



## Simulation of BSDF's generated with Window6 and TracePro – preliminary results

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# Simulation of BSDFs generated with Window6 and TracePro – preliminary results

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Department of Civil Engineering

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$$\frac{\partial T}{\partial t} = \frac{\lambda}{\rho c_p} \frac{\partial^2 T}{\partial x^2} \int_a^b \epsilon \Theta^{\sqrt{17}} + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$$

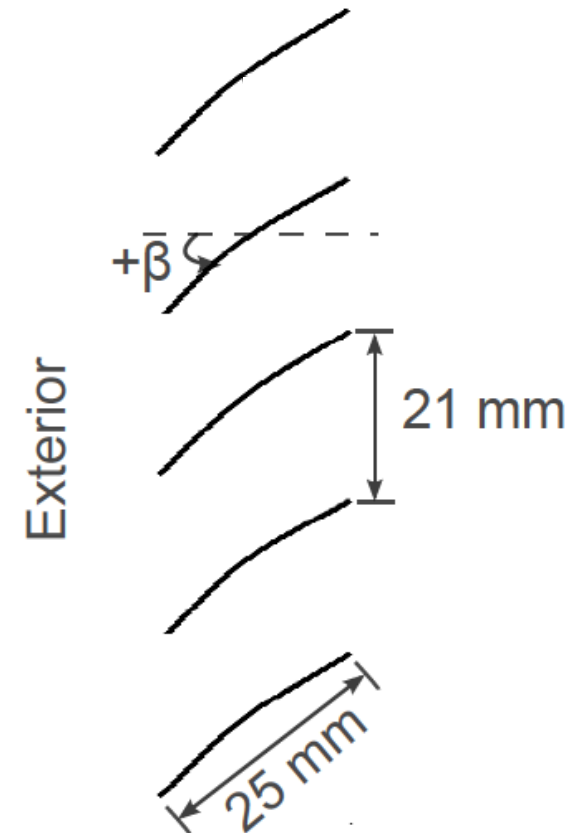
$\chi^2$   $\Sigma$   $\gg$   $!$

# Goal: Simulate with full directional properties

- Three phase method opens possibility to easily simulate complex fenestration systems. The method accepts BSDF descriptions in Klems coordinates
- Baseline: Window6 – Radiosity
- Simulate with full directional properties (specular systems) – Raytracing

## Status:

- Comparison between diffuse venetian blind:
  - Ideal properties, perfectly diffuse, 70% reflectance (Window6, slat material A)
  
- Compared by applying annual simulations

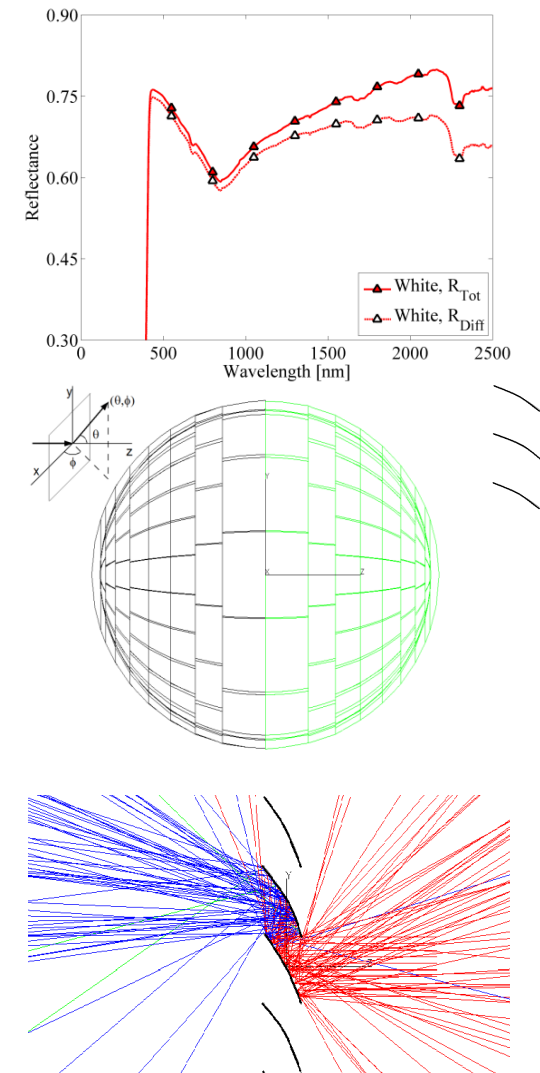


## Window6 - Radiosity

- Accurate method for predicting the hemispherical transmission and reflection of slat shading systems.
- *Limitation:*  
One exception is the use of slat materials with a strong specular component of reflectance. In these cases even the hemispherical transmittance and reflectance can be significantly in error and the directional behavior will be poorly represented. For specular blinds we must rely on raytracing to generate full bidirectional properties, (Rubin et al., 2007).

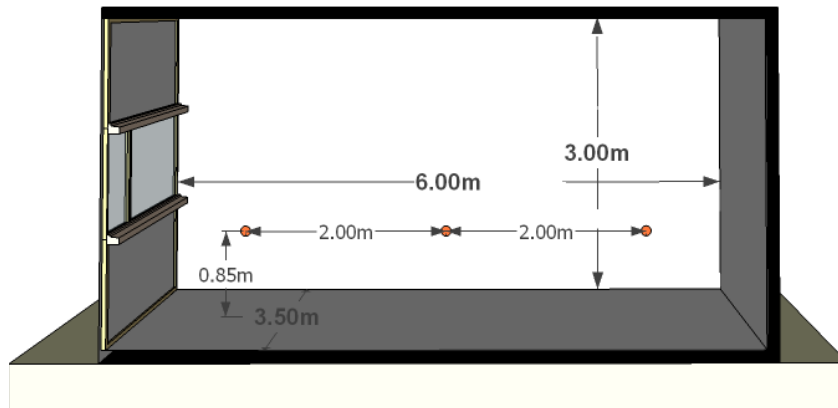
# TracePro - Raytracing

- The optical properties are assigned to the slats
- The Venetian blind system is "placed" in a virtual sphere, which is used as light source and detector
- Transmittance and reflectance for the Venetian blind system is simulated for a few different slat angles



