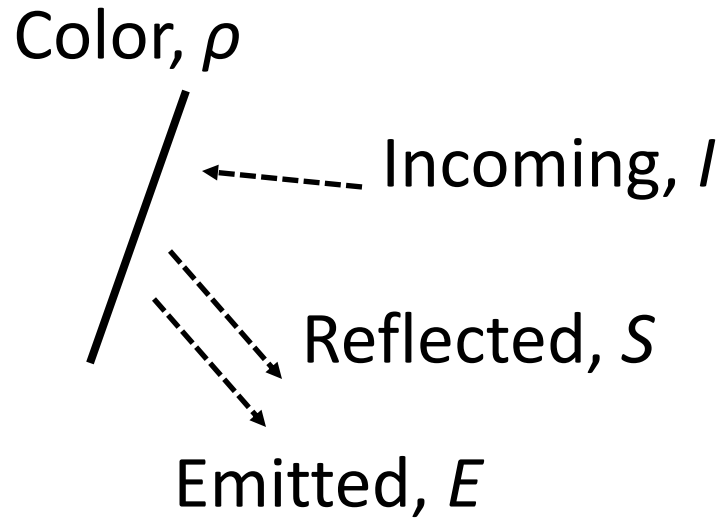


Speeding up the radiosity rendering algorithm using the kernel- independent FMM

Ross Adelman

12/13/2011

Radiosity



$$R_i = E_i + S_i$$

$$R_i = E_i + \rho_i I_i$$

$$R_i = E_i + \rho_i \sum_{j=1}^N F_{ji} R_j$$

Radiosity kernel

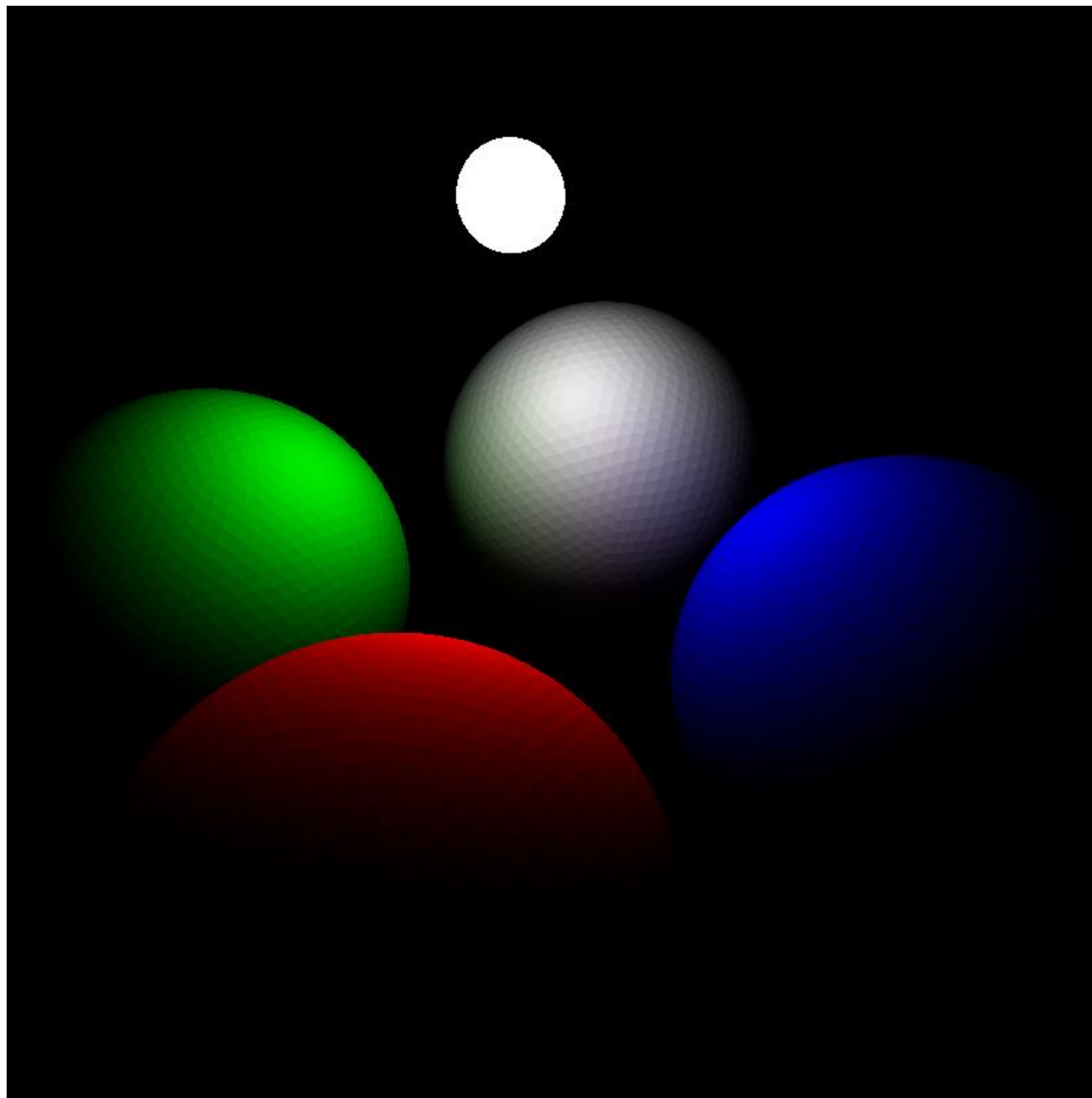
$$R_i = E_i + \rho_i \sum_{j=1}^N F_{ji} R_j$$

$$F_{ji} = -\frac{1}{A_i} \int_{A_i} \int_{A_j} \frac{(\mathbf{n}_i \cdot (\mathbf{r}_i - \mathbf{r}_j)) (\mathbf{n}_j \cdot (\mathbf{r}_i - \mathbf{r}_j)) dA_j dA_i}{\pi |\mathbf{r}_i - \mathbf{r}_j|^4}$$

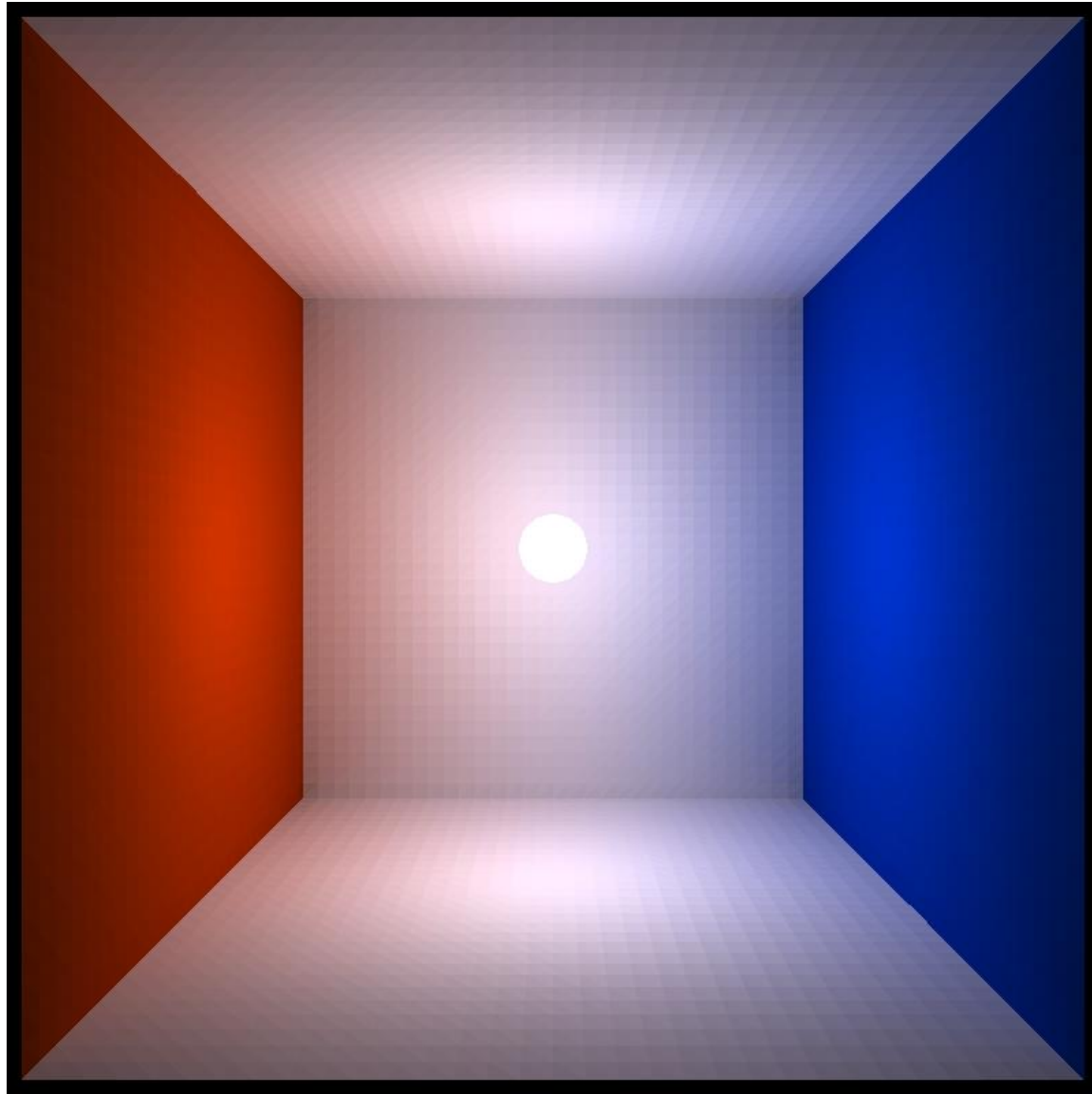
In my implementation, I approximate this by

$$F_{ji} = -\frac{A_j}{M} \sum_{k=1}^M \frac{(\mathbf{n}_i \cdot (\mathbf{c}_i - \mathbf{r}_k)) (\mathbf{n}_j \cdot (\mathbf{c}_i - \mathbf{r}_k))}{\pi |\mathbf{c}_i - \mathbf{r}_k|^4}$$

