

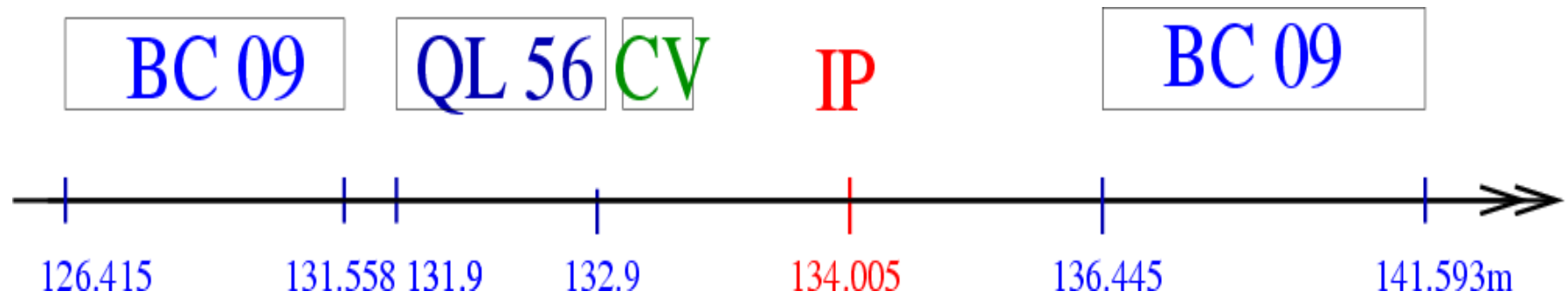
Description of the electron beam

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1. Beam line
2. Divergence of the electron beam

A lot of thanks to Blanka & Uwe

Beam line



Matix Elements

Quadrupol QL 56

Drifft Space

$$M_{QL56} = \begin{cases} \begin{pmatrix} \cos\Omega & \frac{1}{\sqrt{|k|}}\sin\Omega \\ -\sqrt{|k|}\sin\Omega & \cos\Omega \end{pmatrix} & \text{focusing} - y \\ \begin{pmatrix} \cosh\Omega & \frac{1}{\sqrt{|k|}}\sinh\Omega \\ \sqrt{|k|}\sinh\Omega & \cosh\Omega \end{pmatrix} & \text{defocusing} - x \end{cases}$$

$$M_{drift} = \begin{cases} \begin{pmatrix} 1 & s \\ 0 & 1 \end{pmatrix} & y \\ \begin{pmatrix} 1 & s \\ 0 & 1 \end{pmatrix} & x \end{cases}$$

where $\Omega = \sqrt{|k|}s$

$$\text{Dipole BC 09} \quad M_{dipole} = \begin{cases} \begin{pmatrix} \cos\frac{s}{R} & R\sin\frac{s}{R} \\ -\frac{1}{R}\sin\frac{s}{R} & \cos\frac{s}{R} \end{pmatrix} & y \\ \begin{pmatrix} 1 & s \\ 0 & 1 \end{pmatrix} & x \end{cases}$$

