A Geometry-Based Soft Shadow Volume Algorithm Using Graphics Hardware

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and
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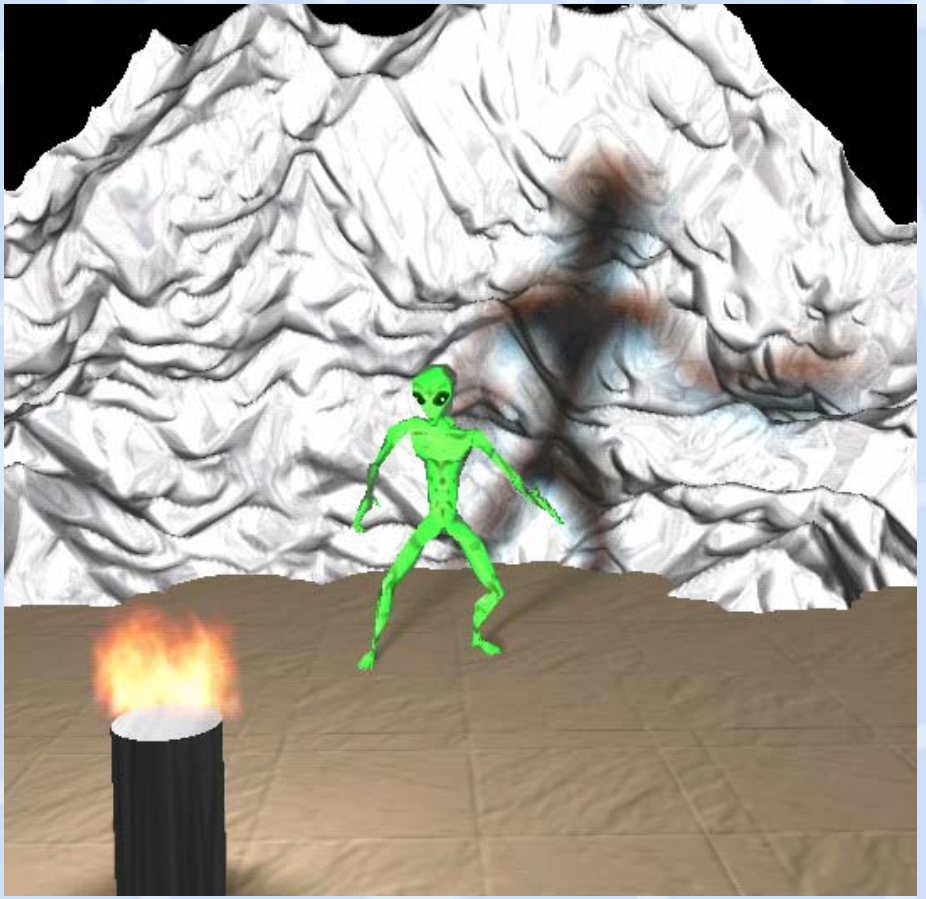


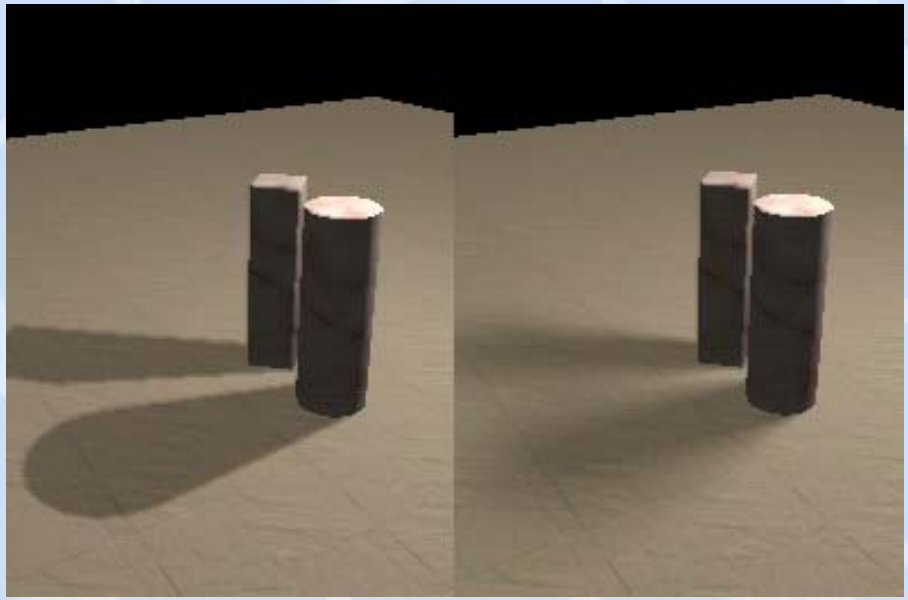
We present:

A Soft Shadow Volume Algorithm:

- Area light sources
- Simple volumetric light sources
- Textures and short video textures as lights
- Real-time performance with programmable graphics hardware
- Approximate soft shadows
  - Trade speed vs accuracy

Intro demo

A short recap…

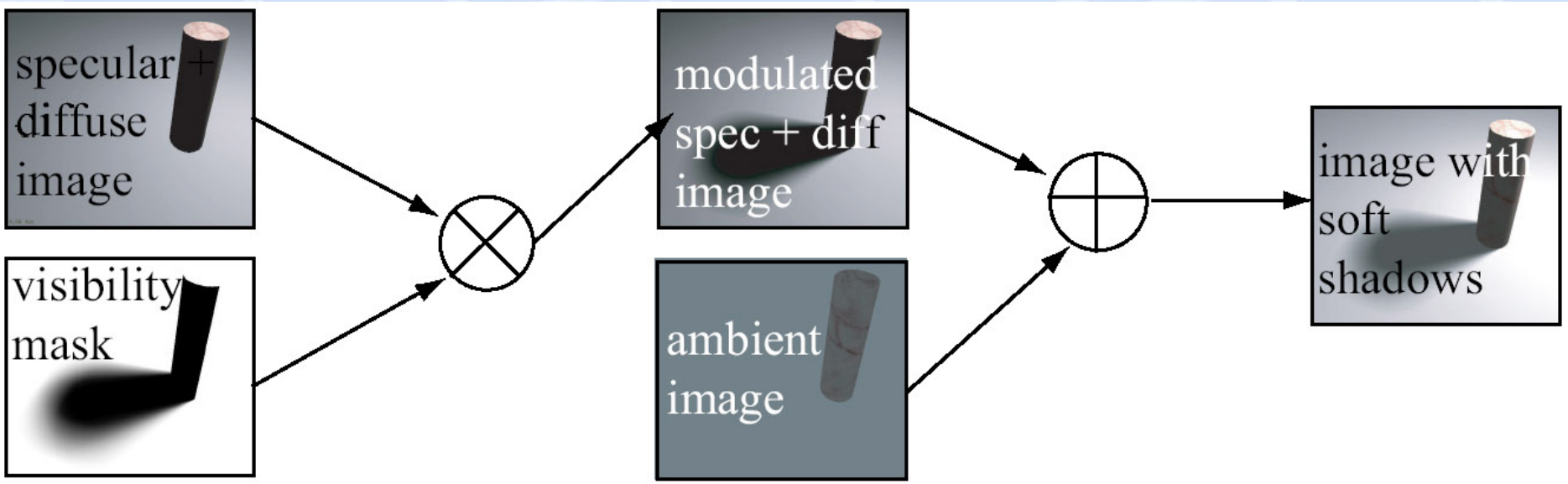


HARD SOFT

Area/volumetric lights give soft shadows

- Real lights have area or volume
- Thus, soft shadows more realistic

Overview

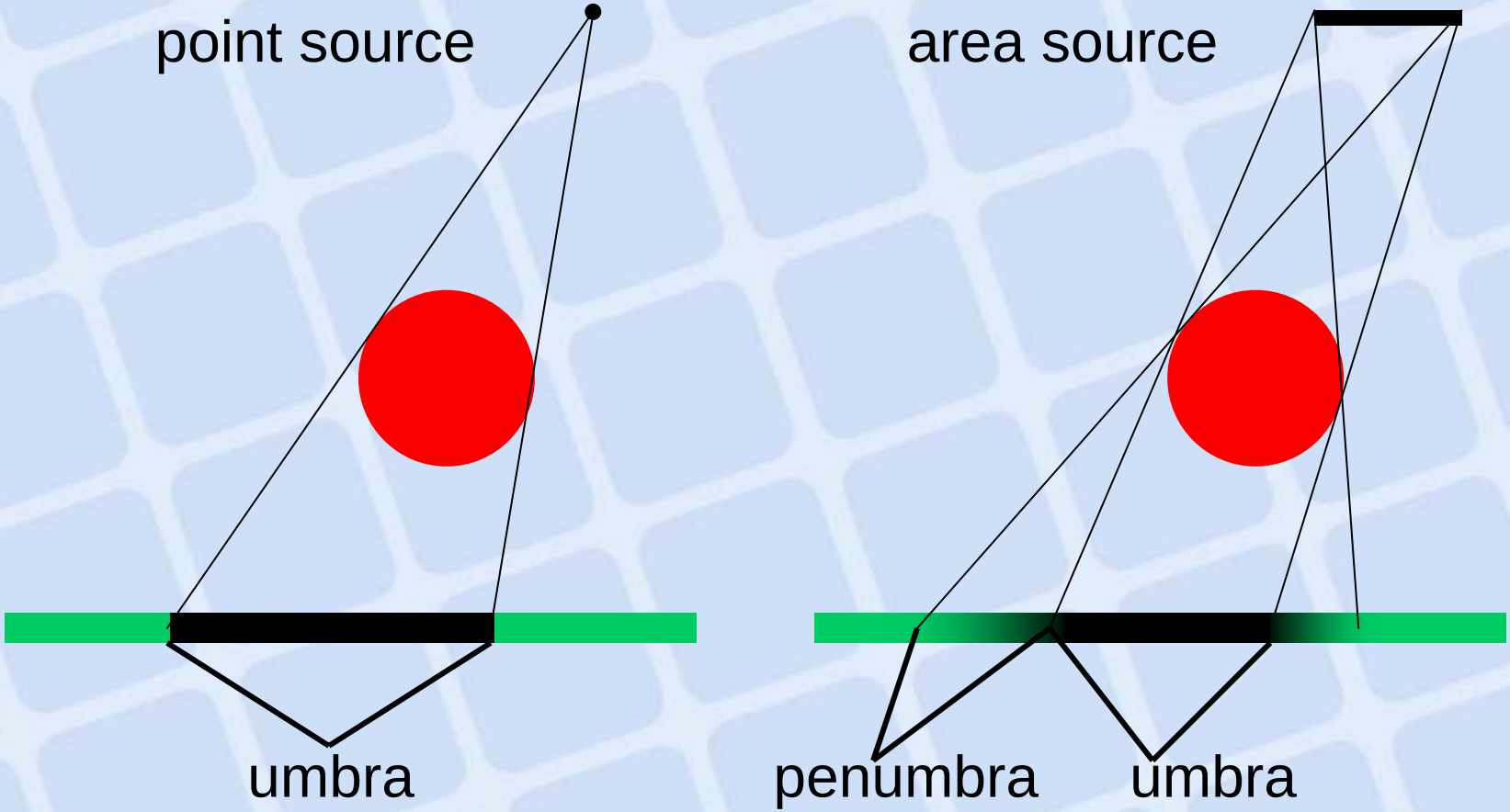


Computation of visibility mask:

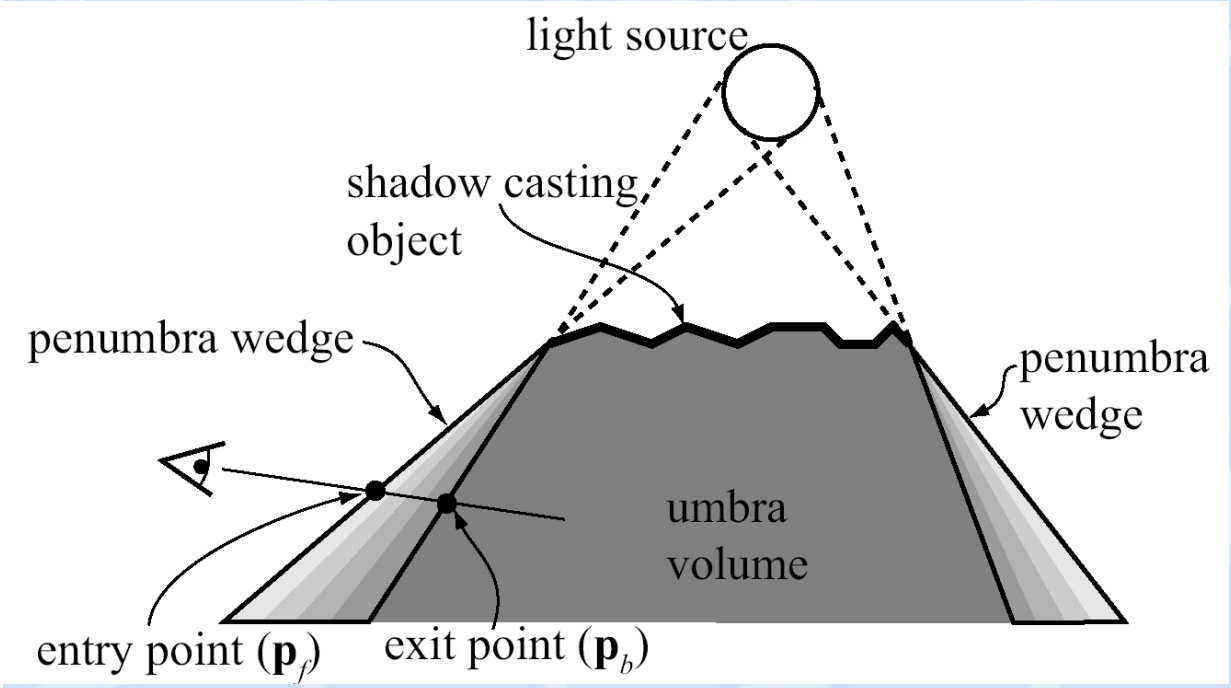
- 1st pass: Render hard shadow
- 2nd pass: compensate for overstated umbra

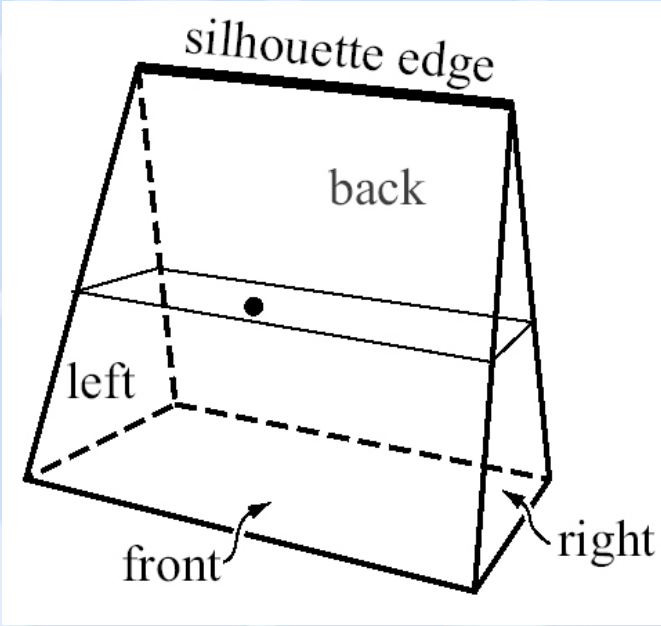
Hard vs. soft shadows

Two different light source types:



A Real-Time Soft Shadow Volume Algorithm

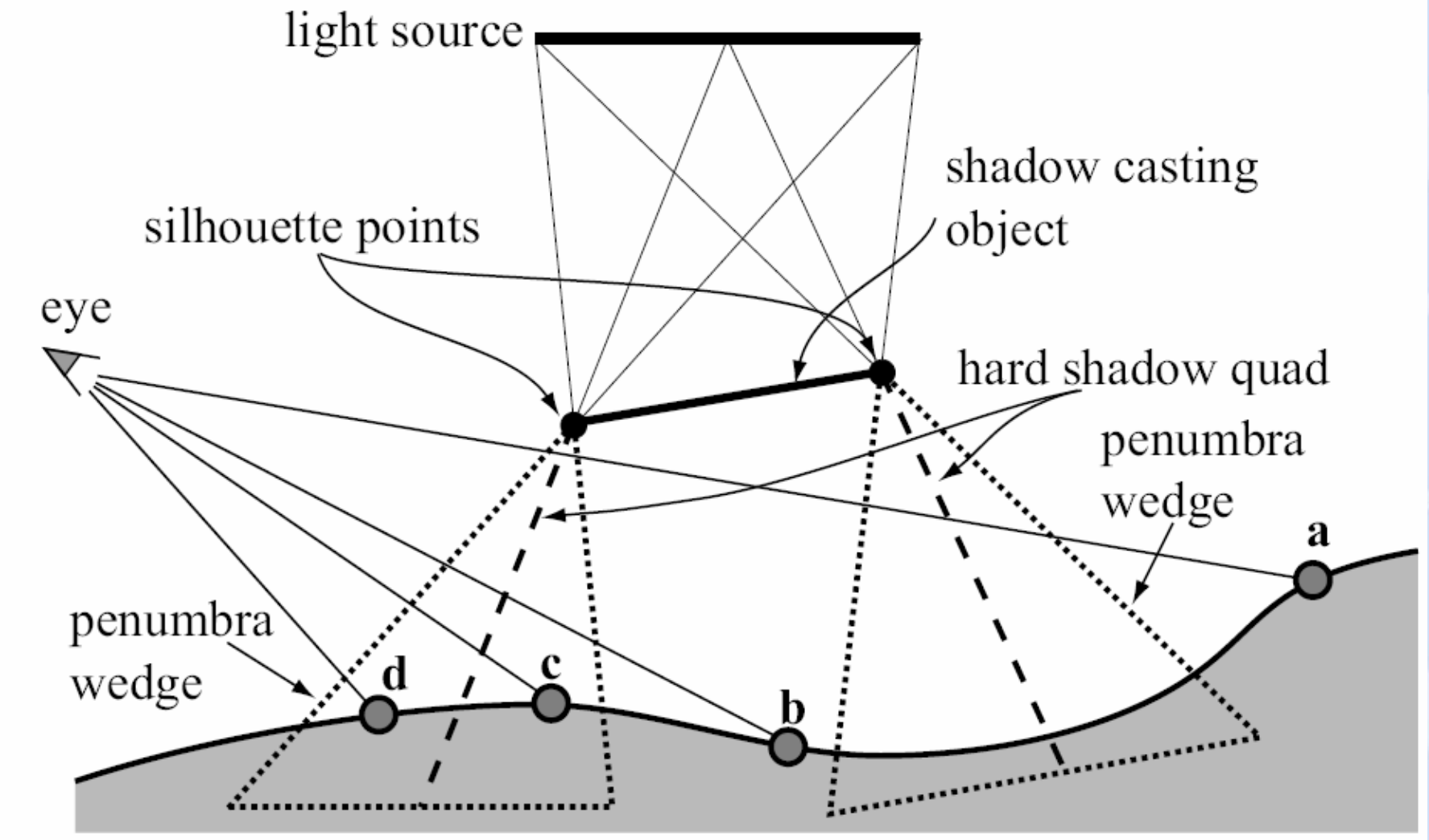




Wedges

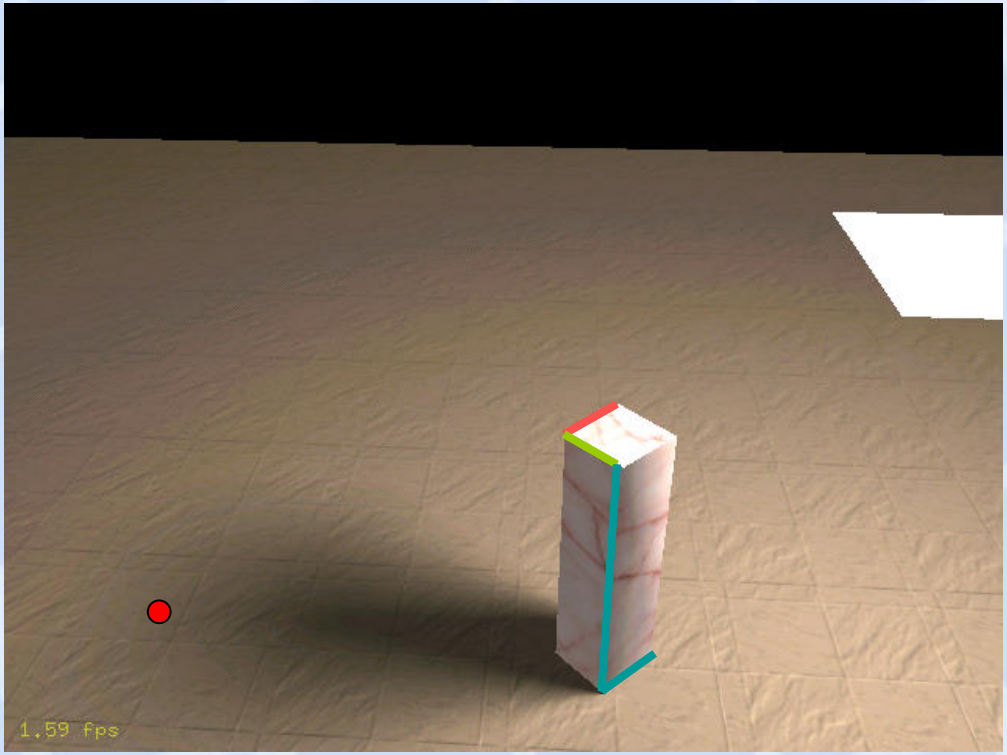
- Each silhouette edge has a corresponding wedge
  - Provides a piece of penumbra contribution
  - Rasterized by pixelshader

