

Vacuum Requirements & Challenges on ISIS

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Acknowledgements

Geoff Matthews

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ISIS from above



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ISIS Key Facts

- Began operations in 1985
- Research community of approx 2000 people.
Approx. 500 publications/year
- Second target station (TS2) operational since 2008
- £21million approved in 2011 for TS2 Phase 2
- ISIS contribution to science and economy - www.isis.stfc.ac.uk



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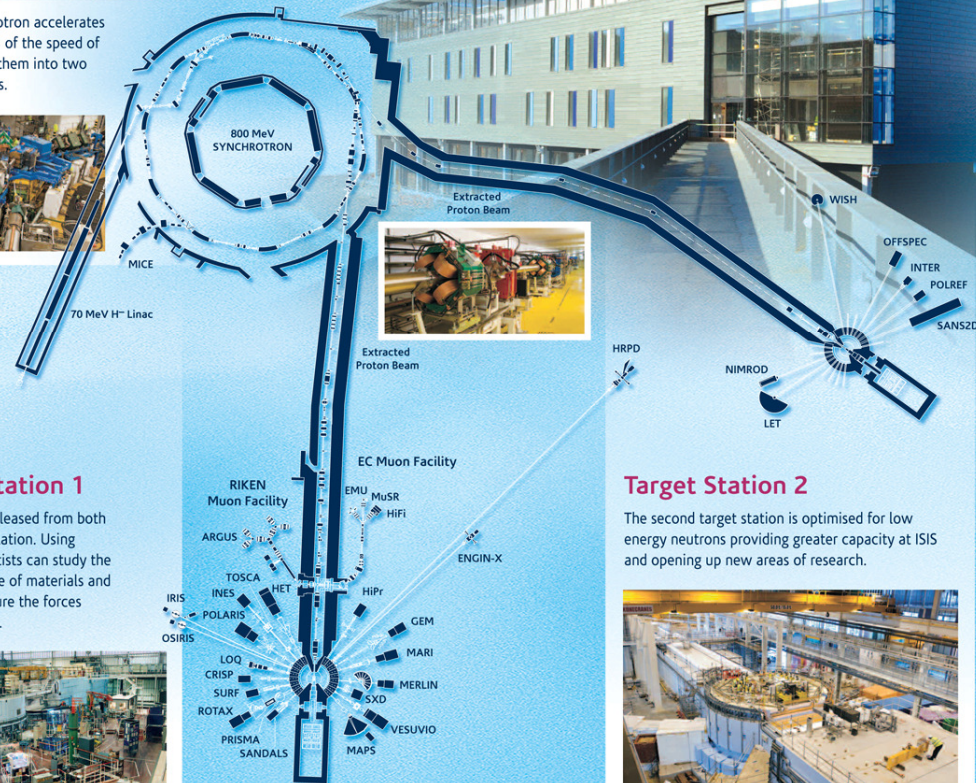
ISIS is a high power accelerator that fires high energy protons into two targets to release neutrons for experiments.

The ISIS synchrotron accelerates protons to 84% of the speed of light then fires them into two tungsten targets.



Target Station 1

Neutrons are released from both targets via spallation. Using neutrons, scientists can study the atomic structure of materials and can even measure the forces between atoms.



Target Station 2

The second target station is optimised for low energy neutrons providing greater capacity at ISIS and opening up new areas of research.



