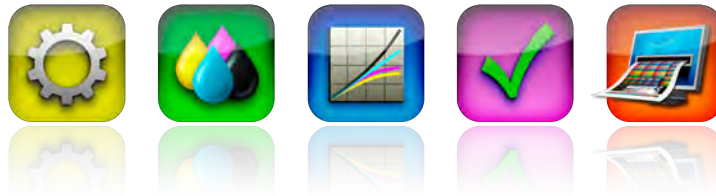


# Curve<sup>3</sup>

## User Guide

Second Edition



Software Version 3.0.1

Document Version 006w

October 2013

([www.hutchcolor.com/CurveGuide.htm](http://www.hutchcolor.com/CurveGuide.htm))

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## 1

# 1. Introduction

This section explains...

- What is Curve3
- Differences compared to Curve2
- Functionality levels
- How to use this guide
- Installation and registration
- Updates and problem reporting



Figure 1.1 The Curve3 Splash Screen

## What is Curve3?

**Curve3™** is a multi-purpose software calibration program designed to simplify the IDEAlliance G7® calibration method. Curve3 is the direct descendent of two previous software generations: Curve2™ (2009) and IDEALink Curve™ (2006), which was the world's first G7 calibration tool.

With Curve3 you can:

- Calibrate any stable printing system to match the G7 specification
- Calibrate by the legacy TVI method to match ISO-standard TVI curves or user-created custom TVI curve sets
- Calibrate “special” inks that are not part of a normal CMYK four color set
- Verify whether an ink and substrate combination meets the tolerances of a printing specification such as GRACoL® or SWOP®, prior to calculating calibration curves
- Verify calibration accuracy of a sample print against the G7 specification

With the optional **VPR** (Virtual Press Run) module you can:

- Convert a characterization file measured from an un-calibrated device into values that would be measured after calibration
- Optimize a characterization data set to reduce the effects of uneven printing or measurement errors

## Differences Compared to Curve2

While maintaining the same proven performance of Curve2, Curve3 adds some exciting new quality, functionality and convenience enhancements like:

- 4D input data smoothing for unstable systems or data
- User-specified non-linear initial calibration
- Save and load user-defined Control Point lists
- Measured-black aim-point to improve digital press calibration
- Normalize High Densities option to suppress unnatural shadow contrast
- User-defined custom TVI target curves
- Special ink calibration for CMYK+ printing
- Spectral VPR applies curves to full spectral data
- Enhanced graphing and reporting
- Expanded native RIP support

## Quick Look

If you're already familiar with Curve2, here's a quick look at what each new feature means. You'll find more details in the main body of this guide.

### **4D Input Data Smoothing**

In **Create Curves** the **Smooth** button removes some of the worst data errors due to printing unevenness or measurement problems. Switching on **Smooth** typically gives a better calibration when only a limited number of measured samples are available and/or the printing or measuring systems are unstable or unreliable.

### **Non-Linear Initial Calibration**

In **Create Curves** a set of pre-existing plate curves can be loaded via the **Based On:** list. This is valuable when your first press run or print was made through non-linear RIP curves. Section 5 explains how to create and load a pre-existing plate curve file.

### **Custom Control-Point Lists**

In **Create Curves** you can now save and load custom Control Point lists. If you save these in a folder called “Control Point Files” located in the folder from which Curve3 launches, your custom lists will appear in the pop-up menu of Control Point sets.

### **Native Black Aim-Point**

In the **Create Curves – White/Black** tab, the **As Printed** button changes the gray balance algorithm above 50% to aim for the printing system’s “native” printed color at 300% CMY, instead of G7’s perfect neutral. On systems with a strongly colored 300% CMY patch, **As Printed** leads to smoother calibration curves and better ICC profiles, with little change in overall appearance.

*CAUTION: **As Printed** may cause the system to fail G7 and should only be used when the 300% patch cannot be made neutral by physical press or ink adjustments.*

### **Normalize High Densities**

In the **Create Curves** window, the **Normalize High Densities** button is designed to minimize curve artifacts such as sharp bends in the high density end of the CMY calibration curves. This can result in much smoother tonality in high density areas of the image, and lead to better ICC profiles.

*CAUTION: **Normalize High Densities** may cause the system to fail G7 and should only be used when the CMY curves show sharp tone changes above 50% (see Troubleshooting for examples).*

### **Custom TVI Curves**

In **Setup - TVI** custom TVI curves can now be loaded as well as the six standard TVI curves from ISO 12647-2. *Section 9* and *Appendix: F* explain how to work with custom TVI curves.

### **Special Ink Calibration**

Special Ink calibration lets you calibrate non-CMYK inks using a simple, universal algorithm based on Delta E. Being Lab-based, it doesn’t require spectral data, the same algorithm is used for all inks, and the resulting calibration curves are typically nearly linear – similar to legacy calibrations.

*This non-proprietary algorithm has been proposed to IDEAlliance as a possible standard. If another method is chosen, the new algorithm will be included in future Curve3 versions.*

### **Spectral VPR**

**VPR** can now be applied to spectral measurements as well as Lab or XYZ files.

### **Enhanced Graphing and Reporting**

The **Ink Hue / Chroma** graph is now augmented with six **L\* / Chroma** graphs showing the L\* vector of each ink scale, while the **Results** chart adds solid ink Lab values as well as Delta E.

### **Expanded native RIP support**

Curve3 can export calibration data in the native RIP formats of a number of new RIPs and controllers. New RIPs will be added when available, so be sure you are using the latest version.

## **Functionality Levels**

Curve3 consists of three modules, or functionality levels, which are activated at three price levels. Each paid module includes all the functionality of the previous module(s). When no modules are active, the software enters Demo mode. The number of licensed modules is shown on the splash screen, as follows:

### Demo Mode



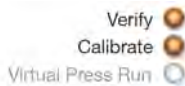
In **Demo** mode some pre-loaded P2P files allow you to see how Curve3 calibration works. User-supplied files cannot be loaded except in the **Ink Test** window.

### Verify Module



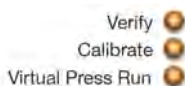
The **Verify** module allows a sample print to be verified for “G7 Grayscale” or “G7 Targeted” compliance. Calibration is disabled but demo files allow you to see how Curve3 calibration works.

### Calibrate Module



The **Calibrate** module adds the ability to calculate G7, TVI or Special Ink calibration curves.

### Virtual Press Run Module



The **Virtual Press Run** (VPR) module saves the cost of a verification press run and helps create smoother data sets by reducing the effects of uneven printing or measurement errors.

## About this User Guide

The following typographical conventions are used throughout this document

- Software applications, terms, menu items and command buttons are in ***bold italics***.
- A *reference* (italics) points to another part of the text or another information source.
- *Alerts and important notes are shown in red italics.*

The guide is structured in sections to help with navigation.

### Section 1 – Introduction

Explains what Curve3 does, how to use this guide, software installation, registration, updates and problem reporting.

### Section 2 – Software Principles

Introduces the main operating principles, windows and controls of Curve3.

### Section 3 – Setup

Describes how to use the Setup window.

### Section 4 – Ink Test

Describes how to use the Ink Test window.

**Section 5 – Calibrate**

Describes how to use the **Calibrate** window and its sub-windows.

**Section 6 – Verify**

Describes how to use the Verify window to see if a print or proof complies with the G7 specification.

**Section 7 – Virtual Press Run**

Describes how to use Virtual Press Run to eliminate a second press run or optimize data.

**Section 8 – G7 Calibration Workflow**

Leads you step-by-step through a typical G7 Calibration – primarily for new users.

**Section 9 – TVI Calibration Workflow**

Leads you step-by-step through a typical TVI Calibration.

**Section 10 – Special Ink Calibration Workflow**

Leads you step-by-step through a typical Special Ink Calibration.

**Section 11 – Applying Calibration Values**

Describes how to apply the curve values calculated by Curve3 in RIPs, printer drivers or Photoshop.

**Section 12 – RIP-Specific Notes**

Some notes on how to enter Curve3's Control Point values into some specific RIPs.

**Section 13 – Iteration**

Describes how to calculate an *iterated* calibration from a print made through a previous G7 calibration.

**Section 14 – Trouble-Shooting**

Illustrates some problems caused by certain printing situations and suggests how to deal with them.

**Appendix: A – Target Printing**

Explains what you need to know before printing a P2P target.

**Appendix: B – Target Measuring**

Explains how to produce good measurement data from the P2P or other targets.

**Appendix: C – The Printing Guide**

Explains how to print and use the Printing Guide.

**Appendix: D – The Calibration Run Report**

Explains how to print and use the Calibration Run Report.

**Appendix: E – References**

Contains some explanations and formulae referenced by the User Guide.

**Appendix: F – Custom TVI Curves**

Explains how to make and use a custom TVI target curve.

**Appendix: G – G7 Via Color Management**

Explains how to pass G7 Master test if your RIP doesn't accept calibration curves.

### Typos, Errors or Suggestions

To report errors or suggestions concerning this User Guide, please contact [don@hutchcolor.com](mailto:don@hutchcolor.com).

## System Requirements

Curve3 is a stand-alone software available for Mac OS X and Windows XP or later.

**IMPORTANT:** Once installed, there is a charge to change your Curve3 license to another OS.

## Differences Between Mac and Windows

Apart from some cosmetic differences, the Mac and Windows versions of Curve3 are functionality identical.

## Installing and Registering Curve3

When you purchase Curve3 you will receive an authorization code that must be registered to unlock the software. To receive a serial number go to [www.chromix.com/Curve3/register](http://www.chromix.com/Curve3/register) and enter your authorization code, username, platform etc. Download Curve3 at <http://www.chromix.com/Curve3>, run it and enter your username and serial number.



Figure 1.2 Different license codes are entered to activate each module

## Custom Folders for Control Points and Color Standards

In the folder from which Curve3 launches, it is useful (but not essential) to create two sub-folders called **“Color Standards”** and **“Control Point Files”**. The purpose of these folders is described in *Section 4: Adding Custom Target Color Spaces* and *Section 5: The Create Curves Panel - Saving Custom Control Point Lists*.

## Software Updates

If **Check for new versions daily** is checked in **Preferences**, free updates will install automatically.



Figure 1.3 Software Update notice (Mac)

## Reporting Software Problems

You can report problems or suggestions for new features using the Curve3 feedback system, accessed in Windows through the **Window** menu and in Mac OS through the **Curve3 menu**



Figure 1.4 Accessing the Feedback System on Mac (left) and Windows (right)

### Maxwell users

If you have a Maxwell account (free at [www.chromix.com](http://www.chromix.com)) and you use the same email address associated with your Maxwell account when submitting Curve3 feedback, all your feedback items will be linked to your account and you can log into Maxwell to check their status.



# 2

## 2. Software Principles

This section introduces the main operating principles, windows and controls in Curve3.

### The Main Menu Bar

Curve3 has a menu bar at the top of the desktop (Mac) and the Curve3 window (Windows).

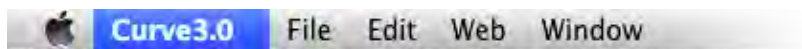


Figure 2.1 The Curve3 Menu bar in Mac OS X

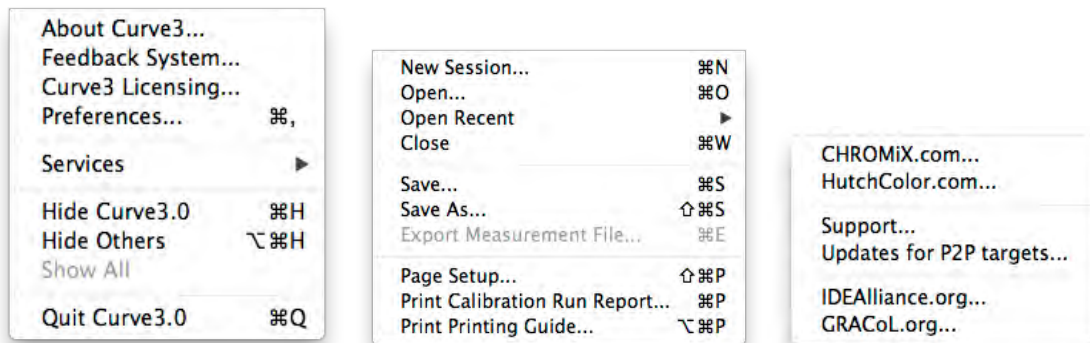


Figure 2.2 The Curve, File and Web menus (Mac OS X)

### Main Function Buttons

Curve3's main functions are accessed by icons above the main window, or by the **Up / Down Arrow** keys.



Figure 2.3 The main Function Icons (left to right) for Setup, Ink Test, Calibrate, Verify and VPR



Each function is described in detail within its own section of this document.

## Calibration Runs

The main unit of work in Curve3 is the **Calibration Run**. A Calibration Run refers to a single print run or test print. Data files from the Calibration Run are loaded into Curve3 as measurement files created by measuring the P2P target in software like **basIColor Catch™**, **Konica Minolta Color Care™**, **X-Rite i1Profiler™**, **X-Rite MeasureTool** or **X-Rite ColorPort**.

For more details on printing and measuring, see *Appendix: A* and *Appendix: B*.

## Output Product

The product of a Calibration Run is a list of CMYK **Curve Point** values or **Calibration Curves** that, when entered into the printer or RIP, should result in a properly calibrated print.

## Sessions

In Curve3 multiple Calibration Runs may be grouped into a **Session** containing all measurements and settings from one or more Runs. Sessions can be saved, loaded and opened via the **File** menu.

### Creating a New Session

To Create a new session Launch Curve3. If it is already running, select **File - New Session...**

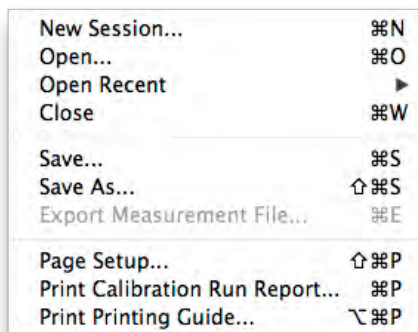


Figure 2.4 The File menu (Mac)

### Saving a Session

To save a session, select **File Save...** and give the session a suitable name. To save a copy of an existing session, select **File Save As...**

### Opening a Session

To open a session, select **File Open...** or if Curve3 is not running, double-click the session to launch Curve3 and open the session.

## Working With Graphs

Most of the graphs in Curve3 can be enlarged, magnified and scrolled. Move the mouse over the lower part of a graph to reveal the graph's **Scroll**, **Magnify** and **Expand / Contract** controls.

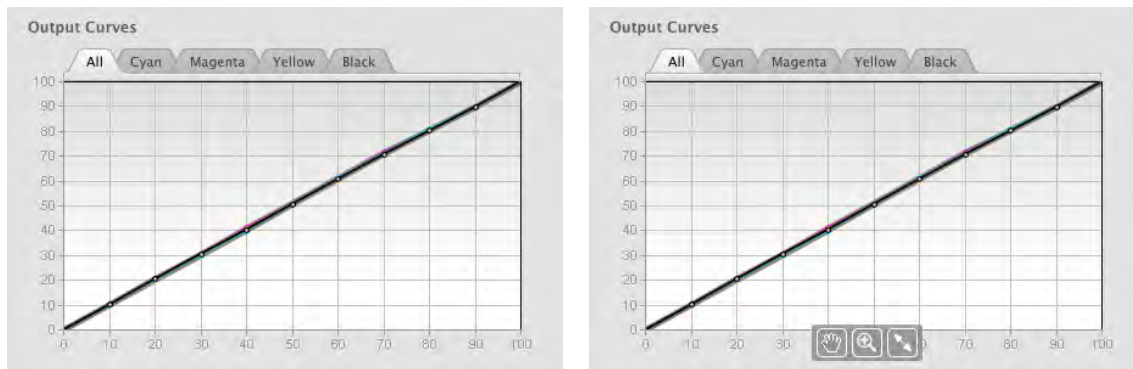


Figure 2.5 Output Curves graph with zoom controls hidden (left) and visible (right)

### Expanding and Contracting a graph

To expand a graph, move the mouse over the lower part of the graph until the tools become visible, then click the **Expand / Contract** tool. The graph will become larger, occupying most of the window height. To restore the graph to normal size, click **Expand / Contract** again.



Figure 2.6 The Expand / Contract tool

### Magnifying a Graph

To zoom in on a graph, move the mouse over the lower part of the graph until the tools become visible, then click the **Magnify** tool. Click on the graph and it will zoom in, centered on where you click. Keep clicking to increase the zoom factor.



Figure 2.7 The Magnify tool

To reduce the zoom factor, hold down the **Option** key (Mac) or the **Alt** key (Windows) while you click. The **Magnify** tool works whether the graph is in normal or expanded mode.

### Scrolling a Graph

If a graph has been zoomed, only part of it will be visible in the frame. To reveal hidden areas, click and hold the **Scroll** tool (hand symbol) on part of the graph and drag in the required direction.



Figure 2.8 The Scroll tool

## Shortcut Keys

### Up / Down arrows

The keyboard Up / Down Arrow keys perform different functions, depending on where you last clicked on the user interface.

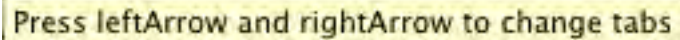
If there is more than one Run in a session, you can quickly switch between Runs by clicking once in a spare area of the Runs list, then using the Up / Down Arrow keys. **For convenience, each Run will open in the same panel as the Run you started from.**

If there is more than one File in the Measurements list, you can quickly switch between Runs by clicking once in a spare area of the Measurements list, then using the Up / Down Arrow keys.

If you are not in either the Runs or Measurements list, the Up / Down arrow keys will also move between the main Function windows, similar to clicking the main icons.

### **Left / Right arrows**

In a *window* with tabbed panels, such as **Calibrate**, use the **Left / Right Arrow** keys to move between that window's tabs.

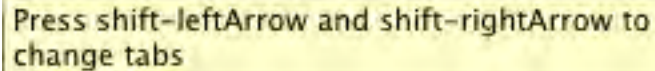


Press leftArrow and rightArrow to change tabs

Figure 2.9 The left/ right Arrow reminder prompt

### **Shift + Left / Right arrows**

In a *panel* with tabs, such as **Analyze** or **Create Curves**, use the **Shift-left Arrow** and **Shift-right Arrow** keys to move between that panel's tabs.



Press shift-leftArrow and shift-rightArrow to change tabs

Figure 2.10 The shift-left/ right Arrow reminder prompt



## 3. Setup

When you launch Curve3, **Setup** is the first window you see. To get to Setup from another window, click the **Setup** button. The Setup window lets you define global parameters such as calibration **Method (G7, TVI or Special Ink)** and the type of values needed by the RIP (**Wanted or Measured**). You can also enter session data like company, equipment, media, etc. in the **Notes** panel.



Figure 3.1 The Setup window

### Curve Method

The **Method:** buttons let you choose between **G7**, **TVI** and **Special Ink** calibration. The main purpose of Curve3 is to calibrate for G7. TVI calibration is included primarily for European users and to allow comparisons between the two methods. Special Ink calibration lets you calibrate special ink colors (not part of a normal CMYK ink set) such as red, green, blue, pink, beige, etc.

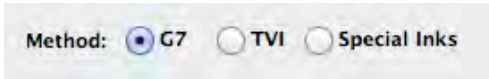


Figure 3.2 Calibration method options

### TVI Curve Selection

When calibrating by the TVI method, you can choose one of the standard ISO 12647-2 TVI curves or your own custom TVI reference curves, as described in Section 9.

*Note: TVI calibration has nothing to do with the G7 specification*

### Special Ink Calibration

Up to four non-CMYK inks can be calibrated at once by printing the P2P target with any inks you like, replacing the normal C, M, Y and K inks. For more information see Section 10.

*Note: Special Ink calibration has nothing to do with the G7 specification*

### Measured vs. Wanted

If your RIP only accepts ‘Measured’ values (there is no place to enter Wanted values), click the **Measured** box in the Setup window. Otherwise leave it set to **Wanted**.

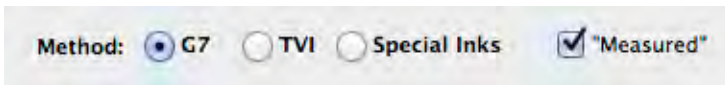


Figure 3.3 The ‘Measured’ option

Clicking **Measured** changes the Control Point percentage values and curve graphs in the **Create Curves** window. For more information see Section 5.

Control Points: "wanted" values					Control Points: "measured" values				
Entry	C	M	Y	K	Entry	C	M	Y	K
0.0	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
10.0	10.48	9.29	9.52	8.38	10.0	9.57	10.82	10.53	12.08
20.0	21.85	19.39	20.27	17.13	20.0	18.32	20.61	19.76	22.96
30.0	32.29	29.87	30.76	26.84	30.0	27.73	30.13	29.27	33.55
40.0	42.74	39.75	41.59	35.12	40.0	37.64	40.31	38.40	45.95
50.0	52.84	49.46	51.83	43.85	50.0	46.59	50.46	48.42	56.00
60.0	62.68	60.68	64.52	53.39	60.0	57.68	59.40	56.42	67.69
70.0	73.30	71.11	77.09	62.24	70.0	66.73	68.85	64.38	77.80
80.0	82.19	81.76	87.39	72.83	80.0	77.56	78.31	72.03	85.93
90.0	91.64	91.44	93.65	85.28	90.0	88.29	88.28	84.02	93.45
100.0	100.00	100.00	100.00	100.00	100.0	100.00	100.00	100.00	100.00

Figure 3.4 Effect of ‘Measured’ control on the Control Points in the Create Curves window

### Information and Notes

In the left half of the Setup window, optional data entry fields accept information about the device, media, etc. which will be included on the **Printing Guide** and **Calibration Run Report**.



Figure 3.5 The setup window showing fields for basic information to be saved with the session

The **Notes** box provides room for other information about the session such as unusual operating conditions, problems encountered during the run, any particular reasons for the exercise, or what you had for lunch.

## 4

## 4. Ink Test

The **Ink Test** window shows you if an ink and substrate combination will meet a certain printing specification or color space. It includes an **Ink Hue / Chroma** graph (also known as the “spider graph”), six **L\* / Chroma** graphs, a chart of delta-E values for ink solids. If the sample file contains spectral values, solid ink densities are also shown, otherwise the **Density** column shows “n/a”.

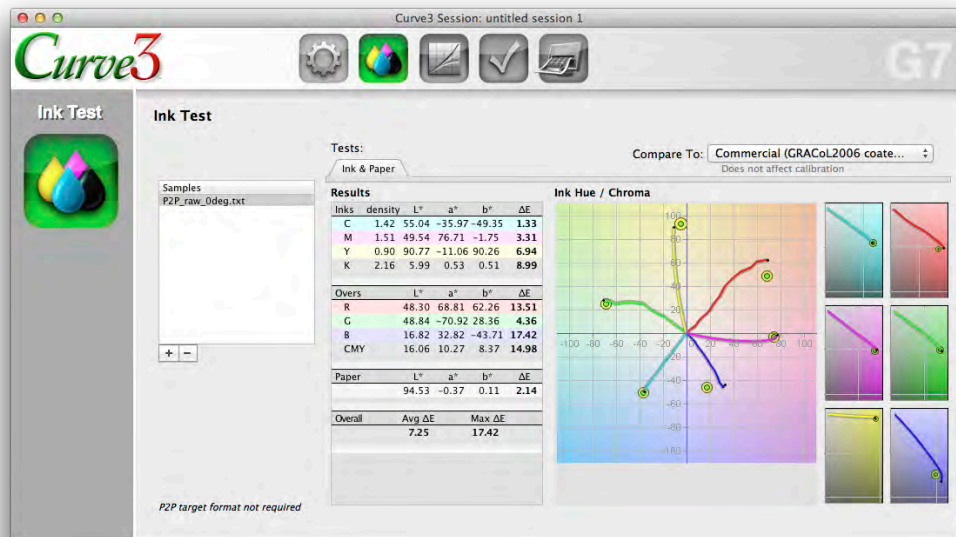


Figure 4.1 The Ink Test window

### Samples

The **Samples** list accepts measurement files from a wide variety of targets, including:

- P2P
- IT8.7/3
- IT8.7/4
- ECI 2002



- HC2052
- IDEAlliance ISO 12647-7 Control Strip
- Ugra/Fogra Media Wedge CMYK

Measurement files from custom targets can also be used so long as they are in CGATS format.

There is no practical limit to how many patches you can have in a sample file. Curve3 automatically finds the solid ink and substrate values based on each entry's CMYK values.

Although multiple measurement files can be added to the Samples list, results are only shown for the single sample file highlighted in the list.

## Comparison Color Space

The **Compare To:** list lets you define the target color space used when evaluating Ink values. If you don't know what color space to use, leave it at the default setting.

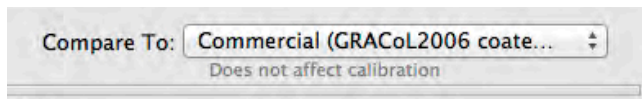


Figure 4.2 The **Compare To:** list in the **Ink Test** window

**NOTE:** The selected color space has **no effect** on the resulting calibration, it simply changes the reference CIE Lab values used to calculate Delta E in the **Ink & Paper** chart, and the target circles in the **Ink Hue / Chroma** and **L\* / Chroma** diagrams.

## Adding Custom Target Color Spaces

You can add color spaces to the Target Color Space list by creating a **Color Standards** folder in the same location as your Curve3 software, and adding CIE data sets to this folder. Data can be any characterization target set in standard CGATS format, or a custom text file. After the next launch of Curve3 these data sets will appear in the **Compare to:** list in the **Ink Test** and **Verify** windows as well as the **Analyze** tab in the **Calibrate** window.

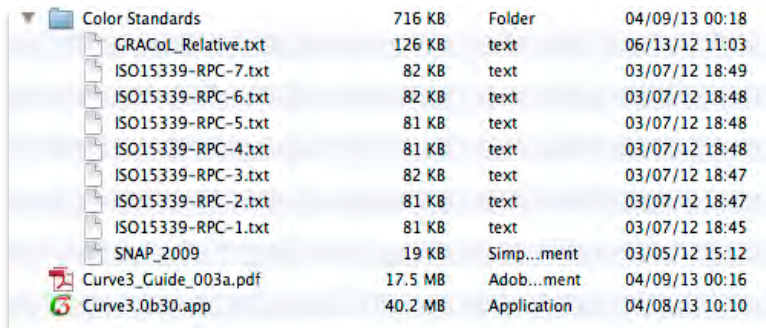


Figure 4.3 A user-created **Color Standards** folder in the Curve3 home folder

### Creating a Custom Color Space File

If you don't have a characterization data set for the color space you want to compare, you can create a custom text file (for example in the Microsoft Excel .txt format) containing (CIE Lab and/or CIE XYZ) for the minimum CMYK values illustrated below, or any super-set thereof.



BEGIN_DATA_FORMAT							
SAMPLE_ID	CMYK_C	CMYK_M	CMYK_Y	CMYK_K	LAB_L	LAB_A	LAB_B
END_DATA_FORMAT							
NUMBER	9						
BEGIN_DATA							
1	0	0	0	0	83	0	4
2	0	100	0	0	53.94	46.33	-0.85
3	100	0	0	0	57.58	-24.34	-28.48
4	100	100	0	0	41.17	5.94	-24.06
5	0	0	100	0	78.47	-2.36	59.3
6	0	100	100	0	52.55	42.86	24.53
7	100	0	100	0	53.47	-34.76	16.37
8	100	100	100	0	39.33	-0.05	-0.88
9	0	0	0	100	35.8	1.29	3.54
END_DATA							

Figure 4.4 A minimal Target Color Space reference file recognized by Curve3

## Results Panel

### Densities

If a Sample file contains spectral data, the **Results** panel will show CMYK Status-T density values. If the sample file contains only CIELAB or CIEXYZ data, the density fields will contain “n/a” (not available) or zeros.

Results					
Inks	density	L*	a*	b*	ΔE
C	1.42	55.04	-35.97	-49.35	1.33
M	1.51	49.54	76.71	-1.75	3.31
Y	0.90	90.77	-11.06	90.26	6.94
K	2.16	5.99	0.53	0.51	8.99
Overs	L*	a*	b*	ΔE	
R	48.30	68.81	62.26	13.51	
G	48.84	-70.92	28.36	4.36	
B	16.82	32.82	-43.71	17.42	
CMY	16.06	10.27	8.37	14.98	
Paper	L*	a*	b*	ΔE	
	94.53	-0.37	0.11	2.14	
Overall	Avg ΔE		Max ΔE		
	7.25		17.42		

Figure 4.5 Densities are only shown when a spectral data file is selected. If Lab data are supplied, the density values will say “n/a” or zero.

**Note:** Before using these densities for press control, check that the press control measuring instrument produces the same densities on the same sample print.

### Delta-E

Individual delta-E values are shown for the selected sample, as well as average and maximum delta-E. The average delta-E is calculated from all nine solid values including paper (substrate) but excluding the CMY (300%) value.

## Ink Hue / Chroma Graph

The **Ink Hue / Chroma** graph shows the  $a^*$ ,  $b^*$  plots of pure CMY inks and two-color RGB overprints in the CIE  $a^*/b^*$  diagram.

The shape and smoothness of the lines depends on how many patch values are in the sample file. The example on the left is from a P2P with 12 samples from 0% to 100% of each color. The sample on the right is from a file containing just one solid (100%) measurement for each color.

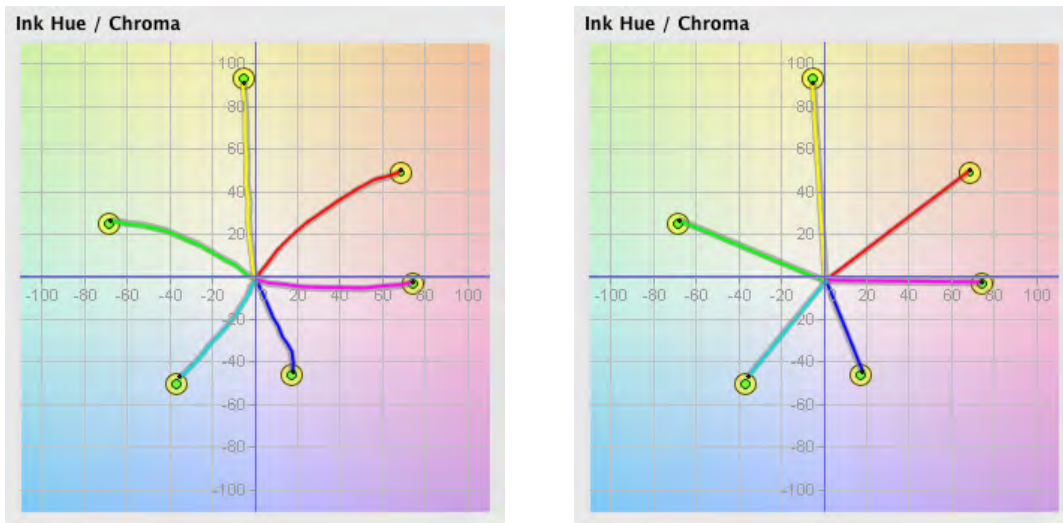


Figure 4.6 Files with 12 tints per color (left) and only one solid patch per color (right)

Ideally each colored line should end inside its small green circle. The larger yellow circle indicates the maximum range of permitted deviation. If the line ends outside the larger circle that solid color is considered to have a “critical” error which should be solved either by changing ink densities, or through color management.

The size of the green and yellow circles can be adjusted in the **Preferences** window by the **Max dE warn:** and **Max dE critical:** numbers under **Measurement Warnings**.

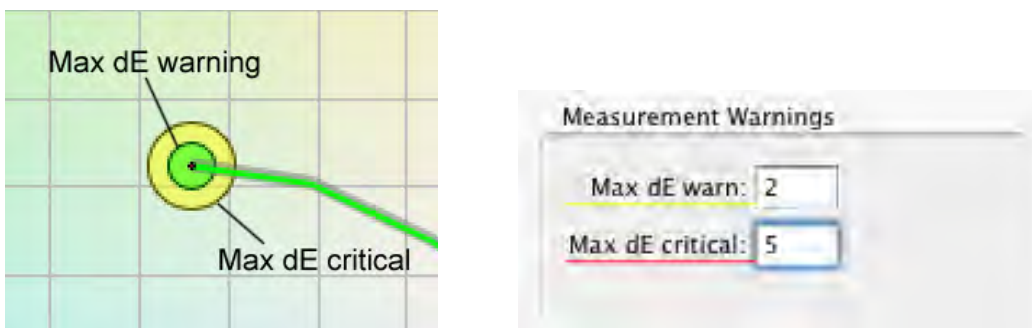


Figure 4.7 Delta-E circles in the Ink Hue / Chroma graph (left) and how their sizes are controlled in Preferences (right)

## Ink L\* / Chroma Graphs

The **Ink L\* / Chroma** graphs show the CMY and RGB scales in terms of  $L^*$  (vertical axis) and Chroma (horizontal axis).

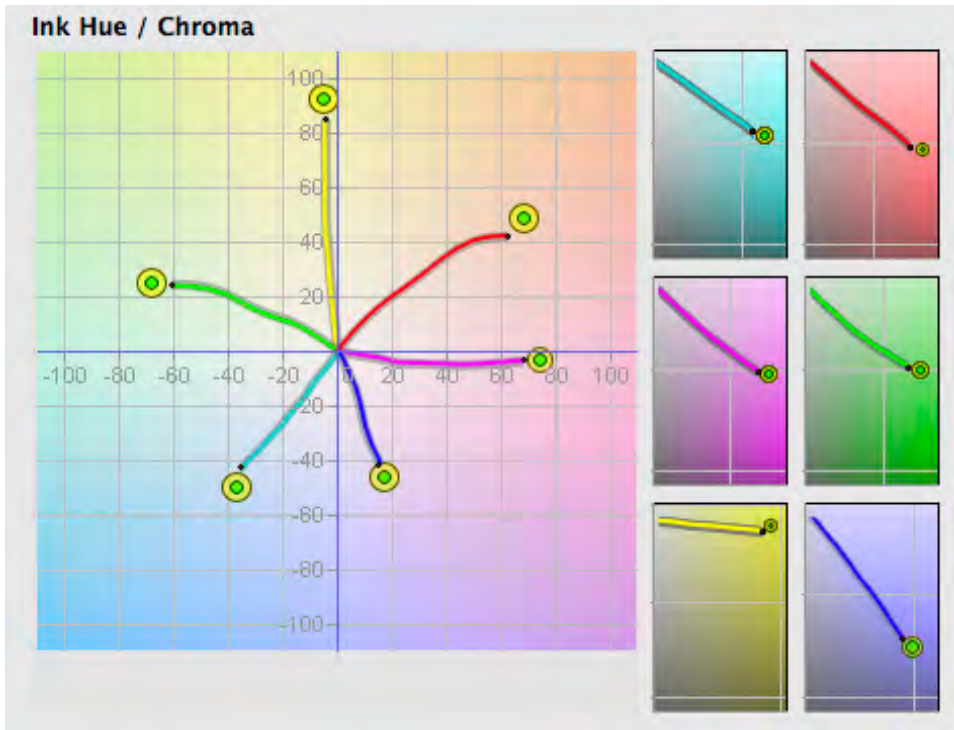


Figure 4.8 The Ink L\* / Chroma graphs alongside the Ink Hue / Chroma diagram

## 5

## 5. Calibrate

The **Calibrate** window is where Curve3 performs its most important function – calculating calibration curves. Calibration begins by selecting a **Run** from the **Calibrate Runs** list.

