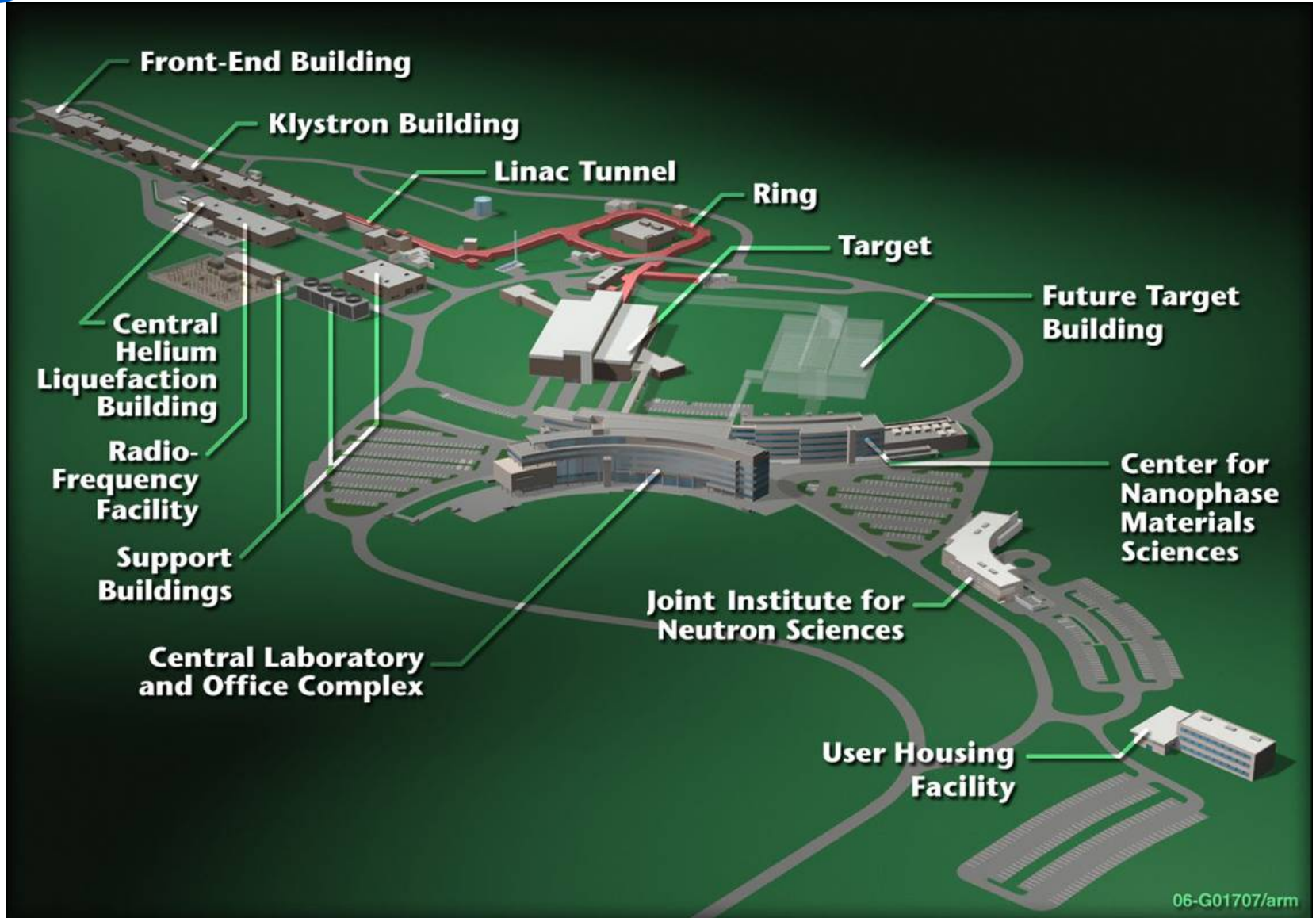


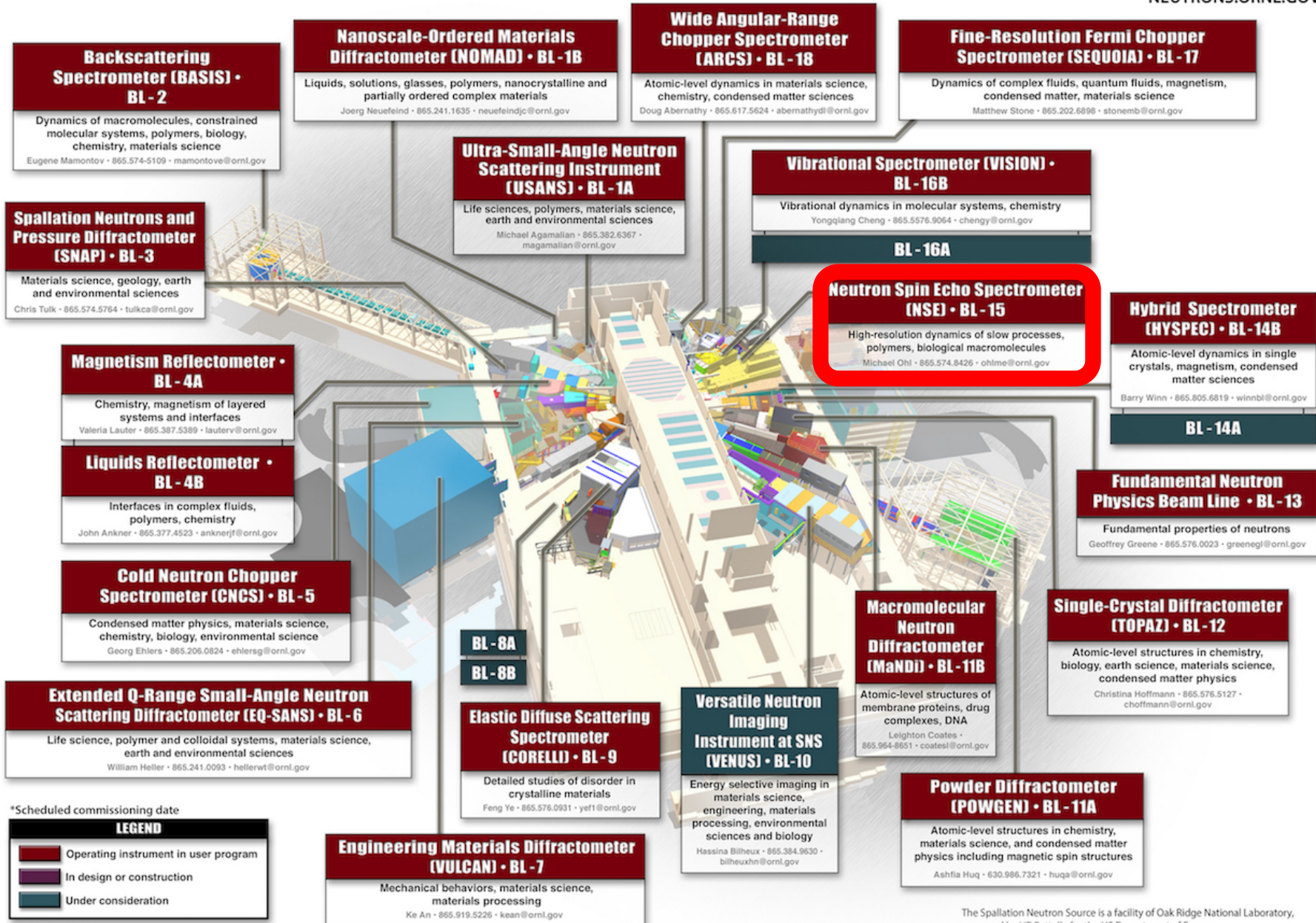
SNS-NSE

NSE Instrument at the Spallation Neutron Source

Piotr A. Żołnierczuk
Juelich Centre for Neutron Science

1. Introduction
2. The Instrument
3. Data Reduction Challenges
4. Summary





Backscattering Spectrometer (BASIS) • BL - 2

Dynamics of macromolecules, constrained molecular systems, polymers, biology, chemistry, materials science

