

Ronald: A Multithreaded Path Tracing Renderer

SENG 475 Final Project

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<https://github.com/jayden-chan/ronald>

August 15 2022

What is Path Tracing?

- ▶ Computer graphics technique for creating photo realistic renderings

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- ▶ Monte Carlo integration

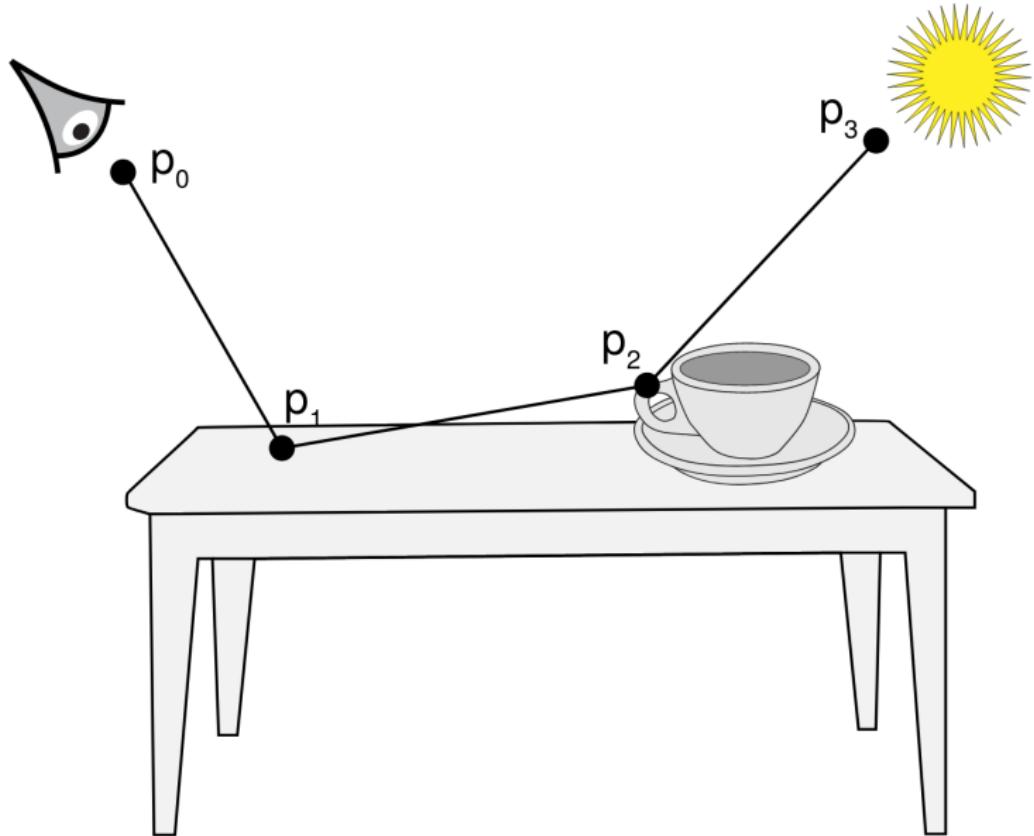
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- ▶ Based on the physical characteristics of light and the world (PBR)

What is Path Tracing?

- ▶ Computer graphics technique for creating photo realistic renderings
- ▶ Monte Carlo integration
- ▶ Based on the physical characteristics of light and the world (PBR)
- ▶ Very slow

What is Path Tracing?



What is Path Tracing? – The Rendering Equation

$$L_o(\mathbf{x}, \omega_o, \lambda, t) = L_e(\mathbf{x}, \omega_o, \lambda, t) + \int_{\Omega} f_r(\mathbf{x}, \omega_i, \omega_o, \lambda, t) L_i(\mathbf{x}, \omega_i, \lambda, t) (\omega_i \cdot \mathbf{n}) d\omega_i$$

