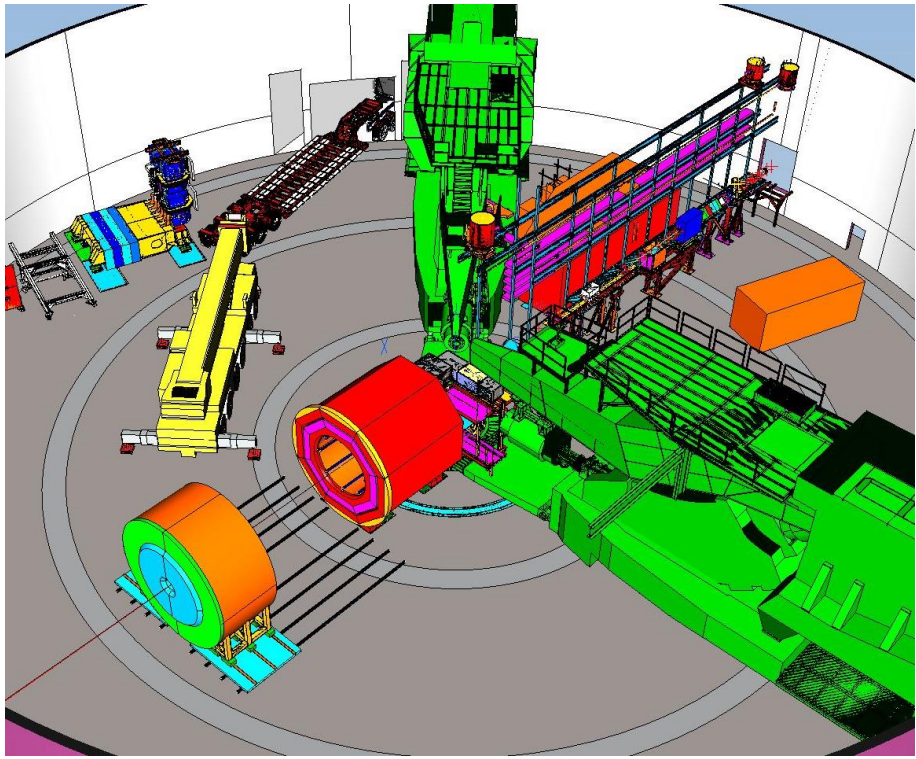
SoLID Collaboration Meeting

Magnet & Infrastructure Support



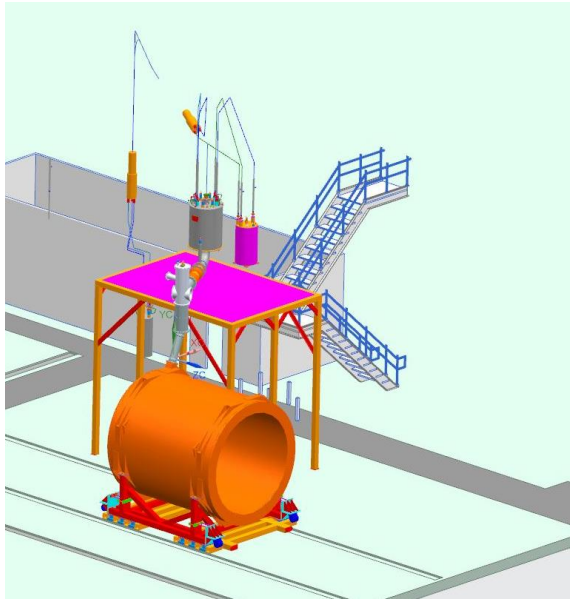
Whit Seay

Presentation Outline

- Magnet
- Infrastructure
- Comments from Director's Review

Magnet – Cold Test Update

- Majority of our effort is focused on the cold test
- Merged the CLEO refurbishment/static test and cold testing into Phase 1
- Detector Support Group (DSG) is making steady progress on SoLID control system
- Hall C has provided engineering and design support for the CCR and interface with the current lead stack (turret). Performed an analysis of the coils in the test lab to identify field boundaries.
- Designing support and personnel access platforms for CCR, heat exchanger and turret



Merged CLEO Refurbishment and Cold Testing (Phase 1)*

1. New Instrumentation and Control System – FY18
   - Design the system – completed
   - Identify hardware and software requirements – completed
   - Procurement – completed
   - Assemble and test the new I&C – in progress

