1. New Features

1.1 What's New in GMG ProfileEditor?

This chapter summarizes all major changes that have been applied to the program since the latest release. It is recommended that experienced GMG ProfileEditor users read the information provided in this chapter very carefully, so that they can take full advantage of all new software features. Please follow the links for a detailed description of the new features.

New Feature	*Description*	*Where to Find*	*See Also*
Compensate color shifts caused by OBAs	New option **Optical Brightener Compensation**: Many print media come with varying amounts of optical brightening agents (OBAs) in their coating that may cause color shifts. If you are using media with optical brighteners, this option will help you to produce profiles that compensate the negative impact of OBAs while maintaining the whiteness levels und image contrast.	MX4**: Common** tab > **Optical Brightener Compensation**	"Optical Brightener Compensation (OBC)" on page 2
Improved profile quality	When generating CMYK output values, values are automatically **smoothed** and **outliers** are **removed**.	**Measure** menu > **Calculate CMYK from Target Values**, **Calculate CMYK from Current Values**, **Calculate CMYK Using Gamut Mapping**	
Enhanced options to preserve the ink purity	Unlike device independent profiles, device dependent profiles have the ability to preserve pure colors. Applying improved algorithms, GMG ProfileEditor enables the user to preserve the purity of **primary** (CMY) and **secondary** (CM, CY, MY) colors and of color **combinations** with Black (CK, MK, YK, CMK, CYK, MYK), keeping the colors free of contamination.	MX4, Conversion Profile: **Gamut/Separation** > ColorServer Mode > **Settings** button> **Purify Colors** tab.	"Purify Colors" on page 2
Major overhaul of the gamut mapping algorithm	When calculating new profiles, the mapping of colors between input and output color space has been greatly improved.	**Measure** menu > **Calculate CMYK Using Gamut Mapping**	"New Gamut Mapping" on page 4 "Comparing the Input and Output Color Spaces" on page 5 "Calculating a Profile with Gamut Mapping" on page 8 "Rendering Intents" on page 8 "Advanced Gamut Mapping Settings" on page 10

1.2 Optical Brightener Compensation (OBC)

Note Please select **no** filter (**Filter** = **None**) in the **Measurement Settings** if you want to create a profile with OBC. Selecting a filter will gray out the **Optical Brightener Compensation** option so that it cannot be accidentally used with filtered measurement data.

Many print media contain fluorescent whitening agents to enhance the whiteness effect. Such additives absorb light in the UV range and re-emit light in the blue range. While our eyes perceive the increased amount of reflected blue light as simply brighter or bluish-white, a spectrophotometer tells a different tale, measuring shades of blue which do not match our visual impression. For example, a measured *b value of -5 (which suggests a definite blue appearance) is usually perceived as a bright white. A profile based on such measurement values usually produces prints with an overall bluish cast.

Some measuring devices feature a **UV cut filter** which blocks the UV amount of the light source of the measuring device. Visually, however, profiles calculated with UV cut measurements tend to produce prints that have a rather yellowish cast to them. The discrepancy between measured and perceived color often leaves the user end up with prints that are either too blue or too yellow.

To strike a balance between those two effects, we have integrated an **Optical Brightener Compensation** (**MX4**: **Common** tab). Selecting this option after measuring the target values makes GMG ProfileEditor generate counter-balancing **Lab Target Values**. These counter-balancing values are based on averaged values of a visually correct and media-neutral paper white tint. For control and flexibility, we added a slider for further corrections towards Blue or Yellow. Generally, we recommend to use the default setting with the handle of the slider set to the middle. If your paper, however, is strongly colored, for example, your prints come out too yellow, you can compensate this by moving the slider towards **More Blue**.

Where can I view the changed target values?

Click on the **4d Color Space** tab and activate the option **Show Compensated Values (Optical Brightener Compensation)**. The compensated a* and b* values are displayed in the **Target Values** columns. These compensated values cannot be exported.

Tip Display the compensated values to know the actual Delta E values when iterating the profile. Not displaying the compensated values does not mean they are not used, they are just not shown.

OBC and Gamut Mapping

The **Optical Brightener Compensation** should always be activated first **before** performing a gamut mapping (**Measure** menu > **Calculate with Gamut Mapping**) to get accurate results.

1.3 Purify Colors

Note The **Purify Colors** tab in GMG ProfileEditor allows for very specific changes of the visual appearance of colors and should thus only be used by advanced users.

The color purity can be an important issue, for example, when dealing with graphical objects with deep saturated colors which after a conversion may print slightly different (though color accurate). In such cases, you might need to effect a trade-off between colorimetric accuracy and color purity.

