

DEC '16  
ISSUE

# PARTICLE POST

COLLIDER-ACCELERATOR DEPARTMENT

PREVIOUS ISSUES  
November 2016

Contact: [A. Lamberti](#)

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Quote of the Month: "Science is an imaginative adventure of the mind seeking truth in a world of mystery." - Cyril Hinshelwood

## A WORD FROM:

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### NOTE FROM OUR CHAIR: Thomas Roser

During the week of November 28 a number of us travelled to Rockville, MD, for a "Community Panel" review of the Accelerator R&D needs of the future Electron Ion Collider (EIC). We presented lists of R&D items for both the Linac-Ring and the Ring-Ring design concept for eRHIC. Our highest priority R&D item is the development of a high intensity polarized electron source followed by the completion of the Coherent electron Cooling (CeC) Proof-of-Principle experiment over the next two years.

A team from JLab presented a list of R&D items for their version, JLEIC, for an Electron Ion Collider. Their highest priority is the development of fast electron cooling of high energy proton beams. The meeting clearly showed opportunities for collaboration between JLab and RHIC. This includes high intensity polarized electron sources, where JLab is the world leader, and electron cooling, where the CeC experiment would be the first demonstration of electron cooling of high energy hadron beams of tens of GeV.

[VIEW UPCOMING CONFERENCE PROJECTIONS.](#)

**\*PROJECTIONS DUE ASAP\***

## DID YOU KNOW??

Check out who received an employee Service Award this year! Collider-Accelerator Dept. employees who received a [Service Award](#).

Check out who received an employee [Spotlight Award](#) this year!

**Congratulations to the Hoffman family who welcomed beautiful baby Lillian Paige to their family on November 17, 2016!**

## EVENTS/SEMINARS

**December 16 - (Lobby, Bldg. 911A | 9 - 10:30am) C-AD Holiday Breakfast**

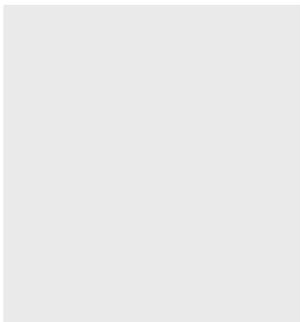
**December 16 - (Meadow Club, Port Jefferson Station | 7 - 11 pm) BERA Holiday Party**

**December 23 - Lab Holiday: Christmas Eve (1/2 day, observed)**

**December 26 - Lab Holiday: Christmas Day (observed)**

**December 27 - Lab Holiday: Floating Holiday**

**December 31 - (Suffolk Theater, Riverhead | 8**



**Lillian Paige Hoffman**  
**6 lbs. 8 oz.**

pm) New Year's Eve with BERA

January 2 - Lab Holiday: New Year's Day

January 9 - (Berkner Hall, Room B | 8:30 am)  
Office of Educational Programs Event:  
"College Mini-Semester/CSTEP Winter  
Program"

January 11 - (CFN, Bldg. 735, 1st Floor  
Conference Room | 10 am) Center for  
Functional Nanomaterials Seminar:  
"Predictive modeling of x-ray spectroscopy  
and the OCEAN code"

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*IN OTHER NEWS...*

*SNMMI's 63rd Annual Meeting Highlights  
History of FDG and Showcases New Research*  
More than 5,700 physicians, technologists,  
scientists and exhibitors gathered at the Society  
of Nuclear Medicine and Molecular Imaging's  
2016 Annual Meeting, held June 11-15 in San  
Diego, CA. This year's meeting included a  
celebration of the 40th anniversary of FDG. [Read  
more.](#)

*Local Scientists Take Home First Place Honors in  
BNL Science Fair*

Budding young scientists filled the auditorium of  
the Suffolk County Legislature on Wednesday to  
educate Legislators on their outstanding projects  
that won first place accolades at the year's  
Brookhaven National Laboratory's Science Fair.  
[Read more.](#)

*New Graphene-Glass Combo Powers  
"Spontaneous" Solar Cell*

Brookhaven Does (Graphene) Windows.  
Apparently the Brookhaven solution to the  
graphene problem has been staring everybody in  
the face, ever since graphene was first discovered  
in 2004: ordinary glass window. [Read more.](#)

*Research Teams Use DNA to Make 3-D  
Nanoparticle Structures with High Precision*  
DNA strands anchored to the surface of  
nanoparticles allow researchers to assemble the

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C-AD Adopt-A-Family 2016 was a success! Thank you to all who donated - your generosity is appreciated!



