

Megastereo: Constructing High-Resolution Stereo Panoramas

Christian Richardt ^{1,2}

¹  Disney Research

Yael Pritch ¹

²  Inria

Henning Zimmer ^{1,3}

³  ETH

Alex Sorkine-Hornung ¹



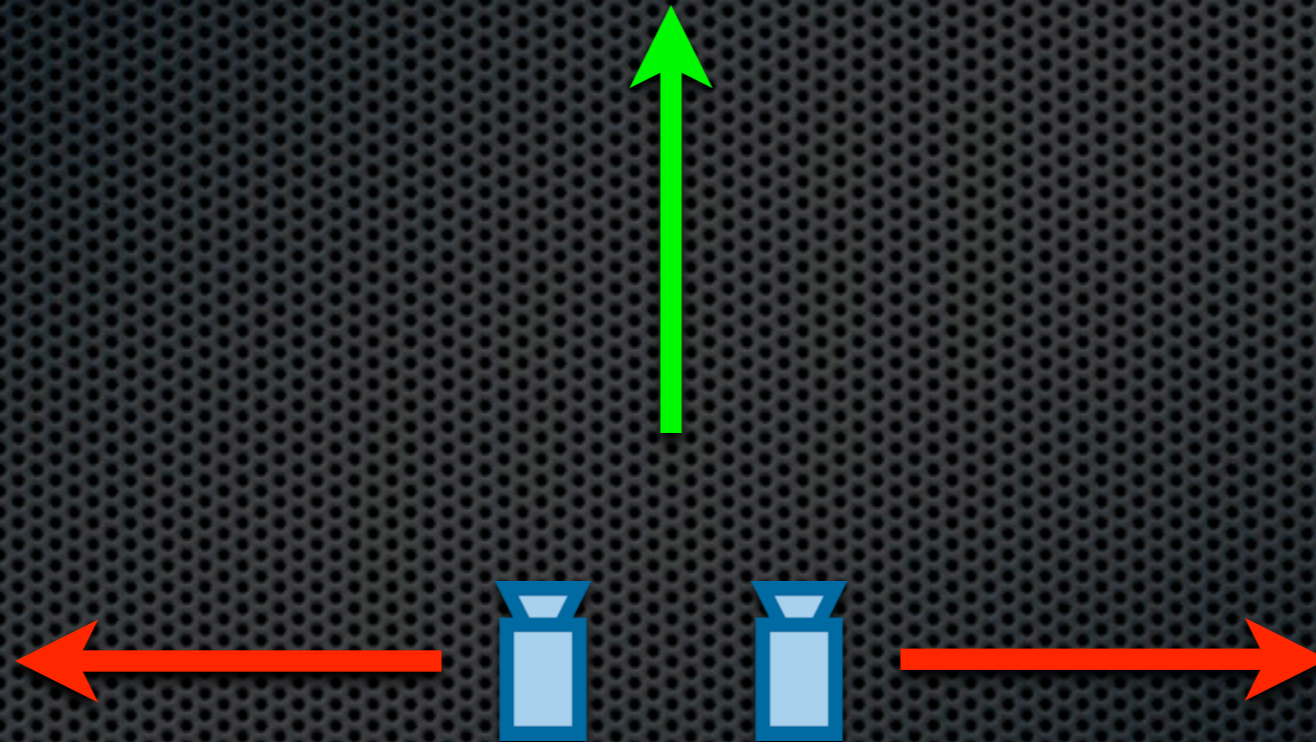


Structure of my talk

1. capturing stereoscopic panoramas
2. our image alignment pipeline
3. our flow-based ray interpolation
4. results + live demo

How to capture
stereo panoramas?

How to capture stereo panoramas?



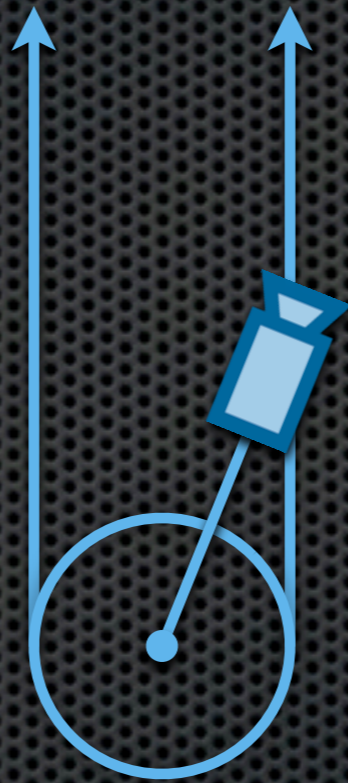
How to capture stereo panoramas?



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How to capture stereo panoramas?



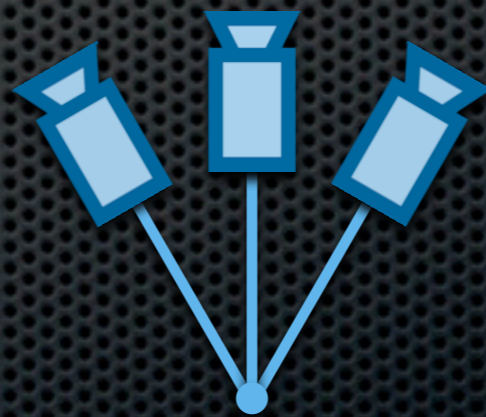
Omnistereoreo panoramas

[Peleg et al., 2001]



