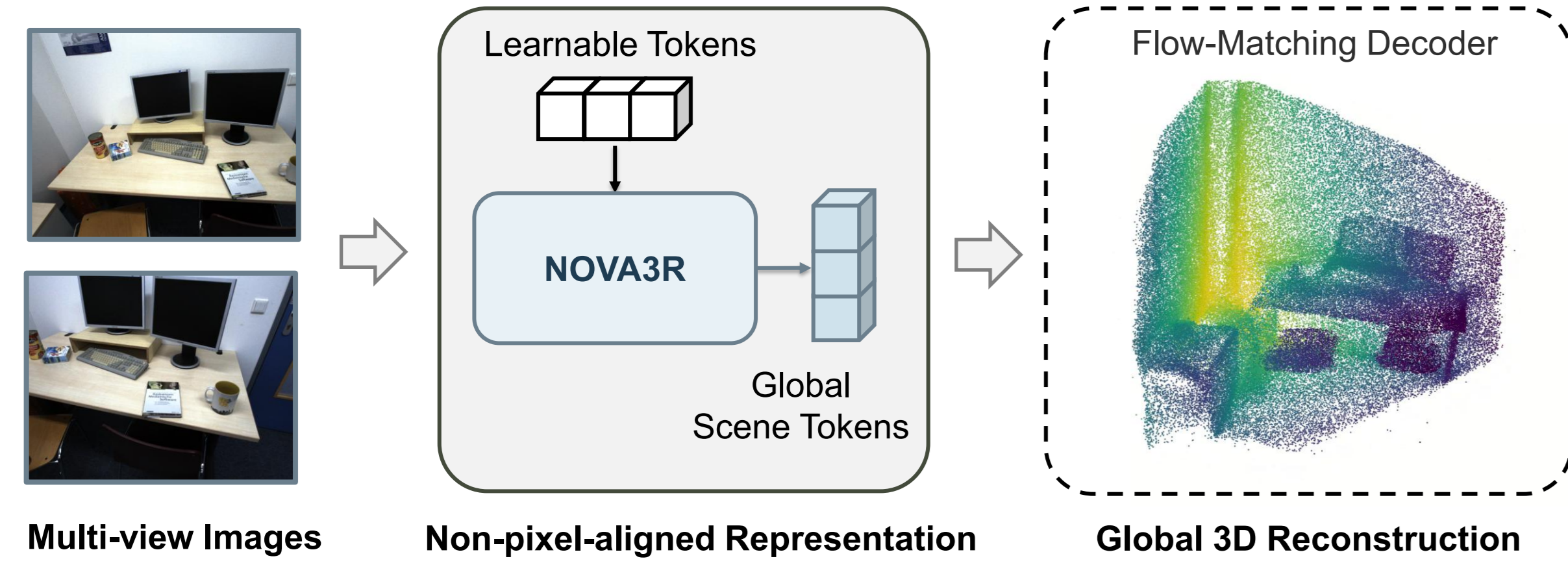


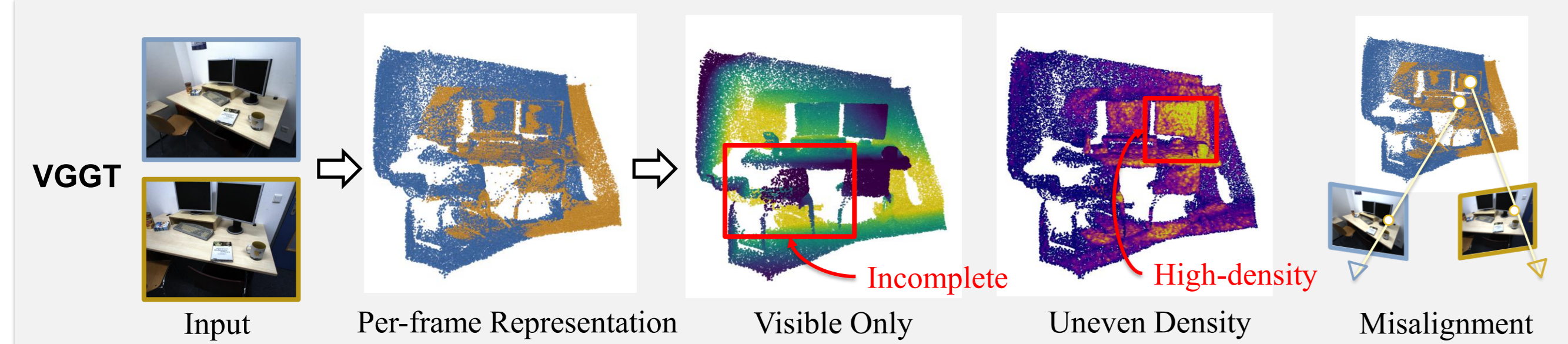
Task: Non-pixel-aligned Reconstruction

Goal: Recover **complete, non-overlapping** 3D geometry from **unposed** images, including both visible and occluded regions, with physically plausible structure.

