

Final Gathering using Ray Differentials



IMM/DTU

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Previous Work

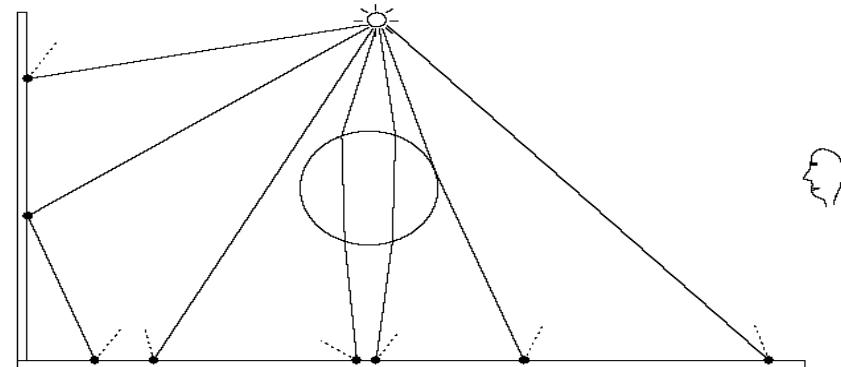
- Goral, C. M., Torrance, K. E., Greenberg, D. P., Battaile, B., Modelling the Interaction of Light Between Diffuse Surfaces, International Conference on Computer Graphics and Interactive Techniques, 1984
- Kajiya, J. T., The Rendering Equation, Computer Graphics, 1986
- Jensen, H. W., Christensen, N. J., Photon Maps in Bidirectional Monte Carlo Ray Tracing of Complex Objects, Computers & Graphics, 1995
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- Christensen, P. H., and Batali, D., An Irradiance Atlas for Global Illumination in Complex Production Scenes, Rendering Techniques 2004 (Proceedings of the Eurographics Symposium on Rendering 2004), pp. 133-141. Eurographics / ACM, 2004
- Christensen, P. H., Adjoints and Importance in Rendering: an Overview, IEEE Transactions on Visualization and Computer Graphics (TVCG), volume 9, number 3, pp. 329-340, 2003
- Fan, S., Chenney, S., and Lai, Y., Metropolis Photon Sampling with Optional User Guidance, Eurographics Symposium on Rendering, 2005
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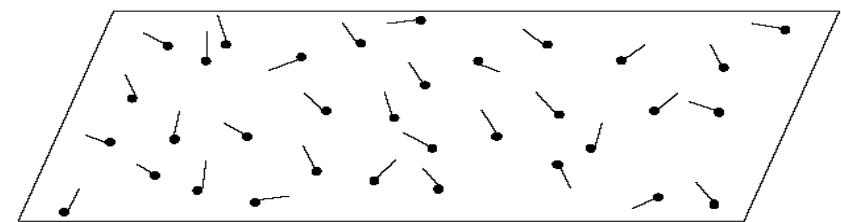
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Final Gathering

