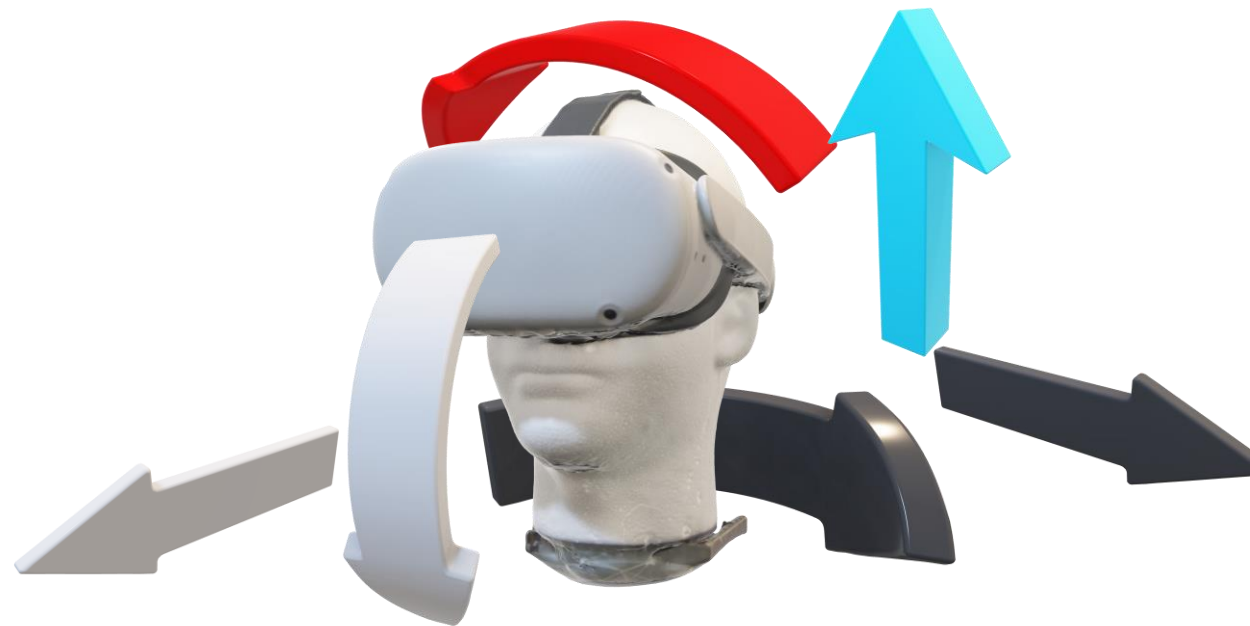




A Spherical Light Field Database for Immersive Telecommunication and Telepresence Applications

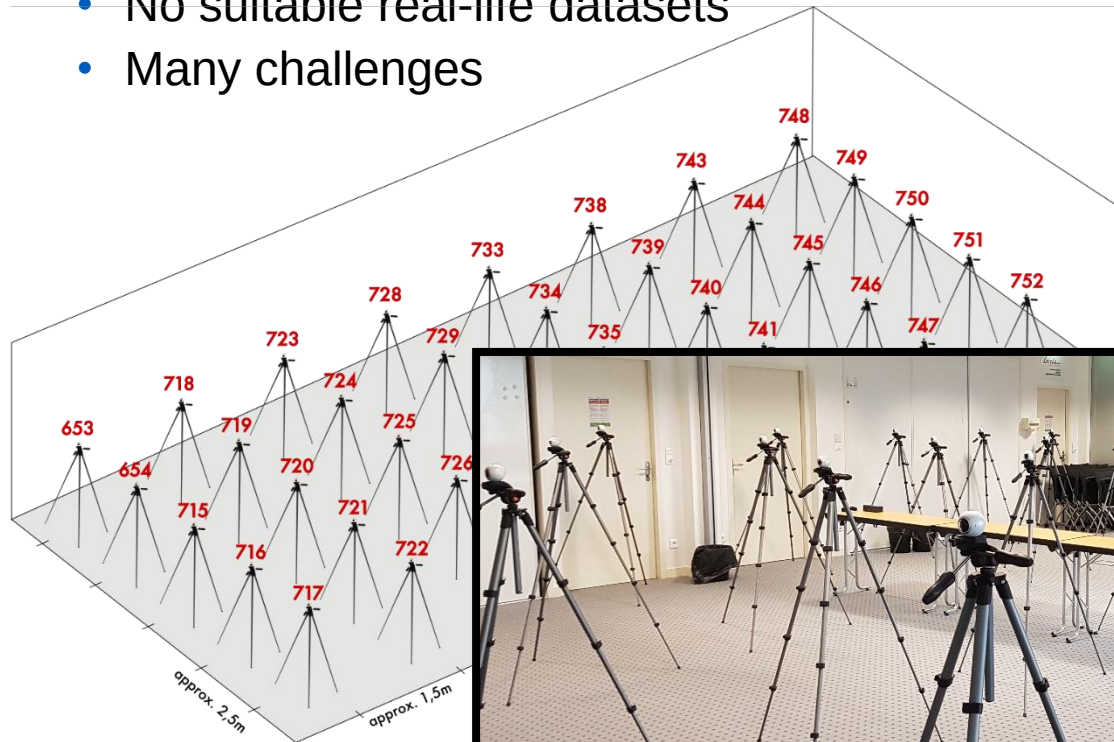
Emin Zerman, Manu Gond*, Soheib Takhtardeshir*,
Roger Olsson, Mårten Sjöström





Point of departure & Motivation

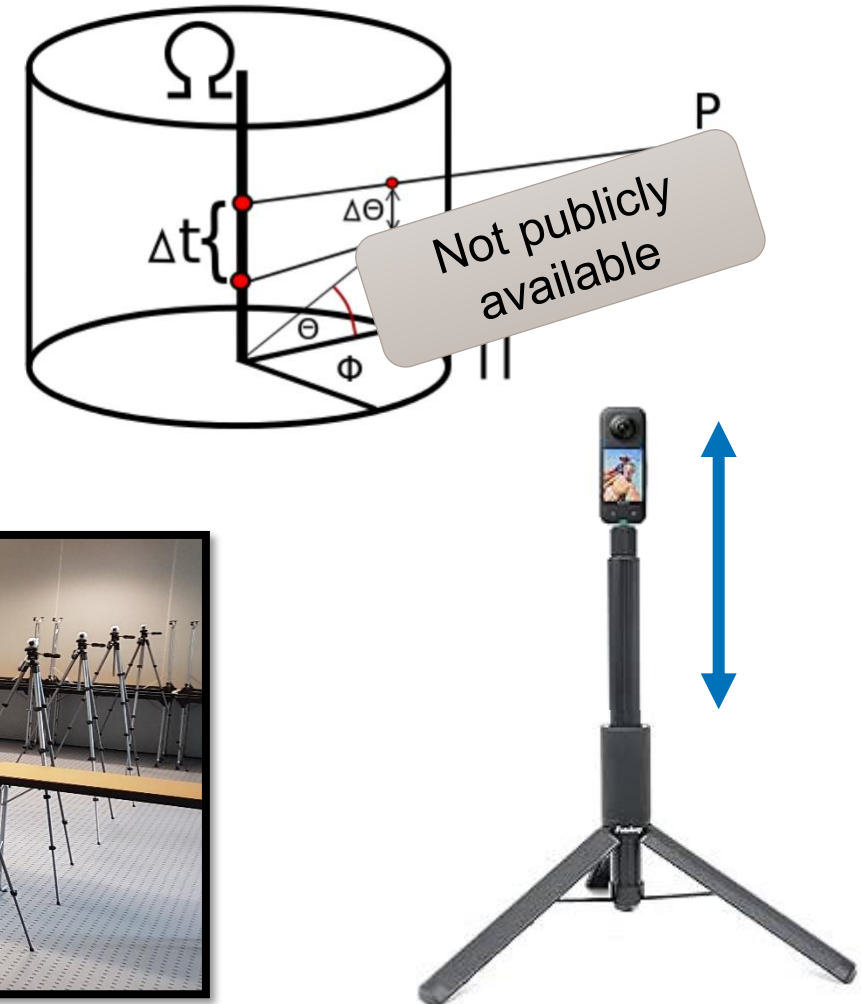
- Need more research on spherical LFs, but
 - No suitable real-life datasets
 - Many challenges



Maugey et al. (2019)

