PSI Center for Neutron and Muon Sciences

Neutron Instrumentation

Design, Criteria and Implementation

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Neutrons in Condsensed Matter Physics

- Neutrons vs. X-Rays
- 5 preferential components
  - Energy and Wavelength
    - 1-6 Å & 1-25 meV
  - Isotopes and light elements
  - Quantative experiments
    - Weak interections
  - Penetration depth
    - Sample & environments
  - Magnetism
    - Magnetic moment

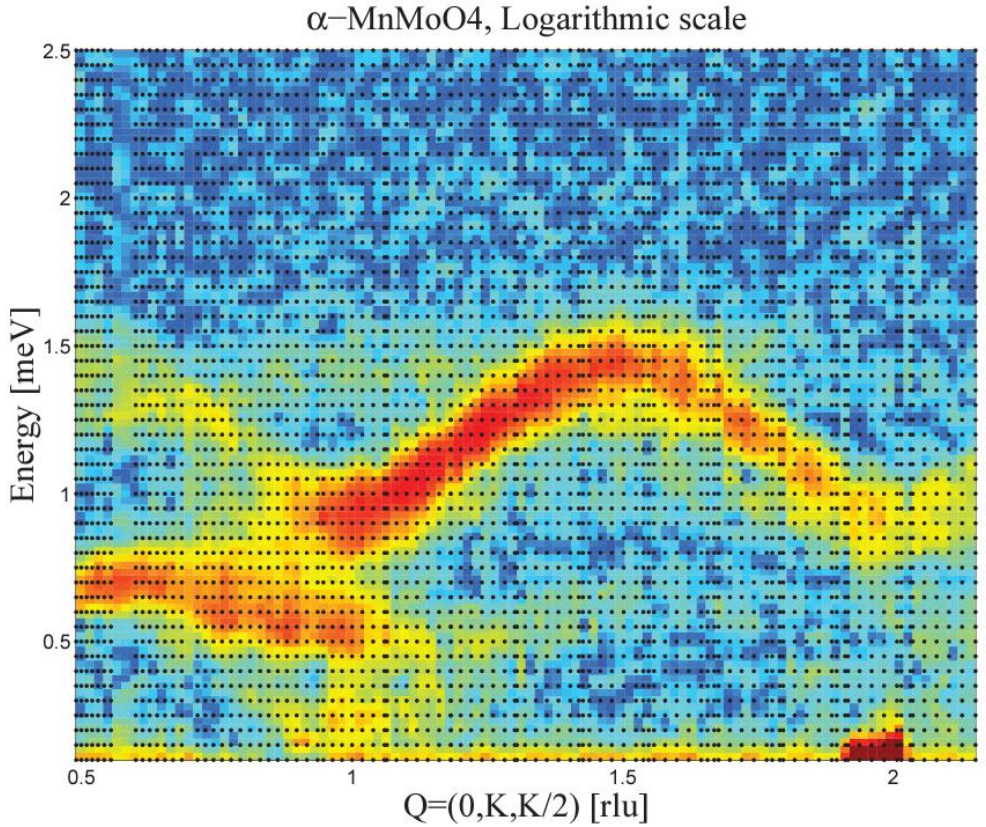
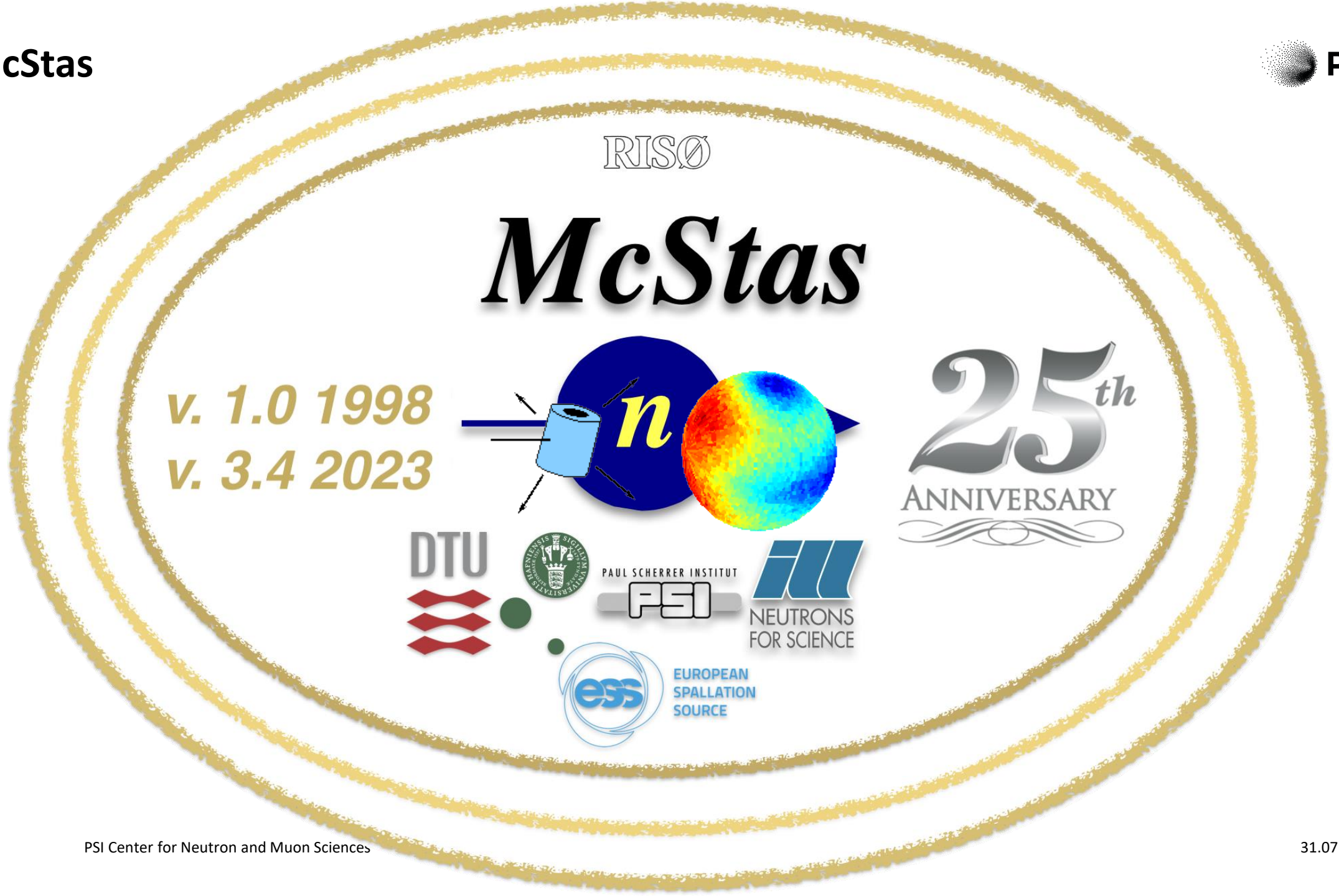


