BROOKHAVEN
NATIONAL LABORATORY

NSRL-08B RUN

May - June 2008

FINAL REPORT

Kelly Guiffreda
RHIC & AGS Users Center
BNL

Peter Guida
Medical Dept.
BNL/NASA

Michael Sivertz
Collider-Accelerator Dept.
BNL/NASA

http://www.bnl.gov/medical/NASA

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EXECUTIVE SUMMARY

During the summer of 2008, a series of radiobiological and physics experiments were performed using the proton and heavy ion beams available at the NASA Space Radiation Laboratory (NSRL). These experiments were part of the sixteenth NSRL scientific run (NSRL-08B) sponsored by NASA's Space Radiation Health Program (SRHP) heavy ion radiobiology research program at BNL.

A total of forty-three proposals were approved for participation in the NSRL-08B run. Of the 43 approved, 34 proposals took part and 9 proposals were withdrawn or deferred. One hundred and seventy four users from fifty-three institutions were represented, forty-two from the United States and eleven from other countries. More than 2700 biological samples were exposed at the NSRL beam line, employing 184:04 hours of beam time (20:21 hours for in vivo studies, 91:45 hours for in vitro studies, and 70:08 hours for physics experiments) delivered in a six week period. In addition, 19:01 hours were used for dosimetry and beam development. Machine set-up and wrap-up took a total of 119:30 hours. Accelerator problems with the NSRL beam accounted for 21:36 hours lost. This gave a total NSRL usage time of 342:21 hours. Since we were not running concurrently with RHIC, there was no time lost while due to RHIC. As a byproduct of this, all accelerator down-time counted towards the NSRL total.

During NSRL-08B, Booster provided protons (50, 100, 150, 200, 250, 600, and 1000 MeV), carbon (200, 250 and 290 MeV/n), silicon (400 and 1000 MeV/n), titanium (240, 380 and 1000), iron (300, 500, 600, and 1000 MeV/n) and sequential fields of protons and iron (1000 MeV/n) beams for biology and physics experiments. The low energy protons were part of the Solar Particle Event Simulator. Experimenters are becoming more interested in studying the effects of low doses and low dose rates. For this reason, our attention has been on developing stable low fluence beams with the same dosimetry capability of the higher intensity beam. The maximum dose rates used for biology experiments were as high as 3.0 Gray/min (Fe 1000 MeV/n). The general spill rate employed was 15 spills per minute with durations of 300 msec/spill. The spill fluence (particles/spill) ranged from 2 x 10^2 (min) to 6.4 x 10^{11} (max). Square beam spots as big as 20 x 20 cm^2 and as small as 1 x 1 cm^2 were employed for biology and physics experiments.

Tandem-Booster were already set-up since the summer run started the day the spring run ended on 14 May 2008. NSRL-08B officially ended at 4:26 PM 20 June 2008.

Projects Reviewed by the BNL Scientific Advisory Committee in Radiation Research

Proposal	PI	Sponsor	NSRL-08B Participation
B-44	DURANTE	ASI	Yes
B-52	SUTHERLAND/GEWIRTZ†	NSBRI	Yes
N-88	SUTHERLAND	NASA	Yes
N-89	HELD	NASA	Yes
N-103	BARCELLOS-HOFF †	NASA-NSCOR	Yes
N-115	BACHER	NASA	Yes
N-128	BLAKELY	NASA	Yes
N-129	LIMOLI	NASA	No
N-134	CHEN †	NASA	Yes
N-135	PLUTH	NASA	No
N-146	WU	NASA	Yes
N-153	MINNA†/STORY †	NASA-DOE	No
N-157	SCHIESTL †	NASA	No
N-159	HALL †	NASA	No
N-167	BURMA	NASA	Yes
N-171	DYNLACHT	NASA	No
N-172	BERKOWITZ	NASA	Yes
N-173	GEARD †	NASA	Yes
N-176	CUCINOTTA	NASA-DOE	Yes
N-177	MORGAN †	NASA	Yes
N-185	SUTHERLAND	NASA-DOE	Yes
N-186	SHAY	NASA	Yes
N-188	GREEN	NASA	No
N-190	IANZINI †	NASA	No
N-192	ENGLEWARD †	NASA-DOE	Yes
N-196	AZZAM	NASA	Yes
N-197	FORNACE †	NASA	Yes
N-199	WARE	NASA	No
N-203	BRITTEN	NASA	Yes
N-204	AMUNDSON	NASA-DOE	Yes
N-207	BELLI	ISS	Yes
N-208	CHEN †	PIGGYBACK	Yes
N-209	WANG	NASA	Yes

Projects Reviewed by the BNL Scientific Advisory Committee in Radiation Research (cont.)

Proposal	PI	Sponsor	NSRL-08B Participation
N-211	RITHIDECH	NASA	Yes
N-212	SMILENOV	NASA	Yes
N-213	TAFROV	NASA	Yes
N-214	BAULCH	NASA	Yes
E-4	HASSLER †	NASA-ESMD	Yes
E-8 / N-154	MAURER	NSBRI	Yes
E-9	DUNGAN †	NASA-EB	Yes
E-13 / N-160	SPENCE †	NASA-ESMD	Yes
E-14	SPENCE †	NASA-ESMD	Yes
E-18	DILMANIAN	SUSB	Yes

† Did not check in with Guest Users Visitors Center for run.

