



Burst-Mode Frequency-Scanning Planar Laser-Induced Fluorescence for Multi- Parameter Measurements

09/26/2024

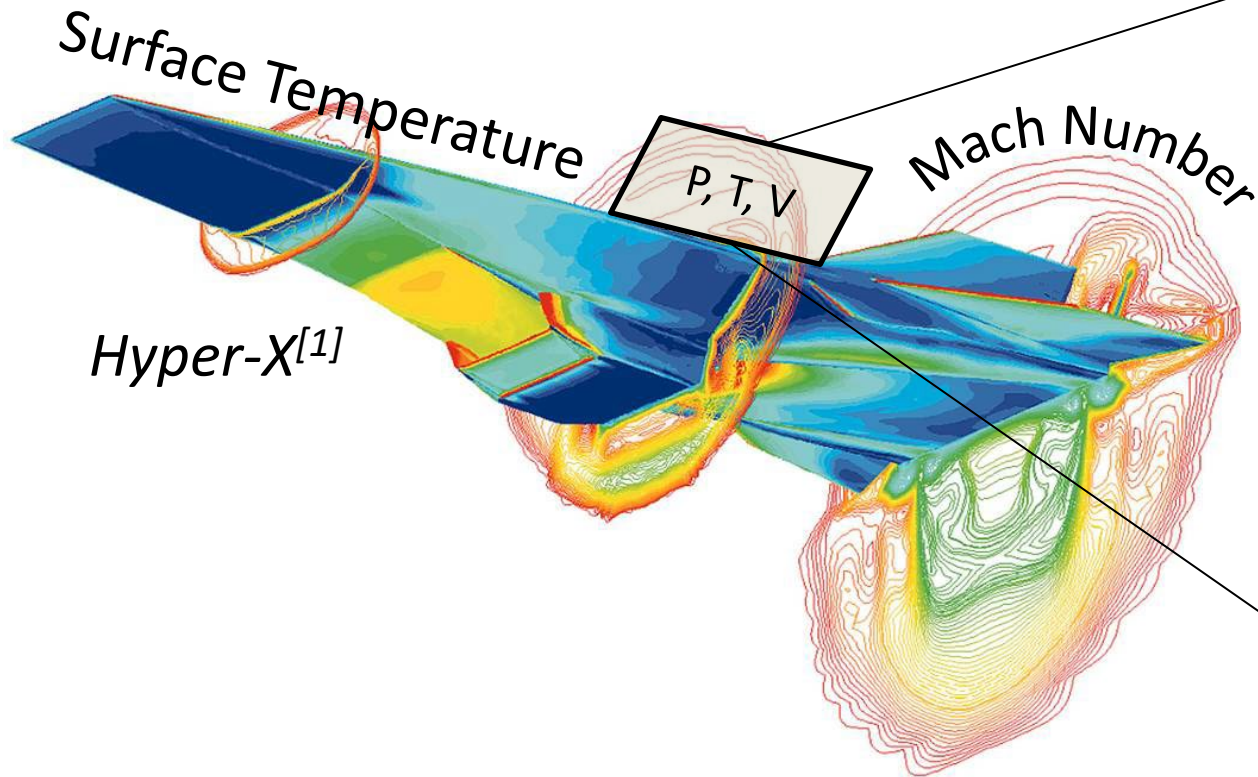
**Amanda M. Braun
Neil S. Rodrigues
Paul M. Danehy**

