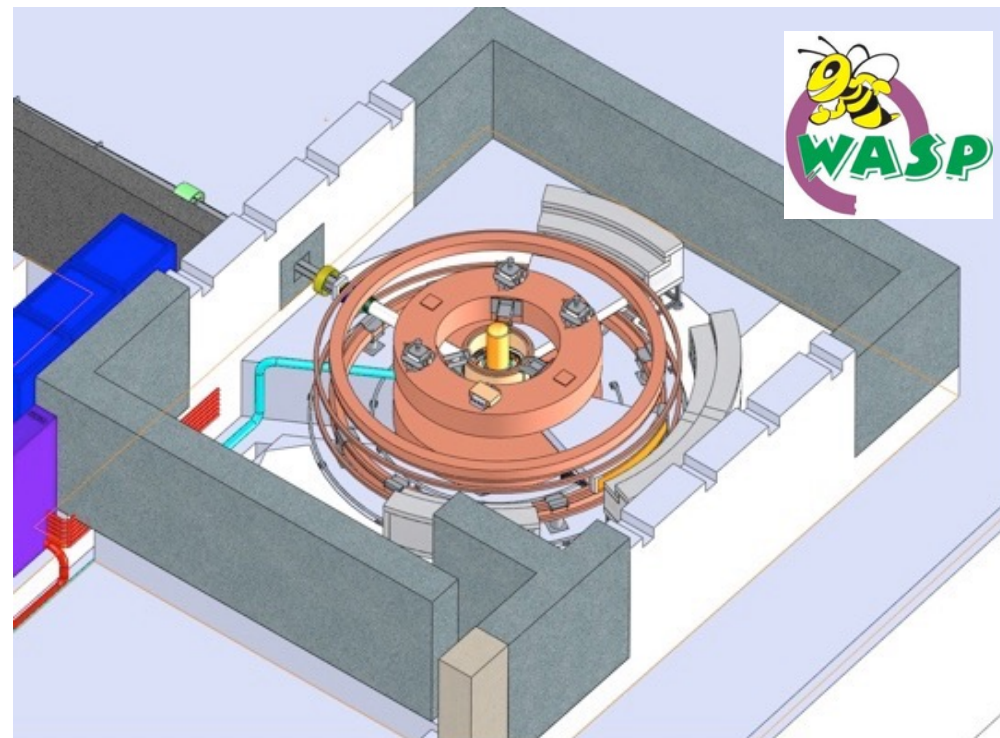


WASP

The new wide-angle neutron spin echo spectrometer at ILL

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Georg Ehlers

Funding and material support



Contents

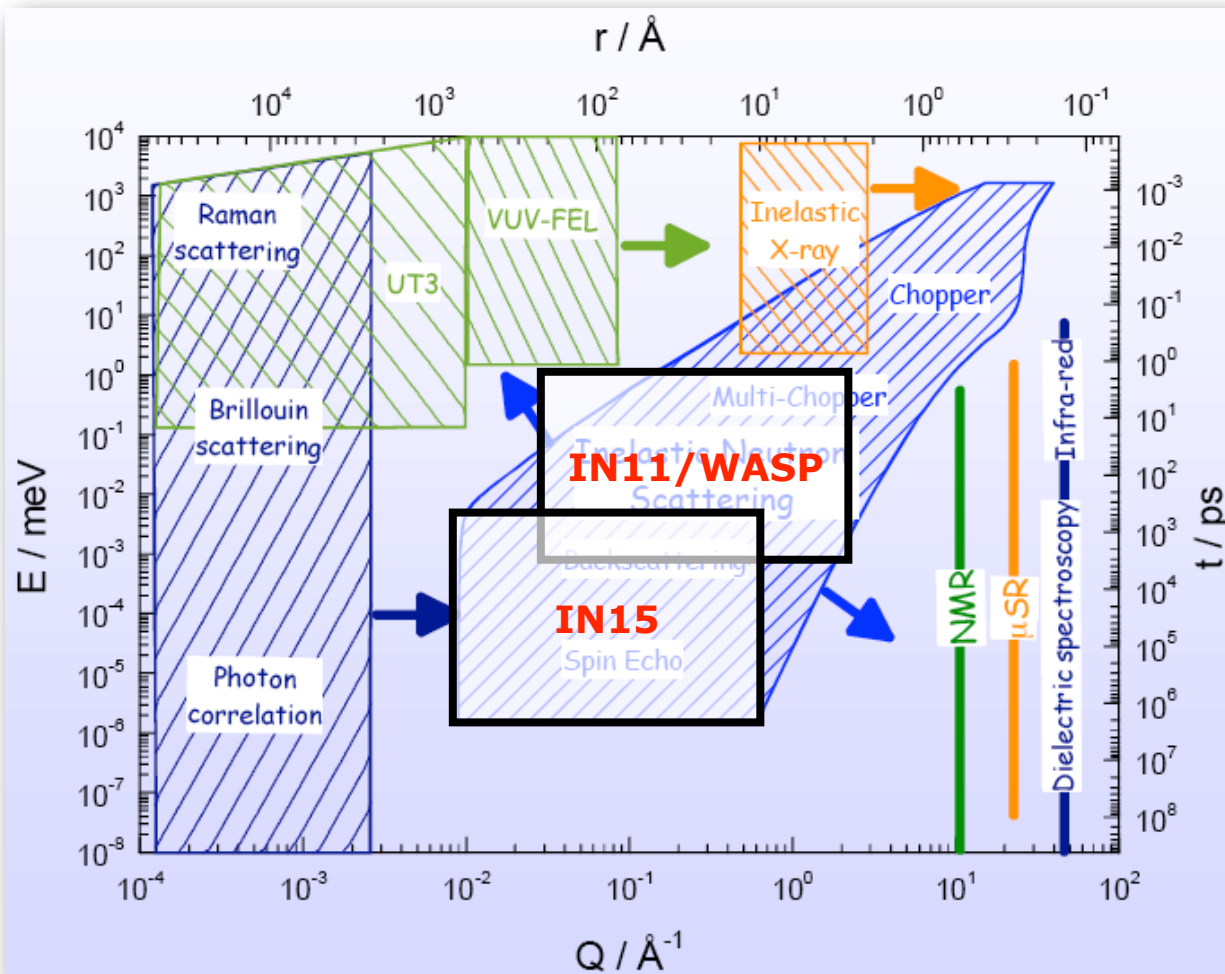
- Technical Principle
- Science Examples
- Project Status

WASP: a replacement for IN11

- NSE spectrometers can cover a huge dynamic window
- With the construction of IN15, ILL could offer two spectrometers, each with a specialisation:
 - IN15: maximum spin-echo time, low Q
 - IN11: maximum Q, moderate spin-echo time

