



NSRL-08A RUN

March - May 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>

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
PROJECTS REVIEWED BY THE BNL SCIENTIFIC ADVISORY COMMITTEE IN RADIATION RESEARCH	4
PARTICIPANT INSTITUTIONS.....	13
RESEARCH PROJECT SPONSORS	14
INSTITUTION STATISTICS.....	14
TOTAL RUN-TIME STATISTICS	15
SCIENCE STUDIES STATISTICS.....	15
ION SPECIES AND ENERGY (MeV/N) DISTRIBUTION	16
RUN TIME DESCRIPTION (HOURS).....	17
BEAM CHARACTERISTICS	19
DOSIMETRY AND BEAM DEVELOPMENTS	20
RUN DATES.....	21
EXPERIMENTERS AND RUN STATISTICS.....	22

EXECUTIVE SUMMARY

During the spring 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 fifteenth NSRL scientific run (NSRL-08A) sponsored by NASA's Space Radiation Health Program (SRHP) heavy ion radiobiology research program at BNL.

A total of forty-seven proposals were approved for participation in the NSRL-08A run. Of the 47 approved, 45 proposals took part and 2 proposals were withdrawn or deferred. One hundred and eighty one users from forty one institutions were represented, 40 from the United States and one from Italy. More than 7000 biological samples were exposed at the NSRL beam line, employing 344:04 hours of beam time (72:29:41 hours for in vivo studies, 192:46:02 hours for in vitro studies, and 79:08:29 hours for physics experiments) delivered in a six week period. In addition, 47:09:38 hours were used for dosimetry and beam development. Machine set-up and wrap-up took a total of 185:24:00 hours. Accelerator problems with the NSRL beam accounted for 49:58:00 hours lost. This gave a total NSRL usage time of 626:35:44 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-08A, Booster provided protons (50, 100, 150, 200, 250, 500, and 1000 MeV), carbon (300, 600 and 1000 MeV/n), silicon (300 and 1000 MeV/n), titanium (150, 500 and 1000), iron (140, 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 which we provided for the first time this run. 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 7.5 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 2×10^2 (min) to 1.5×10^{11} (max). Square beam spots as big as $20 \times 20 \text{ cm}^2$ and as small as $1 \times 1 \text{ cm}^2$ were employed for biology and physics experiments.

Tandem-Booster set-up started on 25 February 2008 with the transport and circulation of Silicon beams at the NSRL complex. Beam was tuned into the target cave on 3 March 2008 and 300 MeV/n Si beams were available for tuning at 7:00 AM 3 March 2008. NSRL-08A officially ended at 1:01 PM 14 May 2008.

Projects Reviewed by the BNL Scientific Advisory Committee in Radiation Research

Proposal	PI	Sponsor	NSRL-08A Participation
B-7	RABIN	NASA	Yes
B-10	CHANG	NASA	Yes
B-52	SUTHERLAND/GEWIRTZ†	NSBRI	Yes
B-67	BLAKELY	NASA	Yes
N-88	SUTHERLAND	NASA	Yes
N-89	HELD	NASA	Yes
N-90	BAILEY	NASA	Yes
N-97	KRONENBERG	NASA	Yes
N-102	HALL†	NASA	Yes
N-103	BARCELLOSHOFF	NASA-NSCOR	Yes
N-108	OBENAUŠ†	NASA	Yes
N-115	BACHER	NASA	Yes
N-129	LIMOLI	NASA	Yes
N-134	CHEN †	NASA	Yes
N-135	PLUTH	NASA	Yes
N-153	MINNA†/STORY	NASA-DOE	Yes
N-155	RABER	NASA	Yes
N-157	SCHIESTL†	NASA	No
N-159	HALL†	NASA	Yes
N-163	WIESE	NASA	Yes
N-164	YU	NASA	Yes
N-166	KENNEDY	NSBRI	Yes
N-167	BURMA	NASA	Yes
N-171	DYNLACHT	NASA	Yes
N-172	BERKOWITZ†	NASA	No
N-173	GEARD†	NASA	Yes
N-174	WARE	NASA	Yes
N-176	CUCINOTTA	NASA-DOE	Yes
N-177	MORGAN†	NASA	Yes
N-185	SUTHERLAND	NASA-DOE	Yes
N-188	GREEN	NASA	Yes
N-190	IANZINI	NASA	Yes
N-194	KUCIK	NSBRI	Yes

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

Proposal	PI	Sponsor	NSRL-08A Participation
N-196	AZZAM	NASA	Yes
N-197	FORNACE†	NASA	Yes
N-198	GLOBUS	NASA	Yes
N-200	HLATKY†	NASA	Yes
N-203	BRITTEN	NASA	Yes
N-204	AMUNDSON	NASA-DOE	Yes
N-207	BELLI†	ISS	Yes
N-209	WANG	NASA	Yes
N-210	ZHI HU†	NASA	Yes
E-2	BRABY †	NASA	Yes
E-3	CHRISTIAN	PIGGYBACK	Yes
E-8/N-154	MAURER	NSBRI	Yes
E-9	KOUBA †	NASA-EB	Yes
E-11/N-156	PISACANE	NSBRI	Yes

