Using Radiance as a baseline for interactive glare risk assessment on the GPU

Radiance Workshop 2023

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VELUX STIFTUNG

Outline

Motivation

Interactive rendering

- Allow user to change view & lighting conditions
- Explore scene and detect glare risks

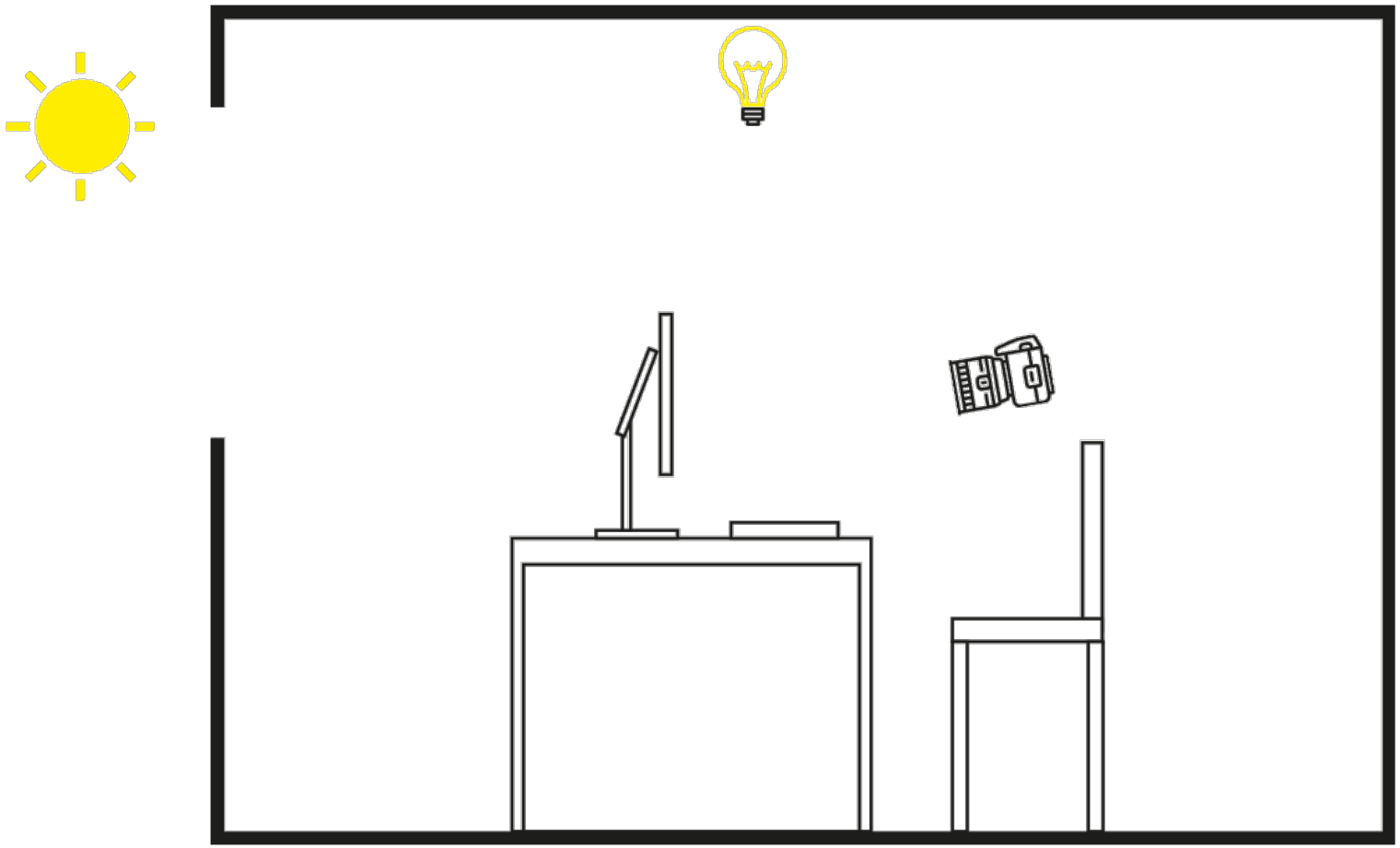
Why compare to Radiance?

