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Tenth Edition
Informal Report

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The AGS Complex

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AGS EXPERIMENTS: 1991 • 1992 • 1993

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BNL 34518
Tenth Edition
Informal Report

AGS EXPERIMENTS - 1991, 1992, 1993

J. C. Depken

April 1994

AGS Department
Experimental Planning and Support Division

BROOKHAVEN NATIONAL LABORATORY
Associated University, Inc.
Upton, New York 11973 U.S.A.

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AGS Experiments - 1991, 1992, and 1993

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This is the *tenth edition*. Please forward suggestions and changes for future editions to:

Division Head, EP&S Division
Brookhaven National Laboratory
Building 911B
Upton, New York 11973 U.S.A.

THE CUTOFF DATE FOR APPROVED EXPERIMENTS INCLUDED IN THIS EDITION IS JANUARY 1, 1994.

FY1993 AGS SCHEDULE — AS RUN

RUNNING
 FACILITY COMMISSIONING
 PARASITIC RUNNING

BY: I. CHIANG
 DATE: 11-22-93

AGS MODE				S	P												P	Au	
BEAM	EXP. NO.	EXPERIMENTER	HRS.	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.			
		AGS STARTUP																	
		AGS-BOOSTER STUDIES																	
A1	852	CHUNG/DZIERBA	887																
A2	865	ZELLER	139																
A3	878	CRAWFORD	986																
			807																
B1	866	CHASMAN/HAMAGAKI	852																
B2		TEST BEAM	831																
B5	871	MOLZON/RITCHIE/WOJCICKI	1155																
			3600																
C1	850	CARROLL/HEPPELMANN	1264																
C5	877	BRAUN-MUNZINGER	775																
C6	874	HUNGERFORD/PETERSON/CHRIEN	804																
C8	890	NEFKENS/CHRIEN/PENG	369																
			300																
D6	813	BARNES/FRANKLIN	2254																
D6	885	MAY/FRANKLIN	10																
D6	886	IMAI/DIEBOLD/PILE	937																
			683																
AGS	880	LEE/RATNER	2																
			320																
C	APT	WARD/ZUCKER	30																
B2	APT	WARD/ZUCKER	20																
		SMALL HIP EXPERIMENTS																	
B1	862	HILL	42																
			36																
B1	863	OTTERLAND/WILKES	30																
			25																
B1	875	JAIN	28																
			2																
B1	883	HEINRICH	29																
			10																
B1	882A	PRICE	23																
C5	882B	PRICE																	
			50																
B1	893	THOMPSON	2																
			1																
AGS MODE				S	P												P	Au	

AGS MODES

S = SHUTDOWN
 P = SLOW EXTRACTED PROTONS, 24.5 GeV
 Au = SLOW EXTRACTED GOLD BEAM, 11 GeV/n
 FEB = FAST EXTRACTED BEAM
 MBE = MULTIPLE BUNCH EXTRACTION
 SBE = SINGLE BUNCH EXTRACTION
 p = 0.8-1.5 GeV PROTONS, FEB

FY1994-95 AGS SCHEDULE

(PRELIMINARY)

RUNNING
PARASITIC RUNNING
LIMITED RUNNING

FACILITY COMMISSIONING
SUBJECT TO APC APPROVAL

- SUBJECT TO CHANGE -
(100 HOURS PER WEEK)

BY: P. PILE
DATE: 3-30-94

AGS Experiments, ≥FY1993 (as of 30 Mar 1994)

Exp/Mode Institutions

E787 SEB	BNL/Princeton/TRIUMF/KEK/INS-Tokyo
E813 SEB	• Alberta/Birmingham/BNL/CMU/Freiburg/IUCF/Kyoto/Kyoto Sanygo/LANL/Manitoba/New Mexico/TRIUMF/Vassar/Yale
E817 PP	Rice/BNL/Johns Hopkins/Minnesota
E821 MBE	BNL/Boston/Cornell/Fairfield/Heidelberg/Illinois/KEK/LANL/LBL/Max Planck-Heidelberg/Minnesota/Novosibirsk/Tokyo/Riken/Yale
E836 SEB	Alberta/Birmingham/BNL/CMU/Freiburg/IUCF/Kyoto/Kyoto Sanygo/LANL/Manitoba/New Mexico/TRIUMF/Vassar/Yale
E841 FEB	ANL/Minnesota/Oxford/Rutherford-Appleton
E844 HIP	BNL/Oregon State
E849 SEB	AT&T Bell Laboratory
E850 SEB	BNL/Minnesota/Mt. Holyoke/Penn State/U Mass-Dartmouth/Tel Aviv
E852 SEB	BNL/Indiana/IHEP/Louisville/Moscow State/Notre Dame/U Mass-Dartmouth
E856 SEB	Bloomsburg/BNL/Case Western/Harvard/Loma Linda/Mass/Syracuse/SUNY Health Science Center
E862 HIP	BNL/Iowa State
E863 HIP	• Alma-Ata/Beijing/Dubna/Jaipur/Jammu/Hunan/Khlopin/Lebedev/Linten/Lund/Phillips/Safarik/Panjab/Tashkent/Washington/Sydney/Hua-Zhong/Yerevan
E864 HIP	BNL/Iowa St./MIT/Penn St./Purdue/Bari/U Mass/Wayne St./Yale
E865 SEB	BNL/Bern/Connecticut/INR-Moscow/JINR-Dubna/PSI/Basel/Pittsburgh/Tbilisi/New Mexico/Yale/Zurich
E866 HIP	ANL/BNL/Columbia/INS-Tokyo/Kyoto/Kyushu/LLNL/MIT/NYU/UC-Riverside/UCSSSL/Tokyo/Tsukuba
E871 SEB	UC-Irvine/U Richmond/Stanford/U Texas/Austin/William & Mary
E874 SEB	• BNL/Colorado/Cornell/Hampton/Houston/Ohio U/TRIUMF/Vassar/Yale
E875 HIP	• SUNY-Buffalo
E876 SEB	William & Mary/Virginia St./George Mason/Columbia
E877 HIP	BNL/GSI/Idaho Nat Eng Lab/McGill/Pittsburgh/Sao Paulo/SUNY-Stony Brook/Wayne St
E878 HIP	UCSSSL/BNL/Columbia/Johns Hopkins/KEK/LBL/Tokyo/UCLA/USRA/Waseda/Yale
E880 PP	ANL/BNL/FNAL/IUCF/KEK/TRIUMF
E881 SEB	BNL/CCNY/RPI
E882 HIP	• UC-Berkeley
E883 HIP	• Siegen
E885 SEB	BNL/CMU/Kyoto/Kyoto Sanygo/Manitoba/New Mexico/TRIUMF/Vassar
E886 HIP	• Birmingham/BNL/CMU/Freiburg/Kyoto/Kyoto Sanygo/New Mexico/Vassar/Yale
E887 SEB	BNL/Hampton/Houston/Indiana/Ohio U/Tokyo/INS-Tokyo
E889 FEB	U. Penn/BNL/UC Riverside/UC Santa Barbara/Linfield/LANL/Louisiana Tech/New Mexico/Southern U & A&M College/Temple/LSU/Montreal/Texas/TRIUMF/Valparaiso
E890 SEB	Abilene Christian/BNL/UCLA/LANL/Julich/Ohio U/Vassar/Zagreb
E891 HIP	BNL/CCNY/UC-Berkeley/UC-Davis/Rice
E892 HIP	BNL/LBL/Iowa State/Stanford
E893 HIP	• Dublin Institute for Advanced Studies
P894 SEB	BNL/INP-Krakow/Jagiellonian Univ/MIT/Niels Bohr Inst/Illinois/Maryland/Yale
P895 HIP	UC-Davis/INFN-Italy/Kent State/LBL/LLNL/Purdue/Texas A&M/Texas
E896 HIP	SSL-LBL/UCLA/Wayne State/Johns Hopkins/UC-Berkeley/BNL/Columbia/LBL/Texas/USRA/Catania/CERN
E898 HIP	LBL/JPL/San Francisco/Columbia/Colorado State/UC Davis
E899 SEB	Colorado/Rio de Janeiro/SUNY-Stony Brook/PINSTECH
P900 SEB	BNL/Indiana/Michigan St./Maryland/Simon Fraser

Title

Continued search for the rare decays $K^+ \rightarrow \pi^+ + \text{neutrals}$
Search for a strangeness -2 dibaryon

Spin transfer in hyperon production
A new precision measurement of the muon g-2 value at the level of 0.35 ppm

Search for a strangeness -2 dibaryon using a ^3He target

Physics calibration of the Soudan-II nucleon decay experiment using neutrinos at the AGS

Measurement of the angular distribution for fragments in the target rapidity region
Search for muonium to antimuonium conversion
EVA, a Solenoid detector for large angle exclusive reactions: phase I - determining color transparency to 22 GeV/c
Search for mesons with unusual quantum numbers
Exploration of the biomedical potential of antiprotons

Electromagnetic dissociation of ^{60}Co and ^{197}Au by ^{136}La and ^{197}Au projectiles
Particle production and fragmentation in collisions of heavy ions in nuclear targets at AGS energies
Production of rare composite objects in relativistic heavy ion collisions
An improved search for the decay $K^+ \rightarrow \pi^+ \mu^+ e^-$

Studies of particle production at high baryon density using the Au beam

A search for a very rare K^0 decays
Kaon-nucleus quasielastic and elastic scattering
Study of particle production and nuclear fragmentation in relativistic heavy ion collisions in nuclear emulsions
 μ^+ surface beam characterization
Study of relativistic nuclear collisions with heavy ion beams using the E814 4 π calorimetry and modified forward spectrometer
Investigation of antinucleus production and search for new particles in nucleus-nucleus collisions at the AGS
The effects of a partial snake on polarization at the AGS
Utilizing $\phi\phi$ spectroscopy to search for exotic glueballs, exotic hybrid or multiquark states
Search for particles with $|Z| \geq 3$ and negative charge or large A/Z produced in central nucleus-nucleus collisions
Fragmentation of Au-projectiles at AGS energies
Experiment to detect AA hypernuclei
Search for new particles in nucleus-nucleus collisions

Do narrow Σ hypernuclear states exist?
Long baseline neutrino oscillation search

A new test of charge symmetry in η production on deuterium
A search for quark matter (QGP) and other new phenomena utilizing Au-Au collisions at the AGS
Capture from pair production
Temperature/zenith angle calibration of polycarbonate track detectors
PHOBOS@AGS: A study of high baryon density using the PHOBOS spectrometer

Exclusive study of nuclear collisions at the AGS

To search for a short lived H dibaryon, short lived strange matter, and to investigate hyperon production in 11.8 A GeV/c AuAu collisions
Genetic and epigenetic effects produced by high energy heavy ions
High energy pion-induced nuclear fragmentation
Energy dissipation & multifragmentation in p+A reactions between 2 & 28 GeV/c

SEB = Slow Extracted Beam - Protons
SBE = Single Bunch Extraction - Protons
• = Completed in FY93

FEB = Fast Extracted Beam - Protons
PP = Slow Extracted Beam - Polarized Protons

HIP = Slow Extracted Beam - Heavy Ions
MBE = Multiple Bunch Extraction - Protons

AGS BEAMS October 1993

Flux/ 10^{13} protons on target													
Beam	GeV/c	$\delta p/p$ (% fwhm)	Prod Ang (deg)	$\Delta\Omega$ (msr)	K ⁺	K ⁻	p	$\bar{p}$	π^+	π^-	GeV/c	Purity	Remarks
Separated Charged Particle Beams													
C4	≤ 0.83	4	0.0	12.	4.6×10^6	1.5×10^6	1.5×10^9	1.0×10^8	6.0×10^9	6.0×10^9	0.80	$\pi^+/K^+ = 0.4$	L=18m, LESBIII
C6,C8	≤ 0.75	5	5.0	10.	3.0×10^6	1.0×10^6	1.0×10^9	1.4×10^8	6.0×10^9	6.0×10^9	0.70	$\pi^-/K^- = 5$	L=15m, LESBII
D6	≤ 1.9	6	5.0	1.6	5.5×10^6	2.3×10^6	3.0×10^8	1.1×10^8	4.9×10^8	4.1×10^8	1.80	$\pi^+/K^+ = 1$	L=31m, 2GEV Beam Line
											1.80	$\pi^-/K^- = 0.8$	
												$\pi^-/\bar{p} = .07$	
Unseparated Charged Particle Beams													
A1*	5-28	3	0	0.2	1.9×10^6	2.9×10^4	5.0×10^9	2.3×10^3	3.0×10^7	1.0×10^7	18		L=130m to MPS, "OR" w/A3
A2	< 6.5	5	3.5	0.75	3.4×10^7	1.1×10^7	4.0×10^8	3.7×10^6	7.4×10^8	5.1×10^8	6		L=40m, Commissioned FY93
A3*	1-28	4	0	0.1			6.0×10^8		1.0×10^8	4.0×10^7	14		Primarily heavy ions, "OR" w/A1
B1*	5-28	3	0	0.05			3.0×10^8		3.0×10^7	2.0×10^7	14		Primarily heavy ions, "OR" w/B5
B2	< 9	1.4	6	0.11	3.4×10^5	1.2×10^5	8.5×10^8	9.5×10^4	1.2×10^7	9.0×10^7	4		Test Beam, Commissioned FY93
C1	1-20	5	0	0.8	3.0×10^7	3.5×10^6	1.0×10^9	0.7×10^8	3.5×10^8	2.5×10^8	13		L=61m, "OR" w/C5
C5*	1-28	2	0	0.15			1.0×10^8				13		L=81m, Primarily heavy ions
Neutral Beams													
B5	2-15		1-4.5	0.1	K_L^0 flux = 5.0×10^8					2-15	$n/K_L^0 = 6$	L=10m, "OR" w/B1	
Muon Channel													
D2	.025-.15	9(π) 30(μ)	135(π)	24(π)	μ^+ flux = 2.0×10^6 Surface μ^+ flux = 2.0×10^6							To be commissioned	
Neutrino Beam													
U					ν flux = $2.0 \times 10^{10}/m^2$ Wide Band $\bar{\nu}$ flux = $1.4 \times 10^{10}/m^2$ Wide Band							Not presently available FEB flux avg. over 1.5m R. $\langle E \rangle = 1.4 GeV/c^2$ Wide Band	
g-2 π - μ Transfer Line													
v1	< 3.0	0.6	0		π^+ flux = 1.6×10^6 μ^+ flux = 7.3×10^5					3.0		L=120m, for injection to g-2 ring Commission in FY96, fast spill	

* These 0° beam lines can be used for full energy polarized protons and/or heavy ion beams

AGS Experimental Area

FY1991 Physics Program

1 Apr - 30 Jun 91, 24 GeV/c protons
1 Feb - 18 Mar 91, 14.0 GeV/c/nucleon Si

Experiment Multiplicity

SEB ≤ 10

SEB+FEB ≤ 12

21 May - 31 Jul 92, 24 GeV/c protons
 21 Mar - 21 Apr 92, 14.0 GeV/c/nucleon Si
 26 Apr - 7 May 92, 11.5 GeV/c/nucleon Au

g-2 μ Storage Ring

V1, π - μ Beam Line

U Line

RHIC Transfer Line

D2- μ Channel

E813, H Search; ATP Test

E886, New Particle Search (HI)

A2-Test Beam; 14 Groups

SSC Test Beam, 14 Groups

E878, New Particle Search (HI)

E863, E868, E875, E882, E883 (HI-Small)

NASA Test (HI-Small)

B2-MPS, E881, $\phi\phi$ Spectroscopy

B2-MESB

Test Beam, 3 Groups

B1 { E859, E866 (HI)

E862, E869 (HI-Small)

B5, E871, $K_L^0 \rightarrow \mu e$; E888, H Search

C1-EVA, E850

Color Transparency

C5 { Test Beam, 1 group
 E814, E877 (HI)

C6-LESBII, Hypernuclear Spectrometer.
 E781, E874, η -Test (P890)

A-tgt { E844, E862 (HI-Small)
 E884, Fractional Charge

C4-LESBIII
 E787, $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

C8-LESBII

SEB $\leq$ 10

SEB+FEB $\leq$ 12

AGS Experimental Area

FY1993 Physics Program

1 June - 31 July 93, 24 GeV/c protons
1 Sept - 14 Oct 93, 11 GeV/c/nucleon Au

AGS Experimental Area

FY1994 Physics Program (planned)

25 March 94

E821, g-2 μ Storage Ring, construction

V1, π - μ Beam Line, construction

I10, E880
Partial Snake

U Line
construction

RHIC Transfer Line
construction

D2- μ Channel

D6-2GeV { E836, H Search; E885, $\Lambda\Lambda$ Hypernuclei
E899, Nuclear Fragmentation

D-Target

A-Target

A2-6GeV, E865, $K^+ \rightarrow \pi^+ \mu^+ e^-$

A3, E864, Strangelets (HI)

B-Target

A1-MPS { E852, Exotics
E891, QGP (HI-Standby)

B2-Test Beam

C-Target

B'-Target

B1, E866, QGP (HI)

B5, E871, $K_L^0 \rightarrow \mu e$

C4-LESBIII
E787, $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

C'-Target

C1-EVA, E850
Color Transparency

C5, E877, QGP (HI)

