Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Experiments on low Reynolds number turbulent flow through a square duct BAYODE OWOLABI, ROBERT POOLE, DAVID DENNIS, University of Liverpool — Previous experimental studies on square duct turbulent flow have focused mainly on high Reynolds numbers for which a turbulence induced eight-vortex secondary flow pattern exists in the cross sectional plane. More recently, Direct Numerical Simulations (DNS) have revealed that the flow field at Reynolds numbers close to transition can be very different; the flow in this marginally turbulent regime alternating between two states characterised by four vortices. In this study, we experimentally investigate the onset criteria for transition to turbulence in square ducts. We also present experimental data on the mean flow properties and turbulence statistics in both marginally and fully turbulent flow at relatively low Reynolds numbers using laser Doppler velocimetry. Results for both flow categories show good agreement with DNS. The switching of the flow field between two flow states at marginally turbulent Reynolds numbers is confirmed by bimodal probability density functions of streamwise velocity at certain distances from the wall as well as joint probability density functions of streamwise and wall normal velocities which feature two peaks.

David Dennis
University of Liverpool

Date submitted: 21 Jul 2015 Electronic form version 1.4