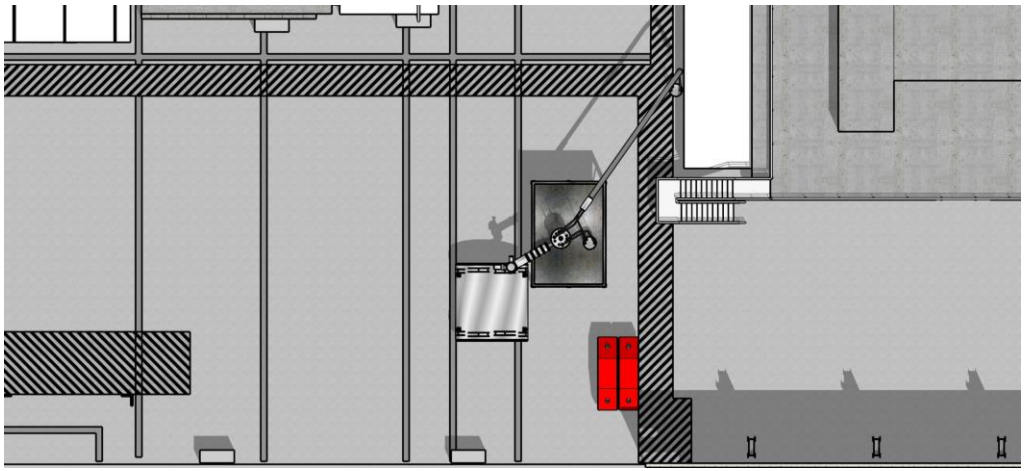
2. New Cryo Control Reservoir – FY 19-20
   - Design to interface w/ CLEO and JLAB ESR system – in progress
   - Procurement: contract awarded – in progress
   - Acceptance testing upon arrival-leak & pressure

3. Static Testing of the CLEO Magnet – FY 18-20
   - Check out existing instrumentation in the cryostat – completed
   - HIPOT test the coil – completed
   - Evacuate the coil – design work progressing
   - Leak test – design work progressing
   - Pressure test – design work progressing

Merged CLEO Refurbishment and Cold Testing (Phase 1)*

4. Test Lab Layout – FY20
   - Run a careful magnetic analysis of coil in test lab* – completed
   - Identify 50 gauss and 5 gauss boundaries* – completed
   - Identify existing transfer lines that can be used in test– in progress
   - Lock down final magnet position for test – in progress

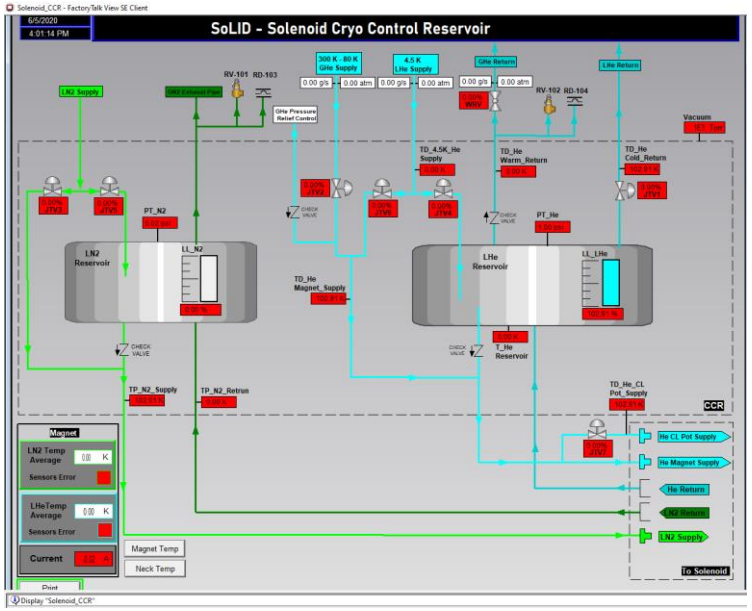
5. Support Structures for Cold Test – FY 20-21
   - Design platform to support CCR/personnel access – in progress
   - Design cryo line supports – on hold



