MAGiC First Science

October 2025

Current proposals/ideas

- RE ferrites like YFe_2O_4 (CO and magnetism) (Manuel Angst)
- Altermagnets, MnF_2?! (Manuel Angst)
- Spin liquids, octupolar correl. $CeSn_2O_7$ like (Romain Sibille)
- Frustrated magnets $GeNi_2O_4$ (Denis Vasiukov)
- Rock salt structure oxides for *hot commissioning* (Werner Schweika)
- Skyrmions?!

Dedicated MAGiC First Science workshop after BoT

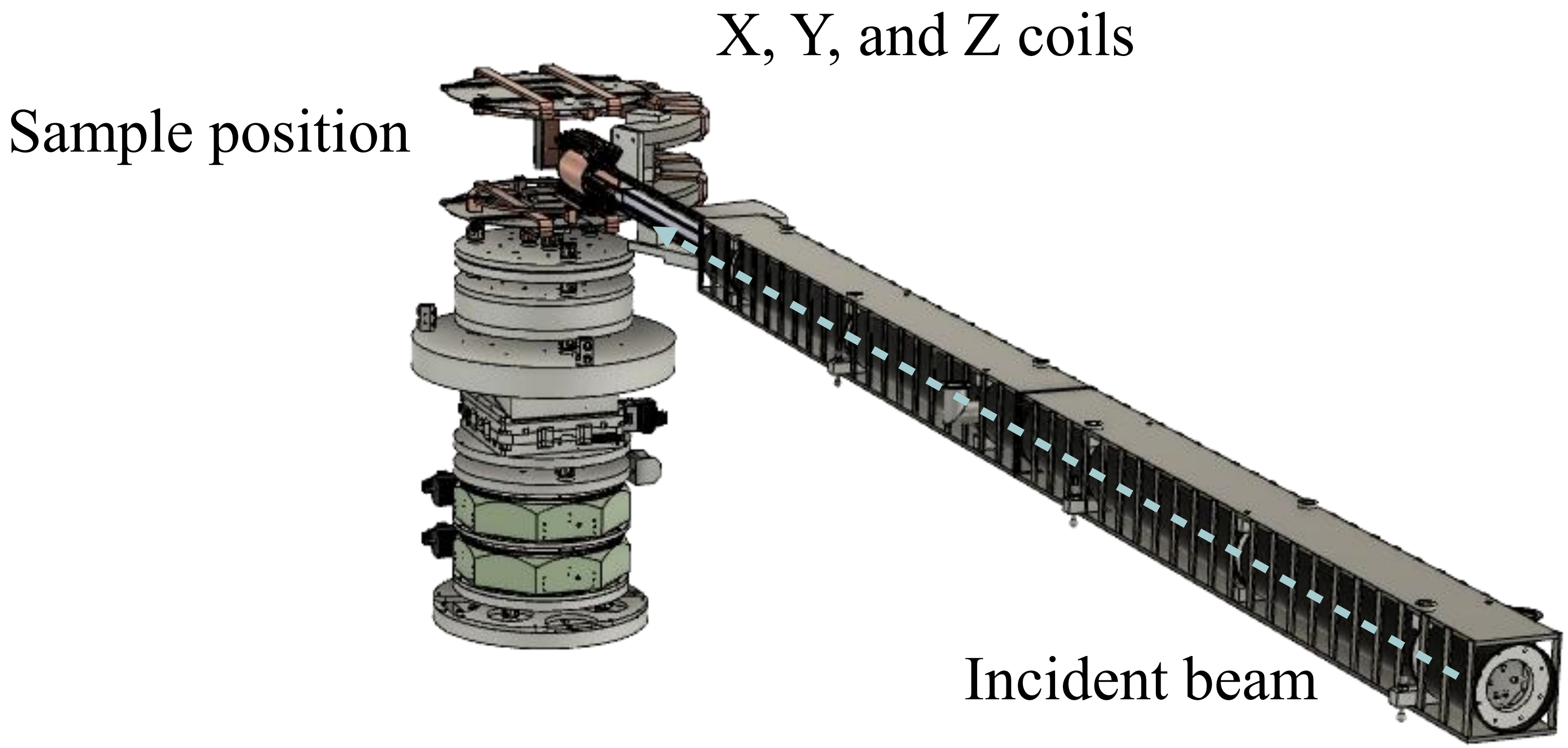
MAGiC Specification

TABLE I. Instrument parameters.

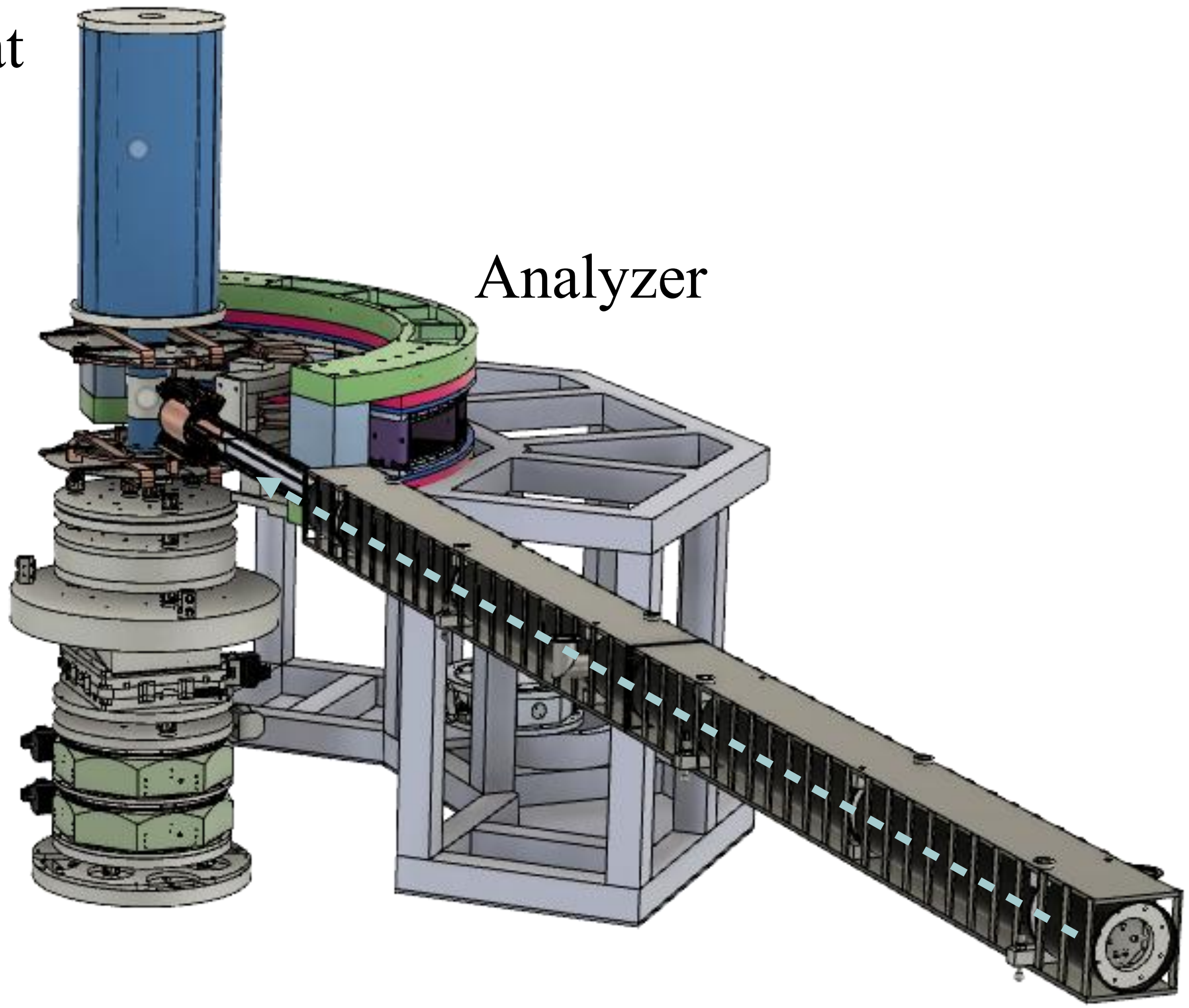
Neutron beam	
Wavelength Range	0.6 – 6 Å
Bandwidth	1.7 Å
Beam spot size	5×5 mm^2
Beam divergence	$\pm 0.3°$

Detector A		Analyzer + Detector B	
Spectrum	cold/thermal neutrons	Spectrum	$\lambda > 2$ Å ($>$ 1.6 Å?!)
Sample environment	Cryostat, Cryomagnet	Sample environment	Cryostat
Temperature range	50 mK – RT	Temperature range	50 mK – RT
Magnetic field	vertical, 0 – 8 T	Magnetic field	none
Acceptance TG5 scope	$60°$ (H) $\times$ $48°$ (V)	Acceptance	$120°$ (H) $\times$ $6°$ (V)
Acceptance full scope	$120°$ (H) $\times$ $48°$ (V)	Horizontal 2θ coverage	$\approx 5° - 160°$
Horizontal 2θ coverage	$\approx 10° - 170°$		

