EIC Beamline Teststand Sensor Upgrade

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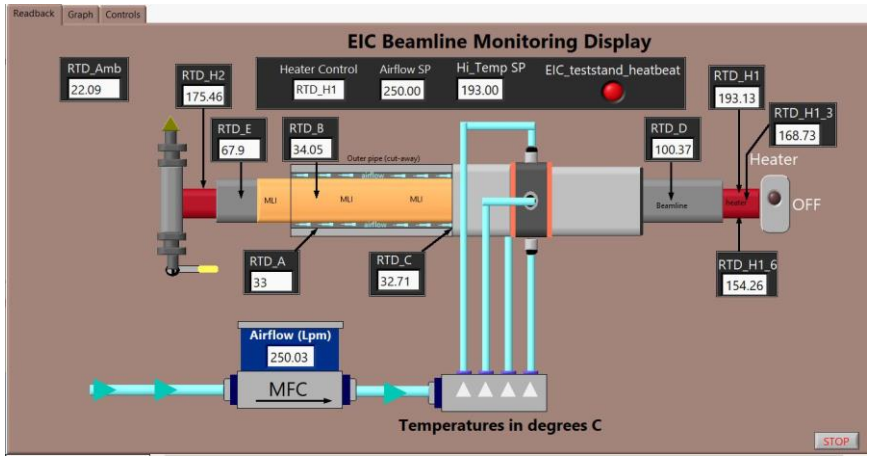
This month we ran several flow tests of the teststand in order to collect data using different flow rates and two different types of insulation from the beampipe. Using the Aerogel we were able to cool the Si surface (inner surface of the outer pipe) to the target temperature (30°C) with the beam line at 100°C. However, the Aerogel crumbled after a few test runs. It was replaced with a multi-layer polyimide composite, but changing the insulation resulted in changes to the test stand so it was difficult to compare one set of readings to the other. One of the changes was that the heater pipe was not in the same rotation when it was reassembled. This meant the controls sensor (RTD_H1) was no longer on top of the pipe (12 o'clock), instead, it was rotated to about 4 o'clock. During the early runs, the heater pipe set point was close to 200°C, now it was about 168°C. This didn't change the fact that the beamline was at 100°C, but we needed to fix it. Additionally, after disassembly, it was noticed that the downstream heater pipe sensor was not contacting the pipe. The flexible strain relief had melted and the sensor pulled away from the tape.

After the teststand was reassembled, I re-attached RTD_H1 to 12 o'clock as well as replaced RTD_H2 (also at 12 o'clock). I decided to add two additional RTDs on the upstream side of the heater at 3 o'clock (RTD_H1_3), and 6 o'clock (RTD_H1_6). This would give us data on the temperature profile of the pipe from bottom to top. We could then compare this to the Ansys models.

- Repair and install RTD on the test stand
- Update software with the new sensors
- Review data



The EIC Beamline GUI was updated with the additional RTDs on the heater pipe (RTD_H1_3 and RTD_H1_6)