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
B-44	**Durante, Marco**	**Ph.D, Principal Investigator**	**Universita di Napoli**
	Pignalosa, Diana	Guest Scientific Associate	University Federico II
B-52	**Sutherland/Gewirtz**	**Ph.D, Principal Investigator**	**BNL, Biology Dept./Univ. of Pennsylvania**
N-88	**Sutherland, Betsy**	Ph.D, Principal Investigator	**BNL, Biology Dept.**
N-89	**Held, Kathryn**	**Ph.D, Principal Investigator**	**Massachusetts General Hospital**
	Kumaraswamy, Deepak	Guest Scientific Associate	Massachusetts General Hospital
	Magpayo, Nicole	Guest Scientific Associate	Massachusetts General Hospital
N-103	**Barcellos-Hoff, Mary Helen**	**Ph.D, Principal Investigator**	**Lawrence Berkeley National Laboratory**
	Groesser, Torsten	Guest Research Associate	Lawrence Berkeley National Laboratory
	Kronenberg, Amy	Guest Scientist	Lawrence Berkeley National Laboratory
	Rydberg, Bjorn E.	Guest Scientist	Lawrence Berkeley National Laboratory
N-115	**Bacher, Jeffery**	**Ph.D, Principal Investigator**	**Promega Corporation**
N-128	**Blakely, Eleanor**	**Ph.D, Principal Investigator**	**Lawrence Bereley National Laboratory**
N-134	**Chen, David**	**Ph.D, Principal Investigator**	**University of Texas Southwestern**
	Aroumougame, Asaithamby	Guest Scientist	University of Texas Southwestern
	Gonzalez, Oscar Ruben	Guest Research Assistant	University of Texas Southwestern
N-146	**Wu, Honglu**	**Ph.D, Principal Investigator**	**NASA - Johnson Space Center**
	Casey, Rachael	Guest Scientist	Universities Space Research Association
	Zhang, Ye	Guest Scientist	University of Houston
N-153	**Story/Minna**	**Ph.D, Principal Investigator**	**University of Texas Southwestern**
	Delgado, Oliver	Guest Jr Research Associate	University of Texas Southwestern
	Perez, Vanessa	Guest Scientific Associate	University of Texas Southwestern
	Peyton, Michael Jess	Guest Scientist	University of Texas Southwestern
N-167	**Burma, Sandeep**	**Ph.D, Principal Investigator**	**University of Texas Medical Branch**
N-172	**Berkowitz, Dan**	**Ph.D, Principal Investigator**	**John Hopkins University**
	Soucy, Kevin Gilbert	Guest Jr Research Associate	Johns Hopkins University
N-173	**Geard, Charles**	**Ph.D, Principal Investigator**	**Columbia University**
	Grabham, Peter William	Guest Scientist	Columbia University
	Hu, Burong	Guest Research Associate	Columbia Nevis Lab
N-176	**Cucinotta, Francis**	**Ph.D, Principal Investigator**	**NASA - Johnson Space Center**
	Rhone, Jordan	Guest Scientific Associate	NASA - Johnson Space Center
	Anderson, Jennifer Anne	Guest Scientific Associate	University of Oxford

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
N-176 (cont.)	**Cucinotta, Francis**	**Ph.D, Principal Investigator**	**NASA- Johnson Space Center**
	George, Kerry Ann	Guest Scientific Associate	Wyle Laboratories at Houston
	Pluth, Janice Marie	Guest Scientist	Lawrence Berkeley National Laboratory
	Huff, Janice Lillian	Guest Scientist	Universities Space Research Association
	Wang, Huichen	Guest Scientist	Temple University
N-177	**Morgan, William**	**Ph.D, Principal Investigator**	**University of Maryland School of Medicine**
	Aypar, Umut	Guest Research Assistant	University of Maryland
	Goetz, Wilfried	Guest Scientific Associate	University of Maryland
N-185	**Sutherland, Betsy**	**Ph.D, Principal Investigator**	BNL, Biology Dept.
N-186	**Shay, Jerry**	**Ph.D, Principal Investigator**	University of Texas Southwestern
N-192	**Engleward, Bevin**	**Ph.D, Principal Investigator**	Massachusetts Institute of Technology
	Kiraly, Orsolya	Guest Scientist	Massachusetts Institute of Technology
	Olipitz, Werner	Guest Research Associate	Massachusetts Institute of Technology
N-196	**Azzam, Edouard Iskandar**	**Ph.D, Principal Investigator**	**University of Medicine and Dentistry of NJ**
	Autsavapromporn, Narongchai	Guest Jr Research Associate	University of Medicine and Dentistry of NJ
	de Toledo, Sonia Maria	Guest Scientist	University of Medicine and Dentistry of NJ
	Li, Min	Guest Research Associate	University of Medicine and Dentistry of NJ
	Yang, Zhi	Guest Research Associate	University of Medicine and Dentistry of NJ
	Zhang, Jie	Guest Jr Research Associate	University of Medicine and Dentistry of NJ
N-197	**Fornace Jr., Albert**	**Ph.D, Principal Investigator**	**Georgetown University**
	Datta, Kamal	Guest Research Associate	Georgetown University
	Doiron, Kathyrn E	Guest Scientific Associate	Georgetown University
	Trani, Daniela	Guest Research Associate	Georgetown University
N-203	**Britten, Richard Antony**	**Guest Scientist**	**Eastern Virginia Medical School**
	Johnson, Angela	Guest Scientific Associate	Eastern Virginia Medical School
	Mitchell, Shamina	Guest Jr Research Associate	Eastern Virginia Medical School
	Rutledge, Robert	Guest Scientific Associate	NASA - Johnson Space Center
	Singletary, Sylvia J	Guest Scientist	Eastern Virginia Medical School
N-204	**Amundson, Sally A.**	**Ph.D, Principal Investigator**	**Columbia University**
	Mezentsev, Alexandre	Guest Scientist	Columbia University

