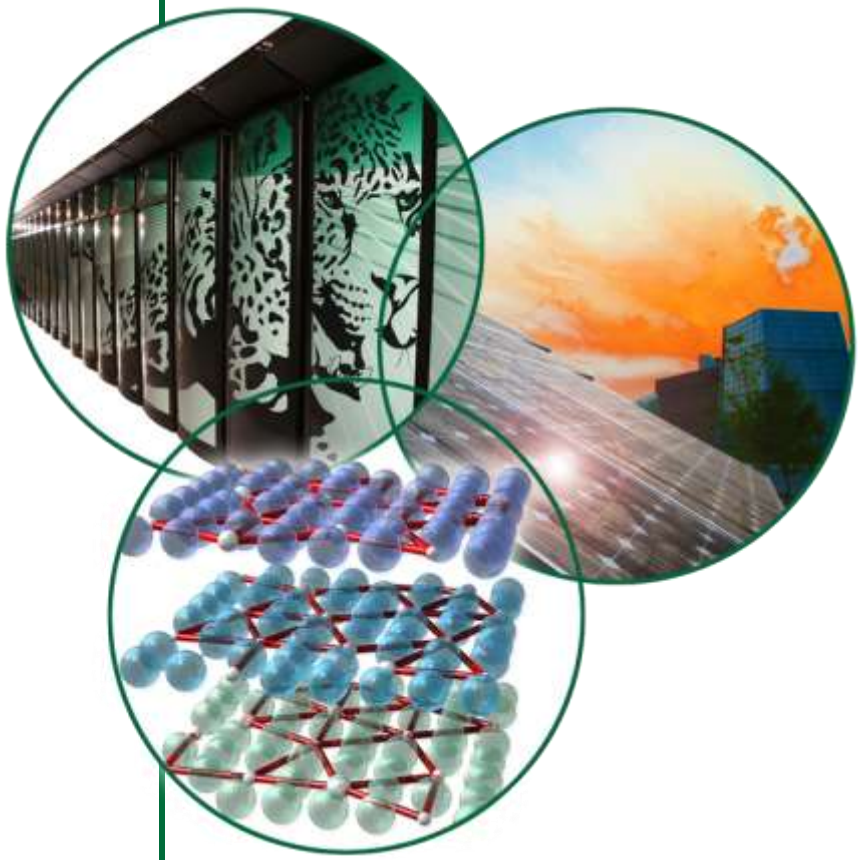
Neutron Sciences at Oak Ridge National Laboratory

