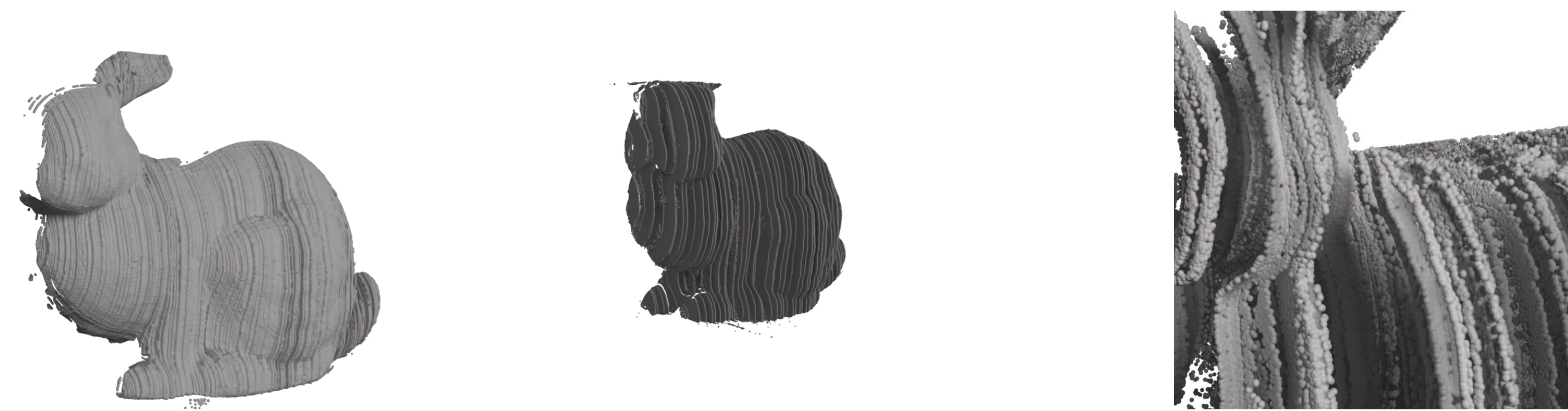


Structured Light (SL) Scanning

Goal: Precise 3D shape acquisition across diverse objects.

Problems: Careful modeling of hardware (including geometric and radiometric calibration of camera-projector pair); careful choice of SL patterns; pixelwise decoding sensitive to noise.

