Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

On the Relation between Spatio-Temporal Forcing and Structure of Turbulence DOUGLAS CARTER, FILIPPO COLETTI, University of Minnesota — The different methods to force turbulence in physical or numerical experiments can have significant effects on the fluid dynamics. Understanding how a given forcing scheme maps on the flow statistics is important both to reproduce desired flow features, and to gain insight in the transfer of energy across the scales. Here we consider the case of the turbulent flow generated by the interaction of pulsating jets. We present a novel installation where pressurized air is issued through 256 independently actuated valves, arranged in symmetric rectangular arrays over two facing planes. The small net mass flux and the randomization of the actuation produces a large region of approximately homogeneous flow at the center of the apparatus, with fluctuations much larger than the mean velocity. The turbulence structure under different firing sequences is statistically analyzed using Particle Image Velocimetry. The forcing parameters include: jet Reynolds number, spacing of the active jets, actuation frequency, and spatio-temporal correlation of the firing patterns. The observables include: integral length scales, turbulent dissipation, energy spectra, and isotropy. We discuss the relation between forcing schemes and flow features, and implications for modeling and flow control.

Douglas Carter
University of Minnesota

Date submitted: 12 Aug 2015 Electronic form version 1.4