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The ISIS Helium Recovery Project

Richard Down

ISIS
Experimental Operations
Cryogenics

CryoUsers 2017

September 04 – 06 Coventry

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The ISIS Helium Recovery Project

- ISIS Helium History
- Collaboration & Networking
- System Layout
- Phase 1 “The Ringmain”
- Phase 2 “Beamline connections”
- The Recovery Building
- PLC Control
- Liquefier and Savings
- Thanks & Questions

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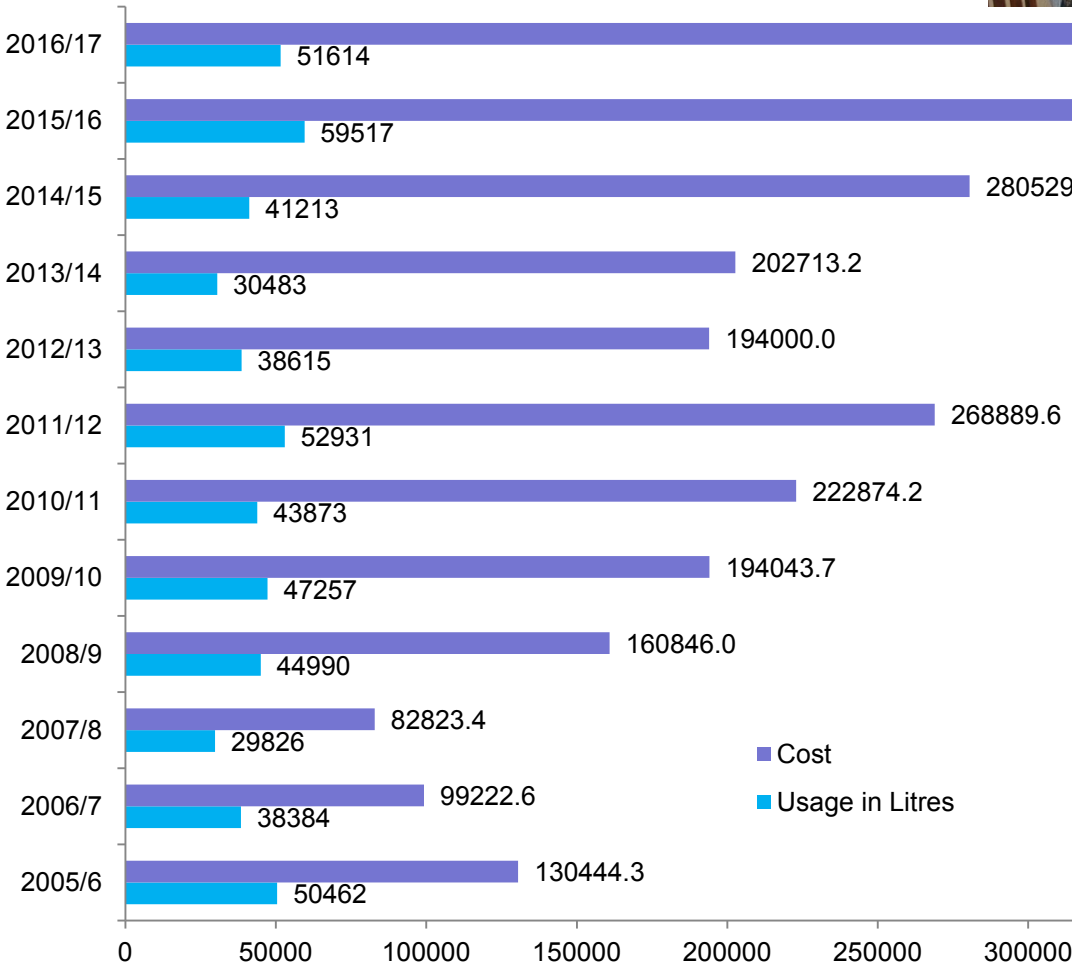
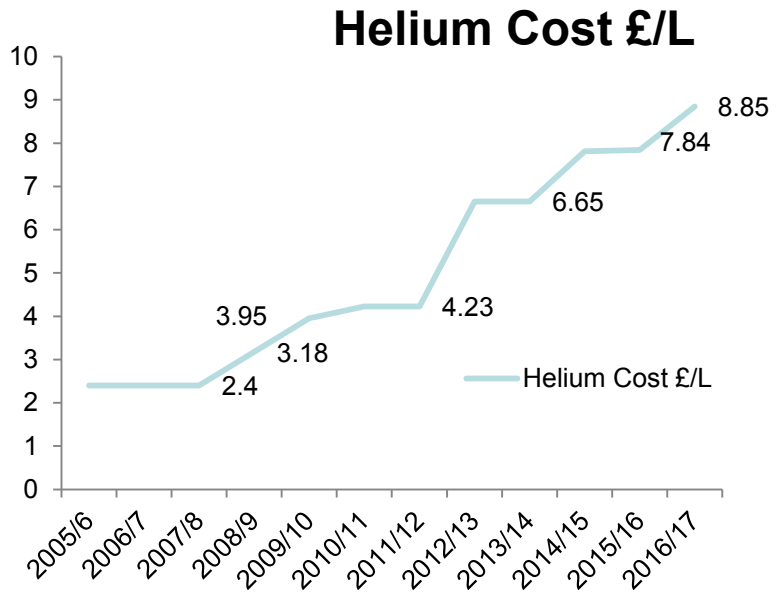
ISIS Helium History





