



NSCL Operations Overview FY 2017

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MICHIGAN STATE
UNIVERSITY

NSCL continues toward FRIB era

The Leadership

- NSCL is operating under its last cooperative agreement with NSF to cover the period FY17 to FY21. Operating hours remain the priority and NSF is committed to support a proper hand-over of NSCL equipment and program to FRIB.
- NSCL is part of the FRIB Laboratory at MSU. Brad Sherrill is the NSCL Director.
 - FRIB Laboratory, Thomas Glasmacher Director
 - DOE sponsored FRIB construction project, Paul Mantica Project Manager
- NSCL Leadership Team (no change since last year):
 - Alexandra Gade (NSCL Chief Scientist),
 - Richard Jacobson (Executive Director),
 - David Morrissey (AD for Operations),
 - Artemis Spyrou (AD for Education and Outreach),
 - Remco Zegers (AD for Experimental Research)
 - Jie Wei (Accelerator Physics Head)
 - Scott Bogner (Theory Head, separately funded)
 - Hendrik Schatz (JINA-CEE Director, separately funded NSF Frontier Center)



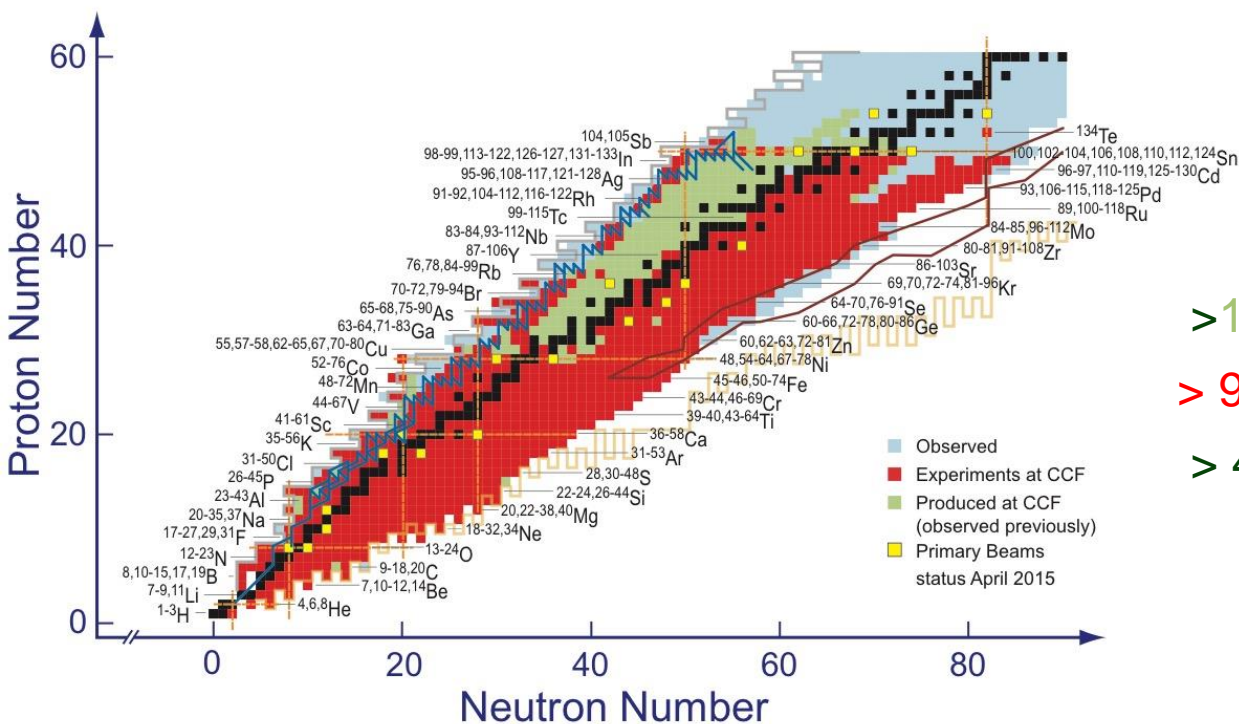
NSCL Operations: Goals

- **Operate the NSCL with high user satisfaction and enable world-class research**
 - Meet high user-demand for fast, thermalized and reaccelerated beams
 - Carry out a complex schedule with many short experiments, each with different RIBs while maintaining a beam availability of approximately 90%
 - Treat users as valued customers and enable them to be successful
 - Train next generation of accelerator physicists and engineering staff
- **Develop new capabilities requested by users to maintain world leadership in nuclear science**
 - Support development, fabrication, installation, commissioning and in many cases operation of the newest experimental apparatus
 - Explore new capabilities with existing resources:
 - » Reacceleration of projectile fragments – large demand from users
