

COHERENT Operations at the SNS

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COHERENT External Review

August 15, 2018

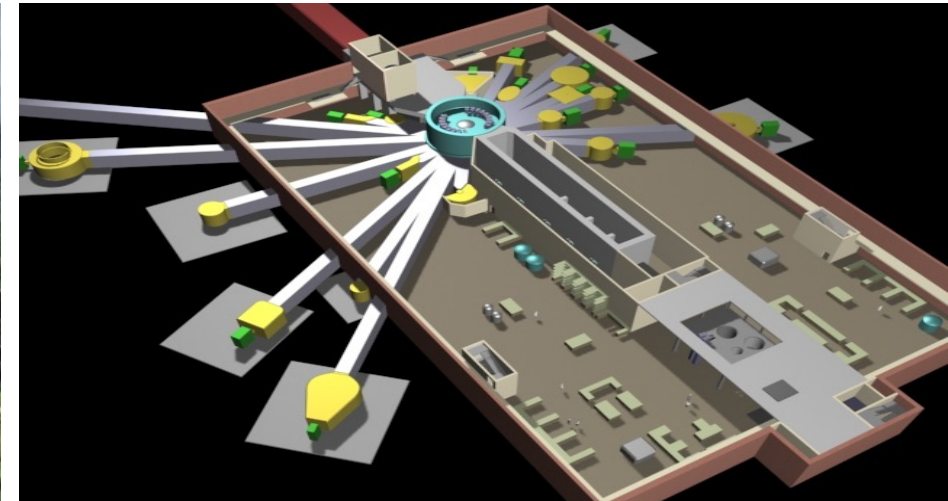
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U.S. DEPARTMENT OF
ENERGY

SNS User Program

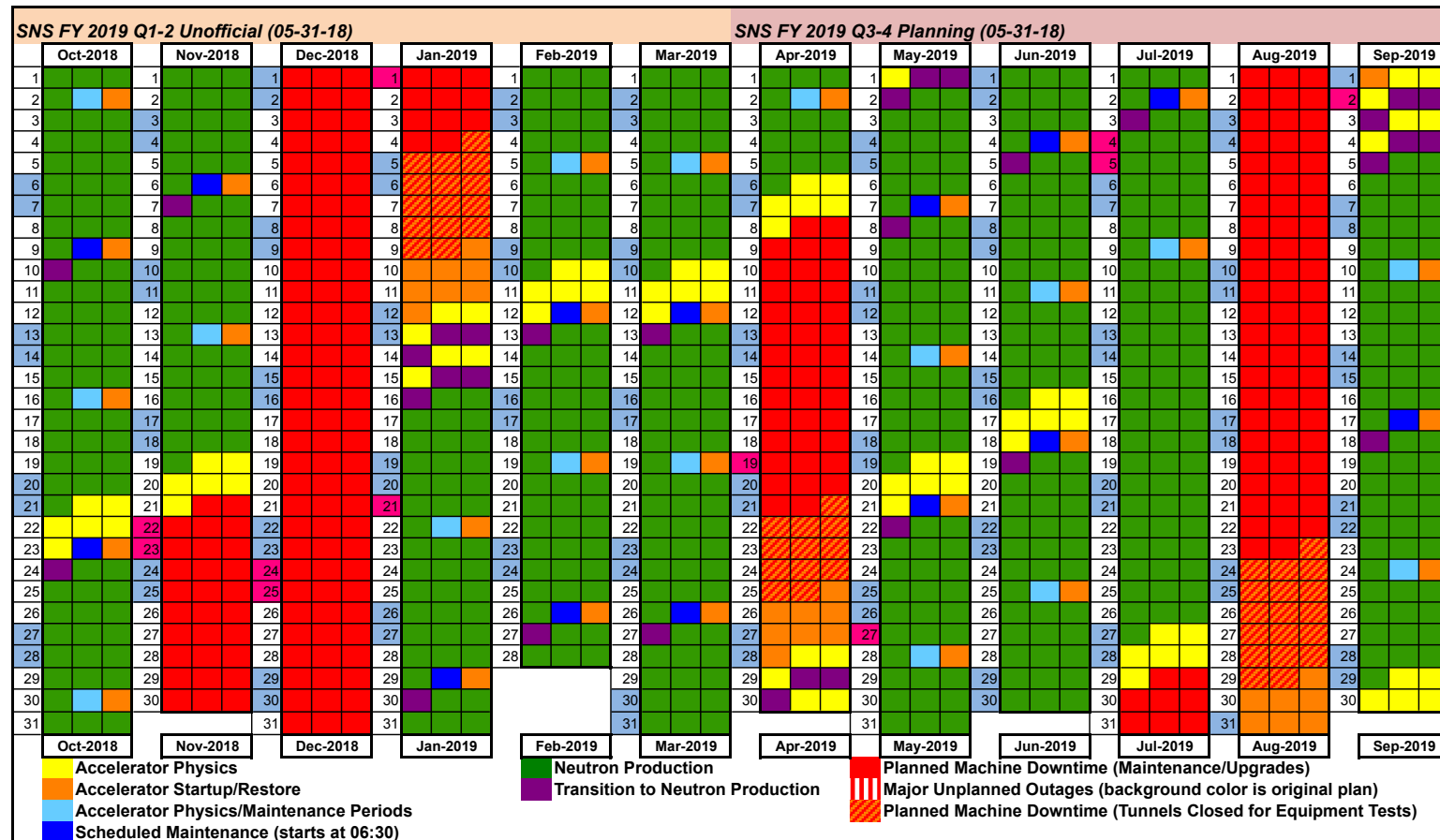
- 19 Neutron Beam-lines for Basic Energy Sciences missions
- 1 Fundamental Neutron Physics Beam-line for Office of Nuclear Physics missions
- 24/7 Operation with round-the-clock support staff, operations and user support
- Dedicated Instrument Scientist for each beam-line instrument
- Over 700 users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



