

## Validation of genBSDF

**McNeil, Andy; Jonsson, Jacob ; Appelfeld, David**

*Publication date:*  
2011

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

McNeil, A., Jonsson, J., & Appelfeld, D. (2011). Validation of genBSDF [Sound/Visual production (digital)]. 10th International Radiance Workshop, Berkeley, CA, United States, 24/08/2011

## DTU Library

Technical Information Center of Denmark

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

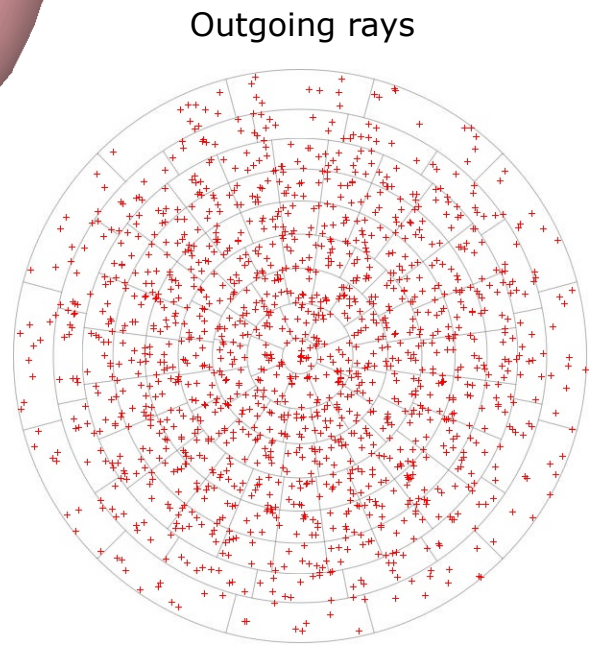
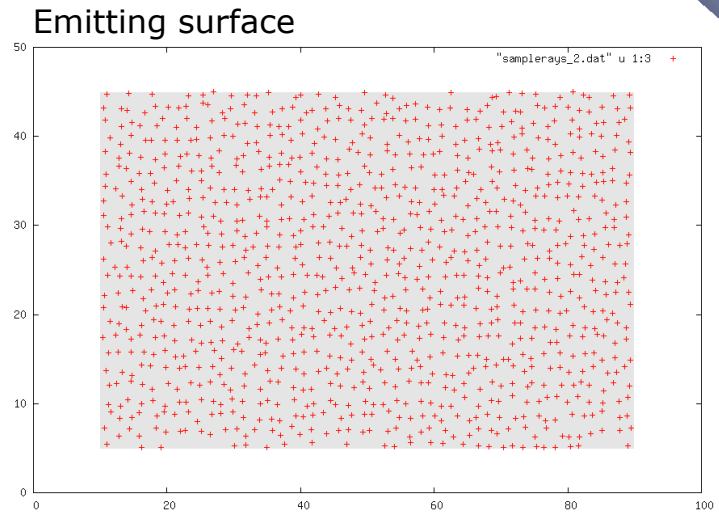
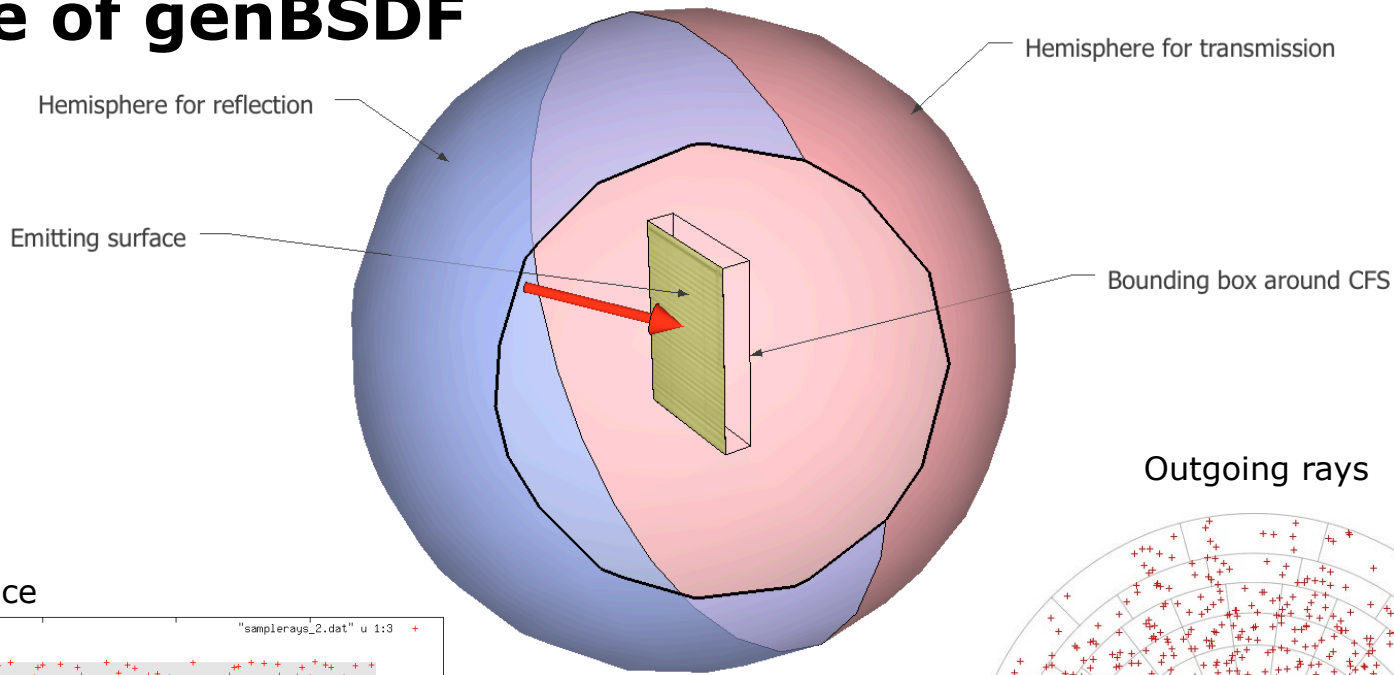


