APERTURES FOR THE AC MACHINE

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1. INTRODUCTION

Experience on the AA machine has shown that for an aperture designed at 100π, the acceptance is reached between 70π and 90π. These differences could be explained by

- the non-accurate evaluation of the β-function,
- the aperture design without any margin.

It is then proposed to take into account these possible limitations for the 200π acceptance design of the AC machine.

2. EVALUATION OF TRANSVERSE APERTURES

2.1. Horizontal half-beam size :

$$\frac{x}{2} = \sqrt{\beta_H \varepsilon_H} + \alpha_p \frac{\delta p}{p} .$$

Vertical half-beam size :

$$\frac{y}{2} = \sqrt{\beta_V \varepsilon_V} .$$

$$\frac{\delta p}{p} = 3\% \text{ (initial state)} ,$$

$$\frac{\delta p}{p} = 0.75\% \text{ (final state)} ,$$

$$\varepsilon_V = \varepsilon_H = 200\pi \text{ (required value)}.$$

It is proposed to add 10% to the beam size dimensions in each plane.

2.2. Closed orbit distortions

For these distortions, it is proposed to have 5 mm on each side of each device and in each plane (H, V).

2.3. Location of PU

PU could be located outside the magnets. However, if the safety margin is large enough, it could be used for PU.

2.4. Thickness of vacuum chamber

It varies between 1 mm and 4 mm according to the size and the aperture in each device.

3. EXAMPLES OF EVALUATION

3.1. Dipole aperture

a) Vertical plane (dipole BHZ 02). See fig. 1.

β_V = 13.6 m at the entrance

$\varepsilon_V = 200\pi$

Half-beam size $\frac{y}{2} = 1.1 \sqrt{13.6 \times 200} = 57.3 \cong 57$ mm.

According to previous specifications, the half-aperture required is :

$$\frac{g}{2} = 57 + 5 + 4 = 66 \text{ mm.}$$

b) Horizontal plane (dipole BHZ Ø7).

β_H = 9.62 m at the entrance

$\varepsilon_H = 200\pi$

$\frac{\delta p}{p} = 3 \times 10^{-2}$ (initial state)

α_p = 3.543 m

Half-beam size $\frac{x}{2} = 154.6 \cong 155$ mm

The half-aperture required is :

$$\frac{h}{2} = 155 + 5 + 4 = 164 \text{ mm.}$$

3.2. Quadrupole aperture (type QW)

a) Vertical plane (Quadrupole QDW 14)

$$\beta_V = 12.84 \text{ m}$$

$$\varepsilon_V = 200\pi$$

Half-beam size $\frac{y}{2} = 55.7 \cong 56$ mm.

The half aperture required is :

$$\frac{g}{2} = 56 + 5 + 4 = 65 \text{ mm. (at x = 110 mm)}$$

b) Horizontal plane (Quadrupole QFW9)

