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PIV measurements in two hypersonic shock wave / turbulent boundary layer interactions ANNE-MARIE SCHREYER, RWTH Aachen University, Institute of Aerodynamics, Germany, OWEN WILLIAMS, University of Washington, WA, USA, ALEXANDER J. SMITS, Princeton University, NJ, USA — Particle Image Velocimetry measurements were performed to study two compression corner interactions in hypersonic flow. The experiments, carried out at Mach 7.2 and at a Reynolds number based on momentum thickness of 3500, included mean flow surveys as well as turbulence measurements in the near-field of the interaction. For the 8° compression corner, the flow remained attached, and for the 33° compression corner a large separation bubble formed. For the attached case, the influence of the shock wave on the streamwise turbulence intensities is weak, but the wall-normal component and the Reynolds shear stress show considerable amplification. In the fully separated case, both the streamwise and wall normal velocity fluctuations, as well as the Reynolds shear stresses, show strong amplification across the interaction. In contrast with the behavior in the attached case, equilibrium flow is approached much more rapidly in the separated case. Turbulence measurements in such complex hypersonic flows are far from trivial, with particle frequency response limitations often significantly reducing the measured wall-normal turbulence. We will therefore discuss these influences on overall data quality as well as the interpretation of flow physics based on these results.

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