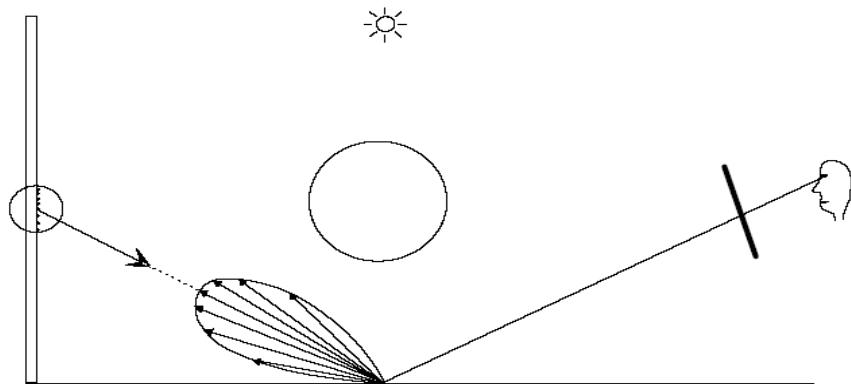
- Emit photons



- Store photons



- Do final gathering



Previous Work

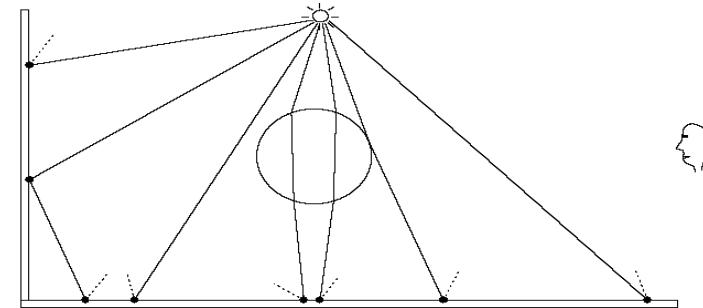
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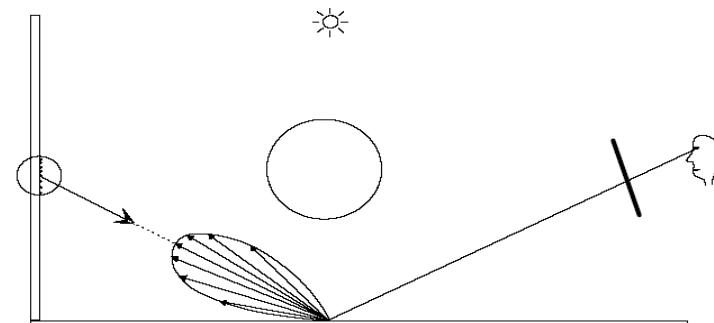
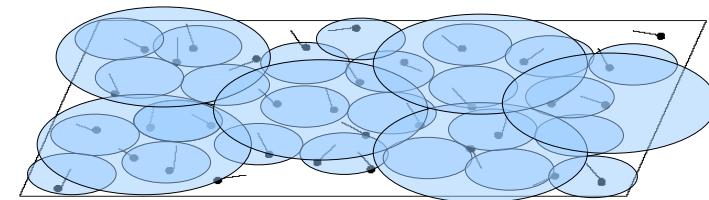
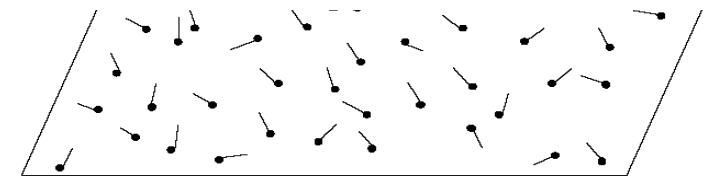
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Method outline [1/3]

