

G-2 MAGNETIC FIELD MAPPING FACILITY

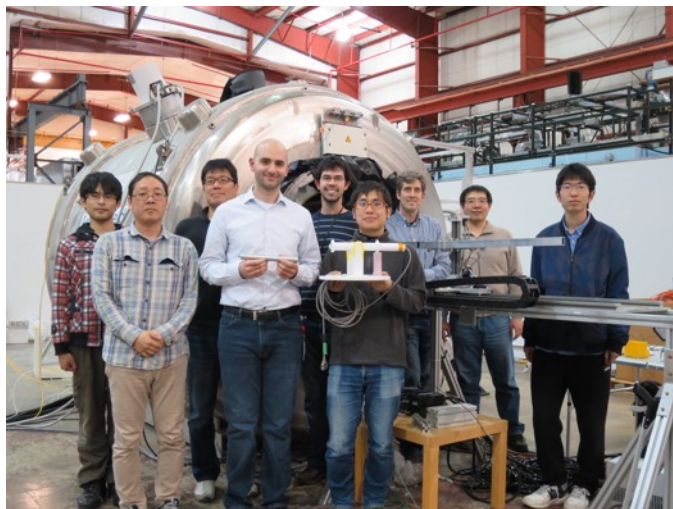


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PROGRAM OVERVIEW

Scientific researches at the 4T superconducting solenoid magnet

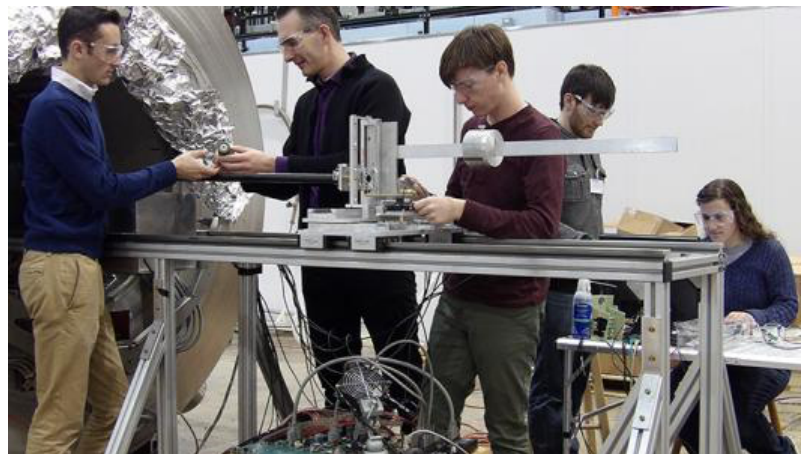
- Calibrations of high-precision nuclear magnetic resonance (NMR) probes
 - Developing/studying the magnetic field scan system for the Muon g-2 experiment
 - Developing/studying the water-based absolute calibration probe for the Muon g-2 experiment
 - Developing/studying the He3 probe for the Muon g-2 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

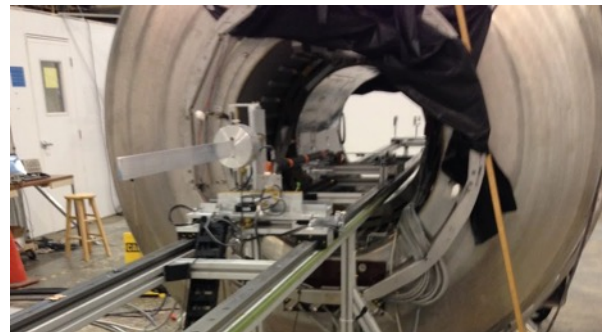
The superconducting magnet



The laser system



The motion stage



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

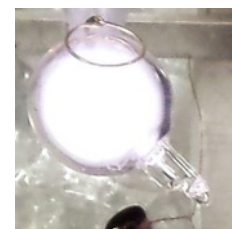
- Activate discharge tube using RF coils (10W, 20V)
- Nuclear spin polarization using class 3b 1083nm laser



He3 probe



Enclosure



Discharge tube

LASER SYSTEM

Safety

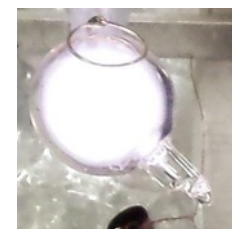
- Microwave hazard
 - IH Survey
 - Awareness training
- Class 3b laser
 - ESH120 laser safety training
 - Require Laser Operation Permit
 - Enclosure during operation



