

Project Proposal

Team 1

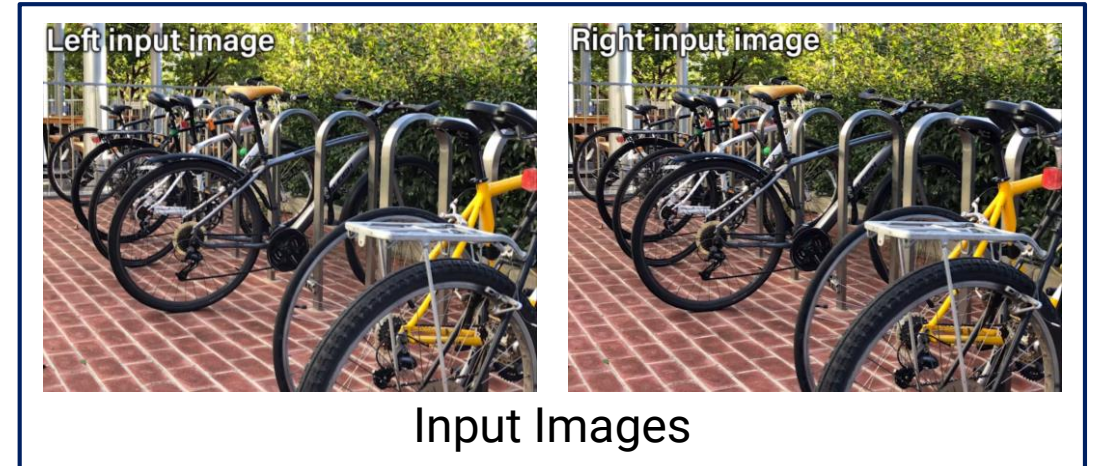
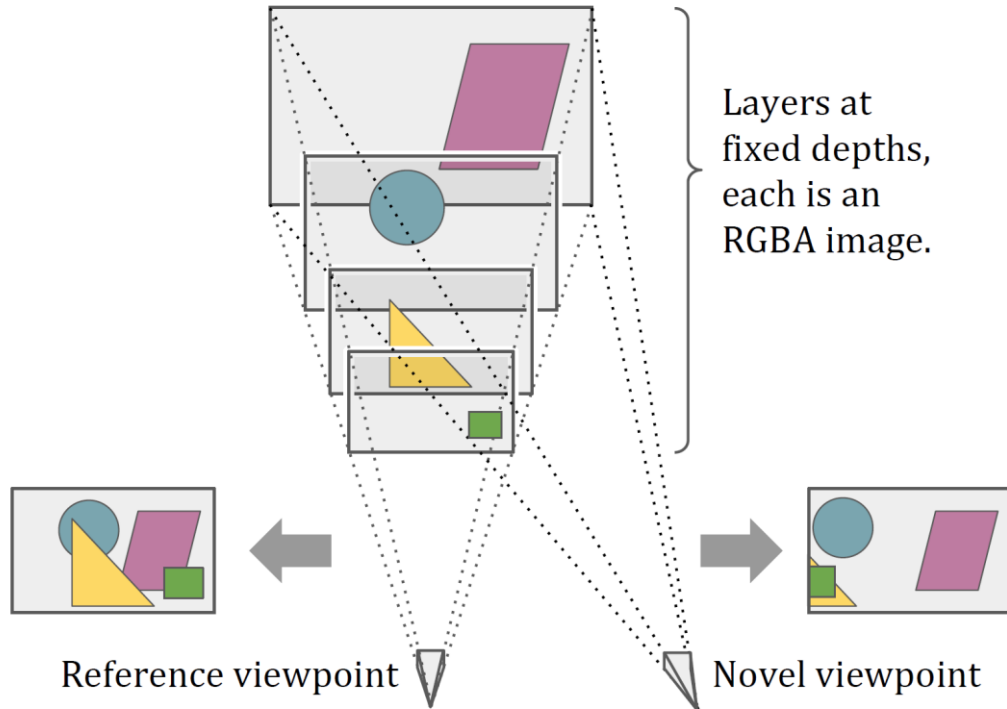
20223664 Dongyoung Choi

