

Exploring the performance of dynamic glazing using Radiance

Galen Burrell
Lighting Manager, View Inc

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View Dynamic Glass intelligently changes tint



TINT

1

Tvis 58%

SHGC 0.41

COG U value – 1.65 W/m2-K (0.29 Btu/hr.-Ft2-F)



TINT

2

40%

0.28



TINT

3

6%

0.11



TINT

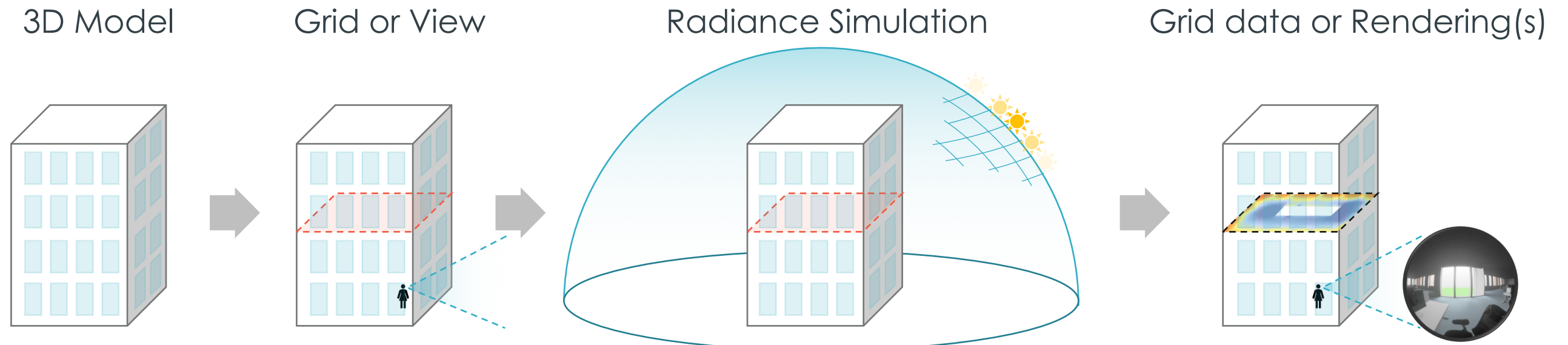
4

0.5-1%

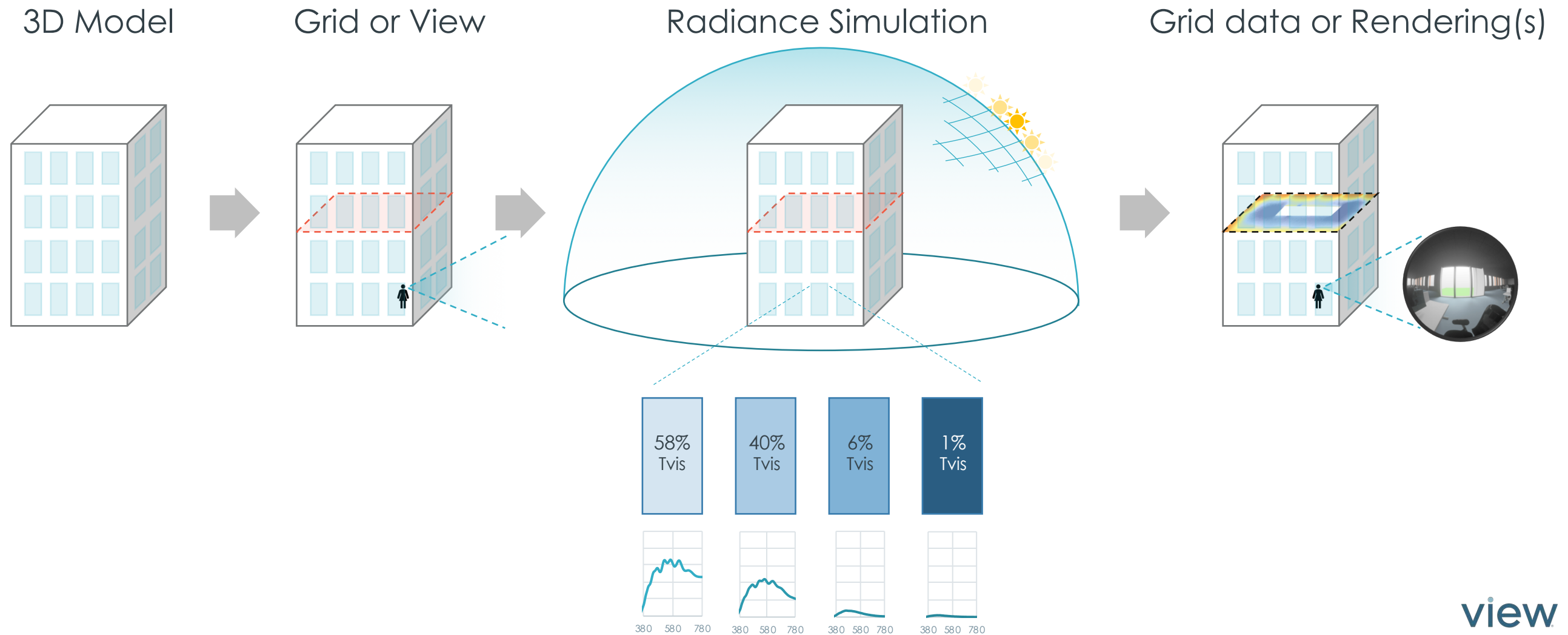
0.09

view

Traditional daylight modeling workflow

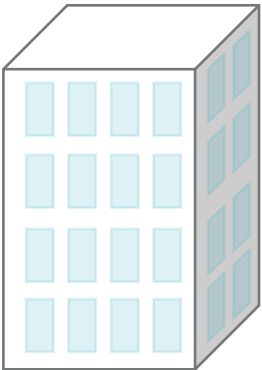


Traditional daylight modeling workflow

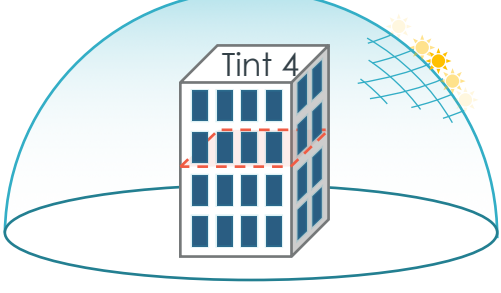
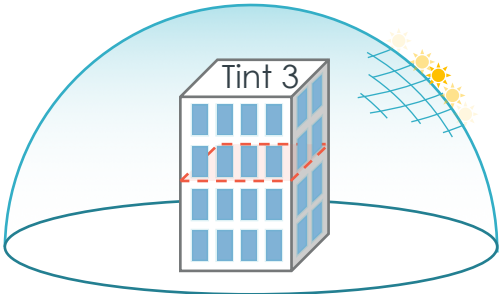
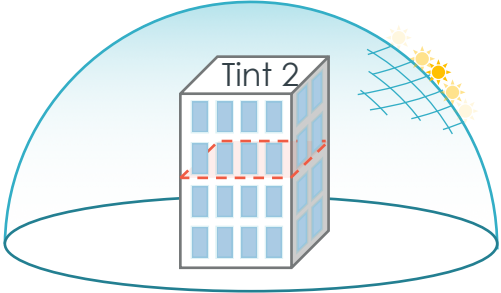
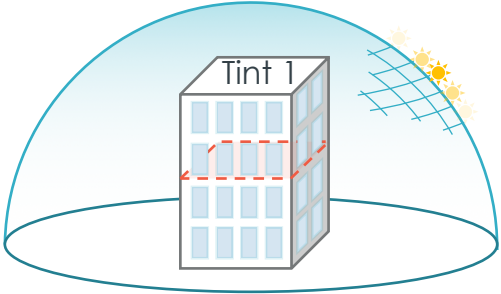
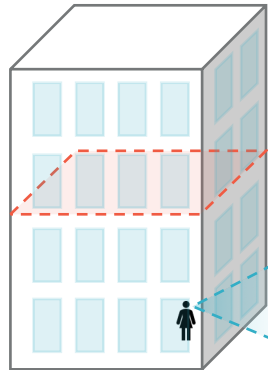


Dynamic glazing modeling workflow

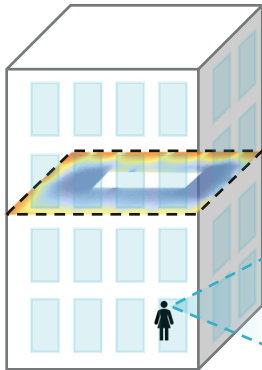
3D Model



Grid or View



Grid data or Rendering(s)



Dynamic Glass Visual Performance



Daylight Quantity - 3Phase Example

Daylight Matrix \times BSDF \times View Matrix \times Sky Matrix = Window Group Illuminance

for each window group for each tint state for each window group for each tint
for each window group



