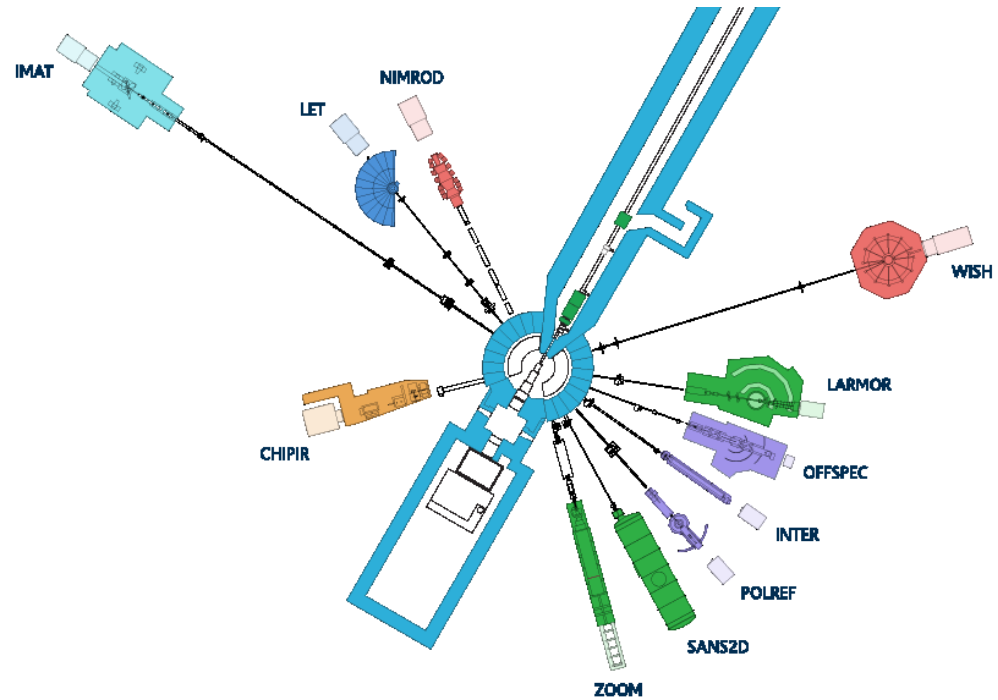


# Update from the ISIS Neutron & Muon Source

UK Neutron & Muon  
Science and User Meeting  
Warwick, 29 April – 1 May

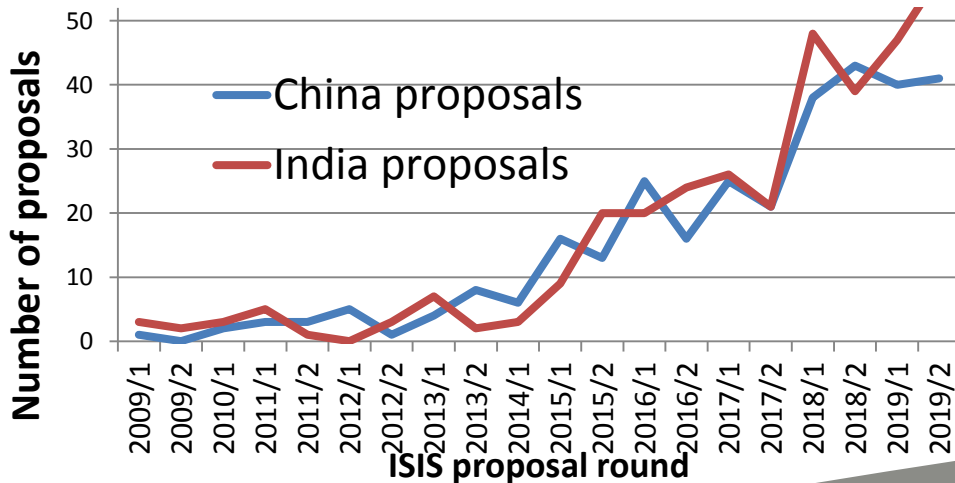
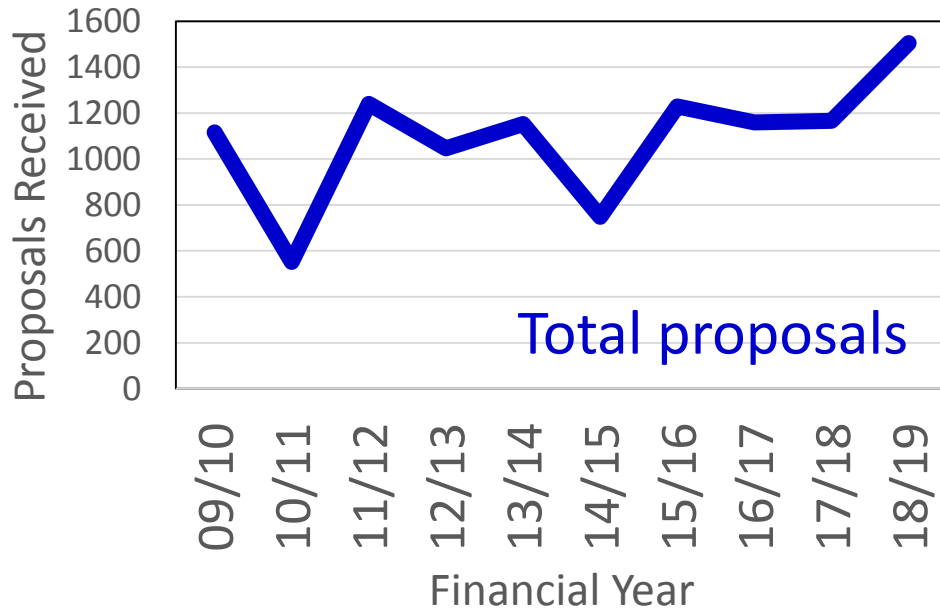
Philip King  
Spectroscopy Division Head



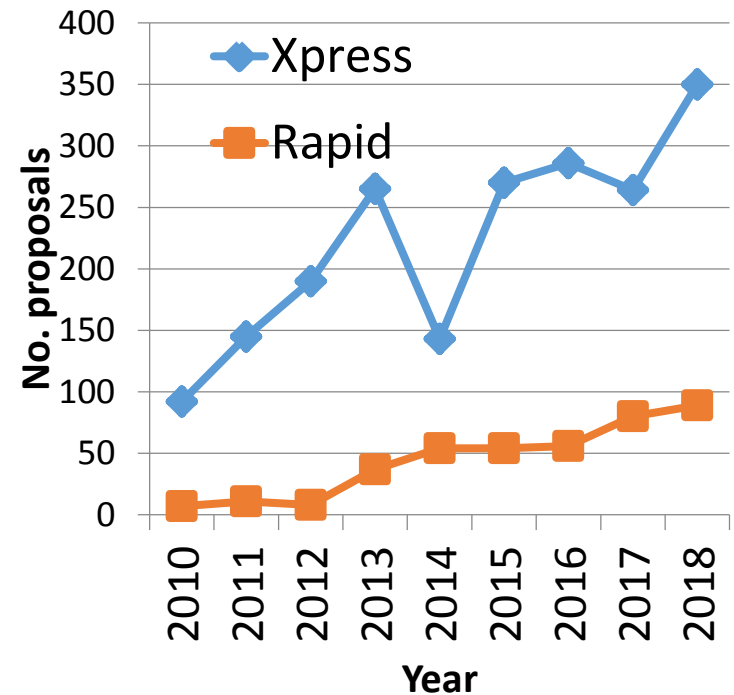
**ISIS 2018 Annual  
Review – available  
from the ISIS  
website!**



