

Predicting Spectral Effects in Architectural Spaces



Pacific Northwest
NATIONAL LABORATORY

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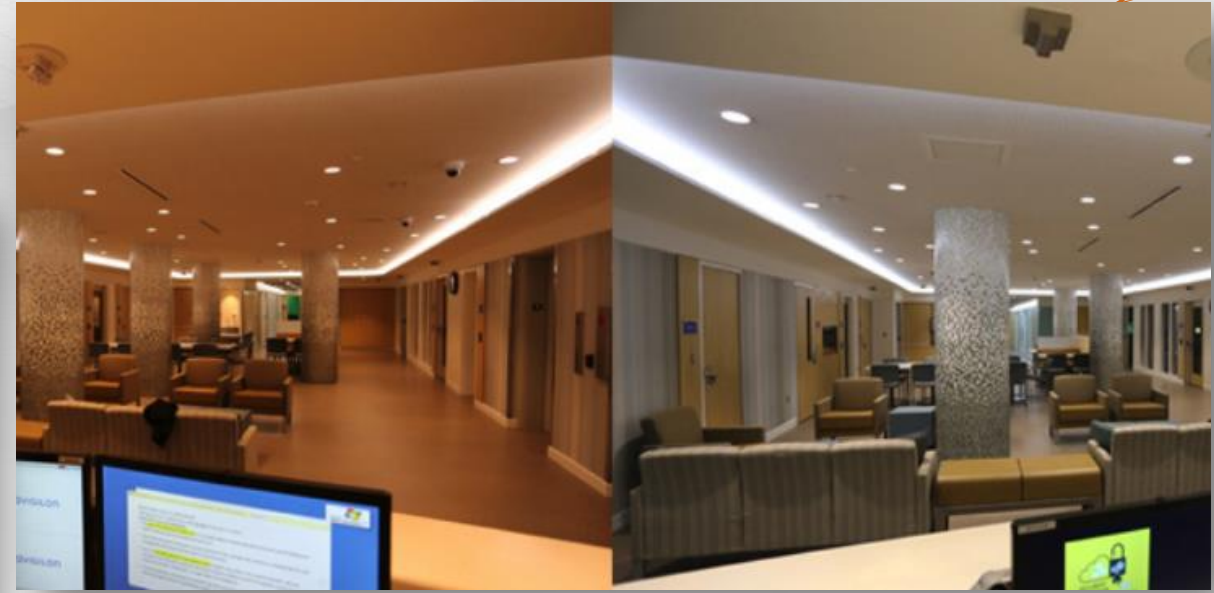
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Pacific Northwest National Laboratory



LIGHTFAIR 2018
Chicago, IL

DOE SSL and Color Tuning



GATEWAY



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CIRCADIAN EMULATION

Intent: To provide light which has intensity and spectrum similar to that of the daily changes of sunlight.

