

Experimental Validation of a Spatial Anti-aliasing Plasma Wave Analysis Technique on a Hollow Cathode Plume

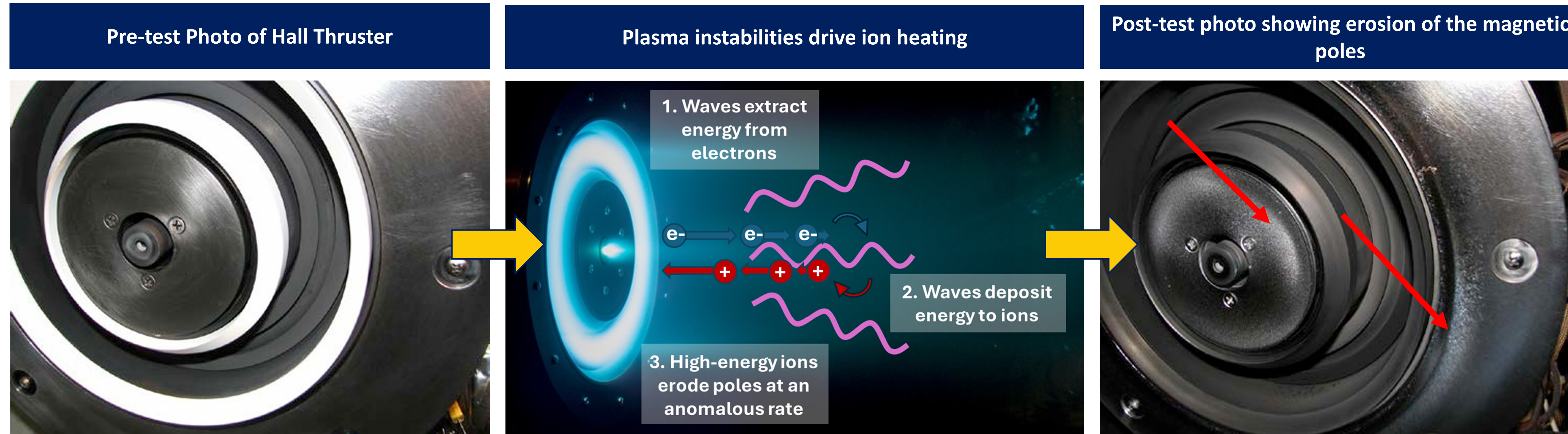


Miron F. Liu and Benjamin A. Jorns