Acknowledgements



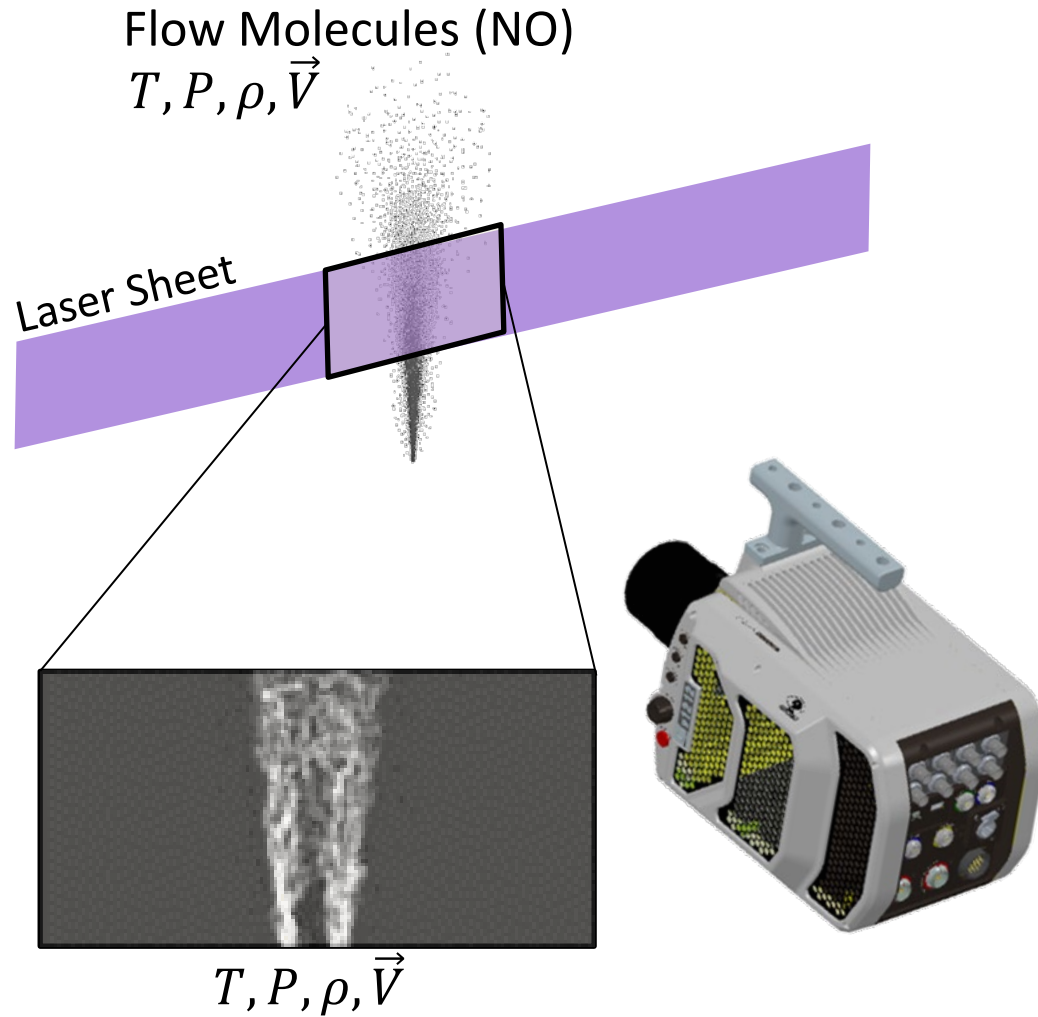
- NASA STMD ESM Project
- SBIR Program
- Dr. Paul Hsu and Dr. Naibo Jiang, Spectral Energies, LLC

Why use optical diagnostics?



