GEO Semiconductor

GEO GW5 ISP Tuning – Local Tone Mapping (LTM)

Revision: 0.2

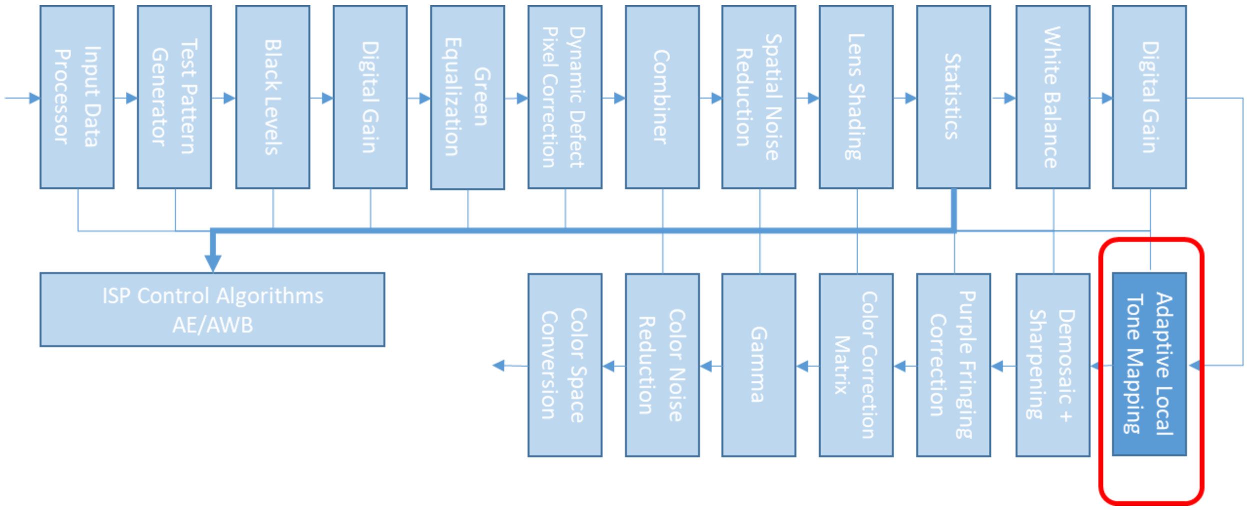
Rev	Date	Comments
0.1	2019/10/11	Initial revision, based on GW5 ISP Tuning guide rev. 0.17.
0.2	2020/10/29	- Added dynamic asymmetry LUT section. - Removed incorrect & outdated information. - Updated parameter descriptions and expanded tuning methodology.

Content

Figures

Tables

1.1. Local Tone Mapping



1.2. Overview

The Local Tone Mapping (LTM) block performs "dynamic range compression" or "tone mapping" of an input image based on a model of the human visual system. It is used in a camera pipeline to map an image sensor's response to something closer to human vision to produce a more natural images under a wide range of capture conditions and dynamic ranges. This is even more important in a high dynamic range (HDR) image where it can help reveal the shadow detail which would otherwise be under-exposed or recovering contrast in the highlights. Overall, this increases the range of tones available to local regions by increasing gain with respect to scene content (see Figure 1).

Figure 1: Local Tone Mapping Example (Disabled/Enabled)

GW5's LTM is based on space-variant or pixel-by-pixel processing algorithms which construct a family of transforms based on analysis of image content. By analyzing the regions surrounding each pixel, an effective tone curve in each color component is generated.

The algorithm is adaptive, meaning that a single set of global parameters may be chosen to process any source image or any video sequence. The LTM algorithm automatically compensates for high contrast scenes, scenes with mid-tones only and so on using local scene content. The images in Figure 2 show the effective tone curves generated by LTM in specific regions by applying the following gains:

Mid tones: Low positive gain
Dark areas/shadows: High positive gain
Bright areas/highlights: Low negative gain