Industrial Path Tracers

RENDERMAN



AUTODESK Arnold



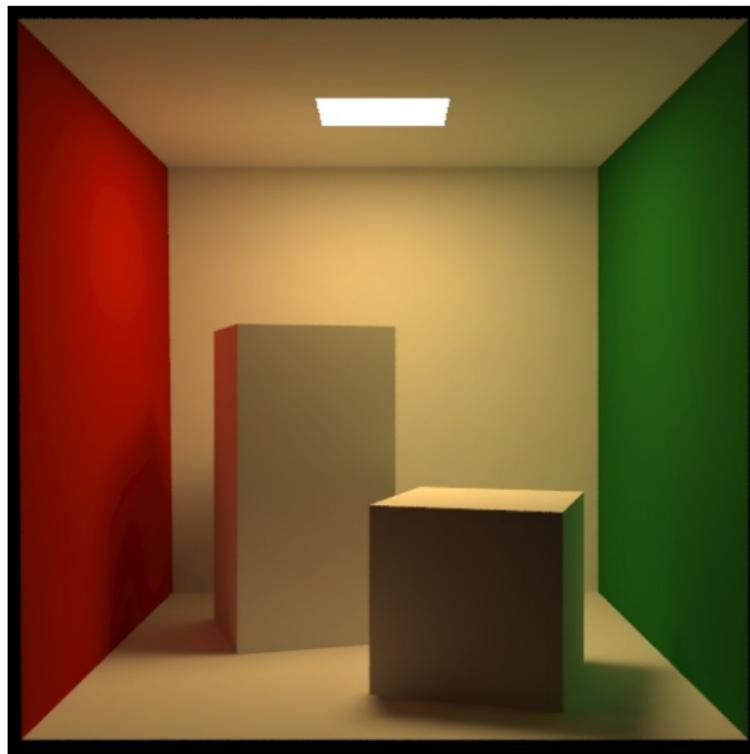
Industrial Path Tracers

RENDERMAN



The Cornell Box

POVRay rendering of the famous Cornell Box scene



The Cornell Box

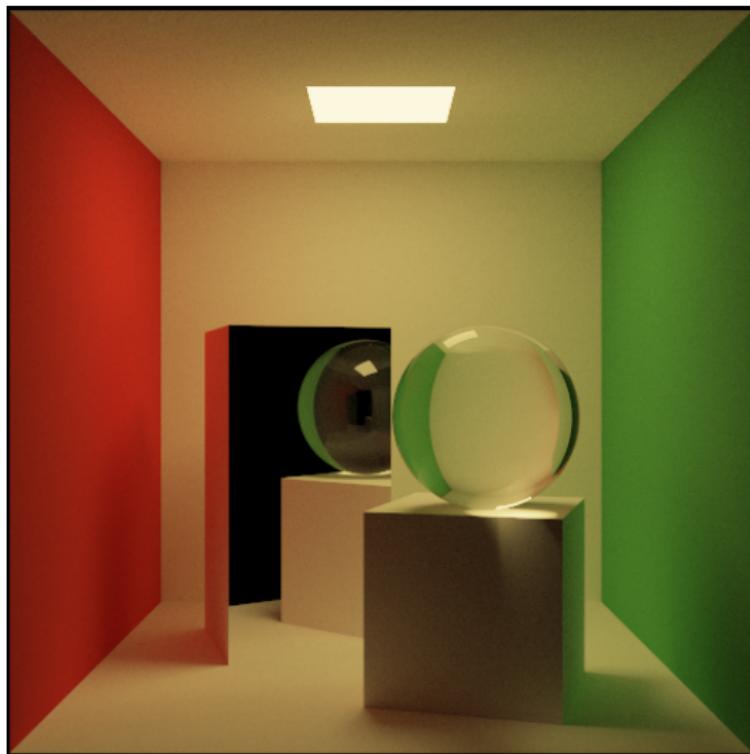
Left: POVRay reference render

Right: My rendering



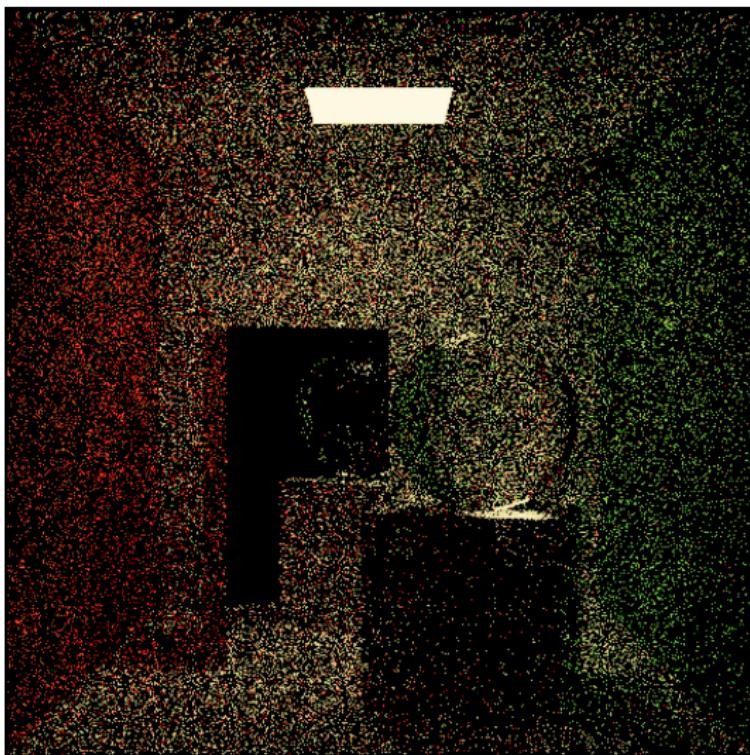
Example: Monte Carlo Integration Convergence