- Radiance is well evaluated
- De-facto standard in glare evaluation

Ignis

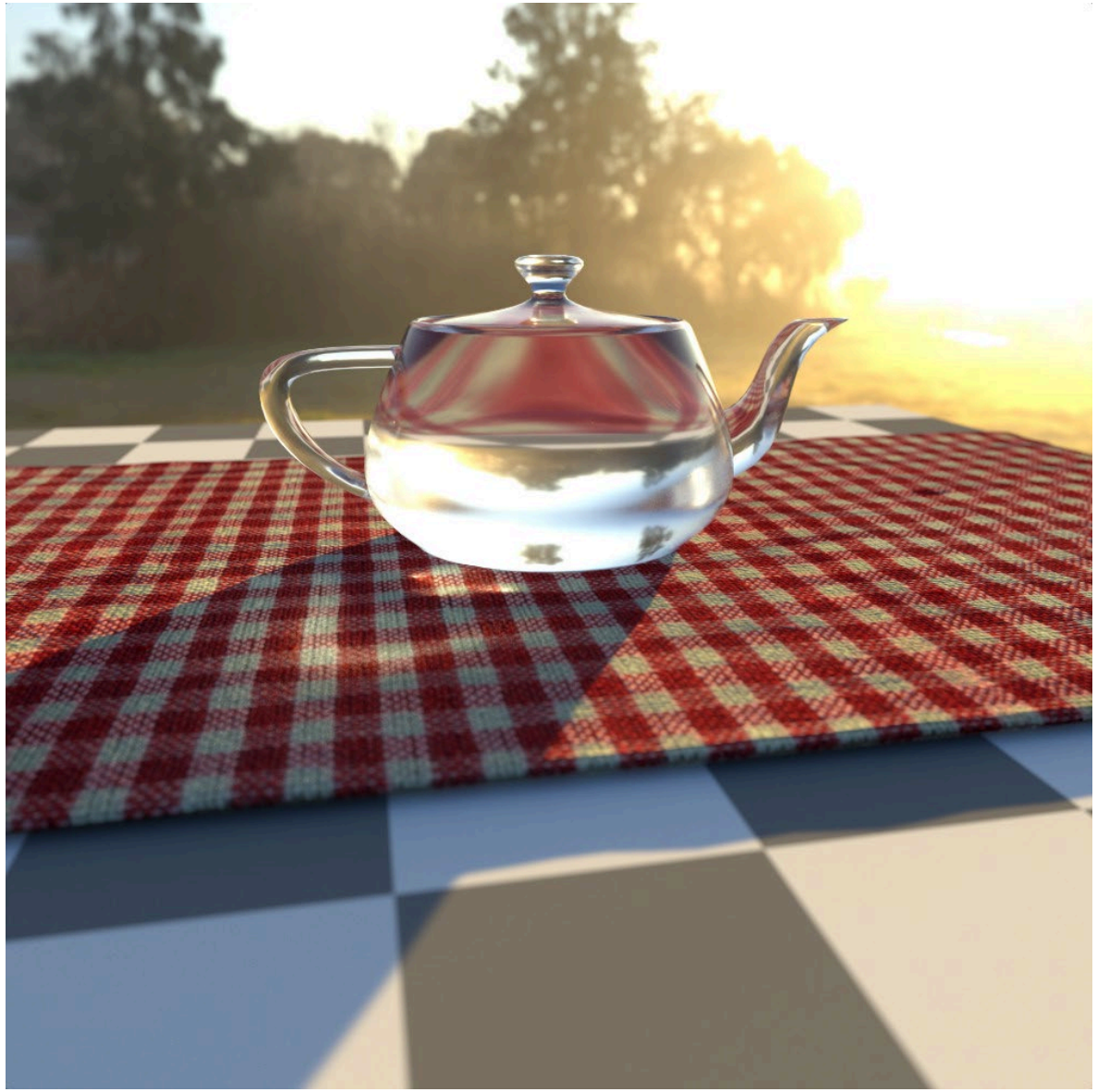
Our own GPU renderer

Monte-Carlo Raytracing



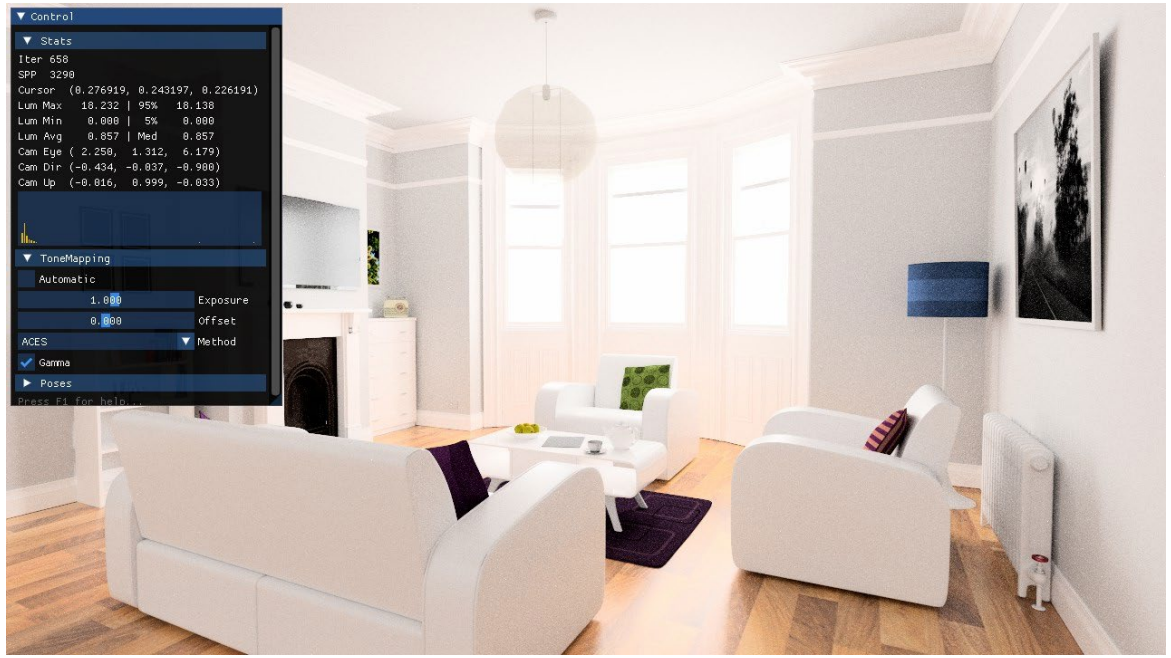
Ignis

- JIT compiling
- CPU & GPU support
- Realtime & Offline capability
- Used in education



igview

- Frontend for Ignis
- Allows interaction with the scene
- Live denoising
- Live ‘evalglare’