Eugene Mamontov • 865.574.5109 • mamontove@ornl.gov

Nanoscale-Ordered Materials Diffractometer (NOMAD) • BL - 1B

Liquids, solutions, glasses, polymers, nanocrystalline and partially ordered complex materials

Joerg Neufeind • 865.241.1635 • neufeindjc@ornl.gov

Wide Angular-Range Chopper Spectrometer (ARCS) • BL - 18

Atomic-level dynamics in materials science, chemistry, condensed matter sciences

Doug Abernathy • 865.617.5624 • abernathyd@ornl.gov

Fine-Resolution Fermi Chopper Spectrometer (SEQUOIA) • BL - 17

Dynamics of complex fluids, quantum fluids, magnetism, condensed matter, materials science

Matthew Stone • 865.202.6898 • stonemb@ornl.gov

Spallation Neutrons and Pressure Diffractometer (SNAP) • BL - 3

Materials science, geology, earth and environmental sciences

Chris Tulk • 865.574.5764 • tulkca@ornl.gov

Ultra-Small-Angle Neutron Scattering Instrument (USANS) • BL - 1A

Life sciences, polymers, materials science, earth and environmental sciences

Michael Agamalian • 865.382.6367 • magamalian@ornl.gov

Vibrational Spectrometer (VISION) • BL - 16B

Vibrational dynamics in molecular systems, chemistry

Yongqiang Cheng • 865.5576.9064 • chengy@ornl.gov

BL - 16A

Neutron Spin Echo Spectrometer (NSE) • BL - 15

High-resolution dynamics of slow processes, polymers, biological macromolecules

Michael Ohl • 865.574.8426 • ohlme@ornl.gov

Hybrid Spectrometer (HYSPEC) • BL - 14B

Atomic-level dynamics in single crystals, magnetism, condensed matter sciences

Barry Winn • 865.805.6819 • winnbl@ornl.gov

BL - 14A

Magnetism Reflectometer • BL - 4A

Chemistry, magnetism of layered systems and interfaces

Valeria Lauter • 865.387.5389 • lauterv@ornl.gov

Liquids Reflectometer • BL - 4B

Interfaces in complex fluids, polymers, chemistry

John Anknier • 865.377.4523 • anknierj@ornl.gov

Cold Neutron Chopper Spectrometer (CNCS) • BL - 5

Condensed matter physics, materials science, chemistry, biology, environmental science

Georg Ehlers • 865.206.0824 • ehlersg@ornl.gov

Fundamental Neutron Physics Beam Line • BL - 13

Fundamental properties of neutrons

Geoffrey Greene • 865.576.0023 • greenejl@ornl.gov

Extended Q-Range Small-Angle Neutron Scattering Diffractometer (EQ-SANS) • BL - 6

Life science, polymer and colloidal systems, materials science, earth and environmental sciences

William Heller • 865.241.0093 • hellerwt@ornl.gov

BL - 8A
BL - 8B

Elastic Diffuse Scattering Spectrometer (CORELLI) • BL - 9

Detailed studies of disorder in crystalline materials

Feng Ye • 865.576.0931 • yef1@ornl.gov

Versatile Neutron Imaging Instrument at SNS (VENUS) • BL - 10

Energy selective imaging in materials science, engineering, materials processing, environmental sciences and biology

Hassina Bilheux • 865.384.9630 • bilheuxhn@ornl.gov

Macromolecular Neutron Diffractometer (MaNDI) • BL - 11B

Atomic-level structures of membrane proteins, drug complexes, DNA

Leighton Coates • 865.964.8651 • coatesl@ornl.gov

Single-Crystal Diffractometer (TOPAZ) • BL - 12

Atomic-level structures in chemistry, biology, earth science, materials science, condensed matter physics

Christina Hoffmann • 865.576.5127 • hoffmann@ornl.gov

Powder Diffractometer (POWGEN) • BL - 11A

Atomic-level structures in chemistry, materials science, and condensed matter physics including magnetic spin structures

Ashfia Huq • 630.986.7321 • huqa@ornl.gov

Engineering Materials Diffractometer (VULCAN) • BL - 7

Mechanical behaviors, materials science, materials processing

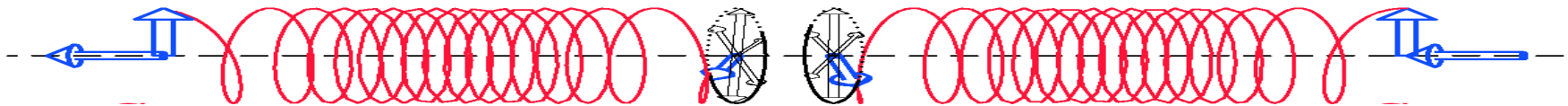
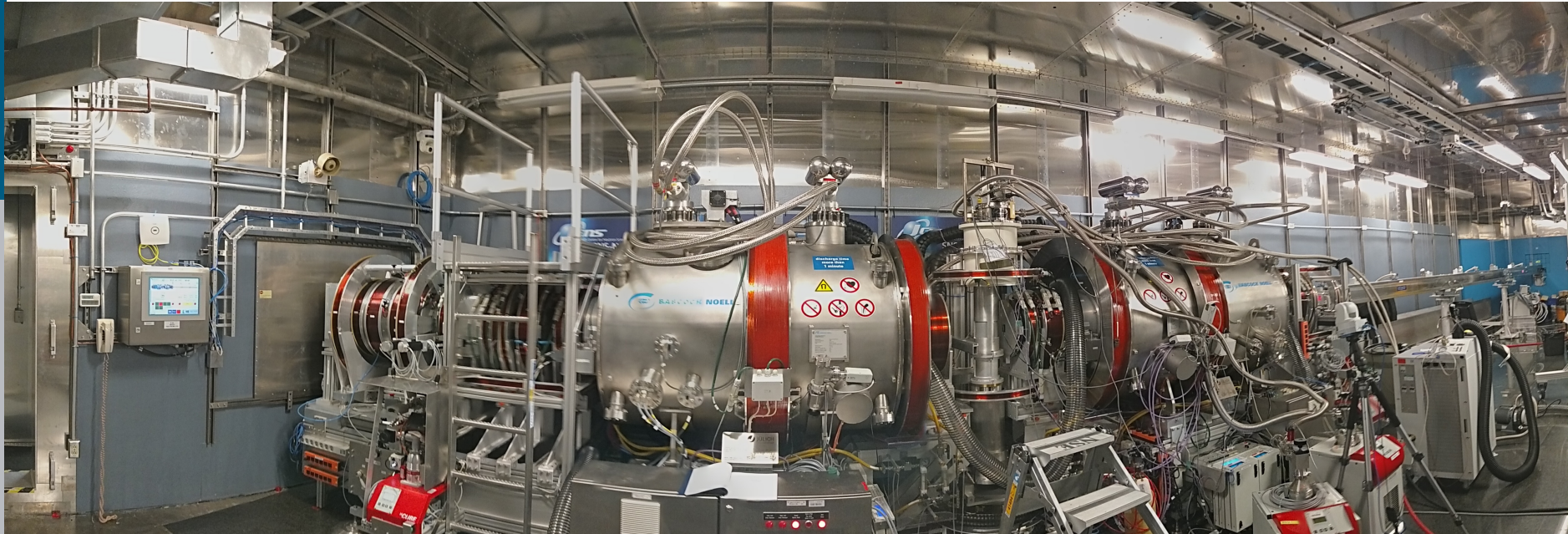
Ke An • 865.919.5226 • kean@ornl.gov

