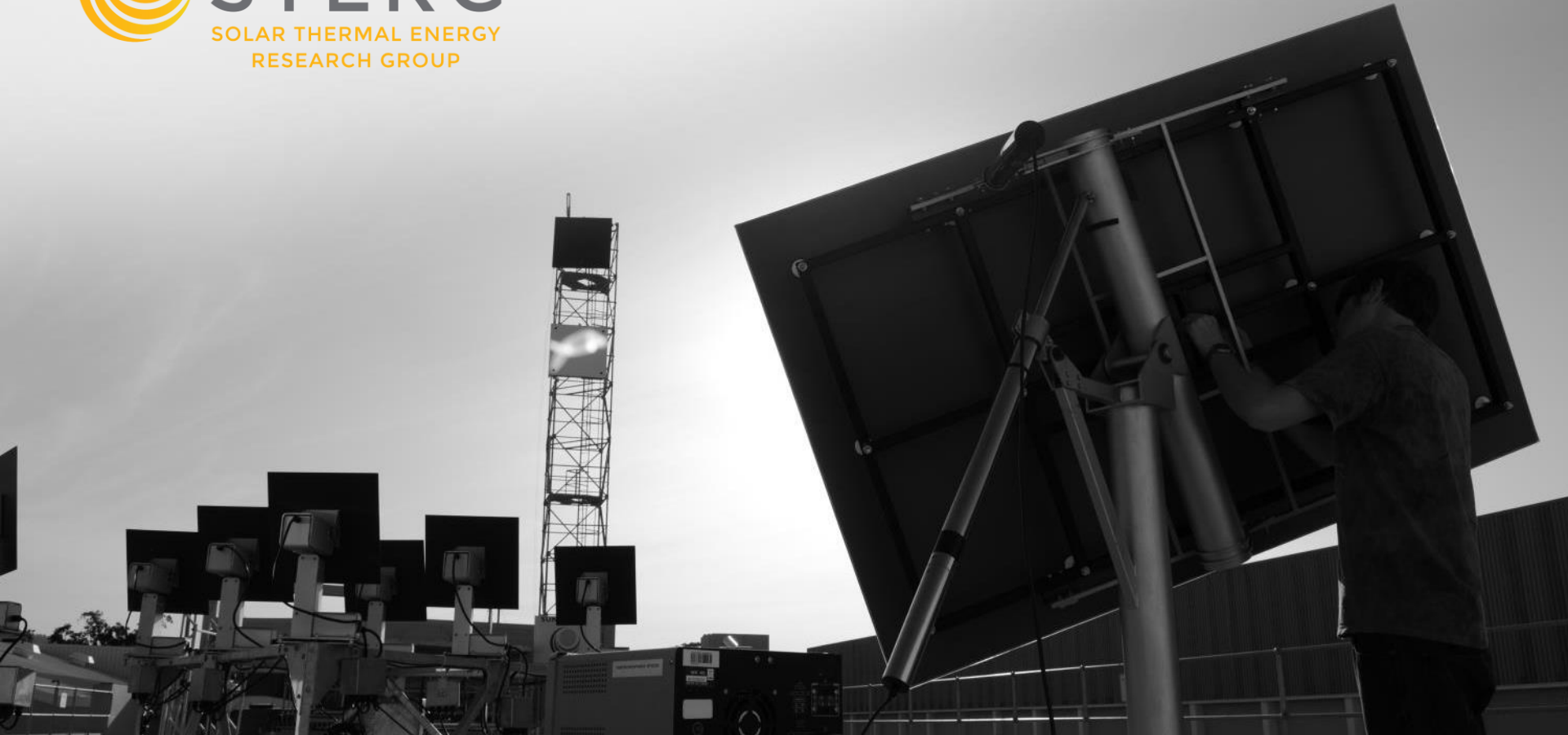




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SOLAR THERMAL ENERGY
RESEARCH GROUP