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
N-207	**Belli, Mauro**	**Ph.D, Principal Investigator**	**Instituto Superiore di Sanita (ISS)**
	Sorrentino, Eugenio	Guest Scientific Associate	Instituto Superiore di Sanita (ISS)
N-208	**Chen, David**	**Ph.D, Principal Investigator**	**University of Texas Southwestern Medical Center @ Dallas**
	Ahn, Haram	Guest Jr Research Associate	University of Texas Southwestern
	Farnbauch, Laure	Guest Scientific Associate	University of Texas Southwestern
	Zhang, Shichuan	Guest Research Associate	University of Texas Southwestern
N-209	**Wang, Hongyan**	**Guest Scientific Associate**	**Thomas Jefferson University**
N-211	**Rithidech, Kanokporn**	**Ph.D, Principal Investigator**	**SUNY at Stony Brook**
	Louise Honikel	Guest Scientific Associate	SUNY at Stony Brook
N-212	**Smilenov, Lubomir**	**Guest Scientist**	**Columbia University, Nevis Laboratories**
	Templin, Thomas	Guest Research Associate	Columbia University
N-213	**Trafov, Stefan**	**Ph.D, Principal Investigator**	**Brookhaven National Laboratory**
N-214	**Baulch, Janet**	**Ph.D, Principal Investigator**	**University of Maryland**
E-4	**Hassler, Donald**	**Ph.D, Principal Investigator**	**Southwest Research Institute**
	Bokman, Ryan Lloyd	Guest Scientific Associate	Southwest Research Institute
	Ganley, Vincent	Guest Scientific Associate	Southwest Research Institute
	Kortmann, Onno	Guest Jr Research Associate	Christian-Albrechts
	Martin, Cesar	Guest Research Associate	University of Kiel
	Tyler, Yvette	Guest Scientific Associate	Southwest Research Institute
	Weigle, Gerald Edwin	Guest Jr Research Associate	Southwest Research Institute
E-8/N-154	**Maurer, Richard Hornsby**	**Ph.D, Principal Investigator**	**Johns Hopkins University**
	Goldsten, John	Guest Research Assistant	Johns Hopkins University
	Grey, Matthew	Guest Research Assistant	Johns Hopkins University
	Lawrence, David	Guest Scientist	Johns Hopkins University
	Maurer, Richard Hornsby	Guest Scientist	Johns Hopkins University
	Roth, David Richard	Guest Scientist	Johns Hopkins University
	Zeitlin, Cary	Guest Scientist	Lawrence Berkeley National Laboratory
E-9	**Dungan, Larry**	**Ph.D, Principal Investigator**	**NASA - Johnson Space Center**
	Kouba, Coy	Guest Scientist	NASA - Johnson Space Center
	Nguyen, Kyson Van	Guest Scientific Associate	NASA - Johnson Space Center
	Toy, Stephanie	Guest Scientific Associate	Muniz Engineering, Inc
E-13 / N-160	**Spence, Harlan**	**Ph.D, Principal Investigator**	**Boston University**
	George, Jeffrey	Guest Scientist	Aerospace Corporation

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
E-13 / N-160(cont.)	**Spence, Harlan**	**Ph.D, Principal Investigator**	**Boston University**
	Mazur, Joseph Edward	Guest Scientist	Aerospace Corporation
	Sorensen, Gerrit	Guest Scientific Associate	Aerospace Corporation
	Larsen, Brian	Guest Scientist	Boston University
	Case, Anthony William	Guest Research Assistant	Boston University
	Golightly, Michael Joseph	Guest Scientific Associate	Boston University
	Heine, Thomas	Guest Research Assistant	Boston University
	Hoxie, Vaughn	Guest Jr Research Associate	University of Colorado at Boulder
E-14	**Spence, Harlan**	**Ph.D, Principal Investigator**	**Boston University**
E-18	**Dilmanian, Avraham**	**Ph.D, Principal Investigator**	**Brookhaven National Laboratory**
	Meek, Allen	Guest Scientist	SUNY Stony Brook
	Rockwell, Andrew	Scientist	Brookhaven National Laboratory
SUMMER SCHOOL	Weil, Michael Michaelis	Guest Scientist	Colorado State University
SUMMER SCHOOL	Nelson, Gregory	Guest Scientist	Loma Linda University Medical Center
SUMMER SCHOOL	Benton, Eric Rene	Guest Scientist	Eril Research, Inc.
SUMMER SCHOOL	Heilbronn, Lawrence Harvey	Guest Scientist	Lawrence Berkeley National Laboratory
SUMMER SCHOOL	Blakely, Eleanor Alice	Guest Scientist	Lawrence Berkeley National Laboratory
SUMMER SCHOOL	Boice, John	Guest Scientist	Vanderbilt University
SUMMER SCHOOL	Borak, Thomas B	Guest Scientist	Colorado State University
SUMMER SCHOOL	Bourdeau-Heller, Jeanne	Guest Research Associate	Promega Corporation
SUMMER SCHOOL	Buonanno, Manuela	Guest Research Assistant	University of Medicine and Dentistry of NJ
SUMMER SCHOOL	Camacho, Cristel Vanessa	Guest Jr Research Associate	University of Texas Southwestern
SUMMER SCHOOL	Huang, Lei	Guest Scientist	Loma Linda University
SUMMER SCHOOL	Huber, Aubrey	Guest Research Assistant	University of Regina
SUMMER SCHOOL	Laiakis, Evagelia	Guest Scientist	Georgetown University
SUMMER SCHOOL	Mariotti, Luca	Guest Research Assistant	University of Pavia
SUMMER SCHOOL	Molinelli, Silvia	Guest Scientific Associate	Fondazione CNAO
SUMMER SCHOOL	O'Neill, Patrick	Guest Scientist	NASA - Johnson Space Center
SUMMER SCHOOL	Papaioannou, Maria	Guest Research Associate	University of Duisburg-Essen
SUMMER SCHOOL	Park, Seongmi	Guest Research Associate	University of Texas Southwestern
SUMMER SCHOOL	Patel, Zarana	Guest Scientist	Universities Space Research Association
SUMMER SCHOOL	Ren, Qing	Guest Scientist	Thomas Jefferson University
SUMMER SCHOOL	Ren, Qing	Guest Scientist	Thomas Jefferson University