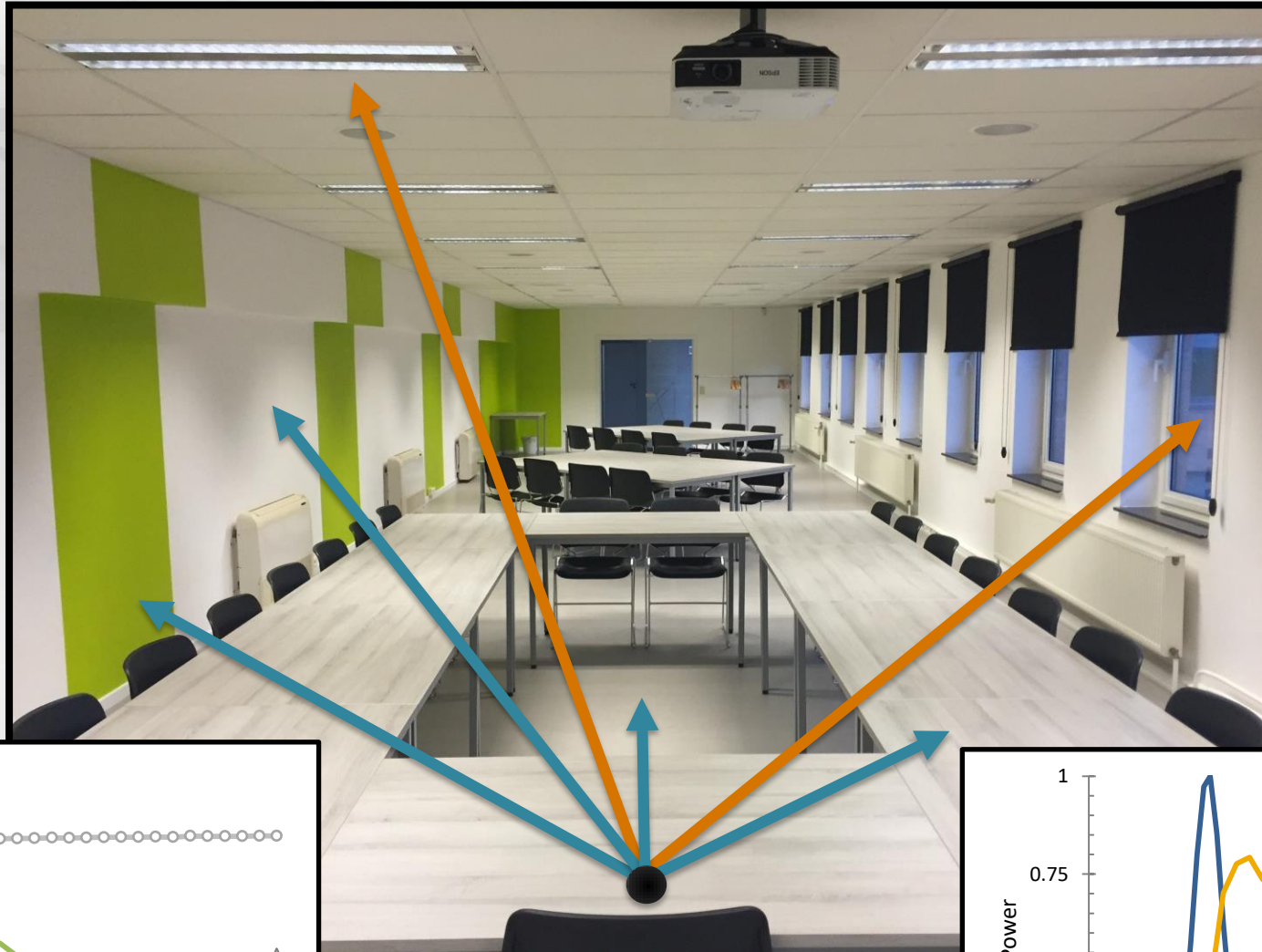
pictures courtesy of unsplash.com



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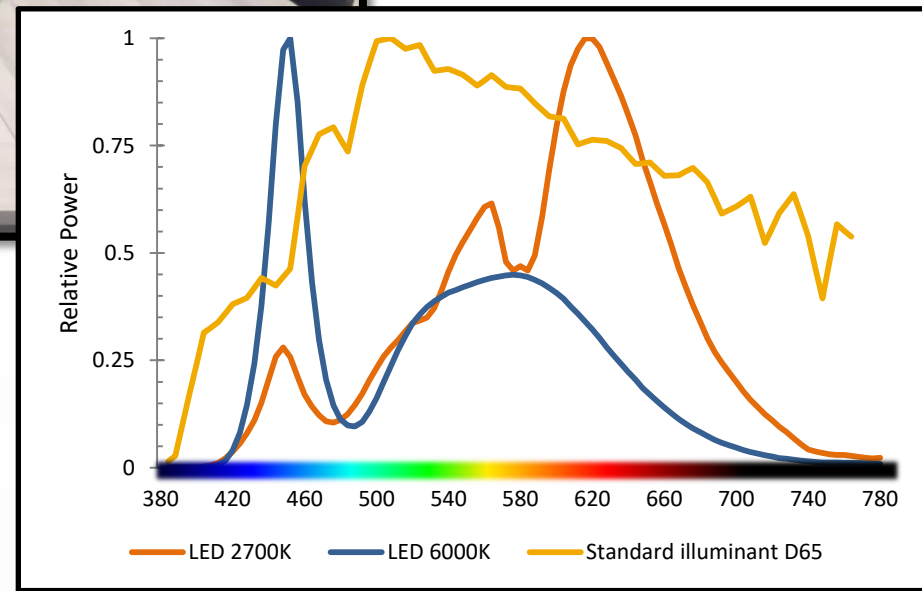
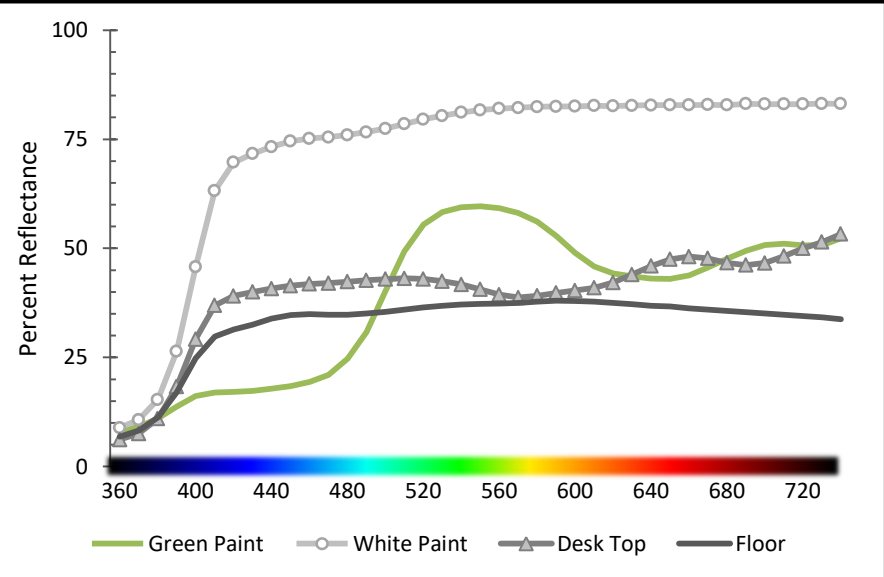
