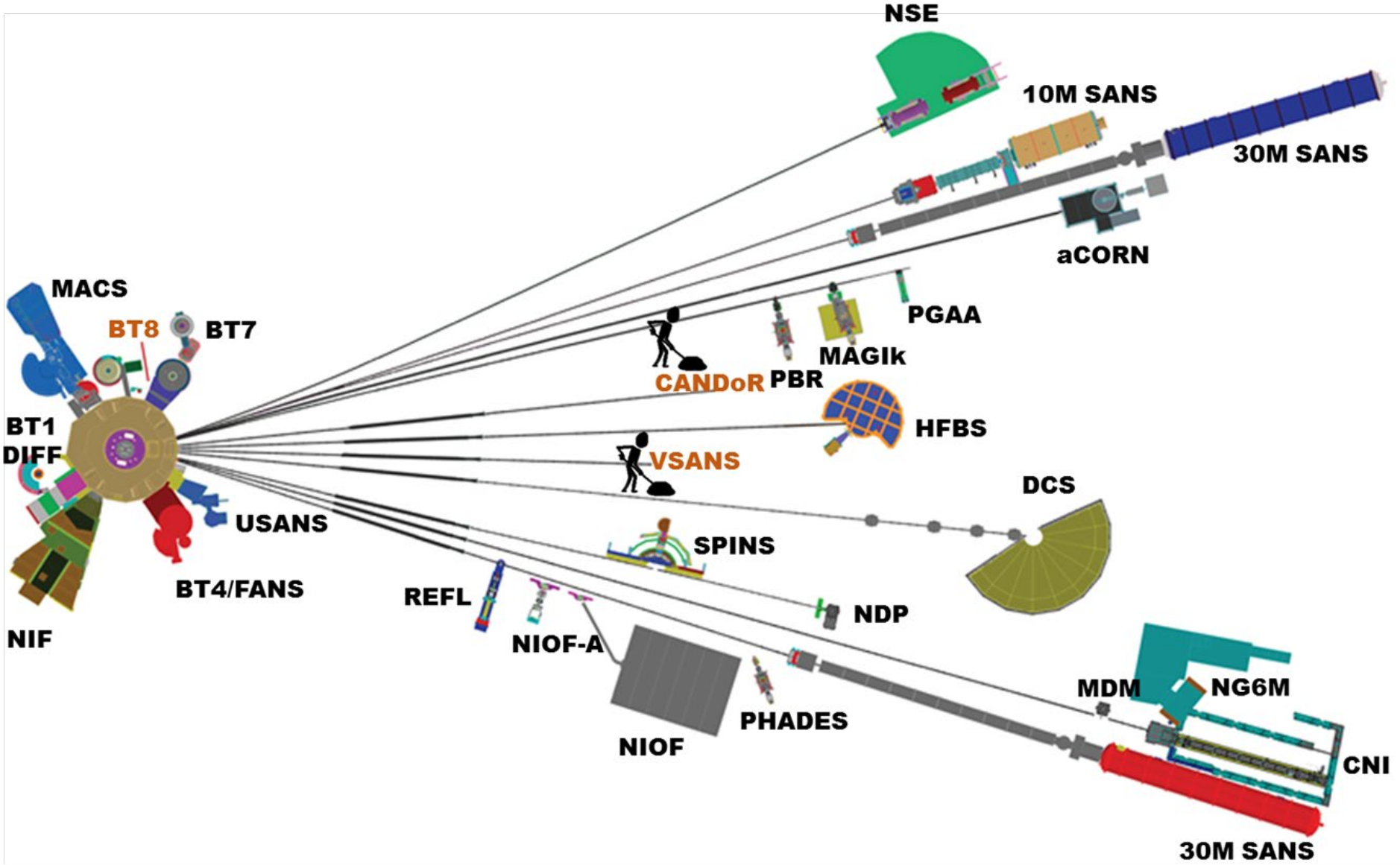
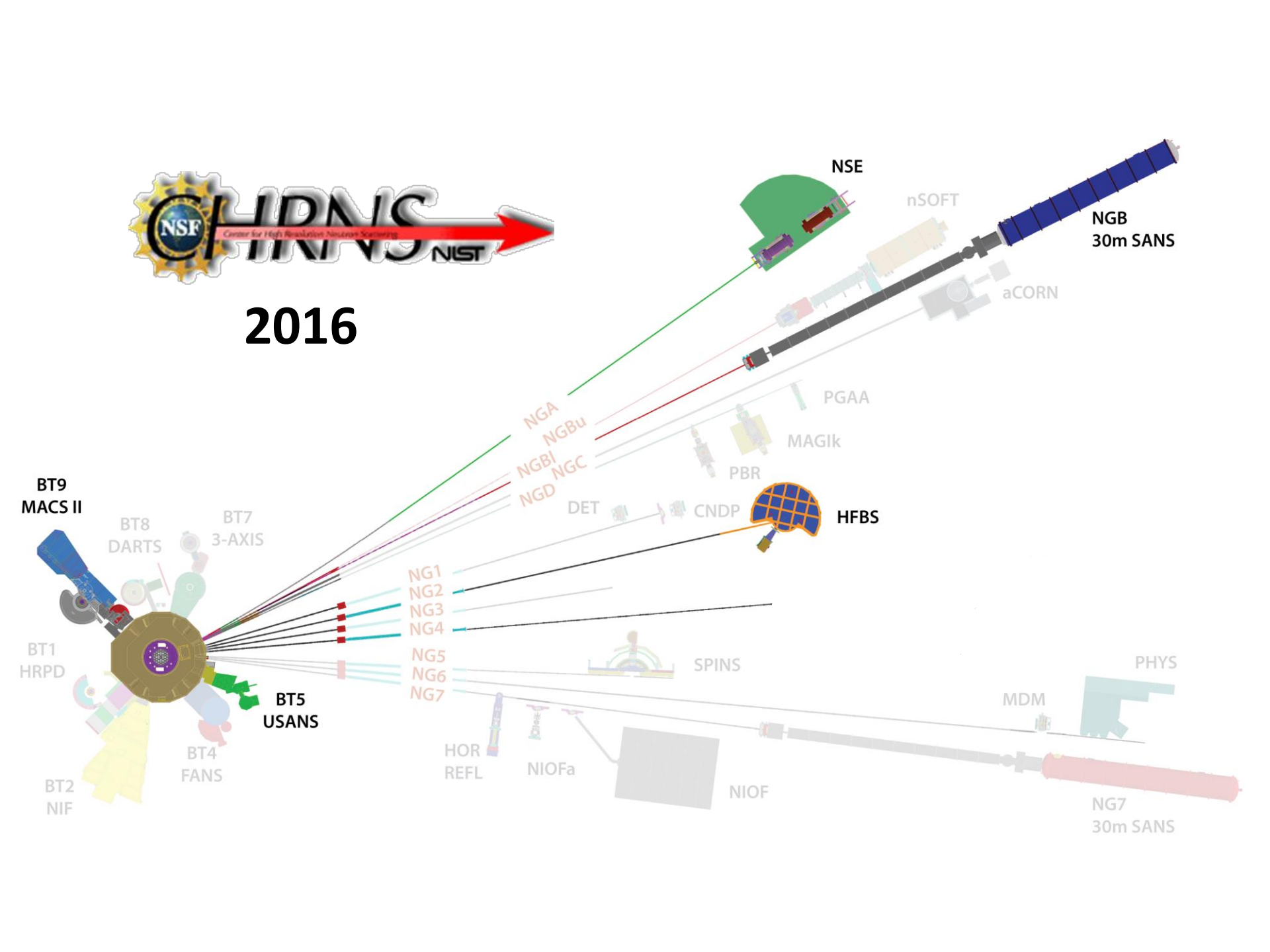
2016
NCNR Update
July 12, 2016


