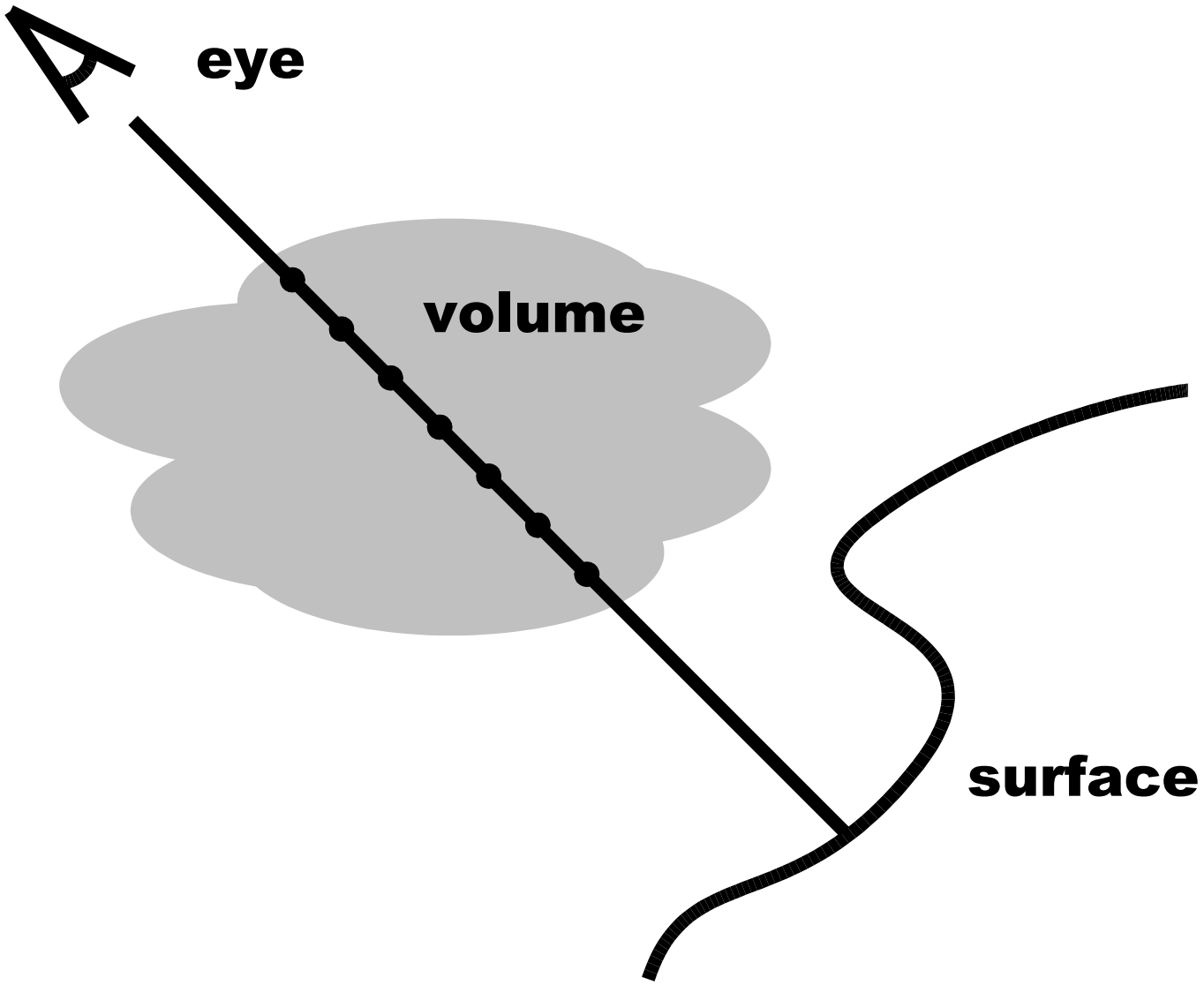
Efficient Camera Motion Blur with Ray-Marching Atmospheric Shaders

