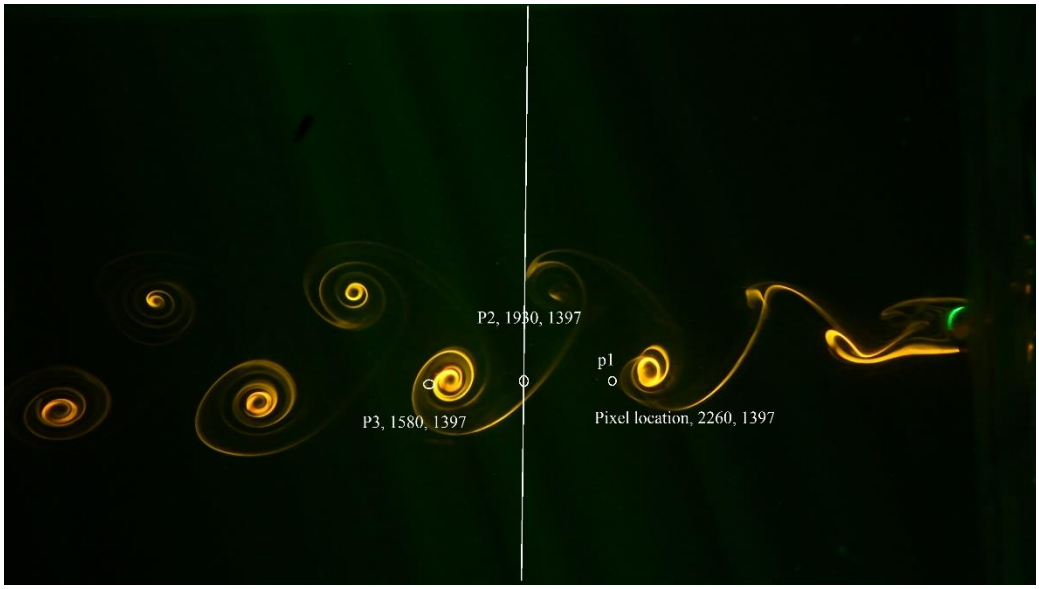
Assignment 2

Measurements and Data Analysis: AE-669

1. Using the hotwire data, plot the normalized autocorrelation function. While plotting, keep the time separation in millisecond. Estimate the integral time scale.

2. Consider the figure given below. First find the normalized correlation of the fluctuating time signal (that can be obtained by subtracting the mean from the instantaneous signal) at P1. Then find the normalized correlation between the signals at points P1 and P2, and the same for the signals at points P1 and P3. Arrange these three plots in one column. Then plot $\Delta\tau$ vs Δx and find the convection velocity of the travelling vortices.



3. Consider the PIV data file (PIVdata.txt) on vortex shedding. These data were acquired at 365 Hz. Total 400 PIV realizations were acquired. The grid size is 100 x 100. There are total 4 columns in the data file. The first, second, third and fourth columns include variables, x, y, U and V. The first 10000 data (that is, row 1 to row 10000 for all columns) correspond to the first PIV realization, the second 10000 data (that is, row from 10001 to 20000 for all columns) corresponds to the second PIV realization, and so on. First calculate the Urms, Umean, Vmean, Vrms at all locations. Then plot the velocity and rms velocity profiles at x= 30 mm but along y direction. Then plot the correlation contours (of r(Δx, Δy)) considering reference point at x=30 mm and y = 0 mm. Then find the time series at points, P1(x=30,y=5), P2(x=33, y=5) and P3(x=36,y=5). the time series of the image intensity (greyscale values) at points P1, P2, and P3. Then find the normalized correlation of the fluctuating u velocity at P1. Then find the normalized correlation of the fluctuating velocity between the points P1 and P2, and between the points P1 and P3. Arrange these three plots in one column. Then plot $\Delta\tau$ vs Δx and find the convection velocity of the travelling vortices.