KICKER MAGNET MATERIALS

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Cooling Ring Kicker Meeting
Building 71, Room 264
Lawrence Berkeley National Lab
Berkeley, California
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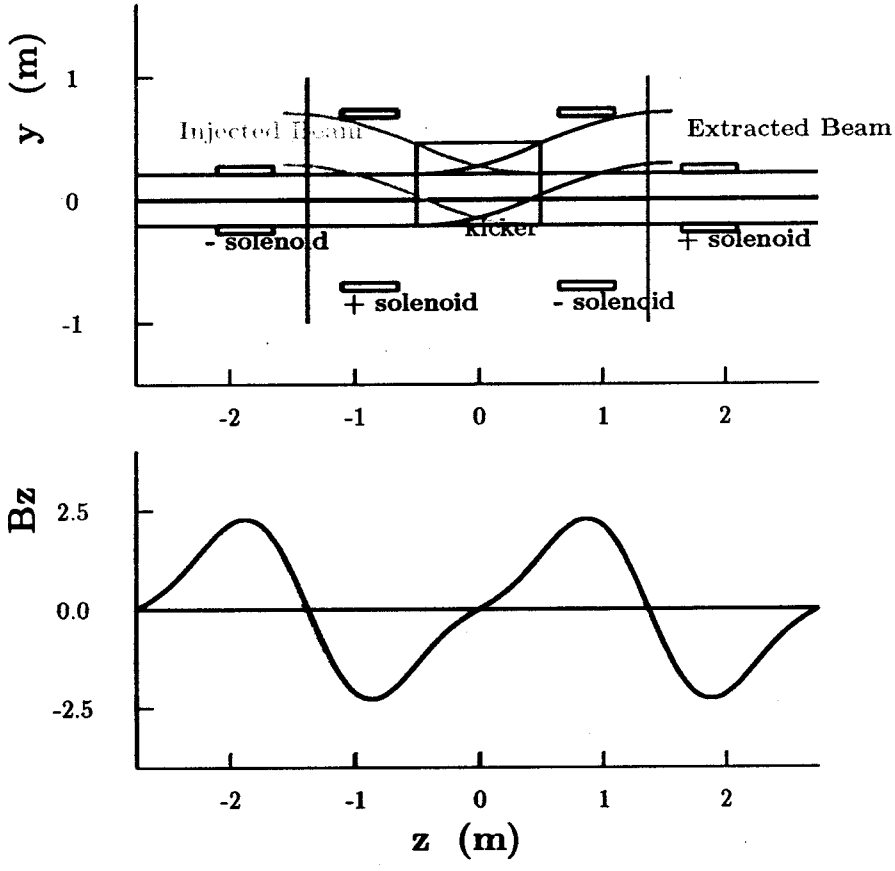
Possible Geometry for Palmer RFOFO Ring

(similar to Balbakov)