†Not Present During Actual Run

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Name	Guest Title	Employer
B-7	Rabin, Bernard Carrhill, Kirsty Cheng, Vivian Shukitt-Hale, Barbara	Ph.D, Principal Investigator Guest Research Associate Guest Jr Research Associate Guest Scientist	University of Maryland University of Maryland University of Maryland Tufts University
B-10	Chang, Polly Yee Bakke, James Wang, Abraham	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	SRI International SRI International SRI International
B-52 B-67	Sutherland/Gewirtz Blakley, Elenor Bjornstad, Kathleen Arnelle Jalbert, Llewellyn Rosen, Christopher James	Ph.D, Principal Investigator Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant Guest Scientific Associate	BNL, Biology Dept./Univ. of Pennsylvania Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-88	Sutherland, Besty	Ph.D, Principal Investigator	BNL, Biology Dept.
N-89	Held, Kathryn Kumaraswamy, Deepak Magpayo, Nicole Yang, Hongying	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate Guest Scientist	Massachusetts General Hospital Massachusetts General Hospital Massachusetts General Hospital Massachusetts General Hospital
N-90	Bailey, Susan M	Ph.D, Principal Investigator	Colorado State University
N-97	Kronenberg, Amy Dan, Cristian Gauny, Stacey Kwoh, Ely	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate Guest Scientific Associate	Lawrence Berkeley National Laboratory Oregon Health & Science University Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-102	Hall, Eric David, Janice Maerki, Jennifer Smilenov, Lubomir	Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant Guest Scientist	Columbia University Columbia University Columbia University Columbia University, Nevis Laboratories

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
N-103	Barcellos-Hoff, Mary Helen Costes, Sylvain Vincent Groesser, Torsten Kronenberg, Amy Mukhopadhyay, Rituparna Ravani, Shraddha Rydberg, Bjorn E.	Ph.D, Principal Investigator Guest Scientist Guest Research Associate Guest Scientist Guest Research Associate Guest Scientific Associate Guest Scientist	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-108	Obenaus, Andre Smith, Anna Lucille Jones, Tamako	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	Loma Linda University Loma Linda University NASA - Loma Linda University Medical School
N-115	Bacher, Jeffery Bourdeau-Heller, Jeanne Grochowski, Emily Halberg, Richard Brott	Ph.D, Principal Investigator Guest Research Associate Guest Research Assistant Guest Scientist	Promega Corporation Promega Corporation Promega Corporation Promega Corporation
N-129	Limoli, Charles Suarez, Vannina Giedzinski, Erich	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate	University of California @ Irvine University of California @ Irvine University of California @ Irvine
N-134	Chen, David Aroumougame, Asaithamby Gonzalez, Oscar Ruben	Ph.D, Principal Investigator Guest Scientist Guest Research Assistant	University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern
N-135	Pluth, Janice Marie Whalen, Mary	Ph.D, Principal Investigator Guest Scientific Associate	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-153	Story/Minna Delgado, Oliver Park, Seongmi Perez, Vanessa Peyton, Michael Jess	Ph.D, Principal Investigator Guest Jr Research Associate Guest Research Associate Guest Scientific Associate Guest Scientist	University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern University of Texas Southwestern

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
N-155	Raber, Jacob Fonareva, Irina	Ph.D, Principal Investigator Guest Jr Research Associate	Oregon Health & Science University Oregon Health & Science University
N-157	SCHIESTL	Ph.D, Principal Investigator	University of California @ Los Angeles
N-159	HALL	Ph.D, Principal Investigator	Columbia University
N-163	Wiese, Claudia Zafar, Faria	Ph.D, Principal Investigator Guest Jr Research Associate	Lawrence Berkeley National Laboratory Lawrence Berkeley National Laboratory
N-164	Yu, Yongjia	Ph.D, Principal Investigator	University of Texas Medical Branch
N-166	Kennedy, Ann R. Avery, Stephen Nuth, Manunya Sayers, Carly Meyer Tuttle, Stephen Ware, Jeffrey Hart	Ph.D, Principal Investigator Guest Scientist Guest Research Associate Guest Research Assistant Guest Scientist Guest Scientist	University of Pennsylvania University of Pennsylvania University of Pennsylvania University of Pennsylvania University of Pennsylvania University of Pennsylvania
N-167	Burma, Sandeep Camacho, Cristel Vanessa Mukherjee, Bipasha	Ph.D, Principal Investigator Guest Jr Research Associate Guest Scientist	University of Texas Medical Branch University of Texas Southwestern University of Texas Southwestern
N-171	Dynlacht, Joseph Garrett, Joy Mendonca, Marc Steven	Ph.D, Principal Investigator Guest Research Assistant Guest Scientist	Indiana University @ Indianapolis Indiana University @ Indianapolis Indiana University @ Indianapolis
N-172	Berkowitz, David	Ph.D, Principal Investigator	John Hopkins University
N-173	Geard, Charles Grabham, Peter William Hu, Burong	Ph.D, Principal Investigator Guest Scientist Guest Research Associate	Columbia University Columbia University Columbia University, Nevis Labs
N-174	Ware, Jeffrey Sanzari, Jenine Kay	Ph.D, Principal Investigator Guest Research Associate	University of Pennsylvania University of Pennsylvania
N-176	Cucinotta, Francis George, Kerry Ann	Ph.D, Principal Investigator Guest Scientific Associate	NASA - Johnson Space Center Wyle Laboratories @ Houston