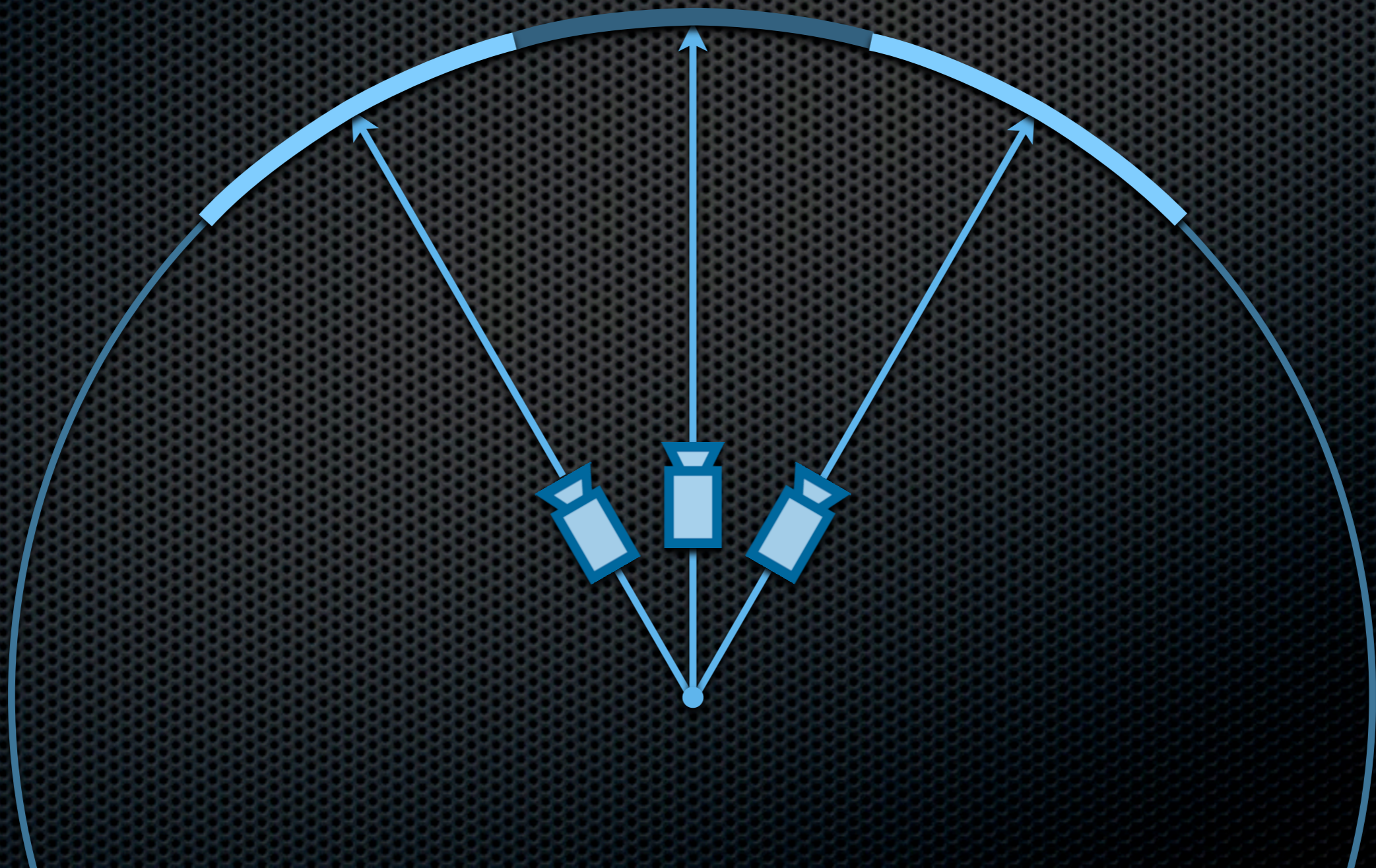
Omnistereeo panoramas

[Peleg et al., 2001]



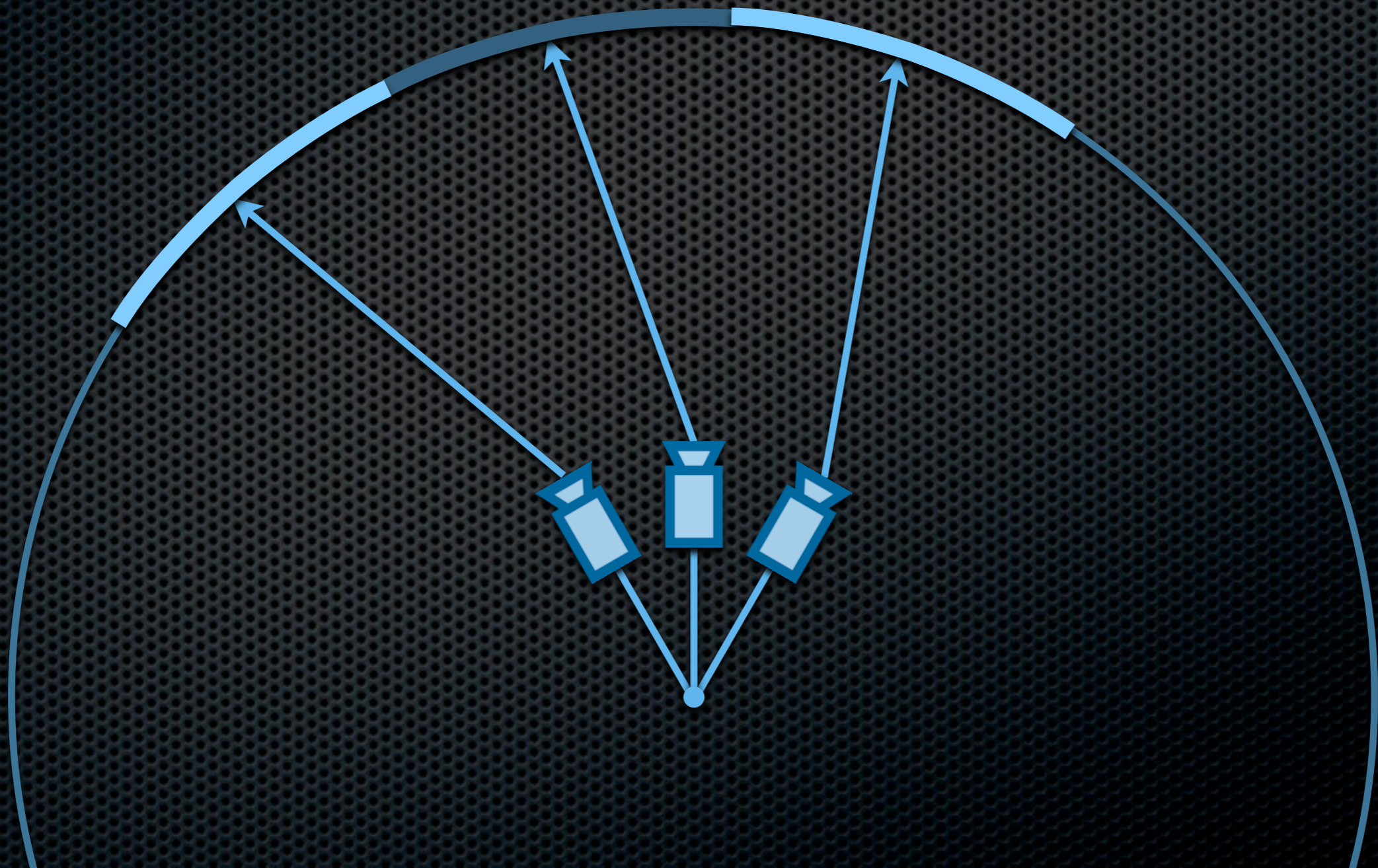
Omnistereeo panoramas

[Peleg et al., 2001]