Twist parameters

Twist parameters for the electron beam

β – amplitude function

α – twist parameter

$$\gamma = \sqrt{(1 + \alpha^2)/\beta}$$

$\alpha\alpha\beta\beta\gamma$

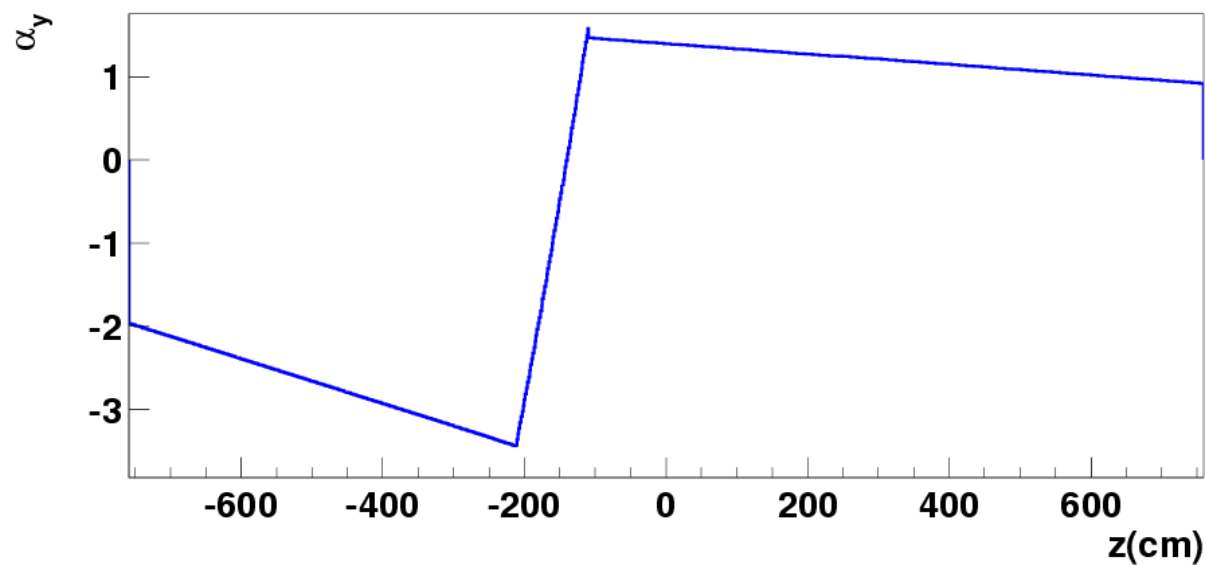
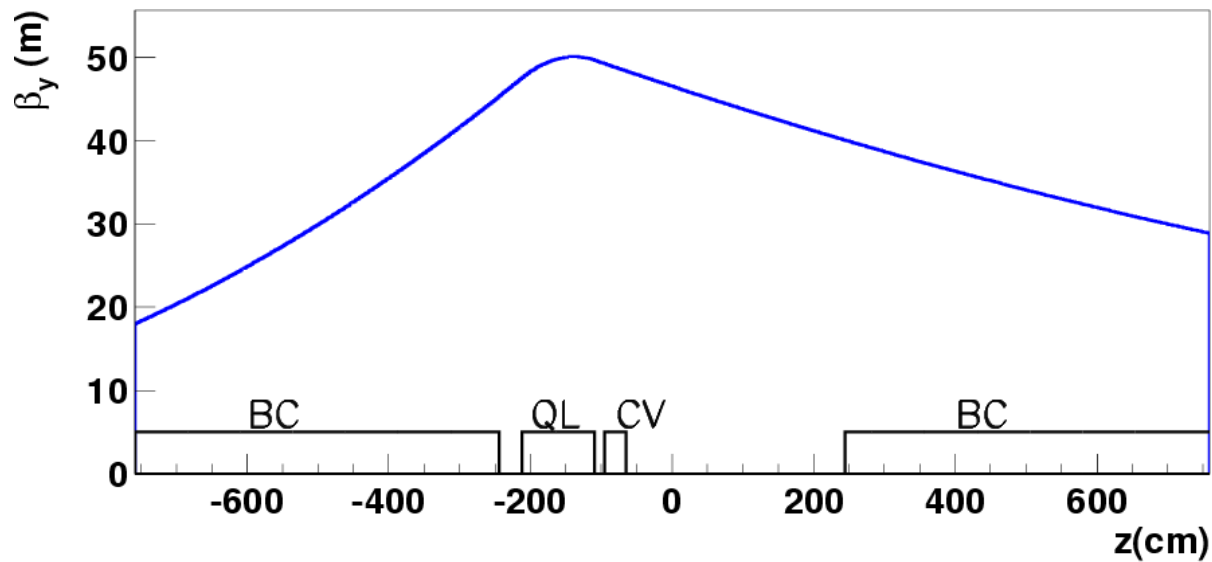
$$M = \begin{pmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \end{pmatrix}$$