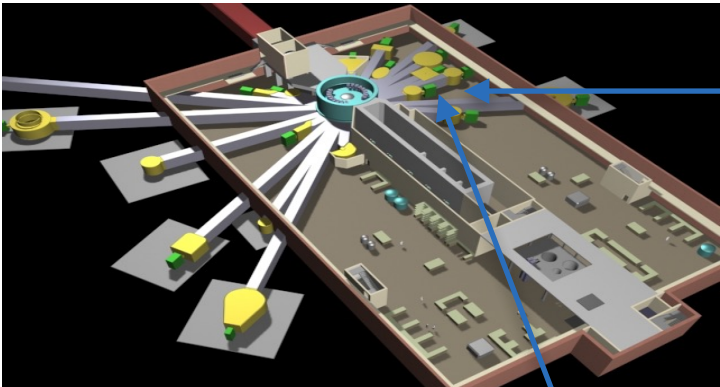
SNS Target Floor

SNS Scheduled Production Operation

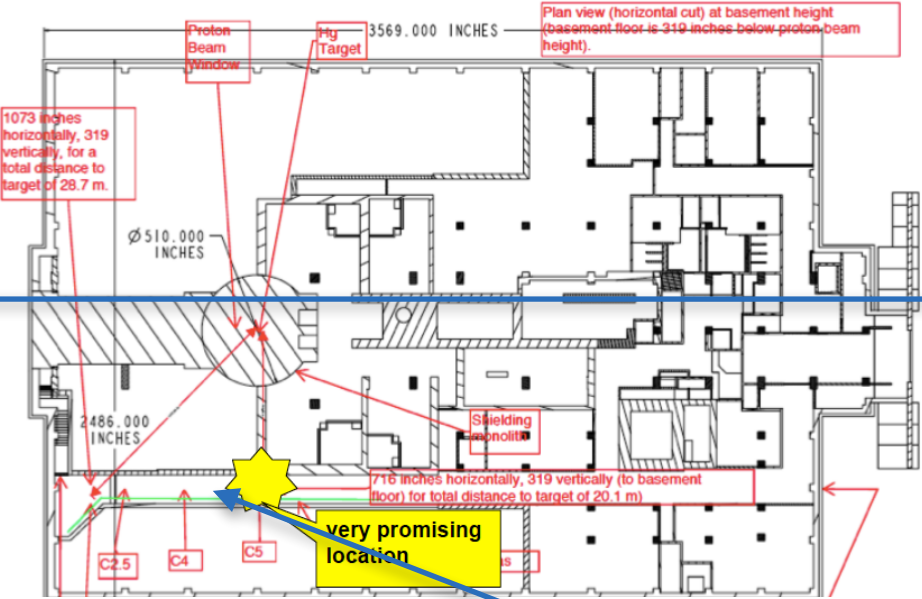
- Goal is 5000 hours per year of neutron production
- Reliably scheduled beam uptime
- Recently completed Inner Reflector Plug replacement (first since 2005) during long shutdown