Improving the heat transfer characteristics of the SCRAP receiver using helical swirled fins

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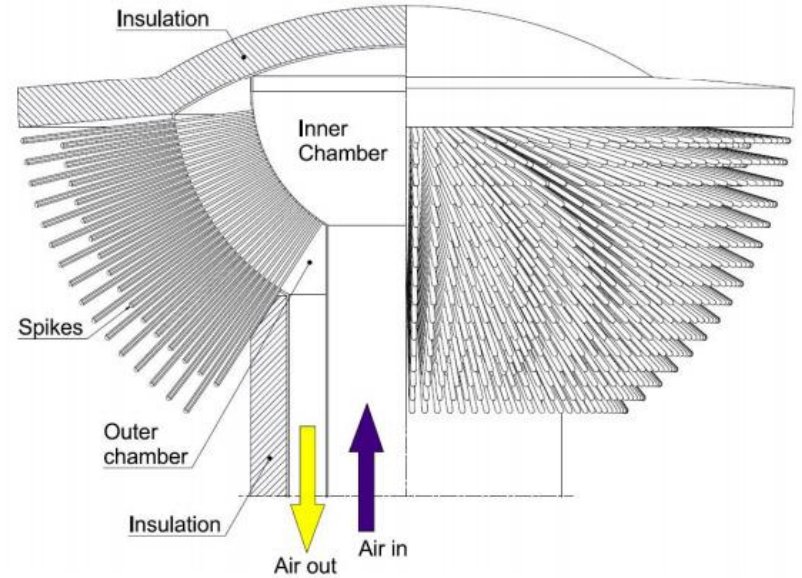
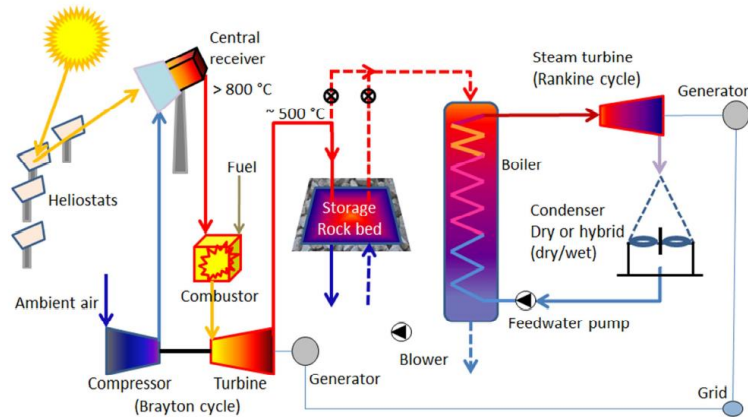
^bCentre for Renewable and Sustainable Energy Studies (CRSES),
University of Stellenbosch