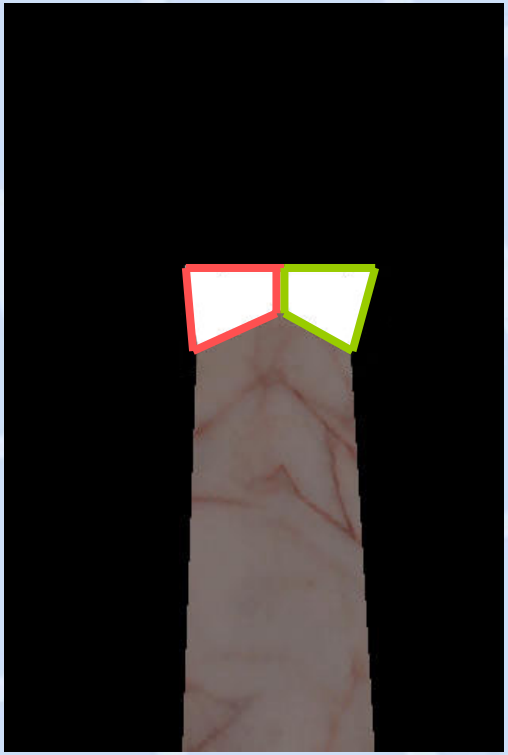
Two-pass algorithm



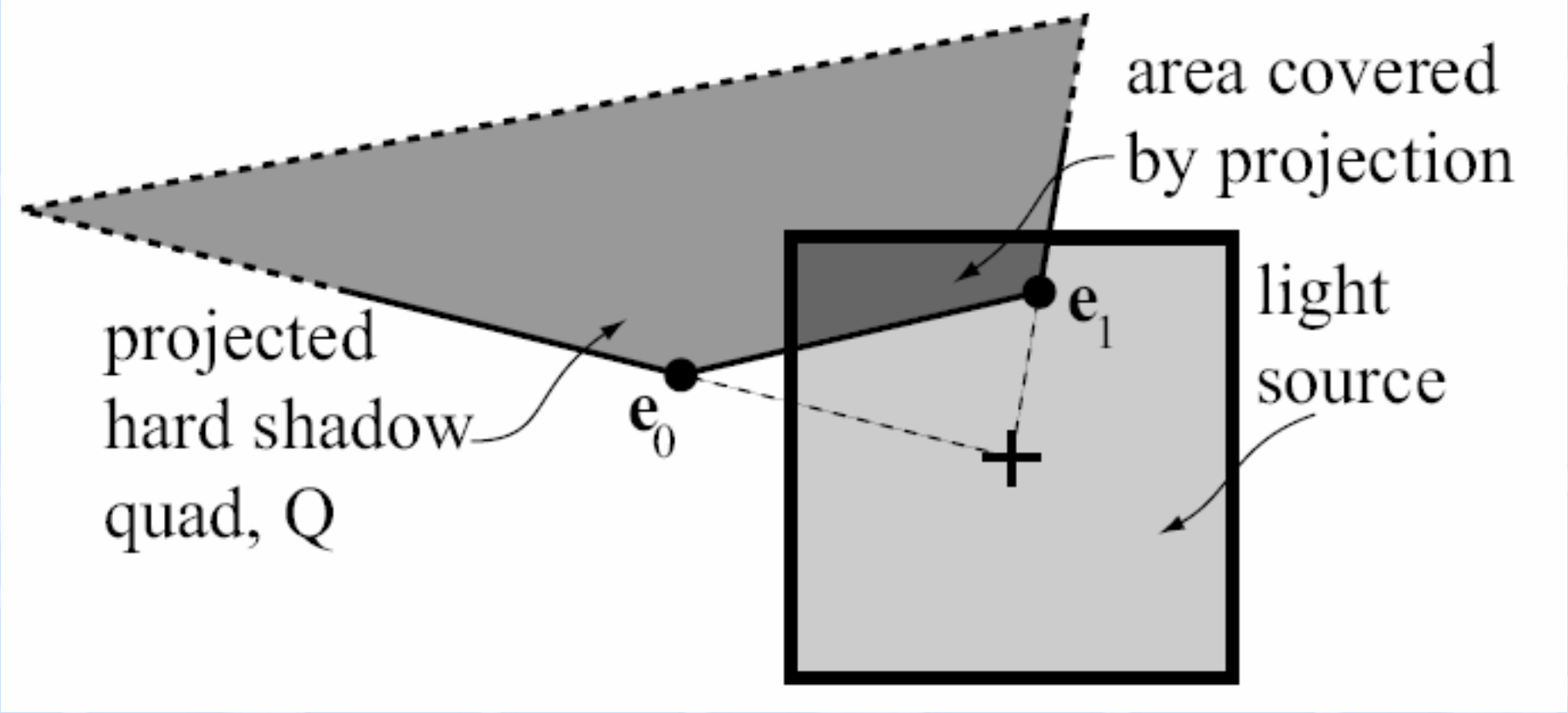
Visibility computation

- Really want to compute how much we can see of the light source

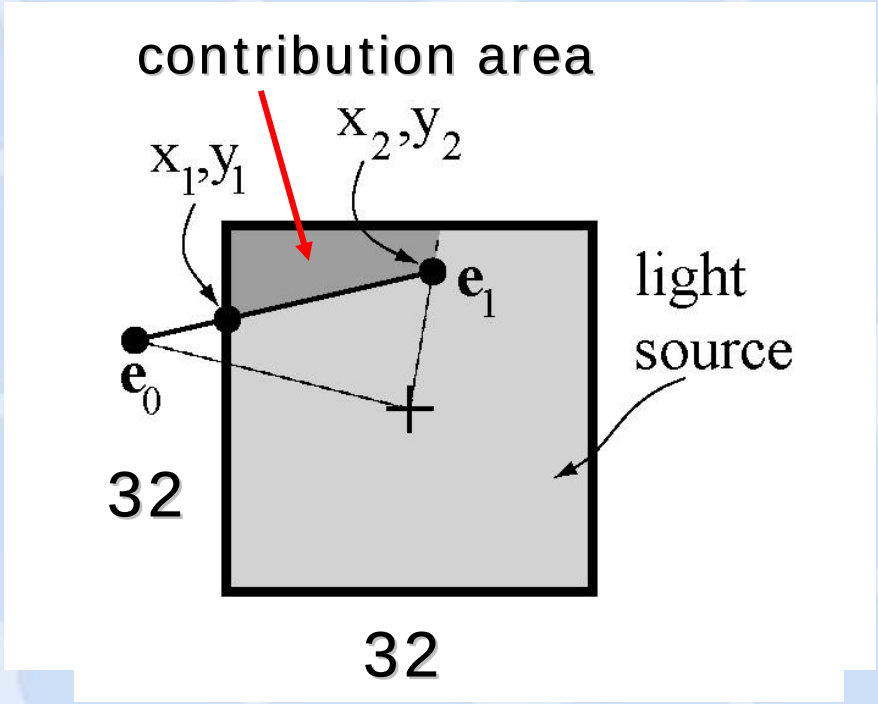


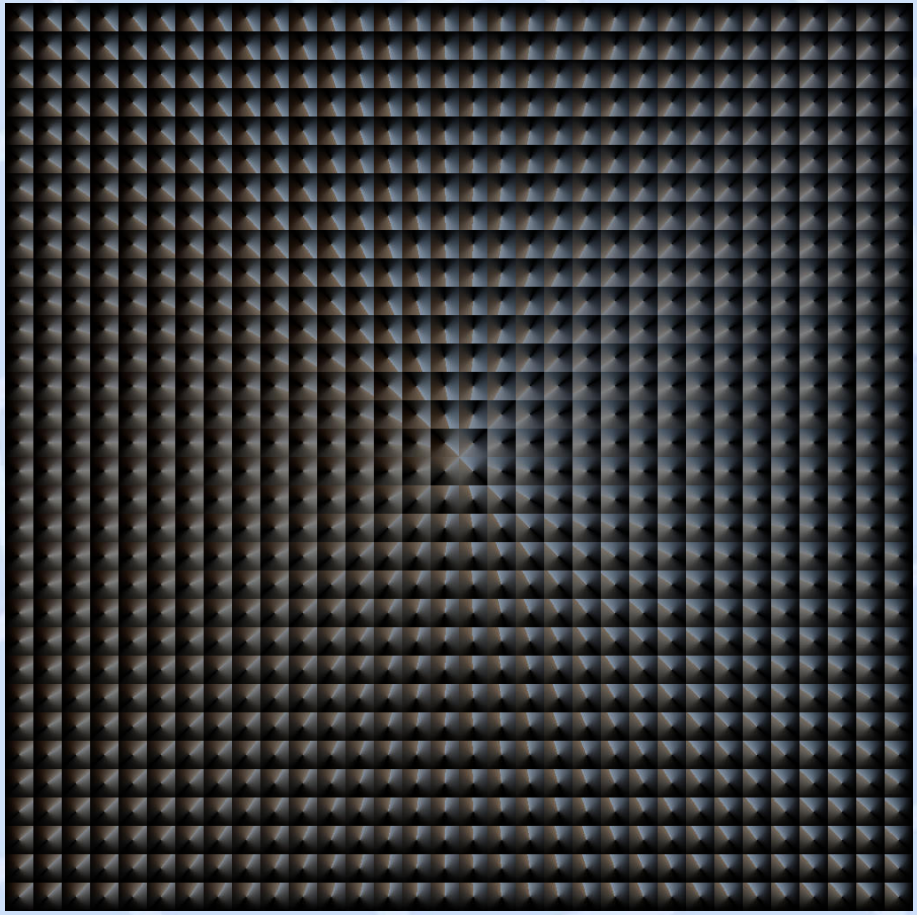


Visibility computation

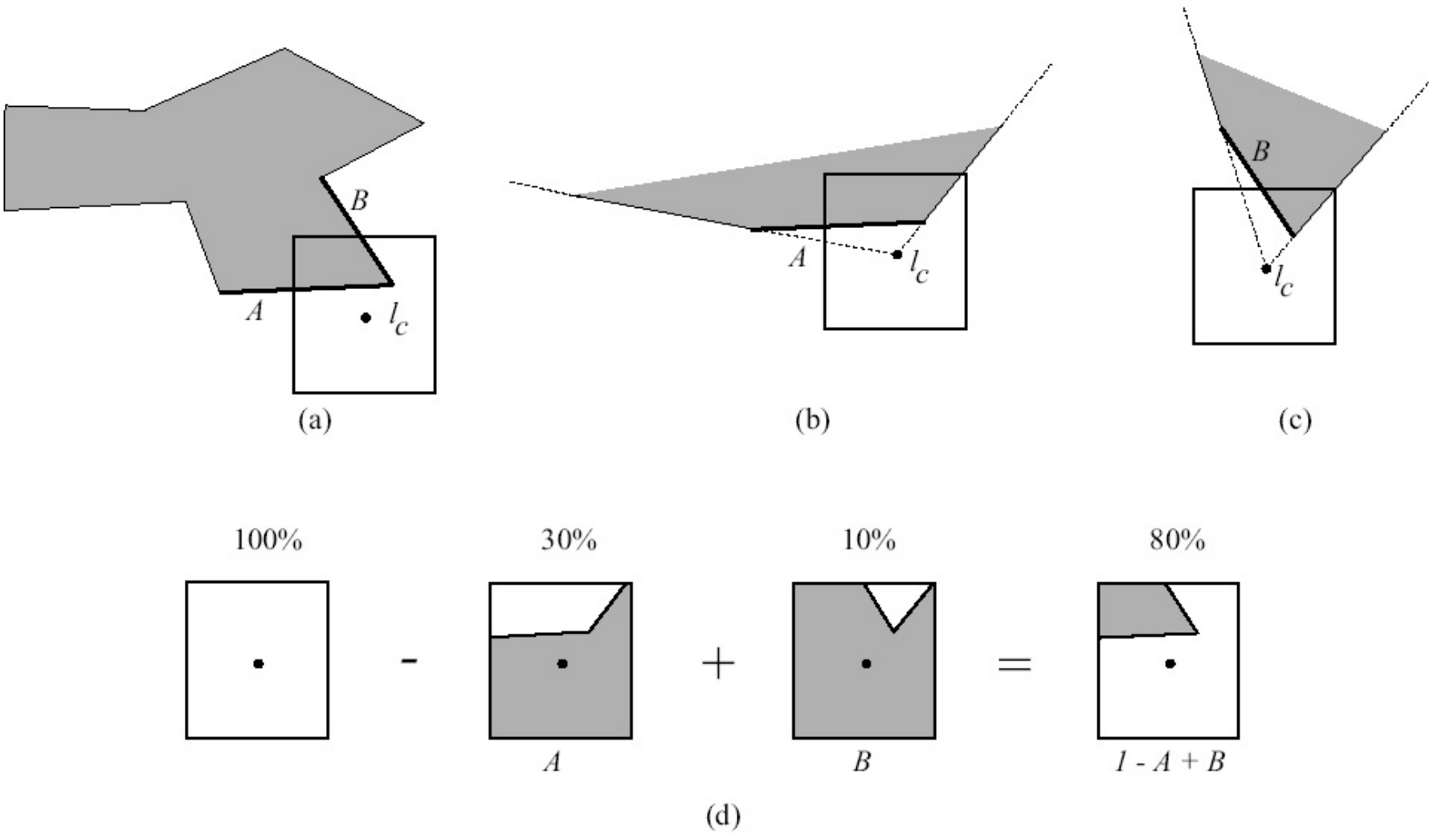


Precomputed contribution in 4D textures





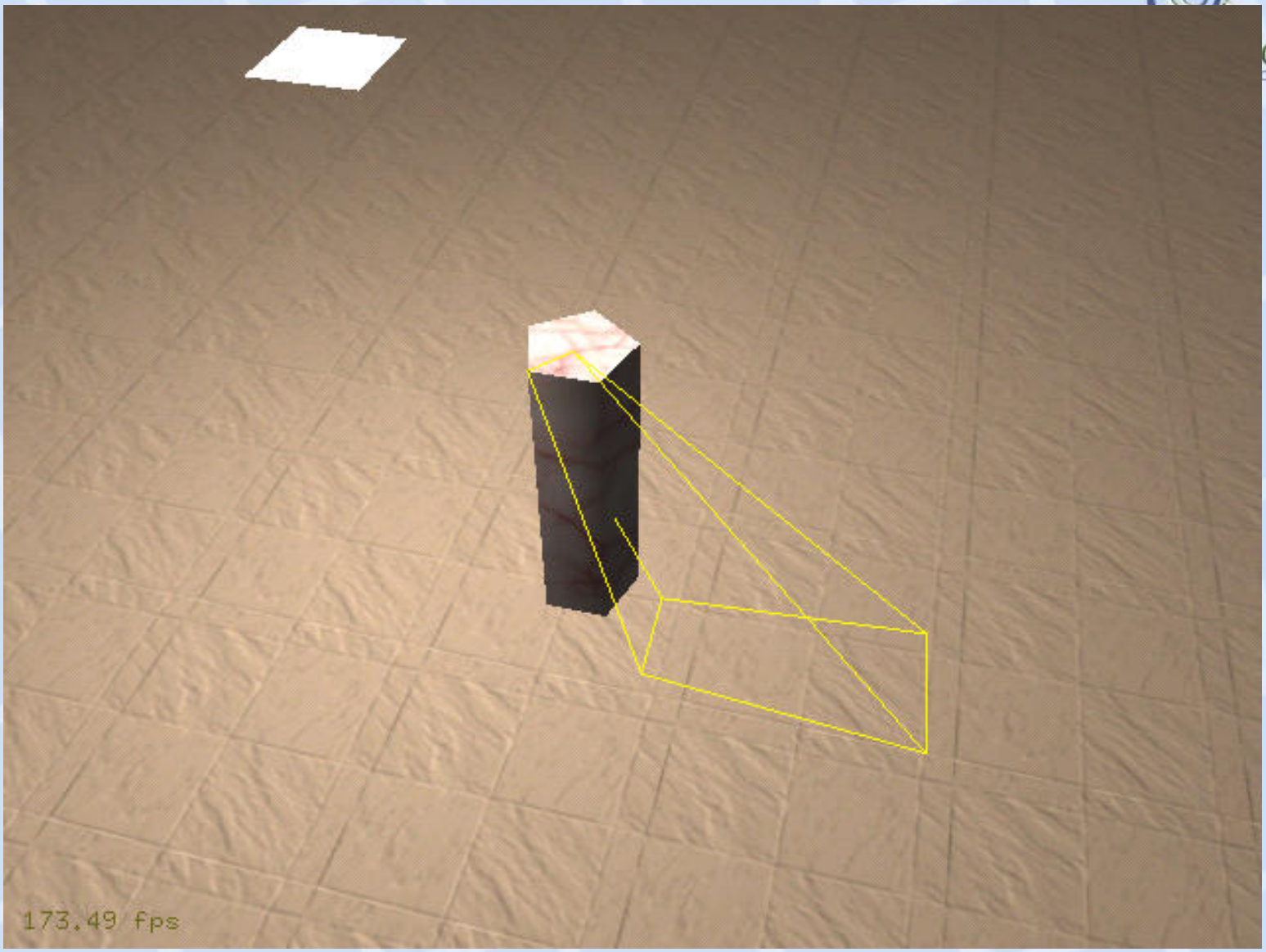
How the visibility computation works:



Rasterize a wedge

rasterizeWedge(wedge W, hard shadow quad Q, light L)
for each pixel (x, y) covered by front facing triangles of wedge
