MITIGATING EDGE FRINGE EFFECTS IN MULTIPLANE HOLOGRAPHY

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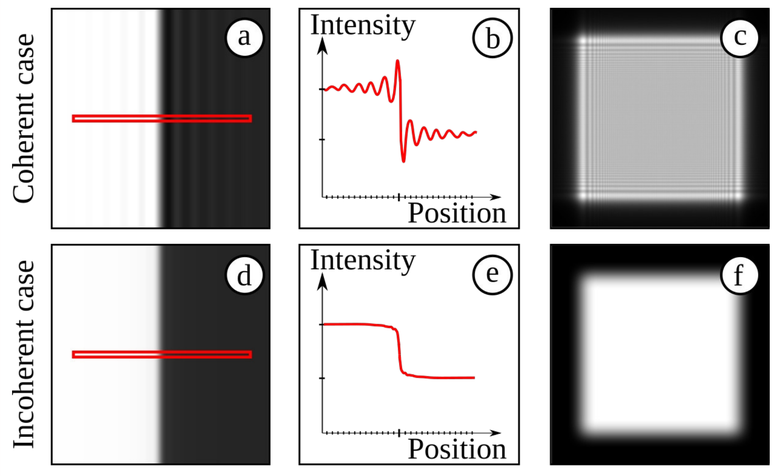
https://complightlab.com/publications/realistic_defocus_cgh

SUMMARY

We present a novel multiplane computer generated hologram calculation approach that enables artifact free and realistic-looking defocus blur for optical reconstructions in a holographic display. We validate our findings for both the numerical reconstructions and optical captures that are acquired from our holographic display prototype. Main contrubutions of our work can be listed as:

- Targeting scheme (Depth-of-field rendered multiplane holograms)
- Loss function for multiplane Computer Generated Holograms
- Multiplane hologram generation pipeline
- Proof-of-concept holographic display

