TOWARDS THE PREDICTION OF VORTEX PAIRING NOISE IN AN EXCITED FREE JET USING PIV MEASUREMENTS

Gloria Romera Guereca, Spain
Supervisors: C. Schram & J. Anthoine

The objective of this project is to study the ability of PIV measurements to calculate noise generated by vortex pairing in a single excited free jet. The pairing between co-rotating vortex rings is one of the most relevant acoustical events for moderate Reynolds number in sub-sonic jets. We use a particular form of the vortex sound theory derived from Möhring's formulation.

The experimental condition studied is 5 m/s, and $Re_D \tilde{}$ 14000. The initial jet diameter is 41 mm. A loudspeaker excites the jet acoustically. This excitation triggers the instability of the jet and organizes the vortex ring evolution making possible to observe the phenomena. The excitation signal and the PIV acquisition triggering signals are recorded allowing measuring the phase of each PIV acquisition. Two different views have been used for the PIV measurements: a global field of view and a close up in the region where the pairing occurs. For the close up several views has been used. The overlapping between the views is around 50 %. It has been developed post processing techniques in order to combine the measurements from the different close field of views. The method proposed discard automatically the views that do not contain the pair of vortices

The velocity field measured is used to study the temporal evolution of circulation, momentum and kinetic energy. The results obtained from the close field of views are compared with the results from the global field of view.

Finally the acoustical source term is calculated. For the global field of view has been shown that the source term may be obtained by using the PIV measurement into the expression derived from Möhring formulation. Moreover it agrees with the results of numerical simulation of the flow. For the close field of view some work is still required to attempt the final calculation. Especially the use of the overlapping of the different view is recommended.

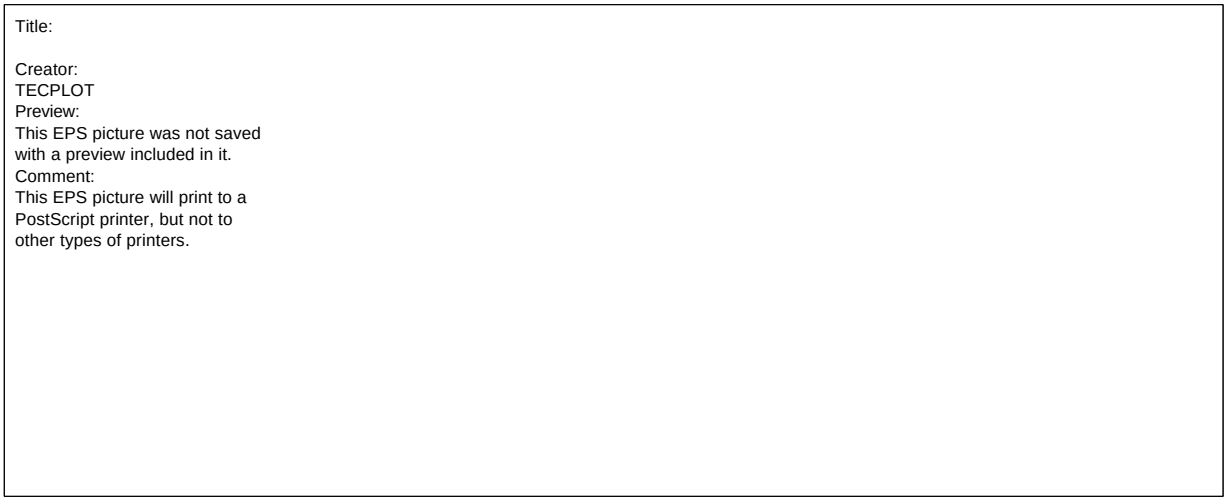

Figure 1: Global field of view and close-up example of close-up in the pairing region