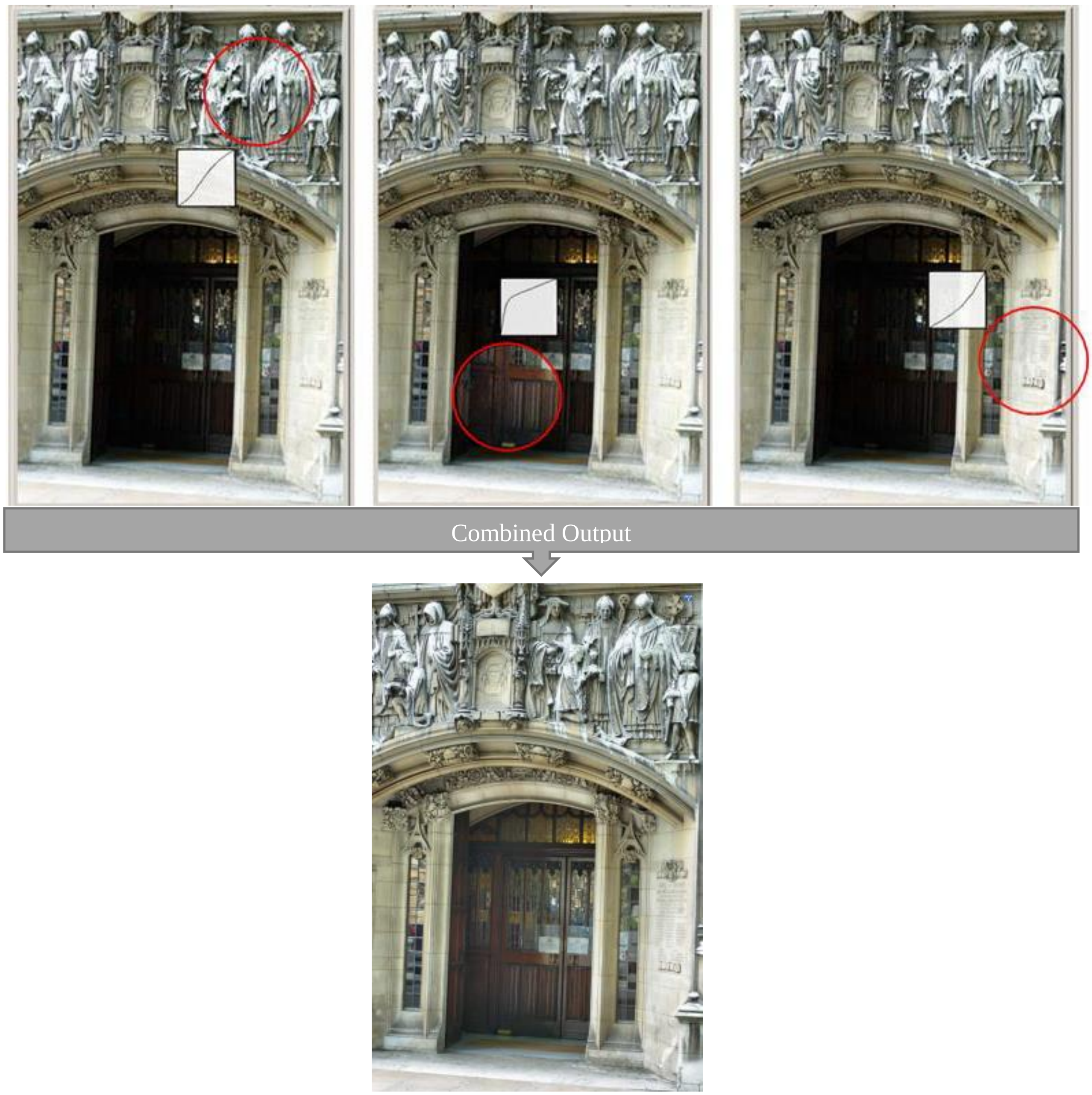


Figure 2: Local Tone Mapping Example (Tone Curves)

The mapping is generated automatically based on analysis of scene content and algorithm control parameters described in this document. The purpose of the transform is to map the image content from an input source such that it remains fully visible on an output display without loss of content, while preserving local color, sharpness, and contrast of the original image.

LTM tuning is introduced at slightly different stages in the tuning process depending on the ISP mode used. However, the tuning process for LTM stays the same for each ISP mode, requiring the majority of other modules to have previously been tuned. The process is outlined below:

- *During phase one* – No tuning required but basic curve applied.
- *During phase two* – LTM tuned in lab conditions for the majority of scenes. Tuning is also verified at the end of phase two.
- *During phase three* – LTM parameters are fine tuned to suit all scenes. Primarily involves modulation of parameters according to gain.

1.3. Tuning Theory

Using space-variant/pixel-by-pixel algorithms, Local Tone Mapping dynamically adapts, producing a different response curve for each input pixel. This means all lighting conditions can be accounted for by setting core parameters.

Key ISP JSON Parameters

Key parameters are found in ISP JSON under "`localtonemapping`" group.

Parameter	**Data Format**	**Description**
`enable`	Binary 0: disabled 1: enabled	Enable local tone mapping (LTM).
`adaptive_enable`	Binary 0: disabled 1: enabled	Enable adaptive LUTs for LTM.
`asymmetry_lut`	Unsigned 20-bit 0 - 1048575 65 entries	20-bit response curve used by LTM when dynamic_asymmetry_enable is disabled. 65 points which are linearly spaced with first point being 0 and last point being 1048575.
`dynamic_asymmetry_enable`	Binary 0: disabled 1: enabled	Enable dynamic response curves to dynamically switch between highlight and lowlight asymmetry LUTs based on EV thresholds.
`dynamic_asymmetry_highlight_switch_ev`	Unsigned 31-bit 0 - 2147483647	Lower limit EV for interpolating between lowlight and highlight asymmetry LUT.