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Steve Bellavia captured this beautiful image of the Heart and Soul nebulae on November 19th.

particles into three-dimensional crystalline lattices. Such control allows researchers to make new materials with desirable properties. [Read more.](#)

*Farmingdale takes first in BNL High School Science Bowl*

Farmingdale High School students have one contest down to a science. [Read more.](#)

*New cathode material stops batteries turning crusty with age*

Scientists at three US Department of Energy (DOE) national laboratories have discovered how to keep a promising new type of lithium ion battery cathode from developing a crusty coating that degrades its performance. [Read more.](#)

*RHIC Particle Smashups Find that Shape Matters*

Scientists colliding football and sphere-shaped ions discover evidence supporting a paradigm shift in the birth of the quark-gluon plasma. [Read more.](#)

*Two American Physics Labs Are Vying for a Billion Dollar Particle Accelerator*

Two labs are vying for government funding to host a billion-dollar atom smasher, and the battle is getting political. [Read more.](#)

*Neutrinos Change Their Flavor and Snag Another Nobel Prize*

Early this morning the world learned that the 2015 Nobel Prize in Physics has been awarded to Takaaki Kajita and Arthur B. McDonald for discovering that neutrinos can change from one type to another. [Read more.](#)

*World's largest atom smashers create world's smallest droplets*

How long can a droplet shrink and remain a liquid? [Read more.](#)

*'Inflatable Dark Matter' Could Explain Why We See Less Than Many Theories Predict*

Many wonderful theories that explain the evolution of the universe fail because they predict more dark matter than is actually out



there. Now a new paper proposes one event in the early universe that would reduce the amount of dark matter in all the theories. [Read more.](#)

*Ion collider produces droplets of primordial goo*

The Relativistic Heavy Ion Collider just spit out tiny droplets of a liquid researchers say resembles the seeds of the cosmos, primordial goo created by the Big Bang, which existed on briefly before cooling the matter that helped birth stars, galaxies and planets. [Read more.](#)

*Brookhaven National Laboratory projects are up for awards*

Four projects developed at BNL have been nominated as finalists for awards to be presented this year by a national magazine. [Read more.](#)

*Scientists Create Primordial 'Perfect Liquid' in Lab*

The BNL's Relativistic Heavy Ion Collider smashed together large nuclei at nearly the speed of light to recreate the fundamental particles in the primordial soup present during the earliest days of the universe. [Read more.](#)

*World's most powerful digital camera being built by US Department of Energy*

The US Department of Energy is building a digital camera that puts your camera to shame. [Read more.](#)

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## WHAT'S GOING ON IN OUR NEIGHBORHOOD?

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### *Interested in Cycling?*

<http://www.bicyclelongisland.org/majoride.htm>

<http://www.cyclotour.com/events.htm>

### *Interested in Running or Walking?*

**Central Park Holiday 10K** - December 17 at 9 am

**Ho Ho Ho 5K Run** - December 17 at 9:30 am

...Check out the [LI Running Calendar](#) for more!

### *Stony Brook Events:*

**Holiday Wishes from Mary Martin and Dinah Shore High Tea Luncheon** - November 16, 2016 - January 11, 2017 (Wed., Thurs., & Sat. at 11:30 am / Sun. at 12:30 pm) at the Educational & Cultural Center. A celebration of Hollywood's stage and film actresses. Enjoy musical highlights from their memorable careers. High tea luncheon performances in a beautifully decorated seasonal setting feature food catered by Crazy Beans.

**Young at Heart: The I Love Lucy Story - Birth of the Modern Day Sitcom** - December 21 (1 - 3 pm) at the Educational & Cultural Center.

**The Creation of Stony Brook Village** - June 1, 2016 - May 31, 2017 (10 am - 5 pm) at the Educational and Cultural Center. Experience the story of the reconstruction of Stony Brook Village through historical documents, photos, original blueprints, sketches, memorabilia and more.

