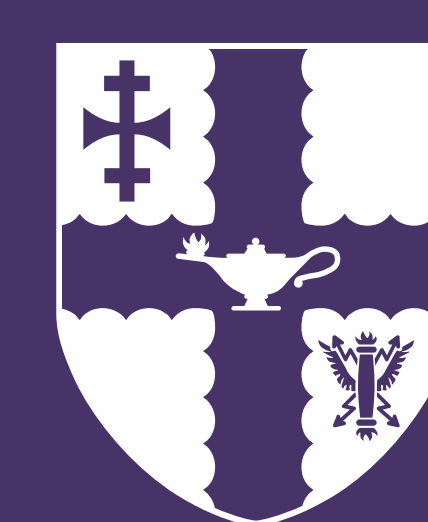


Blender: a 3D animation software explored as a metrology tool



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Why Blender?



Blender is

- Open source software.
- Many options: texturing, animation, tracking, photorealism, modelling, etc...
- 2 metrology applications based at 100 % on it:
 - BLAINDER
 - BlenderProc

Aim:

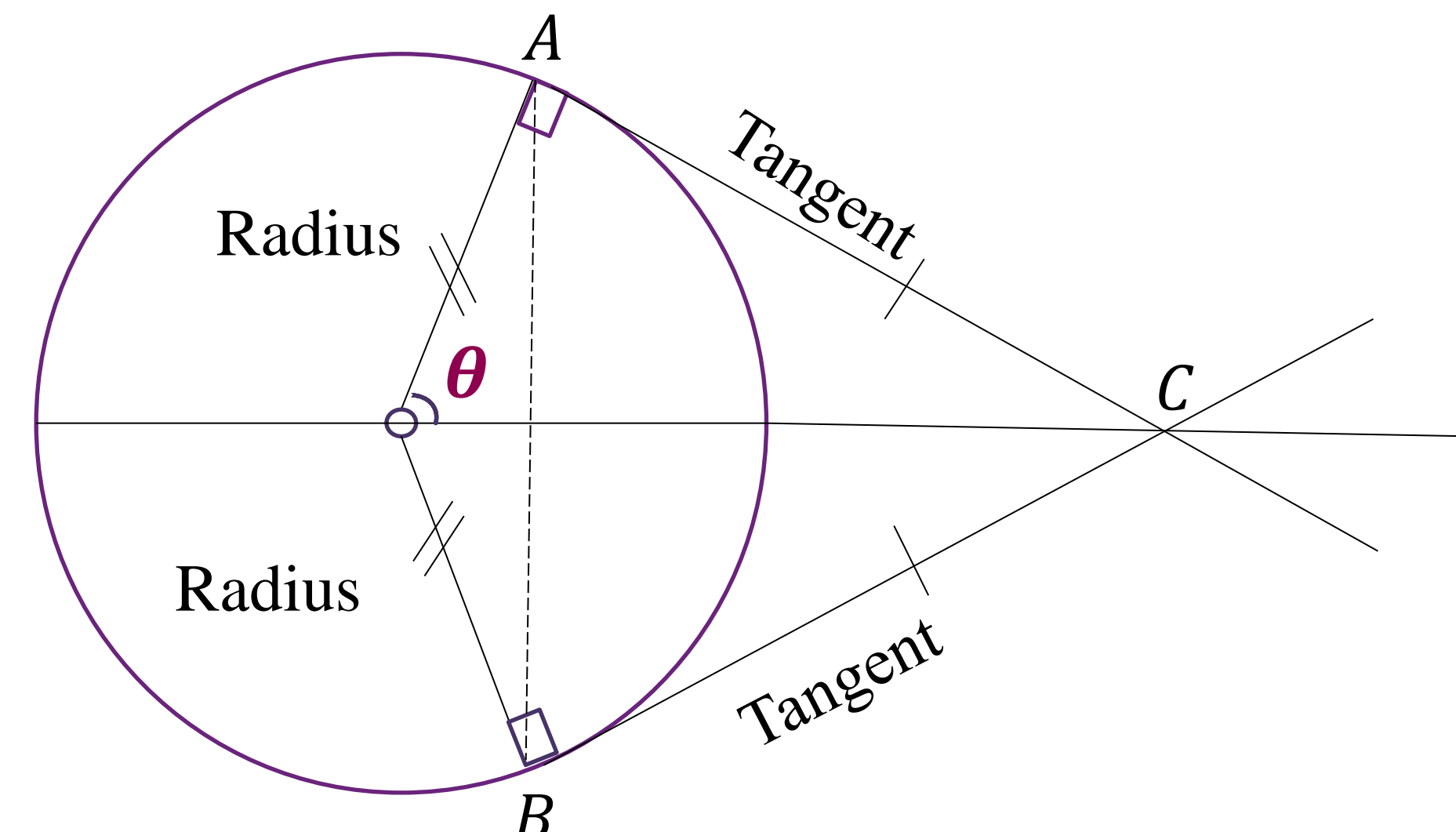
Check whether the laws of optical physics, in the context of camera technology, in the modelling environment are respected, in order to validate Blender as a potential metrology tool.