Generally, it is recommended to calculate a profile first **without** using the options on the **Purify Colors** tab. Check the calculated profile and see to which extent primary and secondary colors are contaminated by other colors. If the contamination is rather small, for example only reaching up to 2 or 3 %, it makes sense to recalculate the profile preserving certain primary and/or secondary colors, to save the profile under a different name, and then compare the two profiles.

As a rule of thumb, the smaller the contamination, the smaller will be the impact of the **Purify Colors** options on Delta E.

How to keep colors pure

- → Start GMG ProfileEditor.
- → On the **File** menu, click **Open** and select the CMYK conversion profile you want to recalculate using **Purify Colors** options.
- → Under **Gamut/Separation**, click the **Settings** button.
  A new dialog box is displayed.
- → Click the **Purify Colors** tab.
- → Select the desired options to keep primary and/or secondary colors pure.
- → Click **OK** to confirm your choice.
- → On the **Measure** menu, click **Calculate with Target Values**.
  The target values will be computed with the gamut file to produce the output values of the profile.
- → On the **Measure** menu, click **Estimate Current Values from CMYK** to calculate the color values as they would be printed.
- → On the **File** menu, click **Save As** and save the modified profile under a new name.
- → Under **Options**, click **GamutViewer**.
  The GMG GamutViewer is displayed.
- → Under **Reference Gamut**, click the **Open** button and select the original profile.
- → Under **Sample Gamut**, click the **Open** button and select the modified profile.

Both profiles are displayed on the **3D** tab. You can choose between different display modes to assess the applied changes. If the sample gamut does not encompass the reference gamut, the respective colors cannot be represented. Should this only pertain to minor color areas at the outer margin of the gamut, the profile may still be acceptable. If the deviations are far out of range, you might have selected too many **Purify Colors** options. In this case, deselect some options and try again until you are satisfied with the result.

1.3.1 Purify Colors Settings

The following table shows all options to preserve the purity of **CMY** color values. The column **Affected Range** contains operational values which indicate the impact of the option. These values can, of course, differ (due to different profiles) and are intended to be a rough guide. The higher the number, the bigger is the potential change on the input colors.

Option	*Affected Range*	*Short Description*
Keep Pure Gradations	9	Keeps the gradations of the selected primary color(s) pure when calculating the profile. Example: The conversion profile would normally convert an input color of C=20, M=0, Y=0 to an output color of C=15, M=3, Y=4. If you select **Cyan**, the final output color may become C=15, **M=0**, **Y=0** (depending on the used profile). Thus the color tone compensation in the Cyan axis is applied, but color tones other than Cyan are ignored.
Keep Pure Secondary Colors	81	When creating a **CMYK Conversion Profile**, you can also keep **secondary colors** pure. **Reds** comprises any combination of Yellow and Magenta without Cyan, **Greens** any combination of Yellow and Cyan without Magenta, and **Blues** any combination of Magenta and Cyan without Yellow. Example: When selecting **Reds**, the color shifts of Yellow and Magenta values are applied according to the profile, but no Cyan is added to keep the **Reds** pure.
Keep Pure Solids	1	This option forces 100 % solid colors to remain unchanged when calculating the profile. It makes sense to select this option in accordance with what you selected under **Keep Pure Gradations**, as only one fulcrum is affected. Example: 100 % Cyan is kept at 100 % Cyan, if **100 % Cyan** is selected.

Option	*Affected Range*	*Short Description*
Keep Solids With	18	Keeps all solid colors unchanged along the selected 100% lines. Example: If you select **100% M or 100% Y**, the axis from Yellow to Red and Red to Magenta is kept at 100%.

The below settings include the **Black** axis, thus enabling the preservation of Black and combinations with Black (**CMYK**). These options aim at separation-preserving profiles with heavy GCR settings.

Option	*Affected Range*	*Short Description*
Keep Pure	81	All colors made up of only C+K, M+K or Y+K remain pure, ignoring all other color tones. Example: The conversion profile would normally convert a blue input color of C=35, M=0, Y=0, K=75 to an output color of C=30, M=2, Y=3 and K=71. If you select **C+K**, the final output color may be C=30, **M=0**, **Y=0**, K=71. Thus Cyan and Black are adjusted, and all other color tones are ignored.
Keep Pure	729	Similar to the above option, but including a third color. All colors composed of the selected primary inks (including Black) remain pure. This option should be used with care as many fulcrums are affected potentially changing the visual appearance of the colors to a great extent. Example: The conversion profile would normally convert an input color of C=5, M=30, Y=30, K=30 to an output color of C=2, M=32, Y=32 and K=34. If you select **M+Y+K**, the final output color may be **C=0**, M=32, Y=32, K=34. Thus Magenta, Yellow and Black values are adjusted and all Cyan values are ignored.
Keep Pure Gradations	9	Colors which are made up of a primary color and 100% Black are converted according to the profile, keeping Black at 100%. Example: The conversion profile would normally convert an input color of C=80, M=0 , Y=0 , K=100 to an output color of C=78, M=2, Y=3 and K=80. If you select **C if 100%K**, the final output color may be C=78, **M=0**, **Y=0**, K=100. Thus Cyan is adjusted according to the profile and Black forced to 100%. Magenta and Yellow values are ignored.
Keep 100% Black	729	This option keeps all colors unchanged which contain 100% Black and should be used with care as many fulcrums are affected potentially changing the visual appearance of the colors to a great extent. Example:: The conversion profile would normally convert an input color of C=0, M=0, Y=50, K=100 to an output color of C=0, M=10, Y=40 and K=80. If you select **100% K**, the final output color may be C=0, M=10, Y=40, **K=100**, forcing K to 100%.

