

COHERENT Operations at the SNS

Jason Newby

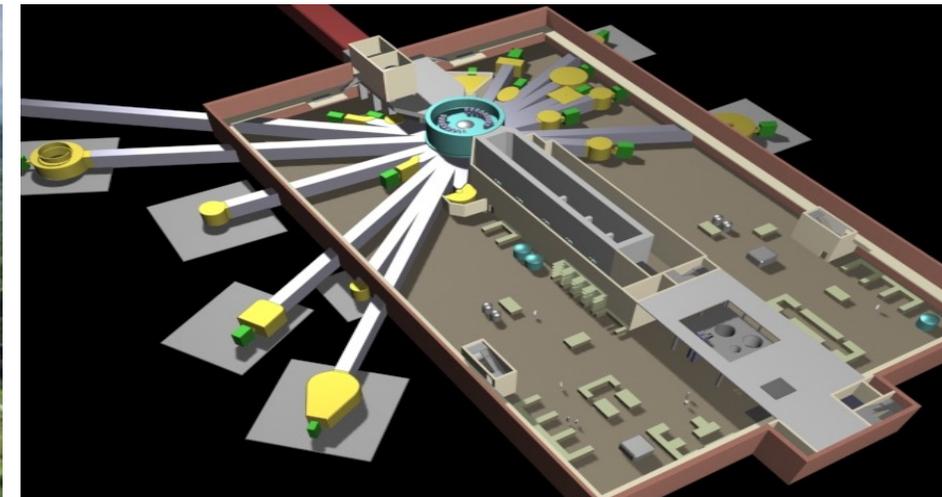
COHERENT External Review

August 15, 2018

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

SNS User Program

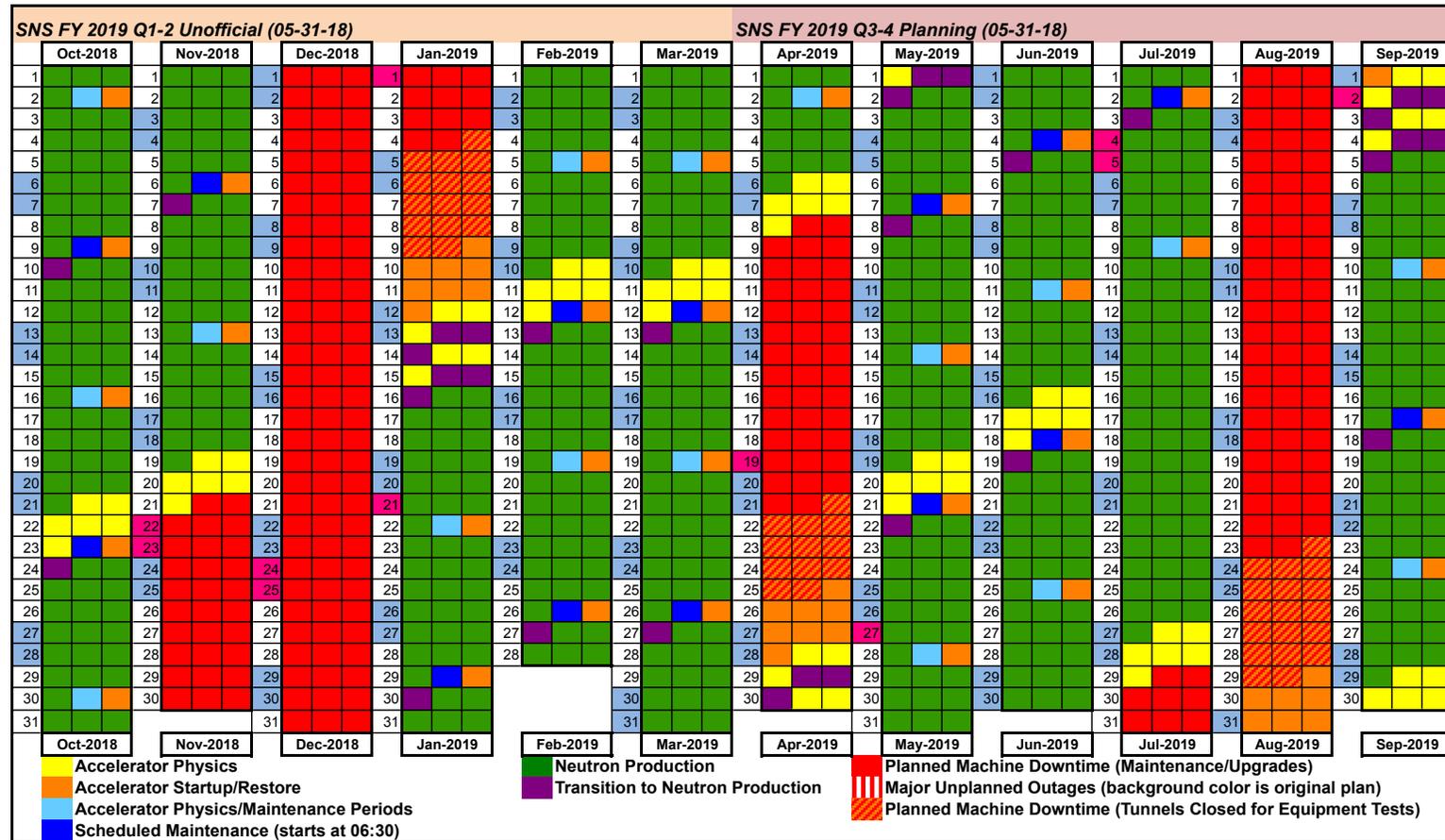
- 19 Neutron Beam-lines for Basic Energy Sciences missions
- 1 Fundamental Neutron Physics Beam-line for Office of Nuclear Physics missions
- 24/7 Operation with round-the-clock support staff, operations and user support
- Dedicated Instrument Scientist for each beam-line instrument
- Over 700 users in 2017 performing 1679 independent experiments.
- 1 Dedicated Laboratory for Neutrino Science