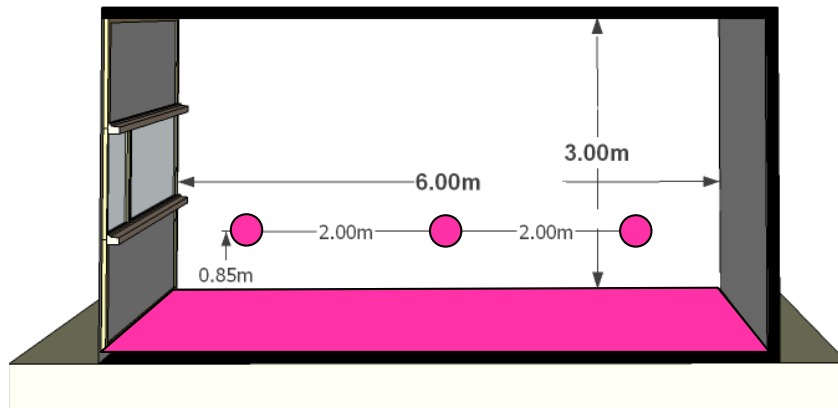
# Three Phase Method

$$i = VTDS$$



# Three Phase Method

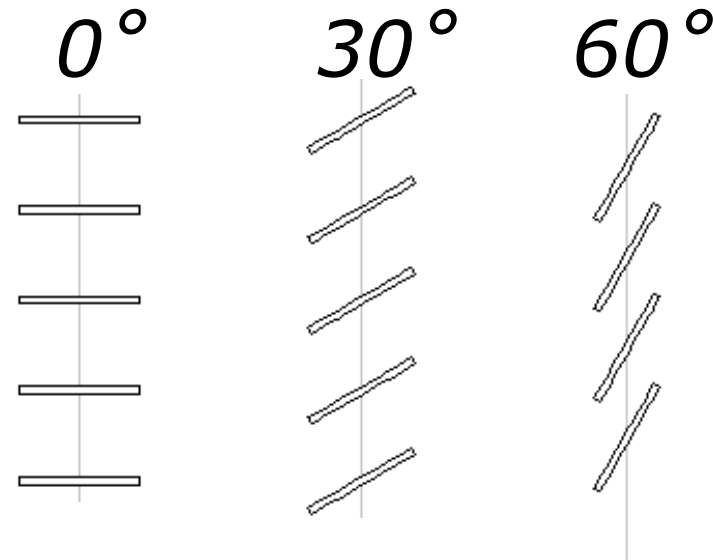
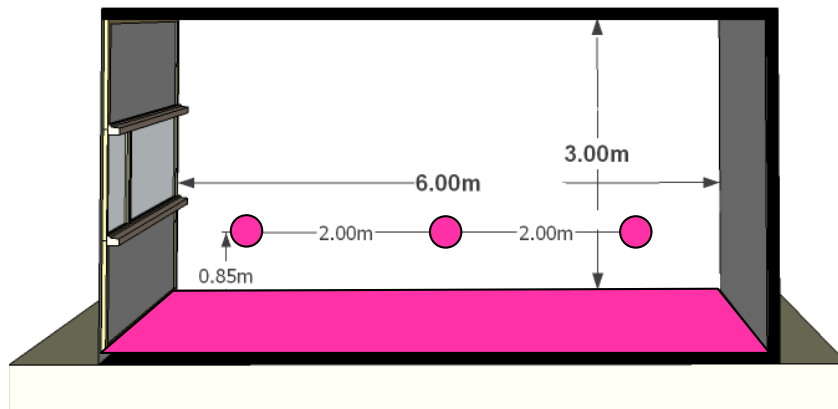
$$i = VTDS$$