Polarisation Analysis Setup

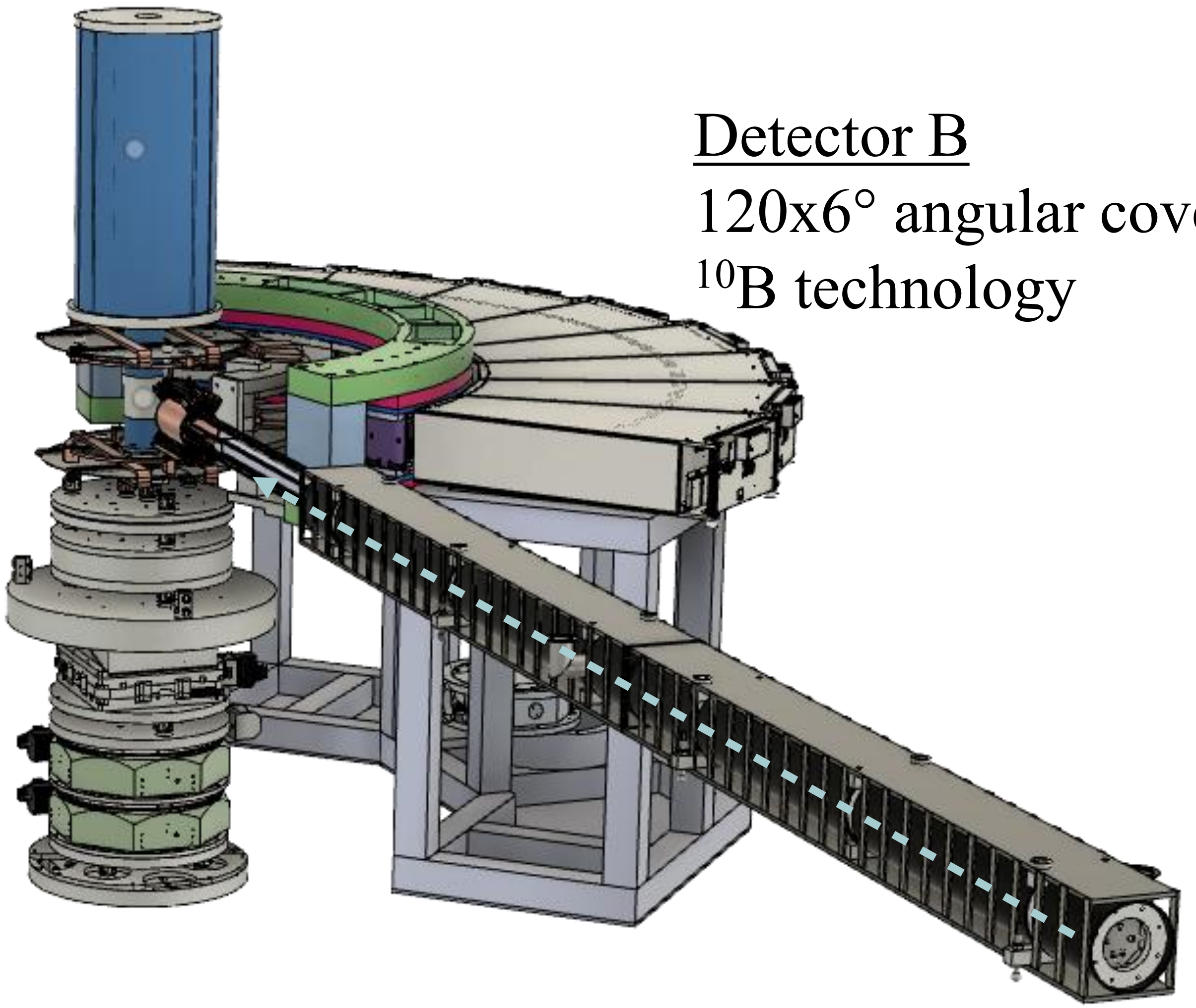


Polarisation Analysis Setup



EUROPEAN SPALLATION SOURCE

Polarisation Analysis Setup



<u>Detector B</u>

120x6° angular coverage

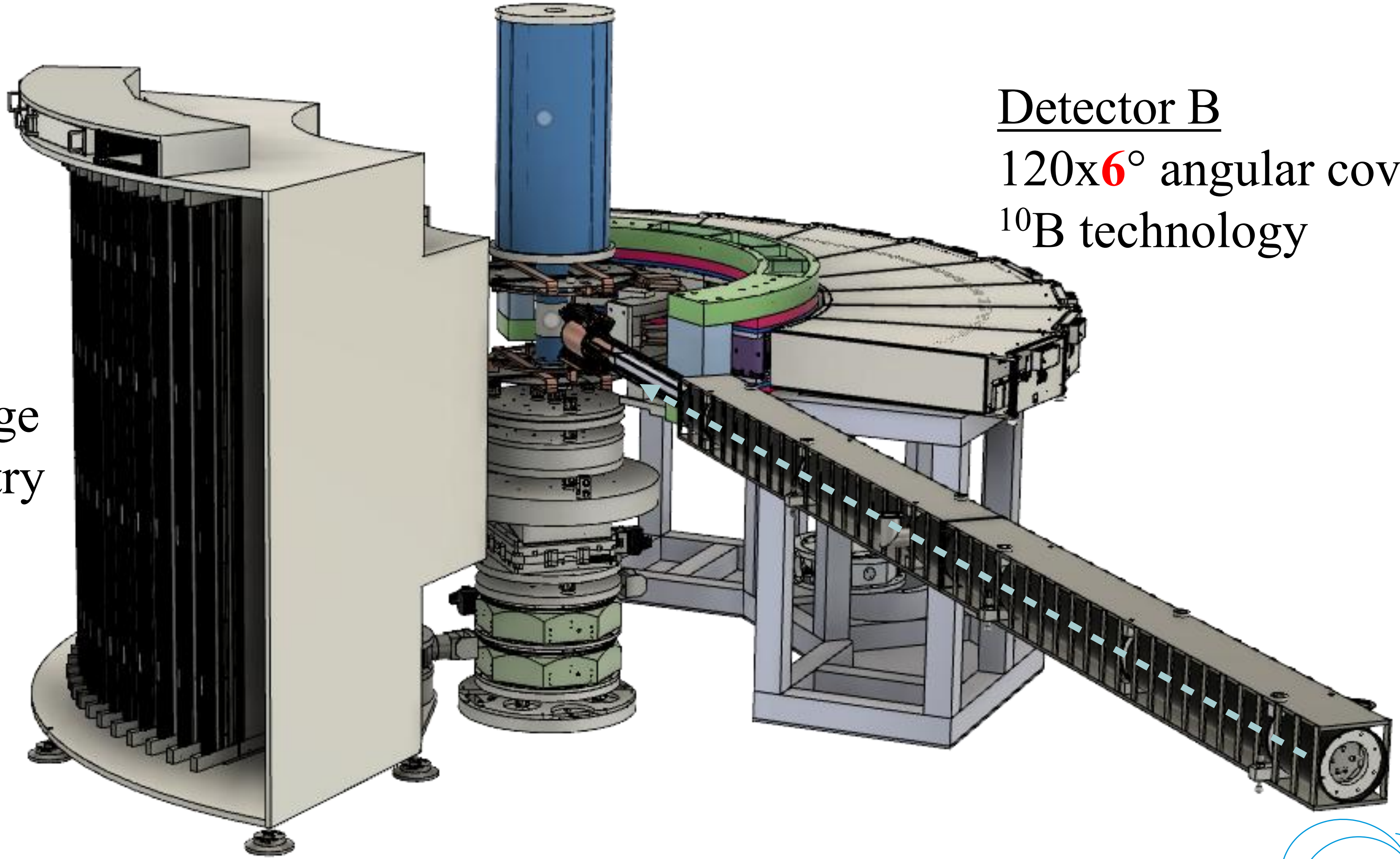
^{10}B technology

Full Polarisation Analysis Setup (Day 1 Scope)

