THE HIGH-INTENSITY LABORATORY

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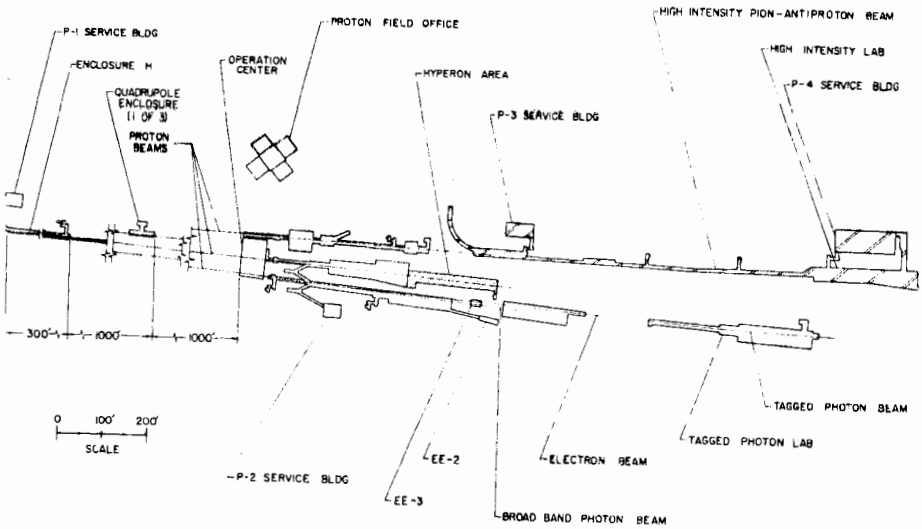
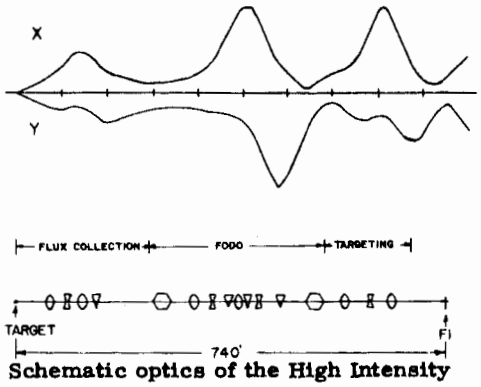
After a major installation effort during the summer of 1978, the High Intensity Laboratory situated in the west branch of the Proton Area has been commissioned and the first round of experiments has started. At this time it is appropriate to report on the results of the first measurements of the properties of the high intensity pion and antiproton transport and to describe the area and the current layout of the beams and the experiments.

The geography of the High Intensity Laboratory is shown on the next two pages. Over 1000 feet of tunnel and experimental hall were constructed during 1976 and 1977 in preparation for the installation and testing of the high intensity transport system. The general features of both the physical plant and the transport system have been described in the P-West High Intensity Laboratory Design Report. The initial installation of the beam transport for the commissioning of the High Intensity Laboratory was composed of conventional magnets (except for an Energy Doubler dipole whose performance has been described in Fermilab Internal Report TM-828-A). Twenty-seven conventional magnets (16 quadrupoles and 11 dipoles) provide focusing and bending for a 400-GeV incident proton beam and ~300-GeV secondary beam. During the commissioning period in August and September of 1978, the secondary beam was operated at energies up to 250 GeV. The philosophy of the optics of the secondary transport system is shown on page 6. As can be seen, the transport consists of a flux-collecting quadrupole triplet, a FODO channel, and a targeting triplet which focuses

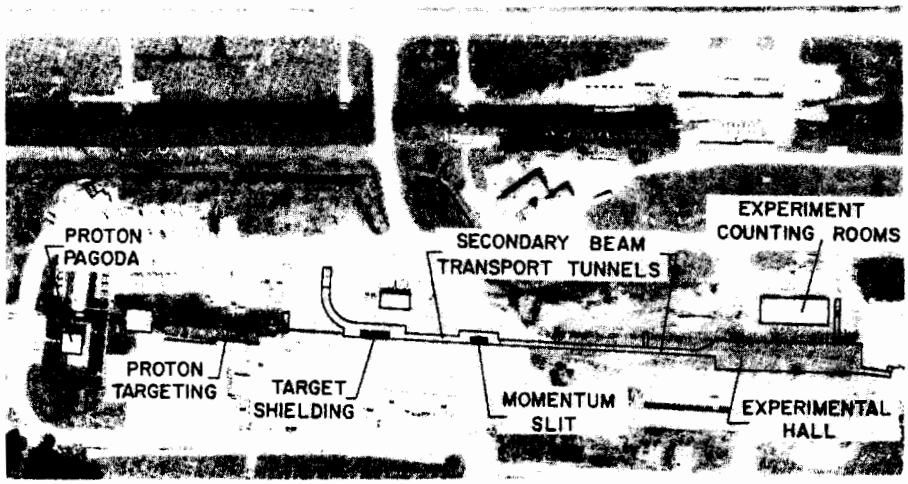


Proton Area layout.

