ITS3 plenary Tuesday 14th February 2022

BBM3: PRELIMINARY EXPERIMENTAL AND CFD RESULTS

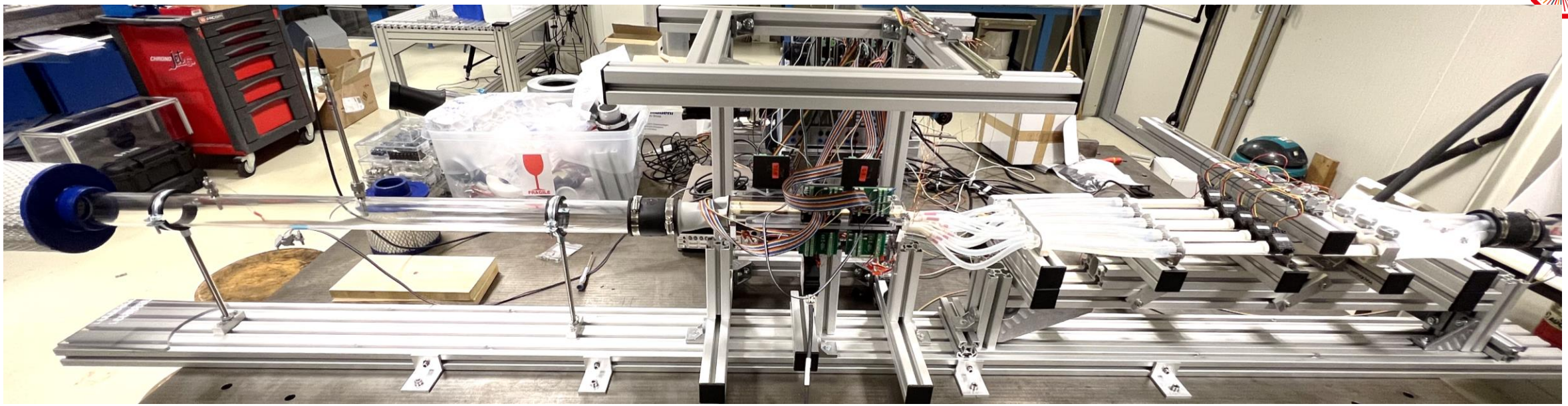
Aitor Amatriain

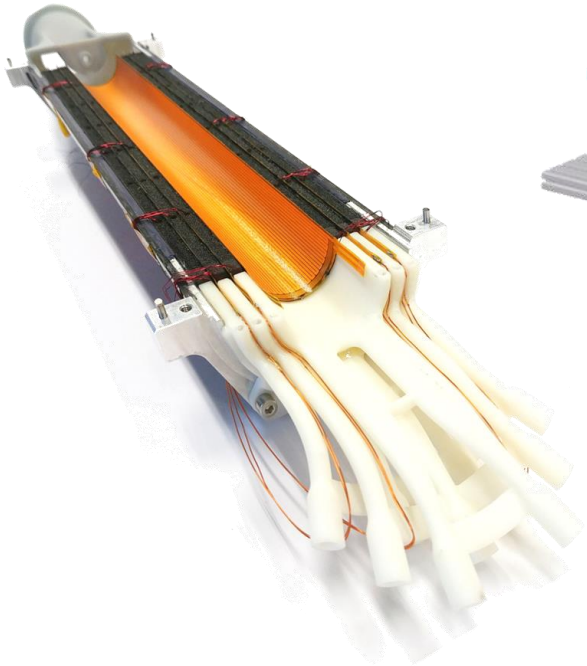
Outline