C8-LESBII
E890, η Physics

C6-LESBII, Hypernuclear Spectrometer
E887, Σ Hypernuclei

Experiment Multiplicity

SEB ≤ 10

SEB+FEB ≤ 12

List of Experiments

Experiment	Collaboration Spokesman	Experiment Title	Page
774	Houston/BNL/New Mexico/Vassar <i>Hungerford</i>	Search for Σ -Hypernuclear Levels in ${}^4\text{He}$	17
781	BNL/MIT/Houston/Carnegie-Mellon/Vassar/NYU <i>Deutsch and May</i>	Spin Dependence of the Lambda Nucleus Interaction Determined by Observation of Hypernuclear Gamma Rays	19
787	BNL/INS-Tokyo/KEK/Princeton/TRIUMF <i>Bryman, Littenberg, Smith</i>	A Study of the Decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$	21
810	BNL/CCNY/Johns Hopkins/Rice <i>Lindenbaum and Platner</i>	A Search for Quark Matter (QGP) and Other New Phenomena Utilizing Heavy Ion Collisions at the AGS	23
813	Carnegie-Mellon/Alberta/Birmingham/BNL/Freiburg/IUCF/Kyoto/Kyoto-Sangyo/LAMPF/Manitoba/New Mexico/TRIUMF/Vassar/Yale <i>Franklin and Barnes</i>	Search for a Strangeness -2 Dibaryon	25
814	BNL/GSI/LANL/McGill/New Mexico/Pittsburgh/São Paulo/SUNY Stony Brook/Tel-Aviv/Texas A&M/Wayne St/Yale <i>Braun-Munzinger</i>	Study of Extreme Peripheral Collisions and of the Transition from Peripheral to Central Collisions in Reactions Induced by Relativistic Heavy Ions	27
817	Rice/BNL/Johns Hopkins/Minnesota <i>Bonner and Roberts</i>	Polarization Transfer in Hyperon Production	29

Experiment	Collaboration Spokesman	Experiment Title	Page
821	Boston/BNL/Budker Inst/Cornell/ Fairfield/Heidelberg/Illinois/LBL/ LANL/Max Planck/Minnesota/ KEK/Riken/Tokyo/Yale <i>Hughes, Morse, and Roberts</i>	A New Precision Measurement of the Muon g-2 Value at the Level of 0.35 PPM	31
836	Carnegie-Mellon/Alberta/ Birmingham/BNL/Freiburg/IUCF/ Kyoto/Kyoto Sangyo/LAMPF/ Manitoba, New Mexico/TRIUMF/ Vassar/Yale <i>Franklin and Barnes</i>	Search for a Strangeness -2 Dibaryon Using a ^3He Target	33
840	Rochester/BNL/Fermilab/Trieste <i>Melissinos</i>	A Search for the Coherent Pro- duction of Light Scalar and Pseudo- scalar Particles	35
844	BNL/Oregon State <i>Cumming</i>	Measurement of Angular Distri- butions for Fragments in the Target Rapidity Region	37
849	AT&T Bell Laboratories <i>Harshman and Mills</i>	Search for Muonium to Anti- muonium Conversion	39
850	BNL/Minnesota/Mt. Holyoke/ Penn State/UMass-Dartmouth/ Tel-Aviv <i>Carroll and Heppelmann</i>	EVA, A Solenoidal Detector for Large Angle Exclusive Reactions. E850: Determining Color Trans- parency to 22 GeV/c	41
852	BNL/Indiana/Louisville/UMass- Dartmouth/Notre Dame/Moscow <i>Chung and Dzierba</i>	Search for Mesons with Unusual Quantum Number	43
854	Rice/BNL/CCNY/Johns Hopkins/ UCLA/Maryland <i>Bonner</i>	Antiproton-Nucleus Interactions at 5-10 GeV/c	45

Experiment	Collaboration Spokesman	Experiment Title	Page
856	BNL/Bloomsburg/Case Western Res/Harvard Cyclotron Lab/Loma Linda/Massachusetts/Syracuse/ SUNY Health Science Ctr <i>Kalogeropoulos</i>	Exploration of the Biomedical Potential of Antiprotons	47
859	ANL/BNL/Columbia/INS-Tokyo/ Kyoto/Kyushu/LLNL/MIT/NYU/ UC-Space Sci. Lab/UC-Riverside/ Tokyo/Tsukuba <i>Remsberg and Zajc</i>	Studies of High-Density Baryon Matter from Extended Measurements of Particle Momentum Distributions and from High-Precision Two-Particle Correlations	49
862	Iowa St/BNL <i>Hill</i>	Electromagnetic Dissociation of ^{59}Co and ^{197}Au by ^{139}La and ^{197}Au	51
863	Alma Ata/Beijing/Chandigarh/ Changsha/JINR-Dubna/Jaipur/ Jammu/Košice/Linfen/Lund/ Marburg/Lebedev Inst/St. Petersburg/Washington/Sydney/ Tashkent-INP/Phys-Tech Inst- Tashkent/Hua-Zhong/Physics Inst-Yerevan <i>Wilkes and Otterlund</i>	Au Beam Exposures for E815: Particle Production and Nuclear Fragmentation in Collisions of Heavy Ions in Nuclear Targets at AGS Energies	53
864	BNL/Iowa St/MIT/Penn St/ Purdue/Bari/Massachusetts/ Wayne St/Yale <i>Sandweiss</i>	Production of Rare Composite Objects in Relativistic Heavy Ion Collisions	55
865	BNL/Bern/Connecticut/INS- Moscow/JINR-Dubna/New Mexico/PSI/Basel/Pittsburgh/ Tbilisi/Yale/Zurich <i>Zeller</i>	Proposal to Perform and Improved Search for the Decay $K^+ \rightarrow \pi^+ \mu^+ e^-$	57

Experiment	Collaboration Spokesman	Experiment Title	Page
866	ANL/BNL/Columbia/INS-Tokyo/ Kyoto/Kyushu/LLL/MIT/NYU/ UC-Space Sc.Lab/UC-Riverside/ Tokyo/Tsukuba <i>Chasman and Hamagaki</i>	Studies of Particle Production at High Baryon Density Using the Au Beam	59
868	Minnesota/Louisiana St/INP- Krakow/ITEP-Moscow <i>Waddington</i>	Exp. 808-Interactions of 14.1 GeV/ nucleon Nuclei from 16) to 197Au in and Heavy Targets	61
869	Minnesota/Washington/Caltech <i>Waddington</i>	Measurement of Fragment Yields for 14 GeV/nucleon Au + X Collisions	63
871	UC-Irvine/Stanford/Richmond/ Texas-Austin/William & Mary <i>Kane, Molzon, Ritchie and Wojcicki</i>	A New Search for Very Rare K_L Decays	65
874	Colorado/Houston/BNL <i>Chrien, Hungerford, Peterson</i>	Kaon-Nucleus Quasielastic and Elastic Scattering at 720 MeV/c	67
875	SUNY-Buffalo <i>Jain</i>	Study of Particle Production and Nuclear Fragmentation in Relativistic Heavy-Ion Collisions in Nuclear Emulsions	69
876	William & Mary/Virginia St/ George Mason/Columbia <i>Kossler</i>	μ^+ Surface Beam Characterization	71
877	BNL/GSI/Idaho Nat Eng Lab/ McGill/Pittsburgh/São Paulo/ SUNY-Stony Brook/Wayne St <i>Braun-Munzinger</i>	Study of Relativistic Nuclear Collisions with Heavy Beams Using the E814 4 π Calorimetry and Modified Forward Spectrometer	73
878	UC-Space Sci.Lab/BNL/UCLA/ KEK/Waseda/Johns Hopkins/ Tokyo/LBL/Columbia/USRA/Yale <i>Crawford</i>	Investigation of Antinucleus Production and Search for New Particles in Nucleus- Nucleus Collisions at the AGS	75

Experiment	Collaboration Spokesman	Experiment Title	Page
880	IUCF/BNL/ANL/TRIUMF/ Fermilab/KEK <i>Lee and Ratner</i>	The Effects of a Partial Siberian Snake on Polarization at the AGS	77
881	BNL/CCNY/RPI <i>Lindenbaum</i>	Utilizing $\phi\phi$ Spectroscopy to Search for Exotic Glueballs, Exotic Hybrid or Exotic Multiquark States	79
882	UC-Berkeley <i>Price</i>	Search for Particles with $ Z \geq 3$ and Negative Charge or Large A/Z Produced in Central Nucleus-Nucleus Collisions	81
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884	Pittsburgh <i>Perera</i>	An Experiment to Enhance Fractional Charge Impurities (FCI) in Semi- conductors to be Used in an Opto- electronic Search for FCIs	85
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890	UCLA/BNL/LANL/Forschungszentrum Jülich/Ruder Boskovic Inst <i>Nefkens, Chrien, and Peng</i>	A New Test of Charged Symmetry in Eta Production on Deuterium	97
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Summaries

of

Experiments

The BNL Hypernuclear Spectrometer System as configured during the initial running phase of E774. Since then the Pion Spectrometer has been moved from the LESB-I beam line to the LESB-II beam line. The Kaon Spectrometer is now comprised of the end elements of LESB-II.

Beam: C6
Status: Complete in 1991
Hours Charged/Approved 1141/1150

EXPERIMENT 774 - SEARCH FOR Σ -HYPERNUCLEAR LEVELS IN ${}^4\text{He}$

University of Houston E.V. Hungerford, B.W. Mayes, H. Piekarz, L.S. Pinsky
Brookhaven National Laboratory S. Bart, R. Chrien, P. Pile
University of New Mexico B. Bassalleck
Vassar College R. Stearns
Spokesman: E.V. Hungerford

The question of narrow (2 MeV) structure in sigma hypernuclei is not completely resolved. This structure is much narrower than theoretical estimates which range from 13 to 80 MeV, and has led to much theoretical speculation as to a mechanism that could suppress the strong conversion process, $\Sigma N \rightarrow \Lambda N$, within the nucleus. The ${}^{12}_{\Sigma}\text{B}$ spectrum has been measured in E774. Earlier published results indicated narrow peaks (2 MeV) in the spectrum. There is no evidence for this structure in this data. All the spectra are reminiscent of final state enhancements and very similar to a spectrum calculated using the continuum shell model. In addition, there is no significant structure below threshold which should be evident if the strong conversion width is suppressed. Thus, the extraction of a sigma spin-orbit strength from these data, as has been previously done, is probably incorrect. This leaves open the whole question of a sigma spin-orbit interaction.

Data is in the final stages of analysis with publication expected in the near future.

The BNL Hypernuclear Spectrometer System as configured during the initial running phase of E781. Since then the Pion Spectrometer has been moved from the LESB-I beam line to the LESB-II beam line. The Kaon Spectrometer is now comprised of the end elements of LESB-II. The target is surrounded with either intrinsic germanium detectors or NaI detectors.

Beam: C6
Status: Complete 1992
Hours Charged/Approved: 1167/1120

**EXPERIMENT 781 - SPIN DEPENDENCE OF THE LAMBDA NUCLEUS INTERACTION
DETERMINED BY OBSERVATION OF HYPERNUCLEAR GAMMA RAYS**

Brookhaven National Laboratory S. Bart, R.E. Chrien, M. May, P. Pile

**Massachusetts Institute
of Technology** M. Deutsch

University of Houston E.V. Hungerford, B. Mayes, L. Pinsky

Carnegie-Mellon University P. Barnes

Vassar College R.L. Stearns

New York University B. Budick

Spokesmen: M. Deutsch and M. May

This experiment measured the γ -ray transitions between hypernuclear states which differ only by the orientation of the Λ spin with respect to the angular momentum of the nuclear core. This directly measures the spin dependence of the Λ nucleus interaction independent of any model. We expect these spin dependent splittings to be less than 300 keV. Germanium detectors were used to observe the γ rays in coincidence with a pure sample of hypernuclear events in a narrow range of excitation energy selected by the hypernuclear spectrometer in LESBI and LESBII at the AGS. This experiment continued the research begun in Experiment 760, the first experiment to utilize this $(K\pi, \gamma)$ coincidence technique.

E-787 DETECTOR

JULY 1990

Beam: C4
Status: In progress
Hours Charged/Approved: 6391/10500

EXPERIMENT 787 - A STUDY OF THE DECAY $K^+ \rightarrow \pi^+ \nu \bar{\nu}$

Brookhaven National Laboratory S. Adler, M.S. Atiya, I-H. Chiang, J.S. Frank,
J.S. Haggerty, S. Kettell, T.F. Kycia, K.K. Li,
L.S. Littenberg, A.J. Stevens, R.C. Strand, C. Witzig

INS-Tokyo K. Ino, T. Komatsubara, T. Morimoto, H. Okumo,
K. Omata, S. Sugimoto, K. Ukai

KEK T. Inagaki, S. Kabe, M. Kobayashi, Y. Kuno, T. Sato,
T. Shinkawa, Y. Yoshimura

Princeton University M. Ardebili, M. Convery, M.M. Ito, D.R. Marlow,
R. McPherson, P.D. Meyers, F.C. Shoemaker, A.J.S. Smith

TRIUMF E.W. Blackmore, D.A. Bryman, L. Felawka, P. Kitching,
A. Konaka, J.A. Macdonald, T. Nakano, T. Numao,
V. Pacradouni, P. Padley, J.-M. Poutissou, R. Poutissou,
G. Redlinger, J. Roy, M. Rozon, R. Soluk, A.S. Turcot

Spokesmen: D.A. Bryman, L.S. Littenberg, A.J.S. Smith

Experiment 787 is a search for reactions of the type $K^+ \rightarrow \pi^+ XX$, where X is a weakly interacting light neutral particle. The experiment is sensitive to such decays at the 10^{-10} level. The prime candidate is $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ which provides a uniquely stringent test of the Standard Model and its parameters because it is the only experimentally accessible process that is dominated by an unambiguously calculable higher order weak interaction. Two body decays $K^+ \rightarrow \pi^+ X$ are also searched for to place constraints on the existence of a variety of hypothetical particles such as axions, familons, hyperphotons and supersymmetric neutrals predicted by extensions to the SM. Several other rare decays including $K^+ \rightarrow \pi^+ \gamma \gamma$, $K^+ \rightarrow \pi^+ \mu^+ \mu^-$, $\pi^0 \rightarrow \nu \bar{\nu}$ and $\pi^0 \rightarrow \gamma XX$ are also being investigated.

The three TPC modules shown in the MPS magnetic field have 12 rows of anode readout wires. Each row is spaced 3.8 cm apart and consists of 256 short anode wires 1 cm of length along the beam direction and with 2.54 mm spacing between wires. The wire number gives the X, Z coordinates and the drift time gives the Y coordinate for unambiguous 3-D point determination. Greater than 120 Si-on-Au track events have been pattern recognized with good efficiencies. Lambdas have been observed. The drift region in each of three modules is 60 cm high by 65 cm wide by 47 cm long. A time-of-flight wall (not shown) identifies anti-protons.

Beam: A1
Status: Complete in 1991
Hours Charged/Approved: 2074/2350

**EXPERIMENT 810 - A SEARCH FOR QUARK MATTER (QGP) AND OTHER NEW
PHENOMENA UTILIZING HEAVY ION COLLISIONS AT THE AGS**

Brookhaven National Laboratory A. Etkin, K.J. Foley, R.W. Hackenburg, R.S. Longacre,
W.A. Love, E.D. Platner, A.C. Saulys

**City College of New York and
Brookhaven National Laboratory** S.J. Lindenbaum

City College of New York C.S. Chan, E. Efstathiadis, M.A. Kramer, K. Zhao, Y. Zhu

Johns Hopkins University T. Hallman, L. Madansky

Rice University S. Ahmad, B.E. Bonner, J.A. Buchanan, C.N. Chiou,
J.M. Clement, G.S. Mutchler

Spokesmen: S.J. Lindenbaum and E.D. Platner

Heavy ion collisions have been studied at the AGS by measuring the angles and momenta of virtually all charged particles emitted in each event for the forward half of the rapidity range in the n-n cross section. Particle identification is approximately accomplished by assuming negative particles are "pions" and positives-negatives are $\approx$ "protons."

The experimenters have found increasing stopping of 14.5 GeV/c Si ions in Si, Cu and Pb targets respectively with near maximal stopping occurring in Pb. We have observed larger K_s^0 and Λ production than simple cascade models predict but including many secondary interactions in the cascade explains the major features of our results except for the transverse momentum spectrum. We have observed and are also studying multi- Λ (2-3) and multi- K_s^0 events. We found a higher exponential slope at low $p_\perp$ for pions. We are also searching for strangelet candidates.

Fig. III.B.1. Schematic layout of the $(\Xi^-, d)_{\text{atom}}$ experiment. The detection of neutrons from the reaction $(\Xi^-, d)_{\text{atom}} \rightarrow H + n$ will be the signature of H particle production.

EXPERIMENT 813 - SEARCH FOR A STRANGENESS -2 DIBARYON

Carnegie-Mellon University	A. Berdoz, G. Franklin, R. Magahiz, R. McCrady, F. Merrill, C. Meyer, B. Quinn, R.A. Schumacher, R. Sukaton, V. Zeps
University of Alberta	M. Rozon
University of Birmingham	J. Lowe, J. Nelson, R. Zybert
Brookhaven National Laboratory	R. Chrien, P. Pile, R. Sawafta, R. Sutter
Freiburg University	T. Buerger, M. Burger, H. Fischer, J. Franz, E. Rössle, H. Schmitt, M. Wieder
Indiana Univ. Cyclotron Facility	J. Szymanski
University of Kyoto	H. Enyo, T. Iijima, K. Imai, N. Saito, S. Yokkaichi
University of Kyoto-Sangyo	K. Okada, F. Takeutchi
LAMPF	P. Barnes
University of Manitoba	C. Davis, L. Gan, M. Landry, L. Lee, S. Page, D. Ramsay, V. Sum, W. van Oers
University of New Mexico Wolfe	B. Bassalleck, M. Chapman, A. Rusek, R. Stotzer, D.
TRIUMF	D. Gill
Vassar College	R. Stearns
Yale University	G. Diebold
Spokesmen:	G.B. Franklin and P.D. Barnes

Motivated by Jaffe's 1977 prediction of a six-quark object with strangeness -2 and $J^{\pi} = 0^{+}$ at a mass of 2150, this experiment proposes to study the strangeness -2 two-baryon mass spectrum from 100 MeV below the mass of the lightest known two-baryon strangeness -2 system, $\Lambda\Lambda$ mass. This particle, called the "H", has been predicted by later bag models as well. Although the mass calculation is model dependent, the predictions are considered within the expected range of sensitivity. The possibility of resonances near the $\Lambda\Lambda$ mass due to conventional meson exchange forces can also be explored since the experiment covers the region both above and below the $\Lambda\Lambda$ mass.