dynamic_asymmetry_lowlight_switch_ev	Unsigned 31-bit 0 - 2147483647	Higher limit EV for interpolating between lowlight and highlight asymmetry LUT.
dynamic_asymmetry_alpha_ev	Float 0 - 1.0	EV temporal smoothing for switching between lowlight and highlight asymmetry LUTs. Higher value means more temporal smoothing is applied. Set 0 to disable.
dynamic_asymmetry_highlight_lut	Unsigned 20-bit 0 - 1048575 65 entries	20-bit highlight asymmetry LUT used when dynamic_asymmetry_enable is enabled. 65 points which are linearly spaced with first point being 0 and last point being 1048575.
dynamic_asymmetry_lowlight_lut	Unsigned 20-bit 0 - 1048575 65 entries	20-bit lowlight asymmetry LUT used when dynamic_asymmetry_enable is enabled. 65 points which are linearly spaced with first point being 0 and last point being 1048575.
filter_mux	Binary 0: default LTM 1: reserved	Enable to use alternative LTM parameters (not recommended).
black_level	Unsigned 20-bit 0 - 1048575	Pixel values, in 20-bit domain, below this value will not be affected by LTM.
white_level	Unsigned 20-bit 0 - 1048575	Pixel values, in 20-bit domain, above this value will not be affected by LTM.
strength_inroi	Unsigned 10-bit 0 - 1023	Strength of LTM application inside of ROI.
strength_outroi	Unsigned 10-bit 0 - 1023	Strength of LTM application outside of ROI.
roi_[hor/ver]_[start/end]	Unsigned 16-bit 0 - 65535	Horizontal/vertical starting/ending points of ROI.[1]
dark_enh	Unsigned 16-bit 0 - 65535	Reserved.
svariance	Unsigned 4-bit 0 - 15	Reserved.
bright_pr	Unsigned 8-bit 0 - 255	Reserved.
contrast	Unsigned 8-bit	Reserved.

[1] [hor/ver] acts as a place holder, indicating there are actually two registers, one for each respective "horizontal" and "vertical" plane. The same principle is applied to [start/end], where a register is present for each.

	0 - 255	
slope_min	Unsigned 8-bit 0 - 255	Used to restrict the slope decrease of the localized tone-curves.
slope_max	Unsigned 8-bit 0 - 255	Used to restrict the slope increase of the localized tone-curves.
variance_intensity	Unsigned 4-bit 0 - 15	Sets the degree of sensitivity for blending between localized regions in the luminance domain.
variance_space	Unsigned 4-bit 0 - 15	Sets the degree of sensitivity for blending between localized regions in the spatial domain.
fwd_alpha	Unsigned 18-bit 0 - 262143	Used when rev_percept_control is set to 1. Adjusts the pre-LTM coefficient value for Gamma DL.[2]
rev_alpha	Unsigned 18-bit 0 - 262143	Used when rev_percept_control is set to 1. Adjusts the post-LTM coefficient value for Gamma DL.[2]
fwd_percept_control	0: disabled 1: gamma DL[2] 2: Sqrt.	Pre-LTM perception-based conversion control. Selects the type of function to convert linear data to perceptually uniform space.
rev_percept_control	0: disabled 1: gamma DL[2] 2: Sqrt.	Post-LTM perception-based conversion control. Selects the type of function to convert linear data to perceptually uniform space.

Table 1: LTM key JSON parameters

NOTE: [hor/ver] acts as a place holder, indicating there are actually two registers, one for each respective "horizontal" and "vertical" plane. The same principle is applied to [start/end], where a register is present for each.

Common Local Tone Mapping parameters

The amount of Local Tone Mapping applied is adjusted using the strength_inroi and strength_outroi parameters for LTM applied inside and outside of the ROI respectively. For tuning and debugging purposes of LTM, roi_[hor/ver]_[start/end] can be configured by setting the pixel coordinates of the ROI and setting the corresponding strength for each ROI. After tuning with ROI is complete, set the ROI to cover the entire frame so that only strength_inroi is used on the image.

The dynamic range compression performed by LTM will be between the black_level and white_level values. LTM will not apply any gain to values below or above these two limiters. Care should be taken in modifying these values, as an excessive high black_level may cause non-linear

[2] GEO does not recommend using Gamma DL mode as it does not adapt to all types of scenes.

data artifacts in the dark regions and excessive low `white_level` may stop the LTM from utilizing the full data range of the ISP (i.e the bright highlights may look too dark).

The fundamental parameter is `asymmetry_lut`, providing the initial response curve. It can be considered that while the asymmetry curve is what primarily drives LTM, this curve is shaped and altered by the other parameters. These other parameters control the weighting towards shadow, mid-tone and highlight slope adjustment or slope restrictions in general.

There are four main control parameters: *slope limits* (`slope_min` and `slope_max`) and *variance* (`variance_intensity` and `variance_space`). The slope limits control the maximum and minimum slope adjustment of the asymmetry curve for localized regions. The variance parameters control the sensitivity of LTM of the surrounding regions, meaning a higher variance will limit the amount of localized LTM adjustment that is independent from surrounding regions.

> **NOTE:** Due the unpredictable nature of LTM, it is often useful to think carefully about the responsibility of each parameter with respect to the desired output effect. LTM is extremely scene dependent and extensive testing is required to find the correct parameter values.

Global Gain Parameters

The parameters listed in Table 2 can be used to apply a global digital gain prior to applying Local Tone Mapping if a global gain is desired in addition to the slope adjustment. Typically this gain is not desired but it can be used to help supplement the Auto-Exposure without affecting the adaptive LUTs throughout the ISP.

Parameter	Data Format	Description
`global_gain_enable`	Binary 0: disabled 1: enabled	Enable global pre-LTM digital gain.
`global_gain_manual_gain`	Float 1.0 - 31.99	Global pre-LTM digital gain value.

