

Putting Radiance to Work Modeling Glass Block

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Radiance Workshop
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First, Where do you work?



terrestrial  LIGHT





Why in the world would you want to simulate glass block?

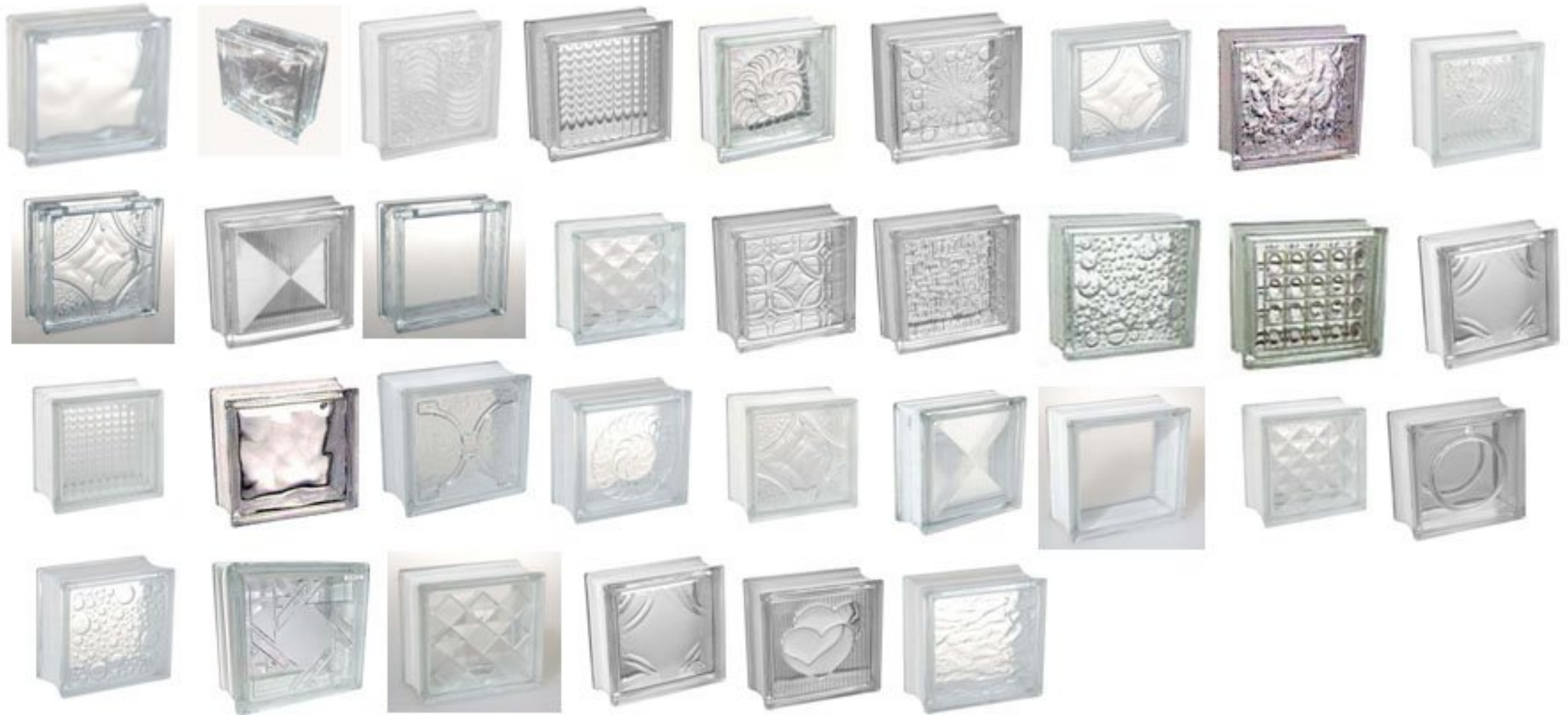
1. It's difficult to model
2. It's a good test case

- Texture
- Angular Selectivity
- Dielectric Interface
- Caustics



3. It's fun!
4. A renovation project has existing glass block.

A product specifically suited for all your
daylight needs!





Grand stairway!
Residential stairway!

Breakroom!
Reception desk!

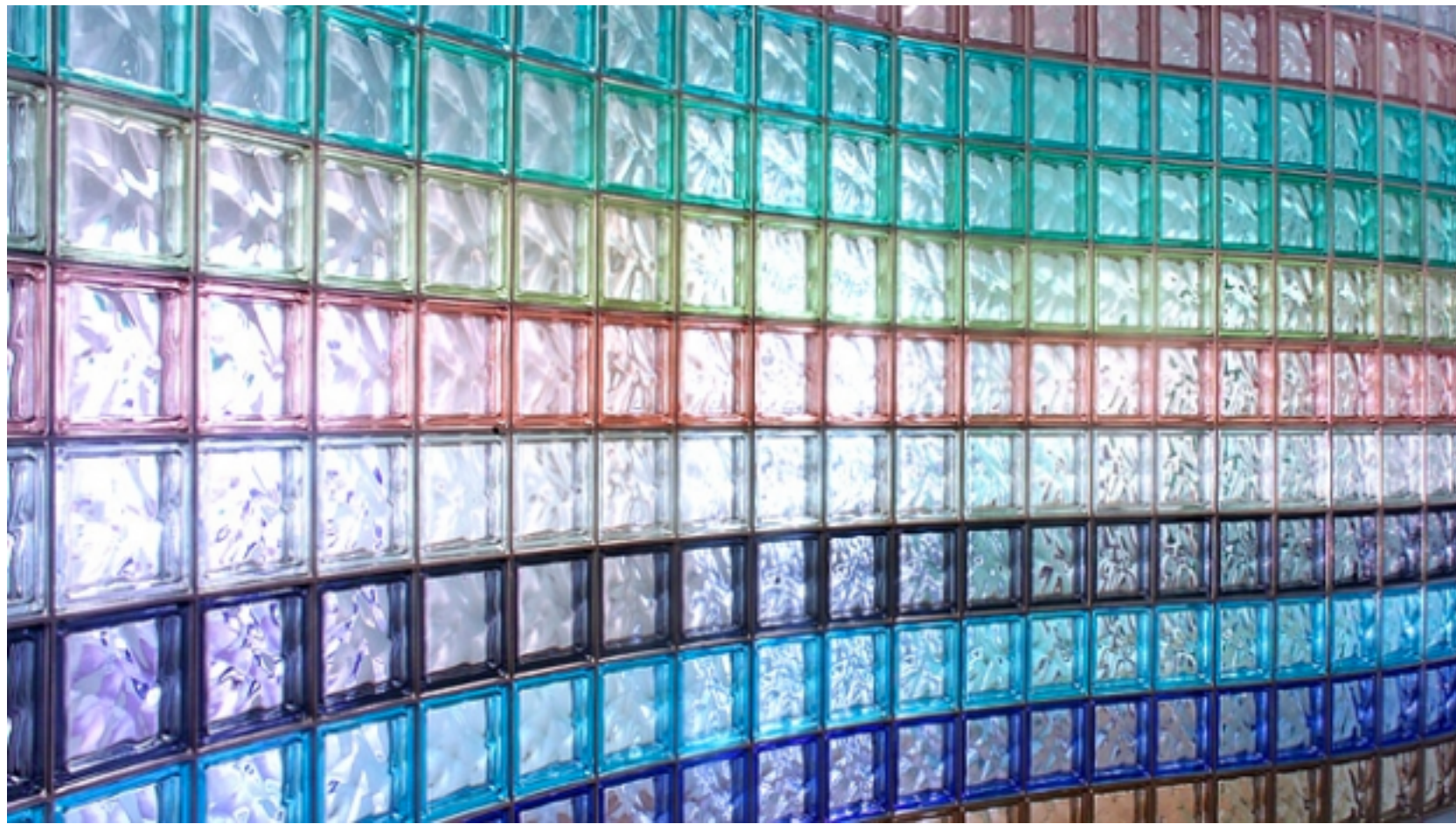


Facade!
Fence!



Shower!
Bay Window!





Rainbows!

Colorful
Designs!



Tetris!!!!



Cheap



Durable



People who live in glass houses shouldn't throw stones...



...unless they live in glass block houses.

Throw those stones!



Simulation methods tested

- Classic Radiance
- BSDF material
- BSDF material w/proxy geometry
- ~~Daylight Coefficient simulation~~
- Three Phase simulation
- ~~Five Phase simulation~~
- PHOTON MAP!

Simulation methods

	Geometry	BSDF
1. Classic Radiance	X	
2. BSDF Material		X
3. BSDF Material w/proxied Geometry	X	X
4. Three Phase Method		X
5. Photon Map	X	

Modeling a single glass block

```
#glassblock.rad
```

```
void texfunc ripply
```

```
6 xwrink ywrink zwrink wrinkle.cal -s .1833
```

```
0
```

```
4 1 1 1 0.25
```

```
rippy dielectric TexturedGlass
```

```
0
```

```
0
```

```
5 0.36 0.36 0.36 1.5 0
```

```
void dielectric FlatGlass
```

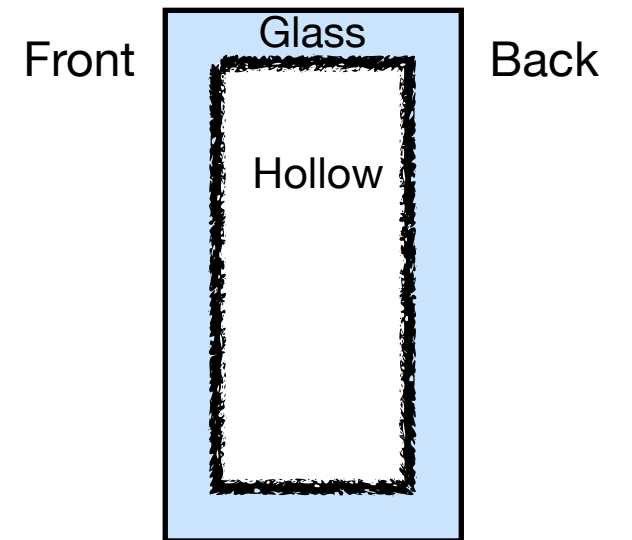
```
0
```

```
0
```

```
5 0.36 0.36 0.36 1.5 0
```

```
!genbox FlatGlass outer .6451 .6451 .3333 | xform -t .0109 .0109 -.3333
```

```
!genbox TexturedGlass inner .6138 .6138 .2708 -i | xform -t .0417 .0417 -.3020
```



Section View

The glass block is surrounded by 1/2 width of mortar.

```
#glassblock.rad (cont.)
```

```
void plastic mortar
```

```
0
```

```
0
```

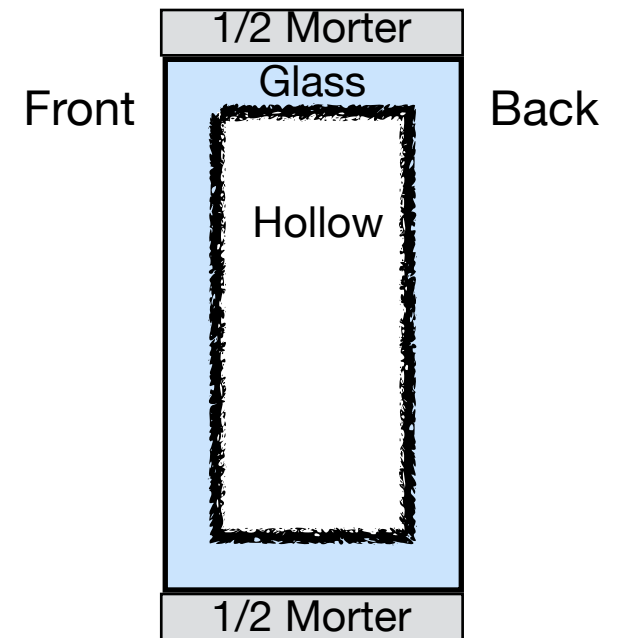
```
5 .3 .3 .3 0 0
```

```
!genbox mortar bottom .6667 .0109 .3333 | xform -t 0 0 -.3333
```

```
!genbox mortar top .6667 .0109 .3333 | xform -t 0 .6560 -.3333
```