### *Port Jefferson Events:*

**Farmers Market** - Every Sunday through February (10a - 2p) at the Village Center. Purchase local produce, honey, bread and baked goods, seafood, international specialties, plants and flower bouquets.

*Check out Erik Forsyth's Travels:*

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## DAY AT THE VINEYARDS...

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*Duckwalk North* - SOUTHOLD - Music on Saturdays (4-6pm)

*Castello di Borghese Vineyard & Winery* - CUTCHOGUE - Vineyard Tours & Wine Tastings Every Thursday & Sunday at 1pm & FREE Jazz Every Saturday (2-4p) with Marguerite Volonts

*Jamesport Vineyards* - JAMESPORT -Live Music from 1-4pm every Fri, Sat & Sun

*Martha Clara Vineyards* - RIVERHEAD - Live Music every weekend

*Palmer Vineyards* - RIVERHEAD - Live Music every Sat (12-4).

*Pindar Vineyards* - PECONIC - Live Music Every Saturday (1-5pm)

*Baiting Hollow Farm Vineyard* - BAITING HOLLOW - Music every Sat & Sun from (2-6)

*Paumanok Vineyards* - RIVERHEAD - Fresh, Local Oysters (2-5pm) every Sat & Sun starting Memorial Day through September



[HTTP://WWW.YACHTFIONA.COM](http://www.yachtfiona.com)

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## NOTE FROM BUSINESS OPERATIONS: Sue Pankowski



The Fiscal Year 2017 budgets for DOE-supported programs remain undetermined at this time. We started the year on October 1 under a continuing resolution (CR) that ran through December 9, and that CR was further extended through April 28, providing us with flat funding to operate until that date. What happens beyond then is anyone's guess - we could end up with a full year CR, or with a budget approved by Congress. The lack of firm budget guidance poses us with challenges as we proceed towards the start of RHIC Run 17 and what is any impact it will have on the length of the run. Now, more than ever, we encourage you to be mindful on your spending decisions and ensure that you are purchasing only what is needed specifically for programmatic goals.

A few reminders on timecards...

- Please remember to complete your timecard at least once a week (if not more frequently).
- If you have a questions about what project/activity to be charged, speak to your supervisor for guidance.
- Make sure to accurately charge any paid time off, be it vacation, sick, or holiday.

Questions on timecard preparation can be addressed to Karen Cestra at 4586.

Wishing you and your family and friends a safe, happy and healthy holiday season!

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## NOTE FROM OUR ACCELERATOR DIVISION: Wolfram Fischer



We are now in the final stages of the RHIC Run preparation. The start of the 4K cool-down wave has been delayed by 2 weeks to 6 February 2017, in order to complete the 704 MHz SRF cavity preparation for CeC. We are also still installing a short test beam line for newly installed DC electron gun for LEReC in IR2. The DC gun was voltage conditioned (still without a cathode) to its operating voltage of 400 kV.

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## NOTE FROM OUR EXPERIMENTAL SUPPORT & FACILITIES DIVISION: Bill Christie



As the holidays approach, work continues in preparation for the upcoming RHIC run. Due to an issue that arose with the 704 MHz CeC rf cavity a decision was made earlier in December to delay the start of the upcoming RHIC Run 17 by two weeks. This is to allow the cavity to be re-cleaned and installed prior to the run.

The revised schedule, which calls for the start of the Cryogenic cool down of the collider to begin on February 6th, can be found on the Web at the following link:

[http://www.c-ad.bnl.gov/esfd/operatingschedules/CAD\\_operation\\_FY17.pdf](http://www.c-ad.bnl.gov/esfd/operatingschedules/CAD_operation_FY17.pdf)

Work continues out in the PHENIX Facility with the disassembly of the PHENIX detector, parts of which are planned to be re-purposed and re-used (R&R) in the sPHENIX detector. A review of the PHENIX R&R effort prior to the two weeks schedule delay indicated that the main magnet for PHENIX would likely have to be left inside the IR during the upcoming run, as there wouldn't be sufficient time to clear space for it in the Assembly building before the shield wall had to be assembled. I haven't been involved in a revisit of the PHENIX R&R schedule since the delay was announced, but it can only increase the probability that the Central magnet will be able to be removed. The advantage of getting it out prior to the run is that it allows for the disassembly of the structure to proceed during the run.