Department of Aerospace Engineering | University of Michigan, Ann Arbor, MI

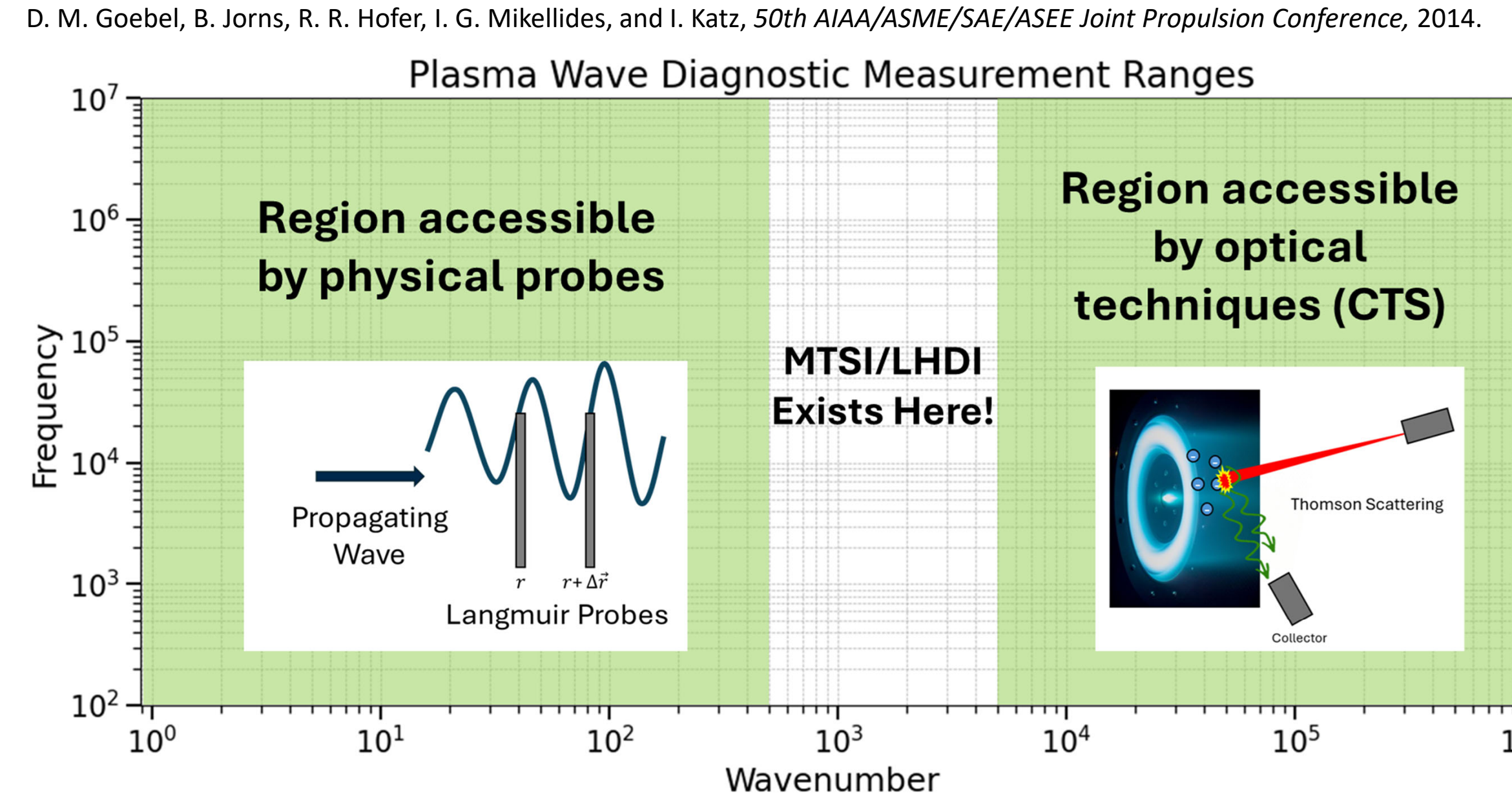
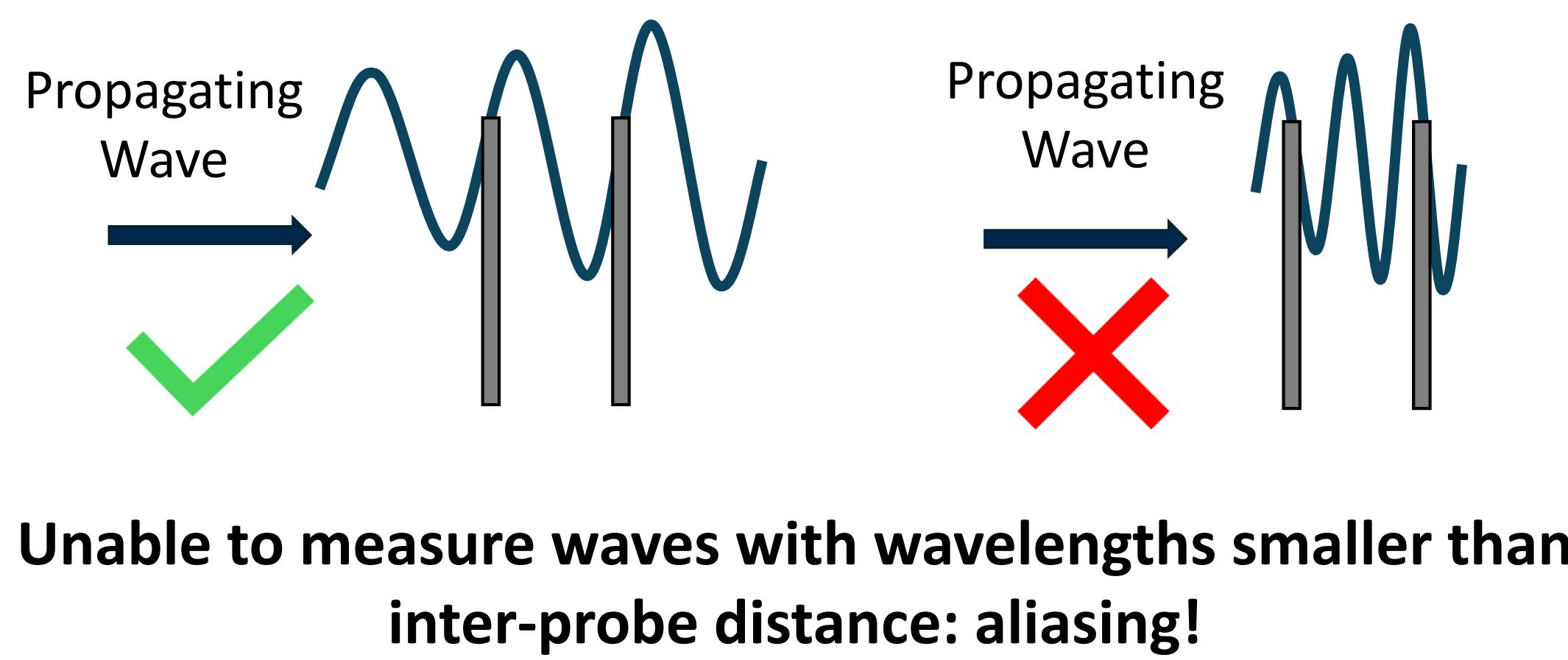


