails then an evaluation will be needed to determine what parts of the printing process/environment are involved and put corrective measures in place. The processes used to do this should become part of the process control system put in place for a printing environment.

2. Quick and easy ColorCheck

You don't necessarily need any special color management training to test the consistency or accuracy of your printed output.

We have included several ColorCheck swatches out of the box to help you get started.

For this example, we will use the ONYX Weekly Baseline swatch.

2.1. Start Print ColorCheck dialog

Once RIP-Queue is online, click on the go to the ColorCheck tab, and click the <Print ColorCheck...> button.

Figure 1 - ColorChek Tab
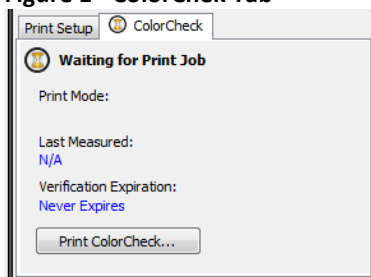
2.2. Print Swatch

Select the color device you want to use, then select the ONYX Weekly Baseline swatch as well as the print mode and quickset to use and click Print. (Note: Printing a ColorCheck swatch overrides various settings of a Quick Set including media and mode if they are explicitly set by the Quick Set).

Figure 2 - Print ColorCheck Swatch Dialog
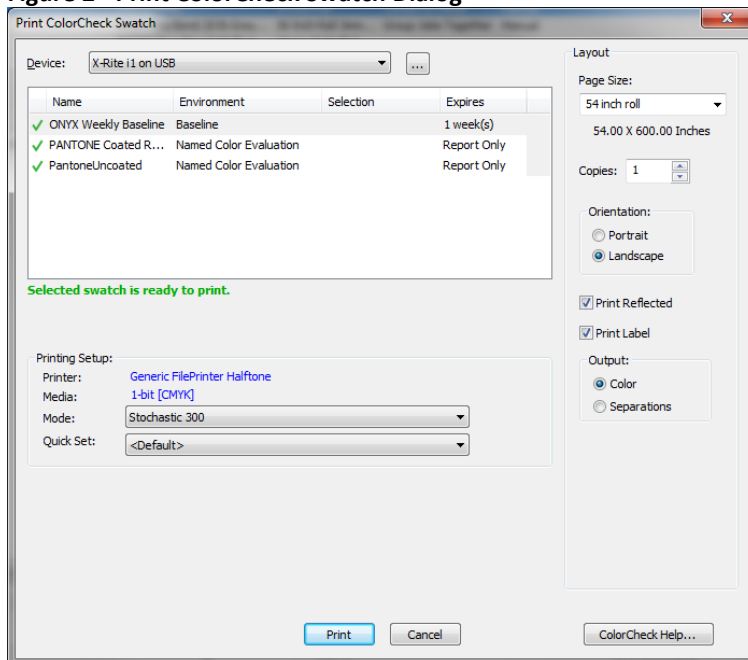
2.3. Measure Swatch

After you print the swatch, the job will switch to a "Waiting To Measure" state. Select the job in the queue and then click the Measure Swatch icon on the top left to measure the swatch.

Figure 3 - ColorCheck Job in Queue with Measure tool enabled
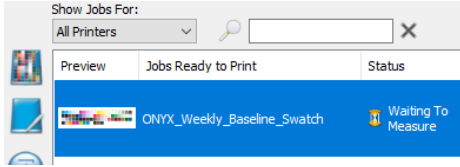
2.4. View Report

After the swatch is read in, you will be presented with your first ColorCheck Baseline report. All the delta E values will be zero because your initial measurements are the baseline for future Baseline tests. The next time you print and read a Baseline swatch it will be validated against these initial measurements.

Figure 4 - Verification Results report after measurement
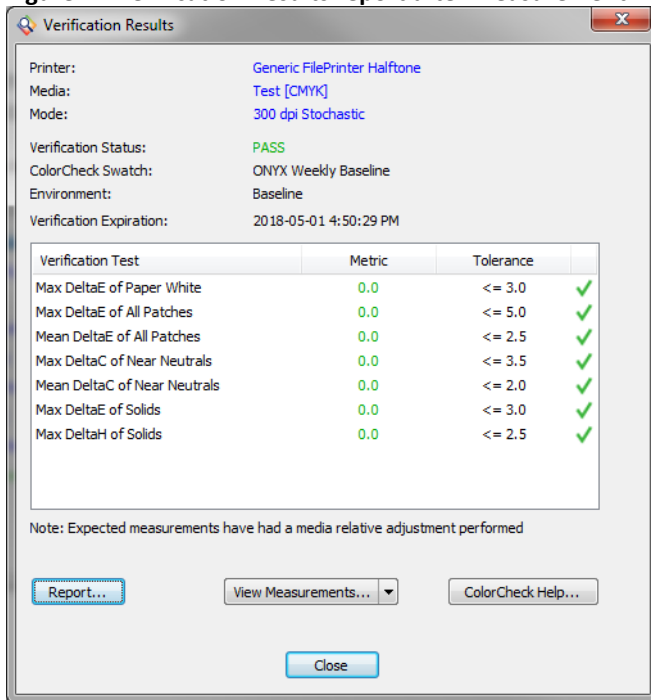
After the Verification Results report is closed and measurements are completed the ColorCheck Swatch job will be moved to the Buffered queue area with the status of the job set to reflect the status of the swatch verification. The swatch verification report can also be viewed by selecting the job and viewing the job properties.

Figure 5 - Verification report from Job Properties
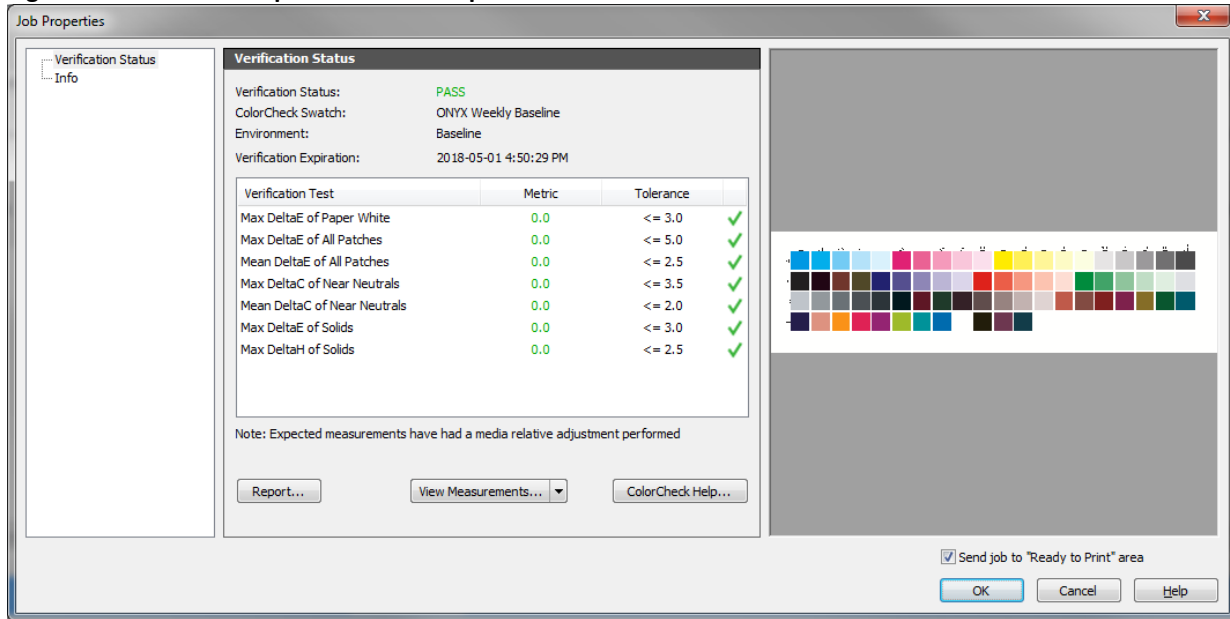
2.5. Working with HTML Reports

A save as dialog is displayed after pressing the <Report…> button from either the post measurement Verification Results dialog or the Job Properties dialog. By default ColorCheck HTML reports are placed in the PCT\Reports folder using the swatch name and the time and date.

Figure 6 - Create HTML report dialog
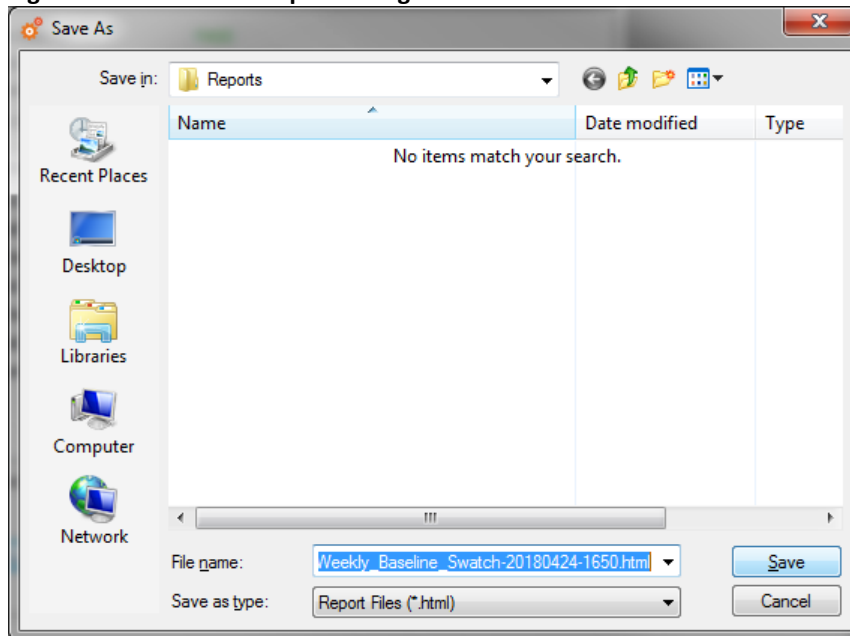
After the HTML report file is saved the default browser is then used to display the report. Several key interactions are possible.

Figure 7 - View of HTML ColorCheck report from Chrome browser

The patches can be hidden by pressing the Hide button.

The columns with up/down arrows in the Patches table can be sorted by clicking on the column header.

Note: Clicking twice on the∆E00 column will sort the color differences from largest to smallest. This is a quick and simple way to determine problem areas.

The current state of the report in the browser can be printed using the browsers print functionality. (Note: The printed report will reflect of the patches hidden or sorted state). From Chrome this is done by pressing the three dots in the upper right and selecting <Print…>.

Figure 8 - Printing ColorCheck HTML report with patches hidden
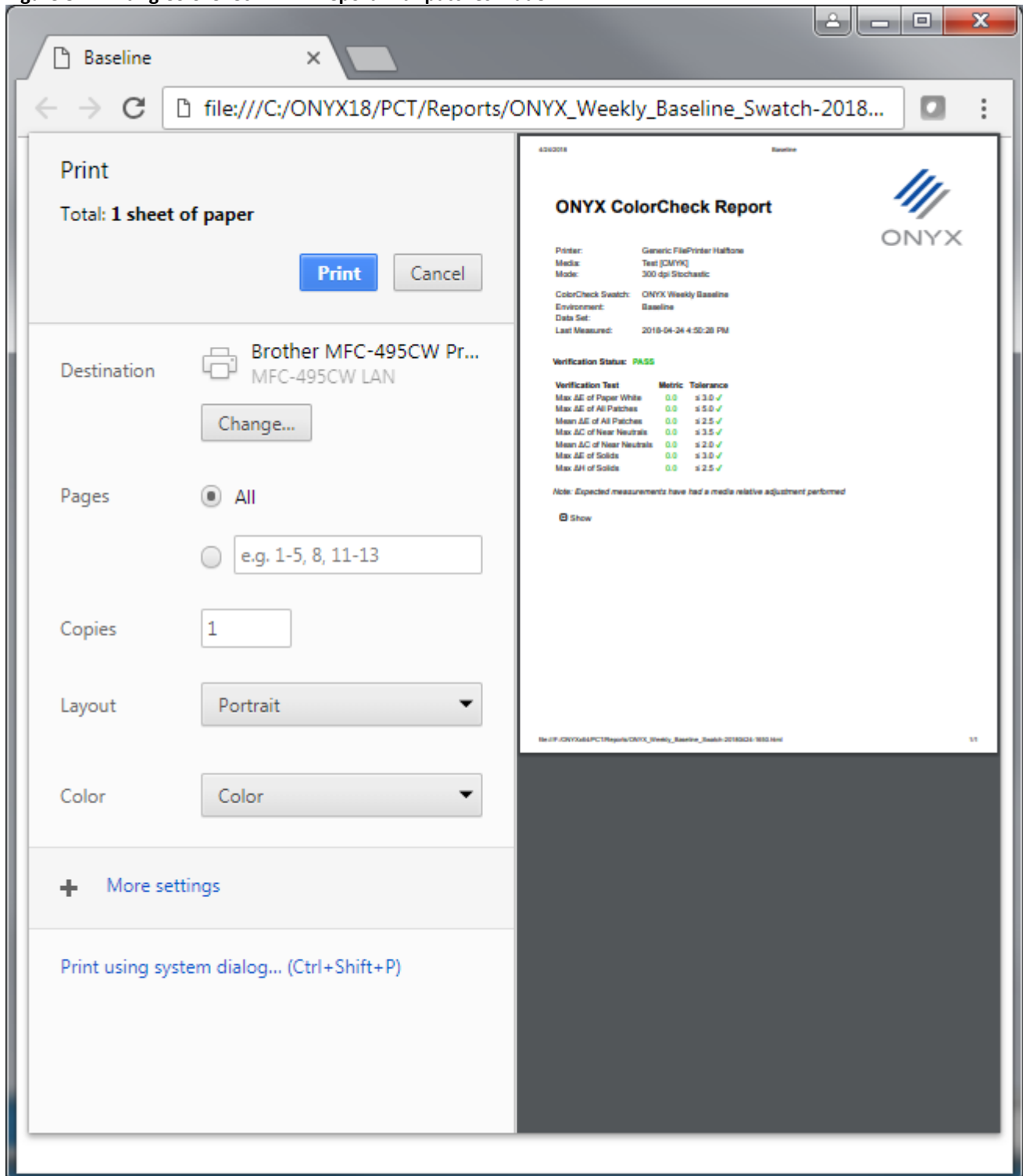
2.6. Working with Swatch Measurements

Measurements of swatch patches can be directly viewed or exported from the <View Measurements…> button at the bottom of the Verification Results or Job Properties dialog. If the

down arrow next to the button is pressed a menu of View Measurements… or Export Measurements… is shown and can be selected.

