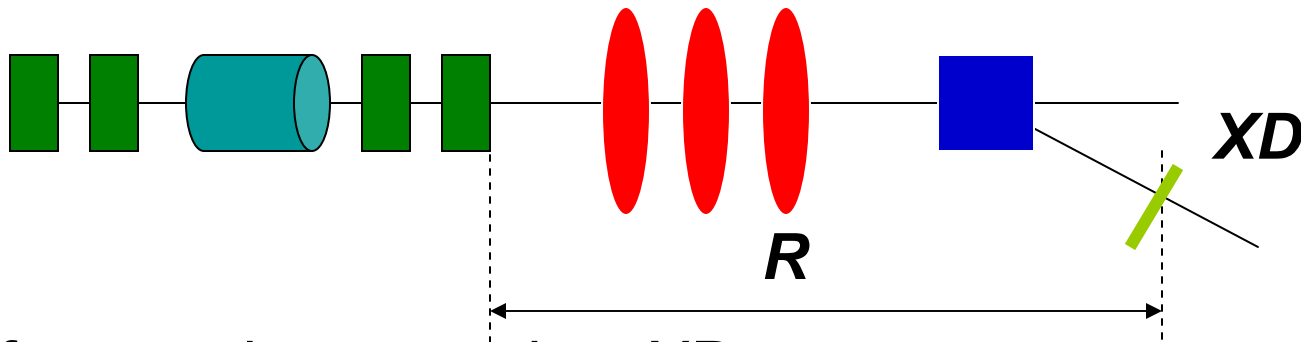


# Correlation measurement (just some thoughts...)

P2, Feb 21<sup>st</sup>, 2008

Side view of the exchanger



Matrix from exchanger exit to XD

$$\mathbf{R} = \begin{pmatrix} \mathbf{R}_{xx'} & 0 & 0 \\ 0 & \mathbf{R}_{yy'} & \mathbf{R}_{y\delta} \\ 0 & \mathbf{R}_{\delta y'} & \mathbf{R}_{z\delta} \end{pmatrix}$$

Each electron map accordingly to

$$\mathbf{x} = \mathbf{R}_{xx',11} \mathbf{x}_0 + \mathbf{R}_{xx',12} \mathbf{x}'_0$$

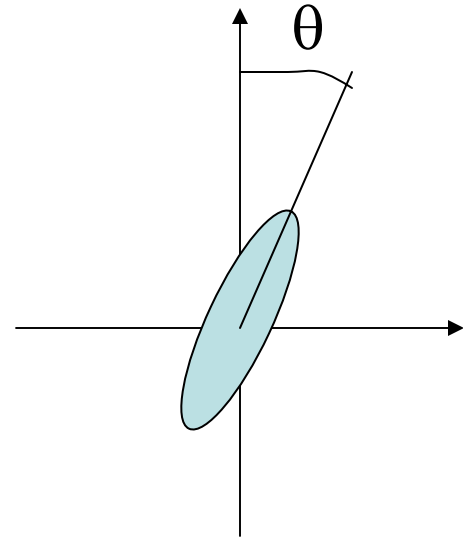
$$\mathbf{y} = \mathbf{R}_{yy',11} \mathbf{y}_0 + \mathbf{R}_{yy',12} \mathbf{y}'_0 + \eta_y \delta_0$$

x-y correlation on the XD is a measure of the coupling between  $\mathbf{x}_0$  and  $\delta_0$

$$\langle \mathbf{xy} \rangle = \eta_y \left[ \mathbf{R}_{xx',11} \langle \mathbf{x}_0 \delta_0 \rangle + \mathbf{R}_{xx',12} \langle \mathbf{x}'_0 \delta_0 \rangle \right]$$

