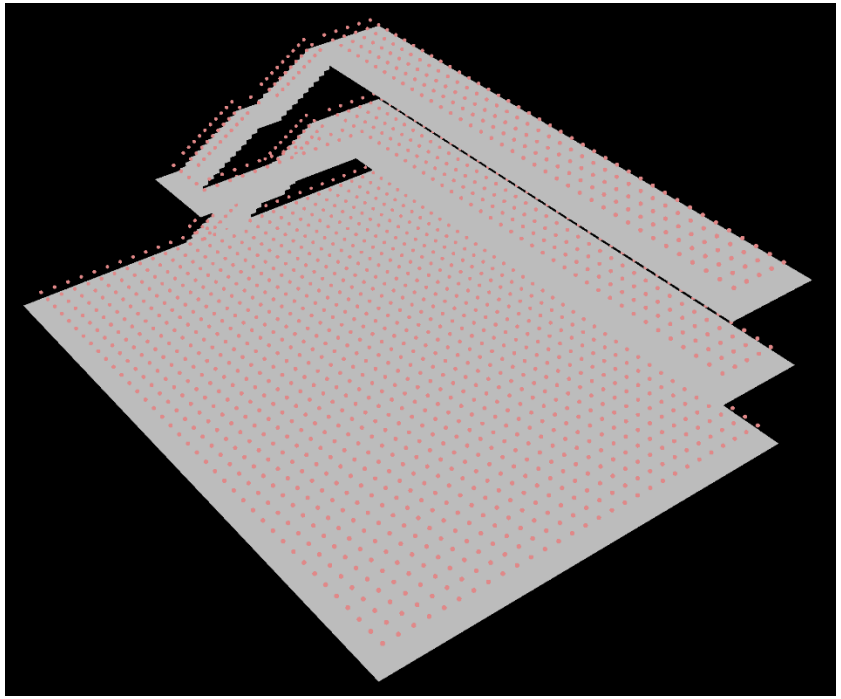
Simulation Tools for Architectural Daylighting and Integrated Controls (STADIC) - Utilities



Craig Casey
Lutron Electronics, Inc.
& Pennsylvania State University

Richard Mistrick
Architectural Engineering
Pennsylvania State University

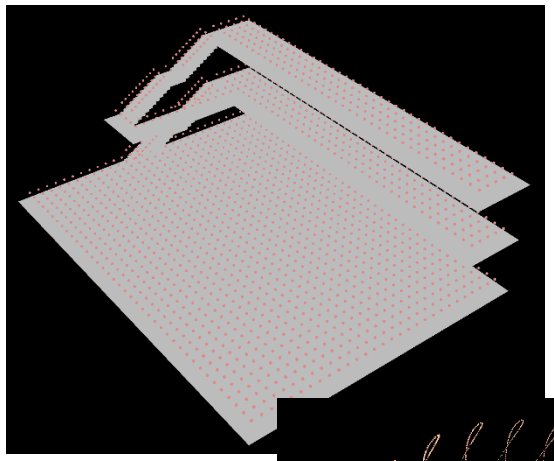
17 August 2015

LUTRON®

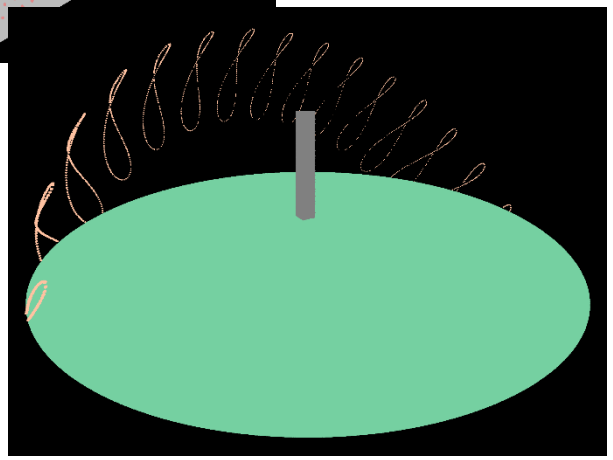
PennState

CBEI CONSORTIUM for BUILDING ENERGY INNOVATION

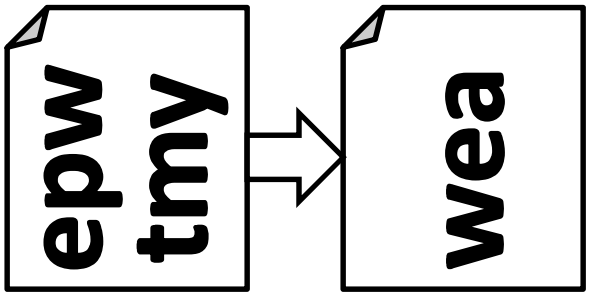
This presentation focuses on the addition of utilities to Radiance that make daylight and other simulations easier



Analysis grid creation

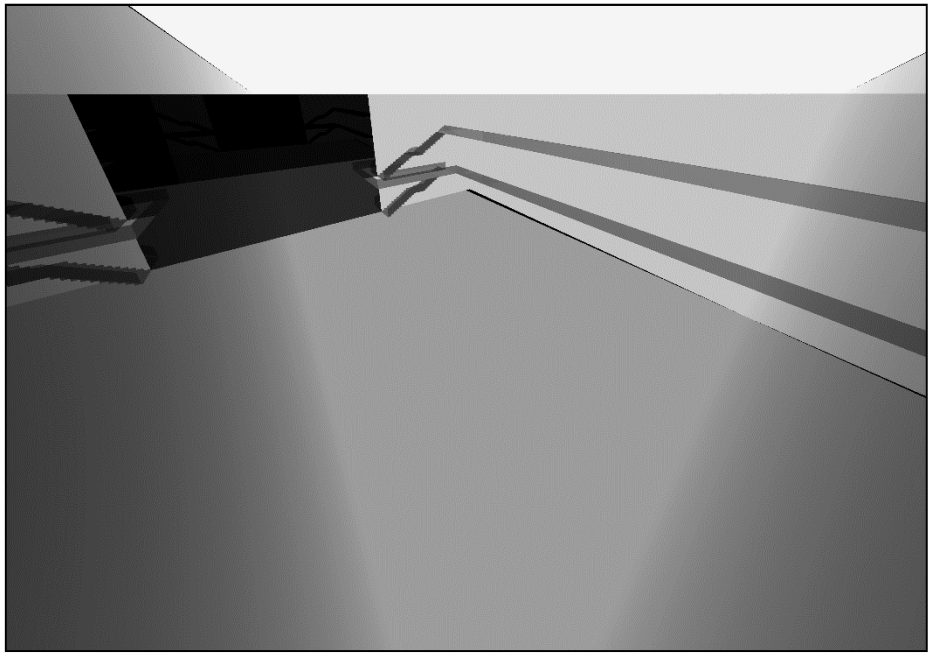


Sun position generation



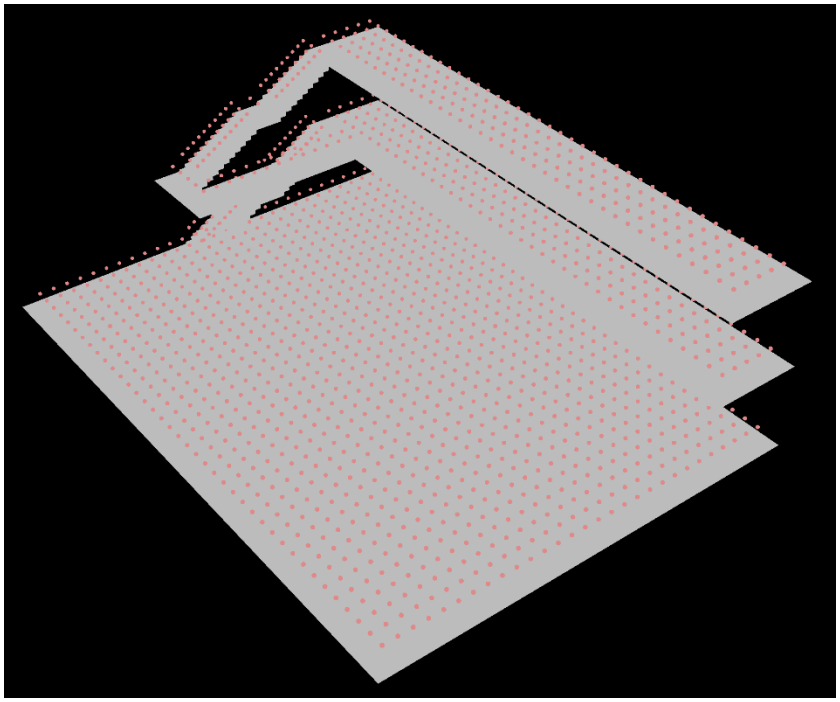
Weather converter

The creation of analysis grids can be time consuming or difficult for arbitrarily shaped geometry.