1.4 New Gamut Mapping

Apart from a detailed description of new features, the following chapters also include useful tips on how to evaluate your target color space and how to choose the best rendering intent for your particular situation.

All advantages on a glance:

- High-quality colors **matching** the original colors as intended by the creator of the document
- Excellent and stable **gray balance**
- **Bright** and **colorful** images with a maximum of contrast and detail
- With the new adjustable **Black Point Compensation** feature, you will be able to use the full dynamic range of the shadows of the target color space and to achieve a deeper black.
- Use gamut mapping algorithms **predefined** by GMG ColorExperts or use you own **custom** settings.
- The gamut mapping settings in GMG ProfileEditor have been **simplified** and **streamlined** while still offering a maximum flexibility to fine-tune a profile. Only rendering intents are available that will give highest quality results.

- **RGB-to-CMYK** separations (in GMG ColorServer) / **PhotoProof** profiles (in GMG ColorProof): The **new** rendering intent **Best Visual Impression – Relative Colorimetric** has been optimized for RGB-to-CMYK separations. With this new rendering intent, you can achieve the **highest saturation** within the technical limitations of the target color space.
- **CMYK-to-CMYK** profiles:
  - The **new** rendering intent **Best Visual Impression – Relative Colorimetric** has been optimized for color conversions where the input color space is **almost identical** to the output color space.
  - The **new** rendering intent **Best Visual Impression – Perceptual** has been optimized for color conversions where the input color space is considerably **larger** than the output color space.

See also:

- "Comparing the Input and Output Color Spaces" on page 5
- "Calculating a Profile with Gamut Mapping" on page 8
- "Rendering Intents" on page 8
- "Advanced Gamut Mapping Settings" on page 10

1.4.1 Comparing the Input and Output Color Spaces

When you create an RGB-to-CMYK separation, a CMYK-to-CMYK conversion, a digital production, or a proof profile, comparing the input and the output color space is essential for deciding which profiling method to use and to get a feeling for the print quality you can expect from the target printing system.

If the output color space is considerably smaller than the input color space, it will technically not be possible to reproduce the input colors in the output color space. In other words: The target printing system in combination with the target print medium will physically not be able to print the input colors. With a good profile, you will be able to get the most out of the system.

In our software, the input color space is referred to as the **Target Values** (because they represent the target colors you want to achieve) and the output color space is referred to as the **Gamut** (meaning the available gamut of the target printing system).

You can use GMG GamutViewer to compare the input color space (**Target Values** of the profile) with the output color space (**Gamut** of the profile). On the **Tools** menu, click **Compare Gamut/Target Values** to show a comparison of both gamuts in 3D or 2D view. You can also use GMG GamutViewer to compare any two color spaces.

If the output color space is much smaller than the input color space, there are basically two possibilities: You can either **clip** all colors that do not fit into the output color space (the so-called out-of-gamut colors) or **scale** the input color space to fit into the smaller output color space (gamut mapping). Imagine a sponge or any other soft material you want to fit into a smaller box: You can either squeeze the sponge or cut off the edges until it fits. If you squeeze it, you will increase the density of the sponge. If you cut it, you will loose material. The situation is similar for gamut mapping: If you scale the input color space, all color values will be redistributed to achieve a similar spatial distribution as on the input color space. This means that the absolute color values will change, which shows when you measure them with a spectrophotometer. But if you look at the printed image, it will "look good", that is, the **visual impression** of the original image will be preserved. If you clip the color space, higher saturated colors will be lost, but the in-gamut colors will be preserved. Even though most colors will not be changed, the visual impression of the original image might be lost. For example, a nice gradation in a bright blue sky might be converted to a uniform single-color area.

In GMG ProfileEditor, using the clipping method or absolute colorimetric rendering intent would mean to use the **Calculate with Target Values** feature (from the **Measure** menu). If the input and output color spaces are very different, this is generally not recommended, as you will loose a lot of color information. This method is best if the output color space covers the input color space or if there are only minor differences (that are not relevant for the processed images).