20214609 Jaemin Cho

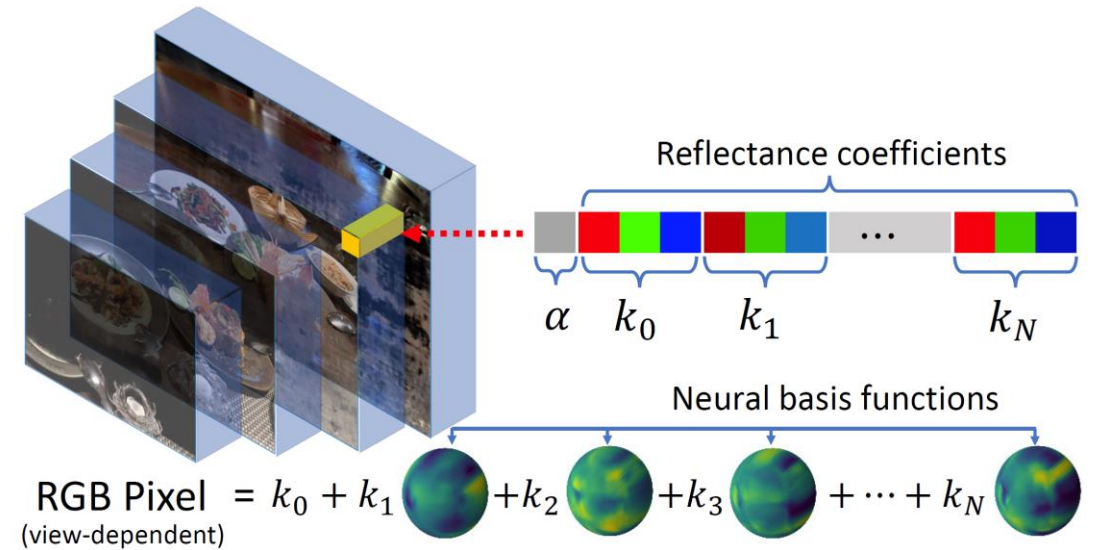
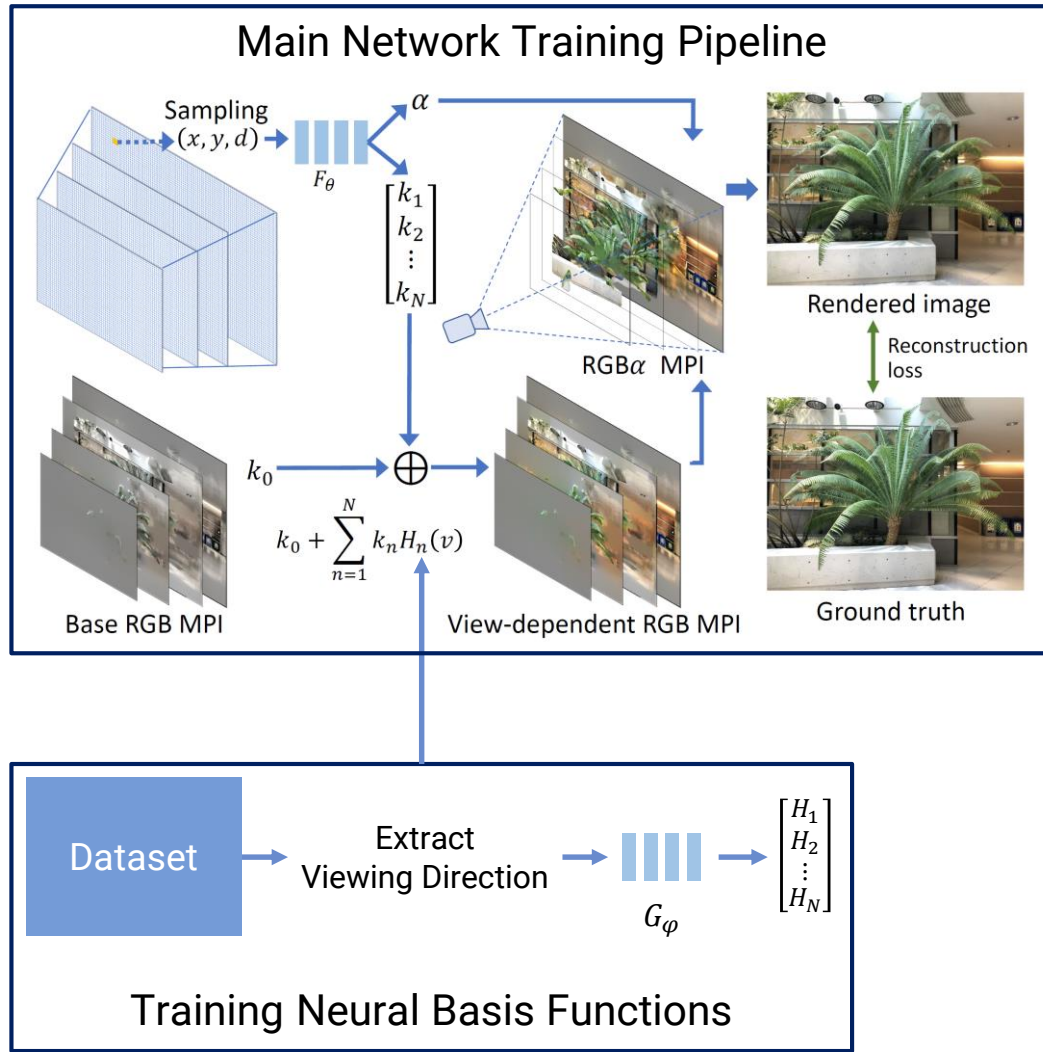