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
SUMMER SCHOOL	Rogers, Kellie	Guest Scientific Associate	Universities Space Research Association
SUMMER SCHOOL	Townsend, Lawrence W	Guest Scientist	University of Tennessee
SUMMER SCHOOL	Wilson, Barbara	Guest Scientist	Jackson State University
SUMMER SCHOOL	Yu, Hui	Guest Scientist	University of Texas Health Science Center at SA
SUMMER SCHOOL	Zahnreich, Sebastian	Guest Scientific Associate	GSI Darmstadt
SUMMER SCHOOL	Anderson, Carl	Scientist	Brookhaven National Laboratory
SUMMER SCHOOL	Azzam, Edouard Iskandar	Guest Scientist	University of Medicine and Dentistry of NJ
SUMMER SCHOOL	Bailey, Susan	Guest Scientist	Colorado State University
SUMMER SCHOOL	Barcellos-Hoff, Mary Helen	Guest Scientist	Lawrence Berkeley National Laboratory
SUMMER SCHOOL	Clark, Jonathan	Guest Scientist	National Space Biomedical Research Institute, Baylor College
SUMMER SCHOOL	Costes, Sylvain	Guest Scientist	Lawrence Berkeley National Laboratory
SUMMER SCHOOL	Cucinotta, Francis	Guest Scientist	NASA - Johnson Space Center
SUMMER SCHOOL	Durante, Marco	Guest Scientist	Universita di Napoli
SUMMER SCHOOL	Guida, Peter	Scientist	Brookhaven National Laboratory
SUMMER SCHOOL	Hall, Eric	Guest Scientist	Columbia University
SUMMER SCHOOL	Held, Kathryn	Guest Scientist	Massachusetts General Hospital
SUMMER SCHOOL	Kennedy, Ann	Guest Scientist	University of Pennsylvania, School of Medicine
SUMMER SCHOOL	Kronenberg, Amy	Guest Scientist	Lawrence Berkeley National Laboratory
SUMMER SCHOOL	Limoli, Charles	Guest Scientist	University of California @ Irvine
SUMMER SCHOOL	Lowenstein, Derek	C-AD Chair	Brookhaven National Laboratory
SUMMER SCHOOL	Rabin, Bernard	Guest Scientist	University of Maryland
SUMMER SCHOOL	Rusek, Adam	Scientist	Brookhaven National Laboratory
SUMMER SCHOOL	Setlow, Richard	Scientist Emeritis	Brookhaven National Laboratory
SUMMER SCHOOL	Shay, Jerry	Guest Scientist	University of Texas Southwestern
SUMMER SCHOOL	Sulzman, Frank	Guest Scientist	NASA - Johnson Space Center
SUMMER SCHOOL	Sutherland, Betsy	Scientist	Brookhaven National Laboratory
SUMMER SCHOOL	Williams, Jacqueline	Guest Scientist	University of Rochester Medical Center
NSRL	Guida Peter‡	Scientist	Brookhaven National Laboratory
NSRL	Tafrov, Stefan ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Keszenman, Deborah‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Pyatt, Beatrice ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Abele, William ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Sutherland, John ‡	Senior Scientist	Brookhaven National Laboratory

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
NSRL	Bennett, Paula ‡	Biology Associate I	Brookhaven National Laboratory
NSRL	Trunk, John ‡	Senior Technical Associate	Brookhaven National Laboratory
NSRL	Medvedeva, Natalia‡	Logistical Support, Scientist	Brookhaven National Laboratory
NSRL	Petry, Maryann‡	BLAF Manager	Brookhaven National Laboratory
NSRL	Jardine, James ‡	Laboratory Specialist	Brookhaven National Laboratory
NSRL	Sivertz, Michael‡	Scientist	Brookhaven National Laboratory
NSRL	Naidu, Mamta ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Kim, Angela ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Billups, Adele‡	Medical Associate	Brookhaven National Laboratory
NSRL	Thompson, Laura‡	Medical Associate	Brookhaven National Laboratory
NSRL	Forrette, Elise‡	Administrative Assistant	Brookhaven National Laboratory
NSRL	Bonti, Kerry‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Snyder, Deborah‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Reiszel, Corrine‡	BLAF Staff	Brookhaven National Laboratory
NSRL	Rusek, Adam‡	Scientist	Brookhaven National Laboratory

‡ BNL Personnel who participated in many different experiments throughout the run.

PARTICIPANT INSTITUTIONS

Universities (40)
Boston University
Christian-Albrechts
Colorado State University
Columbia University
Columbia University, Nevis Laboratories
Eastern Virginia Medical School
Georgetown University
Jackson State University
Johns Hopkins University
Loma Linda University
Loma Linda University Medical Center
Massachusetts Institute of Technology
National Space Biomedical Research Institute, Baylor College
Southwest Research Institute
SUNY at Stony Brook
Temple University
Thomas Jefferson University
University of Maryland
Universita di Napoli
Universities Space Research Association
University Federico II
University of Colorado at Boulder
University of Duisburg-Essen
University of Houston
University of Kiel
University of Maryland
University of Maryland School of Medicine
University of Medicine and Dentistry of New Jersey
University of Oxford
University of Pavia
University of Pennsylvania
University of Pennsylvania, School of Medicine
University of Regina
University of Rochester Medical Center
University of Tennessee
University of Texas Health Science Center at San Antonio
University of Texas Medical Branch
University of Texas Southwestern
University of Texas Southwestern Medical Center at Dallas
Vanderbilt University

National Laboratories/Institutions (3)
Brookhaven National Laboratory
Lawrence Berkeley National Laboratory
Wyle Laboratories at Houston

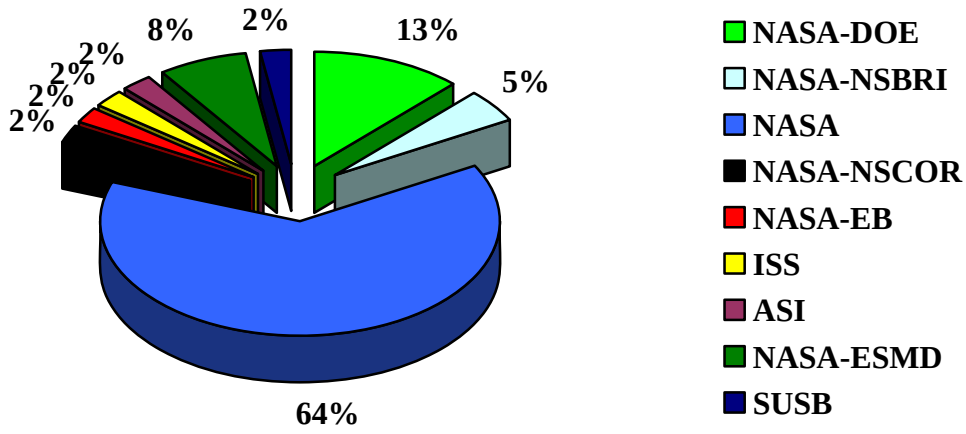
NASA Related Centers/Institutions (2)
NASA - Johnson Space Center
NASA - Loma Linda U. Medical School

