Advanced Computer Graphics

Ray Tracing Project - Project Presentation

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Technical Overview

- Motion Blur (Okulmus)
- Depth of Field (Spiss)
- Advanced Texture Mapping (Mildenberger)
- Extra Features
  - Acceleration Structures (Mildenberger)
  - Camera Control (Spiss)

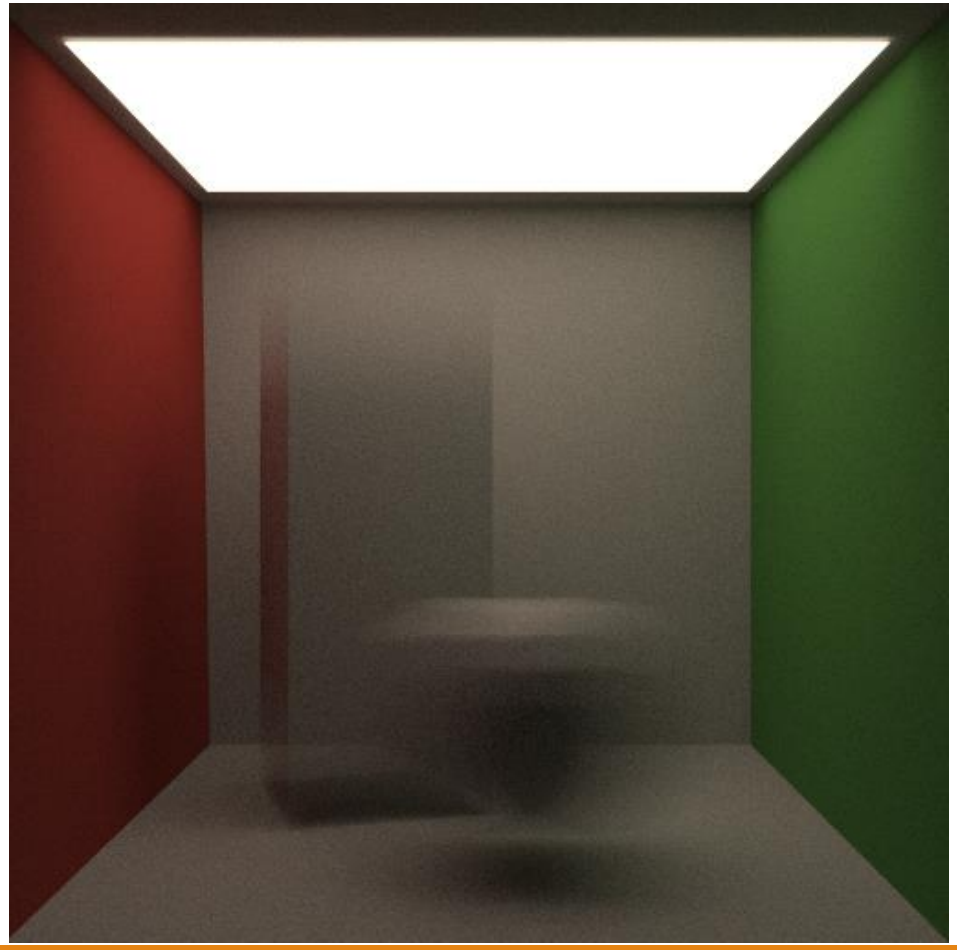
Motion Blur

- First effective solution for Ray Tracing by Cook et al. (1984)
- Idea: Distribute rays over time
- Implementation: Create Motion by creating multiple “time scene”

  Uniformly distribute rays over these scenes

- smallPTs super-sampling was extended, no additional rays are created.

