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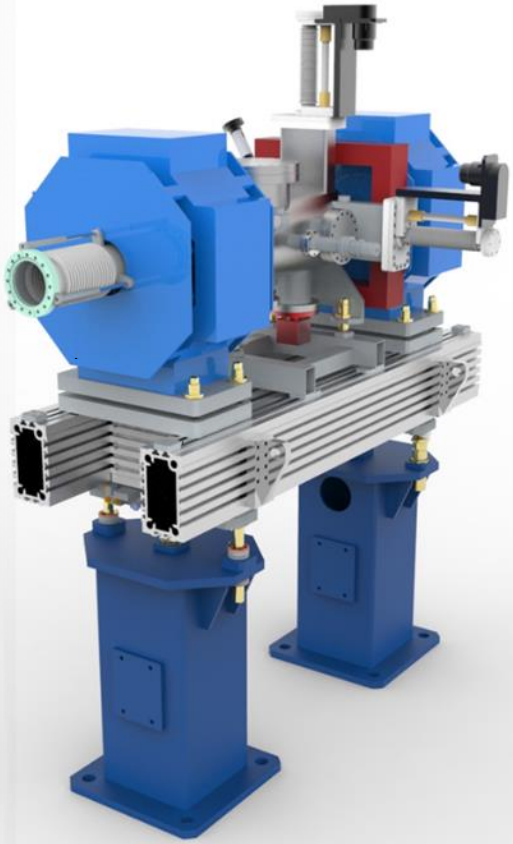
Linac Warm Units - Update

(Beam Transport Modules)



Richard Smith

STFC Daresbury Laboratory

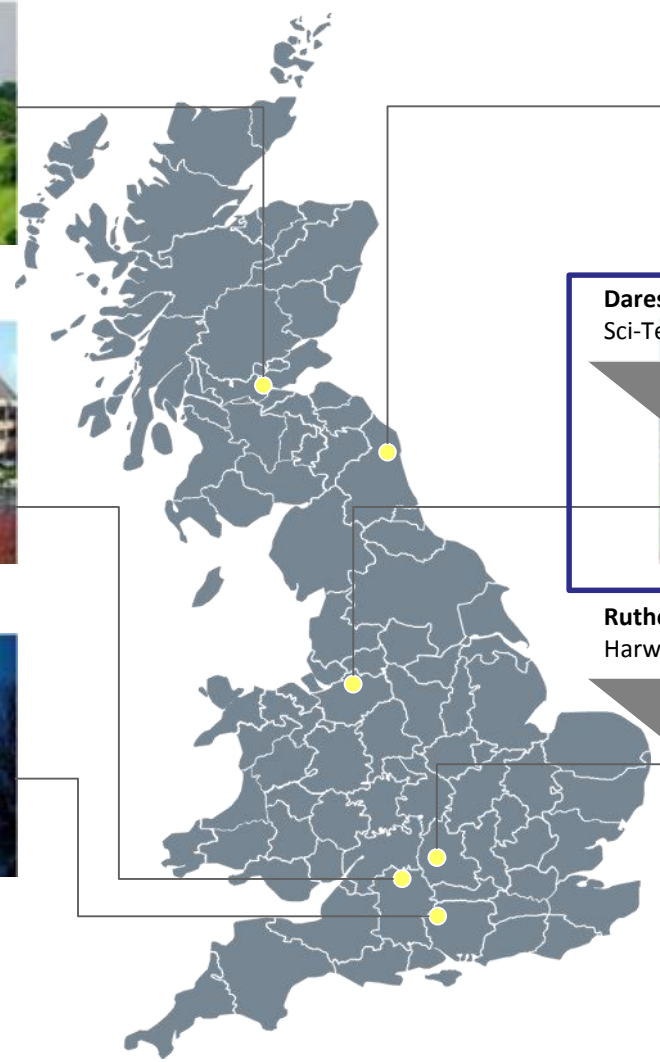
November 2018

Science & Technology Facilities Council

STFC

UK Astronomy Technology Centre
Edinburgh, Scotland

Boulby Underground Laboratory
North Yorkshire



Polaris House
Swindon, Wiltshire

Daresbury Laboratory
Sci-Tech Daresbury Warrington, Cheshire

Chilbolton Observatory
Stockbridge, Hampshire

Rutherford Appleton Laboratory
Harwell Didcot, Oxfordshire

Science & Technology Facilities Council

STFC, Daresbury Laboratory

Project Team

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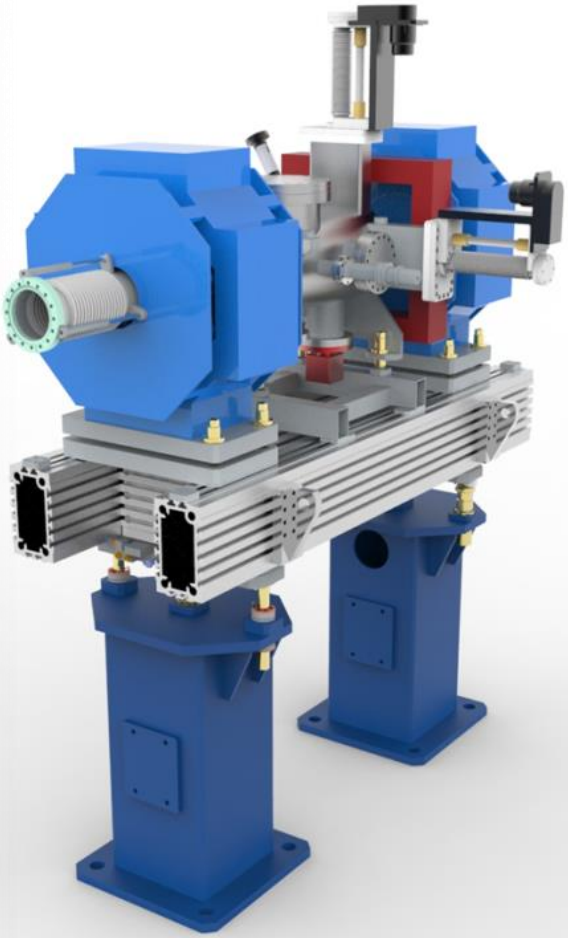
Core Project Team

- Paul Aden
  - Project manager
- Keith Middleman
  - Deputy PM, Vacuum Work Package Manager
- Neil Geddes
  - Project Sponsor
- Richard Smith
  - Project Engineer
- Olly Poyntz-Wright
  - Mechanical Engineer
- Danish Naeem
  - Quality & Mechanical Engineer
- Alan Muir, Philip Craine, Ken Davies,
  - Mechanical Design Engineers
- George Miller, Luke Bayden, Tom Cornes, Dave Coleman, Ninad Pattalwar, Stuart Wildes
  - Core Technicians

Overview of the scope

BTM WP Scope

- To design, procurement and assemble;
  - 2 Prototypes
  - 52 Beam pipe modules
  - 74 Linac Warm Units
  - 3 Differential pumping systems
  - 4 mobile installation cleanrooms



