

'Science at Its Best'

Gold Beam Circulates Readily for First Time in RHIC Blue Ring; Work Underway to Accelerate Beam, Commission Yellow Ring

At the beginning of Michael Harrison's 9:30 a.m. daily meeting on July 16, the accelerator physicists involved with the commissioning of BNL's Relativistic Heavy Ion Collider (RHIC) were depressed.

As they explained to Harrison, who is RHIC Associate Project Director for the Collider, by eliminating all other possibilities methodically, the commissioners could only conclude that their inability to get gold beam to circulate readily in the collider's Blue Ring was due to some sort of obstruction in the vacuum pipe before the 12 o'clock intersection region of the ring.

Working since June 24 (see Brookhaven Bulletin of July 2 and 16, 1999), the commissioning physicists had succeeded in threading the beam clockwise around the ring four times by that meeting. But, metaphorically, pushing it through the eye of the needle was hard work.

"We had systematically eliminated all other problems, but we were still left with the fact that, when the beam would just about get to IP [intersection point] 12, it would lose energy," explained Steve Peggs, who leads the Accelerator Physics Group. With each turn, the beam would lose more energy and begin to spiral off its trajectory; by the fourth turn, it would have so little energy and be so off course that it would dissipate.

"So we could only conclude that something — a dent or a chem-wipe or some other debris in the vacuum pipe — was in the way of our being able to circulate beam," added Peggs.

By talking their problem through among themselves and going back to the control room to implement their "bump" solution — that is, steer around the suspected obstruction — the commissioners turned their depression into elation that very day: at 11 a.m., they succeeded for the first time in circulating beam multiple turns around the Blue Ring, one of the two 3.8-kilometer-in-circumference accelerators making up RHIC.

"The beam pipe is big enough that the beam doesn't have to be straight down the middle," said Peggs. "So we steered for about half an hour, and, all of a sudden, the beam just went."

Last Friday, the first RHIC Blue Ring heavy-ion beam — a single bunch of gold atoms stripped of all their electrons — made thousands of laps around the RHIC track before being dissipated. Since each lap takes 12.5 microseconds, the first beam's total lifetime was less than a second. The gold-ion bunch had an energy of 11 billion electron volts (GeV) per nucleon and an intensity of approximately 10^7 ions per bunch.

Circulating the beam is the first



At a gathering in the AGS-RHIC control room hosted by RHIC Project Director Satoshi Ozaki (standing by computer, center), RHIC Associate Project Director Michael Harrison (seated, center) celebrates the Blue Ring commissioning success with, among others: Lab Director John Marburger (standing behind Harrison), (seated, front from left) Dejan Trbojevic and Steve Peggs, and George Ganetis (second person behind Trbojevic).

and most difficult goal to achieve with any nonlinear accelerator. With this milestone set for the Blue Ring, work is underway to increase beam intensity and to accelerate the beam to higher energy. RHIC was designed to have gold-ion beam with an energy of 100 GeV per nucleon and an intensity of 10^9 ions per bunch.

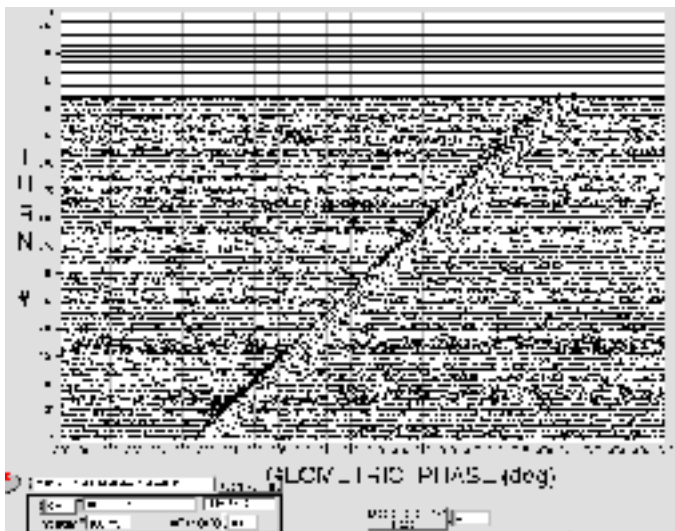
In the meantime, the commissioners are also scheduled to turn their attention to the Yellow Ring on Monday, July 26.