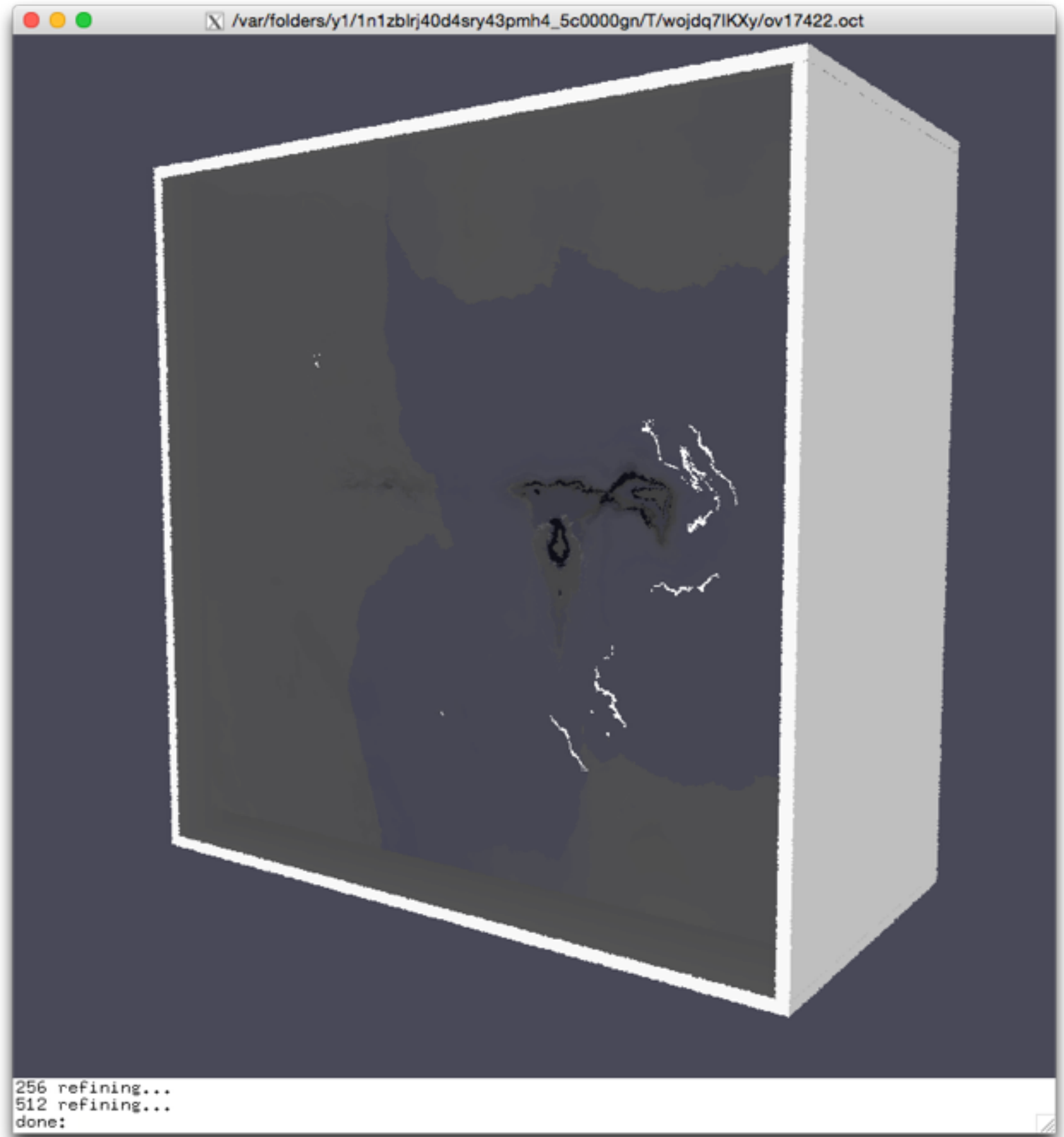
```
!genbox mortar left .0109 .6451 .3333 | xform -t 0 .0109 -.3333
```

```
!genbox mortar left .0109 .6451 .3333 | xform -t .6560 .0104 -.3333
```



Section View

Oooh...

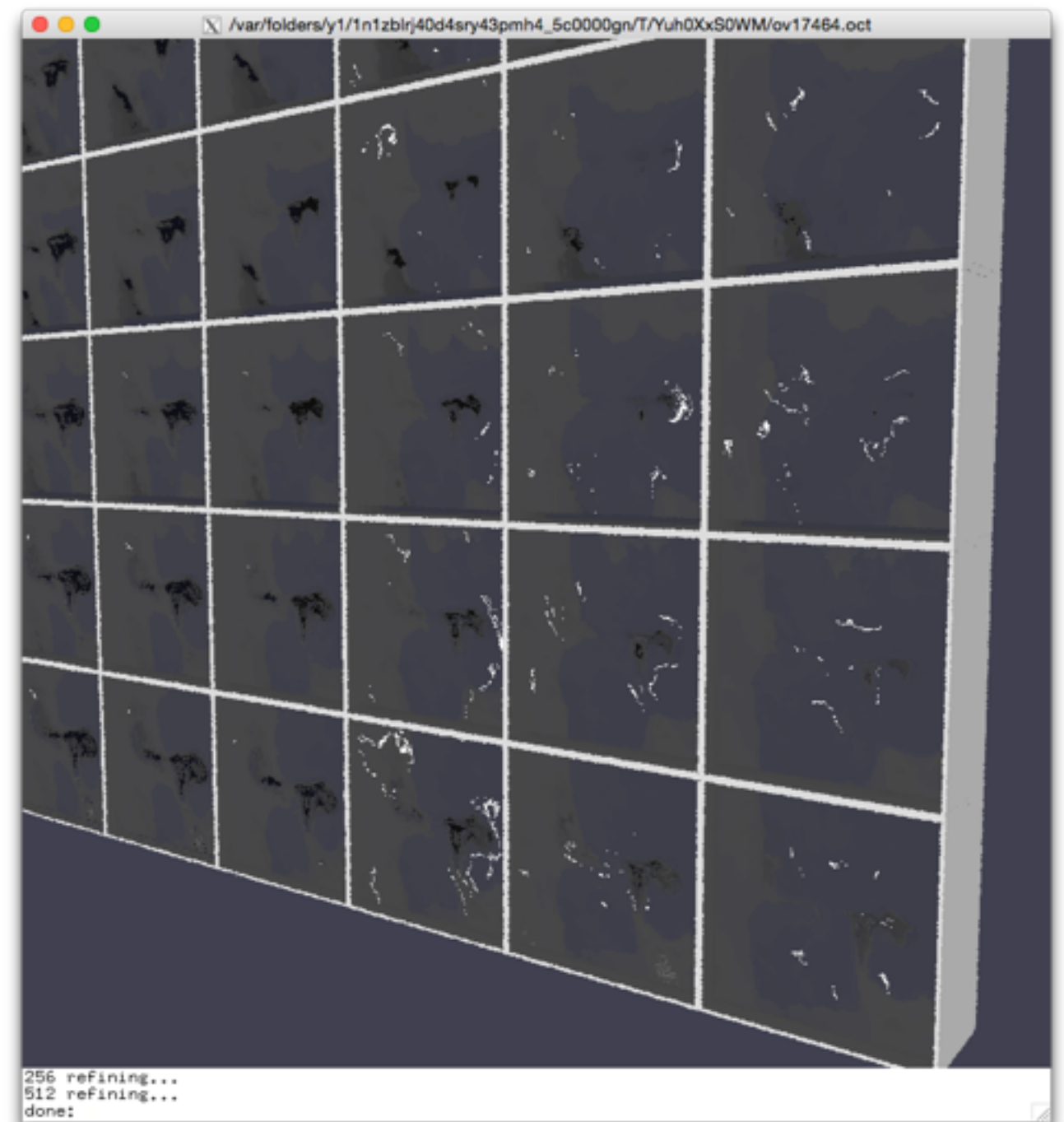


Arraying it into a wall

```
#blockwall.rad
```

```
!xform -a 10 -t .6667 0 0 -a 36 -t 0 .6667 0 glassblock.rad
```

ahhhh...