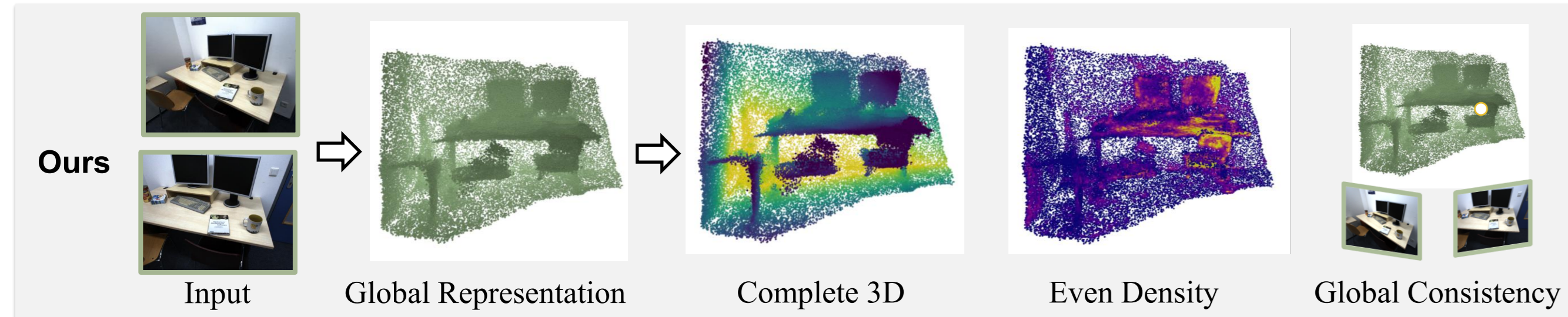


Motivation

Problem: Pixel-aligned methods often recover **per-frame visible geometry**, leading to **incompleteness, redundancy, and misalignment**.

