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Development of a nano-scale crossed hot wire to measure velocity in high Reynolds numbers YUYANG FAN, MARCUS HULTMARK, Princeton University — In very high Reynolds number flows, accurate velocity measurements with conventional hot wires are often limited due to the size and response of the sensors. The Nano-Scale Thermal Anemometry Probes (NSTAPs), previously developed at Princeton, have been used successfully to acquire well-resolved velocity data in multiple high Re facilities. The NSTAP has displayed superior performance compared to conventional hot wires both in the spatial and temporal resolution. However, until now, NSTAPs have been limited to single component measurements. Here, a novel method to combine two inclined NSTAP probes, forming a nano-scale cross-wire, is presented. This enables simultaneous measurements of two fluctuating velocity components with unprecedented spatial and temporal resolution. The two sensing elements of the new x-NSTAP are about one order of magnitude shorter than the conventional cross-wire and are contained within a volume of about $50 \times 50 \times 50\mu$m. The small sensing volume greatly improves the spatial resolution of high Re measurements. The small thermal mass of the new sensors also improves the frequency response to match that of a single component NSTAP. Measurements with the new x-NSTAP are performed in the Superpipe facility at Princeton and results are presented.

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