RESEARCH ACTIVITIES DURING OCTOBER 1976

Halsey Allen

By October 1, there had already been good progress made on accelerator startup from the two-week budgetary shutdown during September. During the first weekend of the month, beam was delivered to the Proton-West Area at both 100 and 400 GeV to complete some absolute beam-intensity calibrations. Startup work continued smoothly with only minor difficulties and by Sunday evening, October 3, tuneup of the extracted 400-GeV beam was underway to all three external areas, using a 1-second flattop. Accelerated beam intensities were gradually improved during October from the 1.5×10^{13} protons/pulse level shortly after startup to an average of 1.8×10^{13} and a peak of over 1.9×10^{13} protons/pulse during the last weekend. After the first week of running, the flattop length was increased to 1.5 seconds. This operating cycle was then maintained through the rest of the month and enabled a match between the very high intensity and spill rate demands of the high-energy physics research program and the capabilities of the accelerator.

High-intensity slow-spilled beam was delivered to all three external experimental areas, in accordance with program requirements, and some 1-millisecond fast spill was also made available in the Neutrino Area. The tuneup and operation of the switchyard within reasonable loss limits under these conditions proved to be a difficult and delicate task, however, and it was often necessary to modify desired beam-splitting ratios. In spite of these difficulties, overall accelerator performance in October was good, with

over 450 hours of beam time available for the HEP research program, an operating reliability of 72%. A total of 1.65×10^{18} protons were delivered at 400 GeV and there were several periods of extended running with minimal interruption. The major fraction of the downtime for repairs was split fairly evenly between the linac and main-ring magnet systems.

Work on the muon research program in the Neutrino Area received the greatest emphasis in October, with the Muon #398 experiment starting up and quickly getting into a data-taking mode at the Muon Lab. Their running has all been done with the N1 beam tuned at 225 GeV/c. Elsewhere in the Neutrino Area, Particle Search #379 used slow spill in the N5 beam line in Lab E to complete some trigger and rate studies during the first half of the month in preparation for future extended running. Following those tests, pinged beam was set up in the N3 line to the hydrogen-filled 30-inch bubble chamber, and after several days of tuneup, a run was begun for 30-in. $\bar{p}$-p @ 50 GeV #344, for which a total of over 137K pictures were exposed by the end of the month. The Neutrino #310 group also ran through most of October, making use of a relatively low intensity 1-millisecond spill pulse on the triplet target train at the end of flattop to test their apparatus and begin taking preliminary data. Two emulsion experiments, E-424 and E-510, each exposed stacks parasitically in the 225 GeV/c muon beam.

The Proton Area program also received a major emphasis this month, particularly in Proton-East, where the Total Cross Section #25A experiment continued their data-collecting effort using tagged photons from electron energies of 40, 60, and 90 GeV incident on hydrogen and nuclear

targets. This work did not begin until October 8, however, as the first four days of P-East running were scheduled for emulsion exposures and cosmic-ray transition-radiation detector tests in the electron beam at the Tagged Photon Laboratory. Three emulsions/electrons experiments (E-340, E-399, and E-510) and the detector test were completed in this period. The exposures were made at 50, 100, 200, and 300 GeV within 44 hours of running. Photoproduction #152B then used the photon beam for a little over a day of testing before E-25A resumed running. During early October, p-p Elastic Scattering #177A continued to do installation and survey work in P-West. The group has been running since then, tuning up equipment, studying trigger rates, and taking preliminary data. In Proton-Center, the Di-Hadron #494 experiment resumed data-taking activities during October following a few days of startup and tuneup work.

One experiment was completed in the Meson Area this month, five other experiments were engaged in data-taking work, and one group was doing setup, tuning, and testing for their upcoming data run. In addition, a single irradiation was carried out by Nuclear Chemistry #81A. In the M1-West line, Inclusive Scattering #324 completed data-collection for this phase of their experiment after three weeks of running which began in September. The beam was then turned over to Form Factor #456 for setup, initial tuneup, and equipment testing during the fourth week of October. Particle Production #415 in the M2 line also used the beam for three weeks to tune up, test, and collect data at + and -200 GeV in a run which completed the experiment. Particle Search #472 then assumed control of the beam and

was quickly taking data. Neutron Elastic Scattering #248 in M3 and K^{O} Regeneration #226/#486 in M4 were also primarily involved in data-collecting activities. Inclusive Scattering #118A, using the single-arm spectrometer in M6 East, collected data with the incident beam tuned at + and -175 and at -100 GeV/c.

Four groups were involved in the October program at the Internal Target Area. p-N Scattering #381 took data at 50, 150, 250, and 350 GeV with both hydrogen and deuterium, using the cold gas jet, during the first week of October. Nuclear Fragments #442 ran parasitically during this time but due to computer trouble collected only a limited amount of data. p-N Scattering #198A then took data for almost a week using the superconducting spectrometer before turning control of the device over to p-p Polarization #313 at mid-month. The latter group ran during the rest of October, but their data-collecting effort was limited to something less than half of the available beam time because of the inability of the helium liquification system to keep up with the operating demand rate. They were further frustrated by a failure of the liquifier that took some five days to repair. Their data were taken over an energy range of 20 to 400 GeV. The Nuclear Fragments #442 group was also able to take some data parasitically during part of the E-313 running time.

