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Jülich Centre for Neutron Science

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NSE Sample Environments Current and Future

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NSE Sample Environments - Current and Future

- NSE Capabilities and Science Demands
- Why Sample Environments?
- Current Environments
  - Science
  - Capabilities
- Future Environments
  - Scientific Motivations
  - Demands
  - Challenges

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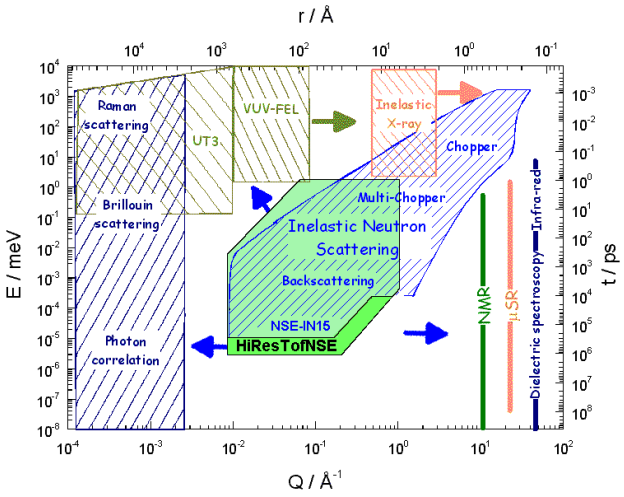
NSE Science Window

- Slow Dynamics
- Q = 0.05–3.5 Å
- 5 ps < t < 400 ns
- Glasses, polymers, proteins, bacteria, proton conductors, nanomaterials, complex liquids



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Why Sample Environments?

- Many ways to increase the capabilities of the NSE
- Major instrument upgrades are expensive and time consuming
- Sample environments are relatively inexpensive
- Sample environments are relatively quick to install
- If you build it, they will come

Current Environments

- CCR Cryostat
- Bio-Oven
- Light Cell
- Electric field Cell

JANIS CCR Cryostat

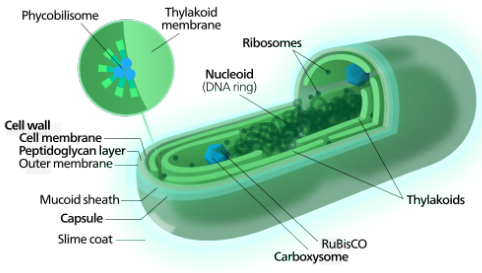
- Industry Standard
- Hot Stick up to 700 K
- Cold Stick Down to 4 K
- Polymers, Glasses, Proteins, Proton Conductors
- Slow Sample Changes

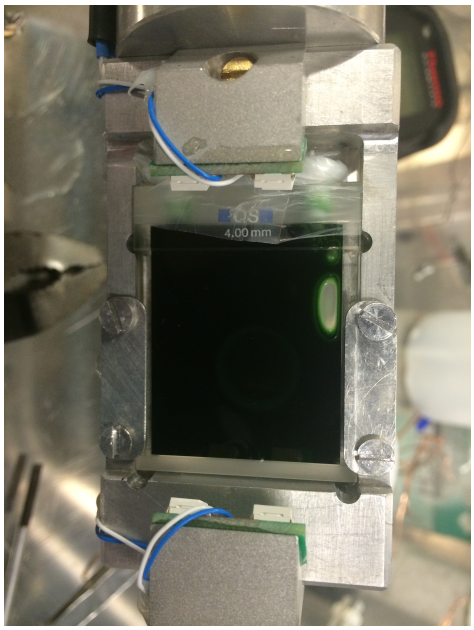
Bio-Oven

- Developed at Munich University
- Stable between 4 and 90 C within 0.1C
- 2 Samples at a time
- High sample holder flexibility
- Mostly biological samples, some polymers, proton conductors

Light Cell

- Developed to study bacteria light harvesting
- Compatible with Bio-oven Stick
- 24 LEDs
- < 50 to > 1700 µE





