POLARIZED PROTON SOURCE DEVELOPMENT

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The 68 Mev proton linear accelerator of the University of Minnesota is a 3-tank system, using grid focusing throughout. A schematic layout is shown in Fig. 1. Because of the grid focusing only low beam outputs are obtained. Typical values, with a P.I.G. ion source in the preinjector, are:

on target in the 10 Mev experimental area 2 x 10^{-7} amp
40 Mev experimental area 3-4 x 10^{-8} amp
68 Mev experimental area 2-3 x 10^{-8} amp .

These values have been sufficient for the type of experiments done.

A polarized proton source is located at the base of the preinjector high voltage dome; this was done in this way because the available space in the high voltage dome is rather limited. The polarized neutral particles from the source, a dissociator and sextupole system performing in essence a Stern-Gerlach type experiment, are allowed to drift through a porcelain column into the high voltage dome where the ionizer is located. The beam with the desirable component is focused and other components are wasted. The number of particles leaving the source sextupole are of the order of 5 x 10^{15} atoms/sec. In the drift space a loss of a factor of 10 is incurred such that, 40 inches above the source, about 5 x 10^{14} atoms/sec arrive in the ionizer. Extracted from the ionizer, a time average of 2 x 10^{11} pps is obtained. The number of polarized protons available in the experimental areas are 1.3 x 10^{7} pps in the 10 Mev area

and 1.5 x 10^6 pps in the 40 Mev area, respectively, with observed polarization of 30 to 35%. The maximum theoretical polarization from the source is 50%.

With particle rates as low as this scattering experiments are difficult. Experimentally, only in the case of helium was it possible with this intensity to resolve the first excited states. Therefore, a new source is under development. Presently the efficiency of the ionizer is low and a more efficient one is contemplated. Also, the new source would be completely installed in the high voltage dome, eliminating the inefficient arrangement of the drift space column between source and ionizer. Also an rf transition section will be included in the source to raise the theoretical polarization limit from 50% to 100%. Investigations are also being done of combining the ionizer with a conventional ion source, for example an rf source, providing the possibility of obtaining polarized and unpolarized particles without having to go through the elaborate procedure of changing sources.

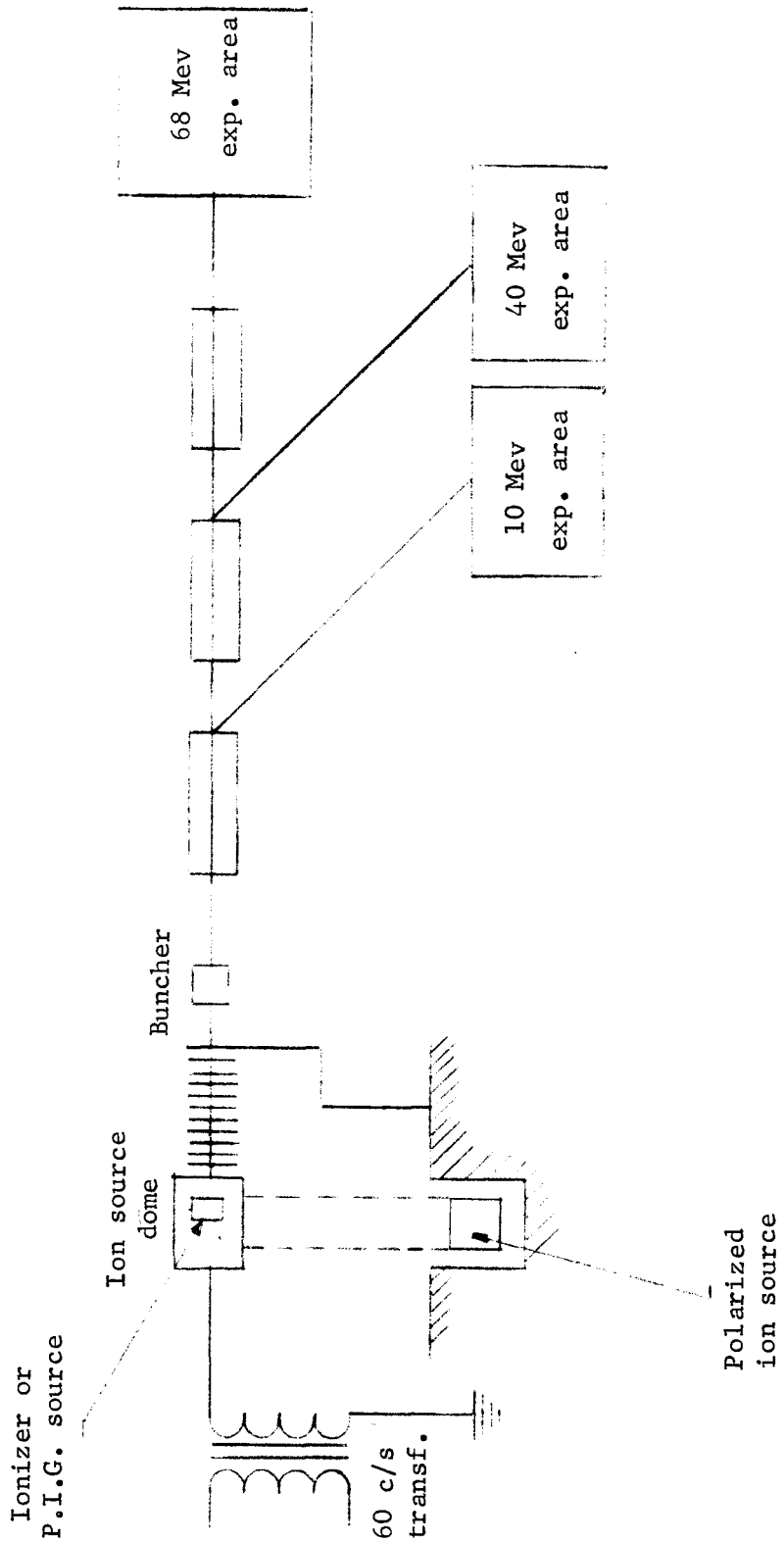
68 Mev
exp. area
40 Mev
exp. area
10 Mev
exp. area
Buncher
Ion source
dome
Ionizer or
P.I.G. source
60 c/s
transf.
Polarized
ion source

Fig. 1