**EXPERIMENT 814 - STUDY OF EXTREME PERIPHERAL COLLISIONS AND OF THE
 TRANSITION FROM PERIPHERAL TO CENTRAL COLLISIONS IN REACTIONS INDUCED BY
 RELATIVISTIC HEAVY IONS**

Brookhaven National Laboratory	M. Fatyga, D. Lissauer, T. Ludlam, S. McCorkle, E. O'Brien, H. Takai, T. Throwe, C. Woody
GSI, Darmstadt	N. Herrmann
Los Alamos National Laboratory	D. Fox, J. Simon-Gillo
McGill University	J. Barrette, S. Gilbert, R. Lacasse, S.K. Mark, M. Rosati, G. Wang
University of New Mexico	D. Wolfe
University of Pittsburgh	W. Cleland, K. Jayananda, D. Kraus, U. Sonnadara, Z. Zhang
University of São Paulo	N. DaSilva, O. Dietzsch, M. Takagui
State University of New York, Stony Brook	P. Braun-Munzinger, G. David, J. Dee, T. Hemmick, B. Hong, W. Llope, M. Rao, J. Stachel, L. Waters, N. Xu, Y.C. Zhang, C. Zou
Texas A&M University	K. Wolf
Wayne State University	R. Bellwied, S. Bennett, T. Cormier, J. Hall, Q. Li, A. Lukaszew, R. Matheus, C. Pruneau
Yale University	S.V. Greene, B. Shiva Kumar, R. Majka, J. Mitchell, F. Rotondo, J. Sandweiss,
Spokesman:	P. Braun-Munzinger

Experiment 814 combines 4π calorimeter coverage with a high resolution forward spectrometer. Extreme peripheral collisions are investigated by making an exclusive study of projectile fragmentation processes induced by Coulomb excitation. Central collision, including transverse energy and charged particle multiplicity production and a search for hydrodynamic flow effects are also studied. In the forward spectrometer, spectra for protons, neutrons and eventually, pions and kaons are measured to provide a detailed picture of the stopping process. A search is made for neutral particles, possibly produced in central collisions. The possible production of strange matter in such collisions is studied. The target area calorimetry provides a reaction trigger while fragments are identified in the forward spectrometer by their momentum/charge, Time-Of-Flight, specific energy loss and kinetic energy. This includes a measurement of anti-proton production and a search for anti-nucleus production in such collisions.

EXPERIMENTAL LAYOUT for E-817

Beam: A1
Status: Awaiting Polarized Proton Run
Hours Charged/Approved: 700/1300

EXPERIMENT 817 - POLARIZATION TRANSFER IN HYPERON PRODUCTION

Rice University

D.L. Adams, S. Ahmad, B.E. Bonner, J.A. Buchanan,
J.M. Clement, M.D. Corcoran, H.E. Miettinen,
G.S. Mutchler, J.B. Roberts, J. Skeens, P.M. Stevenson

Brookhaven National Laboratory S.U. Chung, H. Willutzki

Johns Hopkins University

T. Hallman, L. Madansky

University of Minnesota

K.A. Johns

Spokesmen:

B.E. Bonner and J.B. Roberts

Since the discovery that inclusively produced hyperons are polarized, the underlying cause of the effect has remained a mystery. No perturbative QCD predictions are possible for the kinematic range covered by experiment, but simple parton-based theories that explain the effect in terms of breaking of strings or Thomas precession of strongly accelerated quarks have had a remarkable degree of success in explaining the effect. This experiment aims to measure the hyperon polarization when produced by a polarized proton beam. The question being addressed is how much the hyperon polarization is influenced by that of the proton. The experiment has been performed for the case of lambdas produced by polarized protons at 13 and 18 GeV/c. In rough agreement with the model, the lambda polarization is independent of that of the proton ($D_{NN} \approx 0$) and the left-right asymmetry for lambda production is also near zero. A first measurement of these quantities for Σ^0 production has shown large deviations from the predictions of the model. We expect to continue the Σ^0 experiment to be able to make a definitive test of an extended model which we have proposed.

G-2 π - μ BEAM

The anomalous gyromagnetic ratio of the muon (g-2) will be measured to 0.36 ppm or a factor of 20 times better than it is currently known. The predicted contribution to (g-2) from the first order $W^\pm$ and Z^0 radiative correction is predicted to be 1.7 ppm so this experiment will provide a direct test of the electroweak radiative correction, and hence of the renormalizability of the Glashow-Weinberg-Salam theory. Since a_μ is sensitive to a wide range of non-standard model effects there is a window in which to search for new physics. W or muon substructure, super-symmetry and the existence of new gauge bosons are several possibilities. A 14 m diameter superferric muon storage ring under construction will be completed in 1994. The plan is to be ready for data collection in FY 1996.

Experiment 821 - A New Precision Measurement of the Muon g-2 at the Level of 0.35 PPM

Boston University	E. Benedict, D.H. Brown, R.M. Carey, E.S. Hazen, F. Krienen, Z. Liu, J.P. Miller, J. Ouyang, B.L. Roberts, L.R. Sulak, W. Worstell
Brookhaven National Laboratory	J. Benante, G. Bennett, H.N. Brown, G. Bunce, J.R. Cullen, Jr., G.T. Danby, J. Geller, H-C. Hseuh, J.W. Jackson, L.X. Jia, R. Larsen, Y.Y. Lee, S. Mane, R. Meier, W.-Z. Meng, W.M. Morse, C. Pai, I. Polk, A. Prodell, S. Rankowitz, J. Sandberg, Y. Semertzidis, R. Shutt, L. Snodstrup, A. Soukas, A. Stillman, T. Tallerico, P.A. Thompson, F. Toldo, K. Woodle
Budker Institute for Nuclear Physics	L.M. Barkov, D.N. Grigoriev, B.I. Khazin, E.A. Kuraev, Yu.M. Shatunov, E. Solodov
Cornell University	T. Kinoshita, Y. Orlov
Fairfield University	D. Winn
University of Heidelberg	K. Jungmann, R. Prigl, P. von Walter, G. zu Putlitz
University of Illinois	P. Debevec, G. Garino, P. Harris, D. Hertzog, T. Jones
Lawrence Berkeley Lab./ Brookhaven National Lab.	M.A. Green
Los Alamos National Lab.	W.P. Lysenko
Max Planck Institut fur Med. Forschung, Heidelberg	U. Haeberlen
University of Minnesota	P. Cushman
National Laboratory for High Energy Physics (KEK)	K. Endo, H. Hirabayashi, S. Ichii, S. Kurokawa, K. Mashata, Y. Mizumachi, S. Sakamoto, T. Sato, A. Yamamoto
University of Riken	K. Ishida
University of Tokyo	K. Nagamine
Yale University	S.K. Dhawan, A.A. Disco, F.J.M. Farley, X. Fei, V.W. Hughes, S.I. Redin, Q. Xu
Spokesmen:	V.W. Hughes, W.M. Morse, B.L. Roberts

Experimental apparatus for ^3He target H particle search.

Beam: D6
Status: Approved
Hours Charged/Approved: 0/700

**EXPERIMENT 836 - SEARCH FOR A STRANGENESS -2 DIBARYON
USING A ^3He TARGET**

Carnegie-Mellon University	A. Berdoz, G. Franklin, R. Magahiz, R. McCrady, F. Merrill, C. Meyer, B. Quinn, R. Schumacher, R. Sukaton, V. Zeps
University of Alberta	M. Rozen
University of Birmingham	J. Lowe, J. Nelson, R. Zybert
Brookhaven National Laboratory	R. Chrien, P. Pile, R. Sawafta, R. Sutter
Freiburg University	T. Buerger, M. Burger, H. Fischer, J. Franz, E. Rössle, H. Schmitt, M. Wieder
Indiana University Cyclotron Facility	J. Szymanski
University of Kyoto	H. Enyo, T. Iijima, K. Imai, N. Saito, S. Yokkaichi
Kyoto Sangyo University	K. Okada, F. Takeuchi
LAMPF	P. Barnes
University of Manitoba	C. Davis, L. Gan, M. Landry, L. Lee, S. Page, D. Ramsay, V. Sum, W. van Oers
University of New Mexico	B. Bassalleck, M. Chapman, A. Rusek, R. Stotzer, D. Wolfe
TRIUMF	D. Gill
Vassar College	R.L. Stearns
Yale University	G. Diebold
Spokesmen:	G.B. Franklin and P.D. Barnes

The two component target, used in the $(Z^-,d)_{\text{atom}}$ H search of Exp. 813 will be replaced with a single ^3He target used in the reaction $K^- + ^3\text{He} \rightarrow K^+ + H + n$. With the ^3He target, greater sensitivity to a more tightly bound H is achieved. The ^3He target is to be considered a logical addition to the two component target measurement to extend the region of sensitivity to greater values of binding energy.

Exp. 840 anticipated sensitivity to ellipticity and rotation
as a probe of axion mass and coupling constant.

Non-Accelerator
Status: Complete in 1991
Hours Charged/Approved:

**EXPERIMENT 840 - A SEARCH FOR THE COHERENT PRODUCTION OF LIGHT SCALAR
AND PSEUDOSCALAR PARTICLES**

University of Rochester

R. Cameron, A.C. Melissinos, G. Ruoso, Y.K. Semertzidis

Brookhaven National Laboratory H. Halama, D.M. Lazarus, A.G. Prodell, G. Smith

Fermilab

F.A. Nezrick

Trieste

G. Cantatore, C. Rizzo, E. Zavattini

Spokesman:

A.C. Melissinos

E840 is a non-accelerator experiment designed to search for the coherent production of low mass bosons through their coupling to two photons. An example is the axion which is a natural consequence of the breaking of the Peccei-Quinn symmetry which provides a natural explanation for the absence of CP violation in the strong interaction. Interest in the possible existence of axions has intensified as they are excellent candidates for the dark matter presumed responsible for our lack of understanding of galactic dynamics. In the coherent production experiment, the axions would make their presence known through a minute rotation of the polarization of laser light whose photons interact with the virtual photons of the field of a pair of superconducting CBA magnets. No such rotation was observed with a sensitivity of 10^{-10} radian, leading to an upper limit of $3.6 \times 10^{-7} \text{ GeV}^{-1}$ for the coupling of the two photons to axions of mass below a milli-eV. A subsequent experiment, using the same apparatus with the addition of a low noise, cooled photomultiplier tube searched for the presence of axions through regeneration of the photons in the field of the second magnet by axions produced in the first magnet that have passed through a mirror separating the two magnets. Two days of running resulted in a limit on the coupling of $7.7 \times 10^{-7} \text{ GeV}^{-1}$. Finally an attempt was made to detect a flux of so-called "hadronic axions" produced in the solar interior via the Primakoff effect. This variety of axion has no direct coupling to electrons and therefore is incapable of cooling the sun so that its age would appear much greater than observed. An AGS 18D72 dipole magnet with its axis oriented in the direction of the sun at sunset was used to convert axions into x-ray photons in a vacuum pipe mounted in its gap. An x-ray sensitive proportional wire chamber was coupled to the pipe. With the standard solar model it was determined that the coupling of these "hadronic axions" to two photons could not exceed $7.7 \times 10^{-9} \text{ GeV}^{-1}$ for axion masses less than 0.11 eV. Tests were carried out in preparation for a new polarization experiment which would be capable of directly measuring Delbruck (photon-photon) scattering for the first time.

Evolution of angular distributions of Xe-127 and Ar-37 from the fragmentation of gold by heavy ions as a function of projectile rapidity, y . Filled points from AGS experiment E-844 are compared with existing data at Bevalac energies. Smooth curves indicate general trends. Note that the upper and lower data sets for each product are displaced by a factor of three from central set to simplify the display.

Beam: A
Status: Awaiting high intensity run
Hours Charged/Approved: 32/100

**EXPERIMENT 844 - MEASUREMENT OF ANGULAR DISTRIBUTIONS FOR FRAGMENTS
IN THE TARGET RAPIDITY REGION**

Brookhaven National Laboratory

D. Beavis, J.B. Cumming, P.E. Haustein,
R.W. Stoenner

Oregon State University

W. Loveland

Spokesman:

J.B. Cumming

Angular distributions have been measured for typical light (Ar-37) and heavy (Xe-127) products from the fragmentation of gold by 13.6-GeV/nucleon Si-28 ions. Preliminary results from the April 1992 running period are compared with existing data at Bevalac energies in the accompanying figure. Projectile rapidity, y , rather than its mass is expected to be the dominant variable determining the shape of a distribution. The E844 results, shown as filled points, indicate only small changes in the Xe-127 angular distribution between $y = 1.85$ and $y = 3.44$, consistent with the hypothesis of limiting fragmentation. In contrast, those for Ar-37 suggest a significantly increased suppression of fragments at forward angles for the $y = 3.44$ projectile. These results confirm the integral F/B measurements of AGS E825 which indicated an enhanced "backsplash" for light multifragmentation products which was not expected on the basis of existing studies of p-nucleus collisions up to 400 GeV or of nucleus-nucleus interactions at Bevalac energies. Unfortunately, technical problems led to loss of some E844 data, particularly for Ar-37 at forward angles, and additional measurements are anticipated.

TOP VIEW SIDE VIEW

Beam: D2
Status: Test Approved
Hours Charged/Approved:0/200

EXPERIMENT 849 - SEARCH FOR MUONIUM TO ANTIMUONIUM CONVERSION

AT&T Bell Laboratories

Spokesmen: D.R. Harshman and A.P. Mills, Jr.

This experiment proposes to search for the spontaneous conversion of muonium (M) to anti-muonium ($\bar{M}$) in vacuum, by looking for the spectator orbital positron remaining after the decay of the μ^- . Important constraints will be placed on certain supersymmetric theories that allow the violation of lepton number conservation.

850

Beam: C1
 Status: In progress
 Hours Charged/Approved: 1264/2500

**EVA, A SOLENOIDAL DETECTOR FOR LARGE ANGLE EXCLUSIVE REACTIONS
 EXPERIMENT 850 - DETERMINING COLOR TRANSPARENCY TO 22 GeV/c**

Brookhaven National Laboratory	D.S. Barton, G. Bunce, A.S. Carroll, S. Gushue, Y.I. Makdisi, T. Roser, M. Tanaka
University of Minnesota	N. Christensen, H. Courant, M.L. Marshak,
Mt. Holyoke College	H. Nicholson, S. Sutton
Pennsylvania State University	S. Durant, S. Heppelmann, E. Minor, J.Y. Wu
University of Massachusetts-Dartmouth	D. Martel, J.J. Russell
Tel-Aviv University	H. Aclander, J. Alster, I. Mardor, Y. Mardor, E. Piasetzky
Spokesmen:	A.S. Carroll and S. Heppelmann

In order to extend the range and sensitivity of measurements of large angle exclusives scattering, a solenoidal detector, EVA, will be built. This new detector will increase the solid angle acceptance by a factor of 20 over the existing dipole detector and provide for 1% momentum measurements of outgoing 10 GeV/c particles. The initial experiment, 850, will allow the determination of nuclear transparency up to 22 GeV/c incident proton momentum. The additional momentum constraint derived from the measurement of both outgoing protons will produce a much improved signal to noise ratio. At 6 GeV/c, the missing energy will be ~ 50 MeV, allowing a partial separation of nuclear states. The solenoidal configuration provides an excellent geometry for studying a wide variety of two-body exclusive reactions near 90° in the center of mass. For example, reactions involving the two-body decays of neutral particles

will be very interesting.

E852

Beam: A1
Status: Running
Hours Charged/Approved: 887/2500

EXPERIMENT 852 - SEARCH FOR MESONS WITH UNUSUAL QUANTUM NUMBERS

Brookhaven National Laboratory S.U. Chung, K. Olchanski, D. Weygand, H.J. Willutzki

Indiana University B.B. Brabson, R.R. Crittenden, A.R. Dzierba, J. Gunter,
R. Lindenbusch, E. Scott, Z. Siliak, P.T. Smith,
T. Sulanke, S. Teige, D. Zieminska

University of Louisville C.L. Davis

**University of Massachusetts-
Dartmouth** Z. Bar-Yam, J. Dowd, P. Eugenio, W. Kern

University of Notre Dame T. Adams, J.M. Bishop, R. Cady, N.M. Cason, J. LoSecco,
J. Manak, W.D. Shephard, D. Stienike, S. Taeger,
D.R. Thompson

Moscow State University L.I. Belzer, V.A. Bodyagain, L. Bravina, A.I. Demianov,
A.M. Gribushin, V. Korotkick, N. Kruglov, A. Ostrovidov,
A. Proskuryakov, L. Sarycheva, L.N. Sinev

Spokesmen: S.U. Chung and A.R. Dzierba

Despite a number of experimental searches there is still no unambiguous candidate for a glueball, hybrid or four-quark state, although QCD predicts such objects. However, there are some tantalizing states, among them the $M^0(1405)$ which has exotic $J^{PC} = 1^{-+}$ and the scalar $G(1590)$ which has unusual branching ratios for a quark-antiquark state.

The experimenters will study these and other states, concentrating on decay modes of mesons with multi-photons and 0, 1 or 2 charged particles. The detector is built around the MPS. The target will be surrounded by a CsI veto, charged particle detectors and a scintillation counter. The target will be followed by charged particle detectors, a Cerenkov counter and a 2000-element lead glass calorimeter to detect photons from meson decays.

Fig. 1. Layout of the Multiparticle Spectrometer.

Fig. 2. Beam Line Layout.

Fig. 3. A typical reconstructed event.

Fig. 4. A preliminary missing mass spectra.