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THE INJECTION KICKER SYSTEM OF THE CERN ANTIPROTON ACCUMULATOR

D. Fiander, K. Metzmacher, S. Milner, P. Pearce, A. Poncet, J.C. Schnuriger
CERN, Geneva, Switzerland.

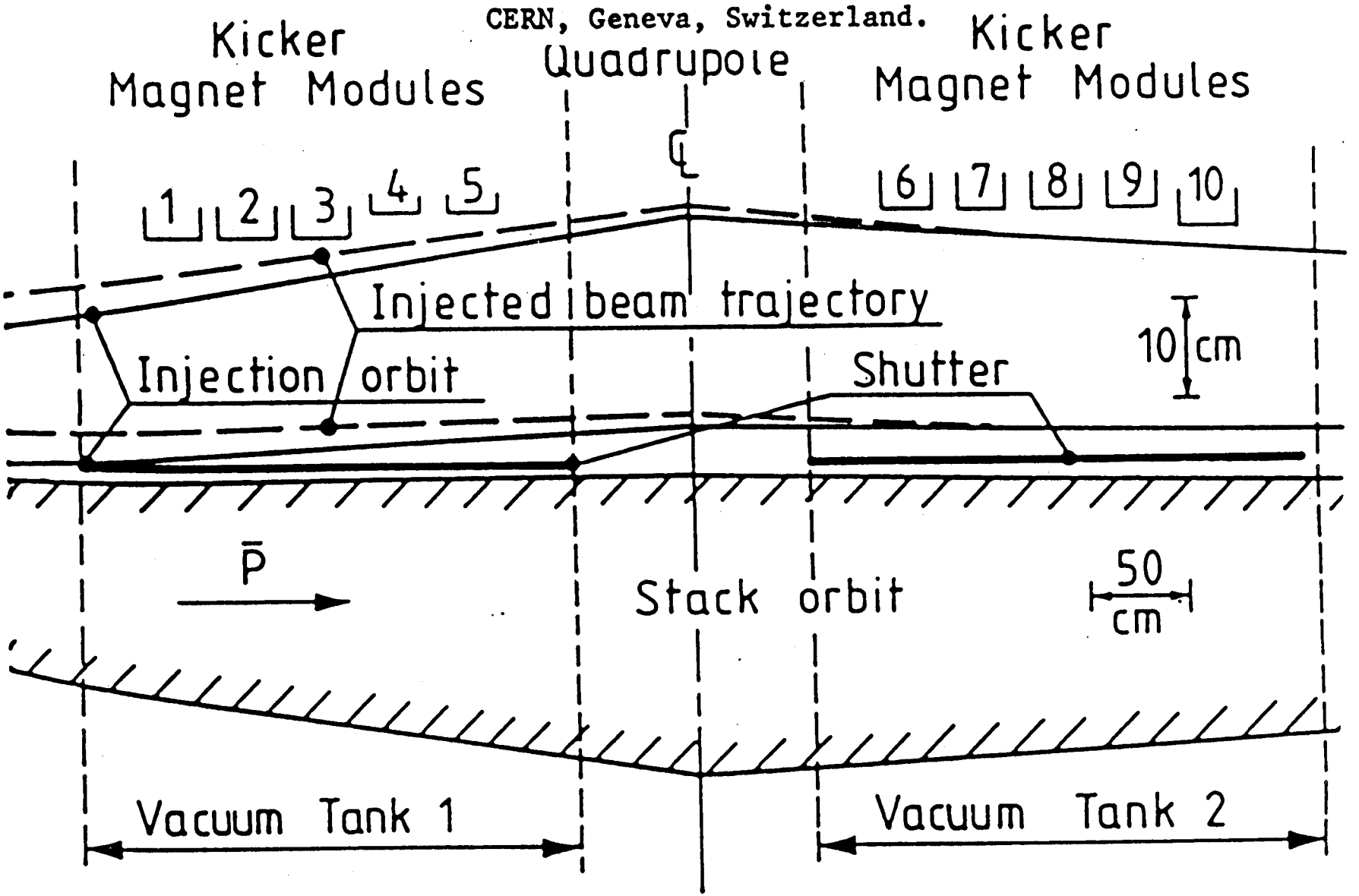


Fig. 1. Beam trajectories in injection kicker region.

KICKER MAGNET COMPARISON

	Palmer et al.	FNAL $\bar{p}$ INJ DEB	CERN $\bar{p}$
$\int B \cdot dl$ (T·m)	0.43	0.181	0.088
Beam (GeV/c)	0.2	8	3.5
Deflection	33°	0.35°	0.42°
B (Tesla)	0.43	—	.018
L (meters)	1.0	—	5.0
J (Joules)	8200	—	13

RETURN YOKE MATERIALS

CMD5005 Ni-Zn Ferrite	0.3 Tesla	Saturation
Metglas 2605SA1	1.6 Tesla	Saturation

SKIN DEPTH @ f = 10 MHz

Corson and Lorraine 540 -541

$$\delta = \left(\frac{2\rho}{2\pi f \; 4\pi \times 10^{-7}} \right)^{\frac{1}{2}}$$

	ρ ($\mu\Omega$-cm)	δ
Copper	1.7	21 μ
Aluminum	2.8	27 μ
Beryllium	4.0	32 μ
Metglas	135	186 μ

So Ala CERN $\bar{p}$ use a shutter to shield the stored beam from the incoming beam.

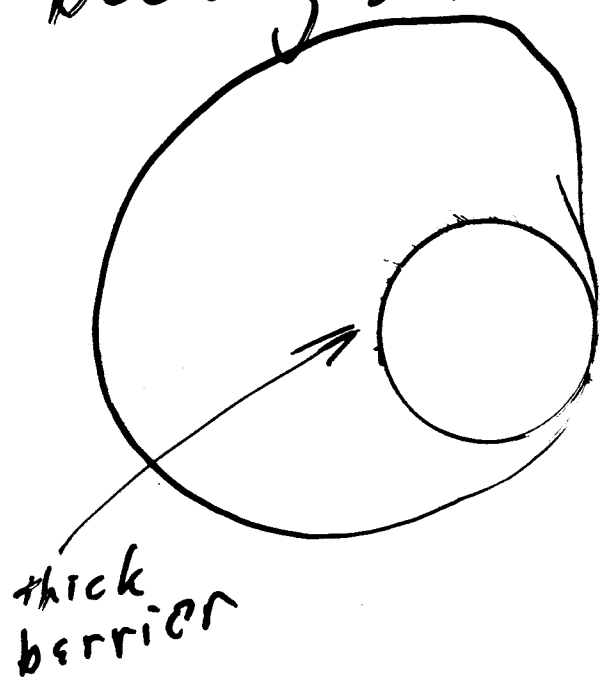
$128\mu = \frac{1}{8}$ mm of Beryllium gives 4 skin depths @ 10 MHz

1. Bunch trains may be longer than rings are big.
2. Kickers may be slower.

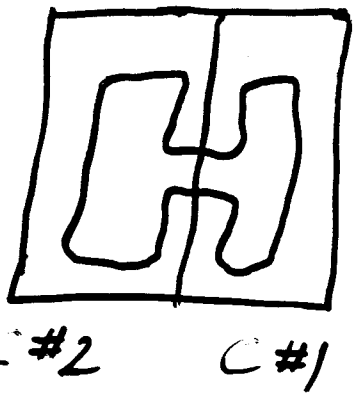
Nickel - Zinc Ferrite
C-Magnet Return Yoke

(1) in free space 0.43 → 0.3T

(2) in a bucking solenoid



Turn a Metglas dipole partially off



Power loss per kilogram of Metglas

$$P = \frac{15}{10^7} 1.9\times10^{-4} (10^7)^{1.51} (1.6)^{1.74} = 24 \ \frac{\text{watts}}{\text{kilogram}}$$