RESEARCH ACTIVITIES DURING AUGUST 1976

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Operation of the accelerator for the current 400-GeV high energy physics research program was resumed toward the end of the first week in August and continued through the remainder of the month. During the first few days in August, work on the main-ring primary-power feeder cables and modifications to the Capacitor Tree were completed, checked, and successfully tested while startup of the linac and booster was in progress. Main-ring startup was then begun with 400-GeV acceleration achieved by Thursday evening, August 5. Operation continued through that weekend with somewhat unstable beam but no significant interruptions, indicating that most of the work projects completed during the shutdown were in reasonable operating condition.

With a few alterations, the program that was suspended in mid-July because of the budgetary shutdown has been continued, using slow-spilled beam from a 2-second flattop in the external experimental areas. The major change in operating mode has been the addition of pinged beam in the Neutrino bypass line in order to work on a backlog of commitments to the 30-in. bubble chamber research program.

Although almost a full month of running was scheduled for HEP research (nearly 550 hours), progress on the program has been slowed by an abnormally large number of accelerator failures interspersed with many short periods of unstable operation while trying to achieve high intensity. Nominal accelerated-beam intensity was gradually increased from about 1×10^{13} protons/pulse immediately after startup from the $2\frac{1}{2}$ week shutdown, to 1.6×10^{13} protons/

pulse by the end of the month. Although beam was delivered for over 360 hours of scheduled time, a 66% reliability factor, this running time was, in general, considerably less efficient in terms of physics research usefulness. Major contributors to accelerator downtime were a series of difficulties with the main extraction septa, booster radio-frequency accelerating-system problems and a massive failure of the ceramic beam pipe for one of the fast-extraction kickers. The overall performance and output from the accelerator during the month of August can definitely be characterized as below par.

The muon program received top-priority emphasis during the August running, with Muon #398 using the N1 beam for the first two weeks of operation, followed by a week for Muon #319. After nearly 18 months of inactivity since their last run, the Muon #398 group spent the time getting their apparatus operational, calibrated, triggers set and generally ready for data taking beginning in October. Muon #319 then took over the beam and, after a few shifts of tuneup and calibration, began collecting high-energy data at +275 GeV in the final data run for the experiment. Elsewhere in the Neutrino Area, the 30-in. bubble chamber was filled with deuterium during the accelerator startup period in preparation for resuming work on that part of the research program. In parallel with the muon running, pinged beam was set up to provide 100-GeV protons, 360-GeV negative pions, and 100-GeV antiprotons for successive runs by the 30-in. p-d @ 100 GeV #194, 30-in. π^--d @ 360 GeV #338 and 30-in. $\bar{p}$-d @ 100 GeV #345 experiments. Six ping pulses per accelerator cycle were directed down the N7/N3 bypass beamline for these runs, with some 50,800, 52,600, and 32,400 pictures taken respectively for the three groups.

The Proton Area research program centered around three major experiments, with two other groups accumulating data parasitically. After about a week of tuning and timing their beam and apparatus, Photon Total Cross Section #25A began taking data at the Tagged-Photon Laboratory in the Proton-East beamline. A photon beam produced by 90 GeV/c electrons was used on various targets for the first segment of the run, while a 135 GeV/c electron beam has been in use for high momentum data since about August 28. Nuclear Fragments #466 parasitically irradiated one target in the P-East pre-target area during the first two weeks of the month, while Detector Development #498 also ran parasitically in the tagged electron-photon beam for about one week at mid-month. In Proton-West, Particle Production #284 has been collecting hydrogen-target data under various configurations with 400-GeV incident protons after a short startup period, while Di-Hadron #494 has been accumulating both di-hadron and di-electron data in Proton-Center when beam stability and spill conditions have permitted such work.

