BROOKHAVEN
NATIONAL LABORATORY

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BNL-8 RUN

FINAL REPORT

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NASA-BNL Liaison Scientist
BNL/NASA webpage:
http://www.bnl.gov/medical/NASA/NASA-home%20frame.htm

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EXECUTIVE SUMMARY

During the Winter of 2001, a series of radiobiological and physics experiments were performed using the BNL's Alternating Gradient Synchrotron to accelerate iron ion beams (Experiment 960, BNL-8). These experiments were part of the eight consecutive run sponsored by NASA's Space Radiation Health Program (SRHP) heavy ion radiobiology research program at BNL.

A total of 25 proposals were approved to participate in the BNL-8 run, 1 of which was a renewal, 12 were continuing projects and 11 which were new proposals. From the total number 22 were full proposals and 3 were piggyback experiments. Thirteen institutions from the United States (6 states plus Puerto Rico), and 2 from foreign countries (Italy) were represented, totaling 78 users. More than 2000 biological samples were irradiated at the AGS A-3 beam line, employing 133 hours of beam time (66 hours for in vivo studies and 44 hours for in vitro studies). In addition, 23 hours were used for physics experiments, and a total of 30 hours were necessary for beam characterization, tuning, dosimetry, and calibration. A total of 37.5 hours of beam time were lost (19%) due to accelerator or power supply related problems.

During BNL-8, AGS provided iron (1.046 GeV/nucleon, LET: 148 keV/μm) and Silicon (0.6 and 1.046 GeV/n, LET: 49 and 42 keV/μm respectively) beams for biology and physics experiments. The dose/rates used were as low as 10 cGy/min and as high as 15 Gy/min. The spill rate employed was 30 spills/min with duration of 500-600 msec/spill. The spill fluence was (particles/spill) 1 x 108 (max) and 1.5 x 105 (min). The intensities (particles/cm^2/sec on target) used during the run were 1 x 108 (max) and 400 (min). A 7.5-cm diameter beam spot was employed as a nominal spot for the majority of the exposures. For larger samples (animals), an elliptical spot was used (up to 9 cm).

Tandem-Booster set-up started on April 7 with the transport and circulation of Si beams at the AGS complex. Beam was tuned into cave on April 9. 600 MeV/n Si beams were available for tuning on April 9. The next several shifts were spent on tuning into the target area, beam diagnostics and establishing several different combinations of beam intensities and spot shapes and sizes for biology running. Biology studies started on the afternoon of April 9 (A. Kronenberg, LBNL) and proceeded through early April 11. After all biology experiments were completed, LBNL (C. Zeitlin) ran 13 hours of fragmentation physics studies with 1GeV/n Si ions. On April 12, AGS tuned 1GeV/n iron beams for physics studies for 6 hours. Biology studies started on April 12 (F. Cucinotta, JSC) and continued until the end of the BNL-8 run (April 17, 0842 AM).

Radiobiological experiments employed cells, tissues, and intact specimens, which required a complex coordination and planning of their respective logistic support. Biological studies used human, mouse, rat and hamster cell lines, human-hamster hybrid cell lines, tumor cell lines and intact specimens (rodents and fish). Physics experiments involved the exposure of solid state detectors and spacecraft materials. The full program was completed in 8 days.

BNL-8 Projects Reviewed by the BNL's Scientific Advisory Committee in Radiobiology (SACR):

Project	P.I.	Status	SACR Review	BNL-8 Participation
B-1	Miller	Continuing	Approved	Yes
B-7	Rabin	Continuing	Approved	Yes
B-3	Cucinotta/Wu	Continuing	Approved	Yes
B-10	Chang	Continuing	Approved	Yes
B-19	Kronenberg	Continuing	Approved	Yes
B-25	Evans	Continuing	Approved	Yes
B-39	Burns	Renewal	Approved	Yes
B-44	Durante	Continuing	Approved	Yes
B-45	Setlow	Continuing	Approved	Yes
B-48	Green	Continuing	Approved	Yes
B-51	Murnane	Continuing	Approved	Yes
B-52	Gerwitz	Continuing	Approved	Yes
B-53	Lupton	Continuing	Approved	Yes
B-54	Kennedy	New	Approved	Yes
B-57	Koniarek*	New	Approved	Yes
B-58	Chen	New	Approved	Yes
B-59	Azzam**	New	Approved	No
B-60	Morell***	New	Approved	Yes
B-61	Pecaut	New	Approved	Yes
B-62	Obenaus	New	Approved	Yes
B-63	Nelson	New	Approved	Yes
B-64	Vazquez	New	Approved	Yes
B-65	Vazquez	New	Approved	Yes
B-66	Narici	New	Approved	Yes
B-67	Blakely	New	Approved	Yes

*Piggyback experiment with B-64 project (Vazquez)

