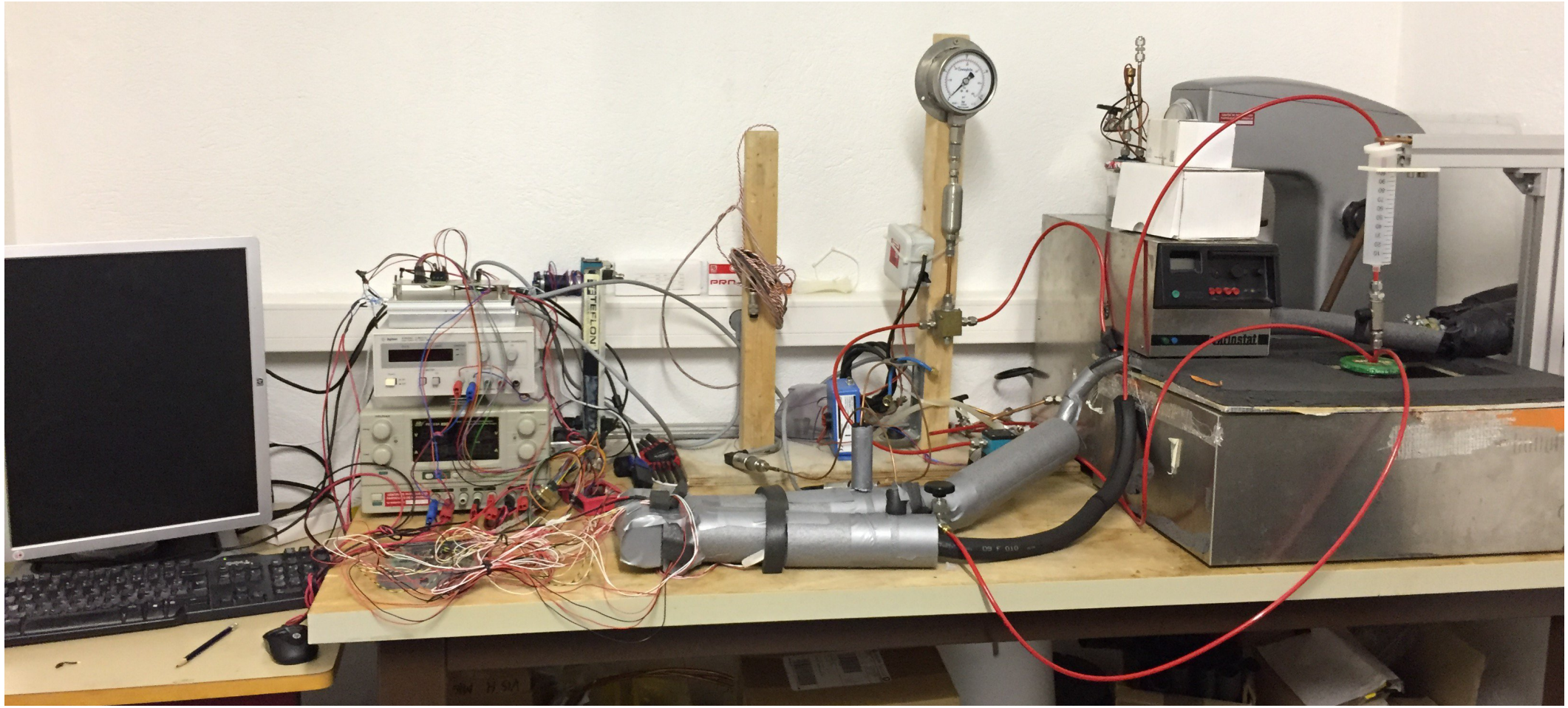
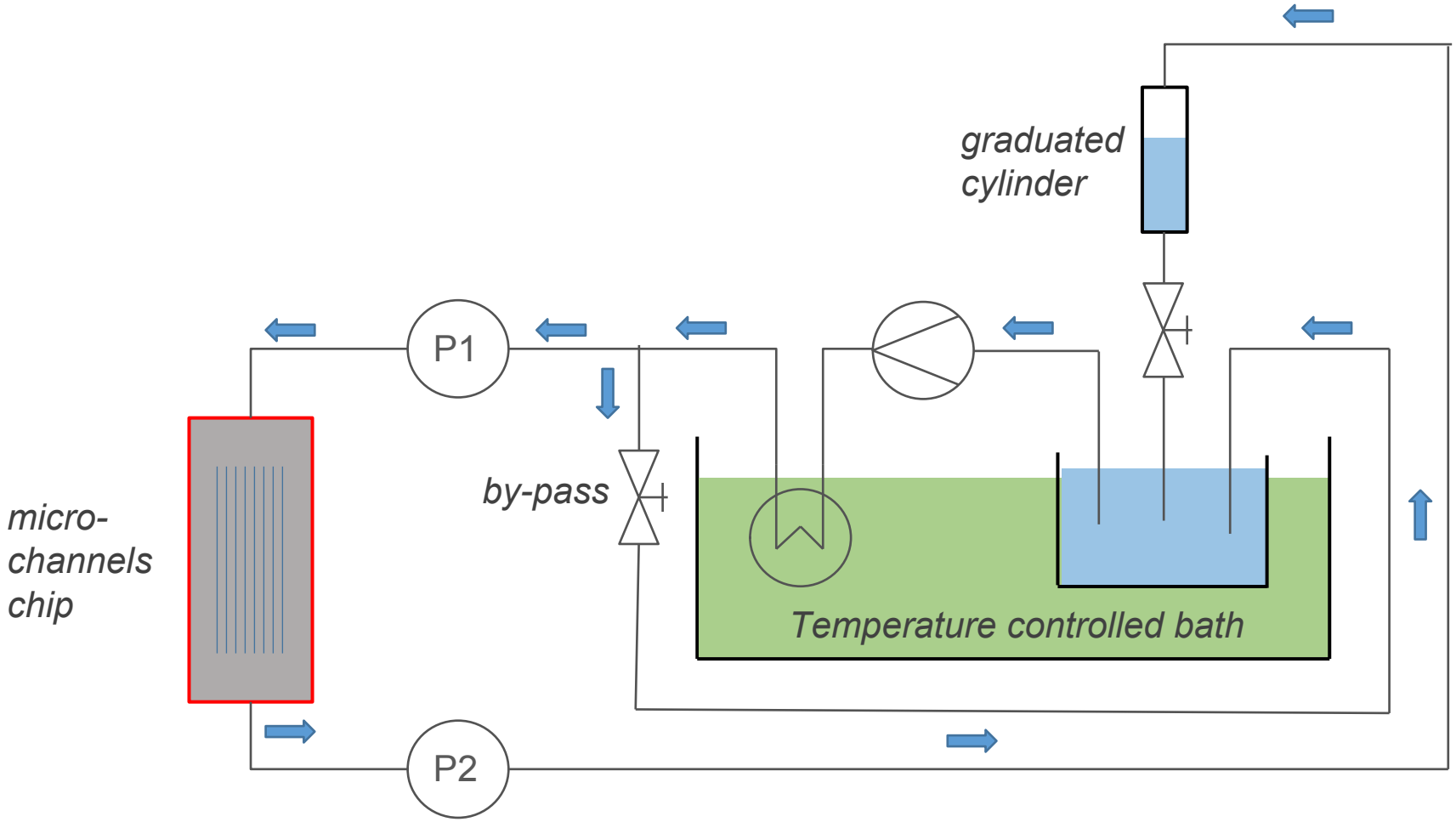