Presented to
Accelerator Advisory Committee

Ian Anderson
Associate Laboratory Director

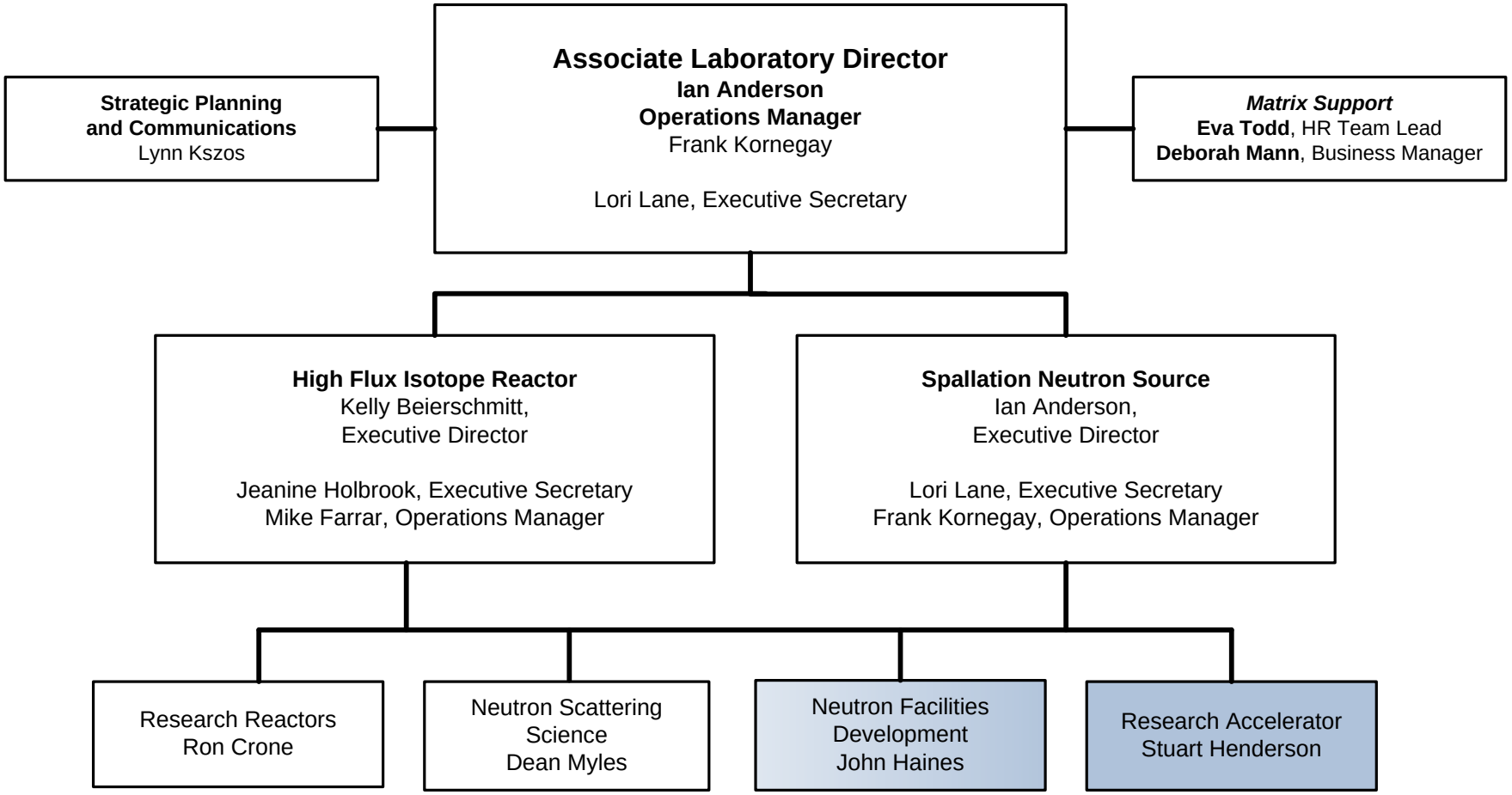
February 2, 2010



U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

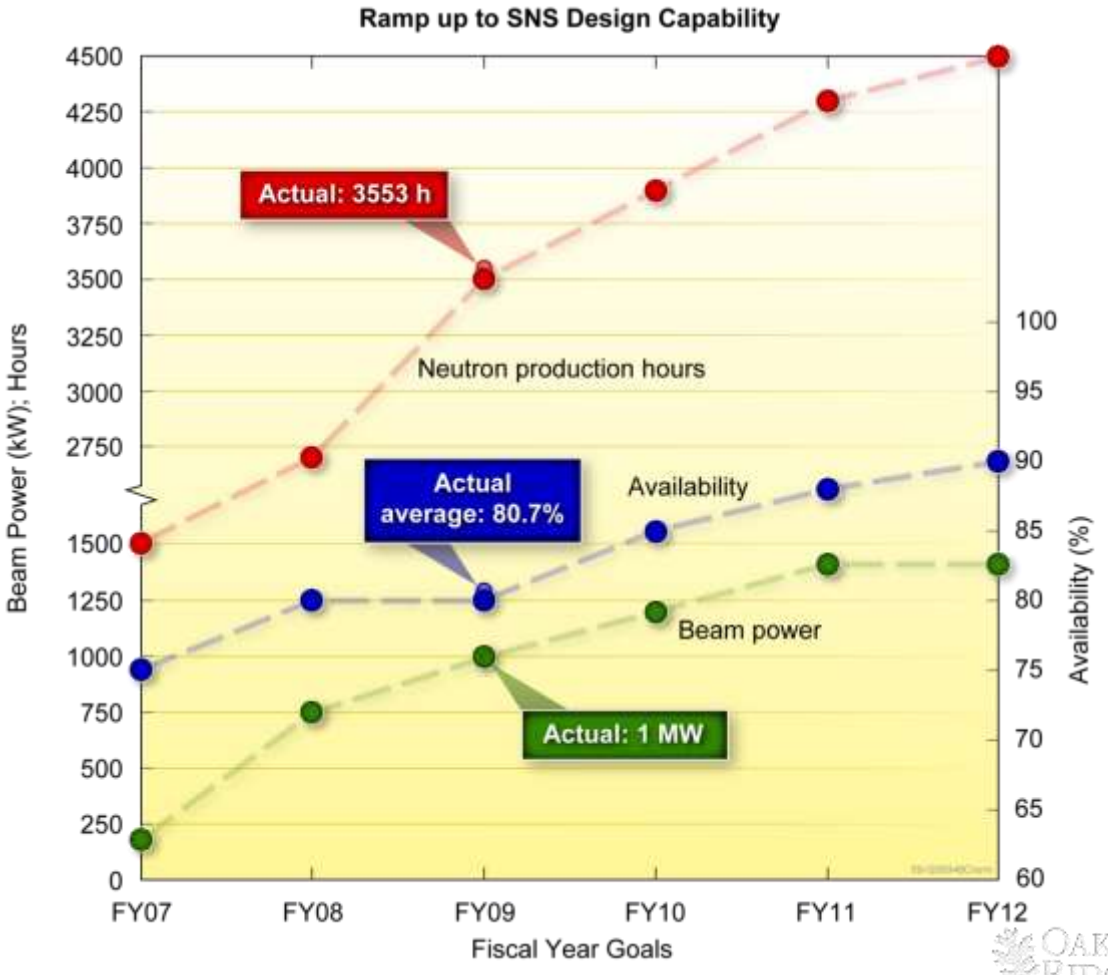
Neutron Sciences Directorate



We are following our ramp up plan - reliability is our primary goal

SNS Operating Statistics (FY 2009)