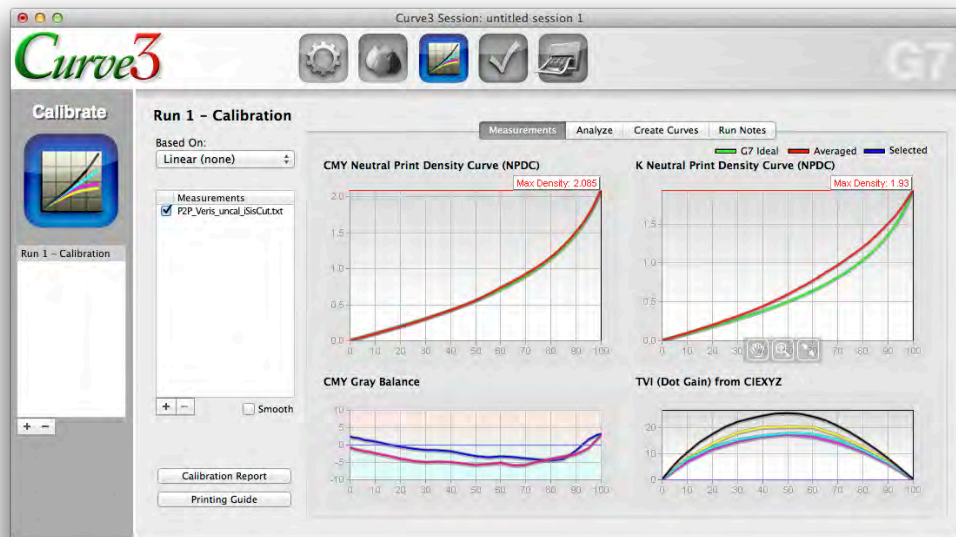


Figure 5.1 The Calibrate window

### The Calibrate Runs List

A **Run** refers to a single print run or printing test. The Calibrate Runs list can contain many runs, each of which may contain multiple measurement files from a single print run or test.

The main product of a calibration Run is a set of **Calibration Curves** defined by a list of CMYK **Control Points** (visible in the **Create Curves** tab) that, when entered into the printer's calibration tables, should result in a properly calibrated print.

### Selecting a Calibration Run

A Calibration Run is selected by clicking on the required Run in the **Calibrate Runs** list. In a new session, only **Run 1 - Calibration** will be visible.

### Creating New Calibration Runs

To create a new Run, click the Plus “+” button below the Runs list. By default, all new Runs will be called ‘Run (n) – Verification (n)’. To change the name of a Run, double-click the name and begin typing. Press **Return** or **Enter** when you are finished.

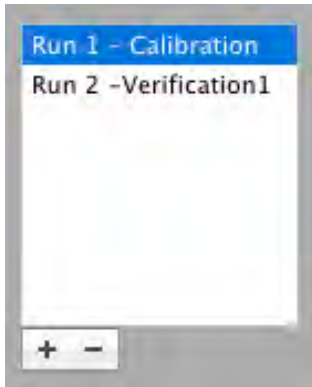


Figure 5.2 The calibrate runs list

### Deleting a Calibration Run

To delete a Run, highlight it in the Runs list then either click the Minus “-” symbol below the list or press the **Delete** key on your keyboard.

### The Printing Guide

(See appendix D)

### The Calibration Run Report

(See appendix C)

## The Measurements List

Each Run has its own **Measurements** list to which you can add P2P measurement files from that print run. P2P measurement files may contain CIELAB, CIEXYZ and/or spectral data. When multiple data types are included in the same file, Curve3 uses those data in the following order of preference; 1. Spectral, 2. XYZ, 3. LAB.

*Note: Curve3 can import the Logo file format from X-Rite MeasureTool® or a CGATS file saved from X-Rite ColorPort®, X-Rite i1Profiler®, Konica Minolta ColorCare® and other software.*

### Adding and Deleting Measurement Files

To add a new P2P measurement file, click the Plus “+” button below the Measurements list and browse for the file you want. You can also drag-and-drop files directly into the Measurements list. If you drag a folder containing multiple files, Curve3 will load all the P2P files in the folder, but ignore files inside any sub-folders. Non-P2P files will be skipped with a warning message.

To delete a measurement file, click on it to highlight it, then either click the Minus “-” button or press the **Delete** key on your computer keyboard.

### Disabling and Enabling Measurement Files

All the measurement files with a check mark are averaged together in the displayed graphs and when calculating correction curves. To disable a measurement file (remove it from the average) clear the checkbox alongside it. To re-enable it make the check mark appear again.

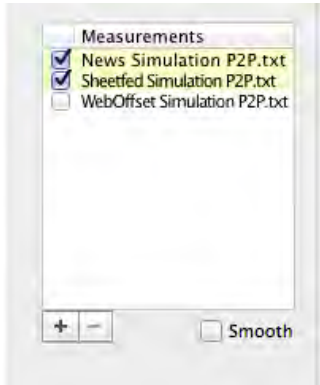


Figure 5.3 De-selected files (un-checked) are omitted from the average.

### Measurement File Warning Colors

When multiple measurement files are in the list, one or more may become tinted yellow or pink to indicate how much they differ from the average of all active (checked) files.

Tolerances corresponding to each color code can be set in the Curve3 **Preferences...** window under **Measurement Warnings**.

- The **Max dE warn** value assigns the delta-E level above which a file turns yellow
- The **Max dE critical** value assigns the delta-E level above which a file turns pink.

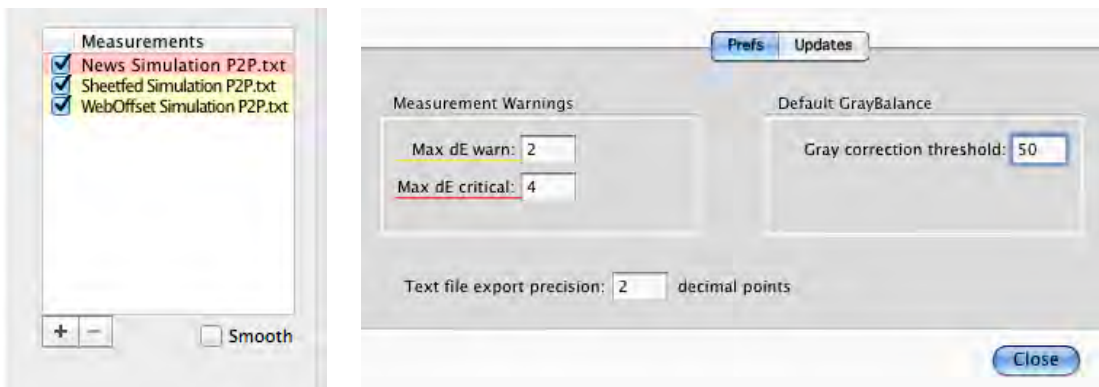


Figure 5.4 Colored files (left) differ from the group average by tolerances set in Preferences (right)

*Note: These tolerance thresholds also affect the size of the circles in the “spider graph” in the Ink Test, Analyze and Verify windows.*

### Measurement File Delta-E Values

Highlighting a single measurement file shows its Average and Max delta-E below the list. Average delta-E is calculated by first calculating the delta-E of each patch in the highlighted file compared to the list average of each patch, then averaging the resulting delta-E values. Max delta-E represents the greatest difference between any patch and its list average.



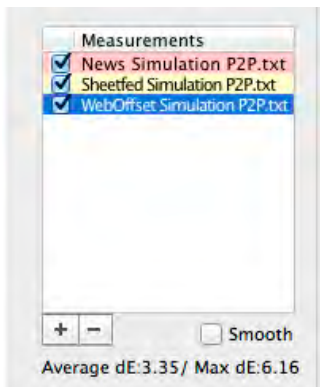


Figure 5.5 Average and maximum delta-E of a highlighted file (blue) appears below the list

## The Smooth Button

The **Smooth** button below the Measurements list can be switched on and off from any of the Calibrate window's sub windows (Measurements, Analyze or Create Curves).

Smoothing reduces the effects of uneven or inconsistent printing or measuring by creating a 4-dimensional "model" of the printing system and effectively "re-printing" the target through the model. The accuracy of the model depends on the number and quality of available measurement files. All the active (checked) files in the Measurement list are combined to create the model. As you add more files, the smoothing function becomes more effective.

Remember that smoothing only affects the behavior of Curve3; it does not improve the smoothness of your printing or measuring system. If you smooth the calibration run, you should also smooth the same number of measurement files on the confirmation run. If smoothing seems to make a major difference to the graphical displays, you should try to analyze and solve the root cause of the printing or measuring problem.

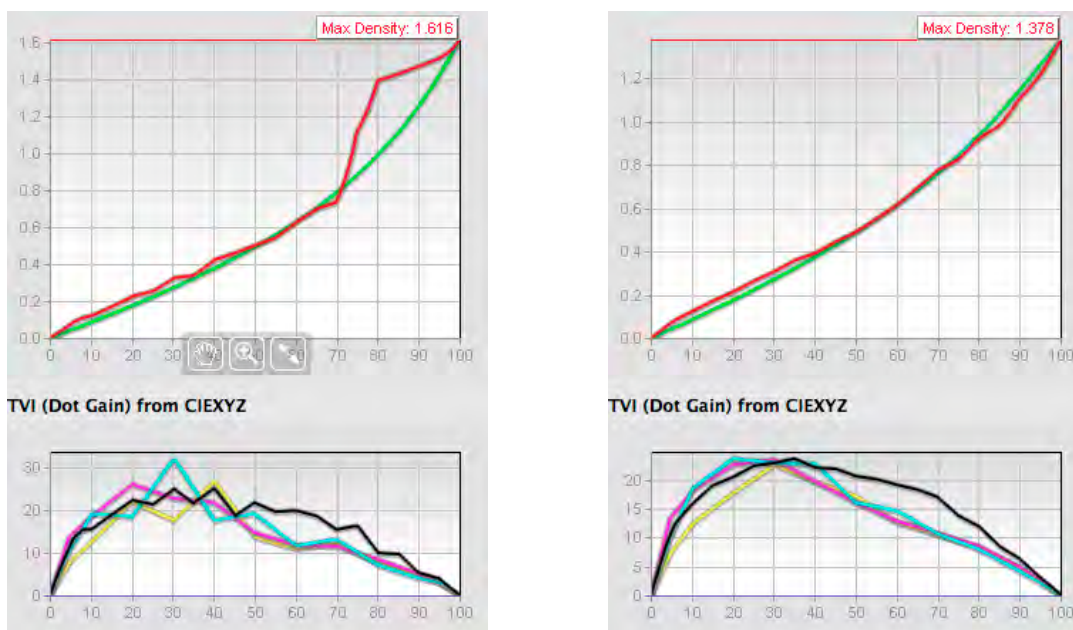


Figure 5.6 Results of extremely uneven printing or measuring: Raw (left), Smoothed (right)

## The Based On: List

If the current Run contains measurement files that were printed through calibration curves from an earlier Run, be sure to select the earlier Run in the **Based On:** list. This selection will not change the graphs and values in the **Measurements** or **Analyze** tabs, but it will affect the calibration curves and Control Point values displayed in the **Create Curves** window.



Figure 5.7 The Based On: list

When a Calibration Run is based on an earlier Run, the resulting Control Point values should REPLACE the values calculated in the earlier Run. This is known as “iteration”. For detailed notes on Curve3 Iteration see *Section 13*.

### Basing on a Previous Session

If the calibration data this Run was based on was saved in an older Curve2 or Curve3 session, start by loading the old session from the **File** menu, then create a new Run, add measurement files from the latest Run, then select the earlier Run in the **Based On:** list.

### Basing on Arbitrary RIP Curves

If the current Run was made through calibration curves that were not generated by Curve2 or Curve3, or if you cannot find the old session, you can load a text file of the initial calibration curves by clicking **Load Initial Curves...** in the **Based On:** list. This can be enormously valuable if the first press run was accidentally made with non-linear plates.

To create an *Initial Curves File* see *Section 13*.

## Function Tabs

Four function tabs appear across the top of the Calibrate window.



Figure 5.8 Calibration Run window tabs (Mac)

The panels opened by each tab are described below. You can click each tab manually or cycle through them with the **left Arrow / right Arrow** keys.



## The Measurements Panel

The Measurements panel shows the condition of your device as you add measurement files.

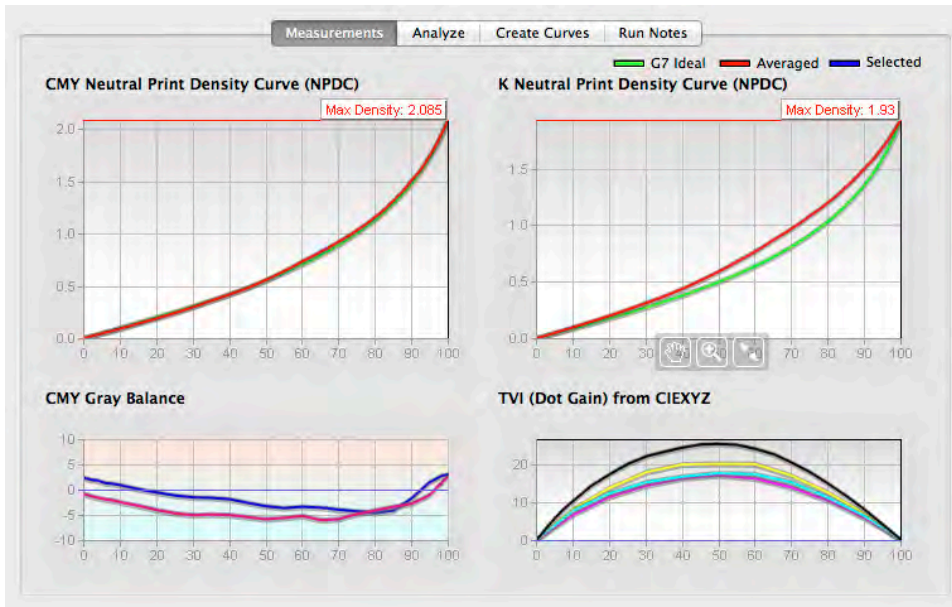


Figure 5.9 The Measurements panel

### NPDC Graphs

When a measurement file is loaded, two NPDC graphs display the measured neutral density values from the P2P in red, with the ideal G7 curve in green. If two or more measurement files are in the list, the red graphs show the average of all active (checked) files.

### Comparing NPDC of a Single Measurement File

To compare one measurement file's NPDC to the average of all active files, click on the file in the Measurements list. The selected file appears as a blue line on the graph. The closer the blue line is to the red line, the better that file fits the average.

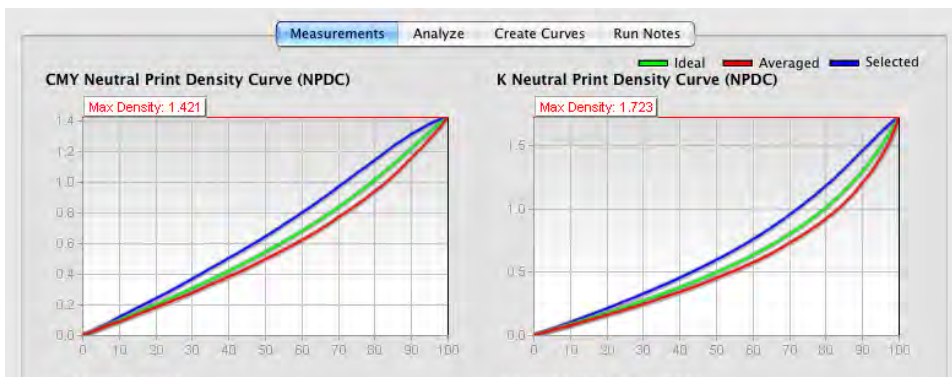


Figure 5.10 Graphs showing average (red) and selected (blue) measurement sets

*Note: Although only one measurement file is highlighted, Curve3 still uses the average of all the active (checked) files to calculate correction values.*

### CMY Gray Balance

The **CMY Gray Balance** graph displays the  $a^*$  (pink) and  $b^*$  (blue) values of the P2P's CMY gray scale. Ideally, both lines should be straight, starting at the substrate (left side) and ending at zero on the right. In practice, these lines are seldom perfectly straight, especially in darker tones (right side).

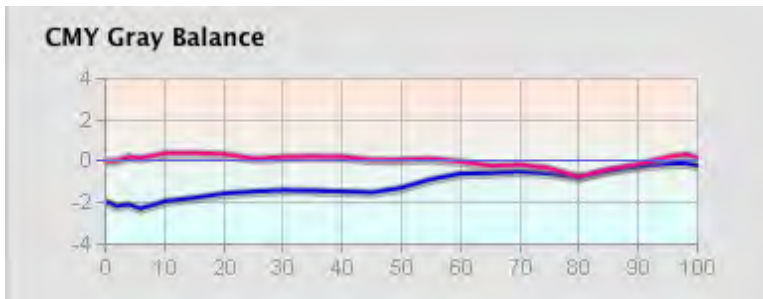


Figure 5.11 CMY Gray Balance graph

### TVI (Dot Gain) Graph

Curve3 displays a TVI (Dot Gain) graph to help evaluate individual ink performance. Because density-based TVI values cannot be calculated from Lab or XYZ data, Curve3 calculates TVI curves from CIEXYZ instead. The resulting curves may be slightly different than traditional density-based TVI curves. For more information see *Appendix: F*.

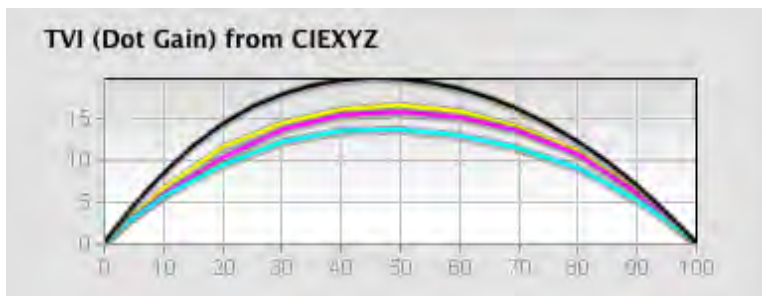


Figure 5.12 TVI Curve graph

## The Analyze Panel

By default, the Analyze panel provides three different views - **Ink & Paper**, **G7** and **TVI**, selected with the **Tests:** tabs. If the current Calibration Run is based on a previous Run in the **Based On:** list, a fourth **Run-to-Run** tab appears. You can click each tab manually or cycle through them with **shift-left Arrow / shift-right Arrow**.

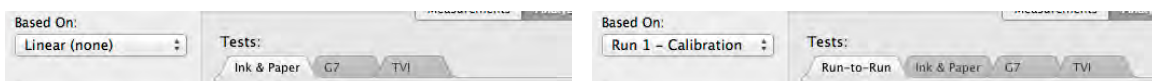


Figure 5.13 The Analyze panel tabs – default (left) and based on an earlier Run (right)

**Ink & Paper tab**

The **Ink & Paper** tab shows the **Ink Hue / Chroma** graph (“spider graph”), along with six **L\* / Chroma** graphs and a chart of measured values for solid ink patches and substrate. CMYK ink densities are also shown if measurement files contain spectral data. The **Ink Hue / Chroma** graph shows the a\*/b\* values of each single ink (CMY) and two-color overprint (RGB) scale from paper white at the center to maximum saturation at the outer ends. The aim point circles show the ideal a\*/b\* values of the color space selected in the **Compare To:** list.

*Note: The **Compare To:** selection only affects this sub-panel and has no effect on the Gray Balance or TVI tests, nor does it affect the calibration curves generated by Curve3.*

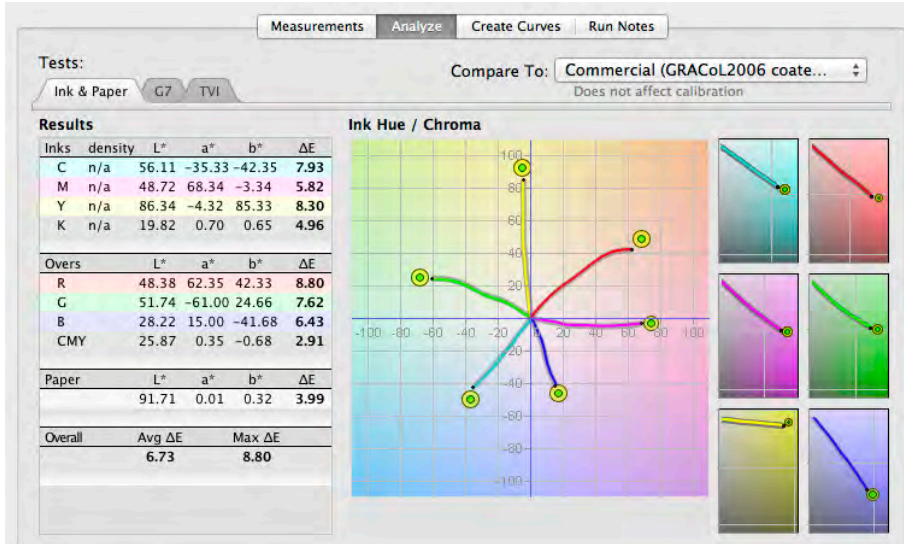


Figure 5.14 The Analyze - Ink & Paper panel

**G7 tab**

The **G7** tab reveals a **Curve Shape (delta-L\*)** graph, a **Gray Balance** graph, average and max delta-L\* values for CMY and K, and average and max Delta-Ch\* values for the CMY gray scale.

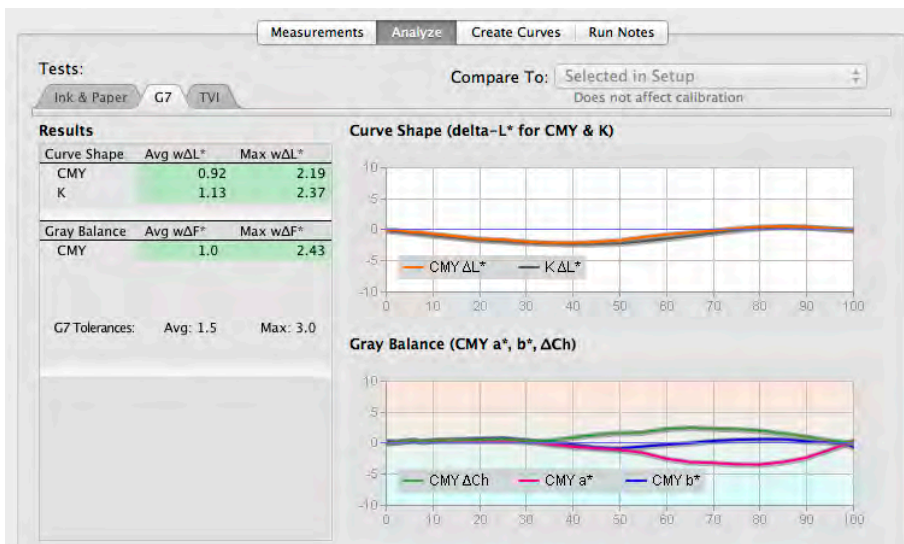


Figure 5.15 The Analyze - G7 panel

**Curve Shape graph**

The **Curve Shape (delta-L\* for CMY & K)** graph has two lines representing the weighted delta-L\* deviation of the CMY gray (orange line) and black (gray line) scales from the ideal G7 NPDC curves.

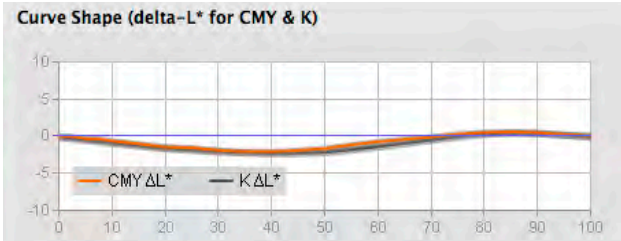


Figure 5.16 The Curve Shape (delta-L\*) graph

**Gray Balance graph**

The **Gray Balance (CMY a\*, b\*, ΔCh)** graph has three lines. The pink and blue lines show the deviation of the CMY gray scale in a\* and b\* respectively compared to ideal G7 gray balance. The green line shows the overall color error in weighted Delta Ch which is a metric of gray balance error explained in Appendix: E.

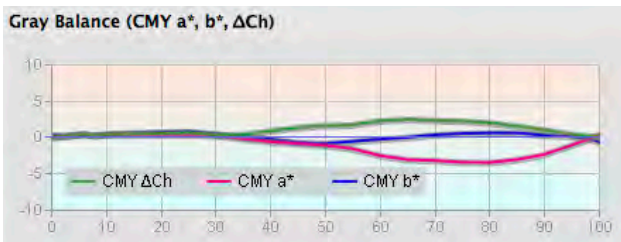


Figure 5.17 The Gray Balance (delta-Ch) graph

**TVI tab**

Selecting the **TVI** tab reveals the TVI graph and a list of TVI values calculated for each ink.

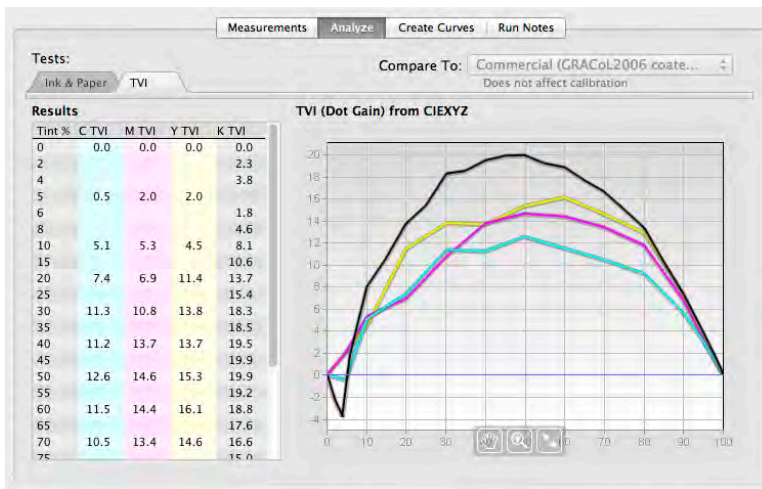


Figure 5.18 The Analyze - TVI panel

Note that the TVI curves are calculated from CIEXYZ, not density (see Appendix: F).



### Run-to-Run tab

The most common cause of apparent calibration errors is the variation of solid ink density or Lab values between runs. The **Run-to-Run** tab provides a simple way of catching these errors by comparing the current Run to the **Based On:** Run. Differences are displayed in Delta-E and (if all measurement files contain spectral data) Delta Density for each ink.

If a previous Run is selected in the **Based On:** list, the **Run-to-Run** tab automatically appears. If **Linear (none)** is selected in the **Based On:** list, the tab disappears.

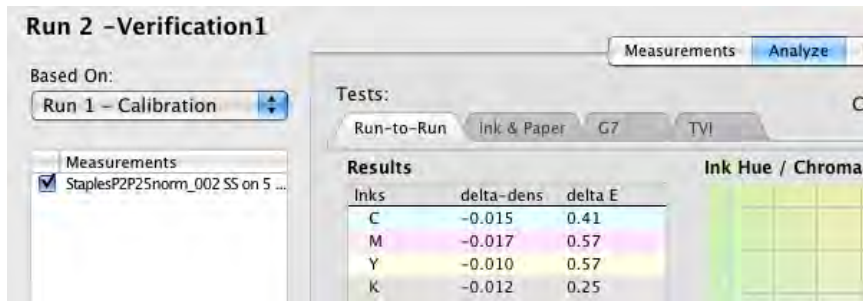


Figure 5.19 The Run-to-Run tab is only visible when a previous Run is selected in the Based On: list

Note: For more information on using the Run-to-Run tab, see Section 13.

## The Create Curves Panel

The most important function of Curve3 is the calculation of calibration curves in the Create Curves panel. To access this function click on the **Create Curves** tab.

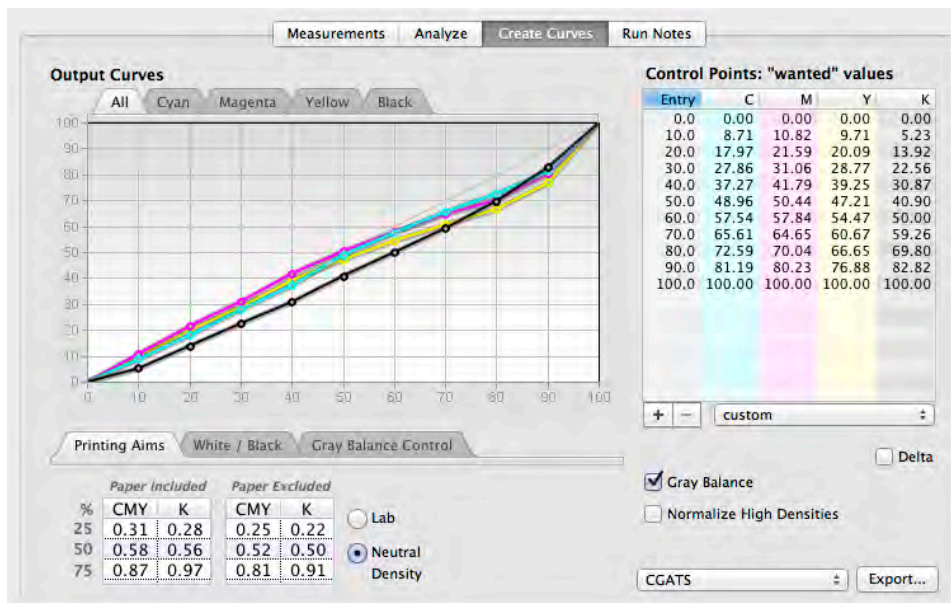


Figure 5.20 The Create Curves panel

The Create Curves panel displays a graph of *Calibration Curves* necessary to calibrate the printing system, a list of **Control Point** percentages, a list of **Printing Aims**, some buttons or tabs that modify the way the curves are calculated, and options for exporting the control point values.

### Choosing Control Point Values

A menu below the **Control Points** list offers pre-set Control Points at intervals of 1%, 5%, 10%, 25% or 50%, plus some RIP-specific presets and “highlight & shadow weighted (P2P)”, with Points for every gray scale patch in the P2P target. You can also save and load custom Control Point sets..

*Note: If your RIP requires a fixed set of Control Points not on the list, send a feedback item with the RIP model and the required control points for possible inclusion in a future Curve3 release.*

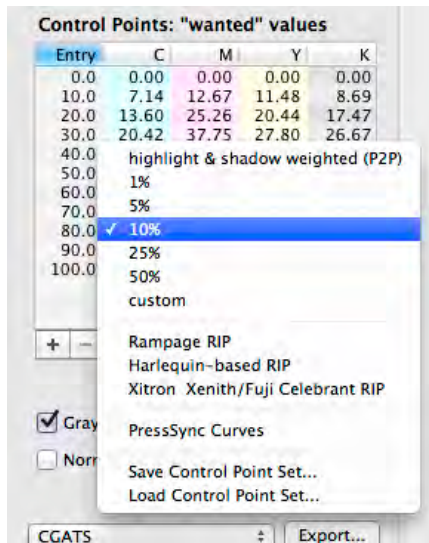


Figure 5.21 Choosing pre-set Control Points

### Adding/Subtracting Control Points

To add a Control Point click on the Plus “+” button below the Control Point Set list. To delete a Point, highlight it, then click the Minus “-“ button. You can add as many points as you like to make the curve shape as smooth as possible, but fewer Points are generally better unless the printer is extremely stable and repeatable or you have averaged many P2P samples from one or more Calibration Runs.

### Which Control Points?

To help decide which Control Points to add, view each graph separately with the color tabs above the graph. In each graph, a gray line shows the ideal curve. The colored line shows the curve made by the current points. Add extra points as needed until the colored line is as close as possible to the gray line.

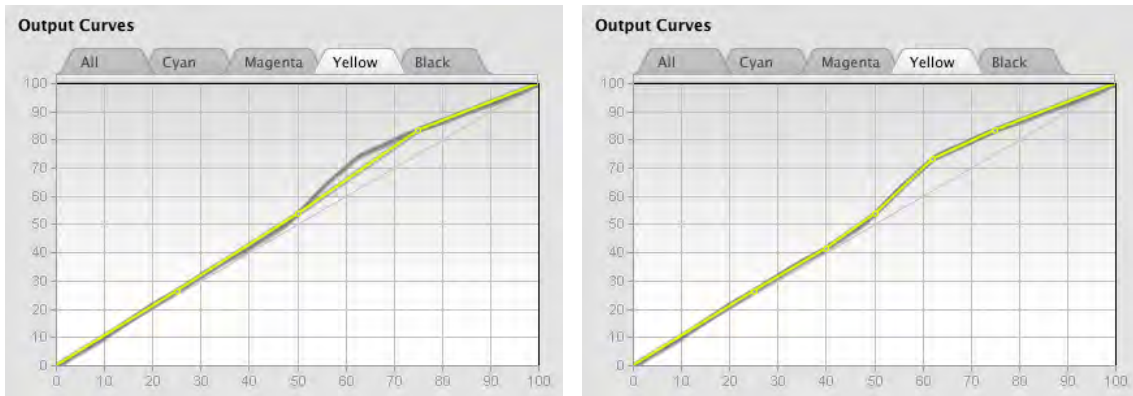


Figure 5.22 Yellow graph showing ideal line (gray) and the current Control Points line (yellow)

In the example above the left hand image shows the poor fit of the yellow curve with Control Points at 25%, 50% and 75%. Adding two more points at 40% and 62% greatly improves the fit.

### Saving a Custom Control Point Set

You can save your own custom lists of Control Points using the **Save Control Point Set...** and **Load Control Point Set...** menu items. If you want your custom sets to appear in the menu list, save it in a folder called **Control Point Files**, located in the folder from which Curve3 launches.

### Delta Values vs Absolute values

By default Curve3 calculates absolute TV (Tone Value) percentages for every Control Point. If your RIP requires delta TVI (Tone Value Increase) percentages instead, click the **Delta** checkbox.

Control Points: "wanted" values				
Entry	C	M	Y	K
0.0	0.00	0.00	0.00	0.00
10.0	0.48	-0.71	-0.48	-1.62
20.0	1.85	-0.61	0.27	-2.87
30.0	2.29	-0.13	0.76	-3.16
40.0	2.74	-0.25	1.59	-4.88
50.0	2.84	-0.54	1.83	-6.15
60.0	2.68	0.68	4.52	-6.61
70.0	3.30	1.11	7.09	-7.76
80.0	2.19	1.76	7.39	-7.17
90.0	1.64	1.44	3.65	-4.72
100.0	0.00	0.00	0.00	0.00

Control Points: "wanted" values				
Entry	C	M	Y	K
0.0	0.00	0.00	0.00	0.00
10.0	10.48	9.29	9.52	8.38
20.0	21.85	19.39	20.27	17.13
30.0	32.29	29.87	30.76	26.84
40.0	42.74	39.75	41.59	35.12
50.0	52.84	49.46	51.83	43.85
60.0	62.68	60.68	64.52	53.39
70.0	73.30	71.11	77.09	62.24
80.0	82.19	81.76	87.39	72.83
90.0	91.64	91.44	93.65	85.28
100.0	100.00	100.00	100.00	100.00

Figure 5.23 Delta Values (left) vs. absolute values (right)

The Delta display is also useful when comparing the calibrated device to the Ideal NPDC curves. Delta values less than 1% typically indicate a good calibration.