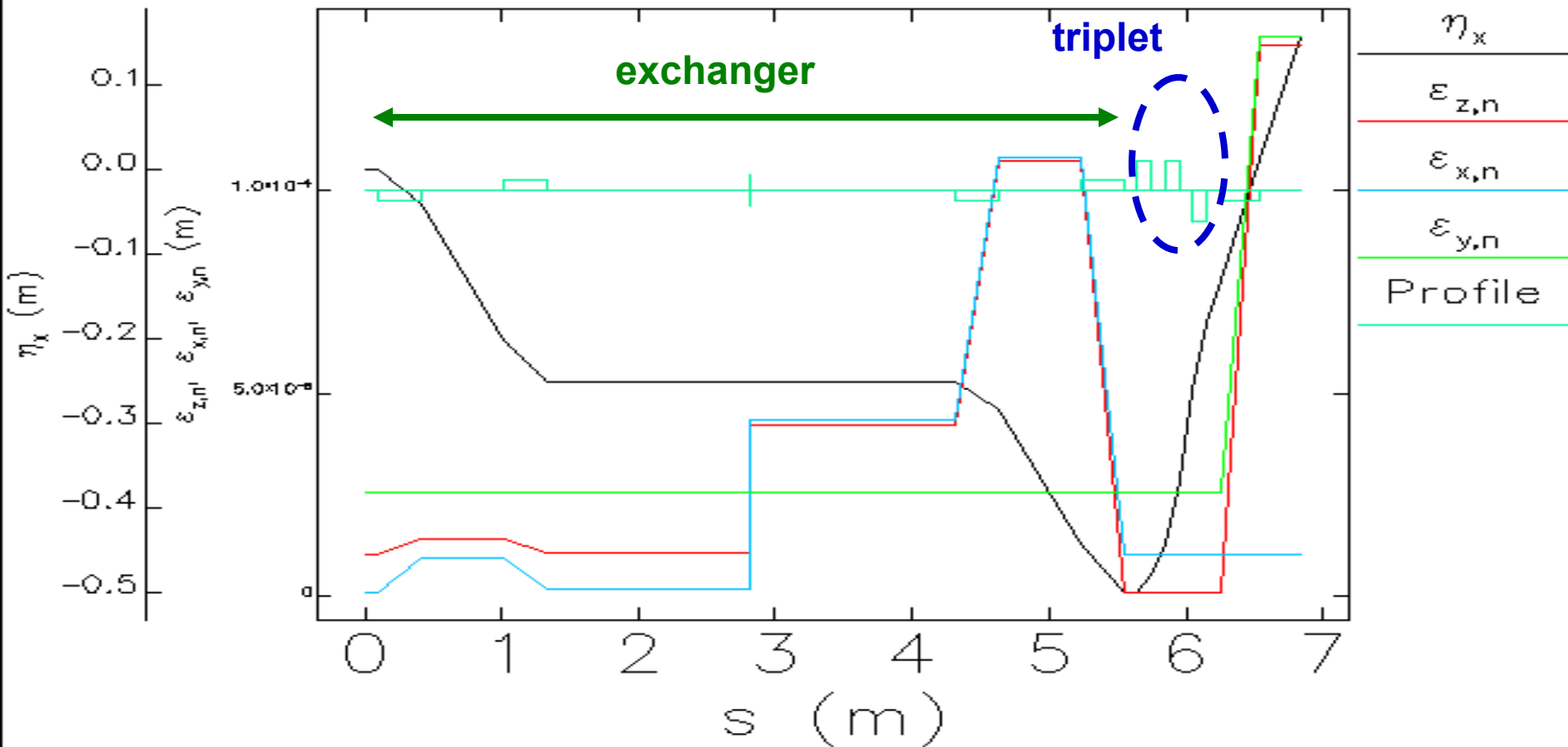
Correlation can be directly (statistically) computed from the digitized image or from the angle

$$\tan \theta = \frac{\langle \mathbf{xy} \rangle}{\langle \mathbf{x}^2 \rangle}$$

