Daylight Simulation: Purpose and Path

Shrikar Bhave | Transsolar | Radiance Workshop 2013 | NREL

Agenda

Transsolar KlimaEngineering

Who we are?

Integrated design

Approach

Daylighting case-studies

Questions

Who We Are?
Offices

Transsolar KlimaEngineering

Stuttgart

New York

Munich

Paris

Who We Are?

Transsolar KlimaEngineering


DAGUERRE
Chicago


GADGETS
T
P
www.GeigerCars.de


DESIGN
BMW ORACLE Racing


DELIGHT

Approach

Transsolar KlimaEngineering

Can it work?

Does it work?

Can it work better?

Work = meeting the defined goals

Daylighting case-studies

Can it work?

Transsolar KlimaEngineering

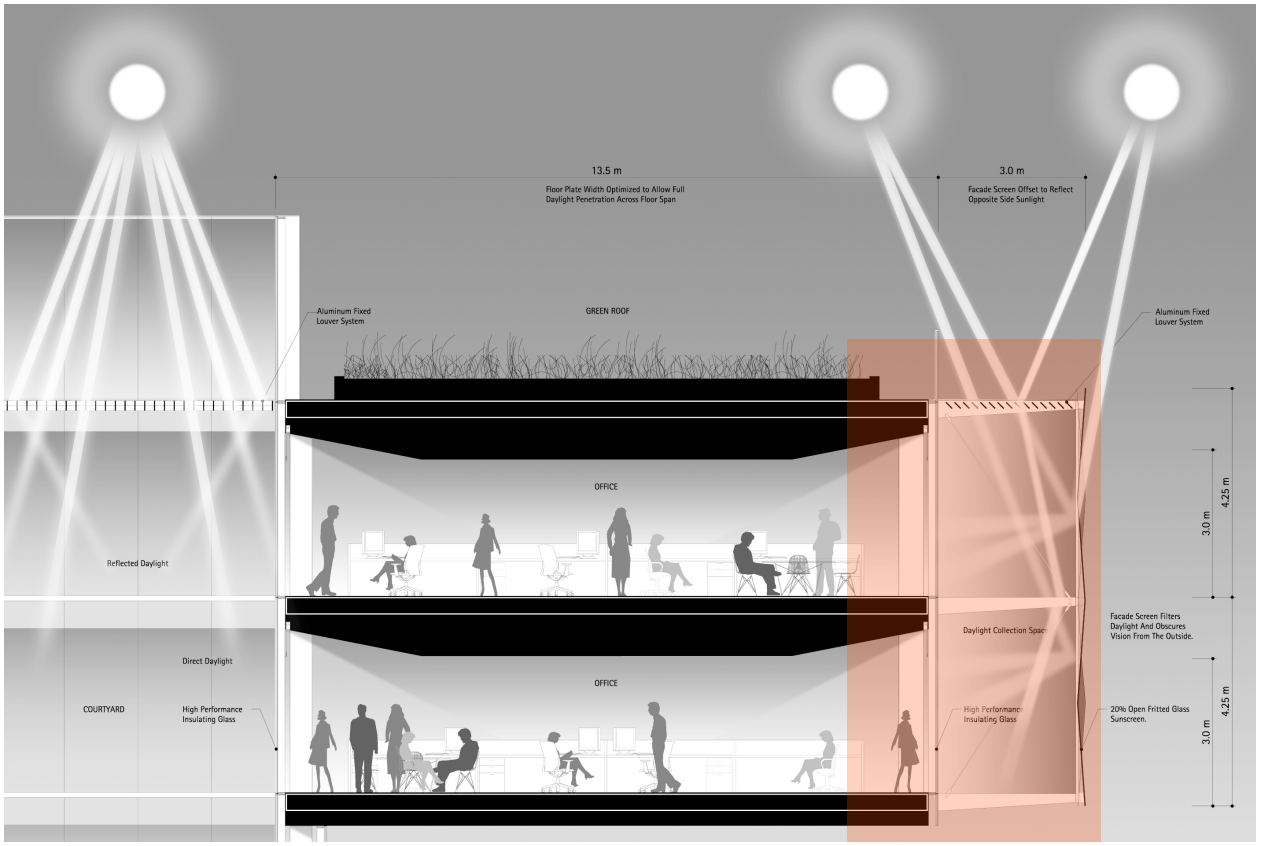
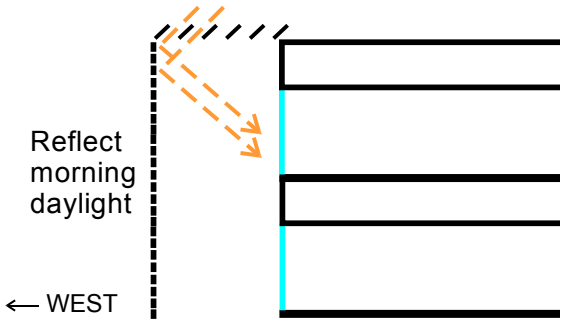


Image Credit: Thomas Phifer and Partners

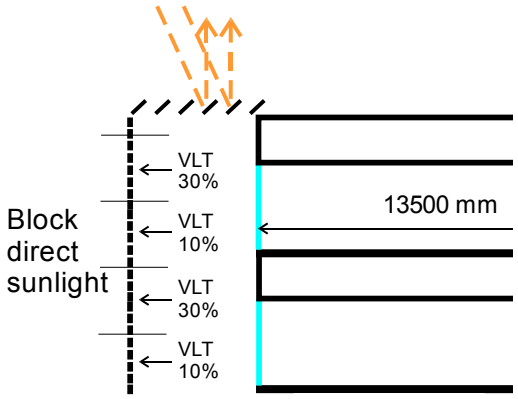
Daylighting case-studies

Can it work?

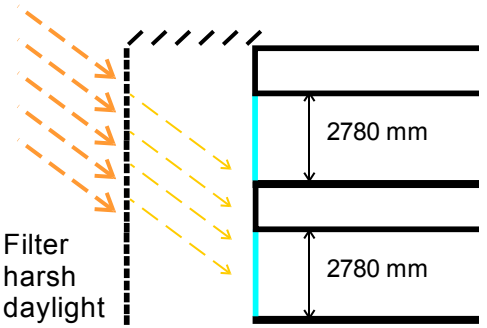
Transsolar KlimaEngineering



Morning



Noon



Afternoon

Daylighting case-studies

Can it work?