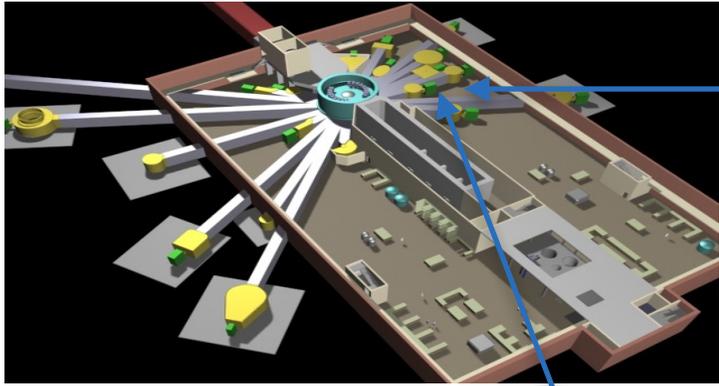
SNS Target Floor

SNS Scheduled Production Operation

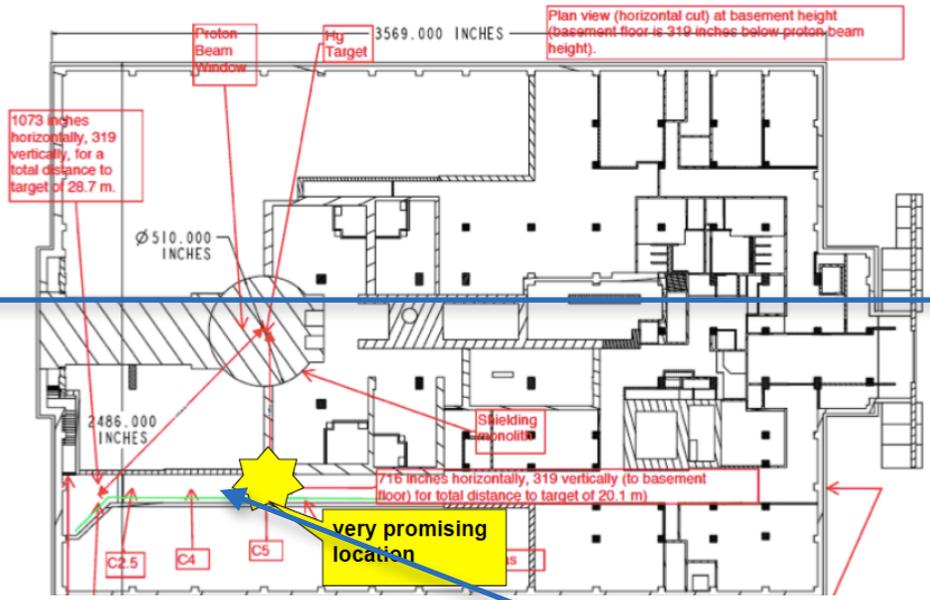
- Goal is 5000 hours per year of neutron production
- Reliably scheduled beam uptime
- Recently completed Inner Reflector Plug replacement (first since 2005) during long shutdown
- No long interruptions planned for next several years
- Plan to operate at 1.4 MW indefinitely



