

LucidShape LID Editing of Dynamic Adaptive Systems

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Abstract

(Note: If you are not familiar with Synopsys' LucidShape[®] software's light intensity distribution (LID) editor, we strongly recommend reading first the white paper #013-2 "LucidShape LID Editing.")

In addition to editing standard two-dimensional LIDs, LucidShape's LID editor can also handle dynamic three-dimensional LIDs, where the third dimension may represent any parameter. This allows, for example, the morphing of two dynamic LIDs into each other.

Possible applications are bending light in adaptive front lighting systems (AFS) or the design of different kinds of wider or narrower high beam patterns.

Principle

In LucidShape, light distributions are usually displayed over a 2D angular UV parameter range. 3D data in turn holds a third value, which can be any arbitrary geometrical or physical parameter (for example, the road curvature). We call this third parameter *W*. In LucidStudio's UV data view, one can navigate through this UVW data by pressing the right mouse button. You can use the LID editor to create 3D LIDs and to alter 3D data.

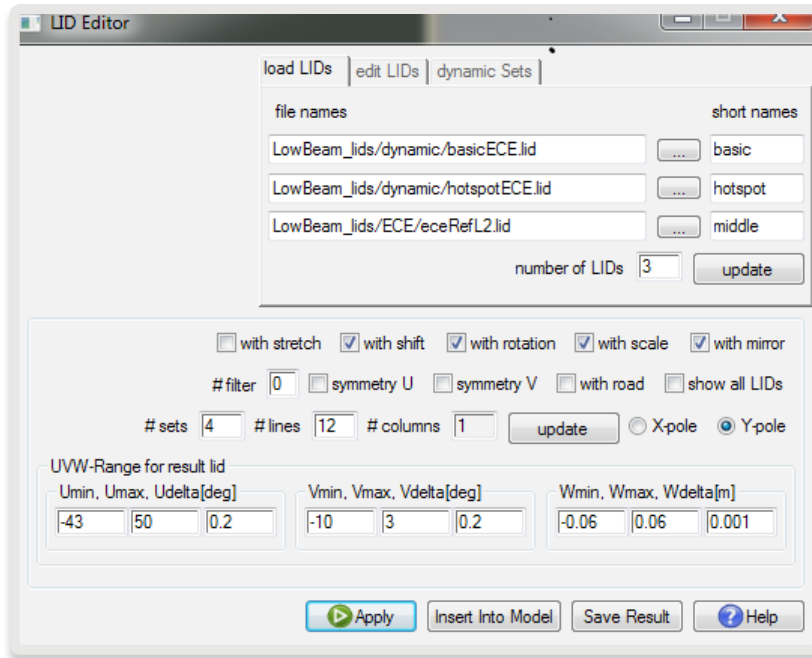


Figure 1. The *load LIDs* dialog box of the LID editor

The individual 3D data consists of dynamic sets. Each set describes a sub-function of motion, like the movement of a hotspot or the stretching or compression of a light intensity distribution. Thus, each set describes a certain dynamic along the parameter W. The data in each set can also be interpolated, either by parameter (the value of W) or pixel wise. The first set can be used as the basic LID, which uses no interpolation. “AFS bending light” (see below) is an example of interpolation by parameter, an example for pixel wise interpolation is also given below in the section, “Pixel Wise Interpolation.”

The LID editor can be used to create dynamic 3D LID files. On the “load LIDs” tab, setting the number of sets (# sets) to a number greater than zero displays the “dynamic Sets” tab. To achieve a certain depth in the W parameter range, one has to set at least two different base points or W values while creating 3D LID files. On the “edit LIDs” tab, as shown below in Figure 2, one can also alter the UVW range for the resulting LID.