Samples: 45000



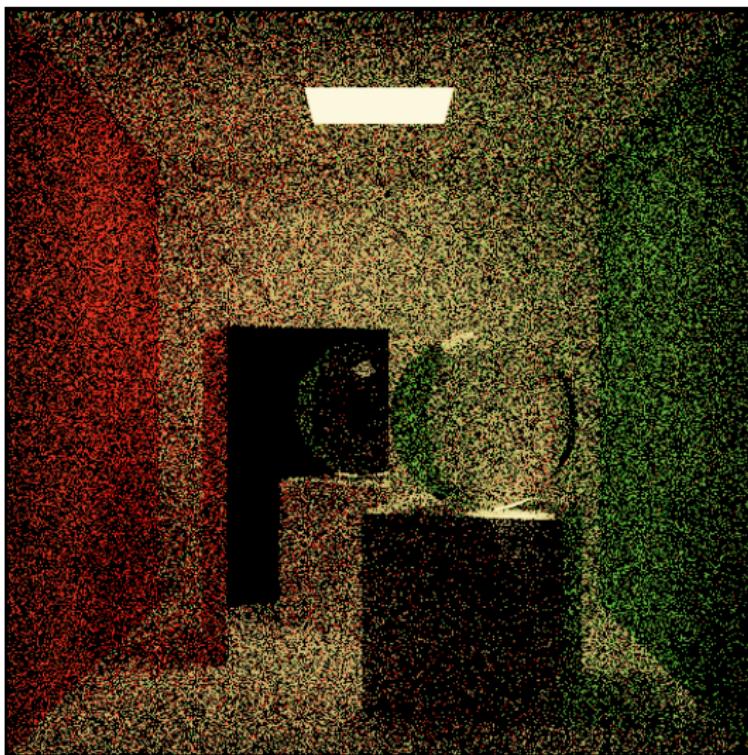
Example: Monte Carlo Integration Convergence

Samples: 10



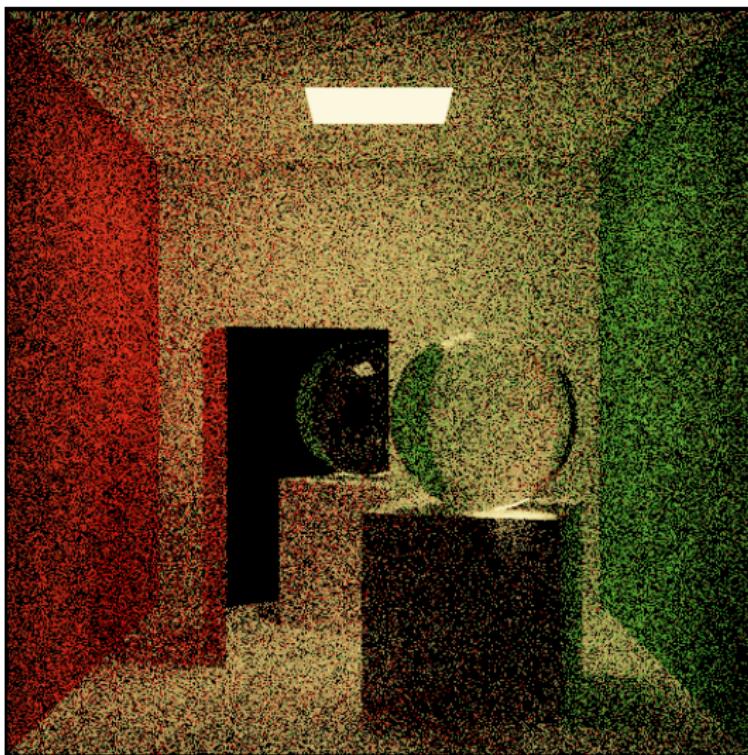
Example: Monte Carlo Integration Convergence

