State of the Art in Photon Density Estimation
(S)PPM in LuxRender

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Version 1.0RC3

Released on July 30th, 2012 - Licensed under GPL v3 - www.luxrender.net - Artwork by Mourelas Konstantinos
LuxRender Details

- Fork of PBRT I
- GPL v2 Software
- C++ on Linux, Windows, Mac OsX, (Android?)
LuxRender Features

- Concurrency (GPU, Threading, Networking)
- Bidirectional MLT path tracing
- Integration with many modeling tools
- Complex materials
- Volumetric rendering
- Resuming
- Light Groups
- Spectral Rendering
- ...

...
Design Choices

- Statistics-less radius reduction heuristic
- Eye pass first, photon pass next
- Global radius
- Hash Grid for photon density estimation
Memory Usage Discussion

Storing HitPoints + Using BSDF HitPoints ⇒ Memory usage
1080p matte material scene = 500 MB of BSDF
Photon BSDF or HitPoint BSDF?
Atomic HashGrid - Init

Hash Cells

Jump List
Atomic HashGrid - Insert

HitPoint 0
Hash = 4

Hash Cells

Jump List
Atomic HashGrid - Insert

HitPoint 1
Hash = 8

Hash Cells

Jump List
Atomic HashGrid - Collision

HitPoint 2
Hash = 4

Hash Cells

Jump List
Global Radius Worse Case
Glossy Surface Handling

Camera

Diffuse  Glossy  Specular
Glossy Surface Handling
Glossy Surface Handling: Always Stores on Glossy
Glossy Surface Handling: Never Stores on Glossy
Glossy Surface Handling: Depends on User Threshold
Concurrent Issues

- Threading - Lot of synchronisations
- GPU - Hybrid Renderer
- Network - SPPM is stateful
Concurrency - Threading

- Store hitpoints on the scene
- Wait until each pixel had an associated hitpoint on the scene
- Build the hitpoint datastructure
- Wait until the structure is built
- Shoot Photons
- Wait until enough photons are stored
- Film
- HitPoint list
- Data-structure
SPPM process depends on pass number

- Nodes are independents and may do the same pass many times
- Nodes are governed by a master
Wavelength Sampling Issues
SPPM still have open research issues

- Handling of glossy materials (MIS?)
- Stateless rendering
- Initial radius heuristic
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Questions ?

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