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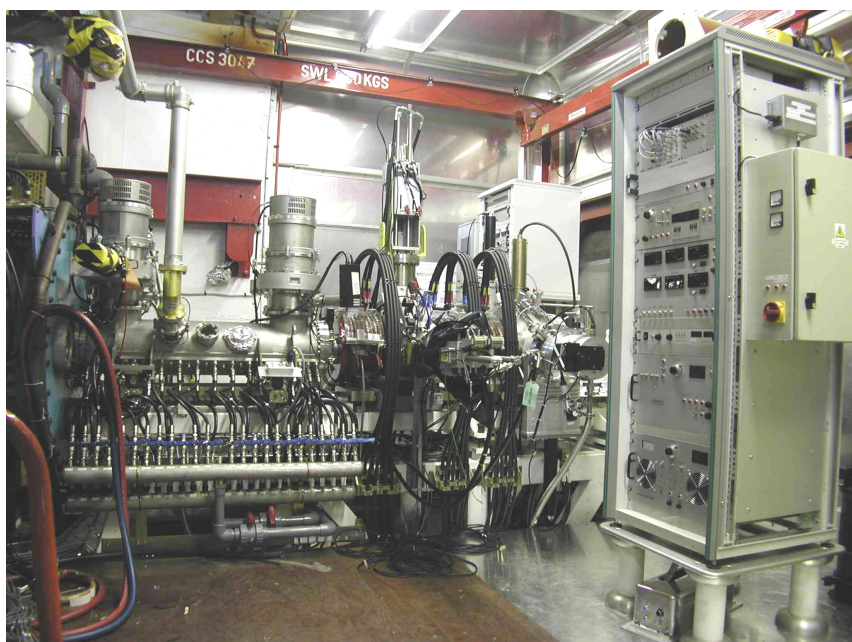
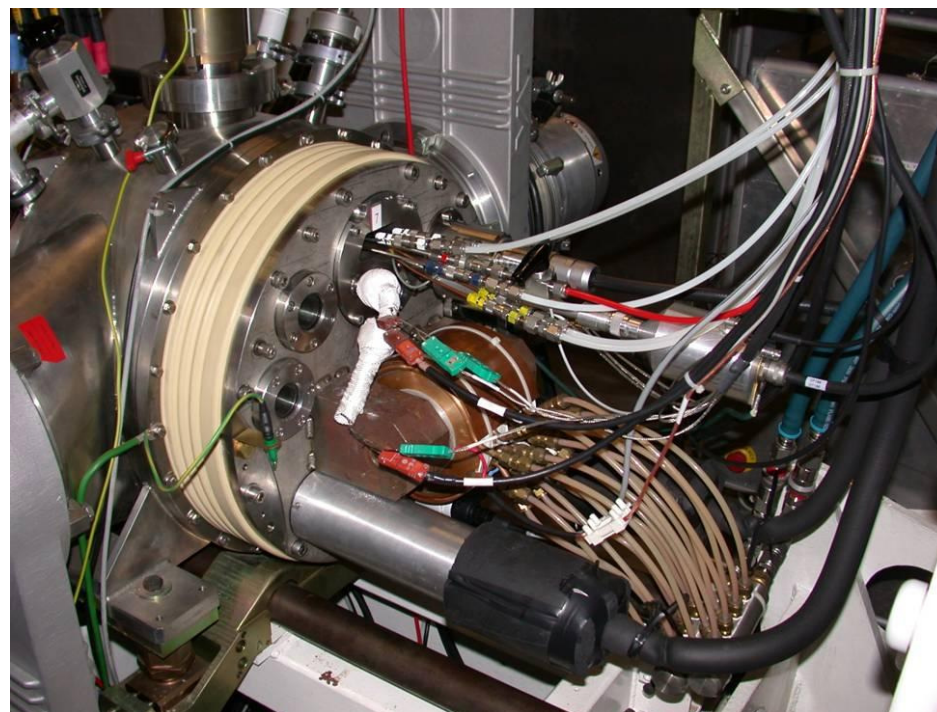
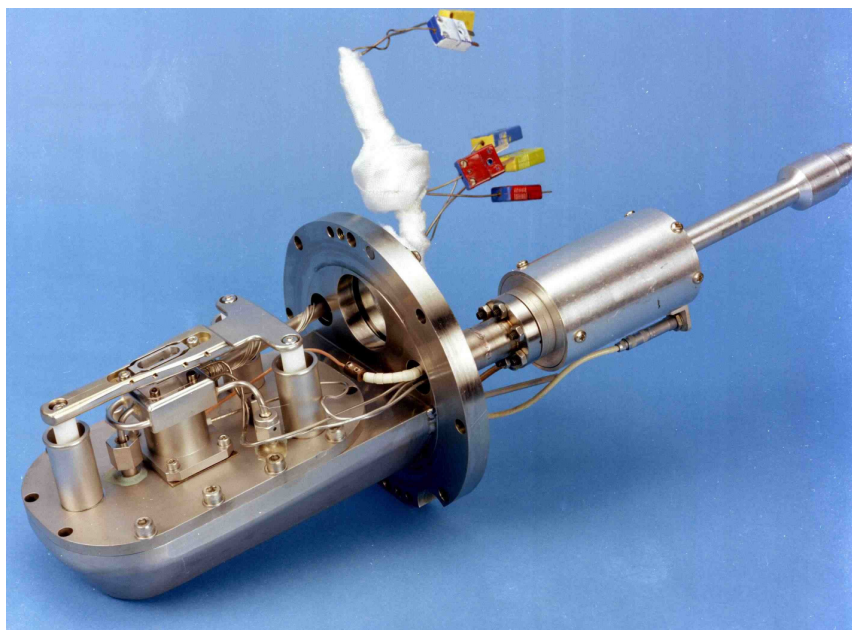
ISIS Vacuum Requirements - Machine