***Scheduled commissioning date**

LEGEND

- Operating instrument in user program
- In design or construction
- Under consideration

SNS-NSE: IN11-Type NSE



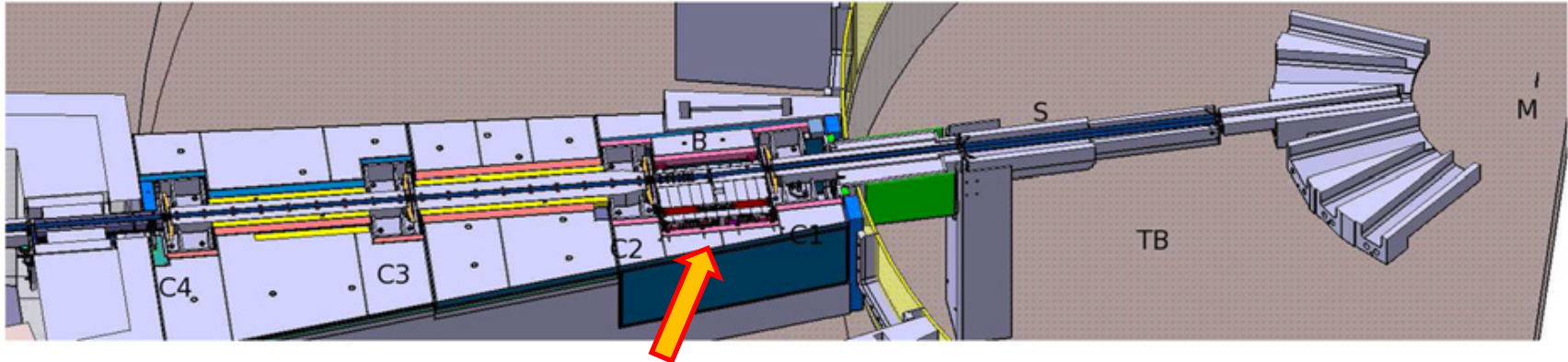
$J_{\max} \sim 0.56 \text{ Tm}$
 4-choppers: $\Delta\lambda = 2.6\text{-}3.1 \text{ \AA}$

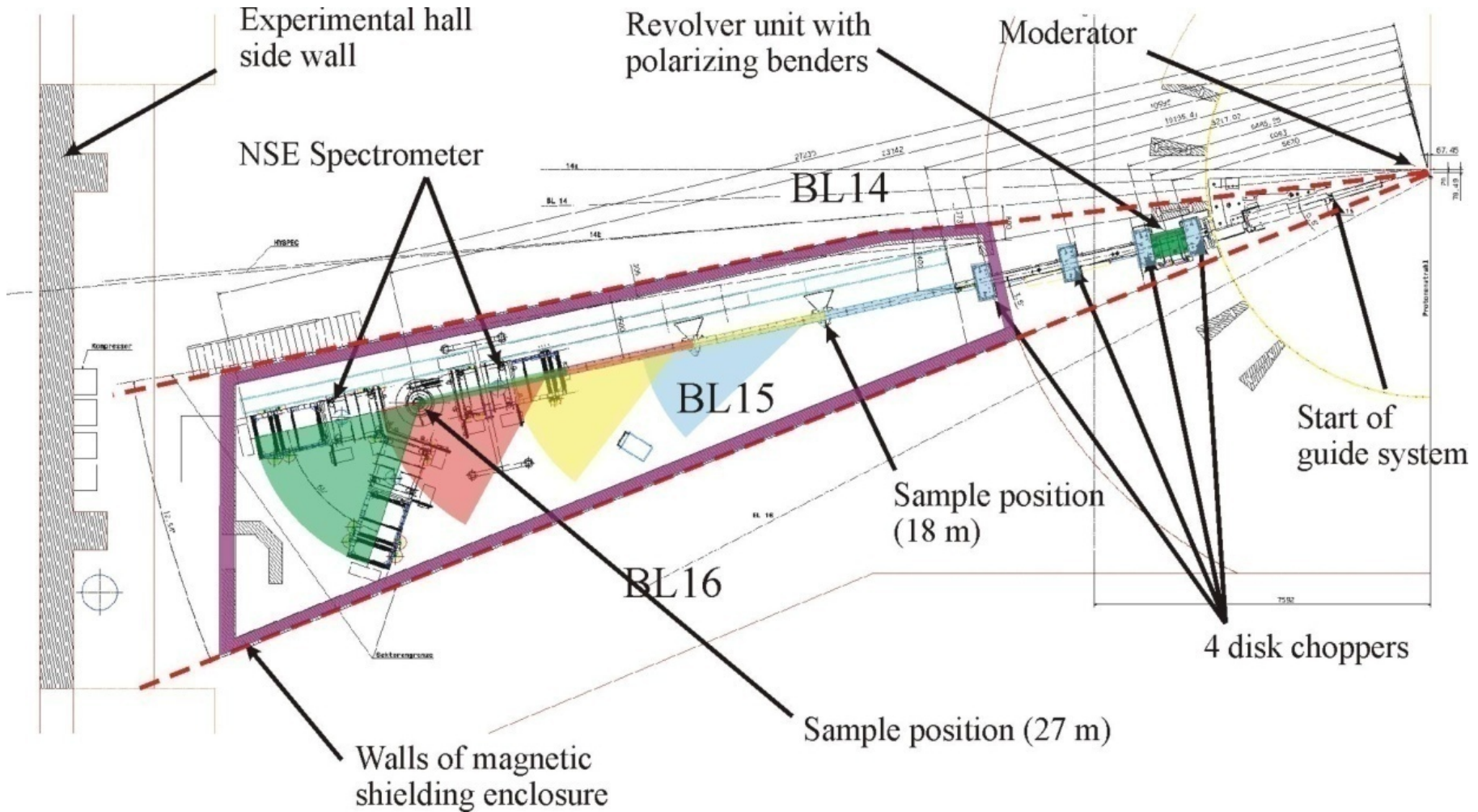
02/2006: MOA signed.

09/2009: First echo.

04/2010: First user.