A test scene

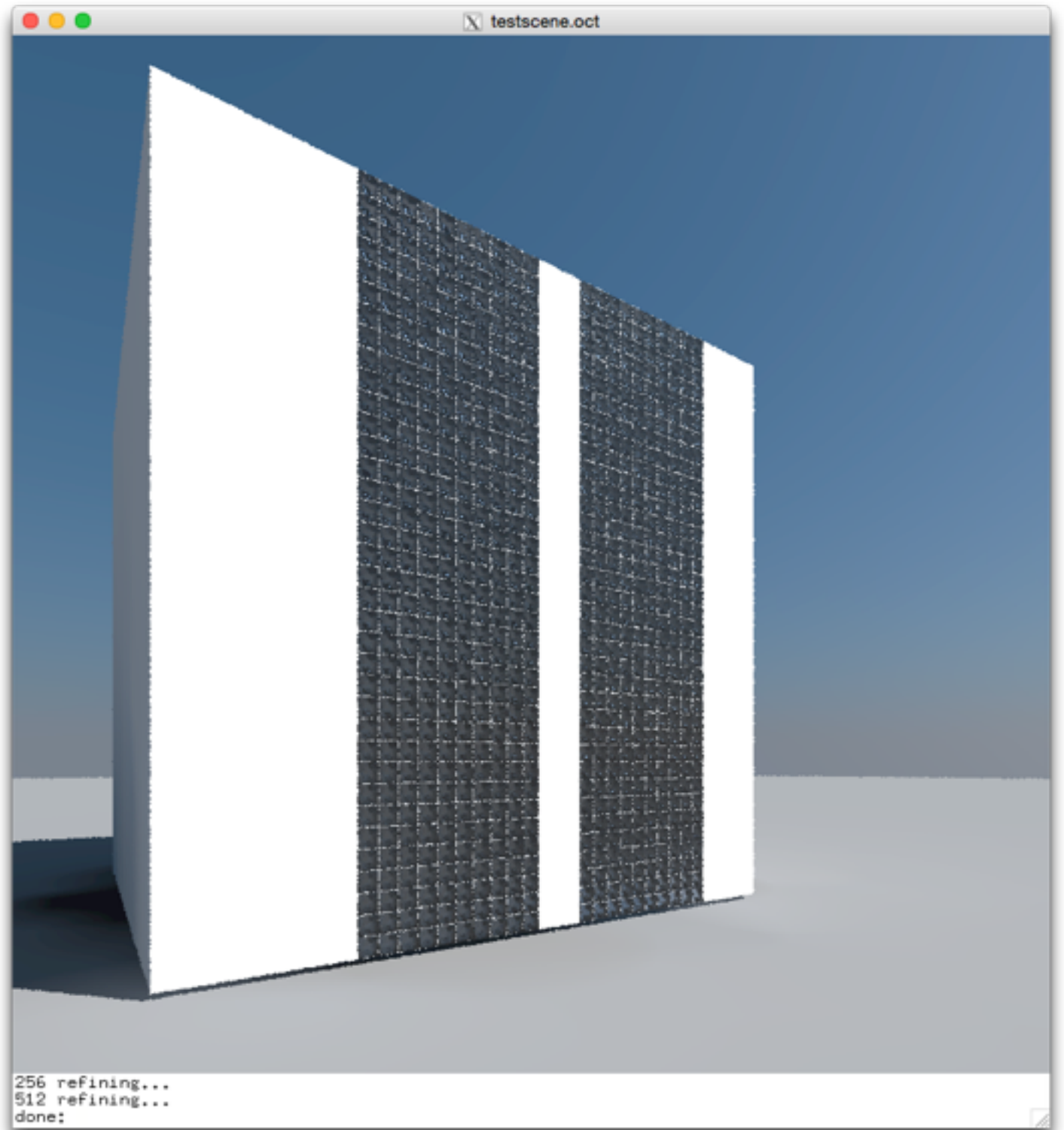
ceiling: 80%

walls: 60%

floor: 30%

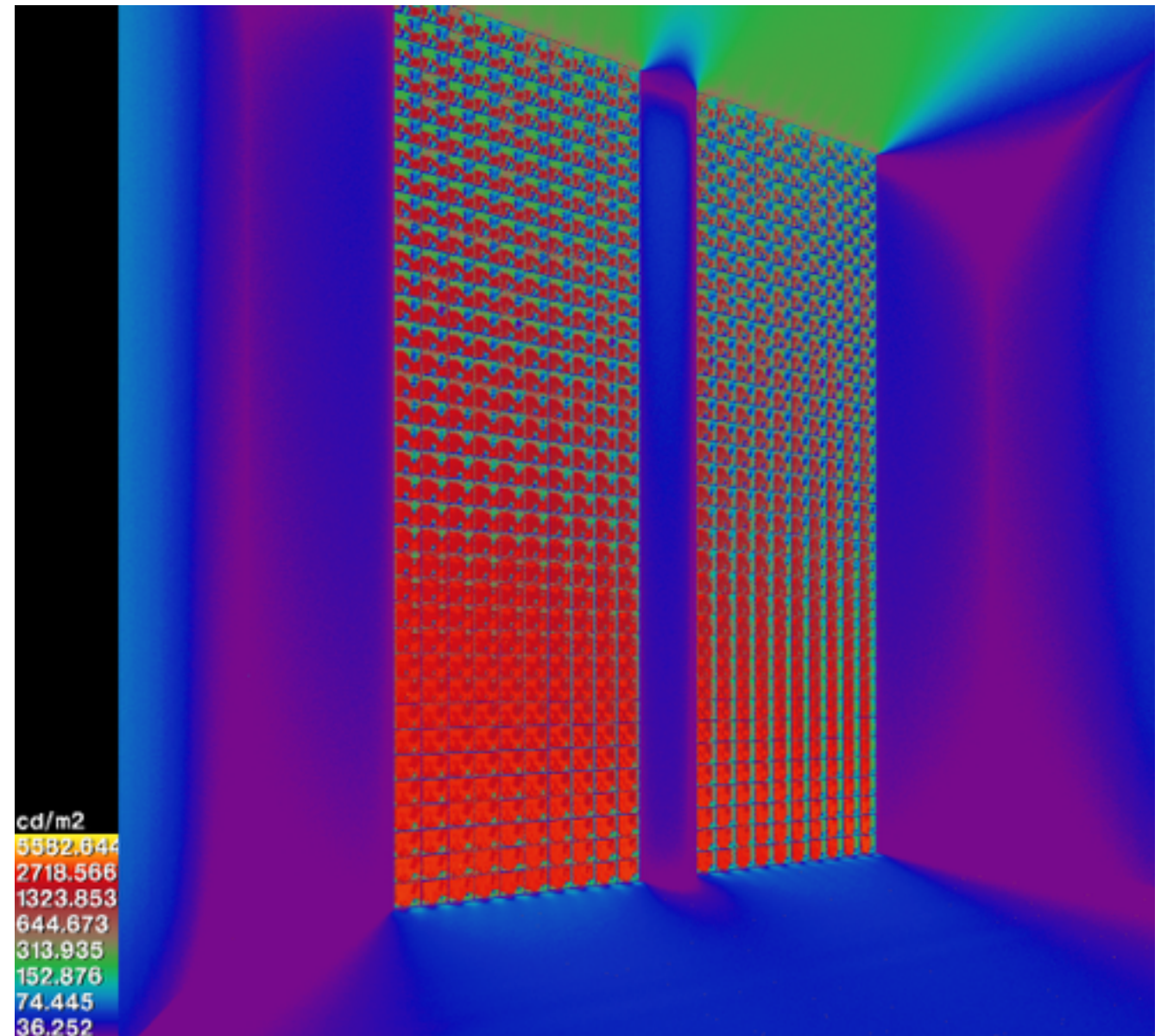
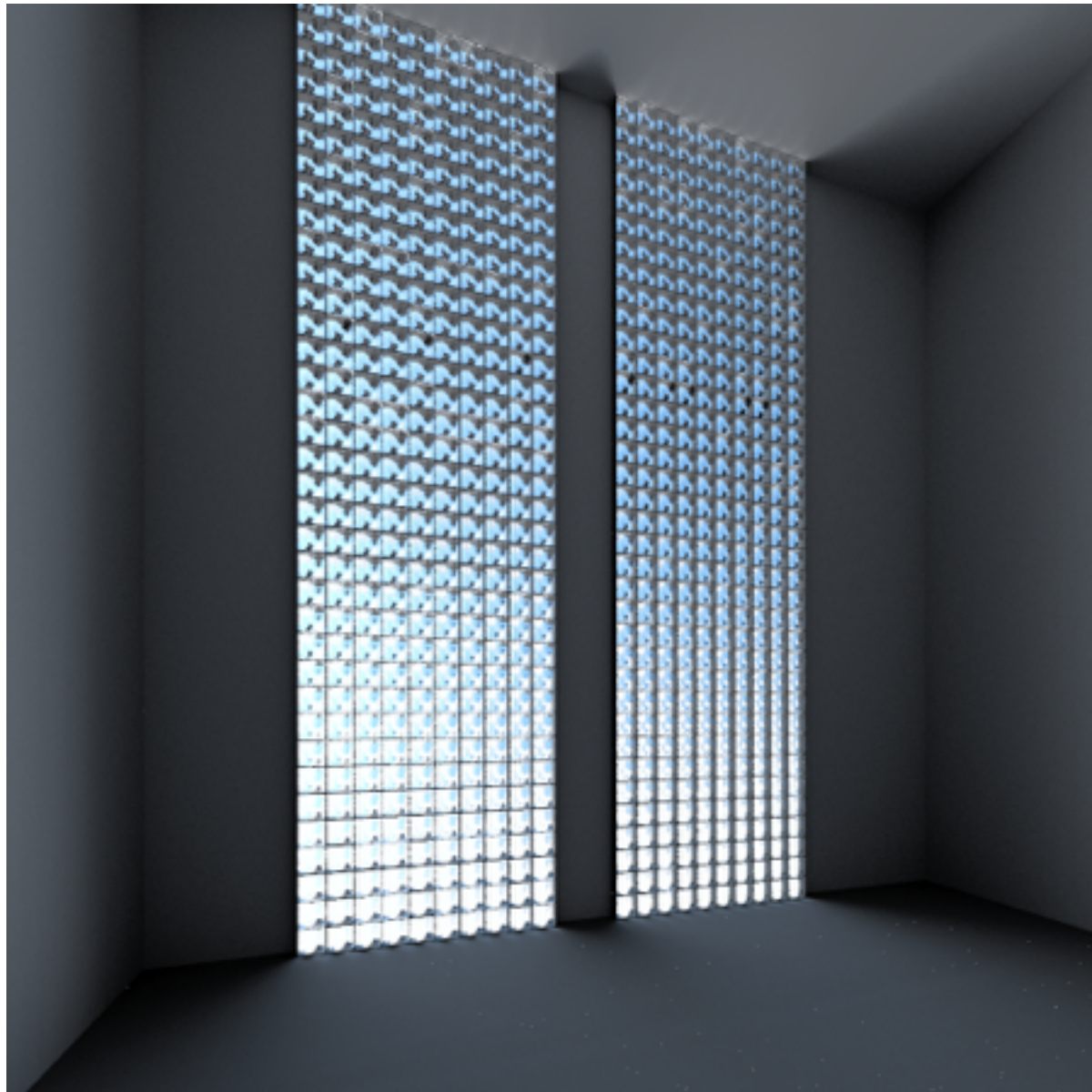
ground: 20%

sky: March 21, 10:00
Utah sky



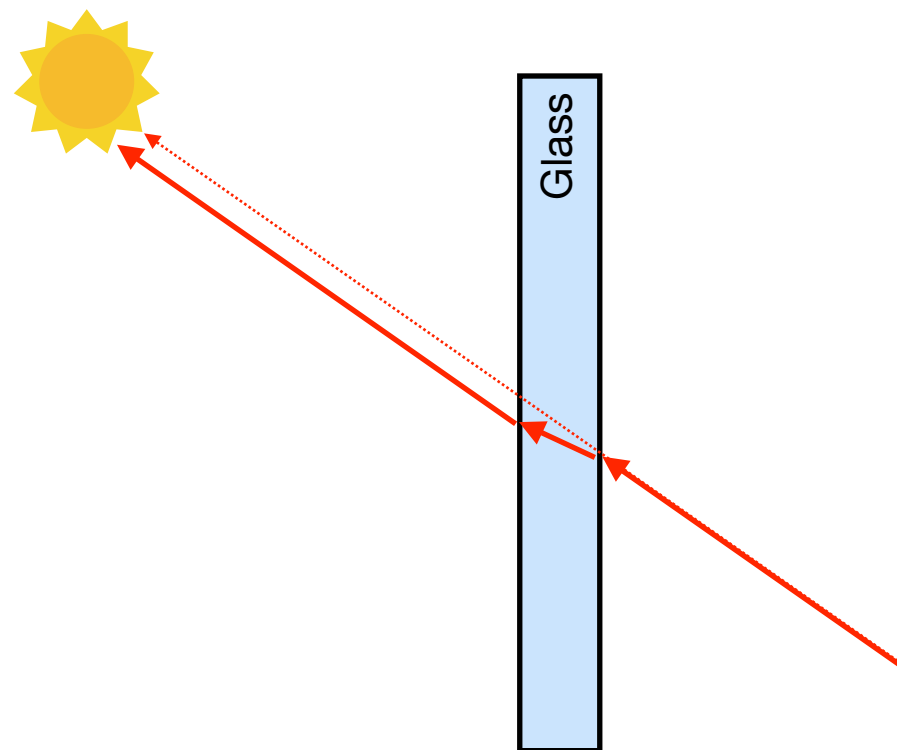
1. Classic Radiance Simulation

```
vwrays -x 2000 -y 2000 -vf v1.vf -pj 1 \  
| rtrace -n 32 `vwrays -x 2000 -y 2000 -vf v1.vf -d` \  
-aa 0 -ad 2000 -ab 4 -aa 0 -lw 5e-6 -st 0 -dc 1 -dt 0 -fac \  
testscene.oct > testscene.hdr
```

