SageGlass®

EC Zone Atlas Tool

2019 Radiance Workshop

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Agenda
EC Zone Atlas Tool

- Introduction
- Single zone EC vs. Multi-zone EC
- Input Parameter
  - Model
  - Location
  - Controls
  - Tinting order
  - Solar control
- Output parameter
  - Tint Schedule
  - Number of hours
  - % of area
- Data Mining
- Zone Atlas Tool Development
- Model Comparison
- Future work

Introduction
EC Zone Atlas Tool

Zone Atlas tool is developed based on series of pre-simulated annual daylight analysis of Electrochromic glazing. Simulations was done by John Mardaljevic using Radiance.

8 Models
In 4 longitudes (London, Chicago, Atlanta, Miami)
7 orientations (NE, E, SE, S, SW, W, NW)
24 different control strategies

Main objective:

- Impact of electrochromic glazing and zoning on daylight performance.
- Exploring different control strategies and its impact on daylight performance.

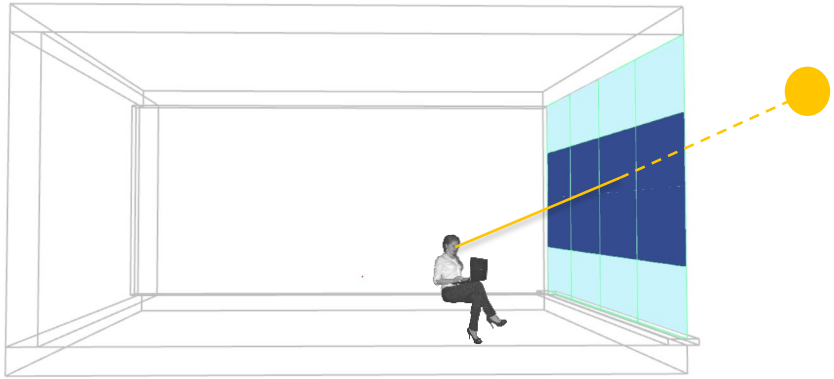

SageGlass- Light Zone

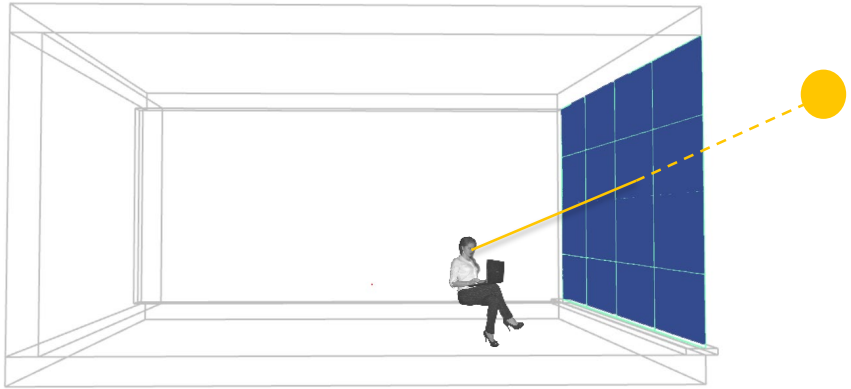

SageGlass- Harmony


SageGlass- Harmony

EC Zoning

EC Zone Atlas Tool





- Intelligent glare control
- Maximize daylight admission
- Improve color rendering

EC Zoning Benefit

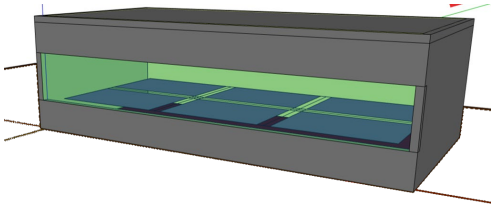
EC Zone Atlas Tool

Single-zone Vs. Multi-zone EC

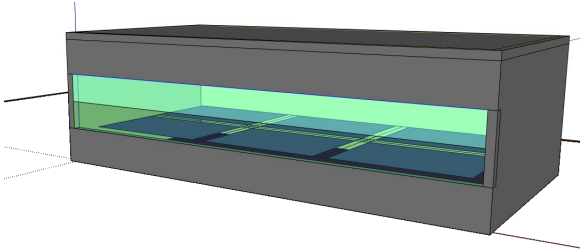
Single-zone Vs. Multi-zone Configuration

Input Parameter
Model Types

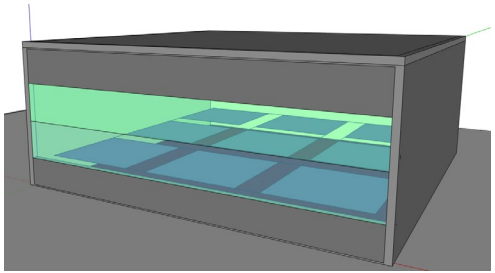
A1
30 ft. x 15 ft. depth
9 ft. ceiling
4 ft. Window Height
1 Zone



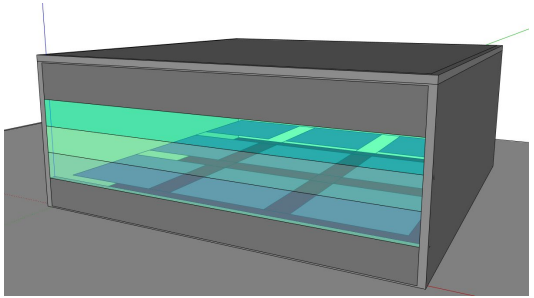
A2
30 ft. x 15 ft. depth
9 ft. ceiling
4 ft. Window Height
2 Zones