- Neutron production hours: 3553
- Average availability 80.7%; availability as high as 98%
- Beam power on target: 1 MW
- Proton bunch intensity: 1.55 x 10^{14} protons per pulse

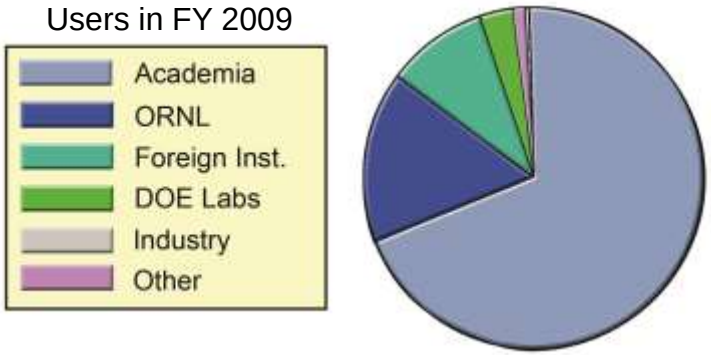


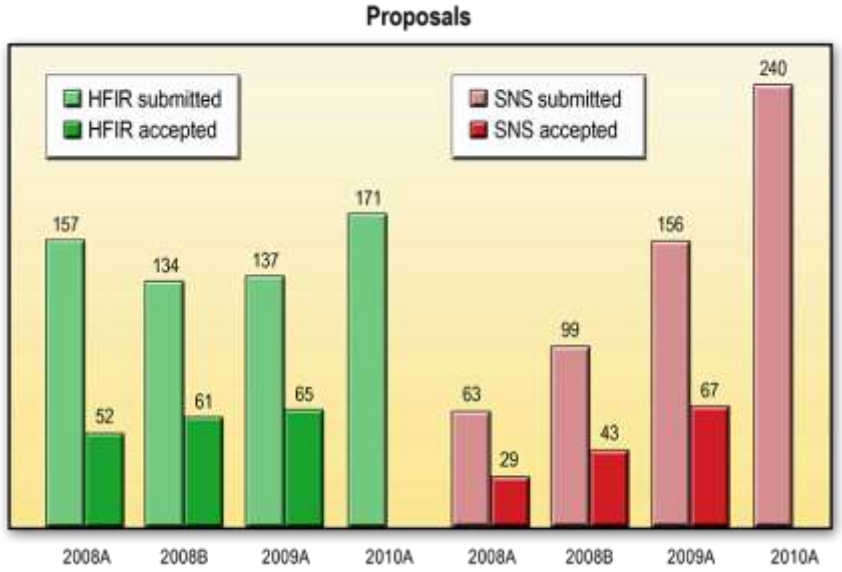
The number of unique users is increasing rapidly as we build to capacity

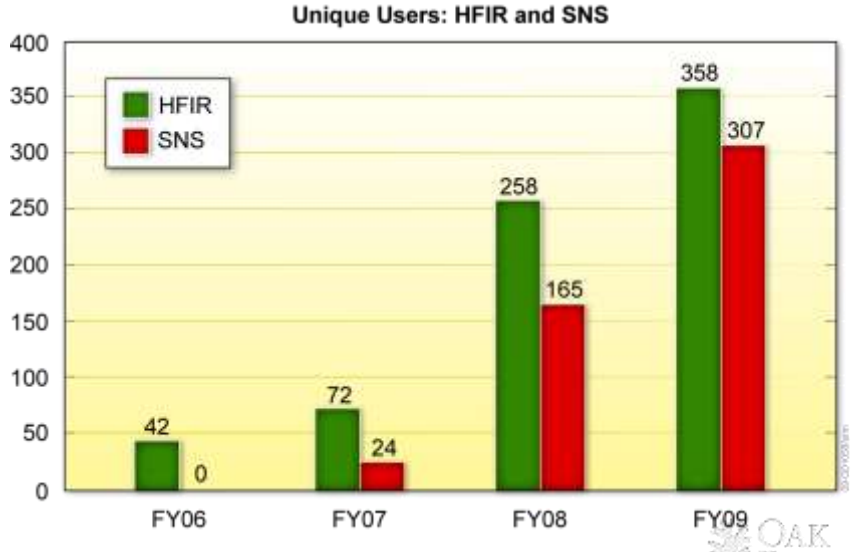
User Statistics – FY 2009

HFIR: Unique users: 358
Total users: 888
Proposals: 137
Experiments: 198
Over subscribed at a rate of 2.05

SNS: Unique users: 307
Total users: 469
Proposals: 156
Experiments: 106
Over subscribed at a rate of 2.48



