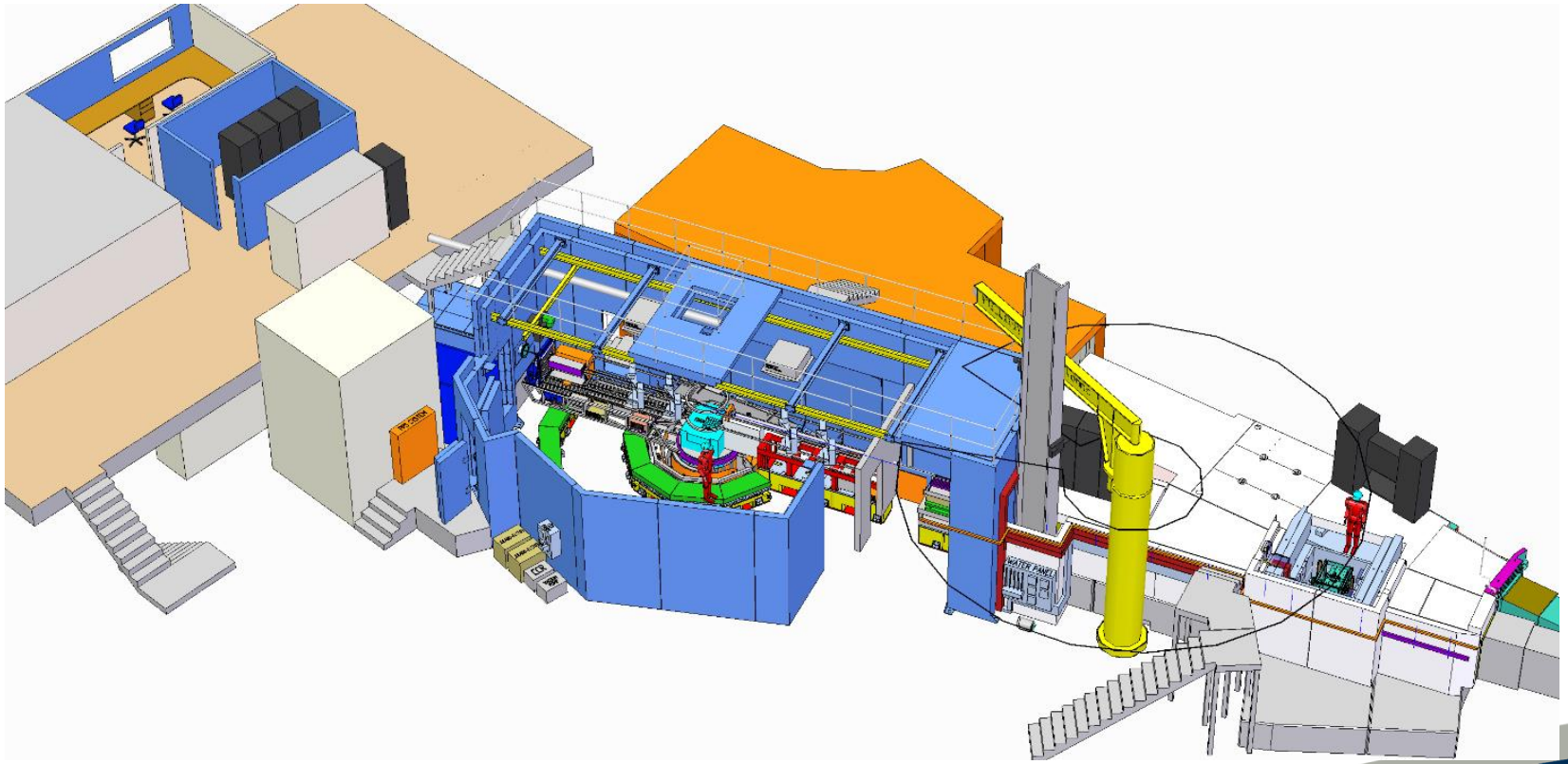
Larmor (& ZOOM) Engineering Considerations



Kevin Jones (Liam Whitelegg)

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Design Considerations

- Physical Components
- Installation (& Services)
- Operational
- Maintenance
- Decommissioning
- Project (Time/Cost/Quality)

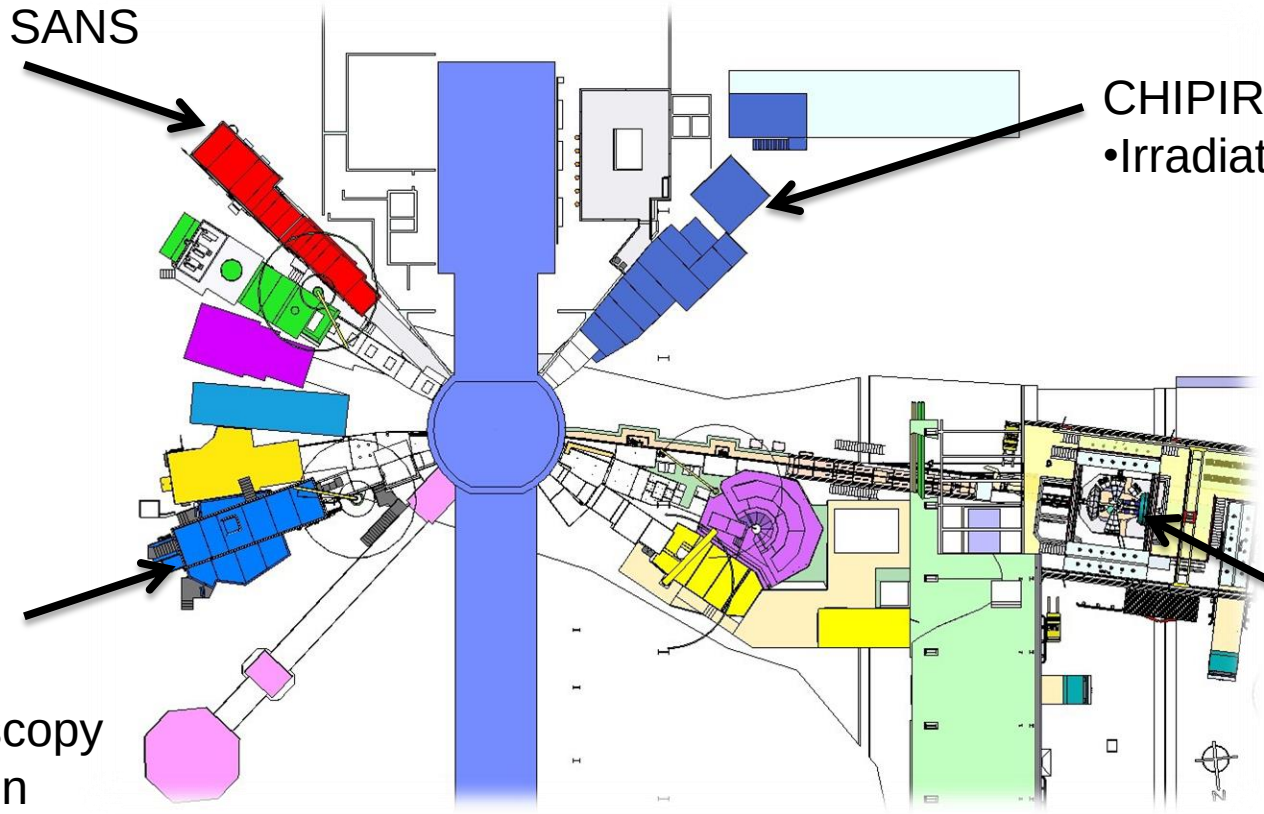
Specification

- Specification
  - This will evolve/creep
  - Flexibility
  - Change Control
- Having a specification does not ensure success
- Communication is key

