



BACKGROUND

- The project was sponsored by a residential HVAC company called Aris Hydronics
- The task was to design a more efficient fan coil unit without making it bigger



Existing fan coil unit

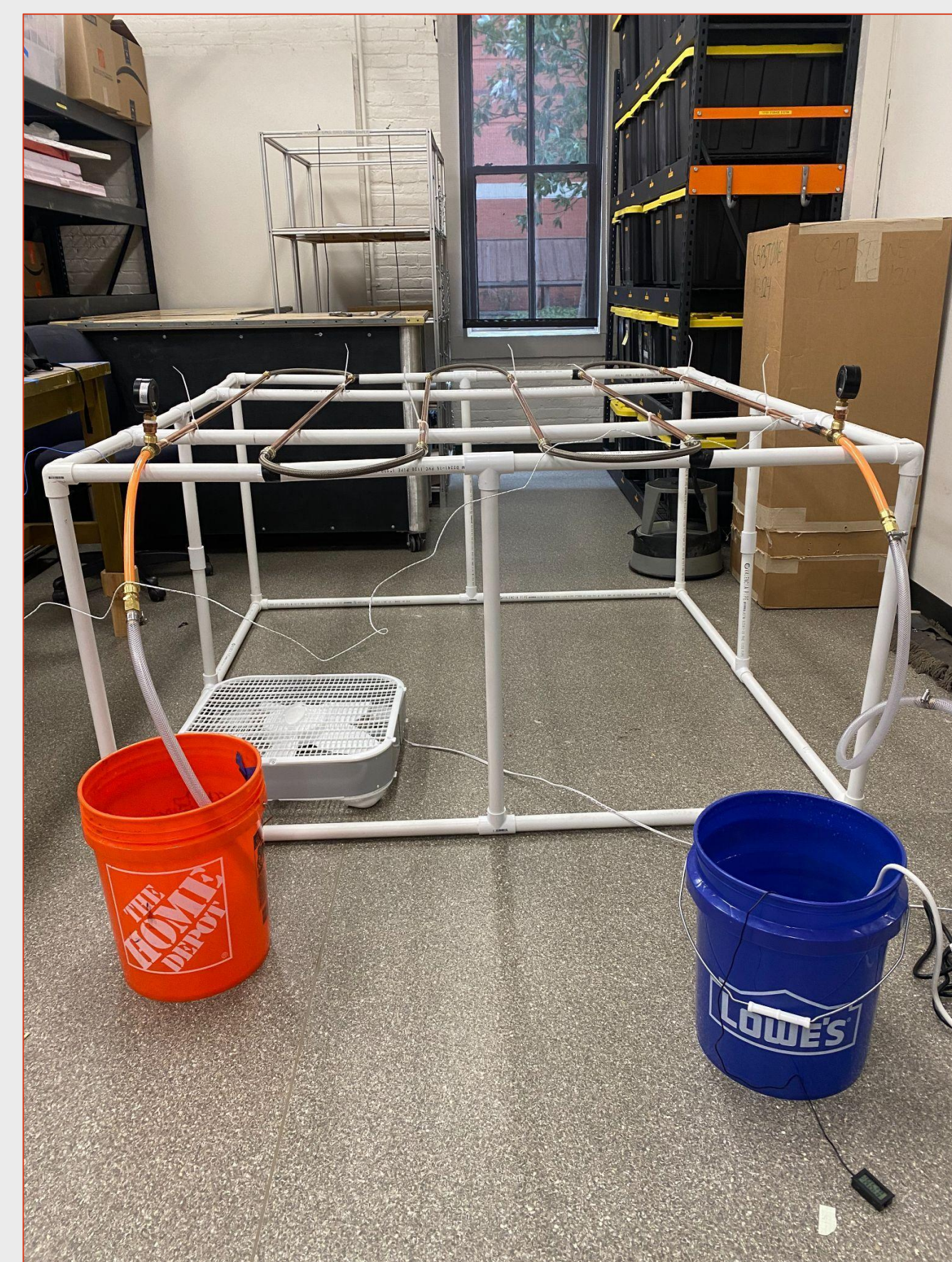
- Team 102 deliberated and elected to pursue a design solution based around generating turbulent water flow inside the heat pipes
- The solution required the manufacturing and testing of twisted-ring turbulators