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Collaboration & Networking

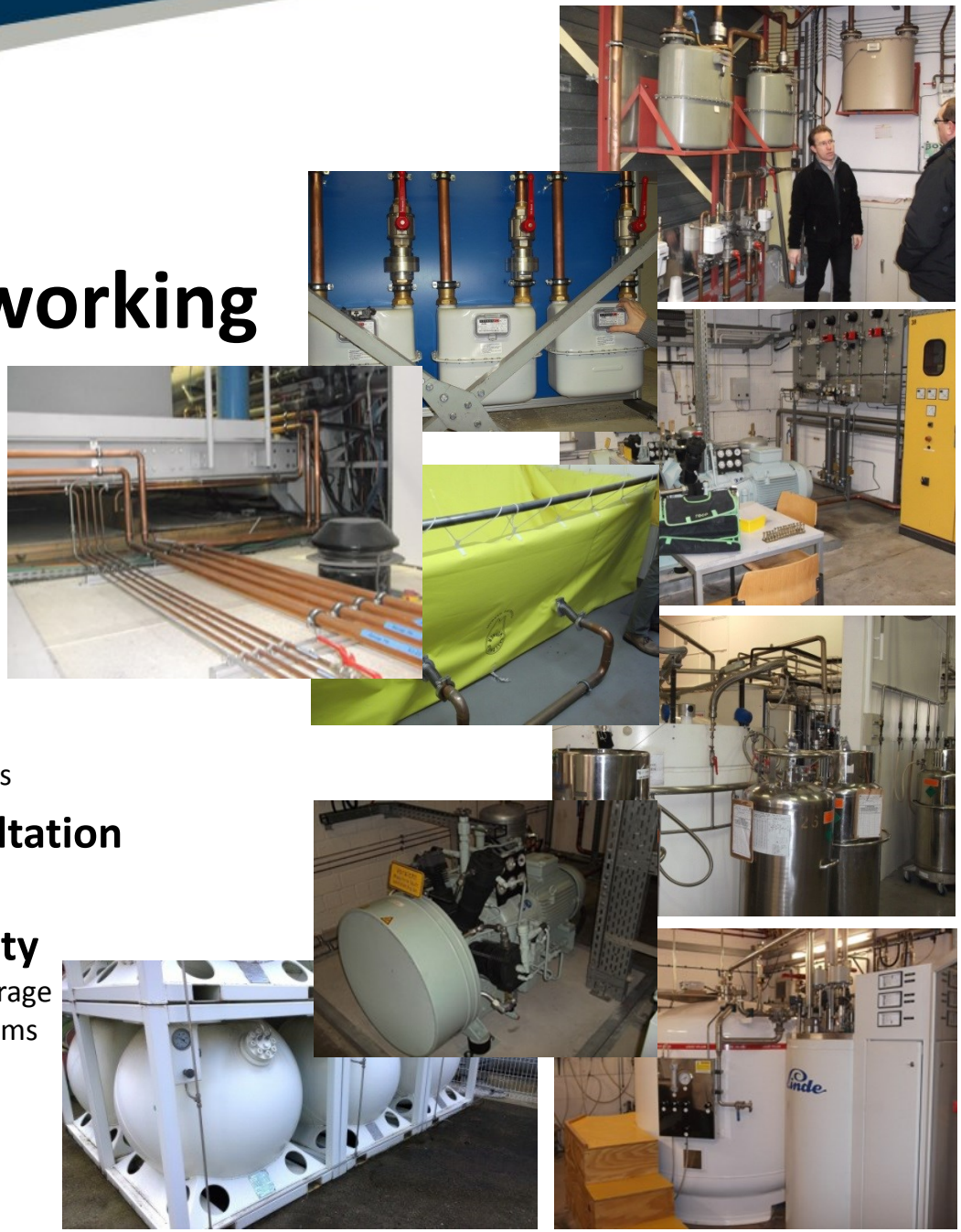
- **Collaboration with DLS**
- **Networking with**

  ILL, HZB, CNRS, ESRF, PSI
- **Consultation by Munroe Brothers**

  Basic costs, P&ID, Compressors, HP Storage,
  LP Storage, Helium measurement, Valves, Suppliers
- **Independent peer review of Consultation**

  Eddy Lelièvre-Berna (ILL), Hamish Nichol (BOC)
- **CryoUsers / He Recovery Community**

  Ringmain, Gas Bags, Compressors, Filtering, HP Storage
  Liquefiers, Gas Metering, Compressor control systems
  HP Pressure Measurement & Control



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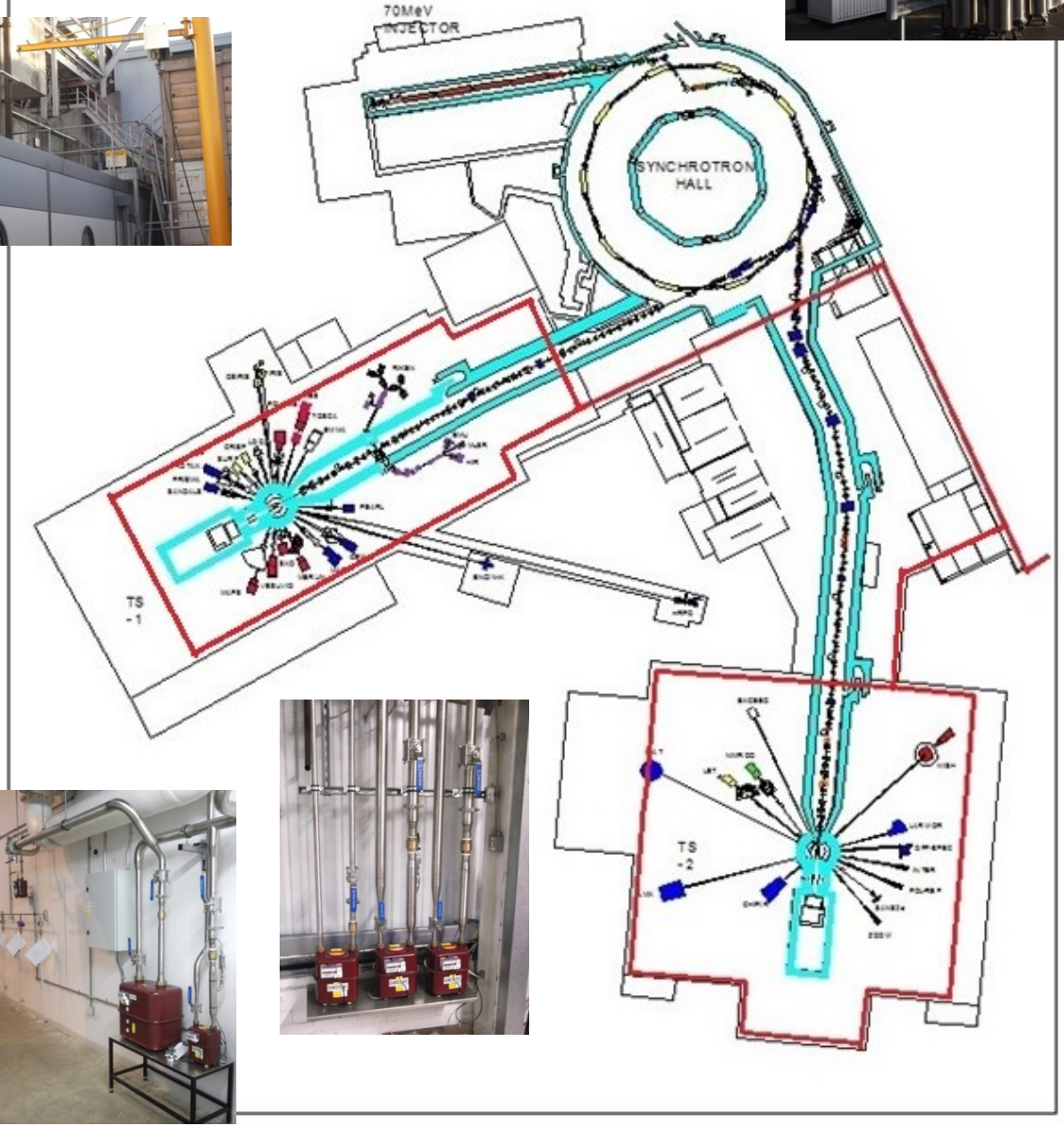
What material: St / Steel