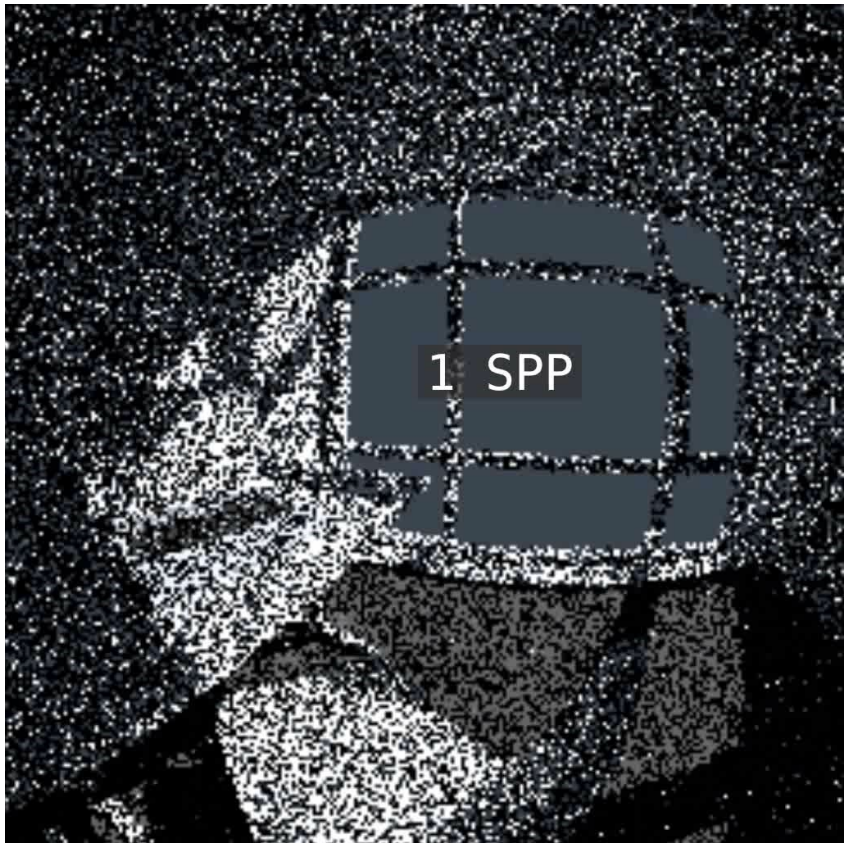
igcli, igtrace & Python

- igcli is a simple console client like rpict
  - This is the frontend we evaluate with
- igtrace allows traversing user defined rays in the same way as rtrace
- We do have full Python integration with Jupyter Notebooks and more!

Challenges

When is enough?

- Ignis uses samples per pixel (SPP) as user parameter
  - Monte-Carlo: Square SPP decreases error by half
- Quality = SPP?
  - Not straightforward
- One solution:
  1. Render with Radiance
  2. Render with Ignis the same duration
- Use time instead of SPP



Parameter Jungling

```
-u+ -ar 0 -aa 0 -as 0 -av 0 0 0 -aw 0 -st 0 -dt 0 -dp 0 -dc 0 -lr 0
-ad 800 -lw 0.00125 -ss 0 -ab 16
```

- Pure Monte-Carlo
- No ambient interpolation
- Sample all highlights
- Follow all shadow rays
- Russian Roulette
- High Ambient division
- Sharp reflections
- Indirect Bounces