Background

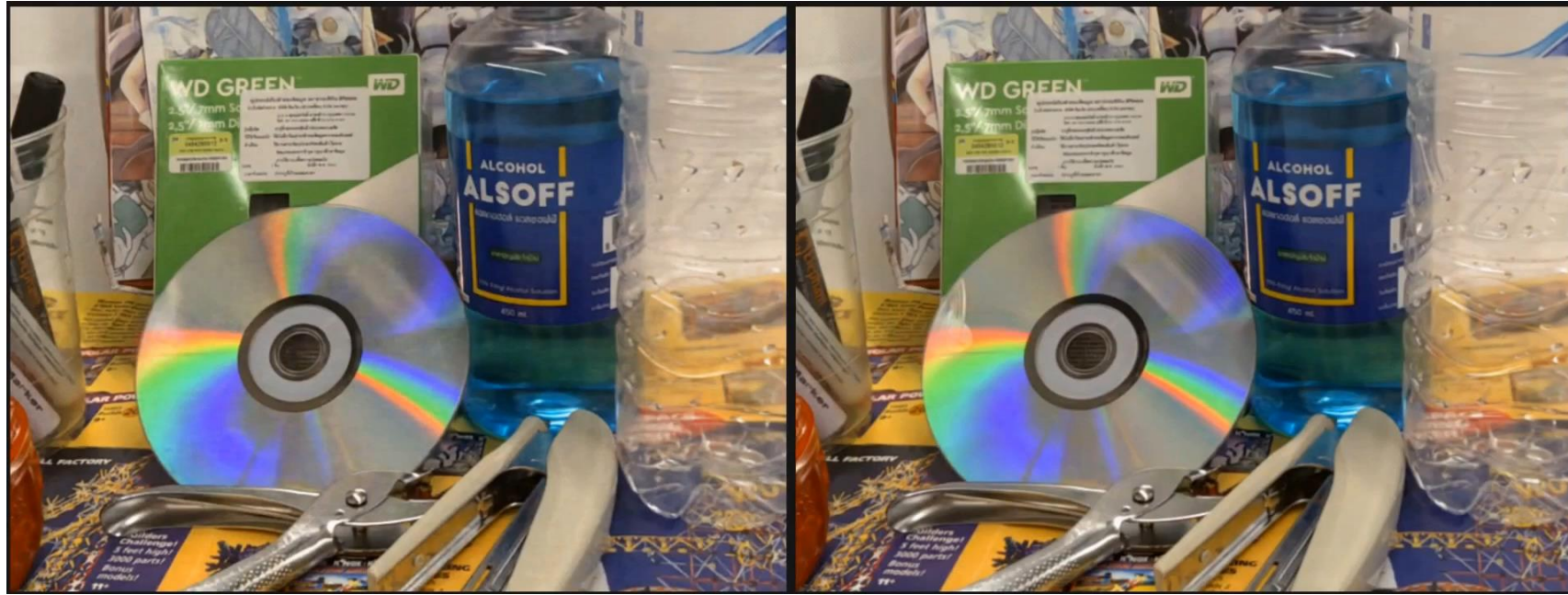
Multiplane Image (MPI)