General		Motion Axes
Instrument Type	Flexible Polarized SANS	
Location	E6	
Moderator	Grooved Methane - Modification required to accommodate Larmor Beam	
Reflector	Modification required to accommodate Larmor Beam	
ISIS Instrument Scientists	Dr. R.M. Dalgliesh, Prof. S. Langridge	
Target centre to moderator face	49.52mm	
Neutron Beam Trajectory	Horizontal, 1.1˚ Offset from nominal E6 Centreline towards E5, Beam centred on Target centre at methane moderator groove height (96mm below target centre).	
Primary flight path	25.3m from target centre	
Secondary flight path	4.3m to detector front face	
Instrument		
Torpedo	Not required.	
Shutter		
Collimation	No special requirements, no insert guide	
Description	Saw tooth collimation to reduce background	
Opening/closing time	30s to open	
Operating frequency	10 times per day	
Insert	Requires re-configuring to view the Grooved Methane moderator.	
Direct beam shielding		
	B4C/Steel/Wax shielding block around beam exit to block path of direct beam	
Guide 1		
Collimation - size, length, direction	m=3, 30x30mm internal cross section straight, horizontal guide starting immediately after the shutter within the bulk shield to the chopper pit.	
Shielding	Guide contained within steel alignment vessel shielded with alternating steel, borated poly, and NIMONIC Alloy plates along its length. Vacuum environment.	

Phase 2 Instruments

ZOOM
•Polarised SANS



CHIPIR
•Irradiation Facility

LARMOR
•Sans
•Spectroscopy
•Diffraction

IMAT
•Imaging
•Diffraction

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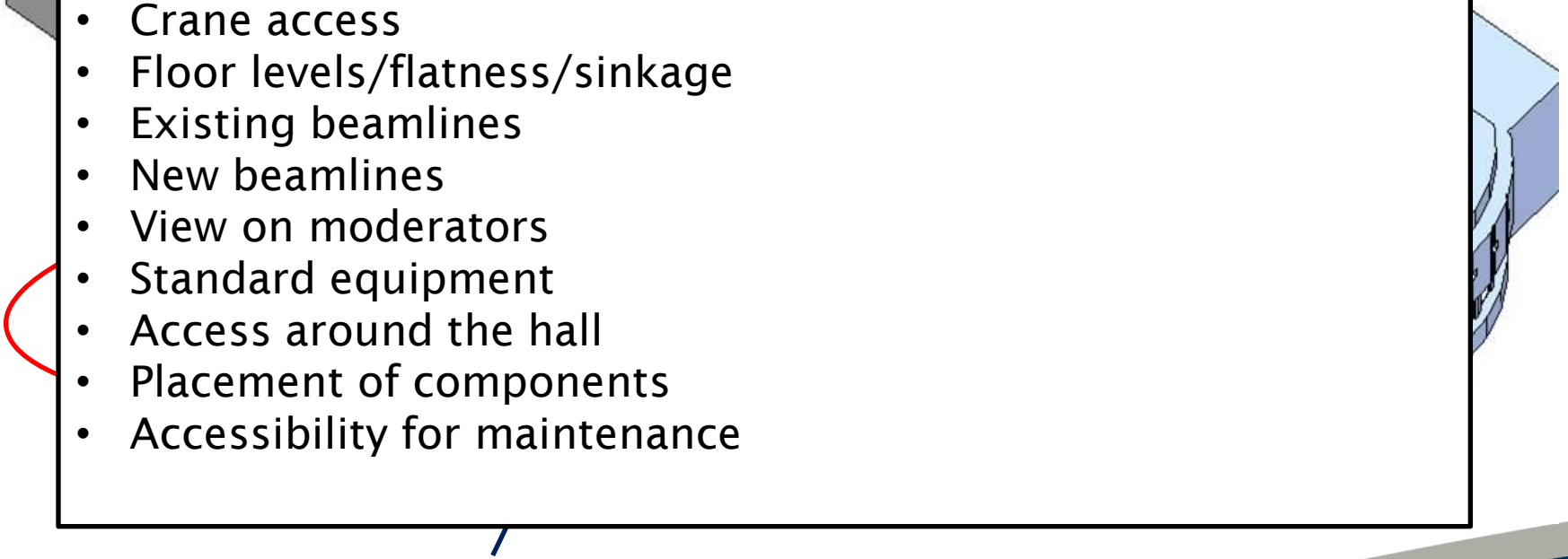
ISIS

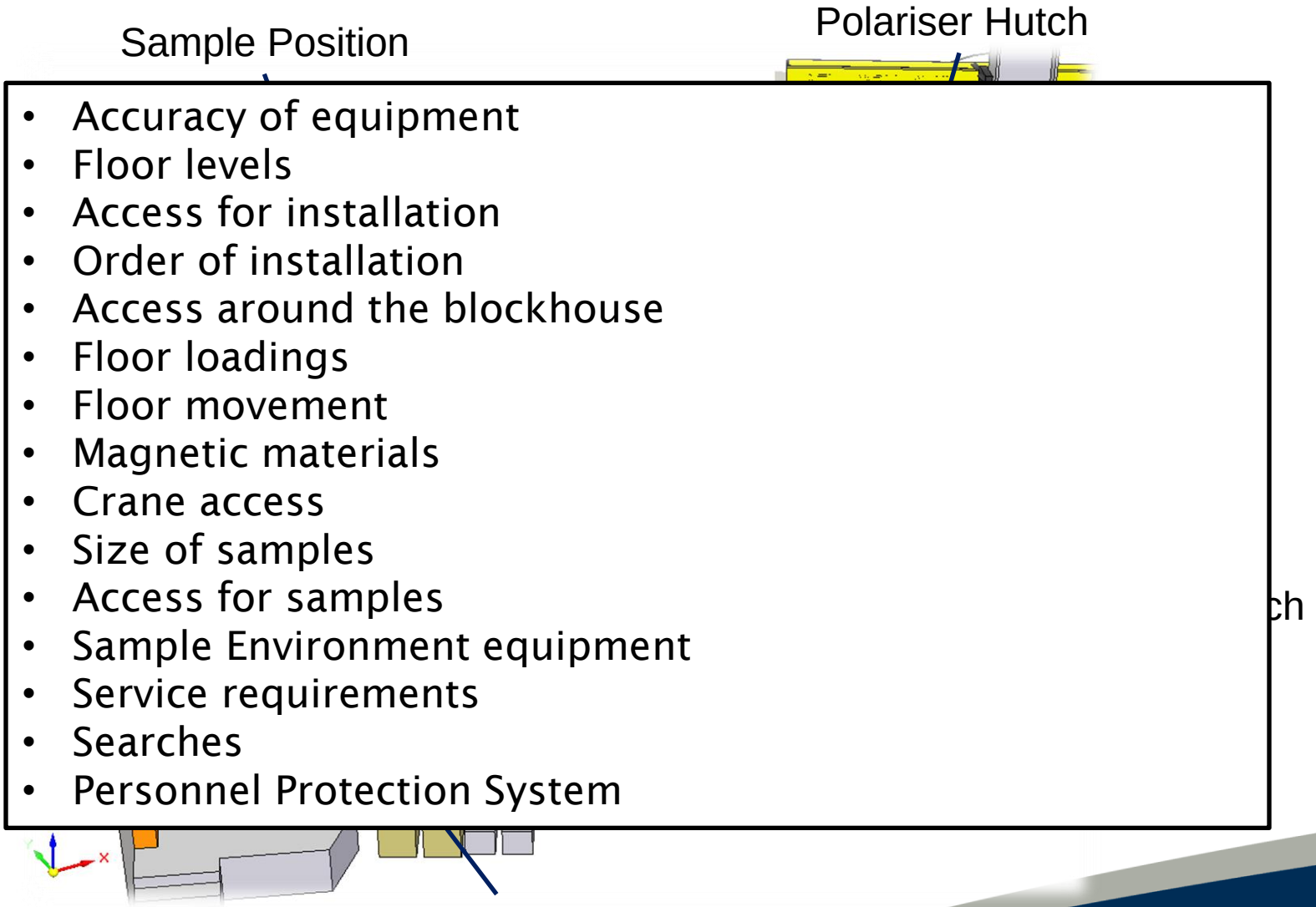
Larmor External Layout

- Hall Layouts
- Building geometry
- Floor loadings
- Service points
- Door sizes
- Temperature and humidity
- Crane access
- Floor levels/flatness/sinkage
- Existing beamlines
- New beamlines
- View on moderators
- Standard equipment
- Access around the hall
- Placement of components
- Accessibility for maintenance



