

RoDynRF

Robust Dynamic Radiance Fields

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TUE-AM-002



Robust Dynamic Radiance Fields

- **Input:** a causally captured monocular video



Robust Dynamic Radiance Fields

- **Output:** space-time view synthesis



Fix time
Change view



Fix view
Change time



Fix time
Change view

Robust Dynamic Radiance Fields

- **Challenge:** COLMAP fails to recover camera poses

Input dynamic
monocular videos



Robust Dynamic Radiance Fields

- Our work tackles this **robustness** problem and showcases high-fidelity dynamic view synthesis results on a wide variety of videos

Reconstructed
poses/geometry



Space-time
synthesis results



Neural Radiance Field (NeRF)

Input

A set of calibrated images



Output

A static 3D scene representation that renders novel views



What are the remaining challenges?

Input

A set of **calibrated** images



Output

A **static** 3D scene representation that renders novel views



Extensions of NeRF

Input

A set of **calibrated** images



Output

A **static** 3D scene representation that renders novel views



Static Scene

Input

Images + **imperfect** camera poses



Output

A **static** 3D scene representation + **registered camera poses**



NeRF [ECCV'20], Mip-NeRF [ICCV'21], DVGO [CVPR'22]

BARF [ICCV'21], SC-NeRF [ICCV'21], NeRF--

Known and accurate camera poses

Unknown or imperfect camera poses



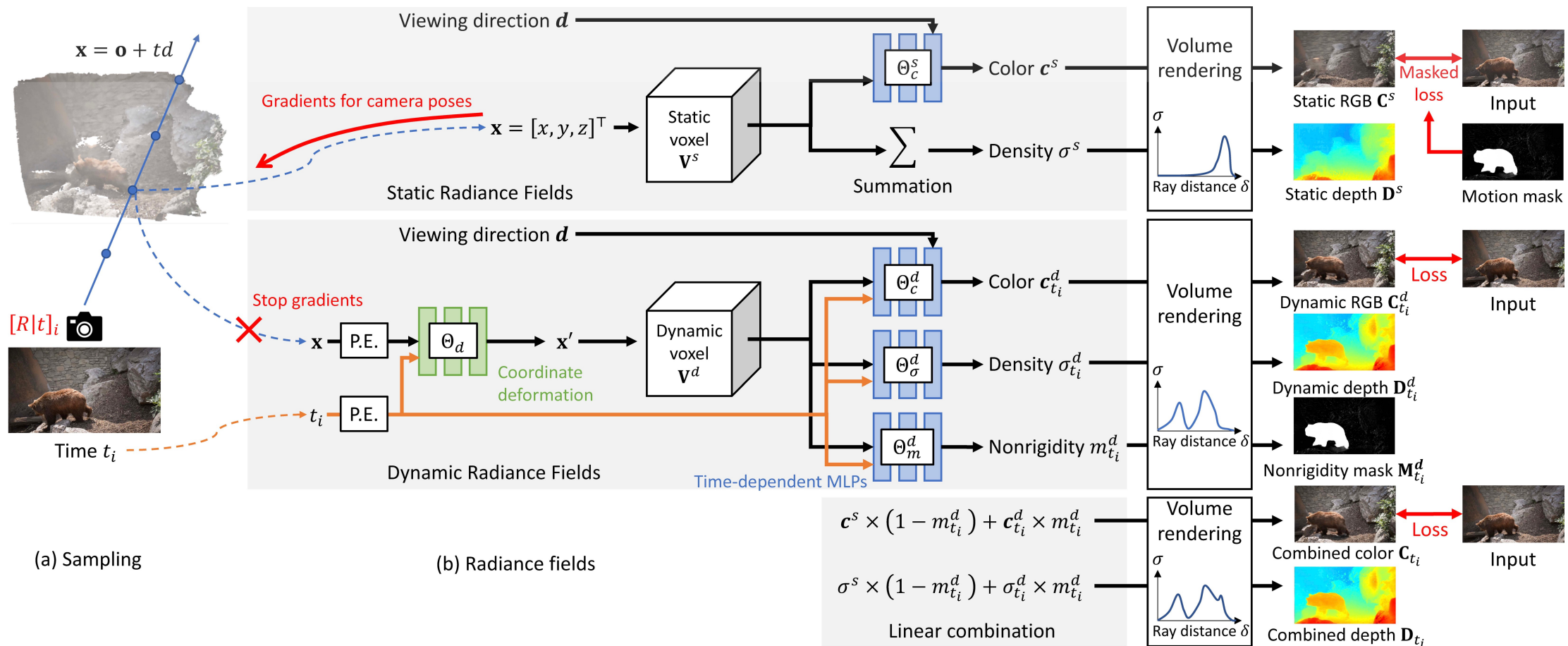
D-NeRF [CVPR'21], NSFF [CVPR'21], DynamicNeRF [ICCV'21]