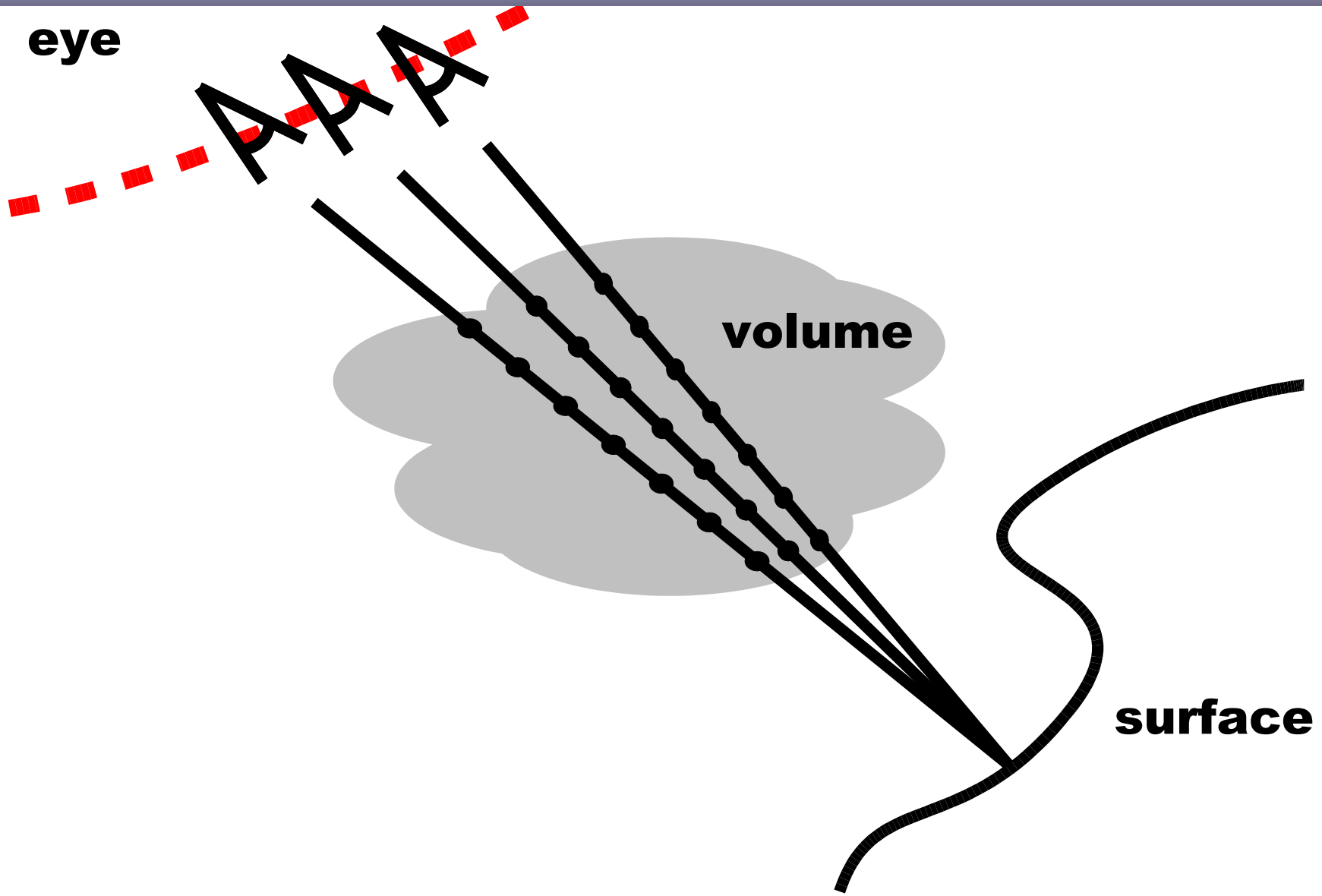
Chris Cooper – Animal Logic Film


eye
volume
surface

Ray Marching

- fast since you don't need geometry

- camera motion blur is a problem within a renderman pipeline since there is no geometry


eye
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Even more sampling in an already slow shader

How did they provide the illusion of camera motion in Ye Olde Days?

