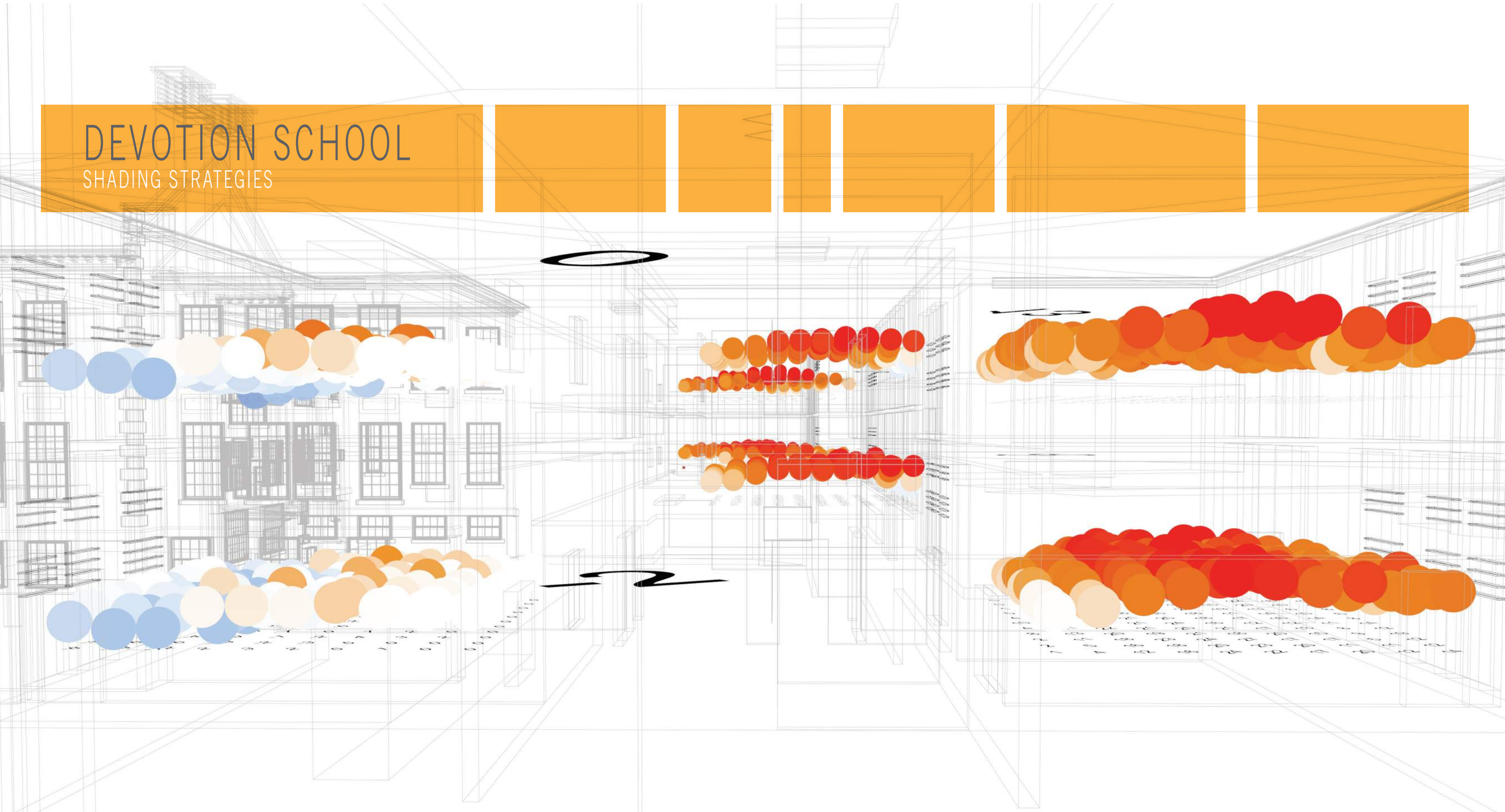
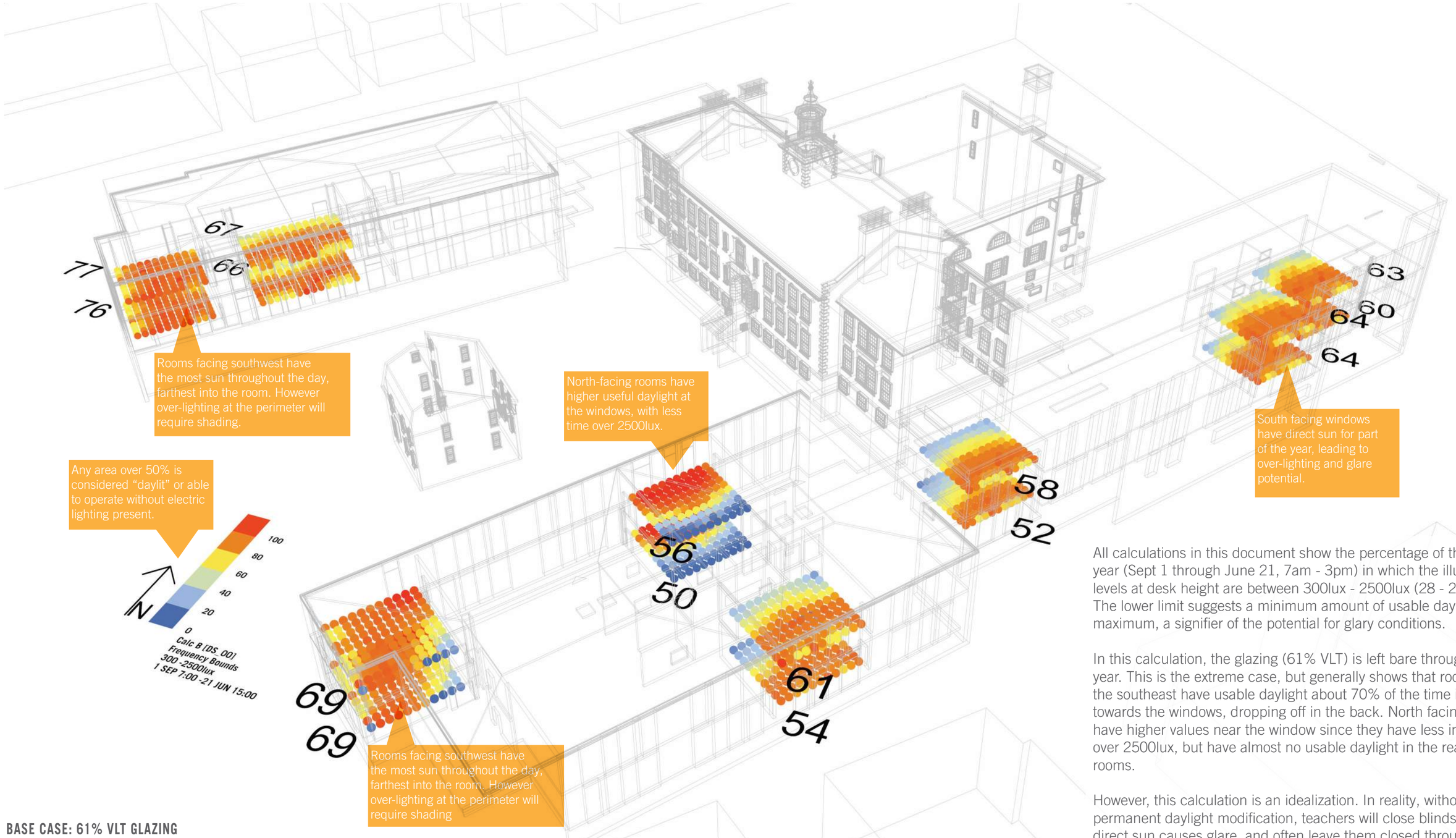
DEVOTION SCHOOL