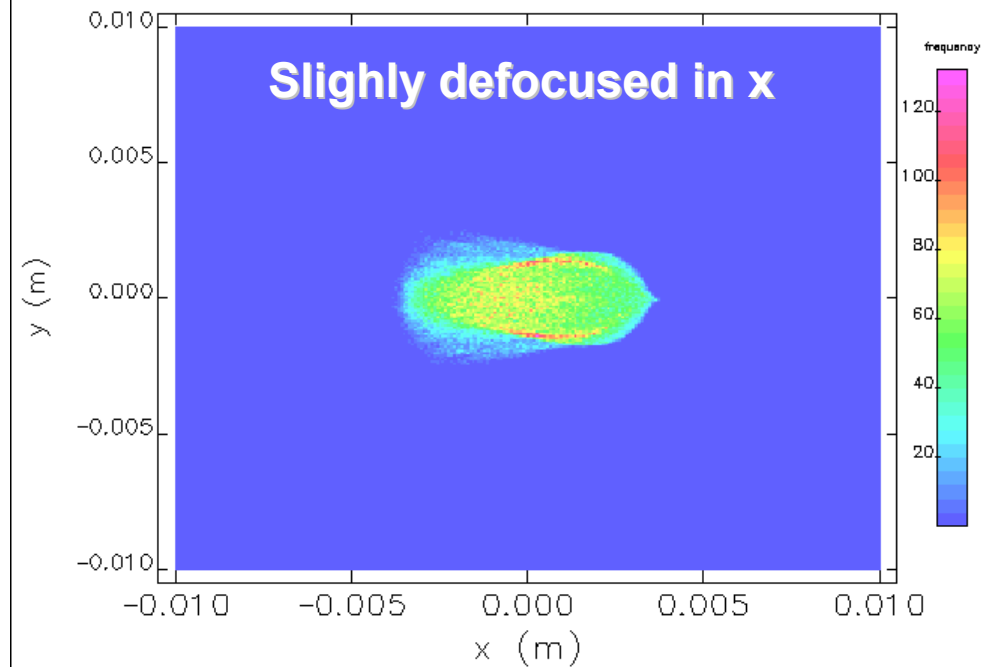
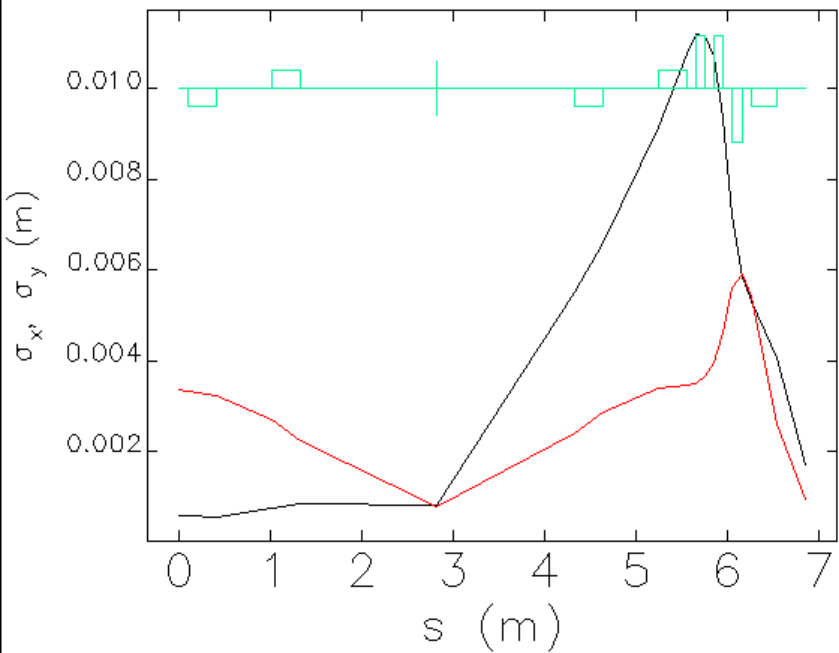
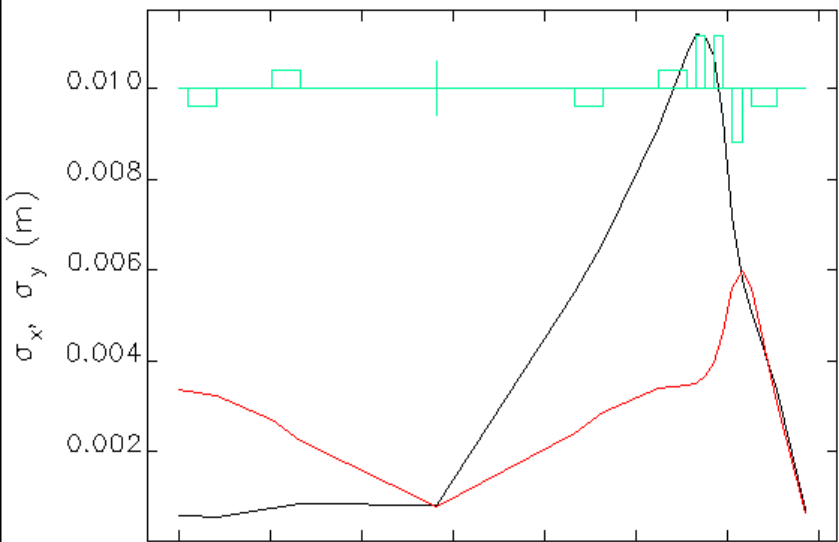