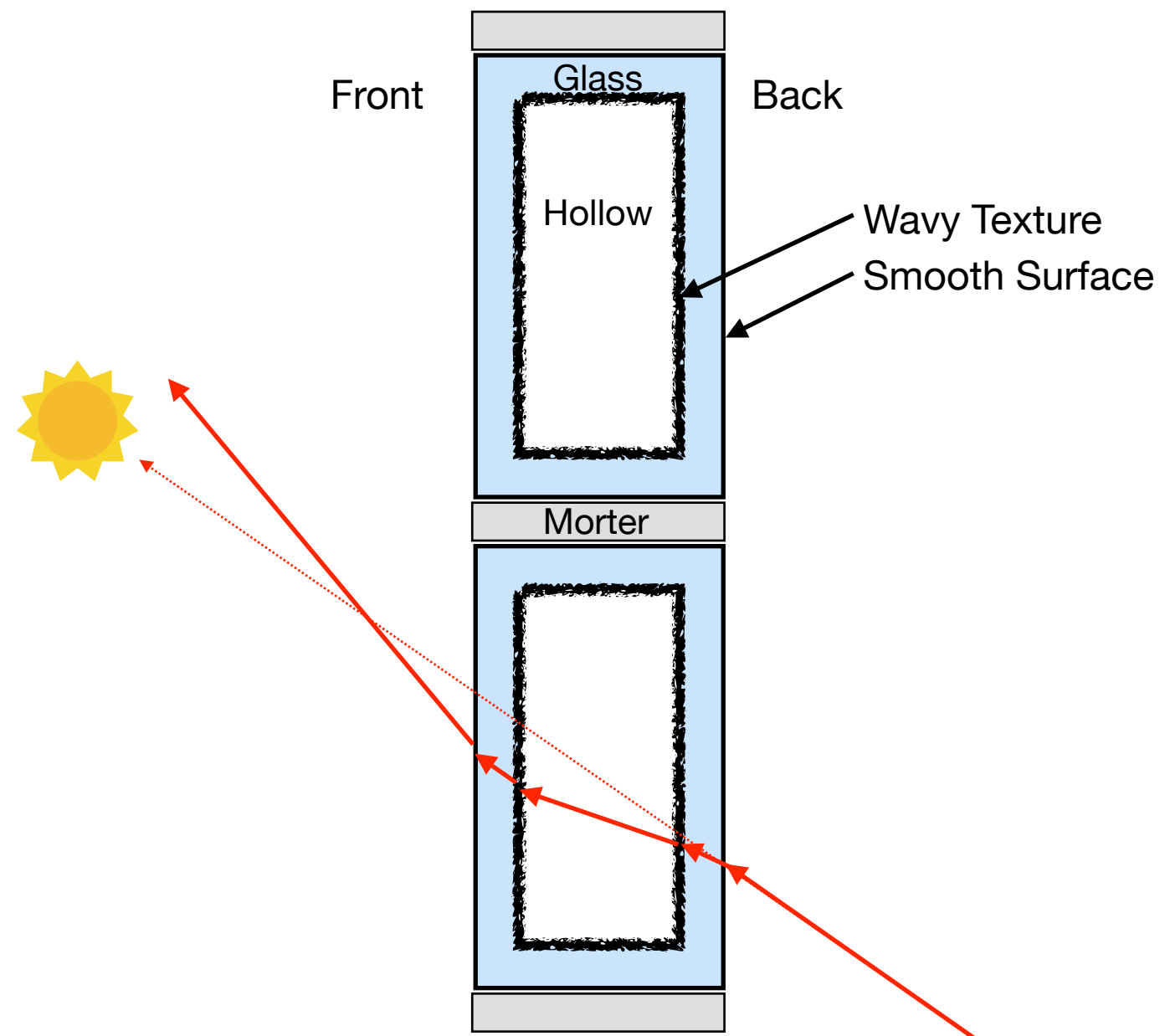


Why is glass block challenging?

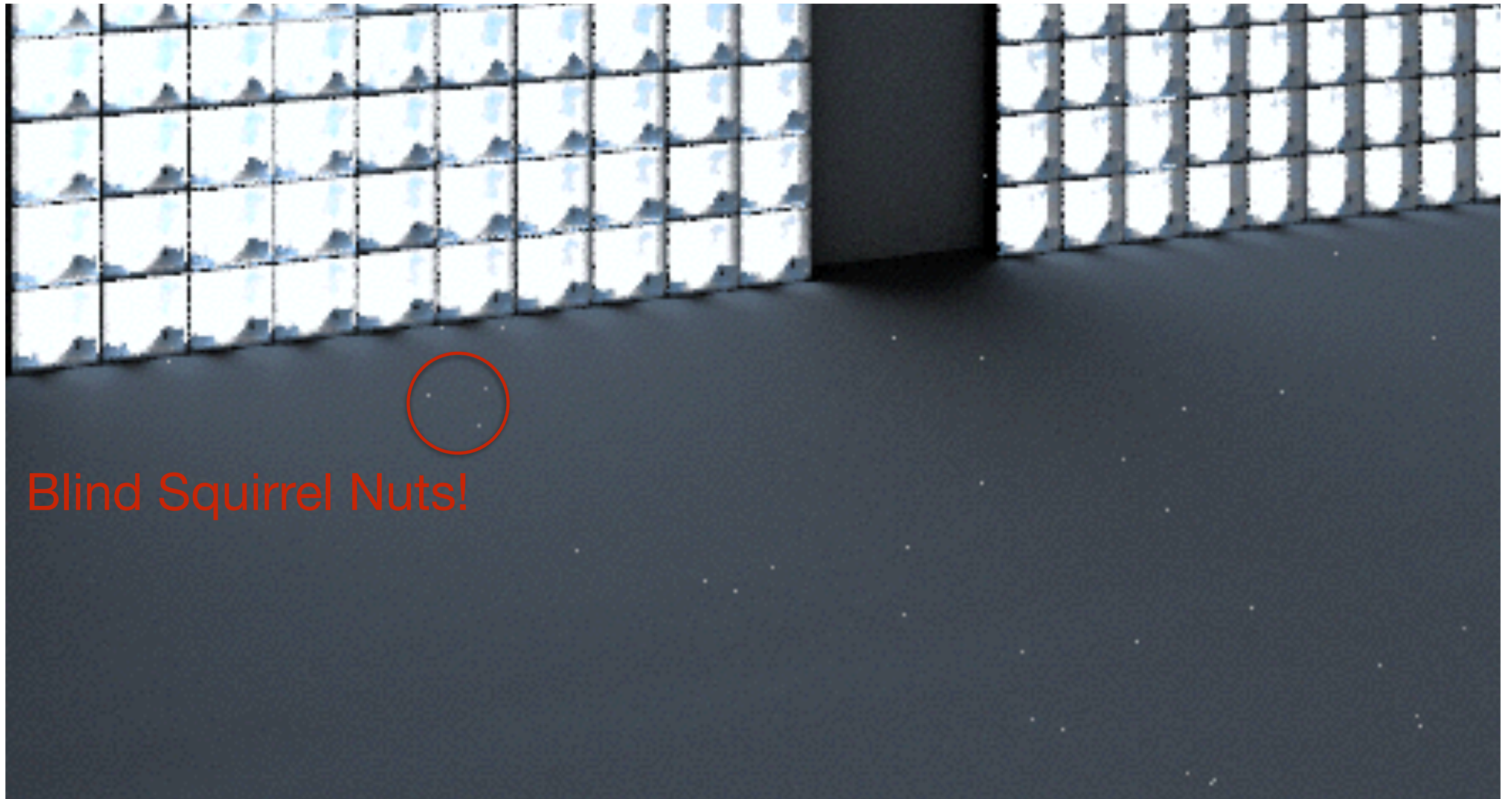
When light passes through parallel dielectric interfaces the ray direction is unchanged, though the ray is displaced.



The wavy texture of the inner surfaces of glass block changes the direction of the ray, making deterministic sampling impossible.

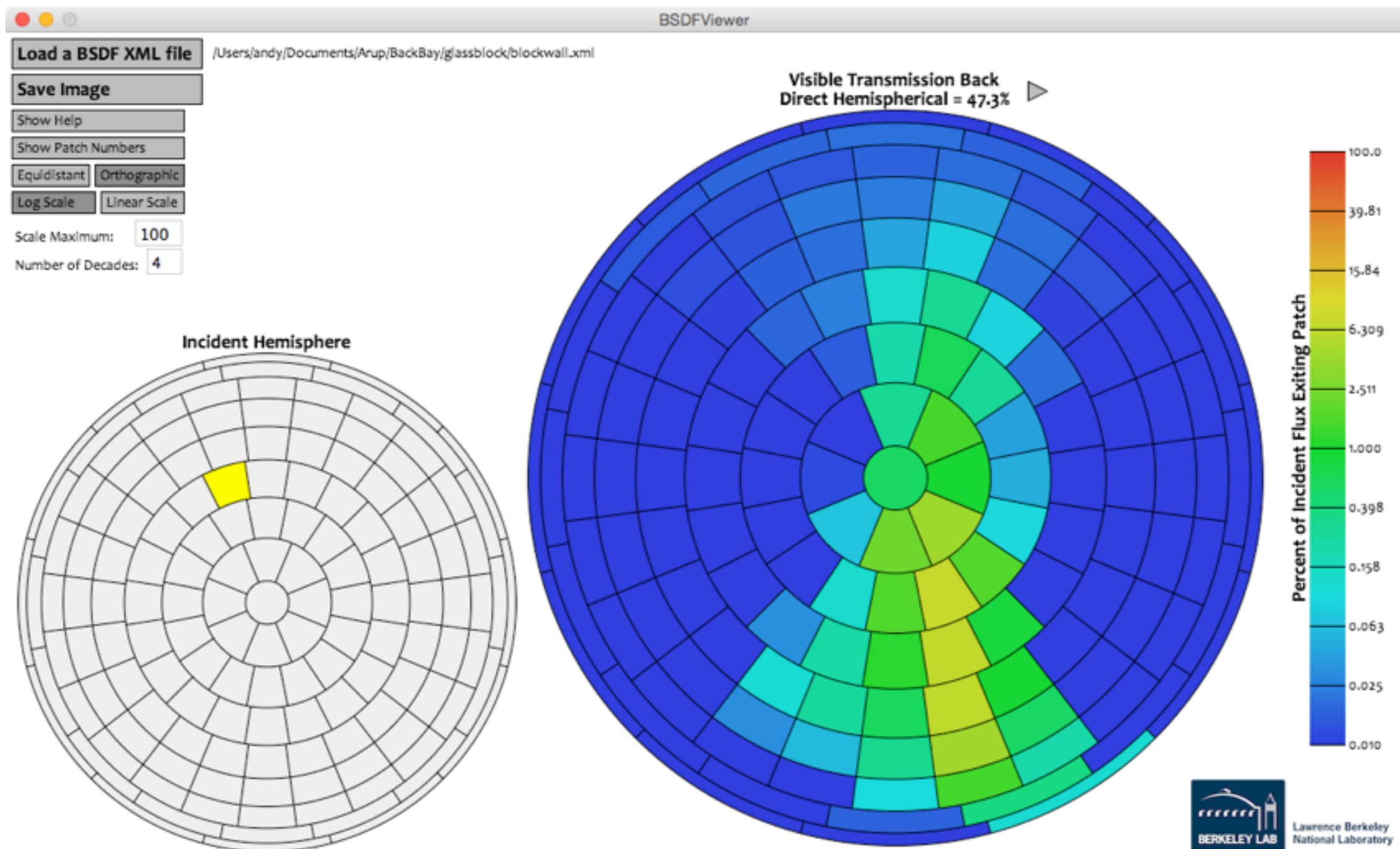


Classic Radiance Simulation



Creating BSDFs

```
genBSDF -n 32 +f +b -c 5000 -r '-ab 4 -ad 100 -lw .001' \  
-geom foot blockwall.rad > blockwall.xml
```