NeX: Real-time View Synthesis with Neural Basis Expansion

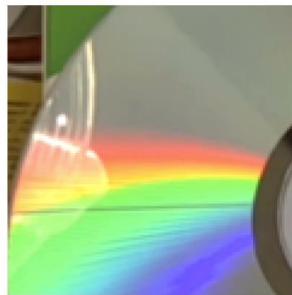


NeX: Synthesis Results

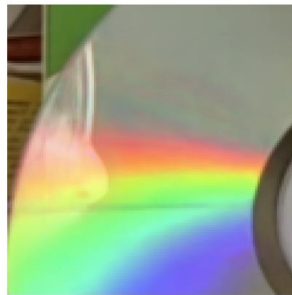


NeRF, 0.02 FPS

Ours, 60 FPS



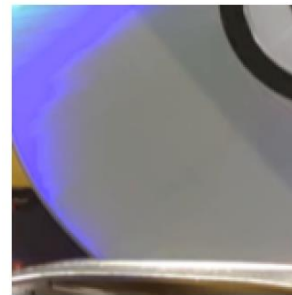
Ground truth



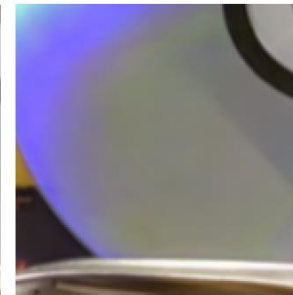
Ours



NeRF[22]



Ground truth



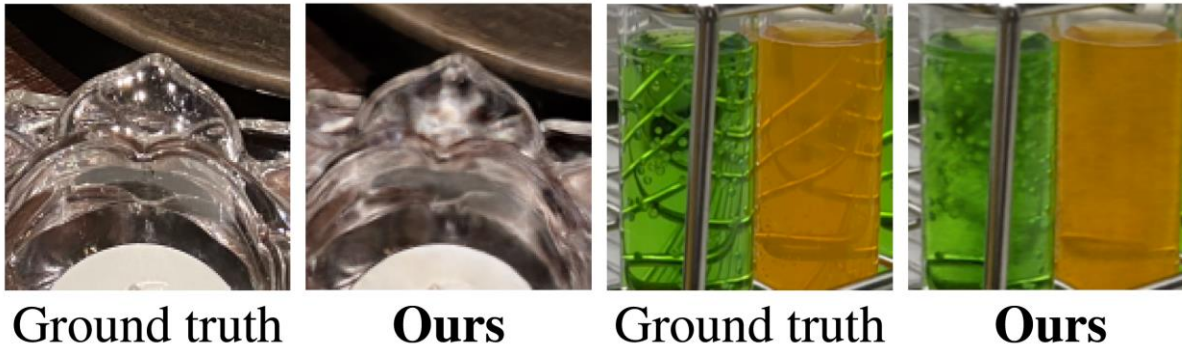
Ours



Standard MPI



- ◆ Need **long time** and **high number** of input views for training
- ◆ Cannot completely synthesize view dependent effect (ex. **sharp highlights**, or **refraction**)