# Proposal numbers

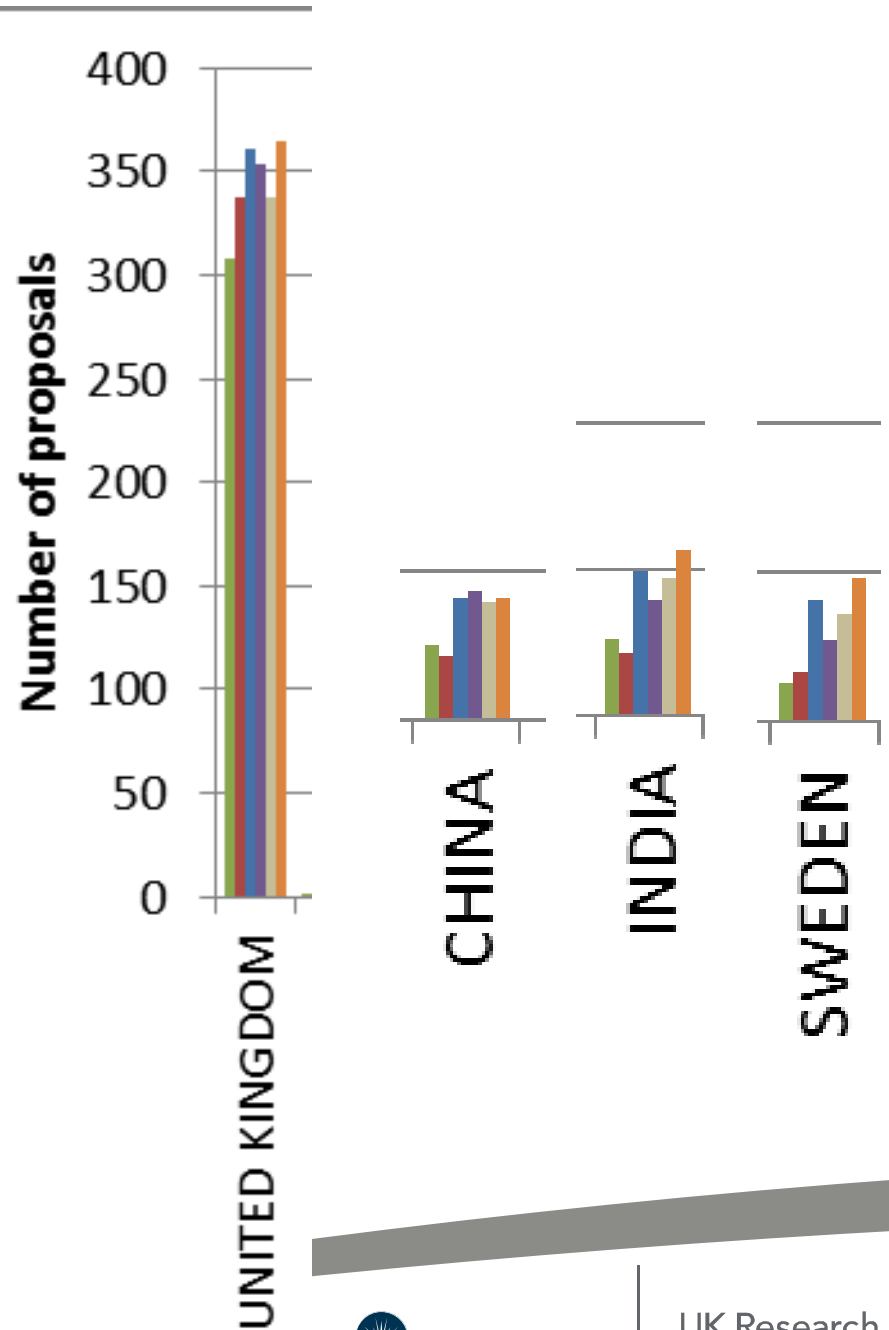


Long shutdowns in 2010, 2014

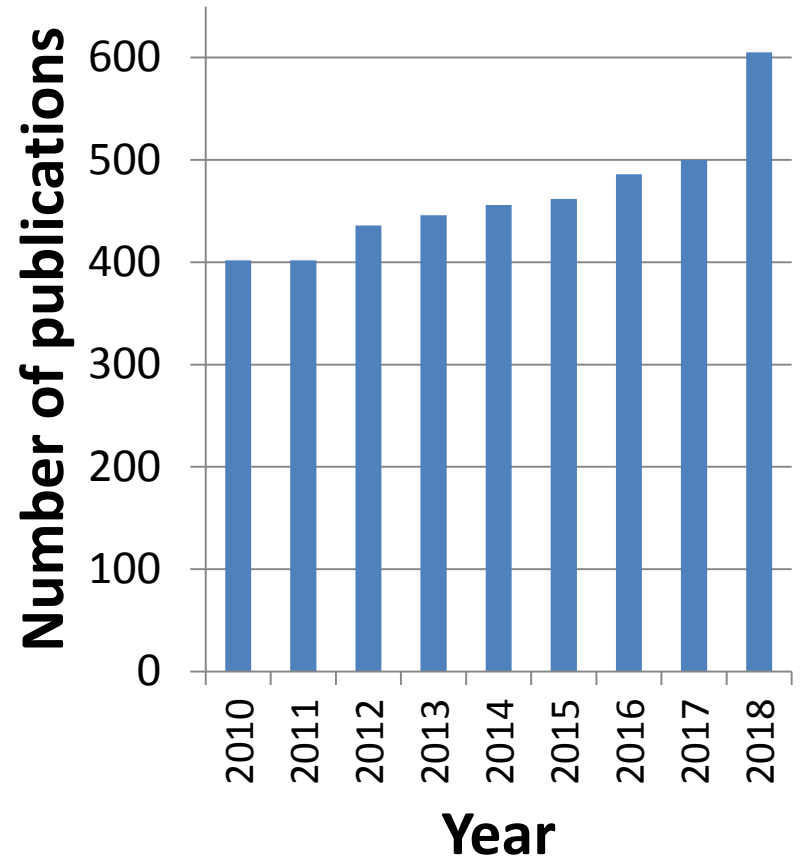
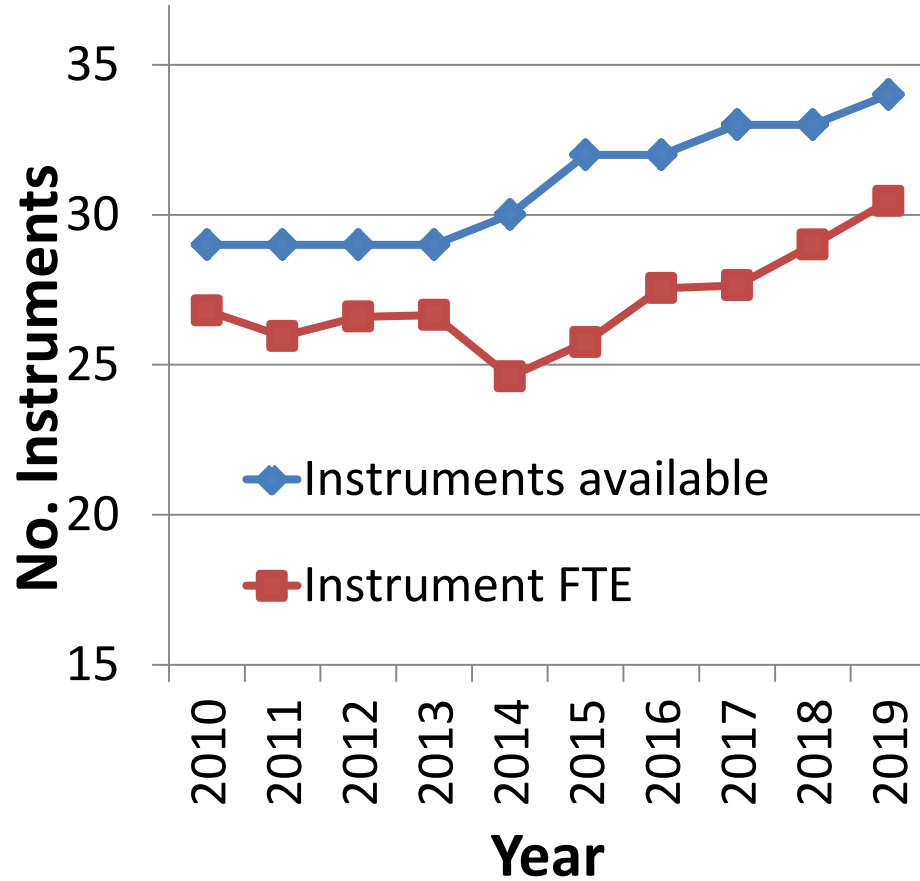


# Proposal numbers

- Round 18/1 (Oct 2017 deadline): 656 proposals
- Previous record: 679 in round 14/1
- **Round 19/2 (Apr 2019 deadline): 748 proposals**
- Previous record: 679 in round 18/1
- China, India, Sweden all up
- A variety of increases in other countries too
- ISIS long shutdown approaching
- Other sources in Europe off



# Instrument and Publication Numbers



# Talking of Publications . . .

- Every experiment has a Digital Object Identifier (DOI)
- Please cite publications
- Points back to the data
- It also enables us to find publications



- Simple formula for the DOI:
- DOI = **10.5286/ISIS.E.RBxxxxxxx** , xxxxxxx is RB number
- Full link:

<https://doi.org/10.5286/ISIS.E.RB1870596>

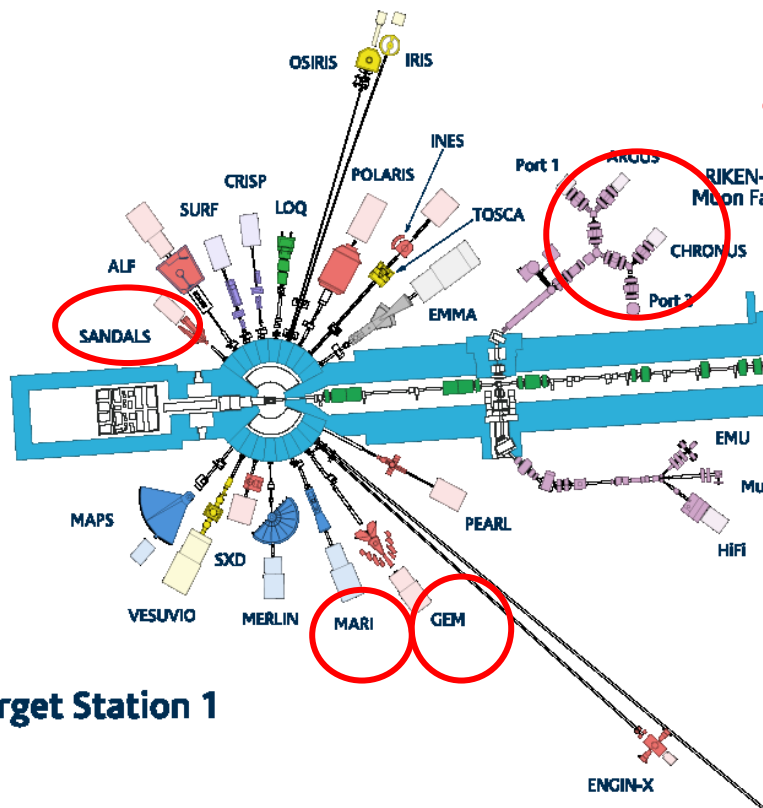
- Search 'DOI' on the ISIS website

# Research Excellence Framework 2021

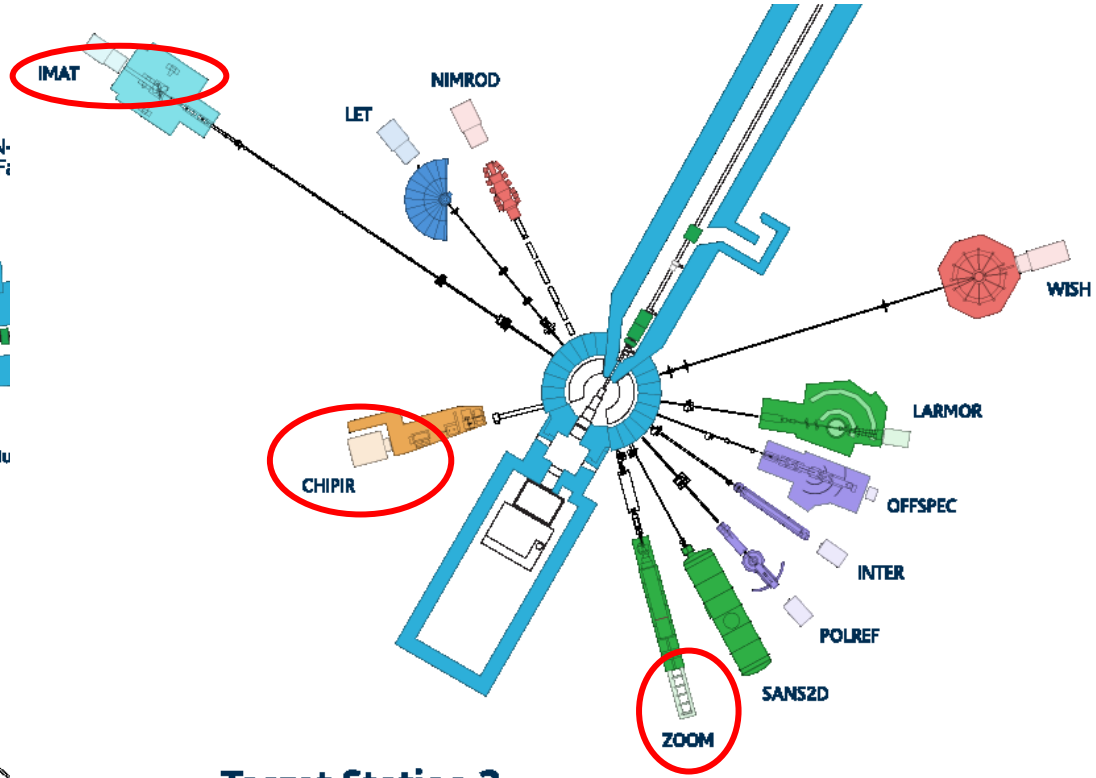
- **The value of ISIS (and ILL, ESRF, Diamond) beamtime can be included as in-kind income**
- Departments-level inclusion
- ISIS provides information centrally
- ‘Bank statement’ giving your beamtime
- Check with REF institutional contact
  
- Case studies!
  
- Search ‘REF’ on ISIS website for more info

**REF** Research  
2021 Excellence  
Framework

# The ISIS Instrument Suite



Target Station 1



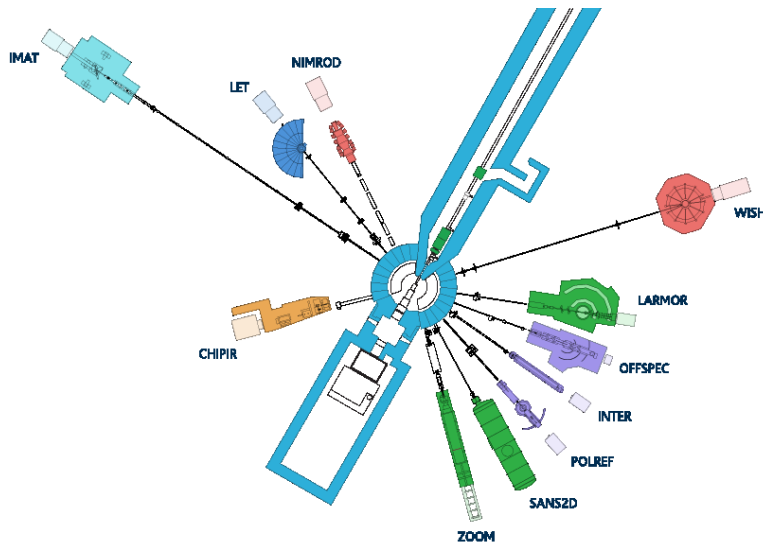
Target Station 2





# 10 years of TS2!

- First neutrons produced:  
Aug 2008, Inter beamline
- 7 initial instruments
- 11 now in the user programme
- ~690 publications to-date
- Enabled international partnerships with India, Sweden, Italy, The Netherlands

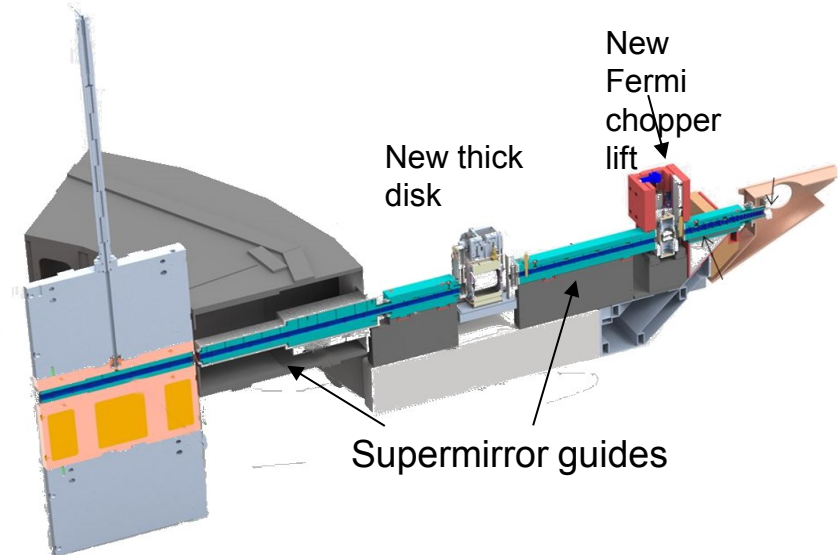


Target Station 2

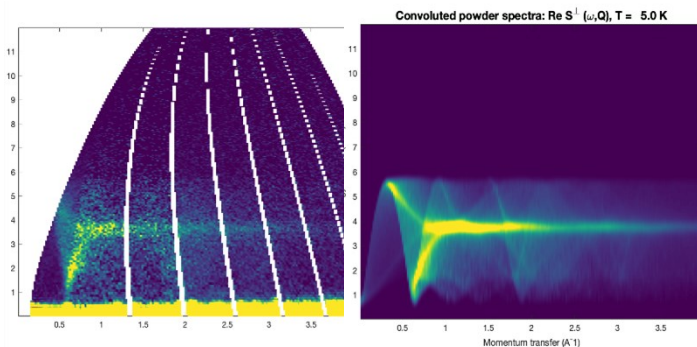


# Mari

- Installation supermirror guides
  - ~ 2x gain at high energy
  - ~ 8x at 10meV
  - ~16x below 10meV
- New 4-slot double disk to allow repetition rate multiplication
- New state-of-the-art detector electronics to improve reliability



## First user cycle February 2019

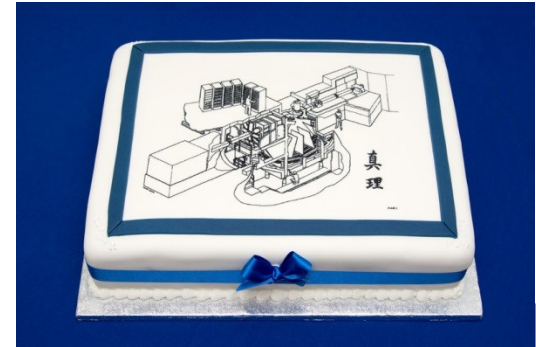
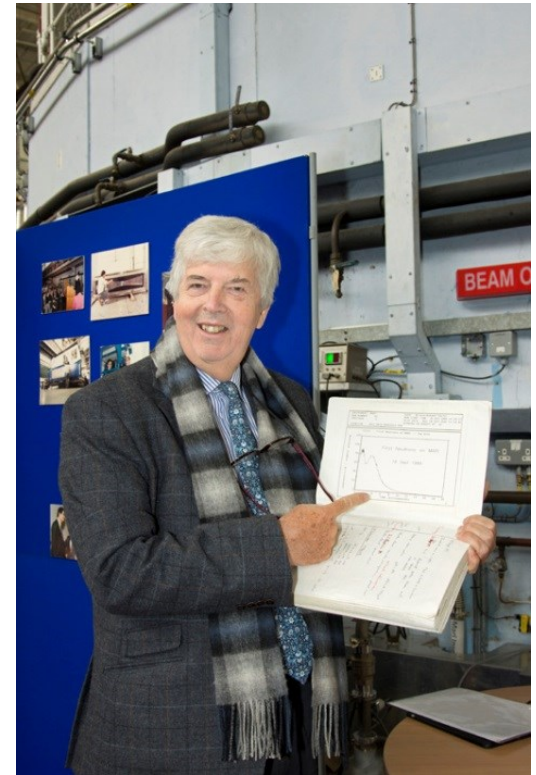


Spin waves in a new family of layered molecular frameworks  $\text{M}(\text{NCS})_2$  – very good signal and still maintaining the low background