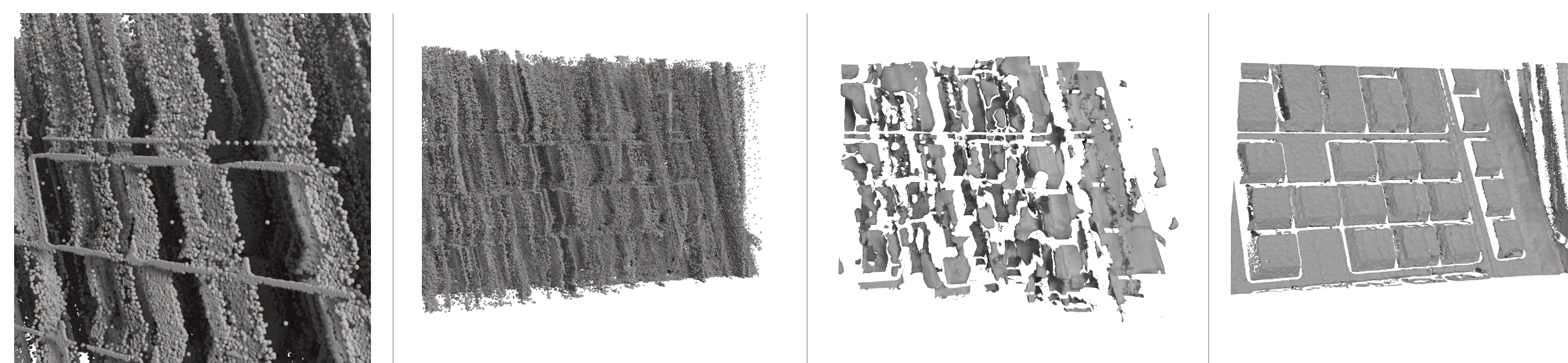


DLP, 11 patterns ✓ LCD, 11 patterns ✗ DLP, 3 patterns ✗

Our Contribution

- We propose a neural inverse SL method **without explicitly modeling the projector**.
- We output **accurate surface with normals** with as few as 3 suboptimal monochromatic patterns and a white flash.
- We scan **over 25 objects** in a handful of projector-camera set-ups, including with a **low-cost LCD projector** and an **analog projector with fixed RGB pattern** for slow-motion scanning to showcase feasibility of our method.

Comparison to Other Works

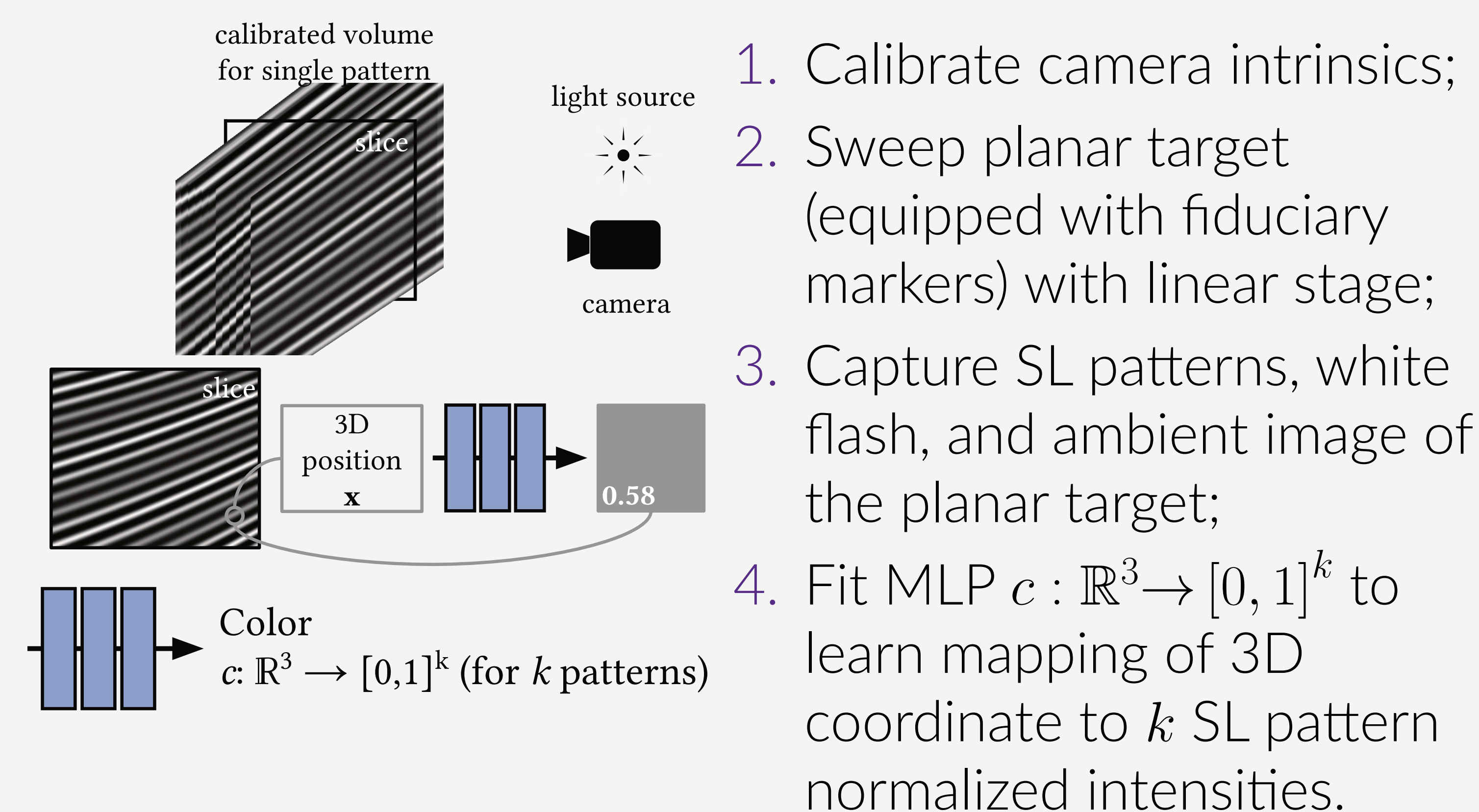


ZNCC [1]: > 100 mm LookUp3D [3]: 20.97 mm TurboSL [2]: 35.85 mm Ours: **0.67 mm**