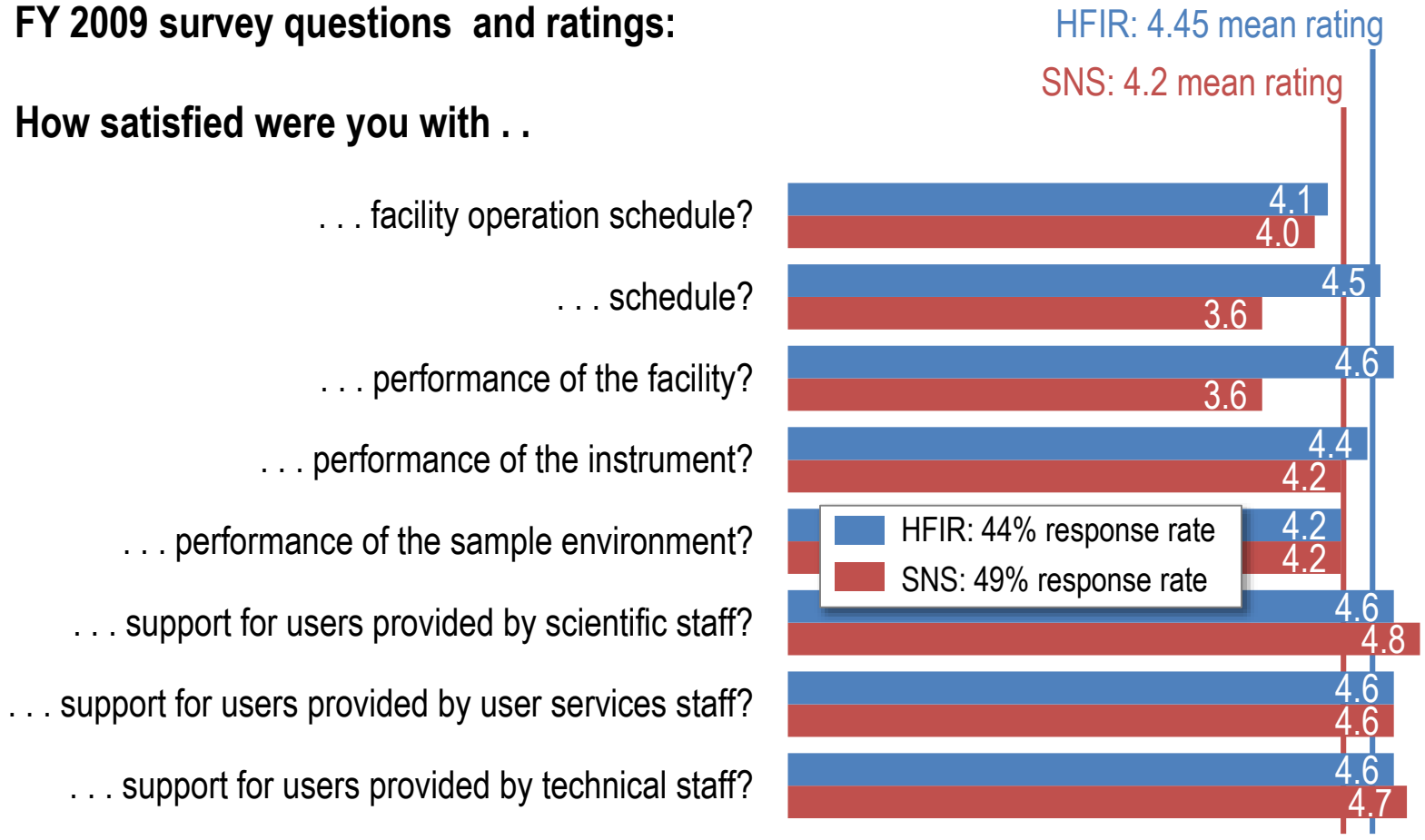




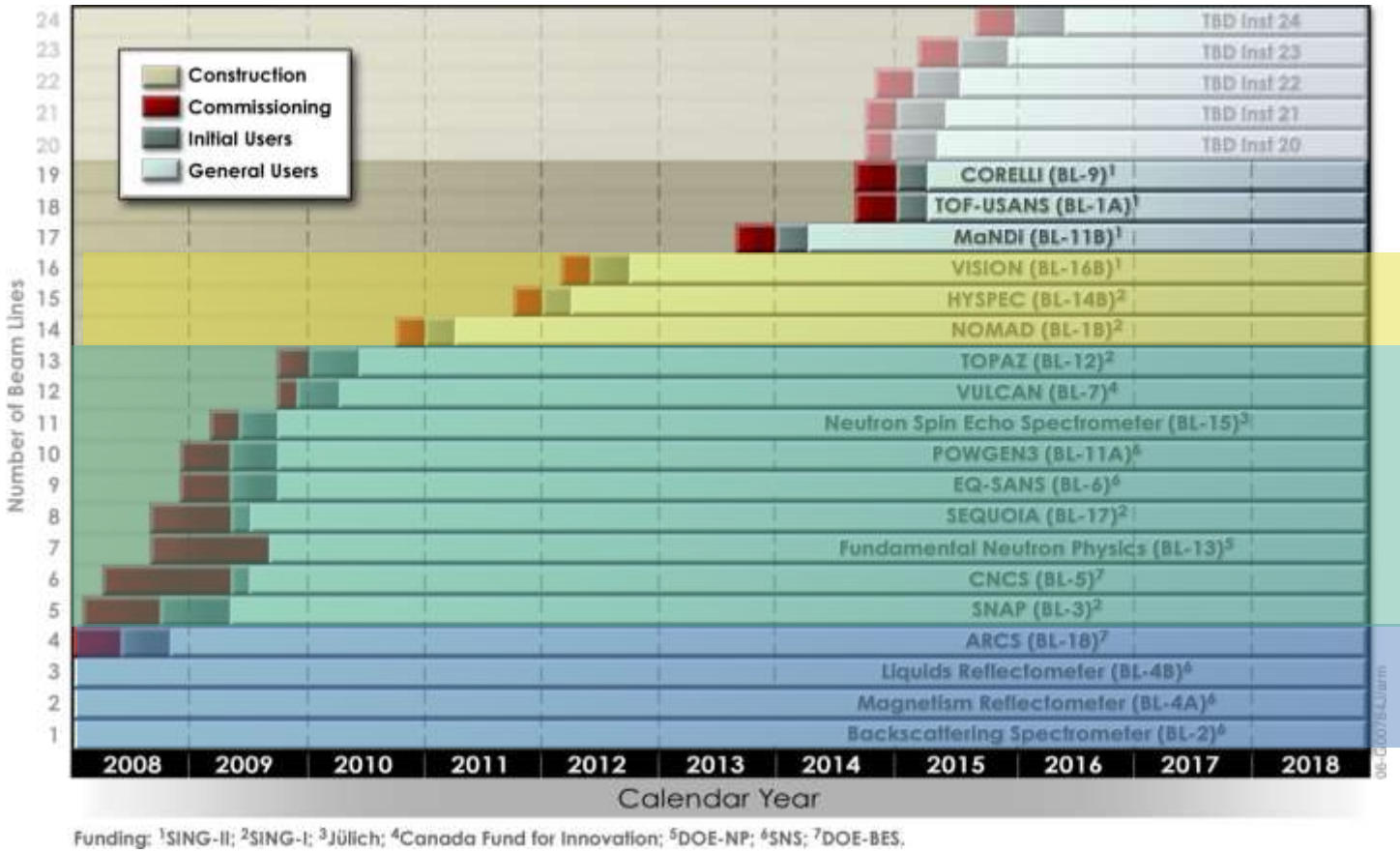
Users are generally satisfied

FY 2009 survey questions and ratings:

How satisfied were you with . .