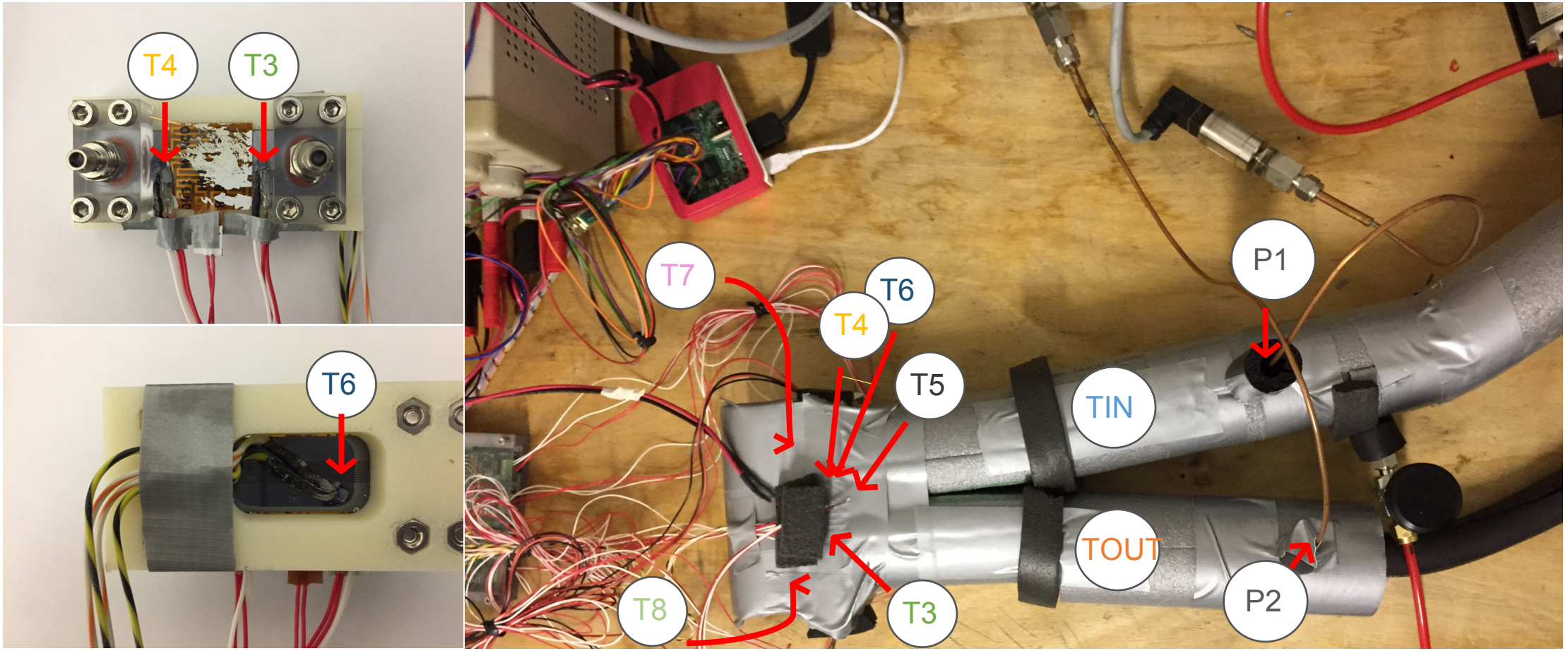
Report on thermal and flow measurements performed on 12/12/2019