Out at STAR we've been working through much of the usual reconnection and testing of the various sub-systems since we rolled the detector back into the IR a few months ago. Still to go before the run are the installation of an Ultra Violet (UV) light curing system for the Forward Meson Spectrometer (FMS, a lead-glass calorimeter), and the final fabrication and installation of the FMS Post Shower detector. The UV system installation is in progress currently. The Post Shower system is waiting for the delivery of Front End Electronics (FEE) boards which we expect to arrive before Christmas. Once these arrive and get installed we hope to be installing the devices starting early in January.

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## NOTE FROM OUR ERHIC R&D PROGRAM: Ferdinand Willeke



No comment at the time of this publication.

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## NOTE FROM OPERATIONS: Paul Sampson



RHIC shutdown, checkout, installation and commissioning efforts will continue throughout December. LEReC and CeC PoP installation continues in and around the 2 o'clock region during weekdays and on weekends. Conditioning of the LEReC electron gun has begun and will continue to mid-month, running in the evening and at night. At present the gun has been conditioned to 420kV. In RHIC sector 3 & 4, installation of the new 9 MHz rf cavities is nearing completion and work on the 56 MHz cavity as well as AC dipole installation is also wrapping up. Preparation and initial testing for the upcoming run is also ongoing. Work at STAR and PHENIX continues on or close to schedule.

AGS checkout is underway and startup with beam will follow. The Booster continues to run for NSRL and will provide polarized beam to the AGS for setup as needed.

LINAC maintenance and shutdown work has been completed. Polarized beam has been fully accelerated and delivered to the 200 MeV polarimeter in HEBT with good intensity and high polarization. LINAC will provide polarized beam for Booster and AGS for setup starting December 12th. Operation of the AGS and Booster will stop for the holiday on December 23rd and resume on January 3rd. BLIP will begin production on January 3rd.

EBIS and Tandem are providing beams for Booster and NSRL as necessary.

The "[RHIC Broadcast](#)" link displays the latest schedules for testing, power disruptions, outages and daily schedules.

To view a list of approved work for the Shutdown or to review past results, go to the [Job Request System](#) and select the appropriate date. This link is behind the firewall and requires privileges to view.

For weekly schedule updates see: [This Week](#), which can be viewed by all.

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Link to: [ATF Newsletter](#)

**NOTE FROM OUR ACCELERATOR TEST FACILITY:** Mark Palmer



No comment at the time of this publication.

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## NOTE FROM OUR MEDICAL ISOTOPE RESEARCH & PRODUCTION PROGRAM: Cathy Cutler



The MIRP group is evaluating novel radioisotopes to meet current clinical needs. One of those projects involves the development of  $^{44}\text{Sc}$  for preclinical studies. The elevation in interest in radioisotope Scandium-44 ( $^{44}\text{Sc}$ ) is due to its nuclear decay properties which enables its use for Positron Emission Tomography (PET) imaging with probes for targeted therapy. The half-life of 3.9 h renders  $^{44}\text{Sc}$  an isotope suitable for labeling small molecules and short peptides having similar half-life for clearance from the human body.

The maximum positron energy ( $\beta^+_{\text{max}}$ ) of 1.47 MeV falls between that of commonly used PET isotopes,  $^{89}\text{Zr}$  and  $^{68}\text{Ga}$ , 0.902 MeV and 1.899 MeV, respectively, suggesting that a PET image obtained with  $^{44}\text{Sc}$  will have acceptable resolution.

Being close to a 100% the positron branching ratio of 94.3% allows the use of lower quantities of  $^{44}\text{Sc}$  for imaging which in turn will minimize the dose burden from its relatively hard gamma ray ( $E_\gamma=1157.02$ ,  $I=99.9\%$ ).

Another advantage of  $^{44}\text{Sc}$  is the availability of the isotope  $^{47}\text{Sc}$  ( $t_{1/2}=3.35$  days) which is a  $\beta^-$  emitter suitable for targeted radiotherapy and has the same chemical properties as  $^{44}\text{Sc}$ . Hence,  $^{44}\text{Sc}$  and  $^{47}\text{Sc}$  represent a so called "theragnostic pair":  $^{44}\text{Sc}$  can be tagged to the same biological vector using the same protocol as  $^{47}\text{Sc}$  thus allowing  $^{44}\text{Sc}$  to be used for dosimetry estimation and biodistribution evaluation before radiotherapy with  $^{47}\text{Sc}$ .

