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Distinct organisational states of large-scale motions in turbulent pipe flow FRANCESCA M. SOGARO, DAVID J.C. DENNIS, University of Liverpool — An experimental investigation focussing on the structural organisation of large scale motions (LSMs) in fully developed turbulent pipe flow has been conducted in the Very Large Scale Pipe Flow (VLSPF) facility at the University of Liverpool. Measurements using high-speed stereoscopic particle image velocimetry in the radial-azimuthal plane at a Reynolds number of 35000 (based on bulk velocity and pipe diameter) have been analysed, paying particular attention to the two-point spatial correlation of the streamwise velocity fluctuations. A method has been developed to select similar individual instances (in time) of the planar correlation to identify the presence of a set of distinct organisational states. The application of the selective correlation method demonstrates how the pairs of positive-negative correlation directly correspond to the presence of persistent positive and negative streamwise velocity fluctuations in the instantaneous velocity fields, often referred to as LSMs. The duration that the selective spatial correlation indicates the flow is in a certain state can be related to the length of the large scale motions in the flow and provides a method of identifying and quantifying the characteristics of LSMs in turbulent pipe flow.

David J.C. Dennis
University of Liverpool

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