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These concepts can easily be adapted to 3d

- discretize the motion

- use multiple transparent planes

- move them at different speeds

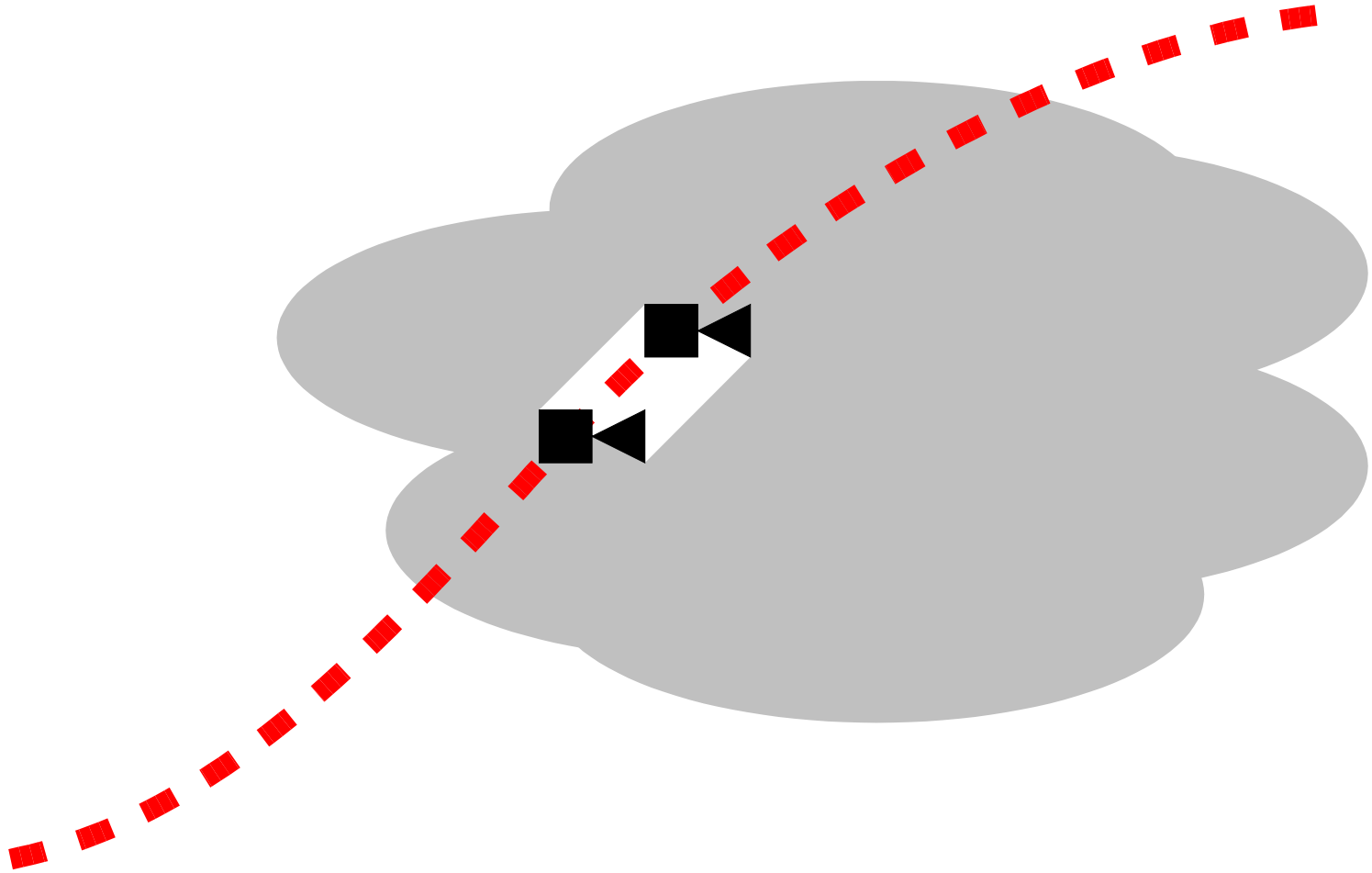
is there a better way?

