

Mu SR Kicker System

The Muon Storage Ring has need of an injection kicker system that will deflect the incoming beam on orbit. The main parameters for the system are:

Type	-	Horizontal
Clear Gap	-	308 mm(w) by 246 mm(h)
Integral BL	-	0.6 Tesla•Meters
Field Flattop	-	2.0 μsec
Field Fall	-	4.0 μsec
Field Variation	-	10%
Rep Rate	-	15 Hz

The proposed system has two engineer defined limits that will be treated as design criteria. Our experience has suggested that the maximum system voltage should be limited to 50k volts and the maximum switch tube current should be limited to 5k amps. These two requirements imply the system impedance of 5 ohms.

The above constraints are such that the peak field will be:

$$B_{\max} = \frac{m_0 \times I_{\max}}{h} \qquad B_{\max} = 0.0255 \text{ Tesla}$$

And the total length of the magnet system will be:

$$\text{Length} = \frac{\int Bl}{B_{\max}} \qquad \text{Length} = 23.5 \text{ Meters}$$

On a per meter basis the inductance, capacitance and the field drift time of the magnet is:

$$L = m_0 \times 1 \times \frac{w}{h} \qquad L = 1.573 \text{ mH / meter}$$

$$C = \frac{L}{Z_0^2} \qquad C = 62.93 \text{ nF / meter}$$

$$\text{drift} = \sqrt{L \times C} \qquad \text{drift} = 0.315 \text{ msec / meter}$$

From the above numbers, we are tempted to install two 12 meter magnet strings each driven by a pulser. We will take a conservative approach at this point and assume that the kicker system will be made up from four 6 meter magnet strings each driven by a pulser.

Figure 1 is included as a proposal for the cross section of the magnet. The mechanical design for the support structure and vacuum vessel is non-existent and will need to be addressed for the next level design. The actual magnet length and number of pulsers will need to be nailed down at that time.

The PFN that will be used to drive each magnet will have:

$$Z_0 = 5.0\Omega$$

$$Length = 2.25msec$$

A *SPICE* simulation of both the PFN and magnet has been completed and the normalized magnet input/output voltage and normalized integral of field is included for reference. Figure 2 is a simplified schematic of the kicker system that was modeled in *SPICE*.

