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Upstream Boundary Condition Sensitivity of the Shock-Boundary Layer Interaction LAURA CAMPO, DAVID HELMER, TONKID CHANTRASMI, GIANLUCA IACCARINO, JOHN EATON, Stanford University — A low aspect ratio Mach 2.1 wind tunnel with a wall-mounted compression wedge is being used to validate uncertainty quantification techniques for CFD. The tunnel is operated continuously, with a mass flow rate of approximately 0.6kg/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 fluctuations applied in the CFD. The compression wedge generates an oblique shock, resulting in flow separation at the base of the wedge. High-resolution PIV measurements are taken throughout the field, with a focus on the shock-boundary layer interaction at the base of the compression wedge and on the location of shock impingement on the opposite wall. The boundary layer is perturbed in a Monte Carlo type experiment using various configurations of well-defined bumps placed upstream of the compression wedge on the opposite wall. The perturbed velocity field is measured at the location where the oblique shock from the compression wedge impinges upon the opposite wall. PDFs of these velocity data are constructed and compared to the predictions of CFD simulations of varying fidelity.

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