	Operational Vacuum (mbar)	Pumps Currently Used
Ion Source	5e-5	5 x Turbo and rotary
Linac	1e-6	16 x Turbo and scroll
Injection Line	5e-7	4 x Turbo and scroll
Synchrotron	1e-7	Ion (40)
EPB1	1e-7	Ion (5)
EPB2	1e-7	Ion (7)



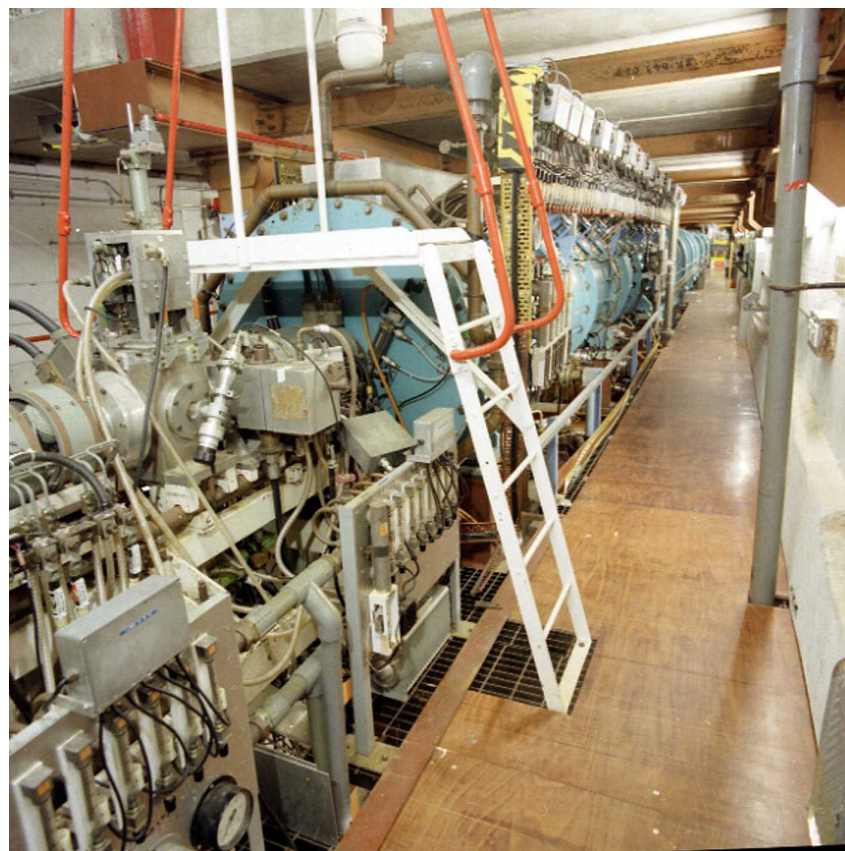
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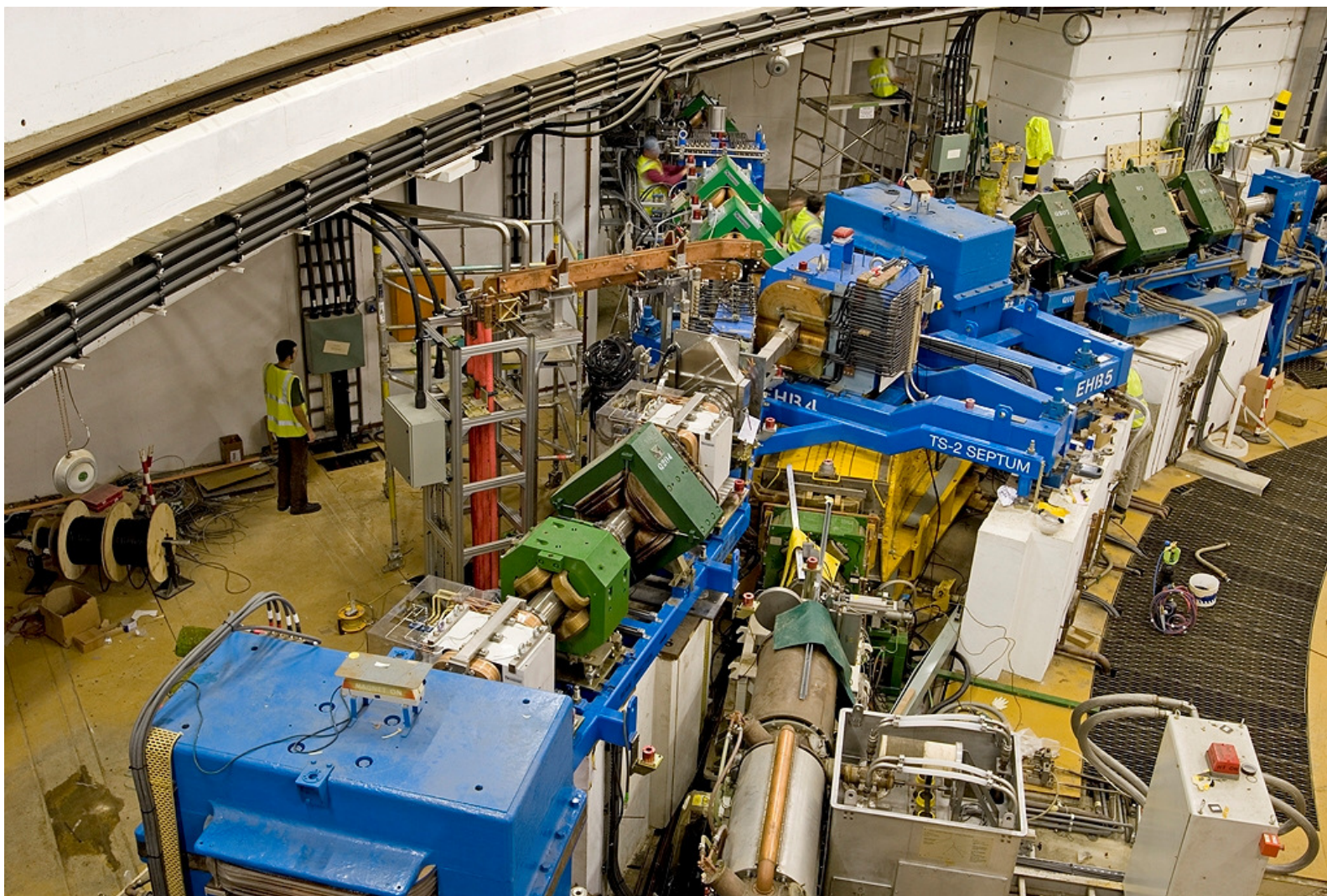
