U.S. MAGNET DEVELOPMENT PROGRAM

Instrumentation magnet - status (a.k.a. “mirror magnet experiment”)

MDP Meeting

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This is a brief update, there is no significant change since last reporting at the end of August last year

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US Magnet Development Program

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US Magnet Development Program

Brief “history” of the “mirror” magnet experiment

- More detailed considerations about such an “experiment” (dedicated magnet test for instrumentation purposes alone) started in 2019, including a “proposal” to MDP
- A technical memo was available at the end of 2020: https://lss.fnal.gov/archive/test-fn/1000/fermilab-fn-1117-td.pdf
- Goals were eventually modified to fit interests and budget, and work started in the beginning of 2022
- The coil was largely instrumented (mostly by Simone) by the end of Summer 2022
- Magnet assembly is carried primarily by Charlie Orozco (eng.) and Martel Walls (tech.) – both occasionally available for this work; Charlie is consulting with Roger Bossert (eng.) as necessary
- Updates were reported in MDP, including recently (on August 30th of 2023) and in various details on August 31st 2022

What is being addressed by the experiment

- Spot-heater arrays
  (quench development signatures, current redistribution)

  https://lss.fnal.gov/archive/test-fn/1000/fermilab-fn-1117-td.pdf

AIIId-M5	Completing spot heater studies to improve voltage-based diagnostics and address "silent" quenches

- Fiber optics development

AIIId-M12a	Install distributed fiber on a mirror magnet for coil strain map

(among other optical fiber development goals)

- Quench antenna development

AIIId-M7	Development of multi-element and flexible quench antennas and localization of quenches using flexible quench antenna arrays
AIIId-M7a	Characterization of different quench antenna designs for use in superconducting devices

- V-I measurement techniques development

AIIId-M5a	Development and comissioning of a dedicated V-I measurement system (multichannel nanovoltmeter) for superconducting magnets

- QCD device and techniques testing/validation

- Analysis based on multi-physics sensors
  (QA, acoustic sensors, fiber optics, coil voltage, strain gauges, …
  ML: Maira Khan, Vittorio Marinozzi)

While many of those were "ready"/available for months if not years, they are still not extensively tested/validated/explored

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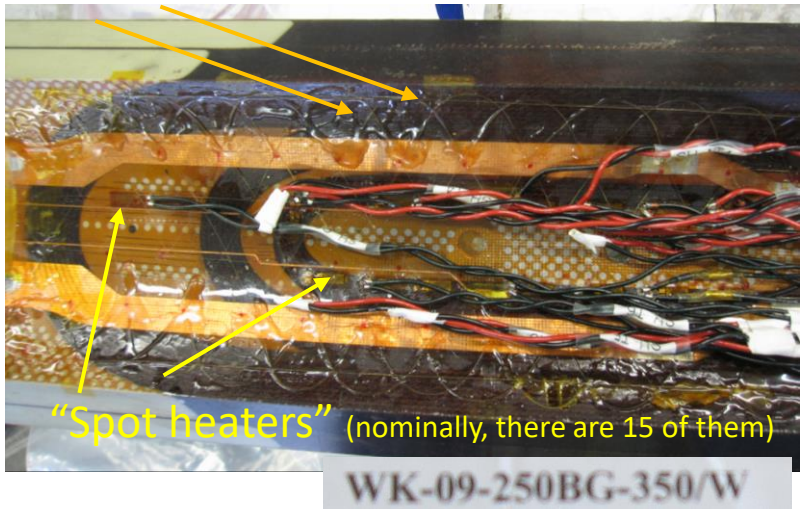
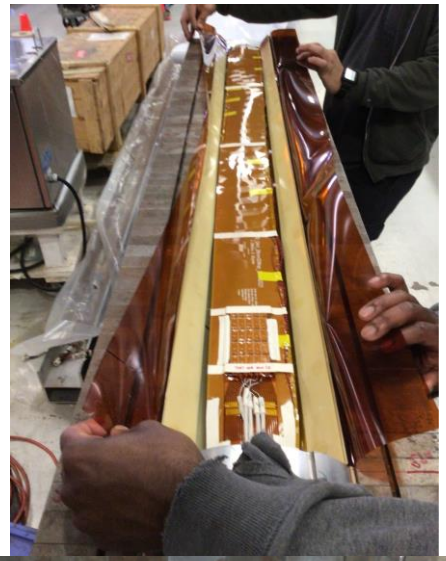
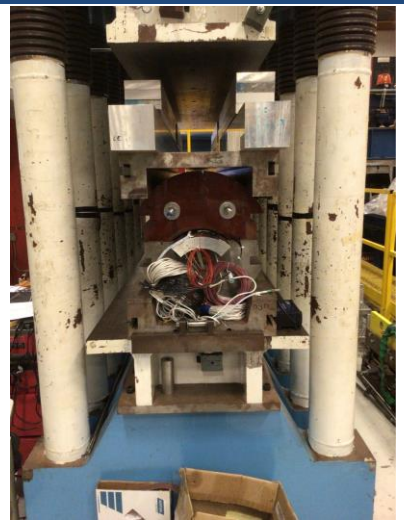


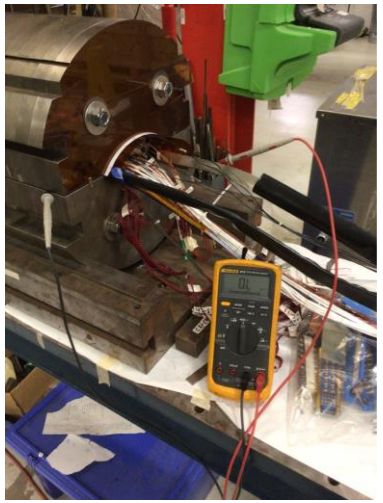
Different types of QA, lead coverage



Status

- During magnet assembly work it was discovered that optical fibers were broken/not responding (this was about half a year ago)
- We are still in recovery mode – new optical fibers need to be glued (old ones are lost)
- In any case, we can not test before May-June due to other tests
- We should aim to be ready with magnet assembly by April-May
- I don’t have guarantees people will be available for completing the work in that time scale (it is about priorities)





Checks during magnet assembly (~ Summer 2023)

Last slide

Interest, support, priority are driving the pace of development

Slow pace is detrimental to goals (focus, efficiency, “critical mass”, real-time development loops)