WORKFLOW FOR COUPLED DAYLIGHT AND ENERGY SIMULATIONS

Tobias Skov Pedersen

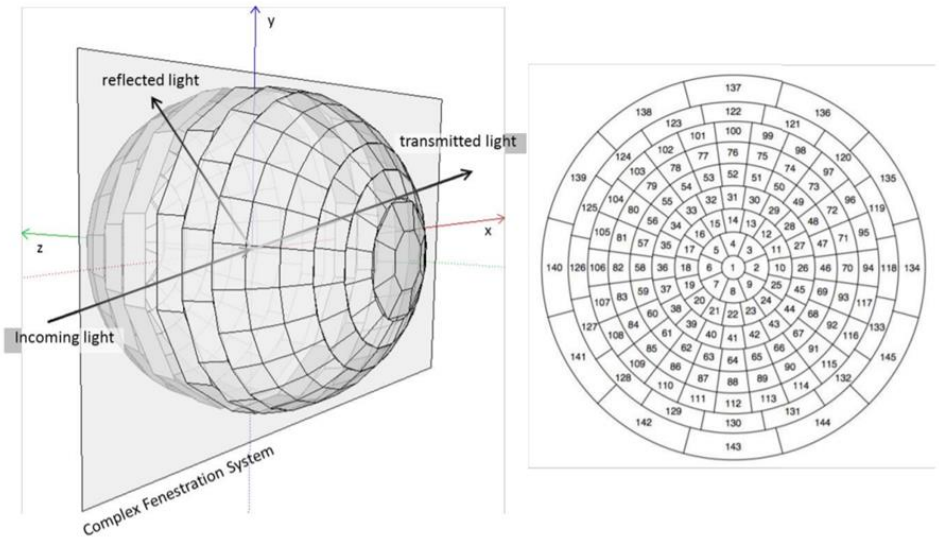
MicroShade®

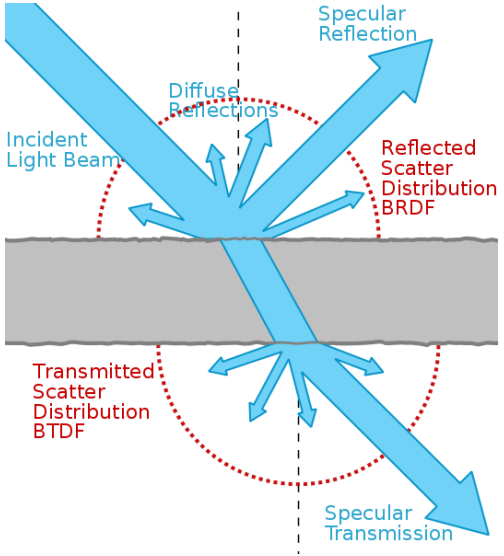
Basic idea

- Shared assumptions: Window definition, geometry, weather data
- Using more up to date methods, than commonly used
- Remove manuel work as much as possible
- Creating the output you need, without further datahandling

Shared assumptions

Window definition - BSDF





Picture: “Glazing system with Transparent Insulation Material for Building Energy Saving and Daylight Comfort” - Yanyi Sun

Shared assumptions

Geometry and weather data

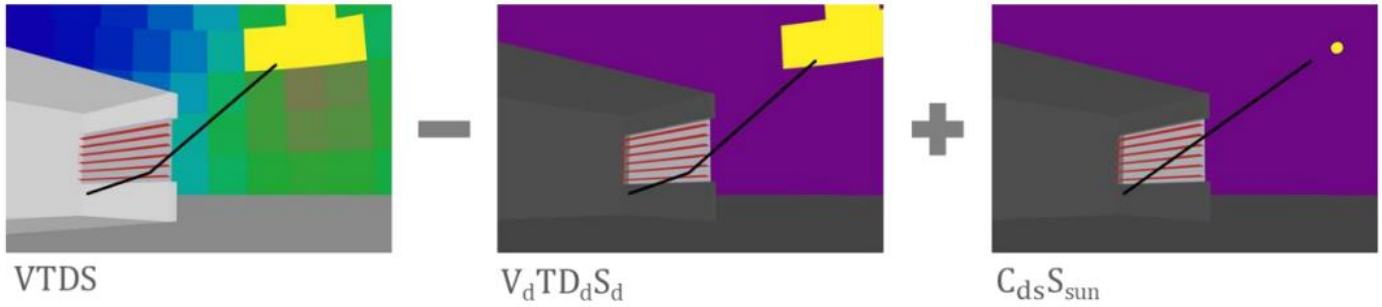
- Geometry accordance by only defining it in one place
- Weather data from the same source

