ReflectorCAD 1.0 — Creating Segmented Reflectors

Stand-alone software application for easy reflector building

This technical publication describes ReflectorCAD® 1.0 from Breault Research Organization (BRO). ReflectorCAD supports construction and analysis of a segmented reflector, greatly reducing the time required from design to prototype. Primarily targeted for automotive applications, ReflectorCAD can be used anywhere segmented reflectors are required. It works well as a stand-alone application, in conjunction with ASAP for additional ray-tracing analysis, or for SAE compliance using the ELTM module in the Advanced Systems Analysis Program (ASAP®), also from BRO.

Choose a base surface

All segments are initially created on a base surface, which typically approximates the desired shape of the finished reflector. Built-in conic and sampled base surfaces are supported. A tool is provided in ReflectorCAD for sampling geometry from an IGES file, so virtually any surface can be used. Figure 1 shows the reflector before any segments have been created. The outline of the base surface is drawn in light blue.

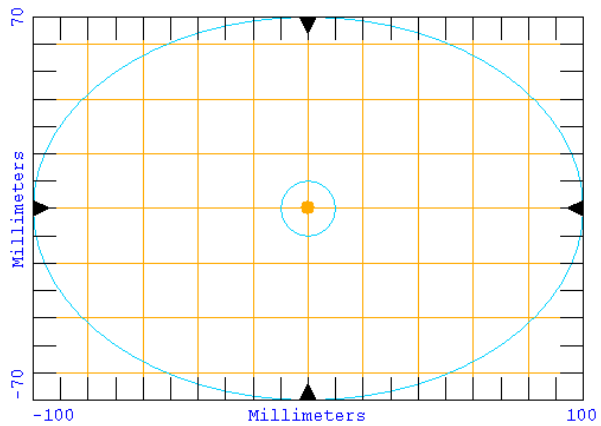

Figure 1 The reflector before creating segments with outline of base surface in light blue

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Choose a source

Sources are modeled as collections of facets, each with its own directional emission pattern. This allows for quick, and accurate, calculation of reflector output. More than 85 source models are available. These include incandescent bulbs, arc sources, and LEDs. Alternatively, source models can be created from a collection of rays produced by ASAP or Radiant Imaging's ProSource® utility.

Figure 2 shows the geometric model for the 9005 headlamp bulb in ASAP and the facets that comprise the corresponding source model in ReflectorCAD. The cylinder of facets near the filament (shown close-up with directional emission data included) carries roughly 90 percent of the model's flux. The remaining flux is captured on the cylinder that surrounds the bulb.

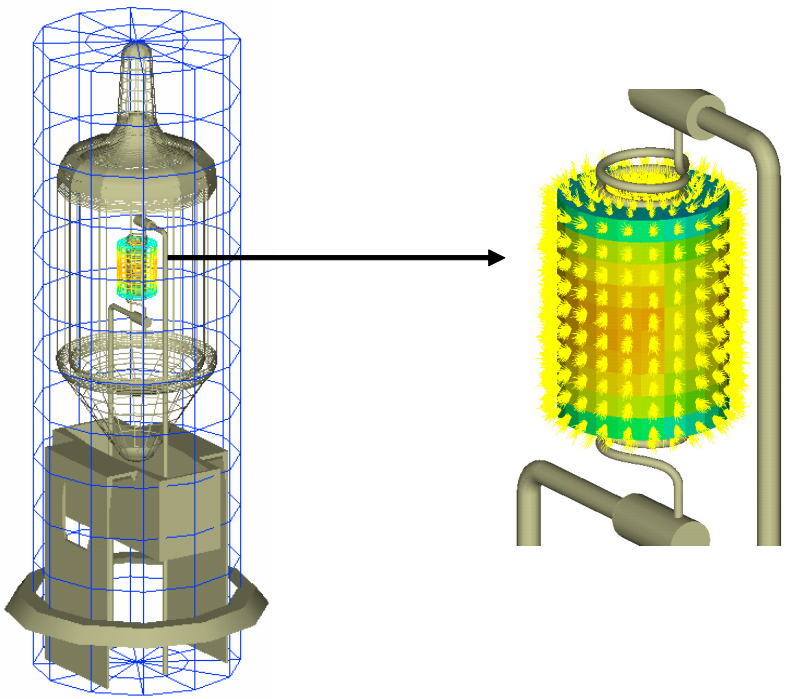

Figure 2 Geometric model for 9005 headlamp bulb in ASAP (left), and facets for corresponding source model in ReflectorCAD

Create and aim segments

Segments, the fundamental building blocks of the reflector, are created graphically using the mouse. Figure 3 shows the reflector during creation of the first segment and after three segments are created. Contours indicate segment height measured relative to the base surface.