Detector A

60x**48**° ang. coverage

^{10}B inclined geometry



Detector B

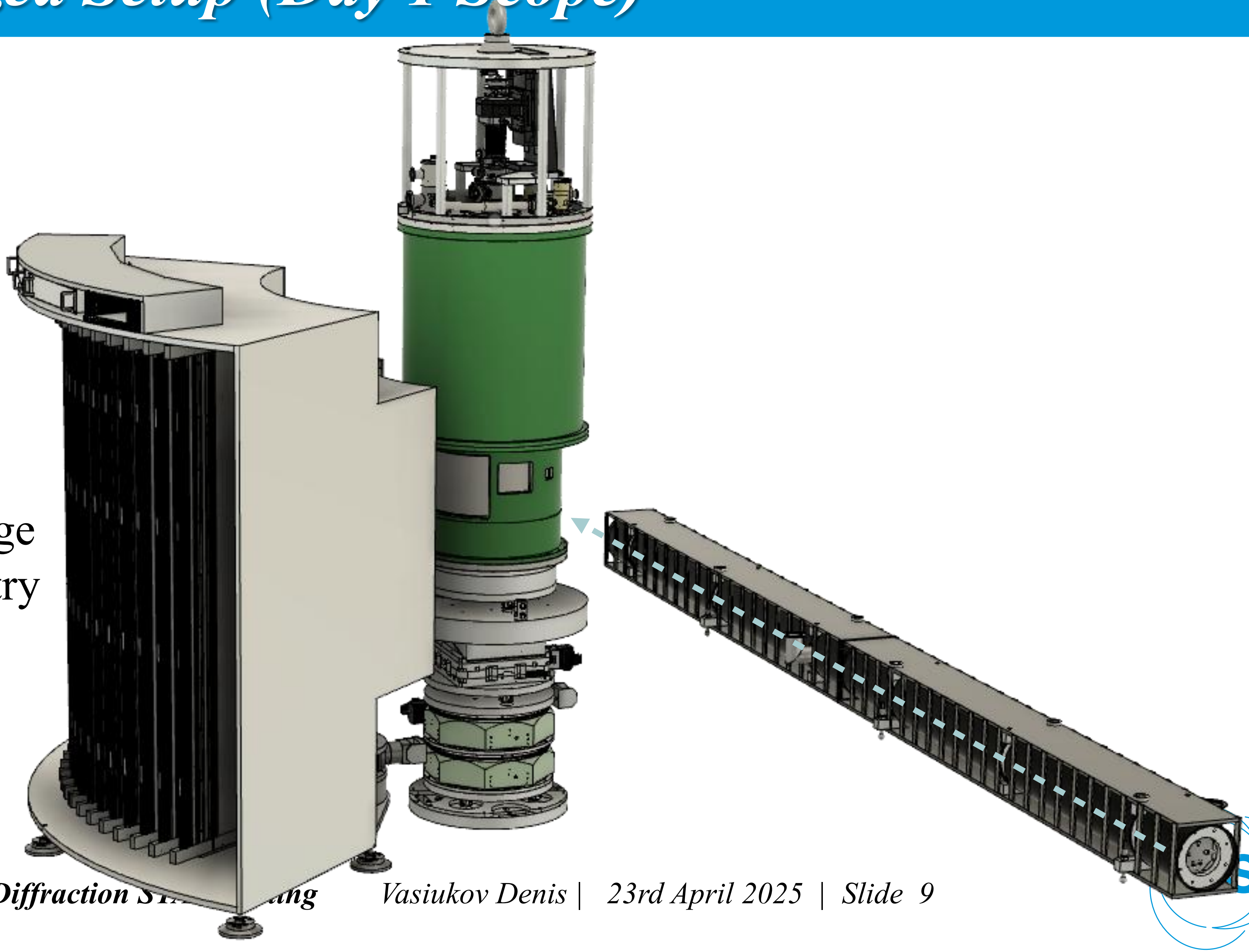
120x**6**° angular coverage

^{10}B technology

Half-polarized Setup

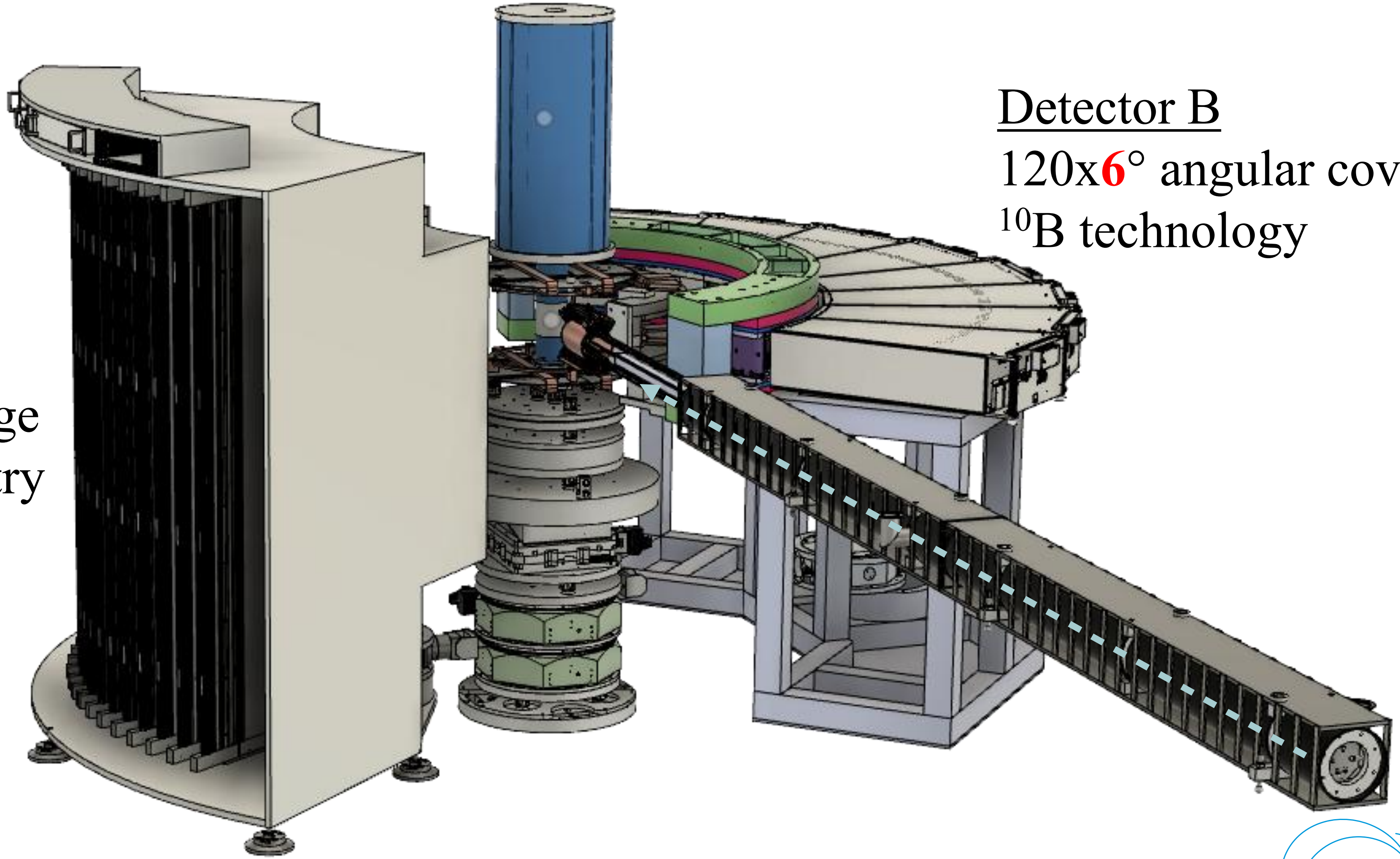
<u>8T vertical cryomagnet</u>
135x40° angular aperture

Half-polarized Setup (Day 1 Scope)



<u>Detector A</u>
60x48° ang. coverage
^{10}B inclined geometry

Full Polarisation Analysis Setup (Day 1 Scope)



Detector A

60x**48**° ang. coverage

^{10}B inclined geometry

Detector B

120x**6**° angular coverage

^{10}B technology

Experimental techniques at MAGiC

- **Magnetic** and crystal structure determination
- Half-polarized setup
  - Spin density
  - Magnetic form factor
  - Local magnetic susceptibility
- XYZ polarization analysis setup (analyzer coverage)
  - Diffuse magnetic scattering
- Spherical polarimetry option

Better to split the HC/First Science to several different runs depending on technique/hardware

Upgrades

I. Goniometric stick 100 – 300 k€

access to 3D reciprocal space instead of 2D plane in a single exp.