NSE
10M SANS
30M SANS
aCORN
MACS
BT8
BT7
PGAA
MAGIk
CANDoR
PBR
BT1
DIFF
HFBS
VSANS
DCS
USANS
SPINS
BT4/FANS
REFL
NDP
NIF
NIOF-A
MDM
NG6M
PHADES
NIOF
CNI
30M SANS

July 2016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NGBl
NGC
NGD
BT9
MACS II
BT8
DARTS
BT7
3-AXIS
NG1
NG2
NG3
NG4
NG5
NG6
NG7
BT1
HRPD
BT5
USANS
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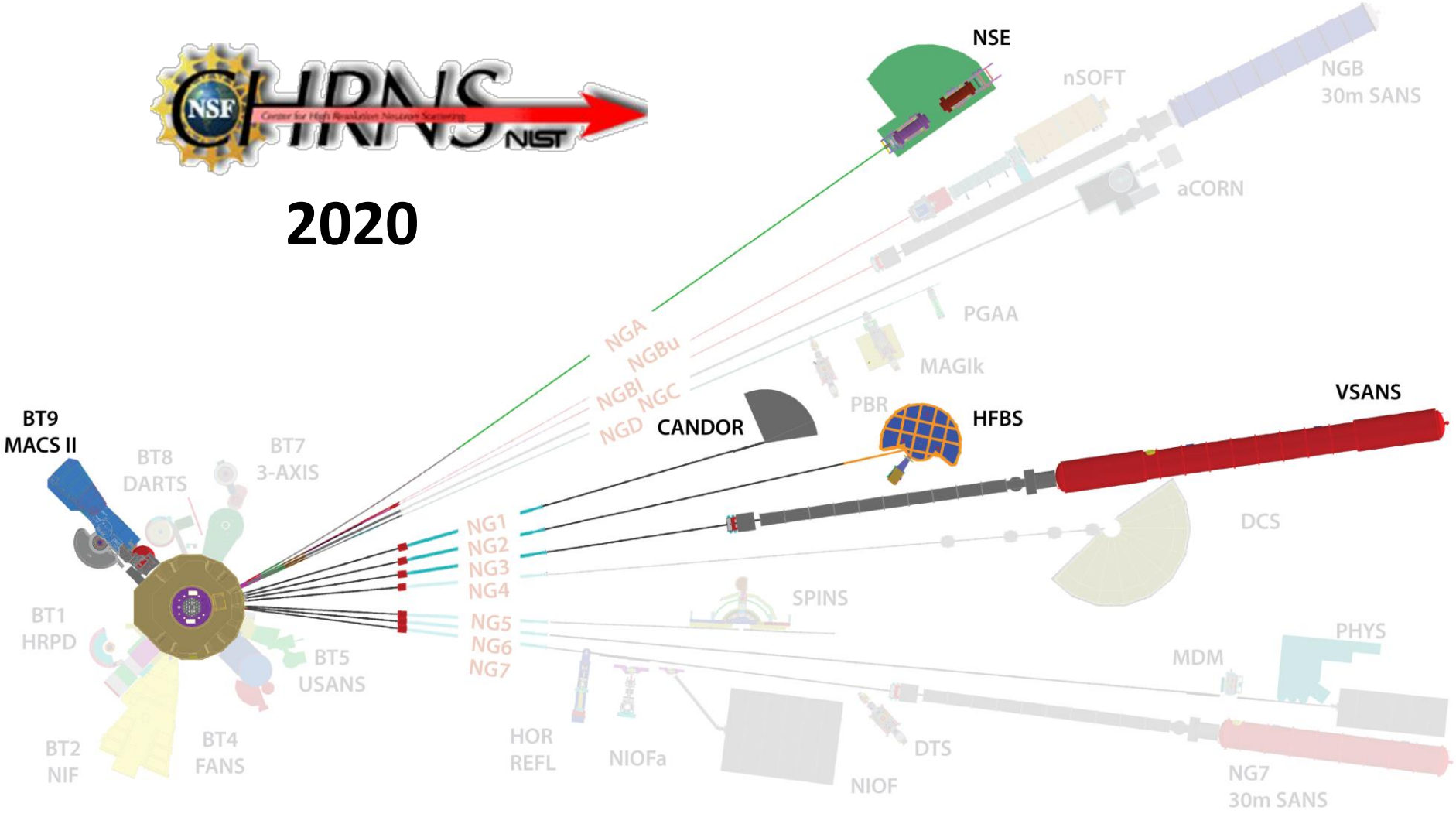
SPINS
MDM
PHYS
NG7
30m SANS