Existing beamlines and
New beamlines

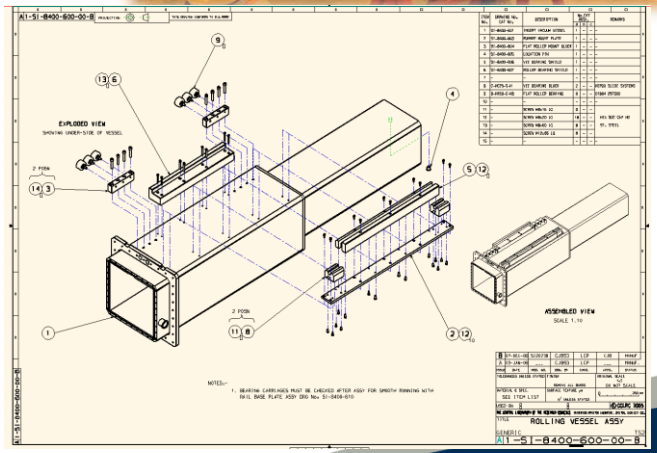
Larmor Internal Layout



- Accuracy of equipment
- Floor levels
- Access for installation
- Order of installation
- Access around the blockhouse
- Floor loadings
- Floor movement
- Magnetic materials
- Crane access
- Size of samples
- Access for samples
- Sample Environment equipment
- Service requirements
- Searches
- Personnel Protection System

Shutter and Insert

- Instrument controlled shutter to block beam.
- Larmor used steel to collimate aperture.
- Glass guide installed within insert vessel
- Rail system adjusted to align guide to beam.



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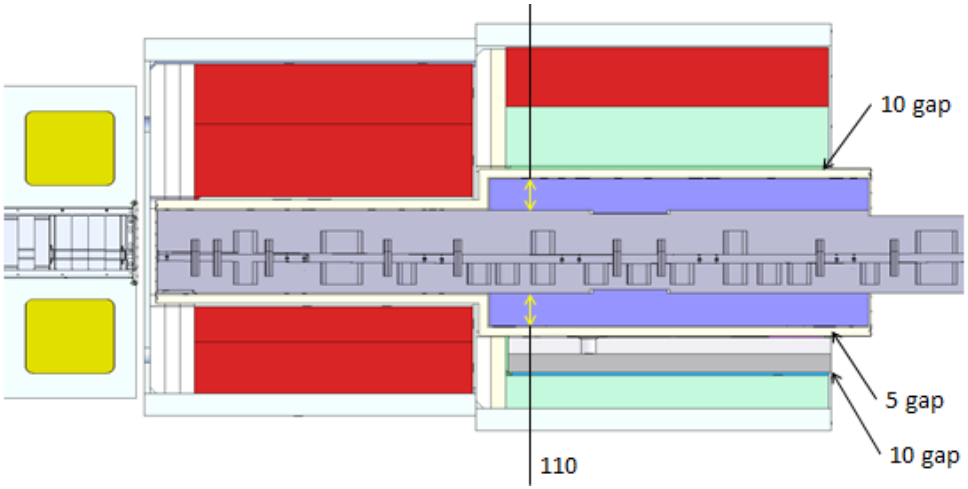
ZOOM Insert & Bender

- Short shut downs to complete installation
- Engineers left space to allow for alignment
- Level of acceptable gap wasn't discussed between engineers and scientist.



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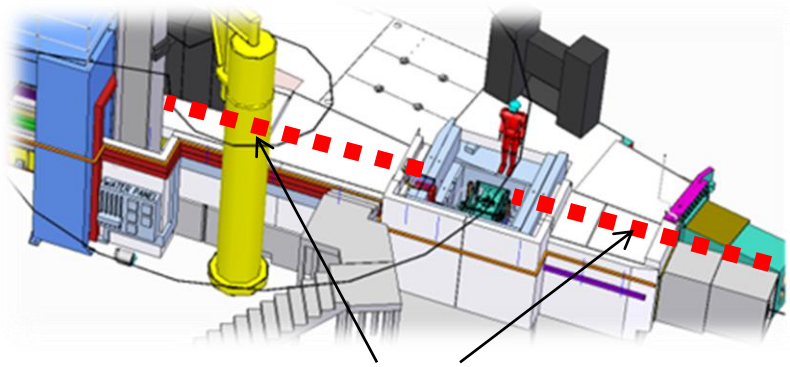
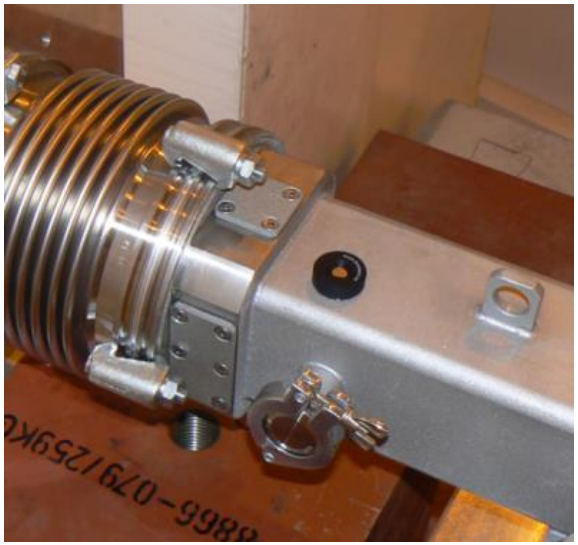
Glass Guide

Guide 1	
Collimation - size, length, direction	m=3, 30x30mm internal cross section straight, horizontal guide starting immediately after the shutter within the bulk shield to the chopper pit.
Shielding	Guide contained within steel alignment vessel shielded with alternating steel, borated poly, and NIMONIC Alloy plates along its length. Vacuum environment.
Choppers	
Location(s)	at 9.7m from the target centre
Frequency (range)	20Hz T0 chopper and 10Hz counter rotating double disc chopper of the same design as INTER and PolRef
Accessibility	maintenance only
Services	As Inter / Polref
Rack location(s)	3 racks & power distribution panel on top of the wax tank shielding
Guide 2	
Collimation - size, length, direction	m=3, 30x30mm cross section straight, horizontal guide starting immediately after the chopper assembly up to blockhouse wall.
Shielding	Guide contained within steel alignment vessel shielded with alternating steel, borated poly, and NIMONIC Alloy plates along its length. Vacuum environment.