# Three Phase Method

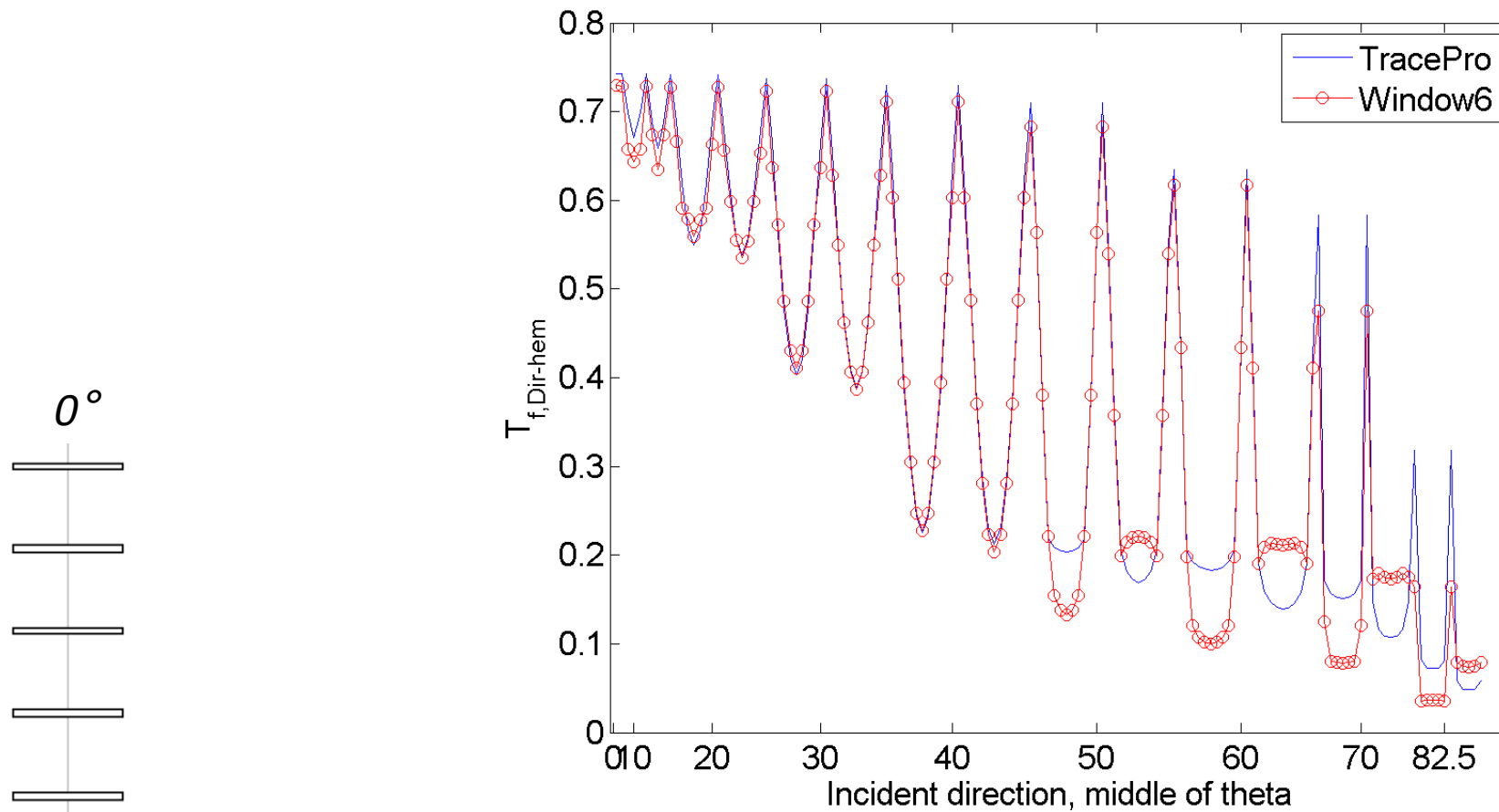
$$i = VTDS$$



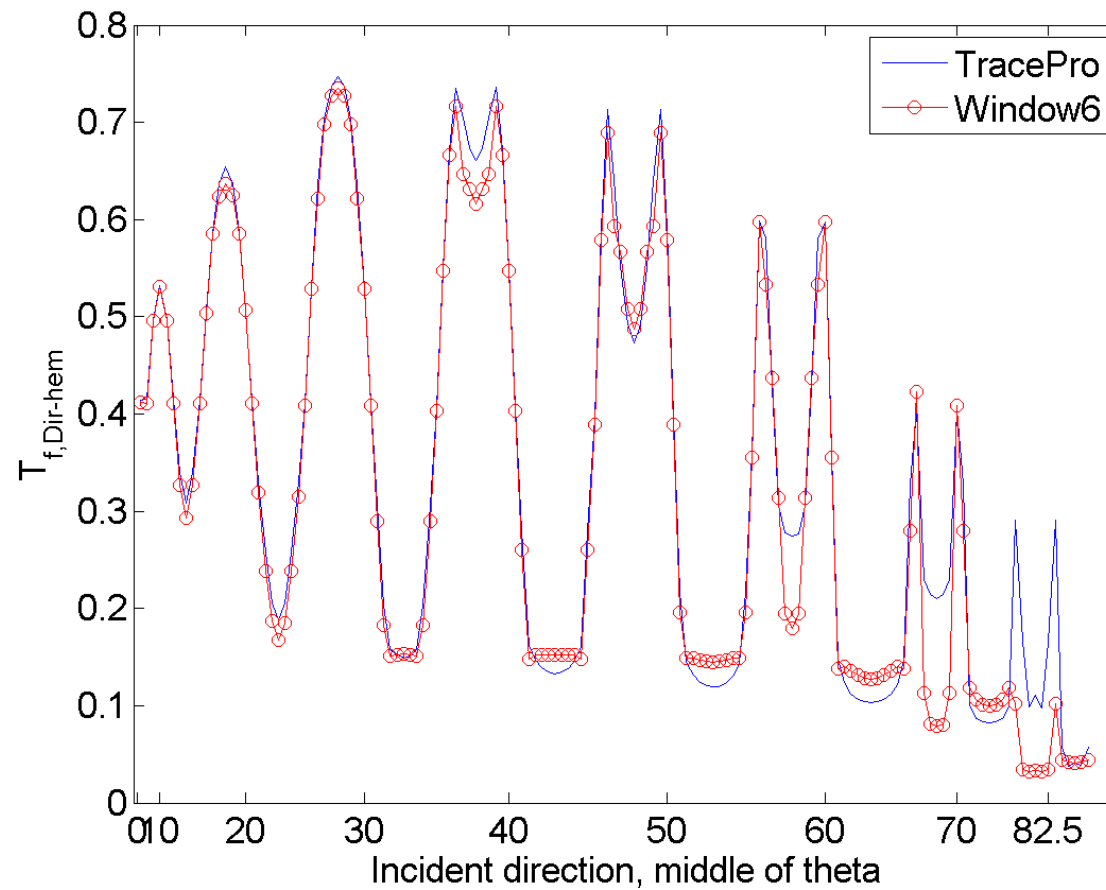
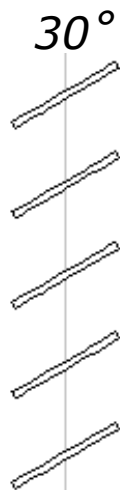
# Results

- Hemispherical transmittance
- Light distribution in the room - Accumulated annual luminance distribution
- Annual time series of illuminance level with time resolution of 1 hour

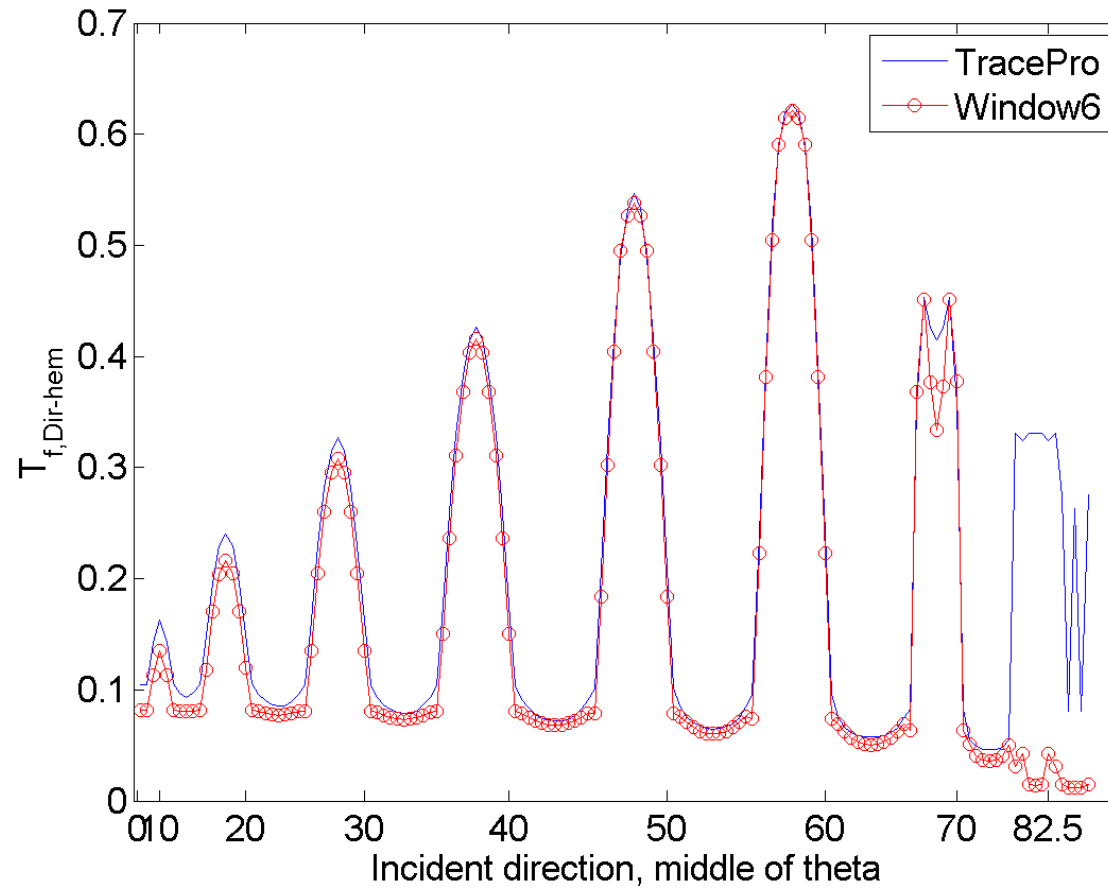
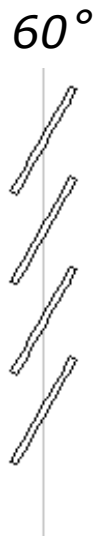
# Hemispherical transmittance