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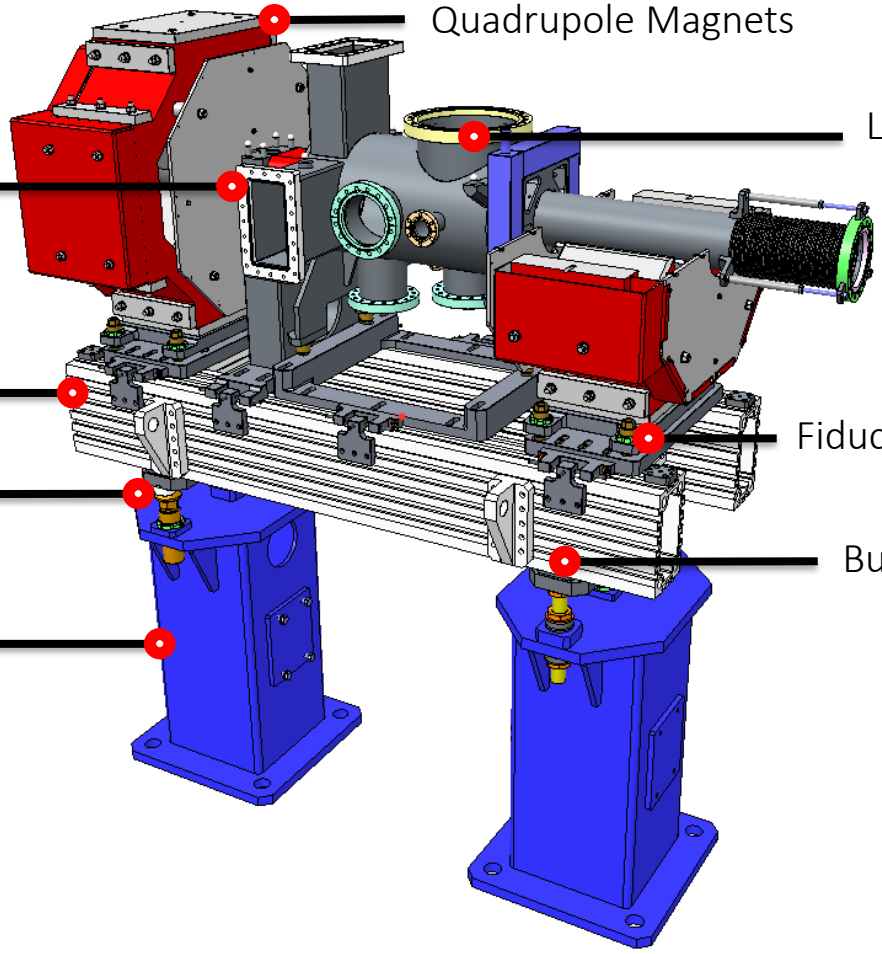
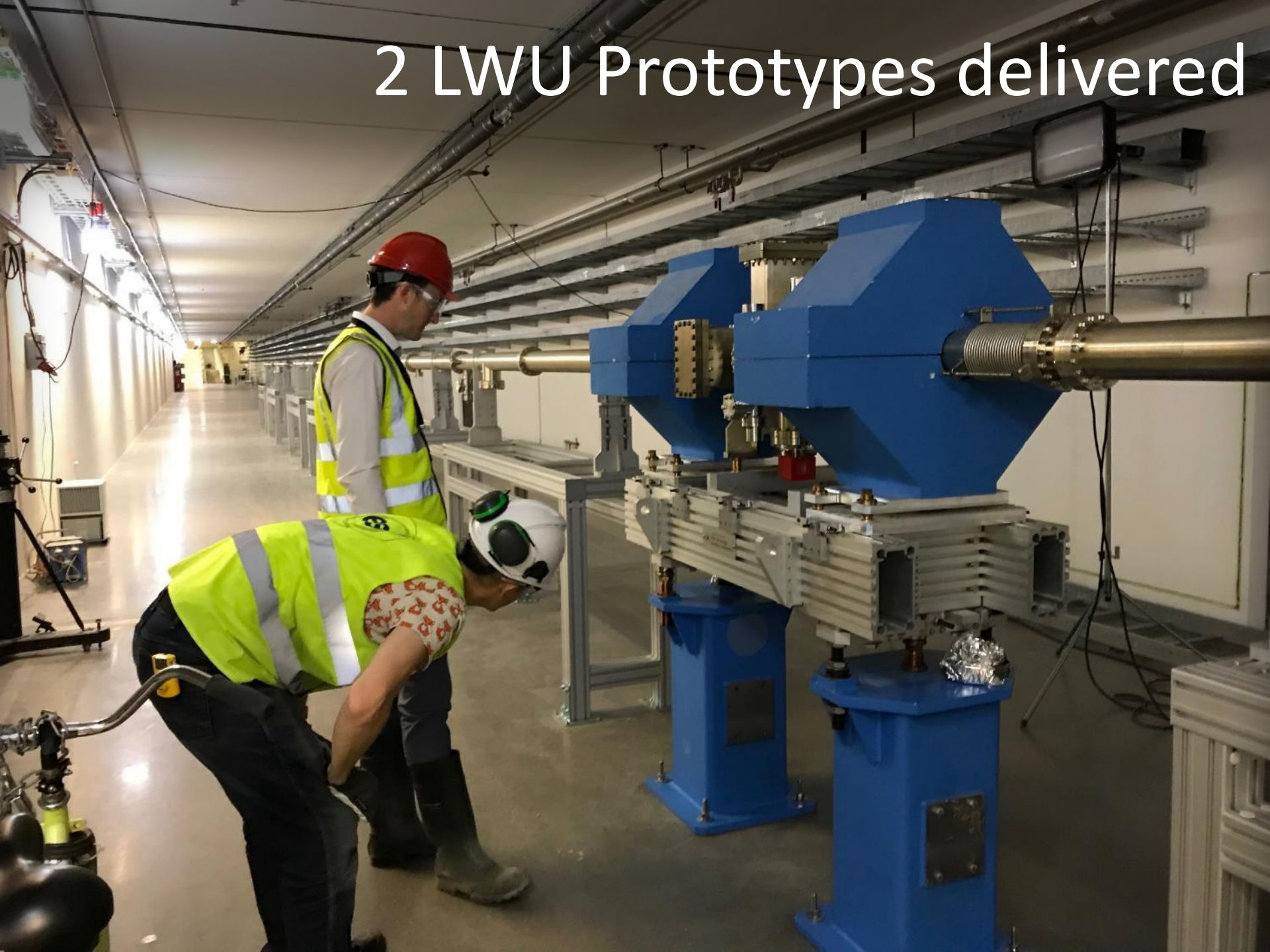
Typical LWU Design



2 LWU Prototypes delivered



BTM WP Scope

- To design, procurement and assemble;
  - 2 Prototypes
  - 52 Dummy Cryo Modules
  - 74 Linac Warm Units
  - 3 Differential pumping systems
  - 4 mobile installation cleanrooms


22 DCM (6 metre) + all stands delivered


12 more DCM ready to ship

BTM WP Scope

- To design, procurement and assemble;
  - 2 Prototypes
  - 52 Dummy Cryo Modules
  - 74 Linac Warm Units
  - 3 Differential pumping systems
  - 4 mobile installation cleanrooms

First elliptical vessels received at STFC…


…cleaned, baked and vacuum tested…
… to discover they leaked!

However, not at the BPM region

(Issues are identifiable and fixable)

BTM WP Scope

LWU Milestones

Date	LWUs
26/01/2019	1
25/07/2019	30
21/01/2020	27
19/07/2020	16

First Magnet pair not due until Jan

All LWU pedestals manufactured

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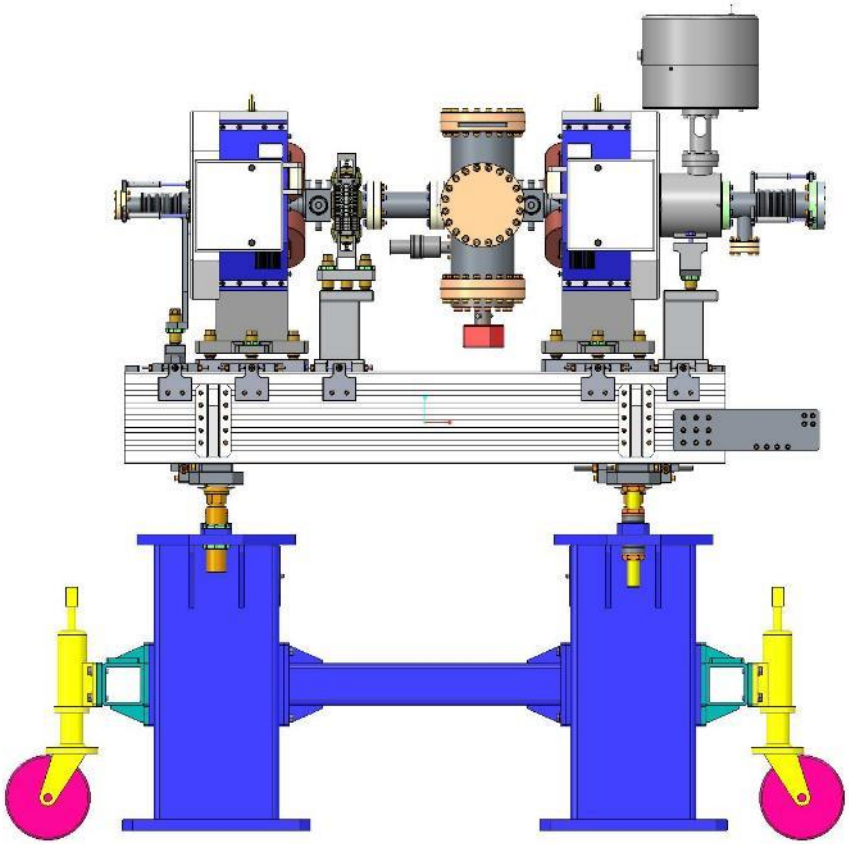
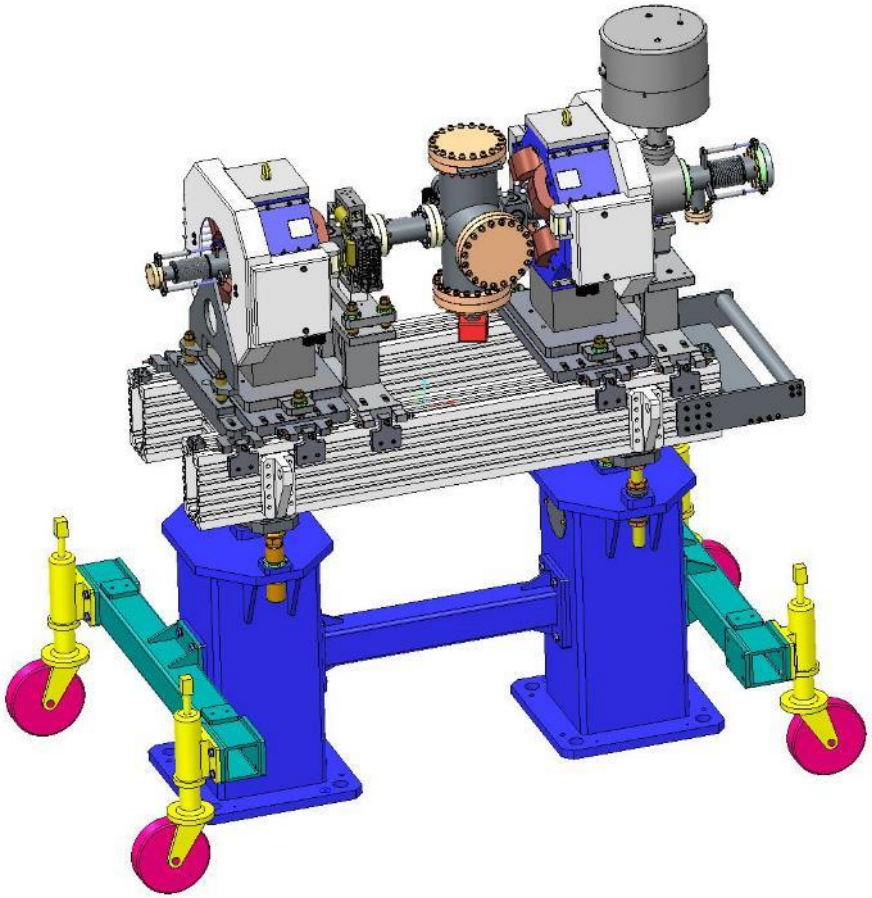
BTM WP Scope