$$\beta_H = 12.3 \text{ m}$$

$$\varepsilon_H = 200\pi$$

$$\frac{\delta p}{p} = 3 \times 10^{-2}$$

$$\alpha_p = 4.04 \text{ m}$$

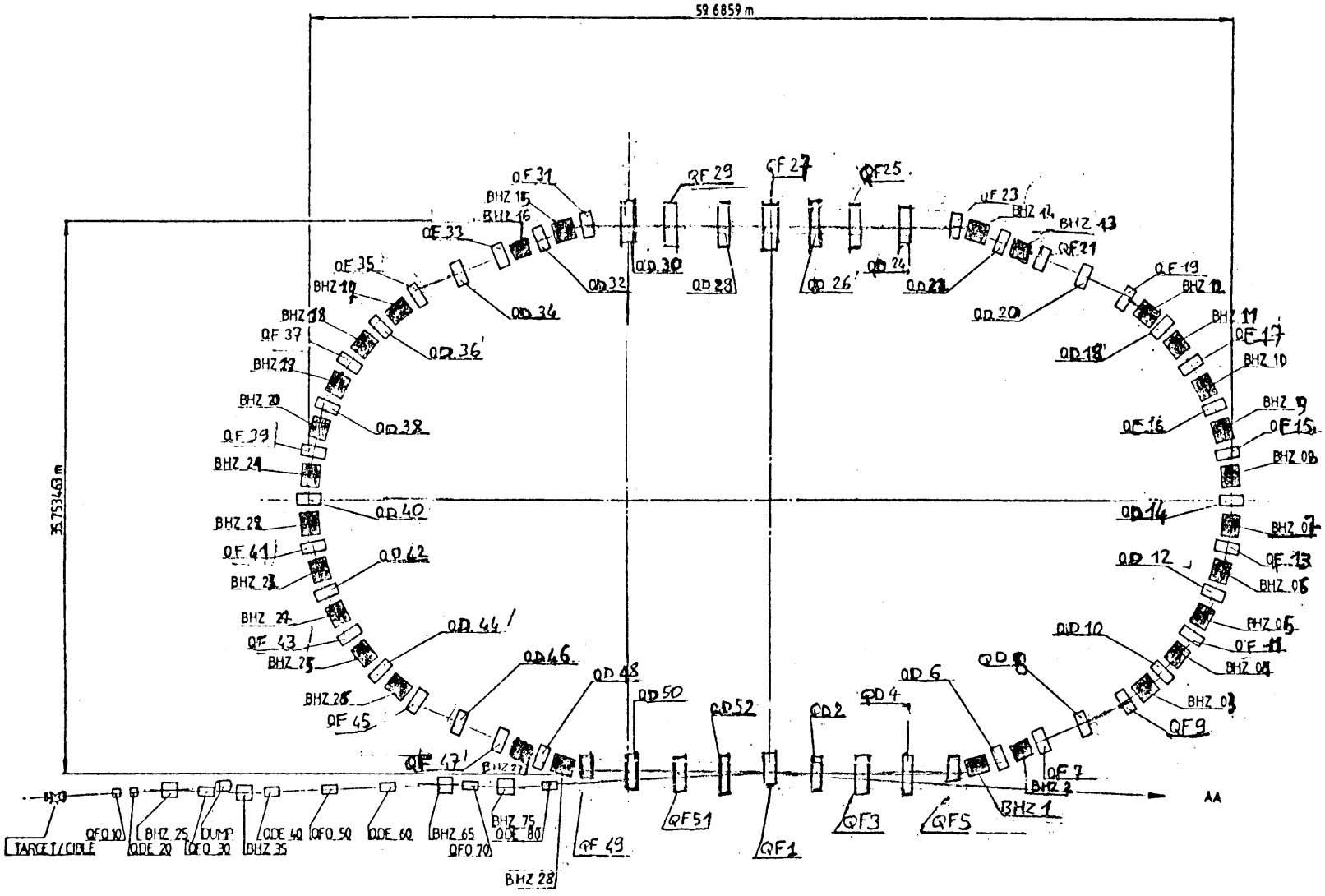
Half-beam size $\frac{x}{2} = 175.7 \cong 176$ mm.

The half aperture required is :

$$\frac{h}{2} = 176 + 5 + 4 = 185 \text{ mm. (at y = 33 mm)}$$

4. CONCLUSION

In order to have a "coherent" machine it is suggested to follow these rules for the aperture design of all AC components (dipole, quadrupole, septum, kicker, cooling PU, etc.)