### Wanted vs. Measured values

Normally the Control Point values shown in the **Create Curves** window of Curve3 are the 'Wanted' percentage values that each Control Point should change to after calibration. For example, if the 50% Control Point has a Control Point value of 55%, the device should output a 55% value for an original file value of 50% so that 50% tones are darkened by 5%.

Some RIPs require 'Measured' values in stead of Wanted values. If so, click the **Measured** box in the **Setup** window and the values in the **Control Points list** will change to show the theoretical TV

values (Tone Values or Reflection Dot Percentages) that would have been measured on an incorrectly calibrated offset plate. The RIP uses these values to calculate the same correction values that Curve3 would have displayed if **Measured** was not selected.



Figure 5.24 Selecting 'Measured' instead of 'Wanted'

Clicking **Measured** changes both the shape of the correction curves and the Control Point percentage values in the **Create Curves** window.

Control Points: "wanted" values					Control Points: "measured" values				
Entry	C	M	Y	K	Entry	C	M	Y	K
0.0	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
10.0	10.48	9.29	9.52	8.38	10.0	9.57	10.82	10.53	12.08
20.0	21.85	19.39	20.27	17.13	20.0	18.32	20.61	19.76	22.96
30.0	32.29	29.87	30.76	26.84	30.0	27.73	30.13	29.27	33.55
40.0	42.74	39.75	41.59	35.12	40.0	37.64	40.31	38.40	45.95
50.0	52.84	49.46	51.83	43.85	50.0	46.59	50.46	48.42	56.00
60.0	62.68	60.68	64.52	53.39	60.0	57.68	59.40	56.42	67.69
70.0	73.30	71.11	77.09	62.24	70.0	66.73	68.85	64.38	77.80
80.0	82.19	81.76	87.39	72.83	80.0	77.56	78.31	72.03	85.93
90.0	91.64	91.44	93.65	85.28	90.0	88.29	88.28	84.02	93.45
100.0	100.00	100.00	100.00	100.00	100.0	100.00	100.00	100.00	100.00

Figure 5.25 Effect of 'Measured' control on the Control Points in the Create Curves window. Note the red warning above the list showing these are not the normal Wanted values

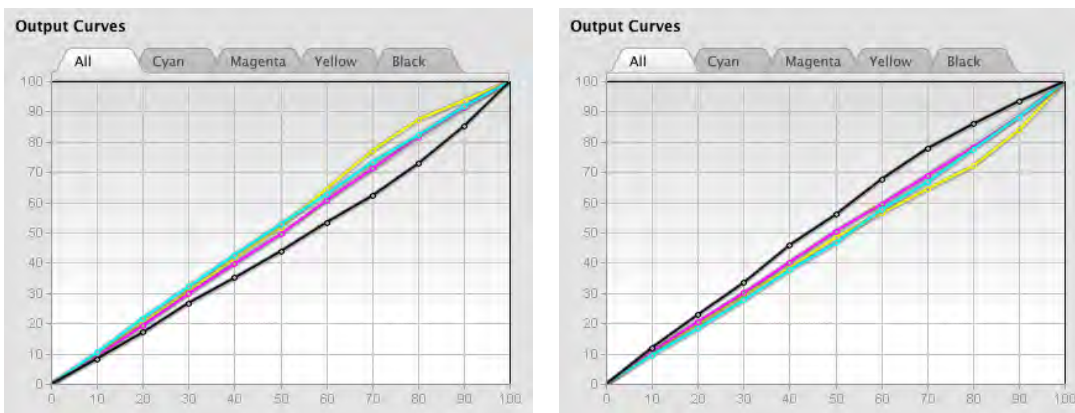


Figure 5.26 Output Curves graph in Wanted mode (left) and Measured mode (right)

### Normalize High Densities

To achieve G7 calibration, some printing conditions require extreme tone changes at high CMY ink densities, usually due to unusual ink trapping, very high ink densities, or using a RIP with complex "Ink Limiting" algorithms. Although the resulting calibration may pass G7, in extreme cases it may be undesirable both visually and as a basis for subsequent ICC profiling.

To solve this, the **Normalize High Densities** button modifies the CMY calibration curves to give smoother transitions in saturated color areas. The resulting calibration should produce better-performing ICC profiles and meet G7 gray balance and tonality requirements in lighter grays, but higher density 3-color grays may not pass G7. Black calibration is unaffected.



Note: **Normalize High Densities** only works with the P2P25 target. Other P2P versions (e.g. P2P26 or P2P27) will produce an error in the Control Points list.

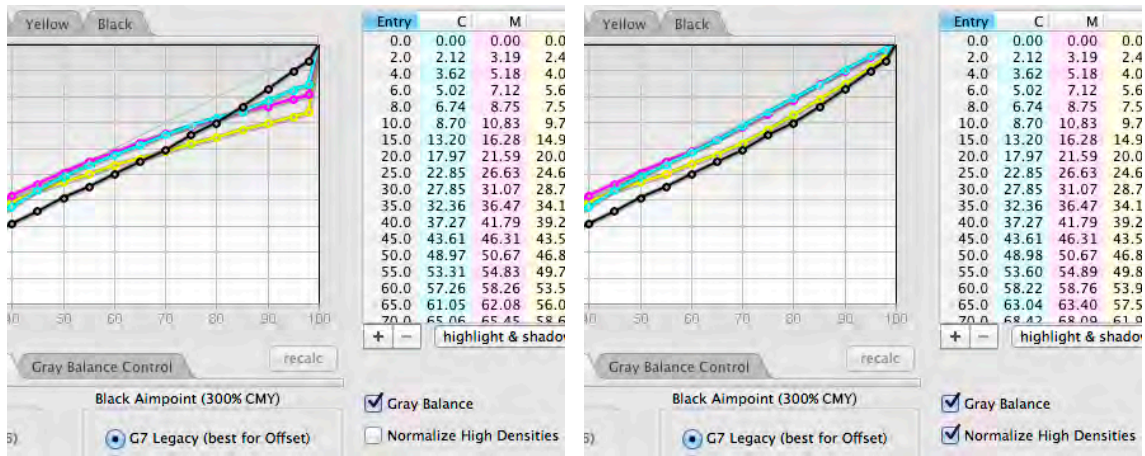


Figure 5.27 An example of legacy G7 calibration curves (left) compared to curves produced with the Normalize High Densities option (right)

**CAUTION: Normalize High Densities may cause the system to fail G7 and should only be used when the CMY calibration curves show sudden tone changes near the darkest point (left).**



Figure 5.28 (Left): A high-density ink jet printer with conventional G7 calibration. (Right): The same printer calibrated with the Normalize High Densities option. Notice the smoother tonality in high-saturation areas (apple, garments, etc.) in the right-hand sample. Also note that the black scales are identical and the lighter half of the CMY gray scale is identical in both prints.

### Export...

Clicking on the **Export...** button lets you export the Control Point values in various file formats.

**Text file export precision:** can be controlled in Preferences.

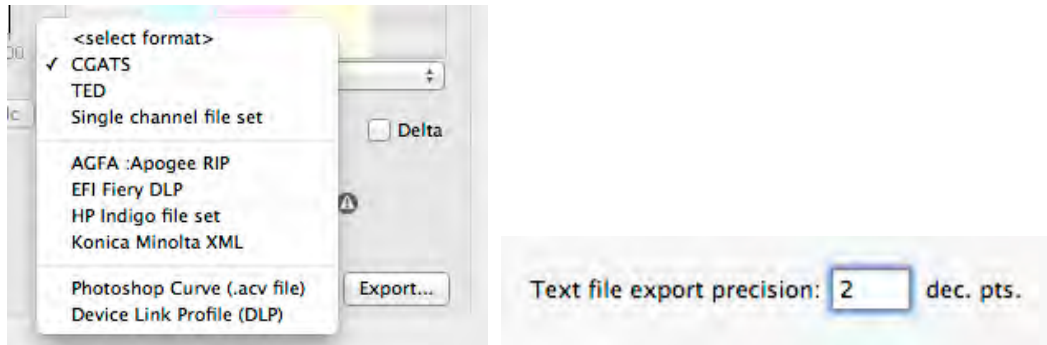


Figure 5.29 The **Export...** format selection list and the text precision preference

Some RIP-native text or .xml files can be loaded directly into the RIP without the need for manual entry (see [Section 12.](#)) If your RIP does not appear in the list, encourage the manufacturer to contact HutchColor or CHROMiX so their file format can be added in a future version of Curve3.

Note that you can also print the list in a **Calibration Run Report** (see [Appendix: D](#)).

### Gray Balance

By default, Curve3 attempts to correct gray balance errors on a 3-color gray scale. Gray balance correction may be less reliable on devices with a very strong gray bias, or where gray balance measurements are inconsistent due to mottling, uneven inking, unstable ink trapping, etc.

### Switching gray balance ON and OFF

Gray balance can be switched ON and OFF by with the Gray Balance button in the Create Curves panel. When the **Gray Balance** button is checked, Curve3 calculates separate Control Point values for C, M and Y. When Gray Balance is unchecked, Curve3 CMY Control Point values are identical.

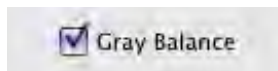


Figure 5.30 The Gray balance switch

Gray balance should only be switched off if the device already produces neutral gray balance without the need for separate curves, or if it is nearly neutral and can be neutralized by physical adjustments next time you print.

## The Gray Balance Control Tab

When gray balance is on you can control some aspects of how gray balance is calculated by clicking the **Gray Balance Control** tab. (These functions are disabled in TVI and Special ink mode.)

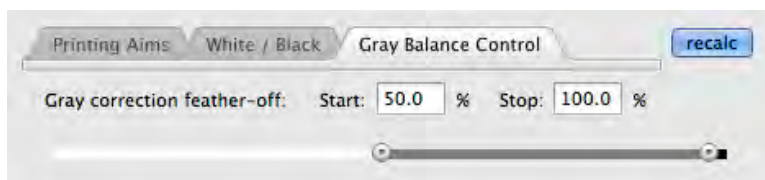


Figure 5.31 The Gray Balance Tab

### Gray Correction Feather-Off

The **Gray correction feather-off**: slider defines the gray scale percentage at which gray balance begins to feather-off, and where gray correction ends completely.

By default, **Start**: is set to 50% and **Stop**: is set to 100%, meaning gray balance is fully corrected from 0% to 50%, but only half corrected at 75%, with no gray balance applied at 100%.

Raising the **Start**: percentage extends gray balance correction further into shadow areas. Although a maximum setting of 100% is allowed, the maximum effective setting corresponds to the darkest gray slice on the P2P target (87.5%). Gray scale steps lower than the **Start**: percentage will have full gray balance correction applied.

Reducing the **Stop**: percentage sets the point at which gray balance is reduced to zero. Gray scale steps higher than the **Stop**: percentage will have no gray balance correction.

The default settings are recommended for most printing presses where gray balance can vary significantly in darker tones from run to run.

*Note: After adjusting the Gray correction threshold, click **recalc** to make the changes active.*

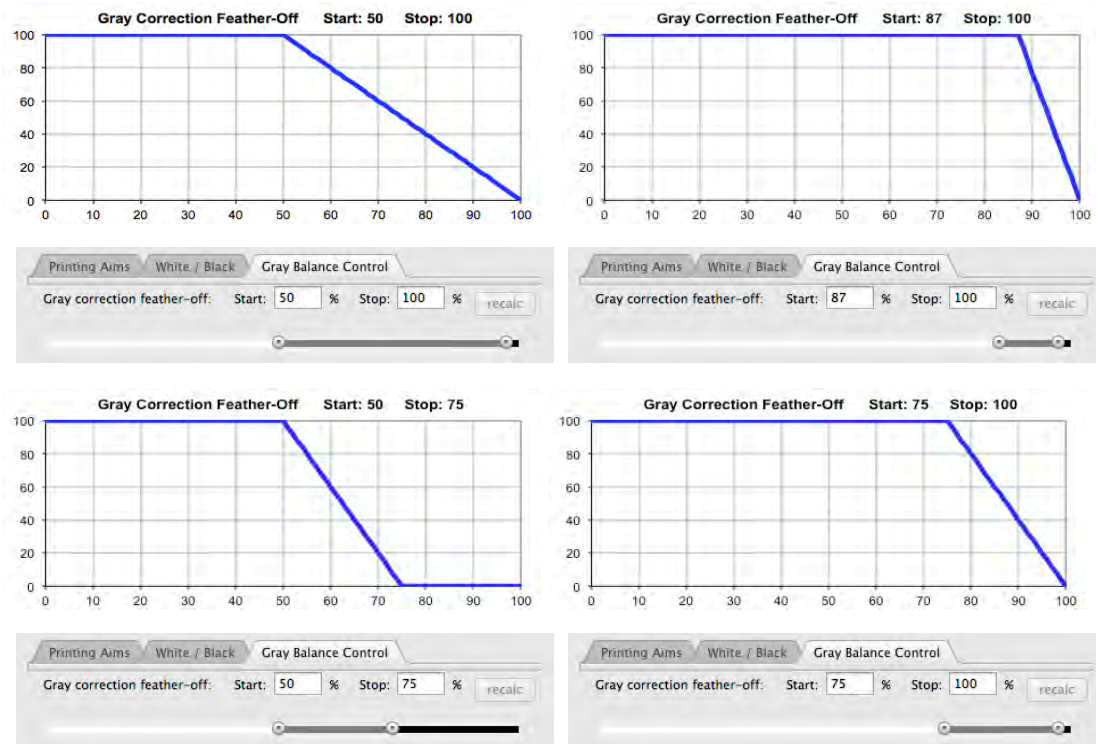


Figure 5.32 Effect of various Gray correction feather-off: Start: and Stop: percentages

### Precision Gray Balance and Blend Gray Samples

Curve3 calculates the most precise gray balance possible from the information in a P2P target. However if the measured data are noisy (e.g. from a grainy or textured print) or uneven, too much precision can actually cause spikes or sudden changes in the Output Curves. If you think the Output Curves should be smoother, try turning **Precision Gray Balance** OFF and/or turn **Blend Gray Samples** ON, then click **recalc**.





Figure 5.33 Default settings for the Precision ray Balance and Blend Gray Balance switches

## The White / Black Tab

The **White / Black** tab lets you modify how Curve3 calculates gray balance, for example to simulate the effect of another colored substrate, or to produce a smoother calibration when the 300% CMY patch has a strong color cast that cannot be removed on press.

### White Aimpoint

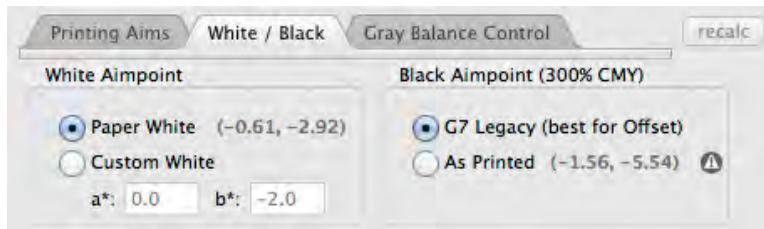


Figure 5.34 The **White / Black** tab

When the **White Aimpoint** is set to **Paper White**, gray balance is based on the color of the substrate on which the P2P was printed. If you want to simulate another substrate color, for example if your paper is close to the desired color but not quite perfect, click **Custom White** and enter the  $a^*$  and  $b^*$  values of the substrate you want to simulate. The resulting calibration curves will simulate the color of the new substrate at all gray levels, except the very lightest tones.

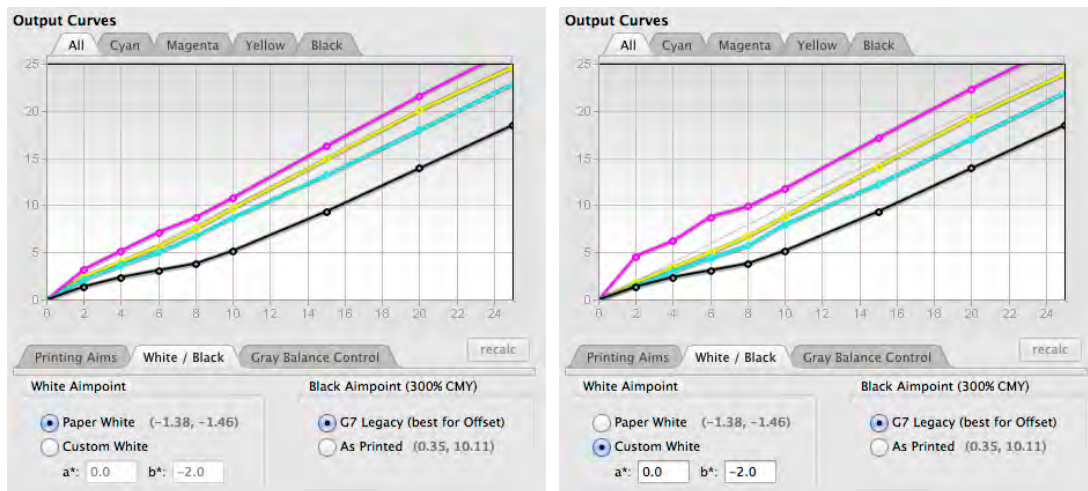


Figure 5.35 The effect of different White Aimpoint settings

**CAUTION:** Custom white deviates from the G7 gray balance principle, and should be used with caution. If the Custom White values are very different from the measured  $a^*$ ,  $b^*$  (shown to the right of the Paper White button), undesirable color shifts may occur and the result may fail G7 tolerances.

### Using White Aimpoint with an ICC Profile

An ICC profile made through a **Custom White** calibration curve will defeat the effect, unless **Absolute Colorimetric** rendering is used. If you want the **Custom White** point to remain visible with an ICC profile, print the characterization target through curves made with the default **Paper White** setting, then after creating the profile, re-calibrate the printer with the desired **Custom White** setting.

### Black Aimpoint (300% CMY)

When the **Black Aimpoint (300% CMY)** is set to **G7 Legacy**, gray balance tries to neutralize the 300% CMY point. If the 300% point is very non-neutral (i.e. strongly colored), gray balance correction may produce very aggressive calibration curves that result in less than ideal printing, for example sharp tone-changes, “plugging” or banding in dark neutrals or saturated color areas.

**CAUTION:** The **As Printed** button is only meant for printing systems in which 300% CMY balance cannot be adjusted, e.g. toner-based digital. **Do NOT use As Printed with an offset press!** Instead adjust the press to make 300% CMY as neutral as possible, prior to calibrating.

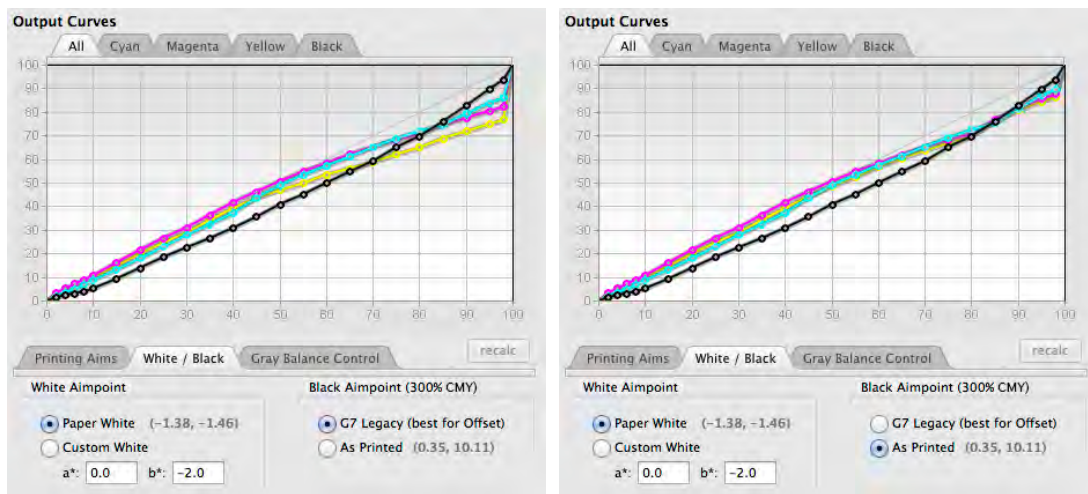


Figure 5.36 Typical effect of Black Aimpoint **G7 Legacy** (left) and **As Printed** (Right)

The **As Printed** button changes gray balance above 50% to aim for the system’s “native” 300% CMY color, instead of G7’s arbitrary 0 a\*, 0 b\* values. With a strongly colored 300% CMY patch, **As Printed** should yield smoother calibration and better ICC profiles, with little change in appearance.

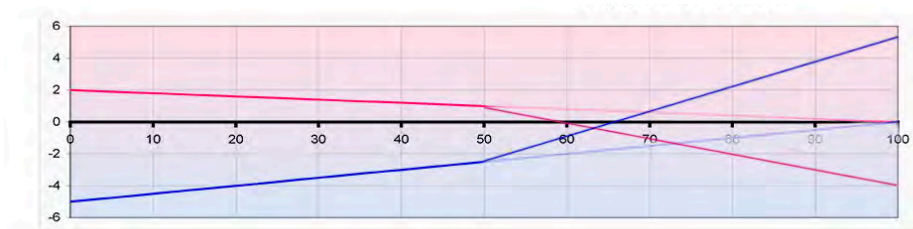


Figure 5.37 Legacy G7 target gray balance (light) vs **As Printed** targets (bold) for 300% = 4 a\*, 4.6 b\*

**CAUTION:** The **As Printed** option may cause the system to fail G7 and should only be used when the 300% patch cannot be made neutral by physical press or ink adjustments.

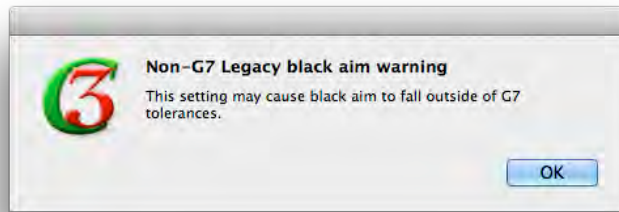


Figure 5.38 Warning message when *As Printed* is selected

## The Printing Aims Tab

The **Printing Aims** tab shows the HC (25%), HR (50%) and SC (75%) aim values for the calibrated device in either ND or L\*. The **Printing Aims** are process control aim values that allow you to test your device's NPDC performance during production.

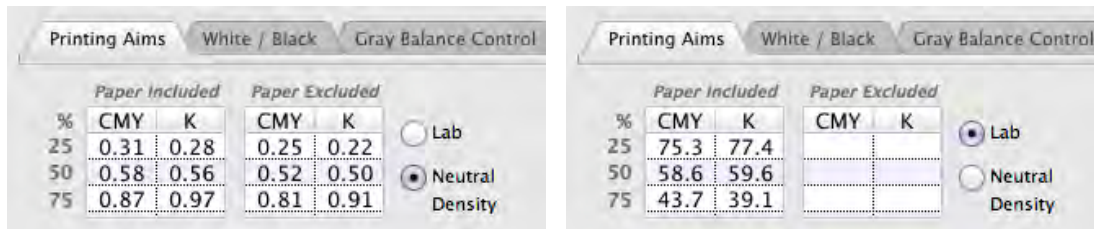


Figure 5.39 Printing Aims in ND (left) and L\* (right)

With the ND button active the **Printing Aims** values are neutral density (ND) values. If you prefer to monitor gray aims in L\*, click the *Lab* button. (L\* aims are only given with paper included.)

*Note: Before using these values for process control, check that your process control measuring device (e.g. spectro-densitometer) measures the same values as the device that read the P2P, by measuring the same sample print with both devices.*



## 6

## 6. Verify

### Curve3 Verify-Only Option

Curve3 can be purchased as an affordable “Verify-only” mode. If your version only allows the Verify function, a single gold ball will show in the lower right side of the splash screen.



Figure 6.1 Curve3 splash screen with only the Verify function licensed

The same Verify functionality appears in all other licensing levels of Curve3, hence the following instructions apply to all Curve3 licensing levels.

### G7 Verify Mode

If the G7 method is selected, the **Verify** window verifies the accuracy of a calibrated device compared to the G7 NPDC curves and gray balance, and to the ink solids defined by the Target Color Space selected in the list.

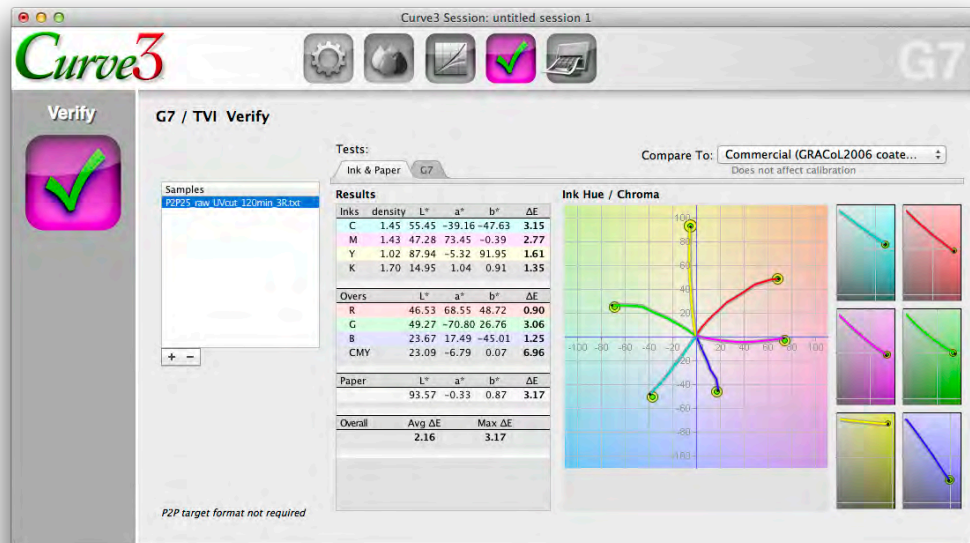


Figure 6.2 The G7 Verify window (Ink & Paper tab)

### Samples list

Sample files can be loaded by dragging them into the **Samples** list, or by clicking the Plus “+” button below the Samples list and navigating to the file location. If multiple samples are loaded in the Samples list, results are only shown for the selected item.

Sample files can be measured from almost any target including, but not limited to:

- The P2P target
- The IT8.7/4 target
- The IDEAlliance ISO 12647-7 target

For more details about compatible targets see *Section 4: Ink Test*.

### Ink & Paper Test

The **Ink & Paper** tab of the Calibrate **Analyze** window is similar to the **Ink Test** window. For a complete explanation of all features see *section 4 Ink Test*.

### G7 tab

Selecting the **G7** tab reveals a **Curve Shape (delta-L\*)** graph, a **Gray Balance** graph and a chart of delta results.

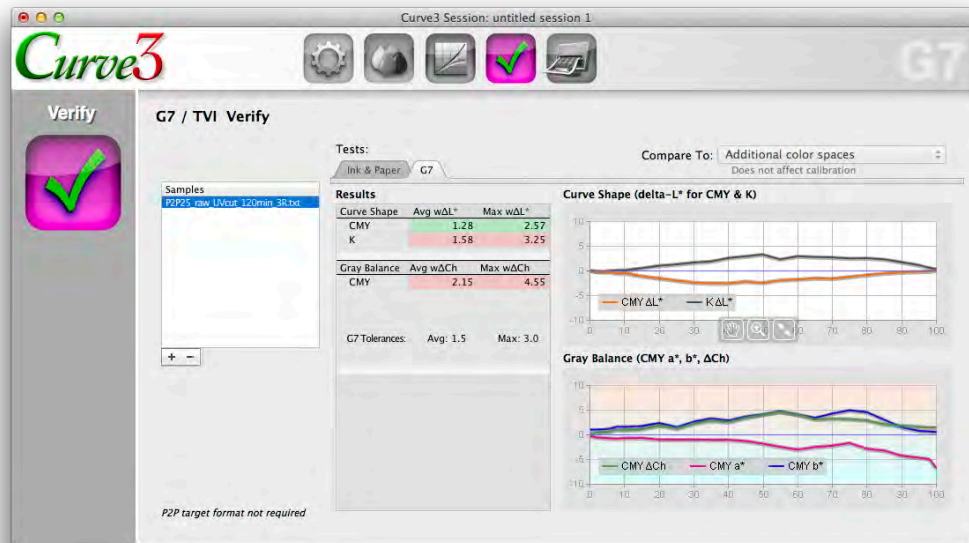


Figure 6.3 The G7 Verify window (G7 tab)

### Results chart

The **Results** chart shows average and maximum weighted delta-L\* ( $w\Delta L^*$ ) for the CMY and K NPDC gray scales, and average and maximum weighted delta-Ch ( $w\Delta Ch$ ) for the CMY scale.

*Note:  $\Delta Ch$  is the same metric as  $\Delta F^*$  used in Curve2.*

### Curve Shape (delta-L\*) graph

The **Curve Shape** graph has two lines representing the weighted delta-L\* deviation of the CMY (orange) and black (gray) scales compared to the ideal G7 NPDC target values.

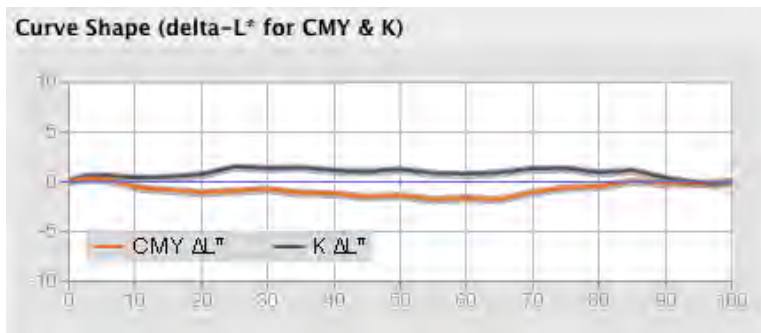


Figure 6.4 The Curve Shape (weighted delta-L\*) graph

### Gray Balance graph

The **Gray Balance** graph has three lines. The pink and blue lines show the absolute  $a^*$  and  $b^*$  values respectively of the CMY scale. The green line shows the relative color error in delta-Ch of the sample compared to the ideal G7 gray balance target values.

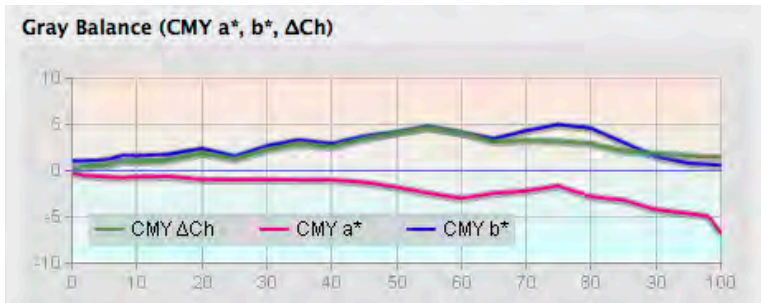


Figure 6.5 The Gray Balance graph

### Weighting Function

A common weighting function defined by IDEAlliance is applied to  $\Delta L^*$  and  $\Delta Ch$ . At the time of writing the function uses the formulae:

$$w\Delta L^* = \Delta L^* \times (1 - \max(0, (\% - 50)/50 \times 0.75))$$

$$w\Delta Ch = \Delta Ch \times (1 - \max(0, (\% - 50)/50 \times 0.75))$$

... and can be visualized graphically as follows:

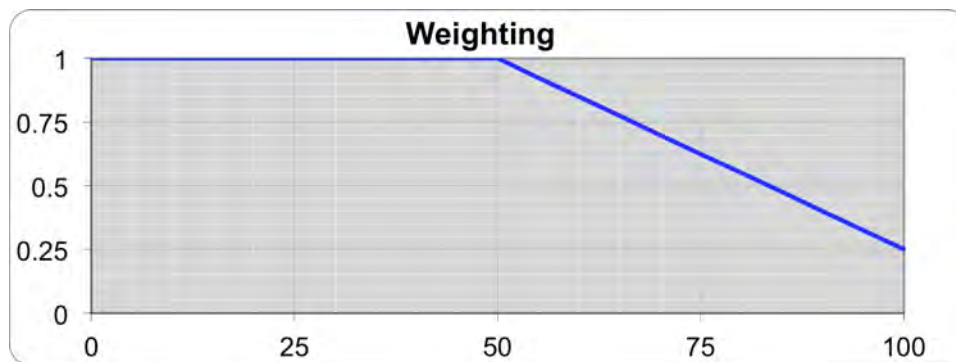


Figure 6.6 The official IDEAlliance weighting function (as of April 2013)

### G7 Tolerances

Tolerances for G7 gray balance and G7 NPDC are established by IDEAlliance and shown below the results panel. At the time of writing the average error in both units must be 1.5 or less and the maximum error must be 3.0 or less.

*Note: If tolerances or weighting function are changed by IDEAlliance, a new version of Curve3 will be released to reflect those changes.*

### TVI Verify Mode

If the TVI method is selected, the **Verify** window verifies the accuracy of the ink solids defined by the Target Color Space selected in the **Compare To:** list. Actual TVI values are also listed for comparison to the target values in external software such as Microsoft Excel.



## 7. VPR (Virtual Press Run)

This section explains the purpose and operation of the optional VPR module.

### Activating the VPR Module

The VPR module can be specified with the original Curve3 purchase or upgraded later. When licensed, the Virtual Press Run sphere in the splash screen is gold, as shown here.



Figure 7.1 Curve3 splash screen with Virtual Press Run module licensed

### Benefits of VPR

The main purpose of VPR is to eliminate the need for a second press run during press profiling. Normally two runs are required, one to calibrate and a second to produce the characterization data. By eliminating the second run, **Virtual Press Run** saves both time and money.