SHADING STRATEGIES





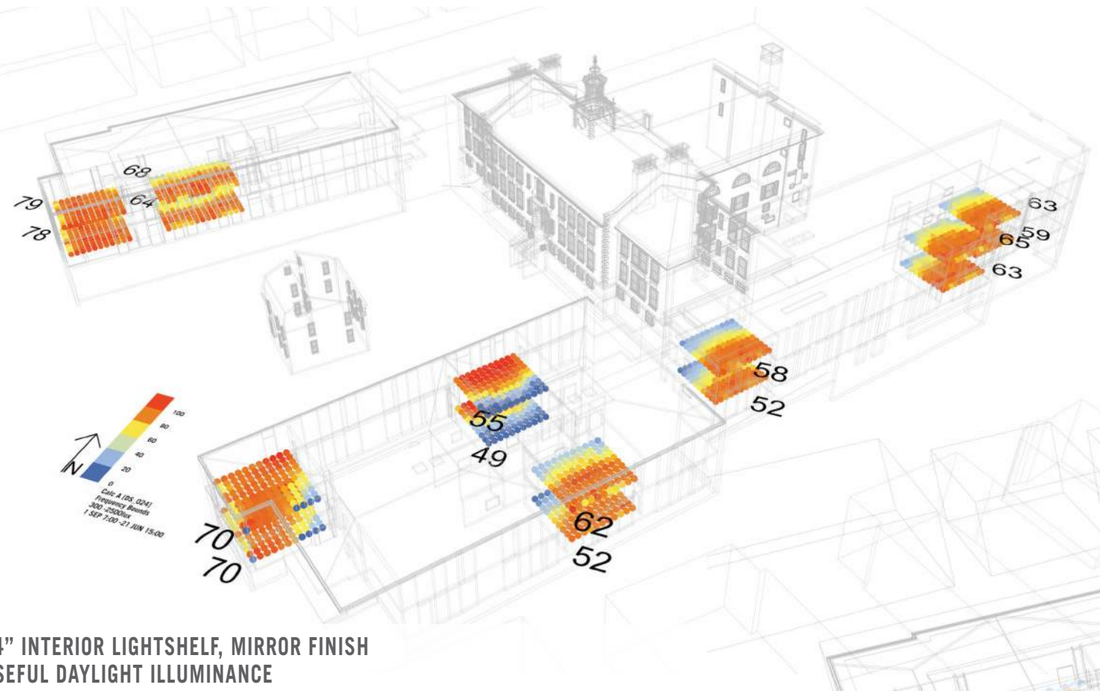
BASE CASE: 61% VLT GLAZING
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500lUX)

All calculations in this document show the percentage of the school year (Sept 1 through June 21, 7am - 3pm) in which the illuminance levels at desk height are between 300lux - 2500lux (28 - 232 fc). The lower limit suggests a minimum amount of usable daylight, the maximum, a signifier of the potential for glary conditions.

In this calculation, the glazing (61% VLT) is left bare throughout the year. This is the extreme case, but generally shows that rooms on the southeast have usable daylight about 70% of the time inboard towards the windows, dropping off in the back. North facing rooms have higher values near the window since they have less intense light over 2500lux, but have almost no usable daylight in the rear of the rooms.

However, this calculation is an idealization. In reality, without any permanent daylight modification, teachers will close blinds when the direct sun causes glare, and often leave them closed throughout the day.

24” INTERIOR LIGHTSHELF, MIRROR FINISH
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500lUX)

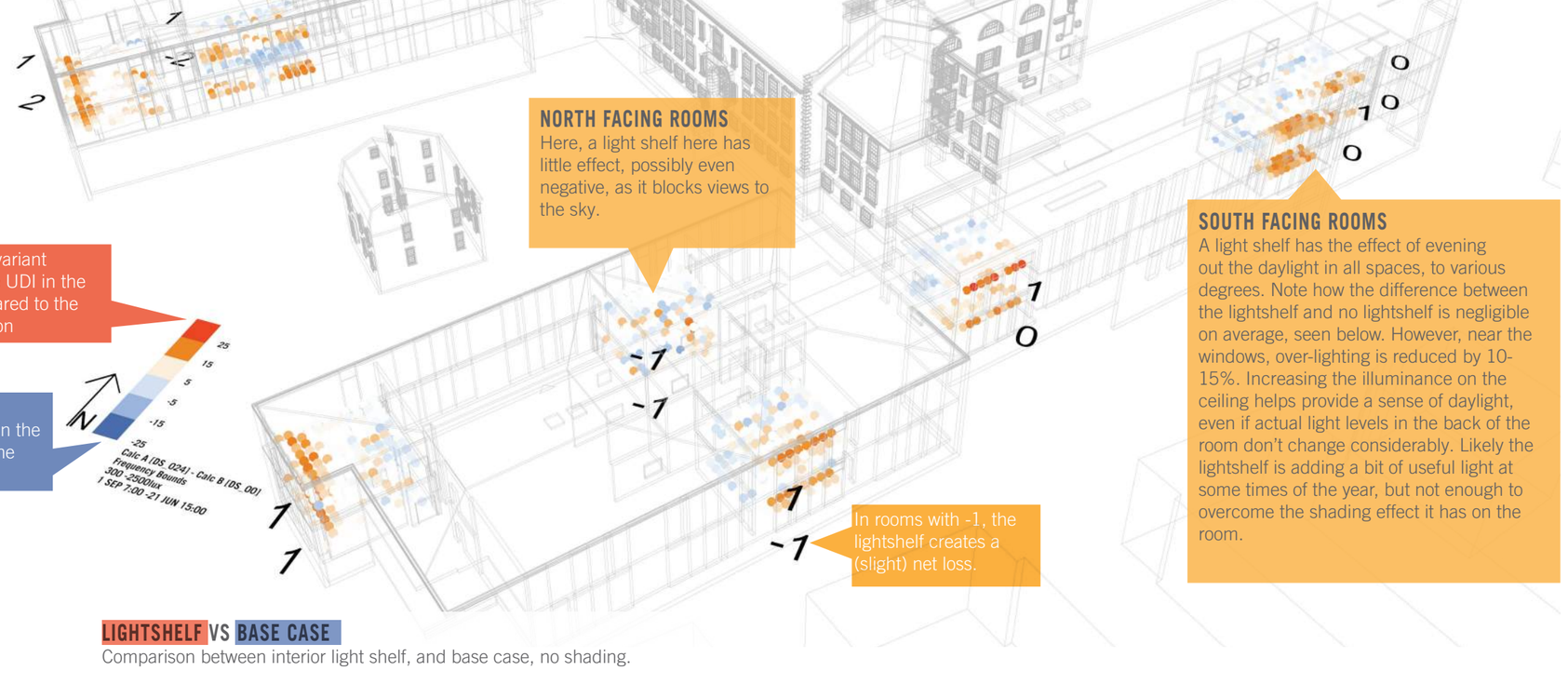


We can use the base case as a comparison to a lightshelf without any shades drawn, shown in this calculation.

Polished Aluminum
92% Reflectance
92% Specularity

RED = This variant improves the UDI in the room, compared to the base condition

BLUE = This variant diminishes the UDI in the room compared to the base condition.

