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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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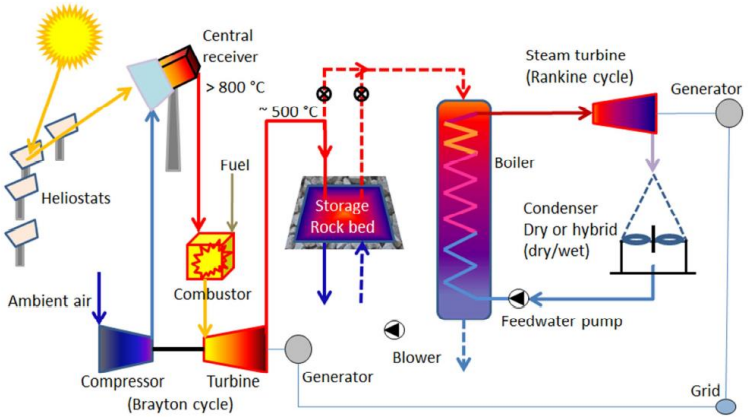
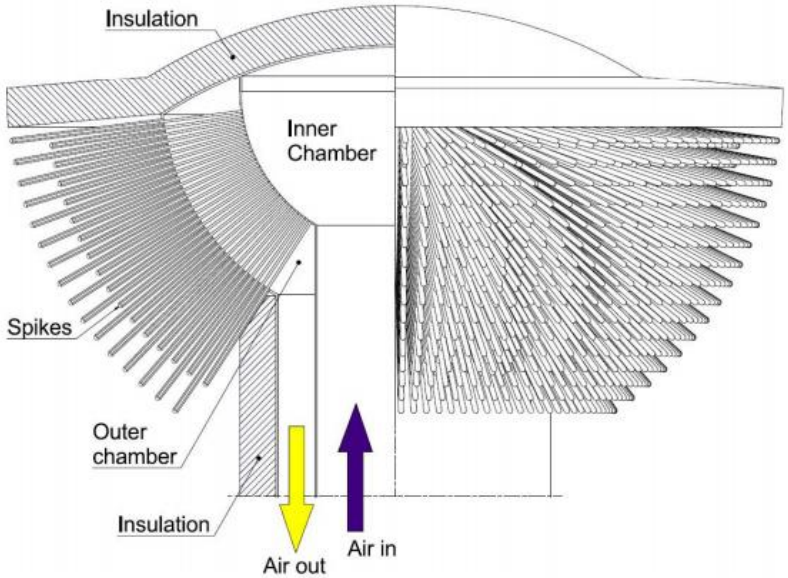
Introduction