Table 2: LTM Global Gain Parameters

1.4. Using Local Tone Mapping during Phase One

Local Tone Mapping should use minimal tuning or alteration in phase one due to the dynamic and unpredictable nature of the algorithm. However, the LTM module should have a default curve. See section “Tuning Procedure – Asymmetry LUT” for how to generate a curve. Use the parameters for the LTM tuning to restrict it to use the asymmetry curve strictly and apply minimal localized processing. Although LTM is not tuned in this phase, it will still need to be enabled to see the image data visually by mapping the high dynamic range input to the lower bit depth output.

1.5. Tuning Local Tone Mapping during Phase Two

As Local Tone Mapping is not used during phase one, tuning starts in phase two after completing the prerequisites listed in Table 3. Ideally, all of the modules in a pipeline will have been previously tuned, although in practice this is not always achievable. As a result, LTM is initially tuned in phase two, after noise reduction, but should be verified at the end of phase two before continuing with phase three.

Prerequisite	**Status / value**
Black level	Tuned
Lens shading	Tuned
AWB	Tuned
CCM revisited	Tuned
Spatial noise reduction	Tuned
LTM	Enabled
Gamma	Tuned with respect to AE target.
AE target	Set to maximize dynamic range while minimizing over/under exposure.

Table 3: LTM phase two prerequisites

Tuning Procedure – Strength

Strength is considered as the main parameter (aside from asymmetry LUT) influencing the amount of Local Tone Mapping adjustment to apply to a scene. The amount of compression to be applied to the image is controlled through the `strength_inroi` parameter, where the parameter will control the level of blending between the LTM adjusted curves and a linear curve.

If the strength is set to 0, all curves are linear for any image providing equal input/output values with no dynamic range compression. Figure 3 shows an example of a scene with an HDR image with linear data vs the same data with LTM applied to readjust the scene data. As strength and variance parameters are increased, the variation between curves in shadows, mid-tones and highlights increases, thus providing larger dynamic range compression.

Figure 3: Linear vs Post-LTM Image

1. When tuning the LTM block, it is recommended to set the strength parameter to the maximum value initially as it will show the full effect of LTM on the image.
2. Begin adjusting asymmetry LUT and then continue to the remaining parameters.
3. Once all other parameters have been adjusted, the strength parameter can be fine-tuned to achieve the correct level of brightness and contrast. Make sure the LTM does not cause any data near highlight to clip and reduce strength or `white_level` as necessary if needed.

Tuning Procedure – Asymmetry LUT

With Local Tone Mapping being the least predictable module, it could be assumed that this also makes it challenging to tune. However, the reality is that using dynamic parameters provides a fairly simple means of tuning, while accounting for a wide range of scenes. Thus, the majority of the work will be to test as many different types of scenes as possible with a variety of dynamic ranges and image details. Initial tuning generates the asymmetry curve before adaptation and manipulation through the parameters previously mentioned.

> **NOTE:** Dynamic range of a digital camera can be described as the ratio of maximum light intensity measurable (at pixel saturation), to the minimum light intensity (above read-out noise). This is a very important definition to remember while tuning because the gain applied by LTM is proportional to the noise boost visibility of the image. Thus, the maximum gain that should be applied by LTM is determined by the dynamic range of the camera system.

1. Generation of the asymmetry LUT (`asymmetry_lut`) can be done in a two ways:
   a. The first option is to create a custom curve in GEO's ISPTune tool as shown in Figure 4.

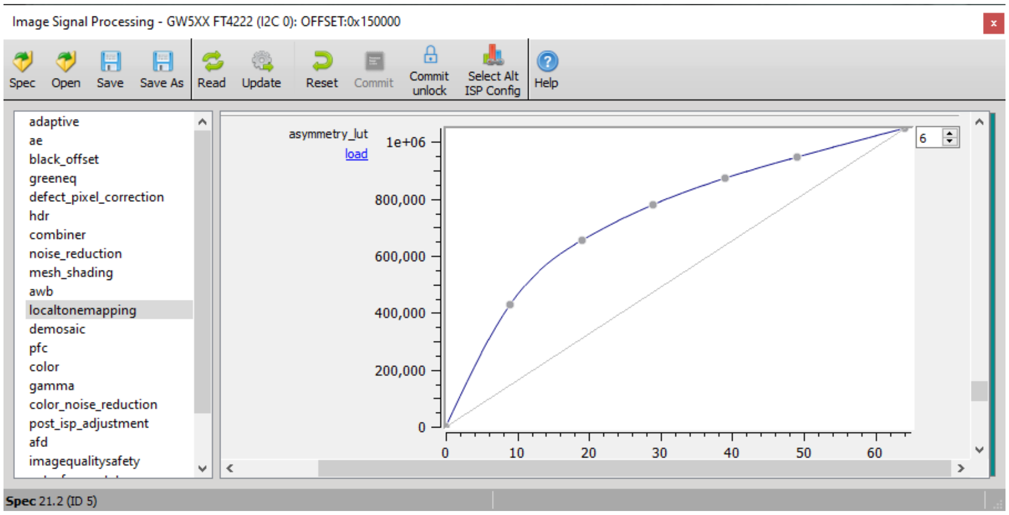


Figure 4: ISPTune GUI for Asymmetry LUT

b. The third option is to generate a curve using formula in a third-party tool such as Matlab or Python scripts and then input the LUT parameters directly in the JSON file.

