

Stochastic Progressive Photon Mapping

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March 7th 2013

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Introduction

Photon Mapping
(PM)

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(PPM)

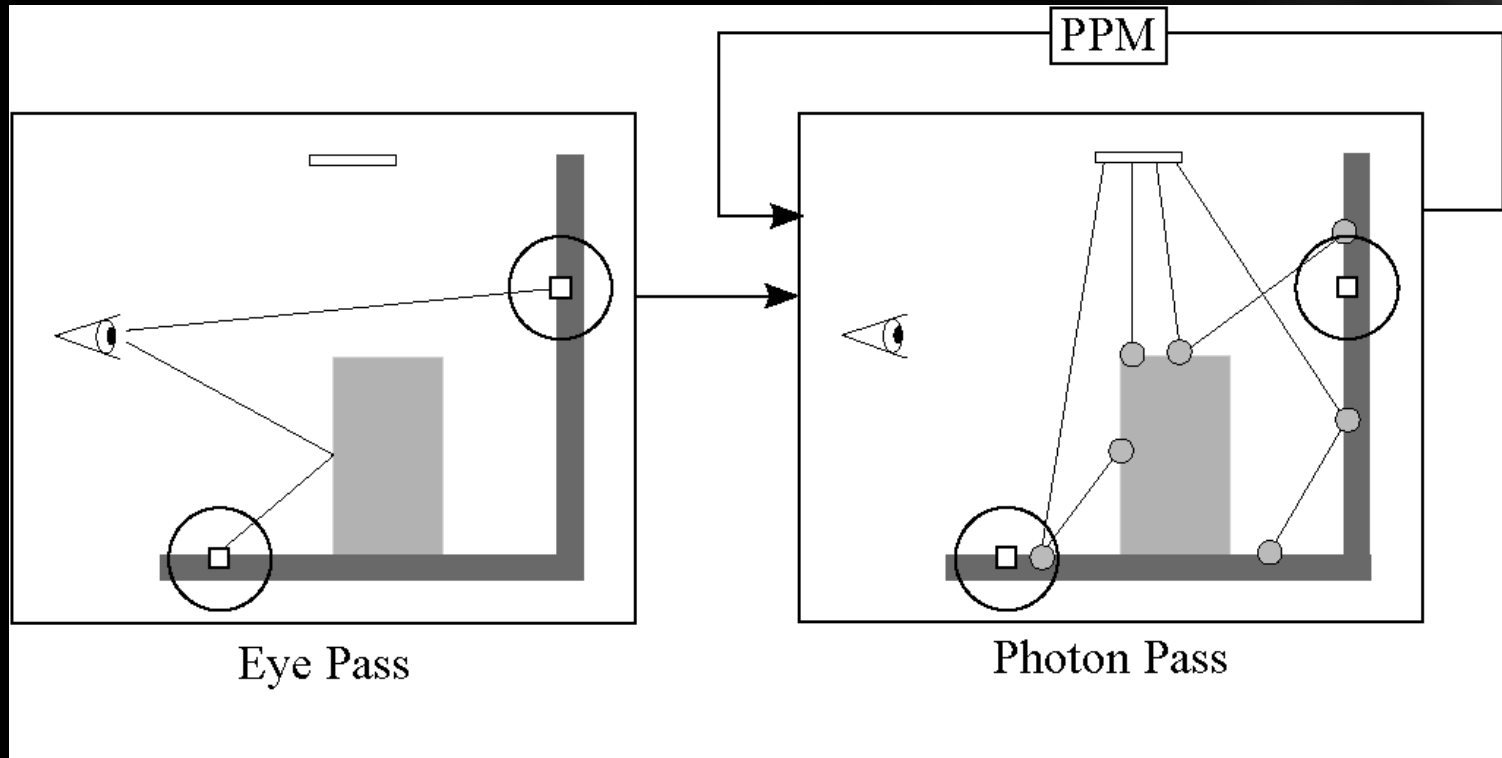
Stochastic Progressive Photon Mapping
(SPPM)