Figure 1: Inelastic neutron scattering data on a single crystal of the molecular magnet α-$MoMnO_4$, taken by the students at the Copenhagen neutron scattering course, 2005. From Ref. [1].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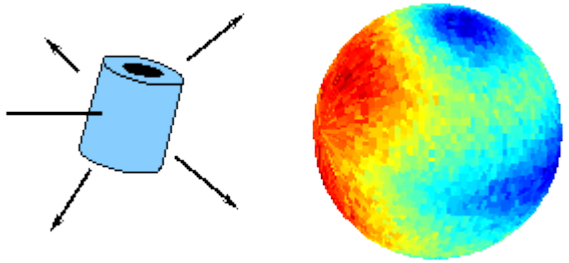
McStas – Monte Carlo Simulations of Neutron

- Monte Carlo simulations
  - LLN
- Ray tracing algorithms
- Models of Complex behavior



McStas – Monte Carlo Simulations of Neutron

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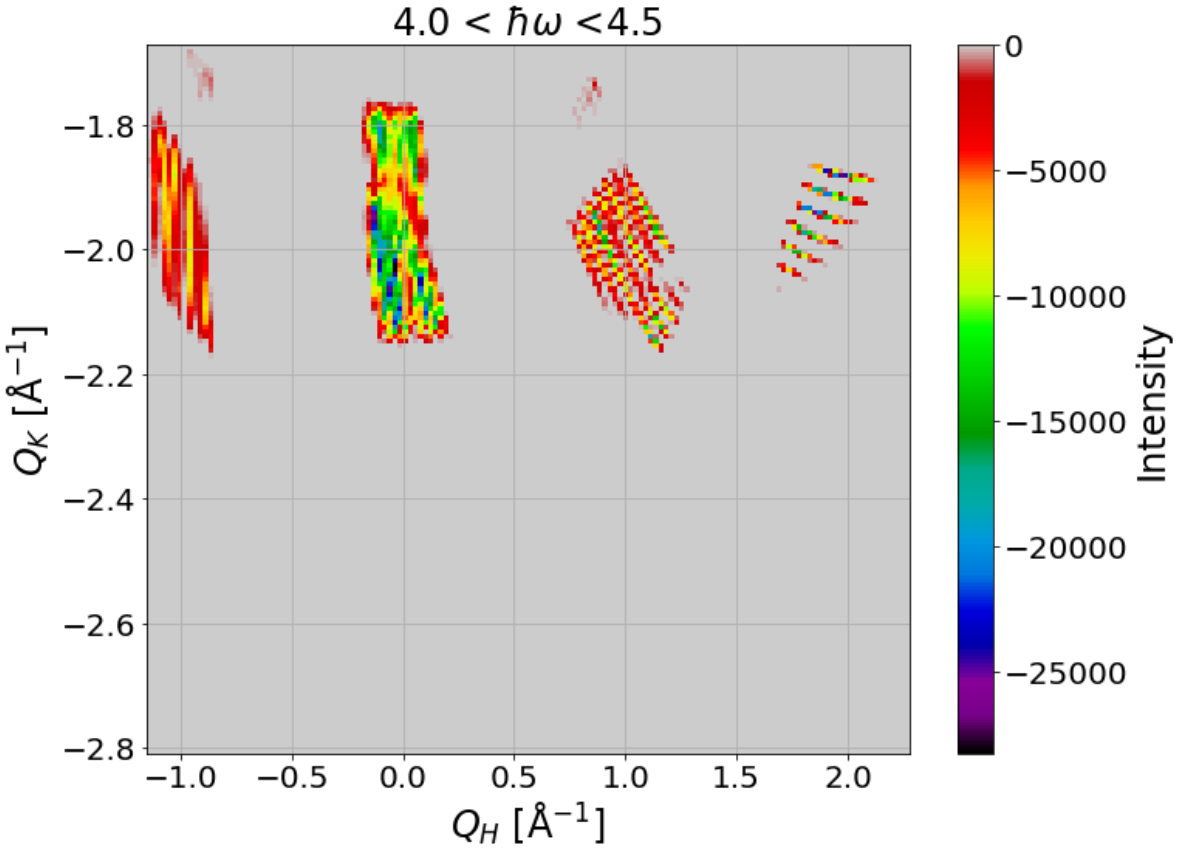
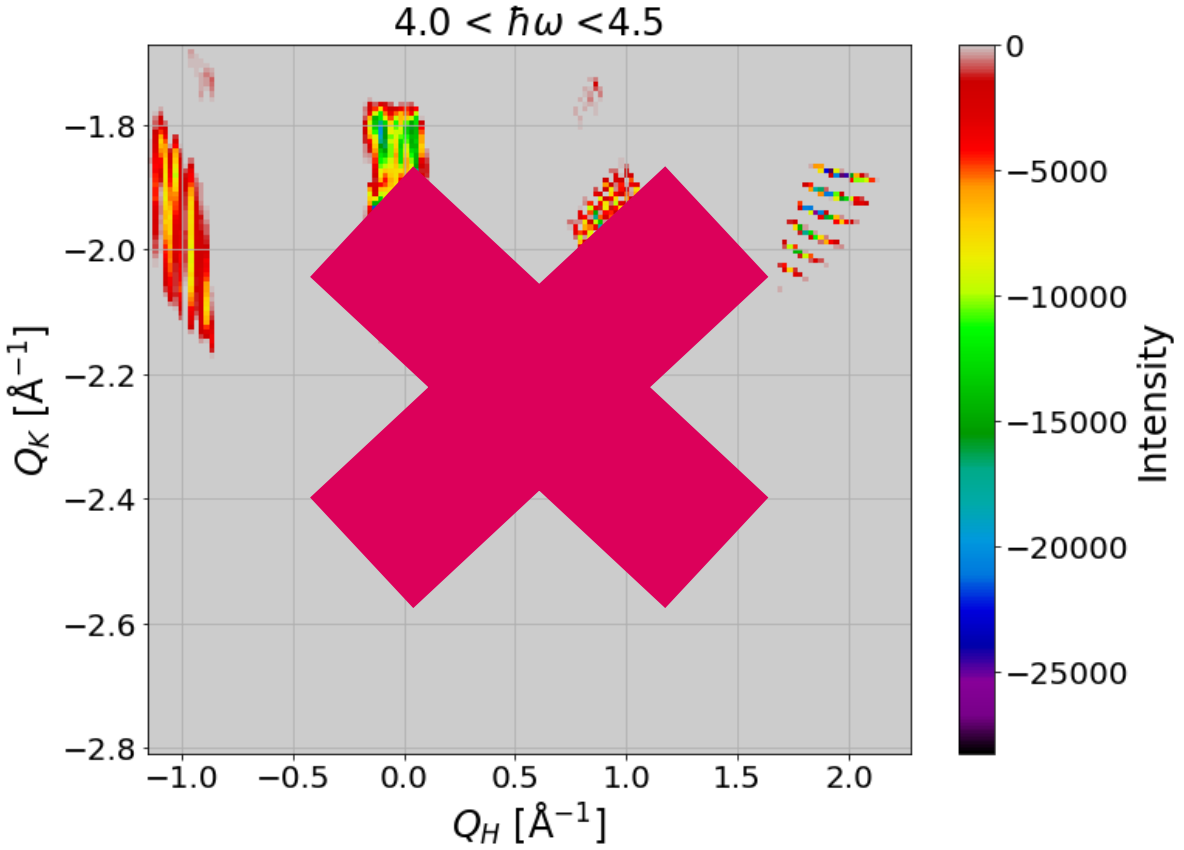
- Models of Complex behavior
  - Based on components and how they are coded