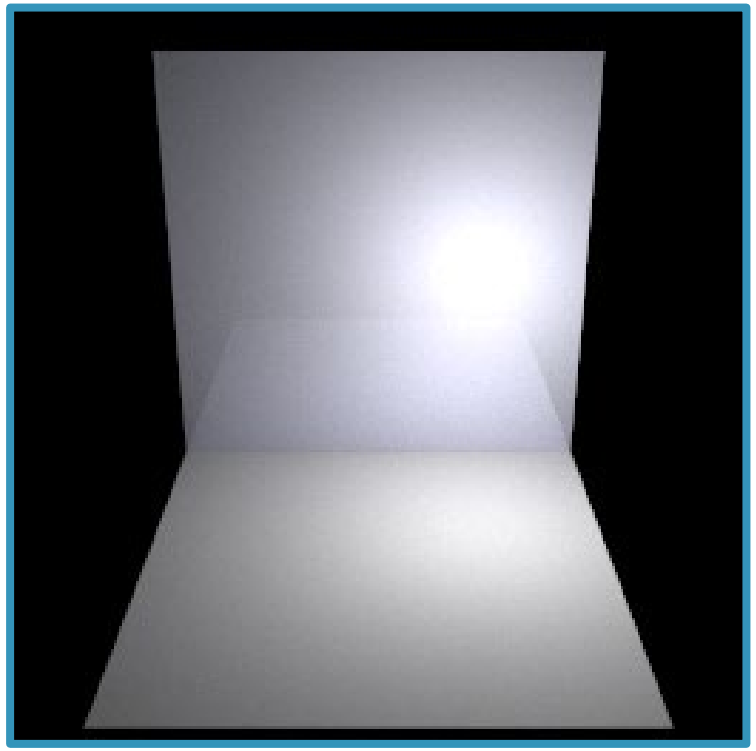
Evaluation

Unit Tests

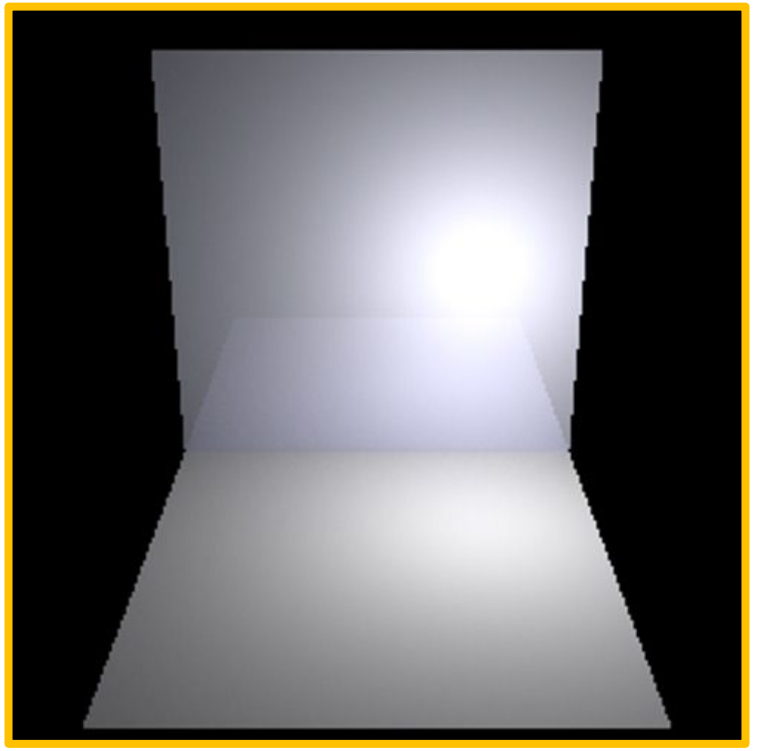
- Generate references using Radiance
- Try to render the same image with our renderer
- Only test specific components
  - Light types
  - Materials
  - Shapes
  - Patterns
  - …
- Advantage: Easy to find local mistakes
- Disadvantage: Does not test interaction of components
- Disadvantage: Impossible to test every input parameter