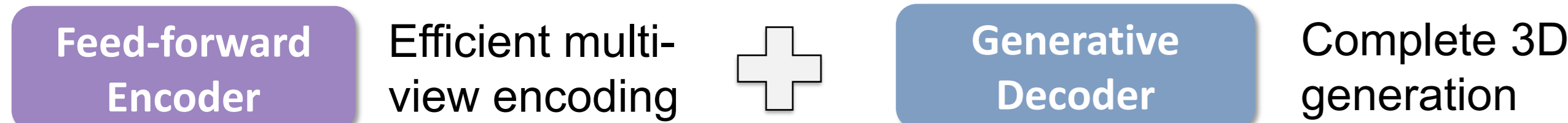


Insight: Recover the **underlying scene**, not just visible pixels



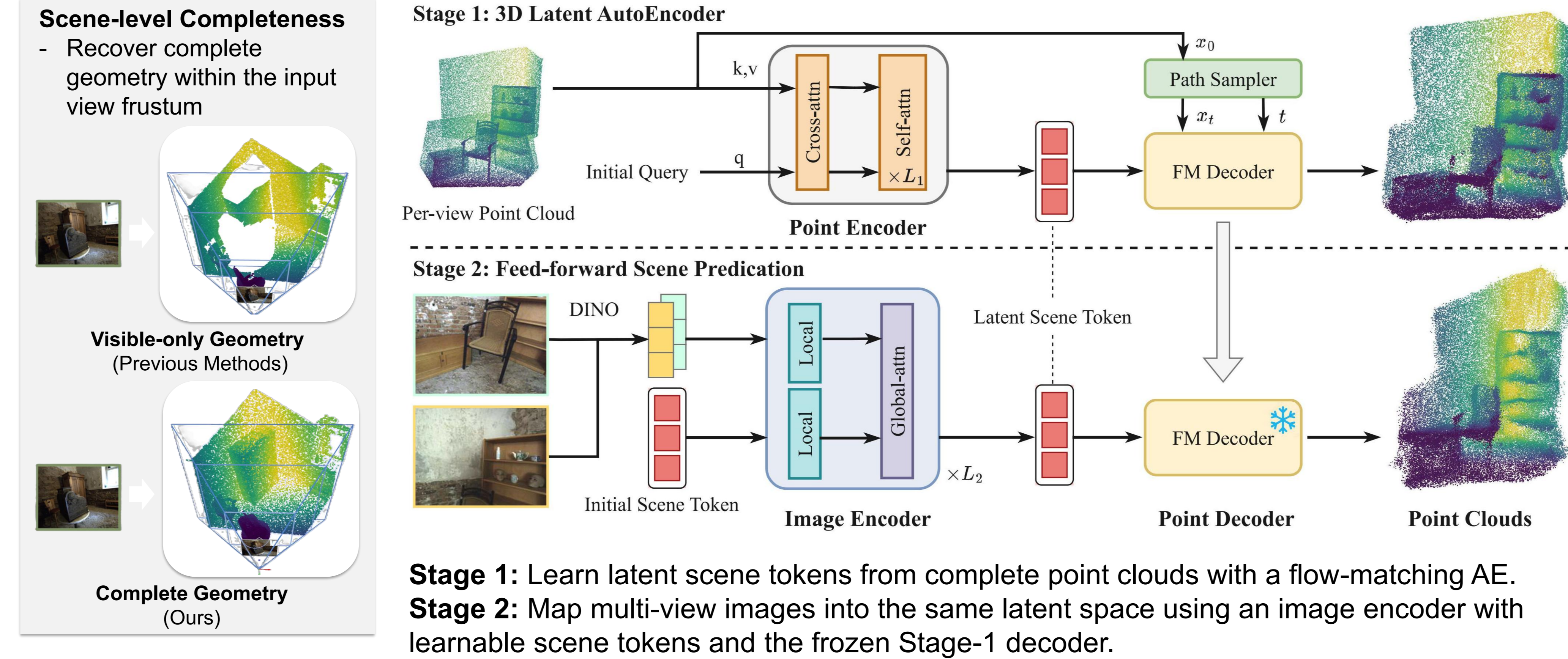
Pixel-aligned: Visible-only geometry, Redundant points, Misalignment artifacts
Non-pixel-aligned: Complete geometry, No redundancy, Global consistency

Our Approach: NOVA3R



- **Unified** framework for object- and scene-level complete 3D reconstruction
- More **complete, uniform, and physically plausible** geometry
- Bridging **feed-forward** reconstruction and **latent 3D generation**

