

JAN '16
ISSUE

PARTICLE POST

COLLIDER-ACCELERATOR DEPARTMENT

Contact: [A. Lamberti](#)

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Quote of the Month: "The most incomprehensible thing about our universe is that it can be comprehended." -Albert Einstein

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NOTE FROM OUR CHAIR: Thomas Roser

RHIC did quite well in the FY16 budget that Congress passed and the President signed at the end of last year. The budget supports a 20-week run this year and if the electric power rates remain low we might be able to run a little longer. The start-up of RHIC is proceeding well so far.

From January 6 to 9 the second Electron Ion Collider user group meeting took place in Berkeley, CA. The link to the presentations is <https://conferences.lbl.gov/event/56/>. I made a presentation on the status of the eRHIC design developments. As I described in last month's Particle Post we are developing options with lower technical risk and also lower cost for the initial project phase with upgrade paths to the full luminosity eRHIC performance. This was well received by the EIC users community. At the same meeting, Tim Hallman, Director of DOE Office of Nuclear Physics, made a presentation that was quite positive about the possibility of the future construction of an Electron Ion Collider starting possibly around 2022-2023.

[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!

C-AD did a fantastic job raising funds for the United Way! Collectively, the candy sale, bake sale and Yankee Candle fundraiser generated **\$800** for the charity!

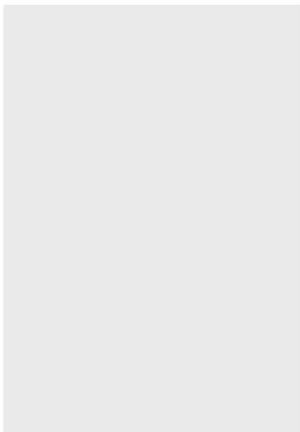
EVENTS/SEMINARS

January 25 - (Berkner Hall, Room B | 12p) English for Speakers of Other Languages (ESOL) Event

January 26 - (Bldg. 510, Large Seminar Room | 3:30p) Physics Colloquium

January 27 - (Bldg. 462, ASAP Lounge | 7p) Association of Students and Postdocs (ASAP) Event

January 29 - Bldg. 510, Room 2-95 | 12:15p) HET



Gift basket donated by C-AD for the United Way Holiday Auction



Adopt-A-Family gifts all packed up and ready for distribution

Lunch Discussions

January 30 - (Berkner Hall Auditorium | 8a) Office of Educational Programs Event

February 5 - (Bldg. 510, Small Seminar Room | 11a) High Energy Theory

February 10 - (Brookhaven Center | 9:30a) Blood Drive

February 10 - (Berkner, Room D | 12p) Brookhaven Women In Science Event

IN OTHER NEWS...

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.](#)

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.](#)

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



Fundraiser table for the United Way Yankee Candle sale

Thank you to all those who contributed to the United Way campaign and made it a huge success!

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.](#)



Rosette Nebula by Steve Bellavia



M42-M43 (Orion and Running Man Nebulae) by Steve Bellavia

WHAT'S GOING ON IN OUR NEIGHBORHOOD?

Interested in Cycling?

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

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

Interested in Running or Walking?

LI State Parks Caumsett 5K Winter Run - Jan 24

LI State Parks Jones Beach 5K - Jan 31 in Wantagh

Long Beach Snowflake 4 Mile Run - Feb 6 in Long Beach

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

For the Kids:

Hot Cocoa and Marshmallows - Jan 20 - Mar 16 (Wednesdays | 10:30am) at the Educational & Cultural Center in Stony Brook Village. Children will listen to a story read by the author and/or illustrator, participate in a craft activity related to the story and enjoy hot cocoa.

DAY AT THE VINEYARDS...

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)

Dinosaur Week! - Feb 16-18 (10am-3pm) at the Educational and Cultural Center in Stony Brook Village. Three fun-filled days of science, crafts, and imagination for kids ages 3-5 and 6-9.

Stony Brook Events:

Chinese New Year Celebration - Jan 31 (2-4pm) at the Educational & Cultural Center in Stony Brook Village. Celebrate the start of the year with drumming, dancers, and a nine-foot lion dance!