Glass Guide



- Survey Nests
- Guide alignment points
- Collimating shielding;
  - Steel
  - Borated Poly
  - Nimonic Alloy

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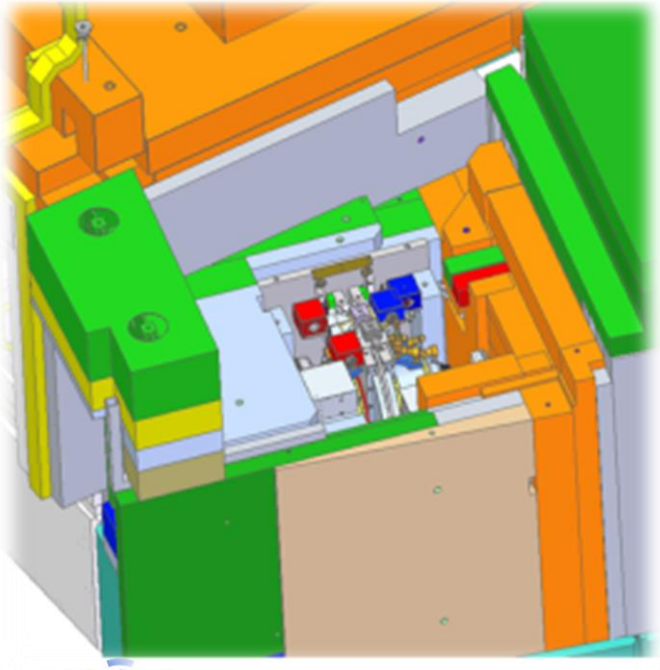
Shielding Considerations

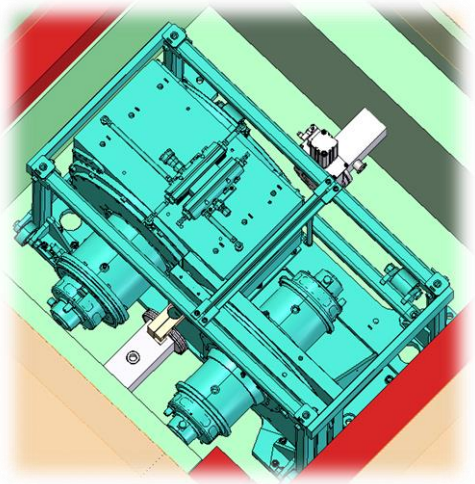
- Tolerances
  - Steel +0/-5mm (10mm gap?)
  - Concrete +/-20mm
  - Borated wax tanks +/-5mm
- Logistics
  - Crane limits
  - Transport limits
- Shine Paths
  - Flatness

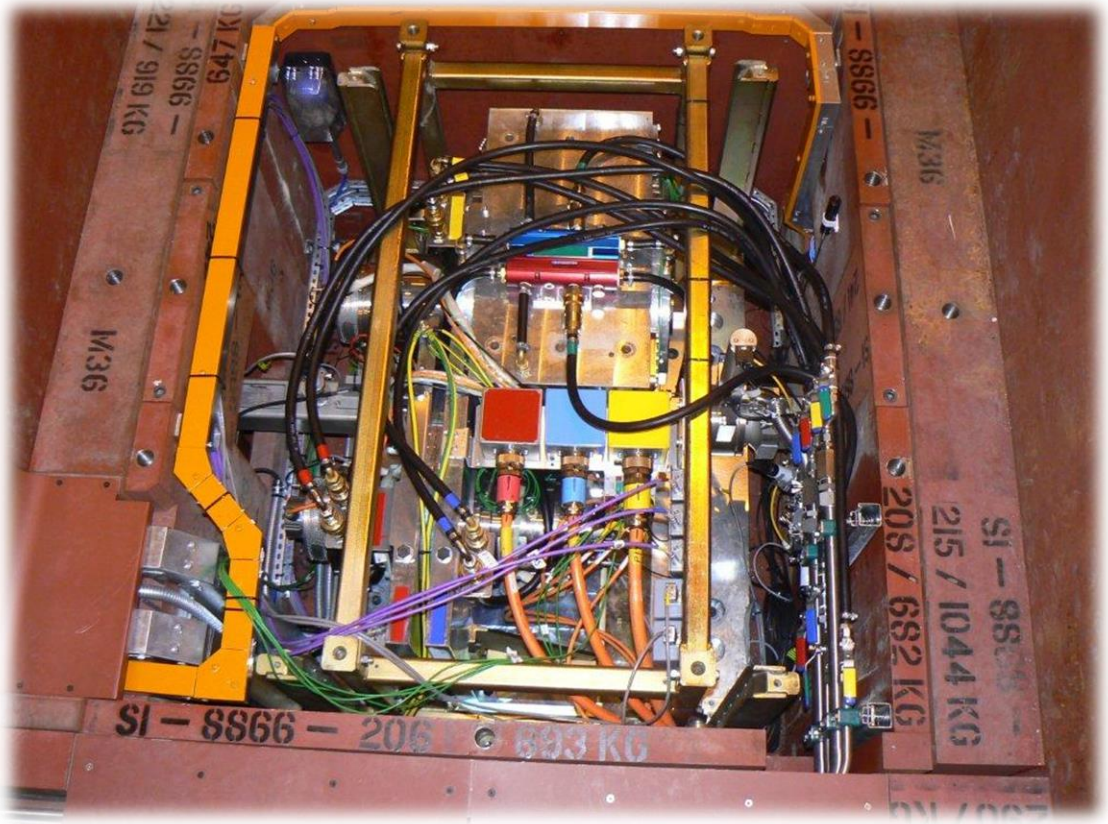
Shielding Considerations

- Access
  - Lifts
  - Accessibility
- Service Routes



Chopper Pits





- Power
- Condition Monitoring
- Water Cooling
- Control Cables
- Radiation Monitors
- Blue Light
- Gate Valve (Compressed Air)
- Beam Monitor

- Foundations
- Securing Bolts (Accessible)
- Guides/rails
- Access

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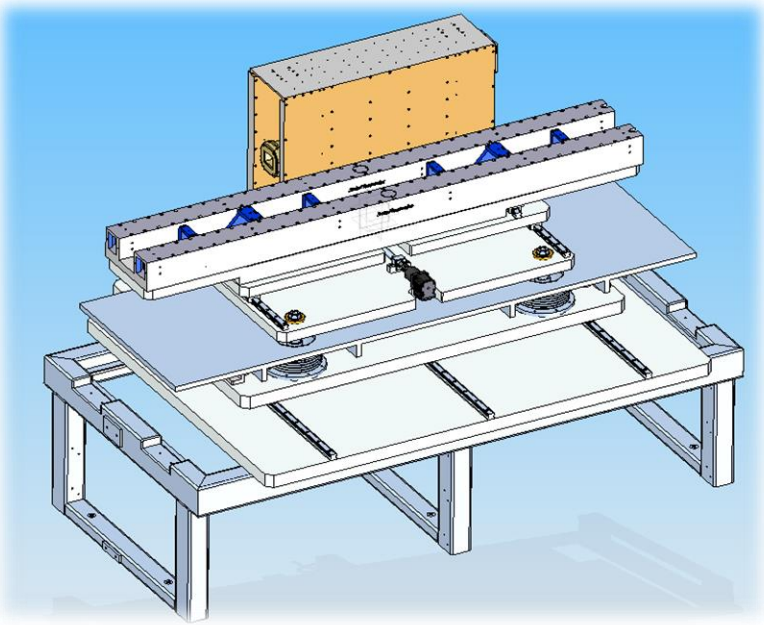
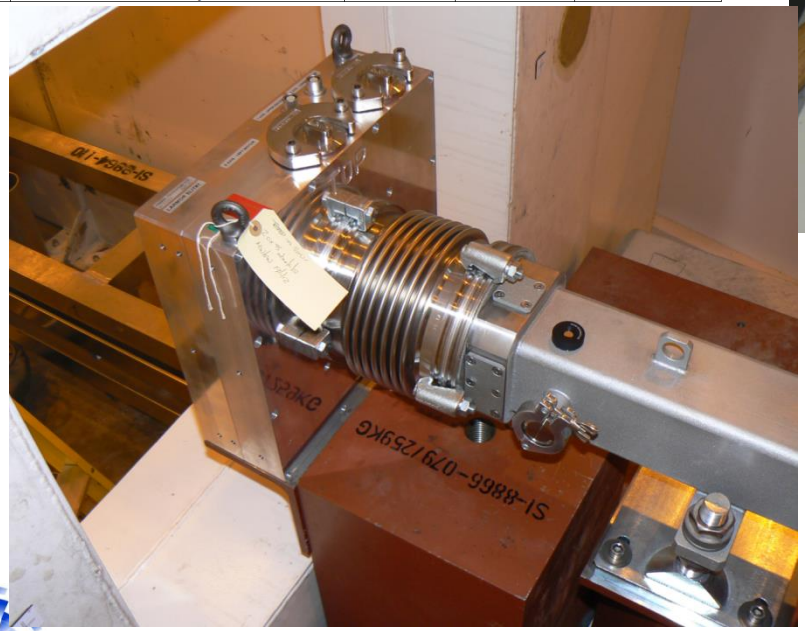
Polariser



