

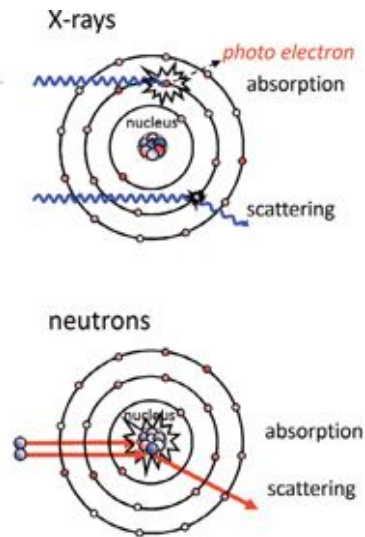
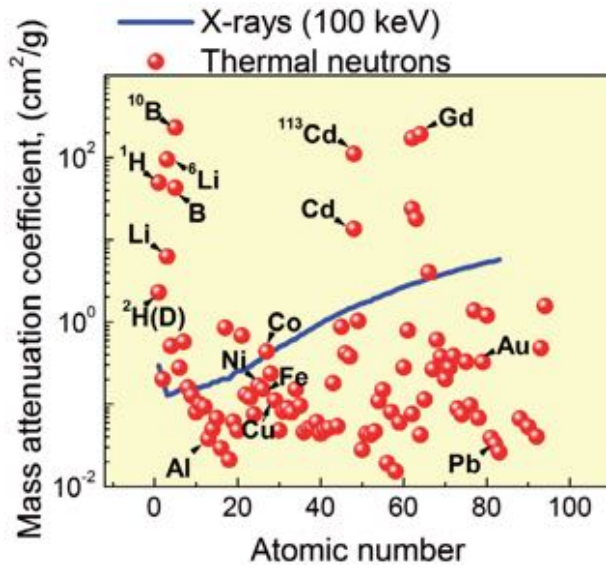


Neutron Imaging

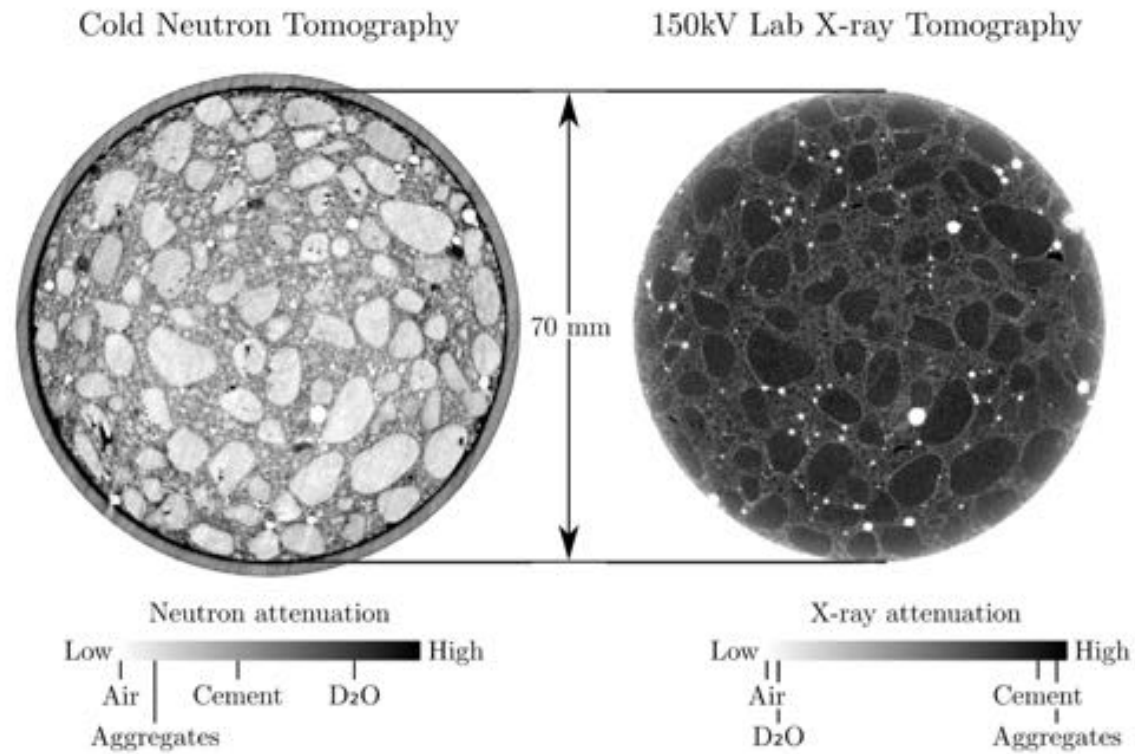
Søren Schmidt

Department of Physics
Technical University of Denmark (DTU)