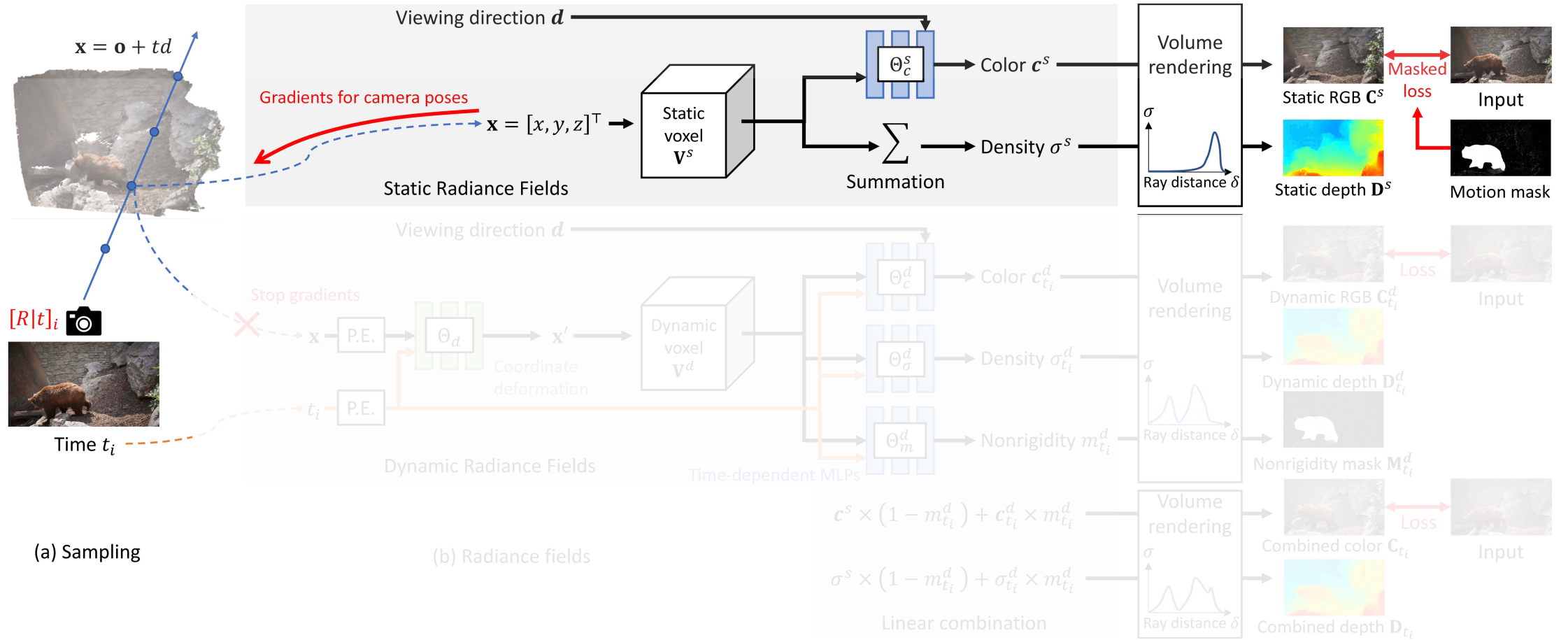
Dynamic Scene

Our targets: Casually captured videos

RoDynRF



RoDynRF – Static Radiance Field + Camera Optimization

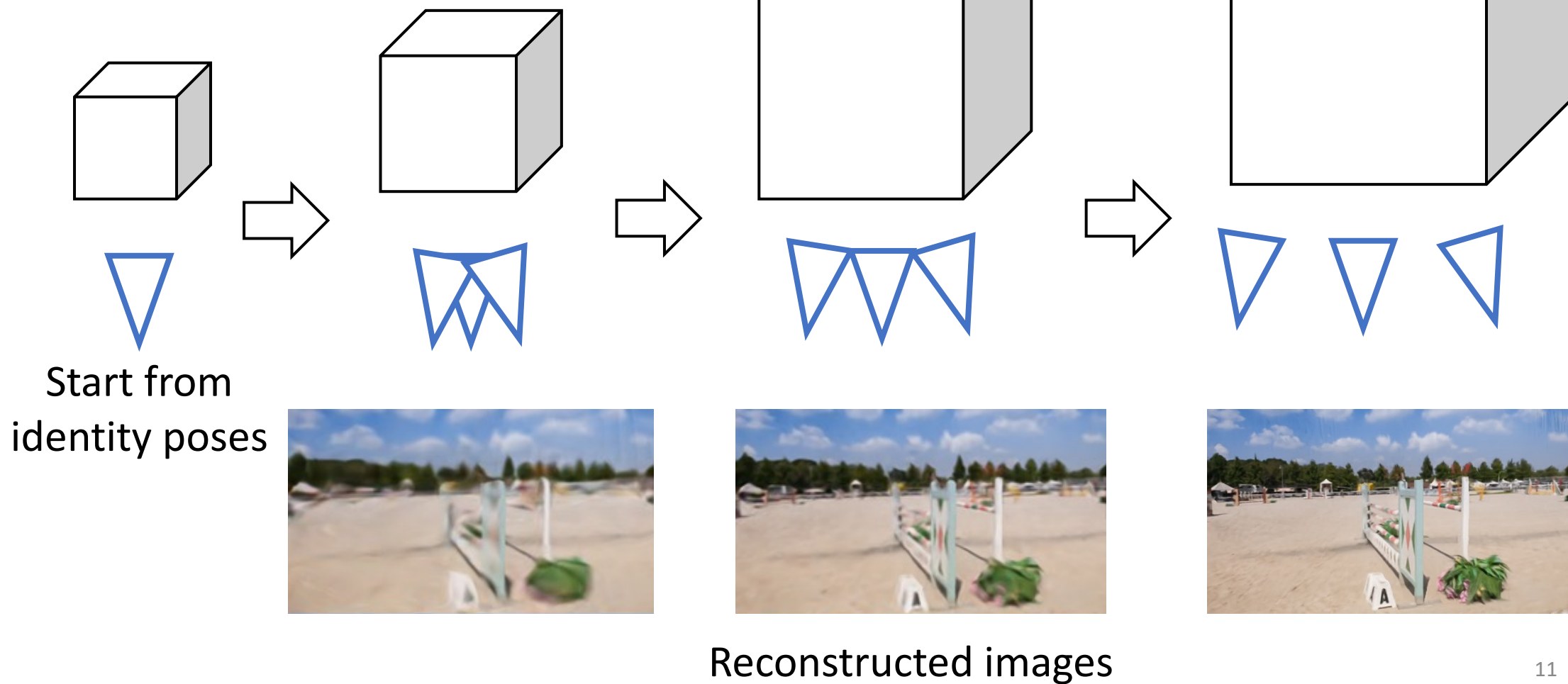


(a) Sampling

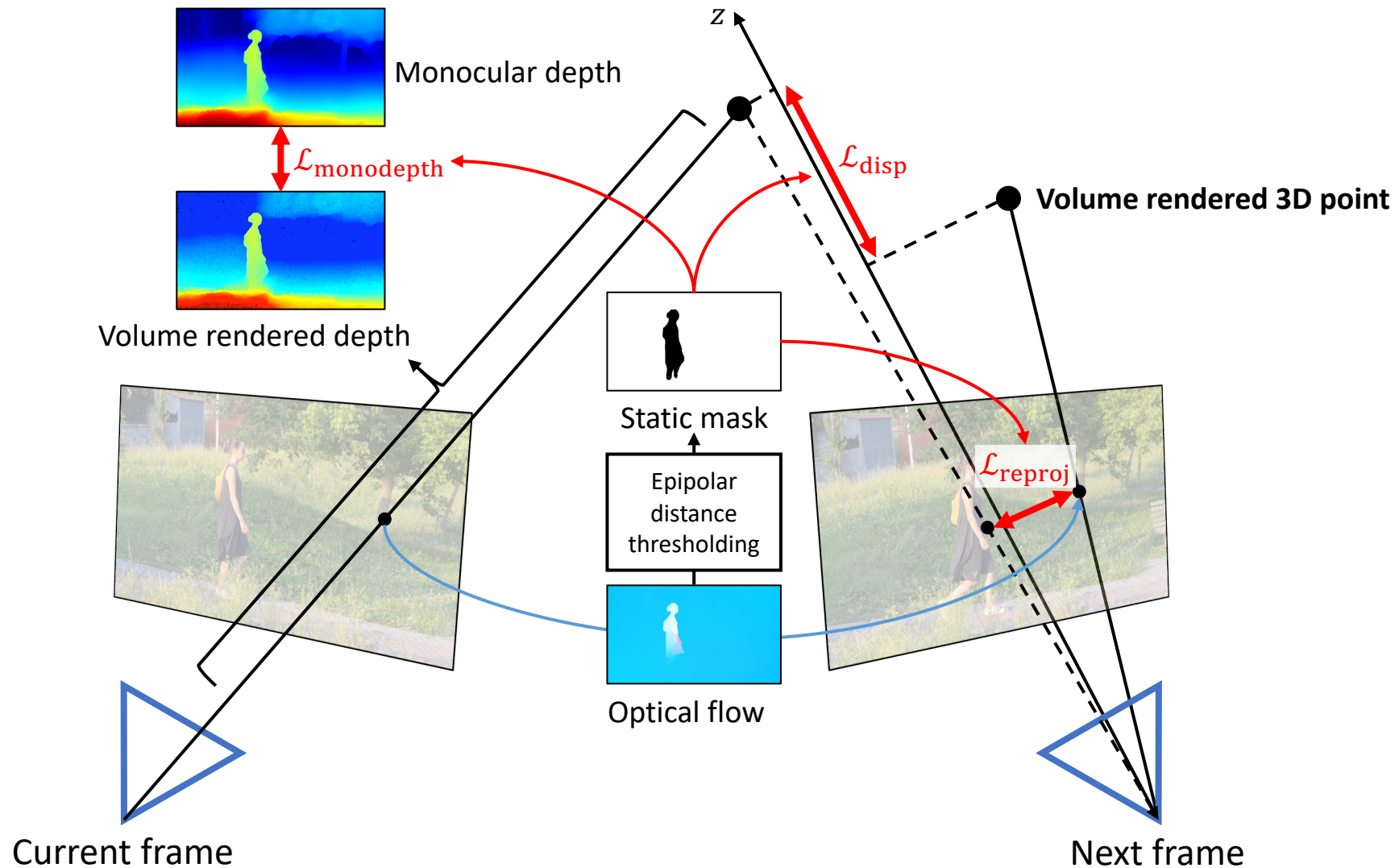
(b) Radiance fields