Omnistereeo panoramas

[Peleg et al., 2001]



Omnistereos panoramas

[Peleg et al., PAMI 2001]



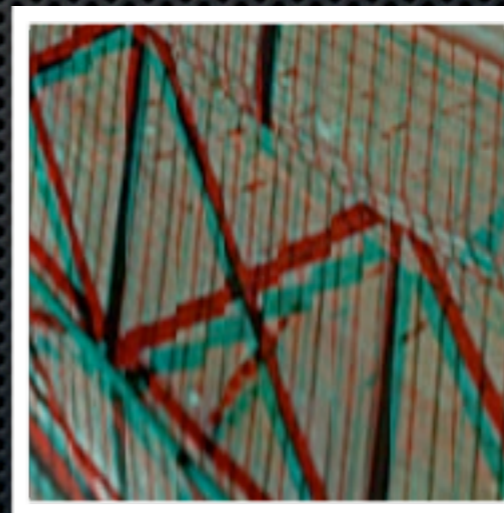
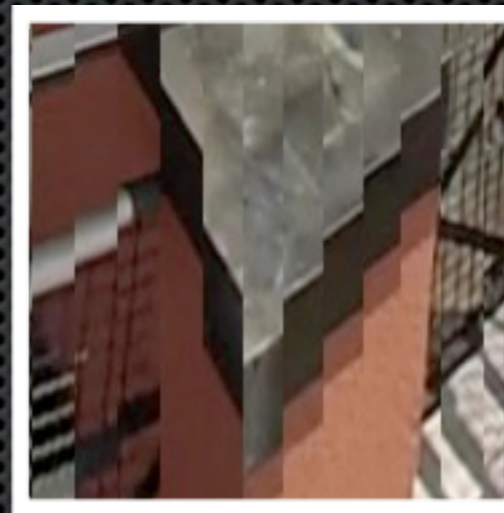
(our result)

Related work

- ✦ panoramas:
 - Szeliski (2006)
 - Brown & Lowe (2007)
- ✦ generalised cameras:
 - Gupta & Hartley (1997)
 - Zomet et al. (2003)
 - Yu & McMillan (2004)
- ✦ multi-perspective:
 - Agarwala et al. (2006)
 - Rav-Acha et al. (2008)
 - Yu et al. (2010)
 - Kopf et al. (2010)
- ✦ stereo panoramas:
 - Hum & He (1999)
 - Peleg et al. (2001)
- ✦ image alignment:
 - Lucas & Kanade (1981)
 - Snavely et al. (2006)
 - Wu et al. (2011)
- ✦ image stitching:
 - Burt & Adelson (1983)
 - Shum & Szeliski (2000)
 - Kang et al. (2004)
 - Levin et al. (2004)

Motivation

- ✦ unresolved practical issues in stereo panoramas:
 - ✦ visible seams
 - ✦ misalignment
 - ✦ vertical parallax
- ✦ this is unpleasant in 2D, but intolerable in stereo



Contributions

- ✦ a general and efficient solution for creating high-quality, high-resolution (stereo) panoramas
- ✦ revised image stabilisation and alignment:
 - ✦ correcting camera orientations
 - ✦ removing undesired vertical parallax
- ✦ interpolating continuous ray space from discrete views:
 - ✦ resolving sampling artefacts
 - ✦ virtually & on the fly

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Input video

- ✦ circular motion
- ✦ challenging:
hand-held
- ✦ 720 × 1280
(Canon S95)



Image alignment: comparison



image-based alignment



our alignment approach

Image alignment: comparison



image-based alignment



our alignment approach

Raw input video



input video



omnistero panorama (crop)