*Addresses technical suggestion from Director's Review

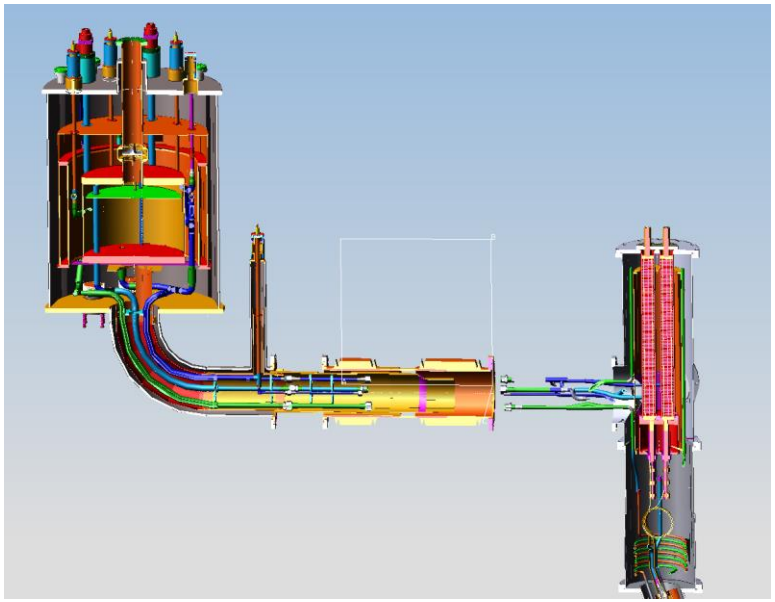
Magnet – Controls

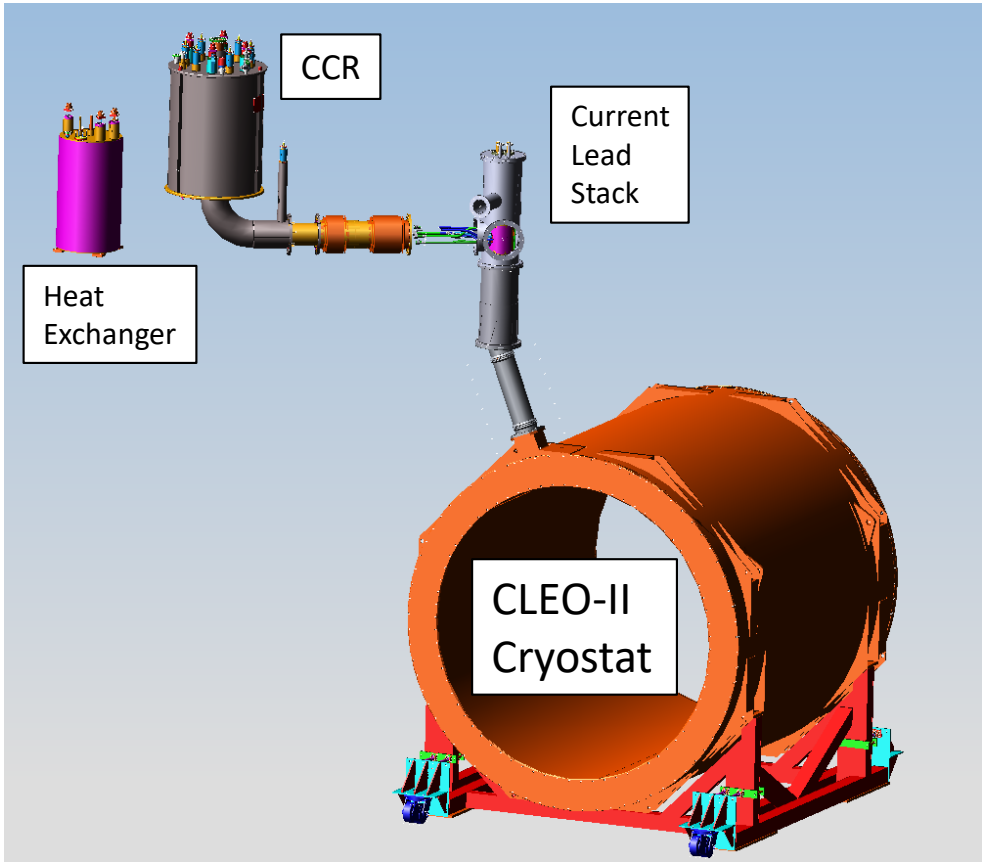
- Detector Support Group (DSG) making steady progress
- PLC code & HMI screen development are progressing well
- Modifying a Hall C superconducting magnet controls program for use with SoLID
- Interface with cryo group and MCC ongoing (CSS)
- Motor controller boards for JT valve control developed and in procurement
- Implementing the PLC code to control and monitor JT valves for heat exchanger
- Neck temperatures, radial and axial supports and radial and axial support expert CSS-BOY screens created
- Latest version of CCR control HMI updated
- Electrical drawings are being updated