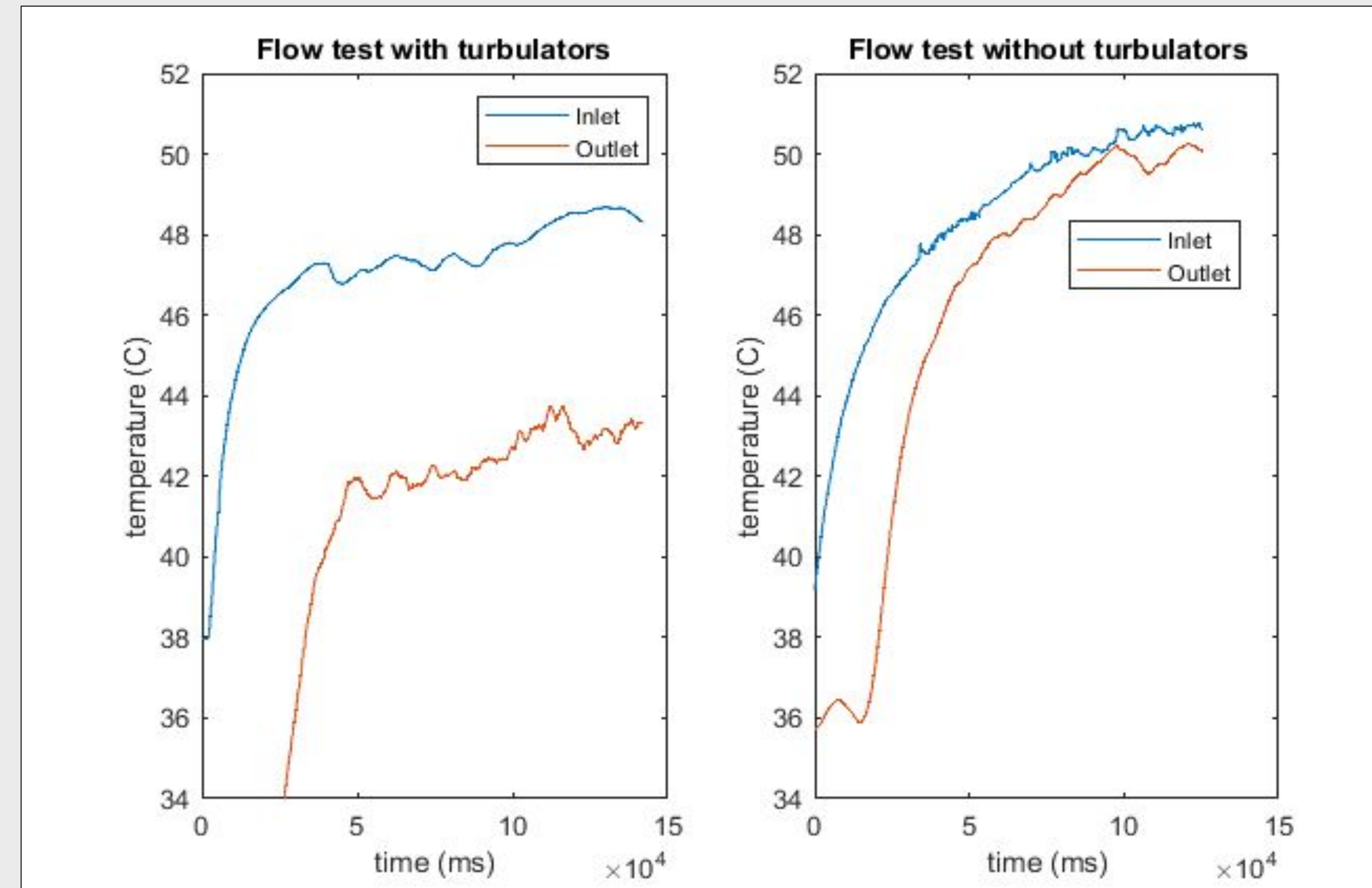
Hydronics Optimization Team

Advisors: Dr. Sarah Oman and Dr. Deborah Pence