Figure 9 - View Measurements...

A CGATS file can be exported using the Export Measurements… and then entering a filename and location to save the exported measurements.

Figure 10 - Export Measurements...
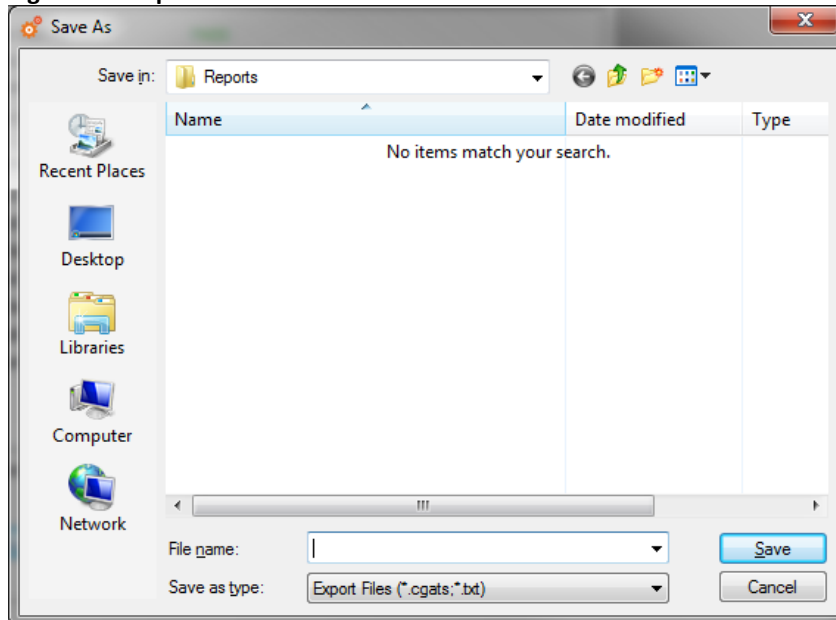
3. Setting up and using ColorCheck

When setting up ColorCheck one should first consider what they want to be able to evaluate and then configure ColorCheck swatch definitions that can be used on a regular basis.
Are you evaluating color consistency or color accuracy? Are you simulating a print standard or simply maximizing the capabilities of your printer?

Care needs to be made when setting up for evaluation of standards simulation as Input profiles in Quick Sets need to be configured to agree with the standards characterization data sets used. ColorCheck validation may fail as a result of color management considerations not being taken into account.

The following use cases provide setup and usage.

3.1. Using Baseline ColorCheck across multiple printers (of same model)

When a baseline swatch is printed and measured the swatch configuration and measurements are persisted as part of a print mode's profile data in the printer repository. Therefore, a baseline's swatch configuration and measurements are saved as part of the print mode definition when either a Printer Install Library (PrnInst) file or an Onyx Media Library (OML) file is created. Additionally, encapsulated mode specific baseline swatch configurations and measurements are imported as part of either installing a printer or importing an OML. This allows ColorCheck baseline checking to be used to ensure that printing is performed the same for multiple printers that can use the same media and print modes.

This is accomplished using the following steps.

3.1.1. Create/import a media and print mode

Use media manager to create and profile a media and print mode. Alternatively one can import a media that doesn't have baseline measurements.

3.1.2. Print and measure a baseline swatch for one or more print modes for a media

Follow the steps in Section 2 to print and measure a baseline swatch for the media and print mode set up in Section 3.1.1. (Note: it may be desirable to first create (or copy and modify) a baseline swatch that will be used to determine that printers are printing the same). (Note: This may be repeated for multiple print modes). Generally it is a good idea to print and measure a baseline after creating a profiling a print mode.

3.1.3. Export media containing one or more baselines

The mode specific baseline swatch configurations and measurements are saved as part of exporting a media. This can be done in three ways. The first is to create a PrnInst from the File>Manage Printers… dialog in Rip-Queue. The second is by exporting medias as an OML file using the <Export…> button on the Media Tab of the Configure Printer dialog in Rip-Queue. The third is by using the <Export…> button after selecting a media in the Media Library section of Media Manager.

3.1.4. Install Printer or Import media containing baseline

Either install a new printer using the PrnInst, or import to an alternate printer from the OML created in Section 3.1.3.

3.1.5. Select the installed/imported media in Rip-Queue

Make the printer in the Rip-Queue be the active printer where the media was installed in Section 3.1.4 by selecting the printer at the top of the Rip-Queue window. Then select the media to be the active media for the printer.

3.1.6. Print an imported baseline swatch

Select the ColorCheck tab in the printer setup panel on left side of Rip-Queue window and press <Print ColorCheck…> to bring up the Print ColorCheck dialog. Select the mode specific baseline swatch (with "<mode>" at end of the swatch name). Select the color device to measure with and the quickset, and then print the swatch.

3.1.7. Measure the swatch and get report

Once the swatch has been printed select the job, measure swatch, and view report as defined in Section 2.

3.2. Print mode relative named color reporting

Both the "PANTONE Coated Report" and "PANTONE Uncoated Report" swatches use PANTONE provided measurement data to determine color differences used in the reports. When mode specific device ink values for printing PANTONE colors are defined, the device values are applied to the printing of the swatch, and color differences are made relative to the PANTONE provided measurement data.

Named color reporting can be configured for color difference comparisons to be made relative to color measurements for the desired device ink replacements. This can easily be done by:

- First, making a copy of the Report swatch definition.

- Second, editing the copied swatch definition, and clicking on the <Options…> button.

- Third, turn on the "Compare with print mode defined colors (when set) check box

- Pres <OK> on the dialogs to save the changes

- Use the updated swatch definition to print and generate a report.

Named color reports using this copy will use the colorimetry of the replaced ink values (based on the default ICC profile associated with the print mode for reporting color difference metrics.

Note: Print modes created using HP PANTONE Emulation define device ink replacements for all PANTONE colors and print mode relative named color reports will show small color differences (since they comparison in relative to the device ink replacements created for the print mode).

3.3. Other cases

Walkthroughs provide a basic guide for setting up and using ColorCheck…

Further configuration can be found in Section 5.

4. ColorCheck Overview

4.1. Introduction

The ColorCheck configuration manager can be used to create, manage and print ColorCheck swatches. Three types of ColorCheck swatches are possible:

> To determine color consistency (Baseline)
> To determine color accuracy (G7 Master, Standards Simulation, and Print Mode Verification)
> Informational (Custom Image and Named Color Evaluation)

After either a color consistency or color accuracy swatch is printed the job will remain in the queue waiting to be measured with a color measurement device.
Once it is measured then verification testing is performed, and the ColorCheck verification status for the print mode is updated.

When ColorCheck swatch definitions are created they can be configured with an expiration time that will flag the print operator when it is time to reprint and measure the ColorCheck swatch.
ColorCheck verification is for informational purposes only. Having invalid, expired or non-existing ColorCheck verification will not prevent jobs from being printed.

4.2. Baseline Environment

The baseline swatch environment allows for a set of custom color patches to be defined along with user defined ColorCheck validation tests to be performed on subsets of the patches.
The first time that a baseline swatch is printed and measured for a print mode, the measurements of the patches will be cached as part of the media repository to establish the "baseline" for any future ColorCheck validation using that print mode.

Figure 11 - Example settings for Baseline environment
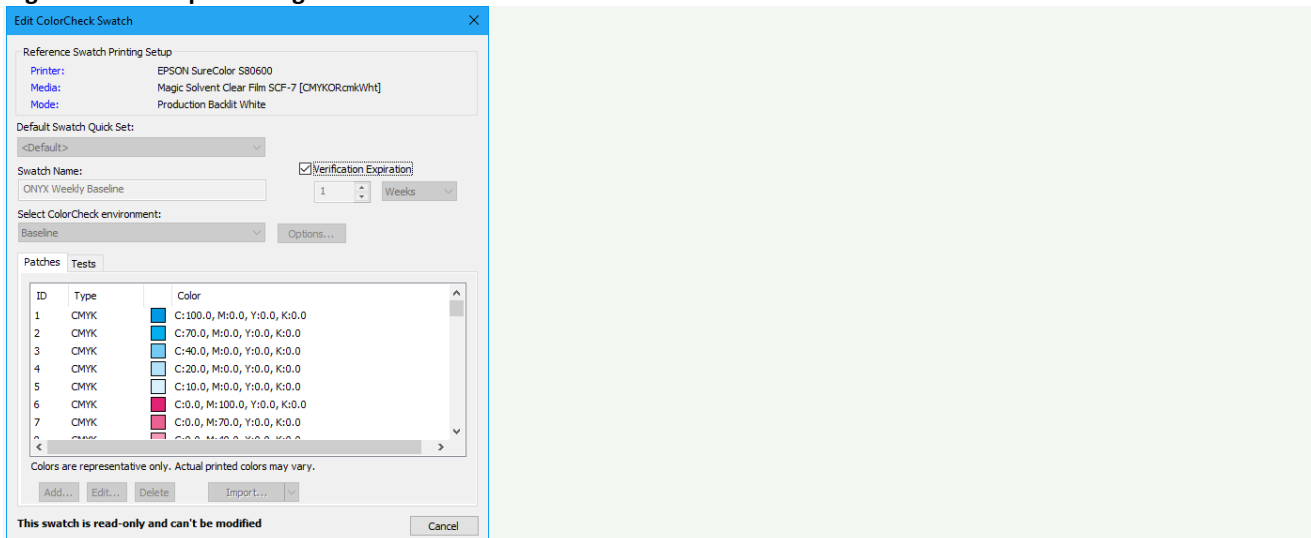
ColorCheck "baseline" measurements and swatches are tracked on an individual mode basis.
Baselines therefore need to be established for each print mode independently.
Thus, they are exported and imported as part of exporting and importing a media.
This allows for baseline measurements to be shared between printers that use the same print modes to determine how consistently they are printing to one another.

Note: When a new baseline is desired then the Baseline Measurements for a swatch can be removed from the Media Library view of the print mode in Media Manager.

ColorCheck validation using baseline swatches can only be used to assess color consistency because baseline swatch validation preformed against previous measurements from previous prints of the swatch using the same print mode.
Other ColorCheck environments should be used to check for color accuracy.

4.3. G7 Master Environment

The G7 Master swatch environment allows for evaluation of calibration and reproduction of CMYK grayscales relative to G7 grayscale methodology advocated by IDEAIlliance.
The premise of G7 calibration is based on the concept of using a Neutral Print Density Curve to define tone scale with colorimetric balancing of grayscale for grayscale combinations of CMY.

Figure 12 - Example settings for G7 environment
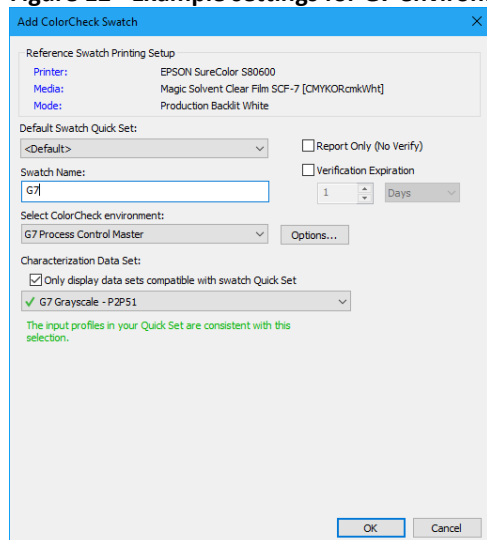
The G7 Master environment has 3 swatch types that correspond to G7 Grayscale, Targeted, and Colorspace requirements.

The swatches and tests involved with the G7 Master environment evaluate various aspects of color reproduction accuracy in the following ways:

4.3.1. G7 Grayscale

The G7 Grayscale evaluation swatches evaluate how well the calibration, G7 correction, or color management settings achieve NPDC tone scale and gray balance for printing CMYK output.
When ICC profiles are not used then this evaluates how well the media model for calibration or the G7 color correction in media manager achieve G7 NPDC grayscale aims for CMYK printing.
When ICC profiles are used then it provides an evaluation of both the G7 applicability of the input profile being used along with the color accuracy of the print mode's output profile.
G7 Grayscale is likely the best choice to use for the purposes of assessing both accuracy and precision without the use of ICC color management.
It does require that the print mode is created in Media Manager with G7 calibration / correction put in place.

4.3.2. G7 Targeted

The G7 Targeted evaluation swatches evaluate how accurately CMYK primaries and secondaries (solid two color combinations) of a reference printing condition are simulated in addition to assessing color management settings used to achieve NPDC tone scale and gray balance for printing CMYK output.

As most digital printers have inks with different color characteristics form conventional press reference printing conditions, G7 targeted swatches should be printed using ICC color management, and the Input profile defined in the Quick Set needs to be consistent with the reference printing conditions associated with the chosen swatch that is printed.

> **Note 1:** Care needs to be made when using G7 targeted evaluation swatches as invalid profile configuration can lead to failure of ColorCheck verification.

> **Note 2:** G7 Targeted evaluation assess how accurately the print gamut of the input profile is simulated by the profile associated with the print mode.

Evaluating accuracy of simulation is not necessarily the same as evaluating accuracy of the output profile as colors inside the gamut of the print mode's profile may not be inside the gamut of the input profile.

4.3.3. G7 Colorspace

The G7 Colorspace evaluation swatches evaluate how accurately various printed CMYK values simulate the results of a reference printing condition in addition to assessing color management settings used to achieve NPDC tone scale and gray balance for printing CMYK output.

