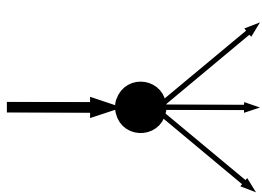


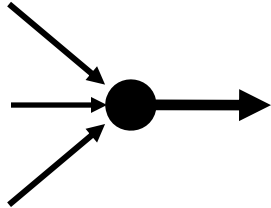
absorption



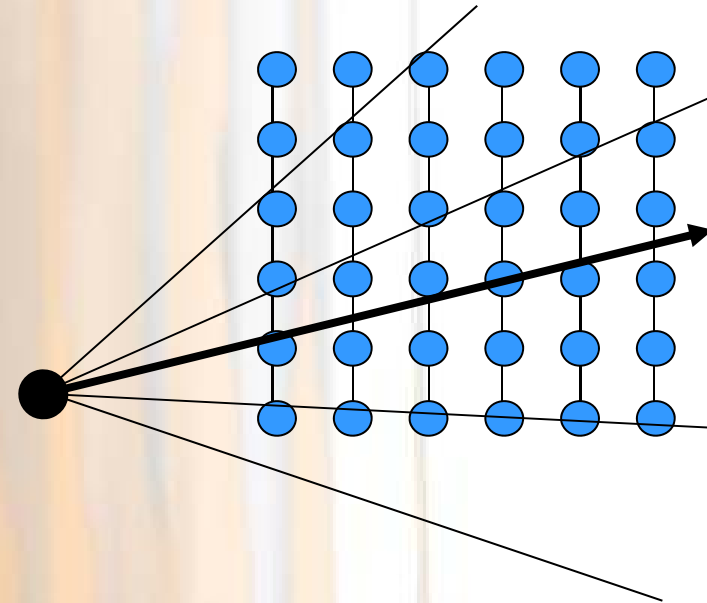
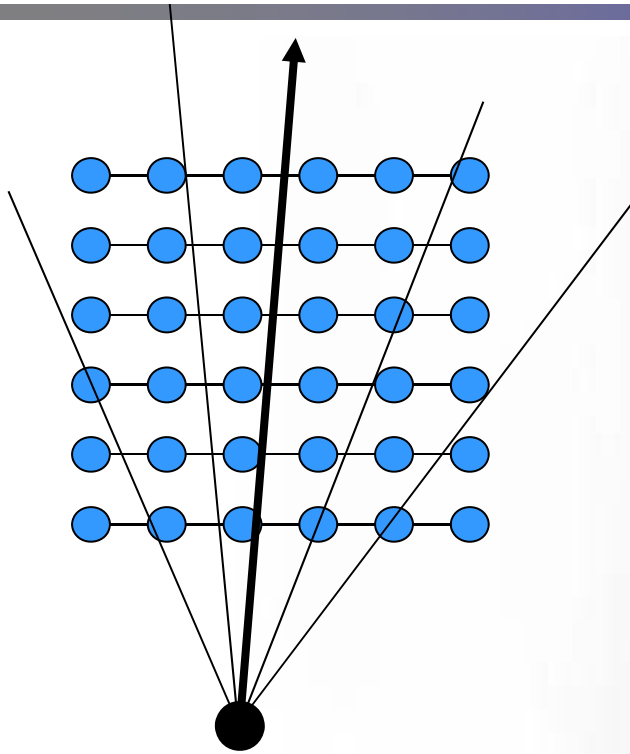
out-scattering