X-rays vs Neutrons

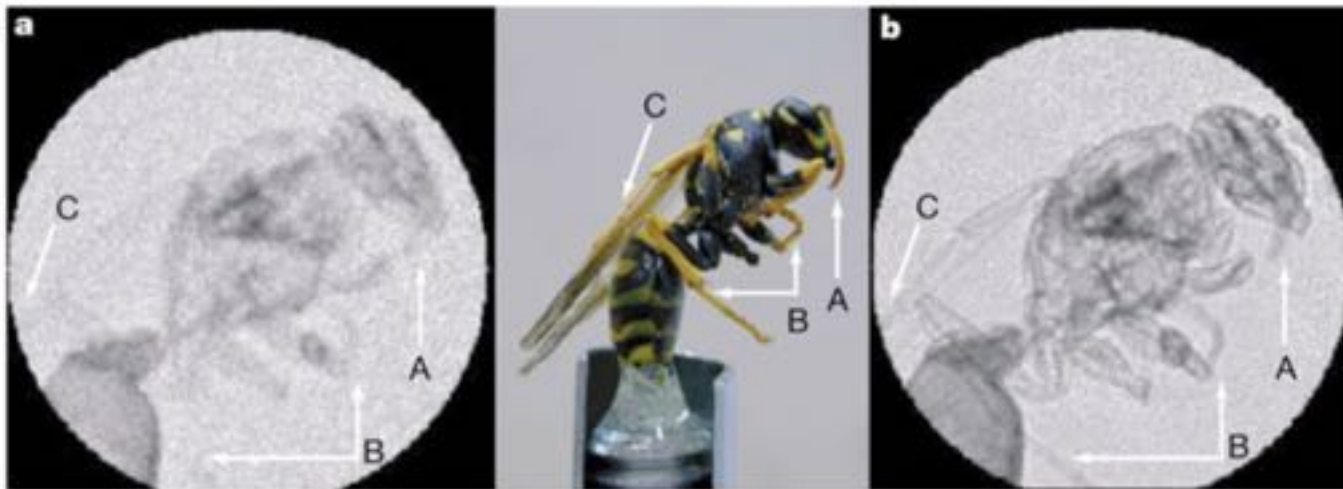


Tomography



M. Yehya et al., Nucl. Inst. and Methods in Physics Research (2018)

Phase contrast imaging with neutrons

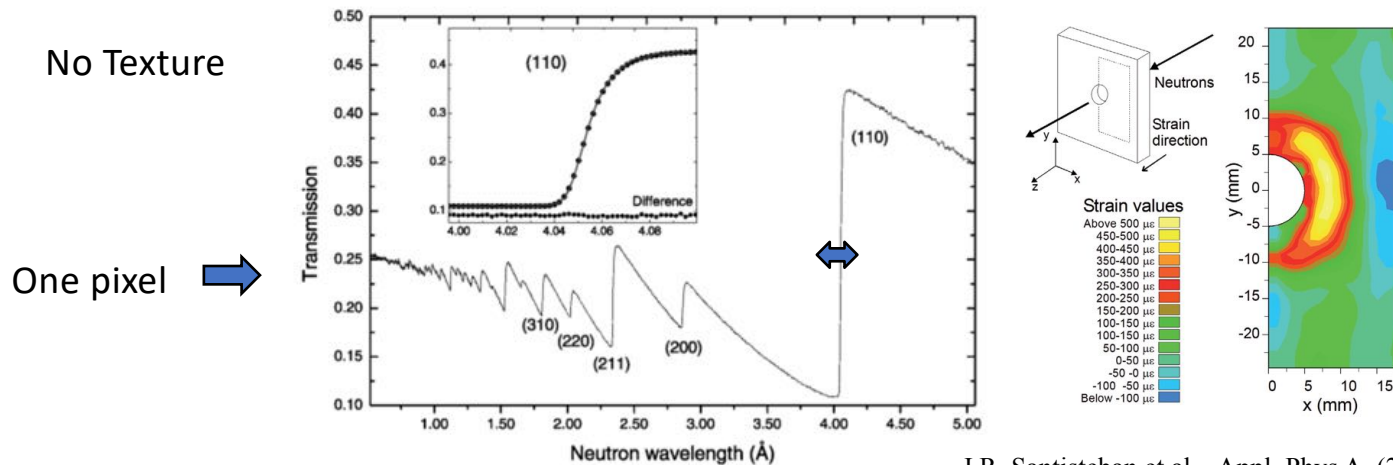


Attenuation

Phase contrast

B.E. Allman et al., Nature (2000).