Phase 1: Ring Main Installation

- 860m 3” St/ Steel Pipe
- 215Off St/ Steel Weld fittings
- 72Off 3”, 2”, 1” Helium tight valves
- St/Steel 3” tube installation joined by Orbital Welding process
- 1st Phase of Ringmain Complete January 2015

Some ISIS Specifics

- We are not billing Individuals.
- Gas meters positioned to combine groups.
- Positioned Remotely to avoid damage.

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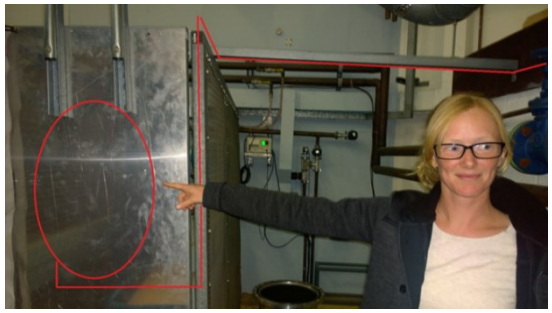
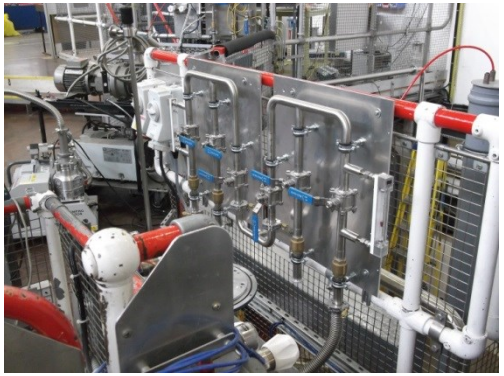
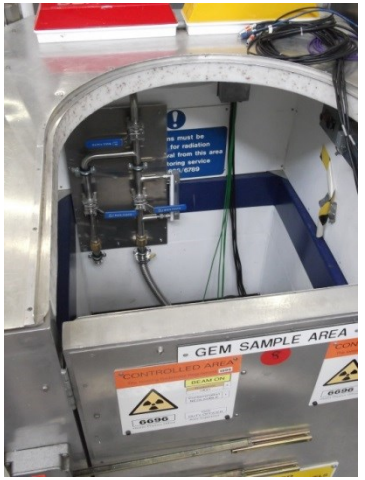
Phase 2 Beam-lines

Beamline Stakeholder Exercises
Preferred Routes / Future Proofing
Beamline Modifications Permits







Complete May 2015
300m 2”, 150m 1” St/ Steel Pipe, 27 Recovery Panels
½” Pressure Return line across Facility

1.75 KM of PIPE INSTALLED

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Recovery Building

Building Total after services and fit out Total £100K

- Power
- UPS
- O2 System
- Ventilation
- Compressed air

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PLC Control System

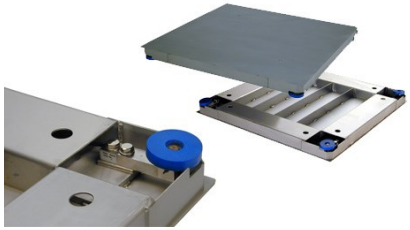
Mass Flow
AliCat

Information that we can get from PLC:

- Cryogen levels
- Cryogen usage
- Gas flow, pressure, quality
- Compression & storage
- Leak detection
- Oxygen depletion
- Alarms via SMS
- Data Record & Archive

Pressure Tamo MiniComb

Gas Flow
U6 (20L/P), U40 (100L/P)



Avery Techtronic Weigh Scale

Mettler Toledo Optical O2 Sensor (PSI)