emission



in-scattering

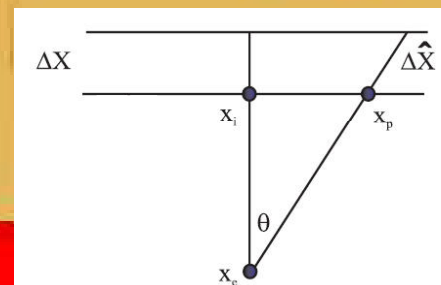


Orient planes to be most **perpendicular** to line of sight

Beer's law
 $I/I_0 = \exp(-ks\Delta x)$



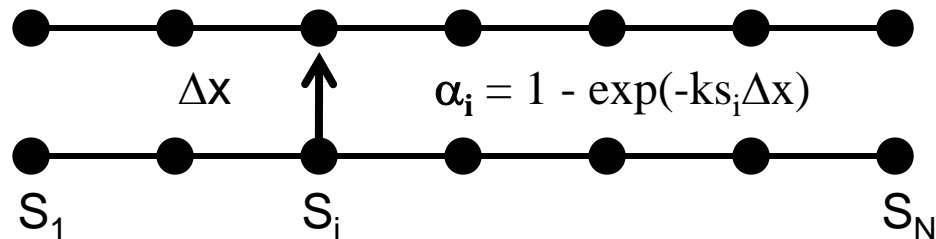
ΔX



3D Smoke

Δx distance between adjacent grid planes
 S_i soot density
 α_i opacity

- FDS computes α for each grid node
- Smokeview combines α 's using the video card



3D Smoke

Correcting α

FDS computed:

$$\alpha = 1 - \exp(-ks\Delta x)$$

Smokeview computed:

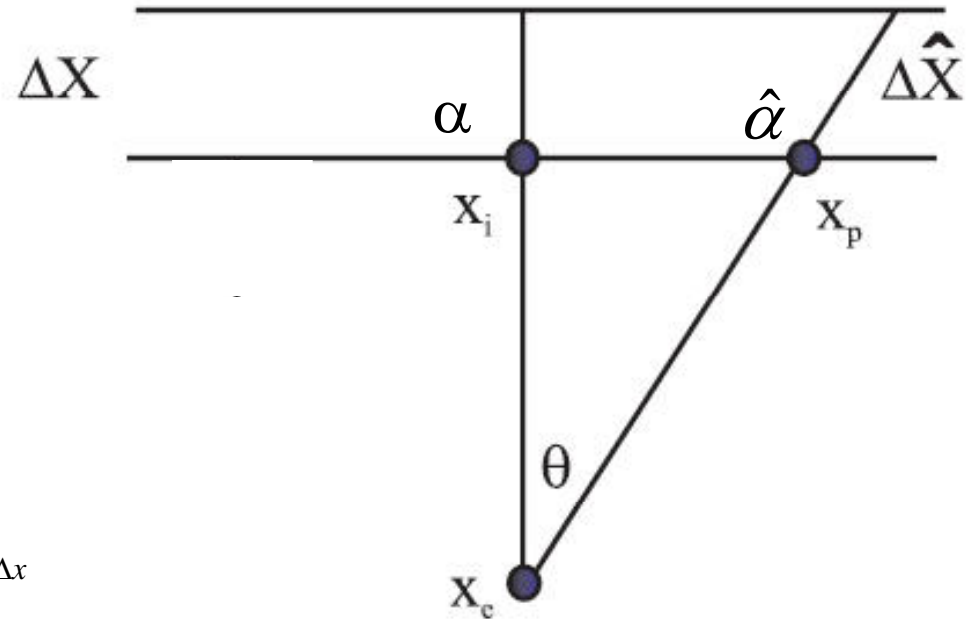
$$\hat{\alpha} = 1 - \exp(-ks\Delta \hat{x})$$

Solve for $\exp(-ks)$:

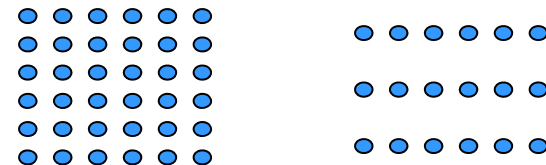
$$(1 - \hat{\alpha})^{1/\Delta \hat{x}} = \exp(-ks) = (1 - \alpha)^{1/\Delta x}$$