McStas – Monte Carlo Simulations of Neutron

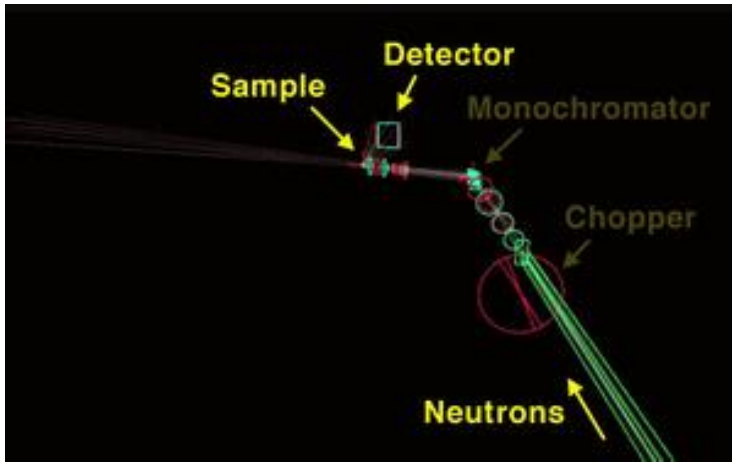
- Monte Carlo simulations
  - LLN
- Ray tracing algorithms
- Models of Complex behavior
  - Based on components and how they are coded
  - Not always coded correctly

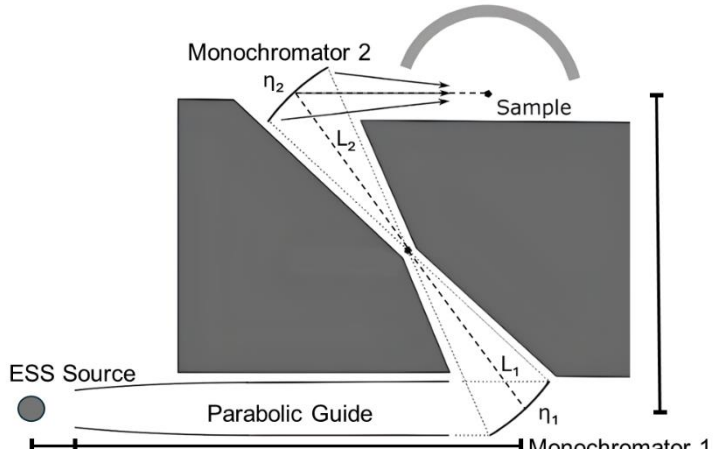


Instrument Design in McStas

Primary Use:

- Instrument design and benchmarking





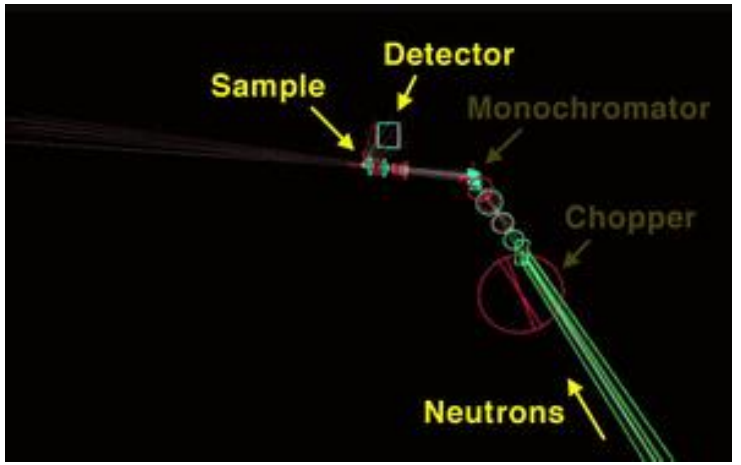
Instrument Design in McStas

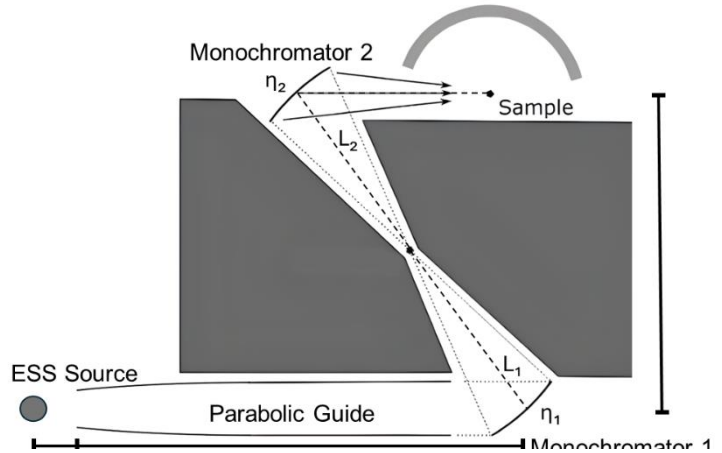
Primary Use:

- Instrument design and benchmarking

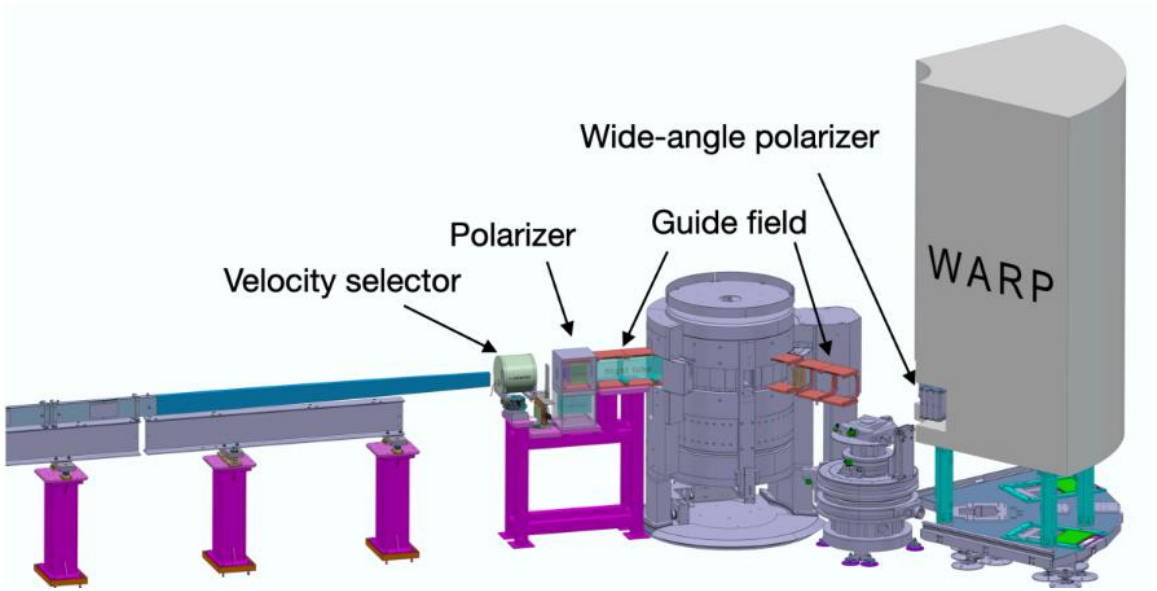
Why use numerical design over analytical calculations?

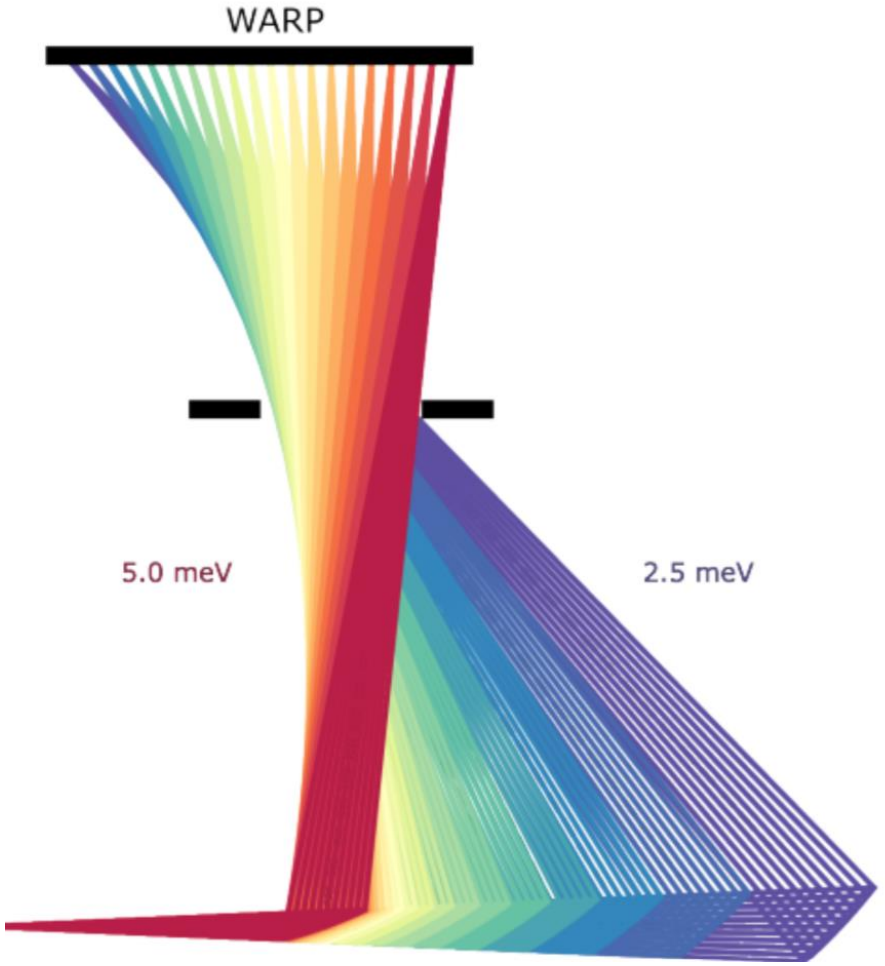
- Source
- Sample
- Mosaicity
- Dimensions and divergence





WARP – Wide-Angle high-Resolution Prismatic spectrometer with polarization option