$$Q = \frac{4\pi}{\lambda} \sin \theta$$

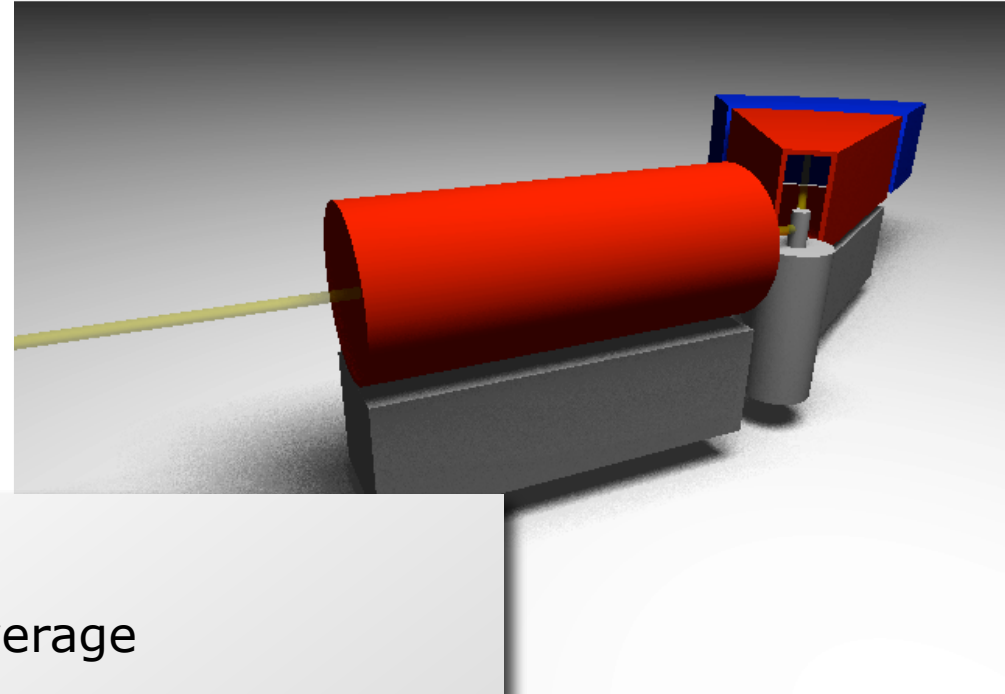
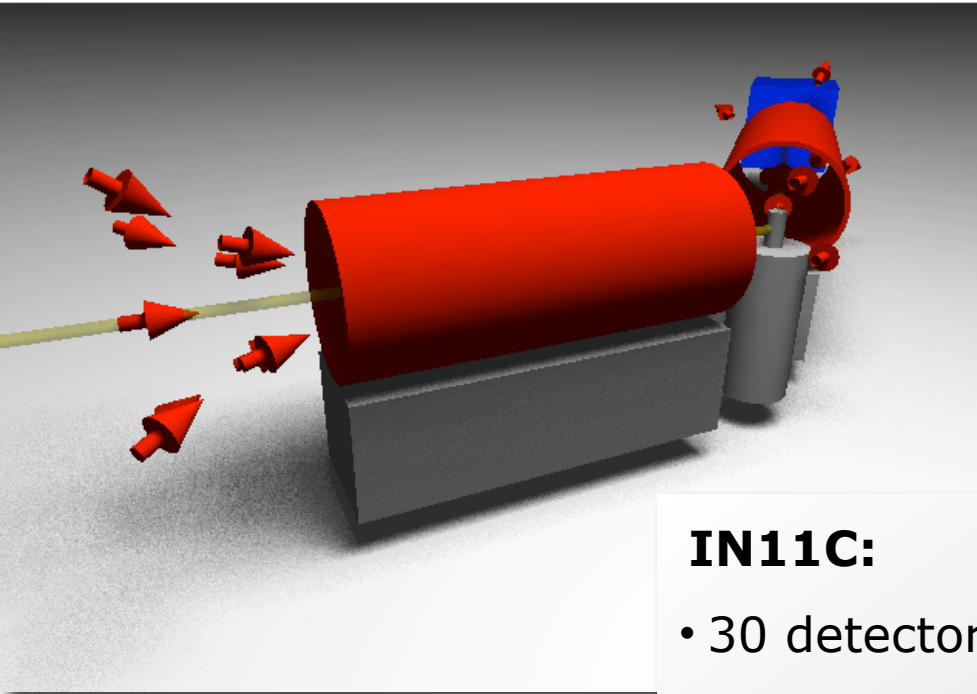
$$t \propto \lambda^3 \int B \cdot dl$$



Large detector coverage essential for high Q

IN11A - high resolution

IN11C - 30° detector bank



IN11C:

- 30 detector coverage
- **Increases** the detection solid angle x20
- **Reduces** maximum spin-echo time /6

New spin-echo concept: SPAN @ HZB, Berlin

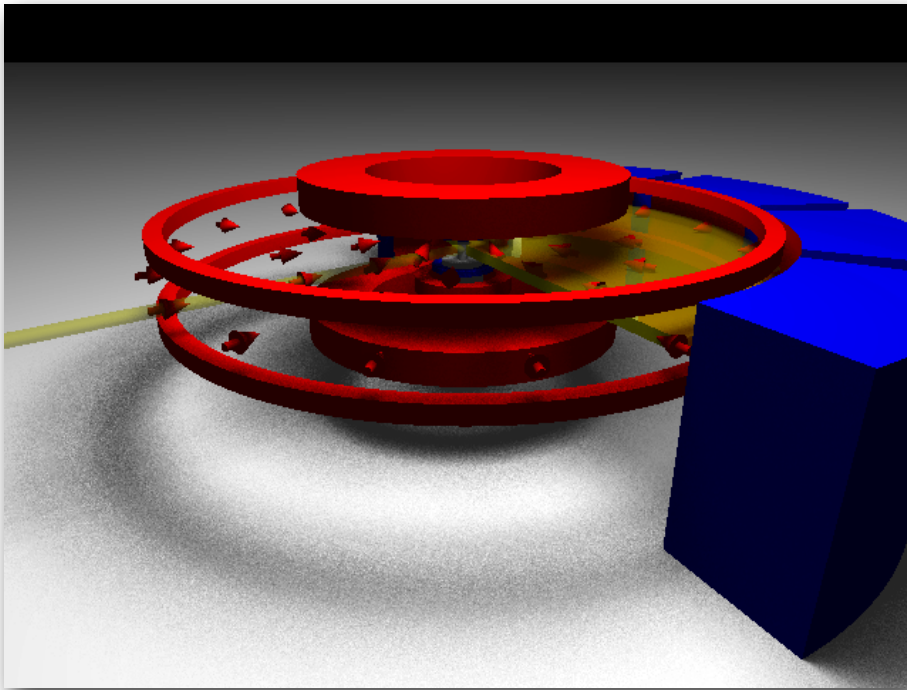


SPAN:

- collinear solenoids are replaced by anti-Helmholtz set-up
- magnetic field is symmetric to sample position in scattering plane

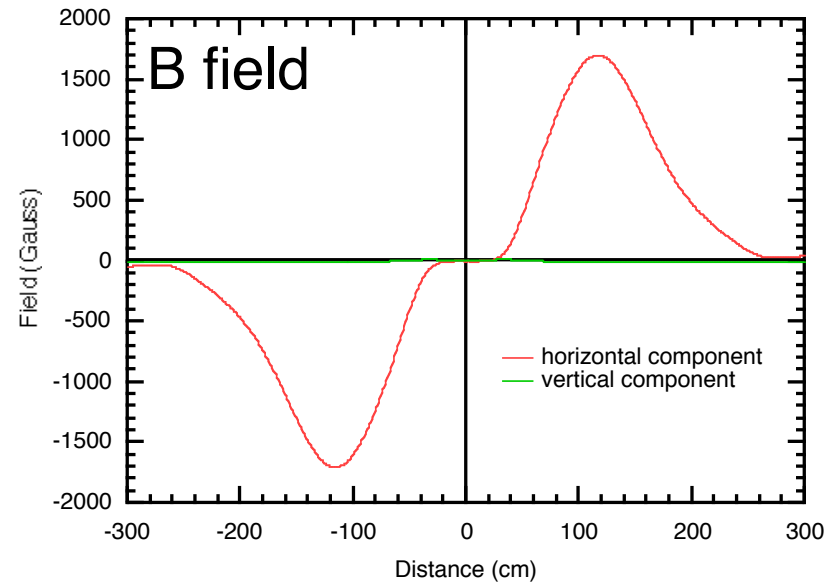
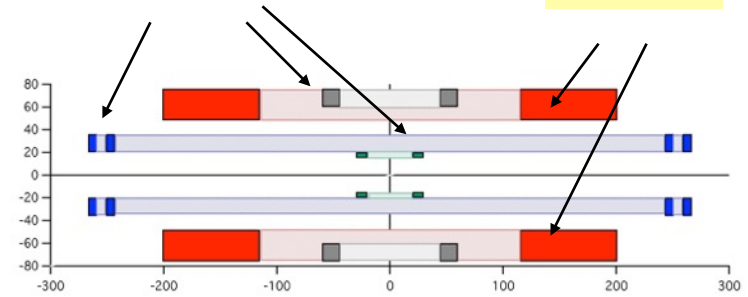
WASP wide angle spin-echo spectrometer

