



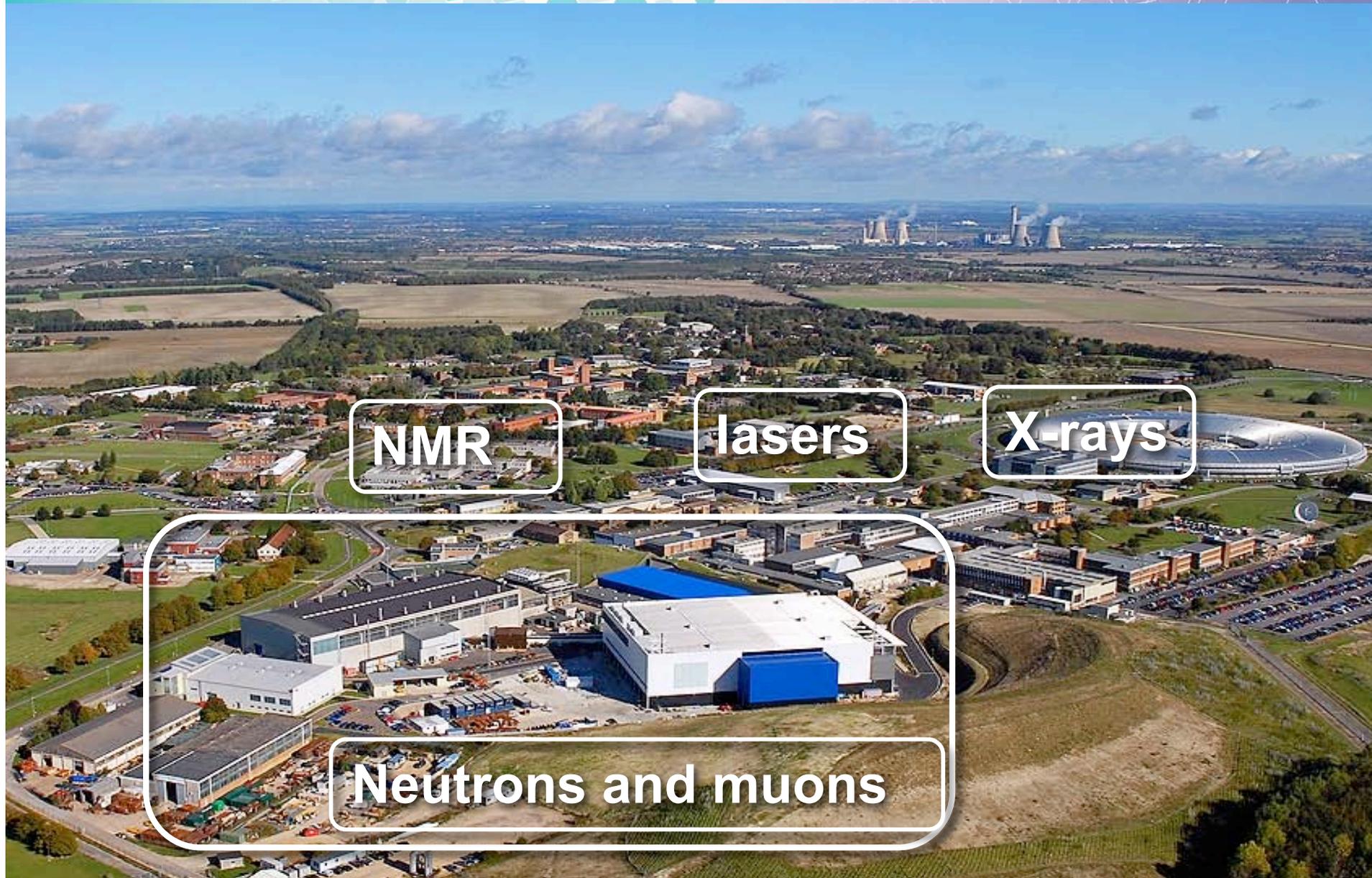
# ISIS – Science and Technology Facilities Council Council

ACCESS Activity presentation  
by Uschi Steigenberger, Philip King, Adrian Hillier  
General Assembly in Villigen, CH  
March 31, 2009



Science & Technology Facilities Council

**ISIS** Harwell Science & Innovation Campus



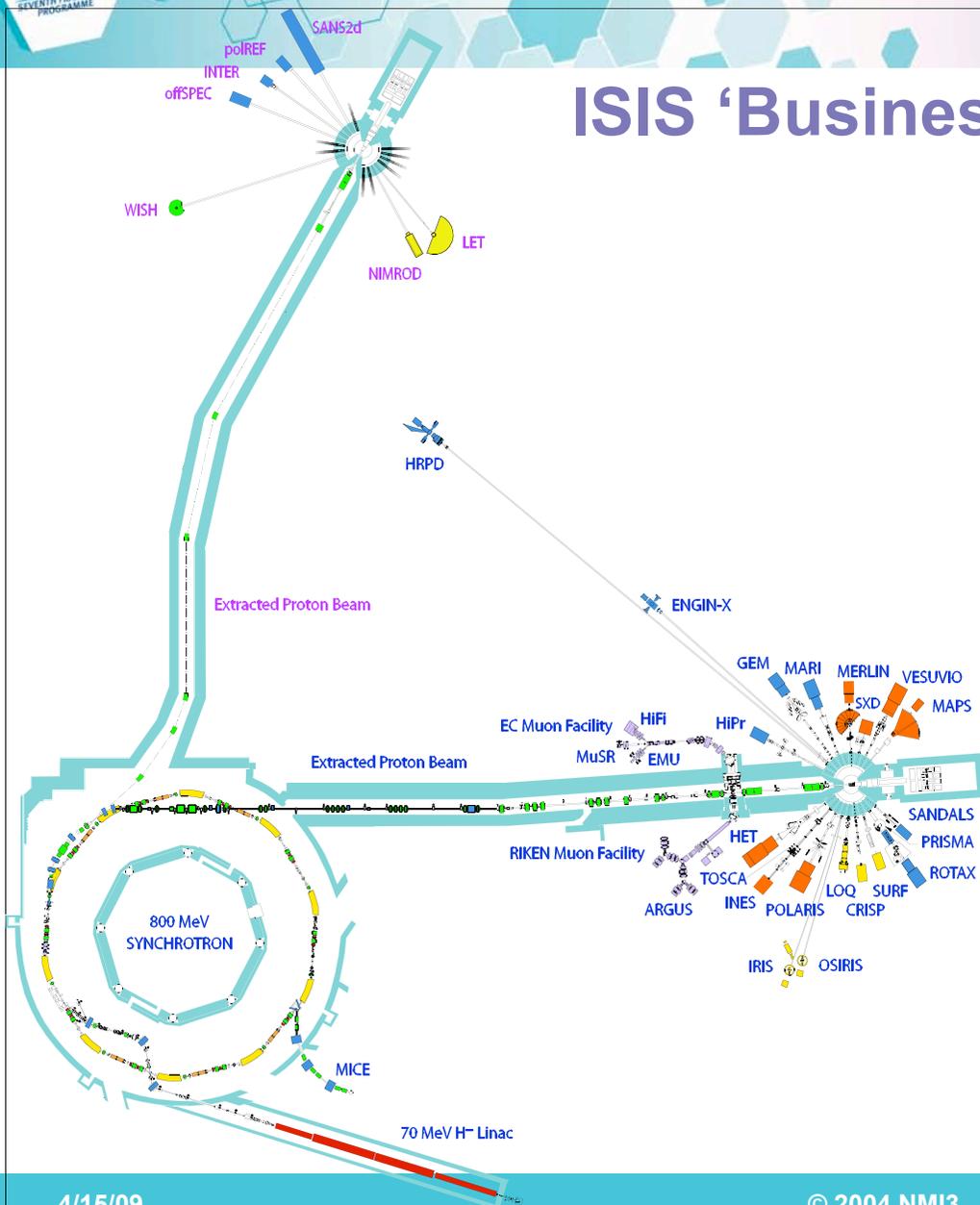
**NMR**

**lasers**

**X-rays**

**Neutrons and muons**

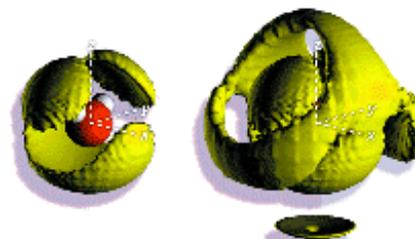
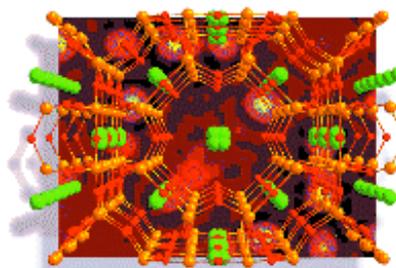
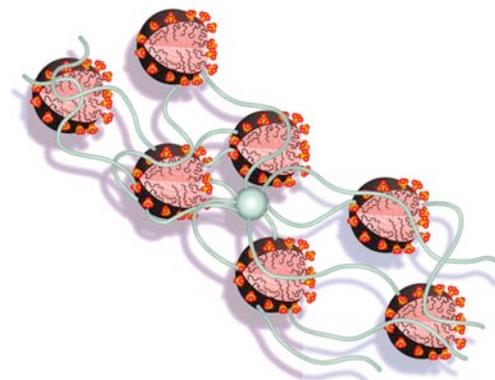
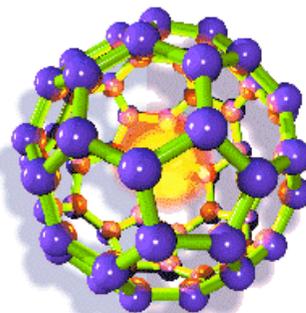
## ISIS 'Business'



