

the drexel  
university recreation  
center  
philadelphia, pa



final thesis presentation | lighting|electrical | britnei godusky | 04.13.11 | dr. houser and prof. dannerth

# presentation outline

## drexel recreation center

outdoor plaza

gymnasium

fitness center

lobby

restaurant

[overview + design concept]

[exterior space]

[daylighting + acoustics]

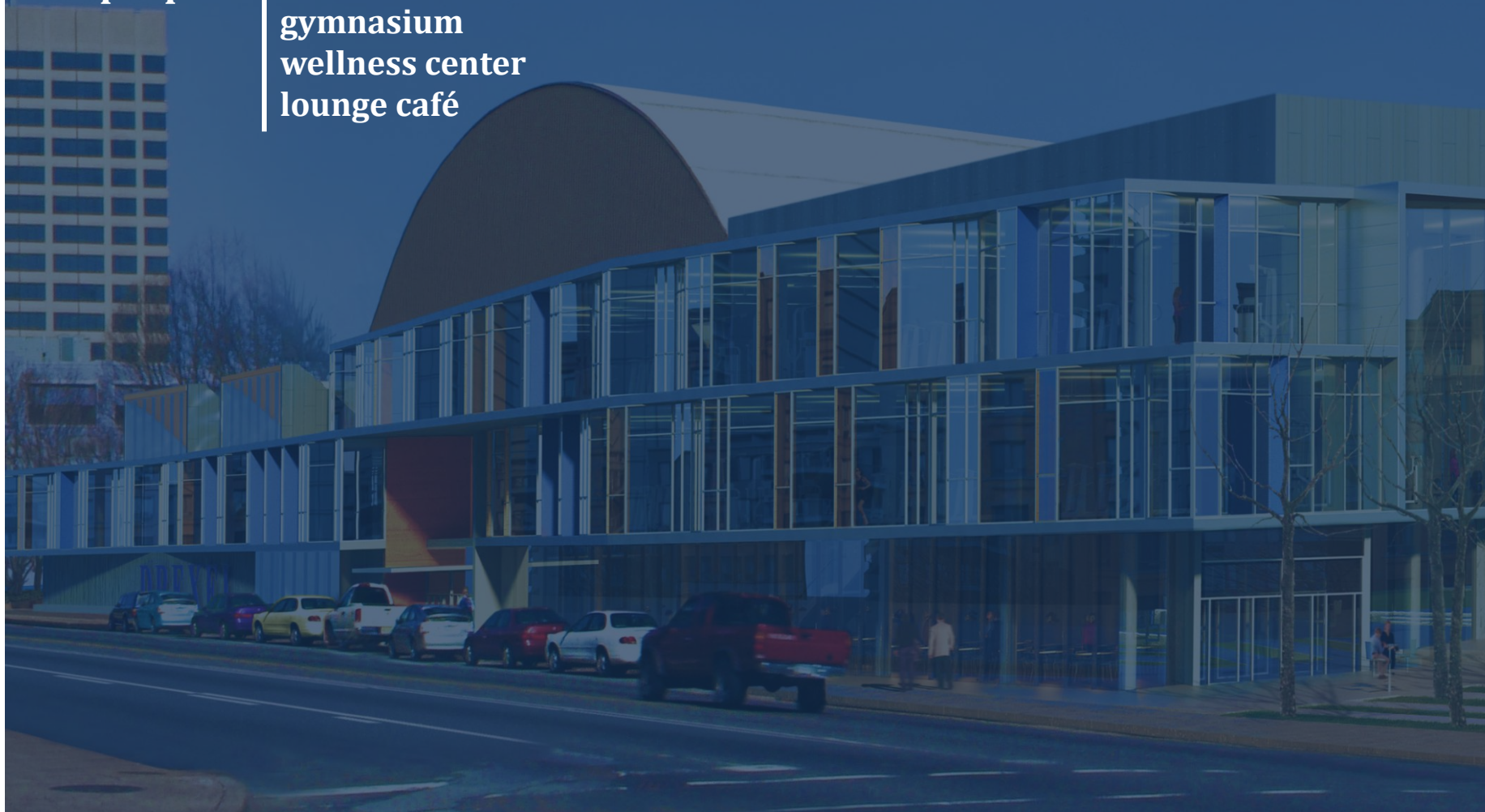
[large workspace + electrical depth]

[circulation space]

[special purpose space]

summary | acknowledgements | questions

size	84,000sf
levels	three above grade
construction	june 2008 – december 2009
cost	41 million
purpose	recreation facility gymnasium wellness center lounge café



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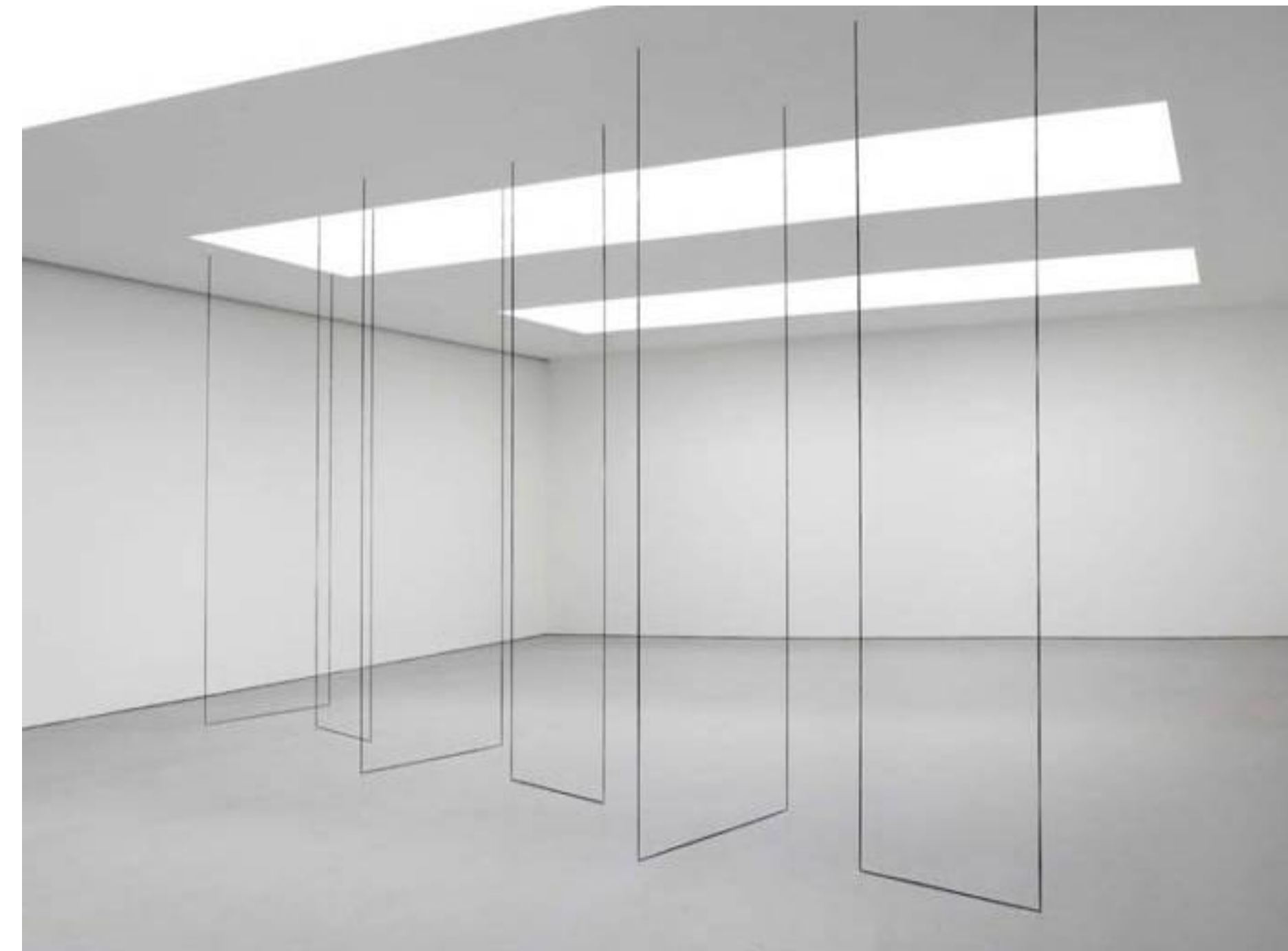
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**minimalist architectural design**

**exposed structural concrete**

**straight lines, strong angles**



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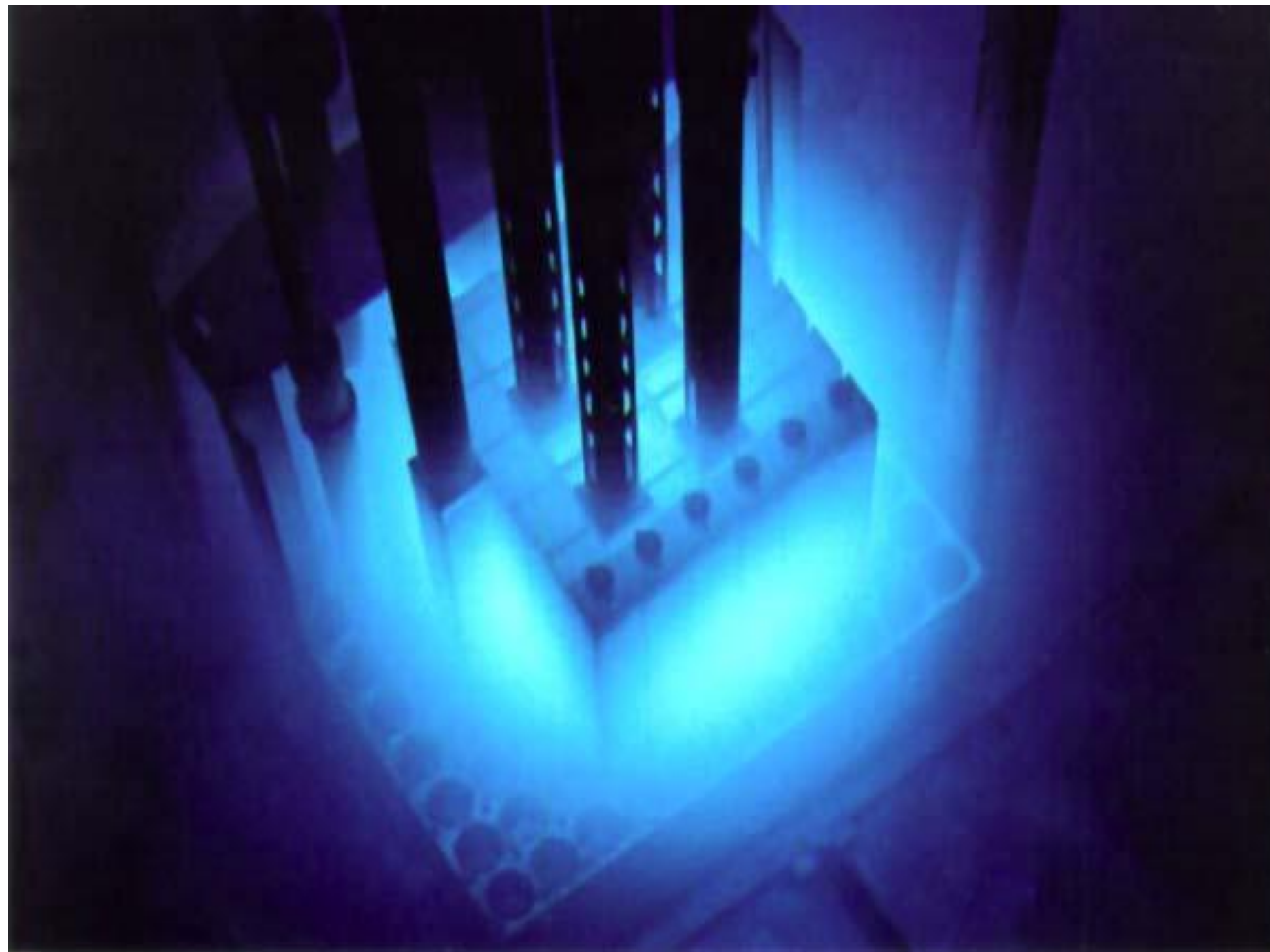
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**core energy** inside and out