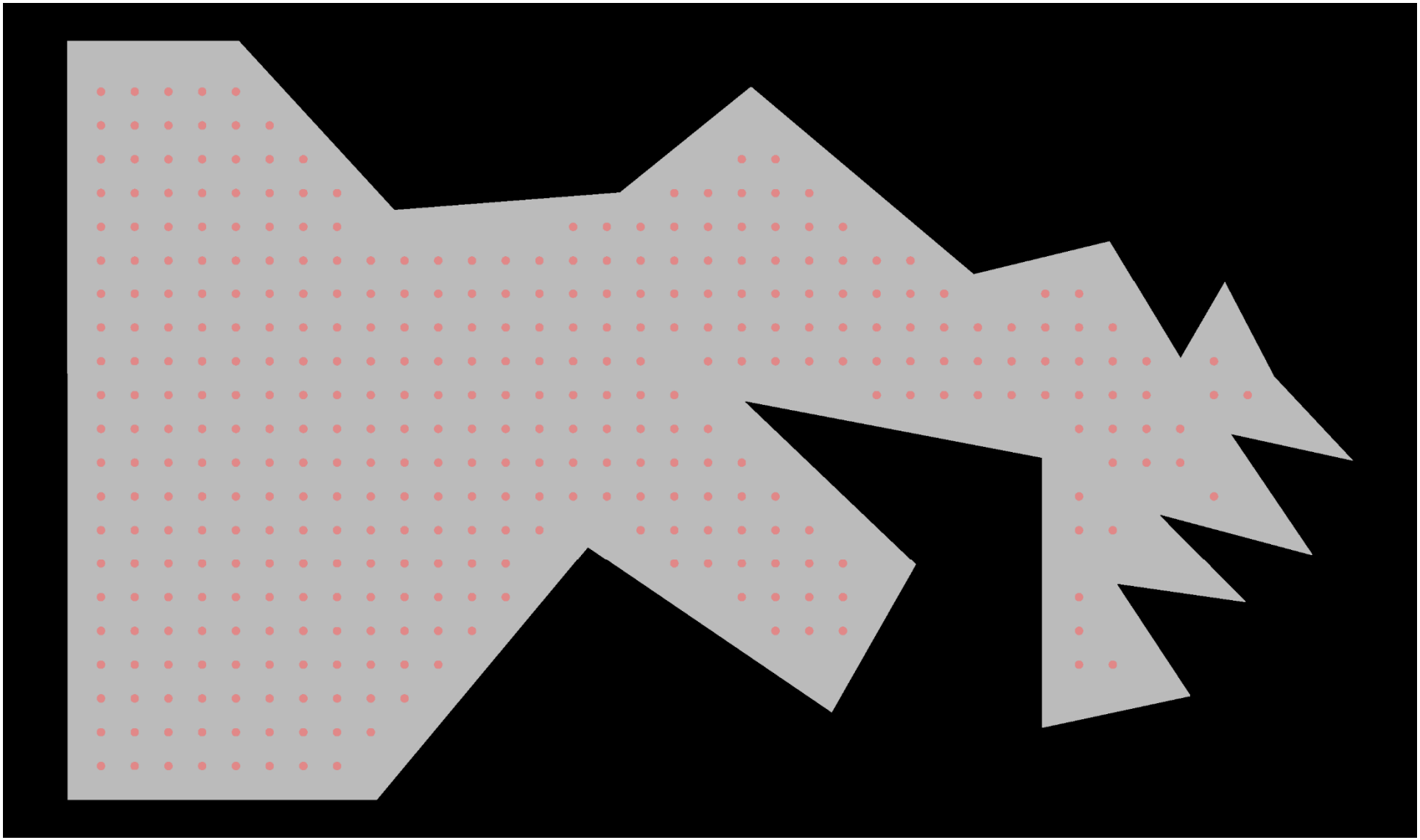


Three story atrium with overlapping geometry and stairs.

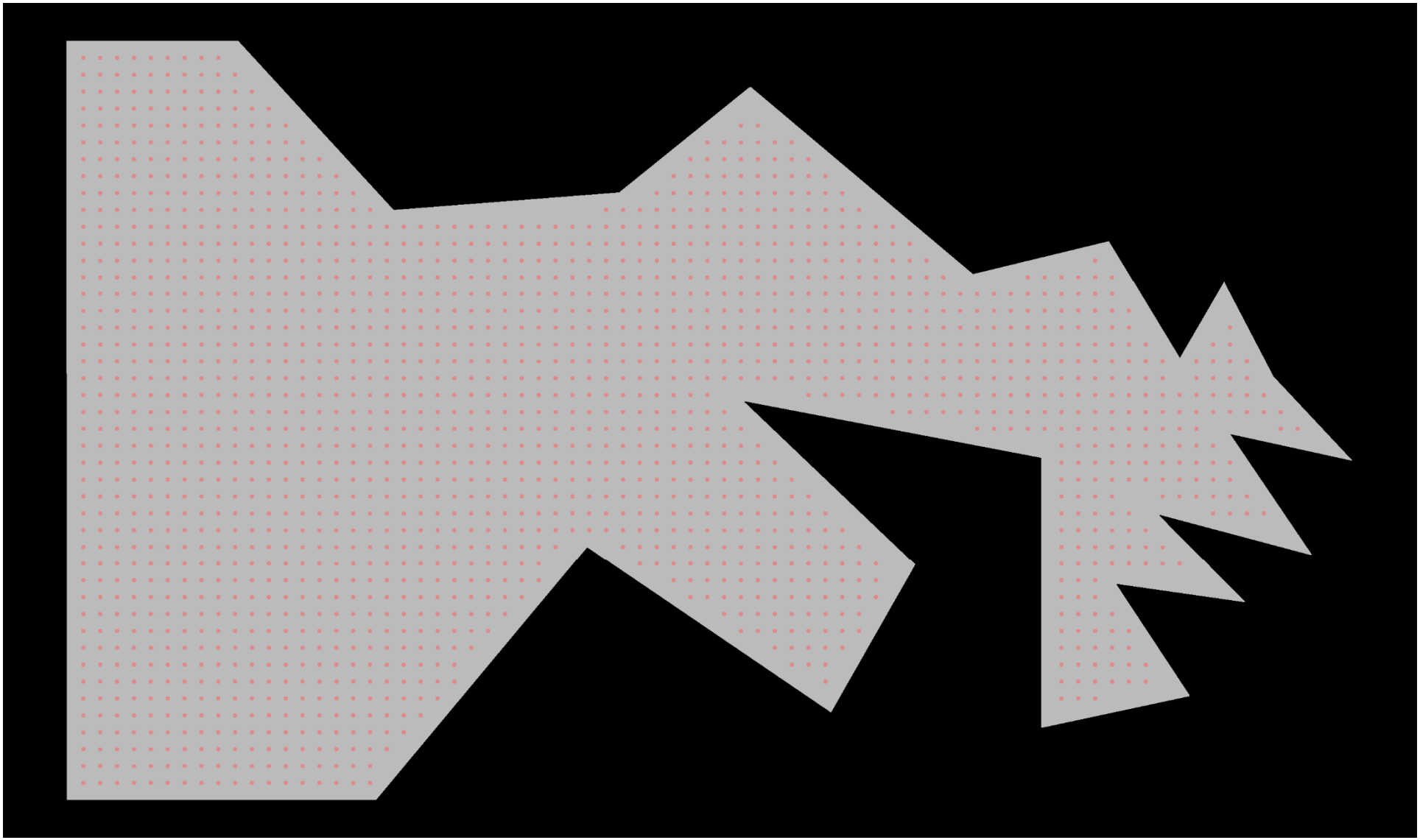
If grids can be related to polygons with particular surface materials, automatic generation is possible.