At the Blue Ring's controls at golden hour was Dejan Trbojevic, who heads the "D" crew, which is one of five teams of commissioners scheduled for 24-hour shifts and which, in addition to Trbojevic, is staffed by Andreas Lehrach and Vadim Ptytsin.

Working with the commissioners were staff of the Alternating Gradient Synchrotron (AGS) Department: AGS operations coordinator Charles Whalen and AGS operator Jennifer Kozak (see photo, page 2), plus the AGS operation support crew of Tim Costanzo, Charles Gardner, and Frank Scheifele. They supervise the gold beam from the time that it is generated in the Tandem Van de Graaff, accelerated by the AGS Booster, and accelerated again and stored by the AGS itself until it is injected into RHIC.

In celebration of this accomplish-

ment — something that the hundreds of employees of the RHIC Project have been working toward since its start in



A plot an rf wall-current monitor signal showing the first 620 turns of the first beam circulating readily in RHIC's Blue Ring.

Glance at RHIC Beam

Beginning next Tuesday, July 27, BNLeers can see a special edition of *GLANCE* in the video kiosk in Berkner Hall, featuring footage shot by Alex Reben on Friday, July 16 shortly after beam first circulated readily in RHIC's Blue Ring.

Reviewing the "bump" strategy noted on a meeting-room board that led to the first freely circulating beam in RHIC's Blue Ring are: (from left) Dejan Trbojevic, Steve Peggs and Satoshi Ozaki.



1983 — corks popped in the control room twice that day.

Champagne was poured immediately after 11 a.m., and then again at 4:30 p.m., when RHIC Project Director Satoshi Ozaki hosted a gathering including Laboratory Director John Marburger, former BNL Director Nicholas Samios, Deputy Director for Science & Technology Peter Paul, Associate Laboratory Director for High Energy & Nuclear Physics Tom Kirk, AGS Chair Derek Lowenstein, the spokespersons or their representatives from RHIC's five experiments, the chairs of the BNL Departments working on RHIC experiments, and others.

In addition to lifting their waxed-paper cups to toast those involved in the immediate success, those assembled congratulated Michael Harrison, and the other groups and sections under his jurisdiction for their

(continued on page 2)

RHIC Blue Beam (cont'd)

roles in building the machine and getting it to work.

"Today is a fantastic day, and the extraordinary effort of everyone working for the RHIC Project is very much appreciated," Satoshi Ozaki exclaimed that Friday.

The RHIC Project Director afterward added, "I give special thanks to Mike Harrison for his outstanding leadership of the collider aspect of the RHIC Project. He has spearheaded the collider effort from collider design, to installation and system shakedown, to instrumentation and controls development, and now — to this success in the commissioning of half of the RHIC collider.

"For this immediate success, I not only praise the talent and skills of all those who have been involved in collider construction, but also those of Steve Peggs and his Accelerator Physics Group, and of George Ganetis and his Electrical Systems Group. Without their ingenuity and perseverance, we could not have succeeded," Ozaki added.

The Project Director concluded, "On behalf of the RHIC Project, I thank the entire Laboratory for making RHIC its centerpiece, and the U.S. Department of Energy, particularly its Nuclear Physics Program Office, for its strong support." (See photo below, right.)

"I am just as excited about this milestone as those who have been involved in this project from the beginning," said John Marburger. "That a stable orbit was achieved so soon after completing construction is impressive, and I am very proud of the team that made it happen. After a long hot summer of frustration, I am sure that the time seemed much longer to the team."

He continued, "I am also impressed with the commissioning process itself. It is truly an empirical process, in which observation, hypothesis, experiment, and correction are carried out in a highly disciplined way. This is science at its best."

