

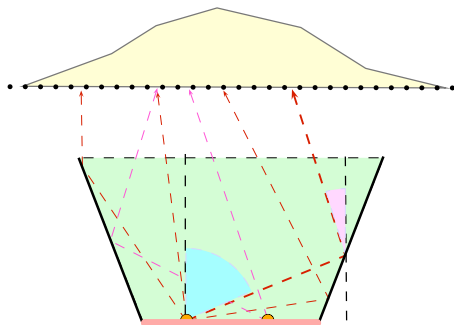
# PHILIPS - A NEW RAY TRACING METHOD FOR NON-IMAGING OPTICS

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SWI - Eindhoven 2012

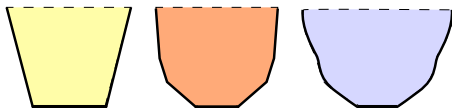
SWI, February 03, 2012





- Input = source position, angle
- Output = target position, angle and light intensity
- Far field

Light intensity depends on light fixture shape.

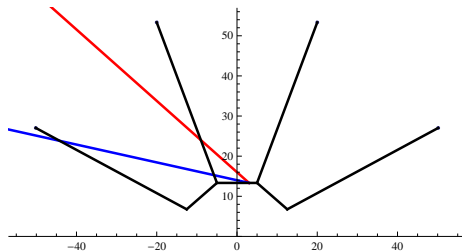


2-faceted, multi-faceted, smooth fixture

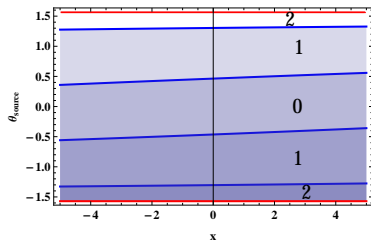
## TWO-FACETED CUP

### Analytical results

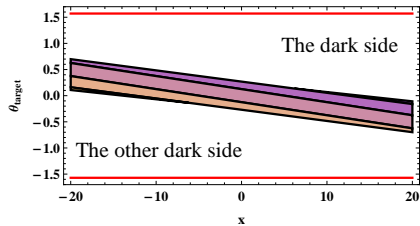
- Geometrical proof: maximum number of reflections
- Finite number of reflections
- Exit position and angle
- Philips example:



Source:



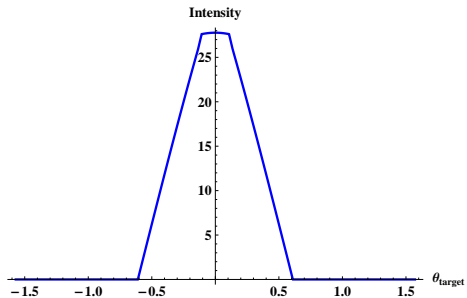
Target:



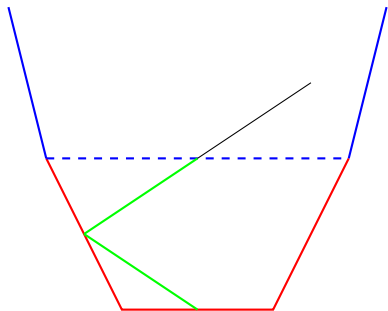
Map source position and angle to target position and angle.

## LIGHT INTENSITY

$$I_{\text{source}} \sim \cos \theta \text{ (Lambertian)}$$

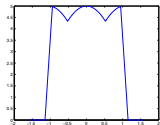
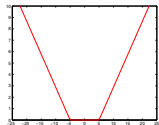


## MULTI-FACETED CUP

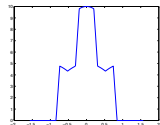
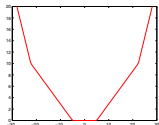


- proof follows same principle
- Finite number of reflections
- Intensity function

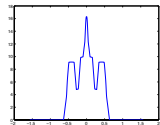
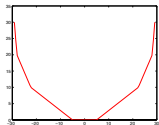
## INTENSITY FOR MULTI-FACETED CUPS



2-faceted Fixture



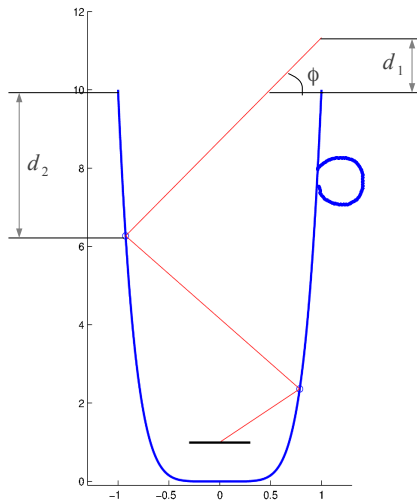
4-faceted Fixture



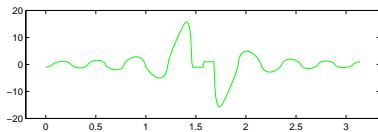
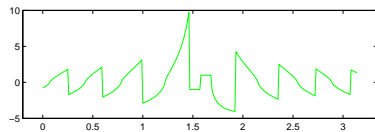
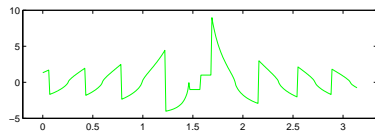
6-faceted Fixture