Non-intrusive
Spatio-temporally
resolved
In situ
measurements

Why use planar laser induced fluorescence



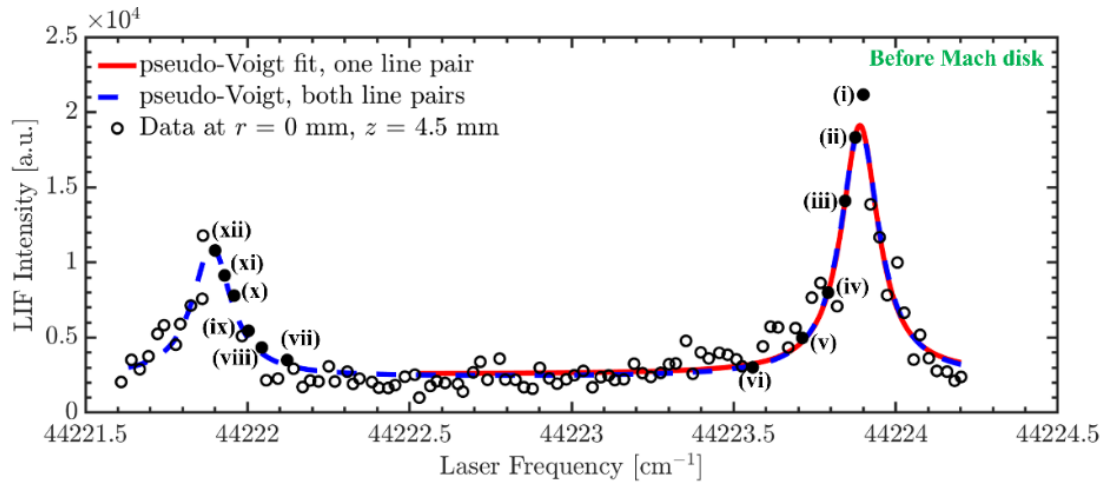
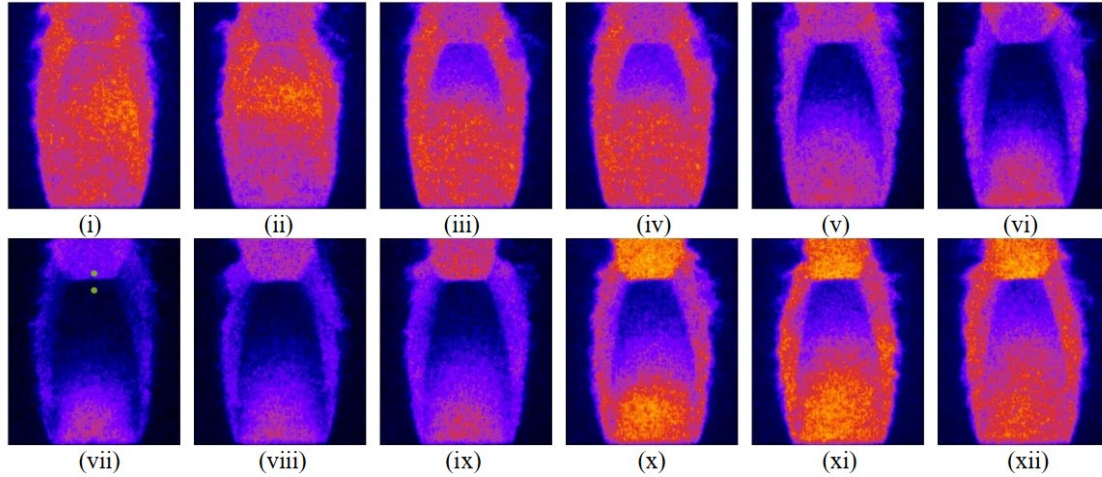
Spatially resolved (2D)
Temporally resolved
Species specific

Usually qualitative
(visualization)

