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Vu-graphs of Presentation by Johannes Claus at RHIC Meeting Wednesday, Nov. 21, 1984

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High Energy Facilities Advanced Projects

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RHIC Technical Note No. 8

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November 26, 1984



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Aperture and Gradient in Qualt upole





$$\beta = \beta^{*} + \frac{(l_{1}+l_{2})^{2}}{\beta^{*}} \rightarrow \text{ constant beam dimensions}$$

$$\beta^{*} \ll l_{1}+l_{2} \rightarrow \sqrt{\beta} = (l_{1}+l_{2})'b\beta^{*} \qquad \text{in crossing point}$$

$$\beta^{*} \ll l_{1}+l_{2} \rightarrow \sqrt{\beta} = (l_{1}+l_{2})'b\beta^{*} \qquad \text{in crossing point}$$

$$equird less of (l_{2}, l_{2}, l_{2}) = (l_{1}+l_{2})$$

$$Space available 's \quad C_{2} \ll l_{2}$$

$$q_{1} \qquad q_{2} \qquad q_{3} \qquad Freedom af dispersion if$$

$$B_{2} = \frac{l_{1}+l_{3}}{l_{3}/l_{1}+l_{3}} + \binom{l_{1}}{l_{3}} \frac{l_{1}}{l_{3}/l_{1}+l_{3}}$$

13-

in

0.175m

93 = 17.5 - 13.7

$$\chi + \varphi_1 - \varphi_2 - \varphi_3 = 0$$

 $\times (l_1 + l_2 + l_3) + \varphi_1 (l_2 + l_3) - \varphi_2 l_3 = 0.$

BC1

5

| * Dipole | e Fields (T) | 3.5 | 4 | 4.5 | 2 | د.د |
|--------------------------------|--------------|------------|------------|------------|------------|------------|
| β*/β* x v | (m/m) | 1.03/5.46 | 1.05/5.34 | 1.06/5.28 | 1.05/5.30 | 1.23/4.57 |
| β _x /β _y | (m/m) | 321/489 | 294/452 | 277/425 | 268/403 | 268/609 |
| BC1 | (ma×nan×am) | 4000×81×18 | 3750×82×18 | 3500×77×18 | 3250×78×17 | 3750×75×19 |
| QC | (mn×mn×mn) | 2902×49×49 | 2799×47×47 | 2875×44×44 | 2762×45×45 | 3826×45×45 |
| HWQC | (mm) | 80 | 77 | 74 | 74 | 74 |
| B/B _i | (T/T) | 2/2 | 2/2 | 2/2 | 2/2 | 1.4/1.4 |
| BC2 | (mm×mm×mm) | 4000×47×50 | 3750×46×48 | 3500×45×48 | 3250×45×45 | 3750×42×56 |
| Q1 | (mn×mn) | 20×57 | 20×55 | 20×55 | 21×52 | 18×64 |

Remarks.

- 1. The first row (labeled Dipole Fields) gives the dipole field in BCl and BC2 that is necessary for colinear beams ($\alpha = 0 \text{ mrad}$) at Bp = 839.5 Tm.
- 2. The dimensions for BCl, QC and BC2 are given in the format (length × half aperture width × half aperture height). They are compatible with a 6σ emittance of $\overline{\epsilon} = 6 \times 33.2 \times 10^{-6}/30 = 6.64 \times 10^{-6}$ rad-m and with a distance between beam centerlines of 35 cm; operation with unequal species has not been considered.
- 3. Changes in beam size/position for off momentum particles have not been taken into account. It is expected that such momentum dependence will be suppressed in the critical places by the sextupole correction system.
- 4. HwQC represents the half overall width of QC, \hat{B}/B_i the peak field in its aperture and the peak average field in its yoke. This magnet contains a superimposed dipole that is adjusted as function of the crossing angle α to prevent net beam deflection due to beam displacement relative to the magnet's center. The strength of this dipole can be about 0.1 \hat{B} .LQ.
- 5. The half aperture dimensions given for Q are based on a gradient of 55.78 T/m in all cases.
- 6. The last column (3.5T, $\hat{B}/B_i = 1.4/1.4$) shows the consequences of reductions in pole tip field and yoke field in QC. It may also be used as a solution for $B\rho = 1200$ Tm, i.e. $E_{final} = 142.8$ GeV/AMU, E_{final} for protons = 357 GeV, provided that BCl and BC2 are built to sustain 5T and QC to sustain $\hat{B}/B_i = 2T/2T$.