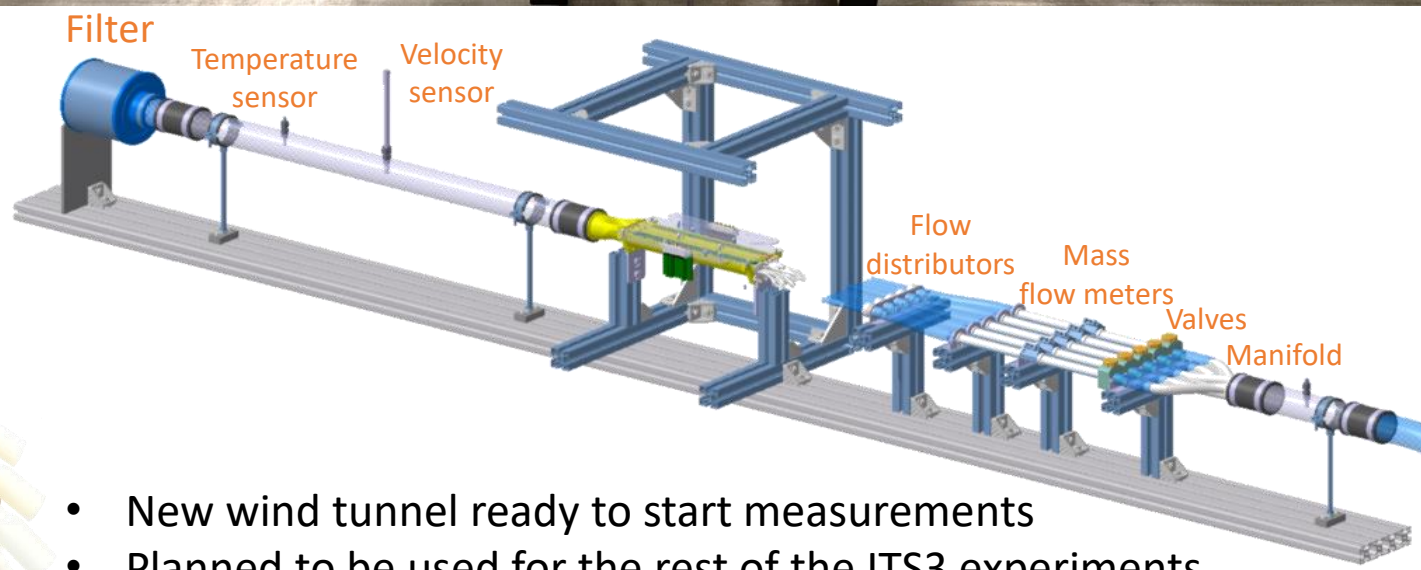
BBM3

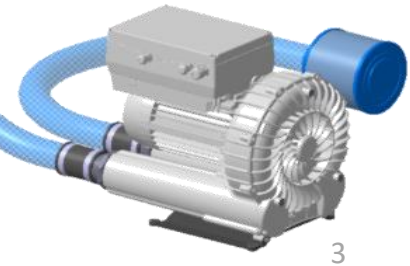
- **BASELINE CASE: COMPARISON OF EXPERIMENTS WITH CFD**
- **INFLUENCE OF THE POWER DISSIPATION IN THE PERIPHERY**
- **FUTURE WORK**