# Outline

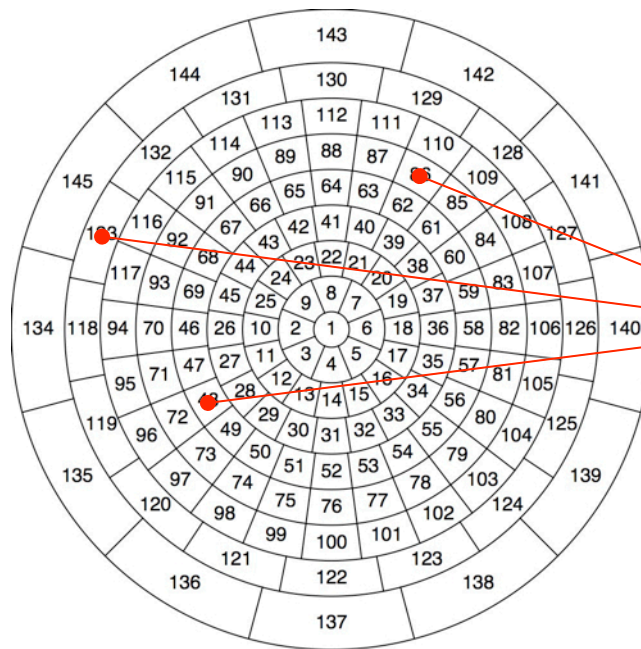


- How genBSDF works – basics
- Validation process
- Four validation cases

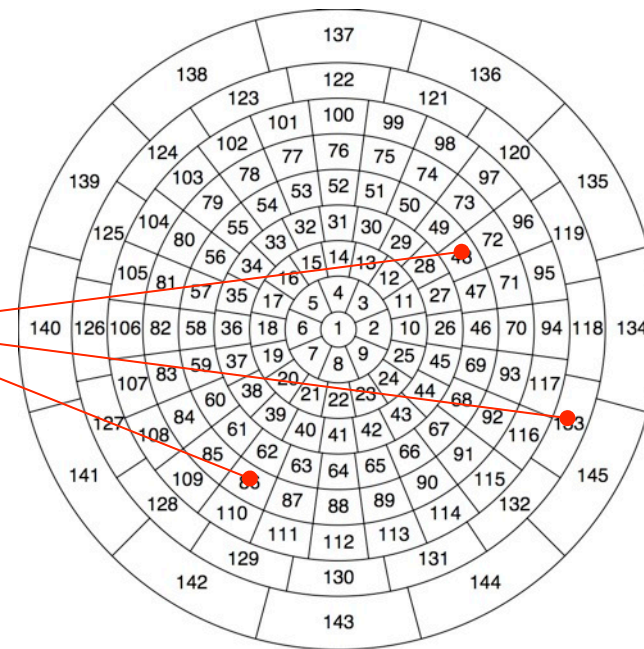
# Usage of genBSDF



Incident angles



Outgoing angles - transmitted

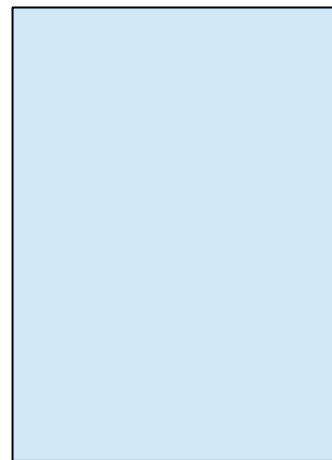


# Validation examples

Test Case	Validated Against
Air (100% specular transmission)	Analytically derived values
50% lambertian transmission	Analytically derived values
Mirrored blinds with flat slats	TracePro simulation
Micro perforated shading film	Gonio-Photometer measurement

Case 1

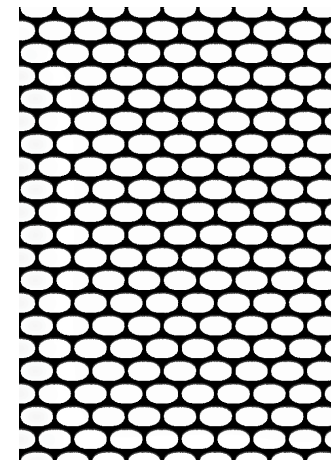
Case 2



Case 3



Case 4



# Example 1

*Air – 100% specular transmission*

- ##Material

void polygon plane

0

0

12 0 0 0

0 10 0

10 10 0

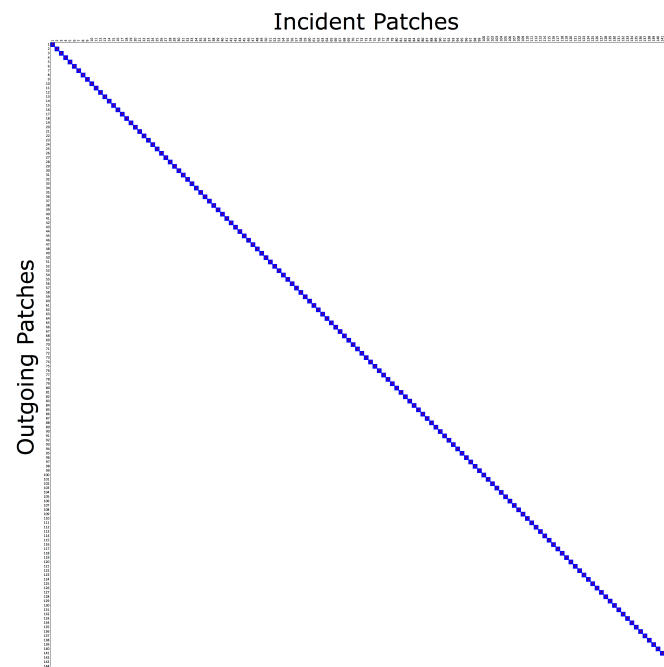
10 0 0

- Analytical solution

$$\frac{1}{\cos\theta \times \Omega}$$

- Diagonal matrix

- All results in theta bends are identical



# Example 1

*Air – 100% specular transmission*

Theta band	Number of phi	Patch numbers	Theta range	Solid angle	Average cosine theta	BSDF value for specular patch	genBSDF result (mean for theta band)
1	1	1	0° - 5°	0.0239	0.9981	41.9043	41.9043
2	8	2-9	5° - 15°	0.0238	0.9811	42.8764	42.8764
3	16	10-25	15° - 25°	0.0234	0.9361	45.6281	45.6281
4	20	26-45	25° - 35°	0.0274	0.8627	42.333	42.333
5	24	46-69	35° - 45°	0.0293	0.7631	44.6724	44.6724
6	24	70-93	45° - 55°	0.0350	0.6403	44.6724	44.6724
7	24	94-117	55° - 65°	0.0395	0.4981	50.7996	50.7996
8	16	118-133	65° - 75°	0.0643	0.3407	45.6281	45.6281
9	12	134-145	75° - 90°	0.1355	0.1294	57.0215	57.0215