Completion of instruments continues according to plan



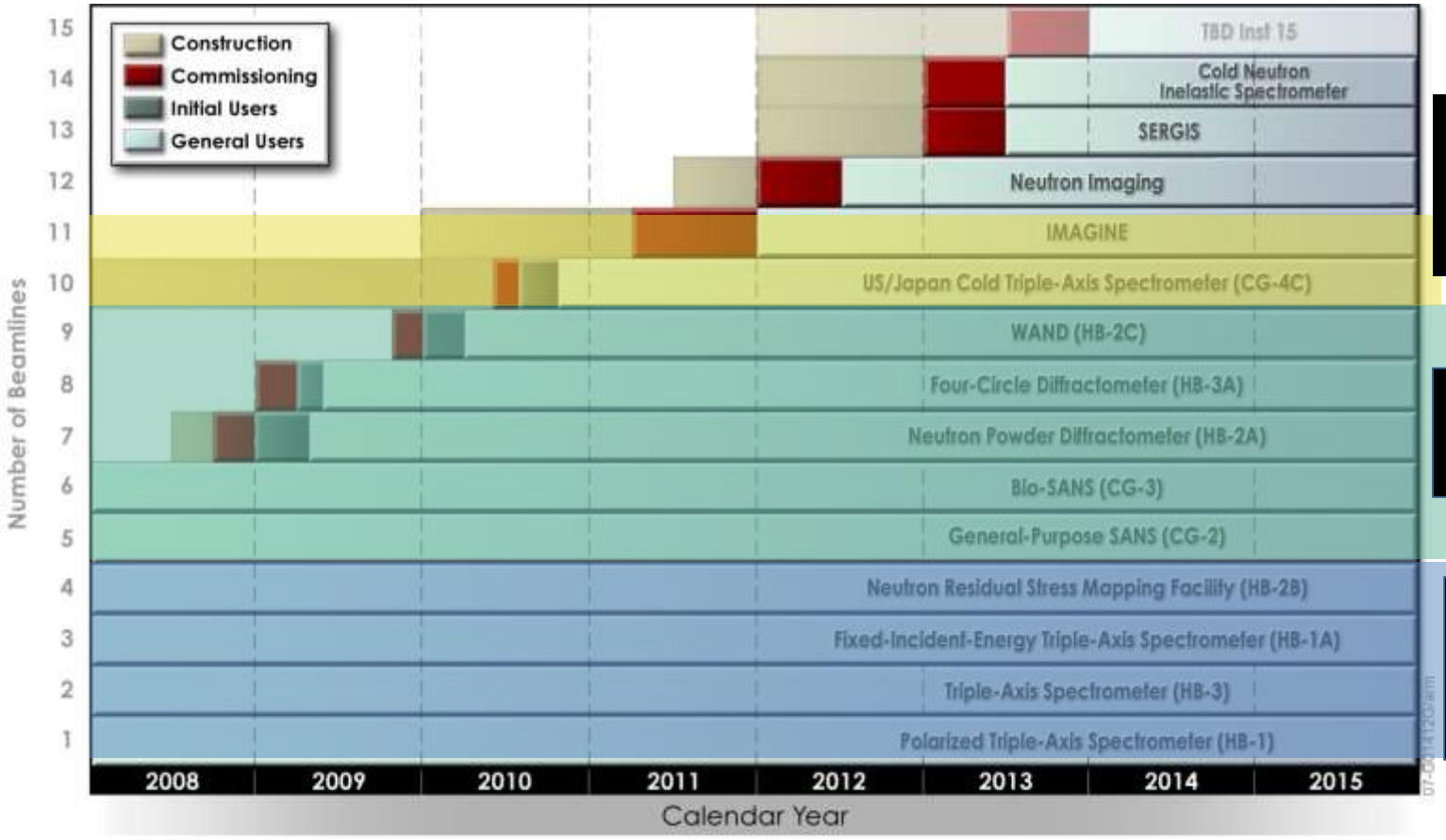
Funding: [1]SING-II; [2]SING-I; [3]Jülich; [4]Canada Fund for Innovation; [5]DOE-NP; [6]SNS; [7]DOE-BES.