Beam: A1
Status: Complete in 1991
Hours Charged/Approved: 672/644

EXPERIMENT 854 - ANTIPROTON-NUCLEUS INTERACTIONS AT 5-10 GeV/c

Rice University	S. Ahmad, B.E. Bonner, J.A. Buchanan, J.M. Clement, A. Empl, G.S. Mutchler, S. Toshkov
Brookhaven National Laboratory	S.E. Eiseman, A. Etkin, K.J. Foley, R.W. Hackenburg, R.S. Longacre, W.A. Love, T.W. Morris, E.D. Platner, A.C. Saulys
BNL and City College of New York	C.S. Chan, M.A. Kramer, S.J. Lindenbaum
Johns Hopkins University	L. Madansky
University of California-Los Angeles	T. Hallman
University of Maryland	D.C. Peaslee
Spokesman:	B.E. Bonner

The purpose of the experiment is to study hot hadronic nuclear matter predicted to form in the annihilation of energetic antiprotons on nuclei. This process probes the high temperature-low density region of the nuclear matter phase diagram. It is therefore complementary to heavy ion experiments which access the low temperature-high density region such as AGS E810. The E854 data run occurred at the MPS facility in May-June 1991. Antiproton beams of 5, 7 and 9 GeV/c were used to interact with C, Al, Cu, Sn and Pb nuclear targets. The layout of the MultiParticle Spectrometer and the beam line elements are shown in Figs. 1 and 2 respectively.

Charged tracks were measured in both the forward and backward direction with drift chambers. In addition, the multiplicity distribution at lab angles of 90 ± 45 degrees was measured with a cylindrical array of silicon diodes surrounding the target. The large angle charged particle multiplicity results are now published and the experimenters are currently in the final stage of data analysis to extract the inclusive neutral strange particle production, overall charged particle multiplicity and the rapidity distributions of λ , anti- λ and K_s in $\bar{p}$ annihilation reactions. It was necessary for the experimenters to write their own tracking program to track the charged particles in both directions. A typical reconstructed event demonstrating the tracking capability is shown in Fig. 3. A very preliminary missing mass spectra of λ and K_s from annihilations of antiproton (9 GeV/c) on Pb is shown in Fig. 4.

Beam: C8
Status: Approved pending funding
Hours Charged/Approved: 0/600

**EXPERIMENT 856 - EXPLORATION OF THE BIOMEDICAL POTENTIAL
OF ANTIPROTONS**

Brookhaven National Laboratory	S. Bart, G. Bennett, R. Chrien, M. Sakitt, R. Sawafter, R. Sutter
Bloomsburg University	L. Gray
Case Western Reserve University	W. Fickinger, D.K. Robinson
Harvard Cyclotron Laboratory	A. Koehler
Loma Linda University	J. Archambeau
University of Massachusetts	A.B. Brill
Syracuse University	L. Huang, T. Kalogeropoulos, J. Reed, Z. Sobolewski, K. Wang, T. Young
SUNY Health Science Center	D. Bassano, S. Manglos, S.C. Prasad
Spokesman:	T. Kalogeropoulos

The potential of antiprotons for practical applications within present antiproton collection capabilities is promising. Suggested applications include direct 3D electron density imaging, 3D multi-elemental imaging, guiding precise and easy delivery of ion beams to targets, and radiation therapy.

In this initial phase of the research, the following physics questions will be addressed: (a) Comparison of antiproton capture rates in complex targets with the Z-law; (b) Studies of the annihilation mechanism in nuclei. These studies of physics interesting on their own right will provide as well basic information in evaluating the proposed applications.

This heavy ion experiment will extend the inclusive cross section measurements of E802 over a significantly larger kinematic range and perform high-precision two-particle measurements on particles produced in nucleus-nucleus collisions. The goal is to provide a comprehensive body of data on inclusive (π , K, p, d) and two-particle correlations ($\pi\pi$, K^+K^+ and pp) which may provide insight into the formation of high density nuclear matter, its subsequent space-time evolution, source kinematics and possible thermodynamic properties.

**EXPERIMENT 859 - STUDIES OF HIGH-DENSITY BARYON MATTER FROM EXTENDED
MEASUREMENTS OF PARTICLE MOMENTUM DISTRIBUTIONS AND FROM
HIGH-PRECISION TWO-PARTICLE CORRELATIONS**

Argonne National Laboratory	S. Kaufman
Brookhaven National Laboratory	D. Beavis, C. Chasman, Z. Chen, Y.Y. Chu, J.B. Cumming, R. Debye, M. Gonin, S. Gushue, O. Hansen, S. Hayashi, M.J. LeVine, B. Moskowitz, J. Olness, L.P. Remsberg, D. Roehrich, M.J. Tannenbaum, J.H. van Dijk, F. Videbaek, H. Wegner
Columbia University	C. Y. Chi, B. Cole, S. Nagamiya, T. Nayak, P. Stankus, O. Vossnack, F.Q. Wang, Y. Wang, Y.D. Wu, X. Yang, W.A. Zajc
University of Tokyo (INS)	Y. Akiba, H. Hamagaki, S. Homma
Kyoto University	H. Kaneko
Kyushu University	Y. Tanaka
Lawrence Livermore National Laboratory	H.C. Britt, J. Costales, N. Namboodiri, T.C. Sangster, J. Thomas, S. Tonse
Massachusetts Institute of Technology	V. Cianciola, W.L. Kehoe, R.J. Ledoux, D. Morrison, R.J. Morse, C.G. Parsons, P. Rothschild, R. Soltz, S.G. Steadman, G.S.F. Stephans, T. Sung, V. Vutsadakis, D.S. Woodruff, D. Zachary
New York University	B. Budick
University of California Space Sciences Laboratory	H.J. Crawford, J. Engelage
University of California at Riverside	P. Beery, S.-Y. Fung, J. Kang, R. Seto
University of Tokyo	R. Hayano, H. Sakurai
University of Tsukuba	K. Kurita, Y. Miake
Spokesmen:	L.P. Remsberg and W.A. Zajc

Schematic diagram of target array for low beam intensity bombardments.

Schematic diagram of target array for high beam intensity bombardments.

Beam: A/B1
Status: Au beam completed 1993;
La to be scheduled
Hours Charged/Approved: 42/36

**EXPERIMENT 862 - ELECTROMAGNETIC DISSOCIATION OF ^{59}Co AND ^{197}Au
BY ^{139}La AND ^{197}Au**

Iowa State University

L. Ewell, J.C. Hill, B. Libby, F.K. Wohn

Brookhaven National Laboratory

J.B. Cumming

Spokesman:

J.C. Hill

Electromagnetic Dissociation (ED) is a purely electromagnetic process occurring in relativistic heavy ion (RHI) reactions in which the Coulomb field of one of the participants generally excites a giant resonance in the other. The most likely decay channel for heavy nuclei is by one-neutron emission. ED was first reported in accelerator experiments (projectile fragmentation) by Heckman and Lindstrom and for target fragmentation by this experimental group. The ED cross section for the reaction $^{197}\text{Au}(^{238}\text{U}, X)^{196}\text{Au}$ at 0.96 GeV/nucleon was measured to be 3.16 ± 0.23 barns. The experimenters are extending their measurements of the ED process to higher energies by measuring yields of target fragments from the collision of ^{139}La and ^{196}Au projectiles on ^{59}Co and ^{197}Au targets.

863

Emulsion chamber with double coated plates.

Simulated Pb-Pb event at 160 A GeV.

T=target

In E863, nuclear emulsions are used as detectors to study ultrarelativistic heavy-ion interactions. The principal aim of the experiment is to investigate global aspects of multiparticle production like the mass and energy dependence of charged particle multiplicities, angular distributions of charged particles, and target and projectile break-up. The experiment, however, also focuses on local particle density fluctuations. Indications of a Quark Gluon Plasma phase transition in terms of high overall particle densities combined with large local fluctuations are studied.

Within the collaboration two complementary techniques are used, each with its own advantages. The conventional technique with horizontally exposed stacks is predominantly used for obtaining minimum bias data, and for special studies of the target break-up. In order to gain maximal resolution in interactions of extreme multiplicities, where many particle are produced in a narrow forward cone, the use of vertically exposed emulsion chambers facilitates the measurement.

Beam: A3/B1
 Status: Completed 1993
 Hours Charged/Approved: 30/25

EXPERIMENT 863 - AU BEAM EXPOSURES FOR E815: PARTICLE PRODUCTION AND NUCLEAR FRAGMENTATION IN COLLISIONS OF HEAVY IONS IN NUCLEAR TARGETS AT AGS ENERGIES

Alma Ata, Institute of High Energy Physics	N.P. Andreeva, Z.V. Anzon, V.I. Bubnov, I.Y. Chasnicov, G.Z. Eligbaeva, L.E. Eremenko, A.S. Gaitinov, G.S. Kalyachkina, E.K. Kanygina, A.M. Seitimbetov, C.I. Shakova
Beijing, Acadmica Sinica	P.Y. Zheng
Chandigarh, Panjab Univ.	M.M. Aggarwal, R. Arora, V.S. Bhatia, I.S. Mittra
Changsha, Hunan Ed. Inst.	Y.X. Li, L. Liang, Z.G. Liu, Z.Q. Weng, Y.L. Xia
Dubna, Joint Institute for Nuclear Research	S.A. Krasnov, J.J. Musulmanbekov, G.S. Shabratova, K.D. Tolstov
Jaipur, University of Rajasthan	K.B. Bhalla, S.K. Gupta, V. Kumar, S. Lokanathan, S. Mookerjee, R. Raniwala, S. Raniwala
University of Jammu	S.K. Badyal, A. Bhasin, V.K. Gupta, S. Kachroo, S. Kitro, L.K. Mangotra, N.K. Rao
Košice, Šafarik University	L. Just, M. Karabova, M. Tothova, S. Vokal, J. Vrlakova
Linfen, Shanxi Normal	X. Chan, S.B. Luo, Y.M. Qin, D.H. Zhang
University of Lund	S. Garpman, B. Jakobsson, J. Nystrand, I. Otterlund, K. Soderstrom, E. Stenlund
Marburg, Phillips University	E.R. Ganssauge, C. Graf, M. Ochs, M. Roeper
Moscow, Lebedev Institute	M.I. Adamovich, Y.A. Alexandrov, M.M. Chernyavski, S.G. Gerassimov, S.P. Kharlamov, V.G. Larionova, N.V. Maslennikova, G.I. Orlova, N.G. Peresadko, N.A. Salmanova, M.I. Tretyakova
St. Petersburg, Khlopin Radium Institute	V.G. Bogdanov, V.A. Plyushev, Z.I. Solovieva
Seattle, Univ. of Washington	T.H. Burnett, J.G. Grote, J.J. Lord, D. Skelding, R.J. Wilkes
Sydney, Univ. of Sydney	A.M. Bakich, L.S. Peak
Tashkent, Institute of Nuclear Physics	E.S. Basova, I.K. Bazarov, D.A. Carshiev, S.Z. Nasyrov, N.V. Petrov, T.P. Trofimova, U.I. Tuleeva, B.P. Tursunov
Tashkent, Physical-Technical Institute	L.P. Chernova, K.G. Gulamov, N.S. Lukicheva, V.S. Navotny, N. Saidkhanov, S.N. Shpilev, E.L. Surin, L.N. Svechnikova, S.I. Zhochova
Wuhan, Hua-Zhong Normal University	X. Cai, Z.R. Hu, Y.D. Li, L.S. Liu, Y.L. Lu, W.Y. Quian, H.Q. Wang, C.B. Yang, D.C. Zhou, J.C. Zhou
Yerevan, Physics Institute	F.A. Avetyan, N.A. Marutyan, L.G. Sarkisova, V.R. Sarkisyan
Spokesmen:	R.J. Wilkes (U.S.) and I. Otterlund (Overall)

Detector Layout. Plan and elevation views are shown for the detectors. For clarity, sections at the neutral line are shown for the magnets, collimators and vacuum chamber. M1 and M2 are the dipole spectrometer magnets; H1, H2, H3 are scintillation counter hodoscopes; S1, S2, S3 are straw tube arrays.

**EXPERIMENT 864 - PRODUCTION OF RARE COMPOSITE OBJECTS IN
RELATIVISTIC HEAVY ION COLLISIONS**

Brookhaven National Laboratory C.B. Dover, T.G. Throwe

Iowa State University L. Ewell, J.C. Hill, B. Libby, F.K. Wohn

**Massachusetts Institute
of Technology** E.S. Hafen, P. Haridas, I. Pless

Penn State University T. Armstrong, R.A. Lewis, G.A. Smith

Purdue University R.M. Davies, A.S. Hirsch, H.Z. Huang, N.T. Porile,
R.P. Scharenberg, B.K. Srivastava, B.C. Stringfellow,
M.L. Tincknell

University of Bari, Italy P. Spinelli

University of Massachusetts M.S.Z. Rabin

Wayne State University R. Bellwied, B. Bennett, T. Cormier, J. Hall, C. Pruneau

Yale University K. Barish, M. Bennett, G.E. Diebold, J. Germani, J. Lajoie,
R.D. Majka, J. Nagle, J.K. Pope, F.S. Rotondo,
J. Sandweiss, B. Shiva Kumar, A.J. Slaughter, E.J. Wolin

Spokesman: J. Sandweiss

The experimenters propose to carry out a systematic set of measurements and searches for "composite" objects produced in high energy heavy ion collisions. These measurements are aimed at studies utilizing the heaviest ions available at the AGS, presumably, up to and including gold ions. Part of the study will involve lighter beams and these could be done at an earlier time, with perhaps an initial detector complement. A major focus of the experiment is on charged composites; however, studies of neutral systems are also considered significant in the study. The experiment is designed to study particles produced in the central region of rapidity which are produced in central collisions. Since composite systems must be produced by the overlap of particles produced in the collision, it is expected that composites will be made mostly in the central rapidity region where overlaps would be most probable.

865

μ IDENTIFIER

P4

χ^2 L

χ^2 R

P3

M2

χ^2 L

χ^2 R

P1

P2

LEFT SIDE

K^+

$7 \times 10^7 K^+ / \text{pulse}$
 $2 \times 10^9 (\pi^+ + p) / \text{pulse}$

RIGHT SIDE

$K^+ \rightarrow \pi^+ \mu^+ e^-$

1 m

In keeping with the original purpose of E802 and E859, this experiment will continue the investigation of semi-inclusive single particle spectra using the gold beam (1) to measure the particle momentum spectra as a function of p_t and y ; (2) to find how these cross sections vary with "central" or "peripheral" collisions as taken from the event characterizing detectors; (3) to measure two-particle correlations; (4) to look for systemic variations in the cross sections with different beams and targets so as to clarify the reaction dynamics; and (5) to seek evidence in this measurement for the production of very dense nuclear matter, or ultimately, the quark-gluon plasma.

Beam: B1
Status: In progress
Hours Charged/Approved Hours: 652/2600

**EXPERIMENT 866 - STUDIES OF PARTICLE PRODUCTION AT HIGH BARYON DENSITY
USING THE AU BEAM**

Argonne National Laboratory	S. Kaufman
Brookhaven National Laboratory	K. Ashktorab, D. Beavis, C. Chasman, Z. Chen, Y.Y. Chu, J.B. Cumming, R. Debbe, M. Gonin, S. Gushue, S. Hayashi, J. LeVine, B. Moskowitz, J. Olness, L.P. Remsberg, D. Roehrich, M.J. Tannenbaum, J.H. van Dijk, F. Videbaek, H. Wegner, F. Zhu
Columbia University	C.Y. Chi, B.A. Cole, S. Nagamiya, T. Nayak, O. Vossnack, F. Wang, Y. Wang, Y. Wu, W.A. Zajc
Institute for Nuclear Study, University of Tokyo	Y. Akiba, H. Hamagaki, S. Homma, H. Sako
Kyoto University	H. Kaneko
Kyushu University	Y. Tanaka
Lawrence Livermore Laboratory	H.C. Britt, J.B. Costales, M.N. Namboordiri, T. Sangster, J.H. Thomas, S. Tonse
Massachusetts Institute of Technology	L. Ahle, V. Cianciolo, W. Kehoe, D. Morrison, C. Ogilvie, S. Park, P. Rothschild, R. Soltz, S.G. Steadman, G.S.F. Stephens, T. Sung, D. Zachary
New York University	B. Budick
University of California Space Sciences Laboratory	H.J. Crawford, J. Engelage
University of California at Riverside	P. Beery, J. Chang, S.-Y. Fung, J. Kang, R. Seto, Q. Xu, Q. Zhu
University of Tokyo	R.S. Hayano, H. Sakurai, K. Shigaki, H. Tamura
University of Tsukuba	A. Kumagi, K. Kurita, Y. Miake, S. Ueno, K. Yagi
Spokesmen:	C. Chasman and H. Hamagaki

868

Schematic diagram of emulsion stack exposures.

Schematic diagram of the emulsion chamber exposures.

Beam: A3
Status: Completed in 1992
Hours Charged/Approved: 27/22

**EXPERIMENT 868 - EXP. 808-INTERACTIONS OF 14.1 GeV/NUCLEON
NUCLEI FROM ^{16}O TO ^{197}Au IN LIGHT AND HEAVY TARGETS**

University of Minnesota

C.J. Waddington

Louisiana State University

**M.L. Cherry, P. Dienes-Jones, W.V. Jones, K. Sengupta,
J.P. Wefel**

**Institute of Nuclear
Physics, Krakow**

**A. Dambrowska, R. Holynski, A. Jurak, A. Olszewski,
M. Szarska, A. Trzupek, B. Wilczynska, H. Wilczynski,
W. Wolter, B. Wosiek, K. Wozniak**

**Institute of Theory and
Experimental Physics
Moscow**

**A.I. Dubinina, O.K. Egorov, E.D. Kolganova,
E.A. Pozharova, T.Yu. Skorotko, V.A. Smirnitski**

Spokesman:

C.J. Waddington

The Krakow-Louisiana-Minnesota (KLM) collaboration has previously exposed small stacks of nuclear emulsions to the light nuclei beams available from the AGS, Exp. 808. The results of this work, when combined with similar exposures of stacks and chambers made at CERN to higher energy beams, EMU07, have been reported in a number of published papers. In April 1992, when beams of heavier nuclei became available with the commissioning of the Booster, the KLM-Moscow collaboration (KLMM) exposed stacks and chambers of nuclear emulsions to a beam of gold nuclei with a nominal energy of 11.4 GeV/nucleon. Excellent exposures were obtained and the emulsions successfully processed at Dubna. Analysis of the interactions in these emulsions is proceeding on schedule and preliminary results based on the detection of more than 1,000 interactions in a minimum bias scan will be reported in 1993.