**creation and consumption**

**fueled from within**

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{ large work space }



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{ circulation space }



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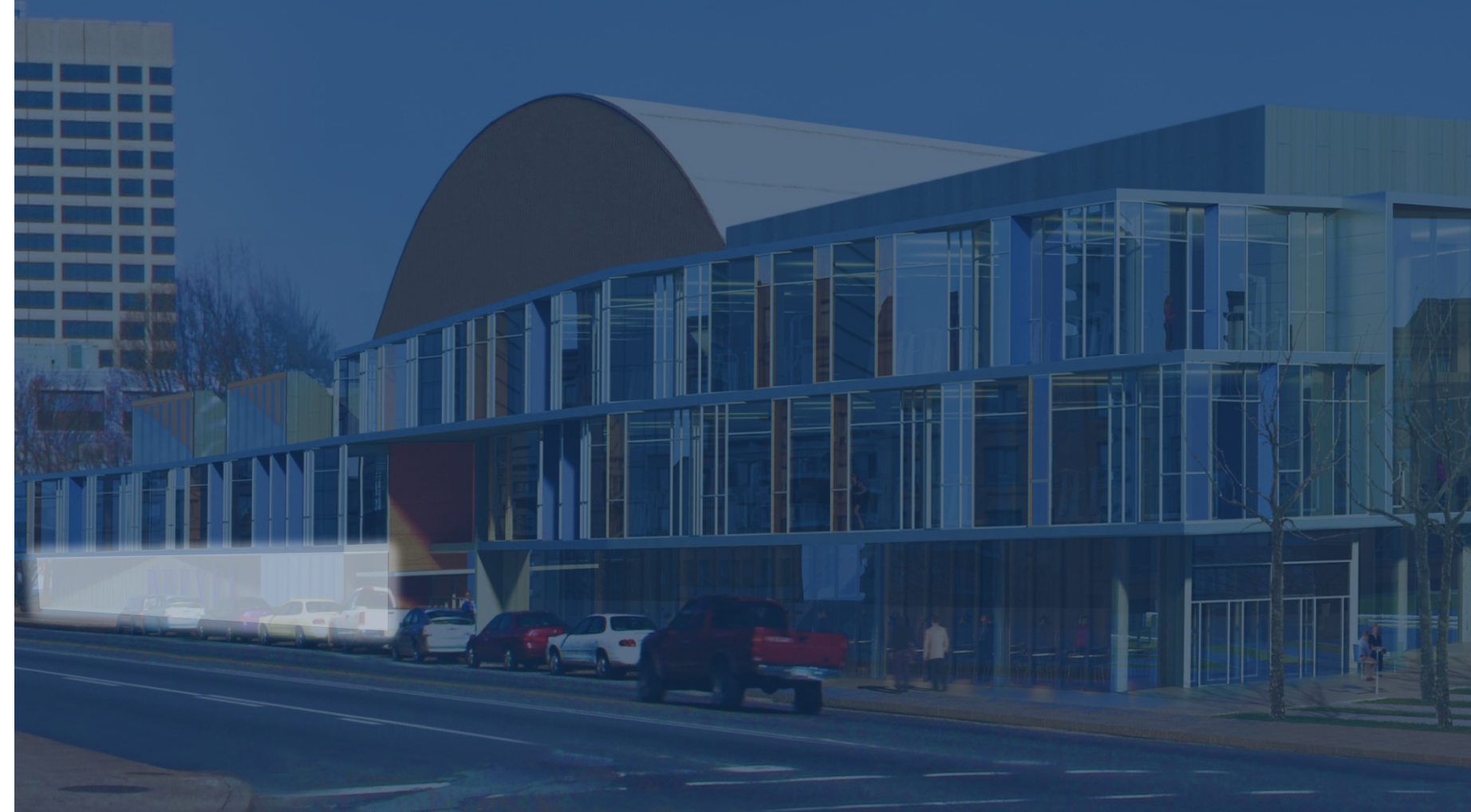
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{ special purpose }  
space





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# design goals

**visibly engaging, welcoming**

**balance public day with private night**

**guide pedestrians with light**

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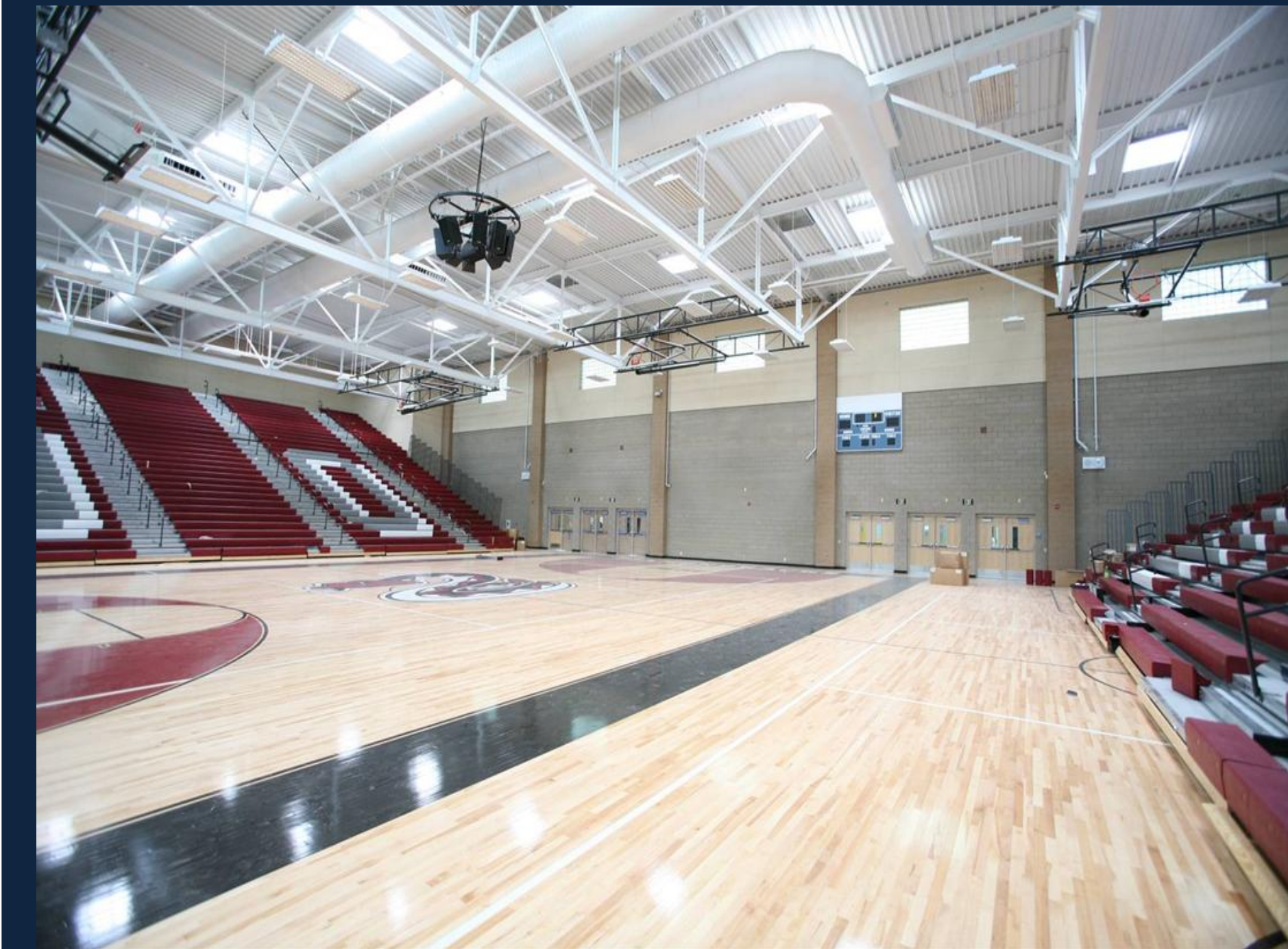
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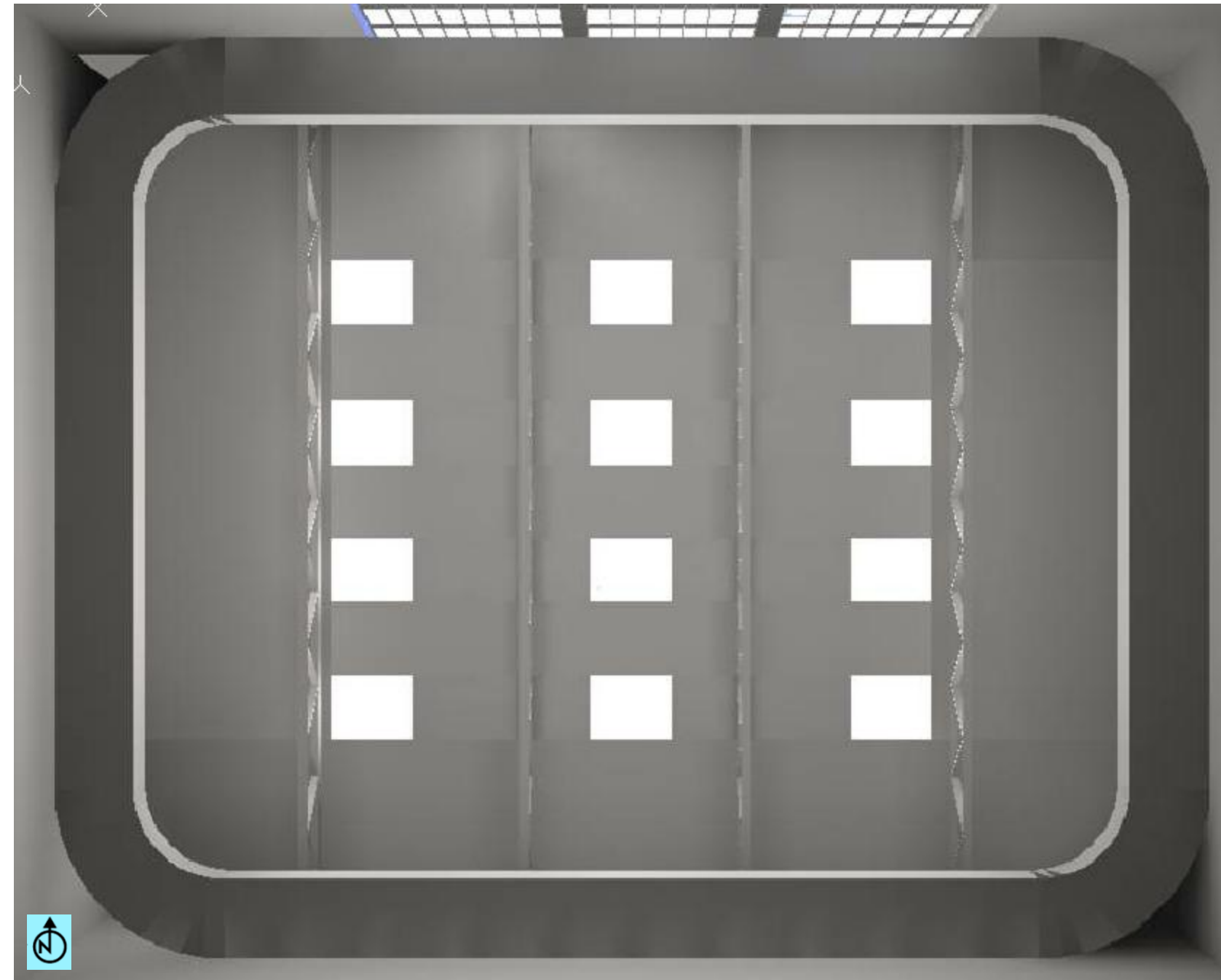
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number	12
dimensions	8'x10'x6"
SSR	6.8% dictated by SkyCalc®
t	.34
U-value	.27
SHGC	.20