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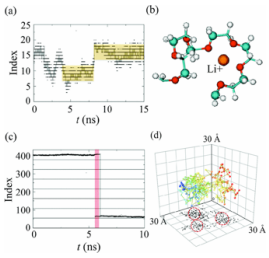
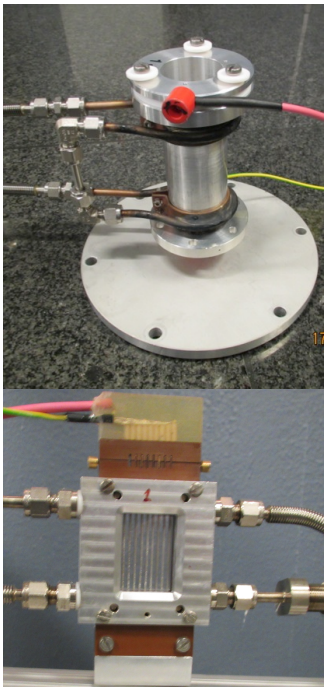
E-field Cells

- Polymer based Lithium Batteries
- Cylindrical Cell
  - > 500 K
  - Quicker / Cheaper
- Flat Cell
  - 2.2 kV
  - Uniform field and Neutronics





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Future Environments

- Pressure Cell
  - Biology, polymers, glasses
- Rheometer
  - Polymers, glasses

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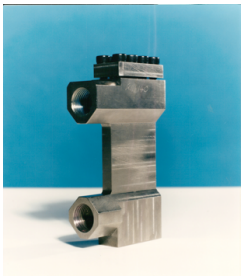
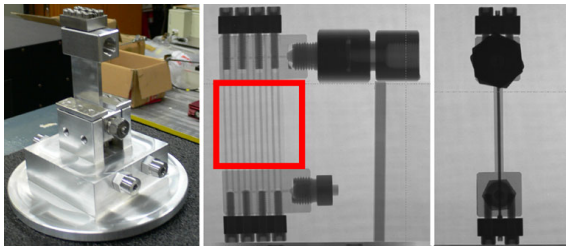
Pressure Cell

- Folding and unfolding of proteins
- 7 kBar
- NSE sample area 30 mm x 30 mm
- Non-ferromagnetic materials



ISIS Flat TiZr Cell
http://www.isis.stfc.ac.uk



(Appavou et. al. Eur Biophys J 2011)

(ZEA-1 Internal Report Feilbach)

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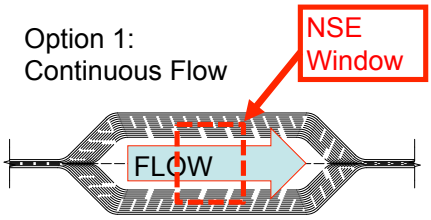
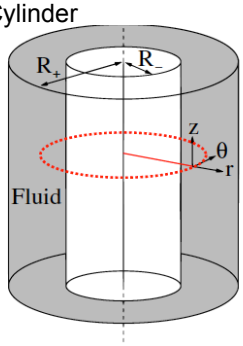
Rheometer

- In situ sheer relaxation
- Non-ferromagnetic materials
- Electrical motor proximity
- Available Space

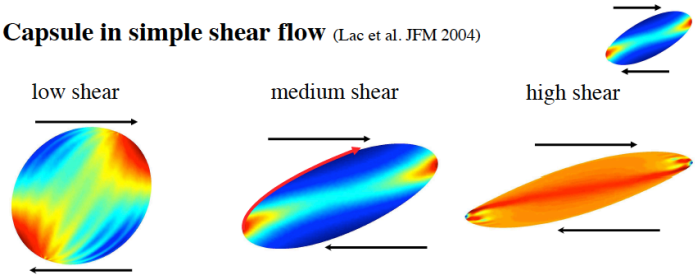
Option 1:
Continuous Flow



Option 2: Concentric Cylinder



Capsule in simple shear flow (Lac et al. JFM 2004)



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