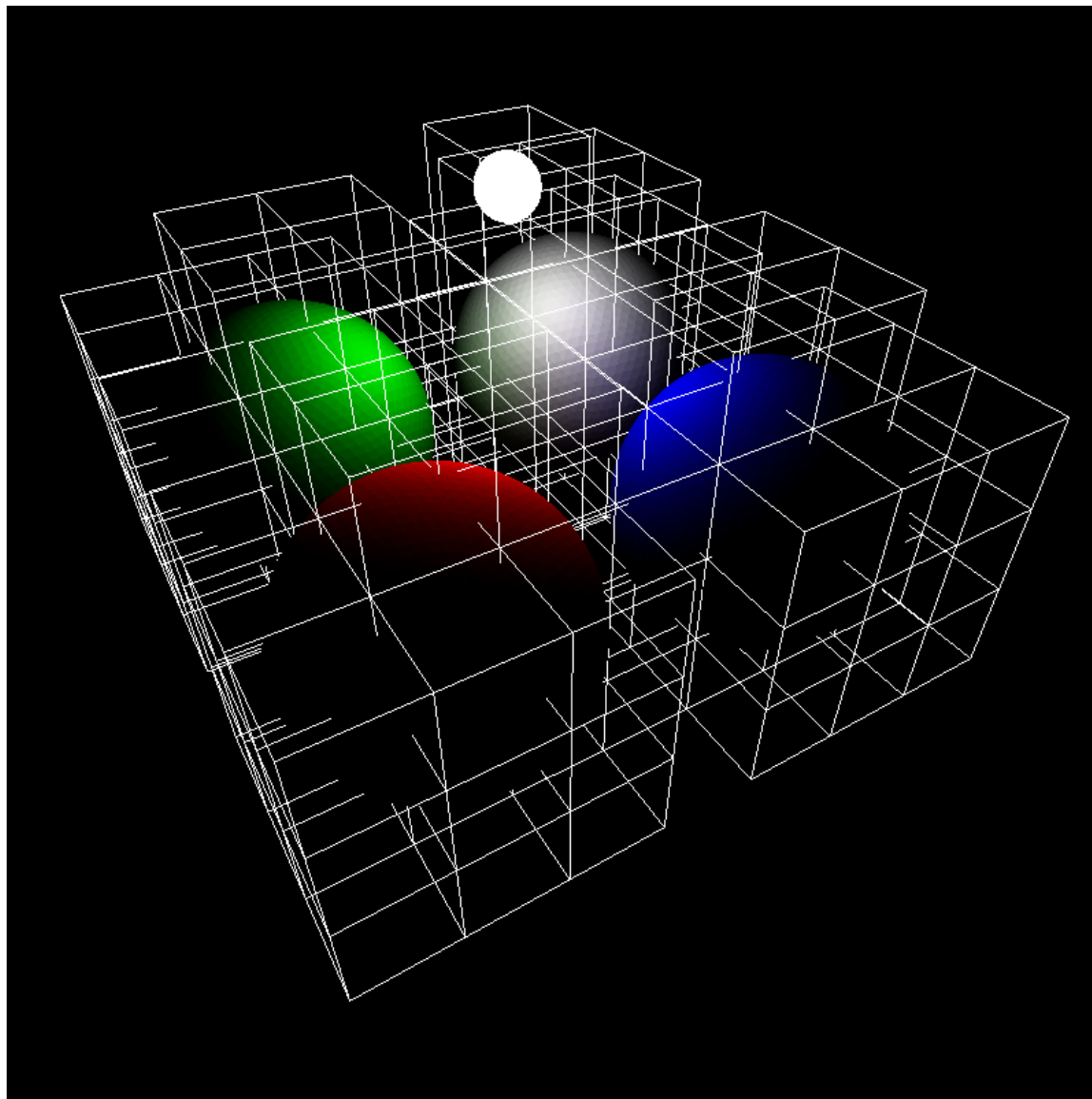
Scene A



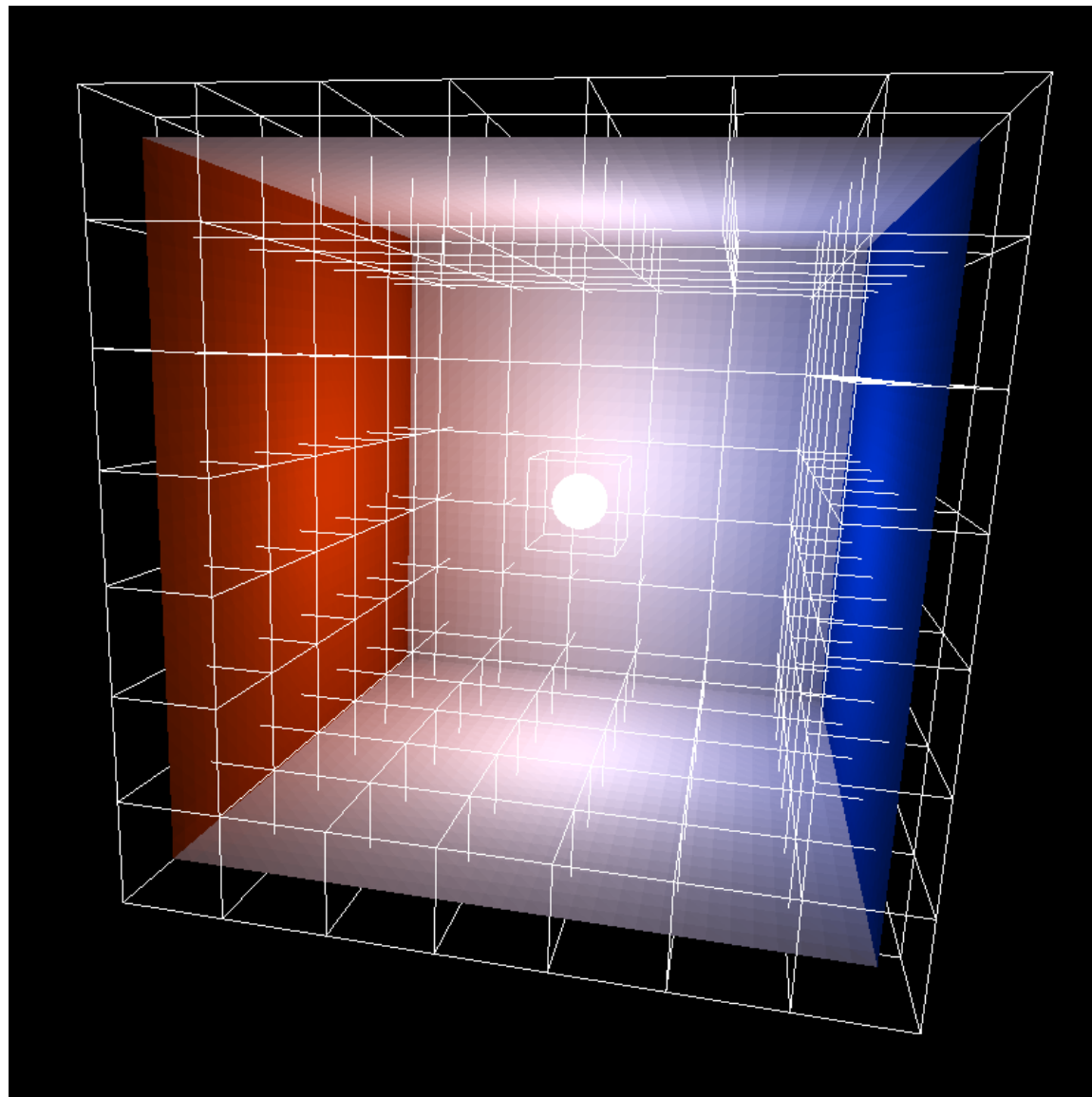
Scene B



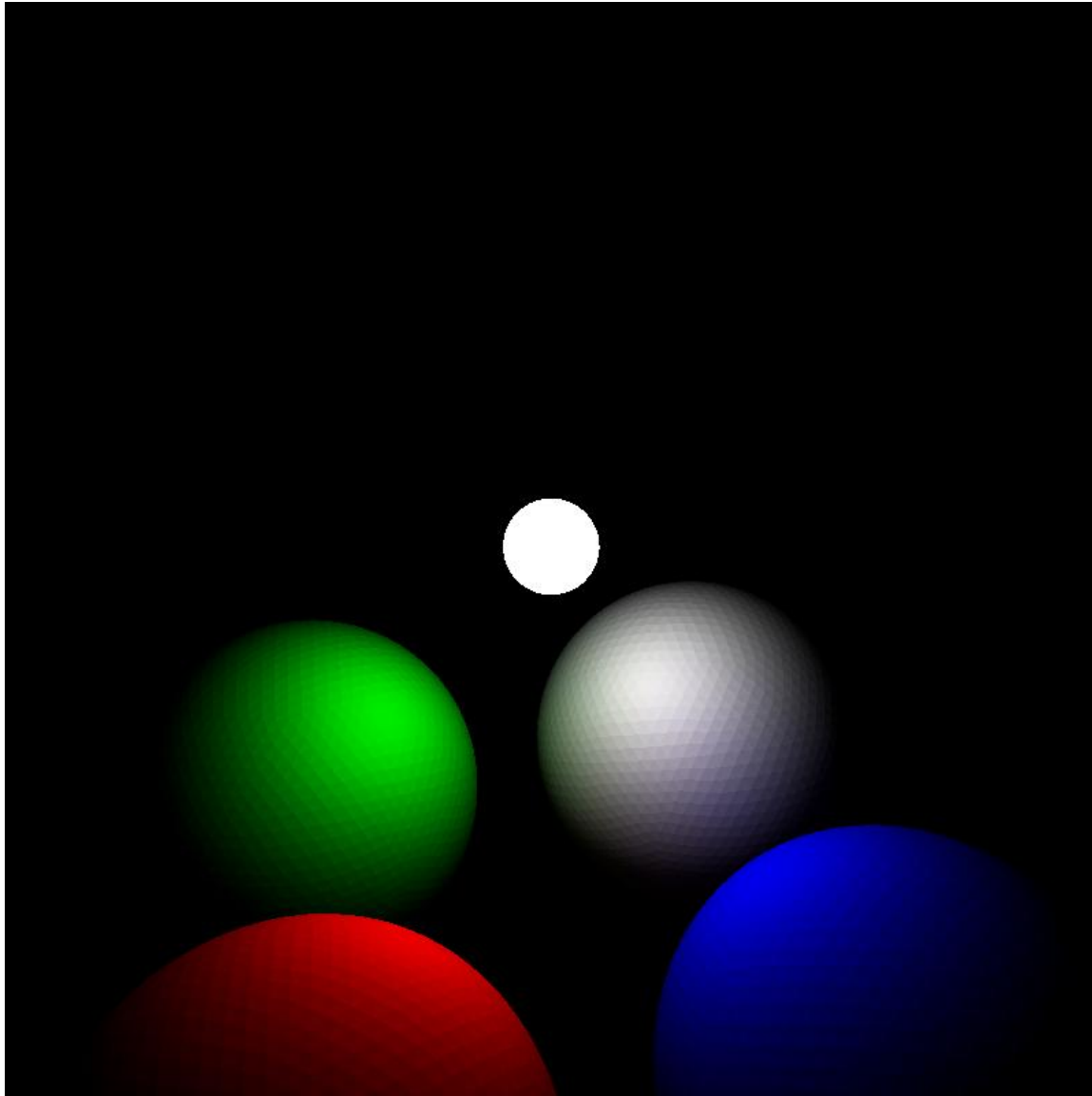
Divide the scene up into boxes



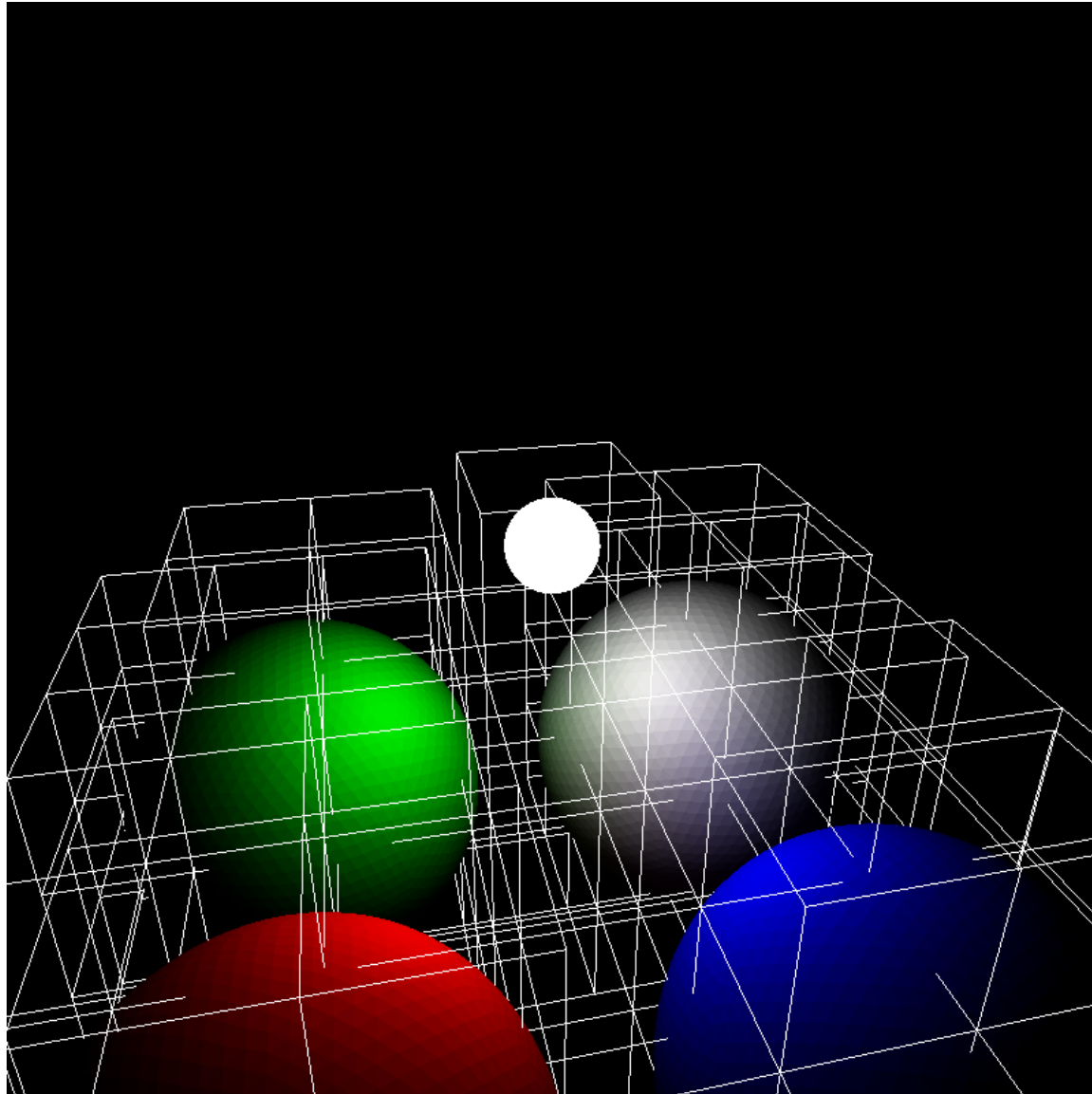
Divide the scene up into boxes



