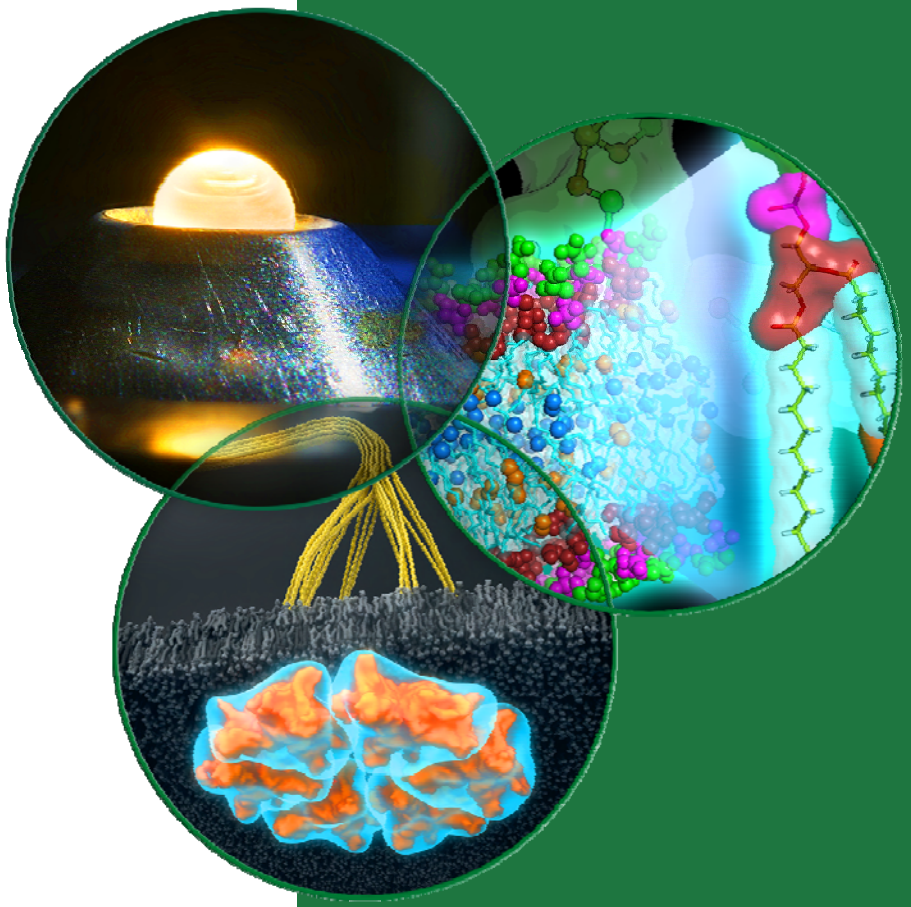
Science Productivity Process and Major Instrument Upgrades



Presented to
Neutron Advisory Board

Presented by
Dean Myles
Chair, Science Productivity Steering Committee.

June 30, 2016
Clinch River Cabin
Oak Ridge, Tennessee

ORNL is managed by UT-Battelle
for the US Department of Energy

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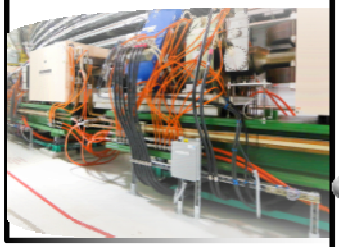
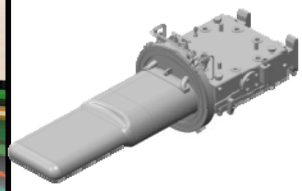
Our NScD strategy translates to 5 immediate organizational goals

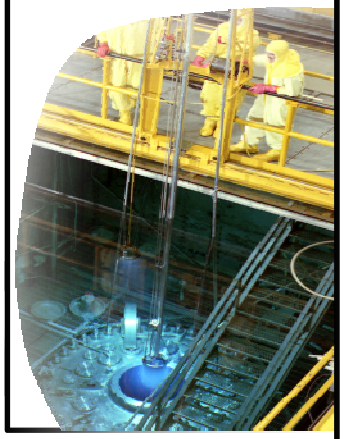
Routine and reliable operation of SNS accelerator at 1.4 MW