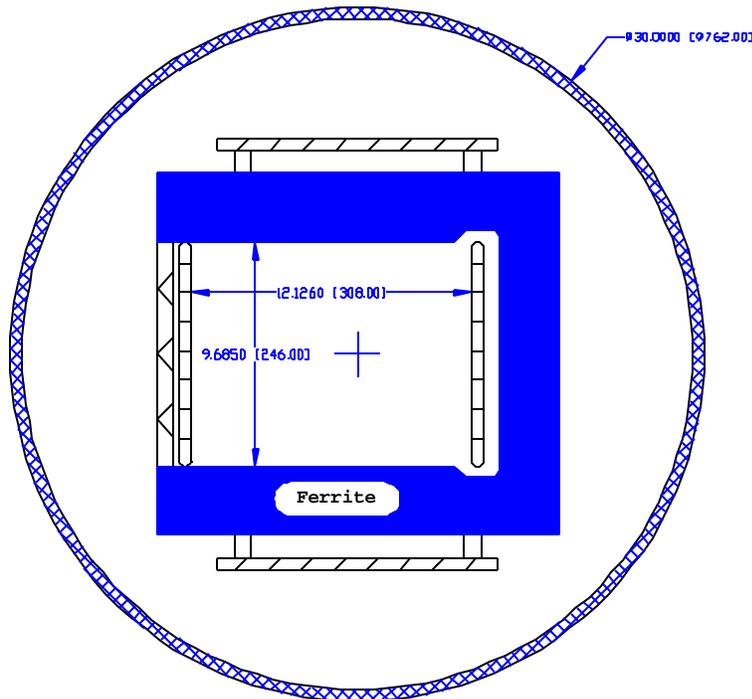


Figure 1 - Proposed Magnet Cross Section

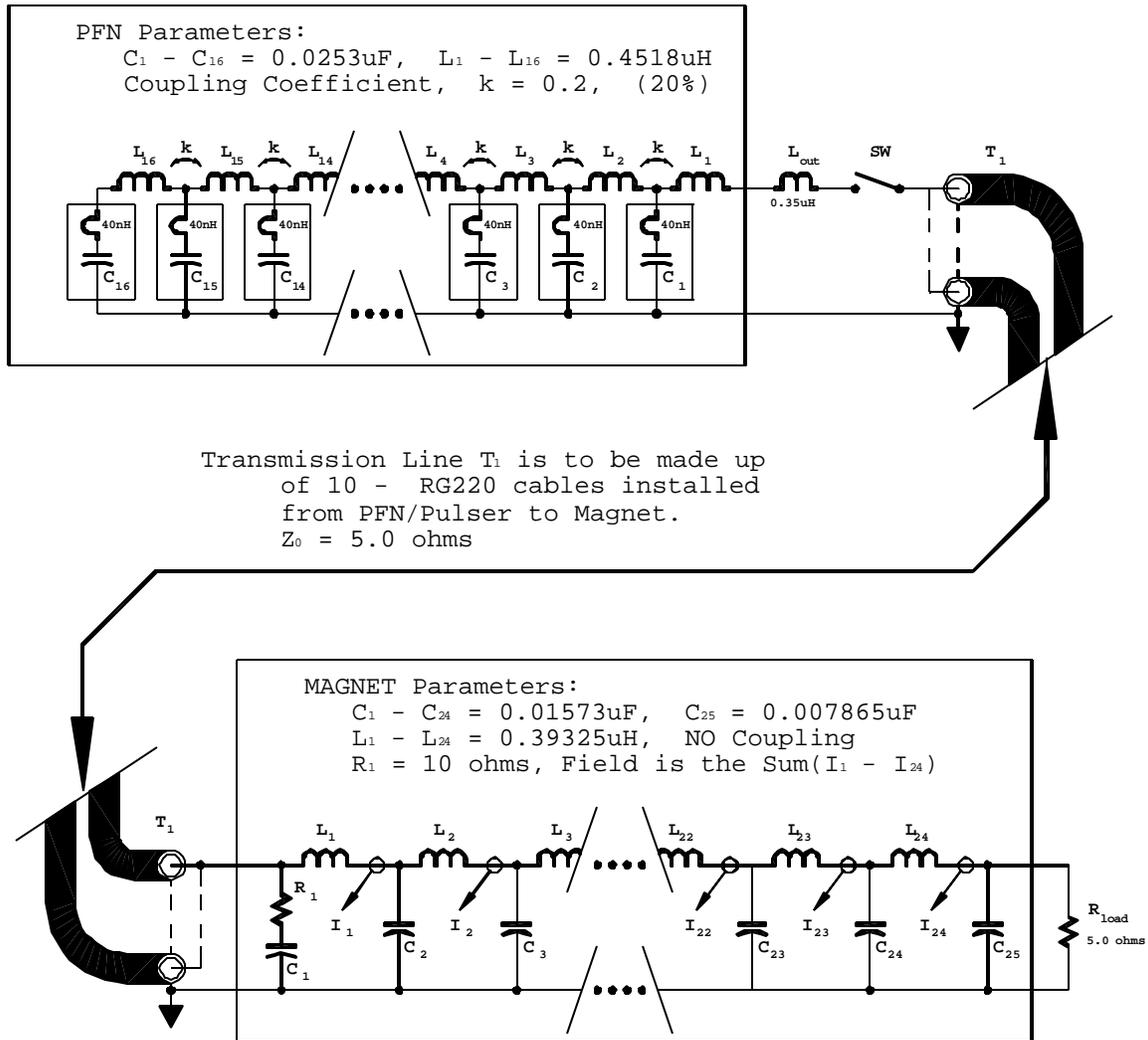


Figure 2 - Simplified Diagram of Mu SR Kicker System
 (used for **SPICE** Simulation)

Spice Simulation of Mu SR Kicker System

PFN, 16 Cell (20% Coupling), $Z_0 = 5.0$ ohms,
Magnet, 24 Cell (NO Coupling) $Z_0 = 5.0$ ohms,
6 Meters, (RELTOL = 0.00001)