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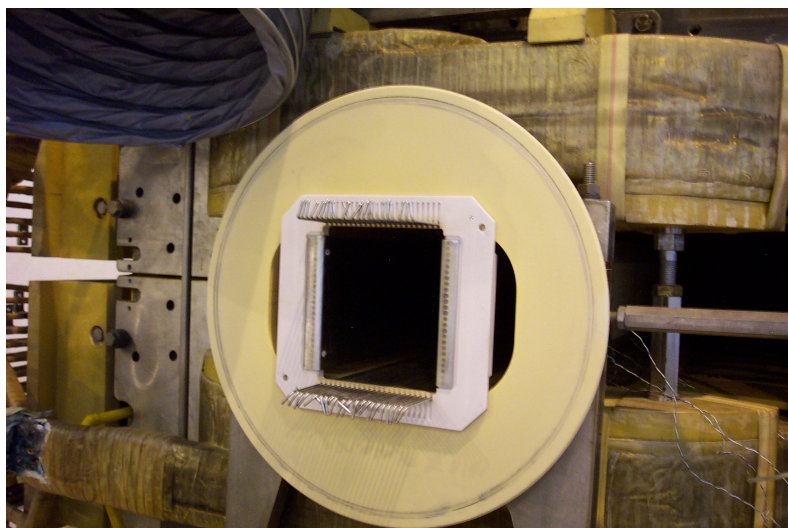
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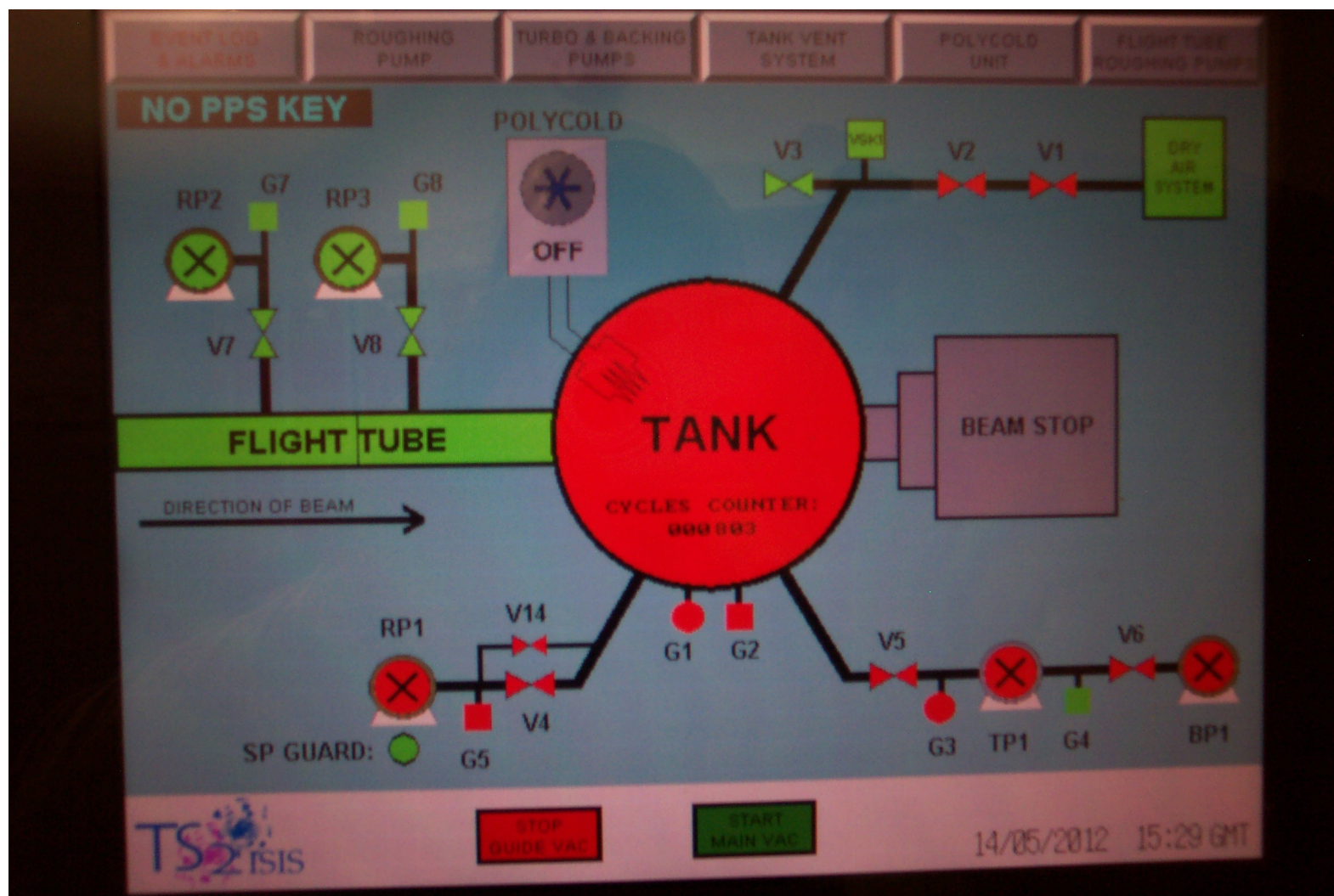
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Instrument Vacuum Requirements

