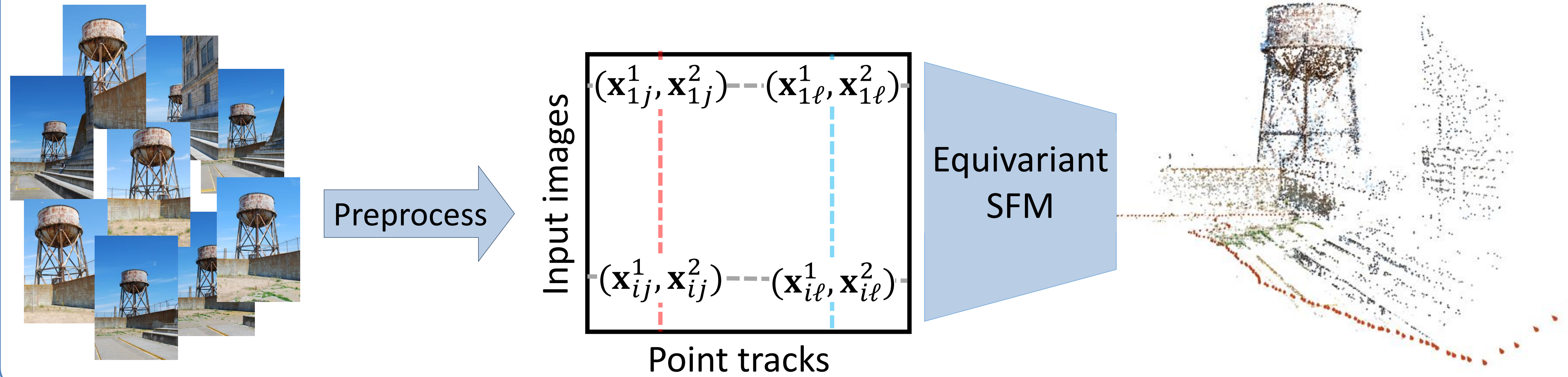


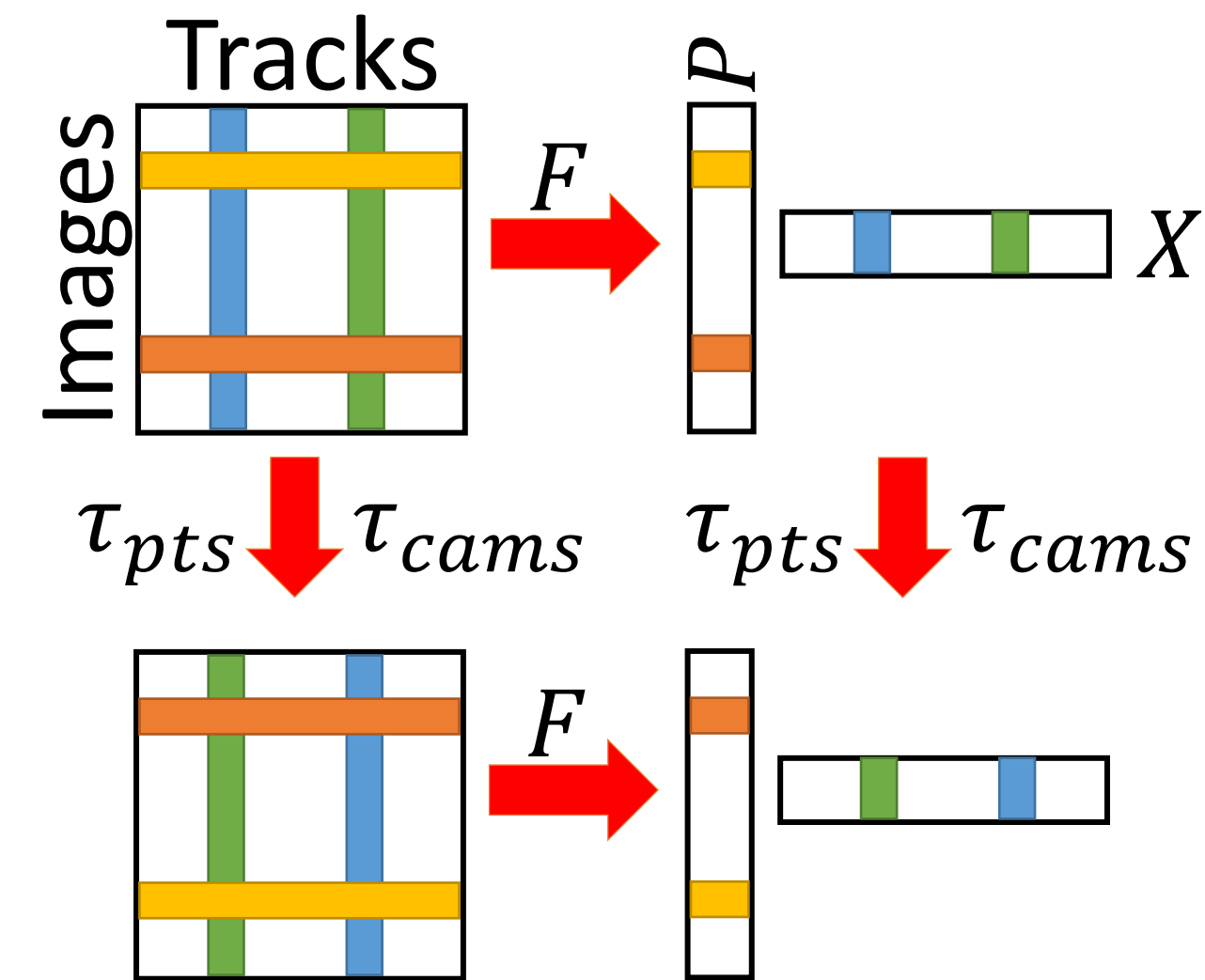
## SFM problem definition:

Given images of a static scene, find camera parameters and 3D scene points



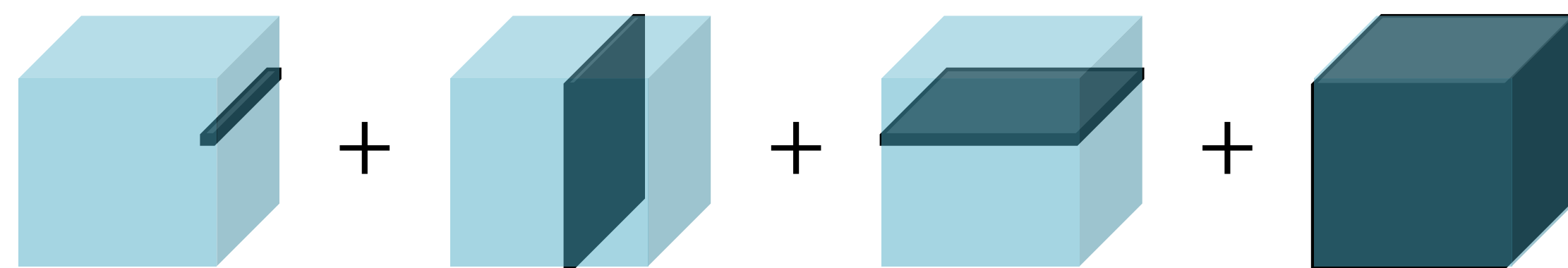
## Task symmetries:

### Equivariance to permutations of rows and columns

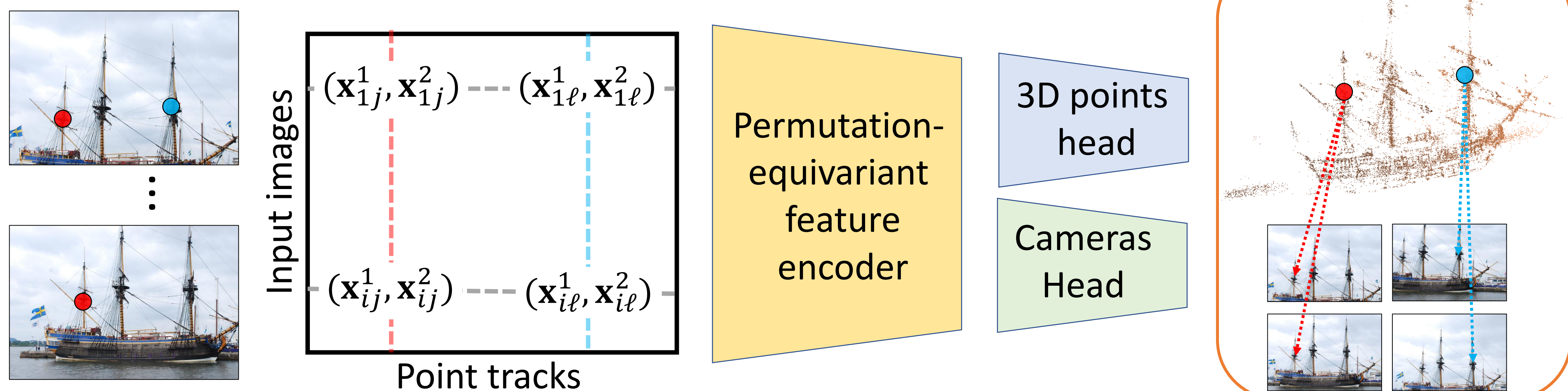


Equivariant layer: equivariant affine function + pointwise activation function (ReLU)

$$\sigma(W_1 \tilde{M}_{ij} + W_2 \sum_i \tilde{M}_{ij} + W_3 \sum_j \tilde{M}_{ij} + W_4 \sum_{i,j} \tilde{M}_{ij} + b)$$