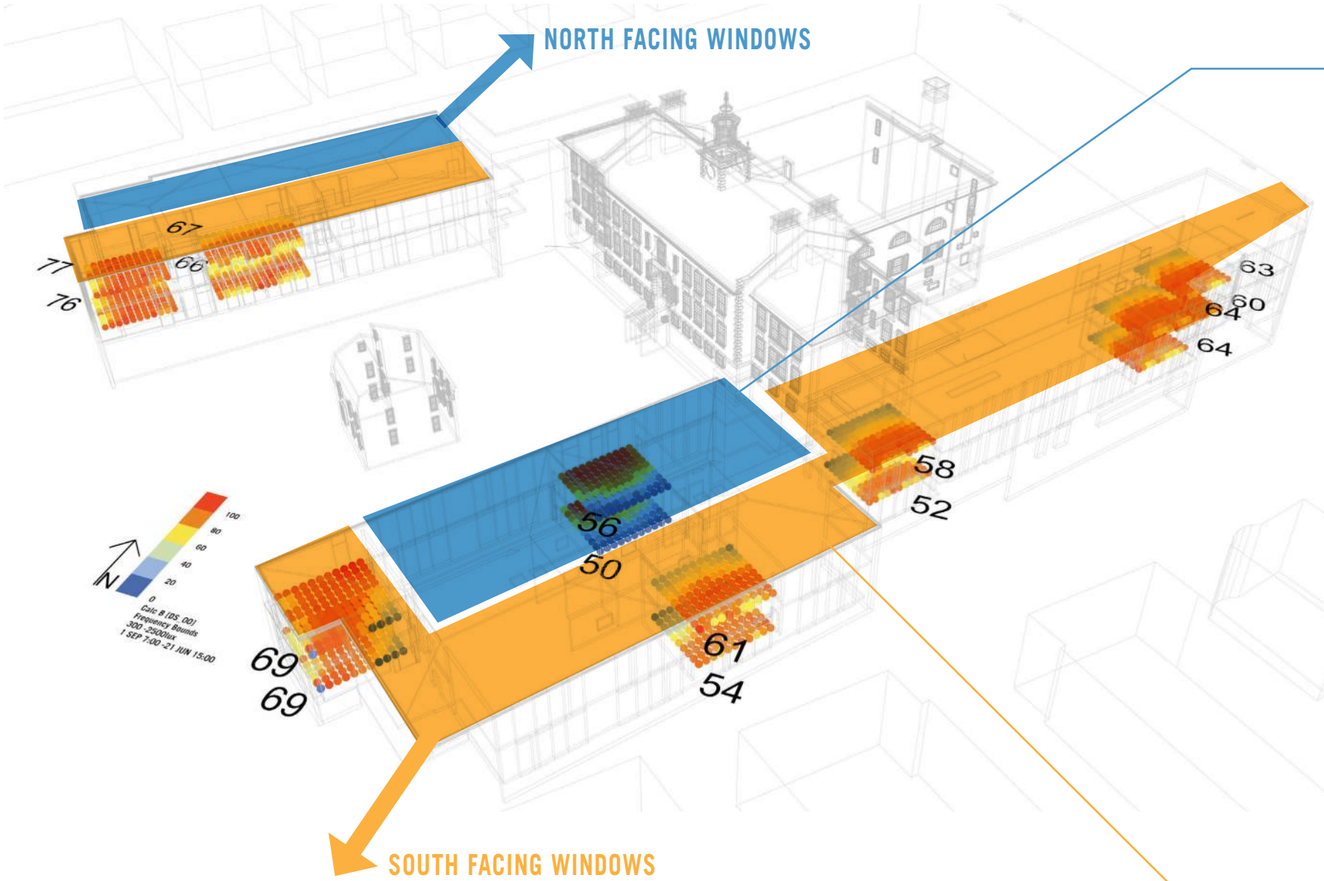


NORTH FACING ROOMS
Here, a light shelf here has little effect, possibly even negative, as it blocks views to the sky.

In rooms with -1, the lightshelf creates a (slight) net loss.

SOUTH FACING ROOMS
A light shelf has the effect of evening out the daylight in all spaces, to various degrees. Note how the difference between the lightshelf and no lightshelf is negligible on average, seen below. However, near the windows, over-lighting is reduced by 10-15%. Increasing the illuminance on the ceiling helps provide a sense of daylight, even if actual light levels in the back of the room don’t change considerably. Likely the lightshelf is adding a bit of useful light at some times of the year, but not enough to overcome the shading effect it has on the room.

LIGHTSHELF VS BASE CASE
Comparison between interior light shelf, and base case, no shading.

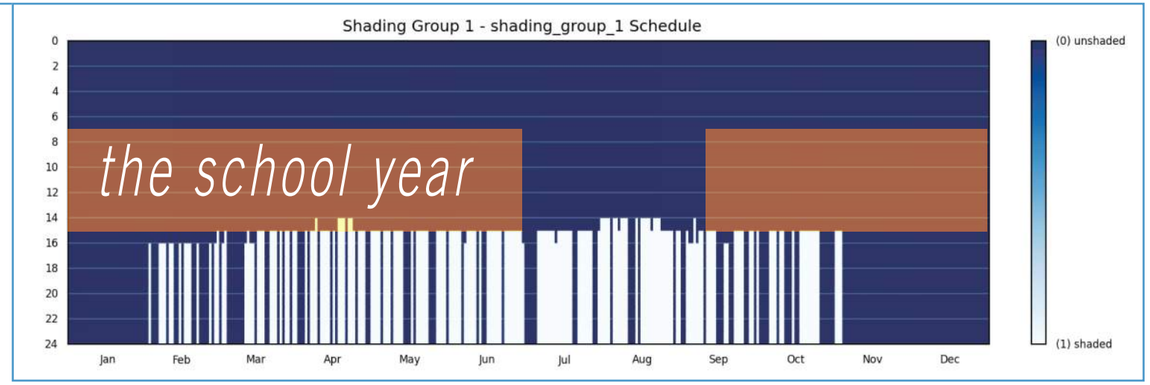


PROBLEM

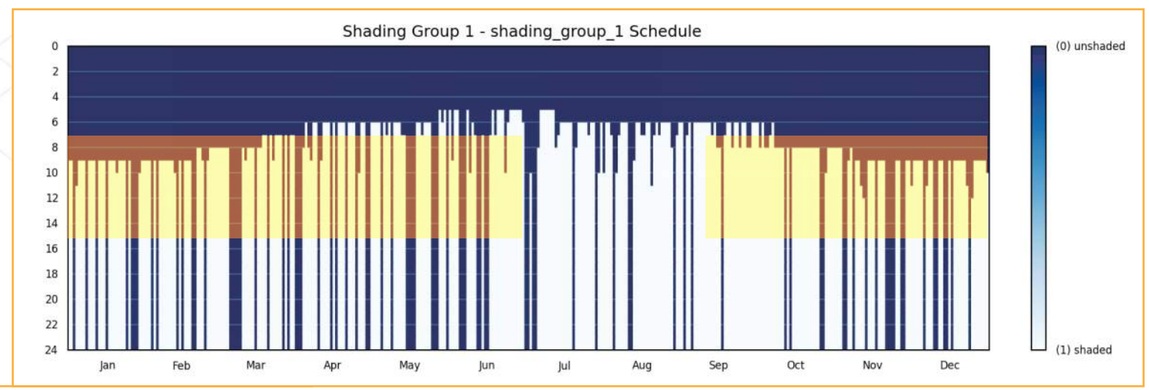
Comparing louvers to clear glass as shown in the previous pages is not realistic - the louvers are a replacement for interior adjustable shading, NOT OPEN CLEAR GLASS. In reality, shades will be drawn if the direct sun causes any glare or discomfort for students. Therefore, we must include shades in the base condition for comparison.

SOLUTION

We calculated a shading profile for a typical south facing, and typical north facing rooms. The results give us a % of the year in which shades would theoretically be drawn, represented by the white lines below. **WITH MANUAL OPERATION, THIS ANALYSIS PRESUMES THAT ONCE THE BLINDS ARE DRAWN, THEY STAY DOWN**. Days with no blinds drawn are overcast.

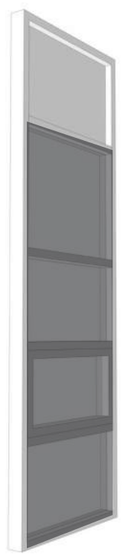


Northwest Windows Shading:
No shades required during school hours

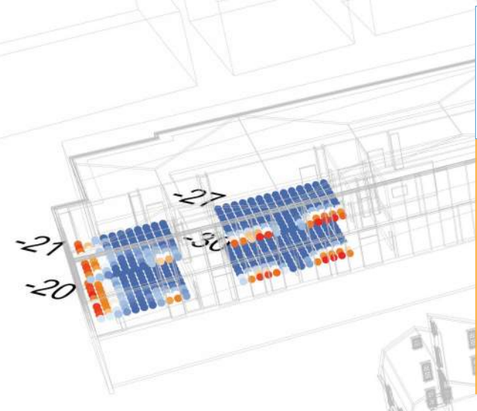


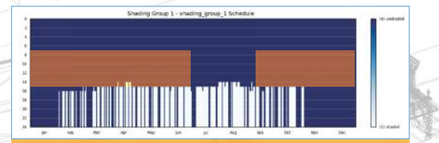
Southeast/west Shading:
~65% of the school year would require shades drawn, according to this profile.

