



NSCL Operations Overview FY 2017

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Associate Director for Operations



MICHIGAN STATE

UNIVERSITY

NSCL continues toward FRIB era

The Leadership

- NSCL is operating under a new 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)



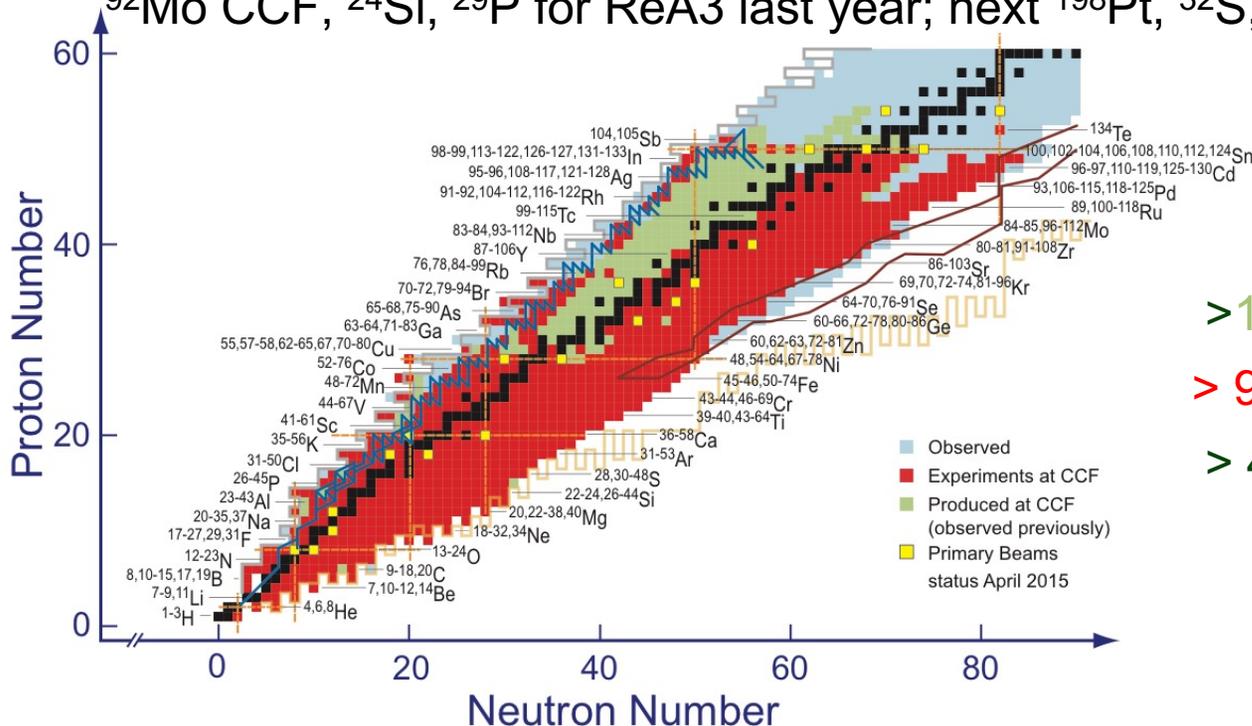
NSCL Operations: Goals

- **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 FY17 scientific program attained this level even with a significant breakdown.
 - Completed second GRETINA program with fast-beams using the S800 spectrometer
 - ReA3 program continued with RIB experiments on General Purpose Line with a few stable beams for reference rxn's and calibration.
 - New beam development based on Letters of Intent, LECM working group outputs, ^{92}Mo CCF, ^{24}Si , ^{29}P for ReA3 last year; next ^{198}Pt , ^{32}S , ^{144}Sm for CCF, ^{30}P , ^{30}S for ReA



> 1000 RIBs produced

> 900 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 the program:

PAC 38: 30 approved [Apr/2014, $\Delta t = \sim 2$ yr] 30/48 proposals or 4246 / 8119 hours

- 6 using reaccelerated beams ... ReA3 complete but EBIT failed ...
- 4 thermalized beams
- 20 fast beams (4 SeGA converted to GRETINA, second campaign)

PAC 39: 26 approved [May/2015, $\Delta t = \sim 1$ yr] 26/48 proposals or 3885 / 8277 hours

- 5 using reaccelerated beams ... EBIT returned, ReA3 program started ...
- 5 thermalized beams
- 16 fast beams (11 GRETINA, second campaign)

PAC 40: 19 approved [April/2016, $\Delta t = \sim 1$ yr] 19/44 proposals or 2744 / 7515 hours

- 2 using reaccelerated beams ... ReA3 program underway ...
- 3 thermalized beams
- 14 fast beams (8 GRETINA, second campaign)