M. Cliffe (Nottingham Univ.) , J. Paddison (Cambridge Univ.)

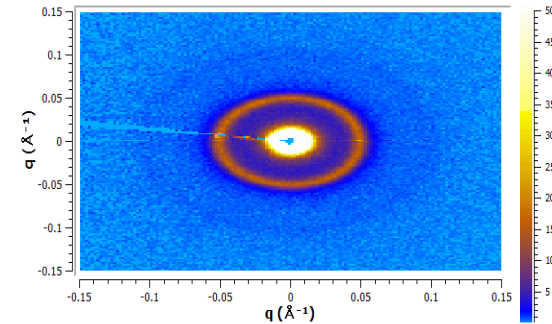
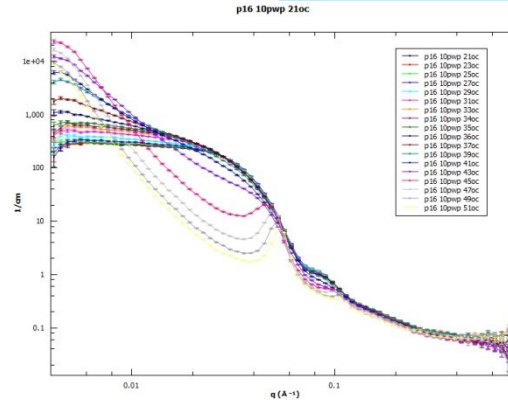
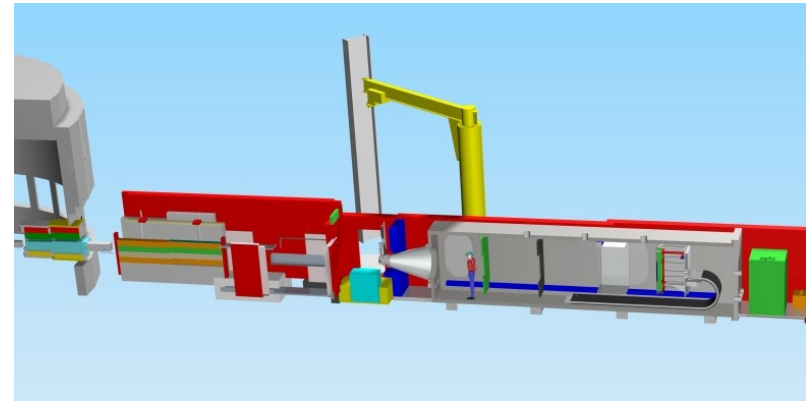


# Mari – and Andrew Taylor

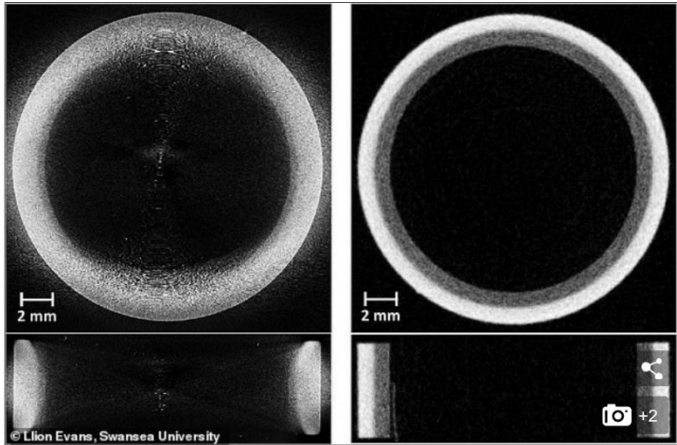


# Zoom welcomes first users

- Zoom: small angle scattering with polarisation
- Now a full part of the user programme
- First users: 2 March 2019
- Theoni Geogiou & team from Imperial
- Simultaneous SANS/rheology experiment
- Investigating structure/function relations on thermo-responsive gels



# IMAT



For the first time, researchers used computerized tomography (CT) scans to examine a coolant design called the tungsten monoblock, allowing for more precise assessment without subjecting the components to destructive test methods

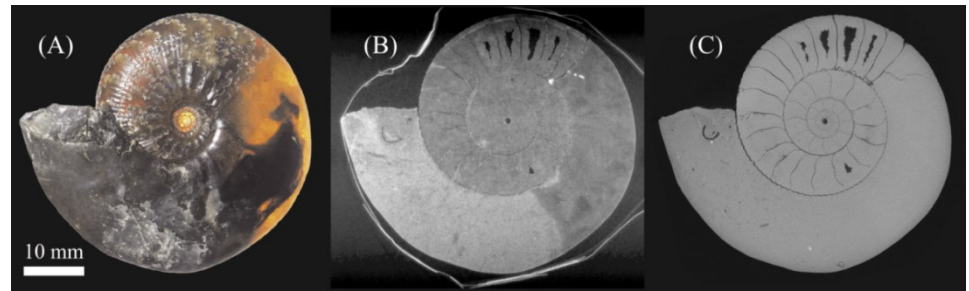


In the latest effort, researchers and Muon Source's neutron im

Thus, it is feasible to image tomography also allows us removing the need to prod

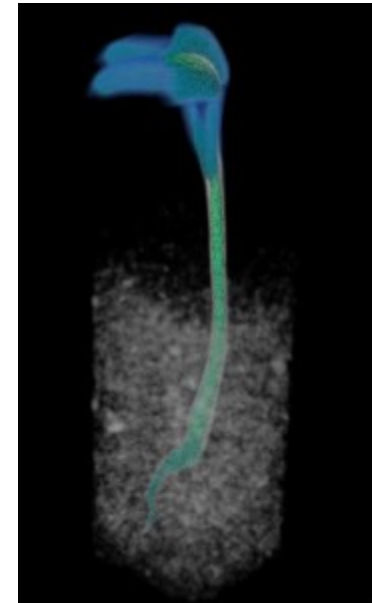
In the latest effort, research Neutron and Muon Source's

The monoblock is a pipe ca



A wide variety of applications:

- Cooling monoblocks for fusion
- Internal fossil structure
- Water uptake in plants



## MailOnline Science & Tech

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"I can't say enough about how comfortable these shoes are."

**allbirds**

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### Fusion power breakthrough as researchers reveal new way to test the safety of 'limitless energy' devices

- Researchers have used CT scans to study cooling components for fusion energy
- They say this is the first time the non-destructive method has been used for this
- It could provide more precise assessment of critical parts in fusion devices

By CHEYENNE MACDONALD FOR DAILYMAIL.COM  
 PUBLISHED: 18:18 4 December 2018 | UPDATED: 20:31 4 December 2018

Search



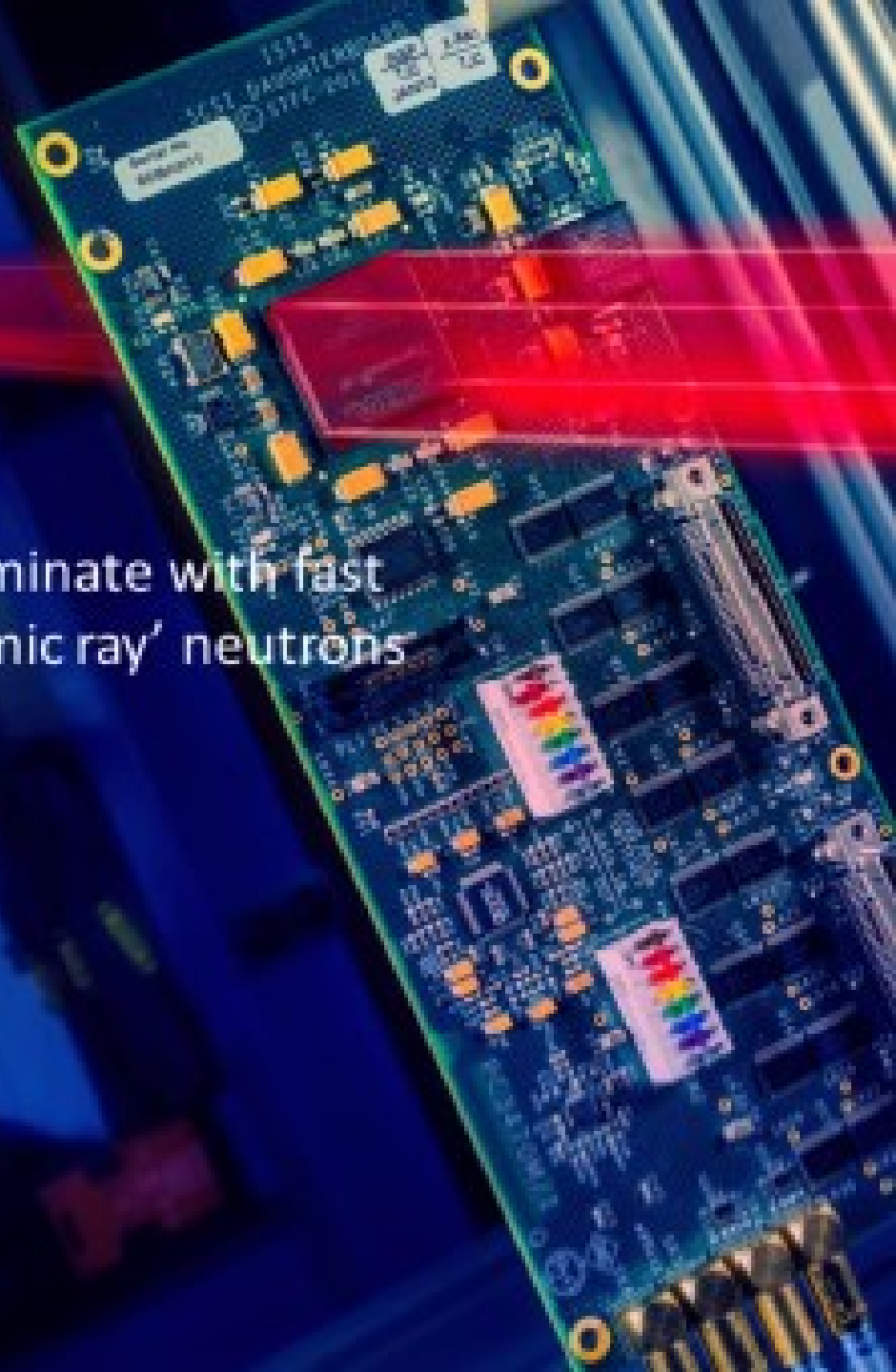
# Chiplr

- Chiplr has been taking users for a year
- 11 companies have paid for beamtime – 46 days sold in 18/19.