- To design, procurement and assemble;
  - 2 Prototypes
  - 52 Dummy Cryo Modules
  - 74 Linac Warm Units
  - 3 Differential pumping systems
  - 4 mobile installation cleanrooms

Differential Pumping Sections

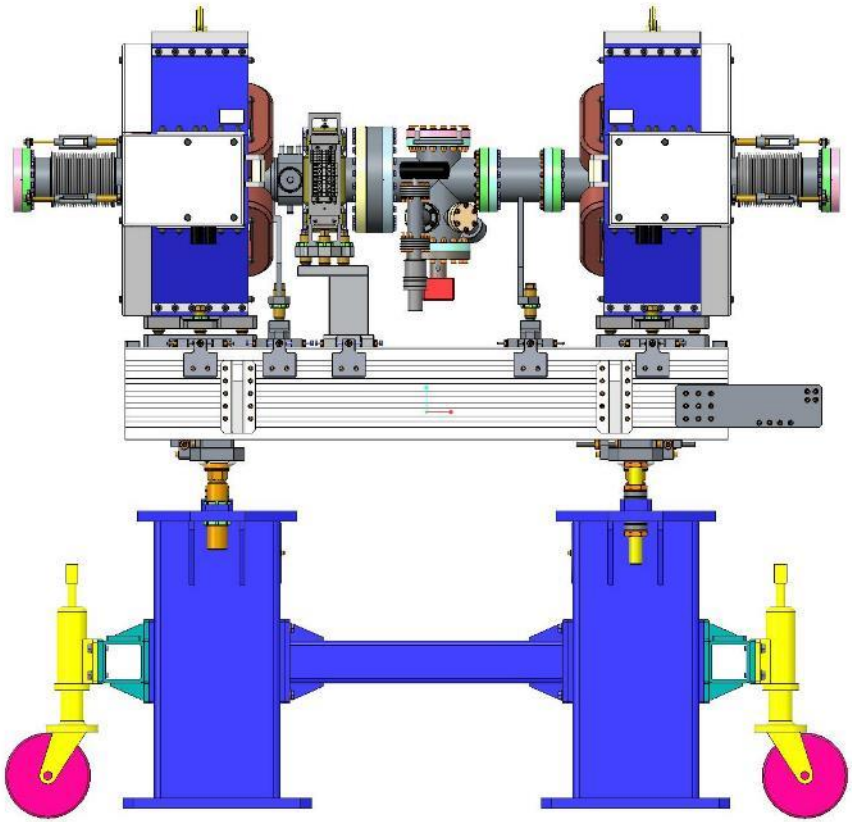
- Low energy pumping system

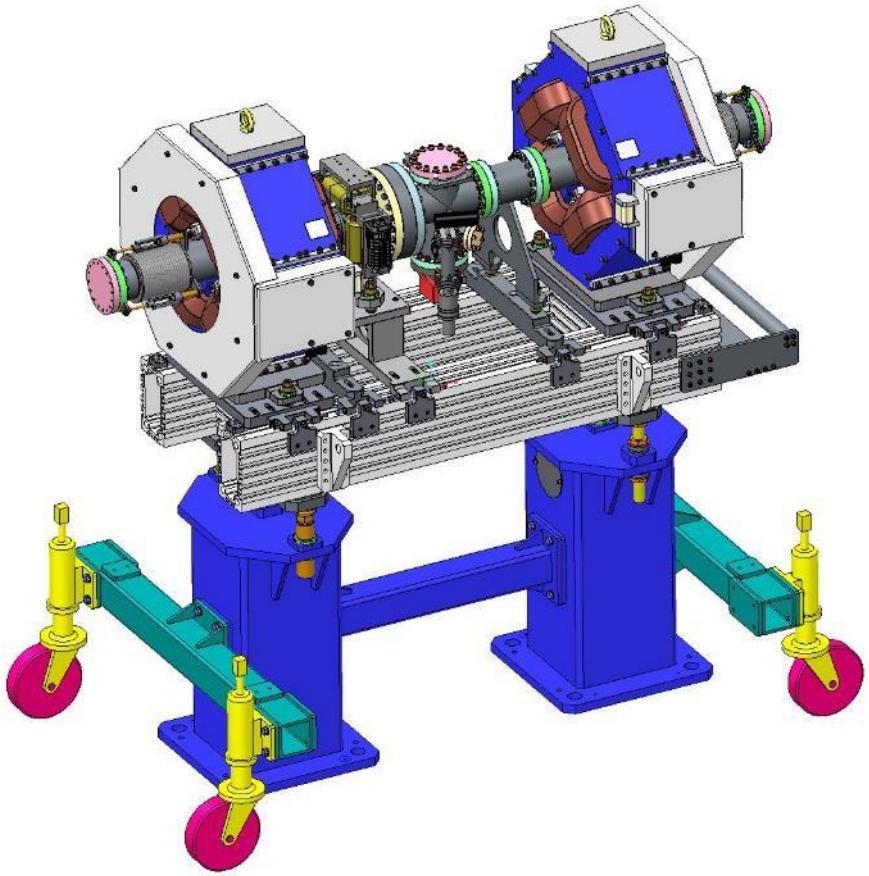




Differential Pumping Sections

- High energy pumping system





BTM WP Scope

- To design, procurement and assemble;
  - 2 Prototypes
  - 52 Dummy Cryo Modules
  - 74 Linac Warm Units
  - 3 Differential pumping systems
  - 4 mobile installation cleanrooms

