# Physically based rendering

## Progressive photon mapping

Kévin Bannier  Billel Hélali  Amaury Louarn

École Supérieure d'ingénieurs de Rennes
Université de Rennes 1

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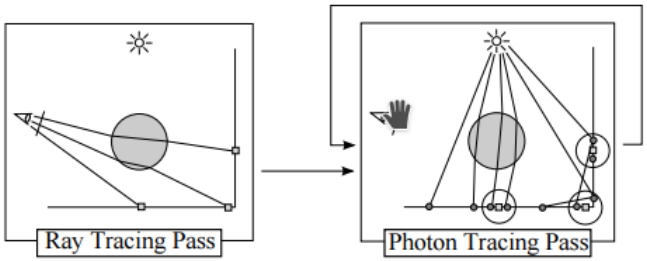
# Definition

- Photon mapping belongs to the family of the particle-tracing algorithms
- Constructing paths from the light onto the objects

- 2 stages:
  1. Generating and sending the photons, with arbitrary accuracy and without storing the full photon map
  2. Final gathering
- Repeat this principle several times and calculate the average picture

# More precisely




Multi-pass algorithm:

1. Ray tracing pass
   - ray tracing to find all the visible surfaces
2. Photon tracing passes
   - Every photon tracing increases the solution
   - Convergence to an optimal solution in infinite time

# Criteria of comparison

Several parameters for the progressive photon mapper:

**Photons per iteration:** The number of photons to be sent at each iteration

**Maximum depth:** The maximum depth of the final gathering rays

**Russian roulette starting depth:** The depth before starting to eliminate photons with the russian roulette algorithm

**Initial radius:** Initial photon query radius

# Photons per iteration

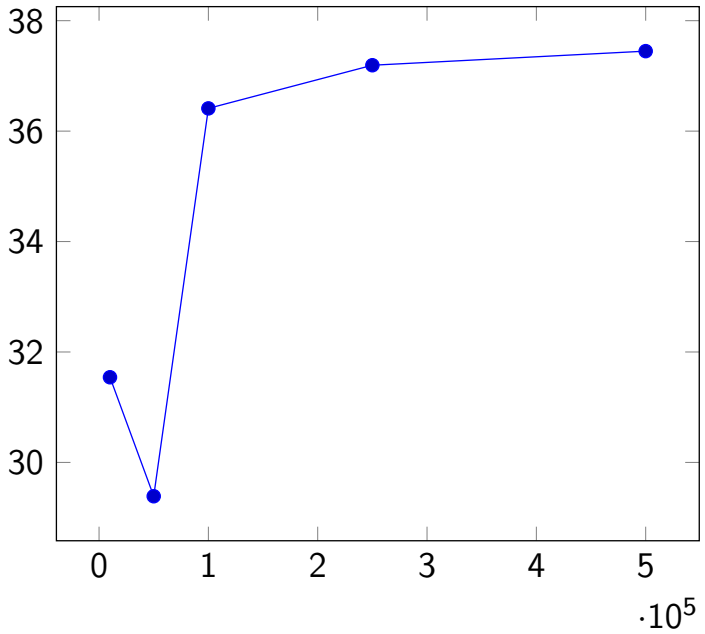



Figure: PSNR according to the number of photons per iteration