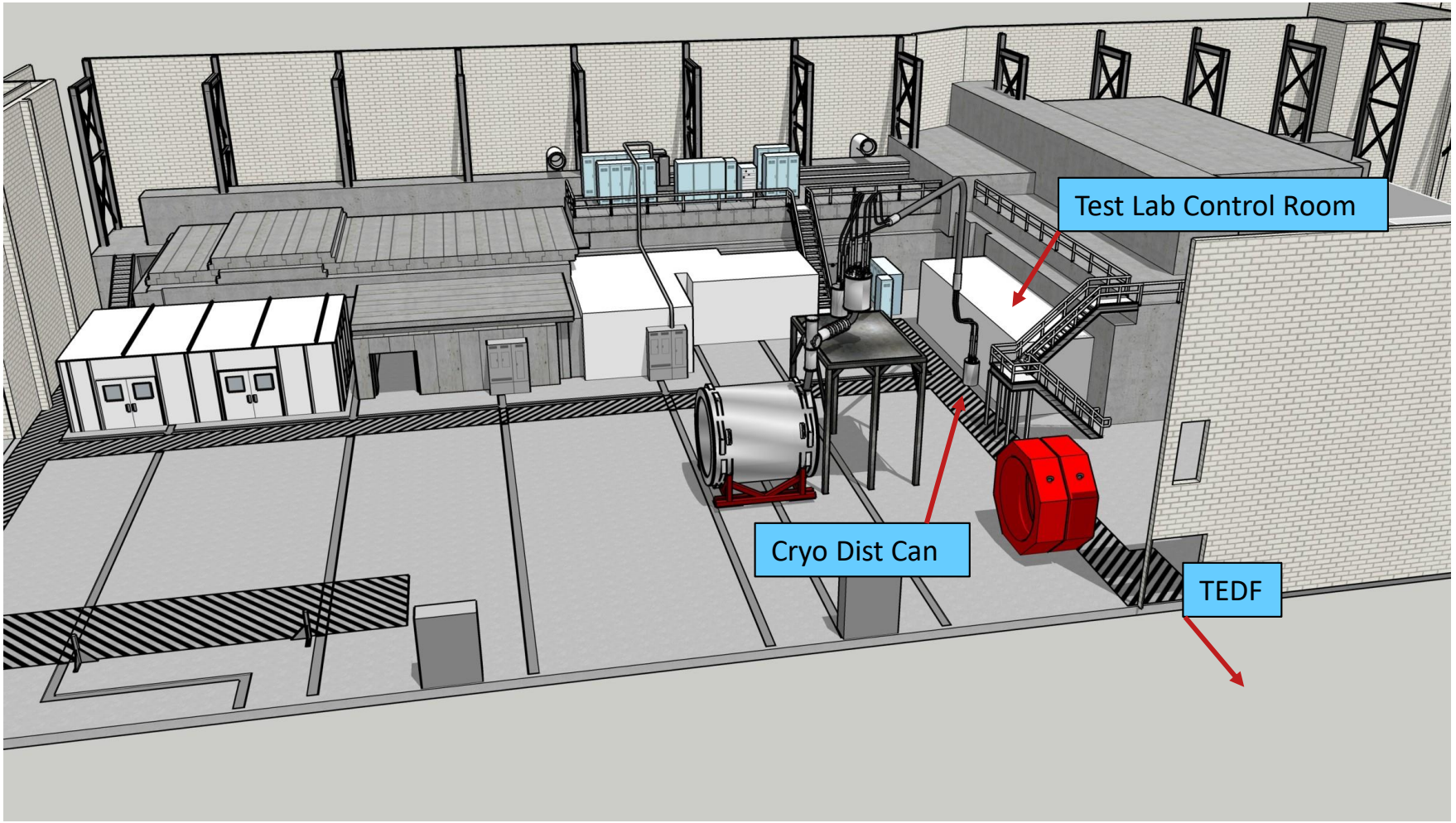
Magnet – Cold Test

- CCR contract awarded March 2020
- Modified Hall C design with 6 units in current operation
- Current lead stack from CLEO to be modified to interface with new CCR
- Existing Hall C heat exchanger will be used for cool down during cold test.