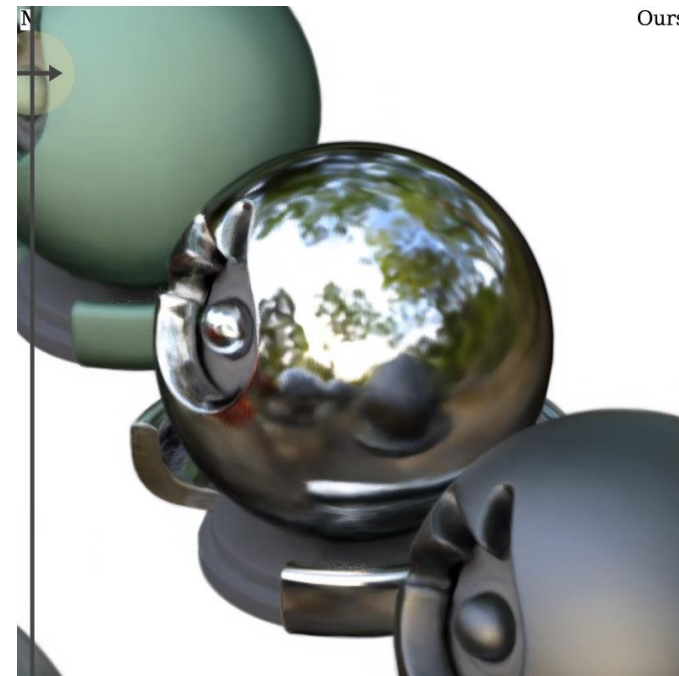
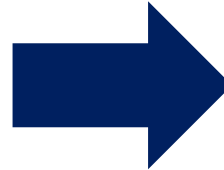




- ◆ RefNeRF reparameterizes the MLP's result as meaningful components such as **normal vectors, diffuse color, and roughness**
- ◆ **Accurate normal vector** is necessary to compute reflectance direction