Results Motion Blur

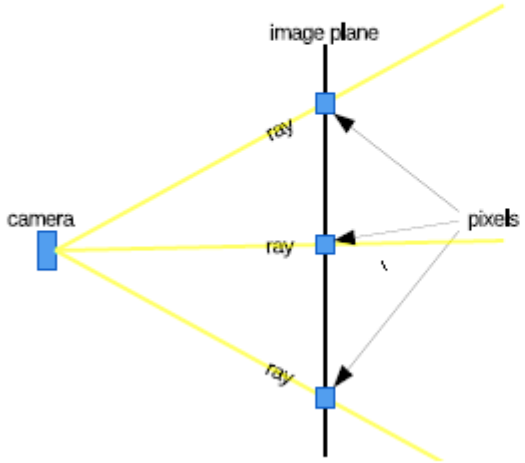


560 spp

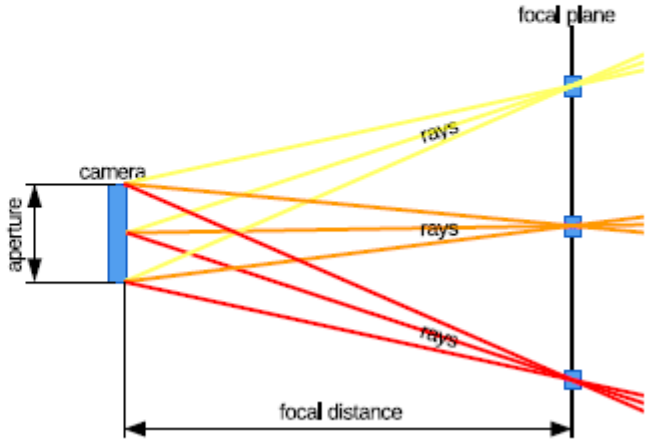
Depth of Field

- smallPT uses pinhole camera model → all objects in focus
- Thin-Lens camera model is more realistic → a focal point exists
- Only objects on focal plane are in focus, everything else is blurred

Pinhole model used in smallPT:

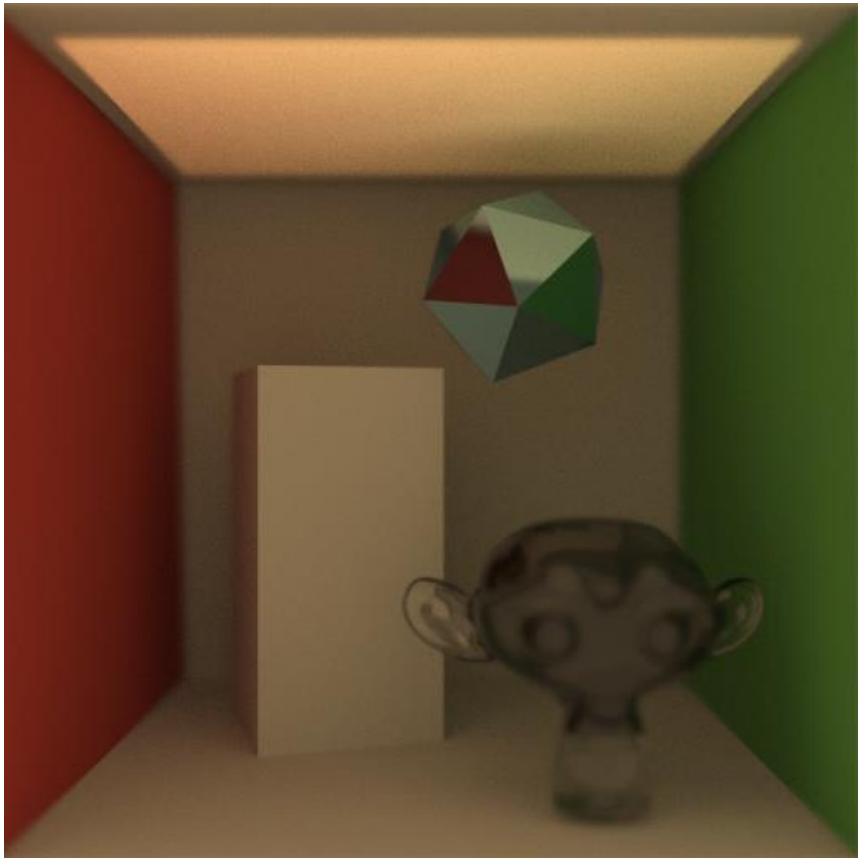


Depht of Field model used in project solution:



Depth of Field Result

1096 spp



1000 spp

Advanced Texture Mapping

- smallPT only allows uniform colour and reflection types (perfectly glossy, everywhere)
- New mapping methods:
  - Normal mapping allows normal transformation for every surface location
  - Texture mapping supplies colour information
  - Specular mapping defines the roughness of the surface (diffuse → mirror)