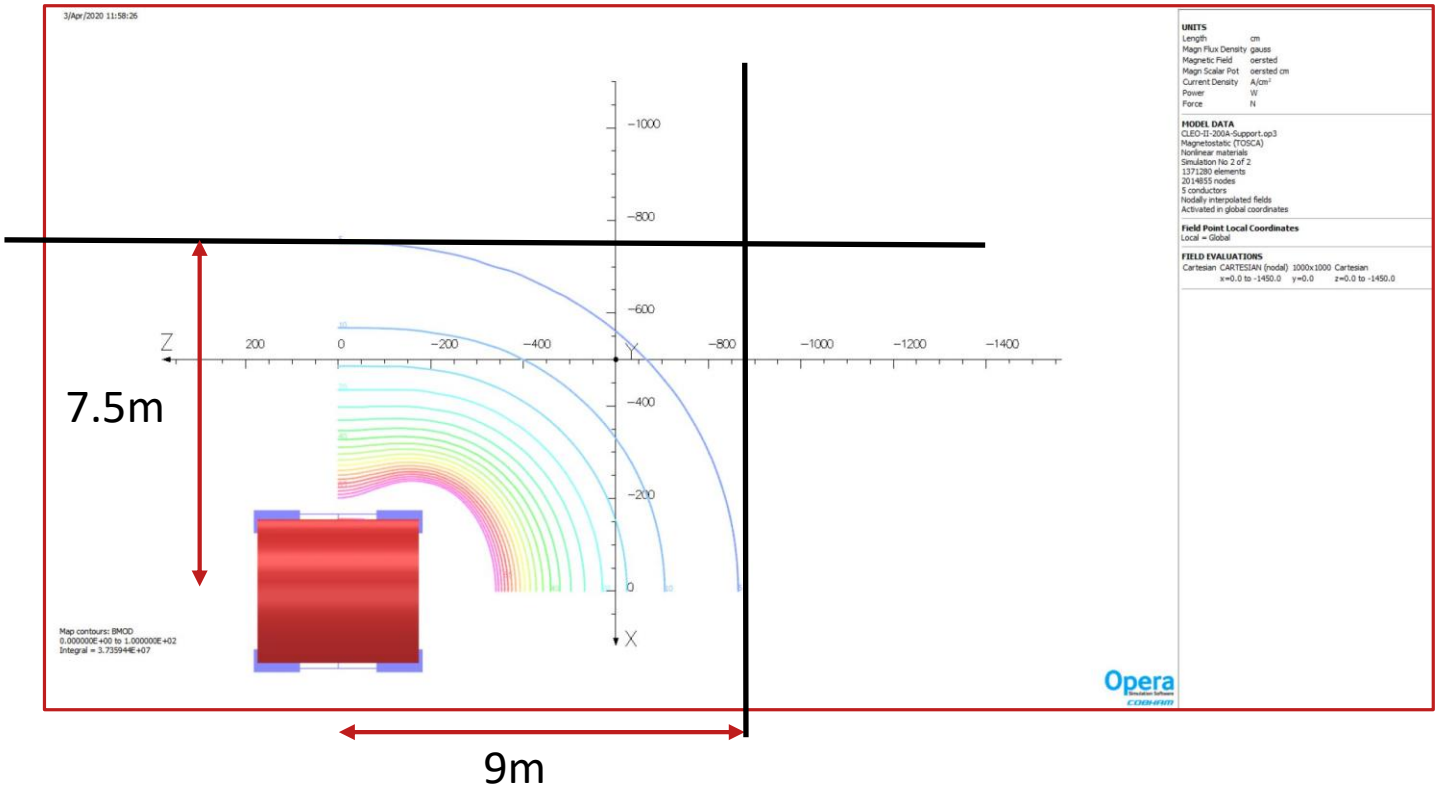
Magnet – Test Lab Layout



Magnet – Test Lab Layout

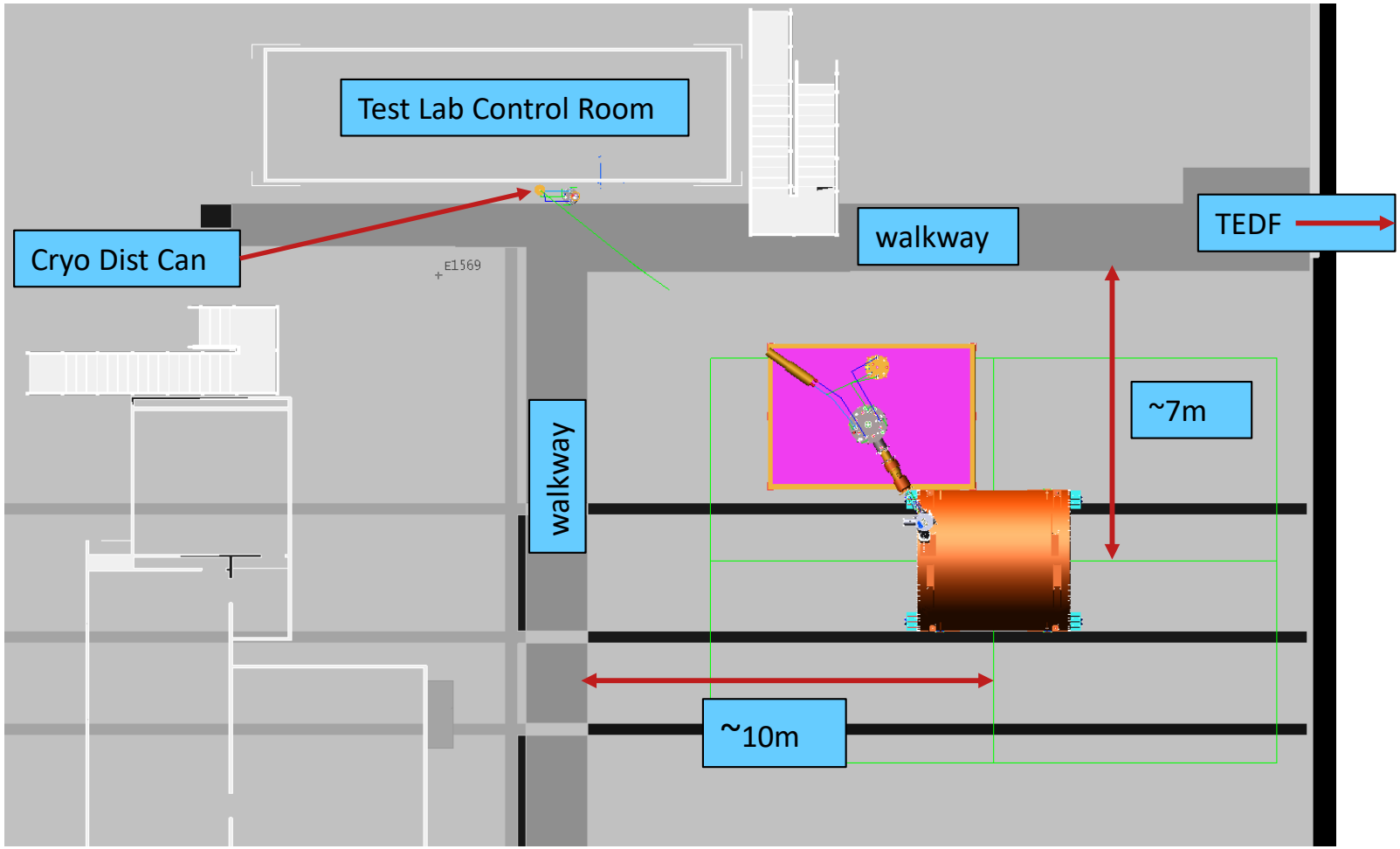
5 gauss boundary of CLEO coil on support stand – 200A