Private Institutions(1)
Massachusetts General Hospital

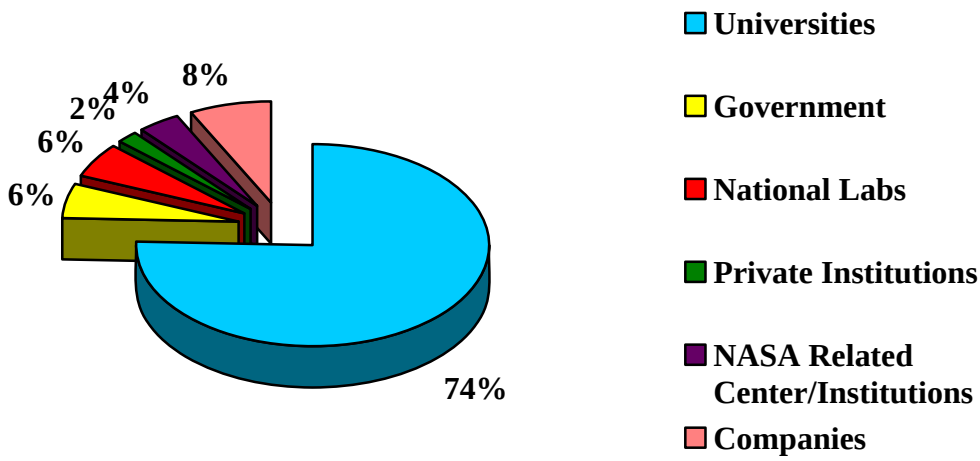
Government (3)
Instituto Superiore di Sanita (ISS)
GSI Darmstadt
Fondazione CNAO

Company (4)
Aerospace Corporation
Eril Research, Inc.
Promega Corporation
Muniz Engineering, Inc

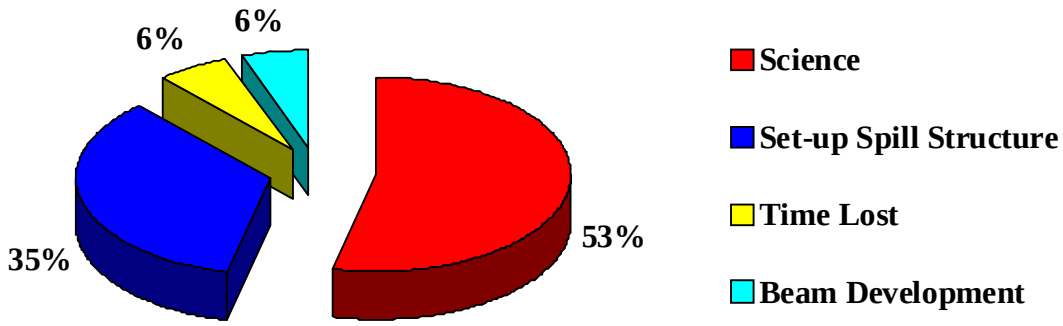
RESEARCH PROJECT SPONSORS



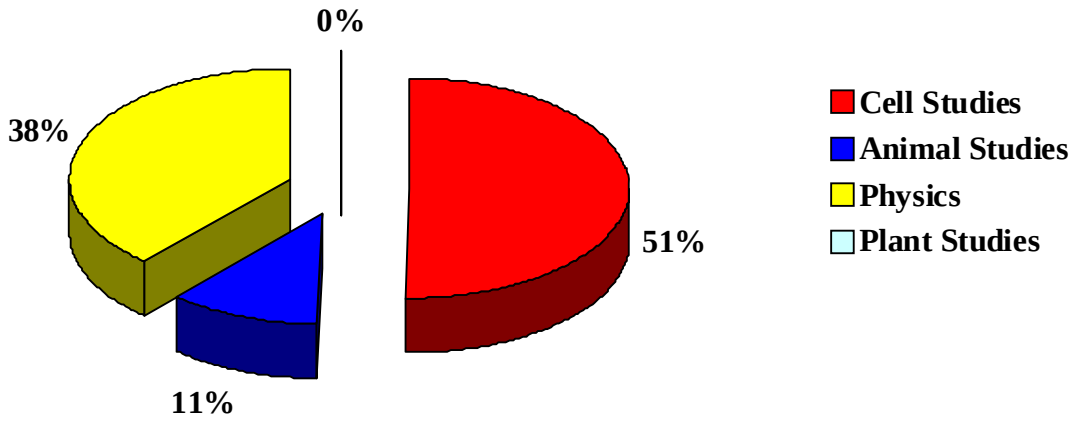
INSTITUTION STATISTICS



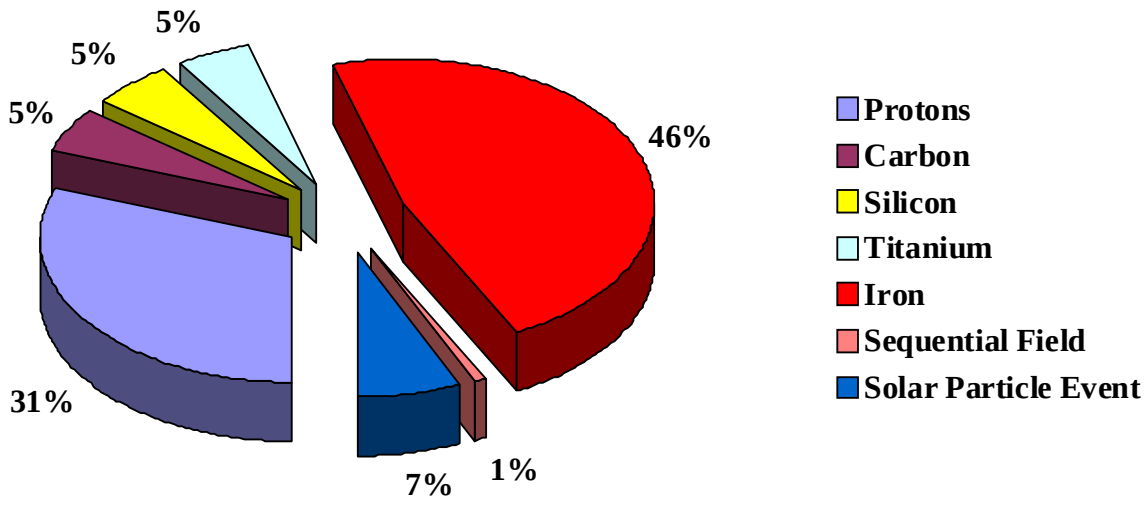
TOTAL RUN-TIME STATISTICS



SCIENCE STUDIES STATISTICS



ION SPECIES AND ENERGY (MeV/n) DISTRIBUTION



RUN TIME DESCRIPTION (hours)