normal cryostat stick, dilution stick, new cryostat

Urgent / start now– need of an assigned person

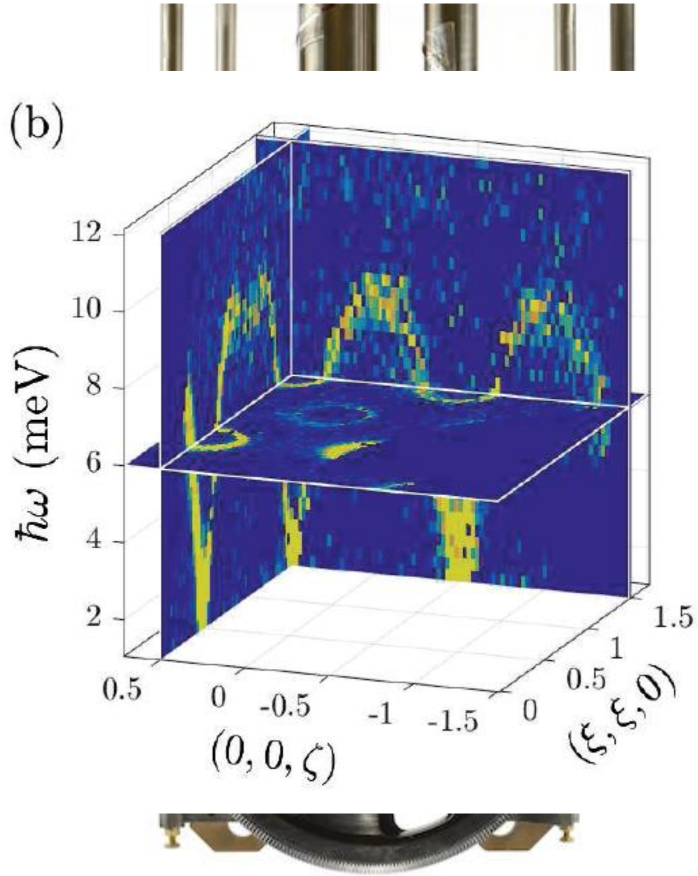
IV. Chopper 300 k€

timeline is 2 years after budget allocation

inelastic/quasielastic scattering option

V. Detector A full scope ~2 M€

timeline after DREAM and HEIMDAL > 3 y
new support and radial collimator



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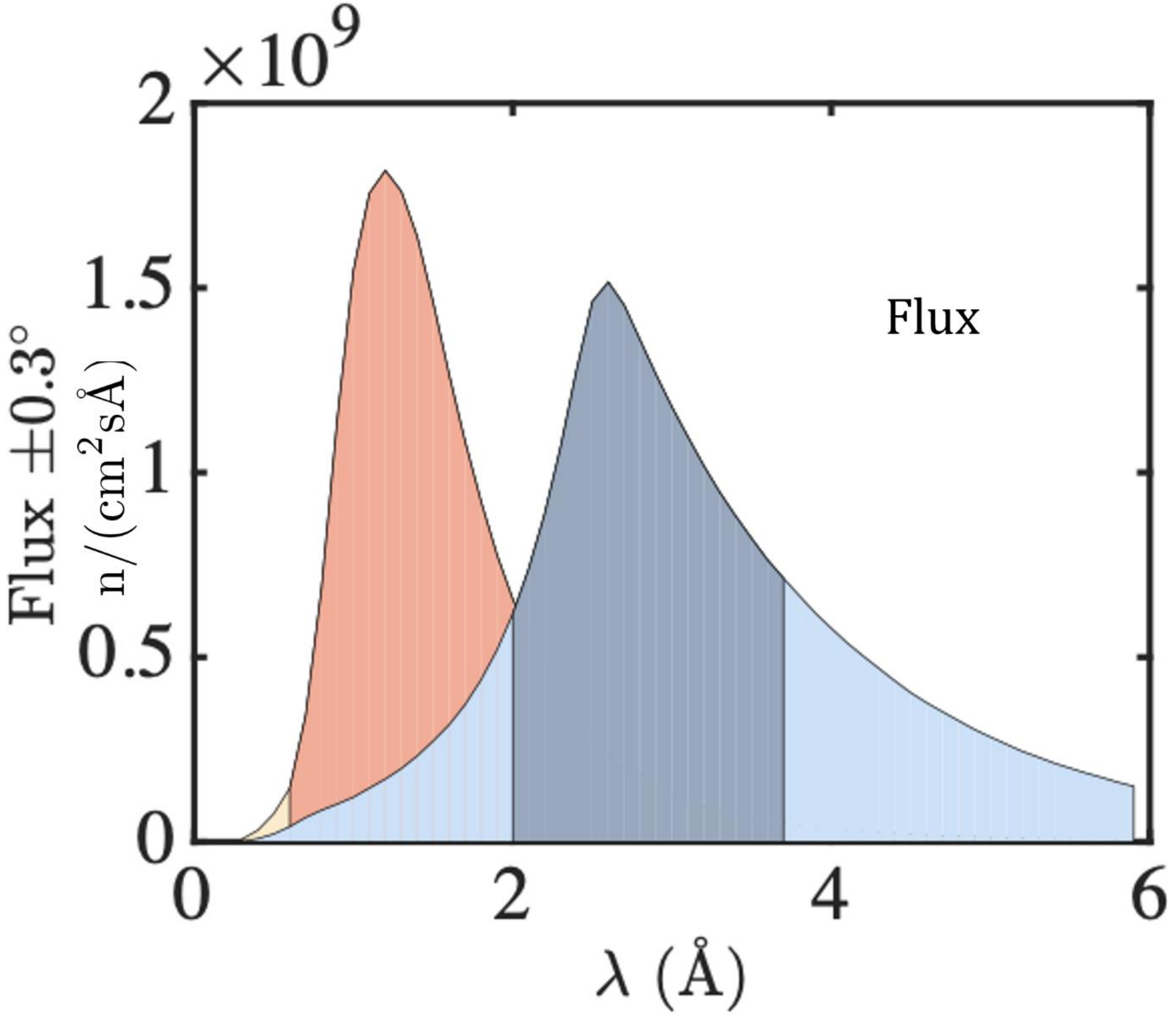
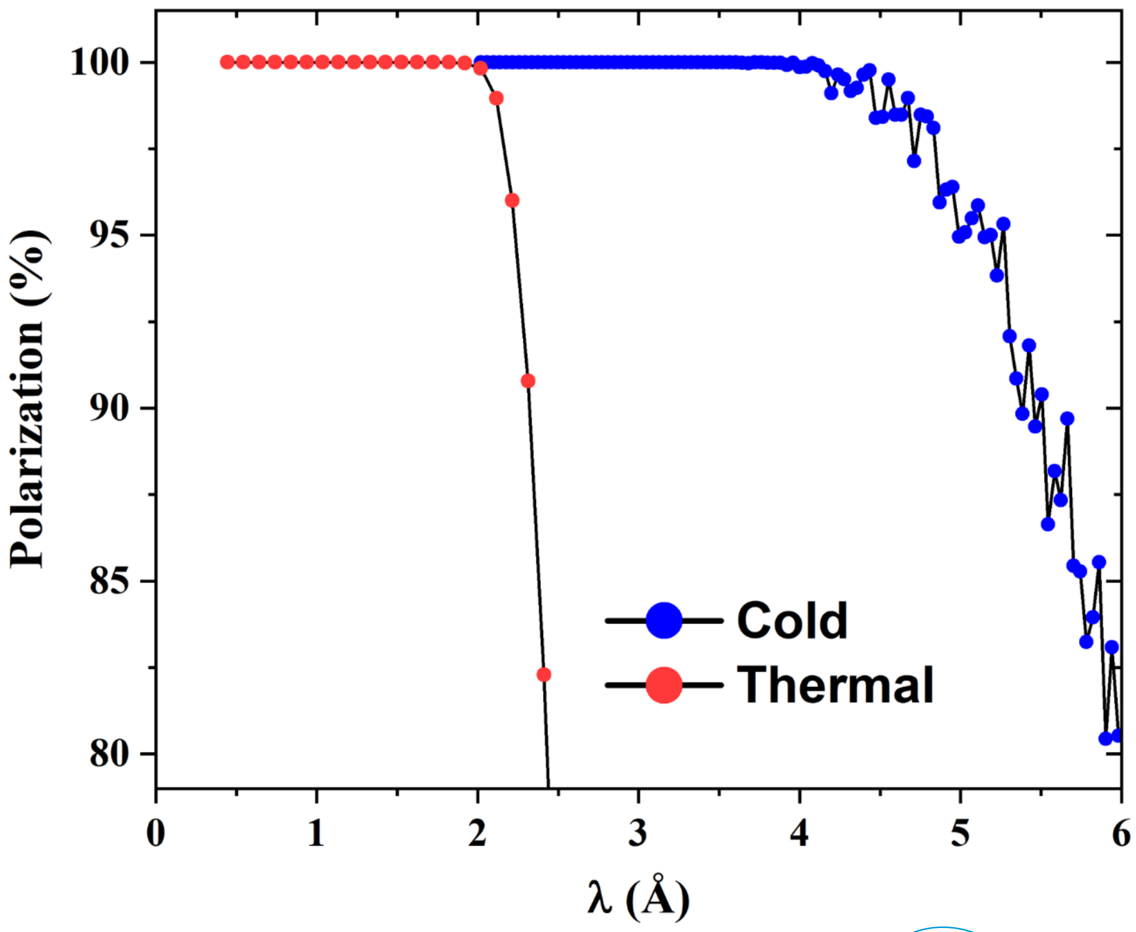
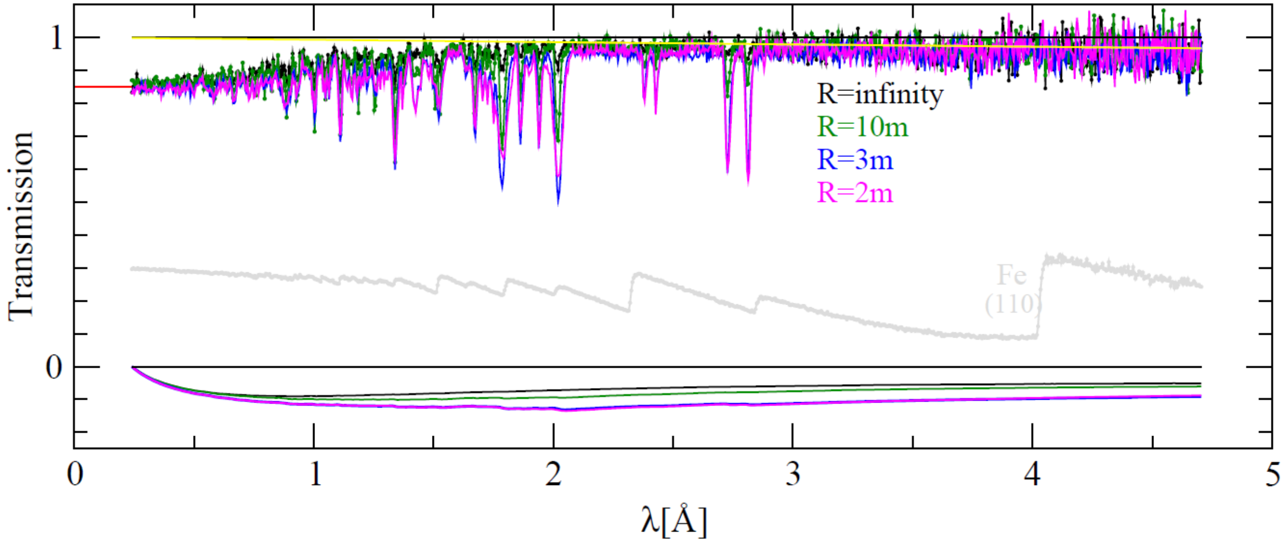
Moderator spectrum and neutron polarization

