PARTICLE IMAGE VELOCIMETRY (PIV) MEASUREMENTS IN F1

PIV objectives at low-speeds

The PIV technique enables the measurement of a 2- or 3-component averaged flow velocity distribution around a model.

PIV application

F1 is equipped with a stereo PIV system based on off-the-shelf PIV cameras and laser, and using in-house FOLKI-SPIV image processing and data reduction software. Laskin nozzles are used to seed the flow by injecting micro-droplets of olive oil downstream of the test section. Coordinated traverse systems allow simultaneous displacement of laser sheet and cameras to survey the flow.

The PIV system was extensively tested in 2009, and validated by comparison with different reference flowfields. The final validation was performed at the beginning of 2010, under pressurized conditions up to 3.85 bar, with a full-span model. 3-component velocity maps can be measured over typical surfaces of about 0.4×0.7 m².

PIV measurements are available on both full-span models and half-models, over the entire operating envelope of the wind tunnel.

Preparation

Preparation is in accordance with usual PIV procedures: set up of optical arrangement (light sheet and cameras), reduced light scattering in the test section (painting of the model and/or wall with Rhodamin or black paint is often necessary), calibration of the whole system. Most of the PIV system optic components are remotely controlled.

Cameras and laser installation is performed in parallel with other preparation tasks. Laser and cameras adjustments and calibration require 2 working days inside F1.

Testing

PIV measurements are performed at fixed flow conditions. Dedicated tests of about 1 min per flowfield measurement are recommended.

When use of a traverse system is not possible, repositioning of the light sheet and cameras, followed by recalibration requires about 3 hours to 1 day of F1 occupancy.

Results

The PIV system has its own independent data acquisition system.

PIV measurements are validated at the end of each run, and available within about 15 min.

Accuracy

Accuracy is strongly dependent on the optical configuration. For a typical wake traversing plane, an accuracy of about 1 % can be expected.