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AA INJECTION FROM ACOL

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1. INTRODUCTION

The beam coming from ACOL into the AA will pass through the AA injection septa chamber to the injection along the same trajectory as at present. However the beam will have a smaller transverse emittance and momentum spread than at present. The entire injection system could be used without modifications. However, in order to recuperate kicker pulse generators for use in ACOL it was planned to build new kicker magnets for the AA. The new kicker magnet design can take advantage of both the reduced beam size and the slower fall time, that is allowed, to specify smaller magnets and fewer modules. This note gives beam dimensions and the kicker strength as a guide to detailed kicker magnet design.

2. BEAM DISPLACEMENT AT SEPTUM EXIT

The decision to keep the present septum magnet and vacuum chamber intact means that the beam displacement should remain at about its present value of 91 mm (32 mm for circulating beam, 32 mm for injected beam, 20 mm for the septum blade and vacuum chamber, 5 mm closed orbit changes and 2 mm reserve). The new injection path need only be designed for a transverse emittance of 25 π mm.mrad instead of 100 π so that if there were a new septum system, the required displacement could be reduced by at least 32 mm and probably by 40 mm with a thinner septum thus reducing the required kick

amplitude by a factor of 0.56. Advantage can be taken of the reduced size of the injected beam to reduce the required displacement by up to 16 mm. However it seems a pity not to gain some extra clearance along the injection path so it is proposed to reduce the kick by only 12 mm to 79 mm. With this trajectory it is necessary to increase the septum current by 1.2% i.e. the power by 1.5%. This is only of significance because of the present small operating margin for the septum.

3. KICKER STRENGTH

It is proposed to eliminate one of the existing injection tanks. There is very little difference in the effectiveness and aperture requirements. It is assumed here that tank K3 is retained. Calculations for kick strength here are based on replacing the 5 modules by a single magnet spanning the same total length of 1.81 m. The actual number of modules needed depends on the required fall time of 180 ns and the magnet termination. When a module layout is determined the operating voltage of the PFN will have to be recalculated.

The transfer matrix from the center of the kicker magnet to the septum is :

$$\begin{bmatrix} 1.017 & 11.31 \\ -0.1467 & -0.6298 \end{bmatrix}$$

so for a displacement of 79 mm, a kick of 7 mR is needed i.e. a value of $\int Bd\ell = 0.0833$ T.m or an average field of 460 gauss over 1.81 m.

4. KICKER APERTURES

These are given in the following graphs. There need only be physical space for the circulating beam while the field quality for the injected beam should be in the range 1 - 3%.

The dimensions given in the graphs are

$$\sqrt{\beta G} + \alpha_p \frac{dp}{p}$$

where $\varepsilon = 25\ \pi$ mm.mrad and

$$\frac{dp}{p} = \pm\ 0.25\%$$

Since the beam coming from ACOL has been precooled we can assume that the particle density are roughly Gaussian so these dimensions are more than adequate and further reduction of the horizontal aperture could be considered.

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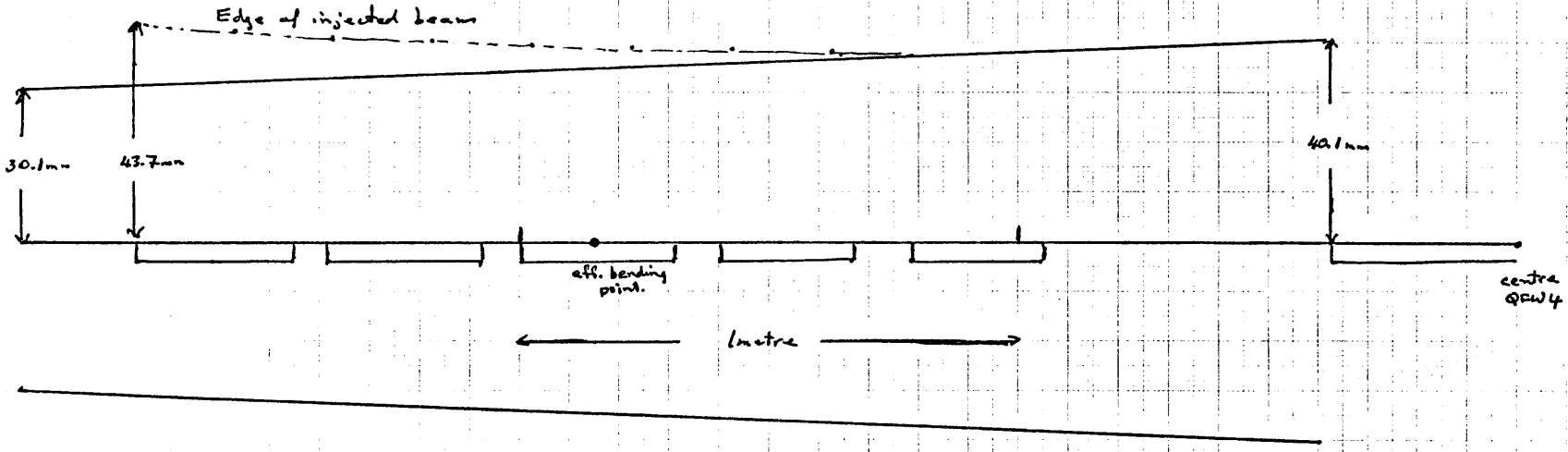


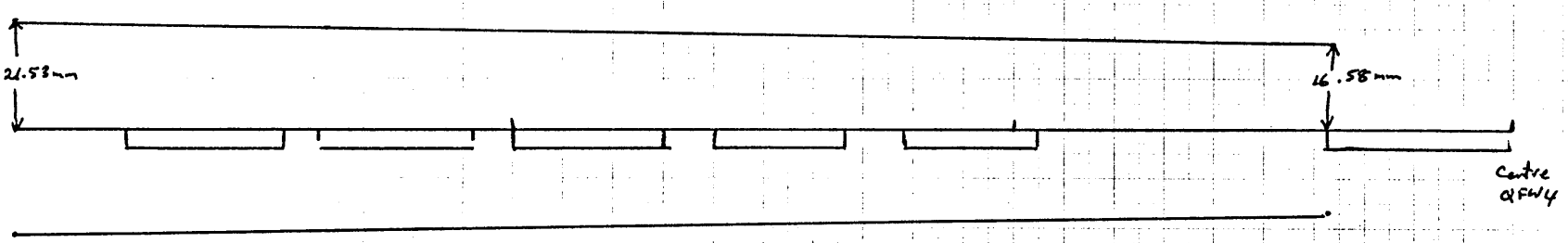
Injection Kicker SS in AA for beam from AEGL

Horizontal plane

K3 tank.

$e = 25\pi$

$\frac{dp}{p} = \pm 0.25\%$



Vertical plane
K3 tank