NOVA3R Pipeline



Quantitative Results

Scene-level Complete Reconstruction on SCREAM dataset

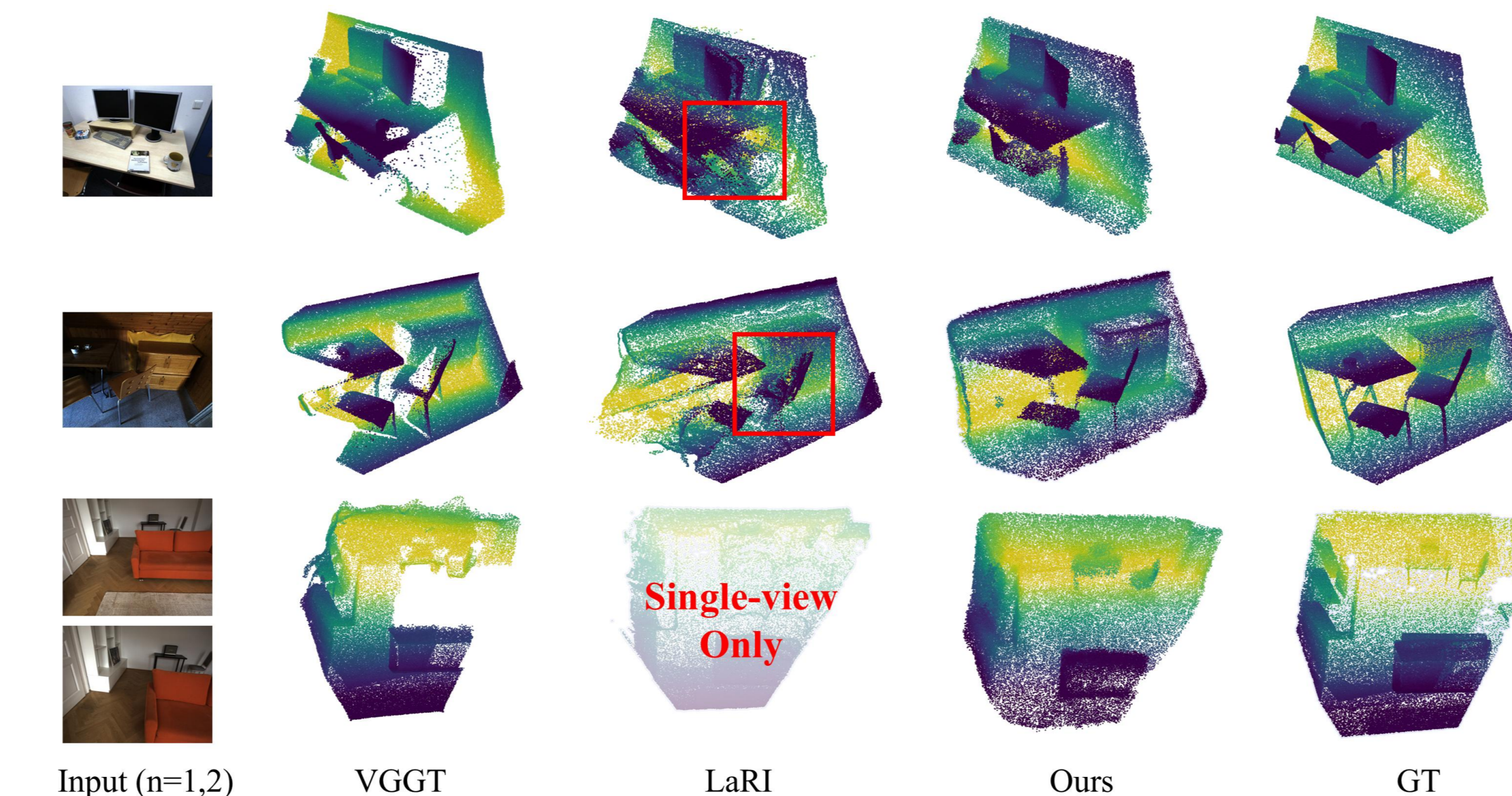
Type	Method	Visible ($K=1$)			Complete ($K=1$)			Complete ($K=2$)		
		CD↓	FS@0.1↑	FS@0.05↑	CD↓	FS@0.1↑	FS@0.05↑	CD↓	FS@0.1↑	FS@0.05↑
Object	TripoSG*	(0.268)	(0.418)	(0.301)	0.242	0.467	0.333	-	-	-
	TRELLIS*	(0.301)	(0.420)	(0.313)	0.256	0.429	0.312	0.286	0.402	0.288
Single-view	Metric3D-v2	0.063	0.803	0.534	0.086	0.725	0.473	-	-	-
	DepthPro	0.055	0.852	0.603	0.079	0.764	0.535	-	-	-
	MoGe	0.035	0.945	0.786	0.063	0.836	0.668	-	-	-
	LaRI	0.057	0.847	0.589	0.059	0.825	0.590	-	-	-
Multi-view	DUST3R	0.059	0.851	0.653	0.086	0.757	0.565	0.061	0.833	0.641
	CUT3R	0.069	0.835	0.679	0.091	0.753	0.543	0.092	0.739	0.532
	VGGT	0.041	0.923	0.754	0.070	0.810	0.657	0.065	0.821	0.606
	Ours	(0.043)	(0.904)	(0.730)	0.048	0.882	0.687	0.053	0.862	0.657