Frequency-scanning Burst-mode PLIF



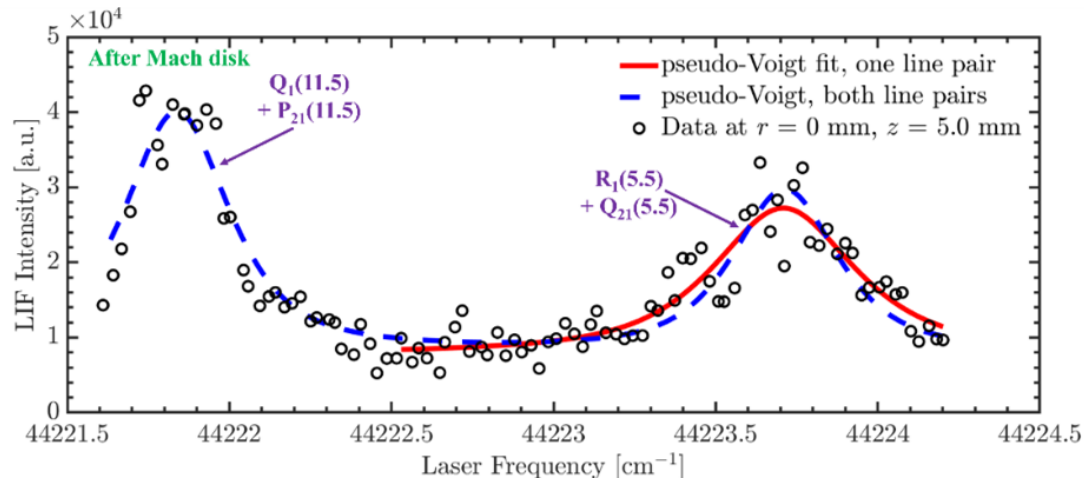
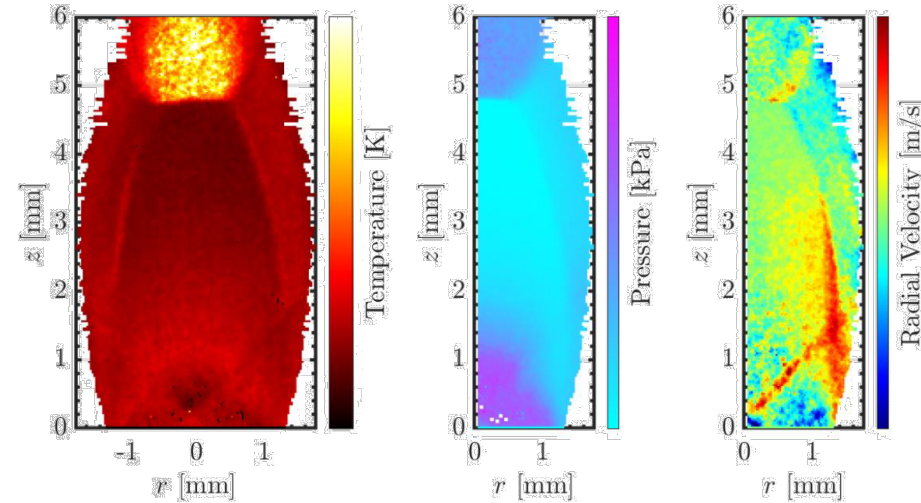
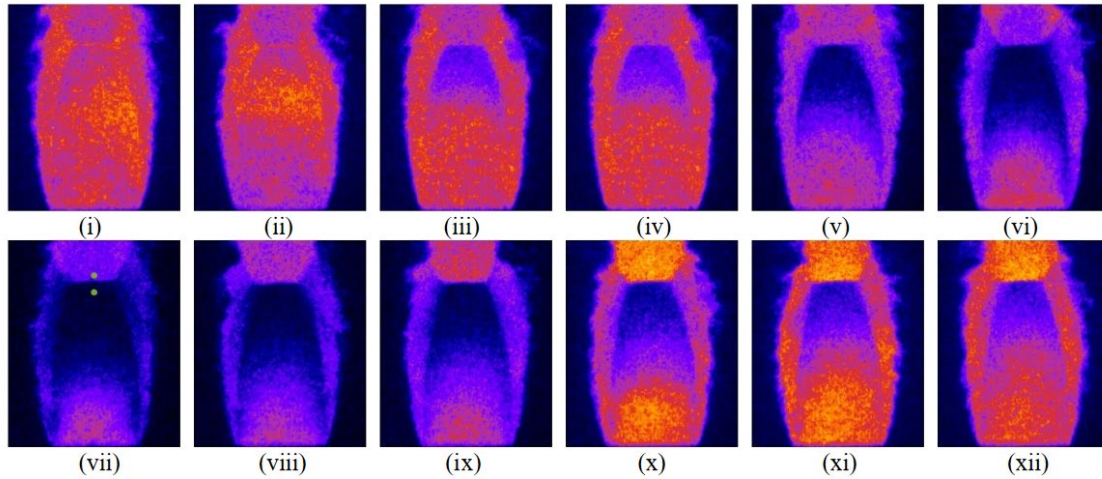
Rodrigues et al.^[2]



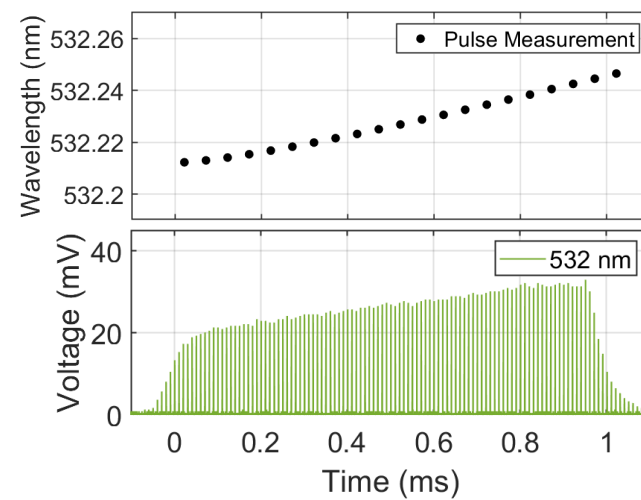
Frequency-scanning Burst-mode PLIF



Rodrigues et al.^[2]



