Opportunities & perspectives for scientists from SLOVAKIA at the Institut Laue Langevin:

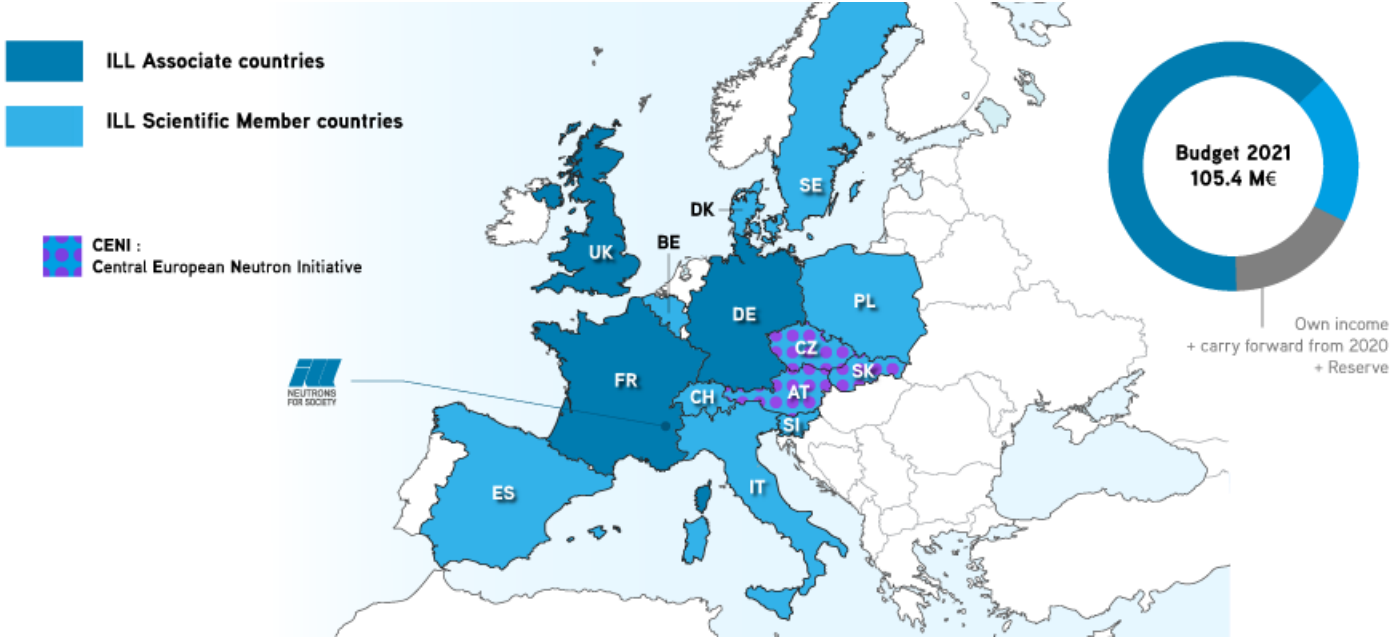
Mark JOHNSON

Head of Partnerships & Communication

(Science Director 2016-21)

More than 50 years of international collaboration

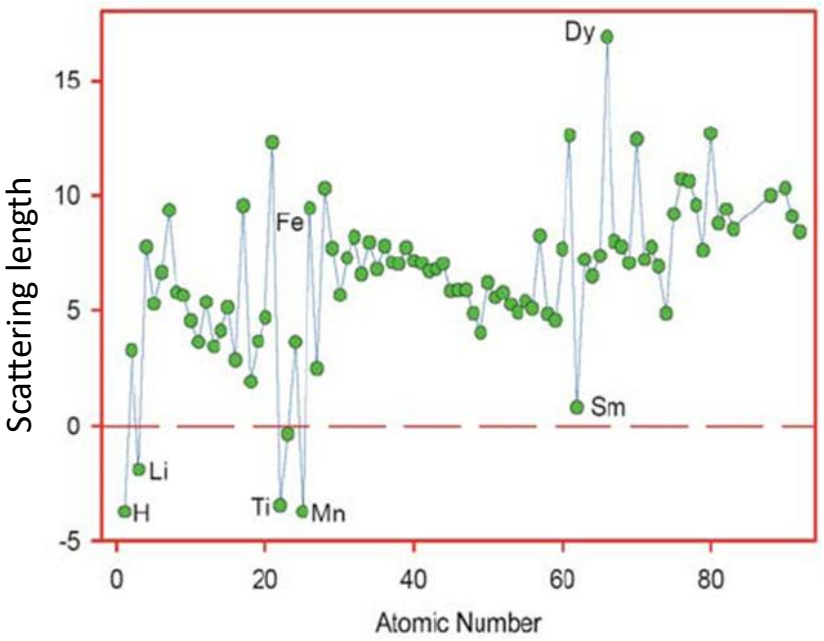
14 Associate and Scientific Member countries



Why neutrons?

A UNIQUE PROBE OF MATTER

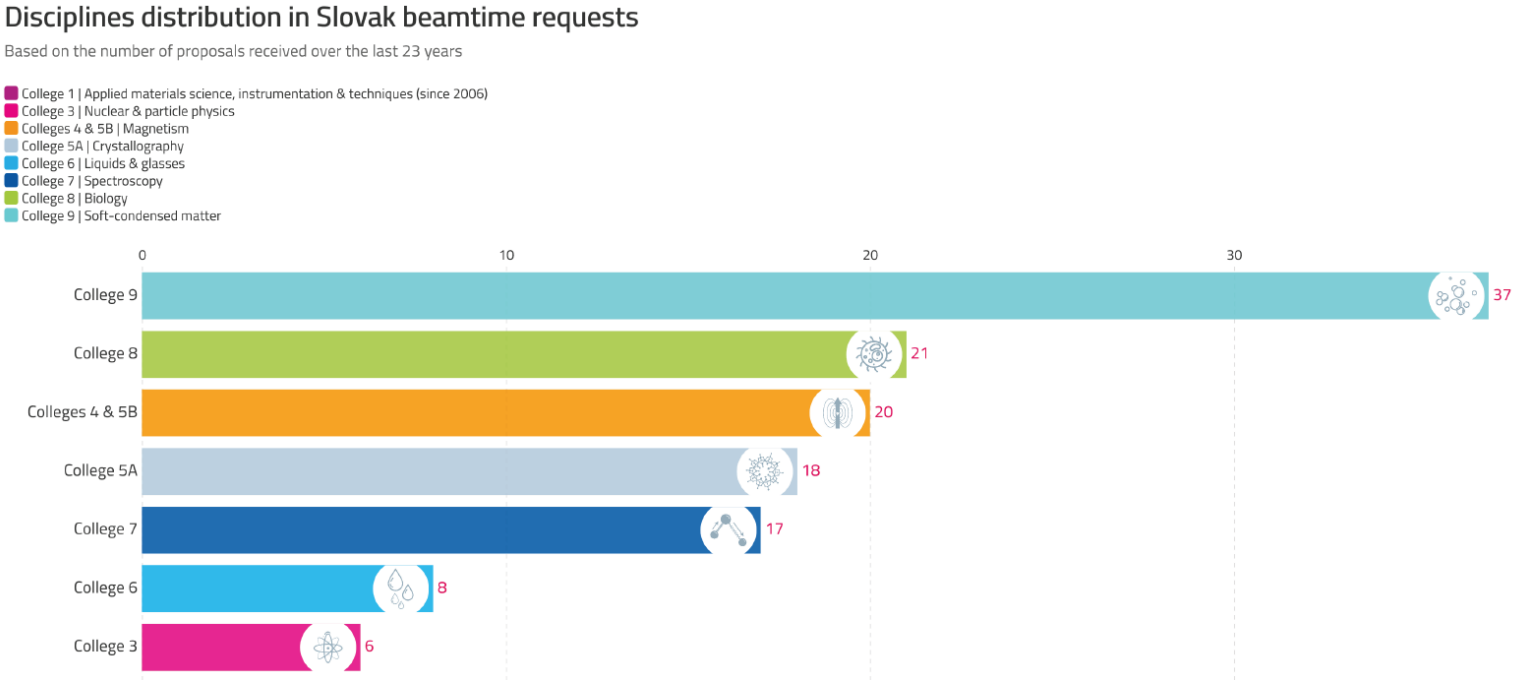
- No charge
- Scatter from nuclei → different contrast to e.g. X-rays
- Sensitive to light atoms (H, Li, O,…)
- Isotopes scatter (& absorb) differently (eg H/D, Li-6/Li-7)
- Contrast matching – making molecules ‘invisible’
- Nuclear spin → magnetic moment
- Probe directly magnetic fields in materials



