

RESEARCH ACTIVITIES DURING DECEMBER 1977

James MacLachlan

The accelerator ran in December at 400 GeV with a 1.25-sec flattop and provided  $2.44 \times 10^{18}$  protons and 401 hours of beam time of the 553 hours scheduled for high-energy physics. The 72% ratio of available to scheduled beam is somewhat below average, but after time had been taken out for a couple of sessions of extraction-system repair, leak hunting near C0, and finding a shorted Main-Ring transformer, the remaining operation was generally quite satisfactory. The accelerator was put into a Christmas standby for the 79-hour period from Friday, December 23, through Monday, December 26. The resumption of running for high-energy physics was reasonably smooth with good beam arriving about 2 shifts after startup. At the end of the month, both the Booster and the Main Ring were running at around their highest recorded intensities.

Considerable progress was made during the month in smoothing the transition between high repetition-rate running during the night hours and slower running on weekdays. Initially, there were severe problems with extraction a few minutes after a major change in cycle time. The Main Ring could be made to run well either at slow repetition rate or at fast repetition rate, but seemingly not both. But, by adjusting the magnet cooling-water temperature to keep the magnets at constant temperature rather than by keeping the water at constant temperature, a  $6^\circ$  change in magnet temperature was eliminated. The extraction difficulties appear to have been related in some poorly understood way to this temperature difference. The day/night

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variation in cycle will apparently be a long-term feature of accelerator operation, because negotiations for a new power contract have reached an advanced stage with provisions that encourage reduced consumption of power during the day. From the standpoint of protons accelerated and available spill seconds, it would already appear that a daytime limit of 55 MW will be workable. More difficult to assess are the effects on experiments, particularly the efficiency of short periods of running for high-energy physics sandwiched between successive daytime study periods. The relative value of continuity of running and the close matching of high-energy physics running to the power schedule is being carefully evaluated; the information from experimenters' hours reporting will be an important indication of the subtler effects of the new power limits.

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FACILITY UTILIZATION SUMMARY -- DECEMBER 1977

I. Summary of Accelerator Operations

	<u>Hours</u>
A. Accelerator use for physics research	
Accelerator physics research	52.6
High energy physics research	400.7
Research during other use	<u>(16.3)</u>
Subtotal	453.3
B. Other activities	
Accelerator setup and tuning to experimental areas	14.0
Program interruption	27.1
Unscheduled interruption	<u>170.6</u>
Subtotal	211.7
C. Unmanned time	<u>79.0*</u>
Total	744.0

II. Summaries of High Energy Physics Research Use

	<u># of Expts.</u>	<u>Hours</u>	<u>Results</u>
A. Counter experiments	13	3167.8	1 exp. completed
B. Bubble chamber experiments	1	337.3	103 K 15' pictures
C. Emulsion experiments	-	-	-
D. Special target experiments	-	-	-
E. Test experiments	1	261.1	Tests complete
F. Engineering studies and tests	-	-	-
G. Other beam use	<u>(2)</u>	<u>5.4</u>	N1 and PW beam tuning
	15	3771.6	

III. Number of Protons Accelerated and Delivered @ 400 GeV ( $\times 10^{18}$ )

A. Beam accelerated in Main Ring	2.44
B. Beam delivered to experimental areas	
Meson Area	0.36
Neutrino Area	
Slow Spill	0.67
Fast Spill	1.19
Proton Area	0.08
Total	2.30

\* Christmas standby

BEAM UTILIZATION BY

	<u>Beam</u>	<u>Hours</u>
MESON AREA		
Associated Production #99	M6E	267.0
Total Cross Section #104	M1W	265.8
Inclusive $K_S^0$ #383	M4	267.4
Multi-Muon #439	M2	263.7
Particle Search #540	M3	194.6
NEUTRINO AREA		
Muon #203A	N1	9.6
Neutrino #310	N0	343.2
Di-Muon #444	N1	328.7
Neutrino #482	N0	351.2
15' $\nu/H_2$ & Ne #546	N0	337.3
DPI Tests	N3	261.1
PROTON AREA		
Photoproduction #87A	P1	259.7
Di-Lepton #288	PC	304.2
INTERNAL TARGET AREA		
Proton Polarization #522	C0	241.1
p-N Scattering #552	C0	<u>128.6</u>
Hours for experiments		3766.2
Hours for beam tuning		<u>5.4</u>
TOTAL HOURS FOR HIGH-ENERGY PHYSICS		3771.6

