

Integral Light Studio

Optimizing the Radiance Workflow: In an Integrated Firm Environment

Brianna Coston, Integral Group

08/23/2017

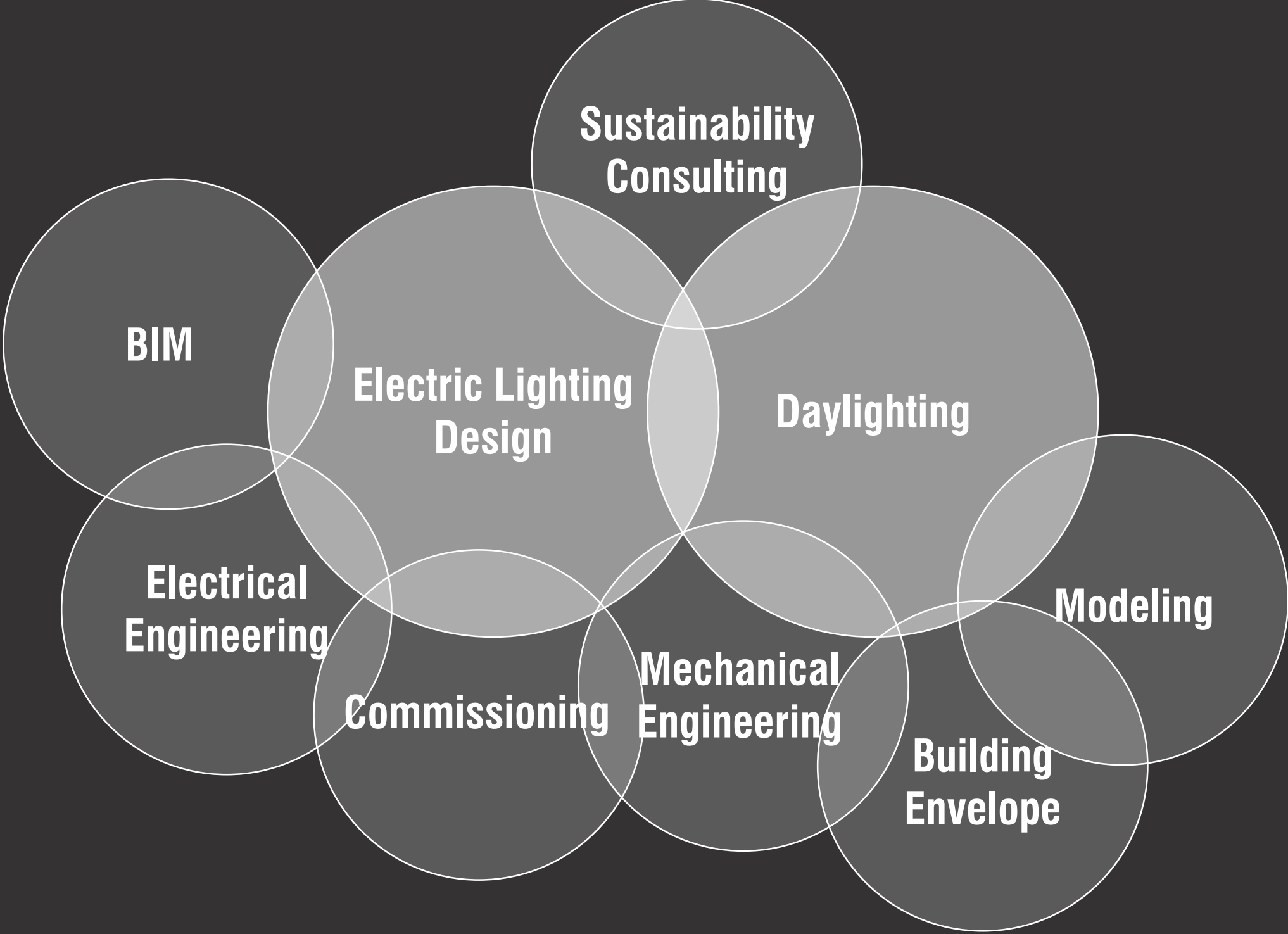


Outline

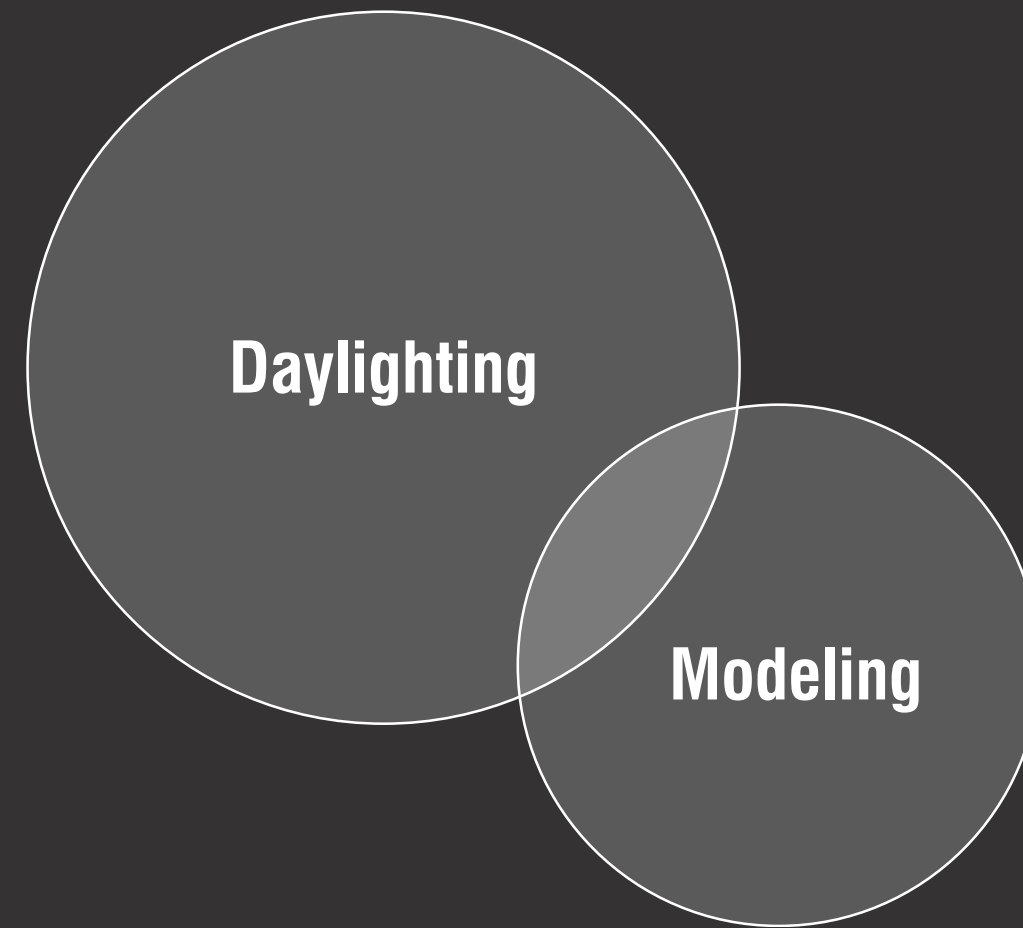
- **Integration with Energy Modeling**
Sacred Heart School - Atherton, CA
- **Integration with Sustainability**
LEED Modeling Workflow
- **Integration with Architects**
Canada College Kinesiology - Redwood City, CA
- **Storytelling with Lighting**
K-8 School in CA
- **Local Surprise**

How do we integrate our work with the rest of our firm?

The Look of an Integrated Design Firm

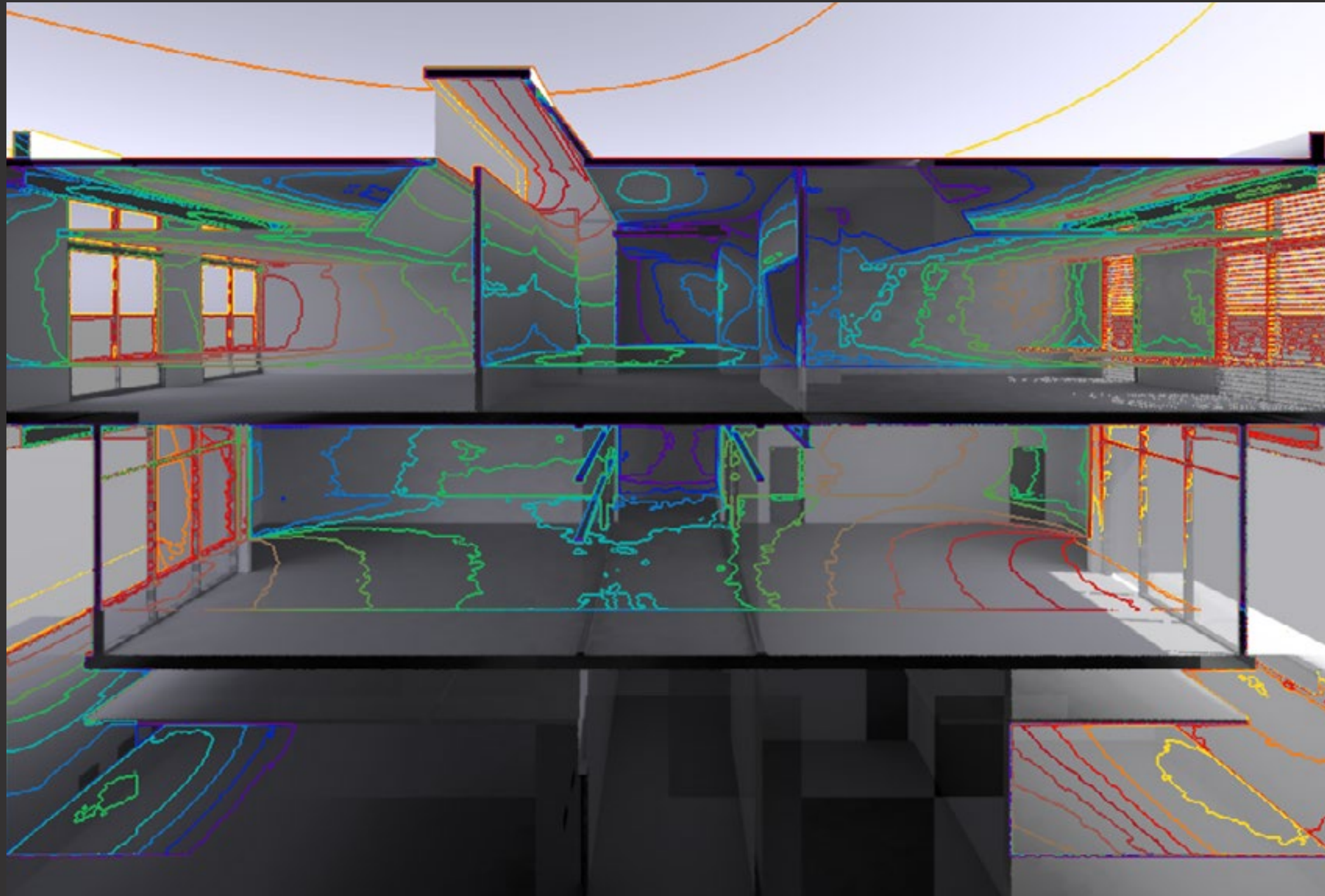


Integration with Modeling



Sacred Heart School - Atherton, CA

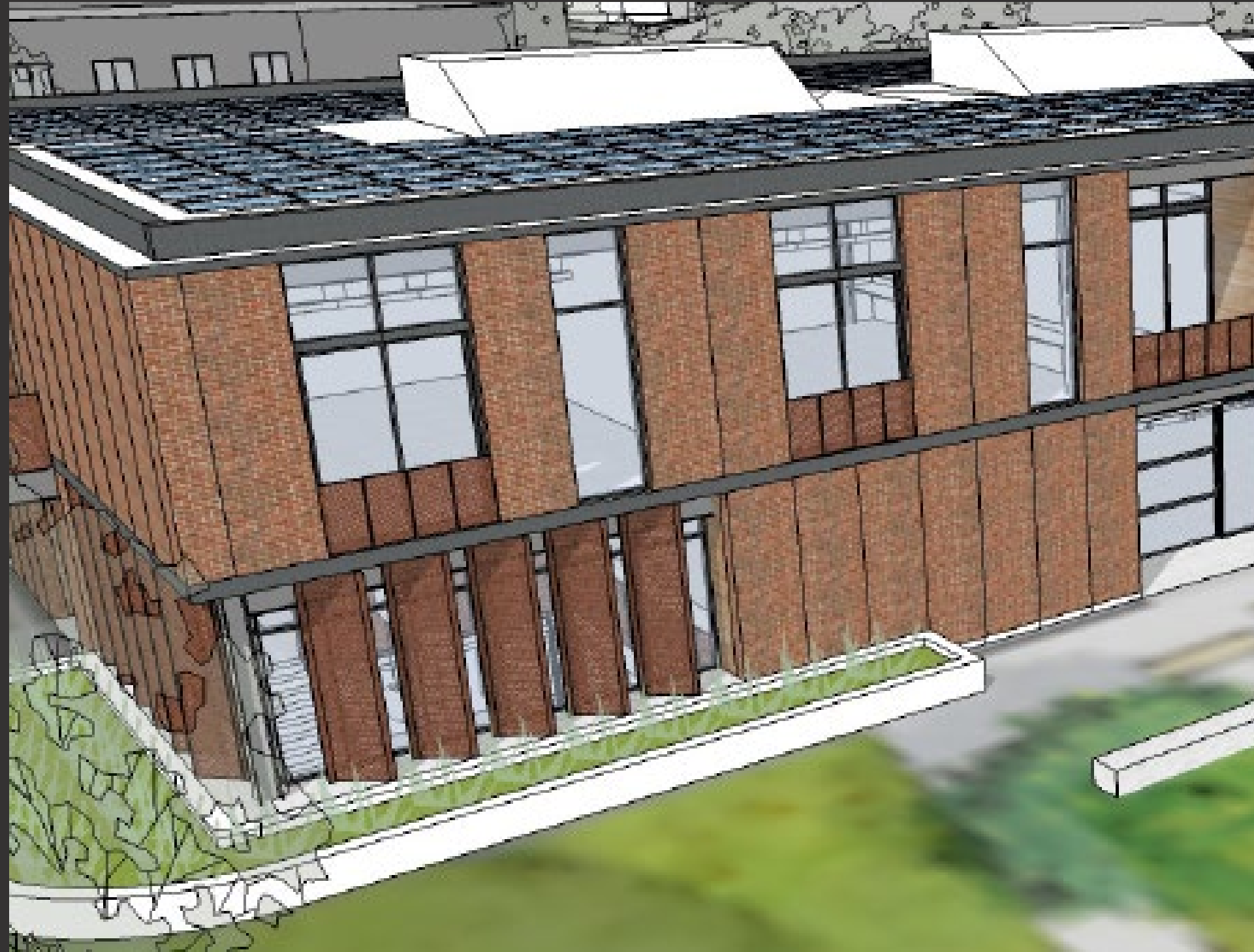
Background



Visual and Thermal Comfort Optimization

South Facade Solar Control

Baseline - Unshaded



South Facade Solar Control - Visual Comfort

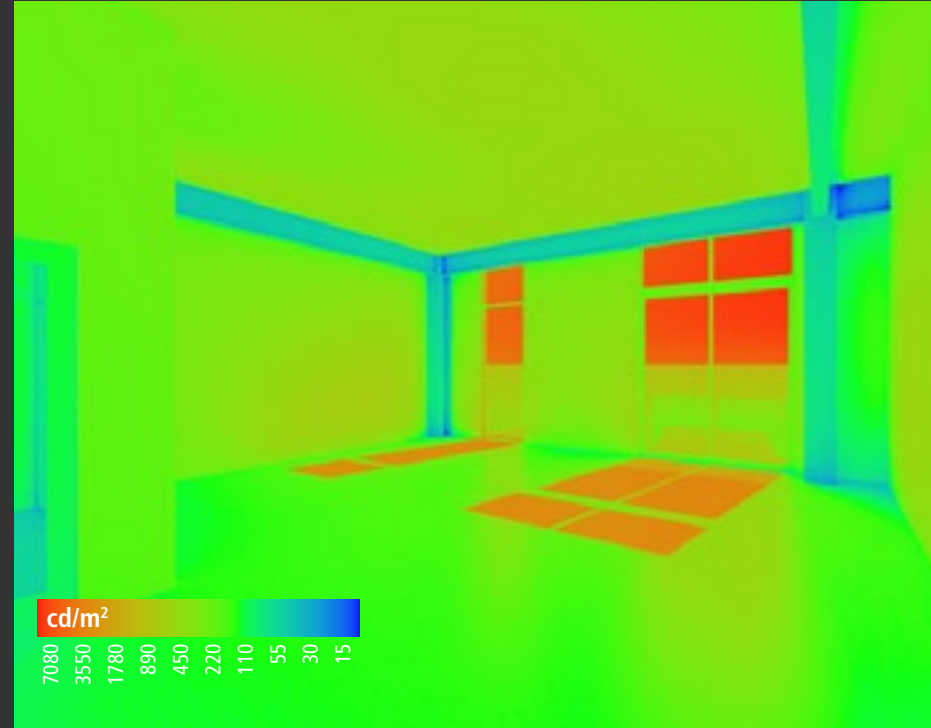
Baseline - Unshaded

Clear Sky, October - Noon

Perspective View



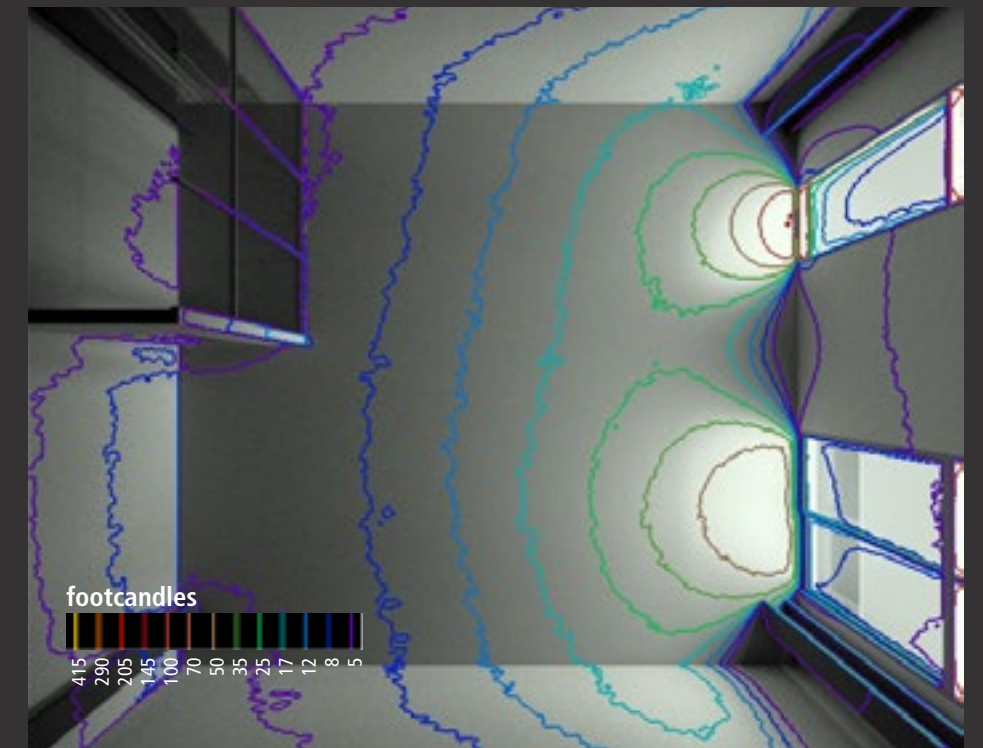
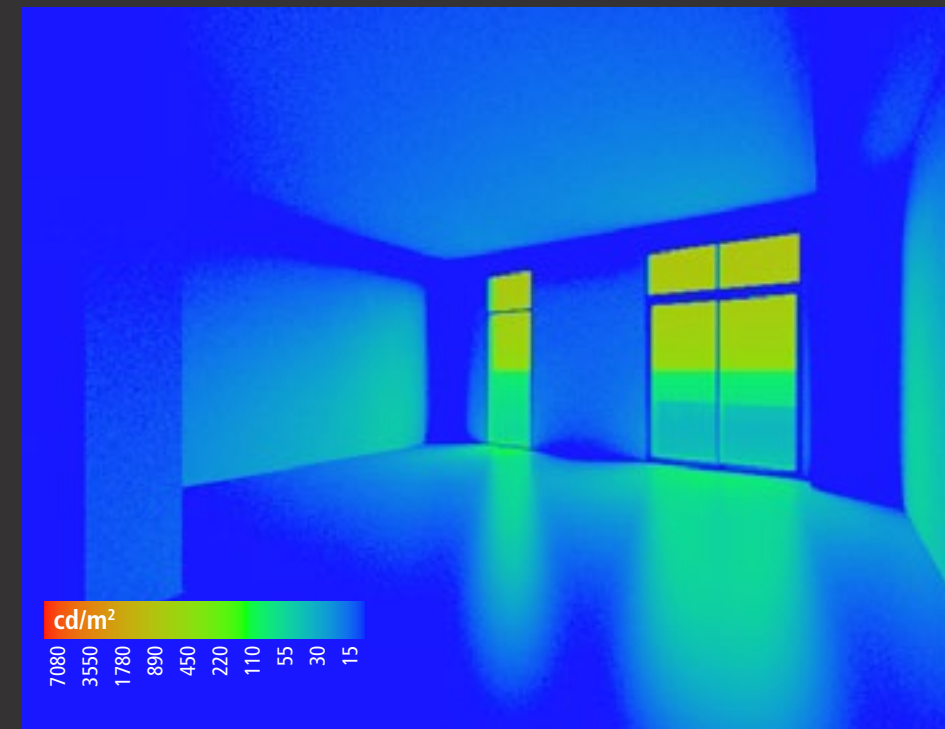
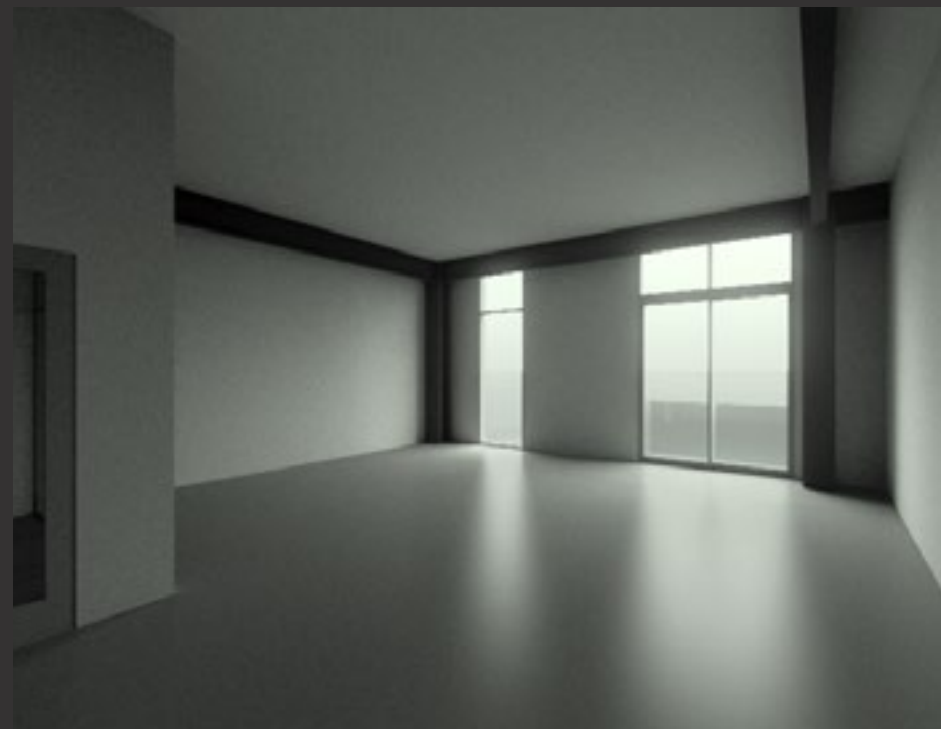
Falsecolor Luminance Map - Surface Brightness



Plan Perspective - Daylight Illuminance Levels



Overcast Sky, December - Noon



South Facade Solar Control Options

Shading Options



Exterior Automated Blinds

Glass: Solarban 70XL
Blinds: Exterior Venetian
Fixed Shading: none



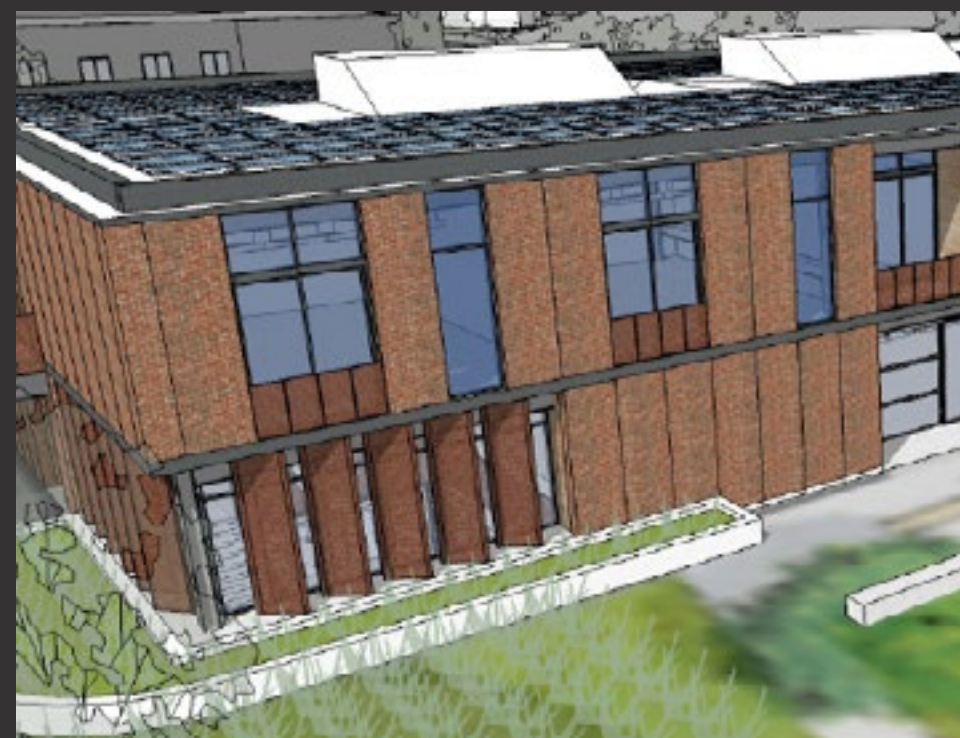
Fixed Exterior Slats

Glass: Solarban 70XL
Shades: Interior Fabric
Fixed Shading: Slats



Fixed Horizontal Overhang

Glass: Solarban 70XL
Shades: Interior Fabric
Fixed Shading: Overhang
Clerestory: Diffusing Film