B1
30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
2 Zones



B2
30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
3 Zones

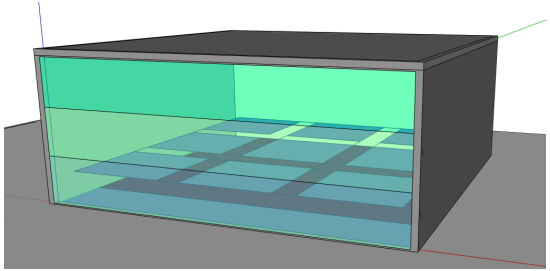


Input Parameter

Model Types

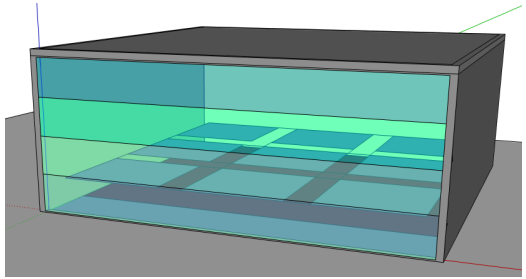
C2

30 ft. x 30 ft. depth
12 ft. ceiling
Full-height Window
3 Zones



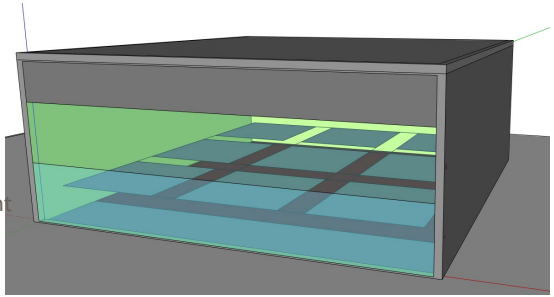
C1

30 ft. x 30 ft. depth
12 ft. ceiling
Full-height Window
4 Zones



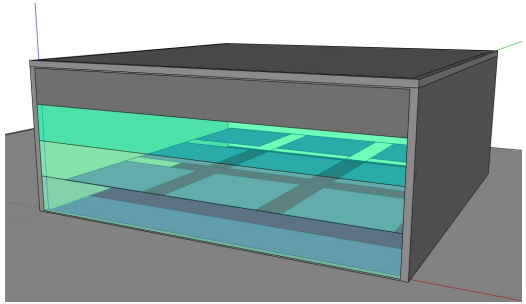
D1

30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
2 Zones



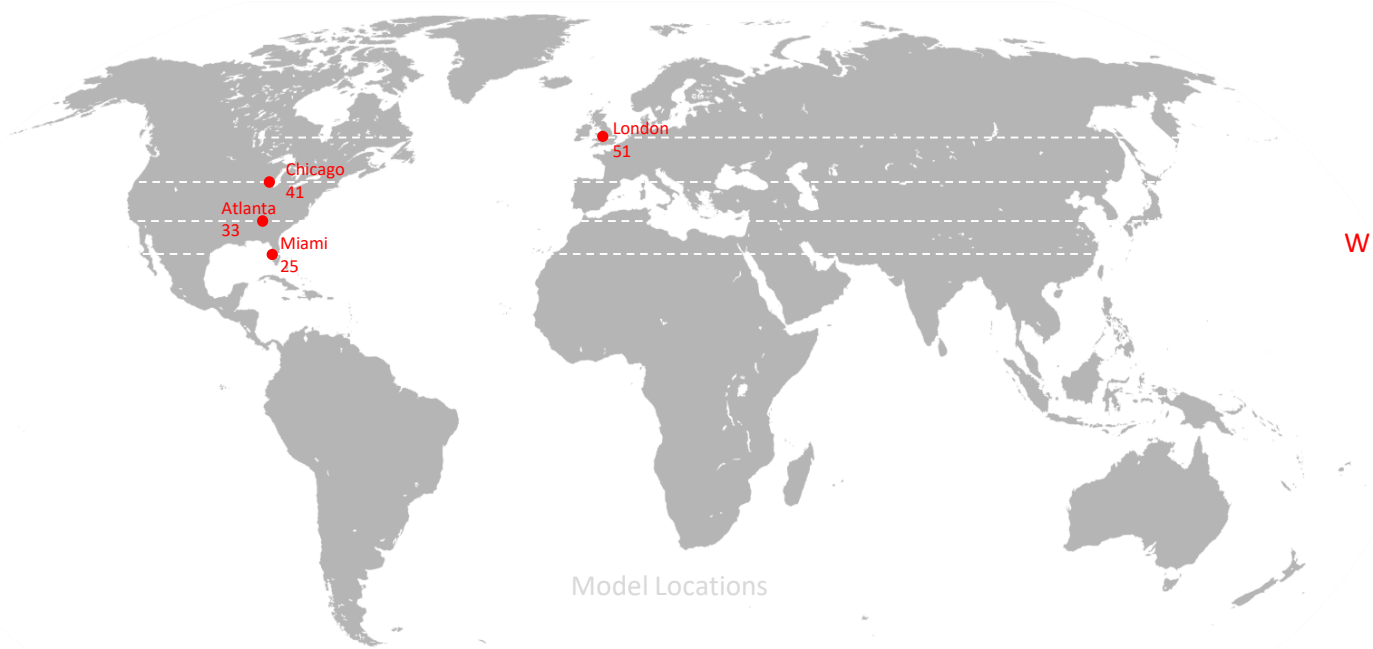
D2

30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
3 Zones

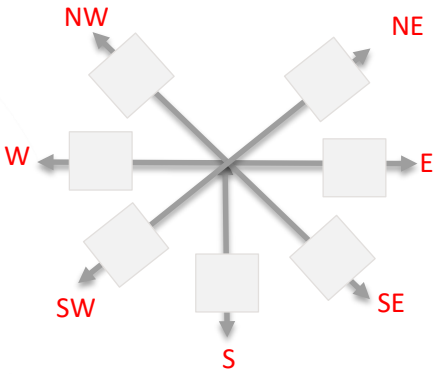


Input Parameter

Model Location and Orientation



Model Locations



Model Orientations

Input Parameter
Control Strategy

Control Strategies:

- 1000 lux over 50%, 60%, 70%, 80%, 90%, 100%
- 2000 lux over 50%, 60%, 70%, 80%, 90%, 100%
- 3000 lux over 50%, 60%, 70%, 80%, 90%, 100%
- 4000 lux over 50%, 60%, 70%, 80%, 90%, 100%

Tinting Order:

- Tinting bottom upward
- Tinting top downward

Solar Control:

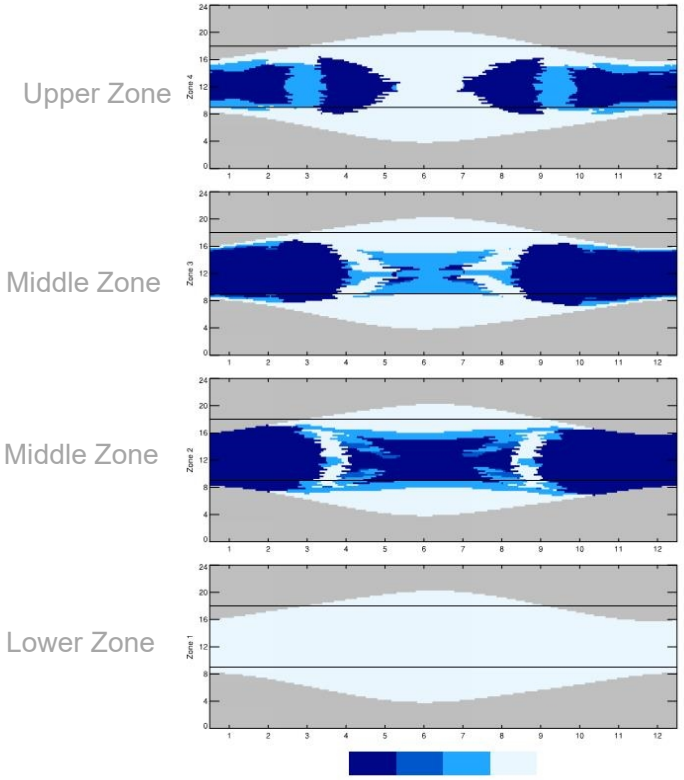
- SHGC control strategy

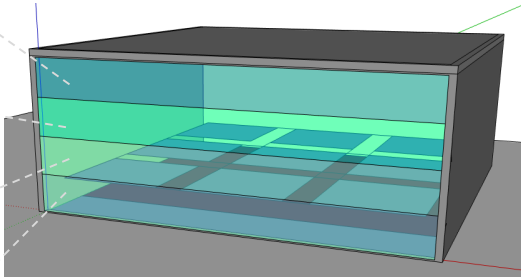
where the bottom zone will be tinted to 6%T if at least one other zone is in the clear state during the “cooling days”. (March 1st to October 31st)