**Piggyback experiment with B-52 project (Gerwitz)

***Piggyback experiment with B-1 project (Miller)

BNL-8 PARTICIPANTS

Exp.	Participants	Affiliation	Title
B-1	C. Zeitlin.	Lawrence Berkeley National Laboratory, CA	Ph.D., Principal Investigator
	J. Miller	"	Ph.D., Co-Principal
	L. Heilbronn	"	Investigator Ph.D., Co-Worker
	R.P. Sigh	"	Ph.D., Co-Worker
	W. Holley	"	Ph.D., Co-Worker
	M. Nyman	"	Ph.D., Co-Worker
	W. Schimmerling	NASA, HDQ, DC	Ph.D., Co-Worker
B-3	F. Cucinotta*	NASA, Johnson Space Center, TX	Ph.D., Principal Investigator
	H. Wu	"	Ph.D., CoPrincipal Investigator
	P. Sagamti	"	Ph.D., Co-Worker
	K. George	"	Senior Research Associate
	V. Willingham	"	BS, Co-Worker
B-7	B. Rabin	University of Maryland, Baltimore County, MD	Ph.D., Principal Investigator
	J. Joseph	Human Nutrition Research Center on Aging,	Ph.D., Co-Principal
	B. Sukitt-Hale	MA	Investigator
	J. McEwen	"	Co-Worker
	S. Szprengiel	"	Co-Worker
	D. Jenkins	"	Co-Worker
	A. Eggleston	"	Co-Worker
B-10	P. Chang	NSBRI, SRI International, Menlo Park, CA	Ph.D., Principal Investigator
	J. Bakke	"	BS, Co-Worker
	J. Orduna	"	BS, Co-Worker
B-19	A. Kronenberg	Lawrence Berkeley National Laboratory, CA	Ph.D., Principal Investigator
	S. Gauny	"	Senior Research Associate
B-25	H. Evans	Case Western Reserve University, OH	Ph.D., Principal Investigator
	T. Evans	"	Co-Worker
B-44	M. Durante*	University "Federico II", Napoli, Italy	Ph.D., Principal Investigator
	M. Belli	National Institute of Health, Rome, Italy	Ph.D., Co-Worker
	G. Simone	"	Ph.D., Co-Worker
	P. Scampoli	"	Ph.D., Co-Worker
	G. Grossi	University "Federico II", Napoli, Italy	Ph.D., Co-Worker
B-45	R. Setlow	Brookhaven National Laboratory, NY	Ph.D., Principal Investigator
	J. Jardine	"	BS, Co-Worker
	A. Shima	University of Tokyo, Japan	Ph.D., Co-Worker
B-48	L. Green*	Loma Linda University, CA	Ph.D., Principal Investigator
	G. Nelson	"	Ph.D., Co-Worker
	D. Murray	"	BS, Co-Worker
	T. Jones	"	BS, Co-Worker
B-51	J. Murnane*	University of California, San Francisco, CA	Ph.D., Principal Investigator
	B. Fouladi	"	Ph.D., Co-Worker
	R. Eltanal	"	BS, Co-Worker
B-52	J. Gerwitz*	NSBRI, University of Pennsylvania	Ph.D., Principal Investigator
	B. Sutherland	Brookhaven National Laboratory, NY	Ph.D., Co-Investigator
	P. Bennett	"	MS., Biology Associate.
	J. Sutherland	"	Ph.D., Co-Worker
	P. Guida	"	Ph.D., Co-Worker
	J. Trunk	"	Co-Worker
	D. Monteleone	"	Co-Worker

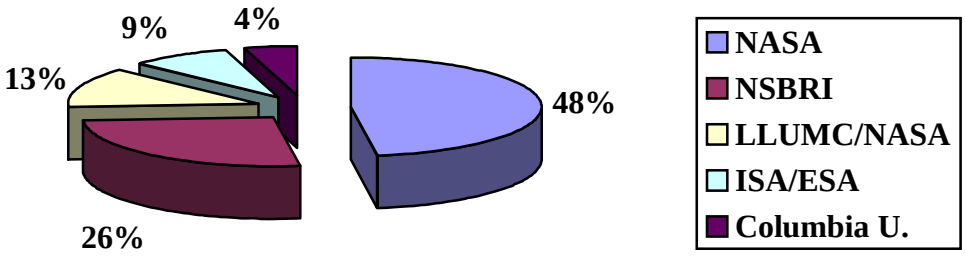
B-53	J. Lupton*	NSBRI, Texas A&M University, TX	Ph.D., Principal Investigator
	L. Braby	"	Ph.D., Co-Investigator
	N. Turner	"	Ph.D., Co-Investigator
	S. Taddeo	"	Co-Worker
	N. Popovic	"	Co-Worker
	M. Young Hong	"	Co-Worker
	C. Henderson	"	Co-Worker
	L. Sanders	"	BS, Co-Worker
	J. Ford	"	Ph.D., Co-Worker
B-54	A. Kennedy	NSBRI, University of Pennsylvania	Ph.D., Principal Investigator
	S. Wan	"	Ph.D., Co-Investigator
	J. Ware	"	Ph.D., Co-Investigator
	J. Donahue	"	Ph.D., Co-Investigator
	M. Stanislaus	"	Ph.D., Co-Investigator
B-57	J. Koniarek*	Columbia University, New York, NY	Ph.D., Principal Investigator
	M. Vazquez	Brookhaven National Laboratory, NY	MD, Co-Worker.
B-58	D. Chen*	Lawrence Berkeley National Laboratory, CA	Ph.D., Principal Investigator
	L. Ding	"	Ph.D., Co-Investigator
B-60	L. Morell*	University of Puerto Rico	Ph.D., Principal Investigator
	J. De Jesus	"	MS, Co-Worker
	I. Vargas Medina	"	BS, Co-Worker
B-62	A. Obenaus	Loma Linda University	Ph.D., Principal Investigator
	W. Kennedy	"	Ph.D., Co-Worker
	T. Loring Meir	"	Ph.D., Co-Worker
B-63	G. Nelson	Loma Linda University	Ph.D., Principal Investigator
	M. Pecaut	"	Ph.D., Co-Worker
	A. Smith	"	BS, Co-Worker
	S. Jones	"	BS, Co-Worker
	S. Rainer	"	BS, Co-Worker
B-64	M. Vazquez	NSBRI, Brookhaven National Laboratory, NY	MD, Ph.D., Principal Invest.
	L. Estevez	"	BS, Co-Worker
	S. Otto	"	BS, Co-Worker.
	O. Thomas	"	BS, Co-Worker
B-65	M. Vazquez	NSBRI, Brookhaven National Laboratory, NY	MD, Ph.D., Principal Invest.
	O. Thomas	"	BS, Co-Worker
	M. Bruneus	"	BS, Co-Worker.
	A. Billups	"	Undergrad-Student
	S. Koslovsky	"	Undergrad-Student
B-66	L. Narici	University of Rome, Thor Vergara, Italy	Ph.D., Principal Investigator
	S. Carozzo	"	Ph.D., Co-Worker
	V. Bidoli	"	Ph.D., Co-Worker
	W. Sanita	"	Ph.D., Co-Worker
	E. Sorrentino	"	Ph.D., Co-Worker
	M. Di Pascale	"	Ph.D., Co-Worker
	N. Peachey	The Cole Eye Institute, Ohio	Ph.D., Co-Worker
	M. Vazquez	Brookhaven National Laboratory, NY	Ph.D., Co-Worker
	F. Cucinotta	NASA, Johnson Space Center, TX	Ph.D., Co-Worker
B-67	E. Blakely	Lawrence Berkeley National Laboratory, CA	Ph.D., Principal Investigator
	K. Bjornstand	"	Ph.D., Co-Worker
	P. Chang	SRI, CA	Ph.D., Co-Worker
B-71	F. Burns	New York University Medical Center, NY	Ph.D., Principal Investigator
	J. Xu	"	Co-Worker