Electrochromic Glass

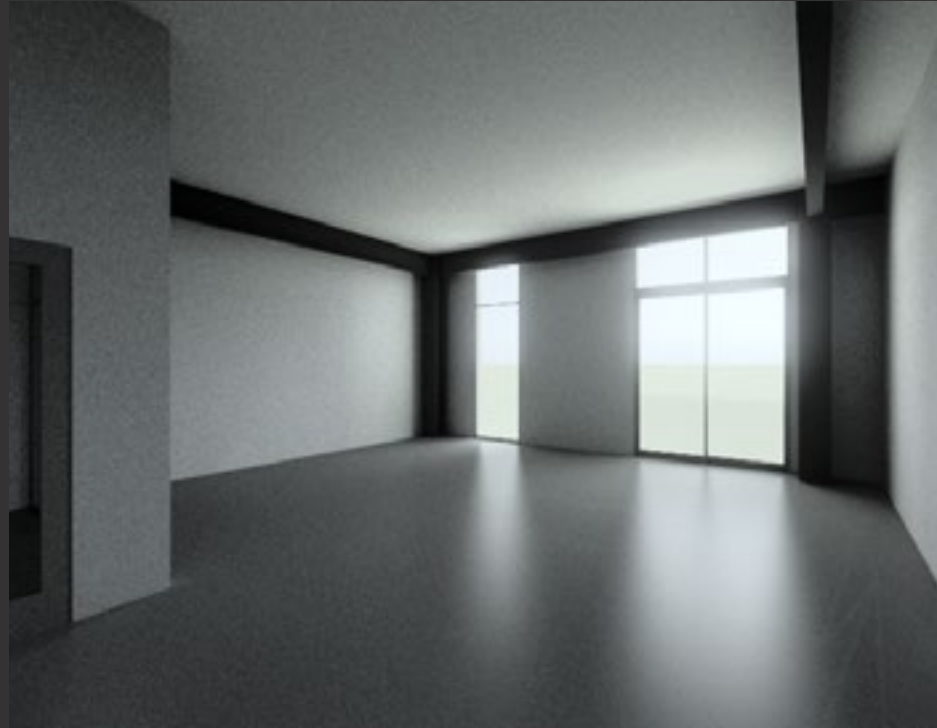
Glass: Electrochromic
Blinds: none
Fixed Shading: none

South Facade Solar Control Options - Visual Comfort Impact

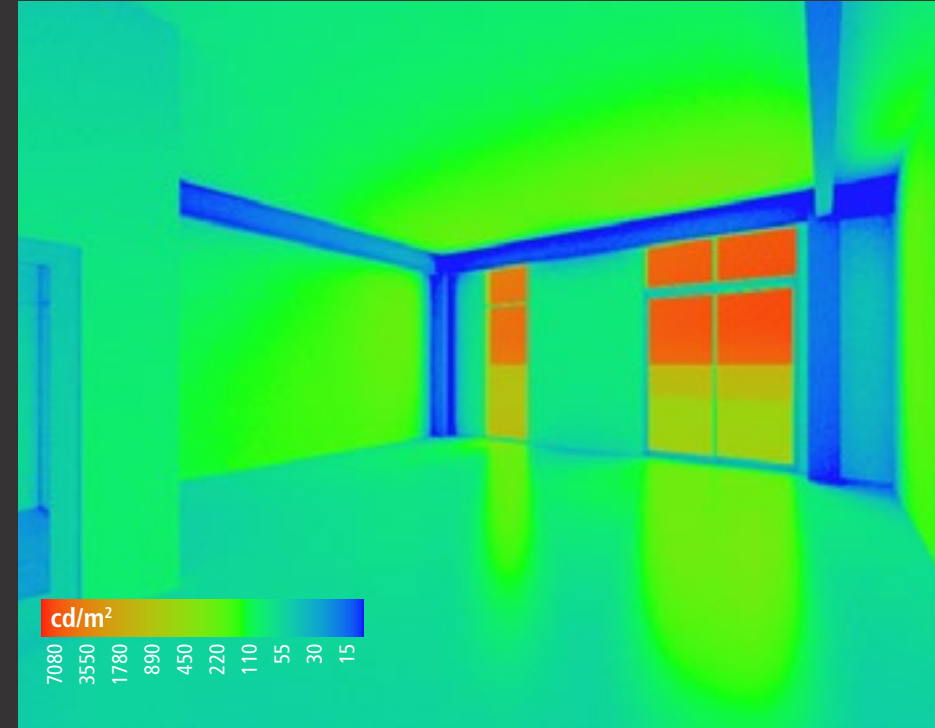
Option 1: Exterior Automated Blinds

Clear Sky, October - Noon

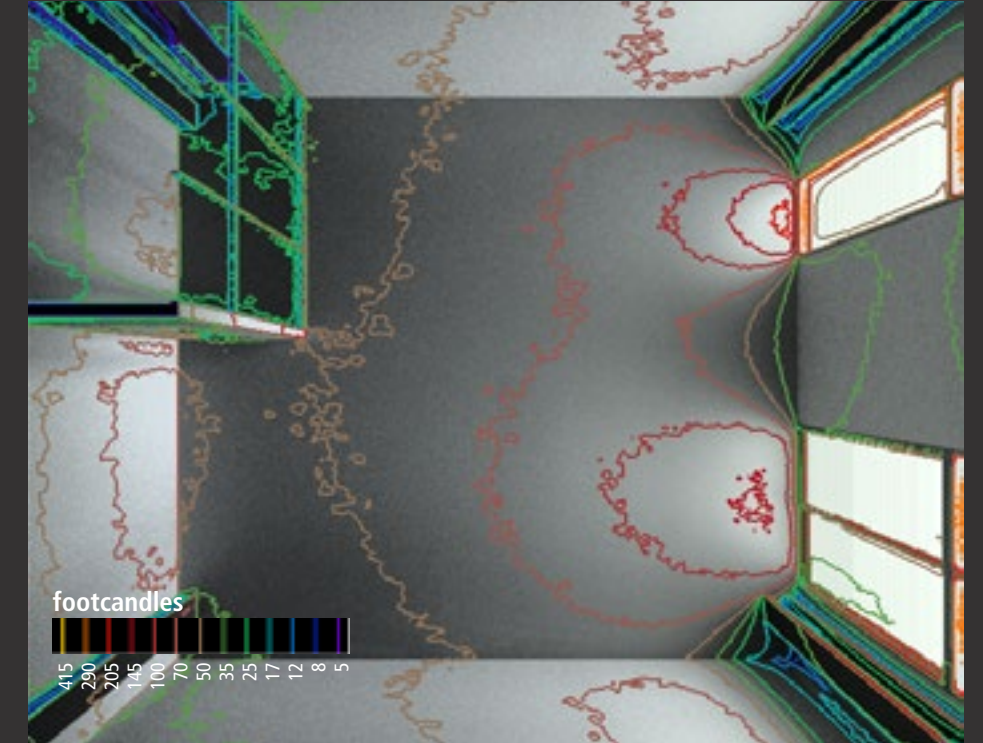
Perspective View



Falsecolor Luminance Map - Surface Brightness

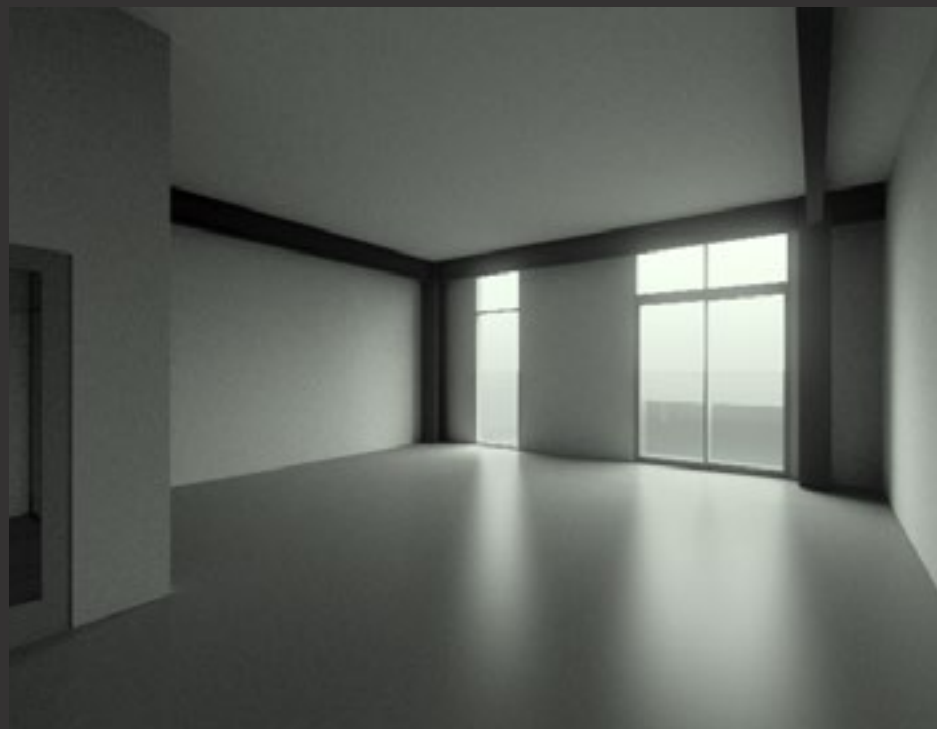


Plan Perspective - Daylight Illuminance Levels

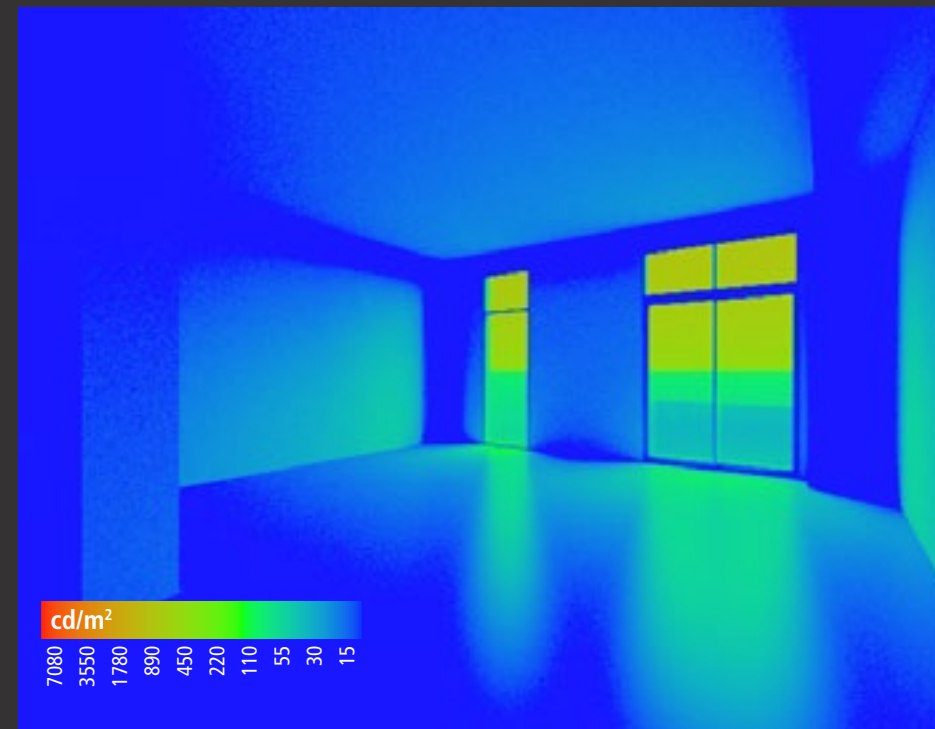


Overcast Sky, December - Noon

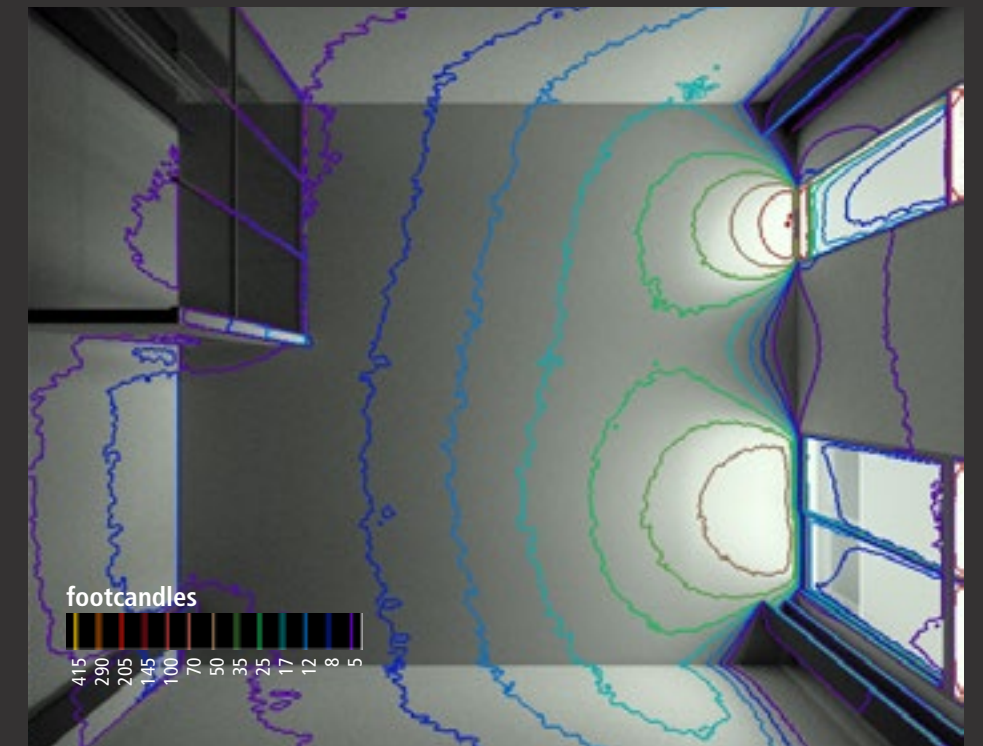
Perspective View



Falsecolor Luminance Map - Surface Brightness



Plan Perspective - Daylight Illuminance Levels

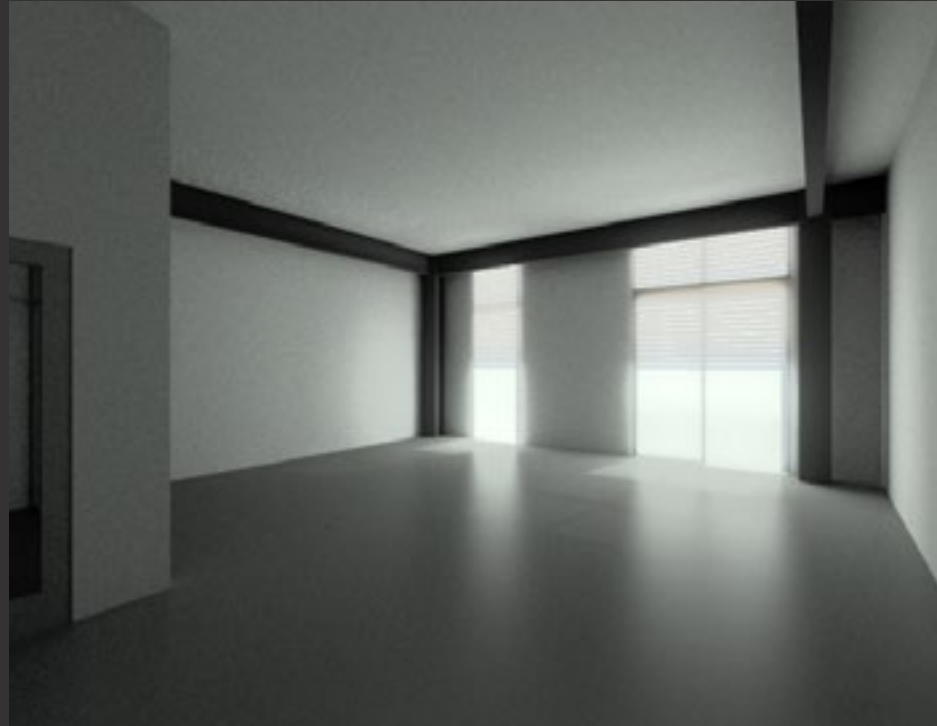


South Facade Solar Control Options - Visual Comfort Impact

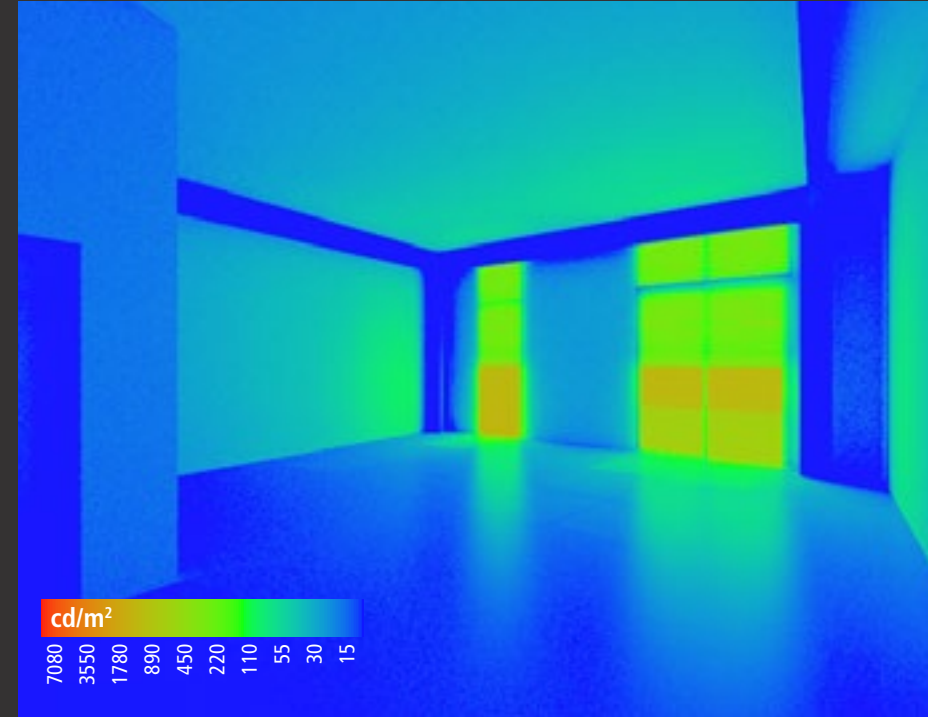
Option 2: Exterior Slats with Interior Automated Fabric Shades

Clear Sky, October - Noon

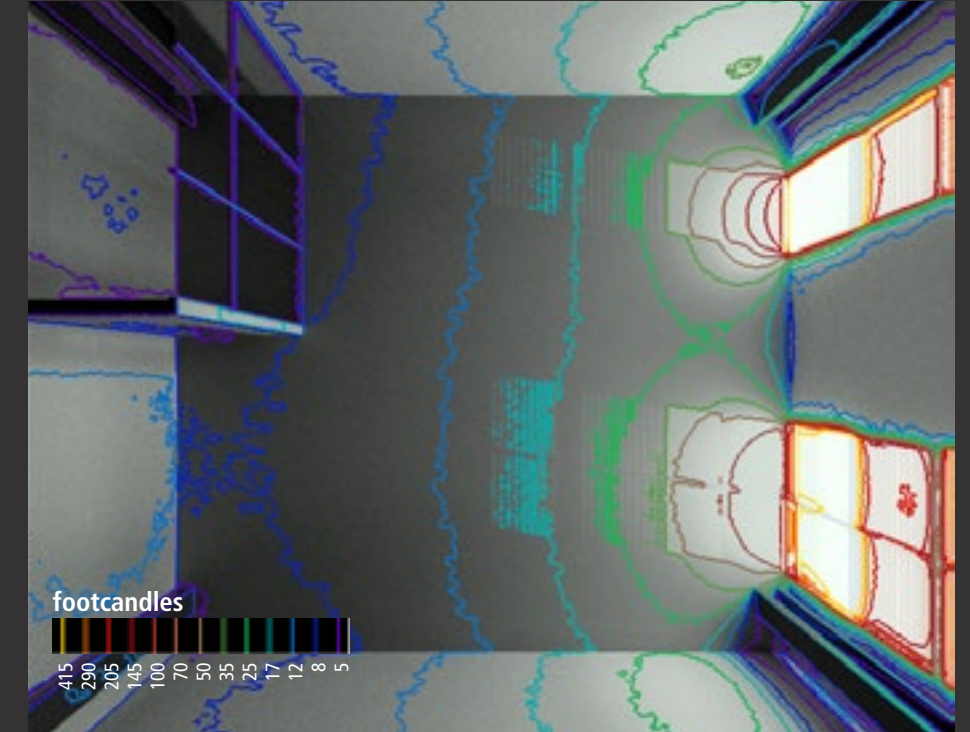
Perspective View



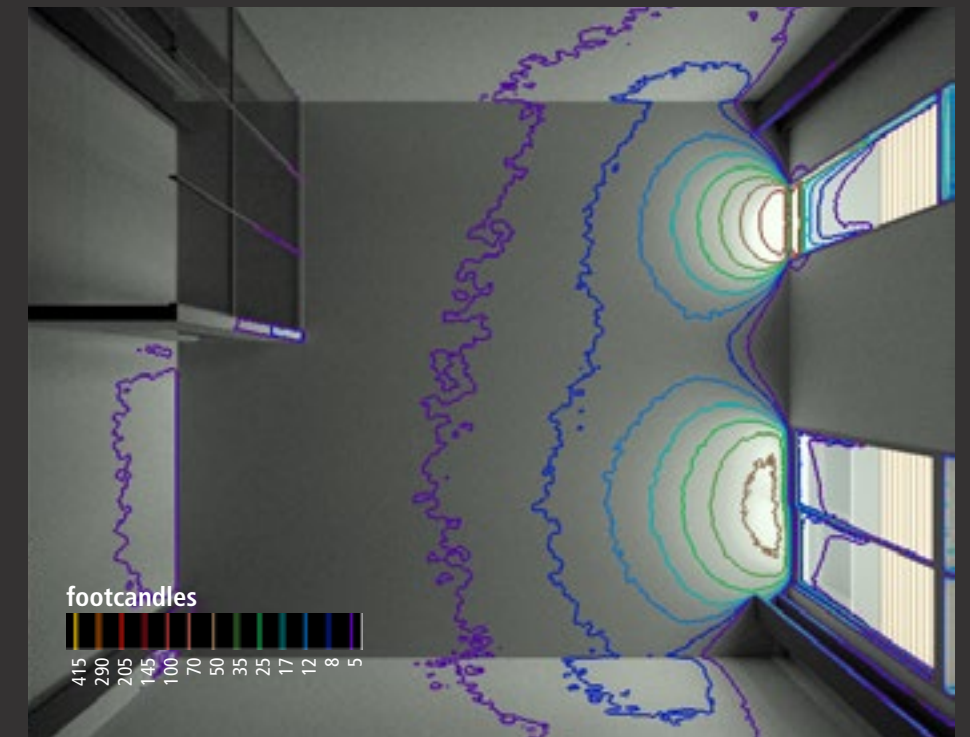
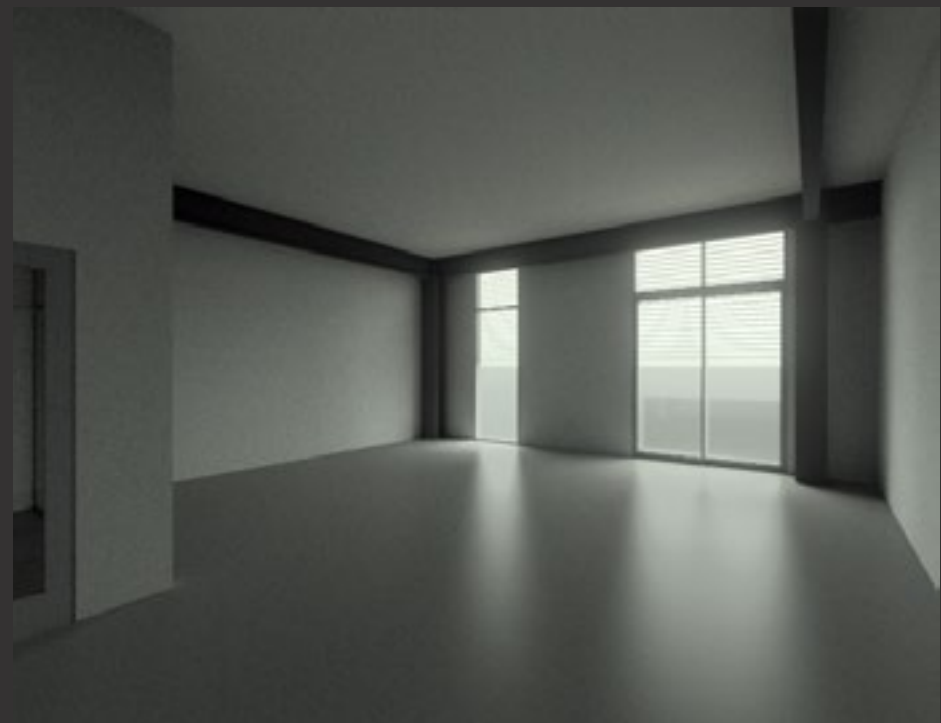
Falsecolor Luminance Map - Surface Brightness