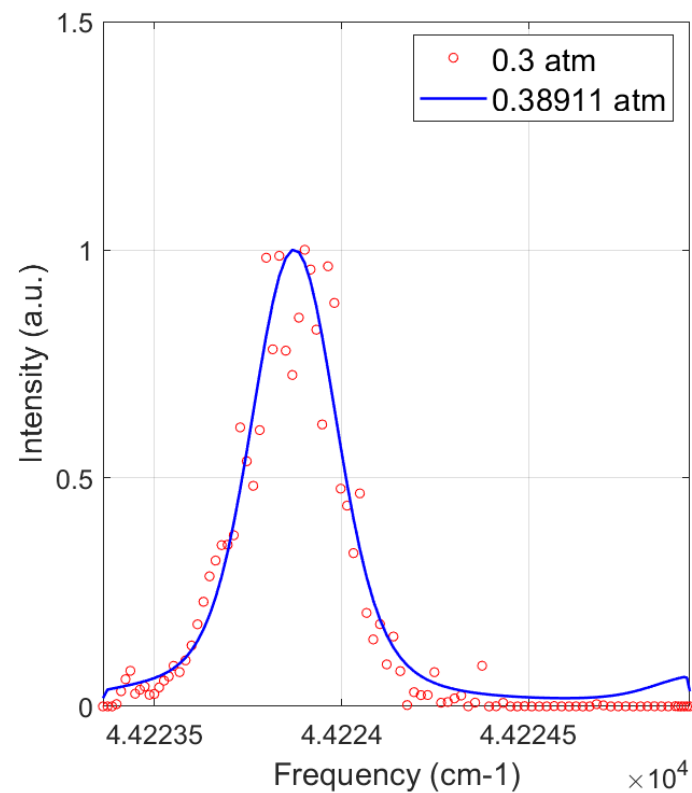
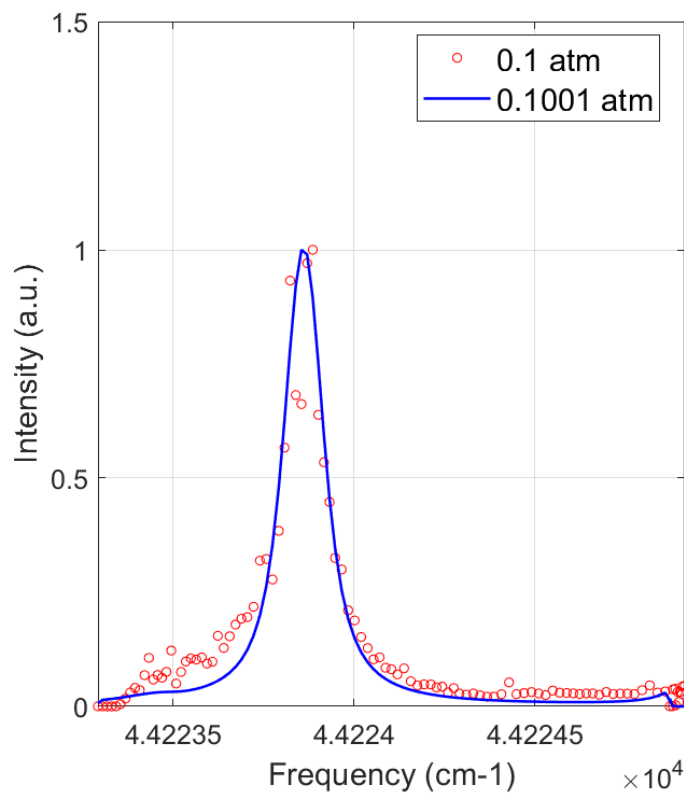
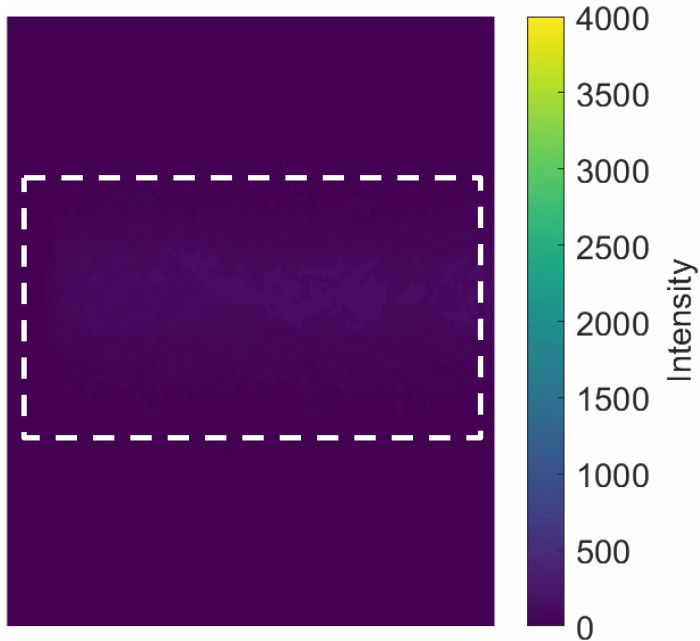
Requires high-speed
wavelength measurement!