Samples: 25



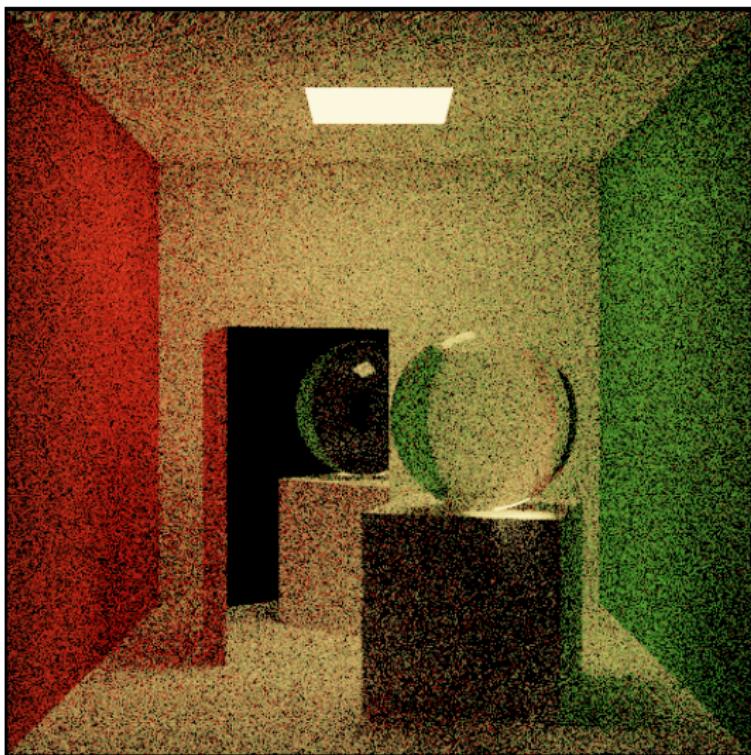
Example: Monte Carlo Integration Convergence

Samples: 50



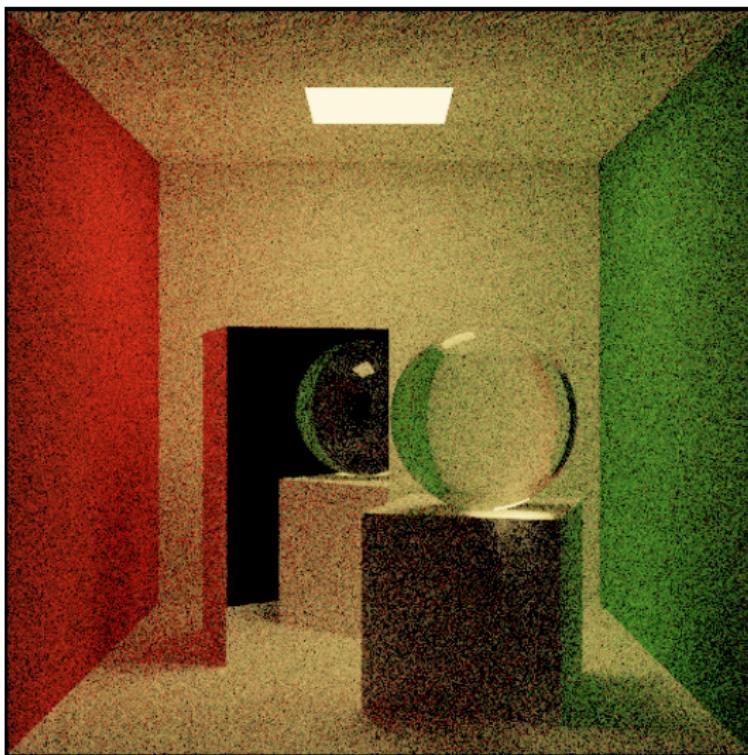
Example: Monte Carlo Integration Convergence

Samples: 100



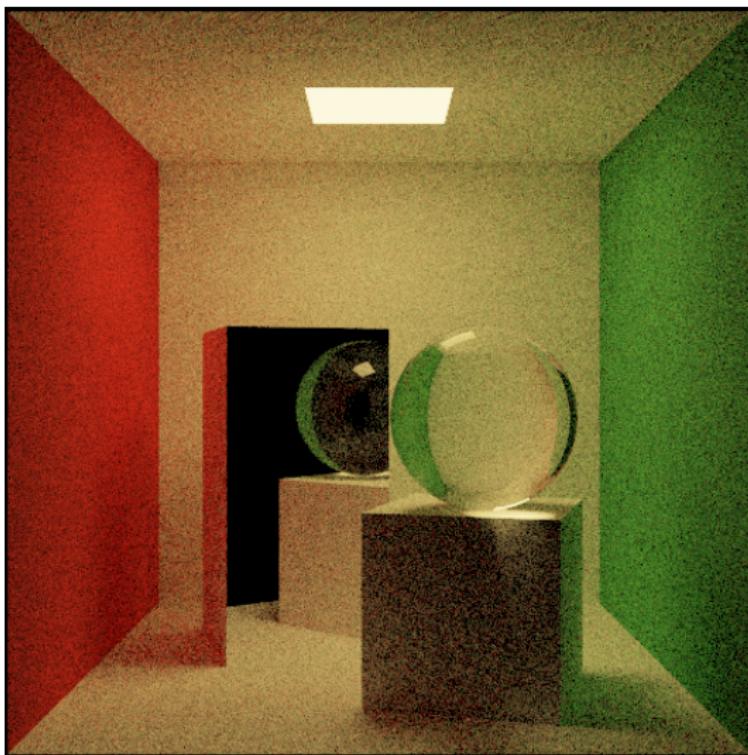
Example: Monte Carlo Integration Convergence