## Example 2

*Lambertian diffuser - 50% transmission*

- ##Material

```
void trans diffuse50
```

```
0
```

```
0
```

```
7 .5 .5 .5 0 0 1 0
```

```
diffuse50 polygon bottom
```

```
0
```

```
0
```

```
12 0 0 0
```

```
0 1 0
```

```
1 1 0
```

```
1 0 0
```

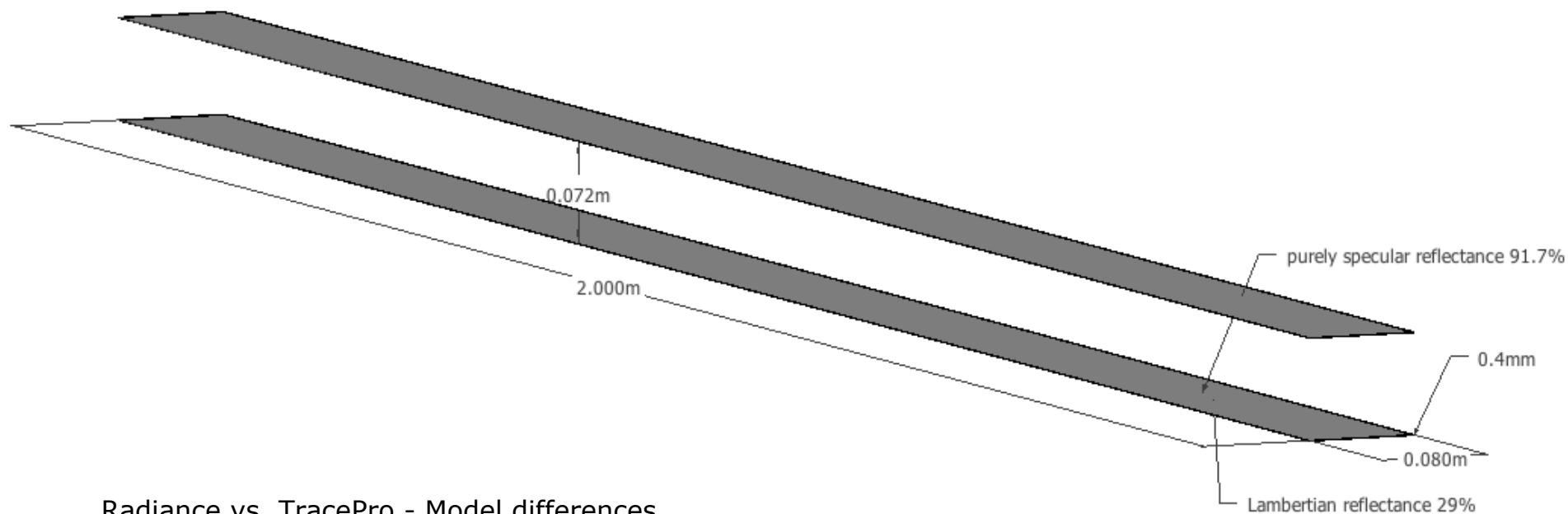
genBSDF settings	-c 1,000
mean	0.15916
maximum	0.16507 3.7% error
minimum	0.15250 - 4.2% error
Mean Bias Error	0.00058%
RMS Error	0.89%