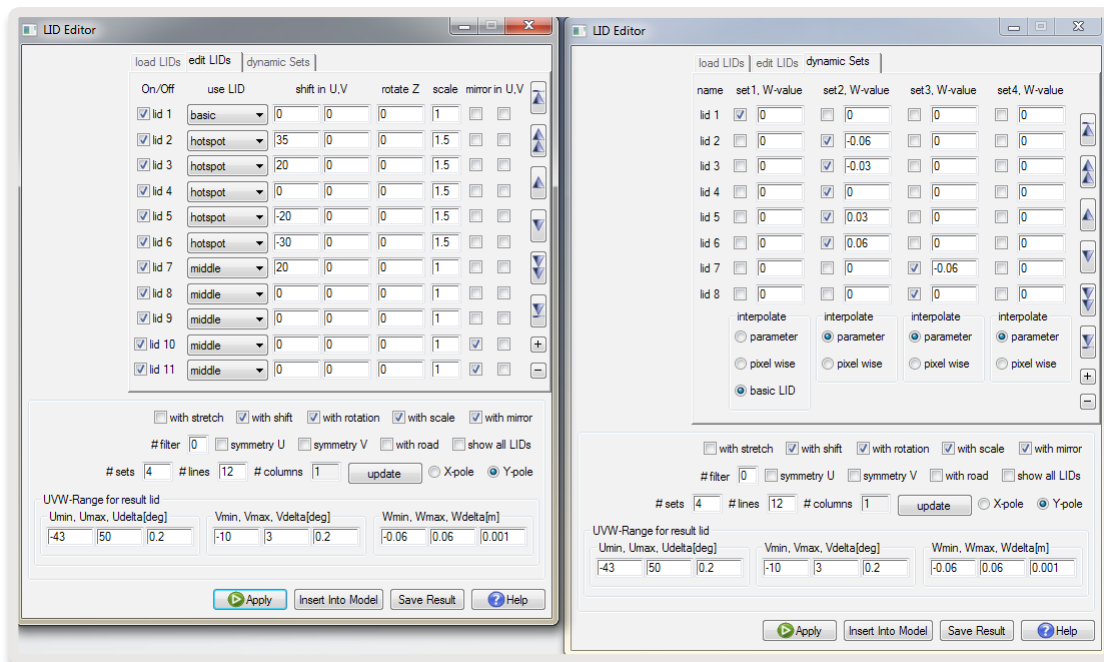


Figure 2. The *edit LIDs* and *dynamic Sets* dialog boxes

AFS Bending Light – Interpolation by Parameter

As an example, we consider the design of an ECE low beam adaptive bending light system. The resulting LID should be a function of the road curvature. So, in this concrete example, the third parameter W becomes the parameter “road curvature” (which is defined as the inverse to the curve radius). Since the resulting LID is a combination of individual LIDs that represent different parts of the reflector, one only needs to change some of the individual LIDs in order to get the desired design in the resulting lid.

One resulting LID consists of several sets. In the *edit LIDs* dialog box as shown above in Figure 2, *set2* for instance consists of the LID’s *hotspot*. The motion in this example is a function of shift: the larger the curvature, the larger the shift. *Shift* is the shift of the individual LIDs in U range. The LIDs *hotspot*, *RefL2* and *RefR2* are shifted in U according to different values of the curvature. For a straight street, the shift for hotspot is set to 0° . For a curve with radius of 16 m, it is set to -30° . This mapping is performed for different curvature values for the remaining LIDs in a similar way. In Figures 4–8, the appropriate LIDs are shown for different curvature values.