- Variable – depends on type of experiment
- On TS1 of the 20 operational instruments 16 require vacuum
- On TS2 of the 7 operational instruments 4 require vacuum





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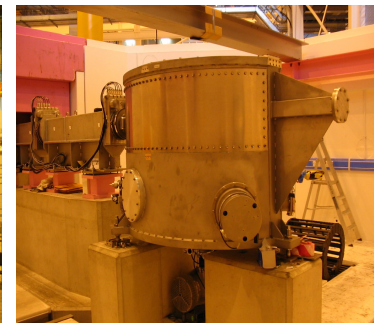
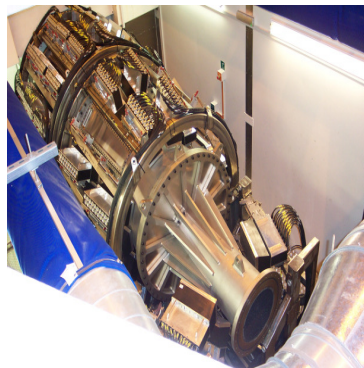
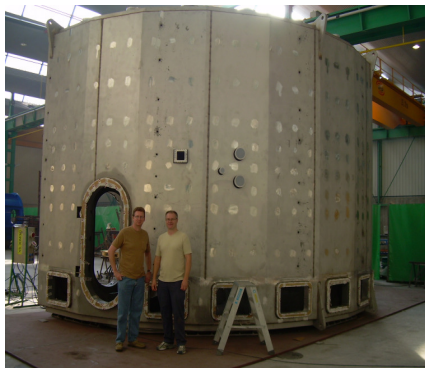


