RESEARCH ACTIVITIES DURING JULY 1976

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Reduced accelerator operation and slower progress on the research program effort during July were a direct reflection of the restrictive financial climate at the Laboratory during the July 1 through September 30 Transition Quarter. As a matter of fact, only 312 hours of beam time were scheduled for high-energy physics research as compared with a normal 600 or more. Of those, beam was delivered for 255 hours giving a performance reliability of 82%. All the running was at 400 GeV and an average intensity above 1.5×10^{13} protons/pulse, with slow-spilled beam from a four-second flattop being extracted to all three external experimental areas. The only major downtime occurred on the second weekend of the month when problems with a linac power amplifier and the failure of an extraction septum resulted in one 18-hour period when there was little useful beam.

Partially as an economy measure, but also to allow the maximum number of Fermilab personnel and users to celebrate bicentennial activities with their families, the accelerator and experimental areas were placed in standby from Friday evening, July 2, until midnight on Monday, July 5. The skeleton operating crew scheduled to monitor accelerator status during this period maintained a minimum level of machine operation and, with several staff members, carried out a number of accelerator research experiments during this period. With this flying start, operation for high-energy physics was underway promptly on July 6 and continued for the next two weeks.

Except for one day booster studies, a three-week facility shutdown began on Monday morning, July 19, and continued into August. Budget limitations necessitated this action and the time was used to complete a number of routine maintenance tasks on a low-key basis by essentially having crews working on only five day shifts per week, an unusual situation at Fermilab. Major accelerator projects accomplished during the shutdown included the moving of the computer control room from the Cross Gallery basement into a new facility across the hall from the main control room, the installation of a new and improved accelerating column in the preaccelerator, and the rebuilding of the 13.8-kV primary-power feeder cables and splices in the so-called P-71 manhole, an area in the main ring power-distribution system that had been subject to an abnormally large number of failures in the past year. Work on these, as well as on many smaller preventive and corrective maintenance projects, was nearing completion by month's end in preparation for initial startup activities.

The Neutrino Area continued its customary role as the largest consumer of the accelerated 400 GeV proton beam in July. The Muon # 319 experiment that started on June 22 continued collecting high-momentum data using 275-GeV muons in the N1 beam. At the start of the three-week facility shutdown, their first run had been completed with some 7.7×10^{17} protons having been delivered on their production target. Meanwhile, Particle Search # 379 continued to work on equipment testing and tuning in Lab E, using low-intensity slow-spill in the N7/N5 bypass line. The Muon Irradiation # 467 experiment, running in the N1 beam behind Muon # 319, parasitically

exposed two thallium and trichloroethylene targets in the Muon Lab during the week prior to the shutdown.

Prior to the July 4 standby period, Muon Search #435 completed the data-taking phase of the experiment in Proton-Central. Elsewhere in the Proton Area, e/γ beam tests were continued in the Proton-East line and Photon Search #95A collected data in Proton-West. Following the July 2 to 5 standby period, P-Central was off for four days to change over to the Di-Hadron #494 experiment, which then spent the remaining nine days of running in tuneup and preliminary data-taking work. Photon Total Cross Section #25A also began using the tagged-photon beam in Proton-East for apparatus tuneup, checkout, and some preliminary data collection. During this same two-week interval, Photon Search #95A collected data in the P-West Area for one week, after which Particle Production #284 took over the beam for a week of tuning and testing prior to the shutdown, in order to be ready for a fast startup when the program resumes in August.

The research program in the Meson Area involved four secondary beam lines and six major experiments in July. Hadron Jets #236A completed a rather long and successful first data run in M1E at -200 and +100 GeV, a run that began in early June and also included some +200-GeV data. Likewise, Inclusive Neutral Meson #350 finished the first phase of their experiment, taking ±100 GeV incident pion data in the M2 beam. Particle Search #397 used the M3 beam for data collection, with Particle Search #366 running parasitically behind them to make some calibration checks and gather further statistics on a di-hadron decay mode of interest from earlier

running in the high-mass region. In the M6-West beamline, Hadron Jets #260 was taking data in relatively smooth fashion throughout the July running period, making use of the multiparticle spectrometer and their cryogenic analyzing magnet. Meanwhile, for Hadron Dissociation #396 there was setup and testing work in the upstream portion of this same beam, parasitic to running for Hadron Jets #260. In addition to these major experiments, Nuclear Chemistry #81A has exposed eight targets to the primary proton beam in the Meson target hall since their last report, four during June and four in July. The M5 test beam was also used by various groups for some incidental equipment tests.