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
N-176 (cont.)	Cucinotta, Francis Huff, Janice Lillian Anderson, Jennifer Anne Harper, Jane Vera Patel, Zarana	Ph.D, Principal Investigator Guest Scientist Guest Scientific Associate Guest Research Associate Guest Scientist	NASA - Johnson Space Center Universities Space Research Association University of Oxford University of Oxford Universities Space Research Association
N-177	Morgan, William Baulch, Janet Elizabeth Dziegielewski, Jaroslaw Goetz, Wilfried Aypar, Umut	Ph.D, Principal Investigator Guest Scientist Guest Research Associate Guest Scientific Associate Guest Research Assistant	University of Maryland School of Medicine University of Maryland University of Maryland University of Maryland University of Maryland
N-185	Sutherland, Besty	Ph.D, Principal Investigator	BNL, Biology Dept.
N-188	Green, Lora Murray Bianski, Brandon Sanchez, Martha Celia	Ph.D, Principal Investigator Guest Scientific Associate Guest Research Assistant	Loma Linda University Medical Center Loma Linda University Loma Linda University
N-190	Ianzini, Fiorenza Napoli, Eleonora	Ph.D, Principal Investigator Guest Scientist	University of Iowa University of Iowa
N-194	Kucik, Dennis F Gupta, Kiran B Khaled, Saman Fatima Wu, Xing	Ph.D, Principal Investigator Guest Jr Research Associate Guest Jr Research Associate Guest Scientist	University of Alabama University of Alabama University of Alabama University of Alabama
N-196	Azzam, Edouard Iskandar Autsavapromporn, Narongchai Buonanno, Manuela de Toledo, Sonia Maria Gonon, Geraldine Yang, Zhi	Ph.D, Principal Investigator Guest Jr Research Associate Guest Research Assistant Guest Scientist Guest Jr Research Associate Guest Research Associate	University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ University of Medicine and Dentistry of NJ

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
N-197	Fornace Jr., Albert Datta, Kamal Doiron, Kathryn E Trani, Daniela	Ph.D, Principal Investigator Guest Research Associate Guest Scientific Associate Guest Research Associate	Georgetown University Georgetown University Georgetown University Georgetown University
N-198	Globus, Ruth Almeida, Eduardo Mojarrab, Rose	Ph.D, Principal Investigator Guest Jr Research Associate Guest Scientific Associate	NASA - Ames Research Center NASA - Ames Research Center NASA - Ames Research Center
N-198	Globus, Ruth Searby, Nancy Yumoto, Kenji	Ph.D, Principal Investigator Guest Scientist Guest Jr Research Associate	NASA-Ames Research Center NASA Headquarters NASA - Ames Research Center
N-200	Hlatky, Lynn Beheshti, Afshin Enderling, Heiko Girdhani, Swati Hahnfeldt, Philip Lamont, Clare Peluso, Michael	Ph.D, Principal Investigator Guest Scientist Guest Scientist Guest Scientist Guest Scientist Guest Scientific Associate Guest Scientific Associate	Tufts University Tufts University Tufts University Tufts University Tufts University Tufts University Tufts University
N-203	Britten, Richard Antony Johnson, Angela Singletary, Sylvia J Singletary, Sylvia J Mitchell, Shamina	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientist Guest Scientist Guest Jr Research Associate	Eastern Virginia Medical School Eastern Virginia Medical School Eastern Virginia Medical School Eastern Virginia Medical School Eastern Virginia Medical School
N-204	Amundson, Sally A. Mezentsev, Alexandre	Ph.D, Principal Investigator Guest Scientist	Columbia University Columbia University
N-207	Belli, Mauro Sorrentino, Eugenio	Ph.D, Principal Investigator Guest Scientific Associate	Instituto Superiore di Sanita (ISS) Instituto Superiore di Sanita (ISS)
N-209	Wang, Ya Liu, Shuang	Ph.D, Principal Investigator Guest Research Associate	Thomas Jefferson University Thomas Jefferson University

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
N-209 (cont.)	Wang, Ya Wang, Hongyan Yu, Yan	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientist	Thomas Jefferson University Thomas Jefferson University Thomas Jefferson University
N-210	Hu, Zhi Murphy, Mark Rommereim, Donald Curry, Terry Zhang, Qibin	Ph.D, Principal Investigator Guest Scientific Associate Guest Scientific Associate Guest Scientific Associate Guest Research Associate	Battell Memorial Institute Pacific Northwest National Laboratory Pacific Northwest National Laboratory Pacific Northwest National Laboratory Pacific Northwest National Laboratory
E-2	Braby, Leslie Xia, Zhenghua Liu, Haifeng	Ph.D, Principal Investigator Guest Jr Research Associate Guest Jr Research Associate	Texas A&M University Texas A&M University Texas A&M University
E-3	Christian, James F. Johnson, Erik	Ph.D, Principal Investigator Guest Research Associate	Radiation Monitoring Devices, Inc. Radiation Monitoring Devices, Inc.
E-8/N-154	Maurer, Richard Hornsby Roth, David Richard Zeitlin, Cary Grey, Matthew	Ph.D, Principal Investigator Guest Scientist Guest Scientist Guest Research Assistant	Johns Hopkins University Johns Hopkins University Lawrence Berkeley National Laboratory Johns Hopkins University
E-9	Kouba, Coy Semones, Edward James Cantu, Marco Riman, Fadi	Ph.D, Principal Investigator Guest Scientific Associate Guest Jr Research Associate Guest Scientific Associate	NASA - Johnson Space Center National Aeronautics and Space Admin. (NASA) NASA - Johnson Space Center NASA - Johnson Space Center
E-11/N-156	Pisacane, Vincent Louis Dicello, John Malak, Henryk	Ph.D, Principal Investigator Guest Scientist Guest Scientist	U.S. Naval Academy U.S. Naval Academy U.S. Naval Academy
NSRL	Sulzman, Frank Michael	Administrator	NASA – Johnson Space Center
NSRL	Guida Peter‡	Scientist	Brookhaven National Laboratory
NSRL	Tafrov, Stefan ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Keszenman, Deborah‡	Associate Scientist	Brookhaven National Laboratory

