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Development of a Multi-Camera System for Tomography in Beam Diagnostics



Introduction

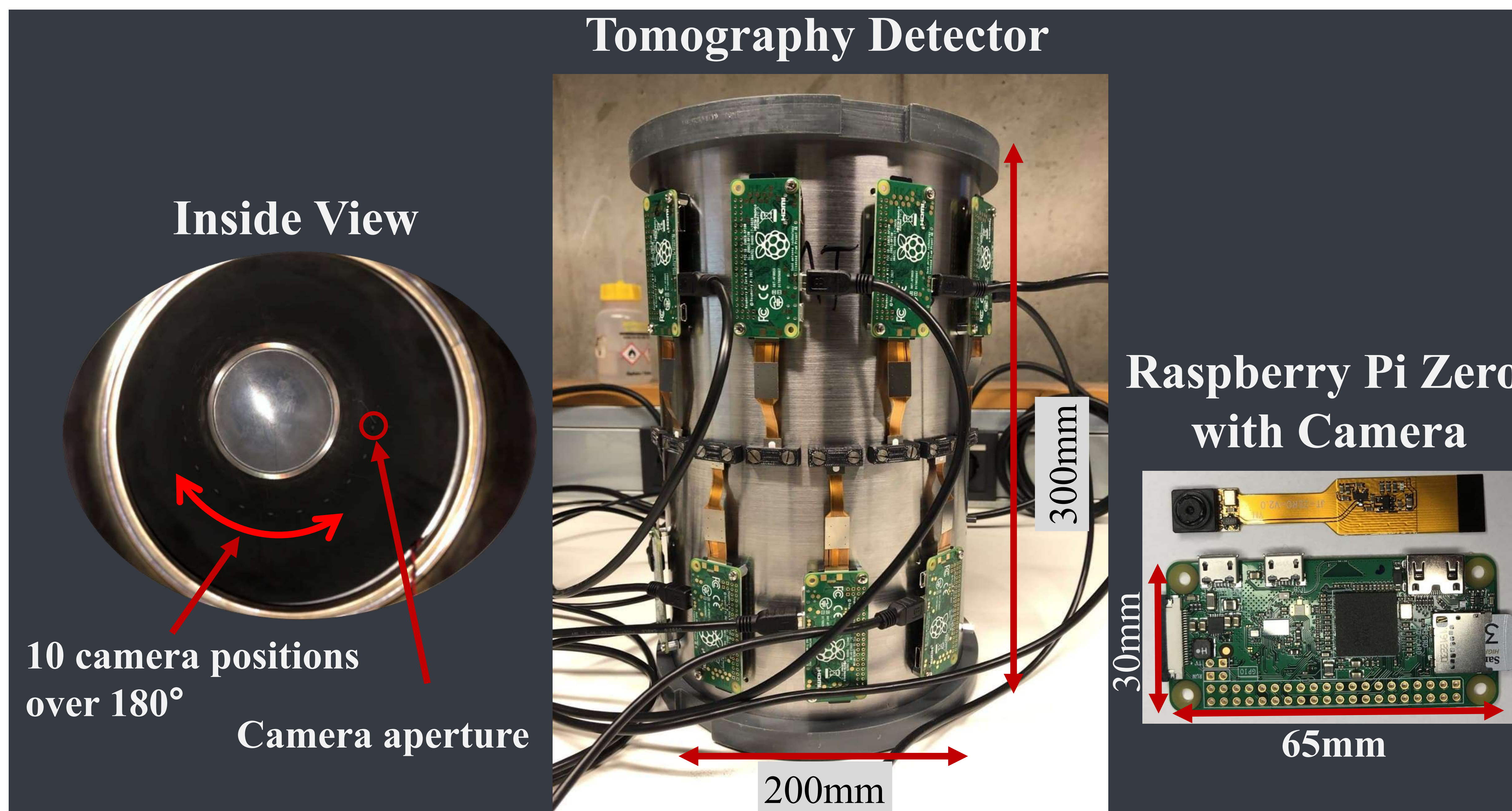
Embedded visual systems in industry lead to advancements of single board computers and single board cameras. Due to the lower power consumption and high flexibility of these miniature devices, a multi-camera system can be developed more effectively. A prototype of a beam-induced residual gas fluorescence monitor (BIF) has been developed and successfully tested at the Institute of Applied Physics (IAP) of the Goethe University Frankfurt [1]. This BIF is based on a single-board camera inserted into the vacuum. The previous promising results led to the development of a multicamera system with 10 cameras. One of the advantages of such a system is the small form factor, allowing this detector to be integrated within the vacuum and in regions that are difficult to access. The overall goal is to study the beam with tomography algorithms at a low energy beam transport section. We hope to reconstruct an arbitrary beam profile intensity distribution without assuming a Gaussian beam.