TOSCA model run by Steve Lassiter



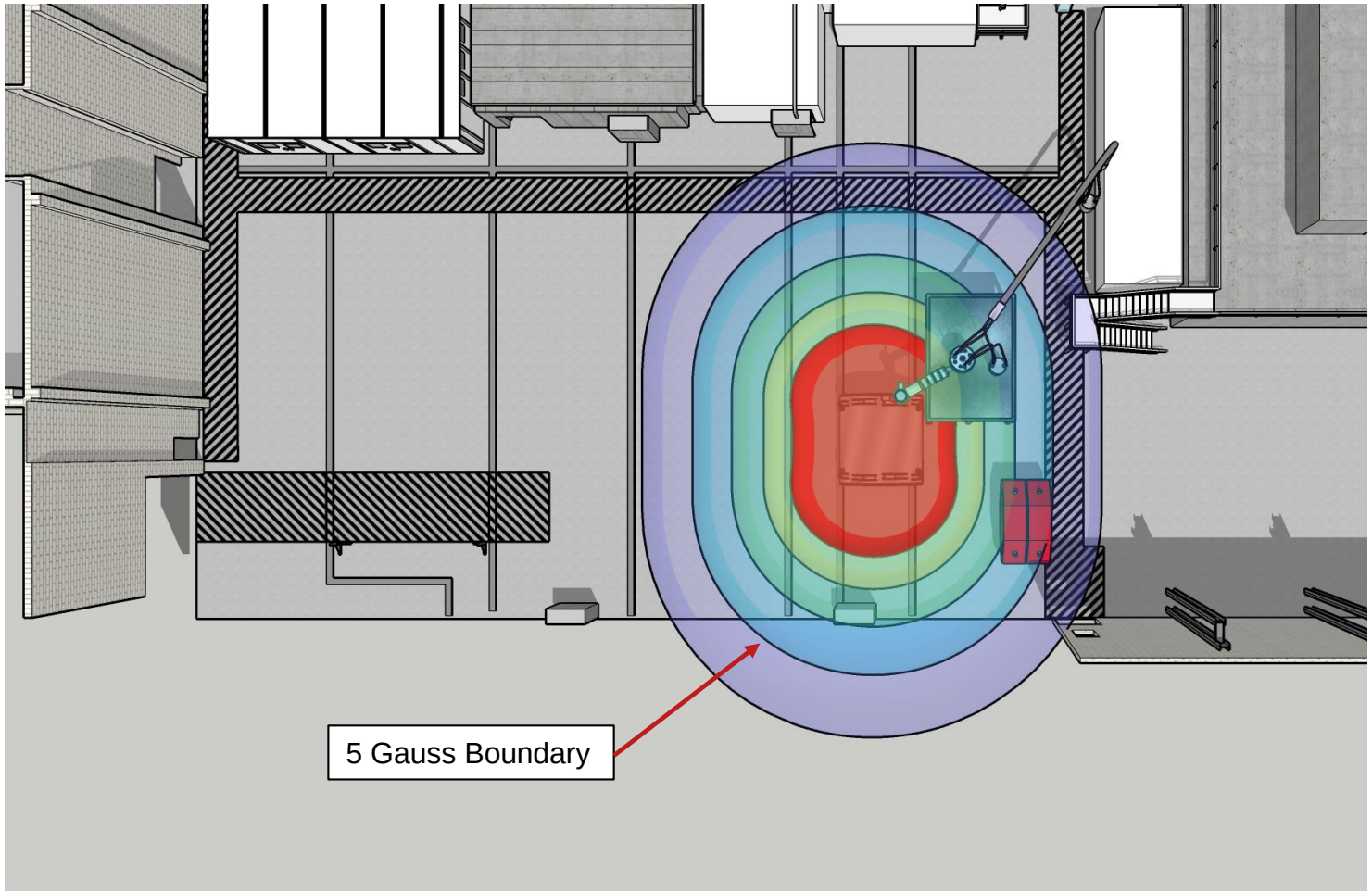
Magnet – Test Lab Layout

Magnet location in test lab



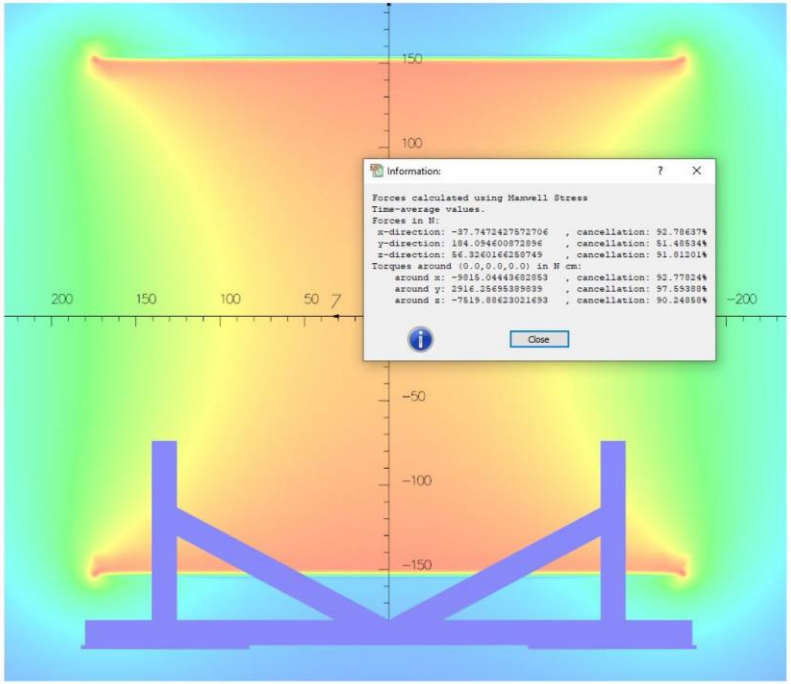
Magnet – Test Lab Layout

Overlay of magnetic field inside the test lab



Magnet – Test Lab Layout

- Forces on the coils and support stand analyzed by Steve Lassiter
- Coil Forces due to presence of support stand are negligible.
- CLEO documentation indicates the coils were run on the support stand at higher currents than we are considering without any issues.