- BSDF =  $\text{trans}/\pi \Rightarrow 0.15915$

- Results from genBSDF ranging  $\pm 4\%$  from analytical method

## Example 3

### *Mirrored blind*



### Radiance vs. TracePro - Model differences

#### **TracePro**

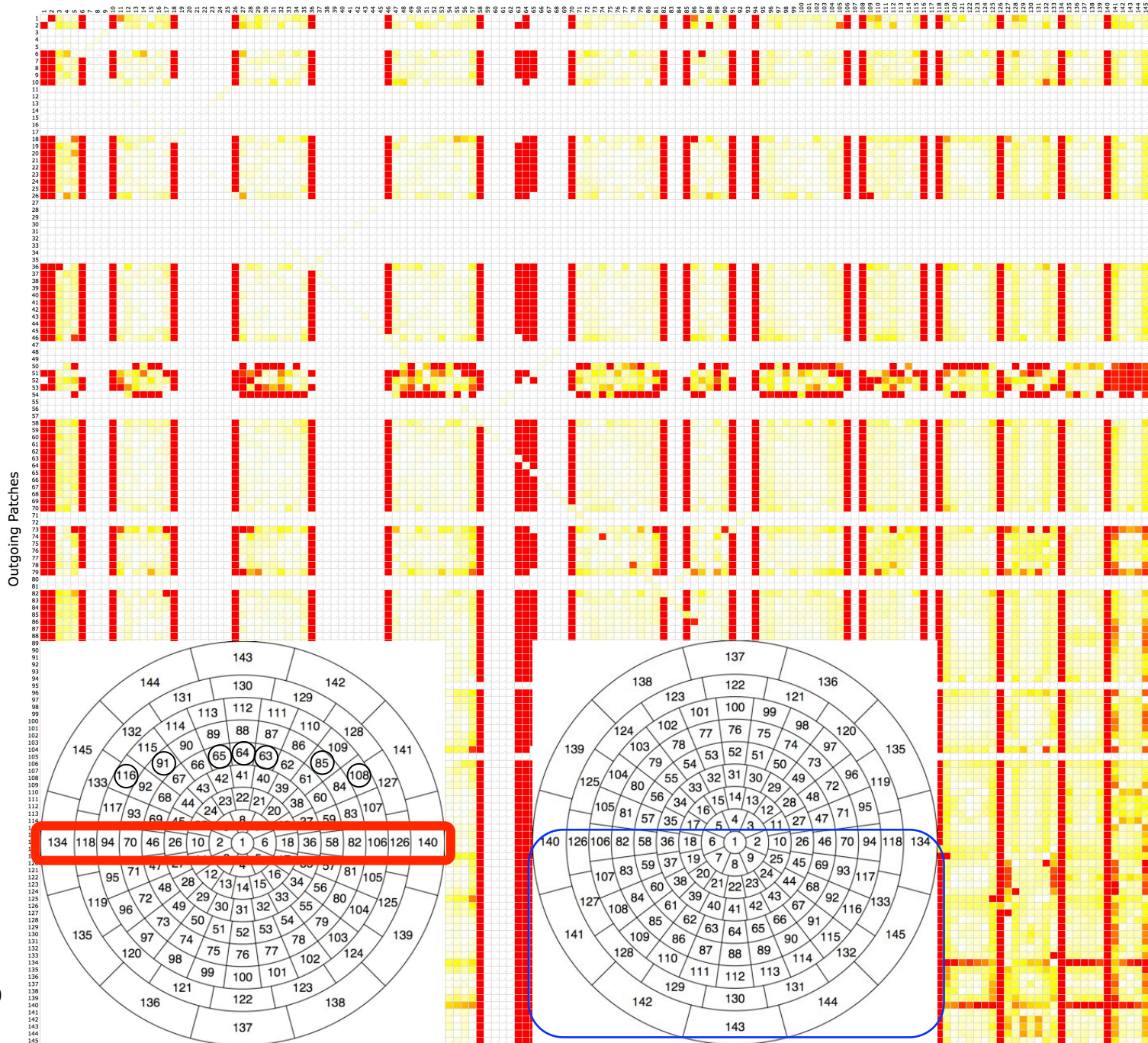
- Two blind slats
- Sample rays were generated along the center line of the blind between the two slats
- The sample rays in Trace Pro were collimated.

#### **Radiance**

- Model approximately 2m wide and 2.016 m tall
- Ray samples origins were distributed randomly over the 2m by 2.016 m blind system.
- Ray directions were randomly distributed over each Klem's patch.
- Sample rays were not collimated

