Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Formation number, pinch-off time and optimal formation time of orifice-generated vortex rings[1] RAPHAEL LIMBOURG, JOVAN NEDIC, McGill University — Vortex rings are generated experimentally by impulsively discharging fluid through a sharp-edge nozzle or orifice. As the actuator pushes the flow through the tube, the shear layer at the outlet rolls-up, detaches and propagates downstream in one or several vortices from which we can define the pinch-off time, the formation number and an optimal formation time. The radial component of velocity at the exhaust of an orifice results in a significant increase in the final circulation, the kinetic energy and the hydrodynamic impulse (Krieg & Mohseni, 2013). Measurements show a 140% increase in the total circulation compared to a nozzle. In the case of orifice-generated vortex rings, the formation number has been found to range between 1.0 to 2.0. Furthermore, the radial component of velocity drastically destabilises the flow which results in an earlier pinch-off of the primary ring. Trailing vortices merge with the primary ring to grow into a well-formed ring at an optimal formation time. Energy consideration based on the Fraenkel-Norbury family of vortex rings accurately predicts the formation number for orifice-generated vortex rings.

[1]Research funded by NSERC

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Date submitted: 31 Jul 2019 Electronic form version 1.4