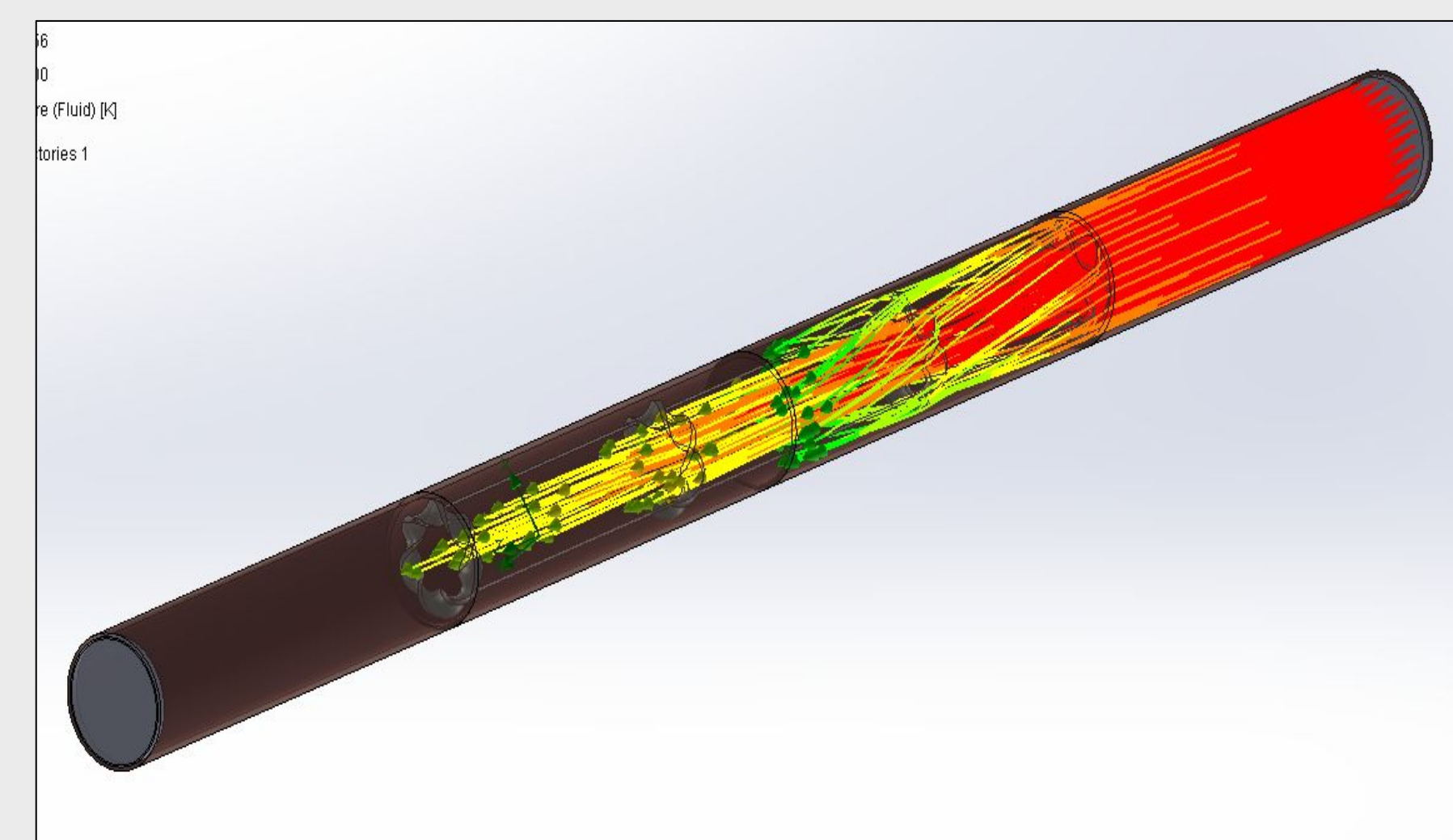
H.O.T. Team Members: Kelton Mckee, Elias Field, Jordan Gutierrez and Isaac Lewis