Samples: 200



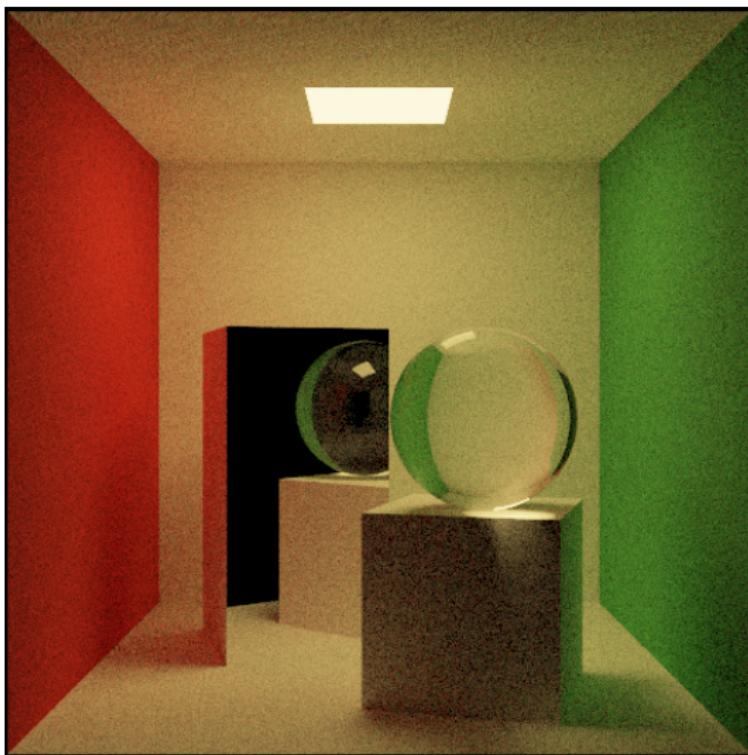
Example: Monte Carlo Integration Convergence

Samples: 500



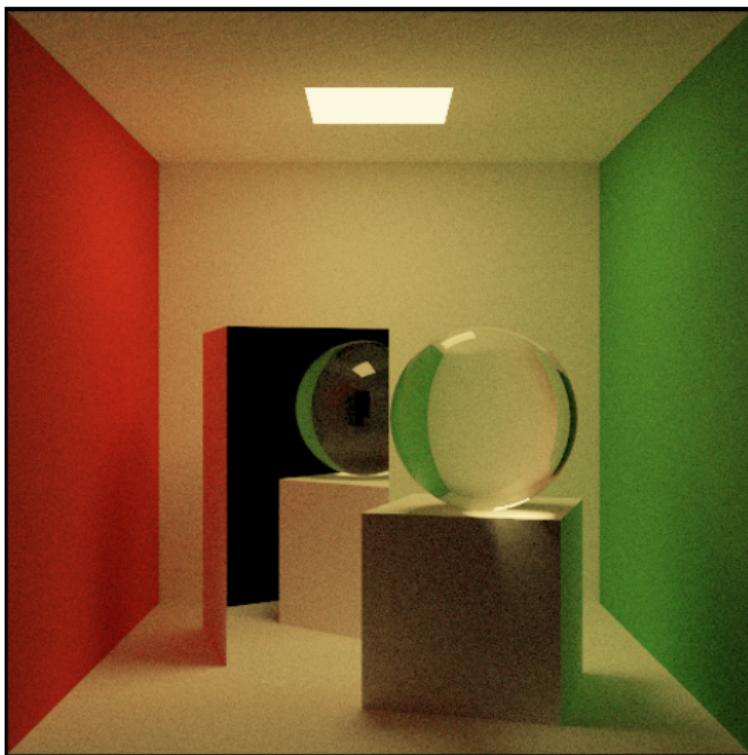
Example: Monte Carlo Integration Convergence

