Dave Tracy

MM-106
0090

NATIONAL ACCELERATOR LABORATORY

MONTHLY REPORT OF ACTIVITIES

F. T. Cole

May 1, 1968

General

1. The AEC authorization bill was passed by the House of Representatives on April 4 and by the Senate on April 8. It has been signed by the President. The 200 BeV accelerator is authorized for construction in fiscal year 1969, with a total authorization of $32.333 million. The appropriation bill is in the House at the time of this report.

2. A tentative decision has been made to incorporate an injection storage ring into the accelerator design. This ring, if built, will have the radius of the main synchrotron and will be mounted on the wall of the main-ring enclosure. In order to avoid confusion with the CERN ISR, we have decided to call our device the accumulator.

Protons will be injected into the accumulator from the booster at 10 GeV kinetic energy. Thirteen bunches will be stored during the 2.6-second cycle. They will then be extracted from the accumulator in one turn and injected into the main ring. The principal advantage of the accumulator is that the booster works continuously rather than in short bursts.

The repetition rate of the booster will therefore be reduced from 15 Hz to 5 Hz. The resulting reduction in the

estimated cost of the booster rf system is comparable to the estimated cost of the accumulator.

The accumulator lattice is to be the same as the main ring, except that there will be three bending magnets between quadrupoles instead of four, in order to reduce stray fields. Some parameters of the accumulator are

Radius	1000	m (approx)
Field (dc)	445	G in bending magnets
Magnet Lengths:		
Bending Magnets	351	in.
Quadrupoles	81	in.
Aperture:		
Radial	5	in
Vertical	2.5	in.
Magnet Cross Section	6 by 6	in.
Excitation Current (single-turn winding)	2200	A
Magnet Power	1.5	MW (approx)
Main-Ring Cycle Period (no flat-top)	2.6	sec
Booster Repetition Rate	5.0	Hz

Various injection storage rings have been discussed over the past several years. The specific idea of utilizing such a ring in the 200 BeV accelerator was proposed to the Laboratory last summer by D. A. Swenson of Los Alamos. The decision will be reexamined in a few weeks before becoming final.

3. The Laboratory staff totals 149 people as of May 1. Of these, 50 are physicists or engineers.

Main Ring

1. Lattice. Reduction of the gradients of the long straight-section matching quadrupoles is being considered

by the theory group in order to increase their apertures. An increase of slightly more than 10% in the product xy would require a reduction in the length of the long straight section by 1 meter.

2. Power Supply. Investigations of possible resonances driven by pulsed loads on the Commonwealth Edison power grid have been initiated. The resonance problems may be made more severe by the shorter main-ring cycle.

An alternative energy-storage system now being studied, which was briefly mentioned in last month's report, could ameliorate these problems. In this system, load variations are smoothed by wound-rotor induction motors. The field winding is connected to the power line and the rotor winding is driven by a cycloconverter, a variable-frequency power oscillator. The frequency is varied with rotor speed to keep the field output in phase with the power line. The cycloconverter also controls the power output of the motor so that the motor acts like a motor when power is flowing back from the magnet system, but like a generator when power is flowing into the magnet, thus decreasing the load variation. In essence, the motor acts as a mechanical amplifier developing its power from the rotational stored energy of its flywheel.

3. Plans for the Coming Month. Bids for the model-magnet power supply have been received and are being evaluated. The stacking fixture is assembled in the EBWR building at Argonne.

The die will be finished May 10 and stamping will begin then.

A permeameter is being constructed and samples will be ordered from steel companies for further permeability measurements.

The coil design for the model quadrupole will be completed.

Booster

1. Lattice. The booster lattice has been restudied with respect to the accumulator. No major changes have been made.

2. Parameters.

Linac	
Energy	200 MeV
Emittance	0.8 π cm-mrad
Booster	
Energy (final)	10.0 GeV
Radius	75.47 m
Cycling rate	5.0 Hz
Injection (nominal)	4.0 × 60 mA
Aperture	
F-magnet	5.0 × 1.5 in.
D-magnet	3.5 × 2 in.
$A_{2V} \times A_{2H}$ (at injection)	$1.6\pi \times 4.8\pi$ (cm-mrad)^2
Number of cavities	6.0
Momentum spread ($\Delta p/p$, after debuncher) from linac	$\pm 0.8 \times 10^{-3}$

3. Plans for the Coming Month. Steel has been ordered for the 3-ft magnet models. The lamination die and copper will be ordered. The stacking fixture is being designed and the power supply is being constructed. Work will also continue on vacuum-chamber development.

Power and cooling requirements for the total booster

structure are being studied to provide data for the enclosure design.

Beams and Targeting

Extraction Hall Parameters. A design of the extraction hall without a crane, is being considered. Fork lifts for moving shielding are to be used. The possibility of "blocking" the tunnel to the target areas, which may shorten the extraction hall was looked into. This work will continue for the next month. Parameters for the extraction hall are also being assembled.

Research Facilities

1. Secondary-Beam Transport. A three-day conference on secondary-beam transport elements was held. A tentative decision has been made to build 4-in. diameter quadrupoles and 2-in. vertical-gap dipoles with a peak current density of 2500 A/in^2.

2. Plans for the Coming Month. It is planned to build in May a scale model of a target area with shielding and typical secondary beams laid out.