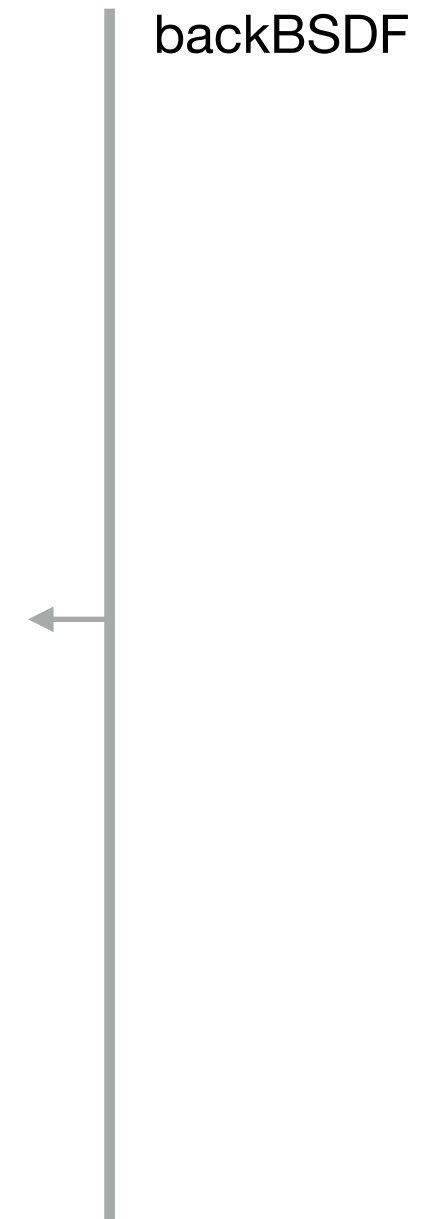


2. BSDF material

```
# blockwall_BSDF.rad
```

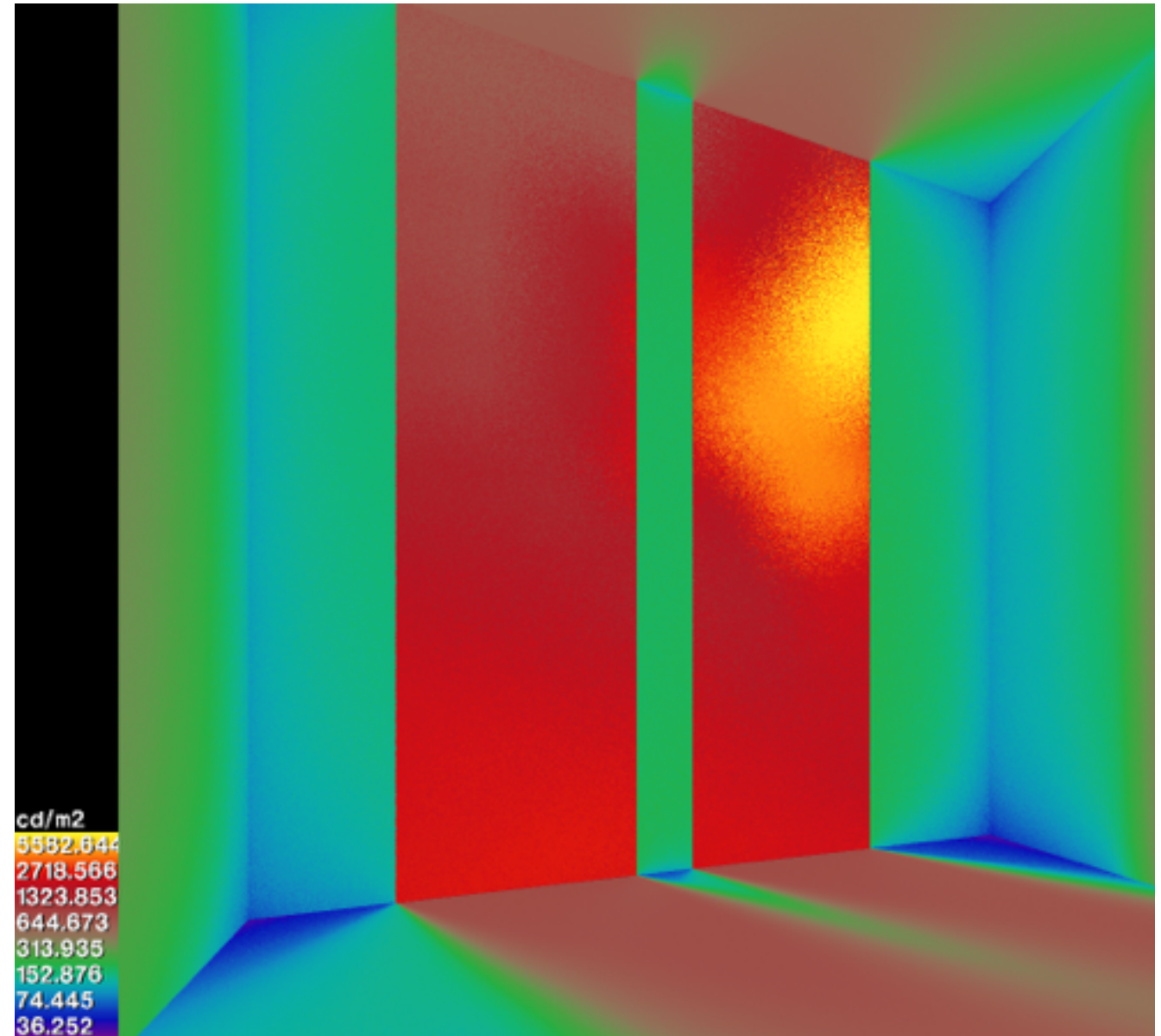
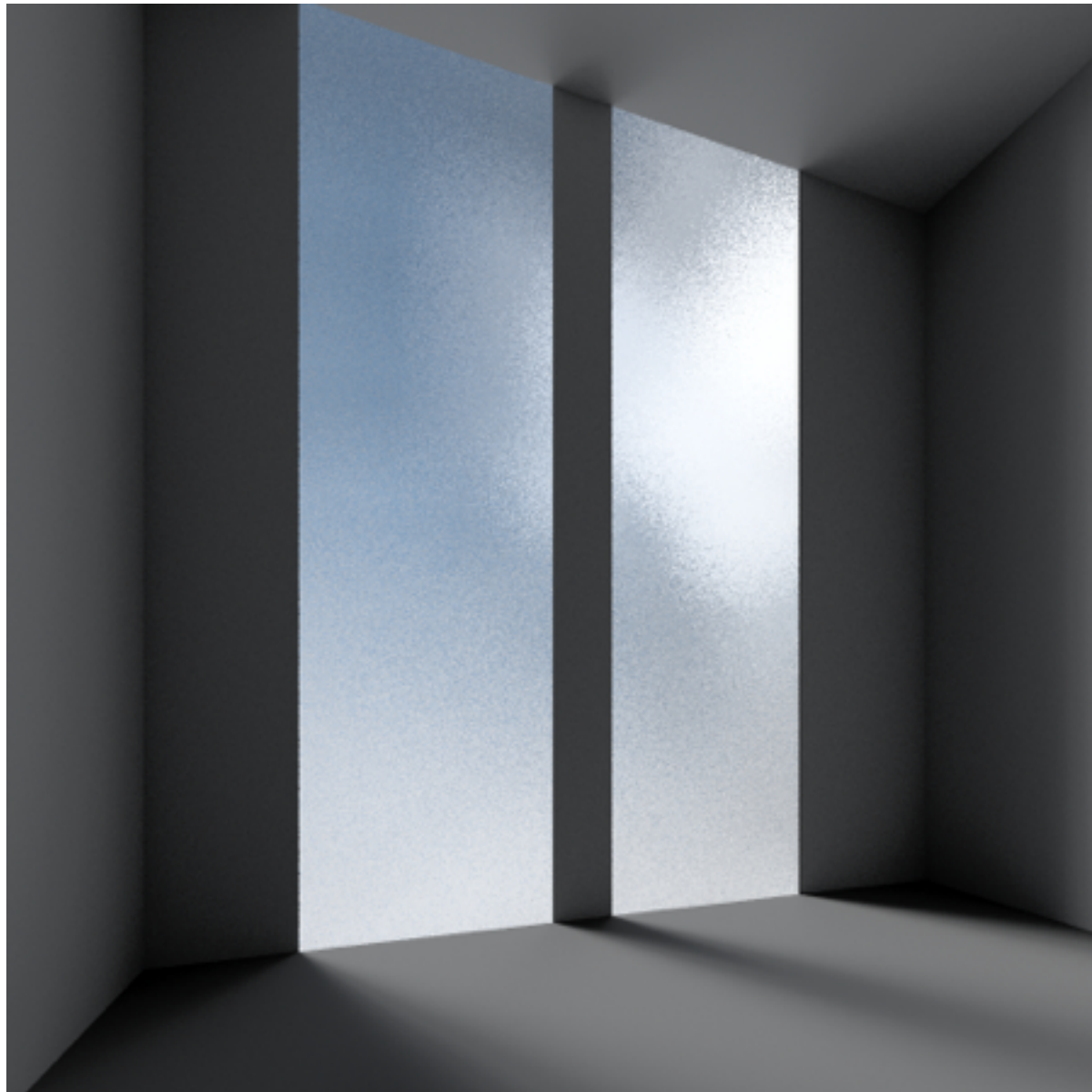
```
void BSDF back  
6 0 blockwall_tt6.xml 0 1 0 .  
0  
0
```

```
back polygon backBSDF  
0  
0  
12 0 0 0  
0 24 0  
6.6672 24 0  
6.6672 0 0
```



2. BSDF material

```
vwrays -x 2000 -y 2000 -vf v1.vf -pj 1 \  
| rtrace -n 32 `vwrays -x 2000 -y 2000 -vf v1.vf -d` \  
-aa 0 -ad 2000 -ab 4 -aa 0 -lw 5e-6 -st 0 -dc 1 -dt 0 -fac \  
testscene_BSDF.oct > testscene_BSDF.hdr
```



3. BSDF material w/ proxied geometry

```
# blockwall_BSDF+proxy.rad
```

```
!xform -a 10 -t .6667 0 0 -a 36 -t 0 .6667 0 glassblock.rad
```

```
void BSDF front
```

```
6 .334 blockwall_tt6.xml 0 1 0 .
```

```
0
```

```
0
```

```
void BSDF back
```

```
6 -.334 blockwall_tt6.xml 0 1 0 .
```

```
0
```

```
0
```

```
front polygon frontBSDF
```

```
0
```

```
0
```

```
12 0 0 -.3335
```

```
0 24 -.3335
```

```
6.6672 24 -.3335
```

```
6.6672 0 -.3335
```

```
back polygon backBSDF
```

```
0
```

```
0
```

```
12 0 0 .0002
```

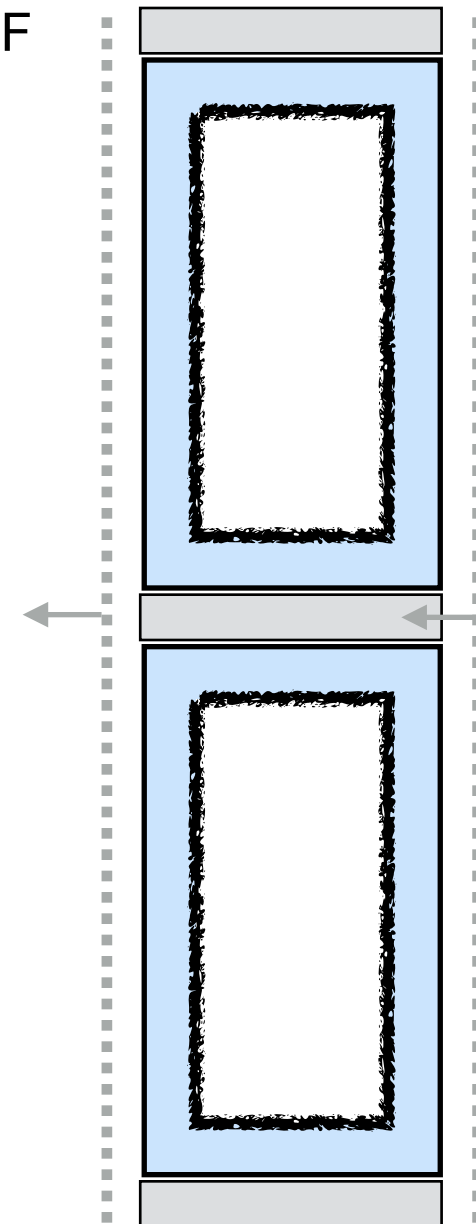
```
0 24 .0002
```

```
6.6672 24 .0002
```

```
6.6672 0 .0002
```

