# Shutdown Update

S.E. / Laboratories

- Maintenance
- Acquisitions/Procurements
- Safety
- Development
- Safety

✓ Work Done

➢ Work To Be Done

Juscelino Leão

# Projects Description

**S. E.:**

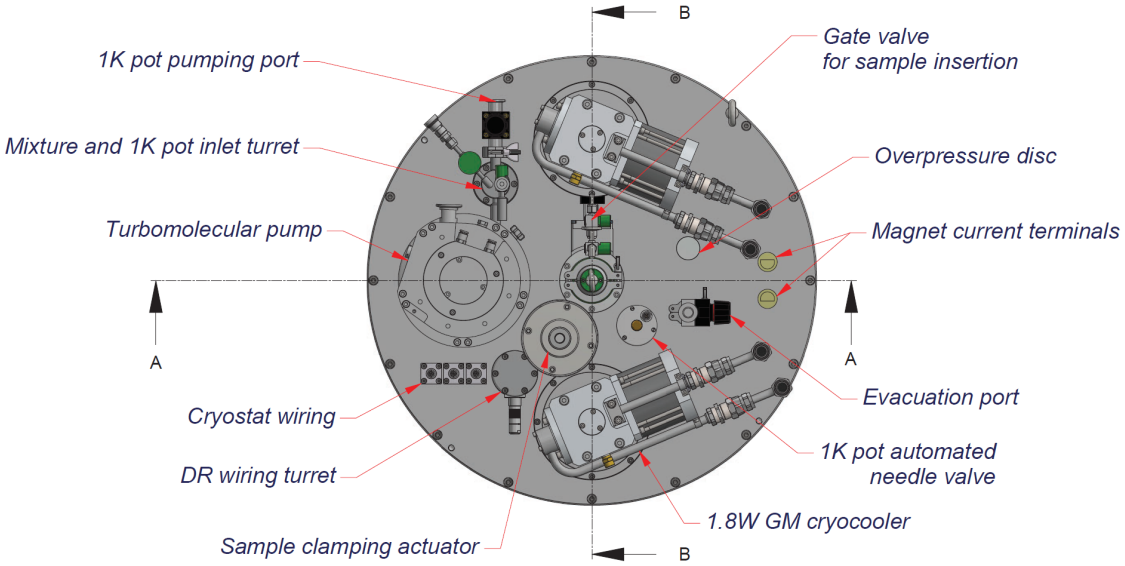
- ✓ 12T Dry Cryomagnet — Acquisitions/Procurements
- ✓ Gas Loading Systems — Maintenance
- ✓ High Pressure Systems — Maintenance
- ✓ 2 GPa Clamp Pressure Cells — Acquisitions/Procurements
- ✓ Vanadium Powder Cans (Assisted Tanya Dax) — Acquisitions/Procurements
- ✓ CCR He Lines Repair (Assisted Tanya Dax) — Maintenance
- ✓ Cryogenics Hands-on Training — Safety
- ✓ Beam Line Equip. SOPs, User/Technical Manuals — Safety
  - ✓ Syringe Pump
  - ✓ Gas-loading
  - ✓ High Pressure
  - ✓ Furnaces

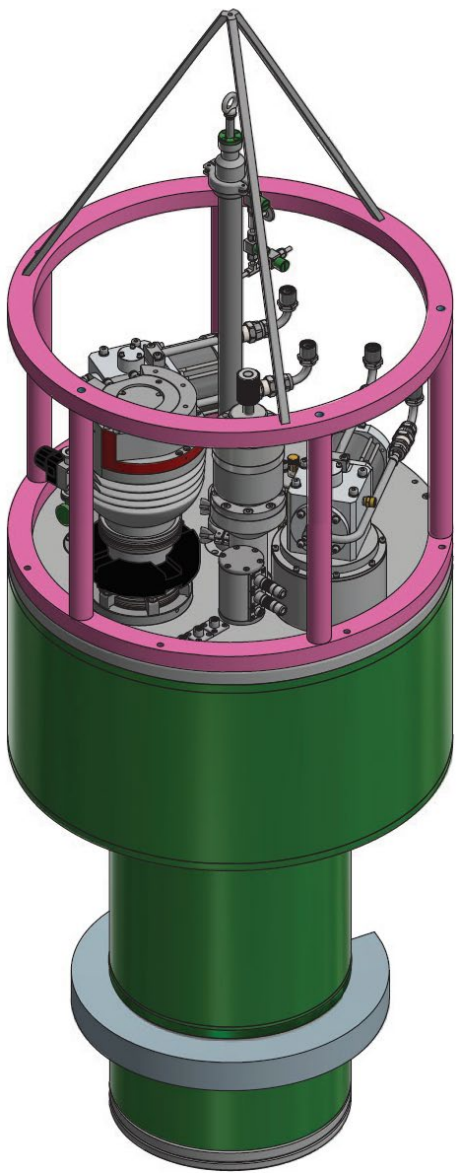
**Laboratory:**

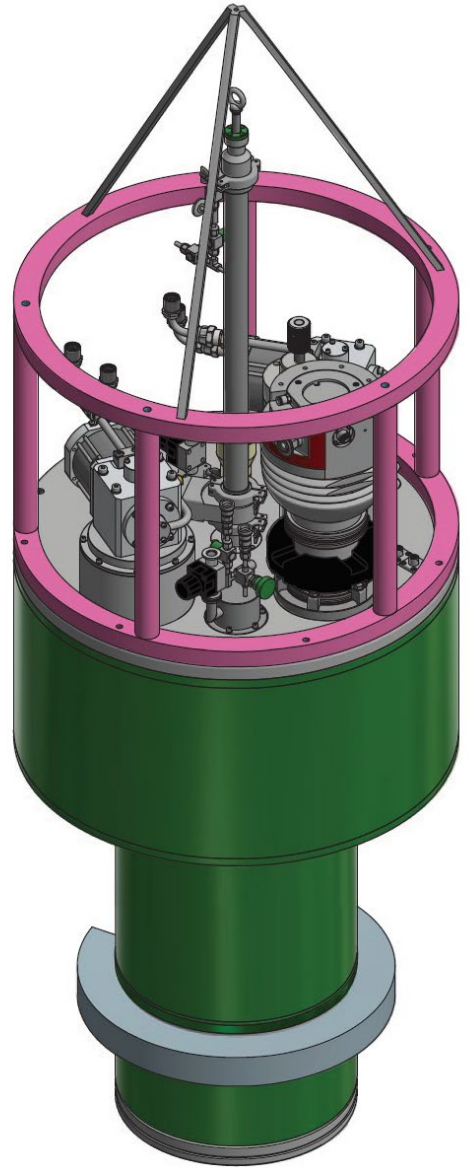
- ✓ Recirculating Baths Inventory and Maintenance — Maintenance
- ✓ FTIR Maintenance — Maintenance
- ✓ Glove Boxes — Maintenance AND Acquisitions/Procurements
- ✓ UV/Vis — Maintenance
- ✓ Laboratory Vacuum Ovens (Assisted Donna Kaltyre) — Acquisitions/Procurements
- ✓ SOP, User/Technical Manuals — Safety
  - ✓ Lab Furnaces
  - ✓ Torch
  - ✓ Spin Coater