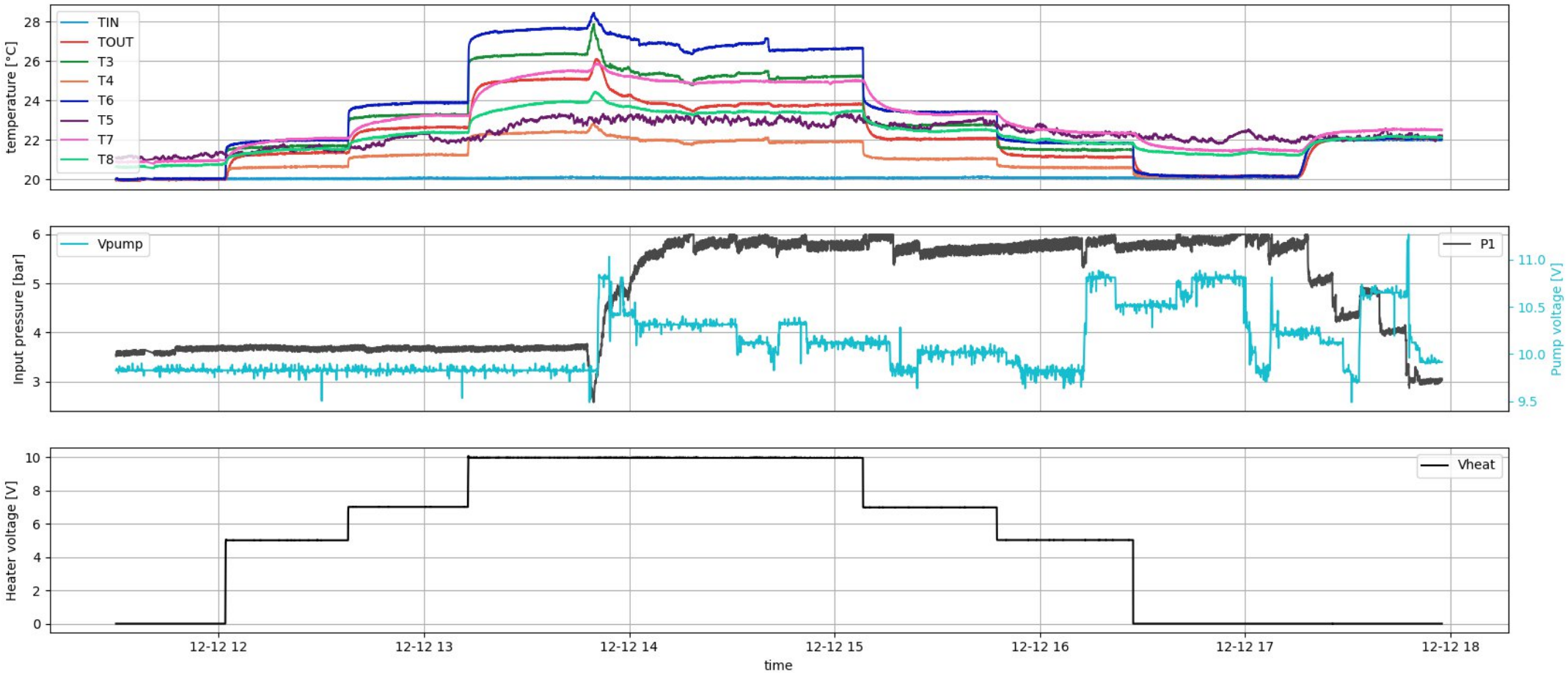
Process flow



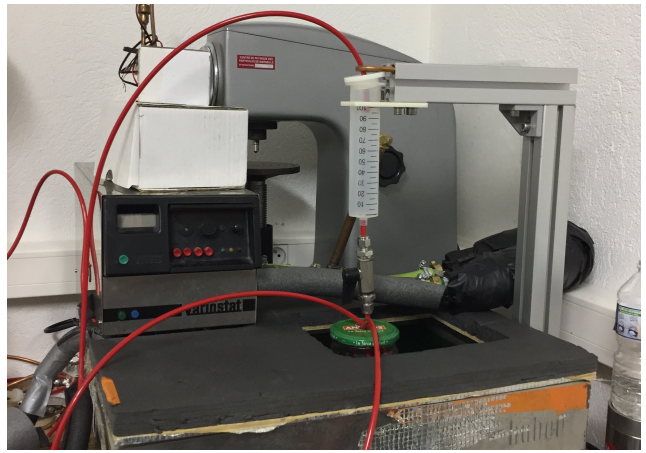
Setup



Data taking : recorded sensors and supplies

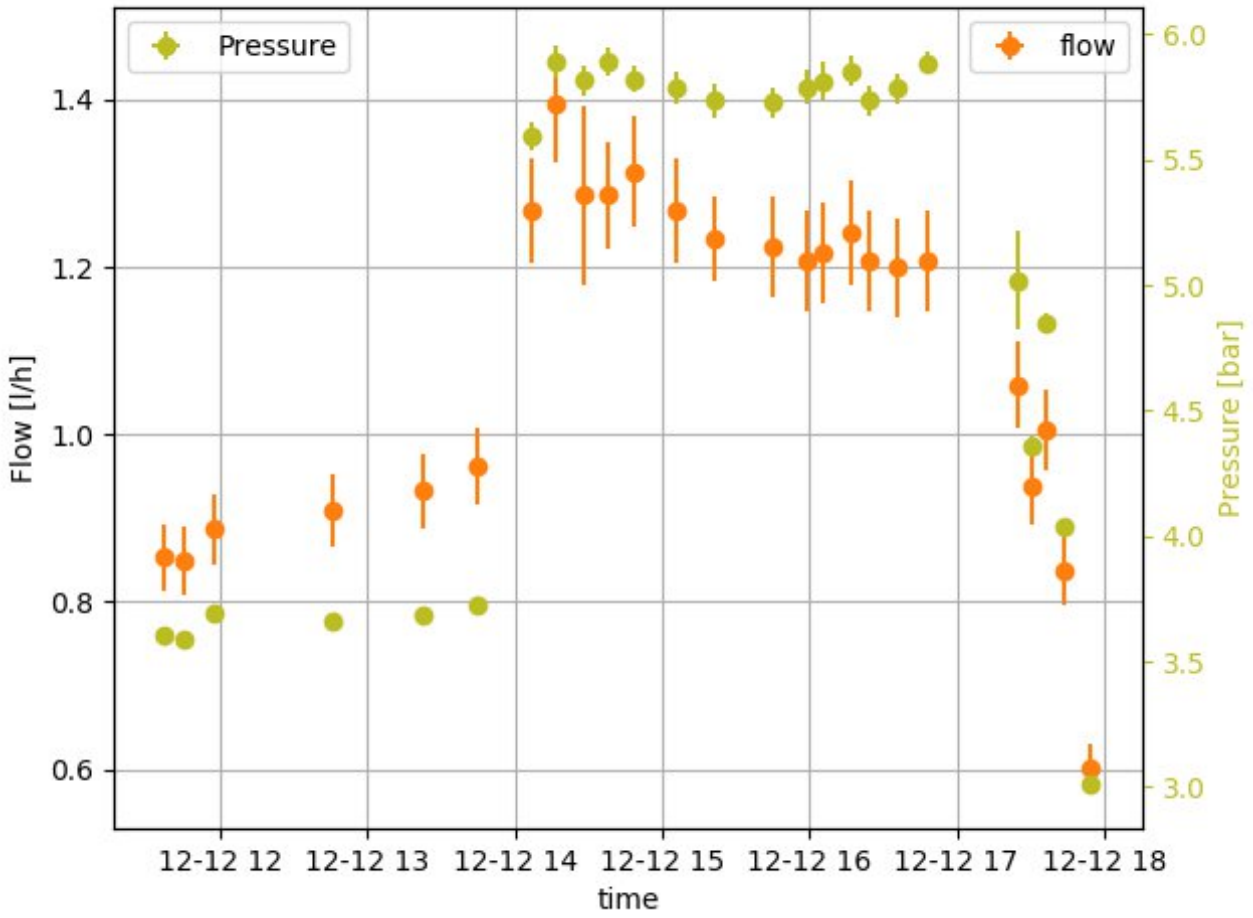


Flow rate : measurements



Measurements performed 'manually'

- count time taken to fill a volume between 2 graduations
- typically :
  - 50 ml (6.2cm) in few minutes
  - uncertainty: ~5% (=~$\sqrt{2}\times 0.2/6.2$)