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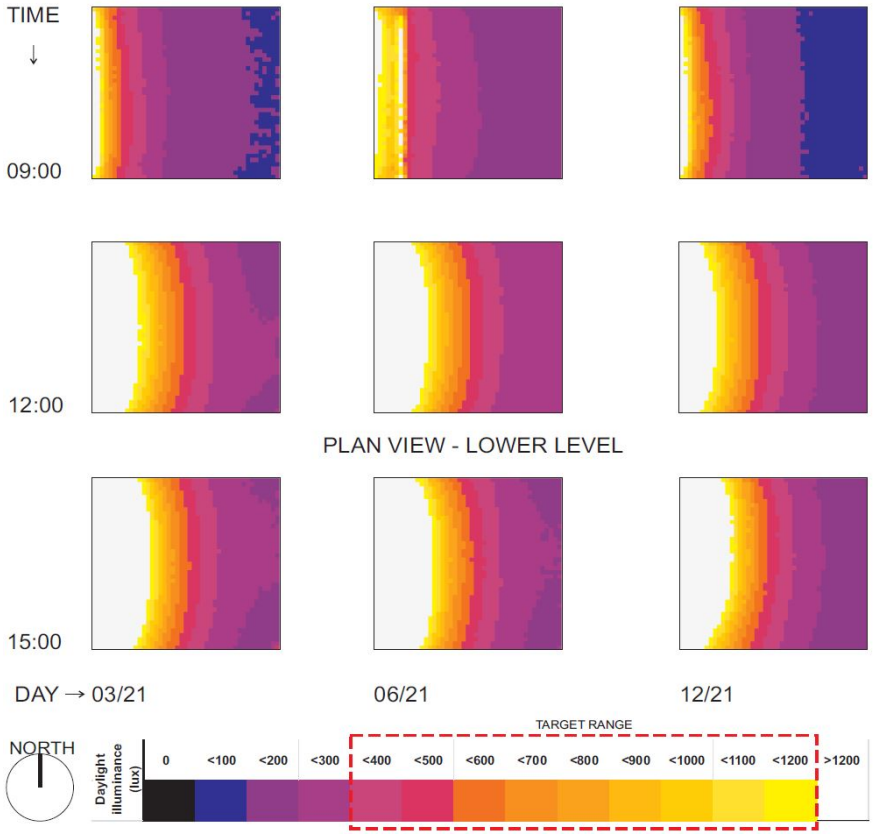
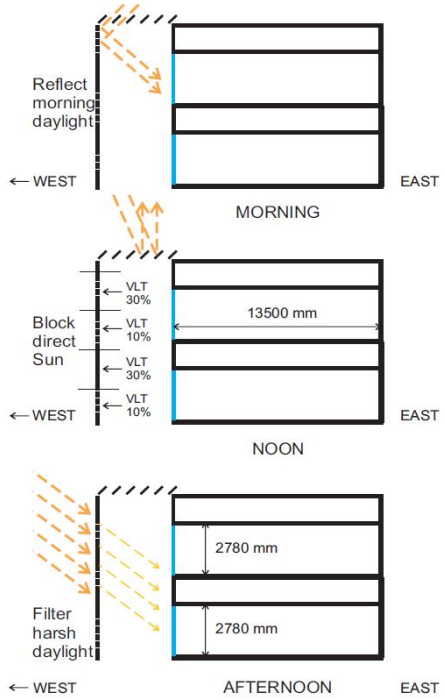
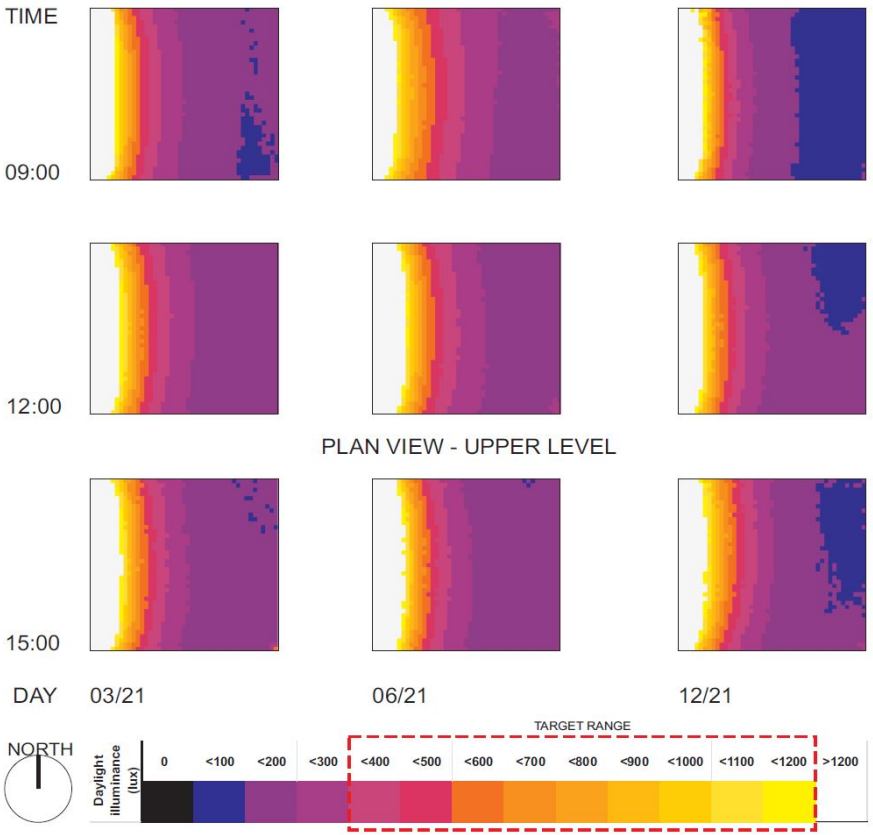


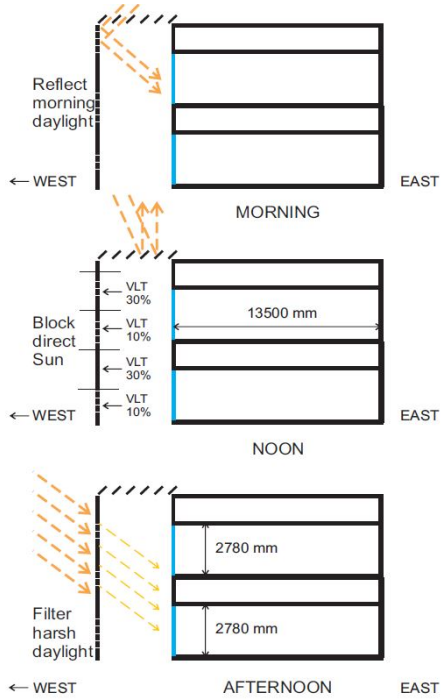


Daylighting case-studies

Can it work?

Transsolar KlimaEngineering





Daylighting case-studies

Can it work?

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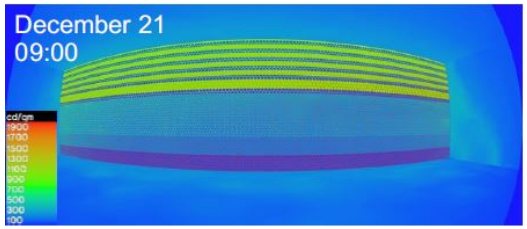
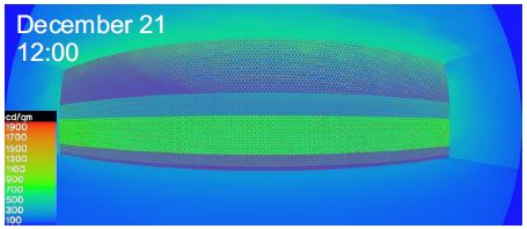
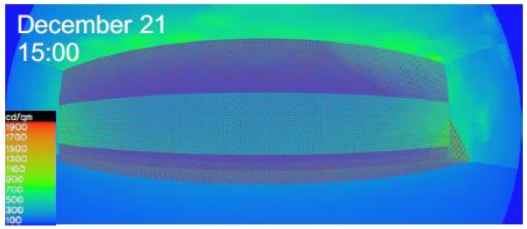
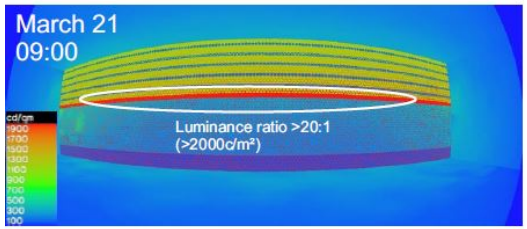
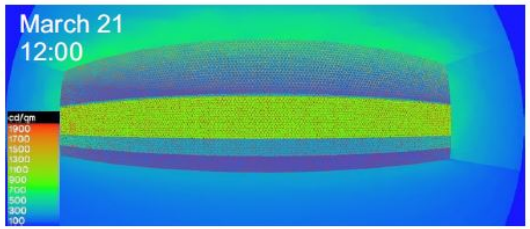
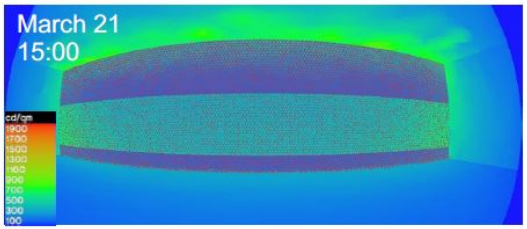


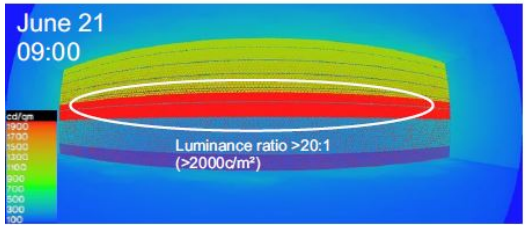


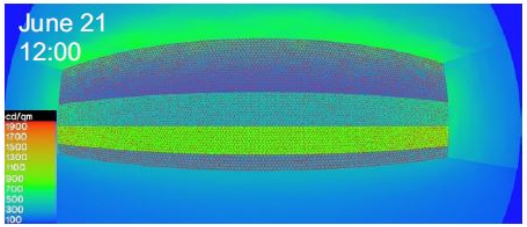


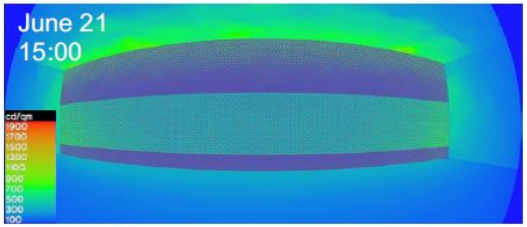












Daylighting case-studies

Does it work?

