Abstract Submitted
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Receptivity Mechanisms in a Rotating Torus: Experiments and Simulations[1] RICHARD CLARKE, SOPHIE CALABRETTO, SCOTT WALBRAN, JIM DENIER, JOHN CATER, University of Auckland, TRENT MATTNER, University of Adelaide — We consider the flow within a rotating fluid-filled torus subject to a sudden change in angular velocity. Previous DNS computations showed the occurence of boundary-layer separation (Hewitt et al., JFM 688), which was conjectured to be linked with structures observed in the top-down visualisations of Madden & Mullin (JFM 265). These showed a "flow front" in the equatorial plane propagating from the outer wall, the position of which was seen to match well with the separated flow structures seen in the DNS. However, in the experiments a second streak was observed at later times on the opposite wall, not seen in the DNS. To better understand this structure, we present the first measurements of the cross-sectional flow, using PIV on an experiment designed to overcome the optical issues in cross-sectional measurements. These demonstrate both the post-separated flow structures seen in earlier DNS, as well as the appearance of a vortex-pair on the opposite equator. These we believe to be likely candidates for the second fronts noted in the Madden experiments. We hypothesise that this vortex pair is generated by small geometric imperfections, an idea seemingly borne out by striking agreement with new DNS conducted in a modified geometry that better represents experimental reality.

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Richard Clarke
University of Auckland

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