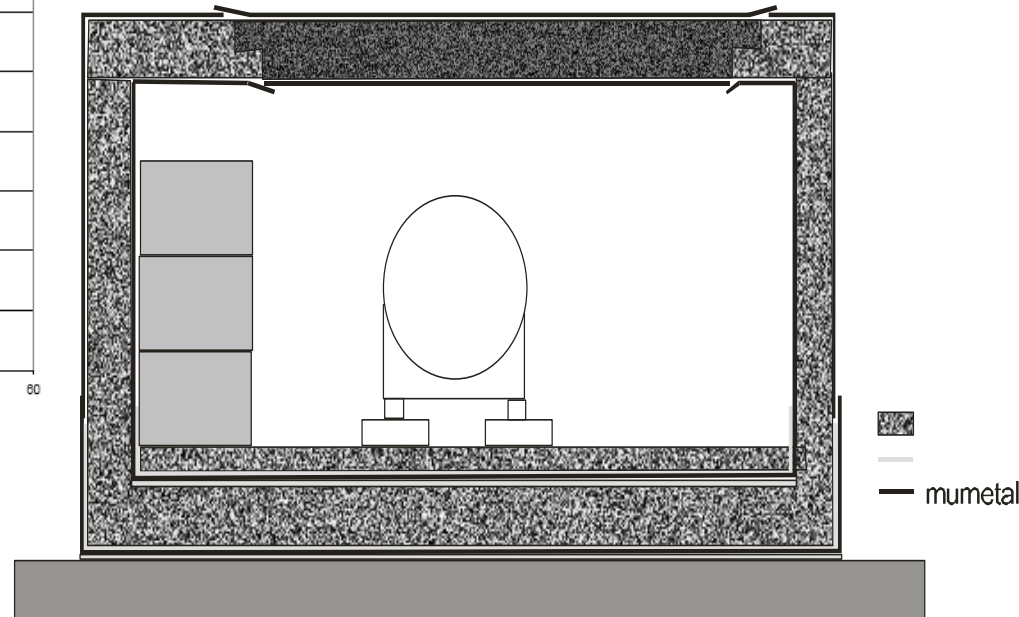
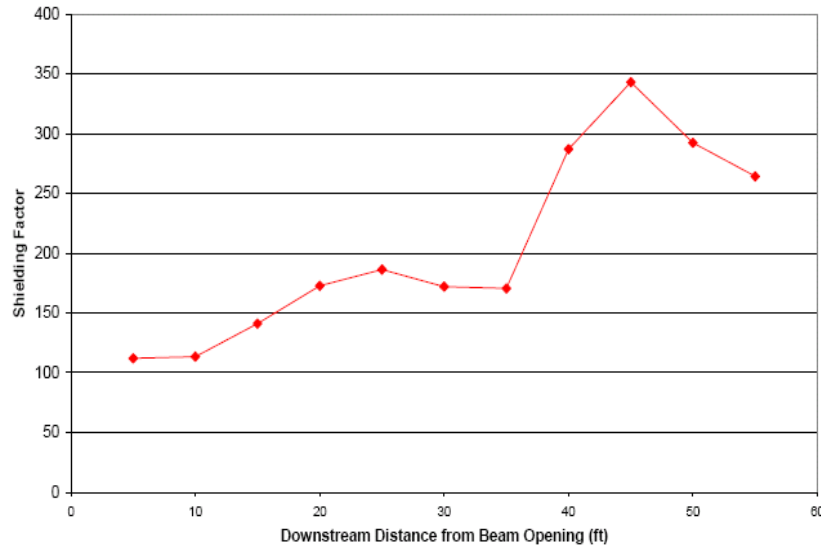
Choppers and Polarizers





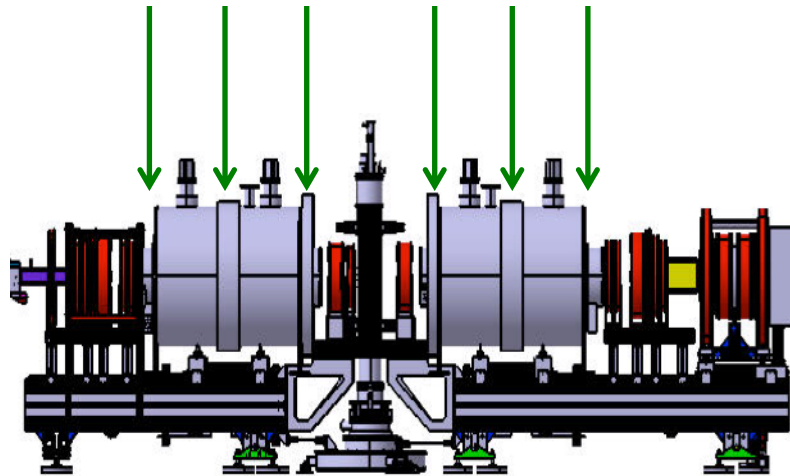
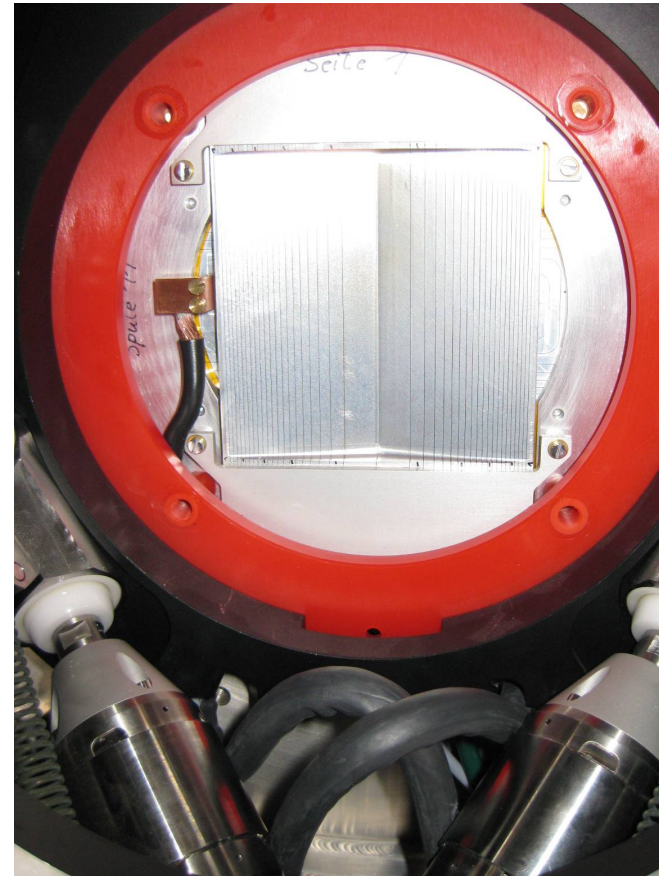
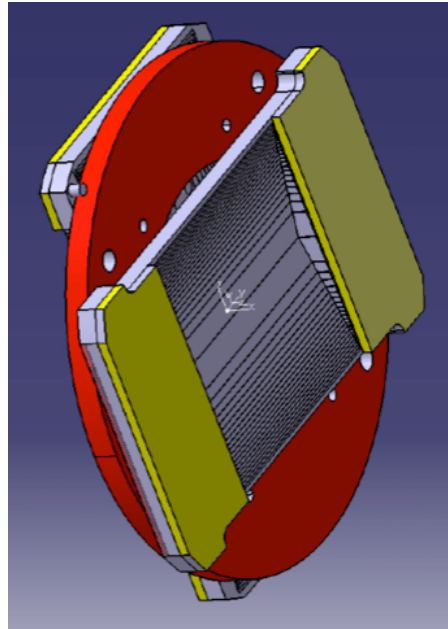
Magnetic Shielding

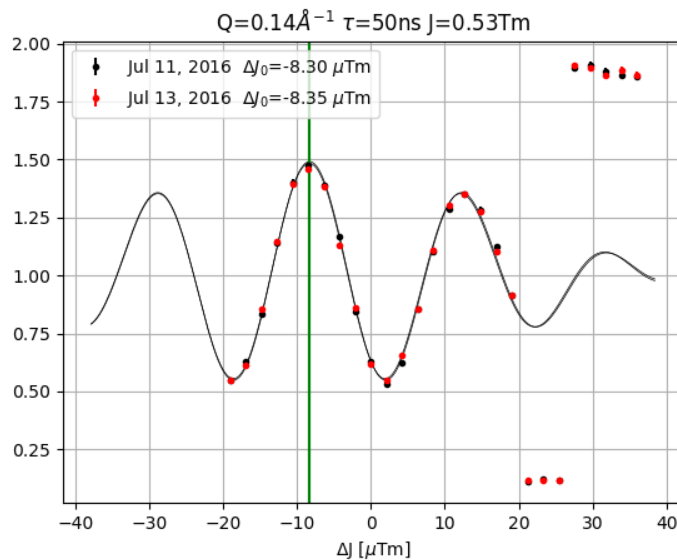
Calculated Shielding Factor along Beam Line