16 will be operational in 2012

13 currently operating

4 instruments operating before 2008

Adding capability at HFIR



11 will be operational in 2011

9 currently operating

4 instruments operating before 2007

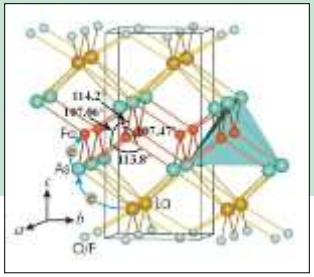
Our scientific productivity is increasing

Publications (CY 2009 to-date)

- SNS: 162 papers, with ~692 unique authors
- HFIR: 107 papers, with ~435 unique authors

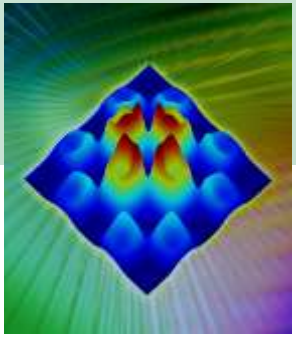
"Magnetic order close to superconductivity in the iron-based layered $LaO_{1-x}Fe_xAs$ systems" Clarina de la Cruz, et al., 2008. *Nature* 453:899-902

421 citations since published in 2008

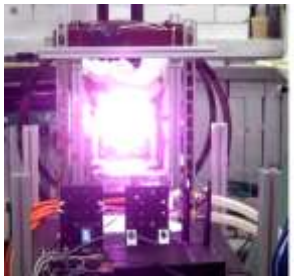


Recent paper gives strong evidence that, if superconductivity is related to a material's magnetic properties, the same mechanisms are behind both copper-based high temperature superconductors and the newly discovered iron-base superconductors

Mark Lumsden and Andy Christianson et al. Nature Physics



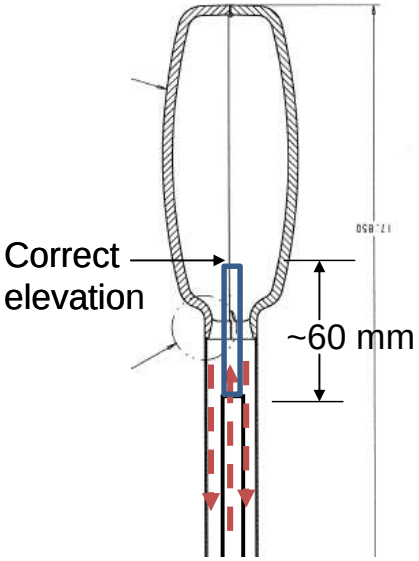
Development Highlights for FY2009



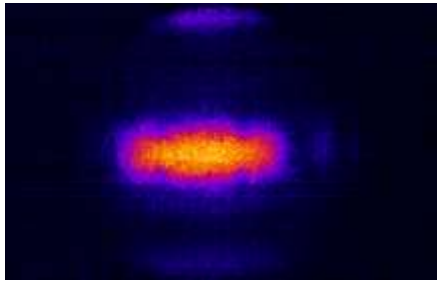
1st in-house produced ^{3}He cells achieved >70% polarization; lifetime >300 h

