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The effect of a variable diameter nozzle on starting jet formation and separation dynamics MIKE KRIEG, CU, KAMRAN MOHSENI — As a jet is forced through a nozzle, the shear layer formed at the interface rolls back on itself forming a vortex ring. At a critical point the circulation of the leading vortex ring becomes saturated causing it to "pinch-off" from the trailing shear flow, which then forms a wake of trailing vortices. Jet separation occurs at a nearly universal formation time (Gharib et. al. 1998). Both squid and jellyfish utilize the large impulse transfer associated with vortex ring formation to propel. Both swimmers are also known to actively change the diameter of the fluid interface during jetting. It was predicted by Mohseni et. al. (2001) that changing the diameter of the shear layer during formation can delay the vortex ring separation. We fabricated a prototype vortex ring generator which controls the jet diameter and jet velocity independently. This device was configured to eject a jet through a nozzle which was both opened and closed at a constant rate. The fluid driving mechanism was configured to compensate for the nozzle deformation and maintain a constant jet velocity. The jet formation dynamics were captured using a high speed camera and commercial DPIV software. The temporal evolution of the invariants of motion (circulation, energy and impulse) was determined from the DPIV velocity field. The invariance principle demonstrated a high accuracy before ring saturation, with some losses due to viscosity.

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