***Not present during the actual run**

BNL-8 PARTICIPANTS STATISTICS

PARTICIPANTS	BNL-8
Ph.D., Principal Investigators	24
M.D., Ph.D., Principal Investigators	1
Ph.D., Co-Principal Investigators	2
Ph.D., Co-Investigator	8
Co-Workers	11
Ph.D.	24
M.D.	2
B.S.	14
M.S.	1
MS Biology Associate	1
Senior Research Associates	2
Undergraduate Student	2
Total:	92

RESEARCH PROJECT SPONSORS:



PARTICIPANT INSTITUTIONS

NASA related centers/institutes (3)

- **NASA, Headquarters, DC**
- **NASA, Johnson Space Center, TX**
- **National Space Biomedical Research Institute, TX**

National Laboratories/Institutes (5)

- **Brookhaven National Laboratory, NY**
- **Lawrence Berkeley National Laboratory, CA**
- **Human Nutrition Research Center on Aging, MA**
- **SRI International, Menlo Park, CA**
- **The Cole Eye Institute, Ohio**

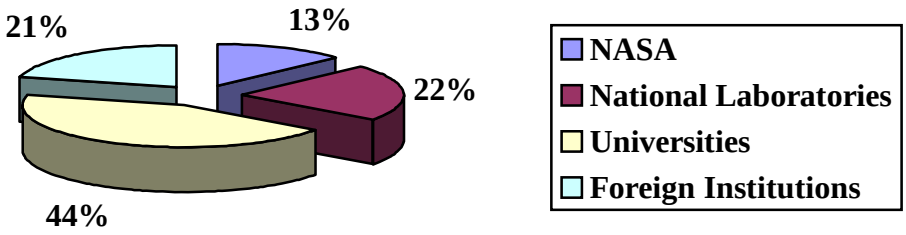
Universities (10)

- **University of Maryland, Baltimore County, MD**
- **Columbia University, NY**
- **Case Western Reserve University, OH**
- **The University of Texas Health Sciences., TX**
- **New York University Medical Center, NY**
- **Loma Linda University, CA**
- **Texas A&M University, TX**
- **University of California, San Francisco, CA**
- **University of Pennsylvania, PA**
- **University of Puerto Rico, PR**

Foreign Institutions (5)

- **University of Rome, Thor Vergara, Italy**
- **University "Federico II", Napoli, Italy**
- **National Institute of Health, Rome, Italy**
- **University of Tokyo, Japan**

INSTITUTIONS STATISTICS:



BNL-8 IRON RUN DESCRIPTION

RUN DATES

Run dates	Scheduled		Actual	
	Date	Time	Date	Time
Run start	04/10	2100	04/12	0800
Run end	04/15	1300	04/17	0842
Tuned into cave	04/10	2100	04/12	0800
Beam delivered for Physics				
Fe 1 GeV/n	04/11	0000	04/12	2100
End run	04/11	0700	04/17	0842
Beam delivered for Biology				
Fe 1 GeV/n	04/11	0800	04/12	1300
End run	04/15	1300	04/12	2100

BEAM TIME DESCRIPTION (hours)

Total Clock Time	(from 04/12 0800 to 04/17 0842)		120.5
Total Beam-on time			95
Total Beam-off time			25.5
Beam Time for Biology			
1 GeV/n In Vitro Studies	29		
1 GeV/n In Vivo Studies	45.5		
	74.5		
Beam Time for Physics			
1 GeV/n	6		
Sub-total		80.5	
Beam time for dosimetry, calibration, tuning, etc.			
1 GeV/n	14.5		
Sub-total		14.5	
Totals		95	

