Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Flow visualization of the trapping induced by vortex breakdown at a junction[1] DANIELE VIGOLO, University of Birmingham (UK), MARCO RICCOMI, Universita' di Pisa (Italy), FEDERICO ALBERINI, University of Birmingham (UK), ELISABETTA BRUNAZZI, Universita' di Pisa (Italy), JESSE AULT, HOWARD STONE, Princeton University — Here we present experimental investigations of the vortex breakdown happening at a T-, Y- or "arrow" shaped junction responsible for the trapping of light material suspended in solution. Considering the ubiquitous nature of T-junctions and bifurcation in general, in industrial as well as biological environments, it is extremely interesting to better understand how this trapping phenomenon happens. In particular, we observed the flow profiles at different sections in order to perform a three-dimensional study of complex structures, such as vortices and recirculation zones, that develop at a bifurcation. We explored Reynolds number ranging from 50 to about 500 for different milli-fluidic devices. Thus we compared standard micro-PIV and a novel optical technique, the Ghost Particle Velocimetry (GPV), that was recently introduced, to investigate the onset of vortex breakdown. Moreover, the experimental results were compared with single-phase OpenFoam numerical simulations performed in the same flow conditions. Finally, we studied the mutual influence of a trapped particle on the flow field inside the recirculation zone by fully exploiting the capability of GPV to produce 3D flow field with a spatial resolution of few tens of microns.

[1]This work was partially supported by the Wellcome Trust [1516ISSFFIRA23]

Daniele Vigolo
University of Birmingham (UK)

Date submitted: 28 Jul 2016 Electronic form version 1.4