Additional benefits include improving the quality of existing characterization data and expanding Curve3 functionality. For example, VPR can:

- Reduce measured differences between the calibration and characterization Runs



- Eliminate conflicting data values caused by uneven printing or measuring
- Apply G7 (or any other Curve3 calibration function) to a pre-existing characterization data set not originally printed with G7 calibration
- Optimize or “smooth” existing characterization data without changing its calibration
- Synchronize, and/or optimize calibration in ESKO’s 7-color CMYK+OGV press data

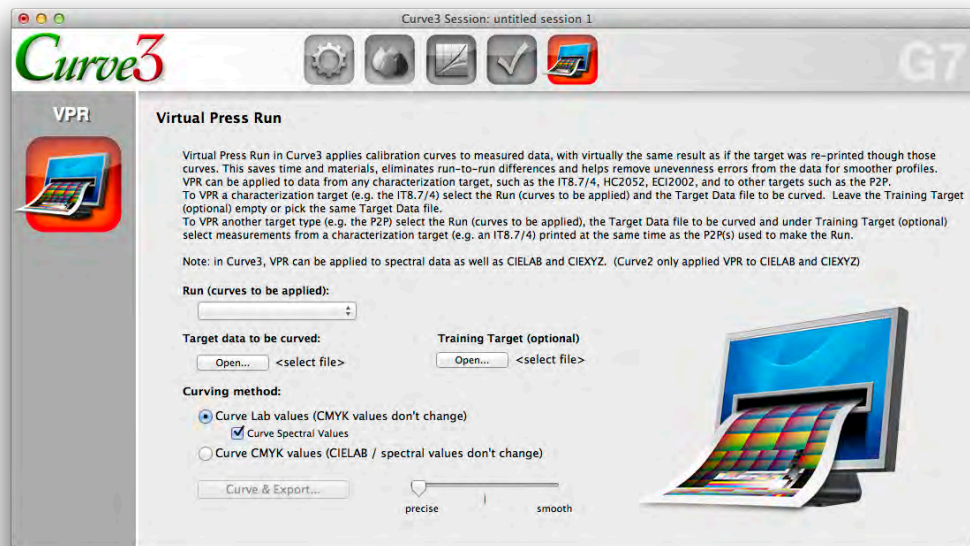


Figure 7.2 The Virtual Press Run window

**Note:** If the VPR function is not licensed the **Curve & Export** button will be inactive

## Difference between Curve2 and Curve3 VPR

In **Curve3**, VPR can export curved data in spectral, Lab and XYZ modes. **Curve2** only exported Lab or XYZ data.

## How VPR Works

In normal use, VPR requires data from both a P2P target and a characterization target (IT8.7/4 or similar), both printed together and/ or exactly the same way. Correction curves calculated from the P2P target are applied to the characterization data set to produce a new data set similar to what would have resulted if the target was re-printed through the G7 correction curves.

From the new characterization data, an ICC profile can be produced representing the device in its optimum calibrated state. This profile can be used to produce proofs that predict how the device will look through the calibration curves, or to convert images into the device’s calibrated CMYK color space.

### Understanding the VPR concept

Conceptually, VPR is similar to assigning an ICC profile to a CMYK text file in CHROMiX ColorThink™, or assigning a CMYK profile to an image in Photoshop, using the absolute colorimetric intent. However instead of a real ICC profile, Curve3 only needs the characterization



data from which an ICC profile would be made. Those characterization data are modified by the calibration curves in the user-selected Run.

By default, VPR looks for characterization data (CIELAB or spectral) in the **Target data to be curved** file.

## Target data to be curved:

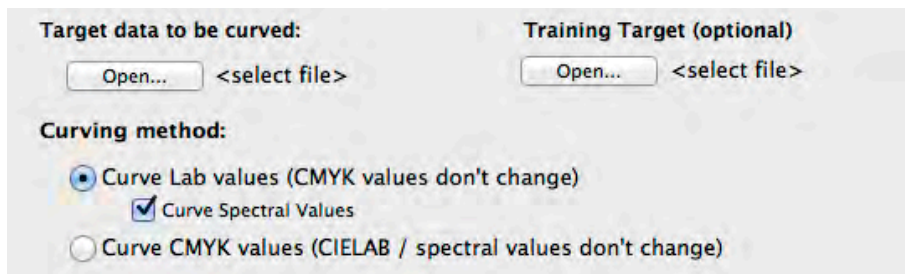


Figure 7.3 The main Virtual Press Run controls

If the **Target data to be curved:** file is a characterization target such as the IT8.7/4 or an HC2052, no separate **Training Target** is needed (it can be left blank).

If the **Target data to be curved:** file is not a characterization target, for example it comes from a P2P, a separate **Training Target** will improve VPR accuracy.

If the **Target data to be curved:** file contains no colorimetric data (only CMYK values) a **Training Target** MUST be selected, otherwise the exported file will only contain CMYK values.

## Training Target

If a **Training Target** is selected, VPR takes the characterization data from that instead, and ignores everything in the **Target data to be curved** file except its CMYK values.

Once a **Training Target** file is selected, it takes precedence over the **Target data to be curved** file for the rest of that Session. You cannot delete the **Training Target**, but you can replace it with another file.

**CAUTION:** For VPR to work correctly the characterization target(s) must be printed in exactly the same way as the P2P target(s) used to create the calibration curves. Ideally both should be printed together in the same Run.

## Curving Method

VPR can be applied by curving either the CMYK values or the Lab values in the characterization data file selected under the **Target data to be curved** menu.

### Curve Lab values

When **Curve Lab values** is selected, the CMYK values in the Target data file remain unchanged but the measured Lab values are altered to what would have been produced if a second run had been printed through the Output Curves. **Curve Lab values** results in a modified characterization data file in the standard CGATS format that should be accepted by all profiling software.

### Curve Spectral values

**Curve Spectral Values** does the same as Curve Lab values, but if the data file contains spectral data, modified spectral values are exported. (Curve2 VPR converted spectral data to Lab.)

### Curve CMYK values

When **Curve CMYK values** is selected, the Lab values measured from the printed Target are unchanged but the CMYK values are altered by the Output Curves in the selected Run. Curve CMYK values results in non-standard CMYK values which may not work in some profiling software, hence **Curve Lab Values...** is the default option.

## Applying VPR to a Characterization Target

VPR can be applied to data measured from a characterization target such as the IT8.7/4 or HC2052, or any custom characterization target saved in the CGATS file format.

To apply VPR to a characterization target:

- Select the curves you want to apply from the **Run (Curves to be Applied)** list
- Select the Target data file with the **Target data to be curved** button
- Select the **Curving method** (normally **Curve Lab values**)
- Set the Quality slider (normally “**precise**” is best)
- Click **Curve & Export** and save the new characterization data file in a suitable location

## Applying VPR to Non-Characterization Data

VPR can be applied not just to a characterization target, but to any data file, such as the P2P or the IDEAlliance ISO 12647-7 Control Target. Using the **Curve Lab values** option, best results will be had by selecting a characterization target in the **Training target** list from the same run. Using the **Curve CMYK** option, no training target is needed.

To apply VPR to a non-characterization target:

- Select the curves you want to apply from the **Run (Curves to be Applied)** list
- Select the Target data file with the **Target data to be curved** button
- Select the **Curving method** (e.g. **Curve Lab values**)
- For **Curve Lab** or **Curve Spectral** values, select a suitable Training target file
- Click **Curve & Export** and save the new data file in a suitable location

## Calibrating Without a P2P Target

If no P2P target was printed, VPR can extract P2P values from a characterization data set. The resulting P2P data can be used to post-calibrate a pre-existing characterization data set to the G7 specification (or a TVI or Special Ink calibration). The process begins with a *Null Calibration Run*:

### Creating a Null Calibration Run

- Create a new Run and load any available P2P data file. (*The P2P does not have to be from the same press run, or even the same printing process*)
- Name this Run “Null Run” for clarity
- In the **Create Curves** window, select **50%** in the **Control Points** list
- Highlight the 50% Control Point and click the “-“ button to delete it
- The resulting **Output Curves** graph should be a straight line from 0 to 100

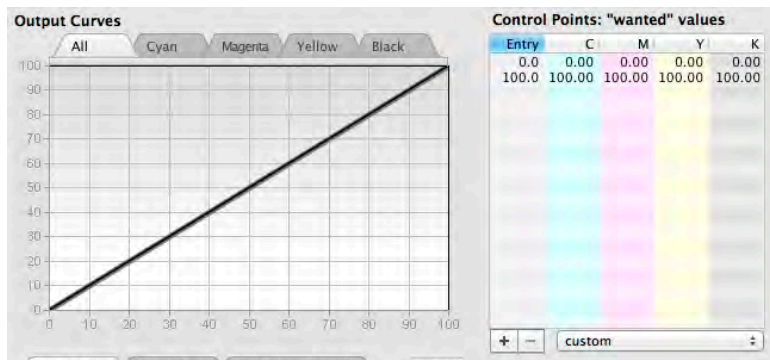


Figure 7.4 A Null Calibration contains only 0% and 100% Control Points

### Extracting P2P data from a characterization data set

- Open the **VPR** window and select the Null Run in **Run (curves to be applied)**:
- Select any P2P data file in **Target data to be curved** (does not have to be from the same press, or even the same printing process)

**Note:** If you want to extract spectral data, the P2P file must already contain spectral data

- Load the data set from which you want to extract P2P data in **Training Target (optional)**:
- Select **Curve Lab values** or **Curve Spectral Values**:
- Select **Precise**, click **Curve & Export...** and save the data with a name indicating the data from which it came, such as "P2P VPR from (data set)"

### Using the extracted P2P data

- Create a new run and load the P2P data extracted from the characterization data
- Select the required mode (G7, TVI or Special)
- Adjust the settings as required (number of control points, etc.)
- Follow the steps above in *Applying VPR to a Characterization Target*

## OneRun Targets

To save space and time and to reduce measurement error, Curve3 with VPR can use a single hybrid target that combines the P2P25 with a characterization (profiling) target such as the IT8.7/4 or the HC2052F. Redundant patches can be removed to minimize target size.

When measurements of a single OneRun target are fed into Curve3, the individual targets are automatically extracted. The P2P patches are used for curve calculation and the remaining patches can be curved by the VPR function to make a new characterization data set for profiling.

### Available OneRun Targets

Pre-made OneRun targets are available that incorporate:

- The P2P25 and the IT8.7/4 target (most popular for press profiling)
- The P2P25 and the HutchColor HC2052F target (for greater precision).

Contact CHROMiX <support@chromix.com> or 866-247-6649 and specify:

- Target size and layout (based on the size of your press and your measuring equipment)
- IT8.7/4 or HC2052F version
- Measuring software: Colorport, MeasureTool, or i1Profiler

### Using OneRun Targets

- Print and measure the OneRun target as normal and import the values into a Curve3 Run
- Save the P2P and the characterization targets data

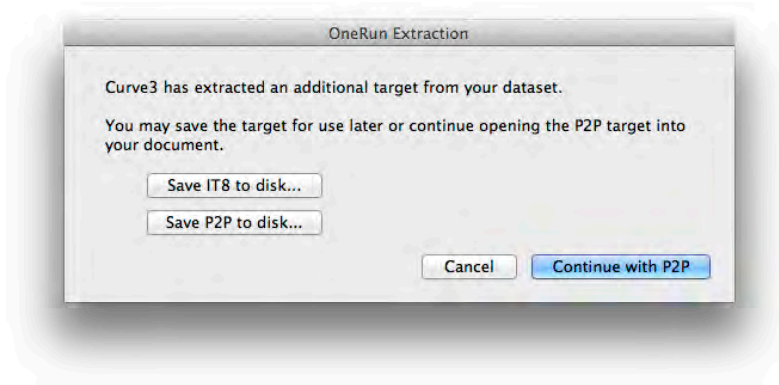


Figure 7.5 A Curve3 dialog lets you save the component targets

- After saving the targets, click **Continue with P2P** to enter your G7 data into a Run
- After creating your calibration curves, click the **VPR** icon (the VPR option must be licensed)
- Choose the run you just made and the saved target data then click **Curve & Export...**

VPR will apply the curves to the measurement data of the characterization (profiling) target. A profile made from this curved data will reflect the condition your press after G7 calibration.

## Optimizing or Smoothing Characterization Data

One of VPR's most valuable benefits is removing anomalies or "noise" in the measured data points of a characterization data set. For example, two patches with the same CMYK percentages that measure differently (due to uneven printing or measuring) will have identical measurements after VPR. The effect is roughly similar to averaging many targets, but with the advantage of reducing spatial errors caused by ink variations across the target.

*Note: Any data can be optimized whether or not it was printed with Curve3 calibration*

The resulting characterization data should produce a smoother profile, with less chance of banding or quantization errors, as shown in the following illustrations.

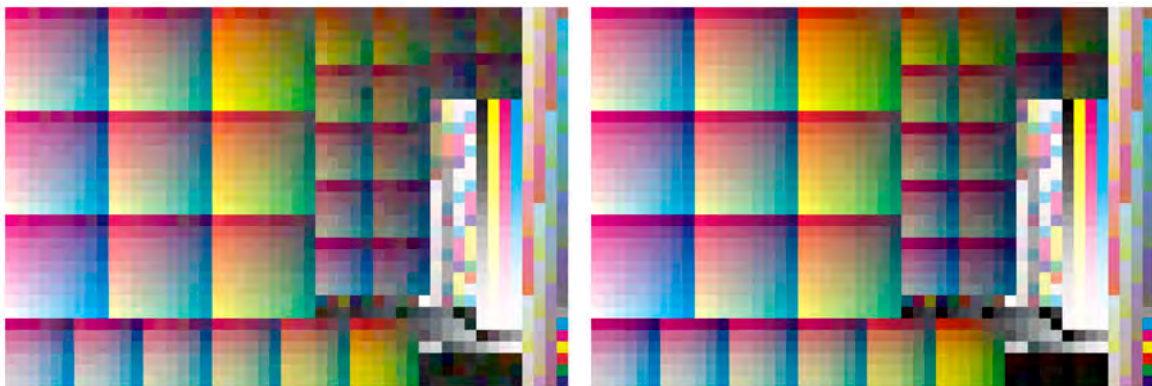


Figure 7.6 The IT8.7/4 target with a profile made from noisy data (left) and the same data after VPR-optimization (right)



Figure 7.7 Banding from a profile made from noisy data (left) and after optimization (right)

### Optimizing the Data

- Create a Null Run (see *Creating a Null Calibration Run*)
- Open the **VPR** window and select the Null Run in **Run (curves to be applied):**
- Load the data set you want to optimize in **Target data to be curved:**
- If the data set contains spectral values, click **Curve Spectral Data** unless you prefer the exported file to contain Lab data instead
- Select **Precise**, click **Curve & Export...** and save the data in a suitable location with a name similar to the original name, plus a word like “optimized” or “smoothed”
- Create an ICC profile from the optimized data in the software of your choice

**NOTE:** If a file written by Curve3 does not have the same “header” (text above the **BEGIN\_DATA** line) as the original file, your profiling software may reject it. If so, copy the rows between **BEGIN\_DATA** and **END\_DATA** in Microsoft Excel and paste them over the same locations in a **COPY** of the original file, then save it as a “.txt” file. You may also have to edit other fields.





## 8. G7 Calibration Workflow

This section takes you step-by-step through a typical G7 calibration workflow in Curve3.

*Note: These notes assume you are already familiar with Curve3's controls and functions as described in the previous sections.*

### Workflow Summary

- Print one or more P2P targets
- Measure the P2P targets
- Load measurement files into Curve3
- Adjust gray balance and other parameters
- Select required Control Points
- Apply Control Points values to the RIP
- Print a new P2P Target through new curves
- Verify G7 calibration accuracy

### Print the P2P target(s)

(See Appendix: A – Target Printing.)

### Measure the P2P targets

(See Appendix: B – Target Measuring.)

### Load measurement files into Curve3

- Click on **Run 1 - Calibration** in the Runs list.
- If the Measurements panel is not visible, click on the **Measurements** tab to reveal it.
- In the Measurements panel either drag and drop P2P measurement file(s) into the Measurements list, or click on the Plus “+” button below the list and browse for the files.



## Select Based On: Status

If this is a new calibration using linear plates or starting curves, leave the **Based On:** list in the **Create Curves** window set to **Linear (none)**.

If the press run was made through a non-linear RIP curve – e.g. a previous linearization curve, you can select that curve in the **Based On:** list, (see *Section 5. The Based On List*).

## Adjust gray balance parameters

- Click on the **Create Curves** tab.
- Open the **Gray Balance Control** tab and set the desired threshold, etc.

## Choose Control Points

In the **Control Points** list select the required number and values of curve points. Start with a pre-set list and add points as necessary using the Plus + button below the list.

## Apply Control Points values to the RIP

To type the Control Point correction values into your RIP you can either read them directly from the **Create Curves** window, or print the list of curve points in a **Calibration Run Report**.

If your RIP accepts digital files directly from Curve3, select the RIP name in the **Export...** list, then click **Export...** and import the resulting file into your RIP.

For more information see *Section 11: Applying Correction Values*.

## Print a new P2P Target through new curves

To confirm the Control Points were effective, print one or more new P2P targets through the new RIP curves. Be sure to use identical ink, substrate and conditions (except for the new RIP curves) as when you printed the first P2P target.

## Verify G7 calibration accuracy

G7 accuracy can be verified in Curve3 either by creating a new (Verification) Run in the **Calibration** window or by loading a measured target in the **G7 Verify** window.

### Verifying G7 calibration with a new Run

Note that all graphs and results displayed in the new Verification Run are based on an average of all selected samples in the list, not an average of all samples.

- Under the **Runs** list click the “+” symbol to create a new Run. The default name will be **Run (#) – Verification(#)** but you can change the name by clicking on it and typing.
- Load one or more P2P measurement file(s) printed through the RIP curves into the **Measurements** list.
- Click on the **Analyze** tab.
- Click on **G7** in the **Tests** menu.
- Check the **Curve Shape (delta-L)** graph.
- Check the **Gray Balance (delta-Ch)** graph.
- Check the **delta-L\*** and **delta-Ch** values in the **Results** chart are acceptable

### **Using the G7 Verify window**

Note that all graphs and results displayed in the G7 / TVI Verify window run are based on a single sample highlighted in the list.

- Click the **Verify** button to open the G7 Verify window.
- Load a measurement file from a new target that was printed through the RIP curves. Note that the target does NOT have to be a P2P, however depending on what target was used some graphs may be invisible or may not display correctly.
- Click the G7 tab.
- Check the **Curve Shape (delta-L)** graph.
- Check the **Gray Balance (delta-Ch)** graph.
- Check the **delta-L\*** and **delta-Ch** values in the **Results** chart are within acceptable tolerances – correct numbers have a light green background



## 9. TVI Calibration Workflow

This section takes you step-by-step through a typical TVI calibration workflow in Curve3.

*Note: These notes assume you are already familiar with Curve3's controls and functions as described in the previous sections.*

### Workflow Summary

- Print one or more P2P targets
- Measure the P2P targets
- Change the calibration mode to TVI in the Setup window
- Select the desired TVI target curves for each ink
- Load measurement files into Curve3
- Select required Control Points
- Apply Control Points values to the RIP
- Print a new P2P Target through new curves
- Verify TVI calibration accuracy

### Print the P2P target(s)

(See Appendix: A – Target Printing.)

### Measure the P2P targets

(See Appendix: B – Target Measuring.)

### Change Calibration mode to TVI

In the **Setup** window change the **Method:** to **TVI**.

## Select TVI Target Curves

Select the desired TVI aim curves for each channel. You can choose different aim curves for each channel from the six standard ISO 12647-2 curves, A through F, representing legacy printing from positive and negative film-based plates, or you can load custom TVI curves as follows:

## Working with custom TVI Target Curves

With custom TVI Target Curves you can imitate the TVI of a previous press run or a custom (non-standard) press condition. To create a custom TVI reference curve set, see *Appendix: F. Custom TVI Curves*

- Select the custom TVI target curve in the **Load Custom TVI** list in the Setup window - this replaces all the target curves for C, M, Y and K
- If you want to use one of the standard ISO curves for one or more inks, first load the Custom Target Curve set, then select the desired ISO curve for that individual ink.

## Load measurement files into Curve3

- Click on **Run 1 - Calibration** in the **Calibrate runs** list.
- If the Measurements panel is not visible, click on the **Measurements** tab to reveal it.
- In the Measurements panel either drag and drop P2P measurement file(s) into the **Measurements** list, or click on the Plus + button below the list and browse for the files.

## Choose Control Points

In the **Control Points** list select the required number and values of curve points.

## Leave Gray Balance ON

The **Gray Balance** switch controls whether three separate RIP values are created for C, M and Y or just one. If Gray Balance is ON, the desired TVI curves will be matched with different RIP curve values for each ink. If Gray Balance is OFF, the Cyan RIP curve values will be copied to Magenta and Yellow and one or more of the individual inks may not match their desired TVI curves.

## Apply Control Points values to the RIP

To type the Control Point correction values into your RIP you can either read them directly from the **Create Curves** screen, or print the list of curve points in a **Calibration Run Report**.

If your RIP accepts digital files directly from Curve3, select the RIP name in the **Export...** list, then click **Export...** and import the resulting file into your RIP.

For more information see *Section 11: Applying Control Point Values*.

## Print a new Target through new curves

To find out if the Control Points are effective, print one or more new P2P targets through the new RIP curves. Be sure to use identical ink, substrate and conditions (except for the new RIP curves) as when you printed the first target.

## Verify TVI calibration accuracy

TVI accuracy can be verified in Curve3 either by creating a new Verification Run in the **Calibrate** window or by loading a measured target in the **Verify** window.

### *Verifying TVI calibration with a new Run*

Note that all graphs and results displayed in the new Verification run are based on an average of all selected (checked) samples in the list.

- Under the **Runs** list click the Plus “+” symbol to create a new Calibration Run. The default name will be **Run (#) – Verification(#)** but you can change the name by clicking on it
- Load one or more P2P measurement file(s) into the Measurements list
- Click on the **Analyze** tab
- Click the **TVI** tab
- Check that the CMYK TVI curves match the target TVI curves



# 10

## 10. Special Ink Calibration Workflow

This section takes you step-by-step through a typical Special Ink calibration workflow in Curve3.

*Note: These notes assume you are already familiar with Curve3's controls and functions as described in the previous sections.*

### Workflow Summary

- Print one or more P2P targets using any desired ink colors in place of the normal Cyan, Magenta, Yellow or Black inks
- Measure the P2P targets
- In the Setup window change the calibration mode to **Special Inks**
- Load measurement files into Curve3
- Select required Control Points
- Apply Control Points values to the RIP
- Print a new P2P Target through new curves
- Verify calibration accuracy

### Print the P2P target(s)

(See Appendix: A – Target Printing.)

### Measure the P2P targets

(See Appendix: B – Target Measuring.)

### Change Calibration mode to Special Inks

In the **Setup** window change the **Curve Method:** to **Special Inks**.

## Load measurement files into Curve3

- Click on **Run 1 - Calibration** in the **Calibrate runs** list
- If the Measurements panel is not visible, click on the **Measurements** tab to reveal it
- In the Measurements panel either drag and drop P2P measurement file(s) into the Measurements list, or click on the Plus “+” button below the list and browse for the files

## Choose Control Points

In the **Control Points** list select the required number and values of curve points.

## Ignore the Gray Balance Switch

The **Gray Balance** switch has no effect in Special Inks mode.

## Apply Control Point values to the RIP

To type the Control Point correction values into your RIP you can either read them directly from the **Create Curves** screen, or print the list of curve points in a **Calibration Run Report**.

If your RIP accepts digital files directly from Curve3, select the RIP name in the **Export...** list, then click **Export...** and import the resulting file into your RIP.

For more information see *Section 11: Applying Control Point Values*.

## Print a new Target through new curves

To find out if the Control Points are effective, print one or more new P2P targets through the new RIP curves. Be sure to use identical ink, substrate and printing conditions (except for the new RIP curves) as when you printed the first target.

## Verify Special Ink calibration accuracy

Special Ink accuracy can be verified in Curve3 by creating a new Verification Run in the **Calibrate** window.

### **Verifying Special Ink calibration with a new Run**

Note that all graphs and results displayed in the new Verification run are based on an average of all selected (checked) samples in the list.

- Under the **Runs** list click the Plus “+” symbol to create a new Calibration Run. The default name will be **Run (#) – Verification(#)** but you can change the name by clicking on it.
- Load one or more P2P measurement file(s) into the Measurements list.
- Click on the **Create Curves** tab.
- Check that the CMYK Curve Point values are no greater than approximately +/- 1.0%.



## 11. Applying Calibration Values

The ultimate product of Curve3 is a set of CMYK Control Point values (a.k.a. “calibration curves” or “linearization curves”) that can be applied in several ways:

- In the calibration or linearization section of a CtP (Computer-to-Plate) RIP
- In the calibration or linearization section of a film-setter RIP
- In the calibration or linearization section of a proofing controller or RIP
- In the calibration or linearization section of a digital press controller or RIP
- In the calibration or linearization section of an inkjet print controller or RIP
- In Adobe Photoshop CS4 (or later) Via DLPs (Device-Link-Profiles)
- In Photoshop 6 (or later) via Photoshop Curves

### Transferring Curve Values to a RIP

Most RIPs and printer drivers provide some form of user-accessible calibration system, but how the calibration system works and what type of information it will accept can vary widely. This section offers general advice on applying the Control Point values produced by Curve3 to the RIP or printer driver. Because calibration utilities differ widely, no single set of instructions will apply to all systems and some experimentation may be necessary.

General notes for some specific RIPs are offered in *Section 12, RIP-Specific Notes*. If your RIP is not mentioned, or you feel the notes are incorrect, please submit comments (ideally with screen images) via the **Feedback System...** for inclusion in future updates of this guide.

If you are not sure how to apply the Control Point values to your specific RIP or device, see your RIP’s instruction manual or contact your RIP supplier.

#### **Manual entry**

To type the Control Point values produced by Curve3 into your RIP you can either read them directly from the **Create Curves** screen, or print the list of curve points in a **Calibration Run Report** from the **File** menu or from the **Calibration Run Report** button.

**Digital entry**

If your RIP accepts digital calibration data directly from Curve3, select your RIP's file type in the list, click **Export...** then import the saved file into your RIP. For the latest information on how to import Curve3 calibration data into a specific RIP, refer to the RIP's instructions.

**Basic Calibration Principles**

Curve3 assumes that the calibration or linearization system controls the behavior of three or four individual CMYK (or CMY) colorants (inks) via separate 1-dimensional curves or LUTs (look-up tables) for each ink. If your printer does not use 1-D calibration curves, or requires more than four calibration curves, it may or may not be directly compatible with Curve3.

**CMYK+ Calibration**

If your printing system uses more than four inks (e.g. CMYK inks plus light cyan, light Magenta, light black, red, green or blue) *and* requires separate calibration curves for each ink, the four calibration curves calculated by Curve3 will not work correctly.

If your printing system applies calibration curves to CMYK data after initial color management but before any ink-splitting functions, as shown in the diagrams below, the four calibration curves calculated by Curve3 should work correctly.

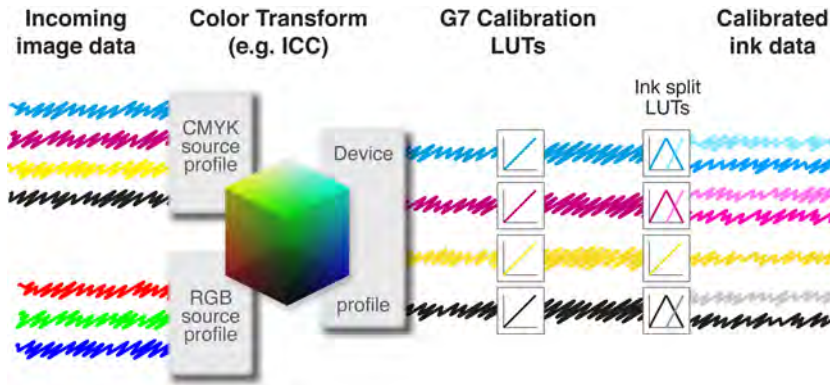


Figure 11.1 Ideal G7 calibration curve location with light and dark inks

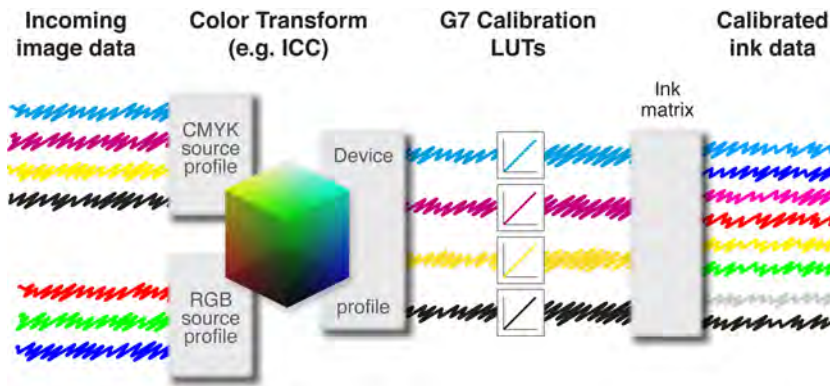


Figure 11.2 Ideal G7 calibration curve location with CMYK plus RGB inks

## Calibration naming conventions

Different manufacturers use different names for the data columns or values their calibration software accepts. The following diagrams illustrate some of the common naming conventions. Typically there are three columns representing the initial file value, the actual value measured on the plate, and the value you want the dot to become after calibration.

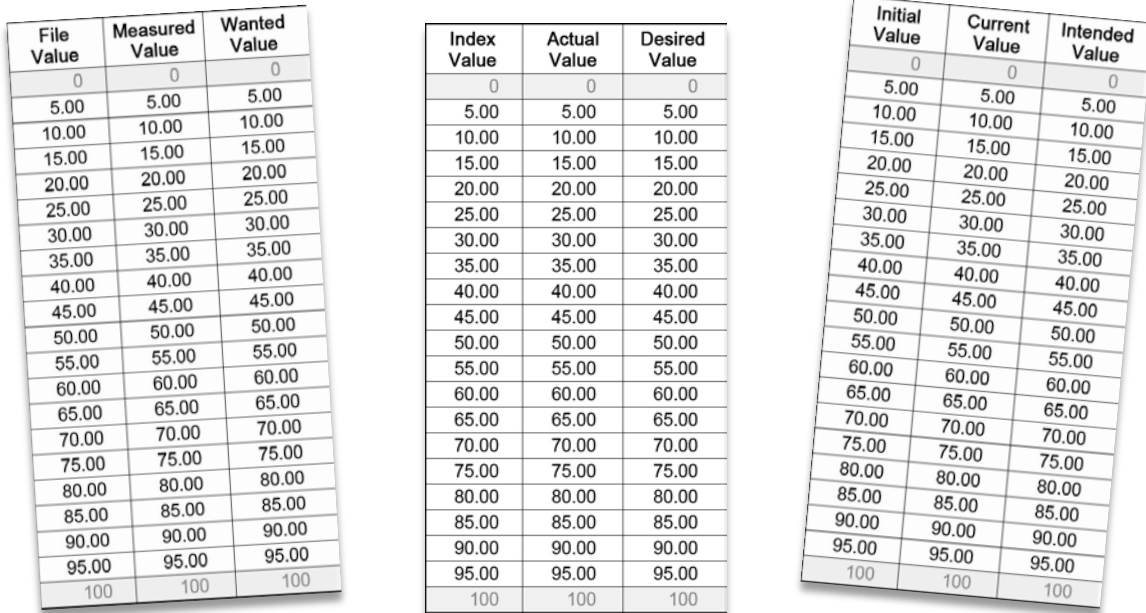


Figure 11.3 Various RIP naming conventions.

## Control points (a.k.a. file values or initial values)

The user interface of a typical RIP calibration or plate linearization system usually begins with a series of control points which may be called ‘file values’, ‘index values’, ‘initial values’, etc. Each control point is named for the image value or halftone dot percentage it controls. In Curve3 these are the **Control Points** listed in the **Create Curves** window

Some rips have a pre-set number of control points. Others allow you to enter your own choice of points. Curve3 has some pre-set Control Point sets and allows you to add or subtract Control Points (see Section 5. – The Create Curves Panel).

## Measured values

In the second column, most plate linearization systems ask you to enter the halftone percentage dot sizes measured on the plate. For Curve3 to work properly, the Measured column values must be the same as the Control Point or File values. If the RIP does not let you enter Wanted values, Curve3 can calculate Measured values instead (see *Measured vs. Wanted Values*).

## Wanted values

In the third column, most plate linearization systems let you enter the ‘Wanted’ percentage values, which may also be called ‘Desired’, ‘Intended’ or ‘Aim’ percentages, etc. By default Curve3 shows Wanted in the **Control Points** window. Usually the wanted percentages will be slightly different for each ink, but on rare occasions, for example if you switch off gray balance, or if the device had no gray balance error, all three CMY Wanted values for any Control Point may be the same.

## Measured vs. Wanted Values

Normally the Control Point values shown in the **Create Curves** window of Curve3 are the percentage values that each Control Point wants to change to calibration. For example, if the 50% Control Point has a Control Point value of 55%, the device wants to output a 55% value for a Control Point, or incoming file value, of 50%. In other words, 50% tones are darkened by 5%. However a few RIPs demand 'Measured' values instead of Wanted values.

### *If the RIP does not accept Wanted values*

If your RIP only accepts Measured values (there is no place to enter Wanted values), click the **Measured** button in the **Setup** window. The Control Point output values will now be calculated as if they were measured directly from single-color scales on the P2P calibration target, and the RIP should determine the correct Wanted values internally.

*Note: The Measured values calculated by Curve3 simulate integrated halftone percentage readings from individual ink scales, but will usually not match percentages measured from the CMY scales of a P2P target, because they include gray balance and NPDC corrections.*

## G7 Calibration vs. Plate Linearization

If your RIP offers two sets of curves for the separate functions of 'Linearization' and 'Tonal editing', G7 calibration can be performed independently of device linearization by loading the Curve3 calibration values in the Tonal editing curves. However if the RIP has only one set of curves for linearization, with no separate editorial tone correction curves, G7 calibration must use the linearization curves, which normally makes separate plate linearization impractical.

In many cases G7 calibration eliminates the need for separate plate linearization, but you still need a way to control plate consistency in production independently of G7 calibration, otherwise a whole new G7 press run would be needed every time the plate system changes.

The following section outlines two methods of controlling plate values independently of G7 calibration, on a RIP that has just one set of curves. Both methods work, but one method may be more suitable depending on your specific RIP and workflow needs.

*Caution: Small differences in measuring geometry, plate processing, plate emulsion color, etc. can produce different plate dot measurements that may not reflect changes in printed dot size. Re-linearization based on plate measurements can sometimes **reduce** printing consistency.*

## Pre-Linearized Method

In this method the plates are linearized before G7 calibration and subsequent plate changes are corrected by adding delta values to the G7 Wanted values without needing a new G7 press test.

*Warning: This method may result in reduced accuracy.*

### *Initial Linearization*

- Prior to G7 calibration, linearize the plates as normal using a video plate reader. This will normally produce different Measured values than Control Point values in the RIP.
- Enter the measured values in the linearization section of the RIP, leaving Wanted values the same as the Control Point values.

*Caution: Avoid linearizing in finer steps than 10%. Smaller steps may introduce errors caused by the measuring instrument or plate artifacts.*



- Expose a new plate and check to see that linearization worked correctly. If it did, the measured plate values should match the Control Point, or File values very closely.

### G7 Calibration

- Perform a careful G7 calibration press run through the Initial Linearization curves created above, and measure the P2P target on one or more good printed sheets.
- Load the P2P measurement file into Curve3 as normal.
- In the **Create curves** window check the **Delta** box.
- Add the delta values shown to the Wanted values in the RIP.
- Expose a new plate and check that the delta values have been achieved on plate, for example if Curve3 asked for a delta of +3% (increase by 3%) at 50%, where the plate previously measured 50% it should now measure about 53%.

### Re-Linearization

Re-linearization should not normally be needed unless there has been a significant change in the plate process, for example a new batch of plates or a change in chemistry or laser power.

- To check linearization, temporarily restore the RIP to a linear state, but don't lose the current Wanted values.
- Expose a new linear plate and measure it.
- If the new Measured values are different from the old Measured values (recorded during the Initial Linearization), enter the new Measured values in the RIP.