Camera Optimization

- Coarse-to-fine strategy



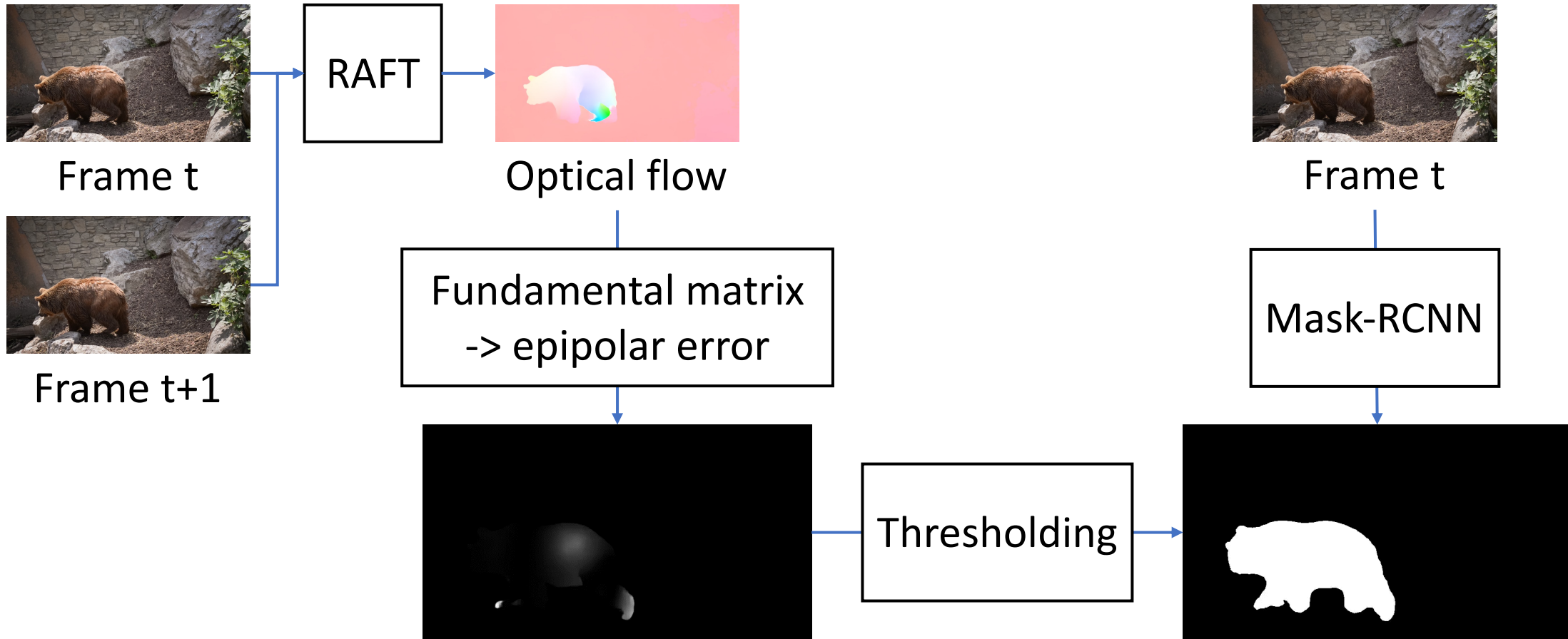
Static Radiance Field + Camera Optimization