BBM3: Overview





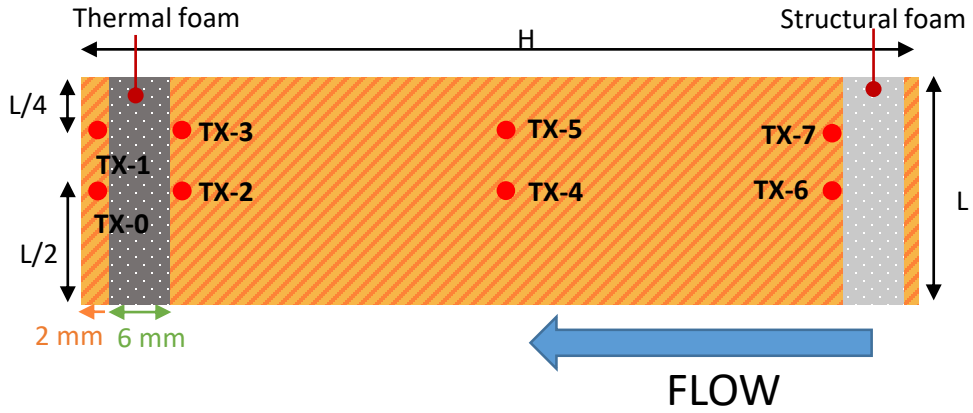




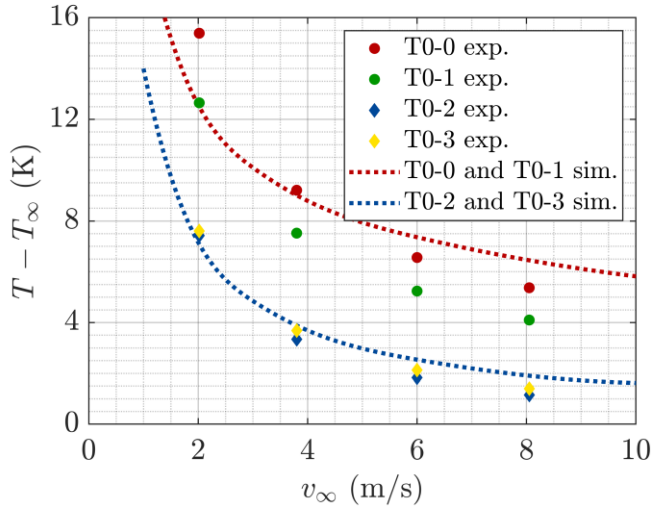
- New wind tunnel ready to start measurements
- Planned to be used for the rest of the ITS3 experiments
- First checks of the sensors and leaks done
- First thermal results expected next week

COMPARISON OF EXPERIMENTAL DATA WITH CFD: PERIPHERY

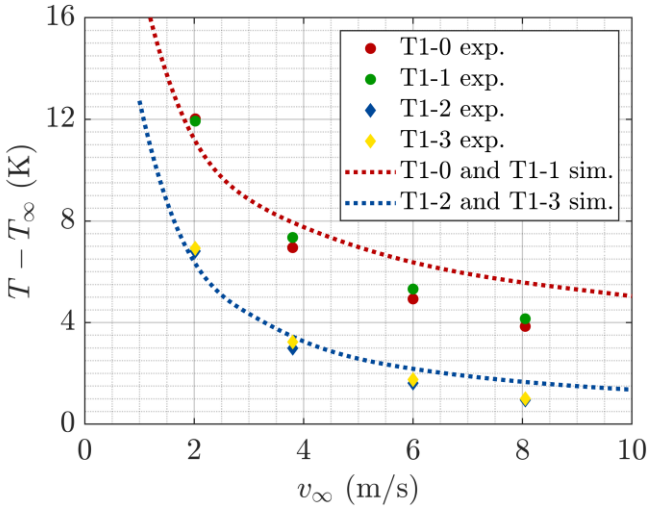
- $q_m = 25$ mW/cm^2, $q_p = 1000$ mW/cm^2



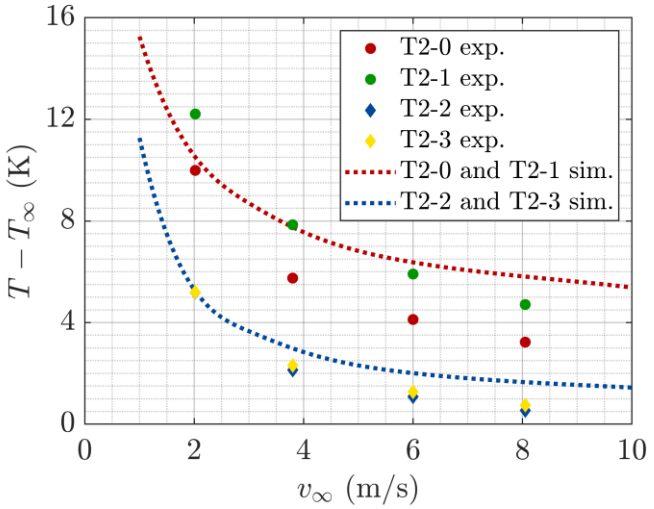
Temperature variation in sensors TX-0, TX-1, TX-2, and TX-3