2016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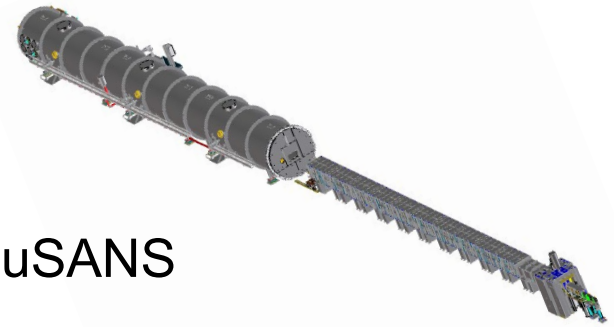
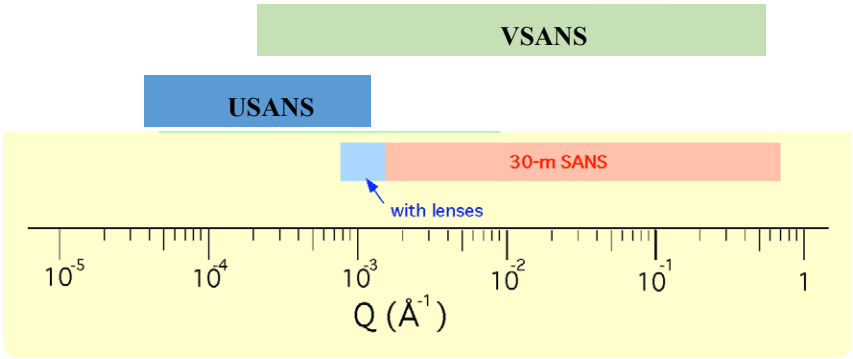
NIOF
NG7
30m SANS

2020

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

VSANS
SCHEDULE

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

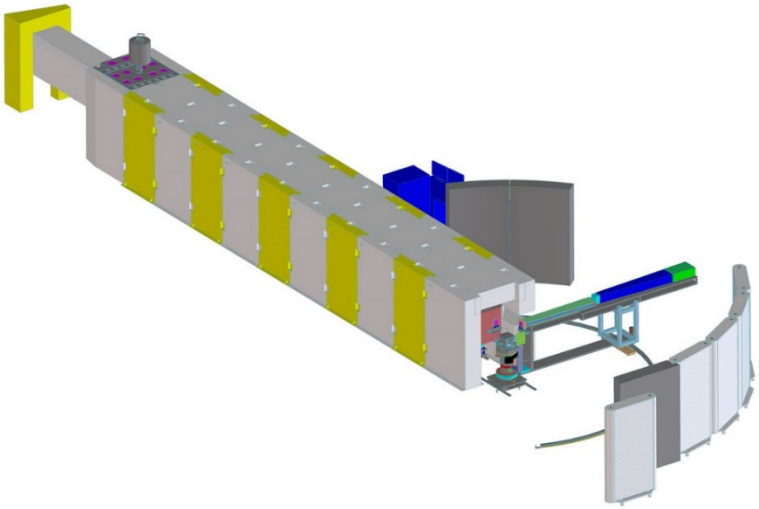
Install/test high resolution detector
Build/install rear carriage
New NISTO software to handle the detector
New NICE software to handle the detector
Data reduction software to handle new detector histogram
Procure/install chiller for MgF_2 prisms and lenses
Build/install/align converging beam apertures