Experimentation:

How a perfect white sphere is perceived by 3 virtual cameras, at a distance of 1, 2 and 4 metres of the sphere, and under different configurations.

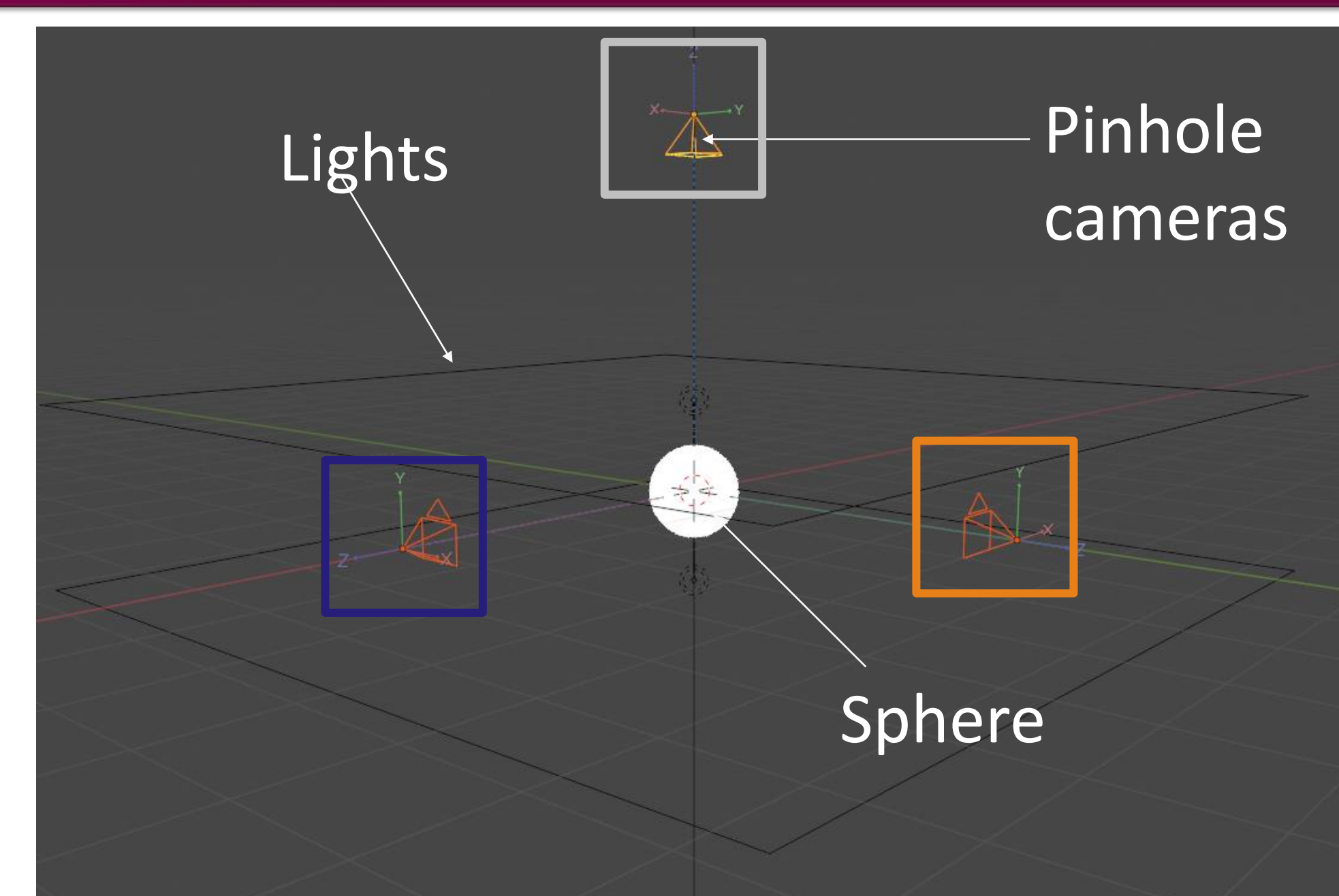
Methodology

Why a sphere?



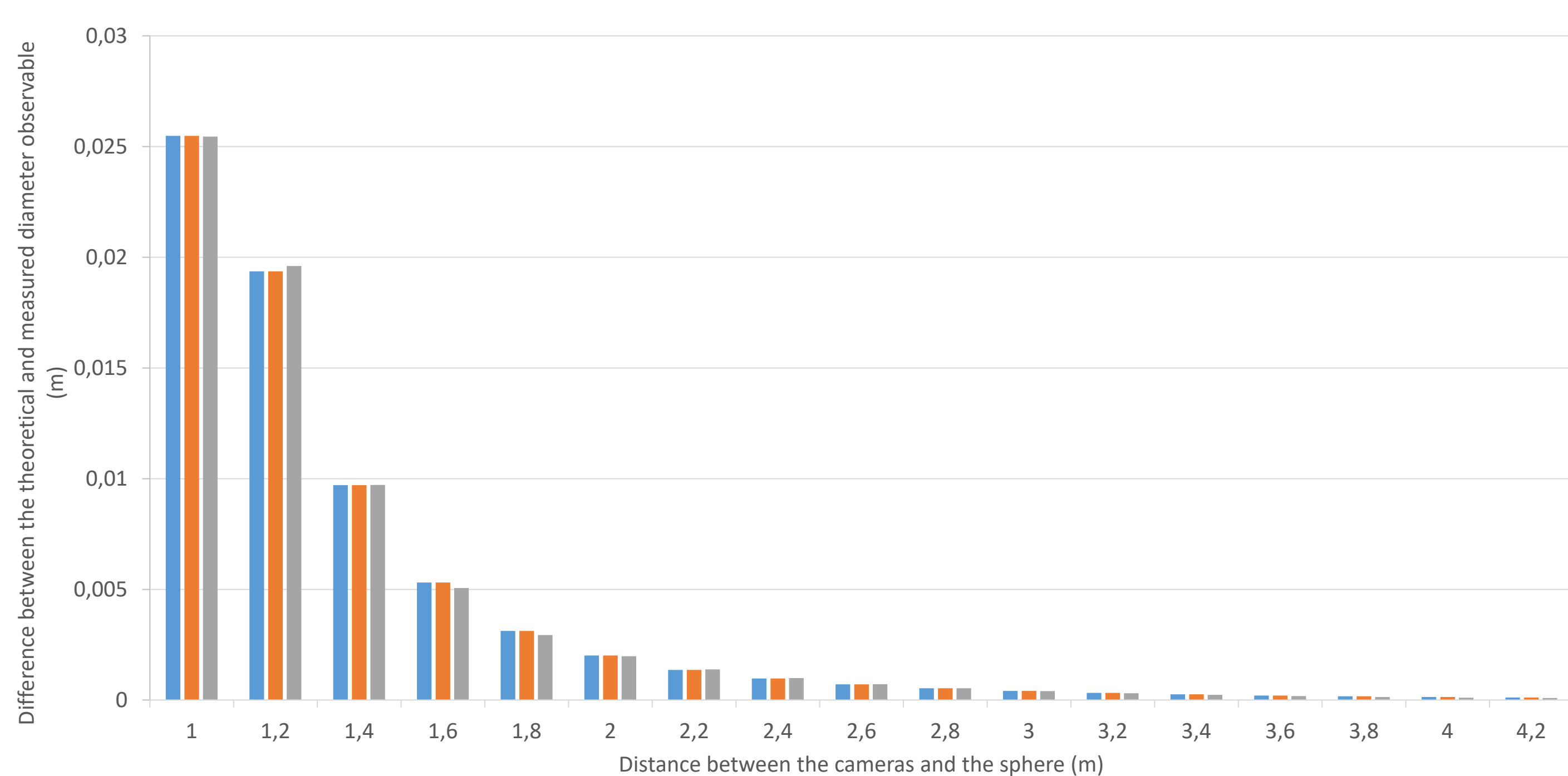
The angle θ increases with the distance between the camera and the sphere increases.