Layer 0



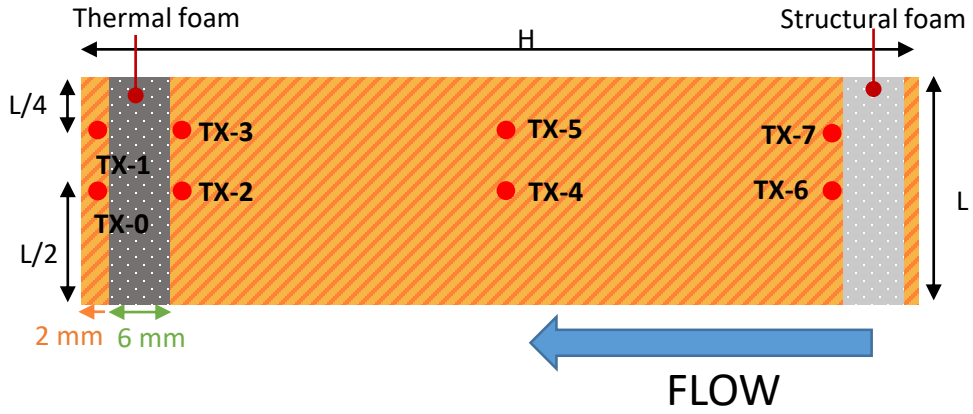
Layer 1



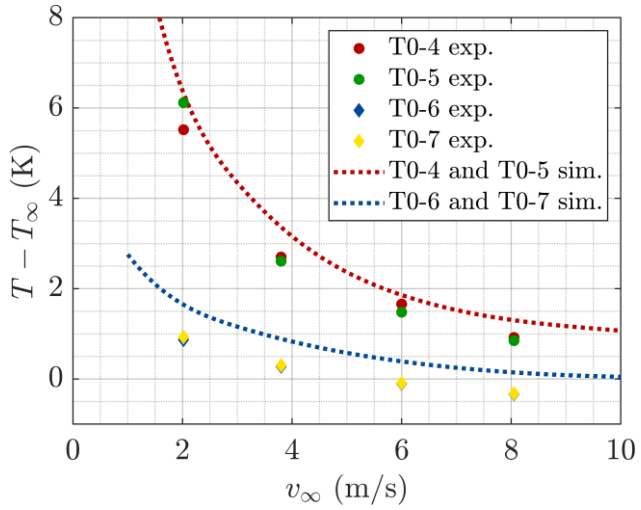
Layer 2

COMPARISON OF EXPERIMENTAL DATA WITH CFD: MATRIX

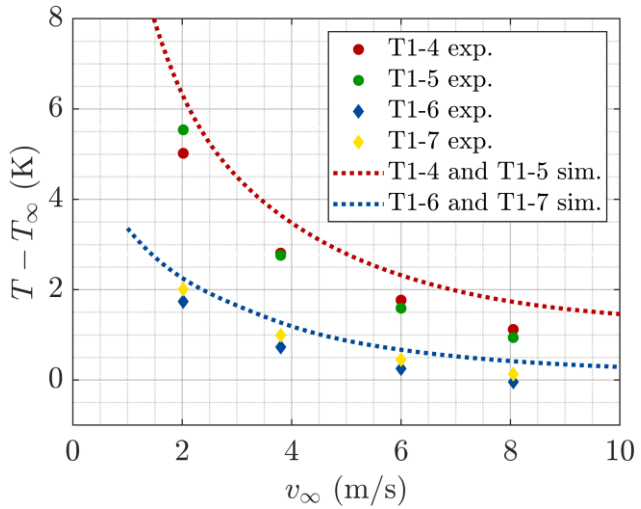
- $q_m = 25$ mW/cm^2, $q_p = 1000$ mW/cm^2