- Module translation stage
- Double V configuration Polariser or mirror guide
- All contained within a vacuum vessel

Slit / Jaw System

	Does in need to be nonmagnetic	Tolerance	Aperture Size	Jaw type	Are slits in vacuum
Jaws	No	**Resolution:** 50 microns **Repeatability:** 100 microns **Positional Accuracy:** 100 microns	45mm x 45mm	10mm B4c	Yes
Slit 1	No	**Resolution:** 5 microns **Repeatability:** 10 microns **Positional Accuracy:** 50 microns	45mm x 45mm	2mm Cadmium, 5mm B_4C	Yes
Slit 2	Yes	**Resolution:** 5 microns **Repeatability:** 10 microns **Positional Accuracy:** 50 microns	45mm x 45mm	2mm Cadmium, 5mm B_4C	Yes
Slit 3	Yes	**Resolution:** 5 microns **Repeatability:** 10 microns **Positional Accuracy:** 50 microns	45mm x 45mm	2mm Cadmium, 5mm B_4C	No



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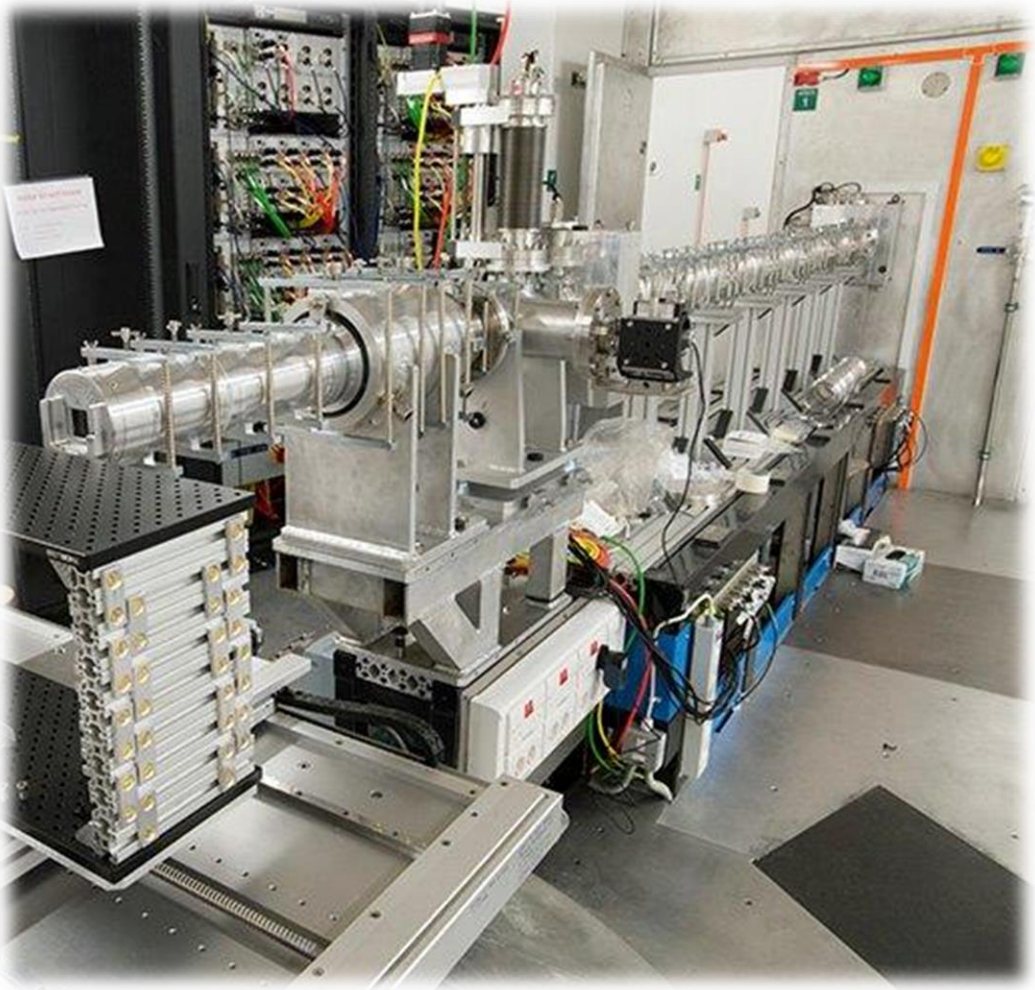
Drift Tubes

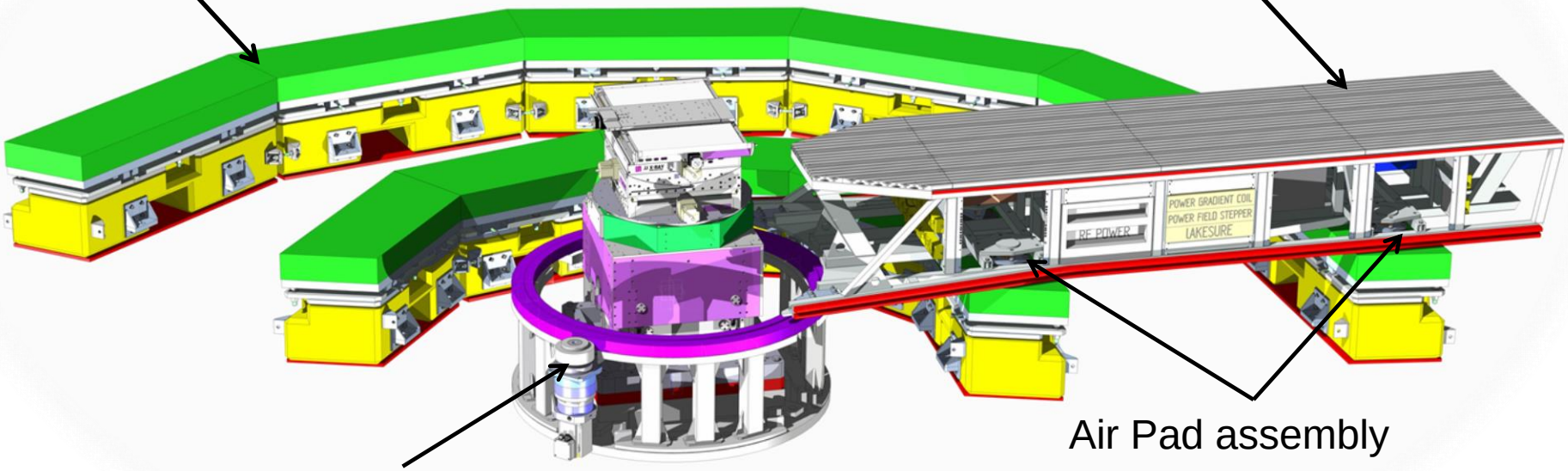


- Guide field magnets required to maintain polarisation.
- Maximum allowable spacing limit.
- Pre sample beam monitor that can retract from beam.

Sample Stack

- 7 axis sample stack from JJ-Xray
- Pictures show load testing and installation.