2 or fewer SNS mercury target changes per year

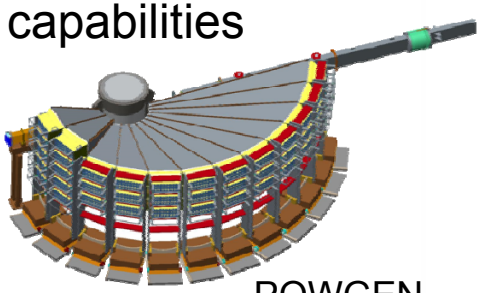


7 cycles per year at HFIR



>400 scientific publications from our beam lines per year

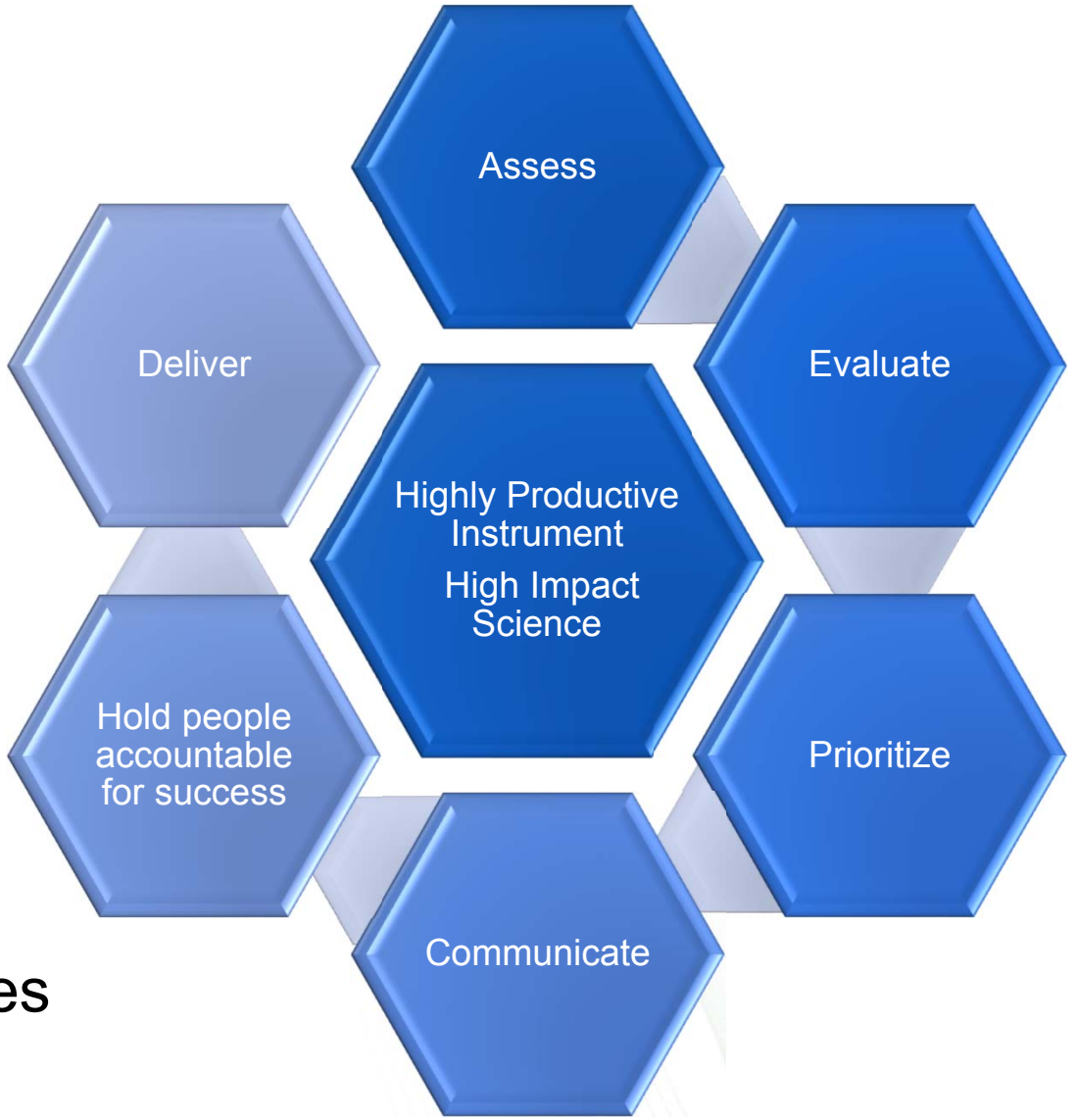
$10M per year available for rolling investments in neutron scattering capabilities



