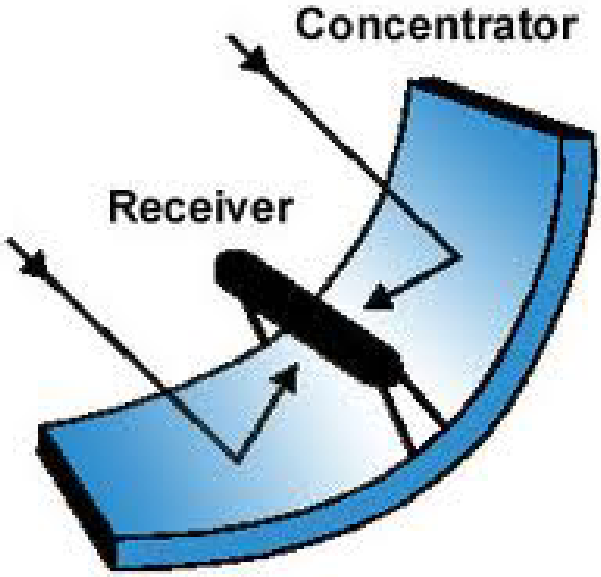
Lambda Research Corporation

Parabolic Trough



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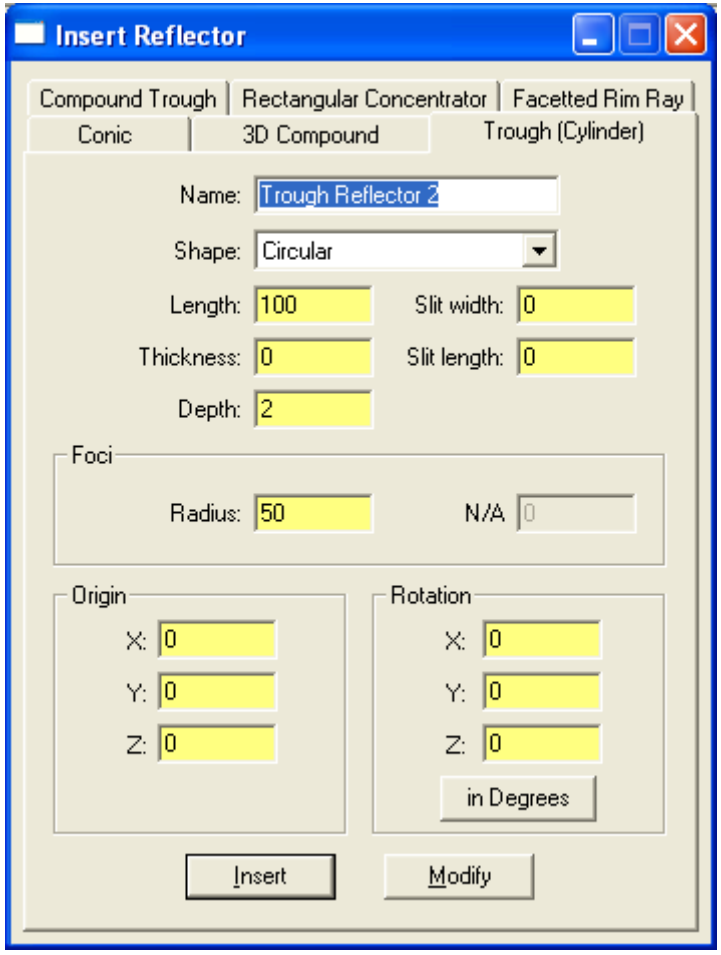
Introduction

- A **parabolic trough** is a type of solar thermal energy collector.
- Parabolic trough solar technology offers the lowest cost solar electric option for large power plant applications.
- It is constructed as a long parabolic mirror (usually coated silver or polished aluminum) with a Dewar tube running its length at the focal point.
- Sunlight is reflected by the mirror and concentrated on the Dewar tube.
- The trough is usually aligned on a north-south axis, and rotated to track the sun as it moves across the sky each day.