As most digital printers have inks with different color characteristics form conventional press reference printing conditions, G7 Colorspace swatches should be printed using ICC color management, and the Input profile defined in the Quick Set needs to be consistent with the reference printing conditions associated with the chosen swatch that is printed.

> **Note 1:** Care needs to be made when using G7 Colorspace evaluation swatches as invalid profile configuration can lead to failure of ColorCheck verification.

> **Note 2:** G7 Colorspace evaluation assesses how accurately the print gamut of the input profile is simulated by the profile associated with the print mode. Evaluating accuracy of simulation is not necessarily the same as evaluating accuracy of the output profile as colors inside the gamut of the print mode's profile may not be inside the gamut of the input profile.

4.4. Standards Simulation Environment

The Standards Simulation Evaluation swatches evaluate how accurately various printed CMYK values simulate the results of a reference printing condition.

Figure 13 - Example settings for Standards Simulation enviroment

Options for printing Standards Simulation swatches allow for various tests relative to different international and published standards to be applied relative to how accurately CMYK values are printed.

As most digital printers have inks with different color characteristics form conventional press reference printing conditions, Standards Simulation swatches should be printed using ICC color management, and the Input profile defined in the Quick Set should to be consistent with the reference printing conditions associated with the chosen swatch that is printed.
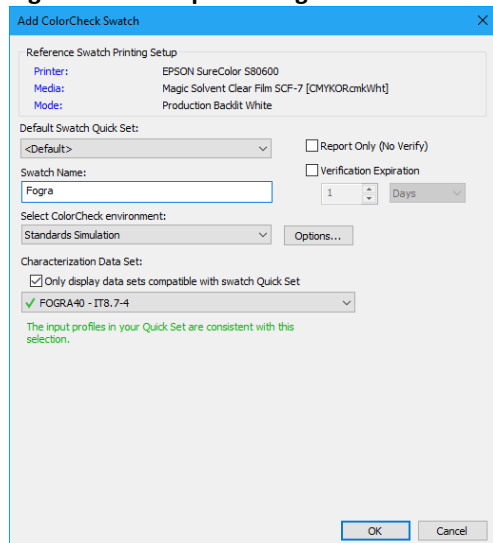
> **Note 1:** Care needs to be made when using Standards Simulation Evaluation swatches as invalid profile configuration can lead to failure of ColorCheck verification.

> **Note 2:** Standards Simulation evaluation assesses how accurately the print gamut of the input profile is simulated by the profile associated with the print mode.

> Evaluating accuracy of simulation is not necessarily the same as evaluating accuracy of the output profile as colors inside the gamut of the print mode's profile may not be inside the gamut of the input profile.

4.5. **Print Gamut Verification Environment**

Print Gamut Verification evaluation swatches evaluate how accurately the profile for the print mode reproduce colors that are known to be inside the print gamut of the print mode. This is accomplished by dynamically determining colors inside the print gamut and then using the output profile to print those colors.

Figure 14 - Example settings for Print Gamut Verification environment
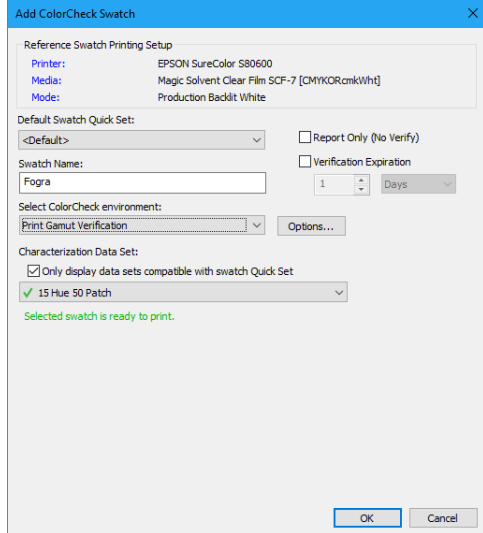
As such Print Gamut Verification does not use the input profile associated with the Quick Set, and therefore doesn't check whether color management settings are appropriate for simulation or any other purposes.

It is used to determine whether the print mode profile characterizes how the printer actually prints.

> **Note:** Print gamut verification can be used to determine if the printer profile is the cause of ColorCheck validation errors simulation based ColorCheck verification.

4.6. Named Color Evaluation Environment

Named Color Evaluation swatches allow for sets of colorimetric or named custom color patches to be defined to assess how well a print mode is able to reproduce the color sets. These colors are reproduced using the same color management used when they are printed as part of PDF/EPS/PS documents.

Figure 15 - Example settings for Named Color Evaluation environment
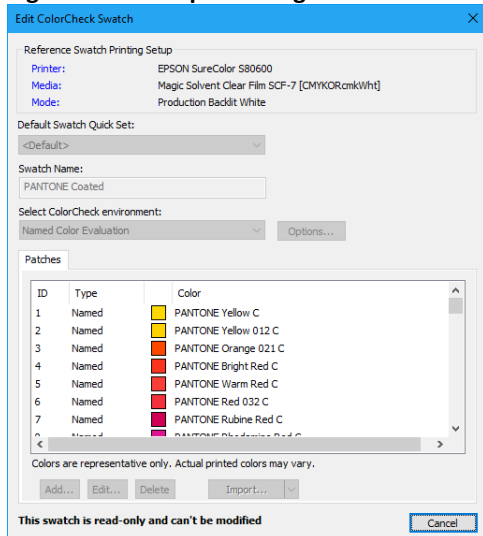
After measurement the swatch report will show how close each of the patches can be printed with overall color difference statistics.

Note: This ColorCheck environment does not update or modify the ColorCheck verification status for a print mode. This ColorCheck environment is simply for generating reports for informational purposes.

4.7. Custom Image Environment

Figure 16 - Example settings for Custom Image environment
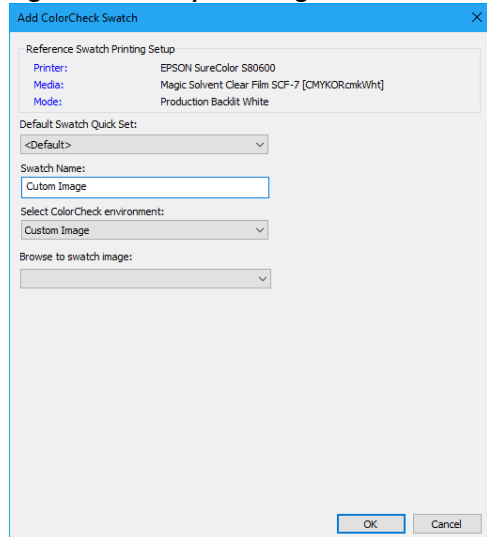
Custom image swatches allow for images provided by 3rd party color validation/verification packages to be easily printed under specified Quick Set conditions. Custom image swatches are not tracked or measured the same as other ColorCheck swatches. They need to be separately measured and used within the 3rd party package involved.

Note: ColorCheck verification status is NOT modified or updated by Custom Image swatches.

5. ColorCheck Configuration

5.1. Introduction

The ColorCheck configuration manager can be used to create, edit/view, delete, print and export/import ColorCheck swatches.
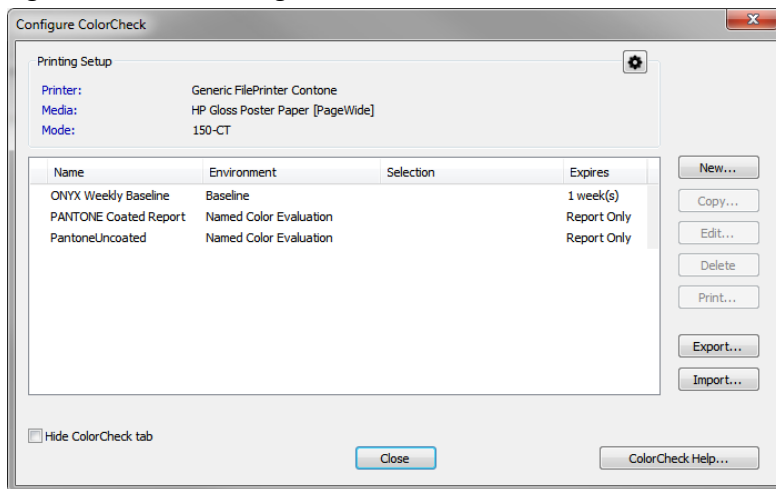
Figure - Main UI to configure ColorCheck

It is intended for the production manager to created pre-defined swatches that are to be used in process control operations in a print shop.

With pre-defined swatches created, the print operator only has to select from the pre-defined list.

You configure ColorCheck swatches by clicking the "Configure ColorCheck" icon on the RIP-Queue toolbar.

The main UI of Configure ColorCheck includes Printing Setup, ColorCheck swatches, and several operations (create, edit/view, delete, print, export, and import). You can setup printing information (Printer, Media, and Mode) by clicking the gear. Three ColorCheck swatches are predefined (ONYX Weekly Baseline and Named Color Evaluation of PANTONE Coated and PANTONE Uncoated). Other ColorCheck swatches you define will also be listed here.
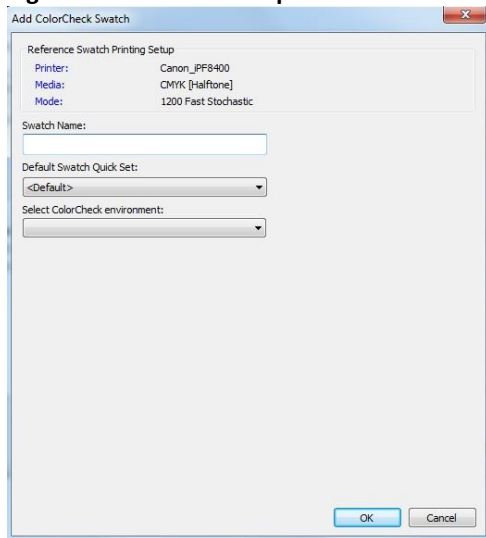
The "Hide ColorCheck tab" when selected will prevent the ColorCheck tab from appearing in the print control area in Rip-Queue.

5.2. Operations within the Configure ColorCheck dialog

5.2.1. New...

This operation is to add a ColorCheck swatch. The printing setup is listed at the top for reference.

Figure 17 - Main UI for operation New...

You first add the swatch name and select the Quick Set to be associated with this swatch. Then you can select from one of the ColorCheck environments to create a swatch definition for.

5.2.1.1. Add a Baseline swatch:

The baseline swatch environment allows for a set of custom color patches to be defined along with user-defined ColorCheck validation tests to be performed on subsets of the patches.

You can add a new Baseline swatch by choosing Baseline in Select ColorCheck environment.

Figure 18 - Main UI to add a new Baseline swatch
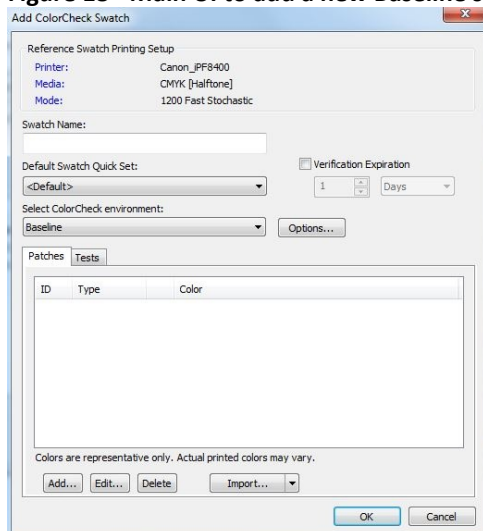
By clicking Options..., you can choose to use absolute values or media-based substrate corrected values to verify measurement.

Figure 19 - Options for Baseline swatch

Note: When media-based substrate correction is selected, the expected values are adjusted based on the measured media colors.

By checking Verification Expiration, you can setup expiration notification time for a ColorCheck swatch.

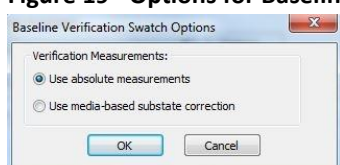The Patches tab lists the customized color patches that you want to print and measure on a routine basis. Each patch has a Patch ID, Patch Type, and Color Data.

- Not all patches in a swatch need to be defined using the same color space (Patch Type) which can be a named color (Pantone), Lab, K, RGB, or various process ink color selections like CMYK, CMYKR, etc.

- A color transformation is performed (as needed) to convert each patch to the color space used by the print mode. If the color space matches the color space of the print mode then no transformation is performed.

- You can add, edit, delete, or import color patches by clicking corresponding buttons in the Patches tab.

- To add a single patch click the button Add.. button.

  Note: You can add different patches by specifying patch type, such as Named color (Pantone), Lab, K, RGB, and different device colors (CMYK, CMYKR, etc.). Color transformation may be needed to print a patch. For example, you want to print a RGB patch or CMYKR patch using a CMYK printer.

- When you want edit a patch in the Patches tab, you just select the patch and click the button Edit... The UI to edit a patch is the same as to add one.

Figure 20 – Add patch for Baseline swatch
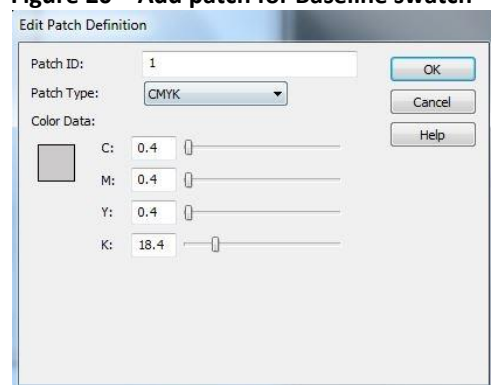
- **Tip**: One quick way to set up a swatch with a lot of patches is to import patch definitions from an already existing swatch. When the import button is pressed it will import patches from SWADEF files. If the drop down next to the Import... button is used then the type of patches and swatch definition file to import from can be selected. Patches can be imported from CGATS files (CMYK, RGB, LAB) or SWADEF files

Figure 21 – Import patches for Baseline swatch

- When you import swatches you will be asked to find a file that you wish to import patches from.