The Lab Director concluded, "My congratulations to everyone who helped bring RHIC to this point. I look forward to a long sequence of such celebrations."

'In Business'

Actually, the night, or owl, shift of midnight to 8 a.m. on July 16 taken by the "A" crew (see photo, above right) headed by Leif Ahrens and staffed by Wolfram Fischer, Pat Thompson, and Johannes van Zeijts set the stage for the D crew's daytime success.

On the owl shift, not only did Pat Thompson work over the phone with Tom Shea, who heads the RHIC Beam Instrumentation Section which de-



AGS operations coordinator Charles Whalen and AGS operator Jennifer Kozak.

signed and built RHIC's monitors, to get beam position monitors working properly at the critical sector 11 just before the 12 o'clock intersection region. But also Wolfram Fischer succeeded making the beam's trajectory of the successive turns match that of the first turn.

Despite other efforts to improve beam survival as it is called, the A crew left the day shift staffed by the D crew with that "little challenge," as they noted in the log.

Around 10:30 a.m., D crew leader Dejan Trbojevic took up the challenge.

"What was the trick?" asked Deputy Laboratory Director Peter Paul, after he and Lab Director John Marburger were called to the control room upon the success at circulating beam in the Blue Ring.

Explained D crew member Andreas Lehrach, "We thought, to get around whatever is in the beam pipe, 'Maybe we should make a bump.'"

"Making a bump" means moving the beam first away from its more or less straight-line trajectory and then, after the obstacle is cleared, moving the beam back to its path around the Blue Ring (see photo, page 1, bottom right). "It is like driving your car around a road block and then back



The A crew: (seated, front to back) Johannes Van Zeijts, Wolfram Fischer, Pat Thompson, and (standing, behind Van Zeijts) A crew leader Lief Ahrens, with AGS operations coordinator Charles Whalen.

onto the main road," said "C" crew leader Todd Satogota.

With the beam trajectory in the center, at position zero, the beam was being lost just before IP 12. So the D crew leader steered the beam +10 millimeters (mm) in the horizontal direction, toward the outside of the ring, but there were still beam losses. At +15 mm, still losses. "So we went in the other direction, and, at minus ten millimeters, the losses disappeared," said Andreas Lehrach.



At the July 16th celebration in the AGS-RHIC control room: (from left) former BNL Director Nicholas Samios, RHIC Project Director Satoshi Ozaki, and Laboratory Director John Marburger.

As the beam was making multiple turns for the first time, Dejan Trbojevic declared, "We are in business."

Obstructions accidentally created within the vacuum pipe in which a particle beam travels in an accelerator are not new or unusual. In fact, the obstacle most talked about by accelerator physicists is a beer bottle that

had been left in the beam pipe during maintenance of the large electron positron (LEP) accelerator at the European particle-physics laboratory, CERN, in Switzerland.

"Whatever was in the way of the Blue Ring beam is trivial," stated Steve Peggs. "But we will attend to it — later."