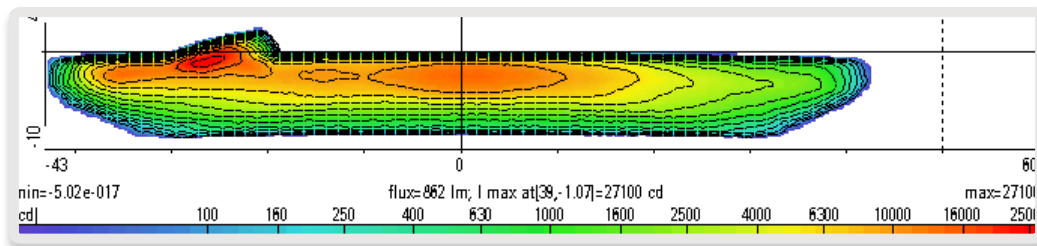


Figure 3. The resulting LID with a curvature of 0.06

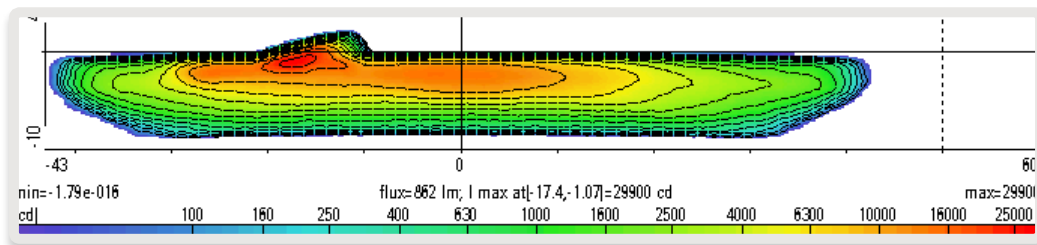


Figure 4. The resulting LID with a curvature of 0.03

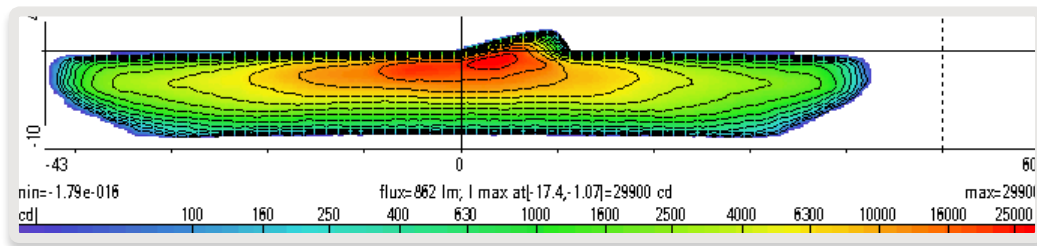


Figure 5. The resulting LID with a curvature of 0, which corresponds to the normal ECE low beam

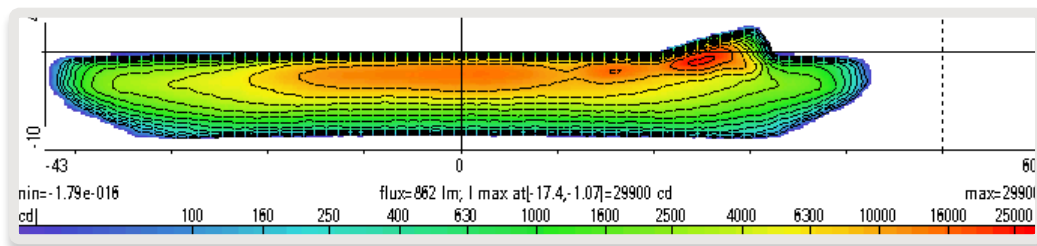


Figure 6. The resulting LID with a curvature of -0.03

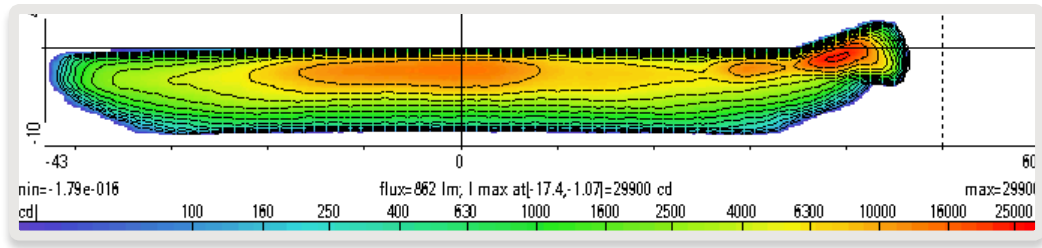


Figure 7. The resulting LID with a curvature of -0.06

One can navigate through these UVW LIDs with the *Navigate 3D UVW Data* dialog box, which is launched by pressing the right mouse button inside the UV data view. (The *Navigate* dialog box is a general feature of *LucidShape*; it is not specific to just the 3D LID editor.)