Plan Perspective - Daylight Illuminance Levels



Overcast Sky, December - Noon

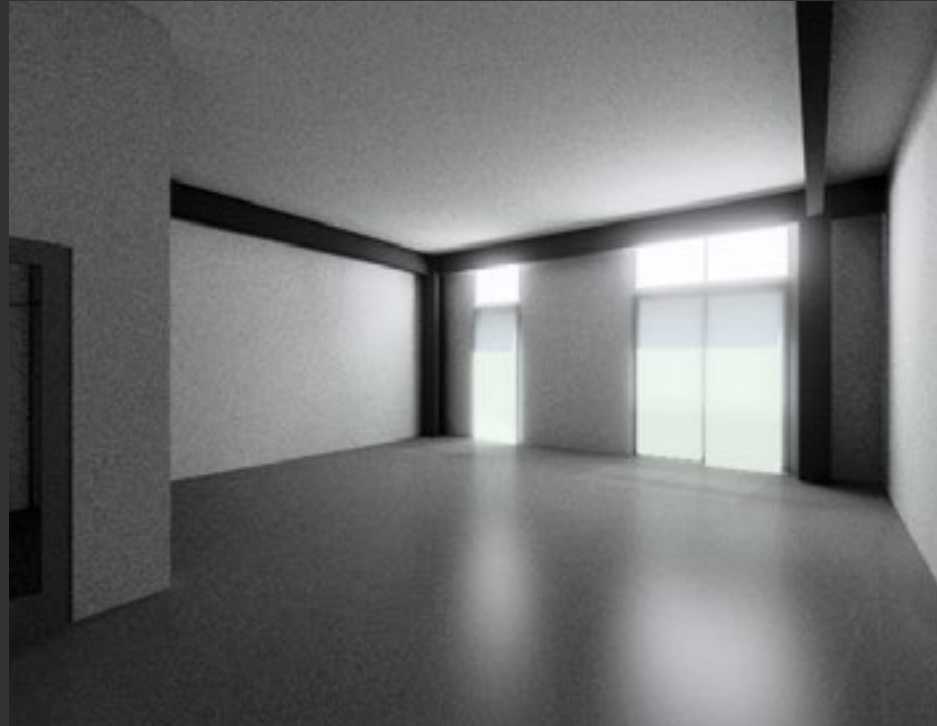


South Facade Solar Control Options - Visual Comfort Impact

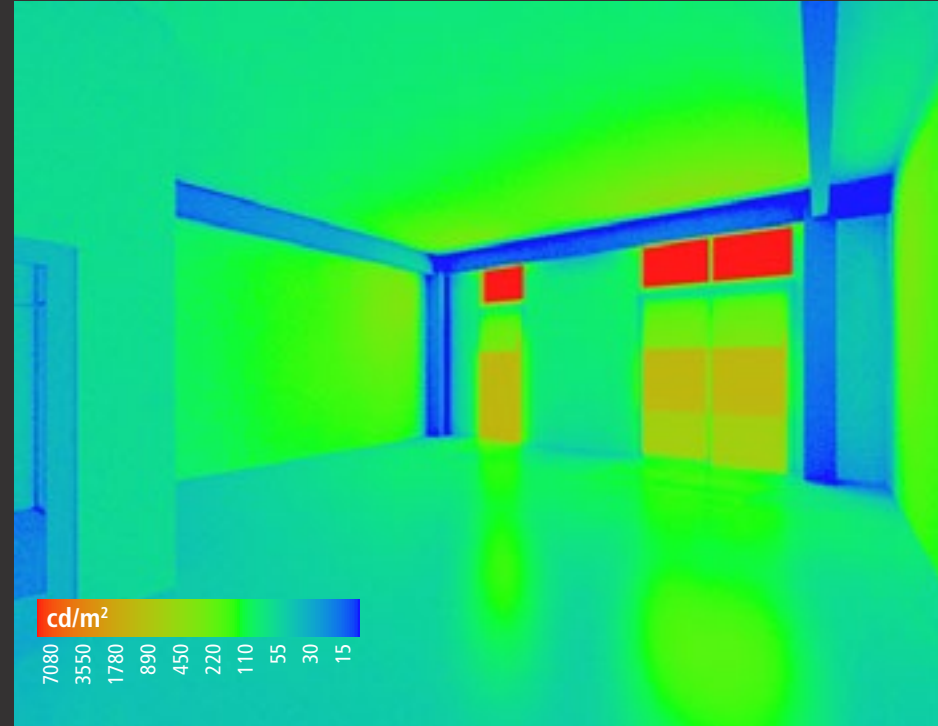
Option 3: Exterior Horizontal Overhang with Interior Automated Fabric Shades

Clear Sky, October - Noon

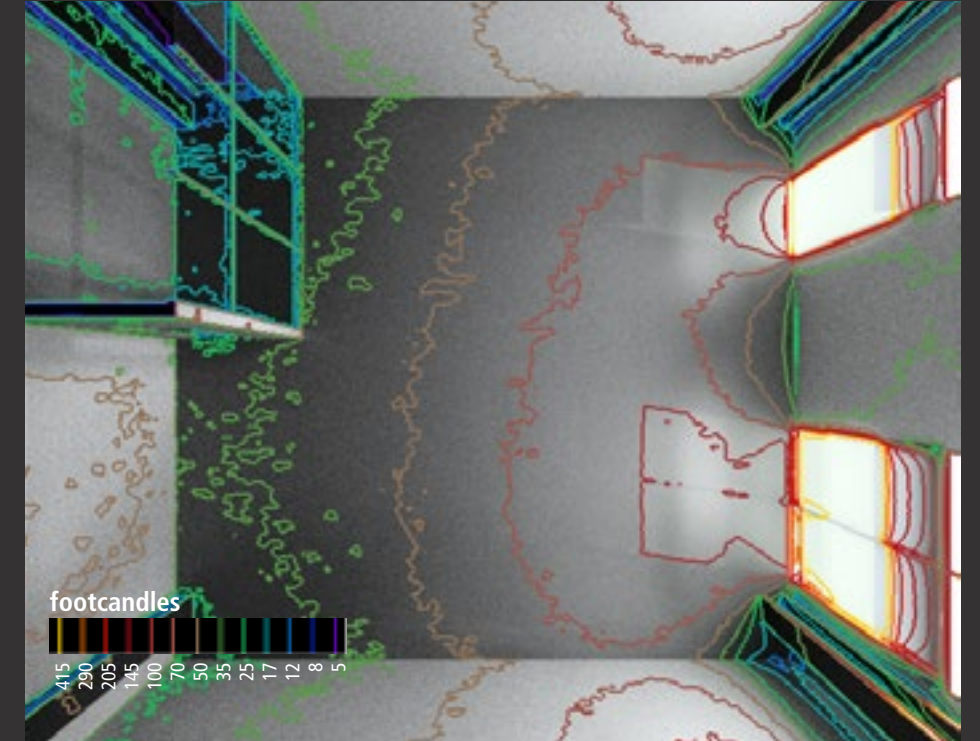
Perspective View



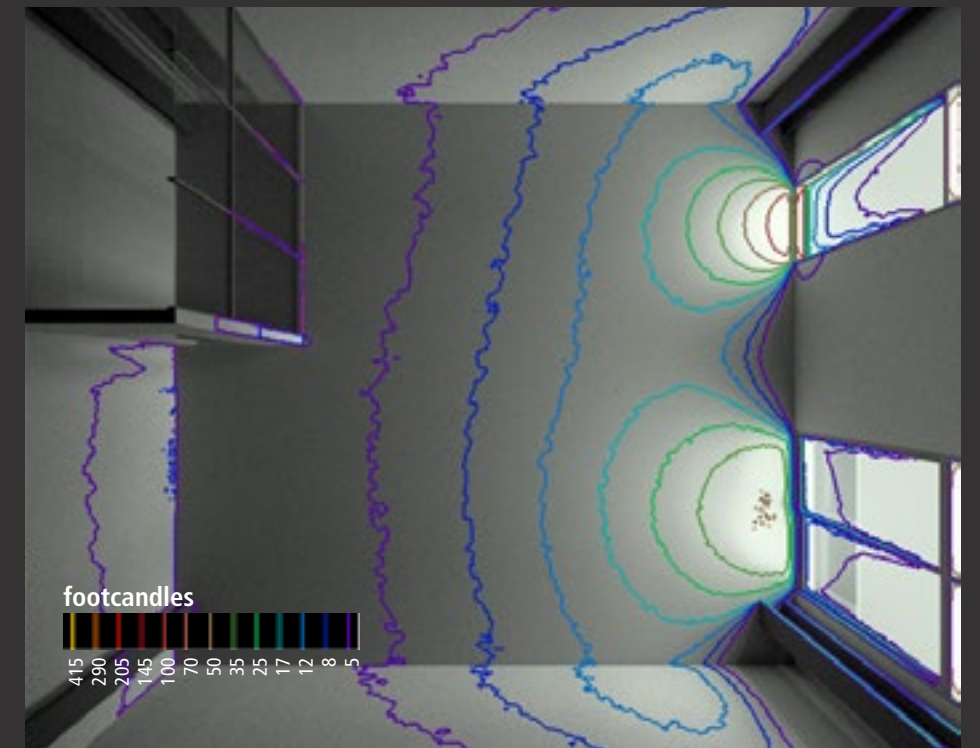
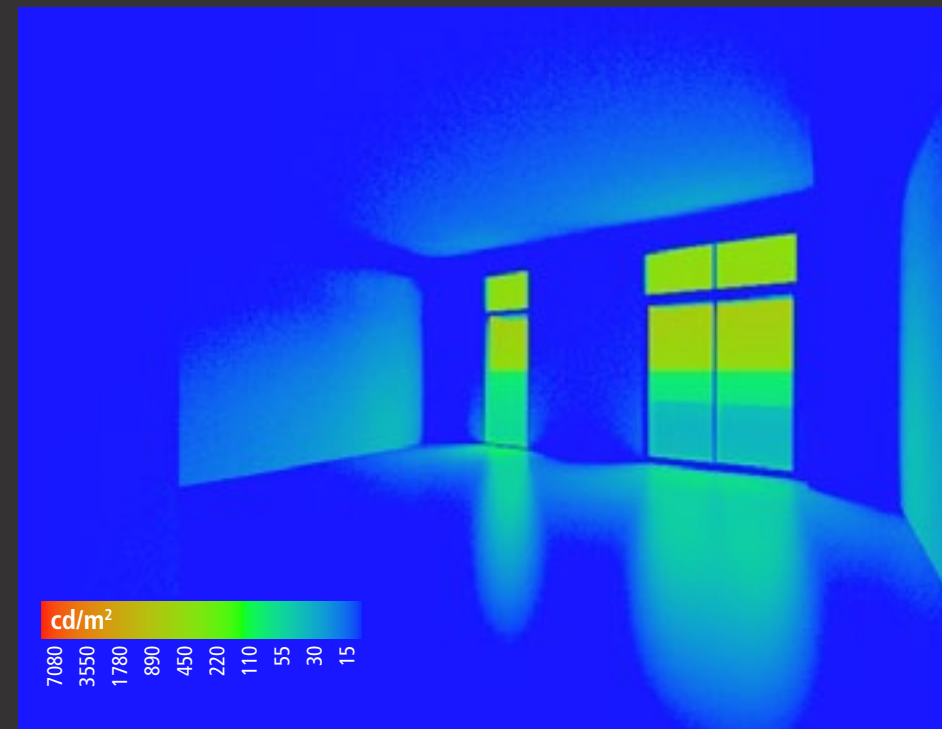
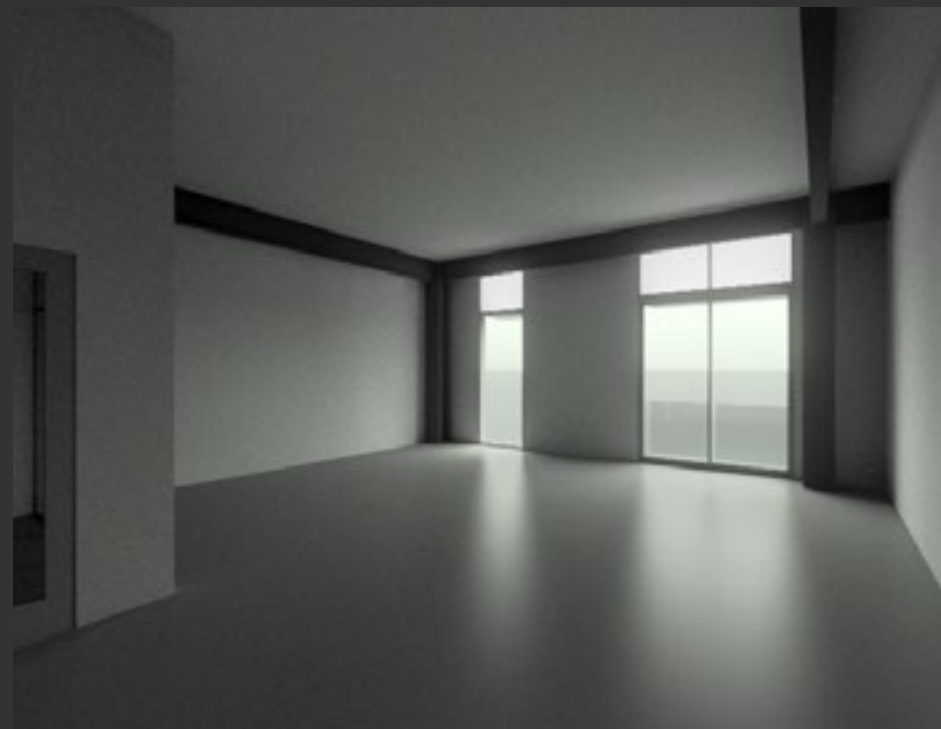
Falsecolor Luminance Map - Surface Brightness



Plan Perspective - Daylight Illuminance Levels



Overcast Sky, December - Noon



South Facade Solar Control Options - Visual Comfort Impact

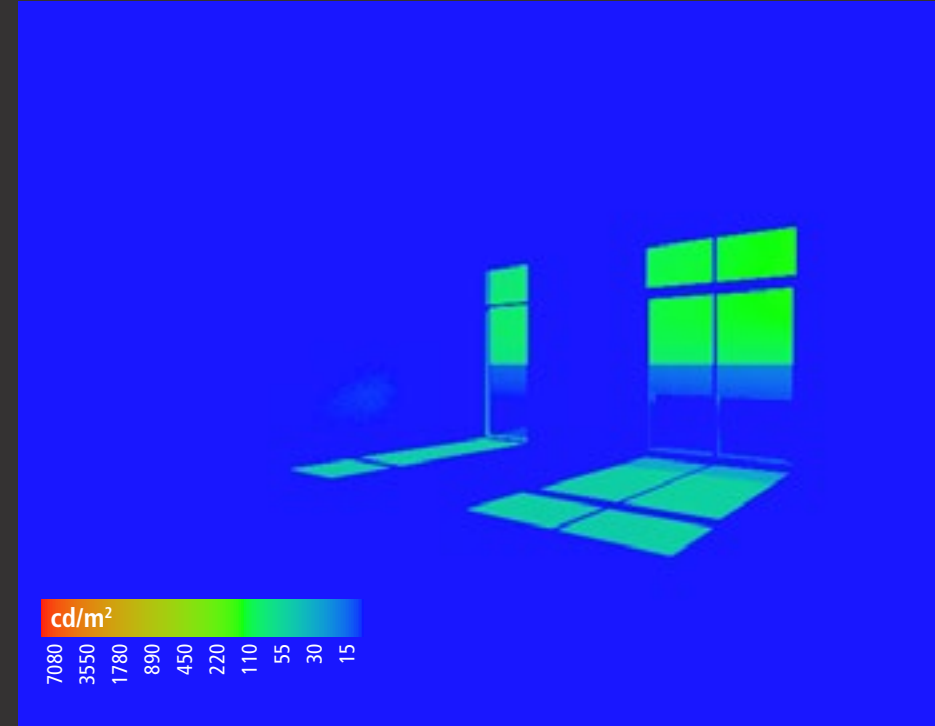
Option 4: Electrochromic Glass

Clear Sky, October - Noon

Perspective View



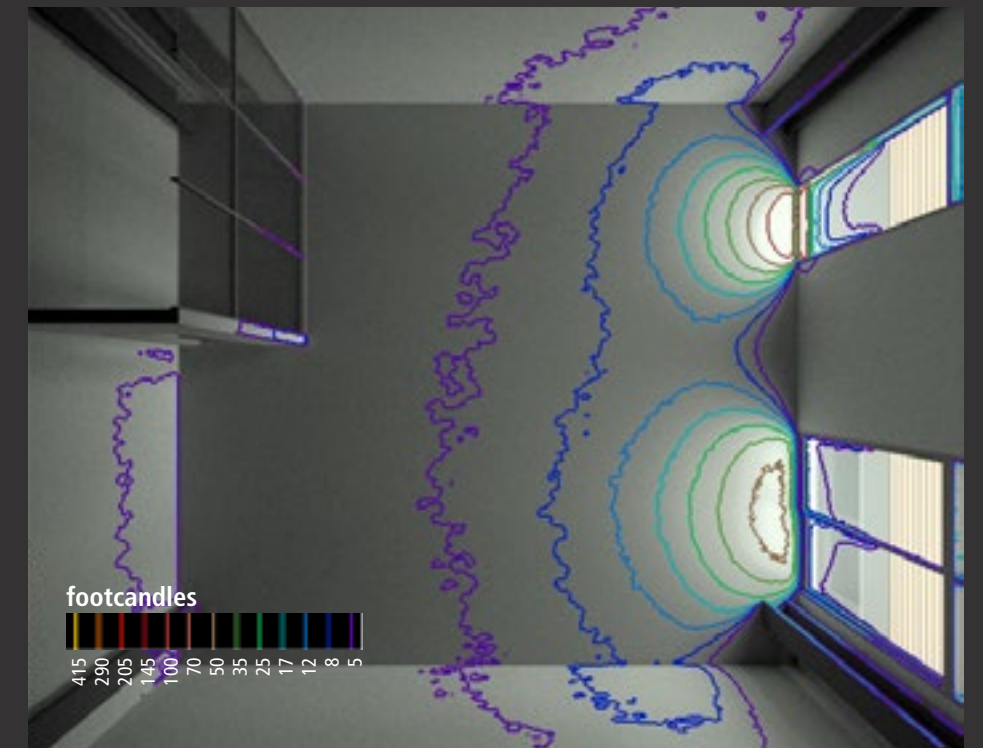
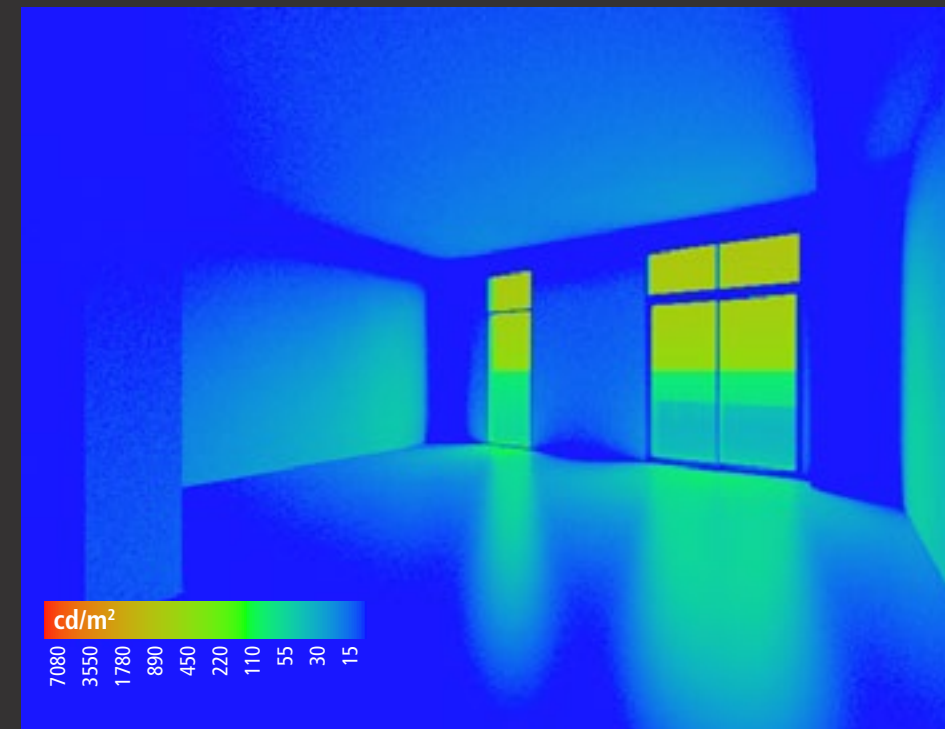
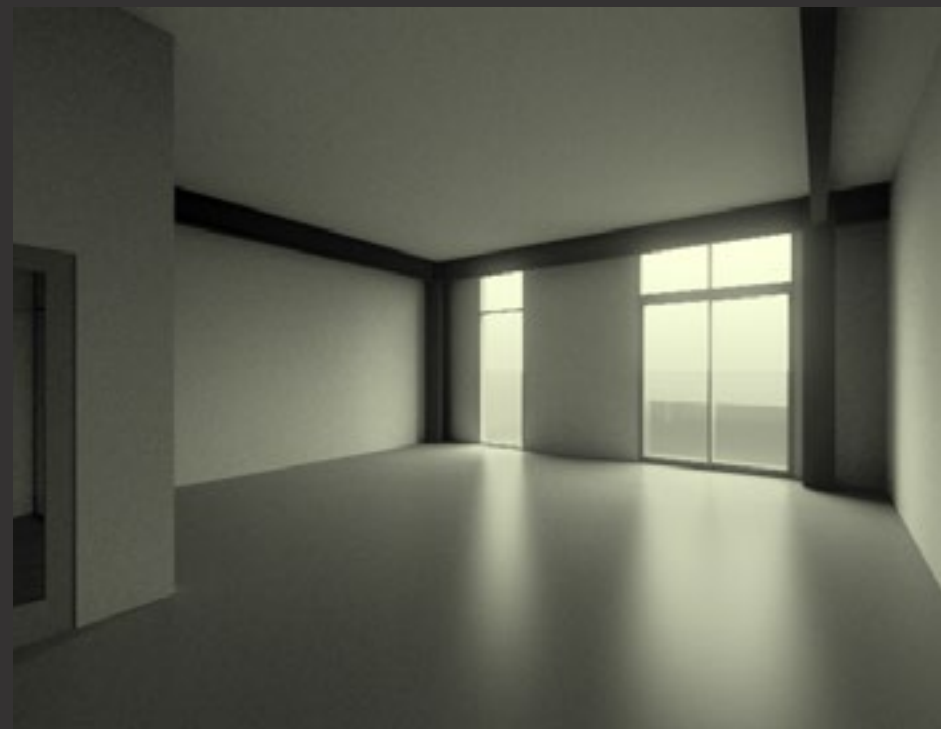
Falsecolor Luminance Map - Surface Brightness



Plan Perspective - Daylight Illuminance Levels



Overcast Sky, December - Noon



South Facade Solar Control Options - Thermal Comfort Impact

Standard Effective Surface Temperatures at Peak / September 27, 2:00pm

Unshaded



Exterior Automated Blinds



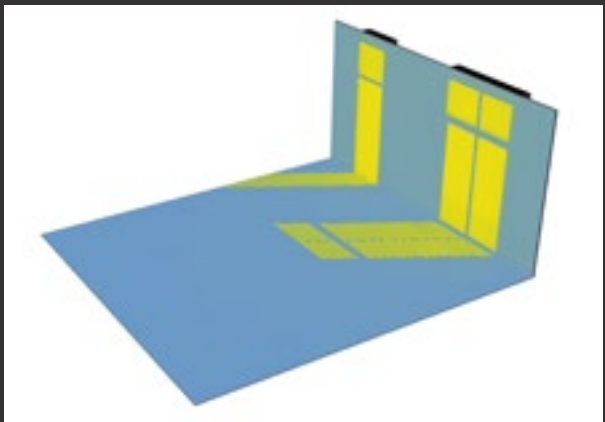
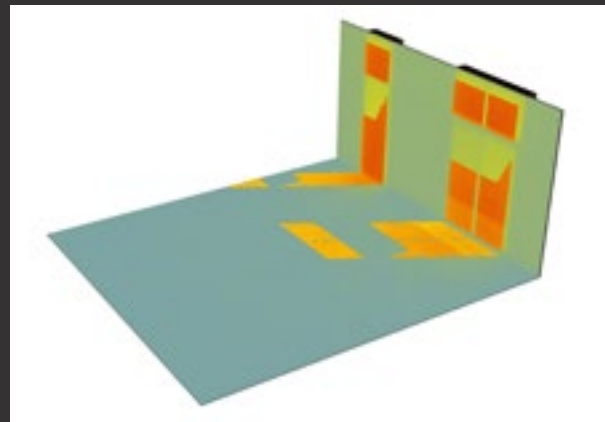
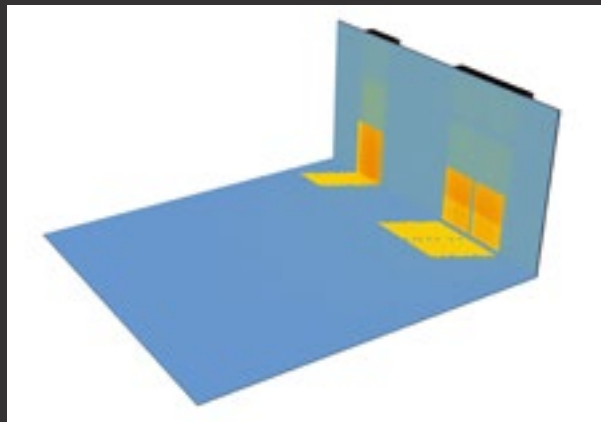
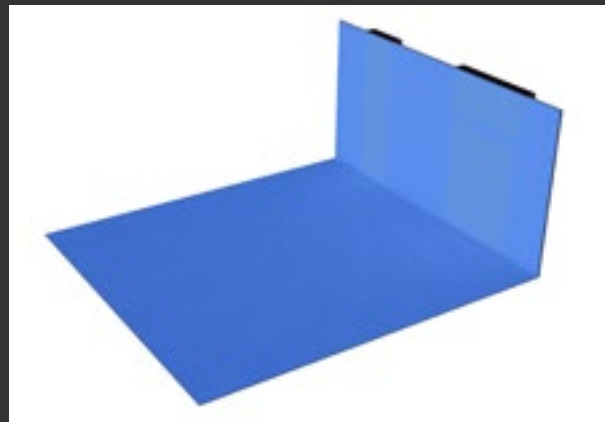
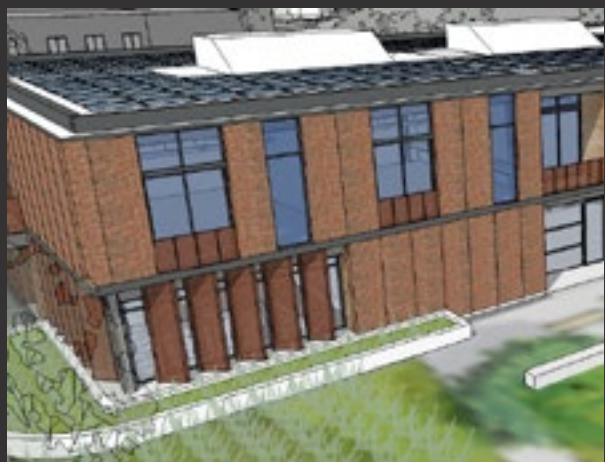
Fixed Exterior Slats