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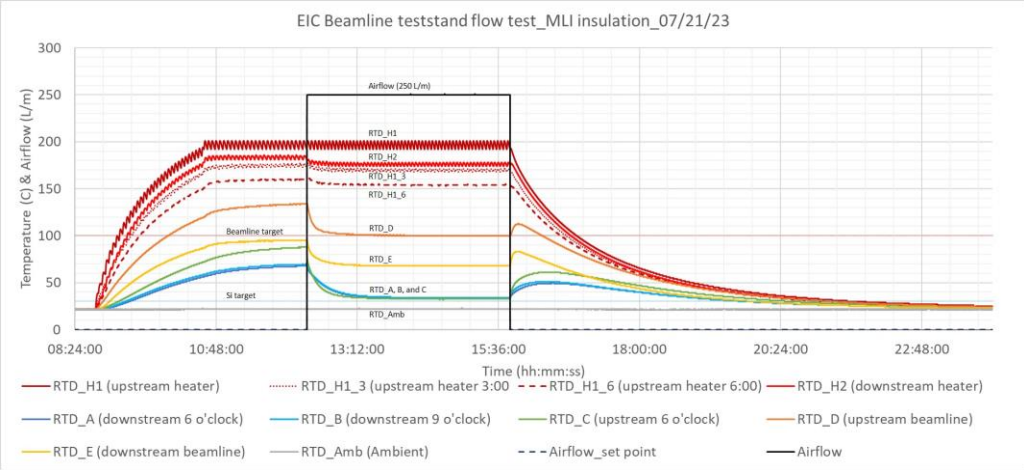
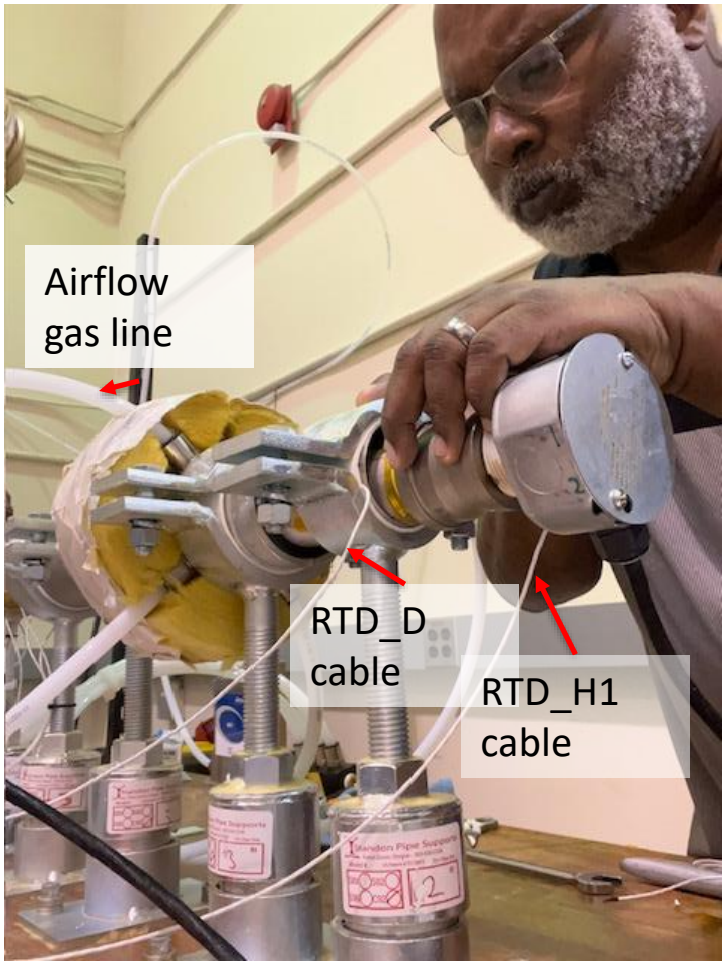
Once all the sensors were attached, I updated the Daq loop and controls GUI of my LabView software to include the new sensors. When we ran new flow tests the heater setpoint was once again close to 200°C, due to the RTD_H1 being at the 12 o'clock position again. The heater pipe profile shows a 15°C difference from the bottom of the pipe to the middle and a 15°C difference from the middle to the top. The temperature at the bottom of the pipe also cycles less than the middle and the top. It seems that the metal contact of the pipes reduces temperature fluctuations.



A plot from 07/21 shows the teststand temperatures have stabilized during a ~3 hour flow test. The beamline is at 100°C, while the Si surface is ~32°C.

In conclusion, I have repaired and reinstalled sensors at the original sensor locations on the EIC beamline teststand heater pipe so that the current teststand measurements can be compared to the initial runs. I have also installed additional sensors so that a temperature profile of the heater pipe can be recorded and reviewed.



Marc McMullen is installing additional RTDs on the heater pipe at the 3 o'clock and 6 o'clock position