Samples: 1300



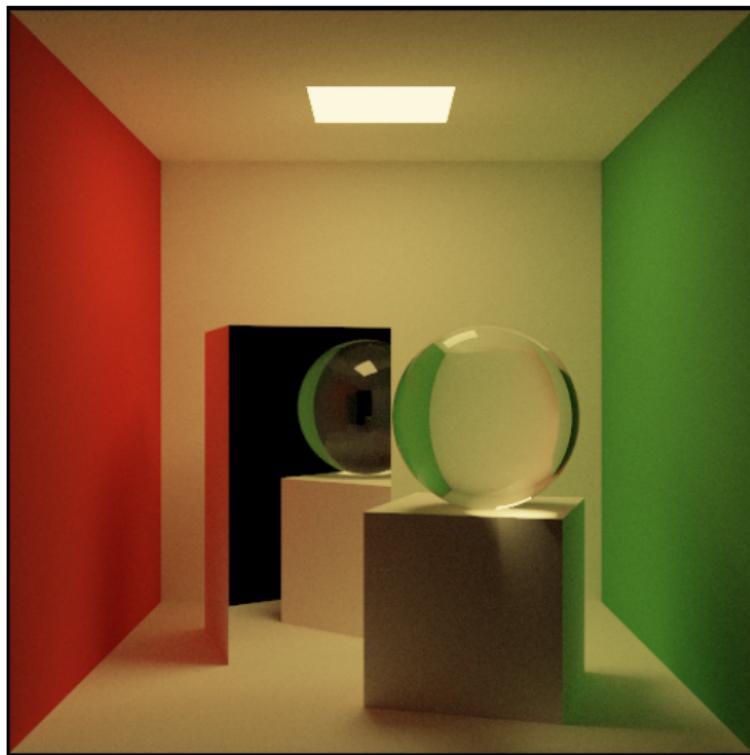
Example: Monte Carlo Integration Convergence

Samples: 3000



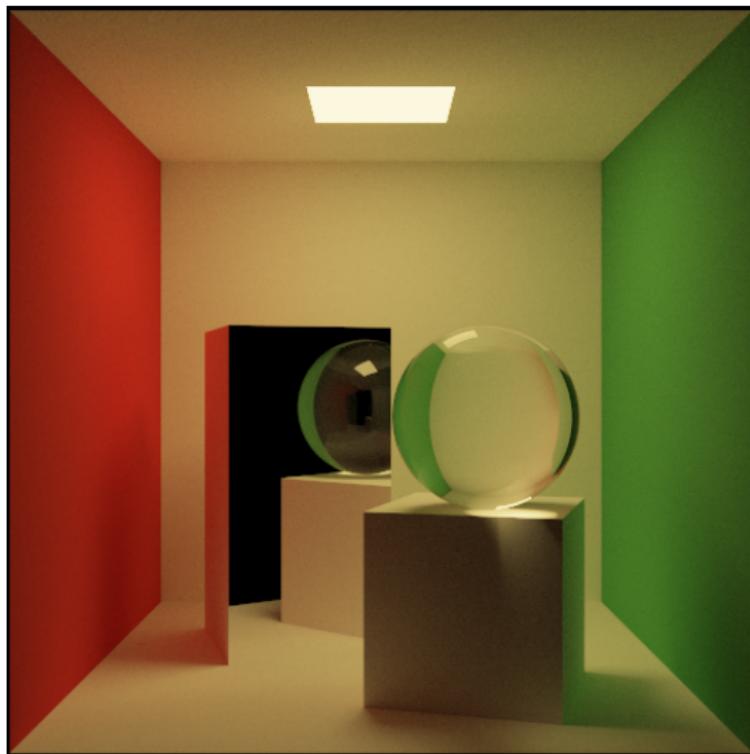
Example: Monte Carlo Integration Convergence