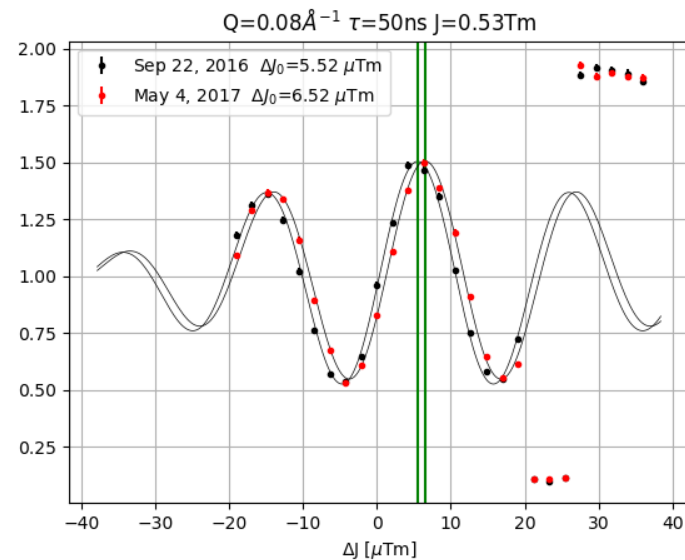
Shielding factor up to 350.

Correction coils

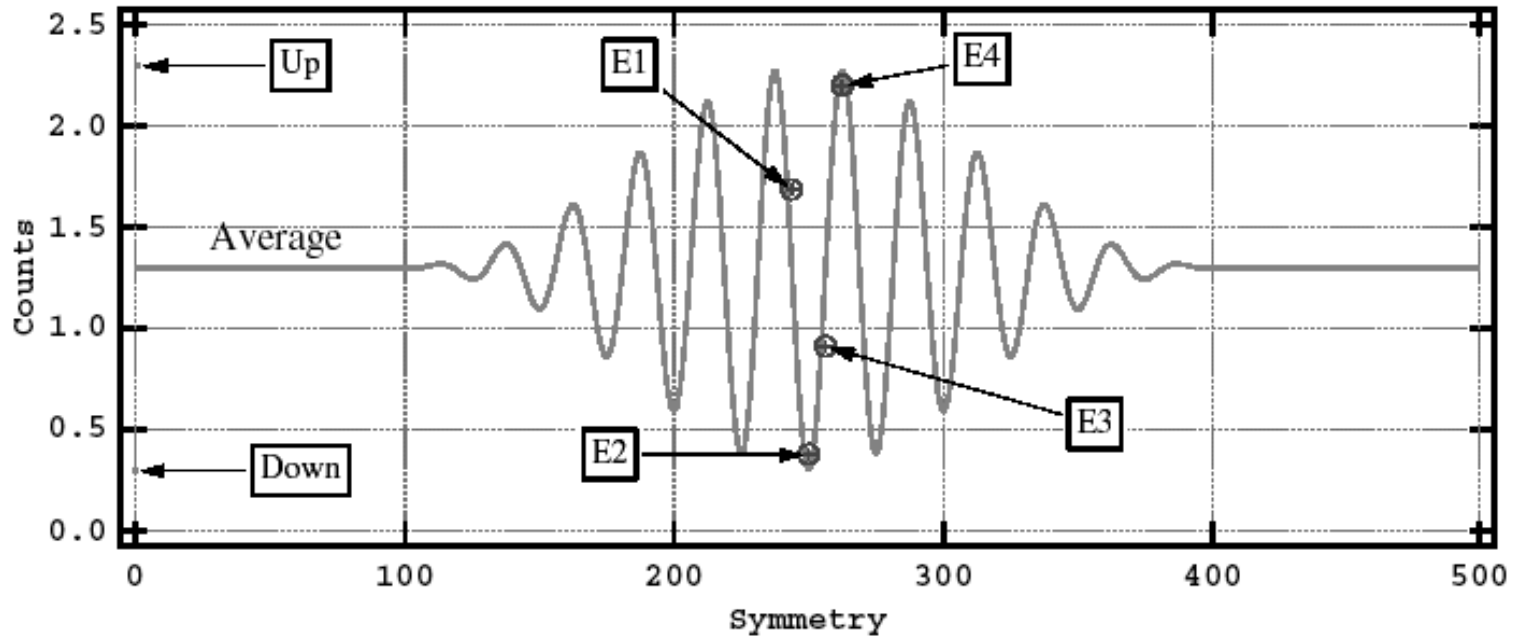




$\Delta J = 0.05 \mu\text{Tm} \rightarrow 1 \text{ deg}$



$\Delta J = 1 \mu\text{Tm} \rightarrow 20 \text{ deg}$



90-degree steps

$$E1 = \text{Aver} + \text{Echo} * \sin(\varphi)$$

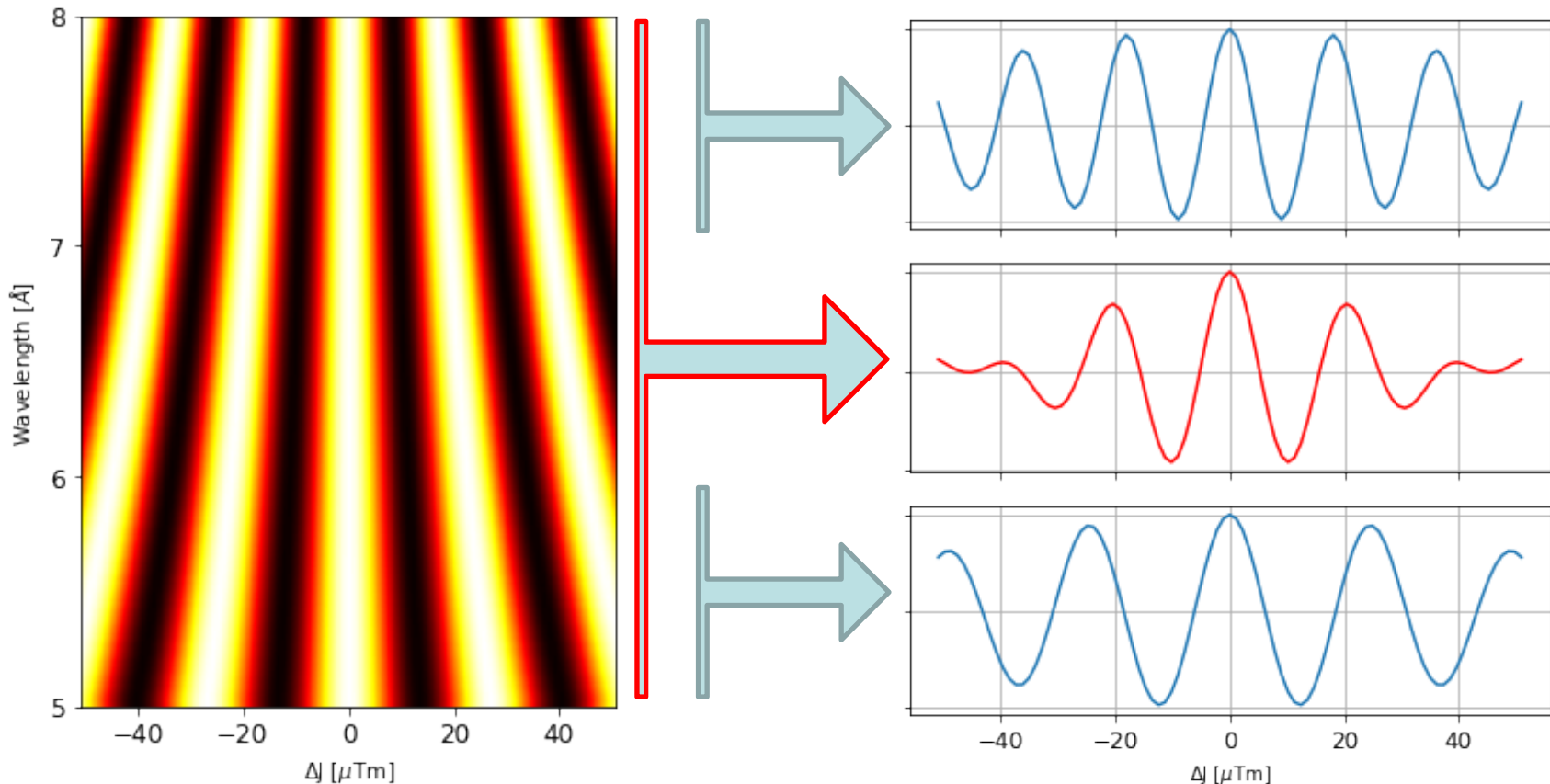
$$E2 = \text{Aver} - \text{Echo} * \cos(\varphi)$$