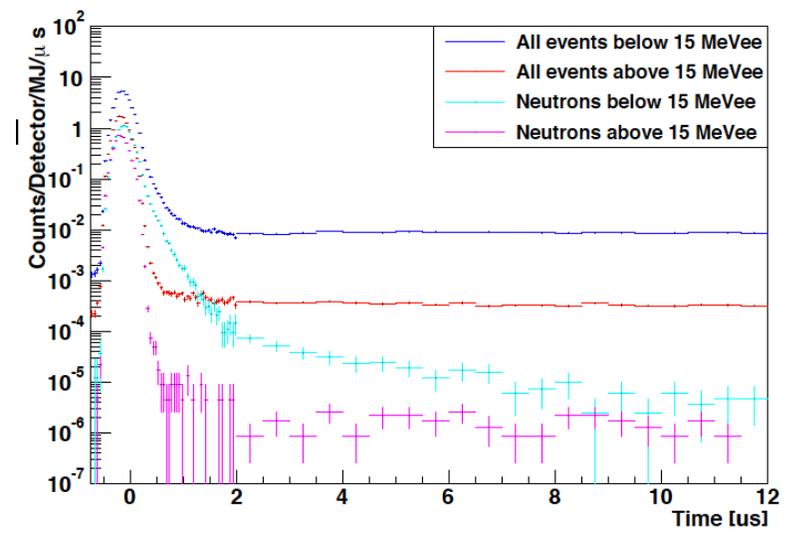
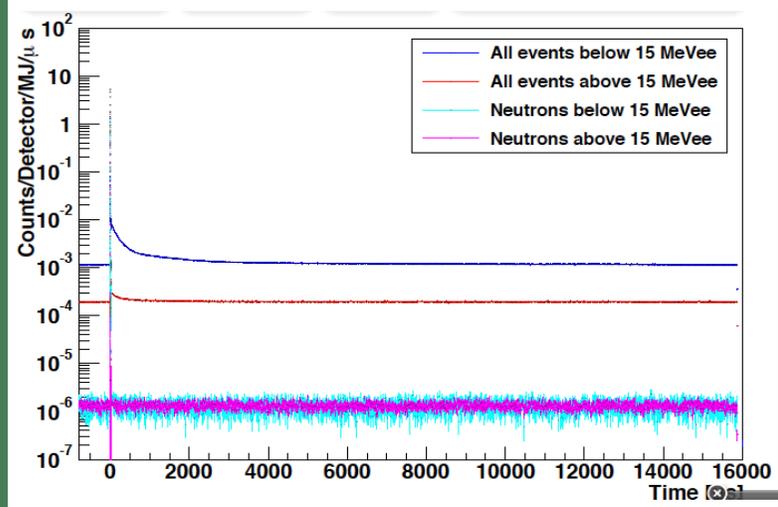
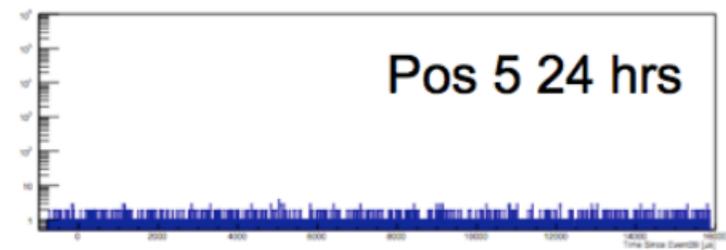
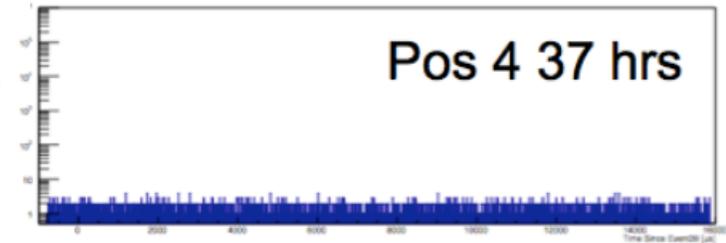
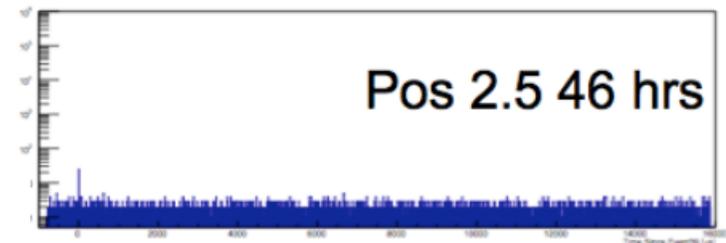
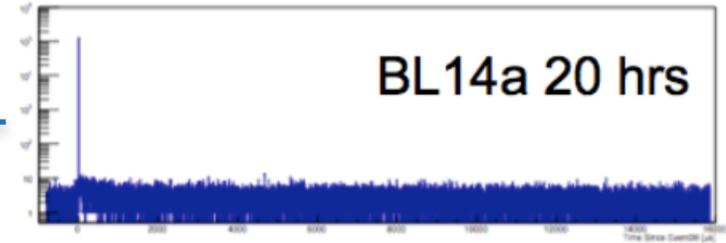
Early Siting Studies