picture courtesy of pexel.com



MATERIAL PROPERTIES

SOURCE PROPERTIES

VIEW POINT



Modeling a UK NICU Patient Room



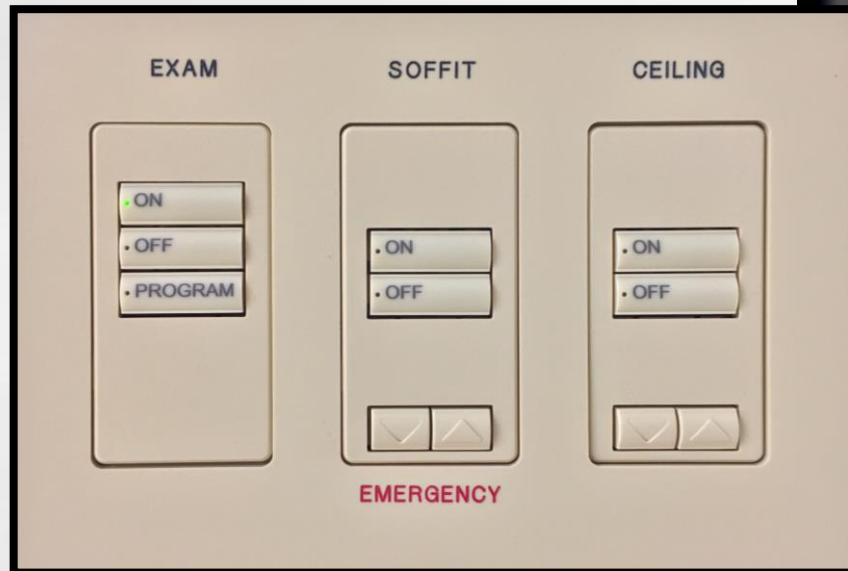
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1. Dawn/Dusk Mode