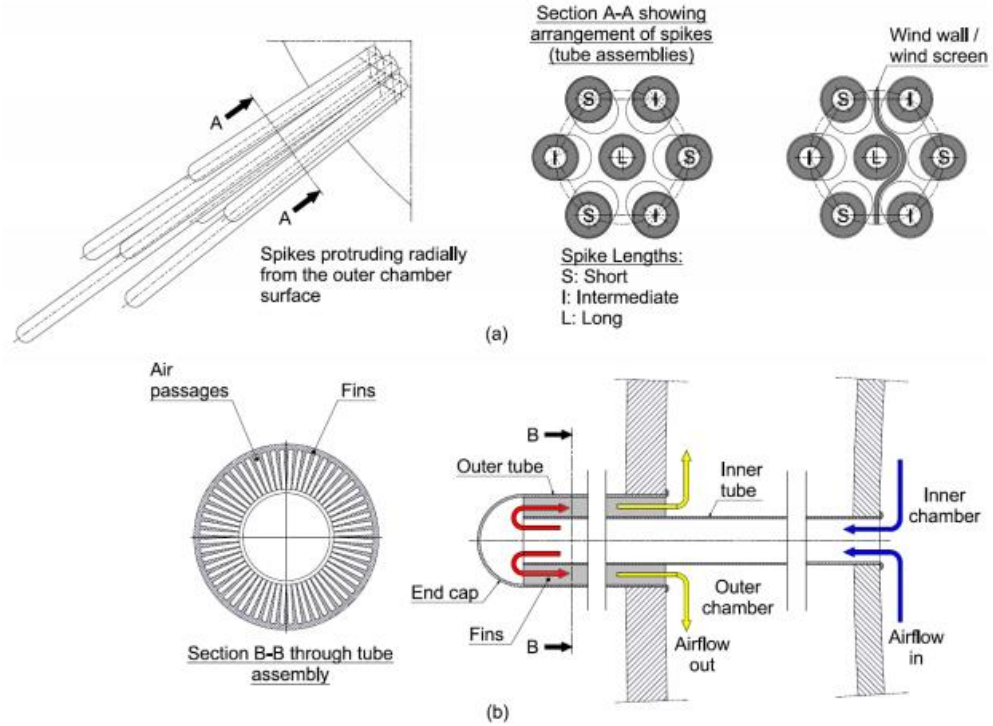
Motivation

- SUNSPOT system
- SCRAP system



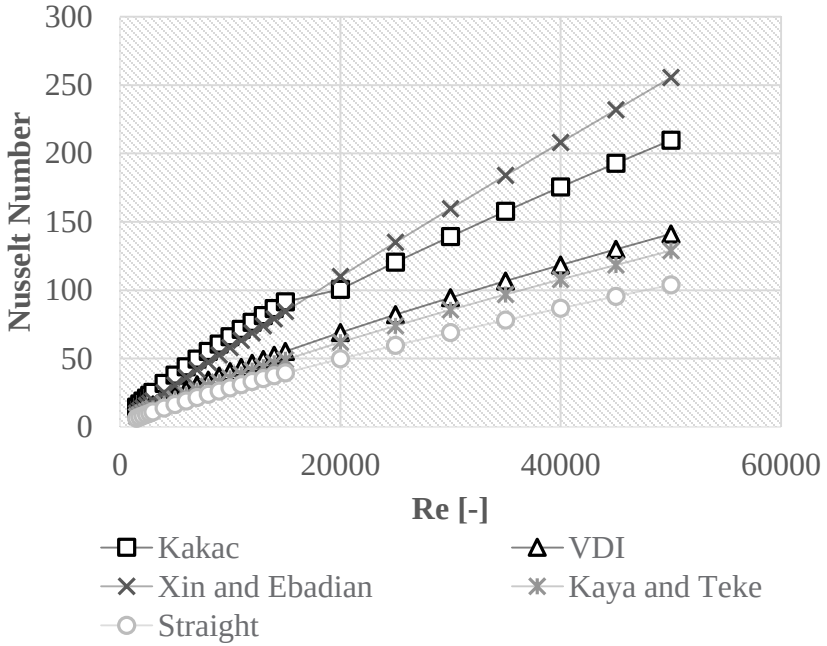


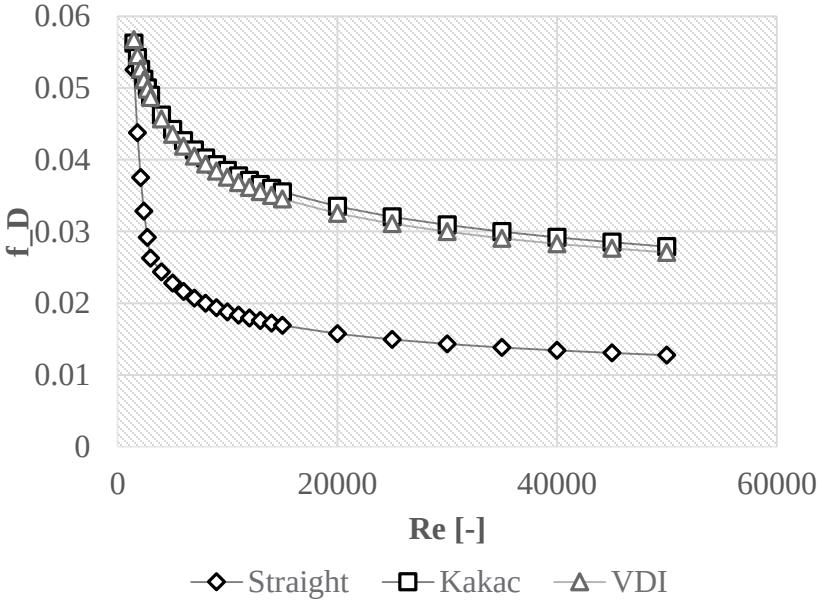
Introduction



Comparison of Empirical Correlations