Transsolar KlimaEngineering

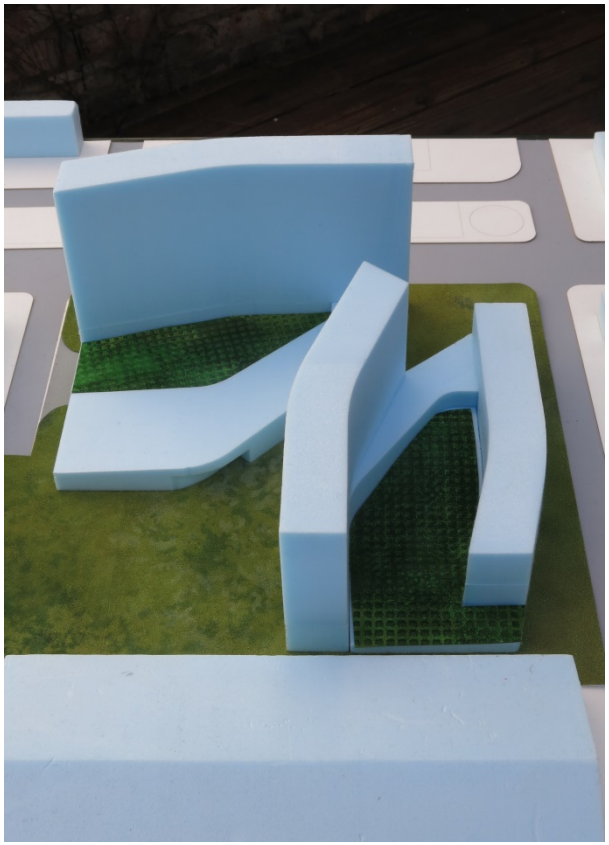
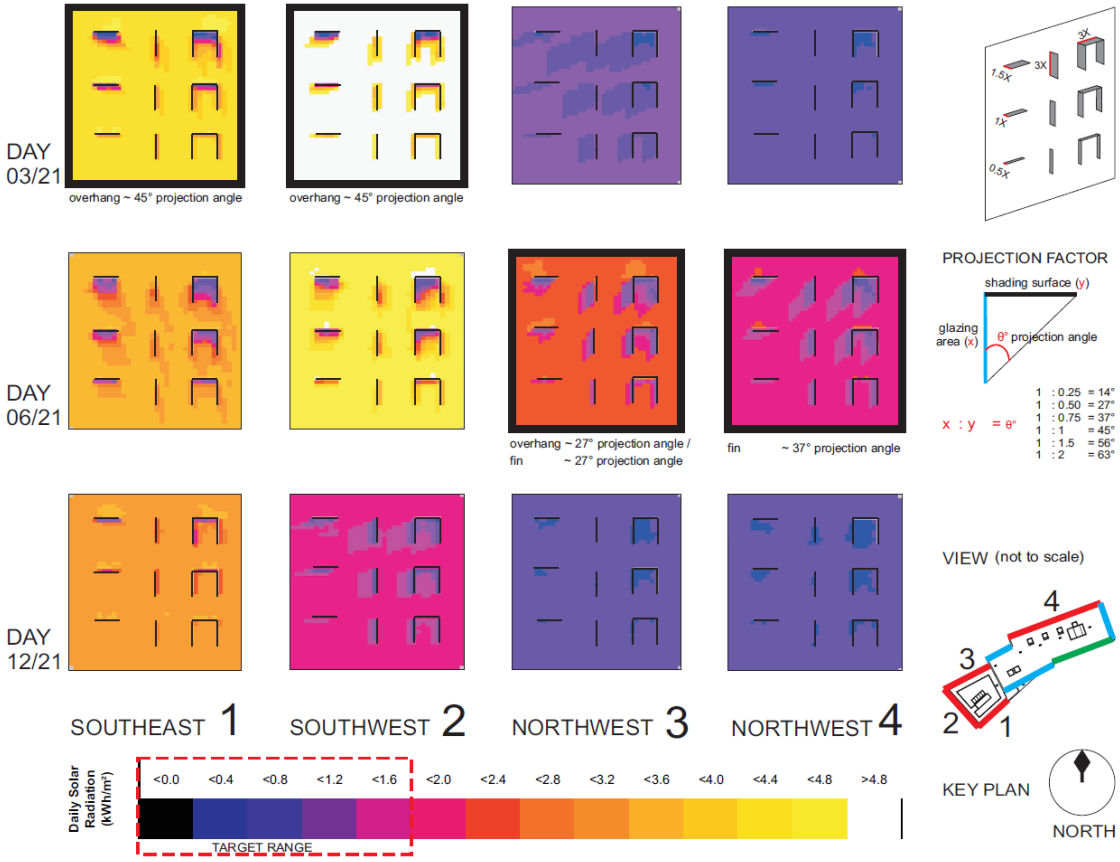


Image Credit: Studio Gang Architects

Daylighting case-studies

Does it work?

Transsolar KlimaEngineering



PROJECTION FACTOR

x : y	= θ°
1 : 0.25	= 14°
1 : 0.50	= 27°
1 : 0.75	= 37°
1 : 1	= 45°
1 : 1.5	= 56°
1 : 2	= 63°

VIEW (not to scale)

KEY PLAN

Image Credit: Studio Gang Architects

Daylighting case-studies

Does it work?

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CAUTION: Results from this tool is highly dependent on a glazing SHGC of 0.29	Change only numbers in red and blue font Goal is to have **Total Transmission** less than **Maximum Transmission**

Double Dorm WWR: 49%

Room Height	Room Width	Window Type	Window Height	Window Width	Current % of window	New % of window	Projection factor	Transmission from Screen or Frit	Net Transmission Factor	
9.8	13.5	proj shd	8.08	3.00	0.38	0	0	100%	0%	
		screened	0.00	0.00	0.00	0.28830469	0	75%	22%	
		fritted	8.08	0.00	0.00	0.25289885	0	73%	19%	*40% frit*
		vision	8.08	5	0.63	0.46417055	0	100%	46%	*0% frit*
		49%	8.08	8.00						
								Total Transmission:	**87%**	
								MaximumTransmission Allowed:	**86%**	

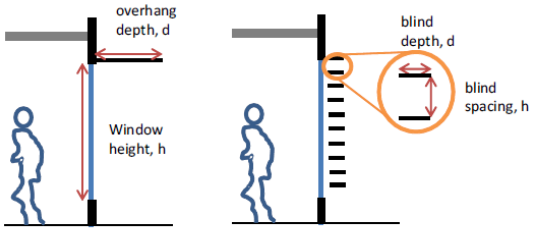
Single Dorm WWR: 34%

Room Height	Room Width	Window Type	Window Height	Window Width	Current % of window	New % of window	Projection factor	Transmission from Screen or Frit	Net Transmission Factor	
9.8	9	proj shd	8.08	1.75	0.47	0	0	100%	0%	
		screened	0.00	0.00	0.00	0.58647757	0	75%	44%	
		fritted	8.08	0.00	0.00	0	0	100%	0%	*0% frit*
		vision	8.08	1.95	0.53	0.41352243	0	100%	41%	*0% frit*
		34%	8.08	3.70						
								Total Transmission:	85%	
								MaximumTransmission Allowed:	**98%**	

Lounge WWR: 90%

Room Height	Room Width	Window Type	Window Height	Window Width	Current % of window	New % of window	Projection factor	Transmission from Screen or Frit	Net Transmission Factor	
24.3	38.2	proj shd	21.8	0.0	0.00	0.25	0	100%	25%	
		screened	0.0	0.0	0.00	0.25	0	50%	13%	
		fritted	21.8	0.0	0.00	0.25	0	47%	12%	*80% frit*
		vision	21.8	38.2	1.00	0.25	0	73%	18%	*40% frit*
		90%	21.8	38.2						
								Total Transmission:	**68%**	
								MaximumTransmission Allowed:	**49%**	

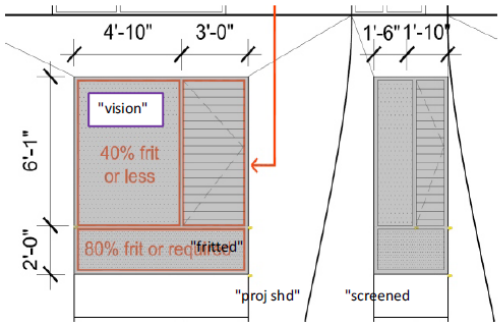
Projection Factor:
(a) the ratio of projected overhang to glazing height OR
(b) the ratio of blind depth to blind spacing
(b) the ratio of blind depth to blind spacing



(a) PF = d/h
this example: PF =0.5

(b) PF = d/h
this example: PF =1

Window Type Names



Daylighting case-studies

Does it work?