Collaboration with HZB & ILL Helium Management

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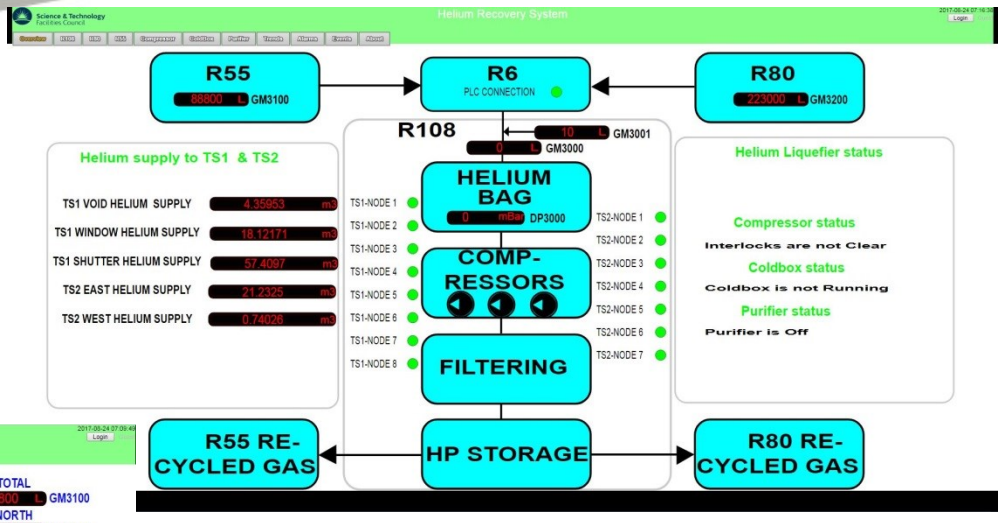
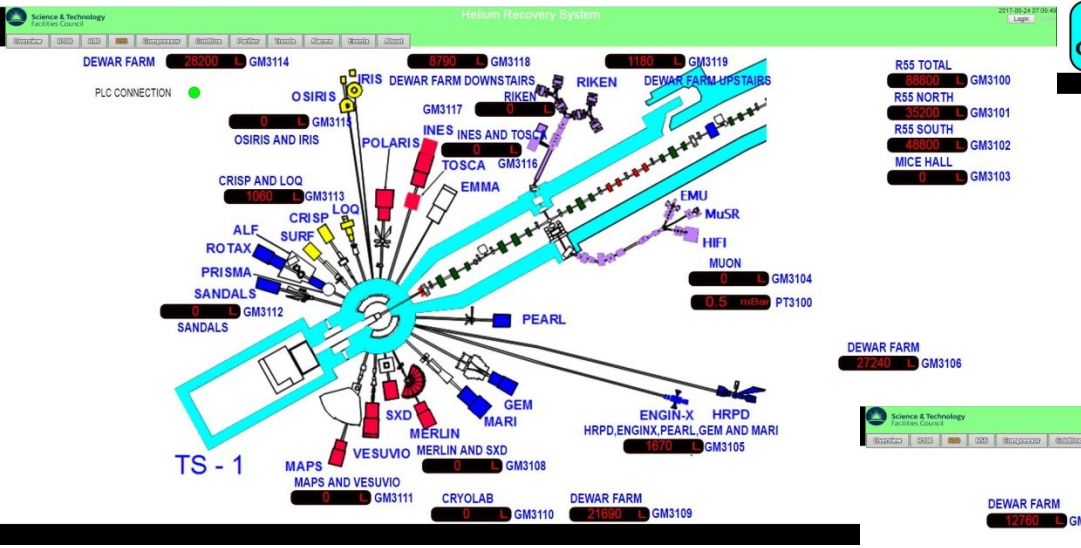
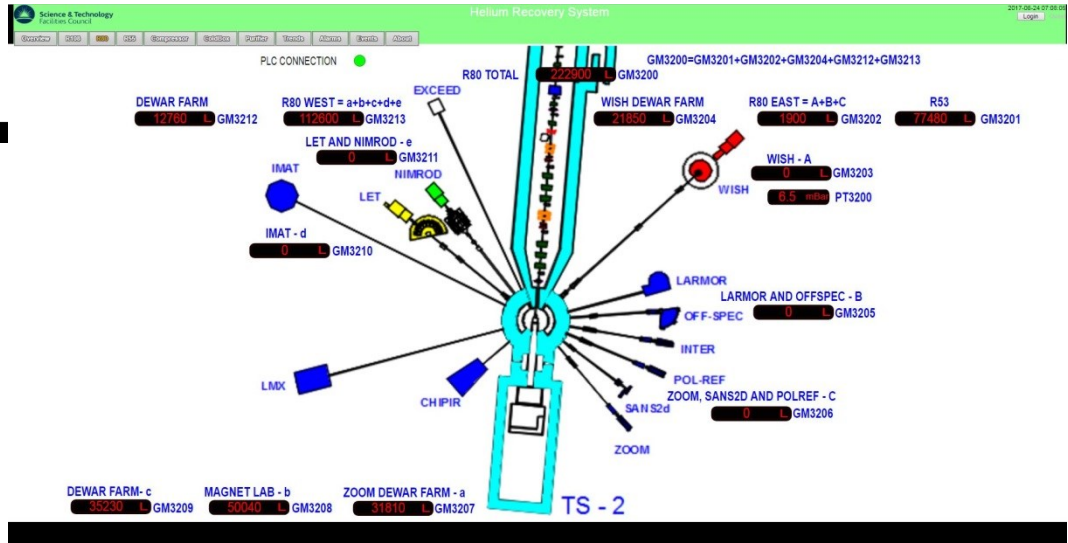
PLC Control System