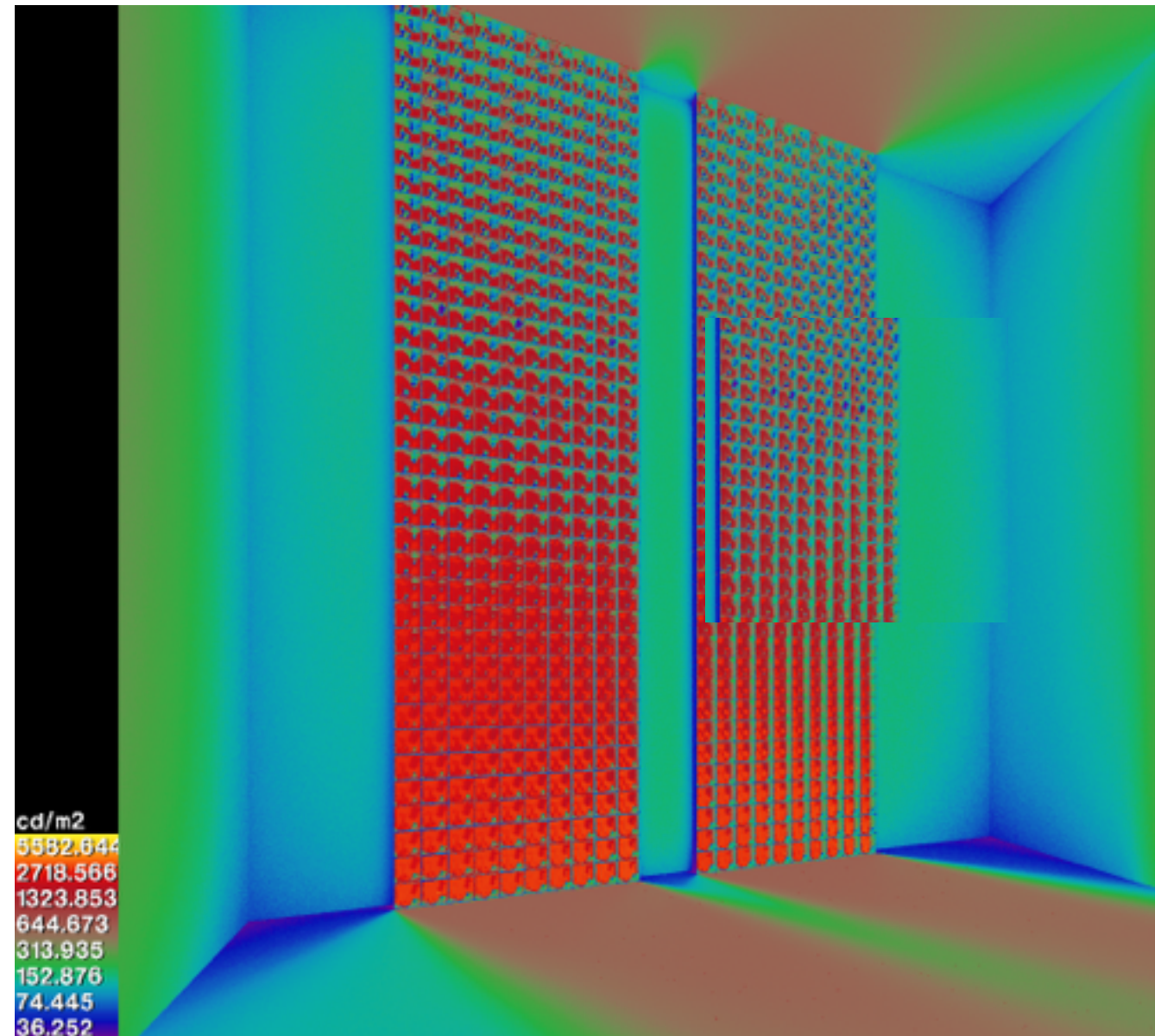
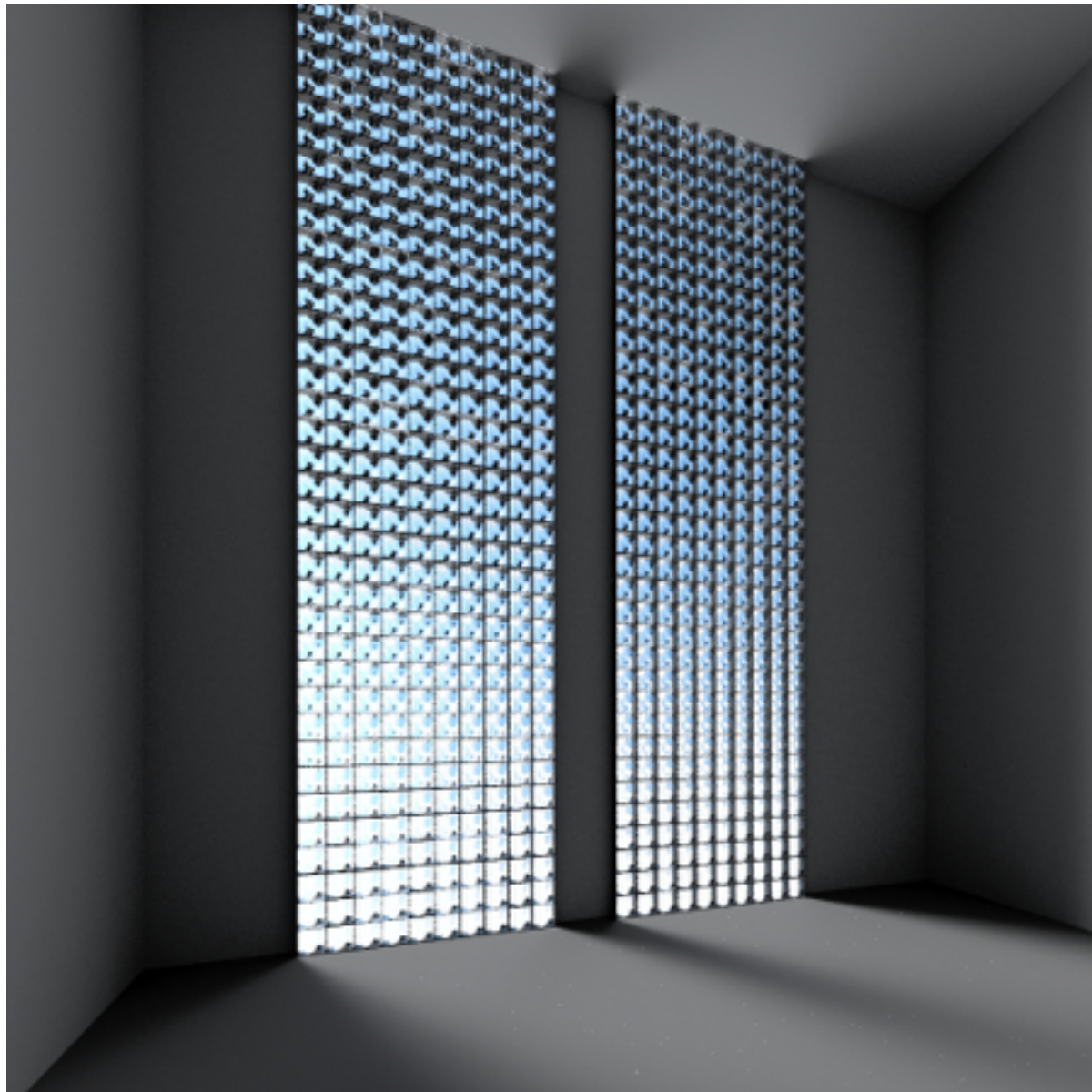
frontBSDF

backBSDF




3. BSDF material w/ proxied geometry

```
vwrays -x 2000 -y 2000 -vf v1.vf -pj 1 \  
| rtrace -n 32 `vwrays -x 2000 -y 2000 -vf v1.vf -d` \  
-aa 0 -ad 2000 -ab 4 -aa 0 -lw 5e-6 -st 0 -dc 1 -dt 0 -fac \  
testscene_BSDF+proxy.oct > testscene_BSDF+proxy.hdr
```



4. Three Phase Method

```
vwrays -x 2000 -y 2000 -vf v1.vf -pj 1 -ff \  
  | rfluxmtx `vwrays -x 2000 -y 2000 -vf ../v1.vf -d` \  
    -ffc -ab 12 -ad 50000 -lw 2e-5 \  
    - blockwall.rad testscene_3ph.rad
```

Sender  Receiver 

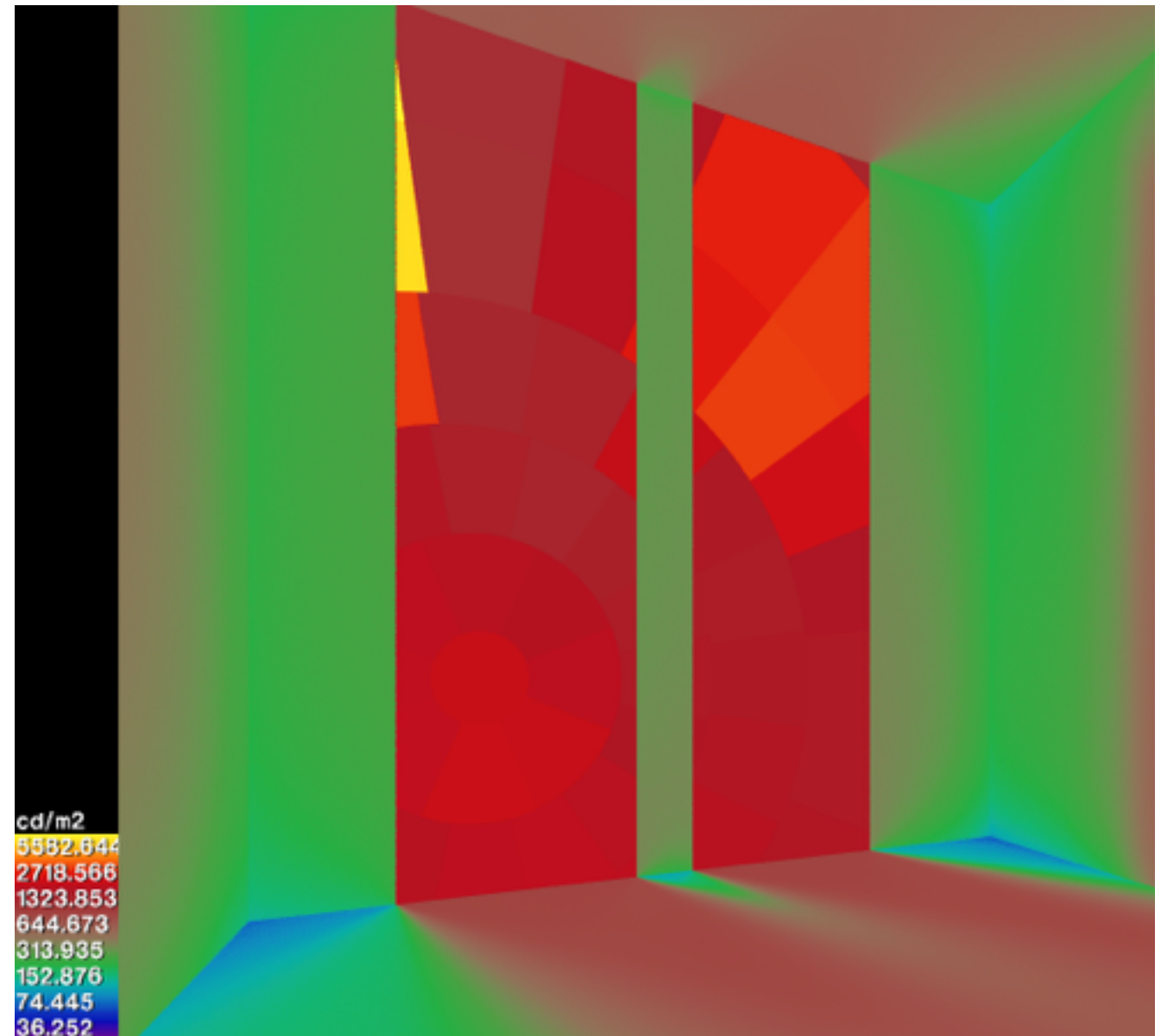
```
rfluxmtx blockwall.rad sky.rad testscene_3ph.rad > exterior.dmx
```

Sender  Receiver 

```
cat sky_utah.rad | genskyvec -m 1 > sky_utah.skv
```


4. Three Phase Method

```
dctimestep images/window_%03d.hdr blockwall.xml exterior.dmx sky_utah.skv \  
> testscene_3ph.hdr
```