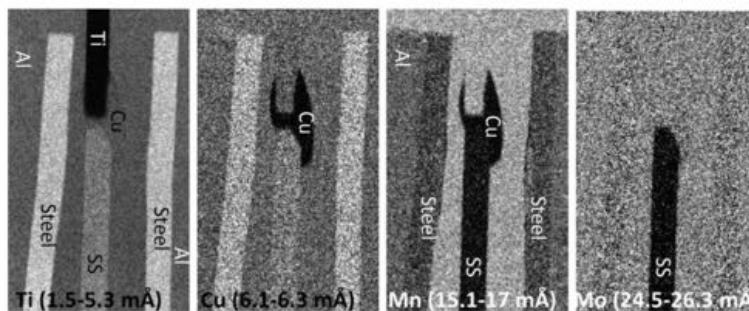
ToF Neutron Radiography – Phase and Strain



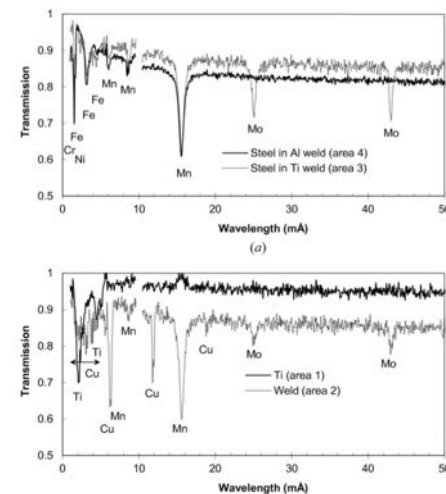
J.R. Santisteban et al., Appl. Phys A. (2002)

Bragg edge: $\lambda = 2d_{hkl} \sin \theta \leq 2d_{hkl}$

Resonance Absorption Analysis



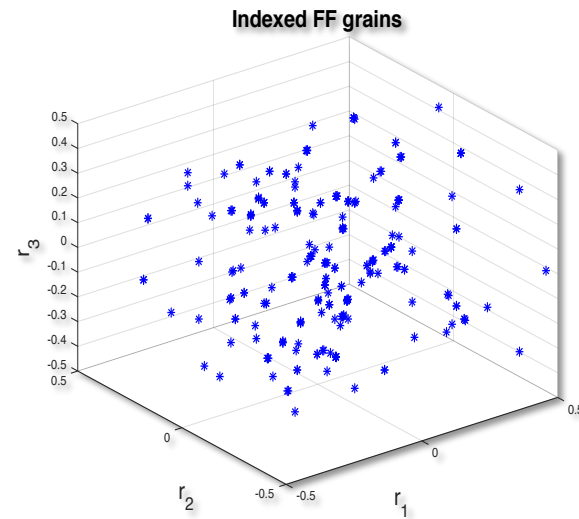
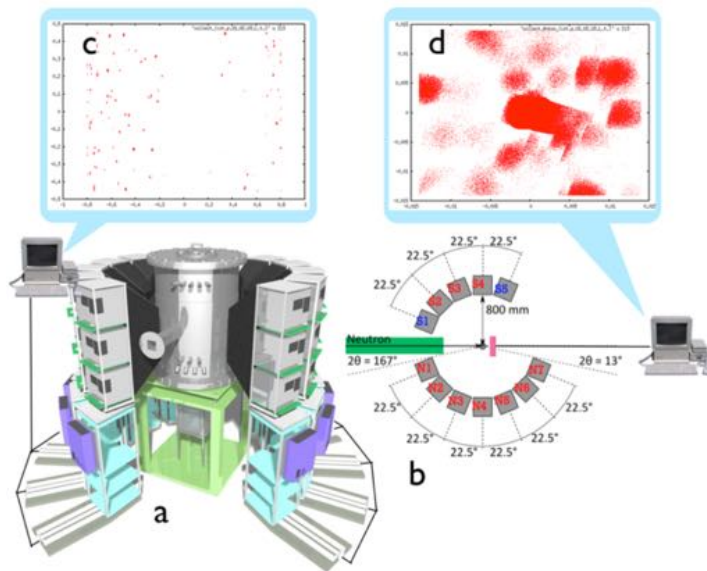
A.S. Tremsin et al. J. Appl. Cryst (2016)