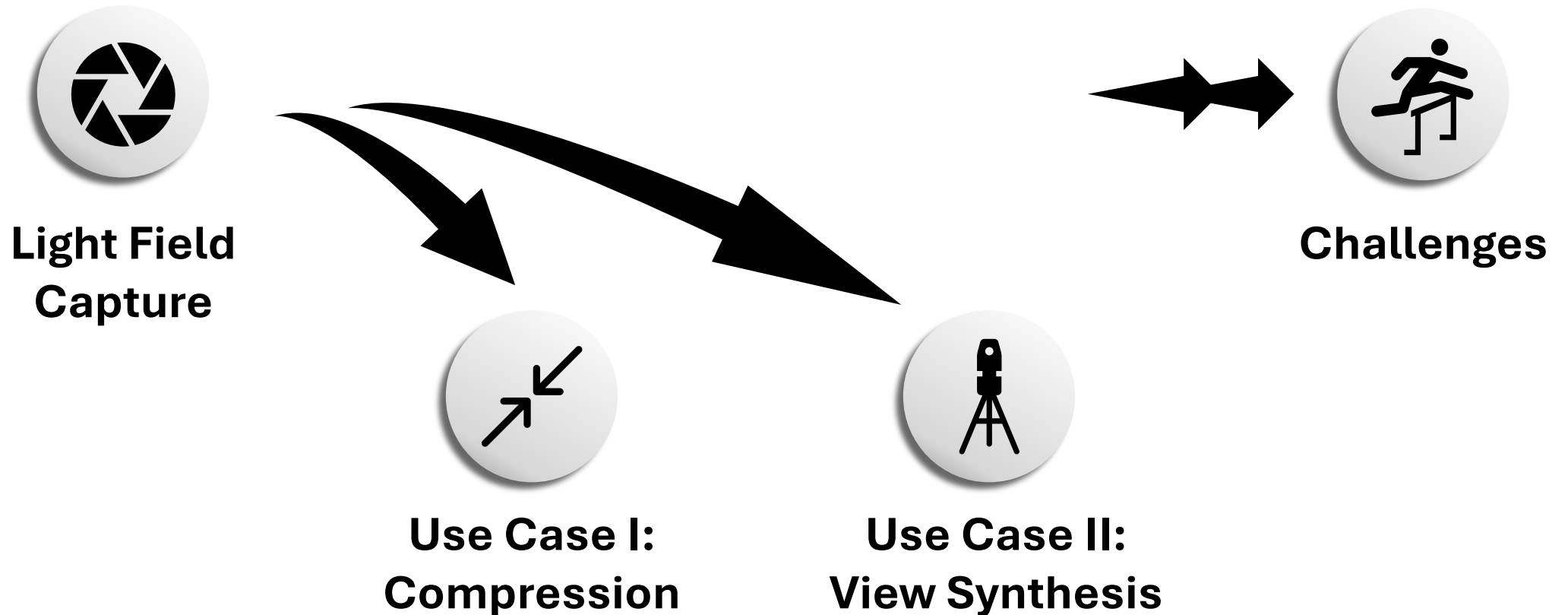


Bernd et al. (2014)

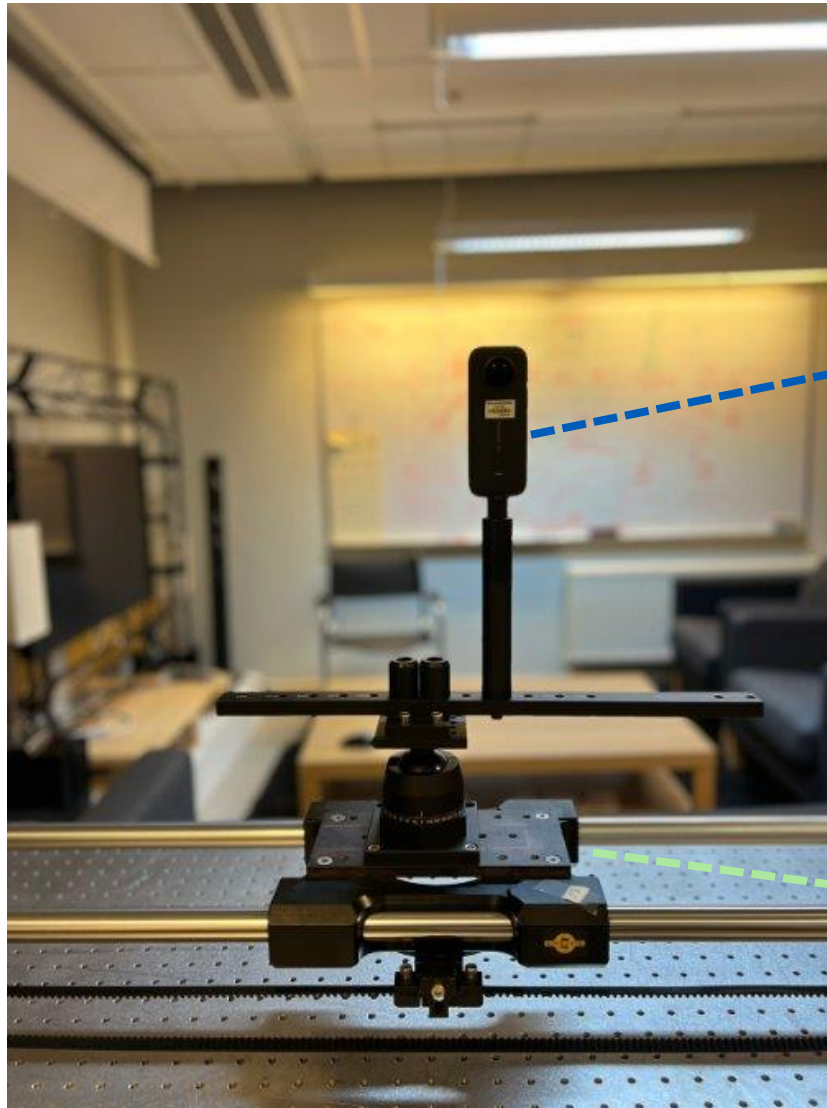


SLFDB

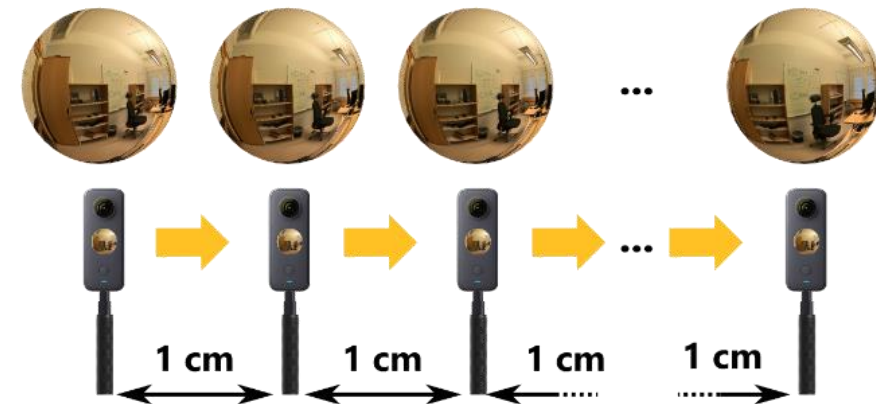
A publicly and freely available spherical light field database