Background



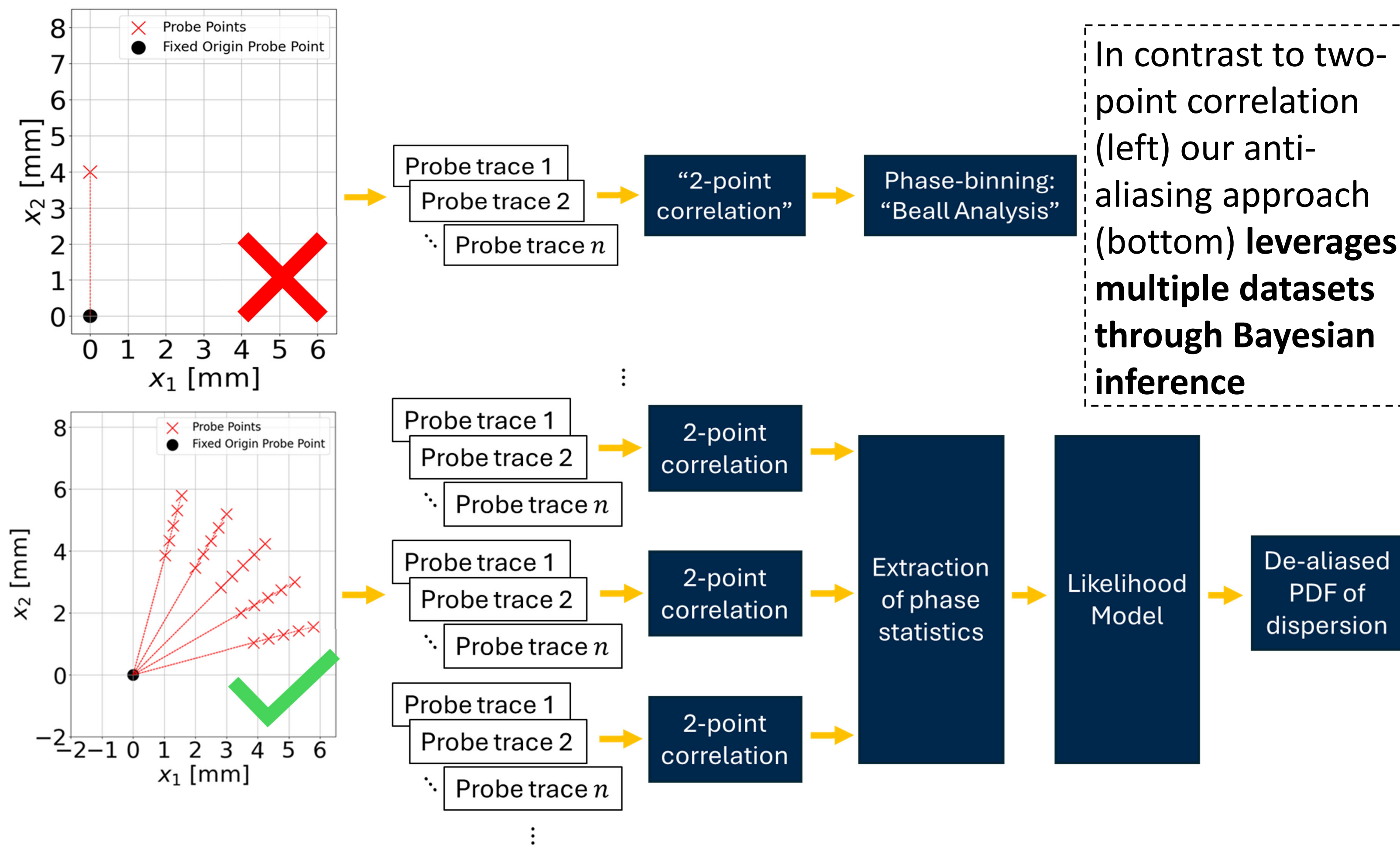
1. **Pole erosion** has superseded discharge channel erosion as the life-limiting mechanism of Hall thrusters
2. **Plasma waves** such as the modified two stream instability (MTSI) and lower hybrid drift instability (LHDI) are thought to dominantly contribute to pole erosion
3. **Measurements of these waves** are critical to understanding the exact processes causing life-limiting erosion
4. **Diagnostic limitations** have unfortunately precluded direct experimental measurement of these plasma waves
5. **Aliasing of wave measurements** has historically been the primary limitation of probe-based diagnostics, which we solve with our anti-aliasing approach