Slovakia @ ILL – a highly-valued partner

Publications, beam time & Scientific fields

- Scientific output: 76 publications since 2001 (source: ILL library database)
- Beam time demand: 0.4% vs allocation 0.3% vs funded 0.2%



Slovakia @ ILL – a highly-valued partner

Examples of recent publications (2021 – 2022)

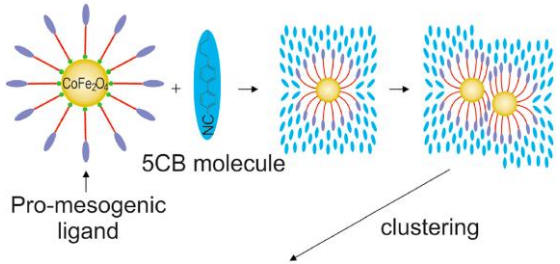
iScience

CellPress OPEN ACCESS

Article

Clustering in ferronematics—The effect of magnetic collective ordering

Veronika Lacková,[1] Martin A. Schroer,[2,3] Dirk Honecker,[4] Martin Hähsler,[5,6] Hana Vargová,[1] Katarína Zakutanská,[1] Silke Behrens,[5,6] Jozef Kováč,[1] Dmitri I. Svergun,[2] Peter Kopčanský,[1] and Natália Tomašovičová[1,7,*]



pubs.acs.org/Langmuir

Article

Cation–Zwitterionic Lipid Interactions Are Affected by the Lateral Area per Lipid

Norbert Kučerka,* Elena Ermakova, Ermuhammad Dushanov, Kholmirzo T. Kholmurodov, Sergei Kurakin, Katarína Želinská, and Daniela Uhríková*

Cite This: *Langmuir* 2021, 37, 278–288

Read Online

IOP Publishing

Journal of Physics: Condensed Matter

J. Phys.: Condens. Matter 34 (2022) 265801 (9pp)

https://doi.org/10.1088/1361-648X/ac6787

The magnetic structure of $DyFeO_3$ revisited: Fe spin reorientation and Dy incommensurate magnetic order

Clemens Ritter[1,*], Rui Vilarinho[2], Joaquim Agostinho Moreira[2], Matus Mihalik[3], Marian Mihalik[3] and Stanislav Savvin[1]

pubs.acs.org/IC

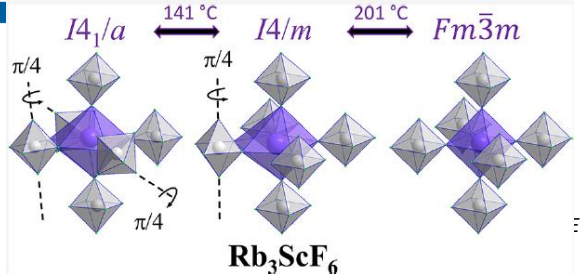
Article

Polymorphs of Rb_3ScF_6: X-ray and Neutron Diffraction, Solid-State NMR, and Density Functional Theory Calculations Study

Aydar Rakhmatullin,* Maxim S. Molokeev, Graham King, Ilya B. Polovov, Konstantin V. Maksimtsev, Erwan Chesneau, Emmanuelle Suard, Rinat Bakirov, František Šimko, Catherine Bessada, and Mathieu Allix

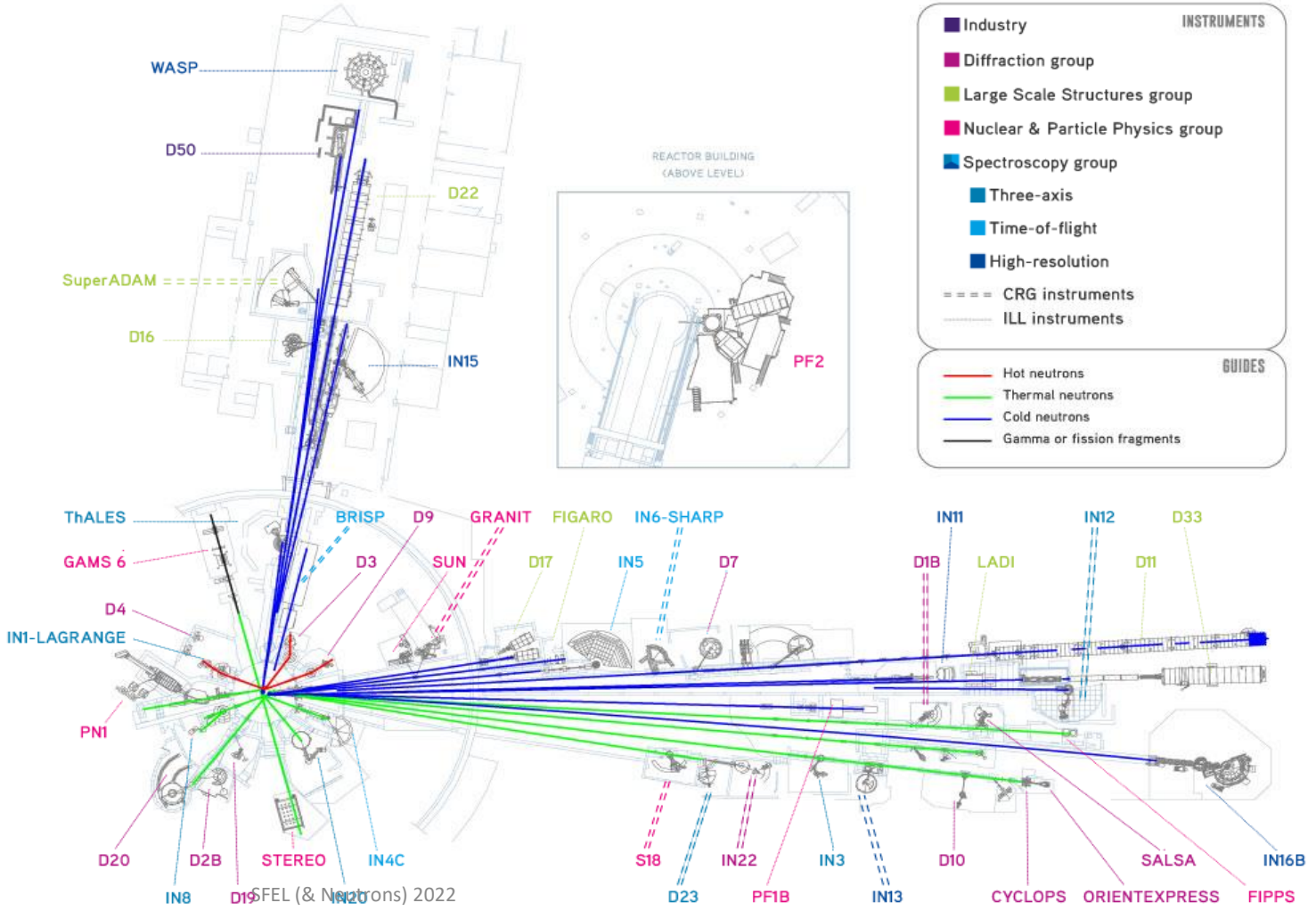
Cite This: *Inorg. Chem.* 2021, 60, 6016–6026