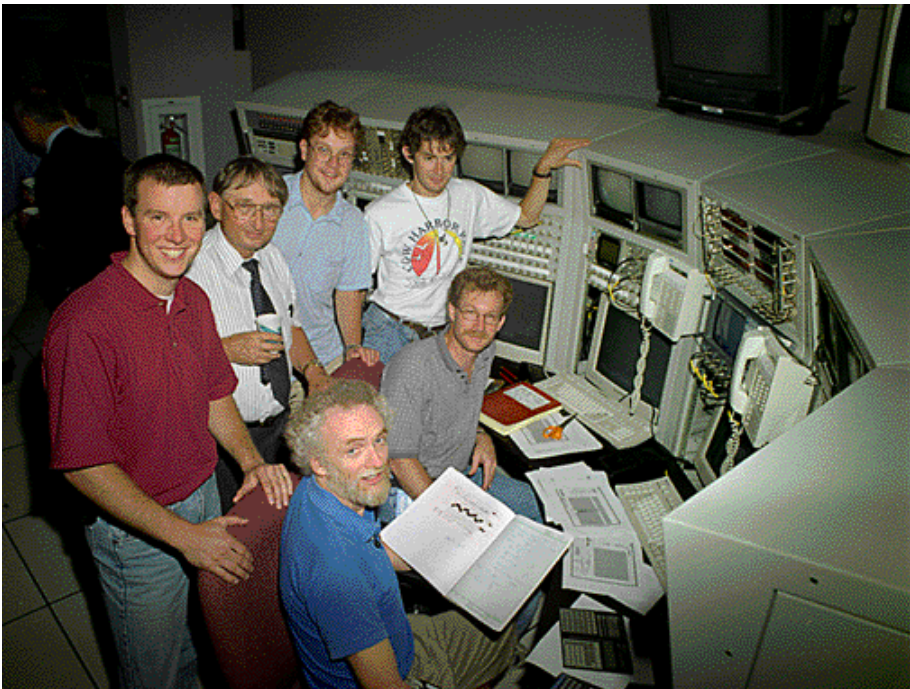
"Later" starts on September 1, when the Blue Ring will begin being warmed up. RHIC is made up of two rings of superconducting magnets installed in cryostats filled with liquid-helium coolant and chilled to 4.6 Kelvin, which is the magnet's operating temperature and is just above absolute zero (see Brookhaven Bulletin of July 16, 1999). As a result, opening up the Blue Ring to inspect the vacuum pipe is impossible until it reaches room temperature. All is to be fixed by November 15.

Name That Tune

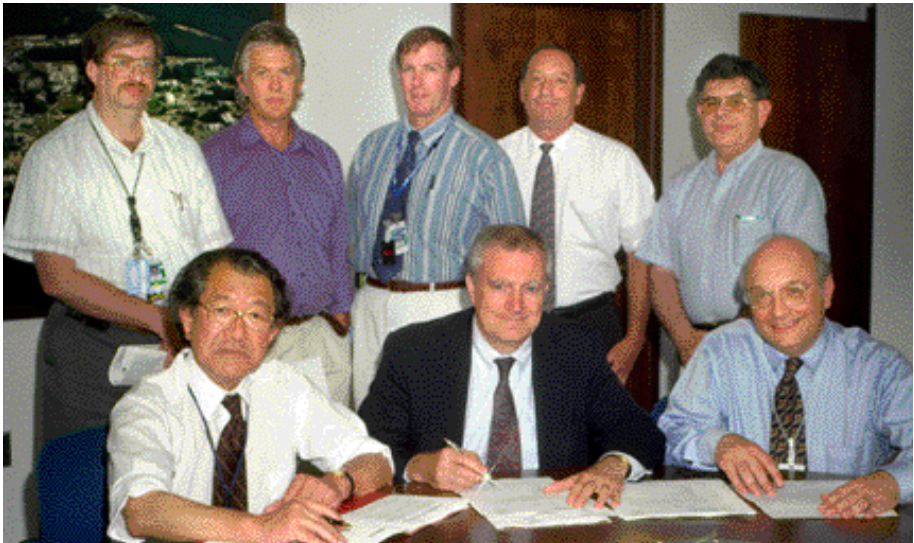
With beam successfully circulating, one of the first things that the accelerator physicists wanted to determine was what are called the Blue Ring's transverse oscillation frequencies, or tunes. These are the beam's numbers of oscillations per lap horizontally and vertically.

Determining the Blue Ring's tunes not only confirmed that the strength of RHIC's magnets was correct, but also determined the winner of the "tune pool" — the accelerator-physics equivalent of a baby pool (see photo and graph on page 3).

Another frequency, however, was of interest to another set of physicists. While members of the RHIC Accelerator Physics Section alternately took a few minutes away from their computer consoles in the control room to



With Deputy Director Peter Paul (standing, second from left) are some of the members of the AGS-RHIC RF Systems Group: (standing, from left) Kevin Smith, Alan Campbell, Emmanuel Onillon, (seated, from left) group leader Michael Brennan, and Joe DeLong.