More than 18000 scenarios

Output Parameter

Tint Pattern





Output Parameter

EC Zone Atlas Tool

% Area of workplane where illuminance < 300Lux

Under-lit

% Area of workplane where 300< illuminance >1000 Lux

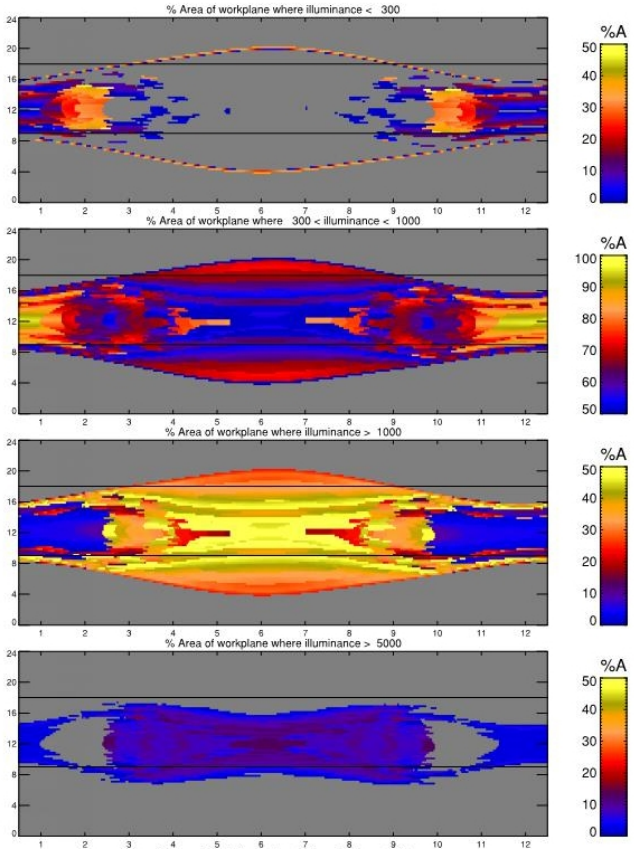
Useful Daylight

% Area of workplane where illuminance > 1000 Lux

Over-lit

% Area of workplane where illuminance > 5000 Lux

Over-lit



Zone Atlas Performance Data

Number of hours- Illuminance

N of hrs. that illuminance < 300Lux

Under-lit

N of hrs. that 300< illuminance >1000 Lux

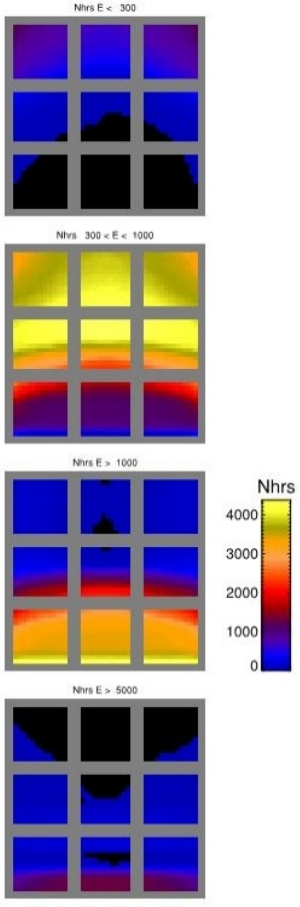
Useful Daylight

N of hrs. that illuminance > 1000 Lux

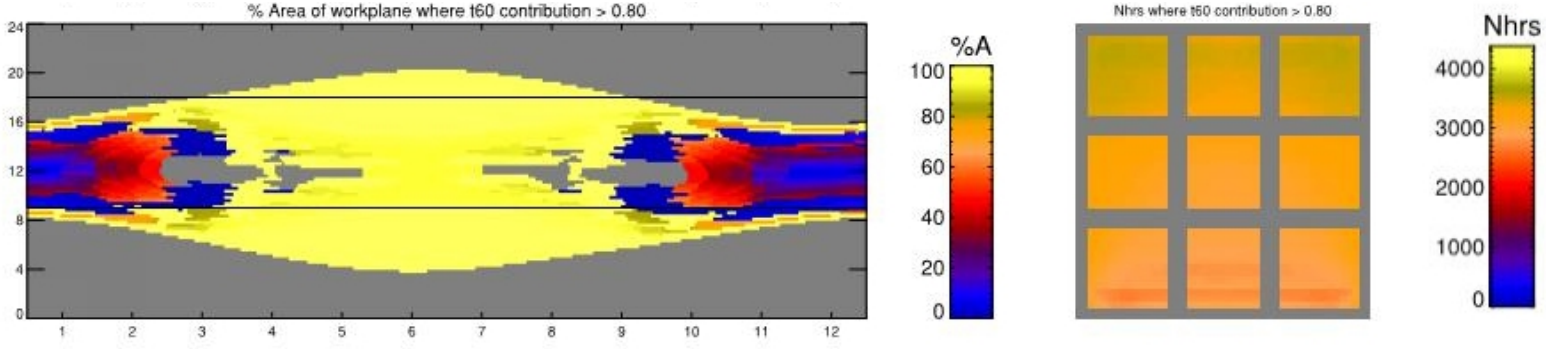
Over-lit

N of hrs. that illuminance > 5000 Lux

Over-lit



Zone Atlas Performance Data
Color Rendering



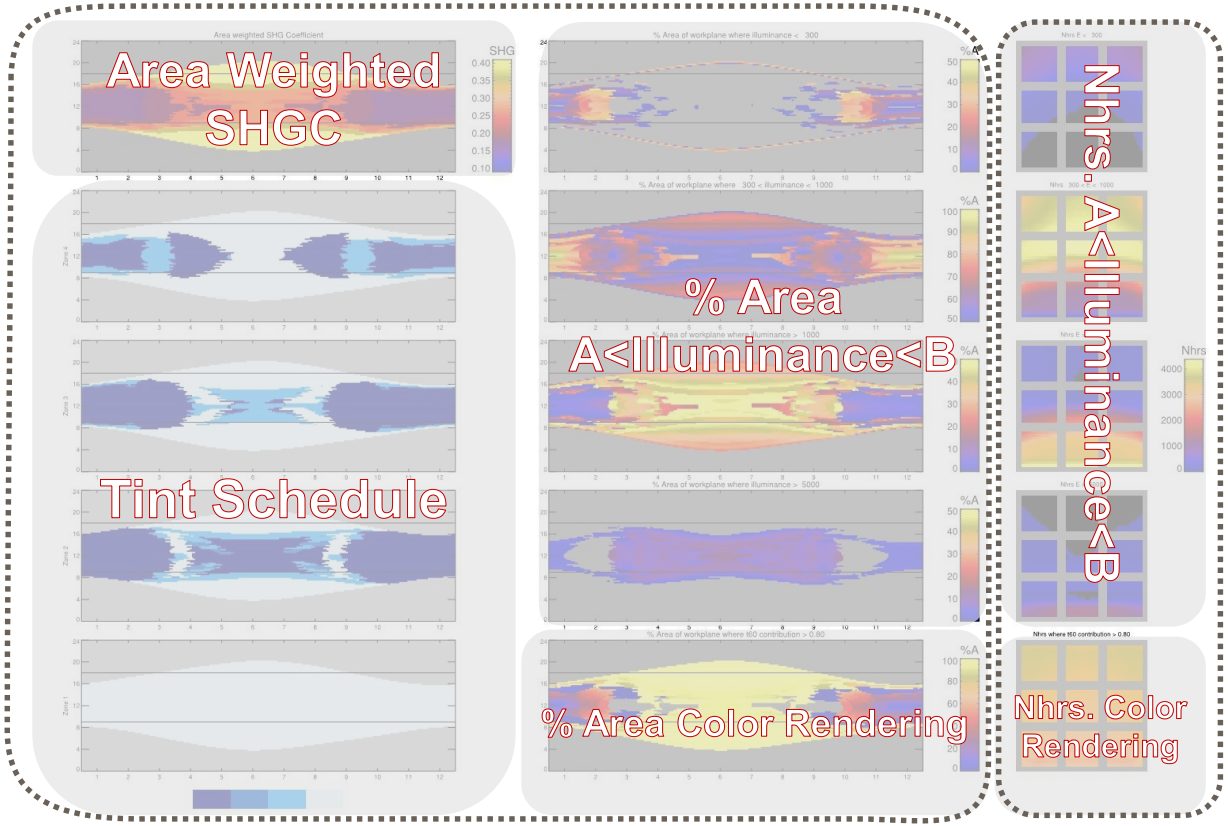
% Area of workplane where T60 contribution> 0.8

# of hours T60 contribution> 0.8

EC Zone Atlas

Performance Data

% of Area



Number of Hrs.