BRTDfunc

Ignis

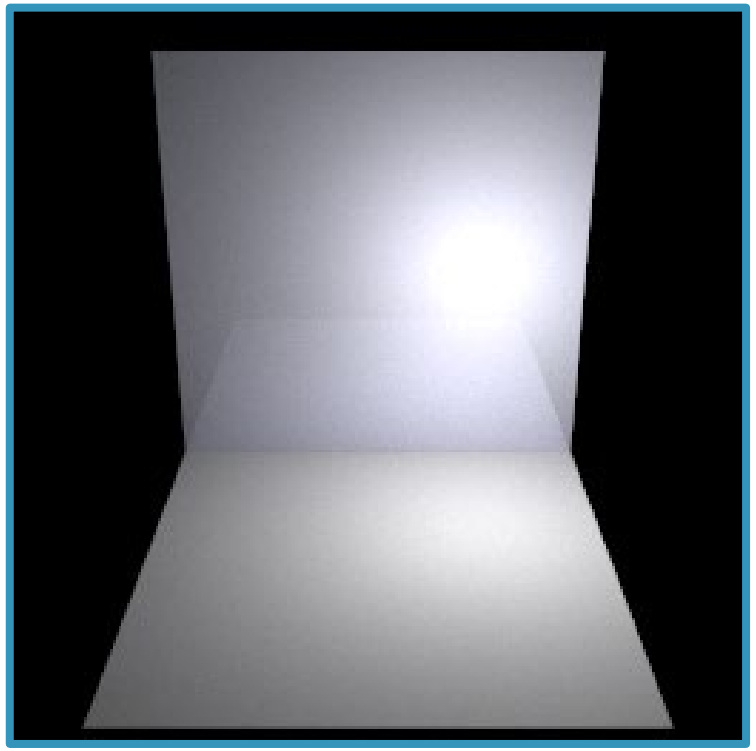


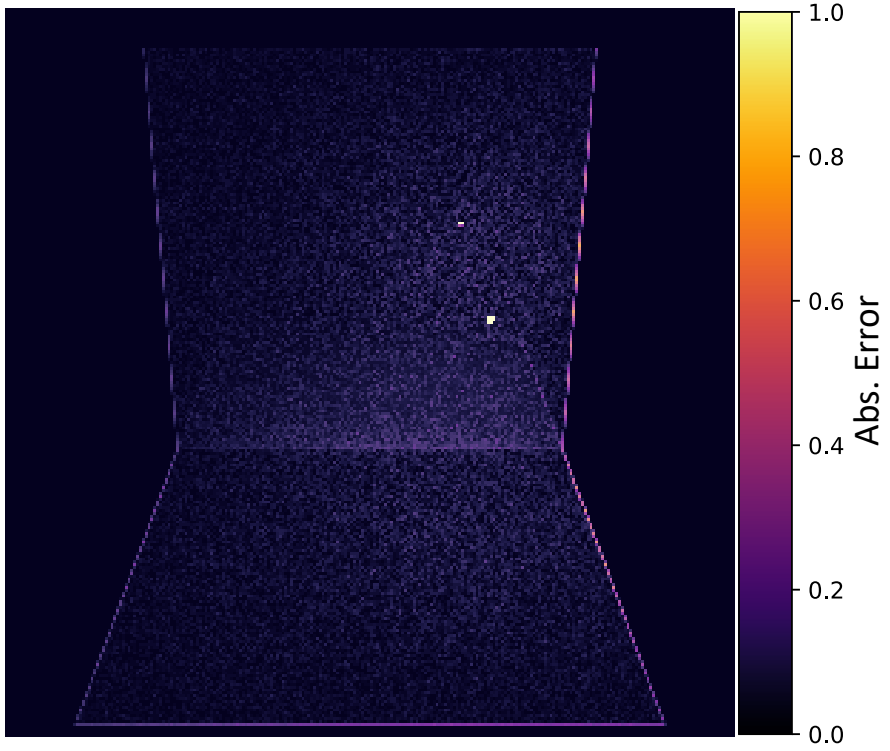
Radiance



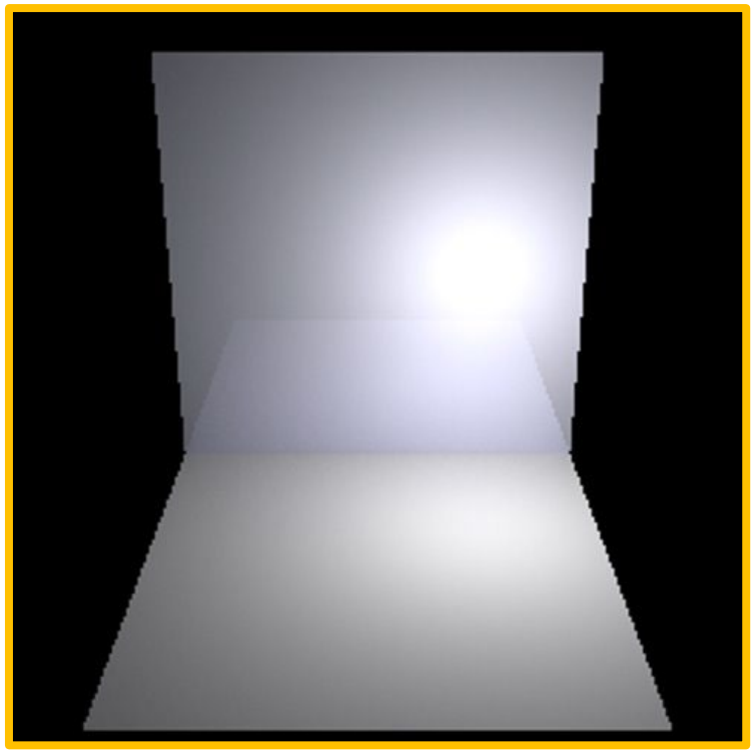
BRTDfunc

Ignis





Radiance