## skylight design overview

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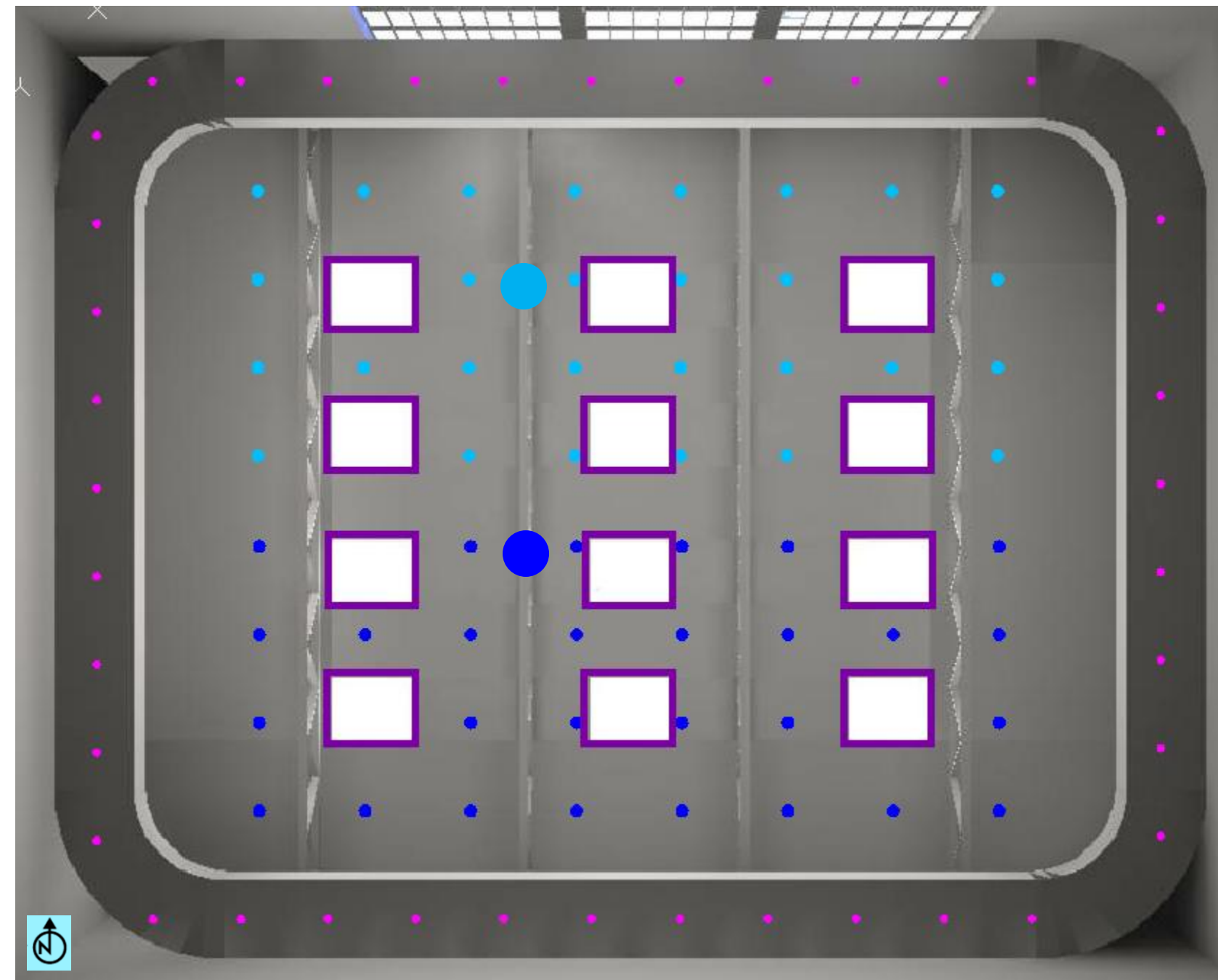
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skylights

zone 1 - interior zone

zone 2 - exterior zone

zone 3 - always on

zone 1 - photosensor

zone 2 - photosensor

## zoning and photosensor control

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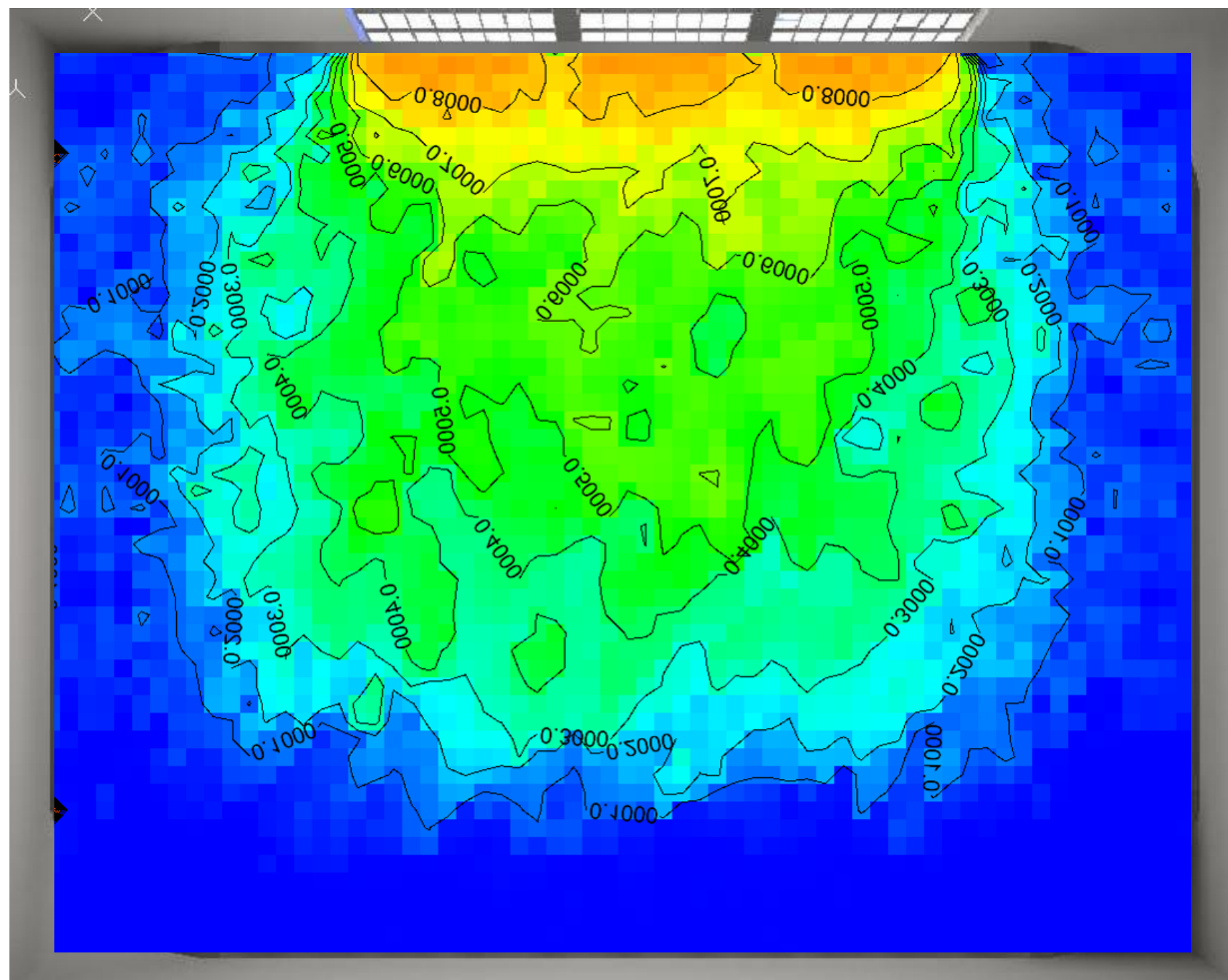
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**daylight autonomy**



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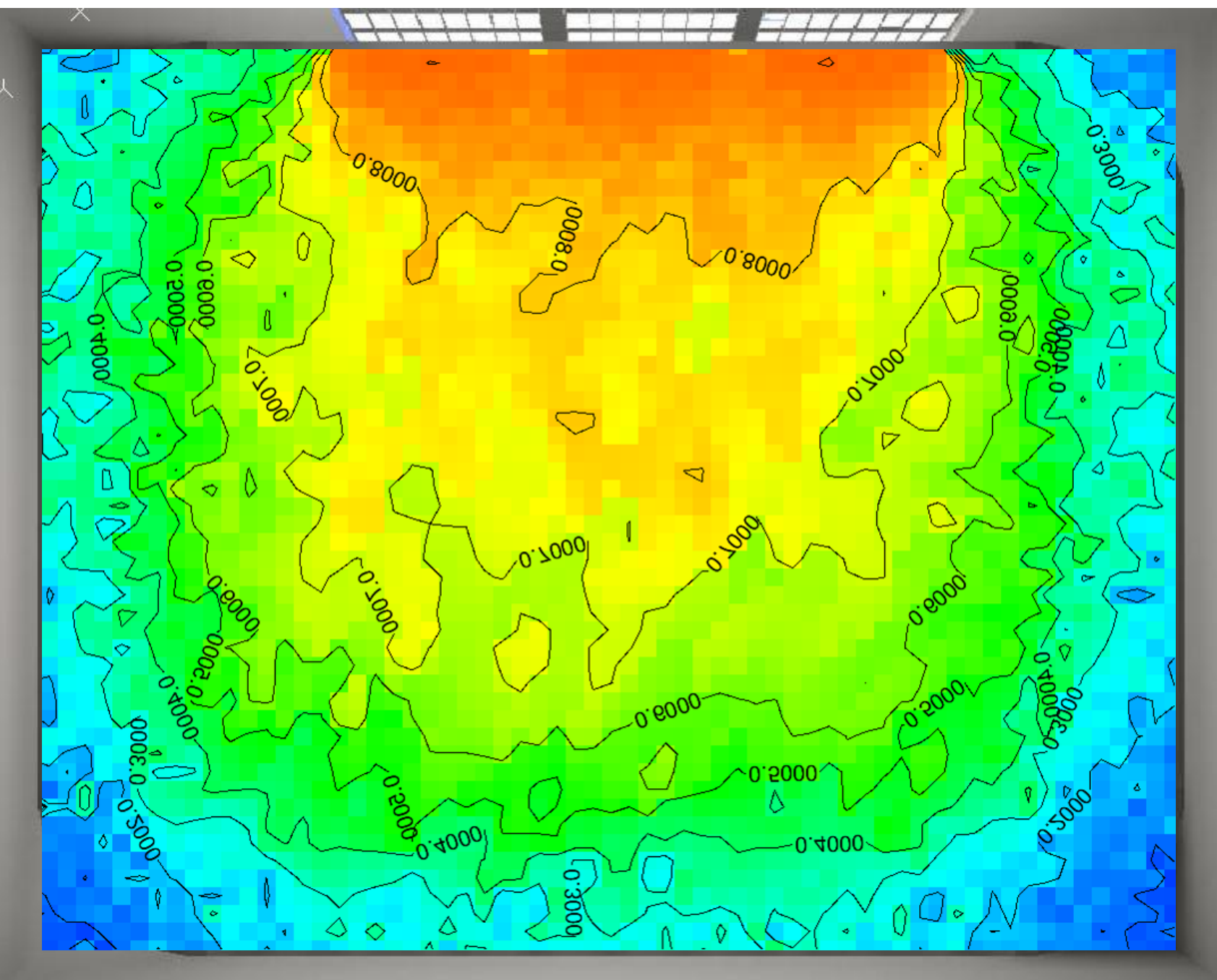
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**continuous daylight autonomy**