- World-leading Pulsed Neutron and Muon Facility
- Broad Academic Base ~1500 users/yr
- 650+ Experiments/ yr
- 18 Neutron + 5 Muon Instruments
- 400+ Publications/ yr
- From 2009: + 7 Neutron Instruments on TS2

## Science at ISIS

- Materials & processing
- Energy for the future
- Environment & clean technology
- Nanotechnology
- Sensors & smart materials
- IT & quantum devices
- Drug design & pharmaceuticals
- Bio-technology & materials
- Cultural heritage
- Fundamental physics & chemistry



# ISIS users at work



1. Shalev Sarial (Hebra University and Weizmann Institute, Israel) and Shalev Sana (Weizmann Institute, Israel) using Rotax to study phase and element variations in Middle Bronze Age copper-based axes. OBE2873

2. François Fillard (CNRS, France) seeking macroscopic quantum entanglement in the isotopic mixture  $KH_{1.0}D_{0.9}CO$  on SXD. OBE2853



3. Erico Perelli Cippo (Milan-Bicocca University, Italy) using Engin-X for comparative analysis of new and end-of-life wheel rims from a high speed train for the identification of rolling contact fatigue effects. Dave Marwell (ISIS) can be seen loading the wheel rim on to the instrument in the background. OBE2887



4. Tom Headen (University College London) at ISIS during his investigations of the structure of liquid toluene and coronene solutions in toluene on SANDALS. OBE2857



Ian Silverwood and Neil Hamilton (Glasgow University) preparing for inelastic neutron scattering studies of catalysis on MAPS. OBE3084



5. Stuart Huntun and Natalia Sorbie (Glasgow University) using Polaris to study the interplay of structure, stoichiometry and anion mobility in new nitride catalysts. OBE2830



6. Heloisa Bordallo (HMI, Berlin, Germany) using Osiris to study the behaviour of the 2D molecular magnet  $Fe(NCS)_2(\text{glyrazine})_2$  under applied magnetic fields. OBE2899



7. Craig Bull and Kasuki Komatsu (Edinburgh University) using SXD to investigate molecular materials under pressure. OBE2892

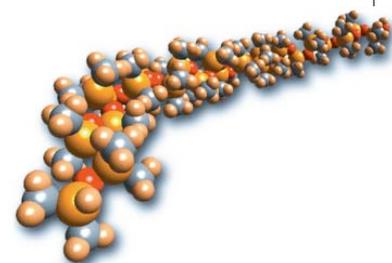
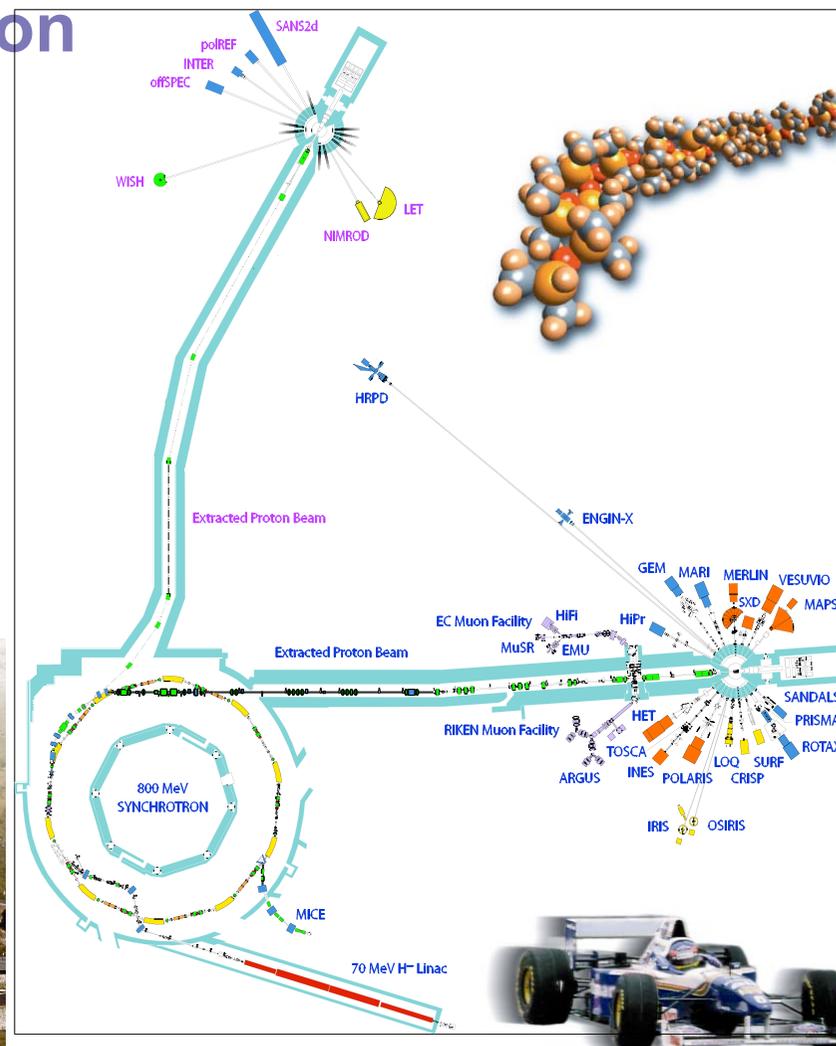
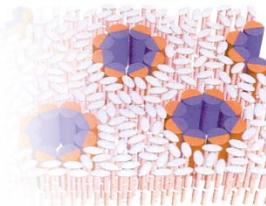
Renka Nilmini (Cariff University) and Lorella Izzo (Salerno University, Italy) preparing samples for studying the effect of polymer stereochemistry on polymer-surfactant interactions. OBE2861



Emma Barney (ISIS), Xuegen Zhai (Salford University), Richard Haynes (ISIS), Nigel Mellors and Christopher Quinn (Salford University) using CEM for characterization of phases and short-range ordering of Cu in Fe-Cu alloys. OBE2840

# ISIS Second Target Station

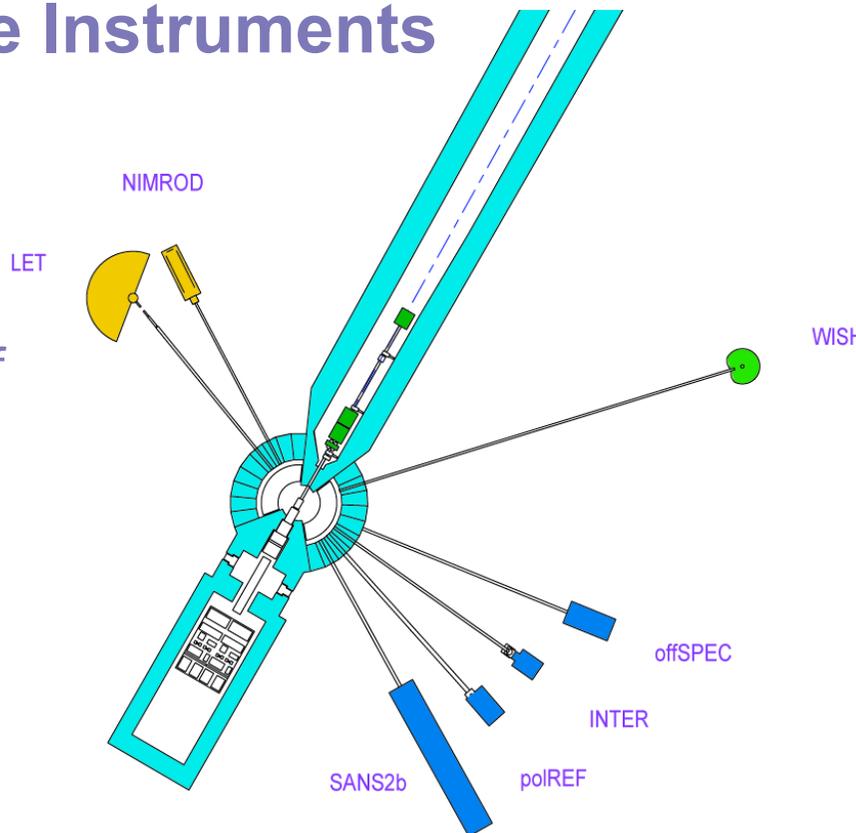
- £150M project
- Key science areas:
  - Soft Matter
  - Advanced Materials
  - Bio-molecular Science
  - **Nanoscience**