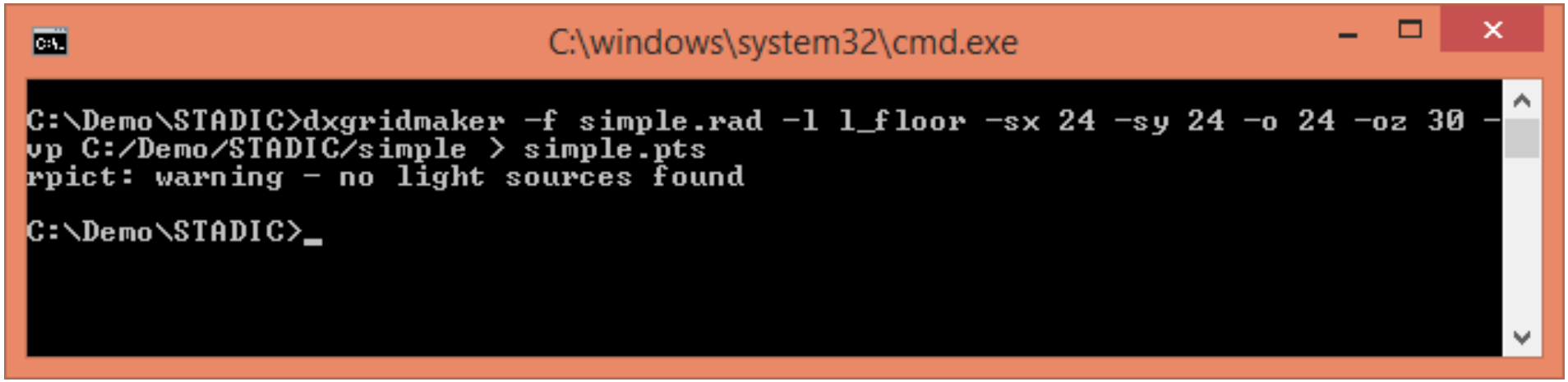
Any tool must be able to address complex, arbitrarily shaped geometry.



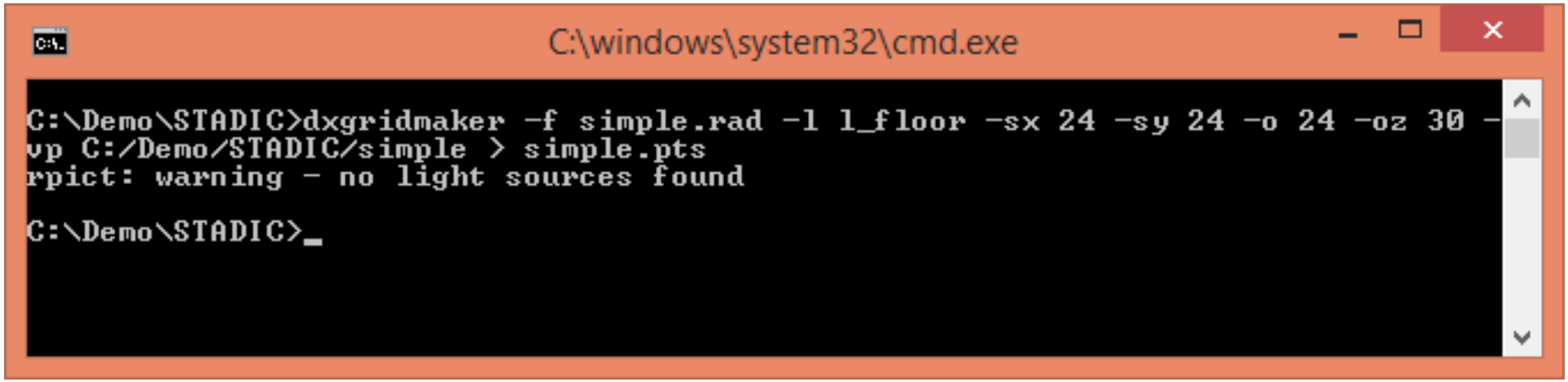
Any tool must be able to address complex, arbitrarily shaped geometry.



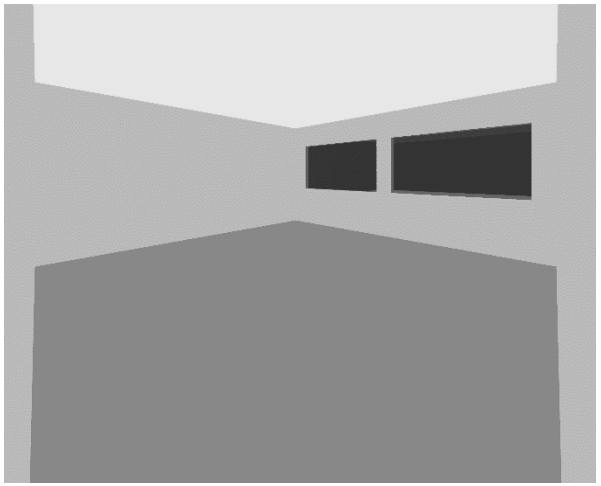
dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