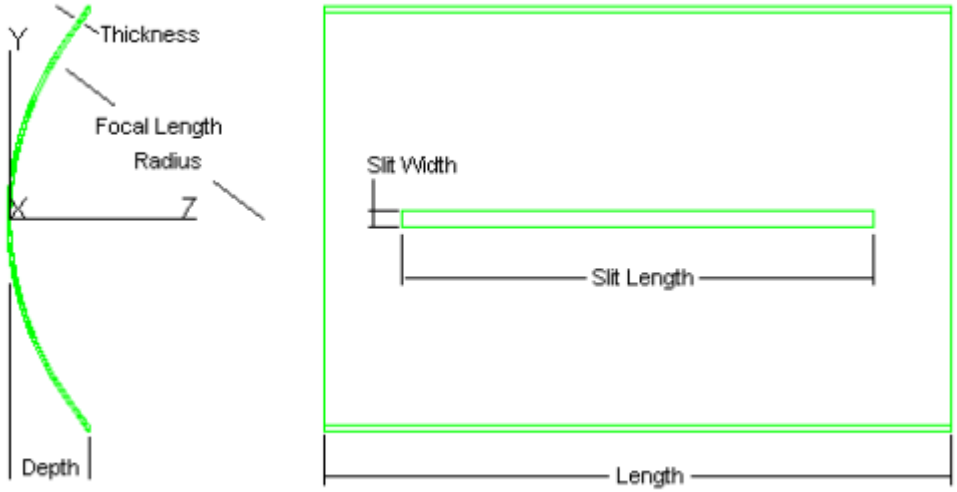
Trough Parameters

- Shape (Circular, Elliptical, Parabolic, or Hyperbolic)
- Length (the length along the cylinder axis)
- Thickness
- Depth (distance from the vertex to the outer edge of the reflector)
- Slit width
- Slit length
- Focal length (s) (or radius for a circular reflector)
- Origin (X, Y, Z coordinates of the vertex)
- Rotation (X, Y, Z rotation angles about the vertex)