Infrastructure

- Steel delivery from Cornell complete!
- Power and LCW upgrades in FY20

Director's Review Comments - Technical

- The Phase II SC magnet's limited cold test should be re-planned to be merged with the Phase I Solenoid rehab plan (which is supported from JLAB operations funds). The schedule for this expanded Phase I scope should be consistent with the completion of approved SOLID pre construction R&D so that the important SOLID SC magnet system is confirmed ready as soon as possible, preferably when SOLID gets CD-0.
  - Rehab plan and cold test have been merged. Test completion likely to run into mid to late 2021. We need to update schedule to factor in any changes due to COVID19.

- It is essential that a careful magnetic analysis be performed of the SOLID Solenoid cold low current test configuration in the Test Lab and the 50 gauss and 5 gauss field boundaries clearly identified. It may be possible to optimize the SOLID Solenoid test location within the Test Lab to minimize magnetic effects on adjacent magnetically sensitive equipment and occupied areas. The magnetic field boundaries must be measured during the SOLID Solenoid low current testing and the 50 gauss boundary, 5 gauss boundary and maybe even a lower magnetic boundary measured and posted.
  - Analysis completed to identify 5 and 50 gauss boundary. Other stakeholders in the test lab are in the loop to provide coordination for testing.

- Develop the magnetic magnet measurement specification (resolution, precision…) – so the testing activity can be adequately planned for and costed. Resolve inconsistency between costed magnet measurement set-up (50k) and number stated in the pre-CDR (200k).
  - Based on JLAB experience the pre-CDR number was the most accurate.

Director's Review Comments - Cost

- A comprehensive magnetic environment optimization study of the SOLID extended iron magnet should be performed in order to support the basis for what is the highest cost item in the magnet WBS. There may be opportunities to improve the magnetic performance, cost, manufacturability, assembly, detector access, detector performance, mechanical support and installation. This next level analysis should be performed in an engineering environment with all the quality considerations necessary included.
  - Magnetic optimization has occurred and will continue as needed to reduce the field in the area of the Chernkov PMT's
  - Continued brainstorming on the detector endcap support and motion system to reduce complexity. This consequently may reduce cost but CAD model has not been updated to explore these options. This should aid with access to individual detectors.

Director's Review Comments - Schedule

- Develop and vet a detailed installation plan which incorporates best engineering practices. This installation plan would optimally include step-by-step CAD models of sufficient detail that a future review panel can clearly see that the steps are included and all major required SOLID items are covered. This is very valuable to support the cost and schedule planning required to establish a pre-construction cost range that can be reviewed.
  - A sufficient CAD model exists that would allow step by step visualization of the installation process. The Hall Work Coordinator's input would be needed to develop and vet a detailed plan.

- The engineering team of hall A has extensive experience in mounting and reconfiguring experiments. The presented manpower for the engineering design for integration and installation seems reasonable (on a high level) and can be traced back to previous experience. However, without documented assumptions and further detail, effort planning this estimate cannot be validated.
  - A slide containing assumptions used to develop the schedule was included in with the additional slides during the review but due to time constraints was never presented.

Director's Review Comments – Risk/Contingency

- The risk cost assigned to installation seems low. Consider revisiting this estimate. If 14 FTE are required for the installation, $100K represents less than 2 weeks delay, which seems rather optimistic. If it is believed to be sufficient; the team should be ready to give a good justification at the next review.
  - 2 weeks of contingency seems low. This needs to be explored further and the risk updated if needed.

- Magnet tests should be given a priority to eliminate this critical risk for the project.
  - The Phase 1 low current cold test has been a priority of the Physics Division to help mitigate the risk associated with the functionality of the solenoid magnet.

Whit Seay

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Questions?

Additional Slides

Installation Estimate

Preliminary Estimate – Slide taken from Director's Review presentation

Magnet assembly (2 months duration) – no other activities in the hall with mobile crane and trucks operating.

- Floor preparation and floor plates installed
- Magnet support installed and aligned
- Magnet steel and cryostat installation

Multiple activities able to run in parallel – two to four tasks possible at same time

- CCR, Cryo lines, power supply and I&C installation (2 months)
- Detectors moved to the hall with additional assembly and checkout
- Detector installation fixtures assembled (4 weeks)
- Beamline installation – where possible (6 weeks)

Magnet testing (Phase 3) (5.5 months)

- Cryostat evacuation (2 weeks)
- Leak & pressure tests – hipot and elec tests (2 weeks)
- I&C calibration (warm and cold – 4 weeks)
- Cool down (1 month – CLEO II required 2 weeks)
- Low and Full current test (4 weeks)
- Field mapping (4 weeks)

Detector installation and final checkout (3 months) *critical path

Installation Estimate

Preliminary Estimate – Assumptions – Slide taken from Director's Review presentation

Magnet assembly (2 months duration) – no other activities in the hall with mobile crane and trucks operating.