POWGEN upgrade

Science Productivity Process:

- Steering Committee
  - Chair, Chief Scientist and Division Directors for QCMD, BSMD, CEMD, NDAV and ISD
  - Recommends actions to Associate Lab. Director
  - Priorities aligned with Science Strategic Plan
- Assessment
  - FY15-16 - Internal
    - Established baseline
  - FY-16-18 - External
    - Beamline Review Panels
- Project teams established
- Technical Director manages integrated project suite

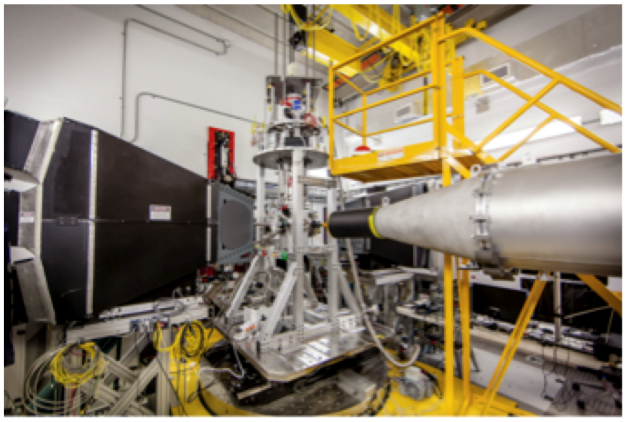


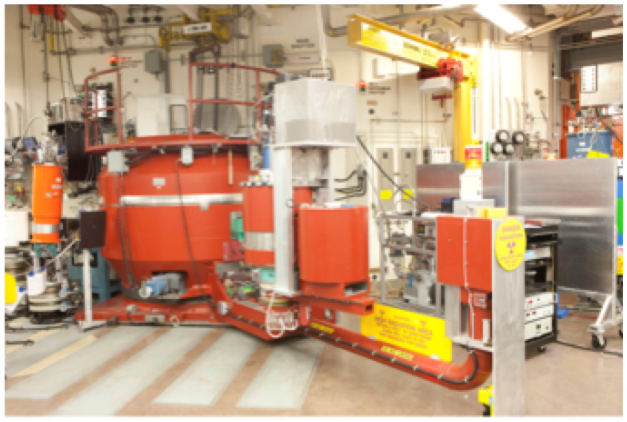
Science Productivity Process:
Investing in Major Instrument Improvements

- **2015: Assess instruments and facility infrastructure**
  - Identify opportunities for developing new capabilities
  - Identify the key issues limiting science productivity
- **2015-16: Science Productivity Steering Committee**
  - Set science priorities (with Divisions & Directorate)
  - **Identify major instrument projects (>$100K / complexity)**
  - Set instrument priorities & resource allocation.
  - Execute and manage projects/resultant actions
- **Actions may include**
  - Prioritization of major upgrades to existing instruments
  - Forming expert teams to tackle complex technical problems/projects
  - Investing in R&D on sample environment/data analysis solutions
  - User community engagement through workshops and reviews

2015 Baseline assessment evaluated each instrument in six areas

Productivity	Does the instrument serve a robust and successful user community?
Capability	Is the instrument equipped to address specified scientific challenges?
Utilization	Does the instrument make efficient use of neutron production time?
Reliability	Are instrument systems performing properly when needed?
Resources	Are resources available to the instrument at a sufficient level?
Safety	Are there issues that present undue risks to users, staff, or the facility?



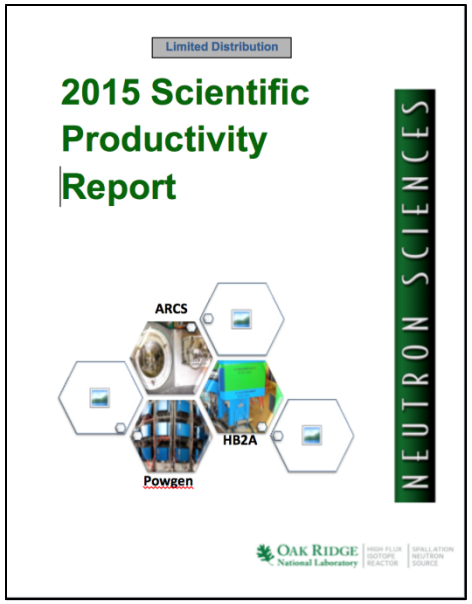


Steering Committee sets FY priorities and initiates major upgrade projects

May/June

Assessment reviews for all 30 instruments

- Set group/ division priorities



Late June

Prioritization meeting: Setting Directorate priorities

- Divisions present science case and concept
- Decision: Allocate resources to develop project plan