100-1000 million times more intense

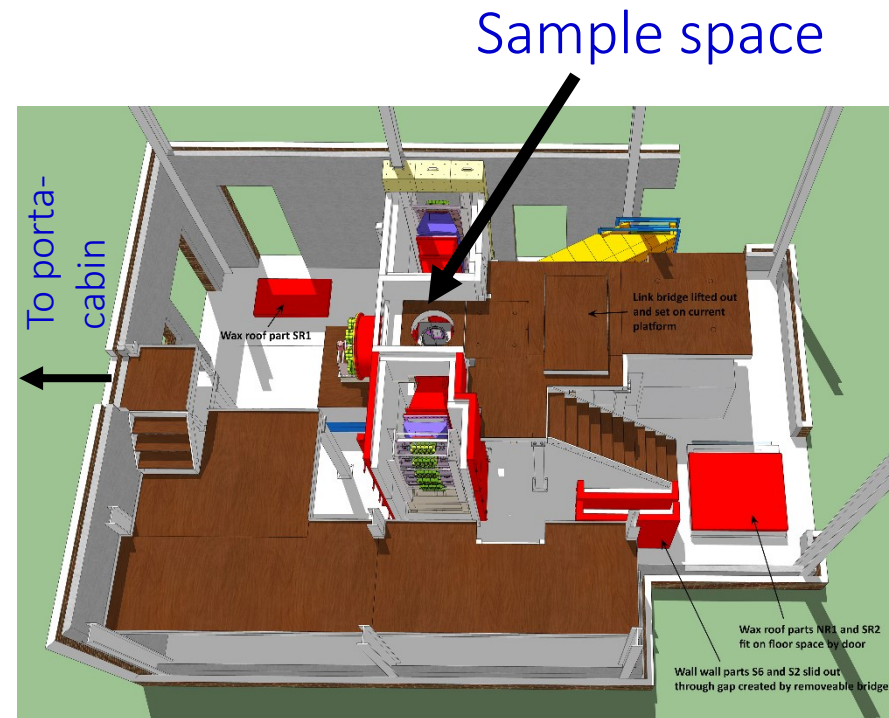
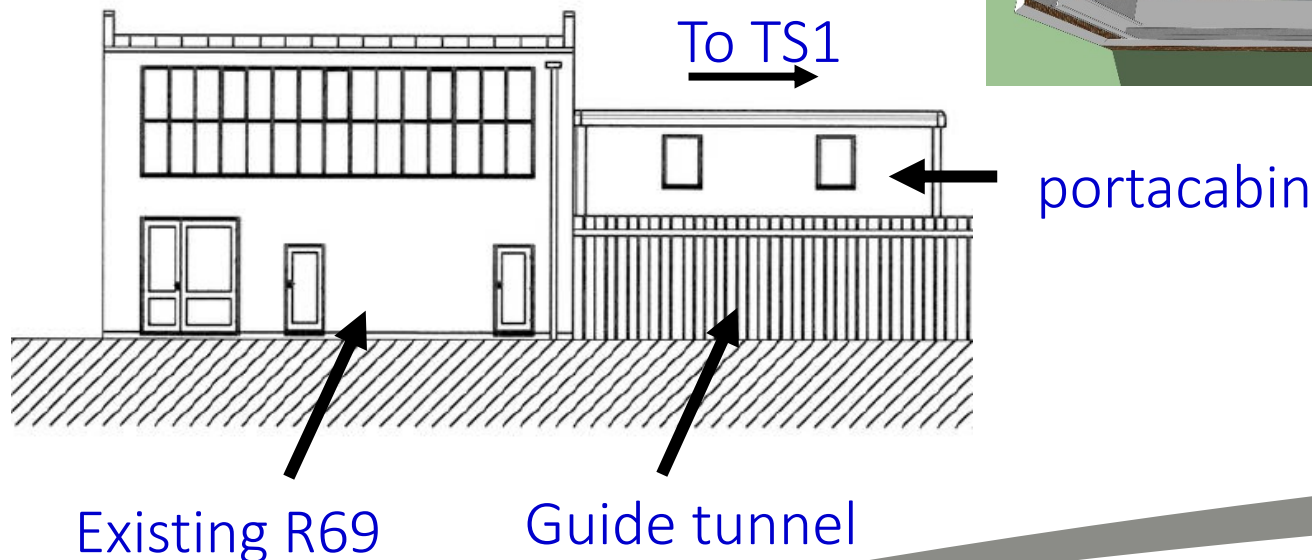
1 hour at ISIS = 100's years in real environment

Illuminate with fast 'cosmic ray' neutrons



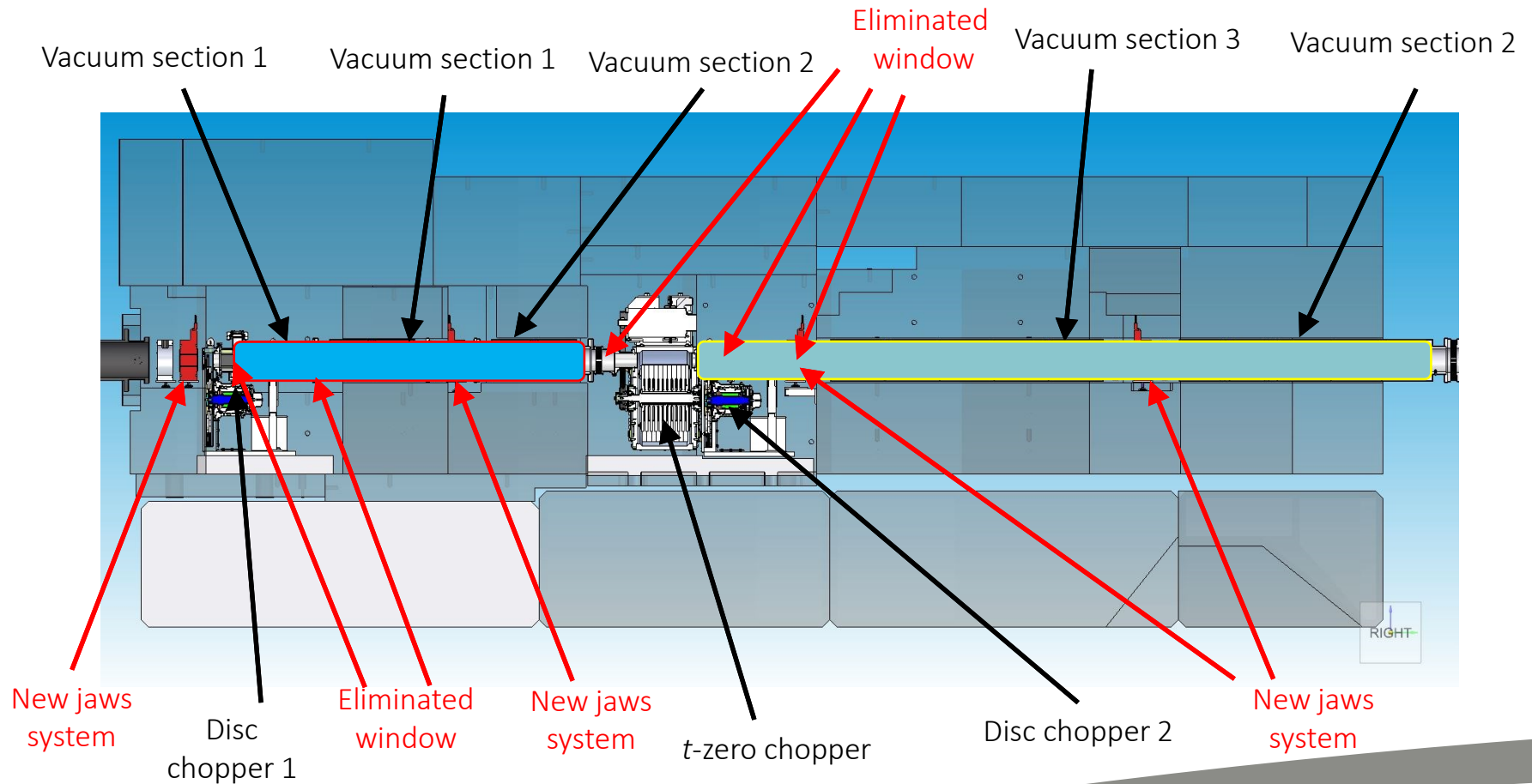
# HRPD – interim works

- Replace detector electronics
- Extend existing mezzanine
- Add portacabin for users
- Provides more space for SE & prep
- Provides better temperatures for people and kit!
- Ready Sept 2019



# GEM

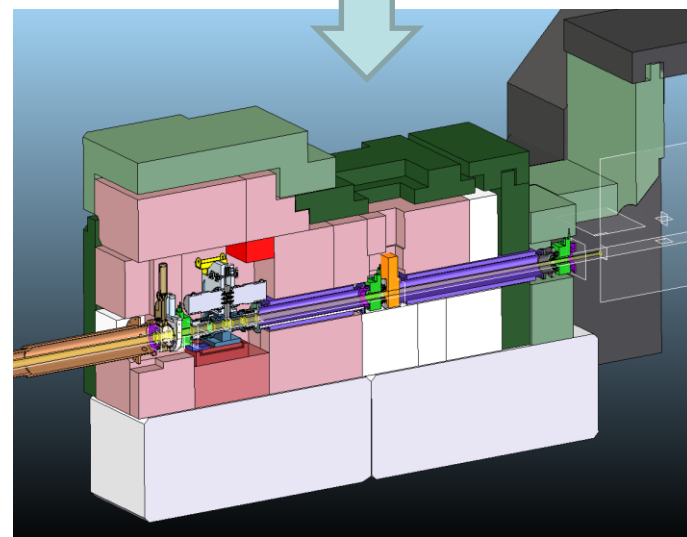
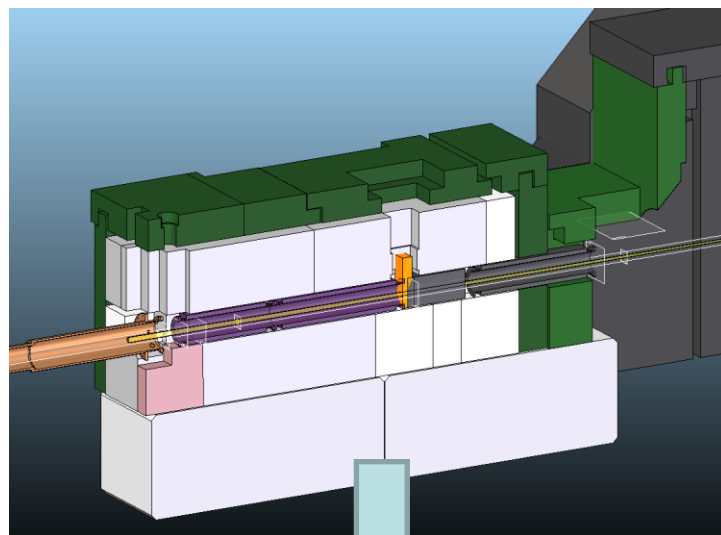
- Remove windows, improved jaws, beam alignment
- More flux (20%), lower background