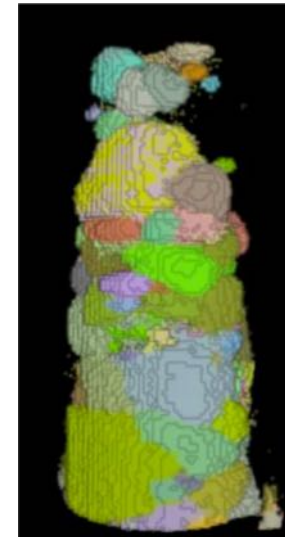
Wide range of applications for neutron imaging

- Engineering Materials
- Energy Materials/Devices
- Functional Materials
- Biological Materials
- Geological Materials
- Archaeological Materials

3DND - determination of 3D crystal structures

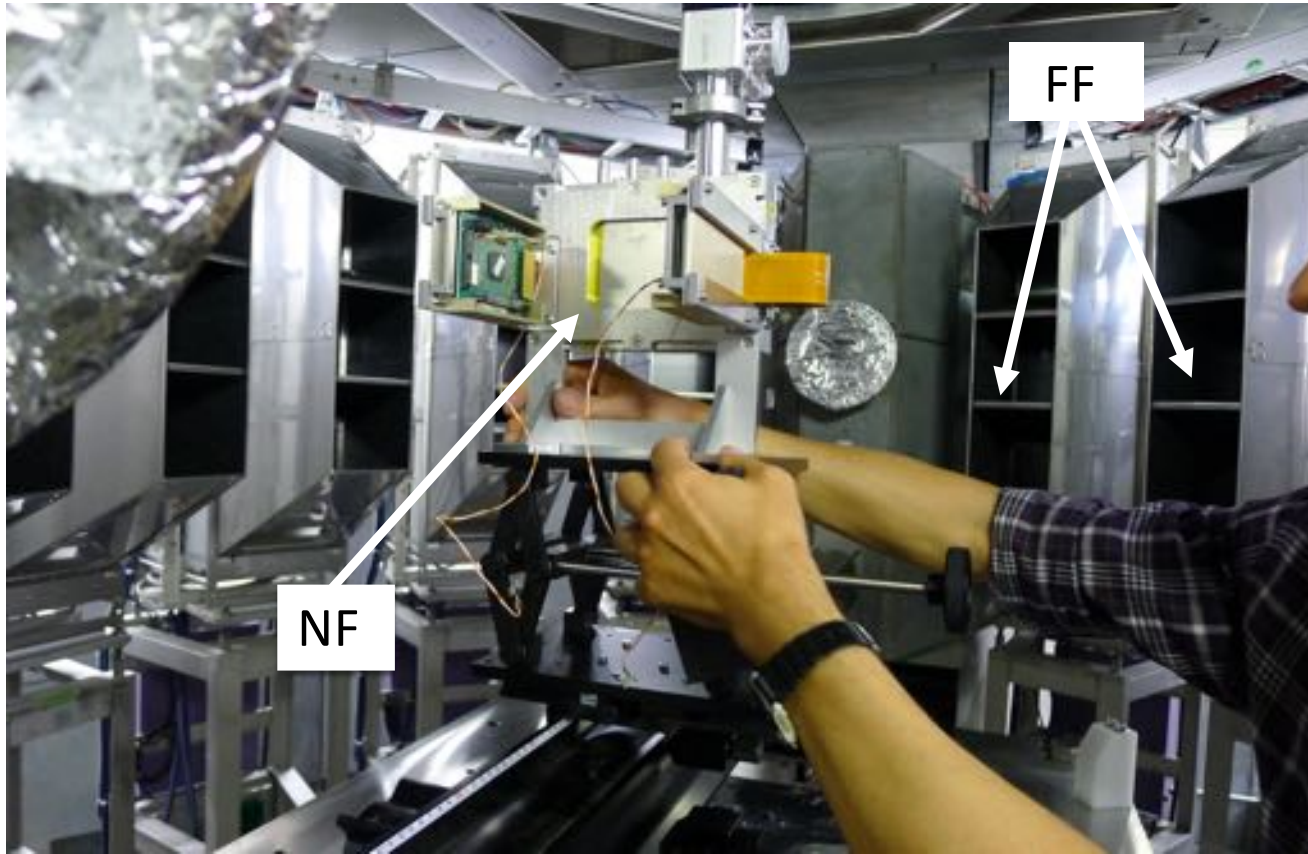