EXPERIMENT -- DECEMBER 1977

Activities

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data:  $\Sigma$  and  $Y^*$  production with 70 GeV  $\pi^+$  and 70 GeV  $K^-$  using the Single Arm Spectrometer  
data: complete;  $H_2$ ,  $D_2$  and nuclear total cross sections for  $\pi^\pm$ ,  $K^\pm$ , p, and  $\bar{p}$  at momenta up to 370 GeV/c  
tuneup: beam tuning and trigger studies for inclusive  $K_S^0$  production by  $K^-$   
tuneup & data: beam tuning, counter timing, and rate studies followed by high mass dimuon production by protons in magnetized Fe beam dump  
tests: looking for delayed energy release from a target bombarded by neutrons

tests: rate studies of chambers and computer interface  
data: prescaled single- $\mu$  and multi- $\mu$  data with an iron-scintillator calorimeter and toroidal muon spectrometer  
data: mass spectrum of dimuons produced by  $\pm 225$  GeV/c  $\pi$  measured with the cyclotron spectrometer  
data: single- $\mu$  and multi- $\mu$  data using the Lab E calorimeter and muon spectrometer  
data: 103K pictures in the 15' chamber with 47% neon hydrogen mixture using the double plane EMI  
tests: complete; tests of the  $\gamma$  detector and ISIS

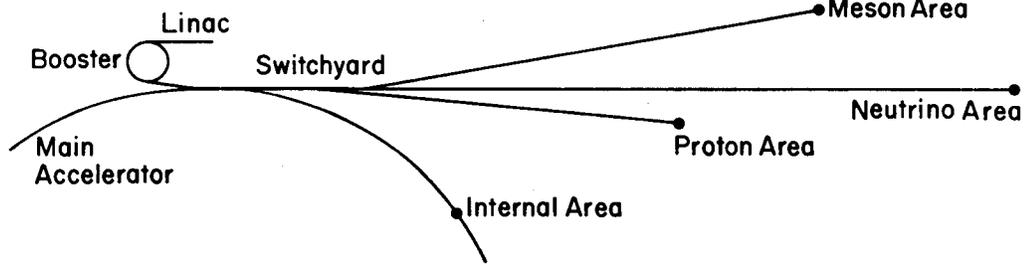
tests: trigger studies and equipment checkout for the production of high mass hadron states with the broad-band photon beam  
data: high mass dimuon data in a high rate configuration

data: recoil proton polarization in pp inclusive scattering at 100-400 GeV  
data: p-p and p-D scattering using the superconducting recoil spectrometer

FERMI NATIONAL ACCELERATOR LABORATORY  
MONTHLY OPERATIONS HISTORY  
DECEMBER 1977

Date	Accelerator	Int. Target Area	Proton Area	Neutrino Area	Meson Area
Thurs. 12/1	Accelerator Maintenance & Development				
Fri. 12/2	Repairs: Main Ring vacuum, Extraction, Linac gas barrier				
Sat. 12/3		p-N Scattering 552	Di-Lepton 288 (PC)	Di-Muon 444 (N1) Neutrino 310 (NO)	Assoc. Prod. 99 (M6E)
Sun. 12/4	Repairs: Extraction		Photoprod. 87A (PE)	Neutrino 482 (NO)	$G_{\pi}$ 104 (M1W)
Mon. 12/5			OFF (PW)	15' $\nu/H_{\mu}Ne$ #546 (NO)	Multi- $\mu$ 439 (M2) Incl. $K^0$ 383 (M4)
Tues. 12/6					Part. $S^0$ Sch. 540 (M3)
Wed. 12/7	Accel. Studies Repairs: MR Vacuum			DPI Tests (N3)	
Thurs. 12/8	Accel. Studies	Proton Polariz.			
Fri. 12/9	$\sim 1.8 \times 10^{13}$ ppp @400 GeV	522			
Sat. 12/10	(1.25 sec flattop)				
Sun. 12/11					
Mon. 12/12					
Tues. 12/13					
Wed. 12/14	Accel. Studies				
Thurs. 12/15	Accel. Studies				
Fri. 12/16	$\sim 1.7 \times 10^{13}$ ppp @400 GeV				
Sat. 12/17					
Sun. 12/18					
Mon. 12/19	$\sim 1.9 \times 10^{13}$ ppp @400 GeV				
Tues. 12/20					
Wed. 12/21				Tests for U203A (N1) DPI Tests (N3)	
Thurs. 12/22	Interlock Tests and Accelerator Studies				
Fri. (H) 12/23	CHRISTMAS STANDBY PERIOD				
Sat. 12/24					
Sun. 12/25					
Mon. (H) 12/26	Accelerator Startup				
Tues. 12/27		p-N Scattering 552	OFF	Di-Muon 444 (N1) Neutrino 310 (NO)	Water System Repairs
Wed. 12/28				Neutrino 482 (NO)	
Thurs. 12/29				15' $\nu/H_{\mu}Ne$ #546 (NO)	
Fri. 12/30	Reprs: MR Xformer		Di-Lepton 288 (PC)		
Sat. 12/31	$\sim 2.2 \times 10^{13}$ ppp @400 GeV (1.25 sec flattop)		Photoprod. 87A (PE) OFF (PW)		