61% VLT GLAZING WITH 5% VLT SHADE - IDEAL SHADE SCHEDULE
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500IUX)

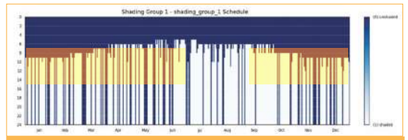


5% VLT Shade

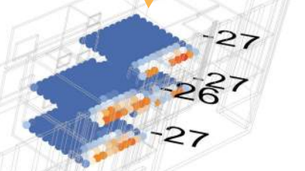


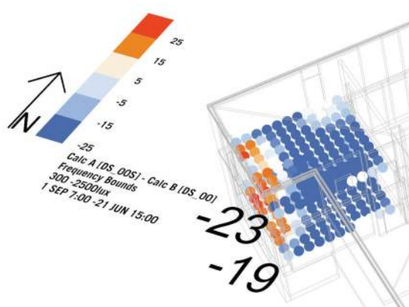


NORTH FACING ROOMS
Minimal shading is present on the north facing rooms, as the shading profile shows that blinds would rarely be required before 3pm. Therefore, little change is seen in those rooms compared to the fully-open simulation.



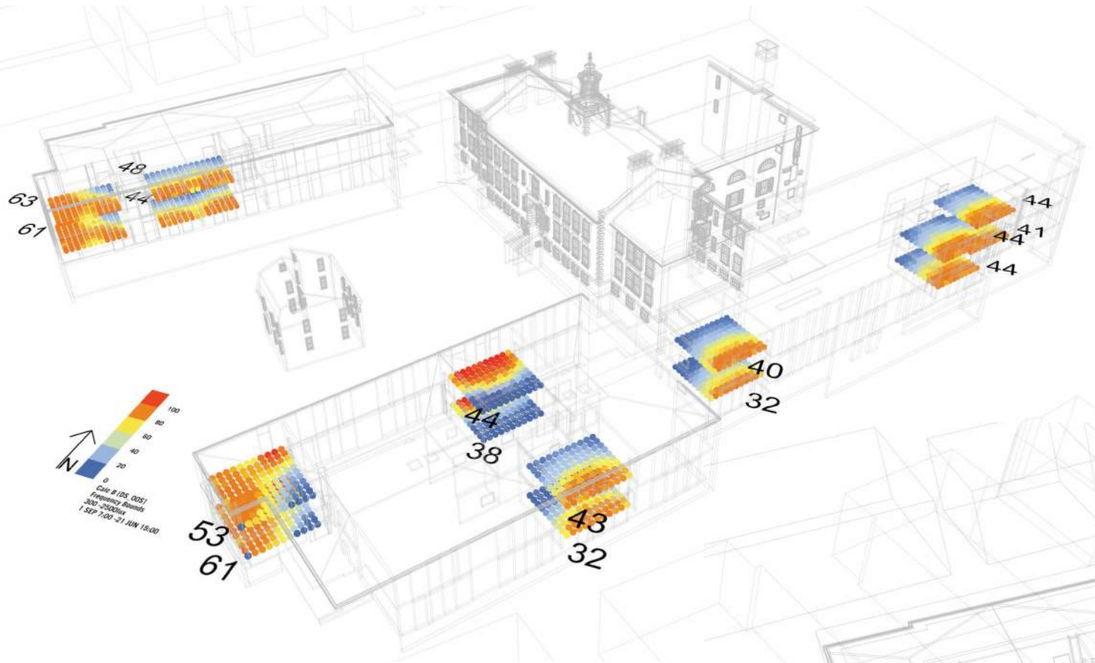
SOUTH FACING ROOMS
This calculation presumes that the shades are drawn on the South facing windows 65% of the time, allowing only 5% light through the shades when drawn. Obviously this creates a substantial reduction in overall illuminance levels throughout all spaces. Only the zones closest to the windows receive the benefit of reduced glare, shown as red dots.



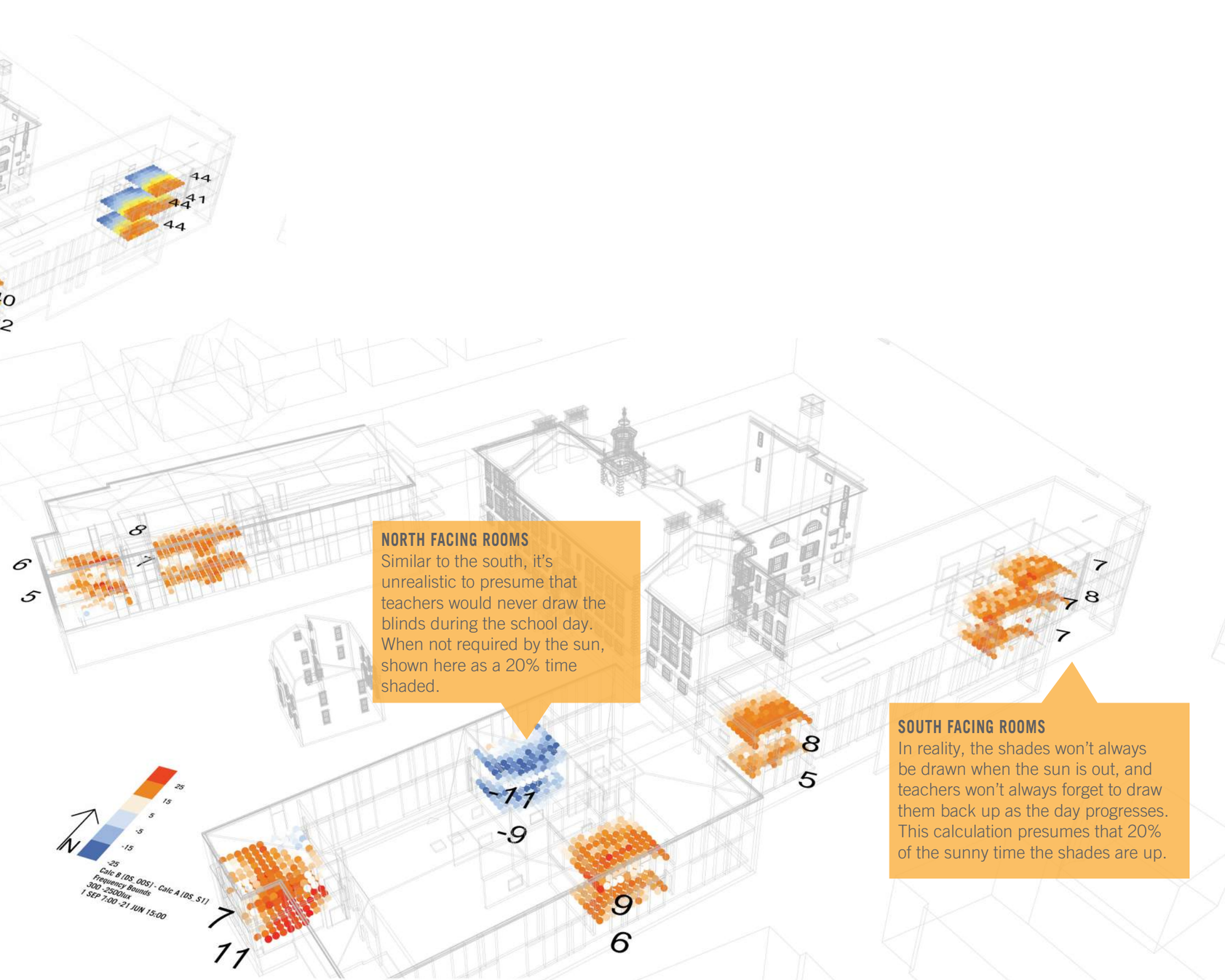


IDEAL SHADES VS BASE CASE
Comparison between shades drawn and no shades.

