# EIC Beamline Test Stand Controls

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2023-01

The silicon detectors of the EIC are located around the beryllium pipe beamline, which is to be heated to 100°C to remove beampipe contaminants.

A mockup test stand was assembled of the EIC beamline, Fig. 1. The mockup simulates the temperature at the outermost pipe (3.5” O.D.), which represents the first layer of the silicon detector. Three resistance temperature detectors RTD_A, RTD_B, and RTD_C are located on the inner surface of the pipe.

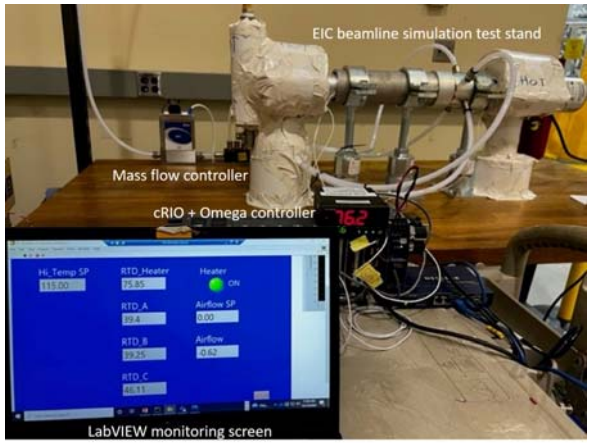


FIG. 1. Mockup of beamline

A heater made from a 1.9”-O.D. pipe is inserted into a 2.5”-O.D inner pipe, which represents the beampipe, Fig, 2. The heater pipe is filled with mineral oil and has a 1100-W immersion heater to heat the oil to a target temperature of 100°C. RTD_Heater is mounted to the external surface of the 2.5” inner pipe.

- Wrote code to monitor the temperature and control the flow of compressed air in the EIC beamline test stand
- Data logged measurements

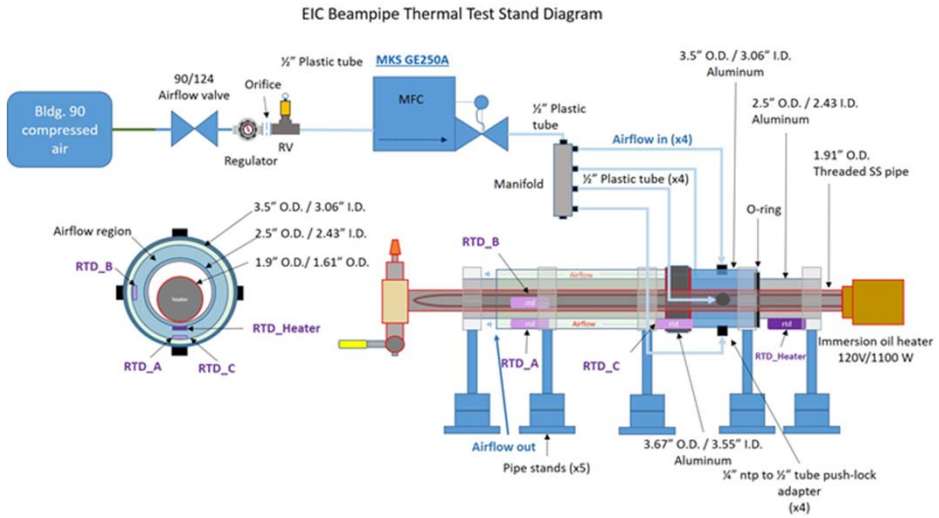


FIG 2. Layout of the mockup of the beamline test stand

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Code that runs on a cRIO 9045 control system was written in LabVIEW to monitor the temperature of the RTDs. A setpoint of 115°C was used, measured by RTD_heater. If the temperature at the surface of the 2.5" inner pipe reached the setpoint, a relay channel on the cRIO would turn off the power of a Lowell AC relay switch. However, the 2.5" pipe never exceeded 87°C.

The test stand has a 250-LPM mass flow controller that flows compressed air into four inlet fittings on one end of the 3.5" pipe. The air flows through the 3.5" pipe and around the 2.5" pipe. The outflow of air is blocked at the inlet end with an O-ring to facilitate the direction of airflow to the outlet end of the 3.5" pipe.

Air flow was set at specific rates (10, 20, 50, 100, 200, and 250 LPM) for several hours, and then shut off for several hours to allow the temperature of the pipes to return to their normal values. The test stand was operated continuously over five days. Data was saved to text files and Excel used to graph the results of the entire test.

To conclude, the results of the test, Fig. 3, show that the inner surface of the 3.5" pipe will rise to ~51°C (RTD_C) close to the O-ring end, and ~40°C (RTD_A and _B) close to the open end.

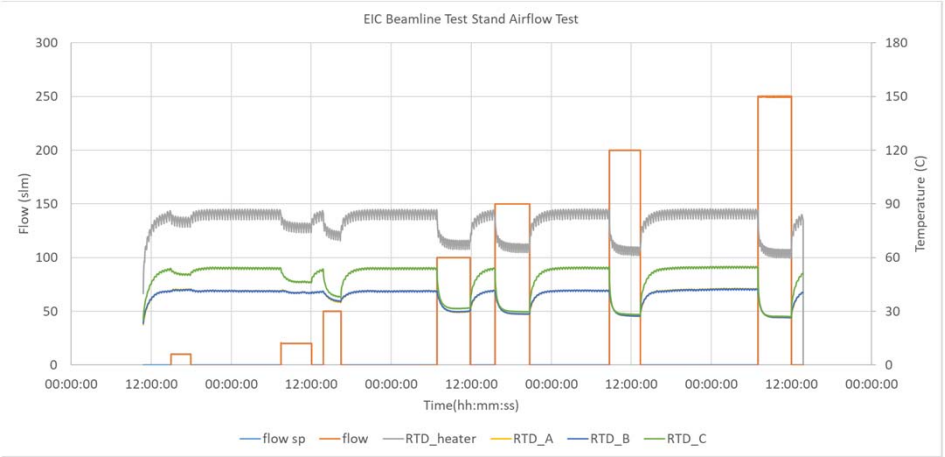


FIG. 3. Air flow and the RTD temperatures vs. time. Air flow is shown as square waves, while the temperatures oscillate due to the heater's thermostat, with dips due to cooling from the air flow. Flow setpoint and flow overlap, RTD_A and RTD_B, overlap as they are close in proximity to one another.