Facility Overview of Gas Meters and Pressures Currently



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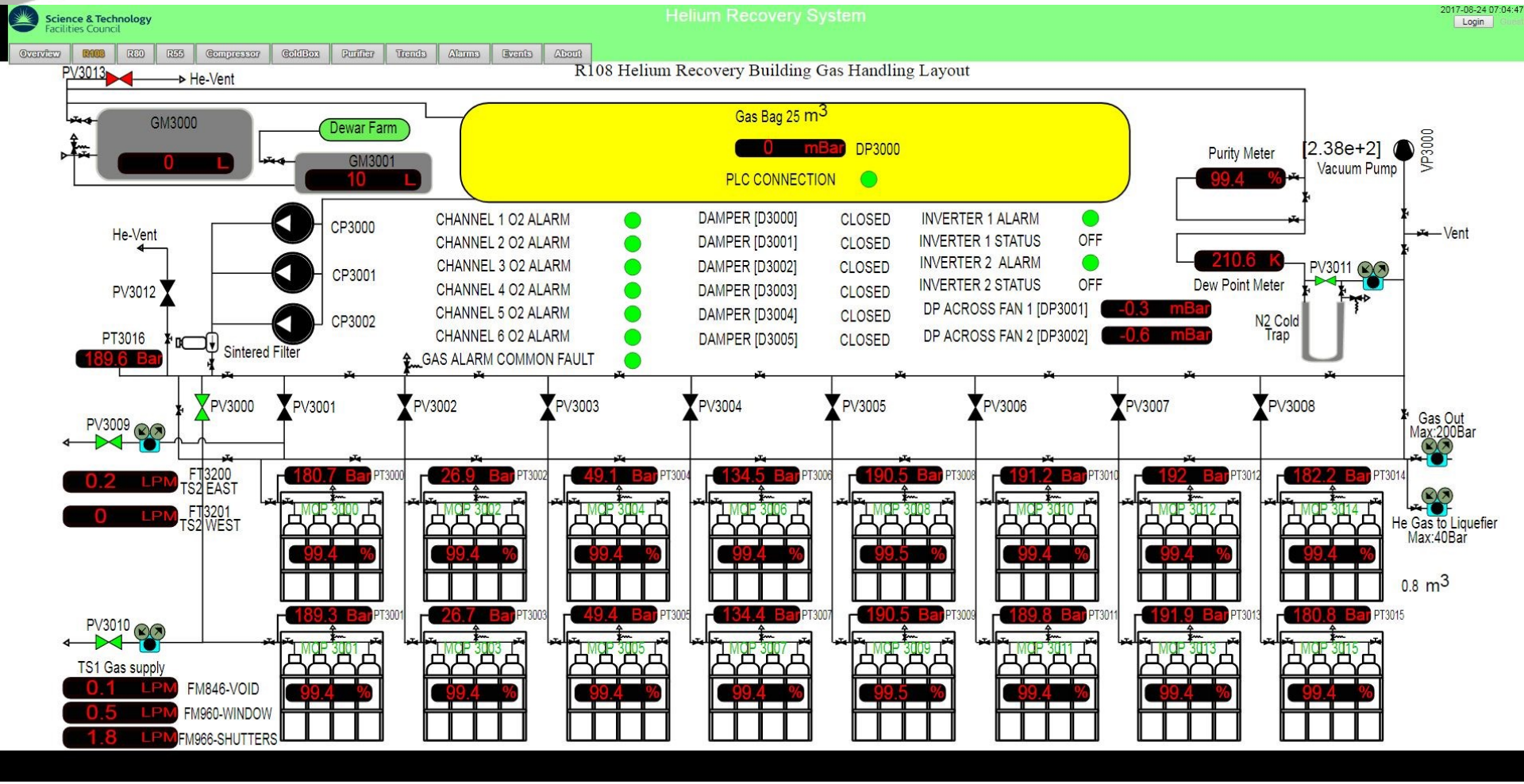
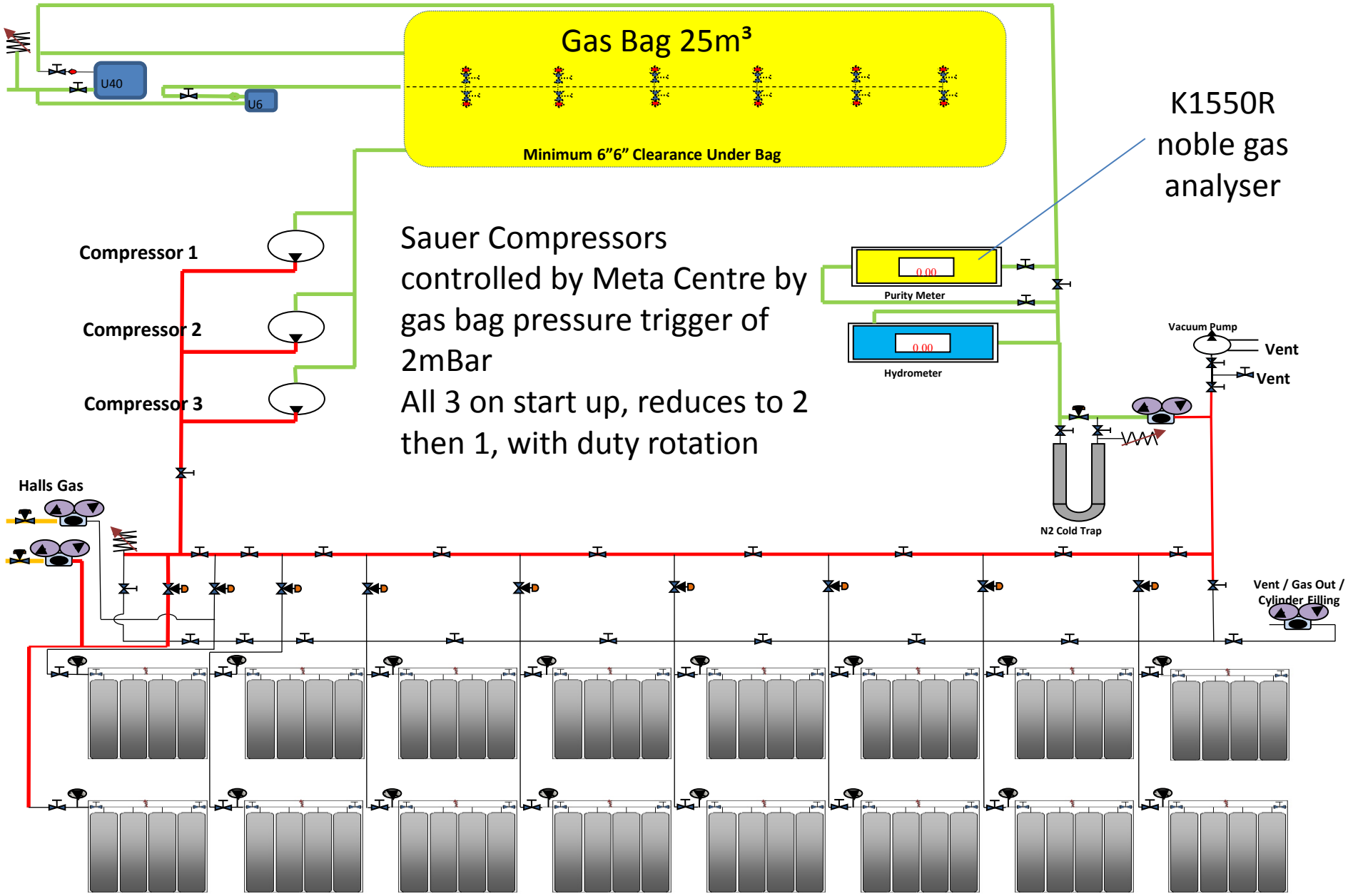


