<div align="center">

Exercise 7
Fuid Dynamics II SS 2022

15.6.2022

</div>

1   Exercise: Wind tunnel measurement

Continue to analyze the datasets in the folder wind_data/LCA, which were measured at 20kHz and in m/s.

- Determine the local energy dissipation rate $\varepsilon(x) = 2\nu \left(\frac{\partial u(x)}{\partial x}\right)^2$, *i.)* by directly calculating the derivative of the velocity field (kinematic viscosity of air is $\nu \approx 0.15 \frac{\text{cm}^2}{\text{s}}$), *ii.)* from the third order structure function $S_3(r)$ using the 4/5-law, and *iii.)* from the energy spectrum $E(k)$ using the prediction of the K41 phenomenlogy.

- Using the result from *i.)*, calculate the scale-resolved energy dissipation rate $\varepsilon_r(x) = \int_x^{x+r} \mathrm{d}x' \varepsilon(x')$.

- Are the probability density functions self-similar?

- Determine a histogram of $\varepsilon_r(x)$ for a few values of r.

- Check whether the histogram follows a lognormal distribution and try to determine the intermittency coefficient from $\sigma(r)^2 = A + \mu \ln \frac{L}{r}$.