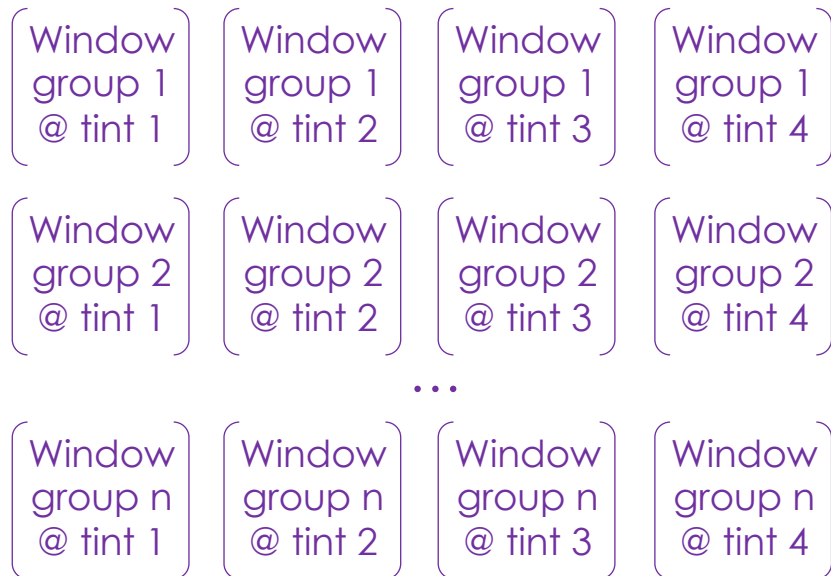
Daylight Quantity - 3Phase Example



Python code

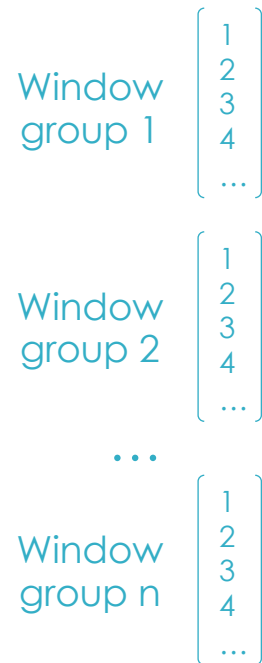
Window Group Illuminance

for each tint
for each window group



Tint Schedule

for each window group



Window Group Illuminance



Total Illuminance

$$\sum \text{Window group Illuminance}$$

Dynamic Glass Visual Performance

Daylight
Quantity

Visual
Comfort

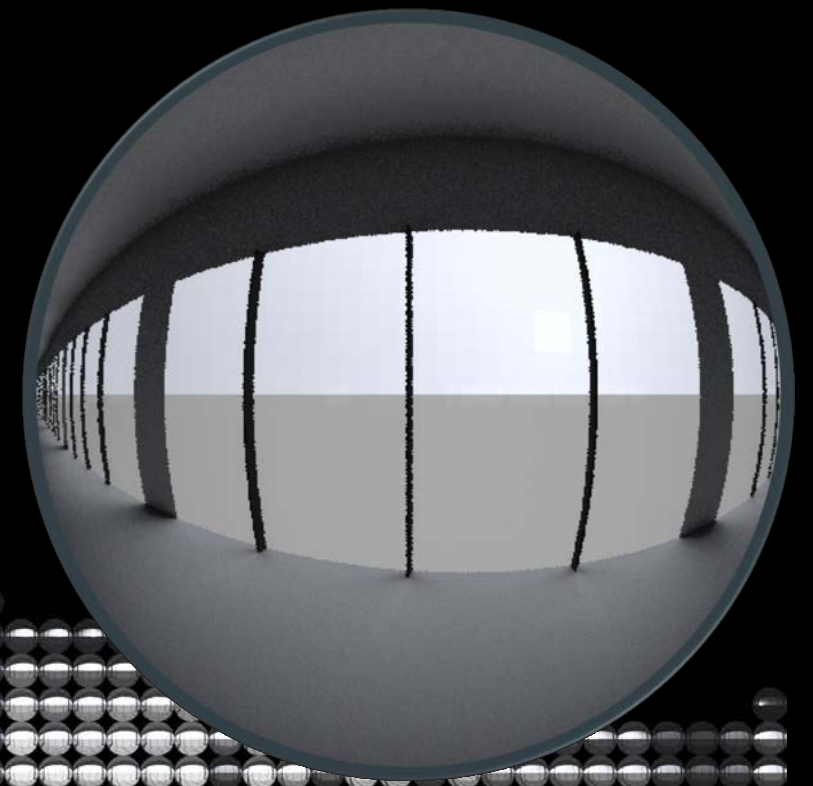
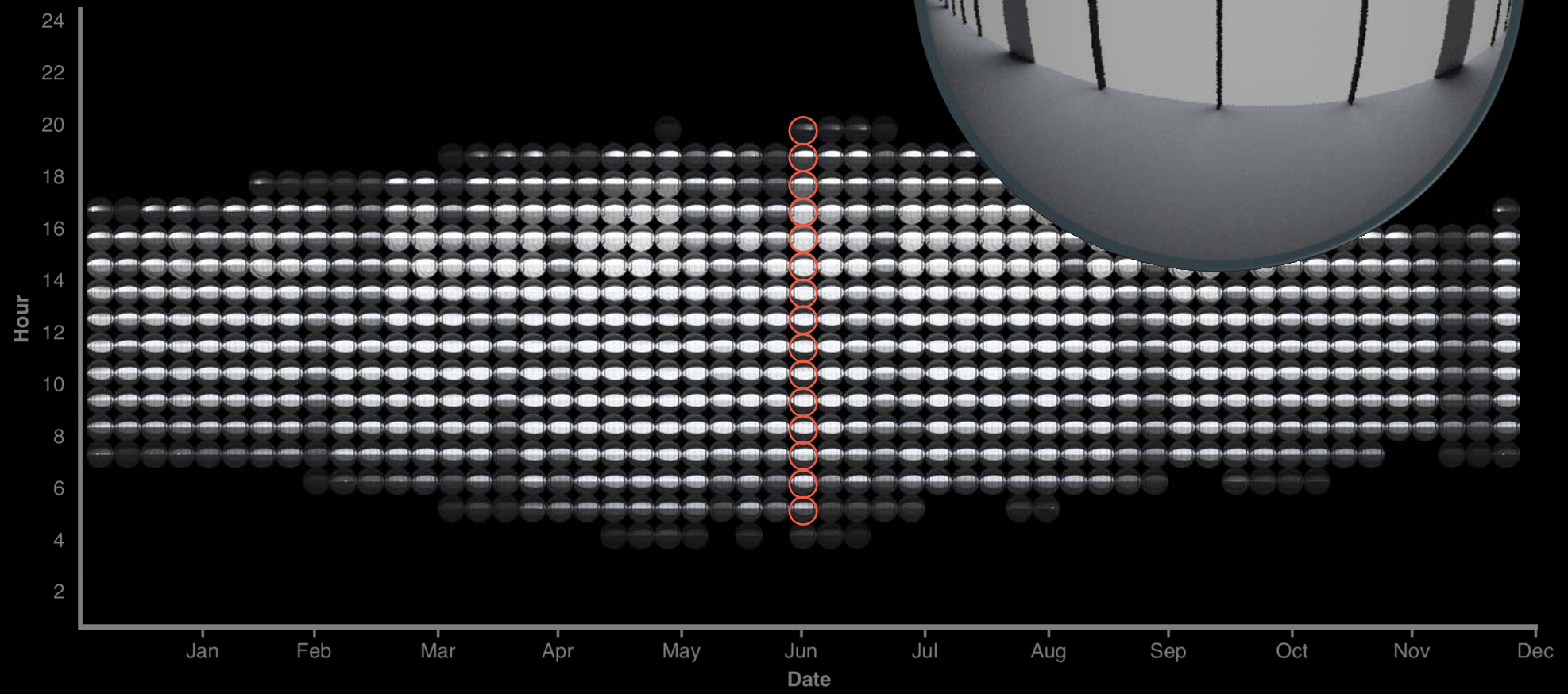
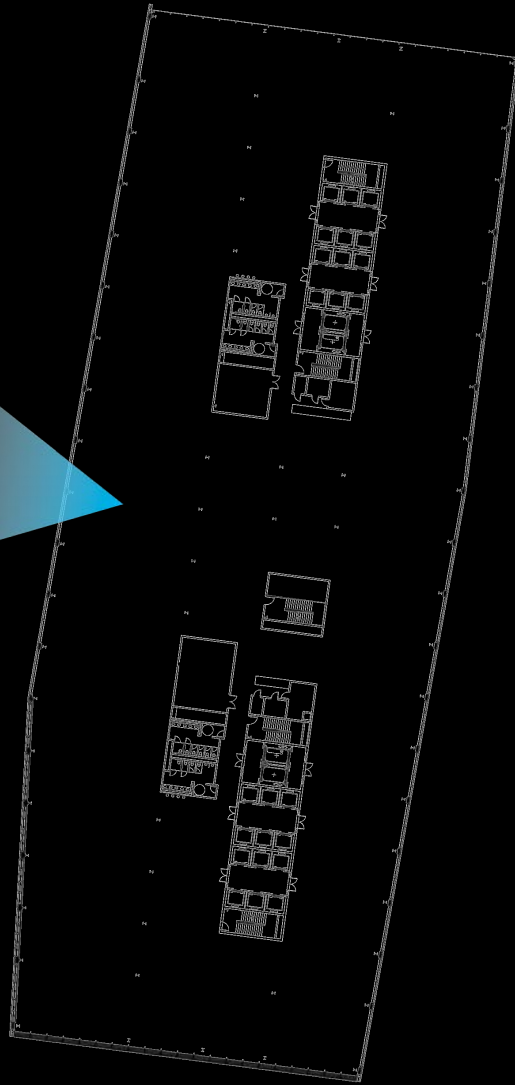
View
Quality

Circadian
Stimulus

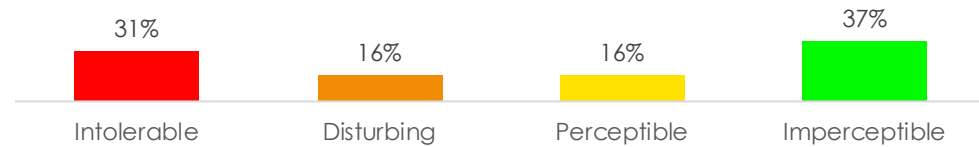
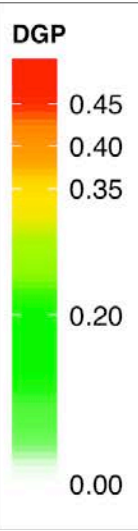
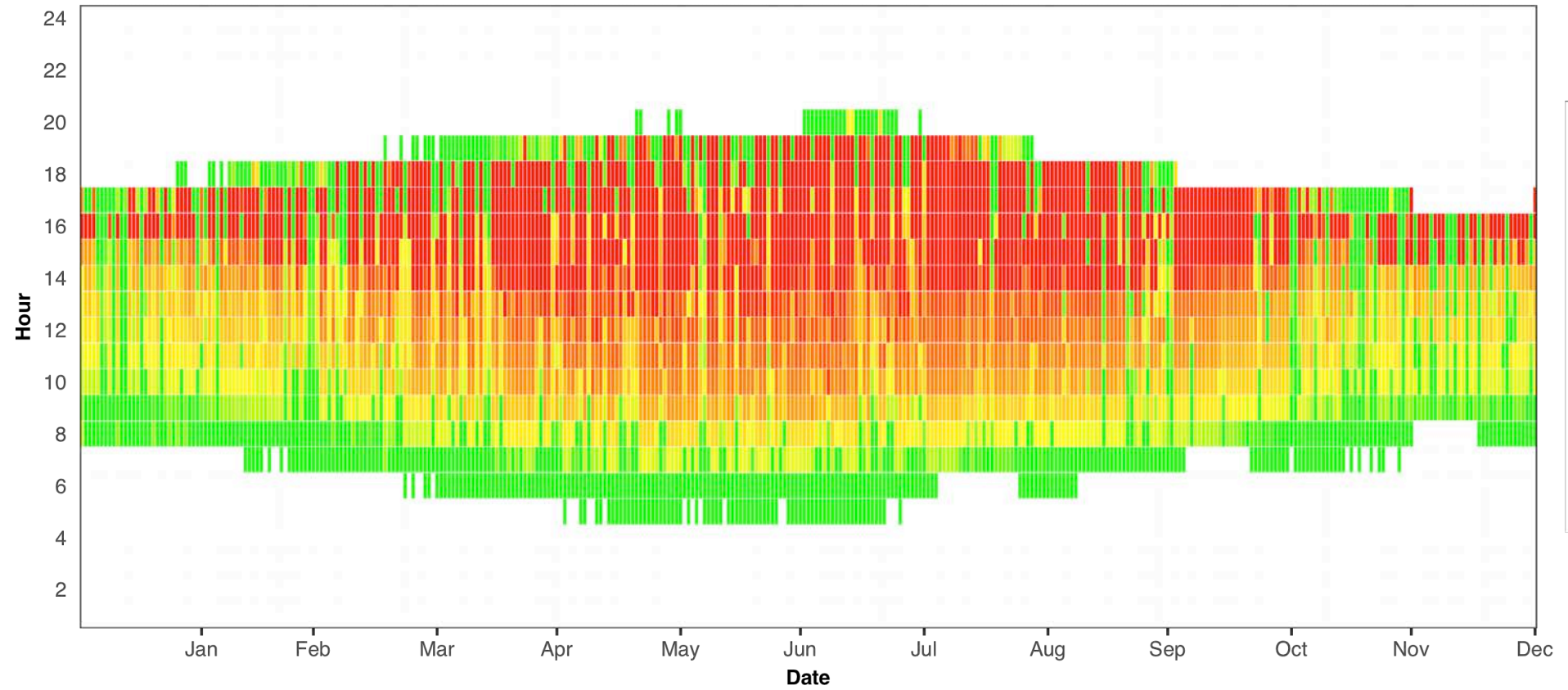
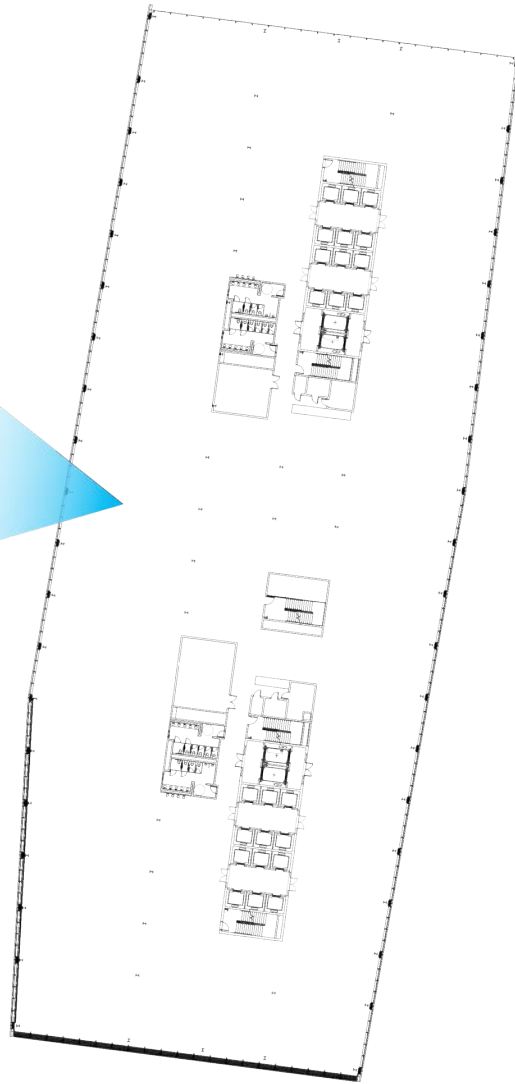
Color
Quality

