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Upstream Boundary Condition Sensitivity of the Shock-Boundary Layer Interaction DAVID HELMER, TONKID CHANTRASMI, CHRIS ELKINS, GIANLUCA IACCARINO, JOHN EATON, Stanford University — A low aspect ratio Mach 2.1 wind tunnel with a 20 ° compression wedge is being used to validate uncertainty quantification techniques for CFD. The tunnel is operated continuously, with a mass flow rate of ~0.7kg/s. The incoming pressure, temperature, and mass flow rate are monitored, and the variation in these boundary conditions is documented to provide bounds for the fluctuation applied in the CFD. The compression wedge causes an oblique shock to form, resulting in flow separation at the base of the wedge. Pressure data are measured using a closely-spaced array of taps near the base of the wedge to map the 2D footprint of the shock. These data show that the flow is only weakly three dimensional. PIV measurements are taken throughout the field, with a focus on the shock-boundary layer interaction at the base of the compression wedge. The field of measurement also includes the location where the shock impinges on the opposite wall, where another separation occurs. Measurements are compared to various CFD simulations to see how different modeling assumptions affect the result and to evaluate the validity of CFD uncertainty quantification techniques.

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