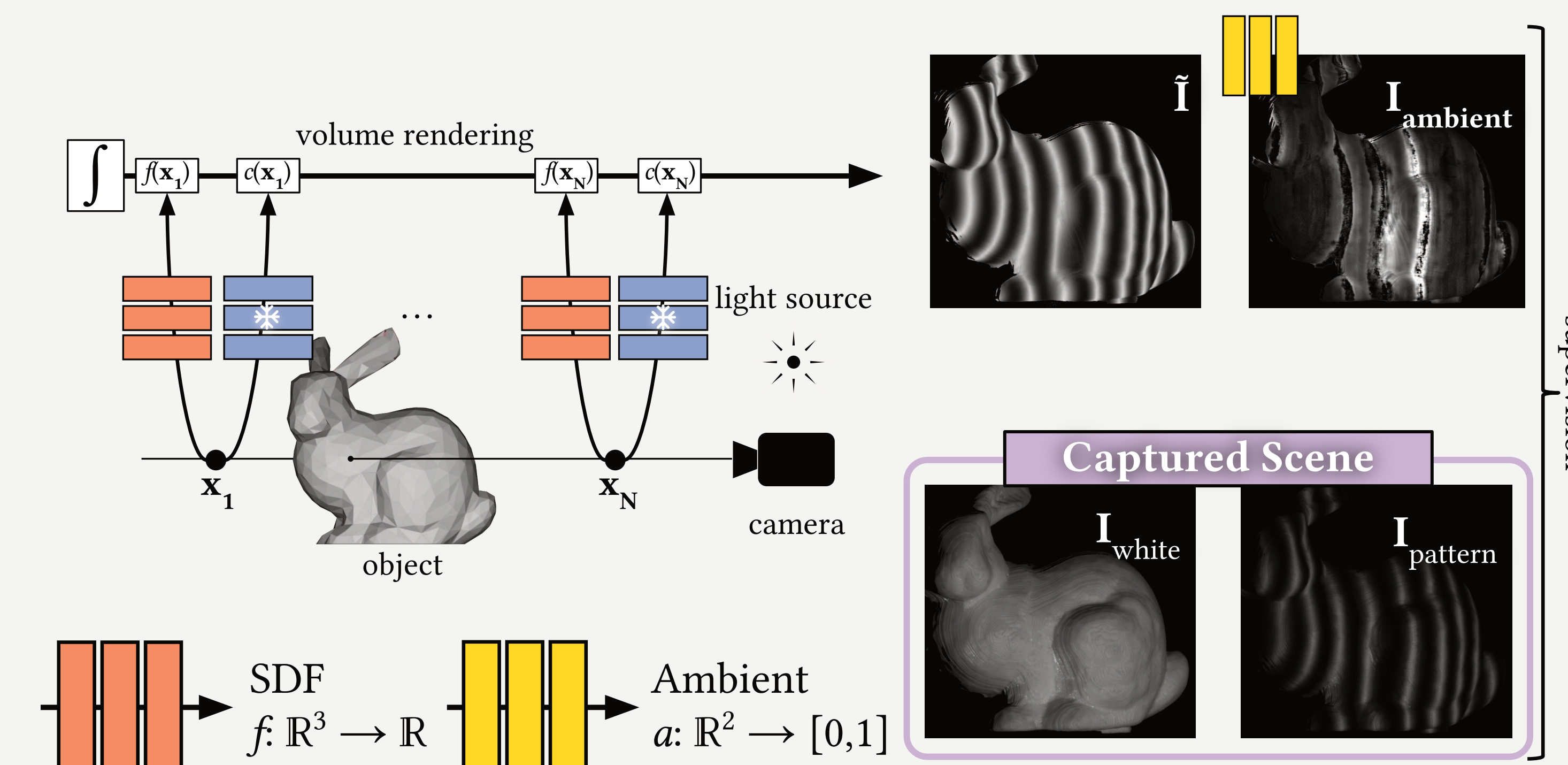
With as few as 3 suboptimal patterns (in this case, 3 random stripe patterns) and a white flash capture, our approach maintains sub-mm accuracy. This allows SL scanning without careful pattern design and without careful hardware calibration.