PAC 41: 16 approved [May/2017, $\Delta t = \sim 1$ yr] 16/32 proposals or 2589 / 6082 hours

- 3 (+1 on reserve) using reaccelerated beams ... program shifting ...
- 5 thermalized beams
- 8 (+1 on reserve) fast beams

Backlog at the end of FY17 Operations will be 7335 hrs. Next PAC likely around May, 2018



FY-17 Scheduled Operation with Two Accelerators

October, 2016 – September, 2017

Total Operating Hours: 5253 hours [significant unscheduled off this year]

Of which 3921(+209) hrs for 24 PAC approved (+3 discretionary) experiments
21(+2) CCF-only RIB experiments (12 with GRETINA),
1(+1) stable beam experiments (irradiations)
2 CCF-ReA3 coupled RIB experiments

Plus 3(+1) ReA3 stable beam experiments, (348 hrs total)

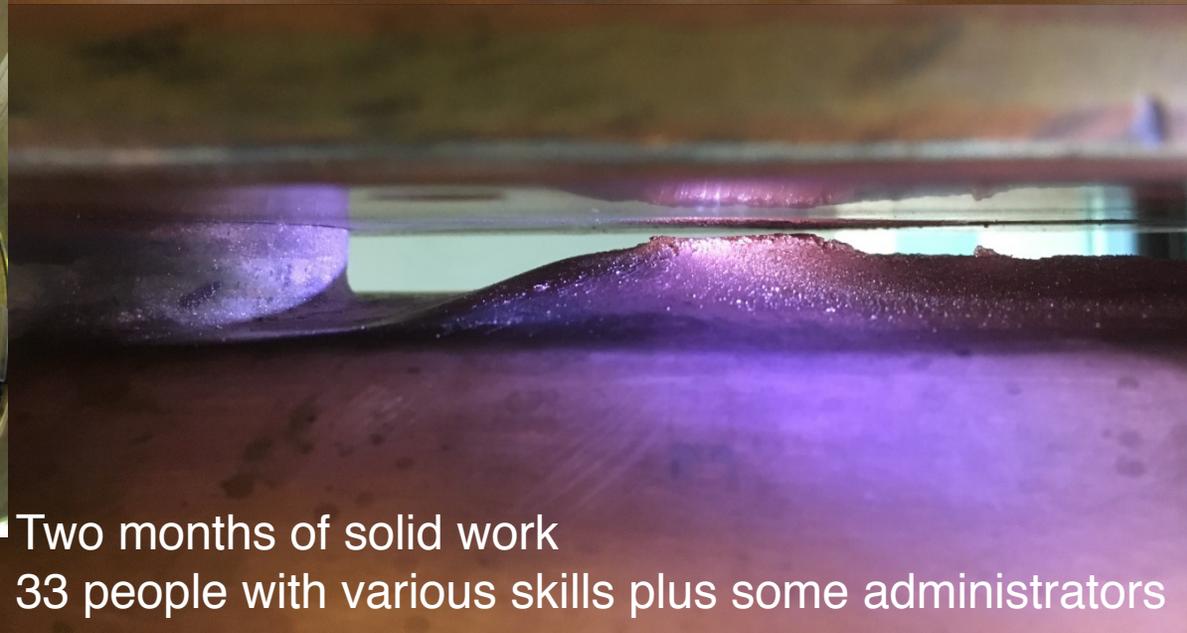
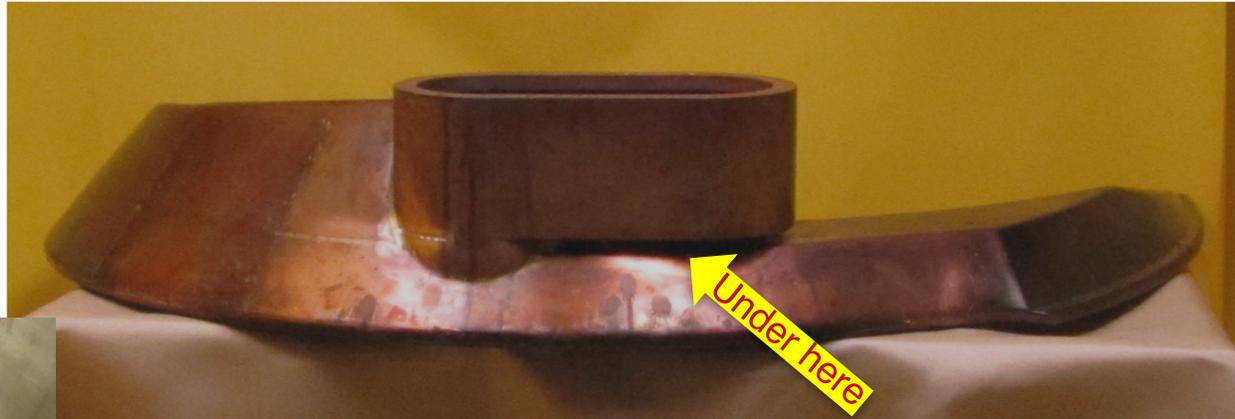
Two significant interruptions:

- One of the Dee's in the K1200 was damaged by sparking and was repaired
- A power glitch from the MSU power plant (July 23) knocked out the helium refrigerator for the NSCL forcing rescheduling of the End-of-FY shutdown



Repair of the K1200 Dee

01:56 26-Jan-17 kabana K1200 C dee continues to spark roughly every 30 seconds. [after winter shutdown]



Two months of solid work
33 people with various skills plus some administrators



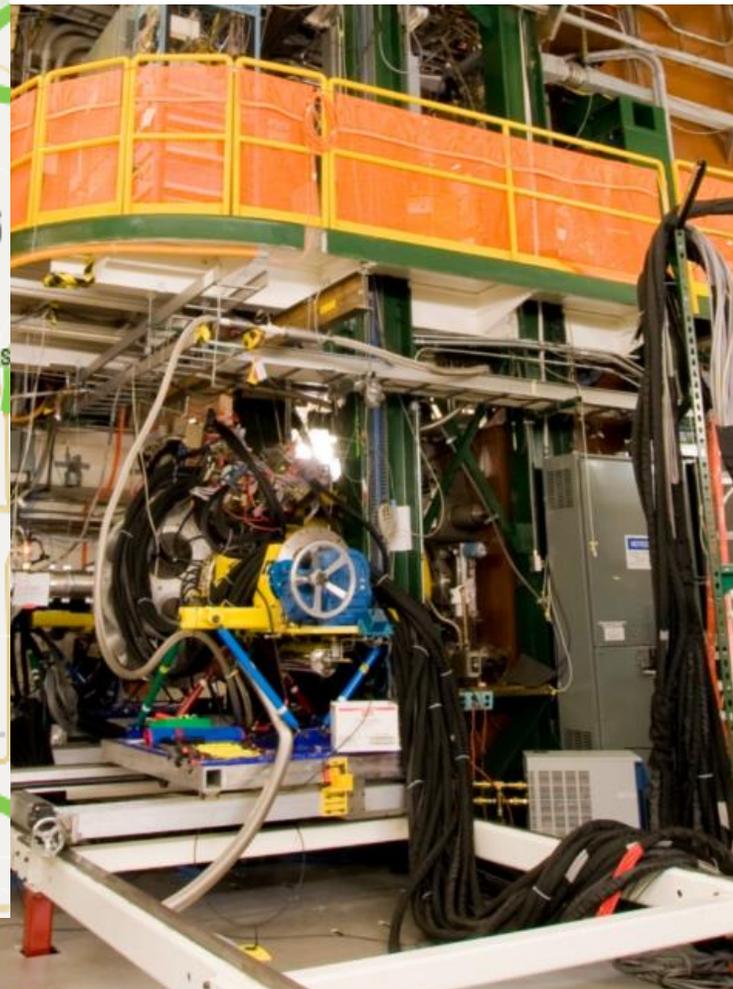
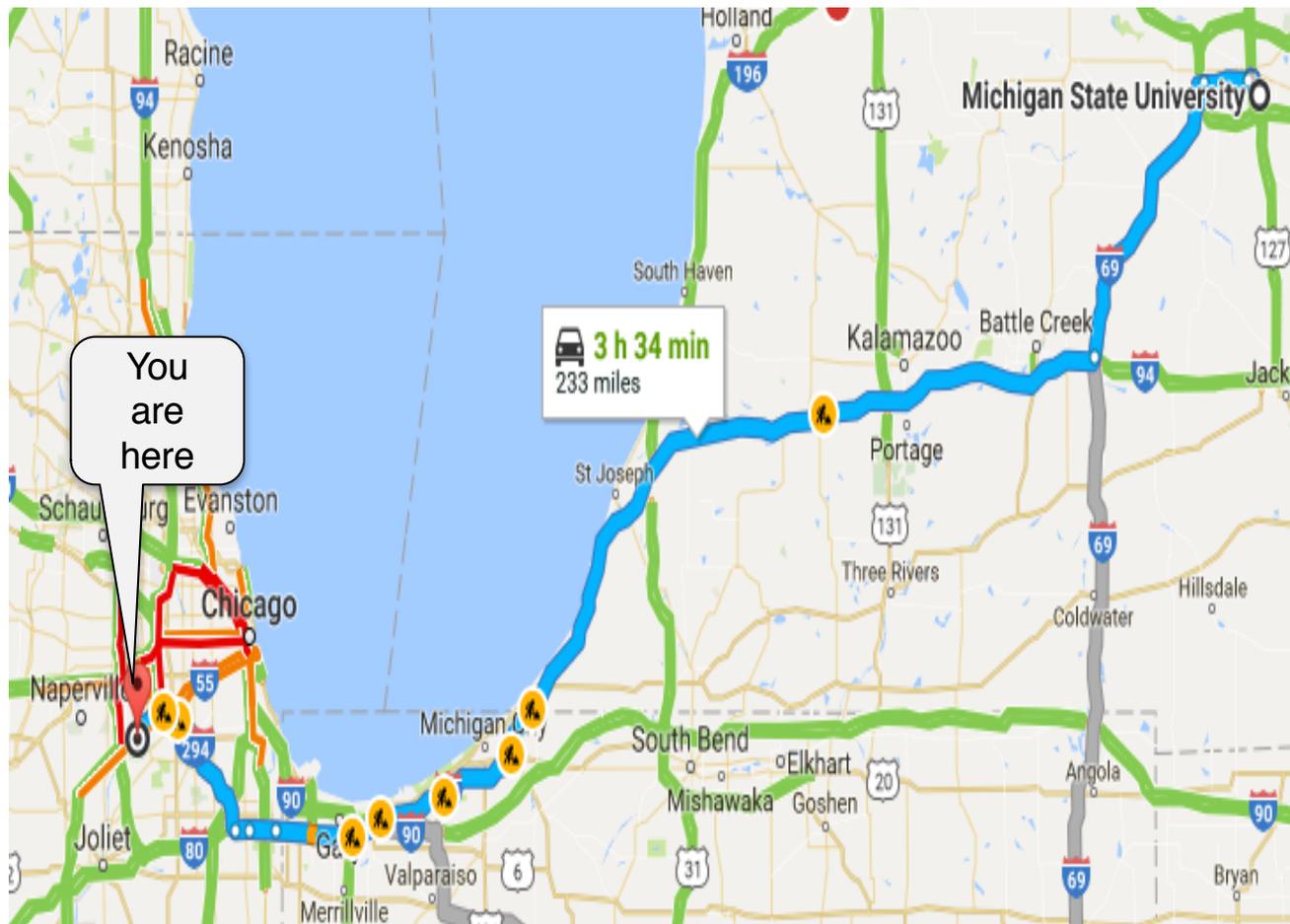
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19:26 25-Mar-17 rencsok Beam list.