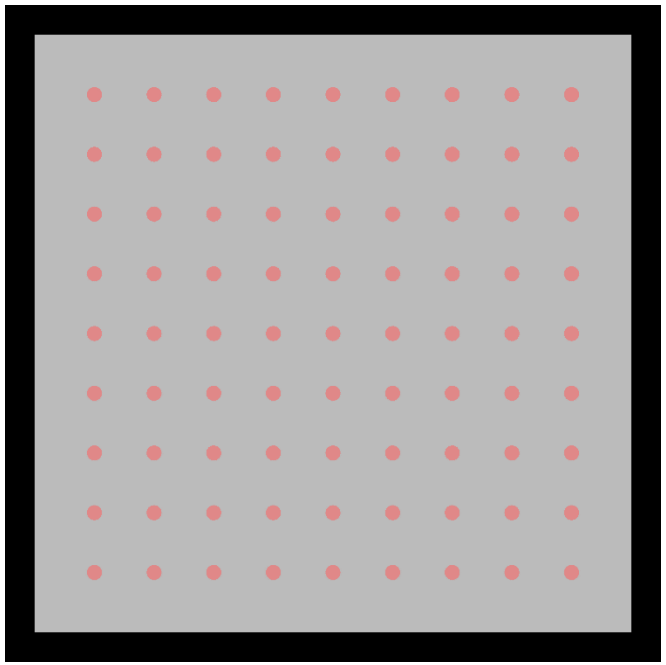


dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

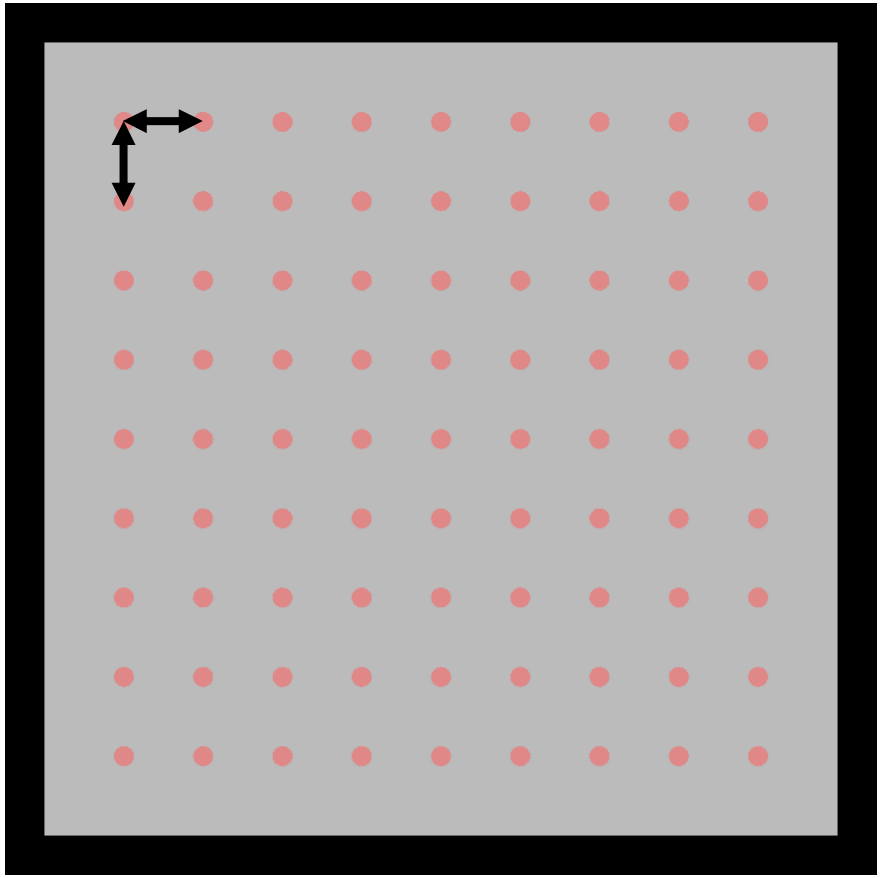




dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

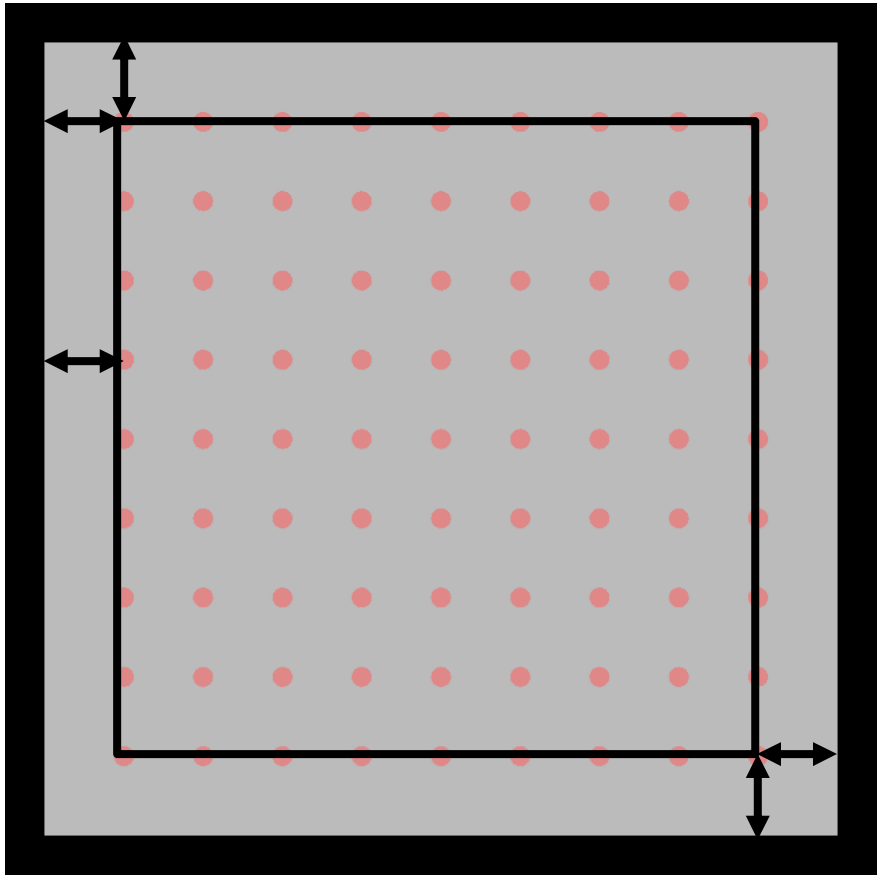
- -sx val
  - The x spacing distance
- -sy val
  - The y spacing distance



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

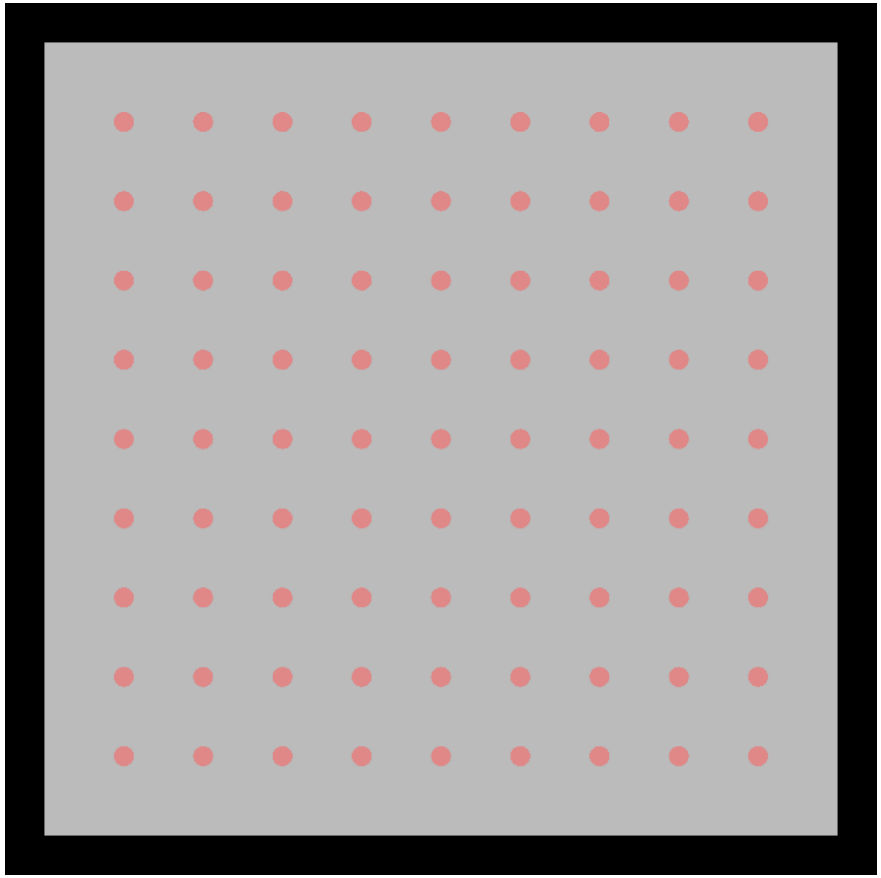
- **-o val**
  - **The boundary offset**
- **-ox val**
  - **The x offset distance**
- **-oy val**
  - **The y offset distance**



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

- **-oz val**
  - **The z offset from the average height of each set of polygons.**
- **-z val**
  - **The absolute z height**