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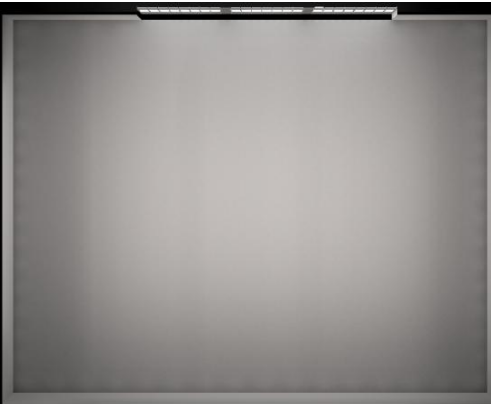
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**spring | fall  
equinox**



**summer  
solstice**



**winter  
solstice**



8am

12pm

4pm



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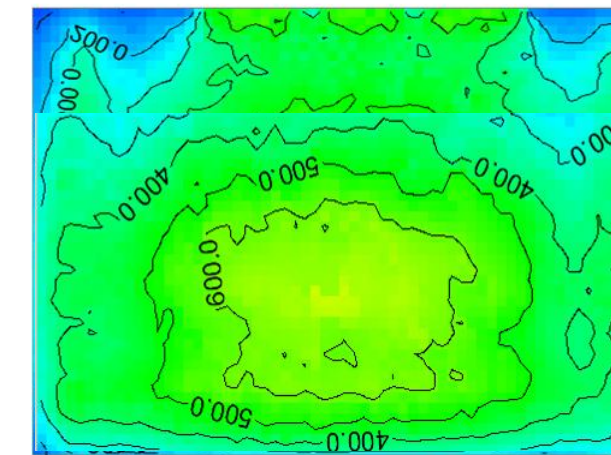
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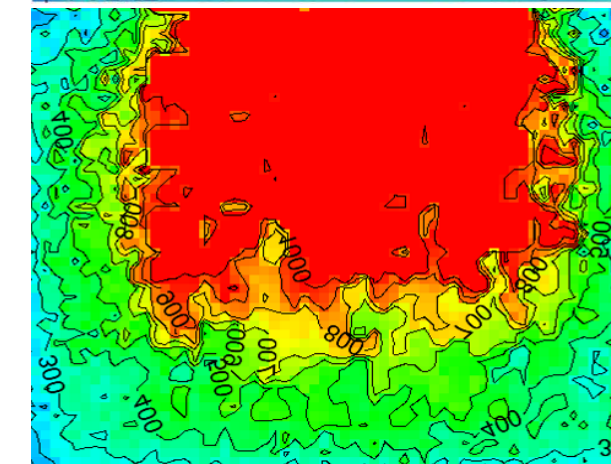
summary | acknowledgements | questions

8am



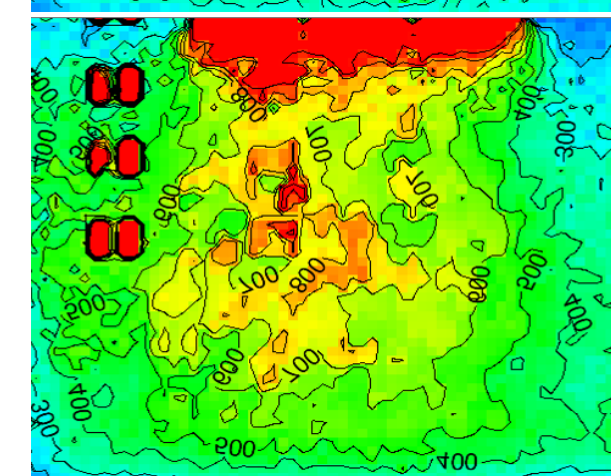
*exterior zone dimmed to .341*  
*interior zone dimmed to .787*

12pm



*exterior zone off*  
*interior zone dimmed to .051*

4pm



*exterior zone off*  
*interior zone dimmed to .385*

**dimming results – spring | fall equinox**

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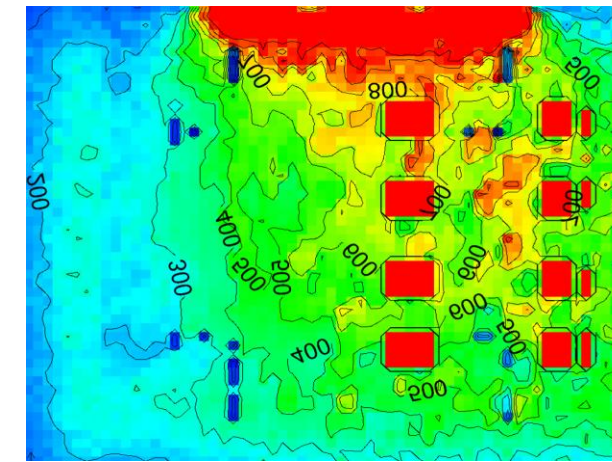
[circulation space]

restaurant

[special purpose space]

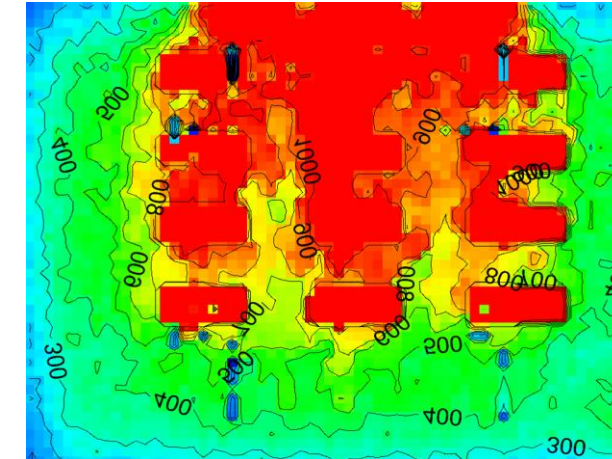
summary | acknowledgements | questions

8am



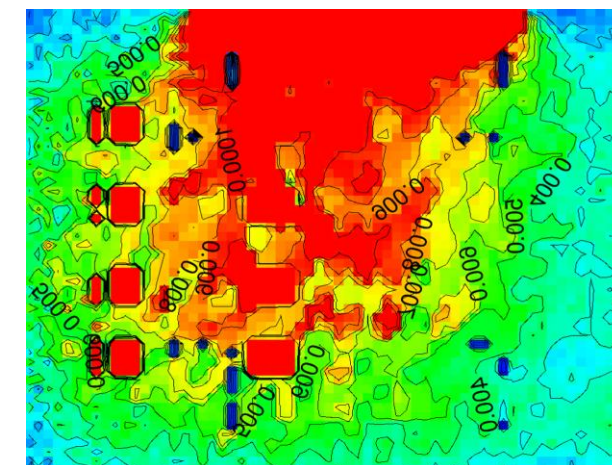
*exterior zone off*  
*interior zone off*

12pm



*exterior zone off*  
*interior zone off*

4pm



*exterior zone off*  
*interior zone off*

**dimming results – summer solstice**

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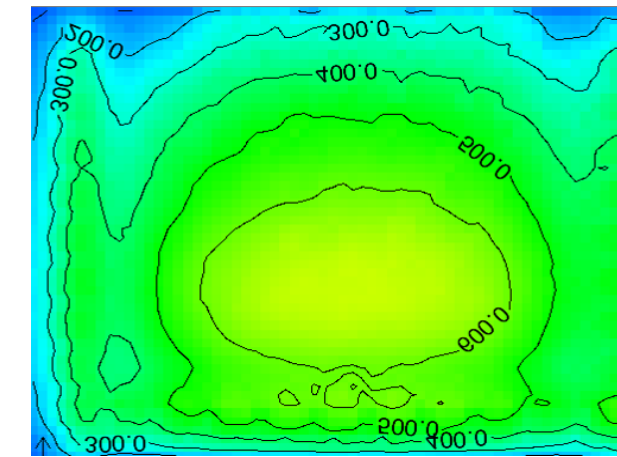
[circulation space]

restaurant

[special purpose space]

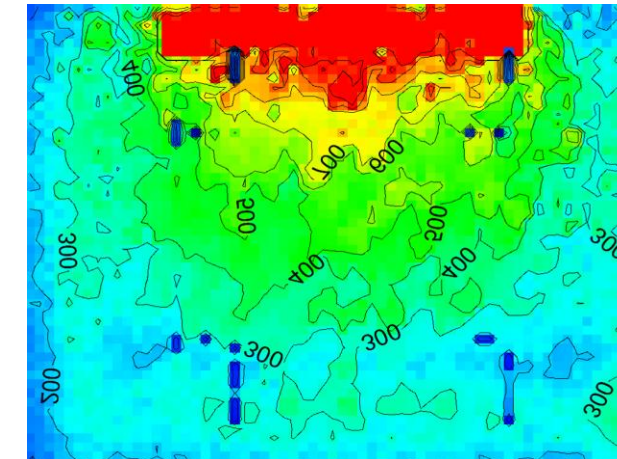
summary | acknowledgements | questions

8am



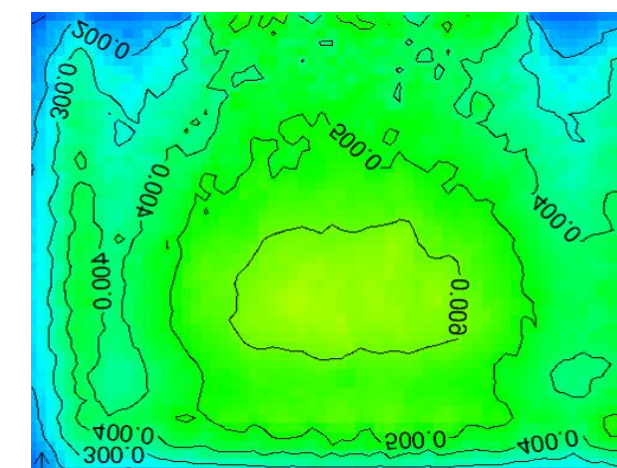
*exterior zone dimmed to .468*  
*interior zone dimmed to .754*

12pm



*exterior zone off*  
*interior zone off*

4pm



*exterior zone dimmed to .321*  
*interior zone dimmed to .636*

## dimming results – winter solstice

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hours of savings:	59,946
total hours of operation:	73,405.44
percentage savings	82%

# energy savings

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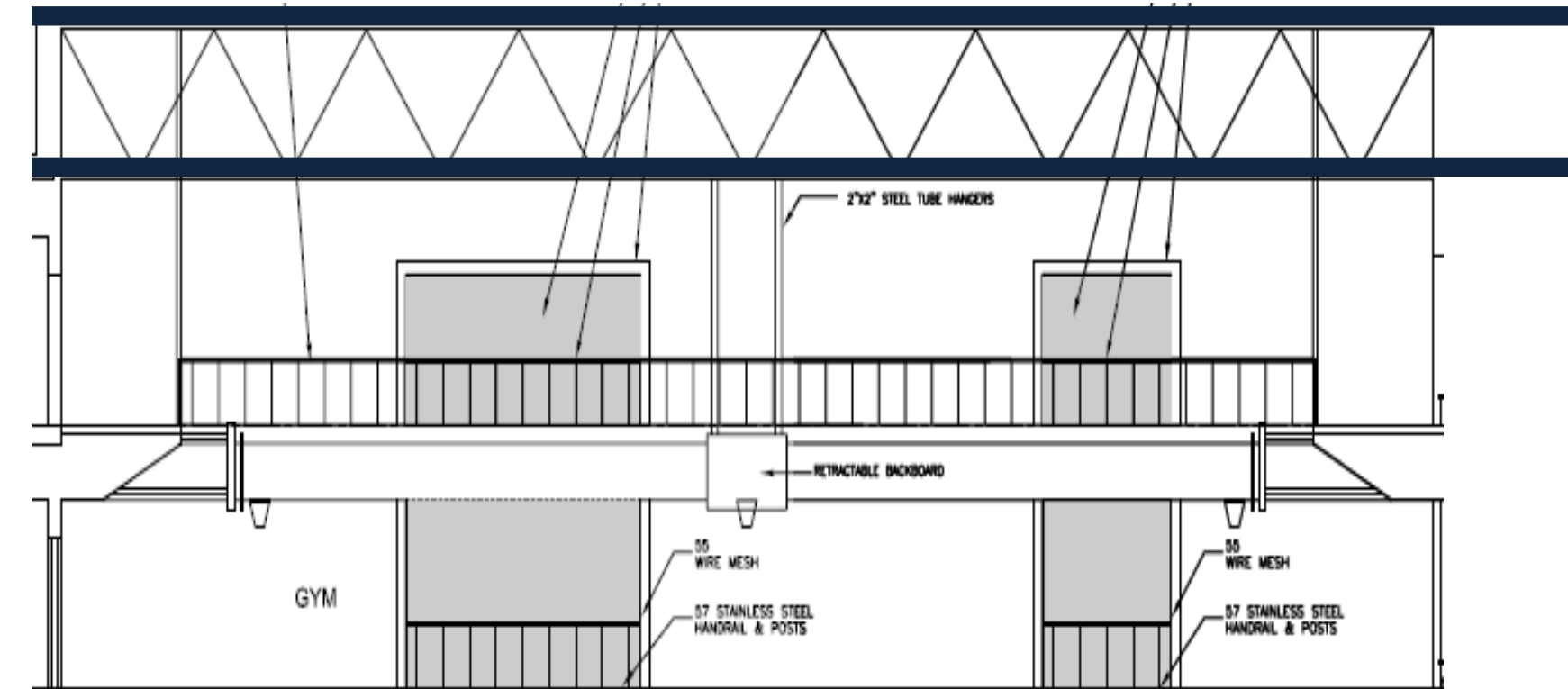
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redesigned ceiling height – 35'

existing ceiling height – 27'