# Percent Difference: genBSDF v. TracePro

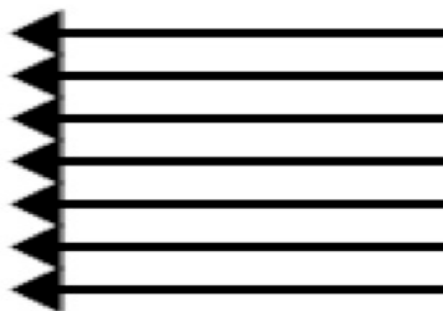
Incident Patches



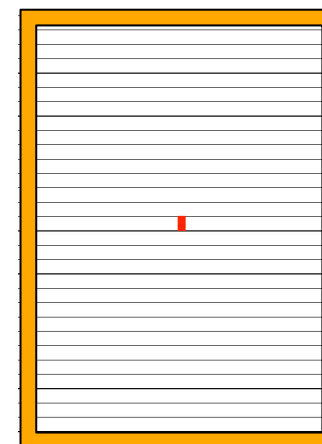
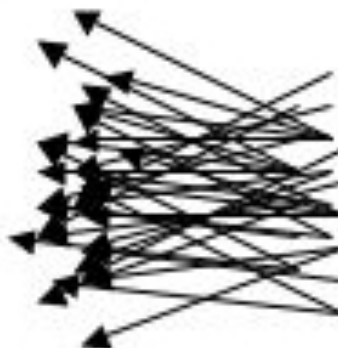
## genBSDF-mod

- Process closer to the simulation procedure in TracePro
- Illuminating source collimated instead of area source
- Emitting surface 2mm wide 72mm tall
- "receiving" surface was changed from a infinite hemisphere to a 20m disk