Graphite monochromator: October 2017

Procure/deliver HOPG
Install graphite

CANDoR

White beam reflectometer



30 × **54** = **1620**

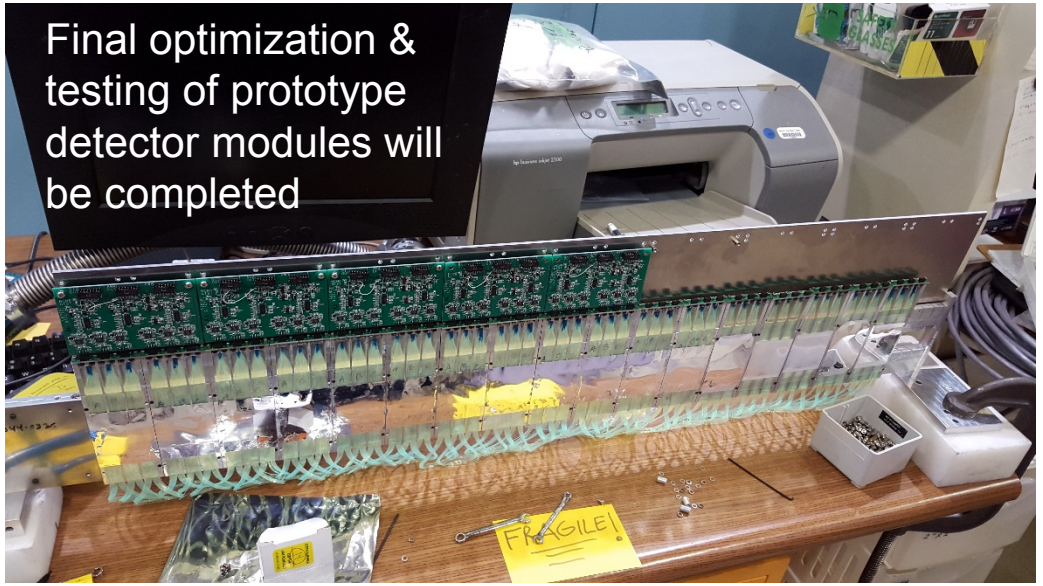
channels dets/array total detectors

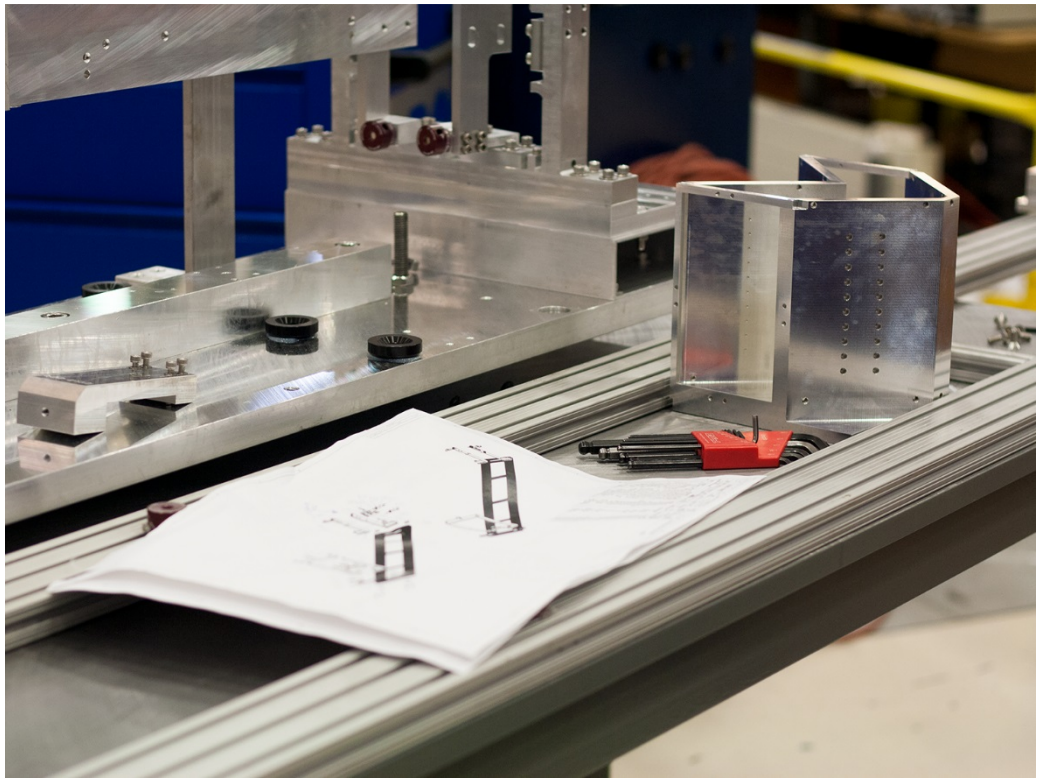
0.3 nm → 10 μm

$\delta Q/Q \approx 0.025$

$\delta\lambda/\lambda \approx 0.015$

Expect CANDoR to be included in the call for proposals around end of CY2017





CANDoR

Schedule

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)

