

FPP3 Experiment 3

3-hole probe traverse

The 3-hole probe is in the wind tunnel, and you should use the wake traverse gear to perform a traverse downstream of the trailing edge of the plate.

Part 1: Setup of the 3-hole probe in the wind tunnel

The 3-hole probe is mounted on a rotary traverse gear, which was used for the calibration of the probe, and that is fixed to the wake traverse gear on the wind tunnel. You shouldn't need to rotate the probe for the wake traverse, but having the probe in the same mounting reduces the likelihood of a change in angle orientation between the calibration machine and the tunnel. The wake traverse gear moves the probe up and down and is controlled by the LabVIEW script. The reference total and static pressures (tunnel) need to be connected to the DSA as well as the probe (3xchannels). The remaining DSA channels can be connected to anything else you would like to measure (or nothing). Ensure that the stepper motor cable is connected to channel 2 of the stepper motor driver box to the wake traverse gear. Finally, ensure that the wake traverse gear is at the zero position (black mark on traverse gear); adjust the traverse gears manually if necessary. **The traverse gears take zero to be wherever they are when you initialise them, so if you start at the wrong zero point you may crash the probe!**

Part 2: How to use the LabVIEW program

The LabVIEW script is similar to that from Experiment 2. Remember that you will need to set the value of AVG appropriately.

Part 3: Traverses

You need to take enough data points to resolve the wake shape, but not so many that it requires a significant amount of time. You should start off by undertaking a fairly coarse traverse so that you know where the wake is and then refining the points in and near the wake until you are happy that you are resolving the wake properly (so that any estimates of total pressure loss coefficient will be accurate).

IF THE PROBE IS ABOUT TO CRASH, TURN THE STEPPER MOTORS OFF AND RE-SET THE TRAVERSE GEAR MANUALLY.

Once you have decided on an appropriate traverse resolution, do a traverse with the tunnel at full-speed and repeat at the low speed setting.

In your report, you should discuss the effect of traverse resolution on the accuracy of the wake shape and the calculation of loss from the measurements. You should also discuss the effect of Reynolds' number on the wake profile and the effect of the location of the wake traverse plane with respect to the trailing edge.

Part 4: Standard deviation

You can compare your measurements of standard deviation from Experiment 1 to those obtained from the 3-hole probe in the freestream and the wake. Record a series of data points with the probe in the wake and then repeat in the freestream (move the probe manually between the two points).