— ANTIPROTON COLLECTOR —

(2sd version)

Fig 1

0 2 4 6 8 10 m

- SCALE -

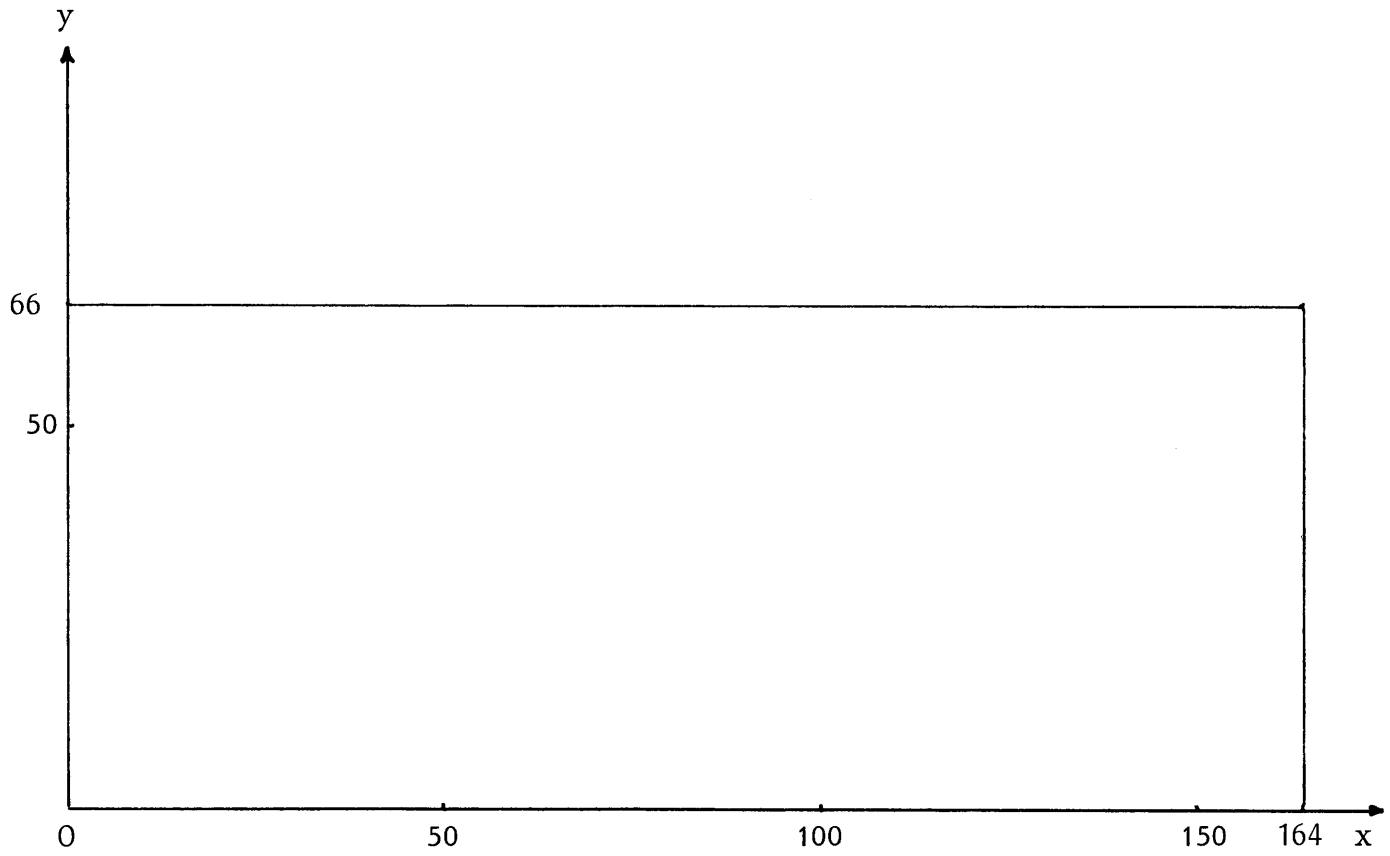


Figure 2 - Space needed for aperture and good magnetic field.