# Phase One Instruments

## Dynamics

**LET** High-resolution measurement of material energy scales

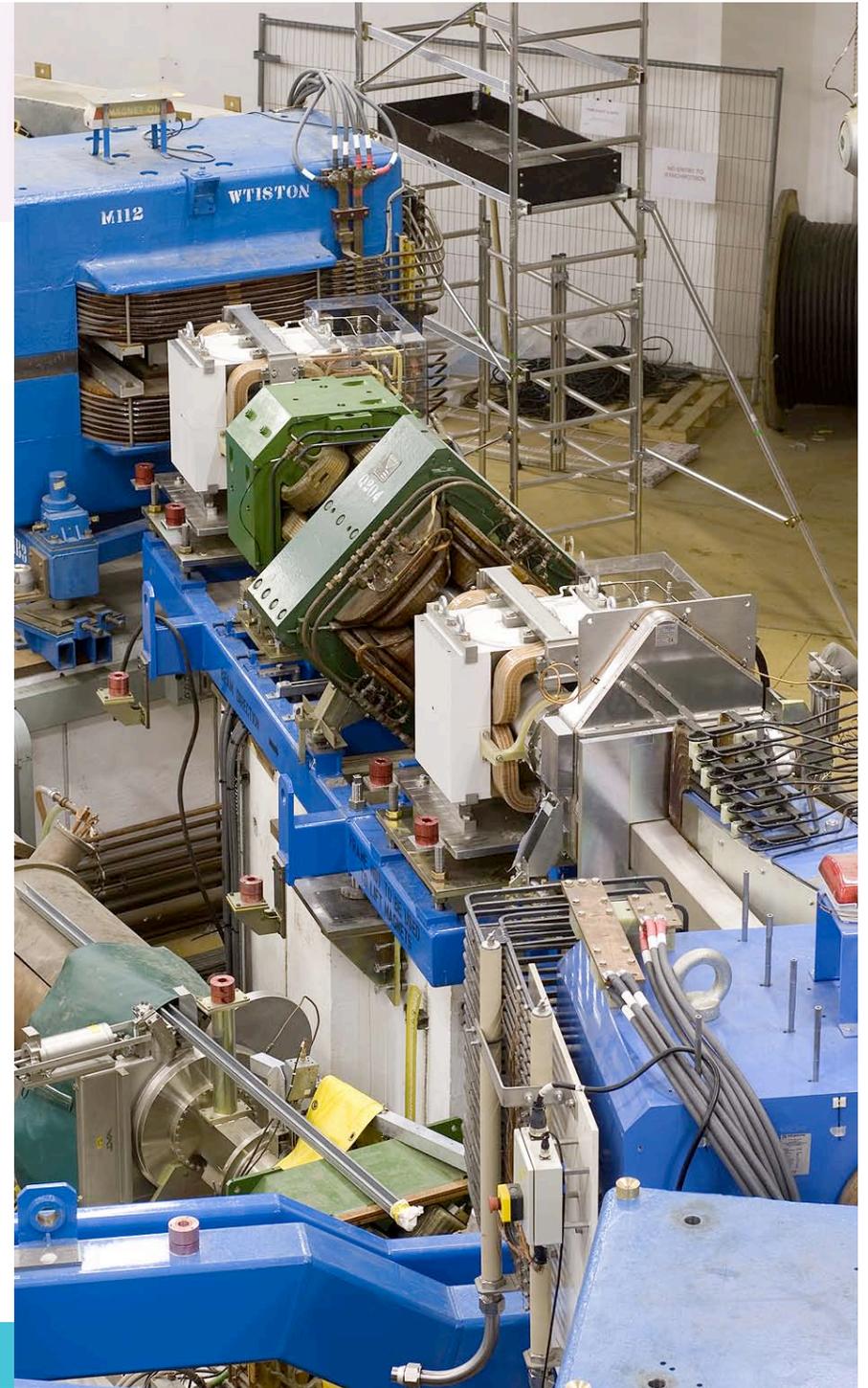
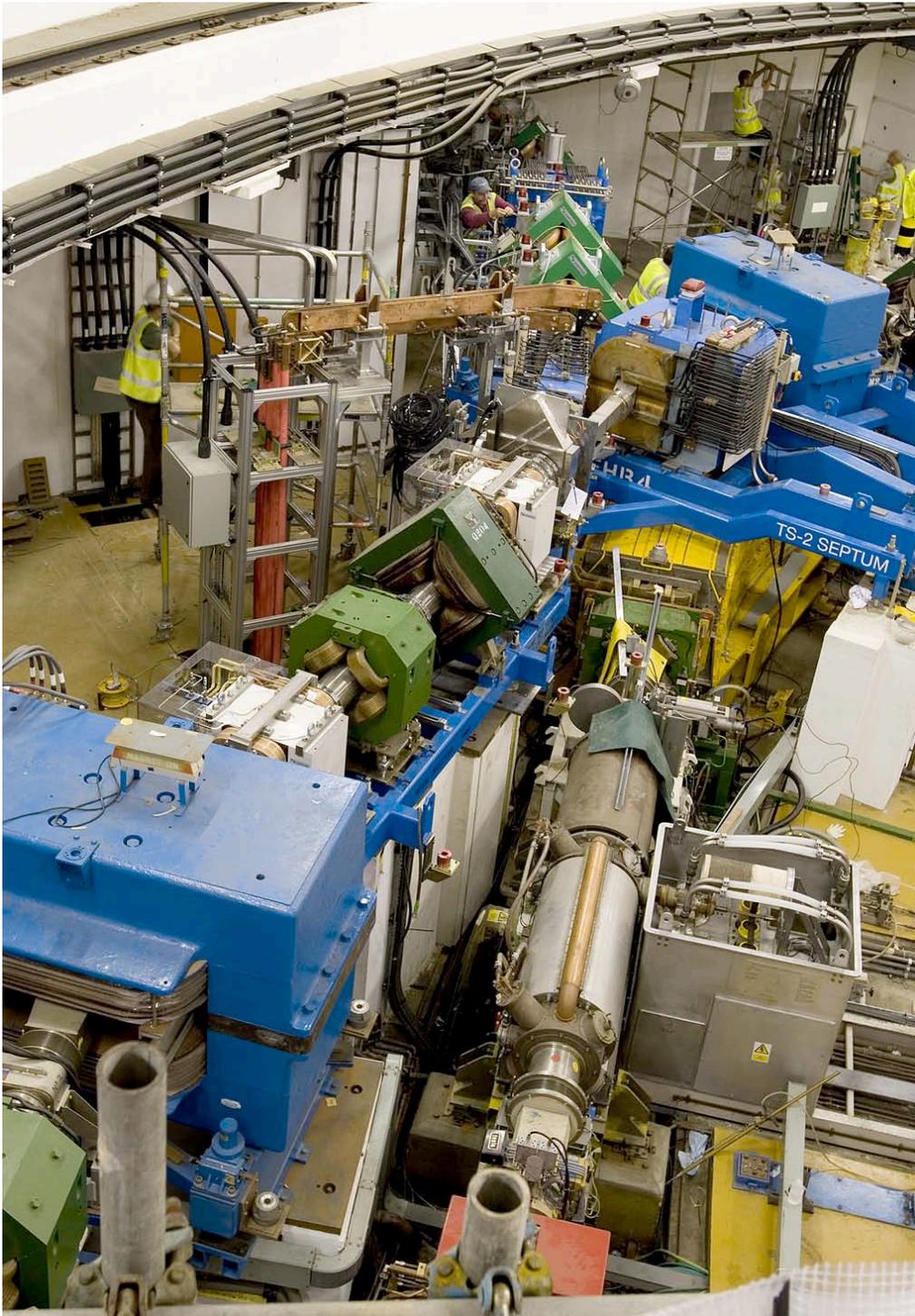


## Structures

**NIMROD** Intermediate range order in liquids  
**WISH** High-resolution magnetic structure  
**SANS2D** Large molecule structure in multi-component systems

## Reflectometry

**INTER** Air/ liquid/ solid interface interactions  
**OFFSPEC** Structures of membrane, protein and liquid interfaces  
**POLREF** Interface measurements in magnetic sensor devices



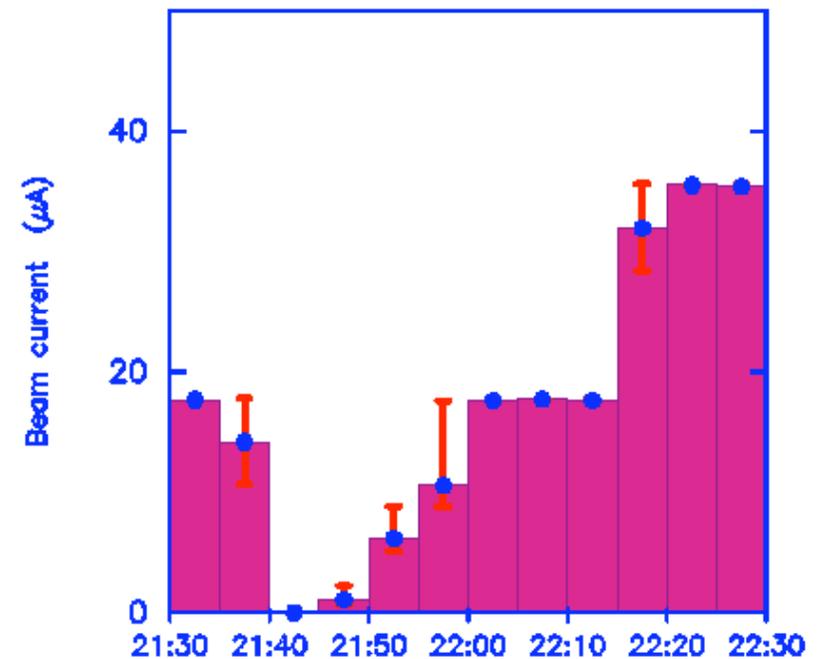


# ISIS Second Target Station

## ■ Milestones

- First protons: 14 December 2007
- First neutrons: 3 August 2008
- 10 pps running: 18 September 2008
  