Orientation space



Direct space

A. Cereser, et al., Sci. Rep. (2017)

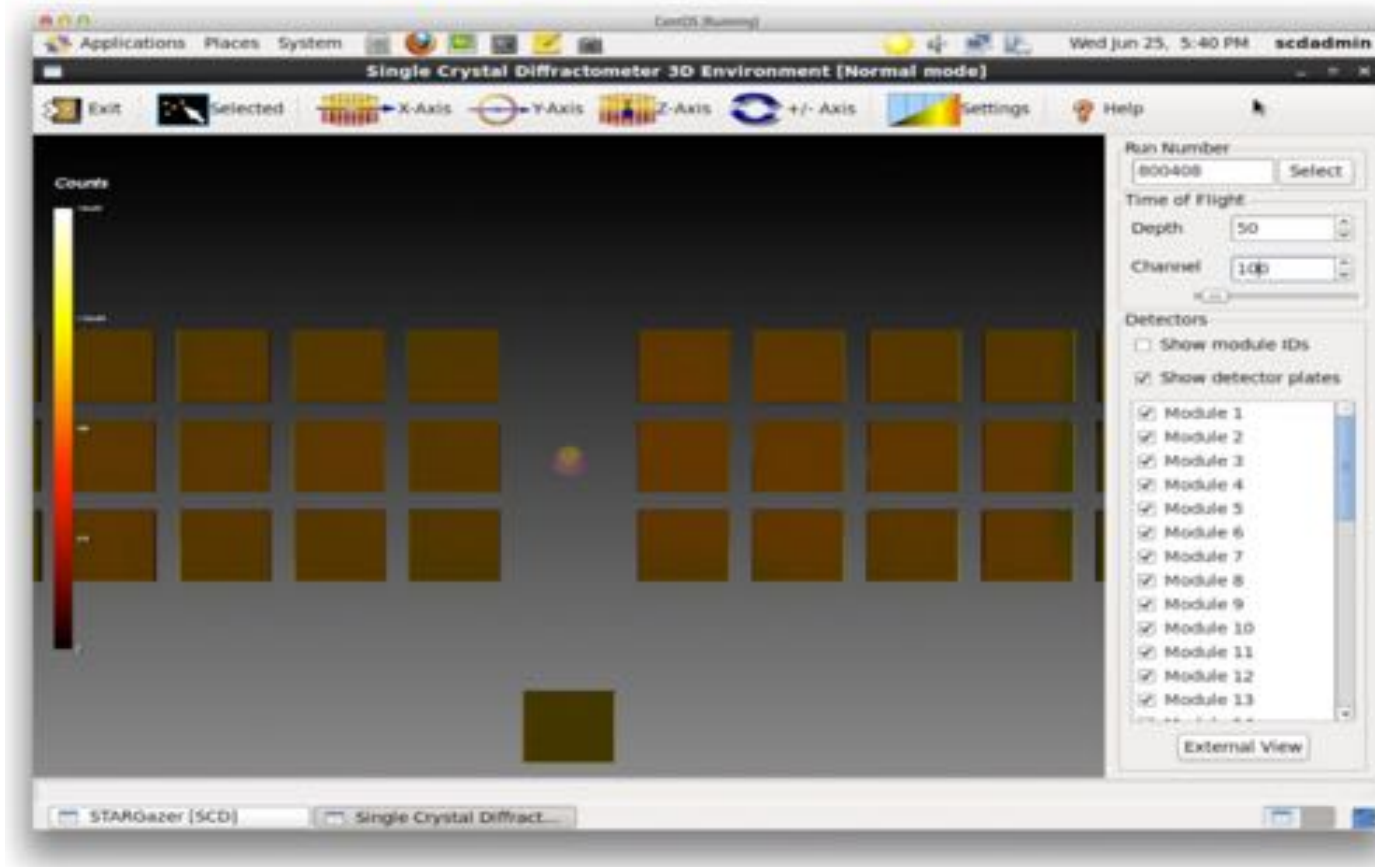


SENJU

Far field Detector - Senju

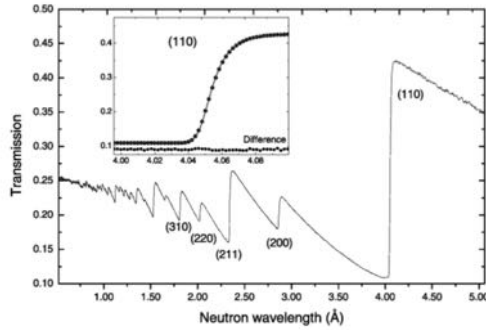
Far field

Time-of-flight

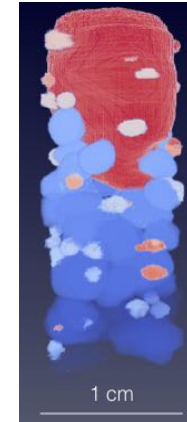


Wavelength range: 0.4 Å – 4.4 Å