EC Zone Atlas

Performance Data

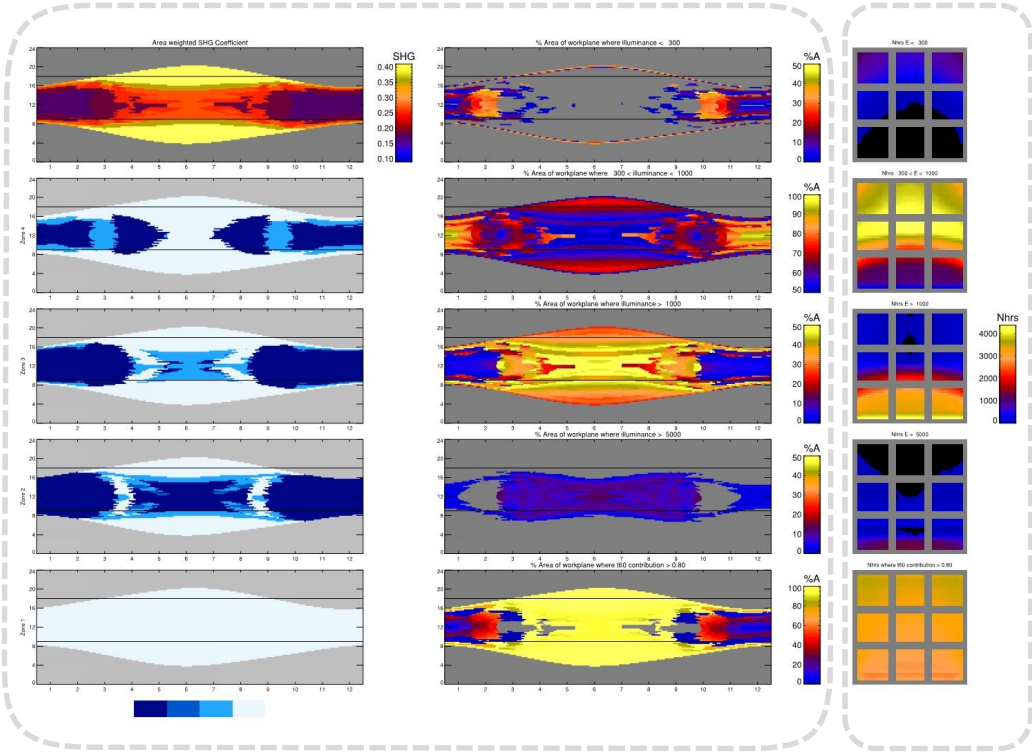
% of Area

Shown in schedule

# of data points = # of time-step

35040 data points

Every 15 minutes



Number of Hours

Shown in floor plan

# of data points = # of sensors

1521 data points

Performance Data

Performance Data

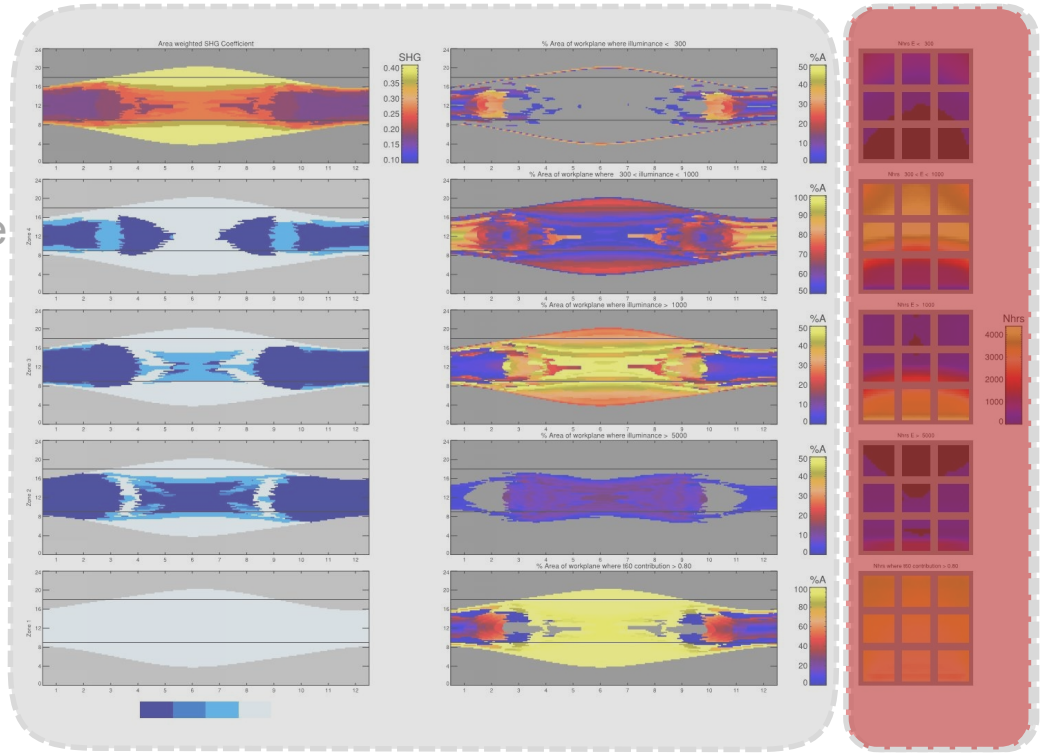
% of Area

Shown in schedule

# of data points = # of time-step

35040 data points

Every 15 minutes



% of area that meets the condition
for more than **50% of Daylight hours**

Number of Hours

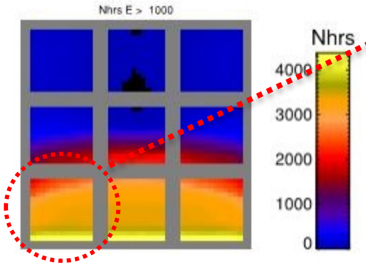
Shown in floor plan

# of data points = # of sensors

1521 data points

Zone Atlas

Performance Data



2511.75	2353.5	2297.5	2212.5	2119	2063.75	2043.25	2026.25	1971.75	1926.25	1859.5	1843.5	1814.5
2276	2164.75	2072	2023.25	1972.5	1918.75	1832.75	1782.25	1767.5	1745.25	1674.5	1627.25	1591
2093	2012.5	1956.25	1848.75	1766	1725.5	1614	1533.5	1468.25	1439.5	1401	1373.25	1356.75
1943	1785.75	1701.75	1570.25	1480	1416.5	1353.75	1309.25	1278.25	1261.5	1246.25	1234.75	1228.25
1615.25	1500.25	1411	1337.25	1272.75	1208.25	1186.5	1170.25	1171	1173.5	1172.25	1171	1167.5
1426.75	1330.25	1252.25	1222.5	1183.75	1163.25	1147.75	1136.5	1132.25	1125.25	1125.5	1124.25	1122
1291	1246.75	1211.5	1175.75	1150	1125.25	1111.25	1103.75	1096.5	1090.5	1087.75	1083.25	1079.5
1236.25	1223.25	1194.5	1156.5	1130.5	1112.5	1089	1076.75	1077	1075.75	1072.5	1070.5	1069.5
1194.25	1192.25	1167.25	1136.75	1115.25	1091.5	1076.75	1073.75	1071.25	1070.75	1074.5	1075.5	1078.5
1140.75	1119.5	1097.75	1078	1069.5	1051.25	1036	1036.75	1040.25	1046	1048	1049.5	1053.25
999.25	999.5	974	964.25	940.75	926.25	932.5	934.75	935.75	944.5	948.25	953.75	951.25
672.75	628.5	591.25	583.75	589	584.25	589	586.75	587.75	585	576.25	568.25	563.25
382	243.75	194.25	158.25	146.75	137.25	137.25	138.25	136.5	133	125.5	120.75	118.25