The Larmor Bench Motion



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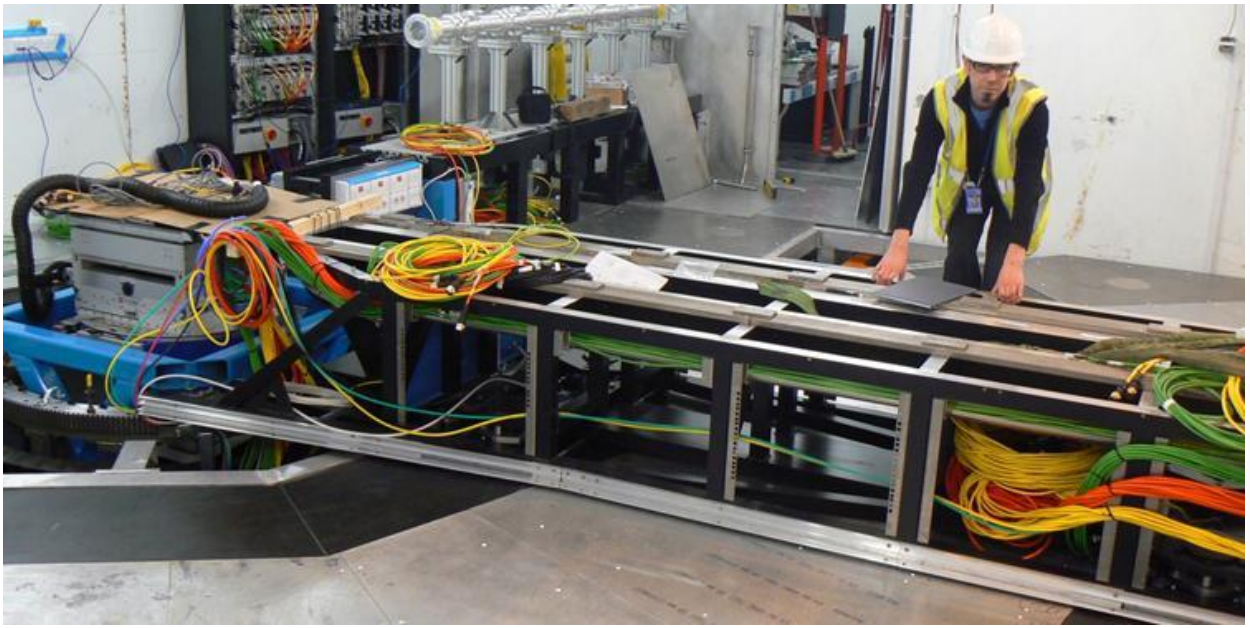
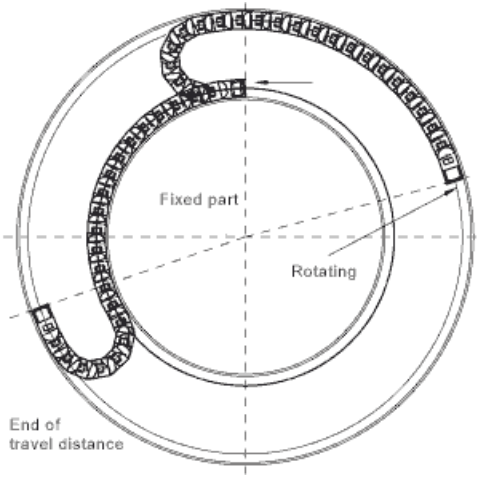
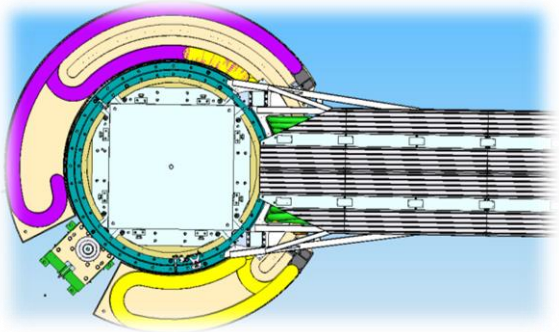
Bench Services

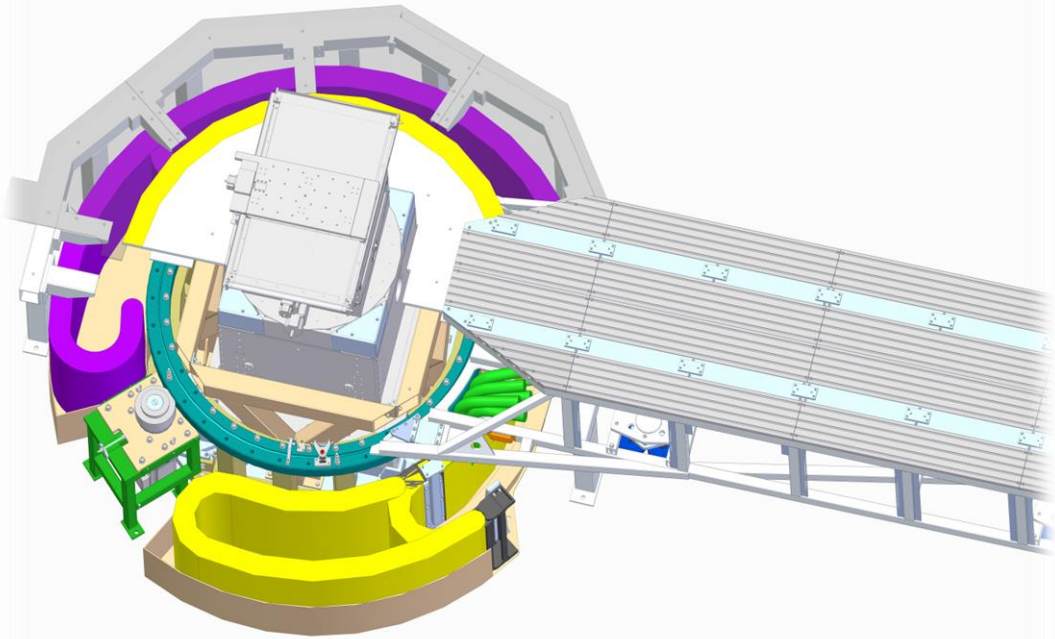
- Cables need to be managed to prevent damage
- A lot easier if designed in before installation
- Drag/Energy chains required