2. Day Mode

3. Exam Mode



Tools Available for Spectral Calculations

Lighting Research Center – Circadian Stimulus Calculator

Step 1: Select Sources

Select Available Sources

Manufacturer: Any

CCT: Any

Lamp: Any

Keyword: Search Sources

Reset Filters

Add Custom Source

Available Sources

- CIE A: Standard Incandescent
- CIE D50: Horizon Daylight
- CIE D55: Mid-Morning Daylight
- CIE D65: Average Daylight
- CIE D75: Overcast Daylight
- CIE E: Equal Energy
- CIE F1: Daylight Fluorescent
- CIE F2: Cool White Fluorescent

Step 2: Edit Variables

Additional Variables

Biological Input Variables	Value
Macular Pigment Optical Density:	0.5

Source Illuminances

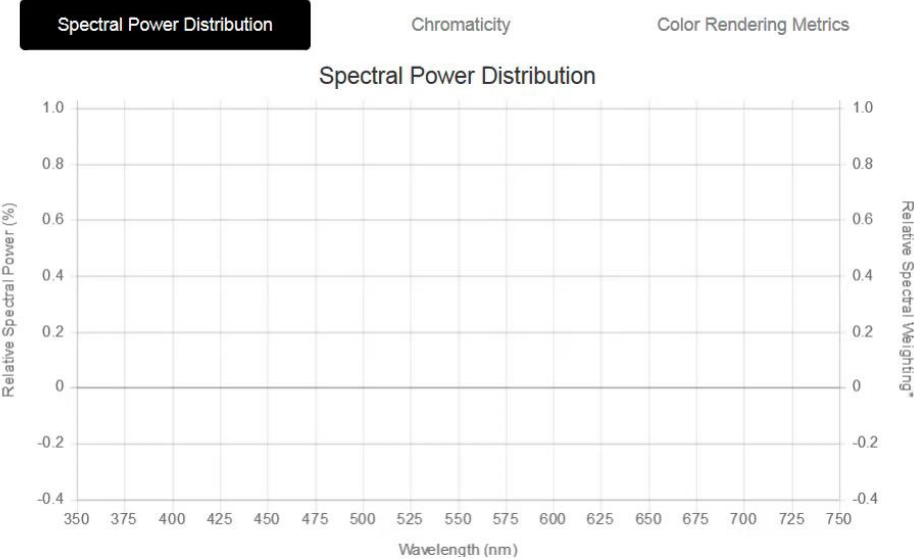
Source	Vertical Photopic Illuminance (lx)	Remove Source
No Sources Selected		