- Emit photons

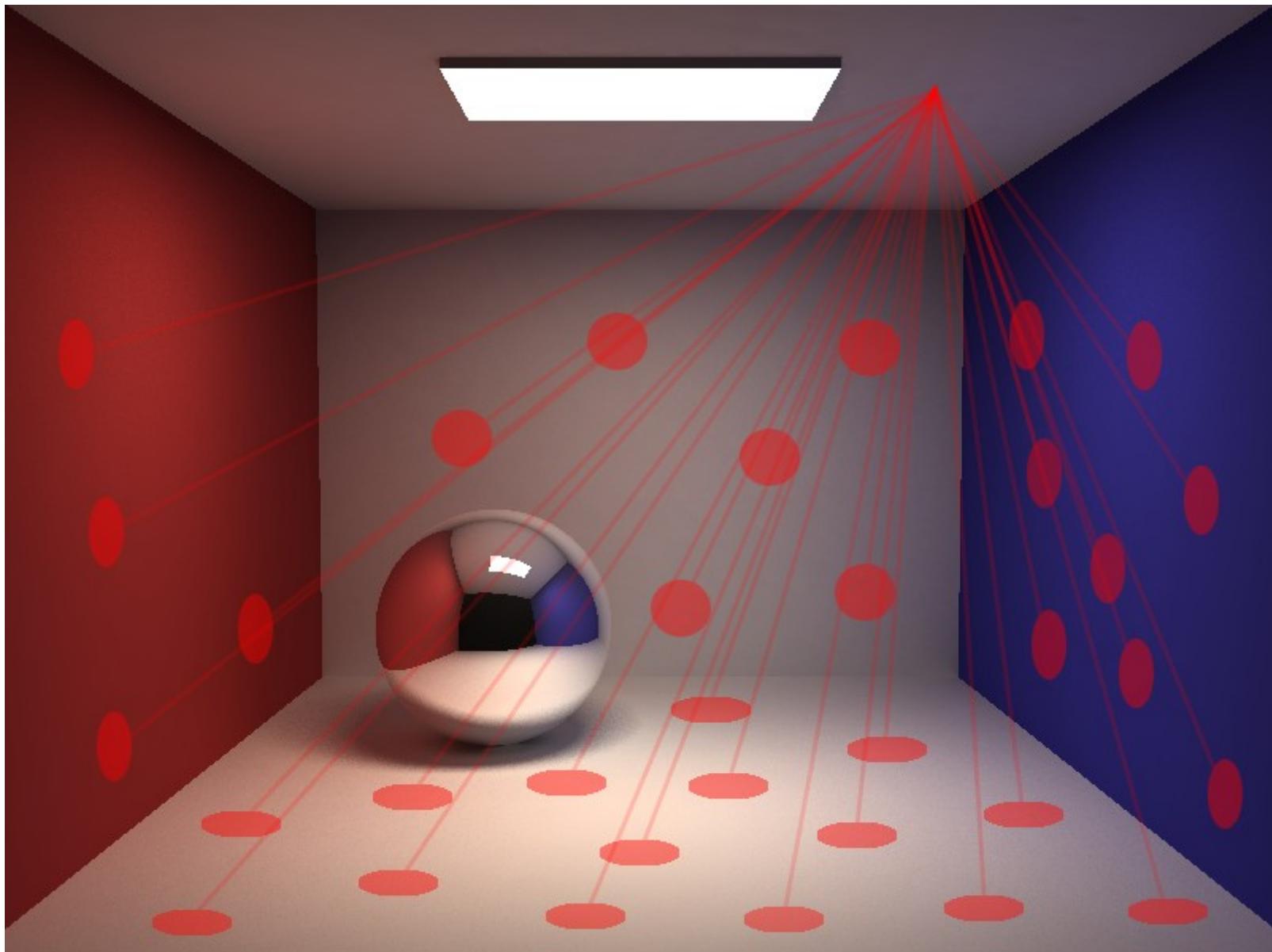


- Store photons
- Create irradiance estimate mipmap
- Do final gathering
 - Estimate footprint of rays using ray differentials



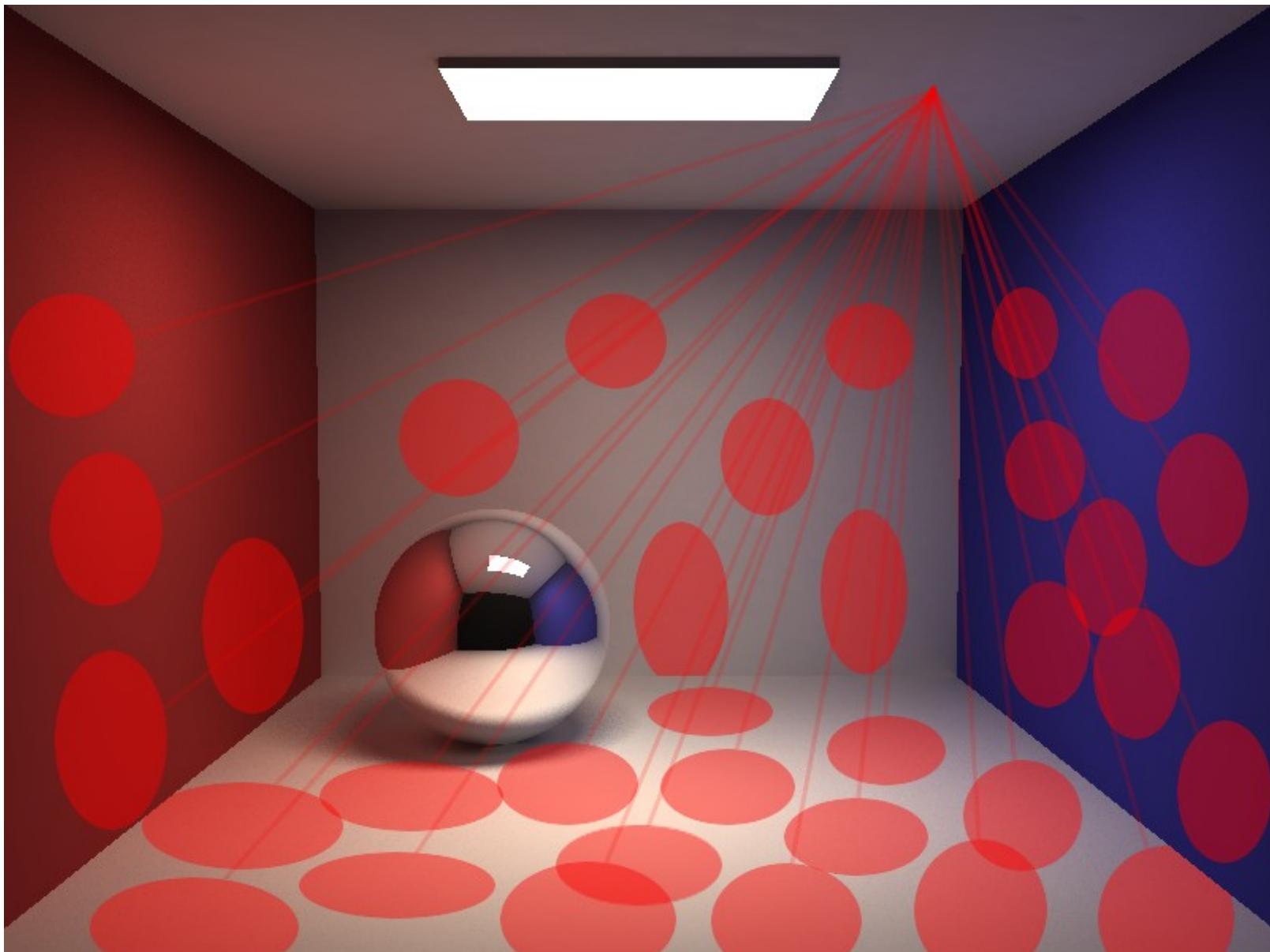
Method outline [2/3]