Port Jefferson Events:

Skating on the Harbor with the Rinx Village Center – Nov 27 – Mar 31 at PJ Village The Rinx
Waterfront Tradition Photo Exhibit Village Center - Jan-Feb at PJ Village Recreation PJ Conservancy
4th Annual PJ Historical Society Dinner - Feb 6 at 6pm at the Port Jeff Country Club

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

Check out Erik Forsyth's Travels:



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

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NOTE FROM OUR ADMINISTRATION: Sue Pankowski

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DOE budgets for FY2016 are in and things are looking relatively good. RHIC funds for operations, AIP and Capital projects are looking at a 3.8% increase over last year. In addition, NASA just renewed our contract for NSRL operations through the end of 2019. Good news as we wrap up our shutdown activities and prepare for the RHIC run 16.

I'd like to remind everyone how important it is to ensure you use the proper project/activity number for your work. Staff at C-AD are involved with many different efforts, including RHIC operations, a variety of upgrades (LEReC, ATF II, and Raster, to name only a few), NSRL, MIRP, and several other Work for Others efforts. All of these different efforts have their own project/activity numbers associated with them that are tied back to the original funding source. It's critical that costs for each effort are charged to the appropriate account, whether you are entering hours on your timecard, preparing a webreq or work order, or buying something with a credit card. Please make sure you are charging the time and/or materials to the program receiving the benefit. If you are not sure what to charge for something, please ask your supervisor for guidance.

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NOTE FROM OUR ACCELERATOR DIVISION: Wolfram Fischer

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We are now set for starting the RHIC 4K cool-down wave on 19 January 2016. We will collide Au+Au at 100 GeV - with Xiaofeng Gu as the Run Coordinator, followed by d+Au at up to 4 different energies - with Chuyu Liu as the Run Coordinator. During Run-16 the Coherent Electron Cooling Proof of Principle (CeC PoP) experiments will run, and we will also make important tests for the low-energy Au+Au program in 2019 and 2020.

The isotope program had a very good start this year. The new BLIP raster system - a project headed by Rob Michnoff - is now in operation. The raster reduces the energy density in the medical isotope targets by about a factor of 5, and allows for higher beam current and isotope yield. Taking full advantage of the Raster the Linac average current now reached 150 micro-A, significantly more than the typical 115 micro-A in the past. Congratulations to Deepak Raparia and his team.

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NOTE FROM OUR EXPERIMENTAL SUPPORT & FACILITIES DIVISION: Phil Pile

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This will be my last Particle Post contribution in my capacity as Head of the C-AD Experimental Support and Facilities Division. As you should know by now I will be retiring on 29 January, ending an enjoyable 34 year career at the lab. Joining me in retirement on 29 January will be Yousef and Al followed by Wuzheng on 31 March. Yousef and I will be moving into a cubicle across from Pete Ingrassia's office and will come around from time to time to partake in Seminars/Colloquia/Other, etc. (assuming they come with coffee and cookies!). Bill Christie will be assuming my role as Head of the Division and will be responsible for future Particle Post articles. Bill will continue to spend time with the STAR experiment as he has a major responsibility as Operations Coordinator for the STAR detector. His primary responsibility, however, will be with this Division. I wish Bill the best and trust that everyone will give him their full support in his new role with C-AD.

RHIC cooldown to 4K is still on track to begin on Tuesday, 19 January. Both STAR and PHENIX received approval to begin flowing flammable gas in their detector systems earlier this week so are on track to be ready to begin setup with RHIC beams when available. The schedule this year is a bit tight given the need for a long 10 week full energy gold-gold run, the desire to collect sufficient statistics during the deuteron-gold energy scan to follow, and the need to dedicate a week at the end for an experiment to test the coherent electron cooling principle (CeC PoP) for eRHIC. The planned 22 weeks of RHIC cryo operation had to be cut back to 20 weeks due to budgetary issues, resulting in loss of contingency days and a shortened runtime for the deuteron-gold energy scan. Hopefully some physics time can be recovered with less time than planned spent beam in setup mode.