Hole Area Ratio and Point Cloud Density Variance

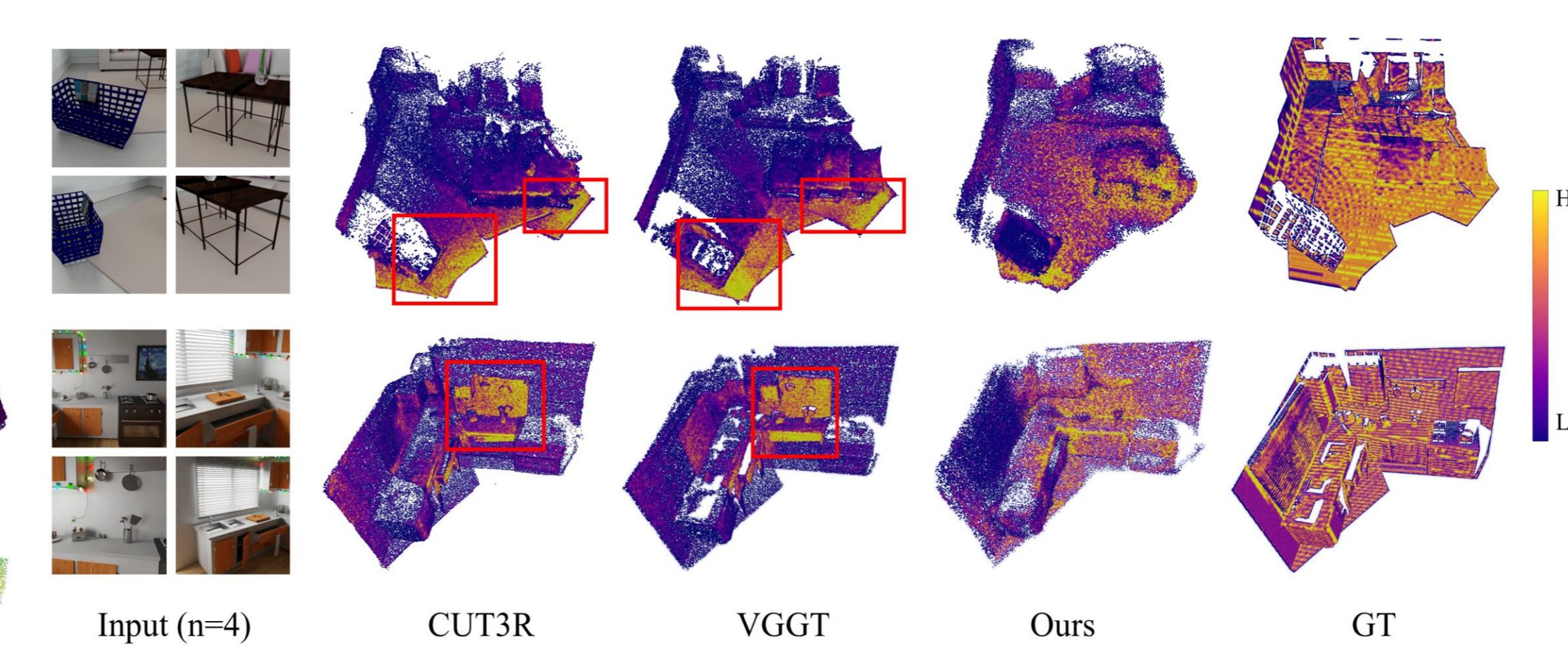
Method	Complete ($K=1$)		Complete ($K=2$)		Complete ($K=4$)	
	Hole Ratio↓	Density Var. ↓	Hole Ratio↓	Density Var. ↓	Hole Ratio↓	Density Var. ↓
DUST3R	0.317	7.758	0.237	6.553	0.257	4.801
CUT3R	0.363	8.402	0.237	6.554	0.326	4.658
VGGT	0.307	7.105	0.238	6.546	0.261	5.217
Ours	0.088	5.127	0.121	2.188	0.134	1.881