Progressive Photon Mapping

Multi-pass photon mapping algorithm

Progressive Photon Mapping, Hachisuka et al., 2008

Progressive Photon Mapping



Progressive Photon Mapping

First pass: Ray tracing to find all visible surfaces

Bounce ray until the first non-specular bounce is seen

Progressive Photon Mapping

Other passes: Photon tracing passes

Emit photons into the scene

Loop over all ray trace hitpoints

- Find all photons within search radius

- Use photons in radius to refine the radiance value in the ray trace hitpoint

Progressive Photon Mapping

Other passes: Photon tracing passes

Search radius is reduced after each photon pass

No need to keep photon map after each photon pass

PPM - Strengths

Robust with complex caustic illumination

More efficient than Monte Carlo methods

Progressive radiance estimate converges to correct solution as more photons are added



PPM - Weaknesses

Radiance estimation on one point

Increase in render time

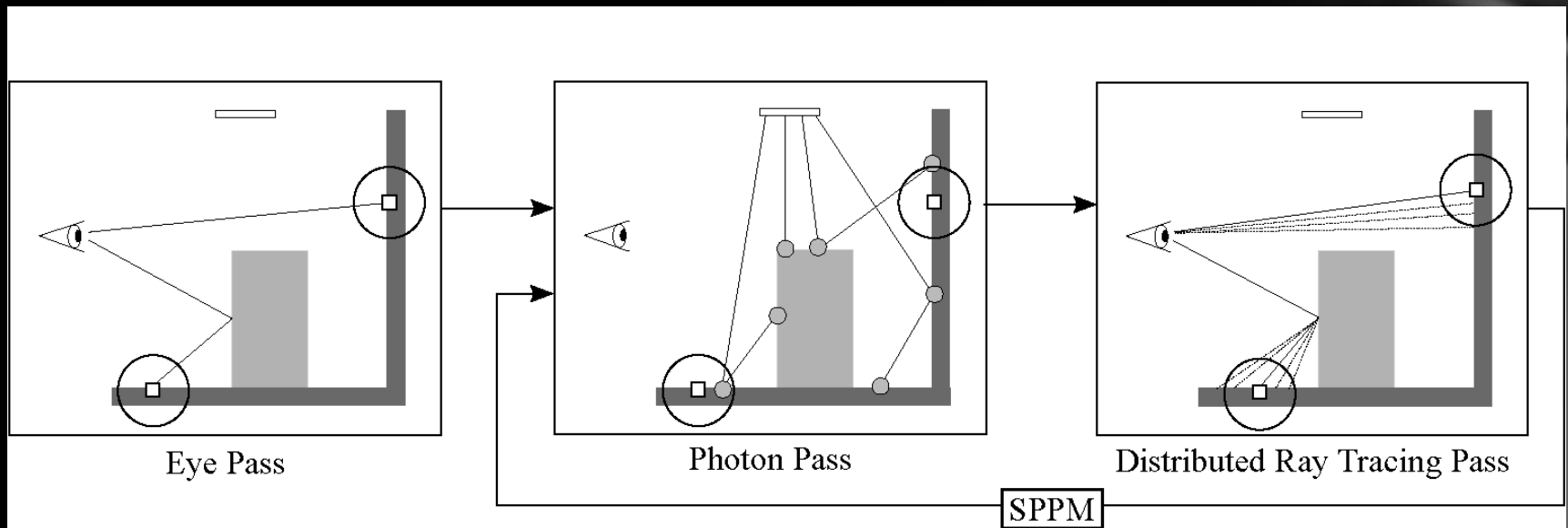
- PM 1 hour
- PPM 4 hours

Stochastic PPM

Computes the correct average radiance value for a region, instead of a point with PPM

Stochastic Progressive Photon Mapping,
Hachisuka and Jensen, 2009

Stochastic PPM



Stochastic PPM

PPM calculates radiance for points

Average radiance over a region needed for distributed ray tracing effects.

Use shared statistics over the ray tracing region.