R108 Helium Recovery Building Gas Handling Layout



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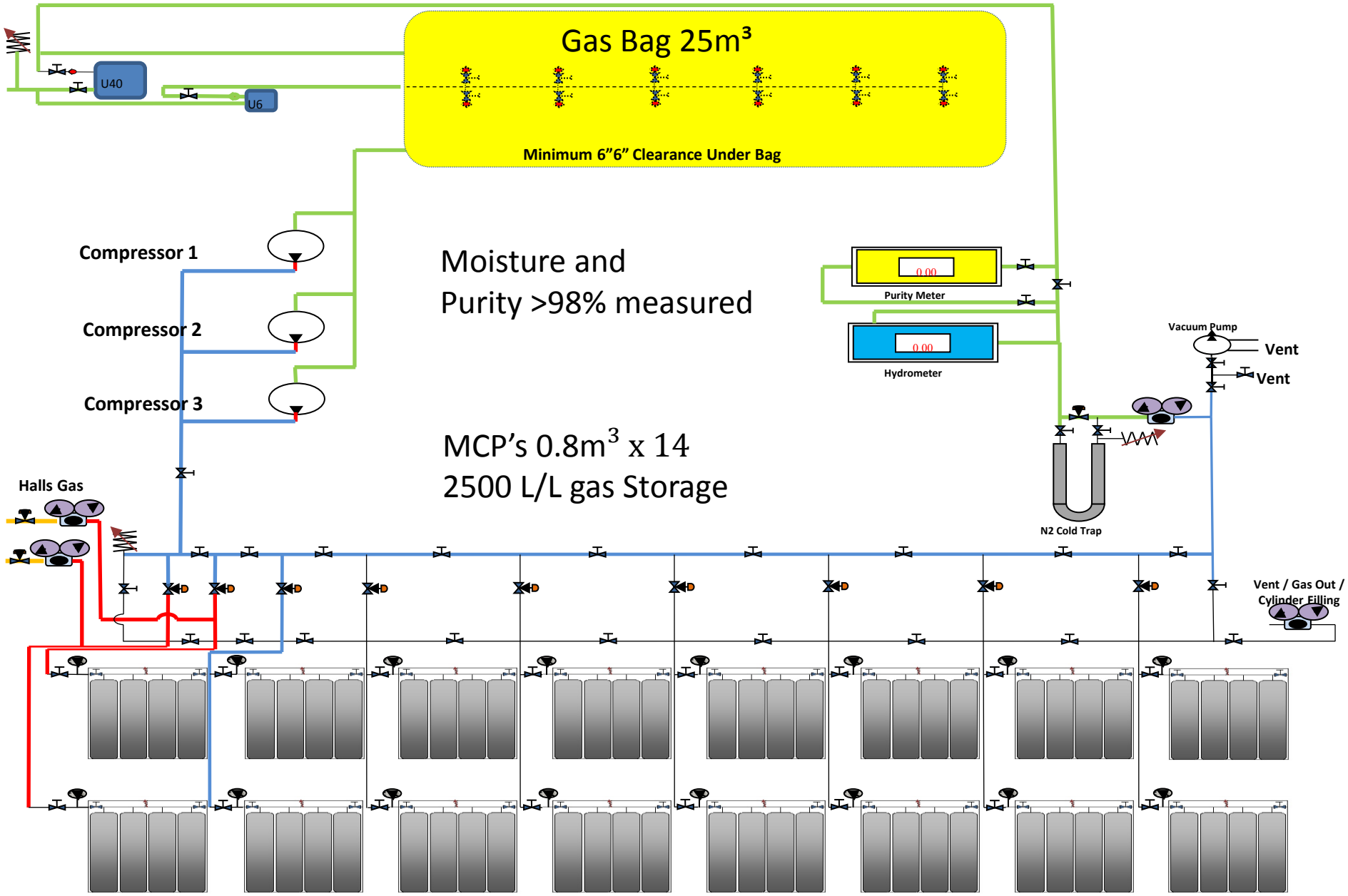

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Explore Options for reprocessing Gas

- Sell to third party
- Re-Use recovered Gas
- Install Liquefier

July 2016 Grand Opening

Helium Recovery at facilities Conference

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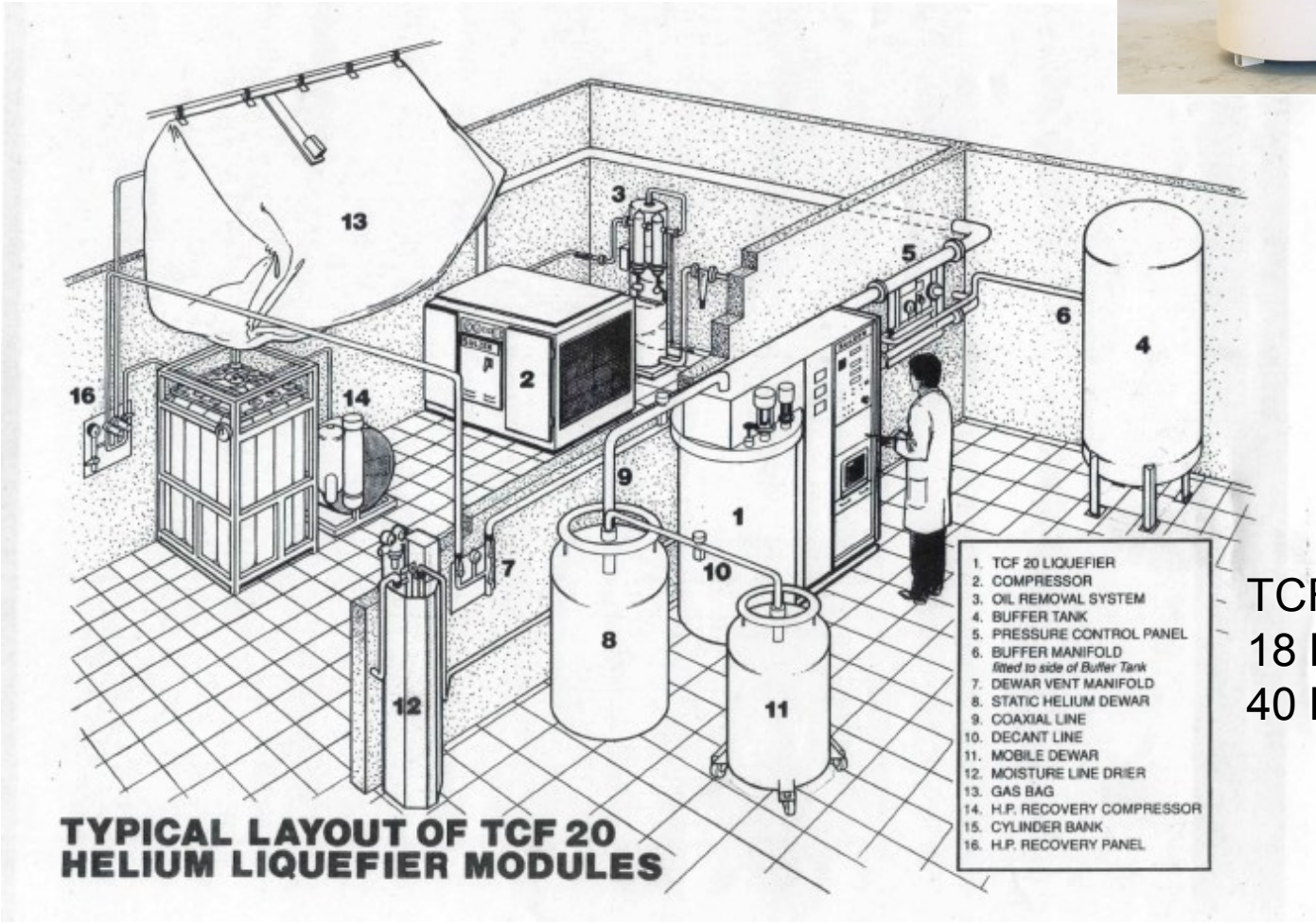
Liquefier Funding secured July 2016
Procurement in place
Contractor appointed
Work to commence Sept 2016



