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national accelerator laboratory

# FACILITIES AND PLANS FOR THE EXPERIMENTAL PROGRAM AT THE 200 GEV ACCELERATOR

E. L. Goldwasser and A. L. Read

September 20, 1967

SUPPLEMENTARY MATERIAL FOR REVIEWERS

# FACILITIES AND PLANS FOR THE EXPERIMENTAL PROGRAM AT THE 200 GeV ACCELERATOR

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It is expected that the main load of experimental activities at the 200 GeV accelerator will be supported by secondary particle beams produced in the bombardment of external targets by external proton beams. A flexible targeting system will be provided through a single proton beam extraction point in the main accelerator. From this point the protons will be fed into a single external proton beam transport line. This line has a three-mile free run to the boundary of the laboratory site. The full three miles will not be exploited initially but will be available for future expansion of the number of experimental facilities and for future extensions for experimentation at higher energies.

The external beam target areas will be fed from beam branches which are switched off the main proton transport line (see figure). Switching will be accomplished through the use of septum magnets. An adjustable fraction of a horizontal ribbon beam will be steered inside the septum where it will be separated from the main transport beam and guided toward a target station. Two of these switch points will be provided initially. Each of the two branch beams will be transported into an external target station in which secondary beams will be generated.

One of the target stations, (C), will be used for the production of secondary beams at zero degrees. Through the use of septum or switching magnets, the proton beam in this station may be shared simultaneously, or alternately, between three targets so as to provide three zero degree secondary beams. The second external target station, (B), may not be used for zero degree secondary beams. The target will be in a field-free region and the secondary beams will be allowed to diverge from the target until they are clear of the on-going proton beam and can be guided by independent beam transport systems. From this target, a number of beams have been designed and about four are expected to be installed, initially. In addition to the two large target stations, a third station, (A), has been designed for direct proton bombardment experiments. For such experiments, since the incident beam has a very high intensity, the target can be very thin. With a thin target the fraction of the protons that interact is small and the radiation and shielding problems are less severe than at B and C. It is appropriate to put a target station of this kind (A) in series with one of the other two target stations since the interference effects in this case would be minimal.

In addition to these three external target stations, and an internal target station (which will be used as a staging facility during accelerator construction), provision is being made for the secondary beams issuing from them. Although it is much too early to plan in detail the experimental program that will be mounted at turn-on time, it is essential to start now by choosing a model which will be changing in time but which can be used as a

guide in planning the experimental areas. The model which has been chosen at this point includes a number of experiments and experimental beams that have been studied in some detail by the design groups at the Lawrence Radiation Laboratory, at CERN, and at NAL. The intensities and other vital statistics pertinent to these beams at a selected group of energies have been calculated and are presented in Table I.

The present design of experimental areas includes shelters for the final experimental equipment stations as well as utilities to feed the beam lines and the experimental stations. However the funds for research apparatus and for secondary beam transport equipment located outside the target stations will come not from the construction budget, but from operating and equipment money that will become available during the construction period.