BNL-8 SILICON RUN DESCRIPTION

RUN DATES

Run dates	Scheduled		Actual	
	Date	Time	Date	Time
Run start	04/09	0000	04/09	0000
Run end	04/15	1400	04/17	0842
Tuned into cave	04/8	2200	04/9	0000
Beam delivered for Biology				
Si 0.6 GeV/n	04/09	0800	04/09	1410
End run	04/10	1000	04/11	1000
Beam delivered for Physics				
Si 1 GeV/n	04/10	1000	04/11	1830
End run	04/10	2100	04/12	0800

BEAM TIME DESCRIPTION (hours)

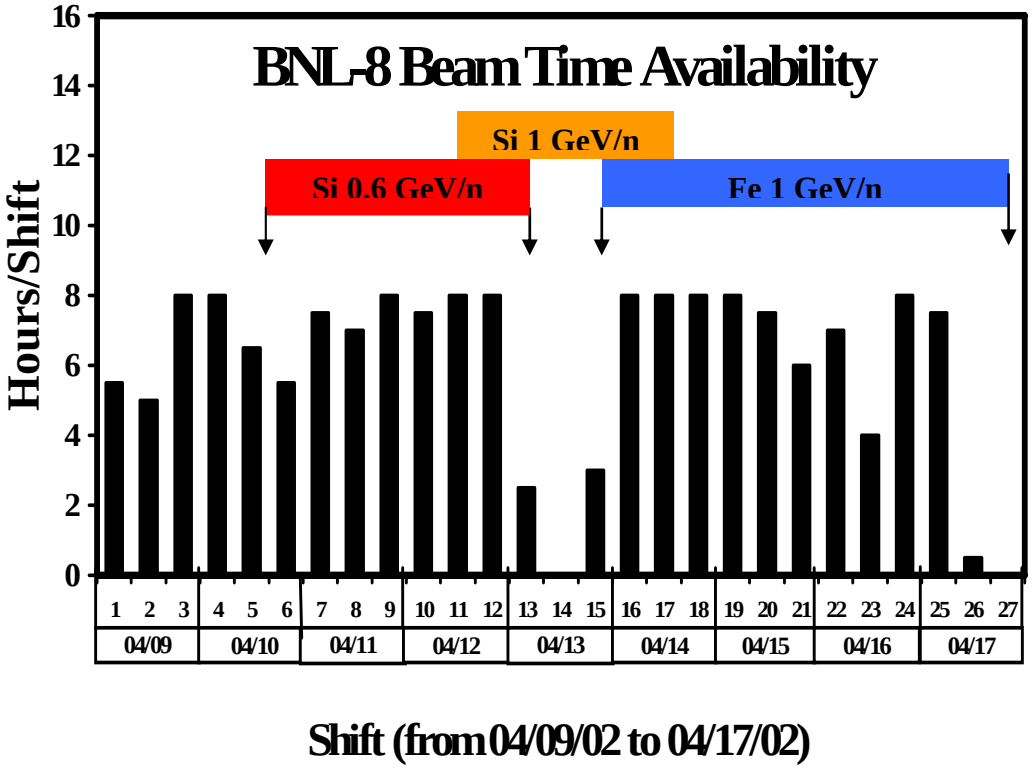
Total Clock Time	(from 04/09 0000 to 04/12 0800)		80
Total Beam-on Time			
0.6 GeV/n	47		
1.0 GeV/n	21		
Sub-total			68
Total Beam-off time			
0.6 GeV/n	11		
1.0 GeV/n	1		
Sub-total			12
Total			80
Beam Time for Biology			
0.6 GeV/n In Vitro Studies	15		
0.6 GeV/n In Vivo Studies	20		
Sub Totals		35	
Beam Time for Physics			
1 GeV/n	13		
Sub-total		13	
Beam time for dosimetry, calibration, tuning, etc.			
1 GeV/n	8		
0.6 GeV/n	12		
Sub-total		20	
Total			68

BNL-8 FINAL RUN DATES

Run dates	Scheduled		Actual	
	Date	Time	Date	Time
Run start	04/09	0000	04/09	0000
Run end	04/15	0600	04/17	0842
Tuned into cave	04/8	2200	04/9	0000

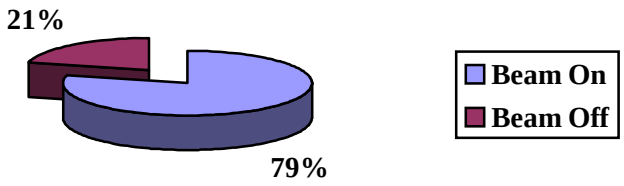
TOTAL BEAM TIME DESCRIPTION (hours)

Total Clock Time	(from 04/09 0000 to 04/17 0842)		200.5
Total Beam-on Time			162.5
Total Beam-off time			37.5
Beam Time for Biology			
In Vivo Studies	66		
In Vitro Studies	44		
Beam Time for Physics	23		
		133	
Beam time for dosimetry, calibration, tuning, etc.	30		
		30	
Totals			200.5