PARTICIPANTS (Principal Investigators are highlighted) (cont.)

Exp.	Name	Guest Title	Employer
NSRL	Pyatt, Beatrice ‡	Medical Associate	Brookhaven National Laboratory
NSRL	Abele, William ‡	Associate Scientist	Brookhaven National Laboratory
NSRL	Sutherland, John ‡	Senior Scientist	Brookhaven National Laboratory
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	Hein, Patricia ‡	Senior Administrative Assistant	Brookhaven National Laboratory
NSRL	Kershaw, 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 (26)

Colorado State University
Columbia University
Columbia University, Nevis Labs
Eastern Virginia Medical School
Georgetown University
Indiana University @ Indianapolis
Johns Hopkins University
Loma Linda University
Loma Linda University Medical Center
Oregon Health & Science University
Texas A&M University
Thomas Jefferson University
Tufts University
Universities Space Research Assoc.
University of Alabama
University of California, Irvine
University of California, Los Angeles
University of Iowa
University of Maryland
University of Maryland School of Medicine
University of Medicine and Dentistry of NJ
University of Oxford
University of Pennsylvania
University of Texas Medical Branch
University of Texas Southwestern
U.S. Naval Academy

National Laboratories/Institutions (5)

Brookhaven National Laboratory
Lawrence Berkeley National Laboratory
Battelle Memorial Institute
Pacific Northwest National Laboratory
Wyle Laboratories @ Houston

NASA Related Centers/Institutions (5)

NASA - Ames Research Center
NASA - Johnson Space Center
NASA - Loma Linda University Medical School
NASA Headquarters
National Aeronautics and Space Admin. (NASA)

Private Institutions(2)

Massachusetts General Hospital
Radiation Monitoring Devices, Inc.

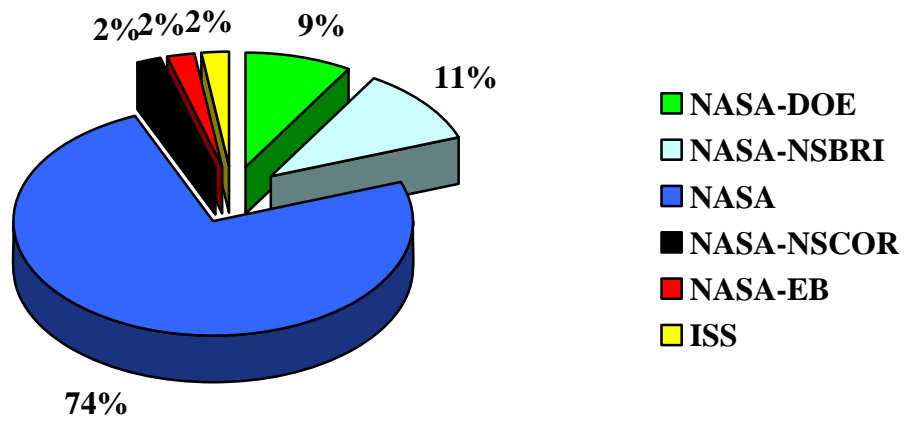
Government (2)

SRI International
Istituto Superiore di Sanita (ISS)

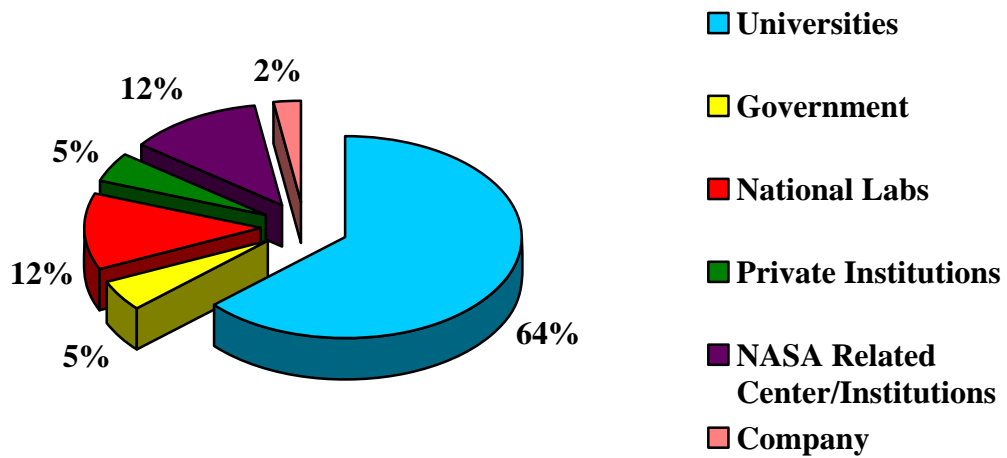
Company (1)