- Useful places to get previously defined patch definitions are as follows:

  o Swatches that are defined using the ColorCheck Configuration dialog are placed in the "Onyx\PCT\SwatchDefs" folder.

  o CGATS files for the standard definition files can be found in the "Onyx\PCT\Standards Simulation" folder.

  o CGATS files for G7 can be found in the "Onyx\PCT\G7 Master folder"

- Patch identifiers are preserved when patches are imported from an existing swatch. Slight changes to the patch identifiers may be made to ensure that each patch identifier is unique.

  The Test tab lists the set of tests on color patches in the Patches tab to perform after measurement of the swatch during the process of swatch validation.

Figure 22 – Add test for Baseline swatch
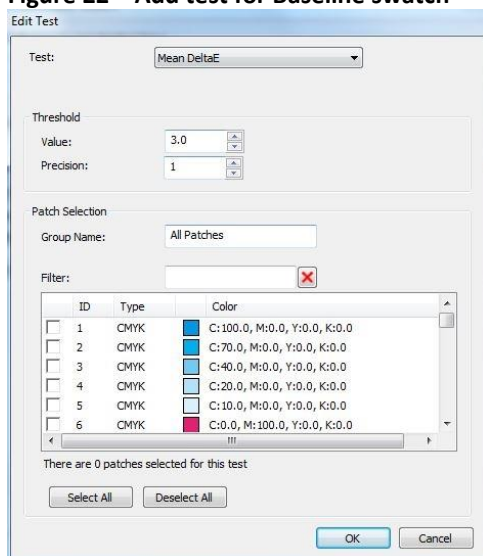
- All the tests in the list need to succeed in order for the swatch being defined to pass validation.

- You can add, edit, or delete tests by clicking corresponding buttons in the Test tab.

- A test is a comparison operation that is performed on one or more patches from the patches tab. A test succeeds if the comparison is less than or equal to the threshold associated with the test.

- You can add a test to be performed during swatch validation by clicking the Add.. button.

- Each test has a minimum threshold (value and precision) that must be achieved for conformance purposes on subset of patches.

  - Thresholds are used to establish acceptability of printed output taking into consideration a number of different factors including (but not limited to):

    o Noticeability of color difference

    o Variability in the printing process

    o Variability in the measurement process

  - The following tests can be used to compare measurements of patches in a swatch to previous baseline measurements for purposes of validation:

    o Mean DeltaE - used to determine whether the average color difference (defined using CIEDE2000) is below a given threshold.

      ▪ In general a DeltaE of less than 2.0 is not physically discernable

    o Max DeltaE - used to define the limit for the worst case color difference for the group of patches associated with the test.

      ▪ This value should generally be larger than a threshold for a Mean DeltaE

    o Max DeltaE should be used to specify the threshold for a single color patch

    o PTile DeltaE - a PTile or (Percentile) DeltaE is used to define the limit for a percentage of the patches associated with the test that have a color difference less than or equal to the threshold.

      ▪ When PTile DeltaE is used you are also prompted for the percentage of the patches to use.

      ▪ **Tip**: Using 95% is equivalent to saying "for the most part" or (95% of the time) the maximum color difference is less than or equal to the threshold.

      ▪ **Note**: Generally PTile DeltaE is better to use than Max DeltaE with a large number of patches.

    o Mean DeltaH / Max DeltaH - used to to determine the average / maximum hue variation (independent of lightness and chroma differences). Max DeltaH is something that is generally used against single ink color solids to determine stability/acceptability of the ink.

- o Mean DeltaC / Max DeltaC - used to determine the average / maximum color shift independent of differences in lightness. Generally used to asses the neutrality of near neutral colors.

- o Mean DeltaL / Max DeltaL - used to determine the average / maximum shift in lightness.

- When a test is created you select the patches that you want to operate on and provide a name for the group of patches (like "Solids" or "Customer Colors").

- **Tip**: The filter provides a convenient mechanism to quickly find colors that have specific values for inclusion in the group of patches to associate with a test

  - o For instance typing in 100 for the filter shows all the patches that have at least one ink channel that have 100% ink.

- You can easily select or deselect all patches by clicking buttons Select All or Deselect All when you want to select the subsets of patches.

- The following tests and thresholds (Based on ISO 12647-7) for groups are defined for the Onyx Weekly Baseline:

Group	Test	Threshold
Paper White	Max ΔE	3.0
All Patches	Mean ΔE	2.5
All Patches	Max ΔE	5.0
Near Neutrals	Mean ΔCh	2.0
Near Neutrals	Max ΔCh	3.5
Solids	Max ΔE	3.0
Solids	Max ΔH	2.5

5.2.1.2. Add a G7 Process Control Master swatch:

Note: The use of G7 Target and G7 colorspace characterization data sets generally relies on color management input profiles to be set up in the Quick Set that is applied when swatches are printed. Before creating Standard Simulation swatches in ColorCheck configuration it may be advisable to first create Quick Sets for each printer with a common name that has the appropriate input profile associated with printing condition that will be used by default for the created G7 based Swatch.
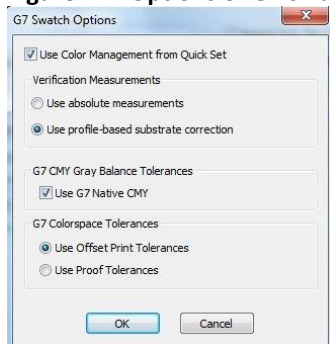
Figure 23 - Add a new G7 swatch
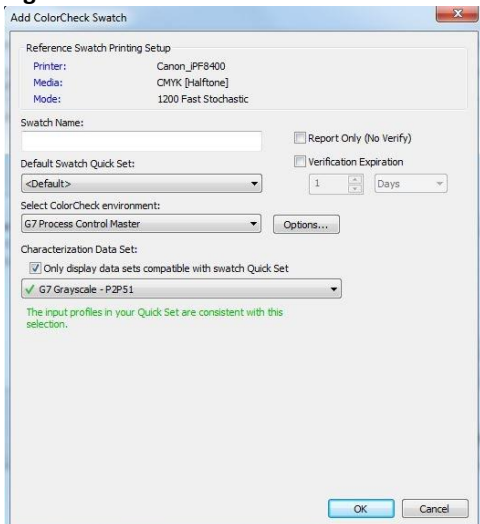
The G7 Process Control Master swatch environment allows for evaluation of calibration and reproduction of CMYK grayscales and other tests relative to G7 grayscale methodology advocated by IDEAlliance.

- You can setup options by clicking the <Options...> button

Figure 24 - Options of G7 swatch

- You can select to use or not use Color Management from Quick Set.

- Note 1: When you check this option, the Color Management setting in Quick Set will be applied, including input profile, rendering intent, and output profile. This is useful for determining how well G7 calibration is accomplished by the color management profiles selected in the quick set. Failure may be due to incorrect input profile selection (which doesn't achieve G7 aims) or by a failure of the printer profile to get accurate results for the associated print mode.

- Note 2: When you uncheck this option, the CMYK values in the selected swatch are directly printed without applying ICC profiles from the Quick Set. This is useful for evaluating G7 correction steps applied during profiling in Media Manager.

- You can choose to use absolute values or media-based substrate corrected values to verify measurement.

Note: When media-based substrate correction is selected, the expected values are adjusted based on the white point of the associated output profile.

- The selection to use Native CMY tolerance allows for balance of 300% ink coverage for print mode specific variations to be accounted for. This is especially important when a print mode has a significant different color for a 300% CMY than for offset printing.

- The final tolerance selection selects the tolerances to use for G7 Colorspace assessment. Offset print tolerances are for day to day printing and proof tolerances are for assessing G7 for proofing.

- By checking <Only display data sets compatible with swatch Quick Set>, G7 characterization data sets compatible with the selected Quick Set are listed with a green check mark next to it. Otherwise, all the G7 characterization data sets are listed with green check icon for those compatible, and red cross icon for those not compatible. Corresponding labels are also displayed with different colors depending on if you select a compatible or incompatible data set.

- When enabling (checking) Report Only (No Verify), you will only get a report for this G7 swatch and the ColorCheck mode verification status will not be updated.

- With Verification Expiration you can setup a time-out period before the G7 ColorCheck swatch is re-printed and re-measured to ensure that printing with the mode is being done correctly.

5.2.1.3. Add a Standards Simulation swatch:

Tip: The use of Standards Simulation generally relies on color management input profiles to be set up in the Quick Set that is applied when swatches are printed. Before creating Standard Simulation swatches in ColorCheck configuration it may be advisable to first create Quick Sets for each printer with a common name that has the appropriate input profile associated with printing condition that will be used by default for the created Standards Simulation Swatch.
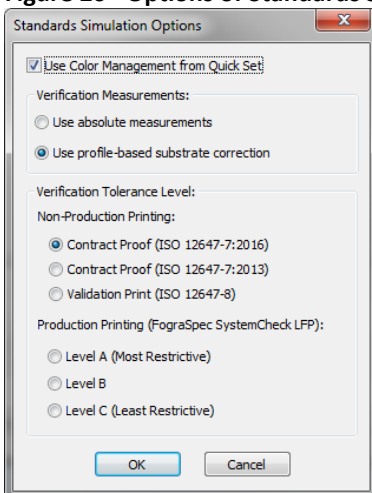
The Standards Simulation Evaluation swatches evaluate how accurately various printed CMYK values simulate the results of a common reference printing conditions, such as IDEAlliance or FOGRA.

Figure 25 - Add a new Standards Simulation swatch
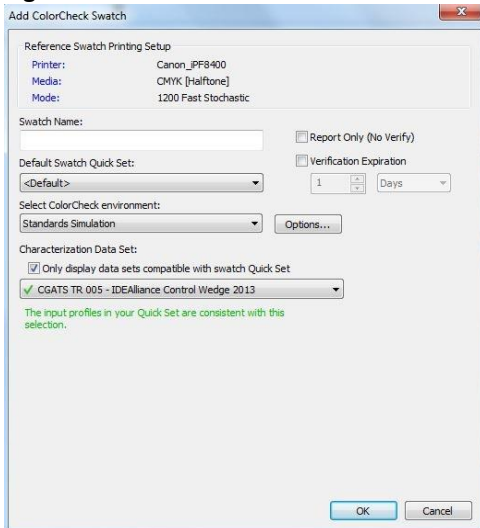
The process and options for adding a new Standard Simulation swatch are similar to the ones for the G7 Process Control Master swatch except of different verification tolerance level options.

Figure 26 - Options of Standards Simulation swatch

- Options for printing Standards simulation swatches allow for various tests relative to different international and published standards to be applied relative to how accurately the CMYK values are printed. You can setup options by clicking Options...,

  o You can select to use or not use Color Management from Quick Set.

  o Note 1: When you check this option, the Color Management setting in Quick Set will be applied, including input profile, rendering intent, and output profile. This is useful for determining how well the associated standard is accomplished by the color management profiles selected in the quick set. Failure may be due to incorrect input profile selection (which doesn't achieve aims of the associated standard) or by a failure of the printer profile to get accurate results for the associated print mode.

  o Note 2: When you uncheck this option, the CMYK values in the selected swatch are directly printed without applying ICC profiles from the Quick Set. This is only useful for evaluating how close the print inks and media are to reference printing condition

defined by the characterization data set. Generally, this is not the case, and therefore using color management from Quick Set is recommended.

- You can choose to use absolute values or profile-based substrate corrected values to verify measurement.

  - Note: When profile-based substrate correction is selected, the expected values are adjusted based on the white point of the associated output profile.

- The verification tolerance level allows one to select from either an ISO based testing standard or a tolerance level for Large Format Printing based on the FograSpec SystemCheck criteria.

  - Contract Proof (ISO 12647-7:2016) / Contract Proof (ISO 12647-7:2013): will mostly be used at the end of the creative work in the production chain. It shows the consistency of the data by giving the appearance to be expected when the printer prints according to the printing condition for which the data has been separated.

  - Validation Print ISO 12647-8): is used primarily in the creative process and reflects a high quality validation of the proposed job content. Therefore, a "Validation Print" is a defined with reproducible quality within the creative phase and not primarily a color reliable reference for the final production run.

5.2.1.4. Add a Print Gamut Verification swatch:

Print Gamut Verification evaluates how accurately print mode reproduces colors that are known to be inside the gamut of the print mode.
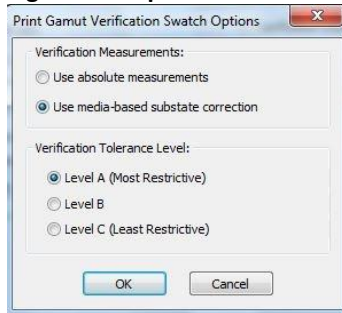
Figure 27 - Add Print Gamut Verification swatch
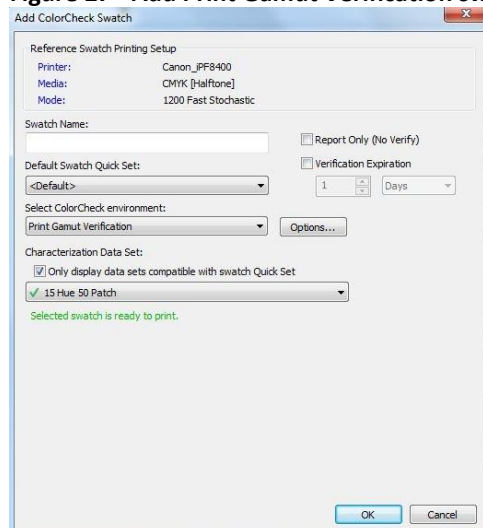
The process and options for adding a new Print Gamut Verification swatch is similar to the G7 swatch and Standard Simulation swatch except of different verification tolerance level options.

**Figure 28 - Options of Print Gamut Verification swatch**

Three levels are defined (Level A, Level B, and Level C). These three levels have the same tests: mean color difference of all patches, 95th percentile of all patches, maximum color difference of all patches, mean chroma difference of gray patches, and maximum chroma difference of gray patches. However, the tolerance is difference. Level A has most restrictive tolerance and Level C has the least restrictive.
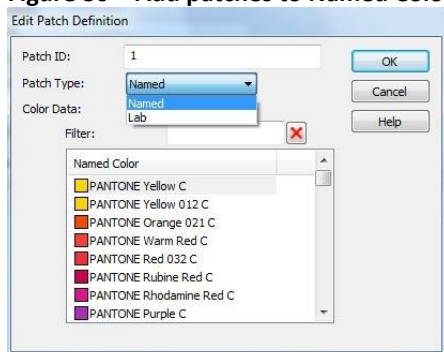
5.2.1.5. Add a Named Color Evaluation:

Named Color Evaluation swatches allow for printed accuracy assessments of custom named color patches or colorimetricly-defined patches.