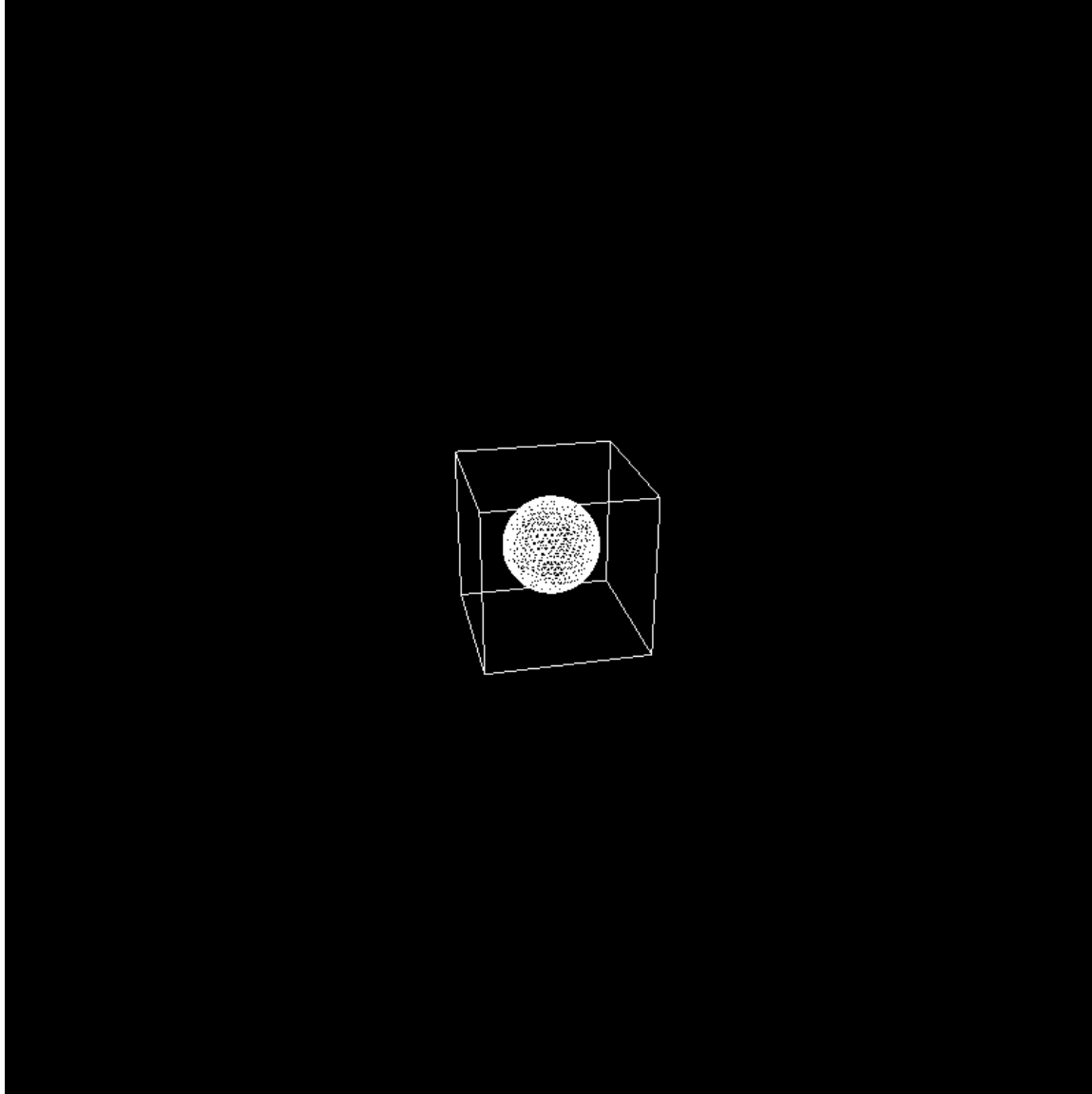
S-expansions -- proxy surface



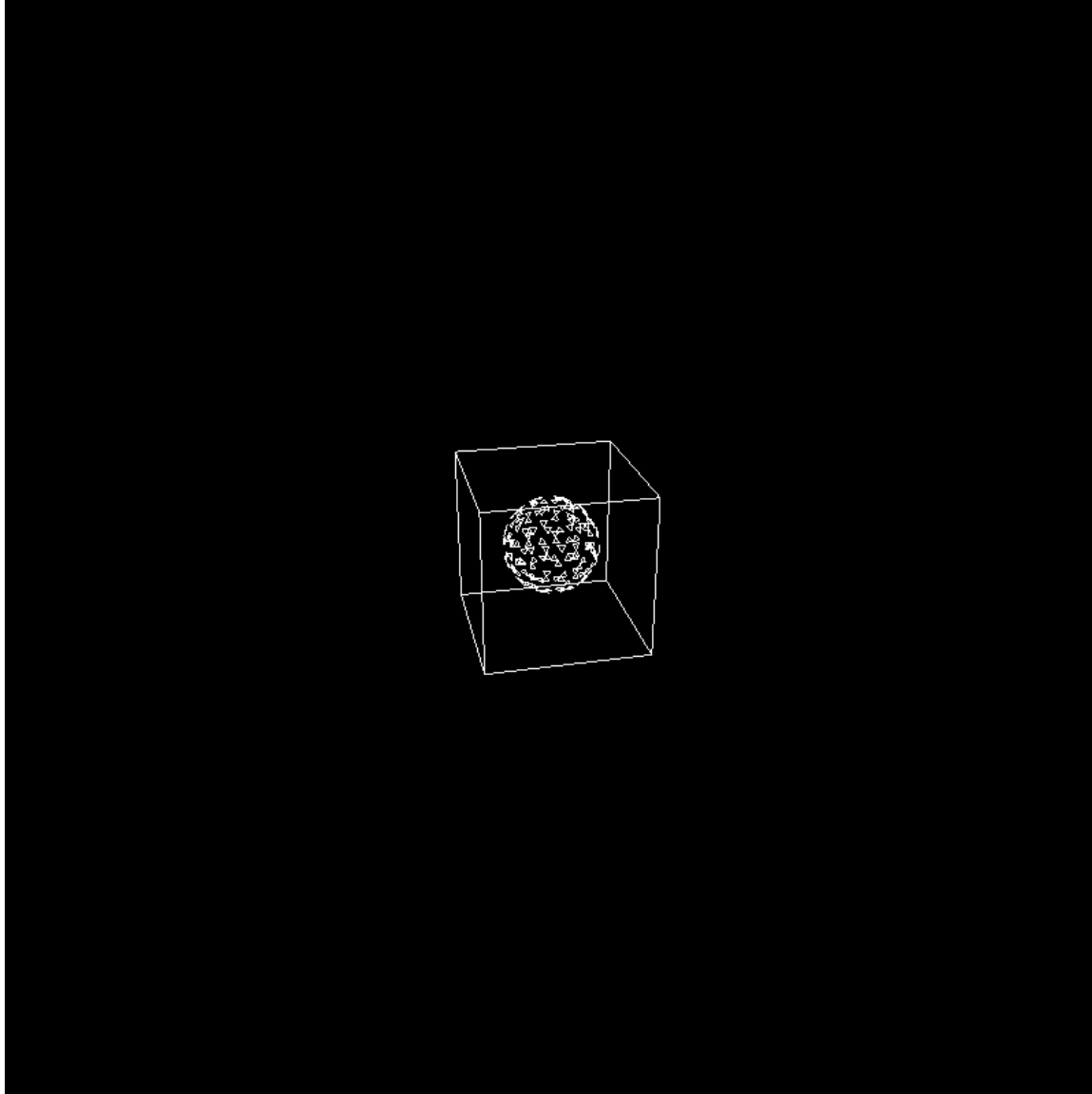
S-expansions -- proxy surface



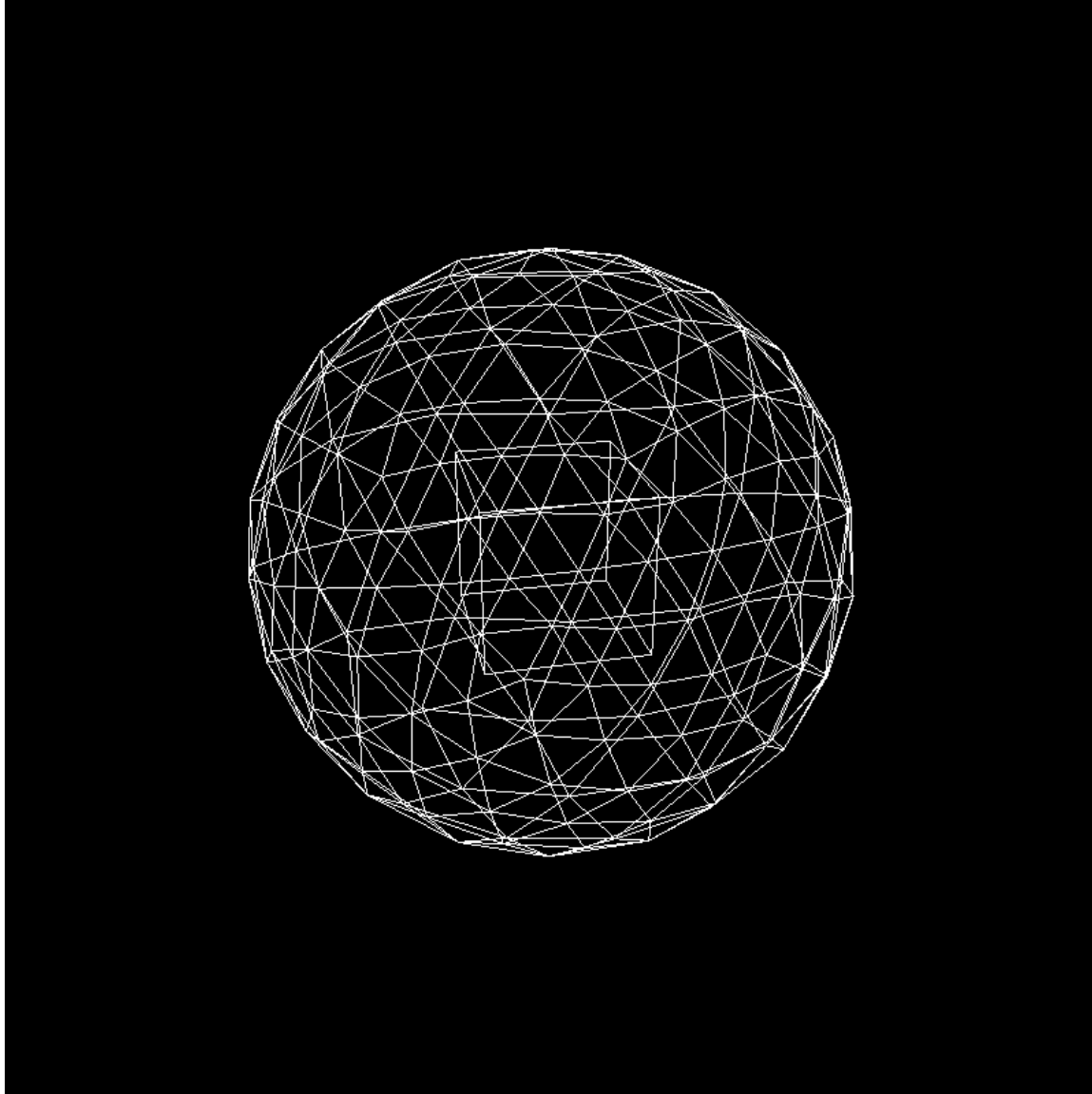
S-expansions -- proxy surface



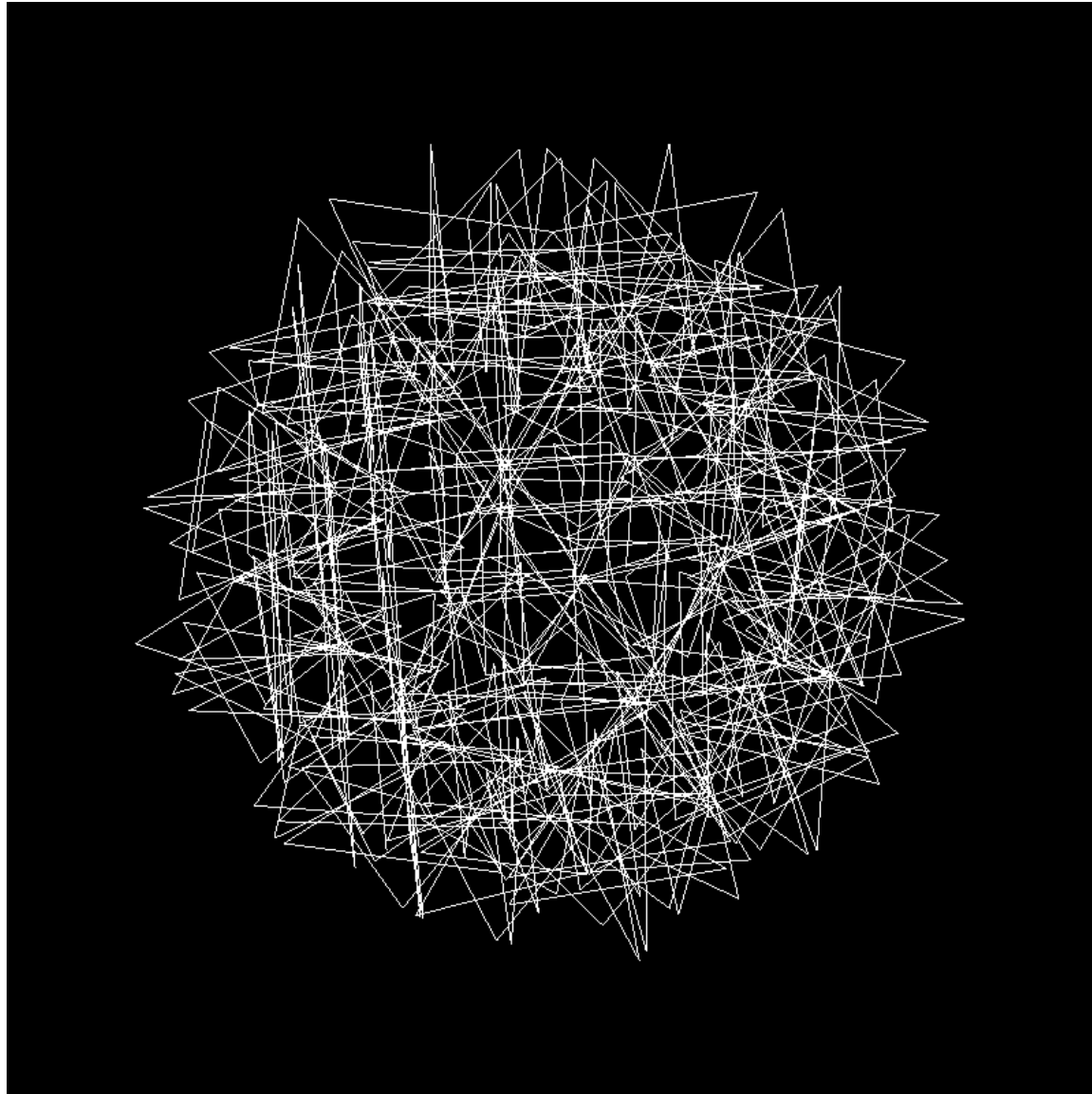
S-expansions -- proxy surface



