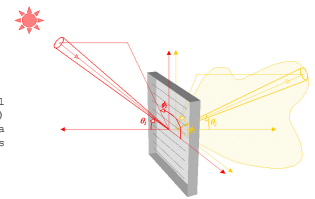


# Experimental and Simulation-Based Approaches to Assess Bidirectional Properties of Complex Fenestration Systems

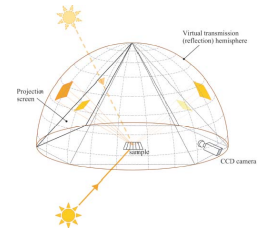
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BTDF and BRDF: The Bidirectional Transmission (or Reflection) Distribution Function as a function of 4 polar angles

## Describing Complex Fenestration Systems (CFS)

- Required information: how is light distributed after transmission (BTDF) or reflection (BRDF) ?
- Deduced information: indoor light penetration variation with time and position

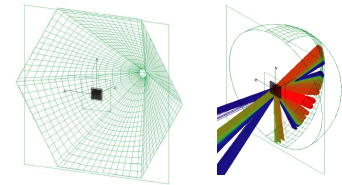


Two examples of experimental approaches in goniophotometry: scanning detector (FHG-ISE, left) vs. flux-based method using a CCD camera aimed at a rotating projection screen (LESO-PB/EPFL, right)

## Experimental Approaches

- Scanning based: Advantages / Disadvantages
  - (+) easy signal to output conversion, directional accuracy
  - (-) time consuming measurement, discrete information
- Flux based: Advantages / Disadvantages
  - (+) time-efficiency, continuous information, flexibility
  - (-) tedious calibration

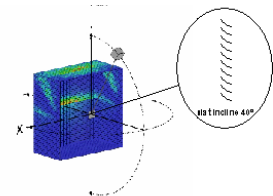
Simulation model developed in TracePro (LESO-PB/EPFL): replica of instrument and ideal set-up with absorbing hemisphere



## Numerical Approaches

- Numerical Approaches incorporate
  - forward ray-tracing algorithms
  - virtual test facilities, reproducing flux-based methods
  - generators to parameterize different samples
- Advantages: time and cost efficiency for
  - analysis of system performance
  - optimization in system design

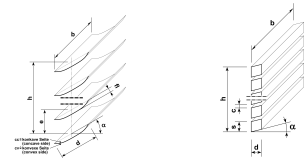
Illustration of FHG-ISE numerical goniophotometer. The flux detected on the sensor planes of the hemicycle is converted into luminance coefficients.



## Database

- Collection of numerous CFS datasets from test facilities worldwide
- System manufacturer's information
- Powerful viewers illustrate the interaction of
  - Sky luminance distribution
  - CFS
  - Room
- Plug-In technology: can be linked into other applications like building simulation engines
- Available under [www.talisy.de](http://www.talisy.de)

Selection of CFS models which can be automatically parametrized. They can be combined in layers with each other and with glazing panes.



Expert mode of the CFS database: Display of a BTDF, a sky luminance distribution, room illumination and control curve of a blind system