Promega Corporation

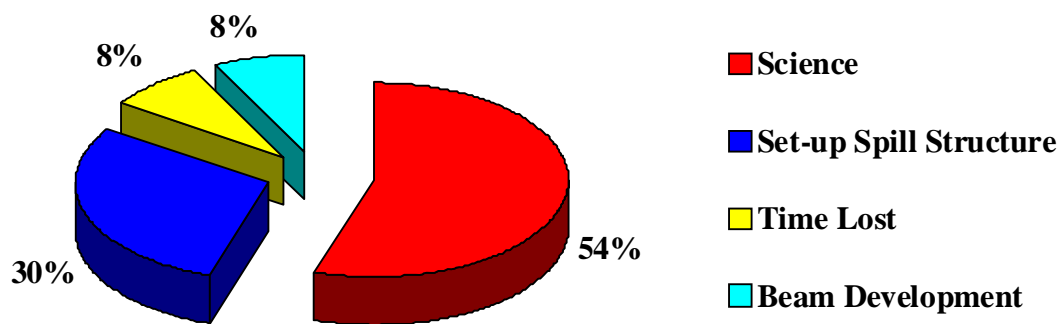
RESEARCH PROJECT SPONSORS



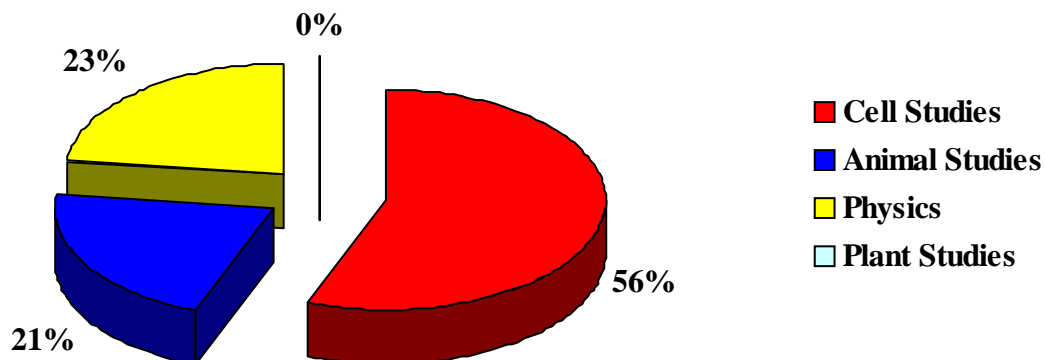
INSTITUTION STATISTICS



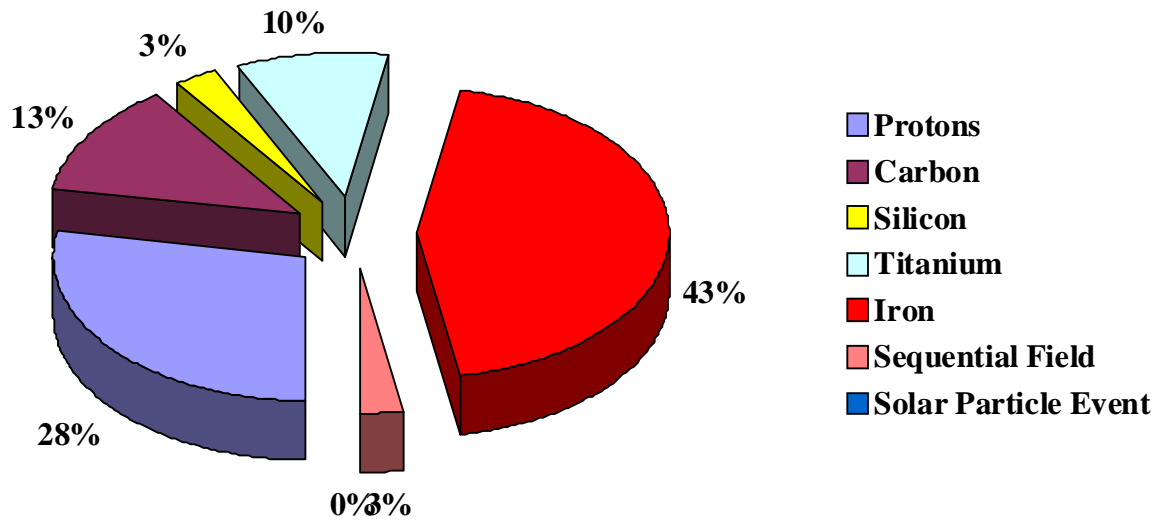
TOTAL RUN-TIME STATISTICS



SCIENCE STUDIES STATISTICS



ION SPECIES AND ENERGY (MeV/n) DISTRIBUTION



RUN TIME DESCRIPTION (hours)

