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CBM POLYETHYLENE FOIL CALIBRATION

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On April 12, 1972 the full beam was extracted in one turn into the Slow External Beam channel. Polyethylene foils were exposed at F10 and A target station and a ratio of 1 CBM proton equaling .757 poly foil proton was measured.

The internal beam was measured by the CBM which had been calibrated on 1/28/72 at 1.69 volts out of the monitor per 1 volt p-p into the PUE cathode follower to give 1 volt per 10^{12} protons or 10^{10} protons per count on the CBM voltmeter.[1] There was no observable beam loss during the time of extraction when the fast kicker was not pulsed. The transmission efficiency of the bunches from the L10 fast kicker to the F7 electrode was 95% ± 1% as measured from photographs of the F7 pick-up electrode signal before and after the kick. The radial position of the beam at F7 was 1.5 in. outside as measured by the F7 PUE and 2.2 in. outside as measured by a radioautograph of the F10 foil. With an outside aperture of 3 to 4 in. between F7 and F10 there should have been no beam aperturing. A spill counter at F10 calibrated by beam loss on the F10 flag indicated less than 0.1% loss in this area. Thus we assume no beam is lost from F7 to F10 and the transmission efficiency to F10 is 95% of the beam measured by the CBM.

A stack of three foils were exposed to the protons at both F10 and A on the first run and at A on the second run. The middle foil was counted. The A foils were measured and weighed, then constant area holes punched out and weighed. The F10 foil's "hot spot" was punched out and weighed. The density of foils was measured to better than 1%. The foils were counted in the chemistry well counter. The protons traversing the foils were calculated using

1. E. Gill, private communication (1972).

29.474 minutes for the mean life of ^{11}C, a gas loss correction[2] of .88, a counter efficiency of .74 and a cross section[3] of 25.9 x 10^{-27} cm^2. The foils exposed at the A station have the equivalent of about 92 mils of aluminum upstream consisting of the A54 SEC, A91 split plates, a thin window, the A91 flag, and about 1 ft of air. From previous[4] tests of foil activation vs. thickness of aluminum absorber upstream of the foil, this material would make the A foil read 4.5% high. The foil exposures are tabulated below.

Run No.	Device	Measured Protons x 10^{13}	Corrected Protons x 10^{13}
1	F10 foil	1.267	1.267
1	A foil	1.327	1.270
2	A foil	1.185	1.134
2	CBM	1.577	1.498

From the first run the transmission efficiency from F10 to A is 100%. The second run gives a ratio of 1 CBM proton equaling .757 ± 1.5% foil protons. This difference in "response" between the CBM and foils will be investigated further, using a calibrated current transformer as another method to measure proton intensity in the machine.

A recent (Feb. 1972) measurement of 60.6% for SEB efficiency (actually 58% when the build-up correction is applied) must now be corrected to 77%. The calculated[5] theoretical SEB extraction efficiency with the present .030 in. F5 septum is 85.3%.

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3. J.B. Cumming, G. Friedlander and S. Katcoff, Phys. Rev. 125, 2078, (1962).
4. G.W. Bennett, private communication (1968).
5. Blumberg, Barton, Bennett, Fox, Glenn, Hsieh, Nawrocky and Soukas, BNL Accel. Dept. Int. Rep. AGS DIV 69-8 (1969) and IEEE Trans. Nucl. Sci. NS-16, 234 (1969).