## materials considered

high performance painted gypsum wall board

12mm rubber track surface

bio channel wood flooring system

exposed structural steel painted white

viracon insulated laminated glazing

insulated skylights

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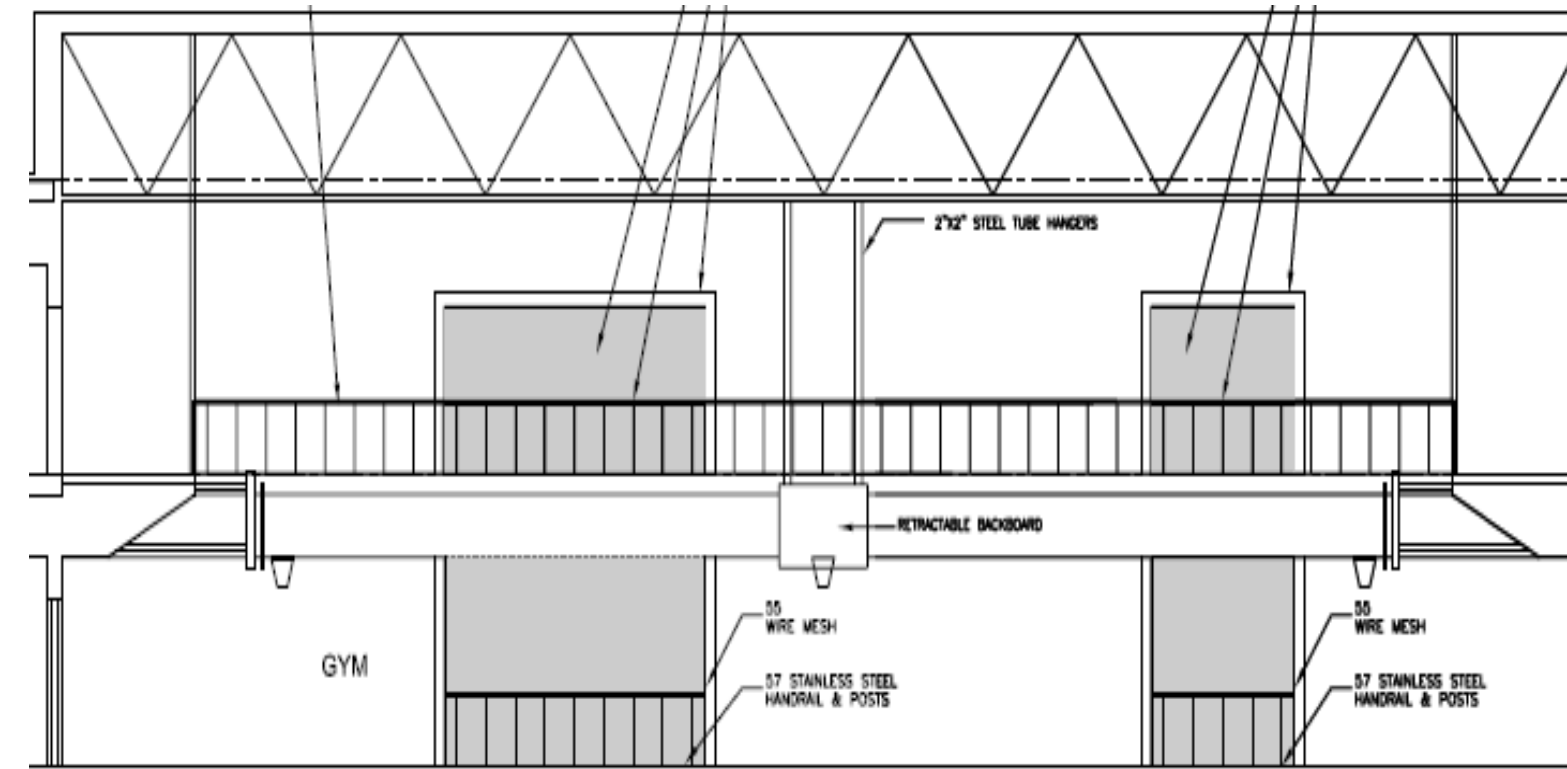
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**target mid-frequency reverberation time: 2 seconds**  
**due to additional activities: 1.8 seconds**



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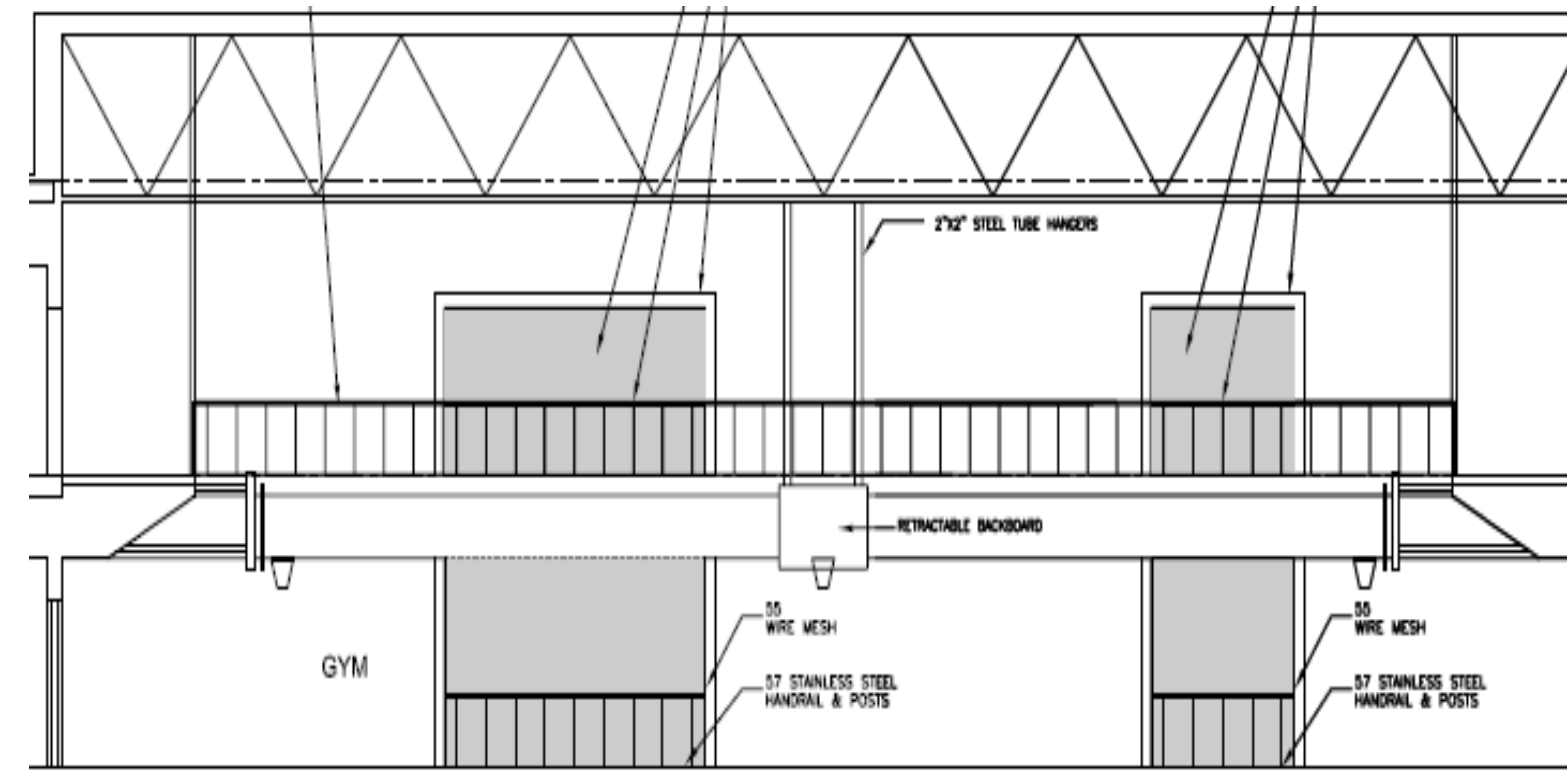
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$$T = 0.05 * \frac{v}{\alpha}$$

Frequency (Hz)	125	250	500	1,000	2,000	4,000
Reverberation Time (s)	1.90	1.99	1.62	1.83	1.32	1.36

**mid-frequency reverberation time: 1.73**

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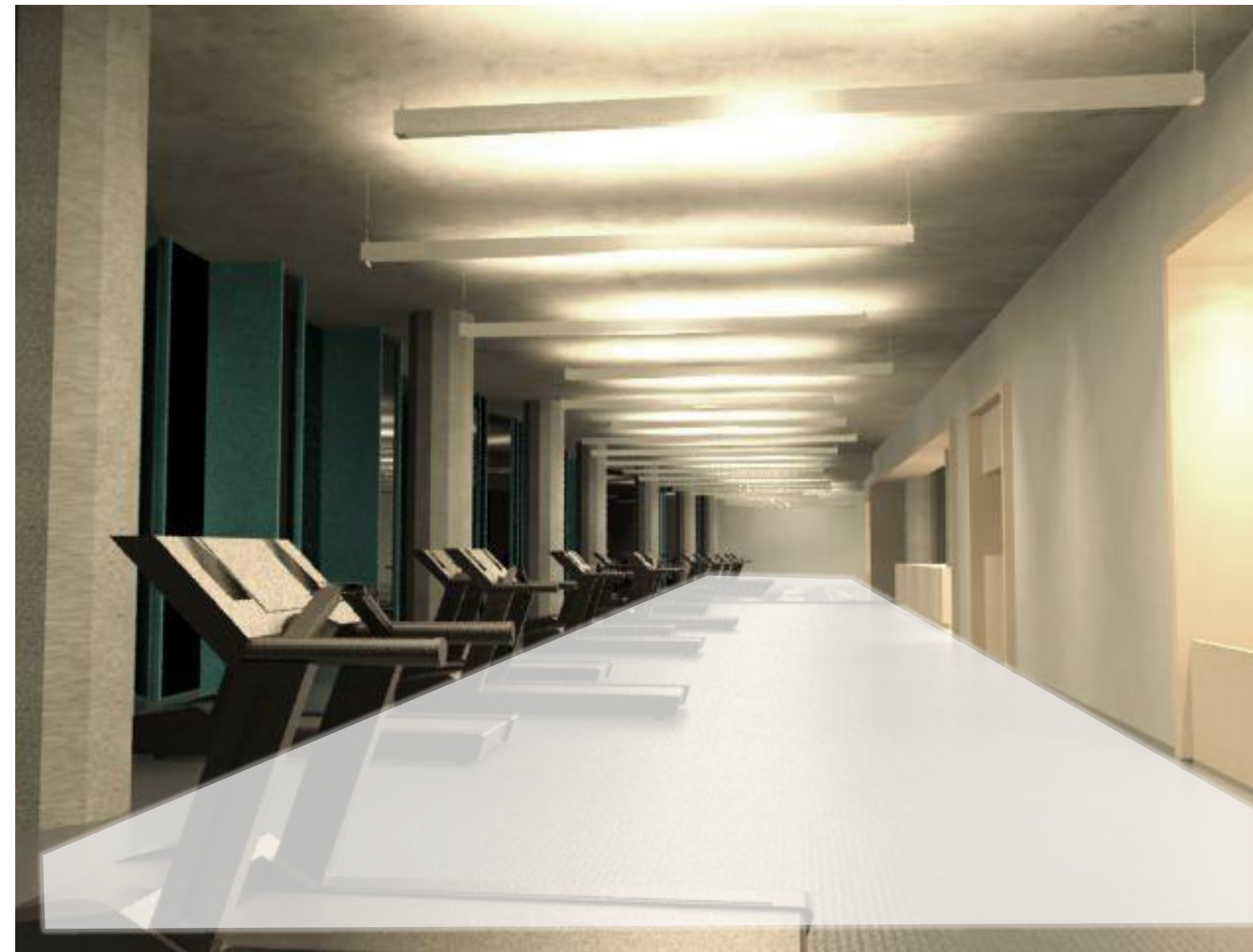
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# design goals