Cable Management







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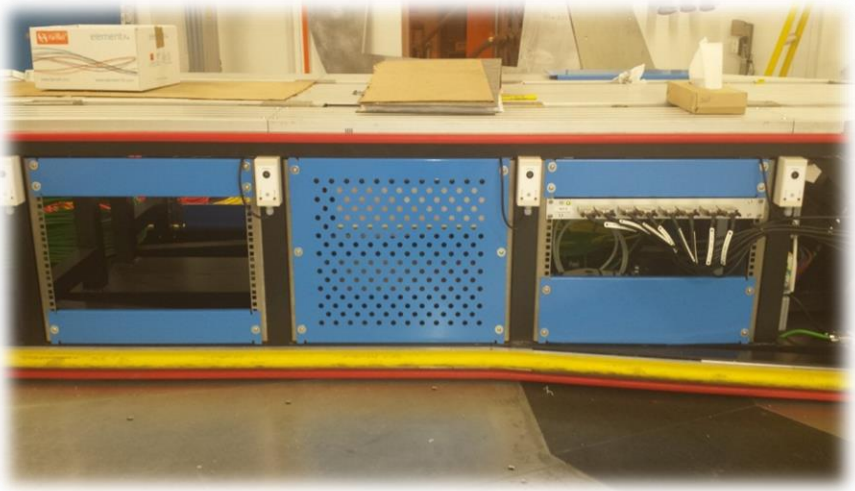
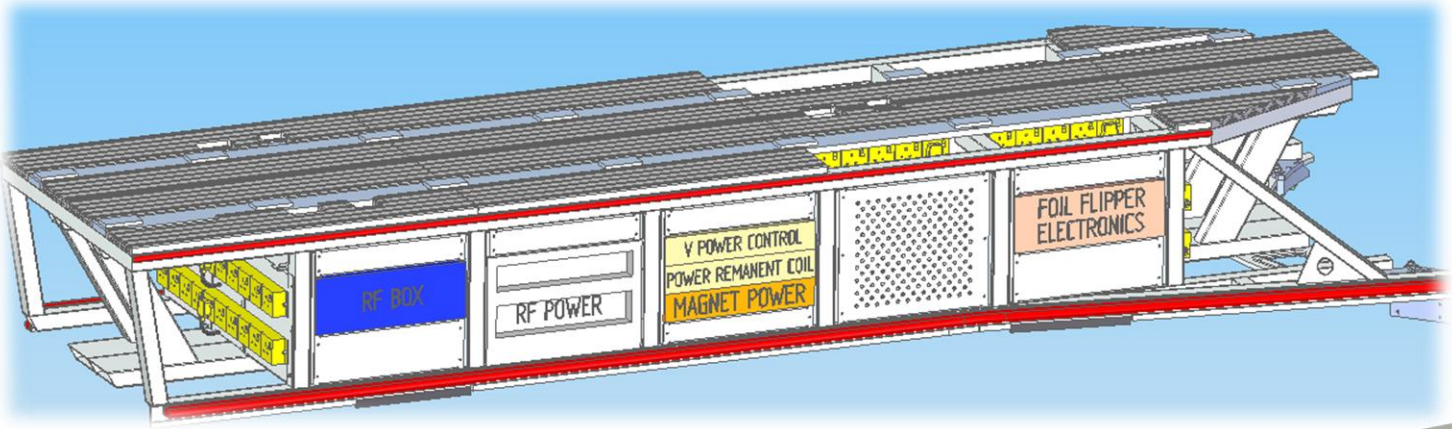
Bench Services

- Motion components require control racks.
- Specialist power supplies required for magnets.
- Network and power sockets required for sample area.





Sans configuration

Vacuum

- **Geometry**
- Safety
- Deflections
- Out gassing/trapped volumes/greases
- Ports/Services
- Window material
- Pump down time/gate valves
- Electronics
- Temperature control
- Access

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Vacuum

- Geometry
- **Safety**
- Deflections
- Out gassing/trapped volumes/greases
- Ports/Services
- Window material
- Pump down time/gate valves
- Electronics
- Temperature control
- Access

Vacuum

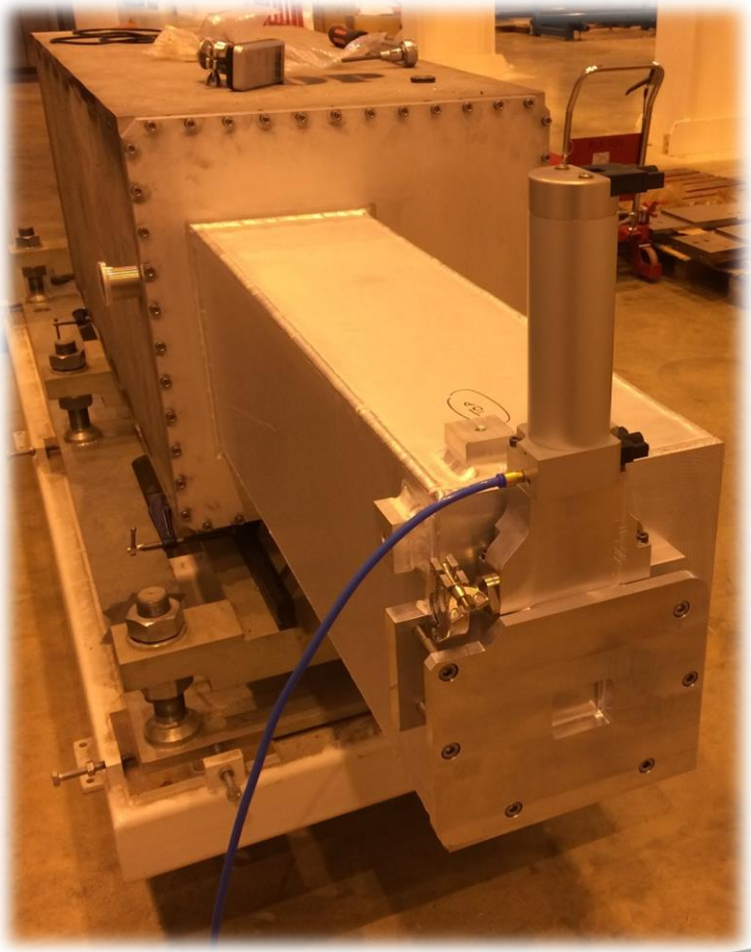
- Geometry
- Safety
- **Deflections**
- **Out gassing/trapped volumes/greases**
- Ports/Services
- Window material
- Pump down time/gate valves
- Electronics
- Temperature control
- Access

Vacuum

- Geometry
- Safety
- Deflections
- Out gassing/trapped volumes/greases
- **Ports/Services/feedthroughs**
- Window material
- Pump down time/gate valves
- Electronics
- Temperature control
- Access

Vacuum

- Geometry
- Safety
- Deflections
- Out gassing/trapped volumes/greases
- Ports/Services
- **Window material**
- **Pump down time/gate valves**
- Electronics
- Temperature control
- Access



Vacuum

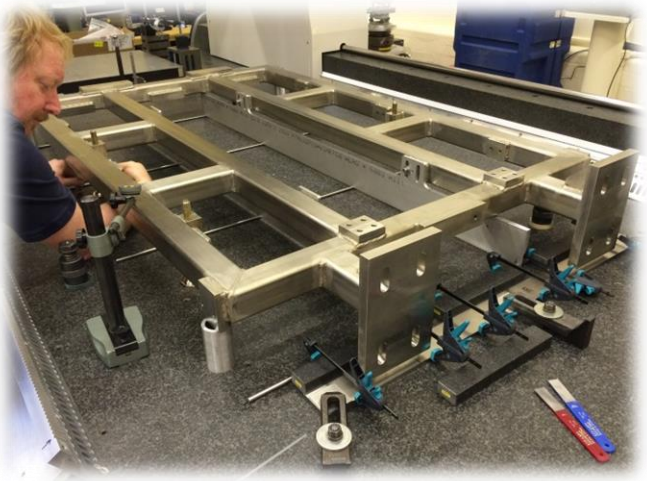
- Geometry
- Safety
- Deflections
- Out gassing/trapped volumes/greases
- Ports/Services
- Window material
- Pump down time/gate valves
- **Electronics**
- **Temperature control**
- Access

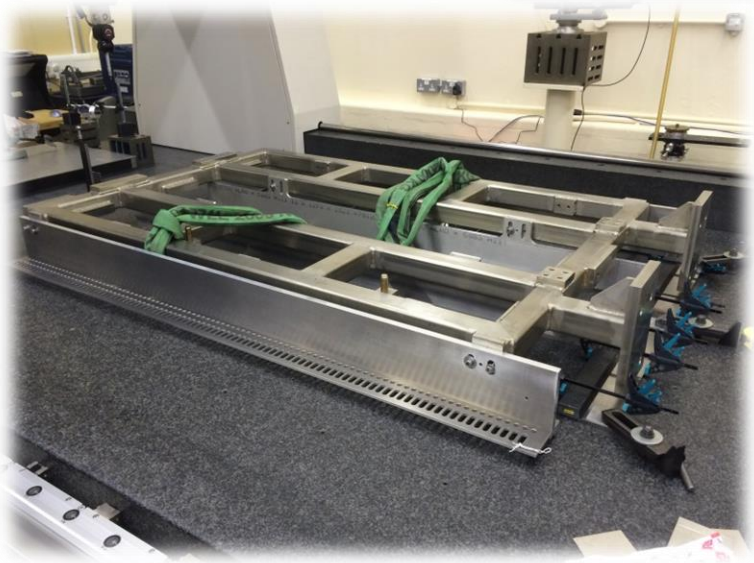
Vacuum

- Geometry
- Safety
- Deflections
- Out gassing/trapped volumes/greases
- Ports/Services
- Window material
- Pump down time/gate valves
- Electronics
- Temperature control
- **Access**