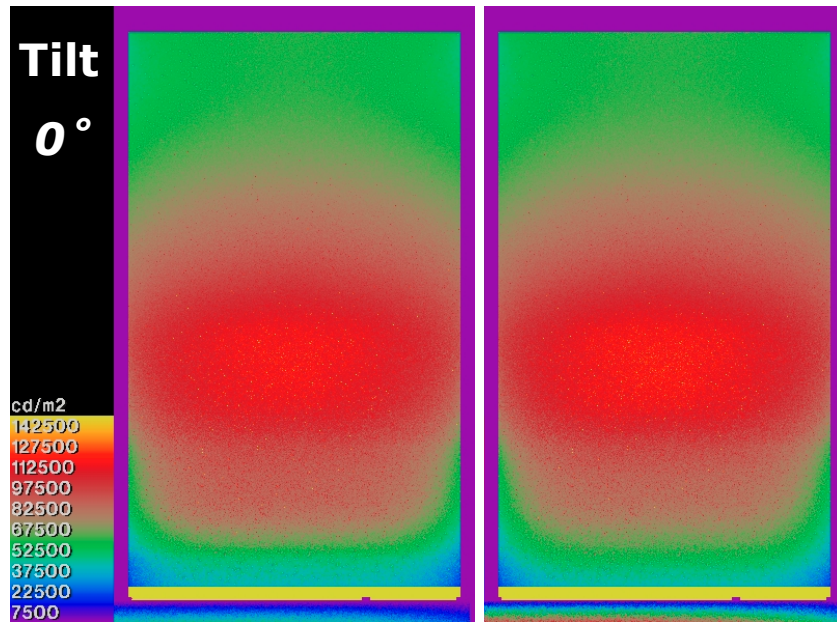
# Hemispherical transmittance



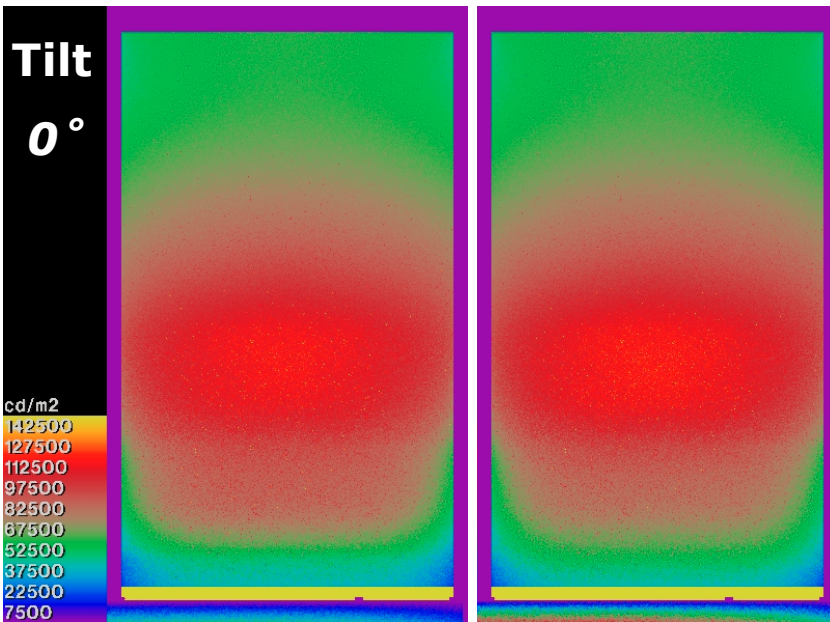
# Hemispherical transmittance



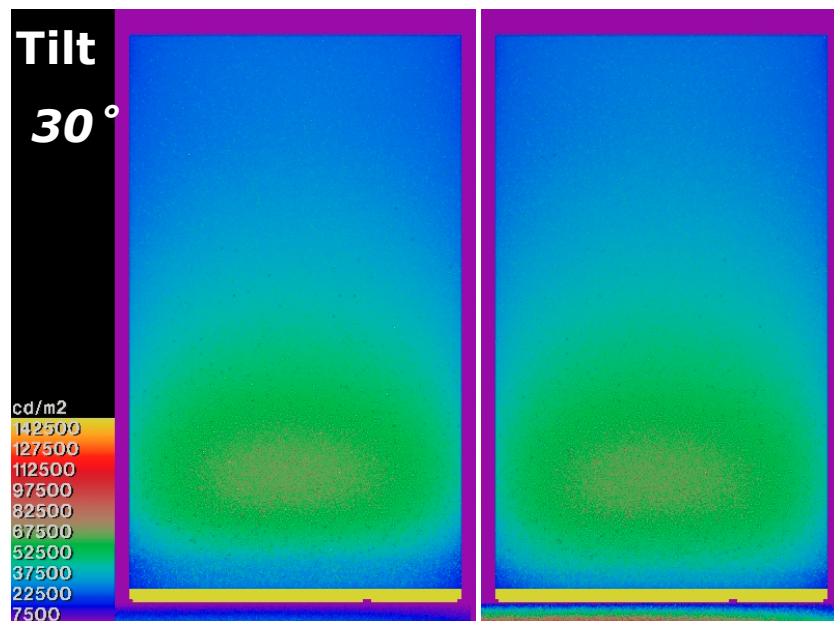
# Light distribution in the room



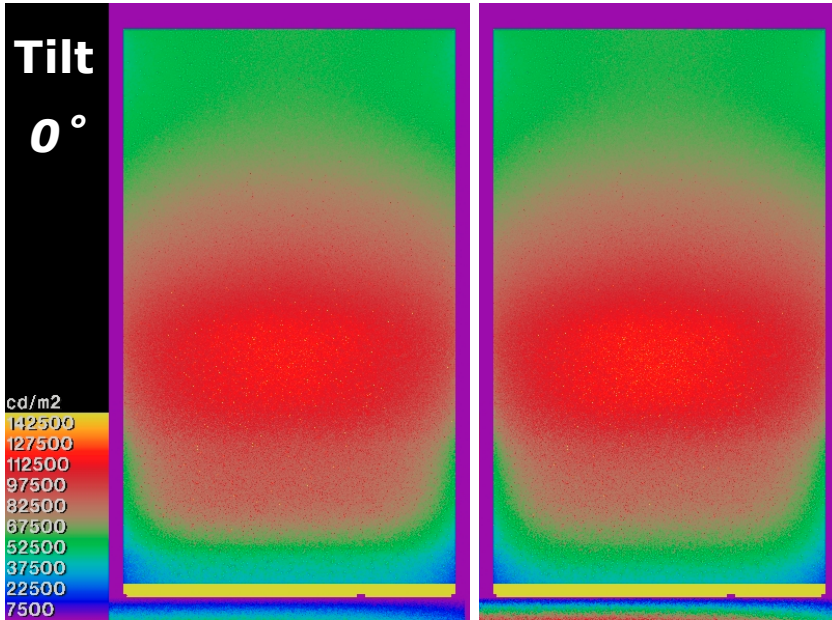