layout and fields



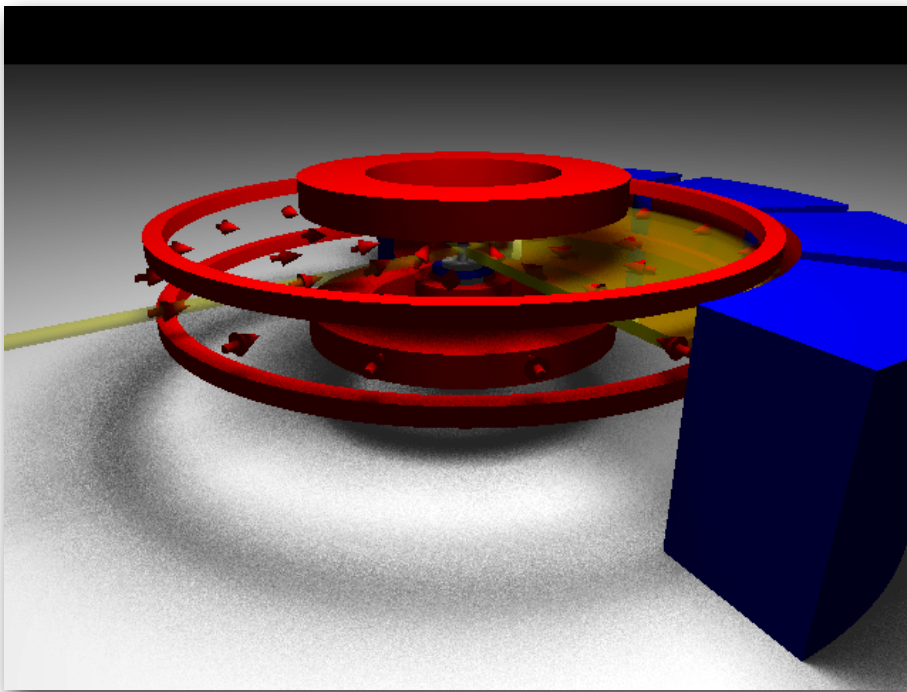
correction coils

main coils



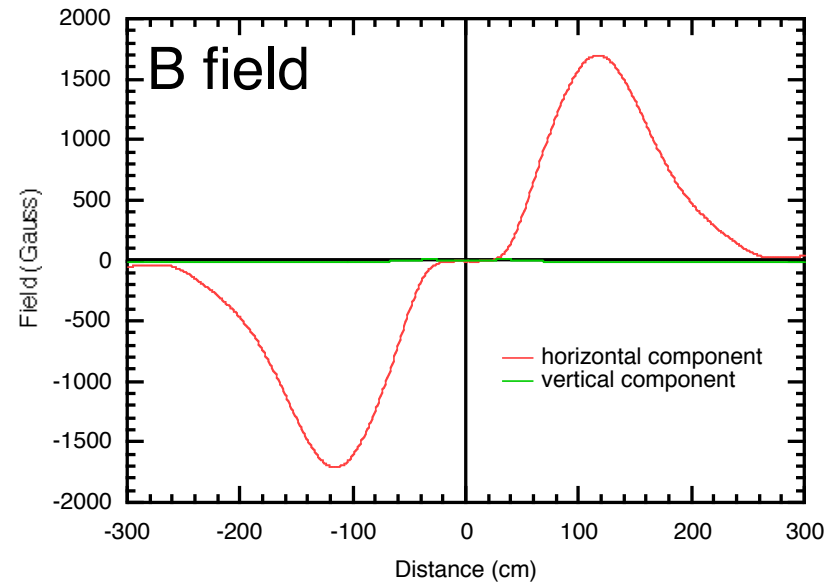
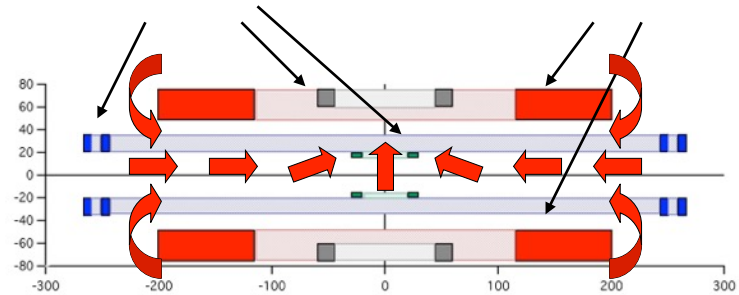
WASP wide angle spin-echo spectrometer

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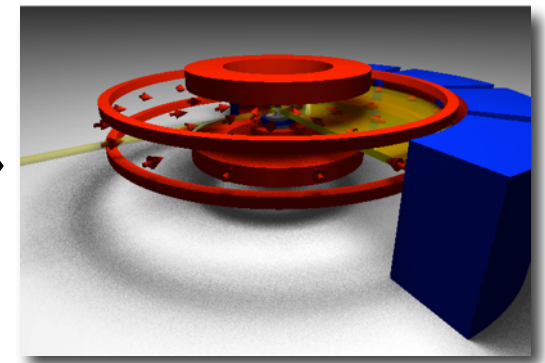
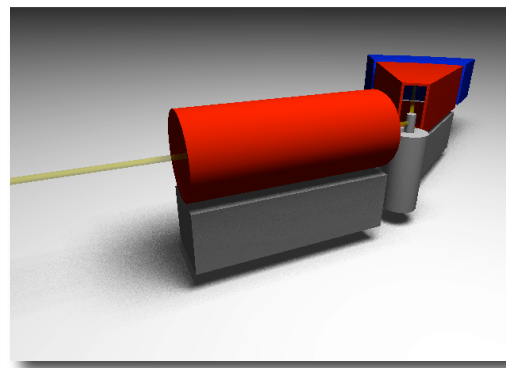
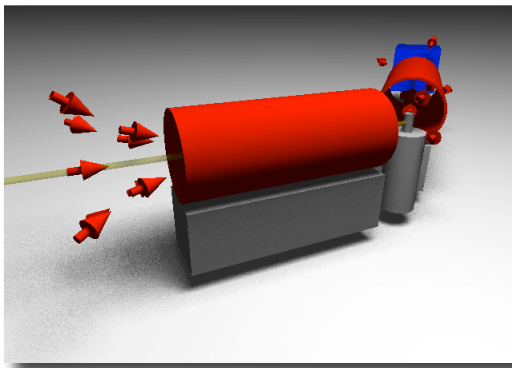


evolution towards WASP

IN11A - high resol.

IN11C - 30° detector bank

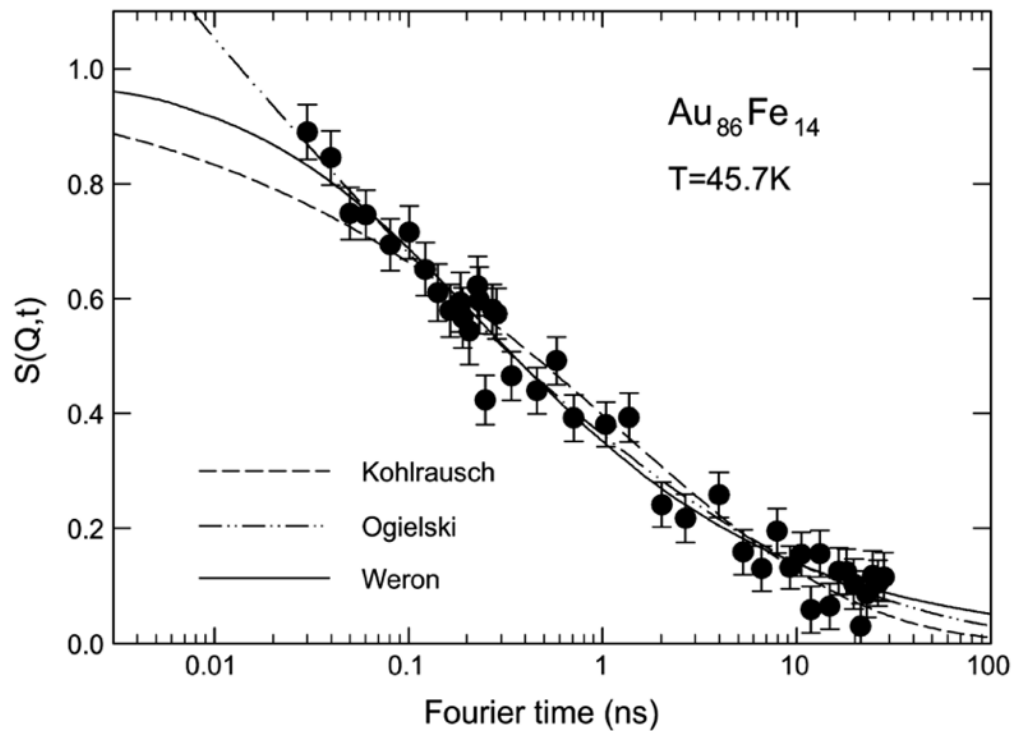
WASP



WASP will:

- Provide same **high resolution** as IN11A
- Increase the **sample flux x5-8**
- Increase the **detection solid angle > x6** (compared to IN11C)