  $\mathbf{p} = \text{point}(x, y, z)$; // z is depth buffer value
  if $\mathbf{p}$ is inside the wedge
    $v_{\mathbf{p}} = \text{projectQuadAndComputeCoverage}(W, \mathbf{p}, Q)$;
    if $\mathbf{p}$ is in positive half space of Q
      $\overline{v}(x, y) = \overline{v}(x, y) - v_{\mathbf{p}}$; // update V–buffer
    else
      $\overline{v}(x, y) = \overline{v}(x, y) + v_{\mathbf{p}}$; // update V–buffer
    end;
  end;
end;

A wedge for each silhouette edge…



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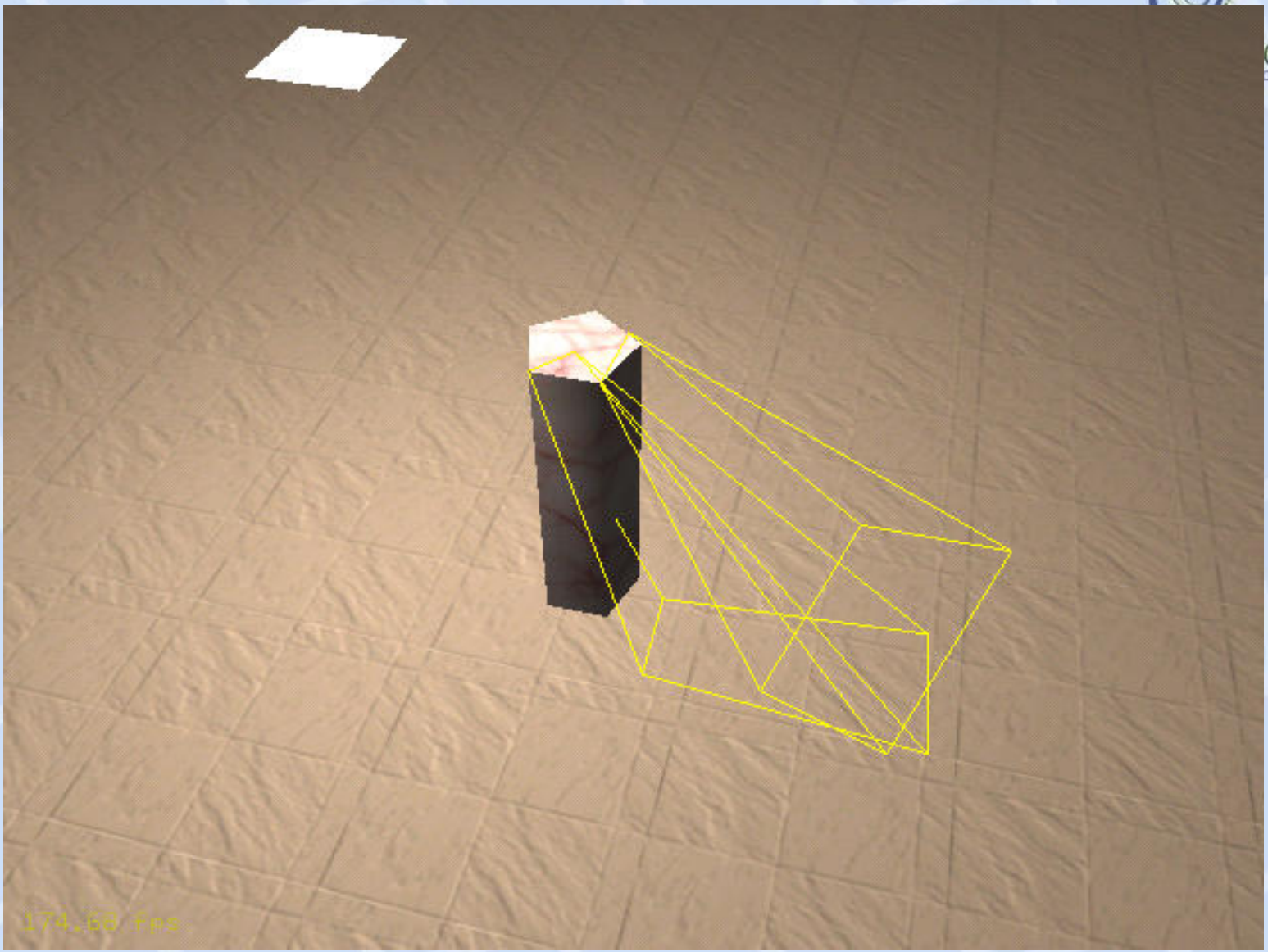

