A written report is required from each member of the student group performing the laboratory exercise. You are encouraged to work together to analyze the data. Your report should include the following:

- A brief description of the experiment
- A sketch of the experimental apparatus, with all relevant dimensions, and the coordinate system.
- A description of the experimental set-up and procedure, including data reduction methods, and the value of all relevant parameters.
- You should submit your analyzed data as the following plots:
  - $\bar{u}(z/r_{1/2})/U_0$
  - $\bar{v}(z/r_{1/2})/U_0$
  - $\bar{w}(z/r_{1/2})/U_0$
  - $\sqrt{\overline{u'^2}}(z/r_{1/2})/U_0$
  - $\sqrt{\overline{v'^2}}(z/r_{1/2})/U_0$
  - $\sqrt{\overline{w'^2}}(z/r_{1/2})/U_0$
  - $\overline{w'(z/r_{1/2})}/U_0^2$
  - $\overline{w'(z/r_{1/2})}/U_0^2$
  - PDF’s of $u'/U_0, v'/U_0, w'/U_0$ at three representative $z/r_{1/2}$ locations (e.g., centerline, $z/r_{1/2} = 1$, and $z/r_{1/2} = 2$).
  - Scatter plots of $u'v'/U_0^2, v'w'/U_0^2, u'w'/U_0^2$ at three representative $z/r_{1/2}$ locations (e.g., centerline, $z/r_{1/2} = 1$, and $z/r_{1/2} = 2$).
  - Spectra of $u', v', w'$ at three representative $z/r_{1/2}$ locations (e.g., centerline, $z/r_{1/2} = 1$, and $z/r_{1/2} = 2$).
- A brief discussion of your results
Your group should select an distance from the jet orifice that is in the range \(40 < x/D < 100\) and measure the profile of the velocity. Please report your \(x/D\) location as part of your report! You may assume the flow is radially symmetric so you can make measurements in the upper half of the jet flow only. You may want to measure beyond the centerline by a point or so just to help verify that you have passed through the centerline.

The jet orifice diameter is 6.05 mm. The flow rate, \(Q\), has been measured with the current configuration by simply measuring how long it takes to fill a fixed volume. The determined flow rate is \(Q=\)?

Think a bit about how you will measure where the ADV measurement volume is in space. The instrument reports the distance of the measurement volume to a boundary if the boundary is within about 30 cm. You could reference the ADV to the tank bottom by locating the ADV within 30 cm of the bed. Then note the elevation on the ADV mounts scale (it is a Vernier) and reference this as your datum and then record the position of the ADV on the scale for each measurement. Alternatively, you can use the ~30cm piece of pipe and the steel plate and position the plate on the top of the pipe under the ADV before each measurement. This will give the ADV a fairly repeatable reference point that should always be within 30 cm of the ADV as you measure the jet profile. Make sure to remove the pipe and plate before you actually make measurements and let the flow reestablish for at least one minute prior to making measurements.

You are left to decide how long you wish to sample each record. Keep in mind you need to get a reasonable estimate of the means, variances, and covariances. Also keep in mind that you will need to calculate three spectra so you may wish to grab longer records at those locations to allow ensemble averaging of multiple spectra.

As a final step make measurements at 3 – 4 \(x/D\) locations within the range \(40 < x/D < 100\) and solve for the jet decay parameter, \(B\), the jet virtual origin, \(x_0\) (Both defined in Eq 3.6 in the notes), and the jet spreading rate, \(S\) (Eq 3.7 in the notes). Take some care to ensure that you are on the jet centerline. You are only required to report the behavior of the mean streamwise component of velocity but you may wish to investigate the behavior of other parameters.

Feel free to play and go beyond what is required!

Enjoy!