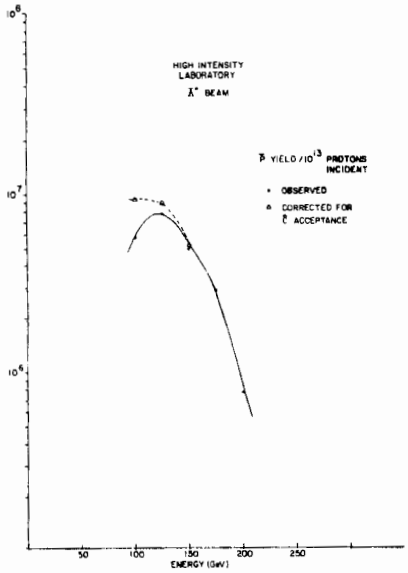
the secondary beam onto the three experimental target points in the 230-ft experimental hall. The bend of the beam is configured in a manner to minimize momentum dispersion in angle and position at these experimental targets. There are two basic modes in which this transport can be operated. The first of these consists of a tune in which a sharp momentum bite can be obtained and the second and third order chromatic aberrations of the beam minimized for best spot size. With this tune the beam can be sextupole corrected. The second type of tune is one in which maximum transmission of pions or antiprotons is achieved with slightly broader spot sizes. The measured yield curves for this "broad band" tune



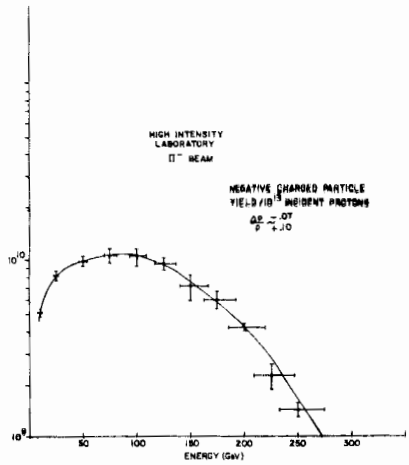
Schematic optics of the High Intensity transport system.



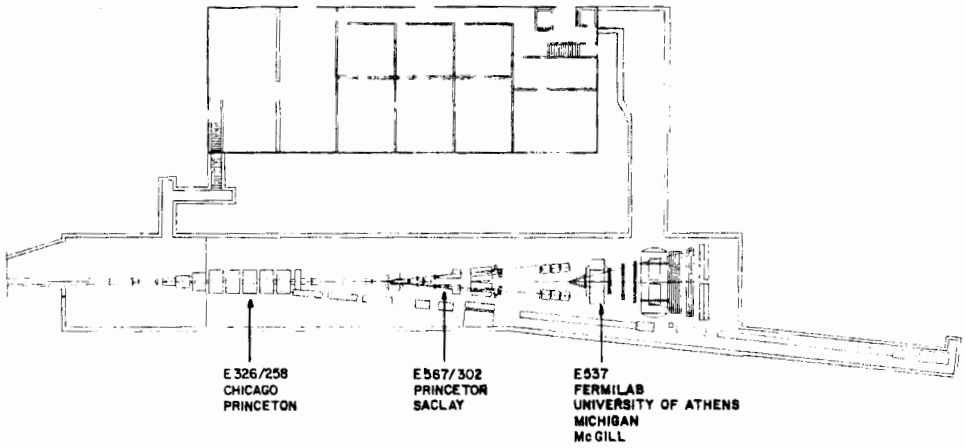
Aerial photograph of the High Intensity Laboratory.



Antiproton yield curve.

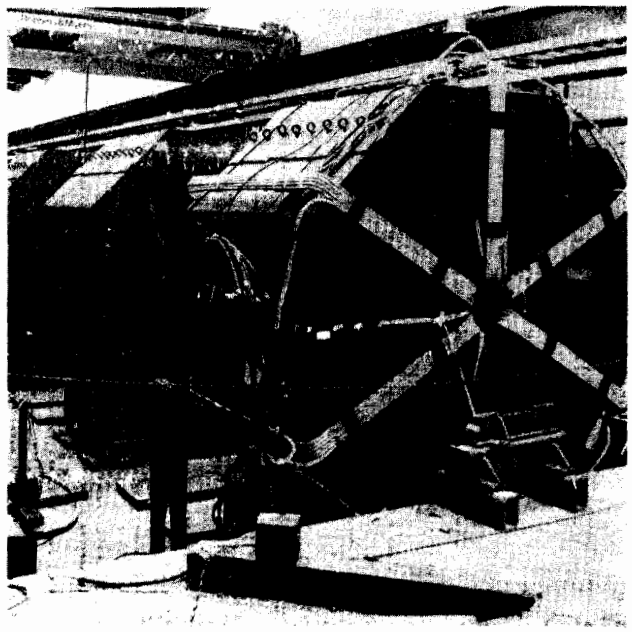


Negative pion yield curve.