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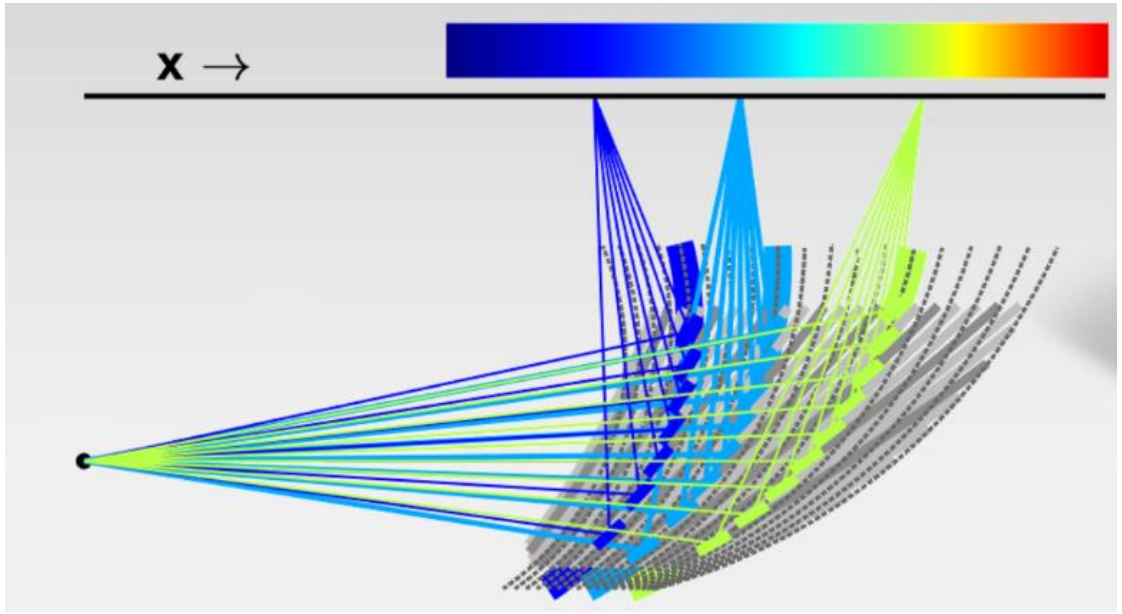
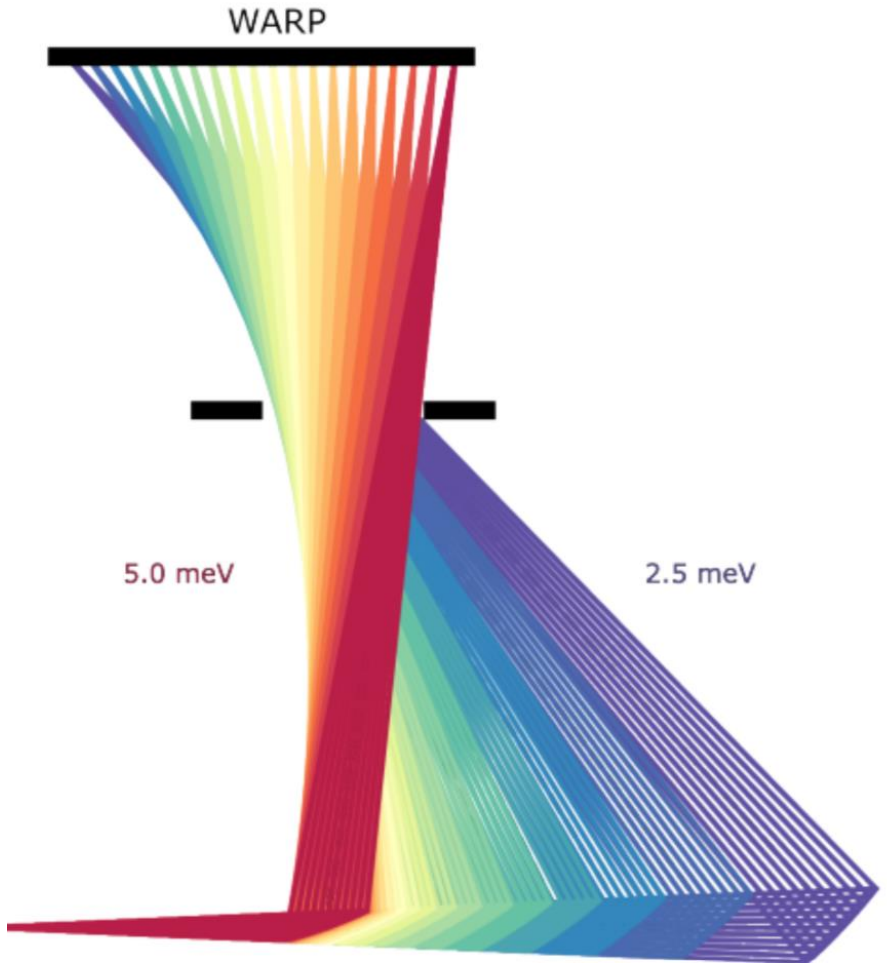
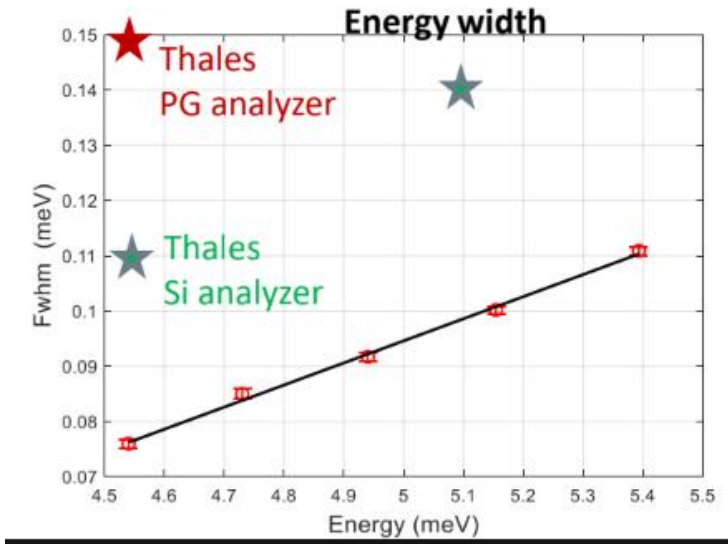