5. Photon Map - Photon Ports



My First
Photon Map

```
# pport.rad
void antimatter pport
1 void
0
0
```

```
void polygon port
0
0
12  0   -.01  0
    0   -.01  24
    6.6672 -.01  24
    6.6672 -.01  0
```

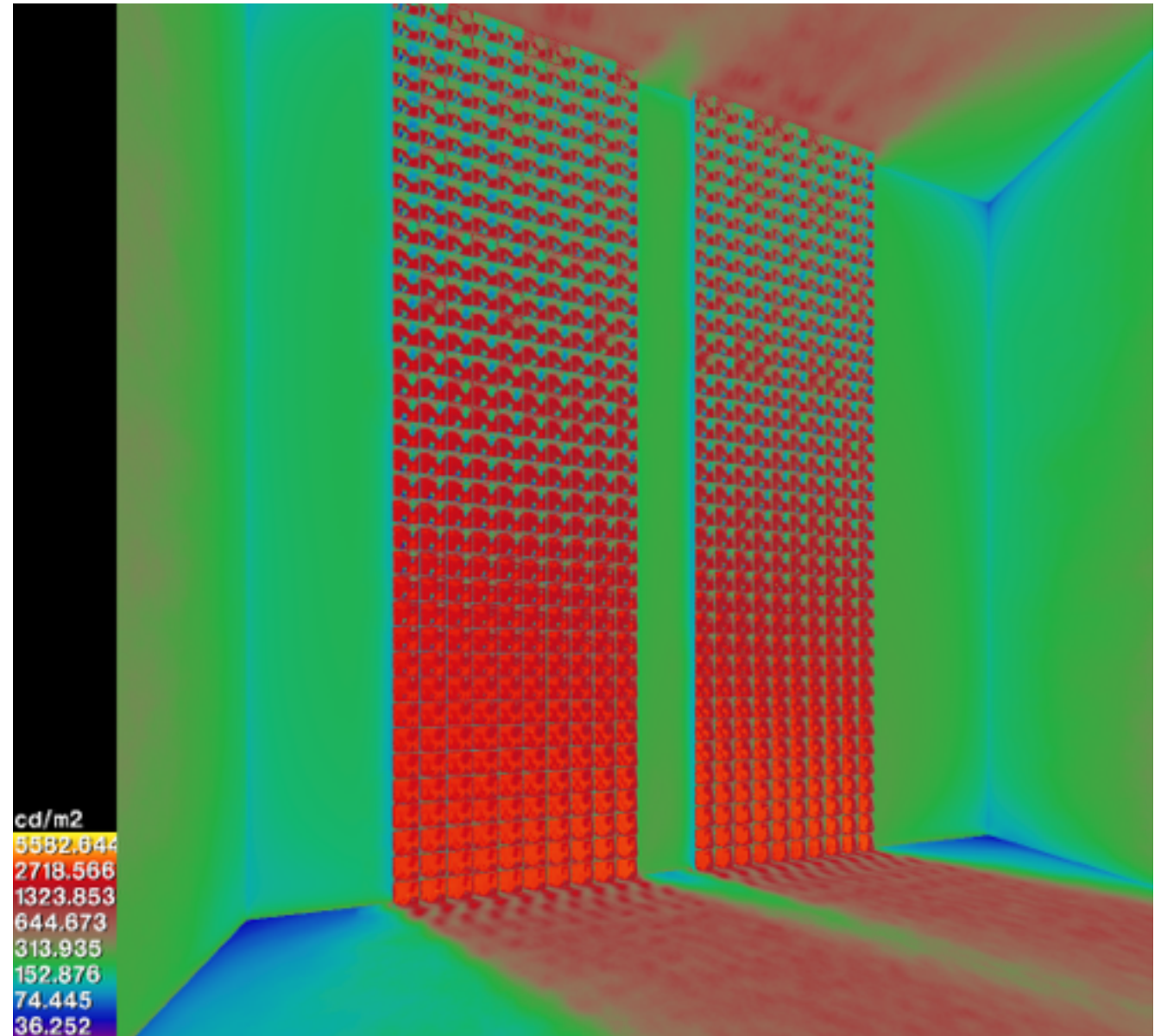
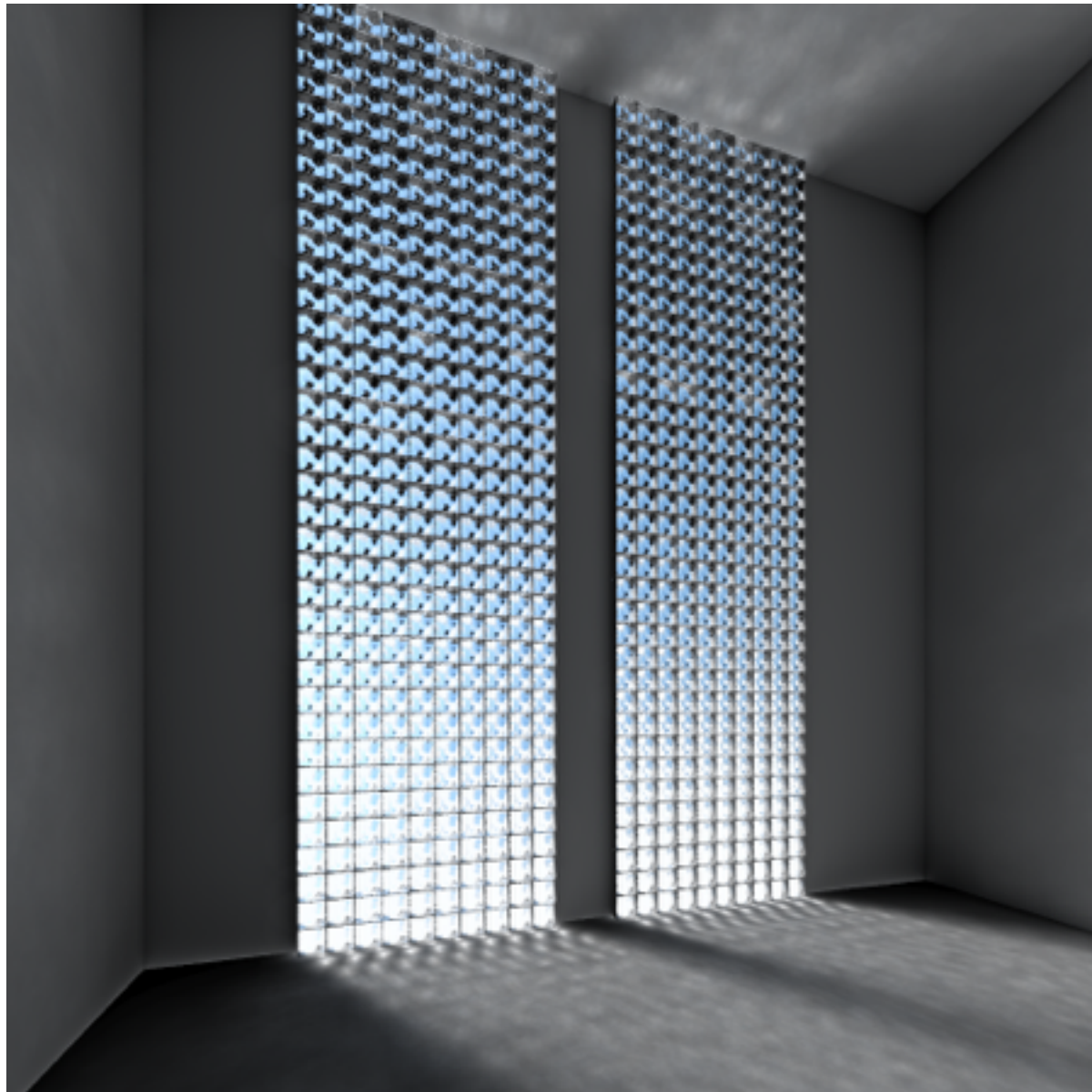
```
void polygon port
0
0
12  8.5  -.01  0
    8.5  -.01  24
    15.167 -.01  24
    15.167 -.01  0
```

```
oconv testscene.rad pport.rad > testscene_pmap.o
```

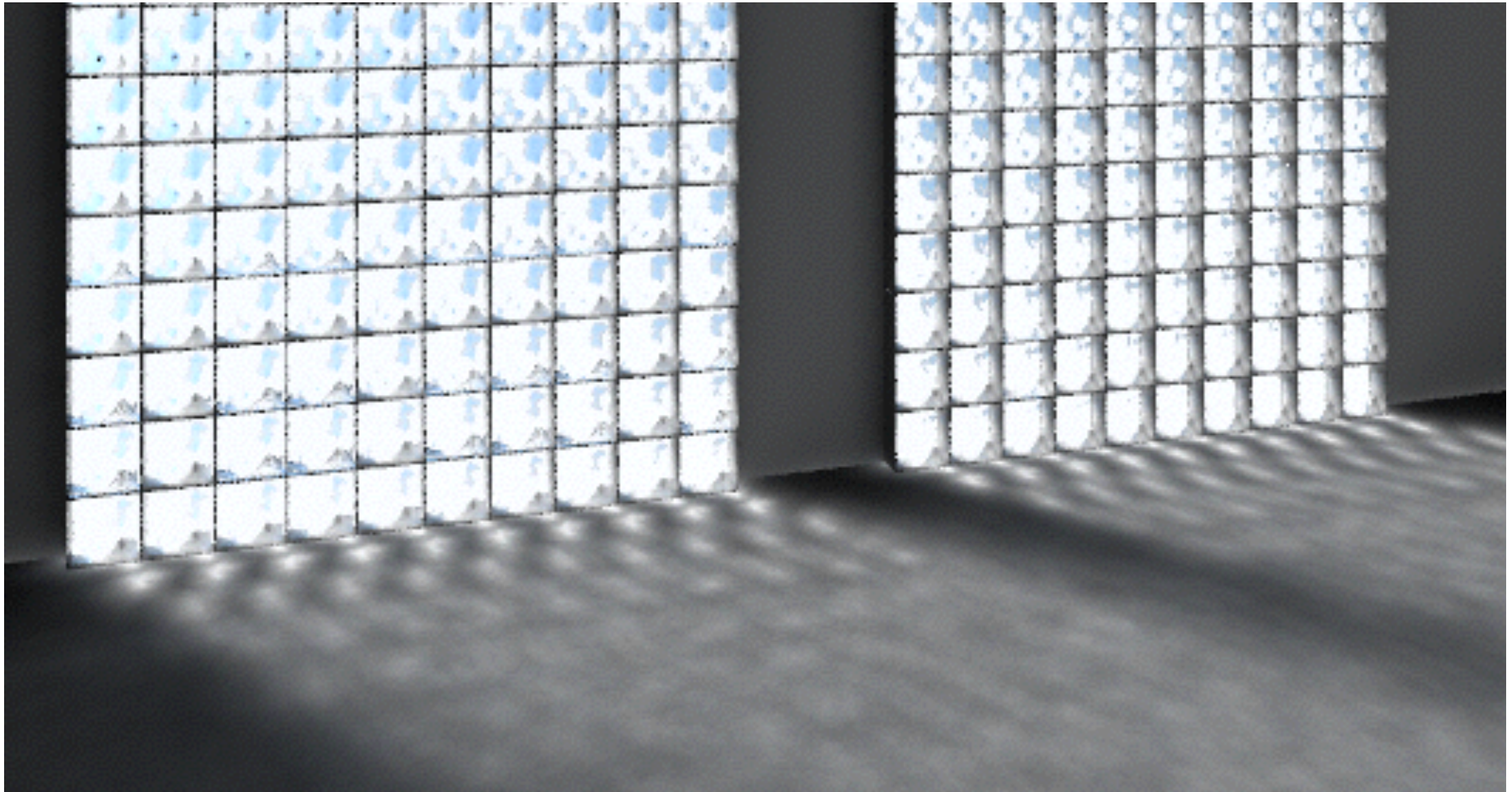
```
mkpmap -apg global.pmp 5000000 \
      -apc caustic.pmp 5000000 \
      -apo pport -t 60 -fo testscene_pmap.oct
```