- No long interruptions planned for next several years
- Plan to operate at 1.4 MW indefinitely



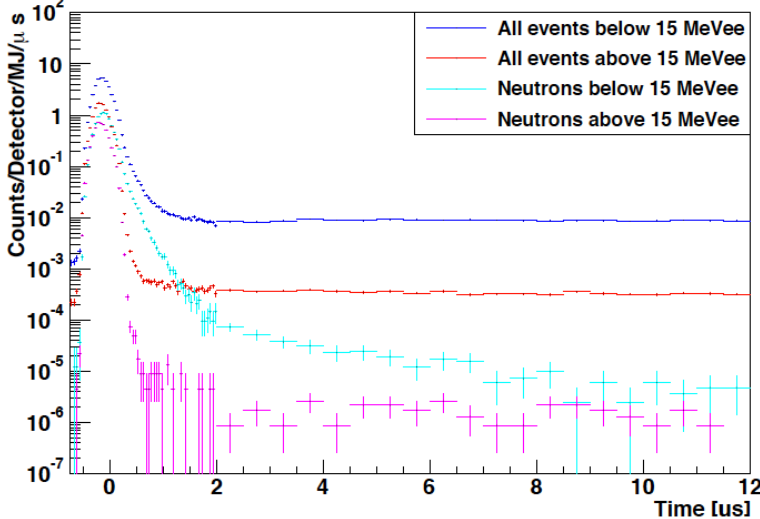
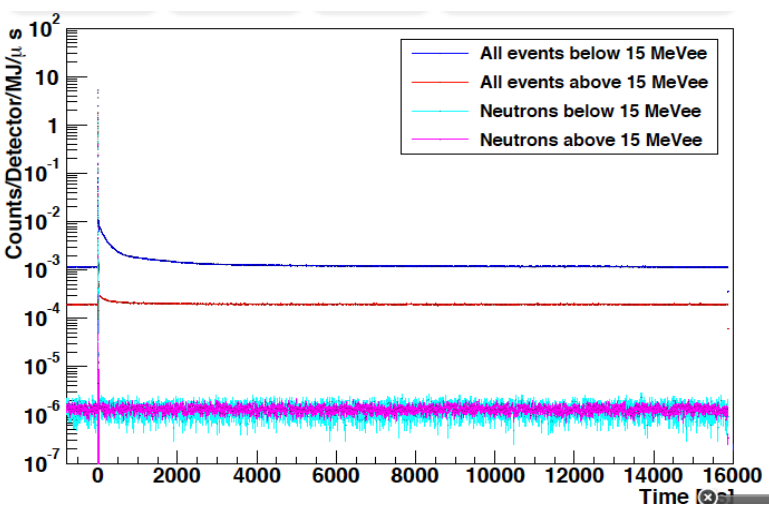
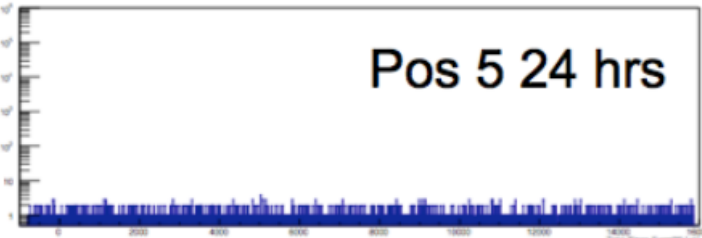
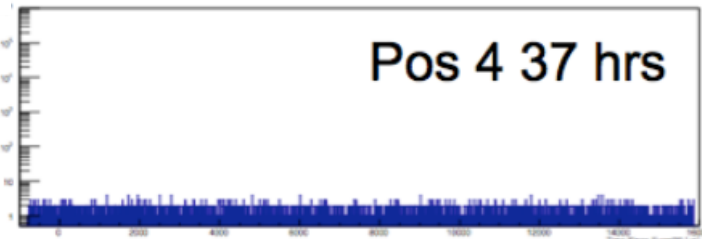
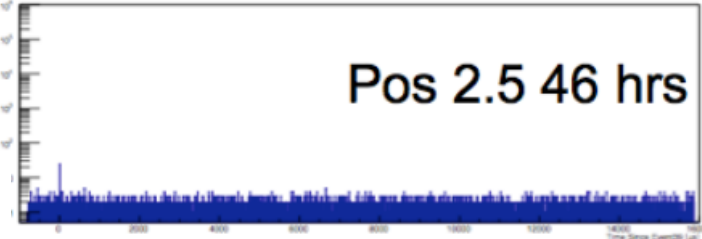
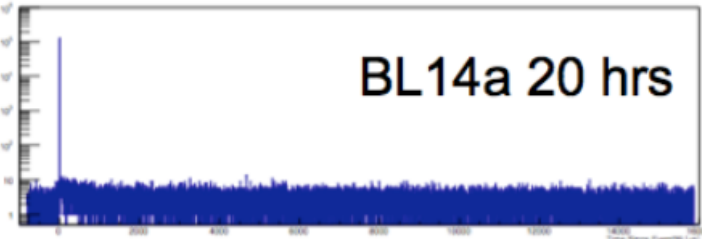
Early Siting Studies