Introduction

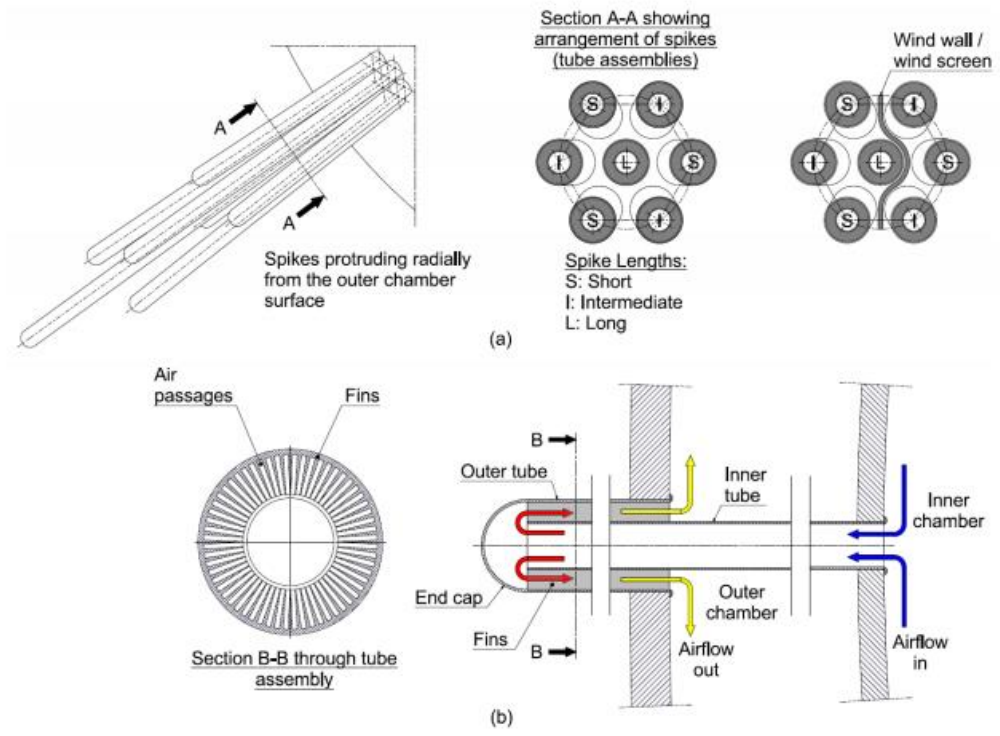


Motivation

- SUNSPOT system
- SCRAP system

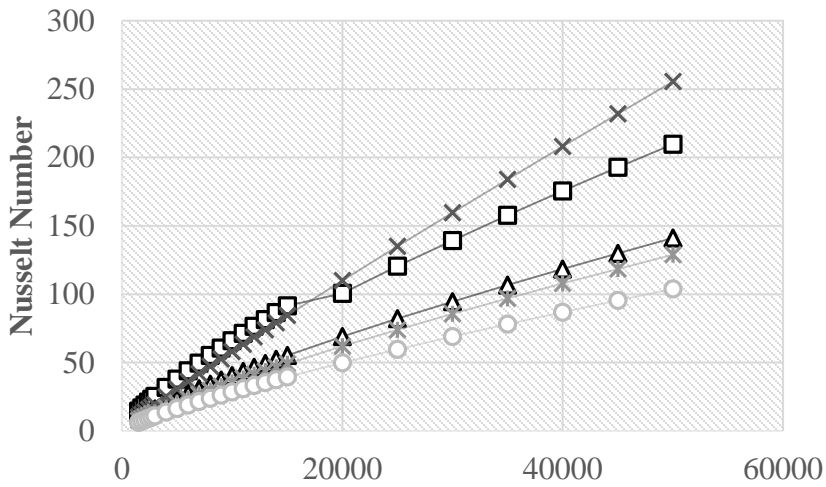


Introduction

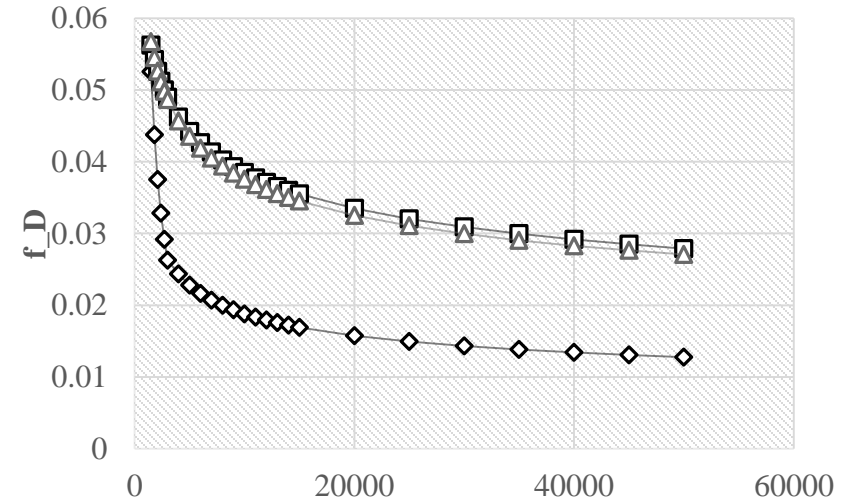