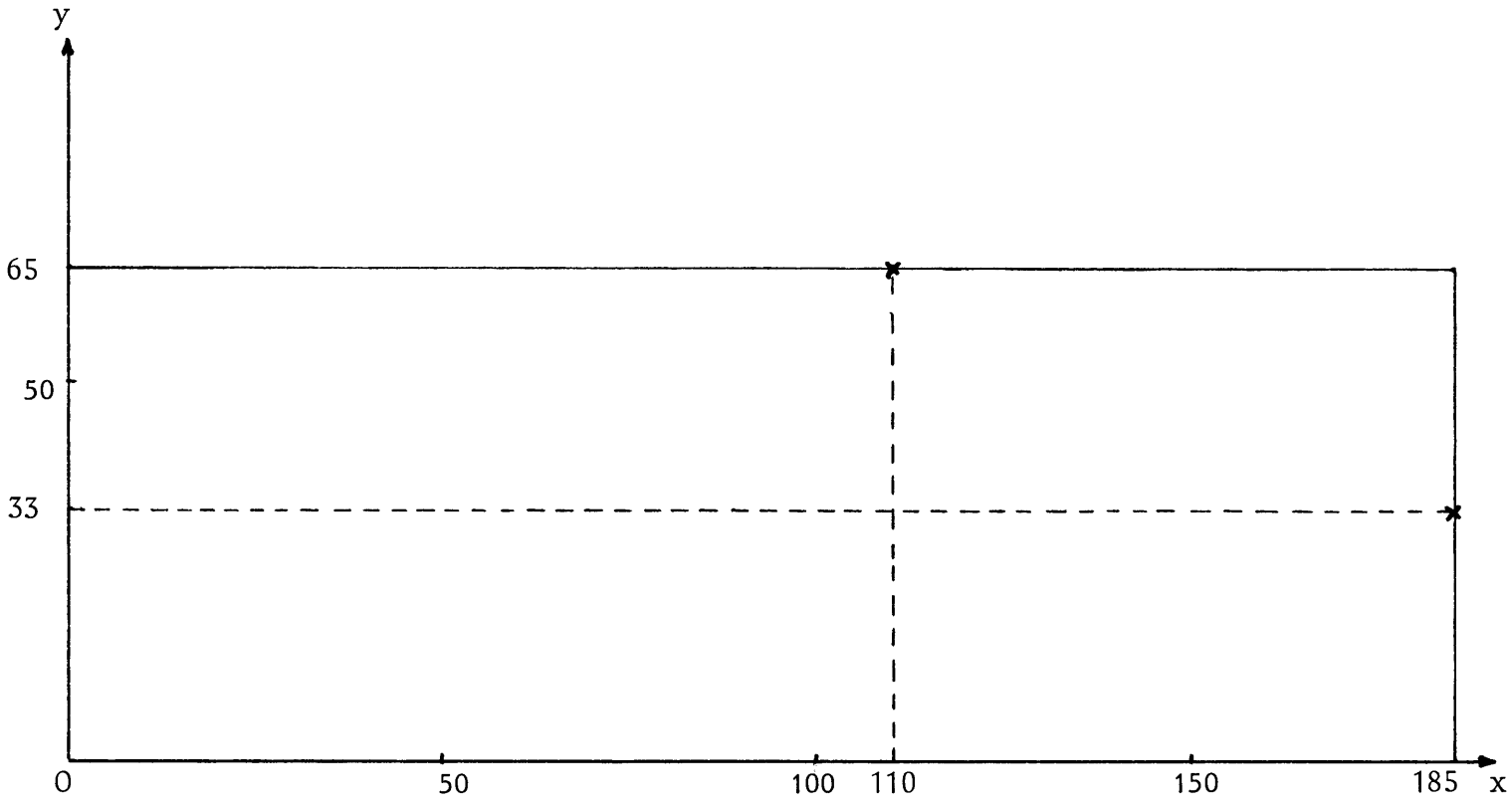


Figure 3 - All quadrupoles should be tangent to this rectangle (here wide type).