collimator 30 ft from the machine, its intensity is about 2×10^6/cm²/sec. Here the energy is 437 Mev due to degradation in the window and air. The beam is monitored with an ionization chamber similar to that of Chamberlain *et al.*[1] The contamination is about 5 percent of the total flux, and consists of a lower energy "tail" of protons which is essentially zero below 370 Mev. Three separate methods have been used to study this contamination (a) measurement of the angle between scattered protons in p-p elastic scattering; (b) measurement of the angular distribution of Cerenkov radiation from the beam traversing glass;[2] (c) a differential range technique using a coincidence-anticoincidence counter telescope. Scattering measurements indicate no left-right asymmetry, and thus the beam is presumed to be unpolarized.

* Work supported in part by the U. S. Atomic Energy Commission.
[1] Chamberlain, Segrè, and Wiegand, Phys. Rev. **83**, 923 (1951).
[2] R. L. Mather, Phys. Rev. **84**, 181 (1951).

Y5. Proton-Proton Scattering at 437 Mev.* R. B. Sutton, T. H. Fields, J. G. Fox, J. A. Kane, W. E. Mott, and R. A. Stallwood, *Carnegie Institute of Technology.*—Proton-proton scattering data, previously reported,[1] obtained by detecting the scattered and recoil protons in coincidence, using targets of CH_2 and C, were carefully checked and satisfactory agreement obtained. Additional data were taken with a liquid hydrogen target by two methods; in one the scattered and recoil protons were detected in coincidence as before for 90° and 50°; in the other only the higher-energy proton was detected using a two-counter coincidence telescope. At small angles enough copper was placed between the counters to absorb everything except elastically scattered protons. The detection efficiency of this telescope was measured in the direct beam with appropriate absorbers to reduce its energy. The relative values of the cross sections are as follows (the errors are from counting statistics):

C.M. angle	90°	65.3°	50.5°	36.4°	30°	27.8°	25.2°	16.6°
CH_2 target	1.00	1.03±0.03		1.16±0.03	1.16±0.03		1.24±0.03	
H_2	1.00		1.09±0.03			1.17±0.05		1.19±0.06

* Supported in part by the U. S. Atomic Energy Commission.
[1] Mott, Sutton, Fox, and Kane, Phys. Rev. **90**, 712 (1953).

Y6. The Total $p-p$ Cross Section Above 400 Mev. A. M. Shapiro, C. P. Leavitt, and F. F. Chen, *Brookhaven National Laboratory.*—The $p-p$ total cross section at six energies between 0.4 and 1.3 Bev has been measured in a program to study the energy variation of this cross section up to 3 Bev. A polyethylene-carbon difference method was employed in conjunction with a fast-coincidence counter telescope and magnetic analysis of the 32° scattered proton beam from a Be target in a Cosmotron straight section. The meson contamination was less than 1 percent. The momentum resolution was about ±4 percent. Transmission measurements were made with various values of θ, the half-angle subtended by the rear counter at the center of the absorber, from 1.9° to 8.3°. The cross sections at each energy were plotted against θ^2, and each total cross section was found by straight-line extrapolation to 0°. The preliminary cross sections are given below.

E (Mev):	410	535	615	830	1075	1275
σ_t (mb):	27	32	38	49	49	47

These values have been corrected for multiple Coulomb scattering in the absorber. The error in each of these points is approximately 2 mb. The sharp rise in the cross section from 400 to 800 Mev may be associated with an increase in the inelastic (meson production) cross section.

Y7. Pickup Deuterons Produced from 95-Mev Protons. W. Selove, *Harvard University.**—Deuterons produced by the interaction of the external beam of the Harvard cyclotron were detected in a scintillation-counter range telescope. Deuterons were separated from other charged particles by simultaneous measurement of range and specific ionization, and the energy distribution measured for deuterons above about 50 Mev, with a resolution of a few percent. Results will be reported of measurements which have been made at several angles with beryllium and carbon, and at one angle with aluminum, silicon, copper, and lead. Calculations are being made as to the nucleon distributions which can be inferred from the experimental results.

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Y8. A Search for Polarization in Charge Exchange Scattering.* H. Bradner and R. E. Donaldson, *University of California, Berkeley.*—A refinement of Wouters'[1] experiment is being made to investigate the asymmetry produced by polarization in double exchange scattering of protons on C or Ta targets. Neutrons are produced in the first scatterer by the internal proton beam of the 184-inch cyclotron. These neutrons are converted in the second scatterer outside the shielding and recorded by two coincidence telescopes. The two telescopes are positioned by an unpolarized beam and all subsequent angular changes are made with the first scatterer. The results to date are:

Targets	1st angle	Counter angle ±6°	Bombarding energy Mev	Rejection energy Mev	$C=\frac{R-L}{R+L}$ percent
Ta	17°	25°	190	90	−1.4±1.6
C	17°	25°	190	110	0.5±2.9
C	35°	35°	245	90	5.2±3.0

Quoted errors are statistical probable errors plus an estimated one percent systematic error. An investigation is now being made on a 10°, 330-Mev initial scattering and on a single charge exchange scattering with a known polarized beam.[2]

* Supported by the U. S. Atomic Energy Commission.
[1] L. F. Wouters, Phys. Rev. **84**, 1069 (1951).
[2] Chamberlain, Segre, Tripp, Wiegand, and Ypsilantis, Phys. Rev. (to be published).

Y9. Polarization of 170-Mev Neutrons.* A. Roberts, J. Tinlot, and E. M. Hafner, *University of Rochester.*—A beam of 240-Mev protons strikes an internal target, T_1, and a set of neutron collimators is placed at the angle $\theta_1=29°$ (lab). Neutrons scatter from a radiator, T_2, and recoil protons are observed in a triple telescope at the angle θ_2 in a horizontal plane, to the left or right of the neutron axis. The telescope has a small acceptance angle (~2°) determined by brass slits, and is accurately mounted on a selsyn-driven turntable whose angular position can be read to 1′. The telescope contains an absorber whose thickness is varied with angle in such a way as to set a neutron threshold of 120 Mev at all angles. An additional internal target, producing forward neutrons on the same axis, is used to check the symmetry. Preliminary measurements have been made at angles $\theta_2=12$, 20, 30, 45, and 55 degrees, using T_1-T_2 combinations Be−CH_2, Be−C, C−CH_2, and C−C. We find that the Be−H asymmetry goes through a maximum of about 5 percent at 30°, and through zero near 45°. The Be−C asymmetry behaves differently, remaining positive up to 55°.

* Supported by the U. S. Atomic Energy Commission.

Y10. Polarization of 310-Mev Protons by Deuterium.* D. Nagle, J. Marshall, L. Marshall, and W. Skolnik, *The University of Chicago.*—The polarization of deuterium for 310-Mev protons has been examined as a function of angle in a preliminary measurement. Protons in an equilibrium