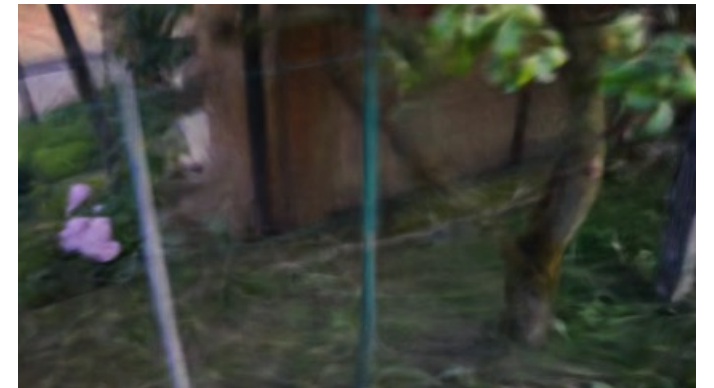
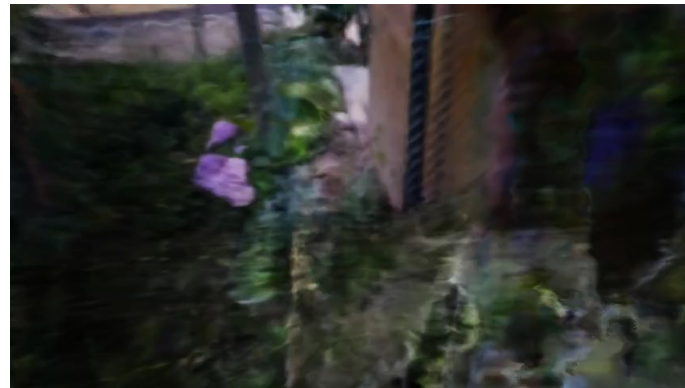
Pose Estimation