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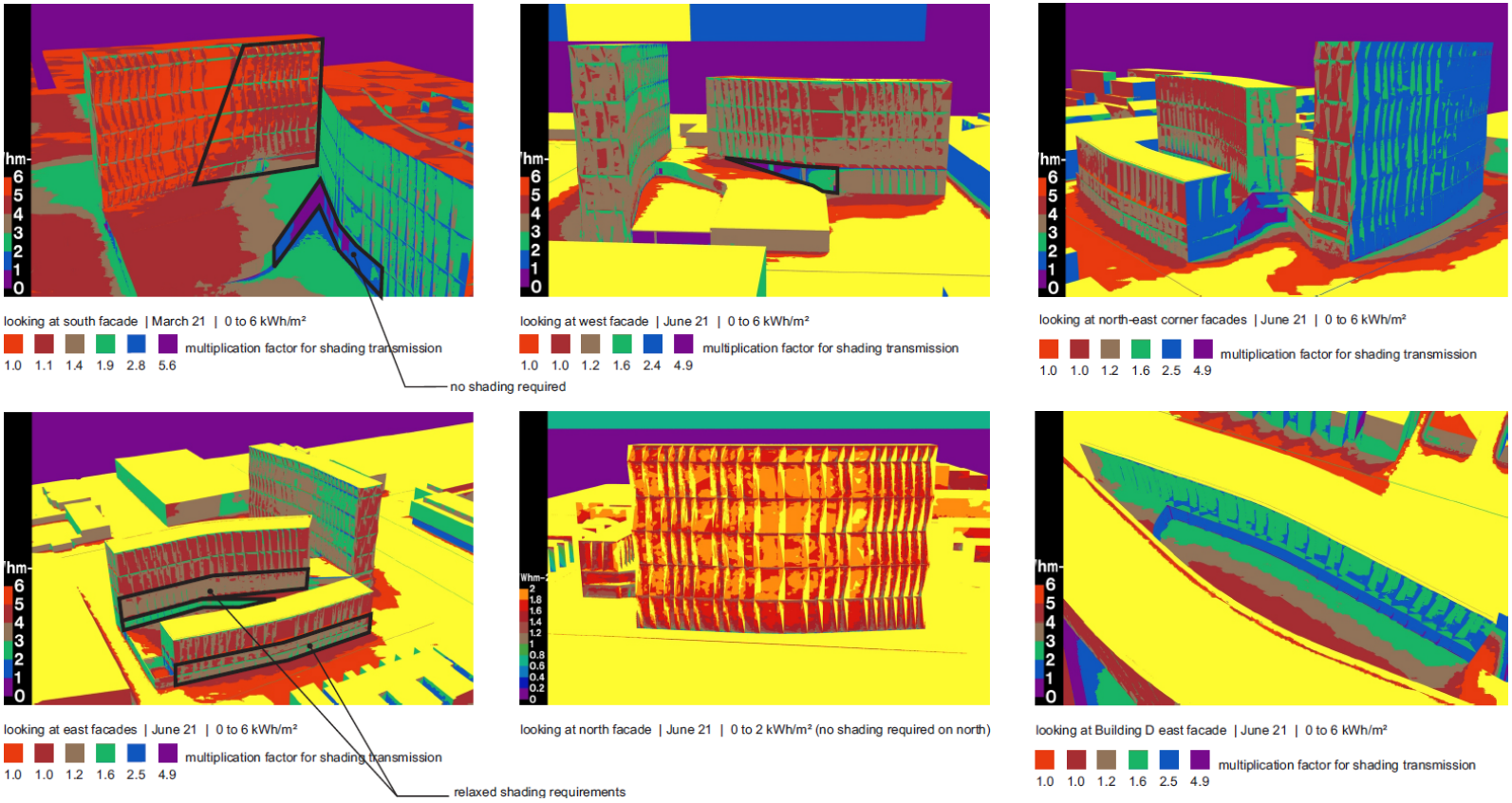

Daylighting case-studies

Can it work better?

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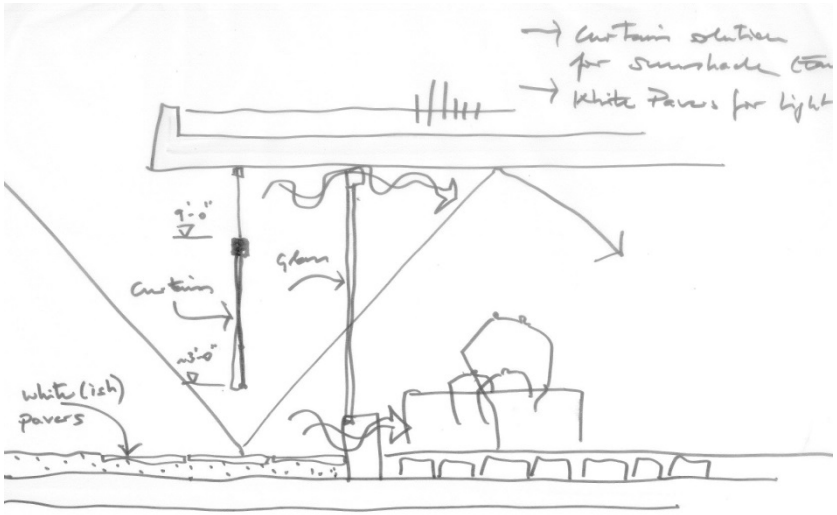

Daylighting case-studies

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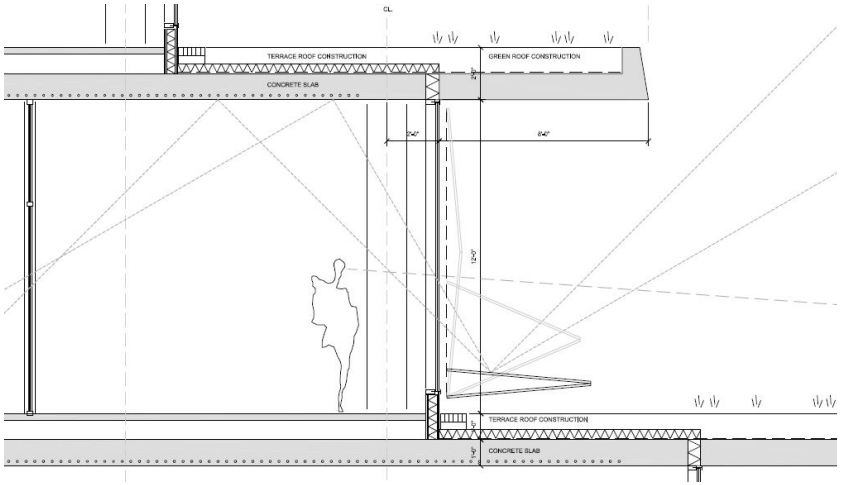
KlimaEngineering



Daylighting case-studies

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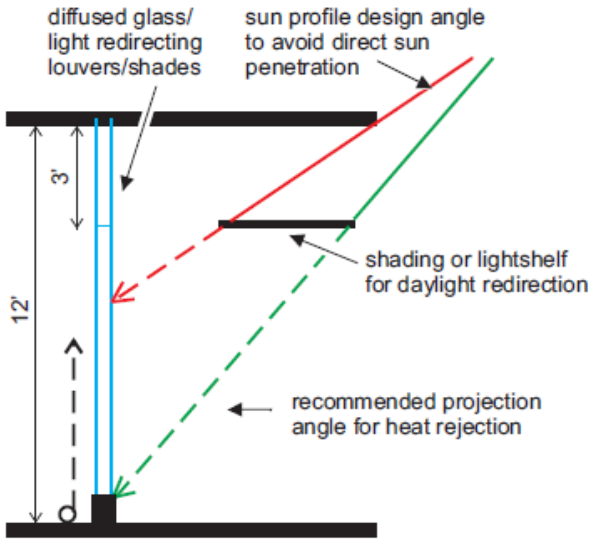
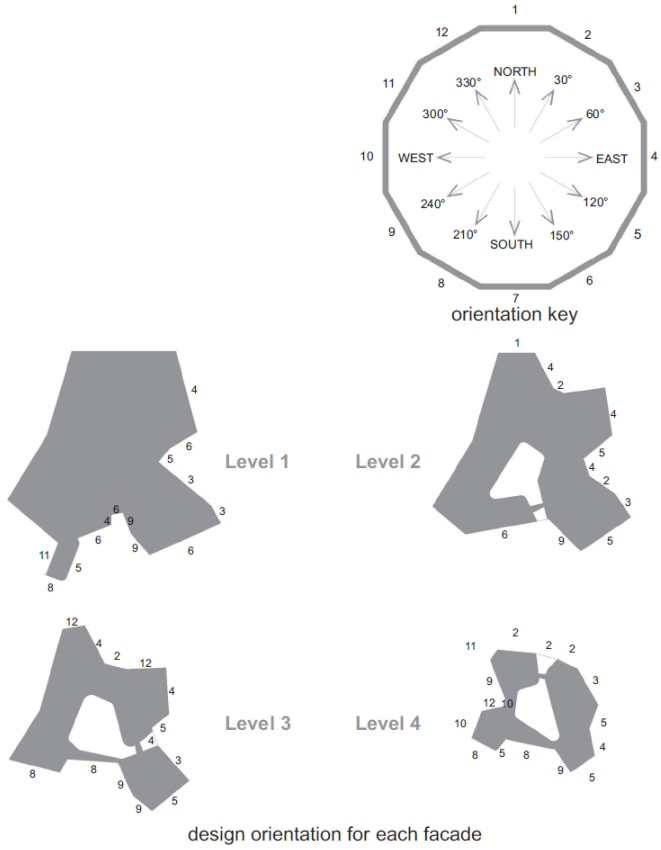


shading concept



orientation key

design orientation for each facade

Daylighting case-studies

Can it work better?