Samples: 15000



Example: Monte Carlo Integration Convergence

Samples: 45000

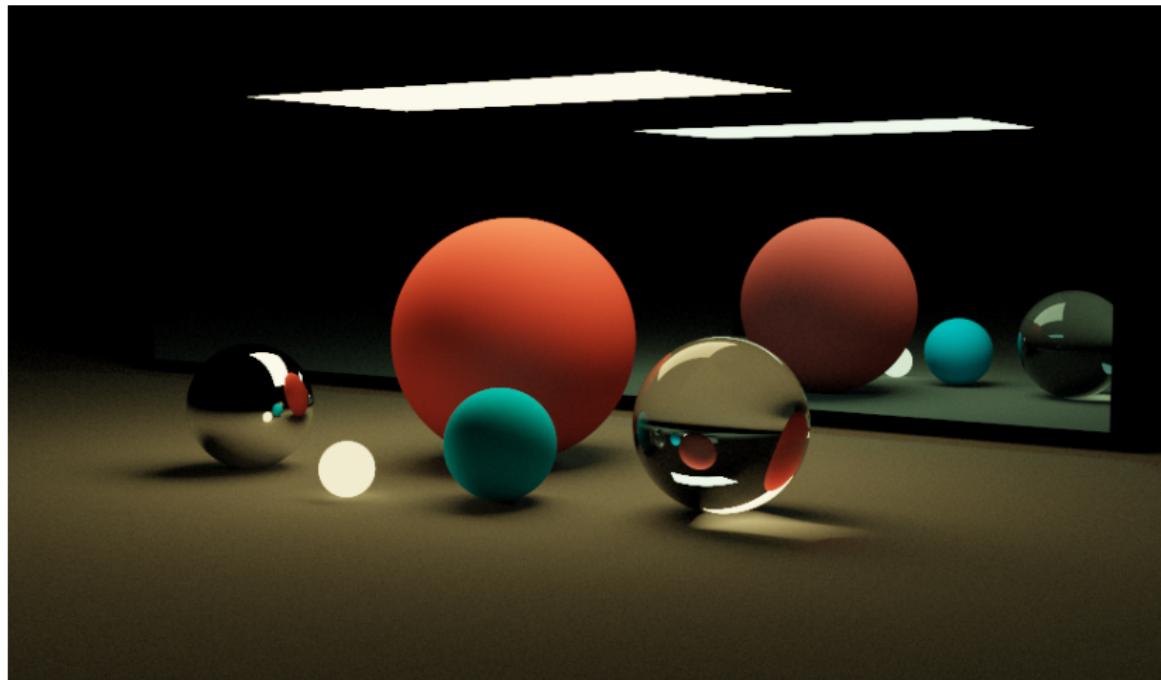


Showcase: Spheres and Mirrors

Samples: 24000

Resolution: 874x512

Scene file: `../tests/scenes/spheres.jsonc`

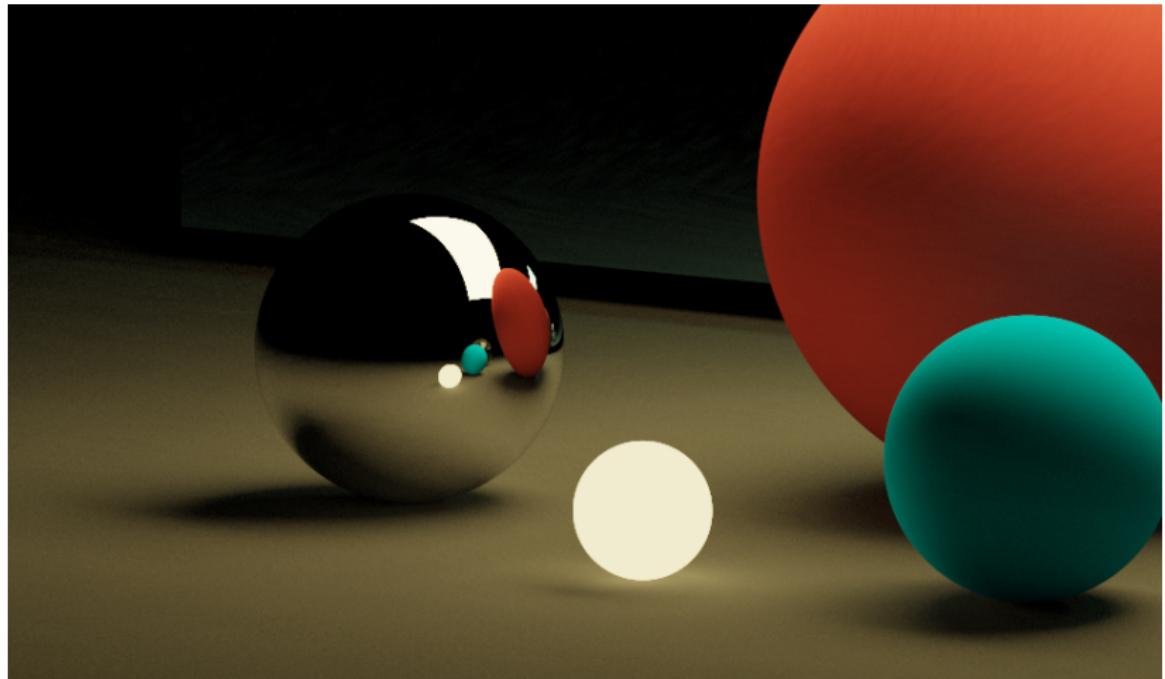


Showcase: Spheres and Mirrors (Zoomed)