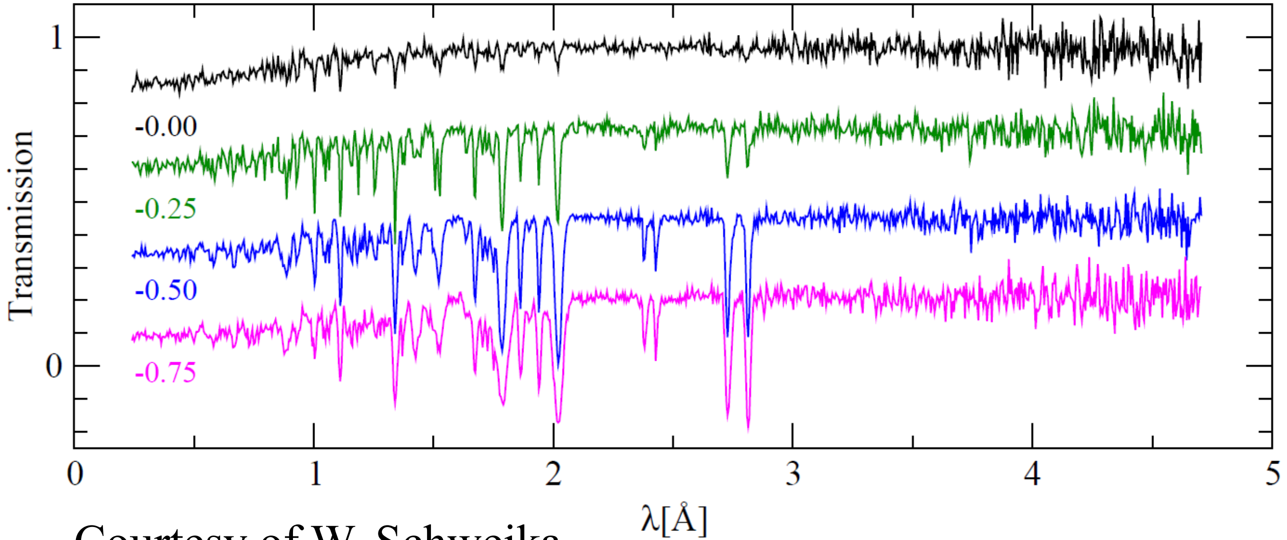




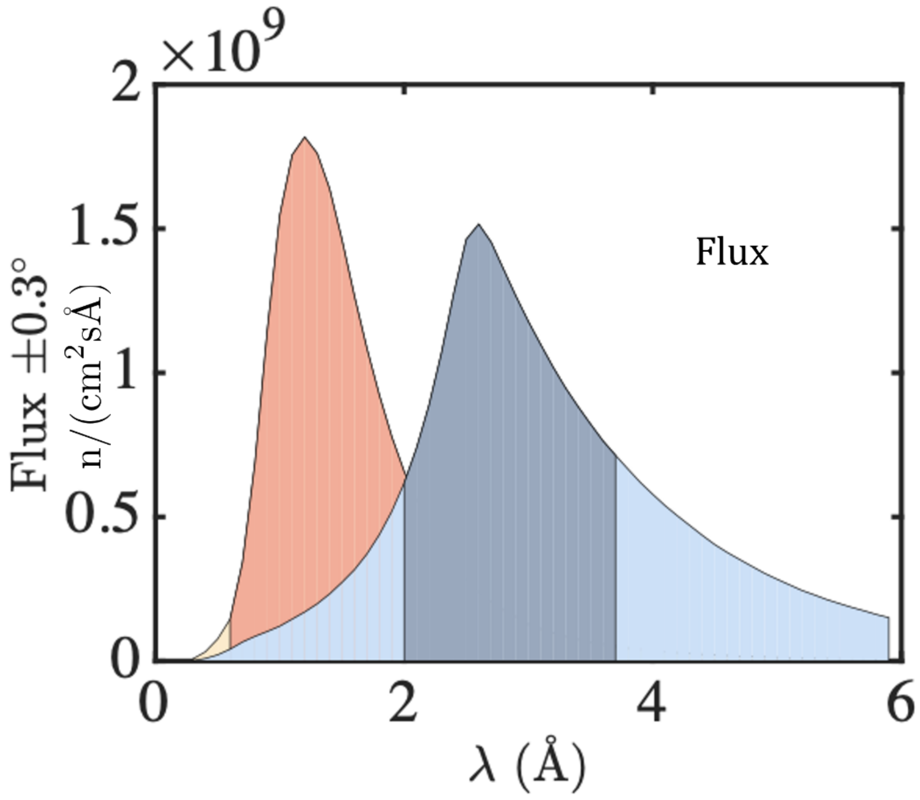
EUROPEAN SPALLATION SOURCE

Neutron transmission of bent silicon wafers





Courtesy of W. Schweika

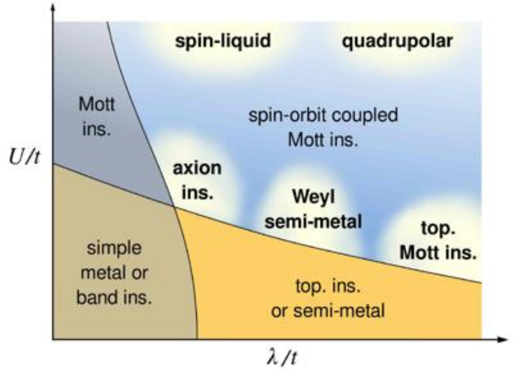


Science case, MAGiC proposal (2015)

- Strong electron correlations (Hubbard model, nickelates, iridates etc.)
- Superconductors (weak magnetic scattering in organic and heavy-fermion superconductors, Varma state in cuprates etc.)
- Frustrated magnetism
- Multiferroics
- Thin films & heterostructures
- Skyrmions

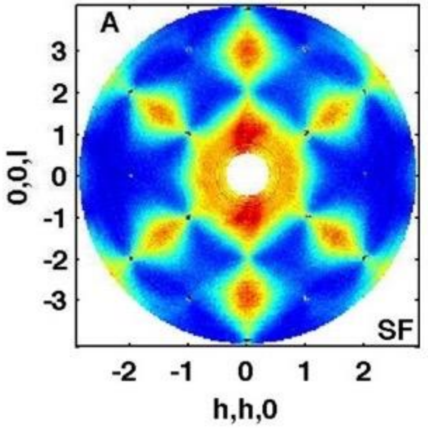
Science case, MAGiC proposal (2015)

Strong electron corr.