Step 3: View Results

Output Plots

Spectral Power Distribution Chromaticity Color Rendering Metrics

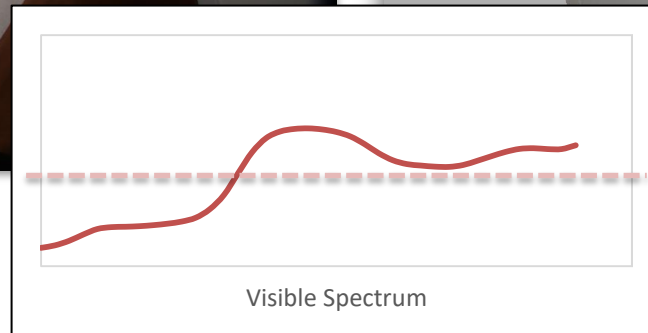
Spectral Power Distribution



Combined Source Value Metrics

Measurement	Value
CS:	0.000
CL _A :	0
Illuminance (lx):	0

Modeling Spectral Effects: AGi32

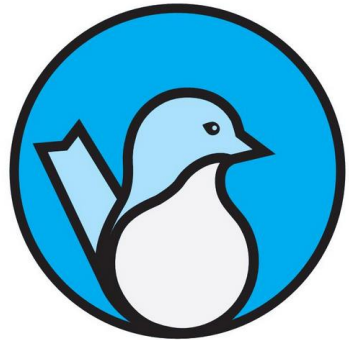


Tools Intended for Spectral Calculations

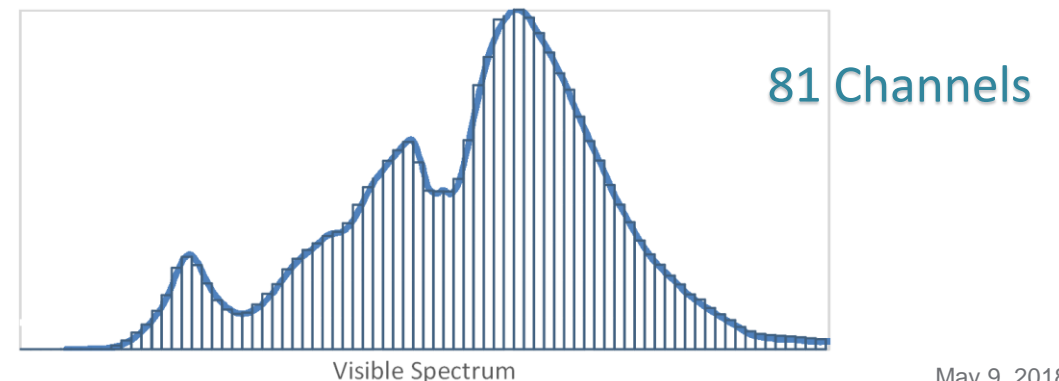
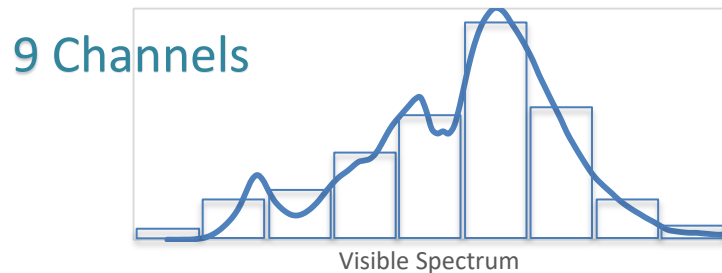
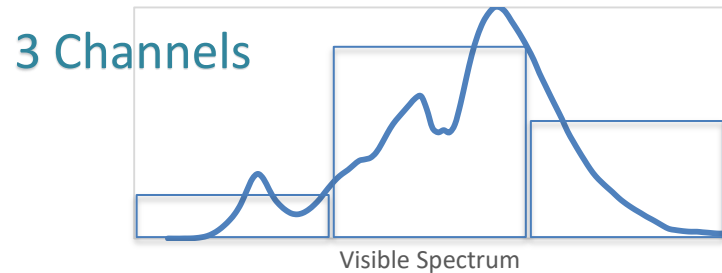
- Utilizes Radiance
- Grasshopper plugin
- Open source



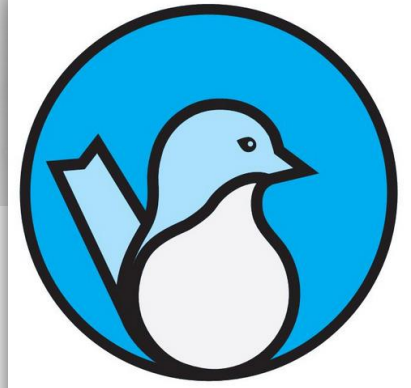
- Utilizes Radiance
- Simulation interface
- Library of materials, luminaires