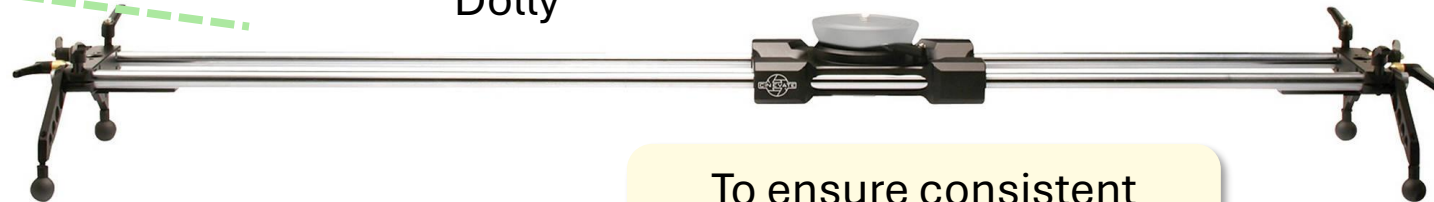
Spherical LF Capture - Setup



Insta 360 x3
Omnidirectional
camera

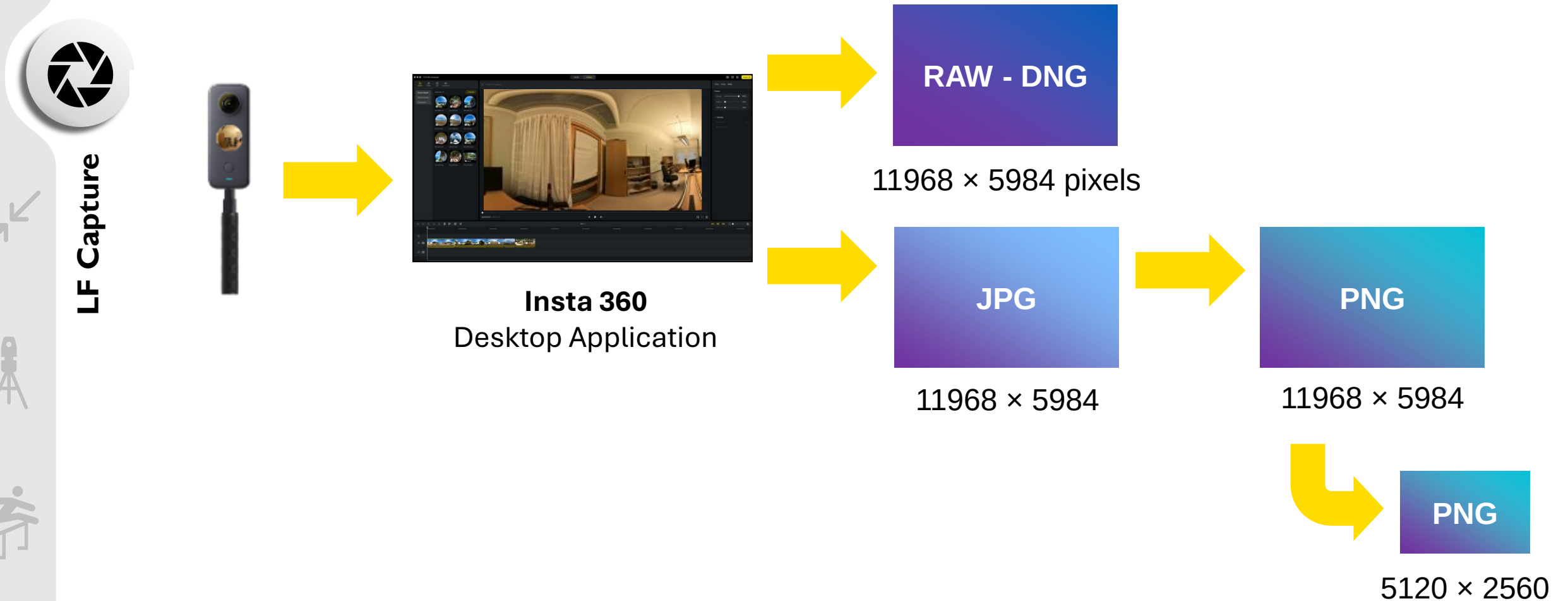


Cinevate Atlas 200
Dolly

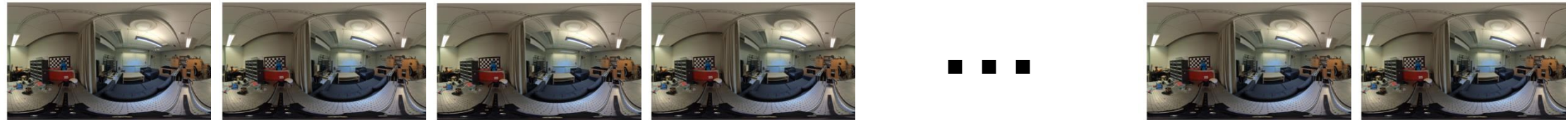


To ensure consistent
and accurate movement

Spherical LF Capture - Process



Spherical LF Capture - Data



1

2

3

4

59

60

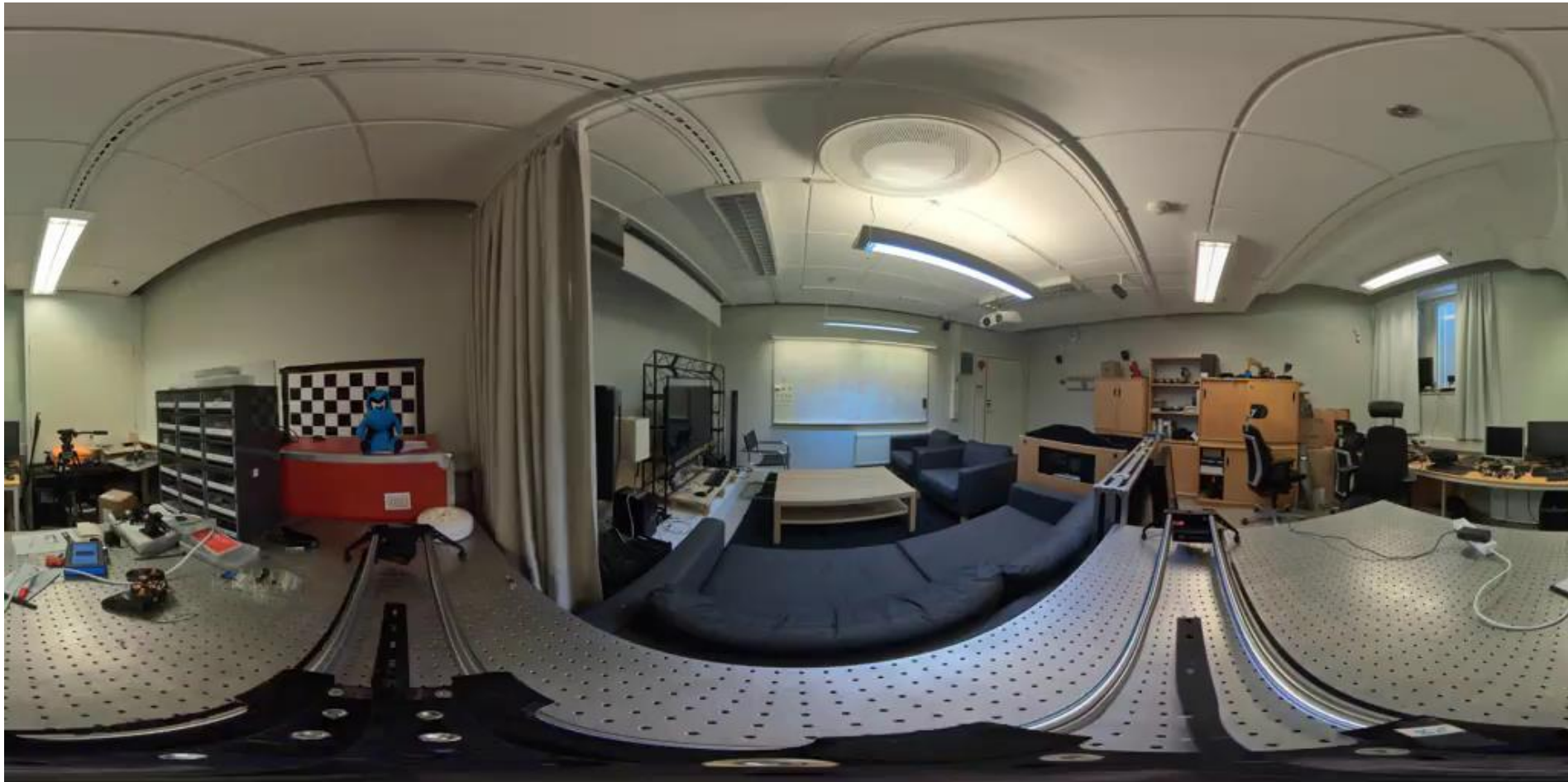
1 x 60 spherical light field
ERP - 5120 × 2560

20 different scenes

- Mid Sweden University,
Sundsvall Campus



Spherical LF Capture - Data



LF Capture

Scene characteristics

- Spatial Index (SI)**

- Calculated based on updated (2022) procedure in ITU T Rec. P.910

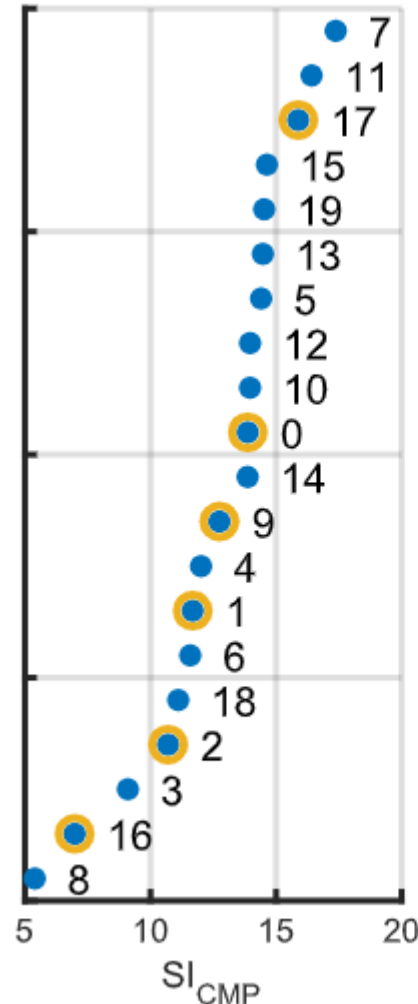
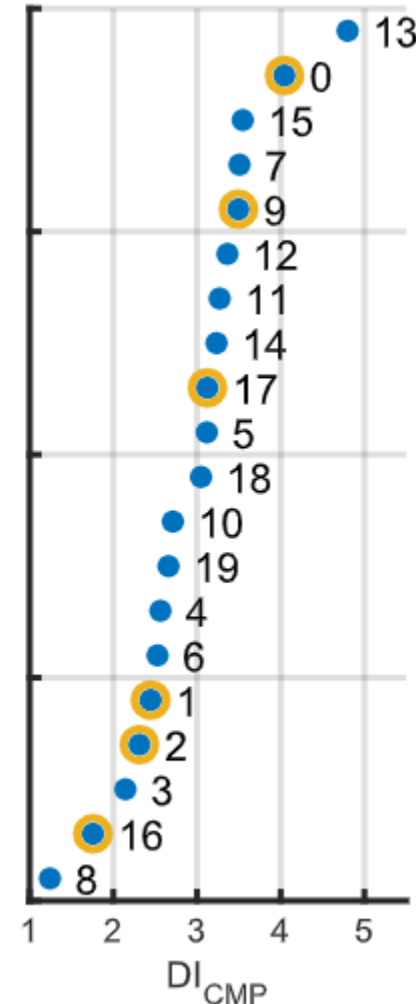
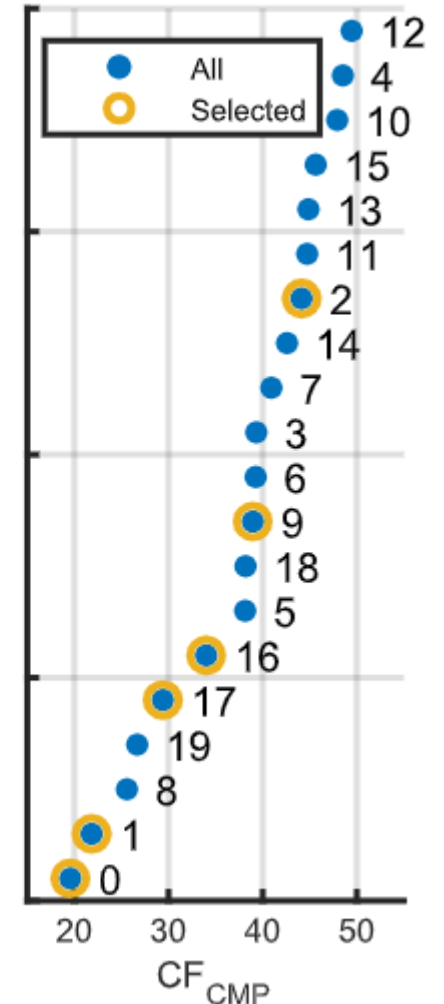
- Depth Index (DI)**