Read Online



NEUTRONS FOR SOCIETY

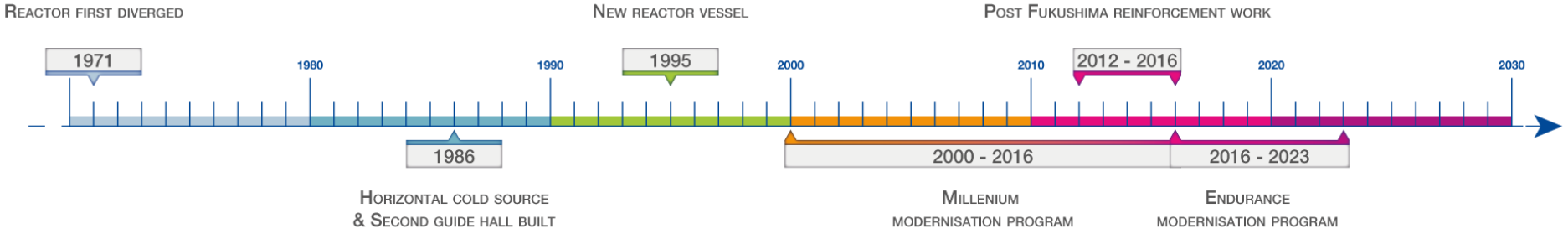
THE MOST INTENSE, CONTINUOUS NEUTRON BEAMS SERVING 40 PUBLIC INSTRUMENTS

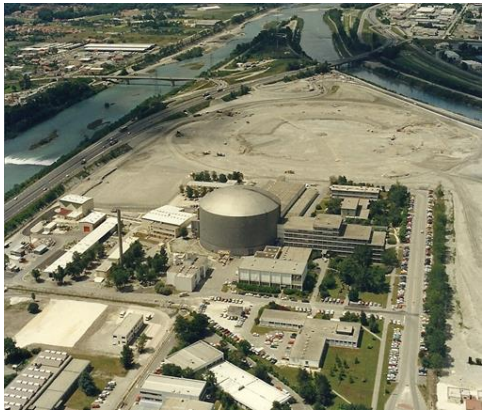


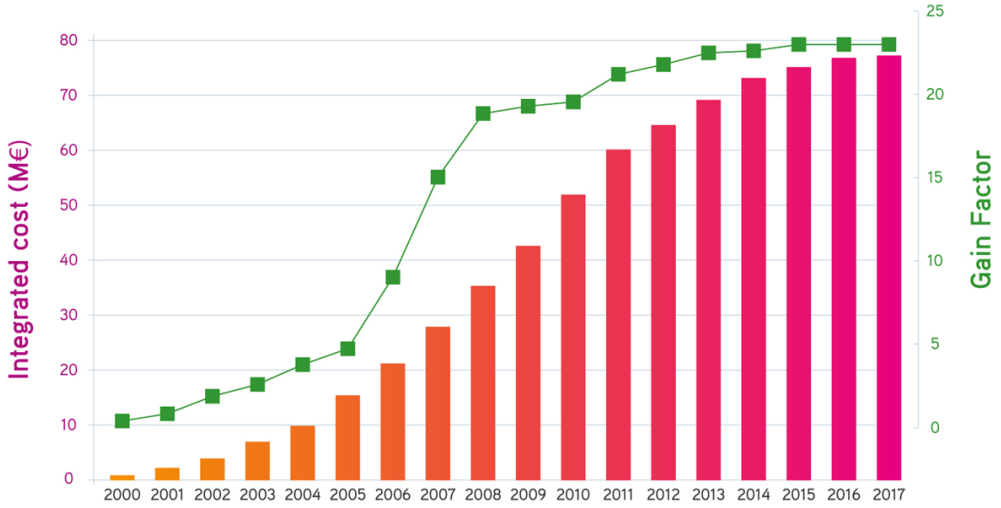
NEUTRONS FOR SOCIETY

Modernisation programmes

Continuous upgrade of our infrastructure and instruments







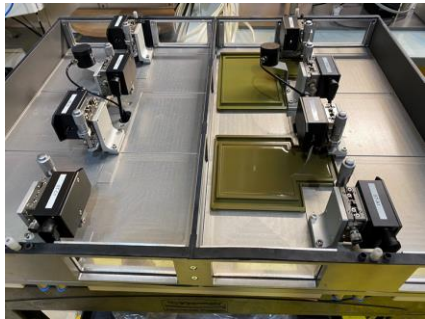
NEUTRONS FOR SOCIETY

Modernisation programmes - ENDURANCE

60 M€ : 2016 - 2023

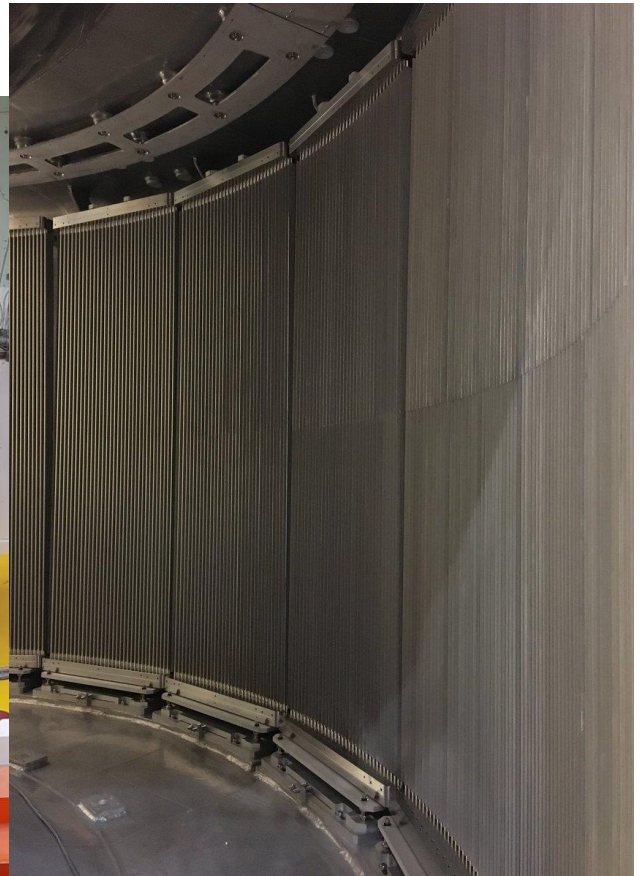
About 20 instruments, upgrades, infrastructure & technology delivered:

- (WASP +) FIPPS, PANTHER, SuperSUN, RAINBOWS, IN5+, D3-liquids, IN20 (NVS, graphite mono & analyser), DALI, D11-D22-D16 detectors, NESSE (sample env), BASTILLE (data treatment)
- *THERMES-IN8, SHARP, D17 (guide & choppers & data treatment software), D22 – SAXS/SANS, IN16-BATS, single crystal XD,…*



PANTHER – THERMAL NEUTRON TIME-OF-FLIGHT SPECTROMETER

- Replaces IN4
- 6x more flux
- 10x less background
- 5 choppers (installed in June)
- 3-He position-sensitive detector
- Single crystal capability
- Polarised neutron capability to come