- INTER, POLREFF, OFFSPEC & NIMROD: in scientific / technical commissioning
- WISH & SANS2D: start in March 2009
- LET: in late spring

22:30 18-SEP-2008 : average current = 17.1  $\mu\text{A}$



# ISIS Second Target Station First Neutrons!

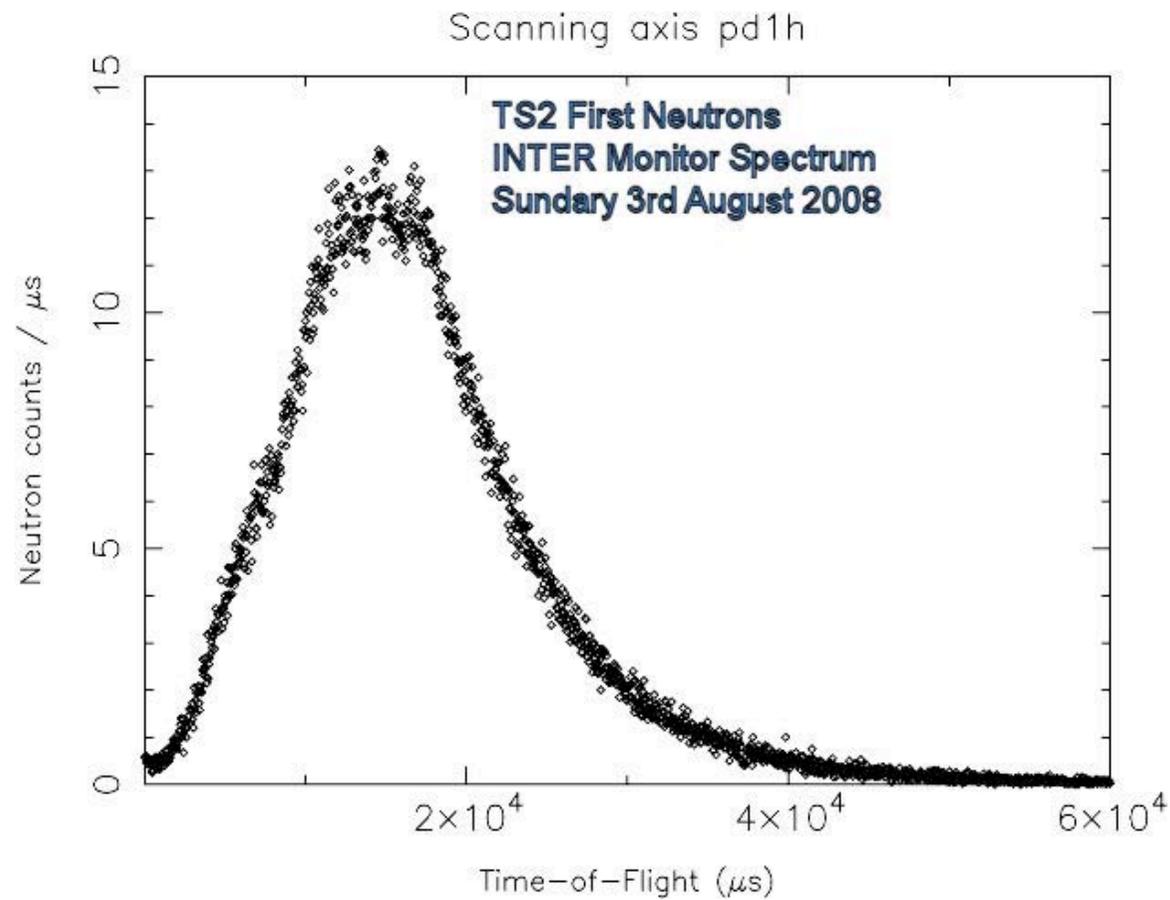


4/15/09

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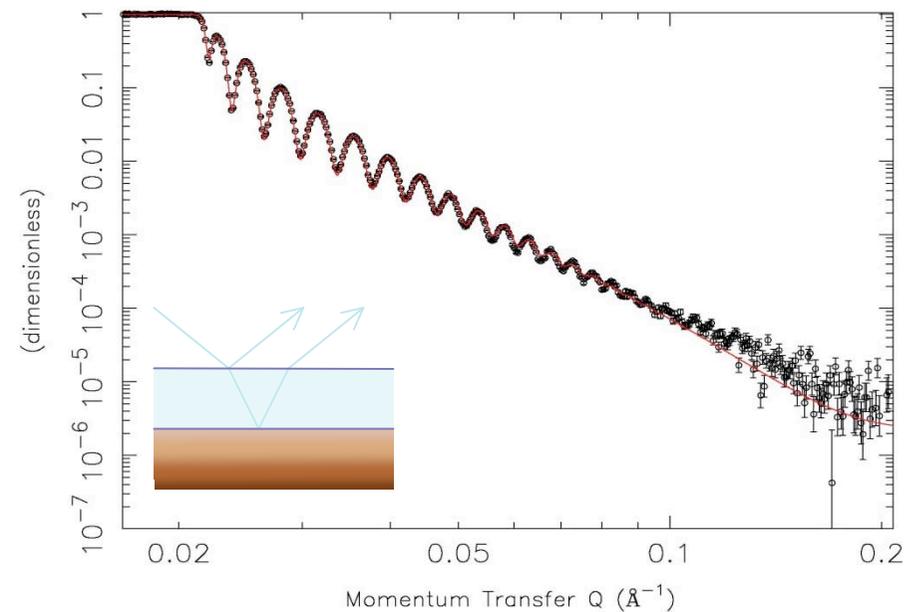
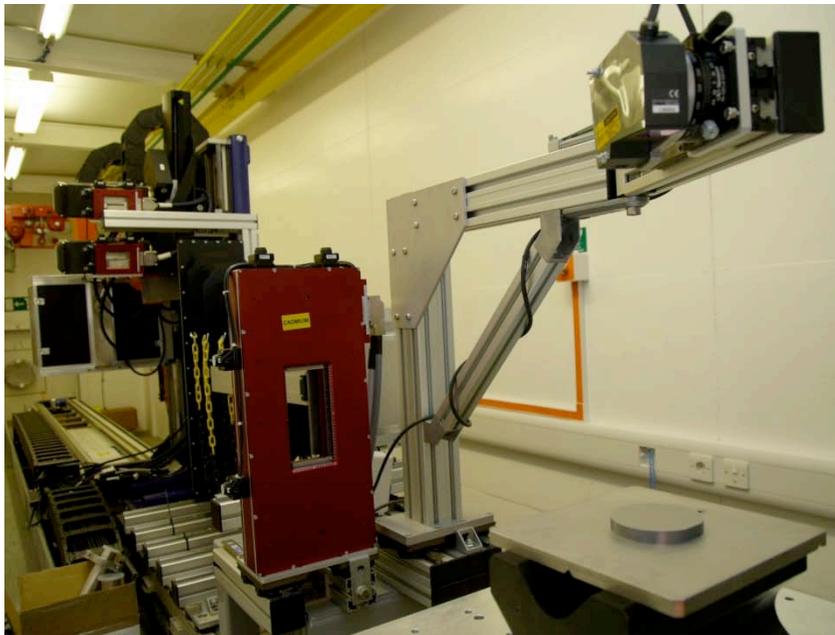
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# ISIS Second Target Station First Neutrons!



## INTER: Chemical interfaces

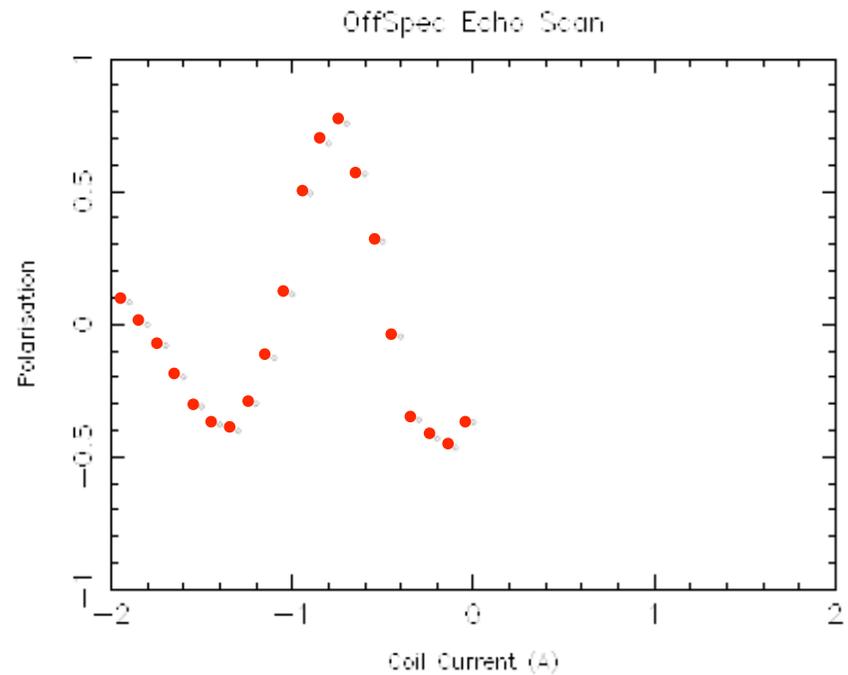
- First neutrons: 3 Aug 2008
- First data: 29 Sept 2008