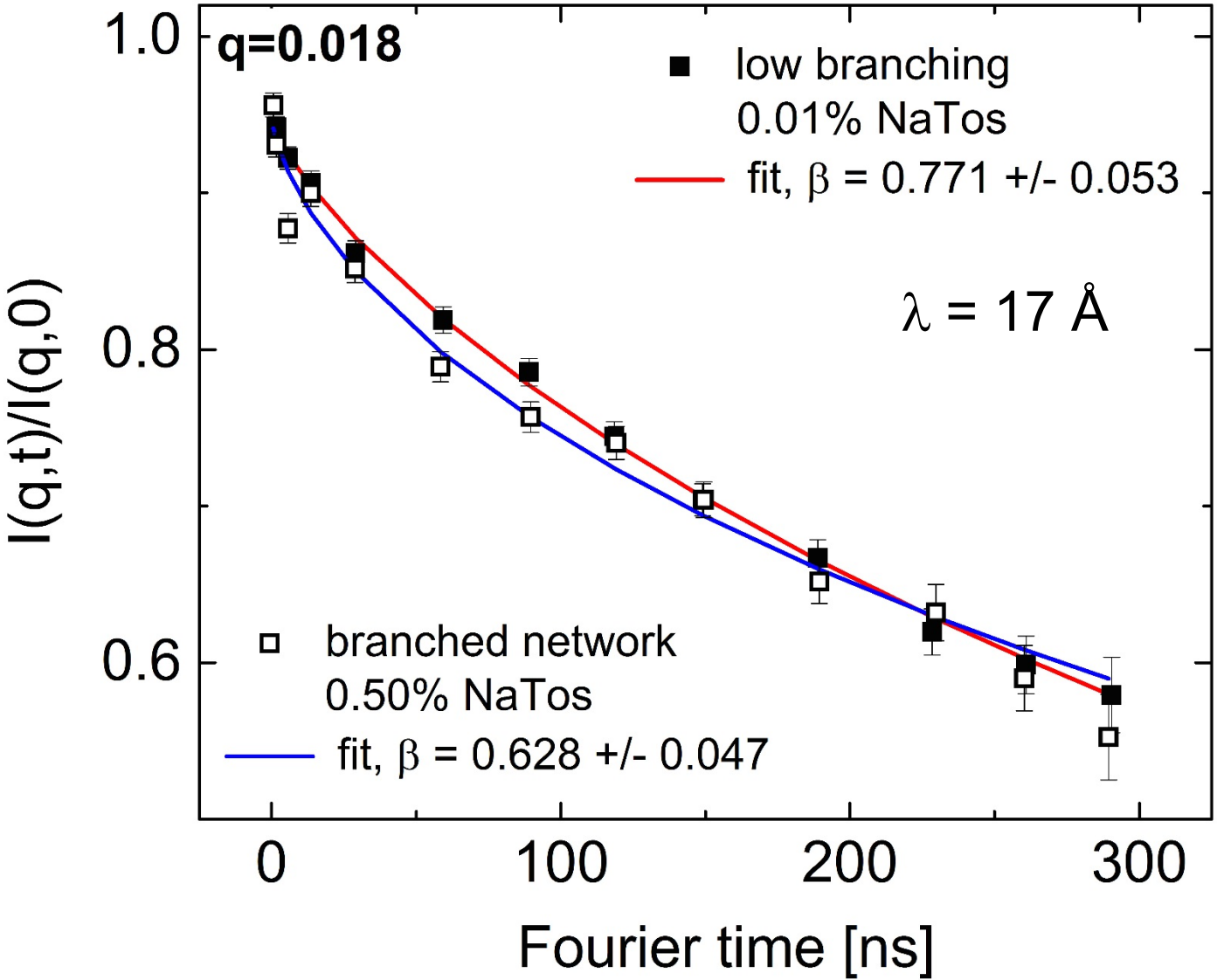
Neutron Spin-Echo

Measured performance > any NSE except IN15: 10 ps to >300 ns

Neutron Spin-Echo

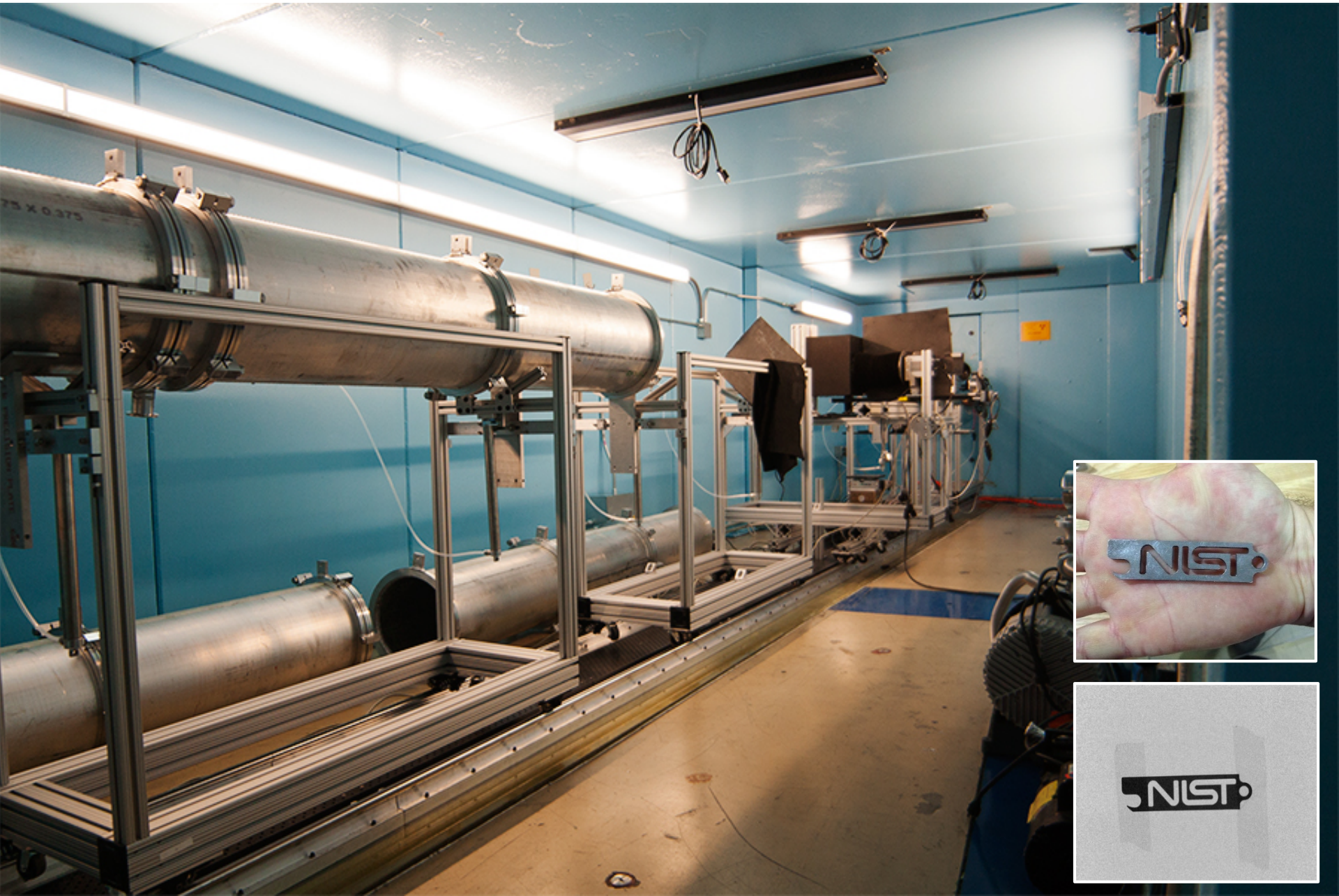
The effect of branching on solution dynamics in polymer-like micelles

Michelle Calabrese and Norm Wagner

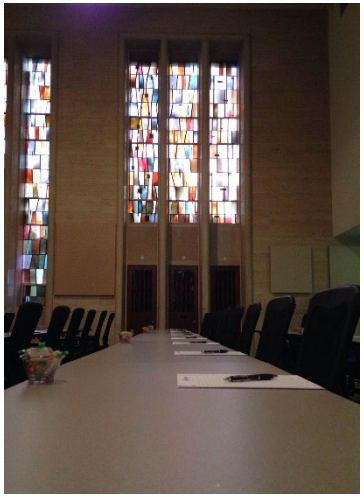


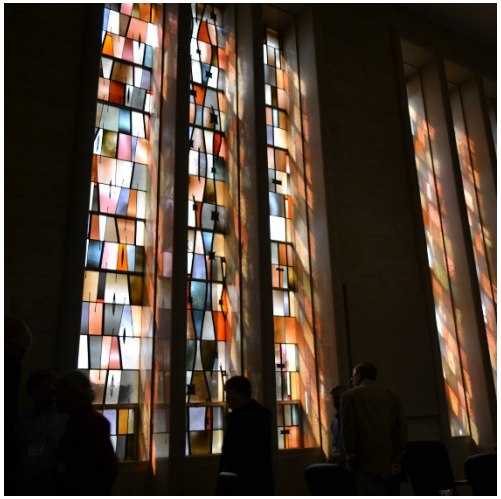
Cold Neutron Imaging

inside the "cave"



Neutron Measurements for Materials Design & Characterization





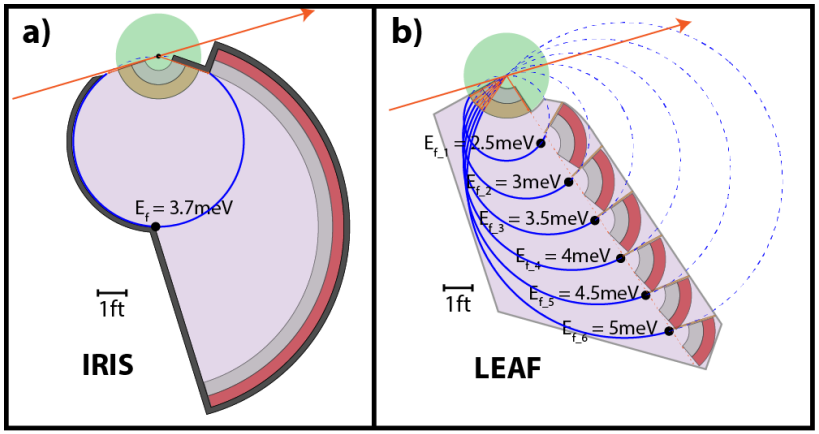
August 21-22, 2014 | Bolger Center | Potomac, MD

