NCNR Sample Environment Projects

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Procurement and Development:
Helium Recovery Project

Helium Recovery System - is a system to collect, store, purify, liquify and re-use Helium gas boil-off from wet cryostats / magnets, Helium pumps and transport Dewars

- Weekly meetings with NCNR team (SE, RFO, ROE, OFPM, AMD, Safety, etc.) (Fall 2019 – Present)
- Bi-weekly meetings with the Contractor on system design, etc. (Fall 2020 – Present)
- Contractor's quality control paperwork review
- System commissioning – December 2022

Helium Recovery Project

End-User Station (EUS) - 29 pcs and **Helium Monitor Station (HMS) - 8 pcs**

- Working with the Contractor on EUS and HMS conceptual designs – finished in April 2021
- Designing and ordering interfaces between SE equipment (cryostats, He dewars, pumps) and EUS (*about $50k+ sub-project*)
- Testing EUS and HMS prototypes: *design changes suggested*

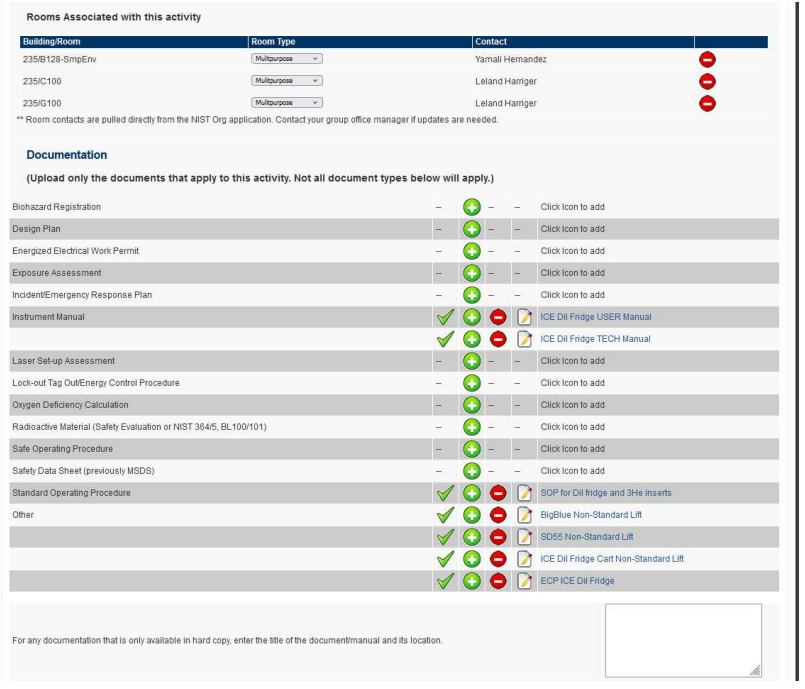
Maintenance and Safety

Maintenance

- SANS ILL #1 Cryostat got a leak to the vac jacket. Repair - In progress
- ICE Dil Fridge insert lost 20% of the 3He-4He mesh (incident). The mesh has been recovered. Tested. - Completed

Safety

- Hazard Review for low temperature inserts - In progress
  - ICE Dil Fridge
  - Oxford Dil Fridge
  - 3He Insert
  - Big Blue



Rooms Associated with this activity

Building/Room	Room Type	Contact	
235/B128-SmpEnv	Multipurpose	Yamali Hernandez	
235/C100	Multipurpose	Leland Harriger	
235/G100	Multipurpose	Leland Harriger	

** Room contacts are pulled directly from the NIST Org application. Contact your group office manager if updates are needed.

Documentation

(Upload only the documents that apply to this activity. Not all document types below will apply.)

Biohazard Registration	--	+	--	--	Click Icon to add
Design Plan	--	+	--	--	Click Icon to add
Energized Electrical Work Permit	--	+	--	--	Click Icon to add
Exposure Assessment	--	+	--	--	Click Icon to add
Incident/Emergency Response Plan	--	+	--	--	Click Icon to add
Instrument Manual	✓	+	−	✎	ICE Dil Fridge USER Manual
	✓	+	−	✎	ICE Dil Fridge TECH Manual
Laser Set-up Assessment	--	+	--	--	Click Icon to add
Lock-out Tag Out/Energy Control Procedure	--	+	--	--	Click Icon to add
Oxygen Deficiency Calculation	--	+	--	--	Click Icon to add
Radioactive Material (Safety Evaluation or NIST 364/5, BL100/101)	--	+	--	--	Click Icon to add
Safe Operating Procedure	--	+	--	--	Click Icon to add
Safety Data Sheet (previously MSDS)	--	+	--	--	Click Icon to add
Standard Operating Procedure	✓	+	−	✎	SOP for Dil fridge and 3He inserts
Other	✓	+	−	✎	BigBlue Non-Standard Lift
	✓	+	−	✎	SD55 Non-Standard Lift
	✓	+	−	✎	ICE Dil Fridge Cart Non-Standard Lift
	✓	+	−	✎	ECP ICE Dil Fridge