2. Tune the asymmetry curve to match the sensor output with your tuned AE settings. Consider capturing a raw output of a variety of scenes and check the histogram to visualize where the data is present.
3. Once you've finalized an asymmetry curve, tune the other LTM parameters and see if there is a particular region (i.e. shadows, mid-tones, or highlights) of your image from the test scenes that consistently underperforms.
4. Retune the asymmetry curve to achieve the desired slope for the desired region and repeat step 3 & 4 until all test scenes perform as expected.

Dynamic Asymmetry LUT

While the initial asymmetry LUT tuning will attempt to find the best balance for a variety of scenes, some cases may require dynamic adjustment of the curve to specifically adjust for the scene content. Dynamic asymmetry LUT parameters provide means to dynamically adapt the asymmetry curve based on the amount of histogram data located in the shadows or highlights.

Key parameters to tune the dynamic asymmetry LUT generation:

Parameter	Data Format	Description
`dynamic_asymmetry_lut_blend_auto_alpha`	Float 0 - 1.0	Blending level between auto-generated and manually tuned asymmetry LUTs. Higher value means applying more auto-generated asymmetry LUT. Set 0 to disable, 1.0 will use dynamic curve exclusively.
`dynamic_asymmetry_lut_temporal_alpha`	Float 0 - 1.0	Temporal smoothing for switching the asymmetry LUTs generated based on dark and bright adjustments. Higher value means more temporal smoothing is applied. Set 0 to disable.

dynamic_asymmetry_lut_hist_source	Binary 0: Pre-LTM 1: Post-LTM	Histogram source used to generate the dynamic asymmetry LUT. 0: pre-LTM histogram, 1: post-LTM histogram (not recommended).
hist_sum_low_thres_perc	Float 0 - 100.0	Low threshold percentage of cumulative histogram. Used to determine the shape of histogram in dark region.
hist_sum_high_thres_perc	Float 0 - 100.0	High threshold percentage of cumulative histogram. Used to determine the shape of histogram in bright region.
hist_bin_low_thres_max	10-bit 0 - 1024	Max of histogram bin low threshold point corresponding to hist_sum_low_thres_perc.
hist_bin_high_thres_max	10-bit 0 - 1024	Max of histogram bin high threshold point corresponding to hist_sum_high_thres_perc.
hist_longexp_bins_dark_thres	10-bit 0 - 1024	Threshold of the number of long exposure histogram bins used for dark region adjustment.
hist_longexp_bins_bright_thres	10-bit 0 - 1024	Threshold of the number of long exposure histogram bins used for bright region adjustment.
dynamic_asymmetry_lut_dark_adj_low_thres	8-bit 0 - 255	Low threshold of dark adjustment value to restrict the higher dark enhancement. Lower value for higher enhancement.
dynamic_asymmetry_lut_dark_adj_high_thres	8-bit 0 - 255	High threshold of dark adjustment value to restrict the lower dark enhancement. Higher value for lower enhancement.
dynamic_asymmetry_lut_bright_adj_low_thres	8-bit 0 - 255	Low threshold of bright adjustment value to restrict the higher contrast enhancement in bright region. Lower value for higher enhancement.
dynamic_asymmetry_lut_bright_adj_high_thres	8-bit 0 - 255	High threshold of bright adjustment value to restrict the lower contrast enhancement in bright region. Higher value for lower enhancement.

Table 4: Dynamic Asymmetry LUT Parameters

The steps to tune the dynamic asymmetry LUT are the following:

1. Set `dynamic_asymmetry_lut_blend_auto_alpha` to zero to disable the dynamic LUT. Tune the lowlight and highlight asymmetry LUTs manually to get something acceptable for most scenes. This will help you decide how to control the dynamic LUT generation as well as how much of the dynamic LUT you want to blend with your manually tuned LUTs.
2. Set the parameters to the following to start with:

Prerequisite	**Value**
dynamic_asymmetry_lut_blend_auto_alpha	0

dynamic_asymmetry_lut_dark_adj_low_thres	0
dynamic_asymmetry_lut_dark_adj_high_thres	128
dynamic_asymmetry_lut_bright_adj_low_thres	128
dynamic_asymmetry_lut_bright_adj_high_thres	255

Table 5: Dynamic LUT Initial Settings

These settings will enable the dynamic LUT to be flexible with the LUT generation. It can be used to determine the thresholds for the histogram to determine what should considered as the dark "shadows" and bright "highlights".

3. Tune the histogram parameters `hist_sum_<>`, `hist_bin_<>`, and `hist_longexp_bins_<>` to define which of the 1024-bins used for dynamic LUT algorithm is the dark shadows and bright highlights. See Figure 5 for an example of the histogram threshold adjustment.