Scientific Case for IN11/WASP: Examples



*Determination of
relaxation lineshape*

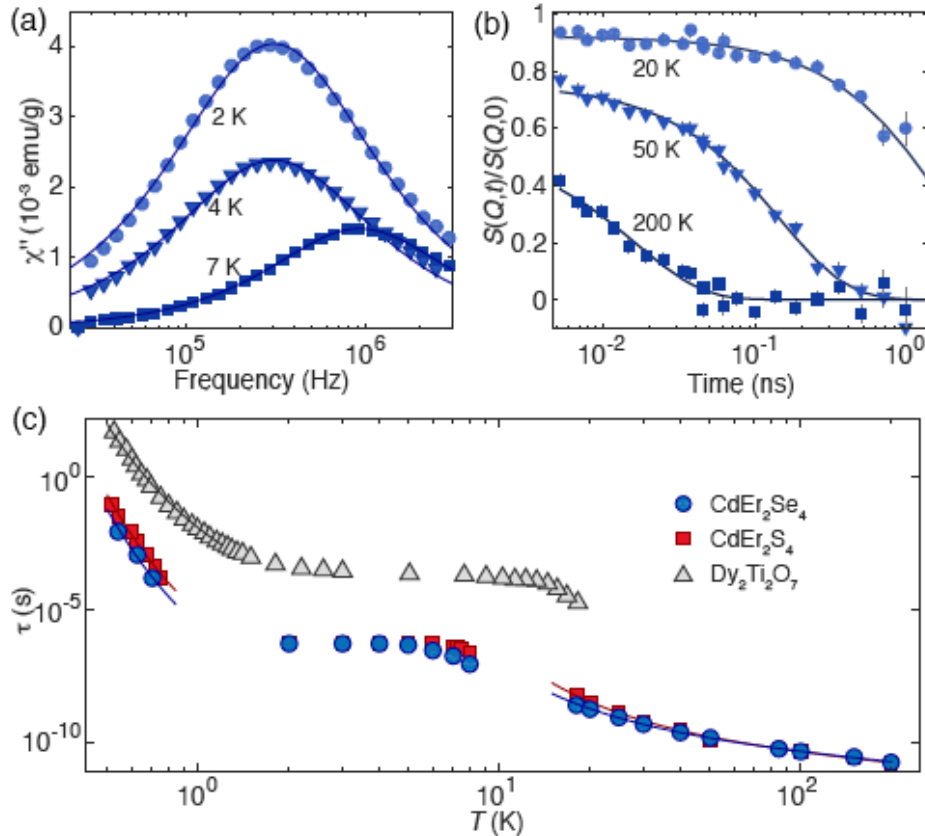
Limited by **statistics** and
spectroscopic range

Cywinski, Pappas et al. PRL
102, 097202 (2009)

further science examples

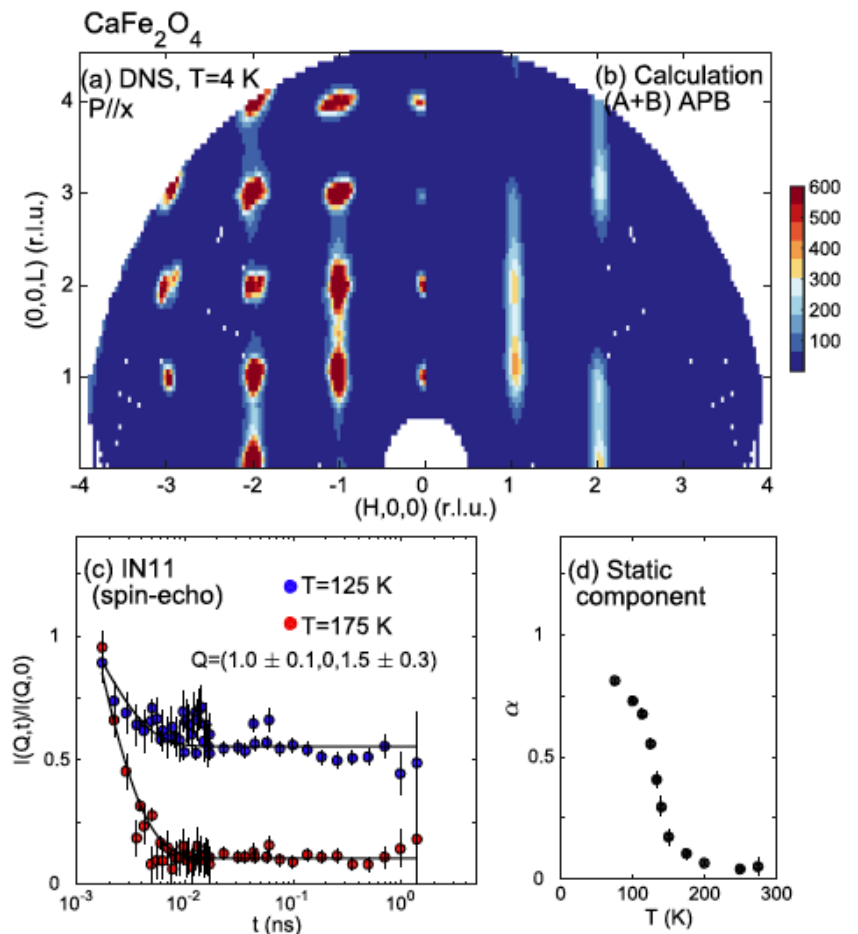
Dipolar spin ice states
with fast monopole
hopping rate in CdEr_2X_4
($\text{X} = \text{Se}, \text{S}$)