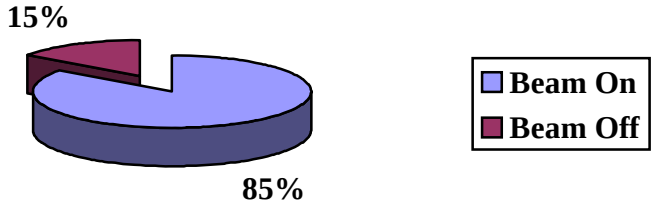


DESCRIPTIVE STATISTICS

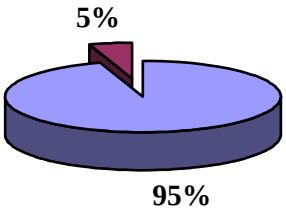
- **Fe 1 GeV/n Beam Availability**



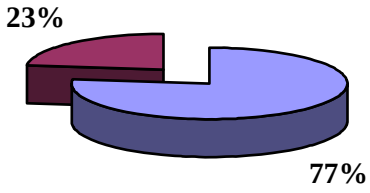
- **Si Beam Availability**



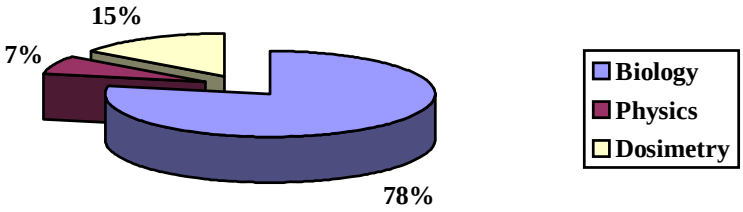
- **Si 1 GeV/n**



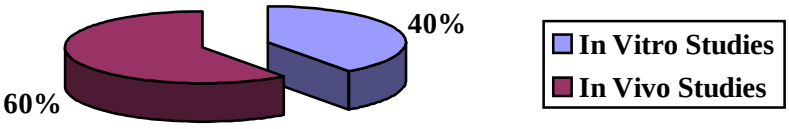
- **Si 0.6 GeV/n**



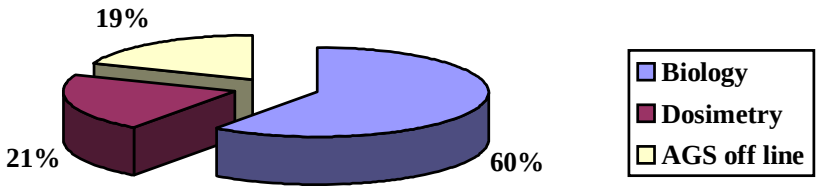
- **Fe 1 GeV/n Distribution of Beam Time Usage:**



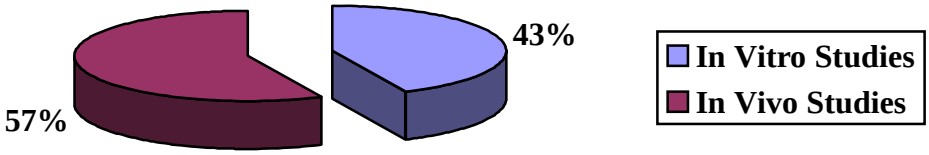
- **Fe 1 GeV/n Distribution of Beam Time for Biology:**



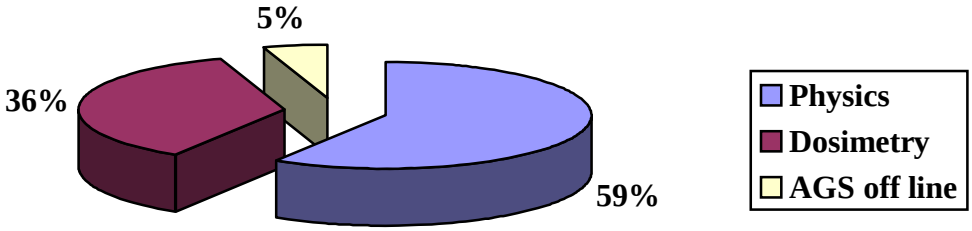
- Si 0.6 GeV/n Distribution of Beam Time Usage:



- Si 0.6 GeV/n Distribution of Beam Time for Biology:

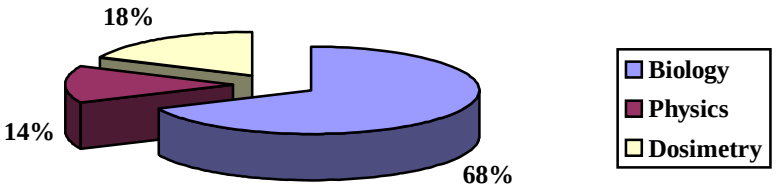


- Si 1 GeV/n Distribution of Beam Time Usage:

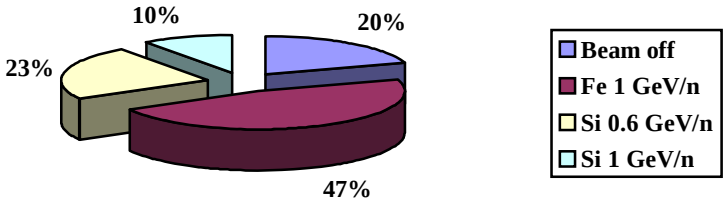


BNL-9 BEAM TIME SUMMARY

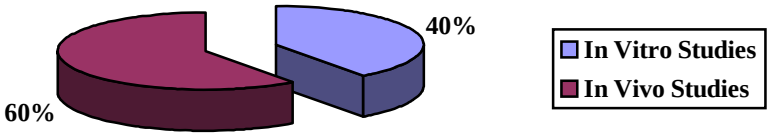
- **DISTRIBUTION OF BEAM TEAM USAGE:**



- **DISTRIBUTION OF BEAM TEAM BY SPECIES AND ENERGIES:**



- **DISTRIBUTION OF BEAM TEAM BY BIOLOGY EXPERIMENTS:**



BEAM CHARACTERISTICS

	$^{28}Si^{14}$		$^{56}Fe^{26}$
	600 MeV/n	**1000 MeV/n**	**1000 MeV/n**
Fluence (particles/cm^2/sec)			
Maximum on target	**TBD**	**100**	**1 x 10^8**
Minimum on target	**400**	**50**	**400**
Spill rate (spills/min)	**18**	**18**	**18**
Spill length (msec)	**500-600**	**500-600**	**500-600**
Particles/spill			
Maximum	**1 x 10^8**	**1000**	**1 x 10^8**
Minimum	**1.5 x 10^5**	**500**	**1.5 x 10^5**
Beam spot diameter (cm)	**7.5**	**4**	**7.5 - 9**
Beam cut off length.	**<1%**	**<1%**	**<1%**
Actual Energy (MeV/n)			
Extracted	**600**	**1200**	**1078**
On Target	**585**	**1182**	**1046**
Actual LET on Target (keV/µm)	**49.5**	**42**	**148**
Dose/rate recorded (cGy/min)			
Maximum	**TBD**	**TBD**	**350**
Minimum	**1**	**TBD**	**0.2**
Minimum dose exposure (cGy)	**TBD**	**5**	**0.1**
No of hours for beam characterization, tuning and dosimetry	**12**	**8**	**14.5**

BNL-8 Run Statistics and Incidents

Date	Shift	HIP Avail.	Non-HIP*	Remarks
04/09/02	1	5.5	2.5	0.6 GeV Si run start, dosimetry. Magnet trip.
	2	5	3	Cooling lines clogged, fire alarm, vacuum problems
	3	8	0	Biology experiments start.
04/10/02	4	8	0	No incidents.
	5	6.5	1.5	Gate door lock broken. Delays due to repairs.
	6	5.5	2.5	Magnet trip and power supply problems.
04/11/02	7	7.5	0.5	MCR call for new settings
	8	7	1	Gate door security problems (re-sweep)
	9	8	0	Change energies to 1 GeV/n, dosimetry. Physics run.
04/12/02	10	7.5	0.5	Tandem problems
	11	8	0	Switch to 1 GeV/n Fe, dosimetry, tuning low intensity
	12	8	0	Physics run starts-end. Biology studies start.
04/13/02	13	2.5	5.5	Tandem problems (valves closed), Vacuum leak at
	14	0	8	Booster. Vacuum leak at TTB
	15	3	5	Interlock problems.
04/14/02	16	8	0	No incidents
	17	8	0	No incidents
	18	8	0	No incidents
04/15/02	19	8	0	No incidents
	20	7.5	0.5	Foil change at Tandem
	21	6	2	Septum magnets problems
04/16/02	22	7	1	idem
	23	4	4	Septum trip, water flow. Chipmunk replacement.
	24	8	0	No incidents.
04/17/02	25	7.5	0.5	Magnet tripped.
	26	0.5	0	End BNL-8
Totals:	26	162.5 hr. (81%)	37.5 hr. (19%)	

*Time loss due to machine or power supply problems, setting up operations.

BNL-8 EXPERIMENTERS AND RUN STATISTICS

Exp. ID	Principal Investigator	Ion & Energy	Beam Time Approved	Beam Time Used	Dose Range (cGy)	Dose/Rate (cGy/min)	Number of Samples
B-1	Zeitlin	Fe, 1 GeV/n Si, 1 GeV/n	8 8	6 13	NA	NA	NA
B-3	Cucinotta/Wu	Fe, 1 GeV/n Si, 0.6 GeV/n	2 2	3 3	NA	NA	NA
B-7	Rabin	Fe, 1 GeV/n Si, 0.6 GeV/n	6 6	6 9.5	50 to 250 200 to 400	100 200	172 70
B-10	Chang	Fe, 1 GeV/n	17.5	4	10 to 200	NA	100
B-19	Kronenberg	Fe, 1 GeV/n Si, 0.6 GeV/n	6 10	6 6	NA	NA	NA
B-25	Evans	Fe, 1 GeV/n	2	1.5	10 & 100	NA	40
B-44	Durante	Fe, 1 GeV/n	5	4.5	100 to 5000	100 & 1500	50
B-45	Setlow	Fe, 1 GeV/n	2.5	1.5	30 to 100	100	70
B-48	Green	Fe, 1 GeV/n	1	1	10 to 300	50 & 100	13
B-51	Murnane	Fe, 1 GeV/n	3	2.5	100 to 800	200	20
B-52	Gerwitz	Fe, 1 GeV/n Si, 0.6 GeV/n	2.5 1	6 2.5	35 to 200 35 to 200	20 & 100 20 & 100	100 100
B-53	Lupton	Fe, 1 GeV/n	11	6	100	100	140
B-54	Kennedy	Fe, 1 GeV/n	4	2.5	5 to 200	NA	200
B-57	Koniarek	Fe, 1 GeV/n	0	0	NA	NA	30
B-58	Chen	Fe, 1 GeV/n	2	1	25 to 200	NA	30
B-60	Morell	Fe, 1 GeV/n	0	0	NA	NA	50
B-61	Pecaut	Fe, 1 GeV/n Si, 0.6 GeV/n	3.5 0	2 2	100 to 2000 100 to 2000	100 to 1000 “	120 120
B-62	Obenaus	Fe, 1 GeV/n	7	3.5	150 & 200	100	90
B-63	Nelson	Fe, 1 GeV/n Si, 0.6 GeV/n	1.5 0.5	5 3	200 & 1000	100-500	46
B-64	Vazquez	Fe, 1 GeV/n	13	10	15 to 240	50 to 150	200
B-65	Vazquez	Fe, 1 GeV/n Si, 0.6 GeV/n	7 3	5 3.5	15 to 200 15 to 200	50 to 150 50 to 150	100 100
B-66	Narici	Fe, 1 GeV/n	12	9.5	NA	NA	10

