

RESEARCH ACTIVITIES DURING NOVEMBER 1976

James MacLachlan

The accelerator had a premier month in November despite two major power interruptions. The accelerated proton total of 2.6×10^{18} is second only to the June, 1975 figure of 2.8×10^{18} obtained in the last month of straight 300 GeV running. The flattop was maintained at 1.5 sec for the entire month. A two-day interruption began on Tuesday morning, November 9, when a main-ring feeder failed because of secondary splice failures. A site-wide outage was caused by the shorting of a secondary bus duct on the spare transformer T-82 at the Master Substation on the following Saturday, November 13. Although power was restored to the experimental areas in an hour and to the accelerator in two hours, the damage done to control systems, etc., cost a day of operation. The accelerator maintenance period arranged during the feeder failure was the only one in November; thus, an unusually high 638 hours of high energy physics research was scheduled. The accelerator operating efficiency of 76% was also above average, so that a record 487 hours of beam time were available. Main-ring intensity records were set and broken several times; the intensity was generally over 2×10^{13} ppp throughout the month. The current record set on the Thanksgiving weekend is 2.41×10^{13} ppp. The major downtime on the Thanksgiving weekend, Sunday, the 28th, was clearly associated with a failure to control the high intensity beam. A vacuum leak in the Main Ring was caused by a wayward beam pulse puncturing the main-ring vacuum chamber in a bending magnet (see the cover photograph).

The Proton Area program ran unchanged through the month. Photon Total Cross Section #25A completed a two-month run on November 30 with a few days of lead glass calibration. They had run nearly all of November at high intensity with the electron beam at 200 GeV, but, following a leak in the target box over the Thanksgiving weekend, they dropped to low intensity for the calibrations of lead-glass counters. Di-Hadron #494 ran steadily in P-Central, obtaining some extended periods of stable running. p-p Scattering #177A changed their geometry to cover the "intermediate" t-range -3 to -13 (GeV/c)² around November 10. With some efforts to improve shielding they eventually were able to use about 4×10^{14} protons/pulse.

The Neutrino Area program was also rather stable. The major high-intensity user was Muon #398, which collected data on inelastic muon-proton scattering. They received about 1.4×10^{18} protons in slow spill and achieved an average μ/p of about 10^{-7} . The experiment 30-in. \bar{p} -p @ 50 GeV #344 was completed at the 30-in. bubble chamber on the morning of November 1. After a somewhat slow start that included repeated troubles with the tagging computer, 30-in. Hybrid #299 ran until Monday, November 22, taking 273K pictures using a beam with nearly 10% K^+ at 150 GeV. Both experiments were run with eight expansions per machine cycle. Experiment #299, setting restrictions on particle count but not on species, achieved extended periods with pictures on nearly every expansion in its later running. A total of 538K pictures were taken in the 30-in. chamber in the operating period that began in August. Neutrino #310 ran much of the early part of the month with about 10^{12} ppp of 1-2 msec spill to establish trigger rates, check

backgrounds, and test the optical spark chambers they were installing. For the last week and a half, they did not run while working intensively to get ready for high-priority running in December. A 12-hour test at 10^{13} ppp on November 5 helped to establish the feasibility of the December run. Neutrino #482 was active in parasitic testing and setup using muons from the slow spill for much of their work. Three tests of the antineutrino plug for use with the horn train, each approximately two hours long, were conducted during the month (11/3, 11/12, and 11/30). The final test of a segmented plug at 1.5×10^{13} of 20- μ sec spill was a success.

The Meson Area had the same experiments in all beamlines for the month. Particle Search #472 completed its run in M2 line on Monday, November 29. Inclusive Scattering #118A took data at -100 GeV in the M6-E line. Form Factor #456 moved from testing and calibration to data taking in the M1W line which they ran to yield about 10^6 particles at -250 GeV. Neutron Elastic Scattering #248 continued to take data routinely. They finished the month with a couple of days of p-p elastic scattering for calibration by taking advantage of time with the M2 line off to run the M3 line as a diffracted proton (95% purity) beam. K^0 Regeneration #226/#486 completed the E486 part of their work (A-dependence of particle-antiparticle cross section difference). They ended the month with tests to establish the optimum Z and thickness of the regenerator for the electron regeneration part of the experiment. The installation for tests of Multi-Muon #439 started the last two days of the month in the M2 line.

The Internal Target Area had a rather meager month with a total of 204 hours spread among four experiments. p-N Scattering #198A received half that time during a little over a week starting November 5 when the helium liquifier was working reasonably well. Adding to the difficulties of two liquifier down periods were cold leak troubles with the jet for p-N Scattering #381. Nuclear Fragments #442 had a productive test run in which they established the feasibility of their running with the most forward angles of the spectrometer arm. p-N Scattering #381 got well underway with a deuterium jet the last two days of the month.

FACILITY UTILIZATION SUMMARY -- NOVEMBER 1976

I. Summary of Accelerator Operations

	<u>Hours</u>
A. Accelerator use for physics research	
Accelerator physics research	53.6
High energy physics research	487.4
Research during other use	<u>(35.7)</u>
Subtotal	541.0
B. Other activities	
Accelerator setup and tuning to experimental areas	5.8
Program interruption	4.6
Unscheduled interruption	<u>168.6</u>
Subtotal	179.0
C. Unmanned time	
Total	<u>720.0</u>

II. Summaries of High Energy Physics Research Use

	<u># of Expts.</u>	<u>Hours</u>	<u>Results</u>
A. Counter experiments	16	3807.0	1 exp. completed
B. Bubble chamber experiments	2	274.3	281K 30-in. pictures; 2 exp. comp.
C. Emulsion experiments	1	-	2 stacks exposed
D. Special target experiments	-	-	
E. Test experiments	-	-	
F. Engineering studies and tests	2	11.0	$\bar{\nu}$ plug tests; N3 had beam test
G. Other beam use	<u>-</u>	<u>51.7</u>	N3 beam tuning
	21	4444.0	

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

A. Beam accelerated in Main Ring	2.63
B. Beam delivered to experimental areas	
Meson Area	.286
Neutrino Area	
Slow Spill	1.36
Fast Spill	.183
Proton Area	.315
Total	2.14

IV. Beam Utilization by Experiment

	<u>Hours</u>	<u>Results</u>
A. Meson Area		
Inclusive Scattering #118A	400.5	Data
K ⁰ Regeneration #226/#486	276.4	Data on E486 complete; tests for E226
n Elastic Scattering #248	374.5	Data
Form Factor #456	409.0	Setup tests and data
Particle Search #472	376.8	Data; experiment complete
B. Neutrino Area		
30" Hybrid #299	265.6	273K pictures and Pb glass calibration; complete
Neutrino #310	142.8	Setup and test data
30" \bar{p} -p @ 50 GeV #344	8.7	8K pictures; complete
Emulsion/Muons @ 50-100 GeV #373		2 emulsion stacks; com- plete
Muon #398	434.1	Data
Neutrino #482	76.4	Setup and checkout
C. Proton Area		
Photon Total Cross Section #25A	375.6	Data
p-p Elastic #177A	350.0	Data
Di-Hadron #494	387.3	Data
D. Internal Target Area		
p-N Scattering #198A	103.0	Data
p-p Polarization #313	22.8	Data
p-N Scattering #381	0.0	Data
Nuclear Fragments #442	40.5	Test data
Total	4081.3	