

# IC23 I Spring 2022 – Lab 9 – Wind tunnel

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*In this lab you will learn how to interface a digital pressure sensor to Raspberry Pi and to conduct different types of differential pressure measurements*

## Learning outcomes

In this lab, you will learn

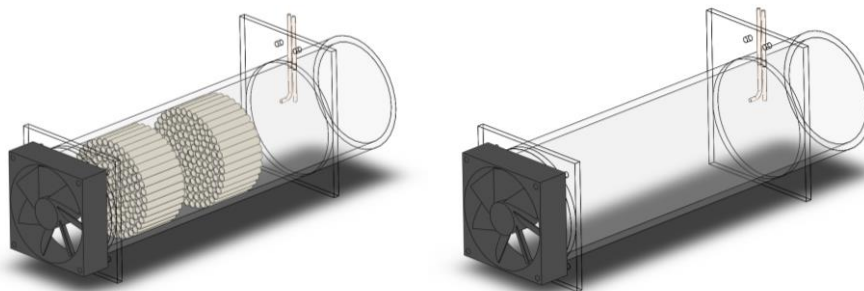
- How to select an appropriate sensor
- How to measure windspeed using the pitot-static-tube principle
- How to characterize a wind-tunnel

## Instructions

This lab is built upon the last lab, where you worked with the differential pressure sensor. This time you will use it to implement a pitot-static tube windspeed sensor with implementation in a wind tunnel.

## Tasks:

1. For the first task, assume we do not have a sensor yet. The goal is to find a differential pressure sensor that enables to measure the wind speed up to 10 m/s using the Pitot-static tube. On that basis, find an analog sensor with the output in Volts. Describe in the report the key features of the sensor and why it was selected.
2. Analyse the function of a flow straightener. Connect the pressure sensor to the two pressure tubes, so that you can measure the difference between stagnation and static pressure. Which tube measures stagnation pressure and which tube measures static pressure? Place the tubes at at least five different locations and create a vertical flow field map with and without the flow straightener. (Hint: You may use this graphs in your report but you may add descriptions. )



3. Determine the power efficiency of the wind tunnel. For this task use a wind tunnel with flow straightener. Measure the input power vs. the wind speed. Determine the point of maximum efficiency. The **maximum voltage supply** on the fans is **7 V**.

**Challenge task:** Place the calibrated Peltier-Element and run it with a constant current so that a cooling effect occurs. Measure with a temperature sensor the cooling when there is now wind flow and for three different wind speeds. What dependency of wind speed and temperature do

you expect? What do you observe? Record the data and derive an explanation to explain your observations.

### Tasks completion criteria:

1. Select one analog sensor
2. Measured the flow profile of both tunnels
3. Acquire the raw data with different data points for efficiency measurement