Data from 169 sensors

>2202 hrs. = 50% of Daylight Hours

1	1	1	1	1	1	1	1	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

8% of area

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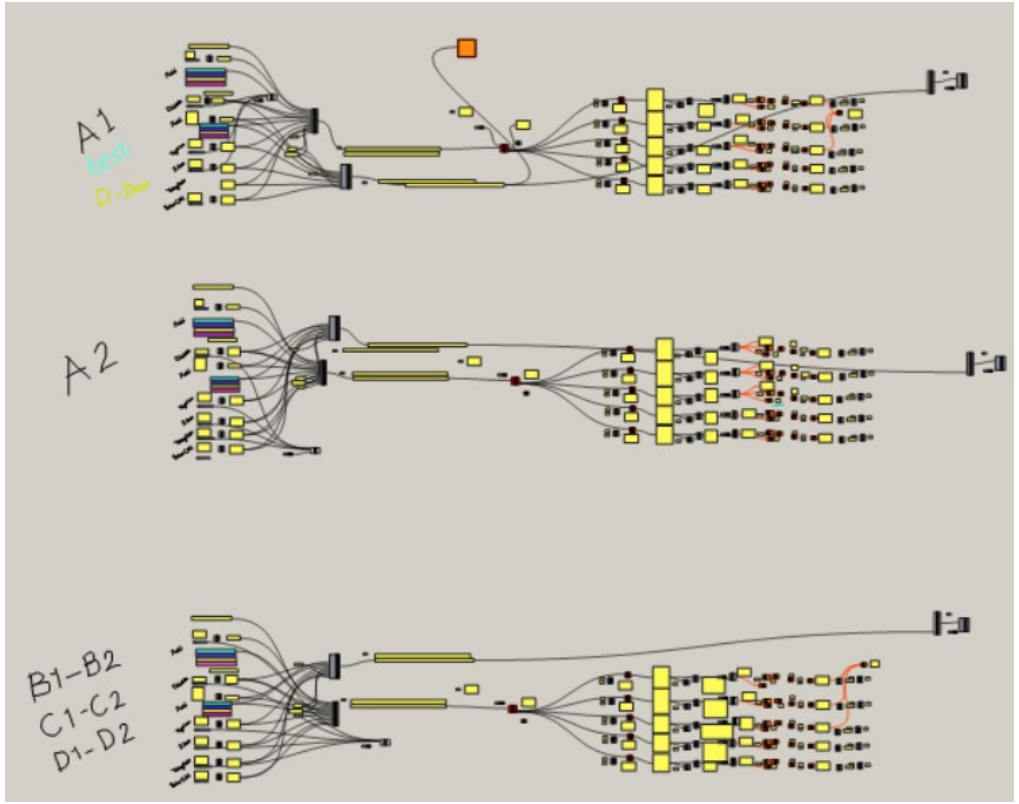
Data Mining

EC Zone Atlas Tool



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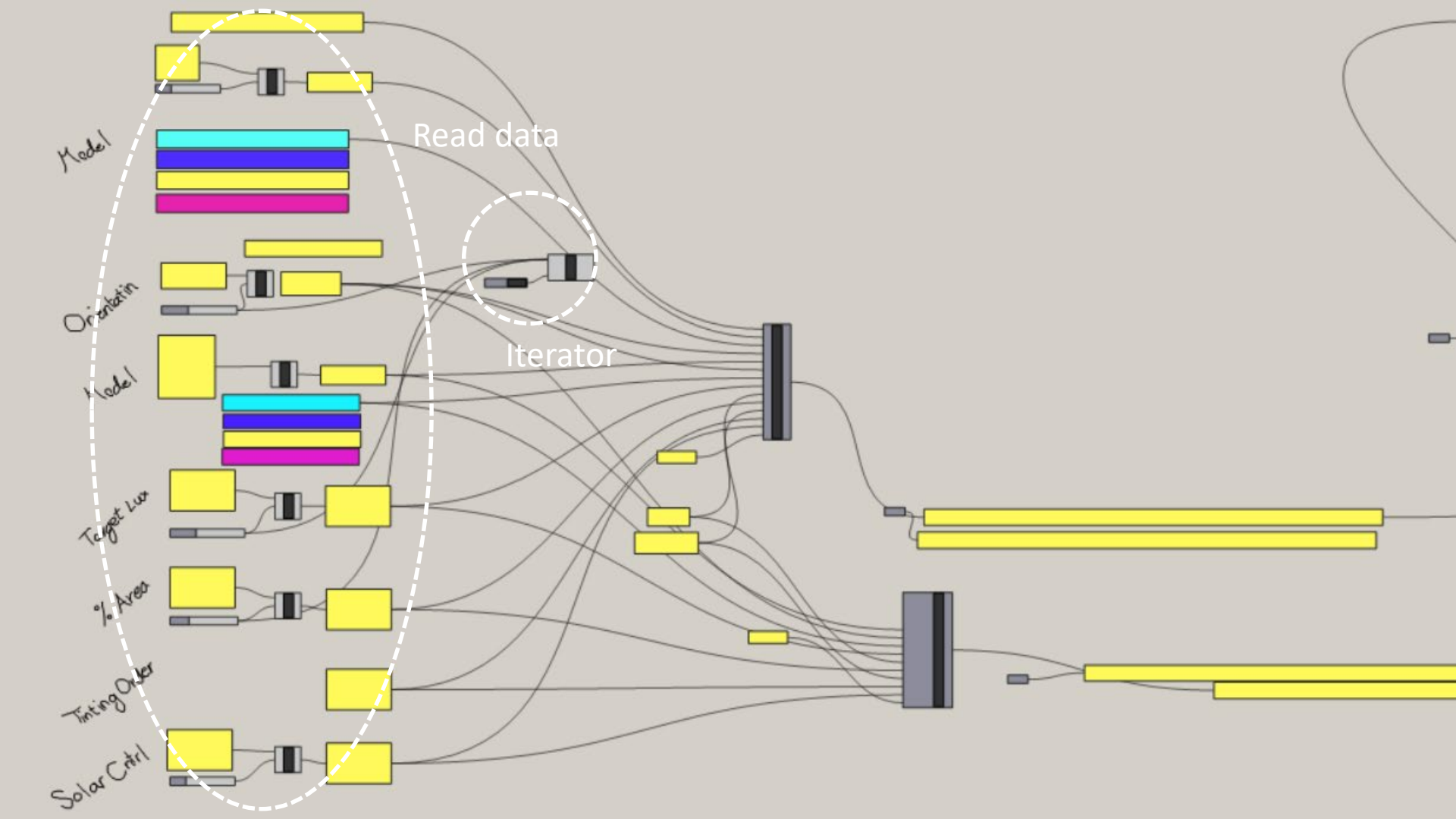
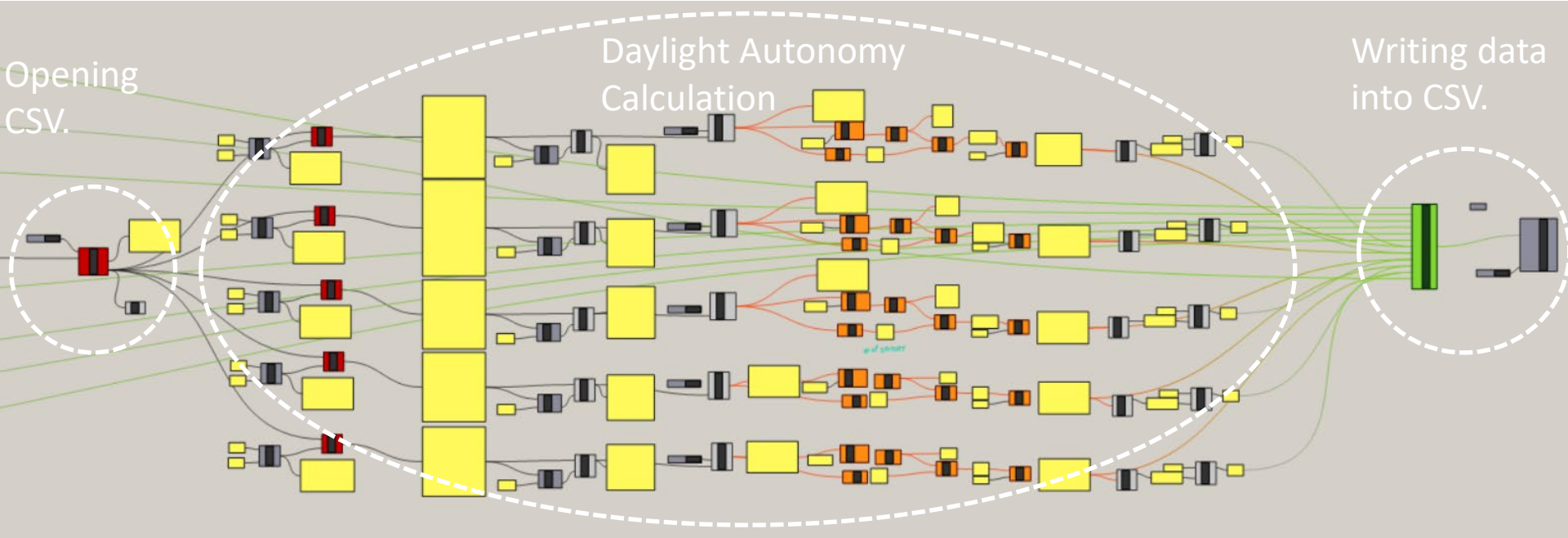