Engines

Micro Shade®

Radiance

Engines
Radiance – 5 PM



Picture: “Daylighting Simulations with Radiance using Matrix-based Methods” - Sarith Subramaniam

Engines
Energy Plus

- Construction:ComplexFenestrationState

- EnergyPlus Energy Management System

Engines

Construction:ComplexFenestrationState

```
!-----------------------------------------------------------------------
!         Complex Fenestration State
!-----------------------------------------------------------------------

Construction:ComplexFenestrationState,
CFS_Window,                                 !- name
LBNLWindow,                                 !- basis type
None,                                       !- basis symmetry type
ThermParam_Glz_62,                          !- window thermal model
CFS_Glz_62_Basis,                           !- basis matrix name
CFS_Glz_62_TfSol,                           !- Tfsol
CFS_Glz_62_RbSol,                           !- Rbsol
CFS_Glz_62_Tfvis,                           !- Tfvis
CFS_Glz_62_Rbvis,                           !- Rbvis
Glass_21013_Layer,                          !- layer 1 name
CFS_Glz_62_Layer_1_fAbs,                    !- fAbs
CFS_Glz_62_Layer_1_bAbs,                    !- bAbs
Gap_9_Glz_62_Layer_1,                       !- gap 1 name
,
,
Shade_27003_Layer,                          !- layer 2 name
CFS_Glz_62_Layer_2_fAbs,                    !- fAbs
CFS_Glz_62_Layer_2_bAbs,                    !- bAbs
Gap_9_Glz_62_Layer_2,                       !- gap 2 name
,
,
Glass_21436_Layer,                          !- layer 3 name
CFS_Glz_62_Layer_3_fAbs,                    !- fAbs
CFS_Glz_62_Layer_3_bAbs,                    !- bAbs
Gap_9_Glz_62_Layer_3,                       !- gap 3 name
,
,
Glass_21436_Layer,                          !- layer 4 name
CFS_Glz_62_Layer_4_fAbs,                    !- fAbs
CFS_Glz_62_Layer_4_bAbs;                    !- bAbs
```

```
!-----------------------------------------------------------------------
!         Matrix Data
!-----------------------------------------------------------------------

Matrix:TwoDimension,
CFS_Glz_62_TfSol,
145,145,
  10.81615,    0.00093,    0.00130,    0.00139,    0.00133,    0.00093,    0.00113,    0.00112,    0.0
  0.00137,    0.00113,    0.00108,    0.00110,    0.00107,    0.00107,    0.00110,    0.00
  0.00143,    0.00126,    0.00119,    0.00130,    0.00106,    0.00093,    0.00097,    0.00102,    0.00
    0.00102,    0.00098,    0.00094,    0.00106,    0.00118,    0.00142,    0.00168,    0.00163,    0.
    0.00120,    0.00127,    0.00136,    0.00125,    0.00119,    0.00116,    0.00116,    0.00117,    0.
    0.00169,    0.00169,    0.00167,    0.00168,    0.00171,    0.00165,    0.00157,    0.00158,    0.
    0.00142,    0.00129,    0.00126,    0.00124,    0.00122,    0.00120,    0.00121,    0.00124,    0.
    0.00169,    0.00167,    0.00169,    0.00172,    0.00175,    0.00179,    0.00178,    0.00165,    0.
```

Interface

Rhino – Grasshopper – Ladybug Tools

Flow of data

Decoupled

Initial data	Engines	Initial output	Data handling	Final output
IGDB (not spectral) IWEC2 Geometry in IDA ICE		IDA ICE interface	Excel	Energy usage Temperatures
”glass” material IWEC1 Geometry in Rhino		.csv	Excel	sDA (EN 17037) UDI