Stochastic PPM

Use randomly generated points in the distributed ray trace region

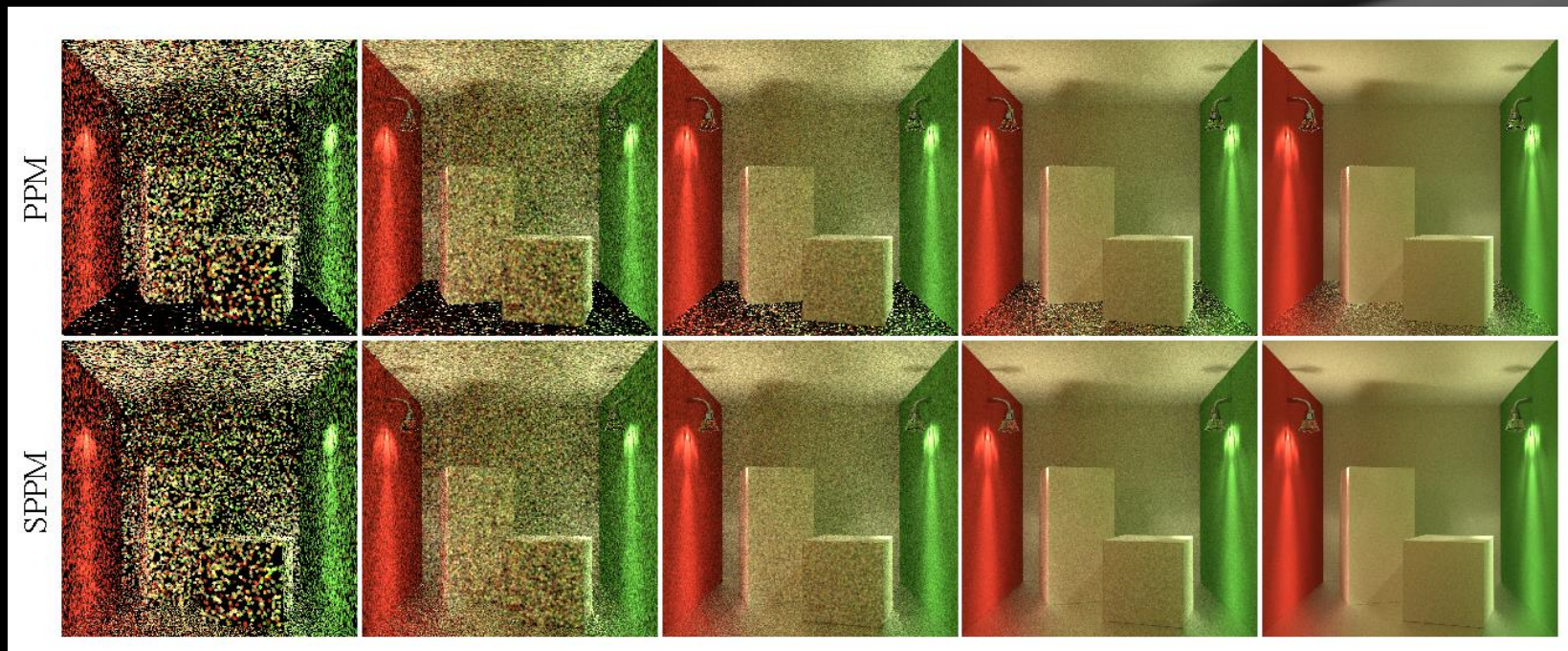
Shared radius over the distributed ray trace region

SPPM - Strengths

Radiance estimation over a region

Robust with distributed ray tracing effects

Less passes for better result



SPPM - Weaknesses

Rendering time ~10% longer than PPM

Limited to surface

More biased - leads to blurriness

Shadow leaks



Future research

Radiance estimation within a volume

- Illuminate medium

Function to determine of required photons

Dynamic SPPM

[http://www.rendering.ovgu.de/rendering_media/downloads/publications/DSP
PM-p-374.pdf](http://www.rendering.ovgu.de/rendering_media/downloads/publications/DSP_PM-p-374.pdf)

Conclusion

Adds distributed ray tracing pass

+Deals with motion blur and depth of field

+Reduces the noise

-Shadow leaks

-Biased

Demo

Result after 4,5 hours