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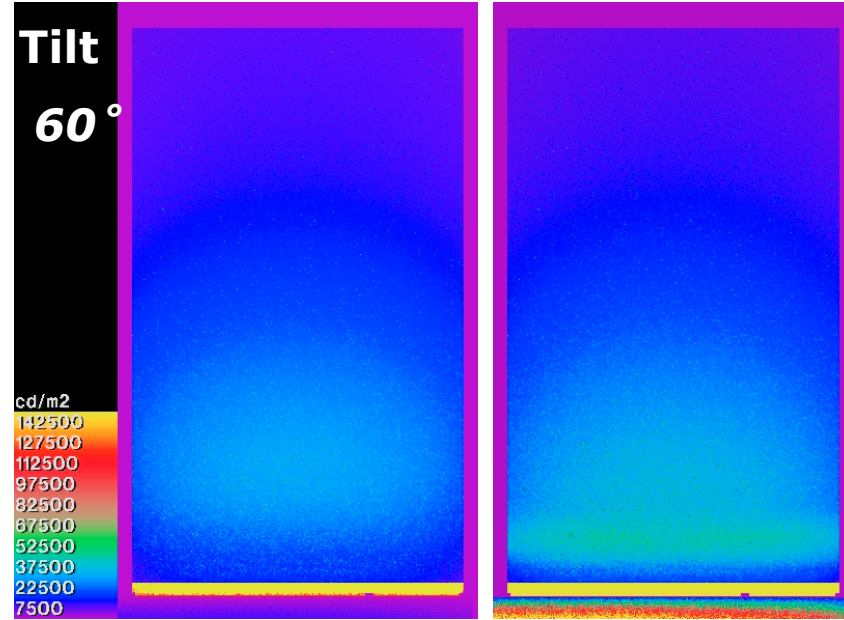
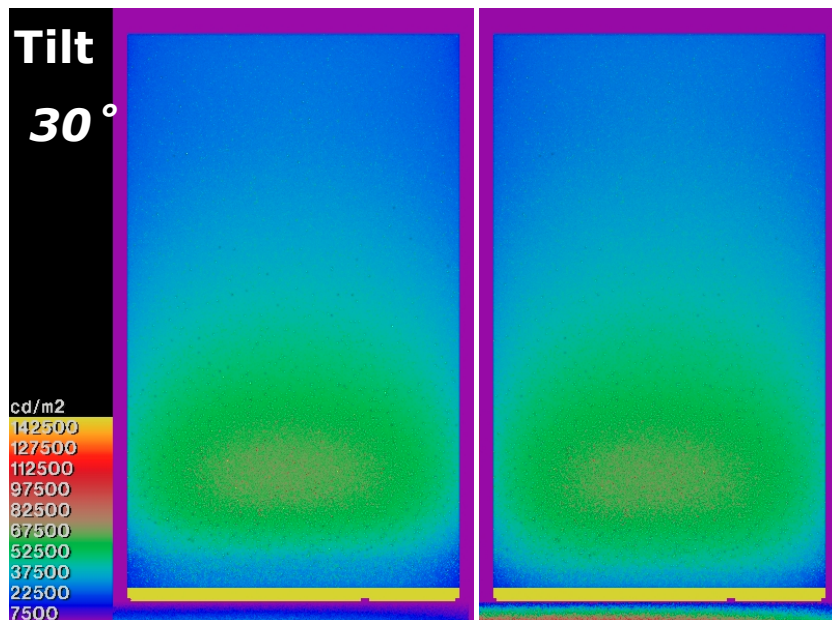
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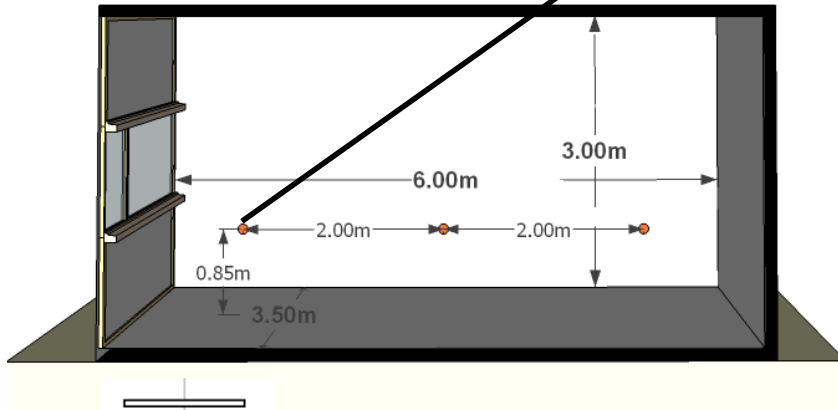
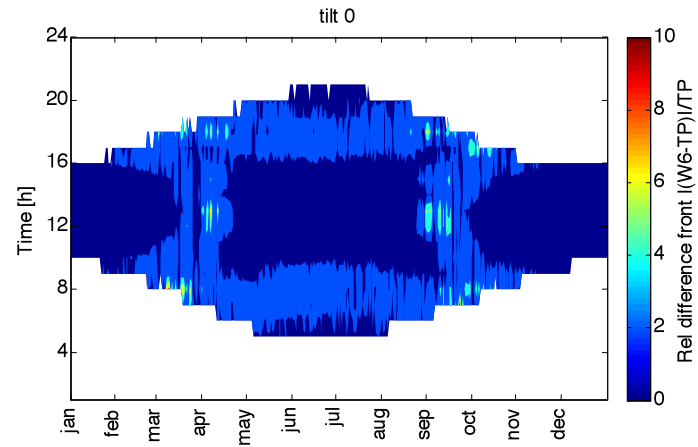