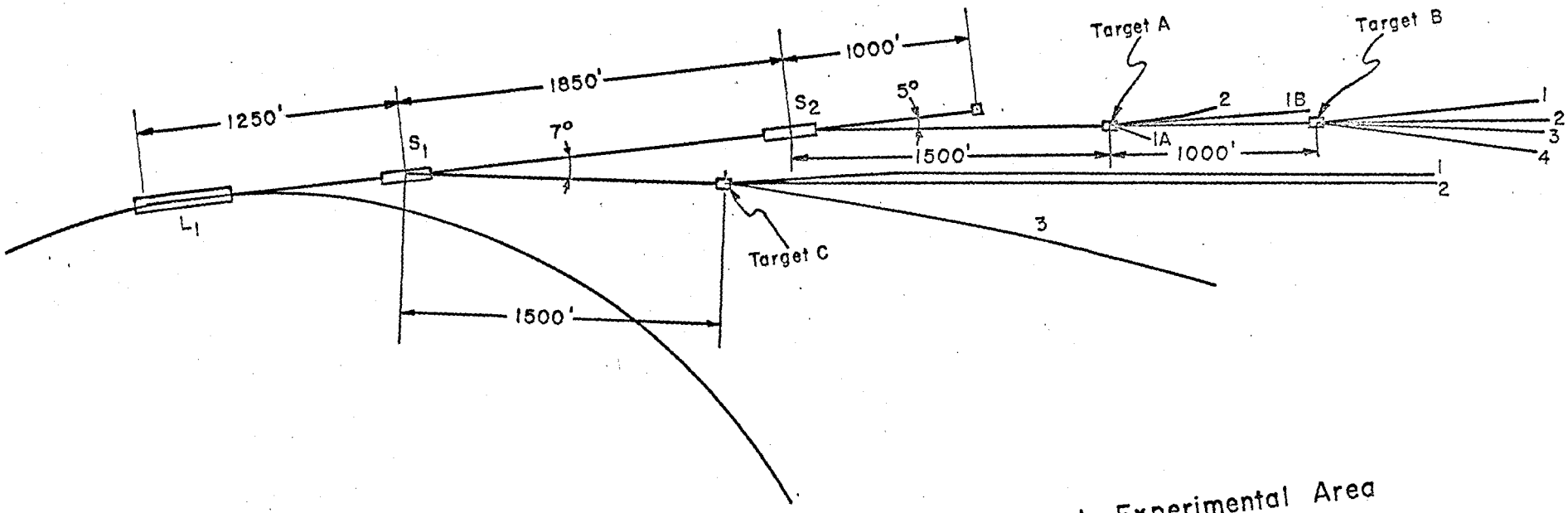
## ACKNOWLEDGMENT

Plans have been developed for experimental areas at NAL during the past few months largely through the participation and collaboration of a large number of visiting physicists. These are too numerous to permit proper acknowledgment of their work at this time. This work was done under auspices of the U. S. Atomic Energy Commission.

TABLE I

CHARACTERISTICS OF SECONDARY BEAMS

| Target Station | Beam No. | Particle | Intensity $sec^{-1}$ | $\Delta E/E$ $\pm$ % | Momentum (GeV/c) | Production Angle |
|---|---|---|---|---|---|---|
| A | 1A | protons | This is large-angle scattering channel for p-p elastic and inelastic scattering. | | | Various: $\sim 10^{\circ}$ - $40^{\circ}$ |
| | 1B | protons | This is small-angle scattering channel for p-p elastic and inelastic scattering. | | | Various: $\sim 0.5^{\circ}$ - $10^{\circ}$ |
| | 2 | $\pi$ | $10^6$ - $10^7$ | 1 | 5 - 25 | 10 mr |
| B | 1 | $\pi$ | $10^6$ - $10^8$ | 1 | 25 -75 | 7.5 mr |
| | 2 | $\pi$ | $10^6$ - $10^8$ | 1 | 50 - 125 | 2.5 mr |
| | 3 | $\pi$, $K^{\pm}$, $\bar{p}$ | $10^4$ - $10^8$ | 1 | 50 - 125 | 2.5 mr |
| | 4 | $\bar{p}$, $K^{\pm}$, (rf separated) | $10^4$ - $10^6$ | 0.1 | 15 - 50 | 7.5 mr |
| C | 1 | $\bar{p}$, $K^{\pm}$, (rf separated) | $10^4$ - $10^6$ | 0.1 | 50 - 150 | 0 |
| | 2 | $\mu$ | $10^8$ - $10^9$ | 10 | 15 - 50 | 0 |
| | | $\nu$ | $10^8$ - $10^9$ | 25 | 5 - 20 | 0 |
| | 3 | $\pi$ | $10^5$ - $10^7$ | 0.1 | 50 - 175 | 0 |




External Experimental Area
Scale 1" = 800'

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