 - » Increase intensities and reach of thermalized beams – implementation of ACGS and CycStopper devices
 - » Prototype harvesting of longer-lived isotopes – new opportunities
 - Seek to upgrade ReA3 energy to ReA6 as desired by users

NSCL Operational Overview

- The NSCL is presently funded to run about 4000 hours/year with a goal of 90% availability [ISO-9001 certified annually]
- The FY18 scientific program exceeded this level without significant breakdowns.
 - ReA3 program continued with RIB experiments on all three lines, started commissioning of SECAR Phase 1, new program of Coul-Ex and an AT-TPC run
 - New beam development based on *Letters of Intent*, *LECM working group requests*:

^{28}Si , ^{32}S , in CCF for ReA3 RIB's last year; next year ^{198}Pt , then ^{144}Sm



>1000 RIBs produced
 > 911 RIBs used in experiments
 > 47 RIBs thermalized
 (of 22 different chemical elements)

NSCL PAC Statistics

Highly Oversubscribed with Broad Experimental Program

Program Advisory Committee reviews proposals, recommends a program:

Previous CA

PAC 40: 19 approved [April/2016, $\Delta t = \sim 1$ yr]

- 2 using reaccelerated beams
- 3 thermalized beams
- 14 using fast beams (8 GRETINA-2B)

... Full Range of Beam Energies Available

2744 / 7515 hours

Present CA

PAC 41: 16 approved [May/2017, $\Delta t = \sim 1$ yr]

- 3 (+1 reserved) using reaccelerated beams
- 5 thermalized beams
- 8 (+1 reserved) using fast beams

... New low-energy Experimental Area

2589 / 6082 hours + reserve

~half of approvals were low-energy expts.

PAC 42: 18 approved (2 reserve) [May/2018, $\Delta t = \sim 1$ yr]

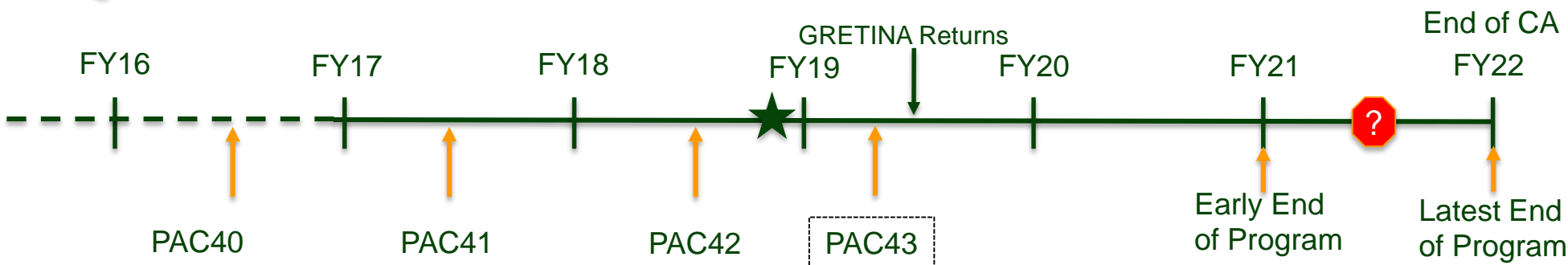
- 2 (+1 reserved) using reaccelerated beams
- 4 thermalized beams
- 12 (+1 reserved) using fast beams

13 of 40 thermal/reaccelerated beams

3321 / 7060 hours + reserve

35% of approvals are low-energy expts.