$$E3 = \text{Aver} - \text{Echo} * \sin(\varphi)$$

$$E4 = \text{Aver} + \text{Echo} * \cos(\varphi)$$

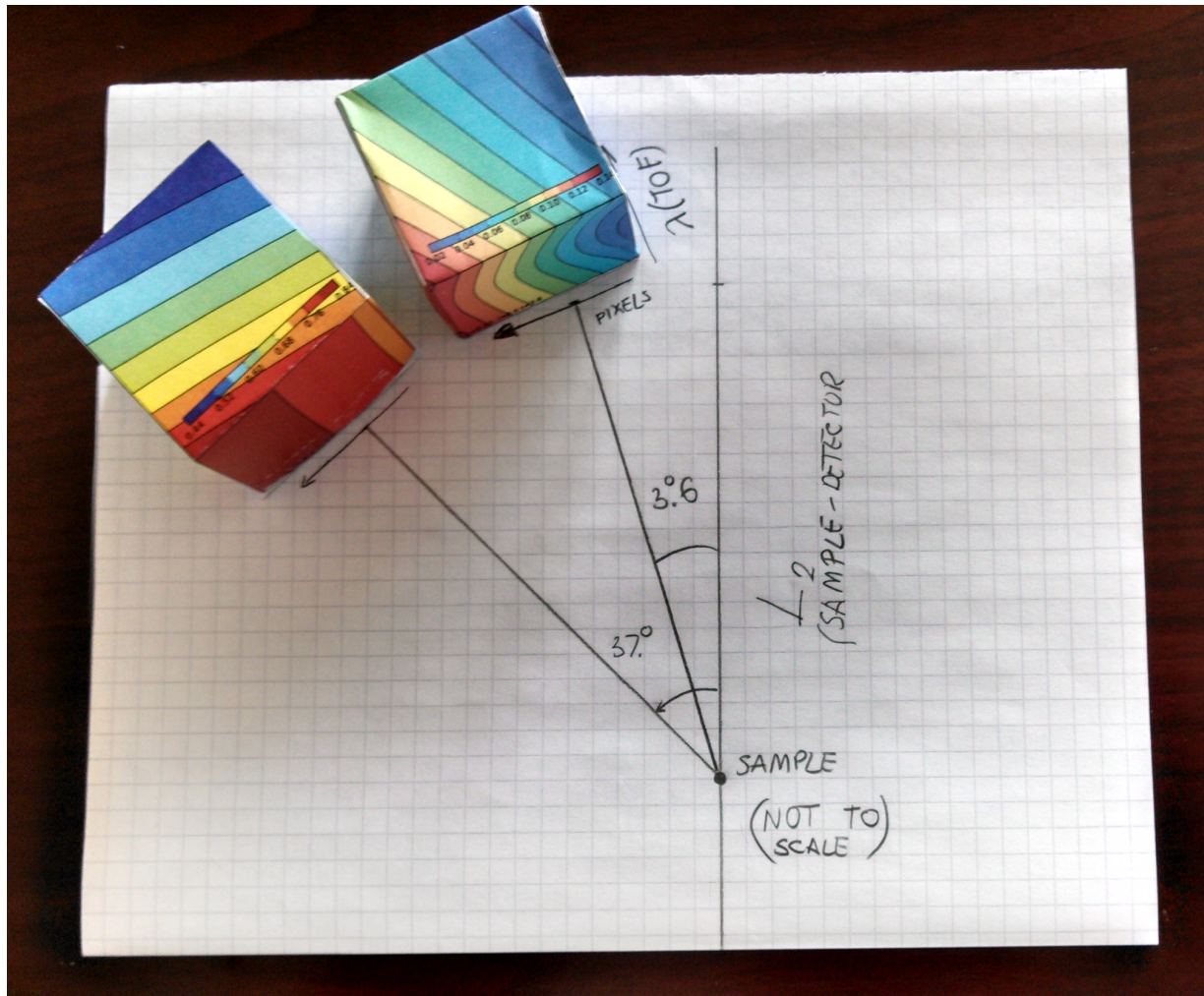
$\Delta\lambda/\lambda_0$ up to ~50%

Echo Signals

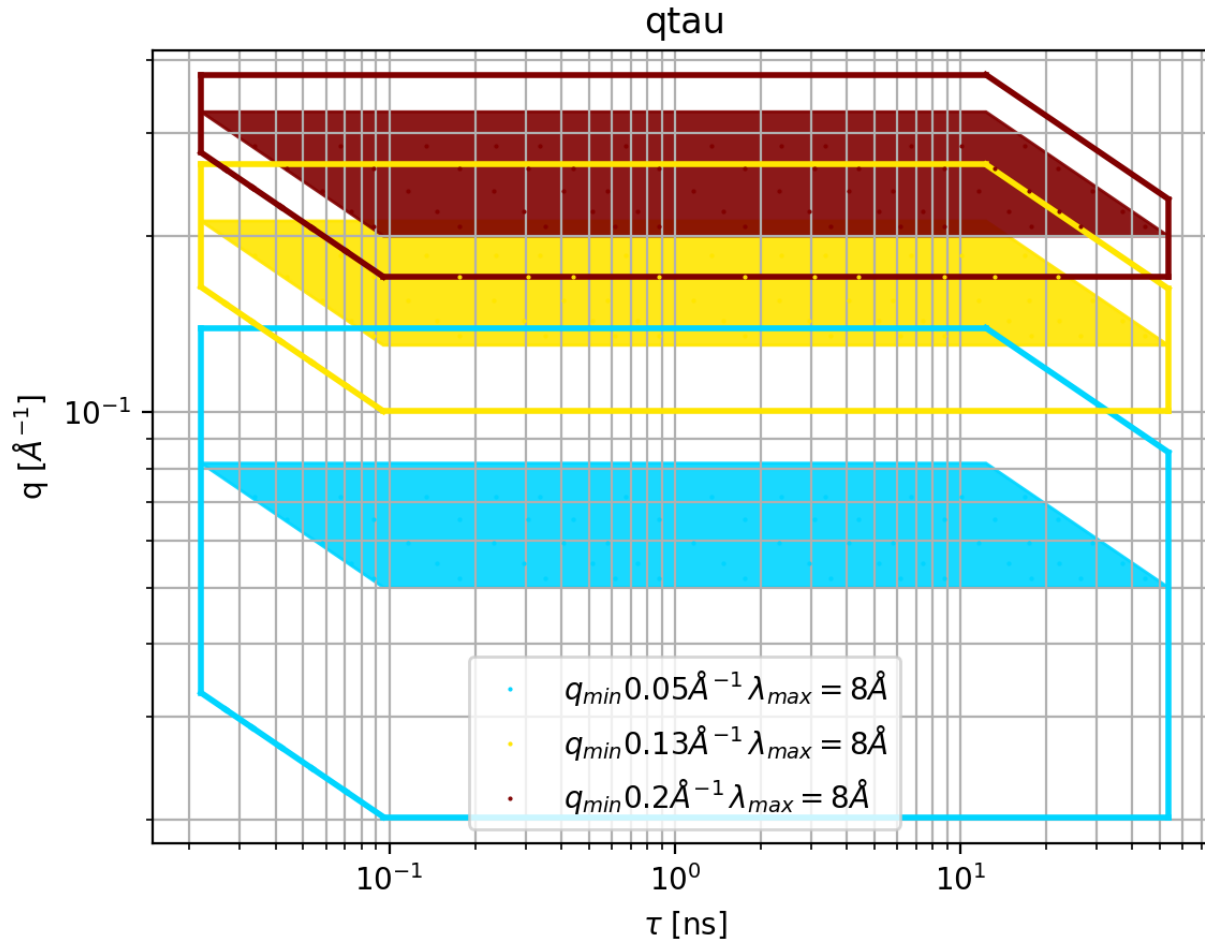


- 1) F. Mezei, Nucl. Inst. Methods **164**, 153-156 (1979)
- 2) B. Farago, Time-of-Flight Neutron Spin Echo: Present Status in F.Mezei, C.Pappas, T.Gutberlet Neutron Spin Echo Spectroscopy, Springer (2003)

TOF NSE + Multi-detector