$$\beta = m_{11}^2\beta_0 - 2m_{12}m_{11}\alpha_0 + m_{12}^2\gamma_0$$

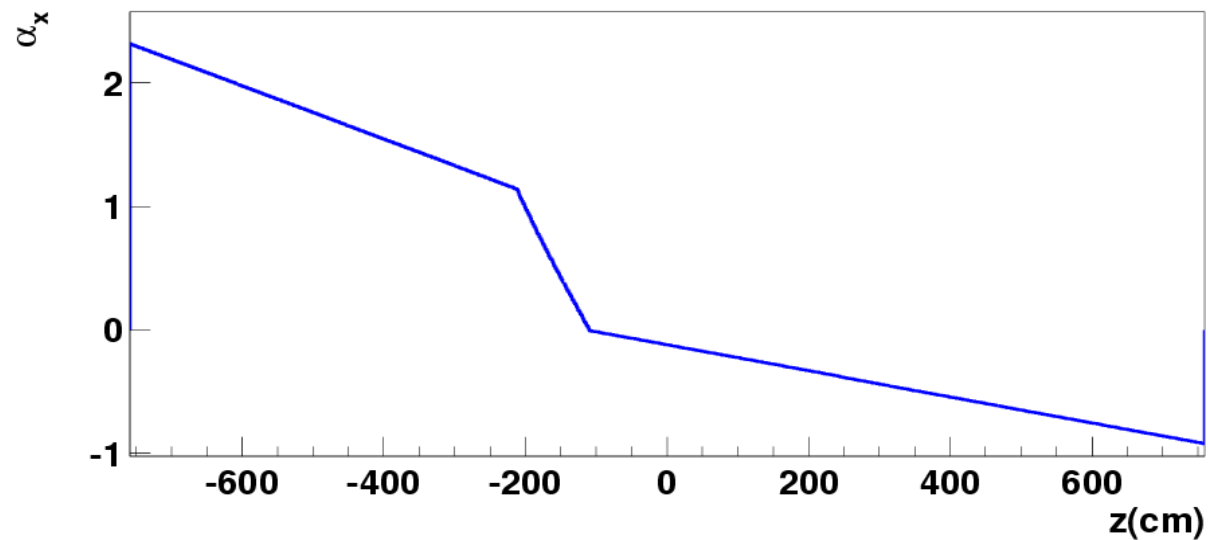
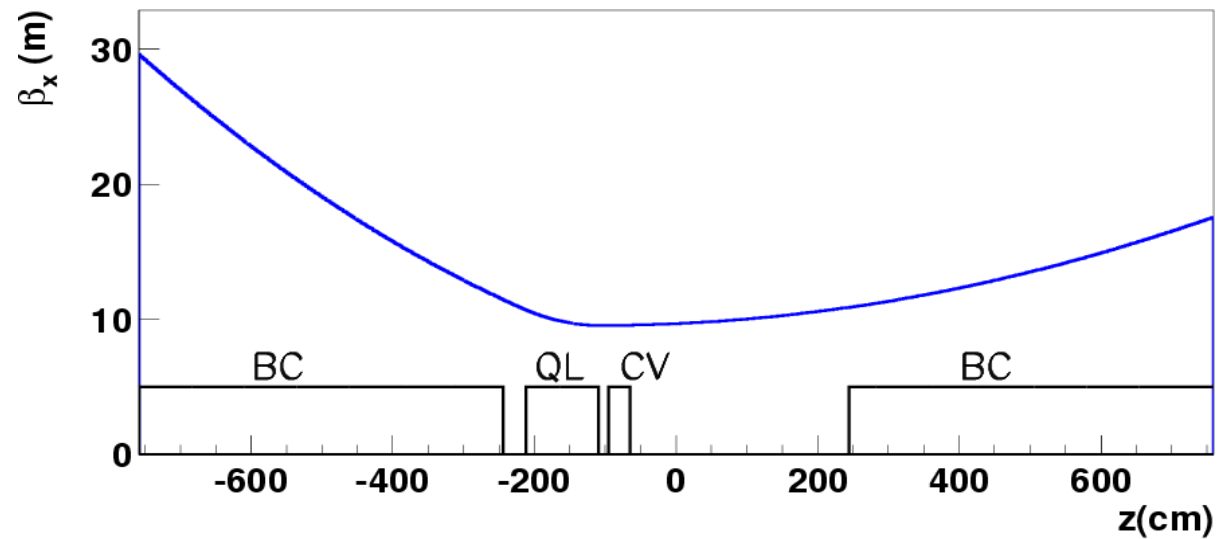
$$\alpha = -m_{21}m_{11}\beta_0 + (m_{22}m_{11} + m_{12}m_{21})\alpha_0 - m_{22}m_{12}\gamma_0$$