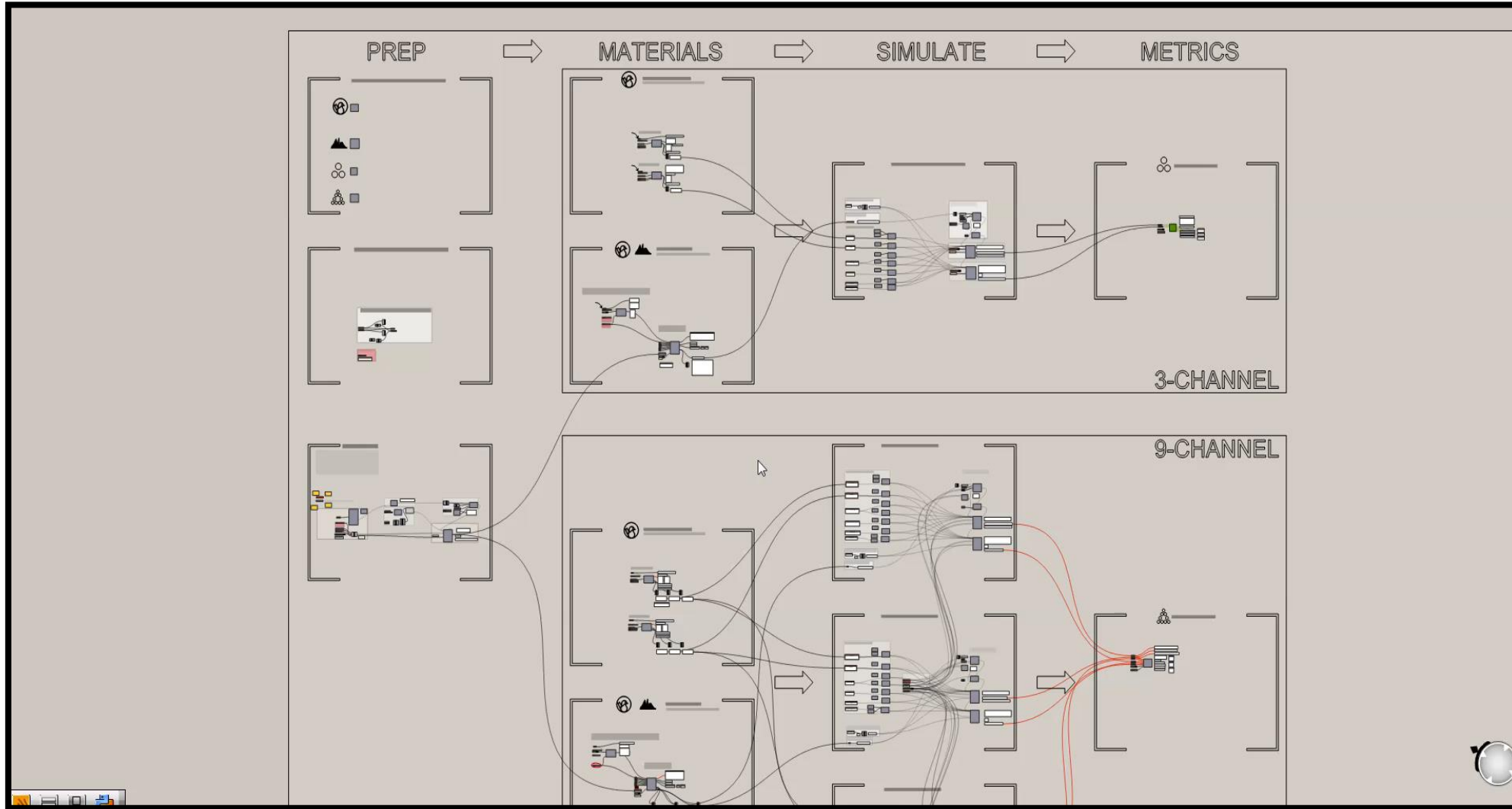
LARK
SPECTRAL LIGHTING



Modeling Spectral Effects: LARK



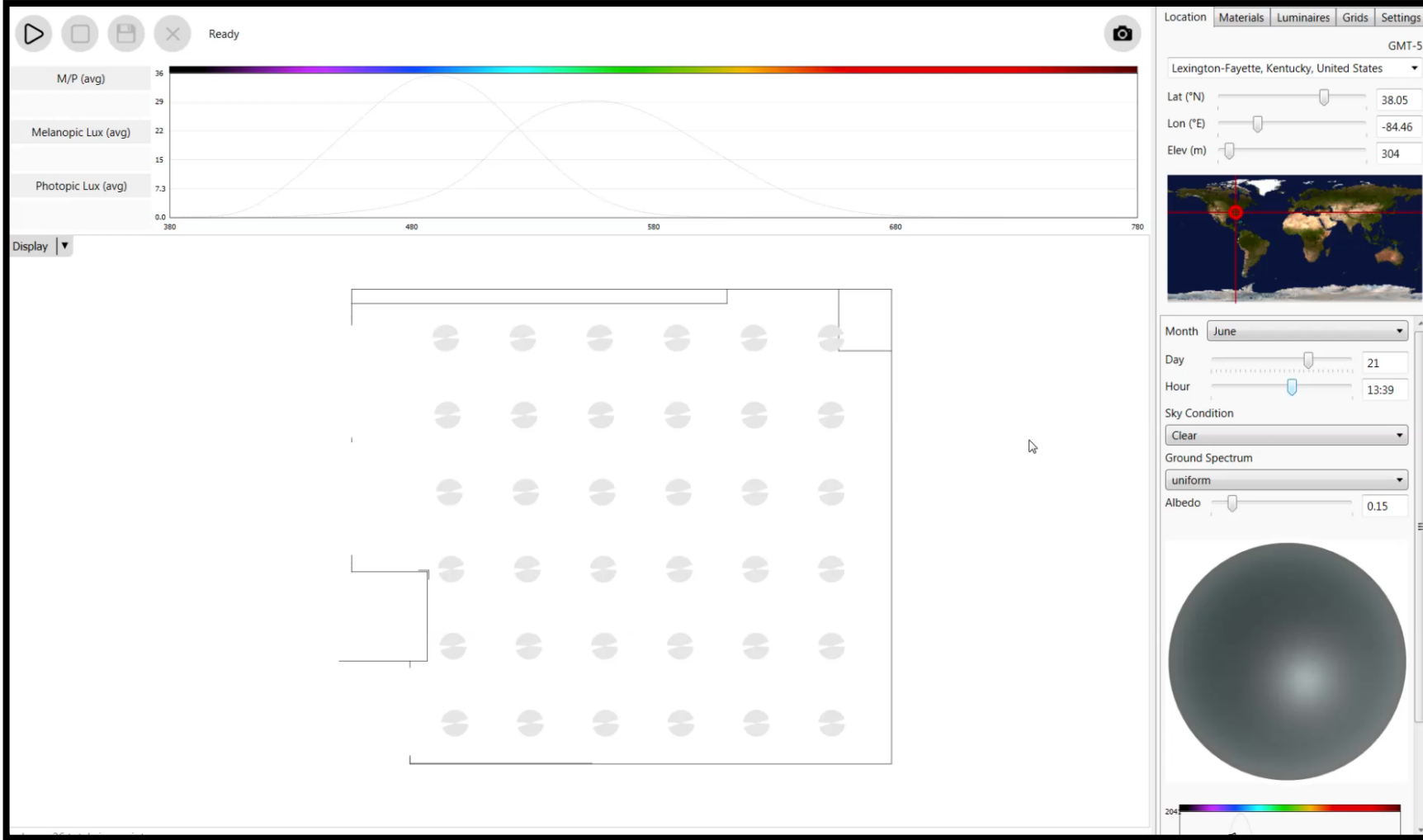
LARK
SPECTRAL LIGHTING



Modeling Spectral Effects: ALFA



Adaptive Lighting for Alertness



What's next?

- How do underlying assumptions of calculation process impact accuracy?
- How will spectral prediction tools be used to make more informed lighting designs?
- What are the energy implications of incorporating spectral prediction tools into the lighting design process?

For more information on GATEWAY reports:
<https://www.energy.gov/eere/ssl/gateway-evaluations>