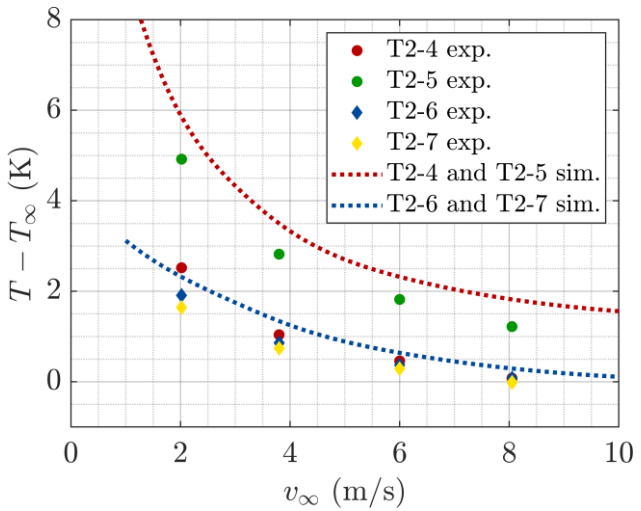
Temperature variation in sensors TX-4, TX-5, TX-6, and TX-7



Layer 0



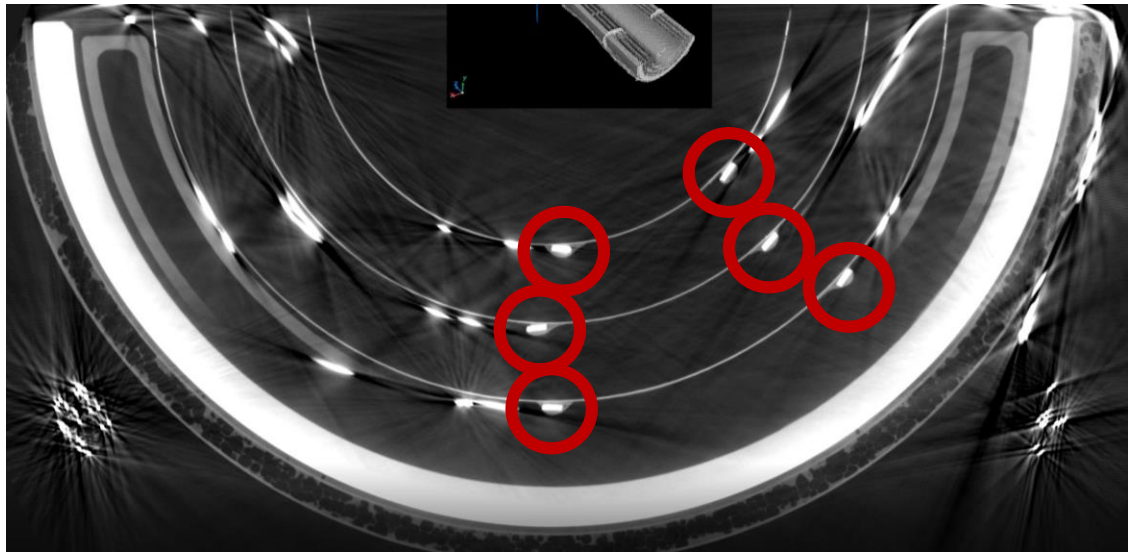
Layer 1



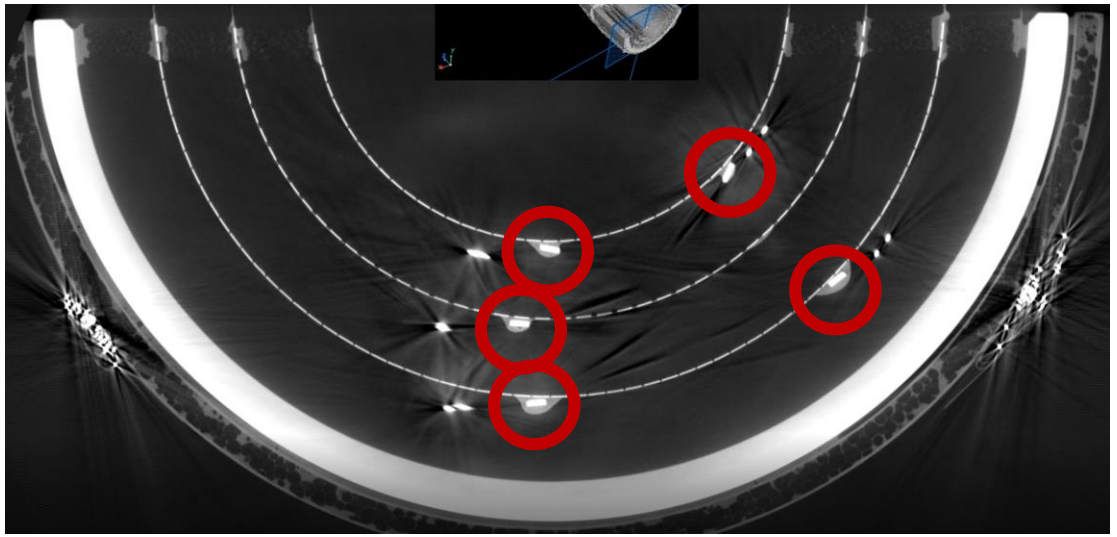
Layer 2

- CFD overpredicts the temperature differences in all cases
- **Negative ΔT in some of the experiments!!**

