Sefaira’s Method for Rapidly Calculating Daylight Metrics Using Radiance

New York • London
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Product Manager, Sefaira
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Experience:
MBH Architects
Hart | Howerton
FME Architecture + Design

Education:
University of Notre Dame
B. Arch ’07 MBA ’14

Best coast?
The West Coast.
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Today’s guiding questions:

• What problem does Sefaira solve, and for whom?

• What unique challenges does Sefaira face?

• How does Sefaira apply Radiance in meeting those challenges?
Sefaira makes it easy for teams to meet project performance goals.
Sefaira Daylighting supports Architects and Specialists at early-stage design.
Project teams won’t meet goals by accident.

They must assess performance early and often, in order to:

• support comparative iteration
• ensure their project is on track to meeting performance goals
• construct a design narrative around high performance solutions
  – Supports and justifies design decisions
  – Fosters a trusting relationship with the client
Project teams need the right tools.
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Speed • Accessibility • Precision

How do we deliver the right balance of Speed, Accessibility, and Precision for early-stage performance analysis?
**Speed • Accessibility • Precision**

- **Fast setup**
- **Parallelization in the cloud**
  - Consume sensor array in pieces.
  - Use multiple processors to churn through rtrace.
- **Daylight Coefficients (DAYSIM)**
Speed • Accessibility • Precision

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- **Simple Scene Setup**
  - Geometry & Materials
  - Grid spacing and layout
  - Location-based information
  - Simulation-specific settings

- **Communication**
  - Metrics
  - Outputs
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Seeking optimum parameters for Radiance and DAYSIM
Assessment

Compare rtrace parameters for their impact on illuminance values and simulation time.

• Point-in-time illuminance assessed at sensor points.
  – Radiance rtrace run locally.

• Three models, five sets of Radiance parameters:
  – Sefaira settings
  – Radiance default “Medium” settings
  – “Daysim3.0Tutorial” settings
  – Specialist-suggested settings
  – Radiance 2.4 “Accurate” settings via radsite.lbl.gov

• Geometry, materials, and lighting kept constant.
Speed • Accessibility • Precision

Sefaira
Radiance Medium Quality
Daysim 3.0 Tutorial
Specialist-suggested
Radsite “Accurate”
Speed • Accessibility • Precision

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Analysis Time (seconds)

- Sefaira
- Radiance "Medium"
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Speed • Accessibility • Precision

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Graph showing Lux values against Sensor Points.
Speed • Accessibility • Precision

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Radiance Medium Quality
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Speed • Accessibility • Precision

Analysis Time (seconds)
Key Takeaways

- **Sefaira settings balance speed and precision.**
  - Using defaults also eliminates setup burden from non-specialists.

- **Context is key:**
  - Early-stage comparative analyses demand analysis that is fast enough and precise enough to inform decision-making.

- **There is room for fine-tuning and expanded analysis:**
  - Sensitivity analysis to tease out greater precision / greater consistency compared to benchmarks
  - Expand scene description detail (e.g. materiality)
  - 5-phase! BDSFs!
Questions?
Making it easy for building project teams to meet performance goals.

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Product Manager / Sefaira Daylighting Visualization
kerger_truesdell@trimble.com
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<th>Radiance &quot;MEDIUM&quot;</th>
<th>Daysim 3.0 Tutorial</th>
<th>Specialist-suggested</th>
<th>Radsite &quot;Accurate&quot;</th>
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Rtrace execution command

```
rtrace -w -h -l+ -u \{Radiance parameters\}
dat_oct_file.oct < sensor_points_file.pts | rcalc -e "\$1=(\$1*0.265+\$2*0.670+\$3*0.065)*179" > dat_results.ill
```
Appendix

Material Definitions

void plastic Massing
0 0 5 0.4000 0.4000 0.4000 0.0000 0.0000

void glass Glazing
0 0 3 tn tn tn \{we incorporate user’s VLT setting\}

\[
\text{tn} = \frac{\sqrt{0.8402528435 + 0.0072522239 \times \text{Tn}^2} - 0.9166530661}{0.0036261119 / \text{Tn}}
\]
2009
Sefaira Founded
Performance Analysis in the cloud

2012
Energy Analysis Introduced

2014
Daylighting Visualization Introduced

2015
EnergyPlus Integration

2016
Sefaira Acquired by Trimble SketchUp