Mip NeRF

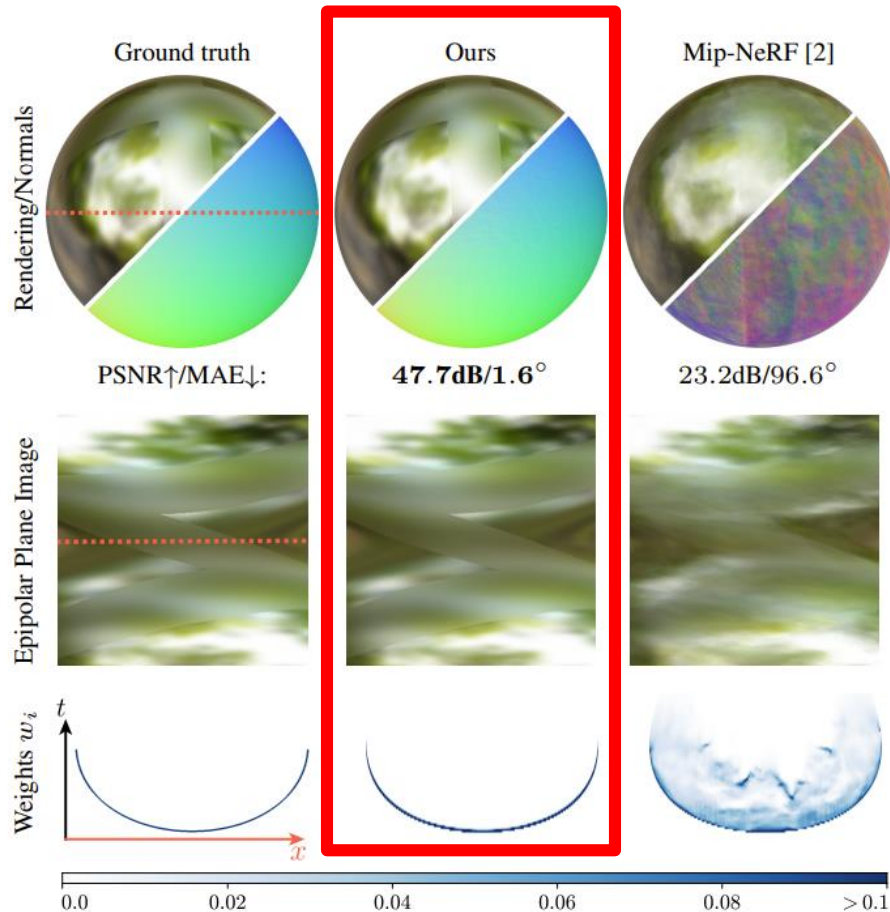


Ref NeRF

Normal Vector in RefNeRF



- By adding **regularizer** term which decreases the density of foggy area to the MLP, they could predict **normal** more accurately

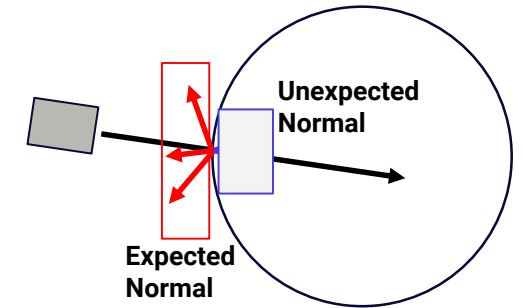


$$\text{G.T. normal: } \hat{n}(x) = \frac{\nabla \text{density}(x)}{\|\nabla \text{density}(x)\|}$$

$$R_1 = \sum_i w_i \|\hat{n}_i - \hat{n}'_i\|$$

Predicted normal
By MLP

$$R_2 = \sum_i w_i \max(0, \hat{n}'_i \cdot d)^2$$



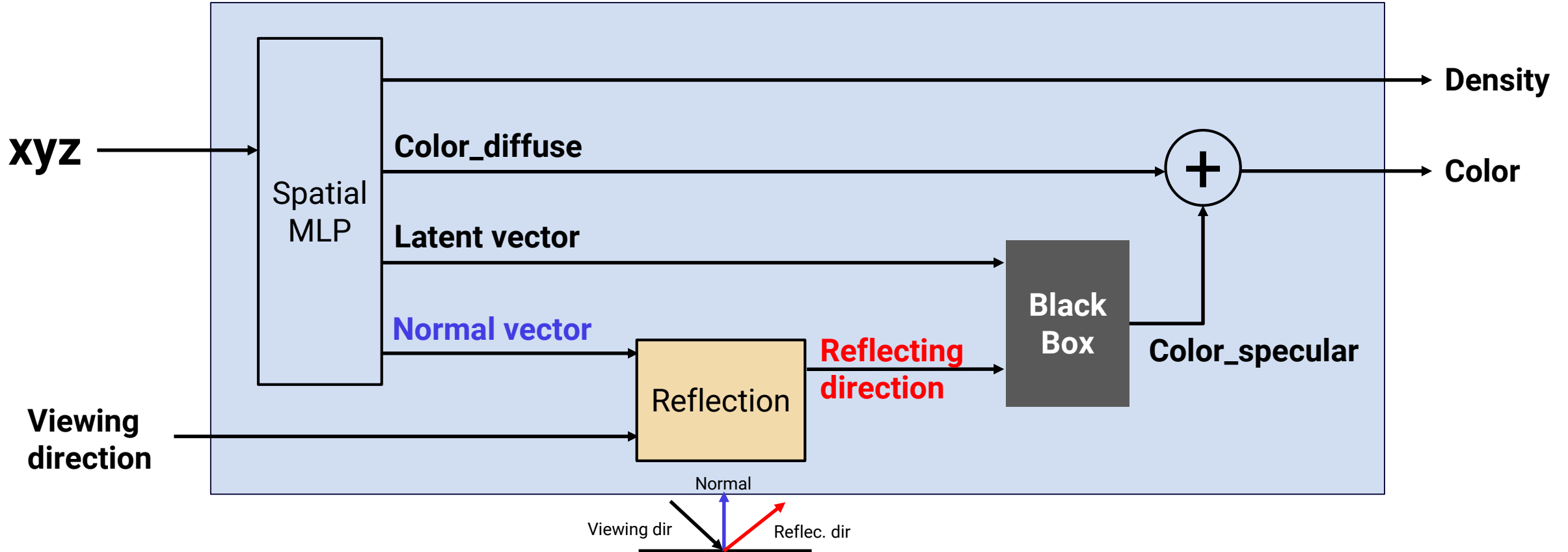
Remove the unexpected normal
(pointing inside of the object)