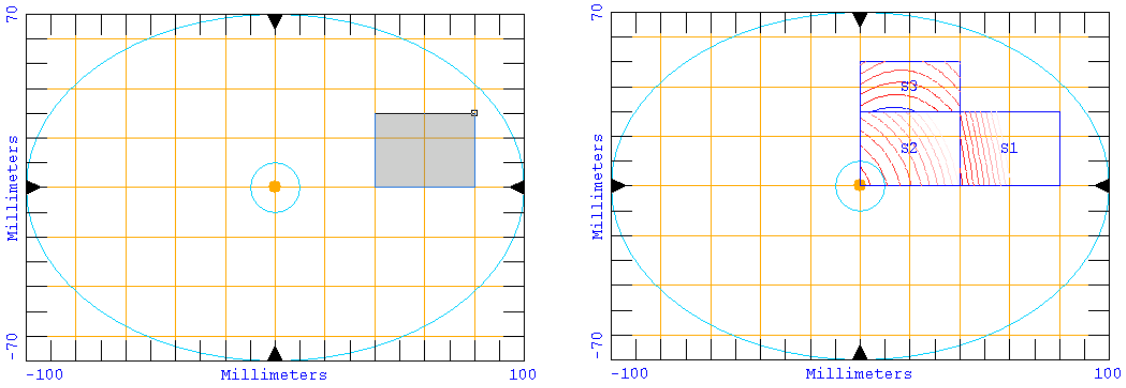

Figure 3 Reflector during creation of the first segment (left), and after three segments are created (right)

By dragging aim points on the output screen, you control segment aim and, therefore, shape. Approximate reflector output, either directional (luminous intensity) or positional (illuminance), is quickly calculated for both individual segments and the whole reflector. Figure 4 shows the initial aim of the first segment and its calculated output.

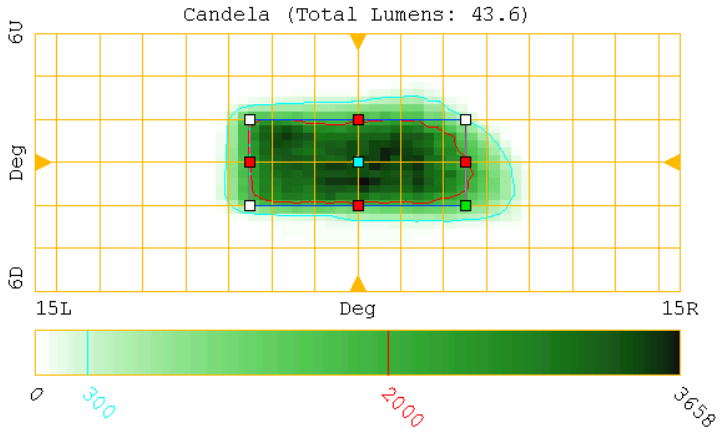

Figure 4 Initial aim of the first segment (indicated by the box) and its calculated output

By moving the aim box, the segment is reshaped to direct output to another area. Output is quickly calculated following each design change, allowing the effects to be immediately observed. See Figure 5.

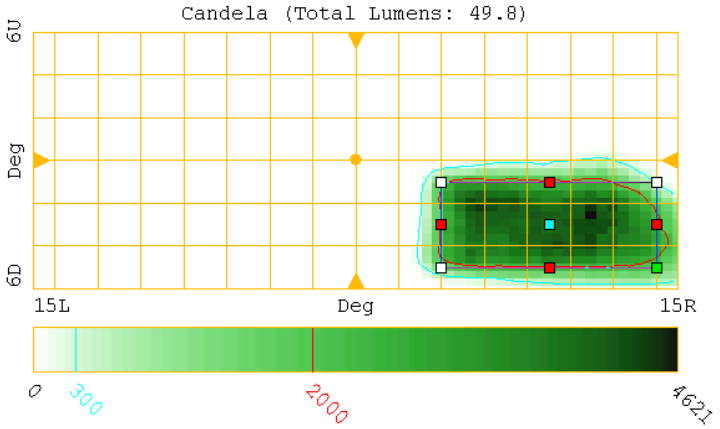

Figure 5 After moving the aim box, the segment is reshaped to direct output to another area

The aim box can be stretched to expand the area illuminated by the segment. See Figure 6.