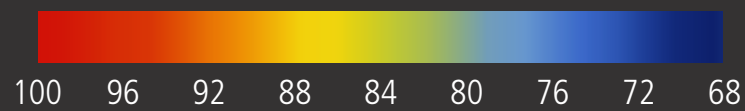
Fixed Horizontal Overhangs



Electrochromic Glass



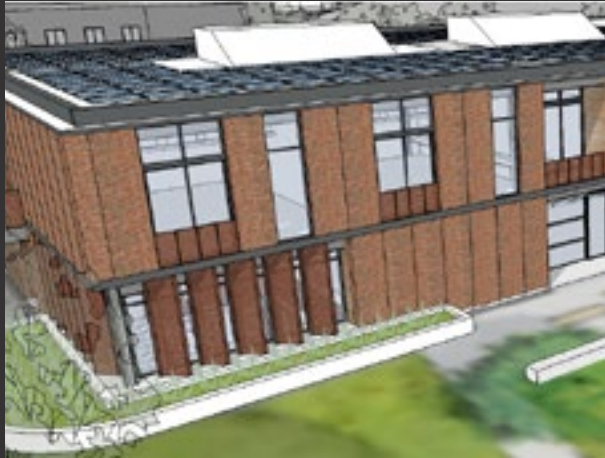
Degrees F



South Facade Solar Control Options - Thermal Comfort Impact

Predicted Mean Vote at Peak / September 27, 2:00pm

Unshaded



Exterior Automated Blinds



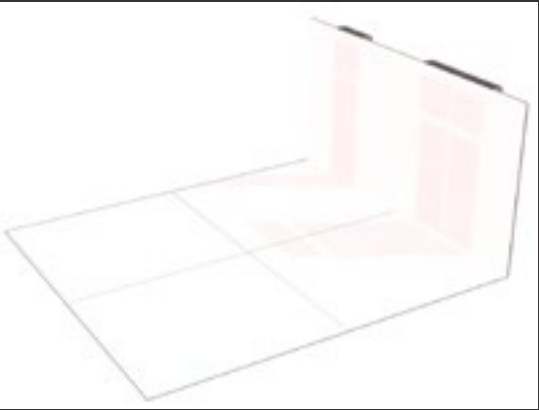
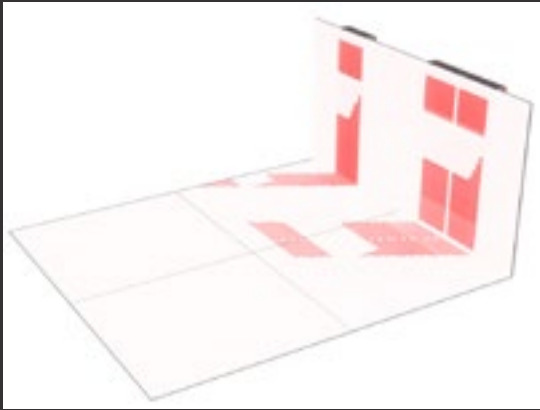
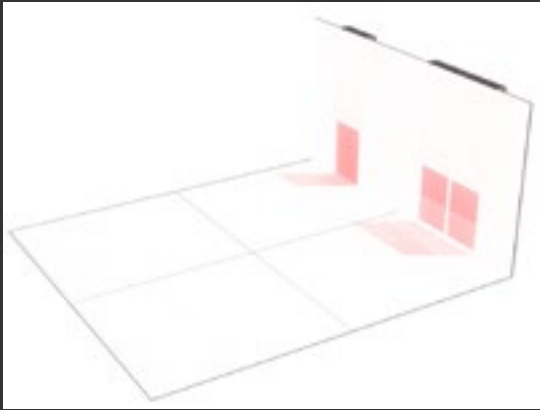
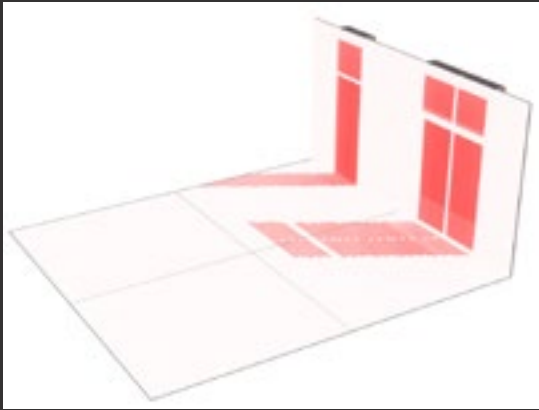
Fixed Exterior Slats



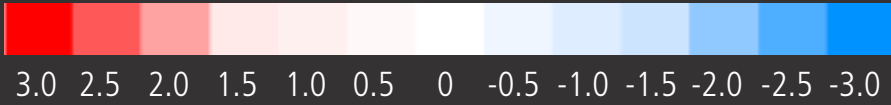
Fixed Horizontal Overhangs



Electrochromic Glass

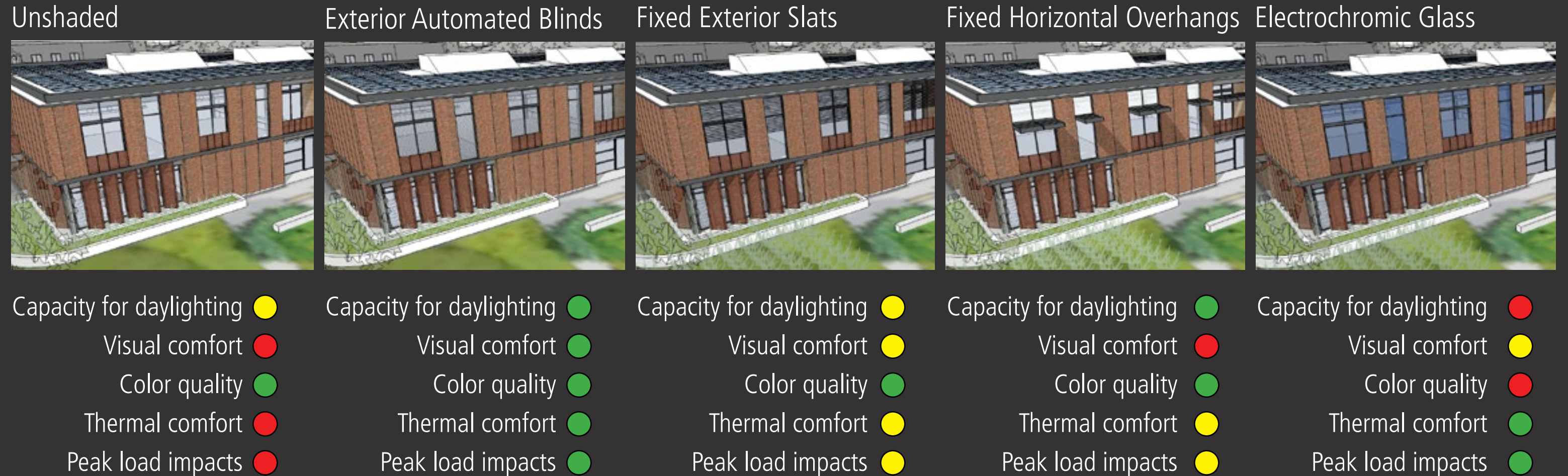


Predicted Mean Vote

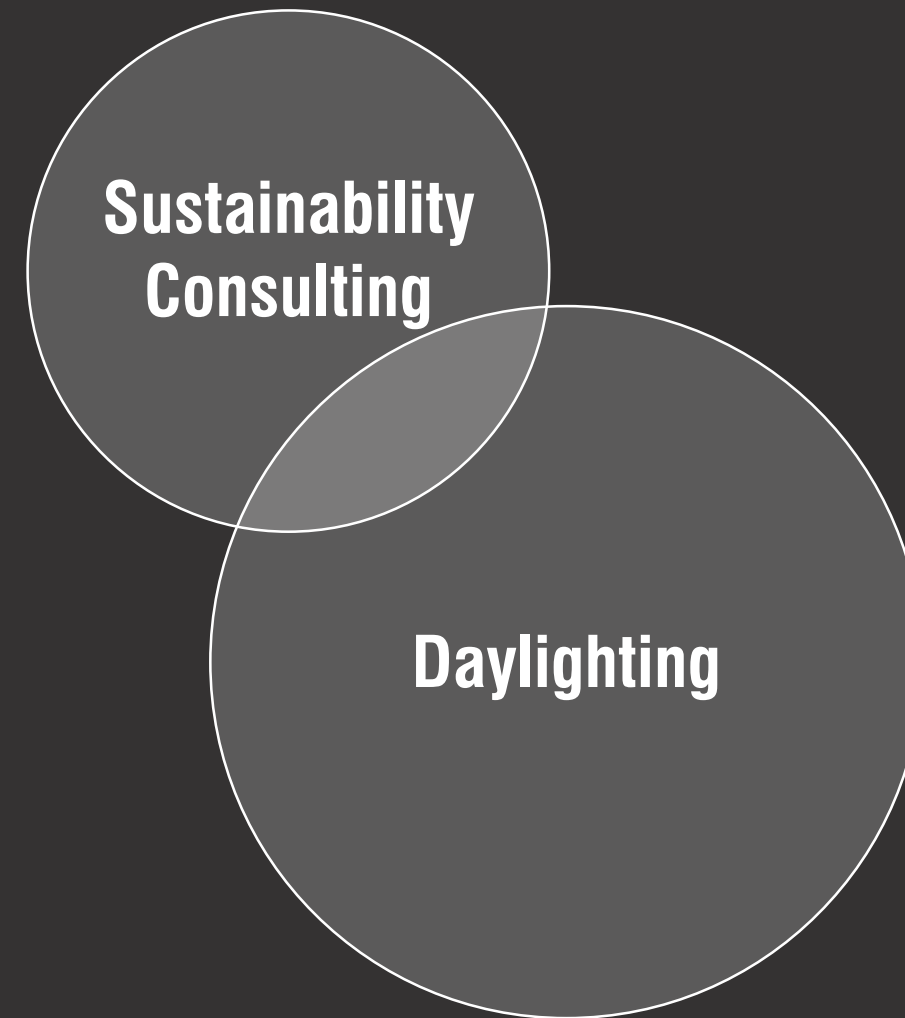


South Facade Solar Control Options

Facade Performance Summary



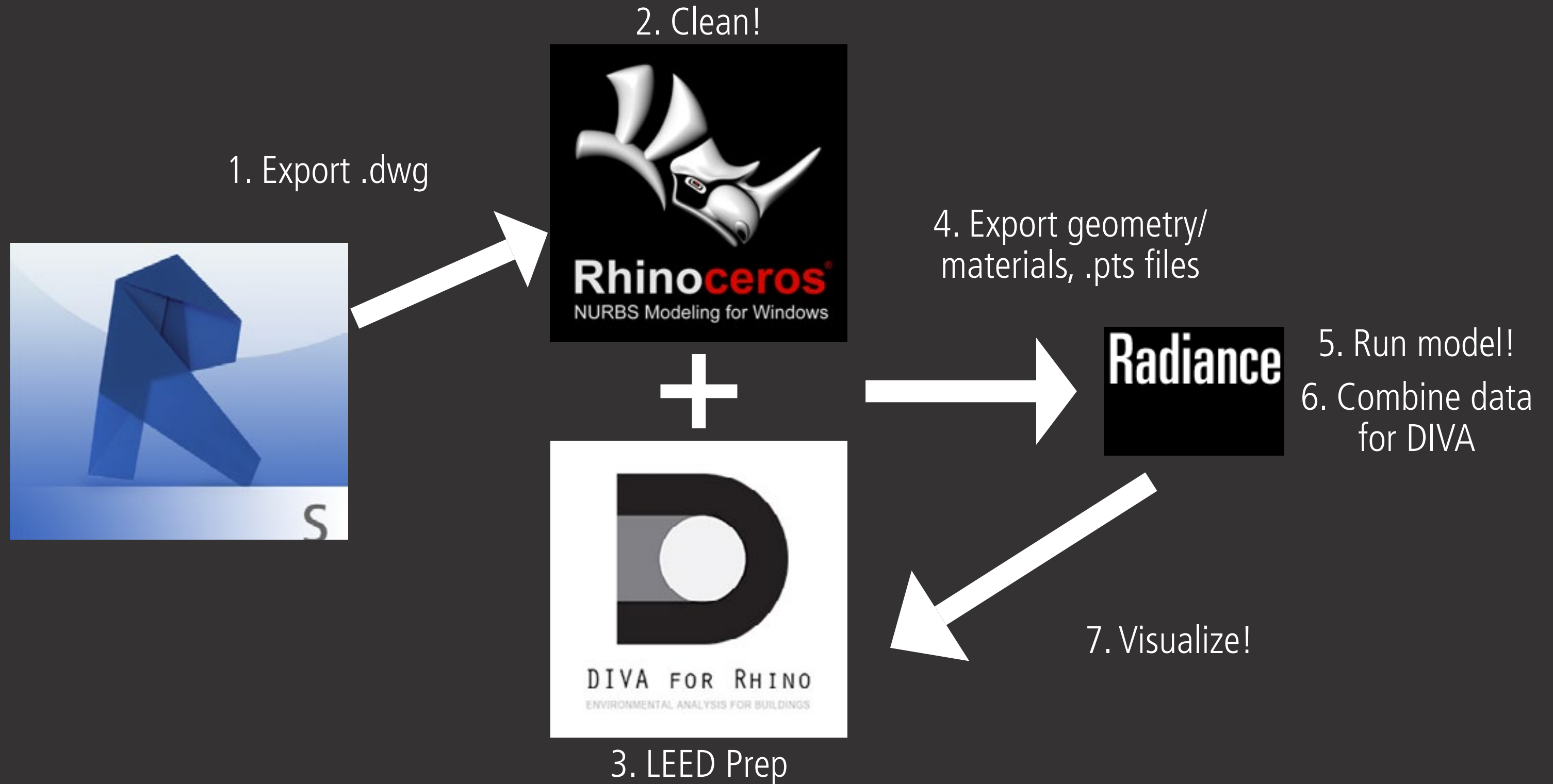
Integration with Sustainability



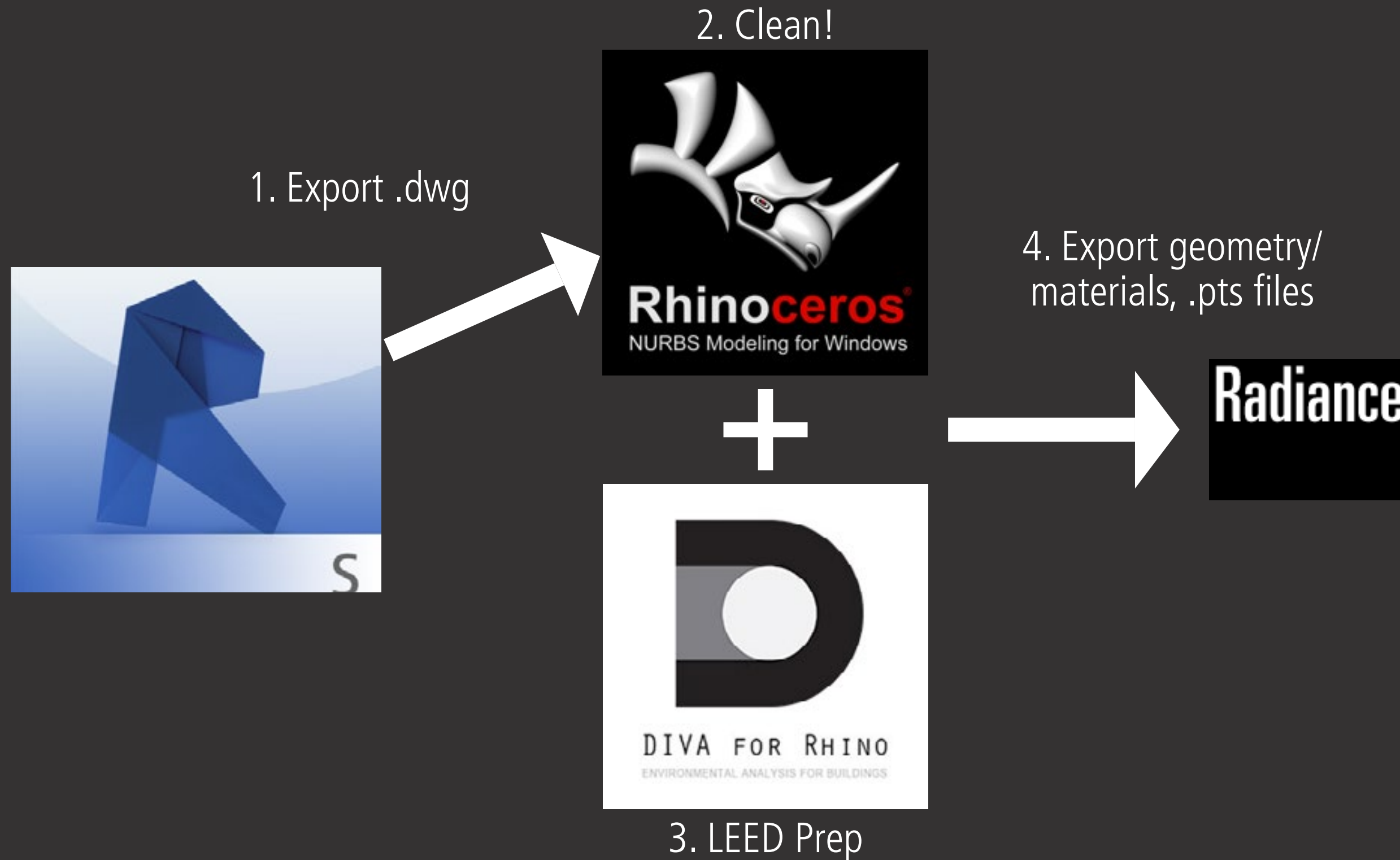
**How do I run LEED models
while still maintaining usage of my computer?**