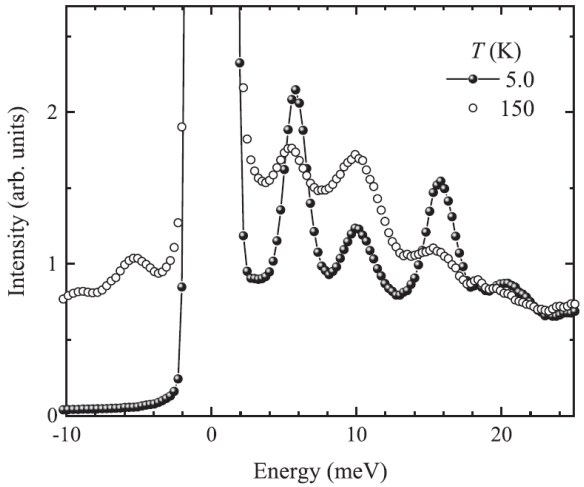


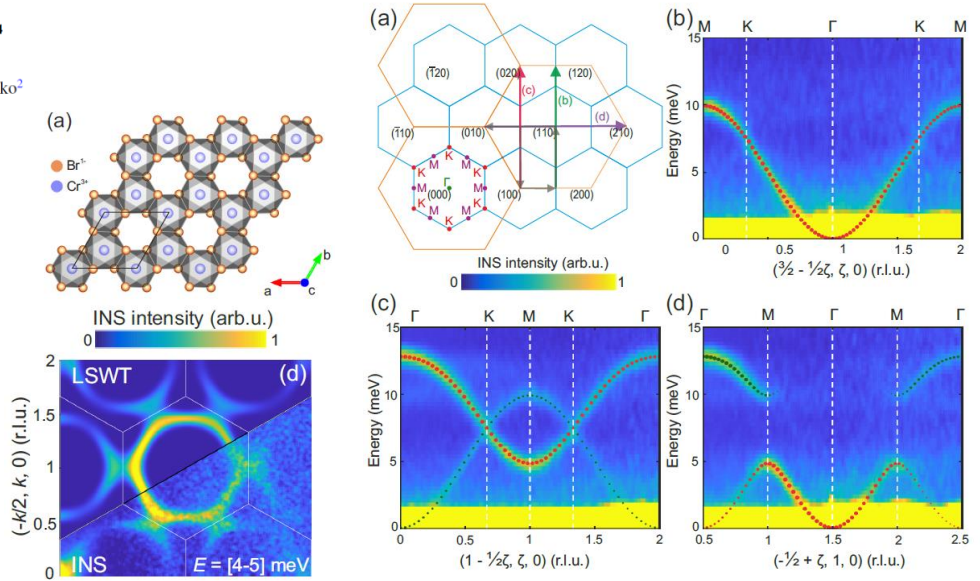
PANTHER – SCIENCE WITH POWDERS & SINGLE CRYSTALS

PHYSICAL REVIEW B **103**, 134433 (2021)

Magnetic structure and low-temperature properties of geometrically frustrated $SrNd_2O_4$

N. Qureshi,[1] A. R. Wildes,[1] C. Ritter,[1] B. Fåk,[1] S. X. M. Riberolles,[2,1] M. Ciomaga Hatnean,[2] and O. A. Petrenko[2]
[1]*Institut Laue-Langevin, 71 Avenue des Martyrs, CS 20156, 38042 Grenoble Cedex 9, France*
[2]*Department of Physics, University of Warwick, Coventry CV4 7AL, United Kingdom*





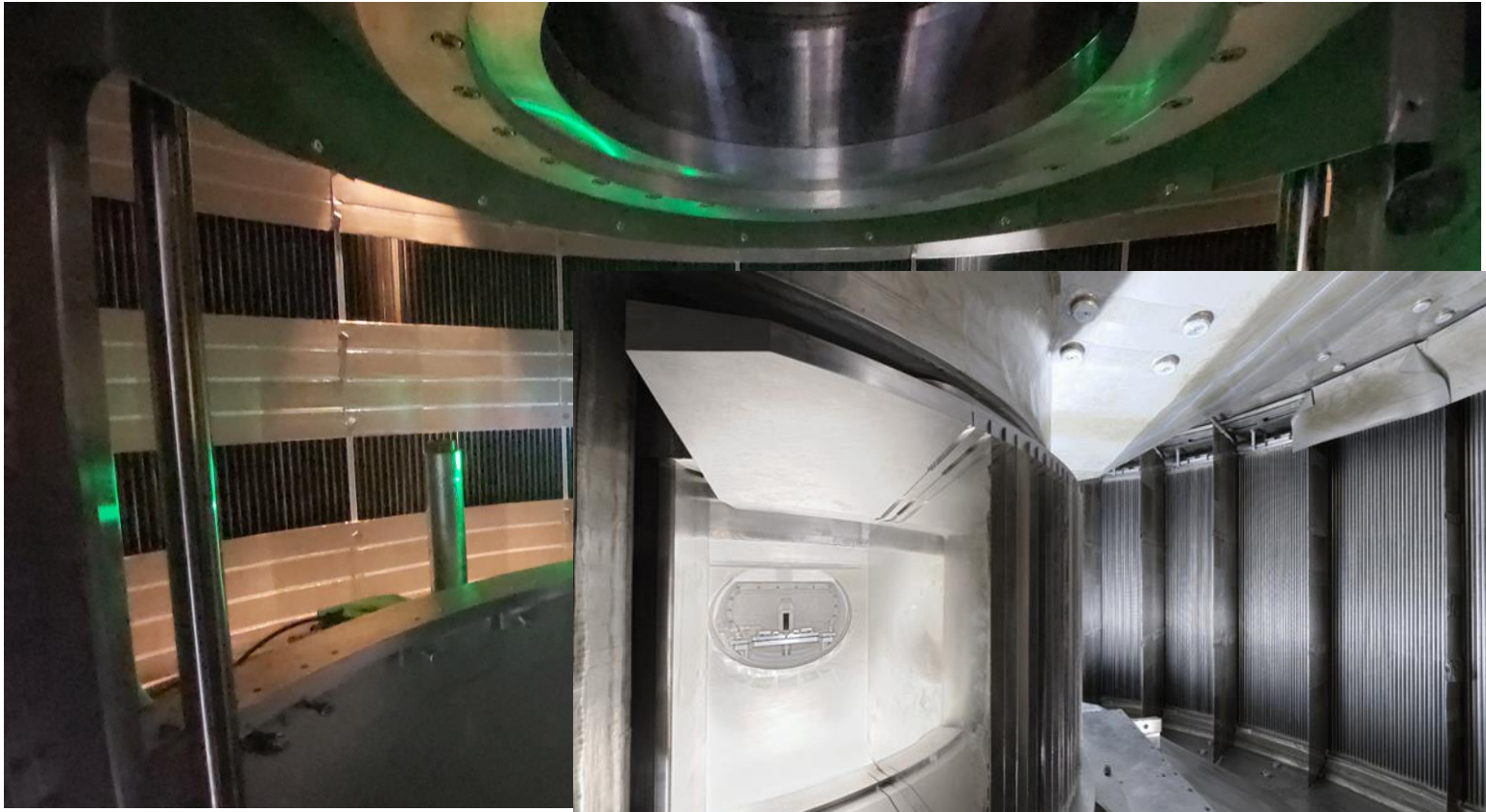
Thermal Evolution of Dirac Magnons in the Honeycomb Ferromagnet $CrBr_3$

S. E. Nikitin,[1,*] B. Fåk,[2] K. W. Krämer,[3] T. Fennell,[4] B. Normand,[5,6] A. M. Läuchli,[5,6] and Ch. Rüegg[1,6,7,8]
[1]*Quantum Criticality and Dynamics, Paul Scherrer Institute, CH-5232 Villigen-PSI, Switzerland*
[2]*Institut Laue-Langevin, 71 avenue des Martyrs, CS 20156, F-38042 Grenoble Cedex 9, France*

https://doi.org/10.1103/PhysRevLett.129.127201

SHARP (IN6 → LLB CRG) – new secondary spectrometer

- 3x bigger, 3-He position-sensitive detector
- All 3 TOF spectrometers now have PSD's