Flow of data
Coupled

Micro Shade®

Initial data

BSDF

EPW

Geometry in Rhino/Grasshopper

Engines

Radiance

EnergyPlus

Data handling and final output

Energy usage
Temperatures

sDA (EN 17037)
UDI

Flow of data

Coupled ideally

Micro Shade®

Define

IGU and shading

Location

Geometry

BSDF database (.xml and .idf)

Radiance

Extracts most up to date weather data

Selecting relevant geomtry faces for you

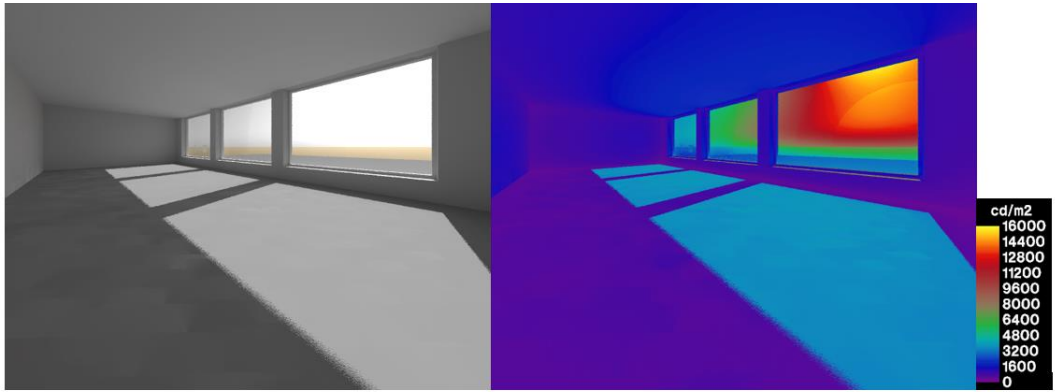
EnergyPlus

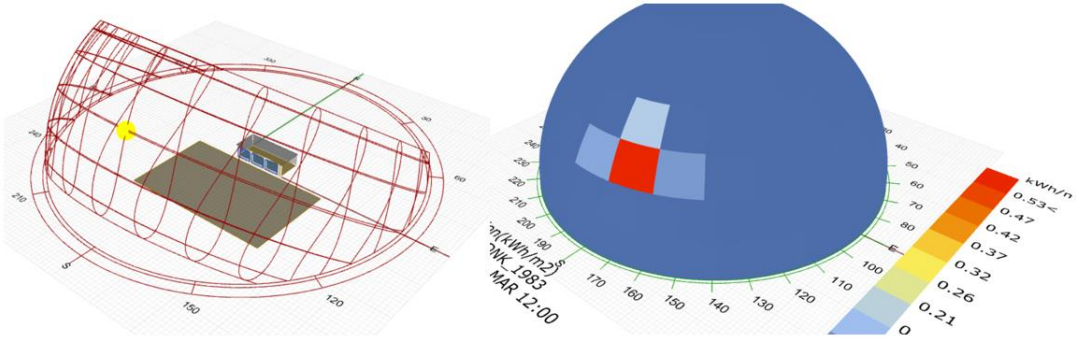
Analyse

Energy usage
Temperatures

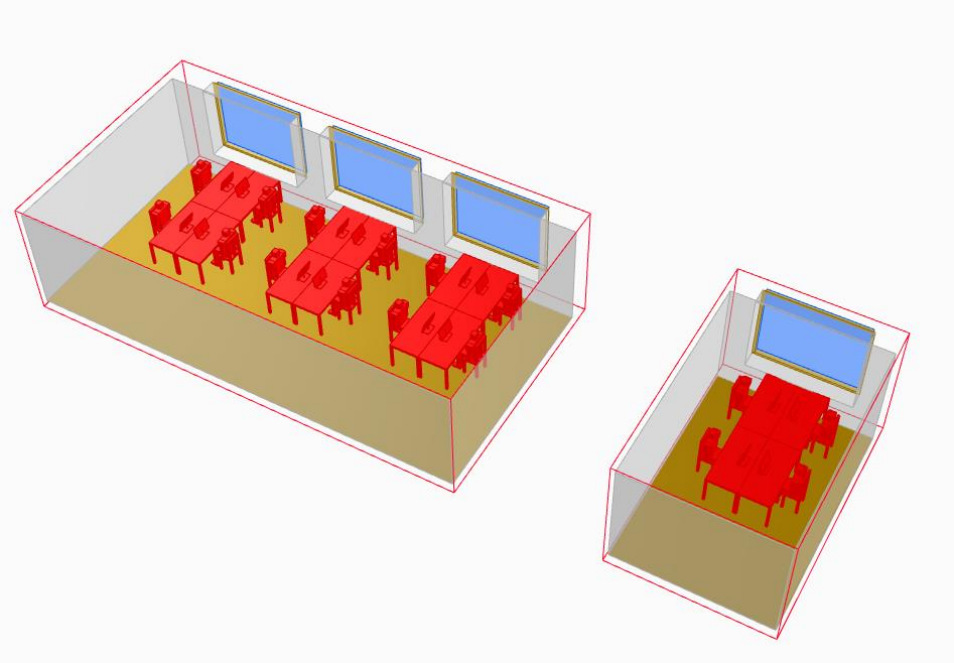
sDA (EN 17037)
UDI

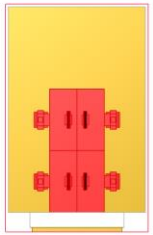