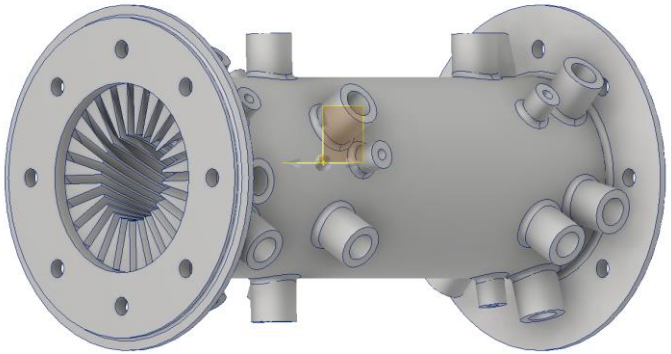
Graphs

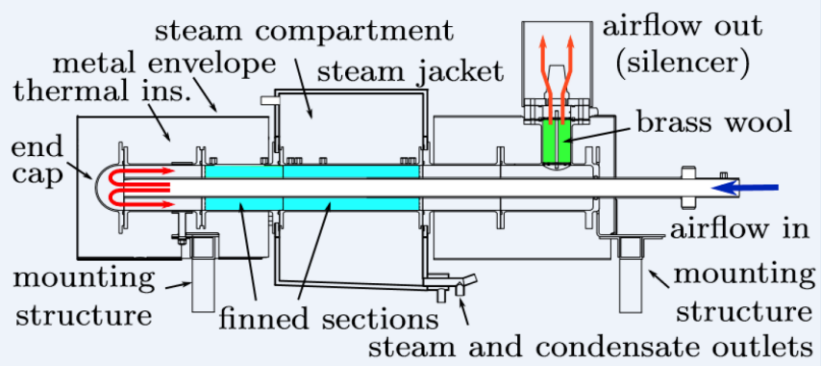




Experimental setup

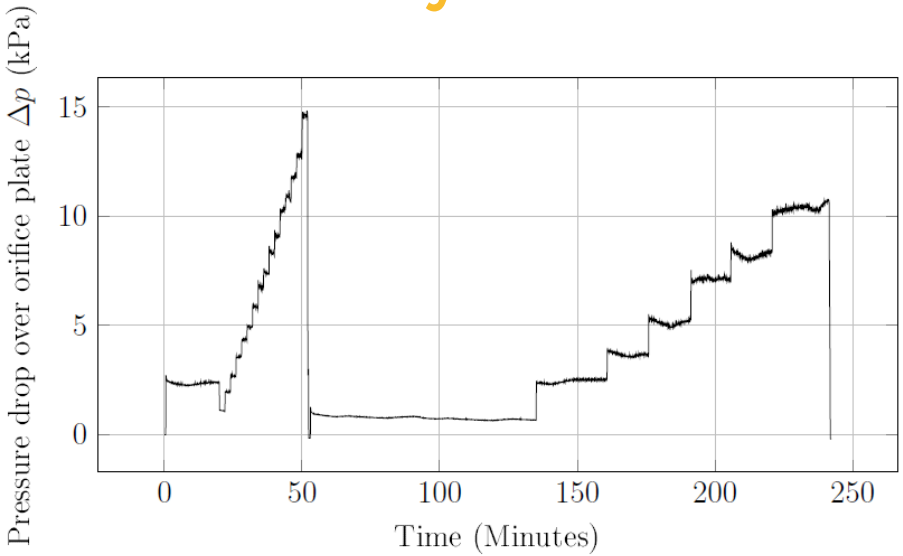
- 200mm Test section
- Selective laser sintering used
- One full turn
- 24 Thermocouples
- 9 Pressure taps