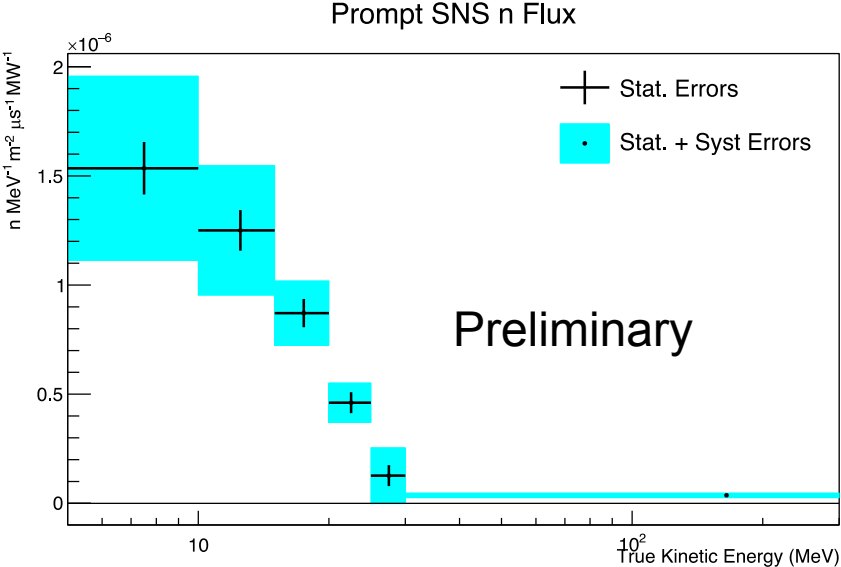
Target Floor



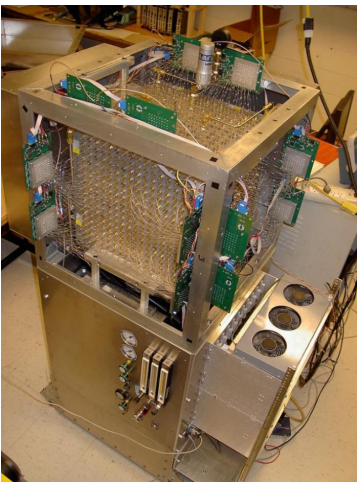
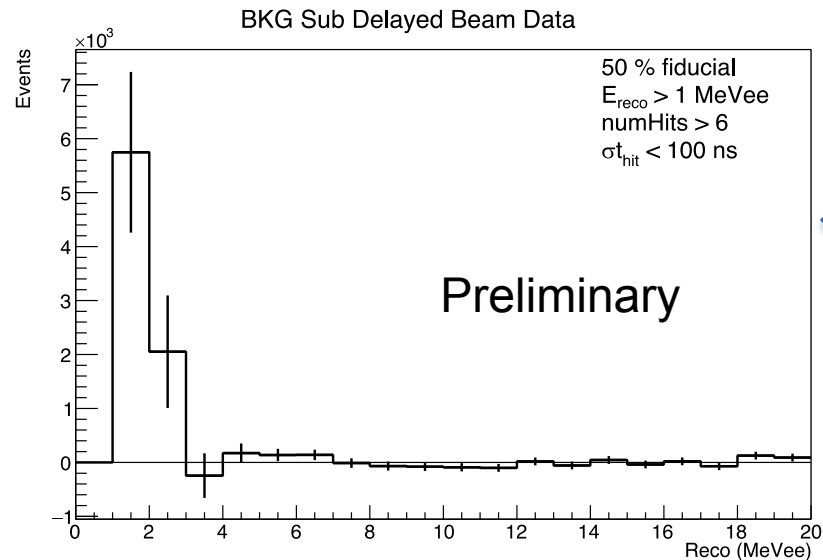
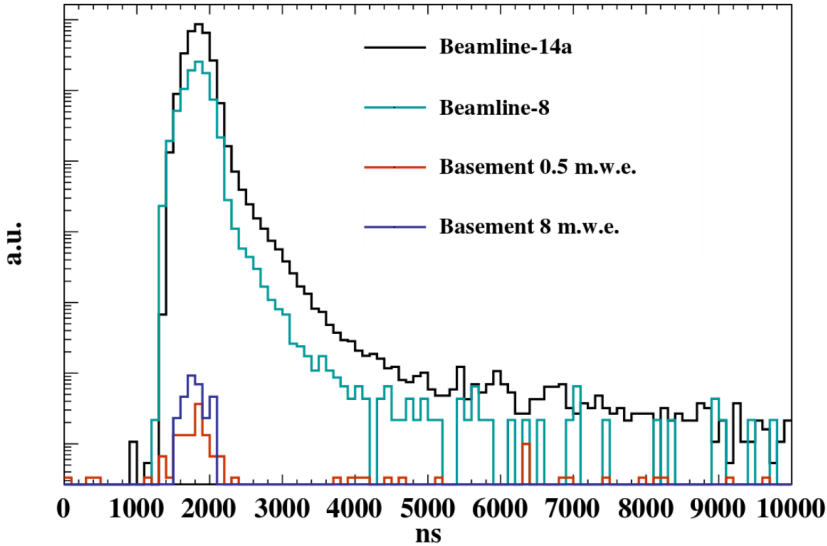
Basement