Commissioning the Blue Ring was made possible on June 24, when DOE gave the Lab permission to operate the ring, following an accelerator readiness review. At the review signing were: (standing, from left) Henry Kahnhauser, chair of BNL's Accelerator Readiness Review Panel; RHIC Associate Project Director Michael Harrison; Michael Holland, DOE Brookhaven Group (BHG); Michael Butler, BHG; AGS Chair Derek Lowenstein; (seated, from left) RHIC Project Director Satoshi Ozaki; BNL Director John Marburger; and BHG Manager George Malosh.

Pick a Student

Completed applications for the fall 1999 Energy Research Undergraduate Laboratory Fellowship (ERULF) Program will be available for review on an electronic database until August 2. The address and passwords are available from the Office of Educational Programs (OEP) or departmental education coordinators. The undergraduate program will run for 16 weeks from approximately August 23 until December 10. OEP will pay for the student's round-trip travel and their stipend of \$350 per week. The sponsoring departments are asked to pay \$125 weekly for their housing. For more information, contact OEP at Ext. 4503 or cathyo@bnl.gov.

BERA Book Fair

BERA will sponsor a book fair in Berkner Hall lobby, Thursday and Friday, July 29 & 30, 10 a.m.-3 p.m. Bigger and better than last year's, the selection of in-stock hardcover books will include children's books, cook books, and best-sellers at up to 70 percent off list price. Some gift items will also be available. Credit cards and checks will be accepted. Also, a drawing will be held for a book of the winner's choice. For more information, call Andrea Dehler, Ext. 3347, or M. Kay Dellimore, Ext. 2873.

Cricket Match 7/31

The BNL cricket team will play a match against an arch rival, Columbia University, on Saturday July 31, starting at 1 p.m. on the official BNL cricket pitch between softball fields 1 and 4 — farthest from the National Synchrotron Light Source. The Lab community is invited to attend.

BNLers who have played before are welcome to join the team. For more information, contact Tony Begley, acting captain, 591-4073 or begley@aps. org, or www.nais.com/~rbegley/cricket.

Classified
Advertisements

Placement Notices

LABORATORY RECRUITMENT - Opportunities for Laboratory employees.

DD7448. HELPER A (temporary opening) - Under general supervision, performs a variety of tasks in a shop or building trade that require a substantial knowledge of a skill in that trade. Possession of the knowledge or skill expected of a journeyman is not necessary. Duties will usually include handling minor assignments in the trade, with a minimum of supervision, and assisting one or more journeymen in more complex assignments. Central Shops Division.

OPEN RECRUITMENT - Opportunities for Laboratory employees and outside candidates.

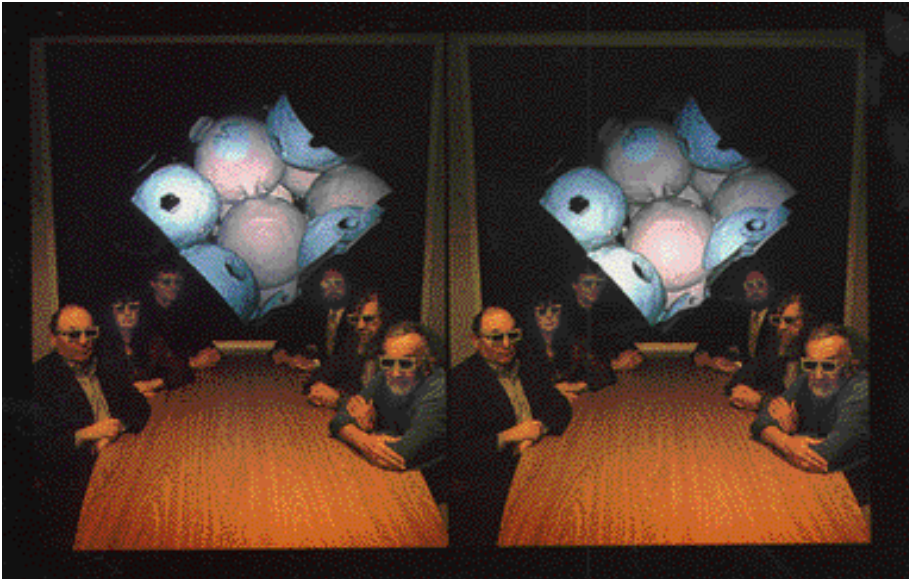
MK2227. ASSISTANT SCIENTIST - To work in the Neutron Scattering Group. Will participate in the design and construction of a state-of-the-art three-axis spectrometer on the new cold source to be installed at ORNL's HFIR. Seeking a creative and motivated scientist to take a leading role in this and related efforts. Will be expected to develop an independent research program utilizing the unique capabilities of neutron scattering. Current topics of research in the group include: high-temperature superconductivity, correlated-electron phenomena, and low-dimensional magnetism. Requires a Ph.D. in physics, with experience with modern design and operation of triple-axis neutron spectrometers highly desirable. Under the direction of J. Tranquada, Physics Department.