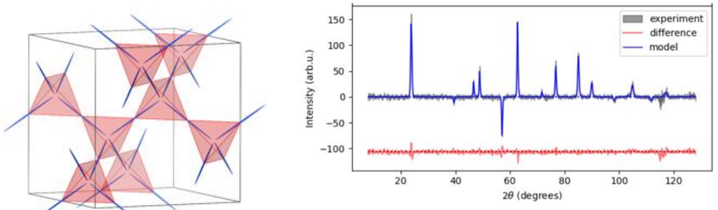
W. Witczak-Krempa et al.,
Annu. Rev. Condens. Matter Phys. (2014)

Frustrated magnetism



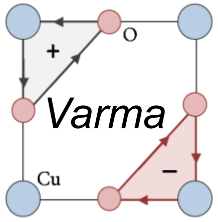
Fennell et al., Science (2009)

spin anisotropies *from powders*

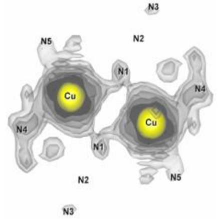


Kibalin & Gukasov PRB (2019)

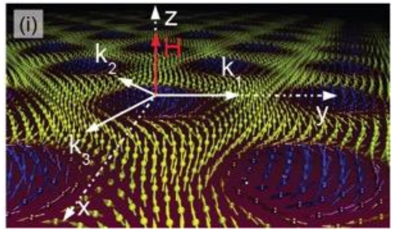
Superconductivity



Molecular magnets Spin densities



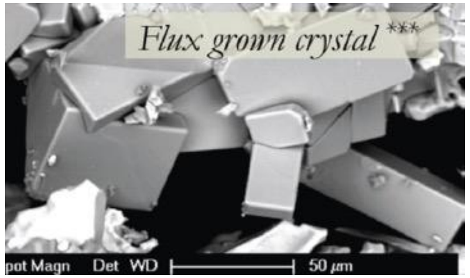
Skyrmions



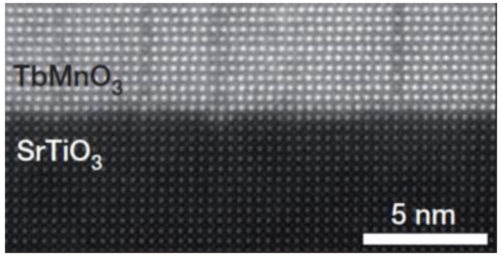
Jonietz et al. Science 2010

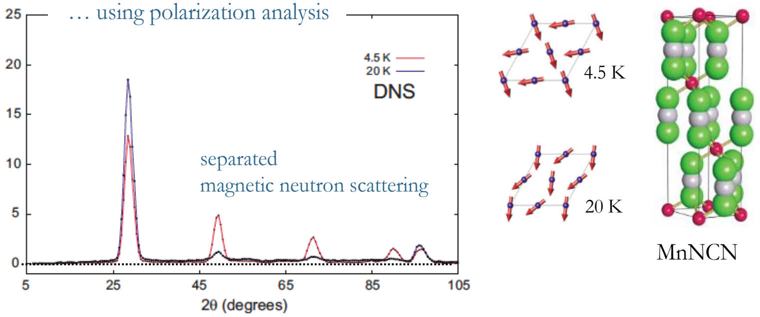
Weak magnetic scattering

small crystals



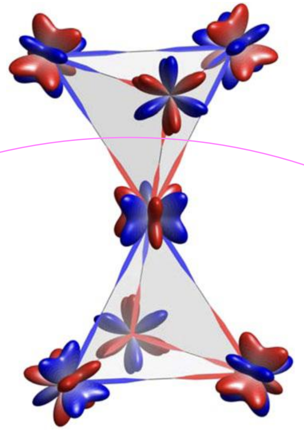
Thin films and heterostructures

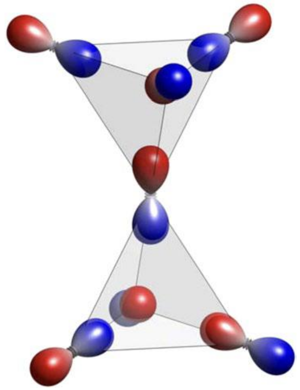




background suppression (nucl, magn, inc)

Frustrated magnetism: Mutlipolar correlations and chiral SL



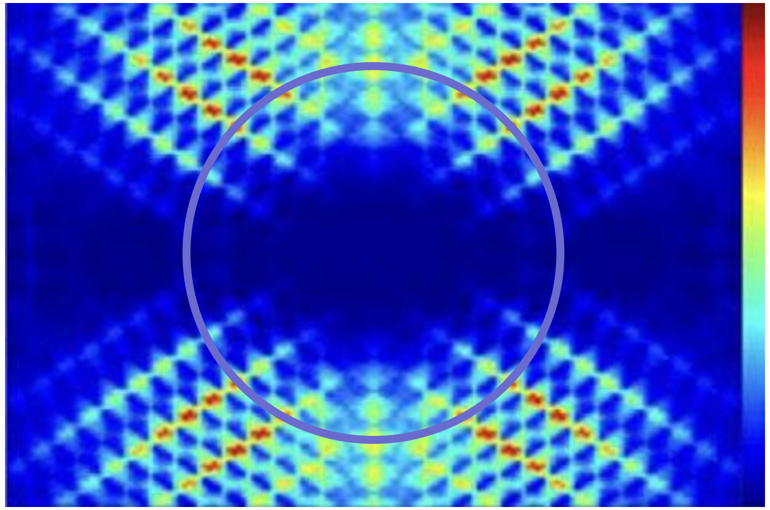


A quantum liquid of magnetic octupoles on the pyrochlore lattice

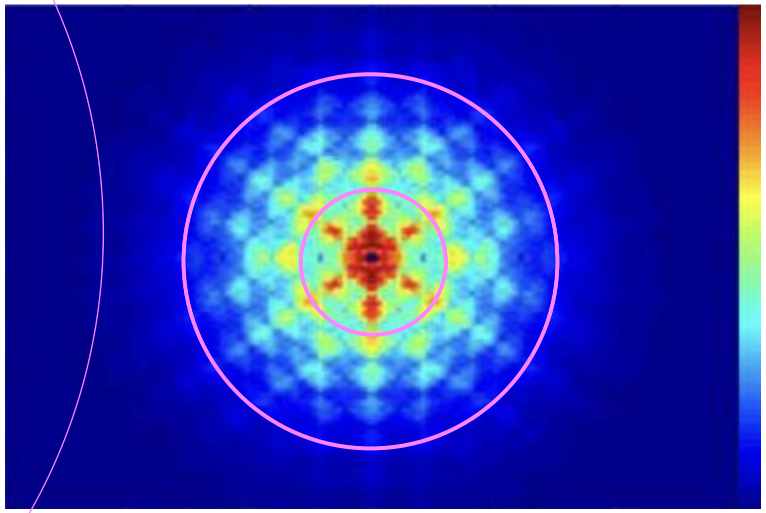
Romain Sibille

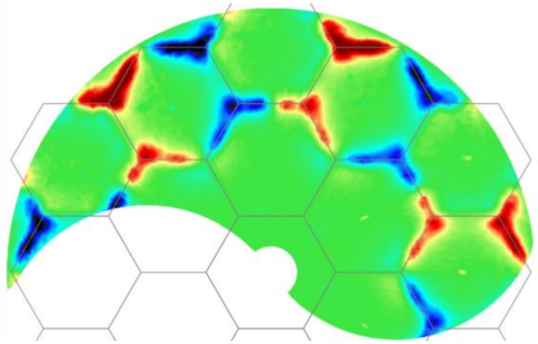
Nature Physics **16** 546 (2020)