But we do not have the masks for casual videos

- Mask out moving objects with epipolar constraints



Static Radiance Field Reconstruction Results

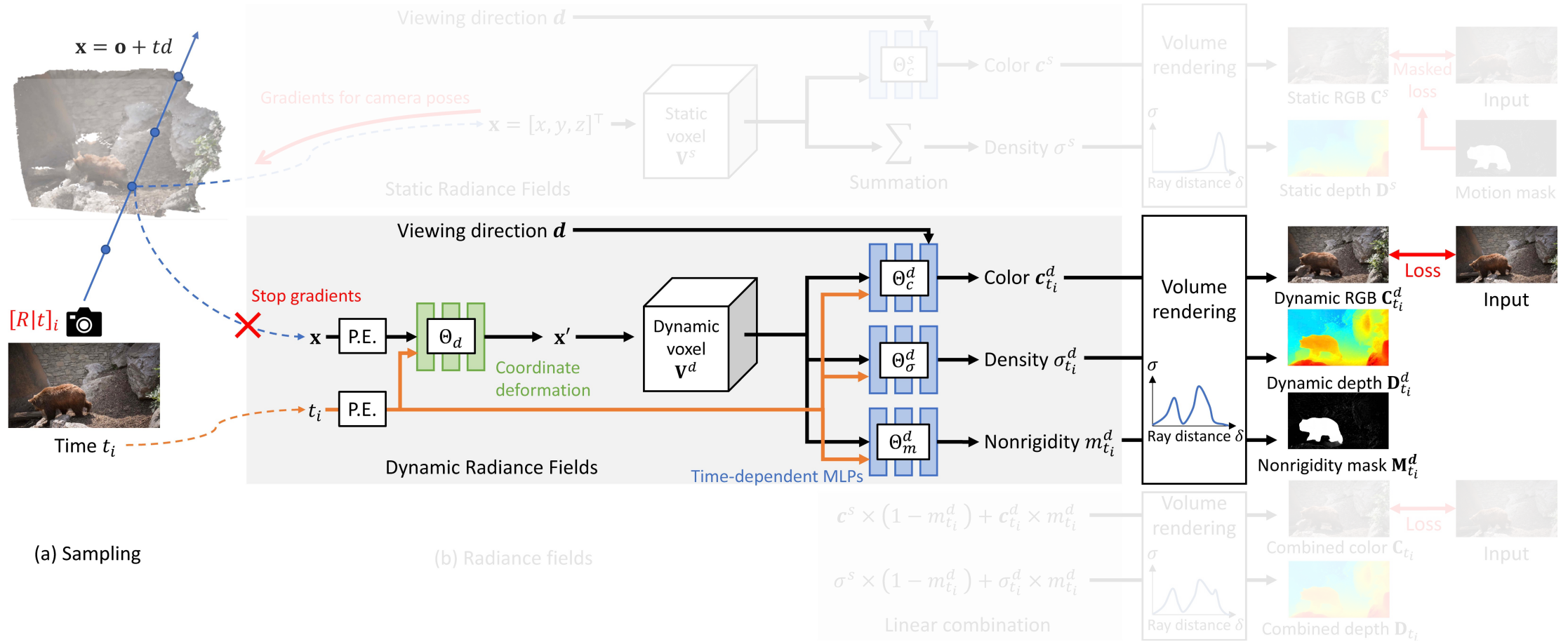


Input video

BARF [ICCV'21]

