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A Lagrangian approach to identifying vortex pinch-off[1] CLARA O'FARRELL, JOHN O. DABIRI, California Institute of Technology — There exists a physical limit to the size of an axisymmetric vortex ring beyond which it rejects further vorticity flux, and a trailing jet forms behind it. This process is termed "vortex pinch-off," and it has been correlated with maximally efficient fluid transport in pulsed jets[2]. The established method for identifying vortex pinch-off consists of measuring the circulation of the vortex ring after it has separated from its trailing shear layer, and comparing it to the total circulation to determine the instant when the vortex ring ceased to accept vorticity[3]. However, this method relies heavily on the vorticity field, which breaks down due to viscous diffusion in low Reynolds number and unsteady biological flows. We introduce a criterion for identifying pinch-off based on the Lagrangian coherent structures (LCS) in the flow, which is found to be in good agreement with the established criterion based on circulation. The Lagrangian criterion is frame-invariant and does not rely on the vorticity field, and so is a useful tool in the study of complex biological vortex-shedding flows.

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[2]Krueger and Gharib, Phys. Fluids, **15**, p. 1271, 2003.
[3]Gharib *et al.*, J. Fluid Mech., **360**, p. 121, 1998.

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