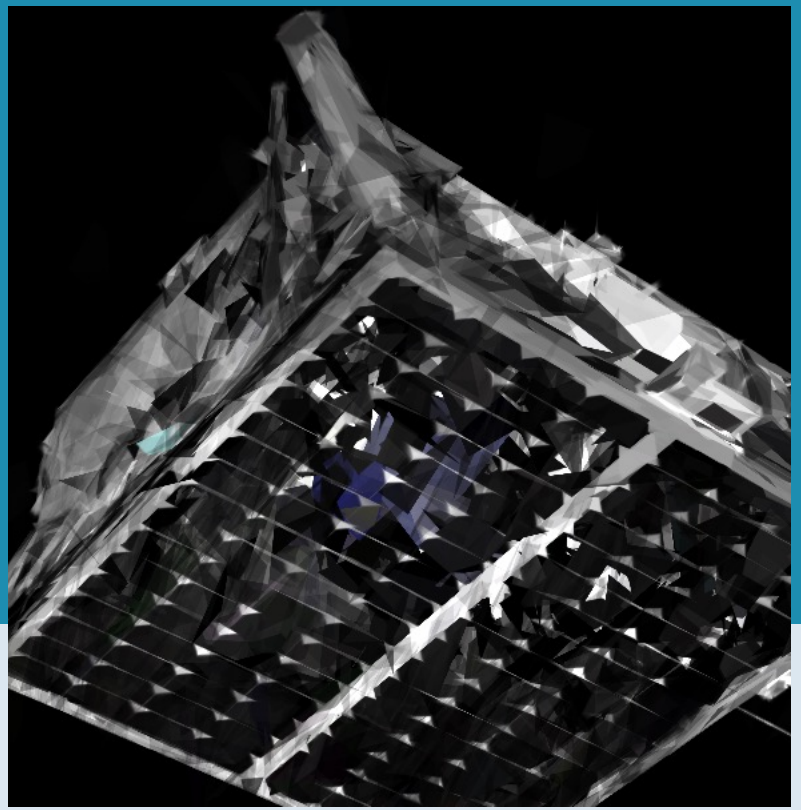
KU LEUVEN UCLouvain

Can Appearance Embeddings Improve Geometry? Revisiting Floaters in Novel View Synthesis



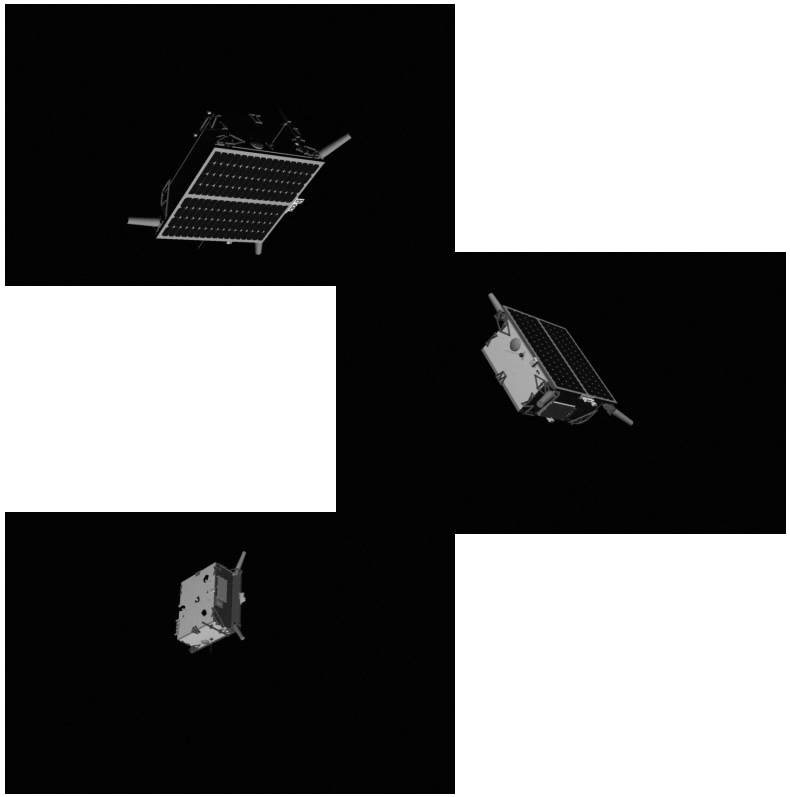
Elias De Smijter, Renaud Detry and Christophe De Vleeschouwer