Case study
Overview

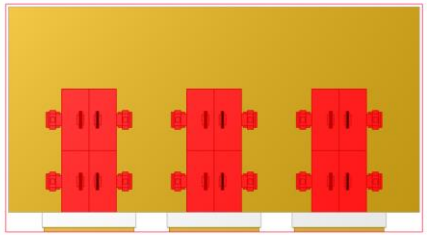


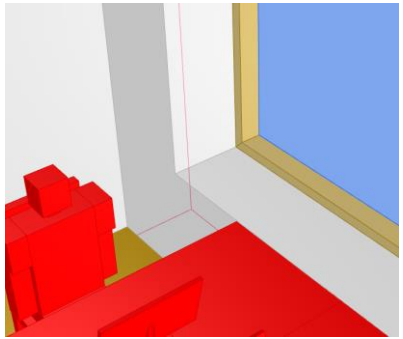


Case study
Geometry



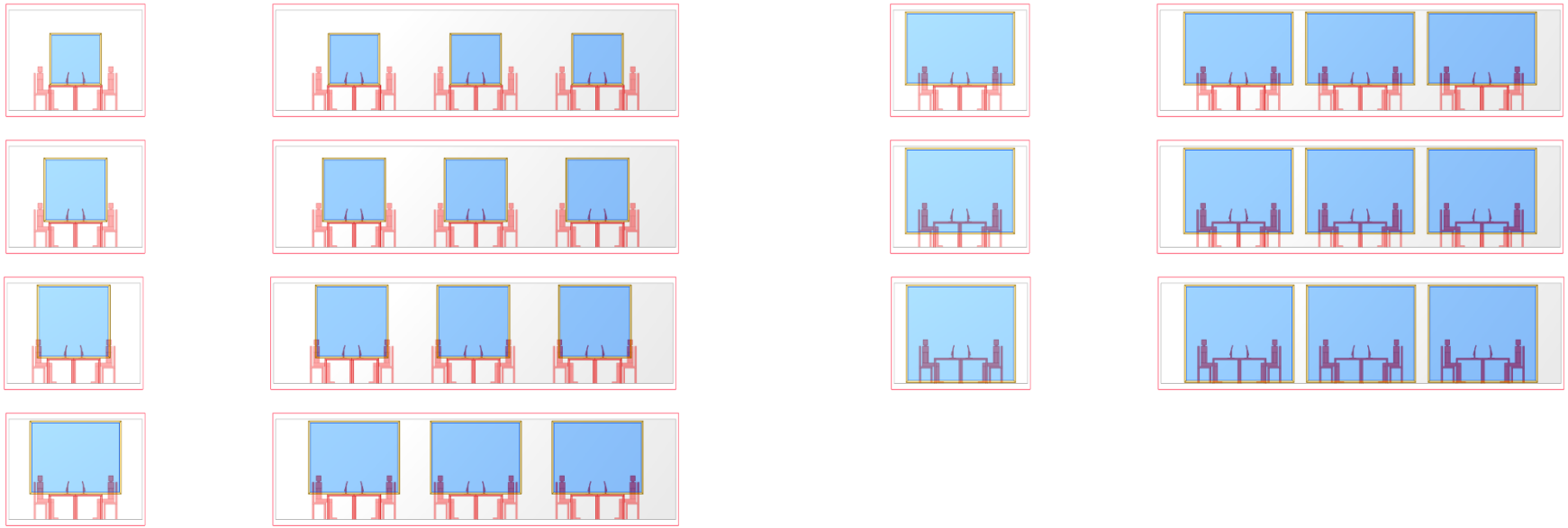




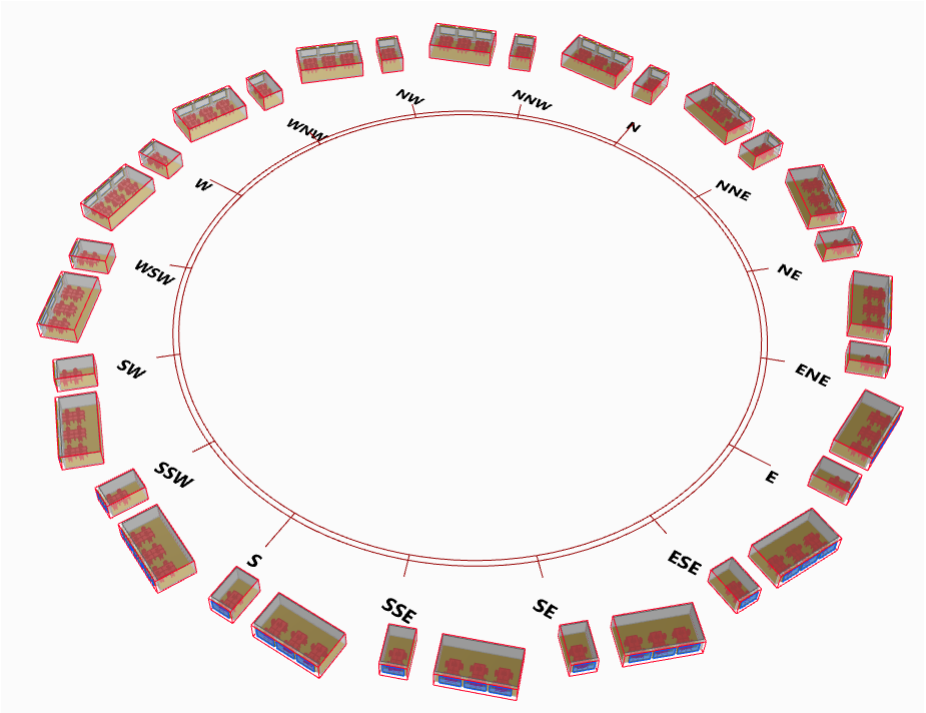


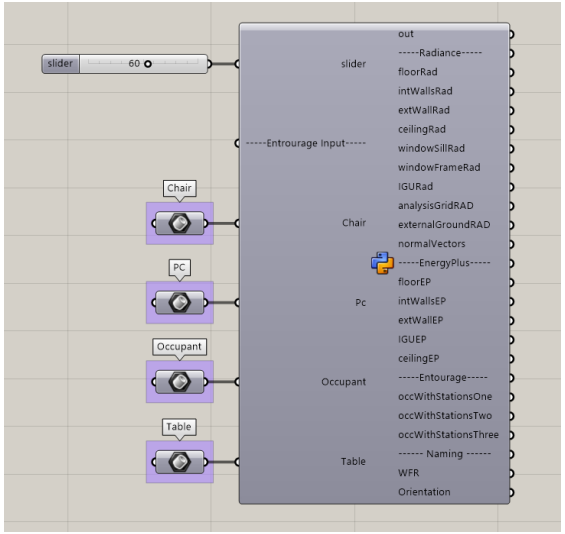
Case study

WFR