NSRL-08B	ION SPECIES AND ENERGIES (MeV/nucleon)										
	H						C			Si	
	100	150	200	250	600	1000	200	250	290	400	1000
Machine Set-Up	3:31:50	6:08:38	2:41:48	1:38:21	1:28:21	20:44:25	1:15:30	2:38:23	2:26:27	1:24:23	5:28:01
Development	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	2:05:58	0:00:00	0:00:00	0:00:00	0:00:00	2:19:56
SCIENCE											
In Vitro	0:00:00	9:50:48	0:00:00	2:45:38	2:28:48	16:34:29	0:00:00	0:00:00	0:00:00	0:00:00	3:20:53
In Vivo	2:38:46	0:00:00	0:00:00	0:00:00	0:00:00	4:53:38	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Others	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00
Physics	3:17:59	0:00:00	4:32:29	0:00:00	0:00:00	10:17:36	2:07:09	4:26:44	4:06:38	2:22:07	2:56:35
NSRL Time Lost	0:00:00	6:30:00	0:00:00	0:00:00	1:00:00	1:26:00	0:00:00	0:00:00	0:00:00	0:00:00	0:35:00
Totals	**9:28:35**	**22:29:26**	**7:14:17**	**4:23:59**	**4:57:09**	**56:02:06**	**3:22:39**	**7:05:07**	**6:33:05**	**3:46:30**	**14:40:25**

(continued next page)

RUN TIME DESCRIPTION (hours) (continued from previous page)

NSRL-08B	ION SPECIES AND ENERGIES (MeV/nucleon)									
	Ti			p/Fe	Fe				SPE	Total
	240	380	1000	1000	300	500	600	1000	N/A	
Machine Set-Up	0:48:55	0:19:59	3:30:35	1:05:27	0:32:29	1:48:30	4:26:20	49:49:45	7:41:53	**119:30:00**
Development	0:00:00	0:00:00	2:23:56	0:00:00	0:00:00	0:00:00	0:00:00	12:11:21	0:00:00	**19:01:11**
SCIENCE										
In Vitro	1:22:22	0:33:39	2:05:01	1:50:13	0:54:43	0:00:00	7:28:31	27:22:39	15:06:50	**91:44:34**
In Vivo	0:00:00	0:00:00	1:25:41	0:00:00	0:00:00	0:00:00	0:00:00	11:23:07	0:00:00	**20:21:12**
Others	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	**0:00:00**
Physics	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	3:02:44	0:00:00	32:57:51	0:00:00	**70:07:52**
NSRL Time Lost	0:25:00	0:25:00	3:00:00	0:00:00	0:00:00	0:00:00	0:22:00	7:53:00	0:00:00	**21:36:00**
Totals	**2:36:17**	**1:18:38**	**12:25:13**	**2:55:40**	**1:27:12**	**4:51:14**	**12:16:51**	**141:37:43**	**22:48:43**	**342:20:49**

Total hours of science is 184:03:32.
Note: Hours of Set-Up and Wrap-Up have been combined into a single category since much of the work done at the end of each day involves preparations for the next day's exposures.

BEAM CHARACTERISTICS

Ion	H						C			Si	
Energy (MeV/n)											
Planned	**100**	**150**	**200**	**250**	**600**	**1000**	**200**	**250**	**290**	**400**	**1000**
Extracted	104.9	154.4	204.5	250	600	1000	203	250	290	400	993.6
On Target	104.9	154.4	204.5	250*	600*	1000*	203	250	290*	400*	993.6
Fluence (particles/cm^2/sec)											
Maximum on target	3.1E+07	5.2E+07	1.0E+02	1.1E+08	1.7E+08	2.5E+08	1.4E+06	1.6E+06	1.0E+02	1.0E+02	1.0E+06
Minimum on target	3.1E+07	2.1E+06	1.0E+02	1.4E+07	8.6E+05	5.0E+06	0.7E+06	0.8E+06	1.0E+02	1.0E+02	5.1E+03
Spill Period (sec)	4	4	4	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300	300	300	300
Particles/spill											
Maximum	8.0E+10	1.3E+11	1.0E+02	2.9E+11	4.4E+11	6.4E+11	3.6E+09	4.0E+09	1.0E+02	1.0E+02	2.6E+09
Minimum	8.0E+10	5.3E+09	1.0E+02	3.6E+10	2.2E+09	1.3E+10	1.8E+09	2.0E+09	1.0E+02	1.0E+02	1.3E+07
Beam Cut Off Accuracy	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Actual LET on Target (keV/µm)	0.710	0.538	0.446	0.394*	0.258*	0.223*	16.08	14.13	12.97*	59.67*	43.66
Max. Dose Rate (Gy/min)											
20 cm x 20 cm	0.3	2.0	1.0E-05	0.4	0.4	1.5	0.1	0.1	1.0E-05	1.0E-05	1.5
Total Dose (Gy)											
Maximum	2.0	2.5	N/A**	4.0	4.0	5.0	2.0	2.0	N/A**	N/A**	4.0
Minimum	0.5	0.1	N/A**	0.5	0.02	0.1	1.0	1.0	N/A**	N/A**	0.02

* No Bragg results are available for H running at 250, 600 or 1000 MeV, C at 290 MeV/n , Si at 400 MeV/n, or Fe at 500 MeV/nucleon. For these energies, only calculated LET is quoted.