Comparison of Empirical Correlations ◀ ▶

Graphs



- Kakac
- ×— Xin and Ebadian
- Straight
- △— VDI
- *— Kaya and Teke

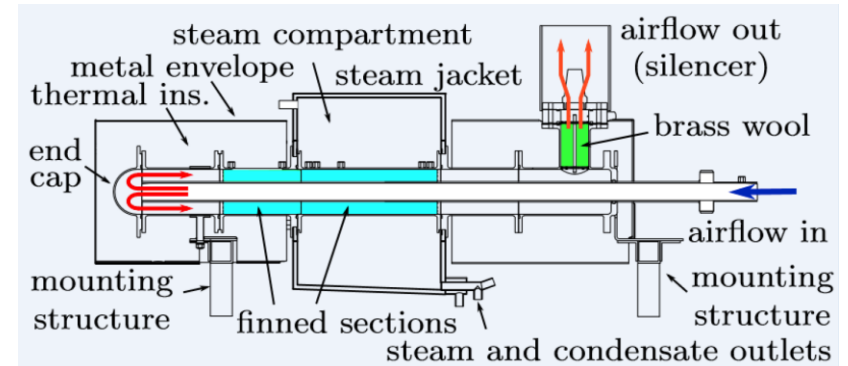
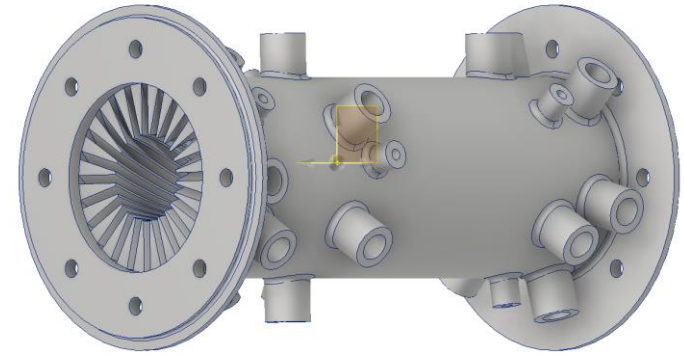