The inaugural meeting of the sPHENIX collaboration was held in Rutgers last month. The election of co-spokespersons was held earlier this month with results to be announced soon! The plan for sPHENIX calls for the removal of the PHENIX experiment from the 8:00 IR to begin this summer with about 18 months required to complete the removals, spanning two RHIC shutdowns. The installation of the sPHENIX components will then begin in 2018 with the experiment ready for beam in January of 2022. All this is contingent on resolving funding issues and approval from DOE (which could come as early as this spring).

The sPHENIX BaBar magnet is about ready for a low power 100 amp test. The test was delayed due to other priorities for use of the ERL refrigeration system. The BaBar magnet is next in line with cooldown scheduled to begin on 27 January and introduction of low current into the coils in early February. As I said last month, this is an important milestone for the sPHENIX project.

The next NSRL run is scheduled to begin on 21 March with experiments supported by NASA-Langley. The experiments will use proton, helium and iron beams for scattering/cross section measurements. The main program (NSRL 16A) will begin on 4 April and run through 13 May and after a short break NSRL-16B will begin and run through June.

The LINAC delivered first beam to BLIP on 16 December. The new beam raster system was then commissioned with beam. Beam rastering was demonstrated on this day and strontium (rubidium-82 generator for cardiac imaging) production targets were put in place, a commendable achievement! The system was fully commissioned and the LINAC beam intensity was gradually increased throughout the remainder of the month with breaks for the weekend and Christmas and New Year's holidays. The LINAC performance has been simply great. The peak current recorded to date was 152.9 microamps and the beam on current has been consistently above 150 microamps for the past 3 days. The previous LINAC peak current was 142 microamps reached last year but only 115 microamps were used for isotope production due to target heating concerns with the non-rastered beam. The net gain in isotope production with the rastered beam at this point is about 30% (150/115). There are plans for about a month of polarized proton studies in the AGS this year and during those periods the available beam for BLIP will be reduced about 8% due to pulse sharing. Gallium target irradiations will resume this year for germanium-68 (gallium-68 generator for tumor imaging) production as well as thorium irradiations for actinium-225 (cancer therapy) development. In addition, R&D irradiations are planned and the group will be subjected to a customer (Bracco) cGMP compliance audit in March (these audits are not to be taken lightly!).

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NOTE FROM ACCELERATOR R&D DIVISION: Ilan Ben-Zvi

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eRHIC Design

The work on eRHIC preliminary Conceptual Design Report (pCDR) is underway. The pCDR will describe several accelerator design options: the Nominal Linac-Ring and Ring-Ring designs as well as the Ultimate Linac-Ring design. The Nominal design options aim at reduced technological risks, while still keeping the machine luminosity at acceptable levels. The Ultimate design can be achieved then following an upgrade path from any of the Nominal designs. The Linac-Ring design options are based on FFAG optics of recirculating passes, with the Nominal design having relaxed requirements on the hadron cooling system and on the electron current produced by a polarized electron gun. The energy recovery linac is based on recently accepted choice of 647 MHz SRF cavity system.

Crab cavity R&D

The 5th Joint HiLumi/LARP - Annual Collaboration Meeting was held in the end of October of 2015 at CERN. CERN has presented the current status and future plan of the crab cavity project, which is one of the most important upgrades among all 19 work packages. CERN will put full effort in fabricating prototype cavities for SPS beam test, and Double Quarter Wave Crab Cavity from BNL was publicly announced to have the first priority among the candidates in their fabrication process. We are highly involved in generating fabrication procedures and working with the engineers at CERN in getting the cavities manufactured, as well as the helium vessel, tuner, and the entire cryomodule.