Plasma Diagnostics Have Wavelength Limits Due to Aliasing

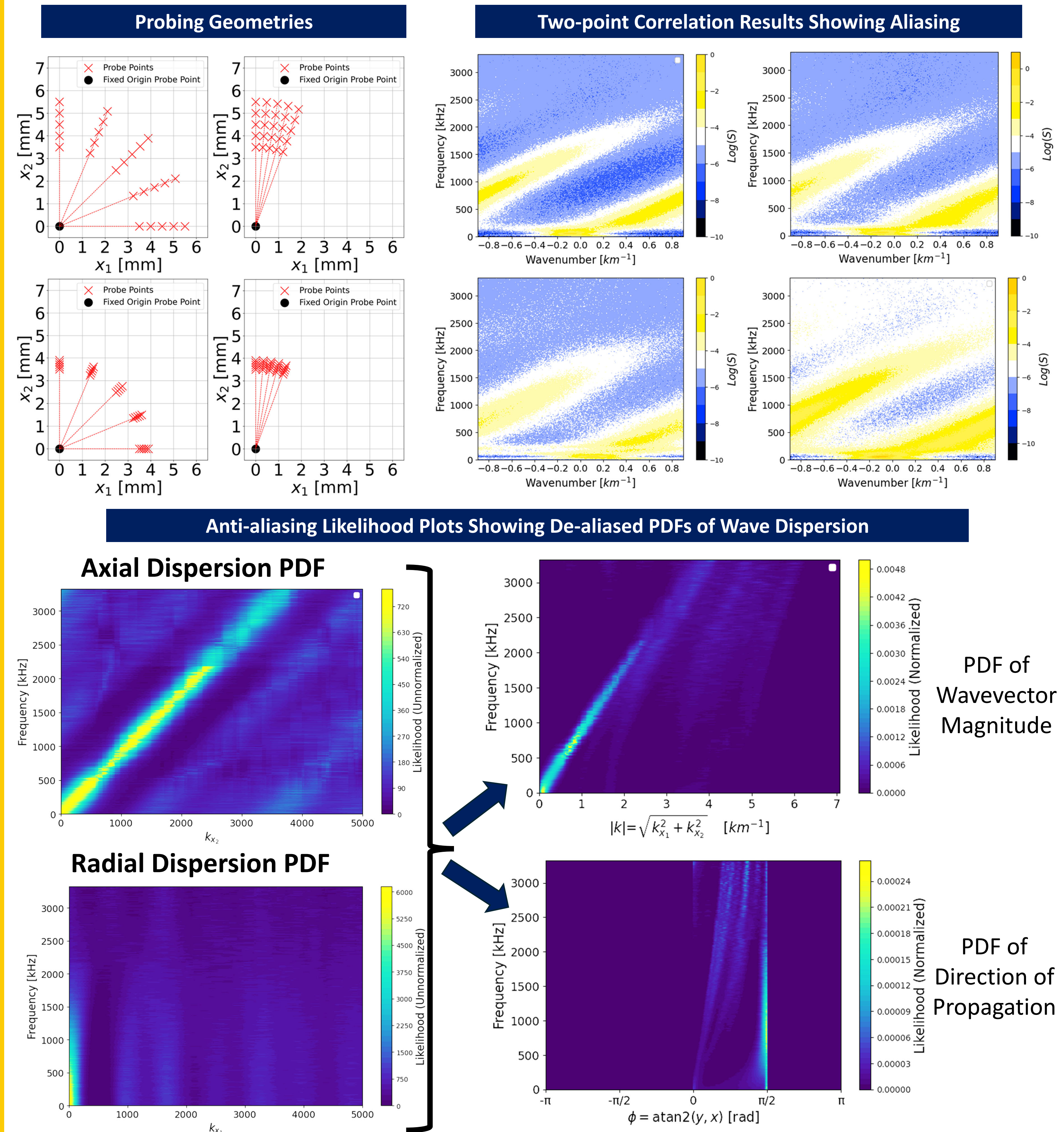


D. M. Goebel, B. Jorns, R. R. Hofer, I. G. Mikellides, and I. Katz, 50th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 2014.