2 Mobile cleanrooms delivered…

…2 more before year end

Schedule

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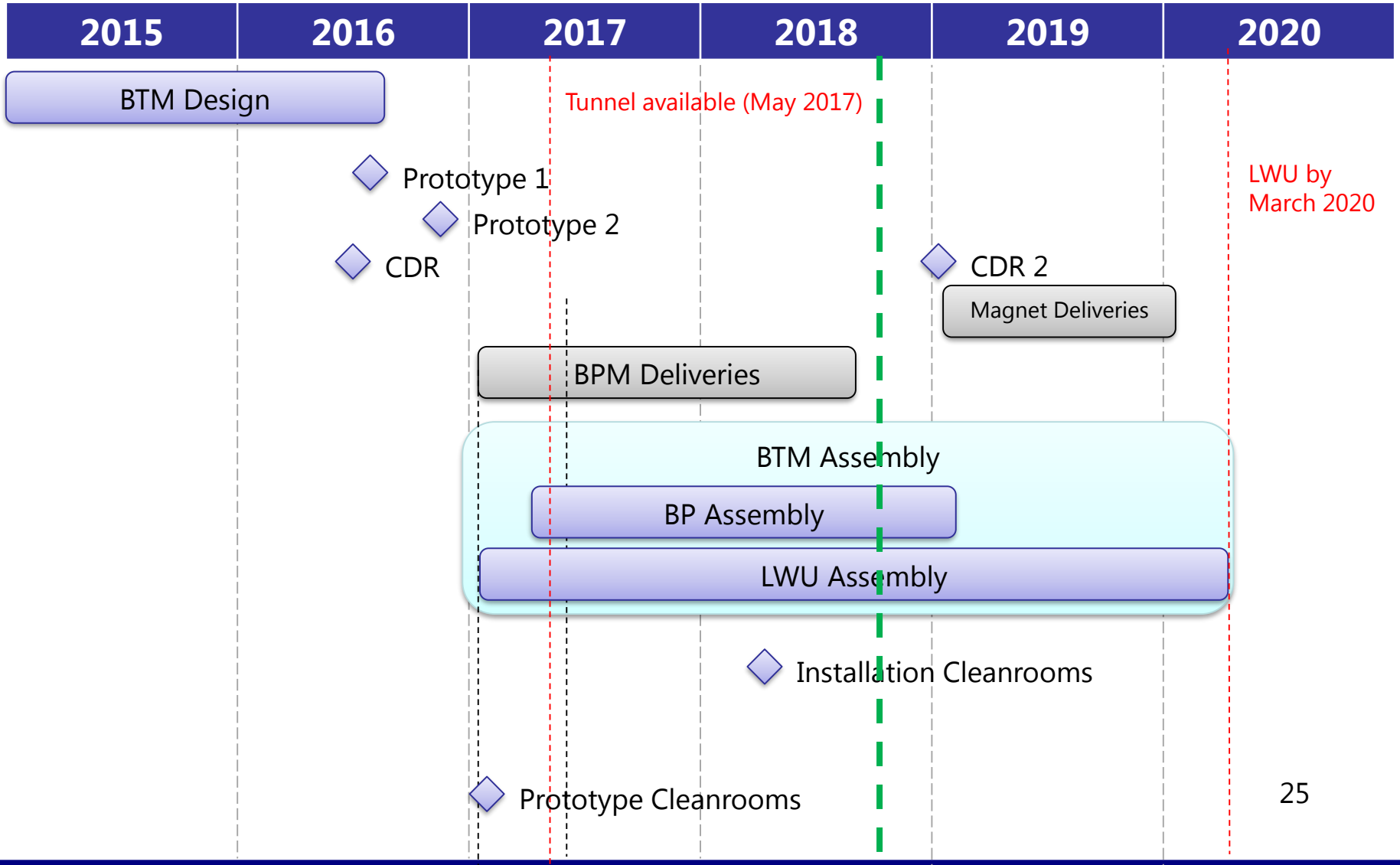
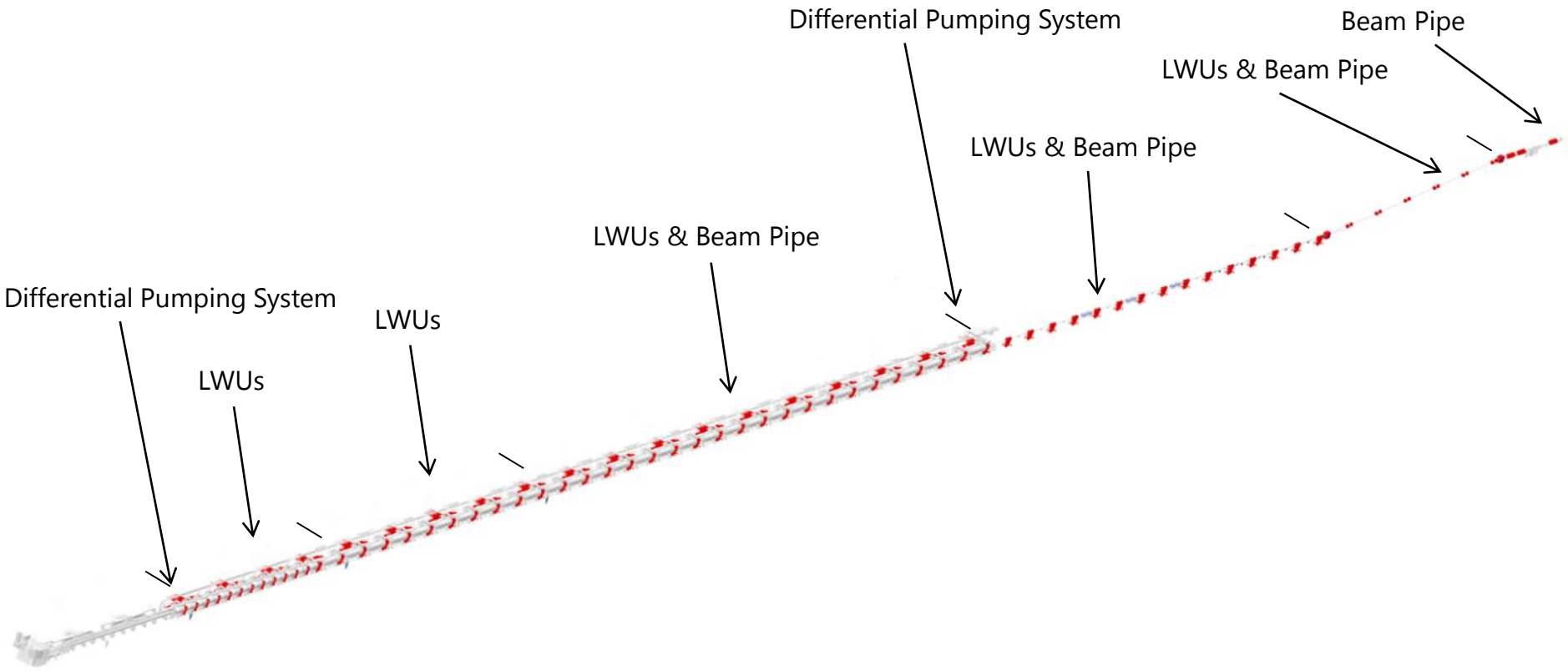
Schedule

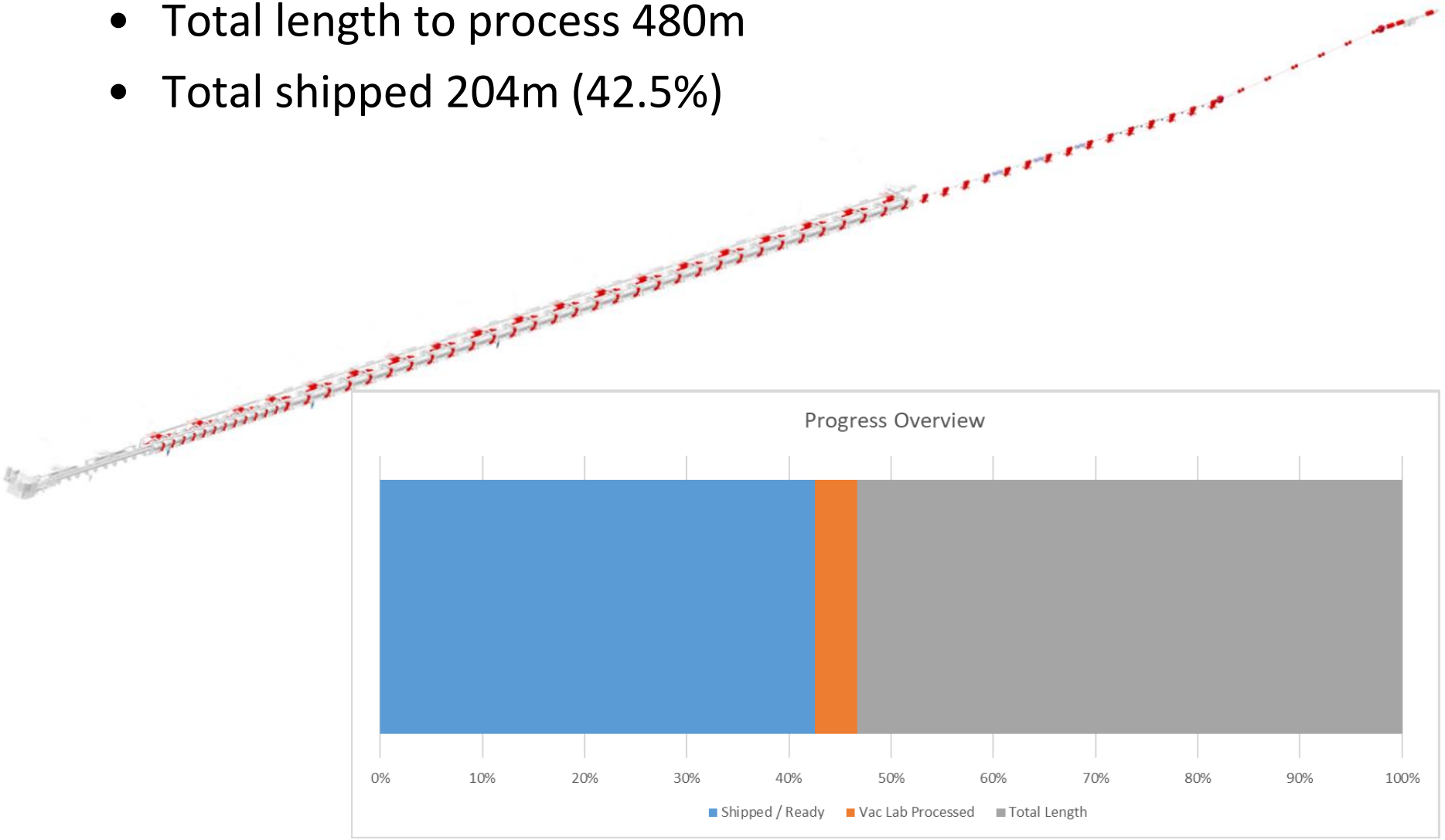


Overview


Differential Pumping System
LWUs
LWUs
LWUs & Beam Pipe
Differential Pumping System
LWUs & Beam Pipe
LWUs & Beam Pipe
Beam Pipe