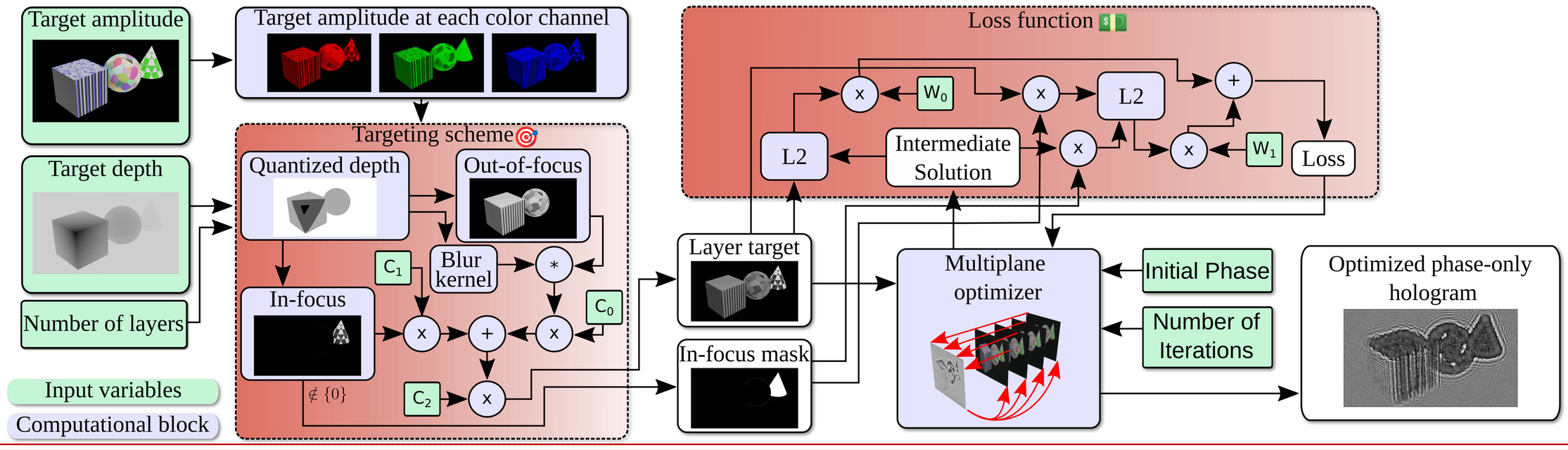
MOTIVATION



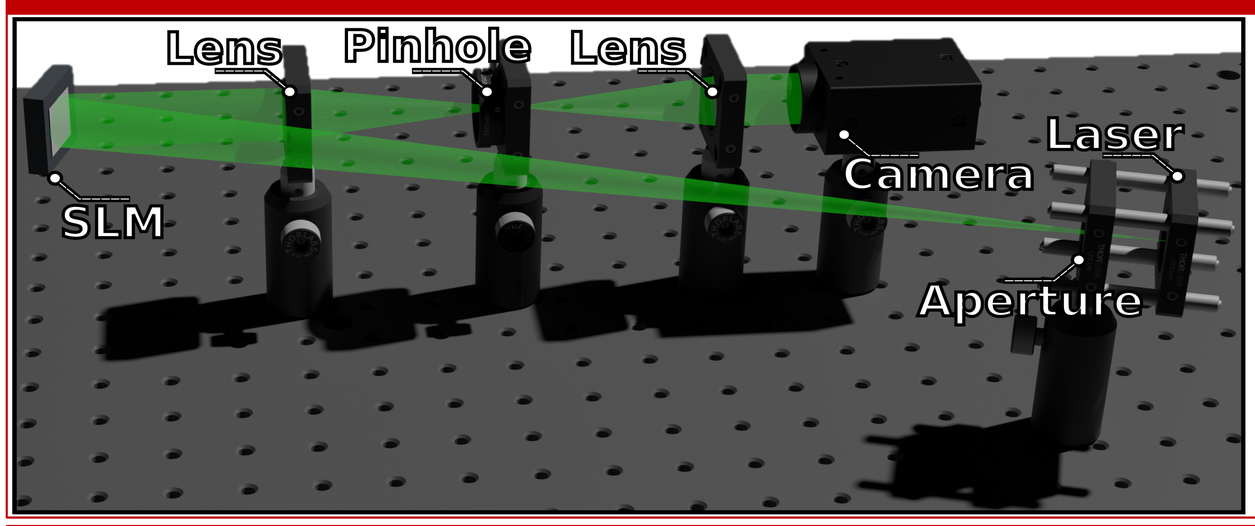
Computer Generated Holography typically relies on coherent light sources such as lasers. Due to the transfer function characteristics of coherent light sources, the defocused parts of scenes look unrealistic to a human observer. Born and Wolf [1] describes these phenomena as edge fringe effects. These fringes are typical in 3D holographic displays at the defocused parts when using coherent illumination (a, b), whereas incoherent illumination (d, e) case does not suffer from such issues.