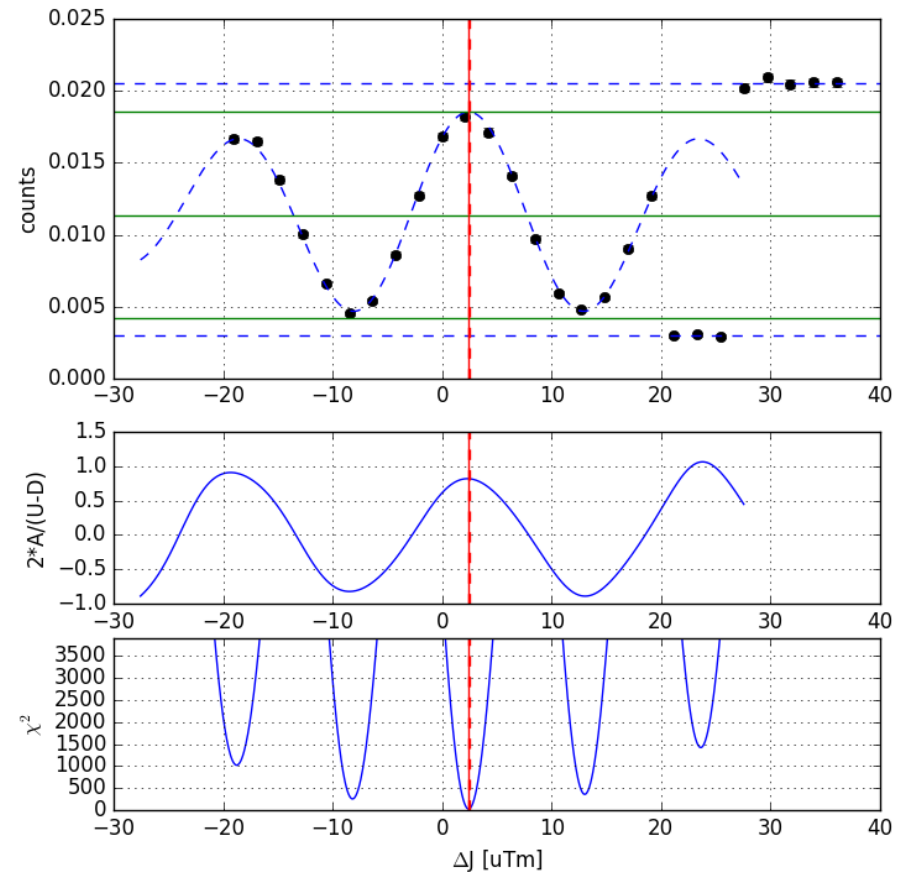
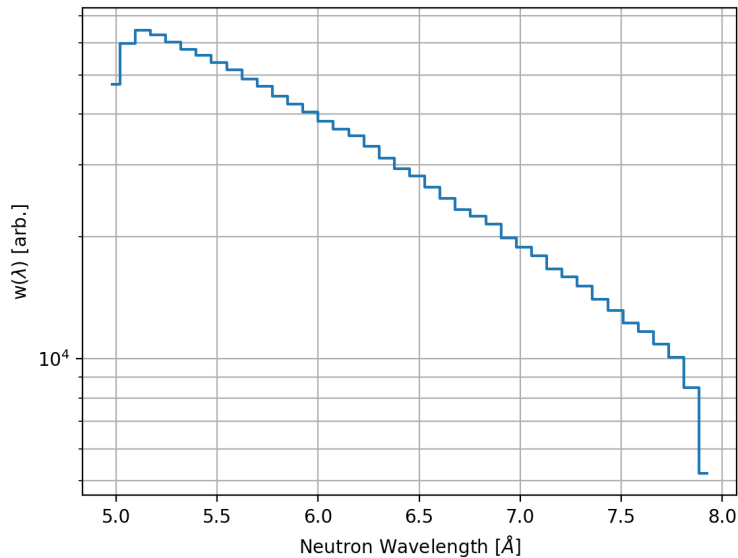
Q-Tau Coverage



DrSPINE - Data Reduction for SPIN Echo

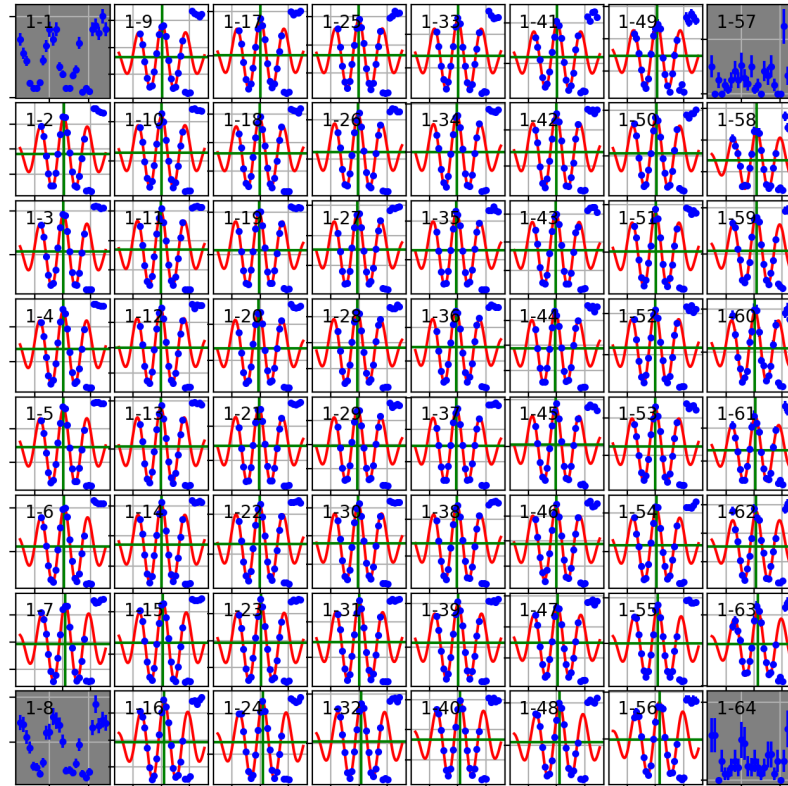
- read data from various instruments
- data integrity, consistency and compatibility checks
- compatible sets, read partial scans
- perform background subtraction (on demand)
- console-based user interface
- macros (scripts) for batch processing
- good documentation