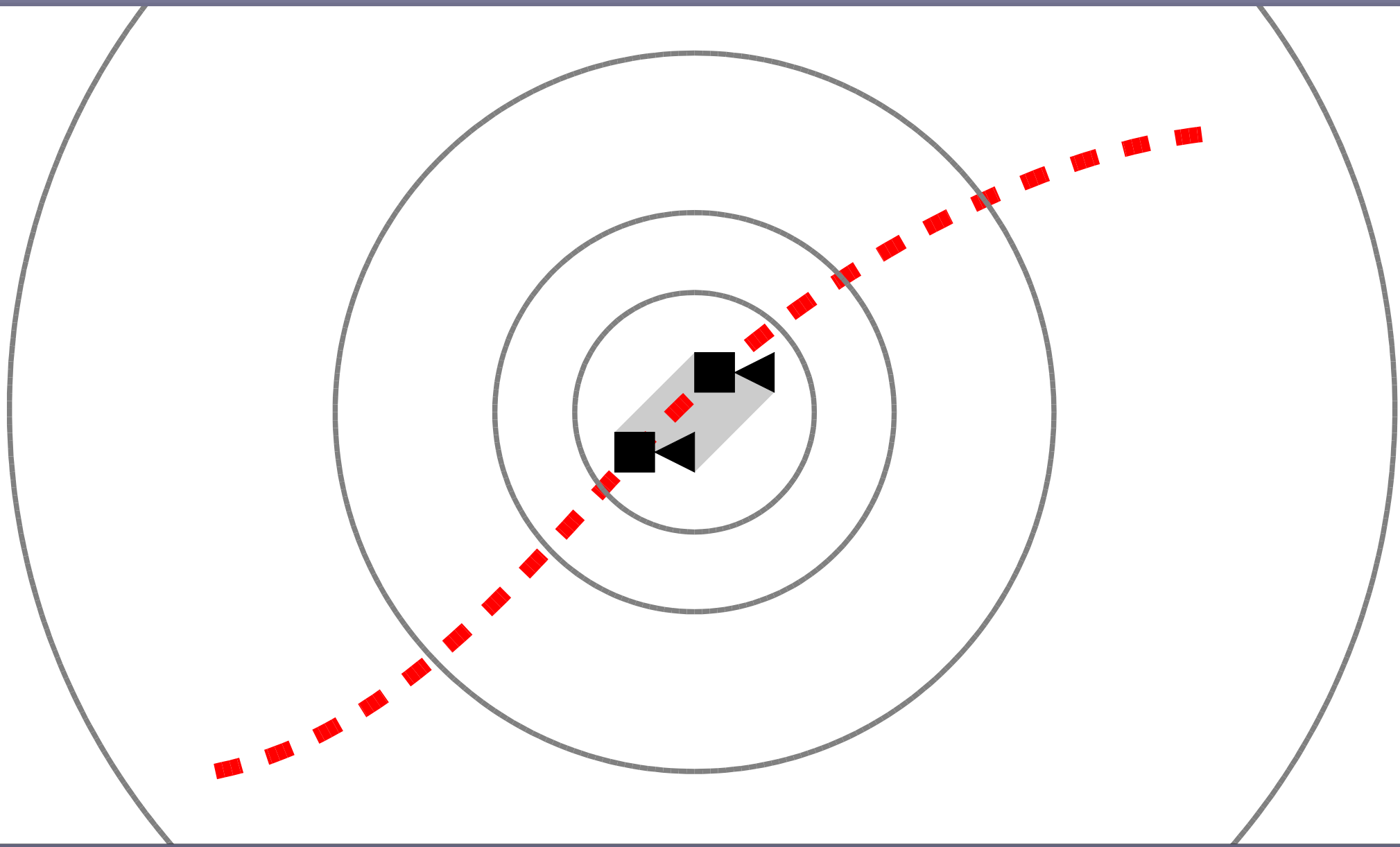
Spheres

- no need to worry about field of view of camera
- fit in more easily with a ray-march pipeline

