

# DESIGN SUPPORT FOR PRACTITIONERS: DESIGN WORKFLOWS AND DAYLIGHT SYSTEM CHARACTERIZATION

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Bartenbach

**Bartenbach**<sup>®</sup>  
research & development

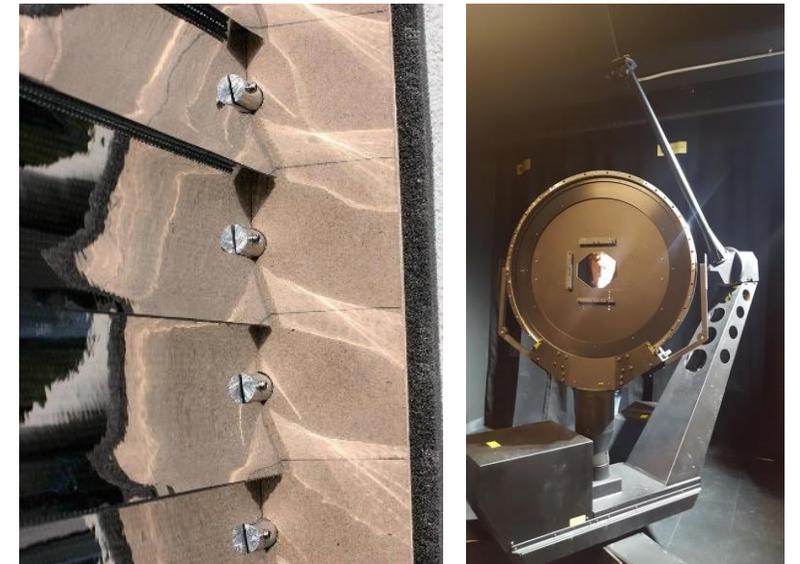
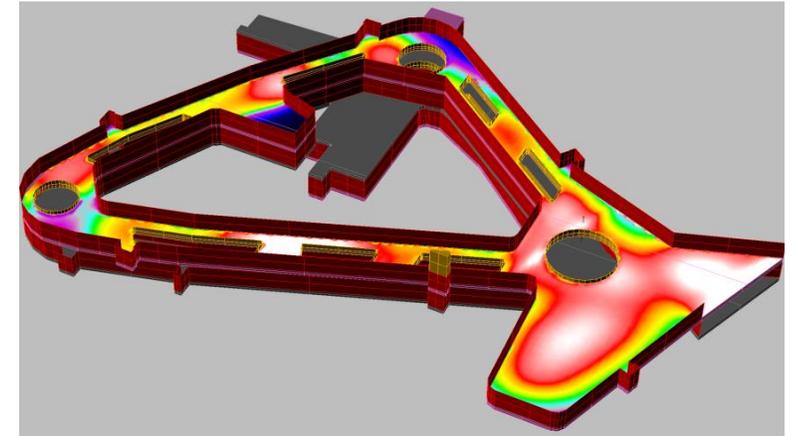
IEA SHC Task 61 / EBC Annex 77: Integrated Solutions for Daylighting and Electric Lighting

Solar Academy Webinar  
September 24, 2020

## Objective

Focus on the application of technical innovations in the field of integrated lighting solutions in practitioners' workflows. Bring findings onto the desktops of designers by integration into widely used software tools, standards and codes, and design guidelines.

- **Review of state-of-the-art design workflows**
- **Standardization of BSDF daylight system characterization**
- Spectral sky models for advanced daylight simulations
- Hourly rating method for integrated solutions