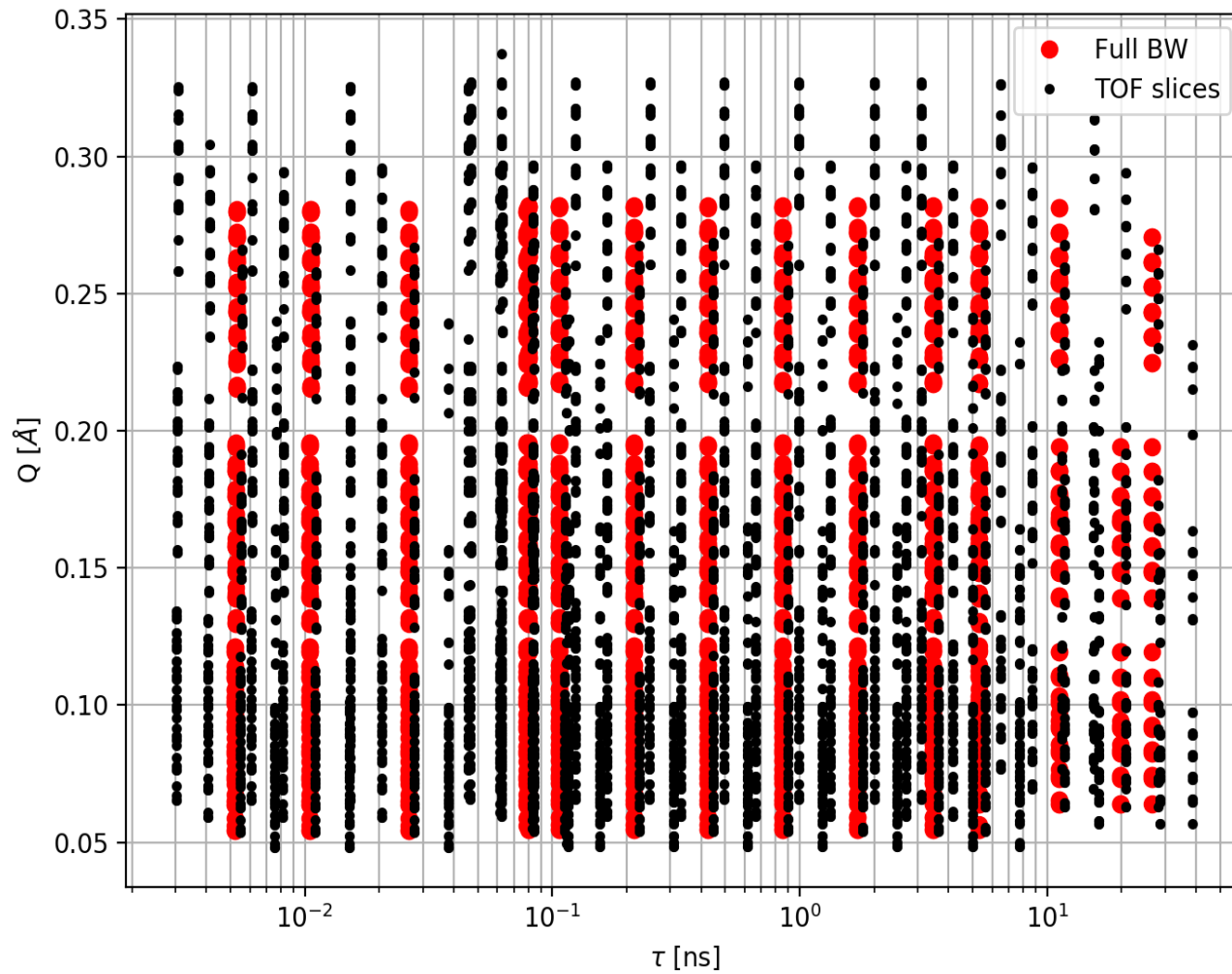
$$f_{\text{pixel}} = B + A \frac{\sum w(\lambda) \operatorname{sinc}\left(\gamma_n \frac{m_n}{h} \delta J \delta \lambda\right) \cos\left(\gamma_n \frac{m_n}{h} \delta J \lambda_0\right)}{\sum w(\lambda)}$$

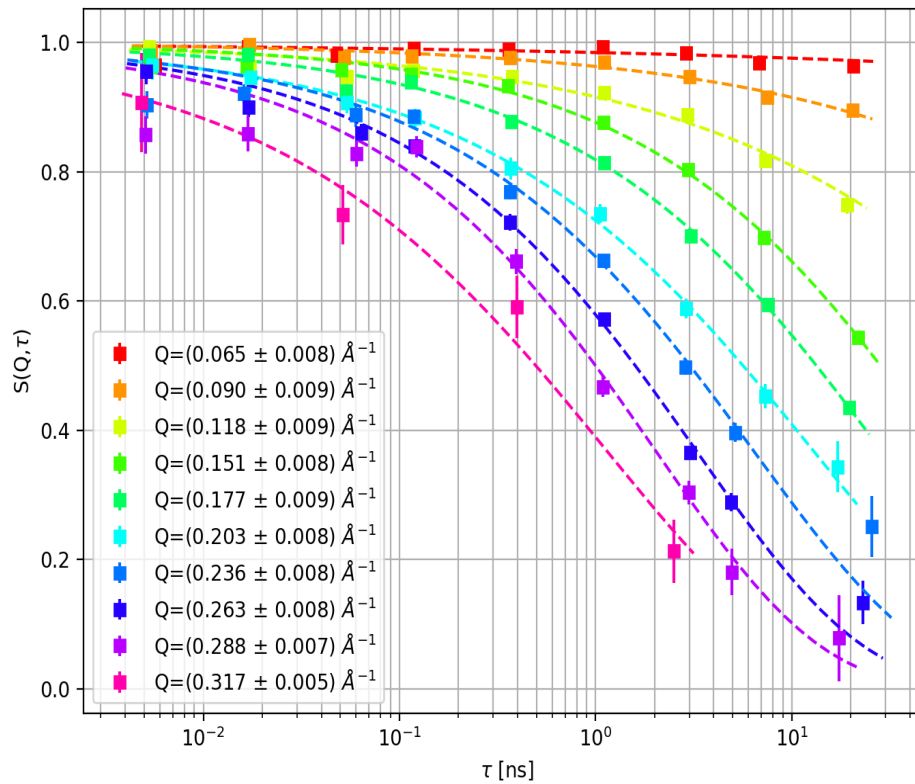


Phase Fitting

ResAAO_413p0K (./fits_5851 echo[1])







- SNS-NSE – first one classical NSE at the pulsed source
- Data Reduction is challenging but we have a solution

- Acknowledgements: M. Monkenbusch, L. Stingaciu, M. Ohl, O. Holderer, S. Pasini, T. Kozielowski, M. Cochran

Thank you!!!