Neutron Measurements for Materials Design & Characterization

NSE: More cooling power → higher current → longer Fourier times

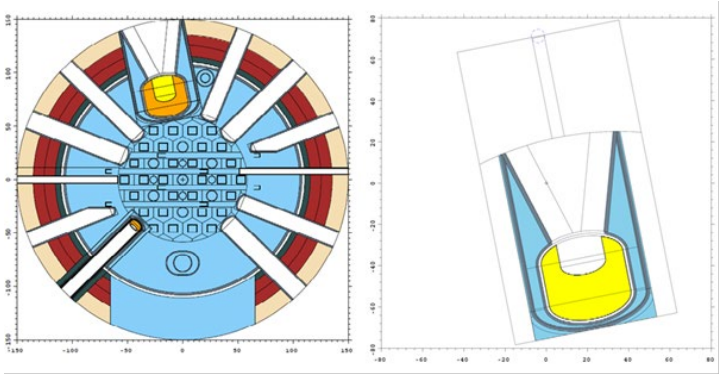
HFBS: Improved converging guide & larger monochromator → ×2.4

COLD TAS: Conceptual design exploration



Thermal Powder Diffractometer: Conceptual design exploration

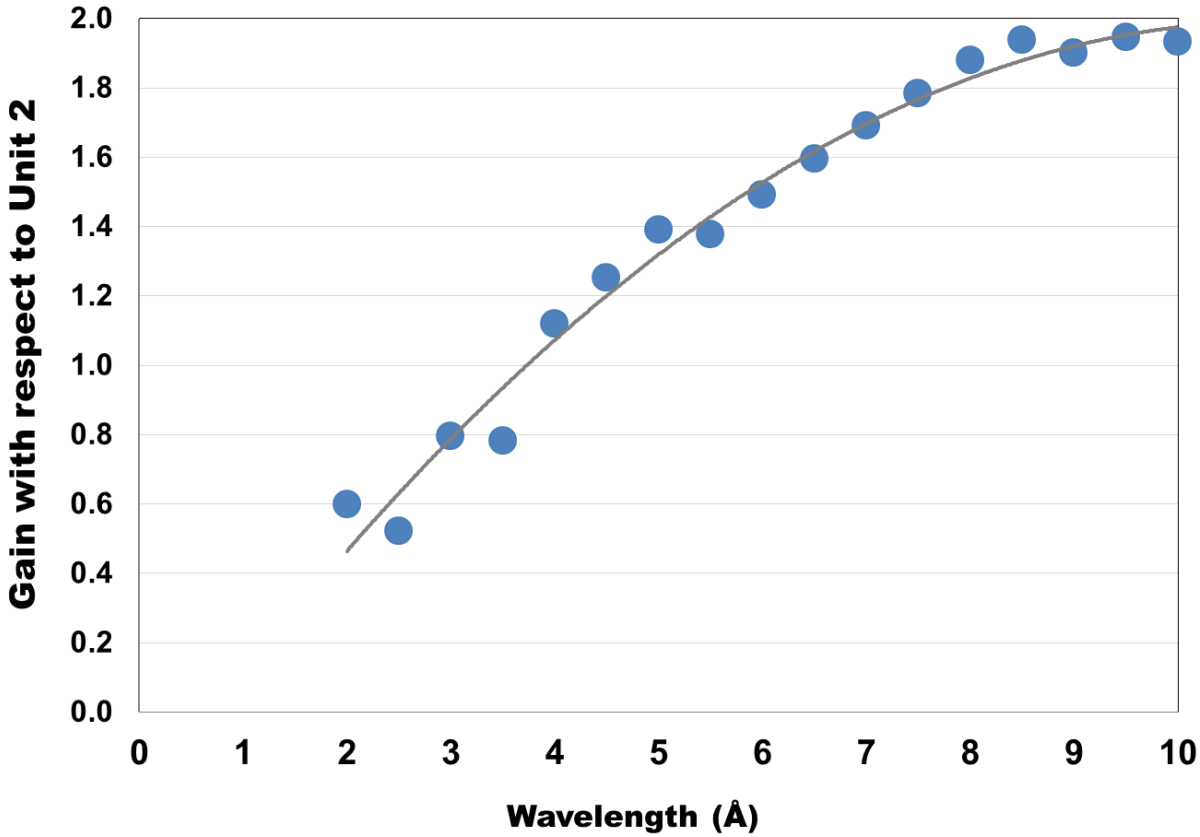
D_2 Cold Source



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

35 liter liquid D_2 cold source (requiring 7 kW refrigerator)