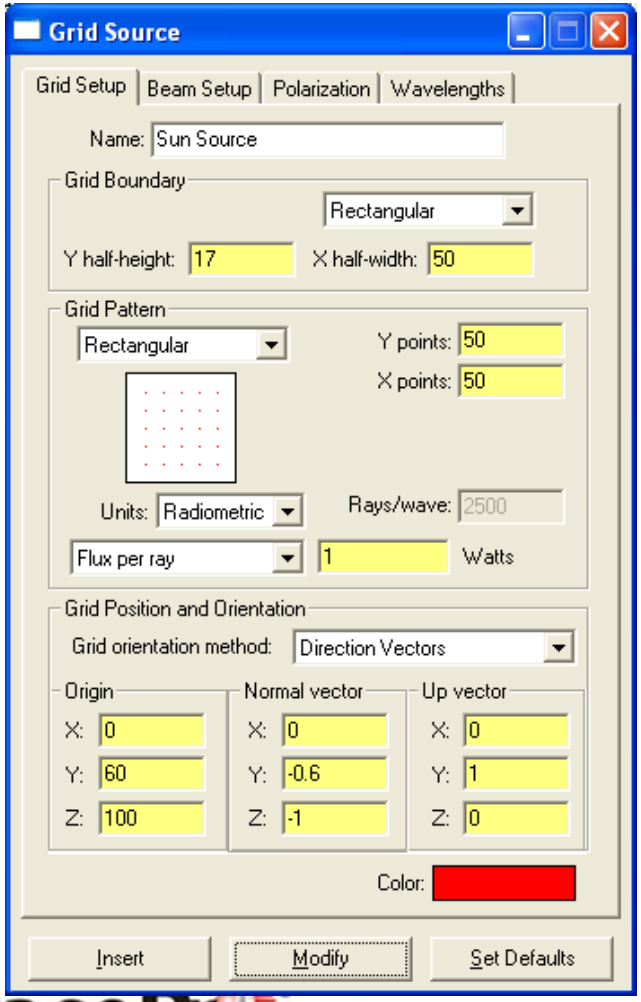
Trough Design

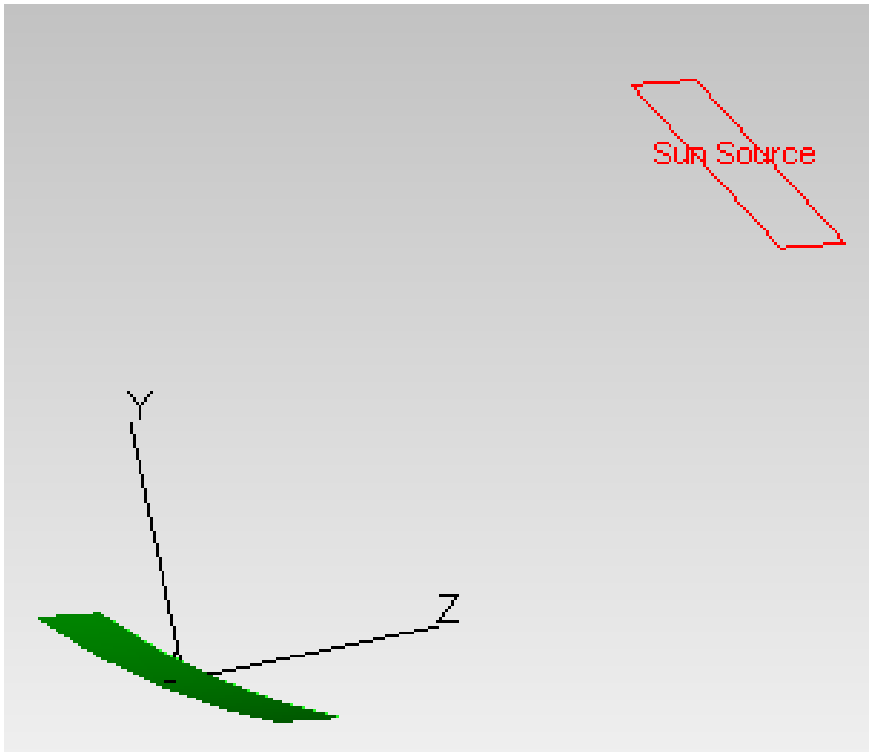


X rotation -55 and shape parabolic

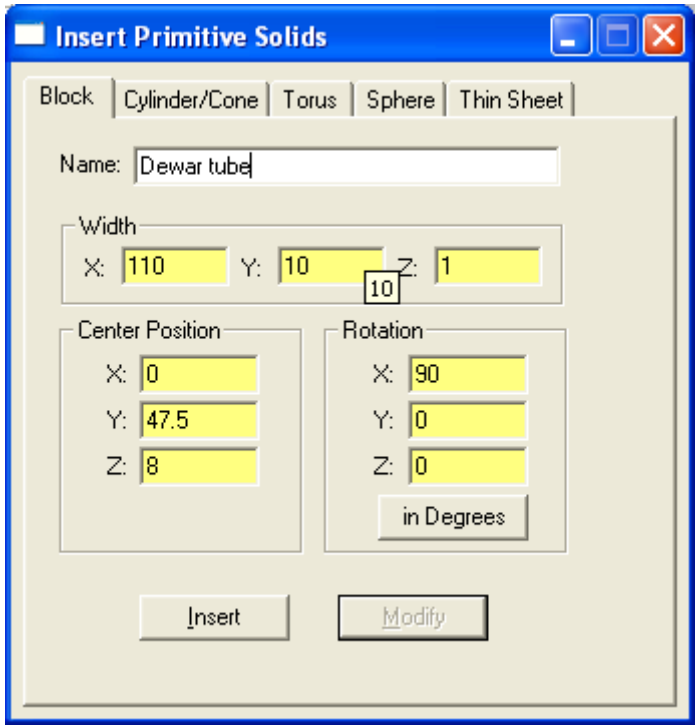


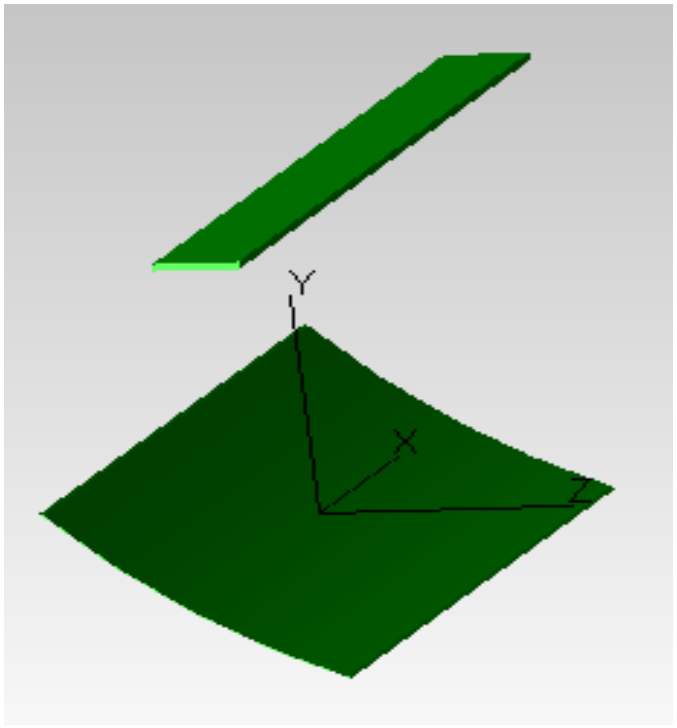
Source


Grid Source
Grid Setup
Beam Setup
Polarization
Wavelengths
Name: Sun Source
Grid Boundary
Rectangular
Y half-height: 17
X half-width: 50
Grid Pattern
Rectangular
Y points: 50
X points: 50
Units: Radiometric
Rays/wave: 2500
Flux per ray
1
Watts
Grid Position and Orientation
Grid orientation method: Direction Vectors
Origin
X: 0
Y: 60
Z: 100
Normal vector
X: 0
Y: -0.6
Z: -1
Up vector
X: 0
Y: 1
Z: 0
Color:
Insert
Modify
Set Defaults