Figure 29 - Add new Named Color Evaluation swatch
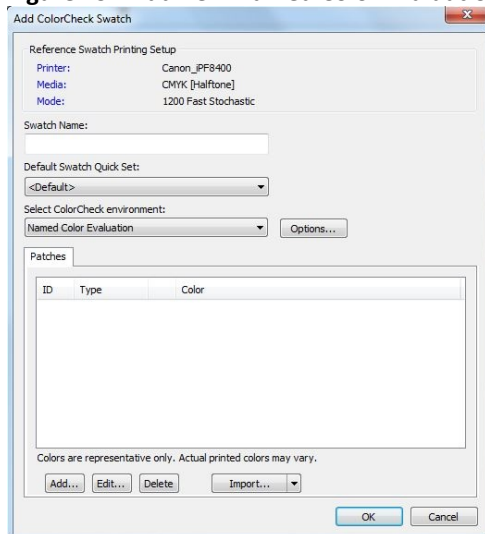
The process and options for adding a new Named Color Evaluation swatch is similar to the Baseline swatch. For example, you can add, edit, delete or import named or CIELAB patches.

**Figure 30 - Add patches to Named Color Evaluation swatch**

The only difference between Baseline and Named Color Evaluation is that you do not have the option to customize tests. The default tests of Name Color Evaluation are to calculate color difference of overall, neutral, highlight, mid-tone and shadow patches.

Named Color Evaluation is a report-only swatch, which means it will not update the ColorCheck status of the print mode.

5.2.1.6. Add a Custom Image swatch:

Custom Image swatches allow for images provided by third-party color validation/verification packages to be easily printed under specified Quick Set conditions.

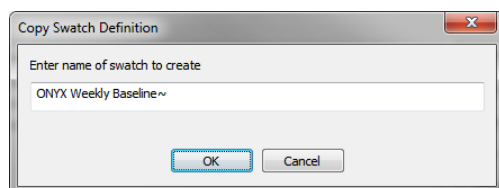**Figure 31 - Add new Custom Image swatch**
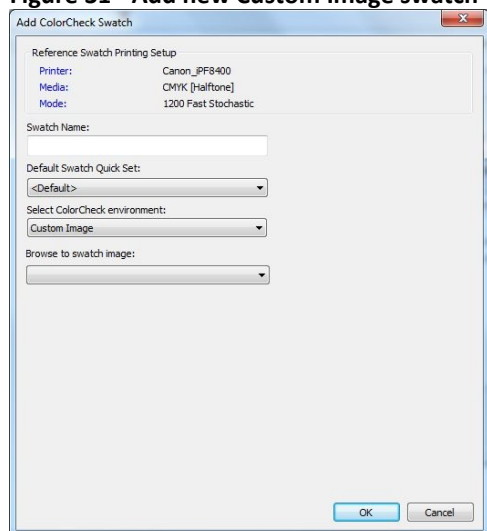
The only option is to browse to identify the Custom Image file to be printed.

5.2.2. Copy...

This operation allows you to create a swatch as a new copy. The resulting copy can be edited even though the swatch that was copied was a read-only ColorCheck swatch.

Figure 32 - Copy Swatch Dialog

This allows one to create custom swatches based upon an existing swatch. One simple example would be to make a copy of the "Onyx Weekly Baseline" swatch and then add some additional named colors that one desires to be verified to print consistently.

5.2.3. Edit.../View...

This operation is to view a read-only ColorCheck swatch or edit a custom ColorCheck swatch. The UI is the same as to add a new ColorCheck swatch for different ColorCheck environments.
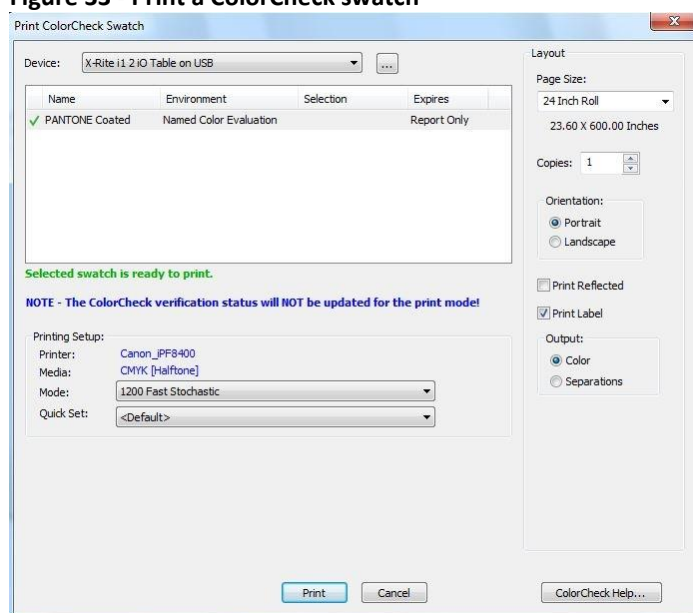
5.2.4. Delete

This operation is to delete a custom ColorCheck swatch. You cannot delete a read-only ColorCheck swatch.

5.2.5. Print...

This operation is to print a selected ColorCheck swatch.

Figure 33 - Print a ColorCheck swatch

You have to setup a color device to measure the printed ColorCheck swatch.

> **Note**: You need to be careful when setting up color device options, such as measurement conditions. These options affect color measurement values of ColorCheck patches. You should use the same color device options each time you print a ColorCheck swatch. You can setup color device options by clicking the ... button.

Information for the ColorCheck swatch to be printed is also listed, which includes swatch name, ColorCheck Environment, Characterization Data Set, and Verification Expiration.

You can setup printer information by selecting Mode and Quick Set. (Note: Printing a ColorCheck swatch overrides various settings of a Quick Set including media and mode if they are explicitly set by the Quick Set).

You can also setup the printing layout, such as page size, copies, orientation, label, etc.

After you have made your selections, click the Print button at the bottom to send the selected ColorCheck swatch to RIP-Queue.

When you go to RIP-QUEUE, you would find the printing job is in the queue and its status is Waiting to Print if the print setup is appropriate. You can click the button Print Now to print the ColorCheck job.

5.2.6. Export...

This operation is to export ColorCheck swatches to an OSL (ONYX Swatch Library) file.

Figure 34 - Export ColorCheck swatches
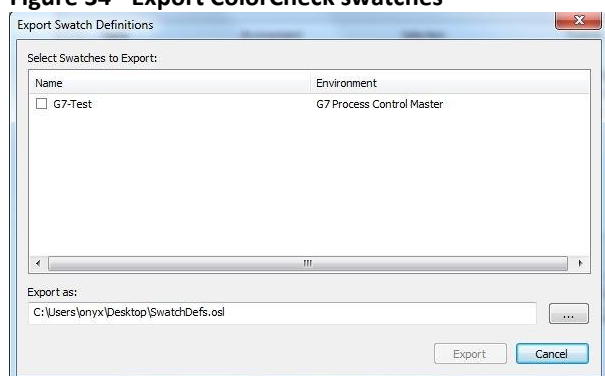
You can select the ColorCheck swatches you want to save.

5.2.7. Import...

This operation is to import ColorCheck swatches from an OSL file.

6. Rip-Queue Usage

You directly work with ColorCheck from Rip-Queue, including printing, measuring, and validating.
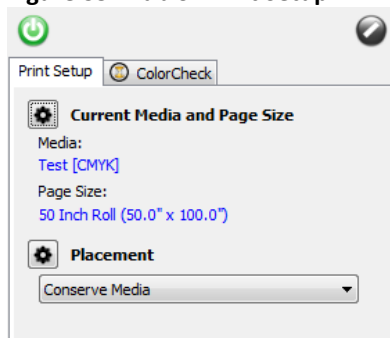
6.1. Print

You can start to print a ColorCheck swatch from either the *Print Setup* tab or the *ColorCheck* tab in RIP-Queue.
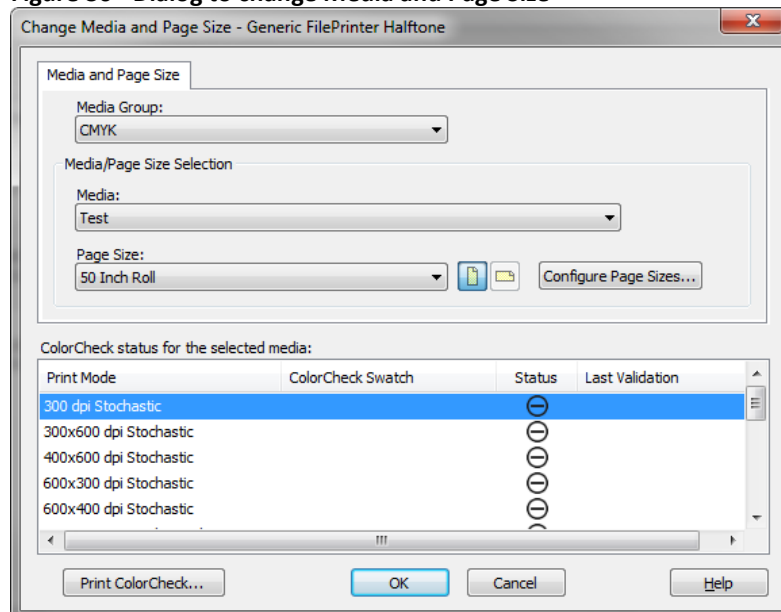
6.1.1. Print from Print Setup Tab

▪ Click the gear in the *Current Media and Page Size* section to open the *Change Media and Page Size* dialog

Figure 35 - Tab of Print Setup

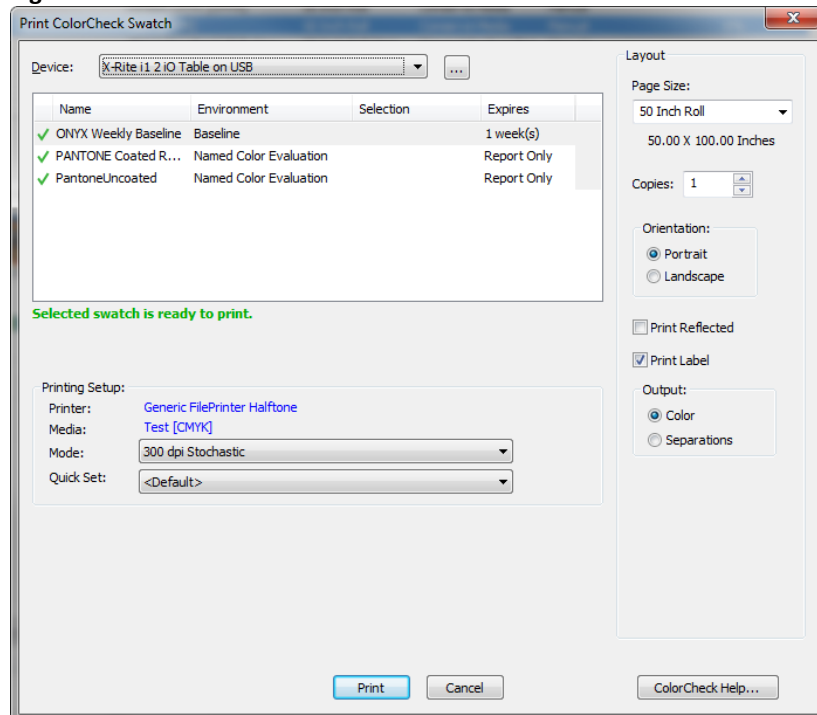▪ Setup the *Media Group*, *Media*, *Page Size*

Figure 36 - Dialog to change Media and Page Size

▪ Select a desired *Print Mode* to run ColorCheck
The current ColorCheck status of each mode is listed
▪ Click the *Print ColorCheck...* button
The *Print ColorCheck Swatch* dialog will display
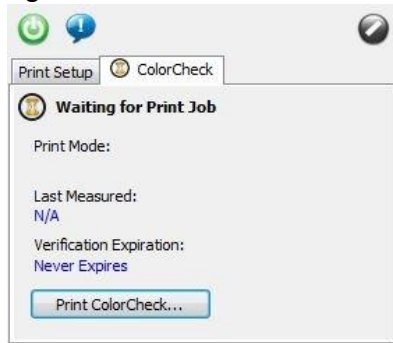
Figure 37 - Print ColorCheck Swatch

- Setup a color device to measure the printed ColorCheck swatch
  Note: You need to be careful when setting up color device options, such as measurement conditions. These options affect color measurement values of ColorCheck patches. You should use the same color device options each time you print a ColorCheck swatch. You can setup color device options by clicking the ... button.
- Select the ColorCheck swatch you want print
  Note: all the ColorCheck swatches are listed, which includes default swatches (ONYX Weekly Baseline, PANTONE Coated, and PANTONE Uncoated) and swatches configured in the Configure ColorCheck dialog
- You can select specific printer information by selecting *Mode* and *Quick Set*.
  Note: Printing a ColorCheck swatch overrides various settings of a Quick Set including media and mode if they are explicitly set by the Quick Set.
- You can also setup the printing layout, such as page size, copies, orientation, label, etc.
- After you have made your selections, click the *Print* button at the bottom to send the selected ColorCheck swatch to RIP-Queue
- In RIP-Queue, the swatch job's status will be *Waiting to Print* if the print setup is appropriate. You can click the *Print Now* button to print the ColorCheck swatch job

