Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Non-equilibrium turbulence scalings in turbulent planar jets[1]
GIOACCHINO CAFIERO, JOHN CHRISTOS VASSILICOS, Imperial College London, TURBULENCE, MIXING AND FLOW CONTROL GROUP TEAM — A revised version of the Townsend George theory, as proposed by Dairay et al 2015, is applied to the study of turbulent planar jets (Cafiero and Vassilicos 2017). Requiring the self-similarity of only few quantities along with the non-equilibrium dissipation scaling law (Vassilicos 2015), it implies new mean flow and jet width scalings. In particular, the ratio of characteristic cross-stream to centreline streamwise velocities decays as the -1/3 power of streamwise distance in the region where the non-equilibrium dissipation scaling holds. In the definition of C_ε both in Dairay et al 2015 and in Cafiero and Vassilicos 2017 the local Reynolds number is based on the local flow width rather than on the integral lengthscale. We verify that the ratio of the integral lengthscale to the flow width is constant, thus enabling the use of the integral flow width in place of the integral lengthscale for defining C_ε. The importance of this result is twofold: firstly it further strengthens the scalings obtained in the works of Dairay et al 2015 and Cafiero and Vassilicos 2017; secondly the flow width is immediately accessible by any mean flow measurement, whereas the estimation of the integral lengthscale often requires an additional hypothesis.

[1]ERC Advanced Grant 320560

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Date submitted: 29 Jul 2017 Electronic form version 1.4