Read data
Iterator
Model
Orientatin
Model
Target Lux
% Area
Tinting Order
Solar Ctrl

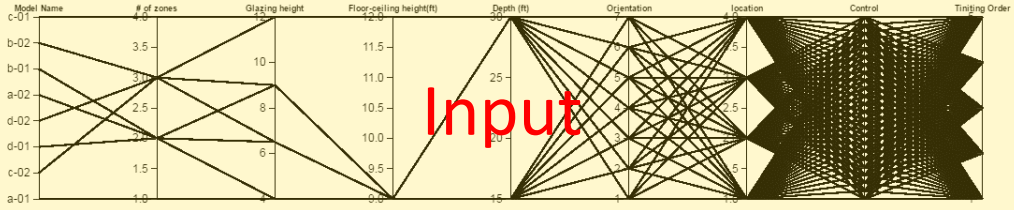
Data Mining

EC Zone Atlas Tool



EC Zone Atlas

Data



→

Output

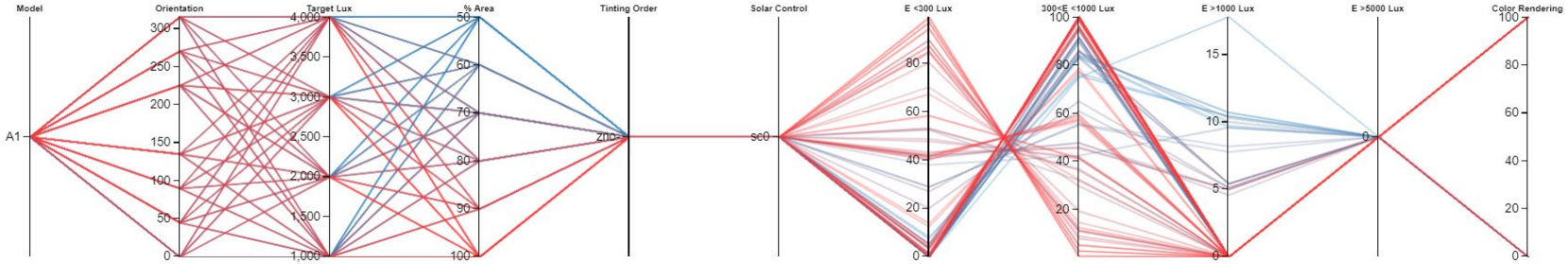
(Performance data)

- Under-lit
- Useful daylight
- Over-Lit
- Color Rendering

D3 Parallel Coordinator

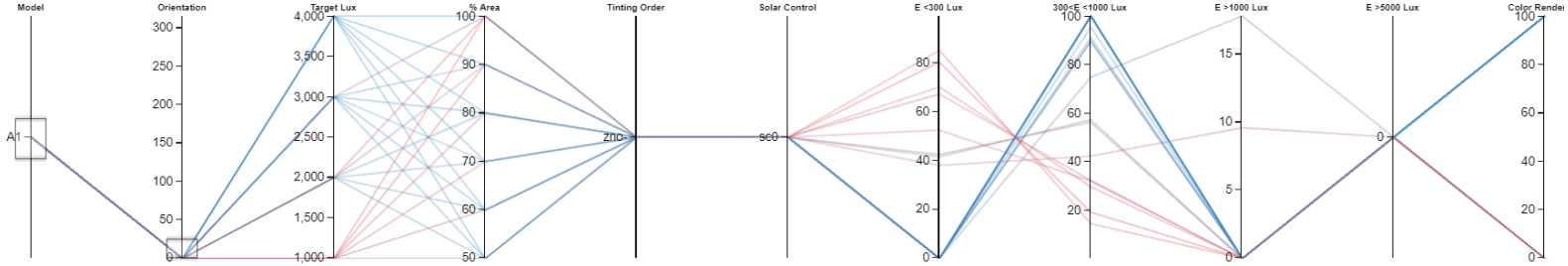
Data Analysis

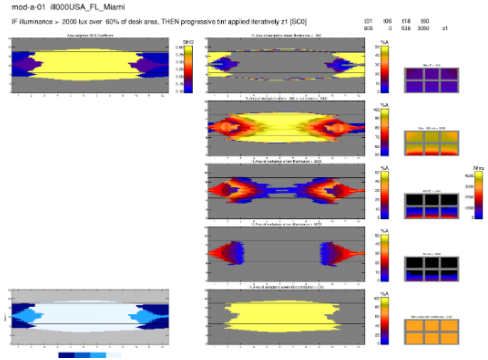
EC Zone Atlas Tool

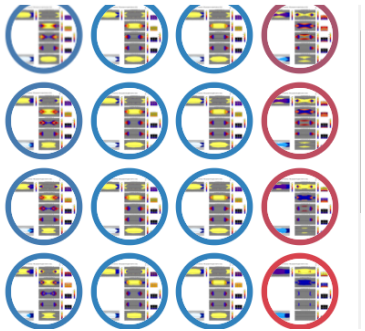


Tool Development

EC Zone Atlas Tool





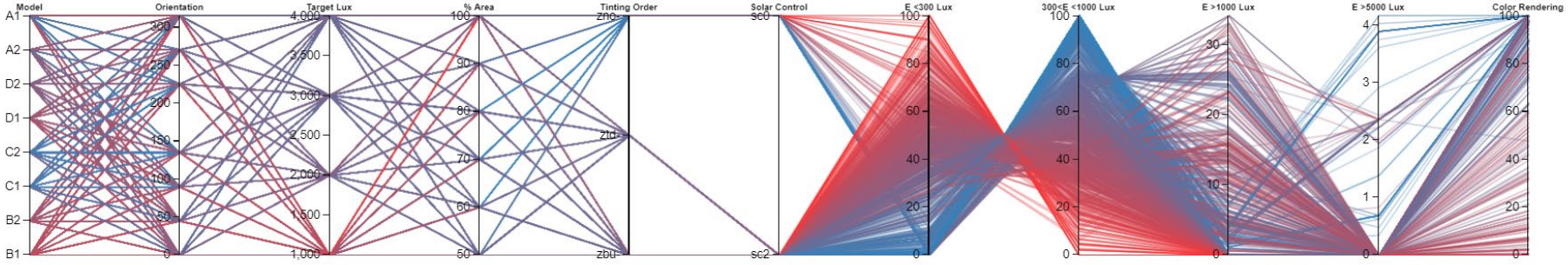


Attributes

Model : A1
Orientation : 0
Target Lux : 2000
% Area : 60
Tinting Order : zno-
Solar Control : sc0
E <300 Lux : 0
300 : 89.7222
E >1000 Lux : 0
E >5000 Lux : 0
Color Rendering : 100

Tool Development

EC Zone Atlas Tool

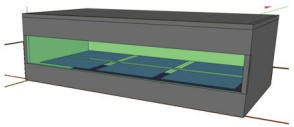


Model	Orientation	Target Lux	% Area	Tinting Order	Solar Control	E <300 Lux	300<E <1000 Lux	E >1000 Lux	E >5000 Lux	Color Rendering	Rating	scid
A1	0	1000	50	zno-	sc0	36.8056	39.0278	5.5556	0	0	0	2358
A1	45	1000	50	zno-	sc0	14.1667	63.75	10.2778	0	0	0	2359
A1	90	1000	50	zno-	sc0	1.3889	82.9167	10.2778	0	100	0	2360
A1	135	1000	50	zno-	sc0	0	84.5833	10.5556	0	100	0	2361
A1	225	1000	50	zno-	sc0	0	84.5833	10.4167	0	100	0	2362

