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Pressure Evolution in the Shear Layer of Vortex Rings as an Indicator of Pinch-Off KRISTY SCHLUETER, Caltech, JOHN DABIRI, Stanford University — Vortex development and shedding occurs in a variety of biological settings, but the physical mechanisms driving this process are poorly understood. In a seminal 1998 paper, Gharib et al. linked the shedding of vortex rings to the integrated velocity of a piston pushed through a hollow cylinder, a metric referred to as formation number. However, the absence of a piston/cylinder configuration in most biological settings makes formation number a confusing metric by which to develop generalized principles of vortex ring pinch-off. In this study, a recently developed algorithm was used to generate pressure fields from PIV data of vortex ring development and pinch-off. The pressure evolution in the shear layer feeding the vortex ring was examined in detail. The formation time at the occurrence of a local maximum in the pressure in the shear layer was found to be a strong indicator of vortex ring pinch-off. It is hypothesized that a pressure maximum separates fluid that becomes a part of the leading vortex ring from fluid that ends up in the trailing jet. By focusing on the pressure evolution in the shear layer, instead of the formation number, which can be difficult to measure or ambiguous to define for biological flows, generalizations to other vortex shedding flows are possible.

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