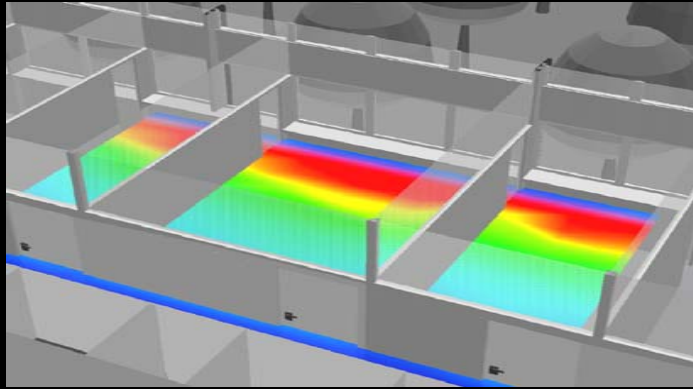
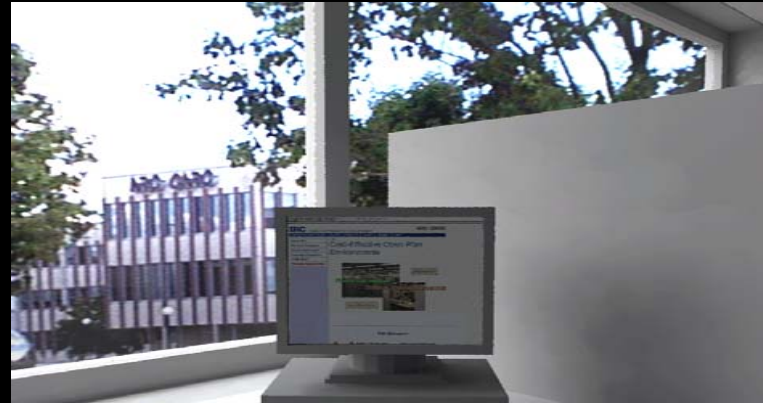


Natural Light in Design

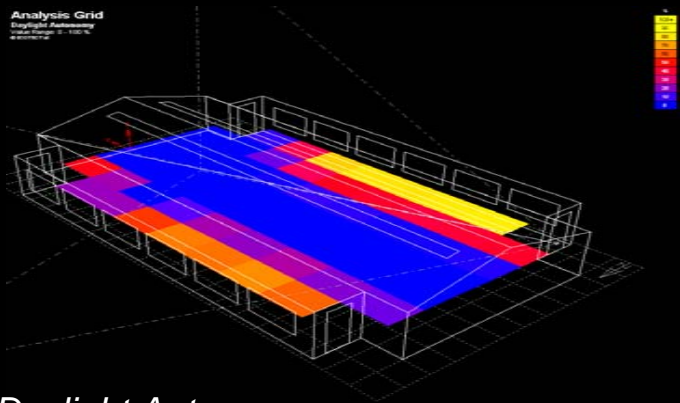
Using simulation tools to explore realistic daylight-responsive solutions