Status of the C-Beta

C-Beta (Cornell BNL Electron Test Accelerator) is an eRHIC prototype to be built at Cornell University. The eRHIC last Advisory Committee closeout said: "...We note that some form of multi-pass linac (ERL or RLA) is necessary for all design approaches thus c-beta is now arguably the most critical R&D element in the program. The Committee considers some c-beta results critical for a CD-1 review (2019)." ... It looks like New York State funding has been approved and the eRHIC prototype c-beta could officially start at February 1, 2016. The C-Beta is an Energy Recovery Linac (ERL). It accelerates electrons from 67-250 MeV with four passes through the 61 MeV superconducting linac. The energy is recovered by bringing electron with 180 degrees phase through the linac an additional four times. This project will show that it is possible to transfer electrons through the single FFAG-beam line with 4 times in energy range, with energies of 67, 128, 189, and 250 MeV. Total of eight passes of electrons with four different energies through the single FFAG beam line will be demonstrated. The goal is to show that correction system for all orbits can remove effects of misalignment and magnetic field errors, the energy recovery, as well as the merging and matching of four different energies from FFAG to the linac, and from the arc to the straight section - four orbits in the NS-FFAG arcs are merged into one straight section. We plan a CDR report by April-May 2016, and commissioning from February 2018 to February 2019.

Polarized Electron Gun R&D

In December the Gatling Gun vessel had vacuum problems, however the problems have been corrected and the gun is now at a vacuum level of better than 2×10^{-11} Torr. This is the lowest vacuum we have seen in the gun's main chamber since initial testing at the manufacturer in California and though 10^{-12} Torr scale vacuum is now routinely achieved in the gun's cathode preparation chamber, this is the best vacuum we have seen to date in the main gun chamber at SBU. Furthermore, this vacuum level was achieved after a very short and relatively low temperature bake following the main vessel being brought up to ambient pressure. So this was a very promising result, at this vacuum level the cathode life will be approximately 100 times longer than previous tests.

Accelerator Test Facility

ATF User scientific program:

AE52 Dielectric Wake Field Acceleration (Euclid Labs, Inc.) - After earlier demonstration of DWFA in a single stage, the researchers are attempting to extend the effect in several consecutive stages. The researchers are addressing here a big challenge on the electron beam quality and alignment through narrow structure. The work is in progress.

AE59 Recirculating Compton Scattering experiment (RadiBeam LLC) - After the successful demonstration of x-ray yield multiplication inside the laser amplifier cavity in an earlier experiment, the researchers switch attention to applying a similar idea to multiplying a repetition rate of an IFEL accelerator. This requires a longer closed-loop laser cavity, which is under a test in this run.

AE65 NOCIBUR (UCLA) - The physical process under investigation is reverse to IFEL acceleration. A properly tapered undulator allows to trap and decelerate an electron bunch with its energy transferred back to a co-propagating laser beam. In December run, researches achieved improved efficiency of trapping electrons in decelerating mode.

AE72 Interaction of a picosecond CO2 laser with materials (NRL) - This proprietary NRL research achieved their goal in a one-week run.

ATF Facility development:

Progress was made in vacuum conditioning of the X-band waveguide as a step to completing installation of a deflector cavity into a beamline to allow time-resolved measurement of e-beam envelope important for a number of user experiments.

ATF-II upgrade:

The ATF-II project re-baseline work is in progress towards completing a plan for DOE review.

Activity continues in the construction of the Ultrafast Electron Diffraction beam line and the multi-terawatt CO2.

A personal note:

I would like to take this opportunity and expand on my plans for a sabbatical leave, as described by Thomas Roser in his email of December 28.

Due to our new approach to the design of eRHIC, we eliminated or reduced the risks that were inherent in the design up to last year. The main unavoidable risk is the application of crab crossing in hadrons, which has not been done in the past. This risk is common to both ring-ring and linac-ring designs. Therefore we need crab crossing and thus the development of a good crab cavity. The risk mitigation must involve a test of a superconducting crab cavity in a hadron storage ring, a rather expensive project.

Fortunately we are engaged in an outstanding R&D program for a crab cavity for the luminosity upgrade of the LHC. My idea of a quarter-wave resonator based crab cavity, the Double Quarter Wave Crab Cavity, has been realized by our great LARP team and is enjoying a tremendous success, as described above. The group is under the leadership of Qiong Wu and including Silvia Verdu-Andres, Binping Xiao, John Skaritka and previously Sergey Belomestnykh. We built a proof-of-principle cavity, which was highly successful in SRF tests, and designed the prototype for tests in the SPS accelerator in CERN, where cavity and cryomodule are now under construction. Since the center of gravity of this development is now at CERN, I must spend more time there on this critical item. I decided to use a sabbatical leave for this purpose, but at the request of higher management I will break this year of sabbatical leave to three periods of four months each, one period per year over the next three years. The first such period will start in June.