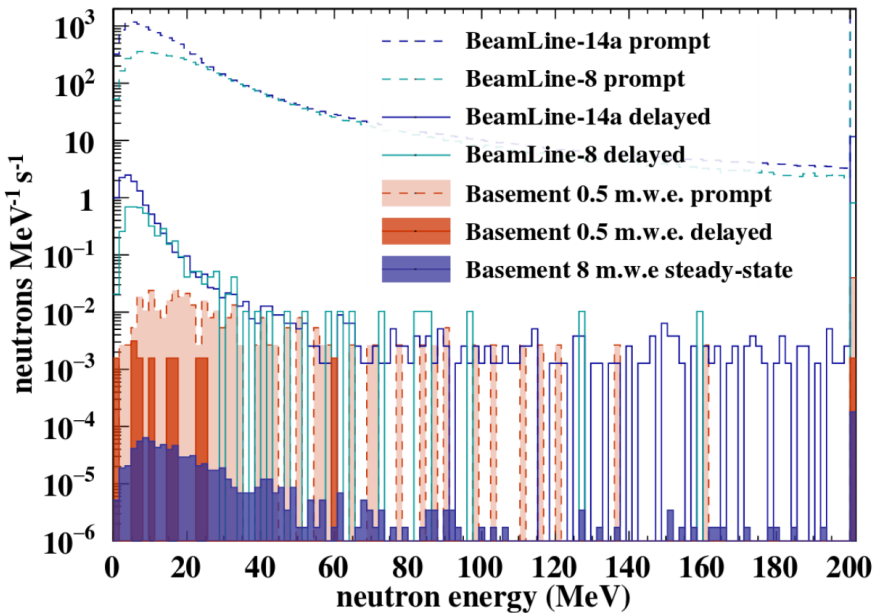
Neutron Flux Measurements in the basement