Detector

- Larmor - 80 x 8mm 3He gas tubes
- 600mm x 600mm coverage
- Pitch of 8.1mm
- Tubes run straight to 0.1mm





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Detector (now in Vacuum)

- SANS-2d - 120 x 8mm 3He gas tubes
- Electronics need to run in atmosphere
- 2 Airboxes filled with electronics
- Over 1000 leak paths
- Access & spare cables required
- Cooling air
- Thermocouples
- 30+ air hoses

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Analyser

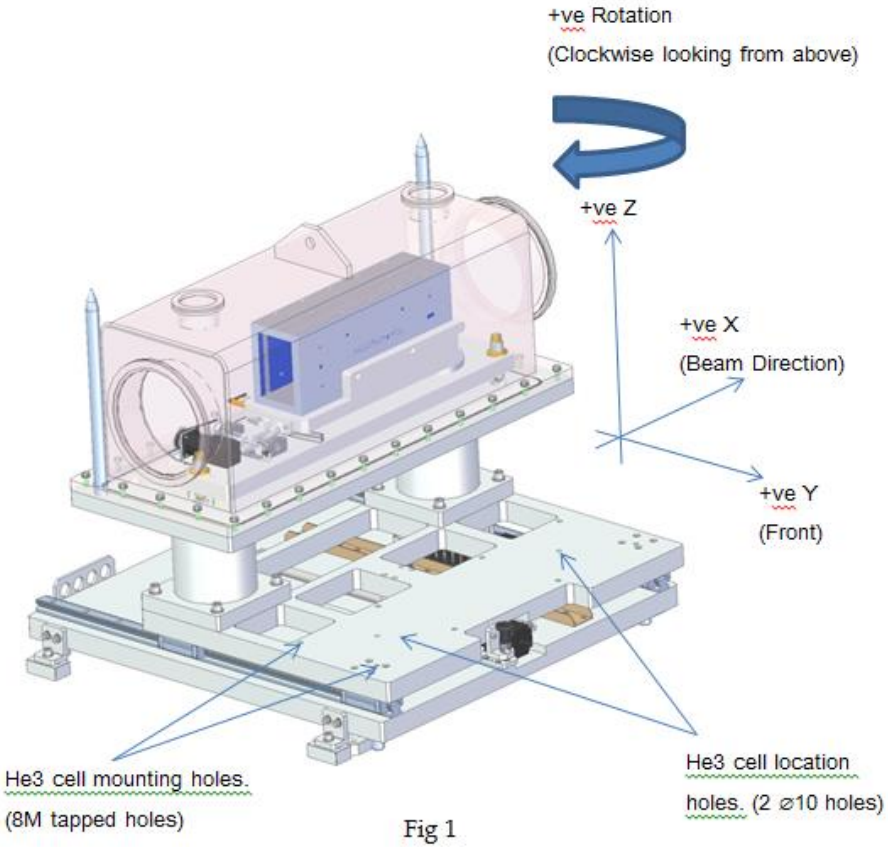
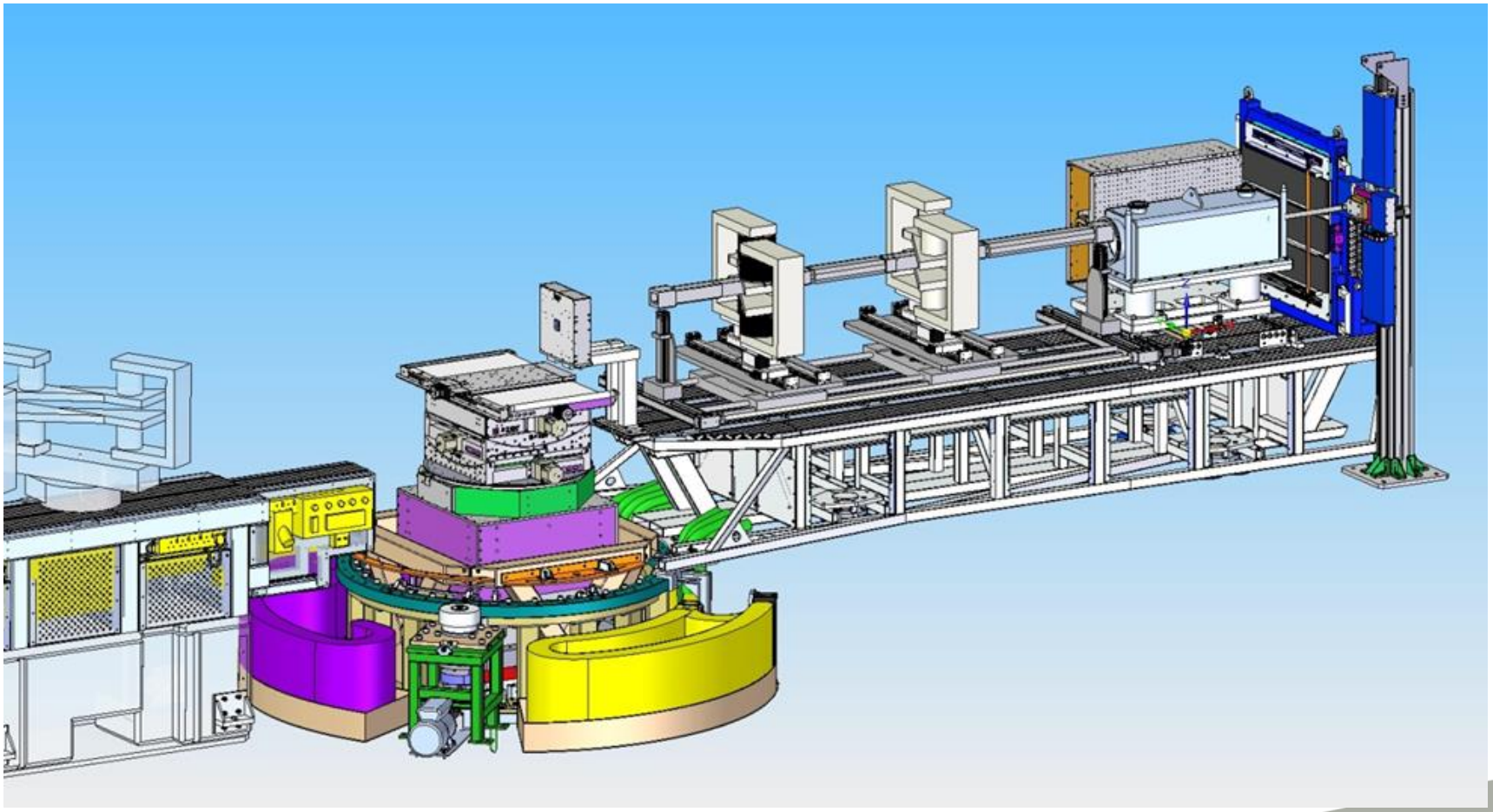


Fig 1

Delft magnet setup



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Conclusion

- Detailed specifications are good
- Communication between scientists and engineers is critical to;
  - Ensure science case is achieved
  - Lower costs where possible
  - Reduce probability of project delays

Questions ??

Magnets provided by Delft University