61% VLT GLAZING WITH 5% VLT SHADE - 'REALISTIC' SHADE SCHEDULE
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500lUX)



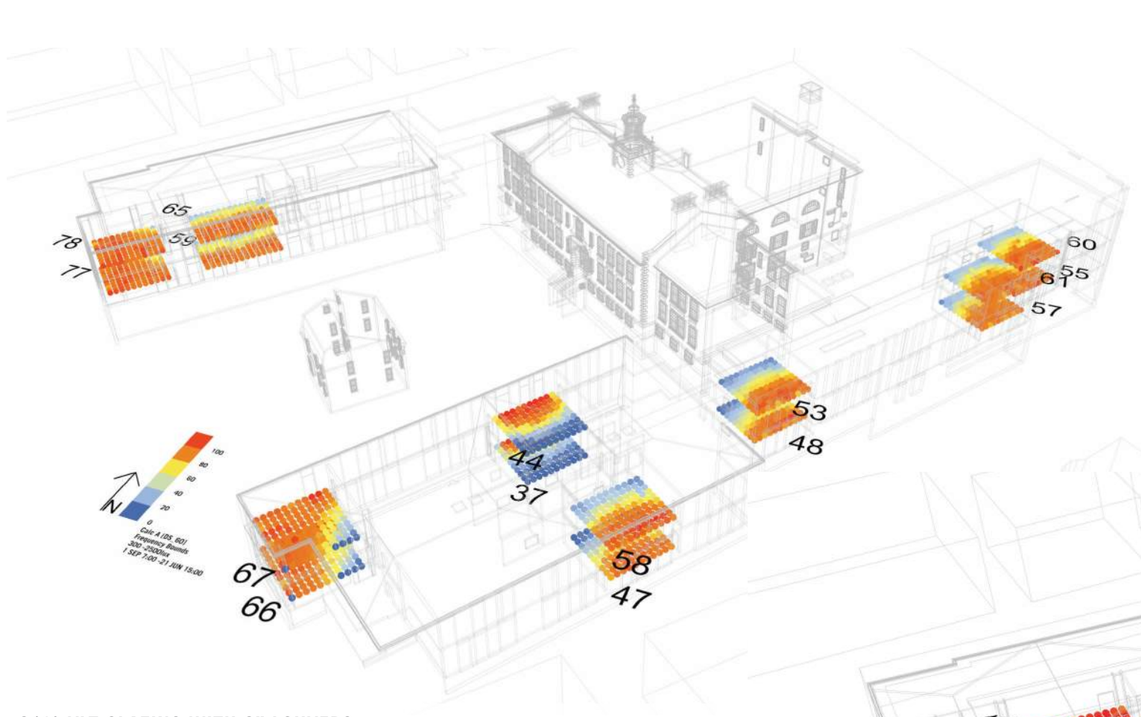
5% VLT Shade



NORTH FACING ROOMS
Similar to the south, it's unrealistic to presume that teachers would never draw the blinds during the school day. When not required by the sun, shown here as a 20% time shaded.

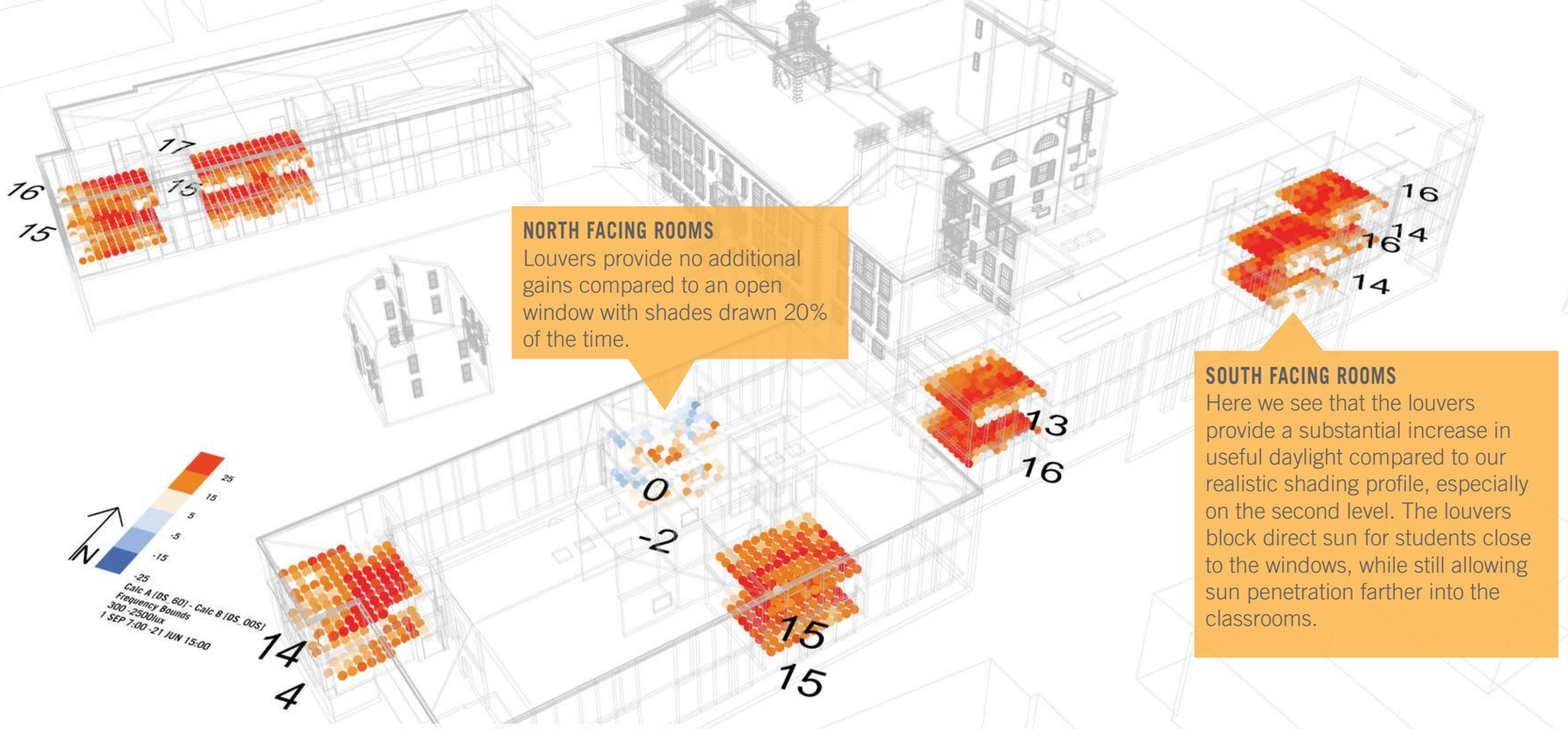
SOUTH FACING ROOMS
In reality, the shades won't always be drawn when the sun is out, and teachers won't always forget to draw them back up as the day progresses. This calculation presumes that 20% of the sunny time the shades are up.

IDEAL SHADES VS REALISTIC SHADES
Comparison between shades drawn 'in reality' to no shades. Red shows areas where the realistic scenario increases UDI.



61% VLT GLAZING WITH 6" LOUVERS
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500lUX)

Chrome
Reflectance: 57%
Specularity: 45%

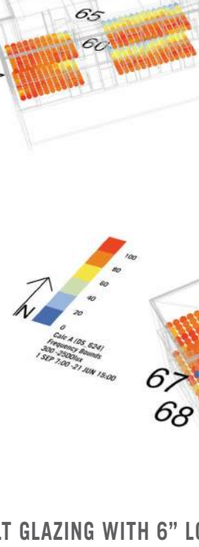


NORTH FACING ROOMS
Louvers provide no additional gains compared to an open window with shades drawn 20% of the time.

SOUTH FACING ROOMS
Here we see that the louvers provide a substantial increase in useful daylight compared to our realistic shading profile, especially on the second level. The louvers block direct sun for students close to the windows, while still allowing sun penetration farther into the classrooms.

6" LOUVERS VS REALISTIC SHADING
Comparison between shades drawn 'in reality' to the ideal provided by shading profile.

