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Leverage the Capability of Princeton Superpipe[1] LIUYANG DING, ALEXANDER PIQUE, SIMERET GENET, DANIEL HOFFMAN, MARCUS HULTMARK, ALEXANDER SMITS, Princeton University, PRINCETON UNIVERSITY TEAM — The Superpipe facility at Princeton utilizes compressed air as the working fluid to obtain high-Reynolds-number turbulence. It comprises a recirculating pressure vessel that can hold up to 220 atm, and a test pipe of 200 diameter long inside the pressure vessel. The range of bulk Reynolds number achievable is $81x10^3$ to $6x10^6$. Previous measurements in the Superpipe have only employed hot wires and only investigated equilibrium flows. We now report our progress in maximizing the capability of Superpipe towards optical measurement of non-equilibrium turbulence at high Reynolds numbers. We designed a new traversing system with a miniature rail mounted inside the test pipe, which allows test models to travel over a large axial distance. The blockage ratio of the rail is 0.6% of the pipe cross section. A linear driving stage is placed in the diffuser section and is 16 diameters downstream of where the flow is sampled. We will present preliminary hot-wire data of turbulence past a streamlined body of revolution, and compare it with PIV measurement of the same flow in a water pipe. In addition, the design of a new PIV system for the Superpipe will be presented. Details regarding imaging and illumination with optical fibers, calibration procedure, and seeding method will be discussed.

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