Samples: 16000

Resolution: 874x512

Scene file: `../tests/scenes/spheres.jsonc`

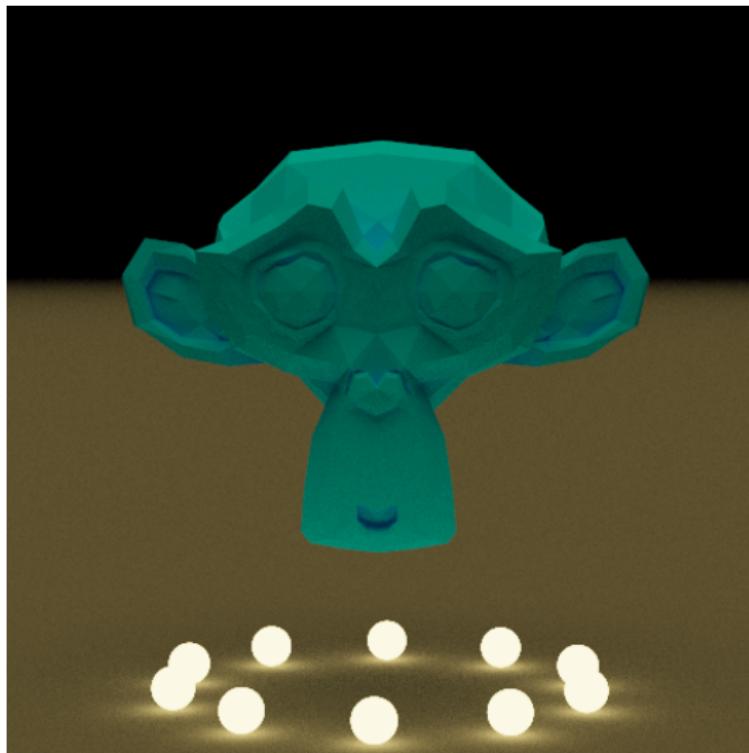


Showcase: Suzanne Test Model

Samples: 4000

Resolution: 512x512

Scene file: [../tests/scenes/monkey_front.jsonc](#)



Showcase: Suzanne Test Model in Glass

Samples: 15000

Resolution: 512x512

Scene file: [../tests/scenes/monkey.jsonc](#)

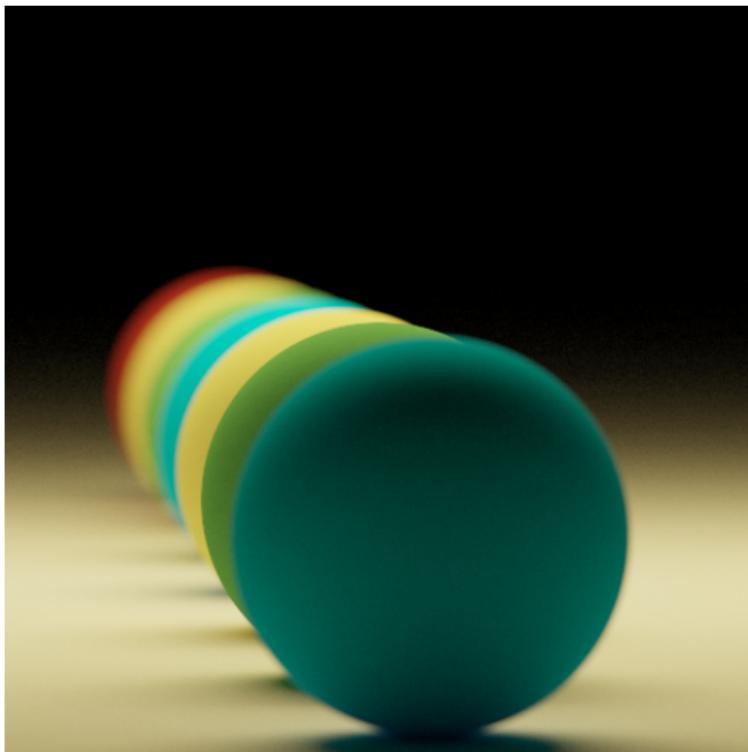


Showcase: Camera Aperture

Samples: 32000

Resolution: 512x512

Scene file: `../tests/scenes/spheres_dof.jsonnc`



Demo