Sun Source
Y
Z

Dewar Tube


Insert Primitive Solids
Block
Cylinder/Cone
Torus
Sphere
Thin Sheet
Name: Dewar tube
Width
X: 110
Y: 10
Z: 1
10
Center Position
X: 0
Y: 47.5
Z: 8
Rotation
X: 90
Y: 0
Z: 0
in Degrees
Insert
Modify


Y
X

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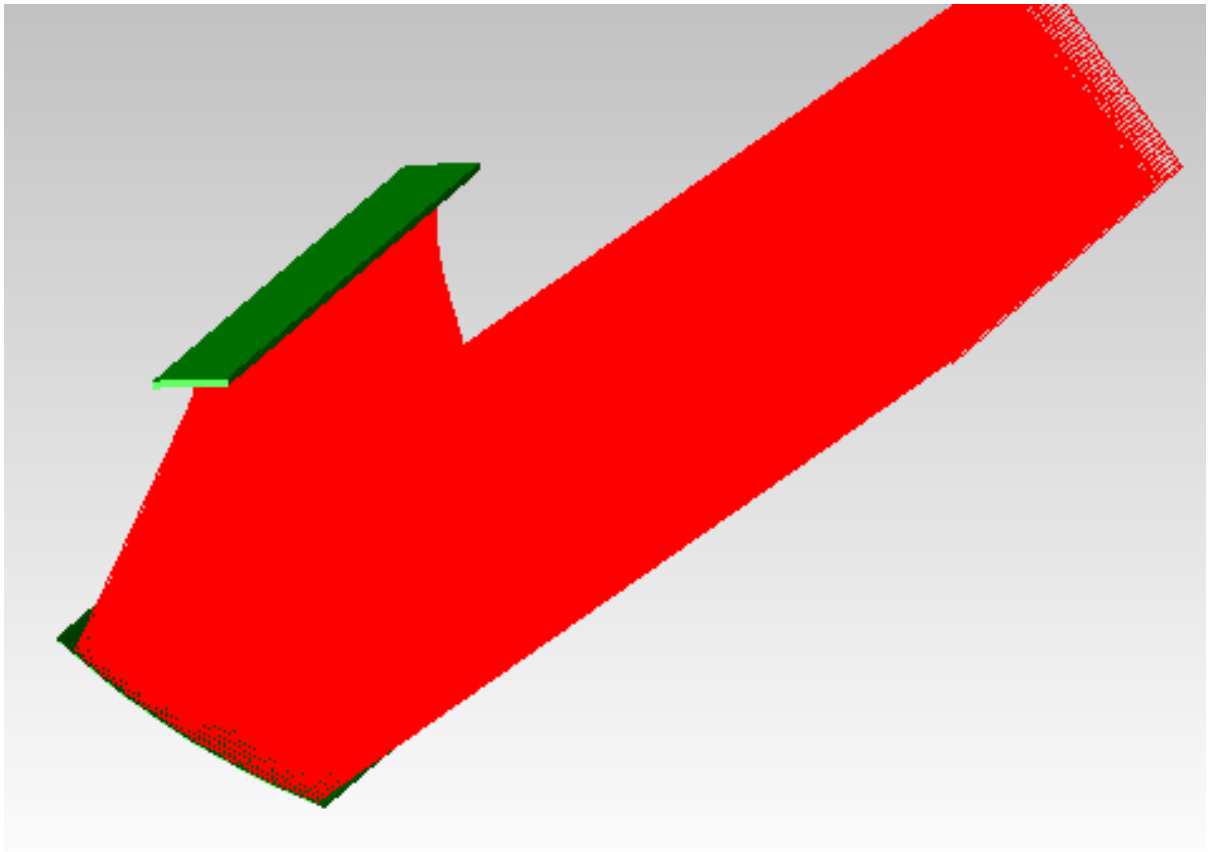
Ray Trace