Progress

- Total length to process 480m
- Total shipped 204m (42.5%)



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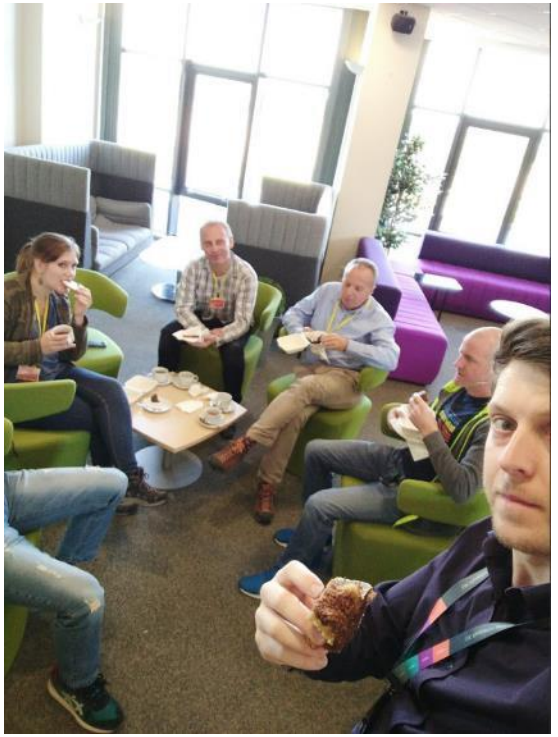
Milestones in TA

Deliverables	Final Delivery Deadline
~~**ESS Vacuum Laboratory consisting of (see Chapter 2.1):**~~ • ~~**[PTF] Particle Test Facility**~~ • ~~**[GCF] Gauge Calibration Facility**~~ • ~~**[OGF] Outgassing Facility**~~ • ~~**[VIF] Vacuum Integration Facility**~~ • ~~**technical data as specified in [PTF], [GCF], [OGF], [VIF]**~~	~~01 July 2015~~
~~**Relevant Technical data package for PDR. See 4.4.2.1**~~	~~2015 (Pre-PDR)~~
~~**Qty 3 x Dummy Test Chambers**~~	~~March 2016~~
~~**Qty 1 x 1st Prototype**~~	~~June 2016~~
~~**Qty 1 x 2nd Prototype**~~	~~August 2016~~
~~**Technical data package as specified for 1st CDR. See 4.4.2.2**~~	~~CDR, June 2016~~
Technical data package as specified for 2st CDR. See 4.4.2.2	CDR, July 2018
Qty 3 x Mobile Clean Rooms	July 2018
Qty 57 x Beam Pipe Units	July 2019
Qty 71 x LWUs	April 2020
Qty 2 x Differential Pumping Systems	April 2020
Qty 2 x Dipole Chambers	April 2020
Technical data package as specified for SAR. See 4.4.3.2.	SAR, minus 5 weeks
Delivery of Final Report and documentation package for Supply. See 4.4.5 and 4.4.6	31 December 2020
Vacuum Technician Support during installation at STFC site. See 4.1.2.1.6	**2018-2019, dates to be agreed**

ESS visit

ESS Visit - Deliverable

- Extremely productive three weeks:
  - Design reviews
  - Mobile Cleanroom sign off
  - Vacuum assembly work
  - Mechanical Assembly work
  - Cleanroom operation
  - Flange assembly discussions
  - Plus some rather enjoyable social events