When $\theta < 90^\circ \rightarrow [AB]$ is not equal to the real diameter of the circle.

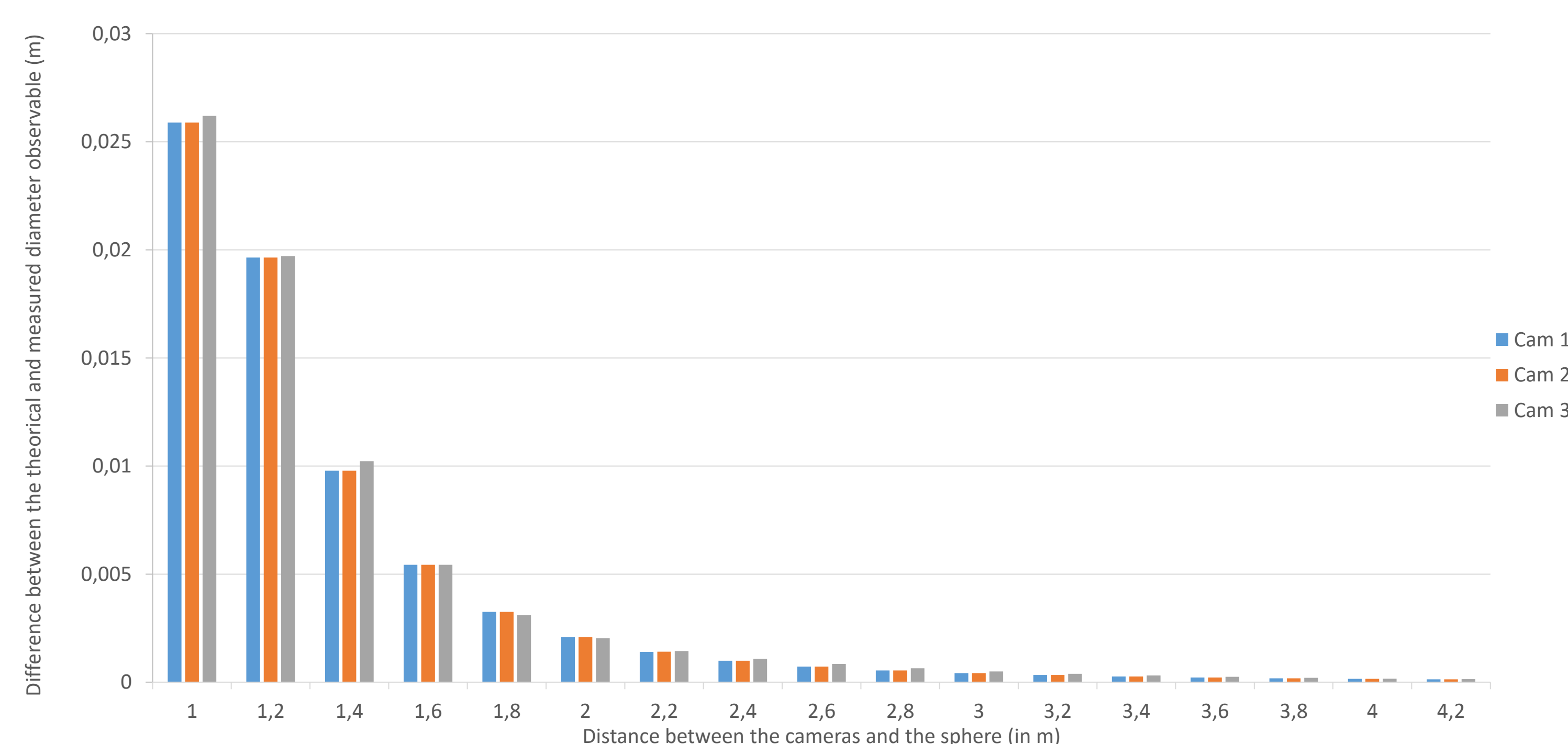


Results

Deviation from theoretical observable sphere diameter (Raspberry Pi, resolution 1,640 x 1,232, sphere constituted of 32 polygons)



Deviation from theoretical observable sphere diameter (Raspberry Pi, resolution 1,640 x 1,232, sphere constituted of 1000 polygons)



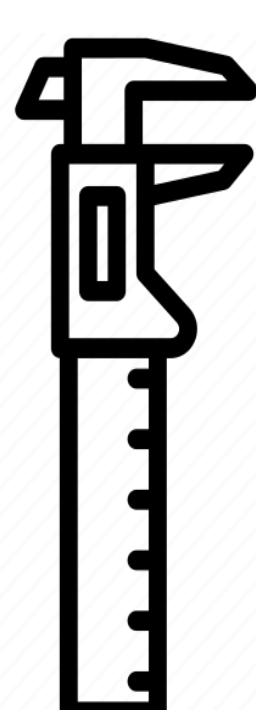
- 1 white sphere with a diameter of 1 m.
- 2 square lights, power 10 kW at 1 m from the sphere.
- 3 pinhole cameras on x, y and z-axes.

Camera parameters

Focal length	3.04 mm
Pixel size	1.12 μm x 1.12 μm
Image resolution	3,280 x 2,464

- The error decreases with the distance increasing \rightarrow At 1.4 m, the difference between the diameters is $1e^{-2}m$, at 4 m, $1e^{-3}m$.
- The number of polygons constituted the sphere does not impact the result.
- The resolution of the picture decreases as well \rightarrow less accurate \rightarrow Error.