1992 BNL layout

Exp 869

Schematic diagram of the detector setup used for the April 1992 AGS gold run. Ion chambers I – 0 to 4 are four gap parallel plate chambers filled with P10 gas. Cherenkov counters C – 0 to 3 contain radiators of Pilot 425 plastic mounted in white diffusion boxes. The multiwire proportional counters MW have 1 mm wire spacing. The target holder can place any of the targets in the beam by remote command. Thirty-two channels of data are recorded for each event at rates of up to 1,000 events/sec.

Beam: B1
Status: Completed in 1992
Hours Charged/Approved: 41/32

**EXPERIMENT 869 - MEASUREMENT OF FRAGMENT YIELDS FOR 14 GEV/NUCLEON
AU + X COLLISIONS**

University of Minnesota

B.S. Nilsen, C.J. Waddington

Washington University

W.R. Binns, L.Y. Geer, J. Klarmann

Caltech

J.R. Cummings, T.L. Garrard, E.C. Stone

Spokesman:

C.J. Waddington

This experiment was proposed in order to continue a determination of the fragmentation of ultra heavy, UH, nuclei begun at the Bevalac as part of a program of cosmic ray studies. It required additional experiments using the new Booster facility at the Brookhaven AGS. The experiments at the AGS would extend the energy range of the measurements upwards to match the energies of the majority of observed cosmic ray nuclei. These measurements would improve our ability to predict the partial cross sections for the production of fragments and allow better calculations of the abundances of the cosmic ray UH nuclei at the sources by taking account of the effects of propagation on the observed abundances. These measurements would also extend current studies of the nuclear physics topics of factorization, limiting fragmentation, charge pickup, Coulomb dissociation and fission.

The detector array used during an exposure to the AGS gold beam in April 1992 is shown. It consists of a combination of ion chambers and Cherenkov counters which identify the particles entering a target and then measure the sum of the charges emitted from interactions in the targets. During the April exposure gold projectiles were allowed to fall on targets of polyethylene, carbon, aluminum, copper, tin and lead. In each case sufficient data was taken to determine partial cross sections of 10 mb with better than 10% accuracy. In addition, a fragmentor was placed in the primary beam, generating secondary beams of fragments. Sufficient of these fragments were generated to allow partial cross sections to be determined in the targets for all projectiles between $Z = 79$ and 70 . The excellent resolution of the detector array allows the identification of fragments with charges as low as $A = 50$ coming from gold projectiles. Preliminary results on the total and partial cross sections of the gold projectiles will be reported in 1993.

Beam: B5
Status: In progress/construction
Hours Charged/Approved: 1155/3600

EXPERIMENT 871 - A NEW SEARCH FOR VERY RARE K_L DECAYS
--

**University of California
at Irvine**

M. Bachman, D. Connor, P. DeCecco, R. Lee,
N. Kanematsu, W.R. Molzon

University of Richmond

P. Rubin

Stanford University

K. Ecklund, C. Hartman, M. Hebert, G.M. Irwin,
M. Pommot-Maia, S.G. Wojcicki

University of Texas at Austin

D. Ambrose, S. Graessle, S. Hamilton, G.W. Hoffmann,
K. Lang, M.R. Marcin, J. McDonough, A. Milder,
P.J. Riley, J.L. Ritchie, C.B. Ware, S. Worm

College of William and Mary

A.D. Hancock, C. Hoff, J.R. Kane, Y. Kuang,
R.D. Martin, R.E. Welsh, M. Witkowski

Spokesmen:

J.R. Kane, W.R. Molzon, J.L. Ritchie, S.G. Wojcicki

This group plans to carry out a new search for the decays $K_L \rightarrow \mu e$ and $K_L \rightarrow ee$, building on the experience from the recently completed experiment, E791. The $K_L \rightarrow \mu\mu$ branching ratio measurement will also be improved. The final E791 single event sensitivity for $K_L \rightarrow \mu e$ was about $1-2 \times 10^{-11}$. The new experiment will reach a single event sensitivity below 10^{-12} , and if no events are observed, will set an upper limit of about 2×10^{-12} . About 10,000 $K_L \rightarrow \mu\mu$ decays will also be observed.

The experiment will take the novel approach of stopping the neutral beam in a beam stop near the upstream end of the spectrometer.

Doubly-differential cross sections for scattering of 720 MeV/c K^+ from Carbon and Calcium at a momentum transfer $q = 500$ MeV/c. The arrows indicate the position of scattering from free hydrogen, and the broad peaks are from quasielastic scattering. The curves are relativistic Hartree, random phase approximations for nuclear matter at the appropriate density (*dot-dashed*) and for the finite nuclei (*solid*).

Beam: C6
Status: Complete in 1993
Hours Charged/Approved : 804/783

**EXPERIMENT 874 - KAON-NUCLEUS QUASIELASTIC AND ELASTIC SCATTERING
AT 720 MeV/c**

University of Colorado

C. Kormanyos, R.J. Peterson, J. Wise

University of Houston

E. Hungerford, B.W. Mayes, L. Pinsky

Brookhaven National Laboratory S. Bart, R.E. Chrien, R. Sawafta, R.J. Sutter

Spokesmen:

R.E. Chrien, E. Hungerford, R.J. Peterson

Incoherent quasielastic scattering of positive kaons should show their putatively long free path through a simple proportionality of nuclear cross sections to the number of target nucleons in isosymmetric ($T=0$) targets. In this case, one can search for evidence of alternations to the free characteristics of nucleons when placed in the interior of a nucleus by precision comparison of quasielastic scattering on several $T=0$ targets with varying volume to surface ratios. Elastic K^+ scattering on some of these targets at the same beam momentum allows a similar but independent test of altered nucleons by way of optical model methods.

The experimenters have measured the quasielastic scattering of 720 MeV/c K^+ from H, D, C, Ca, and Pb at $q = 300, 400, \text{ and } 500$ MeV, finding scattering at nuclear densities of 90%, 69%, and 55% of the central densities for C, Ca, and Pb. A strongly collective response is observed at 300 MeV/c. They have measured elastic scattering of 720 MeV/c and 625 MeV/c K^+ from C over a wide range of angles.

Beam: A3/B1
Status: Completed 1993
Hours Charged/Approved: 28/2

**EXPERIMENT 875 - STUDY OF PARTICLE PRODUCTION AND NUCLEAR FRAGMENTATION
IN RELATIVISTIC HEAVY-ION COLLISIONS
IN NUCLEAR EMULSIONS**

**State University of
New York at Buffalo**

A.Z.M. Ismail, P.L. Jain, A. Mukhopadhyay, G. Singh

Spokesman:

P.L. Jain

Nuclear emulsions will be used to study the nuclear collisions of ^{197}Au , ^{32}S and any other heavy-ion beams when they are available. On an event-by-event basis, shower particle multiplicity, pseudorapidity density and density fluctuations of charged particles, charge multiplicity and angular distribution of projectile fragments, production and interaction cross section of heavily ionizing particles emitted from the target fragmentation, will be measured in nuclear emulsion. Special emphasis will be placed on the analysis of events produced in the central collisions which are selected on the basis of low energy fragments emitted from the target excitation.

876

Beam: D2
Status: Construction
Approved Hours: 300

EXPERIMENT 876 - μ^+ SURFACE BEAM CHARACTERIZATION
--

College of William and Mary	A. Greer, W.J. Kossler, H.E. Schone
Virginia State University	M.R. Davis, C.E. Stronach
George Mason University	W.F. Lankford
Columbia University	G. Luke, B. Sternlieb, Y.J. Uemura
Spokesman:	W.J. Kossler

This experiment proposes to characterize the μ^+ beam produced from π decay on the surface of the D-line production target. Comparisons to similar beams at TRIUMF indicate that a flux in excess of $10^5/\text{cm}^2$ per pulse for 10^{13} protons per pulse might be expected. Such an intensity would make μSR at Brookhaven National Laboratory competitive with TRIUMF and PSI for the majority of this type of research.

E877

Beam: C5
Status: In progress
Hours Charged/Approved: 775/1100

**EXPERIMENT 877 - STUDY OF RELATIVISTIC NUCLEAR COLLISIONS
WITH HEAVY BEAMS USING THE E814 4π CALORIMETRY
AND MODIFIED FORWARD SPECTROMETER**

Brookhaven National Laboratory	T. Ludlam, S. McCorkle, E. O'Brien, C. Woody
GSI, Darmstadt	N. Herrmann
Idaho National Engineering Laboratory	J. Cole, M. Drigert
McGill University	J. Barrette, S. Gilbert, R. Lacasse, S.K. Mark, L. Normand, M. Rosati, N. Starinsky, G. Wang
University of Pittsburgh	W. Cleland, U. Sonnadara, S. Voloshin
University of São Paulo	N. DaSilva, O. Dietzsch, M. Takagui
SUNY at Stony Brook	P. Braun-Munzinger, J. Dee, T.K. Hemmick, B. Hong, Y. Kwon, M. Rao, S. Sedykh, J. Stachel, J. Wessels, N. Xu, Y. Zhang, C. Zou
Wayne State University	R. Bellwied, S. Bennett, T. Budny, T. Cormier, A. French, F. Gang, J. Hall, B. Kim, K. Lahab, Q. Li, A. Lukaszew, R. Matheus, C. Pruneau, J. Sheen, H. Xiong
Spokesman:	P. Braun-Munzinger

Using an upgraded E814 set-up, this experiment proposes to study central collisions between heavy nuclei and projectiles from the Booster/AGS accelerators. The main emphasis is on a detailed study of the energy flow into 4π and measurements of the spectra of nucleons and produced particles for rapidities $y > 1.5$ and low transverse momenta, with event characterization over the full solid angle. In addition, nucleons, nuclear fragments and produced particles in the target fragmentation region will be measured.

E878 Spectrometer A3 line

IC1,2 :	Ionization chambers
Et	multiplicity detector
TOF1,2,3,4:	Multislit scintillator detectors for time of flight
DC1,2,3,4:	6 plane S, T, U drift chambers
CK1,2:	gas Cherenkov detectors
CK3,4:	Silica aerogel Cherenkov detectors

Beam: A3
Status: Completed 1993
Hours Charged/Approved: 986/807

**EXPERIMENT 878 - INVESTIGATION OF ANTINUCLEUS PRODUCTION
AND SEARCH FOR NEW PARTICLES IN NUCLEUS-NUCLEUS COLLISIONS AT THE AGS**

University of California Space Science Laboratory	H.J. Crawford, Y. Dardenne, J. Engelage, L. Greiner
Brookhaven National Laboratory	D. Beavis, R. Debbe
University of California-Los Angeles	J. Carroll, T.J. Hallman, G. Igo
KEK	J. Chiba, K.H. Tanaka
University of Waseda	T. Doke, T. Kashiwagi, J.H. Kikuchi
Johns Hopkins University	R. Welsh
University of Tokyo	R.S. Hayano
Lawrence Berkeley Laboratory	I. Flores, H. Heckman, P.J. Lindstrom, R. Wright
Columbia University	S. Nagamiya, P. Stankus
University Space Research Association	J. Mitchell
Yale University	M. Bennett, J. Nagel, K. Pope, B. Shiva Kumar
Spokesman:	H.J. Crawford

The purpose of the experiment is to investigate antideuteron ($\bar{d}$) production and to search for new states of matter produced in Au-Au collisions at the AGS using the A3 line as a spectrometer. This is a follow-on to the E858 program, an investigation of $\bar{d}$ production in Si+Al, Si+Cu, and Si+Au interactions, which achieved high statistics measurements of the π^- , K^- , $\bar{p}$ spectra at 0° and set new limits on the production of stable negative particles. It was shown that the $\bar{p}$ yield per interaction was smaller than expected and the $\bar{d}$ yield was well below the level calculated from a simple coalescence model. The goal of E878 is to further investigate the hadronization process with a systematic study of pA, SiA, and AuA collisions, to determine $\bar{d}$ production from these systems, and to provide high statistics measurements of the π^- , K^- , p spectra at 0° over a broad range of secondary momenta, 1.5 - 20 GV.

POLARIZED PROTON COLLISIONS AT BROOKHAVEN

Beam: AGS Internal Beam
Status: Construction
Hours Charged/Approved: 2/320

**EXPERIMENT 880 - THE EFFECTS OF A PARTIAL SIBERIAN SNAKE
ON POLARIZATION AT THE AGS**

**Indiana University
IUCF**

D. Caussyn, T. Ellison, H. Huang, B. Jones, S.Y. Lee,
P. Schwandt, Y. Wang

**Brookhaven National
Laboratory**

L. Ahrens, J. Alessi, E.J. Bleser, G. Bunce, P. Cameron,
E.D. Courant, H.W.J. Foelsche, C.J. Gardner, J. Geller,
Y.Y. Lee, Y.I. Makdisi, S.R. Mane, S. Peggs, L. Ratner,
K. Reece, T. Roser, J.F. Skelly, A. Soukas, S. Tepikian,
R.E. Thern, D. Trbojevic, W. van Asselt

**Argonne National
Laboratory**

H. Spinka, L. Teng, D.G. Underwood, A. Yokosawa

TRIUMF

U. Wienands*

Fermilab

V. Bharadwaj, Shao Hseuh

KEK

S. Hiramatsu, Y. Mori, H. Sato, T. Toyama, K. Yokoya

Spokesmen:

S.Y. Lee and T. Roser

This group will build a 4.7 Tesla-meter room temperature solenoid which will be installed in a 10-foot long AGS straight section. AGS polarized proton beam time will be used to perform *partial snake experiments*. These experiments will test the idea of using a partial snake to correct all depolarizing imperfection resonances and also test the feasibility of betatron tune jump in correcting intrinsic resonances in the presence of a partial snake.

* Present address: SSC Laboratory, 2550 Beckleymeade Avenue, Dallas TX 75237-3946.

A Schematic of the MPS II Experimental Arrangement for $\phi\phi$ Experiments.

Beam: B2/A1
Status: In progress
Hours Charged/Approved: 821/1500

**EXPERIMENT 881 - UTILIZING $\phi\phi$ SPECTROSCOPY TO SEARCH FOR EXOTIC GLUEBALLS,
EXOTIC HYBRID OR EXOTIC MULTIQUARK STATES**

**Brookhaven Nat. Lab. and
City College of New York**

S.J. Lindenbaum

**Brookhaven National
Laboratory**

R.W. Hackenburg, R.S. Longacre

City College of New York

C.S. Chan, M.A. Kramer, K. Zhao, Y. Zhu

**Rensselaer Polytechnic
Institute**

G. Adams, K. Vaziri

Spokesman:

S.J. Lindenbaum

The powerful $\phi\phi$ spectroscopy which resulted in the discovery of $I^G J^{PC} = 0^+ 2^{++} g_T(2010)$, $g_T(2300)$ and $g_T(2340)$ (which are prime glueball candidates) will be used to search for exotic glueballs, exotic hybrids and exotic multiquark states.

A first run occurred in the summer of 1992. Analysis of the early data obtained is in progress.

882

Layout of first experiment, showing end of beam pipe, Pb target, and slowing stacks of CR-39 plastic detectors alternating with Pb, at a distance of 1 m downstream from the target. Shaded stacks consist of 12 repeat units of CR-39/Pb; unshaded stacks consist of 3 repeat units.

Layout of second experiment, showing end of beam pipe, Pb target, high-field region of bending magnet, and three tracking chambers consisting of 25 thin CR-39 sheets at 2 cm intervals.

Beam: A3/C5
Status: Completed 1993
Hours Charged/Approved: 43/50

EXPERIMENT 882 - SEARCH FOR PARTICLES WITH $|Z| \geq 3$ AND NEGATIVE CHARGE OR LARGE A/Z PRODUCED IN CENTRAL NUCLEUS-NUCLEUS COLLISIONS

University of California Y. He, D.M. Lowder, P.B. Price
at Berkeley

Spokesman: P.B. Price

Two experiments are proposed which will use CR-39 track detectors to study production of multiply charged composites in central collisions, and in particular search for both positively and negatively charged mid-rapidity particles with $|Z| \geq 3$, especially those with anomalously large A/Z.

Experimental setup used for the irradiation of BP-1. BP-1 detectors were mounted in combination with CR-19 plastic detectors up and downstream of a carbon target.

Beam: A3/B1
Status: Complete in 1993
Hours Charged/Approved: 29/10

EXPERIMENT 883 - FRAGMENTATION OF AU-PROJECTILES AT AGS ENERGIES

University of Siegen

J. Dreute, W. Heinrich, G. Rusch, B. Wiegel, E. Winkel

Spokesman:

W. Heinrich

Stacks of plastic nuclear track detectors and different target materials will be exposed to beams of Au projectiles. The detectors will record tracks of relativistic nuclei with charge numbers $Z \geq 6$. After development of the tracks by etching, they will be detected and measured using completely automated microscope systems. Experiments with high statistics are therefore possible. Multifragmentation events in which several intermediate mass fragments are emitted from the heavy projectile will be studied in detail. Charge, emission angles and transverse momenta of the fragments will be determined. Similar experiments using Kr, Ag, Au and U beams at the BEVALAC have been performed. By a comparison of the fragmentation systematics of Au at AGS and BEVALAC energies, it is hoped to obtain significant indications whether the process of multifragmentation is related to a phase transition of nuclear matter or whether it is a statistical breakup only that does not depend on beam energy.

The good charge resolution of our detectors, especially for fragments with small charges, will allow the experimenters to search for projectile fragments with fractional charge.

TARGET FOR FRACTIONAL CHARGE ENHANCEMENT WITH 24 GeV PROTON BEAM

Beam: A
Status: Completed 1992
Hours Charged/Approved: 13/7

**EXPERIMENT 884 - AN EXPERIMENT TO ENHANCE FRACTIONAL CHARGE
IMPURITIES (FCI) IN SEMICONDUCTORS TO BE USED IN AN OPTOELECTRONIC
SEARCH FOR FCIS**

University of Pittsburgh

S. Betarbet, W.E. Cleland, S. Matsik, A.G.U. Perera

Spokesman:

A.G.U. Perera

This experiment proposes to extend the search for fractional charge impurities (FCIs) in silicon to include a search for FCIs produced by a 28 GeV/c proton beam. A previous search was conducted for naturally occurring FCIs in silicon, yielding an upper limit of 4 FCIs per 10^{20} atoms, lower than any other existing upper limit for naturally occurring fractionally charged particles. A setup consisting of an Al target and a stack of 20 diodes are exposed to the primary proton beam. Using existing upper limits for free quark production by high energy beams, the number of quarks that are expected to be stopped in the sensitive region of the detector are estimated. The experimenters should be able to set a comparable upper limit (within a factor of 3) to the current value.