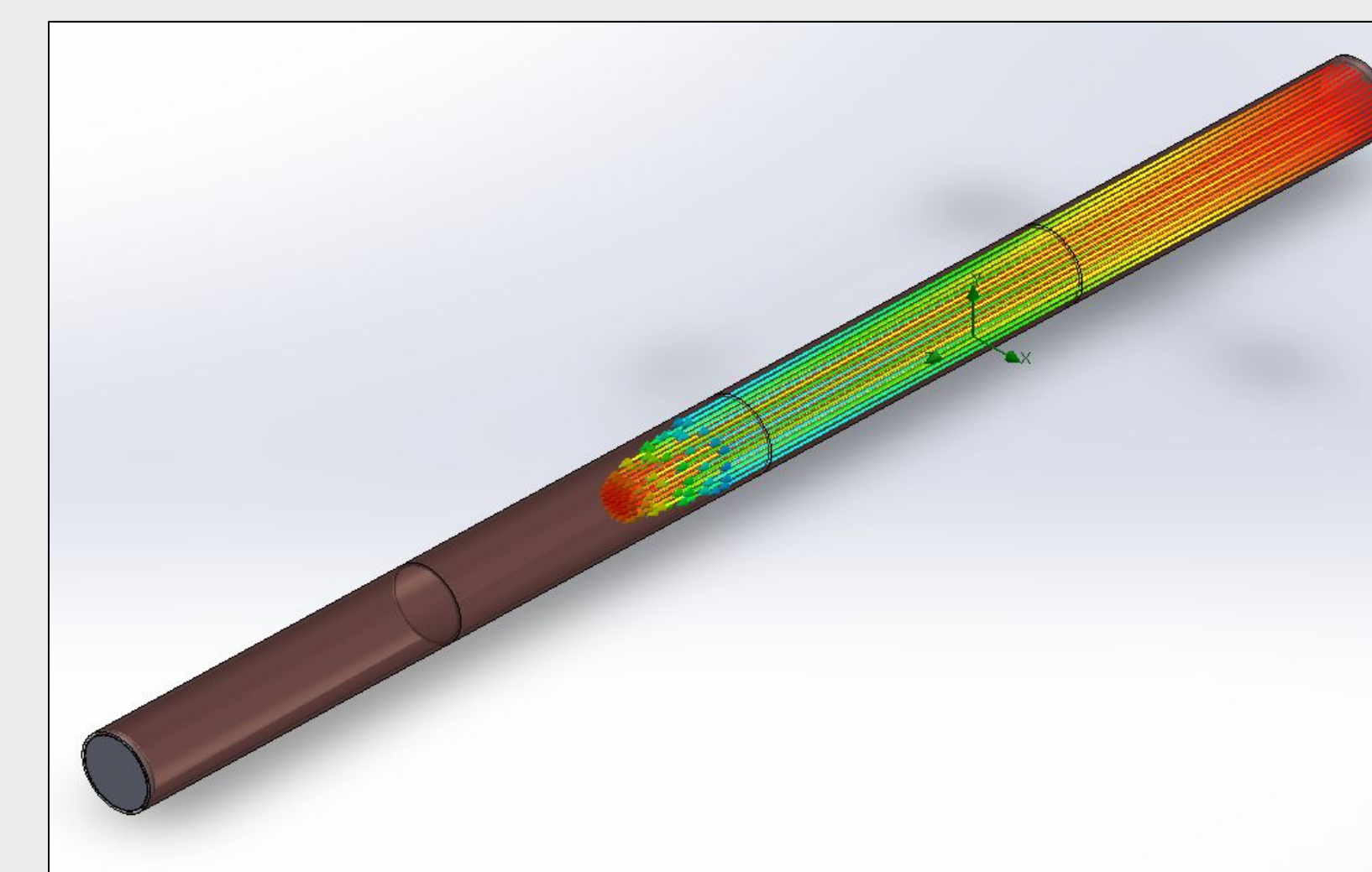
The testing configuration



Testing results displaying temperature differences



SolidWorks Turbulent flow simulation



SolidWorks Laminar flow simulation

Testing

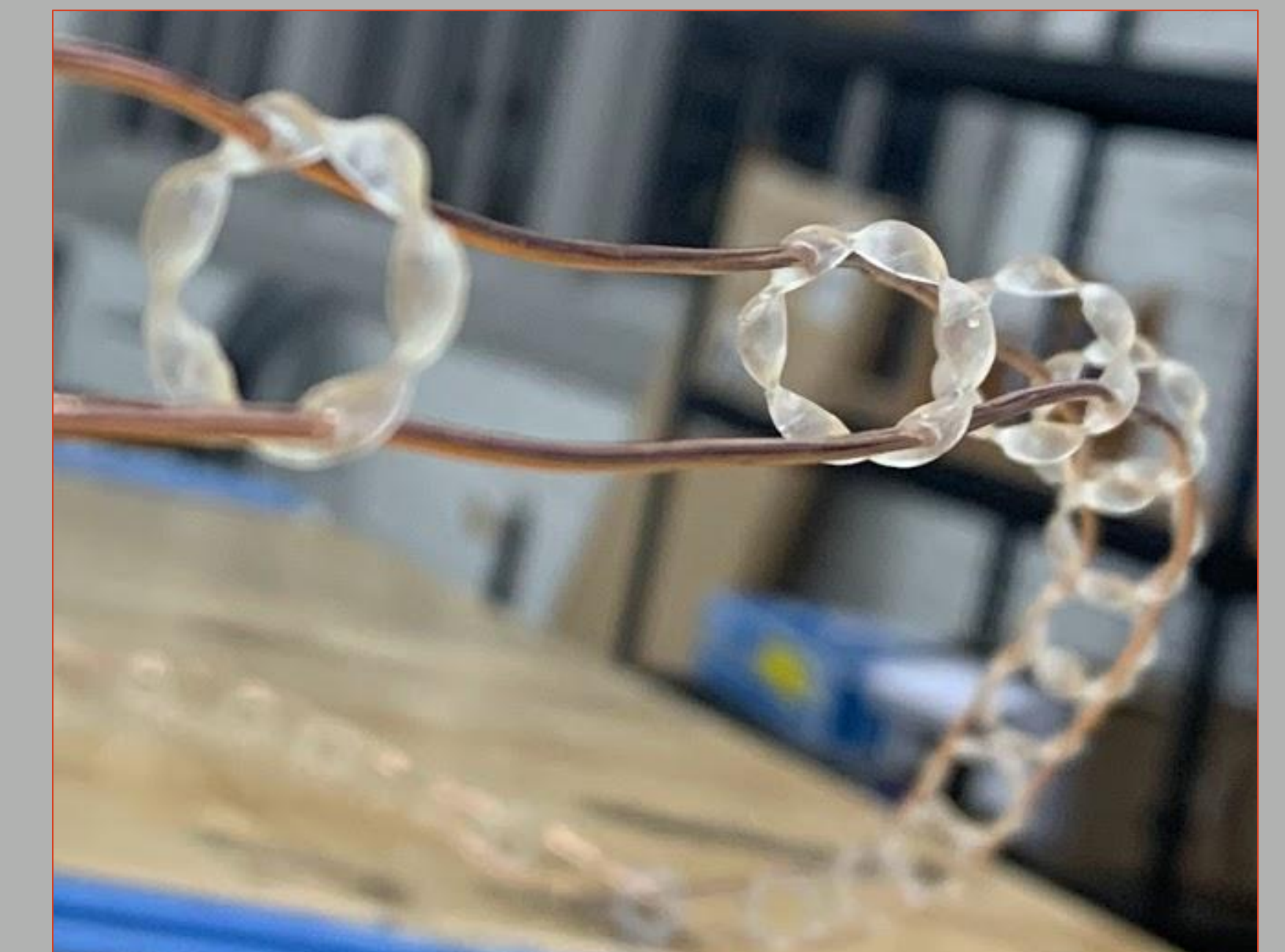
- Testing was performed using a mock heat exchanger constructed out of 1/2" copper pipe
- Thermocouples at the inlet and outlet recorded the temperature drop across the pipes
- The system was tested with and without the twisted-ring turbulators
- Buckets of water were heated to approximately 120°F before being circulated through the pipe system via water pump
- The flow rate and pressure drop across the system was measured for both turbulated and non-turbulated systems