B-67	Blakely	Fe, 1 GeV/n	6	2.5	100 & 400	100	70
B-39	Burns	Fe, 1 GeV/n	3	1.5	1 to 300	50-100	50
Totals			**150 hr**	**133 hr**	**5 to 5000**	**20 to 1500**	**~2121**

BNL-8 PARTICIPANTS, EXPERIMENTAL SAMPLES AND ENDPOINTS

Exp.	Participants	Samples	Endpoints
B-1	Heavy Ion Fragmentation and Transport in Matter **C. Zeitlin (PI)**	Solid state detectors	Heavy ion fragmentation CR39 calibration
B-3	Heavy Ion Induced Chromosome Damage and Biomedical Countermeasures **F. Cucinotta/H. Wu (PI)**	Human lymphocyte and human fibroblast (AG1522)	PCC chromosome damage Gene expression using SELDI Protein Chip System
B-7	Effects of Exposure to Heavy Ions. **B. Rabin (PI)**	Sprague-Dawley Rats	Neurological and neurochemical changes
B-10	Charged Particle Radiation-induced Genetic Change in Transgenic Mice **P. Chang (PI)**	Mice (C57Bl/6), Mice (C57lacZTrp53) henizygous Mice (C57lacZTrp53) nullizygous	Target Gene Recovery and measurement of mutation frequency (MF) Micronuclei measurement Measurement of chromosome aberrations in lymphocytes
B-19	Mutagenesis and Genomic Inestability in Human Lymphoid cells **A. Kronenberg (PI)**	Human lymphoid cells (TK6) and WTK-bclX_L	Apoptosis induction, mutat collection, cell killing and mutation, DSB rejoining/fidelity
B-25	Induction of Genomic Instability in Human Lymphoblast **H. Evans (PI)**	LY-S1 and LY-SR1 murine lymphoblast, human colon cancer cells	Protective effects of WR1065 against cytotoxicity and mutagenic effect. Detection by GFP
B-44	Influence of the Shielding on the Space rad. Biological Effectiveness**.** **M. Durante (PI)**	AG1522 human diploid foreskin fibroblasts	DNA damage and repair. Shielding effects.
B-45	Germ Cell Mutagenesis in Medaka Fish Following Exposure to HZE particle radiation **R. Setlow (PI)**	Male Medaka fish	Mutation induction
B-48	Radiobiology of thyroid follicular cells. **L. Green (PI)**	Thyroid cells	Gene expression alterations
B-51	Particle-Ind. Telomere Loss in Human cells. **J. Murnane (PI)**	SC308H cells	Survival, mutation frequency, chromosomal changes and telomere status.
B-52	Effect of Deep Space Radiation on Human Hematopoietic Stem Cells. **A. Gerwitz (PI)**	TF-1 cells	DNA damage (DSB and clustered damages)

B-53	Nutritional Countermeasures to Radiation Exposure. **J. Lupton (PI)**	Sprague-Dawley rats	Gene expression, tumor incidence.
B-54	Screening of Agents for Protection Against Radiation Induced Oxidative Stress **A. Kennedy (PI)**	Sprague-Dawley rats Htori-3 human thyroid cells 10T1/2 mouse fibroblast cells	Cell transformation. Measure of oxidative stress (DCF). Antioxidant assays in collected tissues.
B-57	Microlesions in Membranes Induced by Heavy Ion Rad. **J. Koniarek (PI)**	Phosphatidylcholine vesicles dye-filled	Florescence signal.
B-58	Radiation Induced Genomic Instability **D. Chen (PI)**	Cells IRS1-SF(neo14) and IRS1-SF(neo4)	Gene maping and radiation damage using FISH techniques, Chromosome painting
B-60	Study of the Effects of Heavy Ion Radiation on Diamon Ultraviolet Sensors. **G. Morell (PI)**	Diamond UV sensors (molybdenum disks covered with diamonds)	Microstructure-property correlations
B-61	Assessment of Pre-pulse Inhibition of the Acoustic Startle Response After in the C57Bl/6 Mouse Exposure to Accelerated Ions. **M. Pecaut (PI)**	C57Bl/6 Mice	Behavioral Testing: Acoustic Startle Response.
B-62	Differential Cognitive, Behavioral, and Biological Effects of Protons and 56Fe Irradiatiion of the Rat Brain **A. Obenaus (PI)**	Sprague-Dawley rats	Behavioral Testing: Radial Arm Maze and Morris Water Maze
B-63	Radiation Induced Gene Expression Profile in C57Bl/6 Mice **G. Nelson (PI)**	C57Bl/6 Mice	Gene Expression using microarray analysis.
B-64	Risk Assessment and Chemoprevention of HZE-Induced CNS Damage **M. Vazquez (PI)**	NT2 human neural stem cells, oligodendrocytes	Survival, apoptosis, gene expression.
B-65	CNS Damage and Countermeasure **M. Vazquez (PI)**	C57Bl/6 Mice	Behavioral Testing: Locomotor activity and Morris Water Maze. Neurochemistry.
B-66	ALTEA-MICE: Effects of transient heavy ion radiation on the electrophysiology of the mice visual system **L. Narici (PI)**	C57Bl/6 Mice	Electrophysiology of retinal estructures
B-67	Lens Epithelium and Proton-induced Cataractogenesis. **E. Blakely (PI)**	Human lens epithelial cells	Changes in gene and/or protein expression of FGF-2, β1integrin $p21^{Cip1}$, apoptosis.
B-71	Selective Inhibition of 56Fe carcinogenesis by Dietary Retinod **F. Burns (PI)**	Sprague-Dawley Rats	Skin tumor induction and modulation by dietary retinyl actetate.