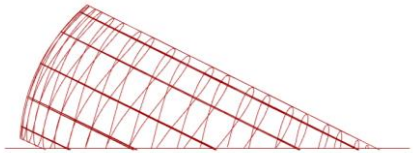
Case study
Orientations



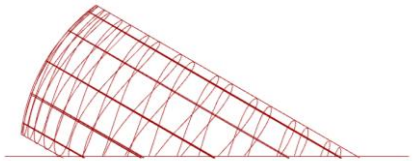


Case study
Locations

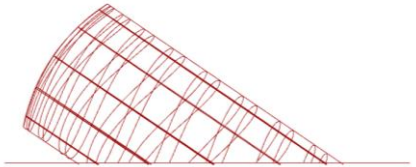
N



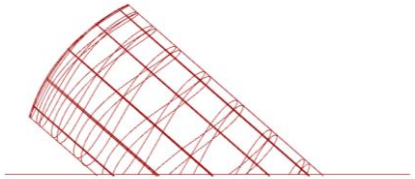
Trondheim



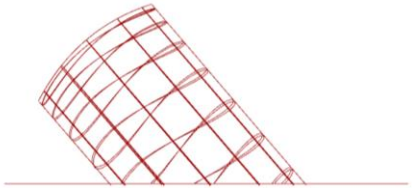
Oslo



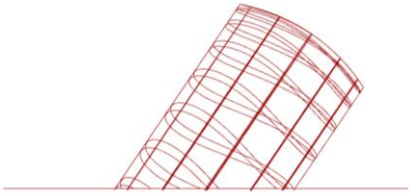
Copenhagen