All refrigerator parts received
NCNR performing system integration

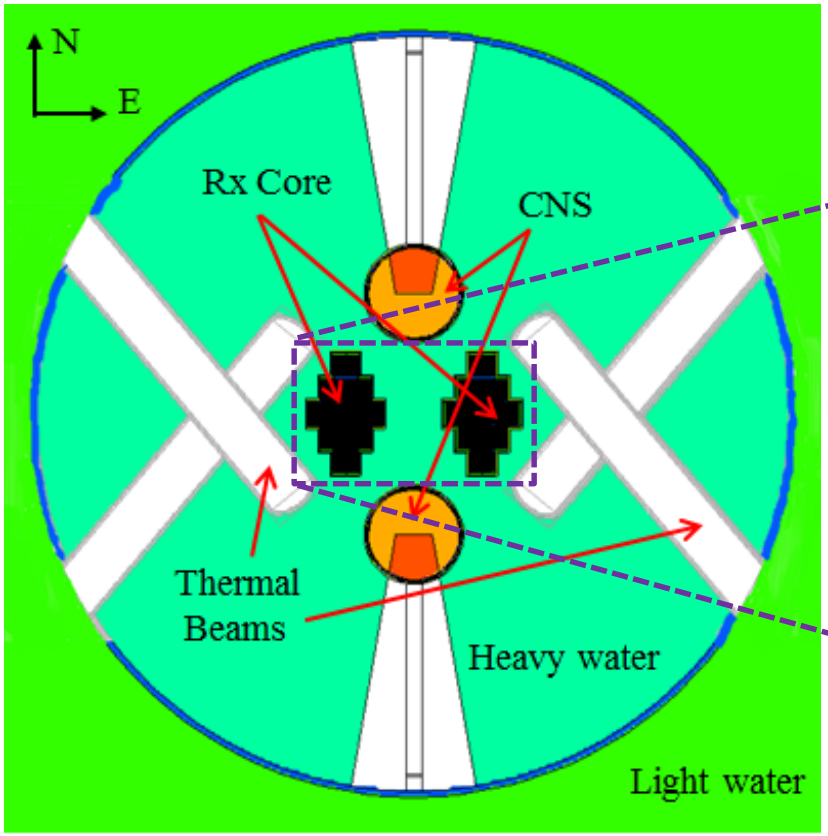


NNSA providing funding to complete CS

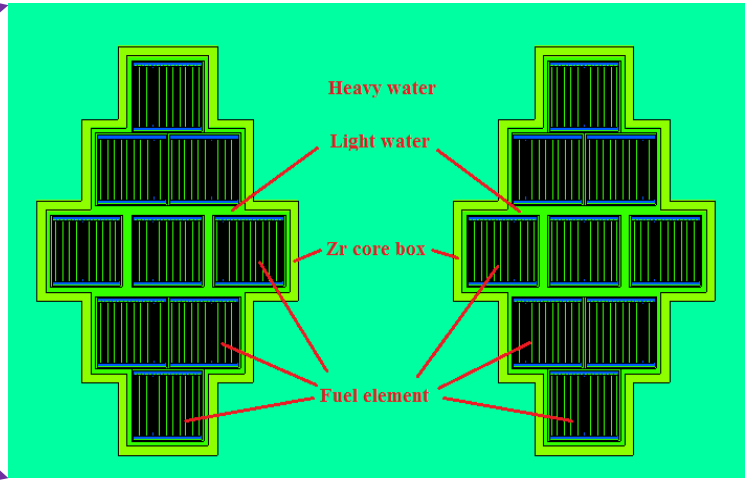
Projected 2022 installation

LEU-Based Replacement Reactor

Preliminary study for LEU replacement reactor for cold neutron production



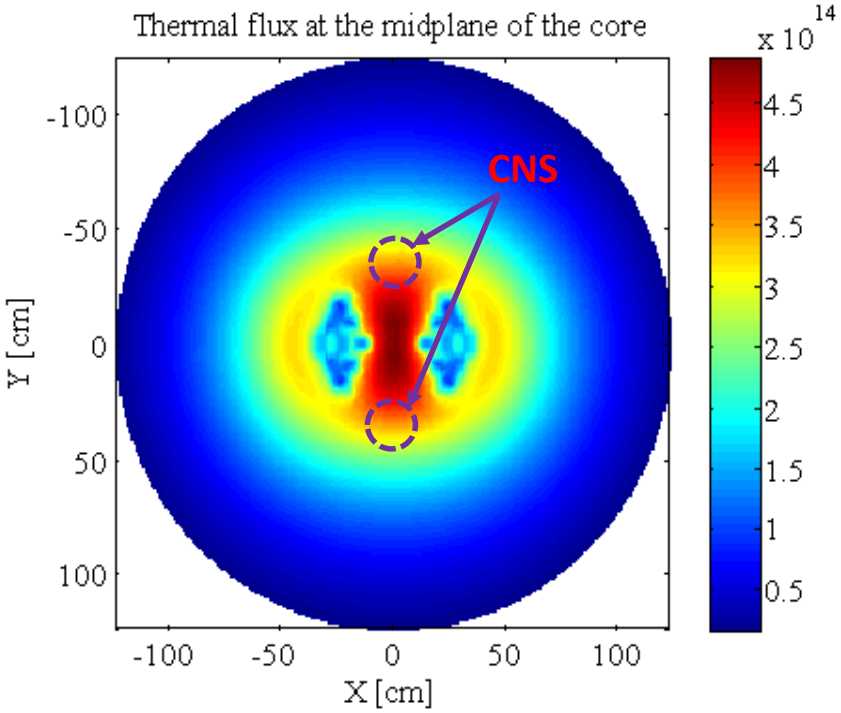
The mid-plane of the split core reactor. Two cold neutron source (CNS) are placed in the north and south side of the core, and four thermal beam tubes are located in the east and west side of the core at different elevations.



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

Properties	NBSR-2	NBSR
Reactor power (MW)	20 - 30	20
Fuel cycle length (days)	30	38.5
Fuel material	U_3Si_2/Al	U_3O_8/Al
Fuel enrichment (%)	19.75	93

Neutron Performance for the NIST Replacement Reactor



Maximum thermal flux at the reflector:

5×10^{14} n/cm^2-s.

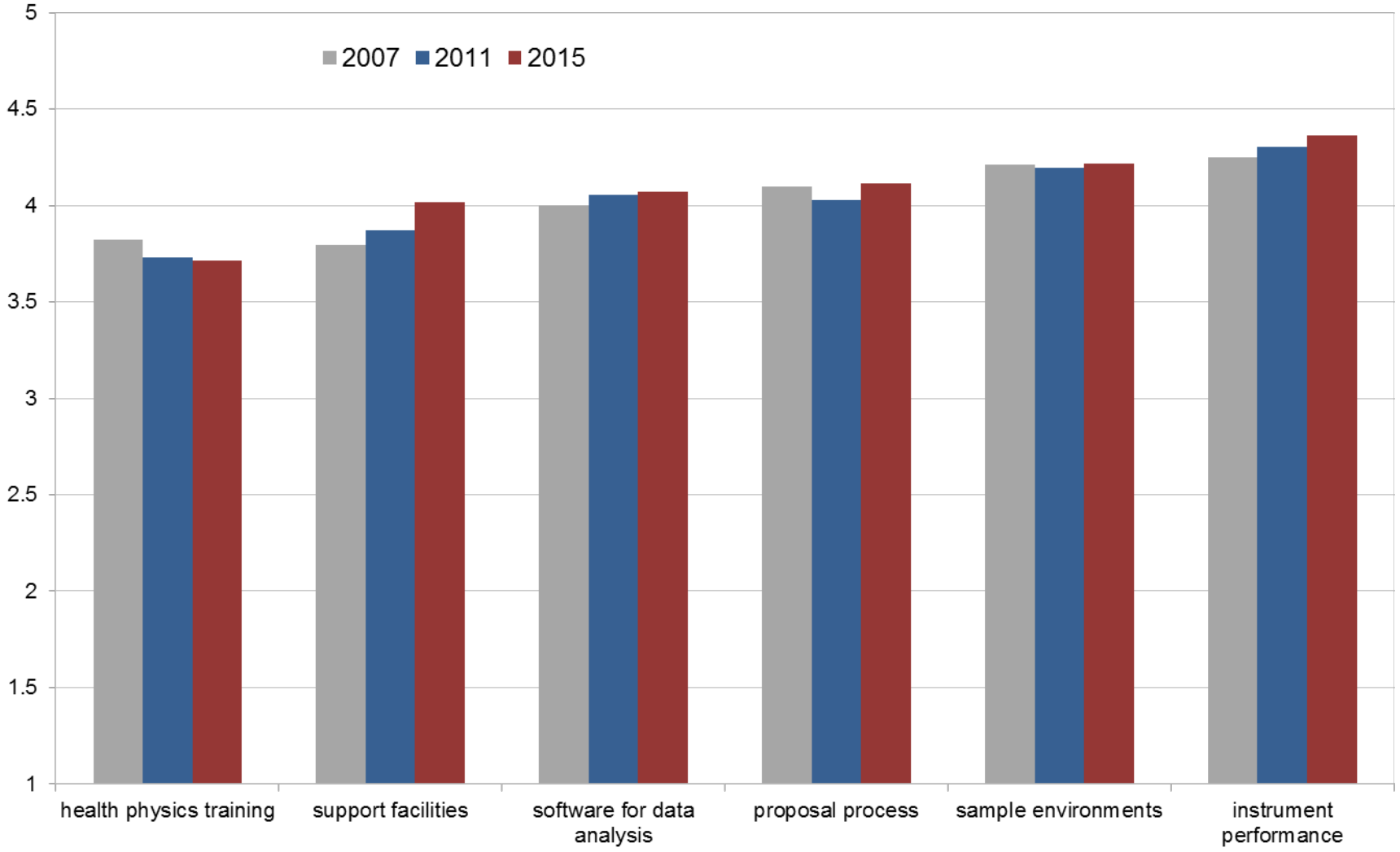
Reactor	Country	Power (MW_{th})	Fuel	Quality factor*
NBSR	U.S.	20	HEU	2.0
HFIR	U.S.	85	HEU	1.2
BR-2	Belgium	60	LEU	2.0
OPAL	Australia	20	LEU	1.5
CARR	China	60	LEU	1.3
NBSR-2	U.S.	20	LEU	2.5