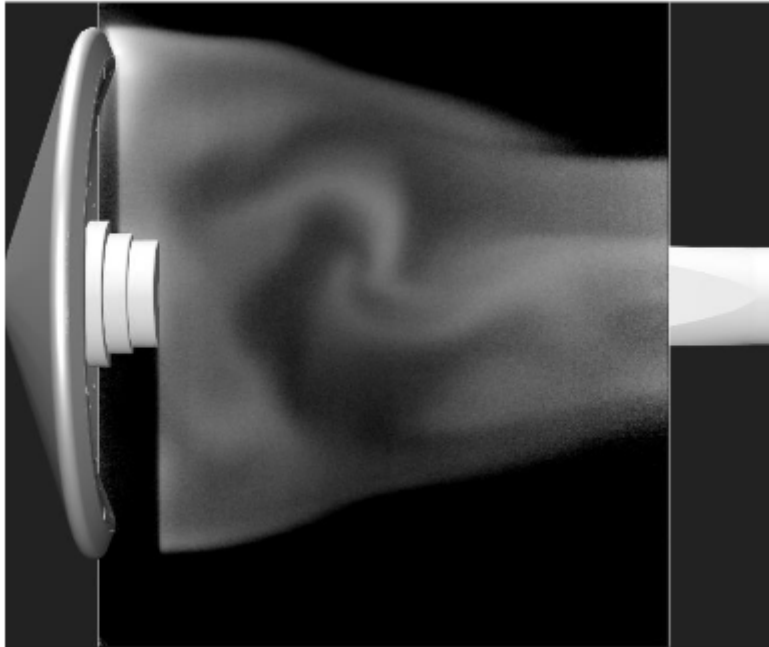
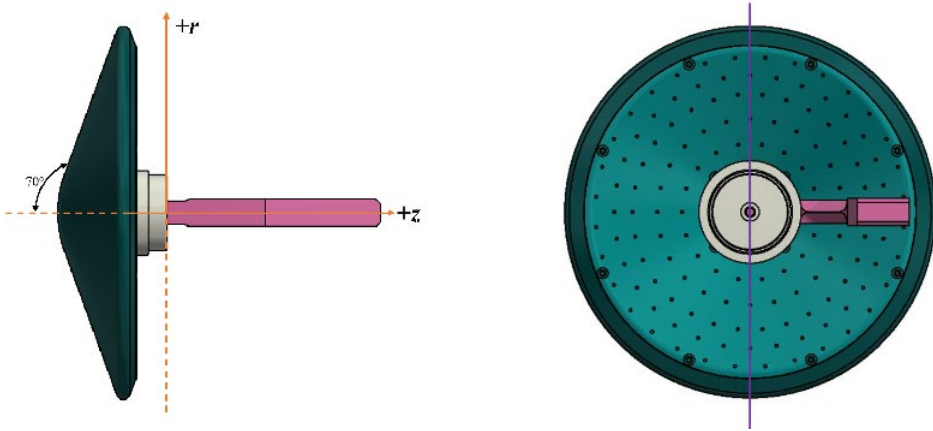
Preliminary Results



0.1 atm, 293 K, 0 m/s



Planned Mach 10 Wake Flow Measurements



Rodrigues et al.^[3]

- 10 Hz $\rightarrow$ 100 kHz Flow Visualization
- Towards kHz-rate temperature, velocity, and pressure measurements

References



- [1] “Hyper-X ED97-43968-1: Computational Fluid Dynamics (CFD) Image of Hyper-X Research Vehicle at Mach 7 with Engine Operating.” <https://www.dfrc.nasa.gov/Gallery/Photo/X-43A/HTML/ED97-43968-1.html> (accessed Oct. 02, 2022).
- [2] N. S. Rodrigues, P. M. Danehy, N. Jiang, P. Hsu, J. Leicht, and S. Roy, “100 kHz High-Spectral-Resolution NO-PLIF Measurements for Compressible Flows,” in AIAA SCITECH 2023 Forum, National Harbor, MD & Online: American Institute of Aeronautics and Astronautics, Jan. 2023. doi: 10.2514/6.2023-0405.
- [3] N. S. Rodrigues, O. K. Tyrrell, E. Rieken, B. R. Hollis, and P. M. Danehy, “FLEET and PLIF velocimetry within a Mach 10 hypersonic air flow,” in AIAA SCITECH 2024 Forum, American Institute of Aeronautics and Astronautics. doi: 10.2514/6.2024-2323.