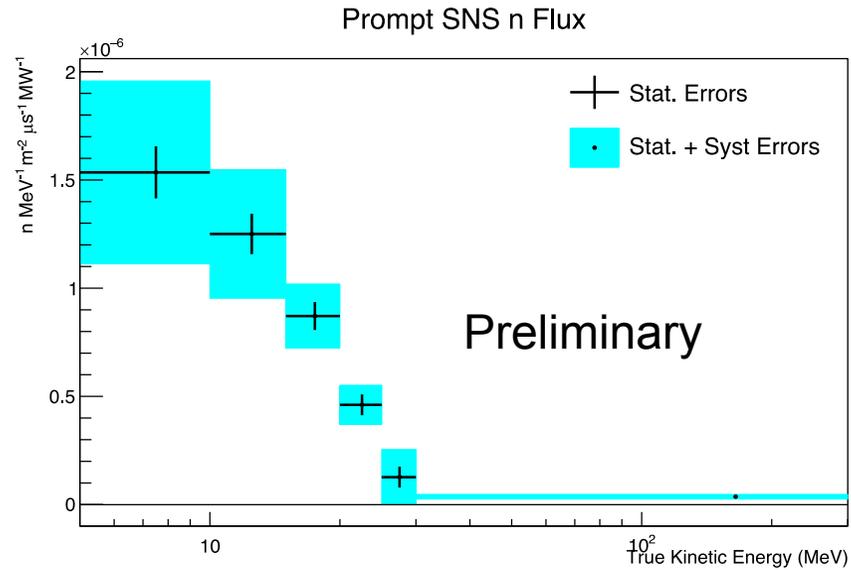
Target Floor



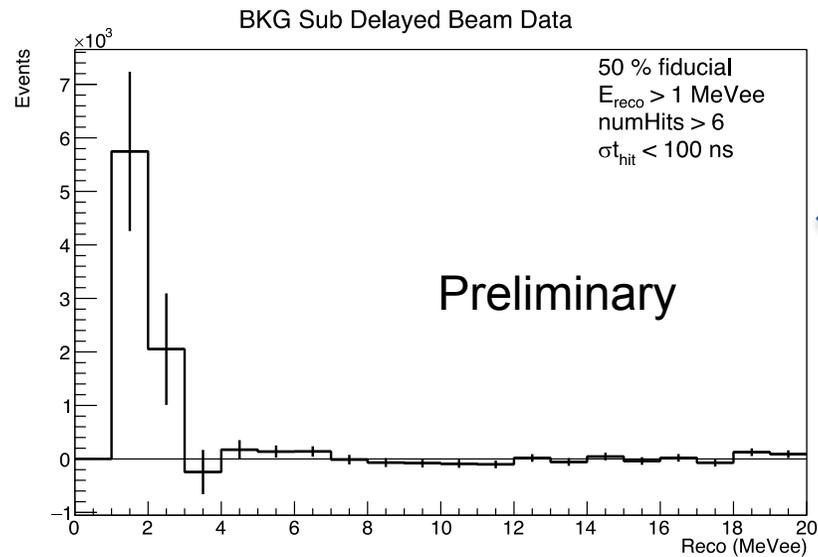