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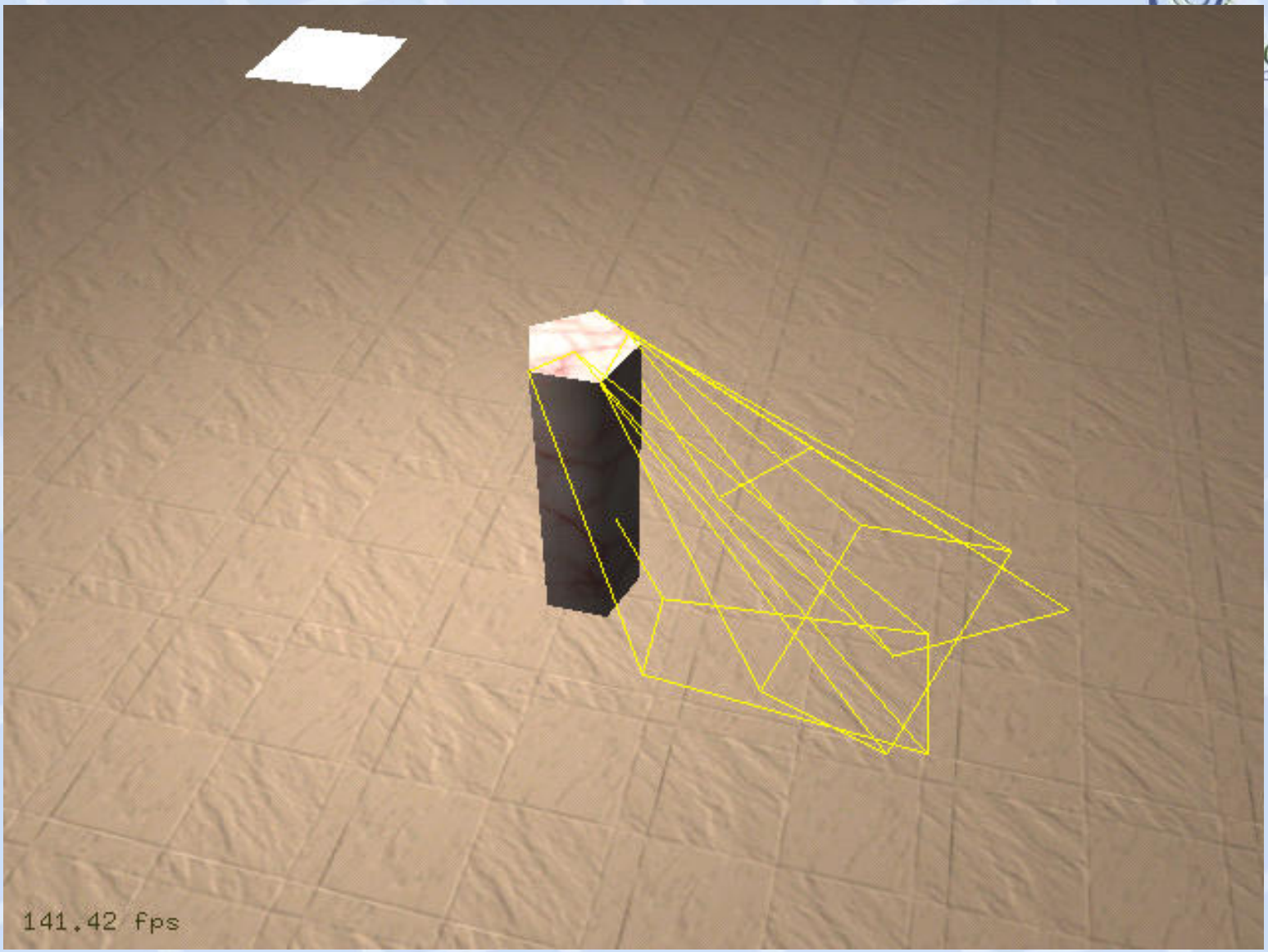
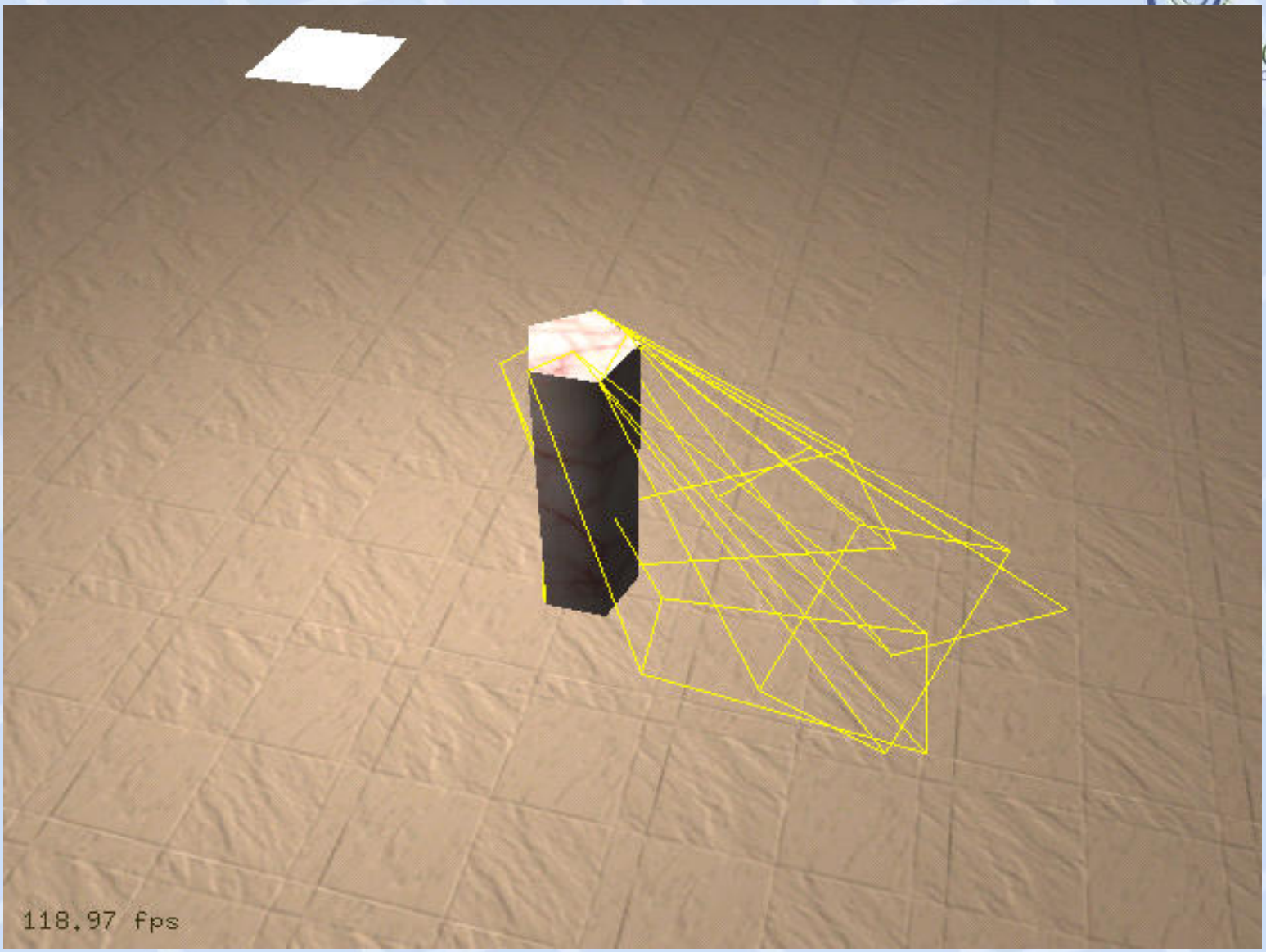