Challenges

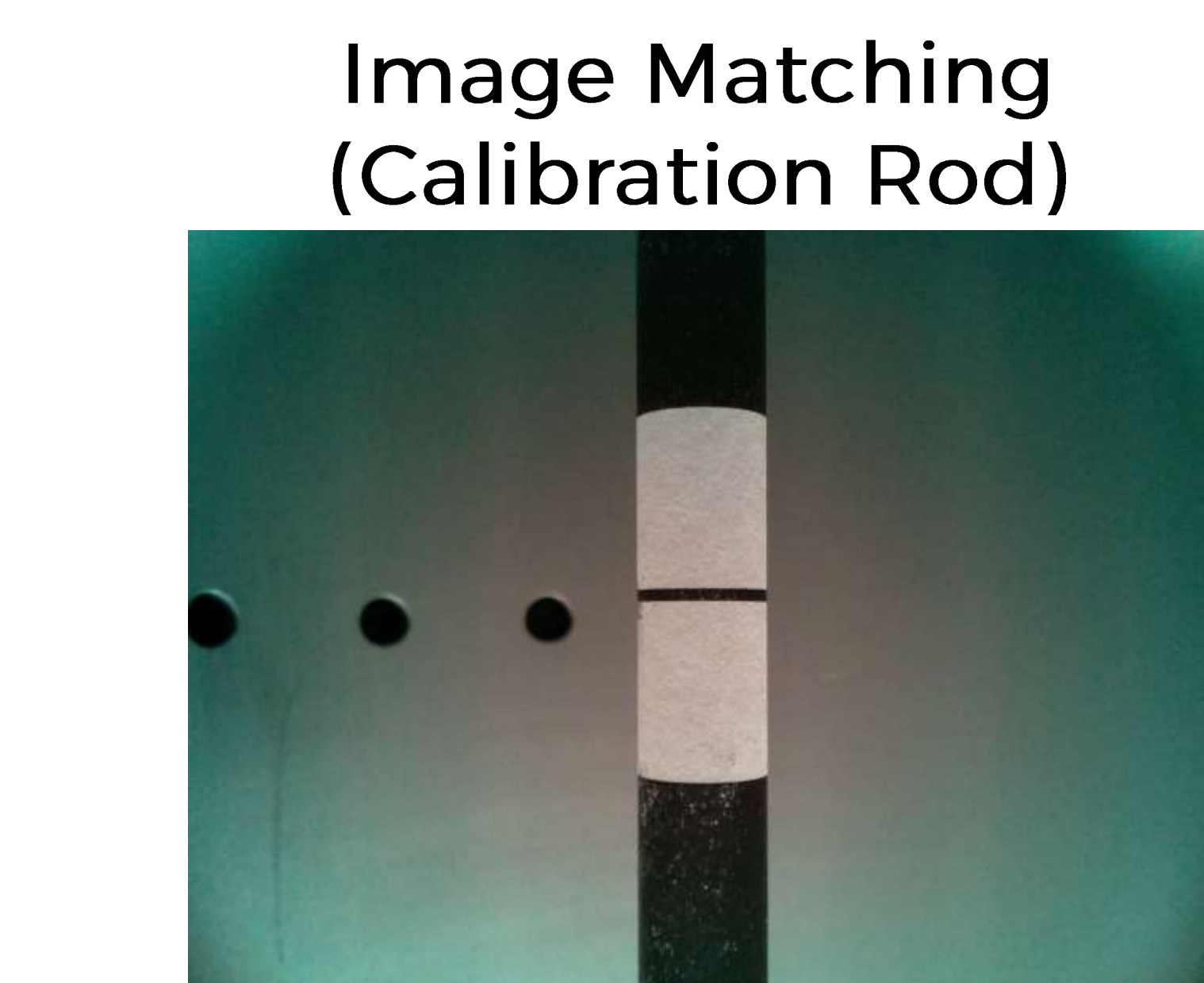
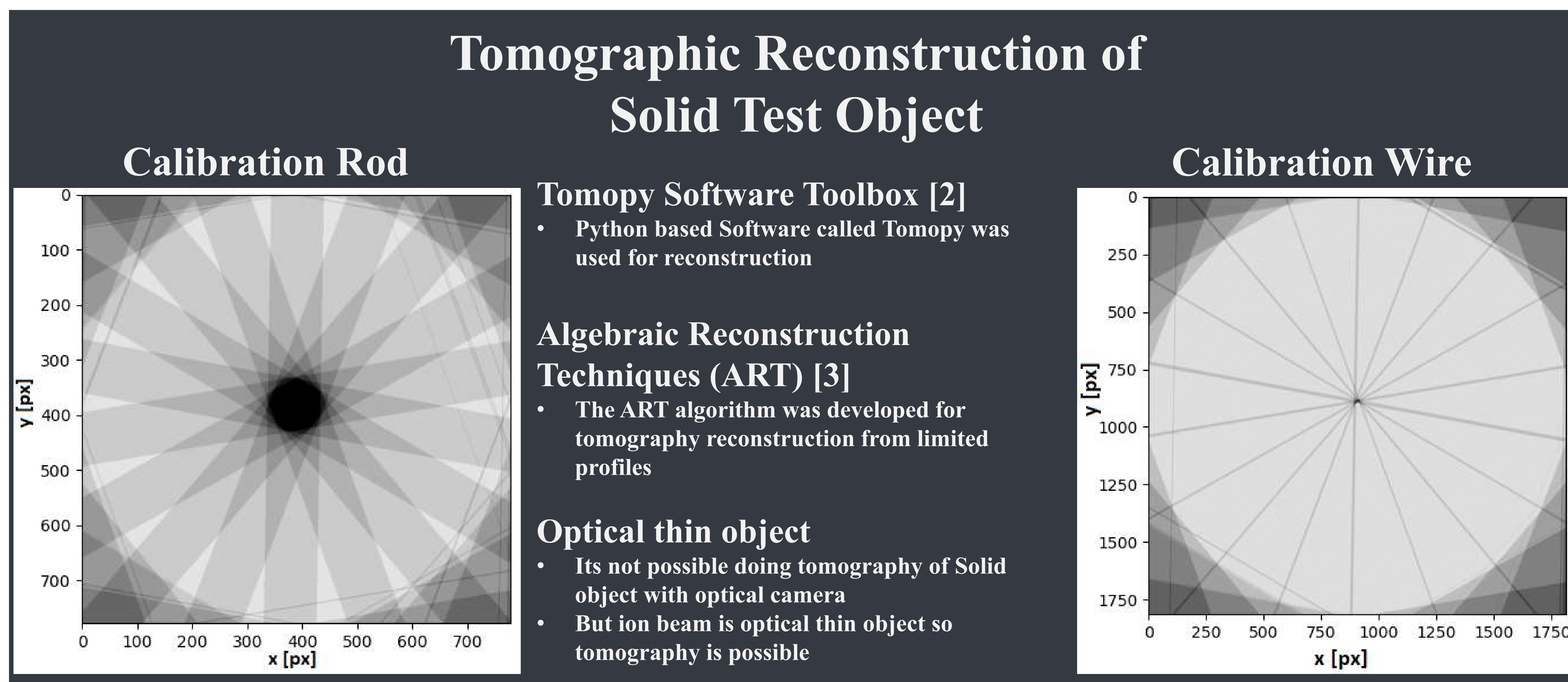
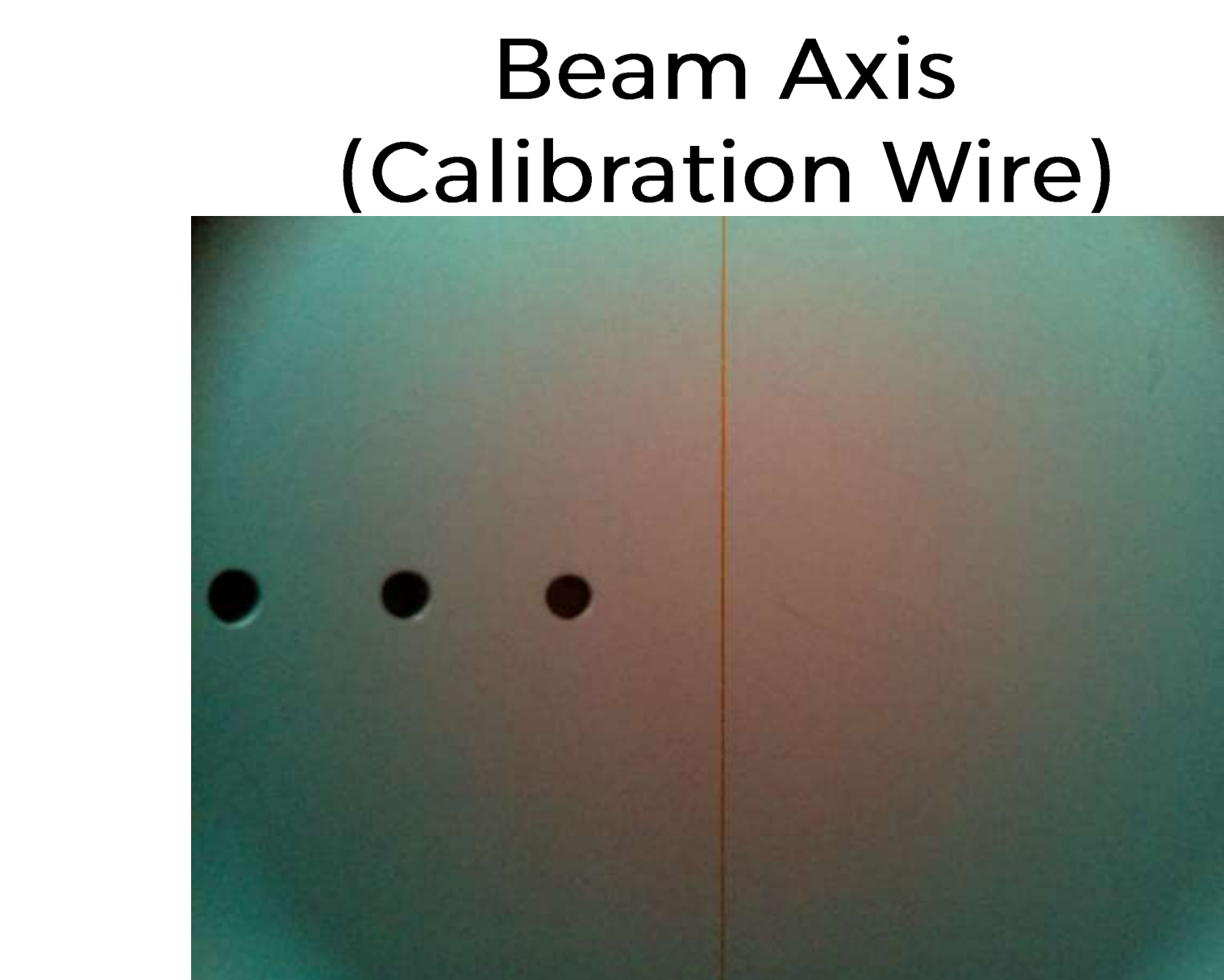
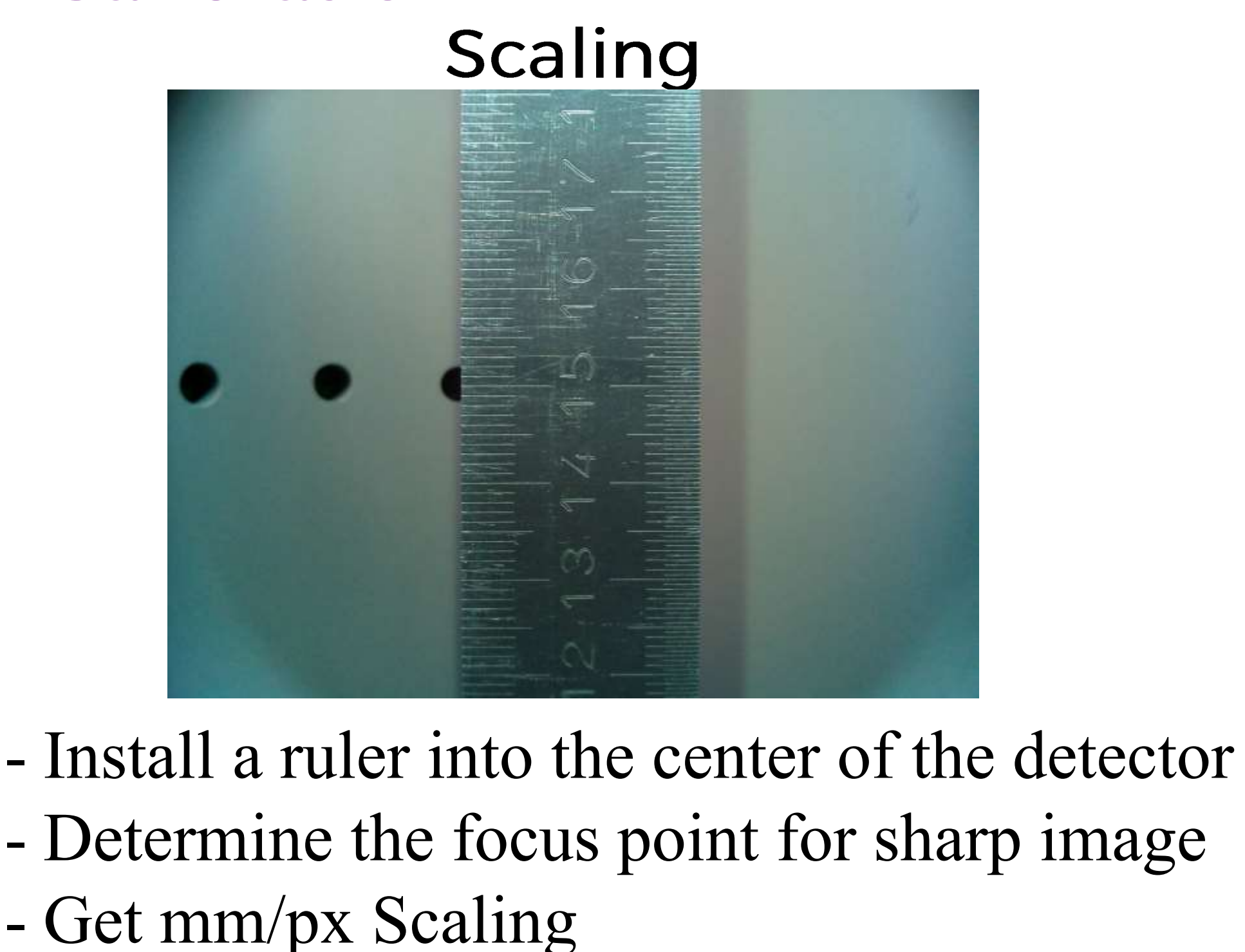
- **Get all cameras parallel into operation**
 - ✓ Usage of a USB hub and its power management system
- **Retrieve Data and control cameras**
 - ✓ Install edge device as wireless access point and control unit
- **Calibration**
 - ✓ Get Scaling
 - ✓ Get center of beam axis
 - ✓ Matching each camera field of view
- **Tomographic Reconstruction**
 - ✓ Image preprocessing
 - ✓ Choose tomography algorithm
 - ✓ Postprocessing of reconstructed image

References

- [1] A. Ates et al., "Development of a Multi-Camera System for Non-Invasive Intense Ion Beam Investigations", presented at IPAC'21, Campinas, Brazil, May 2021, paper MOPAB282, unpublished.
- [2] D. Gürsoy et al., "Tomopy: a framework for the analysis of synchrotron tomographic data", Synchrotron Radiation, (2014), 1188-1193, doi:10.1107/S1600577514013939.
- [3] J.S. Fraser, "Beam Tomography or Art in Accelerator Physics", Los Alamos Scientific Laboratory Report LA-7498-MS, 1978.



Calibration



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