Defined as the maximum thermal flux divided by the thermal power ($\times 10^{13}$ MTF/MW_{th}).

NCNR USER SURVEY

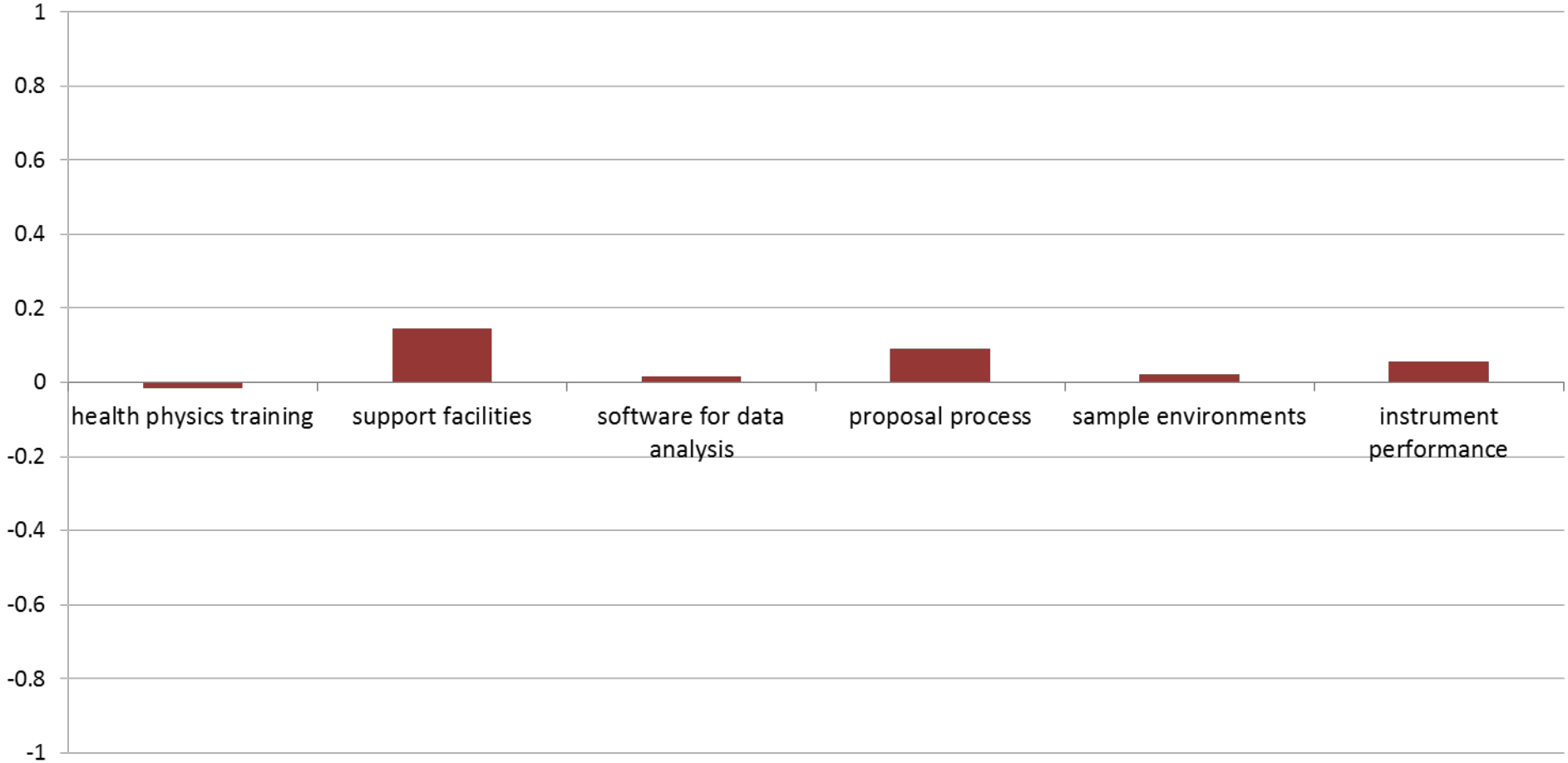
NCNR USER SURVEY

452
respondents



NCNR USER SURVEY

Evaluation difference: 2015 - 2011



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

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.

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...

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.

Sample environments

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

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.

NCNR RESPONSE TO USER SURVEY

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

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