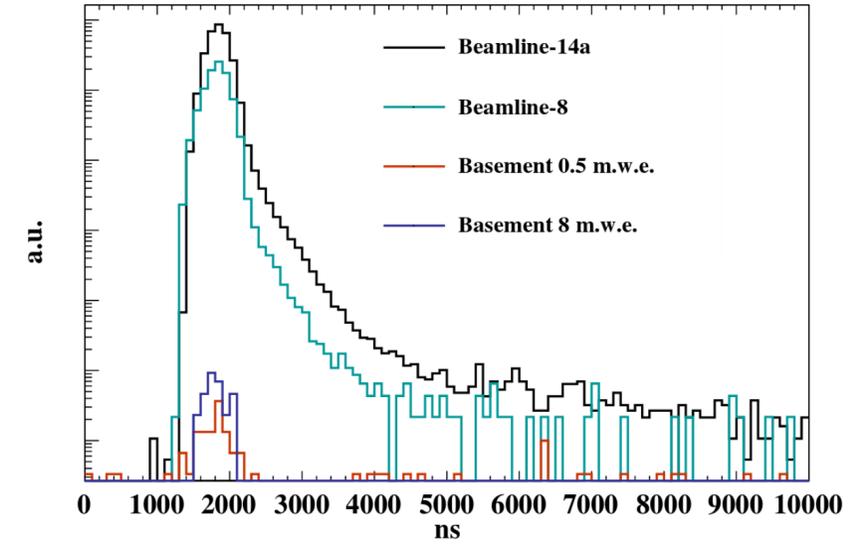
Basement



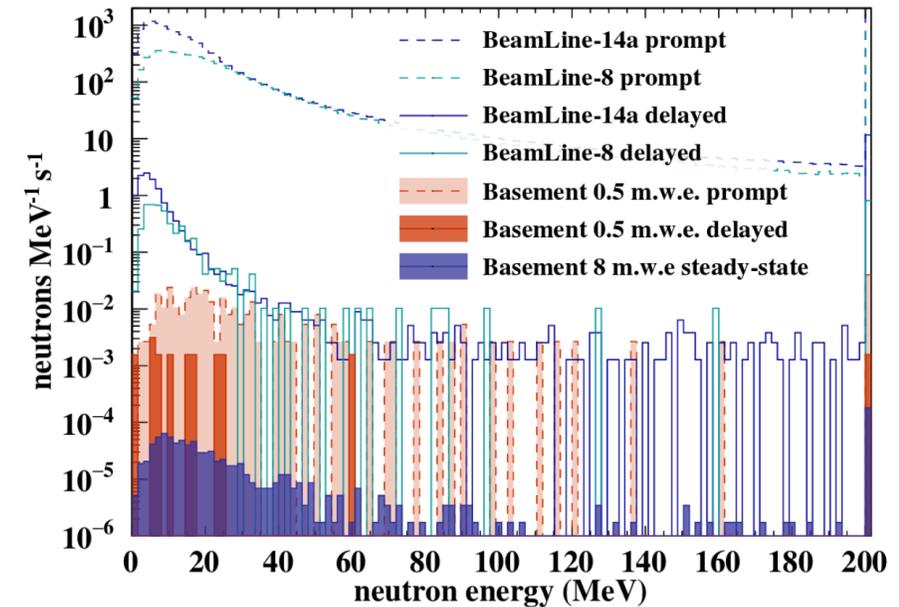
Neutron Flux Measurements in the basement