Model Comparison

EC Zone Atlas Tool

A1
30 ft. x 15 ft. depth
9 ft. ceiling
4 ft. Window Height
1 Zone



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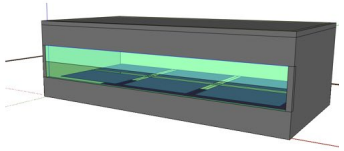
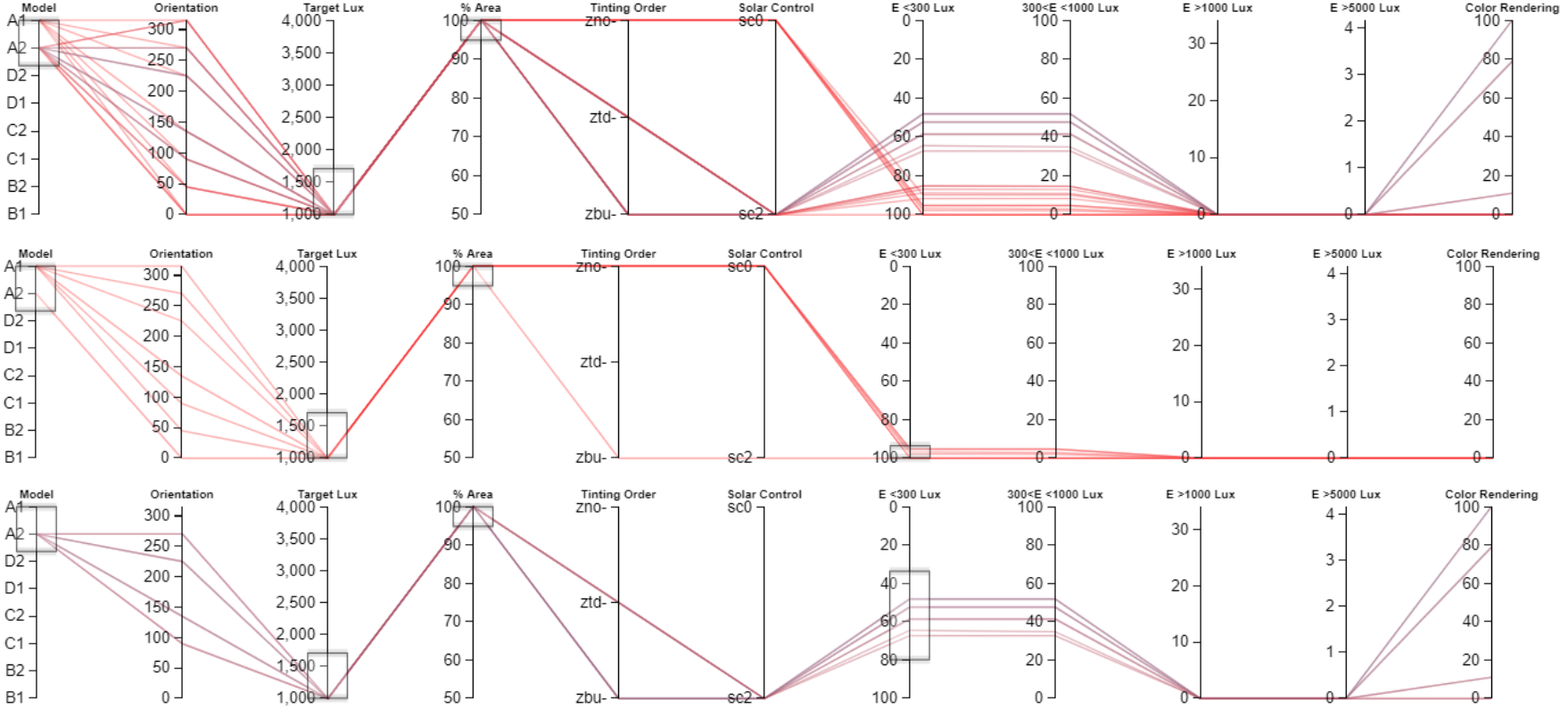
30 ft. x 15 ft. depth
9 ft. ceiling
4 ft. Window Height
2 Zones

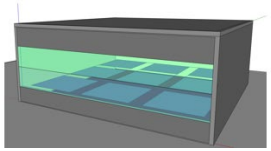




Model Comparison

EC Zone Atlas Tool

B1
30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
2 Zones



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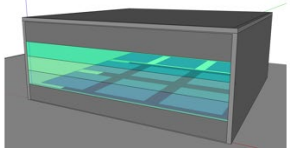
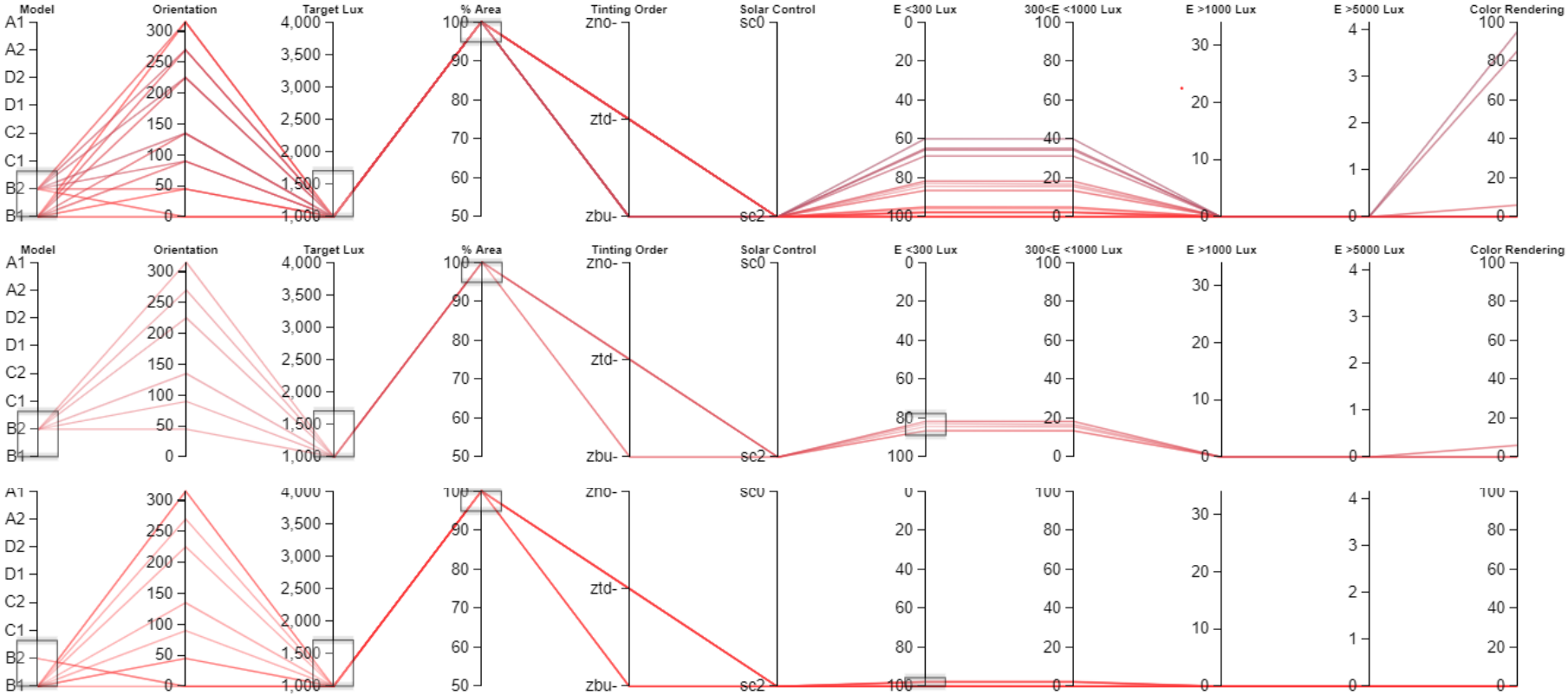
3 Zones