First reflectivity measured on INTER.  
Nickel/Carbon film (1216 Å) on glass

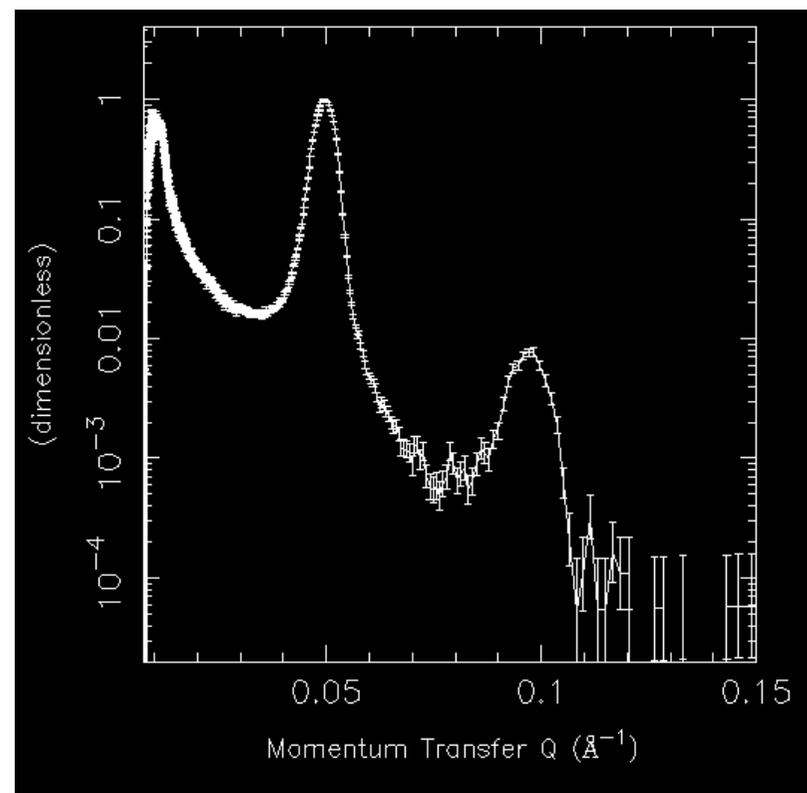
## OffSpec: Spin-echo reflectometer

- First neutrons: 3 Dec 2008
- First spin-echo measurement: 20 March 2009
- Instrumentation in collaboration with Delft



## PolRef: Polarised reflectometer

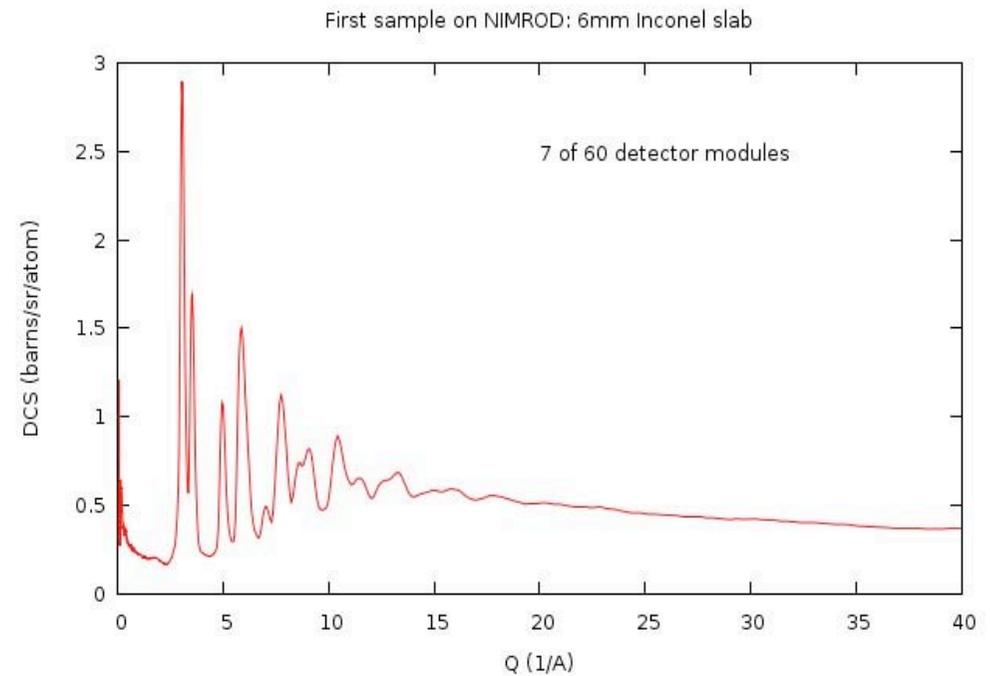
- First neutrons: 3 Dec 2008



Early measurement: [Fe/Si]x22  
Superlattice, unpolarized Beam

## NIMROD: Near and intermediate range order diffractometer

- First neutrons: 10 Dec 2008

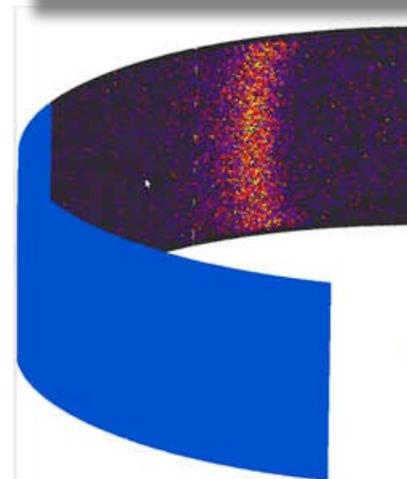
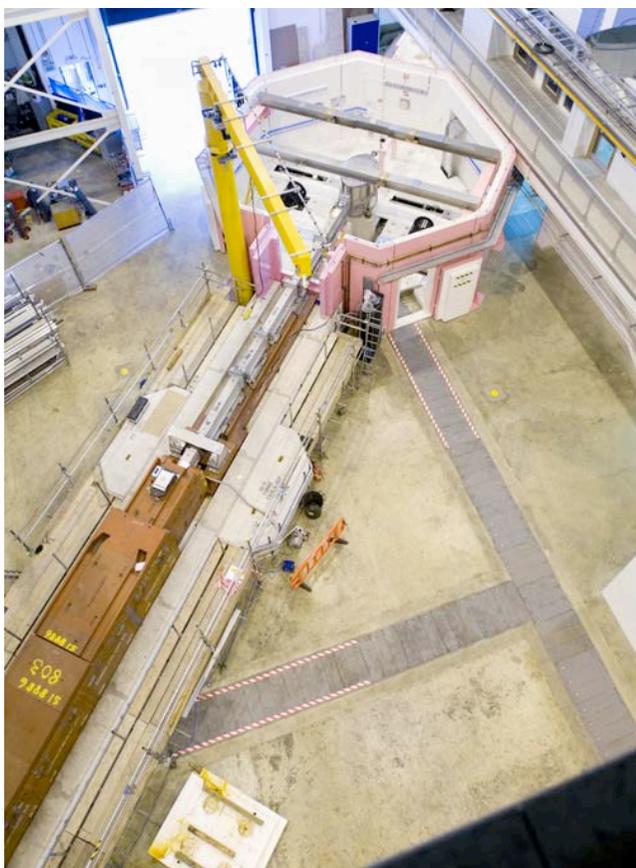


## SANS2d: Small angle neutron scattering



## WISH: Powder and single-crystal magnetic diffractometer

- First neutrons: 23 March 2009



Software as well as hardware!

## LET: cold neutron multi-chopper spectrometer



## TS-2 Instruments: the next steps

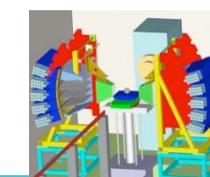
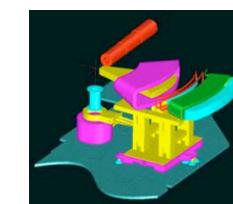
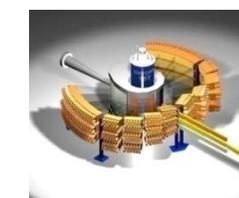
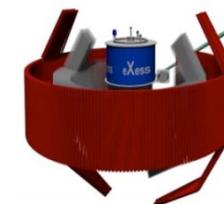
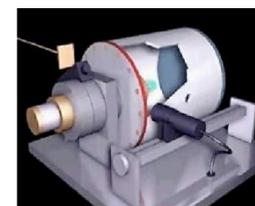
- Phase 1 (£24M+) – 7 instruments
  - INTER, POLREF, OFFSPEC, SANS2D, WISH, LET
  
- Phase 2 (£21M+) – 5 instruments

● Gateway 1& 2	Oct 2008
● Design and development	2009 -10
● Construction	2009 -12
  
- Phase 3 (£25M+) – 6 instruments (TS2 + TS1 ? )

● Earmarked in Large Facilities Capital Fund	16 July 2008
● Design and development	2011-13
● Construction	2012-15