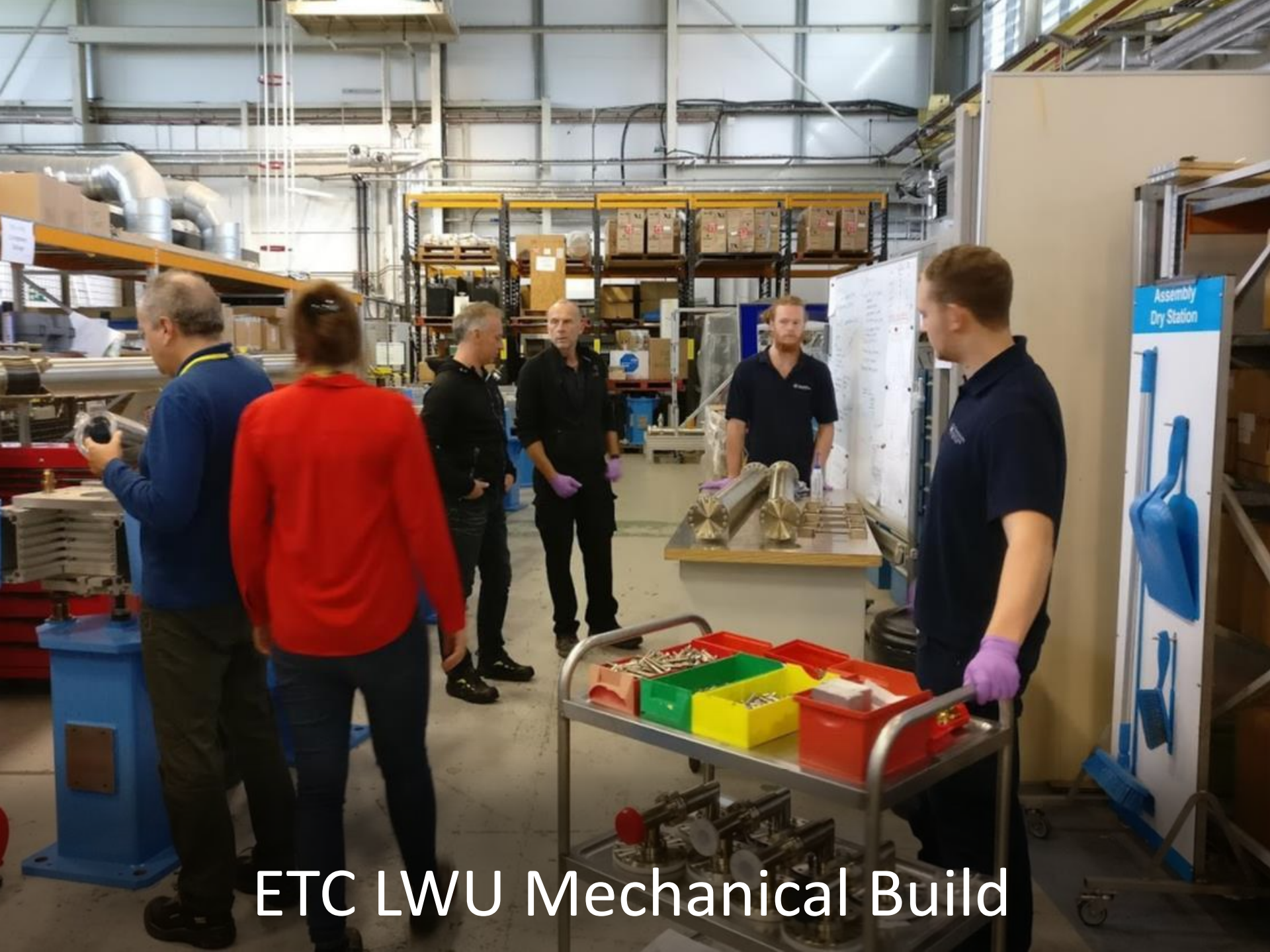


ESS Visit to STFC


ESS Vacuum Group in the STFC Cleanrooms

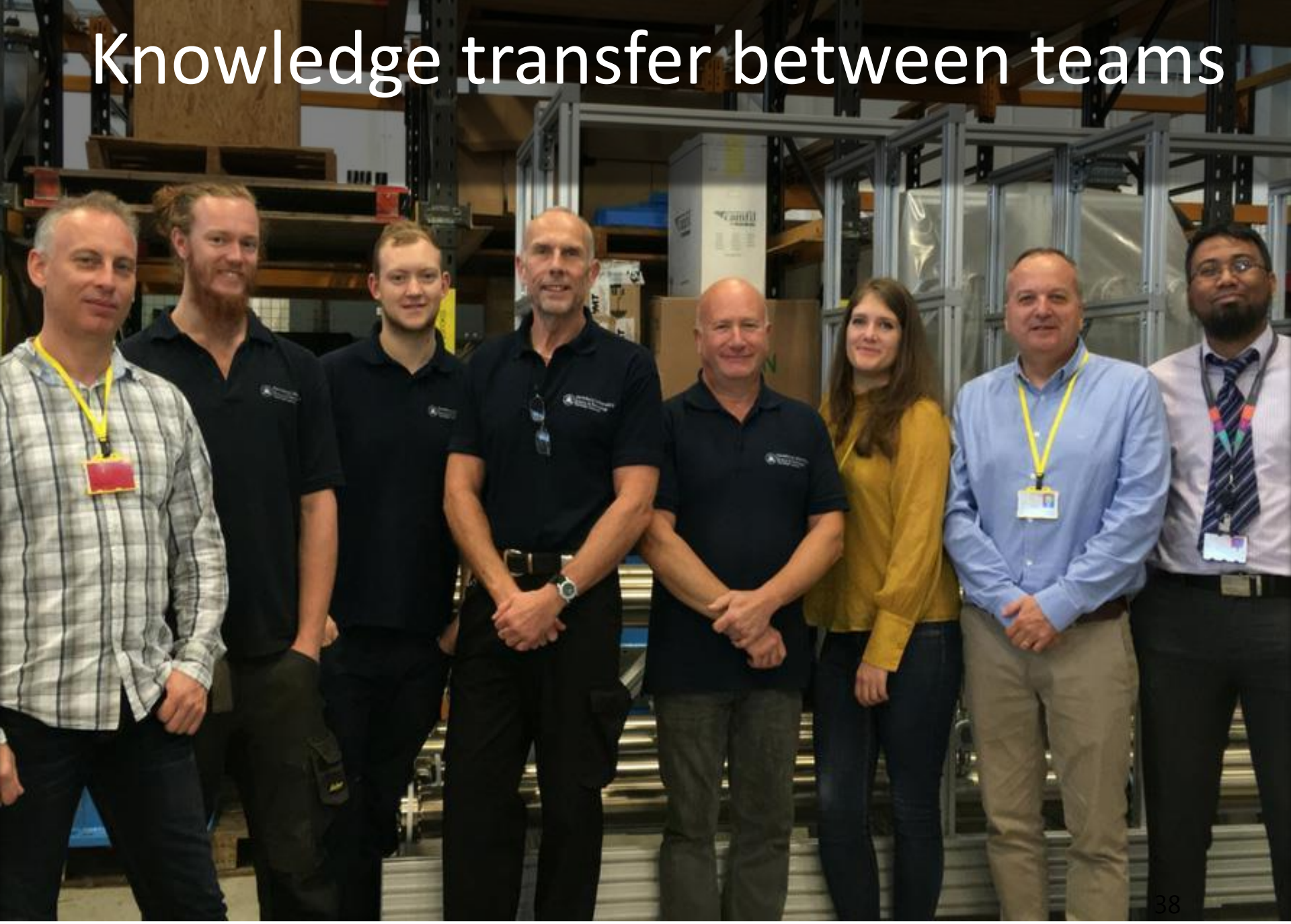
Vacuum Group in the clean assembly area

Vac Lab Processing procedures



ETC LWU Mechanical Build