October 8, 2025

Monocular-only docking missions are becoming increasingly important

Courtesy NASA/JPL - Caltech

We need a model of the object we are docking with, based on monocular images



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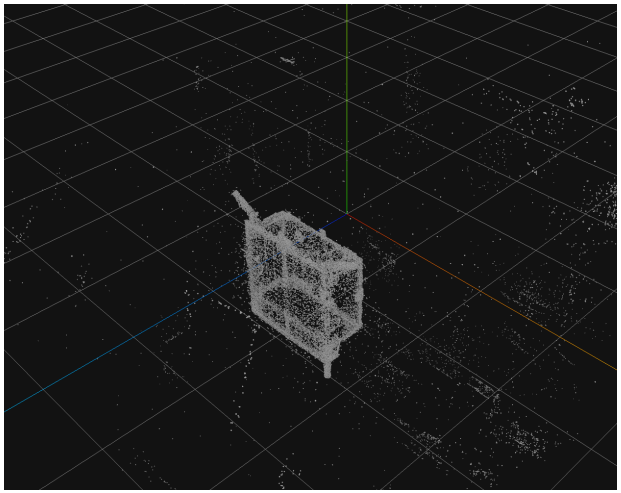
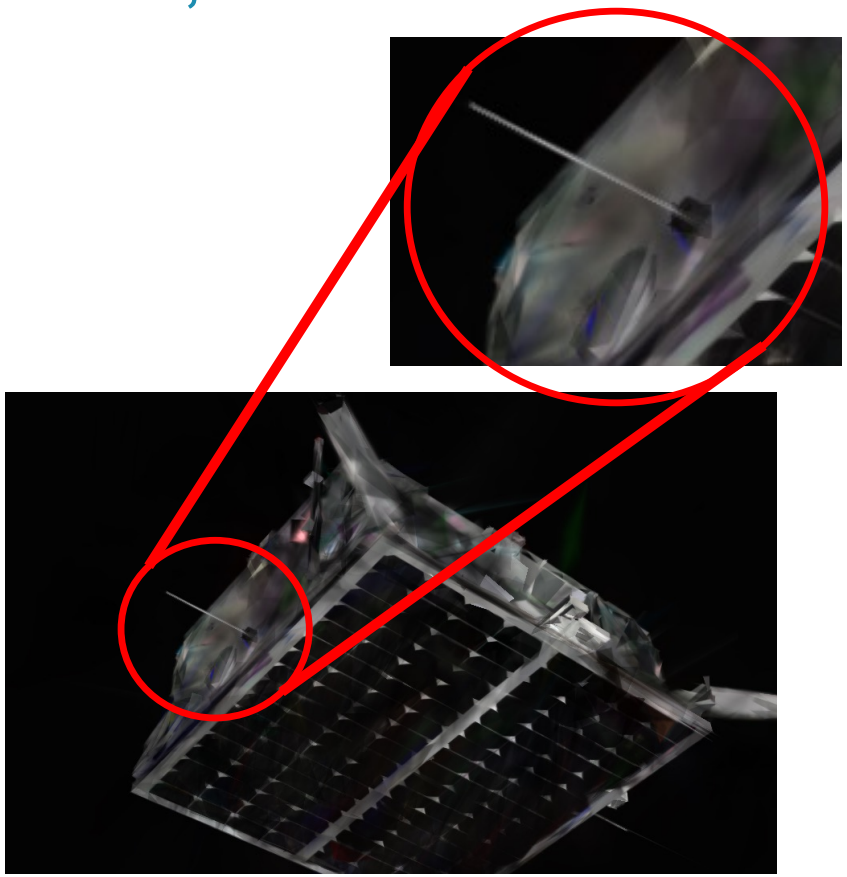
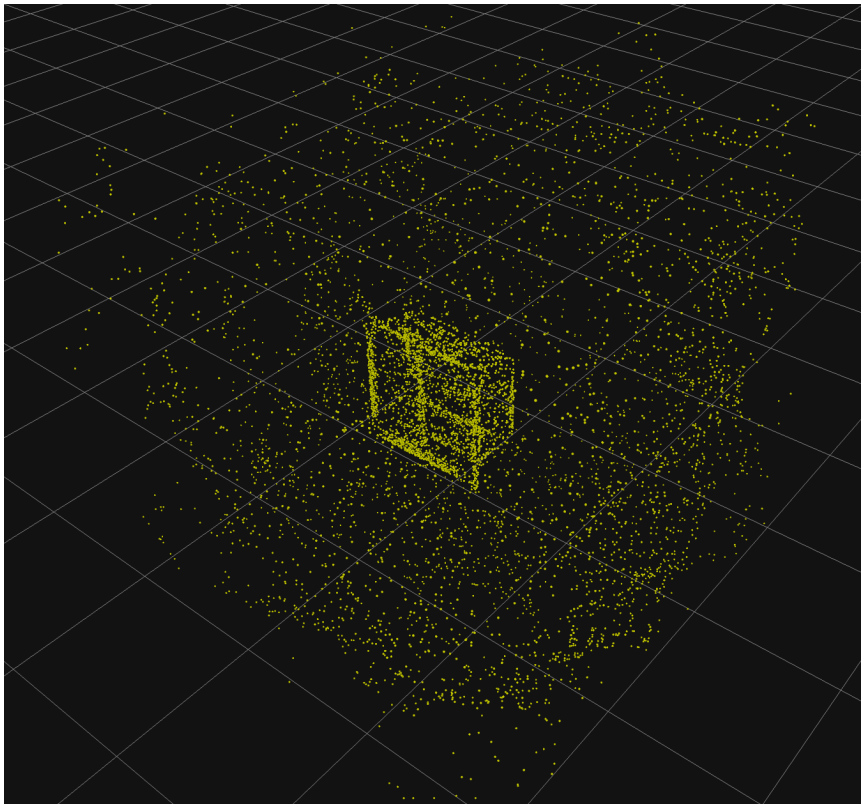
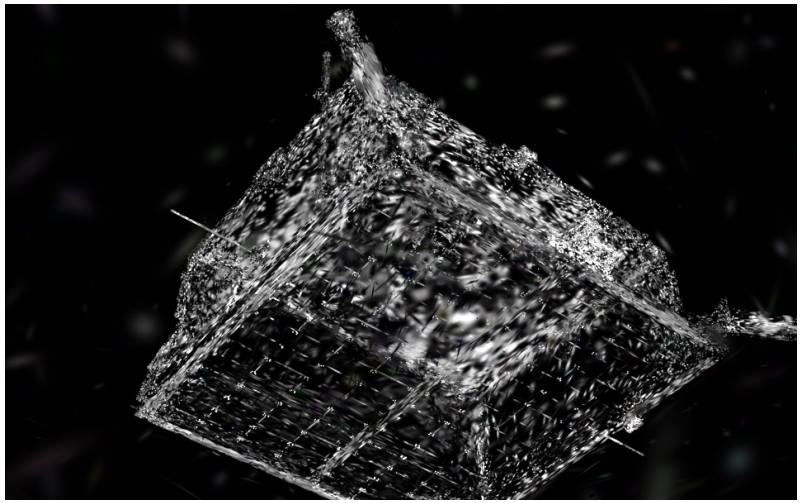