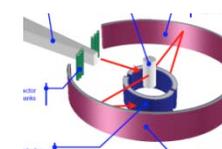
## TS-2: Phase 2 / 3 Instruments

<b>LMX</b>	Macromolecular Crystallography
<b>CHIPIR</b>	Chip irradiation
<b>LARMOR</b>	SANS, diffraction and spectroscopy using Larmor precession of polarised neutrons
<b>Spiral</b>	Real space structure correlations
<b>Zoom</b>	Small-angle scattering from kinetic processes
<b>eXess</b>	Extreme sample environments spectrometer
<b>eXeed</b>	High-pressure crystallography
<b>Nessie</b>	Ultra-slow dynamics spin-echo spectrometer
<b>IMAT</b>	Neutron tomography and cultural heritage



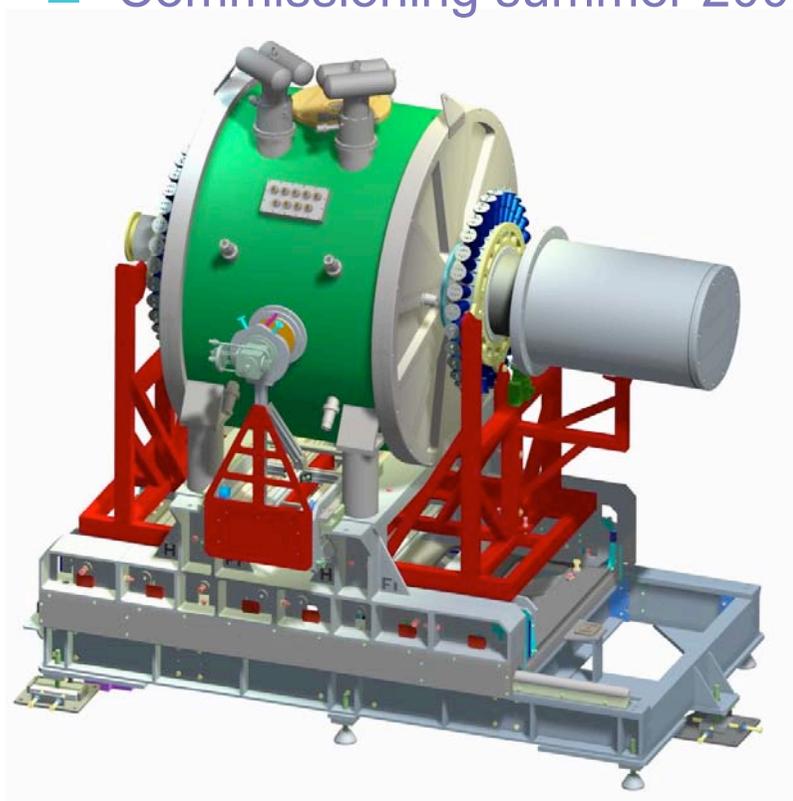
Strategic Development Programme:

- Detectors
- Optics
- Spin Manipulation
- Software



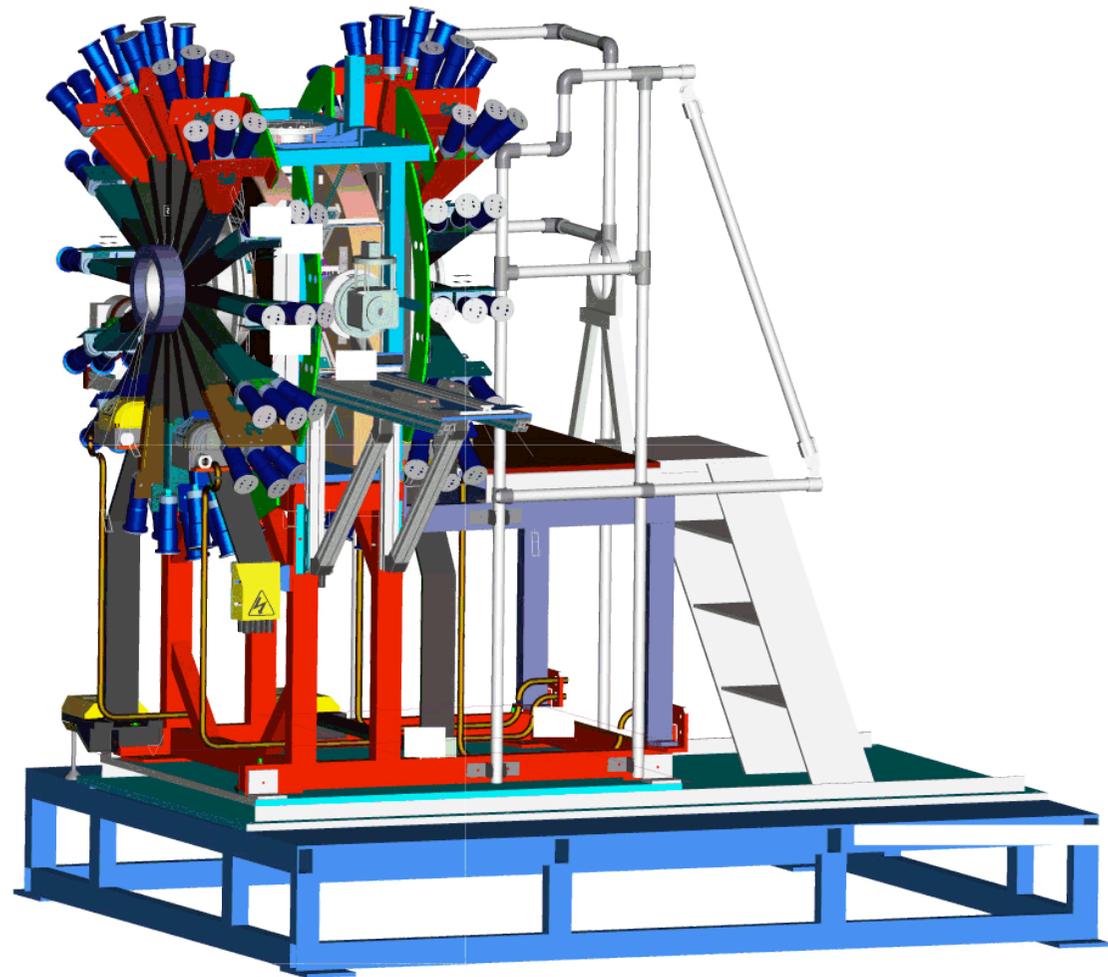
## TS1 Developments: HiFi muon spectrometer

- High-field muon spectrometer
- 0-5 T, 30mK-1500K – unique muon instrument
- Commissioning summer 2009



## TS-1 Developments: EMU muon spectrometer

- Significant upgrade
- 3x data rates
- Better sample environment access
- Improved measurement background
- Installation late 2009

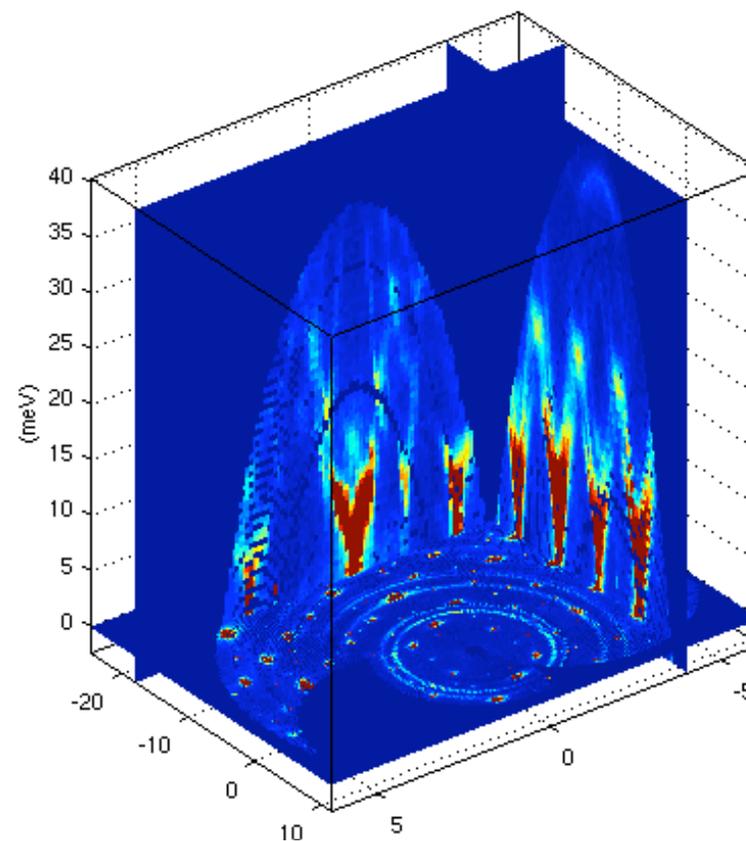
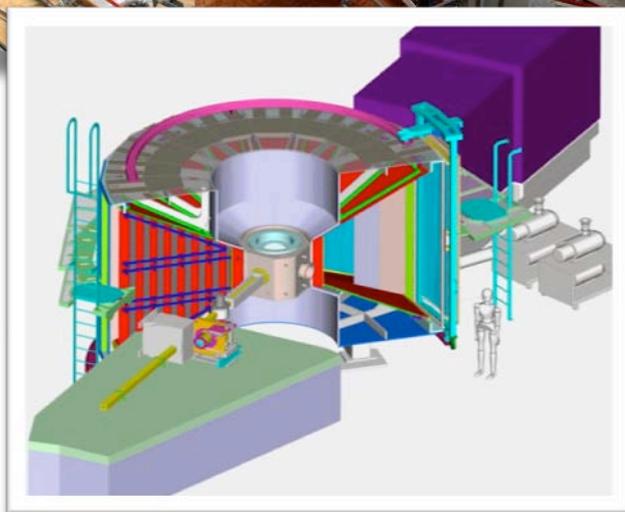