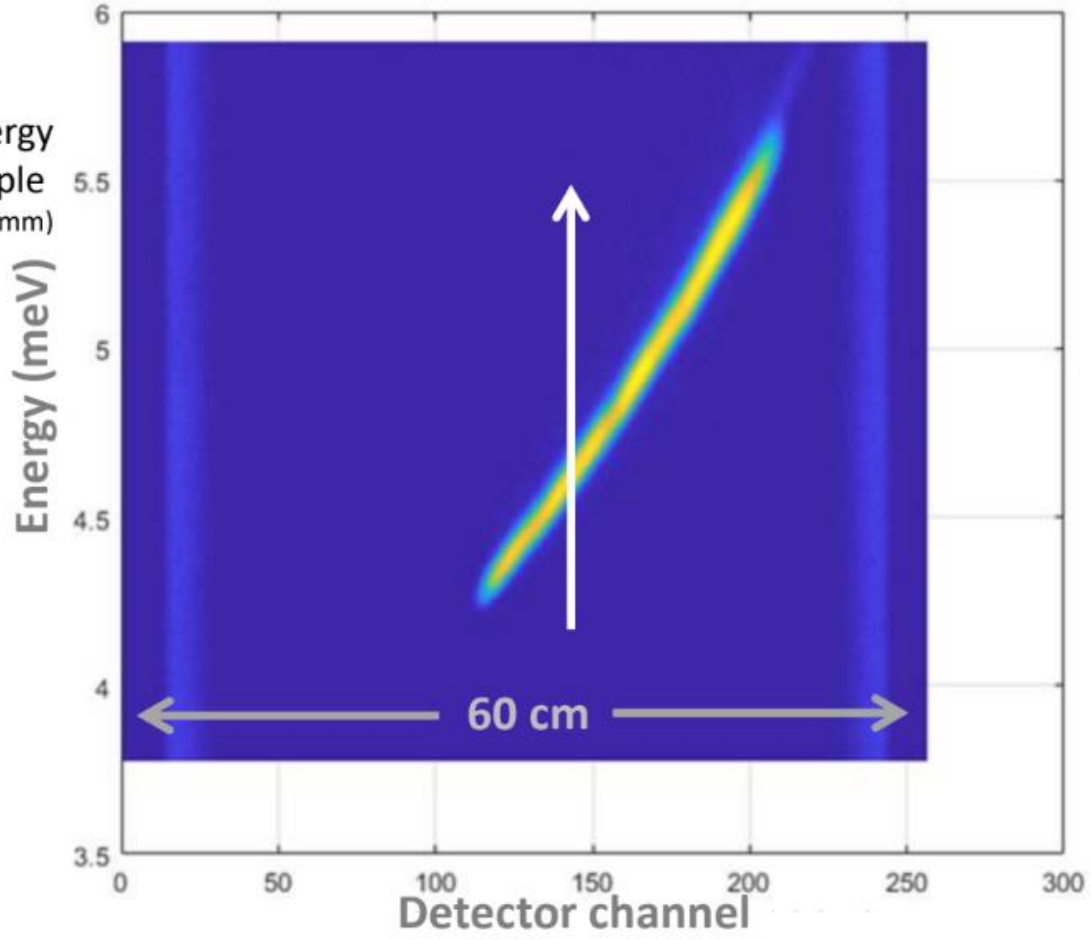


Current ILL Measurements

Prototype (34 silicon blades)