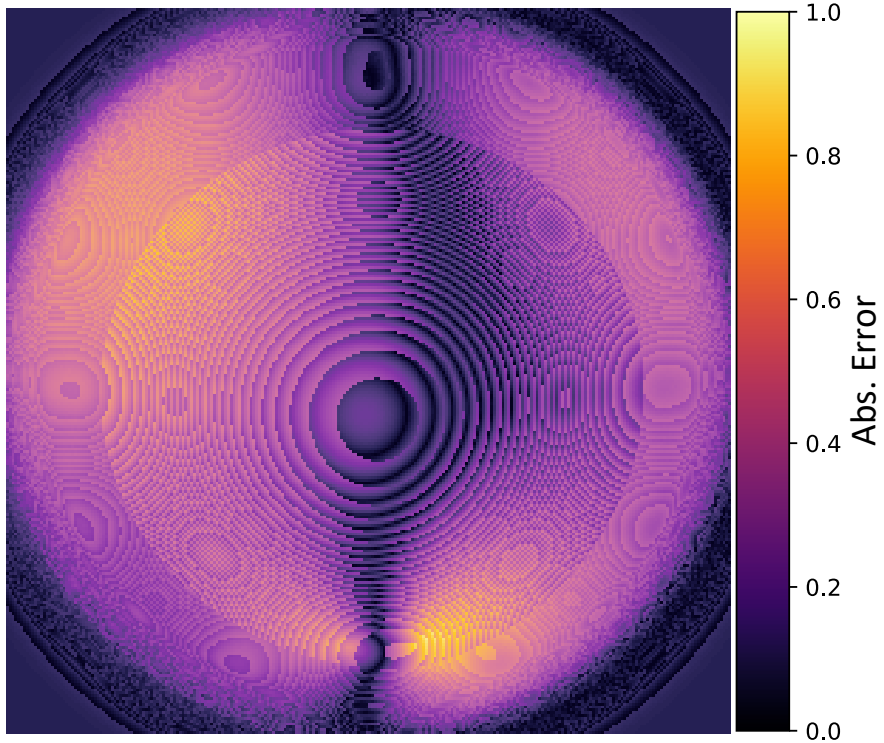
Perez Sky Model

Ignis

Radiance

Perez Sky Model

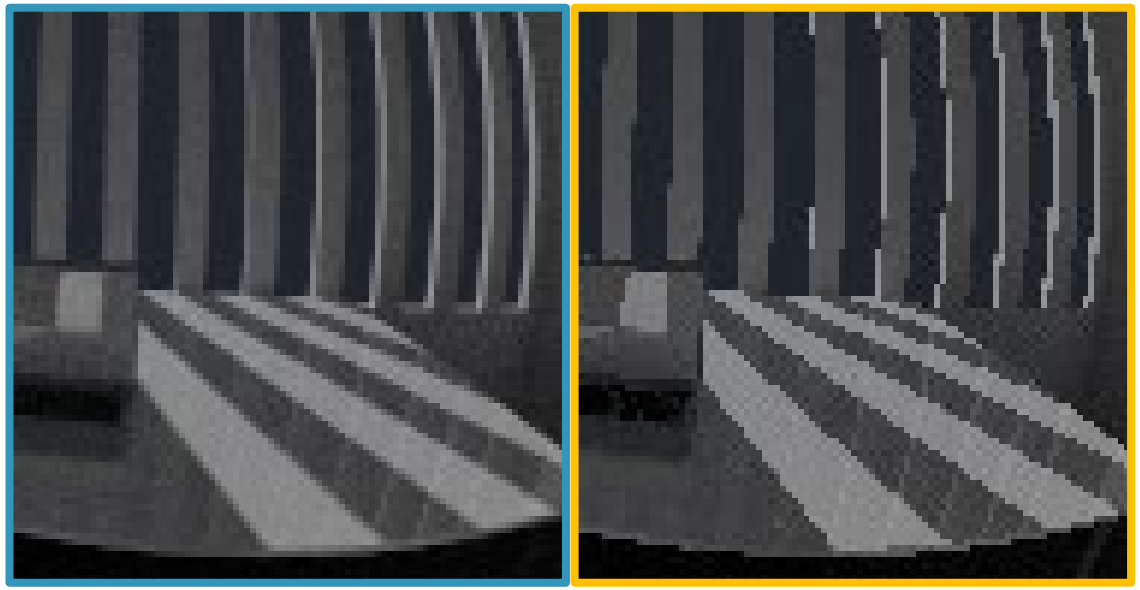
Ignis



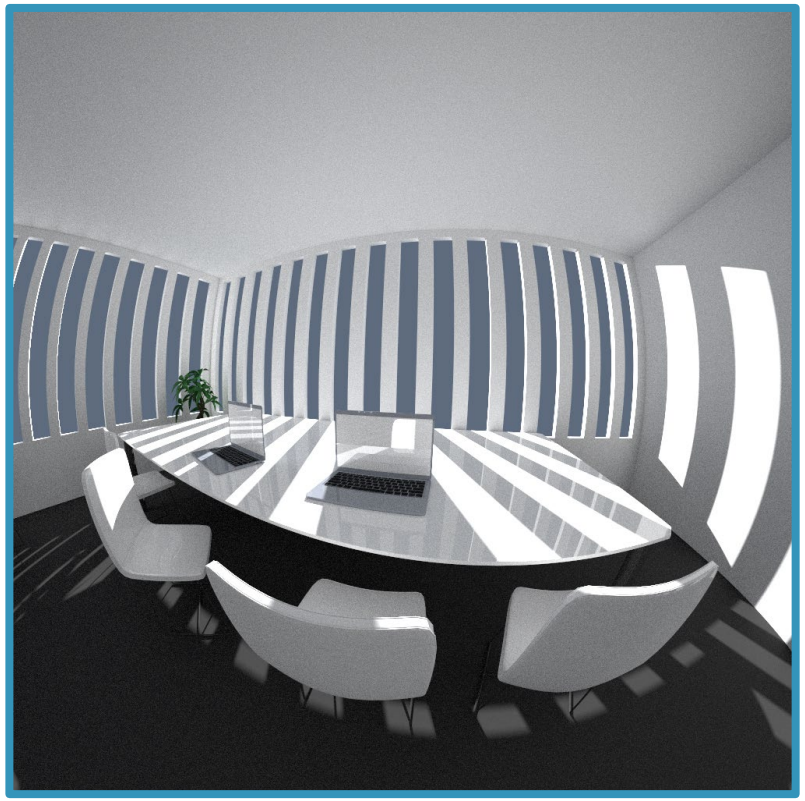
Radiance

Image & Physical Metrics