ATM Result

1000 spp

Extra Feature: Acceleration Structure

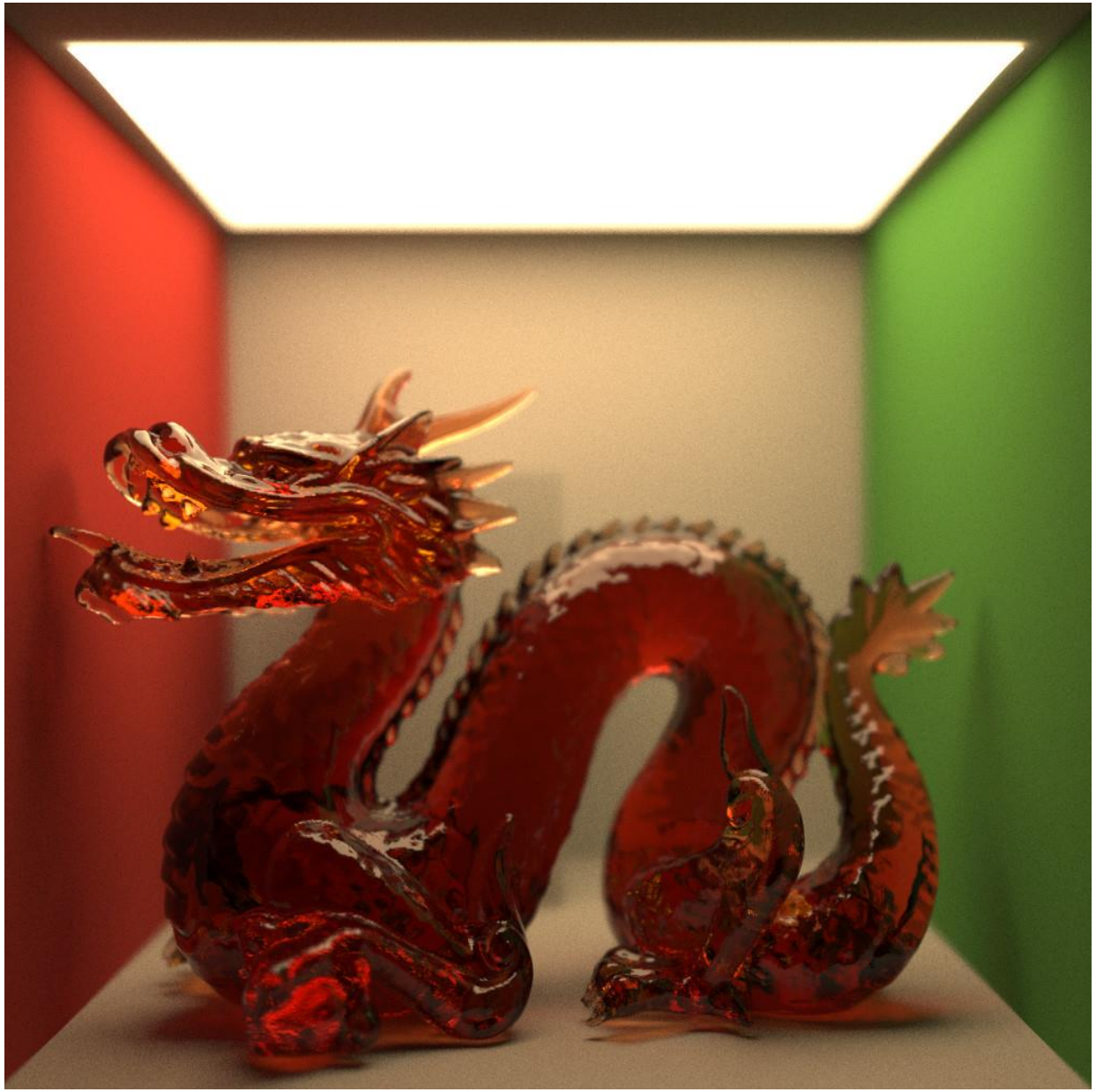
- Raytracing without acceleration techniques is very slow and inefficient
- Acceleration structures allow faster mesh intersection by reducing unneeded checks
- Implemented structures:
  - Bounding Boxes : Only one box for every object
  - Bounding Volume Hierarchy: Octree of Bounding Boxes: From complete scene down to each triangle

Extra Feature: Camera Control

- smallPT only has fixed camera position
- Our implementation allows easy change of:
  - Camera position
  - Camera direction
  - Field of view
  - Focal distance
- Example :

1000 spp

Thanks for listening



1024 spp