# 12 T Dry Cryomagnet

- Integrated 50 mK Dilution Refrigerator and GHS
- +/- 12 T symmetric vertical field
- 35mm split
- +/- 4-degree beam divergence
- Dark Angle: 40 degrees
- Dil Fridge 60+ microWatt minimum cooling power @100 mK

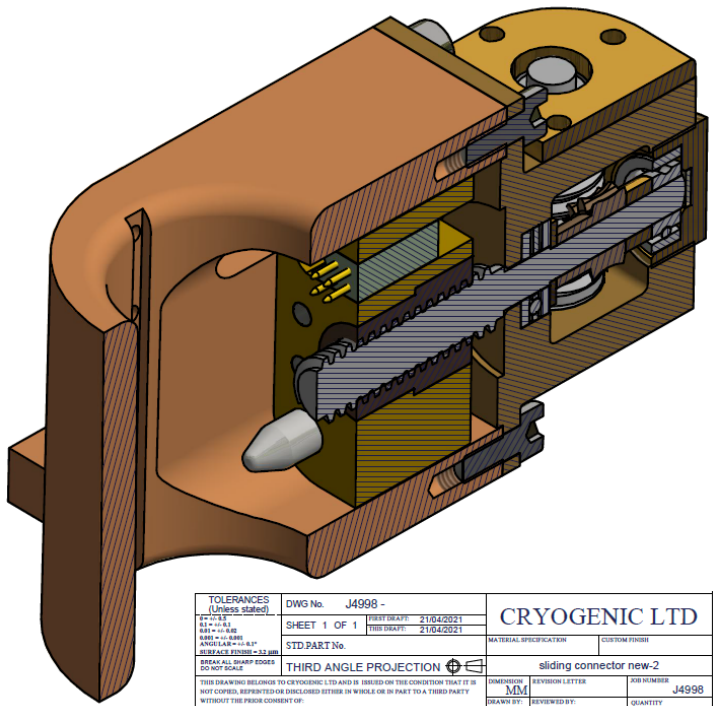


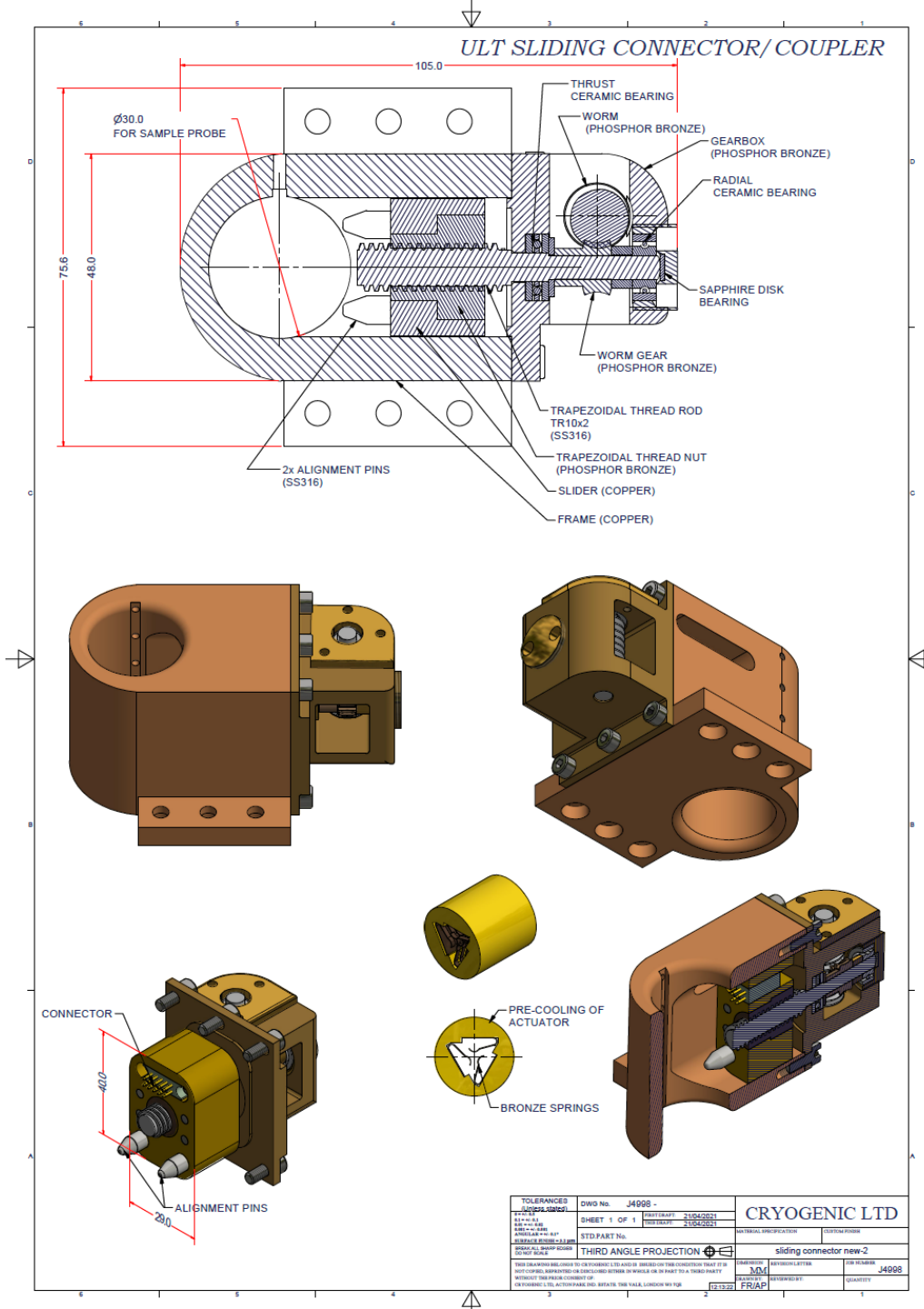


# 12 T Dry Cryomagnet

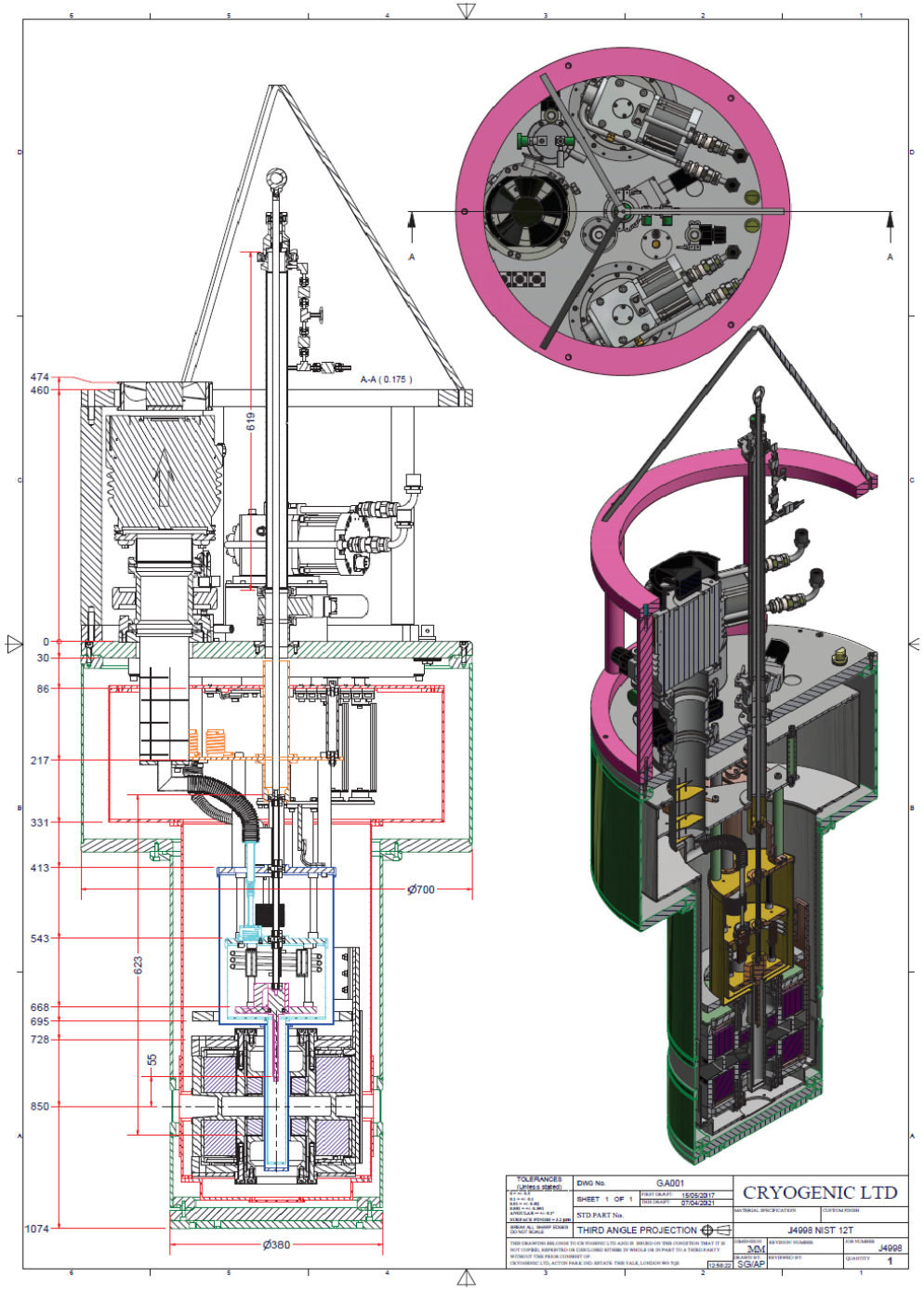
- Integrated 50 mK Dilution Refrigerator and GHS
- +/- 12 T symmetric vertical field
- 35mm split
- +/- 4-degree beam divergence
- Dark Angle: 40 degrees
- Dil Fridge 60+ microWatt minimum cooling power @100 mK



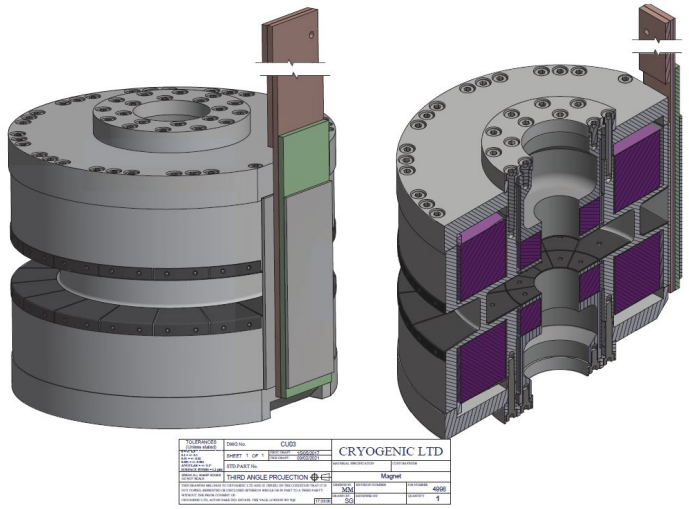
| TOLERANCES (Unless stated) | DWG No. J4998 - | | CRYOGENIC LTD |
|---|---|---|---|
| | SHEET 1 OF 1 | FIRST DRAFT: 21/04/2021 THIS DRAFT: 21/04/2021 | |
| | STD.PART No. | MATERIAL SPECIFICATION | CUSTOM FINISH |
| BREAK ALL SHARP EDGES DO NOT SCALE | THIRD ANGLE PROJECTION | sliding connector new-2 | |
| THIS DRAWING BELONGS TO CRYOGENIC LTD AND IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRINTED OR DISCLOSED EITHER IN WHOLE OR IN PART TO A THIRD PARTY WITHOUT THE PRIOR CONSENT OF: CRYOGENIC LTD, ACTON PARK IND. ESTATE, THE VALE, LONDON W3 7QE | DIMENSION MM | REVISION LETTER | JOB NUMBER J4998 |
| 12:13:22 | DRAWN BY: FR/AP | REVIEWED BY: | QUANTITY |