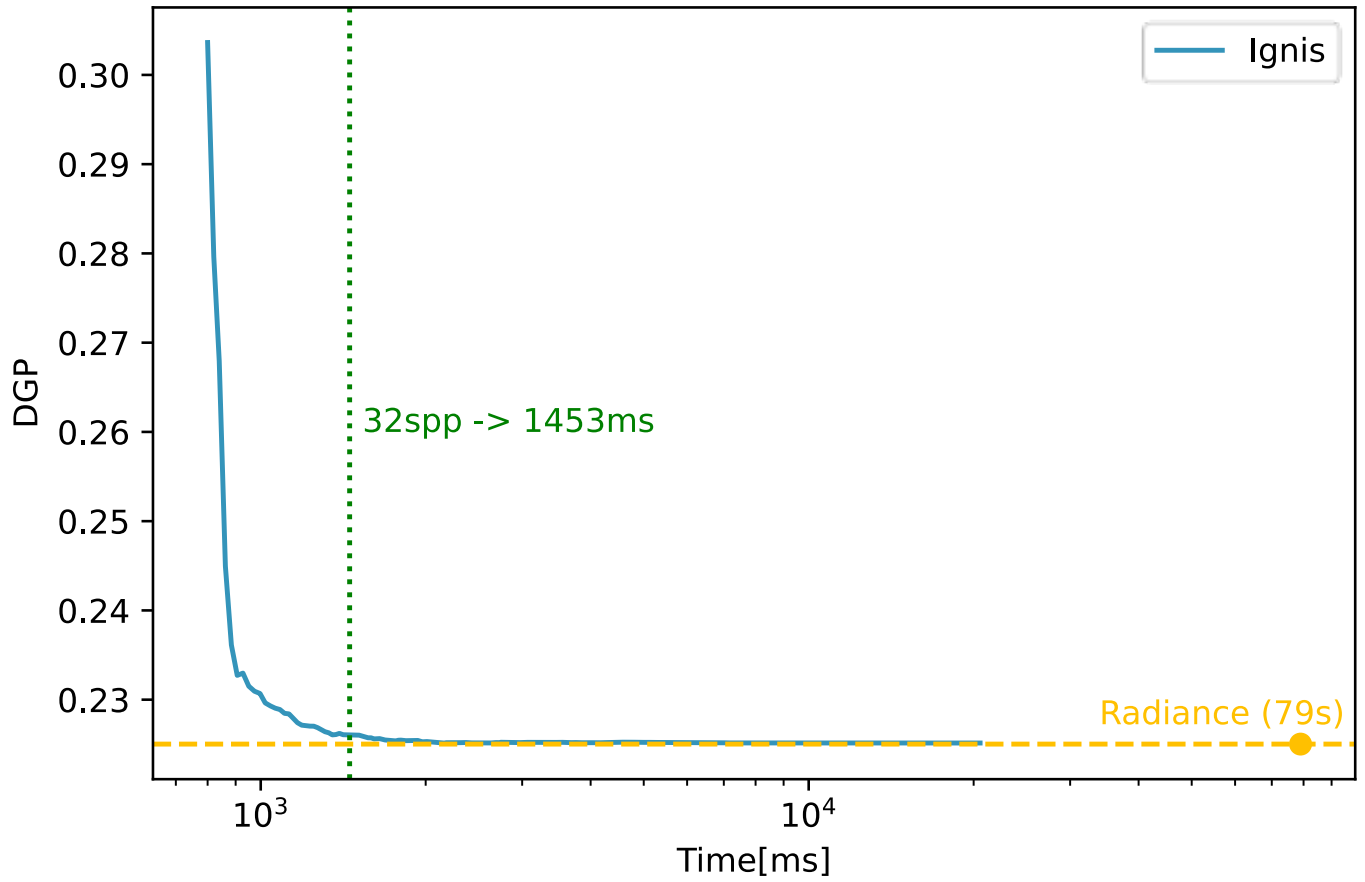
- Quality metric: Mean Squared Error
- Requires high-quality reference image
- No comparison per-pixel
  - Too big difference in pixel filter handling