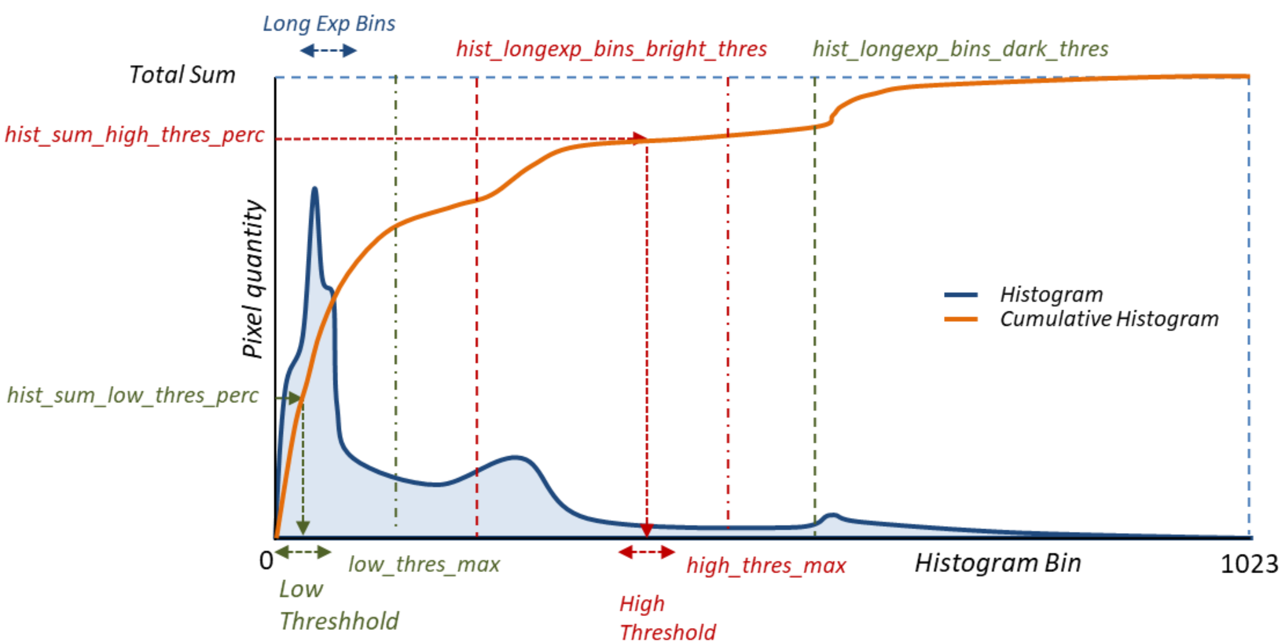


Figure 5: Histogram Thresholds for Dynamic LUT

4. For scenes where the dynamic LUT is not doing a good job, adjust the parameters for `dynamic_asymmetry_lut_dark/bright_adj_<>` to limit the adjustment level for the dark and bright regions by introducing a lower and upper threshold. As shown in Figure 6, adjusting the low/high range for `dark_adj` parameters will cause the dynamic LUT to determine how much it will adjust the brightness in the shadows if the tuned histogram thresholds deem that there is too much data inside the lower bins (assuming bright adjustment is fixed). Meanwhile, Figure 7 shows that adjusting high/low thresholds for `bright_adj` will change

how much the dynamic LUT to changes the contrast in the bright region (assuming the dark adjustment is fixed). These restrictions will be combined to form the final LUT.