*Note: If the plate system has not changed, the Measured values should be within +/- 1% of what they were originally.*

- Restore the current Wanted values to restore G7 calibration.

## Post-Linearized Method

In this method the G7 calibration plates are exposed through a 'Linear' or 'Null' LUT, but the actual plate values are recorded as 'Reference Plate Percentages'. Future plate deviations are corrected by editing the G7 Wanted values until a measured plate matches the original Reference Plate Percentages.

### Initial Plate Setup

- Prior to the G7 calibration run, set the RIP curves so that Control Point, Measured and Wanted values are identical. This should be the same as loading a 'Null' or 'Linear' LUT, but see some important cautions later under *Specific RIP Notes*.
- Produce a set of plates for the G7 calibration run and measure the plate values at 5% or 10% steps.

*Note: The actual Measured values do NOT have to be the same as the file values. For example it is not a problem if the 50% dot measures 45%, 53% or similar.*

- Record these measured values for later reference as Reference Plate Percentages.

### G7 Calibration

- Perform a careful G7 calibration press run through the same Null curves established in Initial Plate Setup, and measure the P2P target on one or more good printed sheets.
- Load the P2P measurement file into Curve3 as normal.

- In the **Create curves** window make sure the **Delta** box is NOT checked.
- Enter the Control Point values shown in Curve3 as Wanted values in the RIP.
- Make a new plate and check that the wanted changes have been made. For example, if Curve3 asked for a 50% dot to reduce to 47%, on the plate the 50% patch should measure about 3% less than whatever it measured without the curves, but it does not have to measure 47%.

*Note: The actual Measured values do NOT have to be the same as the Wanted values shown in Curve3. It is only necessary that the desired RELATIVE changes have been made compared to the original un-linearized plates.*

- If the G7-calibrated plates are correct, measure one or more of the plates at 5% or 10% intervals and record these values as 'Reference Calibrated Percentages' for future use when post-linearizing.

### **Post-Linearization on Top of G7 Calibration**

This method allows you to make small plate linearization changes due to plate batch differences, and is ideal when only one or two curves are used in the RIP. When many curves are affected simultaneously by a basic optical, chemical or mechanical change in the plate system, Post-Linearization Without G7 Calibration (next item) may be more efficient.

- After any change in the plate process, for example a new batch of plates or a change in processing or laser power, measure a plate made through the active G7 calibration LUTs at 5% or 10% intervals.
- Compare the measured percentages with the Reference Calibrated Percentages recorded in G7 Calibration (above).
- If the measured percentages are different from the Reference Calibrated Percentages, add the DIFFERENCE to the G7 Wanted percentages in the RIP. For example if the 50% file value measured 47% in the Reference Calibrated Percentages, but now reads 45%, add 2% to the current Wanted value at 50%.
- Produce and measure a new plate and check that the measured percentages match the Reference Calibrated Percentages.

### **Post-Linearization Without G7 Calibration**

This method is convenient when many G7 curves are affected equally by a basic plate hardware or chemical change that affects all plate workflows. It is also the recommended way to handle plate quality control in general.

- To check the plate process independently of G7 curves, expose a new plate through a Linear or Null LUT.
- Compare the Measured percentages with the Reference Plate Percentages recorded in Initial Plate Setup (above).
- If the Measured percentages are different from the Reference Plate Percentages, adjust laser power or other plate system variables until the measured values match the Reference Plate Percentages.
- Once the measured values match the Reference Plate Percentages, any pre-existing G7 curves should continue to work properly.

## Calibrating Via a DLP

One way of exporting Curve3's Control Points is inside a DLP (Device-Link-Profile). DLPs exported by Curve3 contain precise 1-D CMYK calibration curves, but none of the inter-channel color transformation data normally associated with DLPs. A Curve3 DLP acts like a very precise RIP calibration table which can be used in a RIP or Photoshop. Photoshop can be used either as a low-productivity calibration workflow (if no other RIP solution is available), or to provide a quick and accurate test of Curve3 calibration data prior to installing it in a production RIP.

Note that DLPs exported by Curve3 may or may not work in all RIPs. Be sure to test carefully with your actual workflow before using Curve3 DLPs in production.

### Saving a DLP from Curve3

- In Setup make sure **Wanted** is checked (not **Measured**)

*Caution: DLPs created in Measured mode will NOT produce the desired result.*

- In the **Create Curves** window select **Device Link Profile** in the **Export...** list

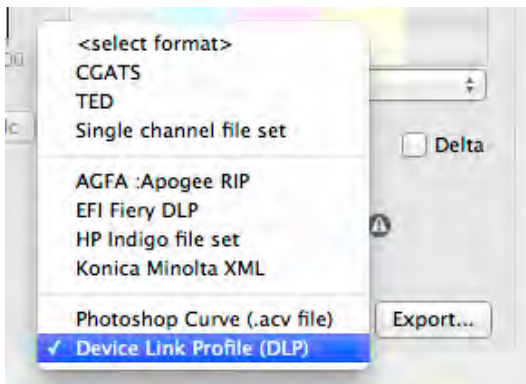


Figure 11.4 Exporting a Device Link Profile

- Click **Export...**
- Give the DLP a recognizable name and save it in your computer's ICC profiles folder

### Choosing Measured vs Wanted with DLPs

Even if the RIP you plan on using the DLP in normally requires Measured values, always build the DLP with the Wanted option selected in Curve3's **Setup** window. This is because a DLP acts separately from the normal RIP calibration curves.

### Using a DLP in a Photoshop workflow

Current versions of Photoshop (CS4 and later) can apply a DLP exported by Curve3. Photoshop CS3 and earlier do not accept DLPs.

A Curve3 DLP can be applied in Photoshop as a low-productivity calibration method if no other RIP solution is available. This is not a very efficient way to apply calibration curves, but it can be useful for converting individual images or for demonstrating Curve3.

A Curve3 DLP is a highly accurate tool by which G7 (or TVI or Special ink) calibration can be applied to an individual image file.

*Caution: For safety, keep a copy of the original image as this process will change pixel values.*

- Open a CMYK file to which you want to apply the DLP

- In the **Edit** menu select **Convert to Profile...** (If Convert to Profile is not visible, first select **Show All Menu Items**)
- Click the **Advanced** button (if visible)
- Under **Destination Space** click the **Device Link** button
- Select the DLP from the **Profile:** list and click **OK**

*Note: This will immediately apply the calibration curves to your image, but may or may not change its appearance, depending on the strength of the curves*

- Save the file under a new name to avoid over-writing the original
- Send the converted file to the device whose calibration curves made the DLP

### **Testing RIP accuracy via Photoshop**

The result of applying a Curve3 DLP in Photoshop should be virtually identical to applying the same control point values in a production printing system or RIP. However in some cases a RIP may produce unexpected results from Curve3 calibration data. This will usually be revealed as a Fail in the **Calibrate – Analyze – G7** window (if using the G7 method) or incorrect curves in the Calibrate – Analyze – TVI window.

If your RIP accepts calibration curves generated by Curve3, but you suspect the curves have not been applied correctly, follow these steps:

- Print an original<sup>1</sup> P2P target with no color management or calibration curves
- Perform a G7 calibration and enter Curve3 calibration values in the RIP
- Also export a DLP with exactly the same Curve3 settings
- Print the same P2P target through the RIP with calibration curves installed but with no other color management
- Measure the printed target and load the data into a new Curve3 Run
- Name the Run “RIP method”
- Open a CMYK image of the same original P2P target in Photoshop CS4 or later
- In the **Edit** menu select **Convert to Profile...** (If Convert to Profile is not visible, first select **Show All Menu Items**)
- Click the **Advanced** button (if visible)
- Under **Destination Space** click the **Device Link** button
- Select the DLP from the **Profile:** list and click **OK**
- Save the file under a new name to avoid over-writing the original
- Print the converted file with the same settings used to print the original P2P
- Measure the printed target and load the data into a new Curve3 Run
- Name the Run “Photoshop method”
- In the **Calibrate** window compare the two Runs using the **Analyze – Ink & Paper** and **Analyze – G7** or (if using the TVI or Special method) **Analyze – TVI** tab
- If the Photoshop method shows a successful calibration but the RIP method does not, carefully check the way you entered the data into the RIP and if necessary, call your RIP provider for help

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<sup>1</sup> Be sure the P2P target image is unprocessed and contains the original CMYK percentages

## Calibrating Via Photoshop Curves

Another way of applying Curve3 calibration curves is via a Photoshop **Curves Pre-set** (.acv) file exported from Curve3. Results should be similar to calibrating with a RIP, but note that the Photoshop Curve will always contain the maximum number of points allowed by Photoshop (14) spaced at 7% intervals, regardless of the Control Point values and spacing you selected in Curve3. If this is a problem, use a DLP instead.

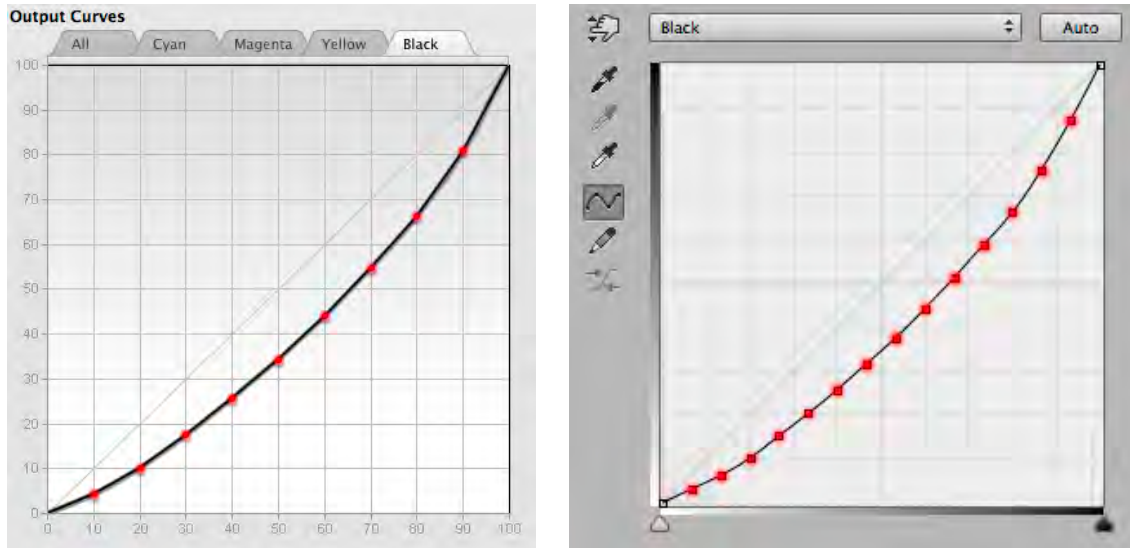


Figure 11.5 User-selected Control Points in Curve3 (left) are translated into 14 equally-spaced Curve points in Photoshop (right) that may not produce the same results as expected.

### Saving a Photoshop curve from Curve3

- In **Setup** make sure **Wanted** is checked (not **Measured**)

**Caution:** Photoshop Curves created in **Measured** mode will NOT produce the desired result.

- In the **Create Curves** window select **Photoshop Curve (.acv file)** in the **Export...** list

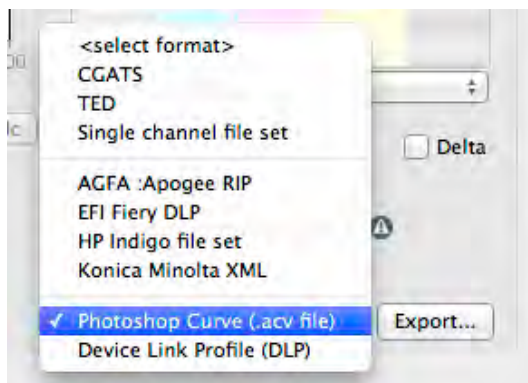


Figure 11.6 Exporting a Photoshop Curve

- Click **Export...**
- Save the .acv file where you can easily find it in Photoshop

### **Using a Curve3-generated Photoshop curve**

Applying a Photoshop curve generated in Curve3 is easy. Although not a very efficient calibration method, it can be useful for occasional work where no RIP is available, or for converting individual images.

*Caution: For safety, keep a copy of the original image as this process will change pixel values.*

- Open a CMYK file to which you want to apply the calibration
- Open the **Curves** dialog either from the **Image – Adjustments...** menu or as an Adjustment Layer in the **Layers** menu
- At the top right of the Curve dialog, click the small icon which reveals more options and select **Load curves Preset...**
- Select the Curves Preset you saved from Curve3. This may or may not change the appearance of your CMYK image significantly, depending on the strength of the calibration curves created by Curve3.
- Apply the curves either by flattening the image (be sure you have a copy) and saving it, or by exporting it as a new file without layers
- Send the curved file to the device whose calibration curves made the .acv file

### **Unit values and precision**

Because an 8-bit pixel has 256 possible tone values, a good calibration system should accept fractional percentage values, as produced by Curve3. If your system only accepts integer percentages (whole numbers like 1%, 2%, 50%) accuracy may be compromised.

Some systems work in 8-bit digital units ranging from 0 to 255 where 255 = white and 0 = black. Curve3 percentages can be converted to 8-bit values using the formula:

$$\text{8bit value} = (100 - \text{output } \%) \times 2.55;$$

A few RIPs accept calibration values in density units, usually with two decimal places. At the present time density values are not provided by Curve3.



## 12

## 12. RIP-Specific Notes

Some tips on how to enter Curve3's Control Point values into specific RIPs. Not all of these notes have been confirmed or endorsed by the respective manufacturers and they are provided as a convenience only, with no guarantee of accuracy.

**CAUTION:** *Due to the continual improvement of third-party software, these instructions may no longer be accurate. Please check with your RIP manufacturer for the latest information.*

### Export File Type List

RIPs that accept files exported from Curve3 are listed in the **Export...** list in **Create Curves**. Some RIPs use generic file types like **CGATS**, **TED** or **Single channel file set**. Other RIPs require custom formats that may be added in future versions of Curve3 as specifications become available.

### Agfa :Apogee

- In **Create Curves – Export...** select **AGFA :Apogee RIP**
- Click **Export...** and save the file with a suitable name (e.g. (name of printer, date)).
- In **:Apogee** select the saved .xml file exported by Curve3

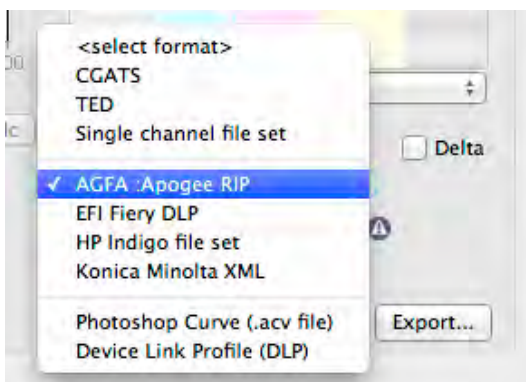


Figure 12.1 The **Export...** file format list with Agfa :Apogee selected

### Caldera

- In **Caldera EasyMedia** print and read the caldera linearization charts, perform ink limiting (if desired) and save the calibration
- At the next screen, print and read a P2P target and import it into a new **Curve3** Run
- In **Create Curves** save the corrections in a CGATS text file, making sure the values are Wanted (not Measured) and NOT deltas
- In **EasyMedia** click the **Previous** button to return to the linearization graphs
- Click on **Open Correction Curves** and import the CGATS text file from Curve 3

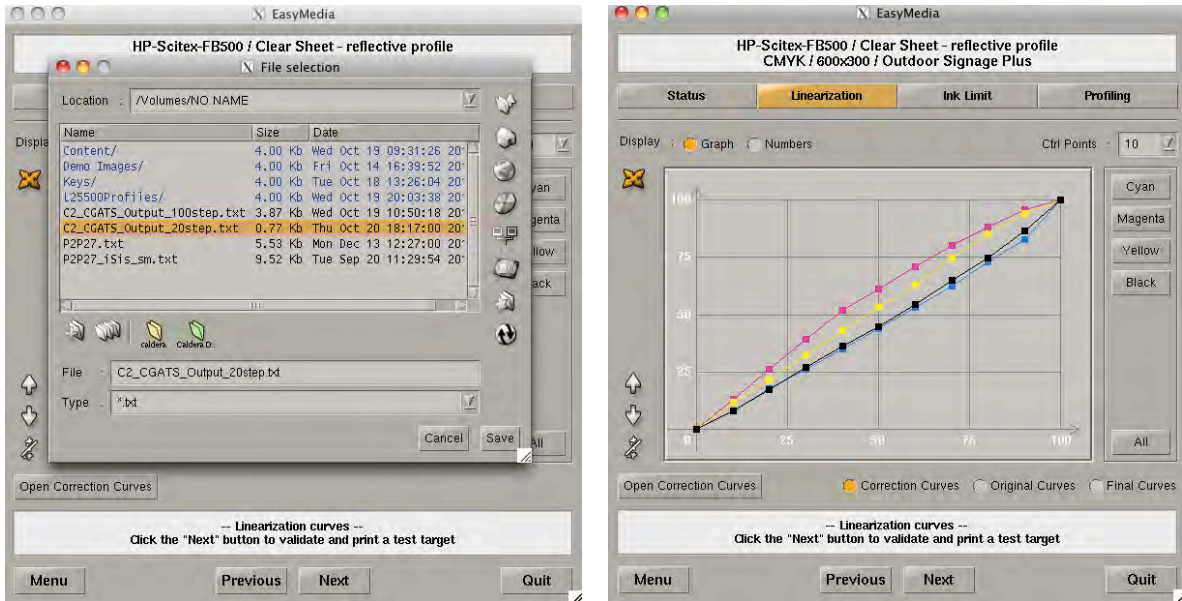


Figure 12.2 Caldera’s import list (left) and correction curves display (right)

- If EasyMedia claims the CGATS file is invalid, open it in Excel and change “SAMPLE\_NAME” to “SampleName” then re-save as Tab-delimited text. (NOTE: Caldera version 9.20 will eliminate this issue)

# media aim points: 1.99 / 2.00				# media aim points: 1.99 / 2.00			
NUMBER OF FILE 6				NUMBER OF FILE 6			
BEGIN DATA FORMAT				BEGIN DATA FORMAT			
SampleID	SAMPLE_NAME	CMYK_C		SampleID	SampleName	CMYK_C	
END DATA FORMAT				END DATA FORMAT			
NUMBER OF SETS 11				NUMBER OF SETS 11			
BEGIN DATA				BEGIN DATA			
A0		0	0	A0		0	0
A1		10	11.22	A1		10	11.22
A2		20	24.55	A2		20	24.55
A3		30	38.05	A3		30	38.05
A4		40	48.74	A4		40	48.74
A5		50	58.57	A5		50	58.57
A6		60	68.16	A6		60	68.16
A7		70	78.04	A7		70	78.04
A8		80	87.73	A8		80	87.73
A9		90	95.35	A9		90	95.35

Figure 12.3 If needed, change SAMPLE\_NAME to SampleName in the CGATS file

- Toggle between *original* and *corrected* curves to confirm that the Curve 3 values seem to have been added to the original curves

- Click **Final Curves** then **Next** to apply the correction curve



Figure 12.4 Caldera's original curves (left) and with Curve3 corrections added (right)

## CREO Prinergy (Harmony Curves)

When printing the first P2P target (whether proofing or plates) do NOT use \*\*\* NONE \*\*\* in either Current or Target. On rare occasions \*\*\* NONE \*\*\* seems to trigger hidden calibration values which are not retained when \*\*\* NONE \*\*\* is replaced by a user-constructed curve, which then causes the G7 process to fail. Symptoms of this failure include unexpected dot values on plate and/or incorrect gray balance or NPDC curves after G7 calibration.

To make the G7 process work reliably in Prinergy, print the first P2P target using your own 'Custom Linear' calibration curve constructed from Current and Wanted curves, as follows:

### Constructing a Custom Linear Current curve in Harmony

- Click **File – New Curve – Current ...**
- In **Current Curve Properties** make sure **Curve Set** is 'CMYK Curves'
- Enter the other required property values
- Click **File – Save Curve As ...** with a suitable name, e.g. 'Custom Linear Current'

### Constructing a Custom Linear Target curve in Harmony

- Click **File – New Curve – Target ...**
- In **Target Curve Properties** make sure **Curve Set** is 'CMYK Curves'
- Enter the other required property values
- Click **File – Save Curve As ...** with a suitable name, e.g. 'Custom Linear Target'

### Constructing a Custom Linear Calibration curve in Harmony

- Click **File – New Curve – Calibration ...**

## EFI

EFI Fiery controllers can accept calibration curves exported from Curve3 as device link profiles (DLPs). There are two basic approaches to applying G7 curves, “Unmanaged” and “Managed”. In the Unmanaged approach, G7 curves are applied without any other color management, typically resulting in a “G7 Grayscale” or “G7 Extreme” compliance level. Unmanaged G7 calibration can also be used as a basis for making custom ICC profiles, which can then be combined with the G7 correction curves into a fully color-managed DLP within the Fiery controller.

The following instructions give an overview of the process. For full details, please consult your Fiery manual or EFI service provider.

### **G7 Curve only (G7 unmanaged):**

This method allows a user to print through the G7 curves alone in an “unmanaged” workflow, resulting in a “G7 Grayscale” or “G7 Extreme” compliance level.

- Warm up the engine and run Fiery Calibration for your chosen media (calibration settings)
  - If no appropriate calibration settings exists for your media / print properties, create a new calibration settings set using Manage Calibration Settings : Create New...
  - Press the Properties button to select and save your Calibration Print Properties (“Settings”), follow all the steps for creating a new Set

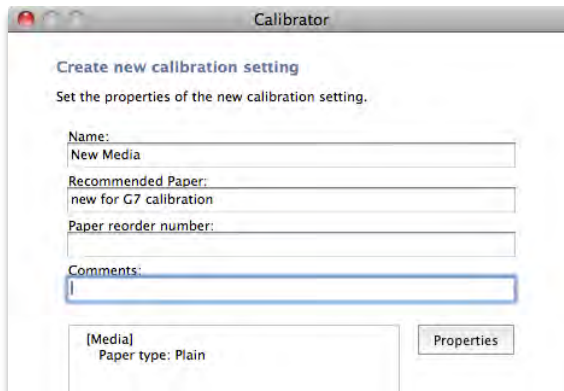


Figure 12.5 Creating New Calibration Settings Set

- In **Color Setup** uncheck “Use media defined profiles if available”
  - Device Center: Color Setup: Color Management: Expert Settings...: Output
  - Set “Default output profile” to your new calibration settings profile
  - Be sure to click Apply in the Color Management Pane

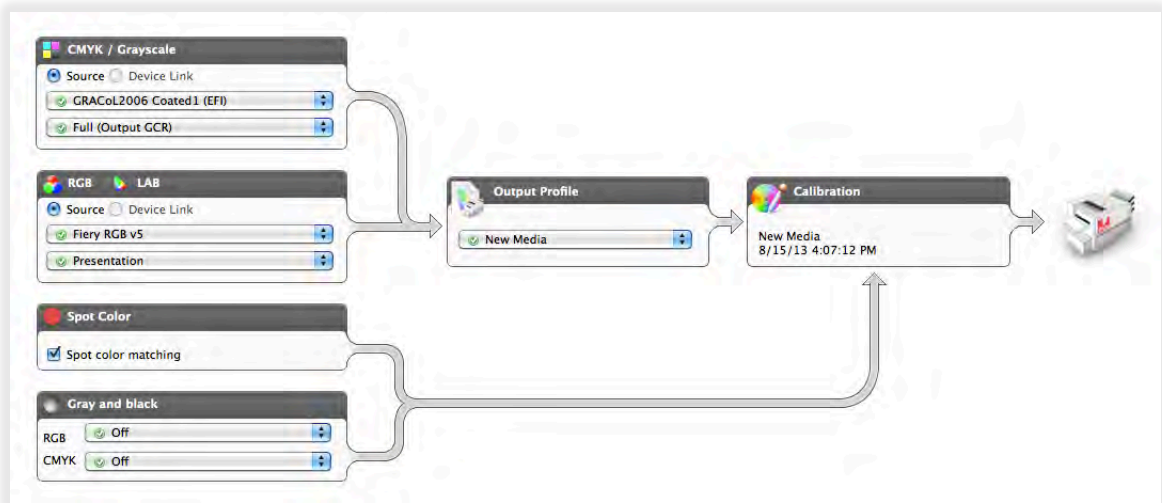


Figure 12.6 Setting New Calibration as Default

- Print the P2P25 target Bypass Conversion
  - Print Properties: Color: Expert Settings...: Color Input: CMYK / Grayscale: Bypass Conversion
  - Print 5 or more copies. If the print area exhibits streaking, ghost images, mottle or unevenness, print more copies and (if possible) rotate half the copies by 180°.
- Measure the P2P25 target(s). If the print area exhibits streaking, ghost images, mottle or unevenness, measure 5 or 6 targets and average them in Curve3.
- Generate G7 correction curves
  - Load one or more P2P measurement files in a new Run
  - For smoother results, click the Smooth button
  - Make sure the Delta option is *NOT* checked
  - High resolution curves are recommended, e.g. highlight & shadow weighted (P2P)
- Export as **EFI Fiery DLP**

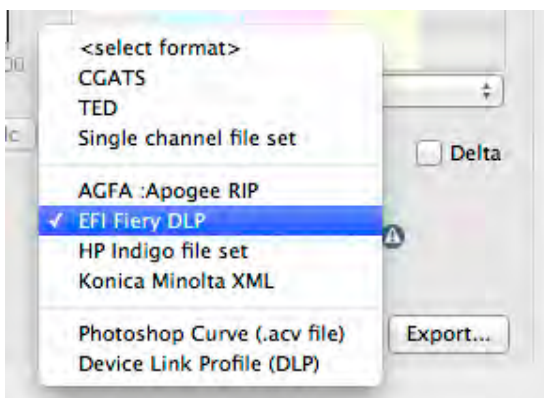


Figure 12.7 Exporting an EFI Fiery DLP

- Upload G7 curves DLP to the Fiery
  - Device Center: Resources: Profiles: Import
  - Associate to a Source profile, and the calibrated Output profile the P2P25 target was printed with



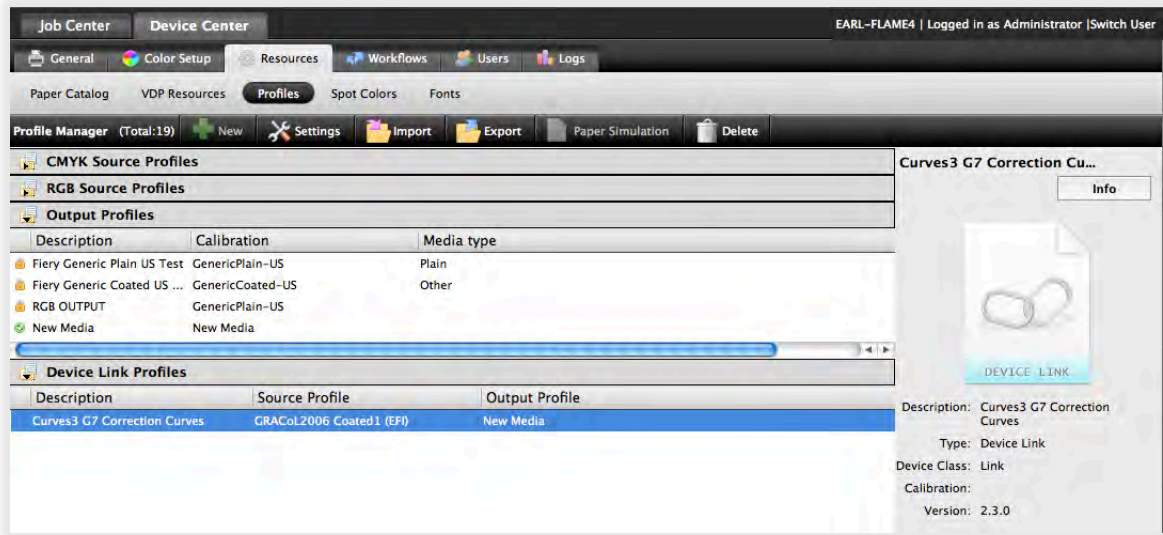


Figure 12.8 Setting DLP Associations

When printing through the associated Source and Output profile, the G7 curve DLP will be used in place of Source and Output profile. The association of the calibrated Output profile is important to get the correct Fiery calibration applied.

### **G7 Curve applied to GRACoL Source and existing Output profile (G7 simulated):**

This method creates a G7 curve for GRACoL CMYK Source and an existing Output profile on the server. The user may use a factory default profile, or a custom created media profile. This is a CMYK simulated / ICC color-managed workflow. However, the G7 correction curve state is not profiled (less accurate).

- Warm up the engine, and run Fiery Calibration for your chosen media (calibration settings)
- In Color Setup, set your Output profile as default
  - Device Center : Color Setup : Color Management : Expert Settings... : Output : Use media defined profiles if available : Off (unchecked)
  - Set “Default output profile” to your calibrated settings profile
  - Be sure to click Apply in the Color Management Pane
- Print the P2P25 target GRACoL Coated
  - Print Properties : Color : Expert Settings... : Color Input : CMYK / Grayscale : “GRACoL2006 Coated1 (EFI)”
  - Print 5 or more copies. If the print area exhibits streaking, ghost images, mottle or unevenness, print more copies and (if possible) rotate half the copies by 180°.
- Measure the P2P25 target. If the print area exhibits streaking, ghost images, mottle or unevenness, measure 5 or 6 separate targets and average them in Curve3.
- Generate G7 correction curves
  - Load one or more P2P measurement files in a new **Run**
  - For smoother results, click the **Smooth** button
  - Make sure the Delta option is *NOT* checked
  - Export as EFI Fiery DLP
- Create “G7 curves – GRACoL – Output” Device Link Profile with Fiery Device Linker 4.5
  - Select “Create a custom device link”
  - Select source profile = your newly created G7 Curves DLP



- Insert intermediate profile = GRACoL2006 Coated1 (EFI)
- Select output profile = your calibrated Output profile

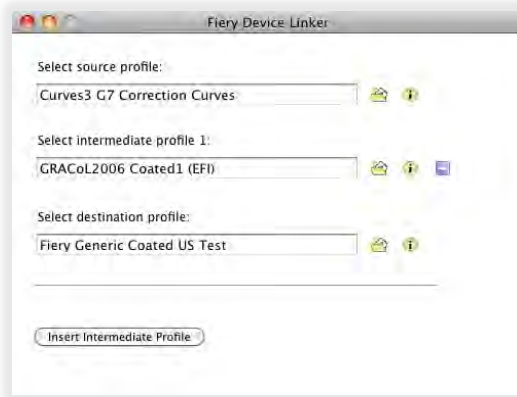


Figure 12.9 Creating G7 Curve - GRACoL - Output DLP

- Rendering Intent
  - If printed P2P25 with Paper Simulation = On, select Absolute Colorimetric
  - If printed P2P25 with Paper Simulation = Off, select **Relative Colorimetric**
  - Preserve gray should be unchecked
- Upload “G7 curves – GRACoL – Output” DLP to the Fiery
  - Device Center : Resources : Profiles : Import
  - Associate to GRACoL2006 Coated1 (EFI) profile, and the calibrated Output profile the P2P25 target was printed with

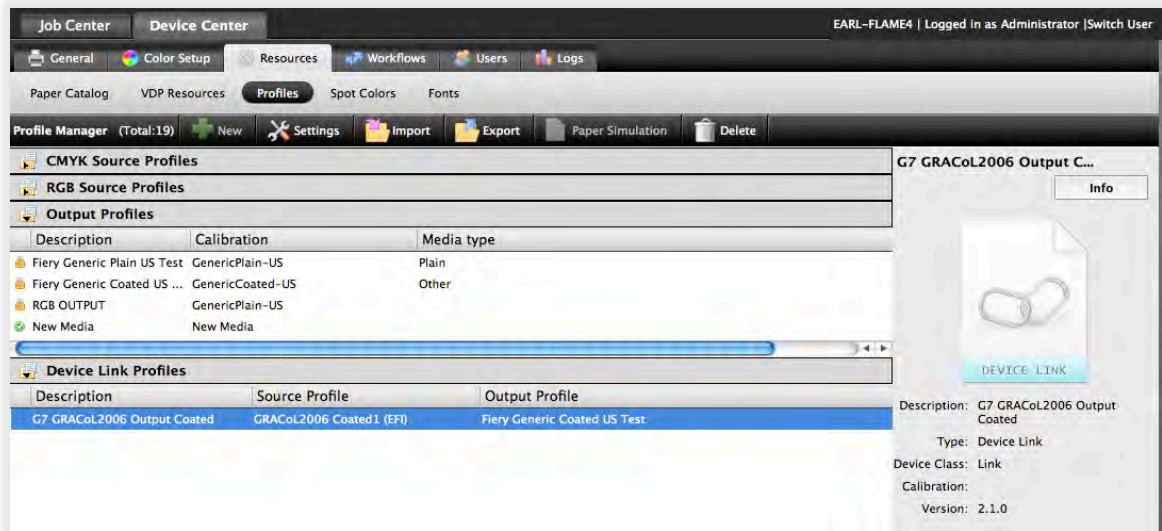


Figure 12.10 Setting DLP Association

When printing through the associated GRACoL Source and Output profile, the “G7 curves – GRACoL – Output” DLP will be used in place of Source and Output profile. The association of the calibrated Output profile is important to get the correct Fiery calibration. This workflow will yield CMYK GRACoL simulated output with the G7 correction curves applied.

### Output profile created with G7 Curve (G7 simulated):

This method uses the first procedure, to create a G7 curve DLP for the native (unmanaged) response of the printer. Then by printing the CPS profiling patches through the G7 curves, a G7 calibrated output profile is produced. Finally, a source profile, the new output profile, and the G7 curves DLP are all combined to create a complete G7 calibrated / color managed DLP. This procedure is the most faithful to the G7 methodology, but requires the most steps.