GRETINA with S800 spectrograph

<http://gretina.lbl.gov/publications>

- June 2012 – July 2013, 24 experiments (30 pubs to date, more expected)
- October 2015 – July 2017, completed 2nd campaign with 24 experiments
- GRETINA is being packed up right now for transportation back to ANL



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U.S. DEPARTMENT OF
ENERGY

Office of Science

Major Facility Developments

- Facility Improvements:

- Expanded low-energy beam area (expected operation Oct/17)
- High Energy Beamlines
 - » Replace problematic doublets in beamline (I184 done, G147 underway)
 - » Repair coil for A1900 dipole to create new spare
- SECAR Installation underway
- Heavy-ion ion source for ReA3 calibration beams
 - » (small) Colutron plasma source being installed before cooler-buncher
 - » Replacement EBIT under consideration for calibration, etc., input from users on beams and intensities continues to be welcome (A. Lapierre, A. Villari)
- Developing a path toward ReA6 (H. Iwasaki)

- MRI Projects:

- SIPT single-ion Penning Trap (testing phase)
- ACGS next generation beam thermalization device (comm. Fall, 2017)
- Cyclotron Stopper (off-line testing), building parts for installation in N2
- He-jet on-line harvesting system (installation now, test CY18)

- Input from the user community on these initiatives and other priorities are welcome and needed (particularly through B. Sherrill, J. Berryman)