Solve for $\hat{\alpha}$

$$\hat{\alpha} = 1 - (1 - \alpha)^{\Delta \hat{x} / \Delta x}$$



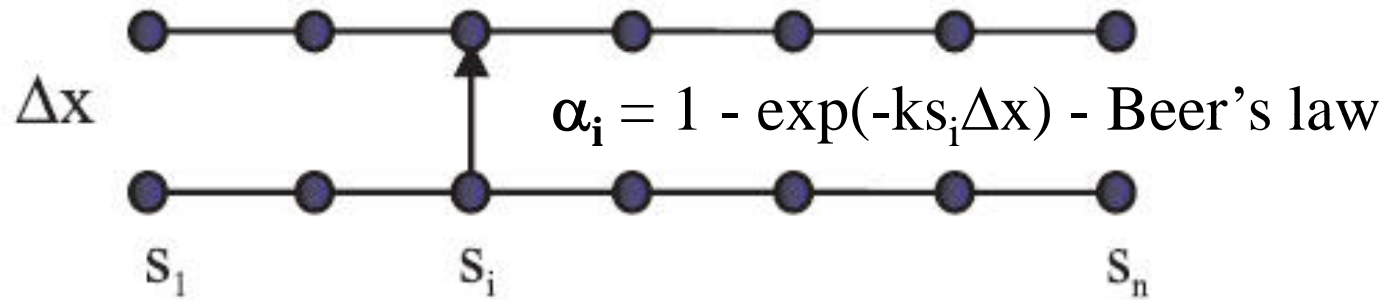
Skipping Frames



$$\Delta \hat{X} / \Delta X = 2 \quad \hat{\alpha} = 2\alpha - \alpha^2$$

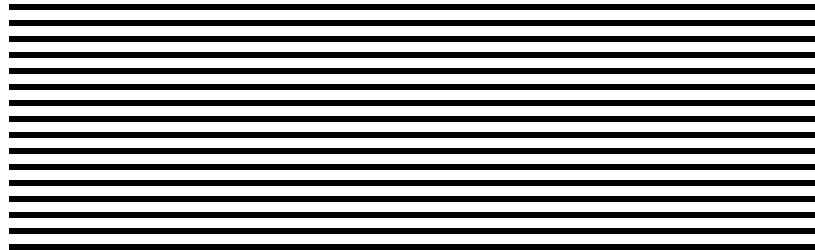
3D Smoke

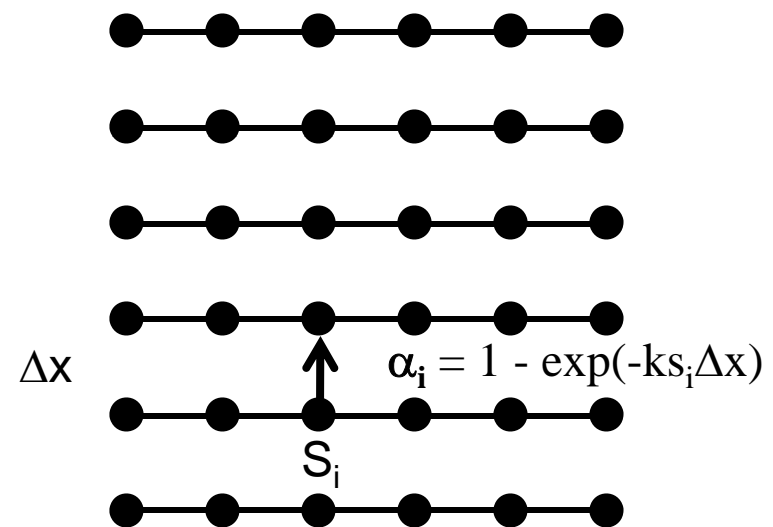
Problems can occur for large grids (Δx small)