- Follow the steps for the **G7 Curve only (G7 unmanaged)** procedure to produce a G7 curves DLP, and install on the Fiery with source and output associations
- From Fiery Printer Profiler 4.5, Print the profiling (characterization) target through the installed G7 correction DLP
  - Select Fiery server, Instrument, Patch Layout, as normal
  - From the Print Properties Dialog, select the G7 correction DLP-associated profiles
    - Color : Expert Settings... : Color Input : CMYK / Grayscale : Source : *Associated Source*
    - Color : Expert Settings... : Output : Default output profile : *Associated Output*
    - Color : Expert Settings... : Color Input : CMYK / Grayscale : Device Link : check

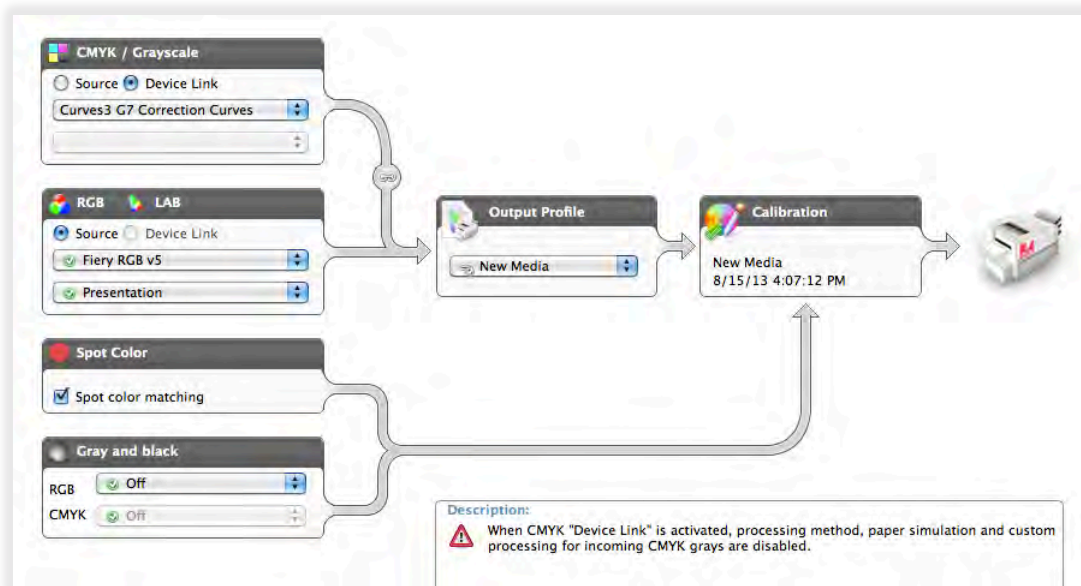


Figure 12.11 Setting Profiling Print Settings, Selecting G7 Correction DLP

- Print, measure, and process, the patches as normal
- Save the resulting profile locally
- Create “Source – Output – G7” curve Device Link Profile with Fiery Device Linker 4.5
  - Select “Create a custom device link”
  - Source profile = your desired Source profile
  - Intermediate profile = your newly created Output profile
  - Output profile = the G7 correction curve DLP
  - Rendering Intent
    - Select **Absolute Colorimetric**, for Paper Simulation = On like workflow
    - Select **Relative Colorimetric**, for Paper Simulation = Off like workflow
    - Preserve gray should be unchecked

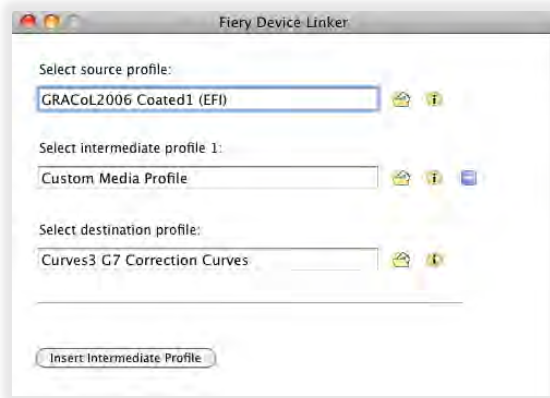


Figure 12.12 Creating Source - Custom Output - G7 Curve DLP

- Upload “Source – Output – G7” curve DLP to the Fiery
  - Device Center : Resources : Profiles : Import
  - Associate to source profile, and an output profile with the same calibration set used to print the profiling patches.

When printing through the associated Source and Output profile, the “Source – Custom Output – G7 Curve” DLP will be used in place of Source and Output profile. The association of the calibrated Output profile used to print the P2P25 and CPS Profiling Patches is important to get the correct Fiery calibration. This workflow will yield CMYK simulated output that is both G7 calibrated and CPS profiled.

## ErgoSoft

The following information, supplied by ErgoSoft, is believed to be accurate at the time of writing. For changes or additional support, please contact your Ergosoft service provider.

### Items needed

- **ErgoSoft RIP**, Release 14.1.2.5090 (or higher)
- **ErgoSoft ColorQPC** (in Option Pack Extended) must be licensed

### Process description

- In the ErgoSoft RIP create a new **Print Environment**
- Perform the standard linearization and set target densities (ink restrictions) as desired
- Print a P2P target and measure it using **ColorQPC** in the ErgoSoft RIP
- Create a **ColorQPC Measure Session**
- Unlock and create new settings then import the P2P\_2009.txt file (found in the P2P Package) as **Device Colors from File** (see diagram below)

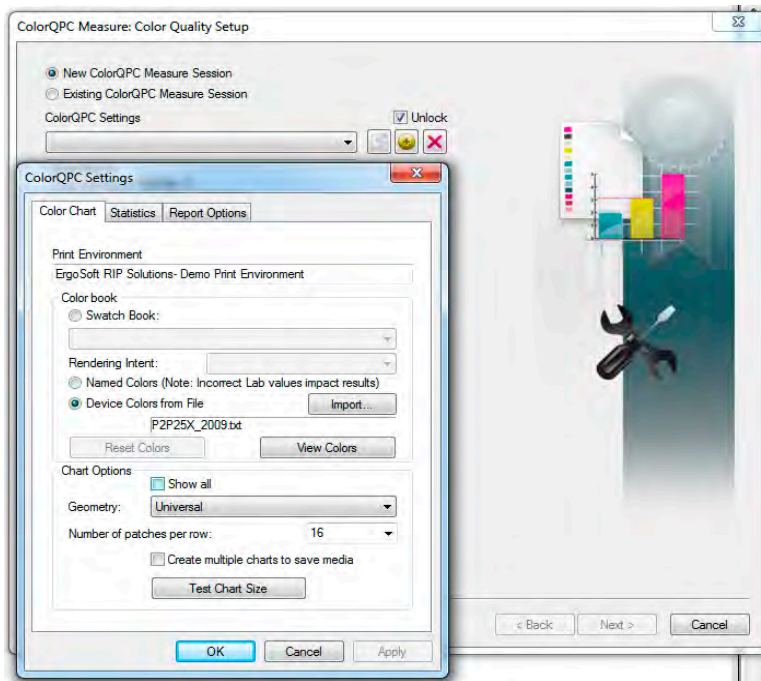


Figure 12.13 Importing P2P reference text file (CMYK values) into a new ColorQPC Measure Session

- Print and measure the ColorQPC chart then click **Export CGATS...** to export the measurement data in CGATS format

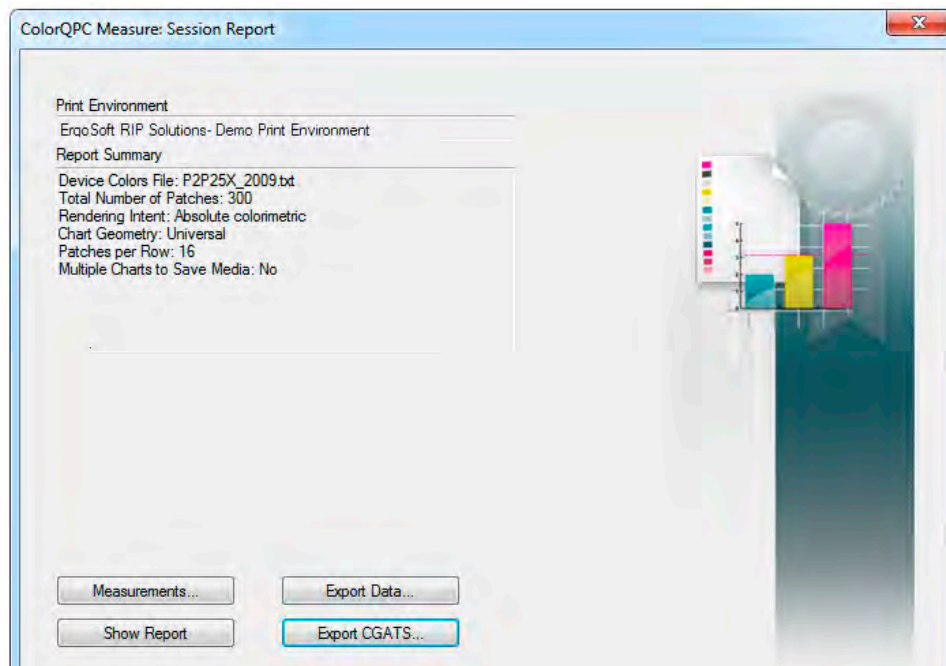


Figure 12.14 Exporting measurement data

### Create calibration curves in Curve3

- In **Curve3** load the CGATS file exported from ErgoSoft in a new Run

- In the **Control Points** list in Curve3's **Create Curves** window select **5%** or **Highlight/Shadow Weighted**
- Export the calibration as a CGATS text file

### Import the calibration into ErgoSoft

Here you import the calibration curves exported from Curve3 as a **target response** in the ErgoSoft RIP's linearization process.

- Open the linearization session created earlier and proceed to the **Target Density Settings**
- Click the **Import** button, select **Curve2 CGATS** format and import the Curve3 CGATS file

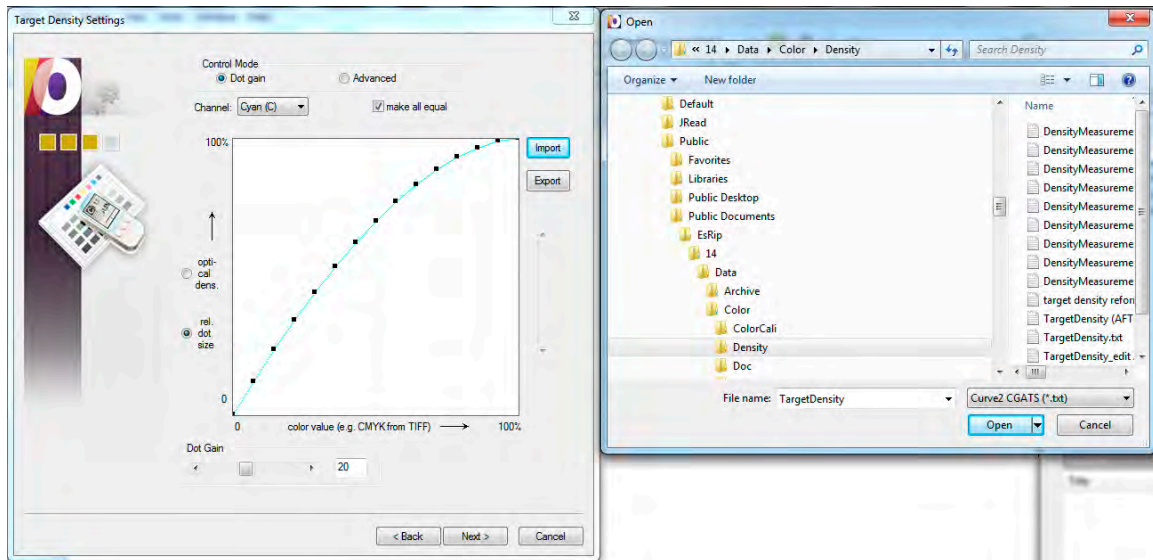


Figure 12.15 Importing Curve3 calibration curves

The print Environment now contains the correction curves and is ready to be used.

### Validation

Before running live work, confirm that the correction curves are working correctly, as follows:

- Create another **ColorQPC Measure Session**
- Unlock, create new settings then import the P2P\_2009.txt file as **Device Colors from File**
- Print and measure the ColorQPC chart and export the CGATS measurement data
- In **Curve3** load the CGATS measurement data file in a new Run
- Check the G7 Pass / Fail status in the **Analyze – G7** tab

If the validation is *not successful* you may export the new curves from Curve3 and import those as new **Target Density Settings** by repeating the steps in *Import the Calibration into ErgoSoft* (above). Remember, this is possible because your ErgoSoft RIP's linearization process is iterative.

## ESKO Nexus / Symphony

ESKO's Nexus RIP is calibrated using the Symphony Calibrator utility. Symphony accepts Control Point data exported directly from Curve3 as follows:

- In **Create Curves – Export** select **Single channel file set**
- Click **Export...** and save the file with a suitable name (e.g. (name of printer, date). This produces a folder containing four simple text files



- In **Symphony** create a **New** calibration (CMYK)
- In the **Edit** menu select a screen ruling under **Nexus Screens...**

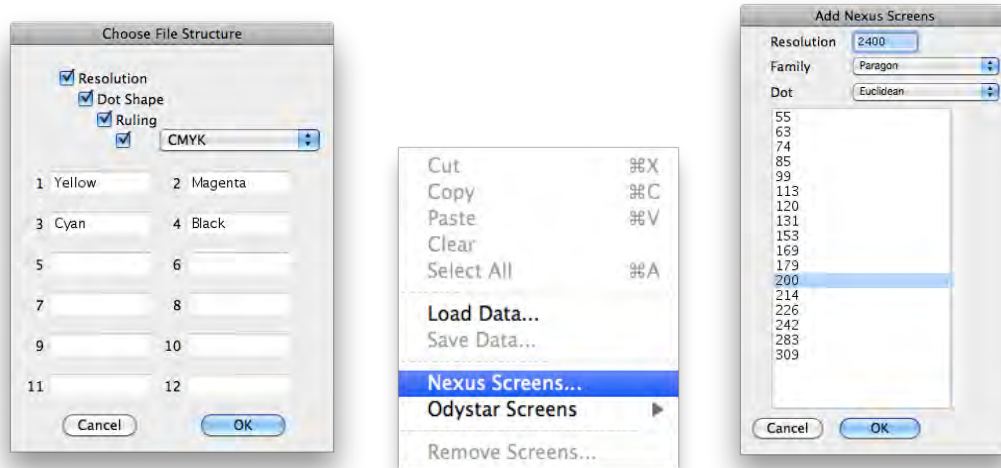


Figure 12.16 Setting up Nexus screens

- Expand the **Curves** list until you see the individual CMYK checkboxes

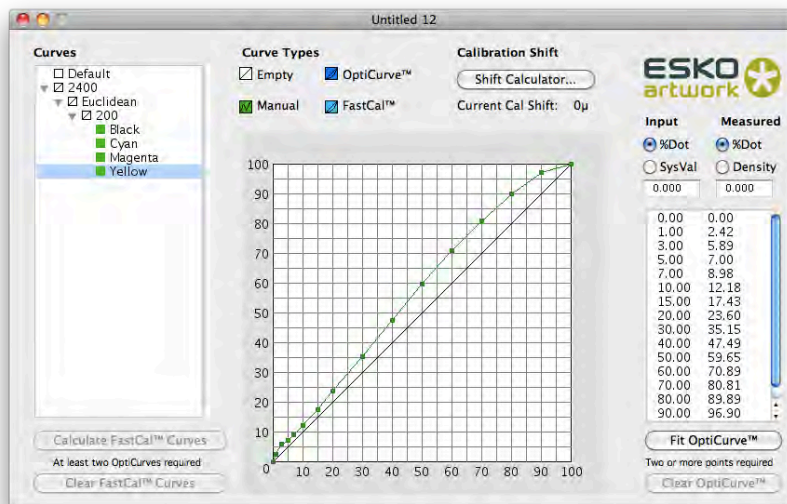


Figure 12.17 Entering calibration values in NEXUS

- Select each color checkbox in turn and in the **Edit** menu select **Load Data...** to import the individual text files exported from Curve3
- In the **File** menu save the calibration in the Nexus **Calibration\_File** folder
- In Nexus load the Symphony curve



## ESKO IntelliCurve

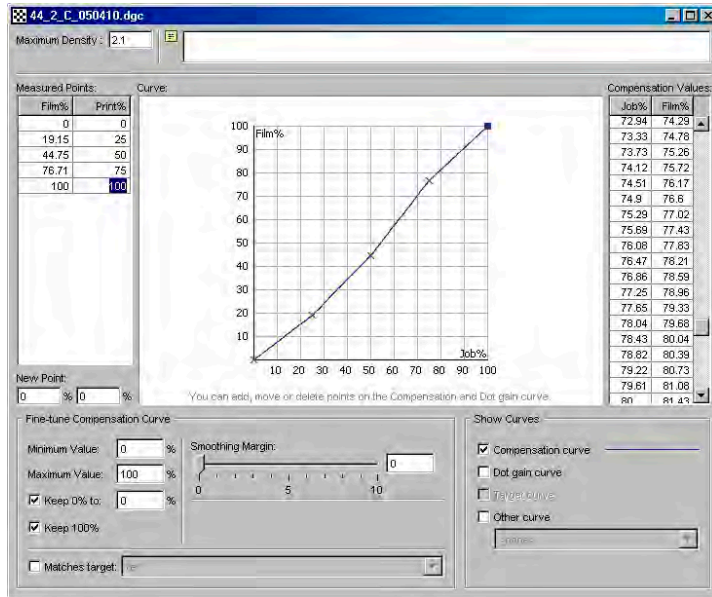


Figure 12.18 The older ESKO IntelliCurve interface

Note that in IntelliCurve, “Measured” points are really “Wanted” when producing a Compensation curve. For maximum adherence to Curve3 values move the **smoothing** slider to zero.

## HP Indigo

Curve3 version 3.0.1 can export curves directly in the HP Indigo RIP format. For detailed instructions on how to install the curves on an Indigo RIP, please see the latest HP’s instructions.

### Print the P2P26 target

Perform a normal HP color calibration, then print the P2P26. The P2P26 target is designed especially to produce better gray balance on Indigo (see section 14: P2P Target Variations).

### Export HP Indigo File set

In Curve3, export the desired calibration as an HP Indigo File Set.

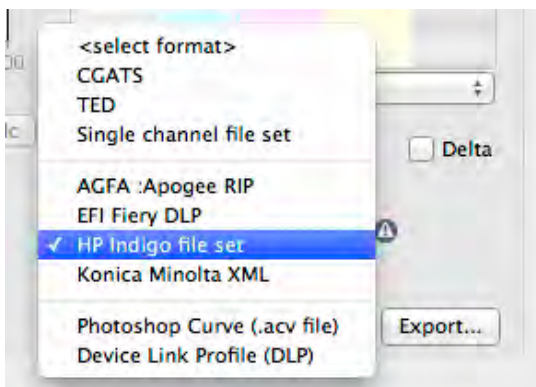


Figure 12.19 Selecting HP Indigo from the Export list

### Import LUTs into HP Production Manager

In HP Production manager, choose **Import** and select the **LUTs...** option.

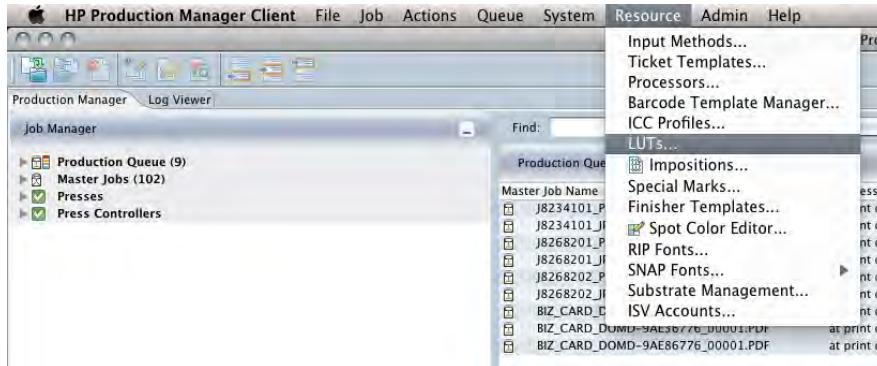


Figure 12.20 The Resource - LUTs option in HP Production Manager

Choose **Import** and select the LUTs to be imported.



Figure 12.21 Selecting the desired LUTs Color Control

In **Job Properties** select **Color Control > LUT Library** and select your LUTs.

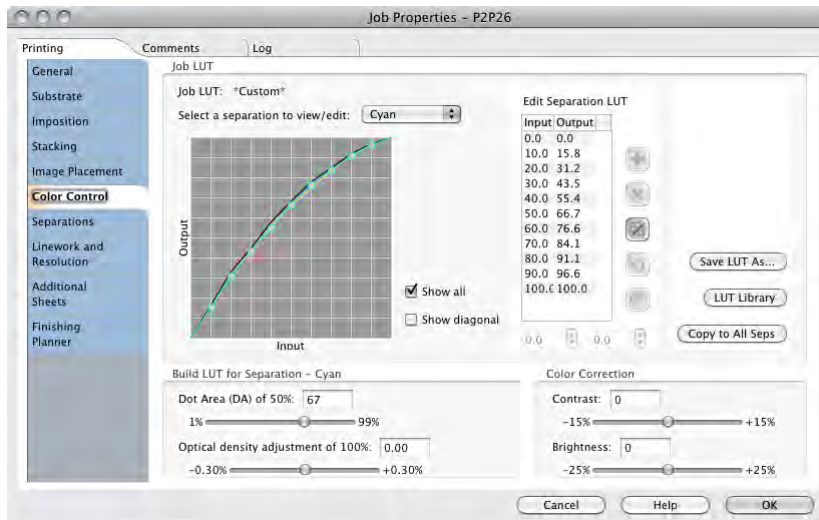


Figure 12.22 LUTs selected via the LUT Library button

## Kodak Approval (XP4)

Unlike most proofing RIPs, calibrating a Kodak Approval XP4 begins by entering density values, not dot percentages, into the **Dot Gain Manager**. The RIP then calculates the equivalent TVI values as a basis for subsequent corrections. This changes the normal process slightly, as follows:

- Run an un-calibrated proof and measure the densities at every 10% plus 5% and 95%.
- Enter the measured densities in **Benchmark Dot Gain** under the **Density Entry ...** button.
- In **Target Dot Gain**, temporarily enter the same percentages for each channel as the Entry values indicated in the left hand column, so Measured values equal Control Point values.
- Run a new proof, measure the P2P target and load the data into a Curve3 Run.
- Go back to the **Target Dot Gain** window in the **Dot Gain Manager** and replace the temporary Target values with the new Control Point values shown in Curve3.

## Konica Minolta IC601

- In **Create Curves – Export** select **Konica Minolta**
- Click **Export...** and save the file with a suitable name (e.g. (name of printer, date).
- In the Konica Minolta IC601 **Color Centro** application open the **Tone Curve Adjustment** tool, select **Load Tone Curve** and load the .xml file exported by Curve3.

## ONYX

The following notes are based on a white paper from Onyx entitled *Curve2 & Media Manager*, reproduced with permission. For additional support, please contact your Onyx supplier.

*Note: G7 Calibration works in Onyx in both Halftone and Contone modes, however the ink restrictions in Contone Mode are controlled by the printer, not Onyx, and may lead to over-inking and difficulty achieving proper per-channel restriction.*

### Overview

- Onyx Media Manager outputs values from a P2P target
- Calibration curves are calculated and exported from Curve3
- Media Manager imports the calculated curves as target densities

### Creating a G7 Media Model

- Create or edit an existing media model in **Onyx Media Manager**
- At the calibration step, click the **Advanced...** button

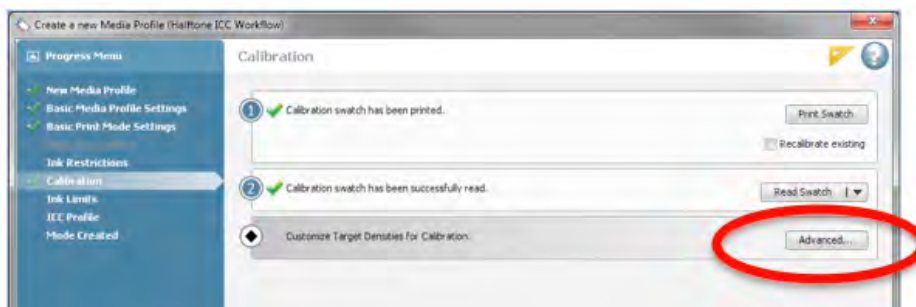


Figure 12.20 The advanced button in Onyx Media Manager

- In the **Tweak Linearization** window click the blue plus button

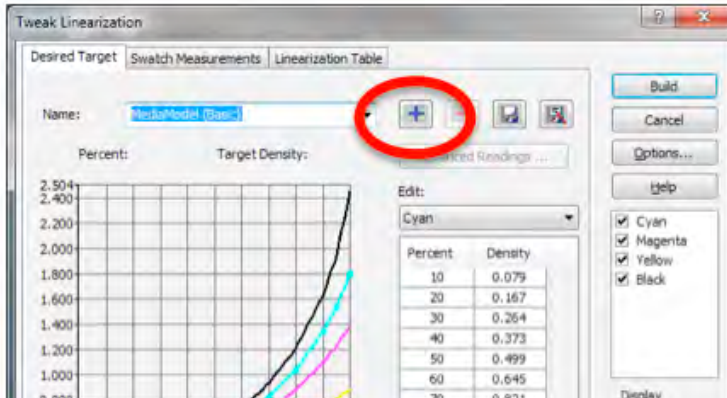


Figure 12.21 The blue plus button

- Enter a name for the new media model
- Select **Curve2/G7 P2P Target** and click **Print**

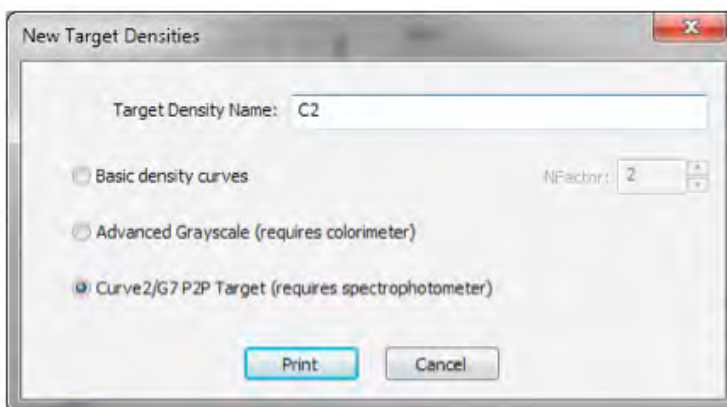


Figure 12.22 Selecting the Curve2/G7 P2P Target definition

- Select the desired measuring device
- For **Based on:** select **<Default Calibration>** which is used for verifying G7 curves at the end of the process

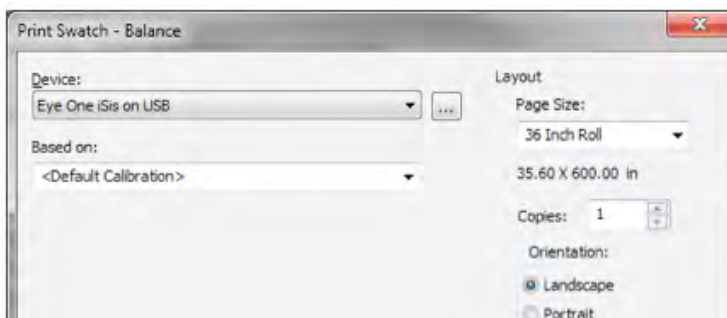


Figure 12.23 Select Based on: Default Calibration

- In the Tweak Linearization window you should see blank curves
- Click **Read Advanced Swatch...** when the P2P target is printed

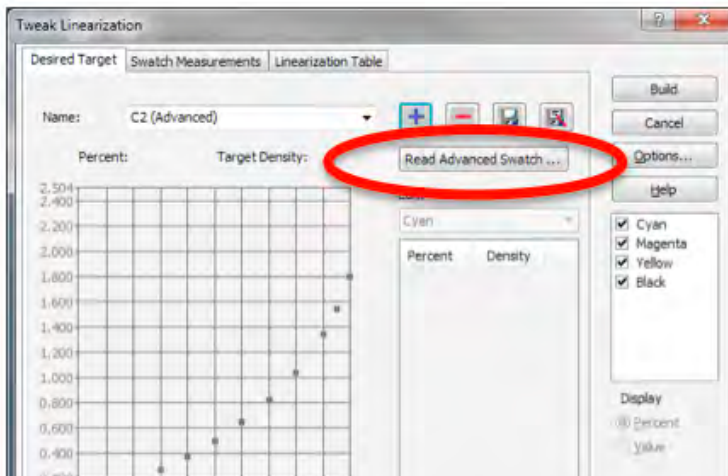


Figure 12.24 Selecting the Curve2/G7 P2P Target definition

- This will take you to the **Build Profile** screen

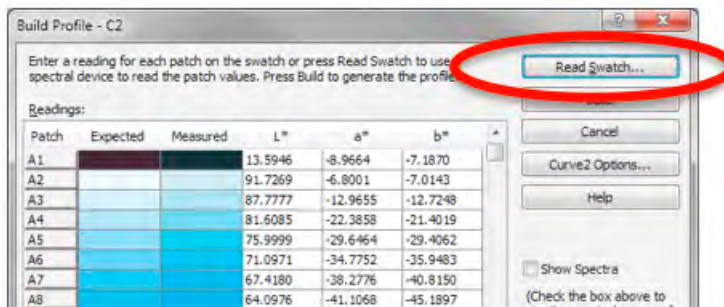


Figure 12.25 The Read Swatch button

- Click **Read Swatch...** and measure the P2P, then click the **Curve2 Options...** button.
- (Do not click build yet. You need the Curve3 data before you can build a media model.)
- In the **Build Options** window click **Export Measurements** to export the measurement file

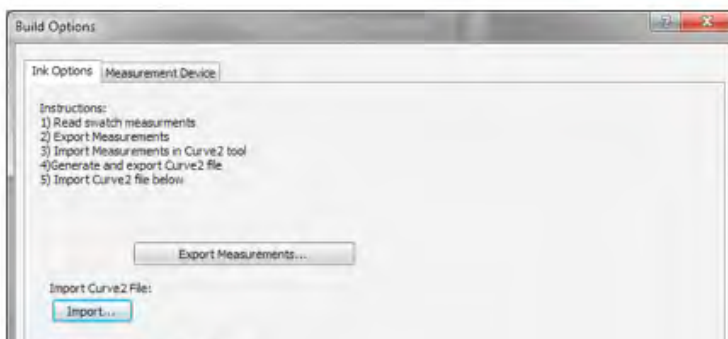


Figure 12.26 The Export button

**IMPORTANT:** Leave this window open while you use Curve3



- In **Curve3** load the text file from Onyx into a new Run, then export a CGATS calibration file
- In the **Build Options** window click **Import...** and select the CGATS.txt file
- Check **Ignore 100% Target Densities** if you don't want to specify 100% target densities
- Click **OK** then in the **Build Profile** window, click **Build**

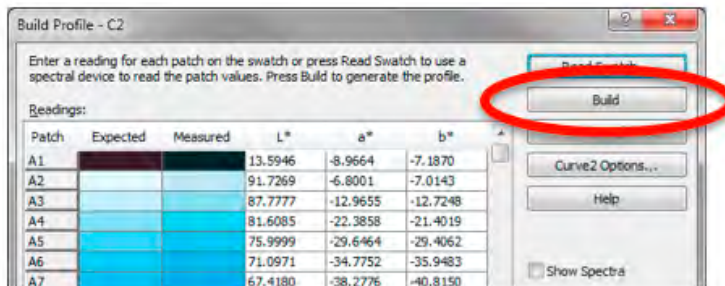


Figure 12.27 The Build button in the Build Profile window

- The new target values from Curve3 will show up in the **Tweak Linearization** window but the curves will not match what you saw in Curve3's **Create Curves** window because ONYX converts the percentages into target densities (don't panic!)

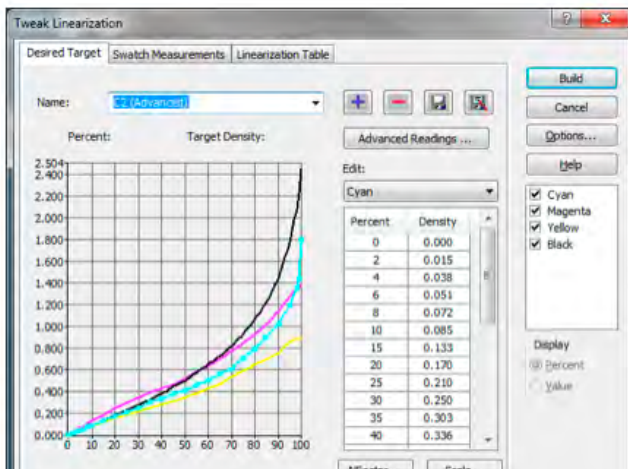


Figure 12.28 Completing the process

- Click **Build** in the tweak linearization window to complete the process

At this point you have completed creating the media profile, but before using it for live work, be sure to verify the G7 calibration, as described next.

### Verifying the G7 Media Model

To verify the new G7 media model, a new *temporary* media model is used to print a new P2P target with the G7 curve settings applied to it. Once verification is complete, the temporary media model can be deleted.

- While still in the Tweak Linearization window, click the blue plus button
- Name the temporary media model, select **Curve2/G7 P2P Target** and click **Print**



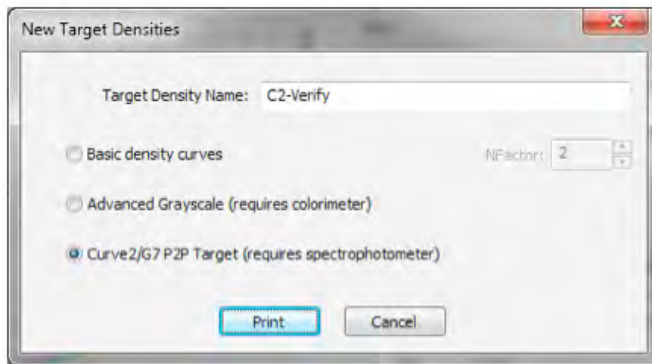


Figure 12.29 Printing the verification P2P target

- In the Print Swatch window select the previous G7 media model from the **Based on:** menu

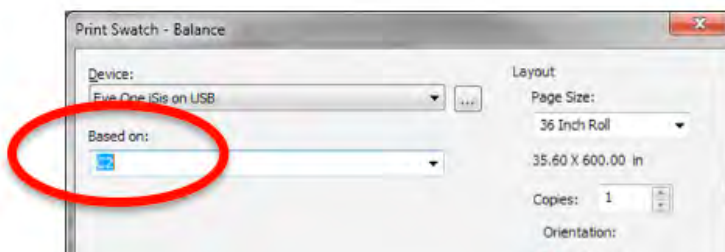


Figure 12.30 Printing the verification P2P target (step two)

- Click **Print**
- Read in the P2P target as before then click **Curve2 Options...**

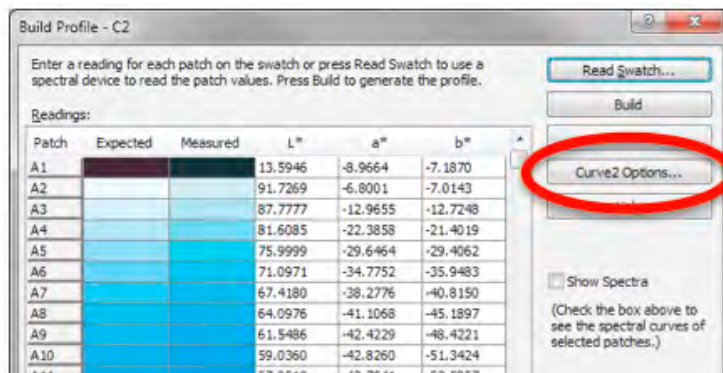


Figure 12.31 Exporting the verification measurements

- Export the .txt file, load it in a new Curve3 Run and see if it meets G7 specifications
- If the results are good, select the temporary media model in the list, then click the red minus button and **Yes** in the warning dialog to delete the temporary media model

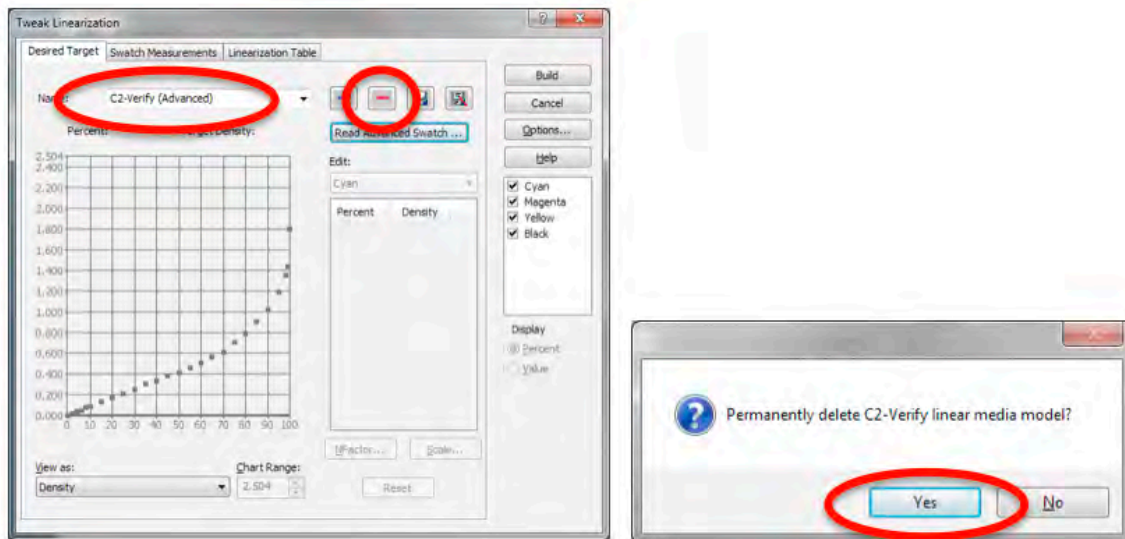


Figure 12.32 Deleting the temporary media model after verification

- Finally, select the G7 media model and click **Build**

## Working With Incompatible RIPs

If no simple method exists to import Curve3 calibration curves into your RIP, you should still be able to achieve G7 compliance through a color-managed workflow that simulates a G7-based reference print condition. (See *Appendix: G*)

## 13

## 13. Iteration

This section describes how to calculate *iterated* correction values from a print based on previous calibration curves. This can be useful when...