Detector configuration for AA experiment. Drift chambers ID1, ID2, and ID3 determine incoming K^- trajectory and are combined with upstream hodoscope data to determine K^- momentum. Drift Chambers FD1, FD2, FD3, BD1 and BD2 determine K^+ momentum. Scintillators IT and BT determine K^+ time-of-flight. Hodoscopes FP and BP determine spectrometer acceptance. Aerogel Cerenkovs IC1, IC2, FC, and BC reject pions. Hydrogen Cerenkov FCH rejects protons.

BNL-AGS D6 Beam Line & E886 Experimental Setup

* Beam Line selects p/Z ($\pm 3\%$)

* E1 Separator selects range of M/Z

* TOF selects M/Z (front and back)

* $\Delta E/\Delta X$ in E1-E4 selects Z

* Full particle tracking through front and back spectrometers
--> p/Z determined twice

Beam: D6
Status: Approved
Hours Charged/Approved: 10/1000

EXPERIMENT 885 - EXPERIMENT TO DETECT $\Lambda\Lambda$ HYPERNUCLEI

Brookhaven National Laboratory	S. Bart, R. E. Chrien, M. May, P. H. Pile, R. Sawafra, R. Sutter
Carnegie-Mellon University	G. Franklin, R. Magahiz, F. Merrill, B. Quinn, R. Schumacher, V. Zeps
Kyoto University	T. Iijima
University of Kyoto Sangyo	F. Takeuchi
University of Manitoba	C. Davis, S. Page, D. Ramsay, W. van Oers
University of New Mexico	B. Bassalleck, J. Lowe, A. Rusek, D. Wolfe
TRIUMF	D. Gill
Vassar College	R. Stearns
Spokesmen:	M. May and G. Franklin

The 2 GeV kaon beam and the spectrometer of Exp. 813 will be used to observe and study the properties of $\Lambda\Lambda$ hypernuclei.

The question of what form matter takes when some strange quarks are present has been the subject of speculation. In the conventional picture, hypernuclei, where the strange quarks appearing lambda particles are the ground state of strange matter. There are suggestions that multi-quark states, rather than lambda particles, are the lowest energy state for matter containing roughly equal numbers of up downs and strange quarks. The H particle is proposed as a six quark state (uuddss) below the mass of two lambda particles. If this is the case, two lambdas in a hyper-nucleus will fuse to form an H particle, as no selection rule forbids it.

Hypernuclei containing one lambda have been intensively studied; there are only 3 candidates (one recent) for $\Lambda\Lambda$ hypernuclei. New data on double hypernuclei will be a cornerstone for understanding proposals for more exotic forms of strange matter.

EXPERIMENT 886-SEARCH FOR NEW PARTICLES IN NUCLEUS-NUCLEUS COLLISIONS

Kyoto University	H. Enyo, T. Iijima, K. Imai, A. Masaike
Kyoto Sangyo University	K. Okada, F. Takeuchi
University of Birmingham	N. Nelson, R. Zybert
Brookhaven National Laboratory	D. Beavis, R. Chrien, P. Pile, R. Sawafta, R. Sutter
Carnegie Mellon University	G. Franklin, R. Magahiz, F. Merrill, B. Quinn, R. Schumacher, R. Sukaton, V. Zeps
Yale University	G. Diebold
University of New Mexico	B. Bassalleck, J. Hall, J. Lowe,* A. Rusek, D.M. Wolfe
Freiburg University	M. Burger, J. Franz, E. Rössle, H. Schmitt
Vassar College	R.L. Stearns
Spokesmen:	K. Imai, P. Pile, and G. Diebold

The purpose of this experiment is to search for new particles, such as strange quark matter (strangelets), in nucleus-nucleus collisions. It has been suggested that strangelets might exist and may be produced in relativistic nucleus-nucleus collisions. Using the 2 GeV/c K-beam line as a mass spectrometer, the experimenters propose to search for long-lived ($\tau > 10^{-8}$ s) particles with large mass to charge ratios ($M/Z > 3$ GeV/c²) as is expected for strangelets.

E886 was approved in late February 1992 for a nominal 100 hour test run during the 1992 heavy ion running period. This marked the first time heavy ions were delivered to the D line. During this test run E886 ran smoothly and efficiently, completing its test runs using available beam not required by other users. A total of 283 beam hours were charged; however, the beam intensity during most of this running was low. Of the 283 hours charged, approximately 20 hours of Au beam and 50 hours of Si beams were at the highest available intensities ($\approx 10^7$ Au and 10^9 Si ions per spill). As a result of the excellent particle identification and high rate capabilities of the D6 beam line and spectrometer system, the production cross sections of a broad range of known particles were quickly measured. This included π^+ , K^+ , p^+ , d, t, ^3He , and ^4He . In the high sensitivity runs associated with the Si strangelet searches, rare nuclear species such as ^6He and ^8He were also measured. For Au running, sensitivity was limited due to the relatively low (10^7 /spill) beam intensity. The strangelet search will continue in FY 93 with, hopefully, a more intense gold beam. The strangelet sensitivity is expected to be sufficient to seriously constrain strangelet production models based on intermediate quark-gluon plasma formation.

* Also at the University of Birmingham.

a)

END VIEW

Beam: C6
Status: Approved
Approved Hours: 800

EXPERIMENT 887 - DO NARROW Σ HYPERNUCLEAR STATES EXIST?

Brookhaven National Laboratory	S. Bart, R.E. Chrien, R. Sawafta, R. Sutter
CEBAF	K. Baker, L. Tang
University of Houston	M. Barakat, E.V. Hungerford
University of Indiana (tentative)	S.M. Bowyer, S. Wells, S.W. Wissink
INS-Tokyo	H. Ota
Ohio University	K. Hicks, B. Larson, R. Michael
University of Tokyo	R.S. Hayano, Y. Shimizu, H. Tamura
Spokesmen:	R. Sawafta, K. Hicks

It is proposed to measure hypernuclear mass spectra for in-flight ($K^-, \pi^\pm$) reactions at $p_\pi = 600$ MeV/c from ${}^7\text{Li}$, ${}^9\text{Be}$, ${}^{12}\text{C}$ and ${}^{16}\text{O}$ targets at the LESBII beam line. The main thrust of this proposal is to provide data with sufficient energy resolution and statistics, in order to investigate systematically whether narrow Σ hypernuclear states exist below or above threshold in light hypernuclei.

If the reported long-lived Σ states are confirmed, the experiment should be able to provide better determinations of their parameters. Subsequently this will help in resolving the ambiguities that exist between the different experiments and put more constraints on the long-standing theoretical questions related to this subject.

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2 of 2

Beam: B5
Status: Completed 1992
Hours Charged/Approved: 401/400

EXPERIMENT 888 - SEARCH FOR THE H DIBARYON
--

Brookhaven National Laboratory M. May, S. White

University of California-Irvine D. Connor, J. Cortese, W.R. Molzon

**University of California-
Los Angeles** R.D. Cousins

Princeton University V.L. Fitch, J. Klein, A.J. Schwartz

Stanford University M.V. Diwan, K. Ecklund, G.M. Irwin, D.A. Ouimette,
S.G. Wojcicki

Temple University J. Belz, V.L. Highland, S.H. Kettell

**University of Texas
at Austin** C.A. Allen, G.W. Hoffmann, K. Lang, M.R. Marcin,
J. McDonough, C.T. Nguyen, P.J. Riley, J.L. Ritchie,
B. Ware, S. Worm

College of William and Mary M. Eckhause, A.D. Hancock, J.R. Kane, Y. Kuang,
W.F. Vulcan, R.E. Welsh, R.G. Winter, M. Witkowski

Spokesmen: R.D. Cousins and A.J. Schwartz

The experimenters propose to search for the H dibaryon (six-quark $uuddss$ state) using the E791 beam line and spectrometer, modified for two H detection techniques. In both cases they will attempt to produce the H 's in the proton-nucleus interactions. In the first technique, they will search for the decay sequence $H \rightarrow \Lambda X \rightarrow p\pi X$ in the decay volume. In the second, they will look for diffractive dissociation of long-lived H 's: $H + A \rightarrow \Lambda\Lambda A \rightarrow p\pi p\pi A$. Combined, the two methods cover a wide range of possible H lifetimes.

E888 completed data-taking in 1992 and is now analyzing data.

AGS Expt 889

Beam:
Status: Approved
Approved Hours: 3000

EXPERIMENT 889 - LONG BASELINE NEUTRINO OSCILLATION SEARCH

Brookhaven National Laboratory	I-H. Chiang, M. Diwan, J. Frank, M. Murtagh, A.J. Stevens
University of California-Riverside	I. Stancu, G. VanDalen
University of California-Santa Barbara	D. Bauer, D. Caldwell, A. Lu, S. Yellin
Linfield College	I. Cohen
Los Alamos National Laboratory	R. Burman, F. Federspiel, G.T. Garvey, W.C.Louis, M. Schillaci, D.H. White, D. Whitehouse
Louisiana State University	R.L. Imlay, W. Metcalf
Louisiana Technical University	K. Johnston
University of New Mexico	B. Dieterle, R. Reeder
University of Montreal	G. Azuelos, P. Depommier
University of Pennsylvania	M. Albert, J. Hill, A.K. Mann
Southern University and A & M College	A. Fazely
Temple University	L. Auerbach, V. Highland, J. Margulies
University of Texas at Austin	C. F. Moore, S. Mordechai*
TRIUMF	J. Beveridge, P. Gumplinger, R. Helmer, J-M. Poutissou, D. Wright, S. Yen
Valparaiso University	D.D. Koetke, R.W. Mainweiler, T.D.S. Stanislaus
Spokesman:	A.K. Mann

A proposal is made here for a long baseline, ν_μ disappearance neutrino oscillation experiment at the AGS. The principal aim of the experiment is to explore the region in the vacuum oscillation space, Δm^2 vs $\sin^2 2\theta$, suggested by the results from studies of the interactions of atmospheric neutrinos in underground detectors. The proposed experiment consists of three linearly aligned, widely spaced, essentially similar, massive imaging water Cerenkov counters to be used in conjunction with a new, high intensity neutrino beam. The experiment will yield data of high statistical precision and small systematic uncertainty. It will extend the explored region in Δm^2 vs $\sin^2 2\theta$ by two orders of magnitude relative to previous accelerator based experiments, and has the prospect, if the atmospheric neutrino results are correct, of definitive identification of neutrino oscillations in the ν_μ -disappearance channel and of the specific values of Δm^2 and $\sin^2 2\theta$ involved. It may be the only means of determining a small ν_e mass.

* Permanent Affiliation: Ben Gurion University, Israel

**EXPERIMENT 890 - A NEW TEST OF CHARGED SYMMETRY
IN ETA PRODUCTION ON DEUTERIUM**

University of California-Los Angeles	M.J. Clajus, B.M.K. Nefkens, J.W. Price, W.B. Tippens, M.J. Wang, D.B. White
Brookhaven National Laboratory	S. Bart, R.E. Chrien, R. Sawafta, R.J. Sutter
Los Alamos National Laboratory	D.M. Jansen, M.J. Leitch, J.C. Peng
Forschungszentrum Jülich	H. Seyfarth
Ruder Boskovic Institute	M. Batinić, I. Šlaus, A. Švarc
Spokesman:	B.M.K. Nefkens, R.E. Chrien, J.C. Peng

The experimenters propose to measure R_1 from threshold at $p_\pi = 607$ MeV/c to the maximum C-8 beam momentum of 750 MeV/c which is beyond the peak of the $S_{11}(1535)$ resonance. They plan to measure the ratio R_2 at incident pion energies that span the opening of the η channel, $p_\pi = 570$ -750 MeV/c. The measurement of R_1 is a direct test of the validity of charge symmetry in the unexplored domain of η -nuclear physics. Violations of charge symmetry are expected as a consequence of the difference in the $n\eta$ and $p\eta$ interactions, and π^0 - η mixing.

A secondary objective of this proposal is to explore the dependence on energy and angle of the $\pi^+d \rightarrow pp\eta$ differential cross section. The $\pi^+d \rightarrow pp\eta$ reaction is being considered as the η production reaction of a new AGS η factory. New tests of C, CP, T and CPT invariance can be done using various rare decays of the η .

The experiment intends to determine the ratios R_1 and R_2 by measuring the relative η and π^0 yields due to π^+ and π^- interactions in deuterium. The η or the π^0 is detected via its $\gamma\gamma$ decay mode using a neutral meson spectrometer.

$$R_1 \equiv d^2\sigma(\pi^-d \rightarrow nn\eta)/d^2\sigma(\pi^+d \rightarrow pp\eta)$$

$$R_2 \equiv d^2\sigma(\pi^-d \rightarrow nn\pi^0)/d^2\sigma(\pi^+d \rightarrow pp\pi^0)$$

E-810 Plan View

Beam:
Status: Approved
Hours Approved: 1000

**EXPERIMENT 891 - A SEARCH FOR QUARK MATTER (QGP)
AND OTHER NEW PHENOMENA UTILIZING AU-AU COLLISIONS AT THE AGS**

Brookhaven National Laboratory	S.E. Eiseman, A. Etkin, K.J. Foley, R.W. Hackenburg, R.S. Longacre, W.A. Love, E.D. Platner, A.C.Saulys
Brookhaven National Laboratory and City College of New York	S.J. Lindenbaum
University of California, Davis	D.A. Cebra
University of California, Berkeley	J. Marx
City College of New York	C.S. Chan, E. Efstathiadis, M.A. Kramer, K. Zhao, Y. Zhu
Rice University	S. Ahmad, B.E. Bonner, J.A. Buchanan, J.M. Clement, G.S. Mutchler
Spokesman:	E. D. Platner

A program is proposed for studying Au-Au collisions at the AGS by measuring the angles and momenta of charged tracks, K_S^0 's and Λ 's using the TPC's and trigger detectors from E810. In order to handle the higher track multiplicities produced by Au beams, a modified geometric arrangement of the TPC modules will be used. This program will allow the experiments to look for anomalous behavior in rapidities (or pseudorapidities), multiplicity, strangeness enhancements, $P_T(E_T)$, energy flow; possibly observe Hanbury-Brown and Twiss effects and other new phenomena. These observations will be on an event-by-event basis so that particularly interesting classes of events can be selected and added together to search for new effects (like strangelets) implying a QGP or other new states of matter in a manner which tends to maximize signal-to-background ratios.

Schematic diagram of the apparatus. The adiabatically decreasing solenoid field (shown schematically by the coil height) transports and focuses the positrons. Small dipoles at either end deflect the positrons and electrons into the scintillator detectors. These detectors measure the positron energy and, from time of flight, determine the emission angle of the positron. Positrons are verified by the 511 keV annihilation radiation detected in the gamma detectors. A large dipole magnet(s) located downstream from the APS separates the charge states of the emerging ions.

Beam:
Status: Approved
Hours Approved: 600

EXPERIMENT 892 - CAPTURE FROM PAIR PRODUCTION
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Lawrence Berkeley Laboratory	A. Belkacem, B. Feinberg, H. Gould
Brookhaven National Laboratory	B. Johnson, P. Thieberger, H. Wegner (retired)
Iowa State University	J. Hill, B. Libby
Stanford University	W. Meyerhof
Spokesman:	H. Gould

The experimenters propose to measure the cross section for capture from pair production and free pair production of 10 GeV/n Au⁷⁹⁺ on Au collisions. This will provide the first measurement of capture from pair production at energies above the 1 GeV/n region. The results are essential to understand the process, to guide ongoing efforts, to develop a nonperturbative theory, and to supply important data for the operations of RHIC. Capture from pair production is the process in which an electron-positron pair is produced by the transient electromagnetic field from a relativistic heavy-ion atomic collision (no nuclear contact) and the electron emerges bound to the projectile ion. It is unique because it is the only recombination process in which the cross section *increases* with energy at relativistic energies. At sufficiently high energies it is predicted to become the dominant recombination mechanism.

Fig. 1: Provisional charge distribution for 257 completely penetrating events.

Fig. 2: Provisional charge distribution $Z > 73$ of selected data set (105 events).

Fig. 3: Frequency distribution of apparent charge for selected events.

TABLE 1

$(Z \geq 88)/(74 \leq Z \leq 87)$		
Ariel-6	3 Actinides	0.015 ± 0.026
Ariel-6 + HEAO-3	3 + 0 Actinides	0.026 ± 0.015
10% of UICRE	10 Actinides	0.035 ± 0.012
Propagated Primordial SS (Browster et al, 1983)		0.013
Propagated Present SS (Browster et al, 1983)		0.0077

Beam: B1
Status: Completed 1993
Hours Approved: 2/1

**EXPERIMENT 893 - TEMPERATURE/ZENITH ANGLE CALIBRATION
OF POLYCARBONATE TRACK DETECTORS**

Dublin Institute for Advanced Studies

Spokesman: A. Thompson

This experiment proposes to measure the track response of polycarbonate to relativistic Au ions at -20°C and to investigate the isotropy of track response to Au at the same energy.

Proposed set-up for the EOS experiment at the AGS (perspective view).