TCF 20
18 L/H Liquid Production
40 L/H N2 Pre-Cool

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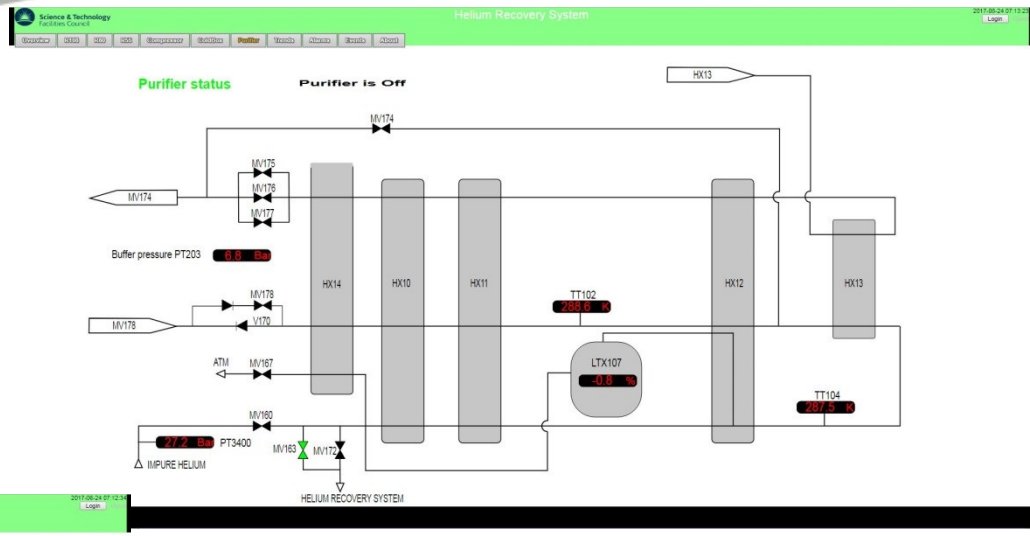
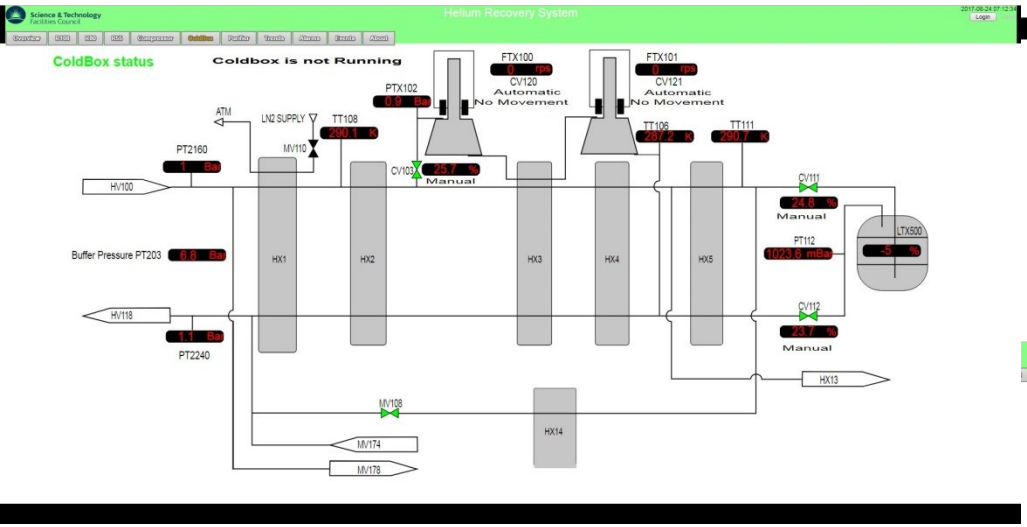
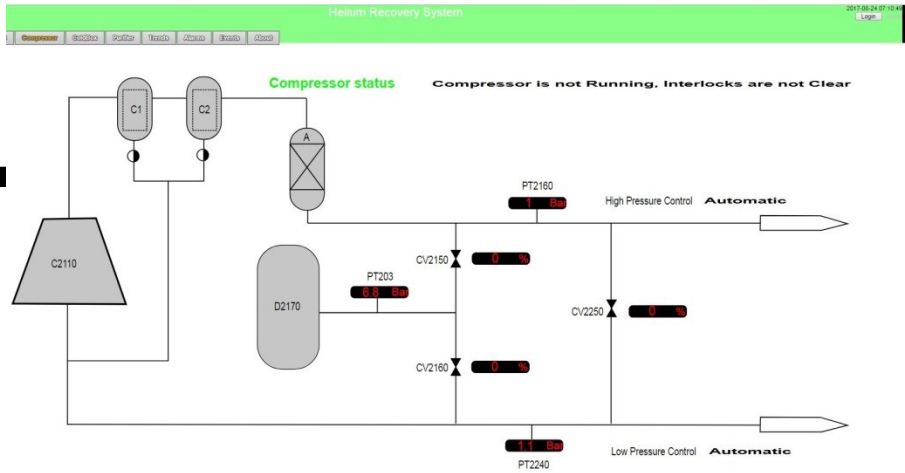
PLC Control System





In addition to Allen Bradley System, Coldbox, Purifier & Compressor view only.