- Geometry is respected.

Conclusion



Detection impacted by the noise, distortion, a mirror texture, the matching between the focal length and the resolution used.

Validating the potential of Blender as a Metrology tool



Digital model not validated.

Digital model maybe better than reality

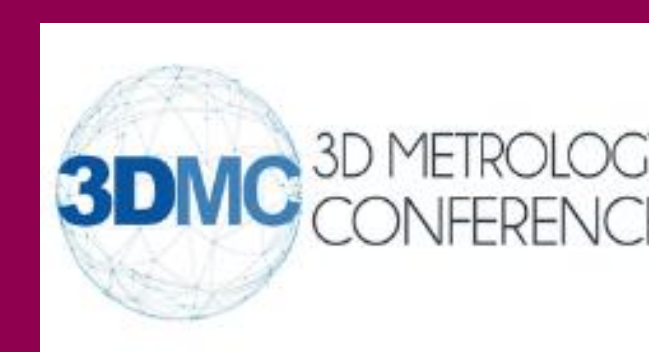


Photorealism?

REFERENCES

1. Thomas L, Stuart R, Stephen K and Jan B. Close-range photogrammetry and 3D imaging, 2nd Ed. Published by De Gruyter. 30 Nov. 2013,
2. Reitmann, S.; Neumann, L.; Jung, B. BLAINDER—A Blender AI Add-On for Generation of Semantically Labelled Depth-Sensing Data. Sensors 2021, 21, 2144. <https://doi.org/10.3390/s21062144>
3. Lukas Stockner, BCON19, October 24th, 2019, Introduction to cycles.
4. 3D Viewing: The Pinhole Camera Model. <https://www.scratchapixel.com/lessons/3d-basic-rendering/3d-viewing-pinhole-camera>

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