Novel view synthesis excels at capturing fine geometric detail, but suffers from artifacts

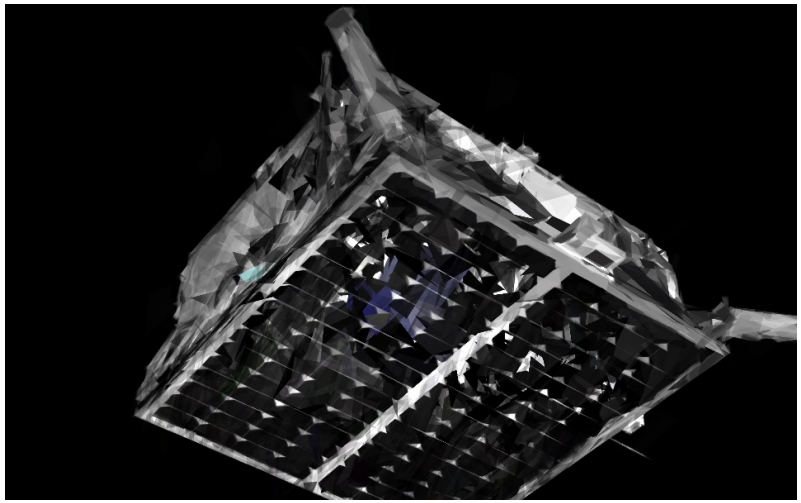




Our goal: evaluate the geometric performance of 3 methods with 2 variants each



Gaussian splatting with accentuated Gaussians

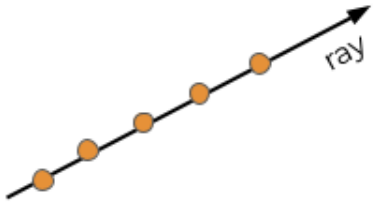


Convex splatting with accentuated convexes

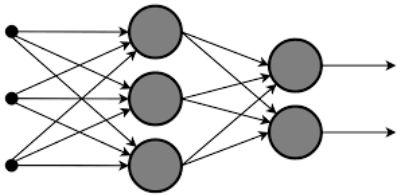
ON THE GEOMETRIC ACCURACY OF IMPLICIT AND PRIMITIVE-BASED REPRESENTATIONS DERIVED FROM VIEW RENDERING CONSTRAINTS
Elias De Smijter, Renaud Detry and Christophe De Vleeschouwer