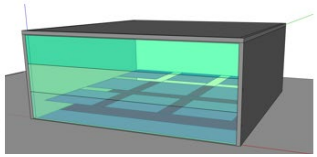




Model Comparison

EC Zone Atlas Tool

C2
30 ft. x 30 ft. depth
12 ft. ceiling
Full-height Window
3 Zones



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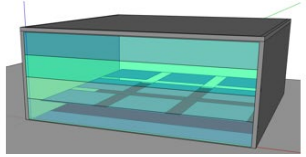
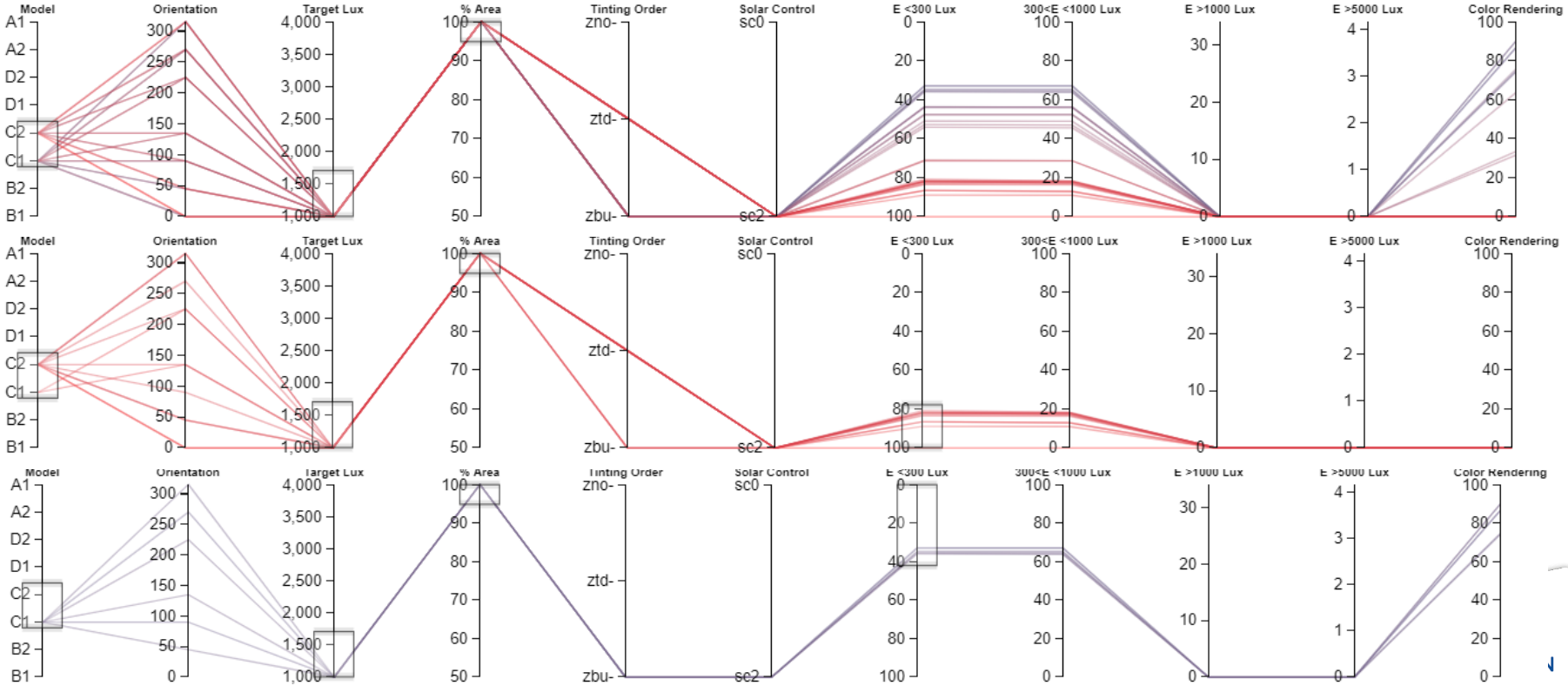
12 ft. ceiling
Full-height Window
4 Zones

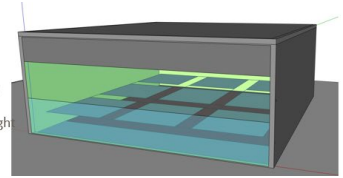




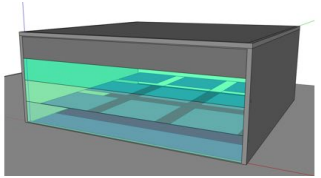
Model Comparison

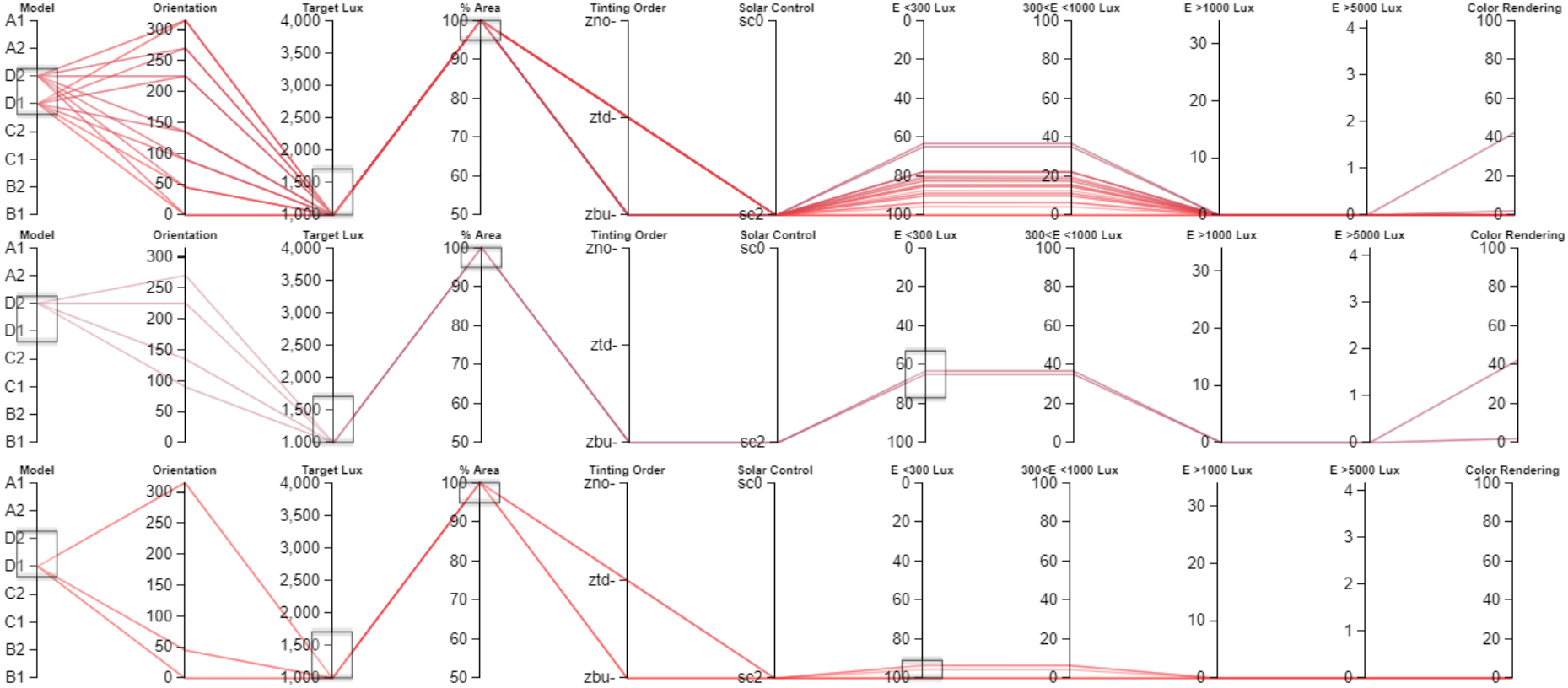
EC Zone Atlas Tool

D1
30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
2 Zones



D2
30 ft. x 30 ft. depth
12ft ceiling
6.5 ft. Window Height
3 Zones





Future Work
EC Zone Atlas Tool

Expanding pre-simulated data including:

- Performance data on clear glass for each model type
- Performance data on single zone EC for model type B, C and D
- Weather sky condition
- Additional locations