VSANS

Data collection rate
~10× SANS & ~300× uSANS

Extended Q-range
2×10^{-4} – 1 Å^{-1}

Flexibility
2%/13.5%/30%

wavelength bands

Expect vSANS to be included in the first call for proposals in 2017
First neutrons on detector: January 2017
Delivery and fit-out of detector vessel
Install/testing of detector carriages
Install/testing of 8 detector panels

First SANS experiment: March 2017
Sample area installed
Basic data acquisition software tested
Tube detector NISTO software tested
Basic data reduction software tested

Full polarized beam operation: May 2017
Polarizer installed
RF flipper installed
Guide fields installed
NICE software polarized beam option tested
Data reduction software for polarized beam tested

vSANS will impact DCS schedule
**VSANS SCHEDULE**

**Kinetic SANS: May 2017**
- Event mode data output (software) from tube detectors (built/tested)
- Event mode option in NICE software (built/tested)
- Event mode data reduction in IGOR software (built/tested)

**Very small Q: High resolution mode: October 2017**
- Install/test high resolution detector
- Build/install rear carriage
- New NISTO software to handle the detector
- New NICE software to handle the detector
- Data reduction software to handle new detector histogram
- Procure/install chiller for MgF₂ prisms and lenses
- Build/install/align converging beam apertures

**Graphite monochromator: October 2017**
- Procure/deliver HOPG
- Install graphite
CANDoR
White beam reflectometer

Final optimization & testing of prototype detector modules will be completed

\[ 30 \times 54 = 1620 \]
channels dets/array total detectors

0.3 nm \rightarrow 10 \mu m

\[ \frac{\delta Q}{Q} \approx 0.025 \]
\[ \frac{\delta \lambda}{\lambda} \approx 0.015 \]

Expect CANDoR to be included in the call for proposals around end of CY2017
First neutrons on detector: September 2017
Scintillator detector production/repeatability
Data acquisition electronics
Installation/testing of detector

First specular reflection experiment: December 2017
Sample area installed
Basic NICE software features tested
Basic data reduction software (built/tested)

Full polarized beam operation: March 2018
Polarizer installed
RF flipper installed
In-situ $^3$He polarization analysis (built/tested/installed)

Non-specular capability available: June 2018
Data reduction software (built/tested)

Event mode available: August 2018
Event mode option in NICE software (built/tested)
Event mode data reduction software (built/tested)
Neutron Spin-Echo

Measured performance > any NSE except IN15: 10 ps to >300 ns
Neutron Spin-Echo

The effect of branching on solution dynamics in polymer-like micelles
Michelle Calabrese and Norm Wagner

$\lambda = 17 \text{ Å}$
Cold Neutron Imaging

inside the “cave”
Neutron Measurements for Materials Design & Characterization

August 21-22, 2014 | Bolger Center | Potomac, MD
Neutron Measurements for Materials Design & Characterization

NSE: More cooling power $\rightarrow$ higher current $\rightarrow$ longer Fourier times

HFBS: Improved converging guide & larger monochromator $\rightarrow$ $\times 2.4$

COLD TAS: Conceptual design exploration

Thermal Powder Diffractometer: Conceptual design exploration
D₂ Cold Source

NNSA-GTRI partnership to mitigate performance losses due to HEU-to-LEU conversion

35 liter liquid D₂ cold source (requiring 7 kW refrigerator)

All refrigerator parts received
NCNR performing system integration

NNSA providing funding to complete CS
Projected 2022 installation
LEU-Based Replacement Reactor
Preliminary study for LEU replacement reactor for cold neutron production

The mid-plane of the split core reactor. Two cold neutron source (CNS) are placed in the north and south side of the core, and four thermal beam tubes are located in the east and west side of the core at different elevations.

The core consists of total 18 fuel elements which are evenly distributed into two horizontal split regions.

<table>
<thead>
<tr>
<th>Properties</th>
<th>NBSR-2</th>
<th>NBSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactor power (MW)</td>
<td>20 - 30</td>
<td>20</td>
</tr>
<tr>
<td>Fuel cycle length (days)</td>
<td>30</td>
<td>38.5</td>
</tr>
<tr>
<td>Fuel material</td>
<td>U₃Si₂/Al</td>
<td>U₃O₈/Al</td>
</tr>
<tr>
<td>Fuel enrichment (%)</td>
<td>19.75</td>
<td>93</td>
</tr>
</tbody>
</table>
Neutron Performance for the NIST Replacement Reactor

Maximum thermal flux at the reflector:

\[ 5 \times 10^{14} \text{ n/cm}^2\text{-s}. \]