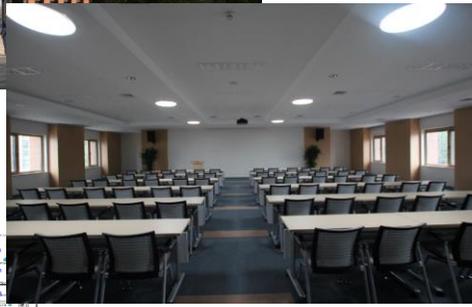
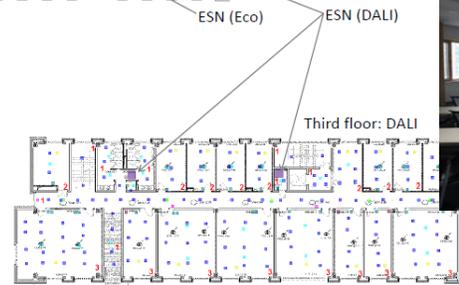
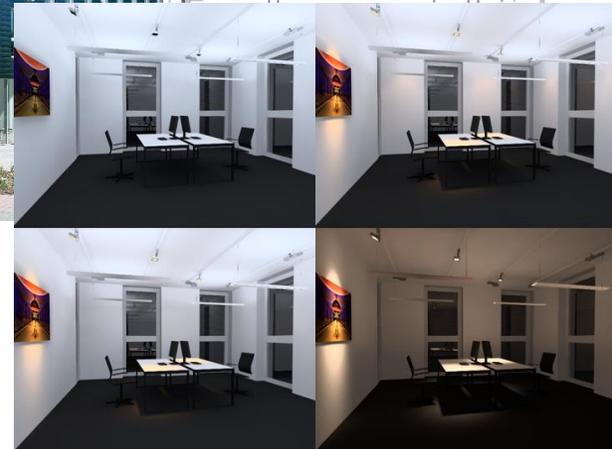
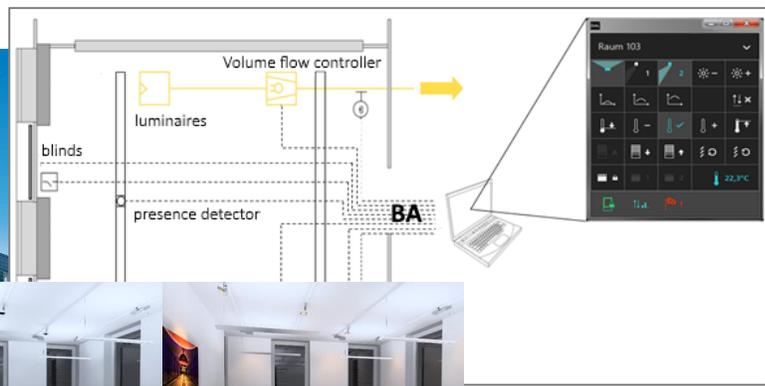
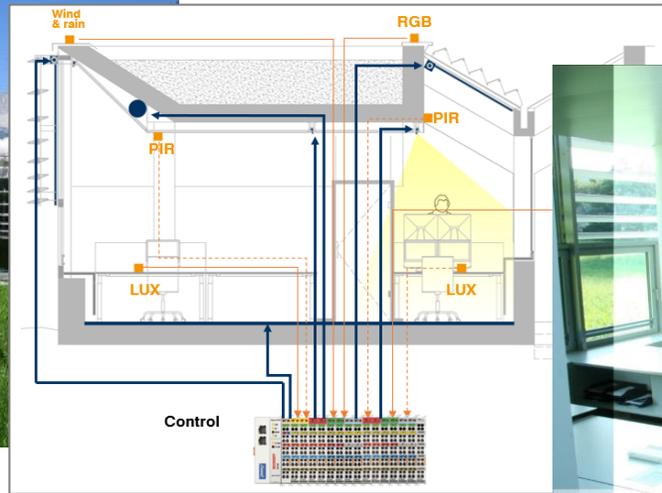


# Design Workflows



## Example Design Projects

- Bartenbach R&D Office
- DIAL Headquarter
- CABR NZEB Office Building



# Design Workflows

## Evaluation of Design Workflows

- General System Design – Workflow at DIAL
- Design in day-by-day work – the DIAL Heavy User
- Lighting design workflow at Bartenbach
- ISO 16817: Design Process for the Visual Environment
- Design workflow as Inform Design
- Fener in the design workflow of façade systems
- Workflow for lighting design projects in Norconsult
- ESTIA Workflow
- LITG Scope of Services

