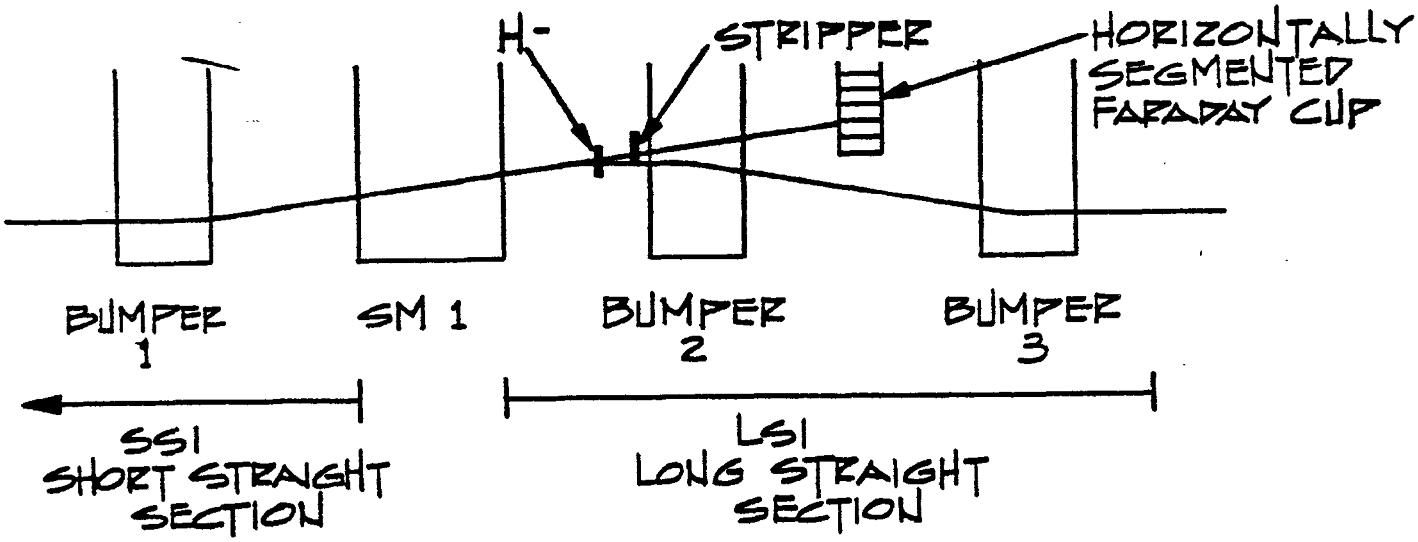
M. Injection Diagnostics and Booster II Operating Experience, Y. Cho, ANL

There are 12 sets of wire scanners distributed between the linac and the RCS injection point. These provide vertical and horizontal positions and profiles. Also, there are two toroids; one at the linac and one just before injection into the RCS for measurement of transmission of 50 MeV H^- beam. We typically inject ~ 5 mA for 40 to 50 μs.

The ring is divided into six equally-spaced long and short straight sections. A Faraday cup is located in L6 which is almost one full revolution around the ring. The two toroids in the 50-MeV line and the L6 Faraday cup are used to measure first-turn coasting efficiency.

A sketch of the injection orbit with the bumpers and strippers are shown below with the curvature of the central orbit removed. By turning off all the bumper magnets and removing the stripper, the injected H^- beam profile can be seen on the segmented Faraday cup. By inserting the stripper, you can strip and unstrip the beam and you can set the position of the stripper. Then, the bumpers are turned on and you can see whatever H- beam that occurs on the original H^0 position but with opposite polarity.



There are two 50% transparent Faraday cups situated in the L3 and L4 straight sections. The injection angle is adjusted by looking at first, second, and third turns.

When the injection angle is properly adjusted and the Faraday cups removed and the ac field off on the main ring magnets, the coasting beam will last for 2 ms with 2 x 10^{12} protons circulating in the ring. Under coasting beam conditions, rf capture is 100%.

Since we have no pulsed vertical steering magnets, similar studies have been undertaken for the vertical injection as was done for the horizontal injection.

There are six position monitors in the six short straight sections. The design of the original position monitor was 2-inches by 2-inches high by 4-inches wide. They were cut into four pieces on the diagonals so that simultaneous horizontal and vertical measurements could be made. The drawback with this configuration is the cross-coupling created by midplane tilts. Consequently, we have designed two new electrodes which are x-sensitive and y-sensitive only. They are installed and will be tested shortly.

The signals from the four segments of one of the position electrodes are added together and used as a fast Q-signal electrode. This signal is fairly clear from its noise and is used for beam phase feedback. The cable picks up RMPS noise which does not effect beam phase feedback, but we would still like to eliminate it. A slow position signal from the electrodes is used as position feedback in the rf amplifier.

We have one horizontal and one vertical residual gas ionization type beam profile monitor. The horizontal device gives a good measure of beam width. For circulating beam emittance measurement, we should have more than one at different points of the β-function.

For extraction, we have an extractable segmented wire ionization chamber (SWIC) in front of the extraction septum magnet. We have occasionally hung a glass plate outside of the ring. With 10^{13} bombarding protons, a beam profile measurement has been made which provides some information which is not obtained electronically. A long tail on the extracted beam is one example.

There are three more SWICS and two toroids further along the 500-MeV transport line. All the SWICS can be used for centering the beam. The last SWIC is just before the ZING-P' target and is always in the beamline for monitoring position and size on the ZING-P' target. The other two SWICS are normally removed from the beamline after tuning.

The two toroids in the 500-MeV line tend to pick up kicker noise because of the time coincidence. This problem is still being worked on and hopefully will be resolved.

We use the kicker magnets at low field level to produce a fast coherent oscillation and analyze the fast position signal with a spectrum analyzer.

1. Question:

Do you really need profile monitors in L3 and L4 for injection profiles? You want to match the α and β emittance to avoid unnecessary beam losses and to optimally fill the acceptance of the ring.

N. Radio Frequency Shielding, C. W. Planner, RL

The SNS will use a ceramic vacuum chamber in the regions with magnetic fields, since the fields oscillate at 50 Hz. Our calculations show that the rf wall impedance will be too high for stable beam motion unless something is done to modify the selectromagnetic environment of the beam.

In the SNS, the longitudinal coupling impedance is dominated by the capacitive term, which contains the factor $(1 + 2 \ln b/a)$. We propose to minimize this term by making the chamber radius b equal to the beam radius a. We will follow the beam profile around the machine with a boundary which terminates the beam electric field.

For the transverse coupling impedance the space change term again dominates and contains a factor $(1 - a^2/b^2)$. This term can again be minimized by making a and b close to one another.

The boundary which terminates the space charge field will consist of an array of 2-mm stainless steel wires top and bottom running longitudinally, with plates at the sides in the bending magnets. These conductors permit the synchrotron magnetic fields to penetrate, but electric fields will terminate on the wires and plates. The quadrupole magnets will have no plates, just wires over the pole tip areas.

O. Theory on Beam Induced Electron Multipactoring, L. Z. Kennedy, LASL

Beam induced electron multipactoring is the production and multiplication of secondary electrons as a result of the transverse