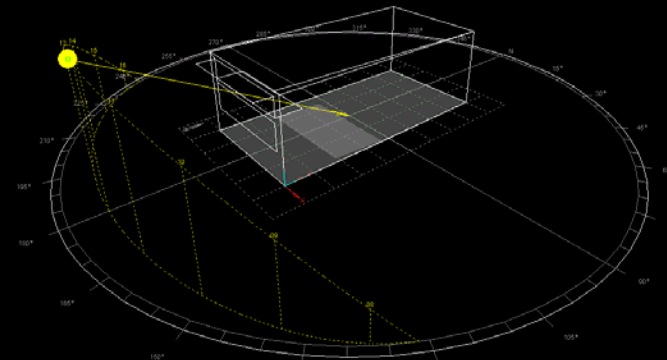
Daylight Factor



Visual Comfort



Daylight Autonomy



Avoidance of Direct Sunlight

Radiance Materials

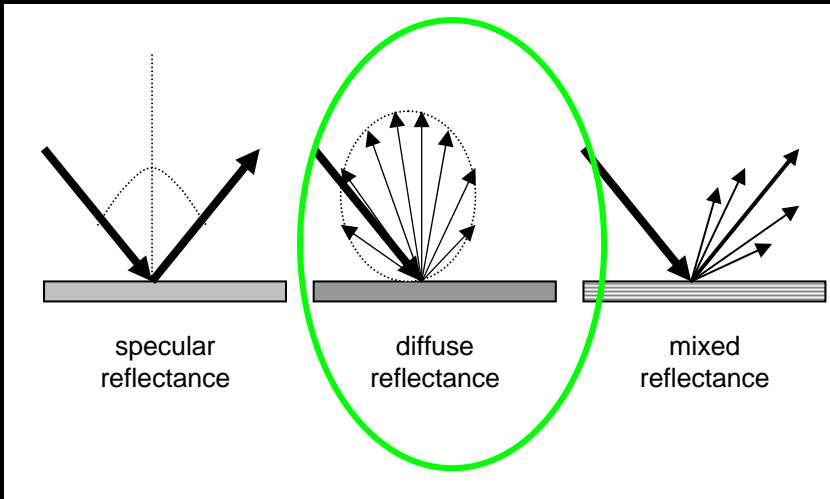
Christoph Reinhart, Ph.D.

Overview – Radiance Materials

Wednesday, Jan 25th 2006

time slot	Content	instructor
Tue 9.30	MISC: announcements, design project teams organization	MA
Tue 10.00	<ul style="list-style-type: none">▪ Hands-on exercises: Review yesterday's content (CR) Boyle Buildings and Technologies (inc. advanced materials) (MA)	MA, CR, all
	<ul style="list-style-type: none">- Introduction to advanced Radiance materials, Ecotect's RADTOOL (CR)	
Tue 11.00	coffee break	
Tue 11.15	<ul style="list-style-type: none">▪ Hands-on exercises: Import Geometries and Materials from other programs (SketchUp, AutoCAD)	CR, all
Tue 12.15	- Specialty topics (to be suggested by participants before the workshop)	MA, CR, all
Tue 13.00	lunch (on your own & design teams should discuss their projects)	
Tue 14.00	<ul style="list-style-type: none">▪ Hands-on exercises: Participants start working on their own models (Participants will have the opportunity to discuss their project ideas with the instructors.)	all
Tue 15.45	coffee break	
Tue 16.00	<ul style="list-style-type: none">▪ Continue previous activities	all
Tue 17.30	end second day	