# Fermi National Accelerator Laboratory



## Experiments in the Research Areas

JANUARY - MARCH 1978

### Internal Area

PROTON POLARIZATION #522  
P-N SCATTERING #552

### Proton Area

PROTON EAST:  
PHOTOPRODUCTION #87A  
PHOTOPRODUCTION #152B

PROTON CENTER:  
DI-LEPTON #288

### Neutrino Area

MUON/HADRON BEAM:  
MUON #203A/#391  
MUON #448

NEUTRINO BEAM:  
NEUTRINO #253  
NEUTRINO #310  
15-FT BUBBLE CHAMBER

### Meson Area

M1 BEAM:  
HADRON DISSOCIATION #272  
PARTICLE SEARCH #490

M2 BEAM:  
MULTI-MUON #439

M3 BEAM:  
PARTICLE SEARCH #540

M4 BEAM:  
INCLUSIVE  $K_S^0$  #383

M6 BEAM:  
MULTIPARTICLE #110A  
HADRON DISSOCIATION #396  
INCLUSIVE SCATTERING #451

SITUATION REPORT-- JANUARY 1978

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FERNI NATIONAL ACCELERATOR LABORATORY  
EXPERIMENTAL PROGRAM SITUATION REPORT

PROGRAM PLANNING OFFICE  
12 JAN 1978

THE EXPERIMENTAL PROGRAM SITUATION AT FERMILAB IS SUMMARIZED BELOW. THE EXPERIMENTS ARE LISTED SEPARATED BY EXPERIMENTAL AREA UNDER CATEGORIES THAT BEST DESCRIBE THEIR CIRCUMSTANCE AS OF JANUARY 1, 1978. FOR EXPERIMENTS WHICH HAVE BEEN COMPLETED OR HAVE RECEIVED RECENT INDICATION OF THE AMOUNT OF RUNNING TIME OR EXPOSURE. THE EXPERIMENTAL AREA NAMES ARE ABBREVIATED AS FOLLOWS: NEUTRON AREA (NA), NEUTRINO AREA (NA), PROTON AREA (PA), INTERNAL TARGET AREA (ITA).

TOTAL NUMBER OF APPROVED EXPERIMENTS - 276

A. EXPERIMENTS THAT HAVE COMPLETED DATA TAKING (205): SPOKESPERSON EXTENT OF RUN TO DATE DATE COMPLETED

(ONLY EXPERIMENTS COMPLETED SINCE 1 JAN 1977 ARE LISTED BELOW)