The internal 3D model can be stored either implicitly or explicitly

Implicit

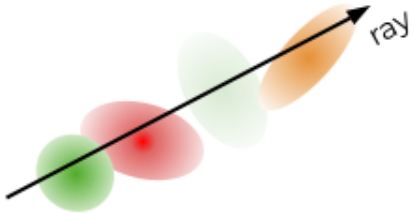


NeRF

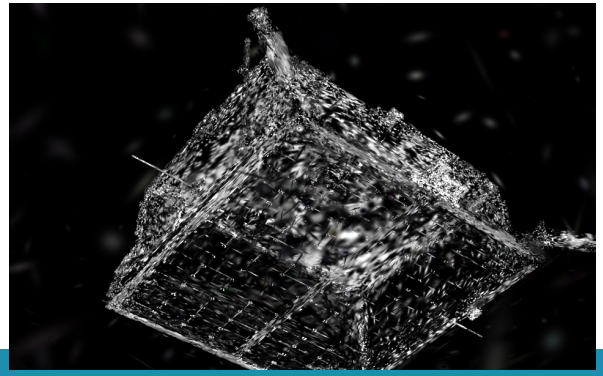


$f: (x, y, z, \theta, \phi) \rightarrow (r, g, b, \sigma)$

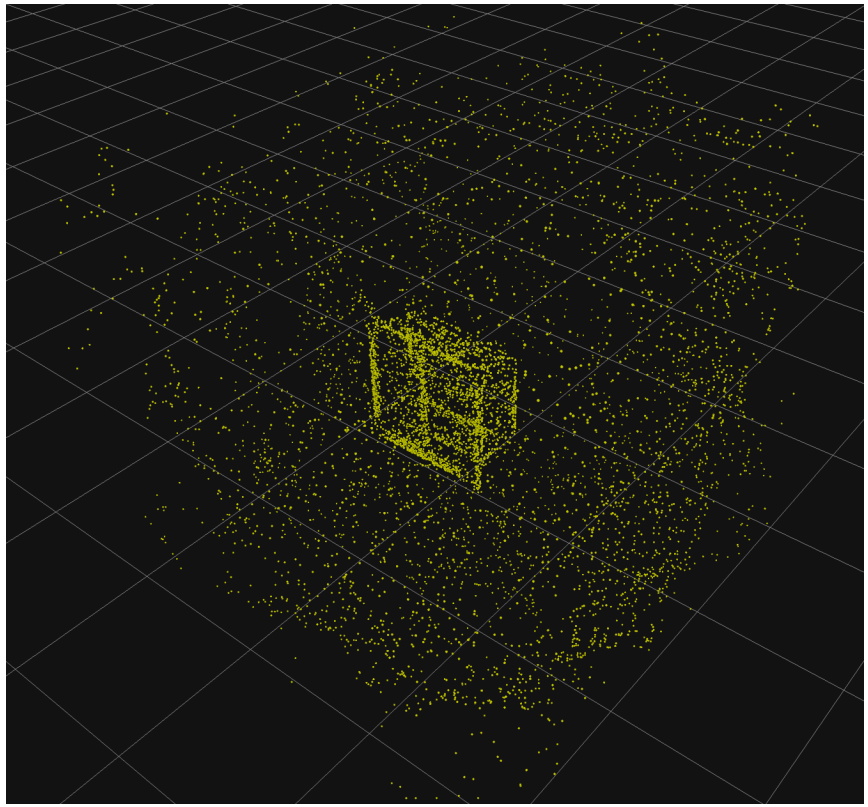