- Favorable staging of return steel in the hall for efficient installation
- Minimum modifications required to the truck ramp to move cryostat in hall
- Simple plates or rails needed for endcap motion – quick installation

Multiple activities able to run in parallel – two to four tasks possible at same time

- Assumes manpower is available to carryout four tasks simultaneously
- CCR, Cryo lines, power supply and I&C installation simplified by Phase 2 work

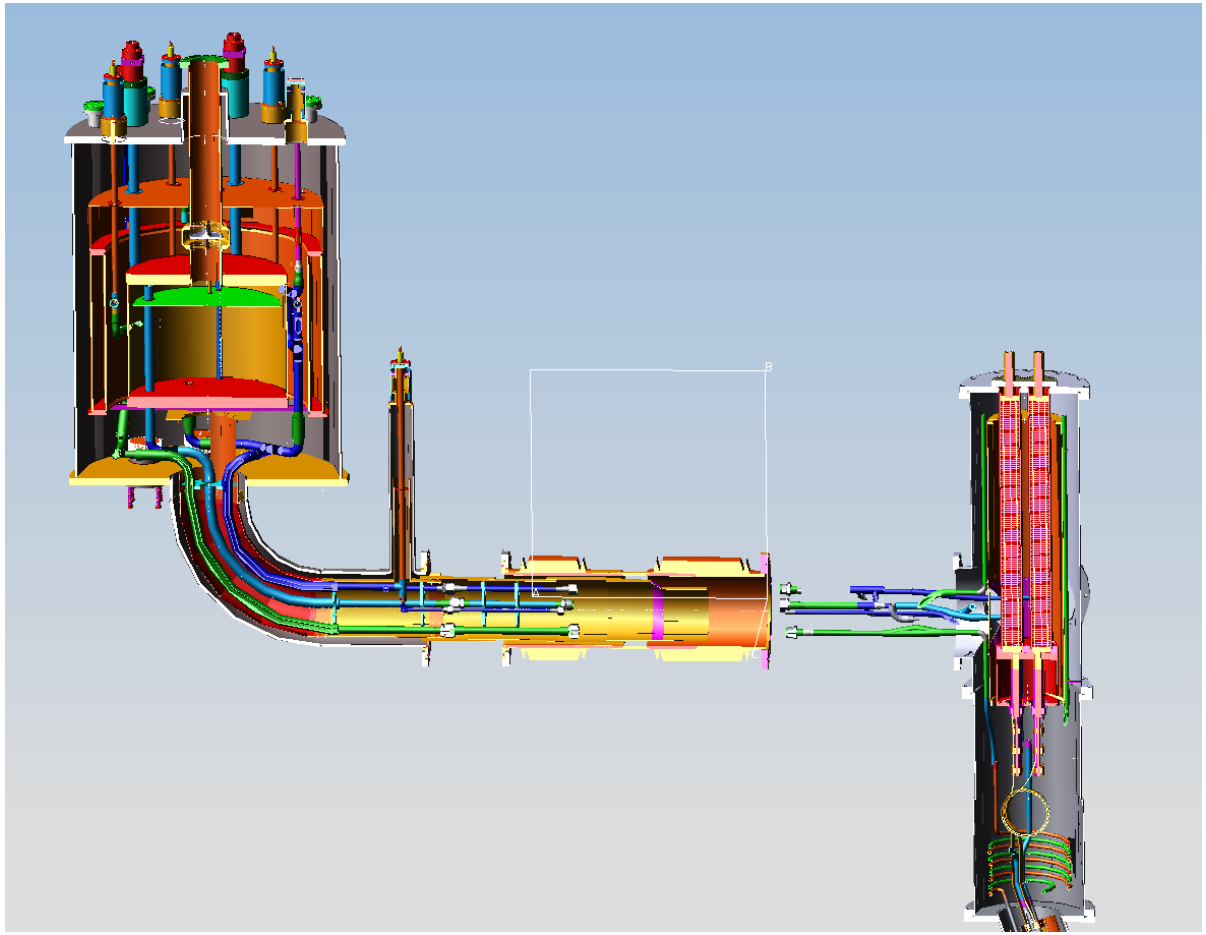
Magnet testing (Phase 3) (5.5 months)

- Assumes a few tasks can start as utility installation completes
- I&C calibration (warm and cold – 4 weeks)
- Depending on Phase 2 cool down experience duration could be reduced down

Detector installation and final checkout (3 months)

- Detectors preassembly has them ready for final assembly on installation fixtures.
- As conceptual design moves forward an improved detector installation estimate can be made.

Section cut through CCR and Current Lead Pot



CLEO Delivery from Cornell

Steel delivery from Cornell completed!

Cleo II @ 200A