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Developments in the ray-tracing code Zgoubi for 6-D multiturn tracking in FFAG rings

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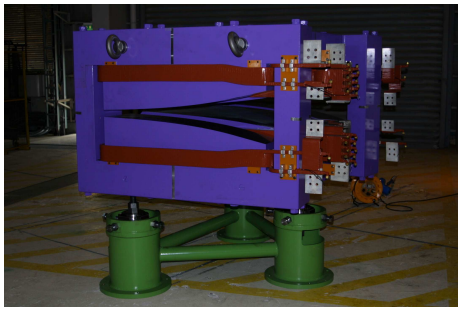
1 Introduction

• The Zgoubi method is based on stewise ray-tracing, and uses an integrator of 6th order in $\triangle s$.
Hence very good symplecticity.
Hence interest in developping further the Zgoubi optics library, for FFAG 6-D tracking simulations.

• FFAG simulations need special elements, like

- sector dipoles with "arbitrary" radial (e.g., non-linear) and axial (e.g., Fringe Fields) dependence of field

$$B_{zi}(r,\theta) = B_{z0,i}\,\mathcal{F}_i(r,\theta)\,\mathcal{R}_i(r)$$



- Scaling FFAG, NC magnets ("`FFAG`" procedure) :
$\mathcal{R}_i(r) = (r/R_{0,i})^{K_i}$
- Scaling FFAG, SC magnets ("`DIPOLES`" procedure) :
$\mathcal{R}_i(r) = b_{0_i} + b_{1_i}(r - R_{0,i})/R_{0,i} + b_{2_i}(r - R_{0,i})^2/R_{0,i}^2 + ...$

- accounting for possible overlapping of fringe fields

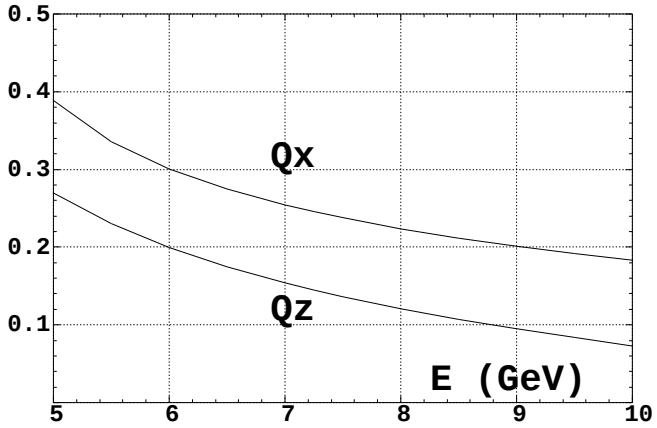
• Linear FFAG use the "`MULTIPOLE`"
Did not necessitate any special developement.

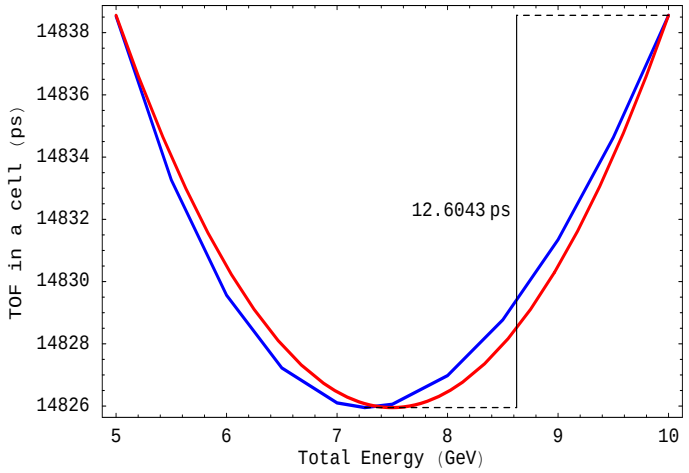
• Isochronous FFAG also uses "`MULTIPOLE`", together with "`DIPOLES''`

During this week transmission simulations have been done in the 5-10 GeV to check the longitudinal emittance growth dependance with the tranvserse dimensions of the beam.

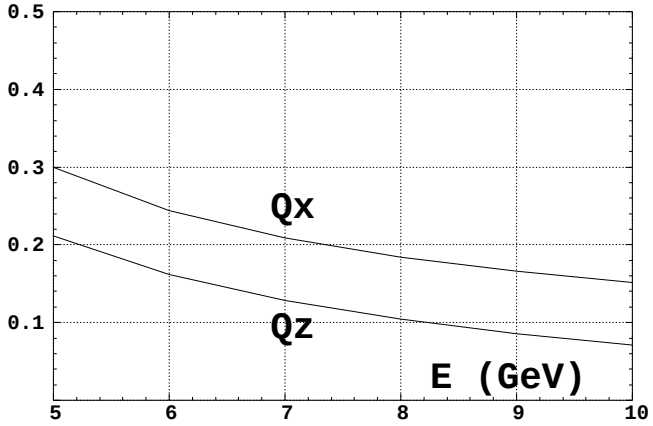
$$\frac{dT}{dJ} = -2\pi p \frac{d\nu}{dE}$$