6.1.2. **Print from ColorCheck Tab**
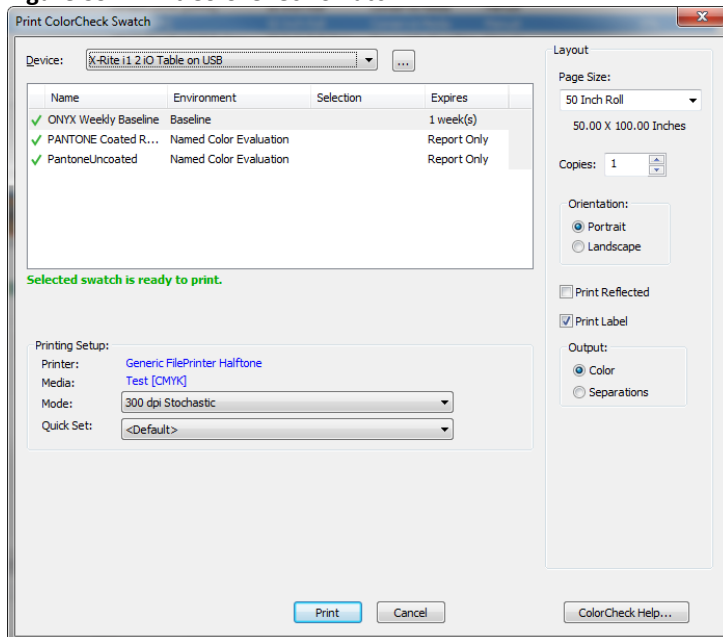
- Go the *ColorCheck* tab in RIP-Queue

Figure 38 - Tab of ColorCheck

- Click the *Print ColorCheck...* button
  The *Print ColorCheck Swatch* dialog will display

Figure 39 - Print ColorCheck Swatch

- Setup a color device to measure the printed ColorCheck swatch
  Note: You need to be careful when setting up color device options, such as measurement conditions. These options affect color measurement values of ColorCheck patches. You should use the same color device options each time you print a ColorCheck swatch. You can setup color device options by clicking the ... button.
- Select the ColorCheck swatch you want print
  Note: all the ColorCheck swatches are listed, which includes default swatches (ONYX Weekly Baseline, PANTONE Coated, and PANTONE Uncoated) and swatches configured in the Configure ColorCheck dialog
- You can select specific printer information by selecting *Mode* and *Quick Set*.
  Note: Printing a ColorCheck swatch overrides various settings of a Quick Set including media and mode if they are explicitly set by the Quick Set.
- You can also setup the printing layout, such as page size, copies, orientation, label, etc.
- After you have made your selections, click the *Print* button at the bottom to send the selected ColorCheck swatch to RIP-Queue
- In RIP-Queue, the swatch job's status will be *Waiting to Print* if the print setup is appropriate. You can click the *Print Now* button to print the ColorCheck swatch job

6.2. **Measuring & Reporting**

6.2.1. **Measure**

This operation is to measure the colors of the printed ColorCheck swatch by the color device specified when printing setup.

After you print a ColorCheck swatch, the status of the swatch job will be *Waiting to Measure*. You can start measuring by clicking the *Measure Swatch* button to the left, right-clicking the ColorCheck job and selecting *Measure Swatch,* or double-clicking on the swatch job and clicking the *Measure...* button.

Figure 40 - ColorCheck job in Waitting to Measure State
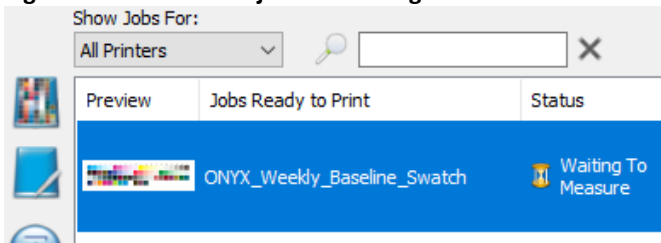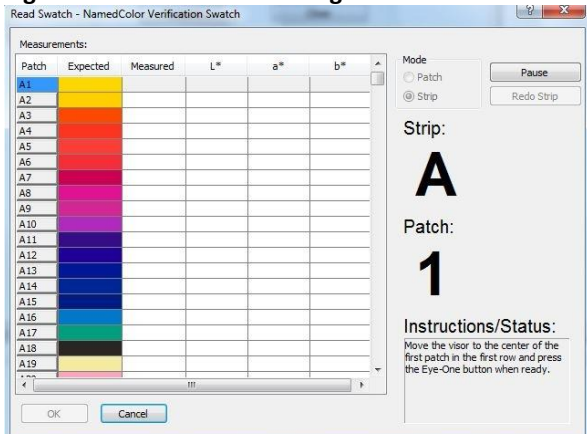

The *Measure ColorCheck Swatch* application and the *Read Swatch* dialog should pop up automatically. If not, you can click the *Measure...* button to starting read the ColorCheck swatch.

Figure 41 - Measure ColorCheck Swatch
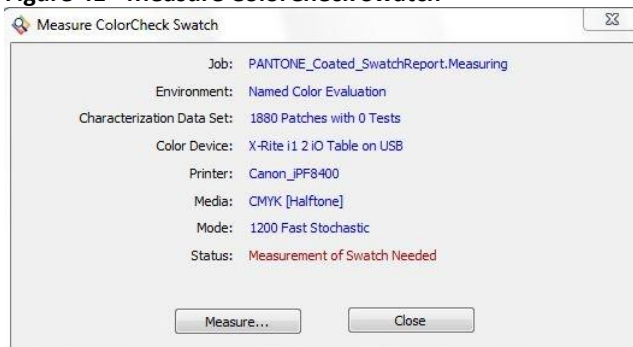
Follow the instructions in the *Read Swatch* dialog to obtain the measured color of the ColorCheck patches.

Figure 42 - Read Swatch dialog

After measuring the ColorCheck swatch, the *Verification Results* dialog then displays automatically. The verification results first display the printer information (printer, media and mode). Then, the pass/fail status of the test, ColorCheck swatch name, ColorCheck environment, and verification expiration. After that, the results of the verification tests, which depend on the options and tests configured for the ColorCheck swatch. You can export a more detailed HTML report by clicking the *Report...* button. You can view or export the color readings by clicking the *View measurements...* button.

6.2.2. **Report**

This option is to export an HTML report for a ColorCheck swatch.

The do this, click the *Report...* button in the *Verification Results* dialog. The HTML report is very similar to the Verification Results, except that extra information, such as patch information, is included. The patch information can include patch ID, expected CIELAB values, measured CIELAB values, and color difference in CIEDE2000. You can hide or expand the patch information by clicking the arrow at the left. You can also resort columns that have arrows in the headers. This is useful to identify the best and worst ΔE measurements.

An HTML report can be printed by printing from the browser. The current state of patch hiding and column sorting is reflected in the print of the HTML report.

6.3. **Working with ColorCheck swatch jobs**

ColorCheck swatch jobs coexist with other jobs in RipQueue. They can be nested and printed with other print jobs with similar print settings. However, after they are printed they will remain in the queue having a *Waiting to Measure* status. Once measured they move to the buffered job queue with a status appropriate for the results of swatch validation or verification.

Job properties for a swatch job can be accessed by either double clicking on the job, clicking on the Job Properties tool on the left of the queue, or selecting the job and then pressing right click and selecting Job Properties.

The *Report/Verification Status* selection in the job properties dialog for a swatch job displays the results of the swatch report/verification (if performed) and a preview of the swatch. Before a swatch job is printed the <Report> and <Measure...> buttons are disabled.
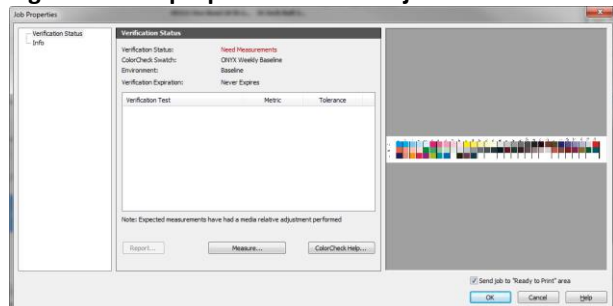
Figure 43 - Job properties of swatch job before printing
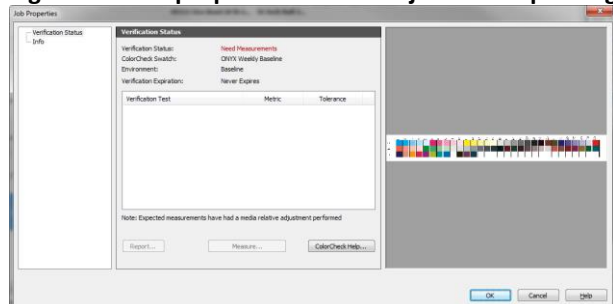
After a swatch job is printed the <Report...> button is disabled, but the <Measure...> button is enabled and when pressed swatch measurements for the job will begin.

**Figure 44- Job properties of swatch job before measurement**

After Measurements are completed the *Report/Verification Status* will be filled with relevant details about the swatch report validation or swatch verification. Additionally, you can export a more detailed HTML report by clicking the *<Report...>* button, or you can view or export the color readings by clicking the *<View Measurements...>* button.

Figure 45 - Job properties of a swatch job after measurement
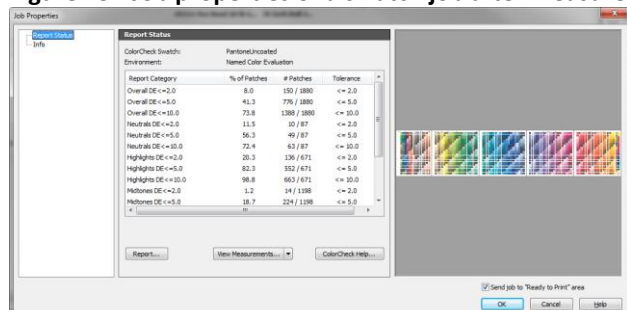
The Info section of the job properties dialog for a swatch job shows information about the swatch job and allows Notes to be associated with the job. Any changes to the notes will be shown in the HTML report after they are changed.

**Figure 46 - Info and notes for ColorCheck swatch job**
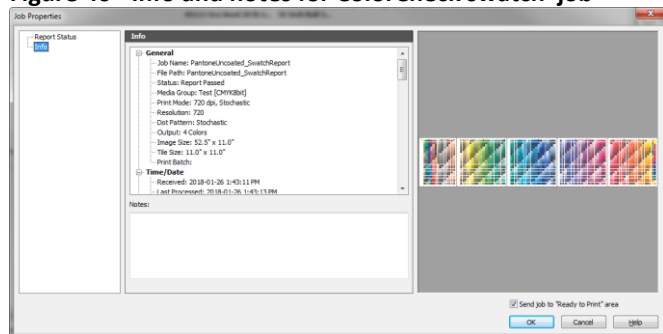
6.4. Job Specific Named Color Evaluation Swatches and Reports

A feature introduced in version 18.5 of Onyx Rip-Queue is the ability to display an estimated named color accuracy report and generate a Named Color Evaluation swatch for just the named colors in a PDF/PS print job.

This can be done from the Job Properties for a print job in Rip-Queue and then selecting the Named Colors view in the tree control.
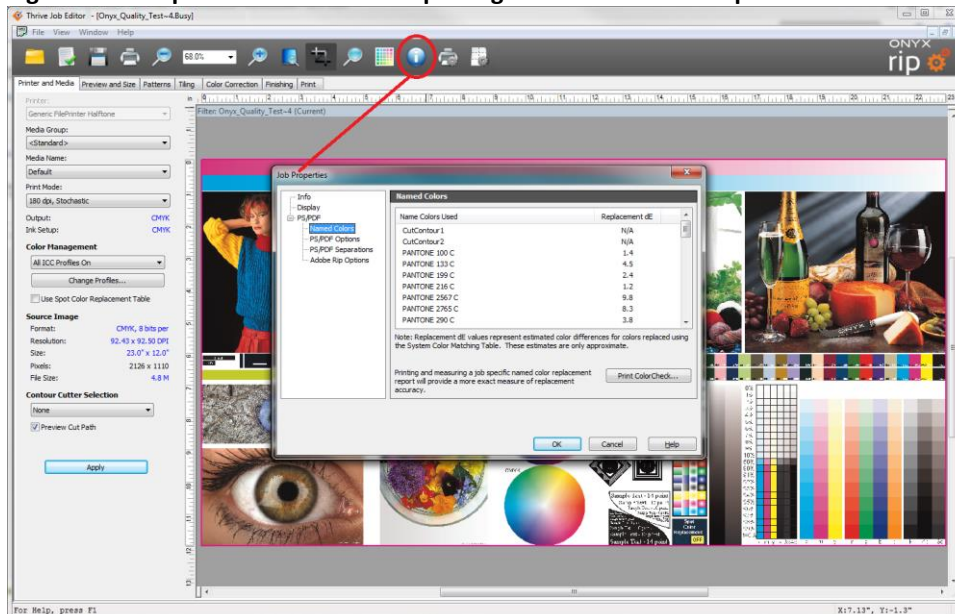
Figure 47 Job Specific Named Color reporting in Rip-Queue Job Properties
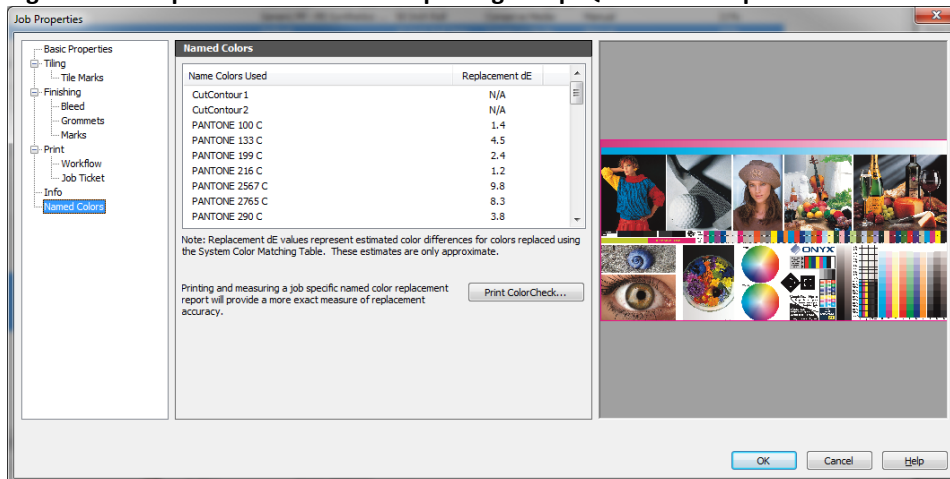
This can also be done using the Job Properties tool for a print job in Job Editor and then selecting the Named Colors view in the tree control.