Spectrally independent!

Glare Analysis

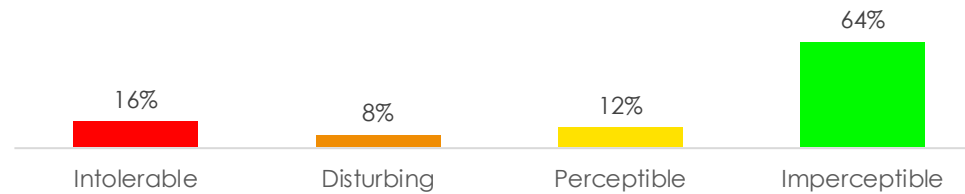
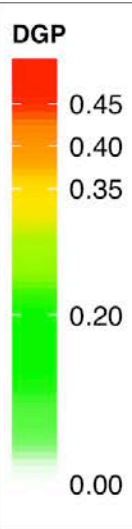
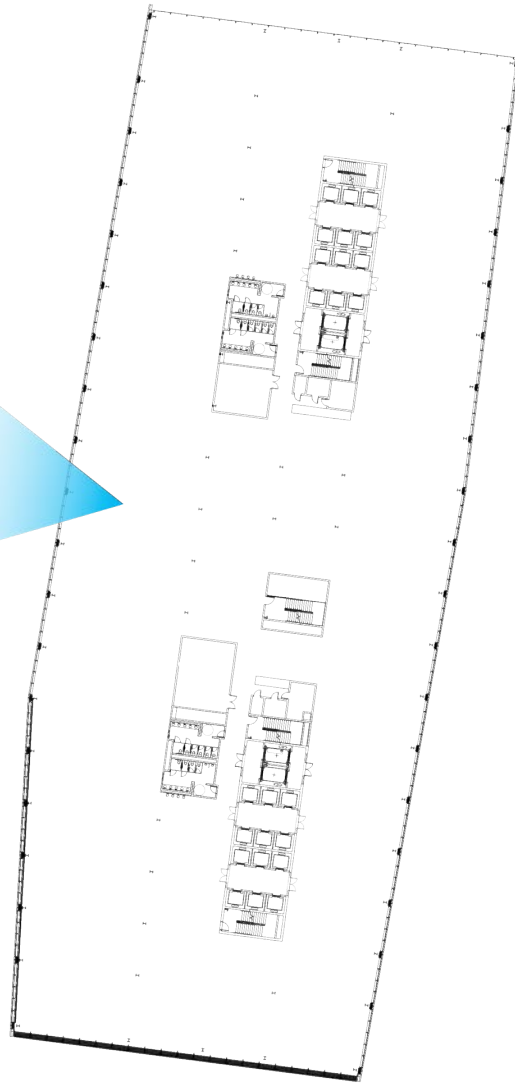


Glare Analysis – 58% Tvis (Tint 1)



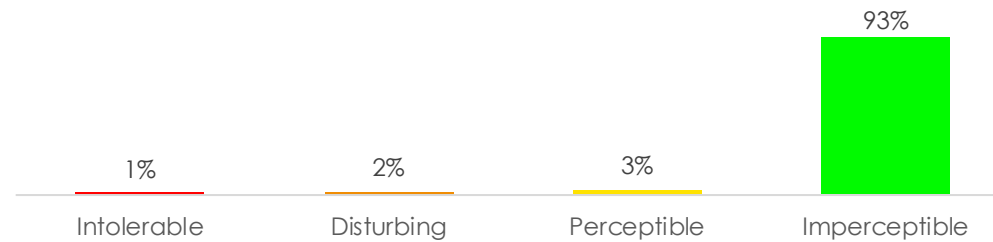
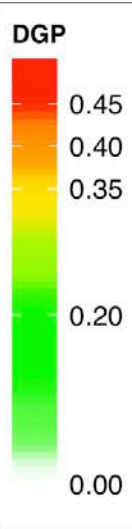
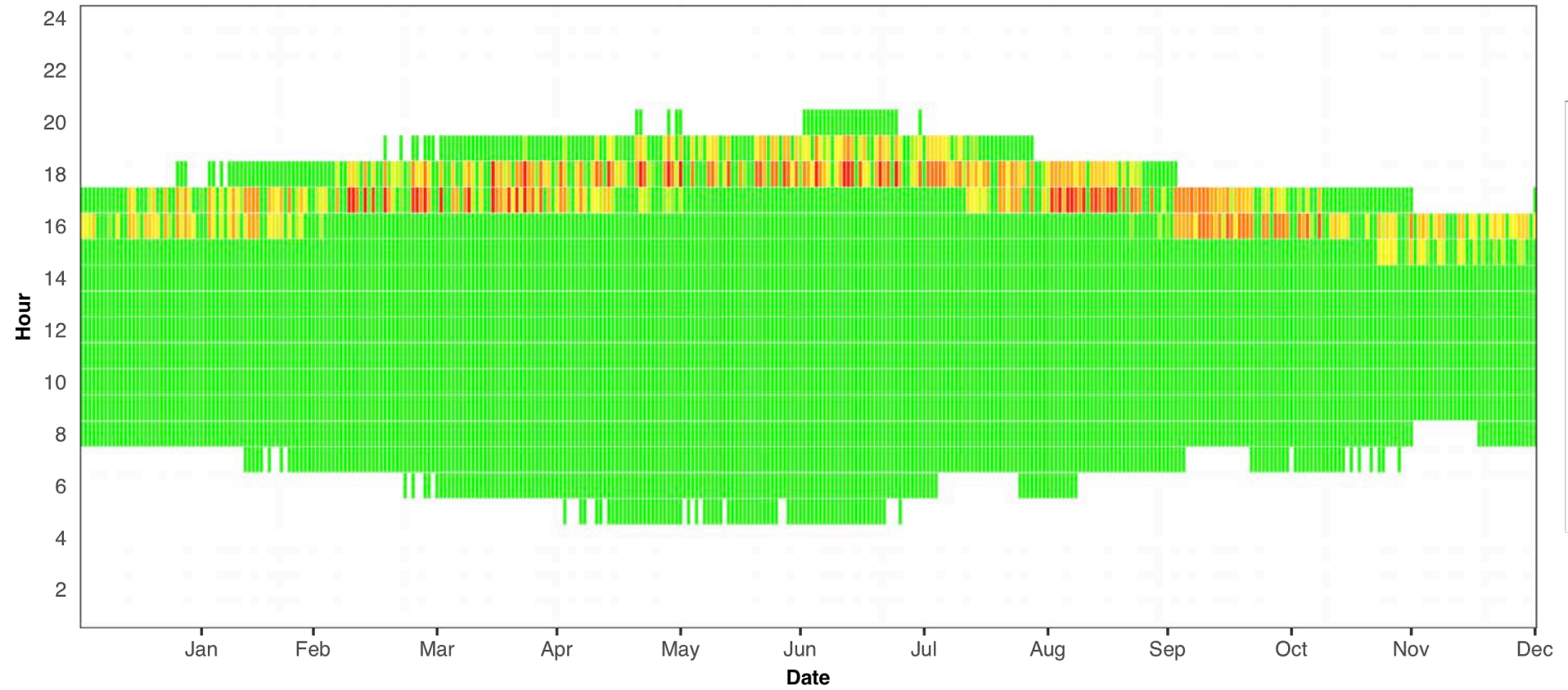
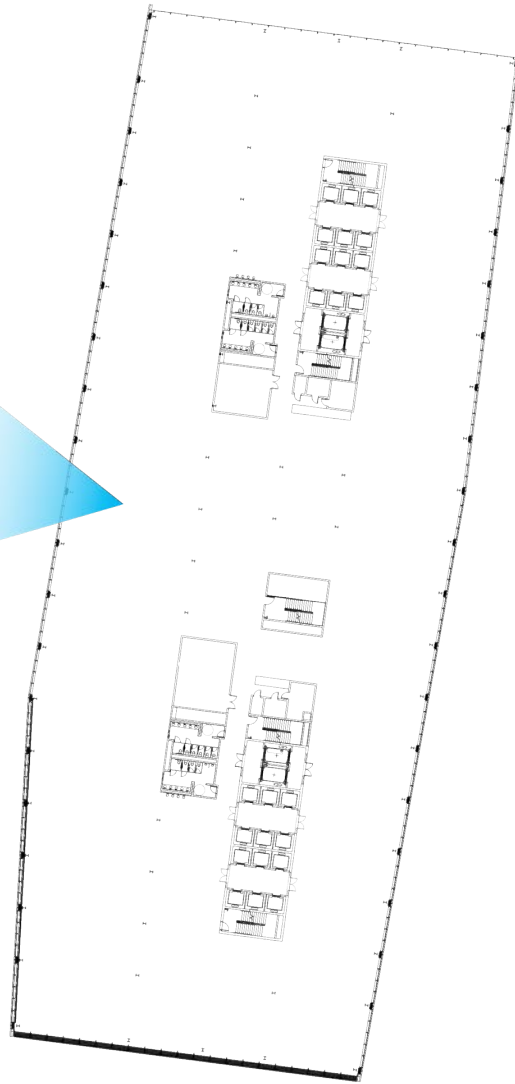
West facing office in New York City
Viewpoint is 5' from the window facing out