RefNeRF pipeline



- ◆ RefNeRF supposes **radiance equation** as a **black box** that takes input as **reflecting direction**

$$L_{out}(w_{out}) \propto \text{Black Box} = F(w_{refelctance})$$



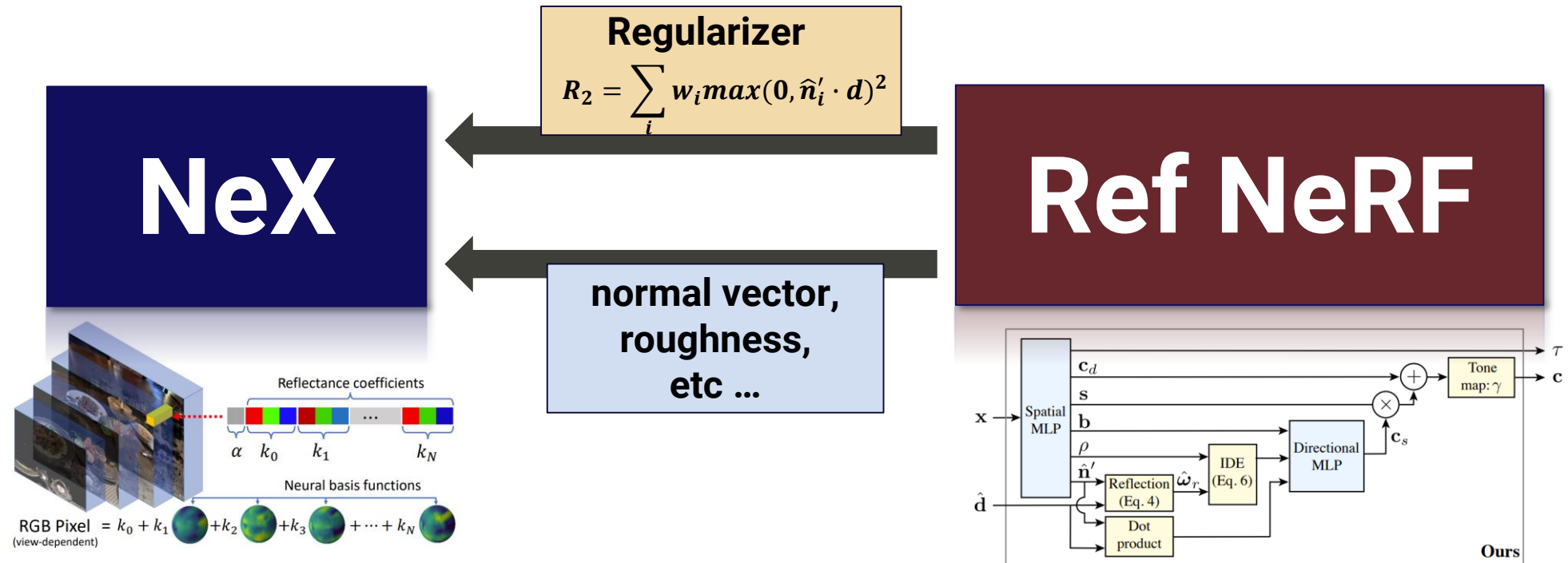


normNeX (ours)