Collimated source

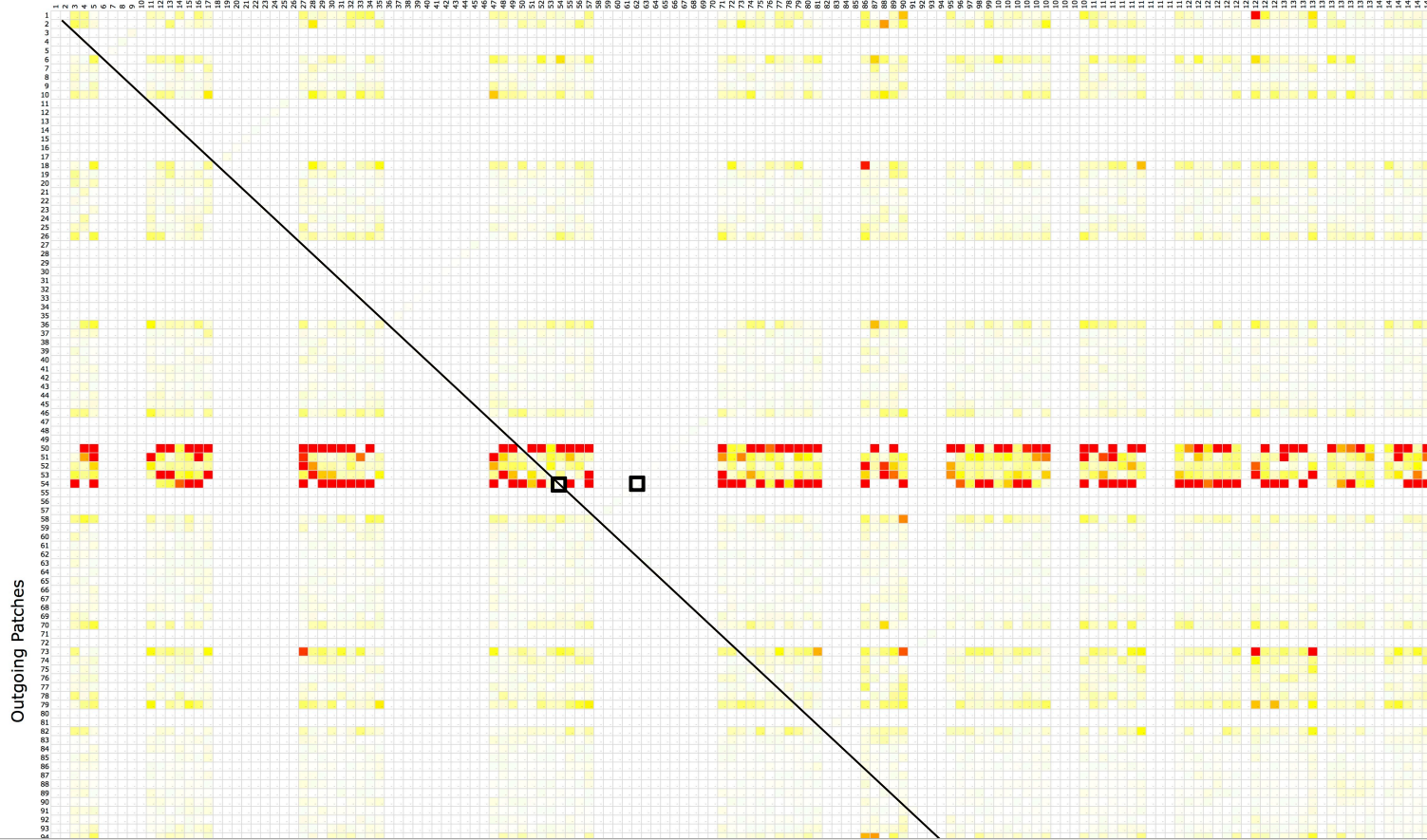


Area source

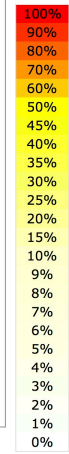
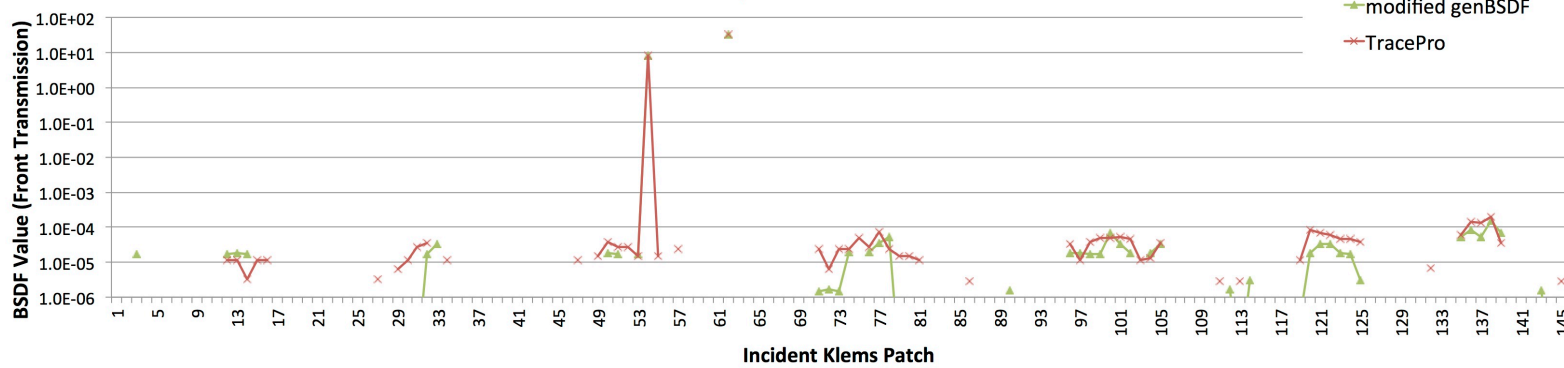