WASP – WIDE ANGLE SPIN ECHO SPECTROMETER

First pub

nature COMMUNICATIONS

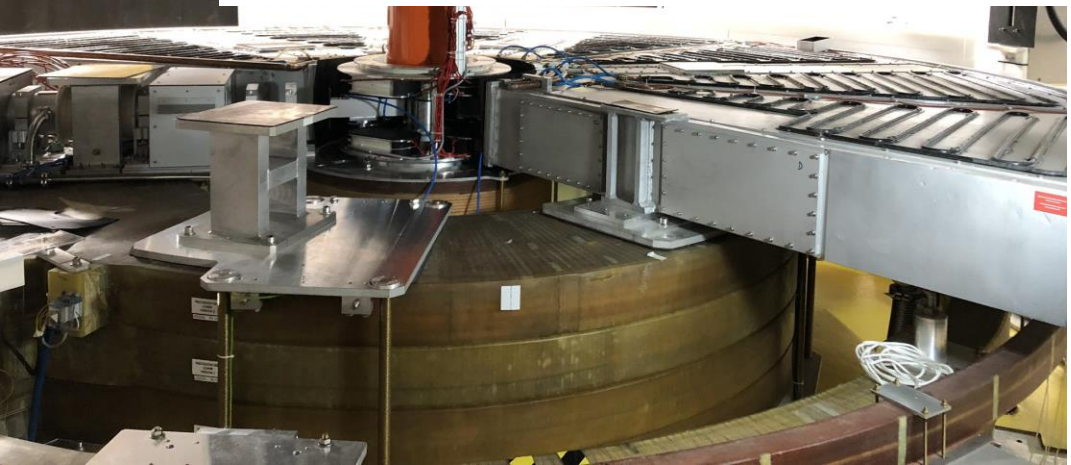
ARTICLE

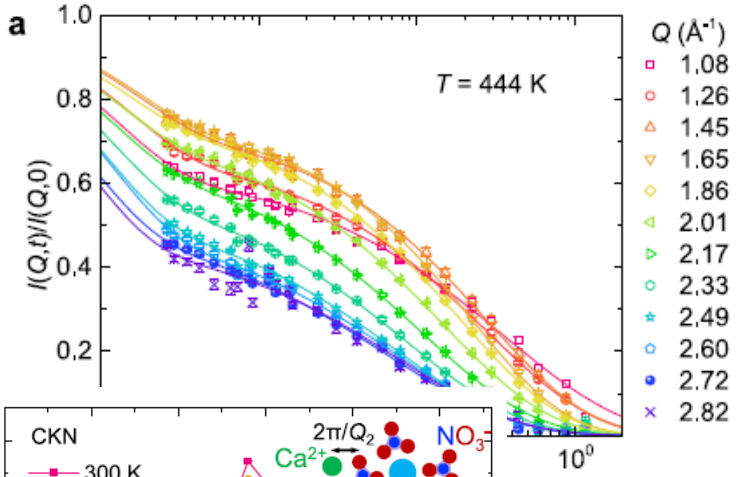
https://doi.org/10.1038/s41467-022-29778-4 OPEN

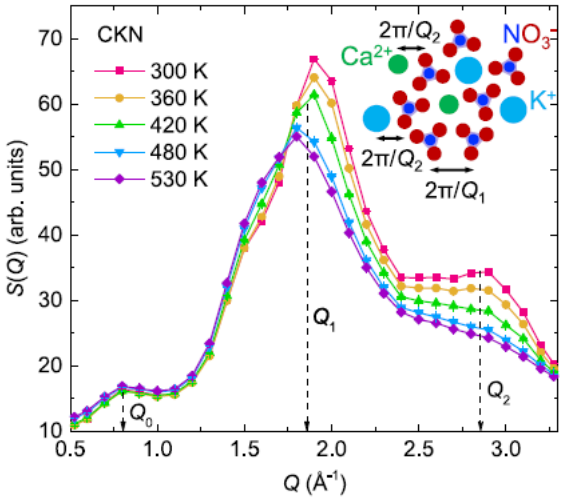
Check for updates

Q-dependent collective relaxation dynamics of glass-forming liquid $Ca_{0.4}K_{0.6}(NO_3)_{1.4}$ investigated by wide-angle neutron spin-echo

Peng Luo[1], Yanqin Zhai[1,2], Peter Falus[3], Victoria García Sakai[4], Monika Hartl[5], Maiko Kofu[6], Kenji Nakajima[6], Antonio Faraone[7]✉ & Y Z[1,2,8]✉