NSRL-08A	ION SPECIES AND ENERGIES (MeV/nucleon)								
	H				C			Si	
	100	200	500	1000	300	600	1000	300	1000
Machine Set-Up	1:18:25	0:36:28	0:33:48	42:08:13	10:58:25	3:48:33	7:42:30	0:33:15	4:25:45
Development	0:00:00	0:00:00	0:00:00	12:40:48	5:11:19	0:00:00	0:00:00	0:00:00	0:00:00
Science									
In Vitro	0:20:12	0:00:00	0:00:00	50:33:19	19:07:13	0:00:00	0:00:00	1:14:38	0:58:17
In Vivo	0:00:00	0:00:00	0:00:00	22:25:42	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
Physics	1:35:46	1:21:51	1:15:51	1:20:37	0:00:00	8:02:53	17:17:53	0:00:00	8:58:06
NSRL Time Lost	1:00:00	0:00:00	0:00:00	27:40:00	2:35:00	0:30:00	0:00:00	0:00:00	0:00:00
Totals	4:14:23	1:58:19	1:49:39	156:48:39	37:51:57	12:21:26	25:00:23	1:47:53	14:22:08

(continued next page)

RUN TIME DESCRIPTION (hours)

NSRL-08A	ION SPECIES AND ENERGIES (MeV/nucleon)										
	Ti			p/Fe	Fe					SPE	Total
	150	500	1000	1000	140	300	500	600	1000	N/A	
Machine Set-Up	00:43:17	03:43:09	13:12:32	5:15:59	1:15:56	0:34:50	1:50:14	7:29:53	69:18:04	9:54:50	185:24:00
Development	00:00	02:44:01	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	26:33:30	0:00:00	47:09:38
Science											
In Vitro	0:00:00	0:00:00	06:49:57	11:01:06	2:50:25	1:18:11	0:00:00	2:30:37	81:11:45	14:50:22	192:46:02
In Vivo	0:00:00	03:06:45	02:04:41	0:00:00	0:00:00	0:00:00	0:00:00	12:18:47	24:49:04	7:44:42	72:29:41
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	01:37:07	0:00:00	18:47:54	0:00:00	0:00:00	0:00:00	4:07:23	1:41:12	13:01:56	0:00:00	79:08:29
Science Sub Total:											344:04:00
NSRL Time Lost	0:00:00	02:30:00	01:56:00	0:48:00	0:00:00	0:00:00	0:00:00	0:19:00	12:40:00	0:00:00	49:58:00
Totals	02:20:24	12:03:55	42:51:04	17:05:05	4:06:21	1:53:01	5:57:37	24:19:29	227:34:19	32:29:54	626:35:44

BEAM CHARACTERISTICS

Ion	H				C			Si	
Energy (MeV/n)									
Planned	100	200	500	1000	300	600	1000	300	1000
Extracted	100	200	500	1000	287.2	600	1000	304.5	990.1
On Target	100*	200*	500*	1000*	287.2	600*	1000*	304.5	990.1
Fluence (particles/cm²/sec)									
Maximum on target	1.89E+04	1.50E+03	1.50E+03	1.20E+05	3.20E+03	2.50E+01	2.50E+01	4.00E+02	6.40E+05
Minimum on target	1.00E+02	1.50E+03	1.50E+03	1.00E+02	2.10E+02	2.50E+01	2.50E+01	4.00E+02	2.50E+01
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	3.03E+07	1.00E+02	1.00E+02	2.00E+08	5.00E+06	1.00E+02	1.00E+02	6.50E+05	2.50E+05
Minimum	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.50E+05	1.00E+02	1.00E+02	6.50E+05	1.00E+02
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)	0.736*	0.453*	0.276*	0.223*	13.04	9.24*	8.01*	68.69	43.69
Max. Dose Rate (Gy/min)									
20 cm x 20 cm	0.5	1.50E-04	1.50E-04	1	1.5	5.00E-03	5.00E-03	1	1
Total Dose (Gy)									
Maximum	0.2	N/A	N/A	1	40	N/A	N/A	1	1
Minimum	0.05	N/A	N/A	1.00E-05	0.1	N/A	N/A	1	1.00E-02

* No Bragg results are available for H running at 100, 200, 500 or 1000 MeV, C at 600 and 1000 MeV/n , Ti at 150 MeV/n or Fe at 500 MeV/nucleon. For these energies, only calculated LET is quoted.

(continued next page)

BEAM CHARACTERISTICS (continued)

Ion	Ti			p/Fe	Fe					SPE
Energy (MeV/n)										
Planned	150	500	1000	1000	140	300	500	600	1000	N/A
Extracted	150	500.6	985.7	1000	139	290.1	500	586	961.5	N/A
On Target	150*	500.6	985.7	1000*	139	290.1	500*	586	961.5	N/A
Fluence (particles/cm²/sec)										
Maximum on target	8.30E+05	2.00E+02	3.90E+02	3.70E+01	7.00E+01	2.50E+01	6.00E+03	4.80E+02	3.70E+02	4.20E+04
Minimum on target	4.10E+05	2.00E+01	1.00E+02	1.00E+02	7.00E+01	2.50E+01	6.00E+03	3.00E+01	2.50E+01	1.00E+03
Spill Period (sec)	4	4	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300	300	300
Particles/spill										
Maximum	3.30E+06	3.30E+05	6.20E+05	6.00E+04	1.00E+05	4.00E+04	2.40E+04	7.60E+05	5.90E+05	6.70E+07
Minimum	200	3.30E+04	1.20E+04	1.00E+02	1.00E+05	4.00E+04	2.40E+04	4.00E+04	1.00E+02	1.50E+06
Beam Cut Off Accuracy	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)	264.7*	133.3	108	0.222/151	389.7	243.4	186.3	175.1	151.6	N/A
Max. Dose Rate (Gy/min)										
20 cm x 20 cm	1.00E-02	1	1.5	0.2	1	0.25	0.1	3	2	0.3
Total Dose (Gy)										
Maximum	N/A	1	5	1	1	0.25	N/A	4	10	2
Minimum	N/A	0.1	0.01	1.00E-05	1	0.25	N/A	0.25	1.00E-05	0.05

DOSIMETRY AND BEAM DEVELOPMENTS

New Beams

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

Carbon at 600 and 1000 MeV/n,
Titanium at 150 and 500 MeV/n, and
Iron at 140 and 500 MeV/n.