For any documentation that is only available in hard copy, enter the title of the document/manual and its location.

Procurements: ILL cryostats

- 3He MACS ILL cryostat #14: needle valve refurbishment has been ordered, installed, tested – Completed
- Upgrade of two ILL cryostats to three heat exchangers: more cooling power, faster prep and sample change times - In progress
- Damaged 70mm sample stick has been sent for repair – In progress
- New 100mm carbon fiber sample stick for MACS ILL is ordered (expected soon) - In progress

Procurement: Custom Rotation System for 100mm ILL Cryostat

Funded by NSF

- Collecting the requirements from NCNR scientists
- Market research
  - Talking to other neutron facilities
  - Talking to manufacturers and engineering companies
- Preparing procurement paperwork
- Submission to AMD: June 2021
- Award: September 2021
- Expected delivery: Spring 2023 (supply chain issues)

The rotation system consist of

- Computer controlled rotation stage to be mounted on top flange of the 100mm ILL cryostat
- Rotatable sample stick to be inserted in 100mm sample well
- Interface mounting flange adapter between rotation stage and cryostat flange
- Interface mounting flange adapter between rotation stage and rotatable sample stick
- Controller, cables, software

IN PROGRESS

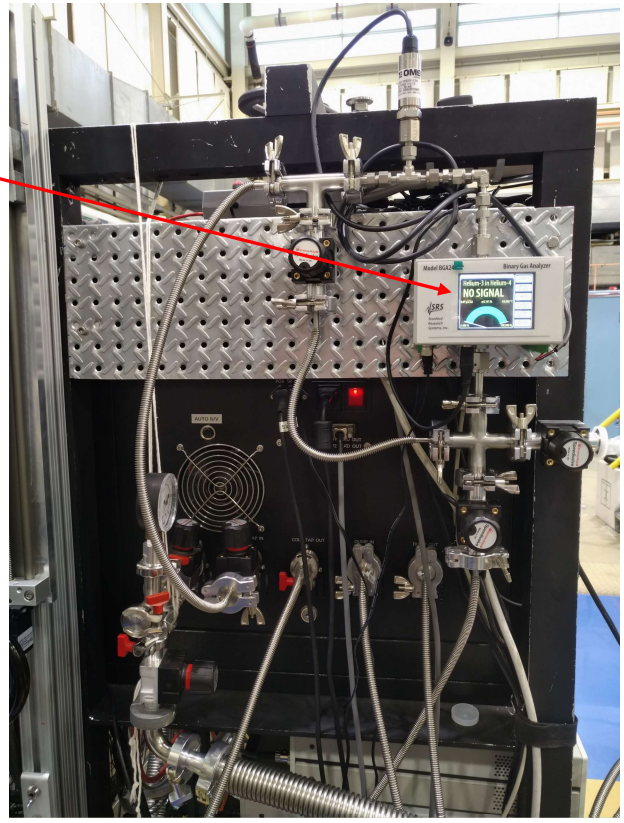
Development: ICE Dil Fridge

➢ Binary Gas Analyzer

Fully integrated into dil fridge gas handling system, this diagnostic and troubleshooting tool allows *in situ* 3He-4He mixture analysis.

Late 2021: Installed, tested

August 2022: First time been used to replenish the lost 3He-4He mesh.