No less than nine user groups were actively participating in the five major secondary beams at the Meson Area, not to mention the parasitic target bombardments in the Meshall incident proton beam by Nuclear Chemistry #81A. Hadron Jets #260 used beam to calibrate their calorimeters and subsequently took data at ±200 GeV in the M6 multiparticle spectrometer while the Hadron Dissociation #396 group tested their experimental apparatus and got preliminary data at an upstream location in the same beam. K^0 Regeneration #226/#486 spent most of the month getting set up and collecting some preliminary data in the M4 beam pit. In the M3 neutral beam, Particle Search #397 completed the data taking

phase of their experiment by August 18, running upstream of Neutron Elastic Scattering #248, who were in the process of setting up for a data run for most of the month. In M2, Particle Search #472 was also tuning, doing trigger studies and preparing for steady data taking with some preliminary runs. The M1 West beam was shared by Form Factor #456 and Inclusive Scattering #324. In the first two weeks of running, the Form Factor group was testing their apparatus and the running feasibility of the experiment using new drift chambers, while the last week in August was used for changeover and startup work by the E-324 group.

There was spirited competition for use of the beam at the Internal Target Area throughout August. Both p-p Polarization #313 and p-N Scattering #198A had only limited running time available for data taking with the spectrometer facility, primarily because of recurrent problems with the helium liquifier required to provide cooling for the spectrometer magnets; unfortunately, many of these failures occurred during accelerator running time. The two groups shared the facility by being alternately scheduled as primary and parasitic users. There was a one-week period during the latter half of the month when, due to interferences, the spectrometer was scheduled to be off to permit test running of a new Russian cold jet by p-N Scattering #381. During this time and also later for several days when the liquifier was being repaired, Nuclear Fragments #442 started up and took preliminary data using a warm jet with their detectors mounted on the spectrometer arm. p-p Inelastic #321 ran in a parasitic mode to the several primary users throughout the month and collected data, pulsing their warm jet at various energies from 8 to 350 GeV.

FACILITY UTILIZATION SUMMARY -- AUGUST 1976

I. Summary of Accelerator Operations

		Hours	
A. Accelerator use for physics research			
Accelerator physics research		24.7	
High energy physics research		360.8	
Research during other use		(52.8)	
	Subtotal		385.5
B. Other activities			
Accelerator setup and tuning to experimental areas		51.4	
Scheduled interruption		118.7	
Unscheduled interruption		188.4	
	Subtotal		358.5
C. Unmanned time			
	Total		744.0

II. Summaries of High Energy Physics Research Use

	# of Expts.	Hours	Results
A. Counter experiments	18	2985.7	-
B. Bubble chamber experiments	3	218.2	135,906 pictures
C. Emulsion experiments	-	-	-
D. Special target experiments	2	154.7	4 target irradiations
E. Test experiments	1	66.7	detector test
F. Engineering studies and tests	1	17.5	1629 pictures
G. Other beam use	-	63.5	tuning
	25	3506.3	2 experiments completed

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

A. Beam accelerated in Main Ring		1.11
B. Beam delivered to experimental areas		
Meson Area	0.18	
Neutrino Area		
Slow Spill	0.59	
Fast Spill	0.00	
Proton Area	0.20	
Total		0.97

IV. Beam Utilization by Experiment

	Hours	Results
A. Meson Area		
Nuclear Chemistry #81A	-	3 Targets
K^0 Regeneration #226/#486	272.5	Preliminary data
Neutron Elastic Scattering #248	133.5	Setup
Hadron Jets #260	248.0	Data
Inclusive Scattering #324	56.0	Setup
Tests for Hadron Dissociation #396	131.5	Test data
Particle Search #397	108.0	Data; complete
Form Factor #456	158.3	Test data
Particle Search #472	289.3	Data
B. Neutrino Area		
30-in. p-d @ 100 GeV #194	102.0	50,850 pictures
Muon #319	136.7	Data
30-in. π^--d @ 360 GeV #338	63.5	52,635 pictures; complete
30-in. $\bar{p}$-d @ 100 GeV #345	52.7	32,421 pictures
Muon #398	154.2	Setup; preliminary data
C. Proton Area		
Photon Total Cross Section #25A	323.7	Data
Particle Production #284	314.9	Data
Nuclear Fragments #466	154.7	1 Target irradiation
Di-Hadron #494	249.6	Data
Detector Development #498	66.7	Test data
D. Internal Target Area		
p-N Scattering #198A	12.8	Data
p-p Polarization #313	36.3	Preliminary data
p-p Inelastic #321	213.4	Data
p-N Scattering #381	74.7	Tests
Nuclear Fragments #442	72.3	Preliminary data
Total	3425.3	