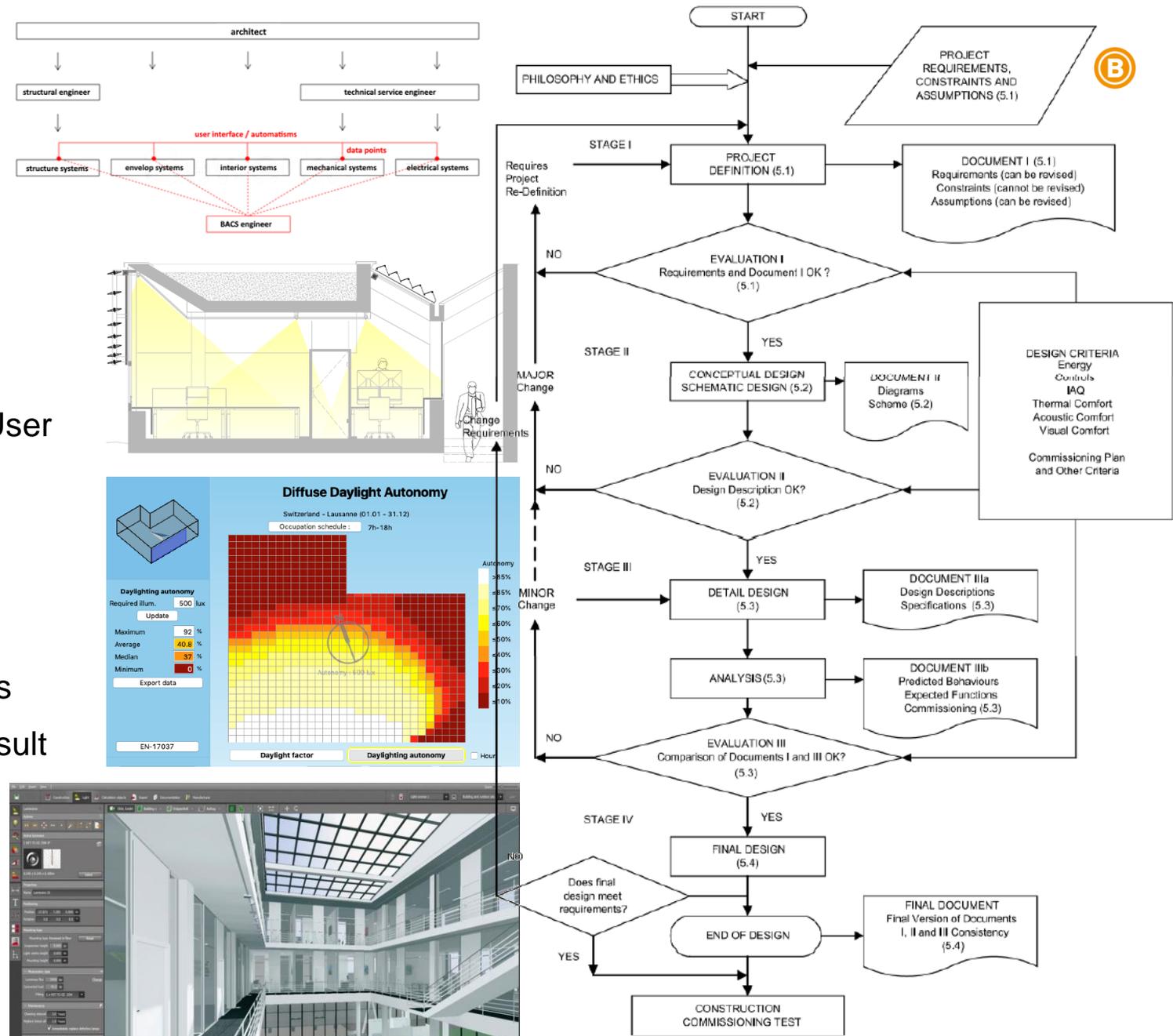
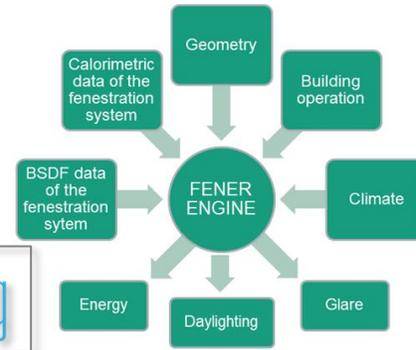


