

## PRESSURE SENSITIVE PAINT (PSP) MEASUREMENTS IN F1

### PSP objectives at low-speeds

PSP allows the measurement of static pressure distribution on the surface of a model using weakly intrusive means. The increase in data density enables determination of local pressure loads on the model, e.g. on movable devices. In addition, the model cost and lead-time are reduced.

### PSP methodology

ONERA PSP system is based on the intensity method. The model is painted with in-house 2-component paint, optimized for pressurized testing and weakly sensitive to the temperature. During the test, the model surface is illuminated with UV lamps. The intensity of light reemitted in the visible spectrum is measured with high-sensitivity cameras and is related to the surface pressure thanks to appropriate calibration. Up to six 16-bit cameras are available, with 1024×1024 or 2048×2048 (under request) pixel resolution. IR camera is used to check temperature homogeneity on the model surface.

PSP measurements are available over the entire operating envelope of the wind tunnel.

### Preparation

A surface mesh of the model is required 3 weeks before the test. Model must be equipped with a small number of pressure taps and temperature sensors (PT100).

Preparations outside the tunnel include the painting of the model by Onera staff, the calibration of paint samples, the installation of UV lamps and cameras.

Final preparation (adjustments of cameras and UV lights, detailed paint calibration) requires about 2 working days inside the test section for the first configuration and 1 additional working day per additional configuration.

### Testing

PSP measurements have to be performed in pitch pause mode. The acquisition time required is in the order of 1 to 5 minutes.

Our PSP technique is validated for hinge moment measurements, assuming a few pressure taps are available on the measured surface.

### Results

The PSP system has its own independent data acquisition system. Data reduction of a pressure distribution over a wing requires a few hours. Integration of a pressure distribution requires additional post-test treatment time.

### Accuracy

Accuracy is estimated to be  $\pm 0.15$  in pressure coefficient at Mach 0.2 and 3.85 bar total pressure. It slightly improves for higher Mach numbers or lower pressure conditions.

### Limitations

Available illumination power and optical access do not allow 360° PSP. Pressure measurements on high lift systems are limited by the viewpoints of the cameras. Our recommendation is to perform PSP measurements at the start of the test.