**high illuminance on ceiling and floor**

**energizing, uplifting**

**bright openness reinforces safety + cleanliness**

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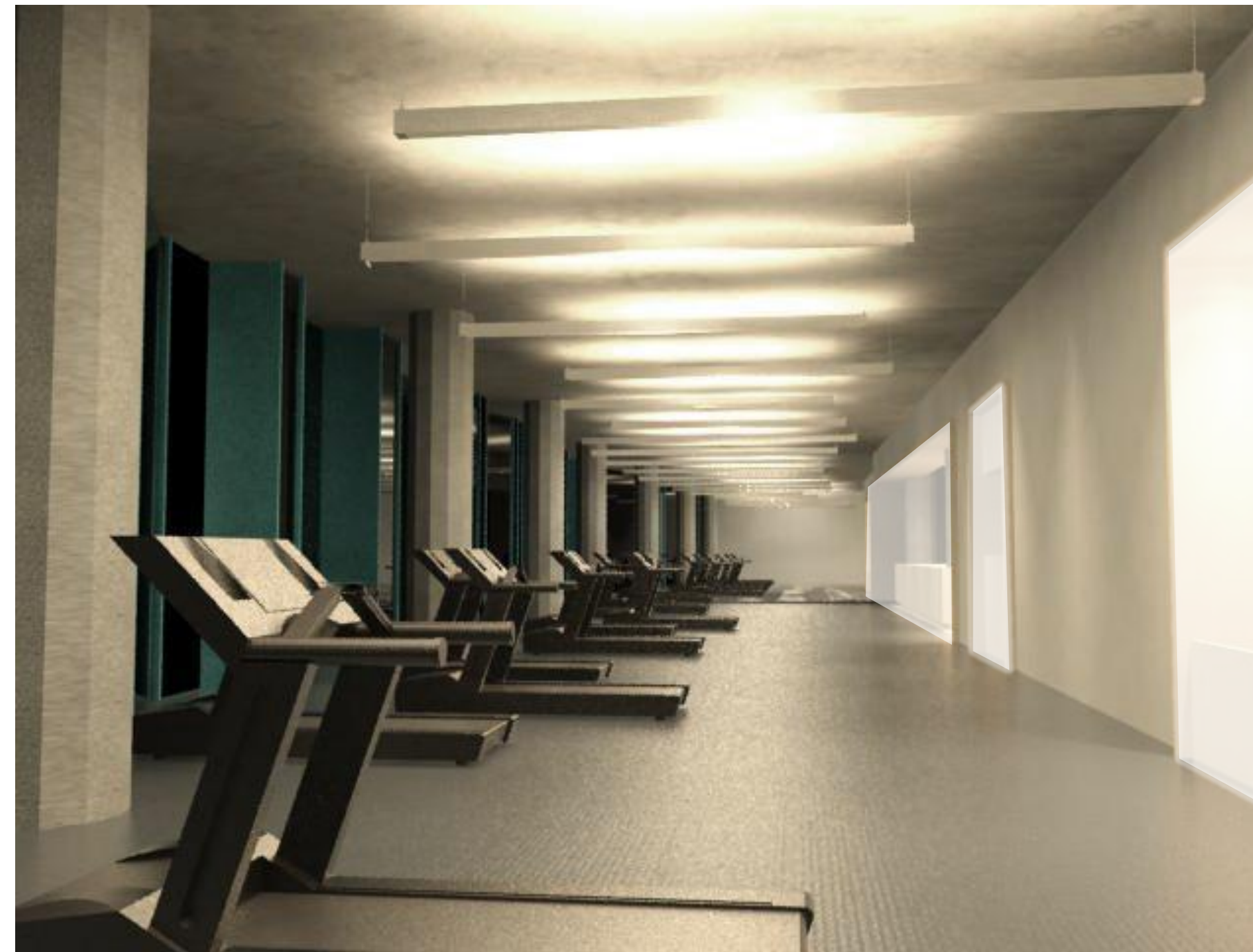
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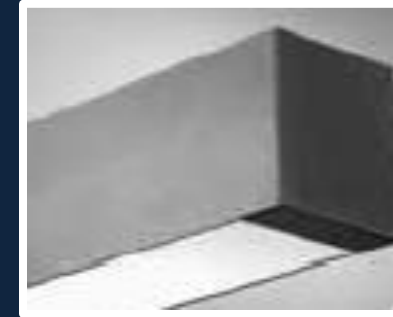
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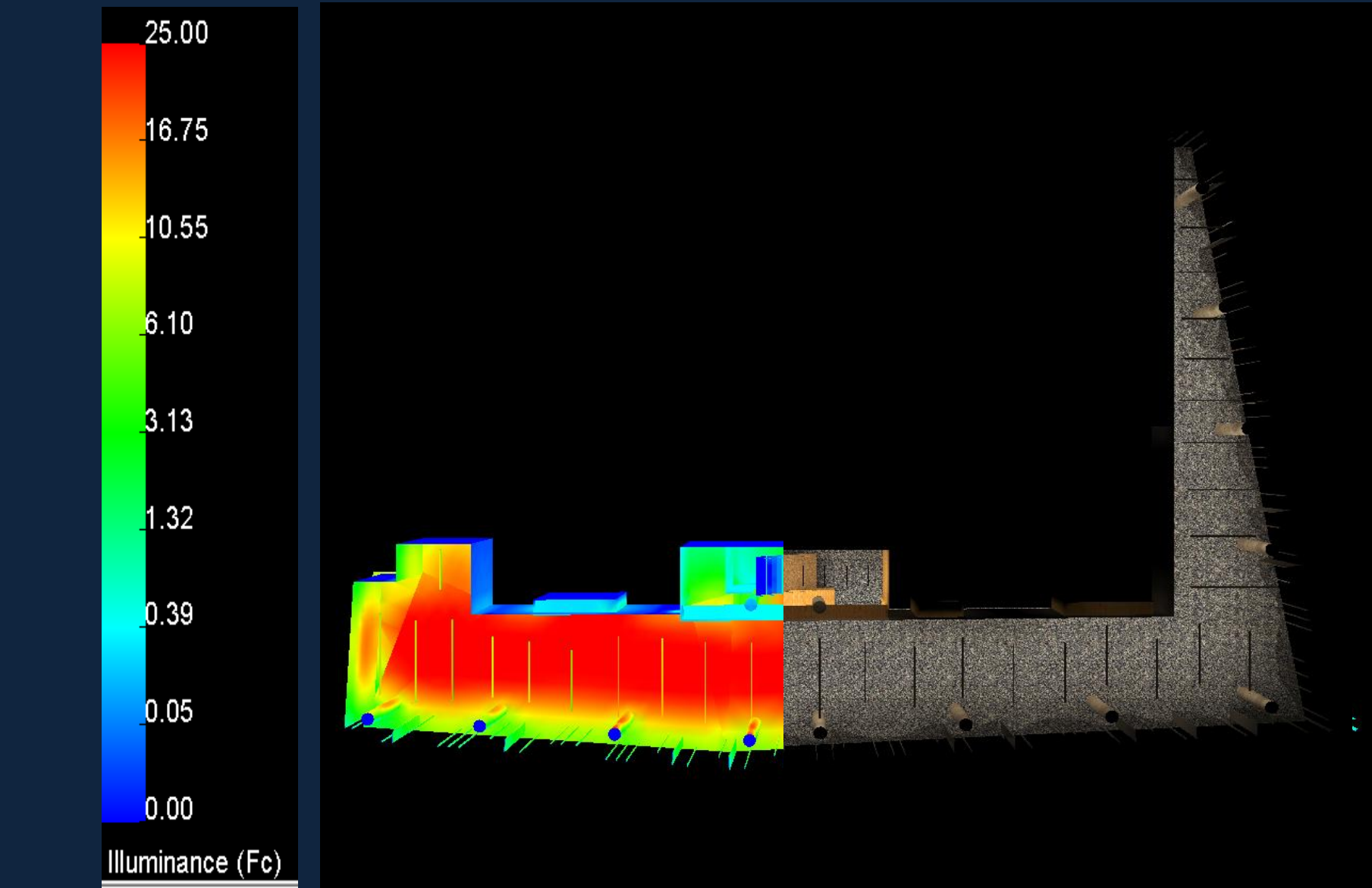
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performance data

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## performance data

	Workplane (1.5')	Ceiling	Vertical
average illuminance	23.90fc	18.77fc	9.81fc
maximum illuminance	42.4fc	65fc	12.9fc
minimum illuminance	9.4fc	2.0fc	7.5fc
uniformity coefficient	0.24	0.89	-
design criteria	20 fc	-	2fc