Results

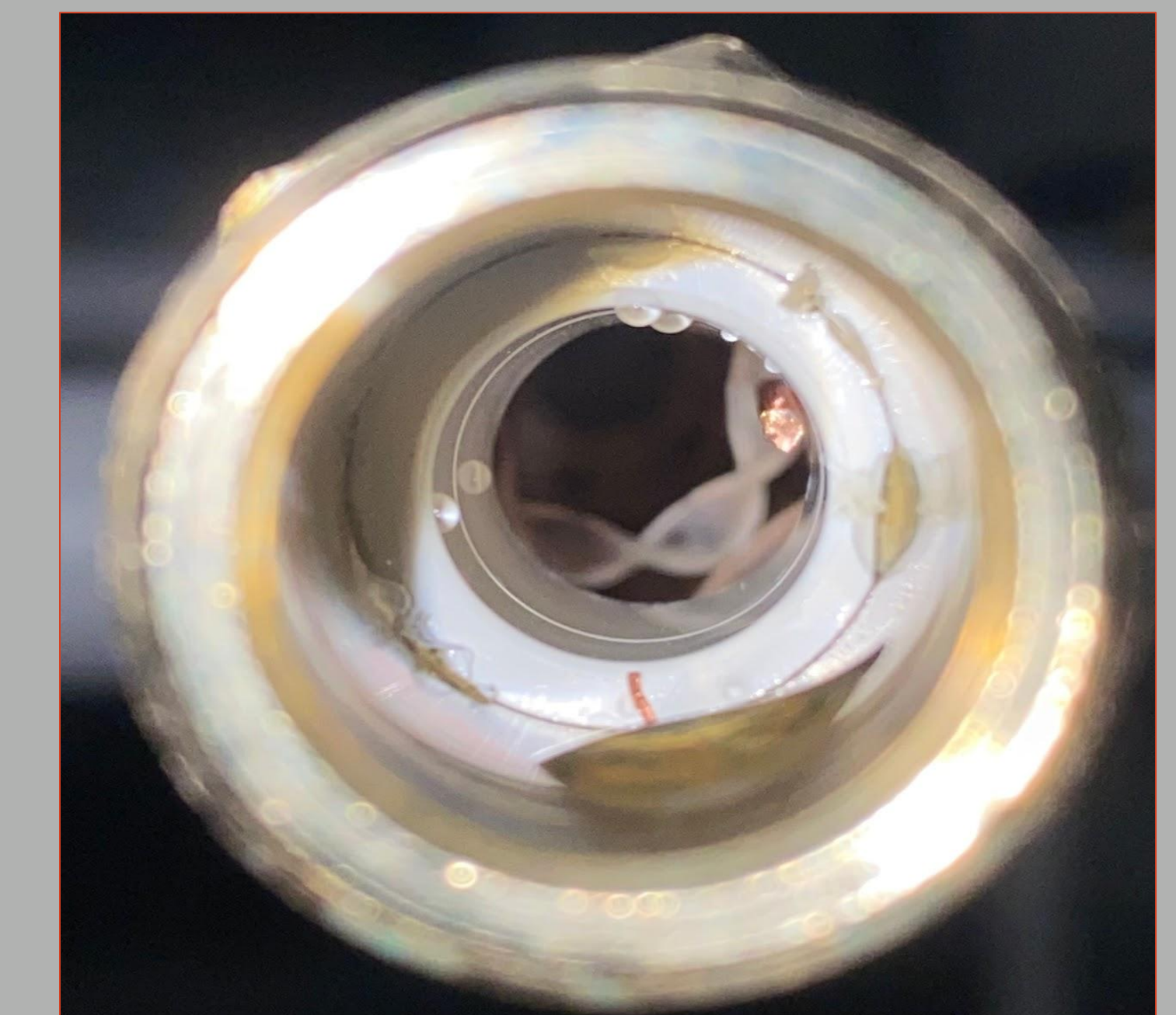
- Turbulators created larger temperature drop, indicating superior heater transfer
- Marginal increase in heat exchanger efficiency met engineering goal set by Aris Hydronics
- Limitations in testing equipment and facilities add significant error to testing data
- Twisted-ring turbulator design could be improved for ease of manufacturing and installation
- Ideal redesign would allow for existing heat exchangers to be retrofitted with twisted-ring turbulators

