Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Experimental Investigation of Reynolds Number Effects on Test Quality in a Hypersonic Expansion Tube[1] TOBIAS ROSSMANN, ALYSSA DEVIN, WEN SHI, CHARLES VERHOOG, Lafayette College — Reynolds number effects on test time and the temporal and spatial flow quality in a hypersonic expansion tube are explored using high-speed pressure, infrared optical, and Schlieren imaging measurements. Boundary layer models for shock tube flows are fairly well established to assist in the determination of test time and flow dimensions at typical high enthalpy test conditions. However, the application of these models needs to be more fully explored due to the unsteady expansion of turbulent boundary layers and contact regions separating dissimilar gasses present in expansion tube flows. Additionally, expansion tubes rely on the development of a steady jet with a large enough core-flow region at the exit of the acceleration tube to create a constant velocity region inside of the test section. High-speed measurements of pressure and Mach number at several locations within the expansion tube allow for the determination of an experimental x-t diagram. The comparison of the experimentally determined x-t diagram to theoretical highlights the Reynolds number dependent effects on expansion tube. Additionally, spatially resolved measurements of the Reynolds number dependent, steady core-flow in the expansion tube viewing section are shown.

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Date submitted: 26 Jul 2017 Electronic form version 1.4