Three main experiments accounted for most of the running time logged for research at the Internal Target Area. p-p Polarization #313 had priority use of the beam through July 7 and collected data at 15, 90, and 190 GeV during most of this period, using the spectrometer with the superconducting dipole and quadrupole magnets operational. p-N Scattering #198A did some parasitic running during the early portion of this time and then took data at 20 to 30, 90, and 190 GeV on a priority basis from July 8 until the shutdown. An electronics malfunction caused the position controller for p-p Inelastic #321's warm jet to fail and damage both the vacuum system and the jet on the first of July. Repairs were completed and the jet was reinstalled about a week later, after which the group was able to run compatibly with the other two experiments. During the next one and one-half weeks of running, they collected data while pulsing the jet at six different energies from 50 to 400 GeV. Nuclear Fragments #442 and p-N Scattering #381 were also actively

engaged in preparations for future running and on that basis made some incidental use of the beam.

In addition to routine maintenance and development work in the experimental areas during the shutdown, a number of projects of special interest were completed. In the Neutrino Area, a new target station was installed in the decay pipe. In Proton-West, construction began on the new Pion Area. In the Meson Area, the entire safety interlock system was modified and improved. In the Internal Target Area, a new cold-gas jet was installed for E-381, thorough wire-orbit measurements were carried out on the superconducting quadrupole for the spectrometer, and improvements were made in the liquid-helium transport system.

FACILITY UTILIZATION SUMMARY -- JULY 1976

I. Summary of Accelerator Operations

		Hours	
A.	Accelerator use for physics research		
	Accelerator physics research	42.1	
	High energy physics research	255.3	
	Research during other use	(60.3)	
	Subtotal		297.4
B.	Other activities		
	Accelerator setup and tuning to experimental areas	12.0	
	Scheduled interruption	370.0	
	Unscheduled interruption	64.6	
	Subtotal		446.6
C.	Unmanned time		
	Total		744.0

II. Summaries of High Energy Physics Research Use

		# of Expts.	Hours	Results
A.	Counter experiments	15	2258.7	-
B.	Bubble chamber experiments	-	-	-
C.	Emulsion experiments	-	-	-
D.	Special target experiments	2	219.2	10 Targets (total)
E.	Test experiments	1	5.0	Partial test
F.	Engineering studies and tests	1	26.4	Beam studies
G.	Other beam use	-	3.6	Beam tests
		19	2512.9	2 expts. completed

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

A.	Beam accelerated in Main Ring			0.907
B.	Beam delivered to experimental areas			
	Meson Area		0.171	
	Neutrino Area			
	Slow Spill		0.547	
	Fast Spill		0.000	
	Proton Area		0.035	
	Total			0.753

IV. Beam Utilization by Experiment

	Hours	Results
A. Meson Area		
Nuclear Chemistry #81A	-	8 Targets
Hadron Jets #236A	231.1	Data
Hadron Jets #260	202.0	Data
Inclusive Neutral Meson #350	227.5	Data
Particle Search #366	29.3	Data; complete
Particle Search #397	238.1	Data
Tests for Particle Production #415	5.0	Tests
B. Neutrino Area		
Muon #319	219.2	Data
Tests for Particle Search #379	153.0	Tuneup and tests
Test Muon Irradiation #467	219.2	2 Targets
C. Proton Area		
Photon Total Cross Section #25A	213.6	Tuneup; prelim. data
Photon Search #95A	115.6	Data
Particle Production #284	93.0	Tuneup
Muon Search #435	30.6	Data; complete
Di-Hadron #494	87.2	Data
D. Internal Target Area		
p-N Scattering #198A	212.5	Data
p-p Polarization #313	36.0	Data
p-p Inelastic #321	170.0	Data
Total	2482.9	