PAC 43 likely Feb/2019, probably the last PAC, note GRETINA is expected to return in CY19



FY-18 Scheduled Operation with Two Accelerators

October, 2017 – July, 2018

Total Operating Hours: 5900 hours (only 456 hrs. unscheduled off)

Of which 4580 hrs for 23 PAC approved (+7 discretionary) experiments

- 22 CCF-only RIB experiments

 - 2 major, 1 minor stable beam experiments (reaction dynamics, irradiation)

 - 5 CCF&ReA3 coupled RIB experiments

Plus 6 ReA3 stable beam experiments, (700 hrs total)

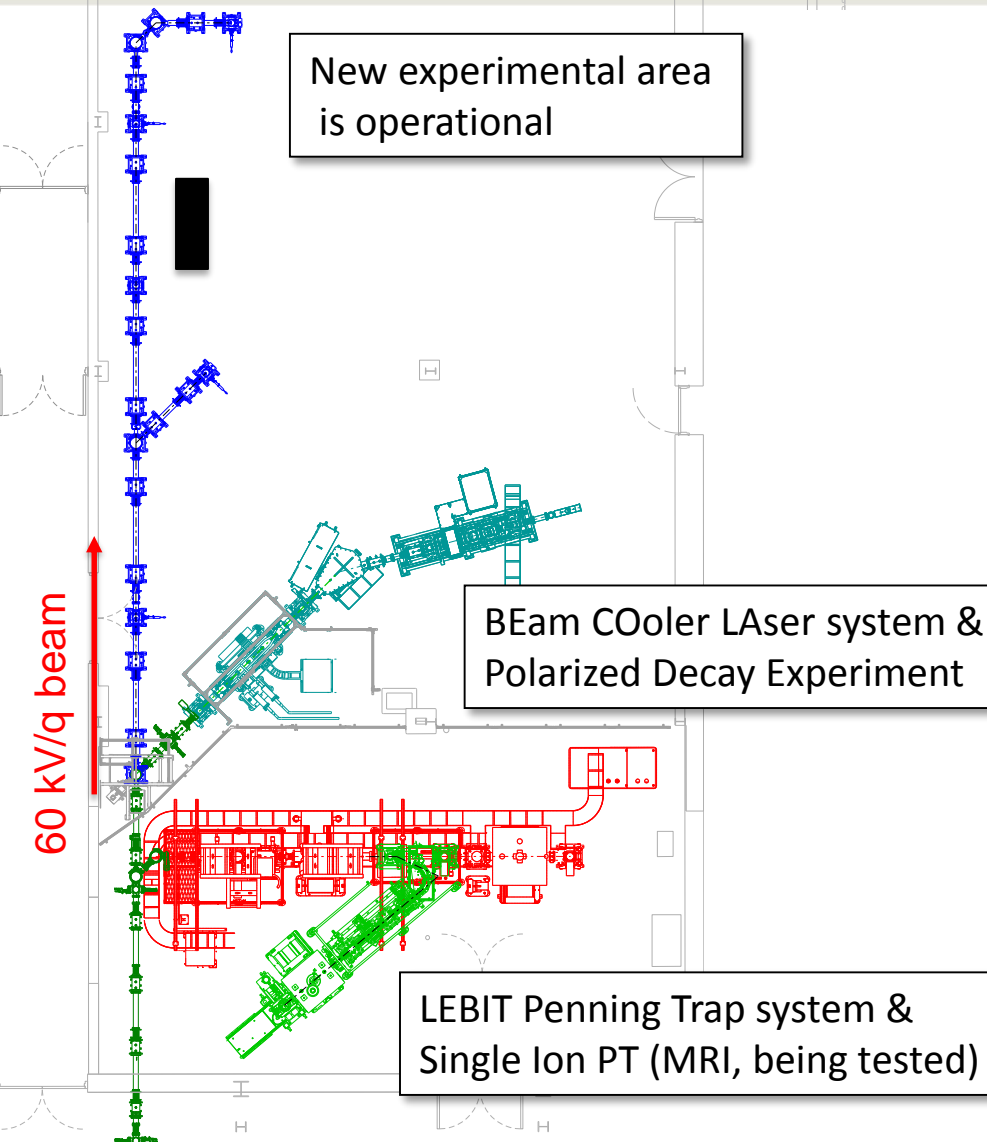
No significant interruptions this year for CCF.