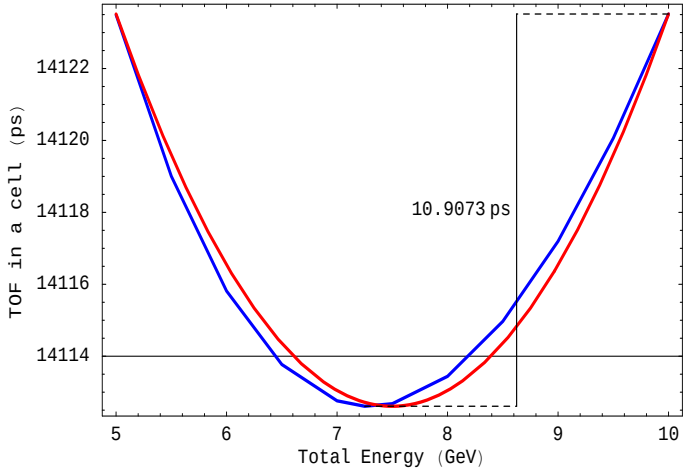
1.1 Original lattice





1.2 Lower tunes lattice

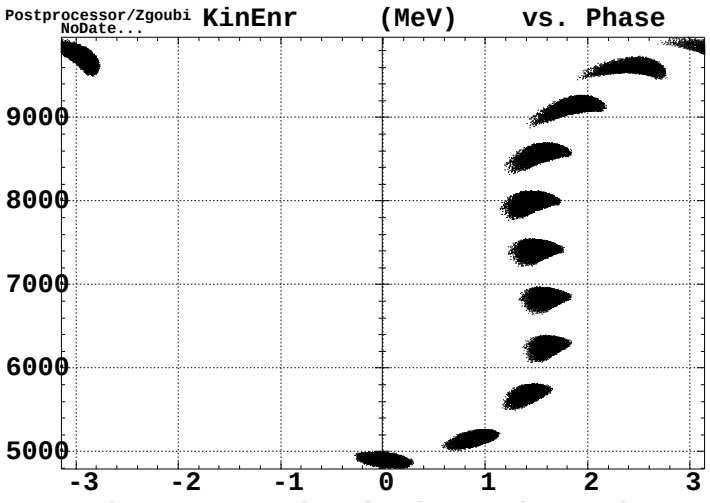




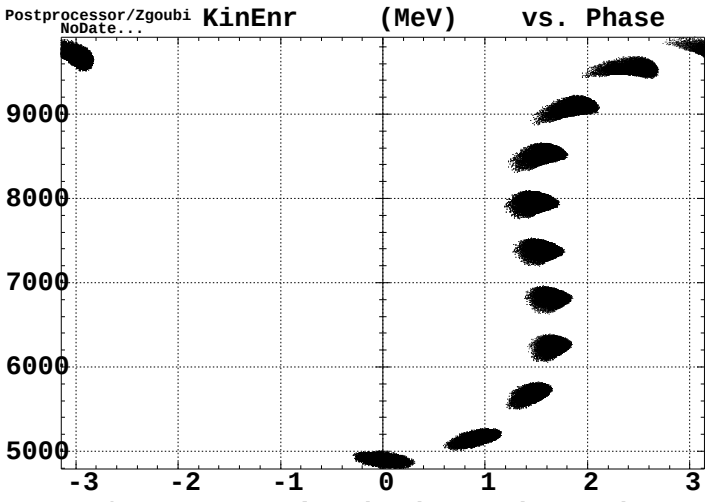
2 Transmission simulations : 5-10 GeV

2.1 Original Lattice

30mm / 0.05 eV.s

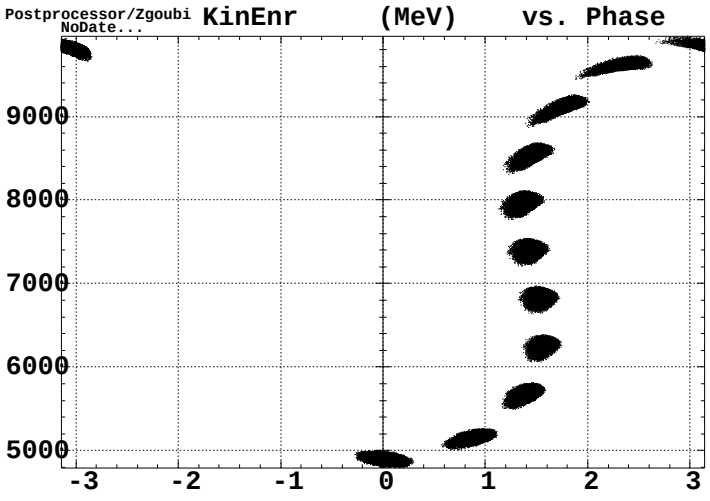


15mm / 0.05 eV.s



2.2 Lower tunes lattices

30mm / 0.05 eV.s



15mm / 0.05 eV.s