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Inertial range ESS scaling deteriorates with increasing Reynolds number EBERHARD BODENSCHATZ, MICHAEL SINHUBER, GREGORY BEWLEY, Max Planck Institute for Dynamics and Self-Organization, MARGIT VALLIKIVI, MARCUS HULTMARK, ALEXANDER SMITS, Princeton University —
We examined the scaling of velocity structure functions in turbulence generated by a classical biplanar grid of crossed bars in the Variable Density Turbulence Tunnel in Göttingen. The flow had neither a mean shear nor strong anisotropy. Despite this, the structure functions did not exhibit power-law scaling unless Extended Self-Similarity (ESS) was employed. The ESS exponents were remarkably stable at Taylor Reynolds numbers between 100 and 1600. That is, at higher Reynolds numbers than in any other comparable flow. However, the extent to which ESS applied at small scales deteriorated as the Reynolds number increased. The experiments were performed in pressurized sulfur hexafluoride gas at pressures between 1 and 15 bar. The data were acquired with both classical hot wires, and with the NSTAP anemometers developed at Princeton.

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