Replaced first target & proton beam window

Completed development beamline at HFIR CG-1

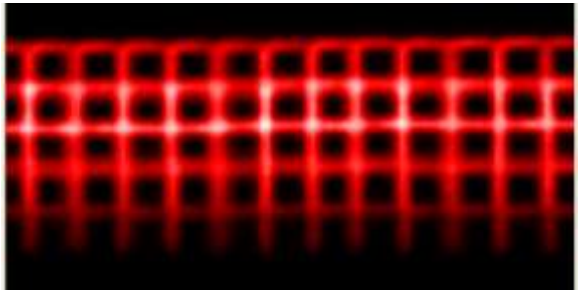


Deployed stint to repair cryogenic hydrogen moderator



Developed and deployed Target Imaging System

Installed new HVCM



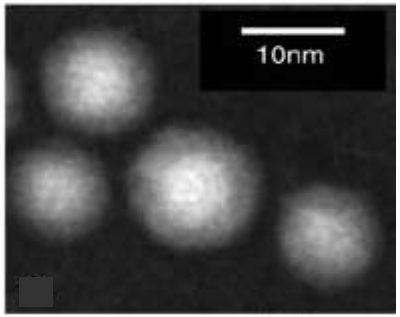
Developed world's best resolution neutron Anger camera (< 1 mm)

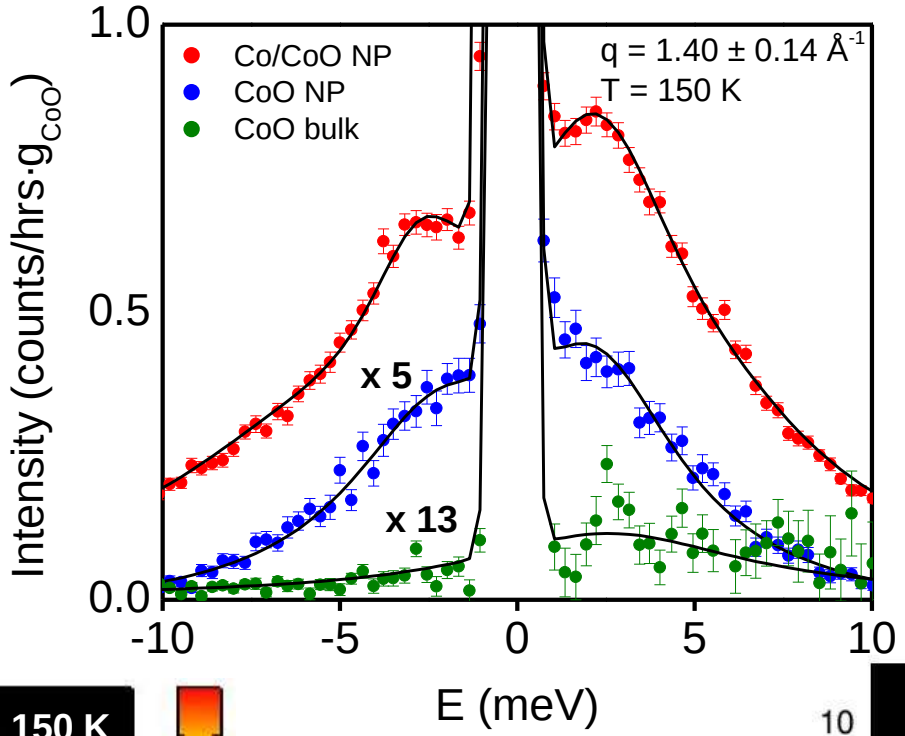
First observation of spin waves in Co/CoO and CoO nanoparticles

M.Feygenson[1], M. C. Aronson[1,2], A. A. Podlesnyak[3], J. L. Niedziela[3], M. Hagen[3]

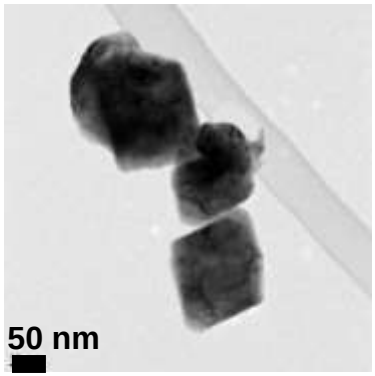
[1]Brookhaven National Laboratory; [2]Stony Brook University; [3] Oak Ridge National Laboratory