One unanticipated refrigerator shutdown for ReA3 due to purify helium system.

Major Facility Developments

- Facility Improvements:
 - Commissioned the extended low-energy beam area
 - High Energy Beamlines
 - » Replace problematic doublet in beamline (G147, done)
 - » Repair coil for A1900 dipole to create new working spare (underway)
 - SECAR Installation and commissioning continues
 - Heavy-ion ion source for ReA3 calibration beams
 - » Replacement EBIT obtained from BNL (A. Lapierre, A. Villari)
 - Developing a plan for ReA6, cryomodule done, shielding obtained from IUCF
- MRI Projects:
 - SIPT single-ion Penning Trap (testing phase)
 - ACGS next generation beam thermalization device, initial comm. done
 - Cyclotron Stopper (off-line testing), working on installation in N2
 - He-jet on-line harvesting system (installation, initial test Fall, 18 ?)
- Input from the user community on these initiatives and other priorities are welcome and needed (particularly through B. Sherrill, J. Berryman)

Expanding Low-energy Beam Area two new end stations

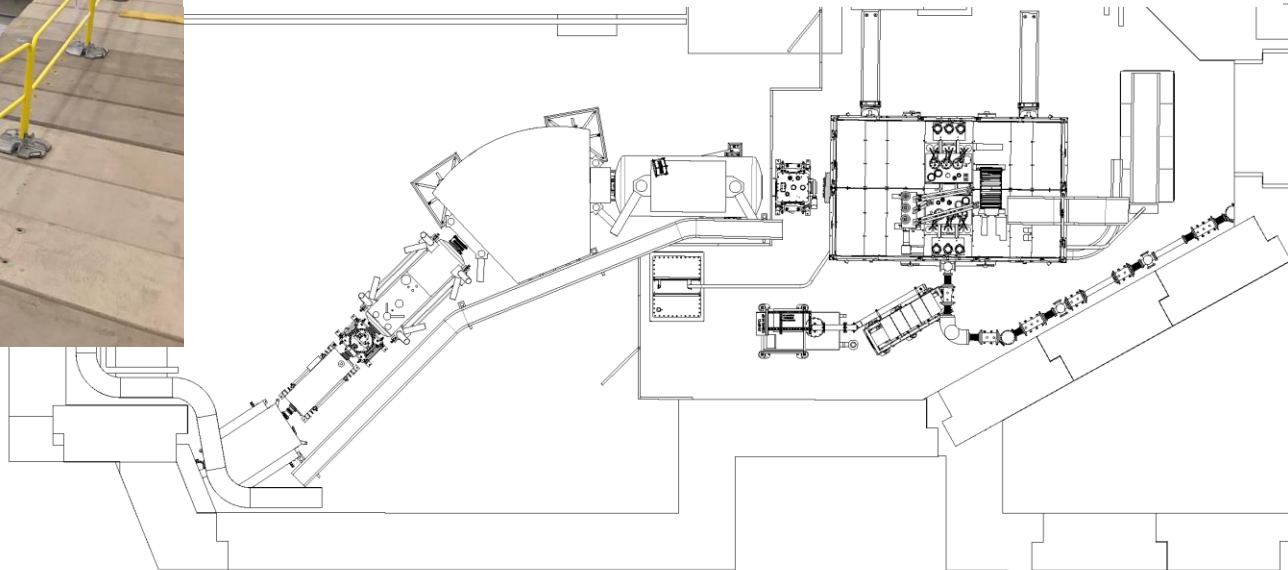


Devices for More Intense Thermalized Beams

Cyclotron Stopper

Cyclotron-stopper is essentially complete, being tested but not connected to beam line. We moving ahead with installation:

- N2/N3 vault cleared, new layout established
- Cyc Stopper – final tests, floor being reinforced
- A1200 Dipole – ready to install
- Beamline Quad doublet – ready to install
- S800-style Triplet – being constructed
- A1900 Dipole – steel ready, coil refurbishing
- A1900 Triplet – ready to install
- Diagnostic Chambers – in fabrication



Devices for More Intense Thermalized Beams Helium Jet

Helium-Jet Ion Source was constructed/tested at ORNL by ORNL, UNIRIB, Center for Radioactive Ion Beams for Stewardship Science at Rutgers University, NSCL

Implementation at NSCL is supported through an NSF-MRI. Installation underway, test CY18 ?