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Country</th>
<th>Power (MW\text{th})</th>
<th>Fuel</th>
<th>Quality factor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBSR</td>
<td>U.S.</td>
<td>20</td>
<td>HEU</td>
<td>2.0</td>
</tr>
<tr>
<td>HFIR</td>
<td>U.S.</td>
<td>85</td>
<td>HEU</td>
<td>1.2</td>
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<tr>
<td>BR-2</td>
<td>Belgium</td>
<td>60</td>
<td>LEU</td>
<td>2.0</td>
</tr>
<tr>
<td>OPAL</td>
<td>Australia</td>
<td>20</td>
<td>LEU</td>
<td>1.5</td>
</tr>
<tr>
<td>CARR</td>
<td>China</td>
<td>60</td>
<td>LEU</td>
<td>1.3</td>
</tr>
<tr>
<td>NBSR-2</td>
<td>U.S.</td>
<td>20</td>
<td>LEU</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Defined as the maximum thermal flux divided by the thermal power (\(\times 10^{13} \text{MTF/MW}_{\text{th}}\)).
NCNR USER SURVEY
NCNR USER SURVEY

Evaluation difference: 2015 - 2011

- health physics training
- support facilities
- software for data analysis
- proposal process
- sample environments
- instrument performance
NCNR USER SURVEY

Proposal process
It is a much easier and more straightforward process than beam time at other labs and the reviews are typically more fair.

Ability to submit as PDF a big improvement

Health Physics
We're lucky to have such a good staff of HP's.

HP training very insightful and I felt well prepared for all possible situations.

The updated training process is a HUGE improvement.

Support facilities
The lab supplies available ensure that experiments will not fail due to lack of availability of any supplies.

They have been very good for decades.

Facilities are well-equipped.

The facilities are excellent.

Sample environments
One of the best among all synchrotron and nuclear reactor facilities over the country.

Instrument-specific
William and Julie are most excellent. They are amongst the most hard working and strong scientists I have met.

The BT-2 scientists have been fantastic to work with.

The new NICE software is fantastic.

Used MACS only once, but WOW...

Data Analysis & Viz
SANS control/reduction/analysis capabilities remain at cutting edge.

DAVE is great. MSlice for MACS is excellent and supported very well.

Refl1d is a significant advance, and keeps getting better.
NCNR USER SURVEY

Proposal process
System for inputting materials/samples is very cumbersome.

...had problems logging on NIST computers from outside of the U.S.

Support facilities
X-ray Laue Machine is highly demanded.

Desks in user office are usually fully reserved

A vending machine with healthy options and even full hot meals should be considered.

Instrument-specific
BT7 data acquisition software causes far too much (~35 seconds/point) overhead between data points.

MAGIK could use some more good slits. The software is not easy to use.

Health Physics
I think the computer based training could be shorter and tailored to the user’s needs.

The amount of material is pretty overwhelming for first-time users, so I think it’s important for the local contact to reiterate what information is important for each specific experiment.

Sample environments
$^3$He system has been problematic.

Need to document data reduction/correction scheme for more advanced sample environments such as 1-2 and 1-3 plane rheo-SANS.

Data Analysis & Viz
Software has too many features, confusing for those who don't use it all the time.

Data processing of time resolved data could be much improved, multiple file addition especially with time resolved data needs improvement.
Proposal process
We are placing an optional suggested reviewer box on the proposal form (Fall 2016)

Scientists submitting a proposal are encouraged to discuss the experiment with an appropriate instrument scientist.

Health Physics
New web-based training implemented in 2013

Training undergoing review for redundancies and unnecessary content

User Amenities
We received permission to text passwords for the visitor’s network upon request

We expect SKYPE to be allowed sometime in 2017

3 additional wi-fi access points have been installed

Support facilities
A lab is being built in the NW corner of the guide hall-available early 2017

X-ray Laue machine is now available in the guide hall

A test station with monochromatic beam (4.1 Å) has been installed in the guide hall.

Sample environments
We have developed a new extensional flow cell for SANS that can be easily reconfigured to create a variety of flow fields and we are actively working to create μflow devices

We have procured a 3T SC magnet for reflectometry (delivery summer of 2016)

AC magnet for SANS that can produce a field with a sinusoidal waveform ordered (delivery summer of 2016)

Instrument control SW
NICE currently running on 8 instruments

NICE will be the DAQ SW for vSANS and CANDoR and then MACS and BT7 (late 2018-2019)

NICE supports time-stamping data and reduction and visualization is still a work-in-progress

Data Analysis & Viz
Reduction & viz for vSANS and CANDoR are the current priorities

We are actively working with the international neutron scattering community on the on-going development of SASView

We are collaborating with the international NSF/EPSRC project, CCP-SAS which calculates scattering density directly from atomistic models
Thank You!

NUG

Michael Crawford
Amber Larson
Michael Mackay
Alan Nakatani (Chair)
Megan Robertson
Rafael Verduzco
Igor Zaliznyak