# A “real” example...

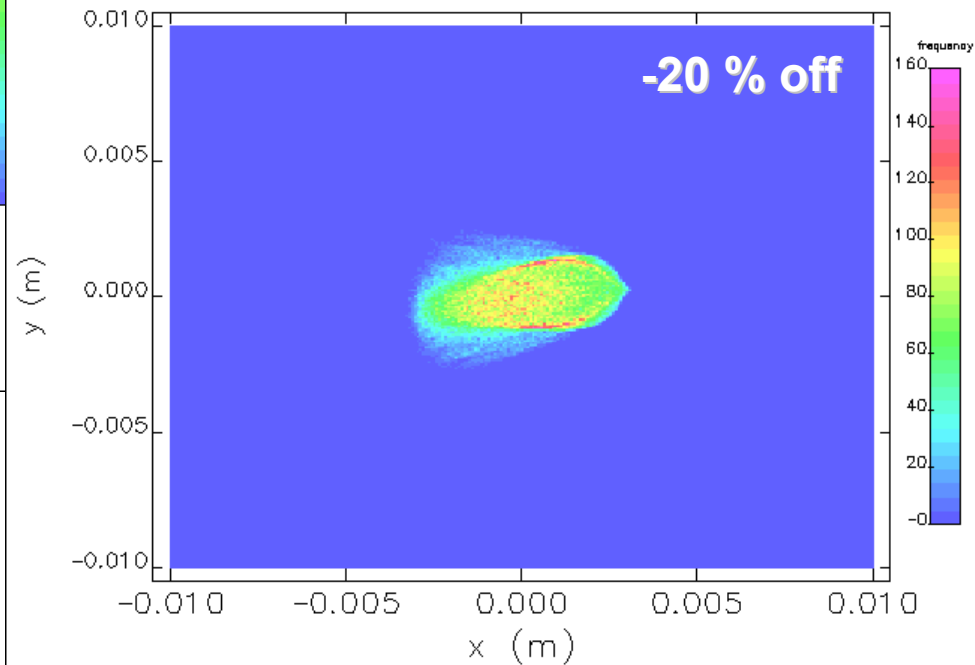
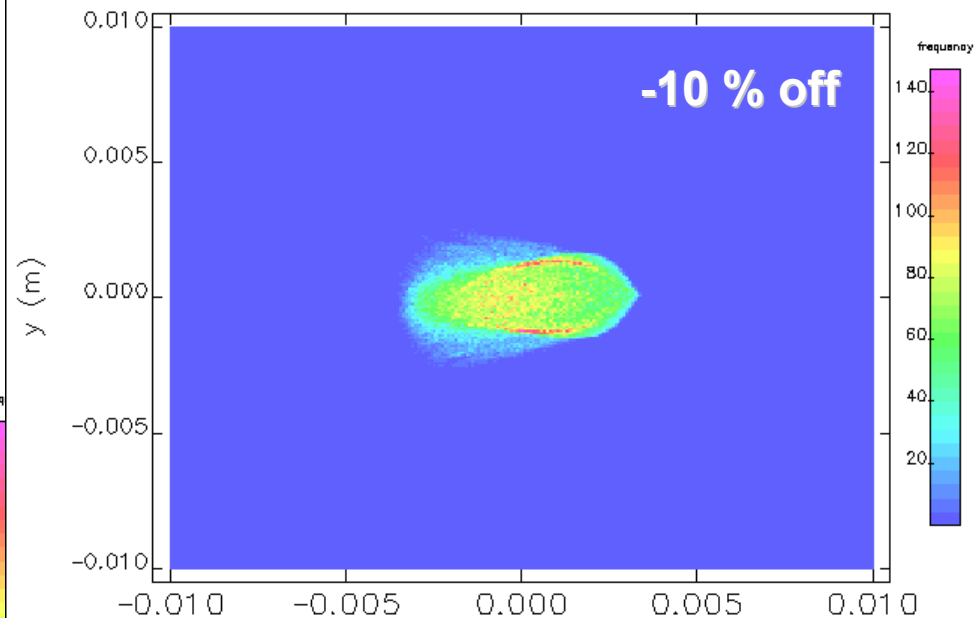
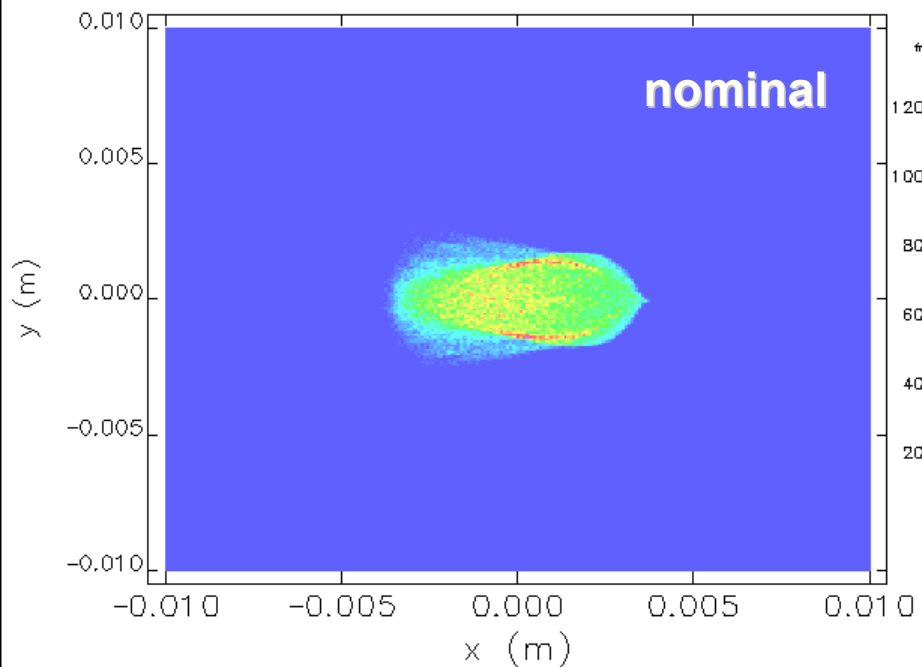
- Simplified example, took Marwan’s phase space distribution, track it through AWA exchanger, added a triplet and a vertical spectrometer
- Did not (forgot) to optimize the  $z$ - $\delta$  chirp