Sandia Scatter Camera

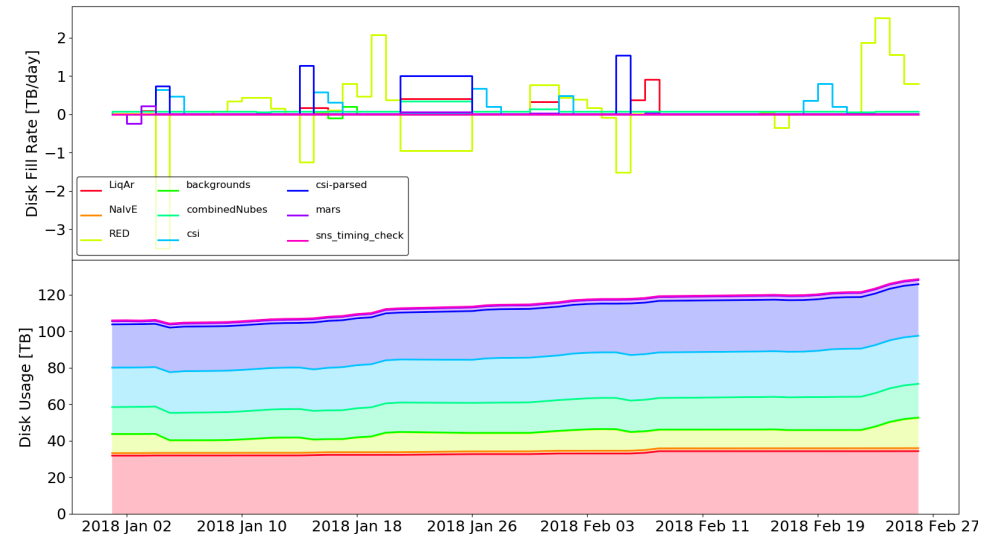


IU SciBath



Supporting Infrastructure

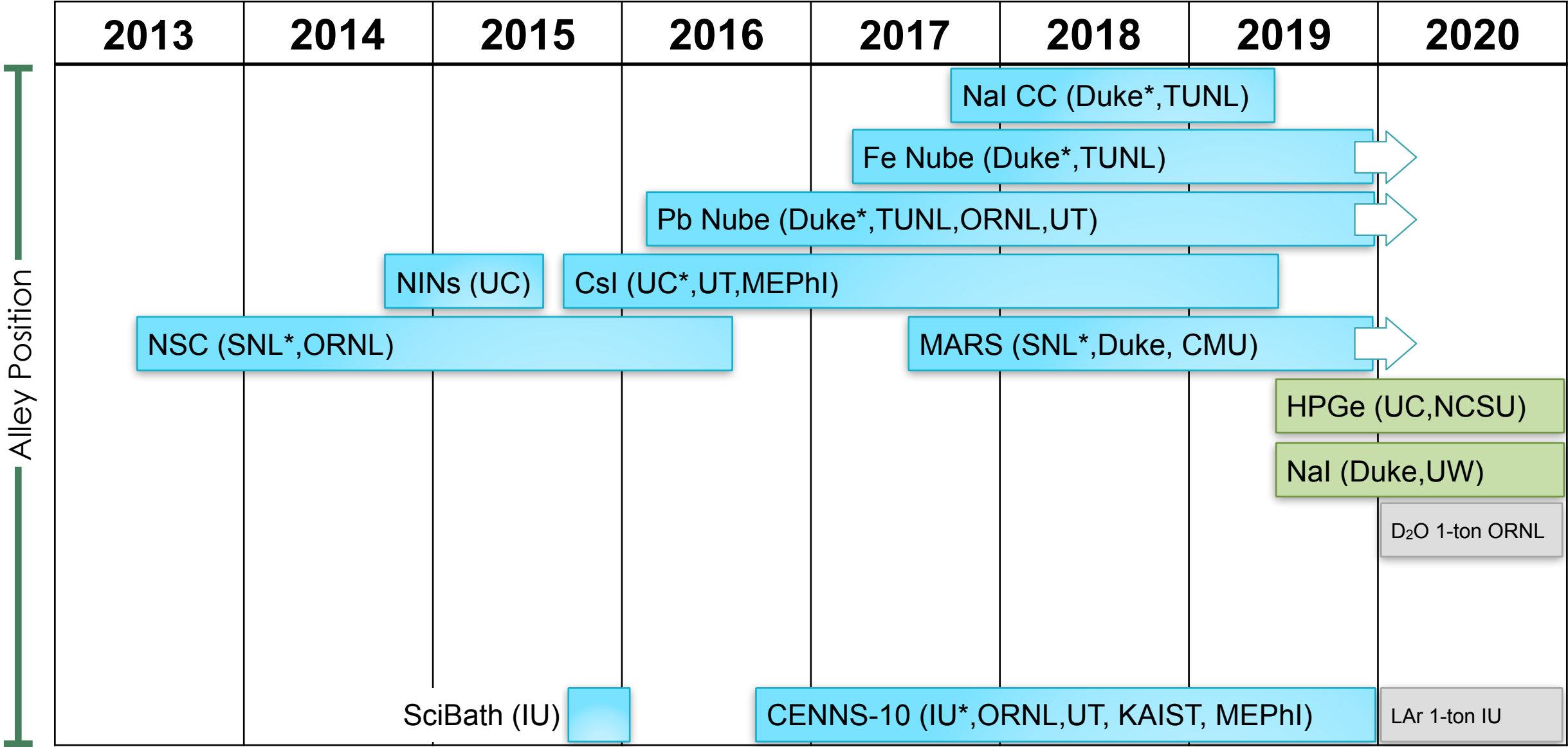
- Neutrino Alley Instrument Network via dedicated router and switch
 - Instrument DAQ/HV/Monitoring
 - EPICS Archival
 - External Gateway <https://coherent.sns.gov>
 - 10 GigE connection to main campus
- Neutrino Computing
 - Dedicated cluster with 392 cores.
 - 380 TB storage hosting raw and processed 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






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<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.