# Percent Difference: modified genBSDF v. TracePro

Incident Patches

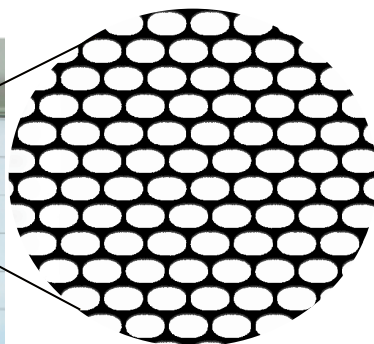


Transmitted Klems Patch #54  
Flat Specular Blinds

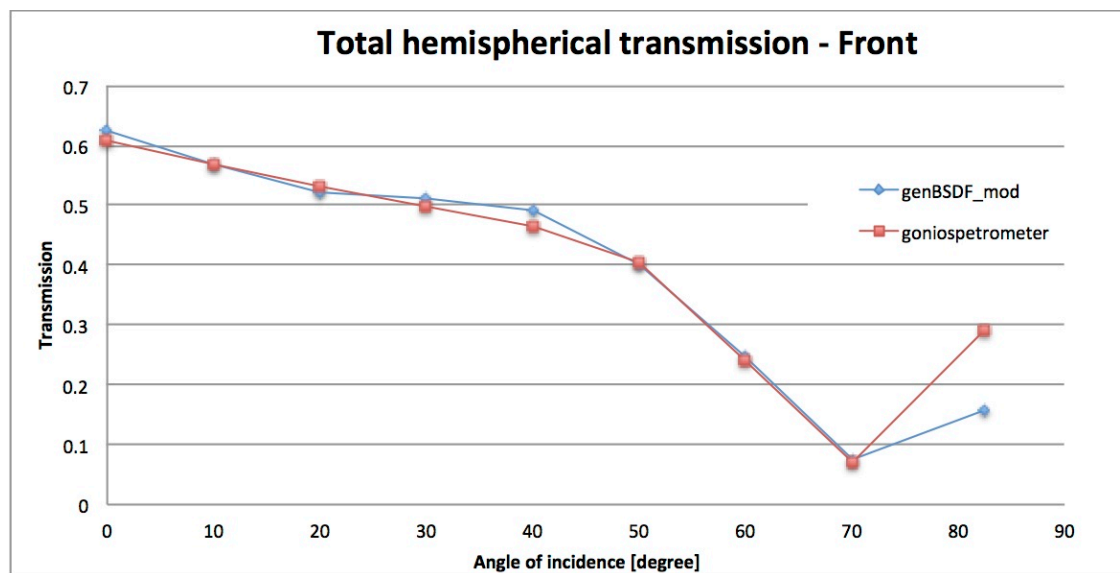


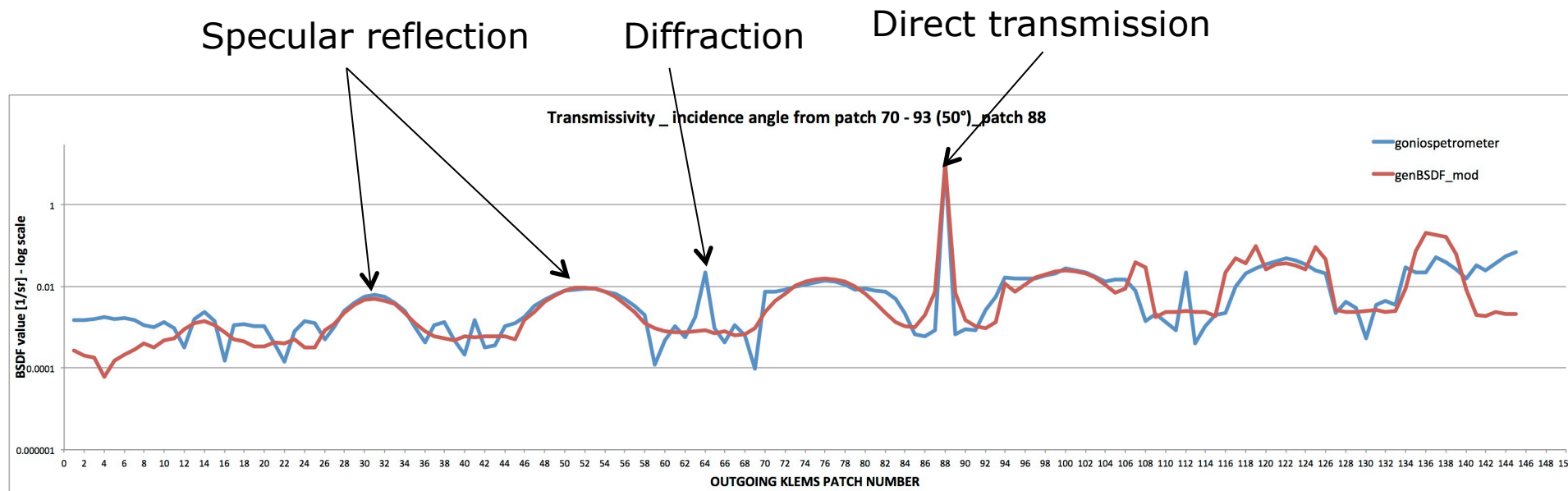
# Example 4

Micro perforated shading film



Incidence angle	Trans. error to gonio.	
	direct	hemispherical
0	2	3
10	2	0
20	2	2
30	2	3
40	5	6
50	4	0
60	1	2
70	37	7
82.5	100	46





## Conclusion

- Comparable results with other methods for obtaining BSDF data
  - Analytical solutions correlate well.
  - The optically complex systems correlate when the simulation procedures are the comparable.
- Radiance only simulates ray optics and will not reproduce wave optic phenomenon including diffraction.
- Model should be built in the way such that light is not escaping or leaking around the geometry.





Questions?