$$= \sigma_{space} [ODI_2^{PQ} - ODI_1^{PQ}]$$

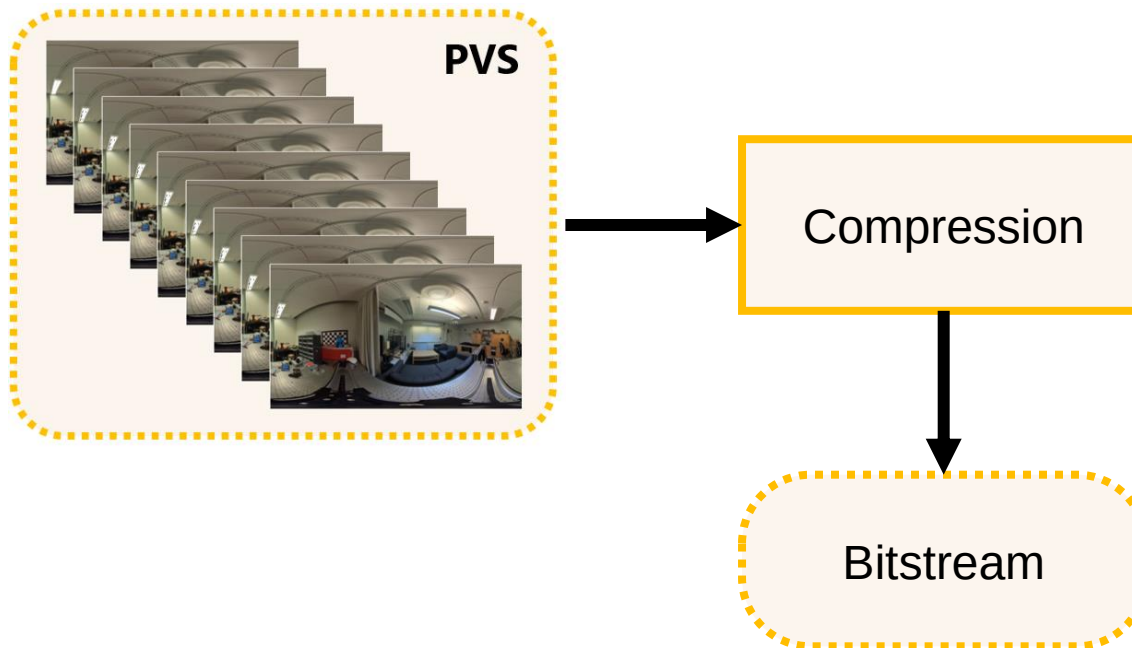
- Colorfulness**

- Hasler & Ssstrnk, 2003

$$= \sqrt{\sigma_{rg}^2 + \sigma_{yb}^2} + 0.3 \sqrt{\mu_{rg}^2 + \mu_{yb}^2}$$



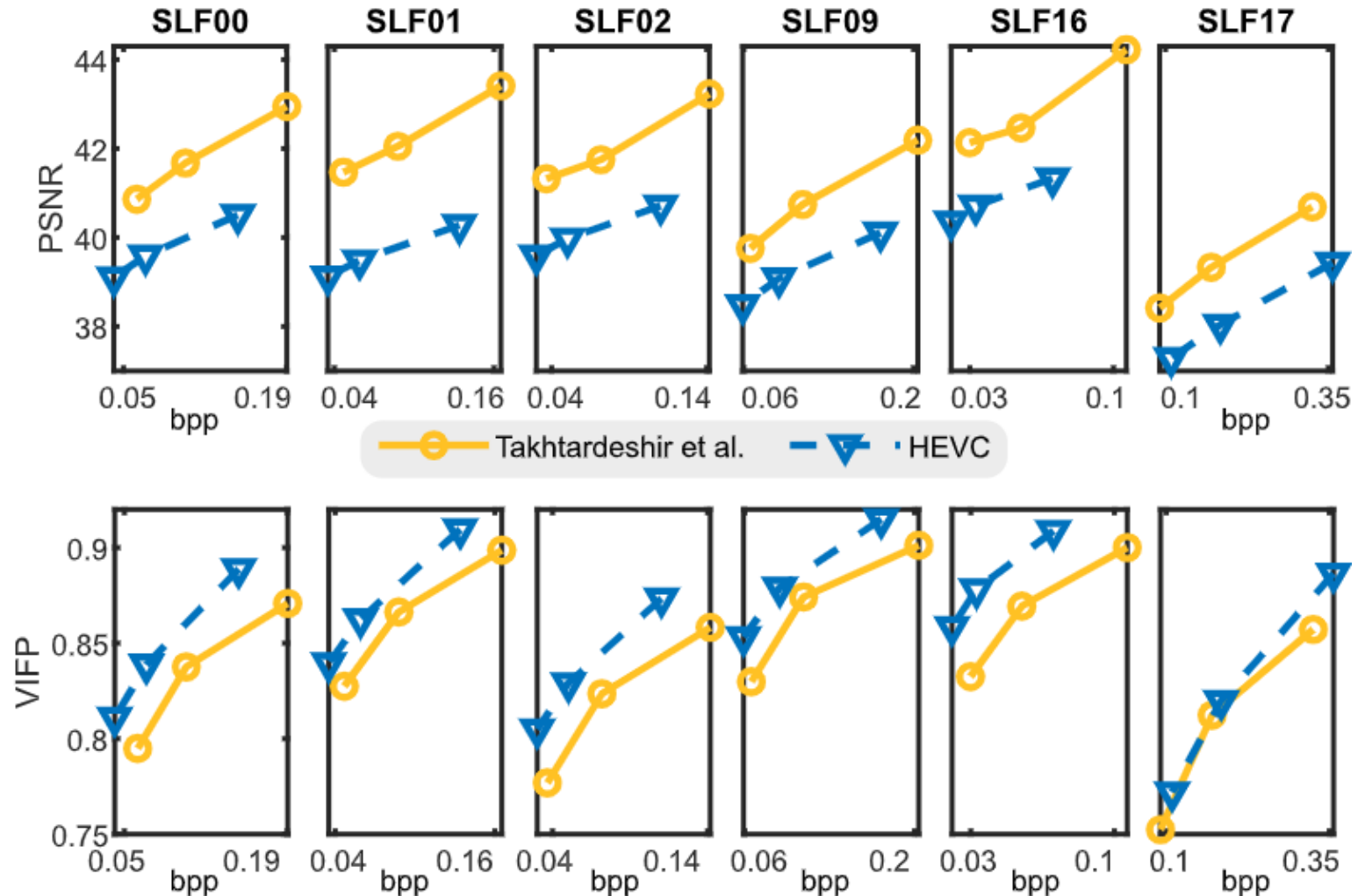
Spherical LF Compression



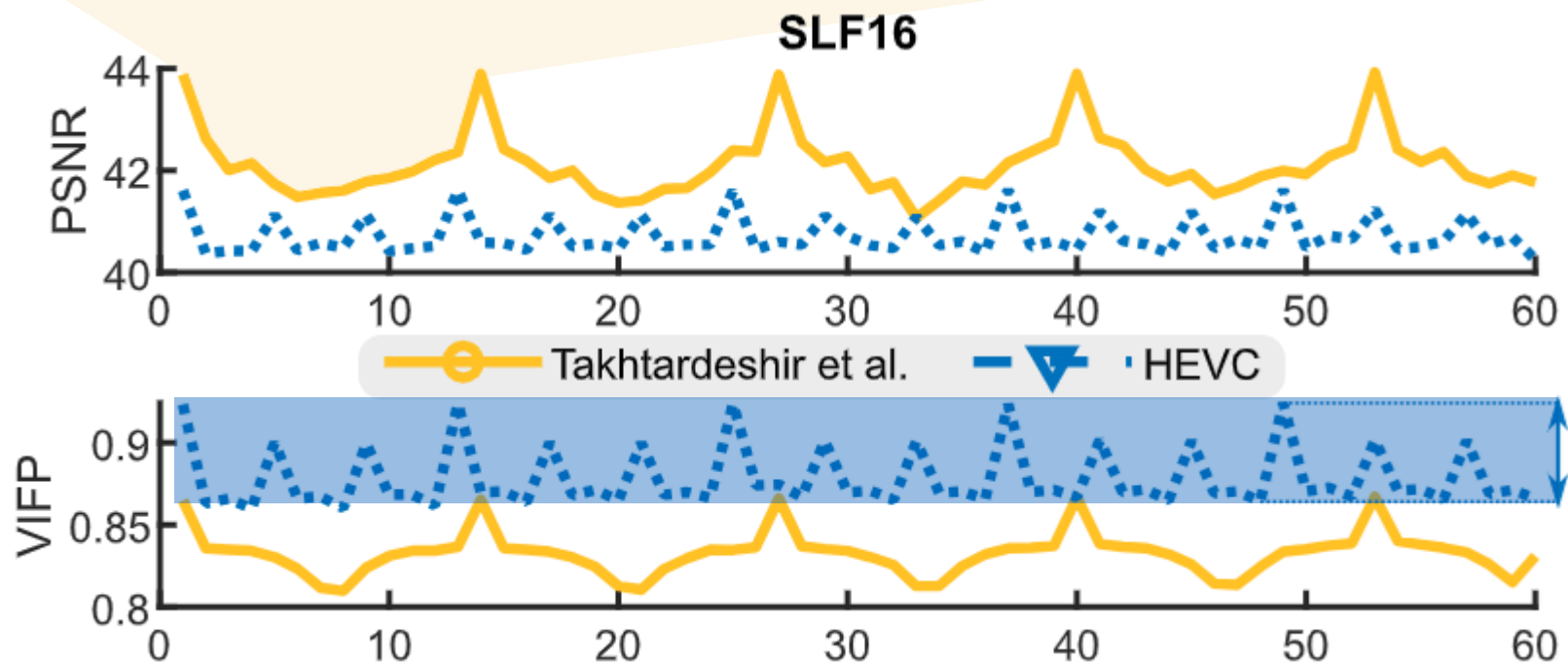
- Takhtardeshir, Olsson, Guillemot, and Sjöström (2024)
 - *Recurrent Learned Video Compression + In-loop filtering*
- High Efficiency Video Coding (ISO/IEC 23008-2:2023)
 - *Used previously for both omnidirectional video and light field compression*

Quality metric results

- Three quality levels for comparison
- Meaningful curves obtained
- Difference between PSNR and VIFp
 - Subjective QA needed