3DND



Continuum



Large grains

+ texture, strain, multiphase

Bragg edge imaging

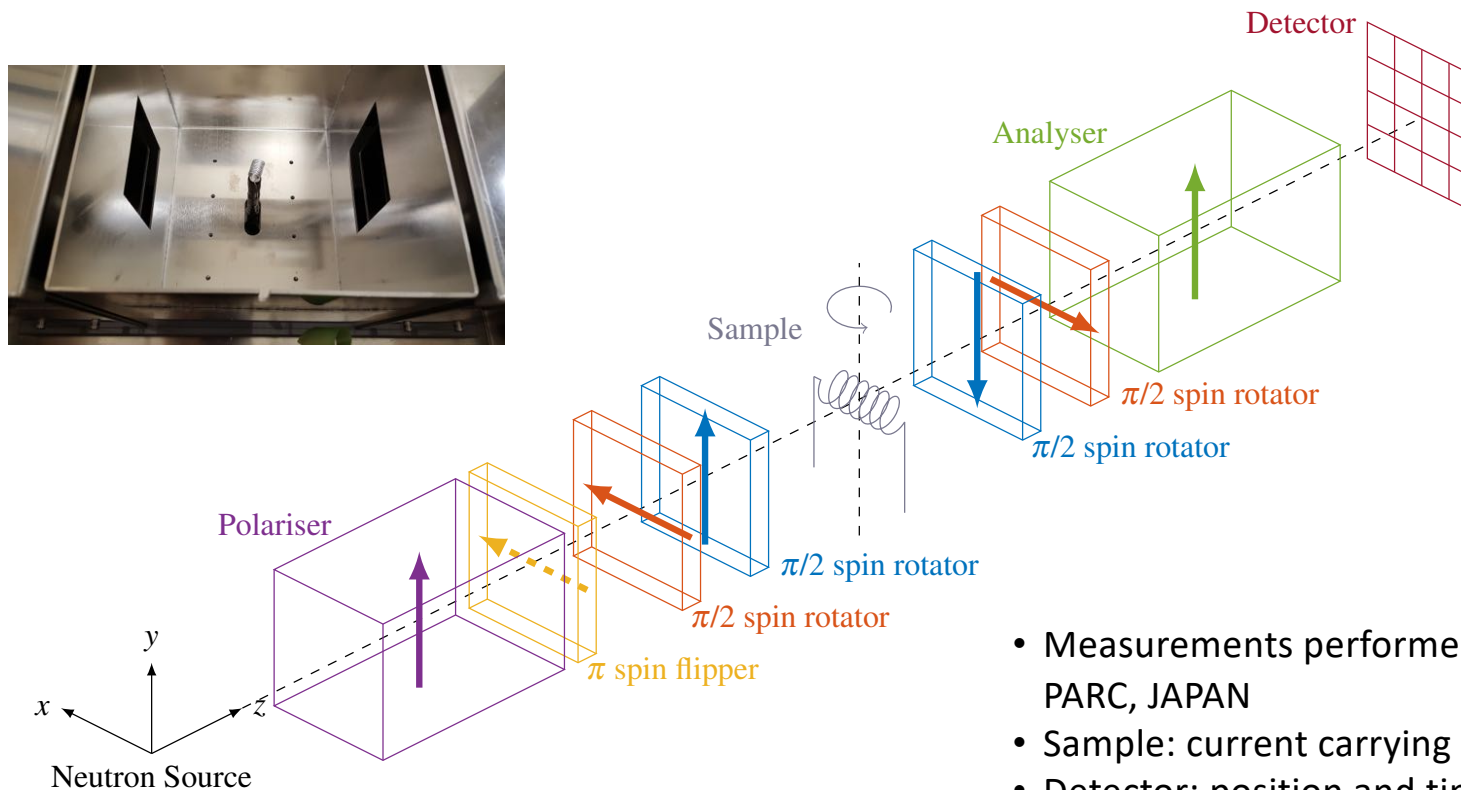
3DND



Unified scheme for 3DND

Imaging with polarized neutrons

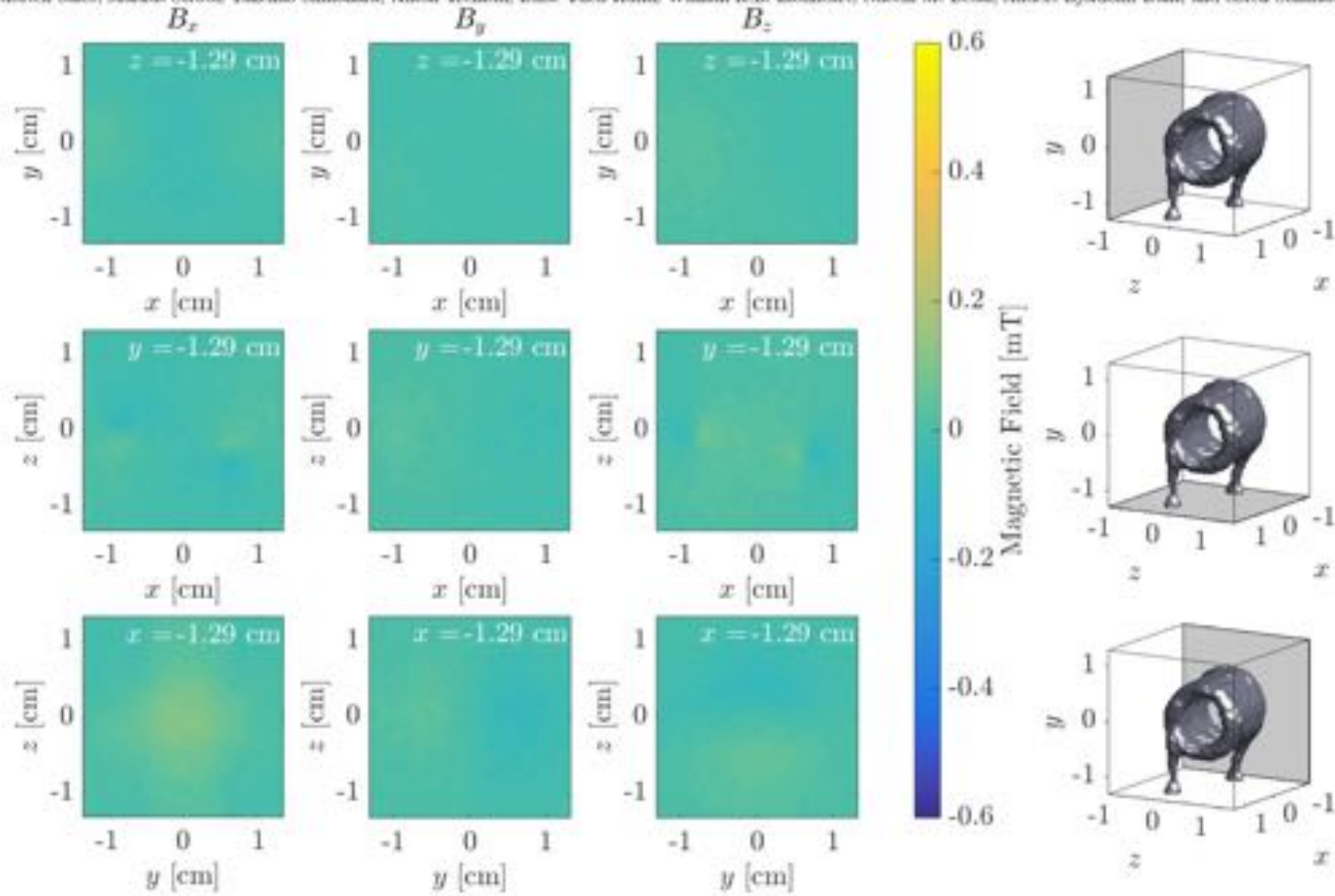
RADEN



- Measurements performed at RADEN, MLF, J-PARC, JAPAN
- Sample: current carrying solenoid
- Detector: position and time sensitive (MCP)

Three Dimensional Polarimetric Neutron Tomography of Magnetic Fields

Morten Sales, Markus Strobl, Takemasa Shinohara, Anton Trenzsch, Luise Theil Kuhn, William R.B. Lionheart, Naveen M. Desai, Anders Bjørholm Dahl, and Sören Schmidt