Production methods for  $^{44}\text{Sc}$  using low energy protons include both direct  $^{44}\text{Ca}(p,n)^{44}\text{Sc}$  and indirect routes  $^{45}\text{Sc}(p,2n)^{44}\text{Ti}(60.0\text{a})\rightarrow^{44}\text{Sc}$ . The later route results in a generator system which is essentially a source of  $^{44}\text{Sc}$  without the need for the accelerator. It however requires a rather high loading activity of long-lived parent  $^{44}\text{Ti}$  whose production in milliCurie quantities requires long term irradiations due to its long half-life and relatively low (40 mb) cross sections.

Dedicated production of  $^{44}\text{Ti}$  in a medium energy cyclotron is not practical because of the high beam cost. BLIP routinely irradiates target stacks for isotope production in which the 93→40 MeV energy range is occupied by RbCl targets. The low proton energy slot (<40 MeV) located downstream (at the back) of those targets offer opportunities for production of long-lived isotopes such as  $^{68}\text{Ga}$  or  $^{44}\text{Ti}$ . The target design in such a case is quite challenging. The power deposition in the target at 160  $\mu\text{A}$  is close to 5 MW. The target has to withstand irradiations lasting for a few weeks under those circumstances. Recent improvement in beam delivery such as the Raster project has helped to spread the power deposition over the face of the target. MIRP is currently developing production method of  $^{44}\text{Ti}$  from a target comprised of Inconel encapsulated 45g Scandium puck. Two 45g targets were irradiated for a week in FY2016. A challenge is the chemical processing which entails separation of tracer amounts (picogram) of  $^{44}\text{Ti}$  from 45g of Sc. The separation process development is under development. The group is evaluating the development of a generator suitable for selective elution of  $^{44}\text{Sc}$ .

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**ARRIVALS:** Welcome!

**Anthony Flores** - Control Systems, Accelerator Division

**Brian Streckenbach** - Facilities and Experimental Support, ES&F Division

**DEPARTURES:** Farewell, you will surely be missed..

**Glynnis Mae Saquilayan**

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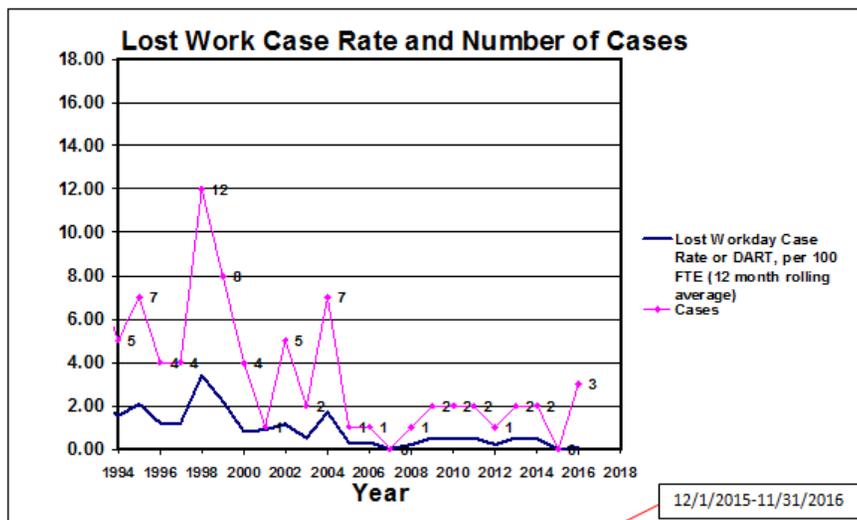
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**SAFETY STATS: Peter Cirnigliaro**



Rolling Average for 12 months

**C-AD Occupational Injury Statistics**

	CY 2016	FY 2017*
First Aid Cases	4	0
Recordable Cases	2	1
Lost Work Cases	2	1

\* Fiscal Year through 11/31/2016