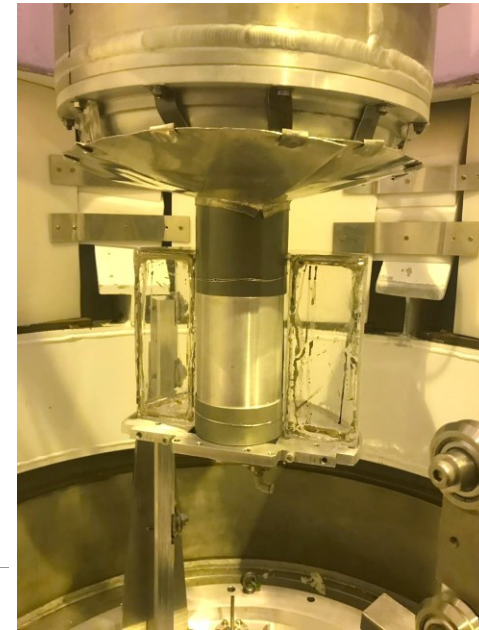
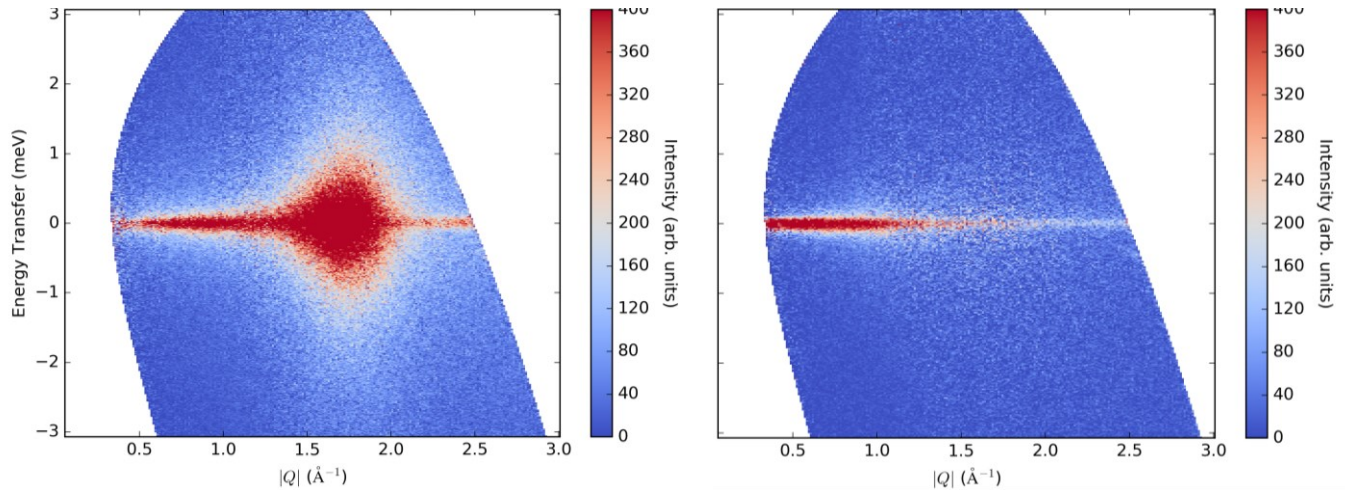


# Sandals

- Installation of a frame-overlap chopper – reducing backing
- Change in collimation – improving neutron flux
- Sandals will be off from Jan 2020 until the end of the long shutdown in 2021; no proposals in Oct 2019.



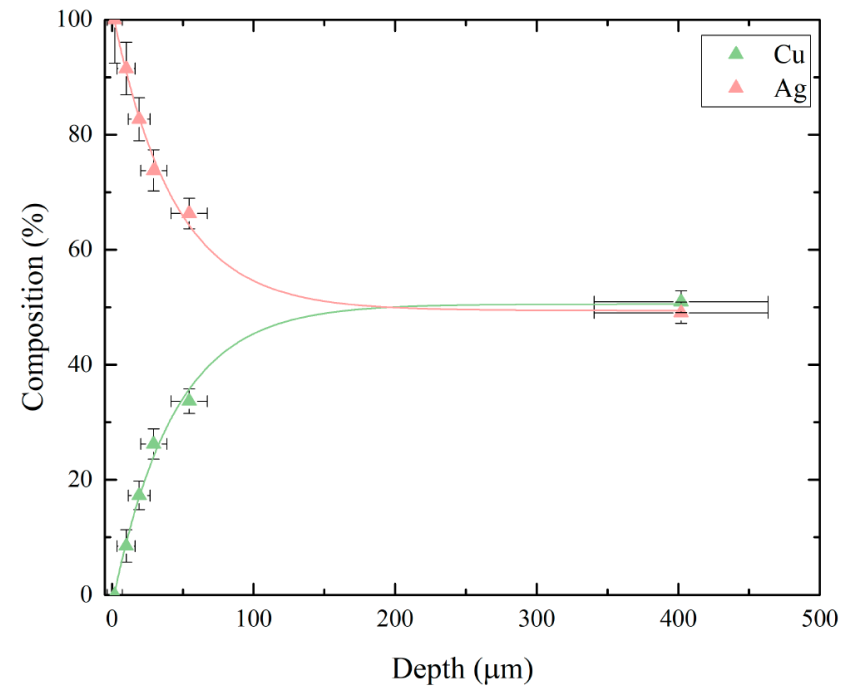
# Polarisation on LET (PLET)



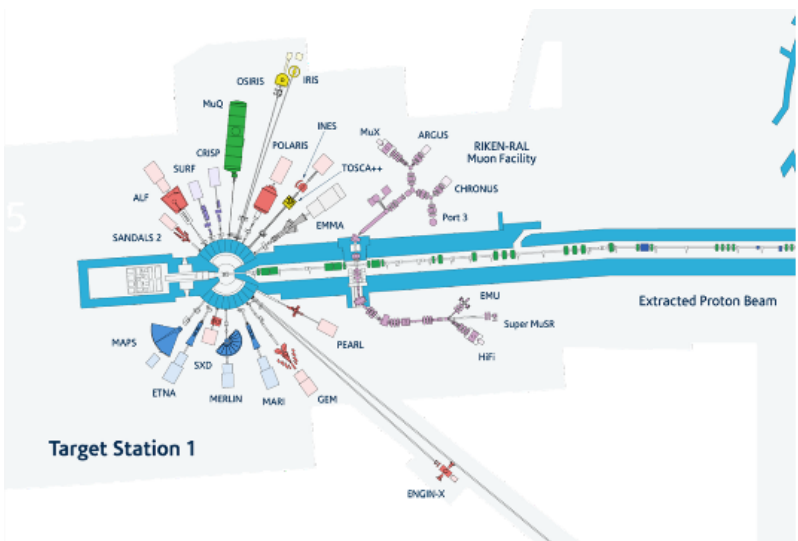
- First official PLET experiment – Arbe & Colmenero (San Sebastian)
- Deuterated-methanol (~7cc), 4 hours counting time on PLET
- Clean separation of Coh and Inc scattering with uncompromised resolution and background

# RIKEN-RAL Refurbishment

- New agreement with RIKEN signed March 2018
- ISIS now owns and operates RIKEN-RAL muon facility
- Japanese user programme continuing
- 6-year refurbishment programme underway: power supplies, magnet cabling, water circuits, detectors, PLC, vacuum, etc.
- 'Normal'  $\mu$ SR; plus elemental analysis