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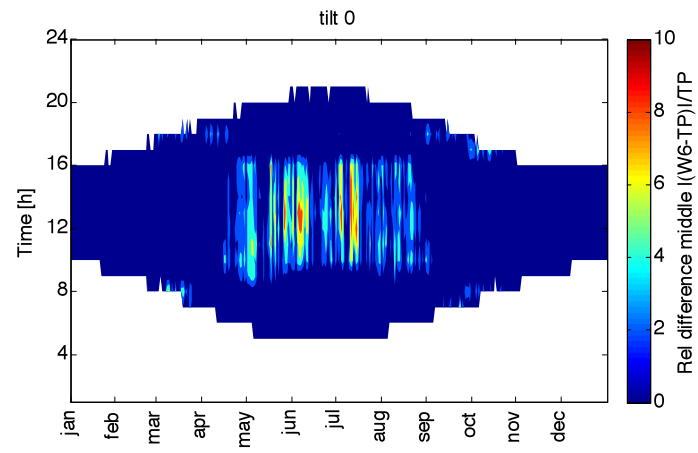
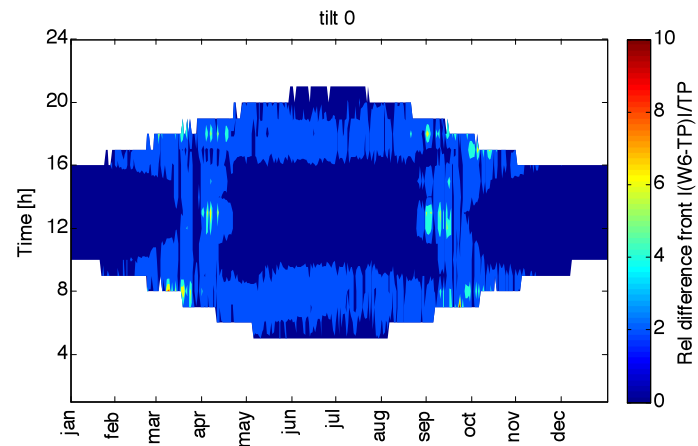
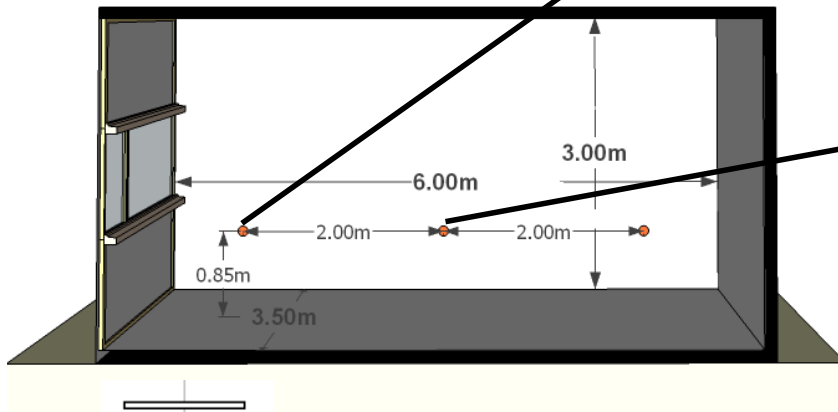


# Time series

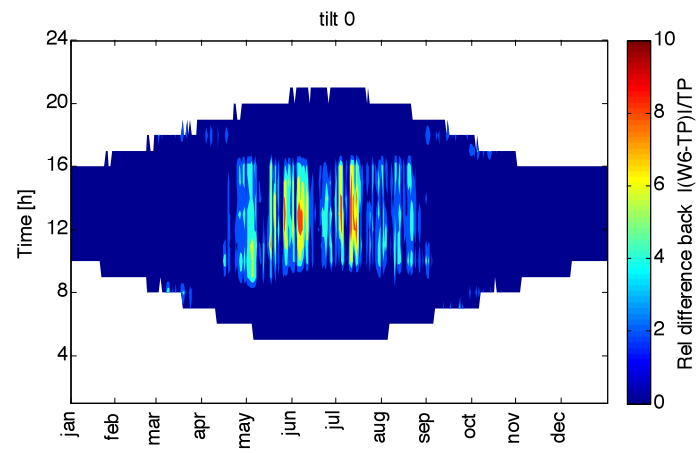
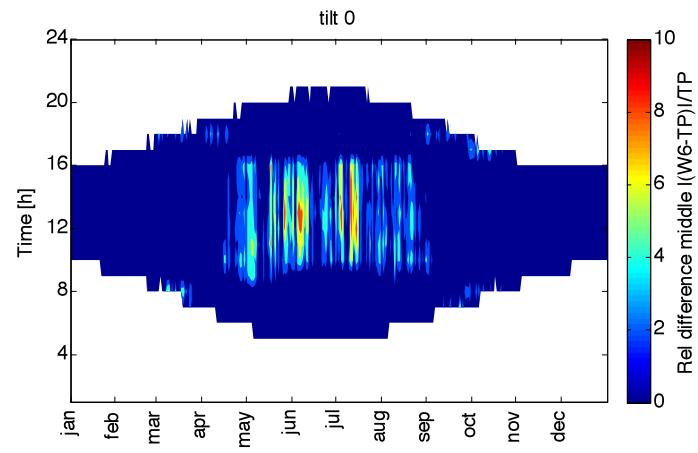
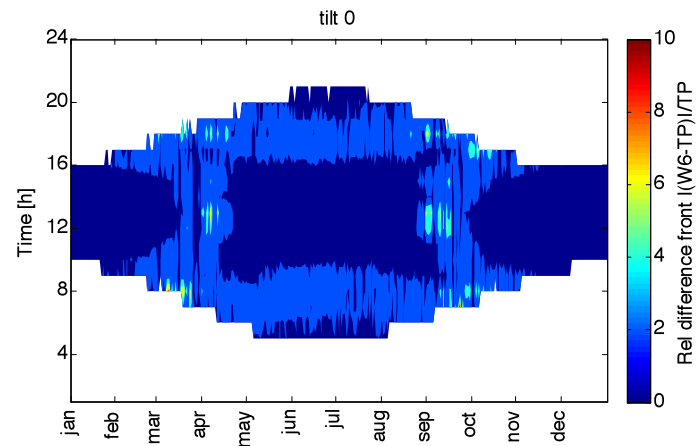
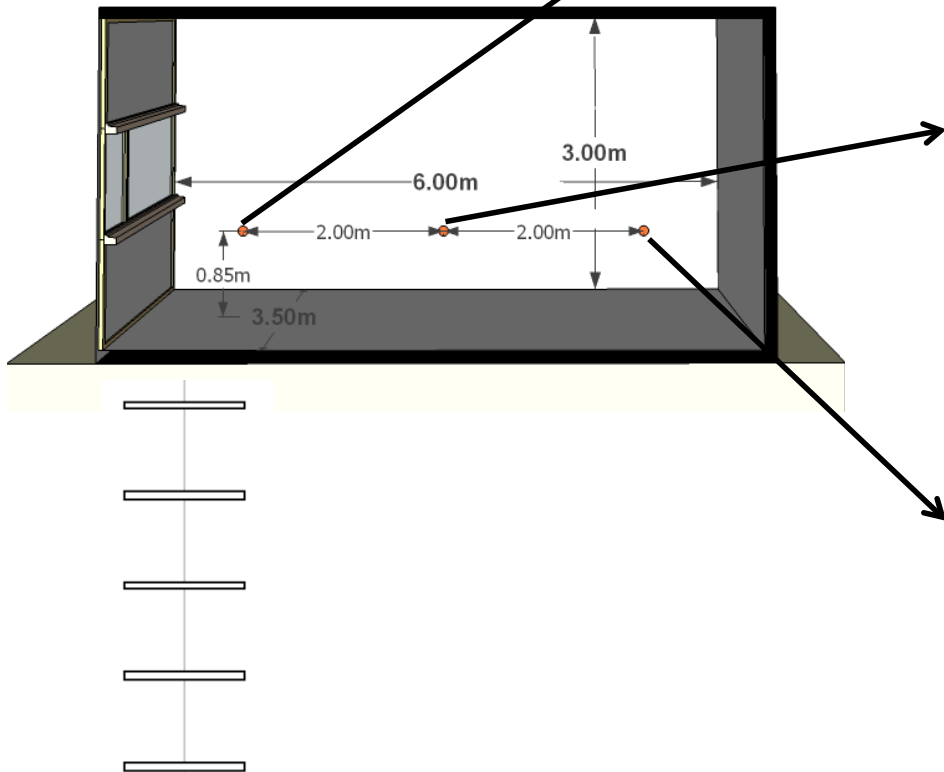
# Tilt 0°