GMG ProfileEditor offers high-quality **gamut mapping algorithms** that will achieve the best possible result on the target printing system.

In the following, we will discuss some typical examples of color space conversions, to help you decide which profiling method and rendering intent might be best for your particular situation.

Input and output color spaces are similar

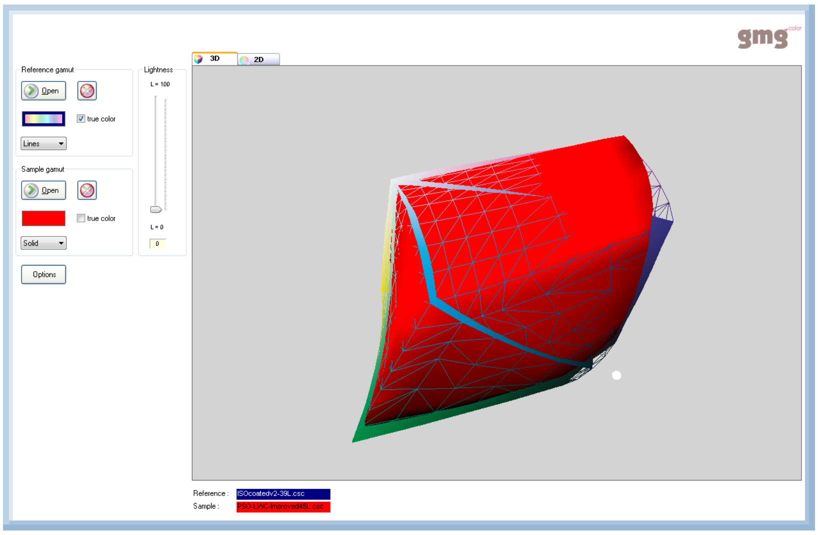

Fig. 1 Input "ISO Coated v2 (39L)" compared to output "PSO LWC Improved (45L)".

The red solid surface represents the smaller output color space, showing through the color grid of the input color space.
The gamut depicted in red is quite close to the input color space. The two printing conditions sheet-fed and web offset (on coated paper) can reproduce very similar color spaces. For a conversion profile, you can use the rendering intent **Best Color Accuracy – Relative Colorimetric**. If a color-accurate reproduction is very important and image motifs do not use a lot of highly saturated colors (on the hull of the gamut), you could even create a profile without gamut mapping.

Similar color spaces, but different black point

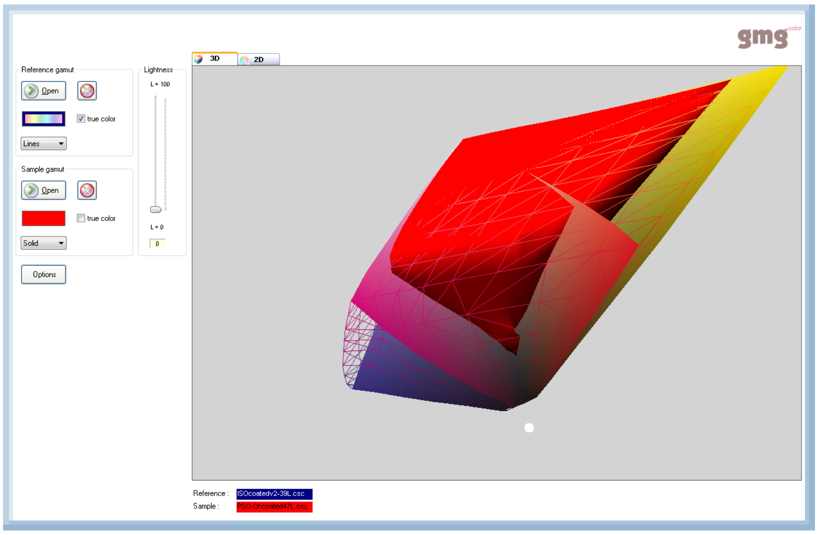

Fig. 2 Input "ISO Coated v2 (39L)" compared to output "PSO Uncoated ISO12647 (47L)".

In the highlights, the two color spaces are more or less identical. As the black point on uncoated media is lighter than on coated media, the output color space "PSO Uncoated ISO12647 (47L)" is limited in the shadows. The shadows will lighten a lot under the target printing condition.
As the two color spaces have a similar white point, you can use the rendering intent **Best Color Accuracy – Relative Colorimetric**. You can control shadow clipping and detail loss in the shadows by using the **Black Point Compensation** feature.