A wedge for each silhouette edge…



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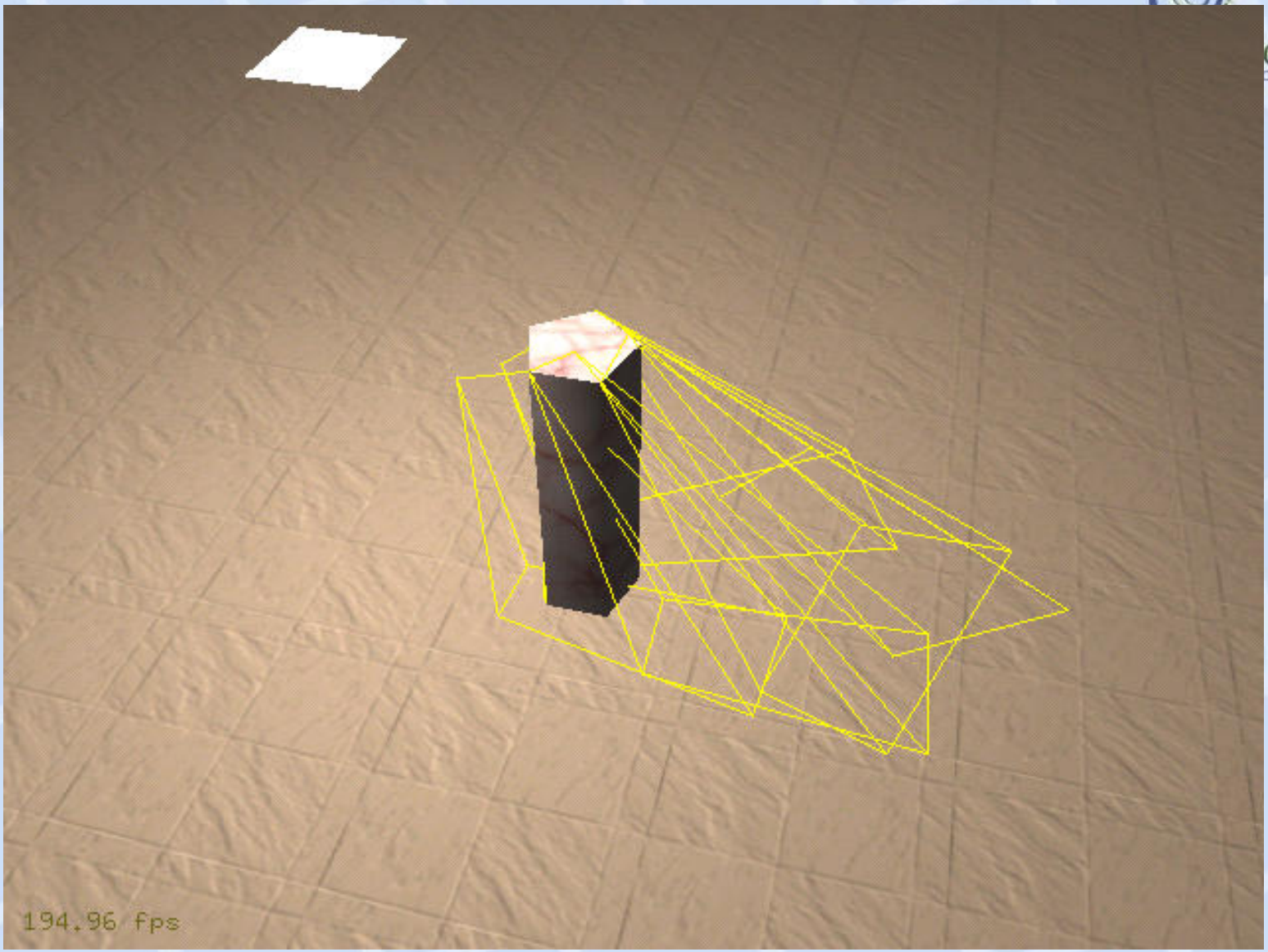
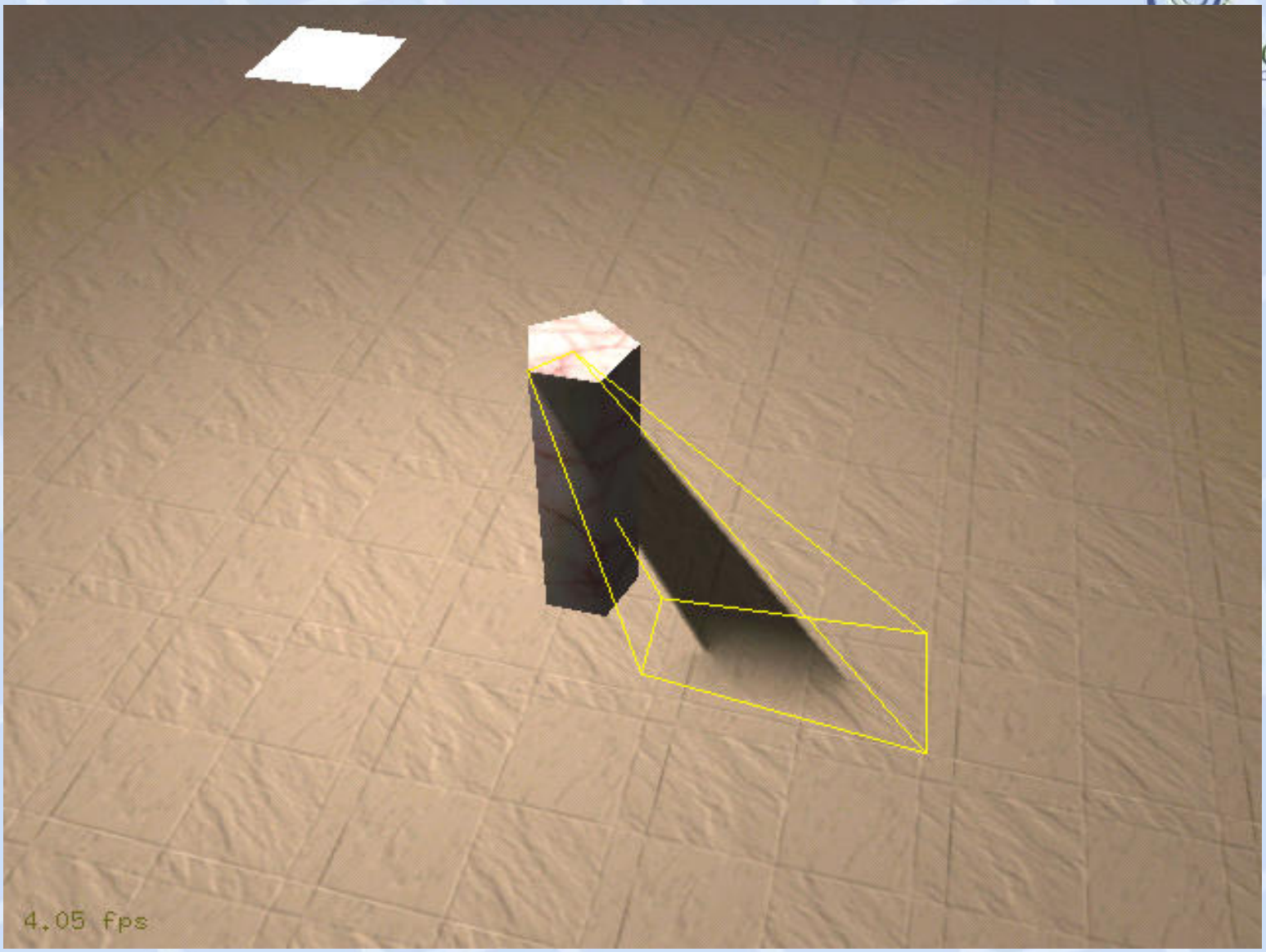
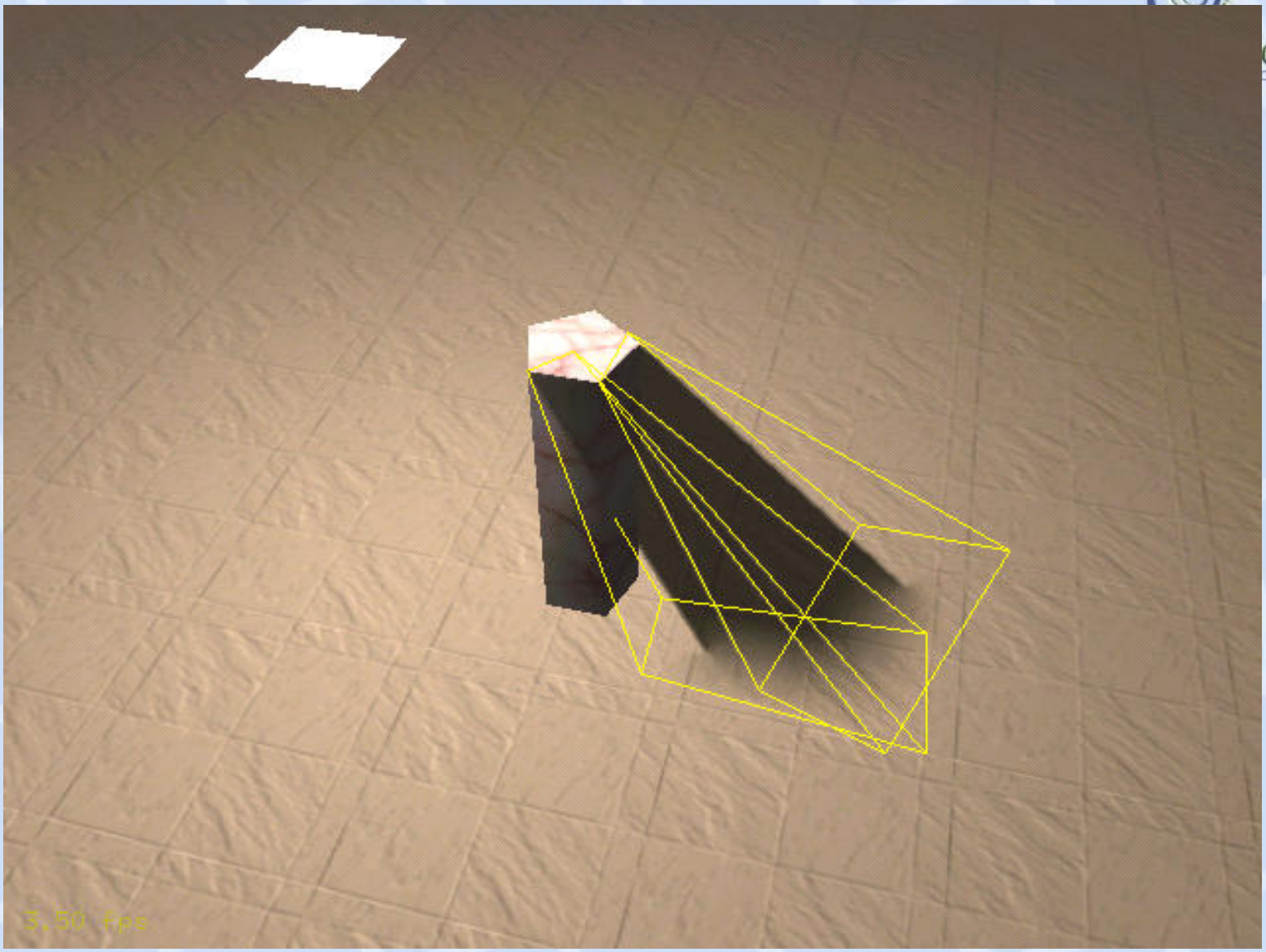


Rasterizing the wedges



Rasterizing the wedges



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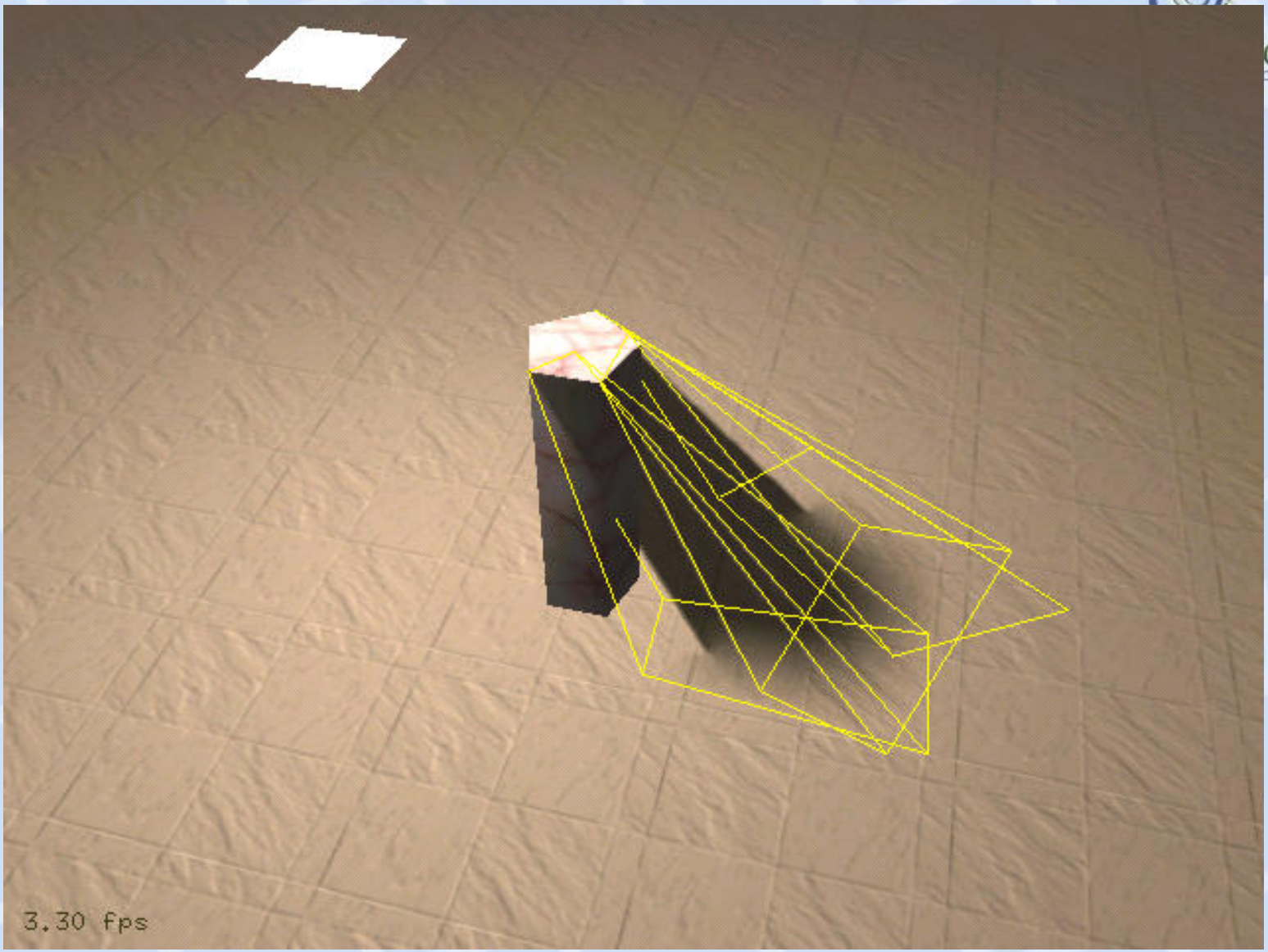