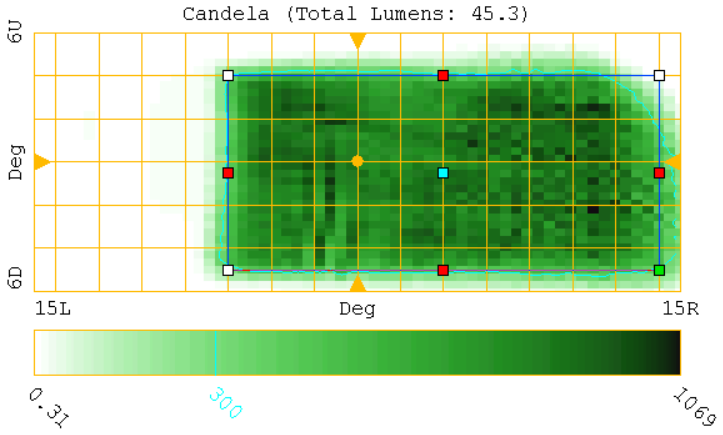

Figure 6 Stretched aim box expands area illuminated by the segment

The aim balance point provides an additional degree of freedom. It allows flux to be directed preferentially to one region of the aim box. Figure 7 shows the result of moving the aim balance point to one area of the aim box.

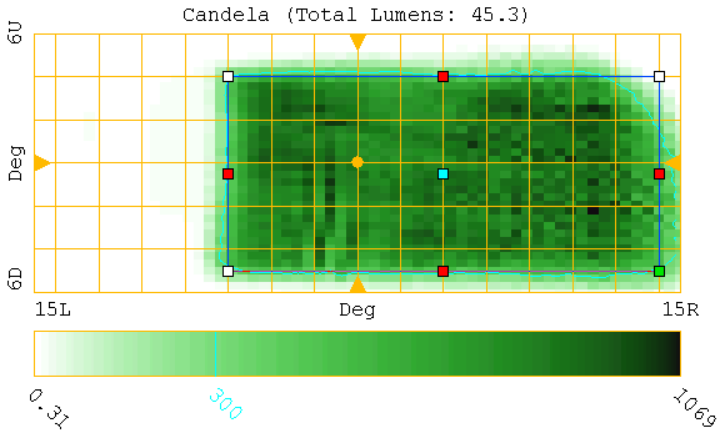

Figure 7 Result of moving aim balance point (small blue square) to one area of aim box

Vertical gradient measurement

Measurements of vertical gradients in the output are easily determined via a graph window. See Figure 8.

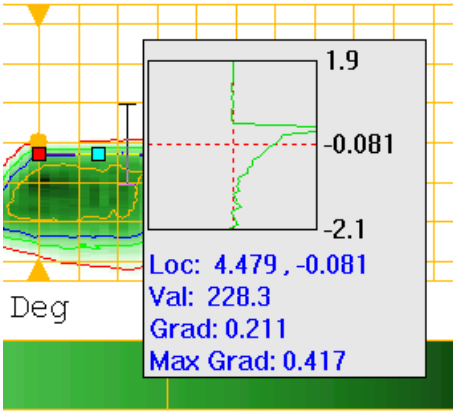

Figure 8 Pop-up graph window showing measurements of vertical gradients

Three-dimensional preview

A three-dimensional (3D) view of the reflector can be generated at any time. The bulb model is represented by a cylinder with facets colored according to the flux per area that passes through them. See Figure 9.

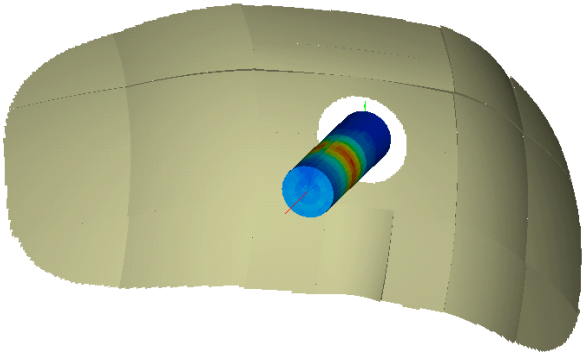

Figure 9 Three-dimensional (3D) preview of the reflector, with bulb model represented by a cylinder

Export to IGES or ASAP

When finished, the reflector design can be exported to an IGES file. Supporting geometric elements (for example, shelves, bulb holder, or front lens) can be added in a CAD package. The design can also be exported directly to ASAP for further analysis. Figure 10 shows a rendering of a reflector design after shelves and ripples were added in a CAD package.

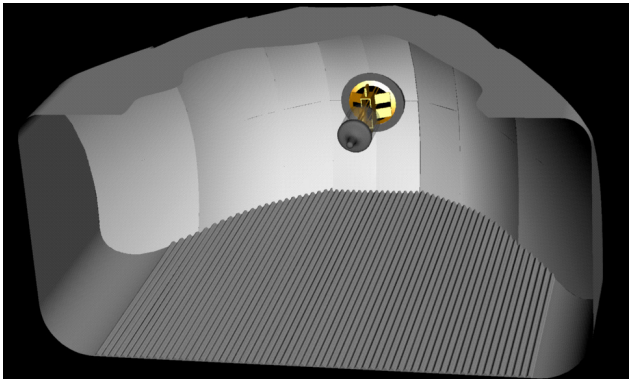

Figure 10 Finished reflector design, which can be exported to an IGES file