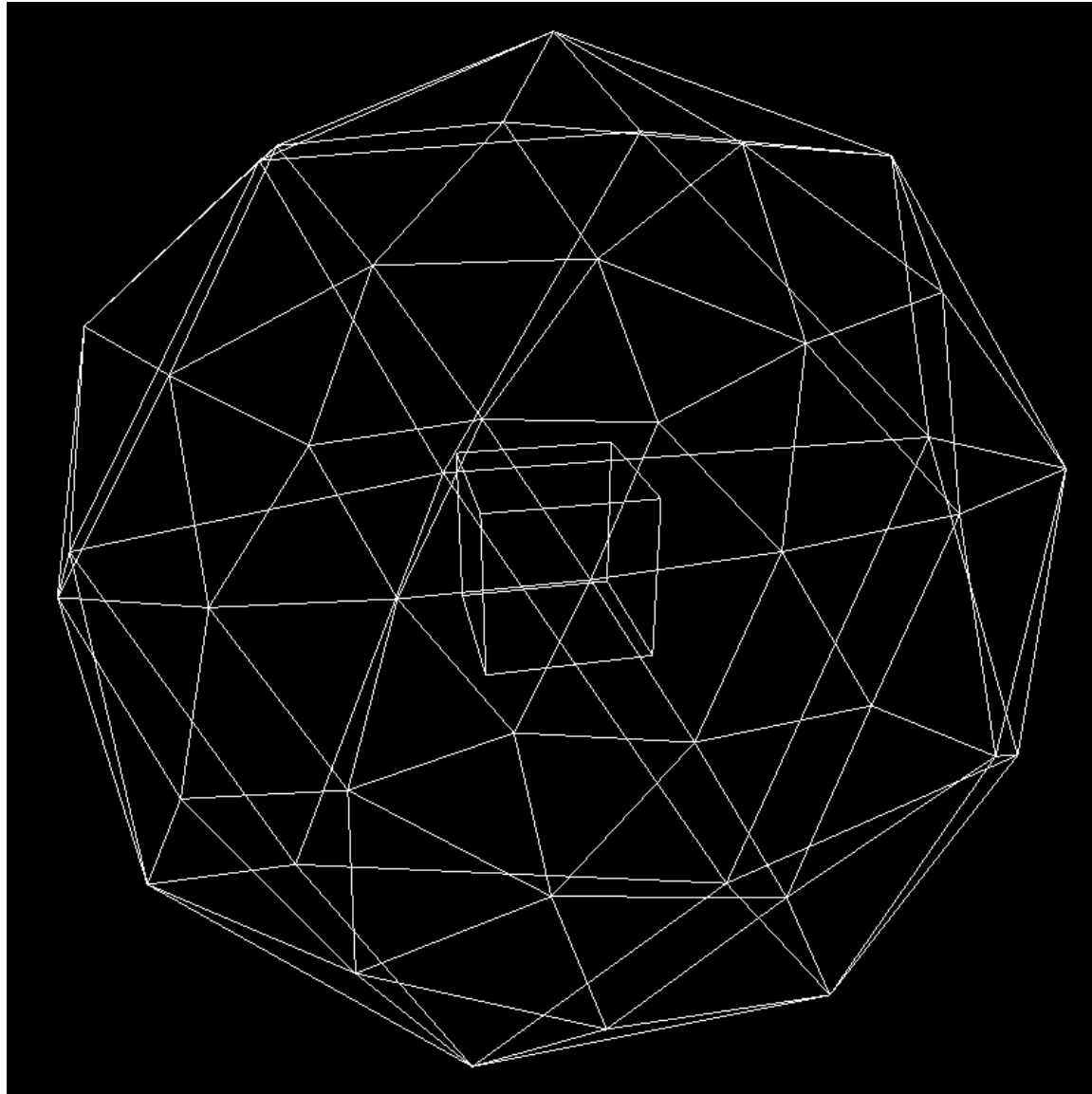
S-expansions -- check surface



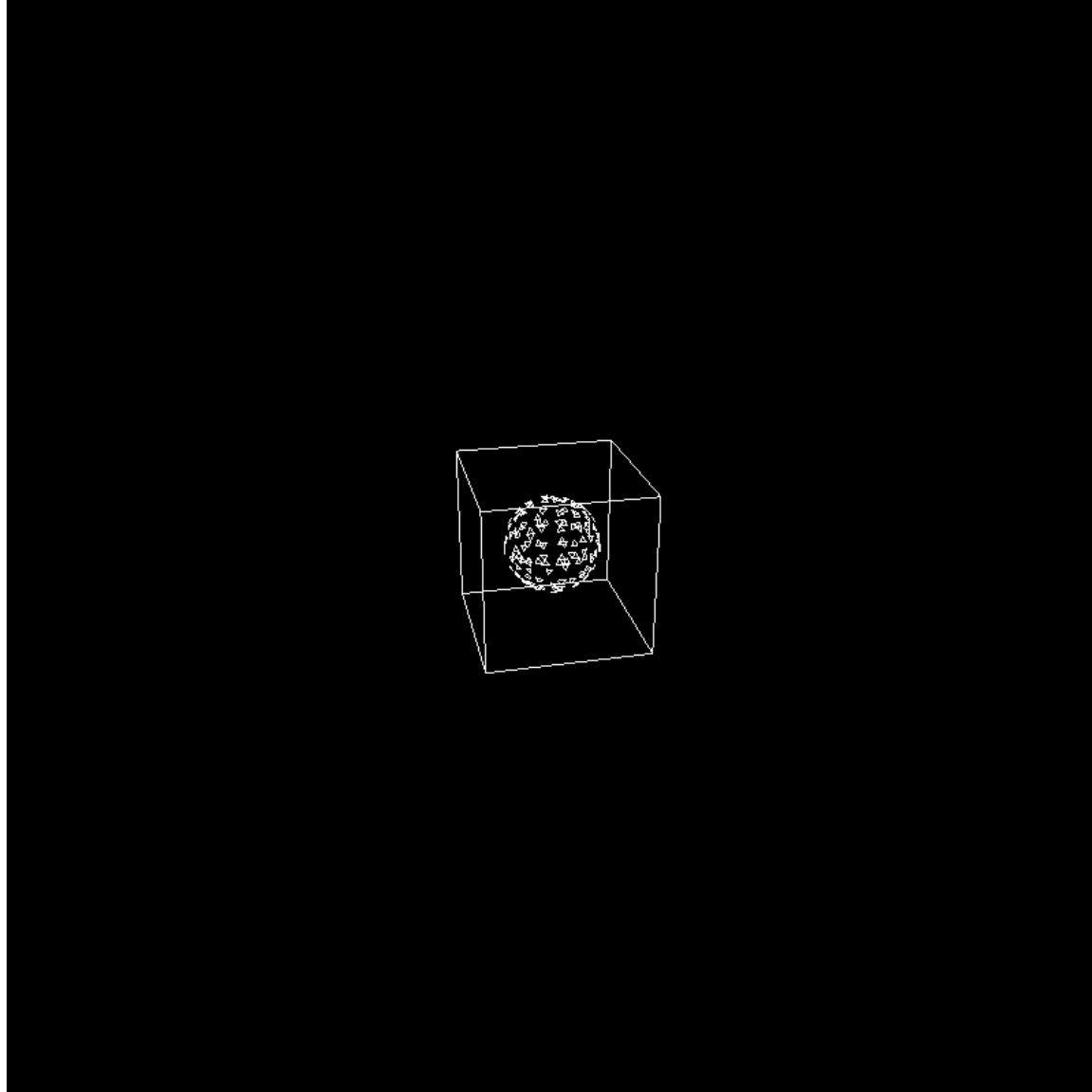
S-expansions -- check surface



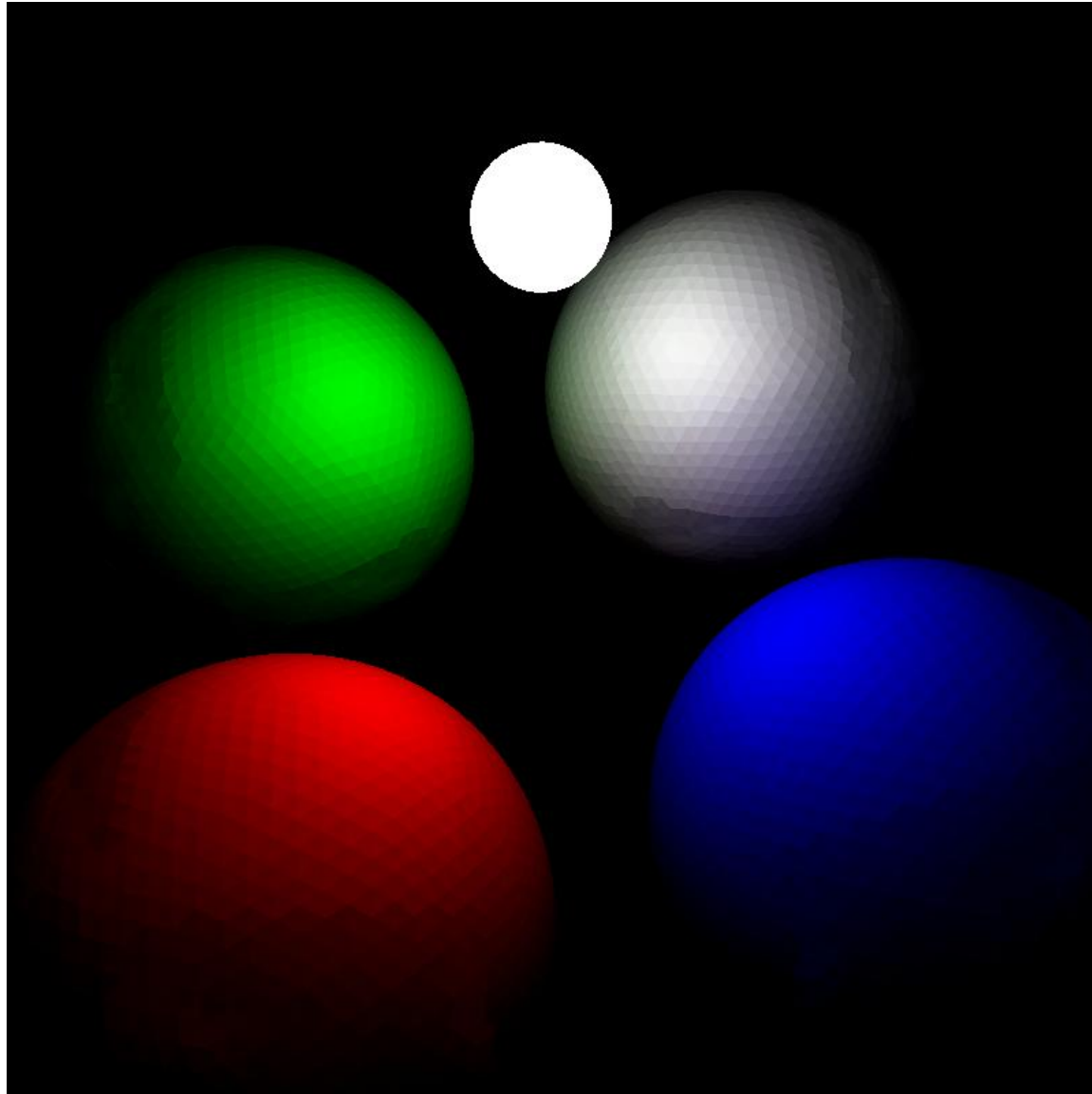
R-expansions -- proxy surface



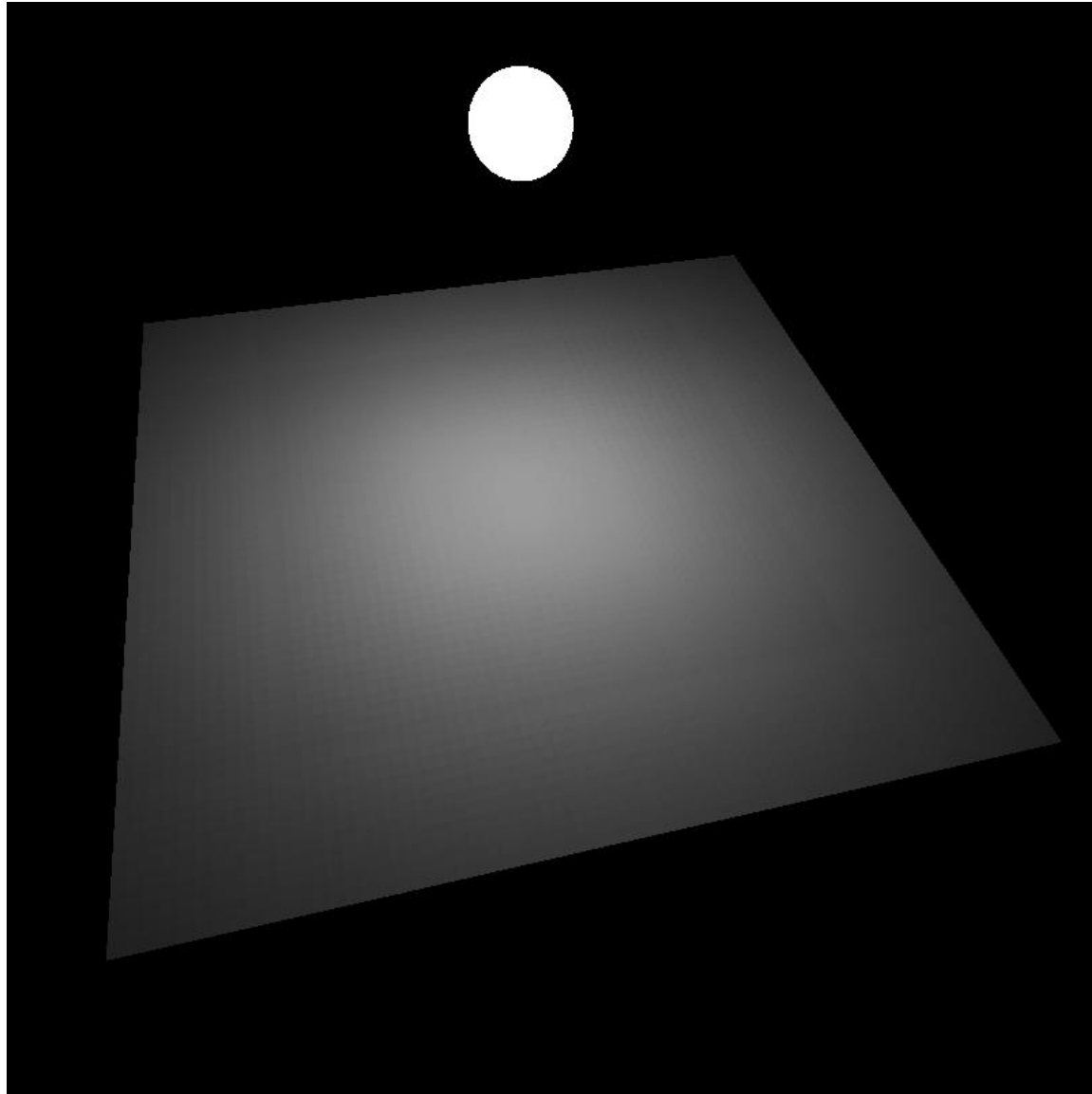