S. Gao et al.,
PRL submitted



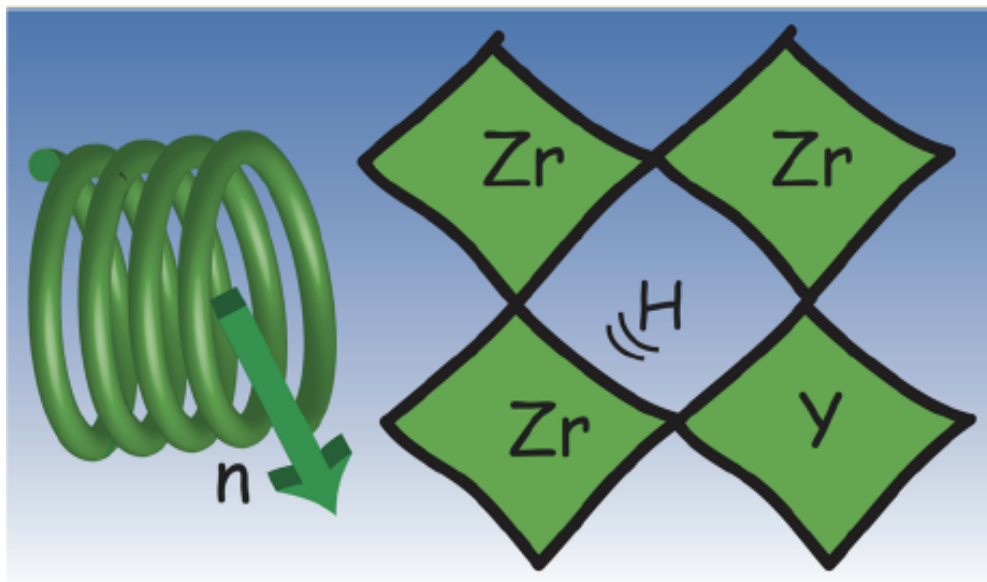
Solitary Magnons in
 CaFe_2O_4

C. Stock et al.,
PRL **117**, 017201 (2016)



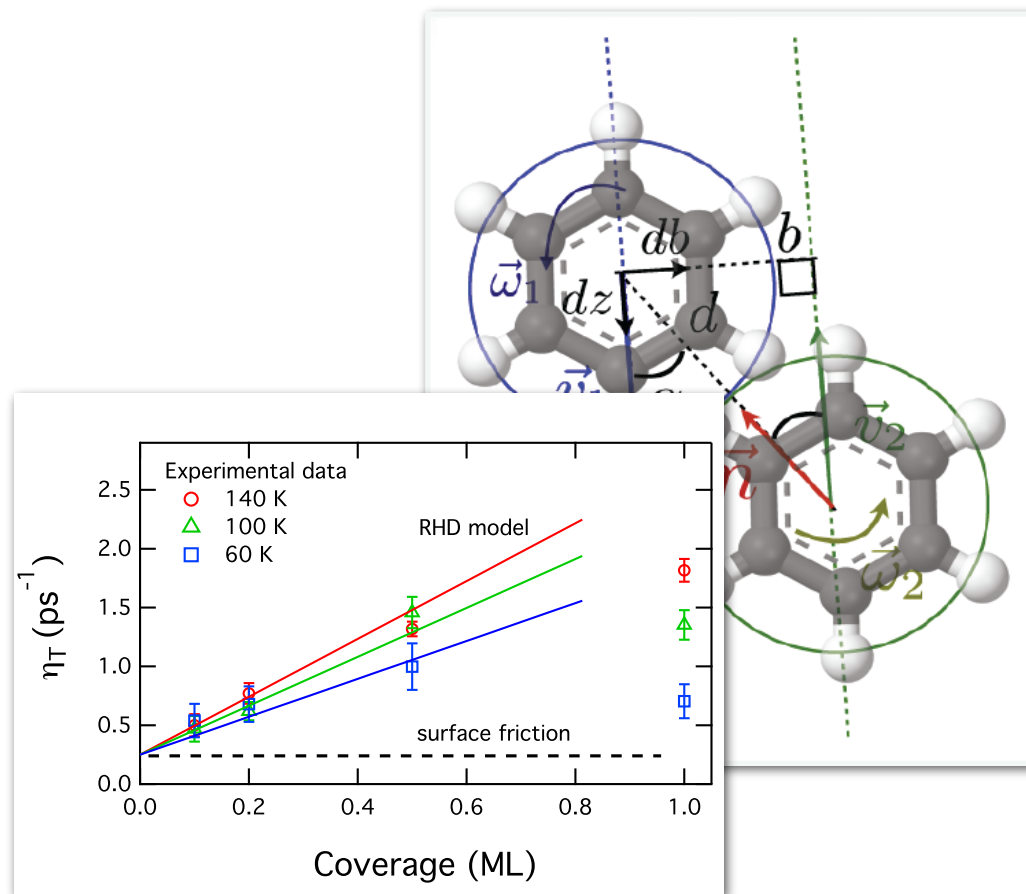
further science examples

Proton dynamics in
 $\text{BaZr}_{0.9}\text{M}_{0.1}\text{O}_{2.95}$ (M = Y and Sc)
D. Noferini et al.,
J. Phys. Chem. C **120**, 13963 (2016)



Aromatic molecules diffuse on graphite

H. Hedgeland, et al., Nature Phys. **5**, 561 (2009)
I. Calvo-Almazan, et al., Carbon **79**, 183 (2014)
I. Calvo-Almazan, et al., J. Chem. Phys. Lett. **7**, 5285 (2016)



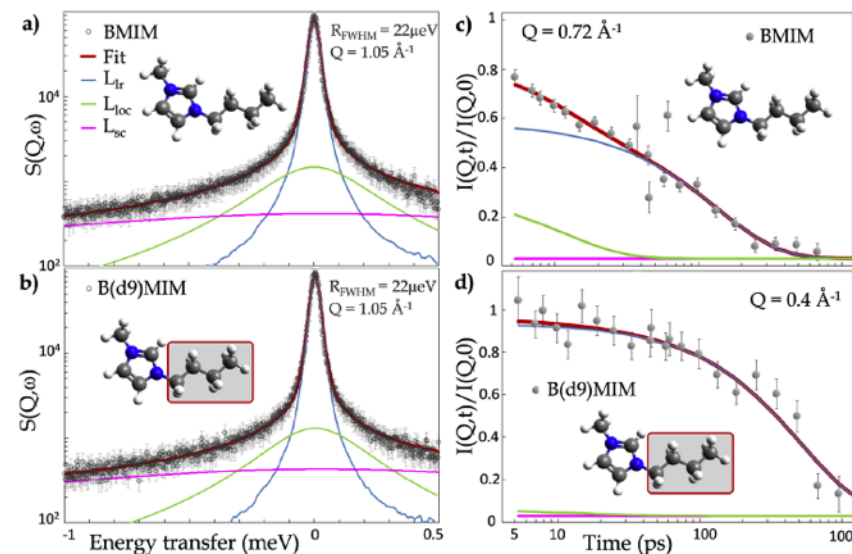
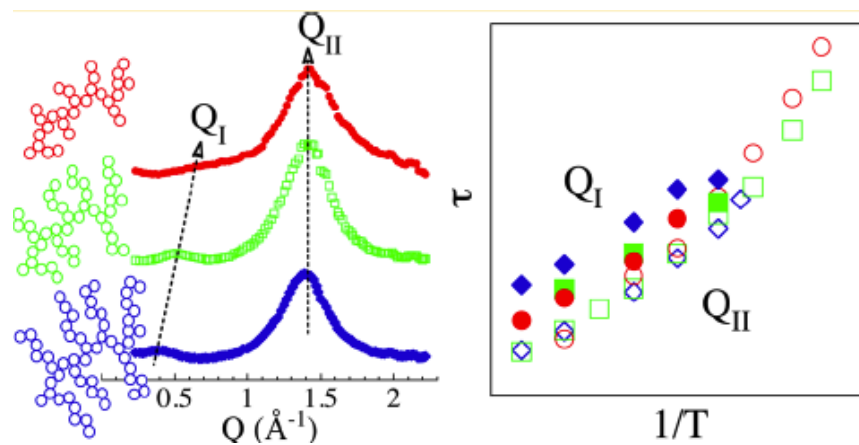
further science examples

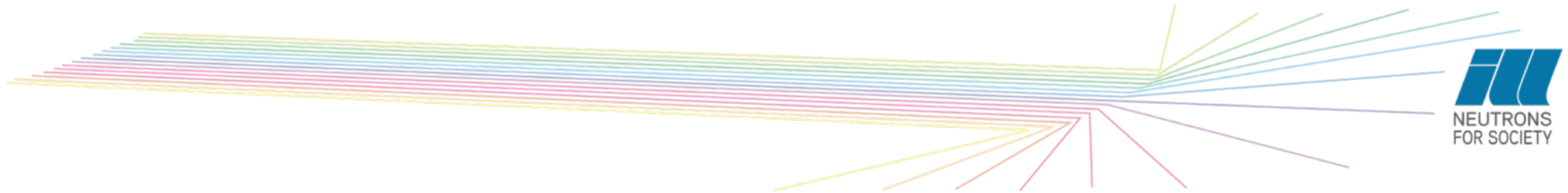
Dynamic differences of asymmetric comb-like polymers disappear at high T

A. Arbe et al.,
Macromolecules **49**, 4989 (2016)

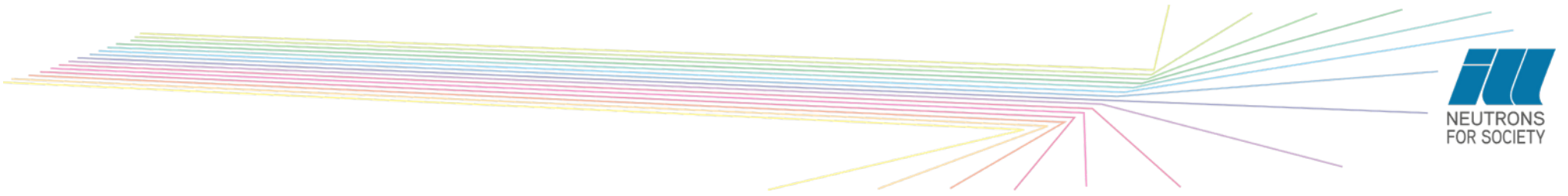
Evidence for the scale-dependence of the viscosity of ionic liquids