Experimental layout of the High Intensity Laboratory Experimental Hall.

The drawing above shows the layout of the three experimental setups which are either in place or are being installed. Because of intense negative pion and antiproton fluxes which are available, the possibilities for studying quark-antiquark interactions are very attractive in the High Intensity Laboratory. Both the study of high intensity pion production of dileptons, which will be performed by a Chicago-Princeton group using a toroidal iron spectrometer situated at the upstream focus in the experimental hall and the study of antiproton production of dileptons, which will be undertaken by a Fermilab-University of Athens-University of Michigan-McGill University group using a large aperture forward spectrometer seated at the downstream end of the hall, will investigate quark-antiquark interactions. At the intermediate target point between these two experimental setups is a double-arm experiment being conducted by a Princeton-Saclay group who intend to first study the production of charmed particles by pions and then to look for



High Intensity Laboratory experimental hall.
(Photograph by Fermilab Photo Unit)

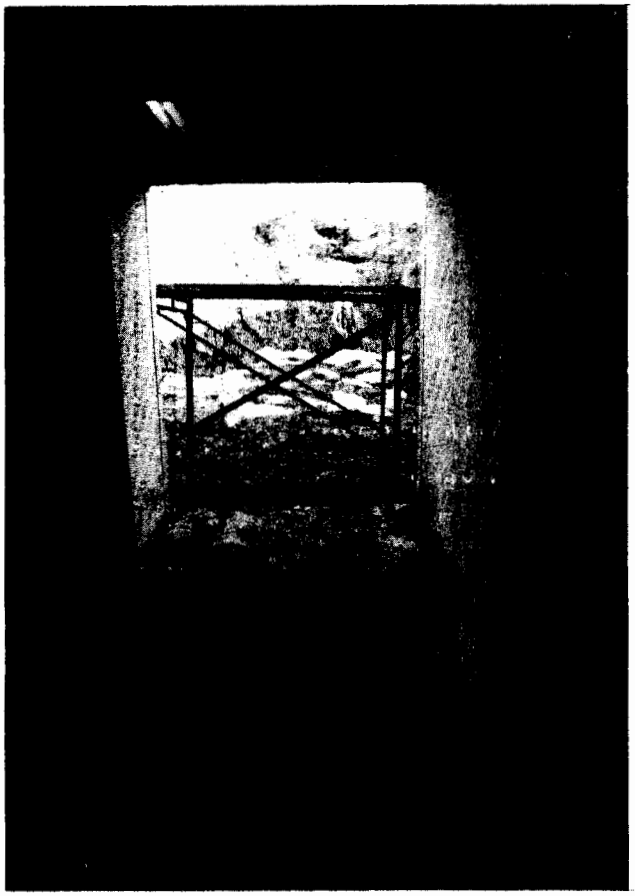
charge conjugation violations in antiproton interactions. The final experimental apparatus in the hall is a forward spectrometer built by the Chicago-Princeton group which will measure 90° production high $p_\perp$ of hadrons by pions to complement their previous measurements of high $p_\perp$ production of hadrons by protons. This single-arm spectrometer and the double-arm spectrometer of Princeton-Saclay have at the time of this writing had shake-down runs in which some preliminary data were taken.

Finally, future plans for the High Intensity Laboratory include a gradual conversion of the conventional transport to a superconducting transport. Construction and testing of a large aperture dipole (described in Fermilab Internal Report TM-822) has already taken place and He refrigerator

installation is underway. The final configuration is outlined in the area design report. It is expected that the superconducting transport capabilities of the High Intensity Laboratory will be implemented in time to take full advantage of the Energy Doubler.

Many people have contributed to the design, construction, installation, and testing of the High Intensity Laboratory. In particular, all the groups of the Proton Department contributed essential skills to this endeavor. In addition R. M. Baltrusaitis, R. Wagner, C. Hojvat, M. Binkley, P. Mazur, and D. Stairs from the Fermilab-Athens-Michigan-McGill group, R. Webb and R. Weatherall from the Princeton-Saclay group, and B. Pope and R. Sumner from the Chicago-Princeton group were very instrumental in the commissioning of the High Intensity Laboratory.

Bill Noe, Jr., Proton Department, working on the extraction mechanism for the High Intensity Laboratory target-box components.
(Photograph by Fermilab Photo Unit)



Construction work has begun in the Meson Department on installation of the M1 enclosure from 810 to 882, one of the three areas under construction. This area of work is to connect existing enclosures and replace a vacuum beam transport buried in the berm. Its construction consists of an 8 ft × 8 ft box culvert assembly tied to the existing concrete structure by a poured in place concrete transition section. The above photograph shows a view of the berm excavation, looking north. The end wall of the upstream enclosure has been removed in preparation for the transition section. The scaffolding seen was utilized when cutting the opening. In the distance, barely discernible, is the end wall of the downstream M1 enclosure awaiting removal.

(Photograph by Fermilab Photo Unit)