R-expansions -- check surface



Interesting artifacts



Interesting artifacts



Solving for the radiosity values on the proxy triangles

Form factors between proxy and check triangles

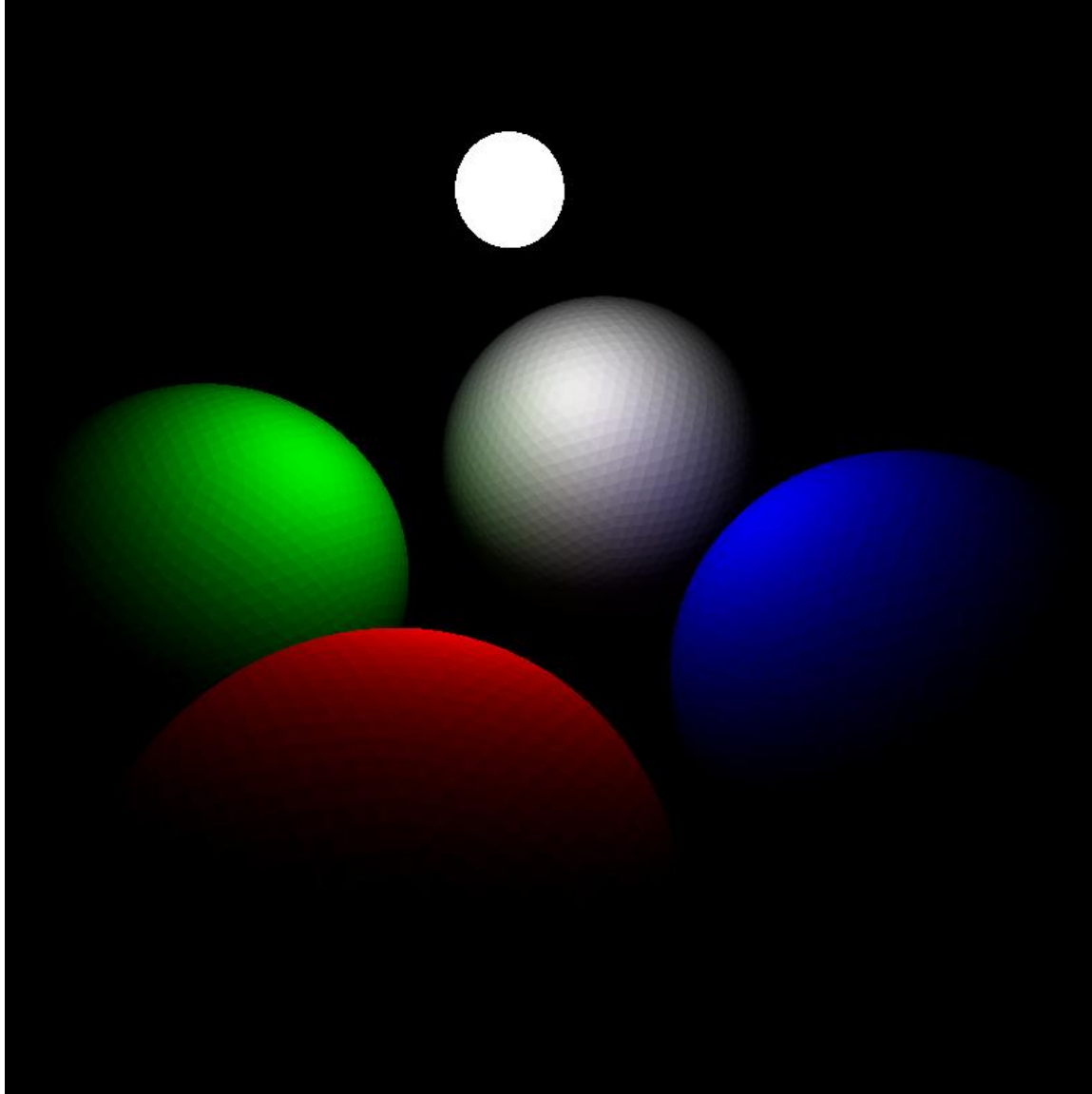
Radiosity values on check triangles due to actual sources