- Using fixed (regular) sampling areas

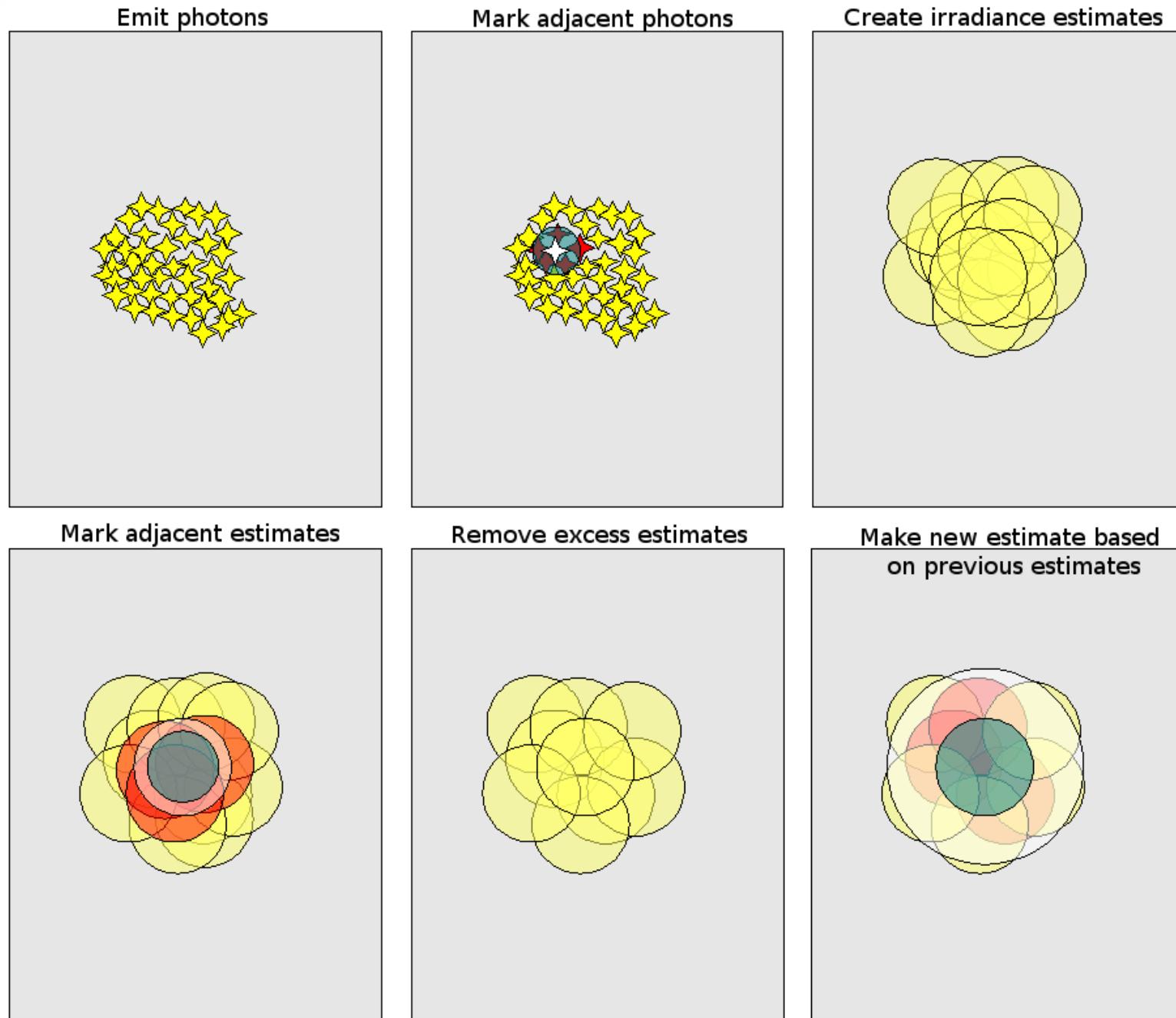


Method outline [3/3]

