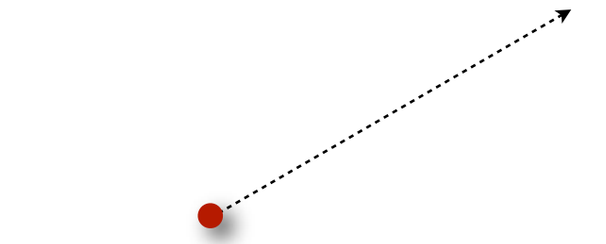
ICE Section meeting
February 9th, 2011

Flat beams in SixTrack

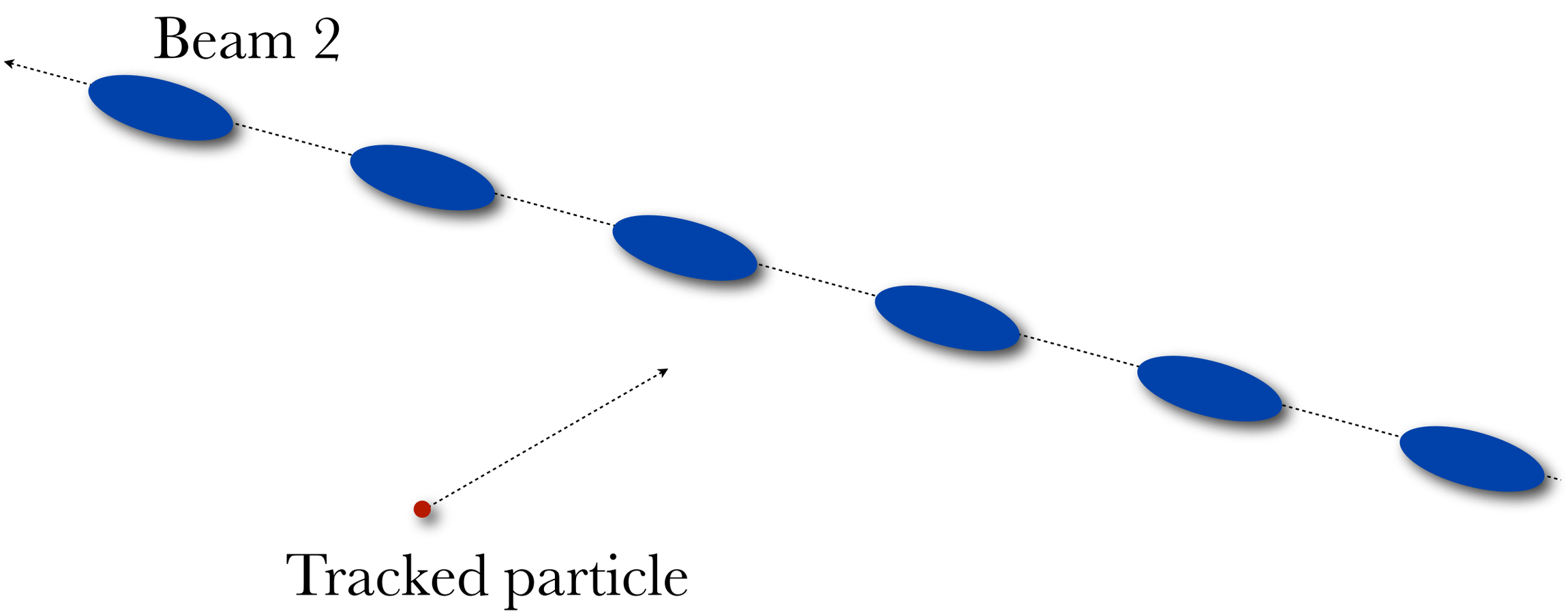
Emanuele Laface

Beam-Beam in SixTrack

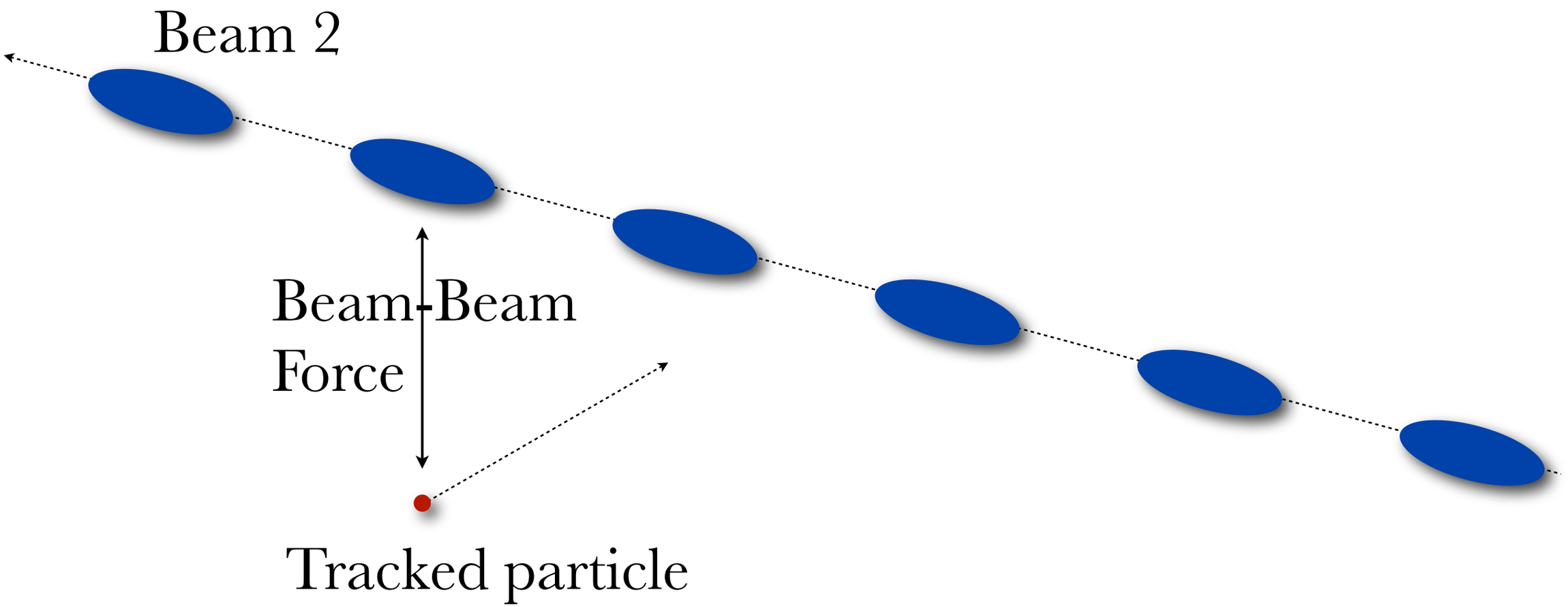


Tracked particle

Beam-Beam in SixTrack



Beam-Beam in SixTrack



Electrical field of a two-dimensional gaussian charge

$$E_x = \frac{Q}{2\epsilon_0\sqrt{2\pi({\sigma_x}^2-{\sigma_y}^2)}}\Im\left(\mathrm{Errf}\left(\frac{\mathrm{x}+\mathrm{iy}}{\sqrt{2({\sigma_\mathrm{x}}^2-{\sigma_\mathrm{y}}^2)}}\right)-\mathrm{e}^{-\frac{\mathrm{x}^2}{2{\sigma_\mathrm{x}}^2}+\frac{\mathrm{y}^2}{2{\sigma_\mathrm{y}}^2}}\mathrm{Errf}\left(\frac{\mathrm{x}\frac{\sigma_\mathrm{y}}{\sigma_\mathrm{x}}+\mathrm{iy}\frac{\sigma_\mathrm{x}}{\sigma_\mathrm{y}}}{\sqrt{2({\sigma_\mathrm{x}}^2-{\sigma_\mathrm{y}}^2)}}\right)\right)$$

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M. Bassetti and G.A. Erskine
“Closed expression for the electrical field of a two-dimensional gaussian charge”
CERN-ISR-TH/80-06

Electrical field of a two-dimensional gaussian charge

this formula is already implemented in SixTrack

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(actually Beam 2 does not exists for SixTrack).

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A problem of this approach is that SixTrack expects the sigmas as functions of the coupled β functions (β_{11},β_{12}...) while MadX evaluates the sigmas in the decoupled case. For the purpose of the LHC (and the upgrade) the linear coupling is small and the approximation can work.

In practice what is new

When the "sixtrack" command is invoked in MadX the fc.2 propose now three additional columns: σ_x, σ_y and σ_s (not used).

To read these three additional columns in SixTrack, the flag lhc, in the section BEAM of the fort.3 file, must be set equal to 2.
(lhc=0 is for symmetric optics, lhc=1 is for anti-symmetric optics and lhc=2 is for "read from file").

Tests performed

I verified that the parameters are loaded correctly.

I tracked an optics with round beams loading the parameters and computing it with SixTrack and I obtained the same results.

I compared the tunes of MadX and SixTrack with a flat beams optics and I obtain the same values.

I did a basic tracking with MadX and SixTrack and the results are the same.