Q. Berrod et al.,
Scientific Reports **7**, 2241 (2017)

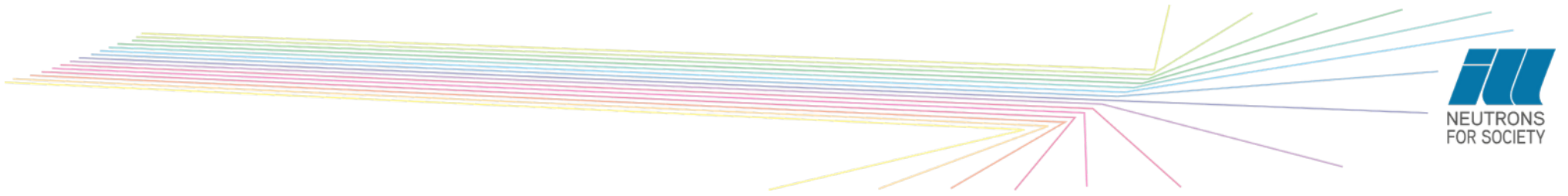






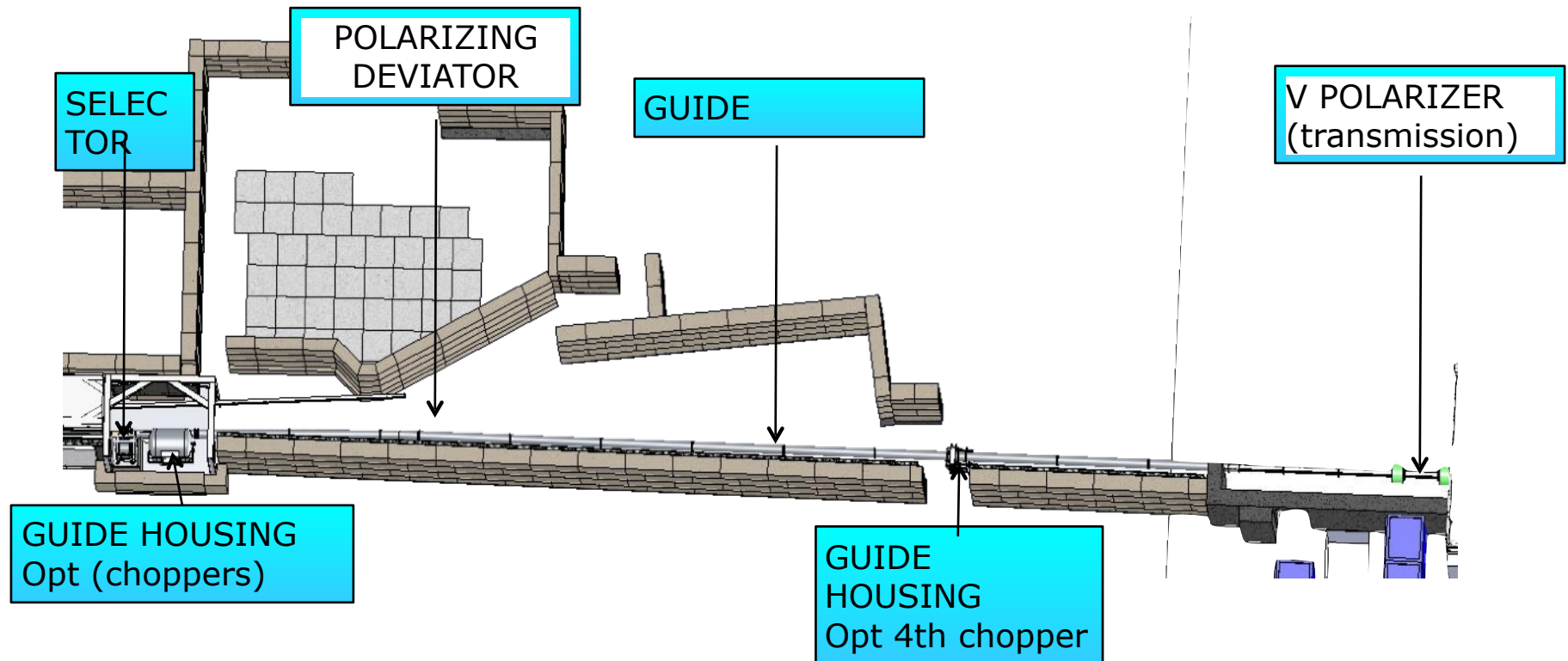


INSTITUT LAUE-LANGEVIN - THE EUROPEAN NEUTRON SOURCE

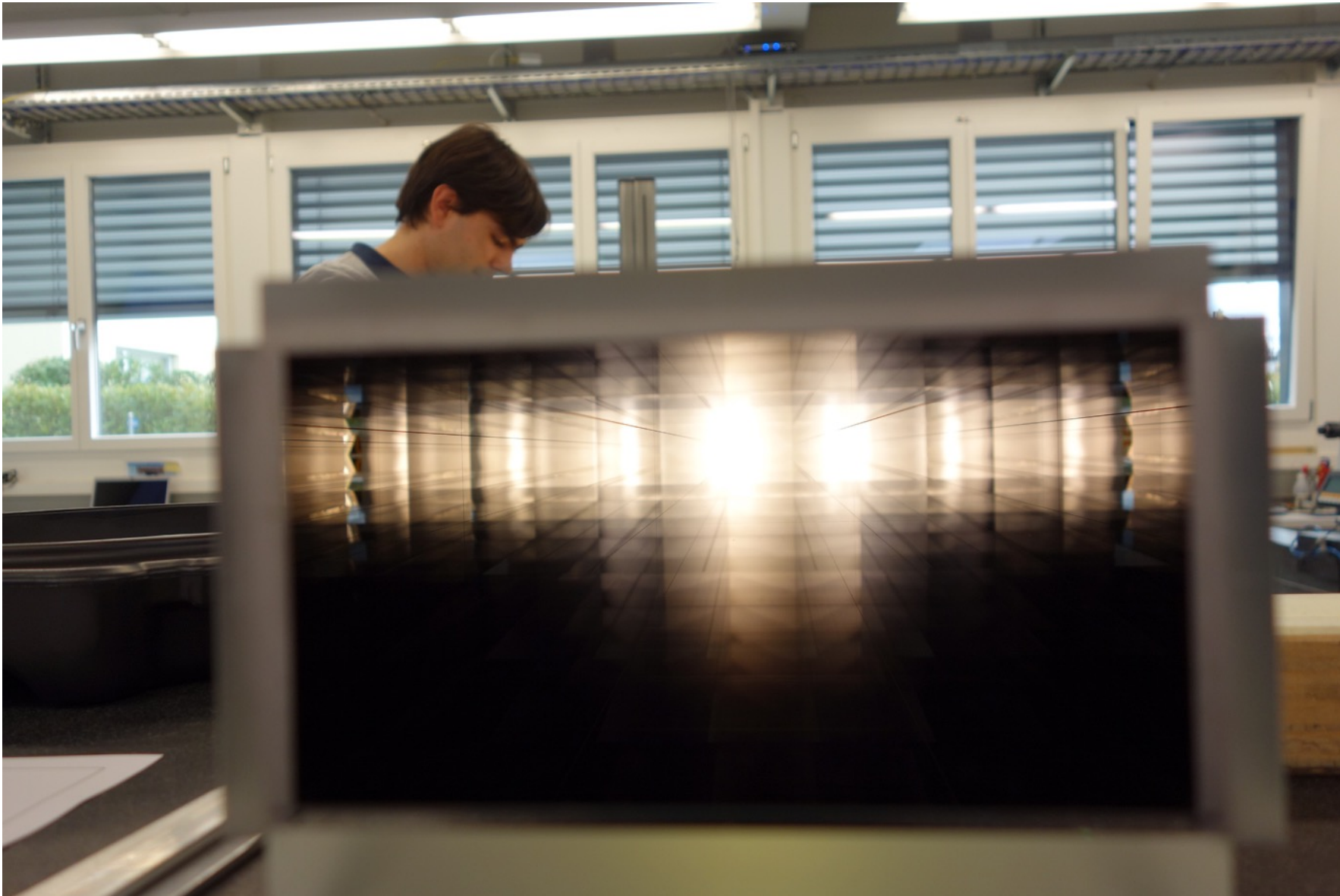


INSTITUT LAUE LANGEVIN - THE EUROPEAN NEUTRON SOURCE

Compound polarizer (IN15)