Lens undistortion

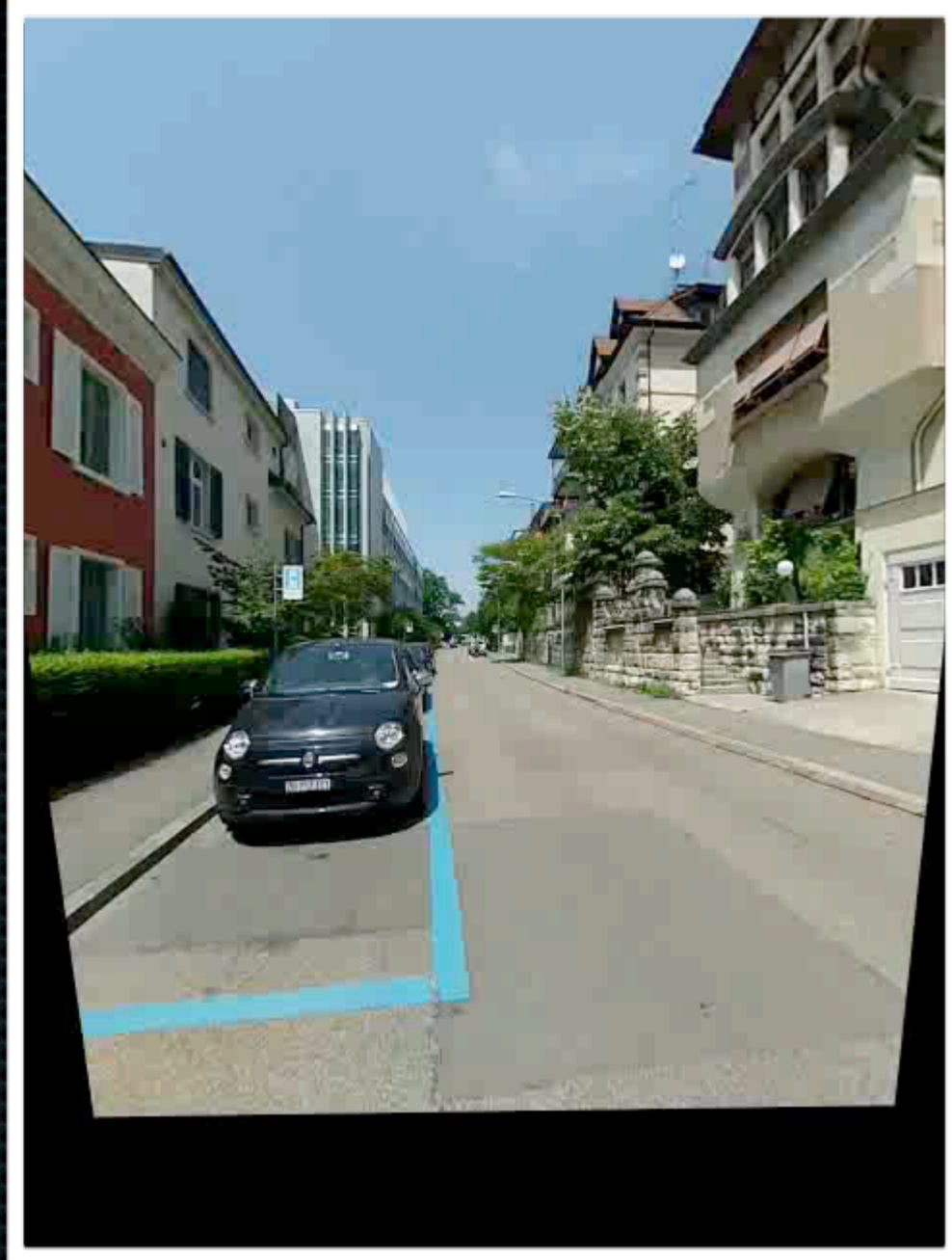


undistorted images



omnistero panorama (crop)

Orientation stabilisation



stabilised images



omnistero panorama (crop)

Vertical parallax cancellation



compensated images

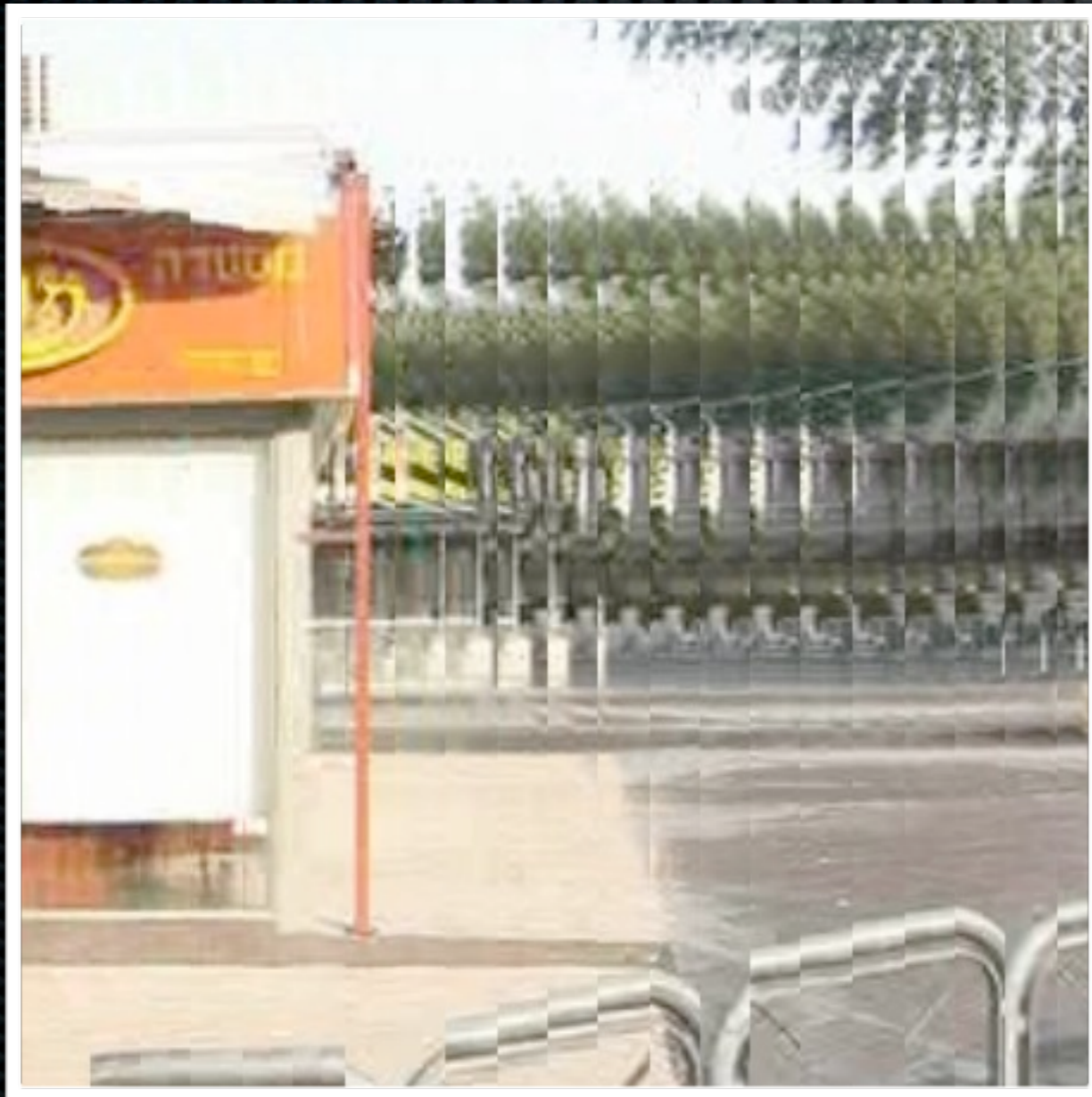


omnistereo panorama (crop)

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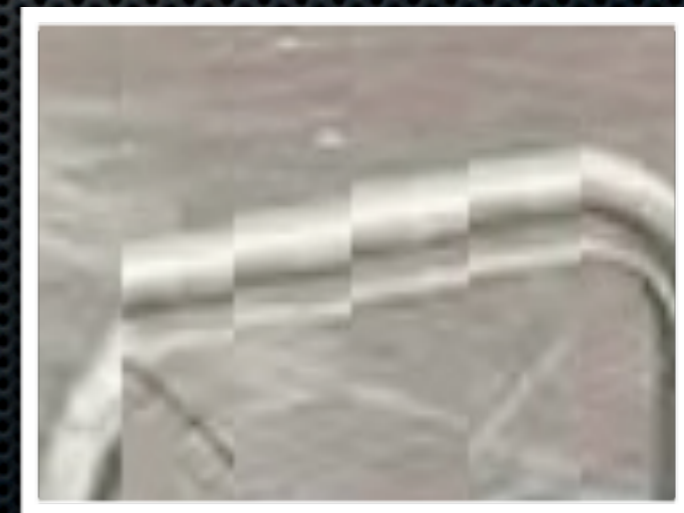
Without strip blending