$$\mathbf{F}\mathbf{x} = \mathbf{b}$$

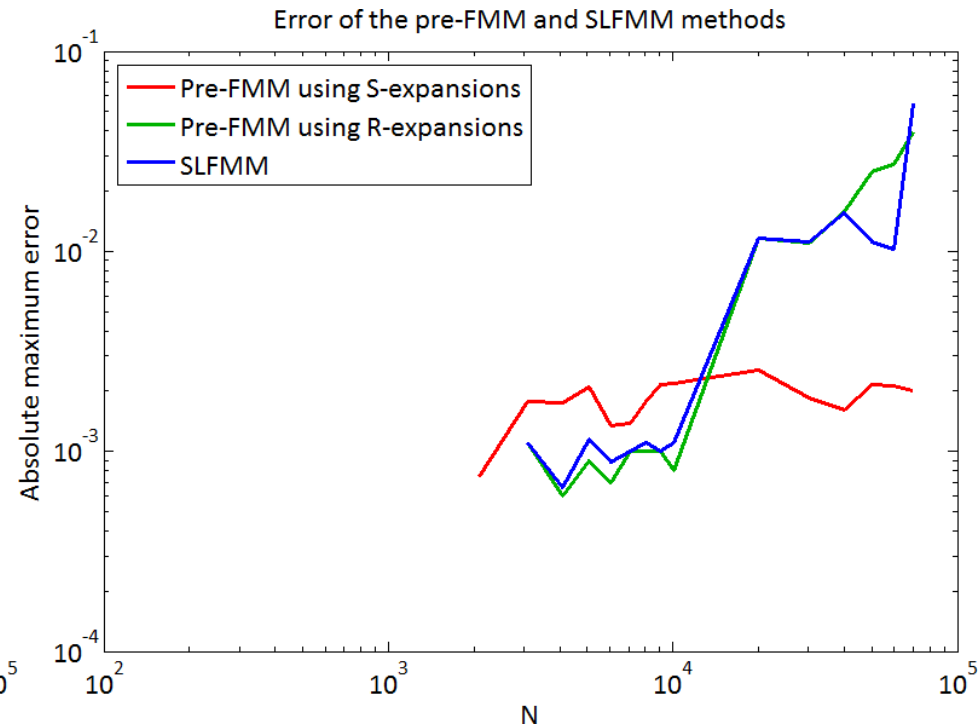
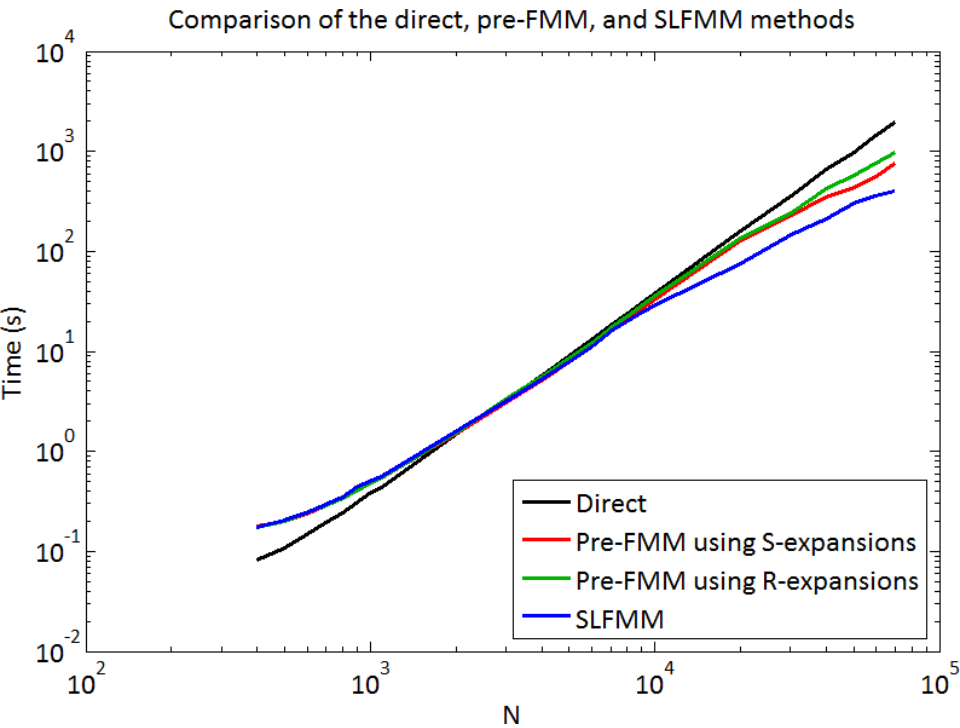
Unknown radiosity values on proxy triangles

To solve this, I use `dgels()` from AMD's ACML library, which is a LAPACK implementation.

