G-2 MAGNETIC FIELD MAPPING FACILITY

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High Energy Physics (HEP)
Independent Safety Review
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PROGRAM OVERVIEW

Scientific researches at the 4T superconducting solenoid magnet

- Calibrations of high-precision nuclear magnetic resonance (NMR) probes
  - Developing/studying the magnetic field scan system for the Muon g-2 experiment
  - Developing/studying the water-based absolute calibration probe for the Muon g-2 experiment
  - Developing/studying the He3 probe for the Muon g-2 experiment
  - Cross-calibration of the two absolute calibration probes from the two Muon g-2 experiments (US vs Japan)
PROGRAM OVERVIEW

Scientific researches at the 4T superconducting solenoid magnet

- Providing strong magnetic field for other research projects at Argonne and out of Argonne
  - Testing MCP performance in strong magnetic field: Argonne HEP Detector R&D group
  - Testing the magnetic cloak for the electron-ion collider: Nils Feege’s group from Stony Brook University
FACILITY OVERVIEW

The superconducting magnet

The motion stage

The laser system

The measurement electronics
SUPERCONDUCTING MAGNET

Operations

- Ramping the current up/down
- Fill the liquid helium
  - Boils off ~4 liters liquid helium out of 3,300l during normal operation
  - Top off every 3 months
- Changing currents in the shimming coils
  - 5 power supplies that deliver up to 10A DC current to shim the field
- Installation of other devices
  - NMR systems, Motion stages
  - Etc.
SUPERCONDUCTING MAGNET

Safety

- High magnetic field
  - Signs for warning people with pacemaker
  - Ferromagnetic metal detection at the door
  - Non-magnetic tool requirement
  - 5 gauss range indicator
  - Checklist for users

- Cryogenic hazard
  - Cryogenic training for operators
  - PPE (cryogenic gloves, safety goggles, etc)
  - Two-person rule
SUPERCONDUCTING MAGNET

Safety

- Vacuum and pressure vessels
  - Protection valves
- Oxygen deficiency hazard
  - Quench emergency Procedure
  - ODH alarm
LASER SYSTEM

Operation

- Activate discharge tube using RF coils (10W, 20V)
- Nuclear spin polarization using class 3b 1083nm laser
LASER SYSTEM

Safety

- Microwave hazard
  - IH Survey
  - Awareness training

- Class 3b laser
  - ESH120 laser safety training
  - Require Laser Operation Permit
  - Enclosure during operation

He3 probe
Enclosure
Discharge tube
MOTION STAGES

Operations

- Assembling and testing the stages
  - Measuring geometries
  - Cleaning rails
  - Installing components of the stages

- Manual and automatic motions for research activities
  - Galil motion control system
  - Completely operated on computer

- Operation of commercial and approved custom electronics.
MOTION STAGES

Safety

- Mechanical crush hazard
  - Require clearance checking before operations
  - Safety limit switches and emergency button
NMR MEASUREMENT SYSTEMS

Operations

- Installation of probes
- Field scanning
- NMR measurements
  - RF pulses
  - Signal amplifiers
  - ADC
- Operation of commercial and approved custom electronics.
NMR MEASUREMENT SYSTEMS

Safety

- Microwave hazard
  - IH Survey
  - Awareness training
HOISTING AND RIGGING

Safety

- Training requirement for crane operators
- Clear path before operation
- Keep crane hook away from the magnet
SUMMARY OF SAFETY CONTROLS

- WCD 26082: 6 tasks
  - Magnet operations
  - Magnet users for research applications
  - Hoisting and rigging
  - Helium NMR probe operation with laser
  - Platform operation with Galil motion control system
  - Magnetic field measurement using NMR probes

- Independent Workers are assigned to the tasks they need to perform through WCD
## SUMMARY OF SAFETY CONTROLS

- **Required trainings**

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<tr>
<th>Course</th>
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<td>ESH117</td>
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<td>ESH195</td>
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<td>PFS21111</td>
<td>Incidental Crane Operator Training</td>
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THANK YOU FOR YOUR ATTENTION!