TURBULATORS

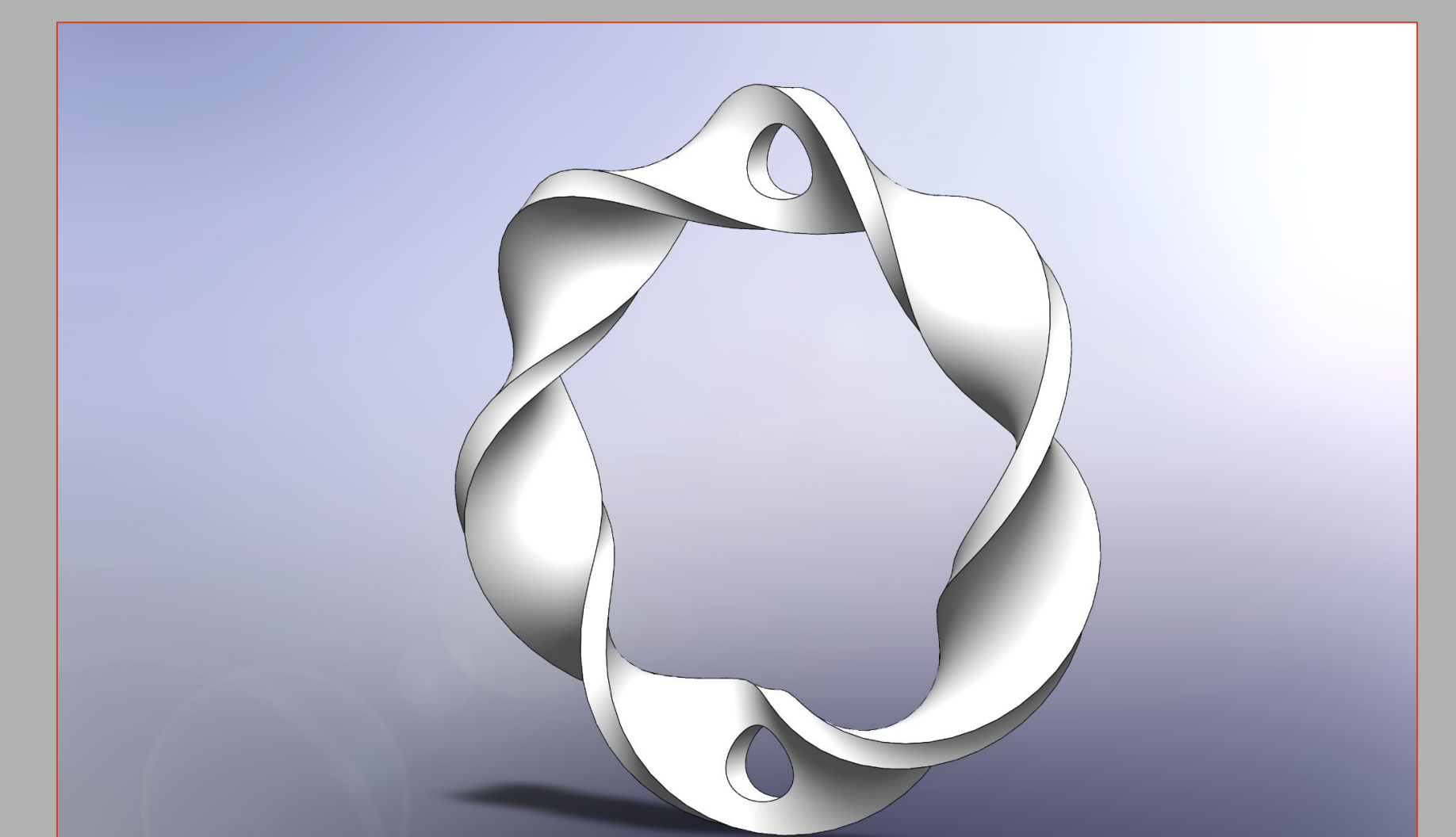
- 3D printed using High Temp resin
- Design to change the flow in the pipe from laminar flow to turbulent flow
- The turbulent flow of the water allows the hot water to mix as it flows through the pipe
- The Turbulators are connected together by a copper wire



Turbulator completed assembly



Turbulators inserted into copper pipe



Turbulator CAD Model

Acknowledgments

- Mr. Robert Benjamin of Aris Hydronics
- Dr. Deborah Pence of Oregon State University
- Dr. Sarah Oman of Oregon State University