Large LEED Model Workflow

Overview



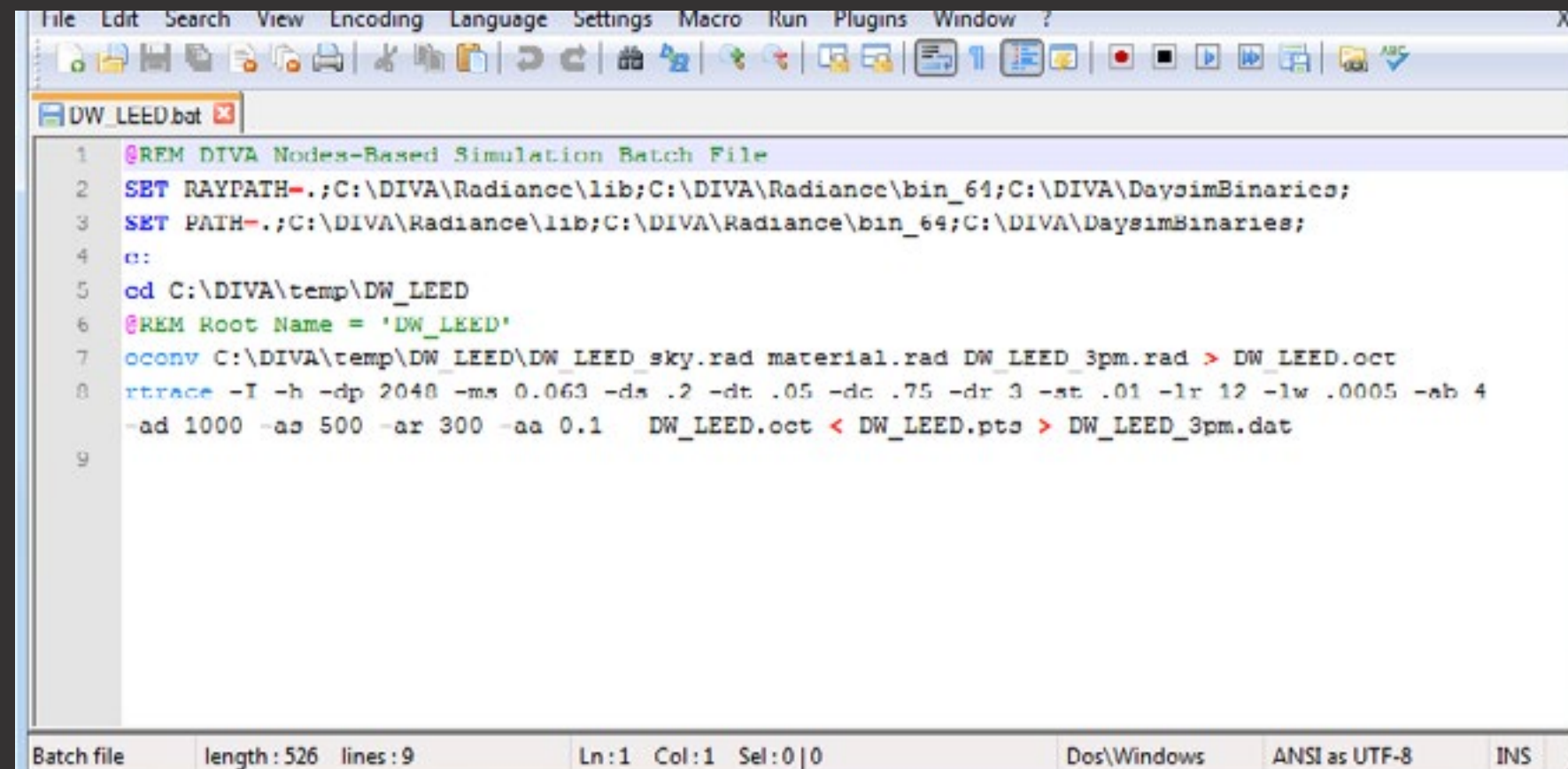
Large LEED Model Workflow



Large LEED Model Workflow

Batch File

C:\DIVA\temp\Project



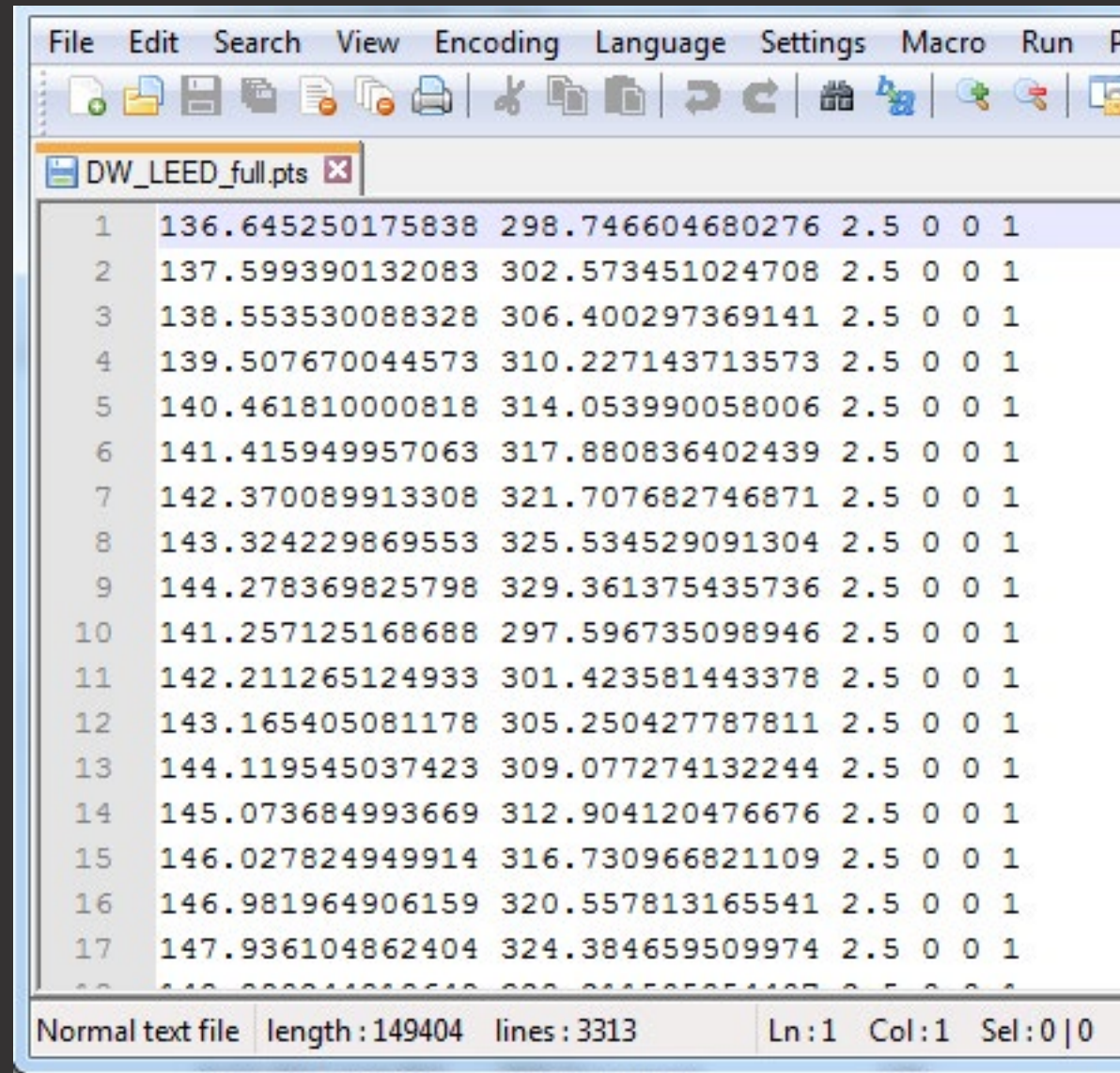
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1 @REM DIVA Nodes-Based Simulation Batch File
2 SET RAYPATH=.;C:\DIVA\Radiance\lib;C:\DIVA\Radiance\bin_64;C:\DIVA\DaysimBinaries;
3 SET PATH=.;C:\DIVA\Radiance\lib;C:\DIVA\Radiance\bin_64;C:\DIVA\DaysimBinaries;
4 c:
5 cd C:\DIVA\temp\DW_LEED
6 @REM Root Name = 'DW_LEED'
7 oconv C:\DIVA\temp\DW_LEED\DW_LEED_sky.rad material.rad DW_LEED_3pm.rad > DW_LEED.oct
8 rtrace -I -h -dp 2048 -ms 0.063 -ds .2 -dt .05 -dc .75 -dr 3 -st .01 -lr 12 -lw .0005 -ab 4
   -ad 1000 -as 500 -ar 300 -aa 0.1 DW_LEED.oct < DW_LEED.pts > DW_LEED_3pm.dat
9
```

Batch file length: 526 lines: 9 Ln: 1 Col: 1 Sel: 0 | 0 Dos\Windows ANSI as UTF-8 INS

Large LEED Model Workflow

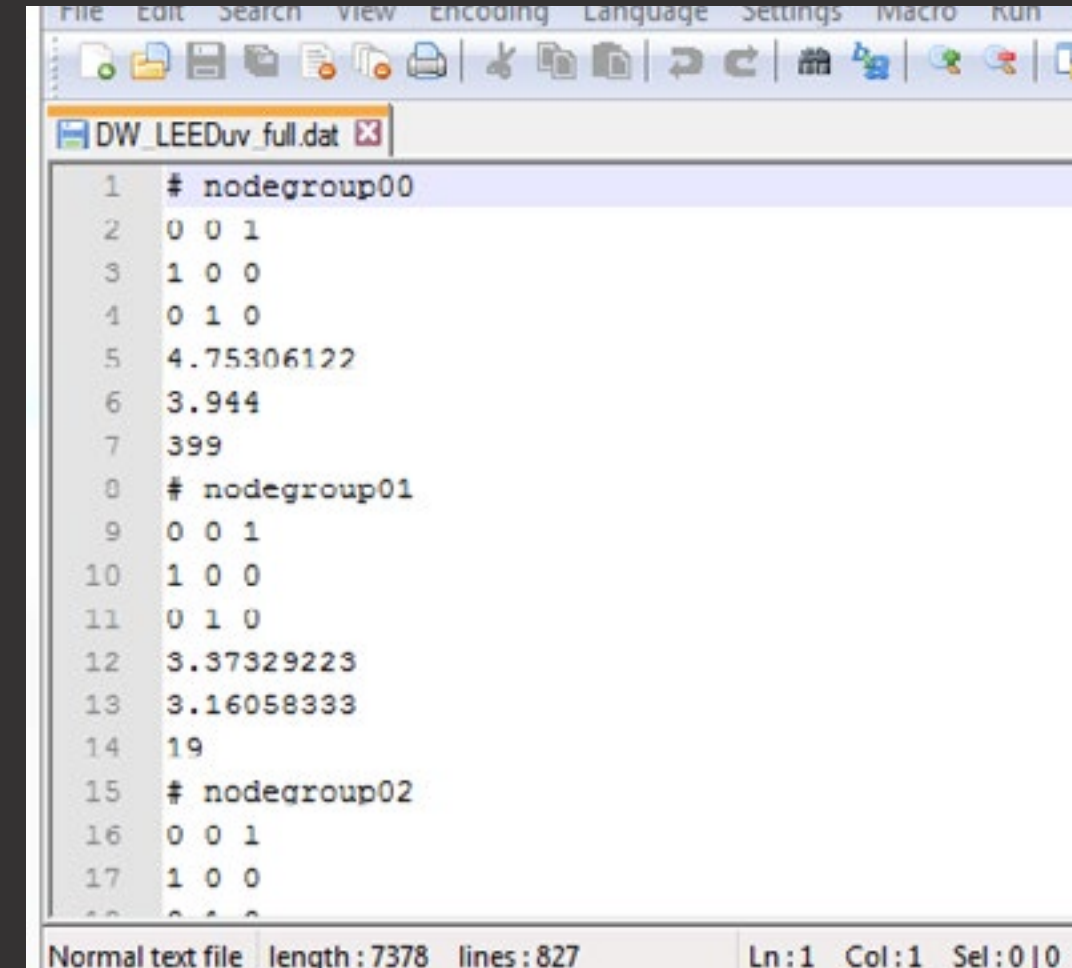
Nodes and Data files

Nodes file - coordinates and normal



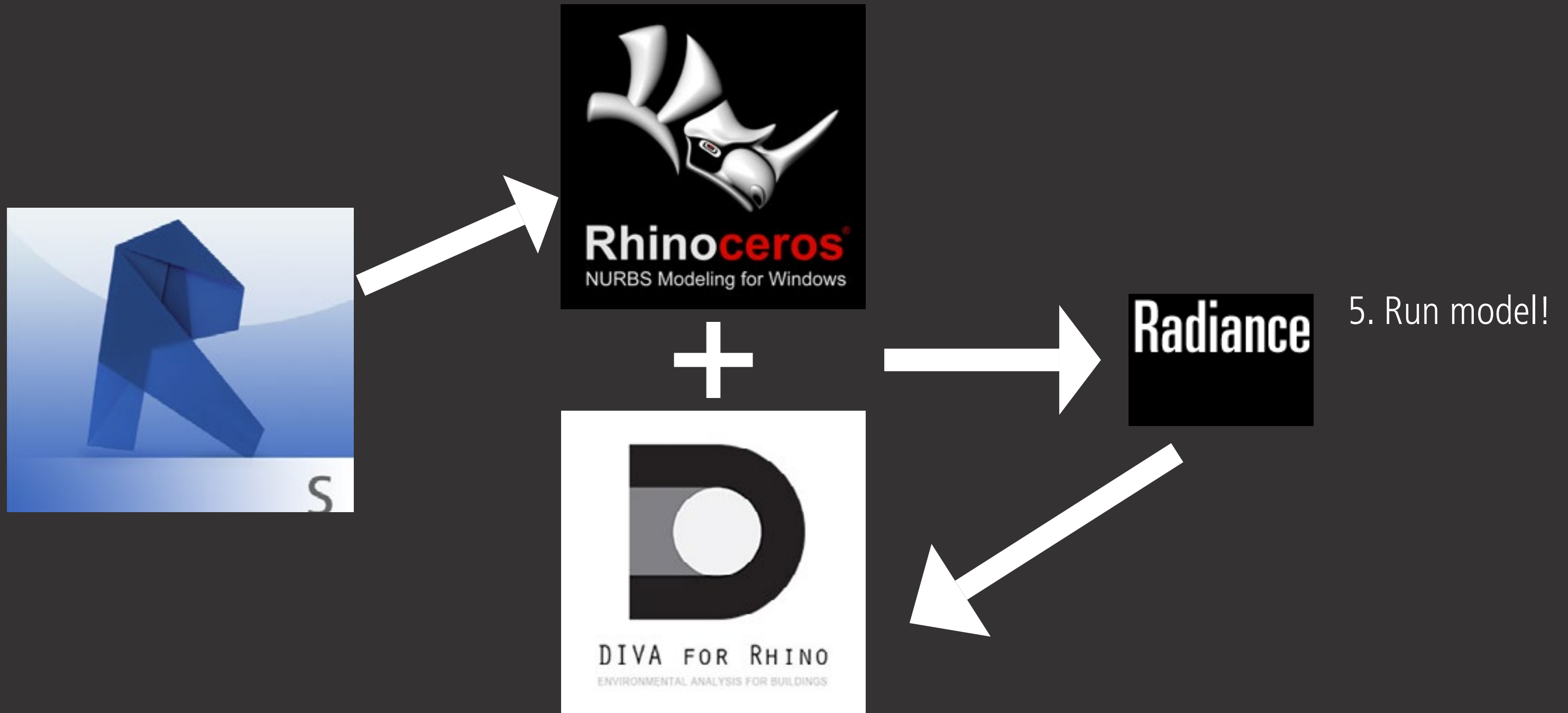
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File Edit Search View Encoding Language Settings Macro Run P
DW_LEED_full.pts
1 136.645250175838 298.746604680276 2.5 0 0 1
2 137.599390132083 302.573451024708 2.5 0 0 1
3 138.553530088328 306.400297369141 2.5 0 0 1
4 139.507670044573 310.227143713573 2.5 0 0 1
5 140.461810000818 314.053990058006 2.5 0 0 1
6 141.415949957063 317.880836402439 2.5 0 0 1
7 142.370089913308 321.707682746871 2.5 0 0 1
8 143.324229869553 325.534529091304 2.5 0 0 1
9 144.278369825798 329.361375435736 2.5 0 0 1
10 141.257125168688 297.596735098946 2.5 0 0 1
11 142.211265124933 301.423581443378 2.5 0 0 1
12 143.165405081178 305.250427787811 2.5 0 0 1
13 144.119545037423 309.077274132244 2.5 0 0 1
14 145.073684993669 312.904120476676 2.5 0 0 1
15 146.027824949914 316.730966821109 2.5 0 0 1
16 146.981964906159 320.557813165541 2.5 0 0 1
17 147.936104862404 324.384659509974 2.5 0 0 1
Normal text file length : 149404 lines : 3313 Ln:1 Col:1 Sel:0|0
```

uv.dat file - space information/node groups



```
File Edit Search View Encoding Language Settings Macro Run P
DW_LEEDuv_full.dat
1 # nodegroup0
2 0 0 1
3 1 0 0
4 0 1 0
5 4.75306122
6 3.944
7 399
8 # nodegroup01
9 0 0 1
10 1 0 0
11 0 1 0
12 3.37329223
13 3.16058333
14 19
15 # nodegroup02
16 0 0 1
17 1 0 0
Normal text file length : 7378 lines : 827 Ln:1 Col:1 Sel:0|0
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Large LEED Model Workflow



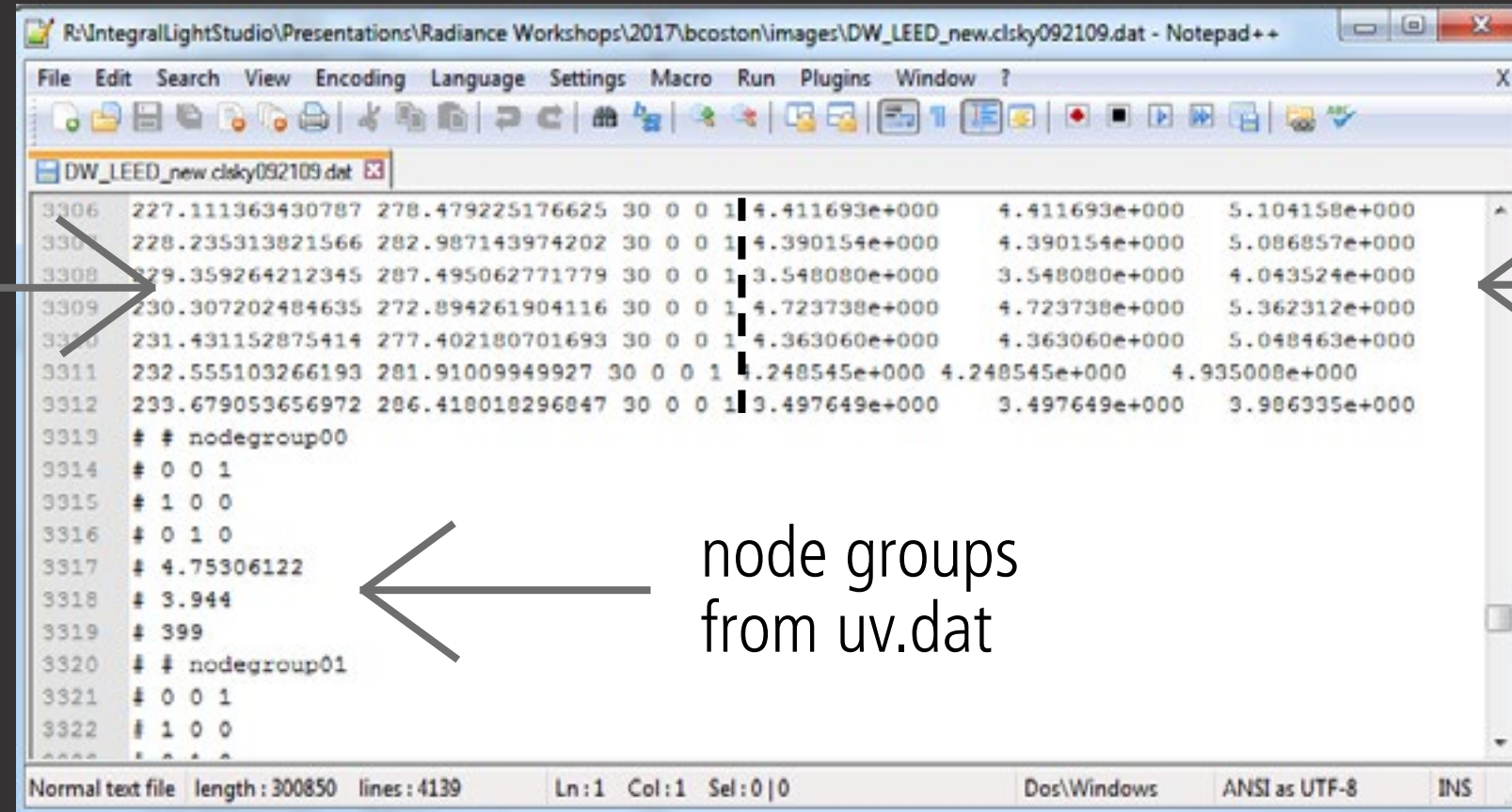
Large LEED Model Workflow

.dat from Radiance

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R:\IntegralLightStudio\Ppresentations\Radiance Workshops\2017\boston\images\DW_LEED_9am.dat - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
DW_LEED_9am.dat
1 4.296978e+000 4.296978e+000 5.240703e+000
2 4.660780e+000 4.660780e+000 5.686715e+000
3 4.464352e+000 4.464352e+000 5.447640e+000
4 3.799203e+000 3.799203e+000 4.634879e+000
5 3.257240e+000 3.257240e+000 3.971244e+000
6 4.670876e+000 4.670876e+000 5.698207e+000
7 5.512654e+000 5.512654e+000 6.725031e+000
8 6.136419e+000 6.136419e+000 7.485820e+000
9 6.304020e+000 6.304020e+000 7.690841e+000
10 3.381084e+000 3.381084e+000 4.120061e+000
11 3.592513e+000 3.592513e+000 4.380021e+000
12 3.545814e+000 3.545814e+000 4.323842e+000
13 3.428764e+000 3.428764e+000 4.181264e+000
14 3.448896e+000 3.448896e+000 4.204491e+000
15 4.136459e+000 4.136459e+000 5.043940e+000
16 4.832404e+000 4.832404e+000 5.892661e+000
17 5.426718e+000 5.426718e+000 6.616199e+000
Normal text file length: 145728 lines: 3313 Ln: 1 Col: 1 Sel: 0 | 0 Dos\Windows ANSI as UTF-8 INS
```

Large LEED Model Workflow

Data file that DIVA can read



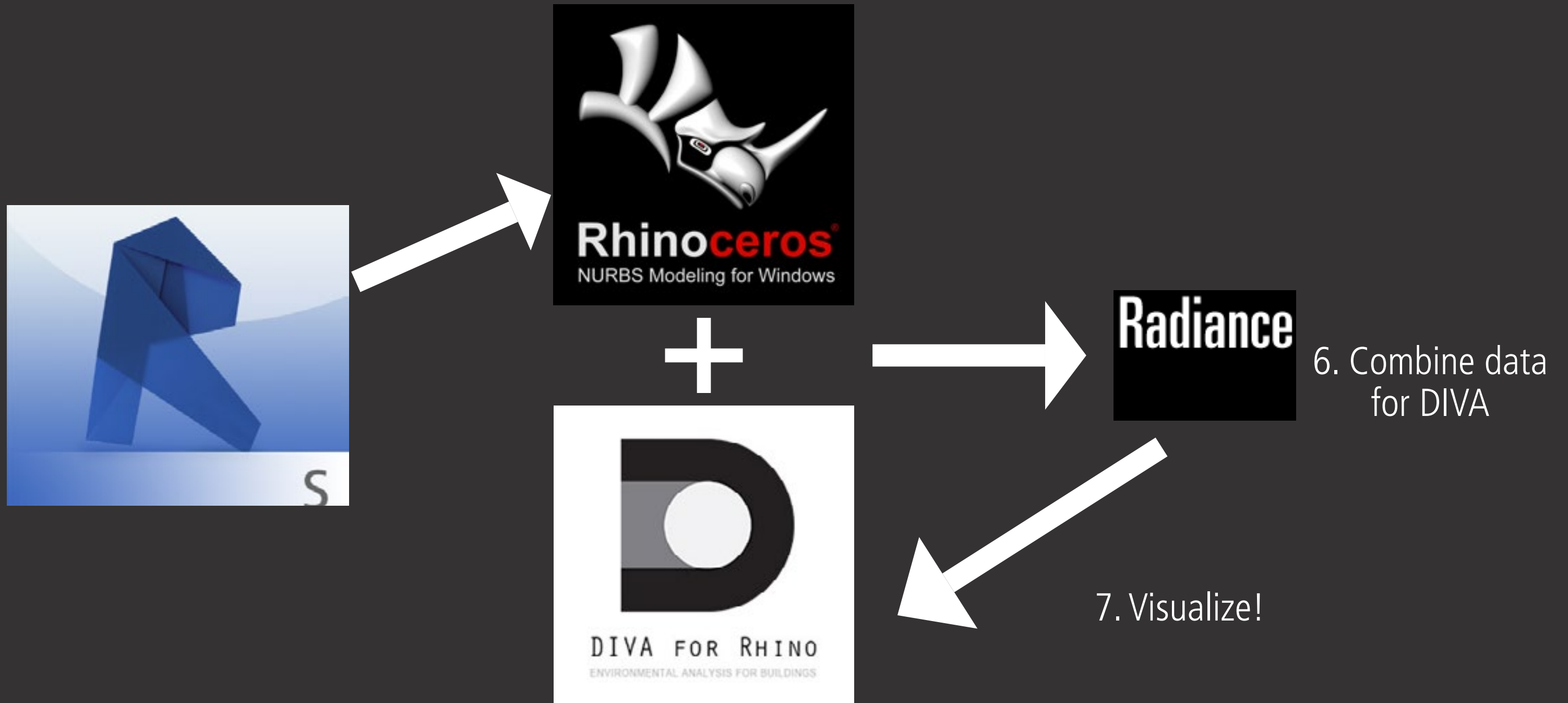
```
R:\IntegralLightStudio\Ppresentations\Radiane Workshops\2017\boston\images\DW_LEED_new.clsky092109.dat - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
DW_LEED_new.clsky092109.dat
3306 227.111363430787 278.479225176625 30 0 0 1 4.411693e+000 4.411693e+000 5.104158e+000
3307 228.235313821566 282.987143974202 30 0 0 1 4.390154e+000 4.390154e+000 5.086857e+000
3308 229.359264212345 287.495062771779 30 0 0 1 3.548080e+000 3.548080e+000 4.043524e+000
3309 230.307202484635 272.894261904116 30 0 0 1 4.723738e+000 4.723738e+000 5.362312e+000
3310 231.431152875414 277.402180701693 30 0 0 1 4.363060e+000 4.363060e+000 5.048463e+000
3311 232.555103266193 281.91009949927 30 0 0 1 4.248545e+000 4.248545e+000 4.935008e+000
3312 233.679053656972 286.418018296847 30 0 0 1 3.497649e+000 3.497649e+000 3.986335e+000
3313 # # nodegroup00
3314 # 0 0 1
3315 # 1 0 0
3316 # 0 1 0
3317 # 4.75306122
3318 # 3.944
3319 # 399
3320 # # nodegroup01
3321 # 0 0 1
3322 # 1 0 0
```

location and nodes from .pts

illumination from Radiane .dat

node groups from uv.dat

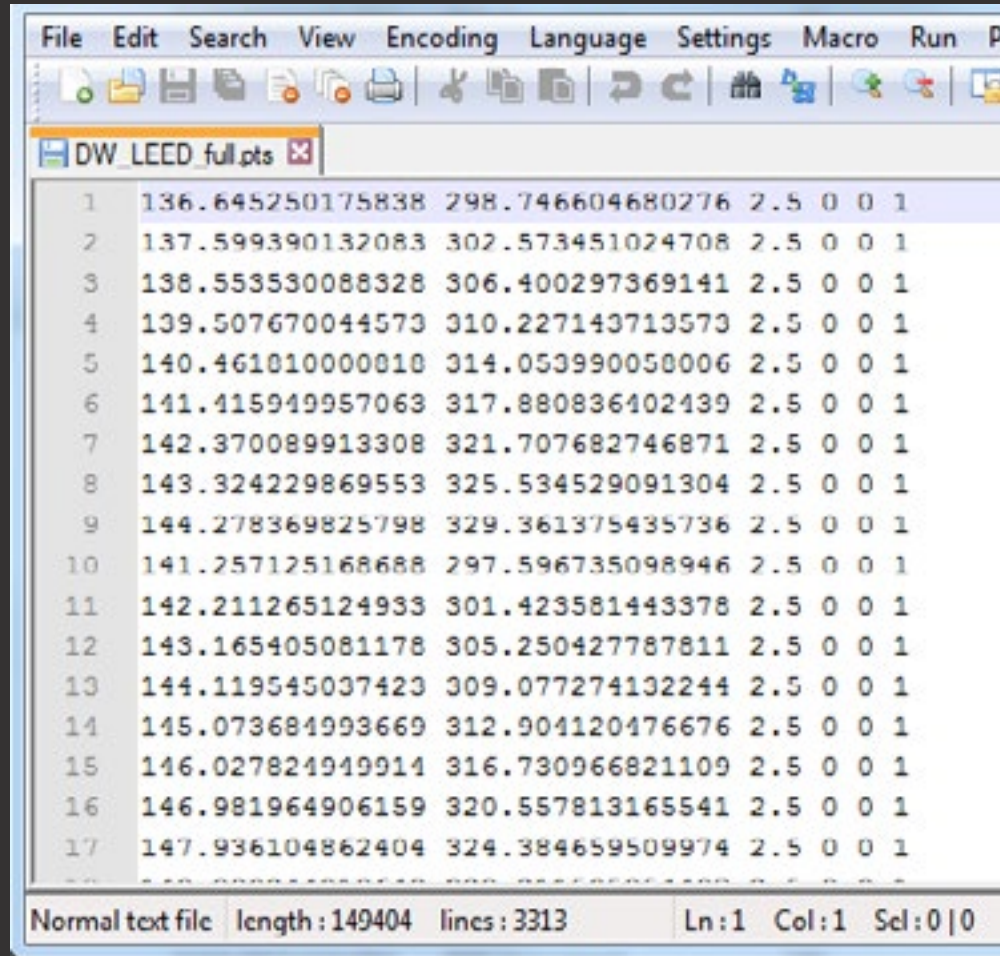
Large LEED Model Workflow



Large LEED Model Workflow

Radiance back to DIVA

All points location and direction data

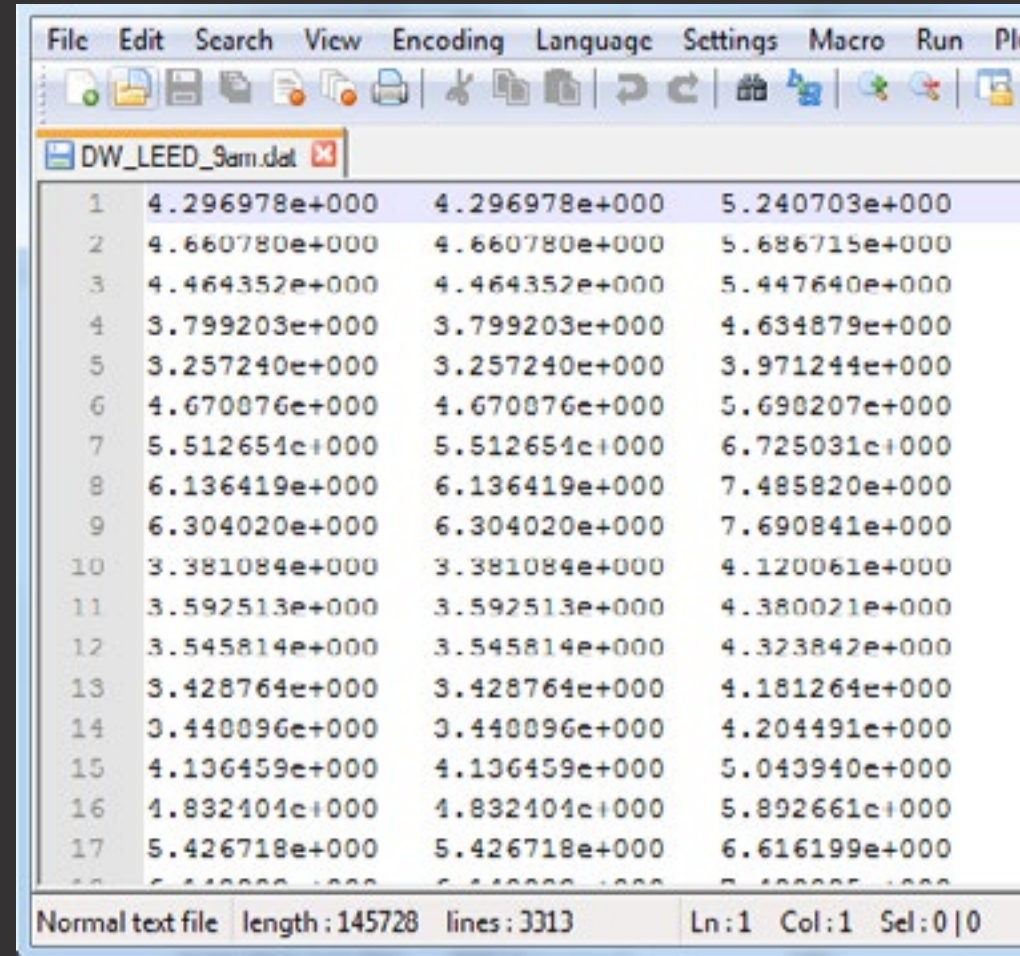


DW_LEED_full.pts

1	136.645250175838	298.746604680276	2.5	0	0	1
2	137.599390132083	302.573451024708	2.5	0	0	1
3	138.553530088328	306.400297369141	2.5	0	0	1
4	139.507670044573	310.227143713573	2.5	0	0	1
5	140.461010000010	314.053990050006	2.5	0	0	1
6	141.415949957063	317.880836402439	2.5	0	0	1
7	142.370089913308	321.707682746871	2.5	0	0	1
8	143.324229869553	325.534529091304	2.5	0	0	1
9	144.278369825798	329.361375435736	2.5	0	0	1
10	141.257125168688	297.596735098946	2.5	0	0	1
11	142.211265124933	301.423581443378	2.5	0	0	1
12	143.165405081178	305.250427787811	2.5	0	0	1
13	144.119545037423	309.077274132244	2.5	0	0	1
14	145.073684993669	312.904120476676	2.5	0	0	1
15	146.027824949914	316.730966821109	2.5	0	0	1
16	146.981964906159	320.557813165541	2.5	0	0	1
17	147.936104862404	324.384659509974	2.5	0	0	1

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Illuminance Data

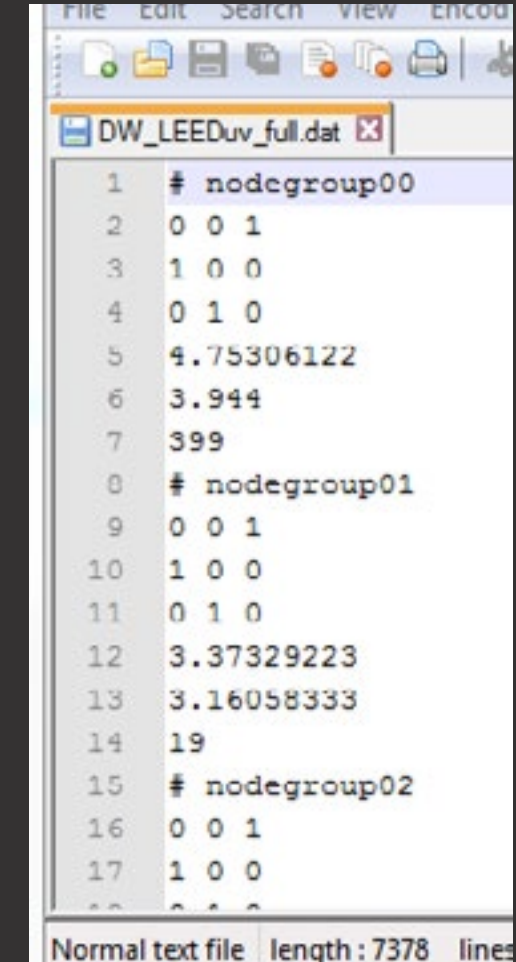


DW_LEED_Sam.dat

1	4.296978e+000	4.296978e+000	5.240703e+000
2	4.660780e+000	4.660780e+000	5.686715e+000
3	4.464352e+000	4.464352e+000	5.447640e+000
4	3.799203e+000	3.799203e+000	4.634879e+000
5	3.257240e+000	3.257240e+000	3.971244e+000
6	4.670076e+000	4.670076e+000	5.690207e+000
7	5.512654e+000	5.512654e+000	6.725031e+000
8	6.136419e+000	6.136419e+000	7.485820e+000
9	6.304020e+000	6.304020e+000	7.690841e+000
10	3.381084e+000	3.381084e+000	4.120061e+000
11	3.592513e+000	3.592513e+000	4.380021e+000
12	3.545814e+000	3.545814e+000	4.323842e+000
13	3.428764e+000	3.428764e+000	4.181264e+000
14	3.440096e+000	3.440096e+000	4.204491e+000
15	4.136459e+000	4.136459e+000	5.043940e+000
16	4.832404e+000	4.832404e+000	5.892661e+000
17	5.426718e+000	5.426718e+000	6.616199e+000