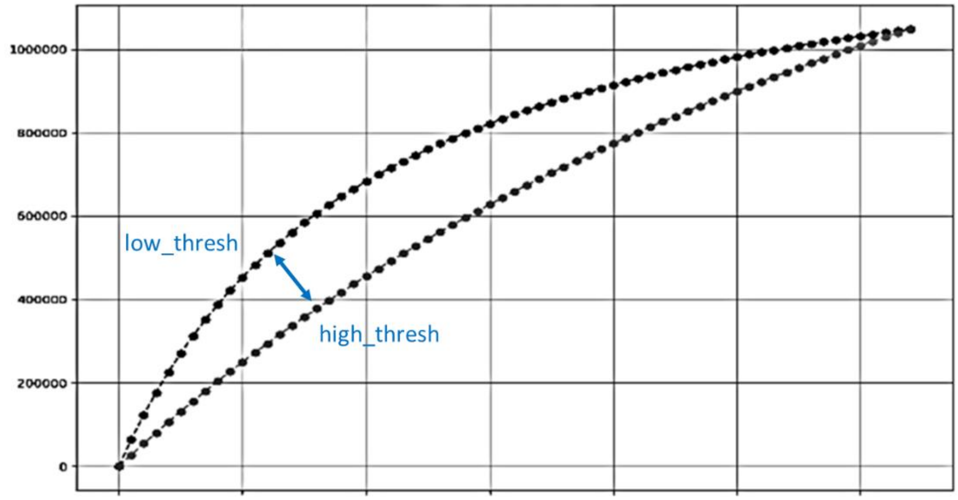


Figure 6: Dynamic LUT Dark Adjustment

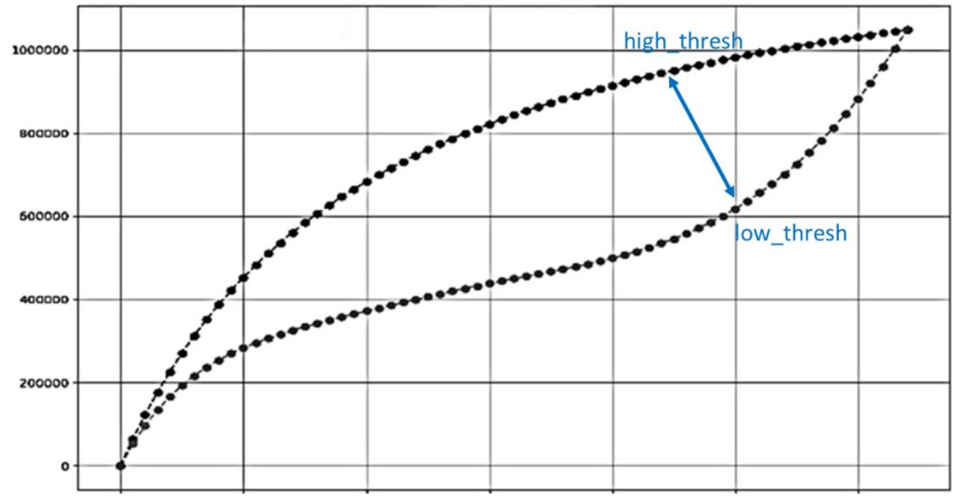


Figure 7: Dynamic LUT Bright Adjustment

5. Adjust the blending level between the manually tuned LUTs and the dynamic LUT with `dynamic_asymmetry_lut_blend_auto_alpha` to find a balance between the custom tuned LUT for the tuned scenes and the dynamic adjustment needed for corner cases.
6. Finally, tune `dynamic_asymmetry_lut_temporal_alpha` parameter to balance between rapid adjustment per scene and smooth transition. Test on moving scenes with rapidly adjusting brightness and dynamic range levels.

Tuning Procedure – Variance Parameters

The variance parameters set the number of filtering stages used to smooth the variations in the tone curves in the spatial (pixel coordinate) and intensity domains. Low values for variance parameters is good for extending contrast and brightness in the smallest possible regions, but typically leads to over-enhancement or an unnatural look compared to the human visual system.

Increasing `variance_space` reduces regional variations in tone curves across the image, while increasing the `variance_intensity` reduces variations in intensity. A simpler way to look at it is the variance for intensity controls the brightness of each region while variance space controls the contrast for each region.

Variance Intensity

Variance Intensity sets the degree of sensitivity in the luminance domain. This means variance intensity affects the sensitivity of the transform to different areas of the image, and can be decreased in order to emphasize smaller regions. If this parameter is set to zero, the sensitivity to the small areas is maximal. The transform becomes more local. When the parameter is set to maximum the transform deemphasizes small local details and the transform becomes more global

The smaller this parameter, the more local is the transform. For an HDR image with shadows and highlights, a small variance value will cause LTM to adjust shadows and highlights brightness almost independently while a large variance intensity value will cause LTM to become progressively more global. This means that minimizing the `variance_intensity` will make shadows and highlights become closer in brightness while maximizing it will keep the shadows dark and highlights bright.

Variance Space

Variance Space sets the degree of spatial sensitivity of the algorithm. The smaller this parameter, the more local is the transform. For an image with shadows and highlights, a small variance value will cause LTM to adjust contrast within the shadows or highlights almost independently while a large variance intensity value will cause LTM to become progressively more global. This means that minimizing the `variance_space` will make details in shadow and highlights stand out even if their brightness begins to look unnatural while maximizing it will keep the details inside the shadows darker and details inside highlights brighter.

Tuning Procedure – Slope Control

The Local Tone Mapping algorithm generates an effective tone curve for each pixel starting with the tuned asymmetry curve modified based on a local analysis of the surrounding image content. For very high dynamic range scenes, local gain generated by LTM may enhance image content such that noise becomes visible or halos are created at the edge of bright and dark contents. Thus, LTM provides several parameters that help restrict the shape of the generated curves, enabling quantitative control of local gain and amount of noise revealed.

The parameters `slope_max` and `slope_min` are used to restrict the luminance space in which LTM can adaptively generate tone curves for each pixel. When these parameters are turned off, LTM may generate curves with strong positive gain in very dark areas and strong negative gain in very bright areas. This response may help increase visibility of details within the scene. However, such enhancement may reveal noise and/or considerably boost contrast in highlights creating an unnatural look (Example: clouds in the sky may look dark). The parameters have been developed to allow control of the curves within a given gradient and intensity range. By reducing `slope_max` and/or increasing `slope_min,` the curves generated dynamically by LTM reduce the adaptivity of the LTM algorithm. See Figure 8 for an example of the LTM tone curve generated for a pixel after applying slope restrictions. Since the final curve depends also on the asymmetry curve, it is important to tune the slope limitation parameters in conjunction with adjustments to the asymmetry LUT.