- Using estimated sampling areas

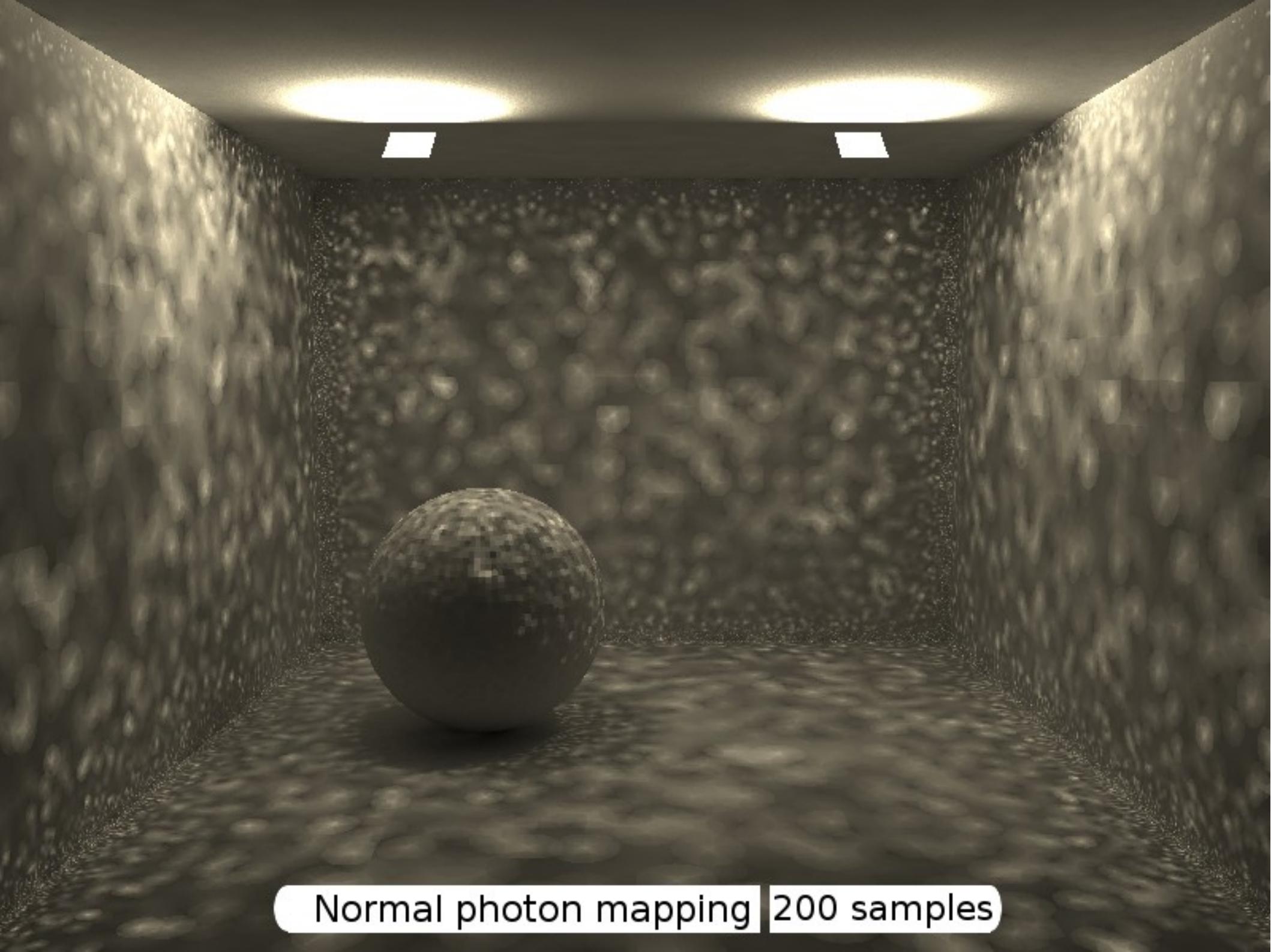


Irradiance estimate mipmap

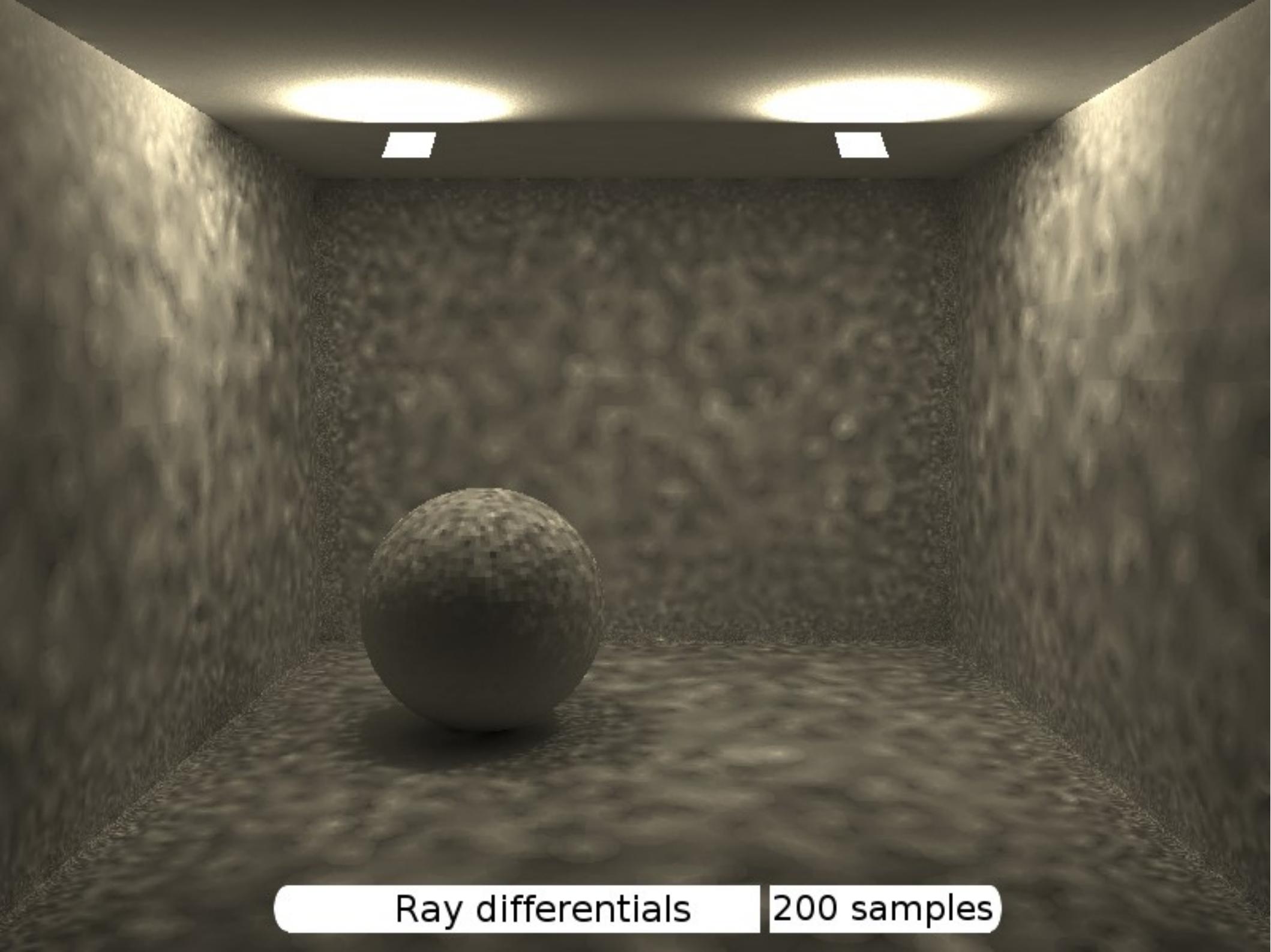


Sampling

- Regular sampling in a cosine lobe
- Add ray differentials to rays
- Differentiated direction is dependent on angle of departure
- Footprint is dependent on
 - Incident angle
 - Distance travelled
- Irradiance is estimated by averaging mipmap