Normal text file length: 145728 lines: 3313 Ln: 1 Col: 1 Sel: 0 | 0

Node Groups/Spaces



DW_LEEDuv_full.dat

1	# nodegroup00
2	0 0 1
3	1 0 0
4	0 1 0
5	4.75306122
6	3.944
7	399
8	# nodegroup01
9	0 0 1
10	1 0 0
11	0 1 0
12	3.37329223
13	3.16058333
14	19
15	# nodegroup02
16	0 0 1
17	1 0 0

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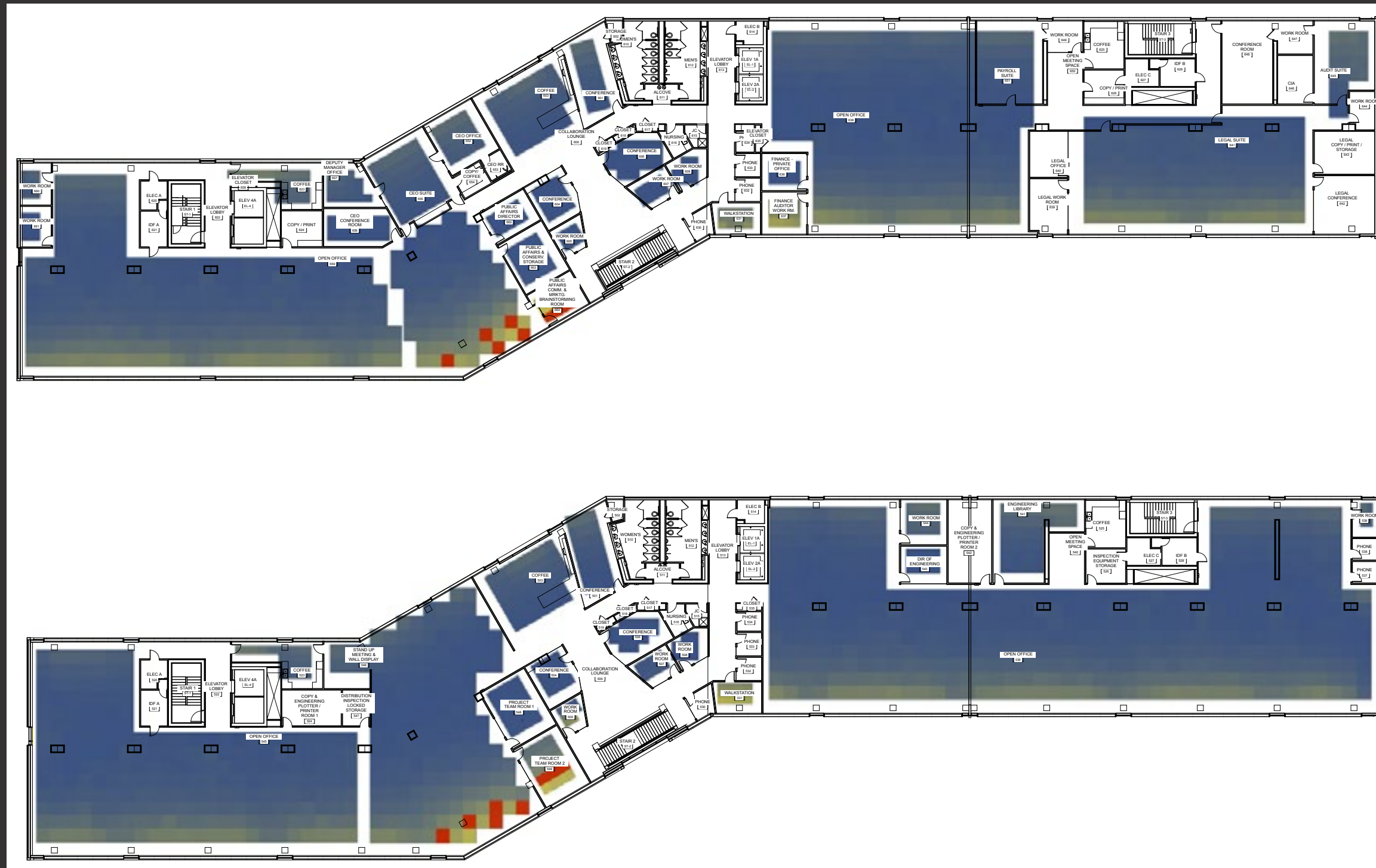
Large LEED Model Workflow

Data file that DIVA can read

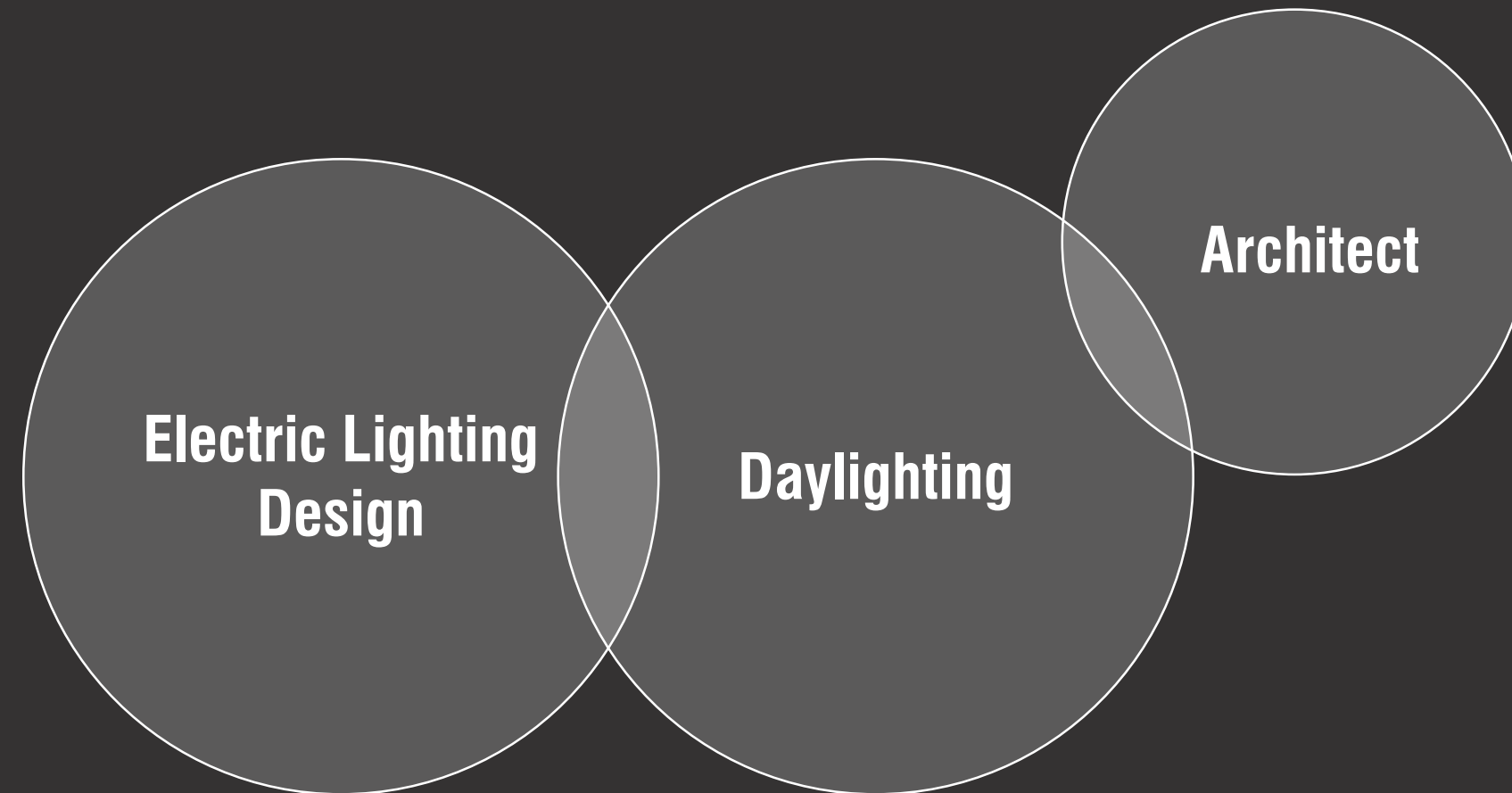
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R:\IntegralLightStudio\Presentation\Radiance Workshops\2017\boston\images\DW_LEED_new.clsky092109.dat - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
DW_LEED_new.clsky092109.dat
3306 227.111363430787 278.479225176625 30 0 0 1 4.411693e+000 4.411693e+000 5.104158e+000
3307 228.235313821566 282.987143974202 30 0 0 1 4.390154e+000 4.390154e+000 5.086857e+000
3308 229.359264212345 287.495062771779 30 0 0 1 3.548080e+000 3.548080e+000 4.043524e+000
3309 230.307202484635 272.894261904116 30 0 0 1 4.723738e+000 4.723738e+000 5.362312e+000
3310 231.431152875414 277.402180701693 30 0 0 1 4.363060e+000 4.363060e+000 5.048463e+000
3311 232.555103266193 281.91009949927 30 0 0 1 4.248545e+000 4.248545e+000 4.935008e+000
3312 233.679053656972 286.418018296847 30 0 0 1 3.497649e+000 3.497649e+000 3.986335e+000
3313 # # nodegroup00
3314 # 0 0 1
3315 # 1 0 0
3316 # 0 1 0
3317 # 4.75306122
3318 # 3.944
3319 # 399
3320 # # nodegroup01
3321 # 0 0 1
3322 # 1 0 0
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```


Large LEED Model Workflow

Final Visualization



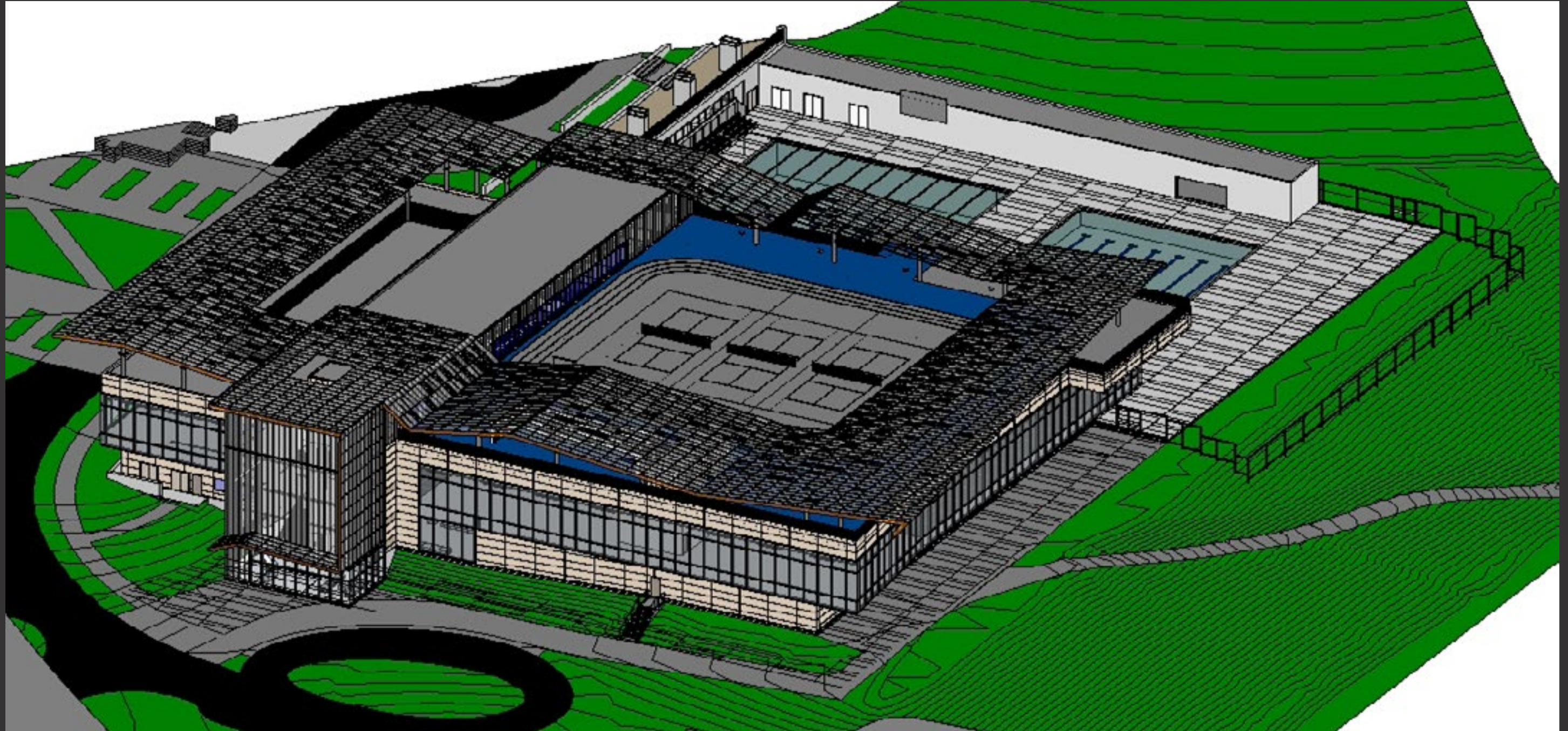
Integration with Architect/Lighting



**How do we further architect's knowledge
about the building they are designing?**

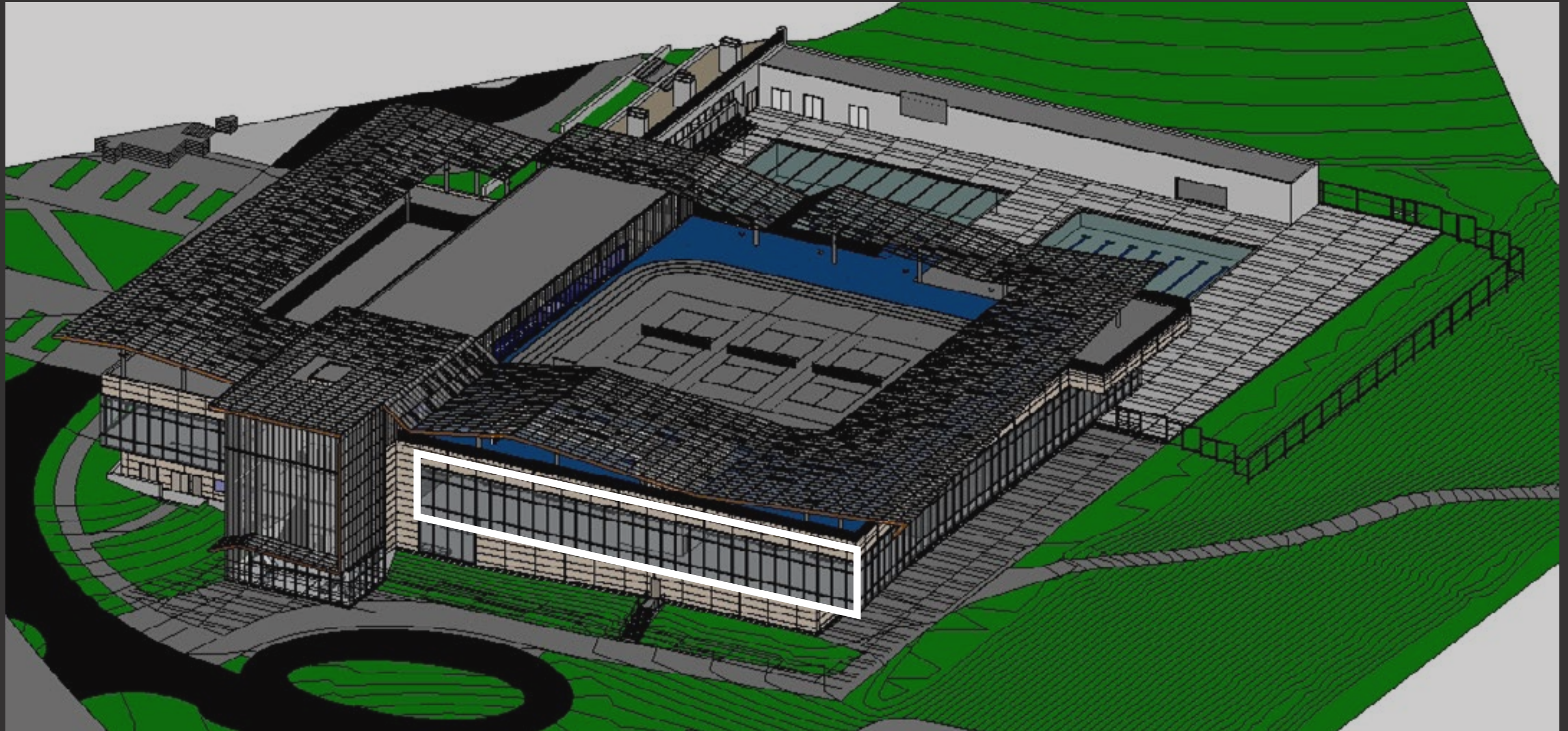
Canada College Kinesiology Building

North Facing Perspective



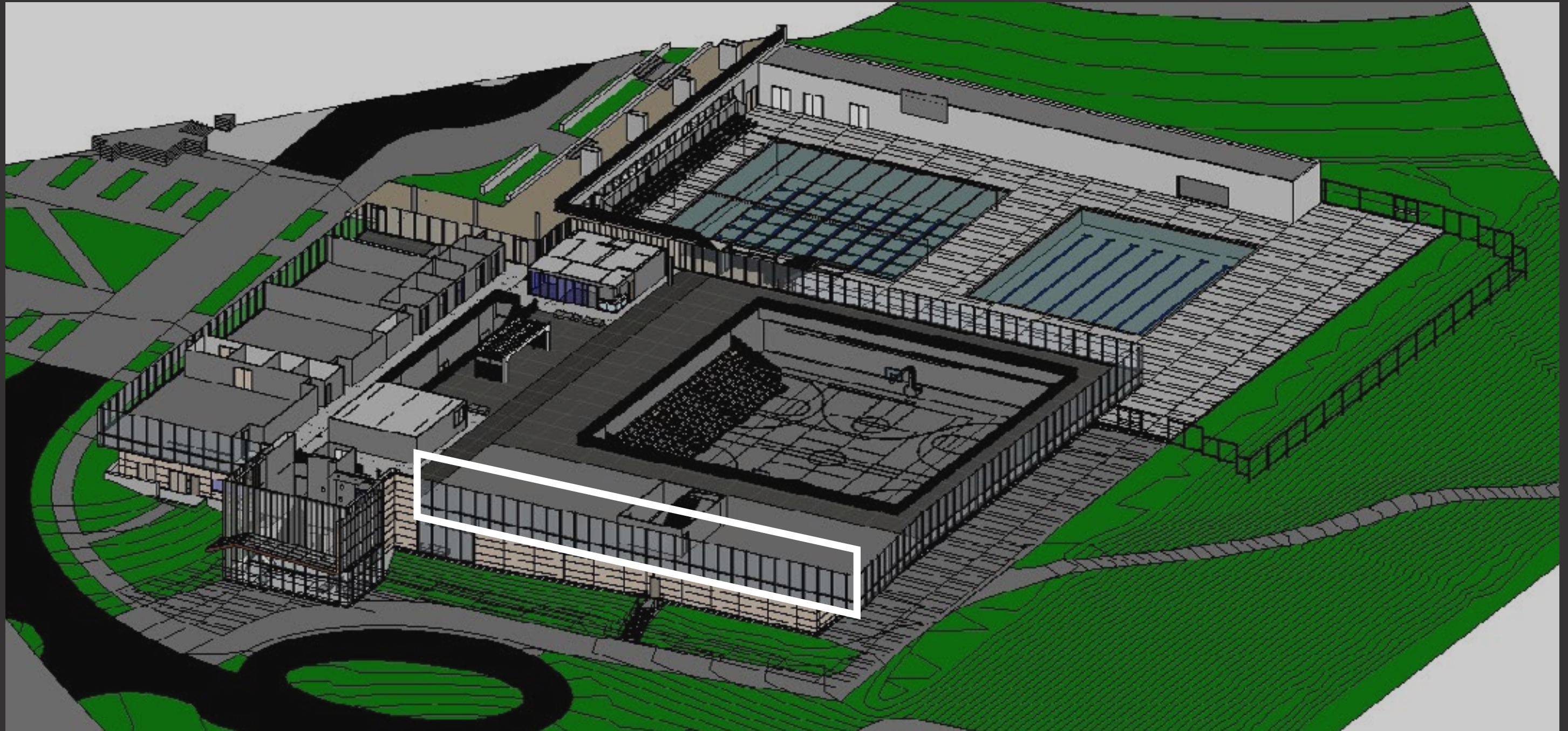
Canada College Kinesiology Building

North Facing Perspective



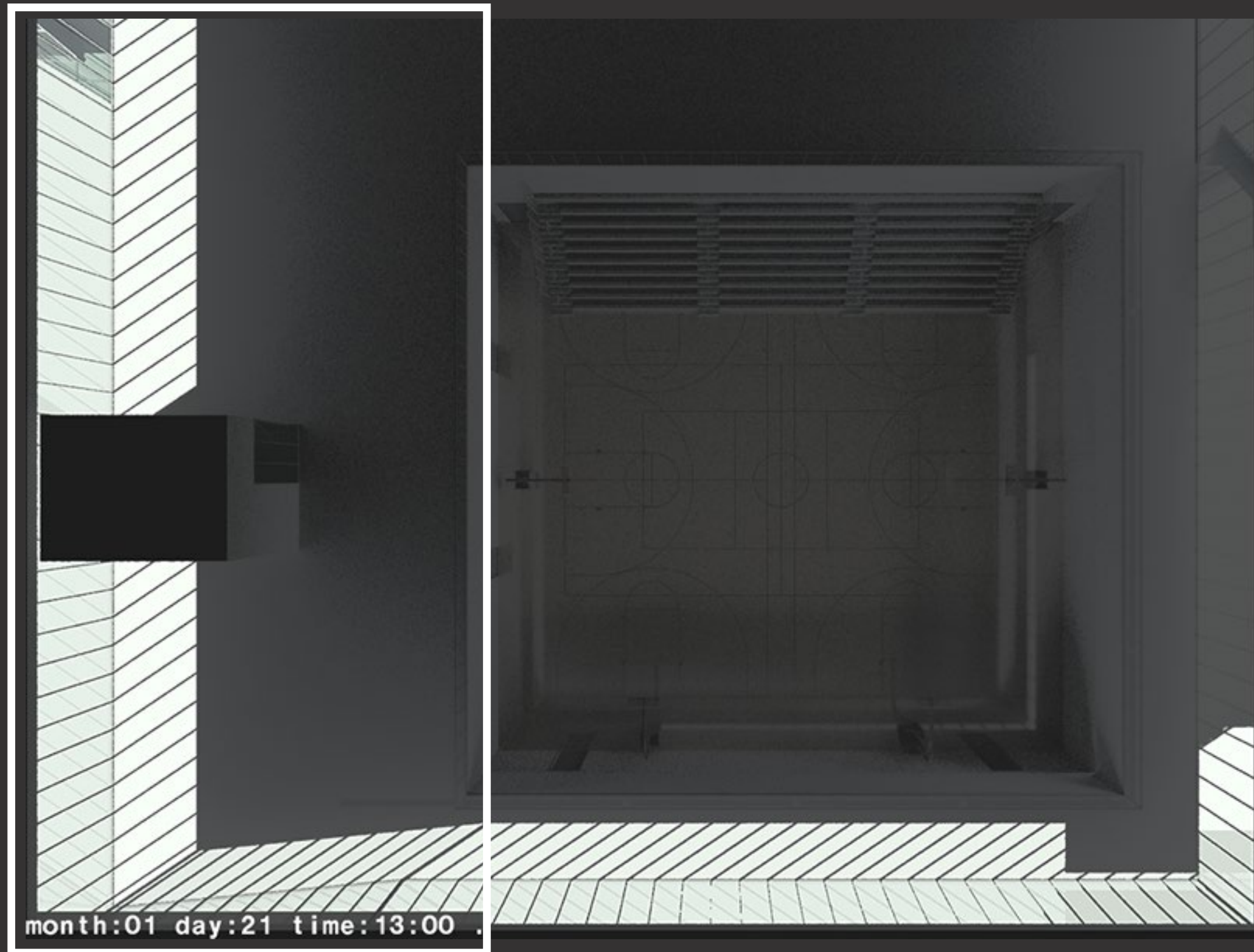
Canada College Kinesiology Building

North Facing Perspective - Cut Through Second Floor



Canada College Kinesiology Building

Second Floor Plan



Daylighting Conditions / Clear, Sunny Sky

September 21, 12:00pm, Second Floor West Fitness Room

With No Shading



With Automatic Fabric Shades



Perspective View

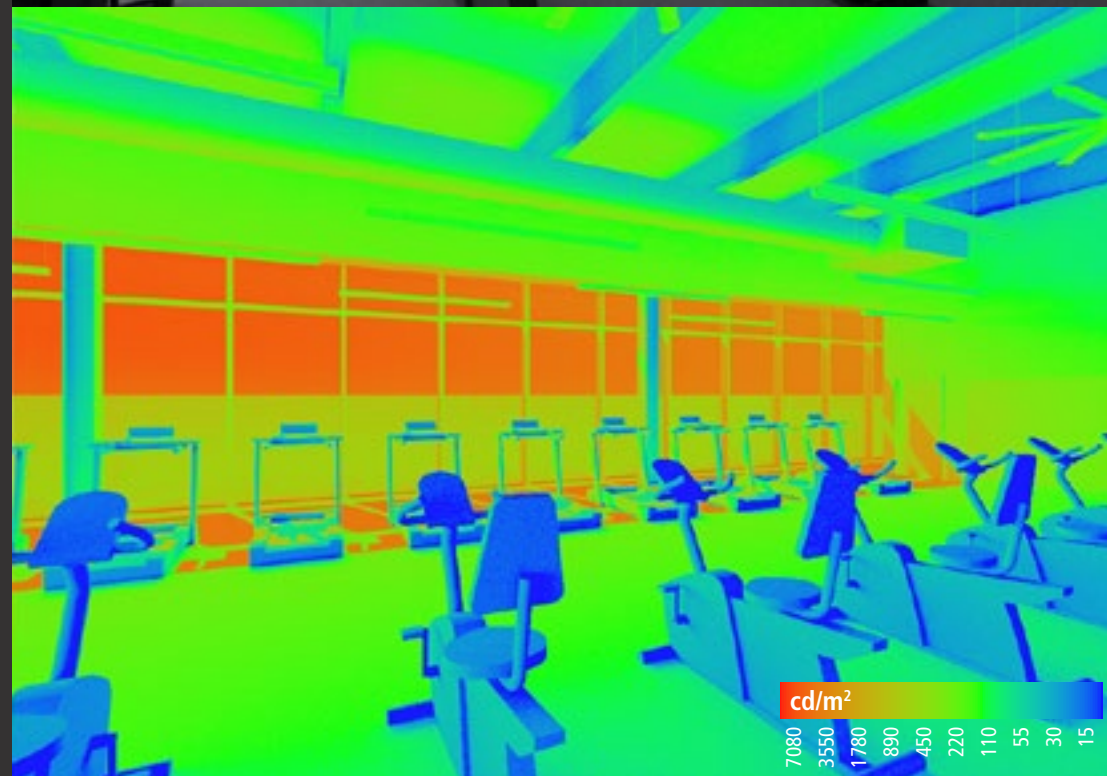
Falsecolor Luminance Map,
Surface Brightness