5. Photon Map

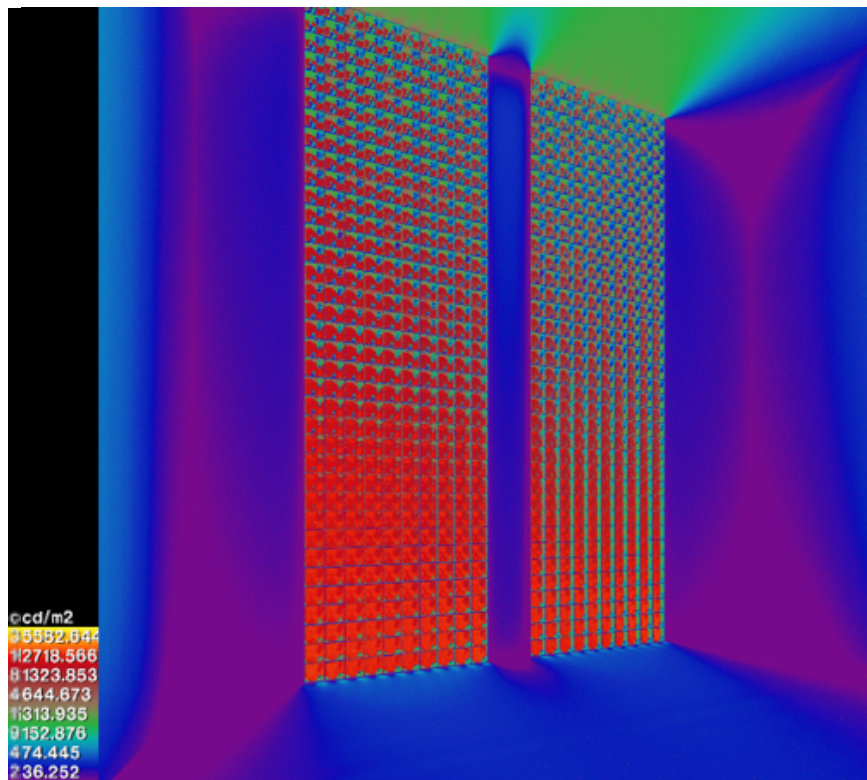
```
vwrays -x 2000 -y 2000 -vf v1.vf -pj 1 | \  
rtrace -n 32 `vwrays -x 2000 -y 2000 -vf v1.vf -d` \  
-aa 0 -ad 2000 -ab 3 -aa 0 -lw 5e-6 -st 0 -fac \  
-ap global.pmp 200 -ap caustic.pmp 200 testscene_pmap.oct > testscene_pmap.hdr
```



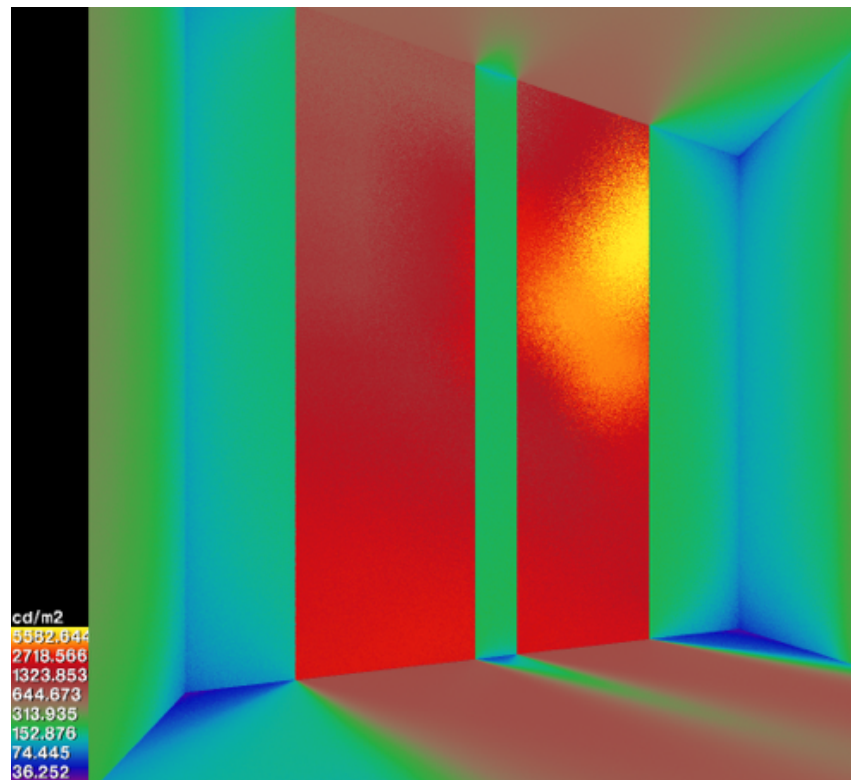
5. Photon Map



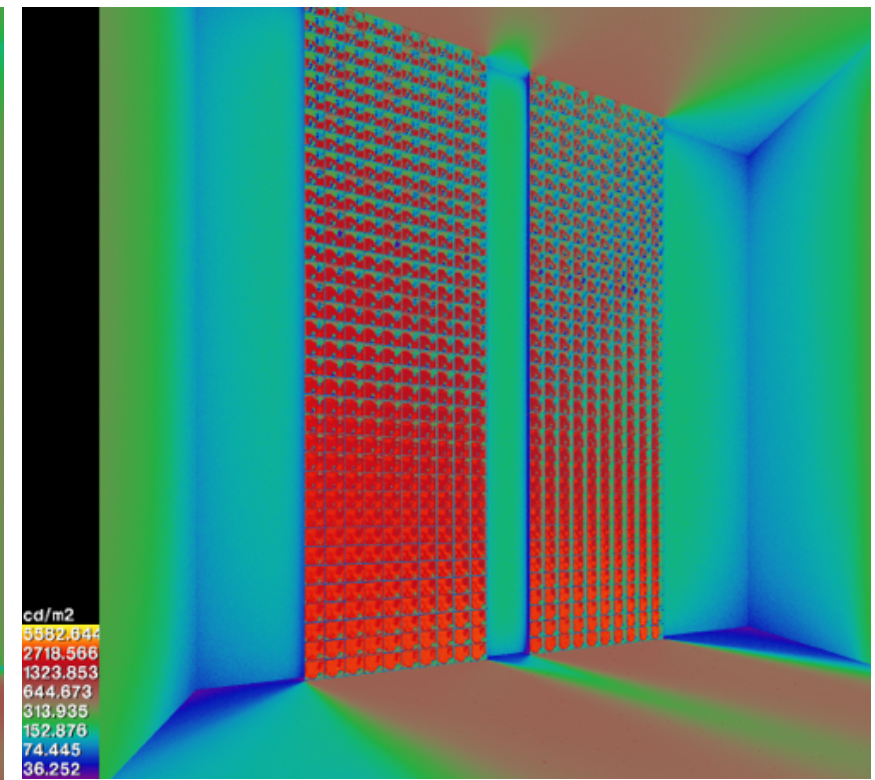
Results Summary



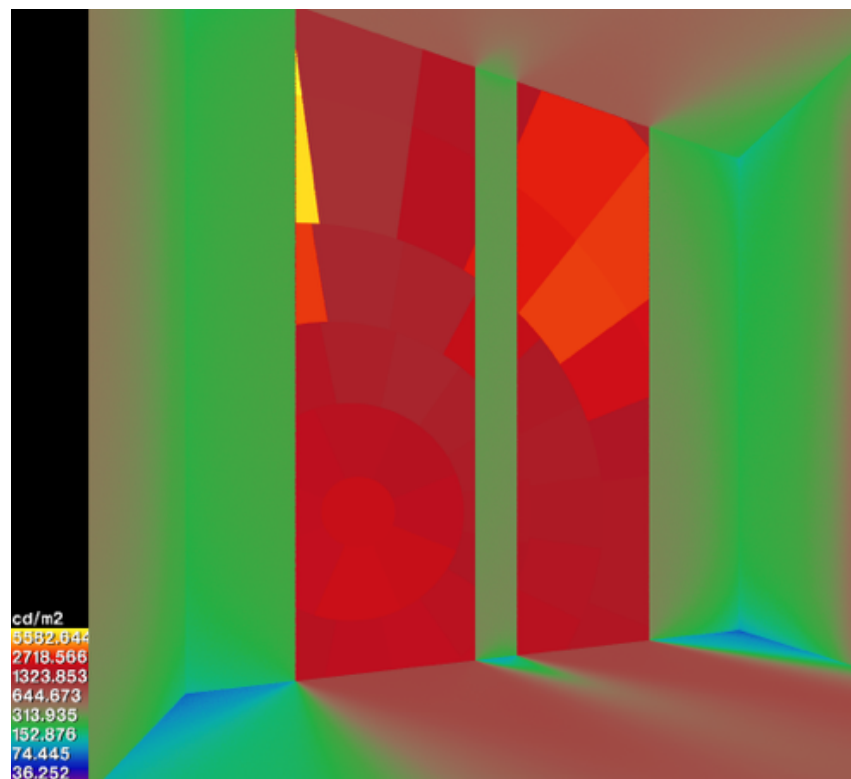
Classic



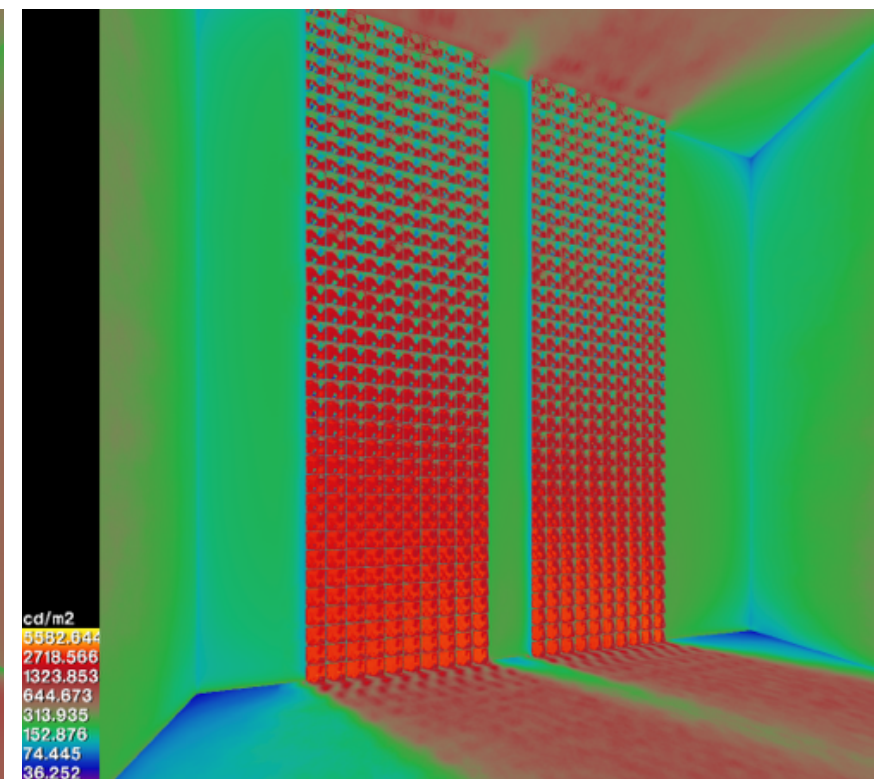
BSDF Material



BSDF Material w/ Proxied Geometry



Three Phase Method



Photon Map

Errata / Comments

- The “pport” surfaces should have the pport material applied. It’s possible that the photon ports were not used in the simulation, hence the need for 5M photons for each map.
- David G-M pointed out the difference of yellow in the BSDF based renderings vs. the geometry based renderings and suggested that there may be blind squirrel nuts in the calculation for the view rays.