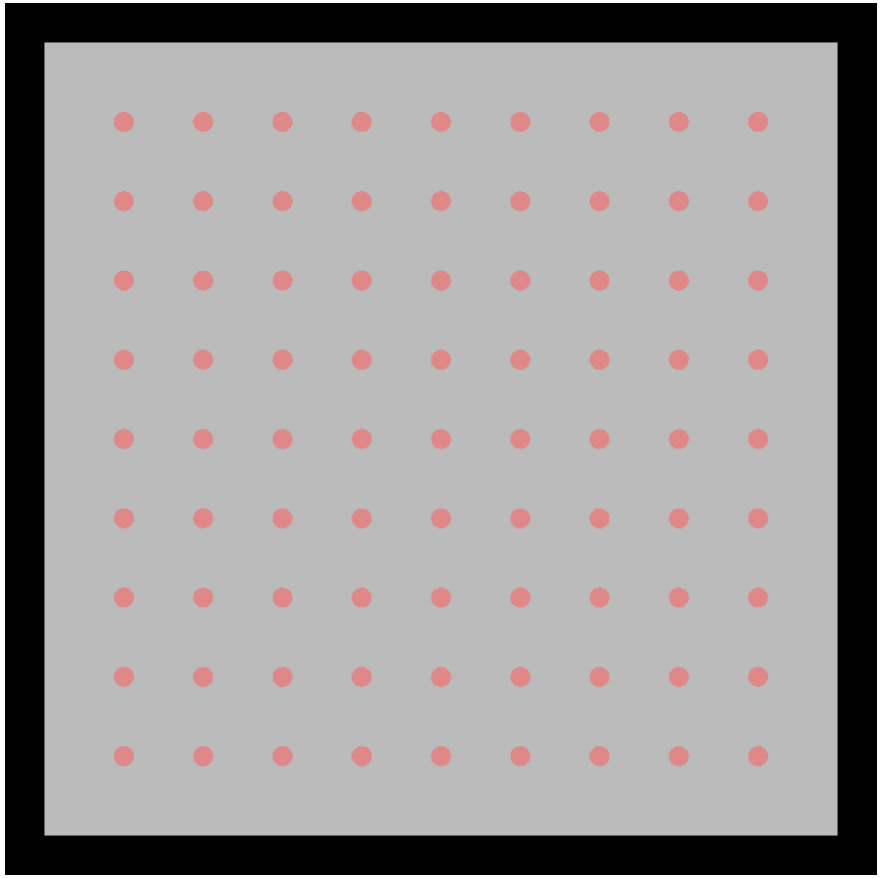


dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

- **-l name**
  - **Set the layer names (modifiers) for placing the grid**
- **-i name**
  - **Set the identifier sub-string for placing the grids**

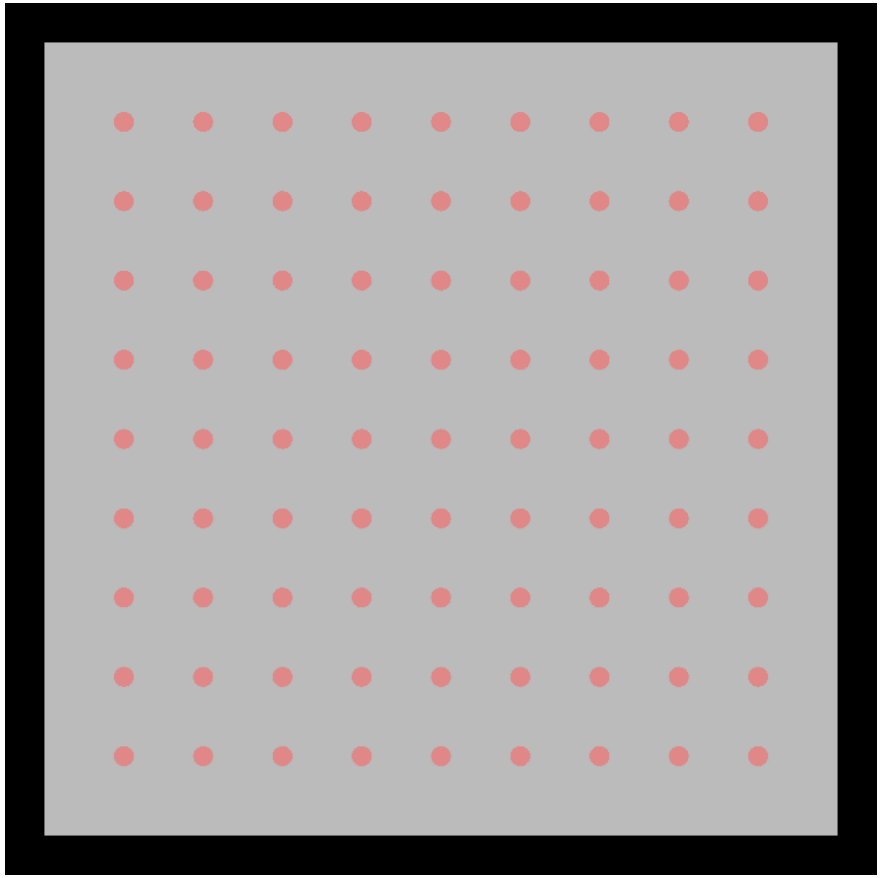
- **More than one can be entered, though each name must have an argument preceding.**



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

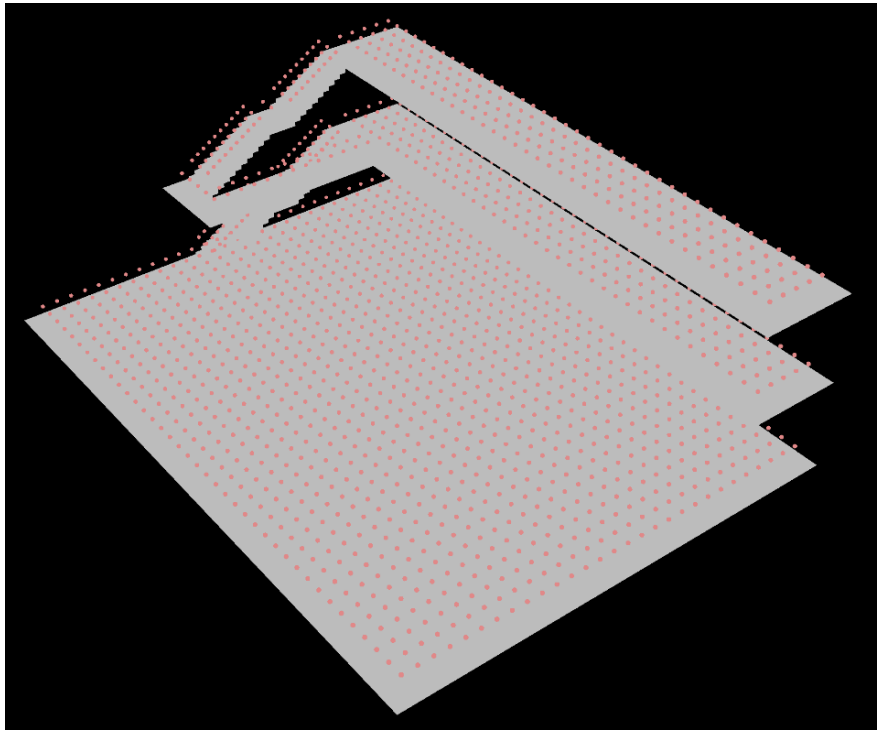
- **-vp location/name**
  - **Set the name or location for the parallel projection rendering of the points.**



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

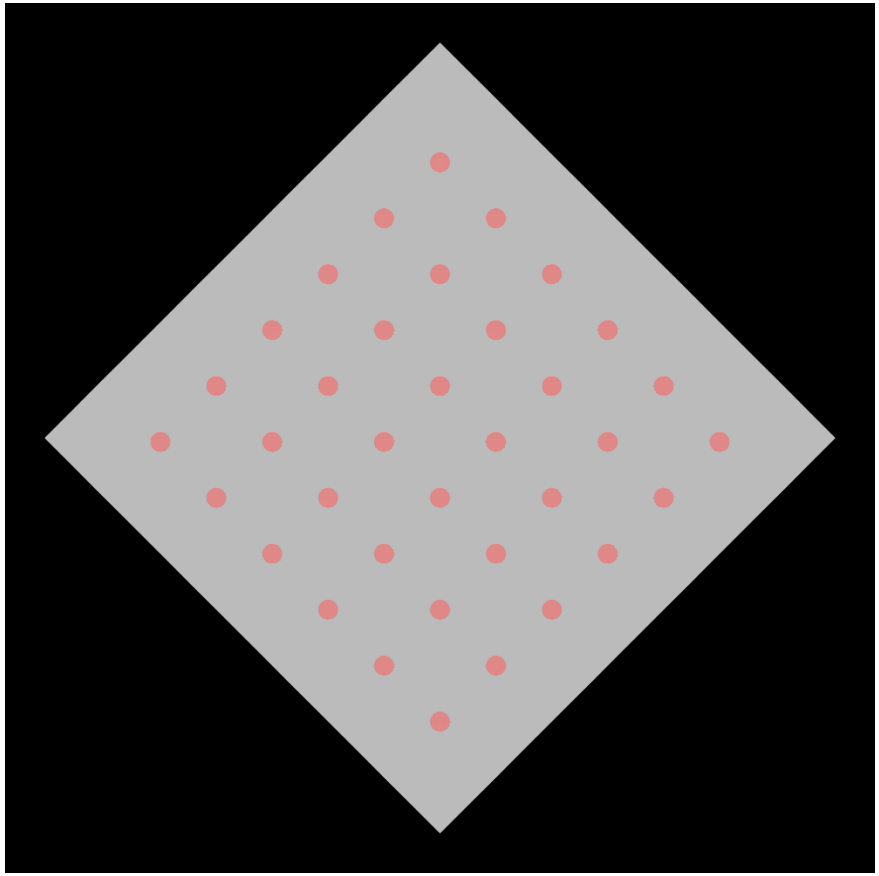
- **-vXX path/name**
  - **Set the name or location for the perspective rendering of the points.**
  - **XX can either be:**
  - **se for southeast**
  - **sw for southwest**
  - **ne for northeast**
  - **nw for northwest**



dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Options:

- **-rz val**
  - **The angle the space is rotated from the x axis. Used to align points with the space.**
- **-t dist**
  - **Set a threshold distance for ignoring polygons that would be too small after offset.**

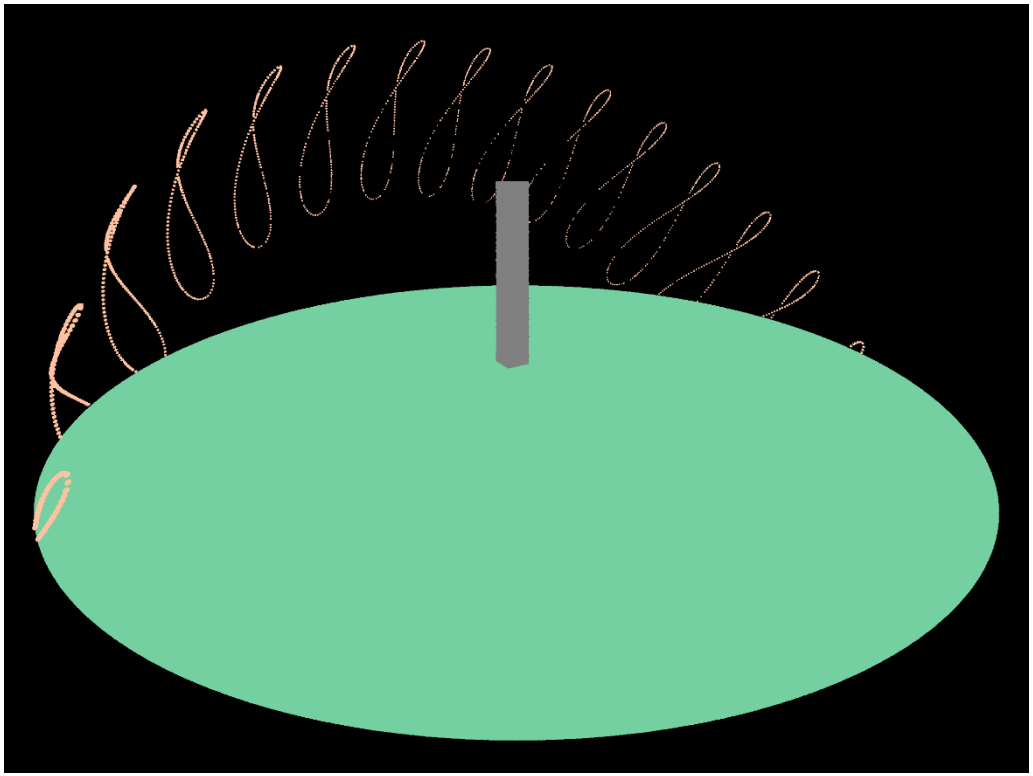


dxGridmaker creates an analysis grid for any shaped room and any number of polygons based on user-defined criteria.

Known problems:

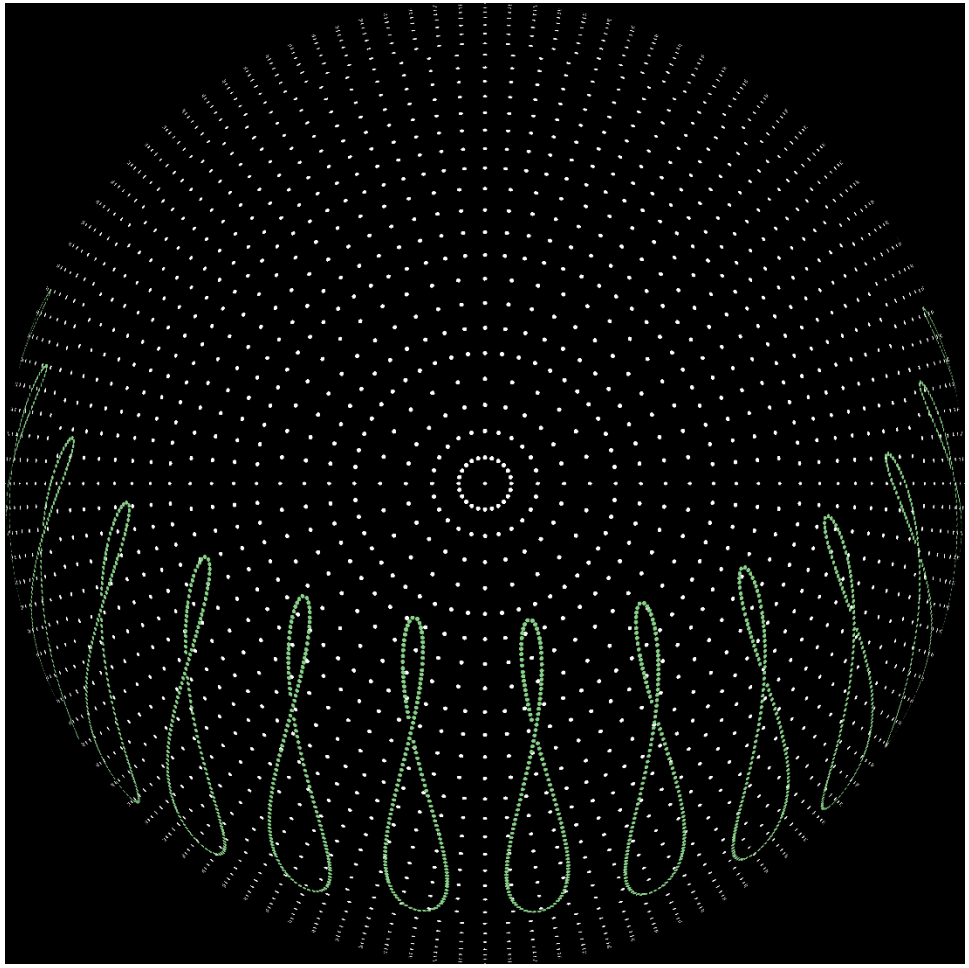
- **Holes in geometry within a single polygon using seams cannot be currently processed.**
- **If polygons do not align perfectly, there may be offset problems that cause no points to be created along a common boundary. With perfect alignment, areas should be merged.**
- **Analysis grids for sloped or vertical surfaces are not currently possible.**

dxAnalemma - sun positions for a multi-phase calculation are improved by producing suns along the analemma path.