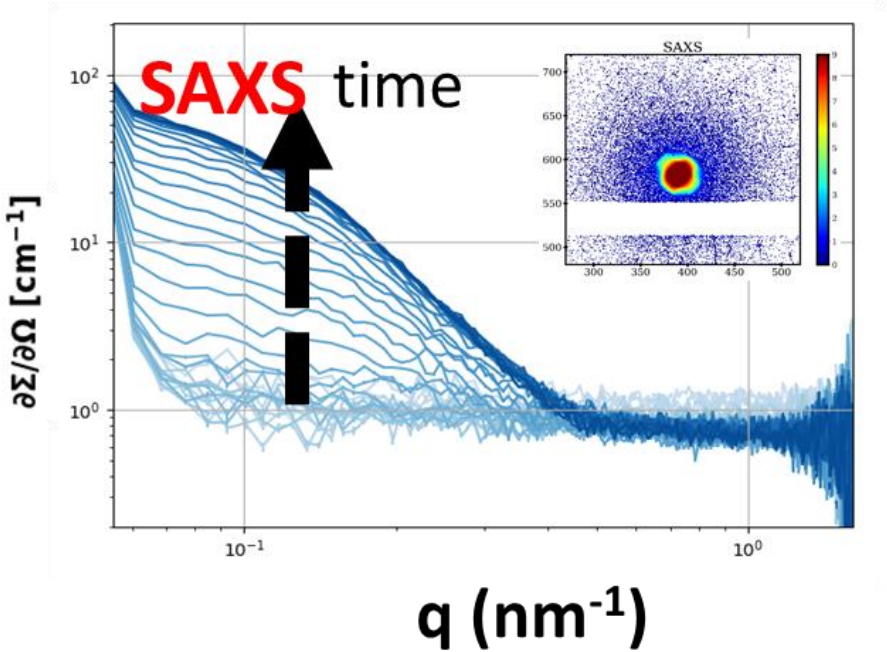


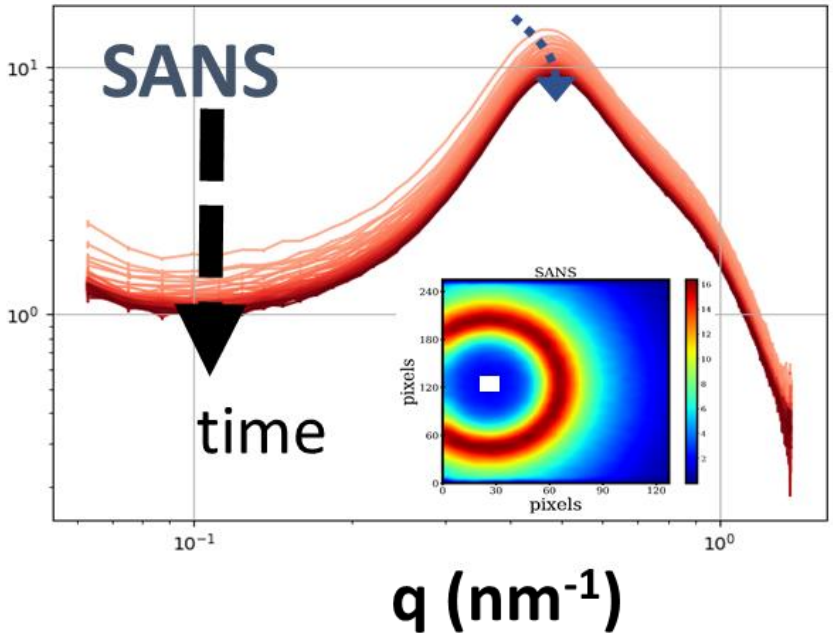
NEUTRONS FOR SOCIETY

In-situ SAXS on D22

In-situ SAXS/SANS

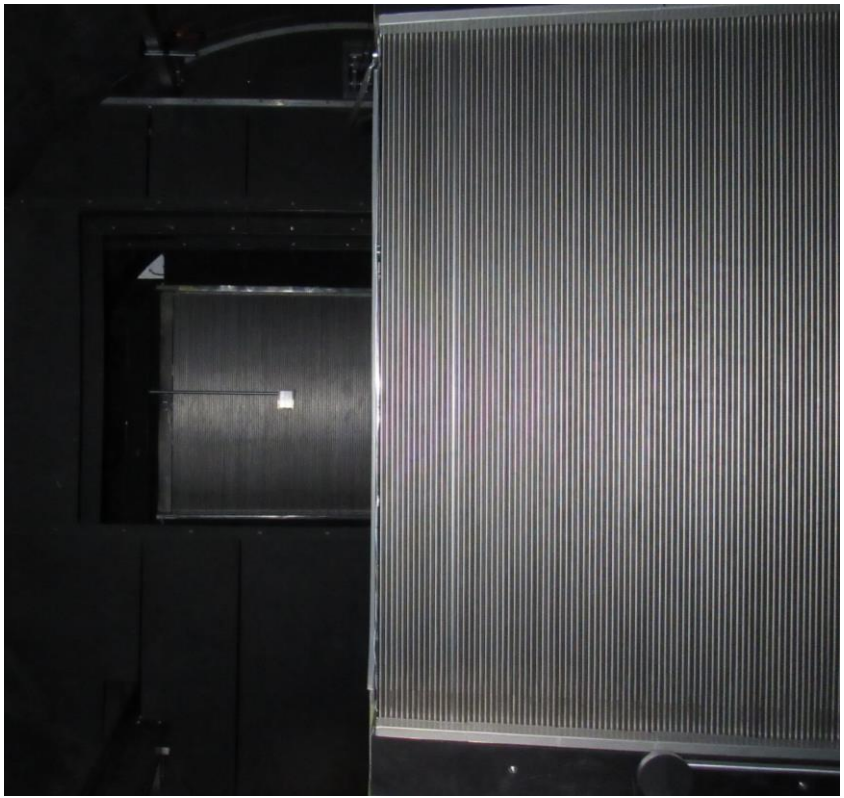
Watching gold nanoparticles grow: Journal of Applied Crystallography **2020,** 53 (3).





D22 – new wide-angle detector

Position-sensitive 3-He detector → 10x increase



You Retweeted

Deuteration @deuteration · 3 May

📢New paper alert ❗
"... mRNA-Containing Lipid Nanoparticles" @acsnano
🔗doi.org/10.1021/acsnan...

➡️Intl collab led by @MalmoUniversity & @AstraZeneca with @ILLGrenoble , @fz_juelich & @tugraz
🧪deuterated cholesterol by @ANSTO & @LSG_ILLGrenoble
🧪dMC3 by @AstraZeneca
#LNP #SANS

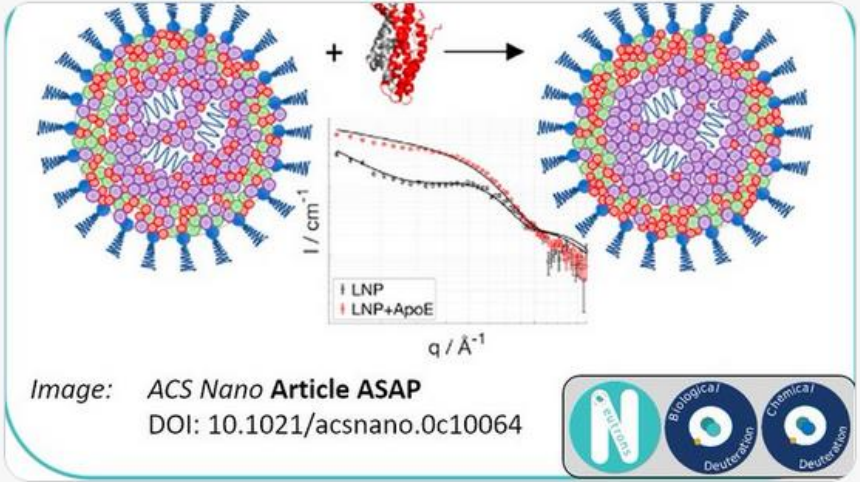


Image: *ACS Nano* **Article ASAP**
DOI: 10.1021/acsnano.0c10064

8 17

DALI – 2nd protein crystallography station

Instrument installed and commissioned: 3x brighter than LADI

DALI – 2nd protein crystallography station

npj | microgravity

www.nature.com/npjmgrav

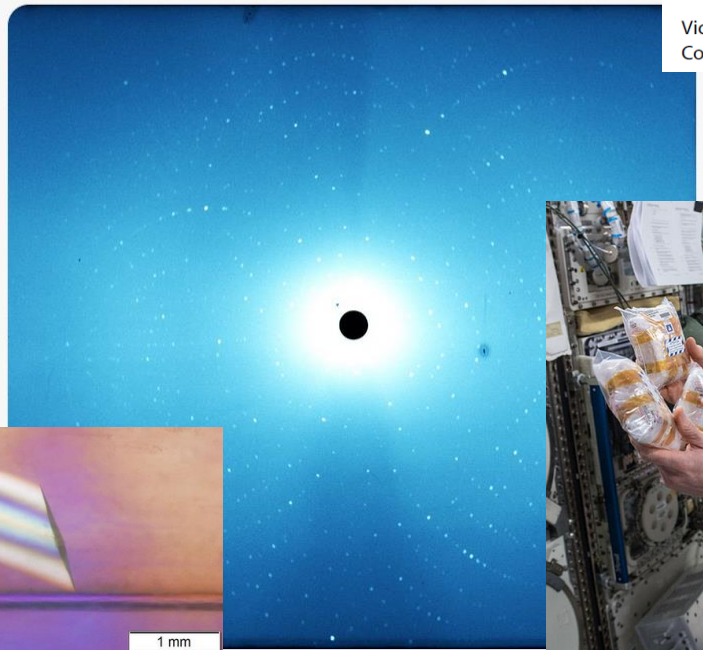
Matthew Blakeley

226 Tweets

Followin

Matthew Blakeley @drmpblakeley · 4 May

Microgravity crystallization of perdeuterated tryptophan synthase for neutron diffraction @ILLGrenoble @LSG_ILLGrenoble @ChemistryToledo @KovalevskyAY @vtforsyth @Nature_NPJ nature.com/articles/s4152...

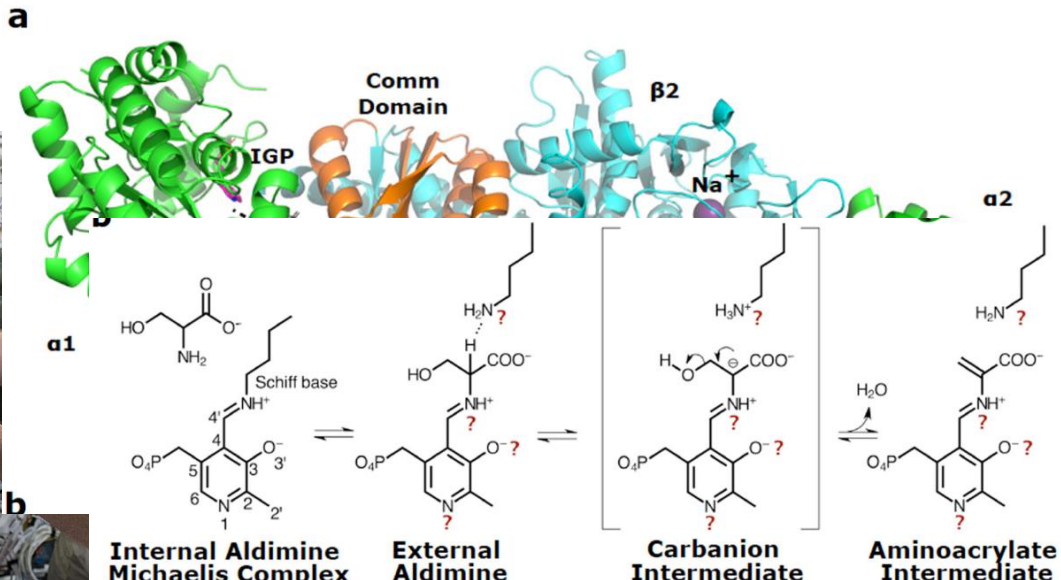


ARTICLE OPEN

Check for updates

Microgravity crystallization of perdeuterated tryptophan synthase for neutron diffraction