Flow rate : -VS- pressure

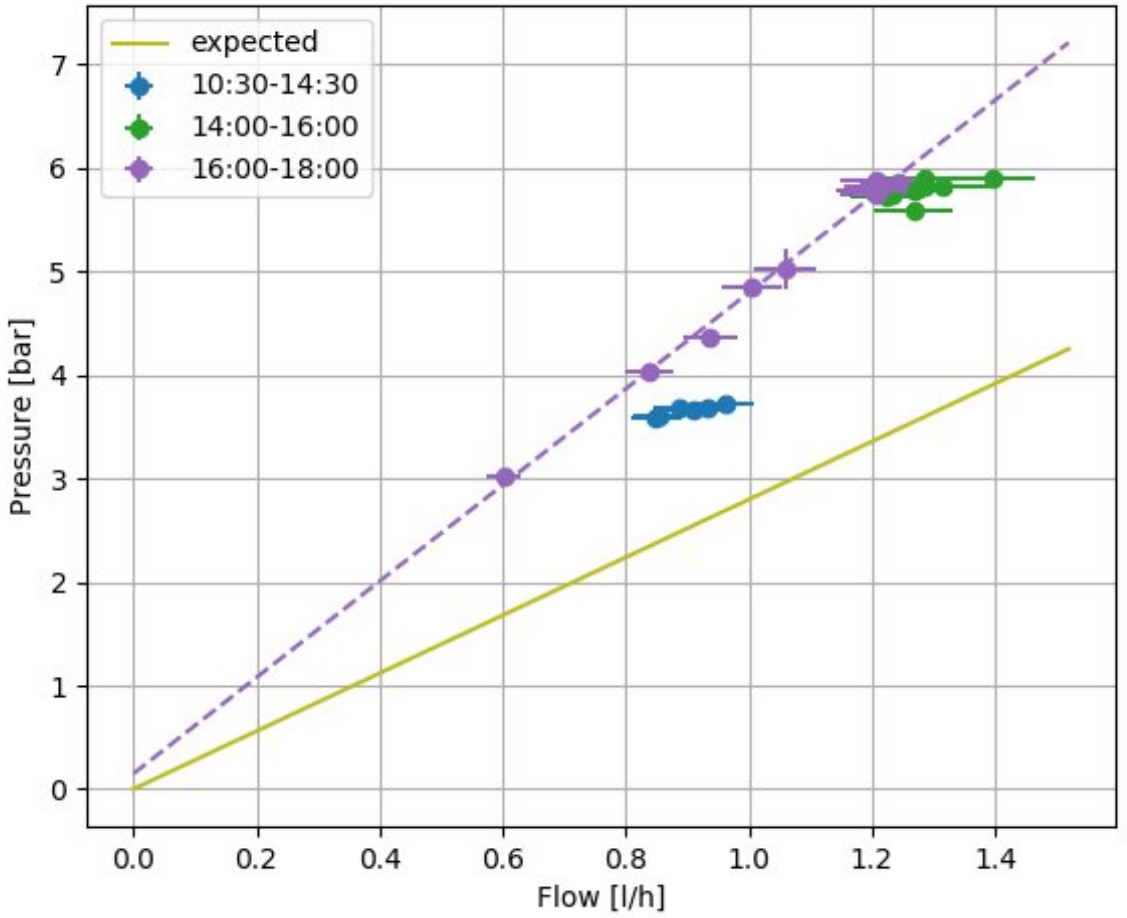
Expected:

- laminar water flow in 10 channels of 70µm $\times$ 200µm $\times$ 4.5cm

  Pressure drop $\propto$ Flow rate

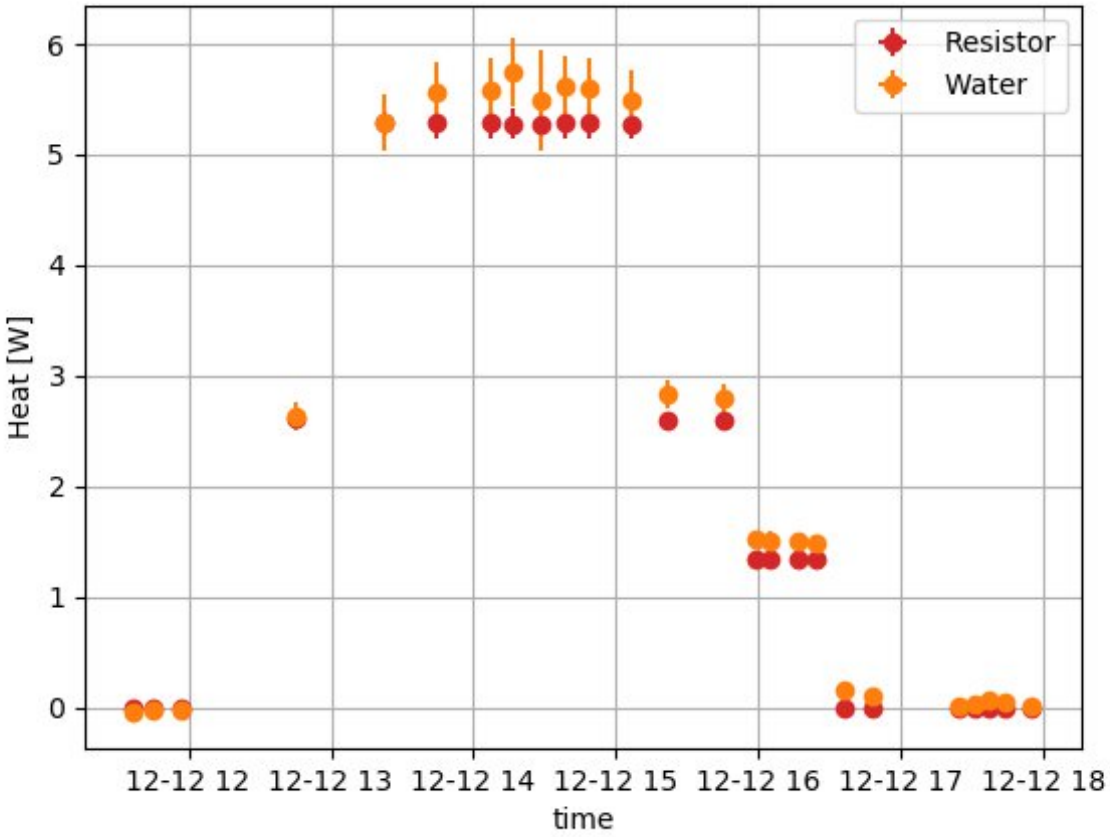
- pressure drop in the connectors not accounted for