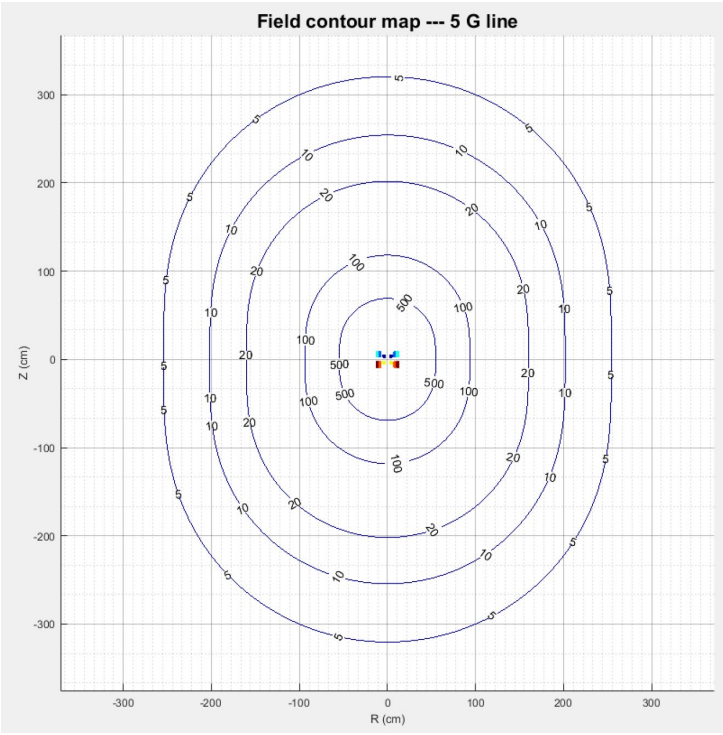


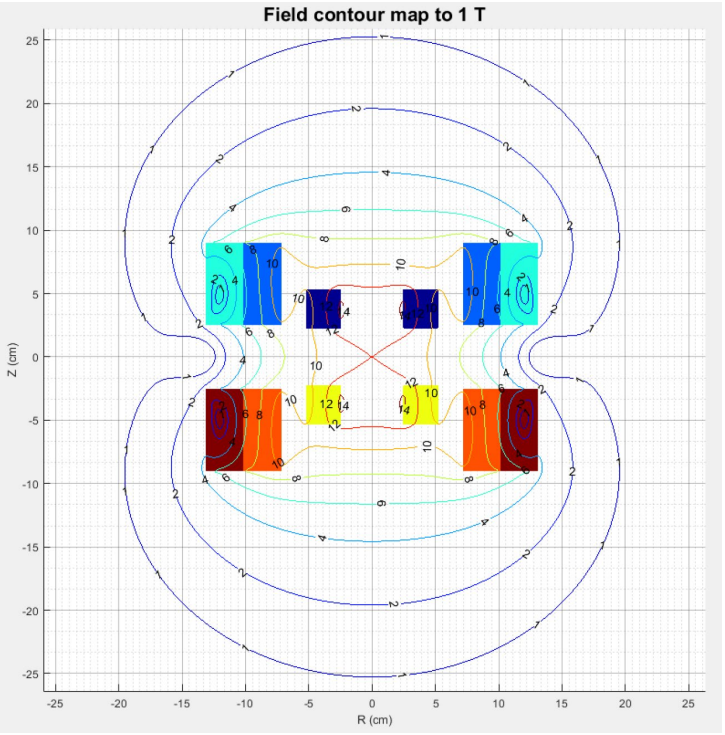

| TOLERANCES (Unless stated) | DWG No. J4998 - | | CRYOGENIC LTD |
|---|---|---|---|
| | SHEET 1 OF 1 | FIRST DRAFT: 21/04/2021 THIS DRAFT: 21/04/2021 | |
| | STD.PART No. | MATERIAL SPECIFICATION | CUSTOM FINISH |
| BREAK ALL SHARP EDGES DO NOT SCALE | THIRD ANGLE PROJECTION | sliding connector new-2 | |
| THIS DRAWING BELONGS TO CRYOGENIC LTD AND IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRINTED OR DISCLOSED EITHER IN WHOLE OR IN PART TO A THIRD PARTY WITHOUT THE PRIOR CONSENT OF: CRYOGENIC LTD, ACTON PARK IND. ESTATE, THE VALE, LONDON W3 7QE | DIMENSION MM | REVISION LETTER | JOB NUMBER J4998 |
| 12:13:22 | DRAWN BY: FR/AP | REVIEWED BY: | QUANTITY |




# First look inside!




Many Thanks to:

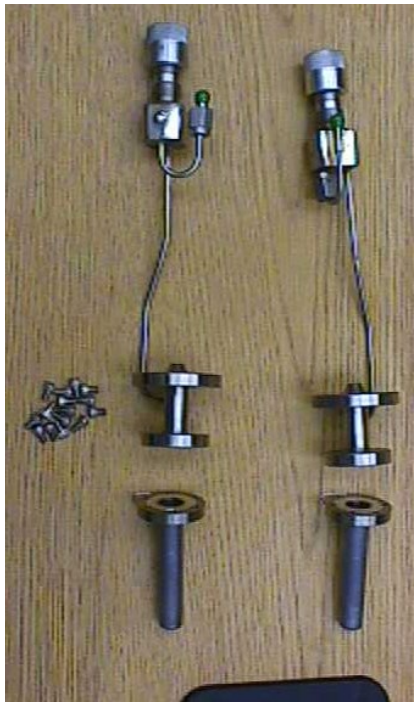
- Collin Broholm
- Don Collie
- Tanya Dax
- Sergiy Gladchenko
- Yamali Hernandez
- Paul Liposky
- Yiming Qiu
- Alan Ye

To name a few…

# 12T Production Plan

CRYOGENIC
CRYOGENIC LIMITED

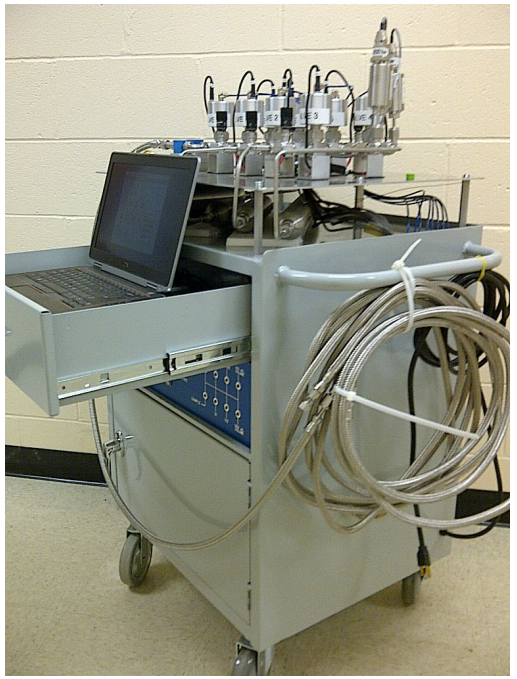
| | Oct-20 | Nov-20 | Dec-20 | Jan-21 | Feb-21 | Mar-21 | Apr-21 | May-21 | Jun-21 | Jul-21 | Aug-21 | Sep-21 | Oct-21 | Nov-21 | Dec-21 | Jan-22 | Feb-22 | Mar-22 | Apr-22 | May-22 | Jun-22 | Jul-22 | Aug-22 | Sep-22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Order placed | ● | | | | | | | | | | | | | | | | | | | | | | | |
| Design of magnet and cryostat | ●●● | ●●●● | ●●●● | | | | | | | | | | | | | | | | | | | | | |
| Design of DR system | | | | ●●●● | ●●●● | ●●●● | | | | | | | | | | | | | | | | | | |
| Finalisation of neutron shielding | | | ●● | ●●●● | ●●●● | ●● | | | | | | | | | | | | | | | | | | |
| Frame and integration design | | | | ●● | ●●●● | ●●●● | | | | | | | | | | | | | | | | | | |
| Compile full design and structural report | | | | | | ●● | ●● | | | | | | | | | | | | | | | | | |
| Nist Design review | | | | | | | ●● | | | | | | | | | | | | | | | | | |
| Post review discussion and modification | | | | | | | | ●● | | | | | | | | | | | | | | | | |
| Preparation of component drawings and BOM | | | | | | ●●●● | ●●●● | ●●●● | | | | | | | | | | | | | | | | |
| Sign off design | | | | | | | | | ●● | | | | | | | | | | | | | | | |
| Machining of cryostat parts | | | | | | | | | ●● | ●●●● | ●●●● | ●●●● | | | | | | | | | | | | |
| Cryostat welding | | | | | | | | | | | | | ●● | | | | | | | | | | | |
| Outer painting | | | | | | | | | | | | | | ●● | | | | | | | | | | |
| Manufacture radiation shield | | | | | | | | | | | | | | ●● | | | | | | | | | | |
| Coil winding | | | | | | | | | | | | | ●● | ●●● | | | | | | | | | | |
| Coil reaction | | | | | | | | | | | | | | ●● | | | | | | | | | | |
| Casting and finishing | | | | | | | | | | | | | | | ●●● | | | | | | | | | |
| Split-pair assembly | | | | | | | | | | | | | | | ●● | ●● | | | | | | | | |
| Assembly of Cryomagnet system including integral DR | | | | | | | | | | | | | ●● | ●●●● | ●●●● | ●●●● | ●● | | | | | | | |
| He-3 Required from NIST | | | | | | | | | | | | | | ●● | | | | | | | | | | |
| Main system test | | | | | | | | | | | | | | | | | ●● | ●● | | | | | | |
| He-3 and DR test | | | | | | | | | | | | | | | | | | ●●●● | | | | | | |
| Test contingency | | | | | | | | | | | | | | | | | | | ●●●● | | | | | |
| FAT | | | | | | | | | | | | | | | | | | | | ●● | | | | |
| Pack and Ship | | | | | | | | | | | | | | | | | | | | | ●● | | | |
| On-site comissioning | | | | | | | | | | | | | | | | | | | | | ●●●● | | | |
| Final Sign-off and payment | | | | | | | | | | | | | | | | | | | | | | ● | | |