Beam:
Status: Conditionally Approved
Hours Charged/Approved: 1688

EXPERIMENT 895 - EXCLUSIVE STUDY OF NUCLEAR COLLISIONS AT THE AGS

University of California, Davis	P. Brady, D. Cebra, M. Partlan, J. Romero
INFN Catania, Italy	S. Albergo, Z. Caccia, A. Insolia, R. Potenza, J. Romanski, G.V. Russo, C. Tuve
Kent State University	M. Justice, D. Keane, D. Weerasundara
Lawrence Berkeley Laboratory	W. Gong, L. Heilbronn, J. Miller, D. Olson, G. Rai, J. Rasmussen, H.G. Ritter, H. Wieman, C. Zeitlin
Lawrence Livermore Laboratory	G. Peilert
Purdue University	A. Hirsch, E. Hjort, N. Porile, R. Scharenberg, B. Shrivastava
Texas A&M University	A.D. Chacon, K. Wolf
University of Texas, Austin	S. Mordechai
Spokesman:	G. Rai

The experimenters propose to carry out a systematic and exclusive measurement of the energy and mass dependence of particle production, correlations, and collective effects in Au+Au collisions. They seek to determine the highest compression achievable in nuclear matter and to study its properties and they will search for evidence for an exotic Equation of State, that is, new physics such as Resonance Matter, Exotica, and QGP. The experimenters are also interested in signatures of critical phenomena in dilute nuclear matter.

It is proposed to measure the four-momentum of light mass particles ($\pi^\pm$, K_s^0 , $K^\pm$, Λ , n , p , d , ^3He , ^4He , ^6He , and the isotopes of Li and Be), projectile fragments from $Z=6$ to $Z=79$, and anti-proton production. The majority of the data will be acquired, on an event by event basis, from a state-of-the-art Time Projection Chamber (EOS TPC) build and used at LBL by the EOS collaboration. The TPC provides continuous tracking, almost 4π acceptance and particle identification for the light mass particles.

List of publications of AGS experiments begins here.

Publications - AGS Experiments 1982 - 1993

This listing was originally prepared using the SLAC data base SPIRES; we now rely on the experimenters themselves to supply us with information. It is easy to miss publications in such a wide search and we apologize for any left out or misidentified. Please let us know about these as well as keeping us posted on your recent publications of AGS experiments.

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Jones, B.	Indiana University, IUCF	(880)
Jones, T.	University of Illinois	(821)
Jones, W.V.	Louisiana State University	(868)
Jungmann, K.	University of Heidelberg	(821)
Jurak, A.	Institute of Nuclear Physics, Krakow	(868)
Just, L.	Šafarite University-Košice	
Justice, M.	Kent State University	(895)
Kabe, S.	National Laboratory for High Energy Physics (KEK)	(787)
Kachroo, S.	University of Jammu	(863)
Kalogeropoulos, T.	Syracuse University	(856)
Kalyachkina, G.S.	Alma Ata, Institute of High Energy Physics	(863)
Kane, J.R.	College of William and Mary	(871, 888)
Kaneko, H.	Kyoto University	(859, 866)
Kanematsu, N.	University of California-Irvine	(871)
Kang, J.	University of California-Riverside	(859, 866)
Kanygina, E.K.	Alma Ata, Institute of High Energy Physics	(863)
Karabova, M.	Šafarite University-Košice	
Kashiwagi, T.	University of Waseda	(878)
Kaspar, H.	Paul Scherrer Institute	(865)
Kaufman, S.	Argonne National Laboratory	(859, 866)
Keane, D.	Kent State University	(895)
Kehoe, W.L.	Massachusetts Institute of Technology	(859)
Kern, W.	University of Massachusetts-Dartmouth	(852)
Kettell, S.	Brookhaven National Laboratory	(787, 888)

Kharlamov, S.P.	Lebedev Institute, Moscow	(863)
Khazin, B.I.	Institute for Nuclear Physics, Novosibirsk	(821)
Kikuchi, J.H.	University of Waseda	(878)
Kim, B.	Wayne State University	(877)
Kinoshita, T.	Cornell University	(821)
Kitching, P.	TRIUMF	(787)
Kitro, S.	University of Jammu	(863)
Klarmann, J.	Washington University	(869)
Klein, J.	Princeton University	(888)
Kobayashi, M.	National Laboratory for High Energy Physics (KEK)	(787)
Koehler, A.	Harvard Cyclotron Laboratory	(856)
Koetke, D.D.	Valparaiso University	(889)
Kolganova, E.D.	Institute of Theory and Experimental Physics-Moscow	(868)
Komatsubara, T.	INS-Tokyo	(787)
Konaka, A.	TRIUMF	(787)
Kormanyos, C.	University of Colorado	(874)
Korotkick, V.	Moscow State University	(852)
Kossler, W.J.	College of William and Mary	(876)
Kramer, M.A.	City College of New York	(854, 881, 891)
Krasnov, S.A.	Joint Institute for Nuclear Research, Dubna	(863)
Krauss, D.E.	University of Pittsburgh	(814, 865)
Krienen, F.	Boston University	(821)
Kruglov, N.	Moscow State University	(852)
Kuang, Y.	College of William and Mary	(871, 888)
Kumagi, A.	University of Tsukuba	(866)
Kumar, S.	Yale University	(814)
Kumar, V.	Jaipur, University of Rajasthan	(863)
Kuno, Y.	National Laboratory for High Energy Physics (KEK)	(787)
Kuraev, E.A.	Institute for Nuclear Physics, Novosibirsk	(821)
Kurita, K.	University of Tsukuba	(859, 866)
Kurokawa, S.	National Laboratory for High Energy Physics (KEK)	(821)
Kwon, Y.	State University of New York-Stony Brook	(877)
Kycia, T.F.	Brookhaven National Laboratory	(787)
Lacasse, R.	McGill University	(814, 877)
Lahab, K.	Wayne State University	(877)
Lajoie, J.	Yale University	(864)
Lal, P.	Jaipur, University of Rajasthan	(863)
Landry, M.	University of Manitoba	(813, 836)
Lang, K.	University of Texas-Austin	(871, 888)
Lankford, W.F.	George Mason University	(876)
Larionova, V.G.	Lebedev Institute, Moscow	(863)
Larsen, R.	Brookhaven National Laboratory	(821)
Larson, B.	Ohio University	(887)
Lazarus, D.M.	Brookhaven National Laboratory	(840, 865)
Lebedev, V.	High Energy Physics Institute, Tbilisi State University	(865)
Ledoux, R.J.	Massachusetts Institute of Technology	(859)
Lee, L.	University of Manitoba	(813, 836)

Lee, L.	TRIUMF	(774)
Lee, R.	University of California-Los Angeles	(871)
Lee, S.Y.	Indiana University, IUCF	(880)
Lee, Y.Y.	Brookhaven National Laboratory	(821, 880)
Leipuner, L.	Brookhaven National Laboratory	(865)
Leitch, M.J.	Los Alamos National Laboratory (890)	
LeVine, M.J.	Brookhaven National Laboratory	(859, 866)
Lewis, R.A.	Pennsylvania State University	(864)
Li, K.K.	Brookhaven National Laboratory	(787)
Li, Q.	Wayne State University	(814, 877)
Li, Y.D.	Wuhan, Hua-Zhong Normal University	(863)
Li, Y.X.	Changsha, Hunan Education Institute	(863)
Liang, L.	Changsha, Hunan Education Institute	(863)
Libby, B.	Iowa State University	(862, 864, 892)
Lindenbaum, S.J.	Brookhaven Nat. Lab./City College of New York	(810, 854, 881, 891)
Lindenbusch, R.	Indiana University	(852)
Lindstrom, P.J.	Lawrence Berkeley Laboratory	(878)
Lisanti, J.	Indiana University	(781)
Lissauer, D.	Brookhaven National Laboratory	(814)
Littenberg, L.S.	Brookhaven National Laboratory	(787)
Liu, L.S.	Hua-Zhong Normal University, Wuhan	(863)
Liu, Z.	Boston University	(821)
Liu, Z.G.	Changsha, Hunan Education Institute	(863)
Llope, W.	State University of New York-Stony Brook	(814)
Lokanathan, S.	Jaipur, University of Rajasthan	(863)
Longacre, R.S.	Brookhaven National Laboratory	(810, 854, 881, 891)
Lord, J.	University of Washington	(863)
LoSecco, J.	University of Notre Dame	(852)
Louis, W.C.	Los Alamos National Laboratory	(889)
Love, W.A.	Brookhaven National Laboratory	(810, 854, 891)
Loveland, W.	Oregon State University	(844)
Lowder, D.M.	University of California-Berkeley	(882)
Lowe, J.	University of Birmingham	(813, 836)
Lowe, J.	University of New Mexico	(865, 885, 886)
Lozano, J.	University of Connecticut	(865)
Lozano, J.	Yale University	(865)
Lu, A.	University of California-Santa Barbara	(889)
Ludlam, T.	Brookhaven National Laboratory	(814, 877)
Lukaszew, A.	Wayne State University	(814, 877)
Luke, G.	Columbia University	(876)
Lukicheva, N.S.	Physical-Technical Institute, Tashkent	(863)
Luo, S.B.	Linfen, Shanxi Normal	(863)
Lysenko, W.P.	Los Alamos National Laboratory	(821)
Ma, H.	Brookhaven National Laboratory	(865)
Macdonald, J.A.	TRIUMF	(787)
Madansky, L.	Johns Hopkins University	(810, 817, 854)
Magahiz, R.	Carnegie-Mellon University	(813, 836, 885, 886)

Magurno, B.	Brookhaven National Laboratory	(865)
Mainweiler, R.W.	Valparaiso University	(889)
Majid, W.	Yale University	(865)
Majka, R.	Yale University	(814, 864)
Makdisi, Y.I.	Brookhaven National Laboratory	(850, 880)
Manak, J.	University of Notre Dame	(852)
Mane, S.	Brookhaven National Laboratory	(821, 880)
Manglos, S.	SUNY Health Science Center	(856)
Mangotra, L.K.	University of Jammu	(863)
Mann, A.K.	University of Pennsylvania	(889)
Marcin, M.R.	University of Texas-Austin	(871, 888)
Mardor, I.	Tel-Aviv University	(850)
Mardor, Y.	Tel-Aviv University	(850)
Margulies, J.	Temple University	(889)
Mark, S.K.	McGill University	(814, 877)
Marlow, D.R.	Princeton University	(787)
Marshak, M.L.	University of Minnesota	(850)
Martel, D.	University of Massachusetts-Dartmouth	(850)
Martin, R.D.	College of William and Mary	(871)
Marutyan, N.A.	Physics Institute, Yerevan	(863)
Marx, J.	University of California, Berkeley	(891)
Masaike, A.	University of Kyoto	(886)
Mashata, K.	National Laboratory for High Energy Physics (KEK)	(821)
Maslennikova, N.V.	Lebedev Institute, Moscow	(863)
Matheus, R.	Wayne State University	(814, 877)
Matsik, S.	University of Pittsburgh	(884)
May, M.	Brookhaven National Laboratory	(781, 885, 888)
Mayes, B.W.	University of Houston	(774, 874)
Mazavia, D.	Tbilisi State University, High Energy Physics Institute	(865)
McCorkle, S.	Brookhaven National Laboratory	(814, 877)
McCradly, R.	Carnegie-Mellon University	(813, 836)
McDonough, J.	University of Texas-Austin	(871, 888)
McPherson, R.	Princeton University	(787)
Meier, R.E.	Brookhaven National Laboratory	(821)
Melissinos, A.C.	University of Rochester	(840)
Meng, W.-Z.	Brookhaven National Laboratory	(821)
Menzel, W.	University of Basel	(865)
Merrill, F.	Carnegie-Mellon University	(813, 836, 885, 886)
Metcalf, W.	Louisiana State University	(889)
Meyer, C.	Carnegie-Mellon University	(813, 836)
Meyerhoff, W.	Stanford University	(892)
Meyers, P.D.	Princeton University	(787)
Miake, Y.	University of Tsukuba	(859, 866)
Michael, R.	Ohio University	(887)
Miettinen, H.E.	Rice University	(814)
Milder, A.	University of Texas-Austin	(871)
Miller, J.	Lawrence Berkeley Laboratory	(895)
Miller, J.P.	Boston University	(821)

Mills, A.P.	AT&T Bell Laboratories	(849)
Minor, E.	Pennsylvania State University	(850)
Mitchell, J.	University Space Research Association	(878)
Mitchell, J.	Yale University	(814)
Mitra, I.S.	Chandigarh, Panjab University	(863)
Mizumachi, Y.	National Laboratory for High Energy Physics (KEK)	(821)
Molzon, W.R.	University of California-Irvine	(871, 888)
Mookerjee, S.	Jaipur, University of Rajasthan	(863)
Moore, C.F.	University of Texas-Austin	(889)
Mordechai, S.	University of Texas-Austin	(895, 889)
Mori, Y.	National Laboratory for High Energy Physics (KEK)	(880)
Morimoto, T.	National Laboratory for High Energy Physics (KEK)	(787)
Morris, T.W.	Brookhaven National Laboratory	(854)
Morrison, D.	Massachusetts Institute of Technology	(859, 866)
Morse, R.J.	Massachusetts Institute of Technology	(859)
Morse, W.M.	Brookhaven National Laboratory	(821)
Moskowitz, B.	Brookhaven National Laboratory	(859, 866)
Mukhopadhyay, A.	State University of New York-Buffalo	(875)
Murtagh, M.J.	Brookhaven National Laboratory	(889)
Musulmanbekov, J.J.	Dubna, Joint Institute for Nuclear Research	(863)
Mutchler, G.S.	Rice University	(810, 817, 854, 891)
Nagamine, K.	University of Tokyo	(821)
Nagamiya, S.	Columbia University	(859, 866, 878)
Nagel, J.	Yale University	(864, 878)
Nakano, T.	TRIUMF	(787)
Namboordiri, N.	Lawrence Livermore National Laboratory	(859, 866)
Nasrulaeva, H.	Institute of Nuclear Physics, Tashkent	(863)
Nasyrov, S.Z.	Institute of Nuclear Physics, Tashkent	(863)
Navotny, V.S.	Physical-Technical Institute, Tashkent	(863)
Nayak, T.	Columbia University	(859, 866)
Nefkens, B.M.K.	University of California-Los Angeles	(890)
Nelson, J.	University of Birmingham	(813, 836, 886)
Nezrick, F.A.	Fermilab	(840)
Nguyen, C.T.	University of Texas-Austin	(871, 888)
Nicholson, H.	Mt. Holyoke College	(850)
Nilsen, B.S.	University of Minnesota	(869)
Nomura, I.	University of Tokyo/INS	(774)
Normand, L.	McGill University	(877)
Numao, T.	TRIUMF	(787)
Nystrand, J.	University of Lund	(863)
O'Brien, E.	Brookhaven National Laboratory	(814, 877)
Ogilvie, C.	Massachusetts Institute of Technology	(866)
Okada, K.	University of Kyoto-Sangyo	(813, 836, 886)
Okumo, H.	INS-Tokyo	(787)
Olchanski, K.	Brookhaven National Laboratory	(852)
Olness, J.	Brookhaven National Laboratory	(859, 866)

Olson, D.	Lawrence Berkeley Laboratory	(895)
Olszewski, A.	Institute of Nuclear Physics, Krakow	(868)
Omata, K.	National Laboratory for High Energy Physics (KEK) (787)	
Orlova, G.I.	Lebedev Institute, Moscow	(863)
Orlov, Y.	Cornell University	(821)
Ostrovidov, A.	Moscow State University	(852)
Otterlund, I.	University of Lund	(863)
Ouimettae, D.A.	Stanford University	(888)
Outa, H.	INS	(887)
Ouyang, J.	Boston University	(821)
Pacradouni, V.	TRIUMF	(787)
Padley, P.	TRIUMF	(787)
Page, S.	University of Manitoba	(813, 836, 885)
Pai, C.	Brookhaven National Laboratory	(821)
Park, S.	Massachusetts Institute of Technology	(866)
Parsons, C.G.	Massachusetts Institute of Technology	(859)
Partland, M.	University of California-Davis	(895)
Peak, L.S.	University of Sydney	(863)
Peaslee, D.C.	University of Maryland	(854)
Peggs, S.	Brookhaven National Laboratory	(880)
Peilert, G.	Lawrence Livermore Laboratory	(895)
Peng, J.C.	Los Alamos National Laboratory	(890)
Perera, A.G.U.	University of Pittsburgh	(884)
Peresadko, N.G.	Lebedev Institute, Moscow	(863)
Peterson, R.J.	University of Colorado	(874)
Petrov, N.V.	Institute of Nuclear Physics-Tashkent	(863)
Piasetzky, E.	Tel-Aviv University	(850)
Piekarz, H.	University of Houston	(774)
Pile, P.H.	Brookhaven National Laboratory	(774, 781, 813, 836, 865, 885, 886)
Pinsky, L.S.	University of Houston	(774, 874)
Pislak, S.	University of Zurich	(865)
Platner, E.D.	Brookhaven National Laboratory	(810, 854, 891)
Pless, I.	Massachusetts Institute of Technology	(864)
Plyushev, V.A.	St. Petersburg, Khlopin Radium Institute	(863)
Po, H.	Yale University	(865)
Poblaguev, A.A.	Institute for Nuclear Research-Moscow	(865)
Polk, I.	Brookhaven National Laboratory	(821)
Pommot-Maia, M.	Stanford University	(871)
Pope, J.K.	Yale University	(864, 878)
Porile, N.T.	Purdue University	(864, 895)
Postoev, V.	Institute for Nuclear Research-Dubna	(865)
Potenza, R.	INFN Catania	(895)
Poutissou, J.-M.	TRIUMF	(889, 787)
Poutissou, R.	TRIUMF	(787)
Powyer, S.	Indiana University	(781)