## TS-1 Developments: RIKEN-RAL Muon Facility

- New, ultra-high data rate spectrometer being installed
- Pressures up to 6 kbar now available
- Laser stimulation of samples possible



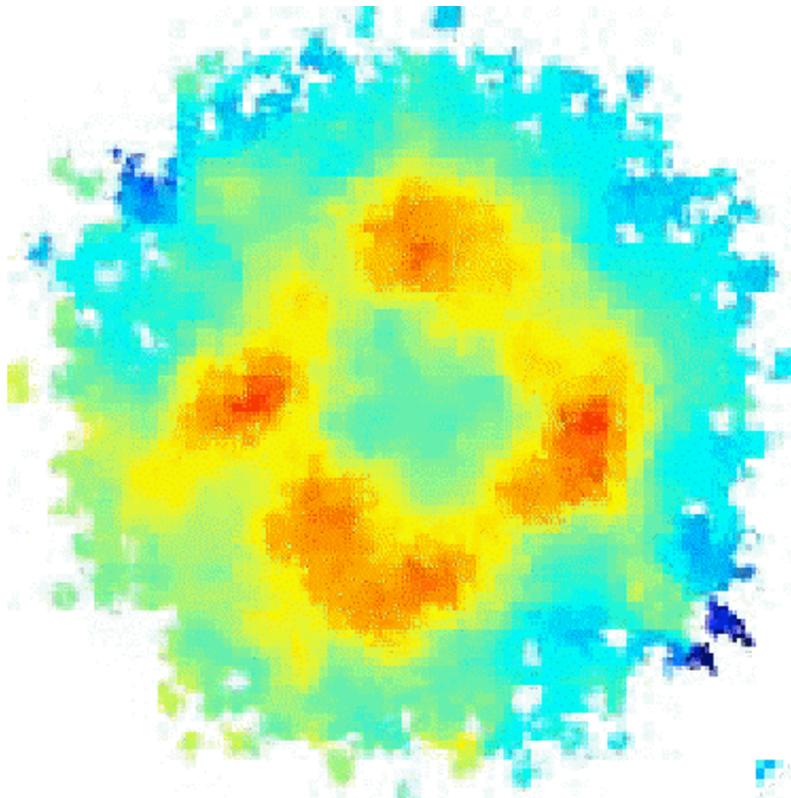
## TS-1 Developments: MERLIN



Phonons in Calcite  
Martin Dove and Beth Cope

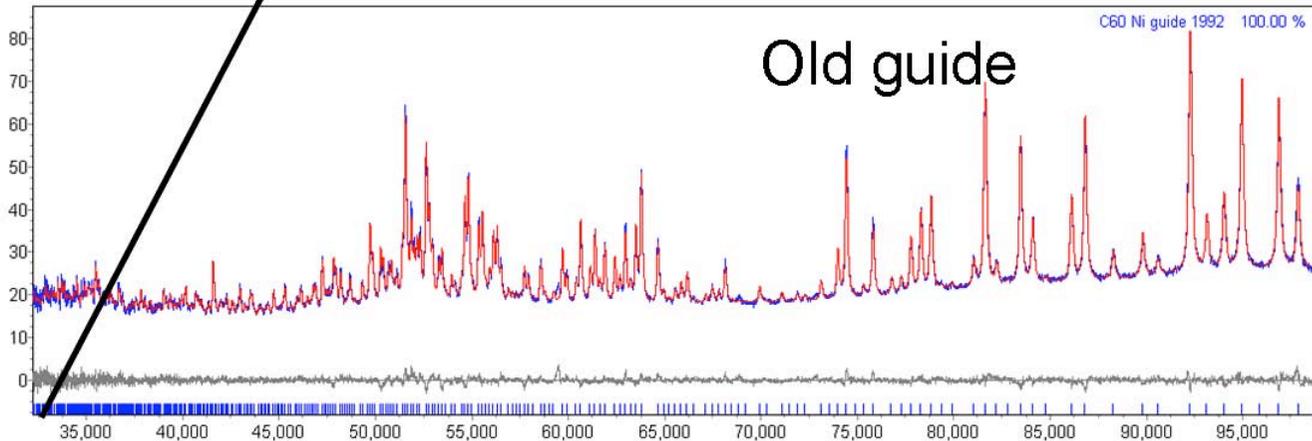
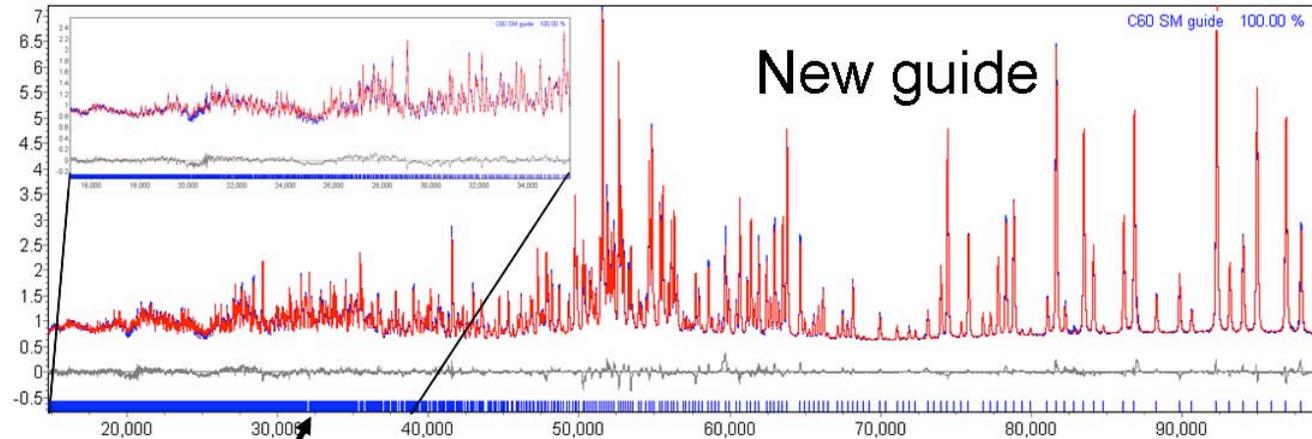
## TS-1 Developments: The end of an era for HET

■ Dec 1984 – Dec 2008



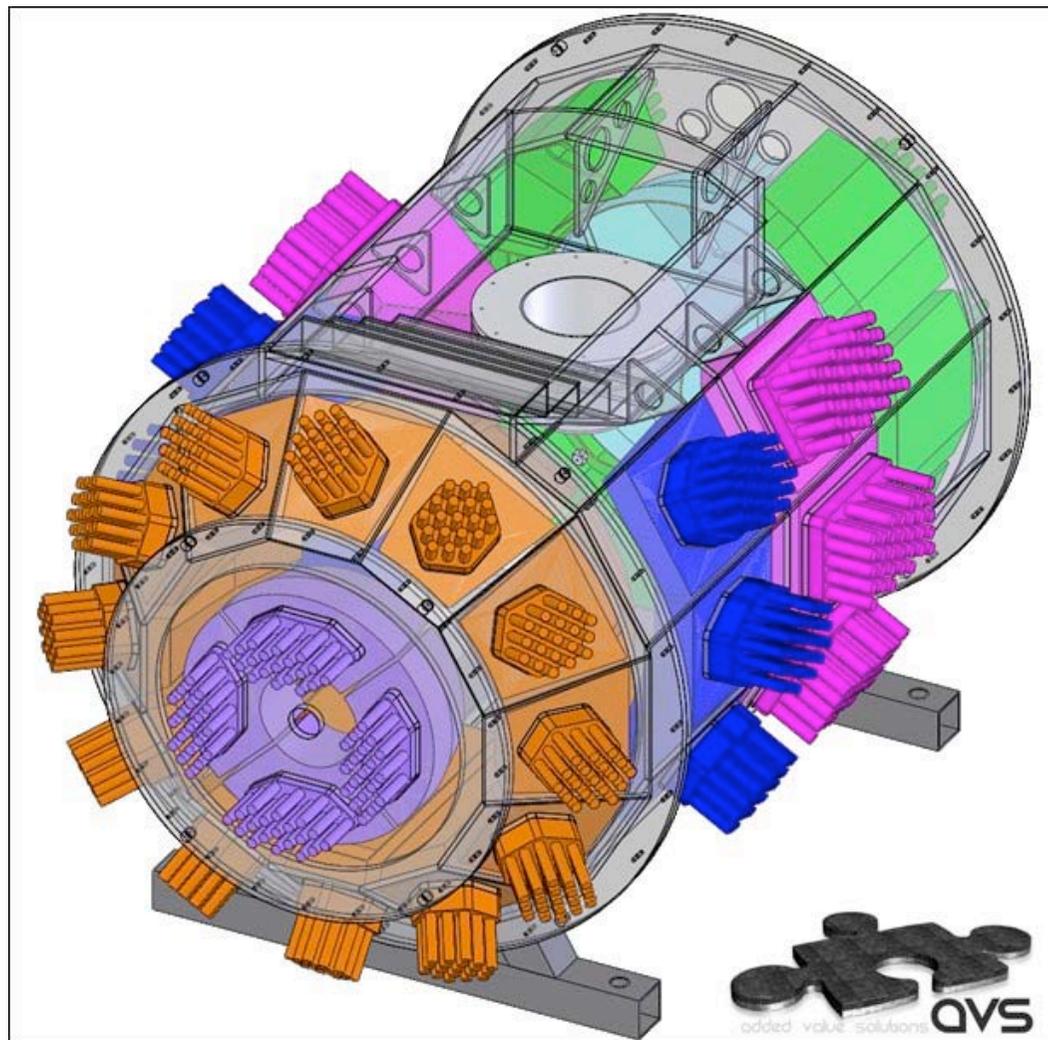
## TS-1 Developments: HRPD

- Installation of new super-mirror guide complete
- Large flux gains have revolutionised instrument performance