Neural LookUp3D (NeLU3D)

Calibration



Reconstruction



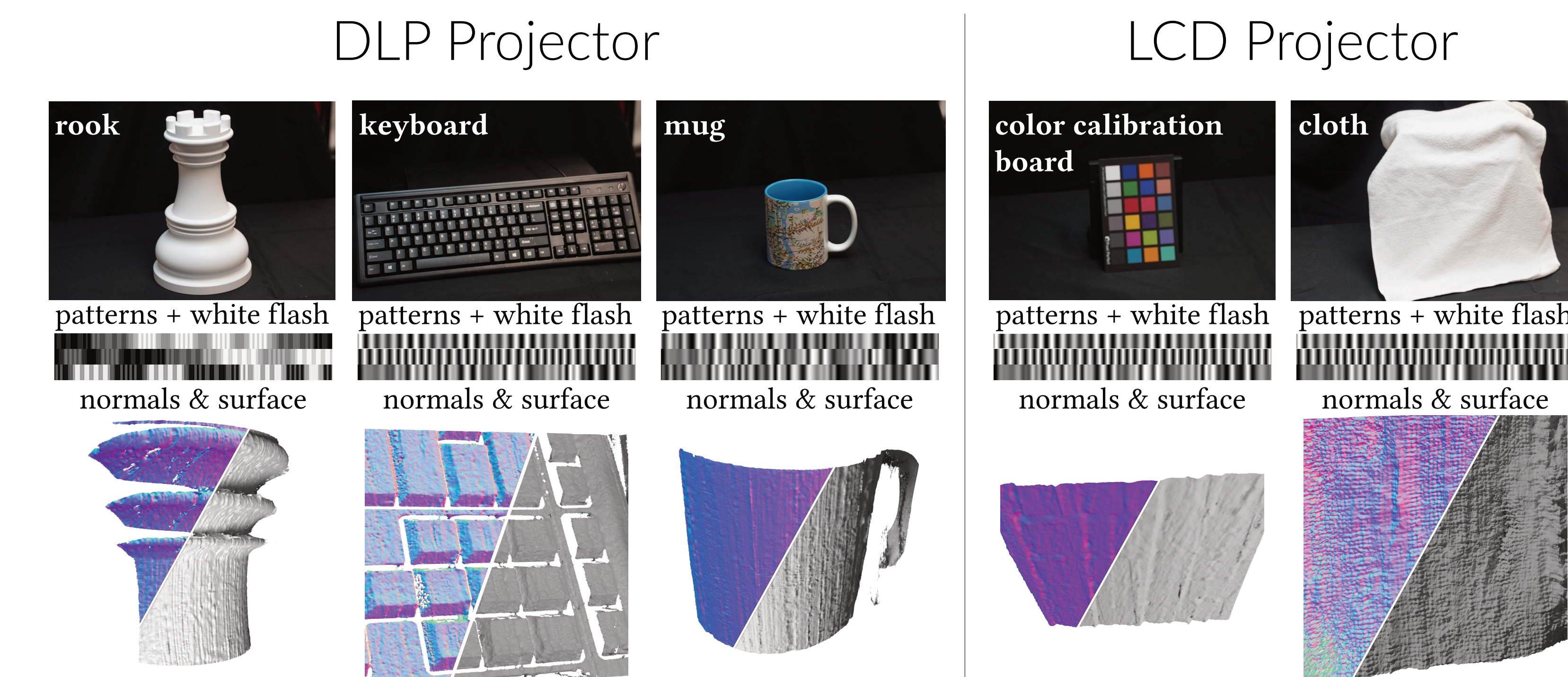
1. Capture unknown shape with SL patterns and white flash;
2. Optimize two MLPs $f: \mathbb{R}^3 \rightarrow \mathbb{R}$ (mapping 3D coordinate to SDF) and $a: \mathbb{R}^2 \rightarrow [0, 1]$ (mapping 2D image coordinates to global illumination contributions) to explain captured images via volume rendering;
3. Extract surface from zero level set of fitted SDF.

