Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

A general approach for time-supersampling of 3D-PIV data by the vortex-in-cell method[1] FULVIO SCARANO, JAN SCHNEIDERS, RICHARD DWIGHT, TU Delft, AEROSPACE ENGINEERING/AERODYNAMICS TEAM — Advancements of tomographic PIV [1] have led into 3D time-resolved experiments to study the dynamical evolution of 3D turbulent flows [2]. The known bottleneck of Tomo-PIV is the high laser power required to illuminate large volumes in airflows, which becomes critical beyond 10kHz. Time-super-sampling is an approach to reduce the sampling rate, proven for frozen turbulence where the advection model yields a significant increase of temporal resolution [3]. Instead, in separated flows, the advection principle yields unacceptable distortions. The use of Navier-Stokes numerical calculations with the vortex-in-cell (VIC) method is proposed herein. The assumption is made of inviscid incompressible flow [4]. The spatial-resolution of the data is exploited to increase the temporal resolution. The dynamical evolution of the vorticity and velocity field between subsequent snapshots in the 3D domain is numerically evaluated. The verification with fully time resolved data of a circular jet indicates a substantial increase of temporal resolution. Interestingly, data sampled below the Nyquist limit could be reconstructed faithfully, indicating the potential of VIC in alleviating requirements on PIV measurement rate.

[1]Work supported by the European Research Council grant 202887.

Fulvio Scarano
TU Delft

Date submitted: 31 Jul 2013 Electronic form version 1.4