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Lawrence Radiation Laboratory
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BEVATRON OPERATION AND DEVELOPMENT. XXV
February, March, April 1960

Walter D. Hartsough

June 7, 1960

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ABSTRACT

Bubble chambers were used in the secondary beams of the Bevatron to investigate $\pi^{\pm}$ interactions in hydrogen and K^- interactions in propane, and to measure the $\theta_1 - \theta_2$ mass difference. Counter experiments were made to study the interactions of K^-, $\pi^{\pm}$ and μ mesons.

Three bombardments were made in the primary beam for the Chemistry Group.

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OPERATION

Bevatron Operation is summarized in Fig. 1 and Tables I and II.

RESEARCH

Table III lists the experimental program undertaken this quarter.

SHUTDOWNS

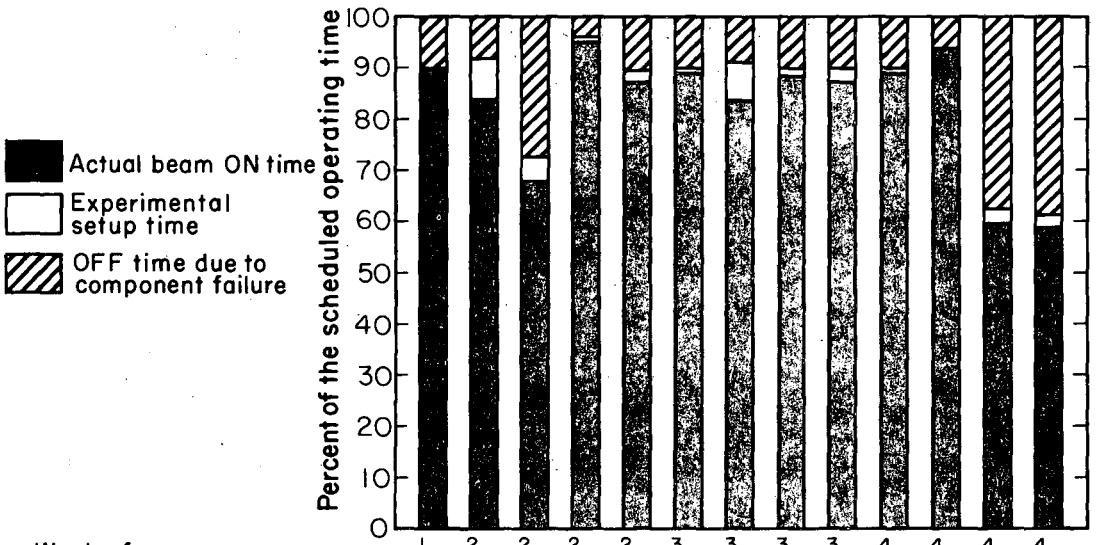
Six shutdowns occurred this quarter.

Scheduled shutdowns were begun on February 4 and March 15 for routine experimental setup changes and for maintenance. On April 9 the Bevatron was off 8 hours because of a scheduled Laboratory power shutdown.

Three unscheduled shutdowns occurred. During the first, February 16-17, the Bevatron was let up to air for repair of spark and glow-discharge damage to conductors of the rapid beam ejector. Shutdowns occurred on April 20 to correct a fatigue failure of one of the coil connections of the west generator rotor and again on April 26 to remove an electrical short between one of the west generator rotor coils and the coil-retaining wedge.

MAGNET POWER SUPPLY

The magnet pulse record appears in Table IV.



Week of	1/31	2/7	2/14	2/21	2/28	3/6	3/13	3/20	3/27	4/3	4/10	4/17	4/24
Crew hours	168	168	168	144	168	168	168	168	168	168	168	168	166½
Turn on and maintenance time (hr)	4½	0	9	9	9	9	6	9	9	11	9	1	4½
Scheduled operating time (hr)	91½	12½	151	135	159	159	114	159	159	144	159	134	163
Scheduled Bevatron test time (hr)	0	13½	8	0	0	0	0	0	0	5	0	0	0
Scheduled shutdown time (hr)	72	142	0	0	0	0	48	0	0	8	0	33	0
Holiday (hr)	0	0	0	24	0	0	0	0	0	0	0	0	0

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Fig. 1. BEVATRON OPERATING SCHEDULE
February, March, April 1960

Table I

Beam Record

Week of (1960)	Number of 8-hour shifts	Total integrated beam (10^{15} protons)
Jan. 31-Feb. 6	12	8.6
Feb. 7-13	--	---
Feb. 14-20	18	2.2
Feb. 21-27	17	5.8
Feb. 28-March 5	21	9.2
March 6-12	21	7.9
March 13-19	14	5.1[a]
March 20-26	20	5.2[a]
March 27-April 2	21	4.7[a]
April 3-9	21	3.0[a]
April 10-16	21	3.6[a]
April 17-23	17	1.3[a]
April 24-30	21	5.0[a]

Maximum beam amplitude at full energy = 3.0×10^{11} protons per pulse
Maximum injected beam = 610 microamperes
Average beam per 8-hour shift = 2.7×10^{14} protons

[a] Beam level was reduced at the request of the experimental group during a portion of this week.