Figure 46. Iteration flowchart summarizing the design process for the building environment including the visual environment. (ISO 16813:2006 Building environment design – Indoor environment – General principles)

# Design Workflows

## Analysis of Simulation Software Tools

- General Information
- Users
- Design Phase
- Algorithms / Engines
- Electric Lighting
- Daylighting
- Control System
- Extended Scope



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	Applies to Software + = yes, o = partly, -- = no											Remarks / explanations	
	AGI32	ElumTools	DALEC	DIALux	DIAL+	DIVA-for-Rhino	FENER	GB SWARE Dali	Ladybug / Honeybee	PKPM	Radiance		RELUX
<b>GENERAL INFORMATION</b>													
Graphical user interface	+	+	+	+	+	+	+	+	+	+	-	+	
Command line interface	--	--	--	--	--	--	+	--	--	--	+	--	
CAD Import	+	+	--	+	--	+	--	+	+	+	+	+	
3D Modeling	+	+	--	+	+	+	--	+	+	+	o <sup>11</sup>	+	11: some tools to create and collect geometry
3D Rendering	+	+	--	+	--	+	--	+	+	+	+	+	
Scripting	--	--	--	--	--	+	+	+	+	--	+	--	
<b>USERS</b>													
Suited for lighting designers	+	+	+	+	+	+	+	+	-- <sup>9</sup>	-- <sup>10</sup>	+	+	9,10: further development of tools and methods used for lighting design are planned for the future
Suited for architects	+	+	+	+	+	+	+	+	+	+	+	+	
Suited for electric engineers	+	+	+	+	+	--	--	+	--	--	--	+ <sup>12</sup>	12: with the add-on "ReluxCAD for Revit" in Revit for BIM projects
Suited for HVAC engineers	--	--	+	--	--	--	--	+	+	+	--	+ <sup>12</sup>	12: with the add-on "ReluxCAD for Revit" in Revit for BIM projects
Suited for building engineers/planners	+	+	+	+	+	+	+	+	+	+	--	+	
Suited for researchers	+	+	+	+	+	+	+	+	+	+	+	+	
<b>DESIGN PHASE</b>													
Suited for early design	+	+	+	+	+	+	+	+	+	+	+	+	
Suited for detailed design	+	+	--	+	+	+	--	+	+	+	+	+	

# Design Workflows

Report available on  
<https://task61.iea-shc.org/>

**SHC**  
SOLAR HEATING & COOLING PROGRAMME  
INTERNATIONAL ENERGY AGENCY

## Workflows and software for the design of integrated lighting solutions

**A Technical Report of IEA SHC Task 61 / EBC Annex 77 T61.C.1**

IEA SHC Task 61 / EBC Annex 77  
Integrated Solutions for Daylighting and Electric Lighting  
From component to user centered system efficiency

Page 1  
IEA SHC Task 61 / EBC Annex 77: Integrated Solutions for Daylighting and Electric Lighting

Page 2

Page 3  
IEA SHC Task 61 / EBC Annex 77: Integrated Solutions for Daylighting and Electric Lighting

Page 4



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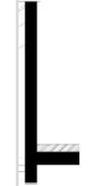