$$\gamma = m_{21}^2\beta_0 - 2m_{22}m_{21}\alpha_0 + m_{22}^2\gamma_0$$

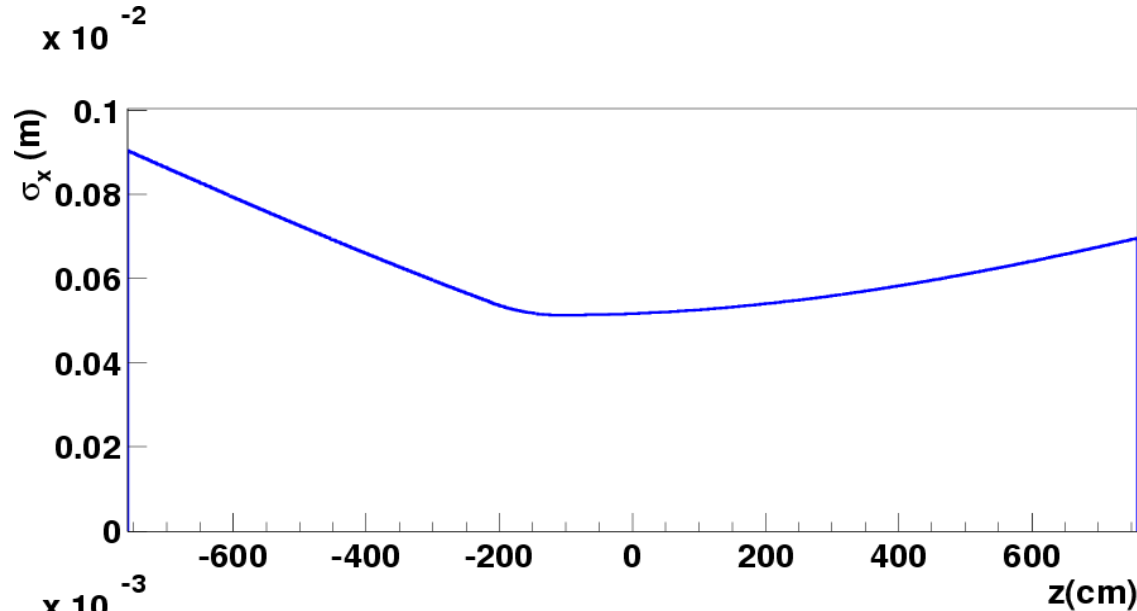
Beam parameters – y



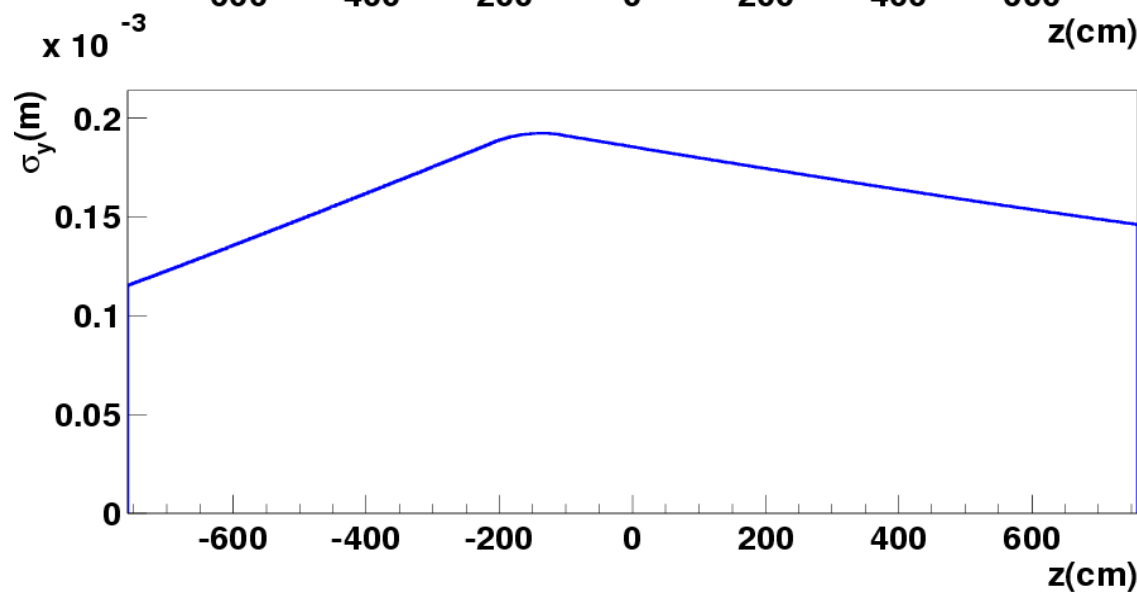
Beam parameters – x



The size of the electron beam

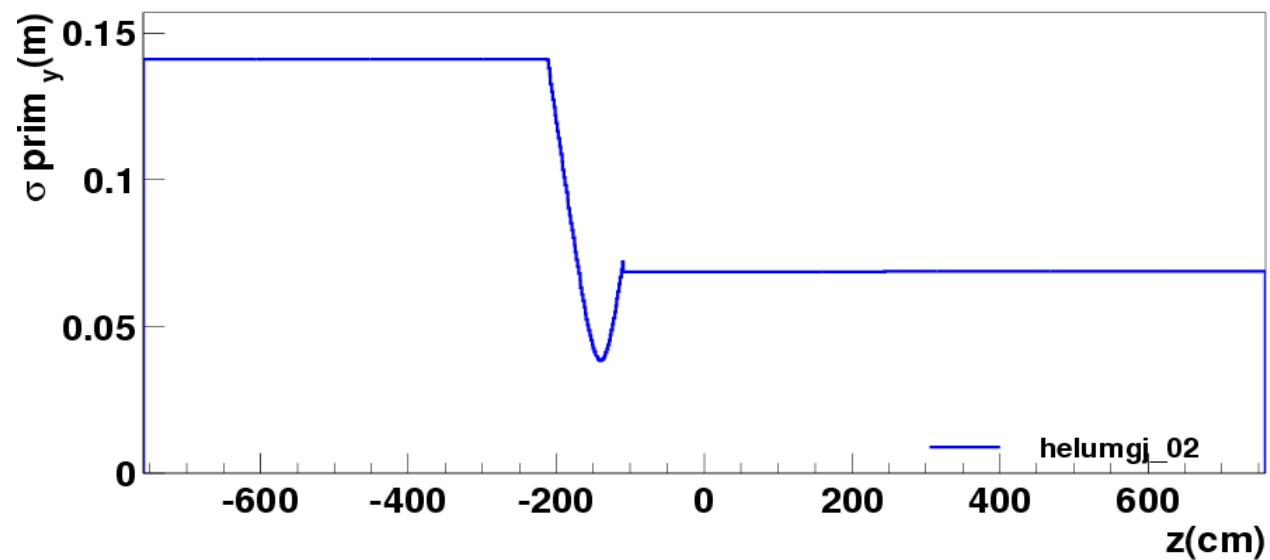