Sandia Scatter Camera

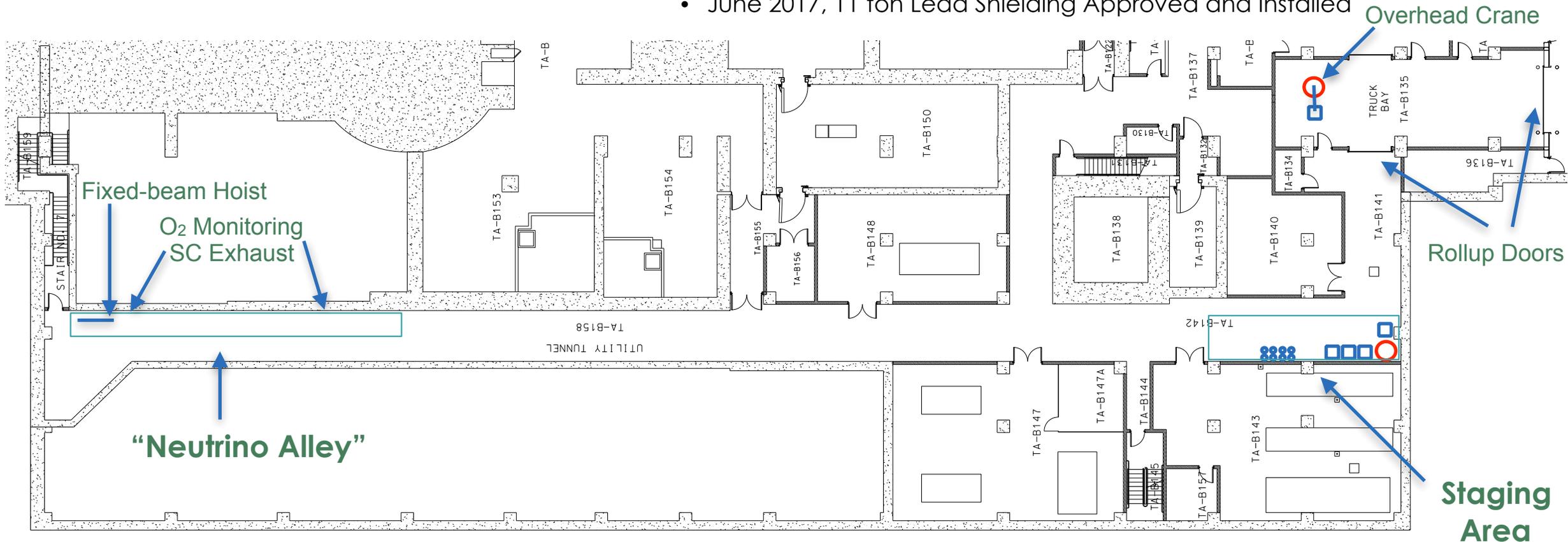


IU SciBath



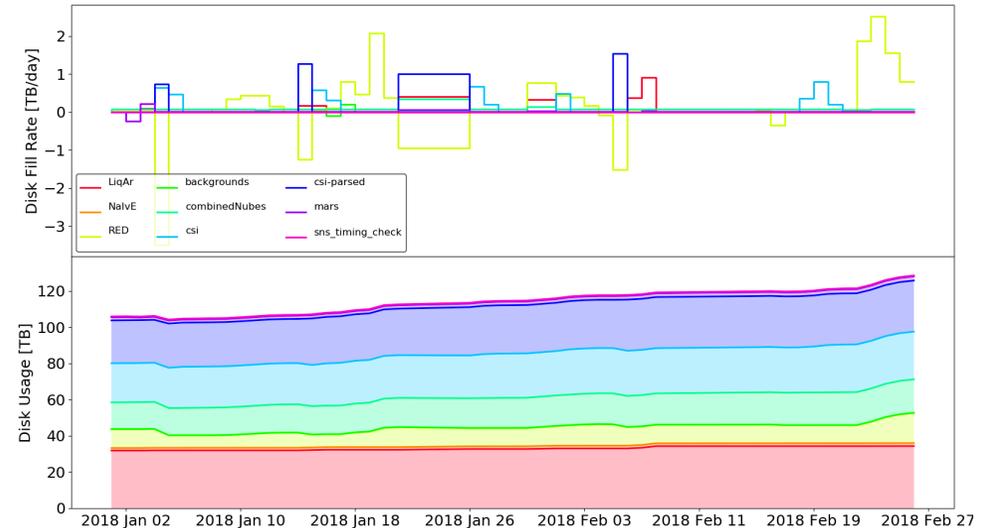
Converting service corridor into “Neutrino Alley”