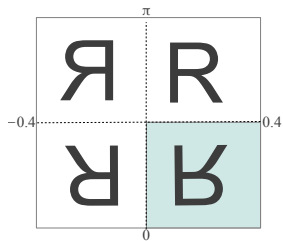
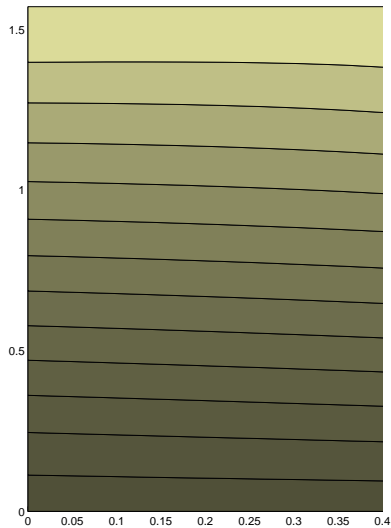
## 2D SMOOTH CUP



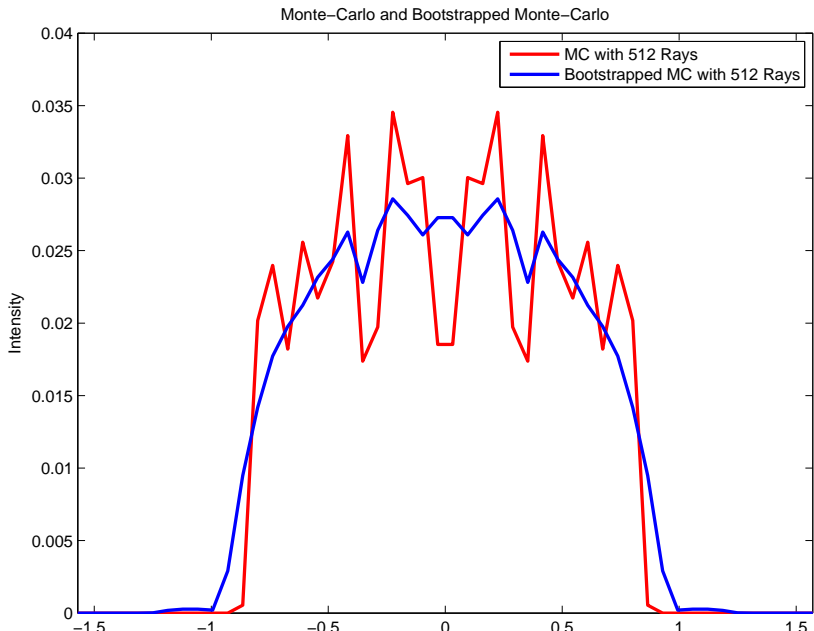
## DESIGNING A FUNCTIONAL



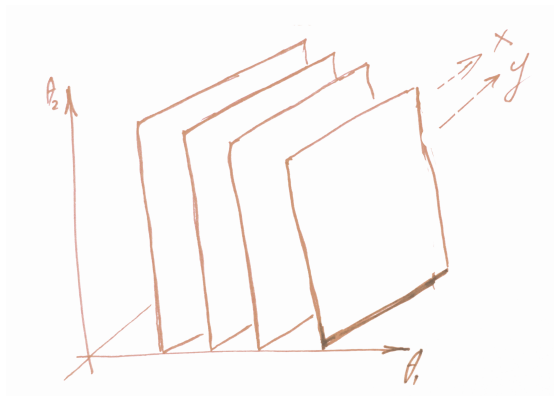
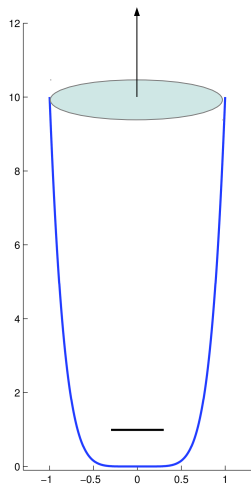
## PHASE SPACE PARTITION



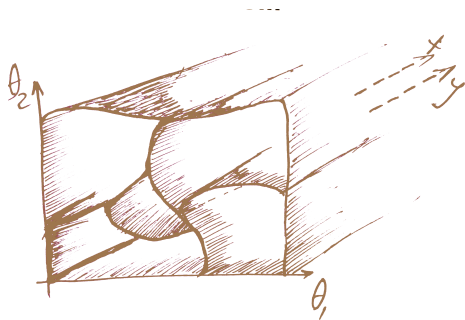
## SMART INTEGRATION



## 3D ROTATIONAL SYMMETRY



## 3D ARBITRARY SMOOTH CUP



During the week, we managed to do several things.

- For mirror-symmetric 2-facet cups:
  - To compute formulas for the boundaries of the source and target phase spaces
  - Implemented the computation in Mathematica
- For mirror-symmetric multifaceted cups:
  - To compute explicit formulas for the intensity function on the far field
  - Implemented the computation in Mathematica
- For arbitrary smooth cups:
  - To develop a deterministic algorithm for numerical approximation of the division of source phase space (with exponential order convergence)
  - To construct an MC algorithm for integration over the source phase space, using bootstrapping
  - Implemented the computation in Matlab