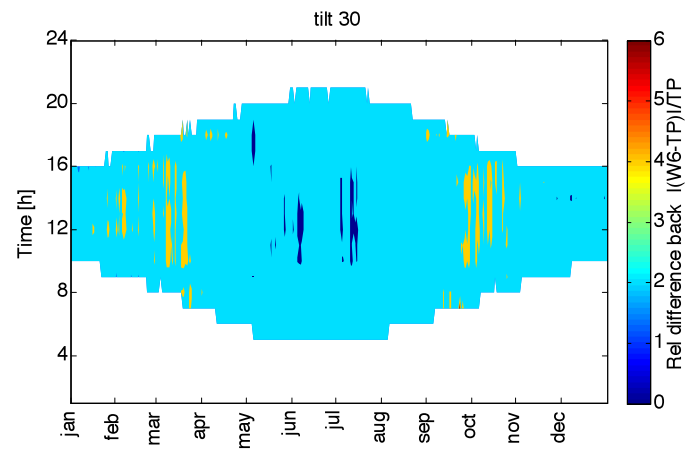
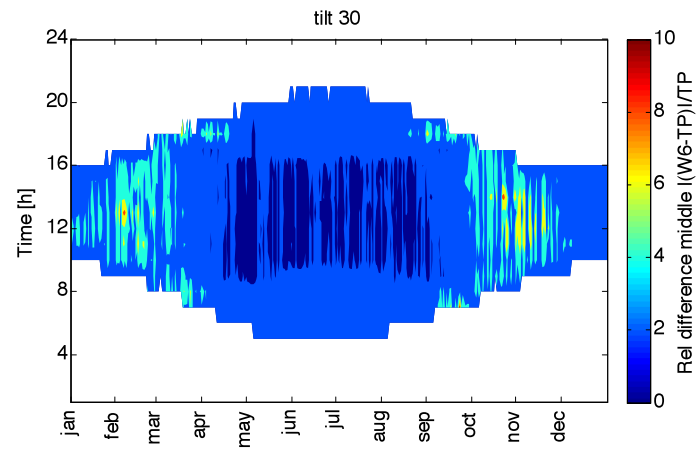
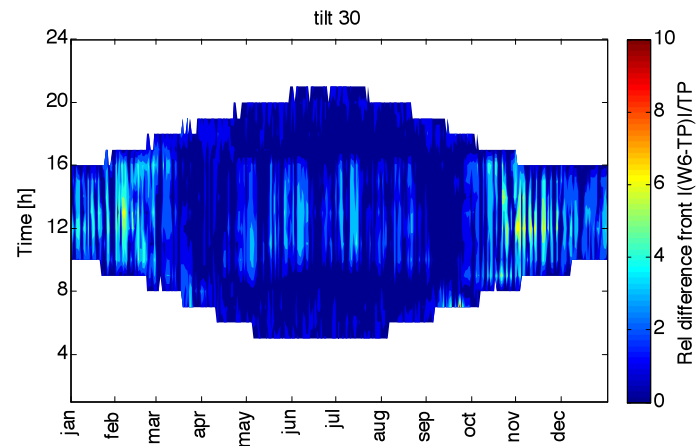
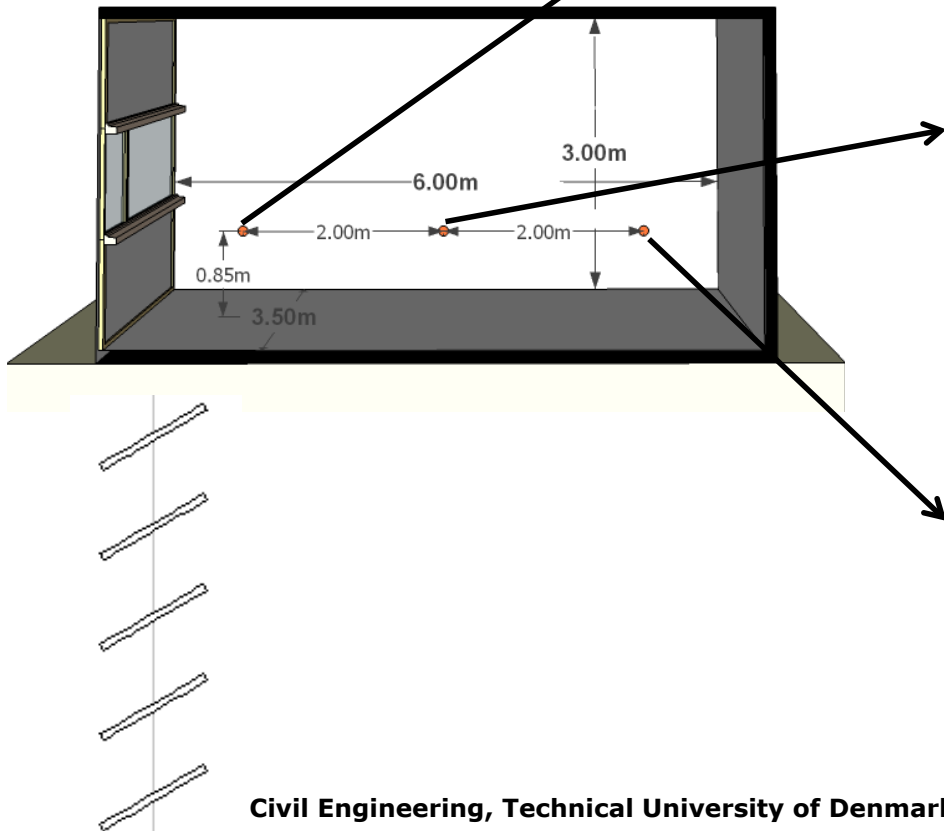
# Tilt 0°