Plastic Material I



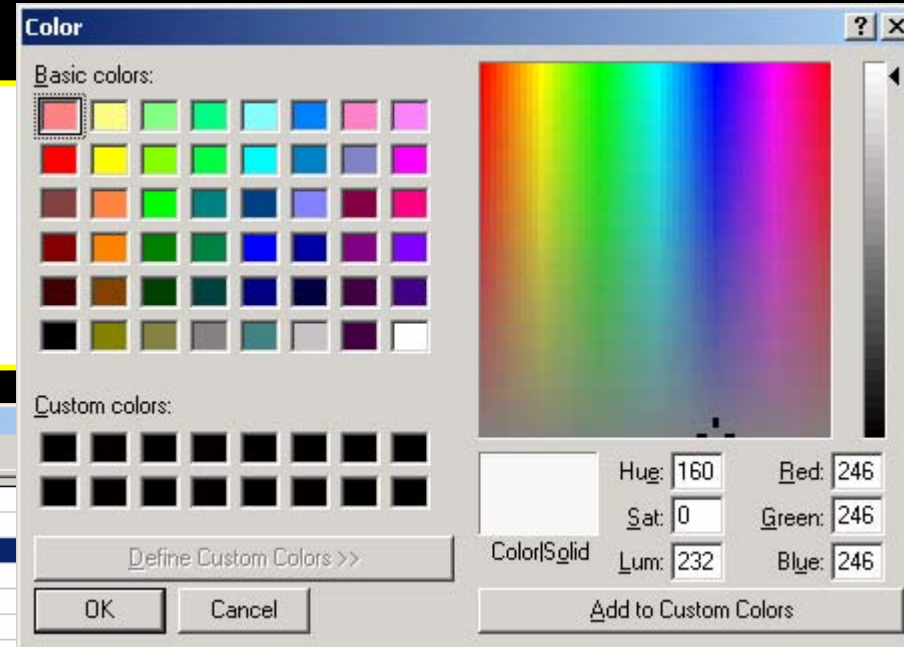
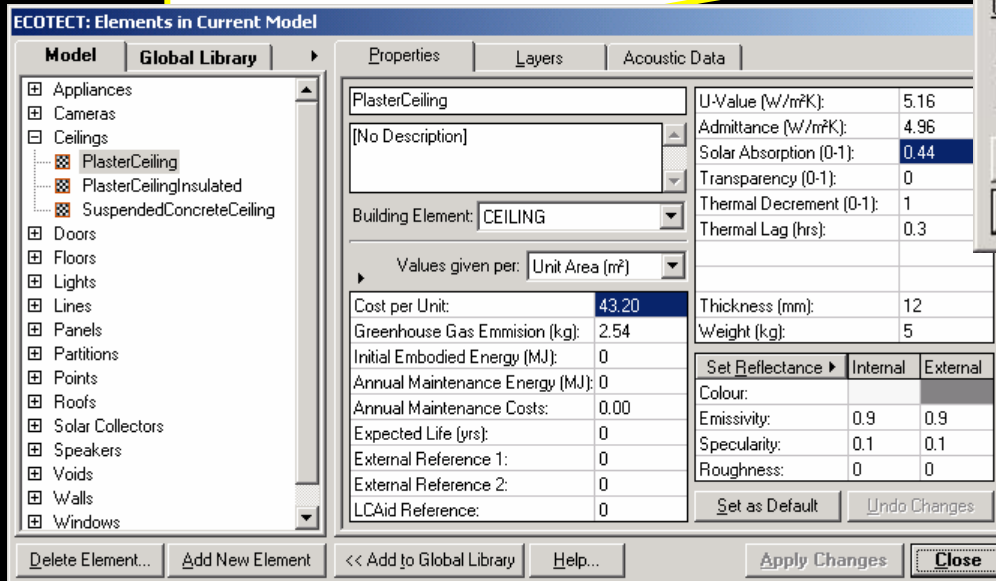
For a perfectly diffuse surface (Lambert surface) holds:

$$L = \frac{E\rho}{\pi}$$

E.g. paper, drywall

Plastic Material II

```
void plastic PlasterCeiling
0
0
5 0.965 0.965 0.965 0.02 0
```



Only internal properties used for Radiance.

Red/Green/Blue: (246/255)=0.965

Specularity_{Radiance} = 0.2 * Specularity_{Ecotect}

Plastic Material III

Typical reflectance values:

- floors 30%
- wall 50%
- ceiling 60 - 80%

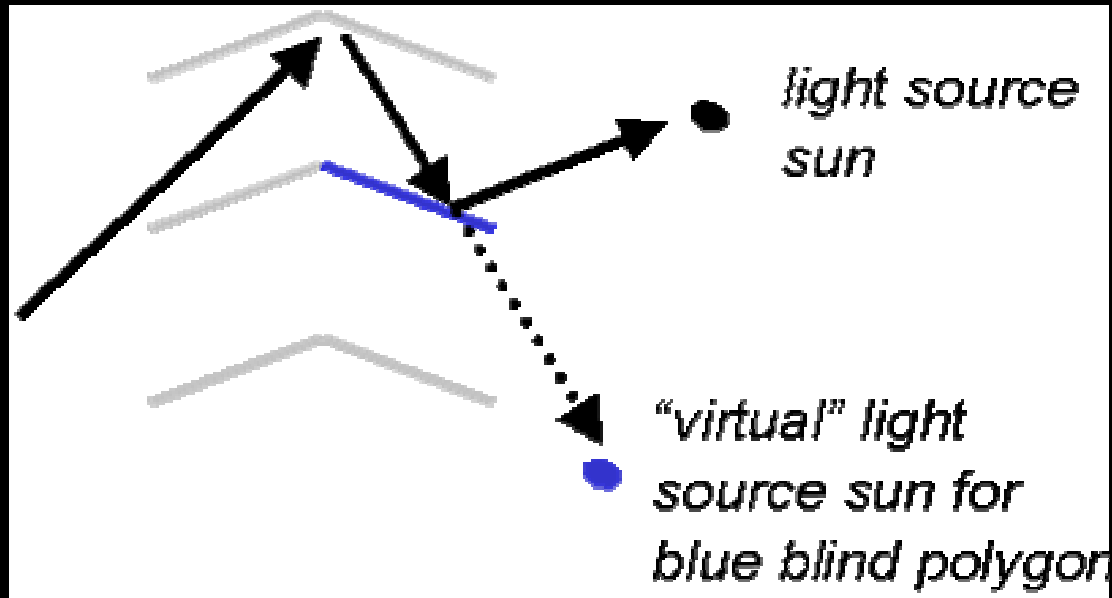
Typical specular values:

- matt 0
- glossy 0.02

Simple measurement to estimate reflectance values:

- Luminance meter + reference sample + overcast sky

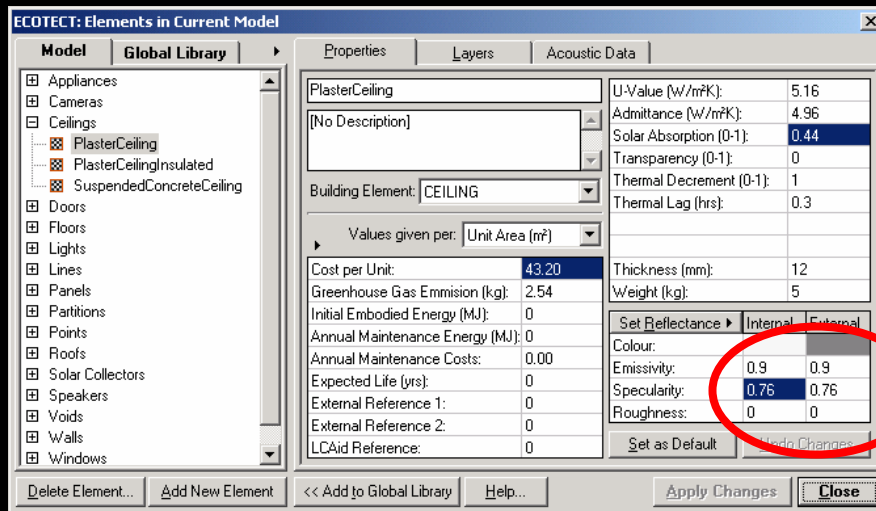
Mirror Material I



Virtual light sources

Mirror Material II

```
void mirror PlasterCeiling  
0  
0  
3    0.965 0.965 0.965
```



If $\text{Specularity}_{\text{Ecotect}} > 0.75 \Rightarrow$ mirror material

Red/Green/Blue: $(246/255) = 0.965$

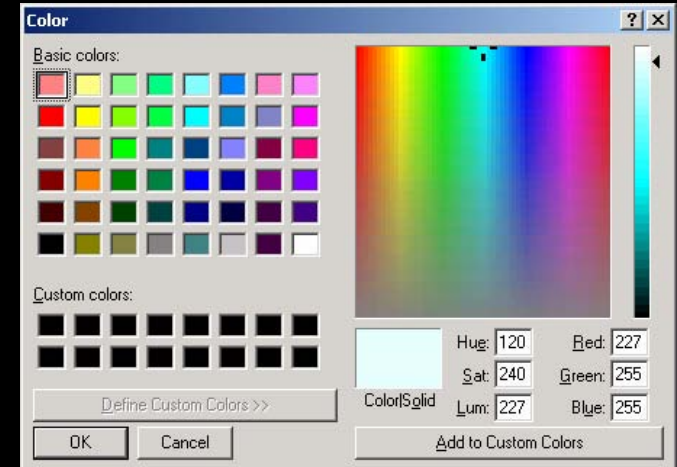
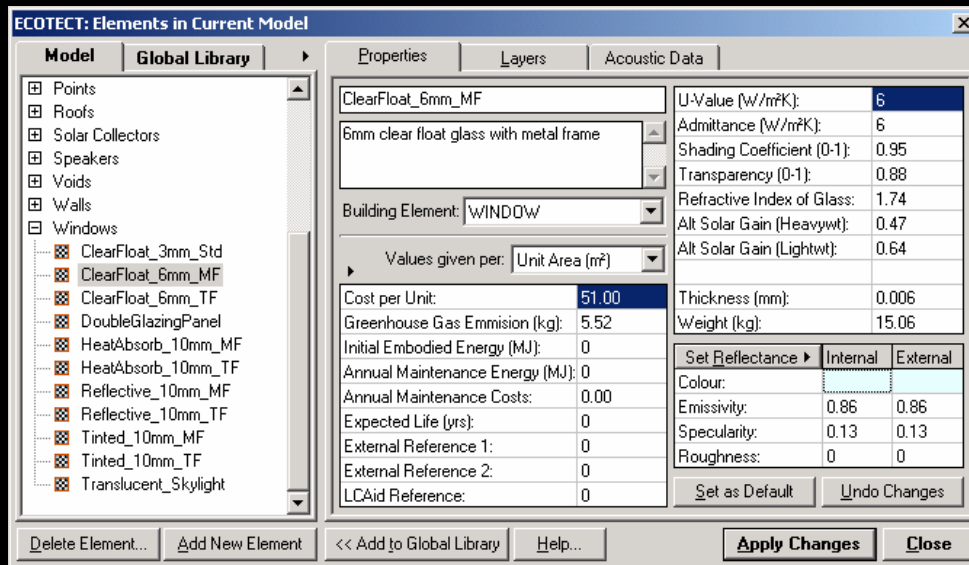
Material Glass

```
void glass ClearFloat_6mm_MF
```

```
0
```

```
0
```

```
3    0.661 0.742 0.742
```