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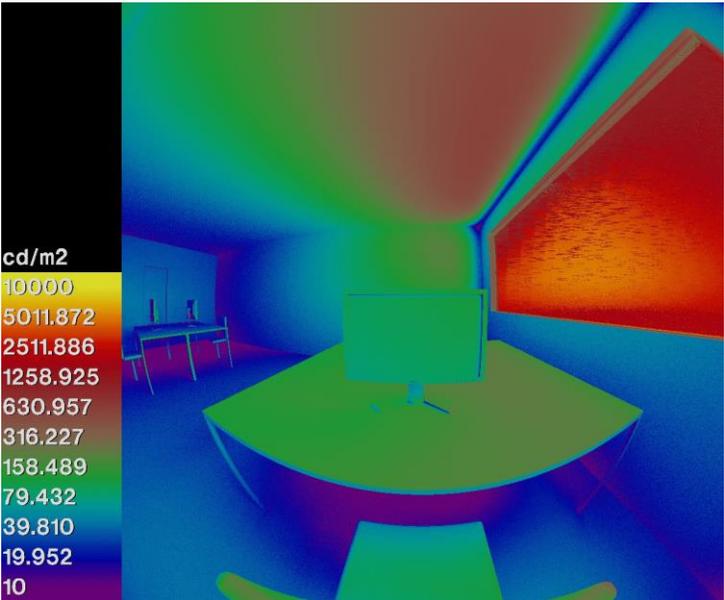
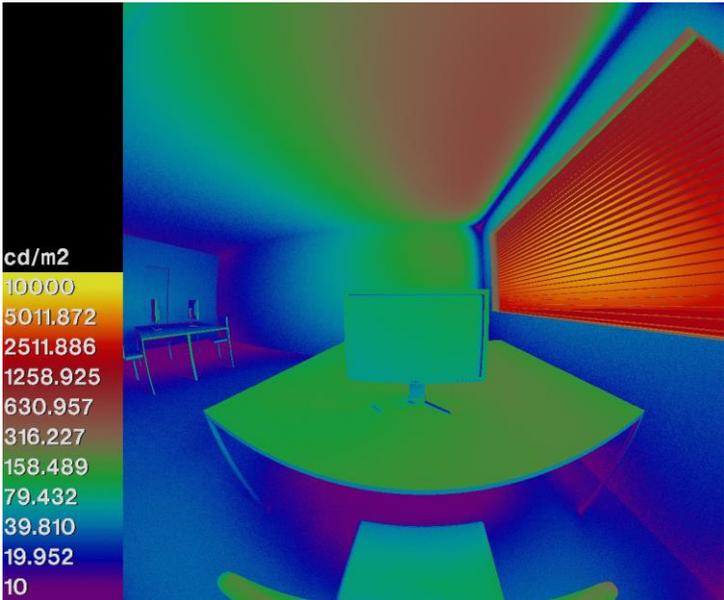
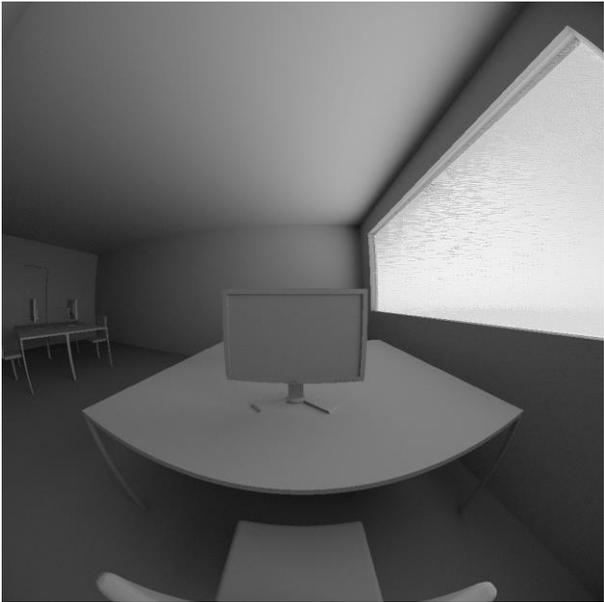
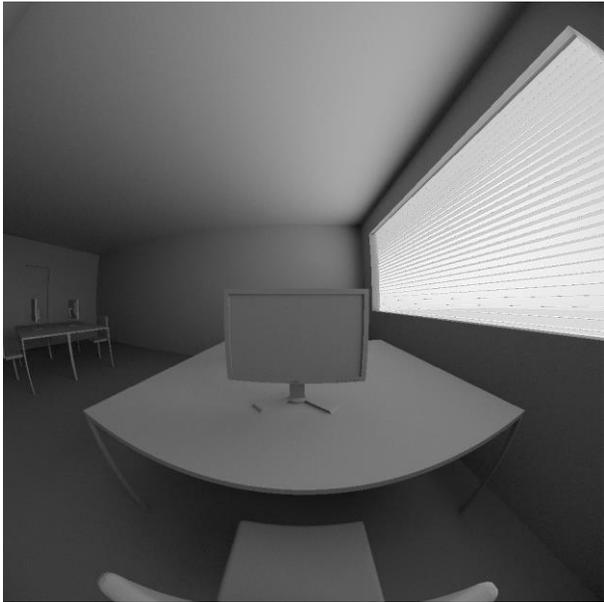