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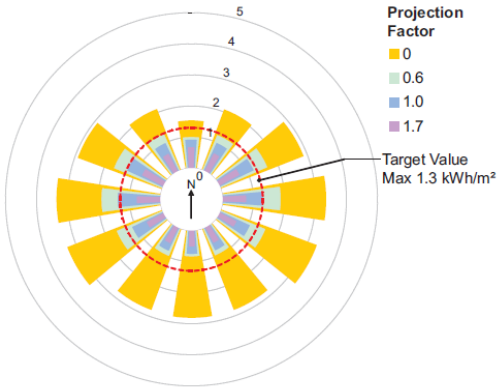
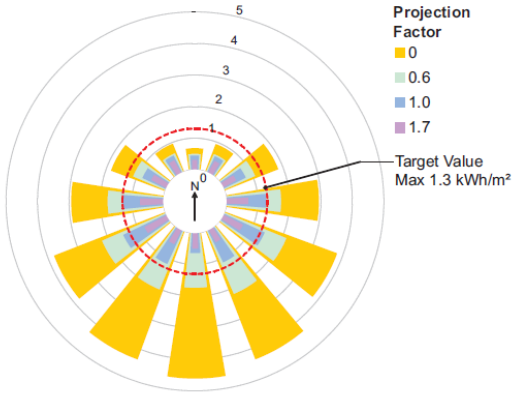
Daily Solar Insolation (kWh/m²)

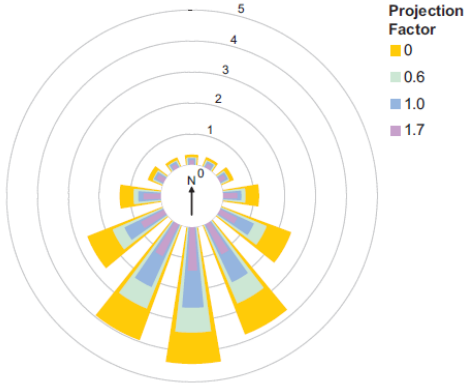
Summer Solstice (June 21)

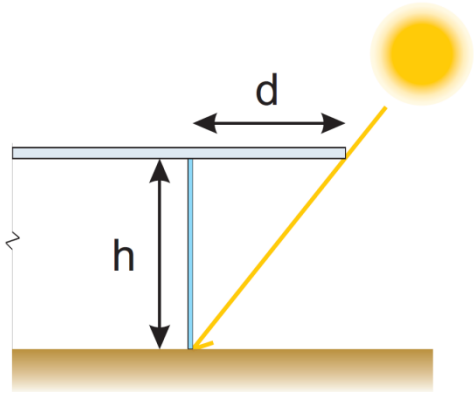


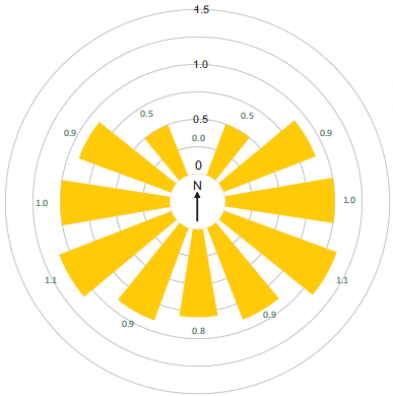
Equinox (September 21)



Winter Solstice (December 21)







Daylighting case-studies

Can it work better?

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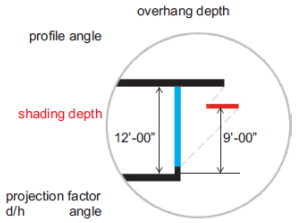
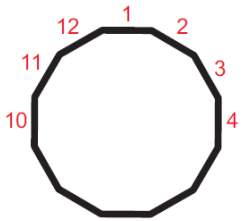


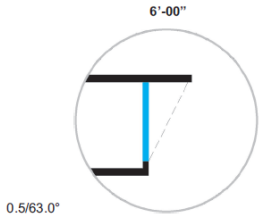
graphic key



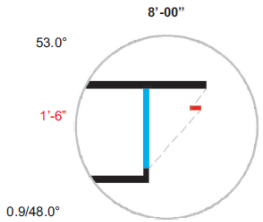
orientation key

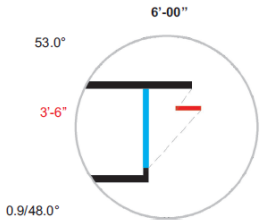
NO OVERHANG OR SHADING REQUIRED FOR NORTH

1



2/12

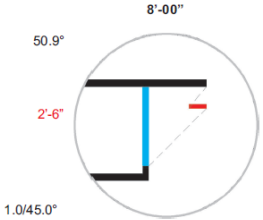


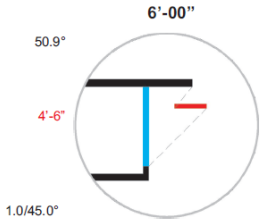


operable interior shading required before 9:00 AM for **facade 3** between Sept 21st and March 21st

operable interior shading required after 03:00 PM for **facade 11** between Sept 21st and March 21st

3/11





operable interior shading required before 10:00 AM for **facade 4** between Sept 21st and March 21st

operable interior shading required after 02:00 PM for **facade 10** between Sept 21st and March 21st

4/10

Daylighting case-studies

Can it work better?

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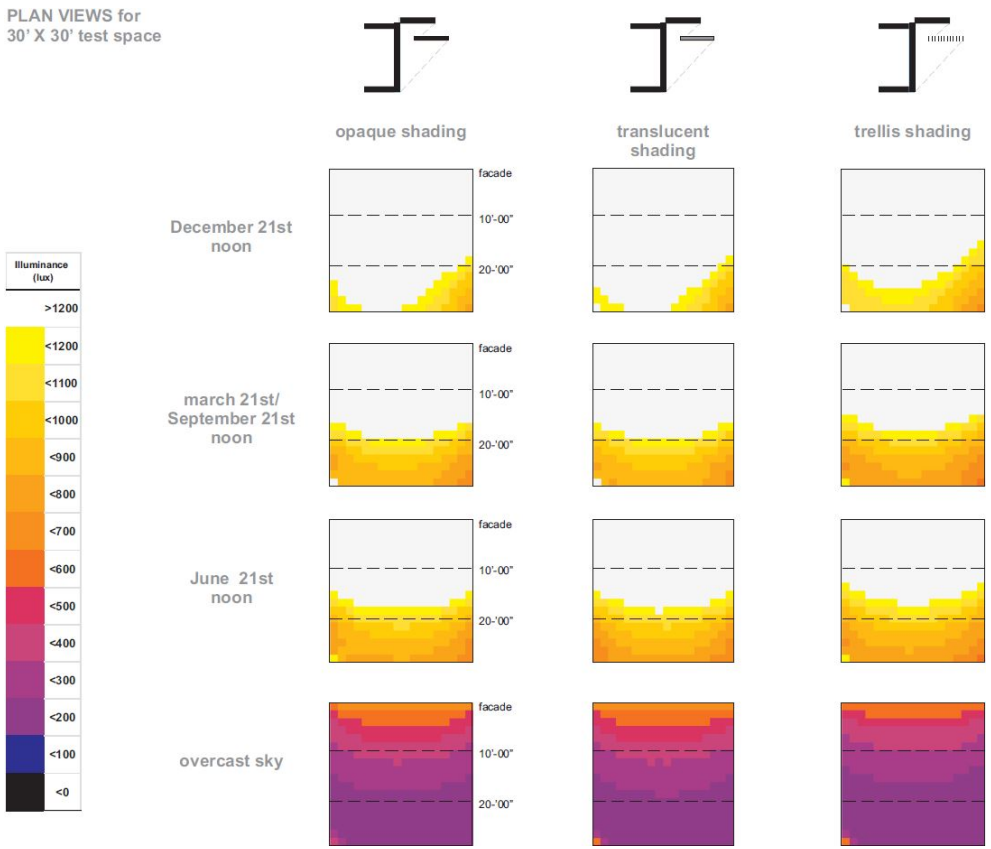