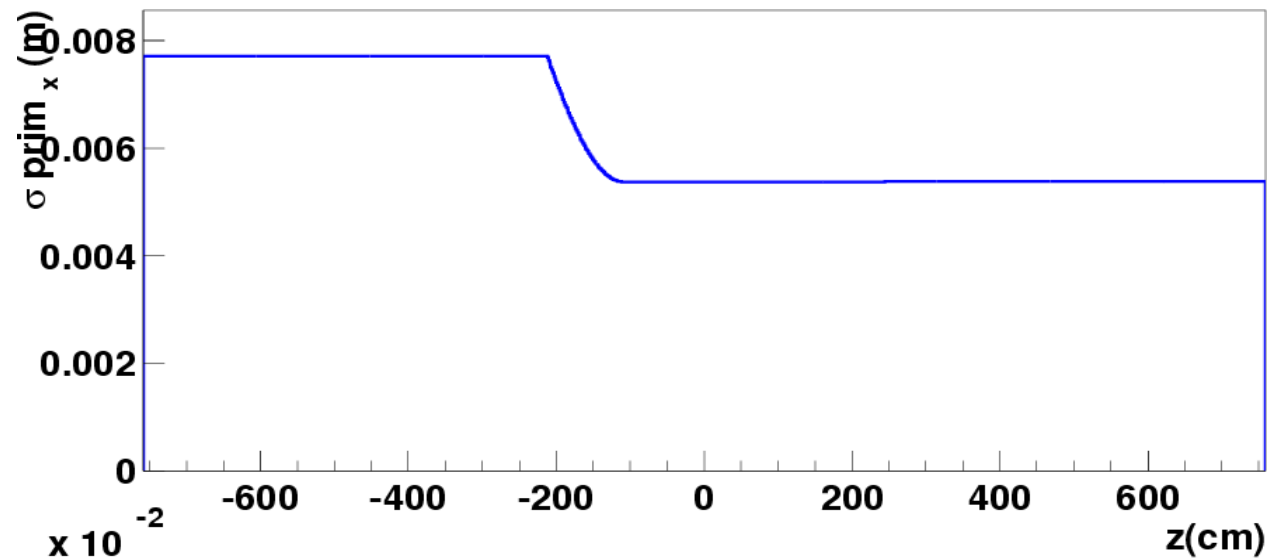


$$\begin{aligned}\sigma_{e,y}(0) &= \sqrt{\epsilon_y \beta_y(0)}, \\ \sigma_{e,y}(z) &= \sqrt{\epsilon_y \beta_y(z)} \\ &= \sqrt{\epsilon_y} \sqrt{\beta_y(0) - 2\alpha_y(0)z + \gamma_y(0)z^2}.\end{aligned}$$