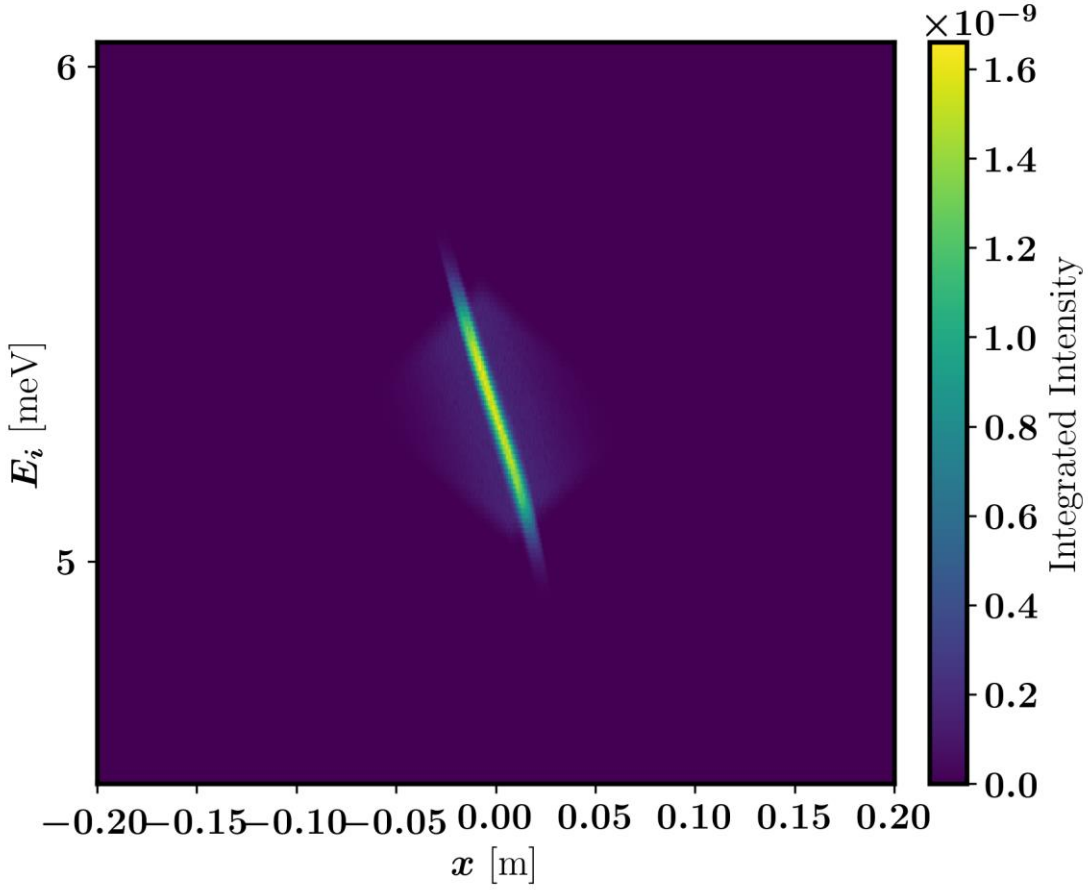
Scan incident energy
on Quartz sample
(h=5mm, ∅=15mm)





Current McStas component design

- Curved Monochromator with mosaicity
- Current design
- Flaws
- Full array causes problems



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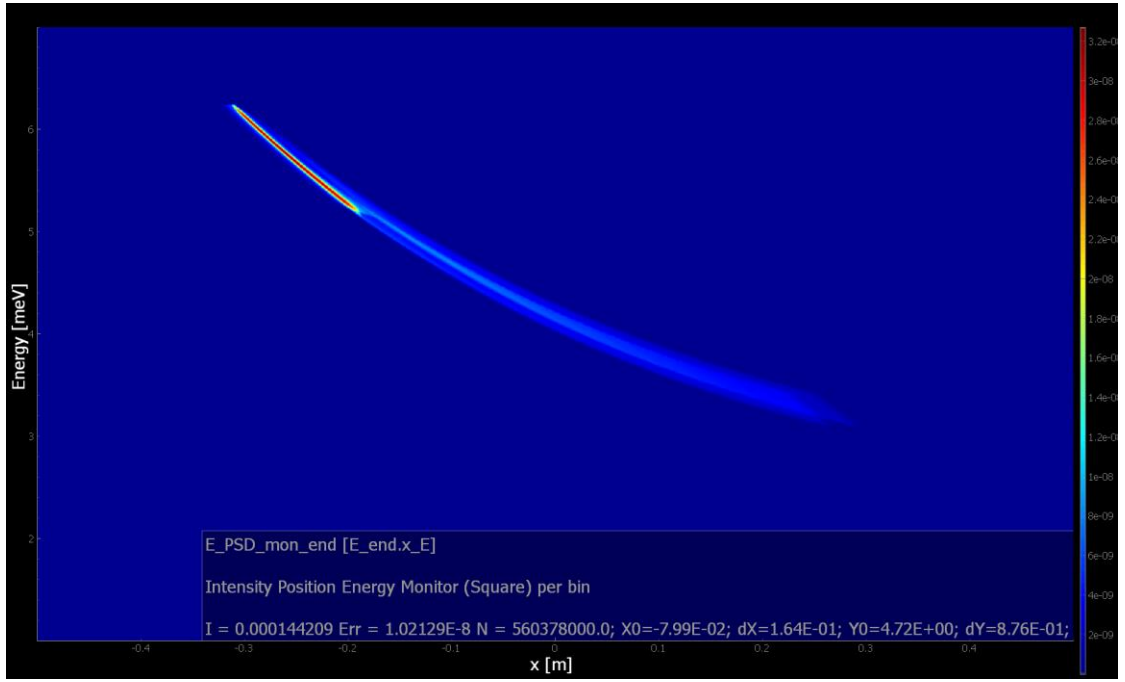

Thank you, Questions?