Figure 48 Job Specific Named Color reporting in Job Editor Job Properties

In either case all of the Named Colors present in the job document file are displayed along with the estimated replacement color differences (Replacement dE) based upon round trip analysis using the ICC profile of the print mode. (Note: Named colors in a job that are not present in the RIP-Queue's System Color Matching Table (defined from Setup>Rip Configuration>Color Matching Table… menu selection in RIP-Queue) will display "N/A" for the estimated Replacement colors difference. They will also not be printed as part of a Print ColorCheck swatch).

Figure 49 – Named color reporting and options for a print job
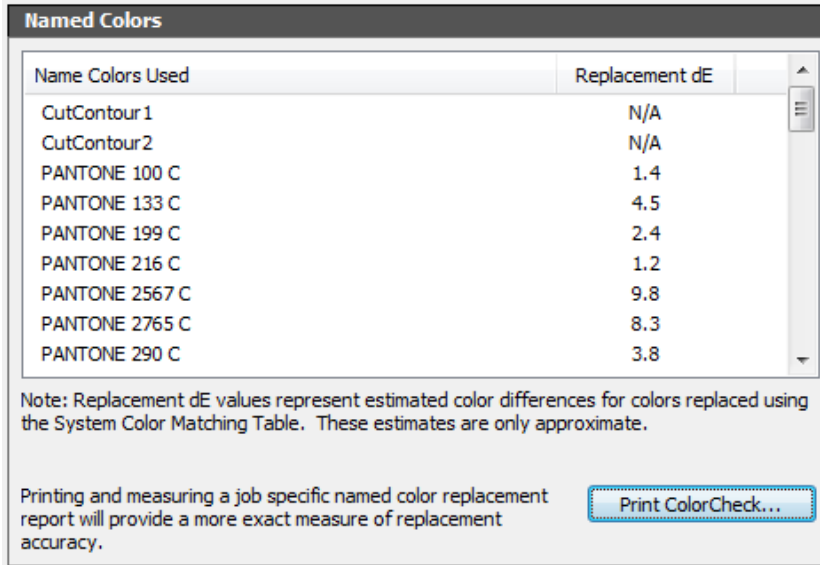
A temporary Named Color Evaluation swatch can be created for just the colors that are both present in the job and the System Color Matching Table by pressing the <Print ColorCheck …> button. Pressing this button brings up the ColorCheck print dialog to configure the color device, swatch options and print settings used to create and print a job specific Named Color Evaluation swatch.

Figure 50 – Print Color Check Swatch for job named colors
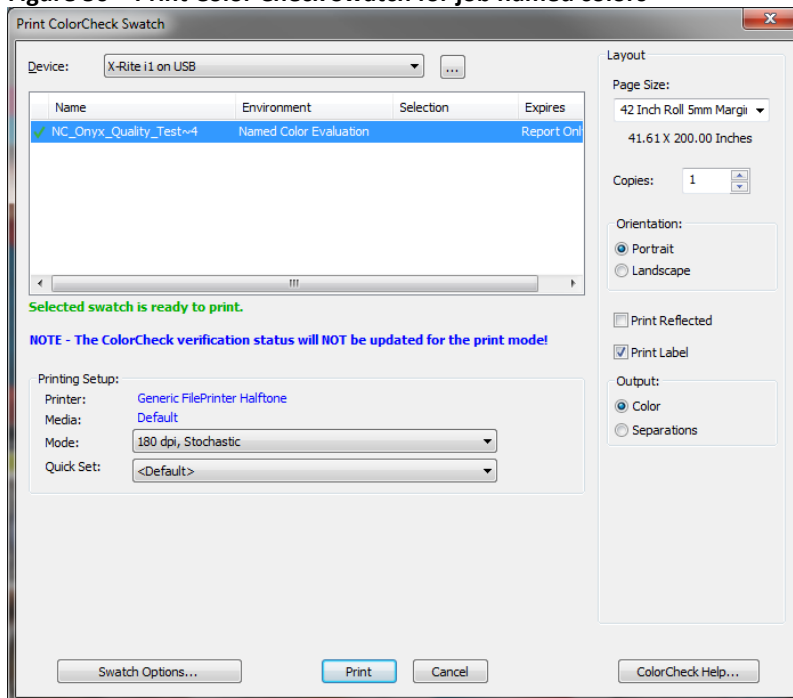
When the <Print> button is pressed, a Named Color Swatch is created in RIP-Queue for the associated printer with the prefix "NC_" before the associated job name. The swatch will have patches for all named colors in the job that are present in the System Color Matching Table.

The resulting ColorCheck swatch job can be interacted with just like any other ColorCheck swatch job in the print queue. Printing this swatch and measuring it will provide expected accuracy for printing named colors in the job used to create the named color swatch.

7. Establishing ColorCheck Baseline measurements during profiling

Baseline measurements can be established as part of the profiling process in Media Manager version 22.5 and later. It is important to note that establishing ColorCheck Baseline measurements does not require licensing to be enabled for ColorCheck. This is because the process of establishing baseline measurements does not involve or perform ColorCheck validation.

The measurements captured by the ColorCheck Baseline profiling step can later be validated as part of ColorCheck validation within RIP-Queue (which does require ColorCheck feature licensing).

Even when ColorCheck licensing is not available it is still **strongly** recommended that ColorCheck Baseline measurements are always captured as part of the profiling process as having baseline measurement in place enables process control to later be implemented when ColorCheck licensing is later acquired or when profiled medias/modes are shared with others that have a ColorCheck license.

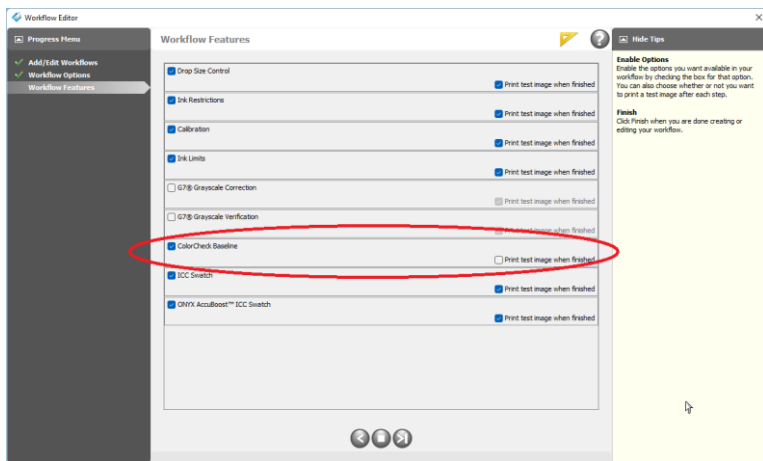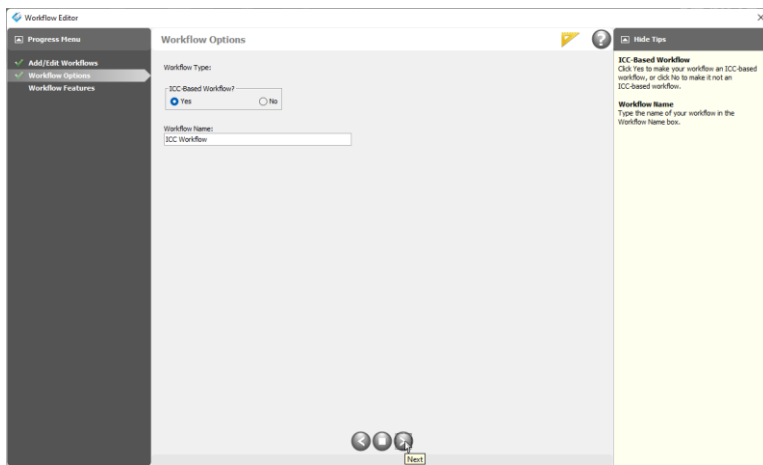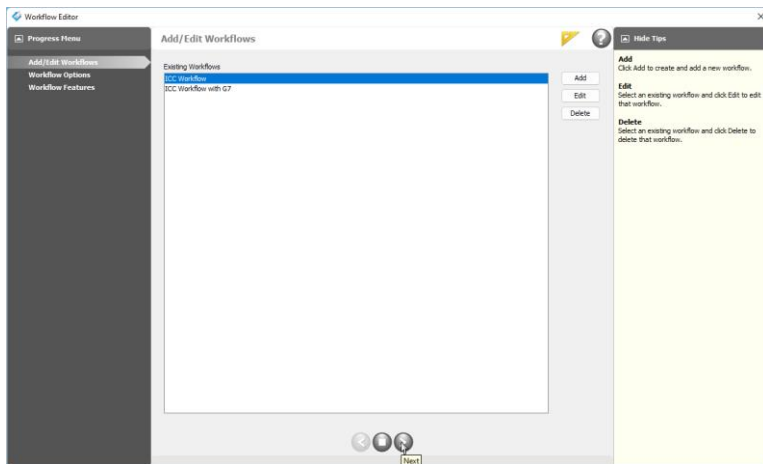### 7.1. Enabling the ColorCheck Baseline profiling step

The ColorCheck Baseline profiling step needs to be enabled in Media manager in order for ColorCheck Baseline measurements to be established as part of the profiling process. This is accomplished by first using the Customize Workflows tool in Reports and Tools in Media Manager as follows:

First the Customize Workflows button is pressed in Reports and Tools.
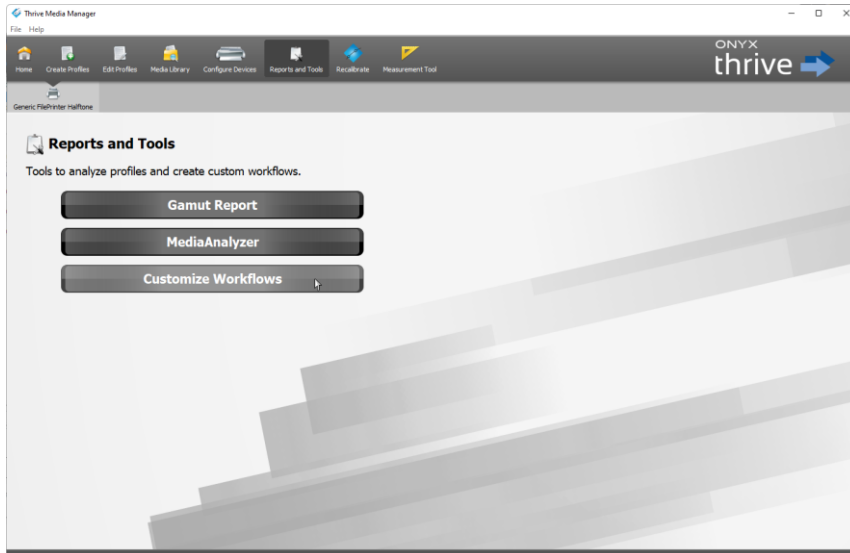
Then the Workflow is selected and the ColorCheck Baseline step is enabled.

Enabling the checkbox for the ColorCheck Baseline step in the workflow enables the ColorCheck Baseline step to be used when profiling a print mode.

## 7.2. Establishing ColorCheck Baseline measurements when profiling

The Establishing a ColorCheck Baseline profiling step is used to capture the state of a print mode as it is profiled. This is accomplished by first printing a baseline swatch using the Print Swatch button.
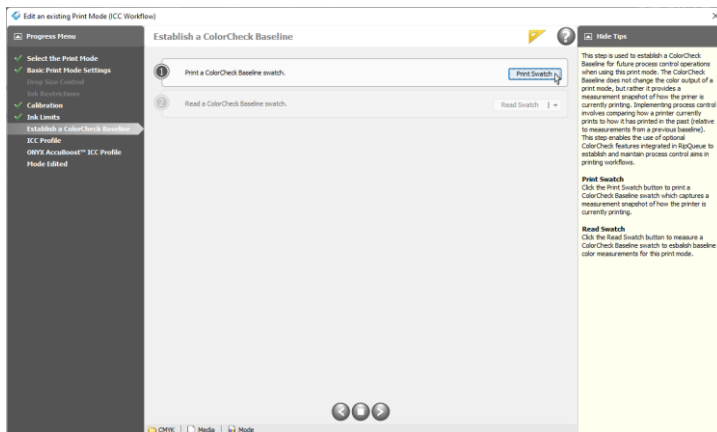
This causes the Print Swatch dialog to be displayed. It is important to select both the color measurement device and ColorCheck Baseline swatch you wish to use to establish baseline measurements.

Note: If custom baseline measurements are desired it is necessary to first create a custom baseline swatch them in RIP-Queue using the ColorCheck administration dialog before trying to profile a print mode.
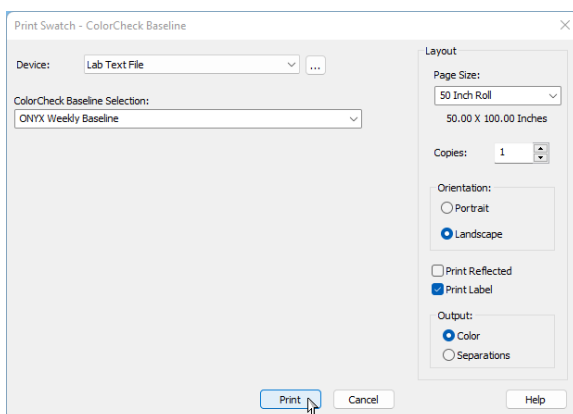

Pressing the Print button causes the selected baseline swatch to be printed.

Note: ColorCheck Baseline swatches printed from Media Manager also need to be measured using Media Manager. This means that they will be treated like all other swatches printed from media manger and they will not behave the same as ColorCheck swatches printing from within RIP-Queue.