September/October

Project plan review: Allocation of resources

- Work planning for projects commencing in next FY
- Design criteria document for larger (capital) projects

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2015: 26 Instrument Projects – 12 FY16 Priorities

High-impact, ready to go. Execute.	Important, not time critical (no action until moved to "A")	Questions to resolve; specific actions to address	Not being considered
A SEQUOIA Vacuum	B SNAP detector rebuild	C HB3 velocity selector	D IMAGINE DNP table
14 T SNS magnet	VULCAN detector expansion	HB2A polarizer	
Mag. Ref. detector table	BioSANS collimator	HFIR cold guide optimization	
NSE Magnetism Capability	NOMAD detector expansion	RAPID	
CG4B Larmor Dev.	CNCS detector expansion	MANTA	
NOMAD bck. reduction	HB1 Heusler analyzer	Spin echo at HFIR	
NOMAD auto-sample changer	USANS spare crystals		
EQ-SANS detector vessel/sample area			
WAND Phase II - detector			
GP-SANS collimator			
POWGEN upgrade			
5 T magnet for pol. Ref./SANS			

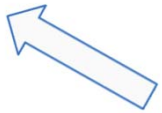
Mid-course review: – Initiated 13th project

A	High-impact, ready to go
	SEQUOIA Vacuum
	14 T SNS magnet
	Mag. Ref. detector table
	NSE Magnetism Capability
	CG4B Larmor Dev.
	NOMAD bck. reduction
	NOMAD auto-sample changer
	EQ-SANS detector vessel/sample area
	WAND Phase II - detector
	GP-SANS collimator
	POWGEN upgrade
	5 T magnet for pol. Ref./SANS

B	Important, not time critical (no action until moved to "A")
	SNAP detector rebuild
	VULCAN detector expansion
	BioSANS collimator
	NOMAD detector expansion
	CNCS detector expansion
	HB1 Heusler analyzer
	USANS spare crystals

C	Questions to resolve; specific actions to address
	HB3 velocity selector
	HB2A polarizer
	HFIR cold guide optimization
	RAPID
	MANTA
	Spin echo at HFIR

D	Not being considered
	IMAGINE DNP table



A	+1 Mid-cycle priority
	TOPAZ: cryostat

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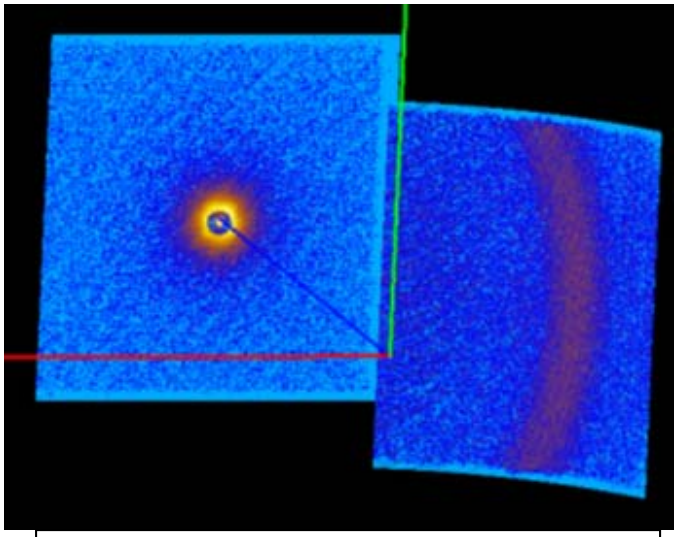
Project Execution: FY 2016 A-list