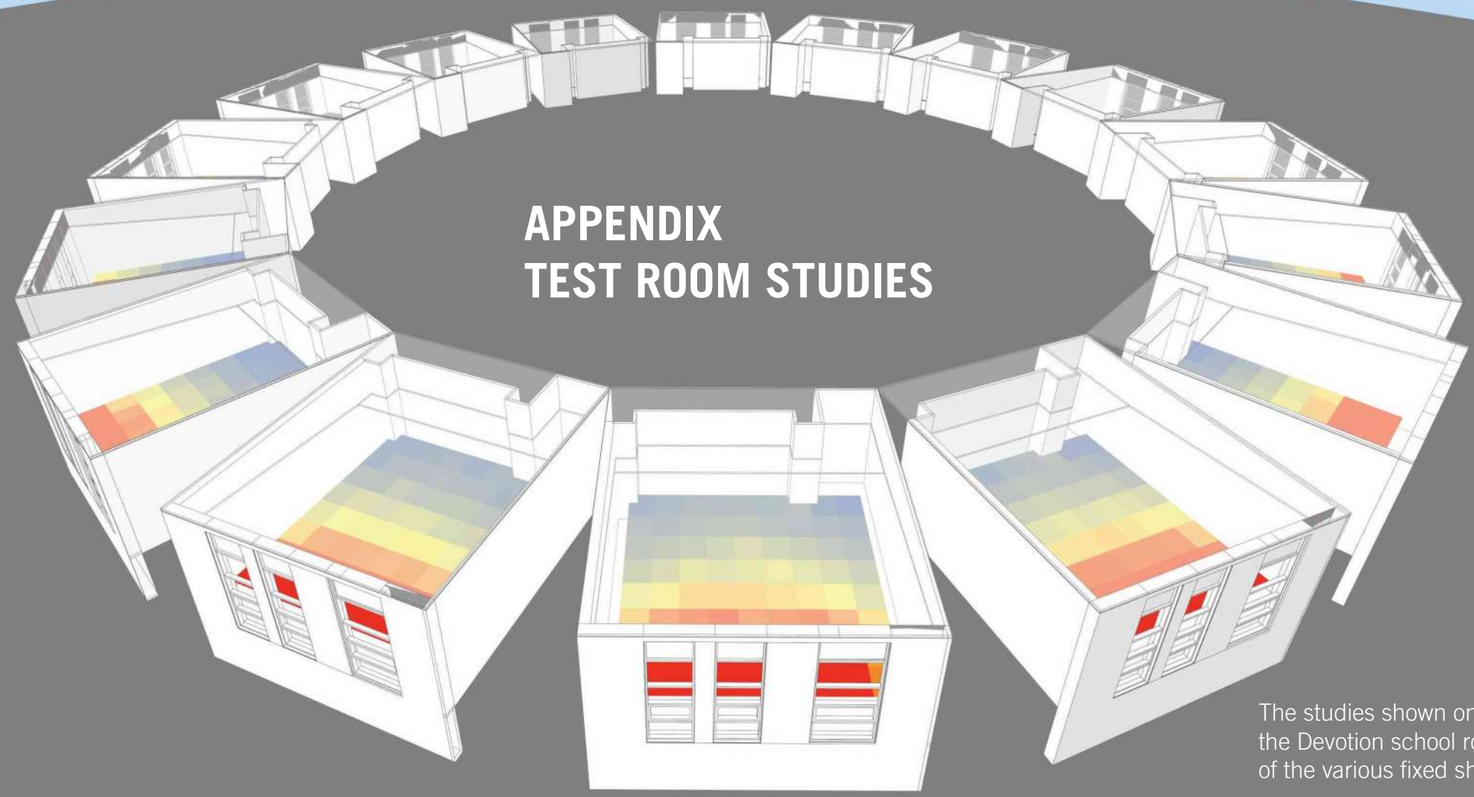
61% VLT GLAZING WITH 6” LOUVERS & 24” LIGHTSHELF
USEFUL DAYLIGHT ILLUMINANCE
(% TIME IN WHICH POINTS IN THE SPACE ARE BETWEEN 300-2500lUX)



NORTH FACING ROOMS
Neither louvers, nor lightshelf are useful on the north.

SOUTH FACING ROOMS
The introduction of both louvers and lightshelf provides the largest gains across the entire space - providing a substantial increase in useful daylight compared to our realistic shading profile.

LOUVERS + LIGHTSHELF VS REALISTIC SHADING
Comparison between shades drawn ‘in reality’ to the ideal provided by shading profile.

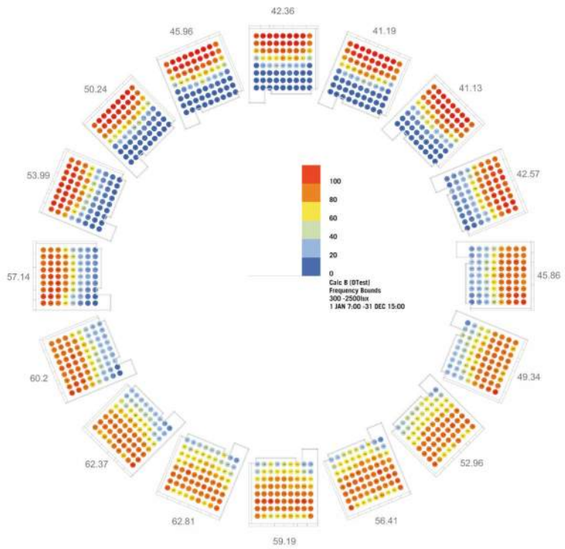


APPENDIX
TEST ROOM STUDIES

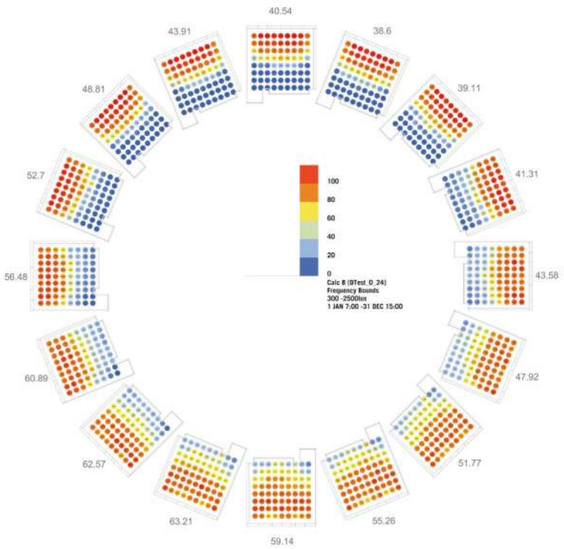
The studies shown on the next pages investigate a typical room of the Devotion school rotated through 360 degrees to see the effects of the various fixed shading strategies.

UDI [300-2500LUX]