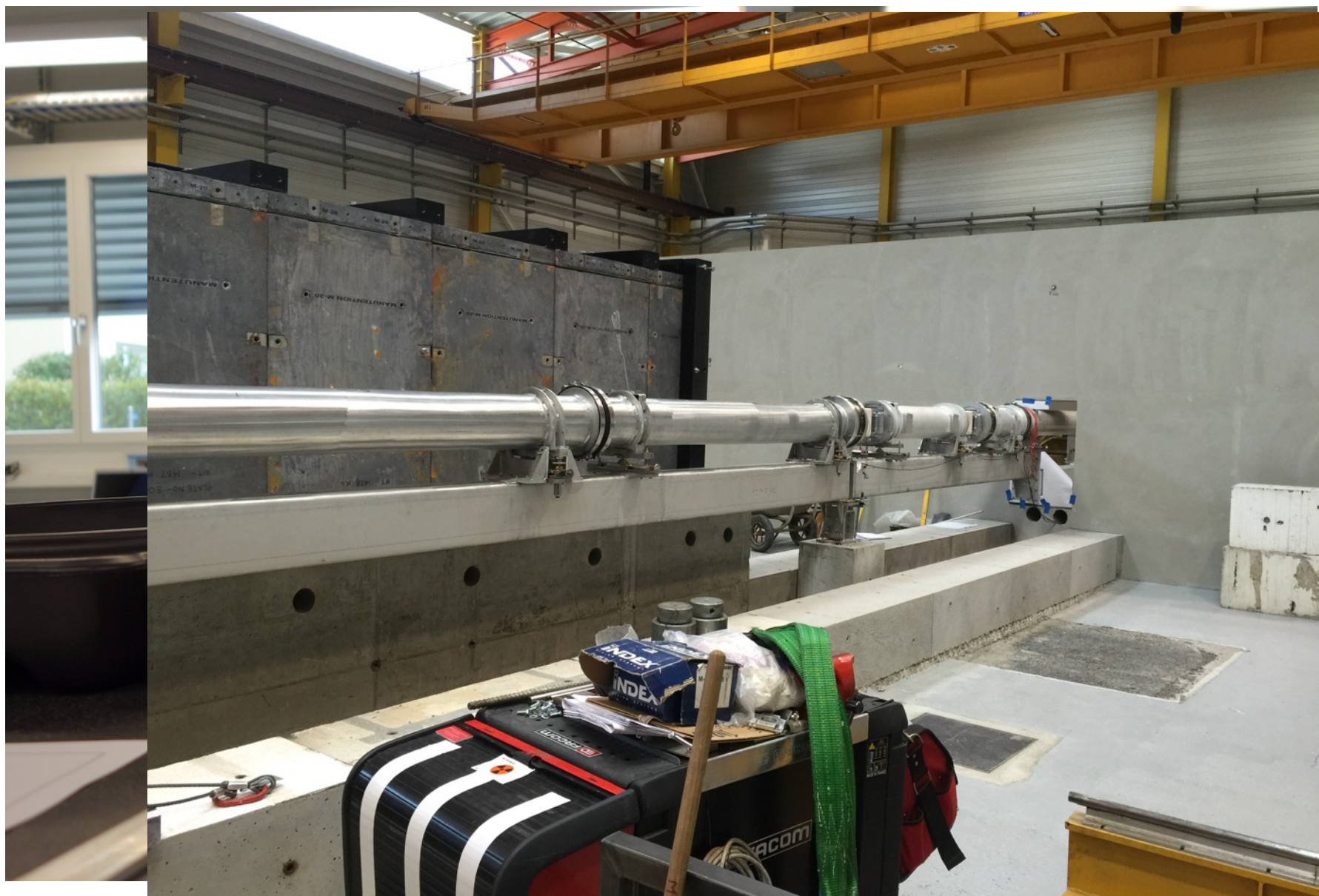


Compound polarizer (IN15)



ER
(on)

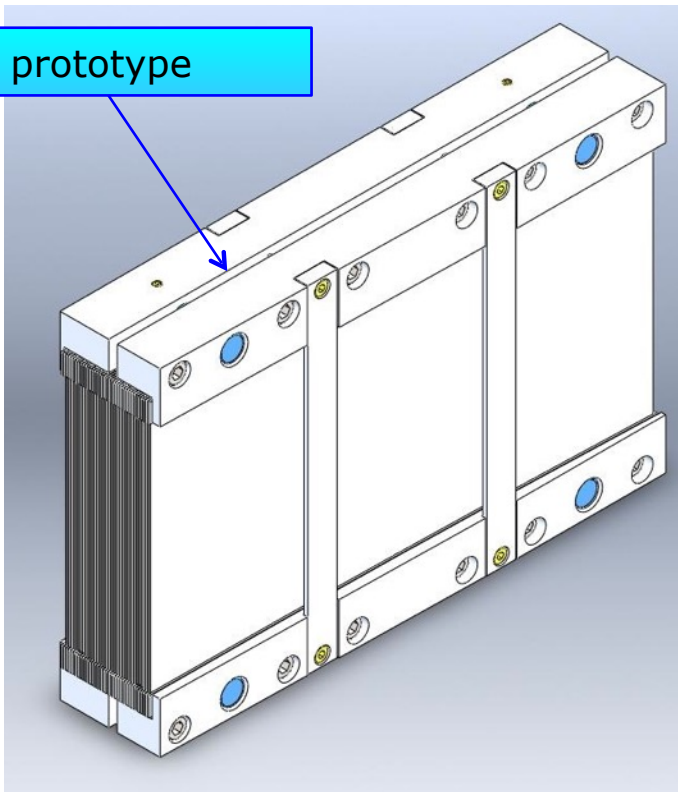
Compound polarizer (IN15)



R
(n)

Analysers (D7)

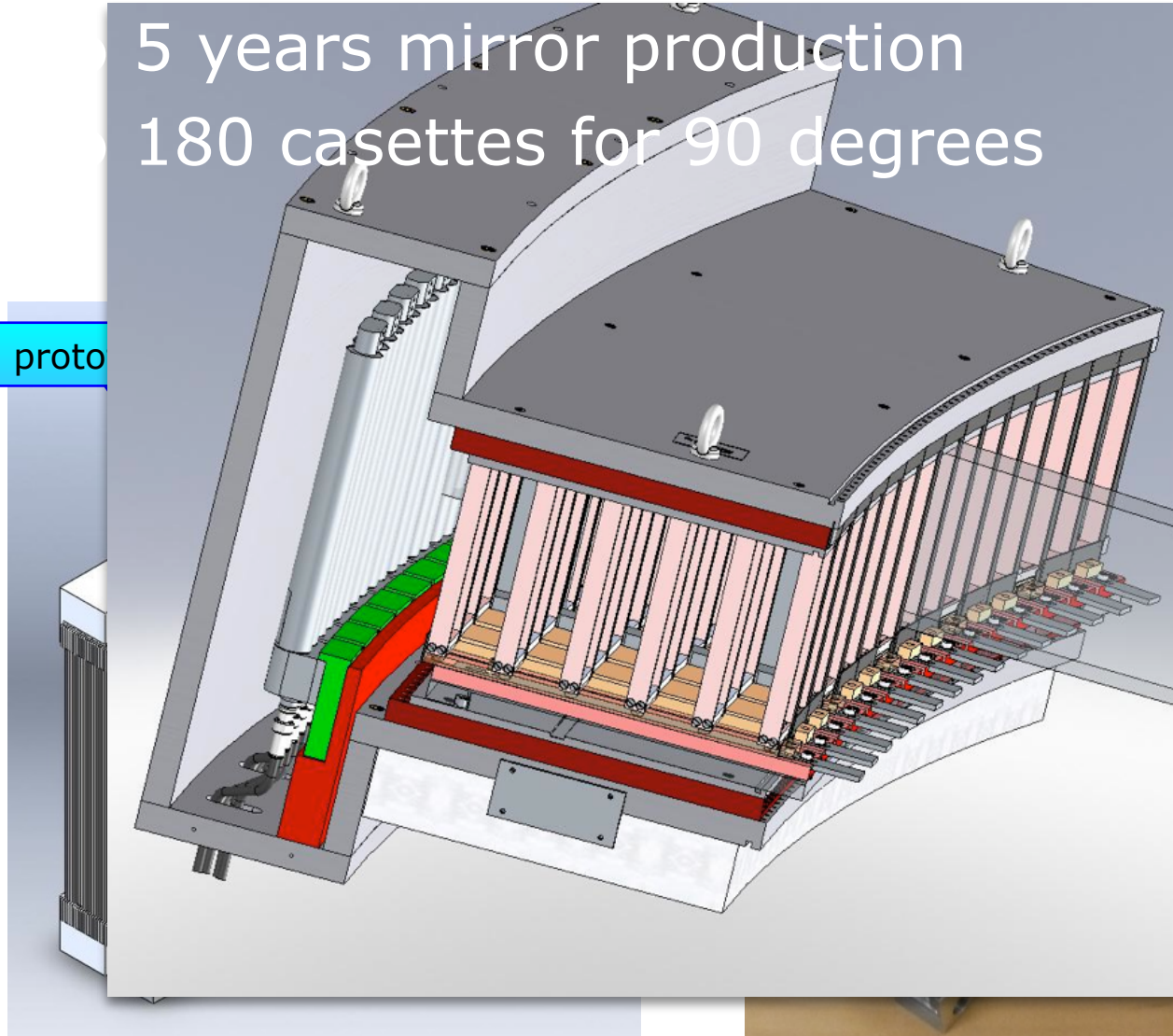
New prototype



Analysers (D7)