TracePro®

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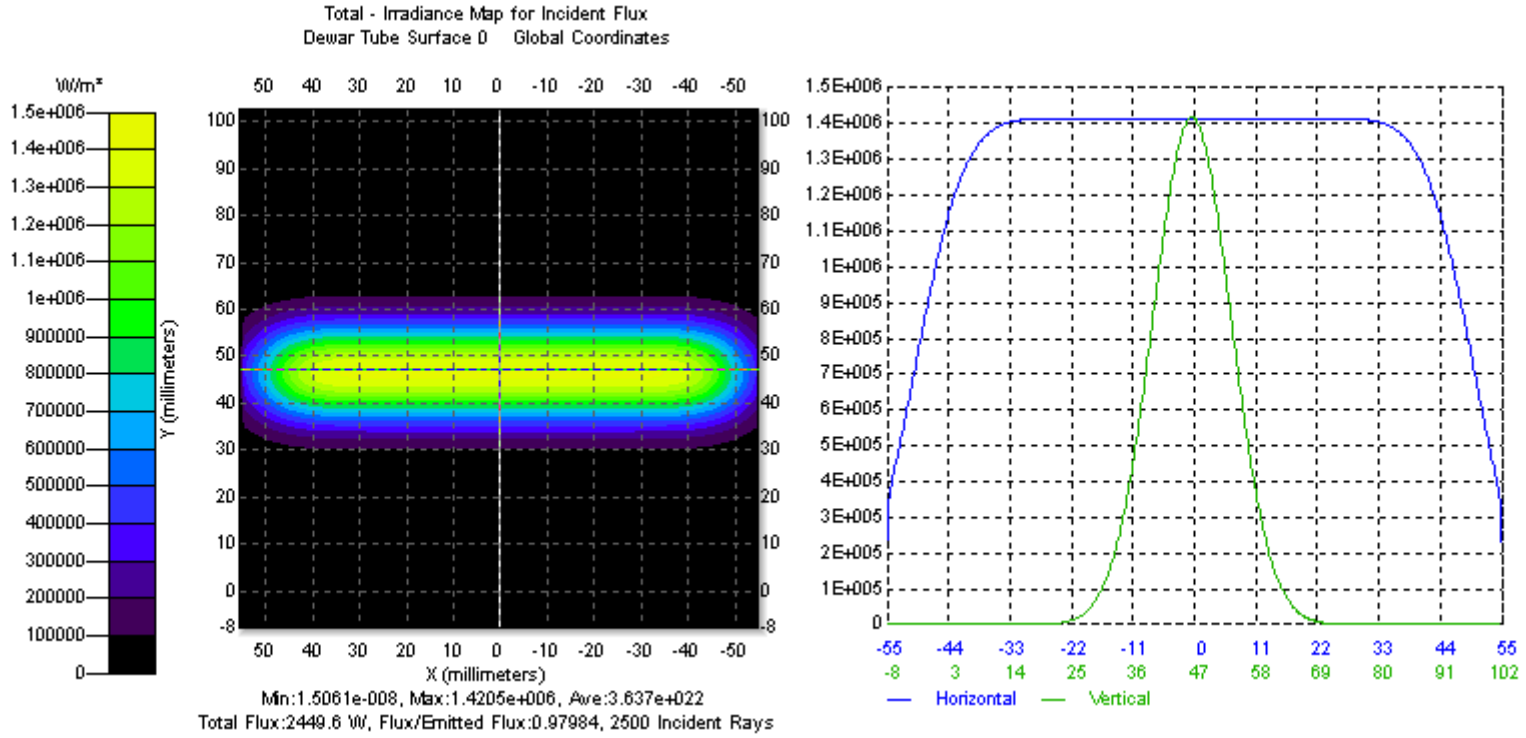
Analysis


Total - Irradiance Map for Incident Flux
Dewar Tube Surface 0 Global Coordinates
W/m²
1.5e+006
1.4e+006
1.3e+006
1.2e+006
1.1e+006
1e+006
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
Y (millimeters)
50 40 30 20 10 0 -10 -20 -30 -40 -50
100 90 80 70 60 50 40 30 20 10 0 -8
X (millimeters)
Min:1.5061e-008, Max:1.4205e+006, Ave:3.637e+022
Total Flux:2449.6 W, Flux/Emitted Flux:0.97984, 2500 Incident Rays
1.5E+006
1.4E+006
1.3E+006
1.2E+006
1.1E+006
1E+006
9E+005
8E+005
7E+005
6E+005
5E+005
4E+005
3E+005
2E+005
1E+005
0
-55 -44 -33 -22 -11 0 11 22 33 44 55
-8 3 14 25 36 47 58 69 80 91 102
Horizontal
Vertical