'refaim' dataset
[Rav-Acha et al., 2008]



far: duplication



near: truncation

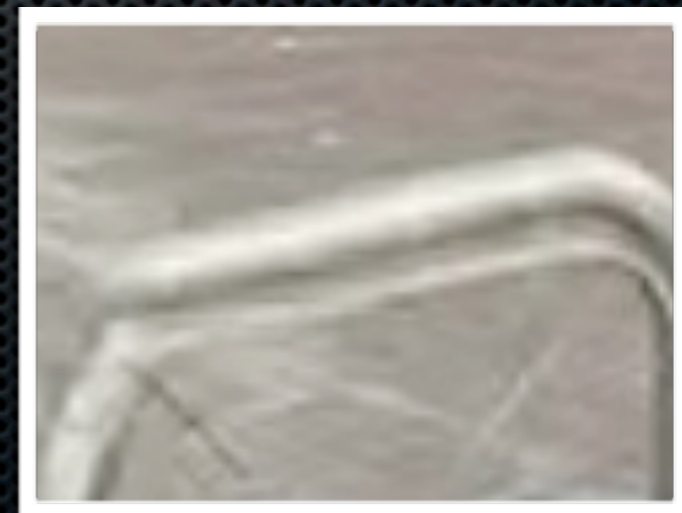
Linear strip blending



'refaim' dataset
[Rav-Acha et al., 2008]