Output color space is much smaller than input color space

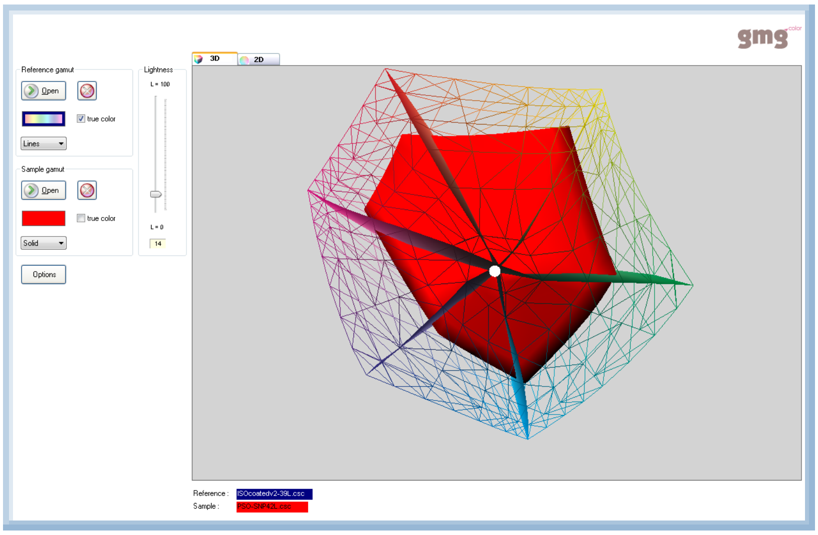

Fig. 3 Input "ISO Coated v2 (39L)" compared to output "PSO SNP Paper (42L)".

The newsprint color space is much smaller than offset coated. To match the visual impression of the original image as best as possible, use the **Best Visual Impression – Perceptual** rendering intent. As at least the shape of the color spaces are similar, it will be possible to achieve a close matching of the visual impression after scaling the input color space to the output color space.

Separation of RGB data to CMYK

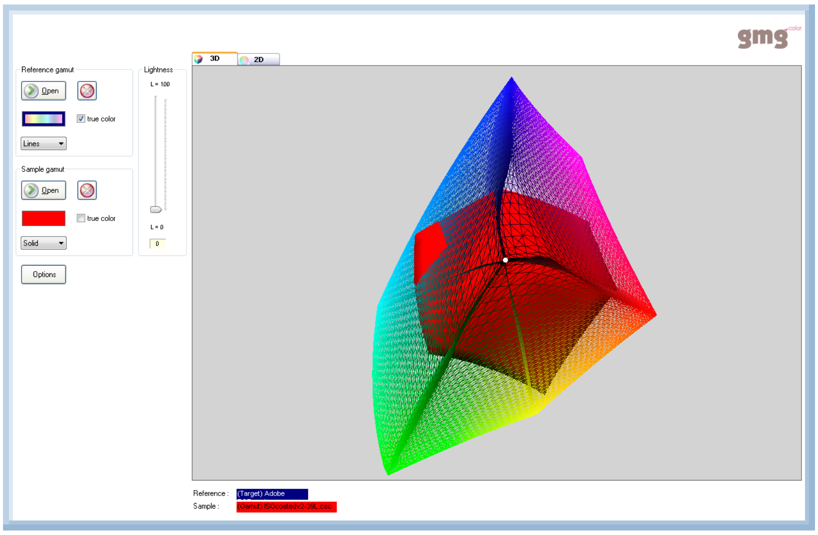

Fig. 4 Input "Adobe RGB (1998)" compared to output "ISO Coated v2 (39L)".

This comparison shows a typical problem when printing RGB images: The printing system (offset coated in this example) can reproduce only a much smaller color space. Therefore, you will always need to use the rendering intent **Best Visual Impression – Perceptual** for RGB-to-CMYK separations.
The shapes of the color spaces are also very different, especially in the green and blue areas. To match the shape of the output color space, scaling alone will not be sufficient; it will also be required to clip out-of-gamut areas after the scaling. You can put more emphasis on the lightness or on the saturation of out-of-gamut colors by moving the **Out-of-Gamut Colors Clipping Mode** slider.

1.4.2 Calculating a Profile with Gamut Mapping

Note When a profile is calculated with gamut mapping, fulcrums are added to the profile. This means, an optimization of the profile by iteration (**Calculate with Current and Target Values**) will **not** be possible anymore after gamut mapping. If you want to optimize the profile, you will need to use the method without gamut mapping (**Calculate with Target Values**) to create a first version of the profile. However, if the source and target color space are quite different, you might not be able to reach the target values within narrow tolerances, resulting in high delta E values.

Note If you use the command **Calculate with Gamut Mapping**, make sure the option **Use Paper Tint Correction** on the **Separation** page (**Common** tabbed page in the profile > **Gamut/Separation** > **Settings**) is **not** selected. This option conflicts with the **Paper Tint Compensation** settings of the gamut mapping mode.