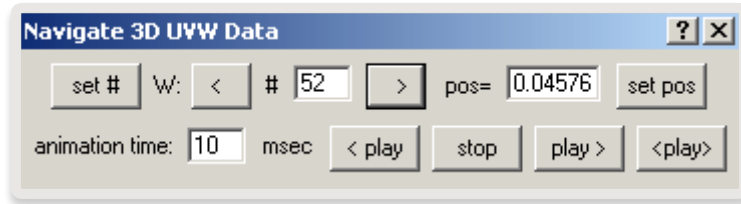


Figure 8. The *Navigate 3D UVW Data* dialog box.

Pixel Wise Interpolation

In the previous example, the interpolation was performed with the setting by *parameter*. By setting the interpolation method to *pixel wise*, one can morph different LIDs into each other.

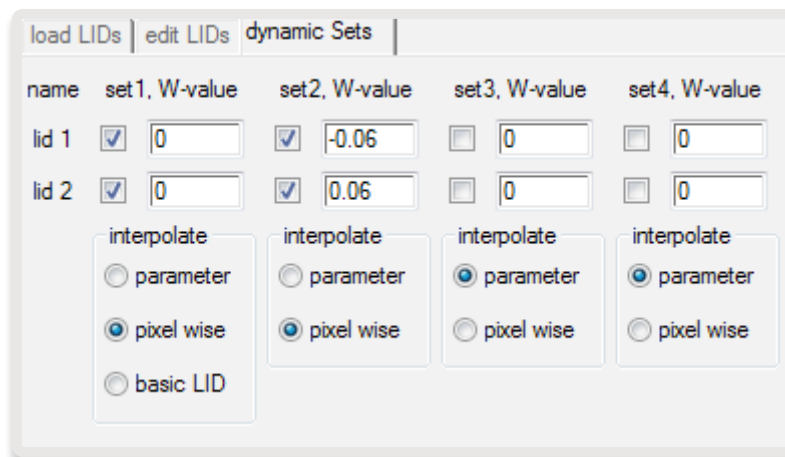


Figure 9. Settings for pixel wise interpolation.

For instance, different kinds of wider or narrower high beam patterns can be transformed into each other. Figures 10–14 show five snapshots from different high beam patterns. The first is a high beam pattern (Figure 10), the last one is a wide high beam pattern (Figure 14). The intermediate beam patterns (Figures 10–12) were created by *pixel wise* interpolation of the LIDs first and last patterns.