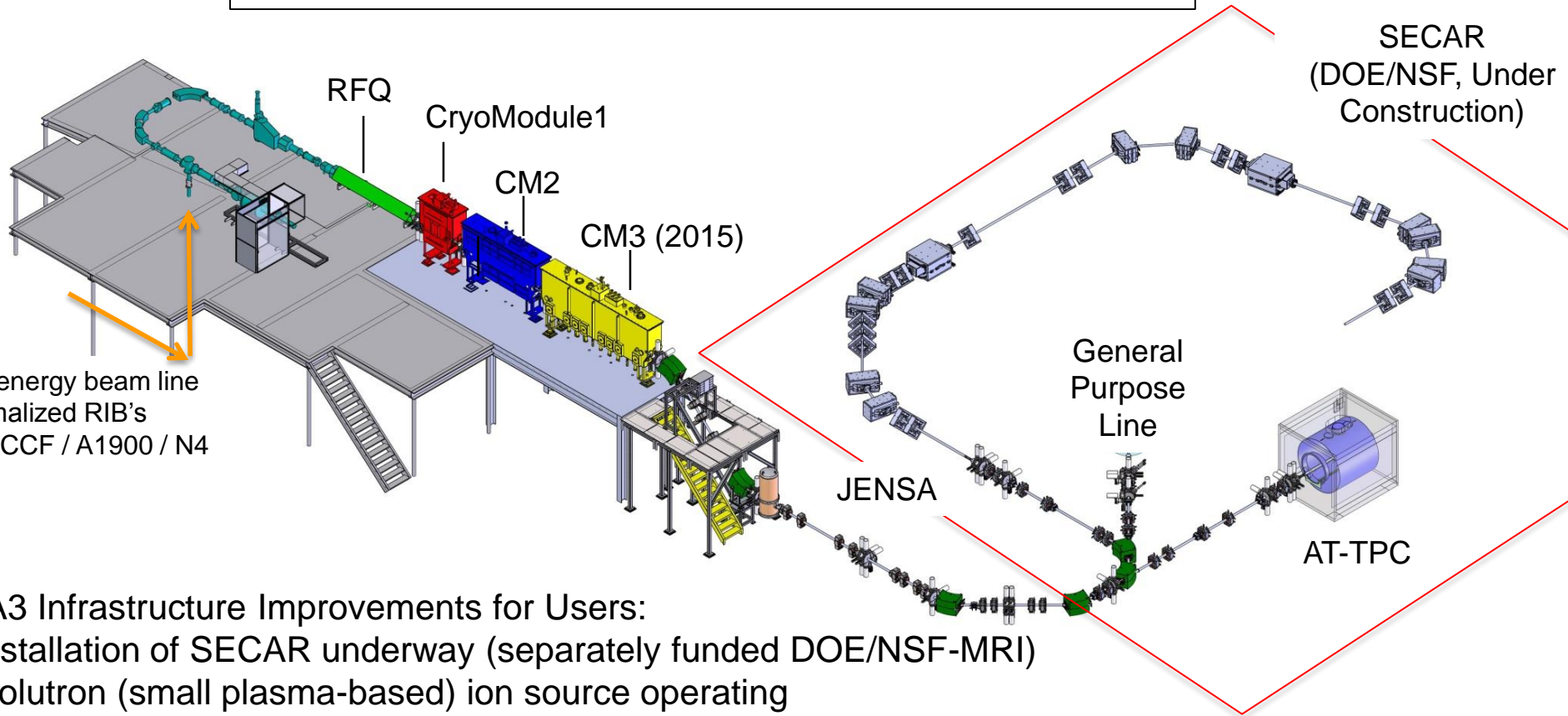


2 Aug 2018



ReA3 Hall Construction

ReA3 Accelerator and Experimental Hall – FY18



ReA3 Infrastructure Improvements for Users:

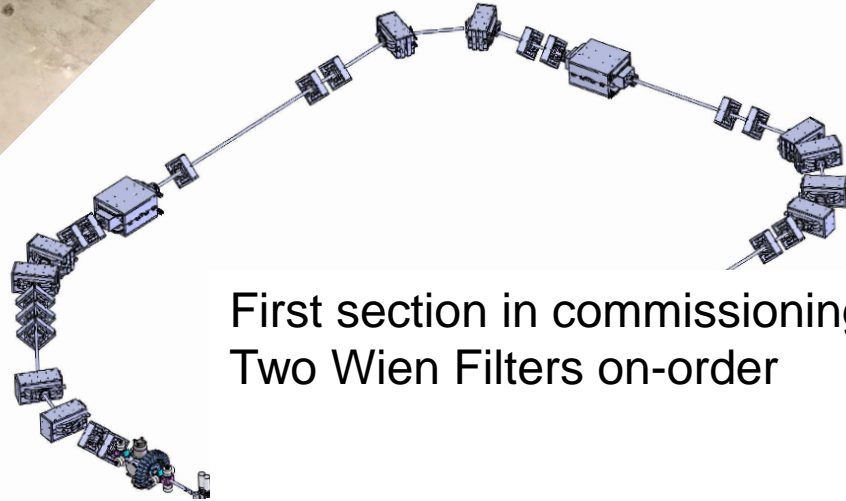
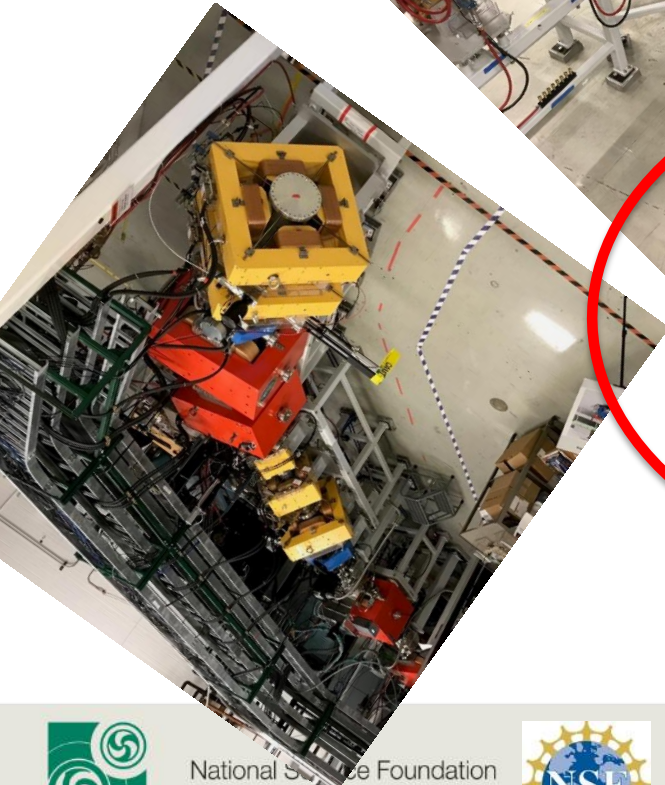
- installation of SECAR underway (separately funded DOE/NSF-MRI)
- Colutron (small plasma-based) ion source operating
- refurbishing BNL-EBIT to provide more intense RIB's