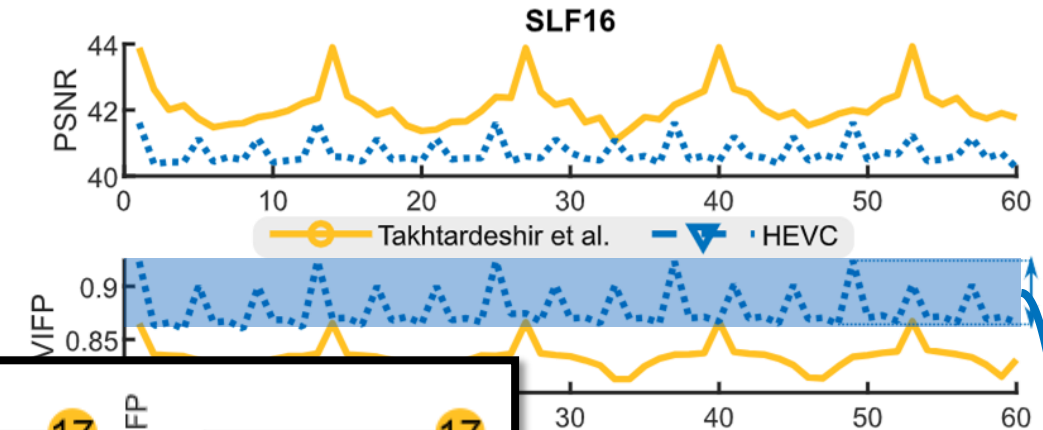
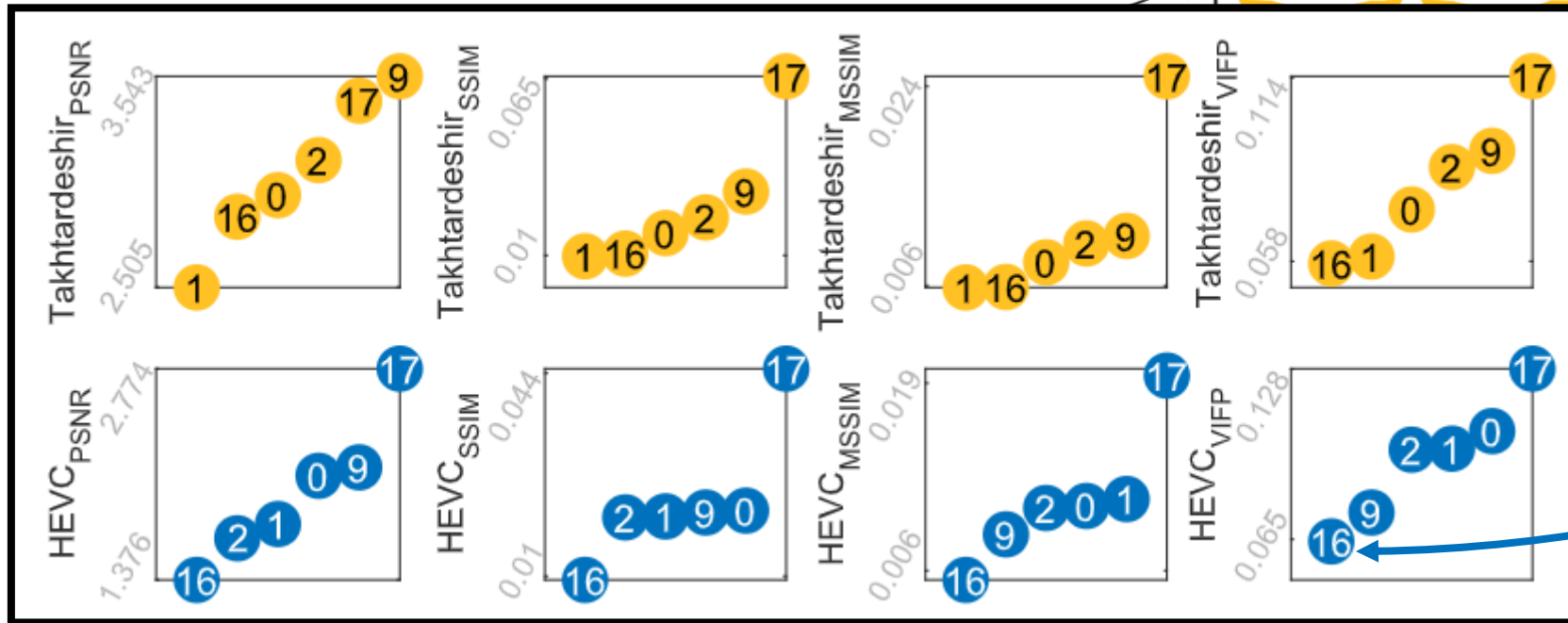
Quality metric results



Compression

Quality metric results

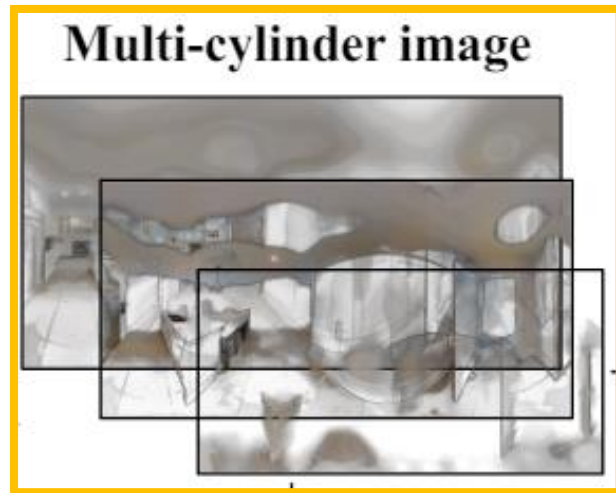
- Amount of quality variation in compression
 - To further characterize the database



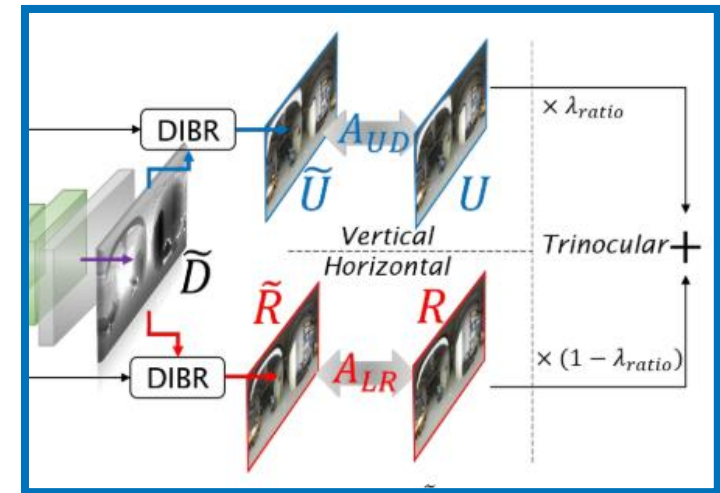
Compression

View Synthesis for Spherical LF

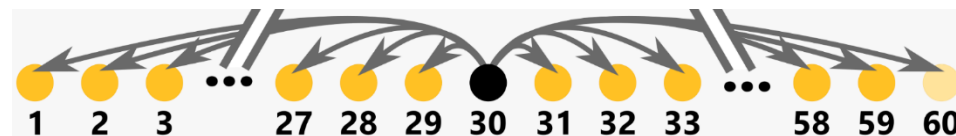
View Synthesis



PanoSynthVR
Waidhofer et al. (2022)

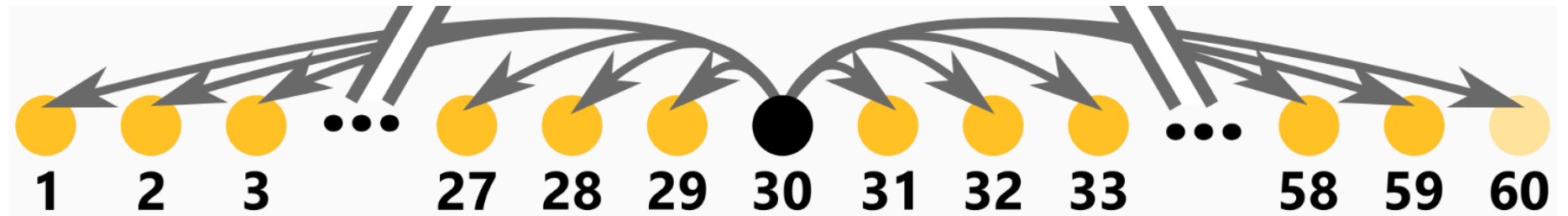
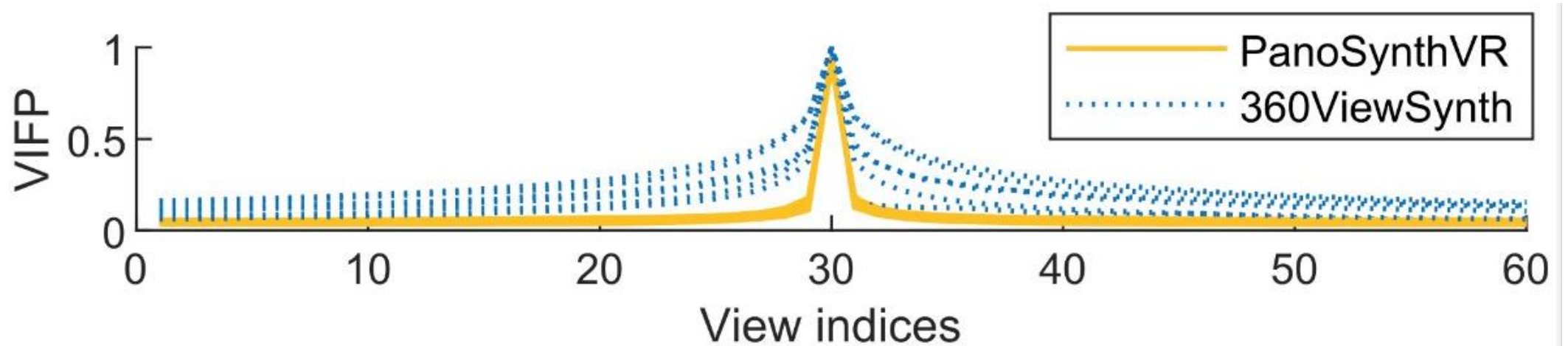