Table II

Analysis of the total lost beam time due to component failure (percent)

Month	Injector	Magnet Power Supply	Radio-frequency Accelerating System	Other
February 1960	53	25	7	15
March 1960	41	31	2	26
April 1960	8	75	2	15

Table III

Bevatron experimental research program
February, March, April 1960

INTERNAL GROUPS

Group and Experimenters	Experiment
Alvarez: Crawford	Study of $\pi^{\pm}$ interactions in hydrogen and deuterium, using the 72-inch hydrogen bubble chamber (0.9 to 1.6 Bev/c)
Lofgren: Cork, Wenzel, Kerth	K^- - p and K^- - n scattering, using counters (1.5-Bev/c K^- beam).
Powell Camerini, Birge, Whitehead	π^+ - p scattering using 15-inch hydrogen bubble chamber (600-Mev/c π^+ beam).
Powell: Camerini, Birge, Whitehead	Study of K^- and K^0 interactions and measurement of the θ_1 - θ_2 mass difference using the 30-inch propane bubble chamber (700-Mev/c K^+ beam)
Seaborg Chang	B_3N_3 target bombardment: 2.01 Bev, 2.4×10^{12} p^+; 4.15 Bev, 2.0×10^{12} p^+; 4.15 Bev, 1.6×10^{12} p^+;
Segrè Steiner, Wiegand, Ypsilantis	π - π scattering (1.5-Bev/c π beam)

EXTERNAL GROUPS

Institution and Experimenters	Experiment
University of Michigan Jones, Perl	π^- - p scattering (1.5-Bev/c π^-)
University of Washington Masek	Study of μ-meson scattering from lead and carbon (3.5-Bev/c π^- beam)

Table IV

Bevatron Motor Set Monthly Fault Report

	4 to 6 pulses per minute						7 to 9 pulses per minute						10 to 17 pulses per minute						Totals				
	1500 to 6900 amp			7000 to 9000 amp			1500 to 6900 amp			7000 to 9000 amp			1500 to 6900 amp			7000 to 9000 amp			Number of pulses	Number of faults		P/F	Ignitrons replaced
MONTH 1960	Pulses	Faults	P/F	Pulses	Faults	P/F	Pulses	Faults	P/F	Pulses	Faults	P/F	Pulses	Faults	P/F	Pulses	Faults	P/F		Arc-backs	Arc-throughs		
January	4809			2289	2	1145	510	1	510	701			5254	2	2627	368039	68	5412	381602	23	50	5227	
February	927	1	927	1097									5519			248528	44	5648	256071	5	40	5690	
March	144			1062			770			735			7501			387451	87	4453	397612	16	71	4909	4B2
April	400												4449			295363	40	7384	329617	10	30	8240	

ACKNOWLEDGMENTS

The Bevatron Group is headed by Edward J. Lofgren. William Wenzel is the alternate group leader. Walter Hartsough, with Glen Lambertson and Wendell Olson assisting, is in charge of Bevatron Operation. Operating Crew supervisors are Duward Cagle, Frank Correll, Ross Nemetz, and Glenn White. Crew members are Robert Allison, G. Stanley Boyle, Ashton Brown, Gary Burg, Norris Cash, Raleigh Ellisen, Robert Gisser, William Kendall, William Lee, Wayne Logan, Kenneth Morgan, David Rowland, Seth Shepard, Joseph Smith, and Peter Williams. The following people carried out special support and development projects: Robert Anderson, Trancuillo Canton, Warren Chupp, Bruce Cork, Kenneth Crebbin, Rudin Johnson, Glen Lambertson, Fred Lothrop, Donald McClure , and Robert Richter. Engineering groups were headed by Edward Hartwig, Electrical Engineering; Clarence Harris, Electrical Coordination; and William Salsig, Mechanical Engineering. Lorenzo Eggertz was in charge of the Electronic Maintenance Group.

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