Victoria N. Drago[1], Juliette M. Devos[2,3], Matthew P. Blakeley[4], V. Trevor Forsyth[2,3,5,6], Andrey Y. Kovalevsky[7], Constance A. Schall[8] and Timothy C. Mueser[1]✉



Imaging: D50/NEXT (UGA + HZB)

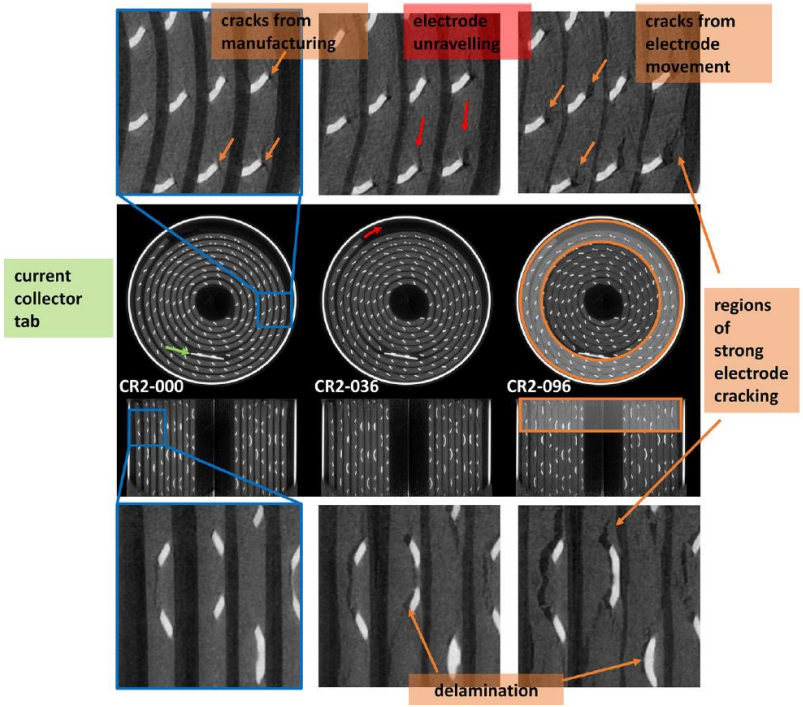
Imaging: perfect application for most intense, continuous, white beams

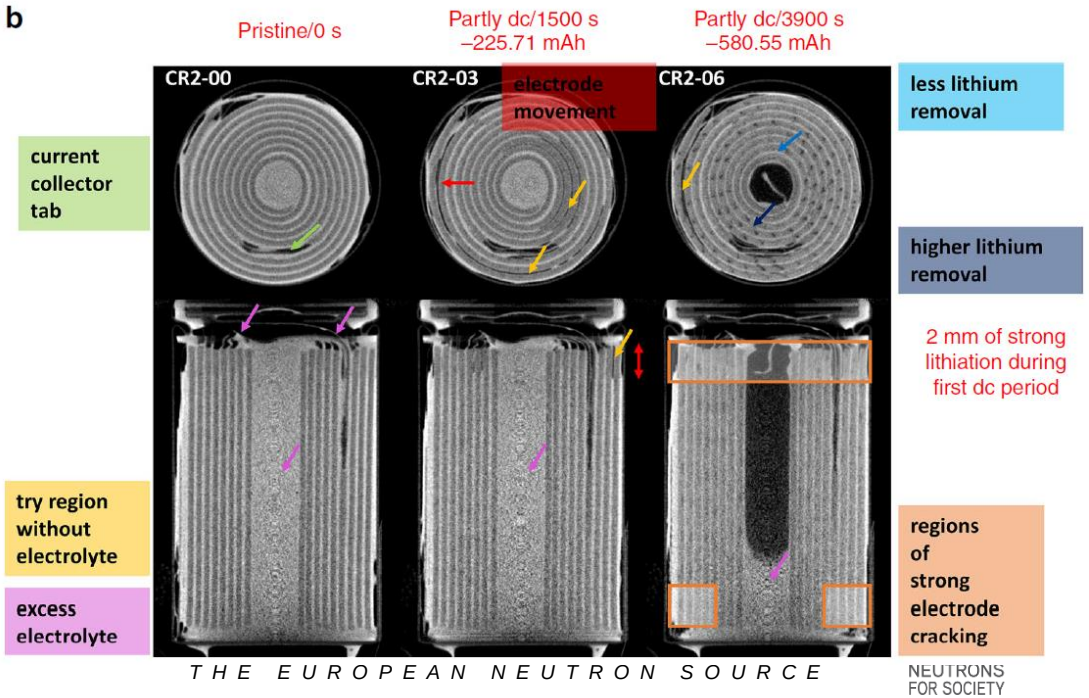
Achievements/specification:

- ~1 *micron* resolution
- 1 *ms* images
- 1 *s* tomography
- simultaneous N+X with ~10 micron resolution (~85% of experiments)

Imaging for clean energy

Fuel cells & Li-ion batteries - NATURE COMM | https://doi.org/10.1038/s41467-019-13943-3