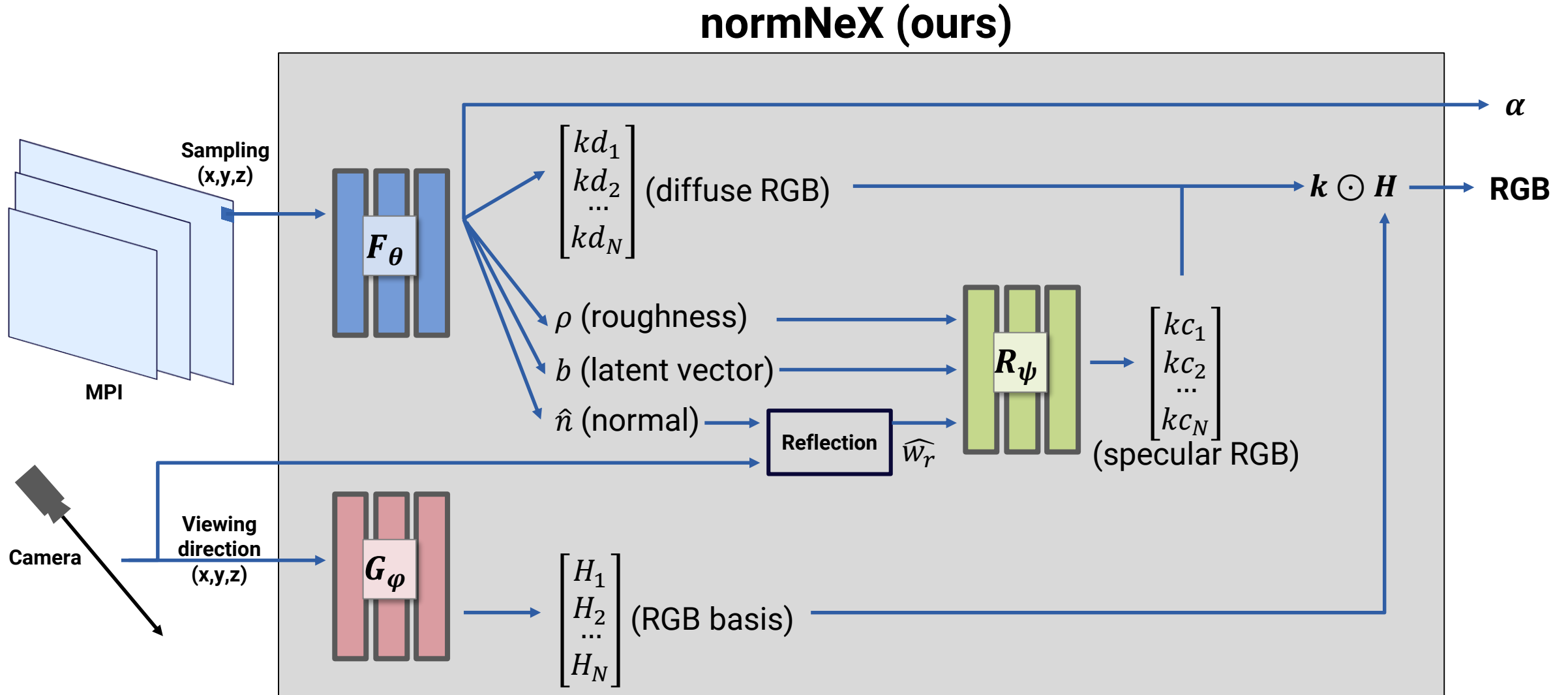
Main Idea



- ◆ Plug the RefNeRF's components to the NeX so as to represent view dependent scene better



Initial Proposal of normNeX Pipeline





- ◆ We will acquire more accurate normal vector in MPI format
- ◆ We can synthesize image better in novel view with view dependent effect (specular highlights, reflectance)



- ◆ Real time rendering (more than 30 fps)
- ◆ Compute accurate normal vectors in MPI
 - ◆ Different coordinate representation with NeRF



- ◆ Tinghui Zhou et al., Stereo magnification: Learning view synthesis using multiplane images, *SIGGRAPH*, 2018
- ◆ Suttisak Wizadwongsa et al., NeX: Real-time View Synthesis with Neural Basis Expansion, *CVPR*, 2021
- ◆ Dor Verbin et al., Ref-NeRF: Structured View-Dependent Appearance for Neural Radiance Fields, *CVPR*, 2022