Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Development and characterization of a Nano-scale temperature probe (T-NSTAP) for turbulent temperature measurement GILAD ARWATZ, YUYANG FAN, CARLA BAHRI, Princeton University, ALEXANDER J. SMITS, Princeton University and Monash University, MARCUS HULTMARK, Princeton University — A new nano-scale temperature probe (T-NSTAP) is presented. The T-NSTAP consists of a miniature, free-standing, platinum wire suspended between silicon supports. The sensor is designed for temperature measurements at high frequencies, operated in constant current mode. The design is based on the cold-wire model proposed by Arwatz et al. (2013) and is shown to have a bandwidth far superior that of conventional cold-wires. This minimizes the effect of temporal filtering as well as spatial filtering on the data and allows for a unique investigation of the full scalar spectrum, including the dissipation range. Data is acquired in a heated grid turbulence setup with constant mean temperature gradient using both the T-NSTAP and a conventional cold wire. It is shown that the cold wire is significantly attenuated over the full range of frequencies including low frequencies with a direct effect on the temperature variance and the scalar rate of dissipation. The model of Arwatz et al (2013) is used to correct the cold wire data and it is shown that the correction works well over the entire spectrum. In addition, the corrected data agrees closely with the T-NSTAP measurements.

Gilad Arwatz
Princeton Univ

Date submitted: 01 Aug 2014 Electronic form version 1.4