Subject BOOSTER APERTURE REQUIREMENTS

Previously the Booster lattice parameters have been computed for $Q_h = Q_v = 6.75$ and with equal entry and exit angles to the faces of the block magnets. However it has always been assumed that the magnets would be angled to minimise sagitta by taking advantage of the variation of the beam envelope in the magnets.

A realistic set of design parameters has now been obtained with $Q_h = 6.65$ and $Q_v = 6.85$ and with the magnets appropriately angled for minimum sagitta. Under these conditions, with magnet gaps of 2.0" in the F magnet and 2.5" in the D magnet, the maximum vertical acceptances of the magnets are both equal to 40π mm mrads for vacuum wall thicknesses of 0.18" in the F and 0.125" in the D (including allowances for twisting etc.) Thus the vertical apertures in other components should be matched to a maximum acceptance of 40π mm mrads..(See Table 1)

Radially, the situation is more complex due to the sagitta in the straight magnets. However, for a given radial aperture it is possible ~~the~~ to compute the maximum radial acceptance for zero momentum spread.(Since the momentum compaction function α_p is very closely proportional to $\sqrt{\beta}$ this is a realistic way of matching apertures.)

The cases considered here correspond to the nominal 'good field' widths (5.0" in the F and 3.5" in the D) and to the vacuum chamber inside dimensions.(5.5" and 4.0" respectively.) The acceptances in these cases were found to be:-

	F magnet	D magnet
Good Fields	90π mm mrad.	90π mm mrad.
Vac Chambers	113π mm mrad.	127π mm mrad.

Clearly under these conditions the radial apertures of items in which aperture is at a premium should be matched either to 113π or 90π. The aperture requirements for ~~these~~ all the cases are given in Table 1.

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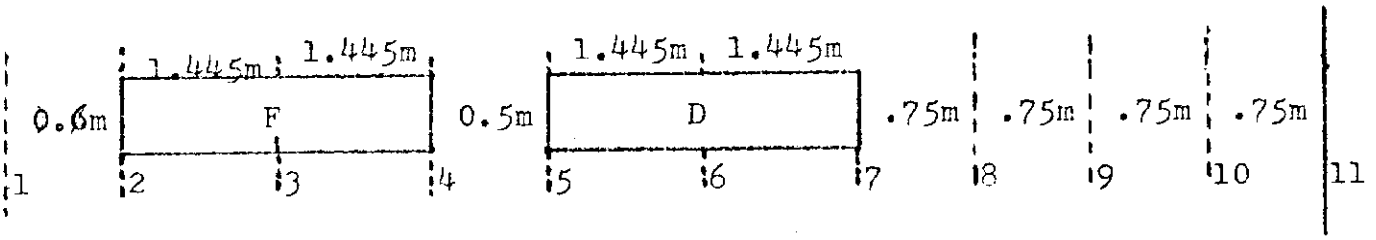

Position Number	β_H (m)	β_V (m)	Vertical height(")	Horizontal Widths (") 90π	113π	127π
1	33.71	5.21	1.137	4.336	4.859	5.151
2	33.75	5.28	1.144	4.340	4.863	5.155
3	30.2	6.66	1.285	4.105	4.600	4.876
4	20.9	10.8	1.637	3.415	3.827	4.057
5	17.3	12.9	1.789	3.107	3.481	3.691
6	10.5	18.5	2.142	2.421	2.712	2.875
7	7.65	20.4	2.249	2.066	2.315	2.454
8	6.95	20.2	2.238	1.970	2.207	2.339
9	6.56	20.05	2.230	1.913	2.144	2.273
10	6.3	19.95	2.224	1.875	2.101	2.227
11	6.2	19.9	2.222	1.860	2.084	2.209

It can be seen from the Table that the aperture requirements in the long straight section are very close to circular if one takes a radial acceptance of 113π mm mrads. Bearing in mind that the most costly apertures are the magnet gaps the logical choice of acceptances for items in the straight sections is 40π mm mrad. vertically and 113π mm mrad. radially. For example, the entrance to the r.f. cavities is close to position 8, requiring a circular aperture of 2.25" diameter.