MK7640. ENGINEERING POSITION - (term appointment, reposting) Requires a bachelor's degree in engineering, with mechanical, basic electrical and vacuum experience desirable. Will be responsible for establishing the new Pulse Laser Deposition Facility working directly with scientific staff. Will design and construct support structures for the equipment, interface the vacuum and laser portions of the system, build a gas manifold, and oversee the necessary interlocks and safety aspects involved in the process. Physics Department.

MK8777. COMPENSATION ANALYST - Requires a bachelor's degree in business administration or related field, several years' experience as a compensation professional, including experience with database manipulation, input/analysis of survey data and writing job descriptions. Additional skills include excellent analytical, mathematical and communication skills, demonstrated ability to work as a team member, and PC skills, including Microsoft Office, Excel, Access, Word, and knowledge of HRIS. American Compensation Association certification preferred. Responsibilities include compensation data compilation and analysis, creating/managing compensation related HRIS and database reports, communicating compensation information to all levels of Lab personnel, conducting market pricing studies and salary surveys, and writing

Summer Sundays '99

Visualize This on Sunday, 7/25



If you have ever wondered what tumors look like, or how drugs interact with cells, or how particles collide, then this Sunday's facility tour of BNL's Information Technology Division (ITD) on July 25 is for you. This Sunday, ITD will open its doors to Lab tourists, to display its three-dimensional visualization technology (pictured above) — and more. More includes a glimpse of the world's tenth-fastest supercomputer, which was built for the RIKEN BNL Research Center at the Lab, housed in ITD and dedicated to calculations of the physics of BNL's Relativistic Heavy Ion Collider. Since no tour will be complete without a trip into cyberspace, Lab tourists will also have 14 Web-browsing terminals available to them for their Internet use. Besides the ITD facility tour, Summer Sunday visitors may take a guided bus trip around the site and participate in the Whiz Bang Science show. Fun for children of all ages, this show is a lively interactive demonstration of basic scientific principles which will be presented at 10:30 a.m., noon, 1:30 p.m., and 3:30 p.m. The history of the site during its pre-BNL days as Camp Upton, a U.S. Army camp during World War I and II, will be on display at the Camp Upton Historical Collection. Housed in a Camp Upton chapel, this museum contains items donated by veterans who had passed through the camp, and artifacts of the Army found on site. Organized by BNL's Museum Programs on Sundays through August 29th, Summer Sunday tours are open to all and are offered from 10 a.m. to 5 p.m., but all must arrive before 3 p.m.

job descriptions based on documentation and audits.
Human Resources Division.

DD8767. CONTRACTS SPECIALIST POSITION - Requires a bachelor's degree in business or equivalent experience; experience with high-technology procurements is desirable. Must be well-versed in all aspects of procurement and have the ability to draft RFPs, contract modifications, and special provisions. Also requires experience performing analyses of cost and man-hour estimates and a knowledge of Federal Acquisition Regulations. Division of Contracts & Procurement.