$Ce_2Sn_2O_7$



$Ho_2Ti_2O_7$

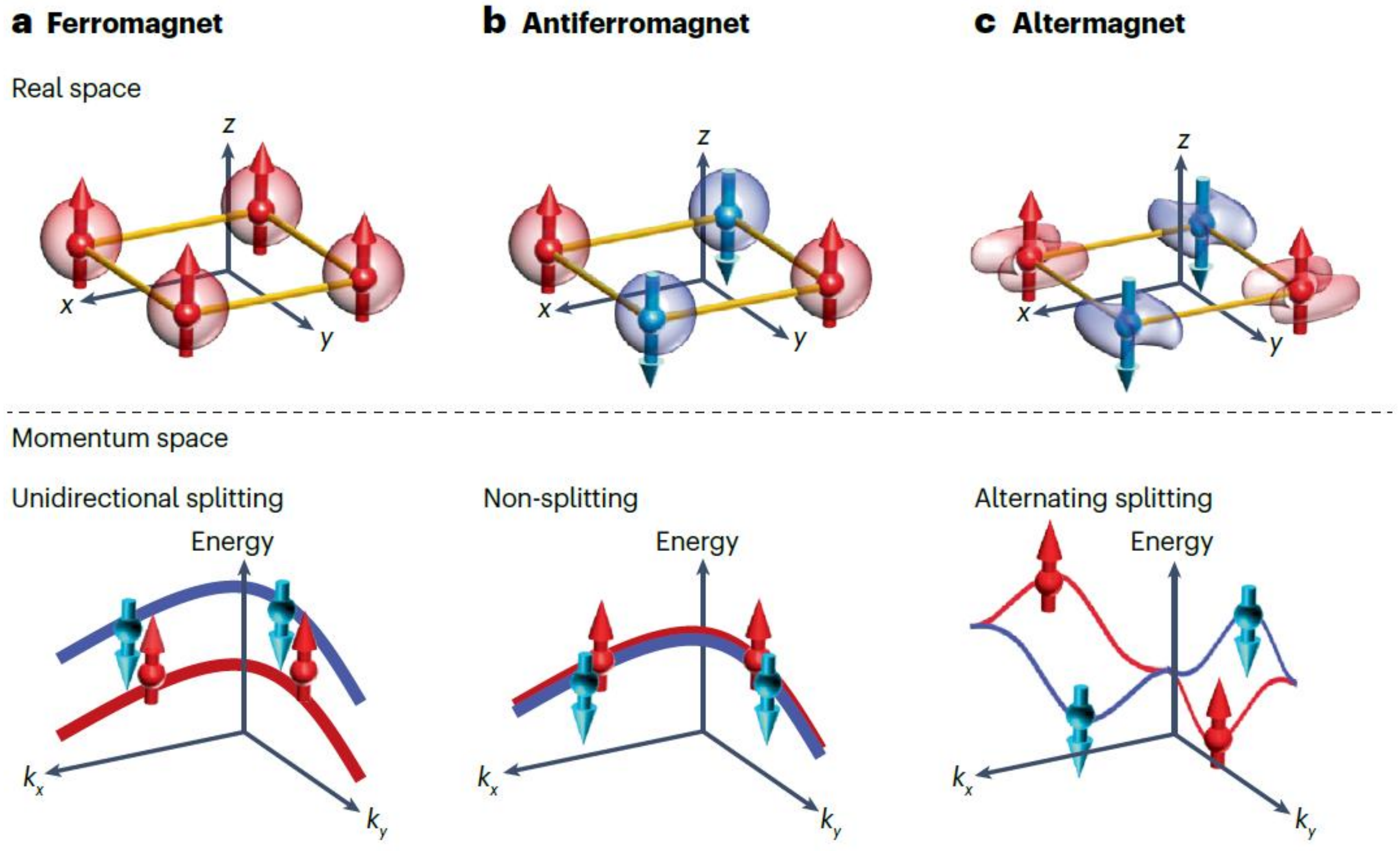




Chiral spin liquid

Schweika et al. PRX (2022)

Altermagnets



Altermagnets, recent preprint

arXiv > cond-mat > arXiv:2509.07087

Search...

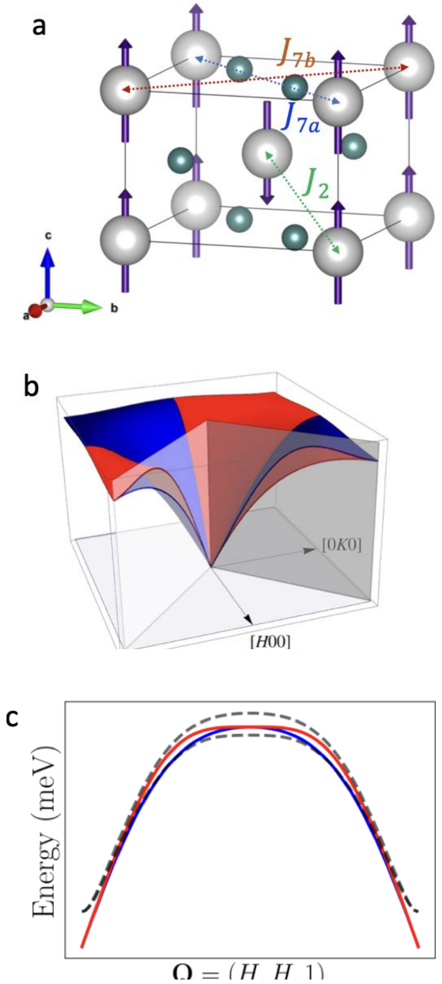
Help | Adv

Condensed Matter > Strongly Correlated Electrons

[Submitted on 8 Sep 2025]

Altermagnetism revealed by polarized neutrons in MnF_2

Quentin Faure, Dalila Bounoua, Victor Balédent, Arsen Gukasov, V. Ovidiu Garlea, Afonso Ribei
Jeffrey G. Rau, Sylvain Petit, Paul McClarty



ction STAP

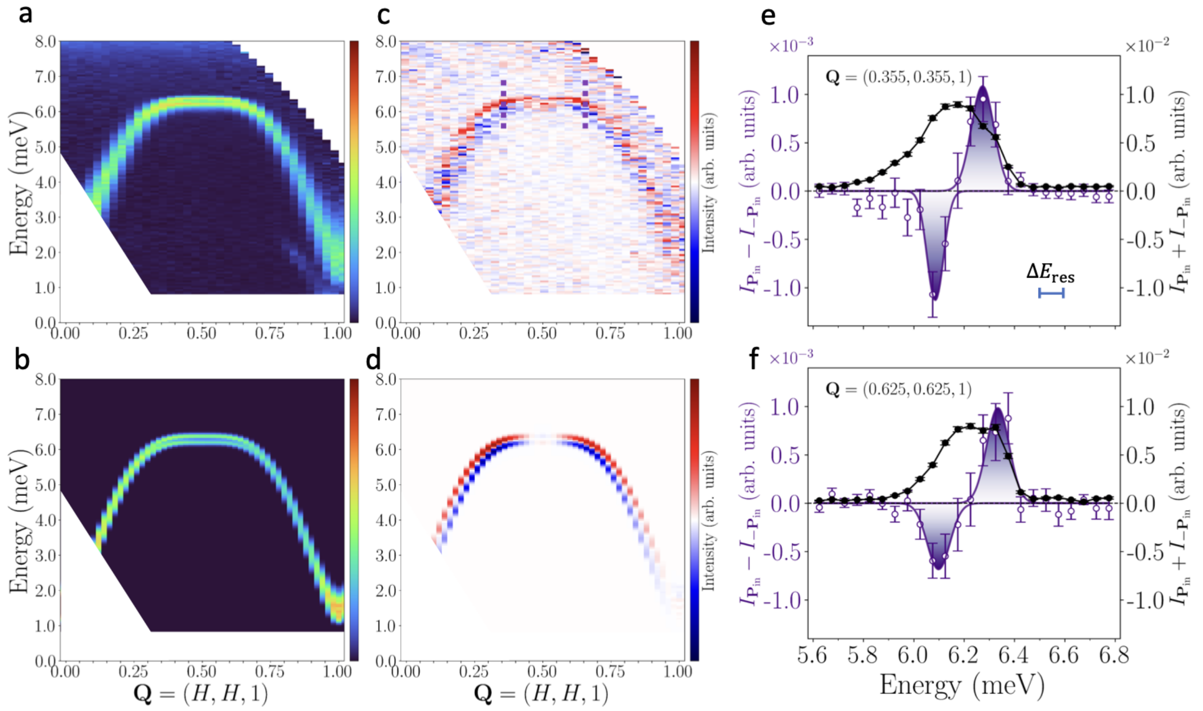


Figure 3: Chirality of magnon bands in MnF_2 revealed by polarized neutrons. (a) Sum of spin wave spectra measured along $\boldsymbol{Q} = (H, H, 1)$ with polarized neutrons $+\mathbf{P}_{in}$ and $-\mathbf{P}_{in}$. The sum is only relative to the unpolarized cross section. (b) Corresponding calculated spin-wave spectra obtained from fitted parameter of unpolarized neutrons spectra. (c) The difference of spectra, relative only to the chiral part of the cross section. Dashed vertical purple lines represent constant-$\boldsymbol{Q}$ energy slices shown in (e-f). (d) Calculated chiralities of the magnon bands obtained from fitted parameters. The pronounced broadening of the magnon bands observed experimentally, compared