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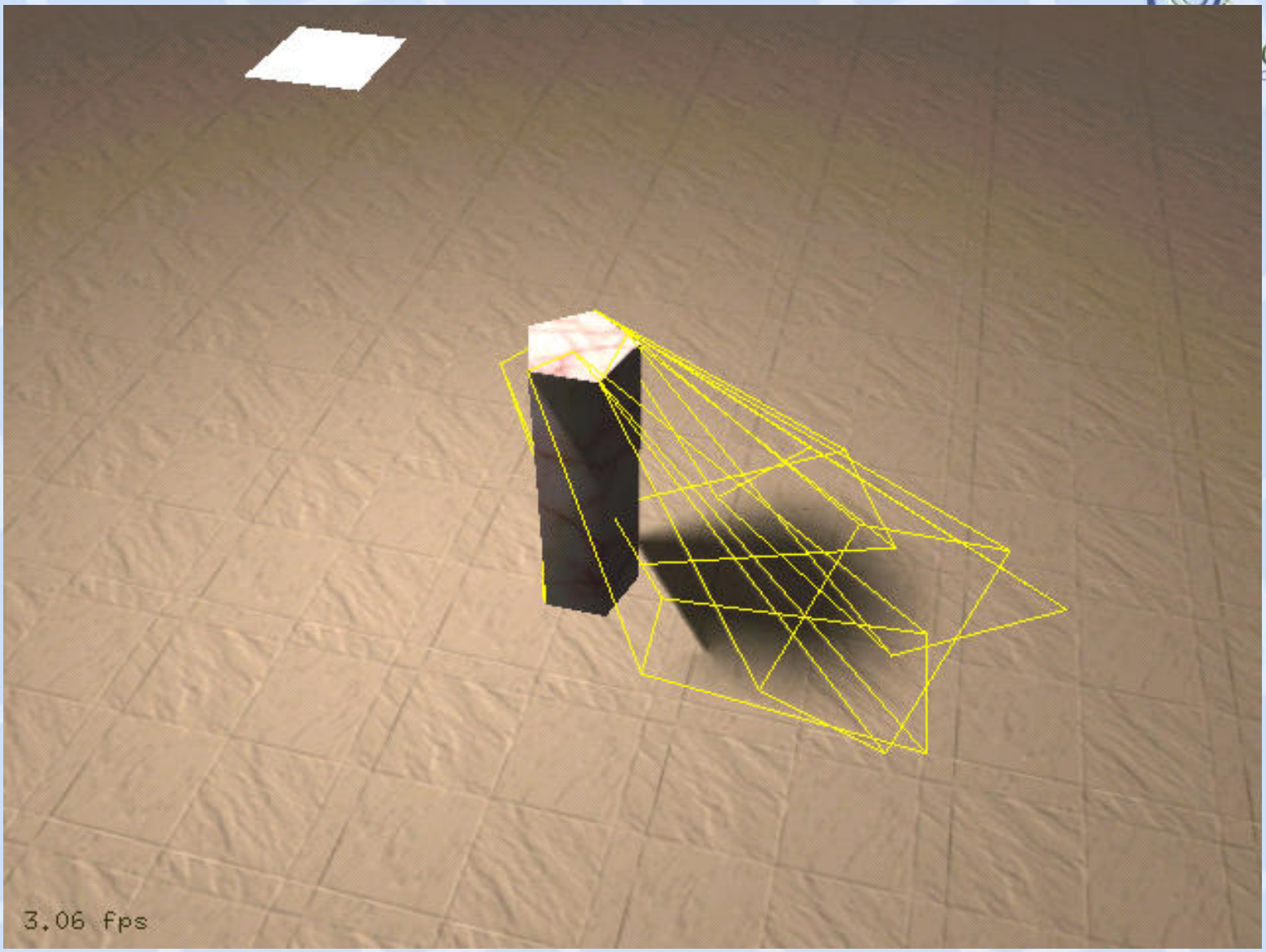

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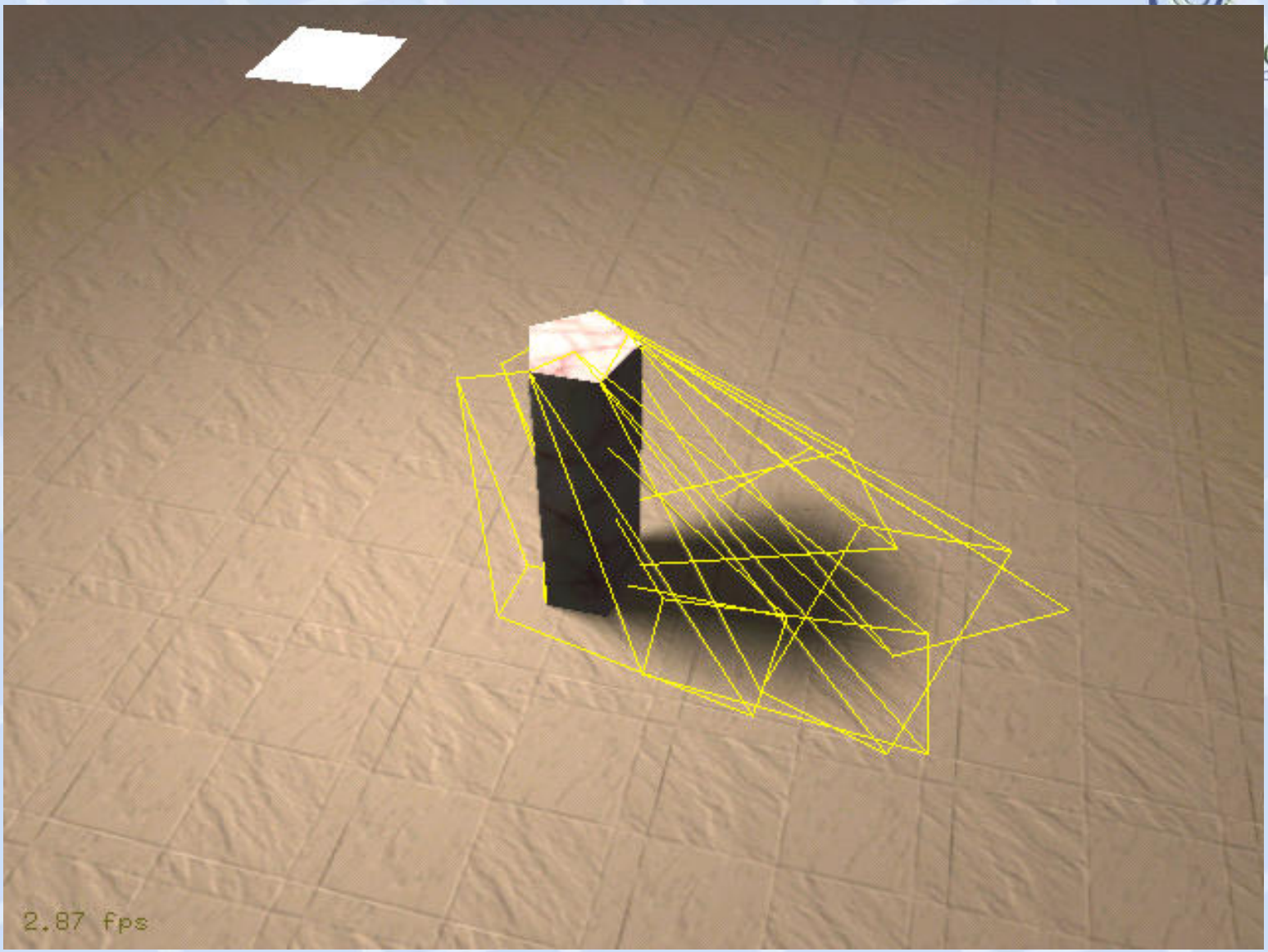
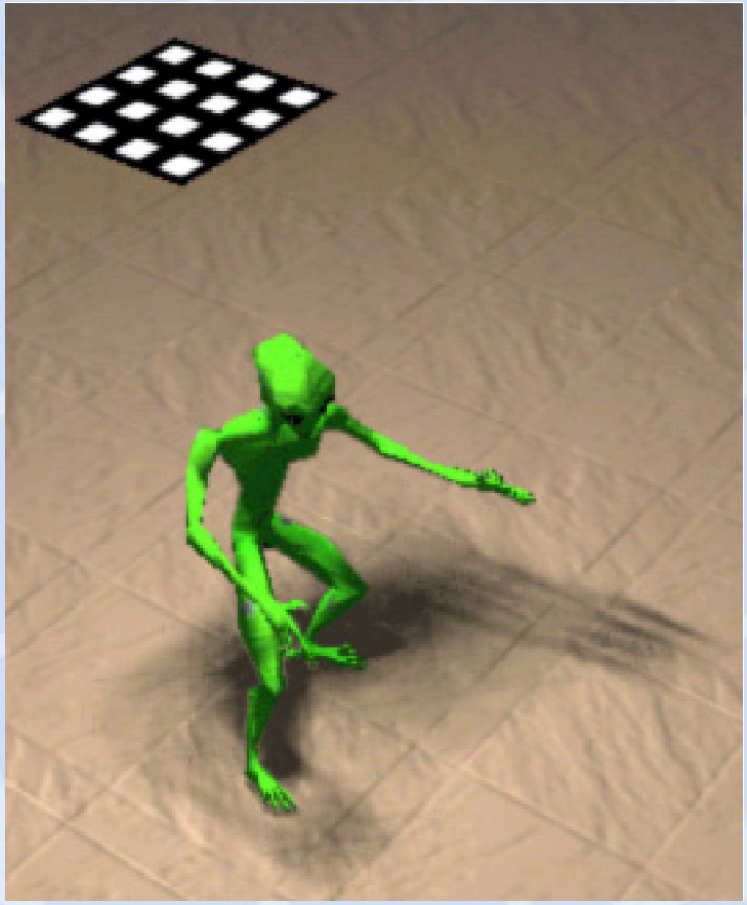
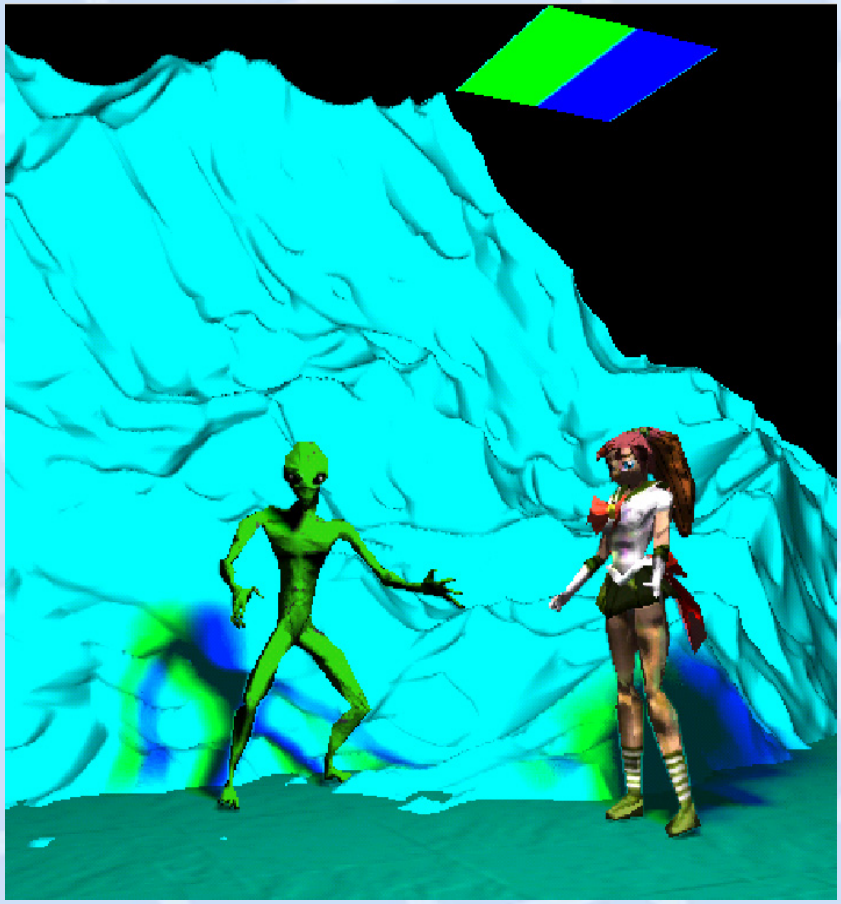