Glare Analysis – 40% Tvis (Tint 2)



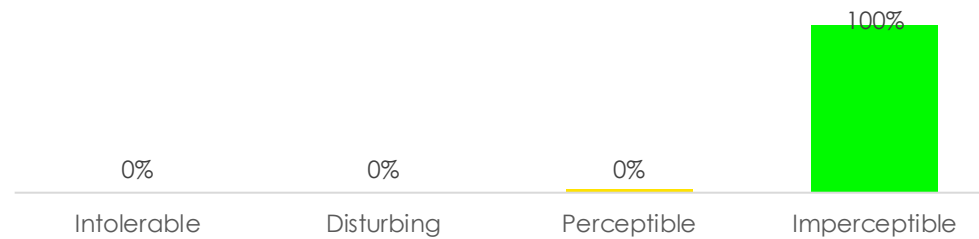
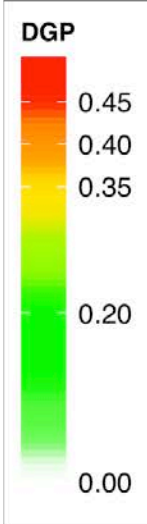
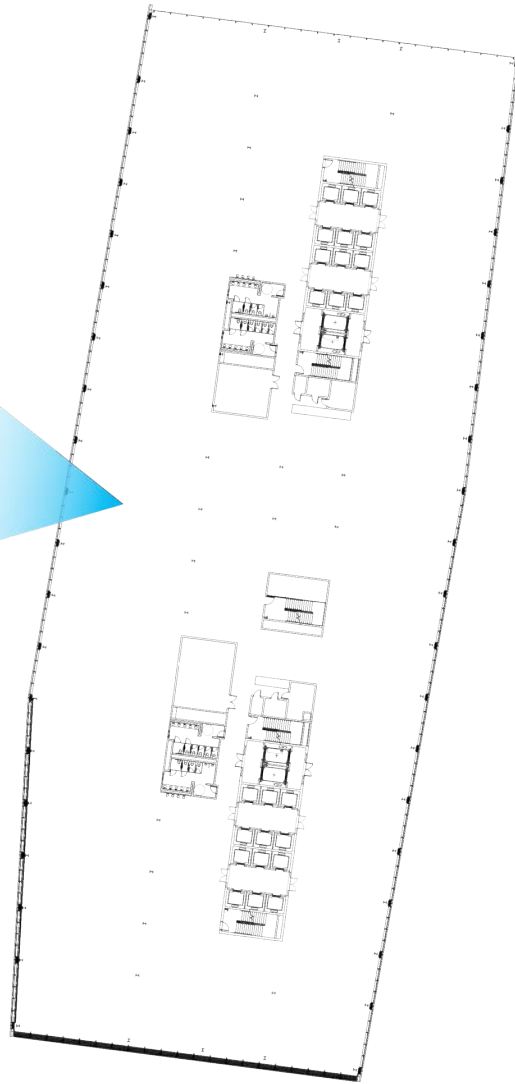
West facing office in New York City
Viewpoint is 5' from the window facing out

Glare Analysis – 6% Tvis (Tint 3)



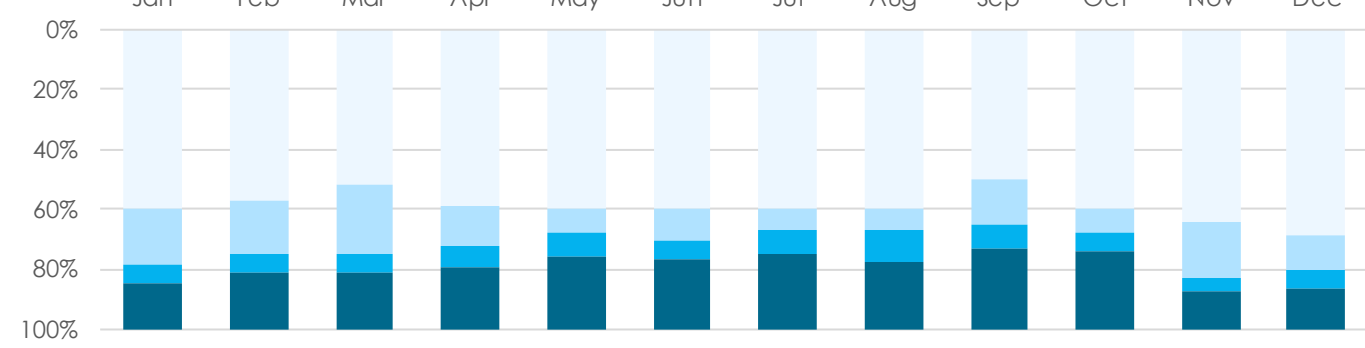
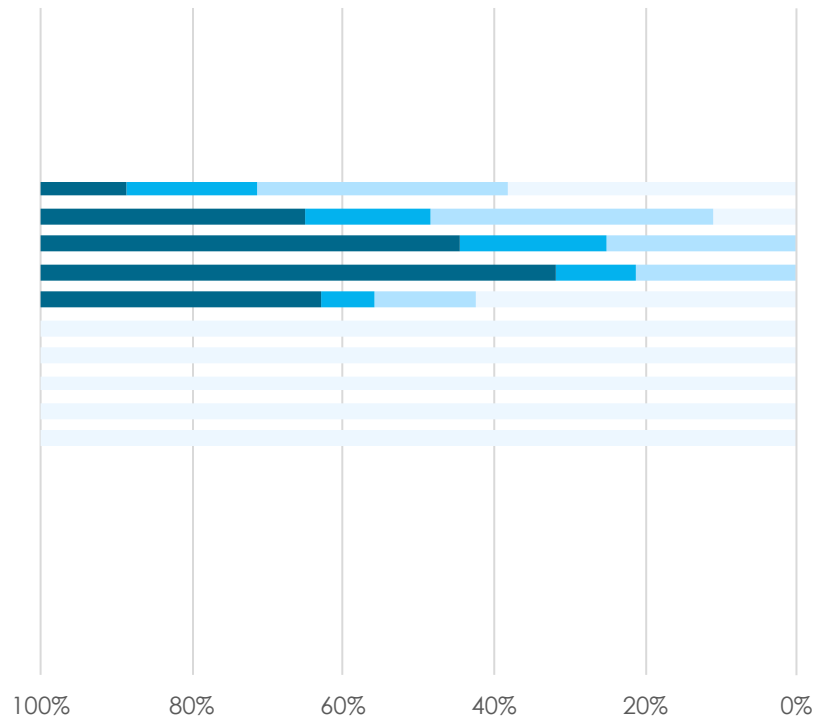
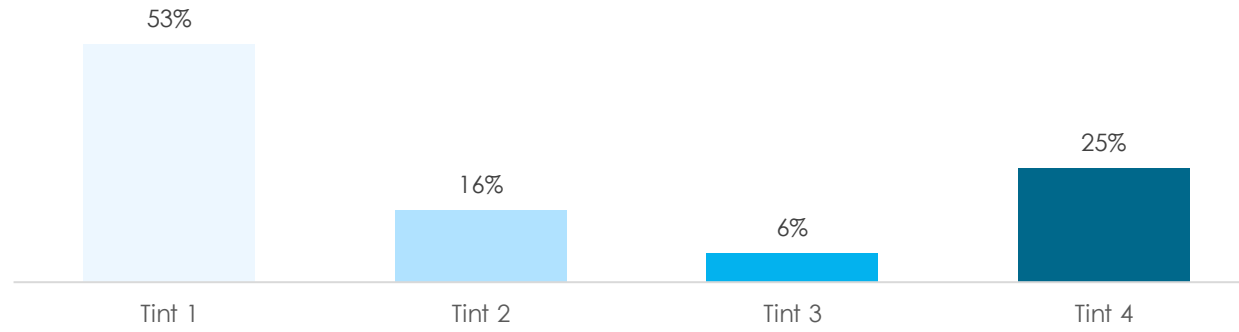
West facing office in New York City
Viewpoint is 5' from the window facing out

Glare Analysis – 1% Tvis (Tint 4)



