Abstract Submitted
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K62SCAN: Experimental Assessment of the Refined Similarity Hypothesis[1] JOHN LAWSON, Max Planck Institute for Dynamics and Self-Organisation, ANNA KNUTSEN, JAMES DAWSON, Norwegian University of Science and Technology, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organisation, NICHOLAS WORTH, Norwegian University of Science and Technology — Experimental and numerical studies of turbulence widely confirm departures from Kolmogorov's famed 1941 Similarity Hypothesis scaling. Kolmogorov anticipated this and later introduced his 1962 Refined Similarity Hypothesis (RSH), which posits that the local, volume averaged dissipation rate determines the scaling of velocity differences at that scale. Previous experimental tests have supported the RSH, but must be regarded as inconclusive, due to systematic errors introduced by the use of surrogates for the local dissipation rate. Recent advances in Scanning PIV now permit us to dispense with this technical limitation. During the K62SCAN EuHIT project, we conducted spatially resolved Stereo PIV and Scanning PIV measurements in the GTF3 von-Kármán mixing tank facility at MPIDS. We collected over 2×10^5 independent time-series Scanning PIV measurements of the turbulence at $R_\lambda = 200$ in a cubic measurement volume approximately 42 Kolmogorov lengthscales to a side. The measurement is able to resolve the instantaneous dissipation and velocity fields, eliminating the need for surrogates. This enables us to present the first direct, experimental assessment of the RSH. Our results complement recent numerical investigations into the RSH scaling.

[1]European High-Performance Infrastructures in Turbulence

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