360ViewSynth
Zioulis et al. (2019)



View Synthesis for Spherical LF

View Synthesis

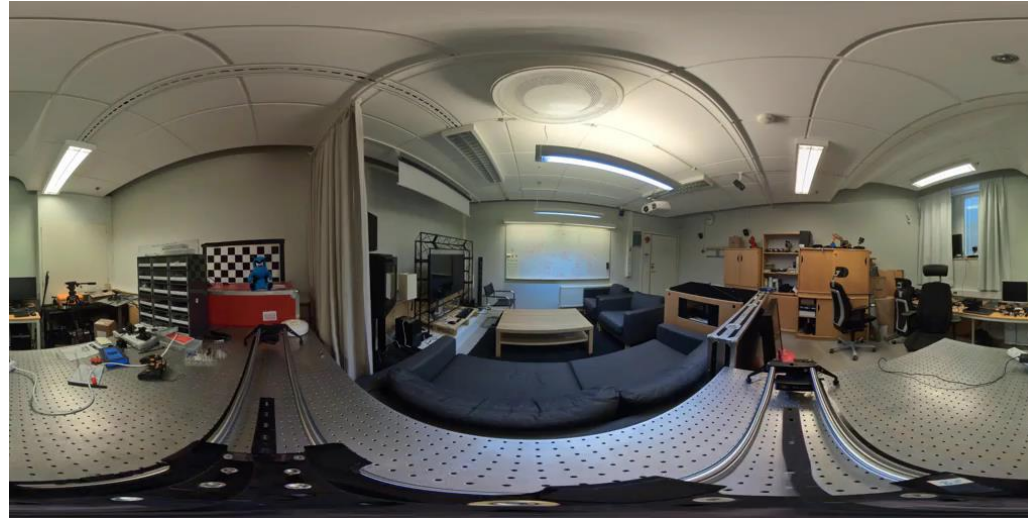
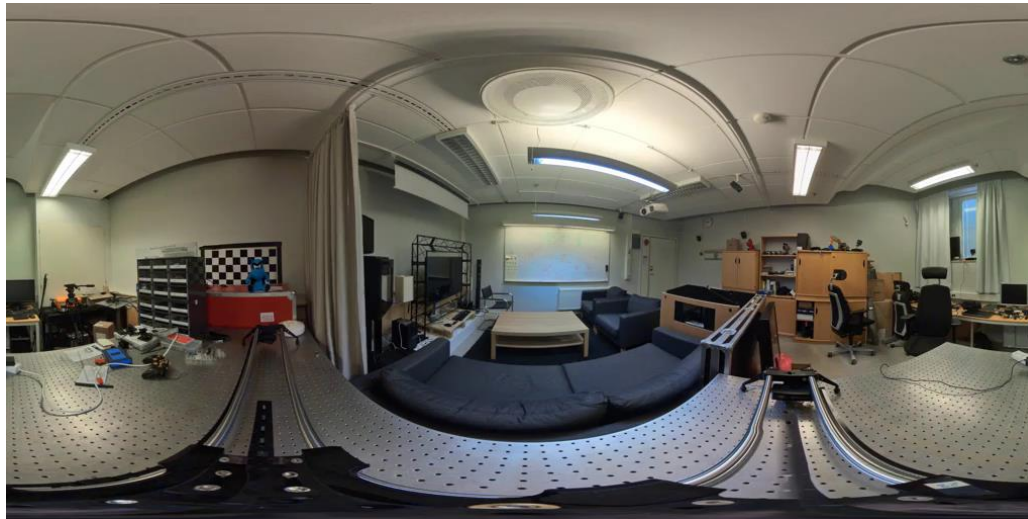


View Synthesis for Spherical LF – **small baseline**

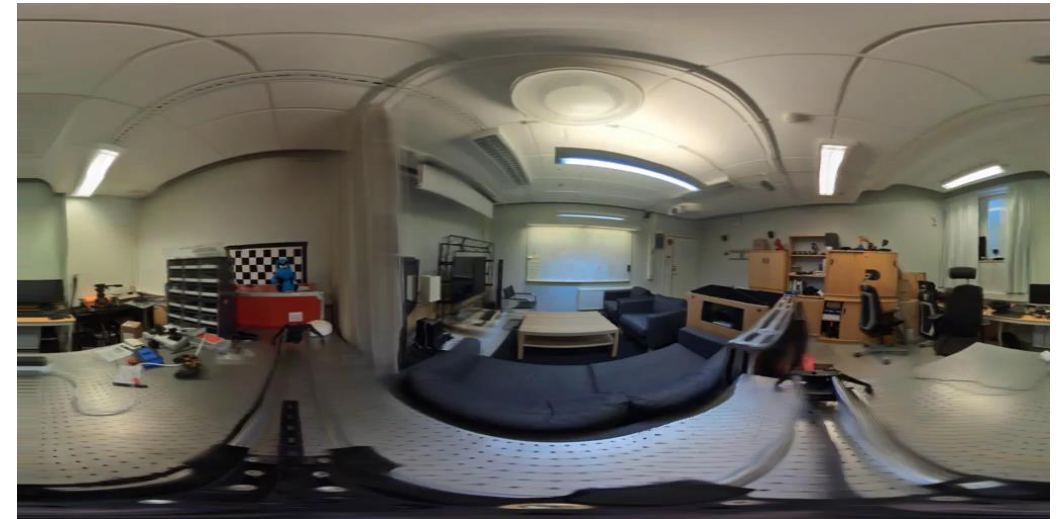
View Synthesis



Ground Truth



360ViewSynth



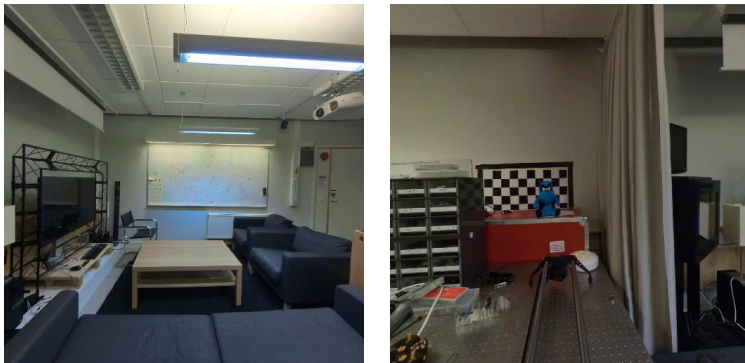
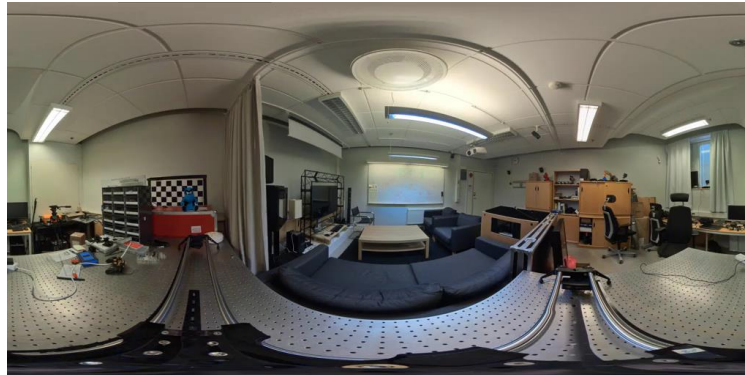
PanoSynthVR

View Synthesis for Spherical LF – **small baseline**

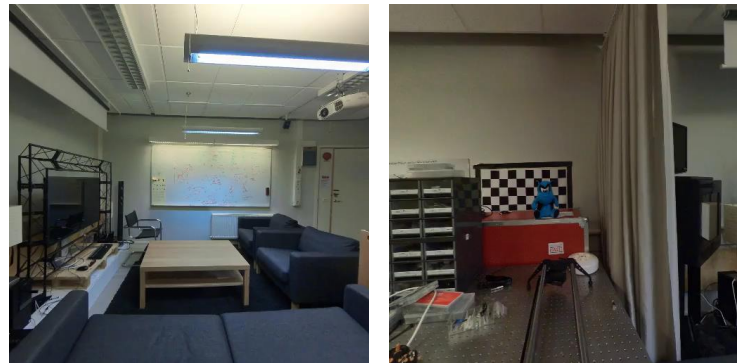
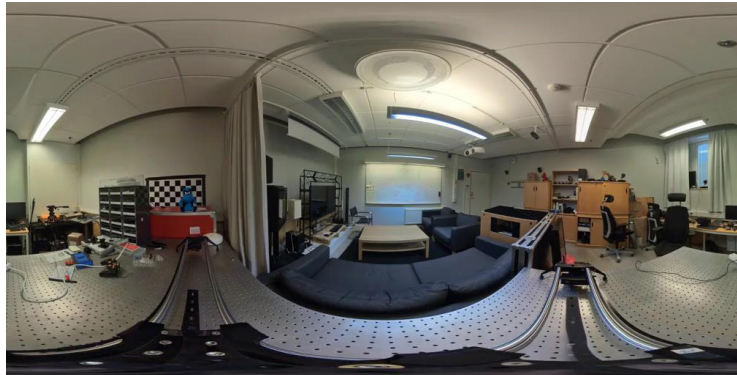
View Synthesis