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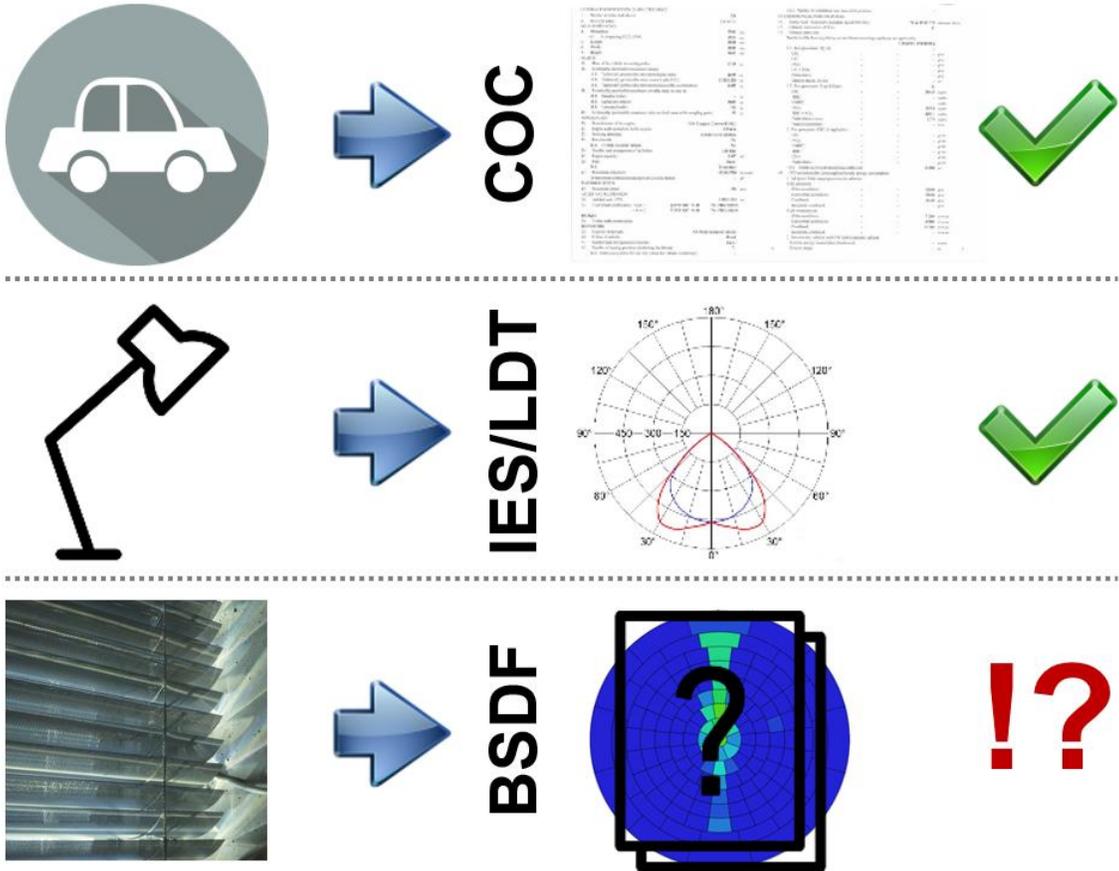
# Daylight System Characterization