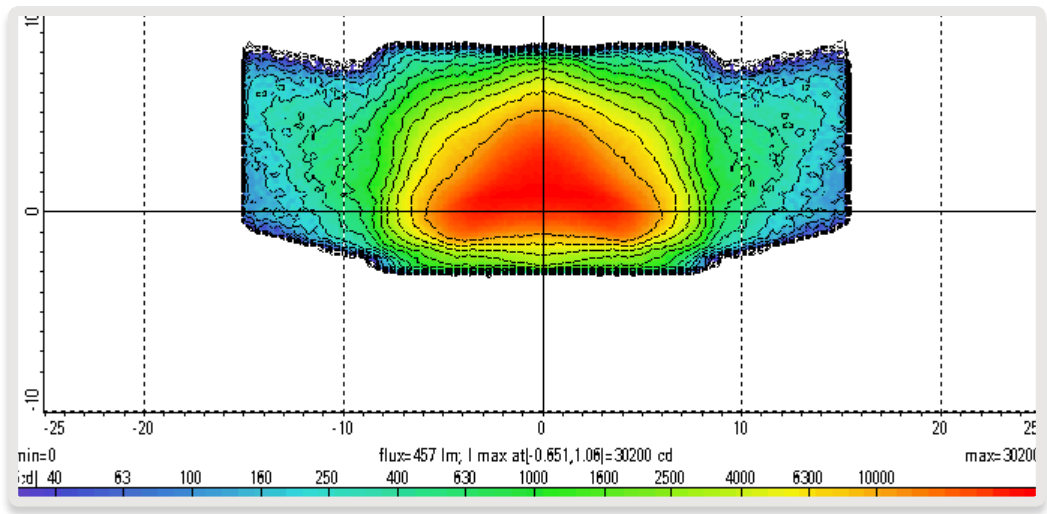


Figure 10. High beam pattern

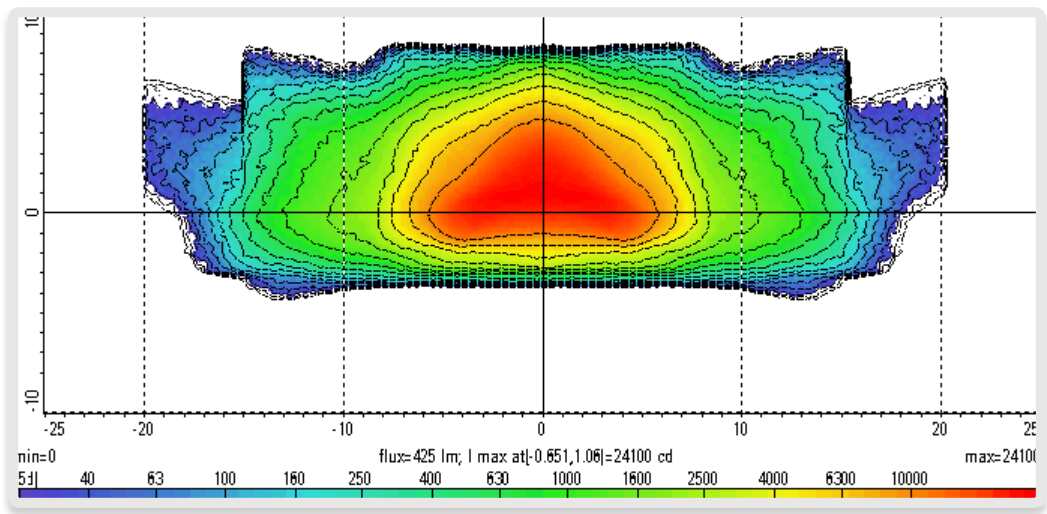


Figure 11. Pixel wise interpolated LID 1

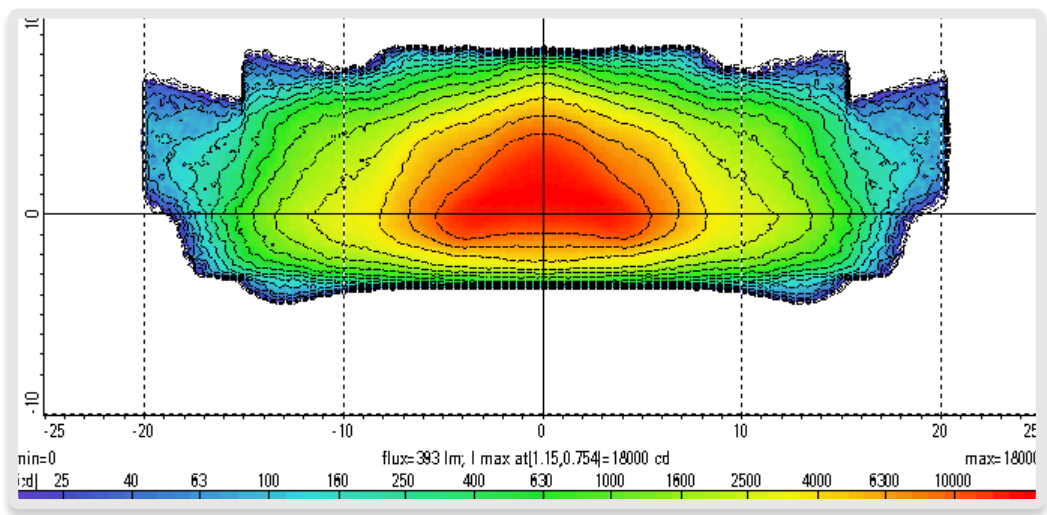


Figure 12. Pixel wise interpolated LID 2

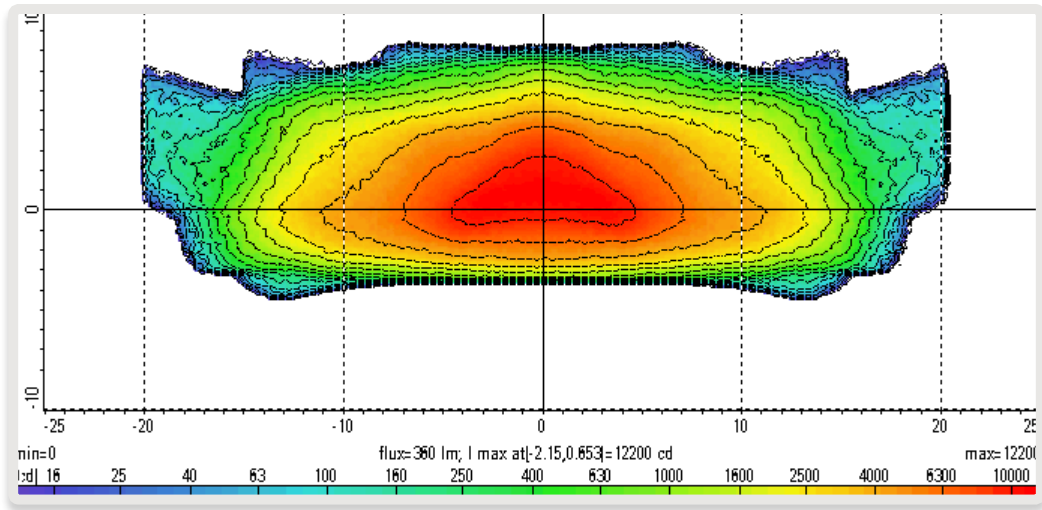


Figure 13. Pixel wise interpolated LIDs 3

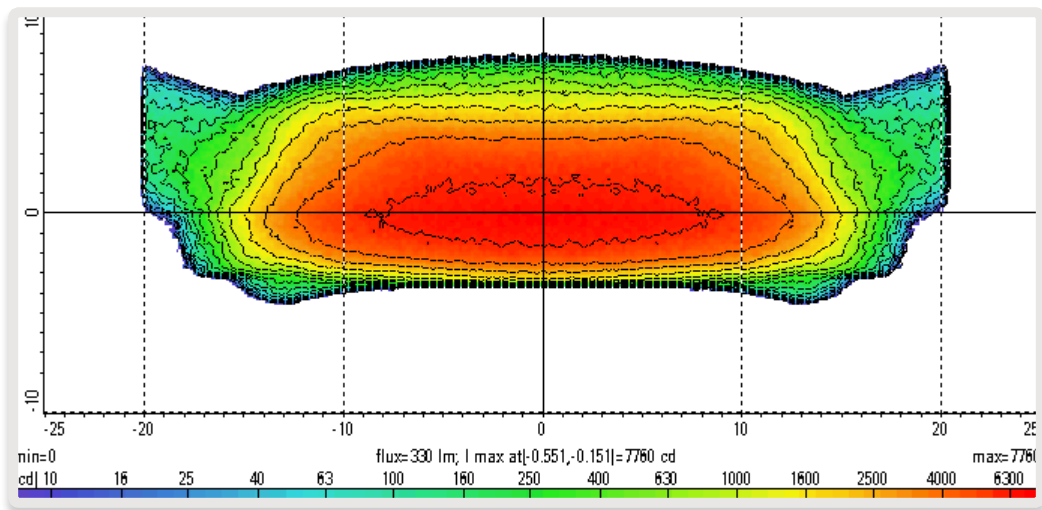


Figure 14. Wide high beam pattern

The number of interpolated frames can be controlled by the parameters $Wmin$, $Wmax$ and $Wdelta(m)$.

To Learn More

For more information on LucidShape and to request a demo, please contact Synopsys' Optical Solutions Group at (626) 795-9101 between 8:00am-5:00pm PST, visit <http://optics.synopsys.com> or send an email to lucidshapeinfo@synopsys.com.