DGP Evaluation

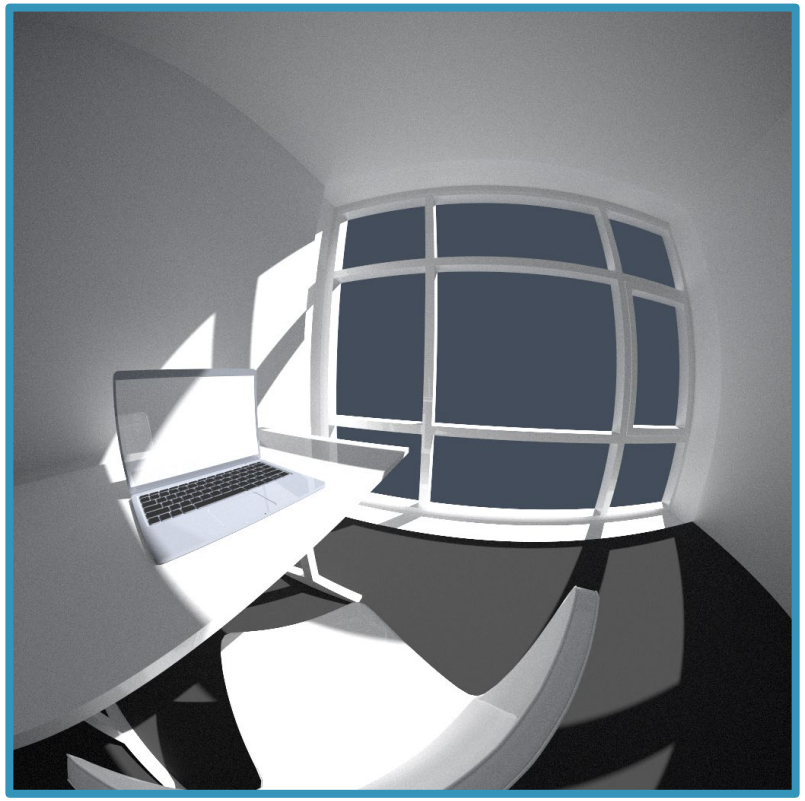


Office

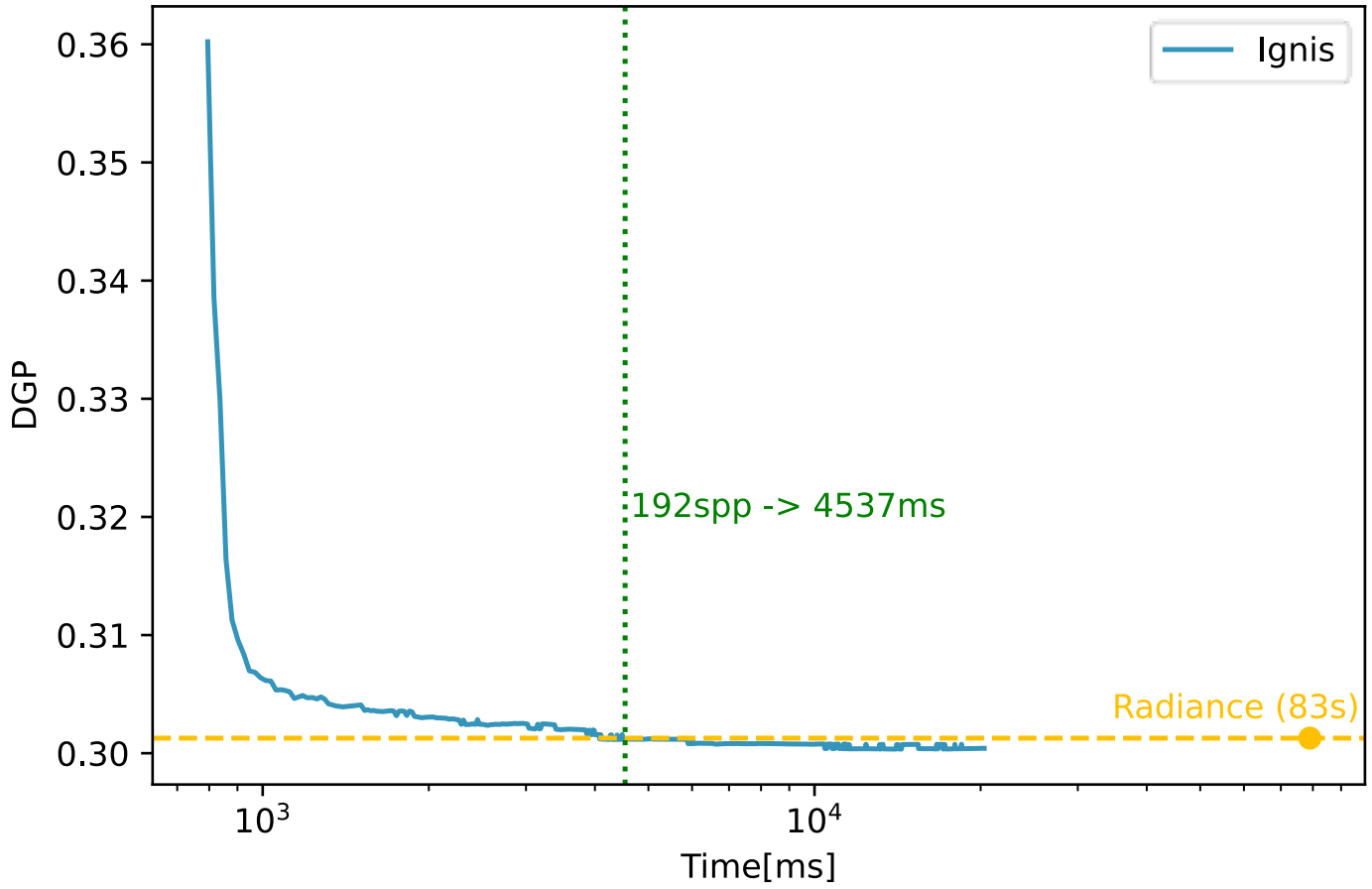


Evaluated on a Laptop with Intel i9-10885H CPU and NVIDIA Quadro T2000 GPU with Max-Q Design

DGP Evaluation



Laboratory



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Outlook

Peak Extraction

- Our handling of peaks is just brute-force
- Make it smarter!
- Peak extraction using better BSDF representations?
- Path Guiding?

Performance

- We want Realtime!
- Make use of hardware accelerated raytracing

Thanks for listening!

Any Questions?

Feedback?

This project has received funding from Velux Stiftung project 1350.