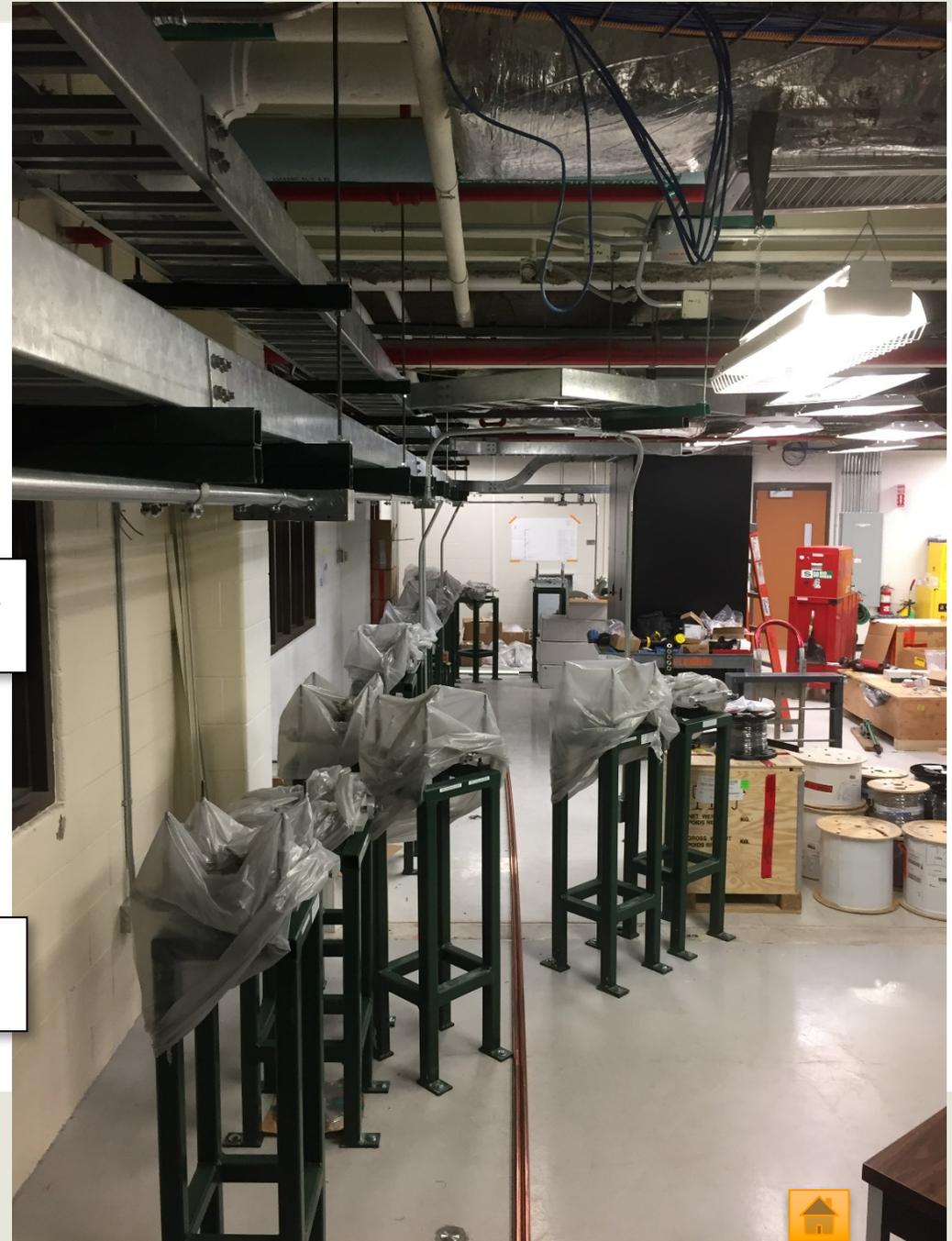
Expanding Low-energy Beam Area two new end stations

New experimental area
All parts in-house,
ready in October, 2017

BEam COoler LAser system &
Polarized Decay Experiment

LEBIT Penning Trap system &
Single Ion PT (MRI, being tested)

60 kV/q beam



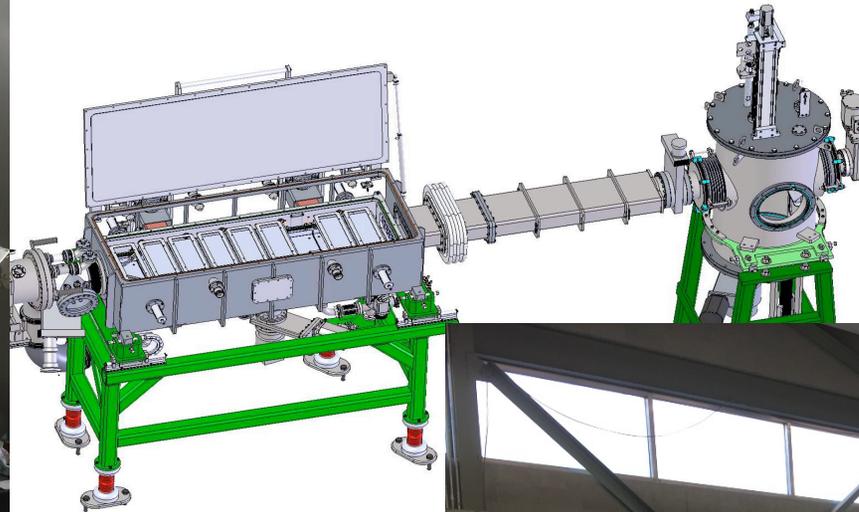
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Devices for More Intense Thermalized Beams with three different MRI's



