MOLLER Coil 3 Prototype Instrumentation

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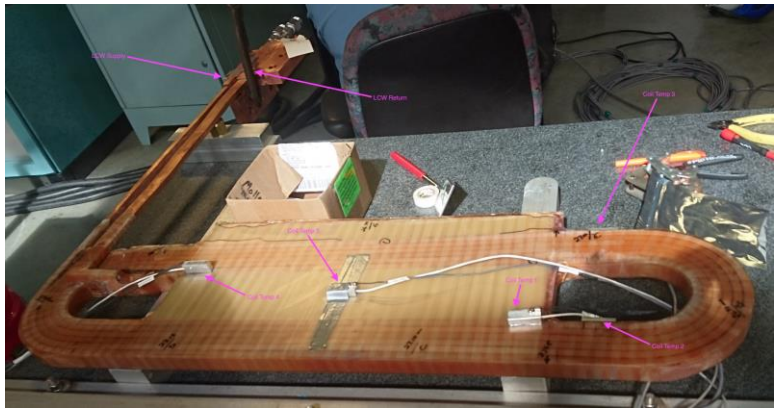
As part of the MOLLER experiment there are several sets of toroidal magnets that are currently being fabricated; one upstream coil and four downstream coils (nominally named coils 1 through 4). These 7-fold torus magnets will act as focusing magnets for the incoming electron beam prior to it reaching the various detectors. As part of the acceptance testing for the first prototype coil, which was coil 3, Aaron and I performed a low current test. The low current, 700A / ~3300 A, was due to limitations of the available magnet power supplies.

The instrumentation was a mix of components that will be used in the final design along with ones from an existing HDIce magnet test stand. The main readback was done with an Allen-Bradley CompactLogix PLC controller. The sensor types planned to be read back were: RTD, thermistor, pressure, flow, voltage and current. The two temperature sensor types (RTD and thermistor, see figure 1 for locations) were planned to be used as a comparison between the types. However, without any native PLC module to readout the thermistors and external readback proved problematic so we removed these from the plan. The pressure sensors were on the LCW supply and return lines while the flow meter measured the LCW supply. Both the voltage and current were from the MPS with the current a later addition to the test plan.

As the setup was a mix of old and new components some of the documentation did not exactly match the in-situ wiring so Aaron and I made the modifications that needed to be done. This included swapping wiring in the terminal blocks for the flow meter and mapping the temperature sensor locations with the physical PLC channels. Also several channels needed to have their scaling modified to get the correct physical unit readouts.

- **Instrumentation wiring and PLC code was modified/added**
- **Troubleshooting done on sensors that gave erroneous outputs**
- **Initial test was completed and sensor values datalogged**



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The main goal for the test plan would be to stop the flow of LCW coolant to allow the coil to self-heat, then restore the flow. This would provide values that could be used for scaling the heating and cooling of the coil as well as look for any mechanical defects in the epoxy. After all instrumentation was verified to be correct the magnet was powered on and the current increased 100 A steps from 0 to 700 A. The LCW supply was then restricted in an attempt to increase the coil temperature. However, Aaron and I found that the main supply valve had an expected (but unknown initially) bypass flow. After closing a manifold valve the coil began increasing in temperature until approximately 65 C upon which the flow was restored and the coil cooled down. Shown in figure 2 is the data from this initial test. The data from the test run is currently being analyzed and no mechanical issues were observed.