West facing office in New York City
Viewpoint is 5' from the window facing out

Tint schedule

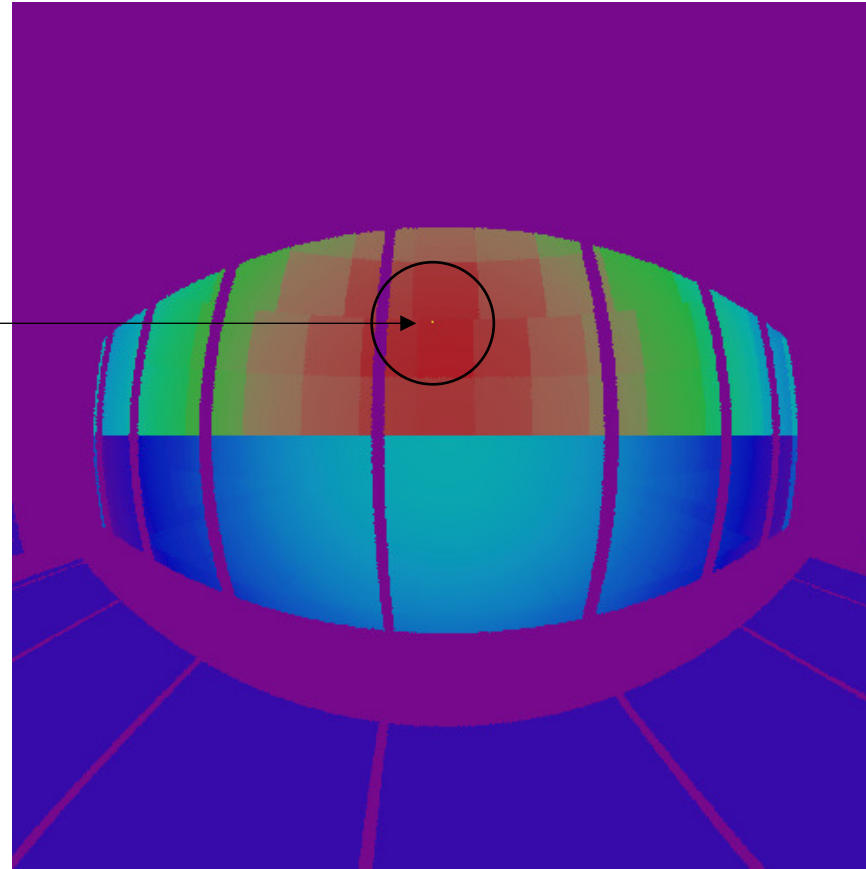


Sky definition

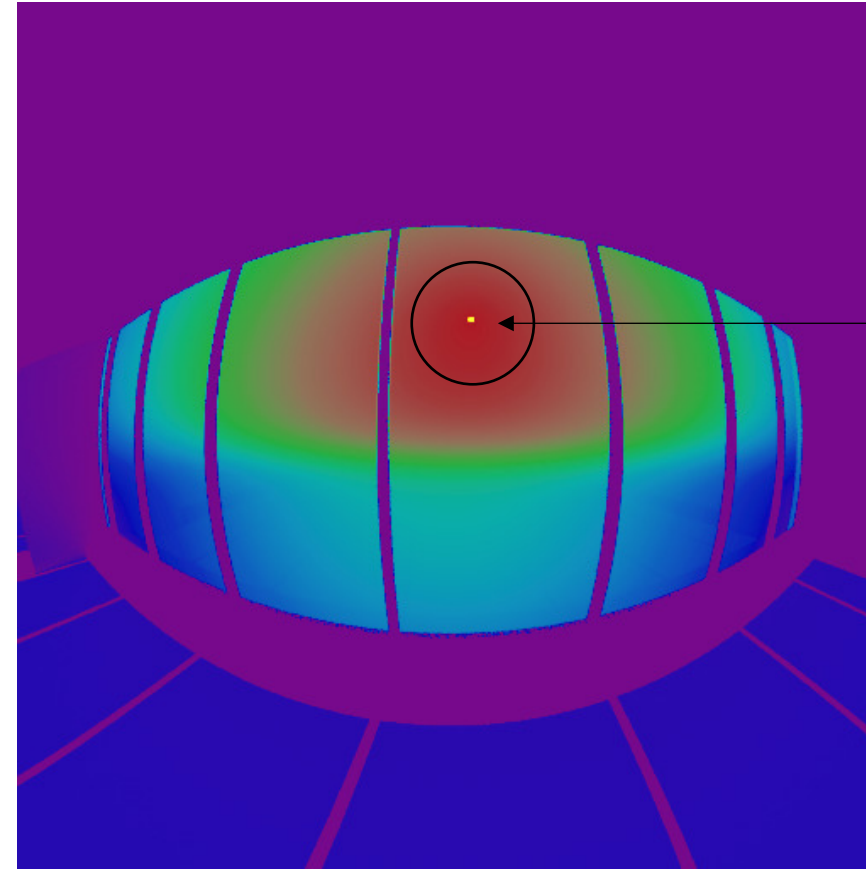
annual (diffuse MF:4 + direct)

gendaylit

Solar disk



Solar disk



Vertical Illuminance

278 lux

279 lux

DGP

40

35

Dynamic Glass Visual Performance

Daylight
Quantity

Visual
Comfort

View
Quality

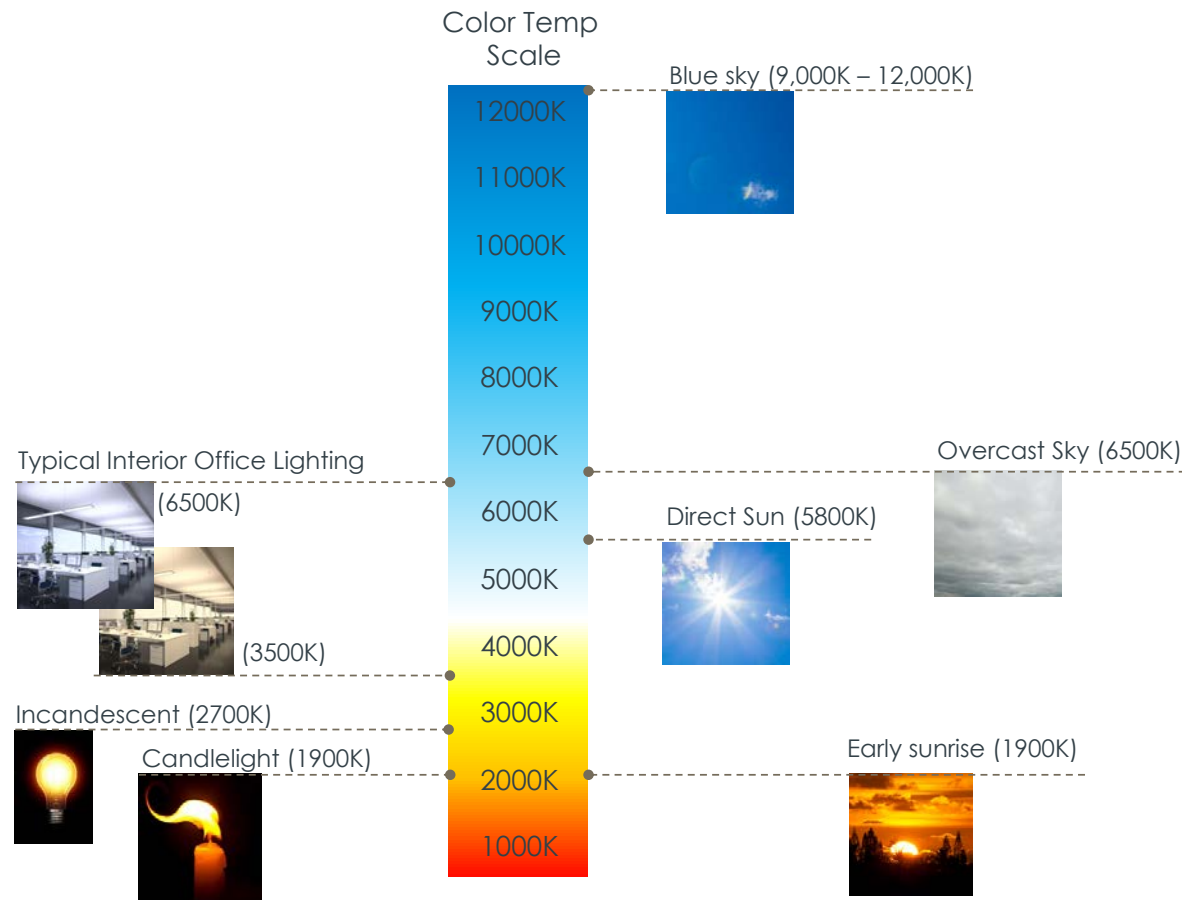
Circadian
Stimulus

Color
Quality

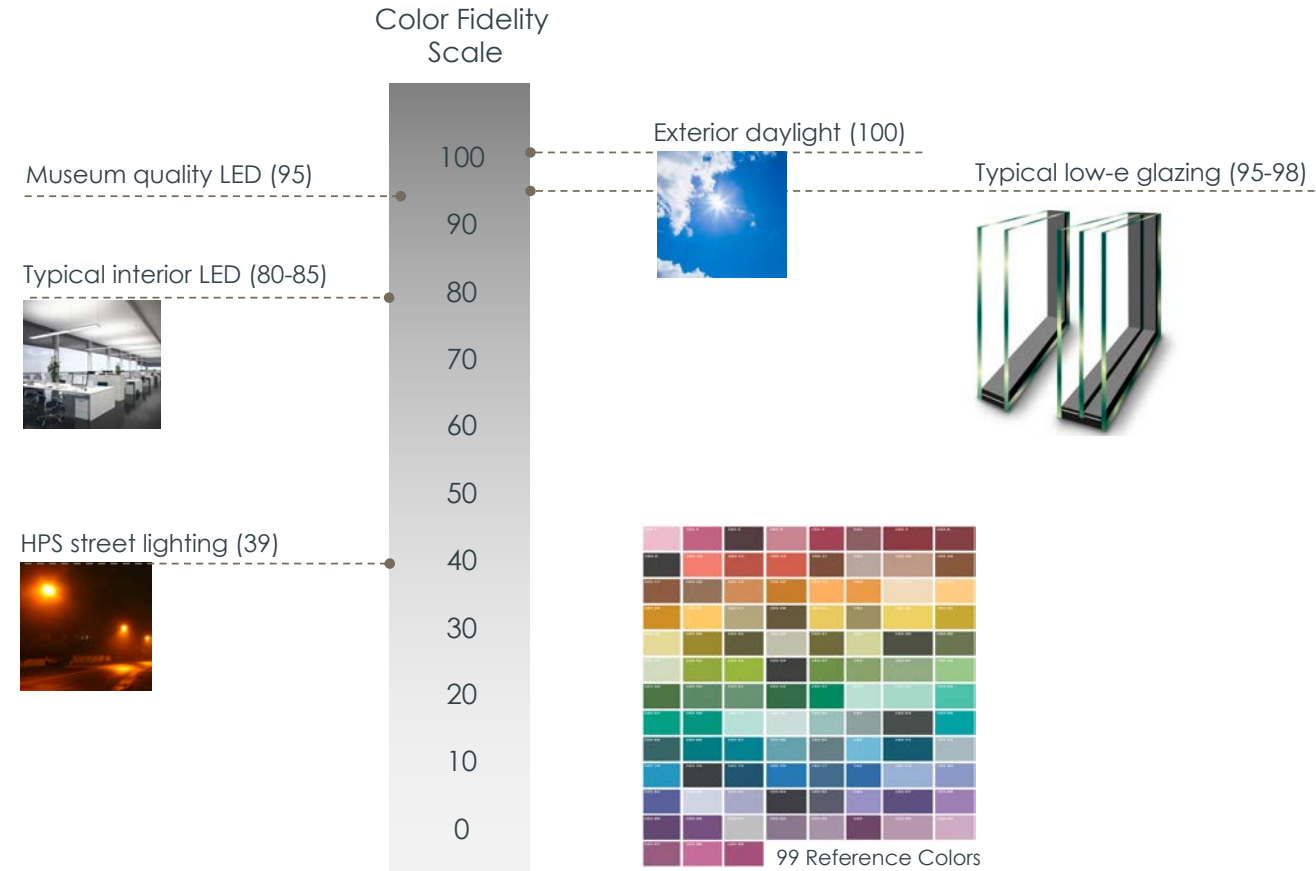
Spectrally dependent!