5 years mirror production
180 cassettes for 90 degrees

New proto



WASP specs



dynamic range
1 ps - 100 ns

0.05 - 4 \AA^{-1}

3-12 \AA wavelength

signal = 50 x IN11C

~ 30 t Cu

~ 0.6 MW max power,
150 kW average power

WASP specs



dynamic range
1 ps - 100 ns

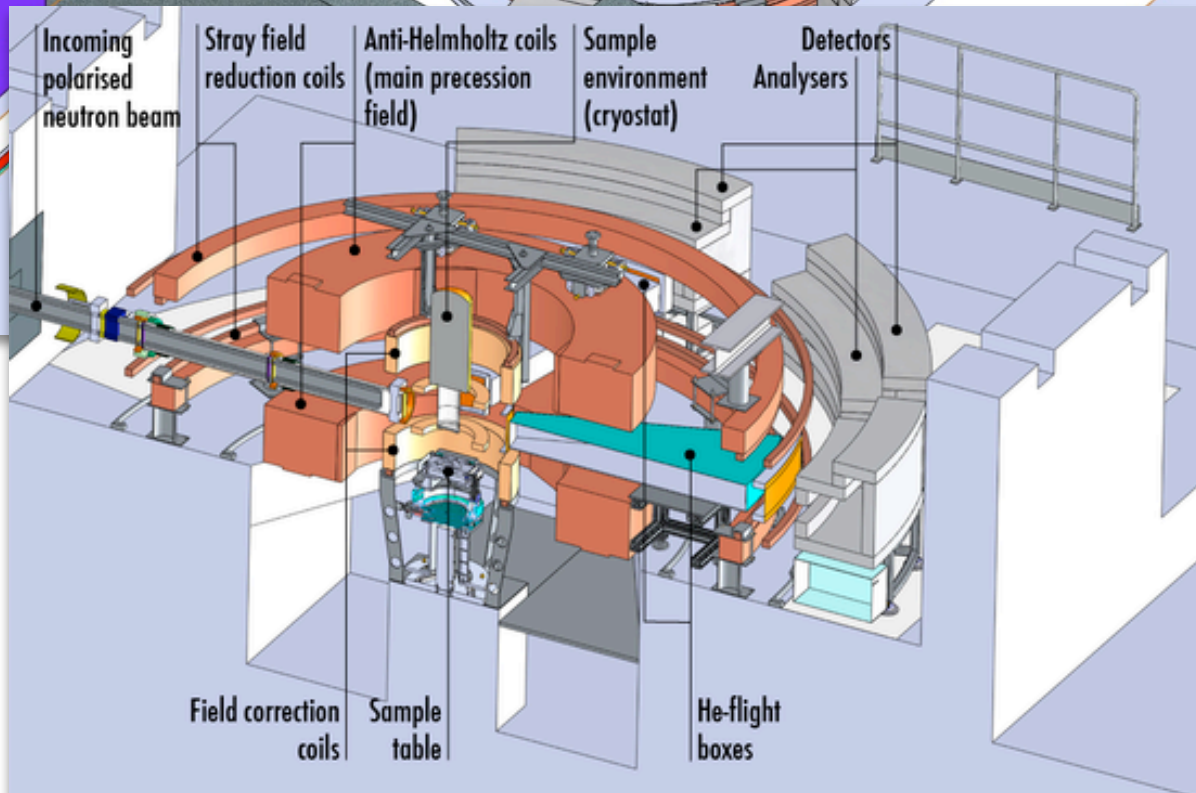
0.05 - 4 Å⁻¹

3-12 Å wavelength

signal = 50 x IN11C

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~ 0.6 MW max power,
150 kW average power



WASP specs



dynamic range
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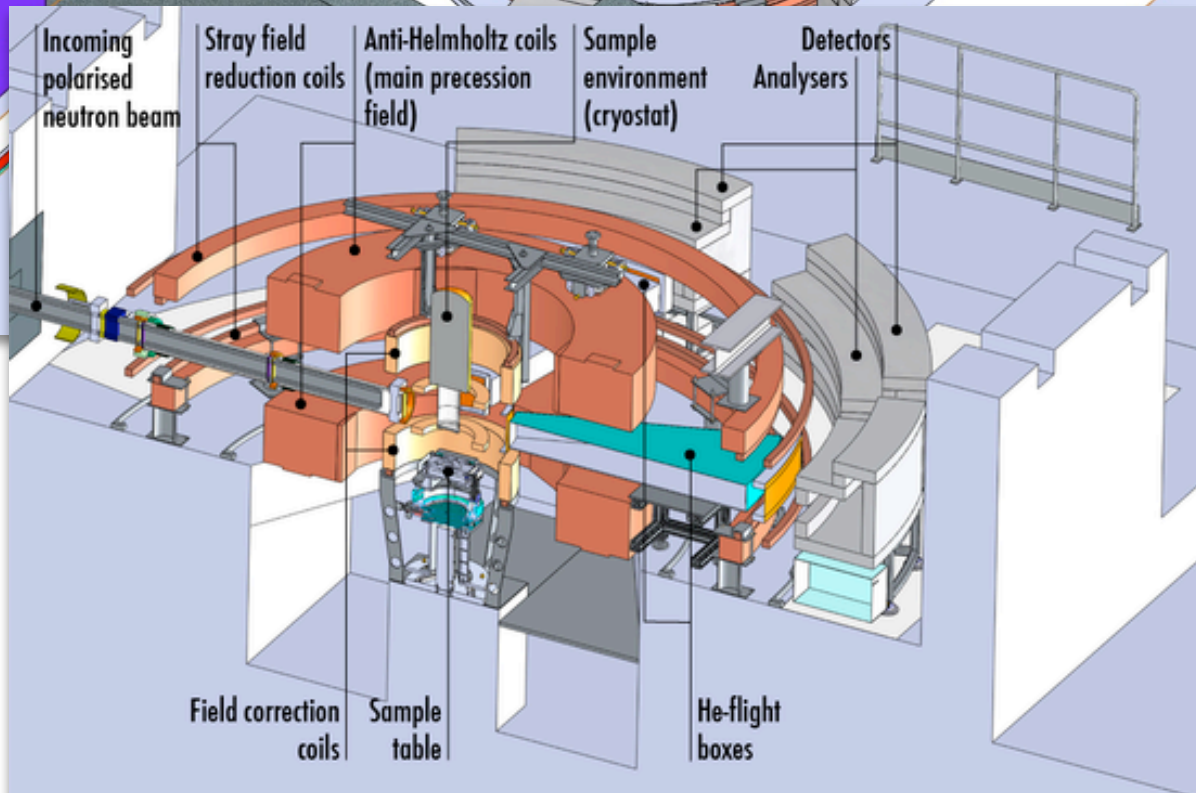
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Magnetic commissioning now
Neutron commissioning 2017/18



Major new infrastructure

- guide hall extended
- new water cooling system
- new transformer
- specific guide
- adapted foundations



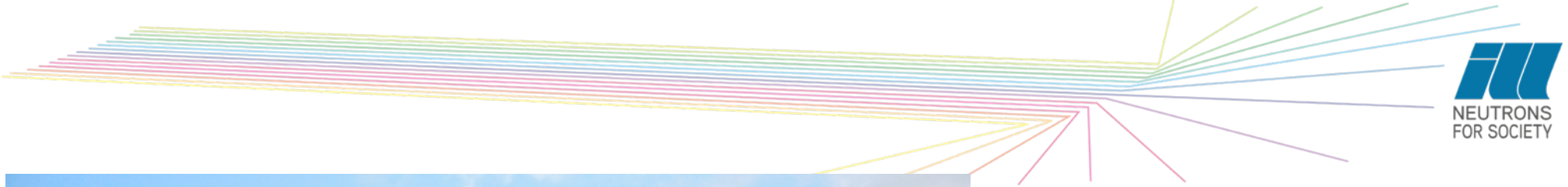
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Major new infrastructure

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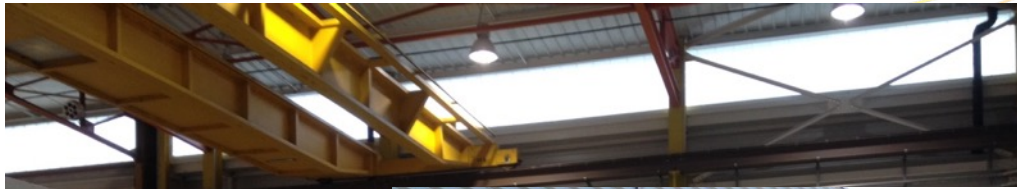
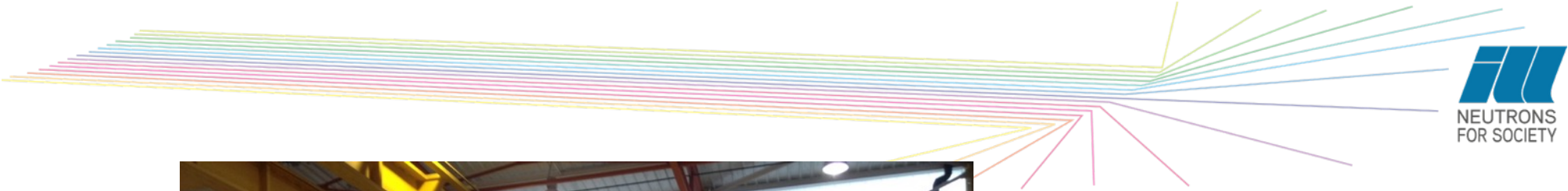
Major new infrastructure

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Thank You!