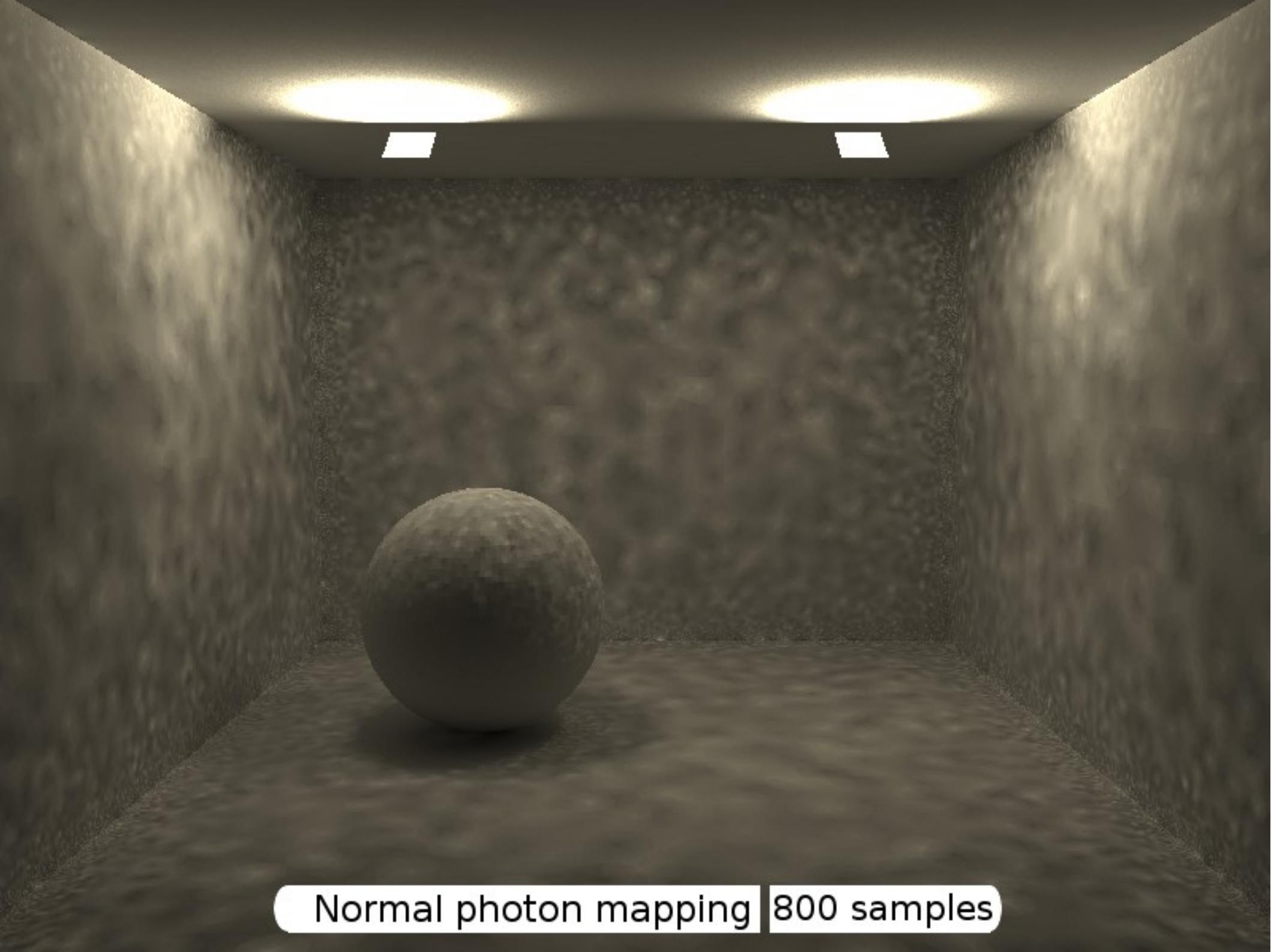


Normal photon mapping 200 samples

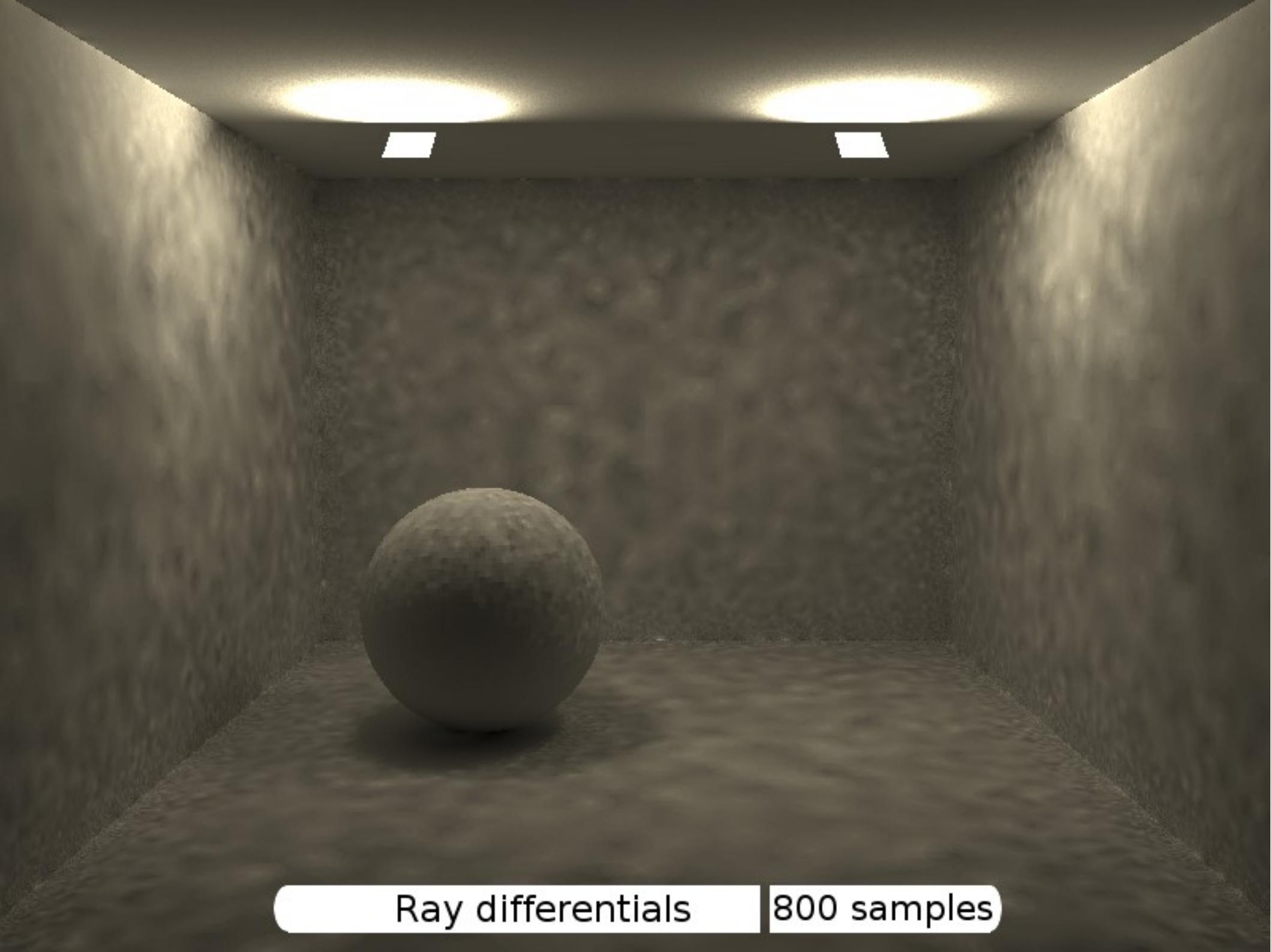


Ray differentials

200 samples



Normal photon mapping 800 samples



Ray differentials

800 samples

Discussion & Summary

- More precise than Irradiance Atlases
- May not be good for complex objects at long distances
- Can easily be combined with customized sampling methods
- Improved image quality with few samples
- Slightly improved speed