Daylighting Conditions / Clear, Sunny Sky

September 21, 1:00pm, Second Floor West Fitness Room

With No Shading



Perspective View

Falsecolor Luminance Map,
Surface Brightness

With Automatic Fabric Shades



Daylighting Conditions / Clear, Sunny Sky

September 21, 2:00pm, Second Floor West Fitness Room

With No Shading



Perspective View

Falsecolor Luminance Map,
Surface Brightness

With Automatic Fabric Shades



Daylighting Conditions / Clear, Sunny Sky

September 21, 3:00pm, Second Floor West Fitness Room

With No Shading



Perspective View

Falsecolor Luminance Map,
Surface Brightness

With Automatic Fabric Shades



Daylighting Conditions / Clear, Sunny Sky

September 21, 4:00pm, Second Floor West Fitness Room

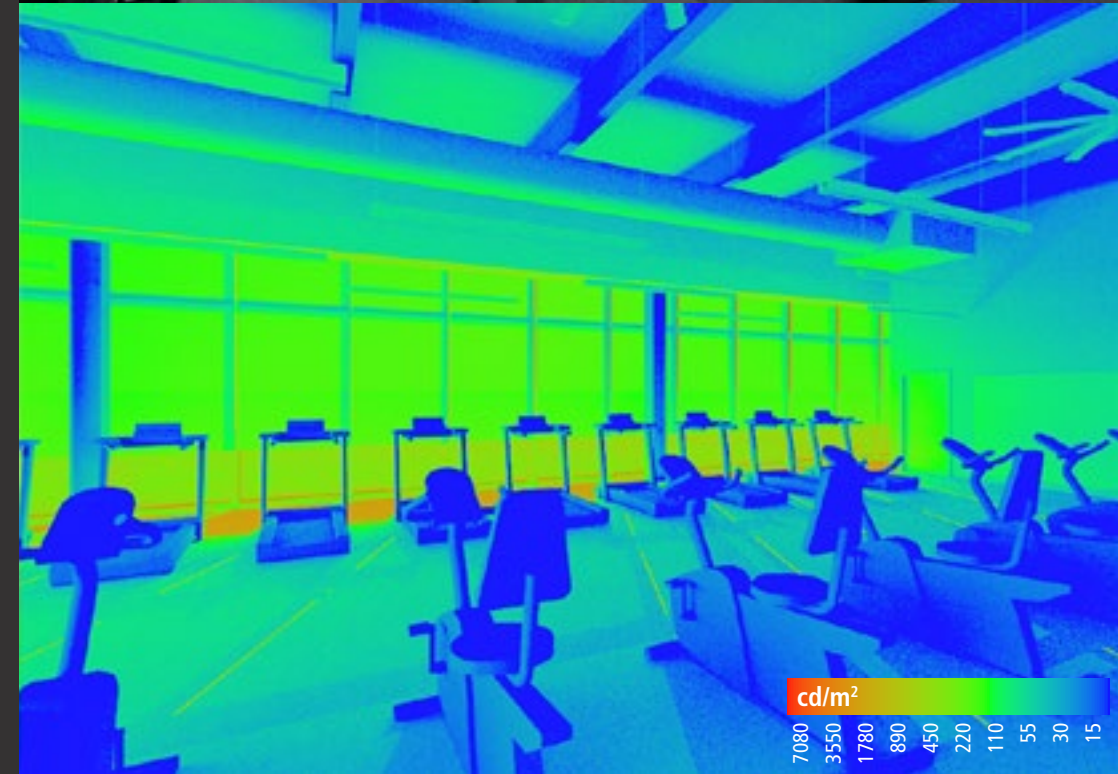
With No Shading



Perspective View

Falsecolor Luminance Map,
Surface Brightness

With Automatic Fabric Shades



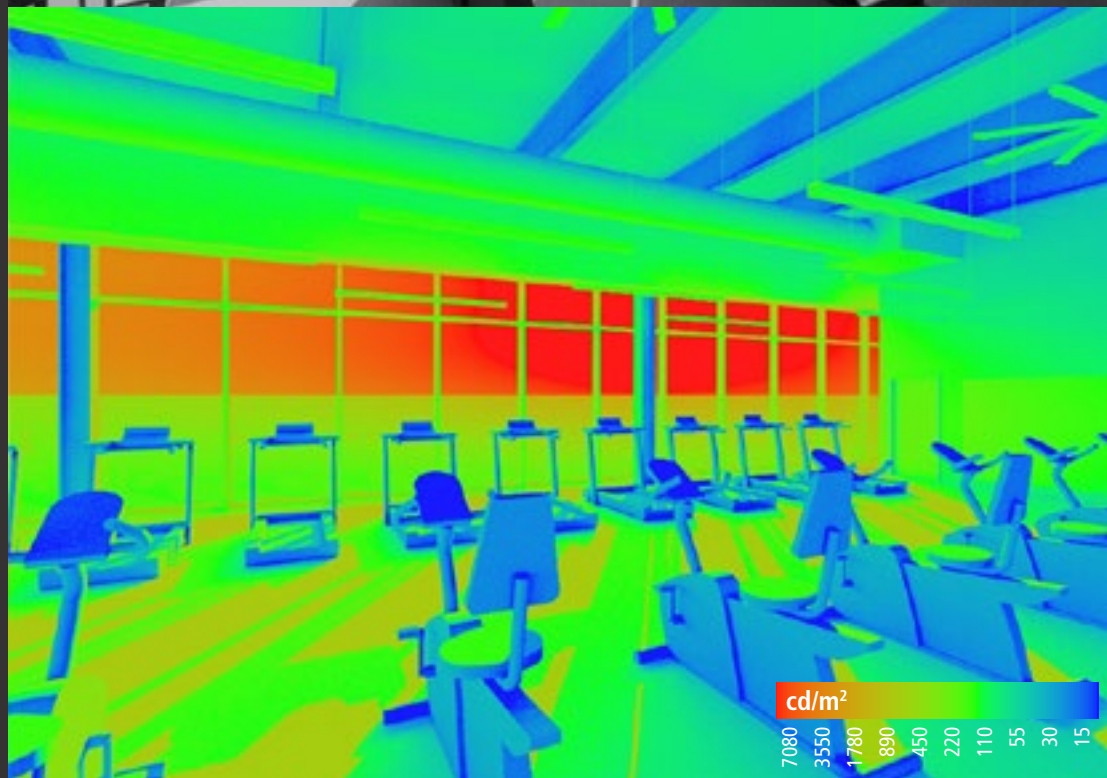
Daylighting Conditions / Clear, Sunny Sky

September 21, 5:00pm, Second Floor West Fitness Room

With No Shading



Perspective View



Falsecolor Luminance Map,
Surface Brightness

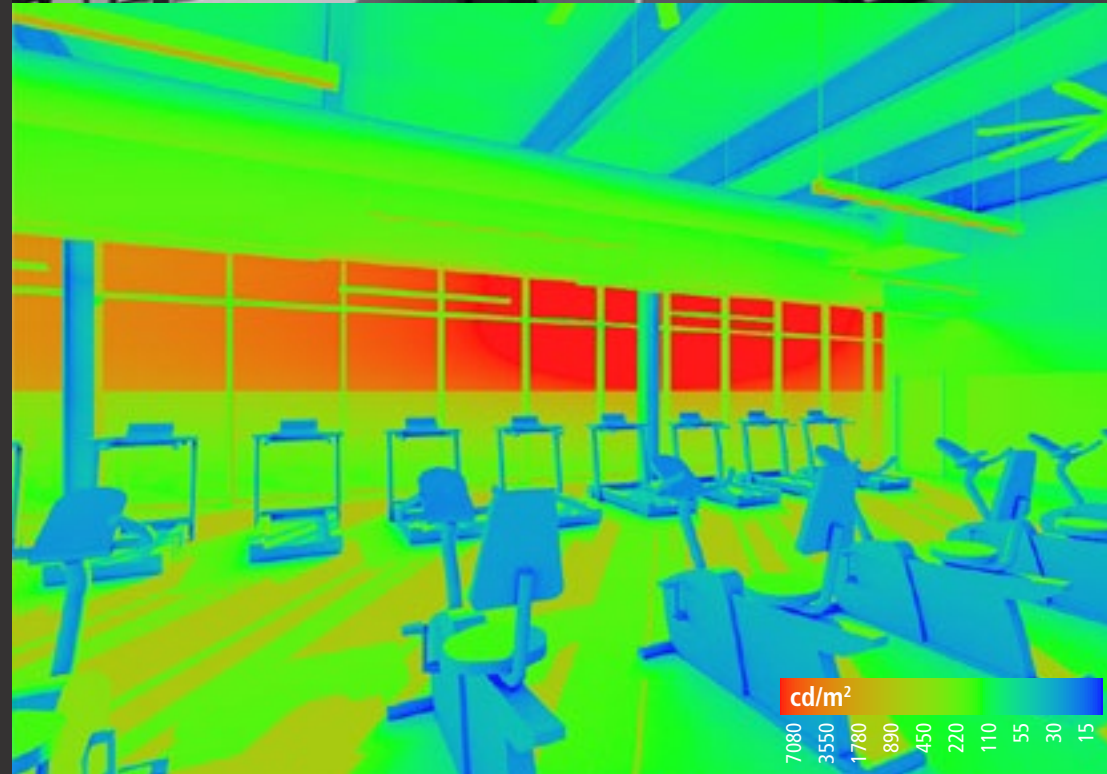
With Automatic Fabric Shades



Daylighting Conditions / Clear, Sunny Sky / Electric Lighting On

September 21, 5:00pm, Second Floor West Fitness Room

With No Shading



Perspective View

Falsecolor Luminance Map,
Surface Brightness

With Automatic Fabric Shades



Daylighting Conditions / Clear, Sunny Sky / Electric Lighting On

September 21, Dusk, Second Floor West Fitness Room

With No Shading



With Automatic Fabric Shades



Perspective View

Falsecolor Luminance Map,
Surface Brightness



Daylighting Conditions / Clear Sky / Electric Lighting on

September 21, Night, Second Floor West Fitness Room

With No Shading



With Automatic Fabric Shades



Perspective View

Falsecolor Luminance Map,
Surface Brightness



Shade Material Comparison

Shade Fabrics Tested

MechoShade EcoVeil

White, 1% Openness

Silver Birch, 1% Openness

Grey, 1% Openness

Shadow Grey, 1% Openness



Visible Light Transmission - **22%**
Diffuse Reflectivity (color) - **70%**

Visible Light Transmission - **11%**
Diffuse Reflectivity (color) - **60%**

Visible Light Transmission - **1.5%**
Diffuse Reflectivity (color) - **30%**

Visible Light Transmission - **0.9%**
Diffuse Reflectivity (color) - **10%**

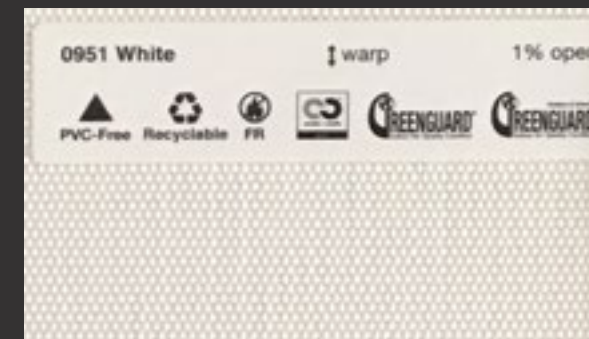
Daylighting Conditions / Clear, Sunny Sky

September 21, 4:00pm

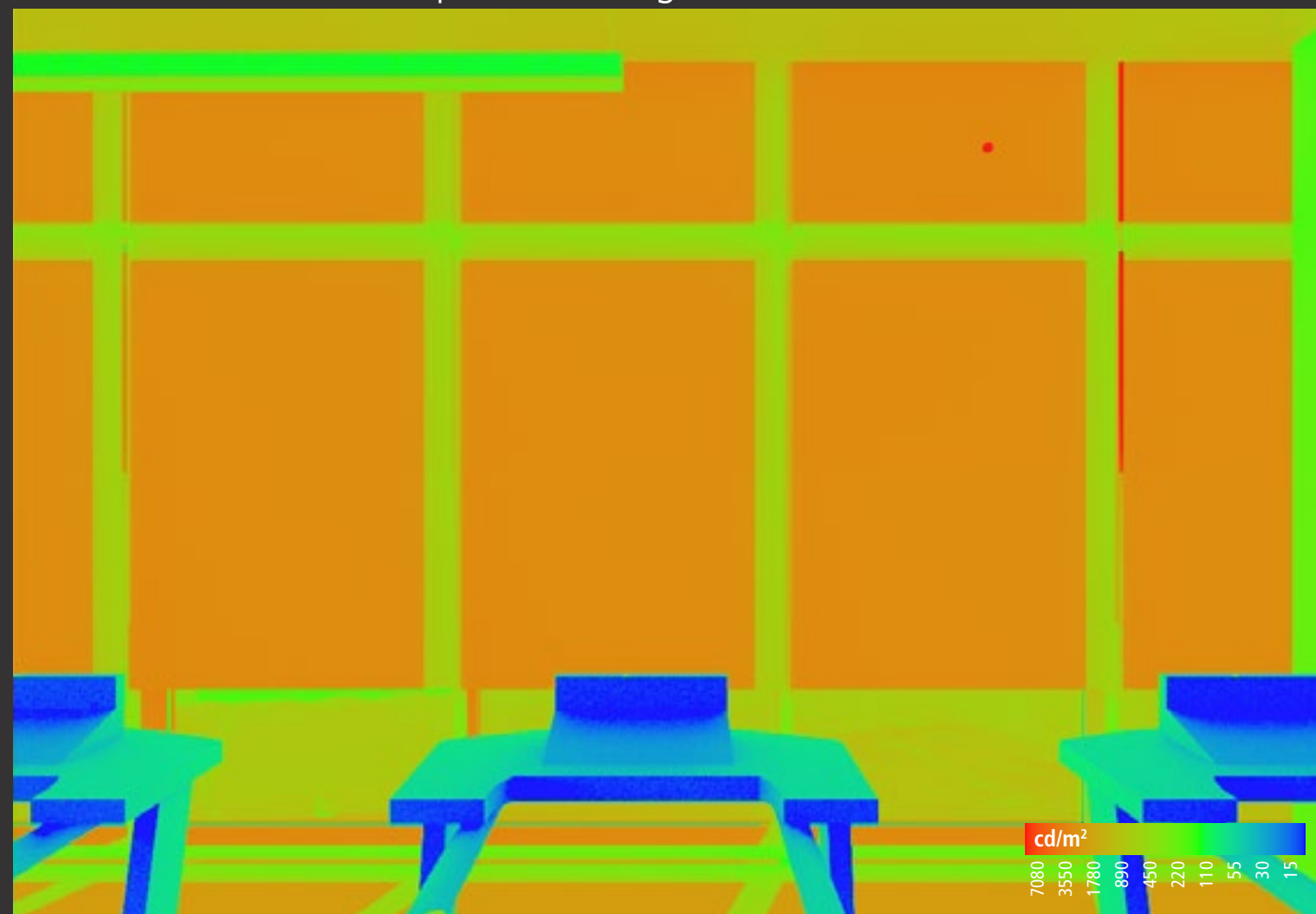
West facing View from Treadmill

White

Perspective View



Falsecolor Luminance Map, Surface Brightness



Daylighting Conditions / Clear, Sunny Sky

September 21, 4:00pm

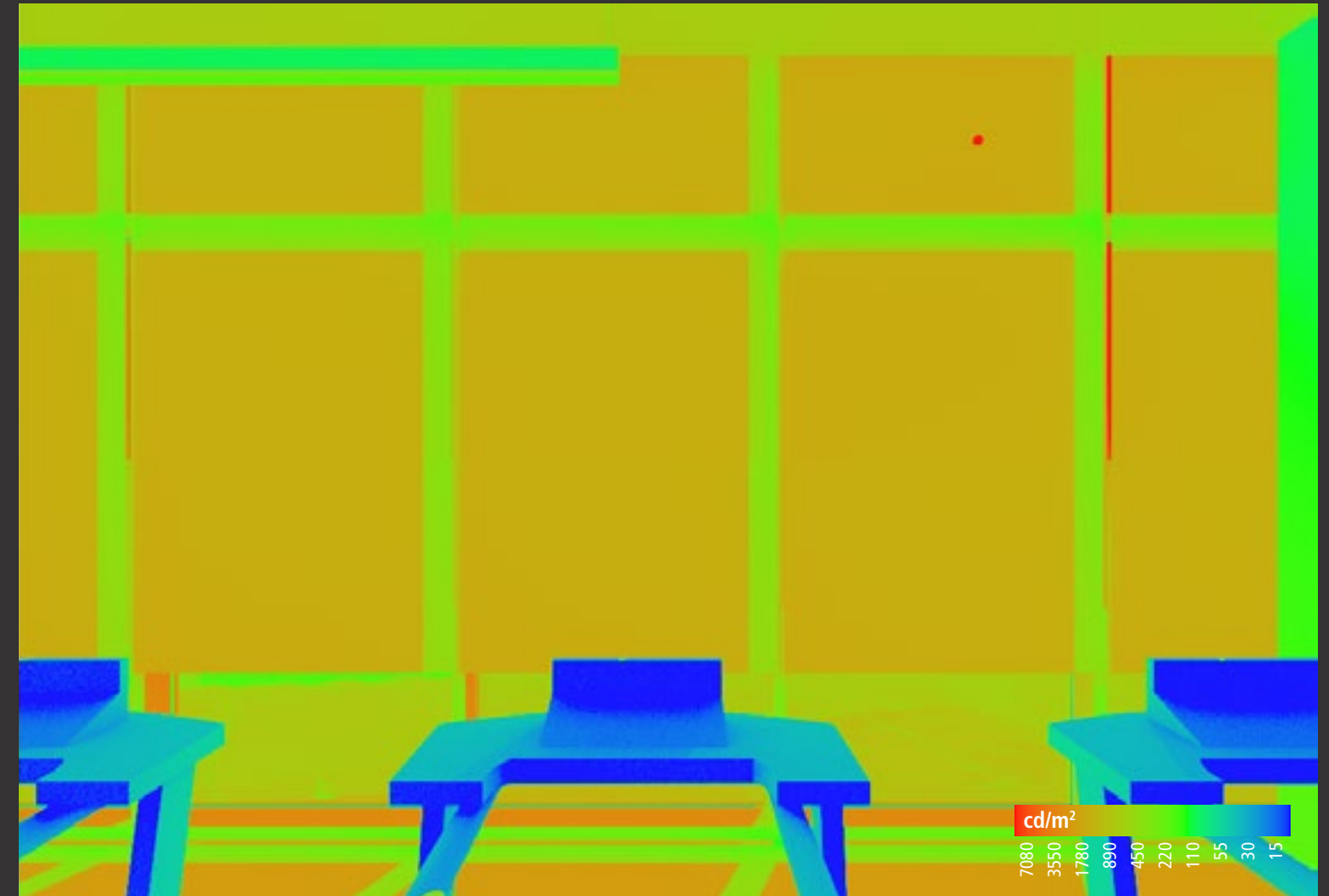
West facing View from Treadmill

Silver Birch

Perspective View



Falsecolor Luminance Map, Surface Brightness



Daylighting Conditions / Clear, Sunny Sky

September 21, 4:00pm

West facing View from Treadmill

Grey

Perspective View



Falsecolor Luminance Map, Surface Brightness



Daylighting Conditions / Clear, Sunny Sky

September 21, 4:00pm

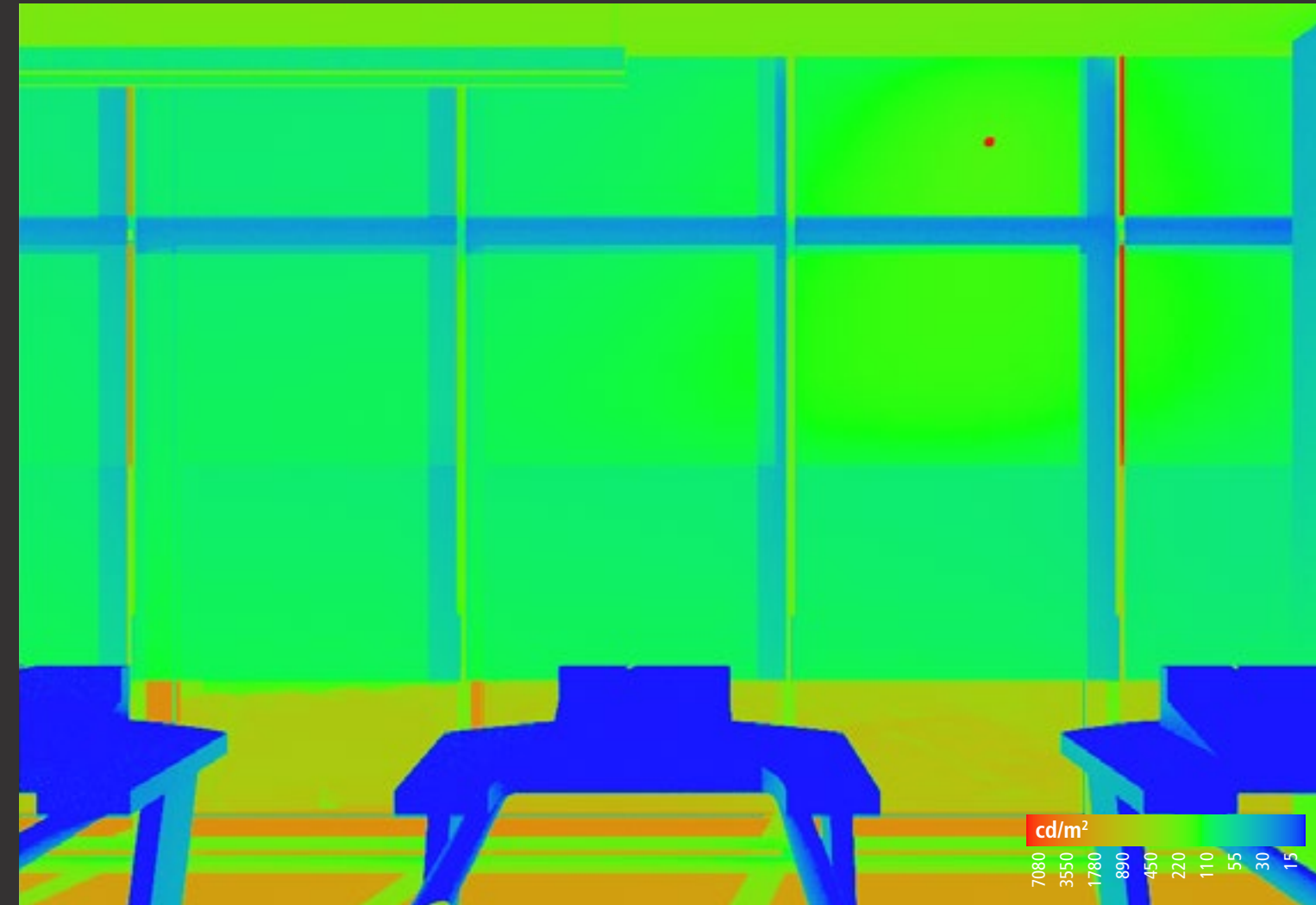
West facing View from Treadmill

Shadow Grey

Perspective View

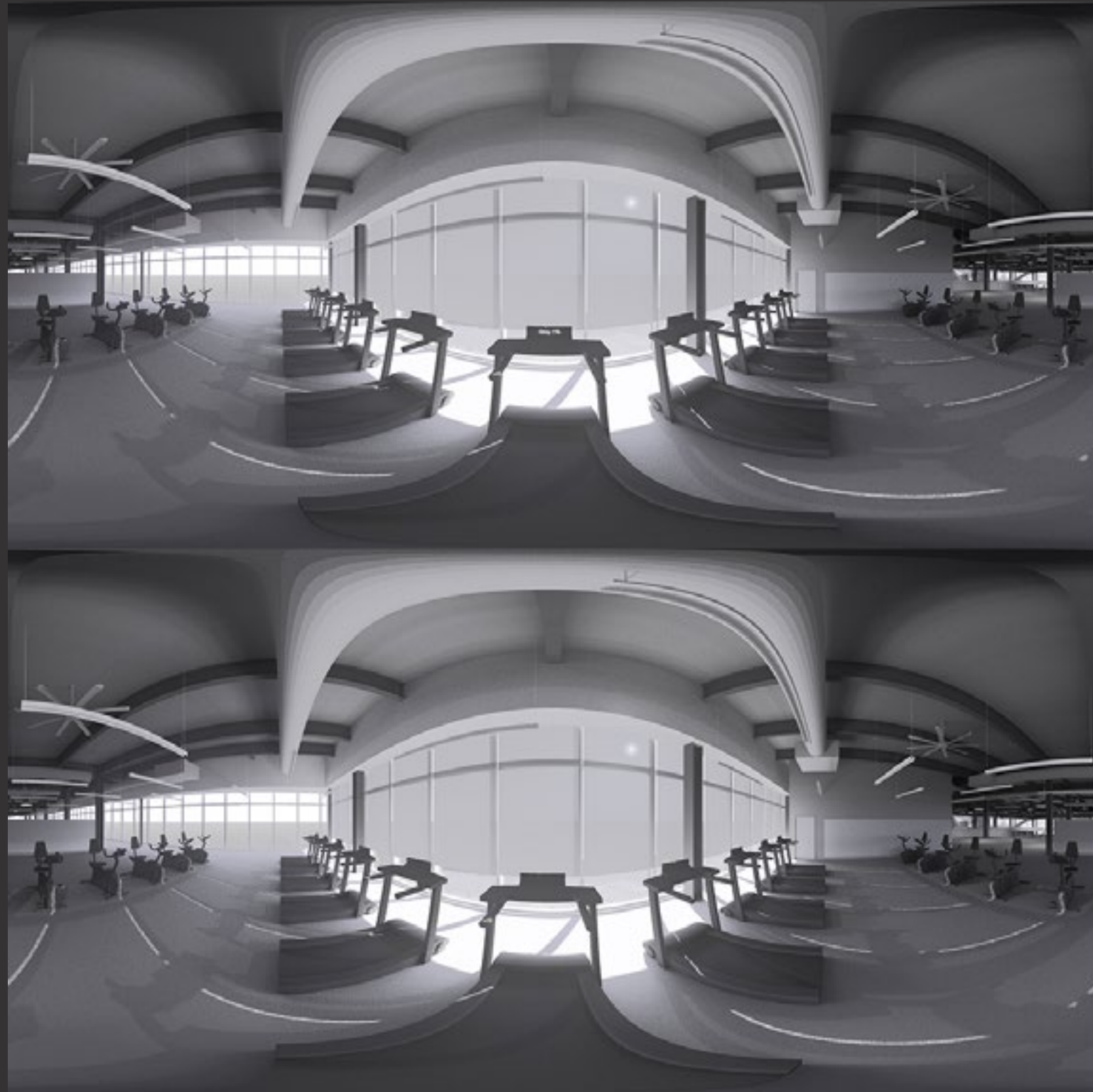


Falsecolor Luminance Map, Surface Brightness



Shade Cloth Comparison

3D360 View for VR



Open YouTube,
Search "Integral Group Shade Cloth"