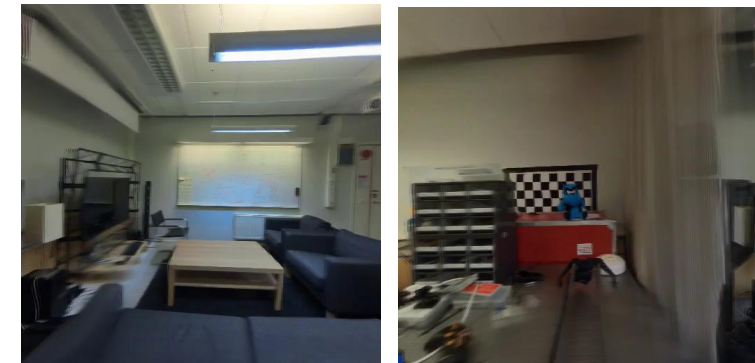
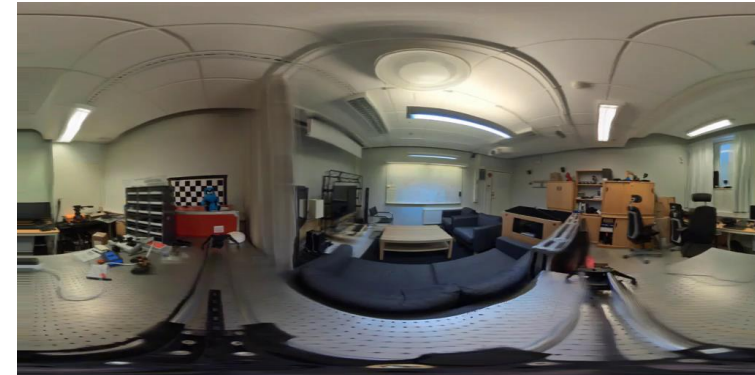
360ViewSynth



Ground Truth



PanoSynthVR



View Synthesis for Spherical LF – **small baseline**

View Synthesis



360ViewSynth



Ground Truth



PanoSynthVR

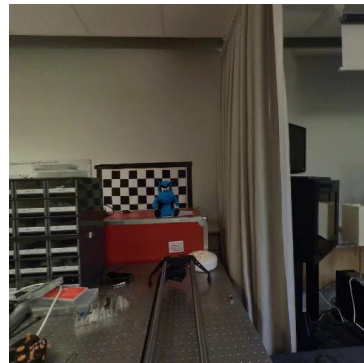
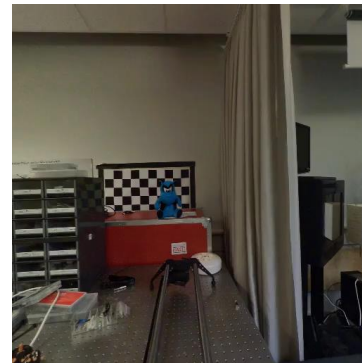


View Synthesis for Spherical LF – **small baseline**

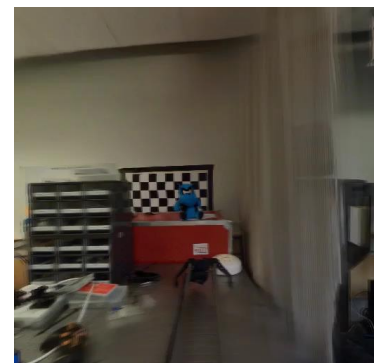
View Synthesis



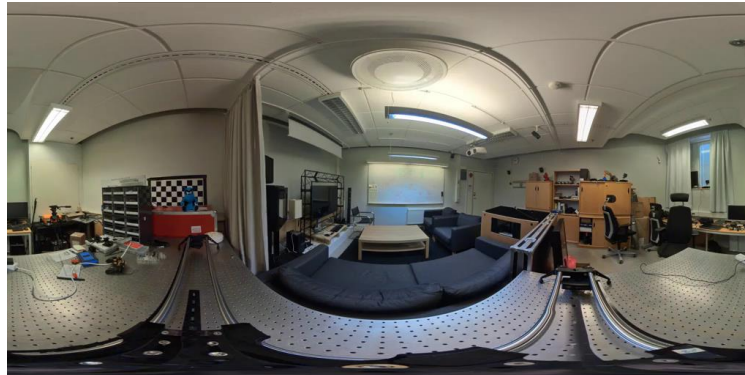
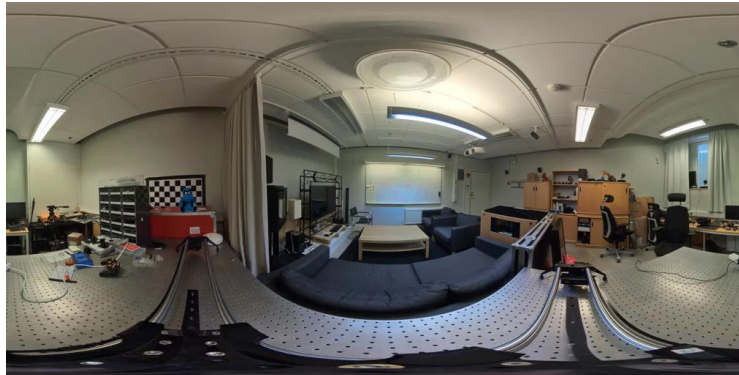
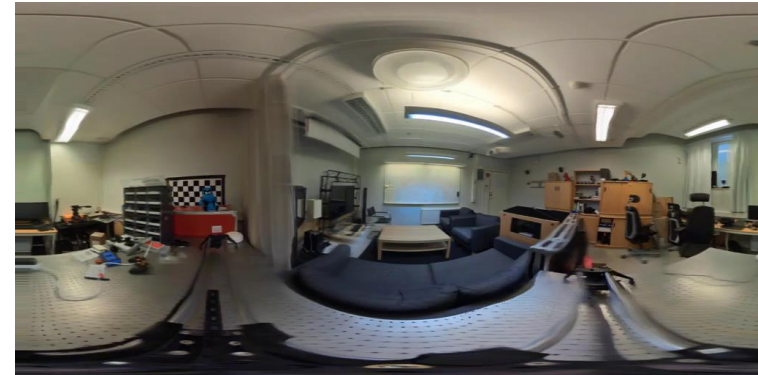
360ViewSynth