- The device has changed since you last calibrated, but you want to avoid the time and cost of re-printing a new P2P target with linear curves
- The first run was made (accidentally or deliberately) with non-linear calibration curves
- You want to ‘tweak’ a previous calibration
- The first calibration was not entirely accurate
- The device is so far out of balance that two iterations are necessary

### The Basis Run

A new Calibration Run can be based on a previous Calibration Run selected from the **Based On:** list. The previous Calibration Run selected from the Based On: list is called the “Basis Run”.

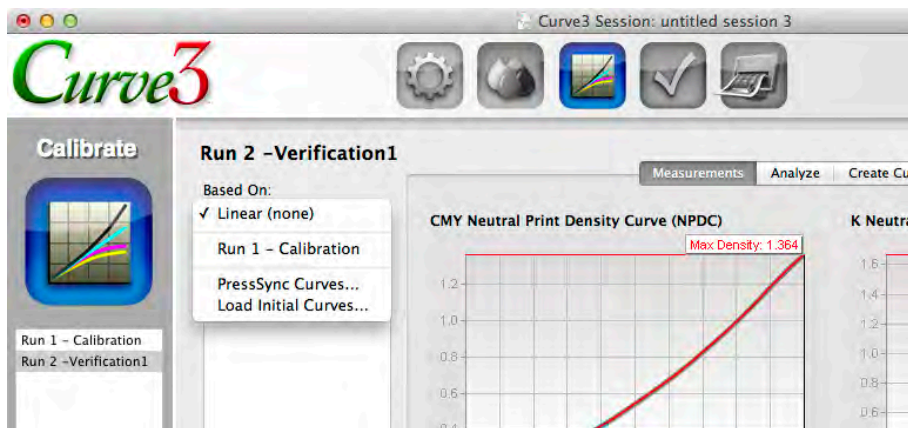


Figure 13.1 The Based On: list

When a Run is based on a previous Run, it becomes indented in the Runs list under its basis Run.

**Caution:** The Basis Run **MUST** be the Run used to create the calibrate curves through which the new P2P target was printed, otherwise iteration will not work correctly

## How Iteration Works

When a verification Run is based on a previous calibration Run, Curve3 calculates the calibration curves with knowledge of the curves that were used when the new P2P target was printed. The calibration curves (Control Point values) calculated by the new Run REPLACE the previous RIP curves, and in most cases will be very similar to the old values.

The illustrations below show how the same P2P file produces different correction values if based on Linear rather than the previous Run.

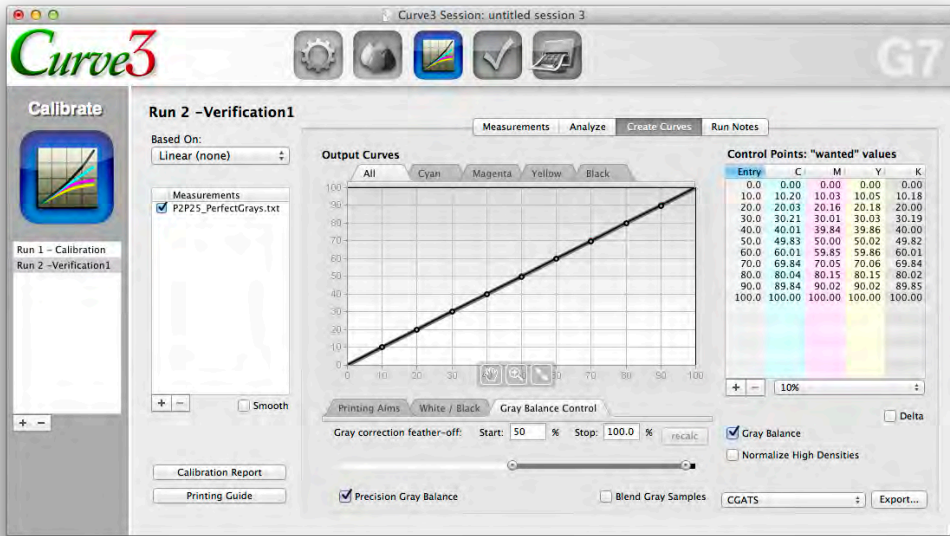


Figure 13.2 A verification Run based on Linear, showing no need for further correction



Figure 13.3 When the same verification Run is based on the initial calibration Run, Curve3 suggests basically the same curves as the first run, knowing that those curves produced a good result

## Applying Iterated Calibration Values

The new Control Point values are *NOT* added to the initial RIP curves as delta values, but must **REPLACE** the old curve values. If you add them as delta values the calibration will fail.

If the device has not changed much between the first and second Runs, the new curves will often be very similar to the old curves. However if the initial curves were not calculated by Curve3 (or Curve2) but were instead entered arbitrarily into the RIP, the new curves should be quite different from the initial curves.

### The Importance of Saving Sessions

Iteration only works if the Basis Run is recorded accurately – ideally in a saved session – which is why you should save every Curve3 session, just in case you need to make an iterated calibration at a later date.

### If You Don't Have a Saved Session

Curve3 allows you to import pre-existing calibration data into a new session as a simple text file as shown below.

## Creating and using an Initial Curves File

The **Initial Curves File** format required by Curve3 is basically the same as a CGATS text file exported from Create Curves. If you know the RIP curve values you can create an *Initial Curves File* as follows:

- At the RIP terminal, record the actual curves applied to the Run involved
- In Curve3 in **Create Curves** create a list of Curve Point values the same as in the RIP
- Export a CGATS text file
- Open the CGATS file in Microsoft Excel or some other text editing software
- Replace the CMYK output values in the CGATS file with the output values from the RIP
- Save the edited file in the **Tab Delimited Text (.txt)** format

	A	B	C	D	E	F	G
1	NUMBER_OF_FIELDS	6					
2	BEGIN_DATA_FORMAT						
3	SampleID	SAMPLE	CMYK_C	CMYK_M	CMYK_Y	CMYK_K	
4	END_DATA_FORMAT						
5	NUMBER_OF_SETS	11					
6	BEGIN_DATA						
7	A0	0	0	0	0	0	
8	A1	10	10.38	10.02	11.98	10.05	
9	A2	20	19.93	20.61	21.02	20.64	
10	A3	30	30.72	30.53	30.29	30.5	
11	A4	40	40.04	39.97	41.22	40.03	
12	A5	50	49.38	49.72	49.95	50.3	
13	A6	60	59.5	60.56	59.8	60.53	
14	A7	70	69.93	70.05	69.79	70.17	
15	A8	80	79.81	80.4	80.33	79.85	
16	A9	90	90.12	90.57	90.57	89.87	
17	A10	100	100	100	100	100	
18	END_DATA						
19							

Figure 13.4 A CGATS text file exported from Curve3. Values in red were edited in Excel® to hold the RIP curve values used in the Run

### Working with an Initial Curves file

In the **Based ON:** list, select the Initial Curves file created as described above.

Note that this will not change anything in the Measurements or Analysis tabs, but it will change the curves and Control Point values shown in the Create Curves tab.



**NOTE:** The Control Points shown in Create Curves tab should REPLACE the control points that were active in the RIP when the print was made.

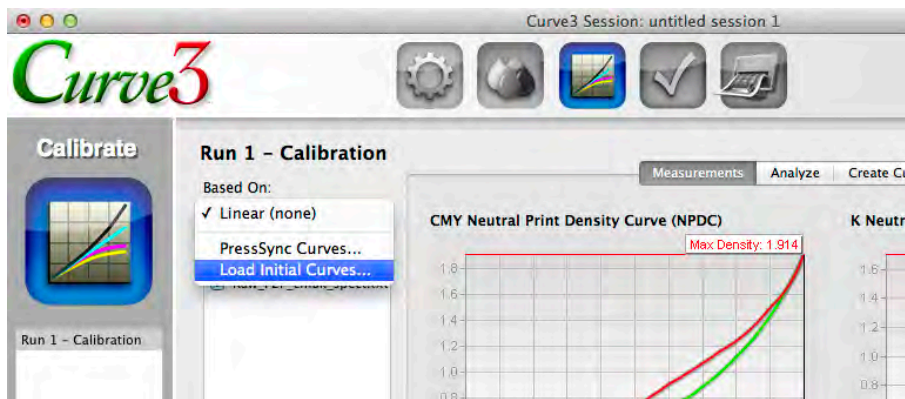


Figure 13.5 The *Load Initial Curves ...* option in the *Based On:* list

## Precision Limits

Typically one to two rounds of iteration will show an improvement in the NPDC and/or gray balance curves. However continuing to iterate beyond one or two rounds can produce an apparent reduction in calibration accuracy. This is not a weakness of Curve3, but rather small run-to-run variations in the printing system causing the iteration process to become unstable. Even a small change in solid ink densities, dot gain or gray balance between runs can cause the corrections calculated for one run to be incorrect for a later run.

Run-to-run accuracy can be monitored easily with the **Run-to-Run** tab in the **Create Curves – Analyze** tab. If your iteration doesn't seem to be working, expect to see a change in solid ink values between runs.



Figure 13.6 The *Run-to-Run* tab showing solid ink density and  $\Delta E$  variations between two runs



## Avoiding Errors

Basing a Calibration Run on a Basis Run can easily go wrong if you are not careful. You must be absolutely sure which Basis Run was used to calibrate prior to the current Run, and the settings in that Basis Run must not have changed, especially the following:

- Measurement files active or disabled in the **Measurements** list
- Number and values of the **Control Points**
- **White / Black** tab settings
- **Gray balance** On/Off
- **Gray Balance Control** tab settings
- **Normalize High Densities** status
- The Basis Run selected in the **Based On:** list (if any)

*Note: A Calibration Run may be based on a Basis Run which was itself based on an earlier Basis Run, which in turn may be based on an even earlier Basis Run, and so on. For Iteration to work correctly it is important that all Basis Runs leading up to the current Run are included in the session, and all Curve3 settings active when each Basis Run was applied have not been altered.*

## 14

## 14. Tips and Trouble-Shooting

This section includes a few cool tips and tricks, and some of the unexpected results that can occur in Curve3 due to printing or measuring problems. In some cases the problem can be addressed with Curve3's controls but in others you may have to re-measure or re-print the data.

### Incorrect i1iO Alignment

If the X-Rite i1iO is incorrectly aligned (wrong corner points entered), the measured data will not align correctly with the percent values in the reference file. This will usually show up immediately as a strange curves in the Measurements window similar to these...

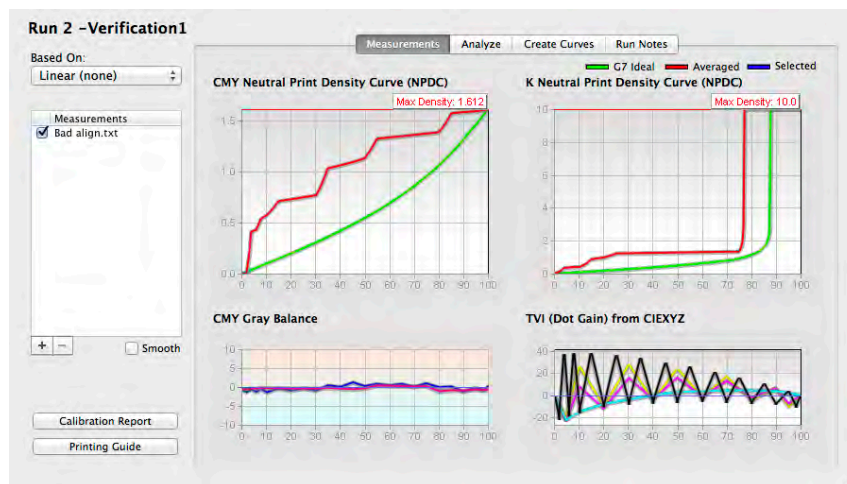


Figure 14.1 Result of incorrect i1iO alignment

### Corrective Action

The only solution to this problem is to re-measure the target using proper i1iO alignment.

### Uneven Printing

If the P2P target is printed unevenly due to mottling, streaking or uneven ink coverage, the NPDC graphs and calibration curves may exhibit reversals or spikes, as shown below.

### Corrective Action

The ideal solution is to solve the problem at the printing device and re-print the P2P target. If that is not possible, try the following actions, but remember the resulting calibration may not seem to be very effective if the printing issues persist.

- Measure multiple targets (as many as possible) and let Curve3 average them
- Click the **Smooth** button
- Select **Blend Gray Samples** in Create Curves
- Click **Normalize High Densities** (but be aware the result may fail G7)

*TIP: Often a combination of the above actions will give the best results, for example measure multiple targets and use **Smooth** and **Blend Gray Samples**.*

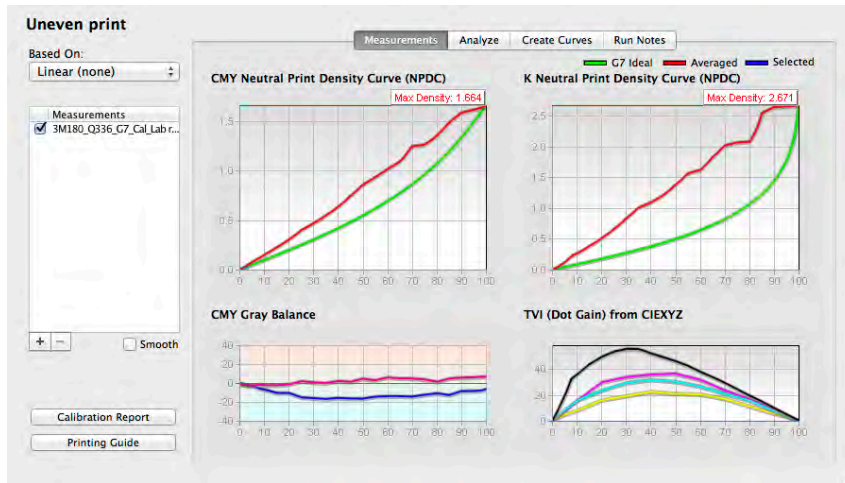


Figure 14.2 Oscillations in the NPDC graphs caused by an unevenly printed P2P target

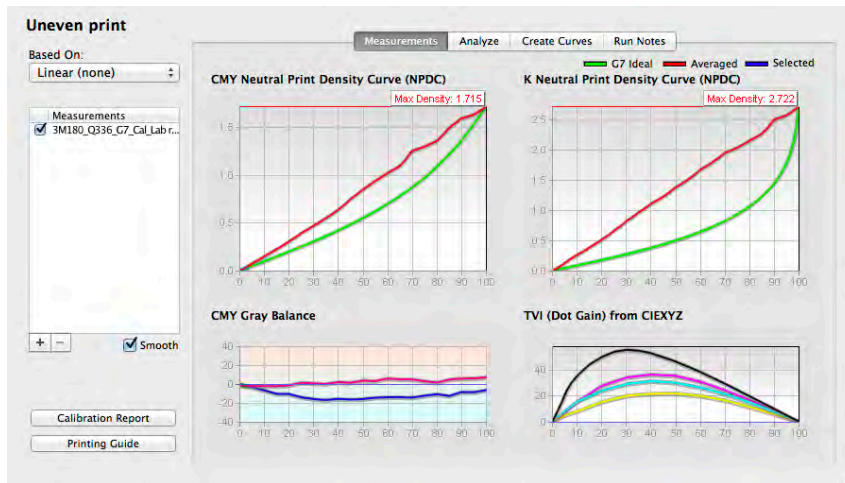


Figure 14.3 NPDC oscillations reduced by the **Smooth** button

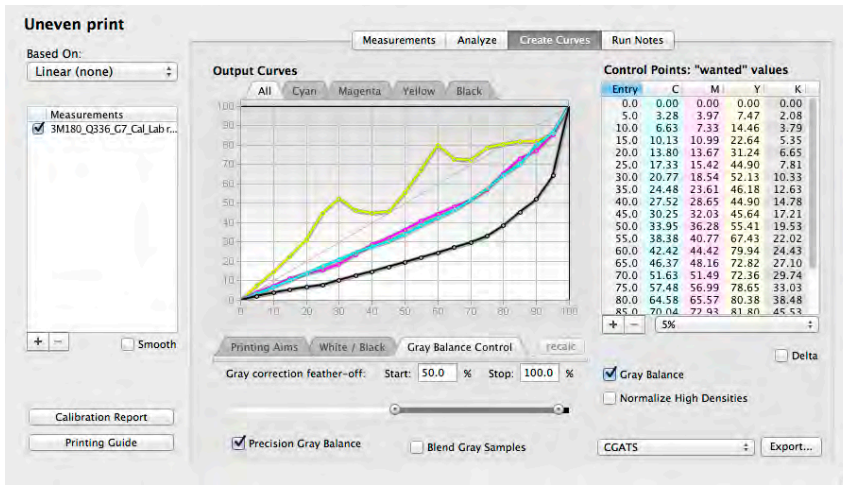


Figure 14.4 Reversals in the calibration graphs caused by an unevenly printed P2P target

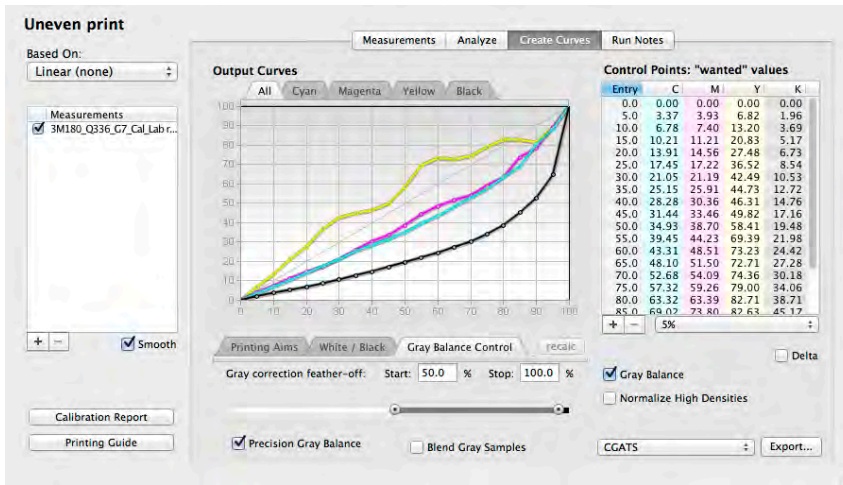


Figure 14.5 Calibration reversals reduced by the Smooth button

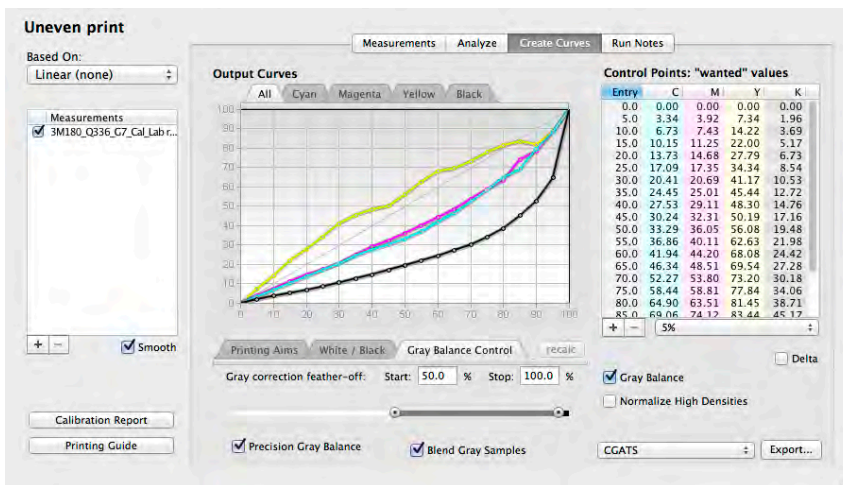


Figure 14.6 Further improvements using Blend Gray Samples





Figure 14.7 Shadow reversals eliminated by *Normalize High Densities*

## Density Reversals

An increase in dot percentage in either of the two P2P gray scales should normally produce an increase in ND (neutral density), but sometimes the ND values start to decrease at very high percentages due to a reduction in gloss, poor ink-trapping, ink-limiting functions, or other causes.

Curve3 cannot calculate G7 NPDC curves correctly from reversal data, so it works-around the problem by adding a small artificial ND increase to every step higher than the one at which reversal first occurred. Typically the calibration will pass G7 even though small errors remain in the darkest part of the resulting NPDC, but in extreme cases the resulting prints may show excessive shadow contrast or tone jumps in high-density areas.

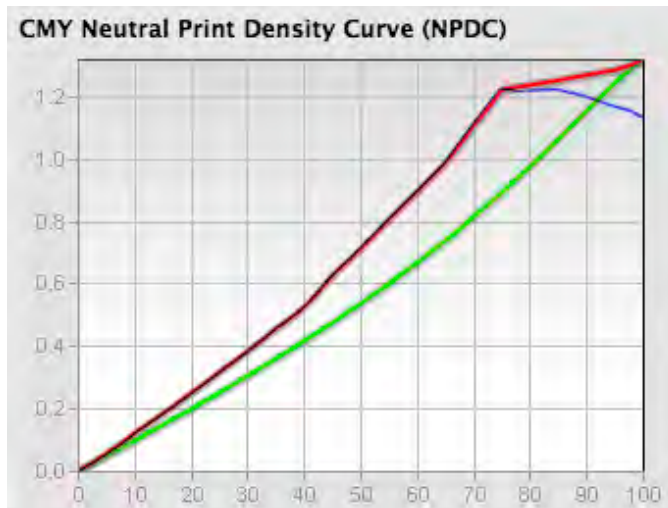


Figure 14.8 Density reversal in original NPDC data (blue) and modified by Curve3 (red)

### Corrective Action

Try eliminating the cause of reversal in the printing process by reducing ink, improving ink trapping or eliminating the RIP function that caused the problem.

If the resulting prints still have too much shadow contrast or sudden tone changes in saturated colors, see suggested actions below in *Extreme Shadow Contrast*.



## G7 Extreme Saturated Detail

Calibrating a high-density ink-jet printer for **G7 Extreme** compliance can result in excessive contrast in saturated color areas, as indicated in the last few steps of the **Output Curves** (left-hand diagram, below). This is one of the rare instances where traditional G7 calibration may not be the best option, either visually or as a basis for subsequent ICC profiling.

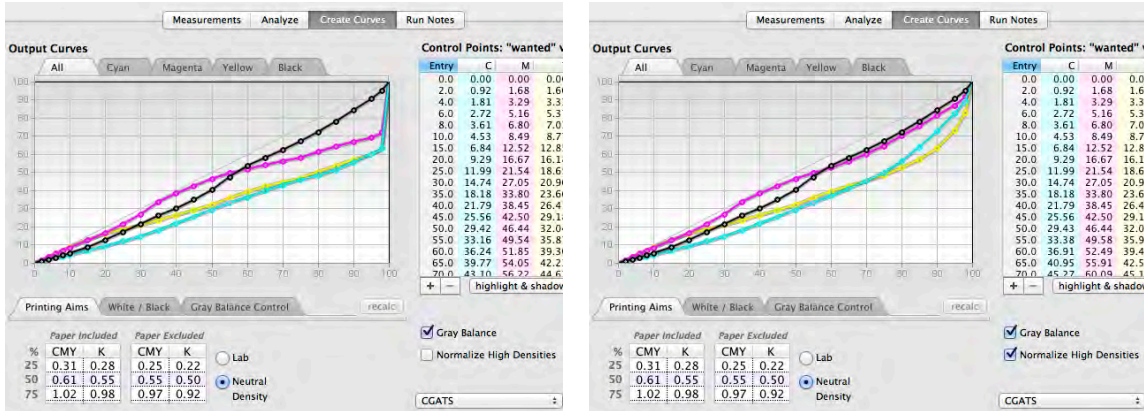


Figure 14.9 Calibration curves likely to produce extreme contrast in the calibrated print (left) and softened with the **Normalize High Densities** option

### Corrective Action

To get a more useful calibration that still retains the main benefits of G7, click **Normalize High Densities**. This replaces the conventional NPDC curves at higher densities with smoother curves that result in more acceptable shadow contrast. Just be aware that the resulting calibration may no longer pass official G7 tolerances (see **Caution** below).

**CAUTION:** The **Normalize High Densities** option may cause the device to fail G7. A Pass can usually be achieved by creating an ICC profile through the Normalized calibration and converting a P2P from a G7-based profile, such as GRACoL2006\_Coated1v2.



Figure 14.11 The **Normalize High Densities** option (right) may produce results that are theoretically further from official G7 tolerances, compared to legacy G7 calibration (left).

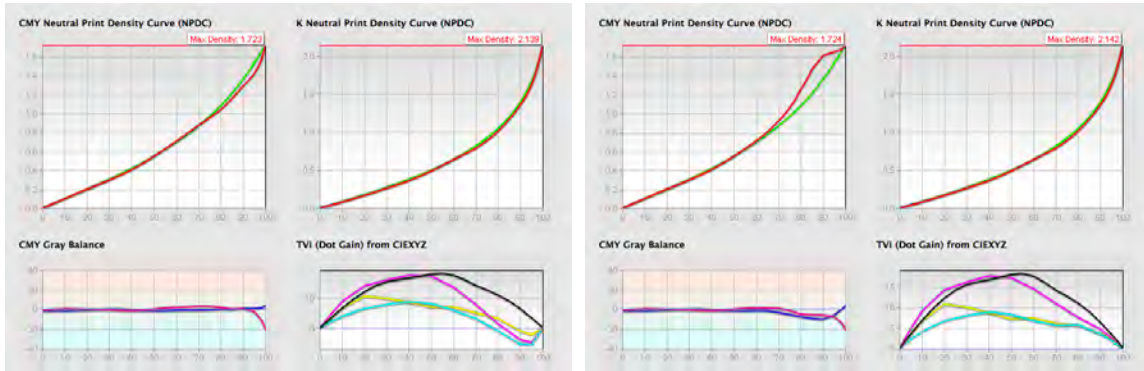


Figure 14.12 Legacy calibration (left) compared to Normalize High Densities calibration (right). Although the CMY NPDC curves appear too heavy in the right graph, the TVI curves show that the individual ink colors are actually smoother, which produced a more pleasing visual image and resulted in a better ICC profile.

## P2P Target Variations

The P2P25 target produces excellent results with most printing systems and should always be used when submitting samples for IDEAlliance G7 Master qualification. However some printing systems or conditions will produce better calibrations with a modified P2P target, such as the P2P26 or P2P27.

Non-standard P2P targets are available from [www.hutchcolor.com](http://www.hutchcolor.com) > Free > Targets and Images.

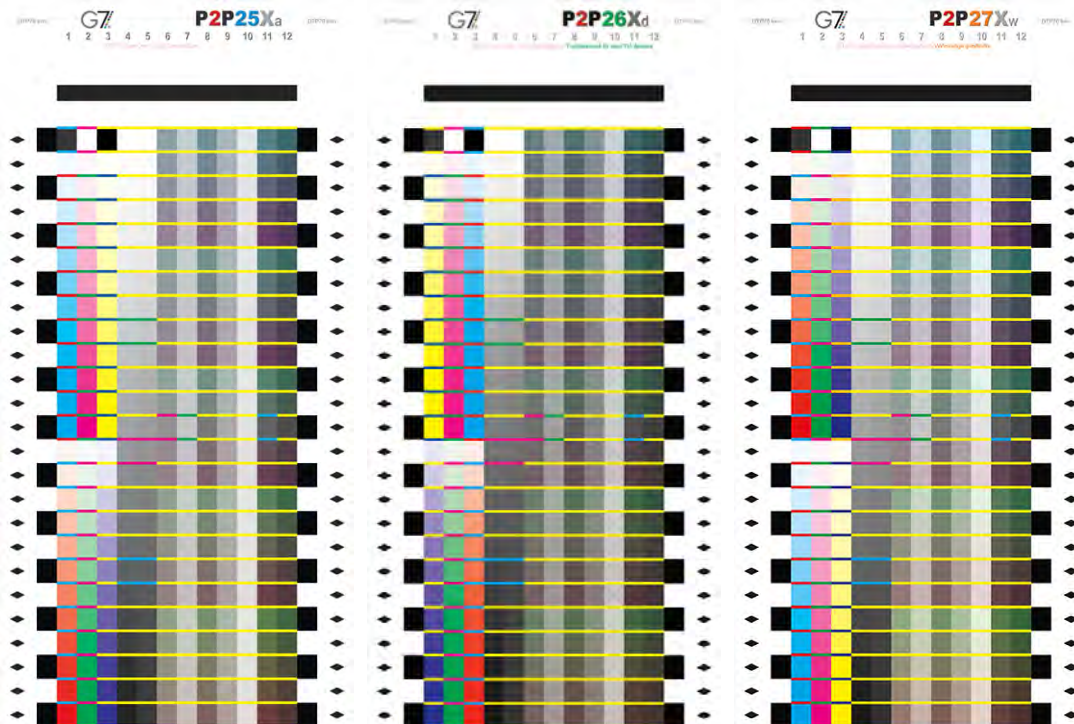


Figure 14.13 P2P25, P2P26 and P2P27 targets. The the first three columns are different to avoid confusion

**P2P27**

On some printing systems, especially wide-gamut ink jet, the gray balance of the first P2P is too far out for an accurate first calibration. Results may be improved either by iteration (See section 13) or by printing the P2P27 target instead of the P2P25.

*CAUTION: When measuring the P2P27 you MUST use the correct P2P27 reference file.*

**P2P26**

Indigo's Basic color calibration system typically produces a very light print with zero dot gain (TVI). This means that when the P2P25 is printed, shadow balance is inaccurately measured, which can lead to less than ideal shadow balance correction. This can be solved by printing the P2P26 instead of the P2P25. The P2P26 target has a 16% TVI curve built in to it so the first print samples shadow gray balance more accurately.

*CAUTION: When measuring the P2P26 you MUST use the correct P2P26 reference file.*

**P2P?**

Future P2P targets may be developed for special applications and will always have a unique identifier number. A higher-numbered P2P target does not necessarily replace the P2P25, but may be designed for special applications.

**Mixed P2P Files**

Results will be incorrect if you combine measurements from two different types of P2P target, for example the P2P25 and P2P27. Make sure all measurement files are from the same P2P target.

# Appendix: A

## A. Target Printing

This section discusses what you should know about printing targets for use with Curve3.

Before performing a G7 calibration with Curve3 you must print at least one sample P2P target on the device you want to calibrate. If you plan on using the VPR (Virtual Press Run) module you must also print a characterization target, for example an HC2052F or an IT8.7/4, with the P2P.

### Establishing a Base-line Condition

Before attempting to calibrate a device with Curve3, be sure it is stable and in a repeatable 'base-line' condition. Record all variables for later reference. Base-line setup depends on the printing device, media selection and many other variables that a good operator should already be aware of. Only a few special situations will be discussed here.

#### *Ink-limiting*

Most ink-jet printers require some form of ink-limiting to prevent excess ink being deposited on the substrate and causing drying problems. Proper ink-limiting settings should be established before printing the P2P target.

#### *G7 calibration and ICC color management*

For maximum flexibility and value, G7 calibration should be performed with color management off. Once the device is calibrated, print a characterization target and create an ICC profile. In a perfect system Curve3's calibration curves should be applied *after* color management is applied in the digital data flow.

If color management cannot be switched off, but editorial tone curves are available in the RIP, print the P2P through an optimized color management setup then enter the G7 calibration into the editorial curves.

### The P2P25 Target

At the time of writing the preferred target for use with Curve3 is the P2P25. Two versions are available, the P2P25 and the P2P25Xa. Instructions for their use are in a ReadMe file in the P2P25 target package.