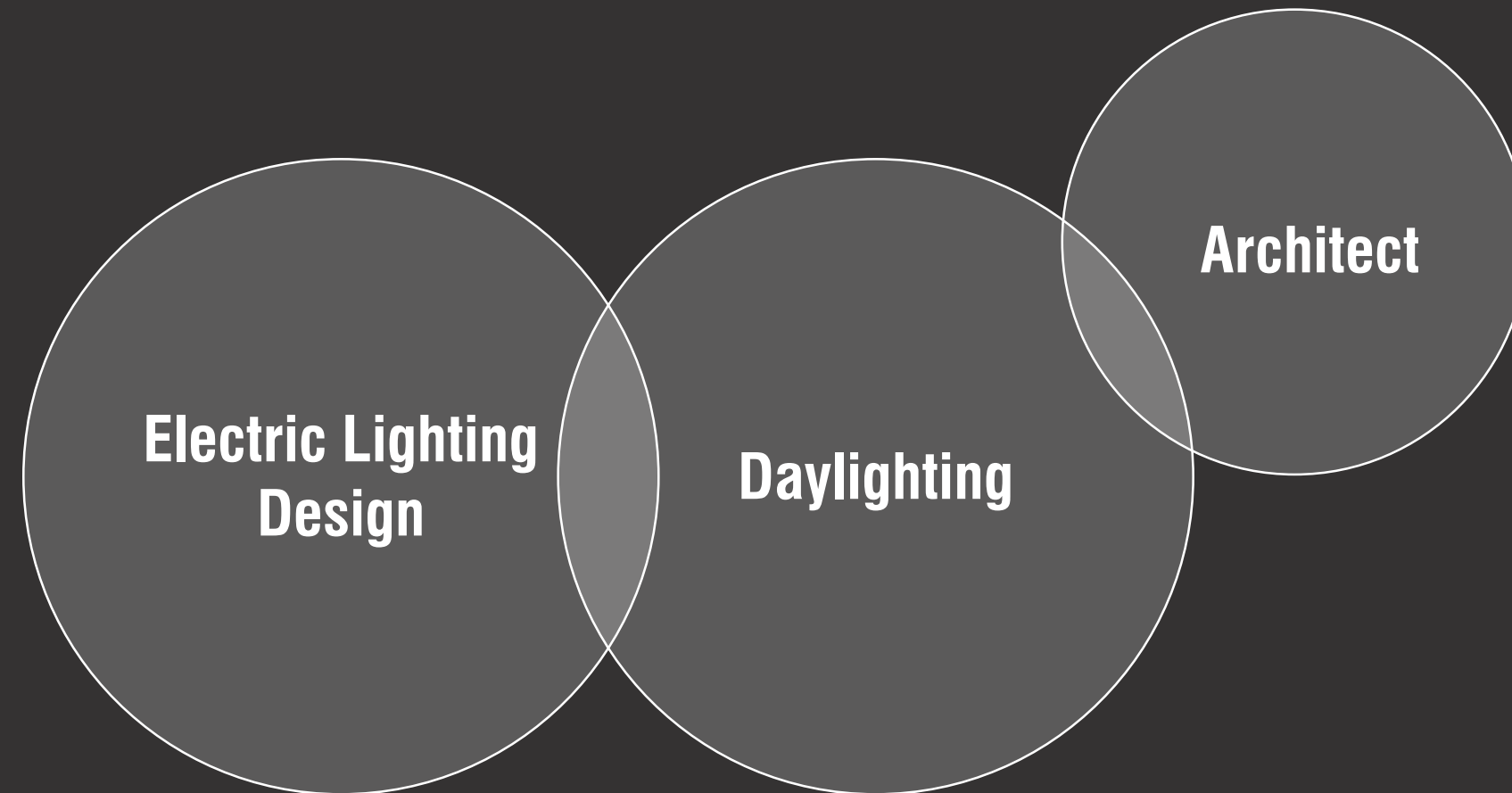
<https://youtu.be/3oJ6iDfnUg8>

Shade Cloth Comparison

3D360 View for VR



Integration with Lighting



How can we use Radiance to tell a story with Electric Lighting?

Elementary School in California

Interior View



Screen backlight

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Interior View



Display lighting



Elementary School in California

Interior View



Downlighting

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Interior View



Decorative Pendants



Elementary School in California

Interior View



Adjustable downlights



Elementary School in California

Interior View



Ensemble

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Exterior View



Graze

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Exterior View



Downlights in vestibule

Elementary School in California

Exterior View



Interior lights - pendants

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Exterior View



Interior lights – screen

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Exterior View



Interior lights - display

08.23.2017

Radiance Workshop 2017

Integral Light Studio

Elementary School in California

Exterior View



Decorative Pendants



Elementary School in California

Exterior View



Column Lights

08.23.2017

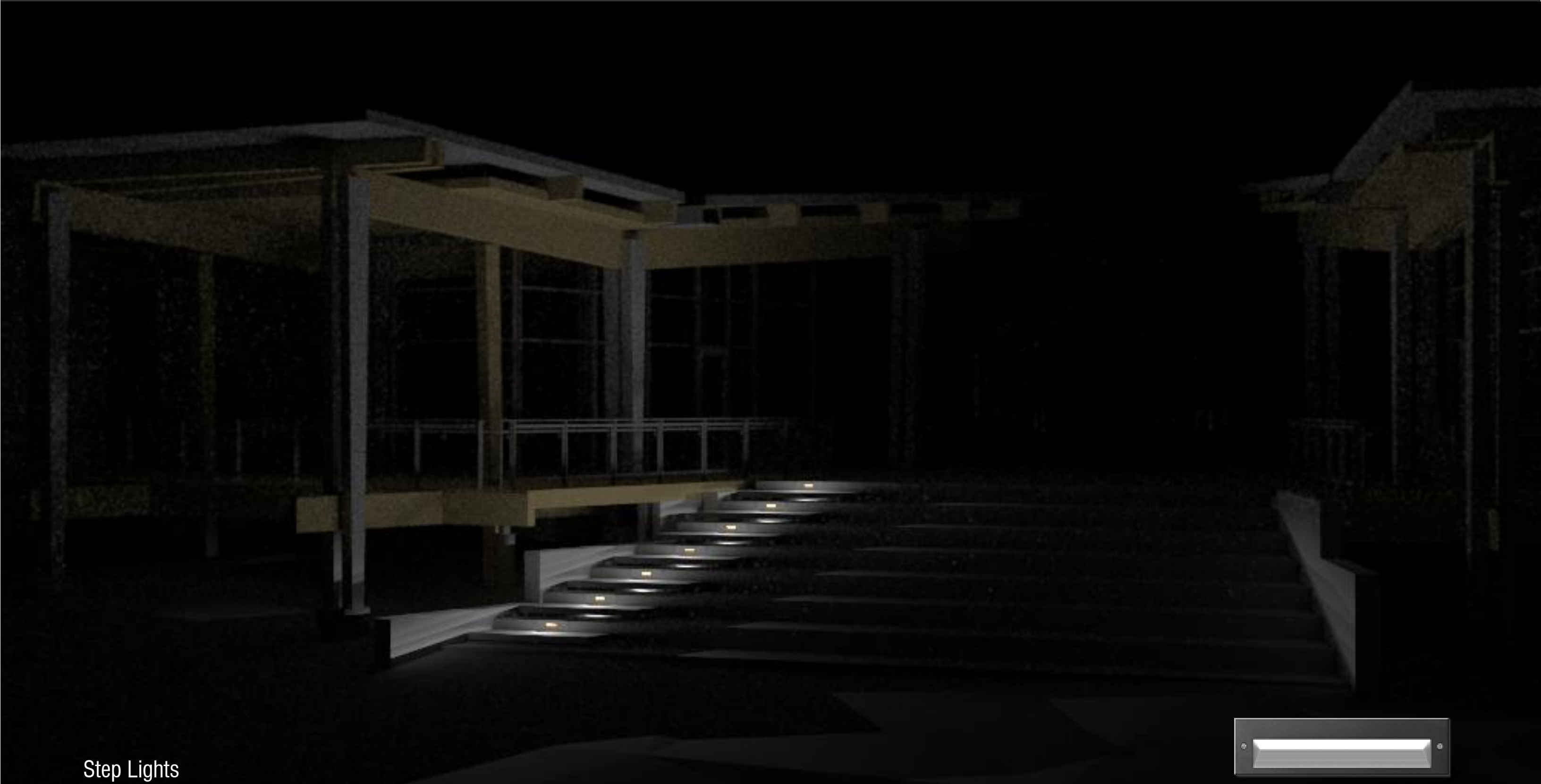
Radiance Workshop 2017



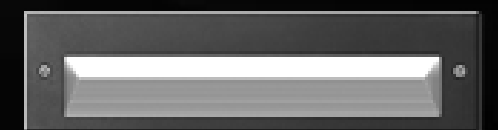
Integral Light Studio

Elementary School in California

Exterior View



Step Lights



Elementary School in California

Exterior View



Ensemble

08.23.2017

Radiance Workshop 2017

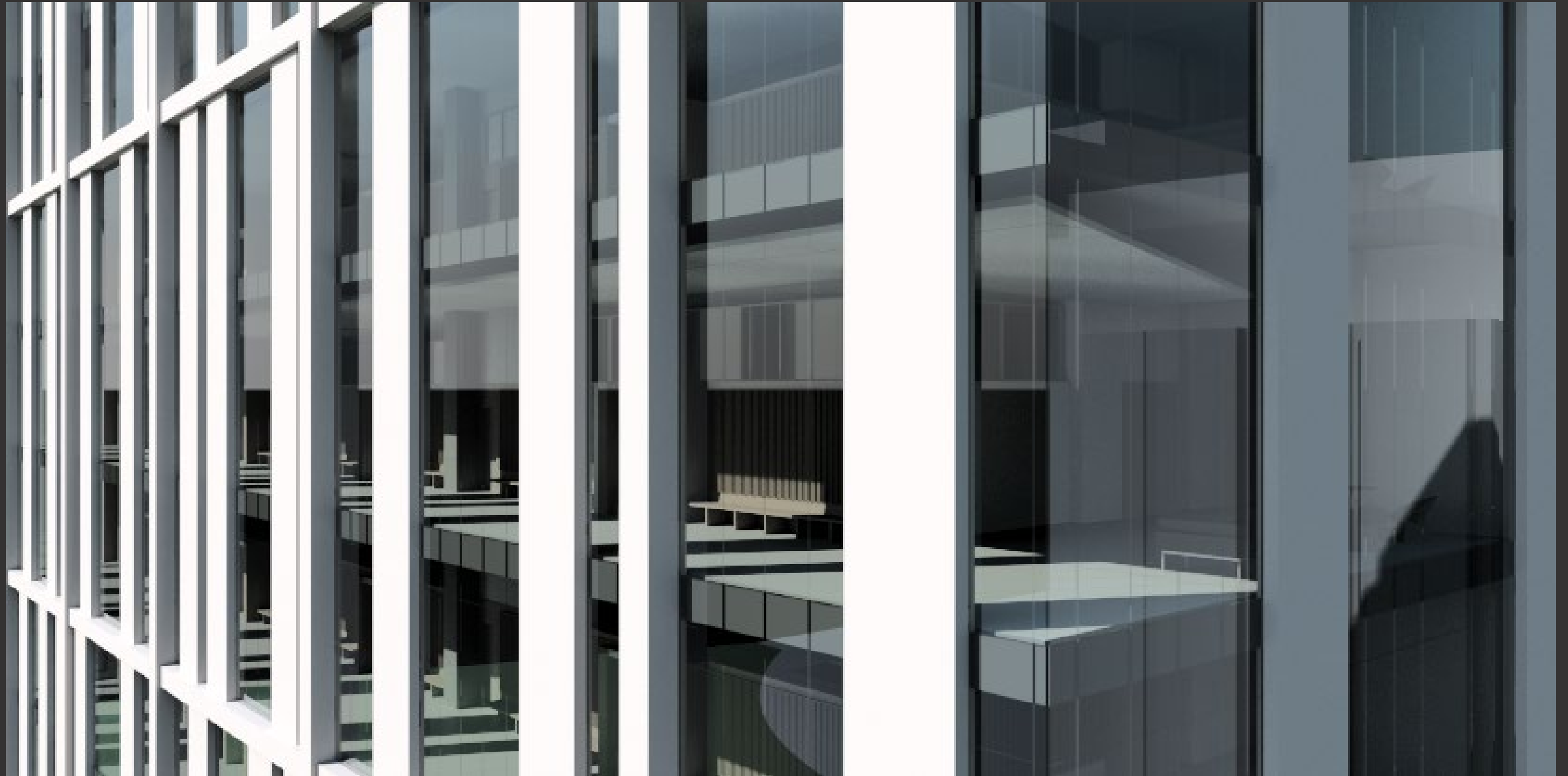
Integral Light Studio

Local Surprise

Multnomah County Courthouse - Portland, OR



Multnomah County Courthouse - Portland, OR



Multnomah County Courthouse - Portland, OR



Multnomah County Courthouse - Portland, OR

Guardian SN 70/37 on Ultra Clear PPG Solarban 72 on Starphire

Guardian SN 70/37 on UltraClear PPG Solarban 72 on Starphire



Multnomah County Courthouse - Portland, OR

Guardian SN 68 on Ultraclear Guardian SN 70/37 on Extra Clear Guardian SN 70/37 on Ultraclear



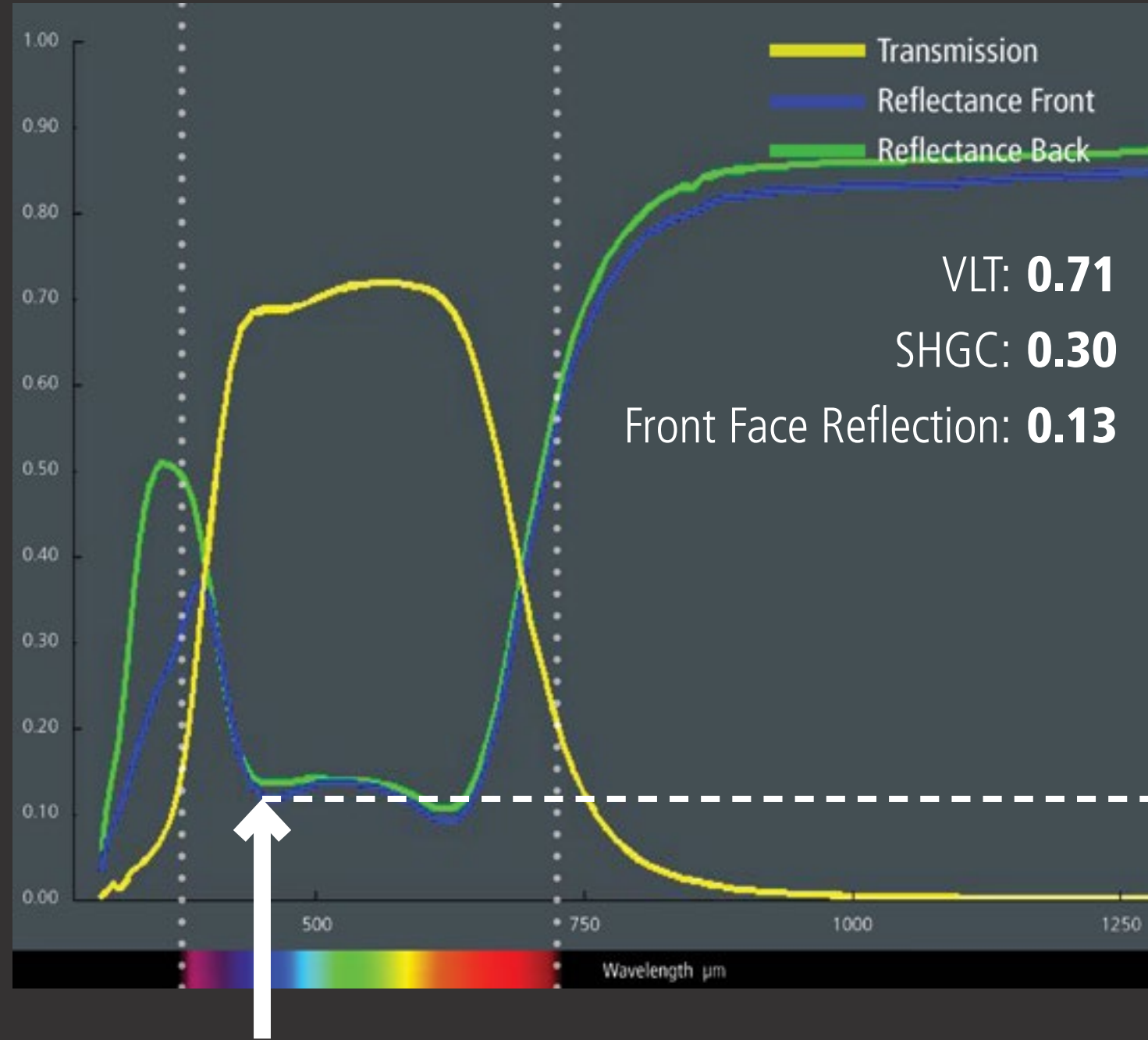
PPG Solarban 72 on Starphire

PPG Solarban 72 on Starphire

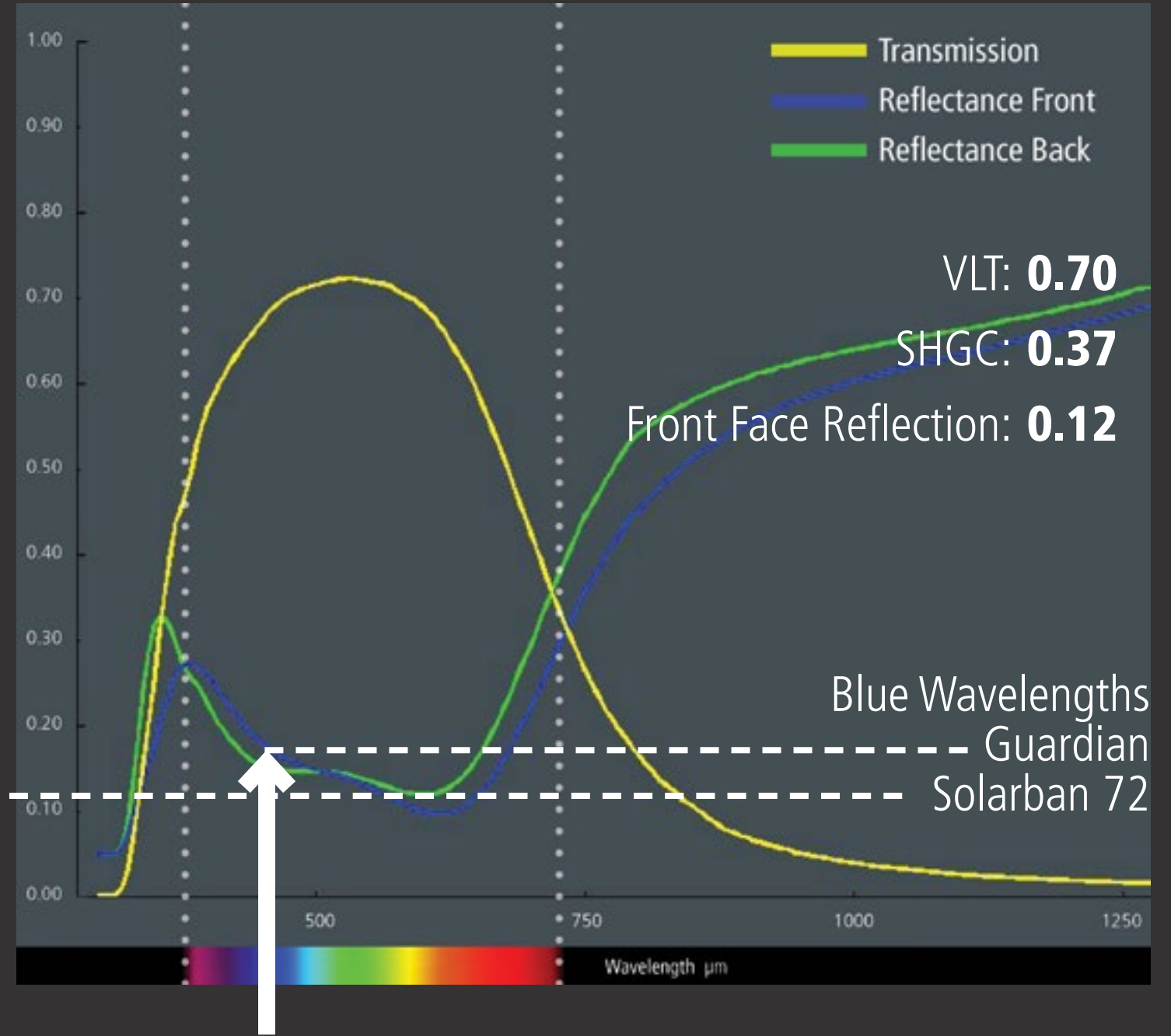
PPG Solarban 72 on Starphire

Multnomah County Courthouse - Portland, OR

PPG Solarban 72 on Starphire



Guardian Super Neutral 70/37 on Extra Clear



Multnomah County Courthouse - Portland, OR

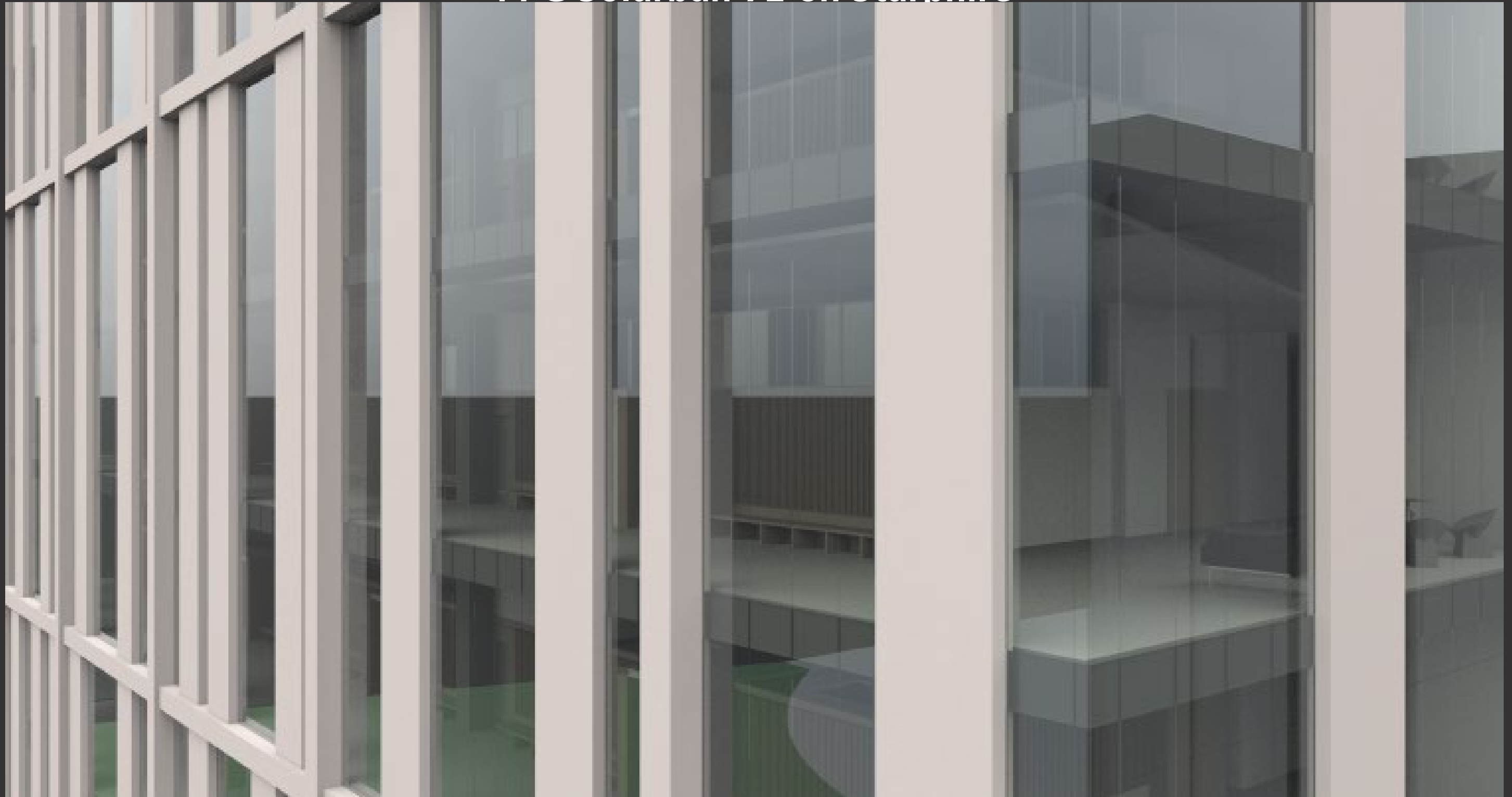
PPG Solarban 72 on Starphire

Guardian SN 70/37 on Ultraclear



Multnomah County Courthouse - Portland, OR

PPG Solarban 72 on Starphire



Multnomah County Courthouse - Portland, OR

Guardian SN 70/37 on Ultraclear



Multnomah County Courthouse - Portland, OR

PPG Solarban 72 on Starphire

Guardian SN 70/37 on Ultraclear



PPG Solarban 72 on Starphire

Guardian SN 70/37 on Ultraclear



Multnomah County Courthouse - Portland, OR



A modern interior space, likely a dining or meeting area, featuring numerous round tables and chairs arranged in a circular pattern. The room is characterized by large glass windows that offer a view of a bright, hazy outdoor scene. The ceiling is equipped with numerous recessed circular lights, and the overall atmosphere is clean and contemporary.

Thank You!
bcoston@integralgroup.com