Cyclotron-stopper is essentially complete, being tested but not connected to beam line. We are developing plans for installation in the N2 vault so as not to interrupt the ongoing low-energy program.



Advanced Cryogenic Gas Stopper is being installed on a second line next to ANL gas catcher. Test this fall.

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

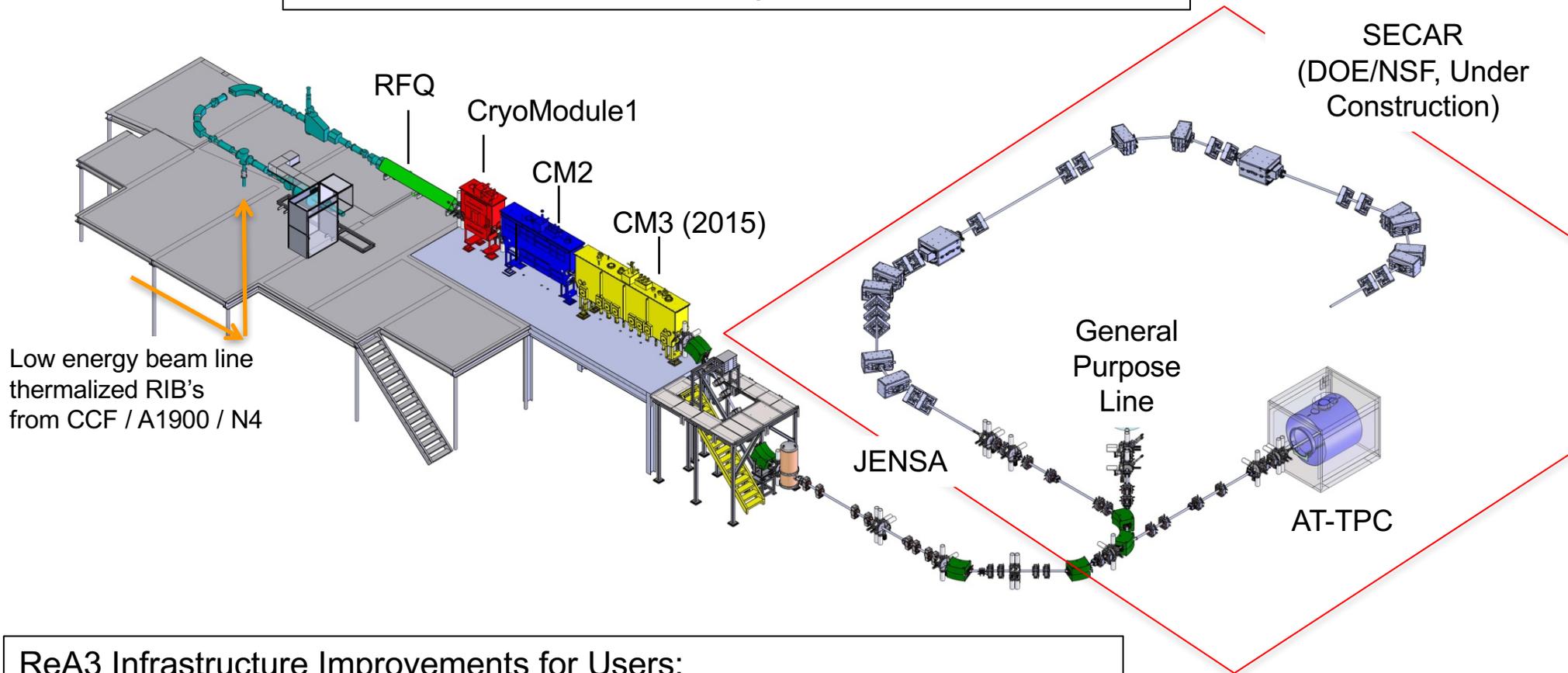


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ReA3 Hall Construction

ReA3 Accelerator and Experimental Hall – FY17



ReA3 Infrastructure Improvements for Users:

- installation of SECAR underway (separately funded DOE/NSF-MRI)
- installation of Colutron (small plasma-based) ion source
- developing a plan for another EBIT (most likely a replacement)