Explicit

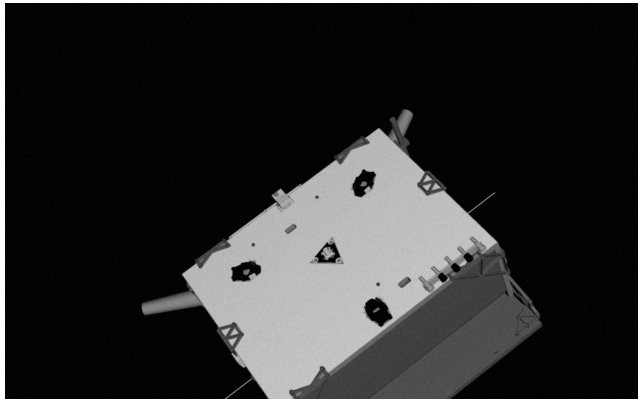


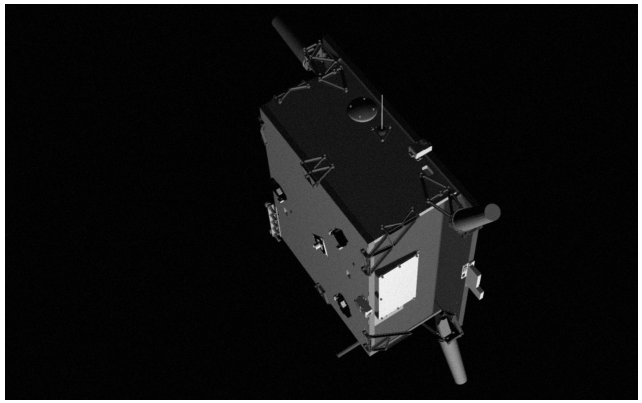
Gaussian splatting



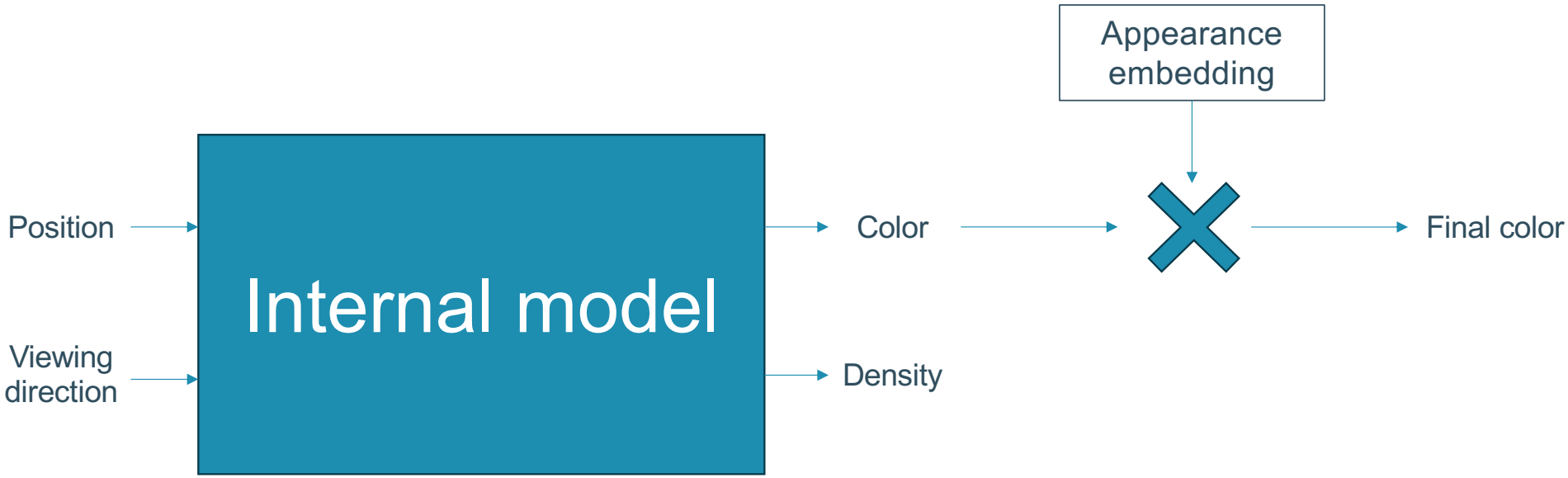
The shift of the internal model from byproduct to main product increases the importance of mitigating floater artifacts