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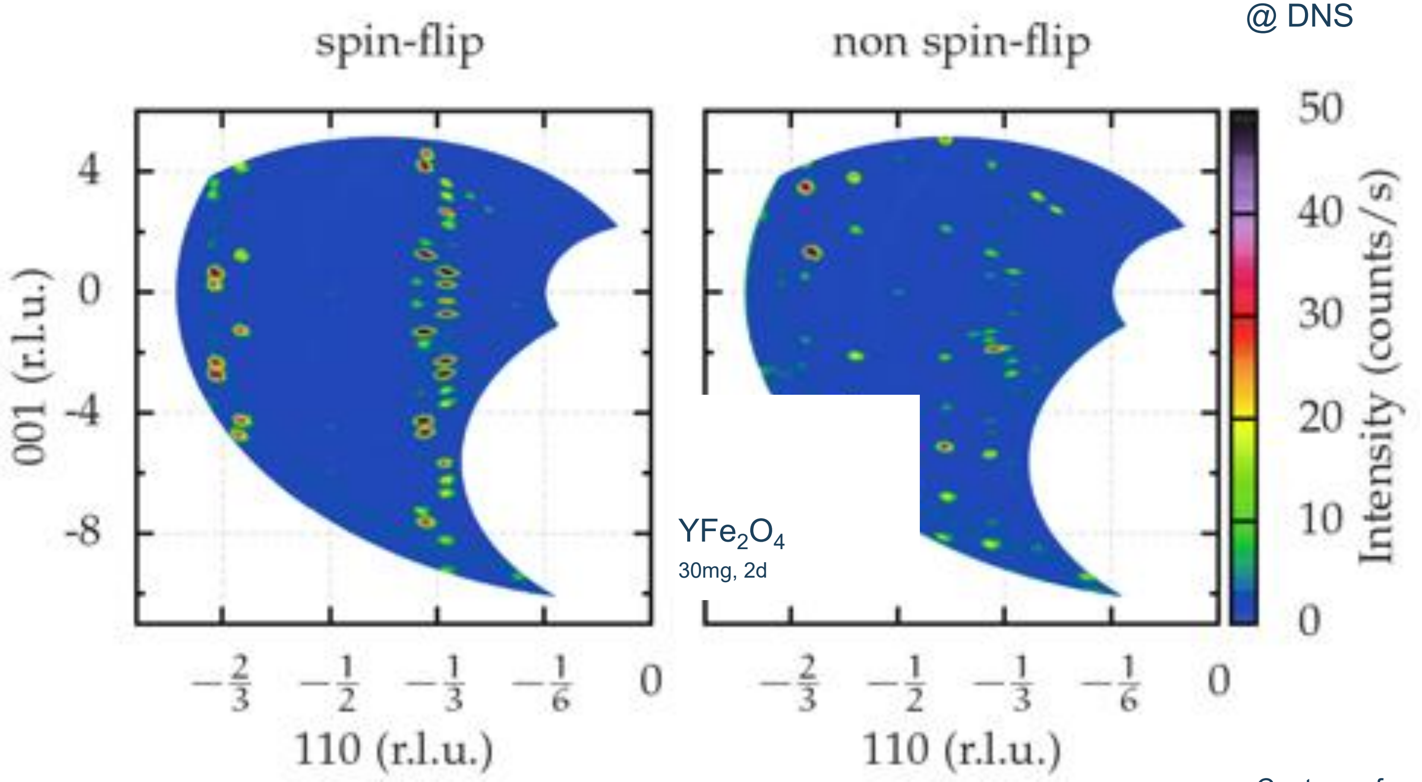
Rare earth ferrites ($REFe_2O_4$)

P_z

@ DNS

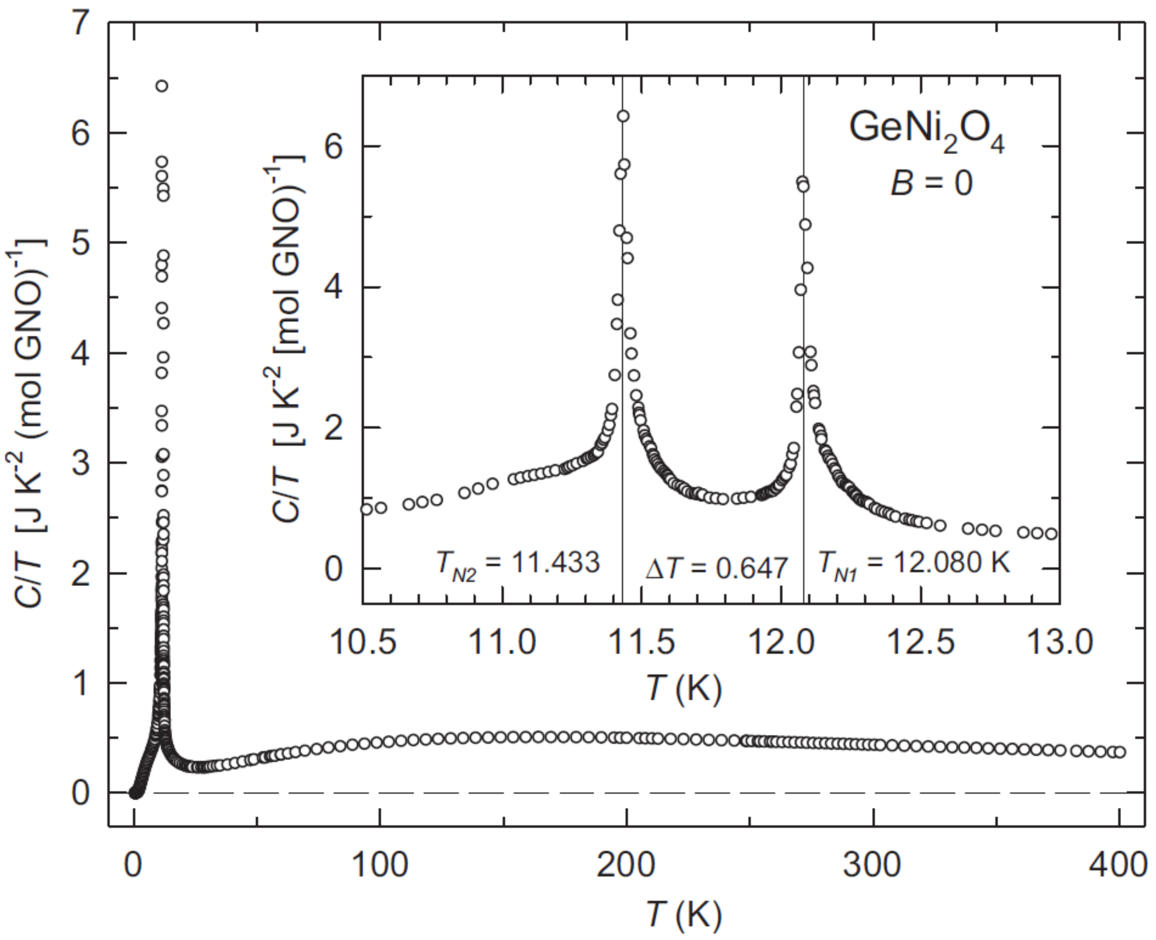


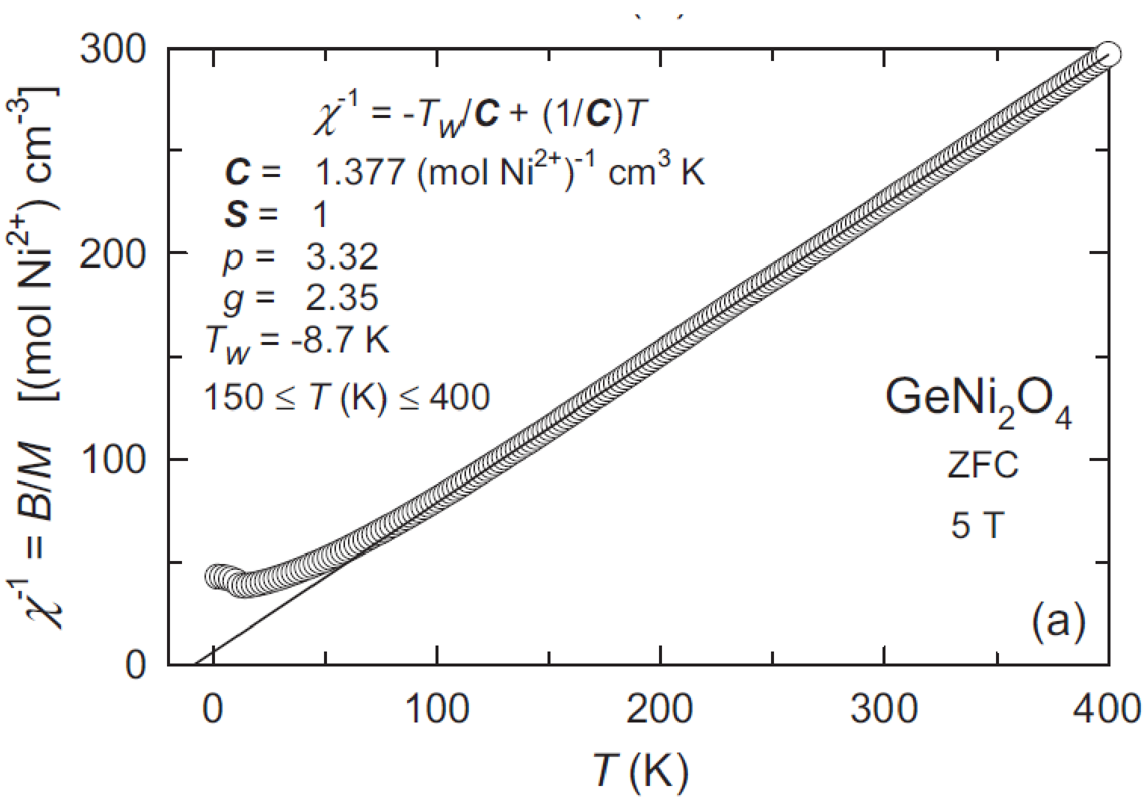
YFe_2O_4
30mg, 2d

Coutesy of
M. Angst

EUROPEAN SPALLATION SOURCE

Short synopsis of $GeNi_2O_4$





Lashley, J. C., et al. *PRB* 78.10 (2008): 104406.