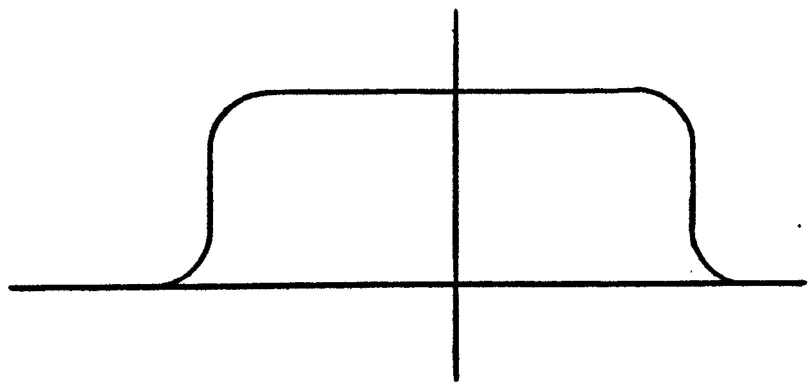
Thus by adjusting the injection angle and δ, one can achieve the desired distribution of charges.

We believe that the best distribution for the space change consideration is uniform distribution in the radial space with tails as shown below for Landau damping.



So far our considerations have been without the space-charge effect; now we consider the space-charge detuning which brings in complications. However, the solution is still there as long as we maintain $\nu = N + \frac{1}{4} + \delta$ with taking into account the space charge, then similar argument can be made.

E. Injection for the PSR, D. W. Hudgings, LASL

For H^- injection at 800 MeV, a bumped orbit is hard because there is only about a 4.5-m straight section. It also may not be good to keep the beam on a foil for the full 8 ms. Pulsed bumps would be especially difficult in the short-pulse work.

An alternative is to use neutral-beam injection whereby a magnetic field strips off the first electron. The beam continues to be further stripped by the moving wheel with foils (as ANL does in Booster II). Gas stripping is only ~ 50% efficient and is not practical here.

Using magnetic field dissociation, the stripping length needed is about 1 mm at 1.8 Tesla. This is an extrapolation of other data so measurements are to be made on a ps scale, but using the extrapolations we propose a length of 6 or 7 mm at 1.7 Tesla to get 100% stripping while adding 1 mrad to the beam half angle.

The suggestion is to bias the magnetic field to increase the gradient and cut down on the beam spread. The magnet is planned to have ~ 1 cm aperture and may be incorporated into some other magnet body. There will be some bend involved but less than a degree (probably a few mrad). This magnet may also be used to degrade beam emittance but this has to be studied further.

F. Direct Extraction H^- Sources, P. W. Allison, LASL

These sources were developed in Novosibirsk and currently Fermilab is using one (a magnetron type) operationally with a 0.1% duty factor. A 4-mA average current source with 120-mA peak pulses should exceed the LAMPF requirements. With cooling this type of source should work.

The brightness of the direct extraction source is 1-2 orders of magnitude higher than for proton sources. Also,

$$B_{norm} = \frac{2i}{\pi^2(\varepsilon_{x,norm}\varepsilon_{y,norm})} = \frac{50A}{(cm\cdot mrad)^2}$$

for my source at the 50% contour level.

The advantages of a direct extraction source are:

- only negative ions are extracted
- gas can be pulsed so gas load is moderate
- the magnetron or Penning source is preferred over the duplasmatron because no electrons come out.

The disadvantages of a direct extraction source are:

- gas economy low, ~ 1%
- uses cesium, but consumption is low
- has never run 120 Hz, 40 mA, 500 μs
- long repair time (~ one day including conditioning)
- LAMPF source has about one month lifetime.