List of personnel that participated in the planning, organization and execution of BNL-8 run

BNL Management:

- Laboratory Director: **Peter Paul**
- Associate Director for High Energy and Nuclear Physics**: Tom Kirk**
- Associate Laboratory Director for Life Sciences: **Nora Volkow**

NASA Management:

- Headquarters: **Walter Schimmerling**
- JSC: **Frank Cucinotta**

Scientific Advisory Committee:

- **Betsy Sutherland** (Chair), BNL
- **Louis Pena,** BNL
- **Richard Setlow,** BNL
- **Joel Bedford,** CSU
- **Les Braby,** PNL
- **Charles Geard,** Columbia University

Collider Accelerator Department-AGS

- Chairman: **Derek Lowenstein**
- Deputy Chairman: **W.T. Weng**
- Associate Chair of Operations: **A.J. McNerney**
- Experimental Planning and Support Head: **Philip Pile**
- Associate Chair for ESHQ: **Ed Lessard**
- ESHQ Division Head: **Ray Karol**
- ESH Coordinator: **Asher Etkin**
- Facility Support Representative: **Chuck Schaefer / Henry Kahnhauser**
- Environmental Coordinator: **Joel Scott**
- Training and Procedures Manager : **John Maraviglia**
- Main Control Room: **Peter Ingrassia**
- Work Control Manager: **Peter Cirnigliaro**
- BNL Laser Safety Officer: **Chris Weilandics**
- Experimental Safety Review Committee: **Yousef Makdisi (Chair)**
- Radiation Safety Committee: **Dana Beavis (Chair)**
- **Acc**elerator Safety Review Committee: **Woody Glenn (Chair)**
- ALARA Committee: **Chuck Schaefer (Chair**
- Associate Chair for ES&H/Q.A: **E. Lessard**
- Accelerator Division Head: **Thomas Roser**
- Chief Electrical Engineer: **J. Sandberg**

- Chief Mechanical Engineer: **J. Tuozzolo**
- Accelerator Physicist lead by: **Leif Aherns**
- Tanden Group leader: **Peter Thieberger**
- Physics Support: **Yusef Makadisi**
- CAD Components and instrumentation support: **David Gassner**
- AGS Radiation Safety Committee: **Ken Reece**
- C-A Dept Training Manager: **John Maraviglia**
- AGS Control Section lead by: **Don Barton**
- Liaison Engineering Group lead by: **David Phillips**
- Liaison physicist: **Adam Rusek**
- RHIC&AGS Users Center: **Susan White-DePace, Angela Melocoton**
- Mechanical Service Technicians led by: **Fred Kobasiuk**
- Survey Group led by: **Frank Karl**
- Beam Service Technicians led by**: Paul Valli**
- Electronic Service Technicians led by: **Bill Anderson**
- AGS Instrumentation Group led by: **Pete Stillman**
- AGS Main Control Room and Operations led by: **Pete Ingrassia**
- Health Physics Group led by: **Chuck Schaefer**
- AGS Electricians led by **Bill Softye**
- AGS Riggers led by: **Nick Cipolla**
- Carpenter and Welder Support Service and Technical Support led by: **Roger Hubbard**

Medical Department:

- Dept. Chair: **John Gatley**
- Medical Liaison: **Marcelo E. Vazquez**
- Building manager: **W. Gunther**
- Administration: **Denise White and Donna Russo**
- Animal Care Facilities: **Maryann Kershaw, Kerry Bonti, Chris Risland.**
- Technical support**: Opal Thomas, Katherine Conkling, Bae Pyatt**
- Training Coordinator: **Ann Emrick**
- **RCD**
  - **Kay Conkling**
  - **Dennis Ryan**
  - **Deana Buckallew**
  - **Jim Williams**
  - **Bob Colichio**

Plant Engineering:

- BLAF Custodian, **P. Abrams**

- Plumbers: **B. McCafferty**
- Painters/Carpenters: **B. Laakmann**
- Electricians: **T. Baldwin**

Biology Department:

- Chairman: **Carl Anderson**
- **Betsy Sutherland**
- Cesiun Source Manager: **Richard Satkoulis**

Lawrence Berkeley National Laboratory:

- **Jack Miller**
- **Lawrence Heilbronn**
- **M. Nyman**
- **R. P. Singh**
- **W. Holley**