Color Metrics Review

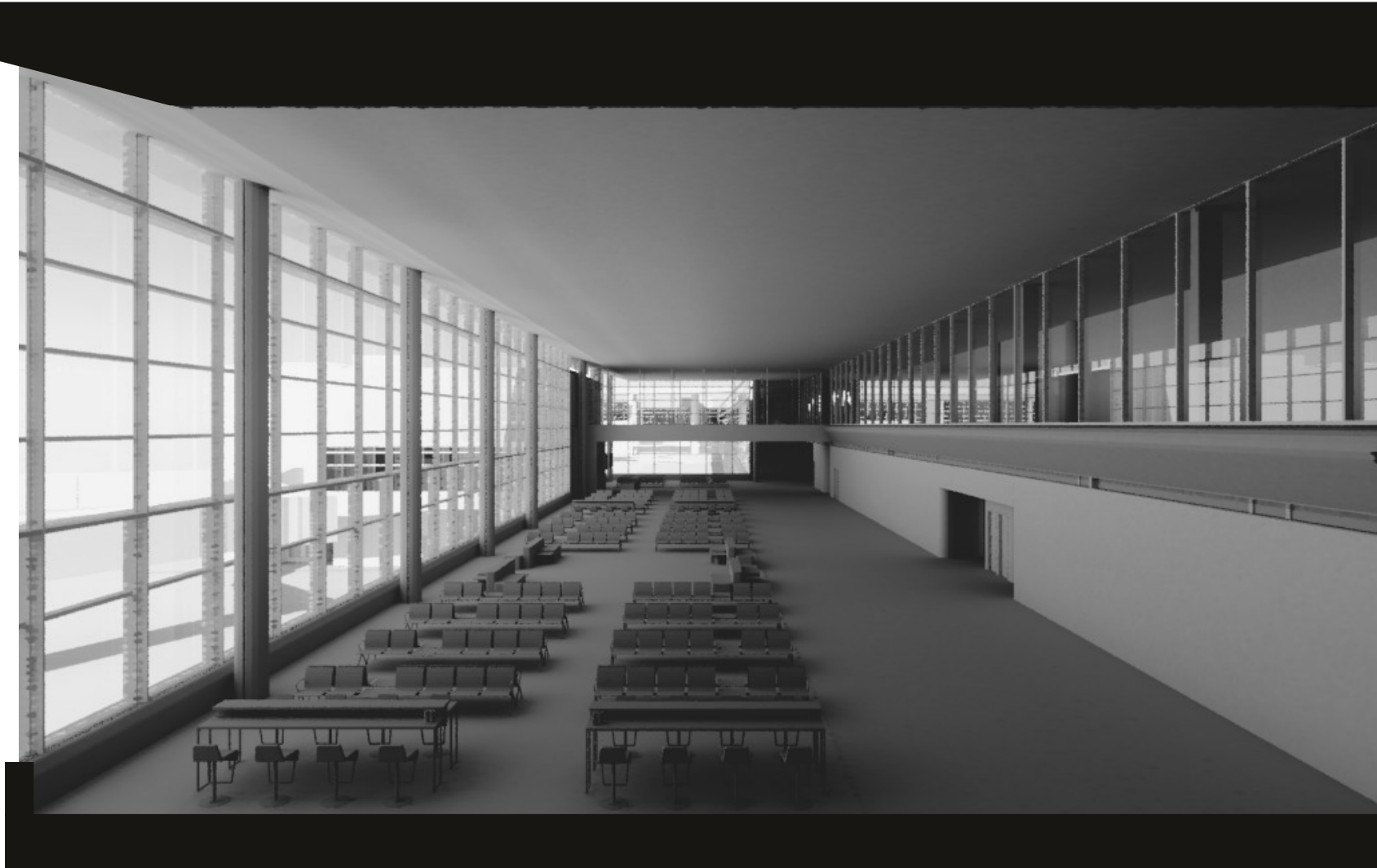
Correlated Color Temperature (CCT)



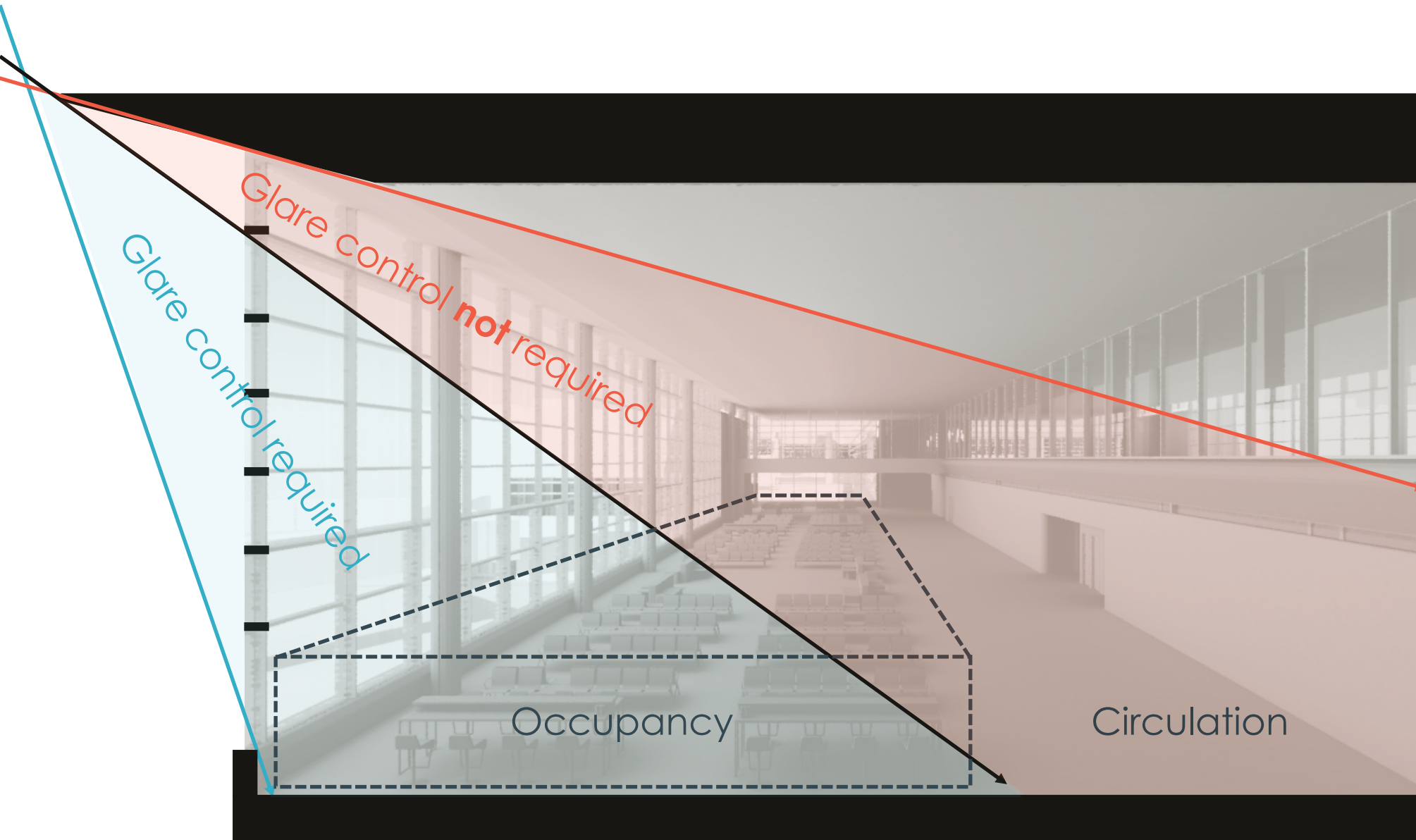
Color Fidelity (Rf)



Airport Project Example

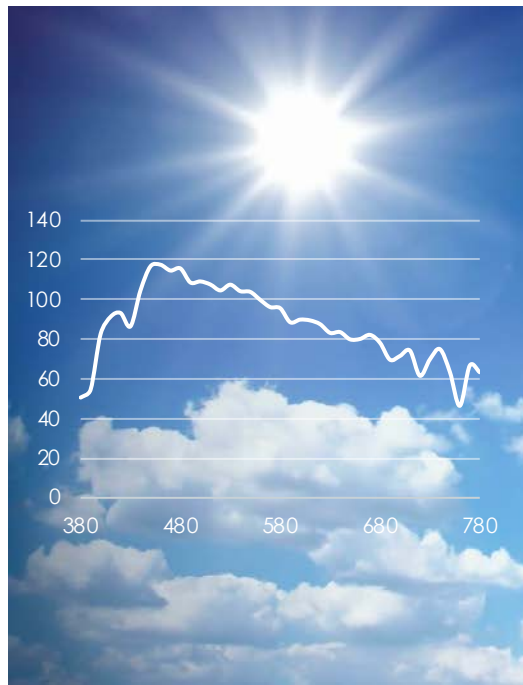


Design Conditions



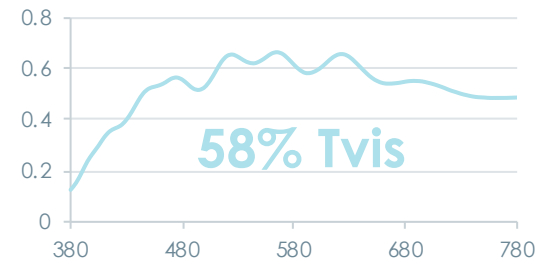
Color Quality of *Transmitted* Daylight

Daylight Spectral Power Distribution (D65)