BASE

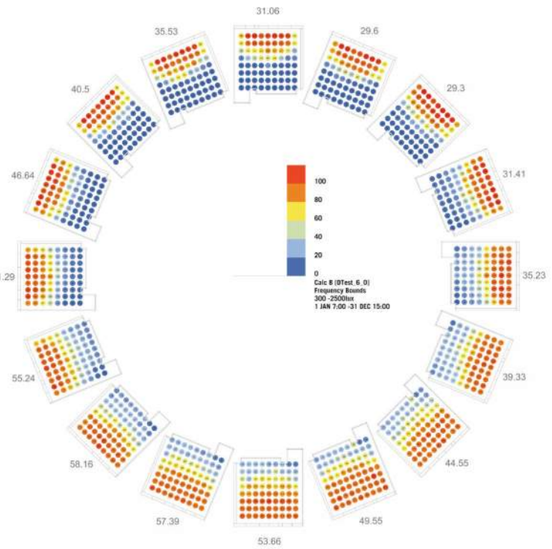


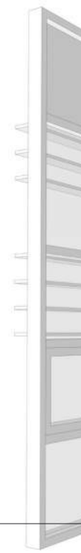
0.24
24” LIGHTSHELF



Polished Aluminum
92% Reflectance
92% Specularity

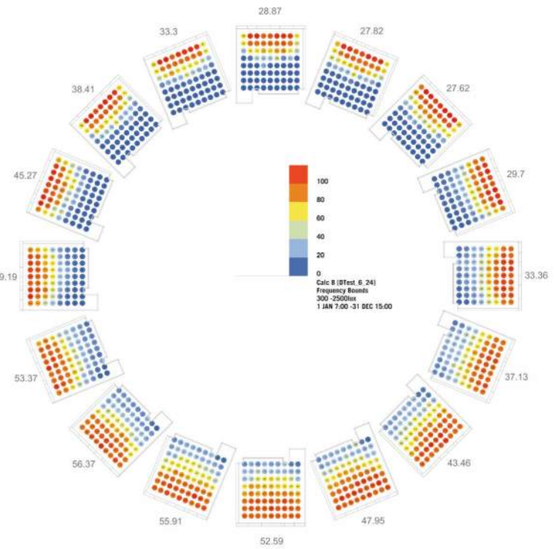
6.0
6”D X 8”T
LOUVERS

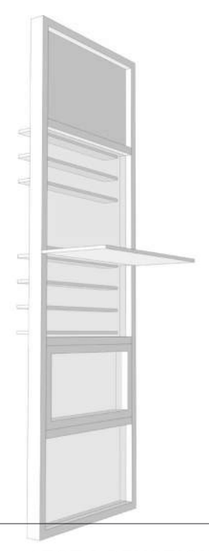




Chrome
Reflectance: 57%
Specularity: 45%

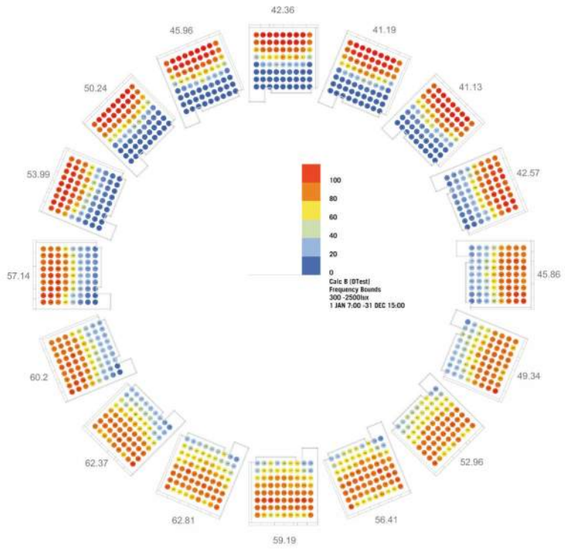
6.24
LOUVERS +
LIGHTSHELF



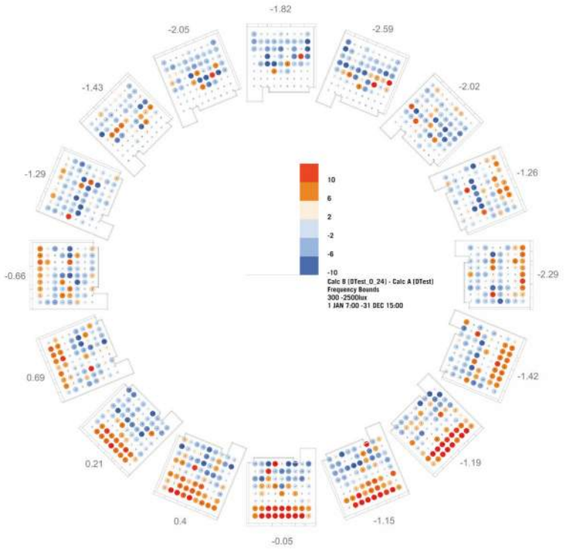


COMPARATIVE UDI [300-2500LUX]