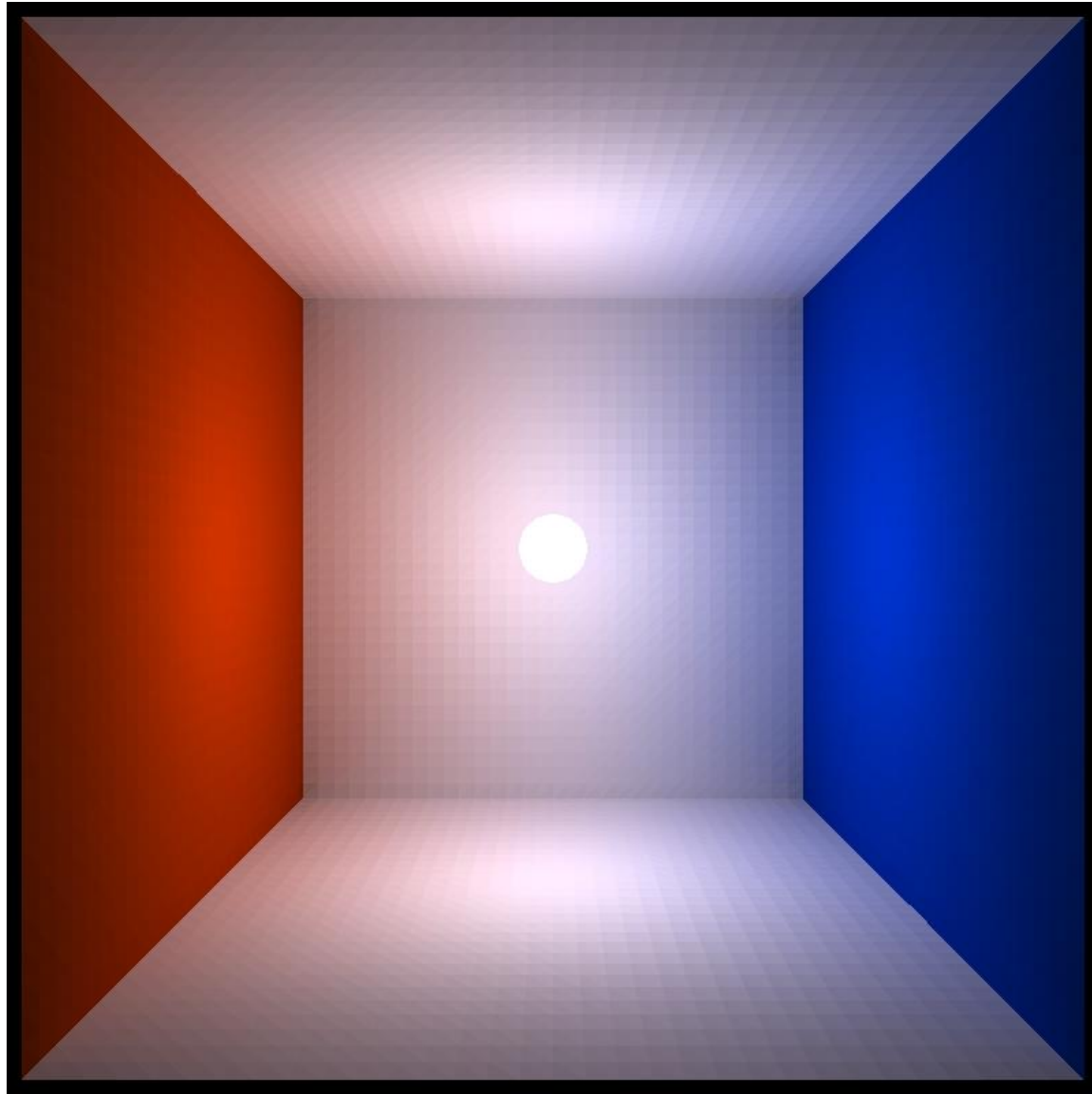
Time/error analysis for scene A



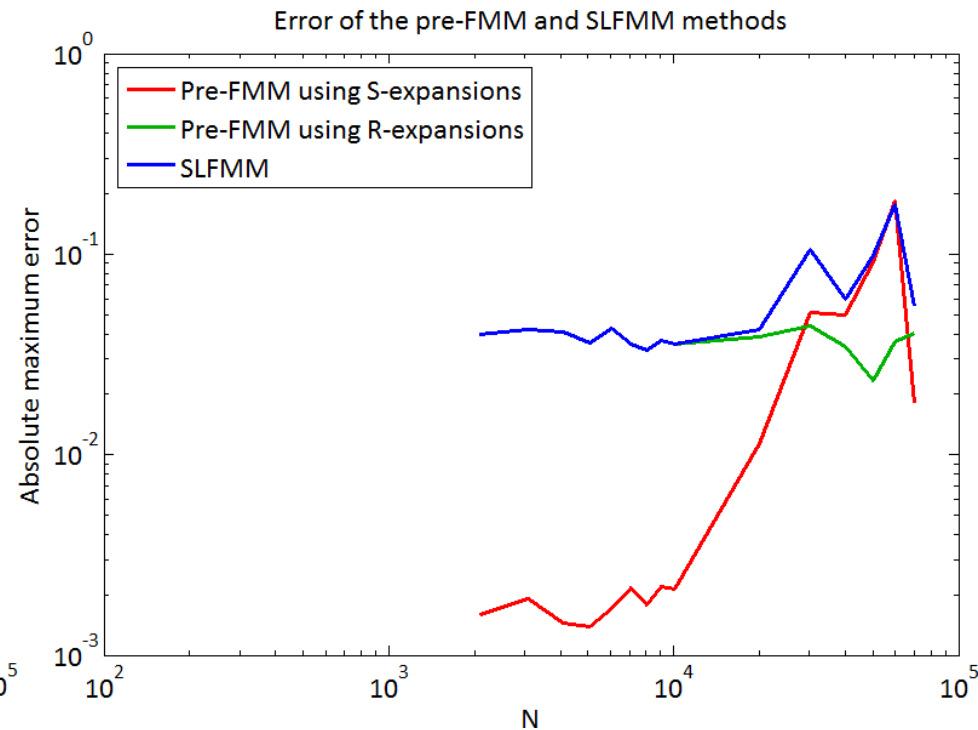
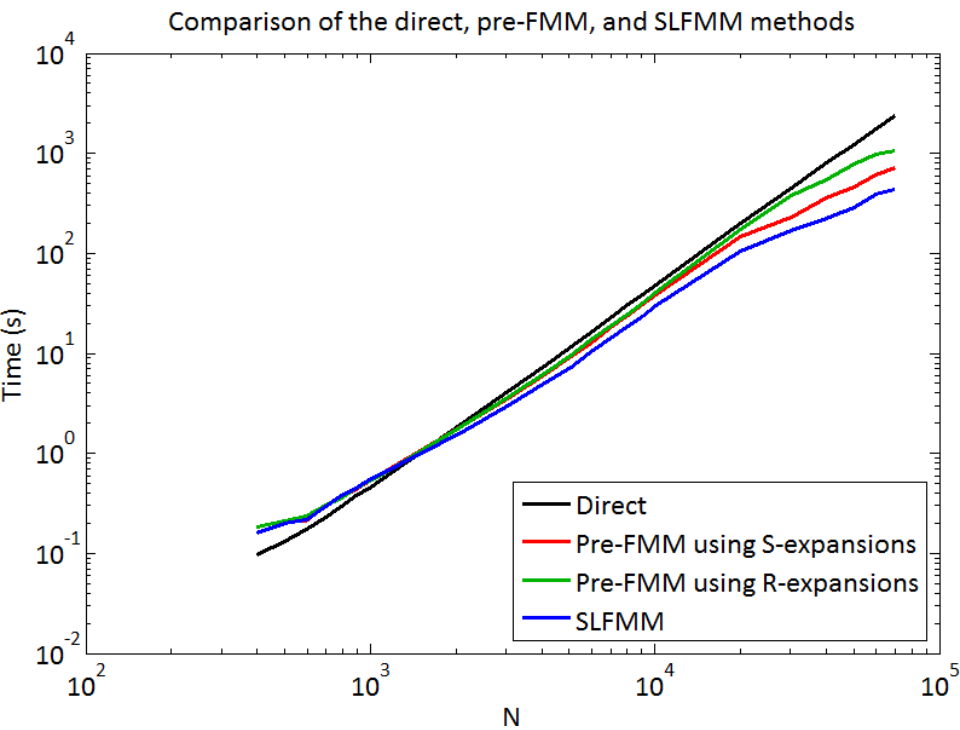
Time/error analysis for scene A