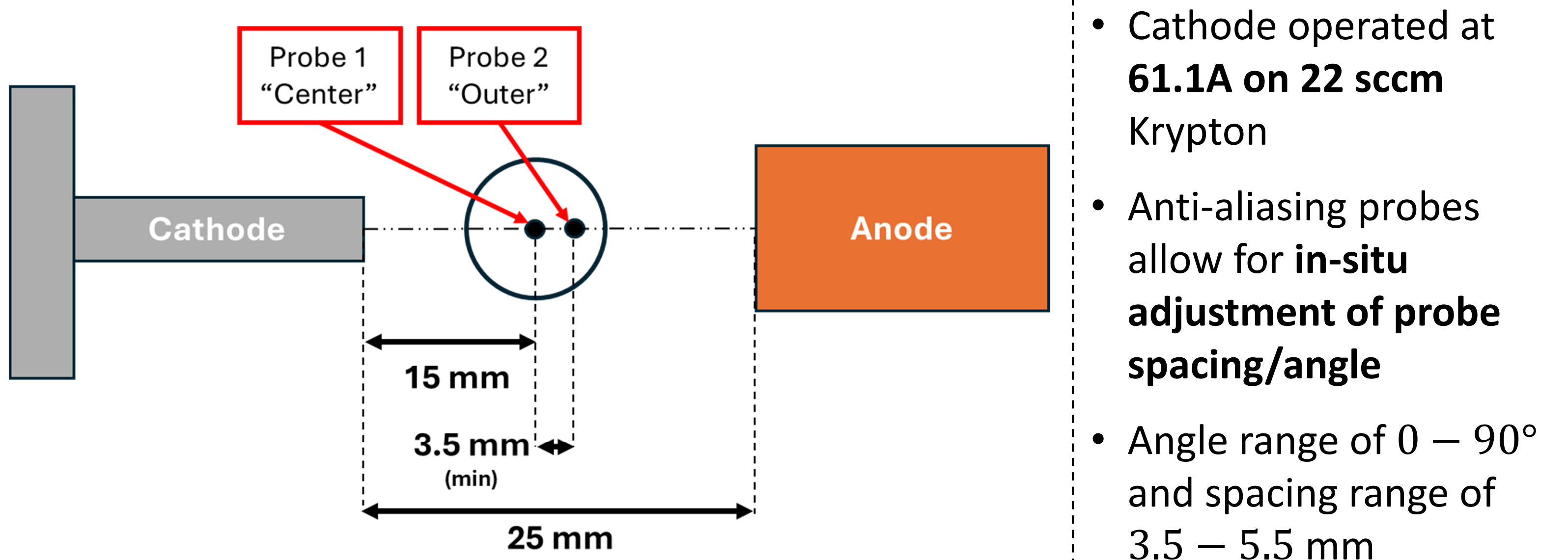
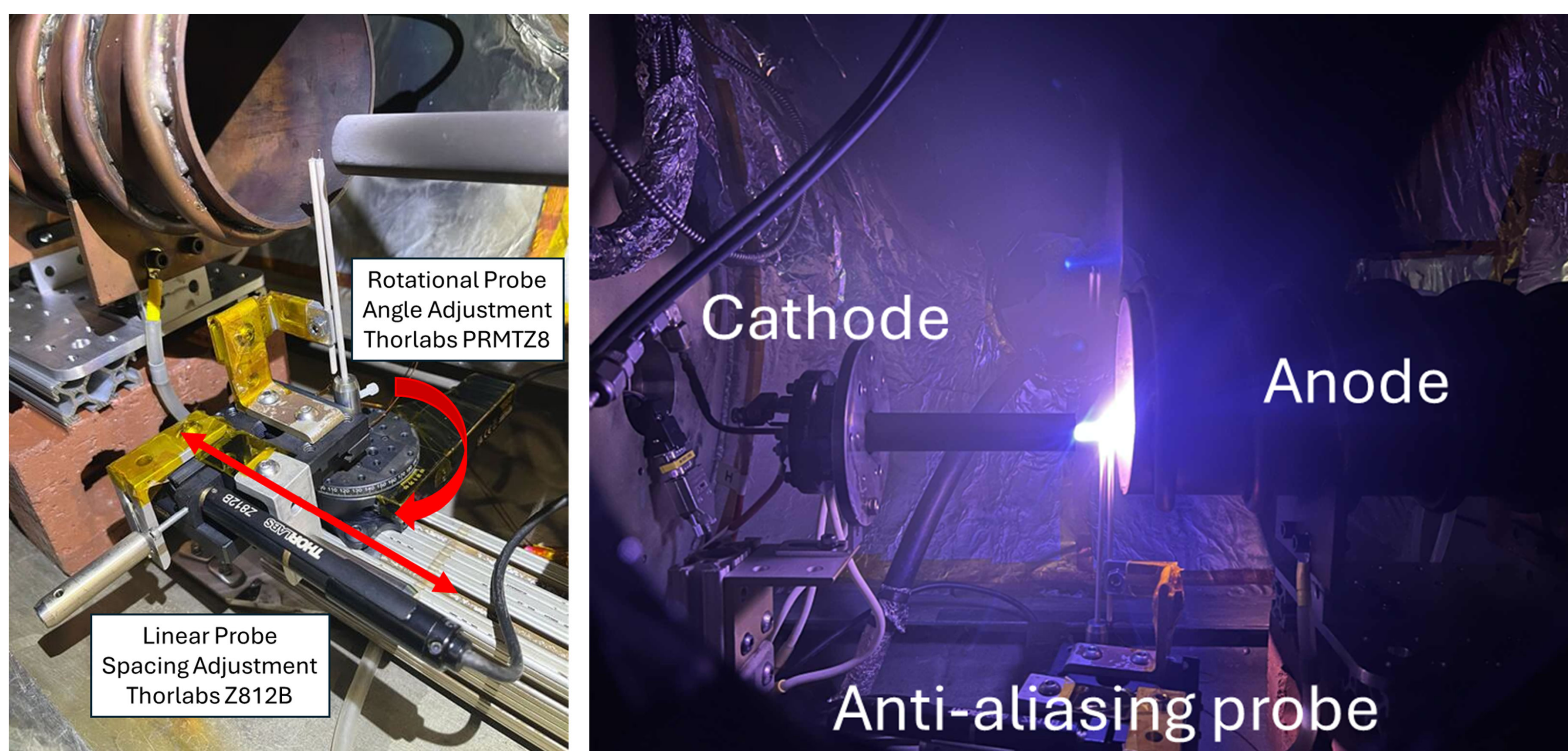
Anti-aliasing Analysis Technique



Results



Experimental Arrangement



- Cathode operated at **61.1A** on **22 sccm** Krypton
- Anti-aliasing probes allow for **in-situ adjustment of probe spacing/angle**
- Angle range of **0 – 90°** and spacing range of **3.5 – 5.5 mm**

Conclusion

- Anti-aliasing algorithm is able to reconstruct ion acoustic dispersion without aliasing
- We are able to infer magnitude and direction of wave propagation
- We have demonstrated this technique can be used to detect waves with wavelengths < 1 mm such as MTSI/LHDI

Acknowledgements

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