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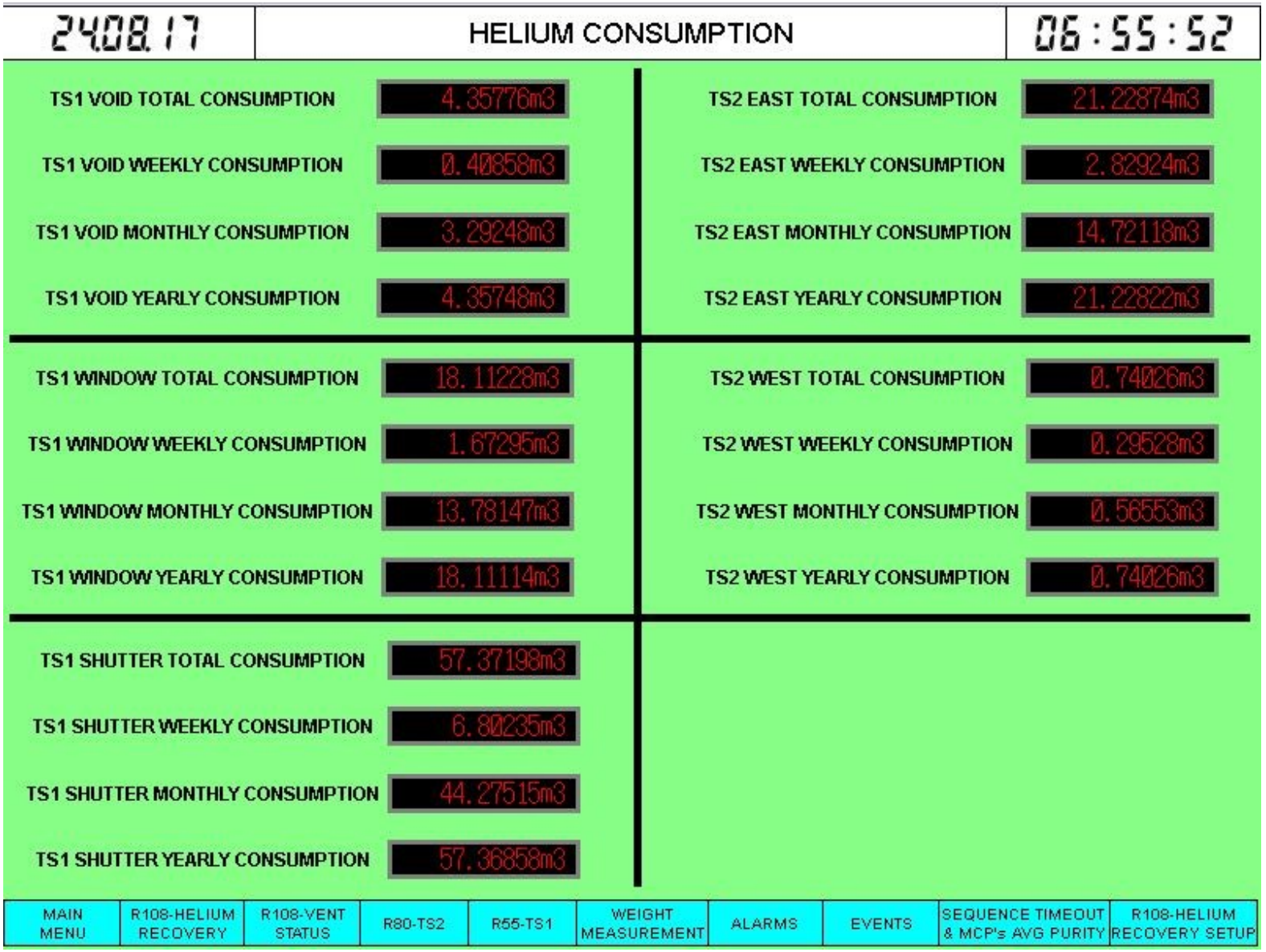
PLC Control System

Resupplied Gas Usage



Resupplied Gas Usage

TS2 use of recycled Helium gas 2nd February 2017

Instrument support purchase of Helium Gas

	2016	2017
January	£2550	£6250
February	£7000	£71
March	£7000	£4200
April	£6200	£72

TS1 Target Station Group use of recycled Helium Gas Cycle prior to 2017/1 late April 2017

Target Station purchase of Helium Gas

Average use TS1 Void	Current
11500 Litres gas per day (1.15 Bottles per Day)	0

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ISIS Helium Liquefier Produces Helium since 17th May

- Liquefaction rate of Linde TCF20 approximately 20 Liquid Litres per hour (480 Litres per Day)

Cryo Engineering GmBh have made improvements to our system

- Cold box heat exchanger modifications make maintenance easier
- Use of Helium transfer to transport Dewar flash gas back to Helium buffer enhances TCF20's performance up to 20%

Liquid purchase 2017/1 prior to TFC20 start up: 2440L Costing £21590

Liquid produced 2017/1 17th May – 2nd June: 3100L Saving £27400

Initial Savings are encouraging we will get Better!!

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Summary

7.5T of Helium could Recovered Annually

- Recovery system Operational
- Some additional connections needed, 3 month shutdown has highlighted losses
- Learning curve has started
- Return gas HP pipework 80%
- PLC control System Operational

To Do

- Phase 2 complete Instrumentation
- DLS Collaboration for Helium Recovery

Additions to system will be ongoing

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Thanks to

IUSG Cryogenics
He Recovery Project Team
Eddy Lelièvre-Berna ILL & Klaus Kiefer HZB
Christian Gianese CNRS
John Graham & Charles Munroe
Central Compressor Consultants Ltd
OXON Fabrications Ltd
Cryo Engineering GmbH

Questions