Item	Lead	Completion Date	FY16 ($k)	Total ($k)
SEQUOIA Vacuum	L. Jones	Summer 2017	708	1,485
14 T SNS magnet	M. Stone	Fall 2017	1,680	2,004
Mag. Ref. Improvement Project	M. Fitzsimmons	April 2017	1,005	1,277
NSE Magnetism Capability	G. Ehlers	Dec. 2015 (1st exp.)	185	334
CG4B Larmor Dev. Beamline	L. Robertson	May 2017	500	500
NOMAD background reduction (I)	M. Tucker	Oct. 2016	143	156
NOMAD auto-sample changer	M. Everett	Dec. 2017	507	715
EQ-SANS detector vessel/sample area modifications	W. Heller	Mar. 2017	330	357
WAND Phase II - detector	M. Frontzek	April 2018	0	1,226
GP-SANS collimator replacement	L. Crow	April 2017	690	1,025
POWGEN Phase-II upgrade	A. Huq	Sep 2017	2,812	4,583
5 T magnet for pol. Ref./SANS	M. Fitzsimmons	August 2017	247	256
TOPAZ cryogoniometer	A. Huq	Spring 2017	205	224
		TOTAL	*9,012	14,142

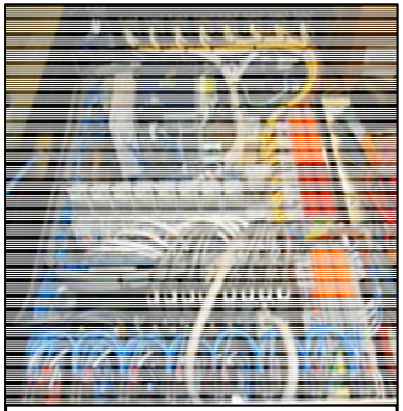
BioSANS' new west wing detectors ready for commissioning

- Installation phase completed
- All startup checklist items completed
- Calibration studies continue and commissioning has begun

West wing detector before installation

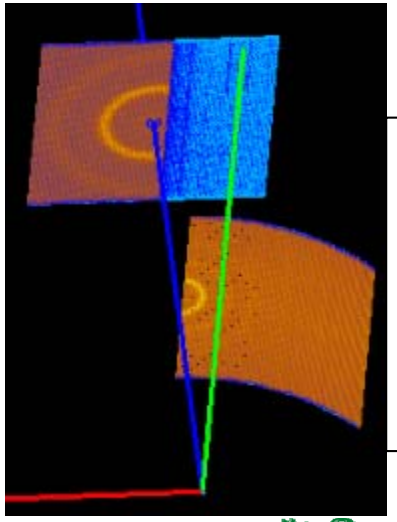


Scattering from C60-fullerenes - ring at q~0.78 previously beyond BioSANS high-q capabilities



Motion control panel

Detector feedthroughs



Scattering from silver behenate

View showing relationship of detectors and curvature of wing

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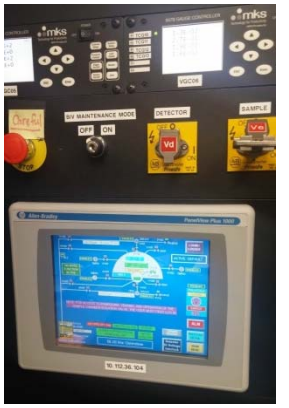
ARCS Vacuum Upgrade

Project goals: Improve performance and reliability of ARCS sample and detector vessel vacuum system

Project completed: February 2016

- Installed new standard roughing pump package, 2 turbo pumps and vacuum gauges
  - Improved vacuum performance: detector tank pumpdown **from > 40 hrs to ~ 18 hrs,** sample tank pumpdown from 20 minutes to ~ 10 minutes
  - Improved operations, reliability and maintenance: existing cryopumps may be regenerated without risk of experiment interruption
- Installed new vacuum control system
  - Improved operational safety: additional interlocks and controls, e.g. checks to inhibit detector high voltage, monitoring of sample isolation valve pneumatic pressure, sample chamber flapper valve to ensure proper venting, guide vacuum monitoring
  - Improved maintenance: facility-written control code may be debugged and improved, uses standard components
- Lessons learned -> FY 2017 SEQUOIA project



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MR – Magnetism Reflectometer Improvement Project

- Awarded contract for hexapod
  - Enables high precision, versatile sample and sample environments positioning
  - Accommodates a variety of sample environment equipment
  - On site in October 2016