Red: $(227/255) * TN(0.88)$

Material Trans I

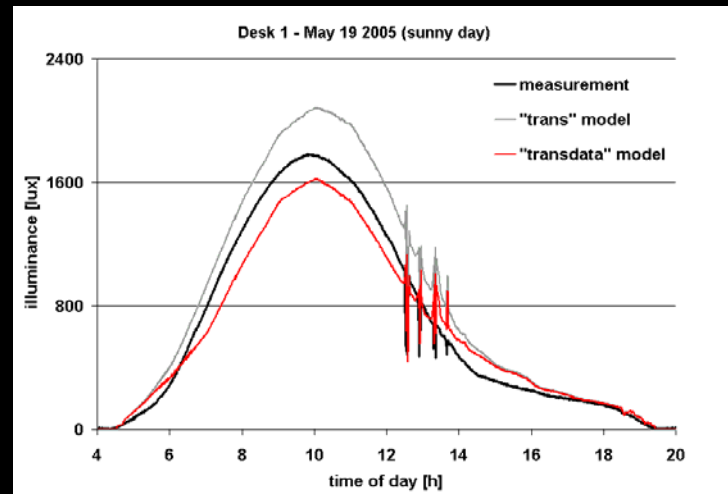
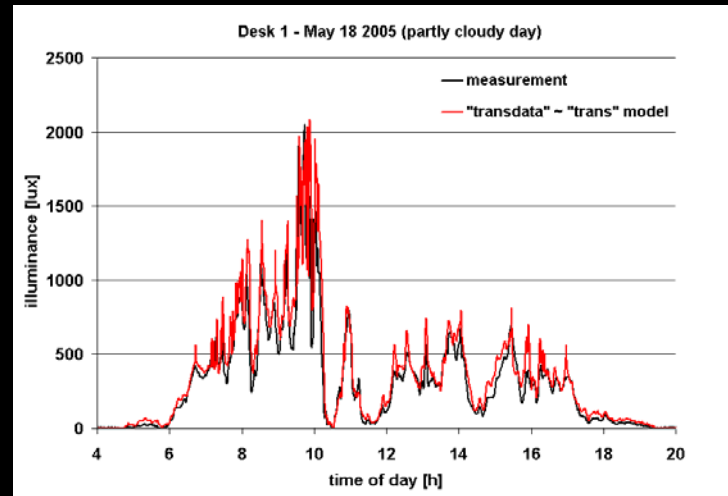
```
void trans PANEL
0
0
7 0.48913 0.48913 0.48913 0.08 0 0.5333 0
# A1      A2      A3      A4      A5 A6      A7
```

>> material database

Material Trans II



Energy & Buildings Reinhart, Andersen 2005 (in review)



Need for a quality controlled material database.