Once the baseline swatch is printed it can be measured using the Read Swatch button which brings up the swatch measurement dialog to measure the baseline swatch patches. After the measurement dialog is closed the baseline measurements are then established for the print mode and the ColorCheck Baseline step is complete, and profiling can progress to the next step.
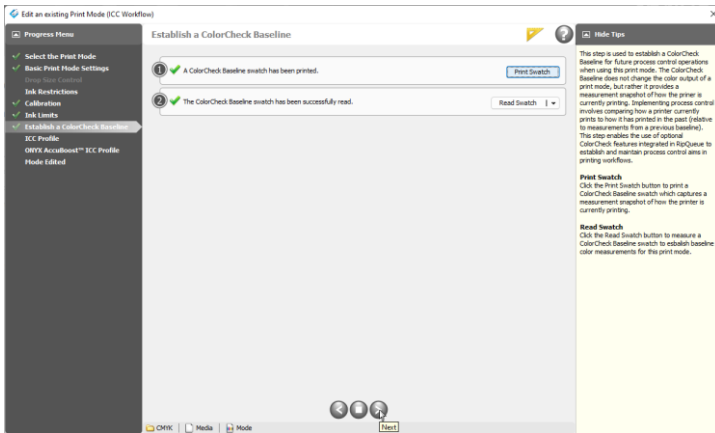
After profiling is complete for the print mode the ColorCheck measurements and swatch will appear under the print mode in the Media Library view in Media Manager.
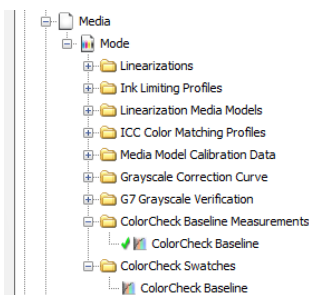
7.3. ColorCheck validation using a baseline established during profiling

ColorCheck Validation can then be performed using a baseline established as part of the profiling process by selecting the "ColorCheck Baseline <mode>" swatch in the Print ColorCheck Swatch dialog in RIP-Queue.
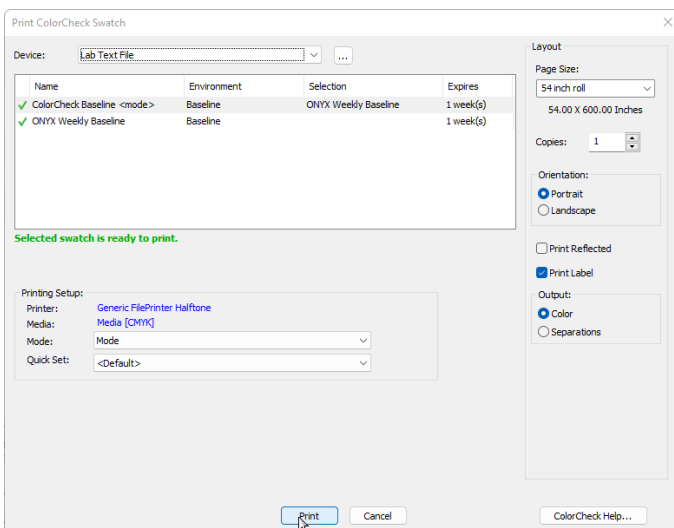
Note 1: The selection column in this dialog indicates which baseline swatch was used when the mode ColorCheck Baseline was established.

Note 2: The ColorCheck Baseline <mode> swatche will only appear for print modes that have baselines established during the profiling process.

8. My ColorCheck validation/verification failed – Now What?

8.1. ColorCheck troubleshooting checklists

A ColorCheck verification can fail for several reasons. The following checklists should be considered as part of troubleshooting and potential resolution of the validation/verification failure:

- The input profiles in the Quick Set used to print the swatch are not compatible with the standard being tested

    o Make sure the Quick Set you are using is configured for the validation you are performing (I.E. For testing G7, a Gracol input profile should be used)

- The media white point is out of spec for the simulating standard where there is a test concerning the media white.

    o The tests include Contract Proof (ISO 12647-7:2016), Contract (ISO 12647-7:2013), and Production Printing (FograSpec SystemCheck LFP) Level A(Most Restrictive), Level B, as well as Level C (Least Restrictive)

    o You can easily check the color of media white point which is the last patch read by the color device.

    o **Tip**: Another media may need to be used, or test using profile-based substrate correction

- The print mode's ICC gamut is capable of simulating a standard but the print mode's ICC is not accurate enough to correctly reproduce in-gamut colors.

    o This might be because the printer is not the same as when the print mode was profiled

        ▪ Check to make sure you are using the correct profiles for the print mode you are using

            • Was the print mode correctly profiled for the media and ink you are using?

        ▪ You can run Baseline to check color consistency of your printer (assuming baseline exists for print mode based on profiled results)

            • If Baseline fails, you need to check if the printer hardware is having problems (dropped nozzles, misalignments, etc.) or if the environmental factors surrounding the printer are not conducive to getting consistent result

                o Ensure the printer is regularly serviced and is properly cleaned and aligned

                o Printing environment (i.e. ambient temperature and humidity) should be kept as consistent as possible

   o Caused by poor accuracy of profile for print mode

- You can run Print Gamut Verification to check how accurately the print mode reproduces colors that are known to be inside the gamut of the print mode

- If Print Gamut Verification fails, you may need to recalibrate your printer, or re-profile your printer, or use AccuBoost to get a more accurate profile.

- o Caused by color device

  - Make sure settings of color device are correct, such as measurement conditions.

    - Fogra Media Wedge CMYK v3 (72 patches), M0

    - IDEAlliance ISO 12647-7 Digital Control Strip 2009 (54 patches), M0

    - IDEAlliance ISO 12647-7 3-Row Control Wedge 2013 (84 patches), M1

  - The color device used for color measurements is not accurate.

    - If you have another color device (B), you can use following steps to check if the employed color device (A) is accurate or not as color device B.If the color device you are using is not accurate, you should consider to certify it if it is not the case.

      - o Export color readings measured by color device A from the dialog of Verification Status. (View Measurements... --> Export)

      - o Print the ColorCheck swatch with setting of color device B

      - o Print the ColorCheck swatch job and take color measurements by color device B

      - o Export color readings measured by color device B

      - o Compare the two exported files.

- o The profile is not accurate enough because more accurate measurements are needed for the ink separation that is being used by the ICC profile

  - Run the AccuBoost step in Media Manager which is designed to increase the in-gamut accuracy of an ICC profile.

- The print mode's ICC gamut is not capable of simulating a standard

  - o How to test if the print mode's ICC gamut is capable of simulating a standard or not?

    - Create a Named Color Evaluation swatch in Configure ColorCheck

   - Add patches by importing the Lab values of the data set of simulated standard

- ▪ Print the Named Color Evaluation swatch with the same color device and same settings (Measurement Conditions)

- ▪ Verify the Named Color Evaluation swatch and analyze patch by patch.

o How to achieve a better gamut?
If you have followed the advised procedure to maximize the gamut, but you get a failure verification result, that means you cannot do much for this printing configuration.

- ▪ Ink Restriction step: ink primaries have been set to low, try to increase it.

- ▪ Ink Limit step: you chose to minimize the artifacts in high coverage colors and you would miss some colors in the shadows, try to increase the ink limit

- ▪ GCR/UCR: if you chose a low max ink, try to increase it.

- ▪ You may to switch to a better media, higher resolution, or re-profile your print mode to try to achieve a better gamut
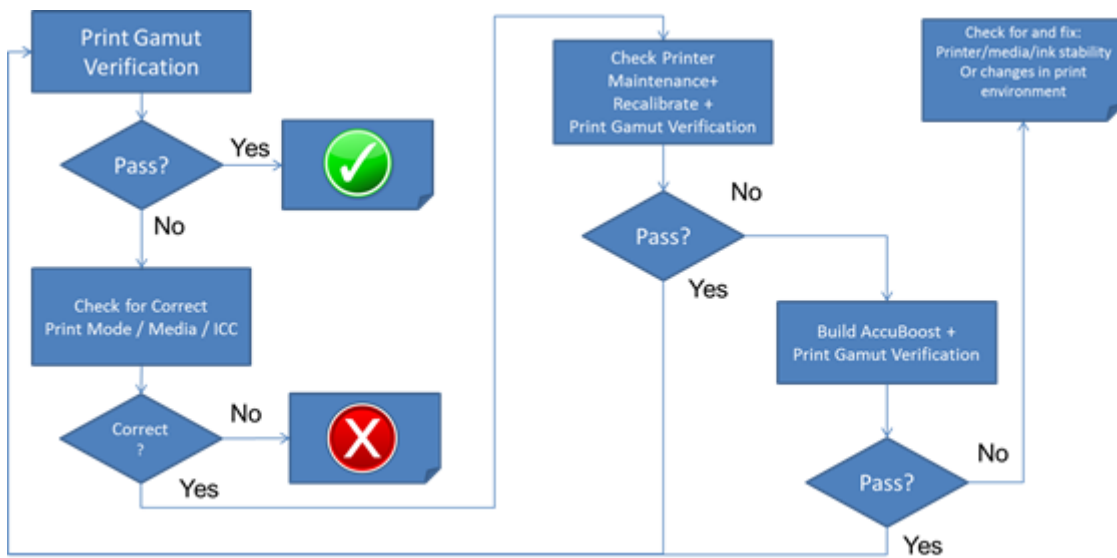
8.2. Baseline troubleshooting flowchart
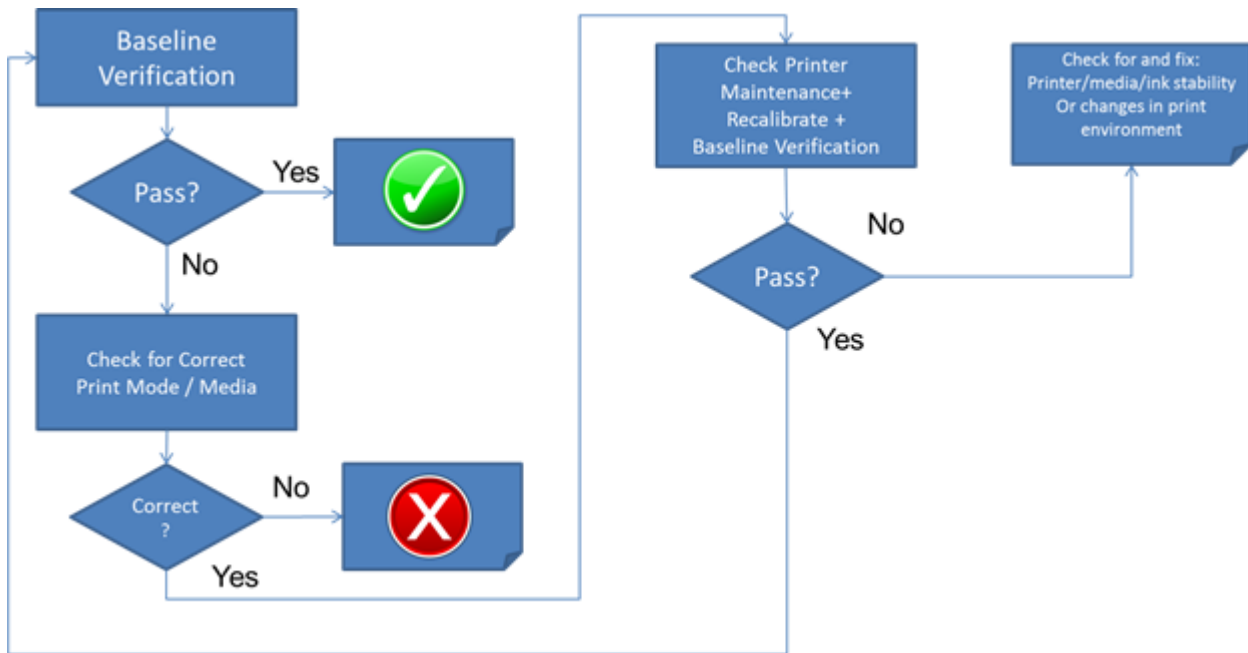
8.3. G7 Master / Standards Simulation troubleshooting flowchart
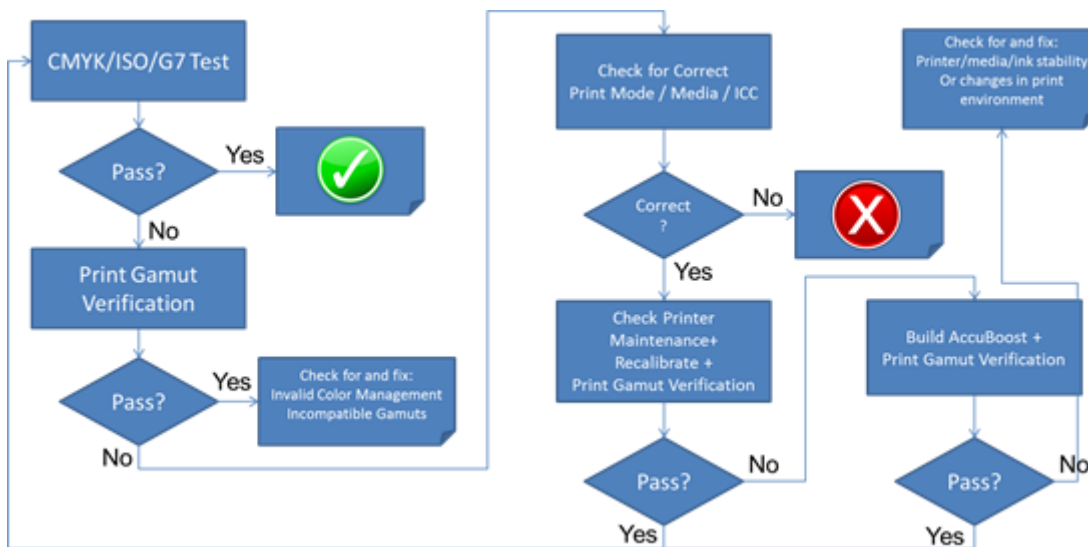
8.4. Print Gamut Verification troubleshooting flowchart

9. Frequently Asked Questions

Q. What do I do if the status of a ColorCheck job is "Measuring", but measurements aren't happening?

A. Select the "Measure ColorCheck Swatch" tool in the system task bar and then cancel the measurement and close the tool.