EIC Beampipe Test Stand

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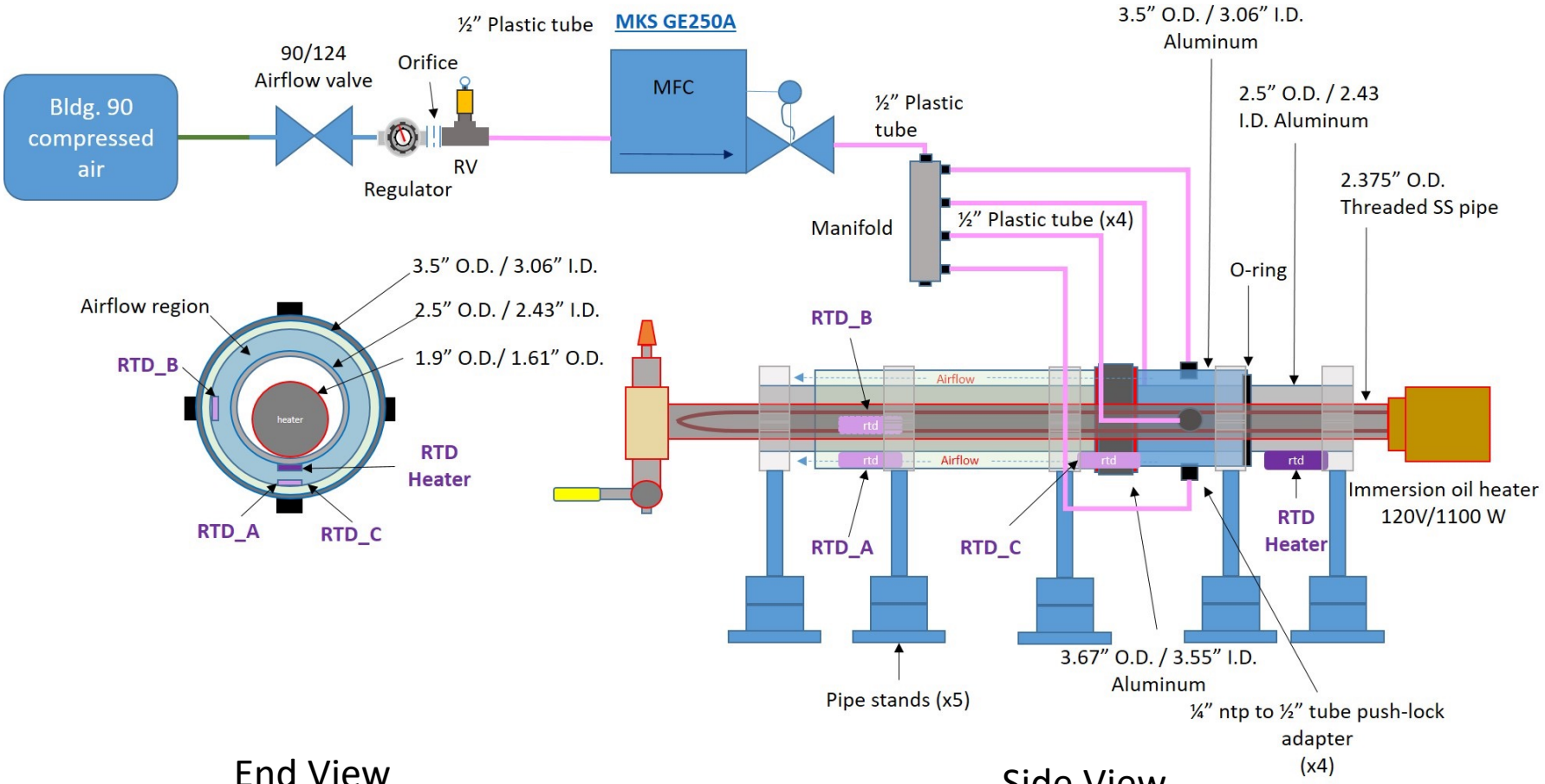
Objective

- Assemble simulated beam line test stand
  - The simulated beam line uses off-the-shelf components that are of similar dimensions to the actual beam line
  - Test stand will be used to validate Ansys simulation of beampipe bakeout and the effects on the first silicon tracking layer
- Develop controls and monitoring system
- Test the system for functionality
- Record data at different air flow values