Solar Particle Event Simulator

For the first time, we implemented the Solar Particle Event Simulator that has been under development. As part of this effort, we delivered proton beams at energies in 25 MeV increments between 50 MeV to 250 MeV.

RUN DATES

Ion	Energy	Scheduled Start	Scheduled End	Actual Start	Actual End
Silicon	300-1000	3/03/08 7:00	3/03/08 19:30	3/03/08 7:00	3/03/08 20:40
Iron	100-1000	3/04/08 7:00	3/05/08 18:30	3/04/08 7:00	3/04/08 16:34
Carbon	300-1000	3/06/08 7:00	3/12/08 16:30	3/06/08 7:00	3/12/08 18:00
Iron	100-1000	3/13/08 7:00	3/17/08 13:00	3/13/08 7:00	3/17/08 12:41
Protons	50-1000	3/18/08 7:00	3/18/08 16:30	3/18/08 7:00	3/18/08 16:54
Iron	100-1000	3/19/08 7:00	3/19/08 14:00	3/19/08 7:00	3/19/08 14:30
Protons	50-1000	3/20/08 7:00	3/20/08 16:30	3/20/08 7:00	3/20/08 18:57
Iron	100-1000	3/21/08 7:00	3/31/08 18:30	3/21/08 7:00	3/31/08 14:43
Protons	50-1000	4/1/08 7:00	4/2/08 18:30	4/1/08 7:00	4/2/08 20:57
Iron	100-1000	4/3/08 7:00	4/3/08 18:30	4/3/08 7:00	4/3/08 17:44
p/Fe	1000	4/4/08 7:00	4/4/08 20:30	4/4/08 7:00	4/4/08 21:49
Protons	50-1000	4/7/08 7:00	4/8/08 17:00	4/7/08 7:00	4/8/08 19:00
Iron	100-1000	4/9/08 7:00	4/11/08 17:30	4/9/08 7:00	4/11/08 17:00
Protons	50-1000	4/14/08 7:00	4/23/08 18:30	4/14/08 7:00	4/23/08 17:30
Iron	100-1000	4/24/08 7:00	4/25/08 16:00	4/24/08 7:00	4/25/08 15:43
Titanium	150-1000	4/28/08 7:00	5/2/08 16:30	4/28/08 7:00	5/2/08 16:12
Iron	100-1000	5/5/08 7:00	5/12/08 19:30	5/5/08 7:00	5/12/08 14:43
Protons	50-1000	5/13/08 7:00	5/14/08 17:00	5/13/08 7:00	5/14/08 13:31

EXPERIMENTERS AND RUN STATISTICS

Proposal	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Rate	Dose Range	Samples
B-7	Rabin	Titanium	500	4:30:00	3:06:45	10-100	10-100	60
B-7	Rabin	Titanium	1000	4:30:00	2:04:41	10-100	10-100	30
B-10	Chang	Protons	SPE	9:00:00	7:44:42	0.1	50-200	60
B-52	Gewirtz	p/Fe	1000	3:00:00	3:13:43	20	10-100	180
N-67	Blakely	Protons	1000	6:00:00	0:54:50	1-25	10-100	60
N-67	Blakely	Titanium	1000	6:00:00	3:45:29	1-100	10-100	114
N-88	Sutherland	Protons	SPE	9:00:00	14:50:22	low	5-20	12
N-88	Sutherland	Protons	1000	2:00:00	2:25:15	20-50	5-20	95
N-89	Held	Carbon	290	6:12:00	3:43:37	.000001-5	.000001-1	150
N-89	Held	p/Fe	1000	0:00:00	4:33:40	.000001-5	.000001-1	150
N-89	Held	Iron	1000	7:00:00	4:54:19	.00001-100	.00001-200	300
N-89	Held	Protons	1000	6:12:00	6:35:43	.000001-20	.000001-200	400
N-90	Bailey	Iron	1000	2:00:00	0:35:27	100	100-200	16
N-97	Kronenberg	Iron	600	0:00:00	0:39:52	100	50-200	8
N-97	Kronenberg	Iron	1000	6:00:00	0:51:19	100	50-200	16
N-97	Kronenberg	Protons	1000	18:00:00	7:48:08	70	100-500	60
N-103	Barcellos-Hoff	Iron	140	5:00:00	2:50:25	10-100	100	12
N-103	Barcellos-Hoff	Iron	1000	10:00:00	8:37:41	10-100	10-100	31
N-108	Obenaus	Iron	600	3:00:00	2:28:24	150	50-400	150
N-115	Bacher	Iron	1000	0:00:00	1:55:14	10-100	100	64
N-115	Bacher	Protons	1000	4:00:00	2:03:32	10-100	100	60
N-129	Limoli	Iron	1000	7:00:00	5:49:35	10-200	2-200	250
N-134	Chen	Iron	1000	2:30:00	3:00:28	100	100	30
N-134	Chen	Silicon	300	2:30:00	1:14:08	100	100	30