AREA	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN	TO DATE	DATE COMPLETED
NA-N1	POLARIZED SCATTERING #61	CHAMBERLAIN	1,900 HOURS		26 OCT 1977
	TOTAL CROSS SECTION #104	KTCIA	2,650 HOURS		22 DEC 1977
	HADRON JETS #236A	ROCKETT	1,700 HOURS		20 JUL 1977
	INCLUSIVE SCATTERING #324	WEISBERG	1,200 HOURS		13 AUG 1977
	FORM FACTOR #456	STORK	1,450 HOURS		13 APR 1977
	HIGH ENERGY CHANNELING #302	GIBSON	350 HOURS		30 MAY 1977
	INCLUSIVE NEUTRAL NESSO #350	RENNY	900 HOURS		17 APR 1977
	HADRON JETS #395	SELVAGE	1,150 HOURS		16 NOV 1977
	INCLUSIVE NEUTRON #404	GUSTAFSON	350 HOURS		5 JUL 1977
	LAMBDA MAGNETIC MOMENT #440	BUNCE	250 HOURS		22 MAR 1977
	LAMBDA POLARIZATION #441	PONDROM	400 HOURS		2 JUL 1977
	NEUTRON-NUCLEUS INELASTIC #438	JONES	350 HOURS		18 APR 1977
	K ZERO CHARGE RADIIUS #226	TELEGDI	1,200 HOURS		17 MAR 1977
	K ZERO CROSS SECTION #406	WINTZIN	950 HOURS		17 APR 1977
	INCLUSIVE SCATTERING #118A	FRIEDMAN	2,550 HOURS		20 JUL 1977
NA-NO-HCRF	15-FOOT ANTI-NEUTRINO/H2 #31A	DEBRICK	211K PIX		13 AUG 1977
	EMULSION/NEUTRINO #53A	162K PIX			24 FEB 1977
	EMULSION/NEUTRINO #536	PIU	2 STACKS		13 AUG 1977
-NOON/HADRON	PARTICLE SEARCH #369	KISK	1,000 HOURS		13 AUG 1977
-15-FT	PARTICLE SEARCH #379	WOJCICKI	1,250 HOURS		8 JUN 1977
PA-PE	PARTICLE SEARCH #325	CRONIN	1,500 HOURS		28 FEB 1977
-PC	DI-HADRON #894	WOOD	1,950 HOURS		21 FEB 1977
-PK	PHOTON SEARCH #95A	COT	3,400 HOURS		17 OCT 1977
	PROTON-NUCLEON ELASTIC #177A	ORSH	2,400 HOURS		19 APR 1977
ITA-C-0	PROTON-NUCLEON SCATTERING #198A	OLSEN	900 HOURS		19 APR 1977
	PROTON-NEUTRON SCATTERING #289	NALANUD	1,050 HOURS		8 NOV 1977
	PROTON-NEUTRON POLARIZATION #313	HELI	850 HOURS		30 MAR 1977
	PROTON-NUCLEON SCATTERING #381	NALANUD	600 HOURS		30 MAR 1977
	NUCLEAR FRAGMENTS #442	TURKOT	1,200 HOURS		13 AUG 1977

B. EXPERIMENTS THAT ARE IN PROGRESS (27): EXTENT OF RUN TO DATE DATE OF RECENT RUN

AREA	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN	TO DATE	DATE OF RECENT RUN
NA-N2	MULTI-NOON #439	GARELICK	700 HOURS		1 JAN 1978
	PARTICLE SEARCH #446	STREIBERG	300 HOURS		1 OCT 1977
-N3	PARTICLE SEARCH #519	LONGO	500 HOURS		1 JAN 1978
-N4	INCLUSIVE K-SHORT #183	KOBRAK	750 HOURS		1 JAN 1978
-N6	MULTIPARTICLE #110A	DZIERBA	1,000 HOURS		1 JUL 1977
	HADRON DISSOCIATION #396	GOULIAMOS	1,200 HOURS		1 JAN 1978
	BACKWARD SCATTERING #390	BARBE	950 HOURS		1 JAN 1978
	ASSOCIATED PRODUCTION #99	DIRELD	400 HOURS		1 JAN 1978
-OTHER	NUCLEAR CHEMISTRY #81A	KAUFMAN	159 BOMBARDMENTS		1 JAN 1978
NA-NO-HCRF	15-FOOT NEUTRINO/H2 #45A	STEVENS	162K PIX		1 APR 1976
	15-FOOT ANTI-NEUTRINO/H2 #68A	WATSON	271K PIX		1 JUL 1977
-NO-TRIPLET	NEUTRINO #310	CLINE	3,350 HOURS		1 JAN 1978
	NEUTRINO #253	RO	300 HOURS		1 JAN 1978
	NEUTRINO #482	BARISH	1,550 HOURS		1 JAN 1978
-NOON/HADRON	15-FOOT NEUTRINO/H2 #546	HOSON	274K PIX		1 JAN 1978
	TEST ROOM IRRADIATION #501	LAMDE	2 TARGETS EXPOSED		1 JAN 1977
-15-FT	DI-HADRON #444	SMITH	1,050 HOURS		1 JAN 1978
	15-FOOT PI - P & 100 #83A	KITAGAKI	11K PIX		1 APR 1975
	15-FOOT PI - P & 200 #89	PRETZER	4K PIX		1 JUL 1975
	15-FOOT PI - P & 360 #38A	LAMBOTTI	20K PIX		1 APR 1976
-OTHER	NUCLEAR FRAGMENTS #466	BASTIEN	COSMIC RAY BURNING		1 JUL 1977
	PHOTOPRODUCTION #87A	KAUFMAN	6 TARGETS EXPOSED		1 JAN 1978
PA-PE	PHOTOPRODUCTION #152B	LEE	3,650 HOURS		1 JAN 1978
	DI-LEPTON #288	HOSCH	900 HOURS		1 JAN 1978
ITA-C-0	PHOTON POLARIZATION #522	LEDEMAN	5,050 HOURS		1 JAN 1978
	P-N SCATTERING #552	OGREN	400 HOURS		1 JAN 1978
		SANBES	150 HOURS		1 JAN 1978