ReA3 Hall Construction

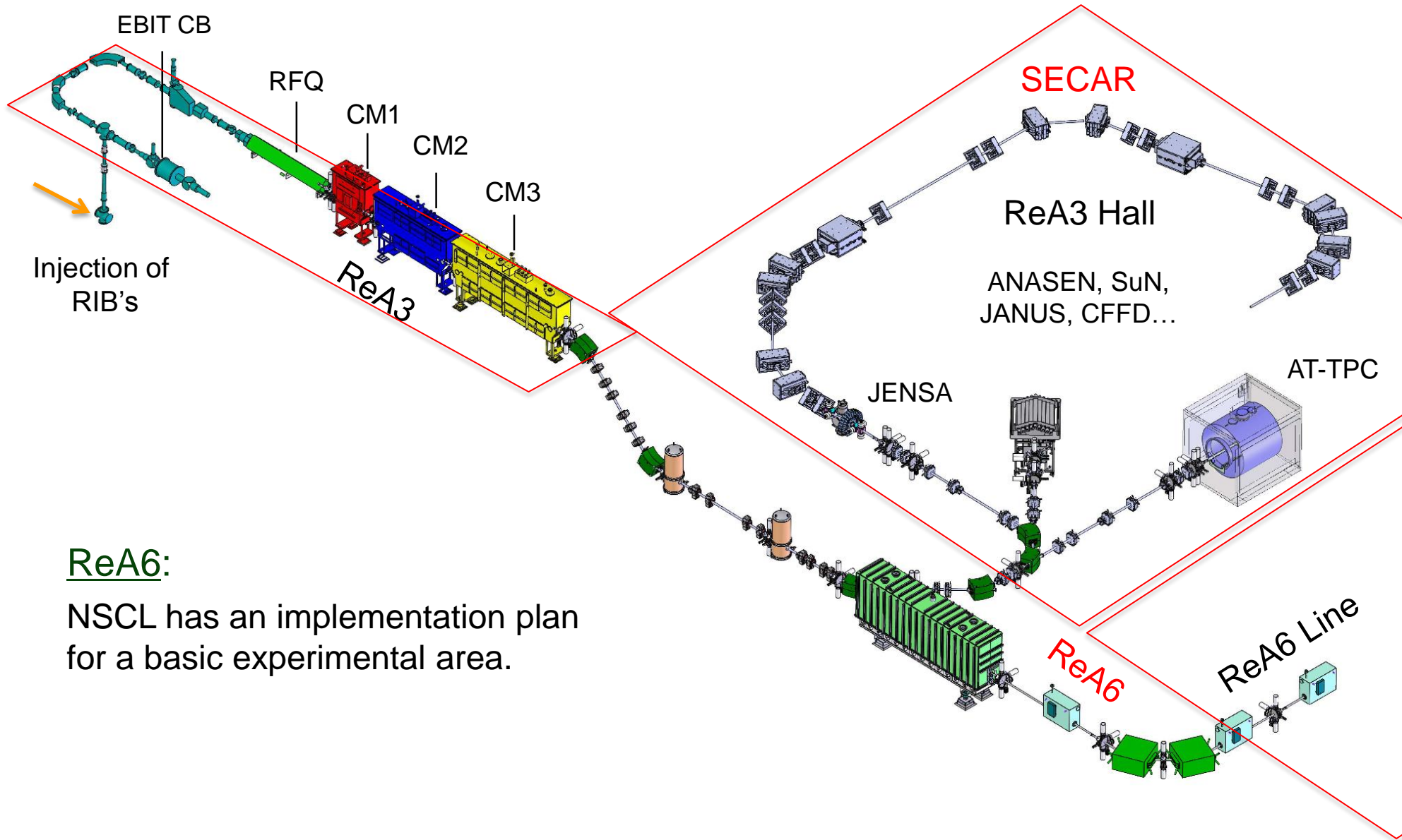
SECAR in ReA3 Experimental Hall – Now

8 Aug 2018



First section in commissioning
Two Wien Filters on-order

Developed a plan for ReA6

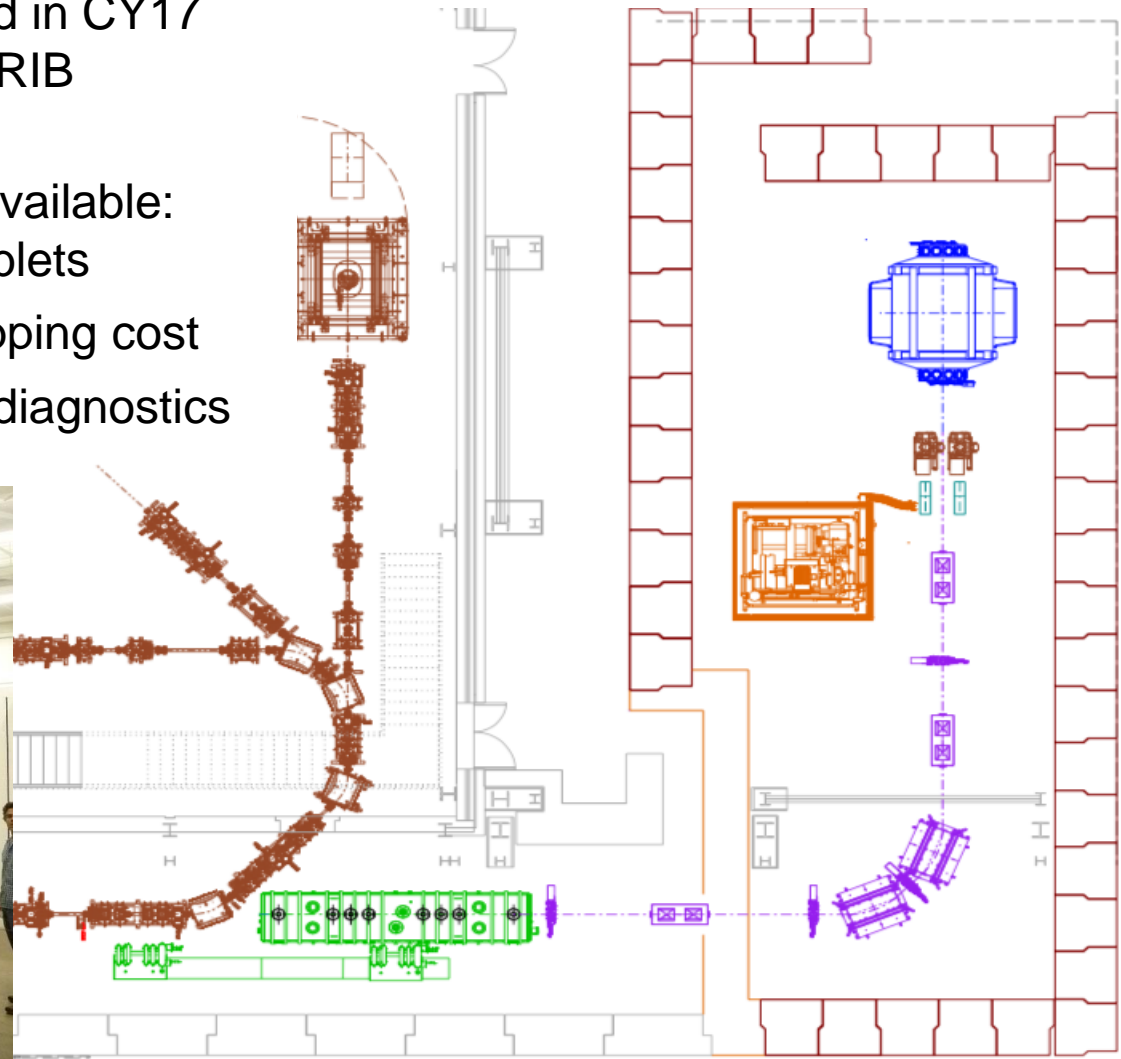


ReA6:

NSCL has an implementation plan for a basic experimental area.

Developed a plan for ReA6

- The ReA6 cryomodule was completed in CY17 and can be installed after testing of FRIB cryomodules is complete (CY18?)
- Four of the five magnets shown are available: NSCL A1200 dipoles, beam line doublets
- Shielding obtained from IUCF for shipping cost
- Missing: doublet (in repair), cryoline, diagnostics



Summary of NSCL Status

- Operations for 5,900 hours last year (the highest ever)
- 25 CCF expts., 5 CCF/ReA RIB expts., 6 ReA expts.
- A number of facility improvements, CycStopper moving soon
- SECAR installation underway
- Plan for ReA6 developed, procurements started
- NSCL NSF CA has 3 more years,
NSCL plans to run ~2.5 more years, then convert to FRIB

ReA6 Layout in MRI Proposal