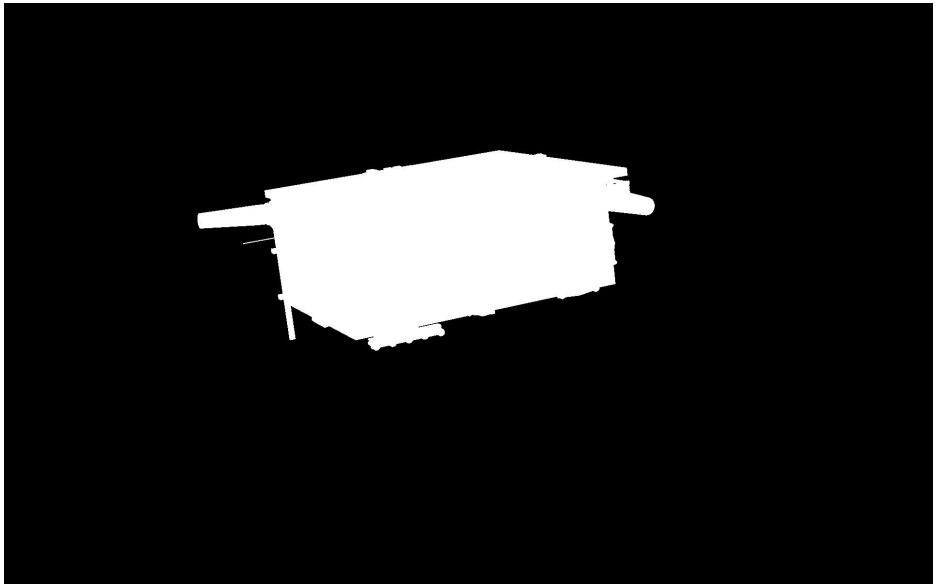




Hypothesis: appearance embeddings can reduce floaters



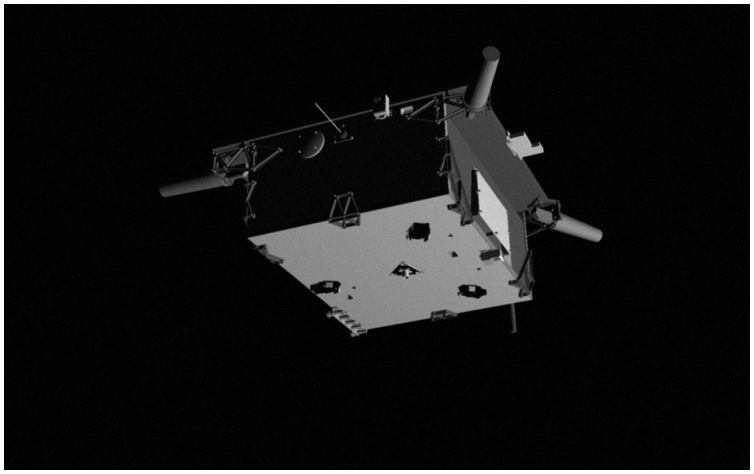
Validation: Use ground truth segmentation masks