- In 2015, ORNL approved LDRD:
 - Prepare service corridor as neutrino laboratory
 - Phase 1 commission RED-100 in “staging area”
 - Phase 2 install RED-100 in “Neutrino Alley”
- Spring 2016, CENNS-10 to substitute for RED-100
- Sept 2016, Electrical, Oxygen Monitoring, FixedBeam Hoist Installed
- July 2016, CENNS-10 delivered
- Nov 2016, Instrument Readiness Review, Cryogenic Operations Begin
- June 2017, 11 ton Lead Shielding Approved and Installed



Supporting Infrastructure

- Neutrino Alley Instrument Network via dedicated router and switch
 - Instrument DAQ/HV/Monitoring
 - EPICS Archival
 - External Gateway <https://coherent.sns.gov>
 - 10 GigE connection to main campus
- Neutrino Computing
 - Dedicated cluster with 392 cores.
 - 380 TB storage hosting raw and processed experimental data and simulations
 - 10GigE connection to OLCF HPC
- 200 TB of Raw Data stored ORNL HPSS (OLCF Project HEP106)
- RAD/Chem and Electronics laboratories on main campus supporting COHERENT collaborators
- Suite of sealed sources for detector calibrations and staging area storage cabinet.

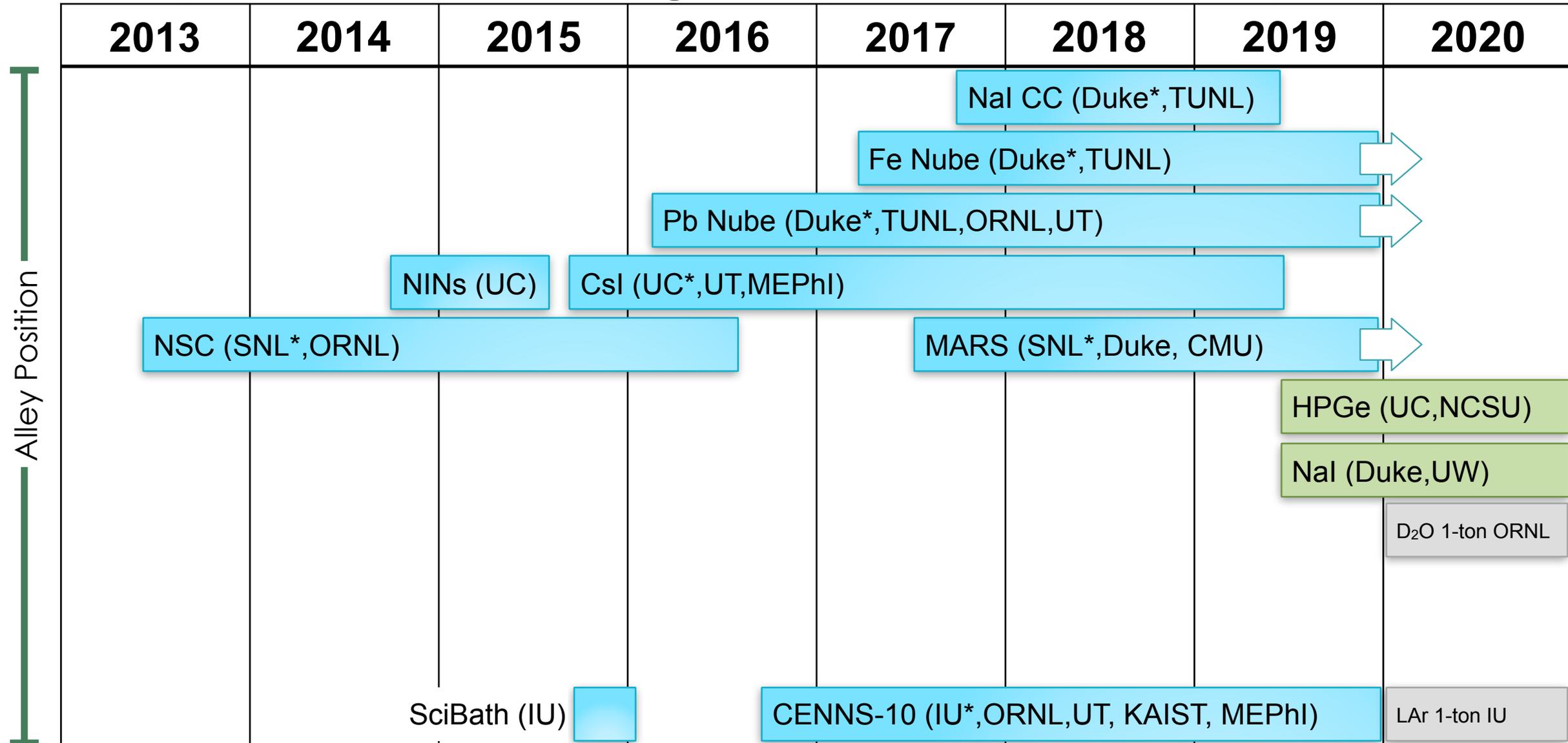


Working in Neutrino Alley

- Memorandum of Understanding defines responsibilities of Neutron Sciences and Physics Division
- Physics Division oversees access, training, work supervision of visiting collaborators.
- All “instrument” work performed by COHERENT collaborators
- All “facility” work performed by SNS support staff

- We have a productive working relationship with SNS research support staff.
- COHERENT pays for all required materials and engineering.

One Experiment synthesizing many detectors and experts



ORNL Support at every level

- Day-to-day support from research mechanics and target operations.
- Research Accelerator Division
 - Enthusiastic support from Director Kevin Jones and now Director Fulvia Pilat
- SNS Upgrades Office Director - John Galambos
- Neutron Sciences Directorate - Paul Langan (ALD)
- Physics Division
 - David Dean (now ALD) and David Radford (Director)
- Nuclear Security & Isotope Technology Division - Cecil Parks