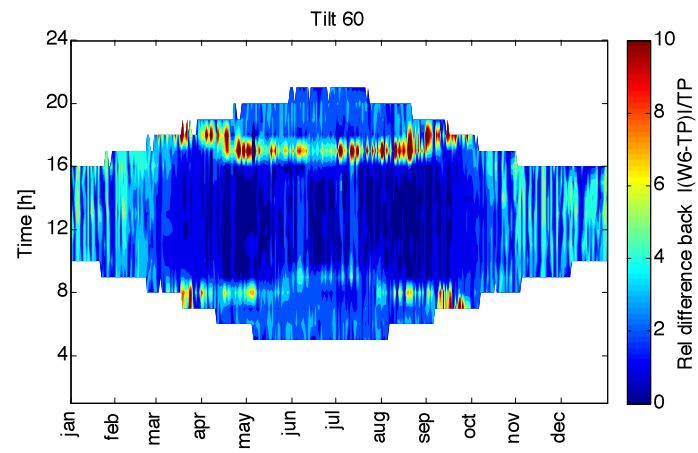
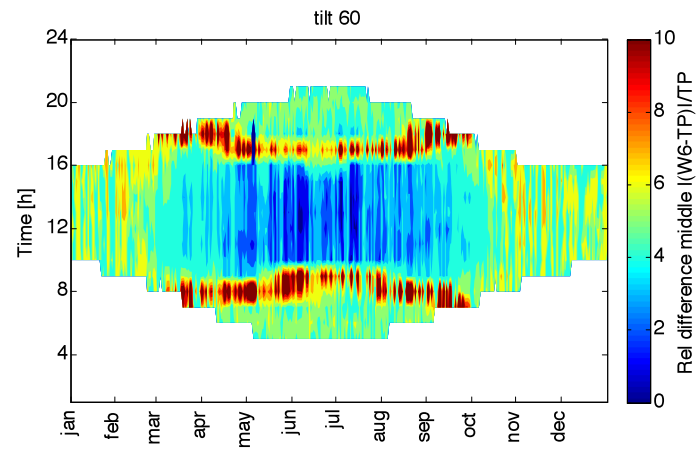
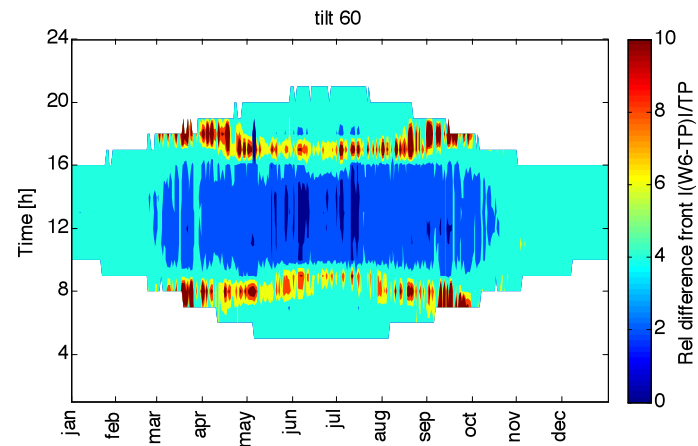
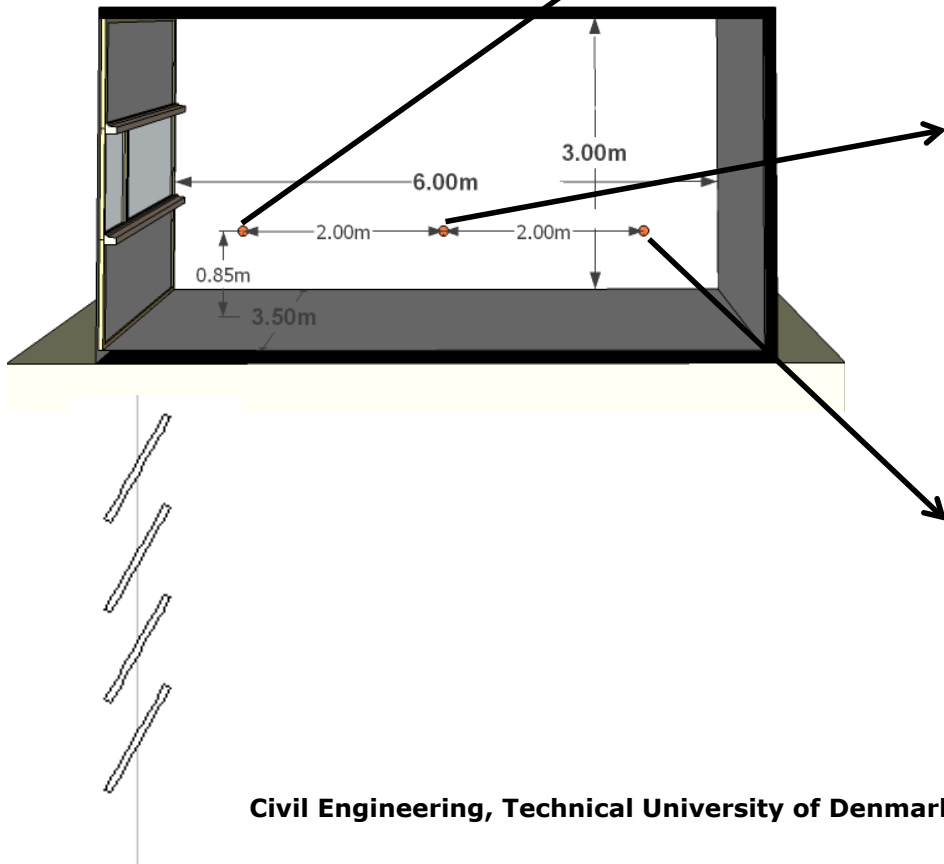
# Tilt 0°



# Tilt 30°



# Tilt 60°



## Conclusion

- OK agreement between simulations with Window6 BSDF and TracePro BSDF
- Highest discrepancy for tilt  $60^\circ$  caused by  
-> light being re-reflected in the blinds



## Future work

- Simulation of a more complex material
- Comparison to full scale measurements