Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Variation of the slope of the velocity power spectrum and intermittency factor corresponding to $160 < \mathrm{Re}_\lambda < 490$[1] ALEJANDRO PUGA[2], University of California, Irvine — It has been observed in many studies, at sufficiently high Reynolds number and for an intermediate range of wavelengths that $E_{11}(\kappa) \sim \kappa^{-n}$. Kolmogorov's 1st and 2nd hypotheses state that n should approach 5/3 as the Reynolds number tends to infinity and that the variation of n from 5/3 is due to intermittency in the dissipation. Wind tunnel experiments are conducted where high intensity turbulence is generated by means of an active turbulence grid modeled after Makita's 1991 design (Makita, 1991) as implemented by Mydlarski and Warhaft (M&W, 1998). The goal of this study is to document the variation of n over a range of Re_λ from 160 to 490. The corresponding values of n are 1.46 and 1.55 where $n = 5/3 - 3.23Re_\lambda^{-0.56}$. This is in disagreement with Mydlarski and Warhaft who found that $n = 5/3 - 5.25Re_\lambda^{-2/3}$. The intermittency factor, μ, is obtained from the slope of the dissipation spectrum where $E_{11}^{\varepsilon}(\kappa) \sim \kappa^{\mu-1}$ and its variation is determined. The intermittency factor is calculated using the spatial derivative of the downstream velocity as determined from the temporal derivative and Taylor's hypothesis. As turbulence intensity increases, it had been hypothesized that μ would become zero. However, Sreenivasan and Kailasnath (S&K, 1992), in agreement with Praskovsky and Oncley (P&O, 1994), have found that μ appears to be nearly a constant of 0.25 ± 0.05. In the current study it is found that the intermittency exponent is nearly a constant, in agreement with Sreenivasan and Kailasnath, but has a value of 0.7.

[1]University of California, Irvine Research Fund
[2]Tim Koster, John C. LaRue

Alejandro Puga
University of California, Irvine

Date submitted: 02 Aug 2013 Electronic form version 1.4