ReA3 Hall Construction

ReA3 Accelerator and Experimental Hall – Then and Now



20 Jun 2016



30 Jul 2017

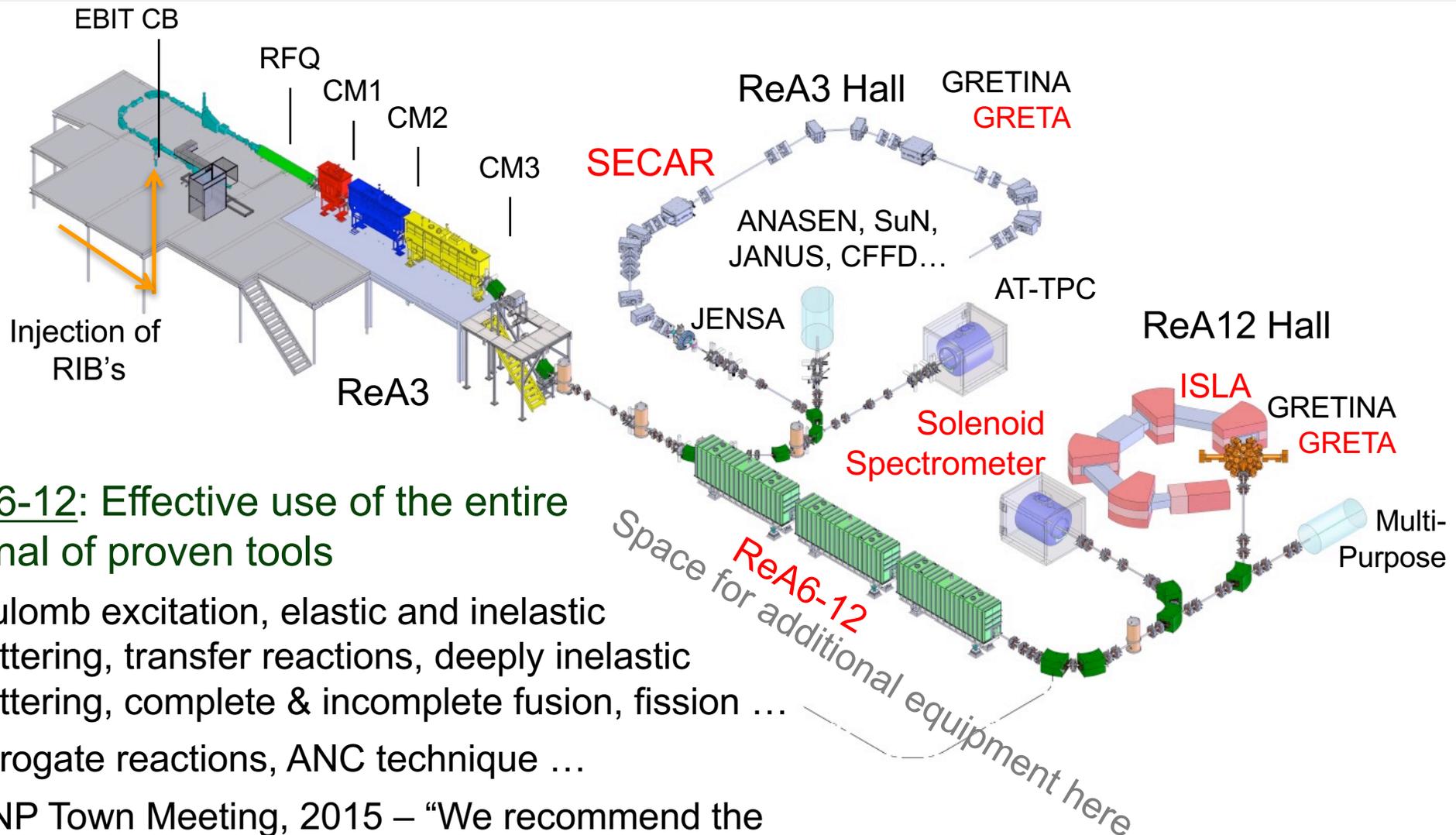
30 Jul 2017



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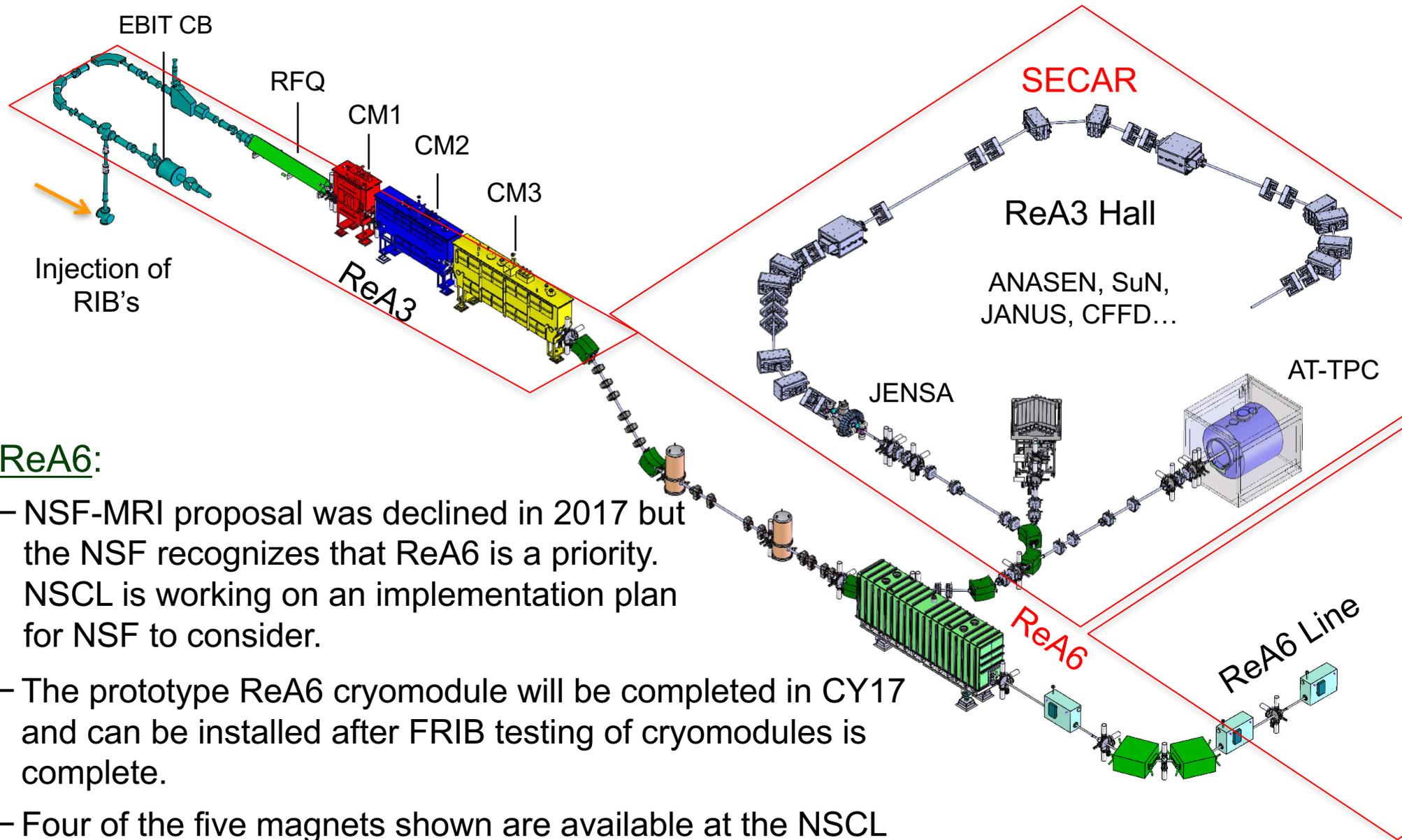
Long Term Goal: ReA 3 \rightarrow 12 MeV/u



ReA6-12: Effective use of the entire arsenal of proven tools

- Coulomb excitation, elastic and inelastic scattering, transfer reactions, deeply inelastic scattering, complete & incomplete fusion, fission ...
- Surrogate reactions, ANC technique ...
- LENP Town Meeting, 2015 – “We recommend the construction of ReA12 in a timely manner”

Developing a plan for ReA6



ReA6:

- NSF-MRI proposal was declined in 2017 but the NSF recognizes that ReA6 is a priority. NSCL is working on an implementation plan for NSF to consider.
- The prototype ReA6 cryomodule will be completed in CY17 and can be installed after FRIB testing of cryomodules is complete.
- Four of the five magnets shown are available at the NSCL (dipoles from the A1200)
- Missing: one doublet, cryoline, vault shielding but plan is to be operational in FY2020

Summary of NSCL Status

- Operation of about 4,100 hours last year notwithstanding a major mid-year repair
- 2nd Fast-beam GRETINA campaign completed
- ReA3 running, SECAR installation underway
- A number of facility improvements are underway
- Implementation plan for ReA6 being developed for NSF
- NSF Cooperative Agreement runs 4 more years (PAC has ~2 yr backlog)