- ◇— Straight
- Kakac
- △— VDI

Experimental setup



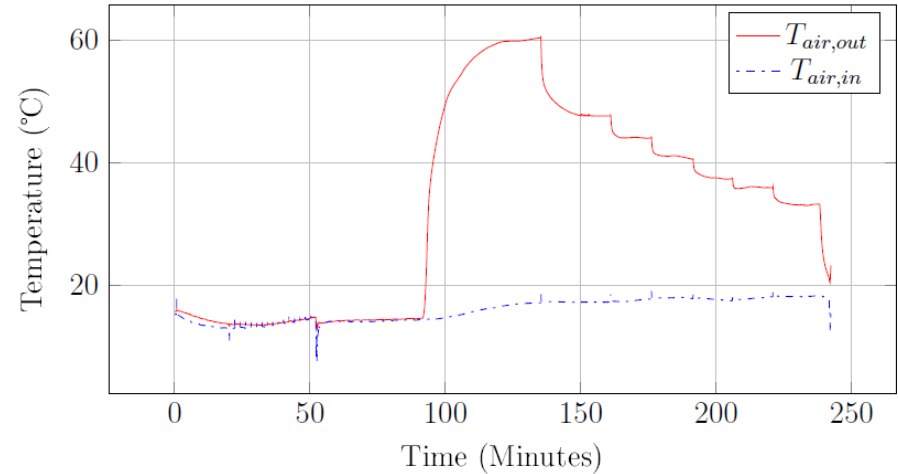
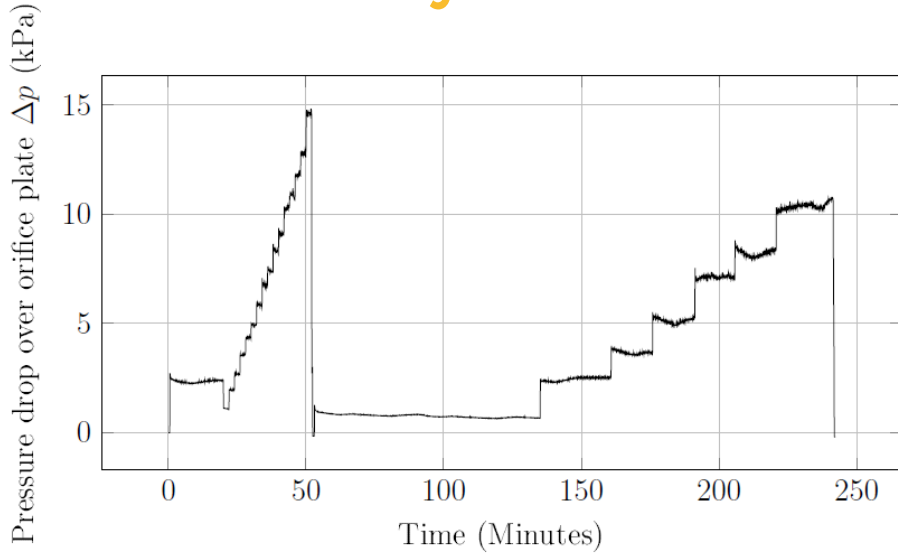
- 200mm Test section
- Selective laser sintering used
- One full turn
- 24 Thermocouples
- 9 Pressure taps



Experimental setup



Preliminary results



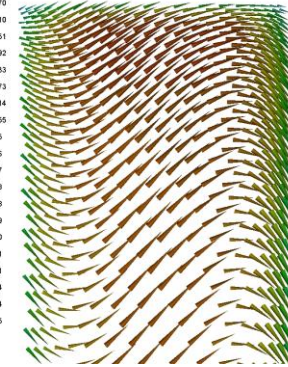
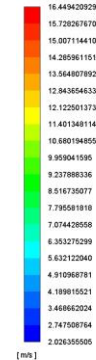
Numerical Simulation

Results and findings

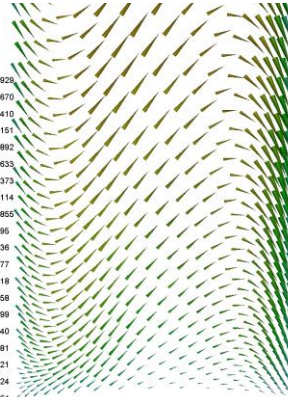
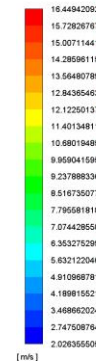
- Secondary flow pattern at different positions downstream of the inlet
- Nusselt number