(continued next page)

BEAM CHARACTERISTICS (continued from previous page)

Ion	Ti			p/Fe	Fe				SPE
Energy (MeV/n)									
Planned	**240**	**380**	**1000**	**1000**	**300**	**500**	**600**	**1000**	N/A**
Extracted	240.4	376.0	985.7	1000	297.9	500	593.9	966.4	N/A**
On Target	240.4	376.0	985.7	1000*	297.9	500*	593.9	966.4	N/A**
Fluence (particles/cm^2/sec)									
Maximum on target	1.2E+05	1.5E+05	2.1E+05	N/A**	7.0E+04	2.0E+03	2.6E+05	1.5E+06	N/A**
Minimum on target	1.4E+04	1.8E+04	2.6E+04	N/A**	1.2E+04	2.0E+03	4.3E+04	7.4E+03	N/A**
Spill Period (sec)	4	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300	300
Particles/spill									
Maximum	2.9E+08	3.8E+08	5.3E+08	N/A**	1.8E+08	2.0E+03	6.6E+08	3.8E+09	N/A**
Minimum	3.7E+07	4.7E+07	6.6E+07	N/A**	3.0E+07	2.0E+03	1.1E+08	1.9E+07	N/A**
Beam Cut Off Accuracy	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Actual LET on Target (keV/µm)	194.5	151.9	108	0.223*/151	239.8	186.3	174.2	151.5	N/A**
Max. Dose Rate (Gy/min)									
20 cm x 20 cm	1.5	1.5	1.0	0.2	1.0	N/A**	1.5	3.0	N/A**
Total Dose (Gy)									
Maximum	2.0	2.0	2.0	3.0	1.5	N/A**	4.0	20	N/A**
Minimum	0.25	0.25	0.25	0.05	0.25	N/A**	0.02	0.01	N/A**

For beams and energies employed for physics experiments only, we did not always make measure of dose rates or integrated doses. For these beams, we indicate "N/A**". Similarly, the SPE was comprised of many differing beams, each with different characteristics.

DOSIMETRY AND BEAM DEVELOPMENTS

New Beams

During NSRL 08B the following beams were developed and used for the first time:

Protons at 600 MeV,
Carbon at 250 MeV/n,
Silicon at 400 MeV/n, and
Titanium at 240 and 380 MeV/n.

RUN DATES

Ion	Energy	Scheduled Start	Scheduled End	Actual Start	Actual End
Protons	50-1000	5/15/08 7:00	5/15/08 18:00	5/15/08 7:00	5/15/08 17:09
Iron	300-1000	5/16/08 7:00	5/19/08 18:00	5/16/08 7:00	5/19/08 17:34
Protons	50-1000	5/20/08 7:00	5/20/08 21:00	5/20/08 7:00	5/20/08 22:10
Iron	300-1000	5/21/08 7:00	5/21/08 20:00	5/21/08 7:00	5/21/08 15:37
Protons	50-1000	5/22/08 7:00	5/22/08 21:00	5/22/08 7:00	5/22/08 16:25
Iron	300-1000	5/27/08 7:00	5/28/08 16:30	5/27/08 7:00	5/28/08 16:32
Protons	50-1000	5/29/08 7:00	5/29/08 16:30	5/29/08 7:00	5/29/08 17:02
Iron	300-1000	5/30/08 7:00	5/30/08 17:30	5/30/08 7:00	5/30/08 12:46
Protons	50-1000	6/02/08 7:00	6/02/08 19:00	6/02/08 7:00	6/02/08 20:18
Iron	300-1000	6/03/08 7:00	6/03/08 16:00	6/03/08 7:00	6/03/08 13:49
Silicon	400-1000	6/04/08 7:00	6/05/08 15:30	6/04/08 7:00	6/05/08 12:38
Iron	300-1000	6/06/08 7:00	6/06/08 20:00	6/06/08 7:00	6/06/08 16:30
Titanium	240-1000	6/09/08 7:00	6/09/08 19:00	6/09/08 7:00	6/09/08 18:05
Iron	300-1000	6/10/08 7:00	6/11/08 20:30	6/10/08 7:00	6/11/08 20:55
Protons	50-1000	6/12/08 7:00	6/12/08 18:00	6/12/08 7:00	6/12/08 18:30
Iron	300-1000	6/13/08 7:00	6/13/08 19:00	6/13/08 7:00	6/13/08 16:35
Protons	50-1000	6/14/08 7:00	6/14/08 19:30	6/14/08 7:00	6/14/08 17:20
Iron	300-1000	6/16/08 7:00	6/16/08 19:30	6/16/08 7:00	6/16/08 15:51
Protons	50-1000	6/17/08 7:00	6/17/08 19:30	6/17/08 7:00	6/17/08 17:41
Iron	300-1000	6/18/08 7:00	6/18/08 20:30	6/18/08 7:00	6/18/08 17:40
p/Fe	1000	6/19/08 7:00	6/19/08 10:00	6/19/08 7:00	6/19/08 16:05
Protons	50-1000	6/19/08 10:00	6/19/08 17:30	6/19/08 16:05	6/19/08 19:01
Carbon	203-290	6/19/08 17:30	6/19/08 19:30	6/19/08 19:01	6/20/08 1:15
Iron	300-1000	6/20/08 7:00	6/20/08 19:00	6/20/08 7:00	6/20/08 12:00
Carbon	200-290	6/20/08 19:00	6/20/08 23:00	6/20/08 7:00	6/20/08 16:26

EXPERIMENTERS AND RUN STATISTICS

Note: Entries in RED indicate time approved by SACRR but not run during this Run 08B.
Entries marked with † indicate time that was deferred from previous running periods.
The entry marked with ‡ was arranged with F. Cucinotta.
Doses measured in "Hd" refer to 1 Held = 100 particles per cm^2.