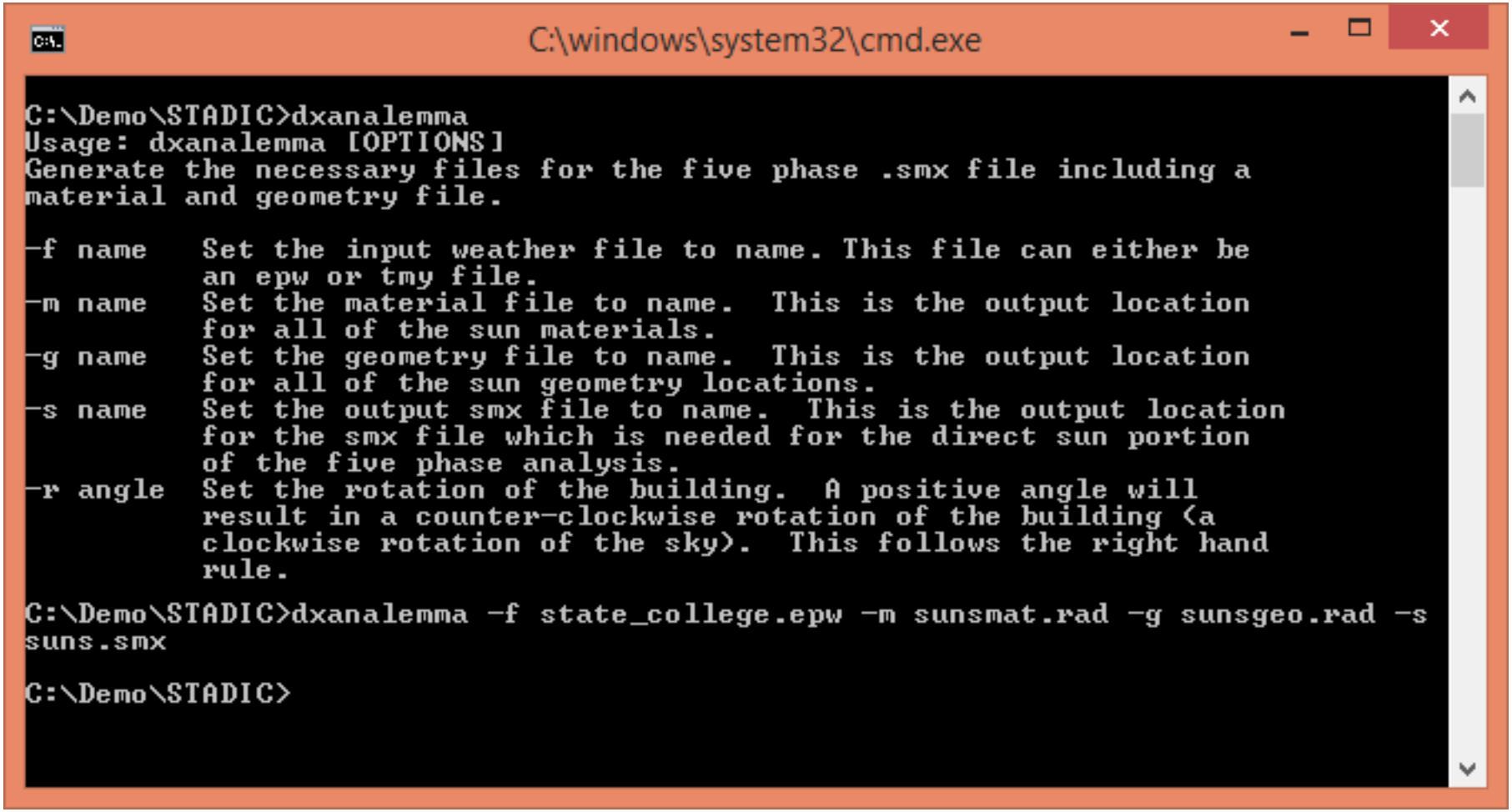
This benefits accuracy, file size, and simulation time.

dxAnalemma - sun positions for a multi-phase calculation are improved by producing suns along the analemma path.



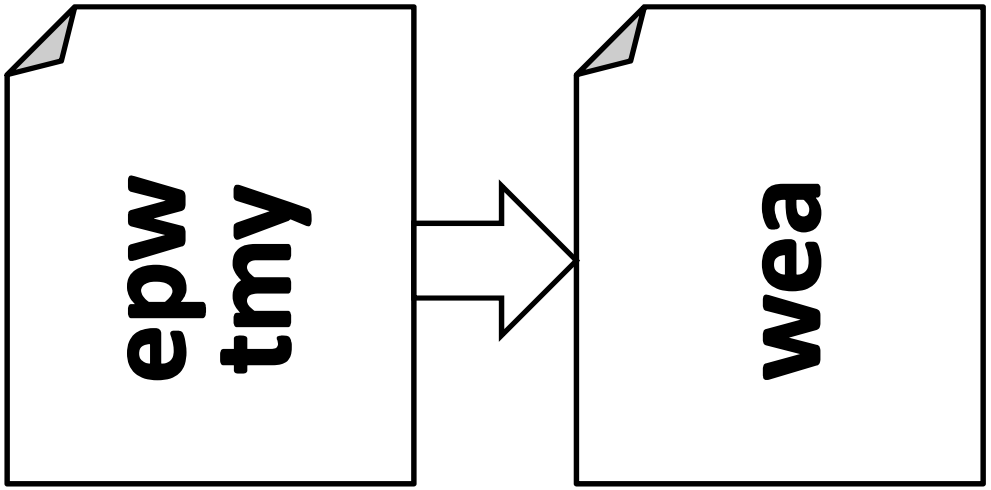
This benefits accuracy, file size, and simulation time for analemma suns vs Reinhart suns.

dxAnalemma - sun positions for a multi-phase calculation are improved by producing suns along the analemma path.



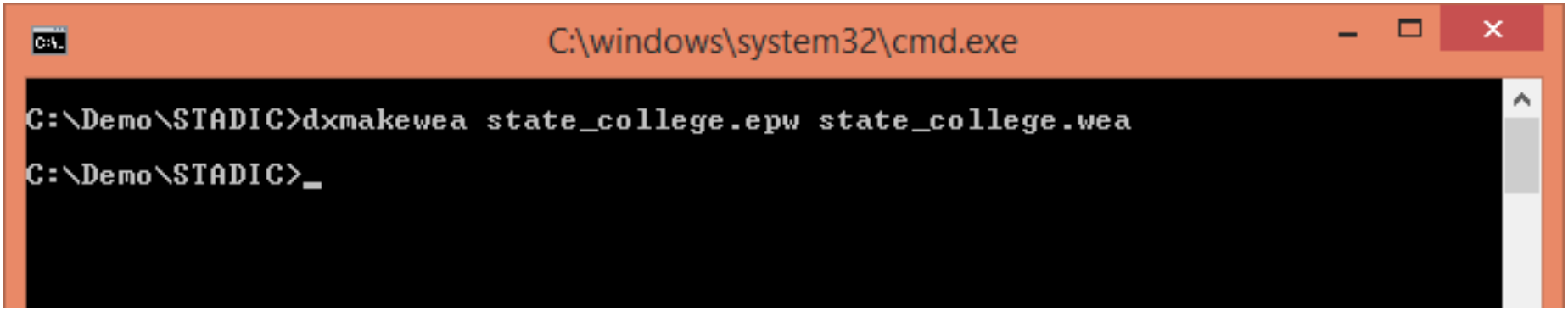
dxAnalemma produces the sun positions throughout the year based on an epw or tmy weather file.

dxMakewea – Converts weather data into the wea format and corrects times to always lie in the center of the interval.



Typically this data contains hours 1 to 24, although it is more accurate to utilize the center of the time interval for sun positions (0.5 to 23.5).

dxMakewea – Converts weather data into the wea format and corrects times to center the listed times in the time intervals.