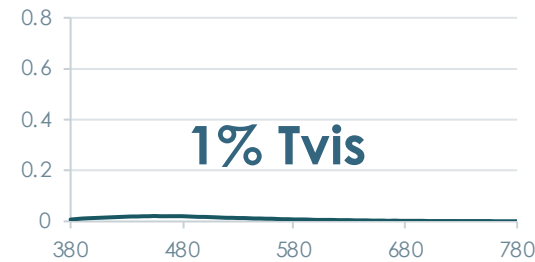


Window Tint 1
Window Tint 4

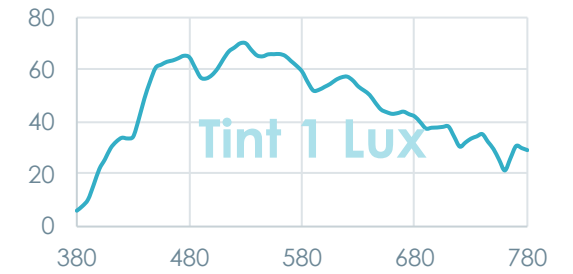
Spectral Transmission @ Tint 1



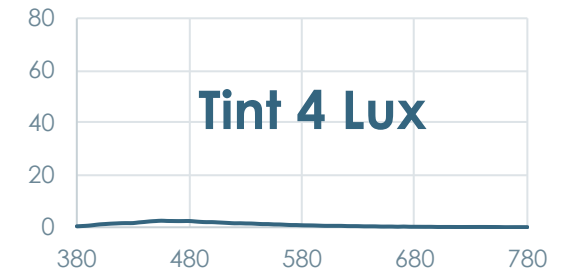
Spectral Transmission @ Tint 4



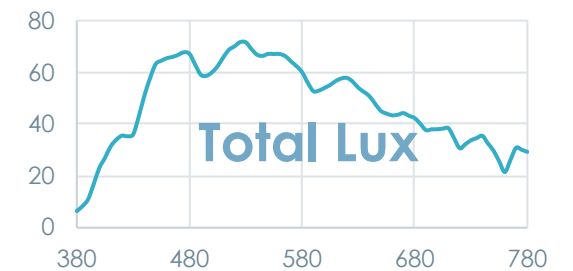
SPD from Tint 1



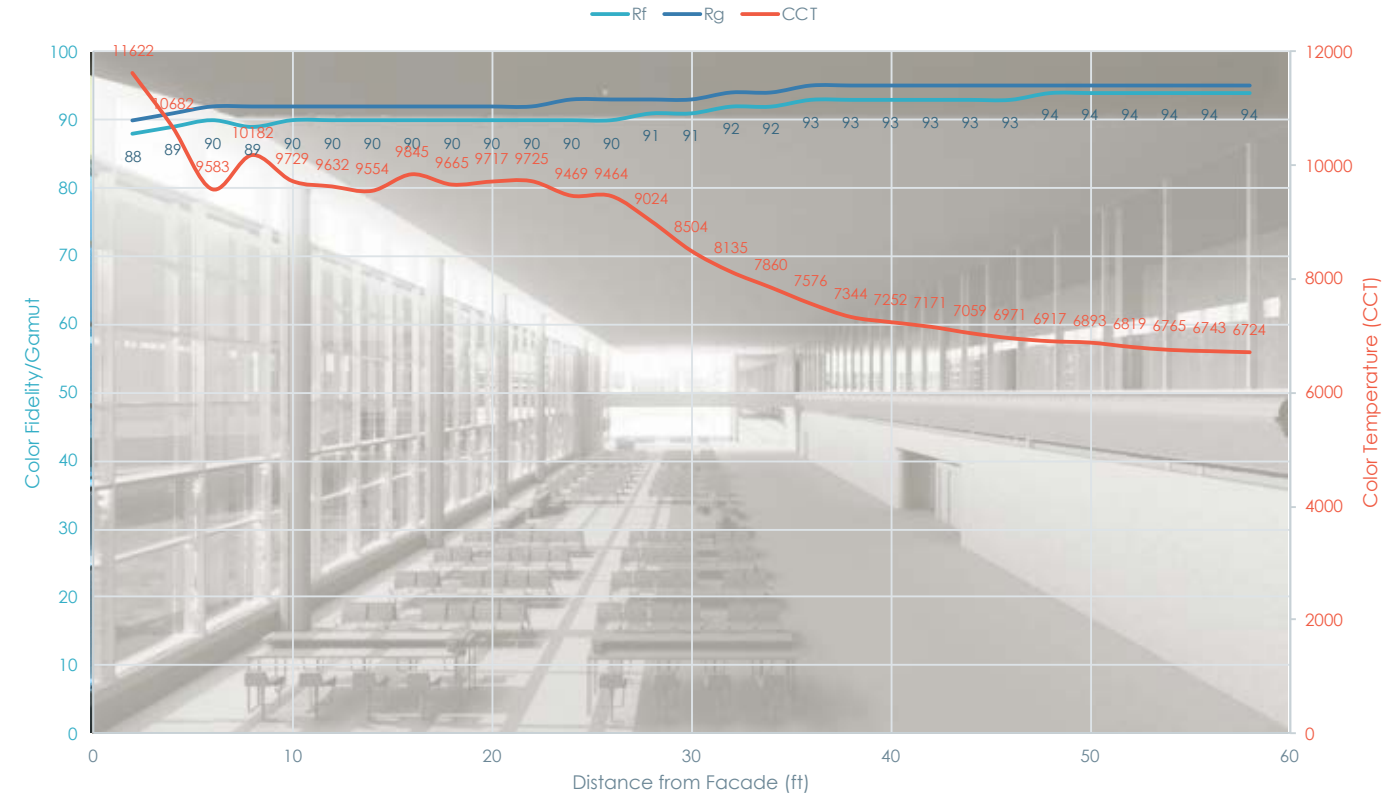
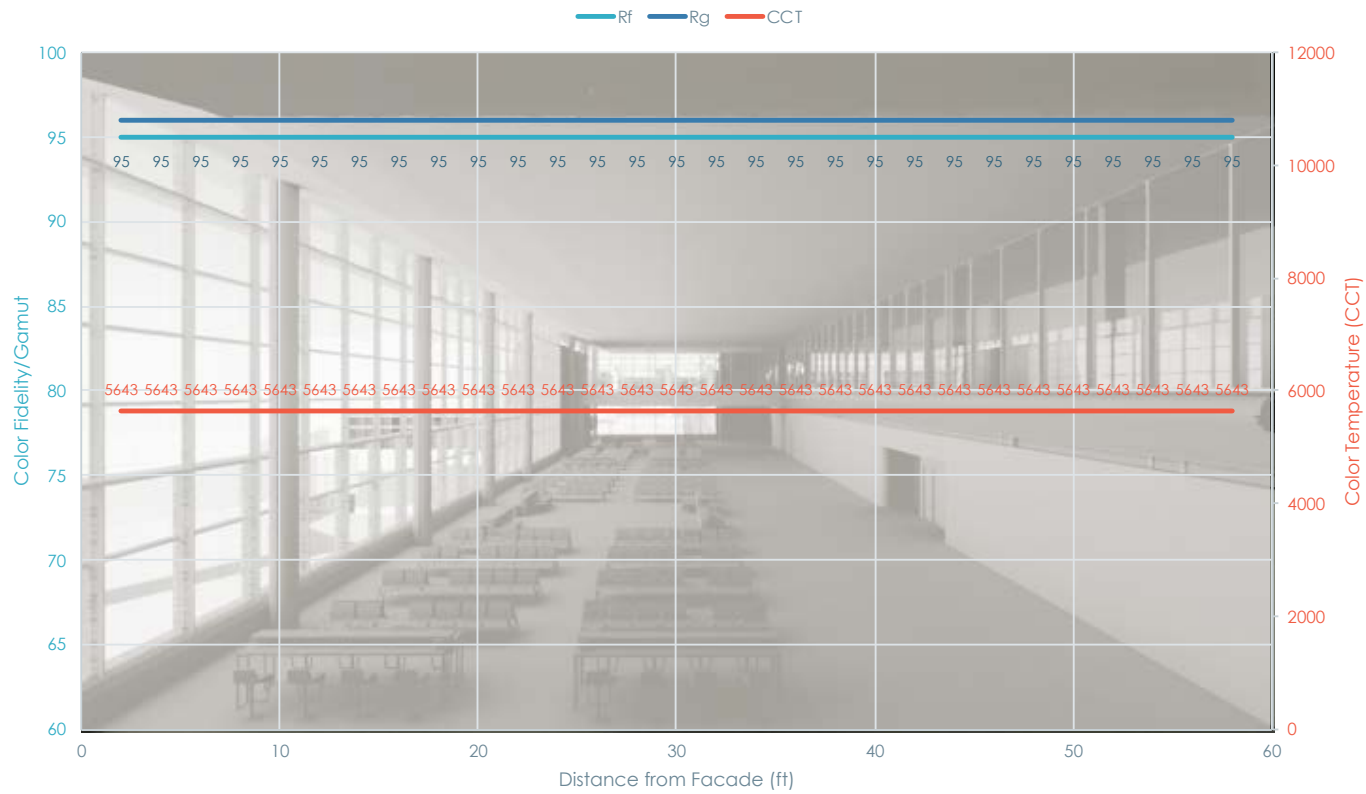
SPD from Tint 4



Total SPD from Tint 1 and 4

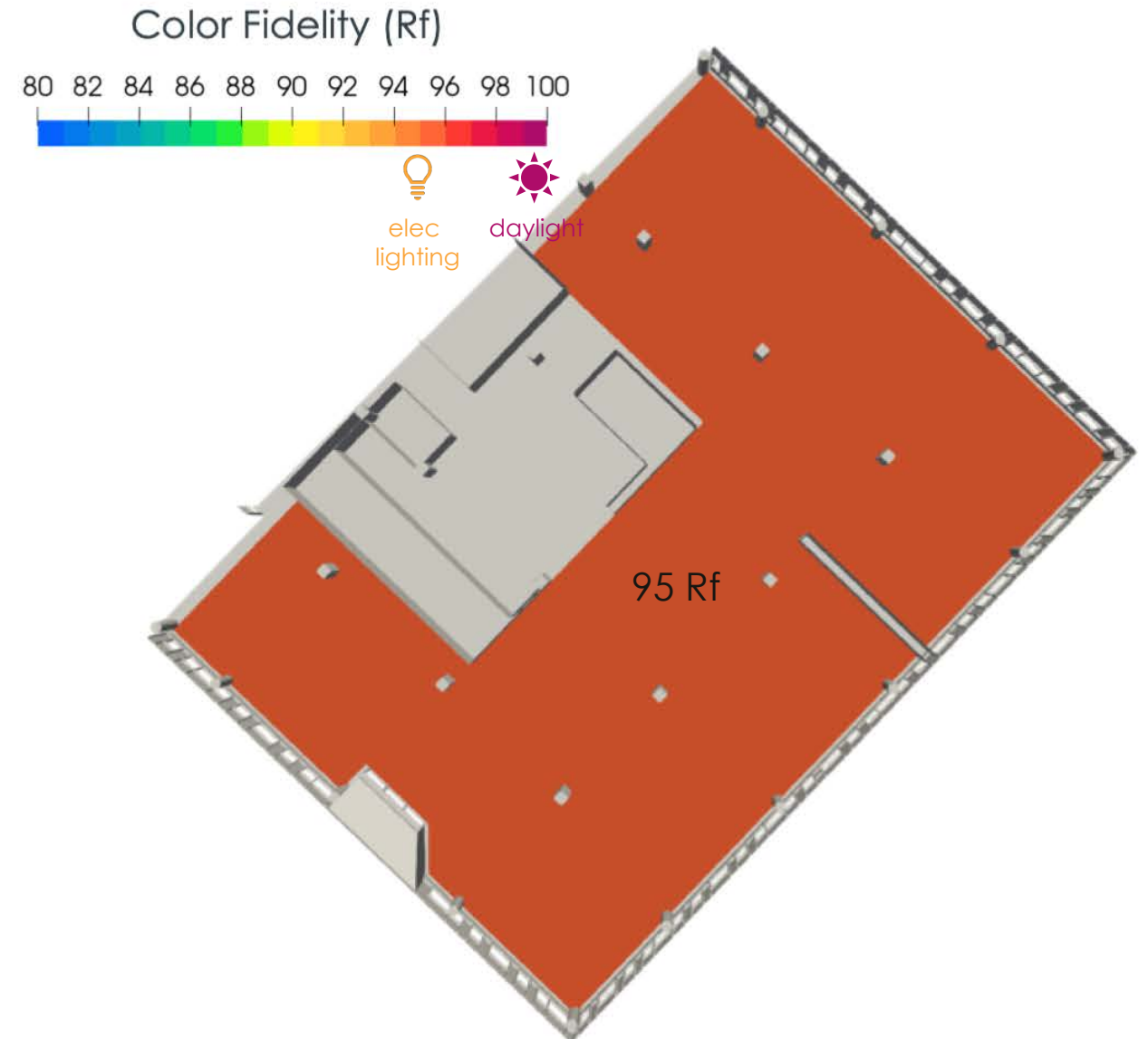
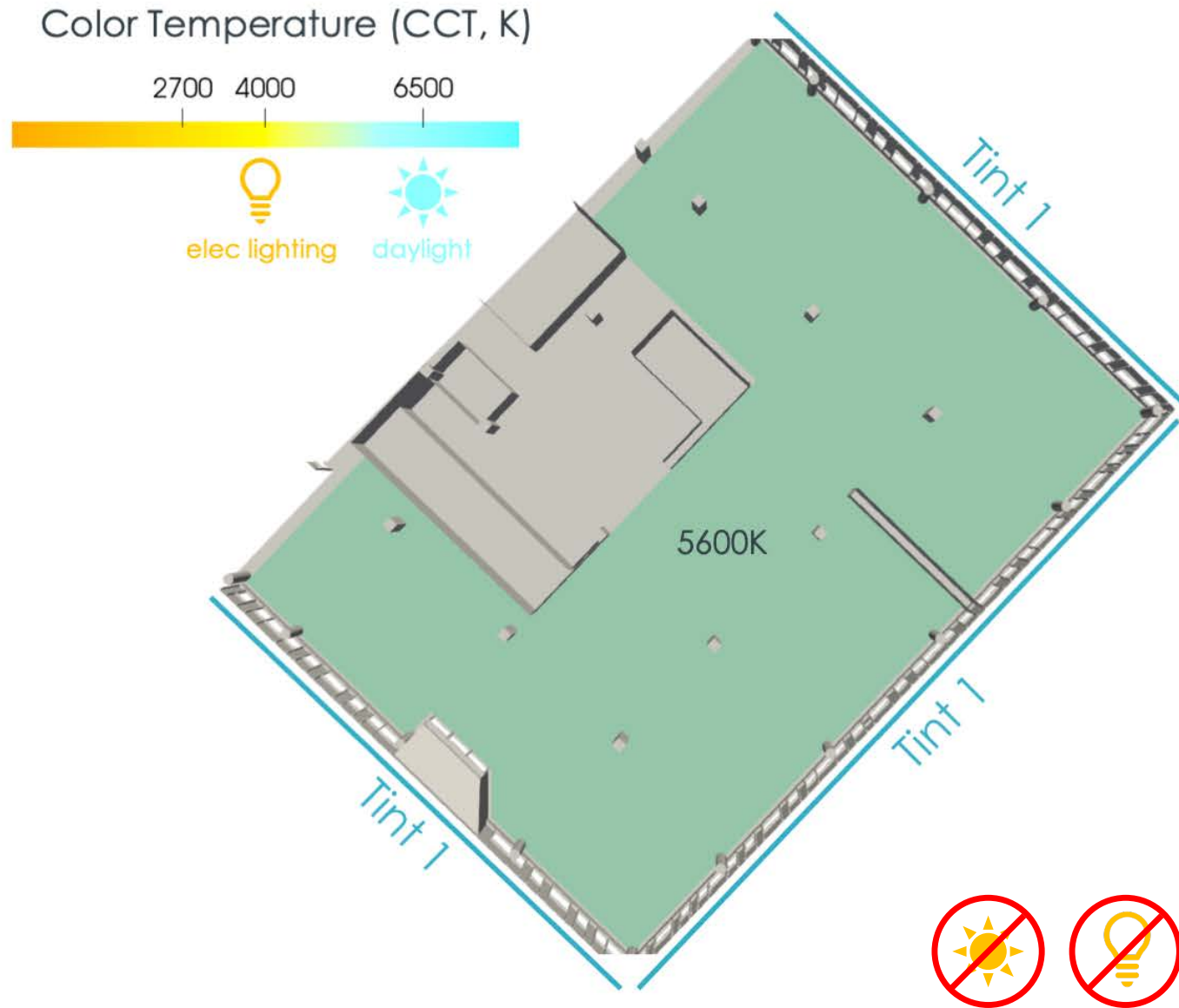