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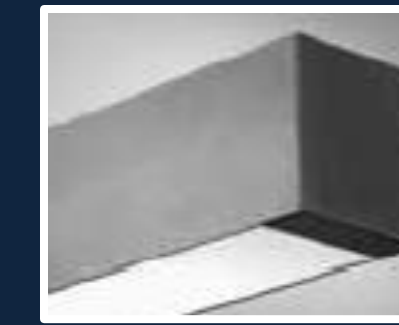
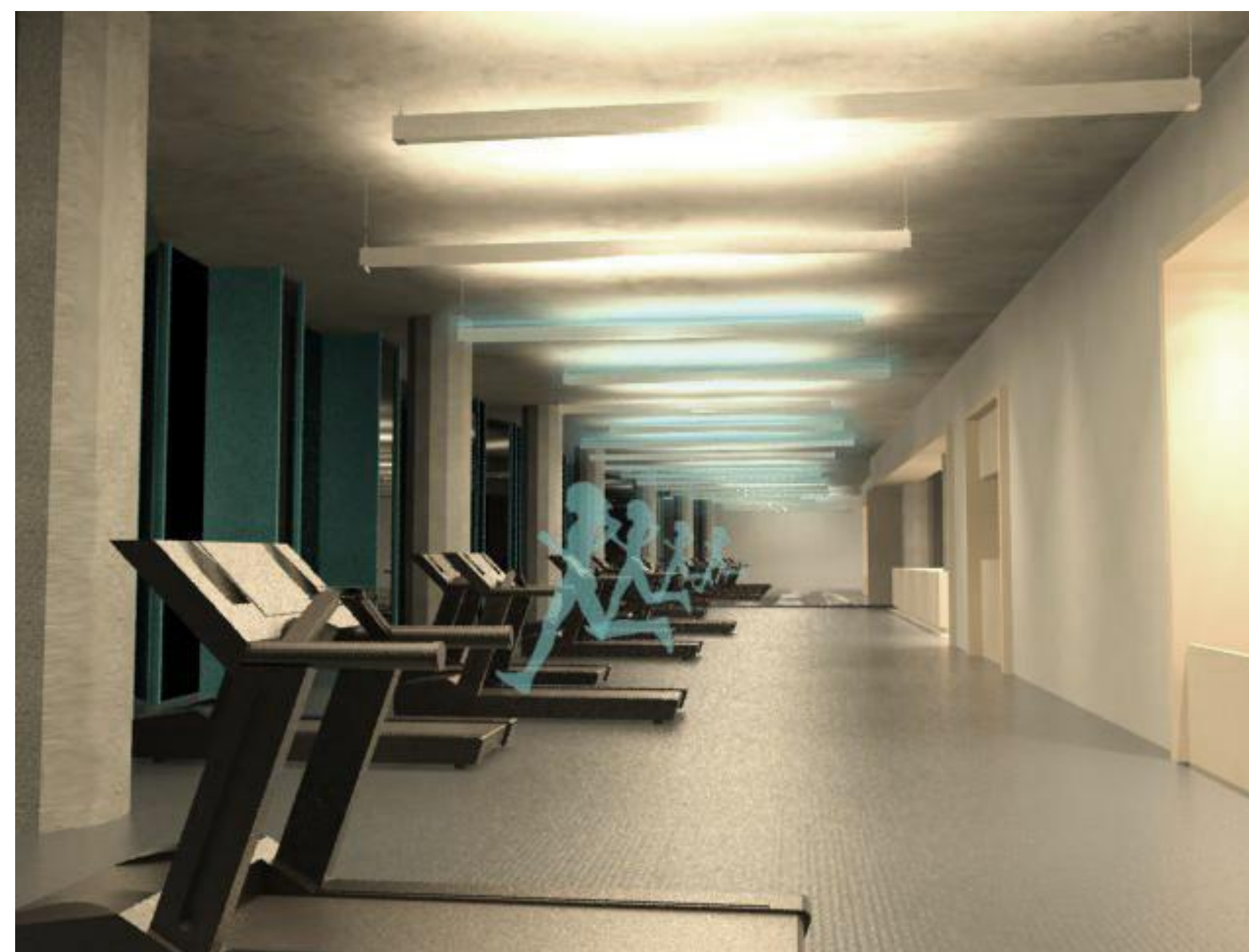
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**kinetic energy generation**



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for a 30 minute workout:

**an elliptical creates 50 watt-hours  
a treadmill creates 100 watt-hours**

**kinetic energy generation**

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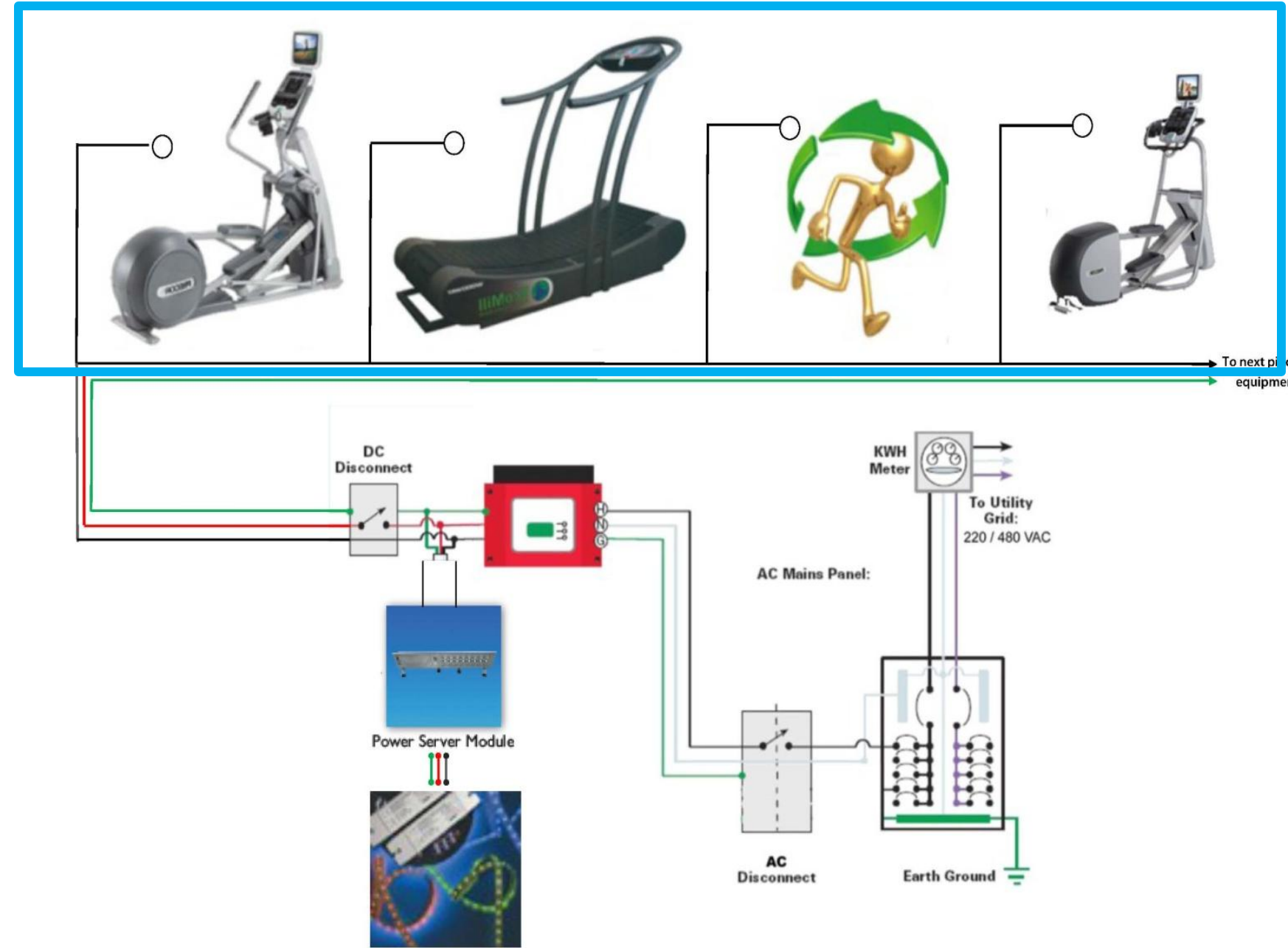
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44 machines on the second floor  
20 machines on the third floor

re-rev™ system overview

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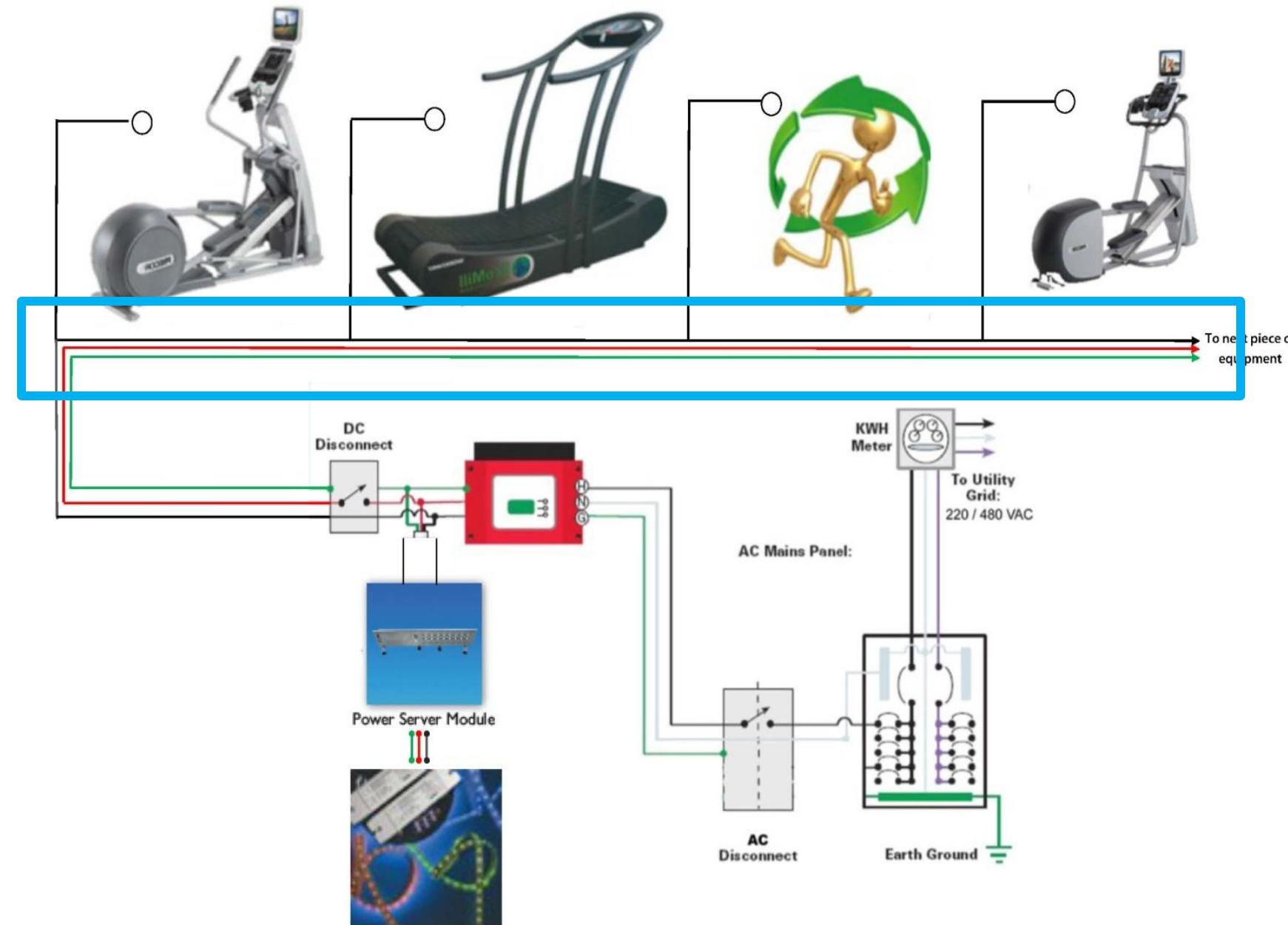
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substitutes typical cooling fan with generator and CPU that converts power to utility grade DC electricity