COMPARISON OF EXPERIMENTAL DATA WITH CFD: DISCREPANCIES



TX0 and TX1 temperature sensors



TX6 and TX7 temperature sensors

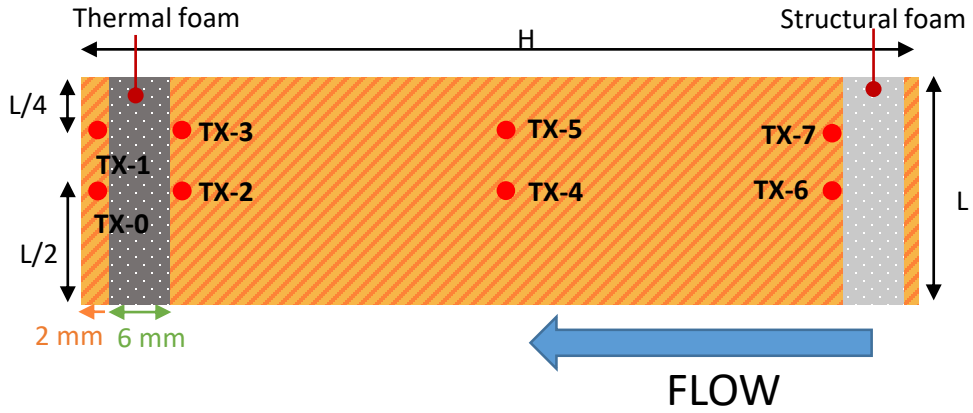
- The sensors are covered by a glue layer (not considered in the CFD)
- The contact surface is not flat, which adds additional thermal resistance