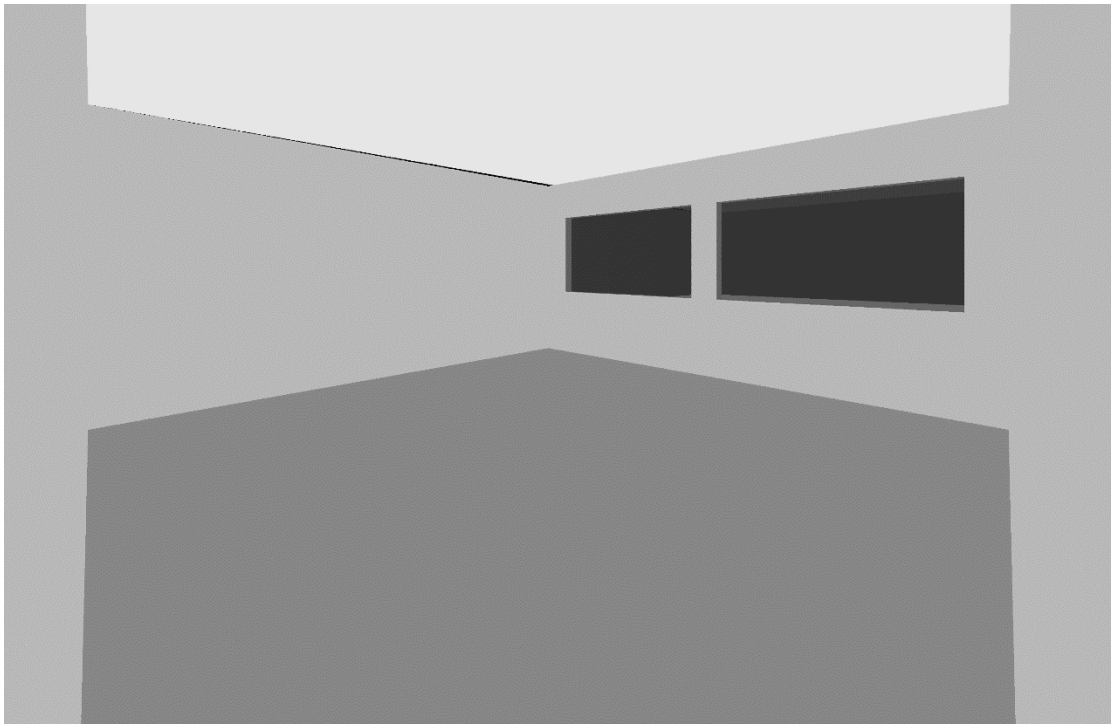


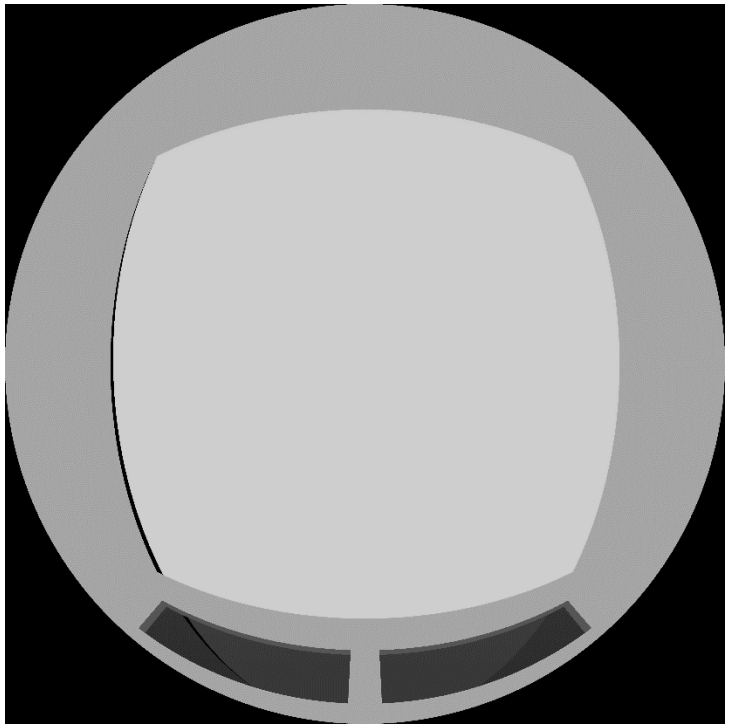
dxMakewea has no options. You simply list the input and output files.

dxMakewea – Converts weather data into the wea format and corrects times to center the listed times in the time intervals.

- Currently Radiance does not make use of the dewpoint temperature in calculations since it is not given in the wea file. The assumption is 11 degrees Celsius.
- This used to calculate atmospheric perceptible water content.
- The use of the dewpoint can make up to a 10% change in the illuminance value.
- The functionality of STADIC will allow us to add this output to a new format for use in Radiance.

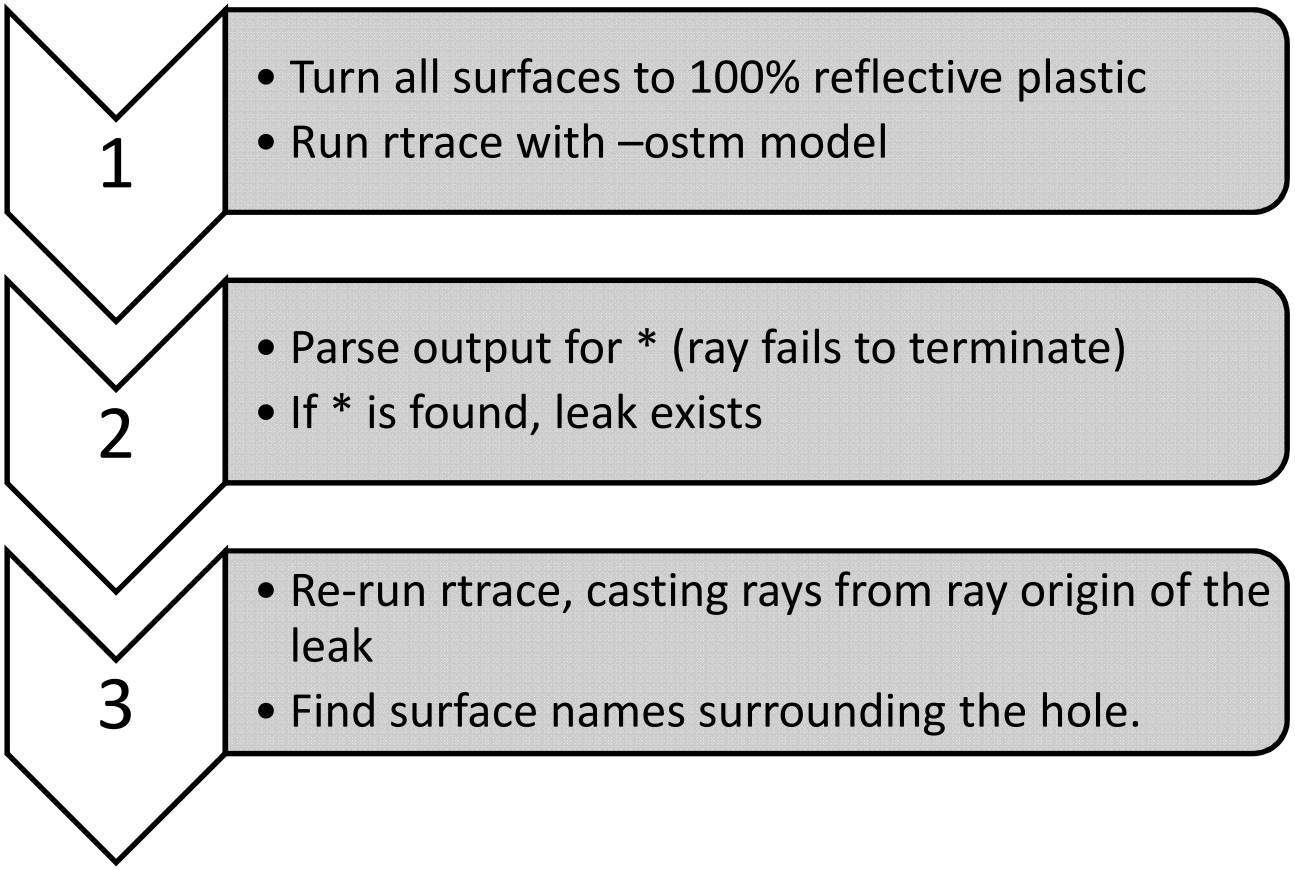
dxLeakCheck – Tests models for light leaks.





This is in the preliminary stages of development.

dxLeakCheck – Tests models for light leaks.



This is in the preliminary stages of development.

In summary, the STADIC utilities were developed to make daylight simulations easier, more accurate, and more efficient.

These programs will soon be released as a separate library within the Radiance package. The programs are open-source and distributed under the standard Radiance license.

Questions?

For more information visit https://github.com/Architectural-Lighting-Simulation/STADIC

LUTRON®

PennState

CBEI CONSORTIUM for BUILDING ENERGY INNOVATION