Development: ICE Dil Fridge

➢ New sample holder for SANS dil fridge experiments

Collaboration with Jonathan Gaudet

- Design
- Material: Al, Cu
- Thermal conductivity test
- Neutron background test

First test results:

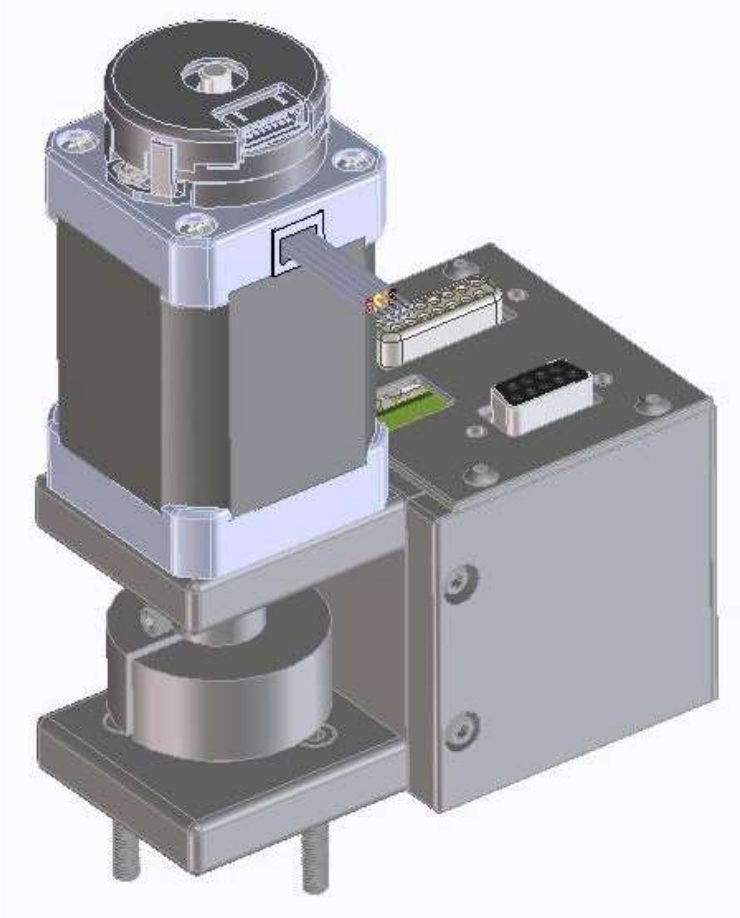
- Aluminum sample holder was able to cool down to 90mK!

Next to test:

- Check Cu sample holder coldest temperature
- Neutron background of both holders

Development:
Needle Valve Automatic Control System for Wet Cryostats and Magnets

- The System automatically adjusts cooling power of wet cryostats and magnets by closing/opening of the Needle Valve
- This adjustment works automatically based on the desired Helium pumping pressure. This pressure, in turn, is automatically calculated based on the temperature range the cryostat is at and based on the direction of the temperature change
- The System can be operated both manually and automatically
- The System consists of:
  - standard commercial items: a step motor and its controller, pressure gauge, cables
  - in-house designed items: Aluminum motor holder, enclosure for the controller and interfaces, LabView based software
- The System will be used for: ILL Orange cryostats (14 pcs), 3He insert for 7T, SANS 9T, 10T, and 15T magnets as well as future SE systems
- The System saves labor, liquid Helium and beam time

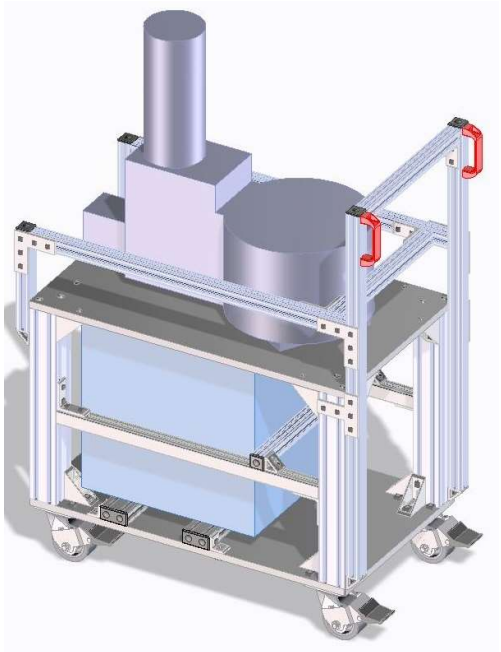


Designed by NCNR Sample Environment group based on the ORNL original design

Thanks to Alan Ye for software support

Development: Cylon 3T Magnet Liftable Cart

Existing Cylon 3T Magnet Cart (non-liftable)