EIC Beampipe Diagram



End View

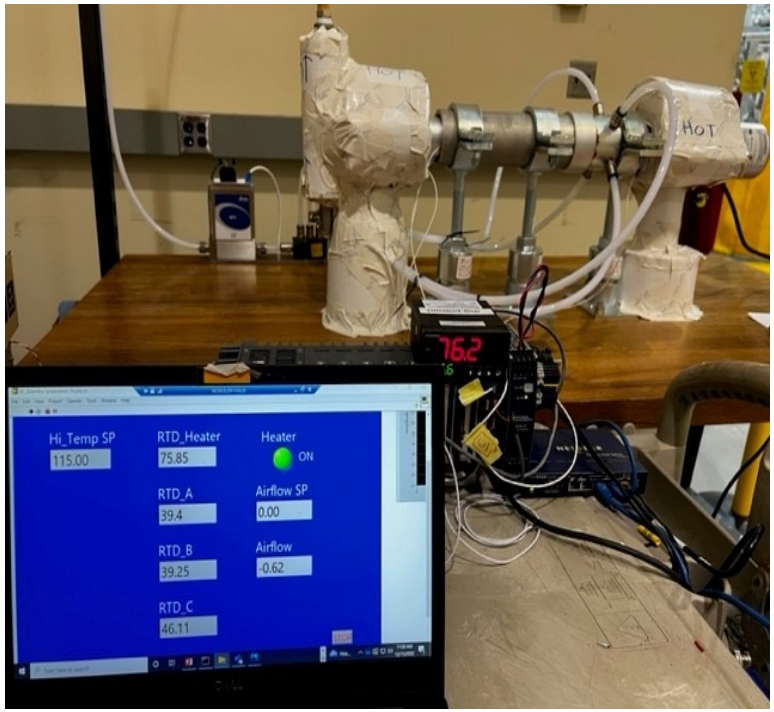
Side View

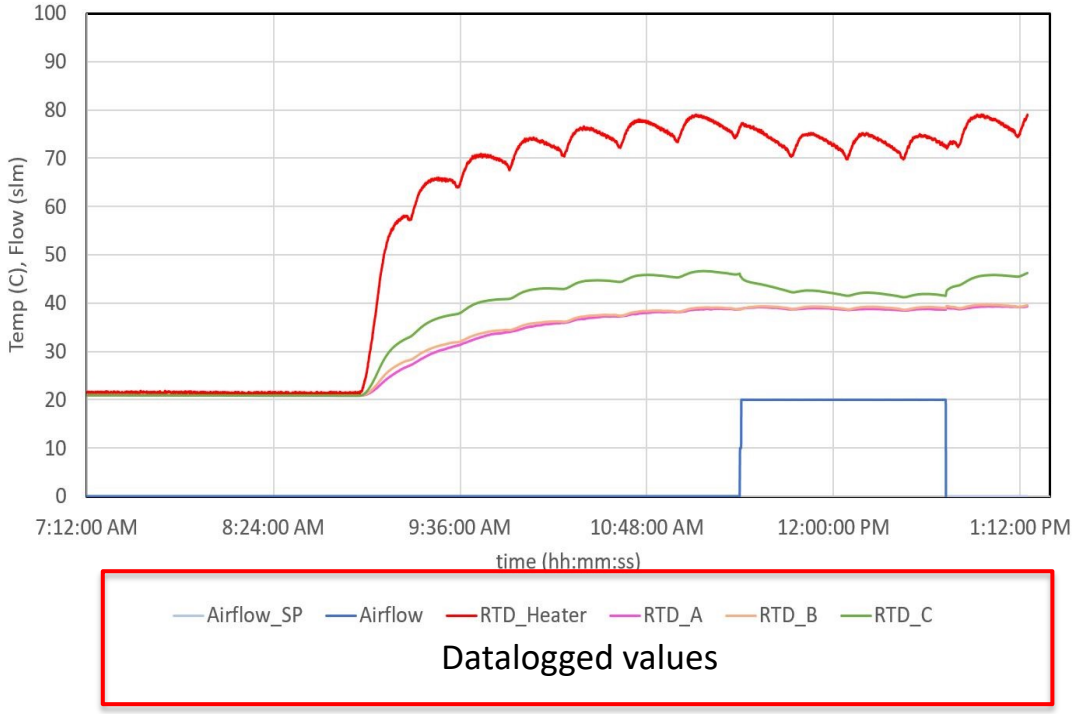
- RTD_A, B and C are inside the 3.5" airflow pipe
- RTD_Heater is on the outside of the 2.5" heated pipe
- The O-ring blocks one end of the 3.5" pipe to direct the flow of air

Assembled Beampipe

After all pipes were aligned, the immersion heater pipe was installed and filled with mineral oil

