BEAM SURVIVAL IN THE COSMOTRON

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During June of 1963 several observations were made of the rate of decay of 1-Bev beams coasting in the Cosmotron.

The beam was accelerated to an energy of 1.0 Bev and then allowed to debunch and circulate while the magnetic field was held constant. The pressure was 1.8×10^{-6} mm Hg average gauge reading. The beam intensity during debunch circulation was observed by operating the normal sum pickup electrode as an ion chamber collector. A collection voltage of 45 volts was used and an ion current of 1 microampere per 10^{11} particles was obtained.

With no rf during circulation, acceleration of the particles is impossible, therefore the magnetic field must not be allowed to change. This was accomplished by operating the radial difference pickup electrodes as ion chambers and feeding the resulting difference signals into the peaker timing system of the magnet power supply to correct magnet voltage. Additional manual control of the peaker timing was required for the successful long beam holds in order to keep near zero the electronic correction which is the resulting electronic output signal as the beam approaches zero intensity.

Fig. 1 is a semi-log plot of survival intensity vs time. The 6-1/8" (full aperture of the Cosmotron) aperture was repeated several times and is plotted for three cases of different intensity. The results show no intensity dependence as expected. The intensity decay is exponential and aperture dependent. From these observations I feel one can conclude that the loss mechanism in the Cosmotron is coulomb scattering instead of random small-angle nuclear scattering.

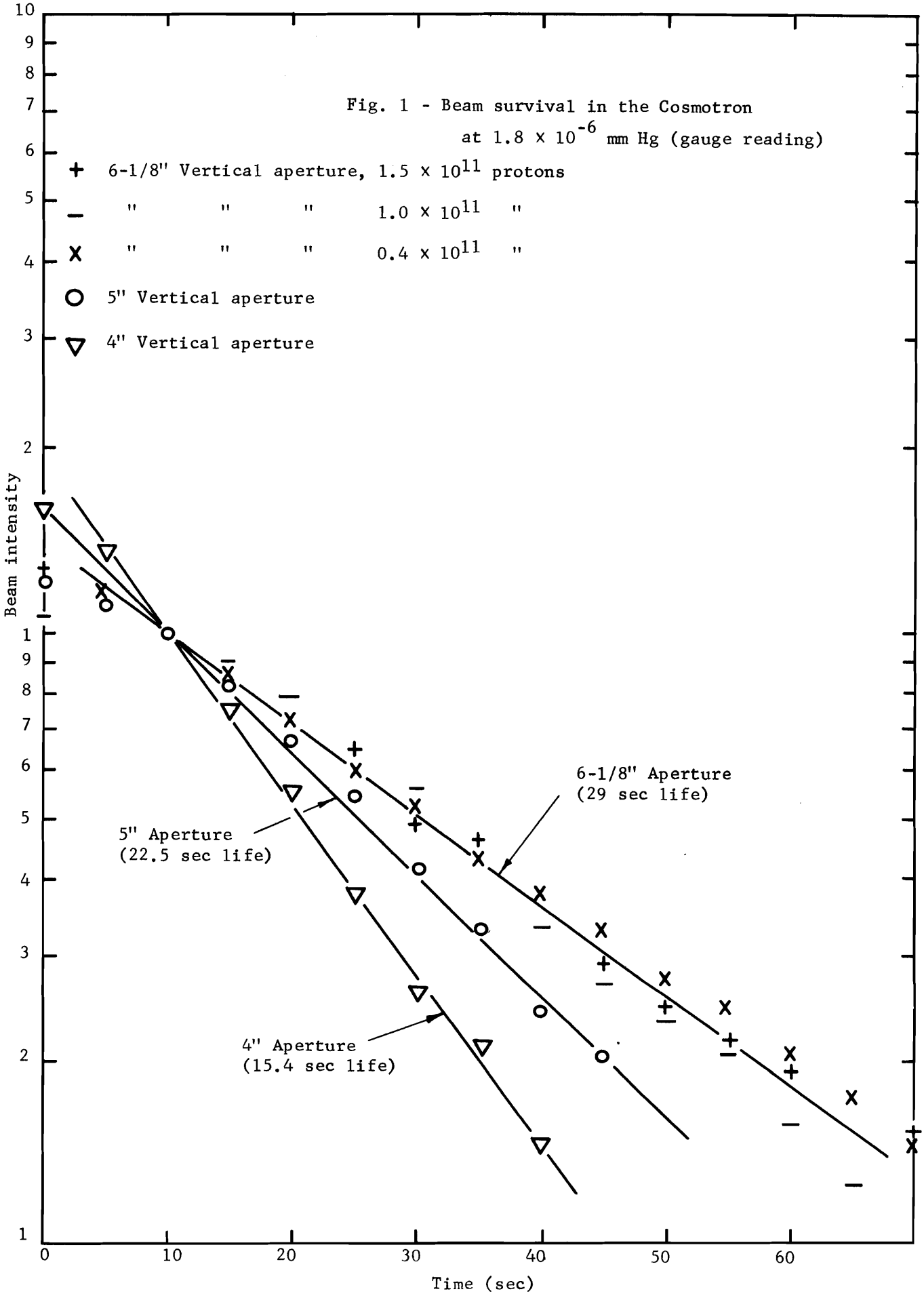
Fig. 1 - Beam survival in the Cosmotron
at 1.8 x 10^-6 mm Hg (gauge reading)
+ 6-1/8" Vertical aperture, 1.5 x 10^11 protons
— " " " 1.0 x 10^11 "
x " " " 0.4 x 10^11 "
O 5" Vertical aperture
▽ 4" Vertical aperture
Beam intensity
Time (sec)
6-1/8" Aperture
(29 sec life)
5" Aperture
(22.5 sec life)
4" Aperture
(15.4 sec life)