Knowledge transfer between teams



LWU to cryo-module connection

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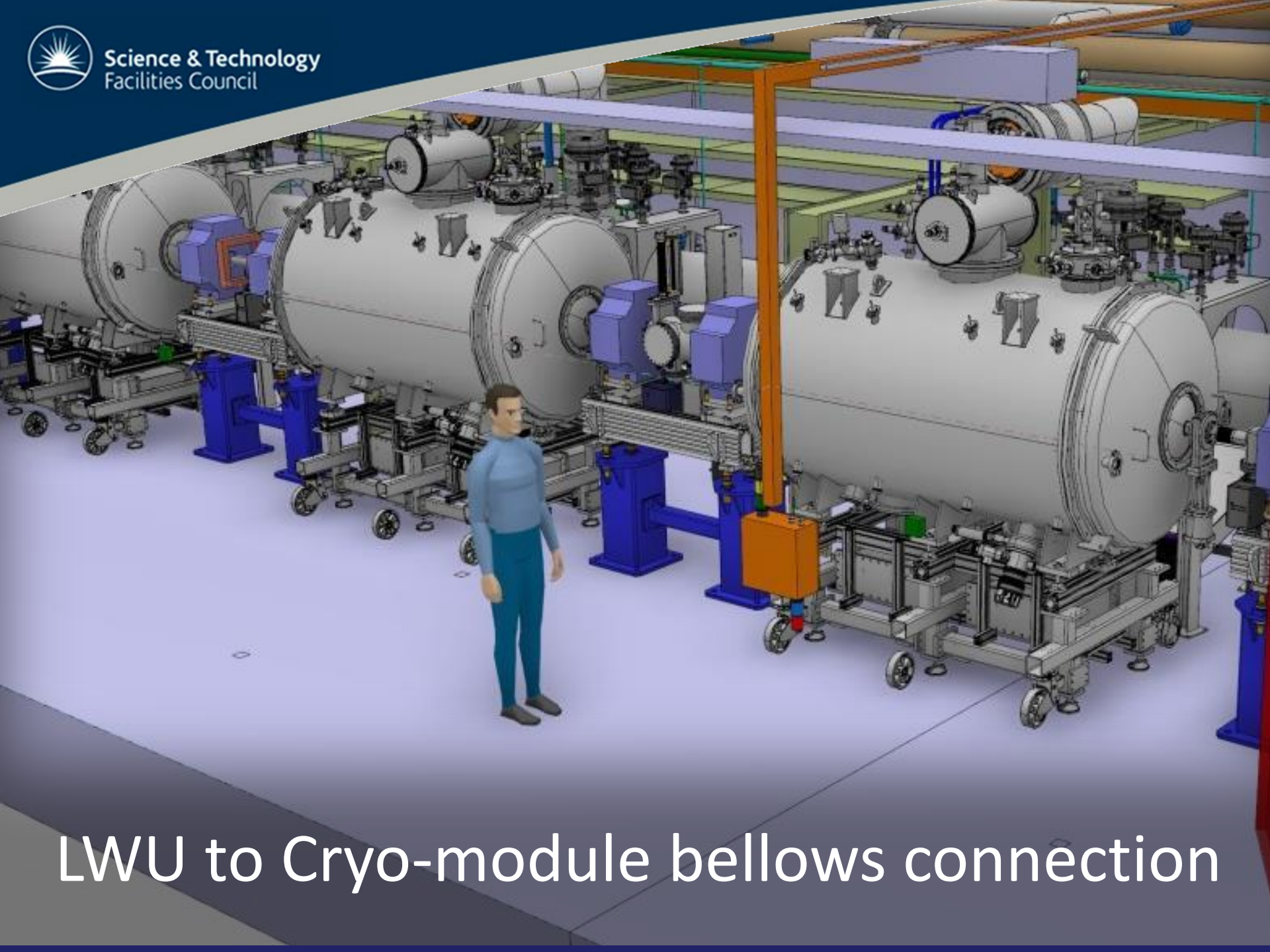
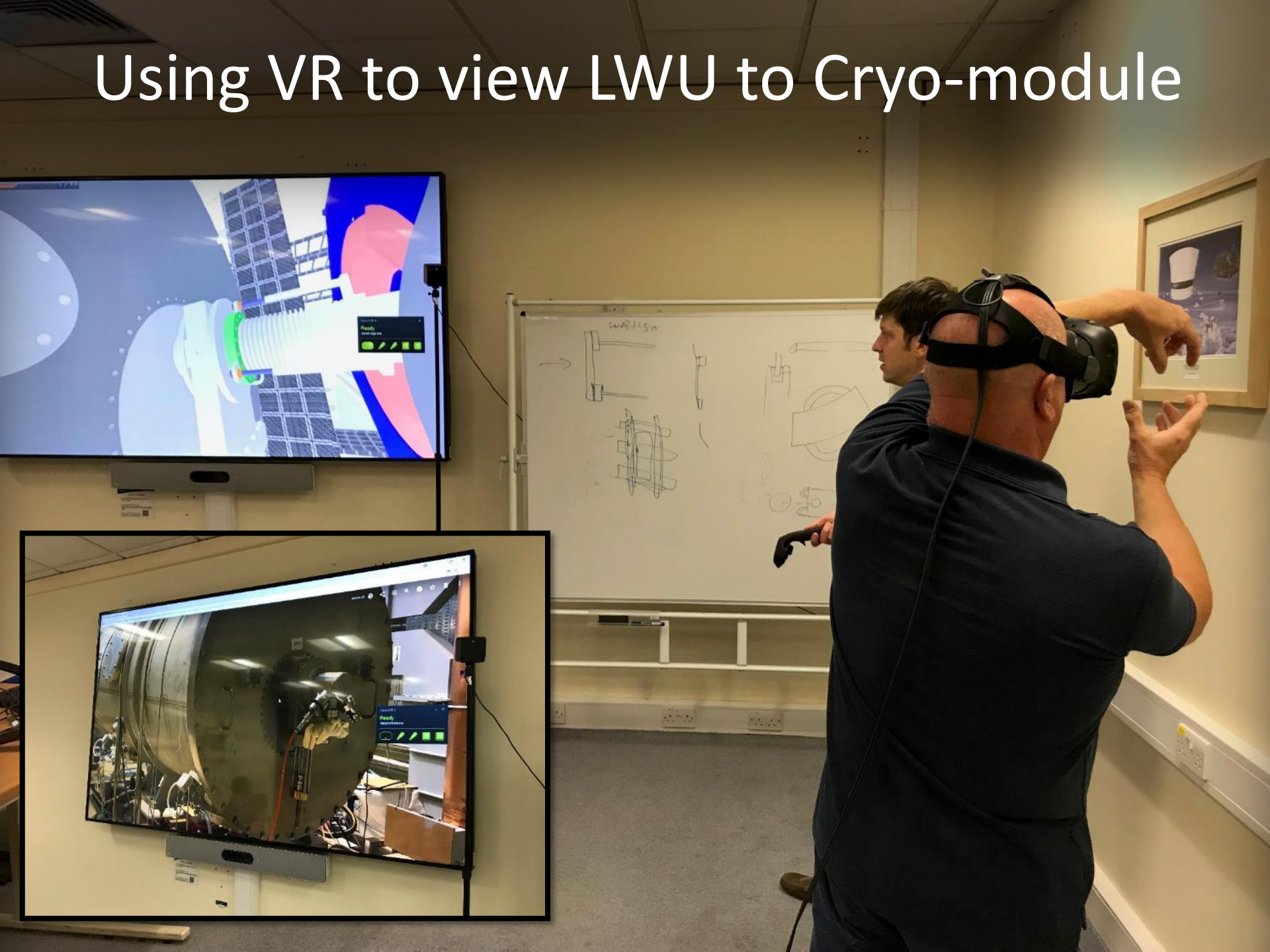
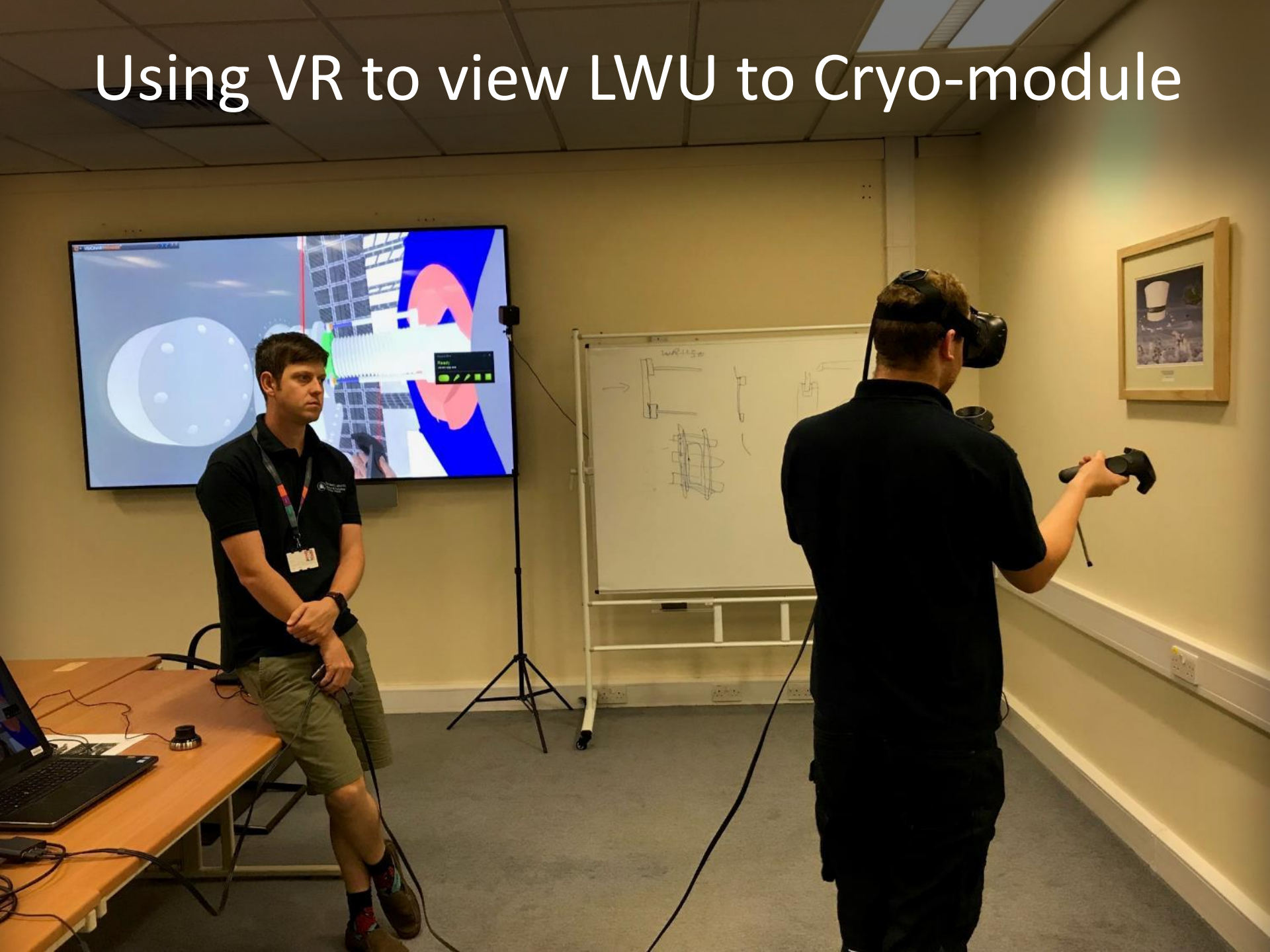