U-Secondary-Row
Velocity Magnitude



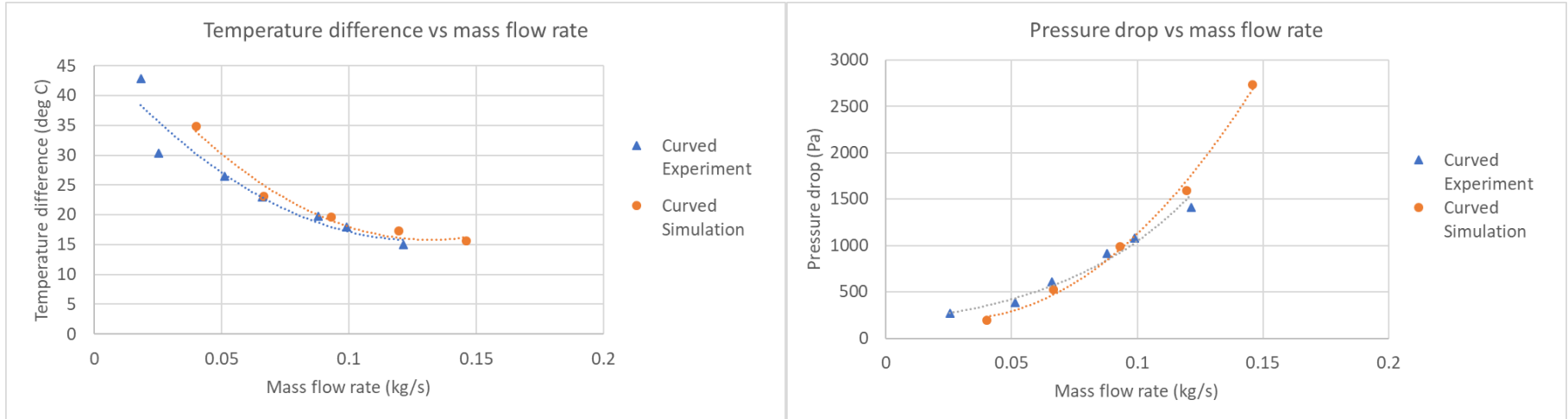
U-Secondary-Row
Velocity Magnitude



Critical Comparison



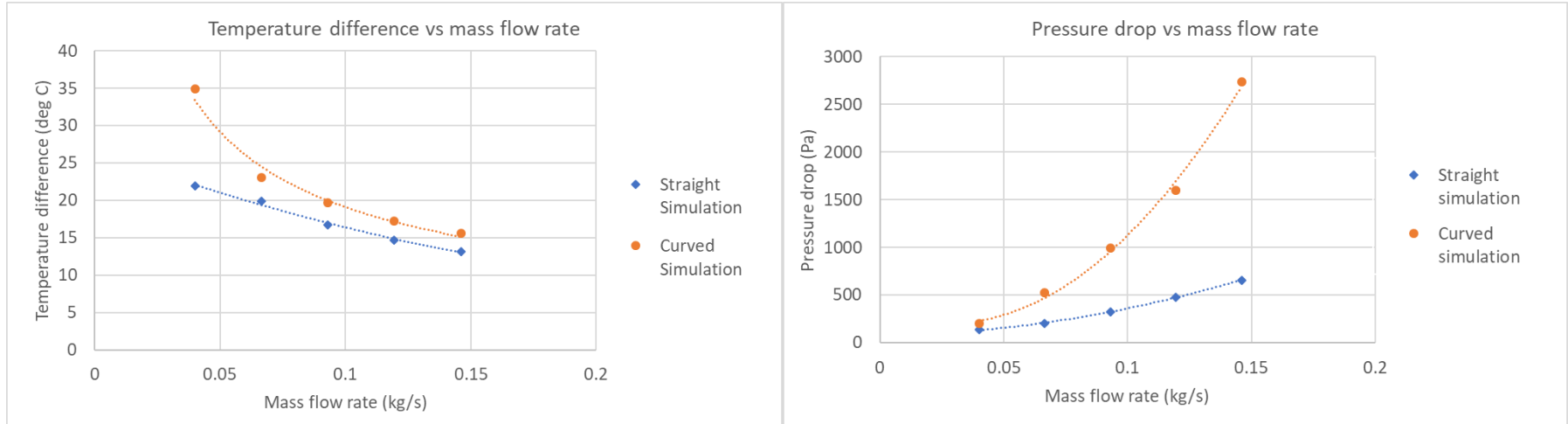
Experiment vs Simulation



Critical Comparison



Curved duct simulation vs Straight duct simulation



Conclusion



- Confirmation of numerical model through experimentation
- Numerical simulations of straight and curved ducts show heat transfer improvement
- Large pressure drop at high mass flow rates

Further research



- Simulate design point conditions
- Simulate different swirl angles
- Simulate different materials

ACKNOWLEDGEMENTS:

Prof TW von Backström and
Dr M Lubkoll

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