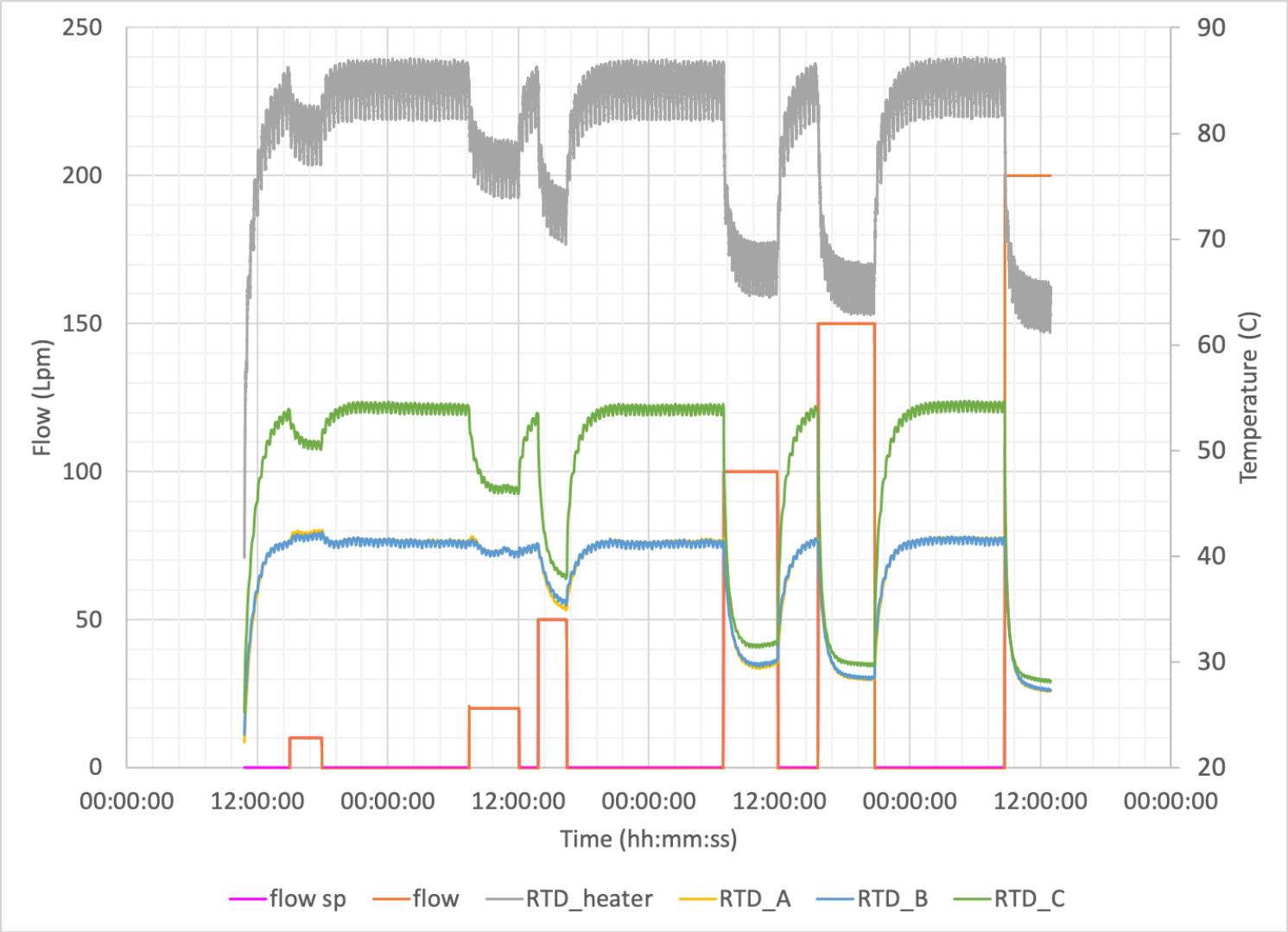
System Test (12/16/2022)





- The system was tested for 4.5 hours to ensure the system was functioning as expected
- The temperature at RTD_Heater increased from 21°C to 78°C in ~3 hours
- 20 slm of air was flowed for an hour, which decreased the temperature at RTD_Heater by 5°C

Flow Test (1/9 to 1/11) – Plot



Flow Test (1/9 to 1/11) – Data

Flow (slm)	~Velocity (m/s)	RTD Heater (℃)	RTD In (℃)	RTD Out (℃)
0	0	85	54	41.5
10	0.1	81	51	42.5
20	0.2	77	46	40.5
50	0.5	73	38	35
100	1	67	31.5	29.5
150	1.6	65	29.5	28
200	2.1	64	28.5	27

- Velocity based on ~15 cm^2 cross sectional area of annulus
- RTD values are approximate/average
  - RTD Heater varied ±3℃
  - RTD In / Out varied < ±1℃

Conclusion

- A test stand simulating flow between the beampipe during bakeout and the first silicon layer was constructed and operated to take data
- While the heater was unable to reach the target temperature trends can be inferred
  - Similar to Ansys results in that eventually additional air flow results in very little change in temperature
  - Having enough flow to cool the first layer (~30℃) results in the beampipe significantly dropping (~20℃) in temperature
- How to actually get flow to detectors still needs to be designed
- Insulate/isolate beam pipe from air flow?