LWU to Cryo-module bellows connection

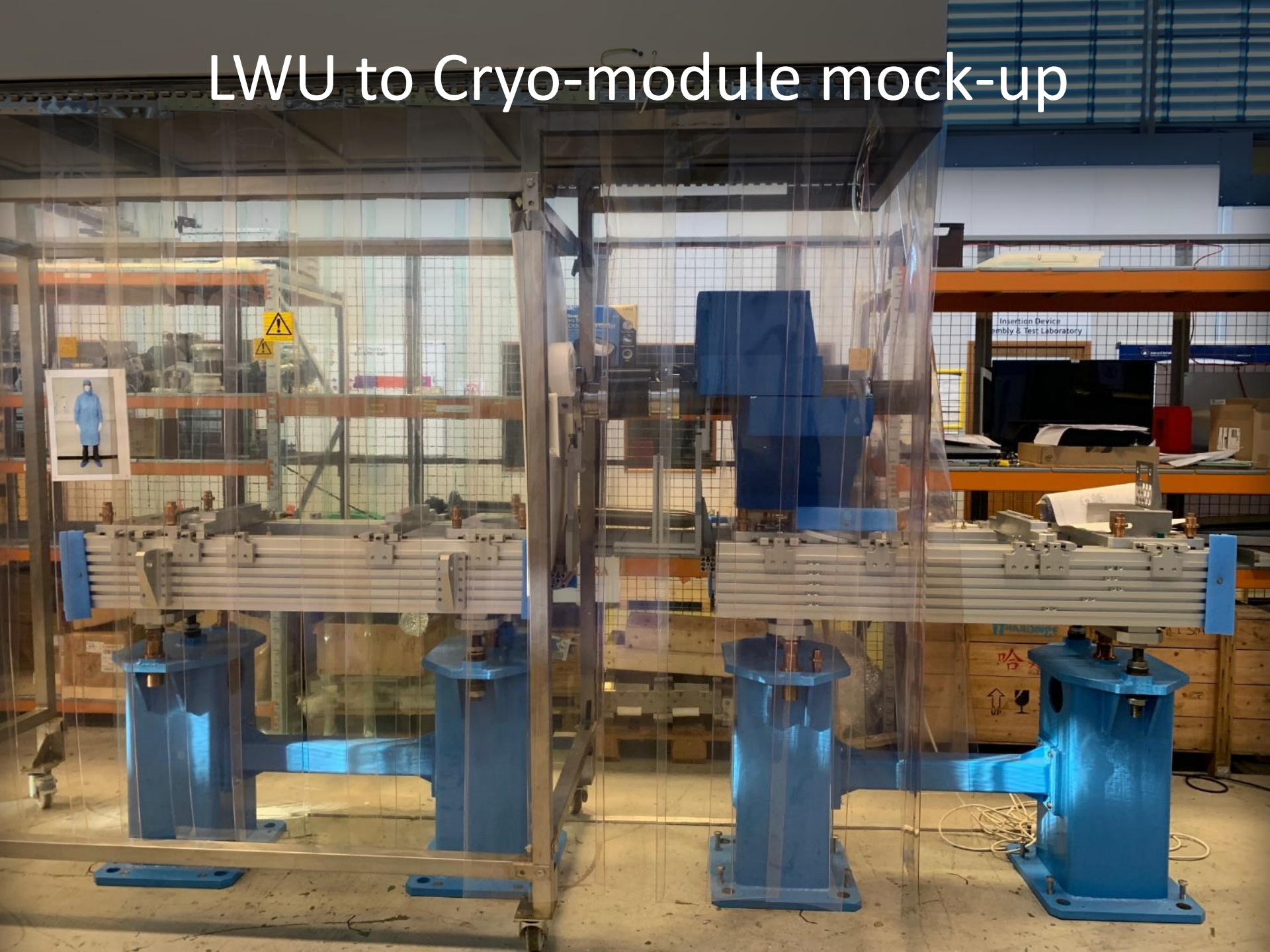
Using VR to view LWU to Cryo-module



Using VR to view LWU to Cryo-module



LWU to Cryo-module mock-up



LWU to Cryo-module - tests ongoing

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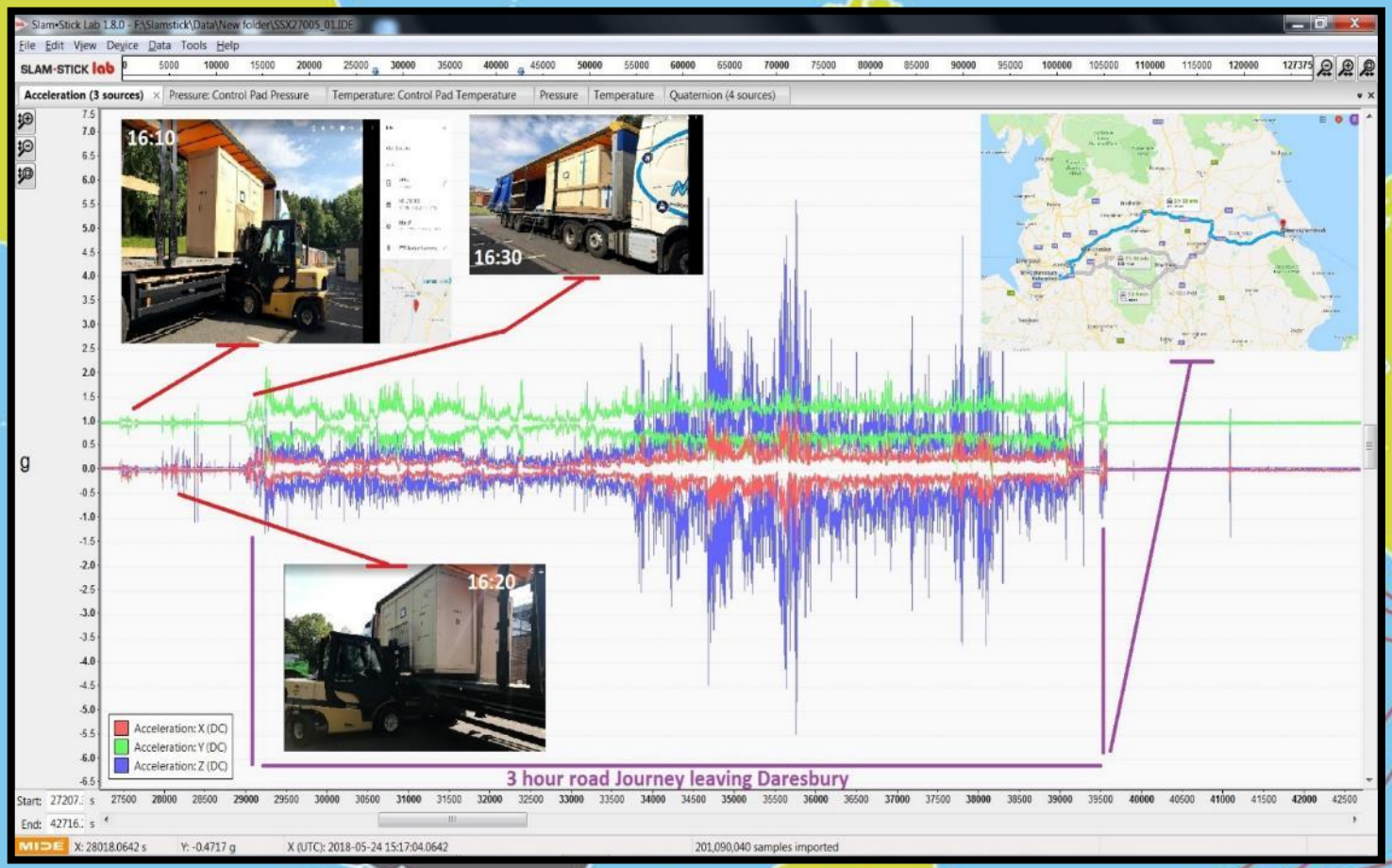
Shock and vibration accelerometer logger

Shock and vibration accelerometer logger



NORWAY

SW

Gothe

Hirtshals

Trell

DENMARK

Rodby

Daresbury

UNITED KINGDOM

Puttgarden

Rostock

Sw

NETHERLANDS

GERMANY

BELGIUM

Scandinavian ferry routes

www.freightlink.co.uk

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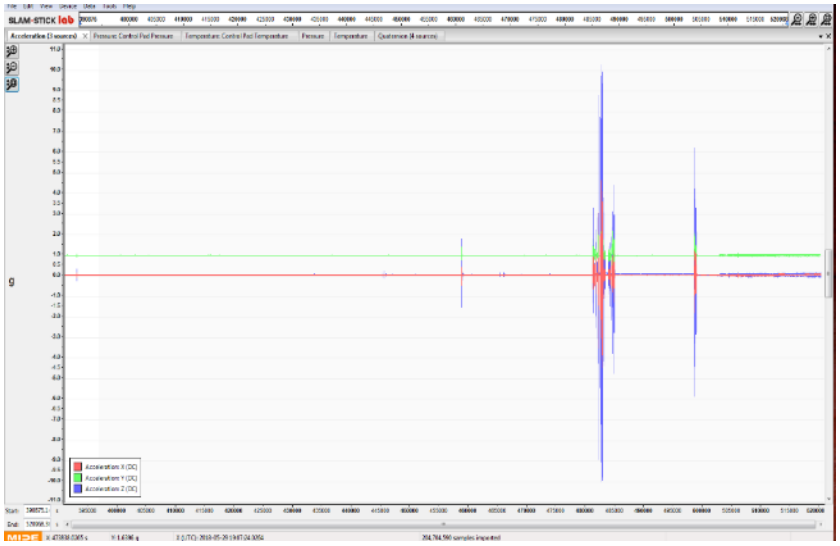
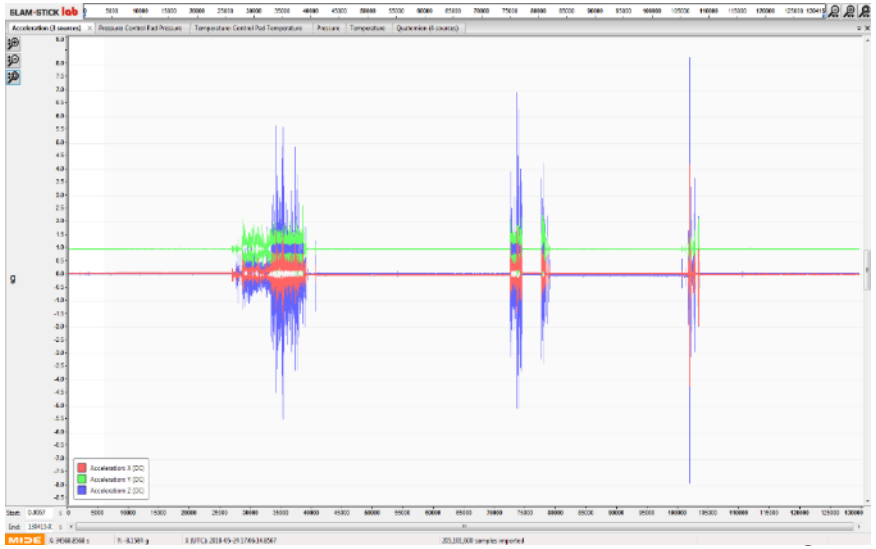
Shock and vibration during transport

- Initial observations show some 10G+ shock events.
- Possible causes:
  - Poor road surface (pot holes)?
  - Crates sliding on the trailer bed (insufficient strapping)?
  - Handled with limited care at the ports (loading/unloading)?





Shock and vibration during transport

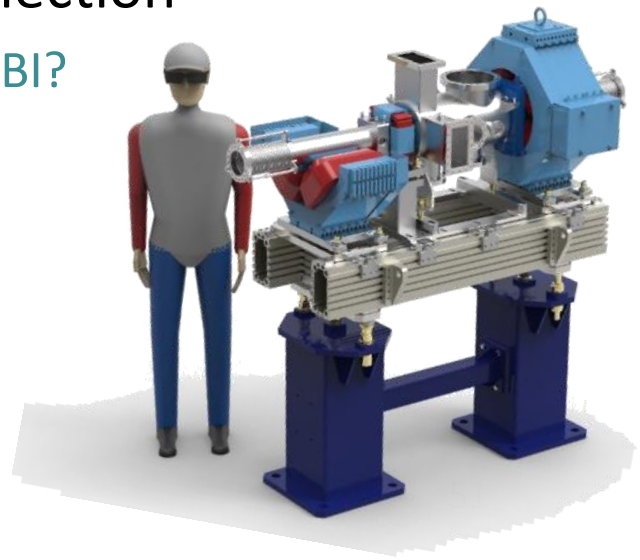
- Actions and potential solutions
  - Re-run the test using ‘air ride’ suspension trailer (DCM’s)
  - Same trailer from Daresbury to Lund
  - Design temporary bracing (magnets) for transport

Damping system in the crate (Cavoflex)

Final summary

- Progressing well
- First LWU due to be delivered early 2019 (30 to follow)
- Pedestals and remaining DCM delivered early 2019
- All mobile clean rooms signed off by end of this year
- Spending time at IK partners facility highly advisable
- Help refine bellows to Cryomodule connection

  *Likewise.. installation methods of interfacing BI?
- Transport method to be optimised
- 240m vessels remain to be processed
- A lot of work still to do - busy 2019




Thank You