Experimental Setup

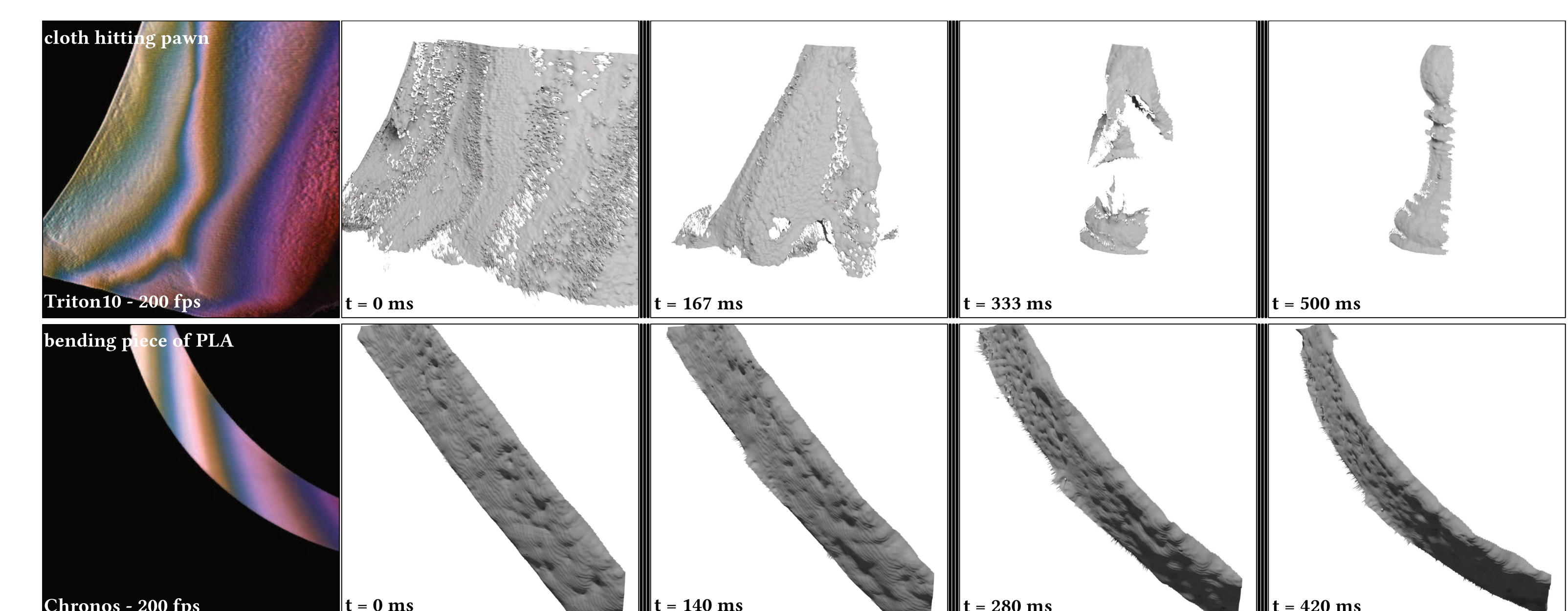


Results

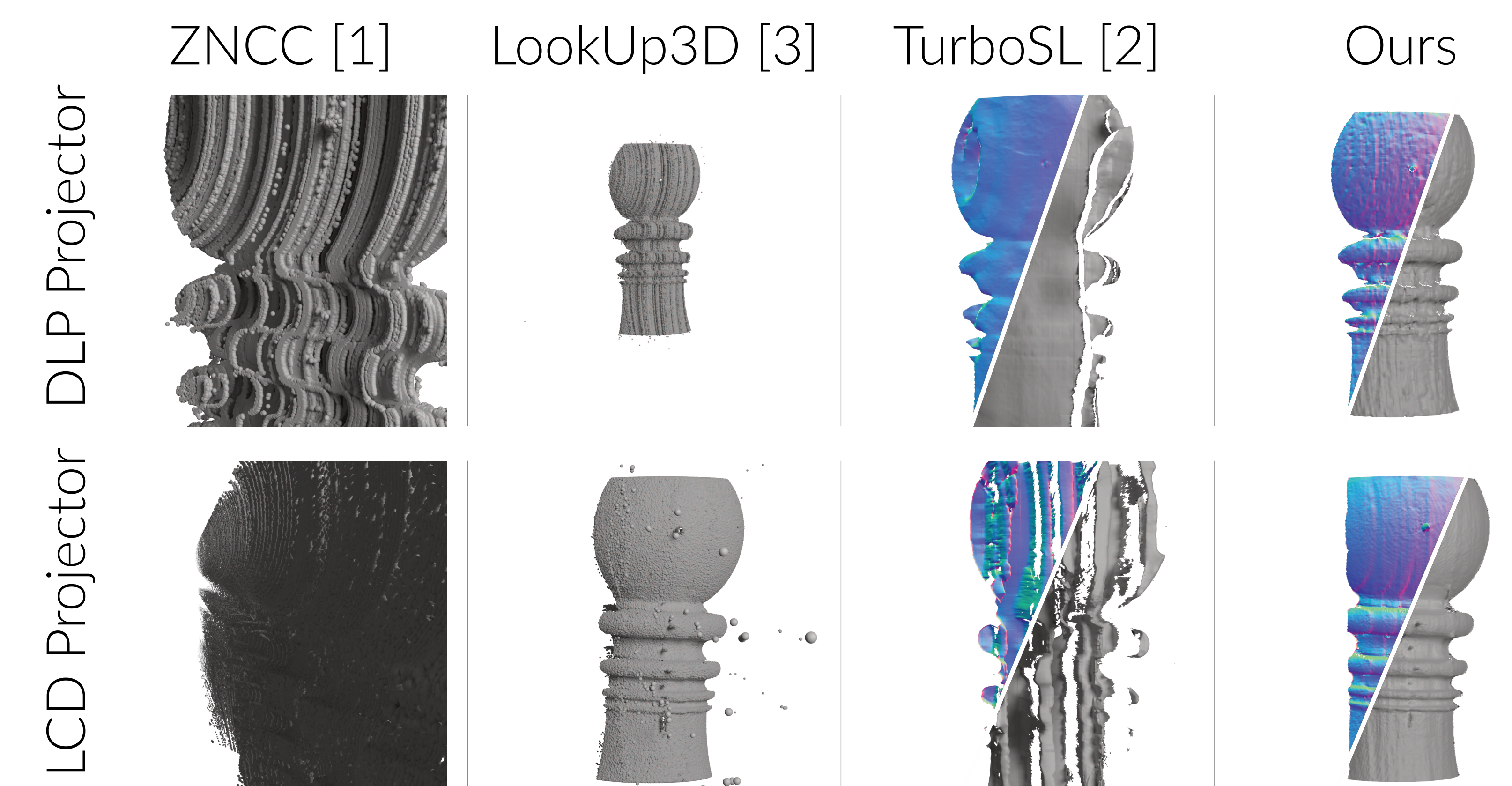
Static Results



Slow-Motion Results (w/ Analog Projector)



More Comparisons (3 SL patterns)



References

- [1] Mirdehghan et al. Optimal structured light à la carte. In CVPR, 2018.
- [2] Mirdehghan et al. TurboSL: Dense accurate and fast 3d by neural inverse structured light. In CVPR, 2024.
- [3] Pereira et al. Lookup3d: Data-driven 3d scanning. In SIGGRAPH Asia, 2025.