How to calculate a profile with gamut mapping

1. On the **Measure** menu, click **Calculate with Gamut Mapping**.
   The **Gamut Mapping** dialog box will be displayed.
2. From the **Mode** drop-down list, select the rendering intent you want to use and adjust the parameters if required.
3. Click the **Calculate** button to calculate the profile.

A new profile will be calculated based on the existing one. New **target values** (referring to the **output** color space) will be calculated based on the **Separation** settings (defined on the **Common** tabbed page in the profile > **Gamut/Separation** > **Settings**) and the **Gamut Mapping** settings.

The target values will then be automatically computed with the linked gamut file to produce the CMYK output values of the profile, including an automated smoothing algorithm (same functionality as **Calculate with Target Values**).

The profile is now ready-to-use.

See also:

- "Rendering Intents" on page 8

1.4.3 Rendering Intents

Gamut mapping is performed with specific calculation modes, also called rendering intents.

Note For RGB-to-CMYK profiles, gamut mapping is always recommended, as CMYK color spaces are generally considerably smaller than RGB color spaces.

When do I use which rendering intent?

Choosing an ideal rendering intent depends on the differences between the input and output color space of the profile and on the purpose for which the profile will be used.

When comparing the input and output color space, the **luminance range** (dynamic range) is the most important factor. If the input and output color spaces are almost identical, input colors can be reproduced on the target printing system. If the luminance range of the input color space is much higher than the luminance range of the output color space, input colors must be either scaled or clipped to match the limited luminance range.

You can use GMG GamutViewer to compare the input color space (**Target Values** of the profile) with the output color space (**Gamut** of the profile). On the **Tools** menu in GMG ProfileEditor, click **Compare Gamut/Target Values** to show a comparison of both gamuts in 3D or 2D view.

See also a detailed discussion of typical examples in the following chapter: "Comparing the Input and Output Color Spaces" on page 5

In the following, we provide a few hard-and-fast rules to help you decide which rendering intent you might need.

- Input color space = **RGB**? => If yes, use **Best Visual Impression – Perceptual**.
- Input color space = **CMYK**
  - Profile will be used for **proofing** or **validation prints**? => If yes, do **not** use gamut mapping. Instead, use the **Calculate with Target Values** feature (from the **Measure** menu). (Make sure the print system you are using is able to reproduce the simulation color space. If you want to print RGB data, you will need to normalize the data to the CMYK simulation space before applying the proof profile.)
  - Output color space **completely covers** the input color space? => If yes, do **not** use gamut mapping. Instead, use the **Calculate with Target Values** feature (from the **Measure** menu).
  - Output color space **almost identical** to input color space (comparable luminance ranges)? (Example: using two similar print media on the same printing system) => If yes, use **Best Color Accuracy – Relative Colorimetric**. In-gamut colors will not be changed by the profile. The higher the difference between the two color spaces, the more out-of-gamut colors will be clipped.
  - Output color space considerably **smaller** than input color space? (Example: Conversion from offset to newsprint) => If yes, use **Best Visual Impression – Perceptual**. The higher the difference between input and output color space, the higher will be the gamut compression, that is, the higher will be the colorimetric deviation from the original colors.

The rendering intents are explained in more detail in the following table.

Available options	*Description*
Best Visual Impression – Perceptual	This rendering intent aims at preserving the **visual impression** of the original image, including saturation and detail, in the limited output color space. The color space will be **scaled** to fit into the output color space, that is, all color values including in-gamut colors will be redistributed. Central colors are remapped more precisely, that is, changed less than colors at the edges of the gamut.
Best Color Accuracy – Relative Colorimetric	(Only available for CMYK-to-CMYK profiles) This rendering intent aims at achieving the highest **color accuracy**. In-gamut colors are reproduced in a color-accurate manner in the output color space. Higher saturated (out-of-gamut) colors are **clipped**. Relative colorimetric aligns the **white point** of the input color space to the output color space, leading to a color compensation when printing on **tinted** paper. As a result, all in-gamut colors are **modified** with respective to the new white point. Apart from that, changes to in-gamut colors are kept to a minimum, so that a maximum color accuracy is achieved. You can manually adjust the **Paper Tint Compensation** and thus the impact on the in-gamut colors. Contrast and detail in saturated areas might be lost when using this rendering intent. You can manually adjust the contrast (**Contrast Adjustment**). An adjustable **Black Point Compensation** can be used to avoid shadow clipping. Out-of-gamut colors are clipped. You can put more emphasis on the lightness or on the saturation of out-of-gamut colors by moving the **Out-of-Gamut Colors Clipping Mode** slider.
No Gamut Mapping (absolute colorimetric)	Creating a profile without gamut mapping has a similar meaning than using an absolute colorimetric rendering intent for ICC based color management. In-gamut colors are color-accurately reproduced and out-of-gamut colors are clipped. Without gamut mapping, it might not be possible to reproduce the **Source Color Space (Target Values)** in the **Output Color Space (Gamut)**, depending on the technical limitations of the printer–medium combination and depending on how different the printer gamut is from the input color space. The deviation between **Current** and **Target** values might be quite high, resulting in high delta E values. It might not be possible to achieve much improvement even by using an iteration cycle. If you want to create a profile without gamut mapping in GMG ProfileEditor, use the **Calculate with Target Values** feature (from the **Measure** menu).