Ours

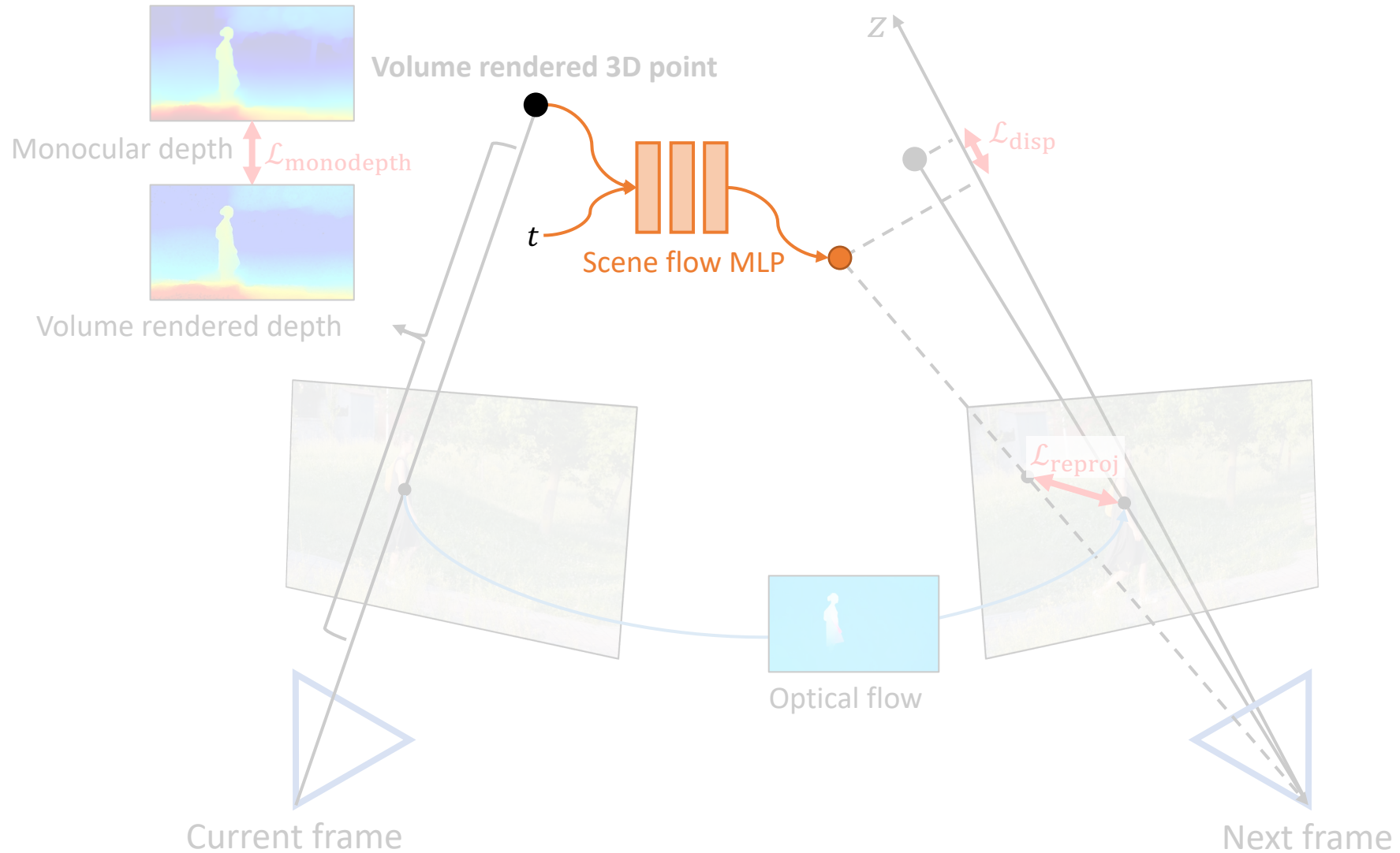
RoDynRF – Dynamic Radiance Field



(a) Sampling

(b) Radiance fields

Dynamic Radiance Field



Space-Time Synthesis Comparisons

- With COLMAP poses



Input video

DynamicNeRF [ICCV'21]

Ours

Visual Comparisons + Our Estimated Poses



Input video



Ours

COLMAP

Fails to recover
camera poses



DynamicNeRF [ICCV'21]

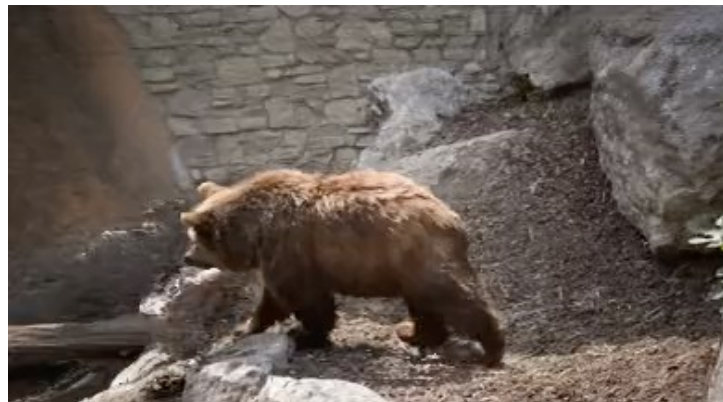


TiNeuVox [SIGGRAPH Asia'22]

Visual Comparisons + Our Estimated Poses



Input video



DynamicNeRF [ICCV'21]

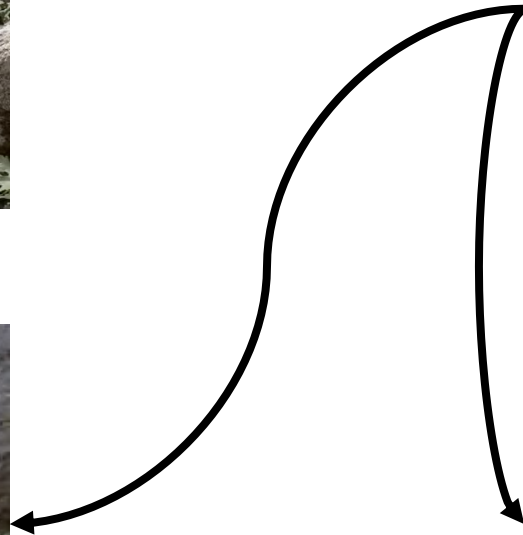
Estimated poses



Ours



TiNeuVox [SIGGRAPH Asia'22]



Visual Comparisons + Our Estimated Poses



Input video

Estimated poses



Ours



DynamicNeRF [ICCV'21]



TiNeuVox [SIGGRAPH Asia'22]