Examples using textured lights



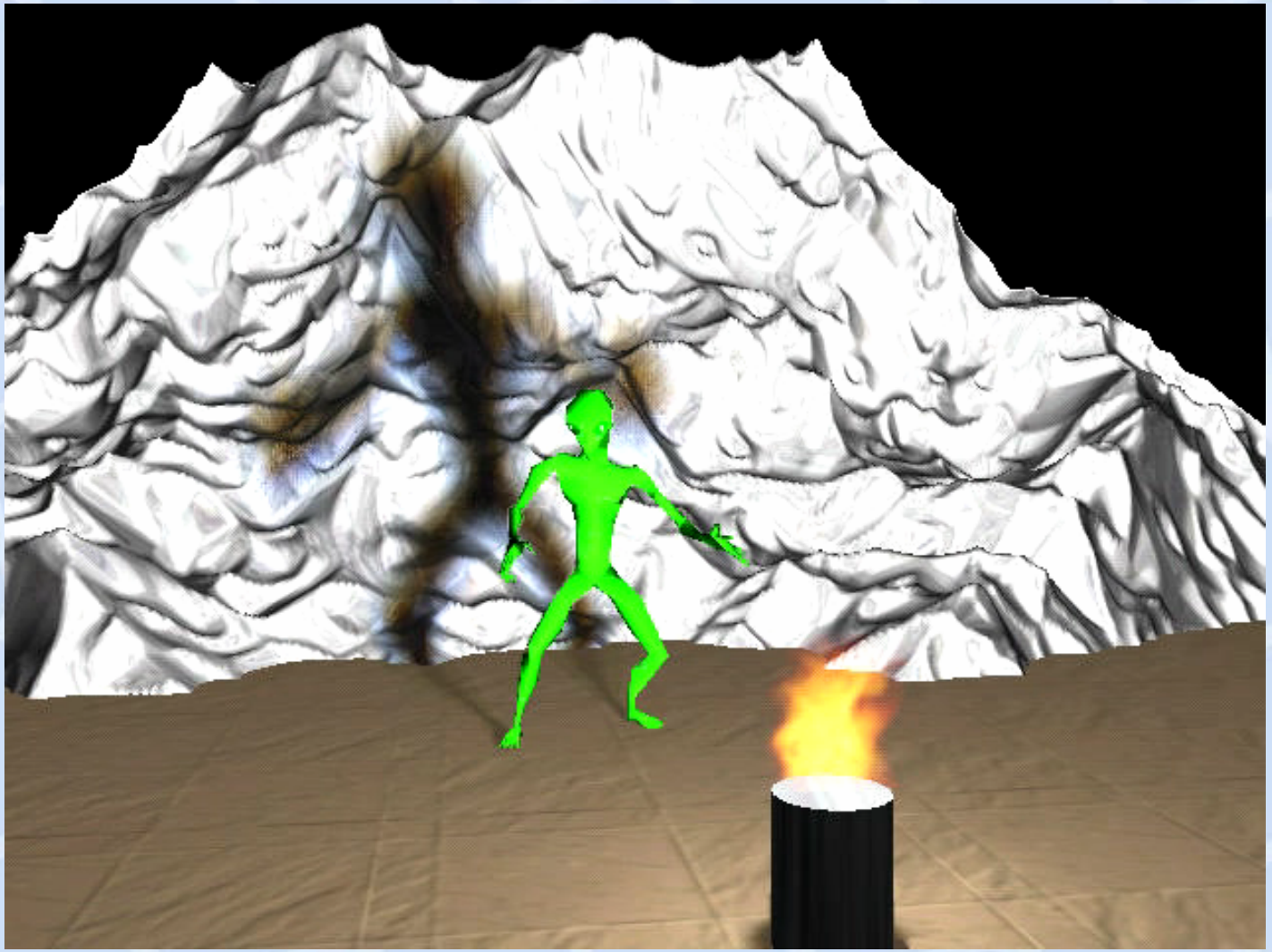
Texture of 16 area lights



Texture of two colors

Fire Demo

Fire Demo

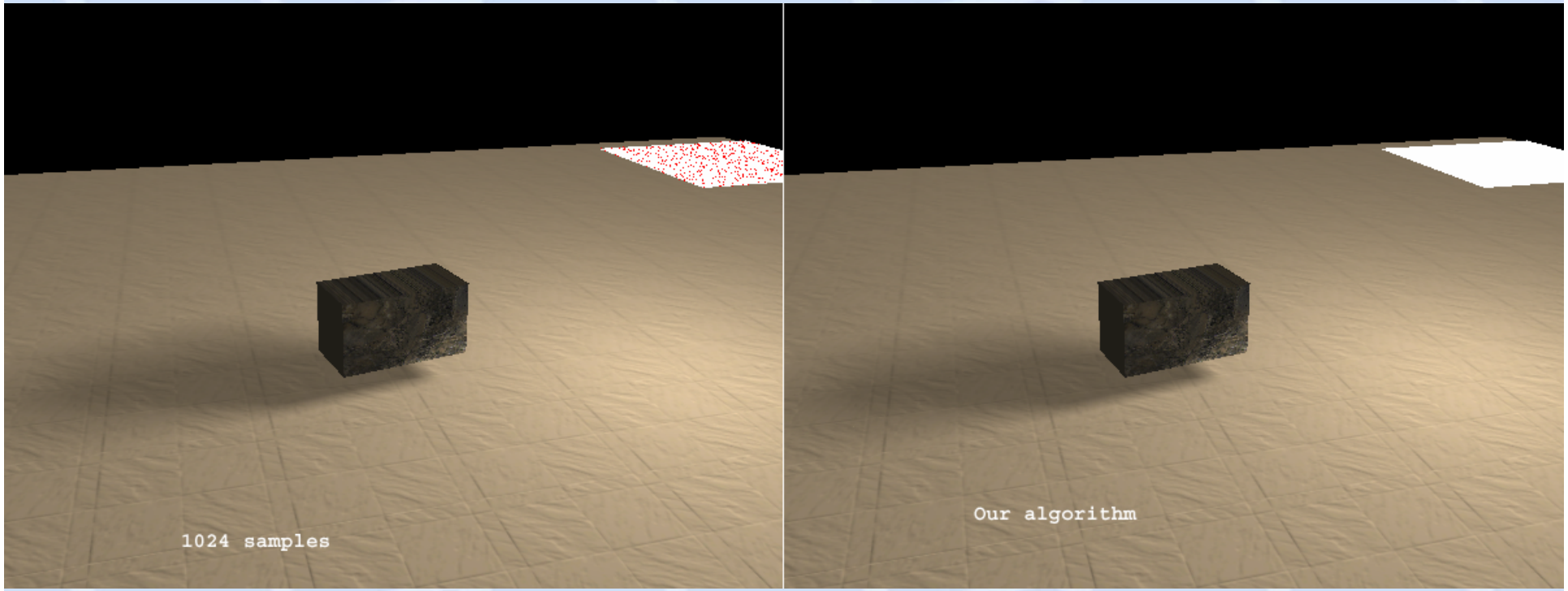


Comparisons

Reference image

Our algorithm

Comparisons



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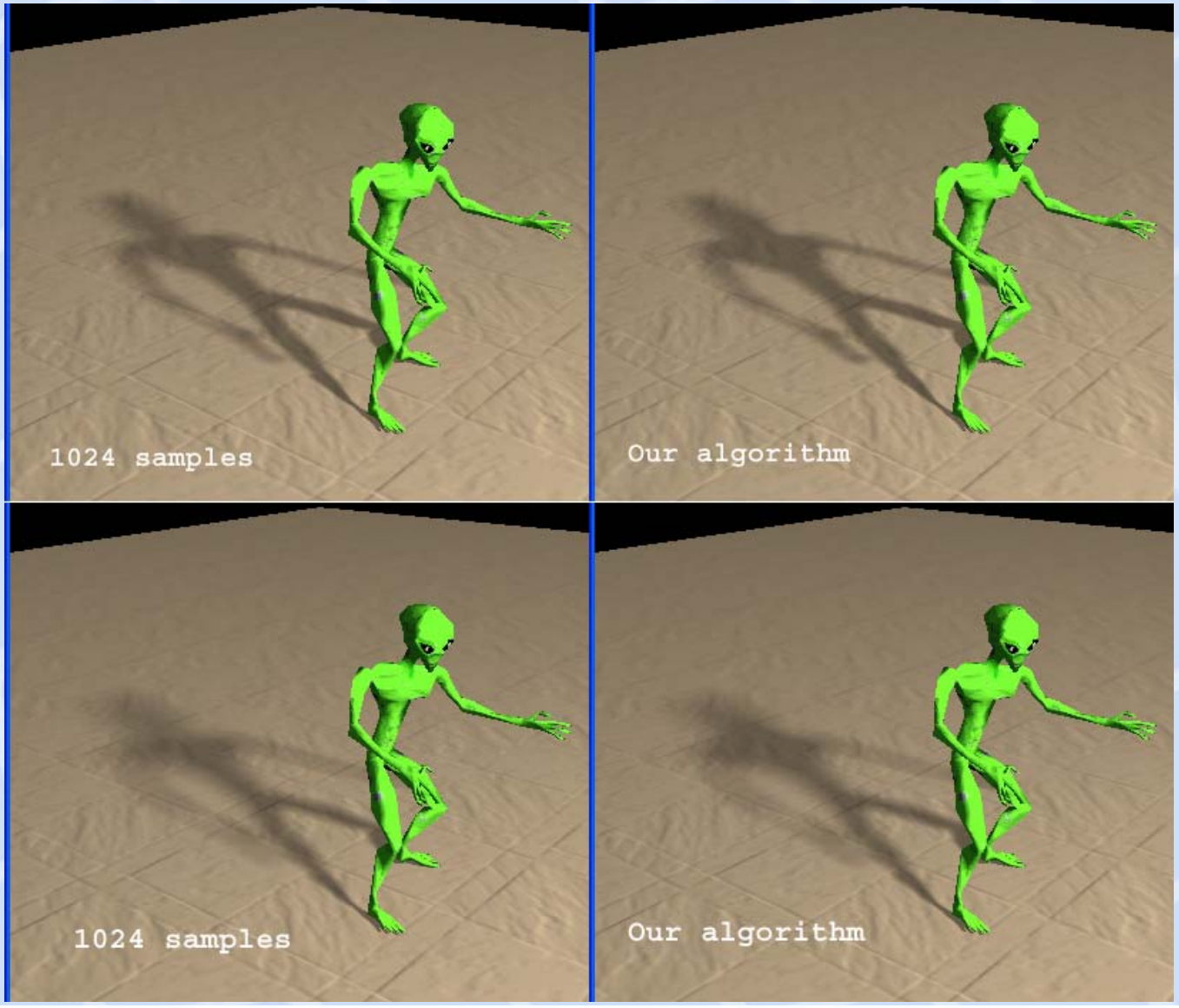

Small light source

Large light source

Comparisons

512 point lights

Our algorithm

The Last Demo