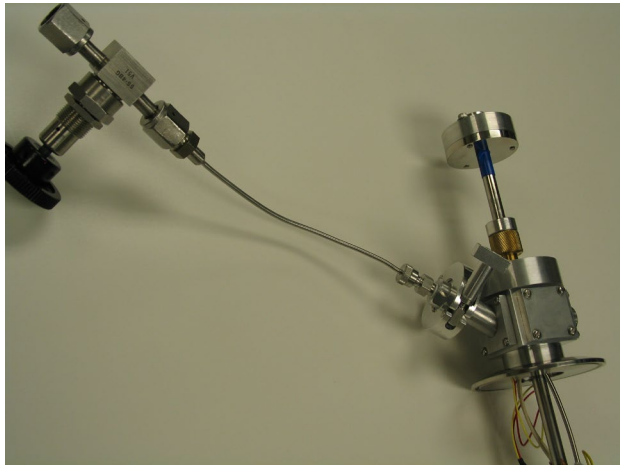


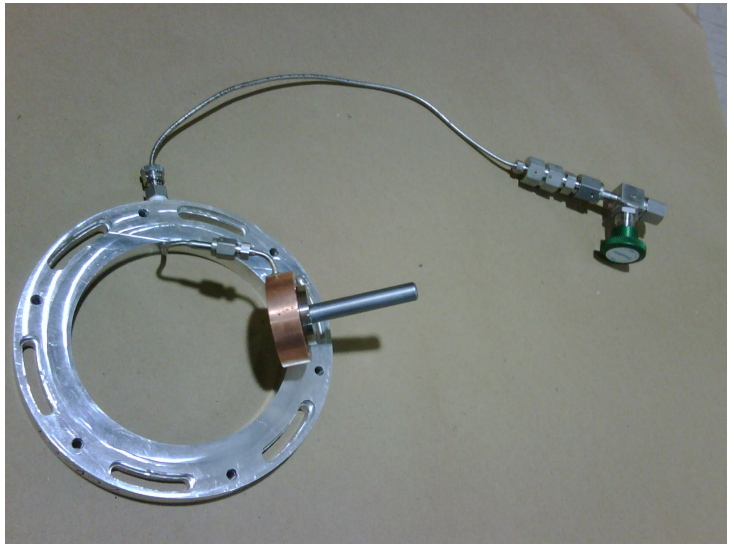
# Gas Loading Systems

- ✓ Maintenance and Recalibration
  - ✓ Manual Gas Loading Cart 2, 35bar
  - ✓ Automated Gas Loading Cart 3, 200bar
- ✓ Inventory of sample can lid interfaces
  - ✓ 20 BLCCR Rings
  - ✓ 10 TLCCR lids
  - ✓ 2 HT TLCCR Sticks
  - ✓ 2 LT TLCCR Sticks

- ➢ TO BE DONE:
  - ➢ Manual Gas Loading Cart 1, 200bar





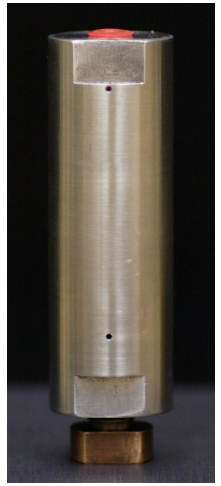


Many Thanks to:
- Donna Kaltyre
- Doug Johnson
- Sean Mullendore

# High Pressure Systems

- ✓ Maintenance
  - ✓ Pressure Rig #1
  - ✓ Empty and decon pressure cells
  - ✓ Training: Full pressure experiment
  - ✓ Updated manual
  - ✓ Updated Safety paperwork
- ➢ TO BE DONE:
  - ➢ Maintenance Pressure Rig #2
  - ➢ Maintenance pressure sticks
  - ➢ Inventory pressure cells and ancillary equipment

Many Thanks to:
- Sergiy Gladchenko
- Doug Johnson
- Sean Mullendore



# 2 GPa Clamp Pressure Cells

- ✓ Prototype and Testing – 1 Assembly
- ✓ Procurement and Acquisition – 6 Assemblies

| ID | Description | Material |
|---|---|---|
| 1 | Cell Body | Aluminum 7075 |
| 2 | Inner Sleeve | Beryllium Copper |
| 3 | Clamping Bolt | Aluminum 7075 |
| 4 | Support Spacer | Tungsten Carbide |
| 5 | Anti Extrusion Ring | Copper |
| 6 | Piston | Tungsten Carbide |
| 7 | Sample Container | Teflon or Lead |