C. EXPERIMENTS THAT ARE IN TEST STAGE (2): EXTENT OF RUN TO DATE DATE OF RECENT RUN

AREA	EXPERIMENT	SPOKESPERSON	EXTENT OF RUN	TO DATE	DATE OF RECENT RUN
NA-NOON/HADRON	NUON #203A	ERTH	10 HOURS		1 JAN 1978
	NUON #391	ERTH			

D. EXPERIMENTS BEING INSTALLED (3): EXTENT OF APPROVAL

AREA	EXPERIMENT	SPOKESPERSON	EXTENT OF APPROVAL
NA-N1	HADRON DISSOCIATION #272	FENDEL	600 HOURS
NA-NOON/HADRON	PARTICLE SEARCH #490	SANDWEISS	TEST RUNNING
	NUON #448	LOONIS	PARASITIC RUNNING

E. EXPERIMENTS TO BE SET UP WITHIN A YEAR (29): EXTENT OF APPROVAL

AREA	EXPERIMENT	SPOKESPERSON	EXTENT OF APPROVAL	NOTES
NA-N2	XI-ZERO PRODUCTION #594	HELLER	400 HOURS	
	LAMBDA BETA DECAY #595	PONDROM	300 HOURS	
-N3	PI-NO ATOMS #533	SCHEWARTZ	500 HOURS	
-N6	INCLUSIVE SCATTERING #451	BARTON	400 HOURS	
NA-NO-DICHROM	NEUTRINO #356	BARISH	1,000 HOURS	
-NO-NO HORN	15-FOOT NEUTRINO/D2 #151A	SNOW	100K PIX	
	15-FOOT NEUTRINO/D2 #227	REGELMANN	100K PIX	
	15-FOOT ANTI-NEUTRINO/D2 #390	CARBONN	300K PIX	
	NEUTRINO #531	BEAT	PARASITIC RUNNING	
	NEUTRINO #553	LONGO	PARASITIC RUNNING	
-OTHER	15-FOOT & EMULSION/NEUTRINO#564	RAND	PARASITIC RUNNING	
	EMULSION/PI - # 200 #481	TAKANASHI	EMULSION EXPOSURE	
	EMULSION/PI - # > OR = 200 #503	OGATA	EMULSION EXPOSURE	
	EMULSION/PI - # > OR = 200 #506	DAKE	EMULSION EXPOSURE	
	EMULSION/PI - #300 #525	KILKS	EMULSION EXPOSURE	
	EMULSION/PI - #300 #568	HEBERT	EMULSION EXPOSURE	
	EMULSION/PI - #300 #573	USHIDA	3 STACKS	
	EMULSION/PI - # 300 #574	MOLTER	3 STACKS	

NOTE: THE ABILITY TO SET UP THESE EXPERIMENTS DURING THE NEXT YEAR IS CONTINGENT ON THE AVAILABILITY OF FUNDS.

