Optimal Mixing, Mass and Heat Transfer in Turbulent Puffs

By Zhengzhong Sun[1], Lian Gan[2], Qianhui Li[1]
1. Department of Mechanical Engineering and Aeronautics, City, University of London
2. Department of Engineering, Durham University

PhD researcher Qianhui Li visited the Dr Gan's lab at Durham University for one week in November 2018. Experiment was performed in the water tank there. The experiment concerns the vortex ring impingement on to a solid surface by means of planar particle image velocimetry (PIV). This SRV initiated the follow-up collaboration with the two research groups. Moreover, the PIV measurement successfully revealed the short wavelength instability taking place throughout the impingement process, which is believed a new mechanism for vortex ring's impingement.

Measurement Results

The vortex rings are produced through a horizontal puff generator. All the PIV measurement is in the water. A Perspex plate is place vertically downstream of the ring nozzle. Part of the impingement process is revealed through the velocity contours below (top row). The first velocity contour reveals the primary ring (inner one) as well as the induced secondary ring, which is slightly weaker. Comparing the ring radius, it can be found that the ring stretches during impingement. Looking at the vorticity contour below, small packets of alternating positive and negative vorticity magnitudes are generated, namely the short-wavelength instability (SWI). It is believed that the SWI is produced during the ring stretching process. Further research on this new mechanism will be performed between the two groups.

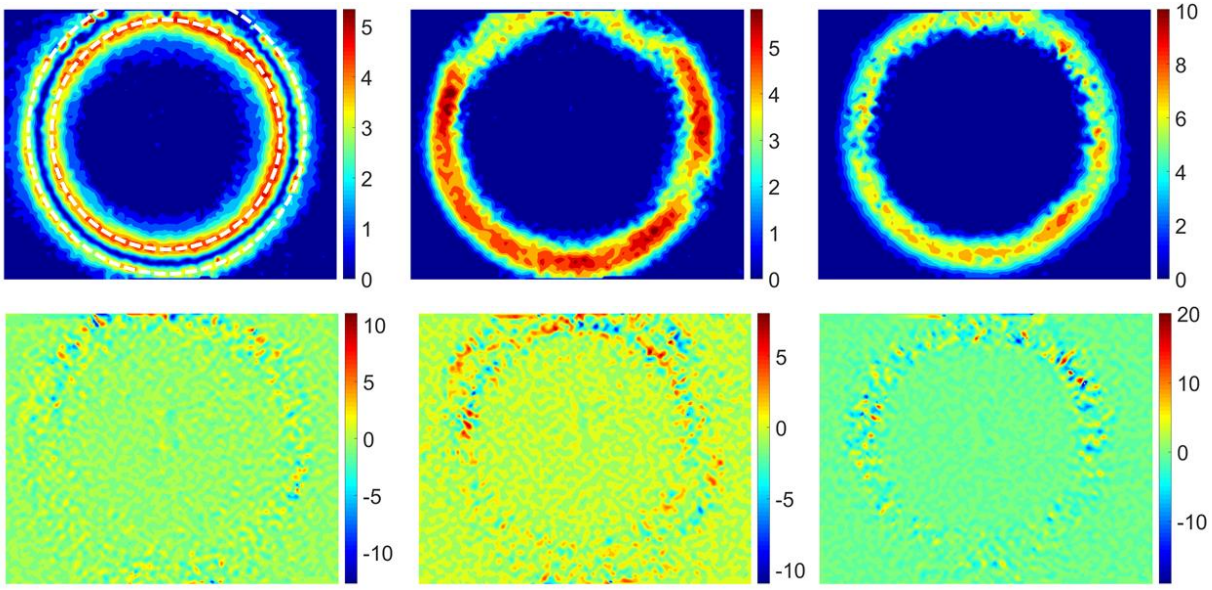

Figure. Part of the impingement process. Top row: in-plane velocity magnitude (unit: mm/s); Bottom row: out-of-plane vorticity component (unit: 1/s).