Sci. Rep. (2018), 8:2214

Research team



Søren Schmidt
DTU



Petr Sittner
UJF



Luise T. Kuhn
DTU



Markus Strobl
PSI



Anton Tremsin
Berkeley



Robin Woracek
ESS



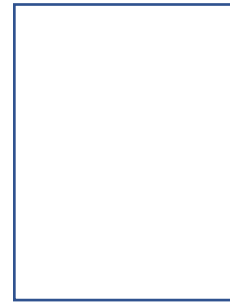
Morten Sales
DTU



Monica Lacatusu
DTU



Stavros
Samothrakis, UJF



Nancy Elewa,
UJF



Bill Lionheart
U of Manchester



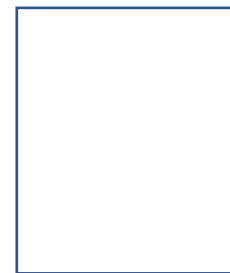
Anders Dahl
DTU



Patrick Tung
UJF



Rune Johnsen
DTU



NN

J-PARC Liaisons

Takenao Shinohara
Takashi Ohhara
Ryoji Kiyanagi

J-PARC Long term
proposal at SENJU
and RADEN, 2019-
2021



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SPALLATION
SOURCE



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1824
The University of Manchester



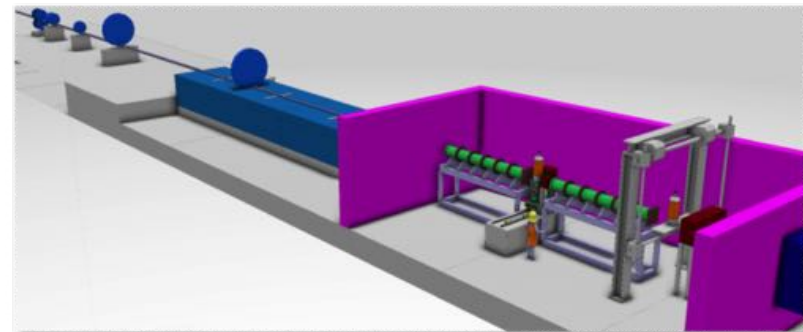
Berkeley
UNIVERSITY OF CALIFORNIA

Synergies with ESS

ESS

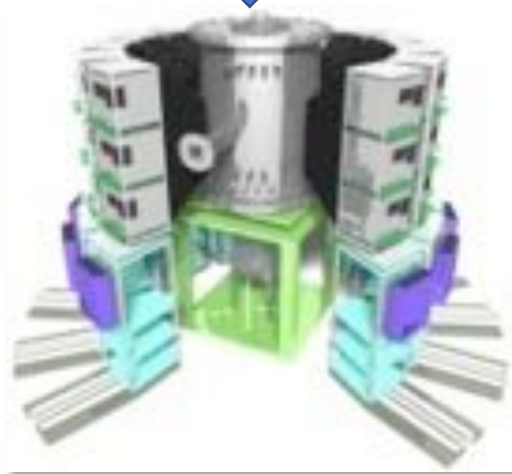


Beamline for European materials Engineering Research



Optical and Diffraction Imaging with Neutrons

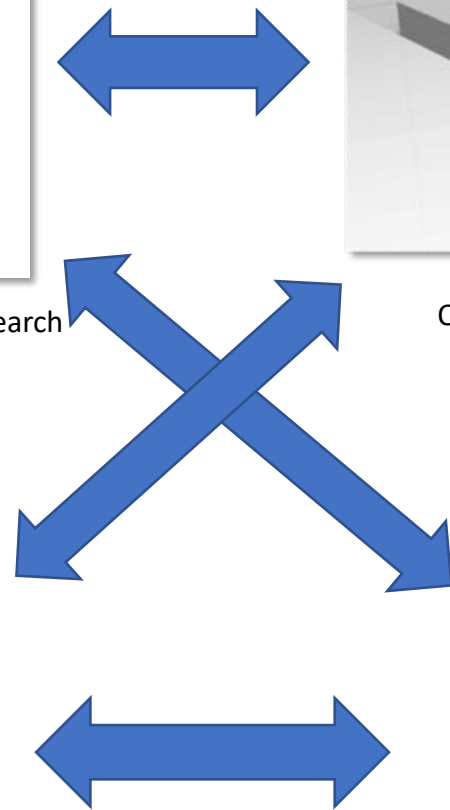
J-PARC



SENJU



RADEN



Thank you for your attention