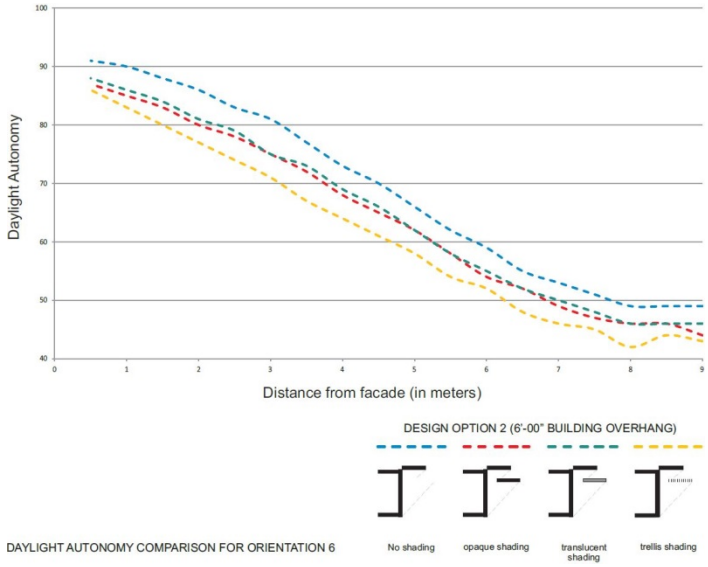

Daylighting case-studies

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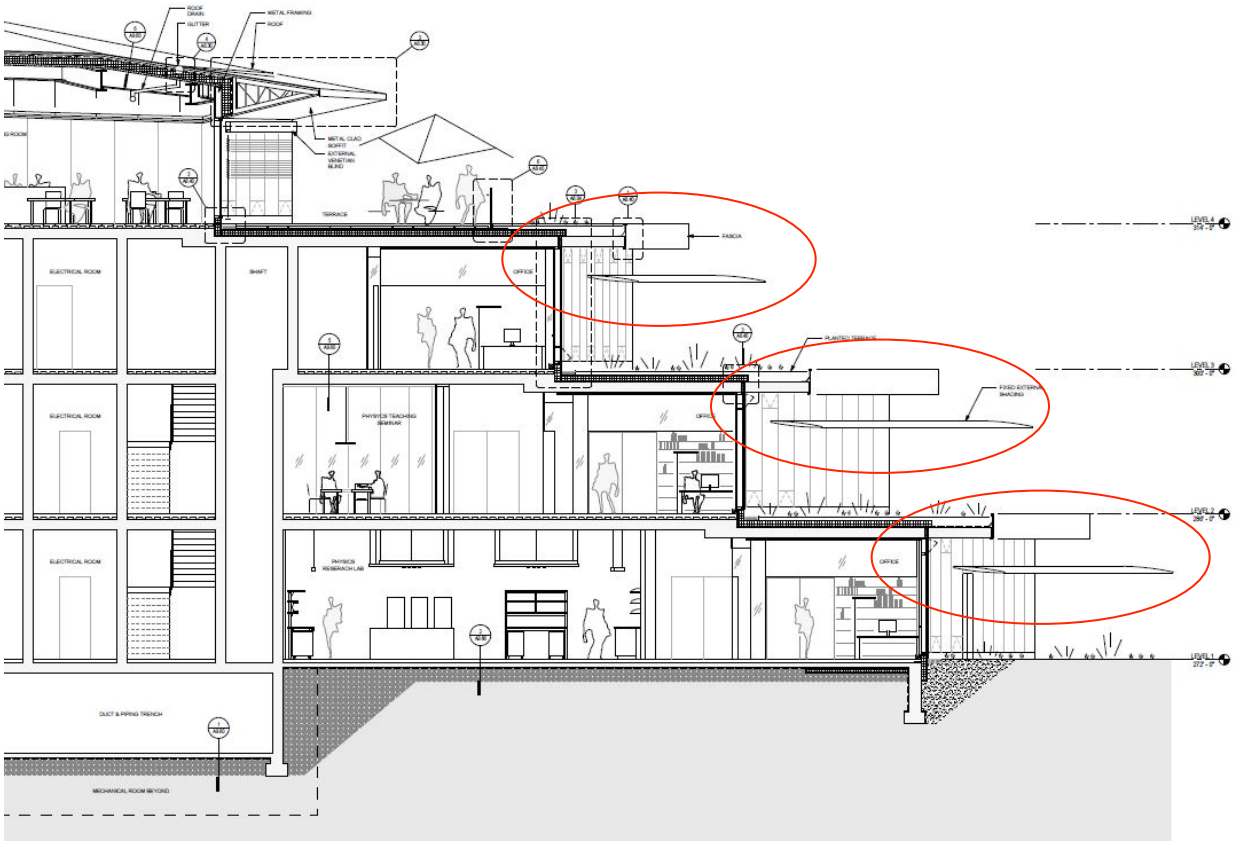

Daylighting case-studies

Can it work better?

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Image Credit: Behnisch Architekten

Daylighting case-studies

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No Direct Sun-penetration

Daylight < 750lux/500lux

Daylighting case-studies

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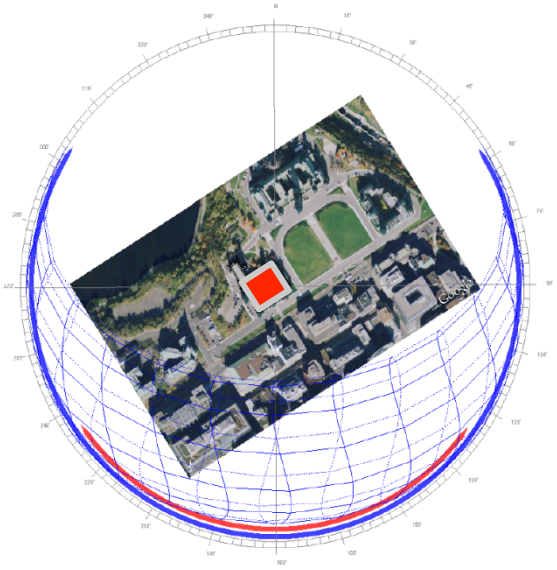
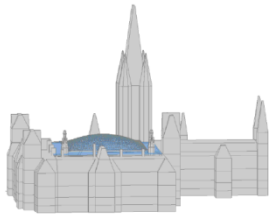
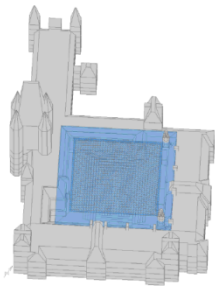
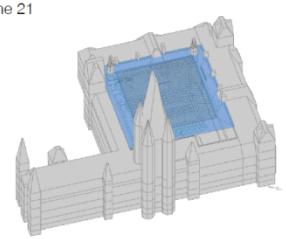