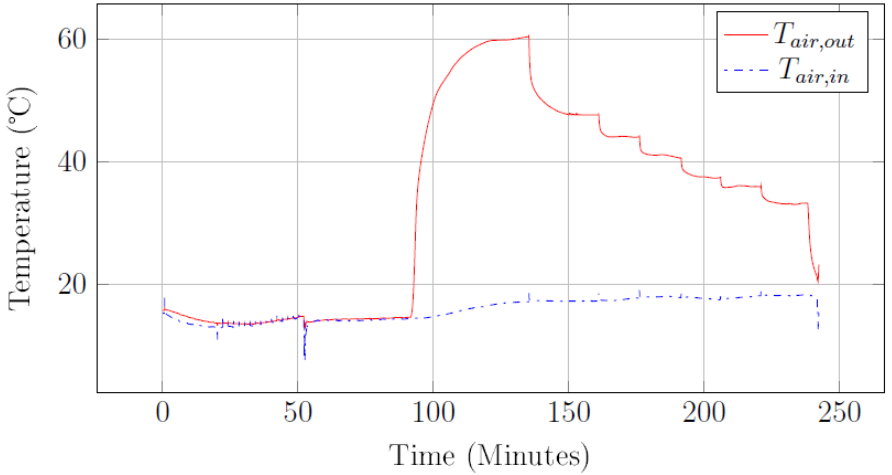




Experimental setup

Preliminary results



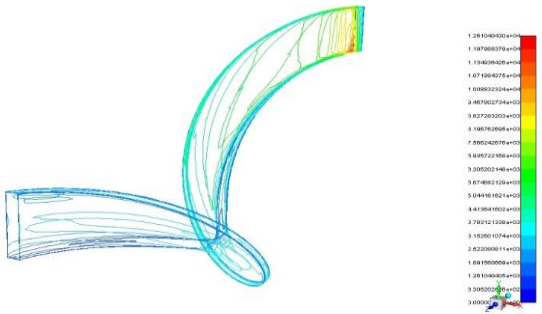


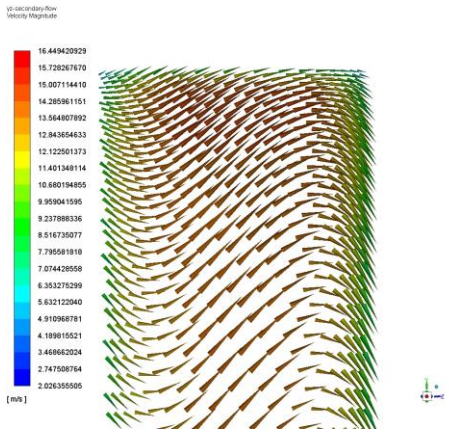
Numerical Simulation

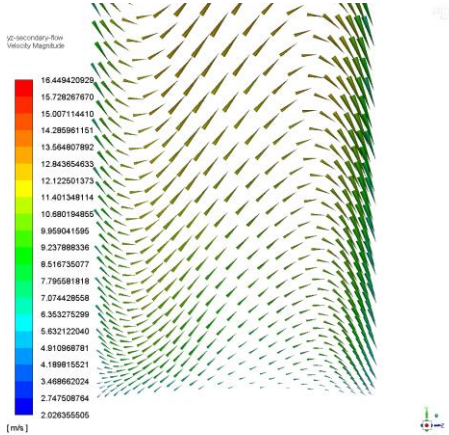
Results and findings

- Secondary flow pattern at different positions downstream of the inlet

- Nusselt number