Reasons of negative ΔT

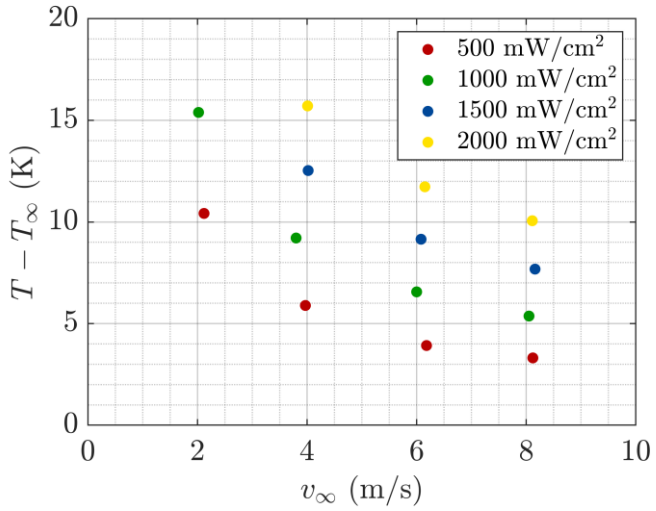
- Accuracy of the temperature sensors. With the experiment not running, there are differences of up to 0.6 °C between the 24 sensors
- Differences in time scales. The inlet temperature (due to the heating of the room caused by the fan) changes faster than the TX6 and TX7 sensors.

INFLUENCE OF POWER DISSIPATION IN THE PERIPHERY (EXPERIMENTS)

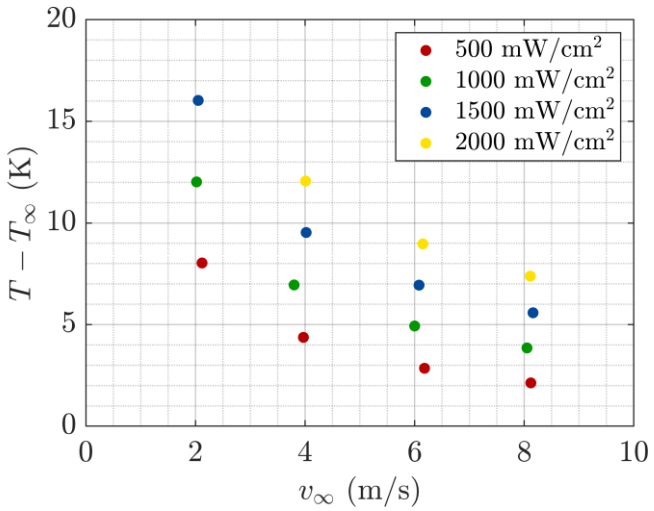
- $q_m = 25$ mW/cm^2,
- $q_p = 1000$ mW/cm^2



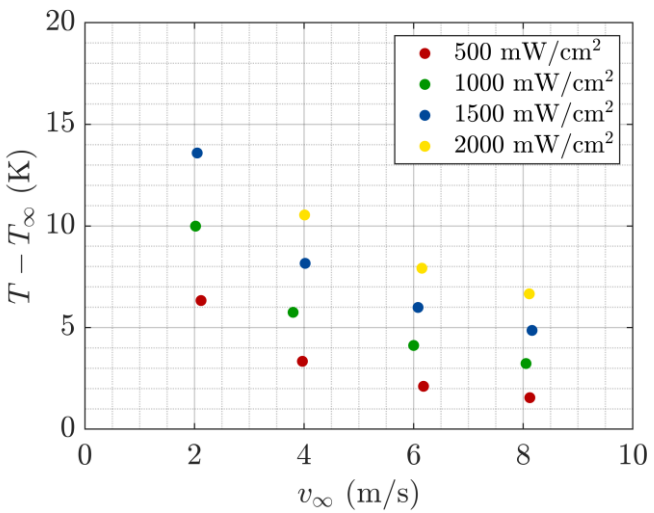
Temperature variation in TX-0 sensor (maximum among all sensors)



Layer 0



Layer 1



Layer 2

- $\Delta T_{max} \sim q_p$ as expected from previous analyses

FUTURE WORK

- Influence of the power dissipation in the beam pipe
- Vibrations generated by the air flow (laser displacement sensor).