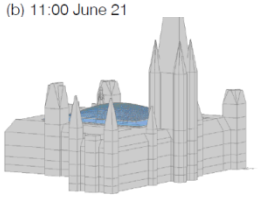
(a) 05:00 June 21



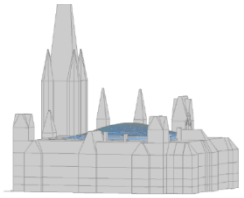
(b) 11:00 June 21



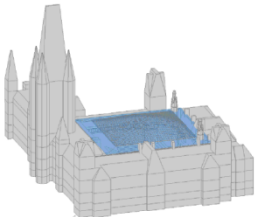
(c) 15:00 June 21



(d) 19:00 June 21



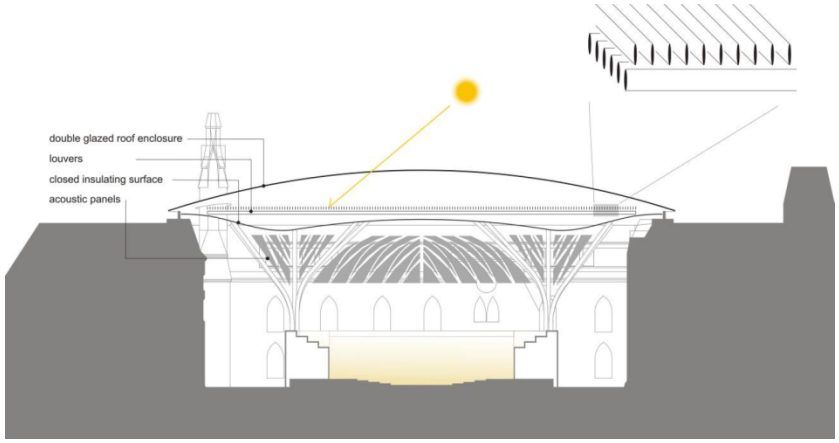
(a) 08:00 December 21

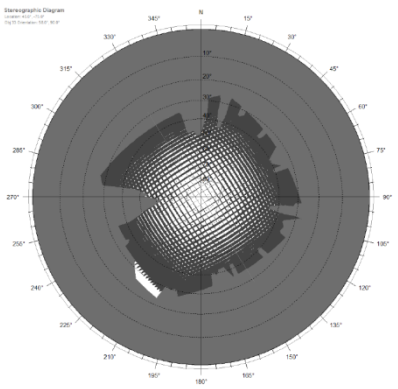


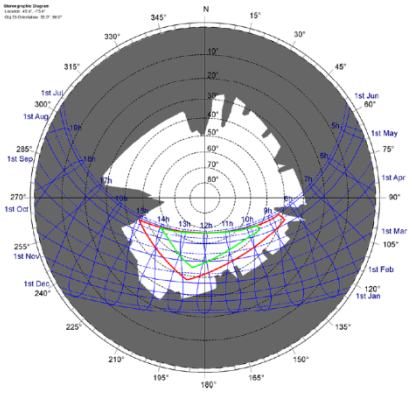
(b) 11:00 December 21

Daylighting case-studies

Transsolar
KlimaEngineering

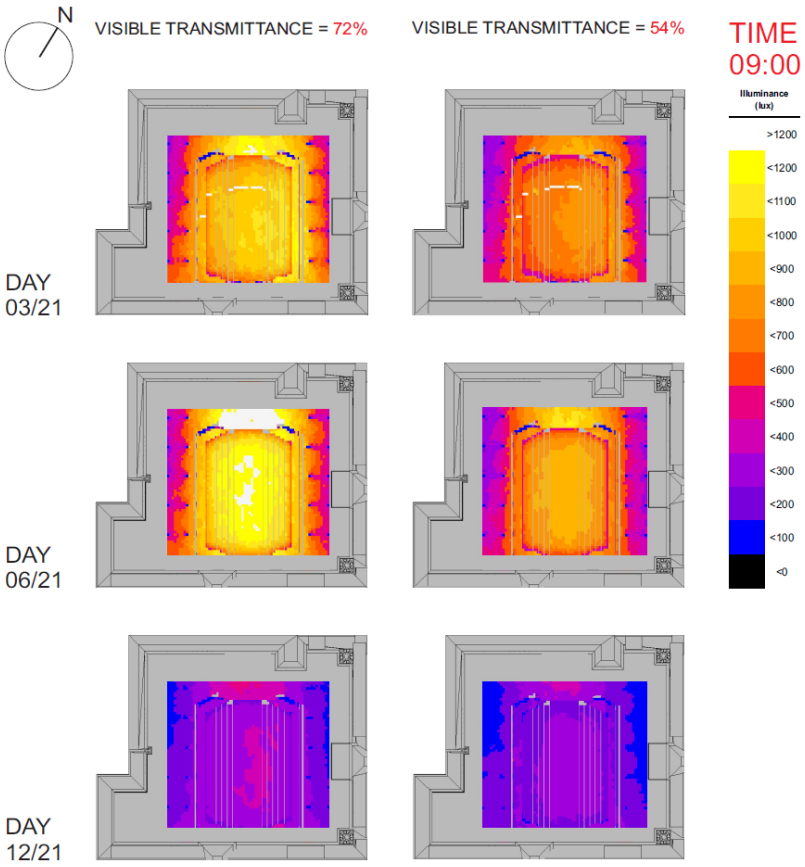






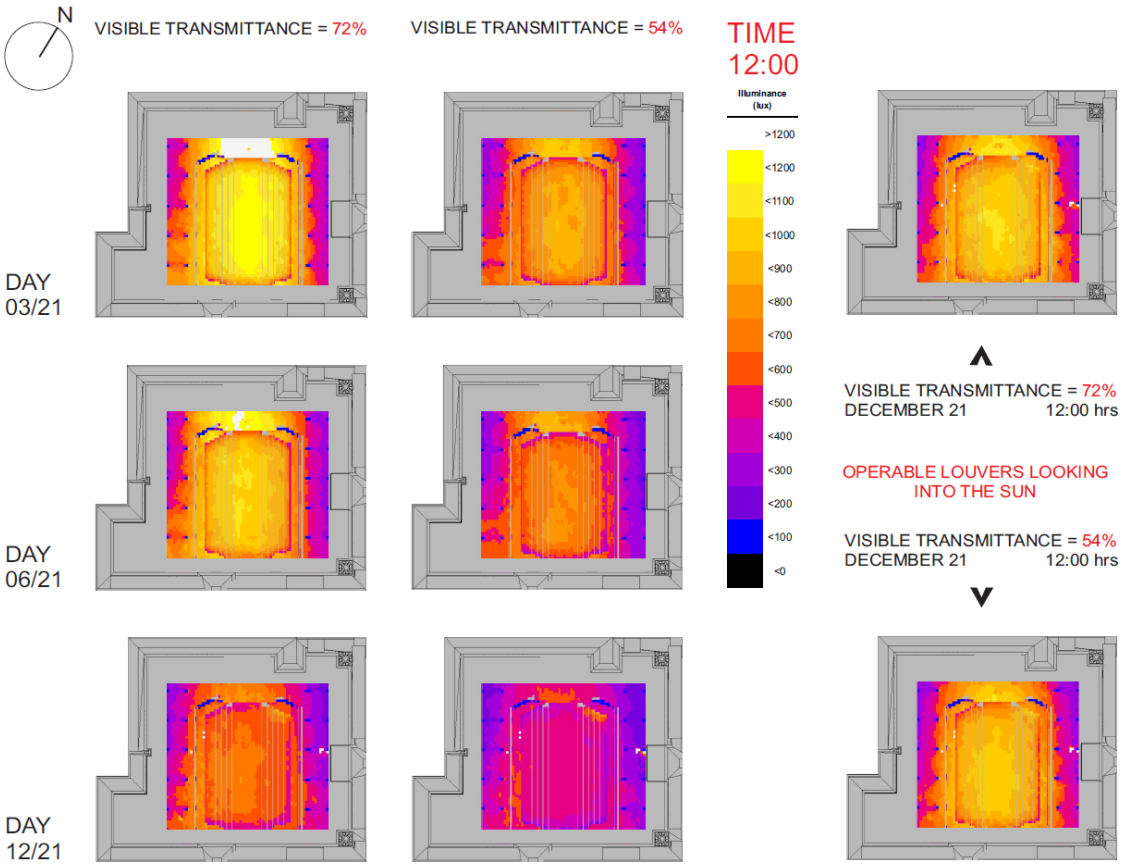
Daylighting case-studies

Transsolar
KlimaEngineering



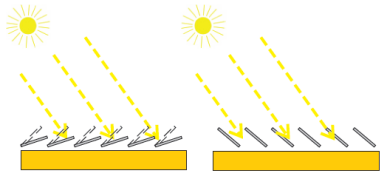
Daylighting case-studies

Transsolar
KlimaEngineering



Daylighting case-studies

Transsolar KlimaEngineering

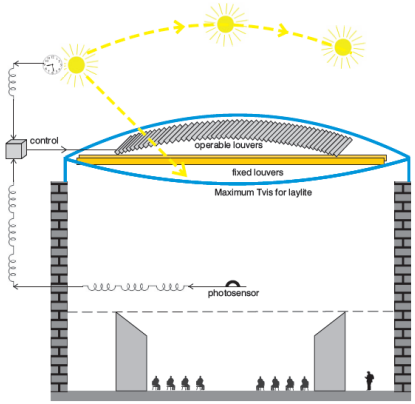


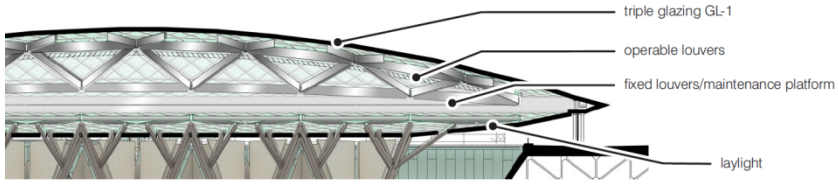
June 12:00

Louvers rotate closed beyond required cut-off angle to reduce daylight to desired level

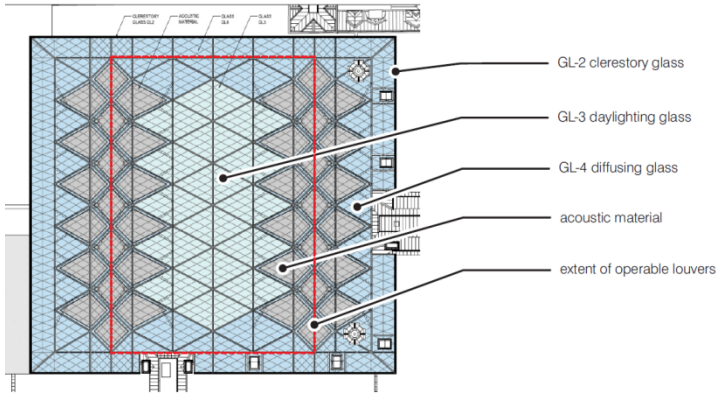
December 12:00

Louvers rotate to face into the sun to increase daylight. Fixed louvers provide cut-off of direct sunlight.