AREA-BRAN		SPOKESPERSON	EXTENT OF APPROVAL
	EMULSION/PROTONS #400 #459	IWAJ	EMULSION EXPOSURE
	EMULSION/PROTONS #400 #457	JACQUOT	EMULSION EXPOSURE
	EMULSION/PROTONS # 400 #575	LORD	2 STACKS
PA-PI	PHOTOPRODUCTION #401	GORNLEY	600 HOURS
	PHOTOPRODUCTION #516	BASH	1,000 HOURS
-PC	CHARGED HYPERON #497	LACH	400 HOURS
-PW	FIOM INCLUSIVE #258	SHOCHET	800 HOURS
	DI-MOOD #326	SHOCHET	800 HOURS
	C-TEST #302	CESTLIK-REGGE	400 HOURS
	PARTICLE SEARCH #567	CESTER-REGGE	500 HOURS

F. OTHER APPROVED EXPERIMENTS (10):

			EXTENT OF APPROVAL
NA-H1	PARTICLE SEARCH #515	ROSEN	800 HOURS
-R6	HADRON JETS #557	HALAMUD	1,600 HOURS
NA-WO-DICHRON	15-FOOT NEUTRINO/H26HIZ #380	BALTAJ	200K PIX
	15-FOOT ANTI-NEUTRINO/H26HIZ #388	PETERSON	200K PIX
-15-PT	15-FOOT P - P 6 ME # 400 #291	SAWS	25K PIX
-30-IM	30-INCH PI - HI 2 # 300 #304	WALKER	200K PIX
-OTHER	EMULSION/PROTONS # 500 #508	WOLTER	EMULSION EXPOSURE
	EMULSION/PROTONS # 500 #524	WILKES	EMULSION EXPOSURE
PA-PE	PARTICLE SEARCH #400	PROPLER	400 HOURS
	PHOTOPRODUCTION #458	LEE	1,000 HOURS

PENDING PROPOSALS (34):

			EXTENT OF REQUEST
NA-H1	HADRON JETS #266	SLOVE	1,500 HOURS
	DETECTOR DEVELOPMENT #427	YUAN	200 HOURS
-H2	PHOTON POLARIZATION #505	YAMIN	100 HOURS
	NUCLEAR CHERISHED #379	TURKOVICH	100 HOURS
	NEUTRAL HIP FROM #555	DELLI	250 HOURS
-R6	PARTICLE SEARCH #489	CUTTS	150 HOURS
	MULTIPARTICLE #523	DEIBER	800 HOURS
NA-WO-DICHRON	NEUTRINO #355	BARISH	1,400 HOURS
-NO-WB HORN	15-FOOT NEUTRINO/H26HIZ #489	HEZICK	450K PIX
	15-FOOT NEUTRINO/D26HIZ #521	VANDER VELDE	200K PIX
	15-FOOT ANTI-NEUTRINO/D26HIZ #539	FRETTER	400K PIX
	15-FOOT ANTI-NEUTRINO/D26HIZ #542	CARROTT	500K PIX
	15-FOOT ANTI-NEUTRINO/H26HIZ #544	KAPLANOV	500K PIX
	15-FOOT NEUTRINO/D26HIZ #545	SHOH	500K PIX
-NEUTRINO	NEUTRINO #572	BEIDER	6,500 HOURS
-HORN/RADORN	FIOM DISSOCIATION #318	ASCOLI	400 HOURS
	NUON #348	WILSON	800 HOURS
-15-PT	15-FOOT P - P # > OR = 300 #208	TAKIDAEV	75K PIX
	15-FOOT PBAR - P # 100 #526	LAWDER	150K PIX
	15-FOOT PBAR - O # 100 #527	LAWDER	150K PIX
	DETECTOR DEVELOPMENT #528	ROBERTS	150 HOURS
	15-FOOT PI - D # 100E360 #538	FRETTER	150K PIX
-30-IM	30-INCH HYBRID #394	WHITMORE	2,250K PIX
	30-INCH PIIP - P # 40 #100 #504	GULJANY	20K PIX
	30-INCH PBAR - D # 200 #511	FEIDMAN	150K PIX
	DETECTOR DEVELOPMENT #550	ATAC	TEST RUNNING
	30-INCH PIIP - P # 100 #558	SHERPHARD	2,250K PIX
	30-INCH HYBRID #565	YAMAMOTO	3,000K PIX
	30-INCH HYBRID #570	PLESS	2,000K PIX
PA-PC	CHARGED HYPERON #353	ECKLUND	600 HOURS
	ZORN FACTOR #486	ECKLUND	800 HOURS
-PW	PARTICLE SEARCH #537	COX	1,400 HOURS
IIA-C-0	PHOTON-PHOTON SCATTERING #5000	FRANZINI	1,000 HOURS
	QUARK SEARCH #571	OLSEN	300 HOURS