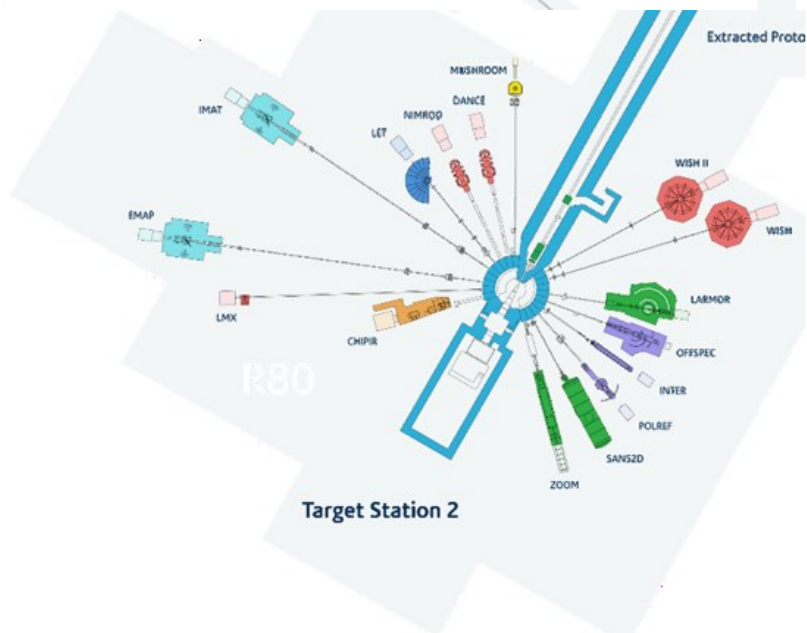


# Endeavour – next generation instruments at ISIS



- HRPD2020
- SANDALS2
- $\mu$ Q
- ETNA
- Osiris
- Tosca++
- MuX
- Super MuSR

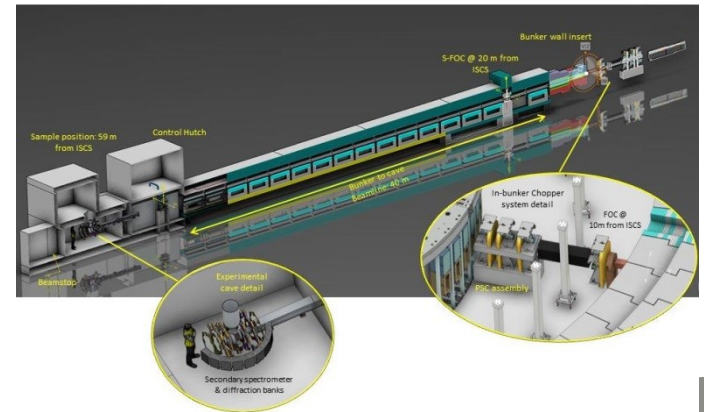
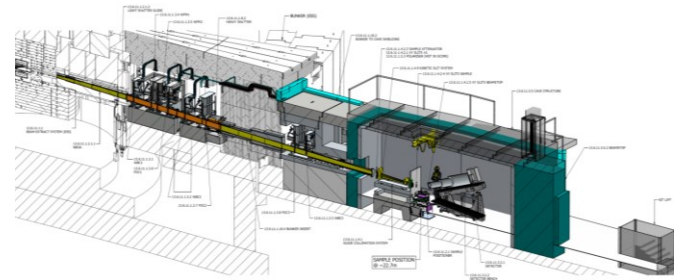
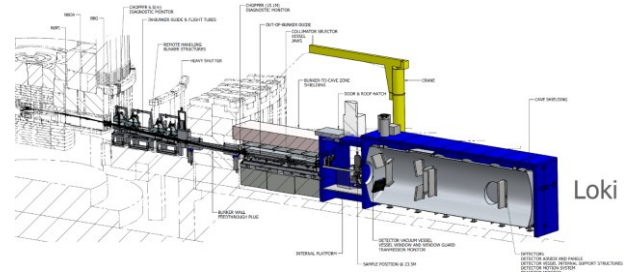
- Large instrument projects: new-builds and upgrades
- ISIS' highest priority large project
- Priority for STFC: expected to be part of UKRI CSR bid later this year
- We continue with outline and detailed design work



- WISH-II
- LMX
- $\epsilon$ -MAP/ISEC
- DANCE
- MUSHROOM

# ISIS construction of ESS instruments

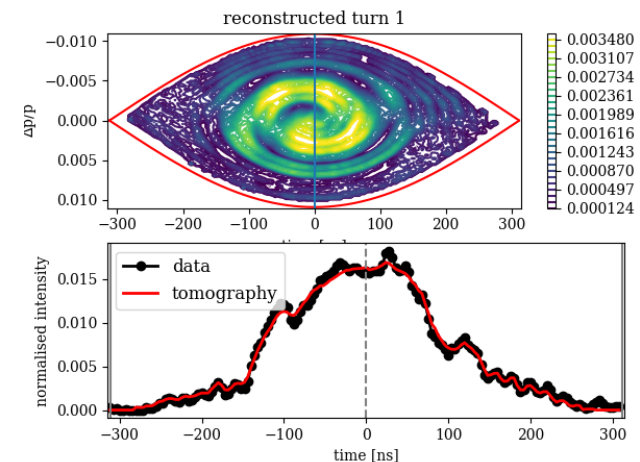
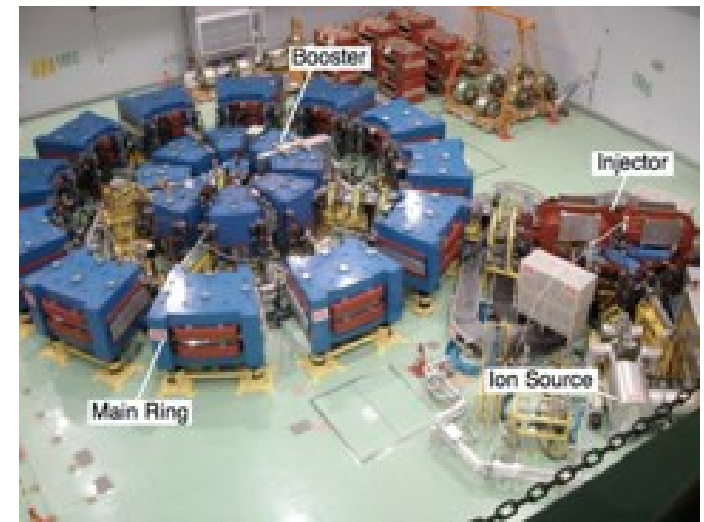
- LOKI (SANS): First order placed!
- FREIA (Reflectometer): concept and layout progressing
- VESPA (Vibrational Spectroscopy, partner with Italy): detailed design underway



# ISIS-II

- Plans for a next-generation source on the 2030+ timescale
- A variety of options – depending on technology chosen and amount of ISIS that is re-used.
- Technology development work is needed over the next few years – e.g. a look at FFAs

FFA at Kyoto University



Reconstructed phase space

# Accelerator obsolescence and development programme

## *Synchrotron vibration system*

- Real-time condition monitoring
- Data analysis for trends and fault investigations



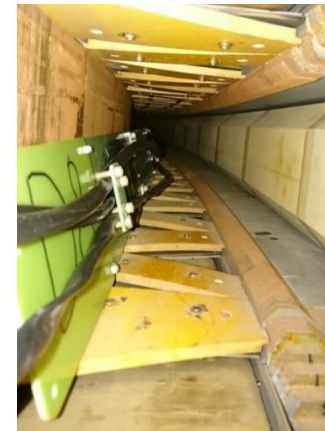
## *TS1 proton beam power supply installation*

- Additional magnets – giving operational redundancy
- Improves proton beam spot at muon target



## *Synchrotron Beam Loss Monitors*

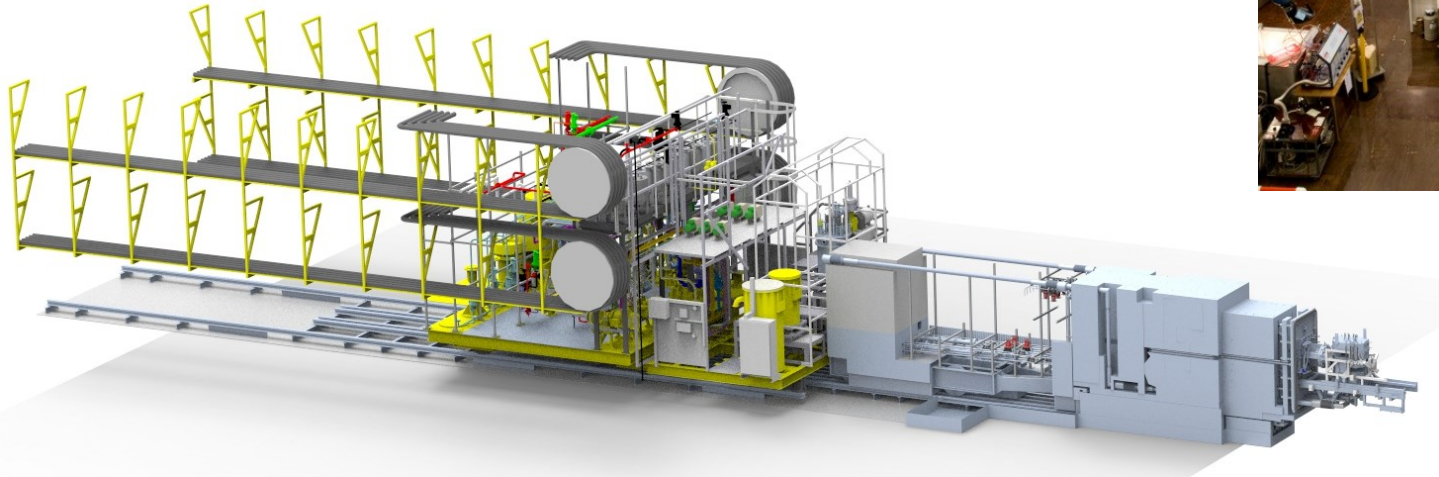
- Scintillators in all dipoles
- 8km of cabling, 900 connections
- Enables optimisation of machine parameters to protect components and reduce activation



*Scintillators installed next to vacuum chamber inside dipole*

# Target Station 1 Refurbishment Project

- Aim: to enable TS1 to operate for many more years to come
- Complete refurbishment of the internals of the target station, including:
  - Design of the target; target cooling systems
  - Moderators and reflector, and all their cooling systems and services which sit behind the target station

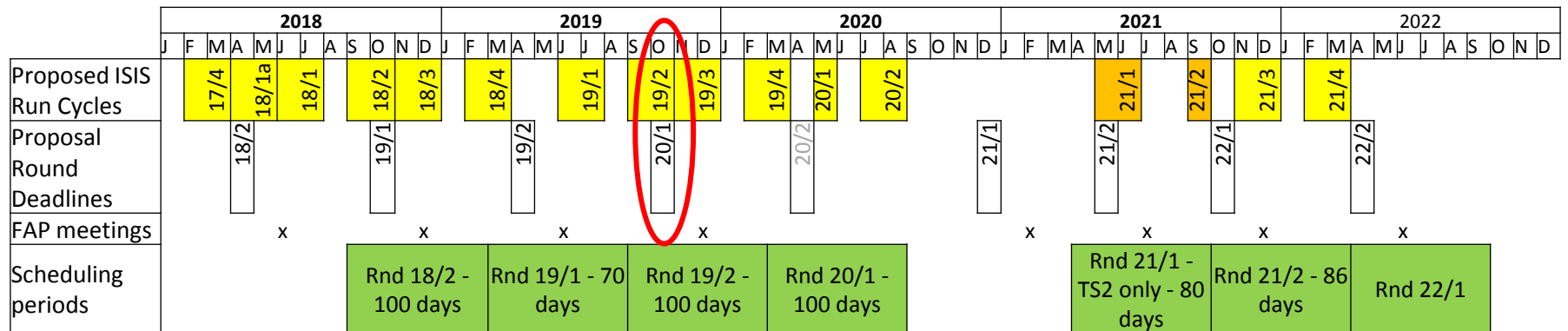




# ISIS Proposal Rounds

Based on the currently-planned ISIS run cycles before and after the long shutdown, shown here are proposal rounds and scheduling periods