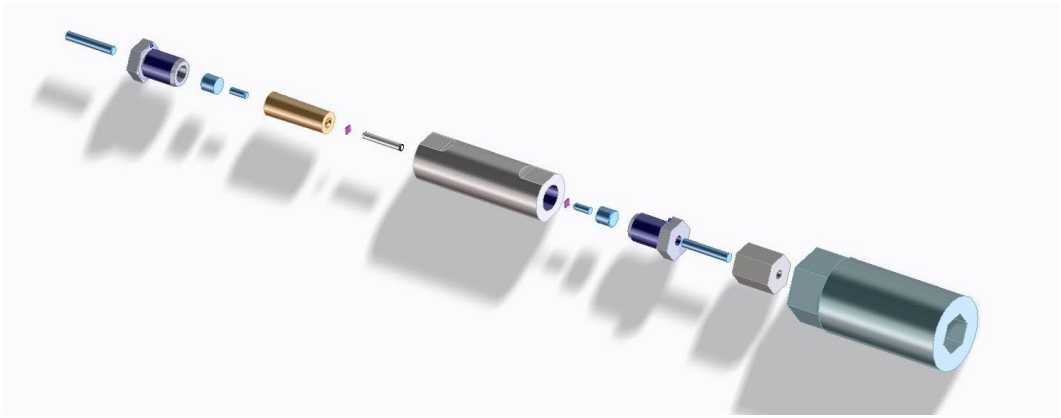
General Info:

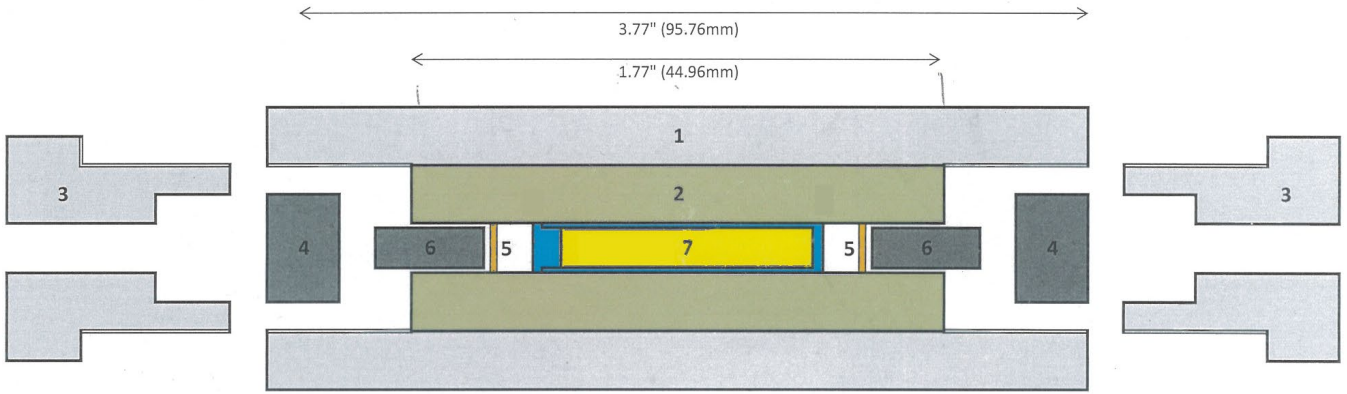
Piston Sizes (length): 10, 15, 20, 25 *mm*

Teflon Sample Container (mm): ID: 4.166 OD: 4.770

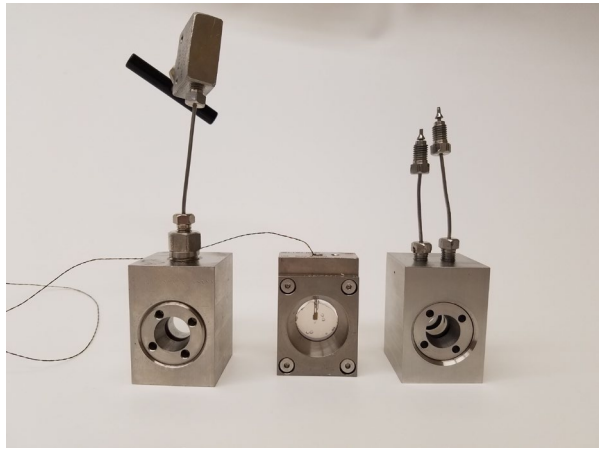
| Enter Shaded Values Below | | |
|---|---|---|
| Length of Pistons Selected | 15 | mm |
| Total Length of Sample Container | 20 | mm |

| Calculated | | |
|---|---|---|
| Sample Volume: | 214 | $mm^3$ |
| Maximum Sample Height: | 15.7 | *mm* |
| Available Piston Travel 2X: | 2.5 | *mm* |
| Compressable Volume: | 273 | $mm^3$ |
| Max Compression Ratio: | 1.3 | |

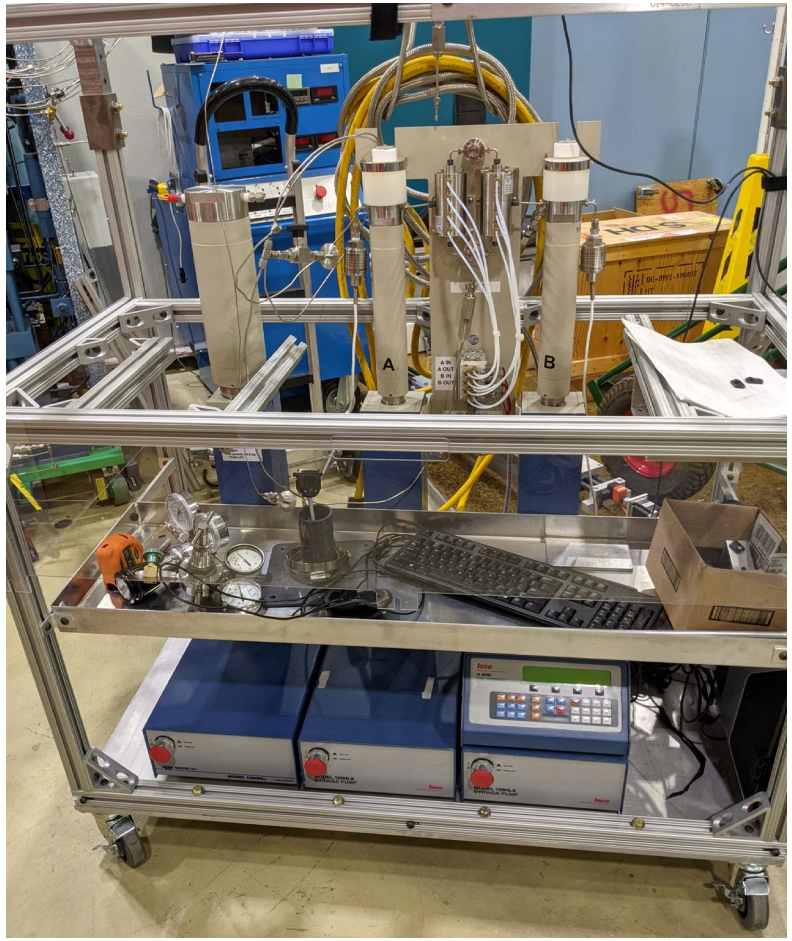




# Syringe Pump System



- ✓ Maintenance
  - ✓ 12 SANS Block Pressure Cells
  - ✓ 4 SANS FLOW Block Pressure Cells
  - ✓ 10 1kbar Pressure Cells
- ➢ TO BE DONE:
  - ➢ Finish setting-up upgrade to three pump system
  - ➢ Develop software upgrade
  - ➢ Test HT seals for block cells