The P2P25 target is available free at [www.idealliance.com](http://www.idealliance.com) and can be downloaded from within Curve3 in the **Web** menu under **Updates for P2P targets...**



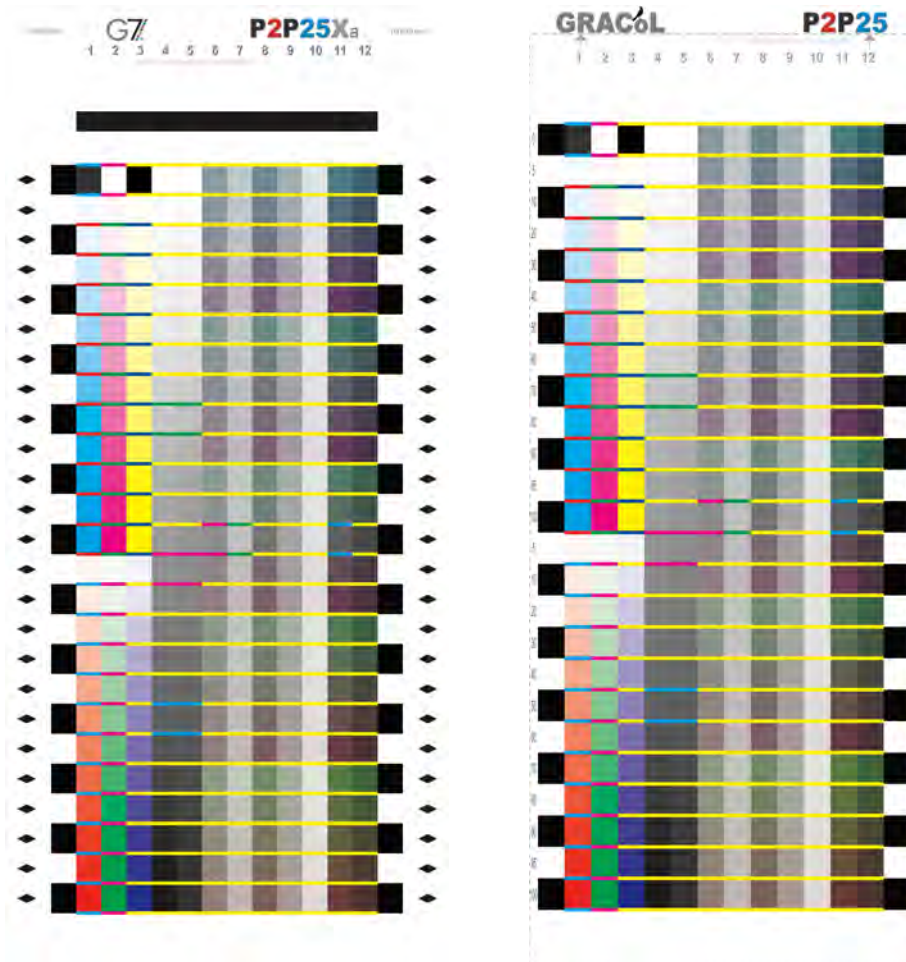


Figure A.1 The P2P25Xa target (left) and the P2P25 target (right)

## Older P2P Targets

Prior to the P2P25 target there were several versions including the P2P12, P2P14, P2P19, P2P21 and P2P23. Curve3 will recognize the P2P23 target if measured with the correct reference file. The P2P23 has only eleven columns and 275 patches, compared to the P2P25 which has 12 columns and 300 patches.

Note that if the P2P23 is measured on the DTP70 in ColorPort, results will be inaccurate due to a problem with the .xml reference file that cannot be resolved.

*Caution: The P2P23 target will give incorrect gray balance results if measured in ColorPort.*

## Working With Non-Standard P2P Targets

When measuring a P2P target other than the P2P25, be sure to use the correct reference file. Curve3 may accept a data file measured with the incorrect reference file, but results will be inaccurate.



## Custom-Generated and Odd-Size Targets

If your measuring device or software does not work with the supplied targets, it may be possible to create a custom target (e.g. in X-Rite ColorPort, MeasureTool or i1Profiler) from a P2P definition file, but be aware of the following:

- Custom-generated target images **MUST** contain fractional percentage values, especially in light patches below 10%. Rounding fractional percentages to integers may lead to inaccurate G7 calibration.
- The supplied TIFF P2P targets use LSB (least significant bit) dithering to simulate better than 8-bit accuracy. This extra precision will normally be lost in custom-generated targets.

## Printing the P2P Target

For a new calibration, the P2P target should be printed in exactly the same way as normal work, but with no calibration curves present in the device RIP or driver. If calibrating a device with possible unevenness, for example an offset press, print at least two targets rotated 180° from each other and let Curve3 average both measurement sets.

If the target will be measured on an X-Rite DTP70 or a X-Rite Eye One, be sure to print the target at exactly the same size as the file. If the target will be measured with an X-Rite i1iO or a hand-held device in spot mode, you can re-size or stretch the P2P target size to fit the measuring area.

### **Back-side printing**

Ideally, nothing should be printed on the reverse side of the P2P. If back-printing is unavoidable, either measure with black backing or make sure the reverse image is a flat tint of uniform color and density across the whole P2P area.

## Printing Multiple P2P targets

On devices with uneven ink coverage or other irregularities across the printing surface, at least two P2P targets should be printed in the same page, if space permits. On an offset or digital press, print as many targets as are practical and average them in Curve3.

The **Smooth** function can improve calibration, even when multiple targets have been measured.

On any device the best calibration curves are made by performing several G7 Calibration Runs over several days or weeks, and averaging the results.

## Averaging Multiple Print Runs

On printing systems whose performance varies significantly from run to run, such as offset lithography, screen printing, flexography and electro-photography (dry or wet toner), one Calibration Run is not enough to determine the average performance of that system over time.

On any device the best calibration curves are made by performing several G7 Calibration Runs over several days or weeks, loading as many samples as you can from each run, then de-selecting any that don't fit the average of the whole group. (See *Measurement File Color Codes* in Section 5.)

# Appendix: **B**

## B. Target Measuring

This section discusses how to successfully measure targets for use with Curve3.

### Measuring the P2P

For detailed instructions on which reference files to use with different measuring devices, software and target versions, see the Read Me file in the P2P package.

### Drying Time

Most printing systems require some kind of drying or curing period before color and density are stabilized. Measuring a target before the drying time is complete may result in incorrect calibration curves. The same rule applies when measuring characterization data for Curve3's VPR function.

Before calibrating or profiling a printing system, find the correct drying time by measuring a P2P target immediately after it is printed, and then again after about 10 minutes, then 30 minutes, and if necessary up to 24 hours. Compare the gray balance and NPDC curves of the measurement files in the Measurements window. When measuring the same target multiple times, be careful not to scratch the surface or damage the target.

Record the minimum drying time after which no change is observed and allow all future samples to dry at least that long before measuring them.

### Coatings

If you normally apply some kind of coating or finish material over the printed surface, for example aqueous or UV varnish in offset lithography or a laminate over ink-jet printing, apply the same finish to the P2P targets, and to any characterization targets when making profiles.

If you sometimes apply the finish and sometimes do not, it is usually best to calibrate with the finish applied, then use the same RIP curves for both conditions.

To determine if you need separate calibration curves for coated and un-coated printing, print a target (or series of targets) with and without coating, but with everything else the same, then compare the NPDC graphs and gray balance corrections suggested by Curve3. If they are nearly the same, use one common set of curves for both conditions.

# Appendix: C

## C. The Printing Guide

The **Printing Guide** is for use in the pressroom and for quality control purposes.

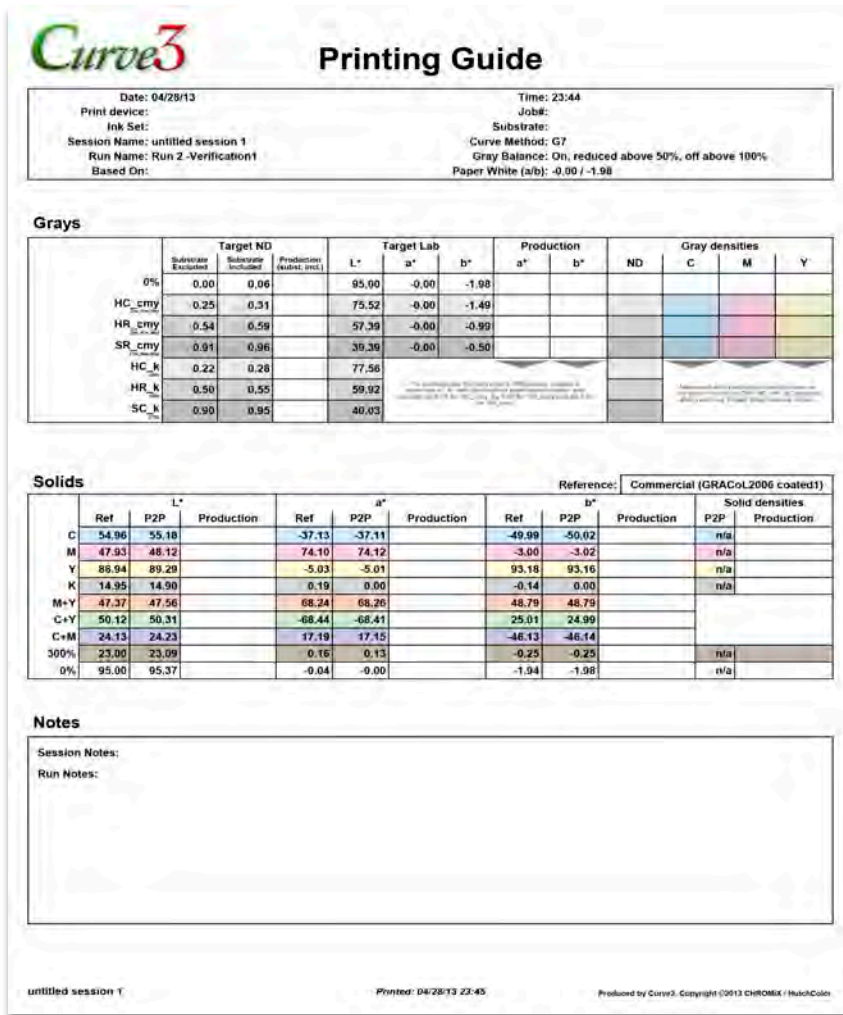


Figure C.1 The Curve3 Printing Guide

*Note: Values in the Printing guide are from the device that measured the P2P target and may be different from values measured with a production control device at the print location.*

## Grays Panel

The Printing Guide shows the target aim values for the calibrated device and media to print to G7 and the Target Color Space selected in Curve3's setup window.

Grays	Target ND			Target Lab			Production		Gray densities			
	Substrate Excluded	Substrate Included	Production (subst. incl.)	L*	a*	b*	a*	b*	ND	C	M	Y
0%	0.00	0.06		95.00	-0.04	-1.94						
HC_cmy <small>(25% Max)</small>	0.25	0.31		75.52	0.07	-1.49						
HR_cmy <small>(50% Max)</small>	0.54	0.59		57.54	-0.13	-1.43						
SR_cmy <small>(75% Max)</small>	0.91	0.96		39.39	-0.31	-0.54						
HC_k <small>(25%)</small>	0.22	0.28		77.43								
HR_k <small>(50%)</small>	0.50	0.55		59.77								
SC_k <small>(75%)</small>	0.90	0.95		39.75								

Figure C.2 Printing Guide Grays panel

The **Grays** panel shows the target values necessary to maintain G7 gray balance and NPDC.

### Target ND

The **Target ND** columns show Neutral Density values for the HC (25%), HR (50%) and SC (75%) control patches for CMY and black-only, with substrate excluded and included. The **Production (Subst. Incl.)** column is for recording Neutral Densities measured during the production run.

*Note: Neutral Density is measured on the **Visual** channel (X-Rite devices) or the **Black** channel (Techkon devices).*

### Target Lab

The **Target Lab** columns show Lab values for the HC\_cmy, HR\_cmy and SC\_cmy control patches, and L\* values for HC\_k, HR\_k and SC\_k patches. All Lab values are with substrate included. The **Production a\* b\*** columns are provided to record a\* and b\* values measured with the production device, but need only be used if the production device measures differently from the device used to measure the P2P target.

To discover whether or not you need to use the Production a\* and b\* columns, test the correlation between devices by measuring the substrate (paper) with both instruments. If the difference is less than 1 a\* or b\* there is no need to fill in these columns. If the difference is greater than 1, measure the substrate and multiply the a\* and b\* values of the production device by the following factors:

Patch	Factor
HC_cmy	0.75
HR_cmy	0.50
SC_cmy	0.25

*Note: Lab values should be measured in D50, 2° observer mode.*

### Gray Densities

The **Gray Densities** columns are for recording separate C, M, Y channel readings after gray balance has been confirmed with Lab measurements. In a production print run many users find it easier to control gray balance by monitoring separate CMY density values than Lab values.

### Solids Panel

The **Solids** panel shows the target values for the seven solid ink patches (CMYKRGB) plus the 300% CMY patch and substrate (0%).

Solids	L*			a*			b*			Solid densities	
	Ref	P2P	Production	Ref	P2P	Production	Ref	P2P	Production	P2P	Production
C	54.96	55.18		-37.13	-37.11		-49.99	-50.02		0.58	
M	47.93	48.12		74.10	74.12		-3.00	-3.02		0.72	
Y	88.94	89.29		-5.03	-5.01		93.18	93.16		0.07	
K	14.95	14.90		0.19	0.00		-0.14	0.00		1.67	
M+Y	47.37	47.56		68.24	68.26		48.79	48.79			
C+Y	50.12	50.31		-68.44	-68.41		25.01	24.99			
C+M	24.13	24.23		17.19	17.15		-46.13	-46.14			
300%	23.00	23.09		0.16	0.13		-0.25	-0.25		1.36	
0%	95.00	95.37		-0.04	-0.00		-1.94	-1.98		0.00	

Figure C.3 Printing Guide Solids panel

### L\* a\* b\*

In the **L\***, **a\*** and **b\*** sections the **Ref** columns show values defined by the **Target Color Space**. **P2P** columns show the values of the P2P calibration target. **Production** columns are for actual production values.

### Solid Densities

With spectral P2P measurements, the **Solid Densities - P2P** column shows solid densities for the four inks, 300% and substrate. Record your production densities in the **Production** column.

*Note: For production control it is convenient to view "All" colors at once.*



Figure C.4 "All" density display modes on X-Rite 528 (top left) Techkon Spectrodens (top right) Konica Minolta FD5 (bottom left) and X-Rite eXact (bottom right)



# Appendix: D

## D. Calibration Run Report

The **Calibration Run Report** is useful when entering Control Points and for quality control.

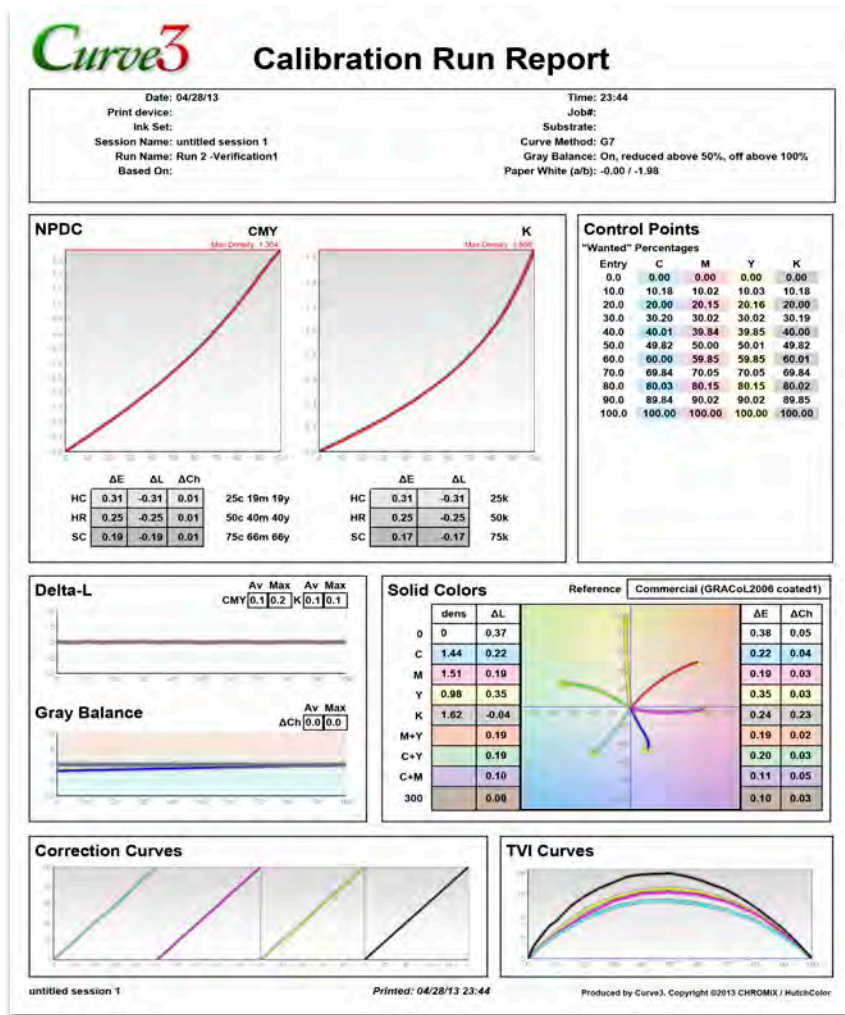


Figure D.1 Calibration Run Report

**CAUTION:** Values in the Calibration Run Report are from the device that measured the P2P target, and may be different from those measured with a print production measuring device.

## Control Points List

Control Points					
"Wanted" Percentages					
Entry	C	M	Y	K	
0.0	0.00	0.00	0.00	0.00	
10.0	10.18	10.02	10.03	10.18	
20.0	20.00	20.15	20.16	20.00	
30.0	30.20	30.02	30.02	30.19	
40.0	40.01	39.84	39.85	40.00	
50.0	49.82	50.00	50.01	49.82	
60.0	60.00	59.85	59.85	60.01	
70.0	69.84	70.05	70.05	69.84	
80.0	80.03	80.15	80.15	80.02	
90.0	89.84	90.02	90.02	89.85	
100.0	100.00	100.00	100.00	100.00	

Figure D.2 Control Points list

The Control Points List shows the percentage values to be entered into the RIP. If your RIP requires "Measured" values, be sure the list says "Measured" Percentages at the top. If not, click the **Measured** button in Curve3's Setup window.

## NPDC Graphs, $\Delta E$ , $\Delta L^*$ , $\Delta Ch^*$

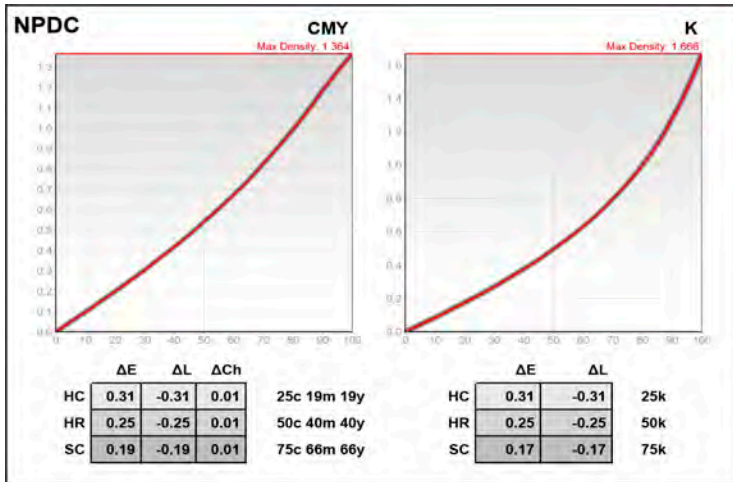


Figure D.3 CMY NPDC graph (left) and Black NPDC graph (right)

The NPDC graphs show the desired graph in green and the measured curve in red. If the green curve is covered completely by the red graph, the NPDC curves are theoretically perfect.

Below the graphs are **Delta-E**, **Delta-L\*** and **Delta-Ch** values for the HC, HR and SC patches.

- The **Delta-E** values show the overall Lab errors at 25, 50 and 75.
- The **Delta-L\*** values shows the Lightness errors independent of hue or chroma.
- The **Delta-Ch** values show the combined error due to color, independent of lightness.

## Delta-L\* and Gray Balance Graphs

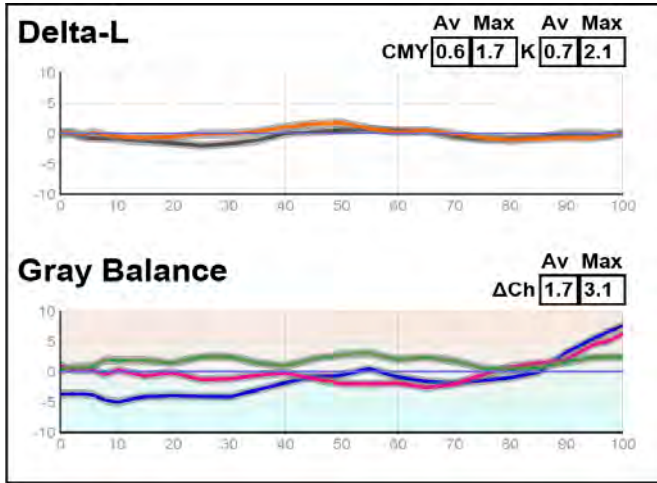


Figure D.4 Delta-L\* and Gray Balance graphs

### The Delta-L\* graph

The Delta-L\* ( $\Delta L^*$ ) graph shows the deviation from ideal lightness of the CMY scale (orange line) and the black-only grayscale (gray line).

### The $\Delta Ch$ (green) line on the Gray Balance graph

The  $\Delta Ch$  (Delta-Ch) line shows the deviation of the CMY gray scale from ideal gray balance throughout the CMY scale. The average and maximum  $\Delta Ch$  values shown above the graph help judge the gray balance performance of the whole scale.

*Note: Delta Ch is explained in Appendix E.*

### The a\* and b\* (pink and blue) lines on the Gray Balance graph

The a\* (pink) and b\* (blue) lines show the a\* and b\* values throughout the CMY gray scale. Ideally both lines should be straight, starting at the substrate values (left) and ending at zero on the right. In practice these lines will seldom be perfectly straight and more error is normal in darker areas.

## Solid Colors Chart

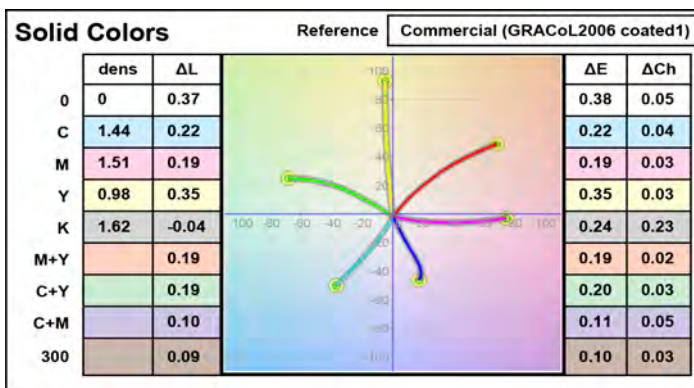


Figure D.5 Solid ink color density,  $\Delta L^*$  values (left) a/b plot (center)  $\Delta E$  and  $\Delta Ch$  (right)

The **Solid Colors** Chart shows an a/b plot (“spider graph”) flanked by four columns containing Status-T density,  $\Delta L$ ,  $\Delta E$  and  $\Delta Ch$  values for the CMYK solid inks, two color RGB overprints, 300% CMY and substrate (0). The **Reference** field shows the Target Color Space.

*Note: Density values are only shown for spectral P2P measurements, otherwise those fields display “N/A”.*

## Correction Curves

The **Correction Curves** graphs are miniature versions of the Output Curves.

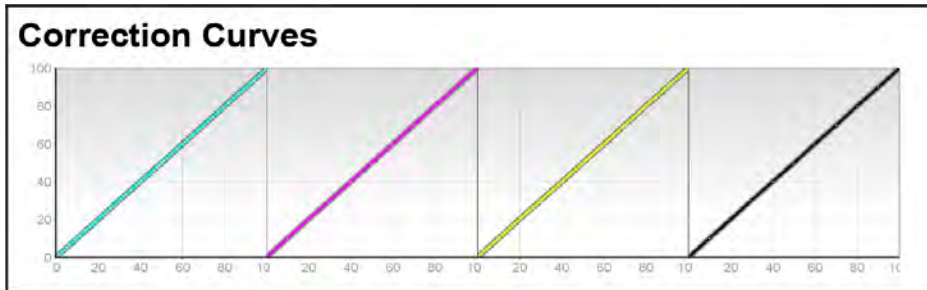


Figure D.6 Correction Curve graphs

## TVI Curves

The **TVI Curves** graph show CMYK TVI curves measured from the P2P target.

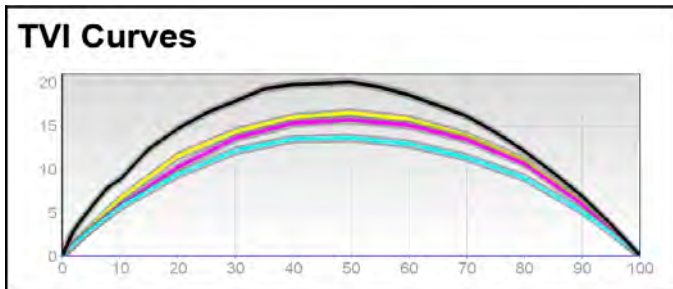


Figure D.7 TVI curves

### TVI calculations

TVI curves are calculated from simple CIEXYZ, where X, Y and Z replace the traditional Red, Green and Blue reflectance values. For more information on TVI calculations see *Appendix: F*.

## Appendix:

## E

## E. References

### Delta-Ch

**Delta-Ch** (formerly known as Delta-F\*) is an absolute (always positive) expression of the combined delta a\* and delta b\* values, where:

$$\Delta Ch = (\Delta a^2 + \Delta b^2)^{0.5}$$

Delta-Ch is the shortest line, or vector, between two points on the a\*/b\* graph, as shown below.

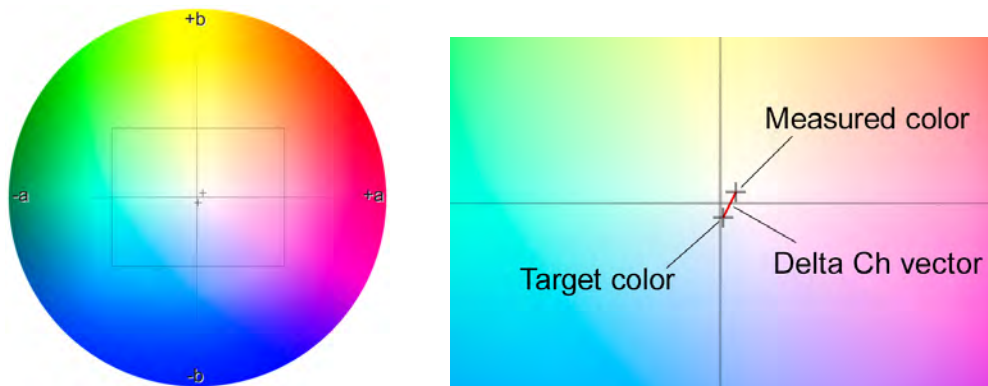


Figure E.1 On a CIE a\*/b\* diagram  $\Delta Ch$  is a straight vector between two samples (enlarged at right)

### Naming

The original name for Delta-Ch was “ $\Delta F^*$ ”, where the letter **F** stood for the German word for color – “Farbe”. Both terms mean the same thing and may appear in various literature.

### Usefulness

$\Delta Ch$  is an excellent metric of gray balance or “nearness to neutral” because color errors are more noticeable than lightness errors in grays or near-neutrals.



## Curve3 File Formats and Data Types

### ***File Formats Accepted by Curve3***

Curve3 accepts most CGATS-standard files saved out of software from Barbieri, basIColor, Konica-Minolta, X-Rite, and others.

Other file types are also accepted, for example the Logo file format exported from X-Rite MeasureTool™ and files exported from CHROMiX ColorThink™.

Custom text files exported from an application like Microsoft Excel® will be accepted so long as each patch row contains both the printed CMYK values and the measured values in a separate row.

### ***Colorimetric Data Types Accepted by Curve3***

P2P measurement files may contain CIELAB, CIEXYZ and/or spectral data. When multiple data types are included in the same file, Curve3 uses them in the following order:

1. Spectral (first preference)
2. XYZ (second preference)
3. LAB (last preference)

# Appendix: F

## F. Custom TVI Curves

This section explains how to create custom TVI curves for use in TVI calibration.

### Creating a Custom TVI Target Curve

- Create a sub-folder called “TVI” in the main folder from which Curve3 launches.
- In Microsoft Excel open a CGATS file exported from Curve3 in **Create Curves**
- Edit the file so it contains the desired number of index percentages (typically in 5% or 10% steps) and the wanted output percentages (not TVI) alongside each index for CMYK

	A	B	C	D	E	F
1	File created by Curve3					
2	#					
3	# Curve3 Run Information					
4	#					
5	# Run: Run 1 - Calibration					
6	# Based On: <none>					
7	#					
8	# Values in this file are 'Wanted'					
9	#					
10	# Gray Balance: On					
11	# reduced after 50%					
12	# until 100%					
13	# media white values: Measured					
14	# media aim points: 1.05 / -3.70					
15	#					
16	NUMBER_OF_FIELDS	6				
17	BEGIN_DATA_FORMAT					
18	SampleID	SAMPLE_NAME	CMYK_C	CMYK_M	CMYK_Y	CMYK_K
19	END_DATA_FORMAT					
20	NUMBER_OF_SETS	21				
21	BEGIN_DATA					
22	A0		0	0	0	0
23	A1	5	8.24	7.916	8.282	9.312
24	A2	10	16.179	15.76	16.476	18.237
25	A3	15	23.578	23.218	24.27	26.498
26	A4	20	30.525	30.311	31.546	34.17
27	A5	25	37.014	36.993	38.025	41.138
28	A6	30	43.293	43.493	44.331	47.735
29	A7	35	49.093	49.566	50.326	53.854
30	A8	40	54.575	55.3	56.067	59.533
31	A9	45	59.779	60.685	61.488	64.792
32	A10	50	64.7	65.704	66.537	69.707
33	A11	55	69.539	70.523	71.34	74.288
34	A12	60	74.058	75.071	75.809	78.54
35	A13	65	78.335	79.42	80.043	82.552
36	A14	70	82.302	83.456	83.964	86.13
37	A15	75	86.098	87.214	87.687	89.302
38	A16	80	89.598	90.572	91.008	92.164
39	A17	85	92.868	93.586	93.978	94.876
40	A18	90	95.634	96.041	96.345	97.005
41	A19	95	98.019	98.163	98.331	98.71
42	A20	100	100	100	100	100
43	END_DATA					
44						

	C	D	E	F
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Figure F.1 A CGATS text file exported from Curve3, showing the Index and TV (Tone Value, not TVI) percentages for a custom TVI target curve set

- Give the text file a suitable name like “GRACoL TVI” and save it in the TVI Curves folder
- IMPORTANT:** The percentages in red are TV (Tone Value), not TVI (Tone Value Increase)

	A	B	C	D	E	F
1	NUMBER_OF_FIELDS	6				
2	BEGIN_DATA_FORMAT					
3	SampleID	SAMPLE_NAME	CMYK_C	CMYK_M	CMYK_Y	CMYK_K
4	END_DATA_FORMAT					
5	NUMBER_OF_SETS 21					
6	BEGIN_DATA					
7	A0	0	0	0	0	0
8	A1	5	8.24	7.916	8.282	9.312
9	A2	10	16.179	15.76	16.476	18.237
10	A3	15	23.578	23.218	24.27	26.498
11	A4	20	30.525	30.311	31.546	34.17
12	A5	25	37.014	36.993	38.025	41.138
13	A6	30	43.293	43.493	44.331	47.735
14	A7	35	49.093	49.566	50.326	53.854
15	A8	40	54.575	55.3	56.067	59.533
16	A9	45	59.779	60.685	61.488	64.792
17	A10	50	64.7	65.704	66.537	69.707
18	A11	55	69.539	70.523	71.34	74.288
19	A12	60	74.058	75.071	75.809	78.54
20	A13	65	78.335	79.42	80.043	82.552
21	A14	70	82.302	83.456	83.964	86.13
22	A15	75	86.098	87.214	87.687	89.302
23	A16	80	89.598	90.572	91.008	92.164
24	A17	85	92.868	93.586	93.978	94.876
25	A18	90	95.634	96.041	96.345	97.005
26	A19	95	98.019	98.163	98.331	98.71
27	A20	100	100	100	100	100
28	END_DATA					
29						

Figure F.2 Any rows above the **NUMBER\_OF\_FIELDS** row can be deleted, if desired, from the file

## TVI Calculations

Curve3's TVI curves are calculated from tristimulus data (CIEXYZ) instead of the density values used in traditional TVI calculations. In Curve2 a **Z factor** was used to improve the correlation with traditional TVI values calculated for offset inks, but the Z function caused problems with other types of inks and is no longer used in Curve3.

The black TVI value should be exactly the same as Status T or Status E density-based TVI but Cyan, Magenta and Yellow TVI values may differ from traditional TVI, depending on ink colors.

## Calculating XYZ-based TVI Target Values

### Required

Paper XYZ values (Xp, Yp, Zp).

Solid ink XYZ values for cyan (XSc), magenta (YSm), yellow (ZSy) and black (YSk).

XYZ values for the for various tint percentages (T) of each ink, e.g. XTc, YTm, ZTy, YTk.

### For each tint percentage (T)

- Cyan\_TV = (Xp - XTc) / (Xp - XSc) x 100;
- Magenta\_TV = (Yp - YTm) / (Yp - YSm) x 100;
- Yellow\_TV = (Zp - ZTy) / (Zp - ZSy) x 100;
- Black\_TV = (Yp - YTk) / (Yp - YSk) x 100;

Therefore...

- Cyan\_TV = Cyan\_TV + T;
- Magenta\_TV = Magenta\_TV + T;
- Yellow\_TV = Yellow\_TV + T;
- Black\_TV = Black\_TV + T;

## Appendix:

## G

## G. G7 Via Color Management

This section explains how to pass the IDEAlliance G7 Master requirements on a printing system that doesn't accept calibration curves.

### No RIP Curves?

If your RIP or printing system doesn't allow you to enter custom calibration curves, you may not be able to use a normal Curve3 calibration, but you can still simulate the appearance of G7 calibration via color management, as follows:

- Calibrate the system by the manufacturer's method, or by whatever means are available
- Create an ICC profile of the system, or use the system's proprietary color management
- Assign a G7-based ICC profile such as GRACoL2006\_Coated1v2.icc, or assign a Reference Print Condition (RPC) based on G7 or CGATS TR015
- Set the rendering intent to **Absolute** or **Relative** Colorimetric (Perceptual is not recommended)
- Print the P2P25 target through the workflow
- Measure the P2P target and load the in Curve3's Verify window
- Check the G7 Pass/Fail condition. If all number fields are green, the system is in G7 compliance

### Limitations

Although this method will simulate G7 and can be used to IDEAlliance "G7 Master" status, you will not be getting the full benefit of G7 calibration. For example:

- You must always use a source profile, so you won't be able to capitalize on the maximum ink saturation of your device for a "G7 Extreme" effect
- You lose Curve3's ability to fine-tune gray balance and tonality in very light tones
- You must re-create a new output profile every time the system changes, whereas in a G7-based system a quick re-calibration can often maintain the value of your original profile

## G7-Based Reference Print Conditions

### **TR015**

The CGATS Technical Report “TR015” constitutes a formal definition of G7. IDEAlliance members can learn about TR015 at [www.idealliance.org](http://www.idealliance.org). Any characterization data based on CGATS TR015 is effectively “G7-based”. The most common G7-based data sets are GRACoL 2006, SWOP3 2006 and SWOP5 2006.

### **CGATS.21**

In 2013 the American National Standards Institute (ANSI) accepted a set of seven standardized Reference Print Conditions (RPCs) published under the group name CGATS.21, that are based on TR015. These data sets cover a wide range of printing conditions from cold-set newsprint to extended gamut offset. More information on CGATS.21 and TR015 can be found at [www.NPES.org](http://www.NPES.org).

Seven free ICC profiles based on CGATS.21 are available at [www.idealliance.org](http://www.idealliance.org).

*Note: For copyright reasons, neither HutchColor nor CHROMiX can provide these documents or the CGATS.21 RPC data sets or ICC profiles.*