

# **6D Beam-Beam SixTrack Implementation in a Crab Crossing Scenario**

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# Reference Systems in 6D BB SixTrack

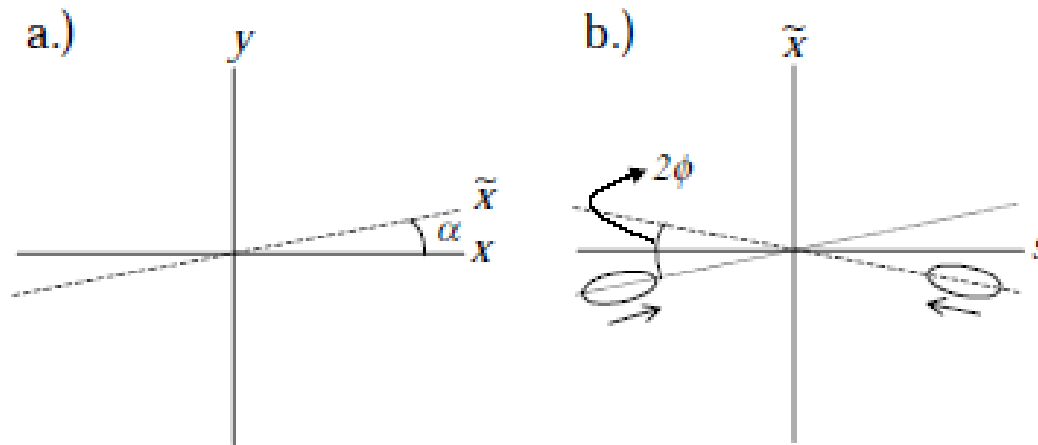


FIG. 1. (a) defines the crossing plane angle  $\alpha$  in the  $(x-y)$  plane and (b) depicts the total crossing angle  $2\phi$  in the  $(\tilde{x}-s)$  plane.

Typically  $\alpha = \pi/2$  at ATLAS and  $\alpha = 0$  at CMS. Values for ALICE and LHCb?

And  $\phi$  is the half crossing angle for each IP.

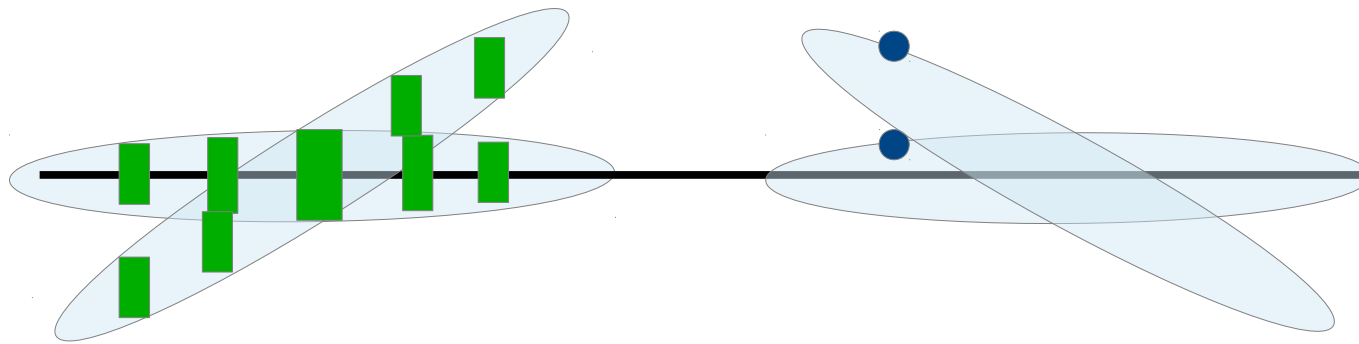
# Lorentz Boost in 6D BB SixTrack

$$\begin{pmatrix} 1/\cos\phi & -\cos\alpha \sin\phi & -\tan\phi \sin\phi & -\sin\alpha \sin\phi \\ -\cos\alpha \tan\phi & 1 & \cos\alpha \tan\phi & 0 \\ 0 & -\cos\alpha \sin\phi & \cos\phi & -\sin\alpha \sin\phi \\ -\sin\alpha \tan\phi & 0 & \sin\alpha \tan\phi & 1 \end{pmatrix}$$

Now includes as well the crossing plane  $\alpha$ . No need to change this part for crab collision.

Test particle will see the effect of the CC in the tracking itself.

# Slicing strong beam in 6D SixTrack



$$\begin{aligned}
 X^\dagger &= Z^\dagger \cos\alpha \sin\phi, & P_X^\dagger &= 0, & Y^\dagger &= Z^\dagger \sin\alpha \sin\phi, & P_Y^\dagger &= 0, & P_Z^\dagger &= 0, \\
 \Sigma_{11}^\dagger &= \Sigma_{11}, & \Sigma_{22}^\dagger &= \frac{1}{\cos^2\phi} \Sigma_{22}, & \Sigma_{33}^\dagger &= \Sigma_{33}, & \Sigma_{44}^\dagger &= \frac{1}{\cos^2\phi} \Sigma_{44}, & \Sigma_{12}^\dagger &= \frac{1}{\cos\phi} \Sigma_{12}, & (2.42) \\
 \Sigma_{13}^\dagger &= \Sigma_{13}, & \Sigma_{14}^\dagger &= \frac{1}{\cos\phi} \Sigma_{14}, & \Sigma_{23}^\dagger &= \frac{1}{\cos\phi} \Sigma_{23}, & \Sigma_{24}^\dagger &= \frac{1}{\cos^2\phi} \Sigma_{24}, & \Sigma_{34}^\dagger &= \frac{1}{\cos\phi} \Sigma_{34}.
 \end{aligned}$$

Here it is where the changes should be done to allow crab collision. In order to have head on strong bunch collision  $\varphi=0$ .  
 There is the possibility of defining two  $\varphi$ :  $\varphi_1$  for the change of reference system and  $\varphi_2$  for the tilting of the strong beam.