1.4.4 Advanced Gamut Mapping Settings

For most applications, you can use the default settings by selecting a rendering intent from the drop-down list. In some cases, it might be required to manually adjust the gamut mapping settings by moving the sliders. Optimum gamut mapping settings depend mainly on the differences between the input and output color space and to a certain degree also on the image motifs you want to process. You might need to empirically determine the ideal settings for your particular situation. To point you into the right direction, the concept behind the gamut mapping settings are explained in the following. Available settings depend on the selected rendering intent.

Paper Tint Compensation

This parameter defines how much the **paper tint** of the output color space or target print medium (defined by the gamut linked within the profile) will affect the printed colors.

The **Paper Tint Compensation** mainly affects the **gray balance** and **less saturated** colors.

Generally recommended is a **Paper Tint Compensation** of **0**, as this setting preserves the paper white and the gray axis of the original image.

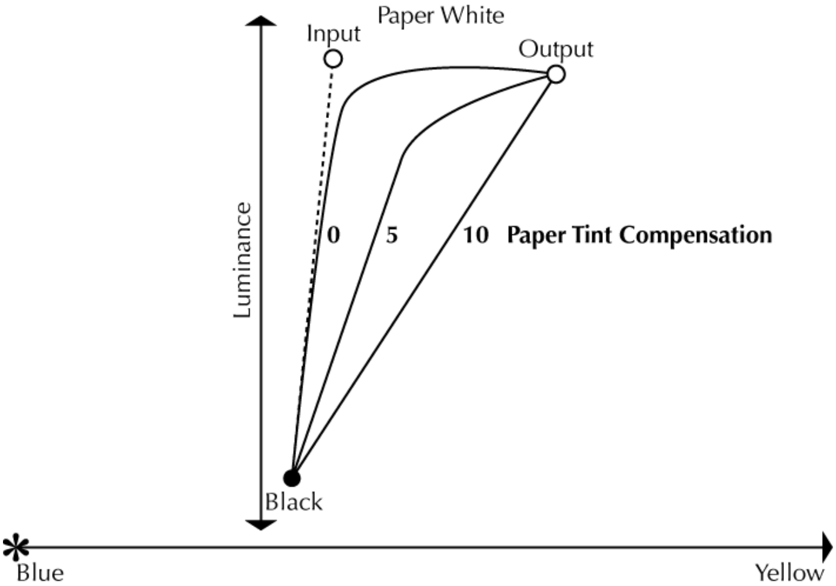

Fig. 5 Paper tint compensation example.

In this example, a color space is converted to a color space with a more yellowish paper tint, for example, from "ISO Coated v2 (39L)" to "ISO Uncoated Yellowish (30L)". That means, the conversion profile shifts the color space from Blue to Yellow.
In a color space, the gray axis connects the paper white with the black point. In the diagram, you can see three gray axis curves, each for a different **Paper Tint Compensation** value (0, 5, 10).
With a **Paper Tint Compensation** of **10**, the gray axis is perceptually mapped to the output color space, without taking the input color space into account.
With a **Paper Tint Compensation** of **0**, the profile preserves the original gray axis as best as possible. As you can see, there is a sharp bend in the curve that could potentially result in visible steps in the highlights (depending on image motifs).

- Move the slider towards **Source** if you want to preserve the original colors, thus "ignoring" the new paper tint. Please note that especially in the highlights, a prominent paper tint in the target color space such as Yellowish cannot be fully compensated. For example, a pure white color will be out of gamut.
- If you move the slider towards **Destination**, the new paper tint will have more effect on the colors, especially on the highlights and on the gray balance.

Contrast Adjustment

Defines the lightness for the highlights and shadows.

- If you move the slider towards **Low**, the highlights will be darker and the shadows will be lighter, that is, you **decrease** the contrast. You will also achieve **more detail** in the shadows.
- If you move the slider towards **High**, the highlights will be lighter and the shadows will be darker, thus **increasing** the contrast.

Black Point Compensation (Relative Colorimetric)

If the black point in the output color space, for example, when printing on uncoated media, is lighter than in the input color space, it will not be possible to reproduce very dark colors. When using a relative colorimetric rendering intent, this would mean that out-of-gamut colors will be clipped, resulting in a loss of shadow detail. Using the adjustable **Black Point Compensation** feature can help avoid shadow clipping.