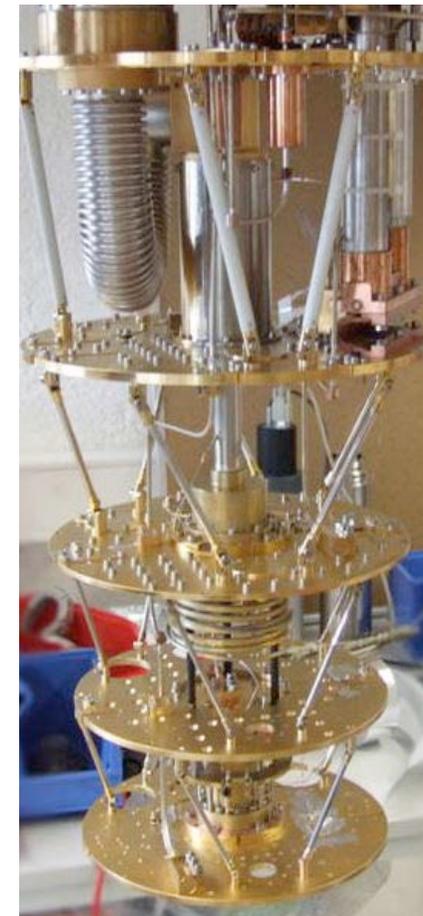
## TS-1 Developments: Polaris

- Major detector upgrade
- Big count rate improvements
- Improved resolution
- Design and layout complete
- Installation early 2010



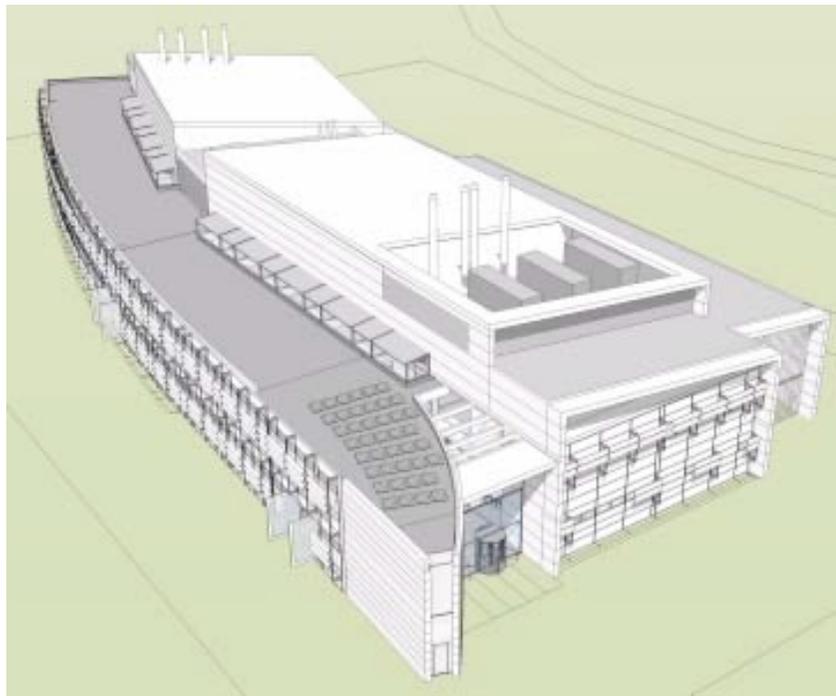
## New experimental capabilities

- Vericod OI cryogen-free dilution system



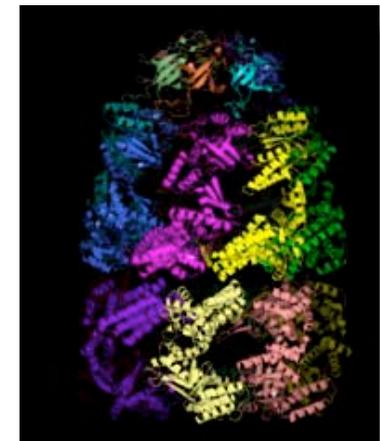
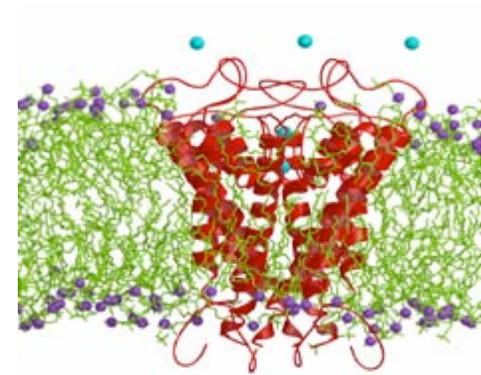
## RAL Research Complex

- Research facilities for users of ISIS and DIAMOND
- Ready Autumn 2009



## Science and Technology Gateway Centres

- Hartree Centre - modelling
  - Imaging Solution Centre
  - Detector Centre
- 
- Science and Business Case under preparation
  - Discussion with Academic Partners – in progress



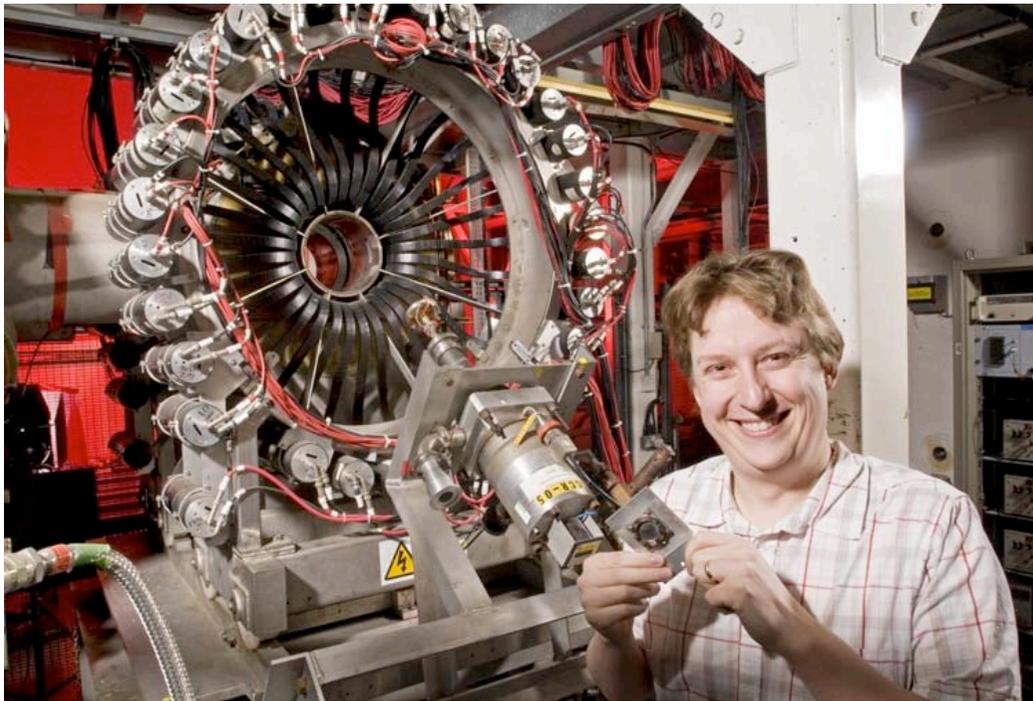


## ISIS Uniqueness

- Unique pulsed spallation source in Europe
- Neutrons and muon for complementary information
- State of the art instrument suite – including 7 new TS-2 instruments
- Very diverse range of science, spanning many disciplines
- Very well-developed user community
- Excellent experimental support – new users actively encouraged
- Technical groups for SE, detectors, electronics, choppers, etc, etc.
- Training for less experienced users – including annual hands-on courses
- 50+ scientists with expertise across a very broad range of science areas who can assist with experiments
- Situated alongside DIAMOND, lasers, research complex . . . . .
- Long history of very successful Access contracts

## Changing faces

- Adrian Hillier: now Muon Access Manager
- Philip King: moving to Networking Activities





And now . . .  
**LUNCH!**



## Your place in Europe

- Statistics on user frequentation / outcome in terms of publications?
  - Previous Access contracts (n+ $\mu$ ): 184 experiments, 351 unique users, 481 user-visits
  - ISIS as a whole: 650 expts / yr, 400+ publications / yr