Roof elements with daylighting function



Laylight components

Future Developments

Transsolar KlimaEngineering

Rhino +

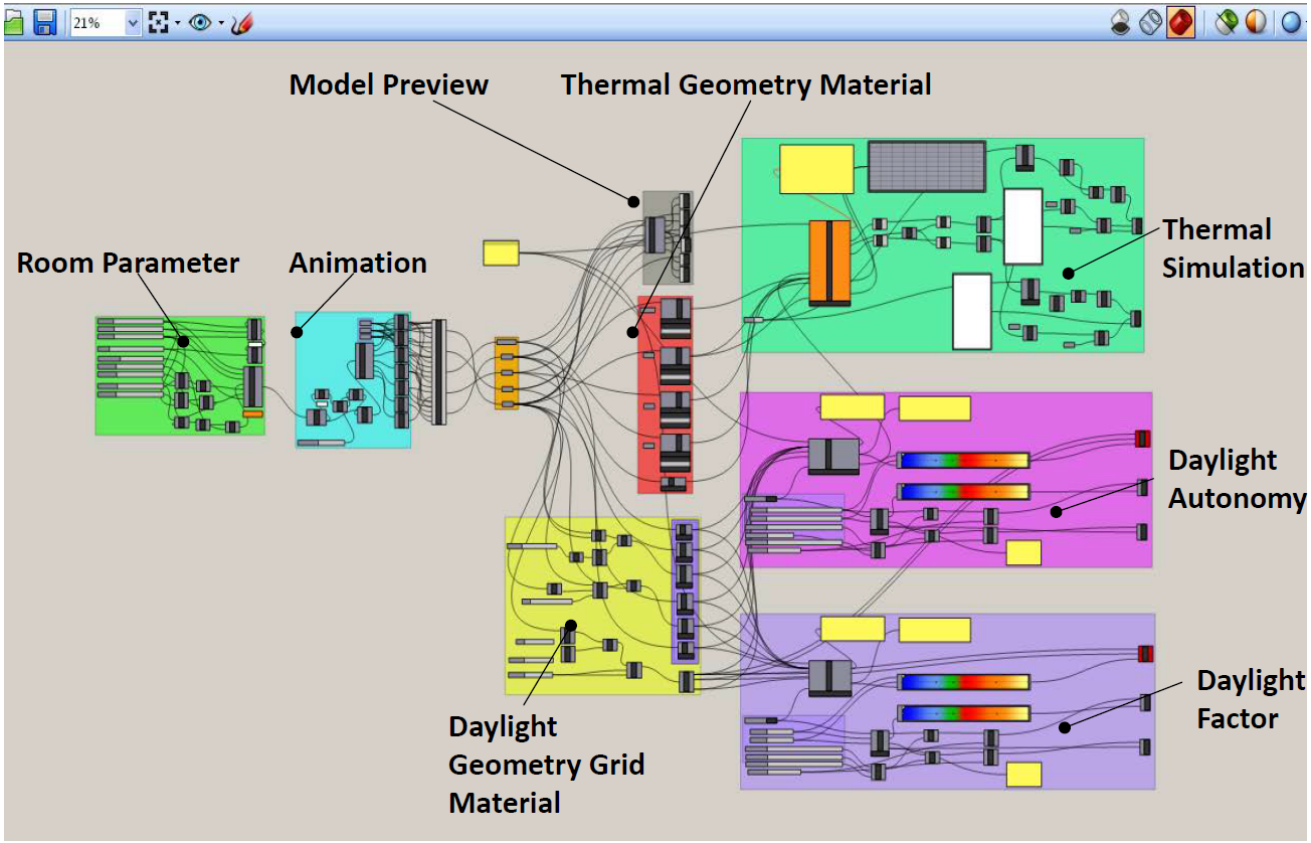
Grasshopper +

DIVA + VIPER +

TRNSYS

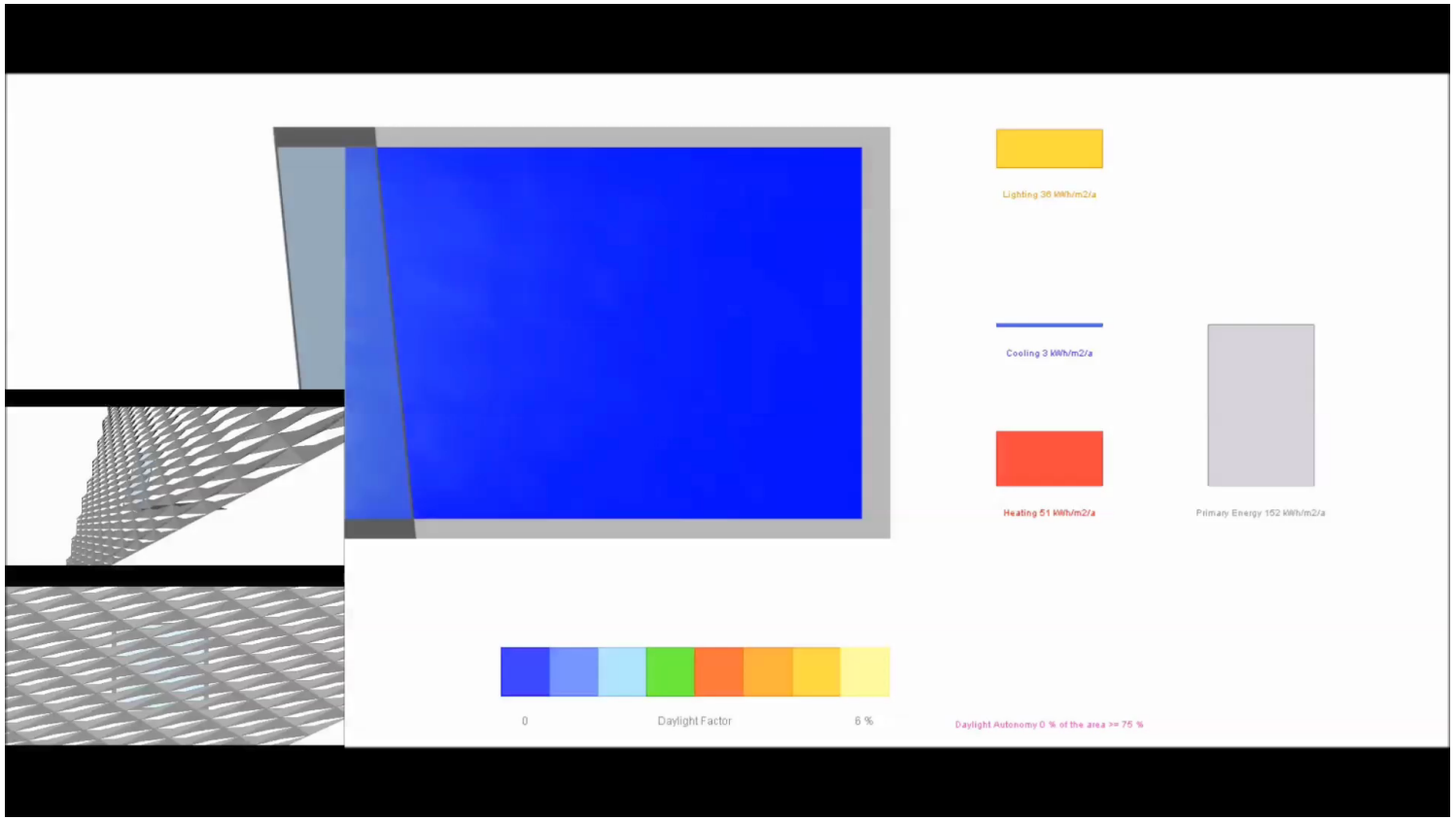
Future Developments

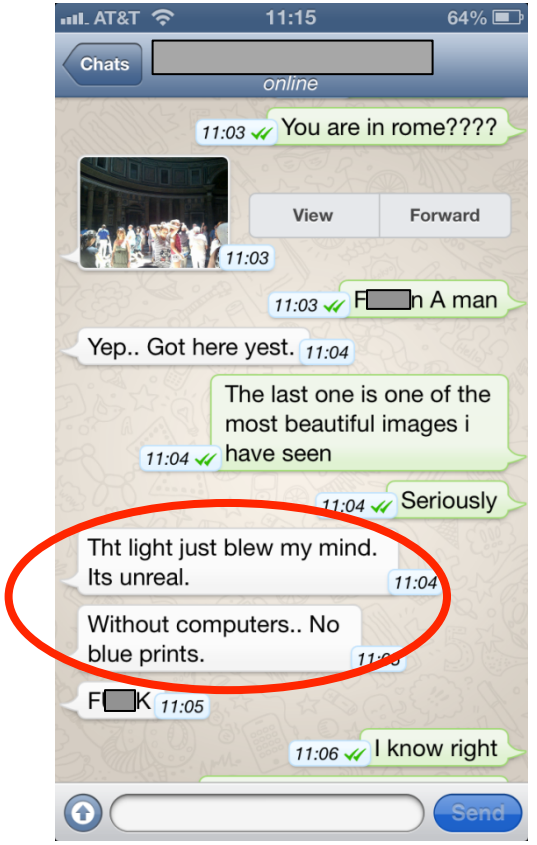
Transsolar
KlimaEngineering

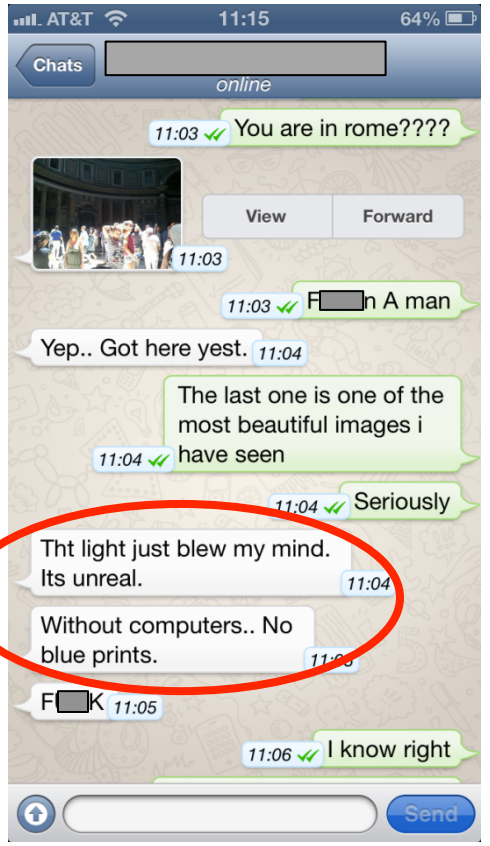


Future Developments

Transsolar
KlimaEngineering




AT&T
11:15
64%
Chats
online
11:03 You are in rome????
View
Forward
11:03
11:03 F[redacted]n A man
Yep.. Got here yest. 11:04
The last one is one of the most beautiful images i have seen
11:04
11:04 Seriously
Tht light just blew my mind. Its unreal.
11:04
Without computers.. No blue prints.
F[redacted]K 11:05
11:06 I know right
Send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Thank You! Questions?