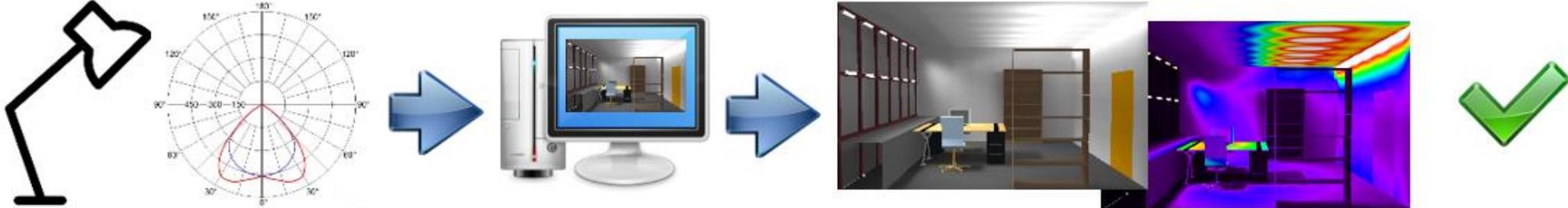
BSDF?



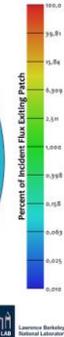
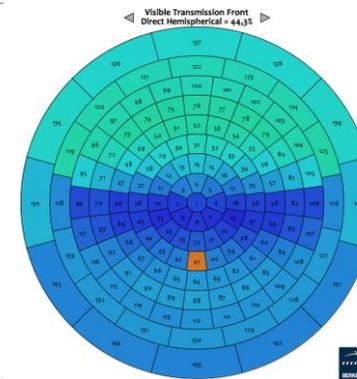
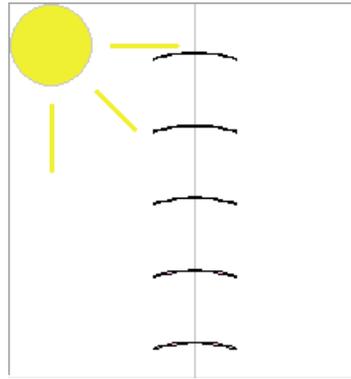
# BSDF Standardization