He3 probe



Enclosure

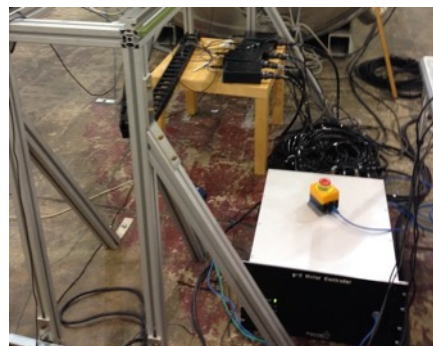


Discharge tube

MOTION STAGES

Operations

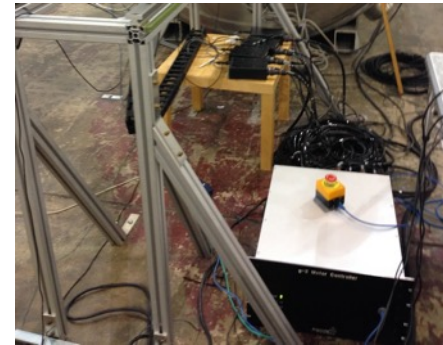
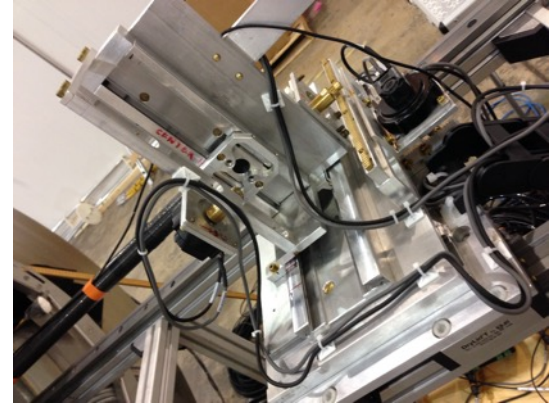
- Assembling and testing the stages
 - Measuring geometries
 - Cleaning rails
 - Installing components of the stages
- Manual and automatic motions for research activities
 - Galil motion control system
 - Completely operated on computer
- Operation of commercial and approved custom electronics.



MOTION STAGES

Safety

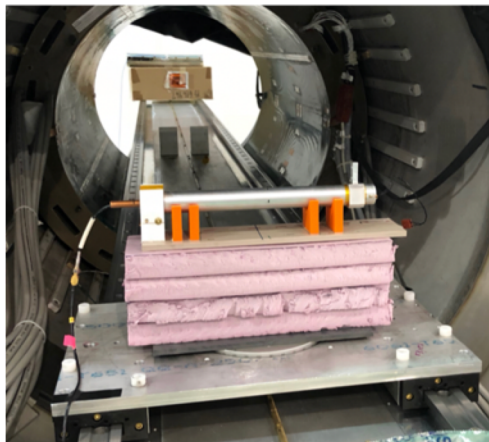
- Mechanical crush hazard
 - Require clearance checking before operations
 - Safety limit switches and emergency button



NMR MEASUREMENT SYSTEMS

Operations

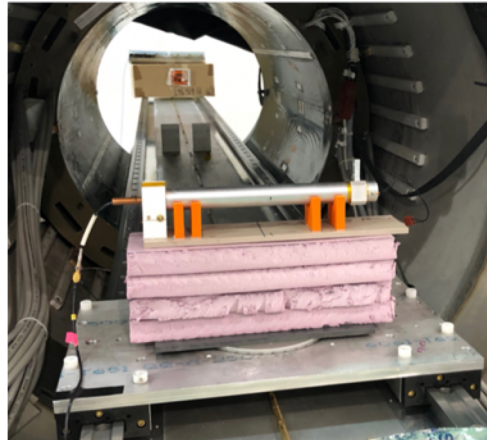
- Installation of probes
- Field scanning
- NMR measurements
 - RF pulses
 - Signal amplifiers
 - ADC
- Operation of commercial and approved custom electronics.



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

| | |
|----------|--|
| ESH117 | Ladder Safety |
| ESH120 | Laser Safety |
| ESH195 | Personal Protective Equipment |
| ESH364 | Radiofrequency and Microwave Safety Awareness |
| ESH433 | Tilting Dewar Cart Training |
| ESH433PR | Tilting Dewar Cart Practical Factor |
| ESH810 | Argonne Pressure Systems Safety Manual Information |
| PFS21111 | Incidental Crane Operator Training |

THANK YOU FOR YOUR ATTENTION!



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