Visual Comparisons + Our Estimated Poses

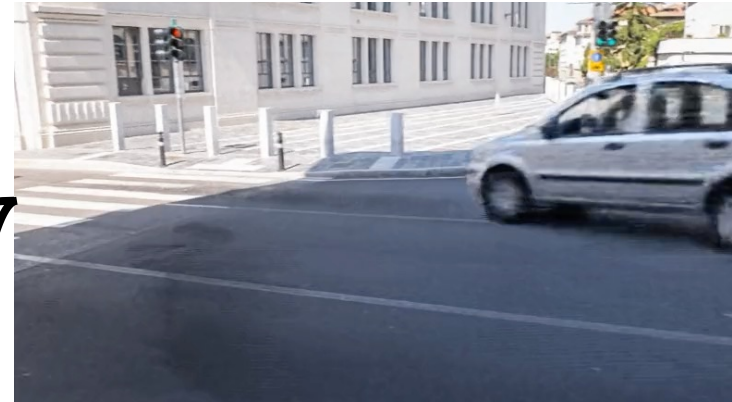


Input video



DynamicNeRF [ICCV'21]

Estimated poses

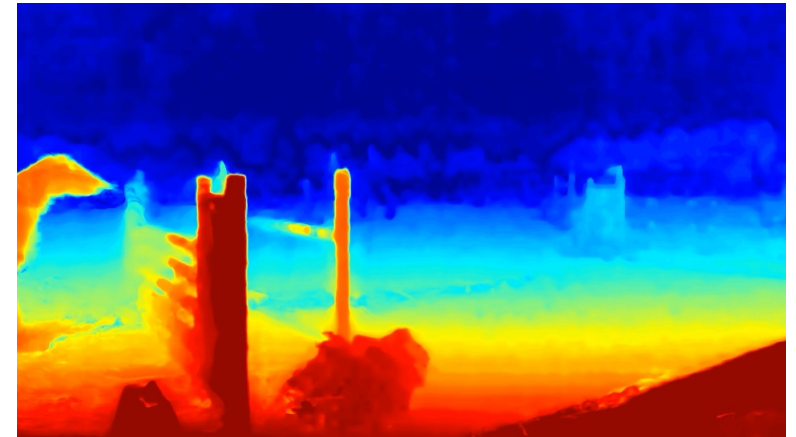
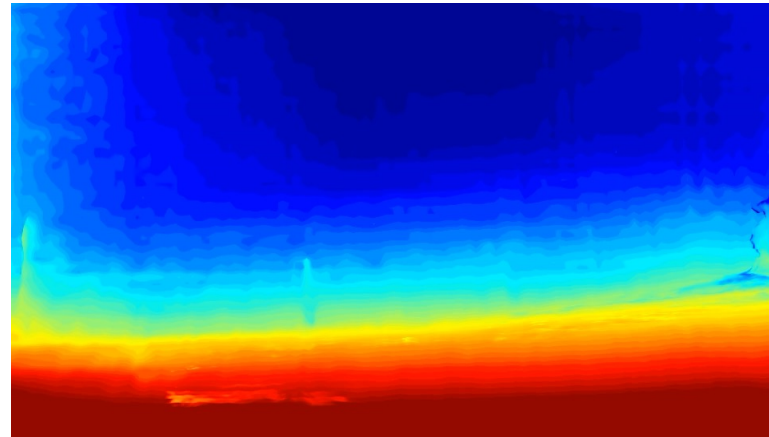
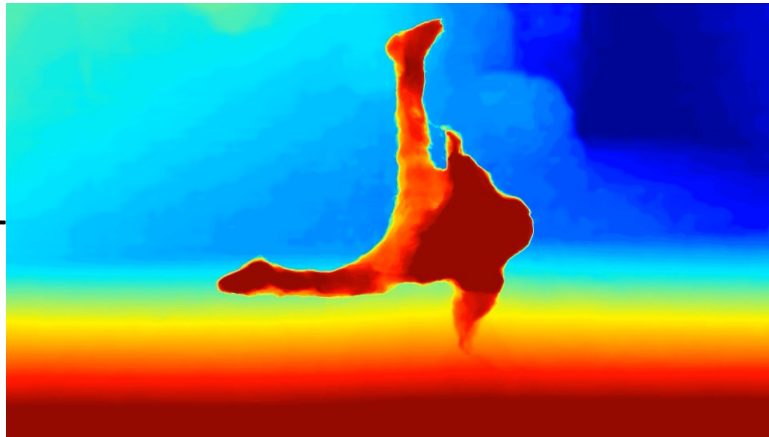


Ours



TiNeuVox [SIGGRAPH Asia'22]

Consistent Geometry Prediction



Failure Cases -- Fast Moving camera



Input



Our space-time synthesis result

Failure Cases -- Changing Focal Length



Input



Our space-time synthesis result



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