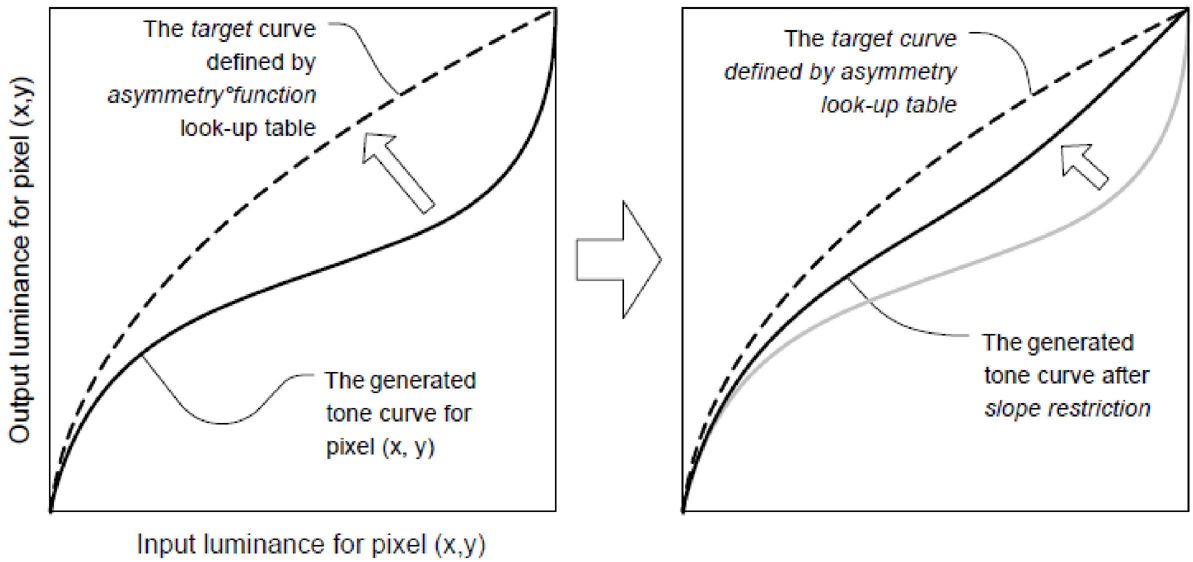


Figure 8: Effect of Slope Limit Functions

Slope Min

Slope Min is used to restrict the slope of the tone-curve generated by LTM. When Slope Min parameter is set to minimum (0), the tone curve slope generated by LTM is not limited. When this value is set to maximum (255), the LTM will not generate a tone-curve with slope less than 3/4 multiplied by the slope of the asymmetry curve for the given intensity. Intermediate values of Slope are linear interpolations between minimum and maximum values.

Slope Max

Slope Max is used to restrict the slope of the tone-curve generated by LTM. When Slope Max parameter is set to maximum (255), the tone curve slope generated by LTM is not limited (maximum slope 15). When this value is set to minimum (0), LTM will not generate a tone-curve with slope greater than 16/15 (48°) multiplied by the slope of the asymmetry curve for the given intensity. Intermediate values of Slope are linear interpolations between minimum and maximum values.

Tuning Procedure – Sample Parameters

The following procedure should be performed in order to determine LTM adaptive effects:

- Set `strength_inroi` to 1023.
- Simulate a global tone mapping transform:
  - Set `slope_max` = 64, and `slope_min` = 0.
  - Set `variance_space` = 15, and `variance_intensity` = 15; this makes the local adaptivity minimum.
- Adjust `asymmetry_lut` for a good global balance between shadows, midtones, and highlights.

To add local adaptivity to the transform:

- Set `slope_min` = 64, `slope_max` = 72.
- Gradually reduce `variance_space`, `variance_intensity` making sure no halos are introduced and that the desired effect is achieved in dark, mid-tones, and highlight regions.
- If more gain is needed in dark regions, `slope_max` can be increased (this may increase noise visibility), and if more contrast enhancement is needed in highlights, `slope_min` could also be increased.

Once a set of tuning parameters has been finalized, consider making adjustments to the Gamma block as well to see the final brightness and contrast of the image as the LTM tuning will have changed the appearance of shadows, mid-tones, and highlights.

1.6. Fine Tuning Local Tone Mapping during Phase Three

After completing the prerequisites listed in Table 6, final adjustments to Local Tone Mapping can be made. Once again, it is worth revisiting LTM at the end of phase three tuning to ensure correct performance.

Prerequisite	**Status / value**
Phase Two prerequisites	Completed
Spatial Noise Reduction	Tuned for all EV values
Demosaic	Tuned for all EV values

Table 6: LTM Phase Three prerequisites

Tuning Procedure – LUTs

By default, Local Tone Mapping will estimate the maximum amount of dynamic range compression to be applied to a given image, even though this may exceed the maximum dynamic range of the system. In these cases, noise will be revealed and/or the overall intensity of the image will be overexposed.

Accounting for this, strength of LTM effect should take into account the total gain of current scene set in `strength_inroi_lut`. It is recommended that for bright scenes (smaller gains), strength is set to a large value, since there will possibly be more contrast in the scene for which LTM will be beneficial. In contrast, for dark scenes (large gains), strength should be set to a smaller value since it may introduce noise.

For noisy sensors or very dark scenes where precise noise management is a high priority, consider relying more on the global effect of asymmetry LUT to control the shadow enhancement while reducing the slope max and increasing slope min to restrict the LTM. Use `dynamic_assymetry_lowlight_lut` to create an asymmetry curve specifically for low light and adjust `slope_min_lut` and `slope_max_lut` for the corresponding gain levels.

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