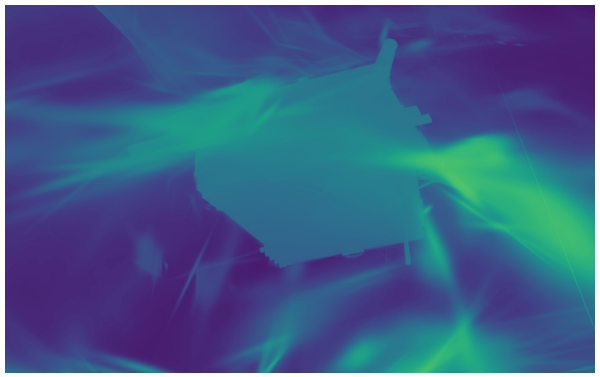
Ground truth mask

Rendered depth

Result: Explicit models have less floaters

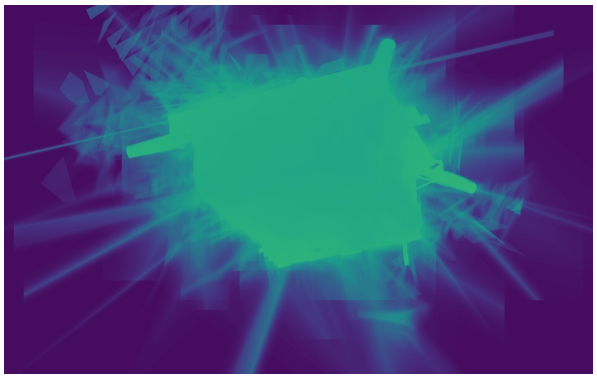


Ground truth render



Explicit – 3D Gaussians

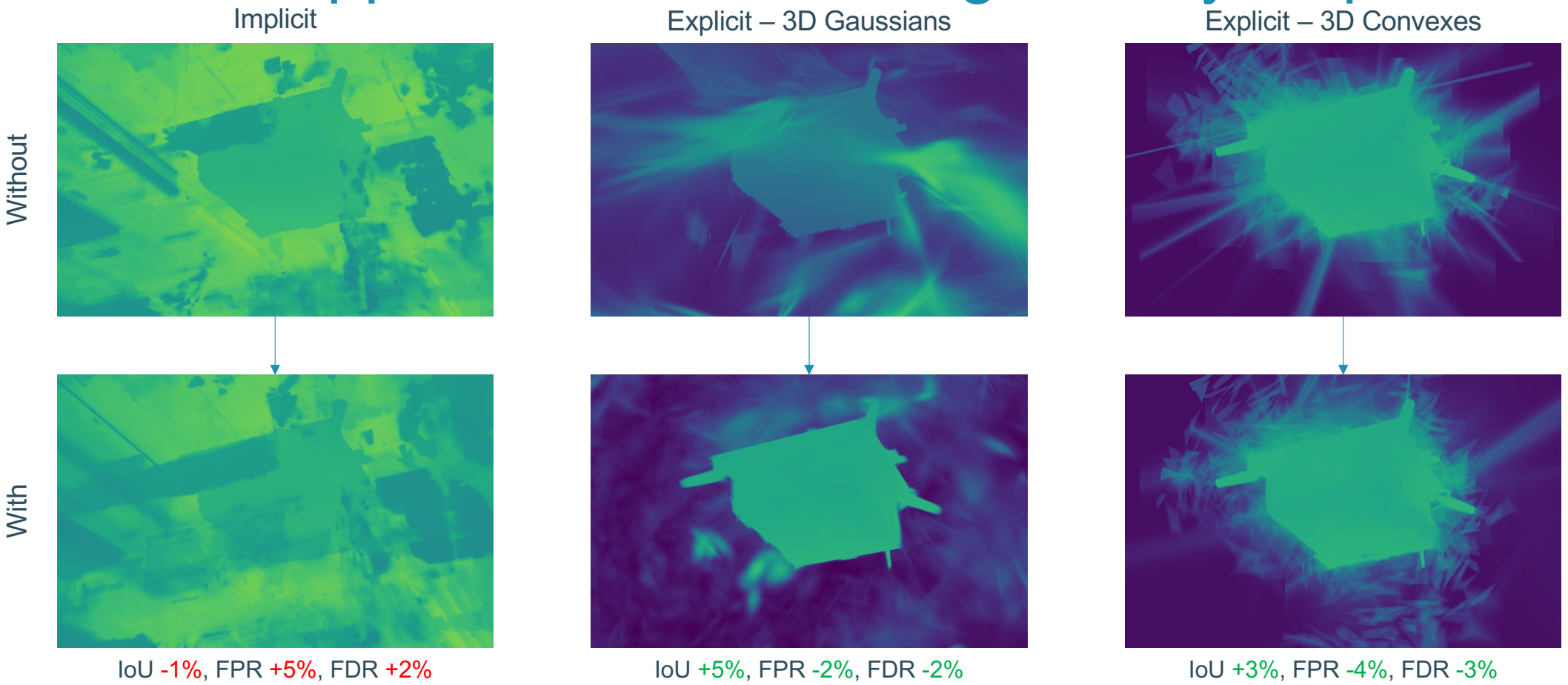
Implicit



Explicit – 3D Convexes

	IoU ↑	FPR ↓	FDR ↓
Implicit	0.18	0.81	0.81
Explicit – 3D Gaussians	0.48	0.15	0.47
Explicit – 3D Convexes	0.37	0.30	0.63

Result: Appearance embeddings barely help



Result: Explicit convexes need the least #parameters

# Parameters	Implicit	Explicit – 3D Gaussians	Explicit – 3D Convexes
Without appearance embeddings	33 935 378	4 298 150	461 127
With appearance embeddings	33 940 626	2 113 574	418 002

Conclusion: use an explicit model with appearance embedding

Full paper on arXiv

- Geometry extraction: Explicit > Implicit
- Floaters: Explicit > Implicit
- Parameter efficiency: With > Without appearance embedding

Full paper on arXiv

Thank you for listening!
Questions

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