Stuttgart

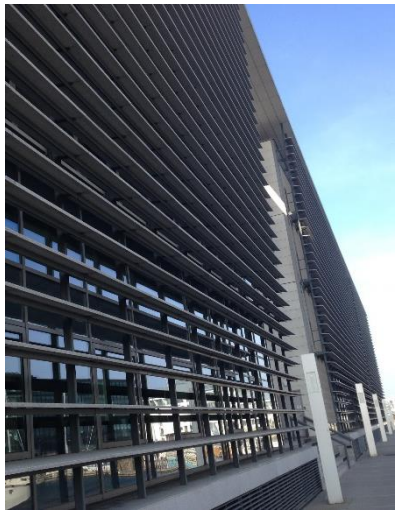


Madrid



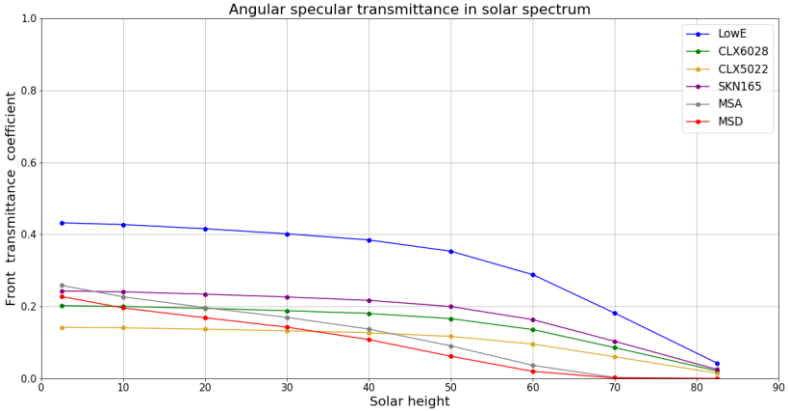
Sydney

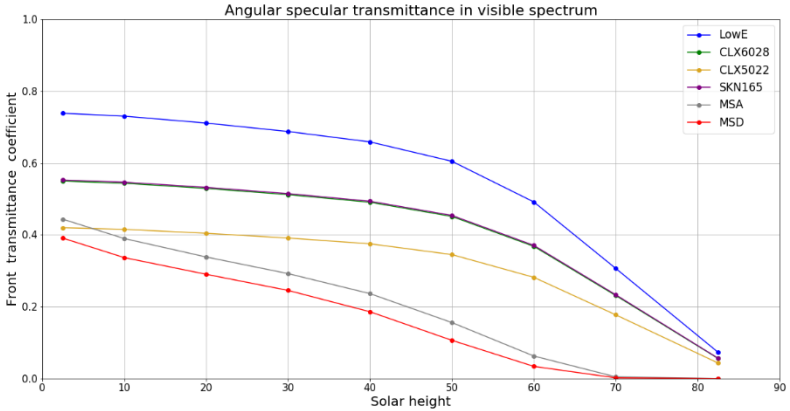
Case study
Shading systems



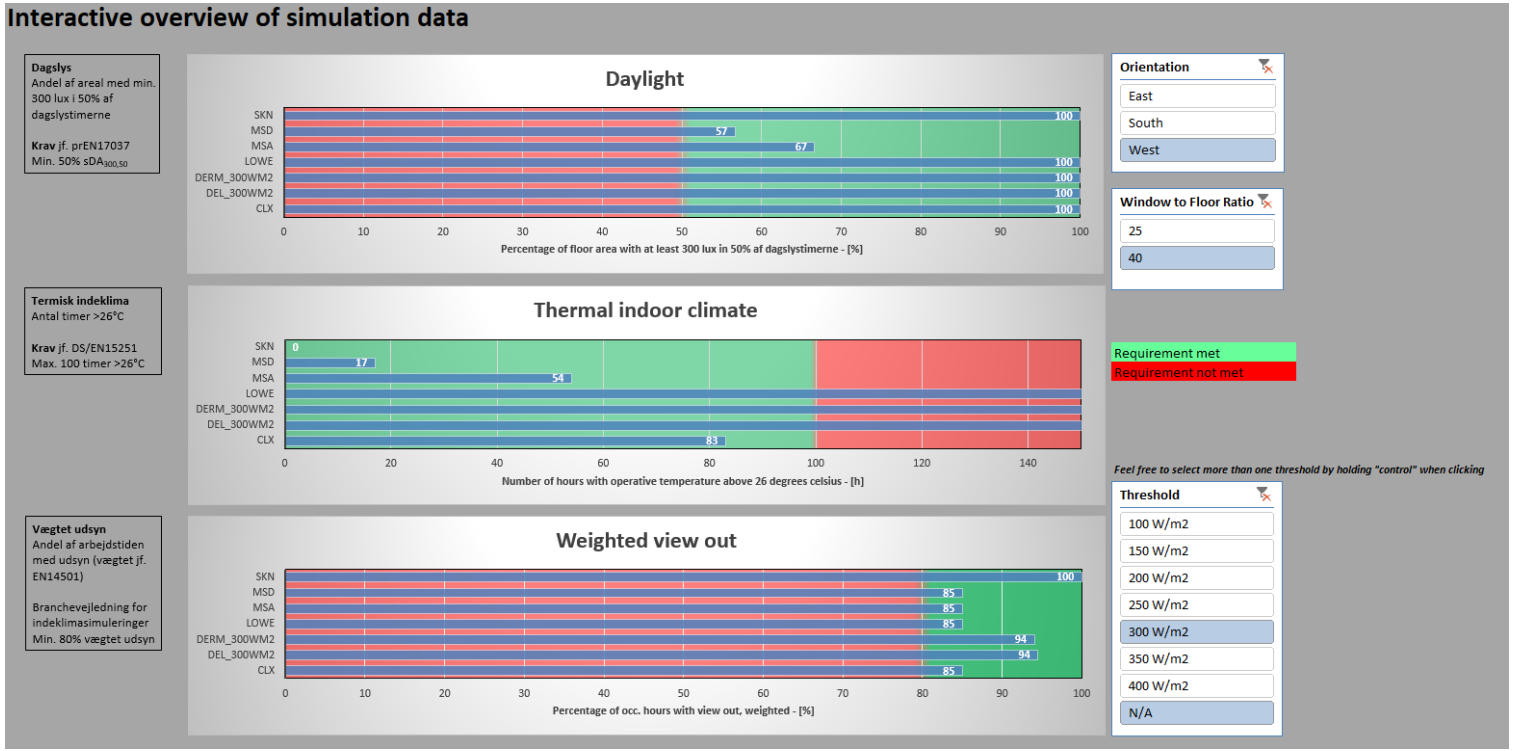
Case study

Passive shading systems





Case study
Presentation layout



Thank you