- ISIS goes off for the long shutdown on 1 Sept 2020
- First beam to both target stations 2 Nov 2021
- TS2 is off for 8 months
- TS1 is off for 14 months (with possibly some beam after ~12 months)

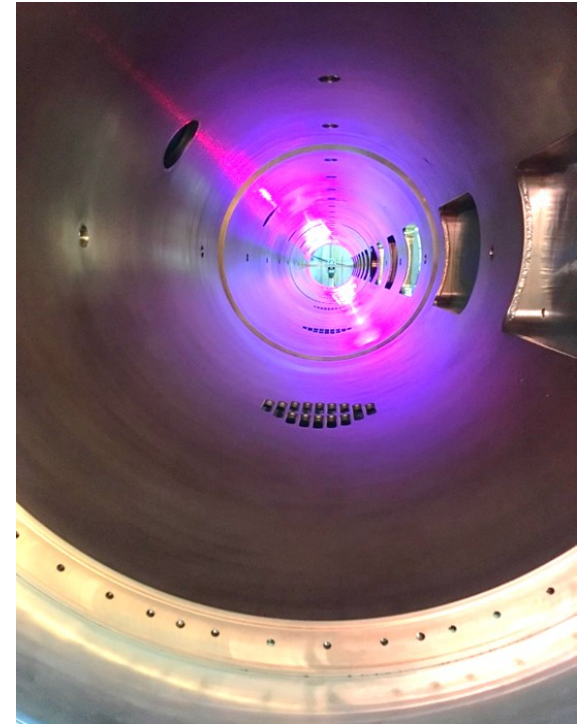


**You are here!**

Cancel round 20/2 (April 2020)

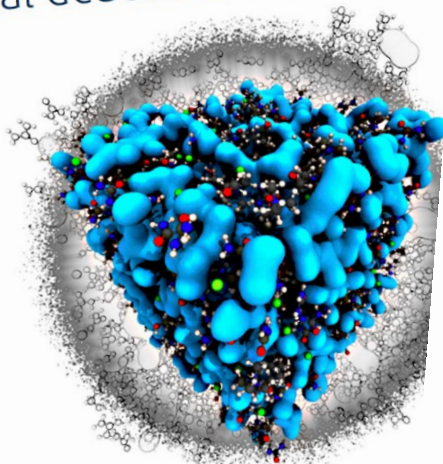
Round 21/1 – TS2 only (Oct 2020)

# Linac tank 4



# ISIS Proposal Rounds

## ISIS Neutron & Muon Source Proposal deadlines and long shutdown



ISIS will have a planned long shutdown during 2020 and 2021. This is to enable significant refurbishment work to take place on the first target station, plus replacement of part of the linear accelerator.

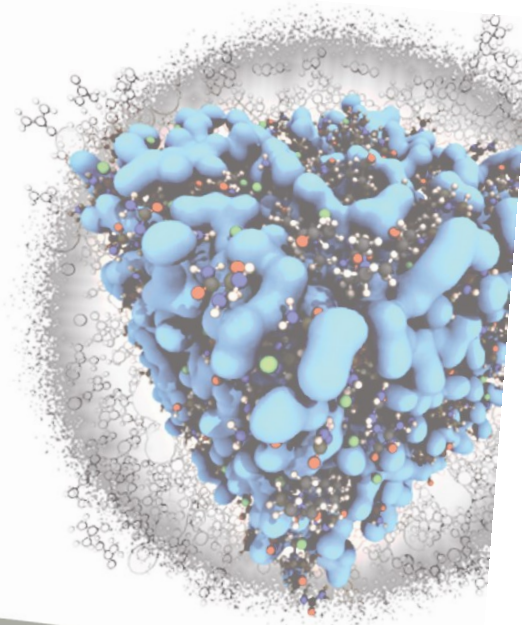
The first target station will not be operating between Sept 2020 and Oct 2021 (14 months). The second target station will not be operating between Sept 2020 and Apr 2021 (8 months).

Proposal deadlines up to 2021 will be:

Round 19/2	Wed 18 Apr 2019: all instruments
Round 20/1	Wed 17 Oct 2019: all instruments
Round 20/2	Cancelled (no proposal round in Apr 2020)
Round 21/1	Late 2020: TS2 instruments only
Round 21/2	Spring 2021: all instruments

*Image: Illustration of how the nanostructure of the Deep Eutectic Solvent, formed from a 1:2 molar mixture of choline chloride and urea, can be modified by the addition of water.*

[www.isis.stfc.ac.uk/Pages/NIMROD-Science-Highlights.aspx](http://www.isis.stfc.ac.uk/Pages/NIMROD-Science-Highlights.aspx)



[www.isis.stfc.ac.uk](http://www.isis.stfc.ac.uk)



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[www.isis.stfc.ac.uk](http://www.isis.stfc.ac.uk)



Science & Technology Facilities Council  
ISIS Neutron and Muon Source



Science & Technology Facilities Council  
ISIS

UK Research  
and Innovation

# International Partnerships

Italy – 6-year agreement, €15M, discussions on renewal

Japan – RIKEN, new 3-year agreement, £3M

Netherlands – £4.5M collaboration

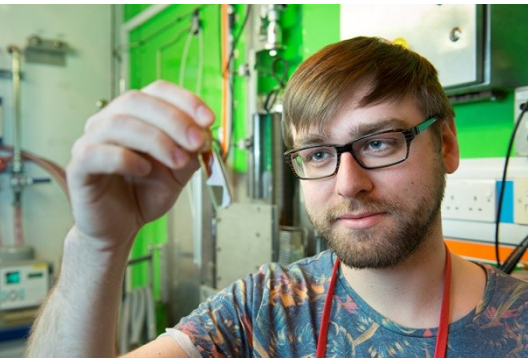
India – £2M agreement, user programme

Sweden - €10M agreements, 30 years of partnership, discussions on renewal

Indonesia, Thailand, Malaysia – UK Newton fund support



# Students

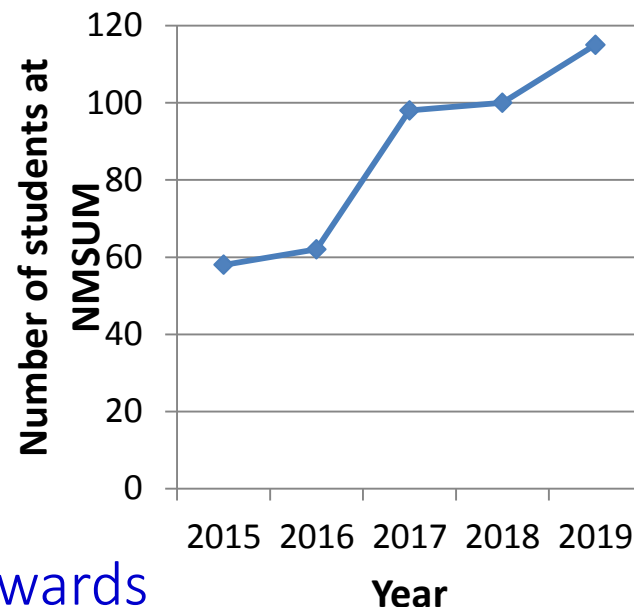


NMSUM day on  
Mon: 115 registered

Studentship call 2018:

- 7 ISIS awards
- 3 joint ISIS/Diamond awards
- 1 joint with Catalysis Hub
- 1 joint with Faraday Institution

**There will be another call for  
studentship applications later this year,  
including Hub & Faraday**



Deadline for Applications 1<sup>st</sup> June 2019

# 16<sup>TH</sup> OXFORD SCHOOL OF NEUTRON SCATTERING

2<sup>nd</sup> - 13<sup>th</sup> September 2019 // St Anne's College, Oxford University

## GENERAL

Neutron Scattering Theory //  
Crystallography //  
Spectroscopy // Sources //  
Neutron Contrast //  
Instrumentation

## TECHNIQUES

Diffraction // Imaging // Reflectivity //  
Small & Wide Angle Scattering //  
Phonons // Vibrational Spectroscopy //  
Polarisation // Compton Scattering //  
Modelling

## APPLICATIONS

Magnetism // Chemistry //  
Soft Matter //  
Solids & Liquids //  
Lipid Membranes

## CONTACT

Dr Victoria Garcia Sakai  
osns@stfc.ac.uk

[www.oxfordneutronschool.org](http://www.oxfordneutronschool.org)



# International Advanced School in Muon Spectroscopy

**15<sup>th</sup> - 23<sup>rd</sup> August 2019**

STFC Rutherford Appleton Laboratory, Oxfordshire, UK

An advanced school on muon techniques for PhD students, post-docs & academics.  
Lectures & practical workshops cover applications of muons in areas such as:

Magnetic materials  
Superconductors  
Energy materials  
Semiconductors

Molecular materials  
Thin films and interfaces  
Extreme environments  
Elemental analysis

Registration open from 25<sup>th</sup> March to 3<sup>rd</sup> June 2019

For further details, contact: Pabitra Biswas, [pabitra.biswas@stfc.ac.uk](mailto:pabitra.biswas@stfc.ac.uk)  
[www.isis.stfc.ac.uk/Pages/Muon-Spectroscopy-Advanced-School.aspx](http://www.isis.stfc.ac.uk/Pages/Muon-Spectroscopy-Advanced-School.aspx)



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Facilities Council



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# User Meetings . . .

## ISIS Engineering User Meeting

24-25 Sept 2019  
Milton Hill House

## ISIS Crystallography User Meeting

4-5 Nov 2019  
Milton Hill House  
(joint with BCA and  
Diamond)



Attendees at the 2017 UK Engineering Neutron User Meeting, Cosener's House





**ISIS** 