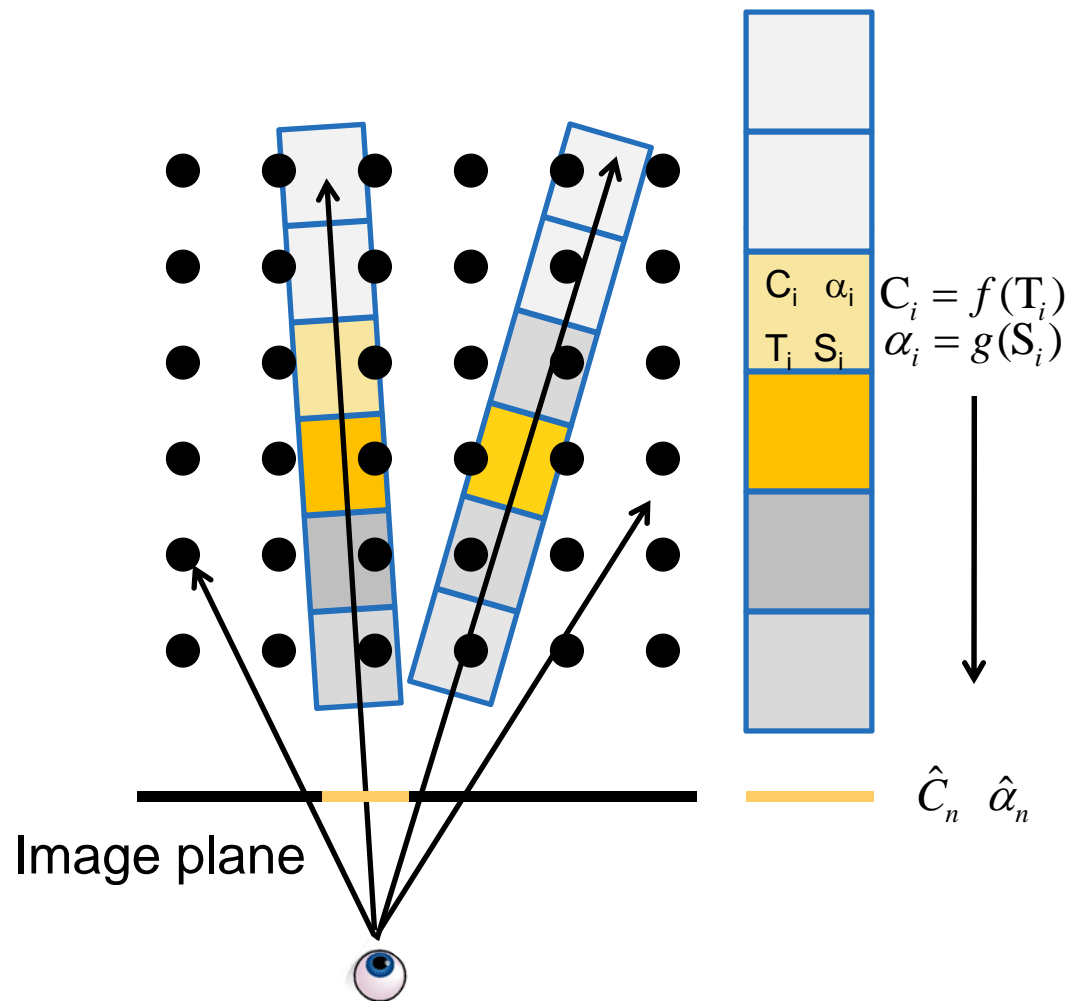


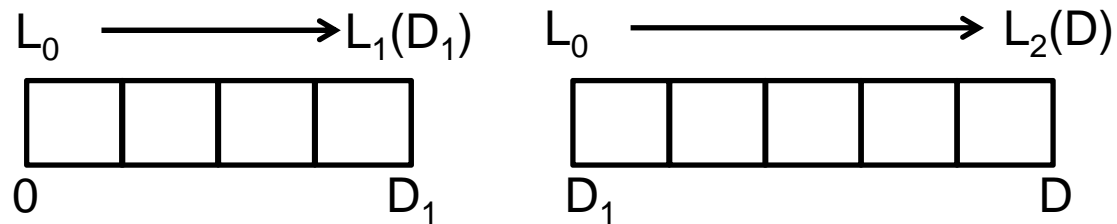
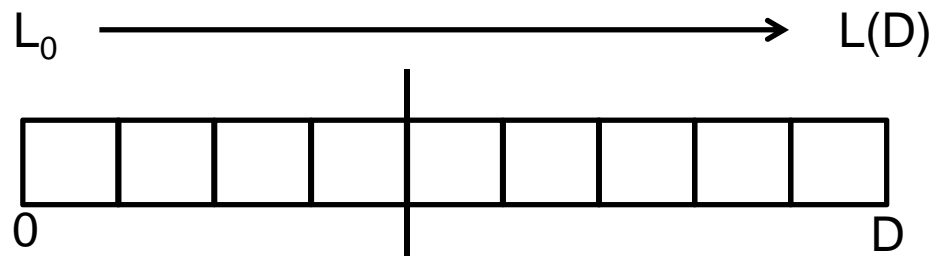
$$\alpha < 1/256 \approx 0$$

More refined grids \rightarrow smaller $\Delta x \rightarrow$ smaller $\alpha \rightarrow$ increased error









L_0 - initial radiance $L(x)$ - radiance at x