re-rev™ system overview

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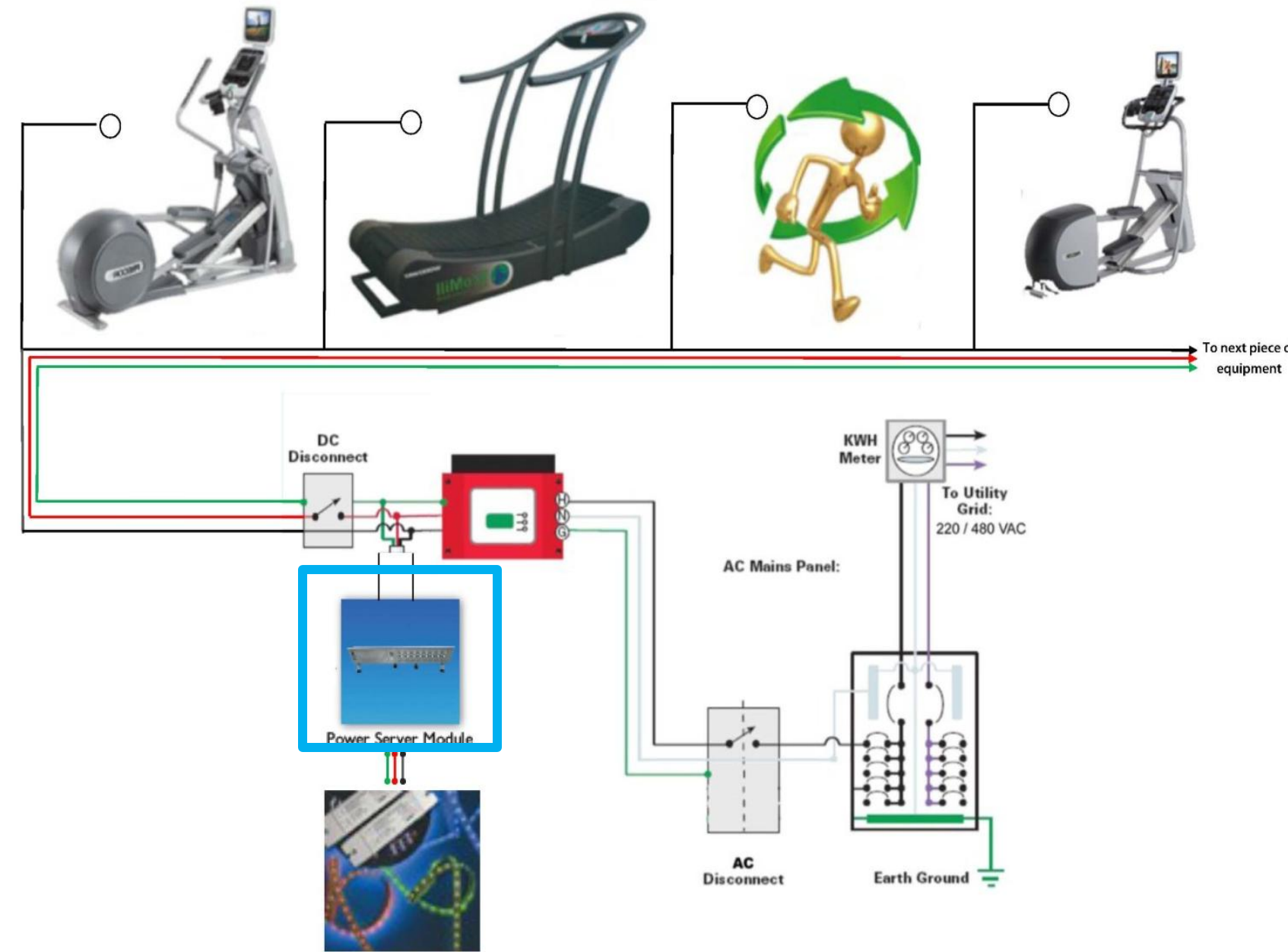
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Nextek Power Server Module  
can accept 24-24.5VDC and  
provides consistent power to  
LED lighting

re-rev™ system overview

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**remaining power returned to grid**

**visible component of energy production**

**provides interaction with building itself**

**conclusion**

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# design goals

**reflect overall design goals**

**impression of public space and clarity**

**uniformity, visual interest**

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# design goals

**create intimacy with perimeter focus**

**differentiate between function of restaurant  
and fitness center**

**core energy of the building transferred into  
design**



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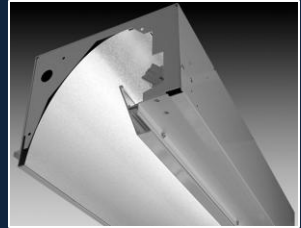
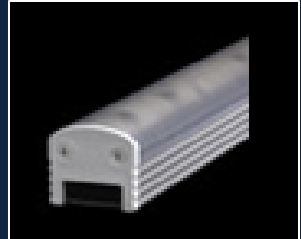
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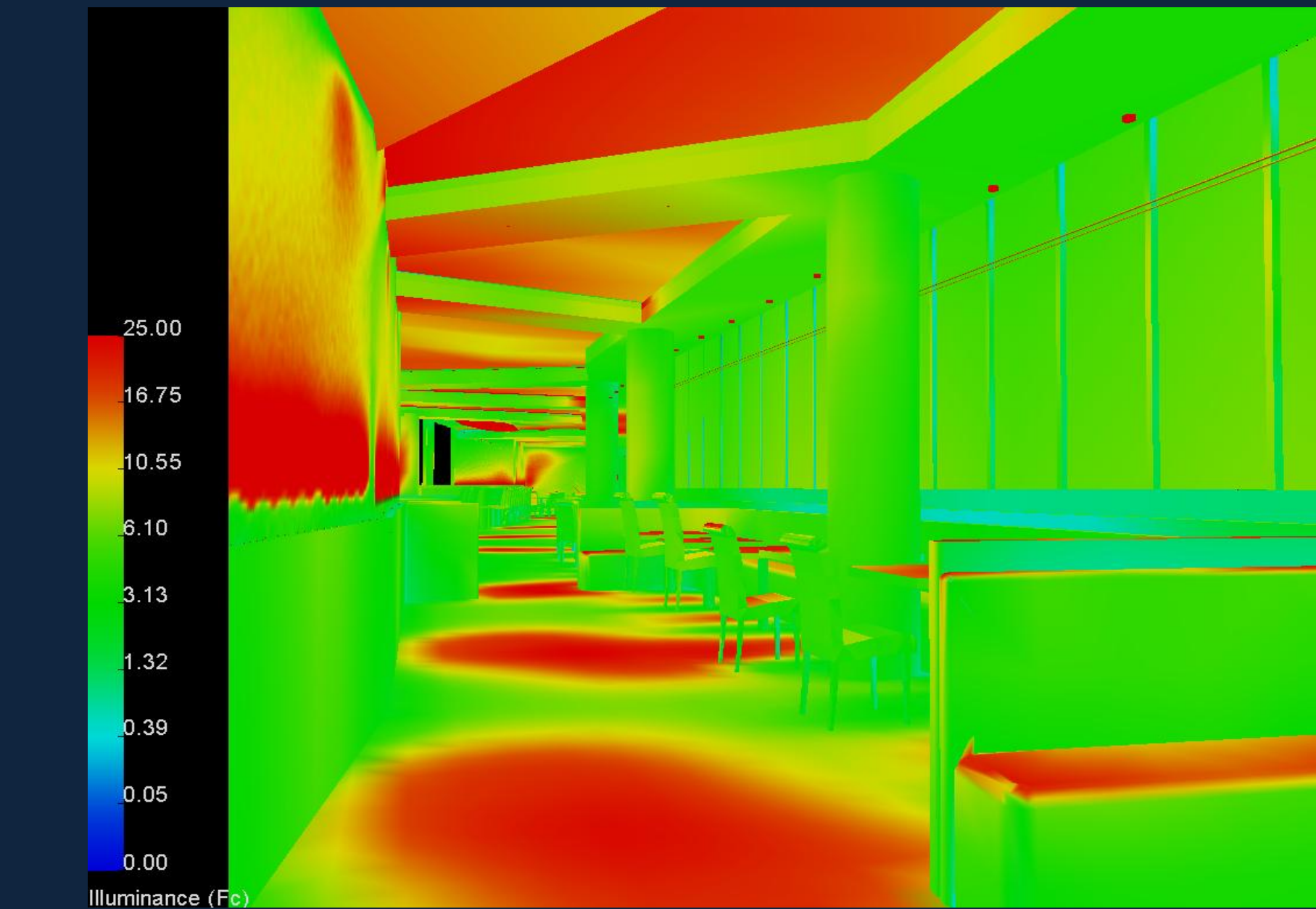
lobby

[circulation space]

**restaurant**

[special purpose space]

summary | acknowledgements | questions



performance data

# presentation outline

drexel recreation center

[overview + design concept]

outdoor plaza

[exterior space]

gymnasium

[daylighting + acoustics]

fitness center

[large workspace + electrical depth]

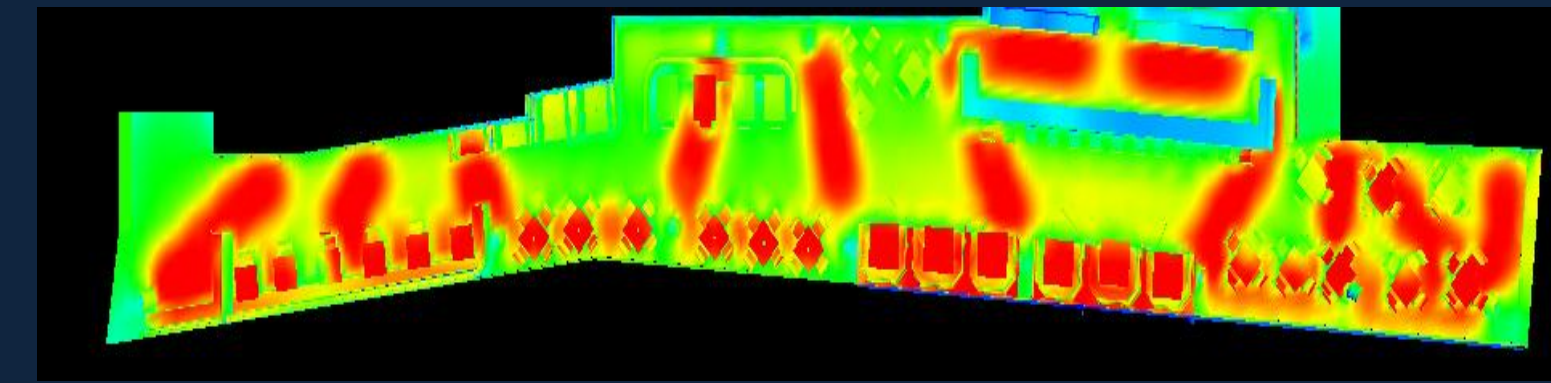
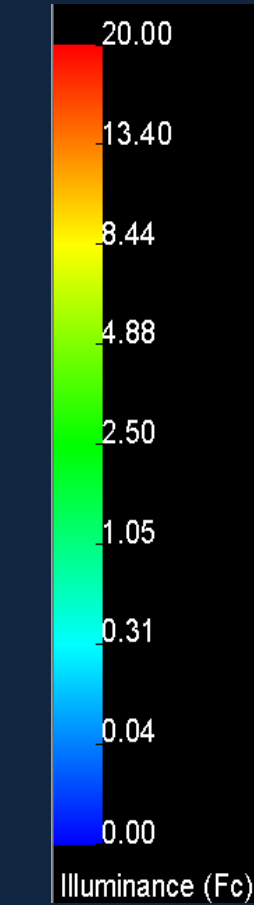
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## performance data

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	Workplane (0')	Tables
average illuminance	13.83fc	10.43fc
maximum illuminance	41fc	32.9fc
minimum illuminance	2.5fc	3.5fc
uniformity coefficient	0.60	-
design criteria	10 fc	10fc

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**lighting** complemented minimalist design  
highlighted core energy of facility  
met all power and illuminance criteria

**daylighting** enhanced aesthetics in space  
saved 82% of lighting load in gymnasium

**acoustics** removal of acoustic ceiling for daylighting  
purposes still provides suitable reverberation time

**electrical** kinetic power harnessing provides interactive  
element of lighting design and feeds power  
back to grid

## conclusions

# presentation outline

- drexel recreation center
- outdoor plaza
- gymnasium
- fitness center
- lobby
- restaurant

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drexel university	owner
sasaki associates	architecture interiors landscaping
ewingcole	mechanical/electrical/plumbing structural fire protection
pennoni associates	civil site design geotechnical/environmental engineering
turner construction	contractor

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ewingcole

mary alcaraz

mike ginder

professors

kevin houser

richard mistrick

ted dannerth

bob holland

sean good

the future andrea wilkerson and craig casey

nextek inc.

paul savage

family and friends

the lighting girls who got me through -

especially haley darst: who knew we could

pull so many all nighters in a row??

special entertainment

the sesame street yip-yips

and ESPECIALLY

everyone who reminded me that i could

when i thought that i couldn't <3



thank you  
questions?



final thesis presentation | lighting|electrical | britnei godusky | 04.13.11 | dr. houser and prof. dannert