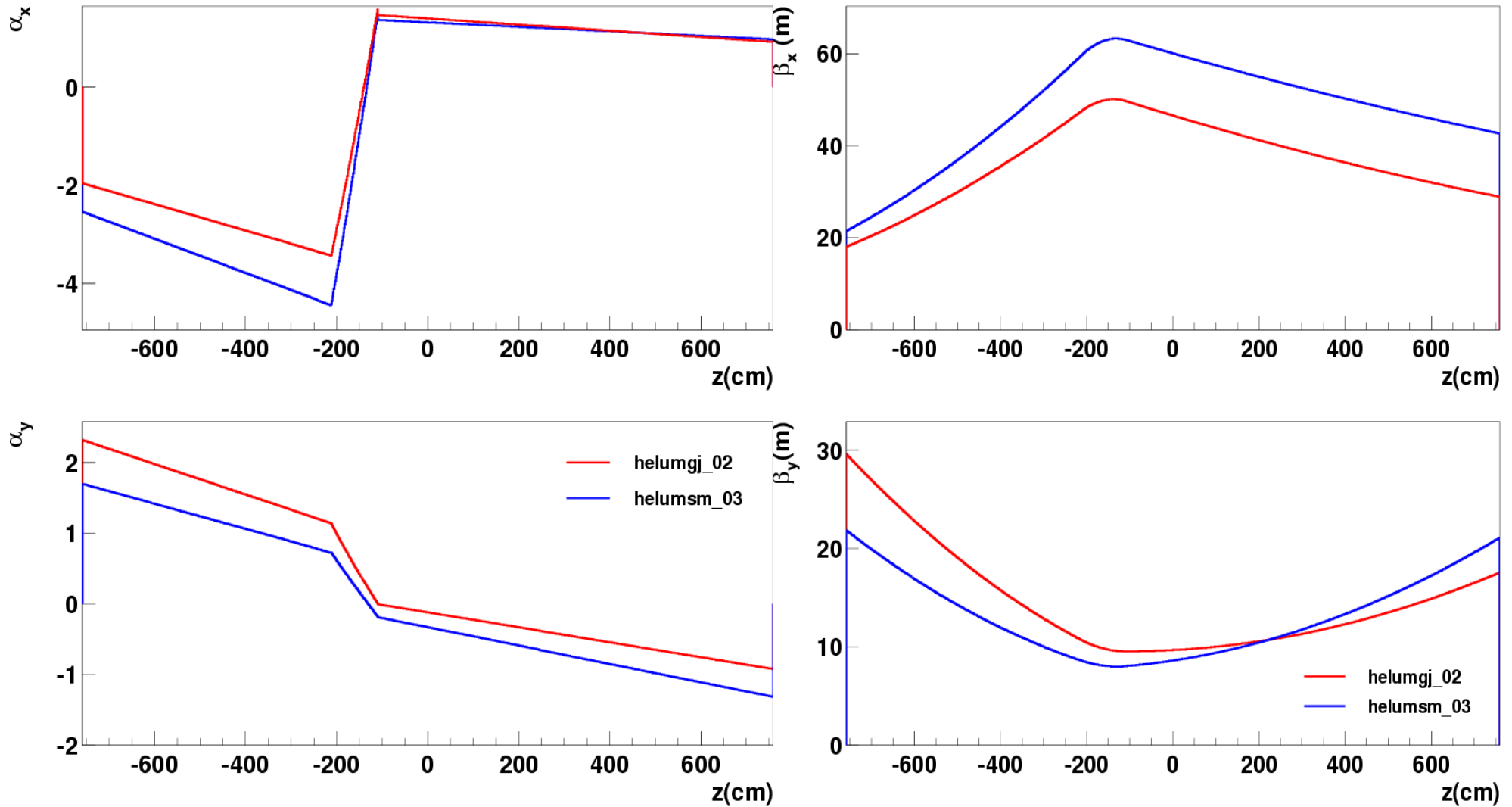


$\epsilon_{y,x}$ - emittance vertical/ horizontal

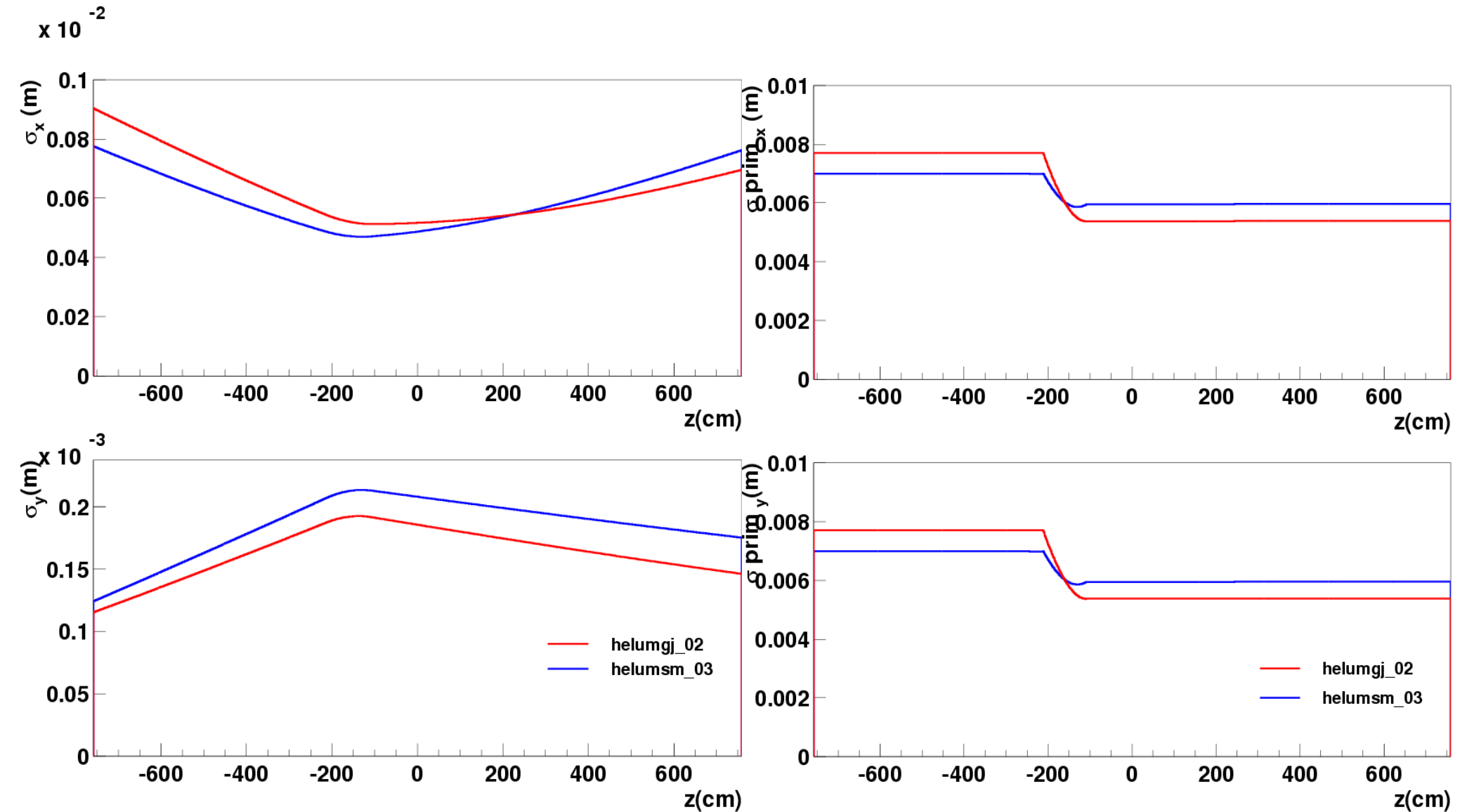
Widths sigma'