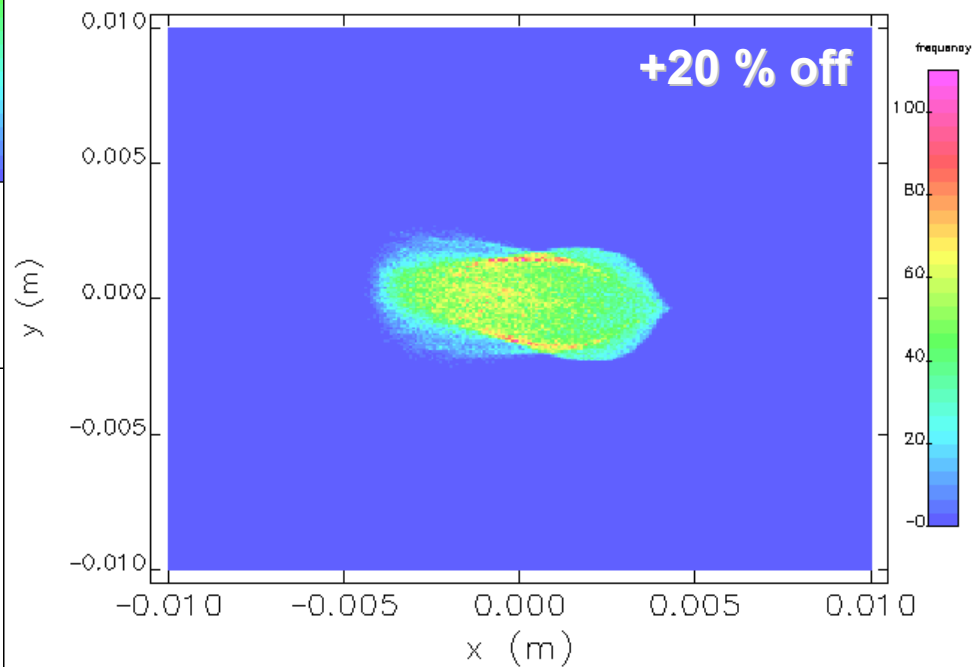
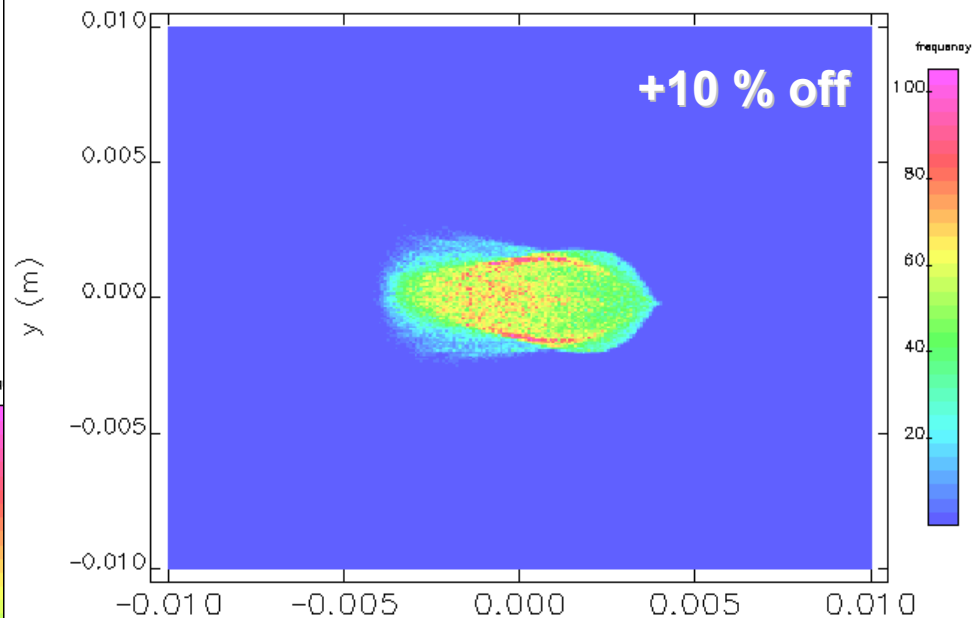
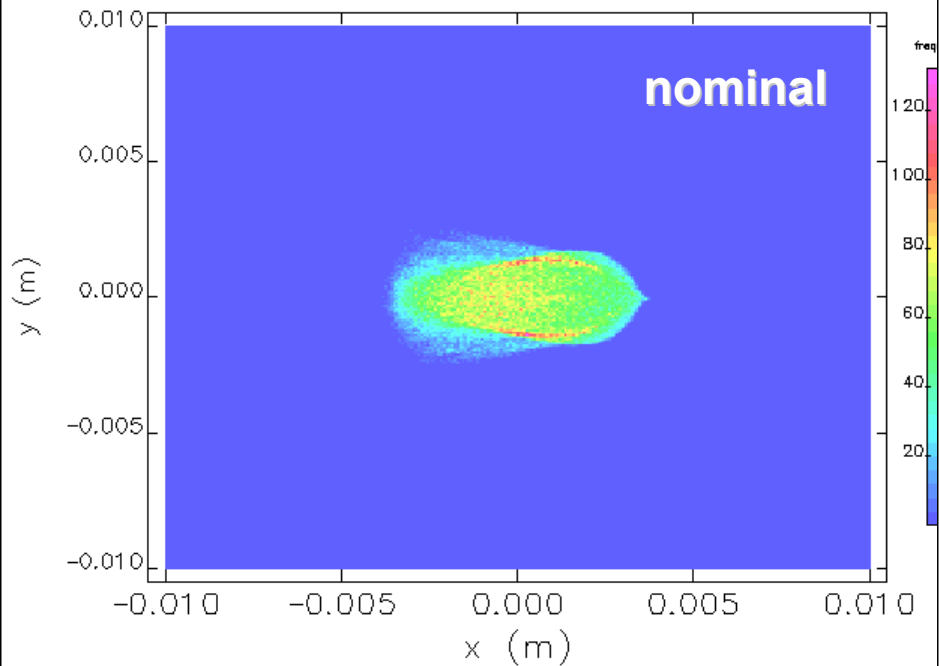
# Setting-up the beam in the spectrometer...



# Sensitivity on cavity voltage (I)



# Sensitivity on cavity voltage (II)



# Summary

- The  $XD$  screen can provide information on the correlation between ( $x$  and  $\delta$ ) and ( $x'$  and  $\delta$ )
- Can be used to tune the deflecting cavity voltage (and probably phase) to insure the beam matrix out of the exchange is uncoupled...
- For a given cavity voltage one can do a quad scan (vary  $R_{xx'11}$  and  $R_{xx'12}$ ) from several measurement of  $\langle xy \rangle$  one could in principle obtain the exact value of the  $\langle x_0 \delta_0 \rangle$  and  $\langle x'_0 \delta_0 \rangle$  correlation