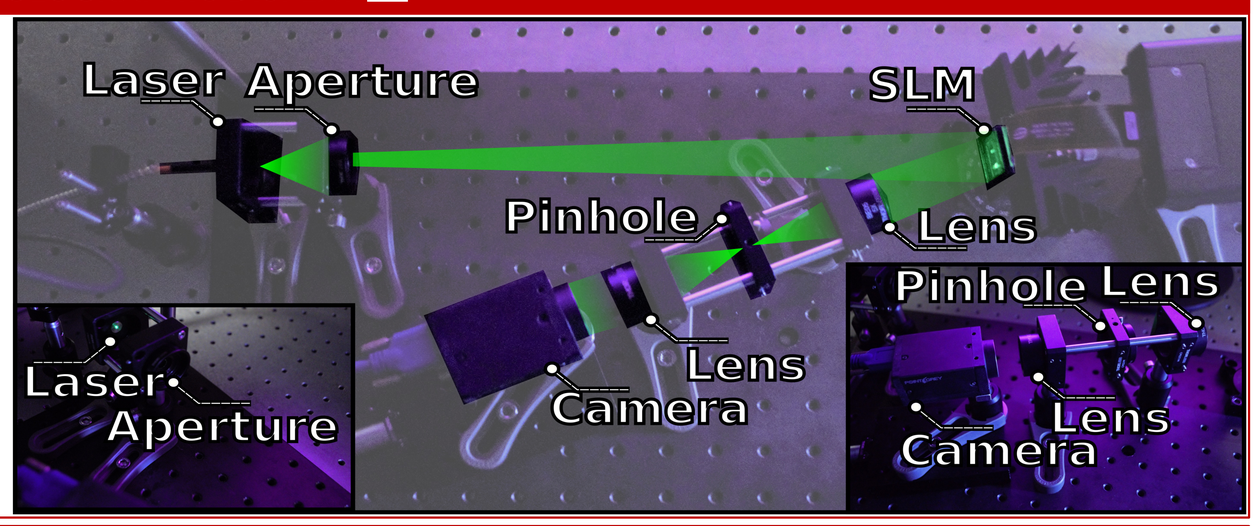
Coherent (c) and incoherent (f) illumination also differ in defocus blur visually. We propose an improved targeting scheme and a new loss function that accounts for these differences can help reproduce incoherent defocus blur in CGH when reconstructing multiplanar images using coherent light sources [2].

MULTIPLANE HOLOGRAM GENERATION PIPELINE

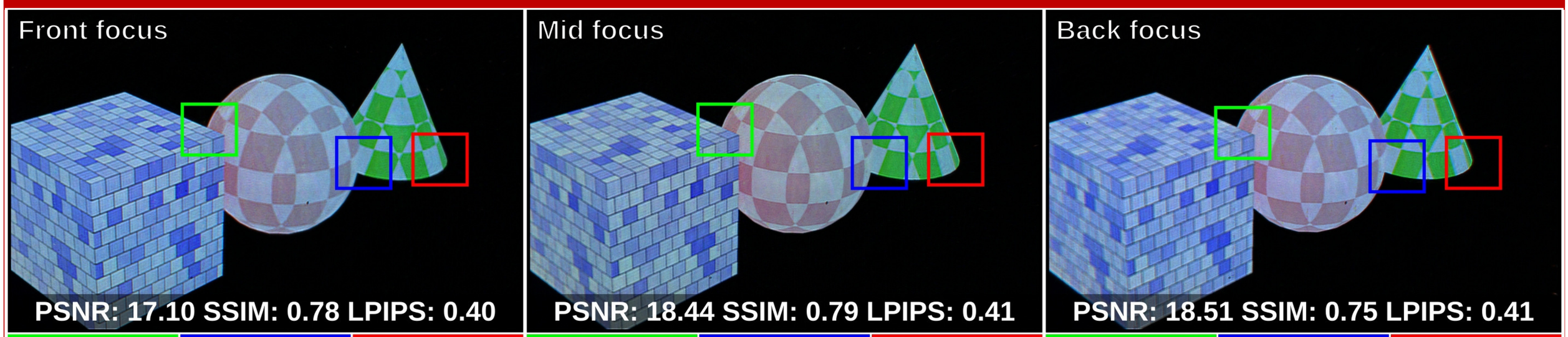


PROOF-OF-CONCEPT HOLOGRAPHIC DISPLAY





CAPTURES FROM PROOF-OF-CONCEPT HOLOGRAPHIC DISPLAY



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REFERENCES

[1] Max Born and Emil Wolf. 2013. *"Principles of optics: electromagnetic theory of propagation, interference and diffraction of light."*, Elsevier.
[2] Kavaklı, K., Itoh, Y., Urey, H. & Ak¸sit, K. 2022. "Realistic defocus blur for multiplane computer-generated holography.", arXiv preprint arXiv:2205.07030 DOI: https://doi.org/10.48550/arXiv.2205.07030

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