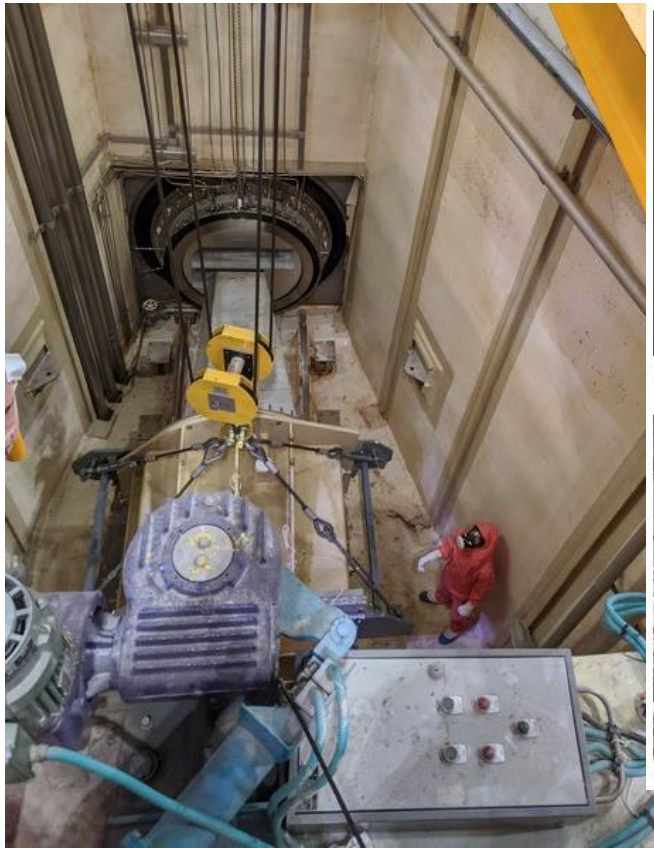


SHUTDOWN 2022

Major maintenance and upgrades – H1-H2 beam tube

SHUTDOWN 2022

See https://www.ill.eu/users/instruments/modernisation-programmes/ill2023



Replacement of the H1H2 Beam tube - long version - 2022

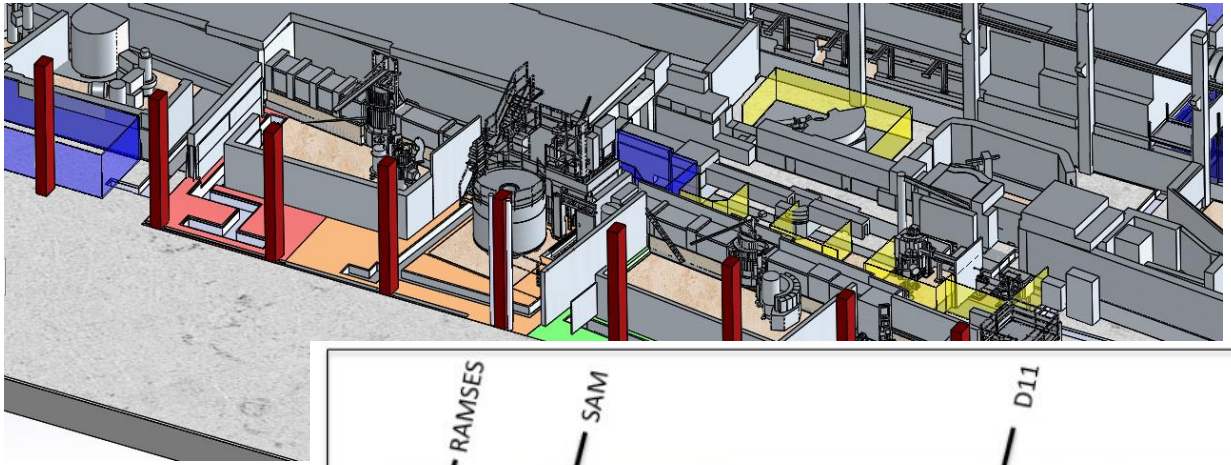
Replacement of the H1H2 Beam tube - short video

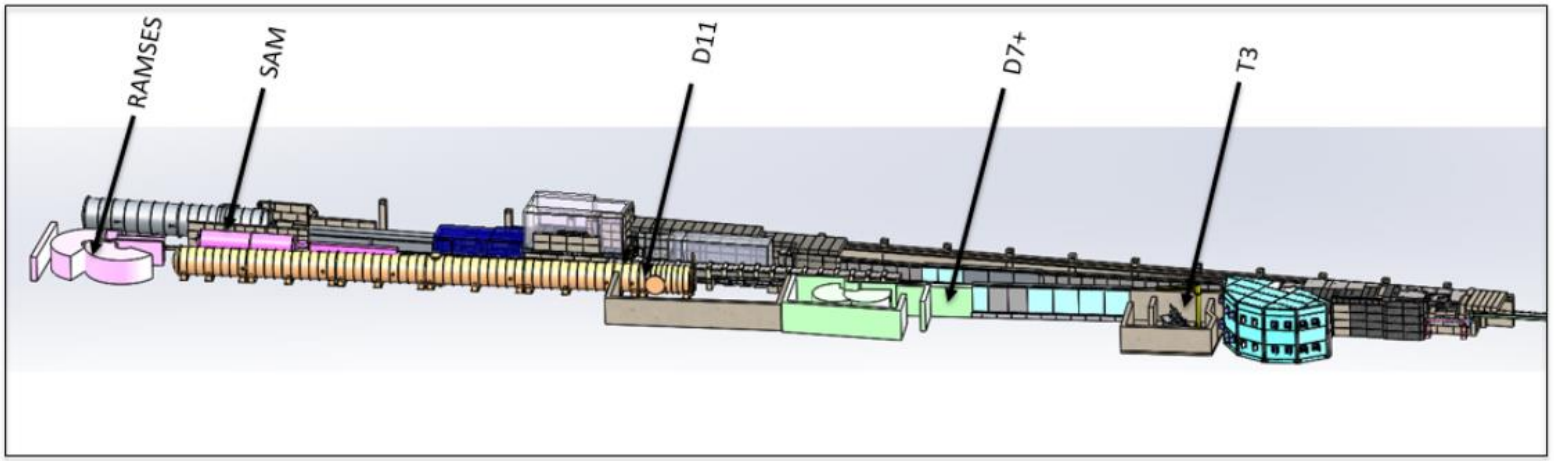
Turning over the H1-H2 beam tube

DrE H1-H2 - divers in the pool

SHUTDOWN 2022

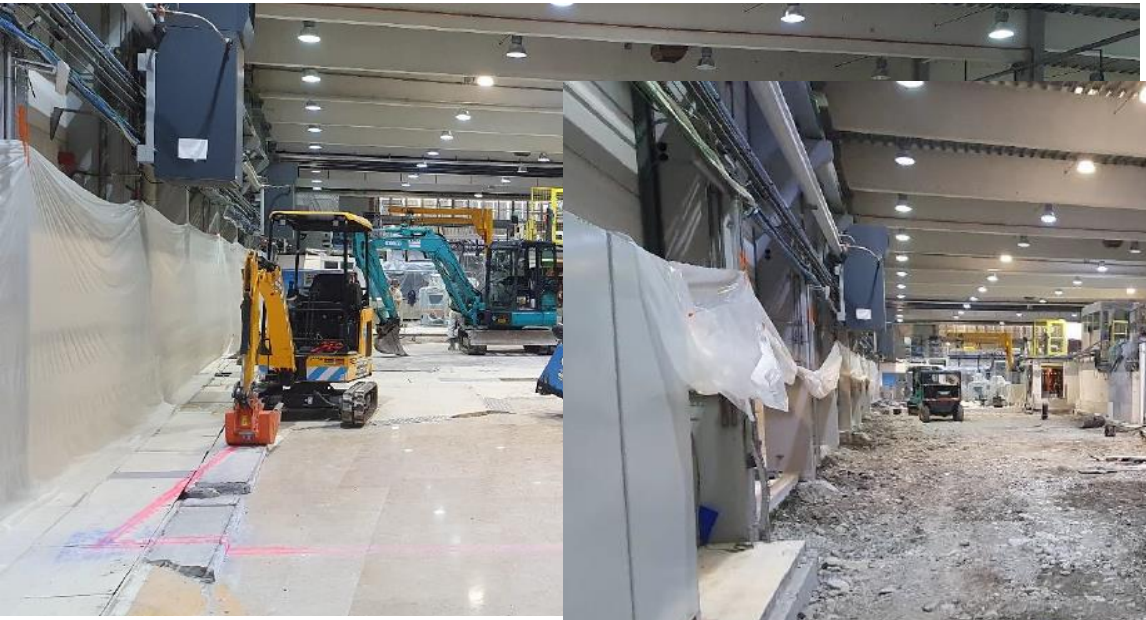
Major maintenance and upgrades – thermal & cold guides + 7 instruments (**H24**: D10+ *(dif)*, IN13+ *(spec)*, XtremeD *(dif)* & **H15**: D007 *(dif)*, D11 *(sans)*, SAM *(sans)*, RAMSES *(spec)* & **MARMOT & D20 &…**





SHUTDOWN 2022

H24 - Preparing the ground: November - December 2021



SHUTDOWN 2022

H24 – Almost ready to install new instruments e.g. D10+, **IN13 (June → this week)**

SHUTDOWN 2022

H15 on the Vercors side of the instrument hall – work everywhere!!!

CONCLUSION – THE NEXT DECADE

- Building on an exceptional year for science in 2021…
- A safe, secure and sustainable reactor through the next decade and beyond
- Endurance upgrade programme (~30 projects) → state-of-the-art facility for science and innovation
- Science programme restarts January 2023 → 160 – 170 neutron days/year

In 2021

176 days of neutrons

5506 instrument days

1435 experiments

1413 user visits

568 publications

2024 – 2033: ILL Associates & Scientific Members

Signature of 6th protocol (UK, FR, D): 15th September 2021

Ďakujem za tvoju pozornosť

INSTITUT LAUE LANGEVIN

NEUTRONS FOR SOCIETY