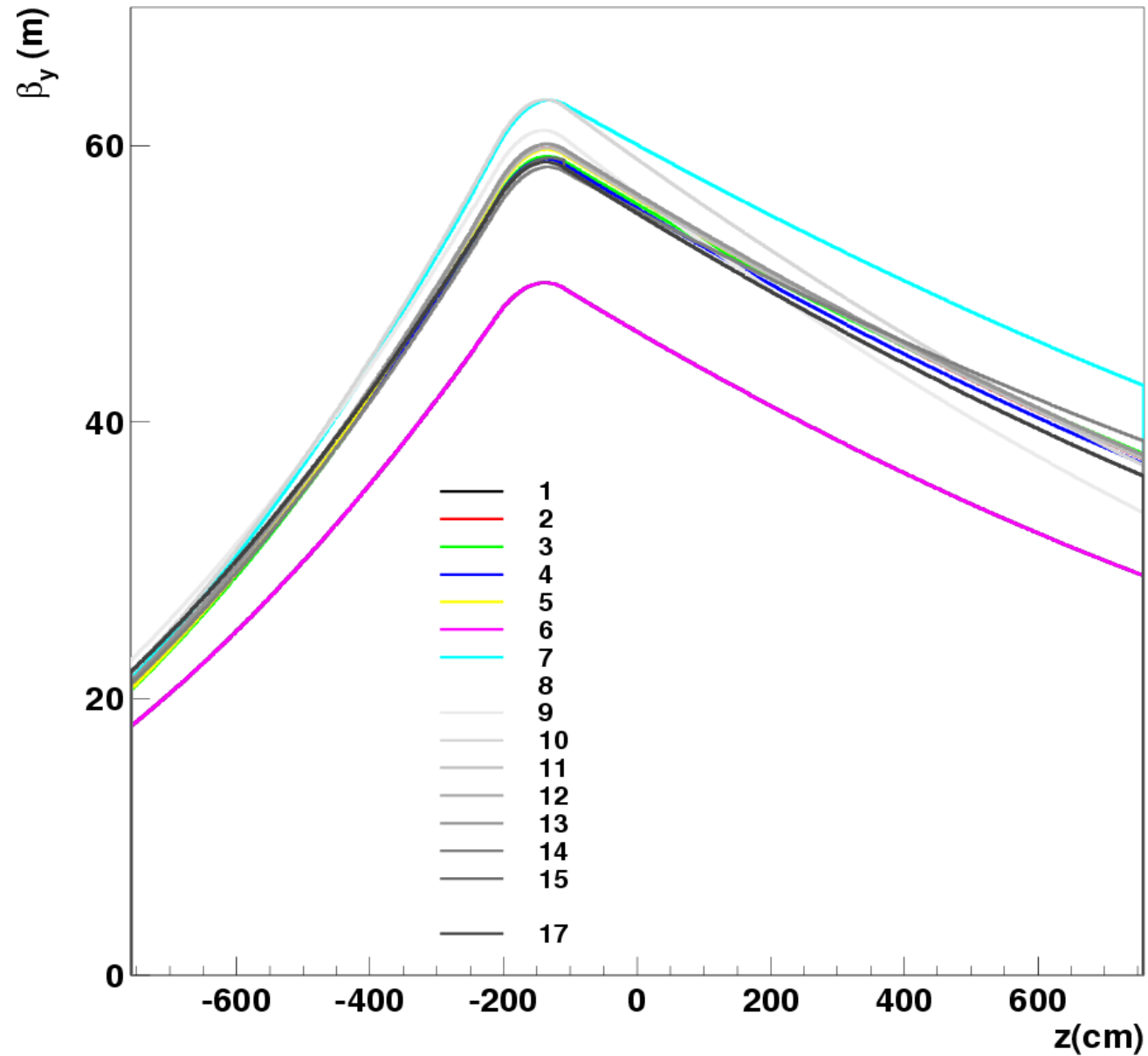
Comparison for two different samples



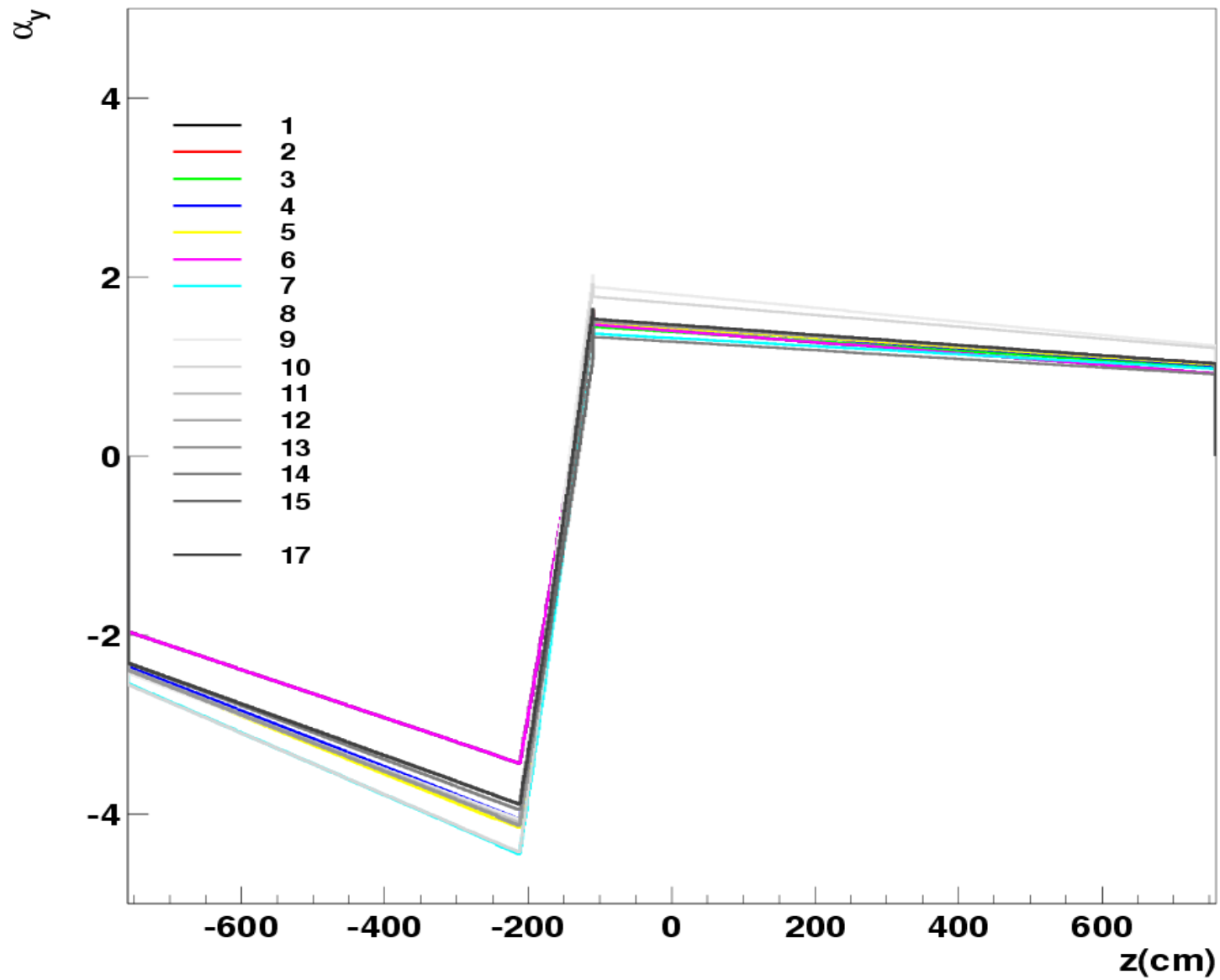
Comparison for two different samples



All optics - β_y



All optics - αy



Summary

Twist parameters have been calculated

Next step:

- calculate real behavior of beam