Raster Magnet

We have held talks with Yi-Nong Rao and again with Iouri Bylinskii and Victor Verzilov present.

It has been decided that priority will be given to commissioning the TPM and then using it, by as early as Sept. 11, to determine as best we can the true size of a horizontally narrow beam tune; even though Y-NR is not fully convinced that we can do this properly due to the thin sensitive zone of the TPM.

VV reported that the electronics are ready and 'all' that is needed is the CONTROLS work.

Y-NR appears confident that we can get a horizontal spread of ~5 mm (2 sigma) using 1UQ1 and 1VQ6.

If this is so the we should begin consideration of a 'Raster' magnet for BL1U.

Raster Magnet

Requirements for a 'Raster' magnet:

1) That it sweep the beam sufficient to reduce the beam density on the window to avoid any creep or fatigue.

2) That it fit in the space available.

3) That it minimize eddy currents, especially in its beam pipe.

4) That it can be built with minimal budget.

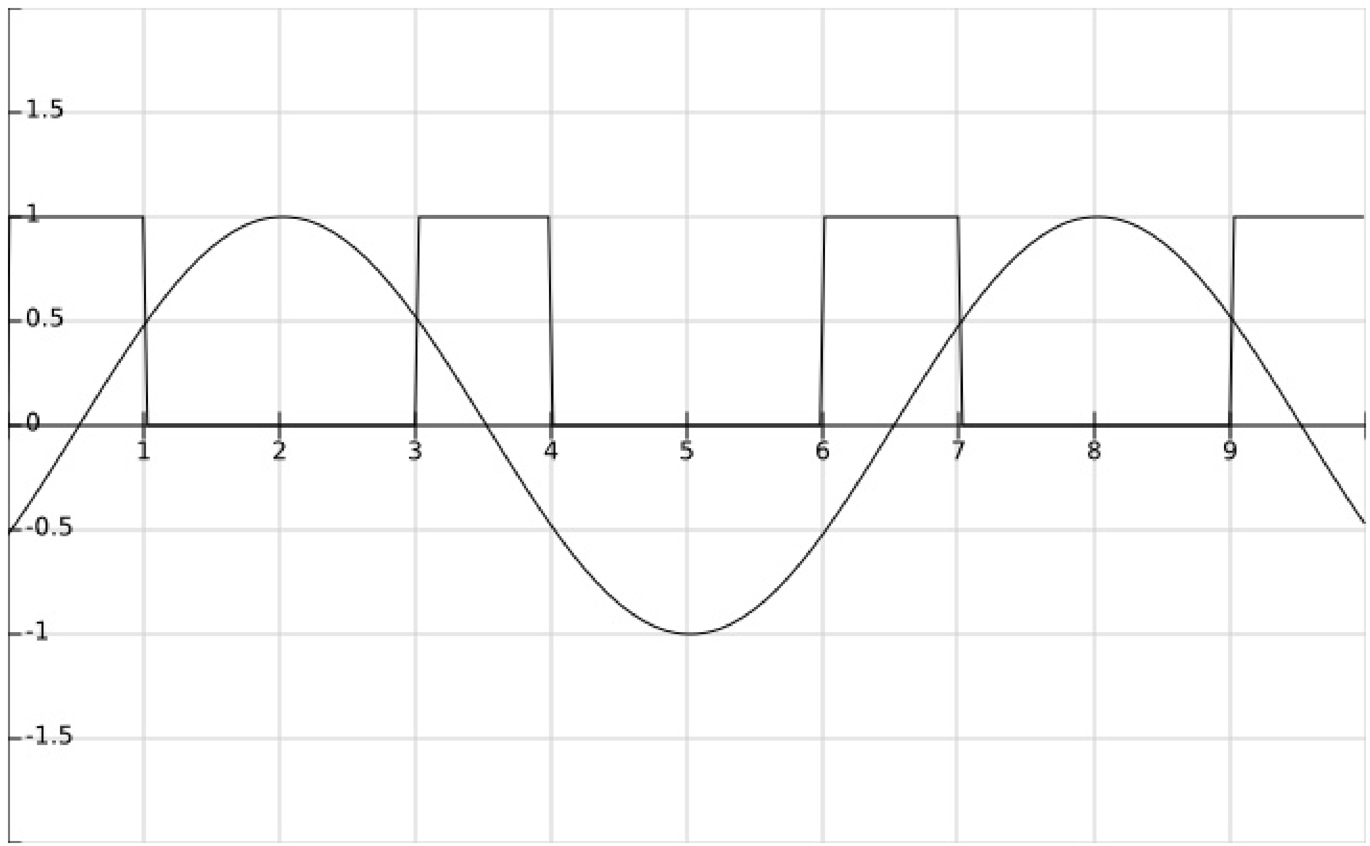
Raster Magnet

There are two basic philosophies to accomplish these goals:

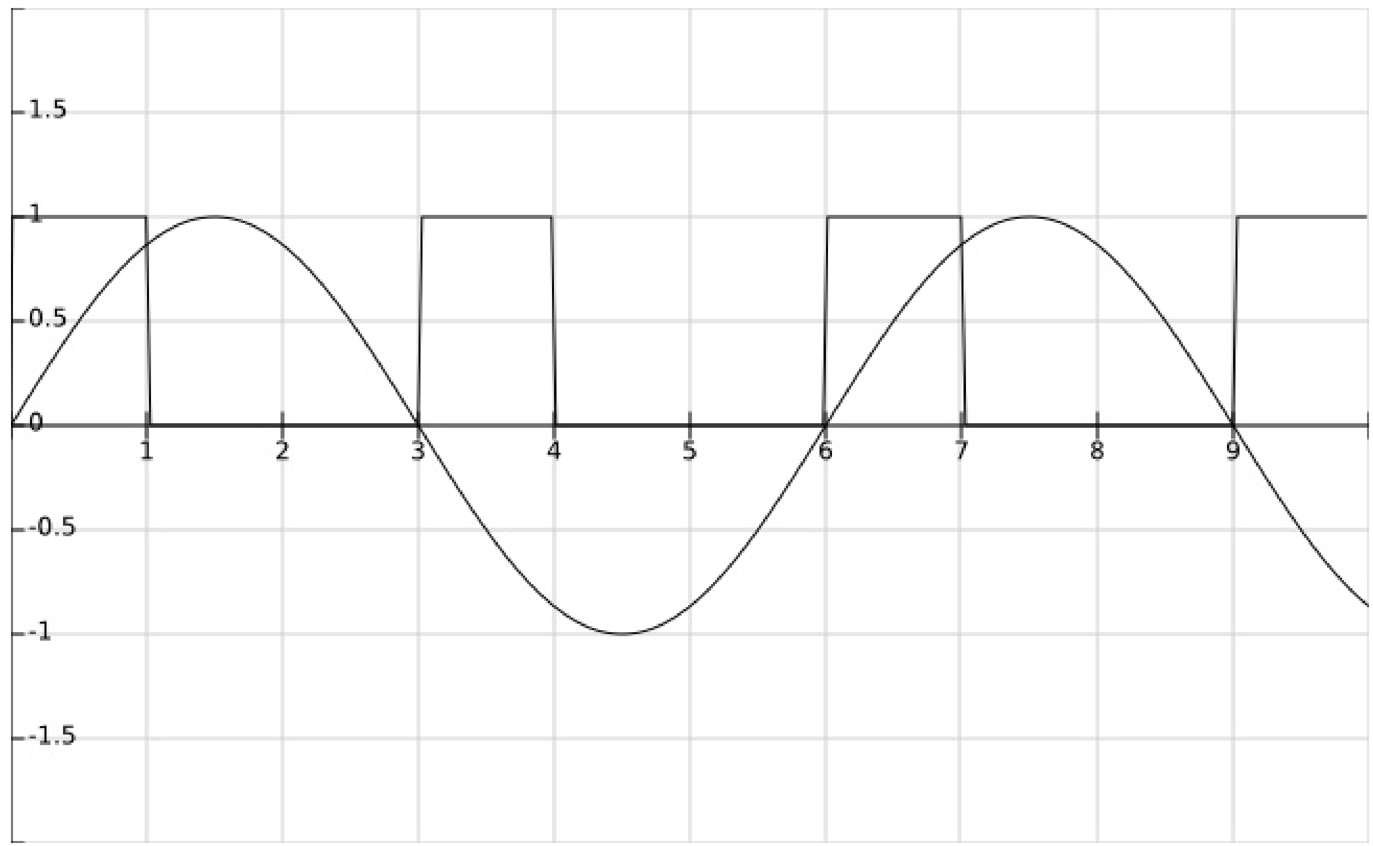
A) A small ferrite core magnet operating at half the Kicker frequency and phase-locked to sweep the beam across the Target within (relatively) linear regions of the sine curve.
B) A small iron core magnet operating at a very low frequency (~Hz) and free of any phase-lock.

(A) requires a non-conducting beam pipe, but can give a relatively flat beam profile.
(B) may not require a non-conducting beam pipe, but would result in the beam having significant 'horns' at the extrema.

±30° in phase at 0-crossing; flat-top, full scan



±30° in phase; lower I_{mag}, half scan, small horns



Raster Magnet

Power loss due to eddy current:

$$P = (\pi^2 B^2 t^2 \nu^2) / (6 \rho)$$

P is power dissipation per volume (W/m^3)

B is the peak field (T)

t is the thickness of a thin sheet (m)

ν is the field frequency (Hz)

ρ is the resistivity (Ωm)

Raster Magnet

For SS316: $\rho = 69 \times 10^{-8}\ \Omega m$

For a 20 cm long magnet B = 0.09 T (5 mrad)

The wall of a beam tube is ~0.003 m thick

Assume $\nu = 1$ Hz

Then $P = (\pi^2 B^2 t^2 \nu^2) / (6\rho) = 0.17\ W/m^3$

Note: *Cu* is $2.22 \times 10^{-8}\ \Omega m$

Fe is $14.4 \times 10^{-8}\ \Omega m$