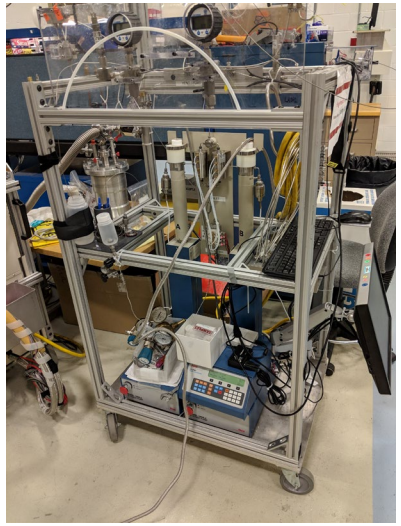



Currently being set-up as a three syringes system

**1000HLf Hazardous Location Syringe Pump**

| | |
|---|---|
| Capacity | 1,015 mL |
| Flow Range | 0.001 to 408 mL/min |
| Flow Accuracy | ± 0.5% of setpoint (Maximum 1.5 µL/min seal leakage) |
| Pressure Range | 0.7 to 137.9 bar (10 to 2,000 psi) |
| Plumbing Ports | 1/4" NPT |
| Dimensions (H x W x D) | 40.3 x 10.7 x 18.4 in (102 x 27 x 47 cm) |

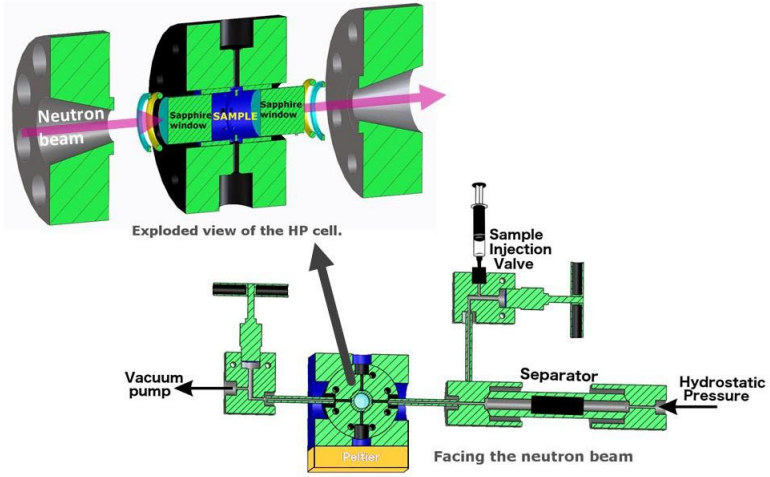
Many Thanks to:
- Doug Johnson
- Donna Kaltyre
- Sean Mullendore
- Colin Wrenn
- Alan Ye

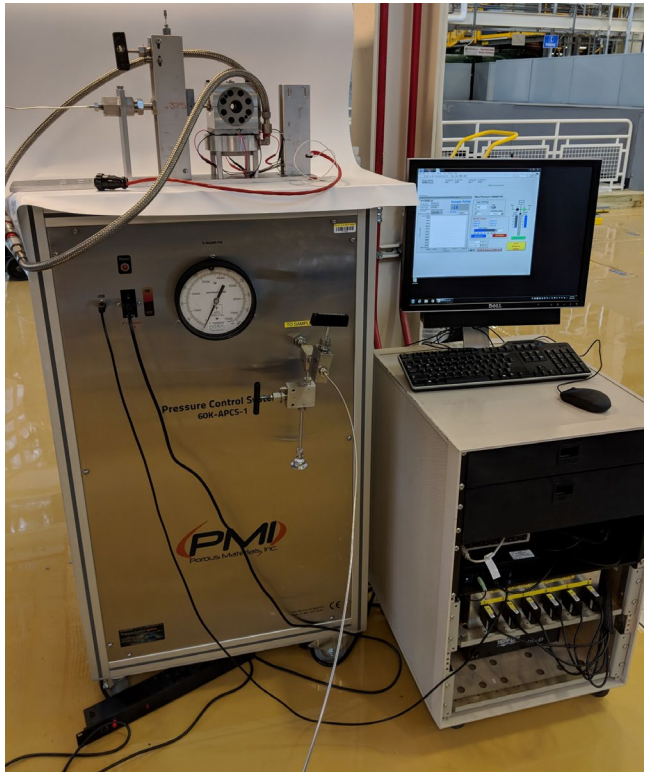


Formally dual syringes

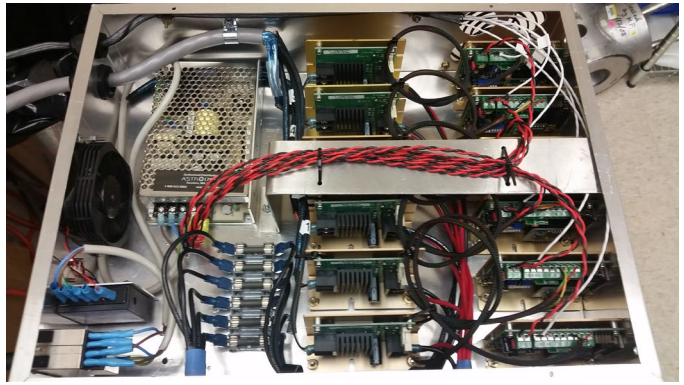
# LIPSS/MUZAC System

- ✓ Maintenance
  - ✓ Replaced power supply
  - ✓ Acquired extra power supply
  - ✓ Training: Full pressure experiment
  - ✓ Updated manual
  - ✓ Updated Safety paperwork
- ➢ TO BE DONE:
  - ➢ Separate LIPSS control
  - ➢ Engineer new cells
  - ➢ Upgrade cell holder
  - ➢ Procure recirculating bath to replace LH45




Many Thanks to:
- Cedric Gagnon
- Doug Johnson
- Susana Teixeira
- Colin Wrenn
- Alan Ye



# Cryogenics Training Video

- ✓ Maintenance
  - ✓ Created on-line video
  - ✓ Begun training new researchers
- ➢ TO BE DONE:
  - ➢ Create updated version incorporating staff suggestions


Many Thanks to:
- Don Lopez
- Alan Munter

https://nistgov.sharepoint.com//SE_Collaborate/SharedDocuments/Safety/Cryogen-Training-Version1.m4v