Pozharova, E.A.	Institute of Theory and Experimental Physics-Moscow	(868)
Prasad, S.C.	SUNY Health Science Center	(856)
Price, P.B.	University of California-Berkeley	(882)
Price, J.W.	University of California-Los Angeles	(890)
Prigl, R.	University of Heidelberg	(821)
Prodell, A.	Brookhaven National Laboratory	(821, 840)
Proskurjakov, A.	High Energy Physics Institute, Tbilisi State University	(865)
Proskuryakov, A.	Moscow State University	(852)
Pruneau, C.	Wayne State University	(814, 864, 877)
Qin, Y.M.	Linfen, Shanxi Normal	(863)
Quian, W.Y.	Hua-Zhong Normal University-Wuhan	(863)
Quinn, B.	Carnegie-Mellon University	(813, 836, 885, 886)
Rabin, M.S.Z.	University of Massachusetts	(864)
Rai, G.	Lawrence Berkeley Laboratory	(895)
Raniwala, R.	Jaipur, University of Rajasthan	(863)
Raniwala, S.	Jaipur, University of Rajasthan	(863)
Rankowitz, S.	Brookhaven National Laboratory	(821)
Ramsay, D.	University of Manitoba	(813, 836, 885)
Rao, M.	State University of New York-Stony Brook	(814, 877)
Rao, N.K.	University of Jammu	(863)
Rasmussen, J.	Lawrence Berkeley Laboratory	(895)
Ratner, L.	Brookhaven National Laboratory	(880)
Redin, S.I.	Yale University	(821)
Redlinger, G.	TRIUMF	(787)
Reece, K.	Brookhaven National Laboratory	(880)
Reed, J.	Syracuse University	(856)
Reeder, R.	University of New Mexico	(889)
Rehak, P.	Brookhaven National Laboratory	(865)
Remsberg, L.P.	Brookhaven National Laboratory	(859, 866)
Riley, P.J.	University of Texas-Austin	(871, 888)
Ritchie, J.L.	University of Texas-Austin	(871, 888)
Ritter, H.G.	Lawrence Berkeley Laboratory	(895)
Rizzo, C.	Trieste	(840)
Roberts, B.L.	Boston University	(821)
Roberts, J.B.	Rice University	(817)
Robinson, D.K.	Case Western Reserve University	(856)
Roehrich, D.	Brookhaven National Laboratory	(859, 866)
Roeper, M.	Phillips University-Marburg	(863)
Romanski, J.	INFN Catania	(895)
Romera, J.	University of California-Davis	(895)
Rosati, M.	McGill University	(814, 877)
Roser, T.	Brookhaven National Laboratory	(850, 880)
Rössle, E.	Freiburg University	(813, 836, 886)
Rothschild, P.	Massachusetts Institute of Technology	(859, 866)
Rotondo, F.	Yale University	(814, 864)
Roy, J.	TRIUMF	(787)

Rozon, M.	TRIUMF	(787)
Rozon, M.	University of Alberta	(813, 836)
Rubin, P.	University of Richmond	(871)
Ruoso, G.	University of Rochester	(840)
Rusek, A.	University of New Mexico	(813, 836, 885, 886)
Russell, J.J.	University of Massachusetts-Dartmouth	(850)
Russo, G.V.	INFN Catania	(895)
Sachelashvili, T.	Tbilisi State University, High Energy Physics Institute	(865)
Saidkhanov, N.	Physical-Technical Institute, Tashkent	(863)
Saito, N.	University of Tokyo	(813, 836)
Sakamoto, S.	National Laboratory for High Energy Physics (KEK)	(821)
Sakitt, M.	Brookhaven National Laboratory	(856)
Sako, H.	Institute for Nuclear Study, University of Tokyo	(866)
Sakurai, H.	University of Tokyo	(859, 866)
Salmanova, N.A.	Lebedev Institute, Moscow	(863)
Sandberg, J.	Brookhaven National Laboratory	(821)
Sandweiss, J.	Yale University	(814, 864)
Sangster, T.C.	Lawrence Livermore National Laboratory	(859, 866)
Sarkisova, L.G.	Physics Institute-Yerevan	(863)
Sarkisyan, V.R.	Physics Institute-Yerevan	(863)
Sarycheva, L.	Moscow State University	(852)
Sato, H.	National Laboratory for High Energy Physics (KEK)	(880)
Sato, T.	National Laboratory for High Energy Physics (KEK)	(787, 821)
Saulys, A.C.	Brookhaven National Laboratory	(810, 854, 891)
Sawafta, R.	Brookhaven National Laboratory	(774, 781, 813, 836, 856, 874, 885, 886, 887, 890)
Scharenberg, R.P.	Purdue University	(864, 895)
Schillaci, M.	Los Alamos National Laboratory	(889)
Schmitt, H.	Freiburg University	(813, 836, 886)
Schone, H.E.	College of William and Mary	(876)
Schumacher, R.	Carnegie-Mellon University	(813, 836, 885, 886)
Schwandt, P.	Indiana University, IUCF	(880)
Schwartz, A.J.	Princeton University	(888)
Scott, E.	Indiana University	(852)
Sedykh, S.	State University of New York-Stony Brook	(877)
Seitimbetov, A.M.	Alma Ata, Institute of High Energy Physics	(863)
Semertzidis, Y.	Brookhaven National Laboratory	(821, 840)
Sengupta, K.	Louisiana State University	(868)
Seto, R.	University of California-Riverside	(859, 866)
Seyfarth, H.	Forschungszentrum Jülich	(890)
Shabratova, G.S.	Joint Institute for Nuclear Research, Dubna	(863)
Shakova, C.I.	Alma Ata, Institute of High Energy Physics	(863)
Shatunov, Ya. M.	Institute for Nuclear Physics, Novosibirsk	(821)
Sheen, J.	Wayne State University	(877)
Shephard, W.D.	University of Notre Dame	(852)
Shigaki, K.	University of Tokyo	(866)

Shimizu, Y.	University of Tokyo/INS	(774, 887)
Shinkawa, T.	National Laboratory for High Energy Physics (KEK)	(787)
Shiva Kumar, B.	Yale University	(864, 878)
Shoemaker, F.C.	Princeton University	(787)
Shrivastava, B.	Purdue University	(895)
Shutt, R.	Brookhaven National Laboratory	(821)
Siliak, Z.	Indiana University	(852)
Simon-Gillo, J.	Los Alamos National Laboratory	(814)
Sinev, N.B.	Moscow State University	(852)
Singh, G.	State University of New York-Buffalo	(875)
Skeens, J.	Rice University	(817)
Skelding, D.	University of Washington	(863)
Skelly, J.F.	Brookhaven National Laboratory	(880)
Skorotko, T. Yu.	Institute of Theory and Experimental Physics-Moscow	(868)
Slaughter, A.J.	Yale University	(864)
Šlaus, I.	Ruder Boskovic Institute	(890)
Smirnitski, V.A.	Institute of Theory and Experimental Physics-Moscow	(868)
Smith, A.J.S.	Princeton University	(787)
Smith, G.	Brookhaven National Laboratory	(840)
Smith, G.A.	Pennsylvania State University	(864)
Smith, P.T.	Indiana University	(852)
Snydstrup, L.	Brookhaven National Laboratory	(821)
Sobolewski, Z.	Syracuse University	(856)
Soderstrom, K.	University of Lund	(863)
Solodov, E.	Institute for Nuclear Physics-Novosibirsk	(821)
Solovieva, Z.I.	St. Petersburg, Khlopin Radium Institute	(863)
Soltz, R.	Massachusetts Institute of Technology	(859, 866)
Soluk, R.	TRIUMF	(787)
Sonnadara, U.	University of Pittsburgh	(814, 877)
Soukas, A.	Brookhaven National Laboratory	(821, 880)
Spinelli, P.	University of Bari	(864)
Spinka, H.	Argonne National Laboratory	(880)
Srivastava, B.K.	Purdue University	(864)
Stachel, J.	State University of New York-Stony Brook	(814, 877)
Stancu, I.	University of California-Riverside	(889)
Stanislaus, T.D.S.	Valparaiso University	(889)
Stankus, P.	Columbia University	(859, 878)
Starinsky, N.	McGill University	(877)
Steadman, S.G.	Massachusetts Institute of Technology	(859, 866)
Stearns, R.L.	Vassar College	(774, 781, 813, 836, 885, 886)
Stenlund, E.	University of Lund	(863)
Stephans, G.S.F.	Massachusetts Institute of Technology	(859, 866)
Sternlieb, B.	Columbia University	(876)
Stevens, A.J.	Brookhaven National Laboratory	(889, 787)
Stevenson, P.M.	Rice University	(817)
Stienike, D.	University of Notre Dame	(852)
Stillman, A.	Brookhaven National Laboratory	(821)
Stoenner, R.W.	Brookhaven National Laboratory	(844)

Stone, E.C.	Caltech	(869)
Stotzer, R.	University of New Mexico	(813, 836, 865)
Strand, R.C.	Brookhaven National Laboratory	(787)
Stringfellow, B.C.	Purdue University	(864)
Stronach, C.E.	Virginia State University	(876)
Sugimoto, S.	INS-Tokyo	(787)
Sukaton, I.	Carnegie-Mellon University	(813, 836, 886)
Sulak, L.R.	Boston University	(821)
Sulanke, T.	Indiana University	(852)
Sum, V.	University of Manitoba	(813, 836)
Sung, T.	Massachusetts Institute of Technology	(859, 866)
Sutter, R.	Brookhaven National Laboratory	(813, 836, 856, 874, 885, 886, 887, 890)
Sutton, S.	Mt. Holyoke College	(850)
Švarc, A.	Ruder Boskovic Institute	(890)
Svechnikova, L.N.	Physical-Technical Institute-Tashkent	(863)
Szarska, M.	Institute of Nuclear Physics-Krakow	(868)
Szymanski, J.	Indiana University Cyclotron Facility	(813, 836)
Taeger, S.	University of Notre Dame	(852)
Takagui, M.	University of São Paulo	(814, 877)
Takai, H.	Brookhaven National Laboratory	(814, 865)
Takeutchi, F.	University of Kyoto-Sangyo	(813, 836, 885, 886)
Tallerico, T.	Brookhaven National Laboratory	(821)
Tamura, H.	University of Tokyo	(866, 887)
Tanaka, K.H.	National Laboratory for High Energy Physics (KEK)	(878)
Tanaka, M.	Brookhaven National Laboratory	(850)
Tanaka, Y.	Kyushu University	(859, 866)
Tang, L.	CEBAF	(887)
Tannenbaum, M.J.	Brookhaven National Laboratory	(859, 866)
Teige, S.	Indiana University	(852)
Teng, L.	Argonne National Laboratory	(880)
Tepikian, S.	Brookhaven National Laboratory	(880)
Thern, R.E.	Brookhaven National Laboratory	(880)
Thieberger, P.	Brookhaven National Laboratory	(892)
Thomas, J.H.	Lawrence Livermore National Laboratory	(859, 866)
Thompson, A.	Dublin Institute for Advanced Studies (DIAS)	(893)
Thompson, D.R.	University of Notre Dame	(852)
Thompson, J.A.	University of Pittsburgh	(865)
Thompson, P.A.	Brookhaven National Laboratory	(821)
Throwe, T.	Brookhaven National Laboratory	(814, 864)
Tincknell, M.L.	Purdue University	(864)
Tippens, W.B.	University of California-Los Angeles	(890)
Toldo, F.	Brookhaven National Laboratory	(821)
Tolstov, K.D.	Joint Institute for Nuclear Research, Dubna	(863)
Tonse, S.	Lawrence Livermore National Laboratory	(859, 866)
Tothova, M.	Šafarite University-Košice	(863)
Toyama, T.	National Laboratory for High Energy Physics (KEK)	(880)

Trabojevic, D.	Brookhaven National Laboratory	(880)
Tretvakova, M.I.	Lebedev Institute, Moscow	(863)
Trifimova, T.P.	Institute of Nuclear Physics, Tashkent	(863)
Truoei, P.	University of Zurich	(865)
Trzupek, A.	Institute of Nuclear Physics-Krakow	(868)
Tuleeva, U.I.	Institute of Nuclear Physics-Tashkent	(863)
Turcot, A.S.	TRIUMF	(787)
Tursunov, B.P.	Tashkent, Institute of Nuclear Physics	(863)
Tuve, C.	INFN Catania	(895)
Uemuera, Y.J.	Columbia University	(876)
Ueno, S.	University of Tsukuba	(866)
Ukai, K.	INS-Tokyo	(787)
Underwood, D.G.	Argonne National Laboratory	(880)
van Asselt, W.	Brookhaven National Laboratory	(880)
VanDalen, G.	University of California-Riverside	(889)
van Dijk, J.H.	Brookhaven National Laboratory	(859, 866)
van Oers, W.	University of Manitoba	(813, 836, 885)
Vaziri, K.	Rensselaer Polytechnic Institute	(878)
Videbaek, F.	Brookhaven National Laboratory	(859, 866)
Vokal, S.	Šafarite University-Košice	(863)
Voloshin, S.	University of Pittsburgh	(877)
von Walter, P.	University of Heidelberg	(821)
Vossnack, O.	Columbia University	(859, 866)
Vrlakova, J.	Šafarite University-Košice	(863)
Vulcan, W.F.	College of William and Mary	(888)
Vutsadakis, V.	Massachusetts Institute of Technology	(859)
Waddington, C.J.	University of Minnesota	(868, 869)
Wang, F.	Columbia University	(866)
Wang, F.Q.	Columbia University	(859)
Wang, G.	McGill University	(814, 877)
Wang, K.	Syracuse University	(856)
Wang, M.J.	University of California-Los Angeles	(890)
Wang, Y.	Columbia University	(859, 866)
Wang, Y.	Indiana University, IUCF	(880)
Wang, H.Q.	Hua-Zhong Normal University-Wuhan	(863)
Ware, C.B.	University of Texas-Austin	(871, 888)
Waters, L.	State University of New York-Stony Brook	(814)
Weerasundara, D.	Kent State University	(895)
Wefel, J.P.	Louisiana State University	(868)
Wegner, H.	Brookhaven National Laboratory	(859, 866, 892)
Wells, S.	University of Indiana	(781, 887)
Welsh, R.	Johns Hopkins University	(878)
Welsh, R.E.	College of William and Mary	(871, 888)
Weng, Z.Q.	Changsha, Hunan Education Institute	(863)
Wessels, J.	State University of New York-Stony Brook	(877)

Weyer, H.	University of Basel	(865)
Weygand, D.	Brookhaven National Laboratory	(852)
White, D.B.	University of California-Los Angeles	(890)
White, D.H.	Los Alamos National Laboratory	(889)
White, S.	Brookhaven National Laboratory	(888)
Whitehouse, D.	Los Alamos National Laboratory	(889)
Wieder, M.	Freiburg University	(813, 836)
Wieman, H.	Lawrence Berkeley Laboratory	(895)
Wienands, U.	TRIUMF	(880)
Wilczynska, B.	Institute of Nuclear Physics-Krakow	(868)
Wilczynski, H.	Institute of Nuclear Physics-Krakow	(868)
Wilkes, R.J.	University of Washington	(863)
Willutzki, H.	Brookhaven National Laboratory	(817, 852)
Winn, D.	Fairfield University	(821)
Winter, R.G.	College of William and Mary	(888)
Wissink, S.W.	University of Indiana	(781, 887)
Wise, J.	University of Colorado	(774, 781, 874)
Witkowski, M.	College of William and Mary	(871, 888)
Witzig, C.	Brookhaven National Laboratory	(787)
Wohn, F.K.	Iowa State University	(862, 864)
Wojcicki, S.G.	Stanford University	(871, 888)
Wolf, K.	Texas A&M University	(814, 895)
Wolfe, D.	University of New Mexico	(813, 814, 836, 865, 885, 886)
Wolin, E.J.	Yale University	(864)
Wolter, W.	Institute of Nuclear Physics-Krakow	(868)
Woodle, K.	Brookhaven National Laboratory	(821)
Woody, C.	Brookhaven National Laboratory	(814, 877)
Worm, S.	University of Texas-Austin	(871, 888)
Worstell, W.	Boston University	(821)
Wosiek, B.	Institute of Nuclear Physics-Krakow	(868)
Wozniak, K.	Institute of Nuclear Physics-Krakow	(868)
Wright, D.	TRIUMF	(889)
Wright, R.	Lawrence Berkeley Laboratory	(878)
Wu, J.Y.	Pennsylvania State University	(850)
Wu, Y.D.	Columbia University	(859, 866)
Xia, Y.L.	Changsha, Hunan Education Institute	(863)
Xiong, H.	Wayne State University	(877)
Xu, N.	State University of New York-Stony Brook	(814, 877)
Xu, Q.	University of California-Riverside	(866)
Xu, Q.	Yale University	(821)
Yagi, K.	University of Tsukuba	(866)
Yamamoto, A.	National Laboratory for High Energy Physics (KEK)	(821)
Yang, C.B.	Wuhan, Hua-Zhong Normal University	(863)
Yang, X.	Columbia University	(859)
Yellin, S.	University of California-Santa Barbara	(889)
Yen, S.	TRIUMF	(889)

Yokkaichi, S.	University of Kyoto	(813, 836)
Yokosawa, A.	Argonne National Laboratory	(880)
Yokoya, K.	National Laboratory for High Energy Physics (KEK)	(880)
Young, T.	Syracuse University	(856)
Yoshimura, Y.	National Laboratory for High Energy Physics (KEK)	(787)
Zachary, D.	Massachusetts Institute of Technology	(866)
Zajc, W.A.	Columbia University	(859, 866)
Zalikhonov, B.Z.	Joint Institute for Nuclear Research, Dubna	(865)
Zavattini, E.	Trieste	(840)
Zeitlin, C.	Lawrence Berkeley Laboratory	(895)
Zeller, M.E.	Yale University	(865)
Zeps, V.	Carnegie-Mellon University	(813, 836, 885, 886)
Zhang, D.H.	Linfen, Shanxi Normal	(863)
Zhang, Y.C.	State University of New York-Stony Brook	(814, 877)
Zhang, Z.	University of Pittsburgh	(814)
Zhao, K.	City College of New York	(810, 881, 891)
Zheng, P.Y.	Beijing, Academia Sinica	(863)
Zhochova, S.I.	Physical-Technical Institute, Tashkent	(863)
Zhou, D.C.	Hua-Zhong Normal University, Wuhan	(863)
Zhu, F.	Brookhaven National Laboratory	(866)
Zhu, Q.	University of California-Riverside	(866)
Zhu, Y.	City College of New York	(810, 881, 891)
Zieminska, D.	Indiana University	(852)
Zou, C.	State University of New York-Stony Brook	(814, 877)
zu Putlitz, G.	University of Heidelberg	(821)
Zybert, R.	University of Birmingham	(813, 836, 886)

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