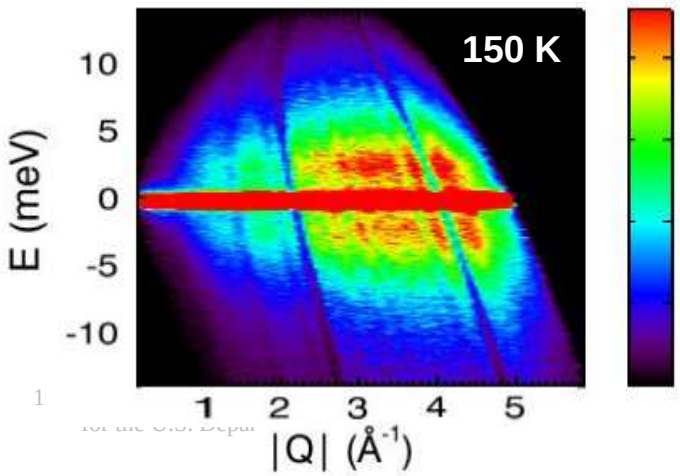
Co/CoO nanoparticles
D ~ 11nm

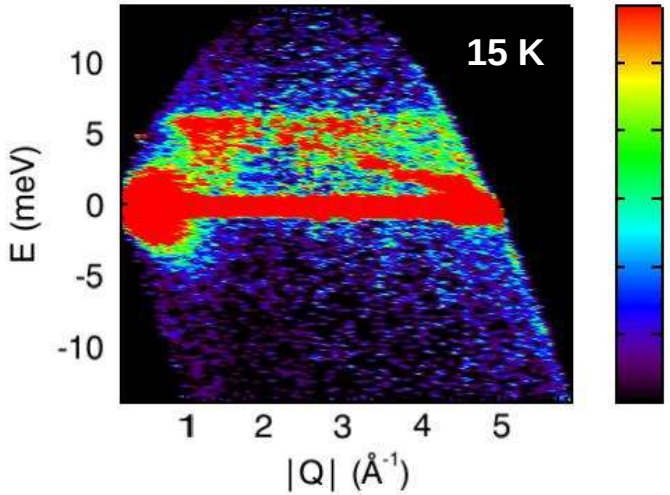




CoO nanoparticles
D ~ 50nm



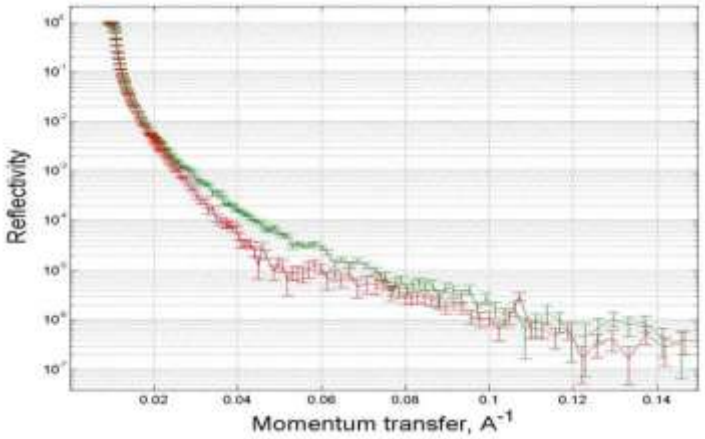




First neutron reflectometry experiment on ITO nanoparticle assembly

Valeria Lauter, Haile Ambaye, Jim Browning, Greg Smith, NScD; Ilia Ivanov, CNMS

- Indium tin oxide (IT0) is used in transparent conductive coatings for liquid crystal displays, flat panel displays, plasma displays, solar cells, and organic light-emitting diodes.
- ITO nanoparticles are assembled layer by layer onto cellulose fibers with poly (sodium 4-styrenesulfonate) (PSS). To strengthen interaction between layers, the nanoparticle assembly is modified with polyethyleneimine (PEI). Samples are coated with either PEI-modified or PEI-unmodified ITO.
- Reflectometry shows that the thickness of the polymer interlayer is what controls the electron transport between the layers.



Green and red curves in the lower plot mark the results of PEI-modified and PEI-unmodified ITO composite films, respectively.

Infrastructure update

Joint Institute for Neutron Sciences	• Construction scheduled for completion in June 2010
ORNL Guest House	• Construction contract awarded for 47 rooms; construction to start in Feb-Mar
Science labs at HFIR	• Operational
Science labs at SNS	• 2nd floor CLO scheduled for completion in May 2010 • Target building materials handling lab complete April 2010 • Mercury and post beam sample handling labs scheduled for completion in November 2010
Melton Valley	• Melton Valley Warehouse is complete and fully functional • The contractor has been selected for the Melton Valley Maintenance Building and design is in progress
Chestnut Ridge	• Cafeteria is open!

Our vision for HFIR and SNS remains on track

HFIR	SNS
• Build out instrument suite • Second Guide Hall and cold source • Neutron Science Support and User Facility	• Power Upgrade Project (PUP) CD-1 approved January 16 – 2011: Start long-lead procurements – 2012: Construction – 2015: Completion • Second Target Station CD-0 approved January 7 – 2014: Construction – 2019: Completion • Complete instruments

Good Progress on Second Target Station

- Analyzed linac capabilities and requirements
- Selected preferred site
- Assessed long-pulse option
- Joint US-Europe long-pulse instrumentation workshop
- Assessed options for proton beam transport
- Developed concept for solid rotating target
- Initiated safety assessments for rotating target
- Held “Town Hall” meeting with user community

What keeps me awake.....

- Building our science productivity and user base at SNS within diminishing budgets
- Safety record and operational discipline
- Accelerator reliability

The funding profile demonstrates the growing emphasis on delivering science

	FY 2008 ($M)	FY 2009 ($M)	FY 2010 Plan ($M)
Accelerator and Site Operations	92.3	90.1	90.6
GPP	3.0	1.1	1.2
Development (incl AIP's)	42.0	41.4	42.1
Science	37.5	44.1	48.1
Total SNS operations	174.8	176.7	182.0
SING I	11.9	12.0	5.0
SING II	6.0	7.0	18.0
PUP			2.0
Reactor Operations	54.4	58.0	60.0
Total	247.1	253.7	267.0


Questions?