Orange cone schematically represents hexapod

Vendor photo of hexapod

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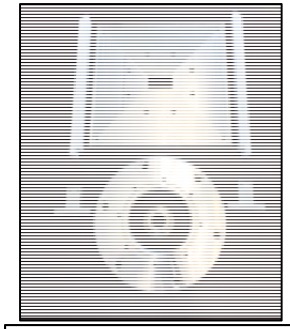
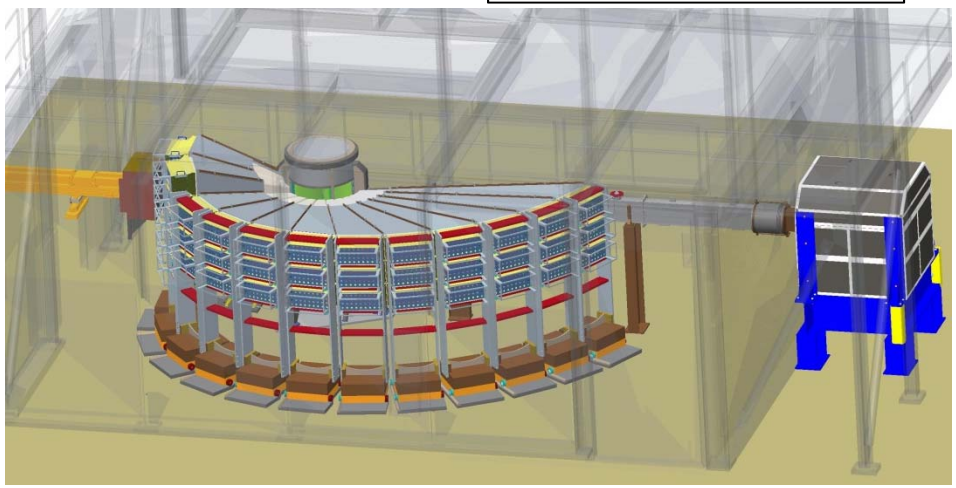
POWGEN Project

- Replaces difficult to maintain sample vessel (thinner window)
- New coarse radial collimator
  - Eliminate shadows (≈10% improvement in detector illumination)
  - Fill with Argon – background reduction
- 10 new detectors – completes one side (40 total)
- New fine radial collimator – eliminate shadowing of highest and lowest scattering angles
- New sample vessel ordered
- Project completion Sept 2017



Window assembly for upstream optics

Support assembly for upstream optics



Instrument Projects – FY17 Priorities

A High-impact, ready to go; develop plan in next 2 months	B Important, not time critical (no action until moved to "A")	C Questions to resolve; specific actions to address	D Not being considered
SNAP Detector rebuild	TOPAZ detector expansion	SNAP Guide	TOF - top loaders #
HB3 velocity selector	SEQUOIA collimator	BL4A Toploader / Halbach Magnet *	
Vulcan Detector build-out	BioSANS collimator	Lab ppms	
CORELLI: Thimble	NOMAD detector expansion	*HFIR cold guide optimization* *	
NRSF-2 Upgrade	HB1 Heusler analyzer	*RAPID* *	
HB-1A backend	USANS spare crystals	MANTA	
HB-3A Anger Cameras		Spin echo at HFIR	
CNCS collimator			
HYSPEC Elevator			
POWGEN: Phase II detectors			

2016-2018: BeamLine Review Panels

- Review the mission need, technical capabilities and scientific impact of subsets of NScD instruments, organized by type and class.
  - Conduct 2 or 3 external Beamline Review Panel/annum
  - In 2016: i) Powder Diffractometers & ii) SANS/Reflectometers
- Aug 3, 2016: Powder Diffraction Review: Chair: John Parise
  - POWGEN, NOMAD, SNAP, WAND and HB-2A beamlines (RAPID)
- Assess instrument performance and science needs, focusing on:
  - Scientific productivity (users/publications etc.)
  - Management structure (number of staff, staff effectiveness)
  - Current capabilities (condition, quality, upgrades needed, etc.)
  - Ability to meet user needs for data collection, reduction, and analysis.
  - Adequacy and reliability of software, sample environment
  - Planned upgrades and future development of instrument suite
- The recommendations and findings of each BRP will inform the priorities for succeeding phases of major instrument improvements.

Summary

- NScD is committing $10M/annum to instrument improvements.
- Current major instrument improvements will be completed in 3-5 fiscal years
- FY16 priorities set/executing:
  - 13 major instrument upgrades in progress
  - (Phased funding - $9M in FY16, $5M in FY17)
- FY17 priorities set/initiated:
  - 10 major instrument upgrades now in project development
  - (~$5M in FY17)
- NScD has established recurring, triennial external reviews of instrument suites and science needs
  - The recommendations and findings of each BRP will inform the priorities for succeeding phases of major instrument improvements

Questions?

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