Proposal ID	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
B-44	Durante†	Iron	1000	4:00:00	0:45:00	100	50-200	14
B-44	Durante†	Protons	1000	5:00:00	5:10:51	100	50-200	97
B-52	Sutherland/Gewirtz	Iron	1000	2:30:00	0:33:56	20	5-300	5
N-88	Sutherland	p/Fe	1000	3:00:00	1:50:13	20	5-300	20
N-88	Sutherland	SPE	50-100	9:00:00	15:06:50	1-60	5-300	90
N-88	Sutherland	Protons	1000	4:00:00	2:01:54	.00001-50	0.0001-300	9
N-89	Held	Iron	1000	7:00:00	3:02:32	1Hd/sp-200	2Hd-200R	500
N-89	Held	Protons	1000	6:12:00	3:25:03	1Hd/sp-10	2Hd-200R	27
N-89	Held	Titanium	1000	6:18:00	0:00:00			
N-97	Kronenberg†	Protons	1000	18:00:00	3:19:31	70	300-500	60
N-103	Barcellos-Hoff	Iron	1000	15:00:00	2:54:54	100	200	46
N-115	Bacher	Iron	1000	0:00:00	0:58:28	20	10-200	24
N-115	Bacher	Protons	1000	1:00:00	0:57:18	20	10-200	20
N-128	Blakely	Iron	1000	10:12:00	8:16:31	50-200	50-200	172
N-134	Chen	Iron	1000	6:30:00	5:26:45	100	100	99
N-134	Chen	Silicon	1000	4:00:00	4:12:04	100	100	84
N-134	Chen	Silicon	300	4:00:00	0:00:00			
N-146	Wu	Iron	600	6:00:00	1:44:27	140	2-400	160
N-146	Wu	Protons	600	0:00:00	2:28:48	40	2-400	120
N-146	Wu	Protons	1000	2:00:00	0:00:00			
N-146	Wu	Titanium	1000	3:00:00	0:00:00			
N-146	Wu	Silicon	1000	0:00:00	0:58:43	10-150	2-400	34
N-167	Burma	Iron	1000	2:00:00	2:01:58	50-150	25-400	46
N-167	Burma	Protons	250	2:00:00	2:45:38	40	50-400	50
N-172	Berkowitz	Iron	1000	2:30:00	1:17:45	100-200	100-300	30
N-173	Geard	Iron	1000	3:15:00	0:30:08	50-100	40-320	16
N-173	Geard	Protons	1000	6:00:00	1:01:07	30	20-320	24
N-176	Cucinotta	Iron	1000	7:00:00	1:43:03	7.5-100	7.5-100	50

Proposal ID	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
N-176	Cucinotta	Protons	150	0:00:00	3:41:17	20-200	10-250	31
N-176	Cucinotta	Protons	1000	4:00:00	0:00:00			
N-176	Cucinotta	Titanium	240	0:00:00	1:22:22	25-150	25-200	50
N-176	Cucinotta	Titanium	380	0:00:00	0:33:39	25-150	25-200	25
N-176	Cucinotta	Titanium	1000	0:00:00	1:23:18	100	25-200	50
N-176	Cucinotta	Silicon	300	3:30:00	0:00:00			
N-177	Morgan	Iron	1000	6:00:00	1:55:52	10-20	10-100	48
N-185	Sutherland	Iron	1000	1:30:00	0:33:56	20	5-300	5
N-185	Sutherland	Protons	1000	1:30:00	2:01:54	.00001-50	0.0001-300	8
N-186	Shay†	Iron	1000	2:00:00	0:43:10	50	200	20
N-186	Shay†	Protons	1000	2:00:00	0:39:19	50	200	16
N-192	Engleward	Iron	1000	1:30:00	1:20:00	100	100	28
N-196	Azzam	Iron	1000	6:30:00	4:33:56	5-100	1-200	103
N-197	Fornace	Iron	1000	1:42:00	2:52:40	50-200	400-800	88
N-197	Fornace	Protons	1000	2:36:00	1:34:07	20	476	30
N-203	Britten	Iron	1000	4:00:00	1:29:36	50	60-200	48
N-203	Britten	Titanium	1000	4:00:00	1:25:41	50	60-200	48
N-204	Amundson	Iron	300	2:00:00	0:54:43	100	25-150	25
N-207	Belli	Iron	600	5:00:00	5:44:04	100	25-150	101
N-209	Wang‡	Iron	1000	0:30:00	0:38:41	300	1000-2000	6
N-211	Rithidech	Protons	100	3:06:00	2:38:46	1	100	10
N-212	Smilenov	Iron	1000	1:30:00	0:57:54	10-100	10-200	5
N-212	Smilenov	Protons	1000	1:30:00	1:17:03	10-50	10-200	5
N-213	Tafrov	Iron	1000	1:00:00	0:25:00	50	50	12
N-213	Tafrov	Titanium	1000	1:00:00	0:41:43	50	50	100
N-213	Tafrov	Silicon	300	2:00:00	0:00:00			
N-213	Tafrov	Protons	200	1:00:00	0:00:00			
N-214	Baulch	Protons	150	6:00:00	6:09:31	2	50-100	54
E-4	Hassler†	Carbon	290	2:00:00	4:06:38	low	low	1
E-4	Hassler†	Iron	1000	5:00:00	7:54:53	low	low	1
E-4	Hassler†	Protons	1000	5:00:00	6:10:58	low	low	1
E-8	Maurer	Iron	1000	16:00:00	16:45:03	low	low	1
E-9	Dungan	Iron	500	0:00:00	3:02:44	low	low	1
E-9	Dungan	Iron	1000	6:00:00	4:01:56	low	low	1
E-9	Dungan	Protons	100	0:00:00	3:17:59	low	low	1

Proposal ID	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Number of Samples
E-9	Dungan	Protons	1000	6:00:00	4:06:38	low	low	1
E-13	Spence	Silicon	400	0:00:00	2:22:07	low	low	1
E-13	Spence	Silicon	1000	5:38:00	2:56:35	low	low	1
E-14	Spence	Protons	200	1:42:00	4:32:29	low	low	2
E-18	Dilmanian	Carbon	203	2:00:00	2:07:09	100	100-200	1
E-18	Dilmanian	Carbon	250	4:00:00	4:26:44	100	100-200	1

Total hours of science approved to run in NSRL Run 08B was 269:48.

Total number of hours of science that ran in Run 08B is 184:04.