Motion

- need stationary spheres with fast moving camera





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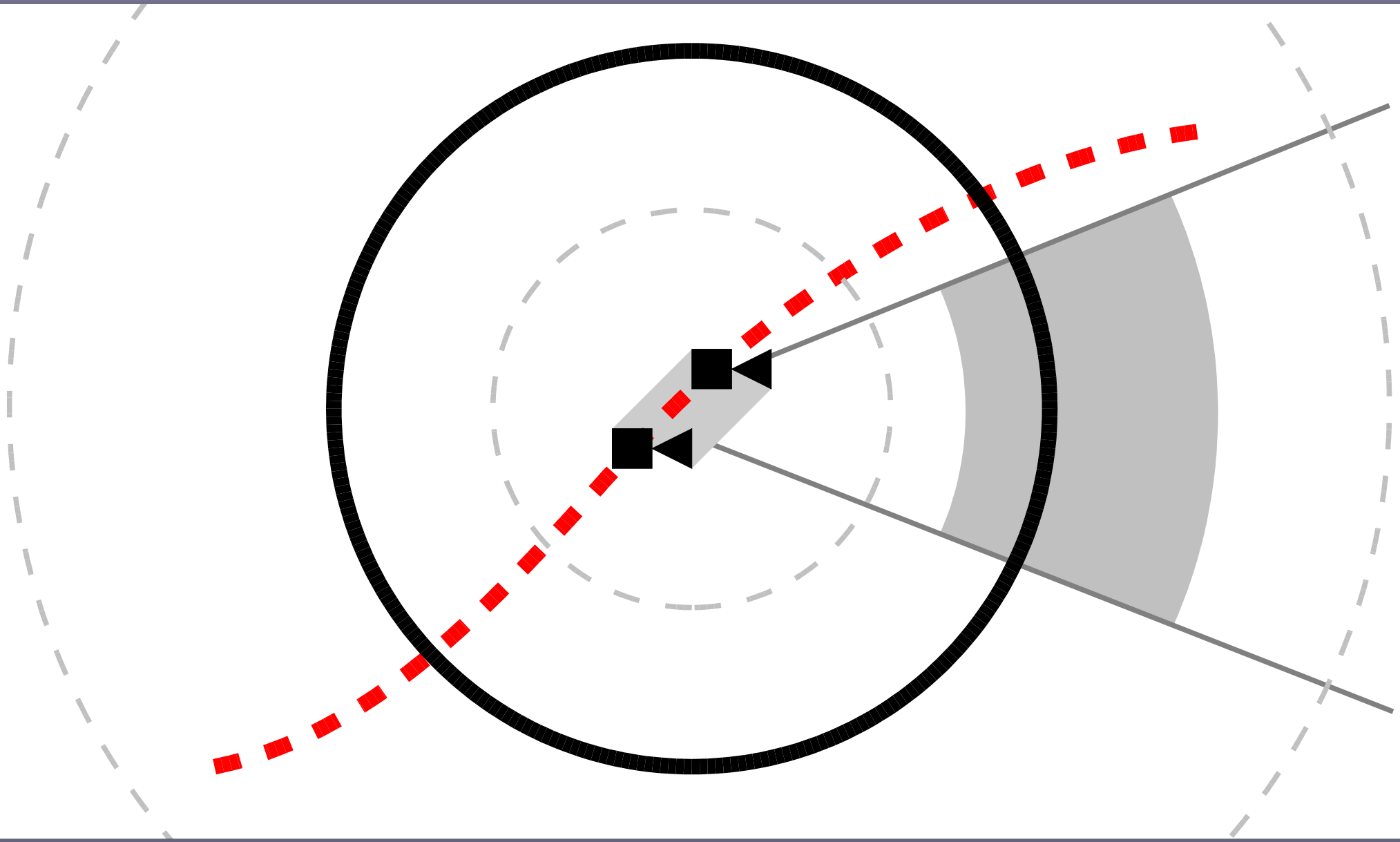

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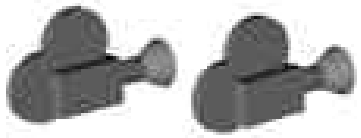
Stationary Spheres with slices of volume



Moving Camera

PRMan features we can take advantage of...

Motion Factor

- to automatically reduce sampling in areas of high motion blur

Opacity Threshold

- to reduce sampling where closer spheres obscure areas of distant spheres

Primitive variables

- so we can set up near & far clipping radii on each sphere using only one shader

Selective motion blur

- can have spheres constrained to camera in scene with no blur (treated as stationary in world space), yet the camera with blur.

Also...

Exponential Radii

- to keep the number of spheres minimal
- keep smallest sphere big enough to avoid eyesplit issues

Overlap & Fade in Clip Radii

- hasn't been necessary if enough spheres are used (between 5 and 20)

Keep the shader simple

- just need to limit the ray marching using the clipping radii