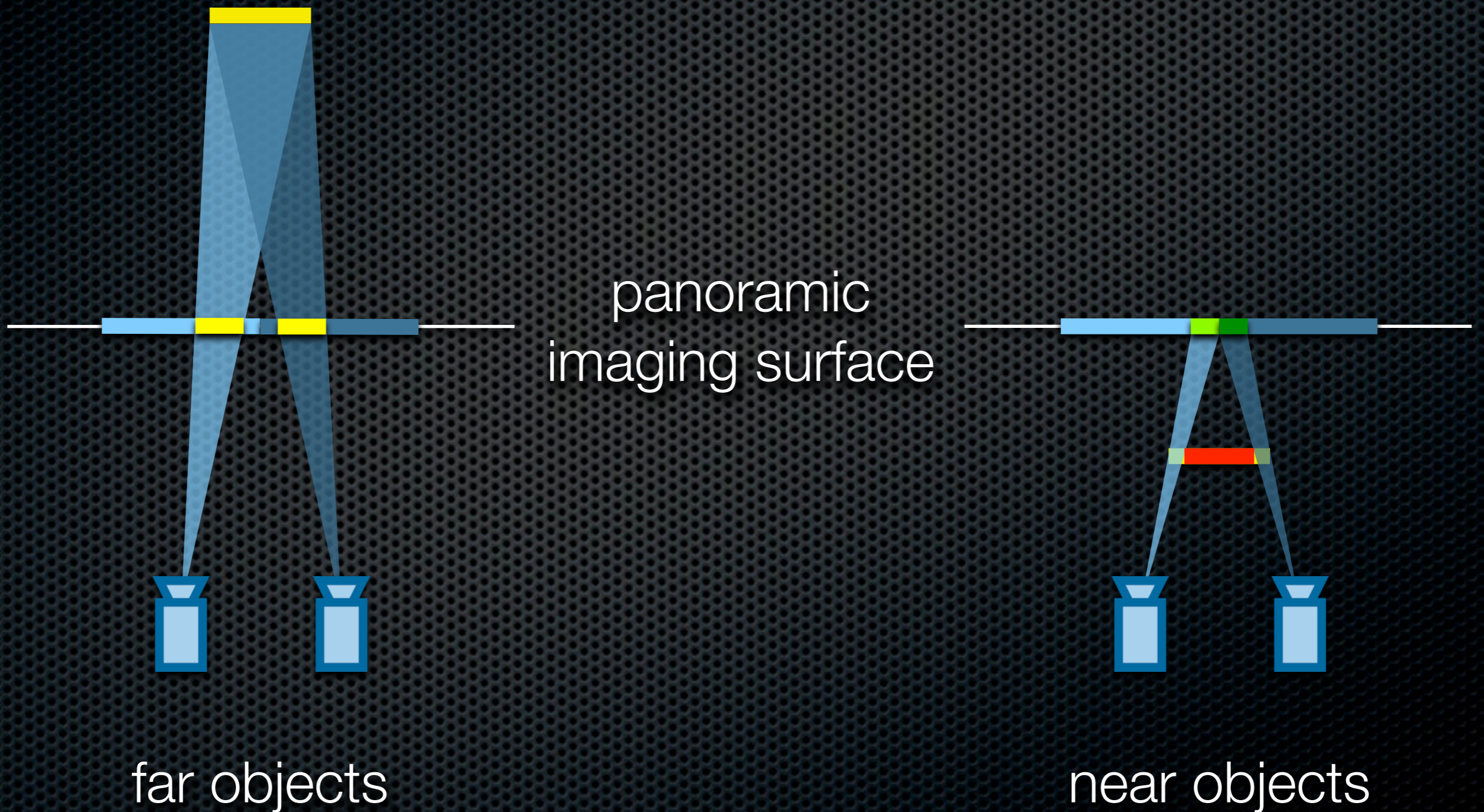


far: duplication

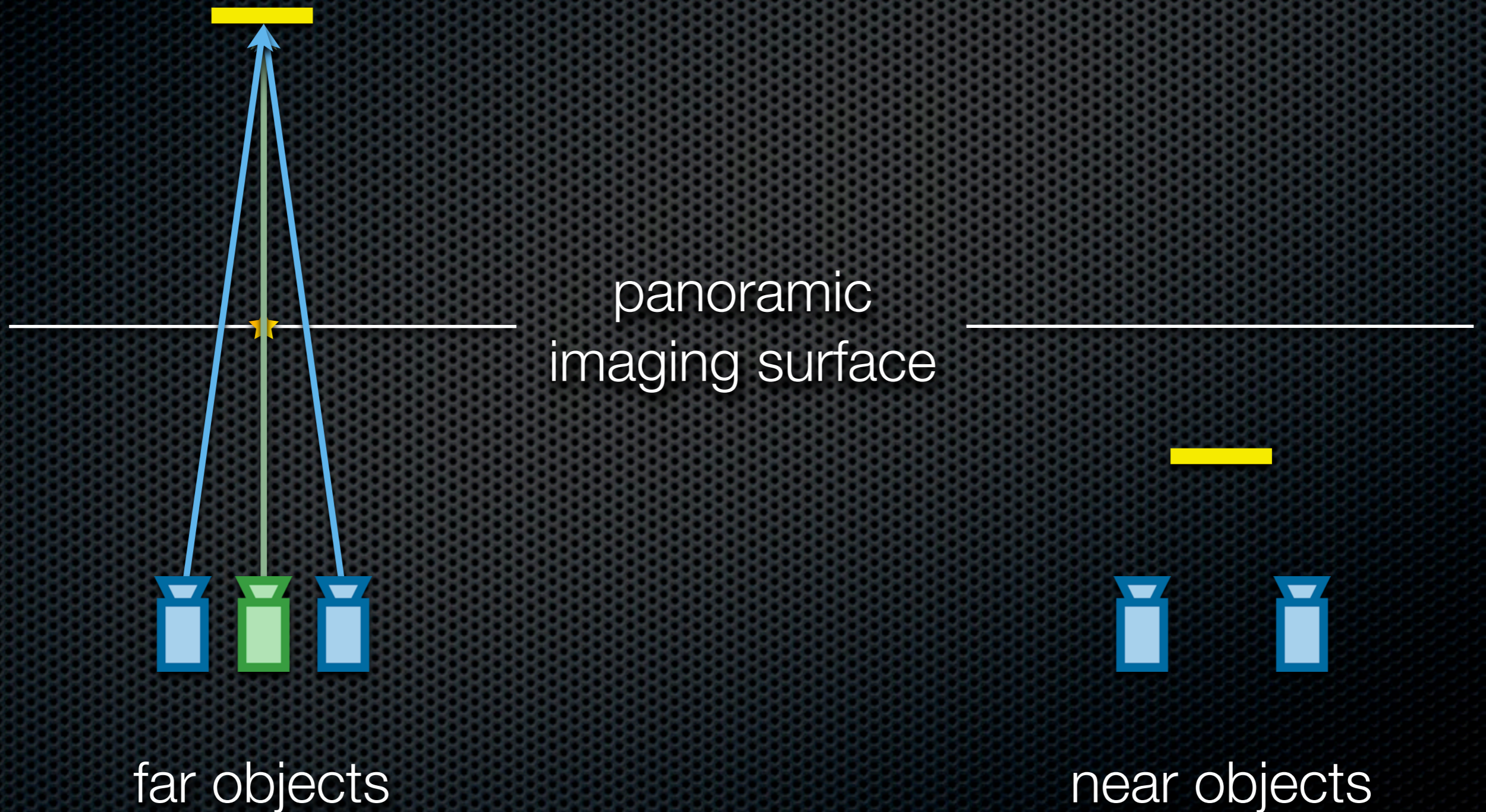


near: truncation

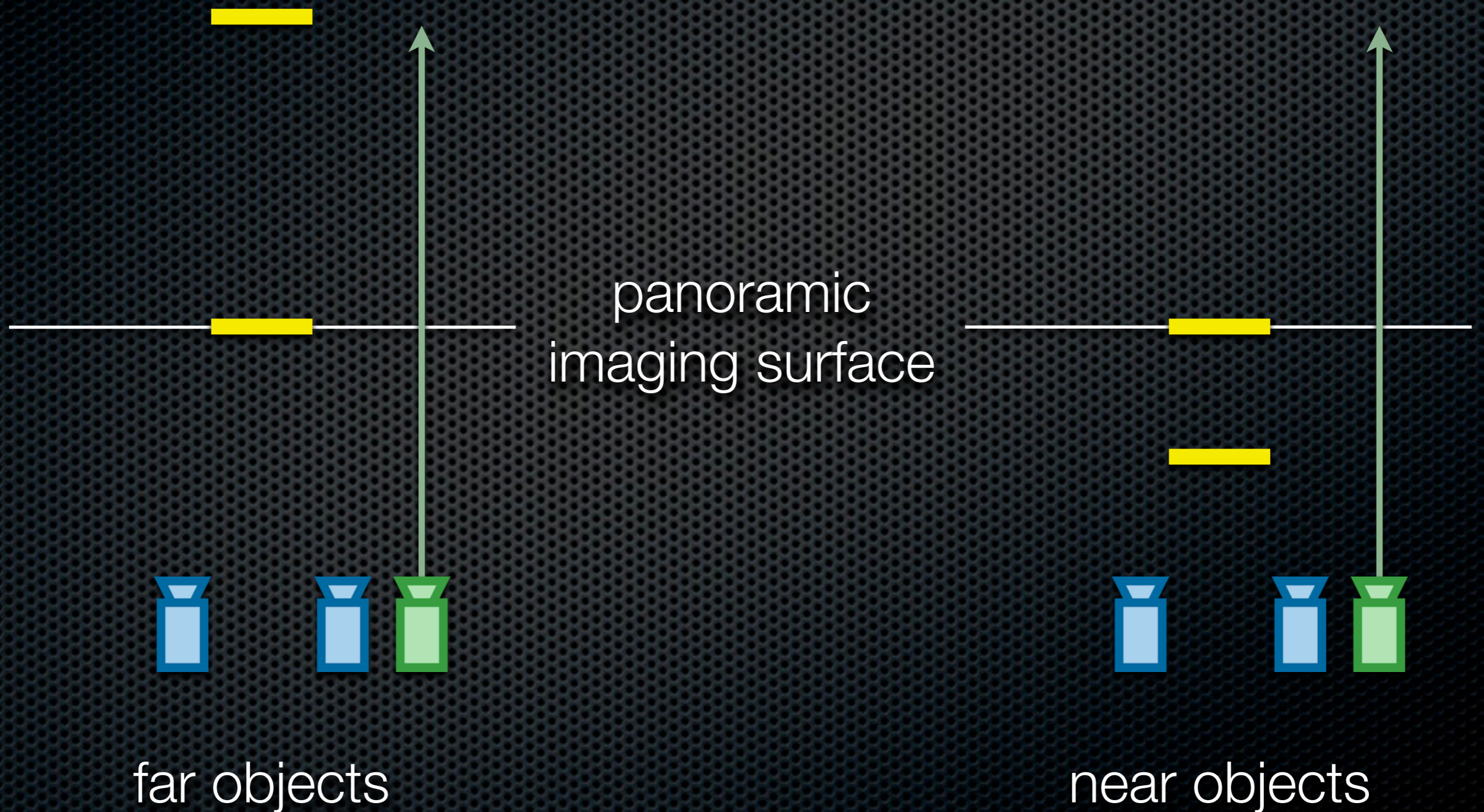
Duplication + truncation