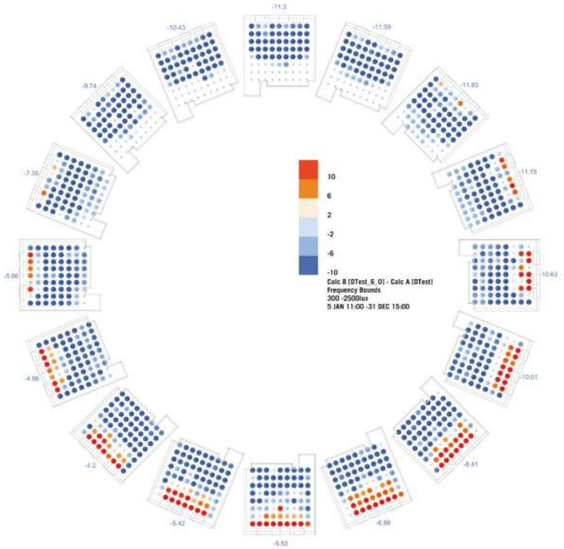
BASE

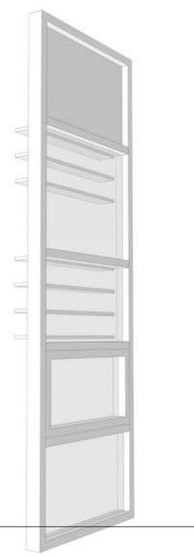


0.24
24” LIGHTSHELF

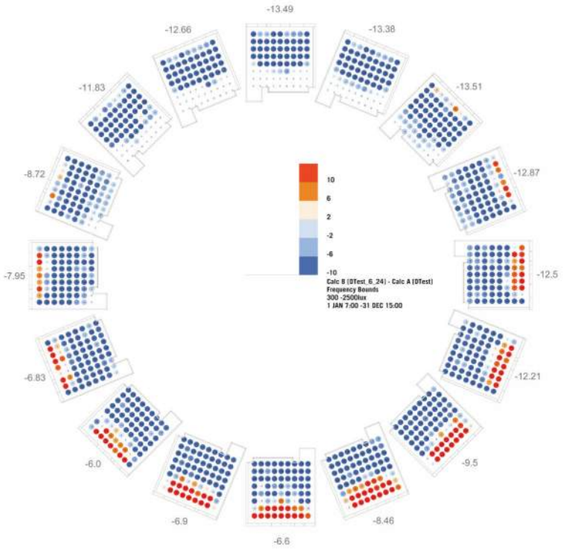


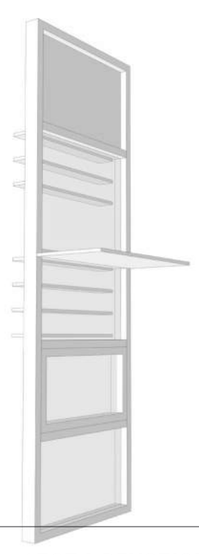
6.0
6”D X 8”T
LOUVERS





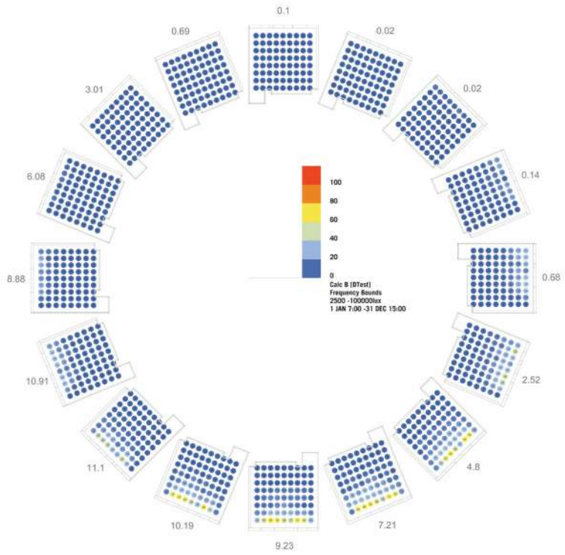
6.24
LOUVERS +
LIGHTSHELF



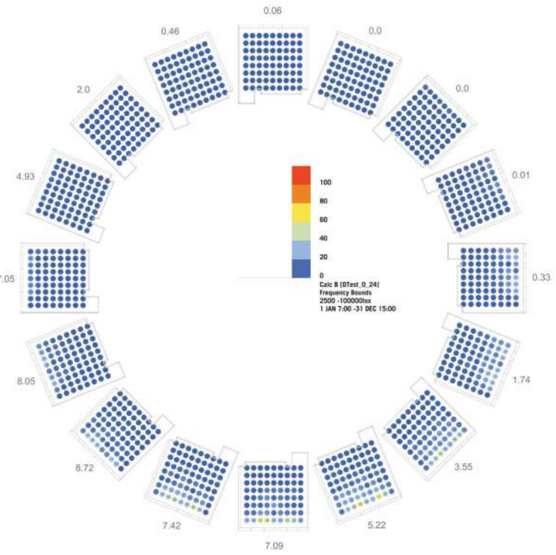


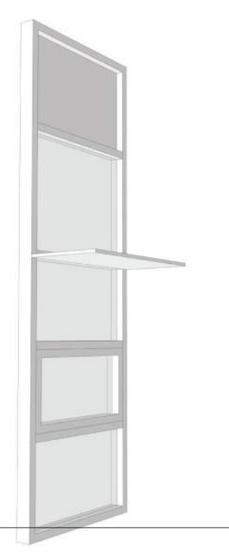
% TIME ABOVE 2500LUX

BASE

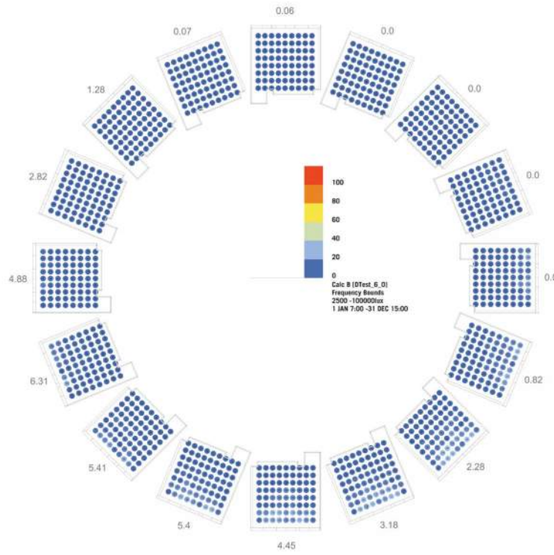


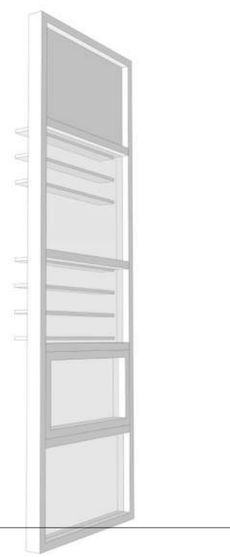
0.24
24” LIGHTSHELF



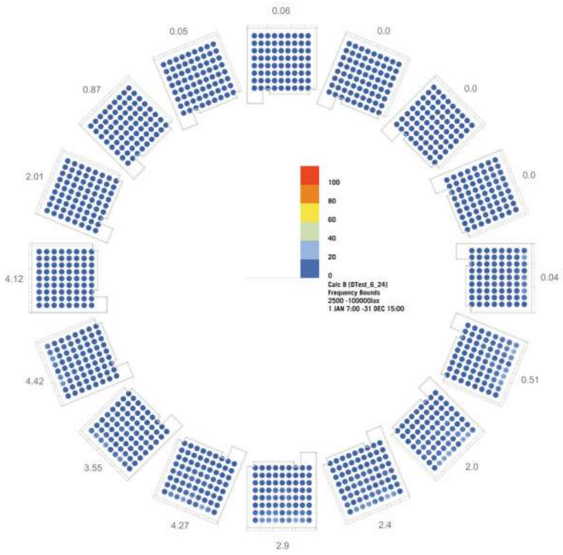


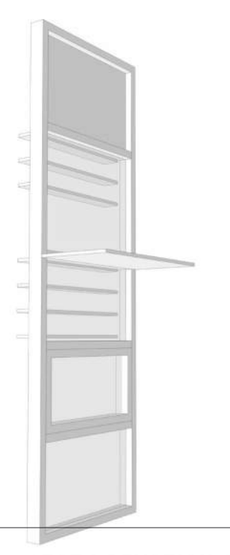
6.0
6”D X 8”T
LOUVERS





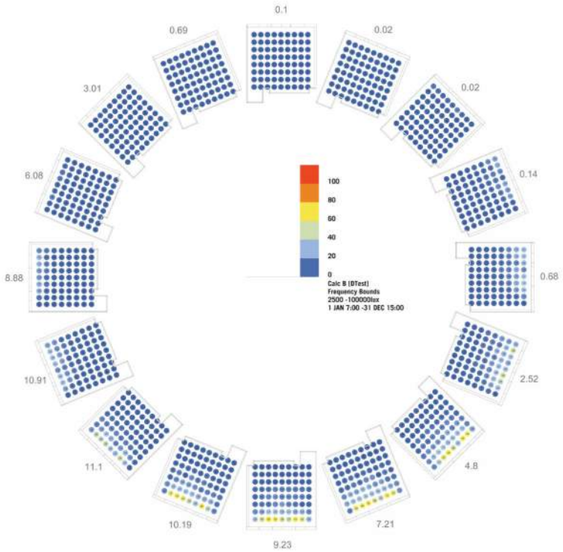
6.24
LOUVERS +
LIGHTSHELF



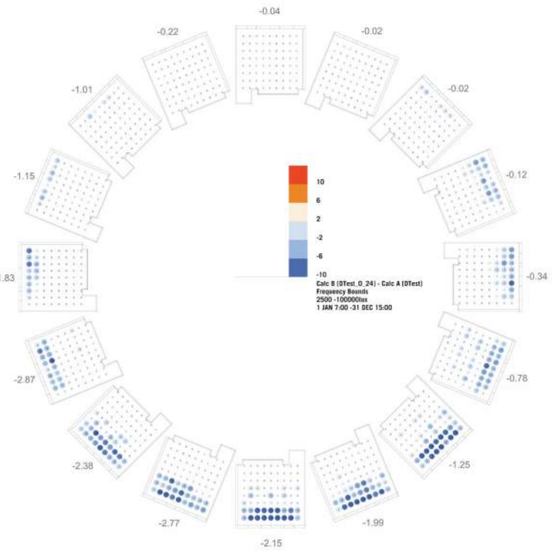


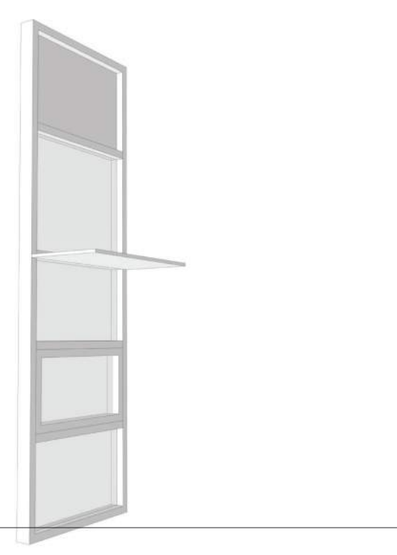
COMPARATIVE % TIME ABOVE 2500LUX

BASE

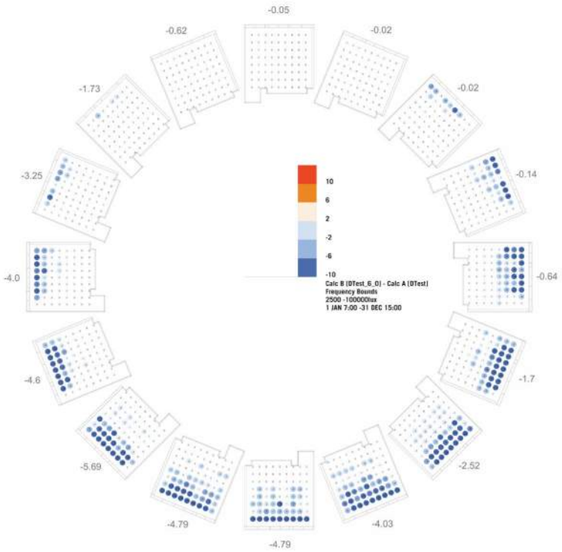


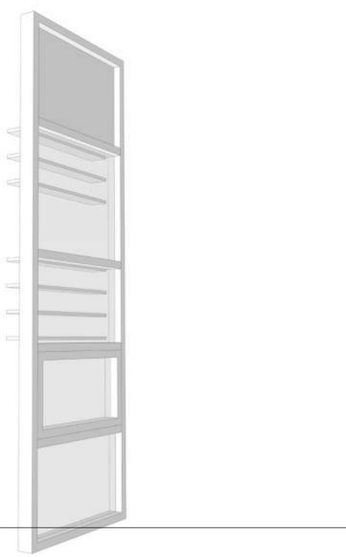
0.24
24” LIGHTSHELF





6.0
6”D X 8”T
LOUVERS





6.24
LOUVERS +
LIGHTSHELF