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Sensitivity of an asymmetric three-dimensional diffuser to inlet condition perturbations[1] EMILY SAYLES, Stanford University, SVEN GRUNDMANN, TU Darmstadt, CHRISTOPHER ELKINS, JOHN EATON, Stanford University — Experiments were performed to investigate the flow in an asymmetric 3D diffuser that is highly sensitive to inlet condition perturbations. Magnetic Resonance Velocimetry (MRV) revealed the development of a three-dimensional separation bubble in the baseline case. The shape and size of this separation bubble could be manipulated through the introduction of longitudinal counter-rotating vortices produced by small delta-wing vortex generators placed in the inlet duct. The changes to the separation bubble were reflected in significant changes in the diffuser's pressure recovery. Similar pressure recovery effects were observed by perturbing the inlet flow with dielectric barrier discharge plasma actuators oriented to generate forcing in the spanwise direction. The plasma actuators can both improve and degrade the diffuser's performance. Two cases, a continuous forcing case which decreases the pressure recovery and a pulsed forcing case which increases the pressure recovery, were selected for further study. Particle image velocimetry was used to better understand how the secondary flows introduced by the plasma actuators interact with the separation bubble, and why they have such a marked effect on the diffuser's performance.

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