## Equivariant-SFM:

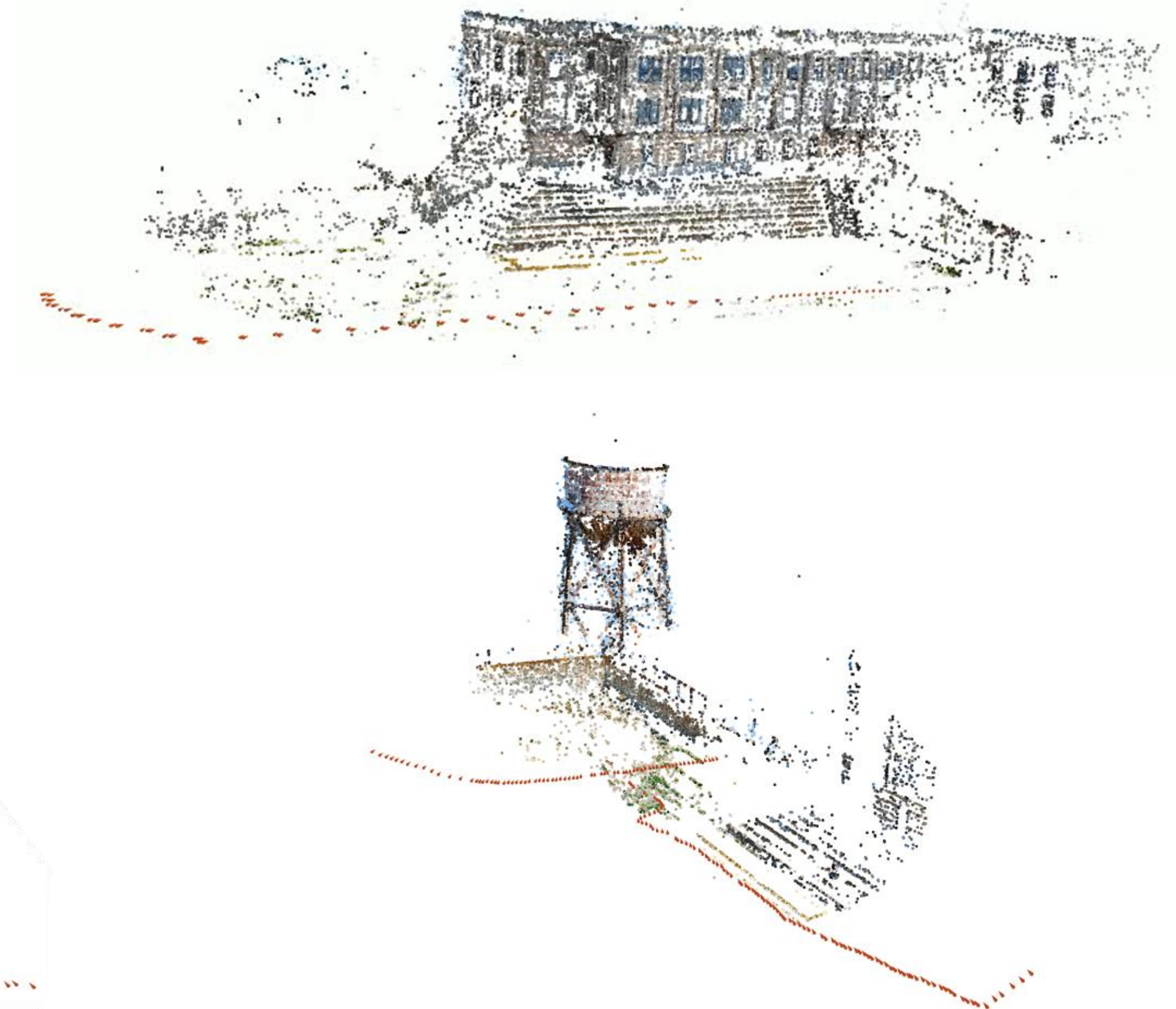


## Results:

### Single scene recovery



### Learning from multiple scenes



Scan	#Images	#Points	Reprojection Error				
			Single Scene	Inference	Fine Tuning	Opt. (short)	Colmap
Alcatraz Courtyard	133	23674	<b>0.81</b>	0.82	<b>0.81</b>	1.61	<b>0.81</b>
Alcatraz Water Tower	172	14828	<b>0.55</b>	<b>0.55</b>	<b>0.55</b>	4.6	<b>0.55</b>
Drinking Fountain	14	5302	<b>0.31</b>	7.21	<b>0.31</b>	110.85	<b>0.31</b>
Nijo Castle Gate	19	7348	<b>0.73</b>	5.81	<b>0.73</b>	19.0	<b>0.73</b>
Porta San Donato Bologna	141	25490	<b>0.75</b>	1.1	0.79	83.02	<b>0.75</b>
Round Church Cambridge	92	84643	1.54	0.5	1.51	28.17	<b>0.39</b>
Smolny Cathedral	131	51115	<b>0.81</b>	15.15	<b>0.81</b>	2.86	<b>0.81</b>
Cathedral In Barcelona	177	30367	<b>0.89</b>	21.46	<b>0.89</b>	1.06	<b>0.89</b>
Sri Veeramakaliamman	157	130013	0.73	16.92	17.26	90.41	<b>0.71</b>
Yueh Hai Ching Temple	43	13774	<b>0.65</b>	1.16	<b>0.65</b>	37.31	<b>0.65</b>