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TS2 vacuum instruments (Phase 1)

		Volume (m ³)	Operating Pressure (mbar)	Pumping System
LET	Chopper spectrometer for low energy excitations	115	5.0e ⁻⁶	2 x Screw, Turbo and Polycold
WISH	Diffractometer for powders and single crystals	1.5	5.0e ⁻⁶	Screw, Turbo and Polycold
NIMROD	Near and intermediate diffractometer	4.5	2.0e ⁻¹	Screw
SANS 2D	Small angle scattering	120	2.0e ⁻¹	3 x Screw



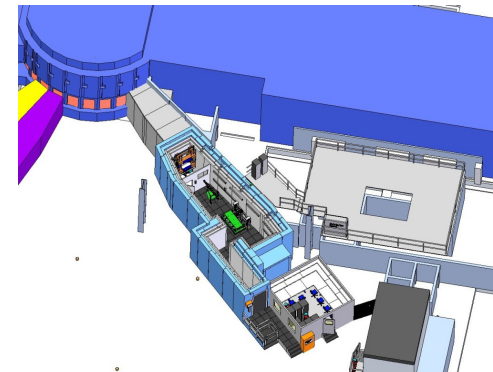
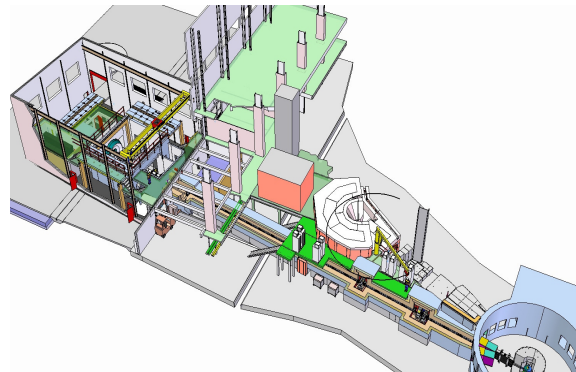
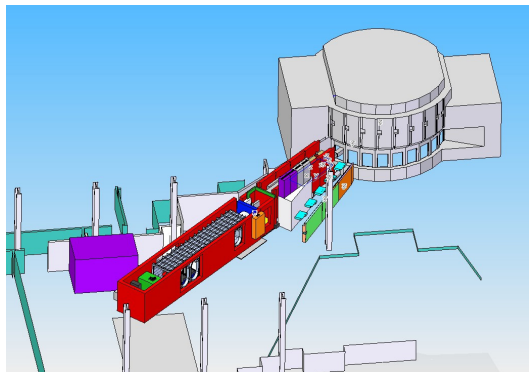
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TS2 Phase 2 Instruments

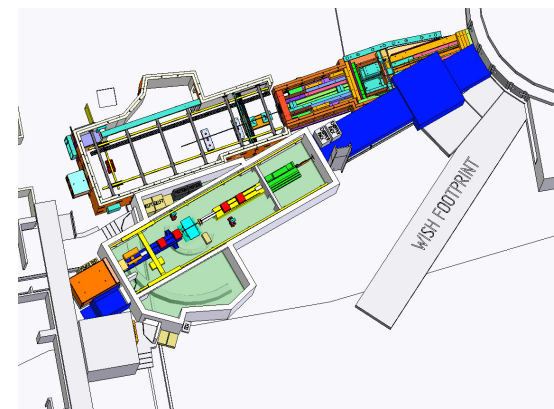


Zoom - A Vacuum Tank (approx 50m³) that can move by up-to 10m

IMAT – 50m long guide tube

LARMOR

Chipir



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ISIS Vacuum Challenges

- Radiation
- Outgassing from Cadmium and Boron Carbide (B₄C)
- Larger vacuum vessels to accommodate detectors – need dry roughing pumps at least 100cm³/h at atmospheric pressure



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