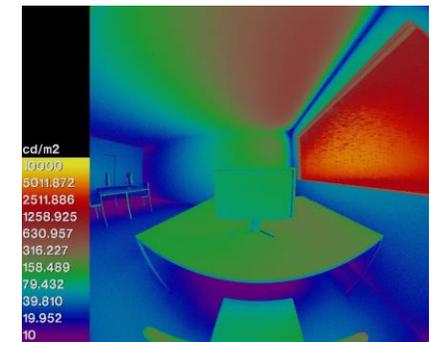
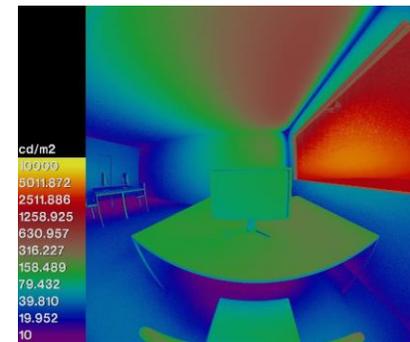
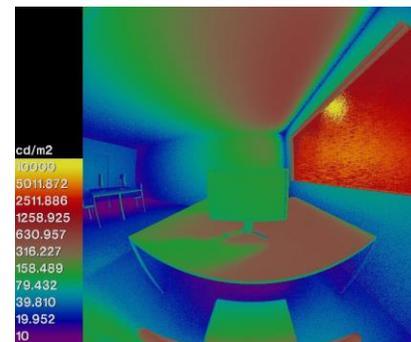
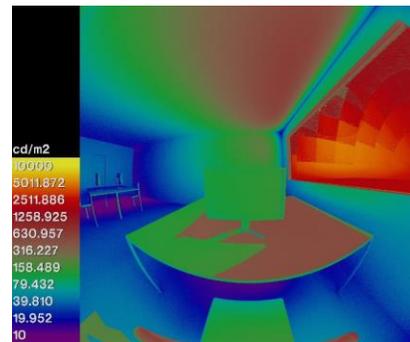
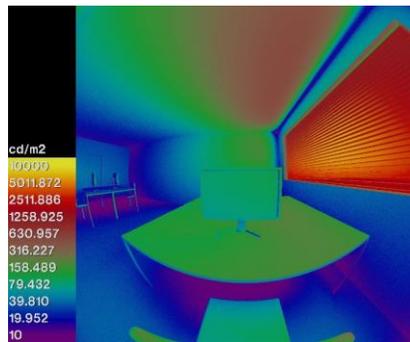
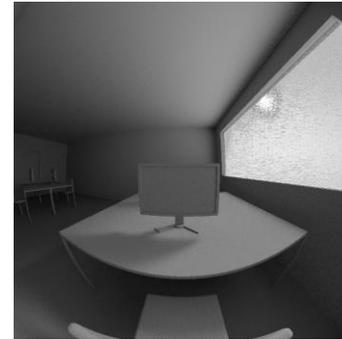
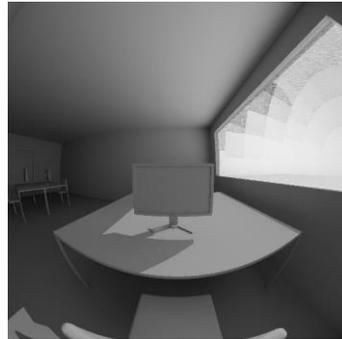
# BSDF Standardization



# BSDF Sensitivity Analysis



Blinds, 00deg tilt  
 CIE Sunny Sky  
 21 March, 10am  
 Innsbruck, Austria (47.3N / 11.4E)



Geometry  
 Ev 1490 lx  
 DGP 0.26

Klens aBSDF  
 Ev 3340 lx  
 DGP 0.59

Klens BSDF  
 Ev 2650 lx  
 DGP 0.35

tt46 aBSDF  
 Ev 1530 lx  
 DGP 0.26

tt46 BSDF  
 Ev 1530 lx  
 DGP 0.26

# Characterization of daylighting systems



**Aim: The „right“ system data for**

- Transparent systems
- Fabrics
- Venetian blinds
- Specular blinds / grids
- Micro-/Nano-structured systems
- Prisms, LCPs
- ...





## Diffuse blinds or grids

Task	Simulation method	System characterization / BSDF
Daylight Factor	Raytracing possibly mkillum continuous sky model	(a) Geometry (b) Low-res BSDF
Point-in-time illuminance for overcast / sunny sky	Raytracing continuous sky model	(a) Geometry (b) Low-res BSDF
Point-in-time glare metric for overcast / sunny sky	Raytracing peak extraction continuous sky model	(a) High-res BSDF (b) Low-res BSDF (with peak extraction)
Point-in-time rendering for overcast / sunny sky	Raytracing peak extraction continuous sky model	(a) High-res BSDF (b) Low-res BSDF if peak extraction
Annual illuminance metric	DC-method or 3-PM	Low-res BSDF
Annual glare metric	5-PM peak extraction	Low-res BSDF and (a) Geometry or (b) High-res BSDF or (c) Low-res BSDF (only if PE)

# Characterization of daylighting systems

Whitepaper to be released soon.  
Stay tuned!



IEA SHC Task 61 / EBC Annex 77  
Subtask C2

A white paper on  
**BSDF generation procedures for  
daylighting systems**

September 17, 2020

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