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AN ALTERNATIVE TO H- INJECTIONS

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In 1986, a committee considered the replacement of the BNL Tandem Van de Graaff with an EBIS, an RFQ, and a 20 MV linac to serve as Booster injector. The latter machines would be placed close to the Booster, eliminating in this way the long heavy ion transfer line, and reducing the manpower and operating costs. A similar injector can be envisaged for injection of positive polarized particles directly into the Booster, bypassing the 200 MeV Linac.

A.S. Belov, et al., have reported[1] a peak 10 mA $\vec{H}^+$ current in pulses of 50 μs FWHM and 76% polarization. It is a "ground state" atomic beam source using a D^+ plasma ionizer. A source with these parameters would be a good match to the Booster injector proposed for heavy ions.

At an energy of 20 MeV, revolution time for protons in the Booster is

$$T_{rev} \approx 3.3 \text{ μs}.$$

Assuming that 15 turns can be injected into the Booster acceptance, the injection time would be

$$T_{inj} \approx 50 \text{ μs}.$$

An average beam current of 8 mA of polarized protons (to allow for the shape of the pulse) corresponds to

$$N_b = 2.5 \times 10^{12} \text{ ppp},$$

which is very close to the Booster space charge limit at 20 MeV.

The present scheme of injection from the Booster into the AGS assumes that four Booster pulses would be injected each acceleration cycle of the AGS. Therefore, the AGS intensity at injection could approach 10^{13} particles per pulse, depending mostly on losses during Booster injection, capture, and acceleration.

In principle, the same RFQ and 20 MV linac could serve both for acceleration of polarized particles (protons and deuterons) and for acceleration of highly stripped heavy ions from an EBIS. In addition to the advantage of having all ion sources (except the H^- source for the proton acceleration) situated in the same location, with a short injection line, it would also be less costly to operate a short, 20 MV linac instead of the existing 200 MeV machine.

Reference

1. A.S. Belov, et al., NIM A255 (1987), p. 442.