FACILITY UTILIZATION SUMMARY -- OCTOBER 1976

I. Summary of Accelerator Operations

		Hours	
A.	Accelerator use for physics research		
	Accelerator physics research	49.7	
	High energy physics research	452.9	
	Research during other use	(26.1)	
	Subtotal		502.6
B.	Other activities		
	Accelerator setup and tuning to experimental areas	18.3	
	Program interruption	29.0	
	Unscheduled interruption	195.1	
	Subtotal		242.4
C.	Unmanned time		
	Total		745.0*

II. Summaries of High Energy Physics Research Use

		# of Expts.	Hours	Results
A.	Counter experiments	18	3710.1	1 completed
B.	Bubble chamber expts.	1	144.8	137.3K 30-in. pictures
C.	Emulsion experiments	4	44.0	25 stacks, 3 exp. comp.
D.	Special target expts.	2	-	2 target exposures
E.	Test experiments	1	22.0	e^- test
F.	Engineering studies & tests	-	2.2	$\bar{\nu}$ plug test
G.	Other beam use	-	73.6	beam tuning in NA
		26	3996.7	

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

A.	Beam accelerated in Main Ring			1.88
B.	Beam delivered to experimental areas			
	Meson Area		.232	
	Neutrino Area			
		Slow Spill	.956	
		Fast Spill	.231	
	Proton Area		.232	
		Total		1.65

*Change to Central Standard Time, 0200, October 31.

IV. Beam Utilization by Experiment

	Hours	Results
A. Meson Area		
Nuclear Chemistry #81A	-	1 target irradiation
Inclusive Scattering #118 \	366.0	Data
K^{O} Regeneration #226/#486	378.3	Data
n Elastic Scattering #248	373.0	Data
Inclusive Scattering #324	263.8	Data
Particle Production #415	190.4	Data; complete
Form Factor #456	45.5	Setup and testing
Particle Search #472	173.1	Data
B. Neutrino Area		
Neutrino #310	292.8	Testing and trigger and background study
30" $\bar{p}$-p @ 50 GeV #344	144.8	137K pictures
Particle Search #379	127.9	Test data
Muon #398	373.4	Data
Emulsions/Muons @ 200 GeV #424	-	1 emulsion stack
Emulsions/Electrons #510	-	2 emulsion stacks
C. Proton Area		
Photon Total Cross Section #25A	274.4	Data
Photoproduction #152B	22.0	Tests
p-p Elastic Scattering #177A	196.7	Data
Particle Production #284	8.9	SEM calibration
Electrons/Emulsion #340	20.0	10 emulsion stacks
Electrons/Emulsion @ 100 GeV #399	12.0	6 emulsion stacks
Nuclear Fragments #466	-	1 irradiation (in progress)
Di-Hadron #494	285.7	Data
Electrons/Emulsion #510	12.0	6 emulsion stacks
D. Internal Target Area		
p-N Scattering #198A	51.4	Data
p-p Polarization #313	178.4	Data
p-N Scattering #381	74.8	Data
Nuclear Fragments #442	55.6	Setup and tests
Total	3920.9	

PROPOSALS RECEIVED DURING OCTOBER AND NOVEMBER 1976

No.	Title	Submitted By
508	Study of the Mechanism for Multiple Production of Particles at High Energies	W. Wolter
509	Search for the Large Angle Scattering of Muons	T. Shirai
510	Study of Cascade Showers Initiated by Electrons	K. Niu
511	Proposal to Study $\bar{p}$-d Interactions at 200 GeV/c with the 30-In. Hybrid Bubble Chamber	A. Fridman
512	The Inclusive Production of Charged Hyperons by Pions	P. F. Shepard
513	Semi-Inclusive Hadronic Interactions at High Energies	G. Brandenberg
514	Proton-Proton Deep Elastic Scattering	J. K. Walker
515	Proposal to Study Charmed Particles Produced in Hadronic Interactions	J. L. Rosen
516	A Study of Photoproduction Using a Magnetic Spectrometer at the Tagged Photon Lab	T. Nash
517	A Proposal to Study Neutrino-Induced Di-Lepton Events Using a Hybrid Emulsion Electronic Detector	A. L. Read
518	A Proposal to Measure Direct Electron Production in p-p Collisions from 100 to 400 GeV/c	F. E. Taylor
519	Proposal to Study High Momentum Transfer Phenomena and Search for New States	P. E. Schlein
520	Search for New Phenomena Associated with High Energy Neutrinos Using the Quadrupole Triplet Beam	W. F. Fry
521	Dilepton Production by Neutrinos in Deuterium	J. Vander Velde
522	A Study of Inclusive Proton Polarization	H. O. Ogren

DATES TO REMEMBER

January 28, 1977	Deadline for receipt of all new proposals to be considered at the March meeting of the Program Advisory Committee.
February 10-11, 1977	Proposal Presentation Meeting.
March 10-11, 1977	Spring meeting of the Fermilab Program Advisory Committee.