Proposal	Principle Investigator	Ion	Energy	Beam	Beam	Dose Rate	Dose Range	Samples
				Time Approved	Time Used			
N-134	Chen	Silicon	1000	2:30:00	0:58:17	100	100	30
N-135	Pluth	Iron	1000	8:00:00	7:11:55	10-100	5-250	400
N-153	Story	Iron	1000	18:30:00	11:51:00	20-100	20-100	27
N-154	Maurer	Carbon	1000	16:00:00	17:17:53	low	low	1
N-154	Maurer	Iron	1000	8:00:00	7:23:53	low	low	1
N-155	Raber	Iron	600	8:48:00	2:35:03	50-100	25-300	100
N-156	Pisacane	Carbon	600	8:00:00	8:02:53	low	low	1
N-156	Pisacane	Silicon	1000	0:00:00	8:58:06	low	low	1
N-156	Pisacane	Titanium	150	8:00:00	1:37:07	low	low	1
N-156	Pisacane	Titanium	1000	8:00:00	16:17:56	low	low	1
N-159	Hall	Iron	1000	5:30:00	0:43:43	25-50	25-200	12
N-163	Wiese	Iron	1000	4:00:00	4:15:05	50-200	31-400	80
N-164	Yu	Iron	1000	2:00:00	0:54:16	50-200	31-400	20
N-166	Kennedy	Protons	1000	16:30:00	16:15:06	5-50	5-150	78
N-167	Burma	Carbon	300	2:00:00	1:34:00	120	50-400	91
N-167	Burma	Iron	1000	2:00:00	2:13:26	100-200	100-400	75
N-171	Dynlacht	Iron	600	3:30:00	2:26:39	150	200	85
N-173	Gear	Iron	1000	2:30:00	1:20:00	50-200	10-320	28
N-173	Gear	Protons	1000	3:00:00	1:38:04	20-30	10-320	28
N-174	Ware	Iron	1000	2:30:00	1:54:39	40-200	10-200	118
N-174	Ware	Protons	1000	5:30:00	3:59:07	5-50	2-530	223
N-176	Cucinotta	Iron	1000	4:00:00	4:54:38	30-100	15-100	116
N-176	Cucinotta	Titanium	1000	3:00:00	3:04:28	10-150	5-500	80
N-177	Morgan	Iron	100	0:00:00	1:13:56	20-50	10-200	36
N-177	Morgan	Iron	1000	6:00:00	1:31:47	50-150	10-200	84
N-185	Sutherland	Carbon	290	6:24:00	3:38:54	100	10-4000	54
N-185	Sutherland	p/Fe	1000	4:00:00	3:13:43	20	10-100	180
N-188	Green	Carbon	300	6:00:00	10:11:12	10-150	10-200	368
N-190	Ianzini	Iron	1000	7:00:00	9:21:30	100	50-200	275
N-194	Kucik	Iron	600	6:30:00	4:37:40	300	500	170

Proposal	Principle Investigator	Ion	Energy	Beam	Beam	Dose Rate	Dose Range	Samples
				Time Approved	Time Used			
N-196	Azzam	Iron	1000	1:30:00	2:08:06	50-150	10-200	10
N-196	Azzam	Protons	1000	9:30:00	10:25:23	20	10-200	183
N-197	Fornace	Iron	1000	2:12:00	3:49:06	60	500-800	100
N-197	Fornace	Protons	1000	5:30:00	4:31:05	70	500-750	80
N-198	Globus	Iron	1000	7:00:00	5:12:33	1-90	0.5-200	73
N-200	Hlatky	Iron	1000	6:05:00	9:10:51	10-80	5-40	511
N-200	Hlatky	Protons	1000	14:36:00	15:45:03	30	100-400	649
N-203	Britten	Iron	1000	2:48:00	2:50:26	50-100	100	88
N-204	Amundson	Iron	300	3:00:00	1:18:11	very low	100/cm ²	32
N-205	Kleiman	Iron	600	4:00:00	2:01:46	50	50	45
N-207	Belli	Iron	1000	5:00:00	5:47:32	50-100	25-150	84
N-209	Wang	Iron	1000	5:00:00	2:23:50	100-170	50-1000	68
N-210	Hu	Iron	1000	3:00:00	1:28:26	150	300	28
N-210	Hu	Protons	1000	0:00:00	0:37:45	20	300	28
E-2	Braby	Iron	600	2:15:00	1:41:12	low	low	1
E-2	Braby	Iron	1000	2:15:00	2:45:40	low	low	1
E-2	Braby	Titanium	1000	2:15:00	2:29:58	low	low	1
E-9	Dungan	Iron	500	0:00:00	4:07:23	low	low	1
E-9	Dungan	Iron	1000	6:00:00	2:52:23	low	low	1
E-9	Dungan	Protons	100	0:00:00	1:35:46	low	low	1
E-9	Dungan	Protons	200	0:00:00	1:21:51	low	low	1
E-9	Dungan	Protons	500	0:00:00	1:15:51	low	low	1
E-9	Dungan	Protons	1000	6:00:00	1:20:37	low	low	1

Total approved hours of science (not including those proposals that chose not to run in 08A is 389:02.

Total number of hours of science that ran in Run 08A is 344:04.