Ground Truth



PanoSynthVR

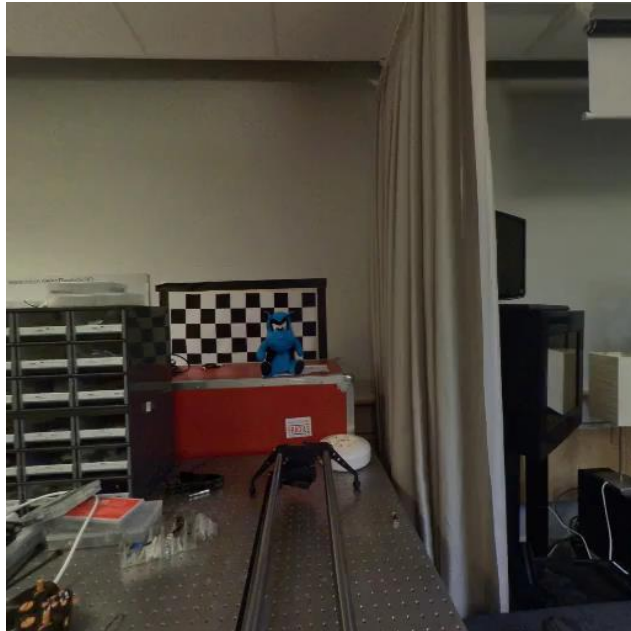


View Synthesis for Spherical LF – **small baseline**

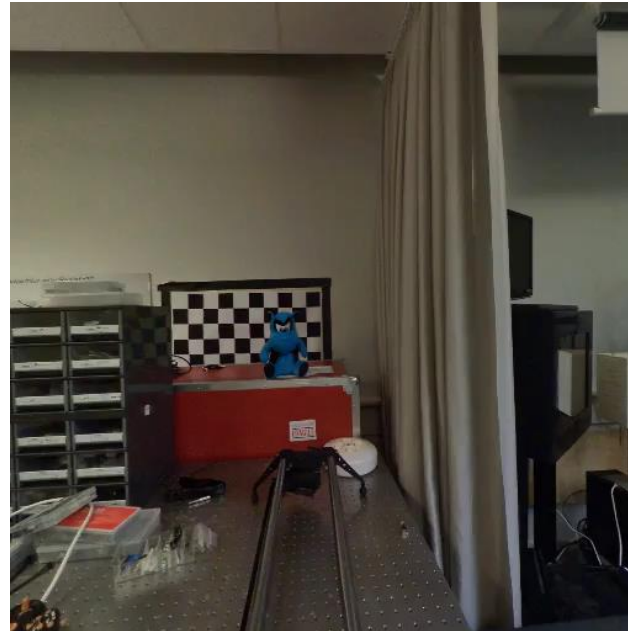
View Synthesis



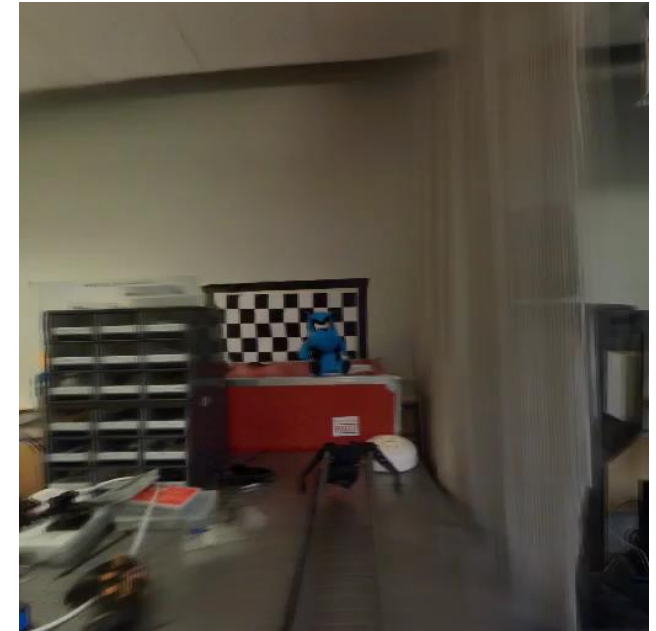
360ViewSynth



Ground Truth



PanoSynthVR

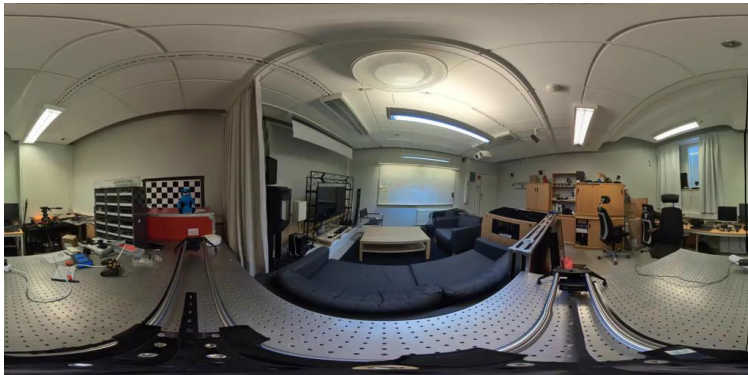


View Synthesis for Spherical LF – **large baseline**

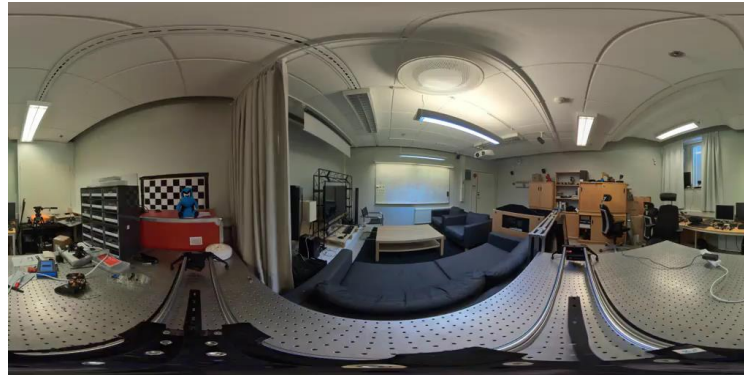
View Synthesis



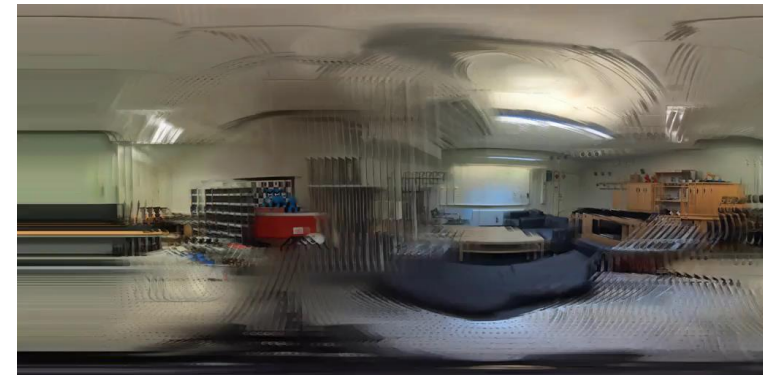
360ViewSynth



Ground Truth

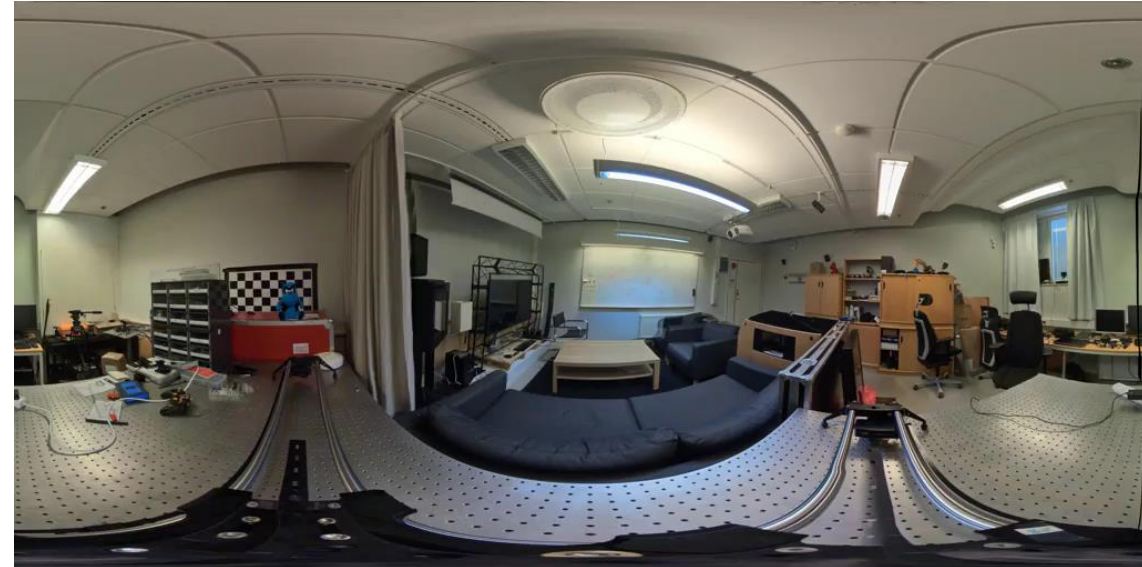


PanoSynthVR



View Synthesis for Spherical LF – large baseline

360ViewSynth



View Synthesis



Open Challenges

- Positioning & static vs. Dynamic
- Lighting
- View synthesis



Open Challenges

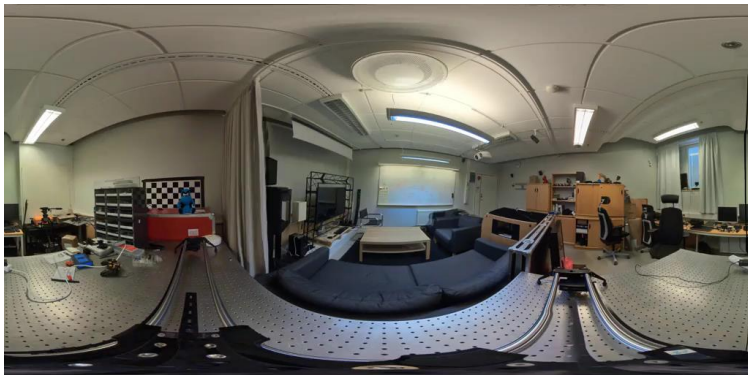
- Positioning & static vs. Dynamic
- Lighting – (Clouds, passing objects, etc.)
- View synthesis – large baseline



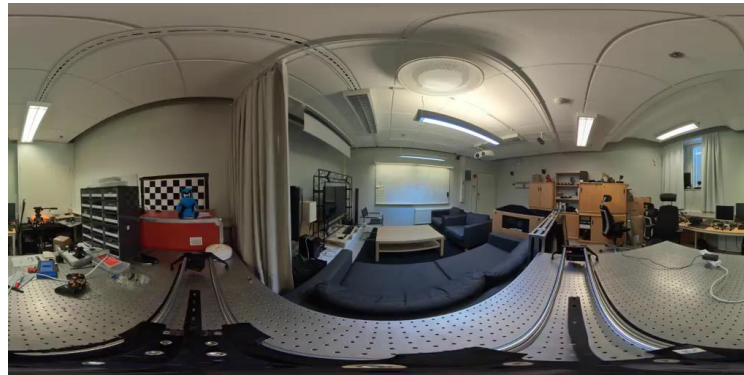
Open Challenges

- Positioning & static vs. Dynamic
- Lighting – (Clouds, passing objects, etc.)
- View synthesis – large baseline

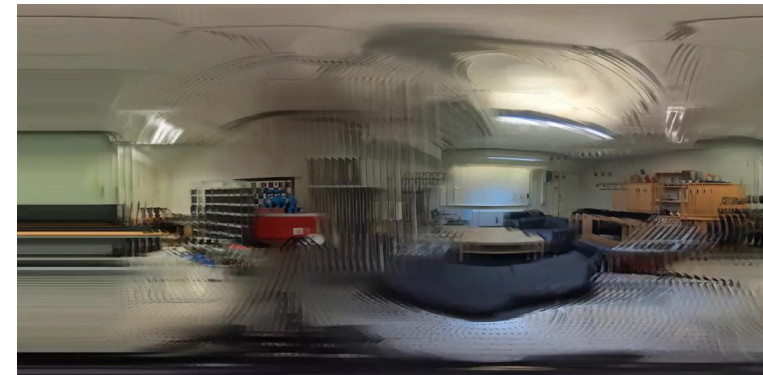
360ViewSynth



Ground Truth



PanoSynthVR



Conclusion

- Public spherical light field database
 - 1x60 views
- Validated on two use cases
 - Spherical LF compression
 - View synthesis
- Many challenges remain
 - Lighting, capture
 - Compression
 - View synthesis



Preview the database:

<https://3zadessg.github.io/SLFDB/SLFDB.html>



Preview the database:

<https://3zadessg.github.io/SLFDB/SLFDB.html>



Dr. Emin Zerman
Associate Senior Lecturer

Mid Sweden University
Department of Computer and
Electrical Engineering

emin.zerman@miun.se

Discussion Point:

What are the **approaches** one should pursue to create more (reliable) data for spherical light fields or omnidirectional view synthesis -- addressing the challenges given in the talk?

How can we

- collect data with 2D or 3D positions, accurately?
- address lighting challenges?