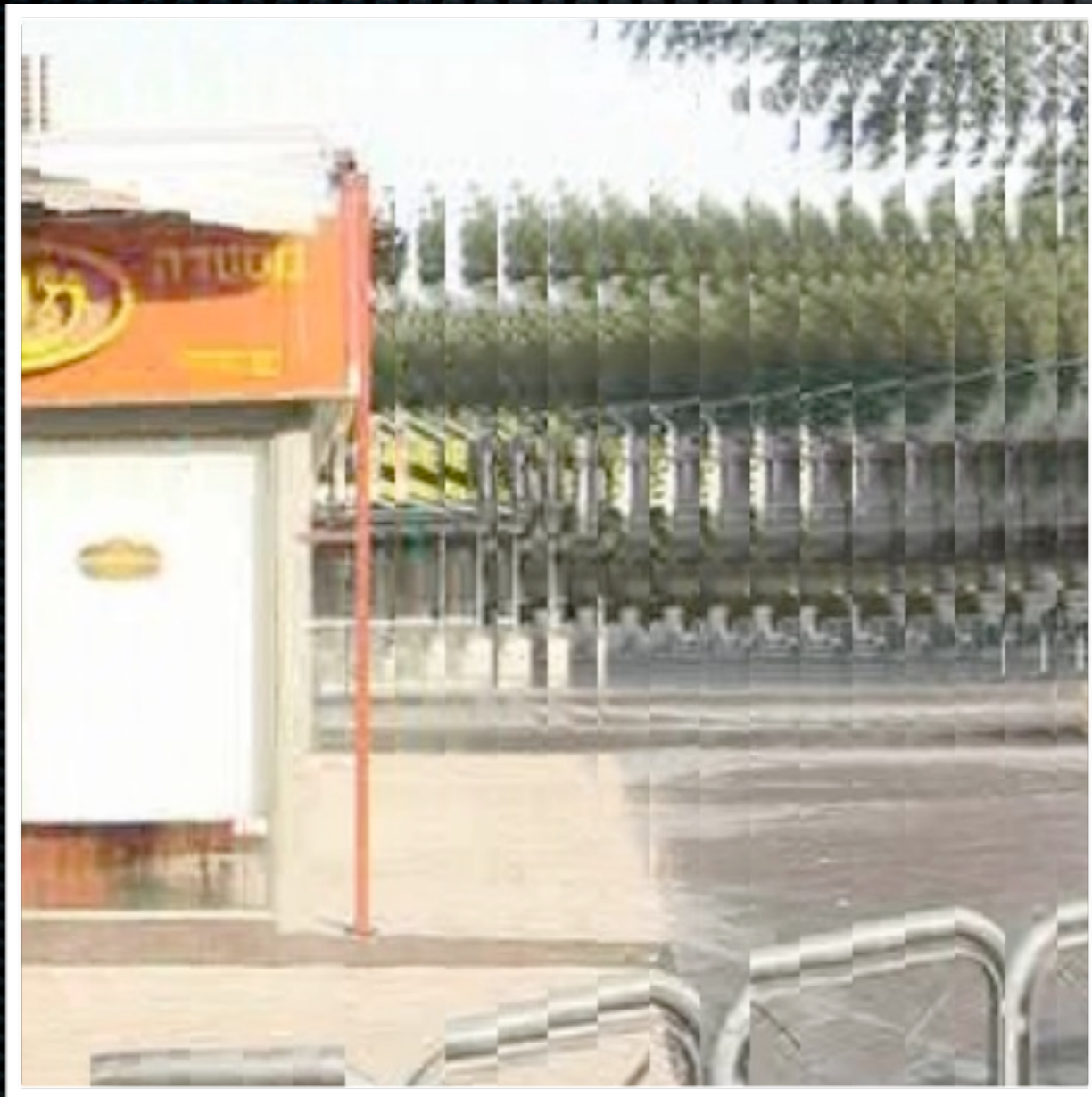
Our flow-based ray interpolation



Our flow-based ray interpolation



Without strip blending



‘refaim’ dataset
[Rav-Acha et al., 2008]