# Maximum depth

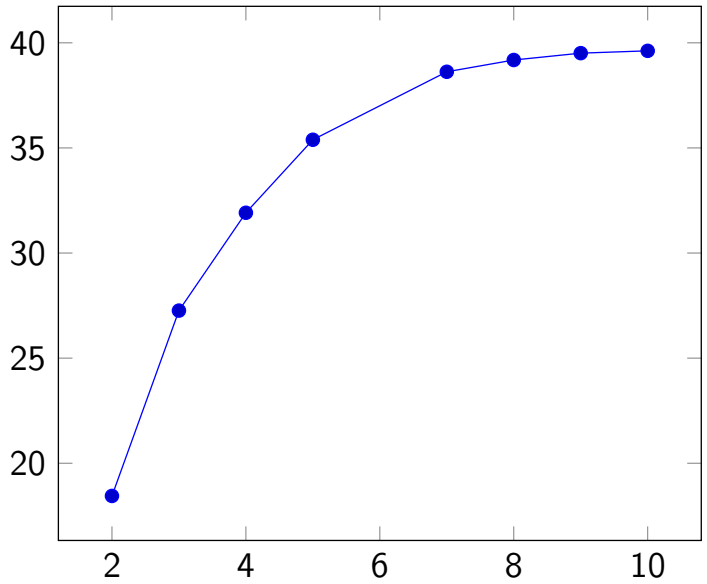



Figure: PSNR according to the maximum depth

# Initial radius

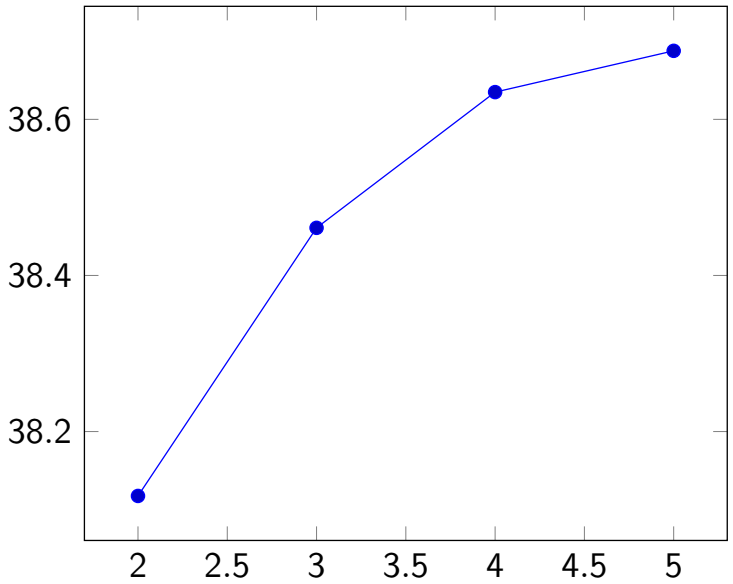



Figure: PSNR according to the initial radius

# Russian roulette starting depth

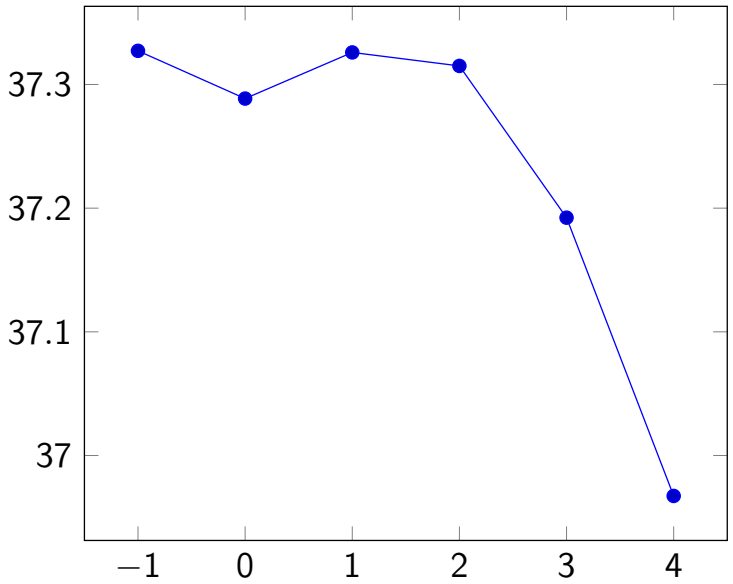


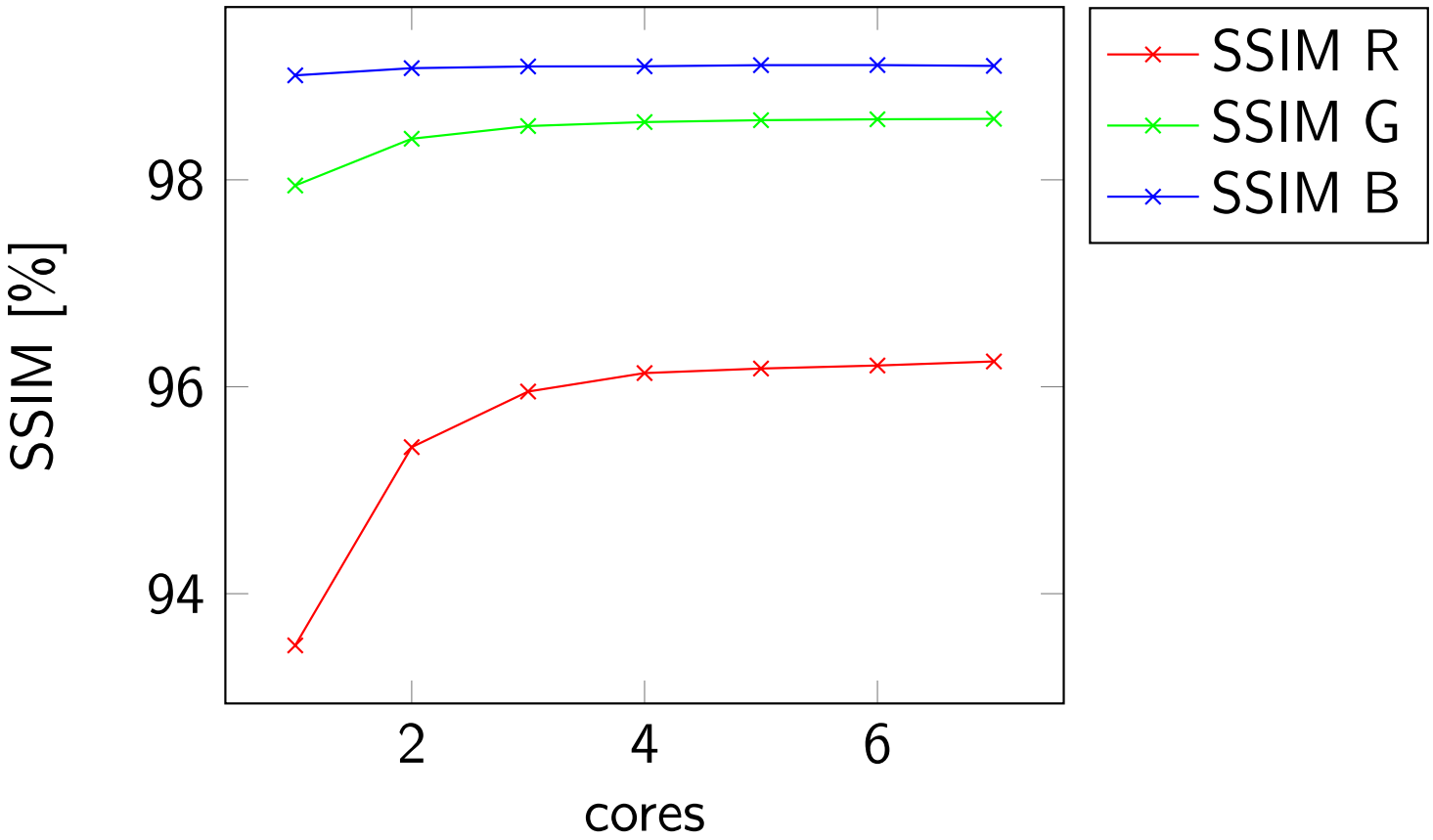

Figure: PSNR according to the russian roulette starting depth

# Context

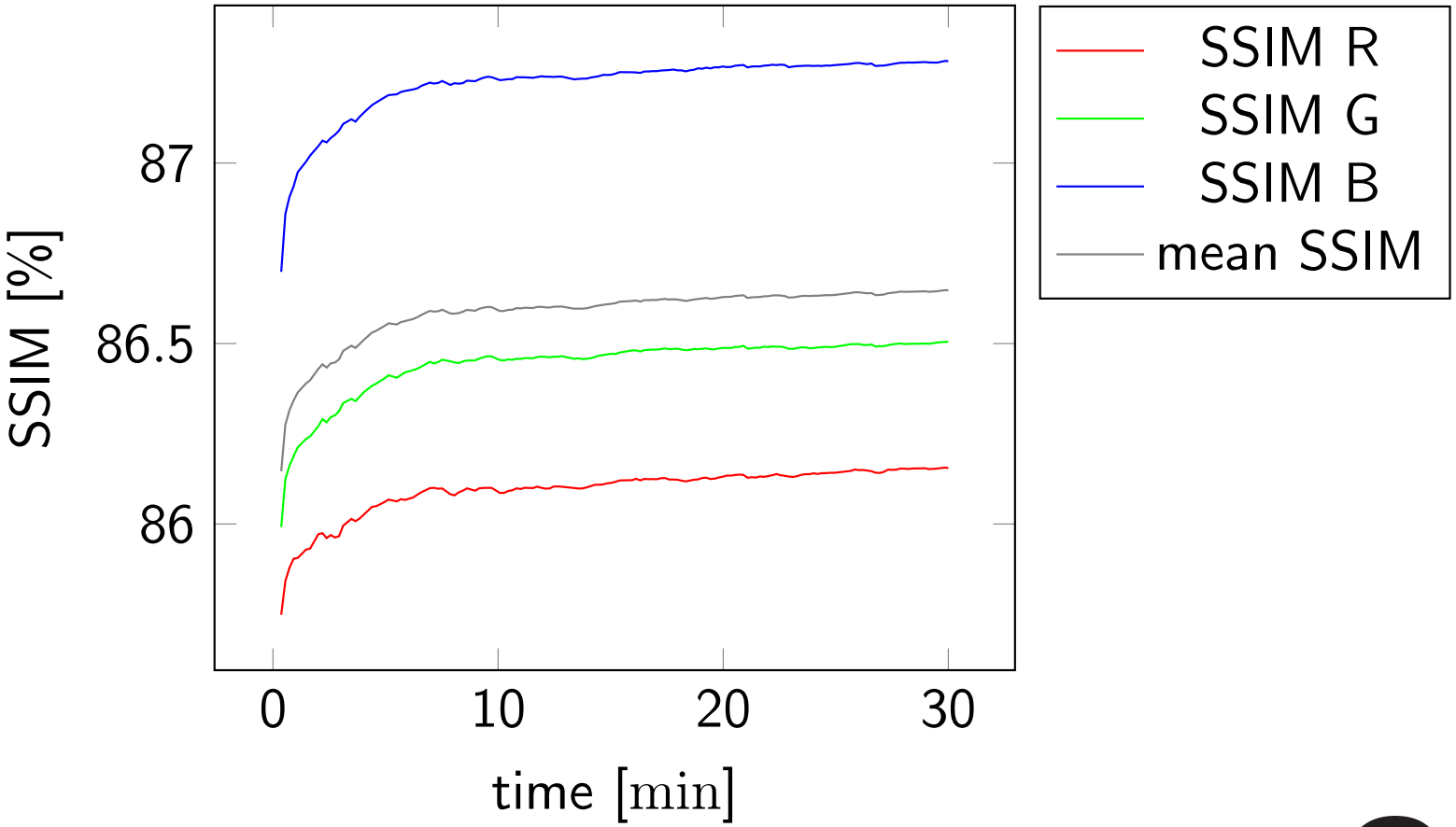
- Image rendering for the cinema (e.g special effects)
- Time-constrained rendering (each render must not take more than a specified amount of time)
- Possiblity of a render farm: the method must be scalable

- Signal-perfect images are not necessary:
  - Each image will not be on the screen for more than 1/24th of a second
  - (Often) presence of motion blur

# Scalability



# Perception by time



# Render process (1/4)

# Render process (2/4)

# Render process (3/4)

# Render process (4/4)