Devoting more time to this essential effort, I have to reduce some of my other responsibilities. The most appropriate one is the SRF group, which I established about 15 years ago. SRF science and technology, which did not exist at BNL for the past forty years, is now one of the items of strength of which we are not only proud, but which is the basis for on-going and future projects such as the 56 MHz cavity, LEReC, eRHIC, the R&D ERL, the CeC PoP experiment and of course the crab cavities. We developed unique and highly successful devices such as the BNL 704 MHz cavity series, superconducting RF guns at 1.3 GHz, 750 MHz and 112 MHz and much more. SRF facilities which were non-existent a mere 15 years ago now include two vertical test facilities, three clean rooms, a niobium processing furnace and a \$2M

worth niobium chemistry facility. Past members of the team achieved prominence: Sergey Belomestnykh as Chief Technology Officer of Fermilab and Andrew Burrill as head of the LCLS-II SRF group at SLAC. Now this mature group can be devoted to critical construction projects and operations in the RF Systems group of C-AD, as well as continue essential eRHIC R&D missions. Thus most of the group has been transferred to the Accelerator Division, where I am confident they they will continue the great work.

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NOTE FROM OPERATIONS: Paul Sampson



Startup for Run 16 is underway. EBIS Booster an AGS setup continues early this month as the final work on RHIC system in the tunnel is being completed. Normal beams have been established in the AGS and extraction to the W dump will commence shortly.

The work in the RHIC tunnel at 1 and 2 o'clock continues to progress. Startup and checkout of the RF systems is ongoing between accesses. Bake outs for CeC are nearing completion and assembly of the LEReC section 1 o'clock is nearing completion. Installation of tunnel ports in the area is ongoing expected to be completed by the 15th of January and the 4K wave will begin on January 19th. Annual Access Controls System testing is ongoing, with some scheduled access interruptions in the RHIC tunnel and service buildings throughout the month.

LINAC is running well for BLIP and complete. The Raster system has been commissioned and is now running routinely, allowing for increased current on target. The first irradiation has been completed and will be ready for processing this month and the second will continue until the 29th of January.

The Booster is presently shut down and will be run for tests before restoring beam operations on January 4th.

EBIS has been running well, delivering beams to the Booster for setup. Work on delivering additional pulses for new bunch merge schemes in AGS has had success and may help to increase the injected intensity for RHIC this run.

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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ARRIVALS: Welcome!

Bill Christie - Experimental Support & Facilities Div.

Robert Pak - Physics Support, Accelerator Div.

Sergei Seletskiy - LEReC, Accelerator Div.

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DEPARTURES: Farewell, you will surely be missed..

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Phil Pile

Yousef Makdisi

Al Pendzick

Wuzheng Meng

Guest Notices:

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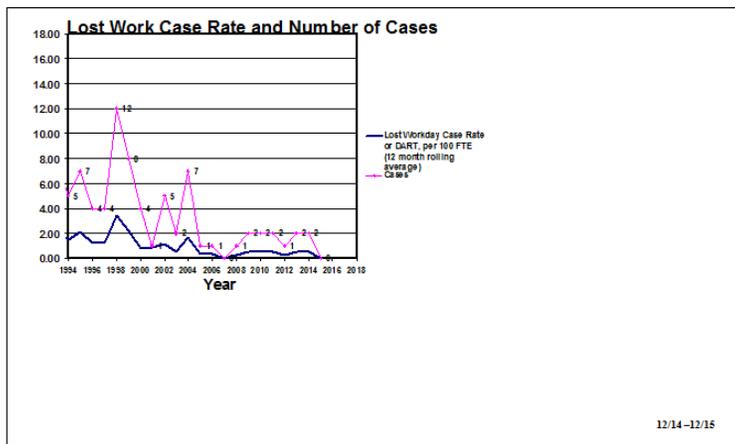
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SAFETY STATS: Peter Cernigliaro



C-AD Occupational Injury Statistics

	For Year 2014	For Year* 2015
First Aid Cases	8	5
Recordable Cases	3	1
Lost Work Cases	1	0

* Calendar Year through 12/15