- You can increase the **Black Point Compensation** level by moving the slider towards **Full**. **Black Point Compensation** preserves image detail in the shadows by **minimizing** clipping in the **shadows**. Thus, the full dynamic range of the output color space in the shadows can be used.
- If no **Black Point Compensation** is used by moving the slider to the left side (**None**), changes to in-gamut colors in the shadows are minimized, though detail might be lost. Deactivate **Black Point Compensation** if you want to avoid color shifts.

Out-of-Gamut Colors Compression Level (Perceptual)

This setting directly affects the **colorfulness** (**chroma**) of an image.

It defines the balance between **scaling** out-of-gamut colors to new color values and **clipping** of out-of-gamut colors.

- Move the slider towards **None (Clipping)** if you want to change in-gamut colors as little as possible. Out-of-gamut colors are **clipped**. As a side effect, image detail and contrast might be lost in highly saturated areas.
- Move the slider towards **Full** if you want to use the full range of the output color space to represent all input colors. Out-of-gamut colors are **scaled** to the target gamut, resulting in a redistribution of all color values, including in-gamut colors. Clipping is minimized. As a side effect, undesired color shifts might occur and image detail might be lost in less saturated areas. Image colors might appear a bit dull, closer to gray.

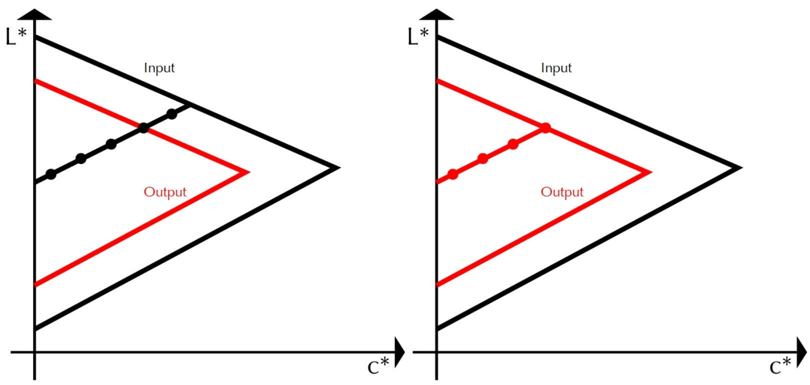

Fig. 6 Clipping mode.

The black curve shows the chroma of the input color space and the red one shows the chroma of the output color space. The diagram on the left side marks a sample of five color values in the input color space or original image (target values) as black dots. On the right side, the five values are mapped to the output color space. The mode **None (Clipping)** was used. This means that the chroma of the four color values that are in-gamut of the output color space will not be changed. The fifth value, which is out of gamut, is clipped. This means that the colors represented by the fourth and fifth dot will be mapped to the same color value, that is, will print identical, resulting in color information loss.

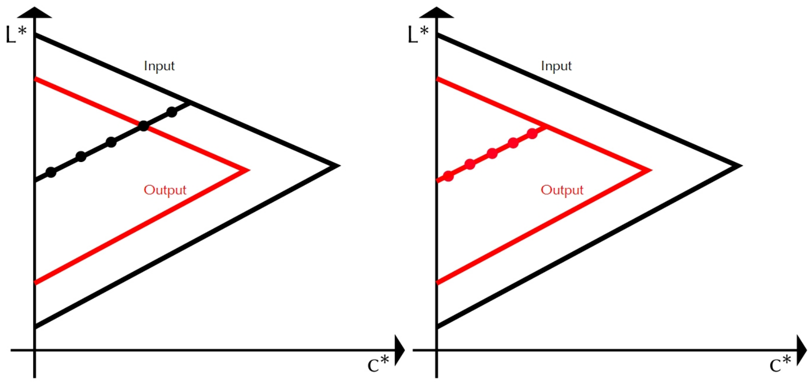

Fig. 7 Scaling mode.

This diagram shows the same situation as the preceding one, but with the **Out-of-Gamut Colors Compression Level** set to **Full**. Out-of-gamut colors are not clipped, but scaled to fit into the output color space. All five color values are reproduced and no color information is lost. All five color values are redistributed, that means, in-gamut colors are changed as well.

Out-of-Gamut Colors Clipping Mode

In the last step of the gamut mapping process, the **Out-of-Gamut Colors Clipping Mode** defines to which position on the surface of the target gamut hull all remaining out-of-gamut colors will be mapped.

- Move the slider towards **Preserve Saturation** if you want to achieve more **colorful** images. This is generally preferred if images have loud colors, for example, business chart graphics.
- Move the slider towards **Preserve Lightness** if you want to bring out more **detail**, more **depth**, and **finer textures**. This is generally preferred for photo or fine art printing.