Qualitative Results

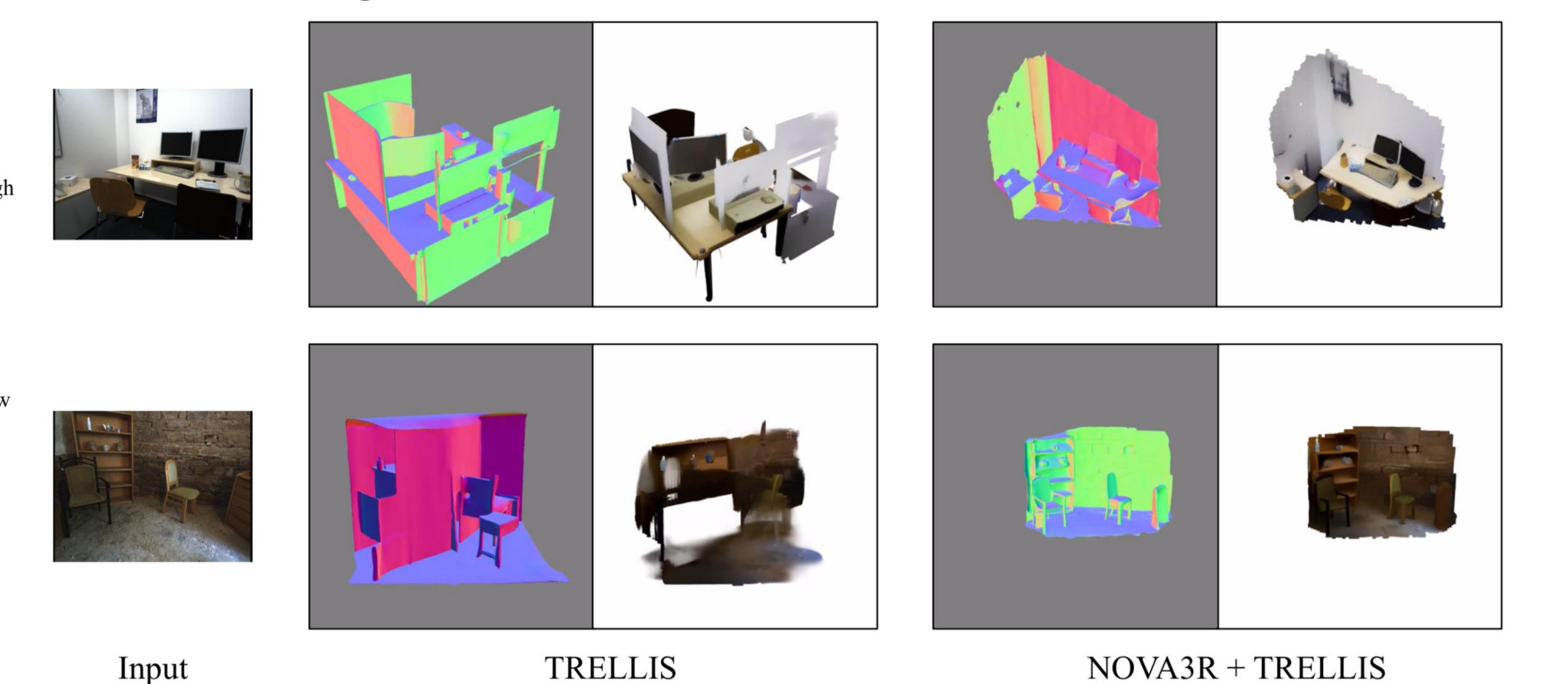
Scene-level Complete Reconstruction



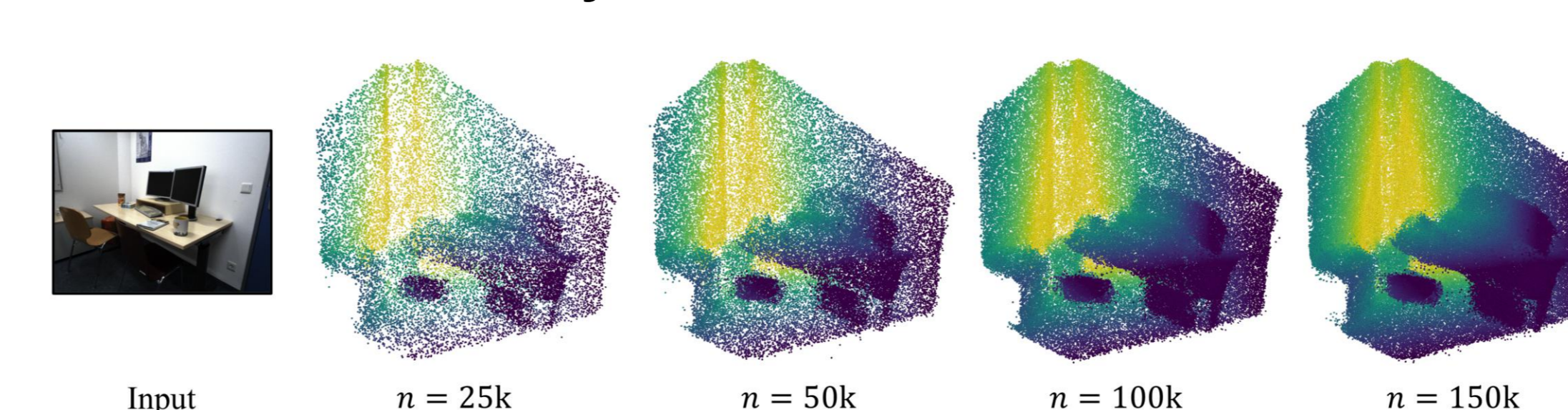
Non-overlapping Reconstruction with Even Density



TRELLIS Integration for Scene Reconstruction



Reconstruction at Any Resolution



Object-level Complete Reconstruction



Extension to Outdoor Scenes