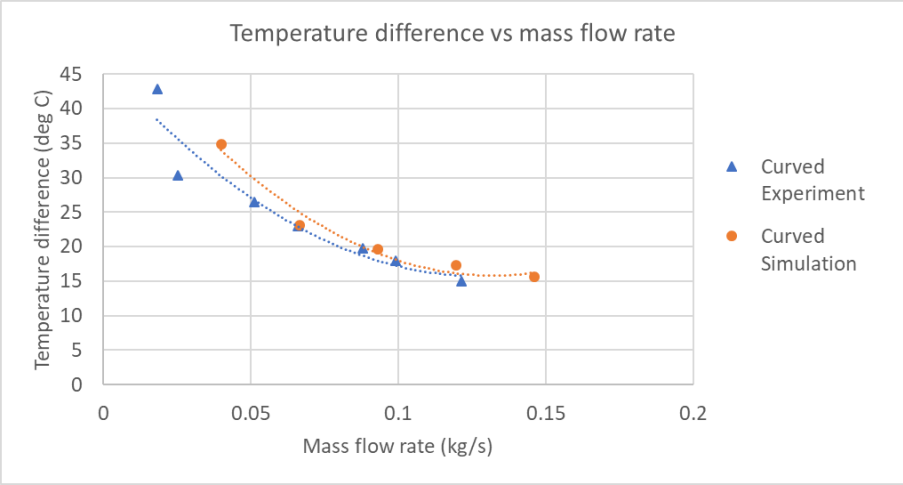


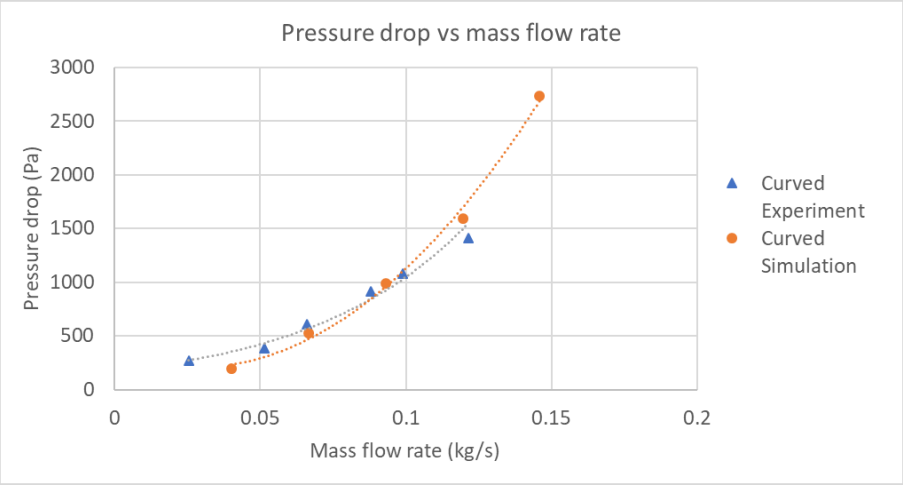




Critical Comparison

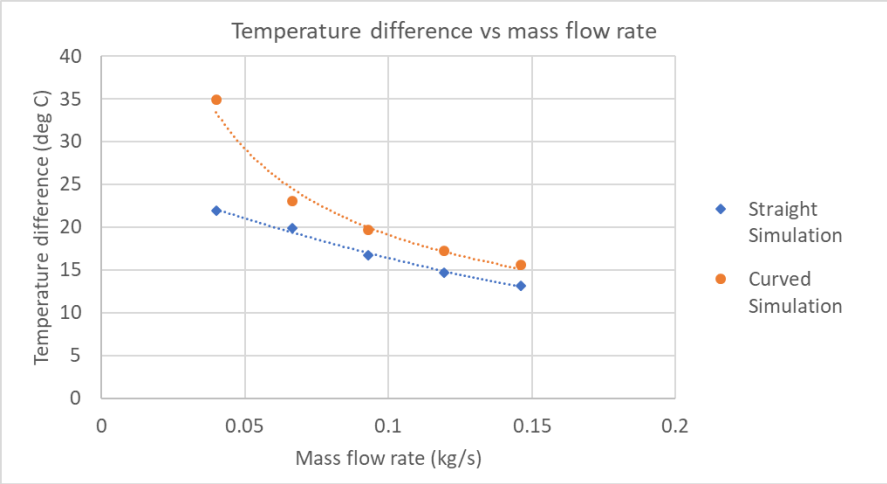
Experiment vs Simulation

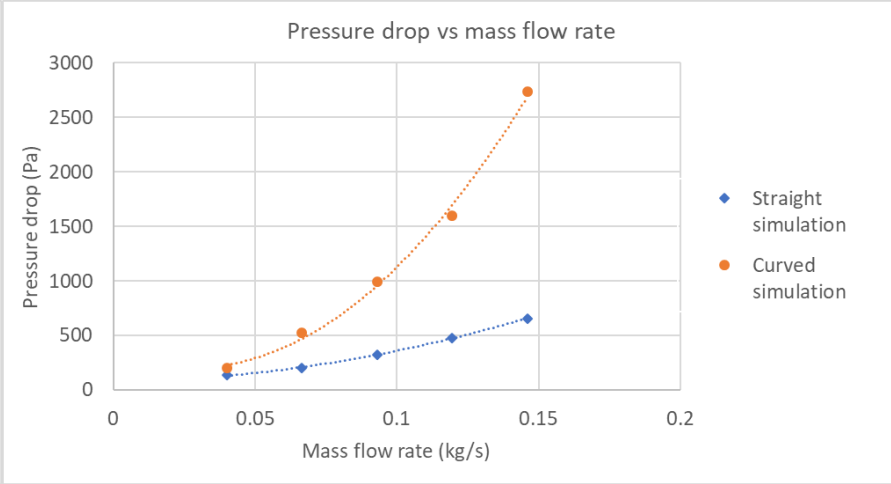




Critical Comparison

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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