- Deputy Director for S&T - Michelle Buchanan

Many thanks from COHERENT to all above!

ORNL has invested over \$1.2M in the Neutrino Program at the SNS
OS/HEP support of ORNL COHERENT staff at 0.4 FTE since 2015

01.03.18

2017's Top Stories from the Office of Science

Our Most Popular Articles of the Year

National Laboratory Articles

The Office of Science's 10 national laboratories report on their latest research news with timely press releases and features. They also profile scientists to highlight the passion and commitment behind the research.

Top five national laboratory articles:

- [New Studies of Ancient Concrete Could Teach Us to Do As the Romans Did](#) (Lawrence Berkeley National Laboratory)
- [New Evidence for a Water-Rich History on Mars](#) (Lawrence Berkeley National Laboratory)
- [World's Smallest Neutrino Detector Finds Big Physics Fingerprint](#) (Oak Ridge National Laboratory)
- [Research Led by PPPL Provides Reassurance that Heat Flux Will Be Manageable in ITER](#) (Princeton Plasma Physics Laboratory)
- [Chemical "Dance" of Cobalt Catalysis Could Pave Way to Solar Fuels](#) (Argonne National Laboratory)

<https://science.energy.gov/news/featured-articles/2018/01-03-18/>

SNS Flux

SNS Hours per Year	5000
Pulses Per Second	60
Protons Per Pulse*	1.35×10^{14}
Pions Per POT* ($KE_p=1010$ MeV)	0.090
Neutrinos/cm ² /flavor/SNSYear @ 20m @1.3MW	2.51×10^{14}
Neutrinos/cm ² /flavor/SNSYear @ 20m @1.4MW	2.81×10^{14}

* Summer 2018 Run @ 1.3 MW, $KE_p=1010$ MeV, ChargePerPulse 2.16E-5

Proton Energy	G4 π/p
939.5	0.082
957	0.084
972	0.086
990	0.088
1010	0.090 [†]

[†] Linear Extrapolation

- In Fall 2018, SNS transitions from 1.3 to 1.4MW indefinitely
➔ Flux @ 20m 2.81×10^{14} neutrinos/cm²/flavor/SNSYear

Summary

- COHERENT has established a laboratory footprint within the basement of the SNS target building
- We have defined the roles and responsibilities of participating organizations.
- The laboratory infrastructure sustainably supports the near/mid term planned experiments including ton-scale cryogenic detectors.