Inconsistency between measurements ?

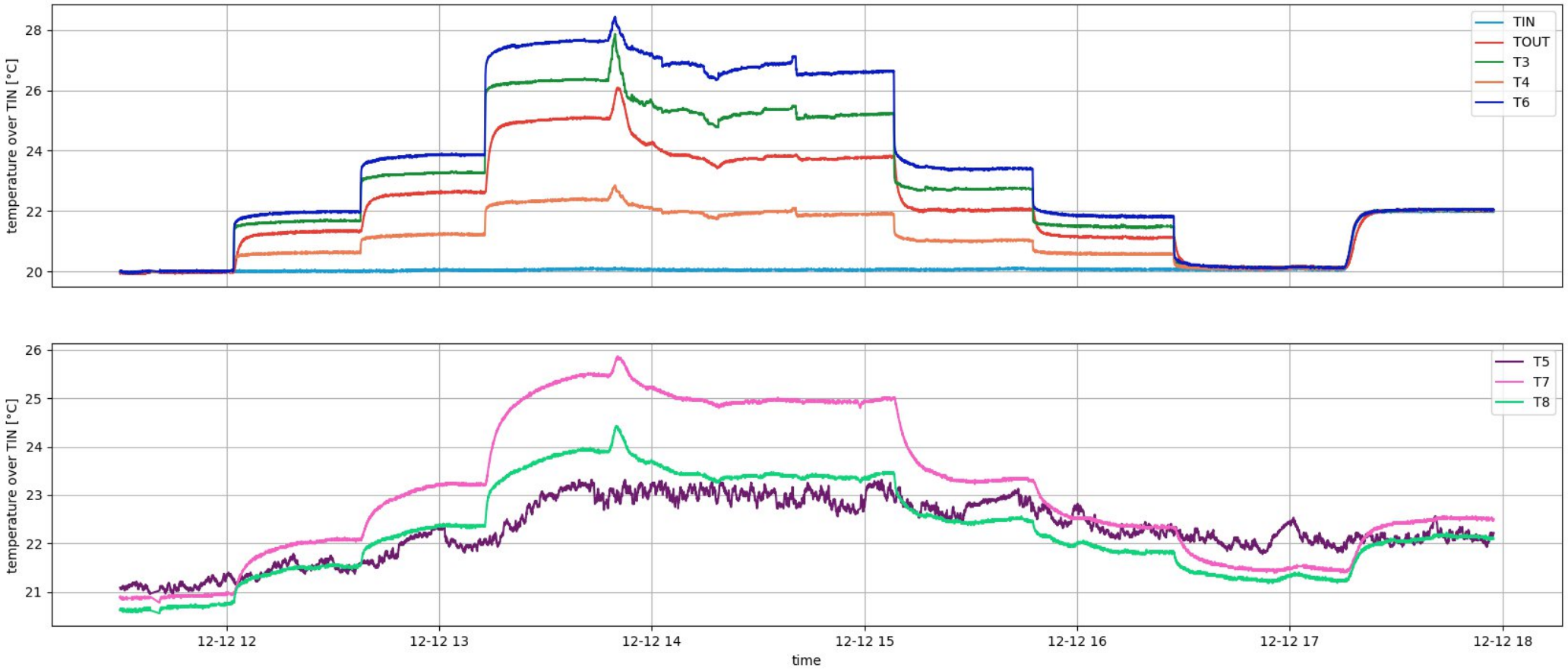


Heat : absorbed and dissipated

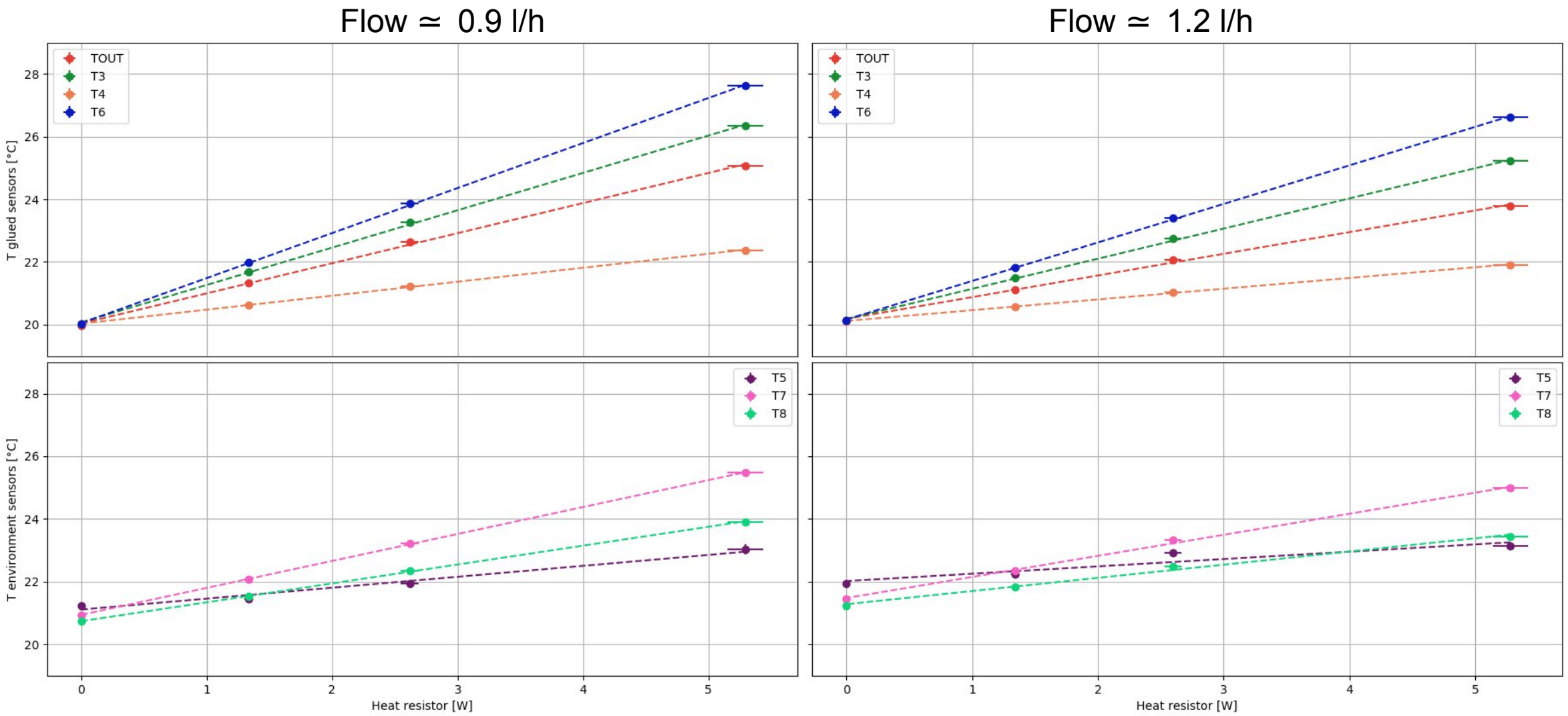
- Dissipated heat :
  - $Q_{resistor} = U^2/R$
  - $R = (18.8 \pm 0.5)\ \Omega$
- Absorbed heat :
  - $Q_{water} = (TOUT - TIN) \times flow \times c_p \times \rho$
- (More than ?) 100% of the dissipated heat is absorbed by the coolant ?



Temperature : measurements



Temperature : -VS- Heat



Conclusion

- Puzzling flow-VS-pressure behavior
  - not easy to get a stable pressure
  - need for a more controlled flow ?
  - should we also try to record the pump power (current intensity)
  - note: a proper flow-meter has been ordered -> should help to understand
- Lack of a proper model to understand both the thermal and flow behavior
- Next ?