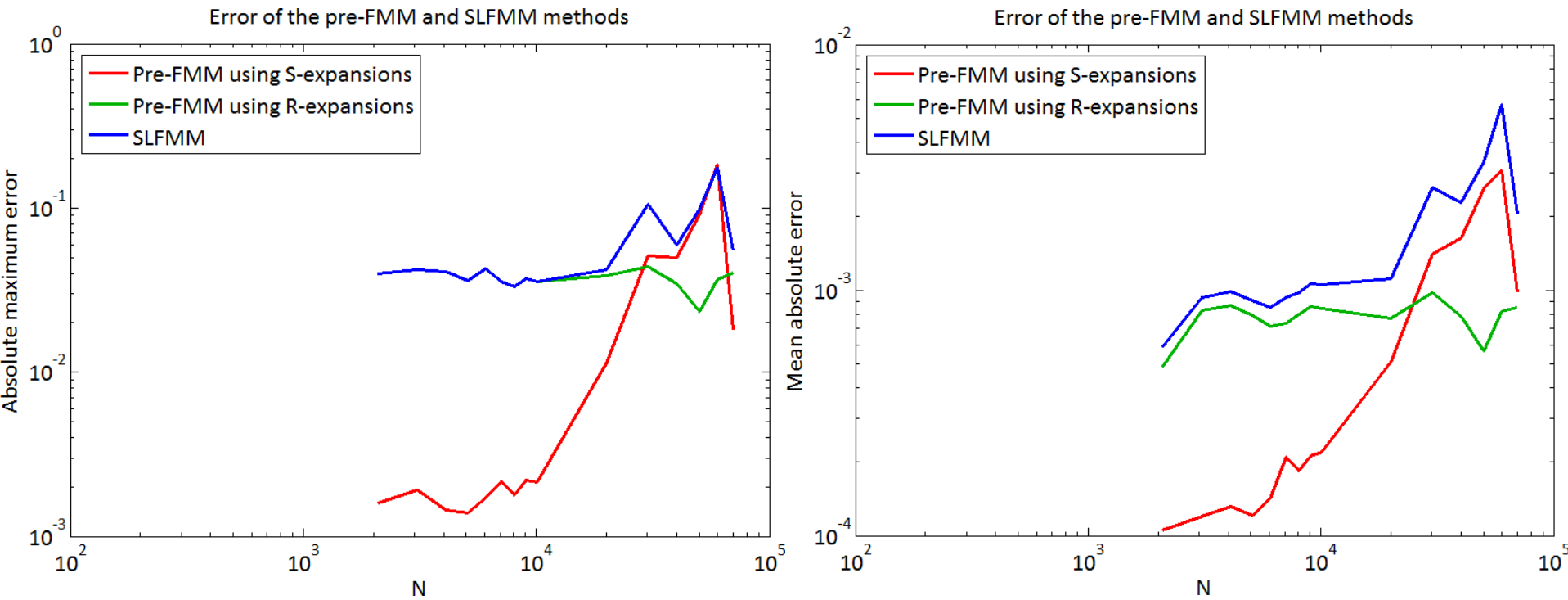
Time/error analysis for scene B



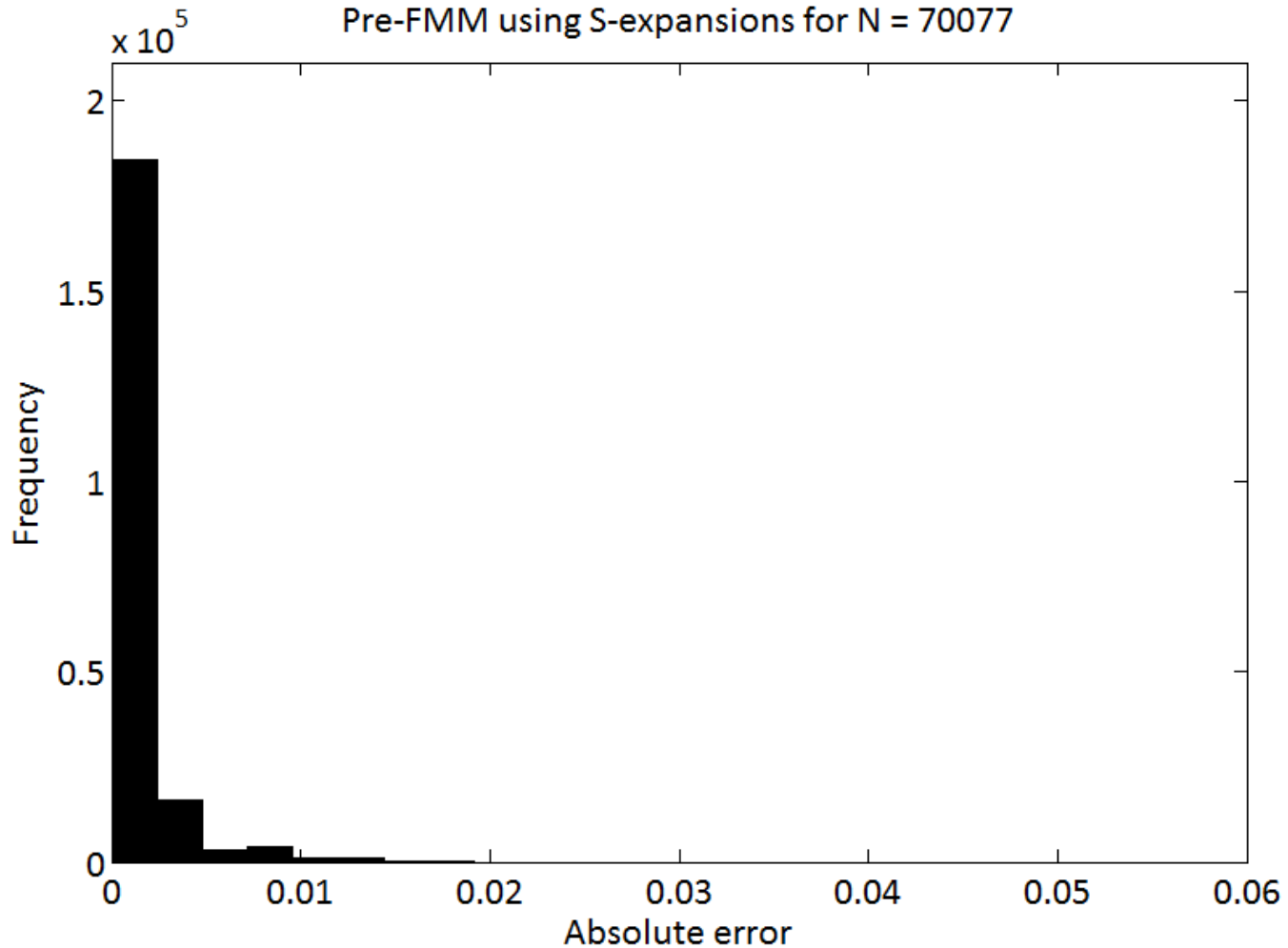
Time/error analysis for scene B



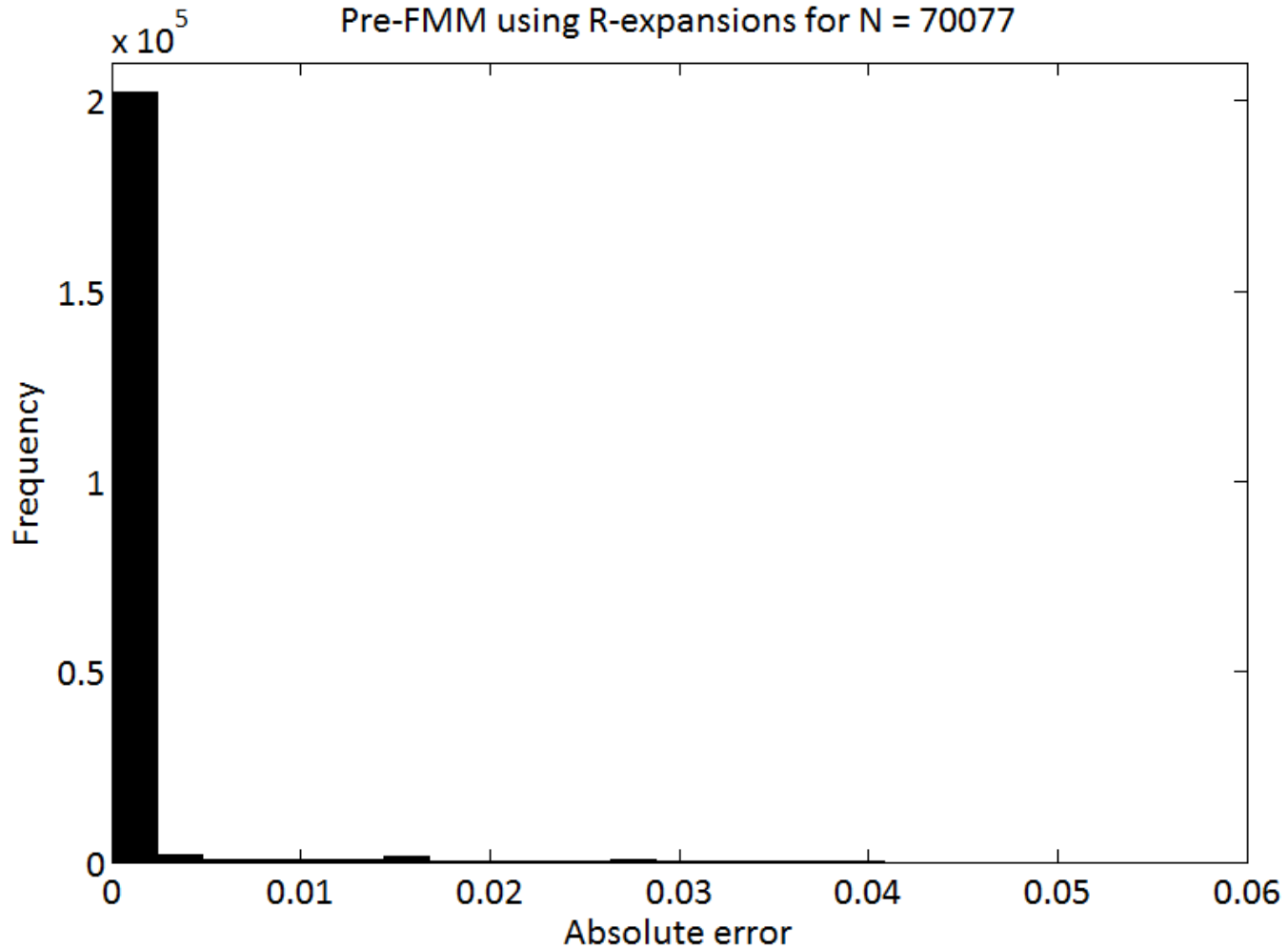
What about mean absolute error?



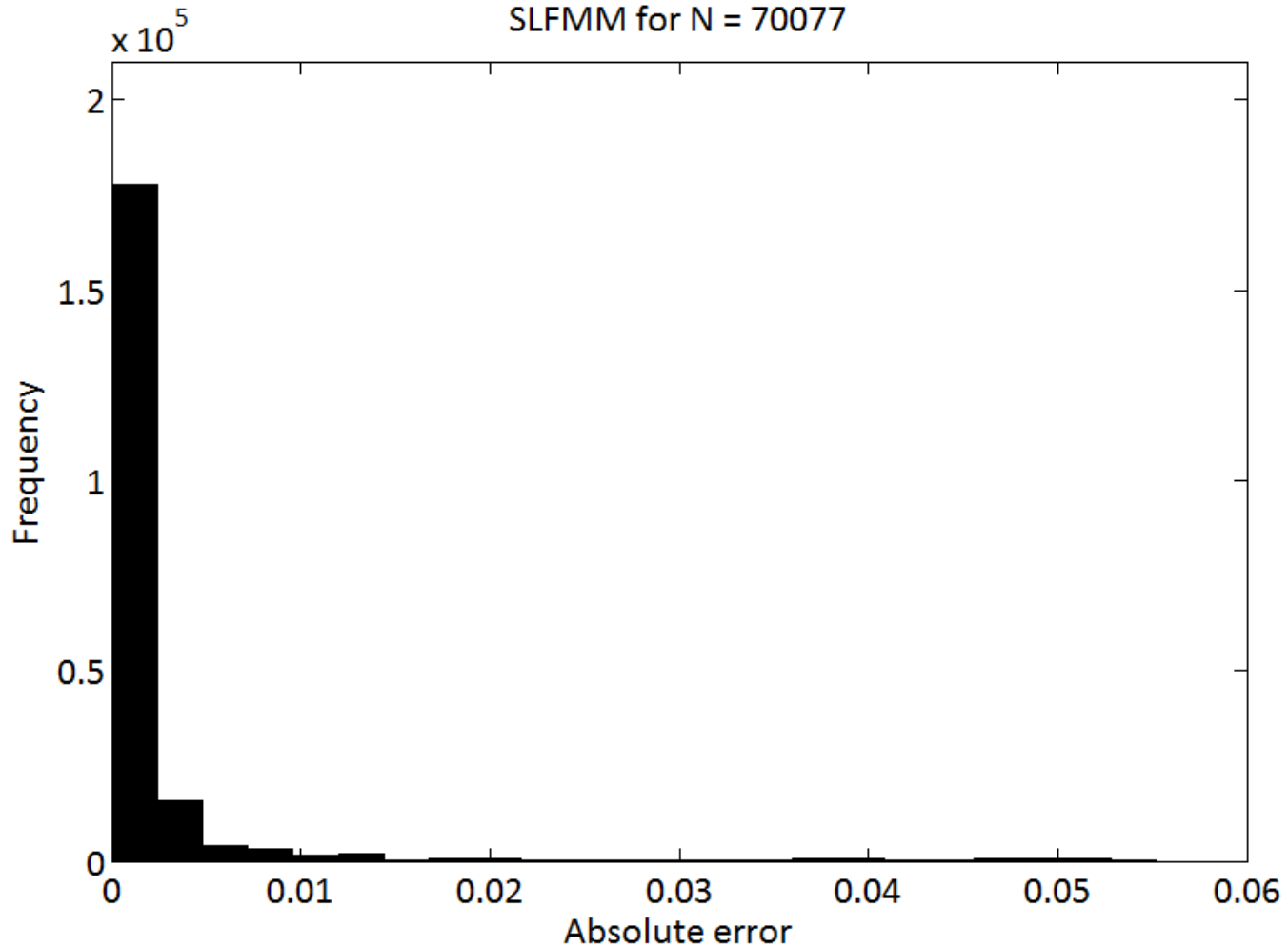
Histogram of error in scene B



Histogram of error in scene B



Histogram of error in scene B



Questions?