Beam Line/ Lab Equip. SOPs, User/Technical Manuals

| Equipment | SOP | User Manual | Technical Manual | STATUS |
|---|---|---|---|---|
| Syringe Pump | ✓ | ✓ | ✓ | Submitted |
| Gas-loading | ✓ | ✓ | ✓ | 09/2021 |
| High Pressure | ✓ | ✓ | ✓ | 11/2021 |
| H2 Pressure | ✓ | | | 12/2020‡ |
| Furnaces | ✓ | ✓ | ✓ | 09/2021 |
| Torch | ✓ | ✓ | ✓ | Submitted |
| Spin Coater | ✓ | ✓ | ✓ | Submitted |
| 2GPa Clamp Cell | ✓ | ✓ | ✓ | Approved |
| Cryogenics Training | ✓ | ✓ | ✓ | Approved |

# Recirculating Baths Inventory and Maintenance

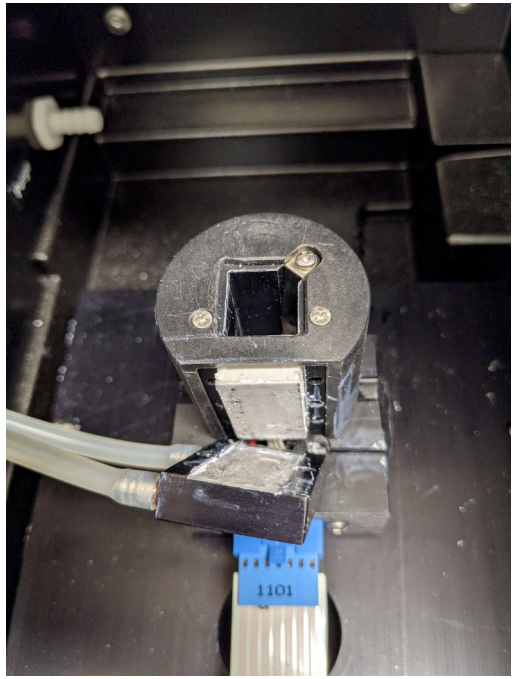
- ✓ Maintenance
  - ✓ 24 Inspected under contract
  - ✓ 4 Need repair
- ➢ TO BE DONE:
  - ➢ Procure replacement for LH45 (SANS)
  - ➢ Send for repair

Many Thanks to:
- Cedric Gagnon
- Donna Kaltyre

| Manufacturer | Model | Serial # | Type | Mfg Code | Location |
|---|---|---|---|---|---|
| HASKRIS | R100 | HB18454 | CHILLER | DLR 21134 | 235, E133 |
| HASKRIS | R175 | H-A12883 | CHILLER | DLR 38188 | A128 |
| HASKRIS | WW1 | HBHB17803 | CHILLER | DLR 64323 | E137 |
| HAAKE | A25 | 1121274701190610 | CHILLER | DLR 57920 | G100 |
| HAAKE | A25 | 1121639401200303 | CHILLER | DLR 64330 | G100 |
| JULABO | F25 | 00208610 | CHILLER | DLR 64322 | E137 |
| JULABO | F25 | 00208611 | CHILLER | DLR 64324 | E137 |
| JULABO | F250 | 10314547 | CHILLER | DLR 57924 | G100 |
| JULABO | F33 | 10208917 | CHILLER | DLR 64326 | G100 |
| JULABO | LH45 | 10160409 | CHILLER | DLR 64327 | G100 |
| NESLAB | RTE111 | R94237217 | CHILLER | DLR 57921 | G100 |
| NESLAB | RTE111 | 197240130 | CHILLER | DLR 64332 | G100 |
| THERMO | NESLAB EX7 | 109133007 | CHILLER | DLR 64321 | E135 |
| THERMO | NESLAB RTE-7 | 106117002 | CHILLER | DLR 57915 | A115 |
| THERMO | NESLAB RTE-7 | 106361007 | CHILLER | DLR 57925 | A123 |
| THERMO | NESLAB RTE-7 | 106179003 | CHILLER | DLR 57917 | B128 |
| THERMO | NESLAB RTE-7 | 105109006 | CHILLER | DLR 57919 | G100 |
| THERMO | NESLAB RTE-7 | 108352004 | CHILLER | DLR 57923 | G100 |
| THERMO | NESLAB RTE-7 | 104240002 | CHILLER | DLR 64331 | G100 |
| THERMO | NESLAB RTE-7 | 106269005 | CHILLER | DLR 64325 | G100 |
| THERMO | NESLAB RTE-7 | 106352005 | CHILLER | DLR 64328 | G100 |
| THERMO | A28F | 0111089301120217 | CHILLER | DLR 57916 | A115 |
| THERMO | ELECTRON | 105234018 | CHILLER | DLR 64333 | G100 |
| JULABO | F25 | 00187471 | CHILLER | DLR 57926 | E133 |

# UV - Vis

- ✓ Maintenance
  - ✓ Repair broken sample block
  - ✓ Replaced heat exchanger
  - ✓ Service call for alignment
- ✓ Acquisitions
  - ✓ Adjustable Microcell Holder
  - ✓ Square Vial Holder
  - ✓ Combination Holder




Peltier holder with heat exchanger recirculatory block detached for diagnostics
The severed wires cause a faulty alarm in the Peltier cell holder control box.

Many Thanks to:
- Donna Kaltyre


Recommended Accessories for the Evolution 201 Single Cell Peltier

# Projects Description

| Future Work | | Estimated Timeline |
|---|---|---|
| **S. E.:** | | |
| ➢ 12T Dry Cryomagnet | Acquisitions/Procurements | On-going to 3rd quarter of 2022 |
| ➢ Maintenance and Inventory High Pressure Systems and Ancillaries | Maintenance | November 2021 |
| ➢ Upgrade Syringe Pump Cart | Maintenance | December 2021 |
| ➢ Test Temp Gradient in HT BCCR (Tanya dax) | Maintenance | November 2021 |
| ➢ Test BeCu Pressure Cells | R&D | March 2022 |
| ➢ Empty and Inventory Irradiated Powder Cans (S.E Group) | Maintenance | December 2021 |
| ➢ Upgrade Software for Three Syringe Pump | Maintenance/ R&D | March 2022 |
| ➢ Test HT SANS Block Pressure Cells | R&D | December 2021 |
| ➢ Upgrade LIPSS Control and new cells | Maintenance/ R&D | TBD |
| **Laboratories:** | | |
| ➢ Recirculating Baths repairs | Maintenance | December 2021 |
| ➢ New Recirculating Baths Procurement | Acquisitions/Procurements | As funds become available |
| ➢ Installation and Implementation of Glove Boxes Remote Manifold | R&D | January 2021 |
| ➢ FTIR operation | Maintenance | November 2021 |
| ➢ Training, and assistance for post-docs | Safety | On-going |

# Thank you!

Questions and/or
Suggestions for R&D for 2023