Color Quality Analysis

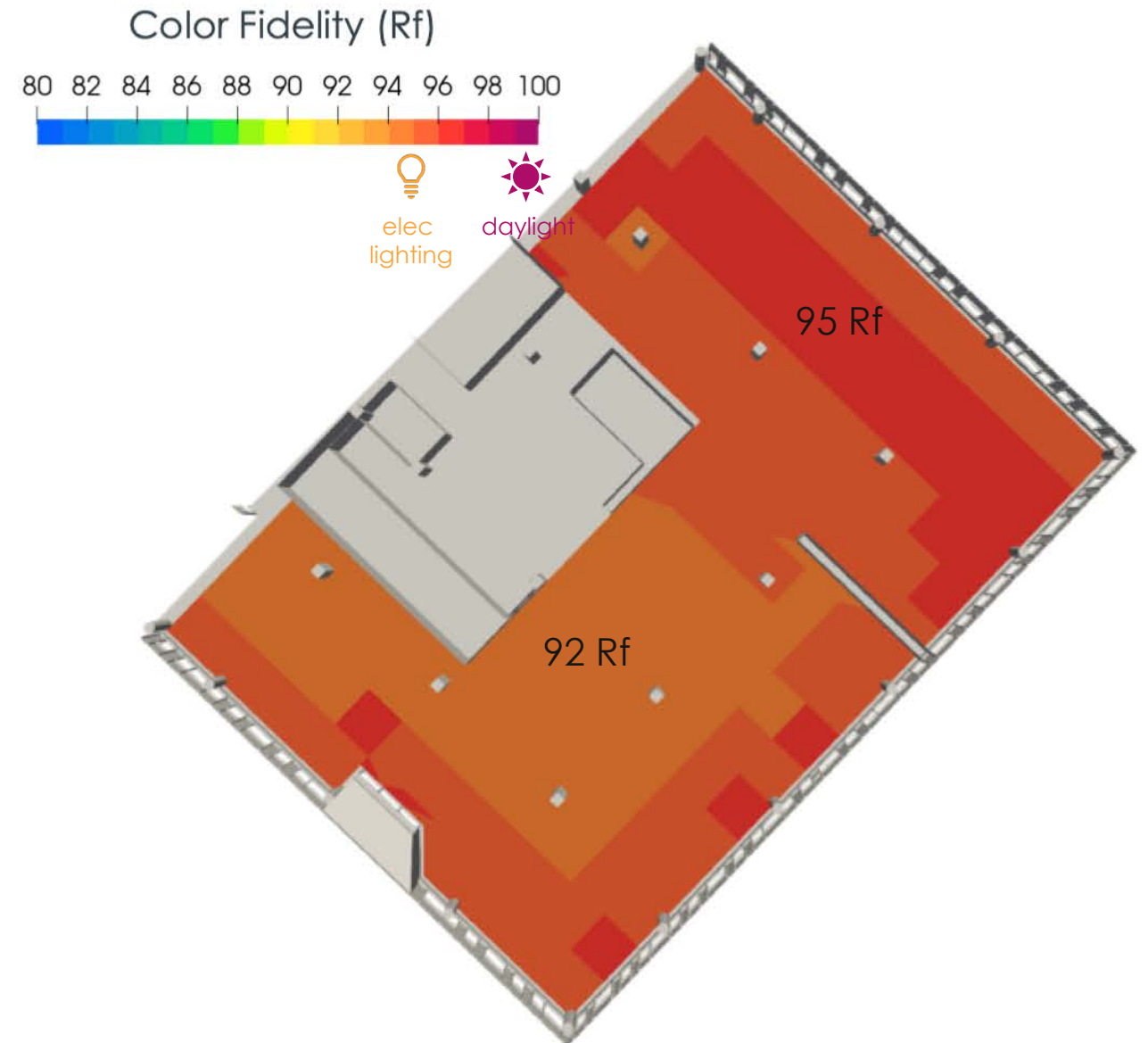
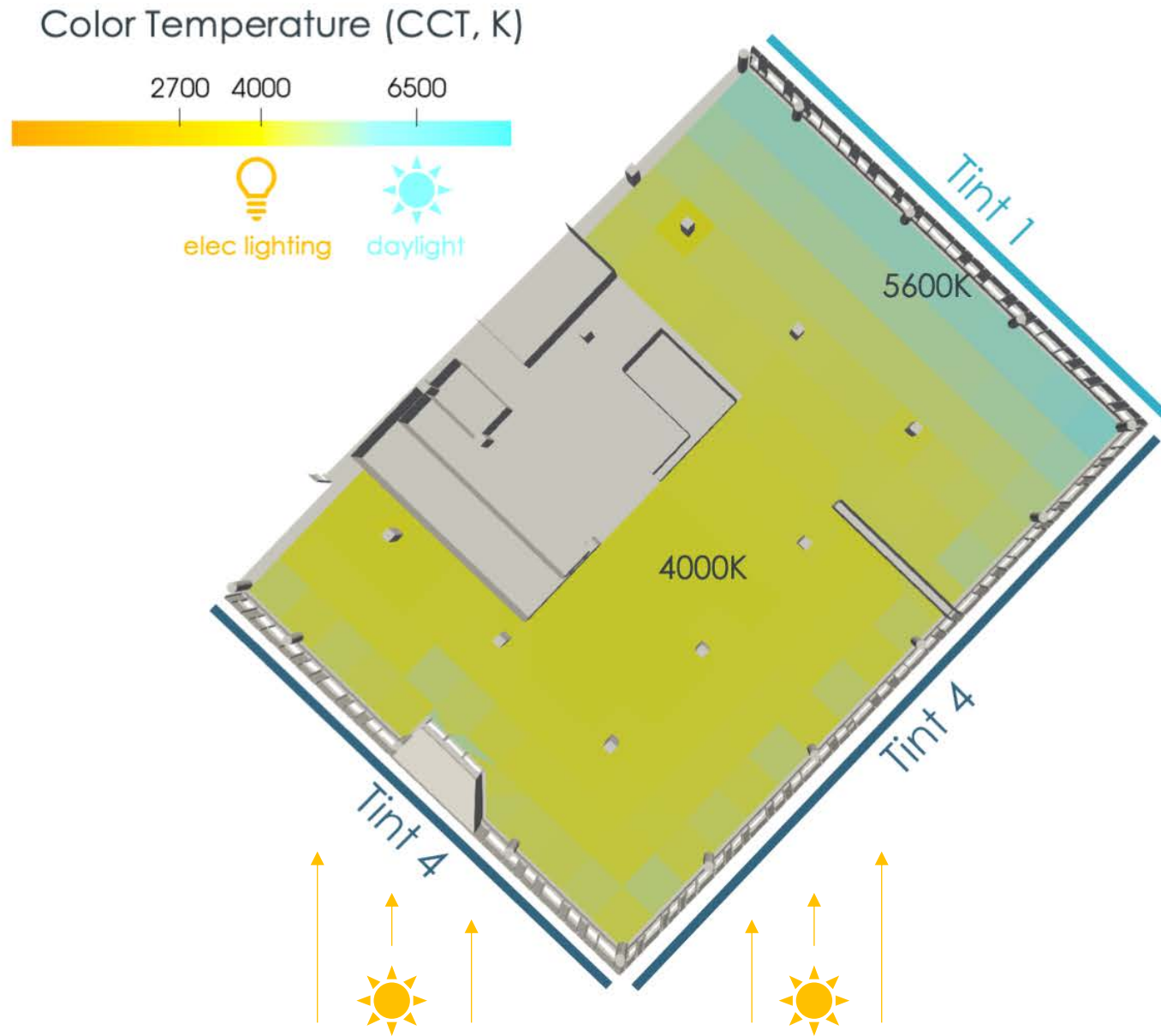


- Analysis is based on combined SPD at each point
- Calculated per IES TM-30-18

Spatial Color Quality



Spatial Color Quality



view®

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Questions?