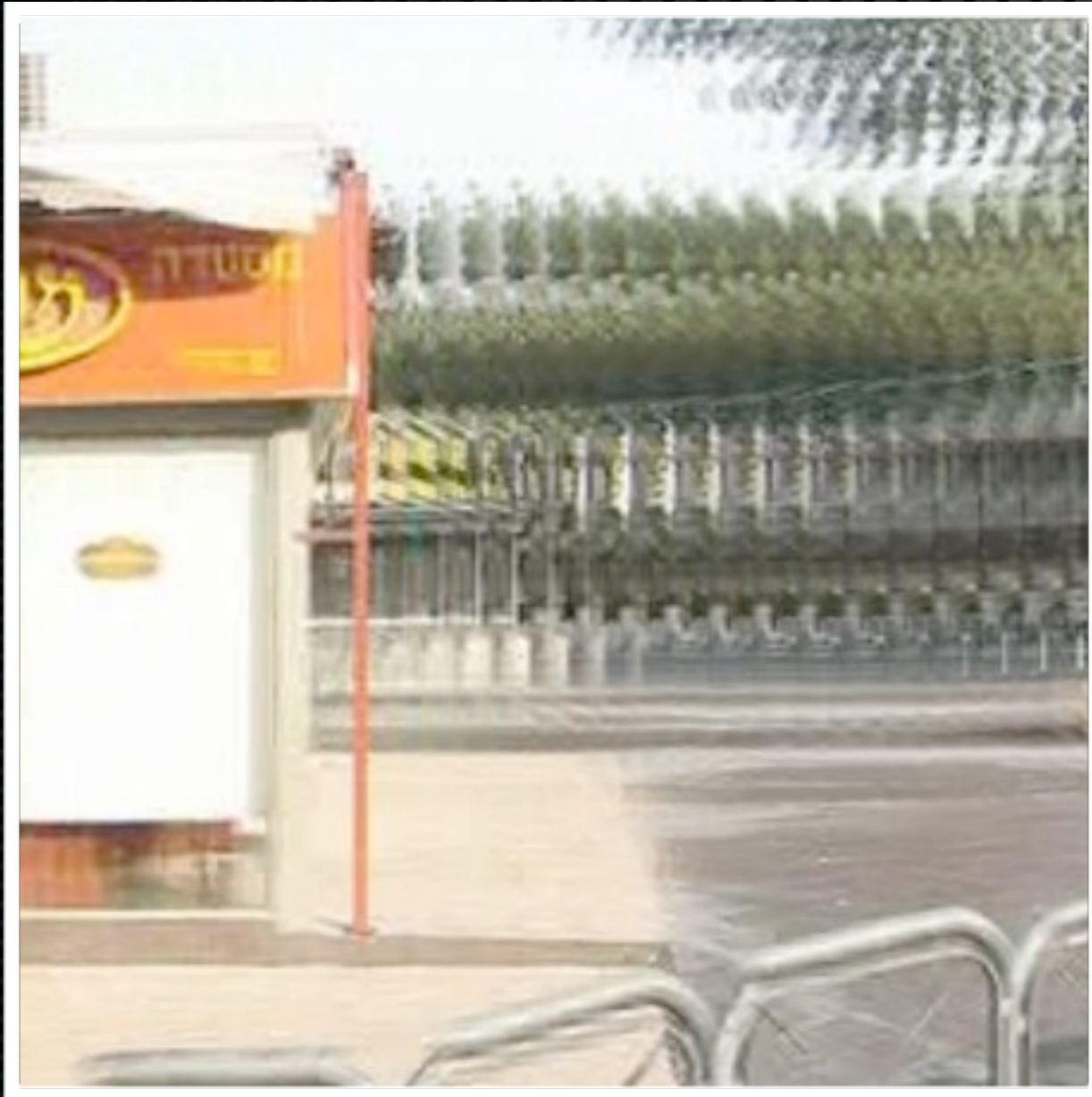


far: duplication



near: truncation

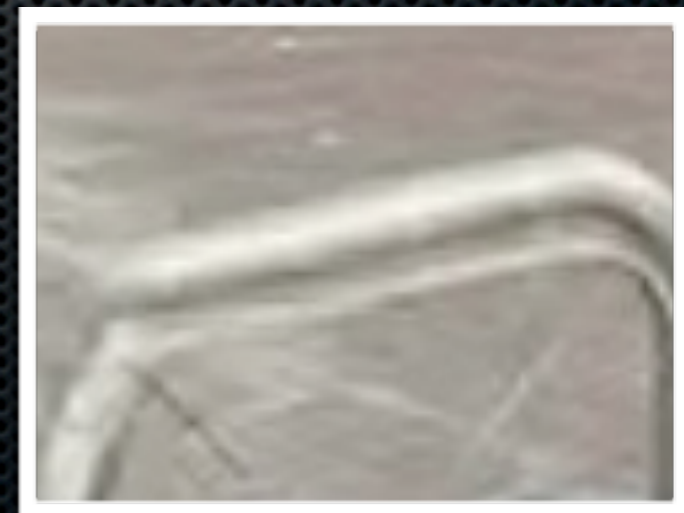
Linear strip blending



'refaim' dataset
[Rav-Acha et al., 2008]



far: duplication

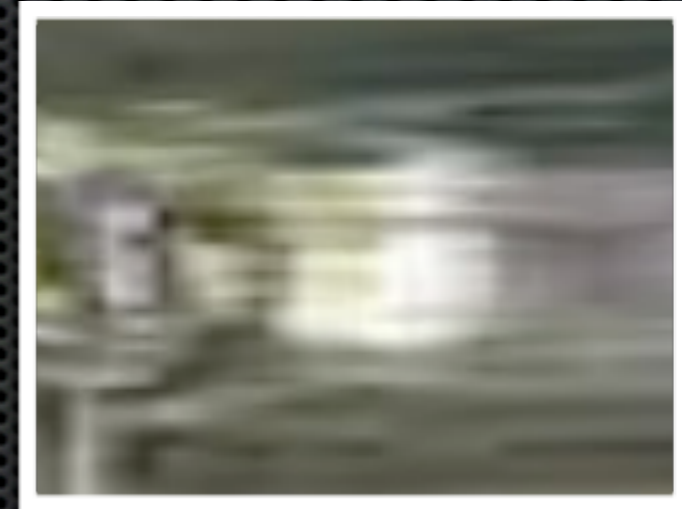


near: truncation

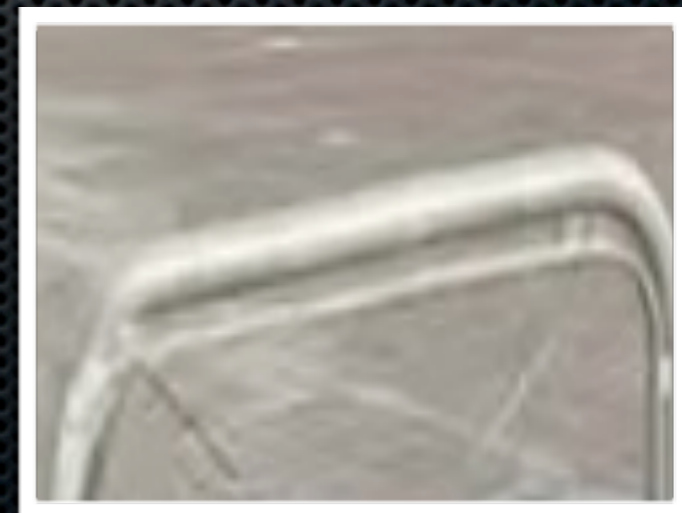
Our flow-based blending



'refaim' dataset
[Rav-Acha et al., 2008]



far: stretching



near: squeezing

Blending comparison



no blending

Blending comparison



linear blending

Blending comparison



our flow-based blending

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360°



zoom



360°



zoom

Street panorama (linear motion)



'refaim' dataset

[Rav-Acha et al., 2008]



360°



100% zoom



140 MP stereo panorama

Live demo

Conclusion

- ✦ a general and efficient solution for creating high-quality, high-resolution stereo panoramas
- ✦ Future work:
 - ✦ extension to more general multi-perspective images
 - ✦ handling changing exposures
 - ✦ stereo panorama videos

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disneyresearch.com/project/megastereo/

Conclusion

*Please see
my poster*

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