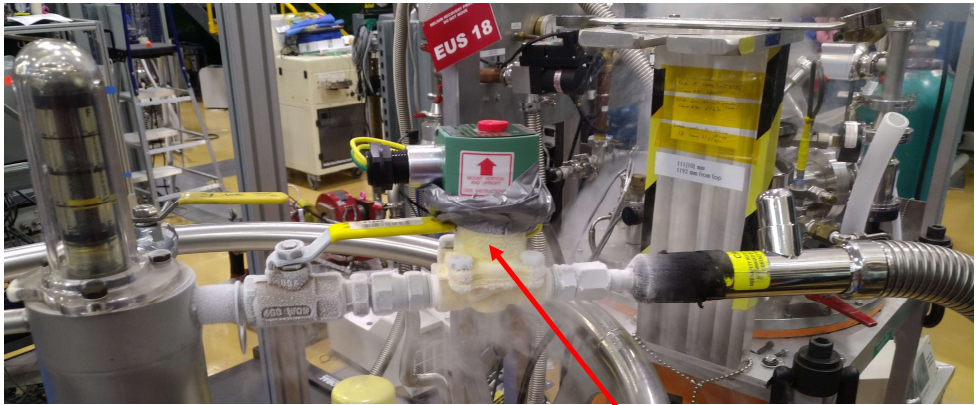


Put on hold due to lack of engineering support

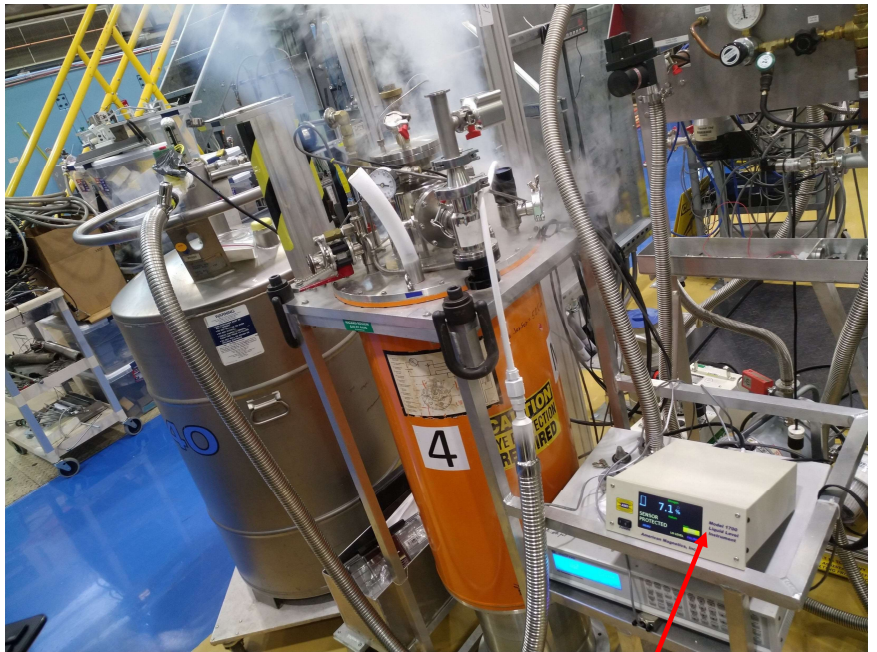
- Made in 2018
- New requirements: Needs to be liftable

Development: LN2 automatic transfer system

Allows to maintain LN2 level within preset limits



Solenoid cryo valve



Cryogen level controller

Next steps:

- Instrument scientists to test the system and return the feedback
- For BT7 and MACS: discuss system setup challenges
- Order parts for several LN2 transfer sets (FY 2023) and get system ready during 2023 shutdown

LHe automatic transfer system –> Sergiy's talk

Any suggestions for 2023 Shutdown?

- New sample holders
- New low temperature capabilities
- New automation ideas

Summary

Completed projects:

- ILL cryostats: maintenance, improvements, procurements
- ICE dil fridge improvements: *in situ* 3He-4He mixture measurement system in operation
- New LN2 auto transfer system

In progress:

- Helium Recovery System
- Custom Rotation System for 100mm ILL cryostat
- Needle Valve Automatic Control for ILL cryostats (first prototype is completed)
- New Cylon 3T magnet liftable cart
- New sample holder for SANS dil fridge experiments
- Upgrade of two ILL cryostats
- New 100mm carbon fiber sample stick for MACS ILL
- New LHe auto transfer system – *Sergiy's talk*