Estimating the effects from non-linearities in the ATF extraction line

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31 May 2007

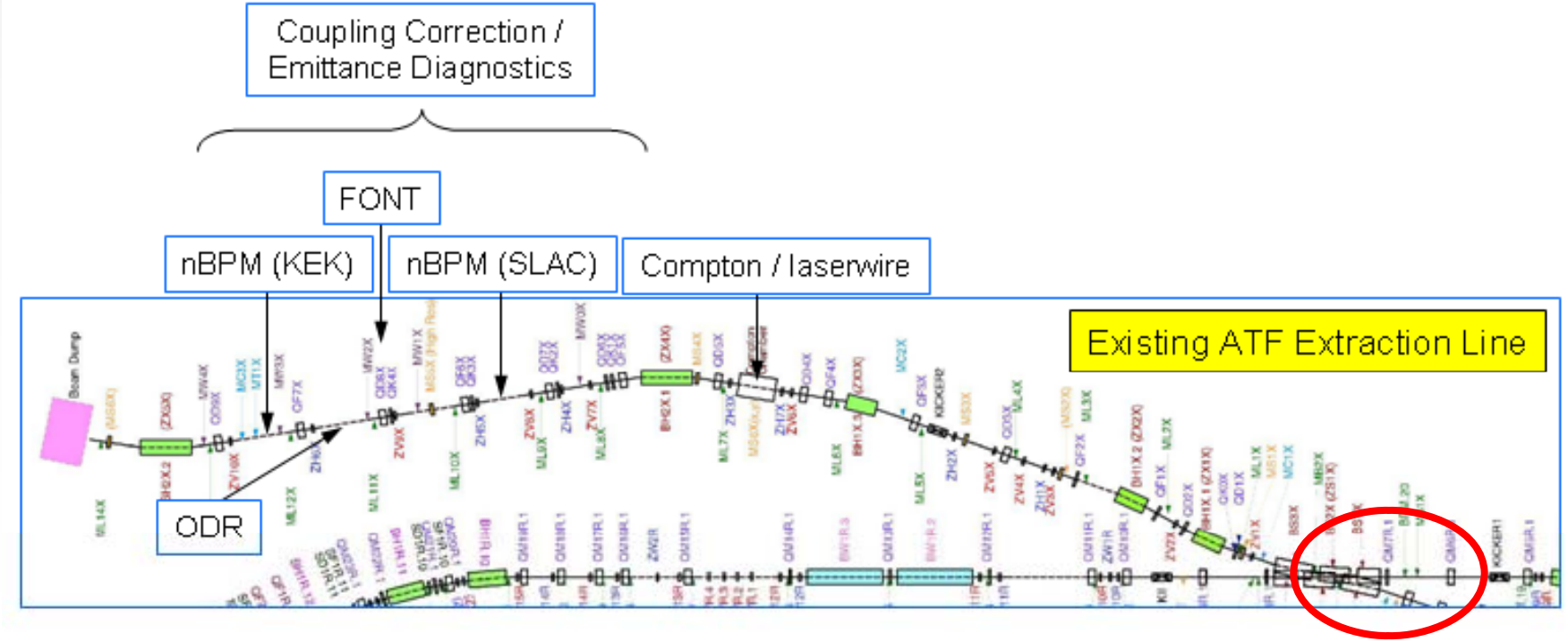
On-going work

Tracking studies in the ATF Extraction Line:

- Using MADX and MAD8

- Introducing multipole components for the septum and the quadrupole QM7 (from C. Spencer)

to estimate the impact on the emittance of the beam.



MADX-PTC (Polymorphic Tracking Code)

Given the transfer map from one location of the accelerator to another one in the form:

$$x_{final} = \Sigma x_{jklmn} x^j p_x^k y^l p_m^y \delta^n$$

and given the particle density at the given location,
The r.m.s. beam size is given by:

$$\sigma^2_{final} = \Sigma x_{jklmn} x_{j'k'l'm'n'} \int x^{j+j'} p_x^{k+k'} y^{l+l'} p_y^{m+m'} \delta^{n+n'} \rho dv$$

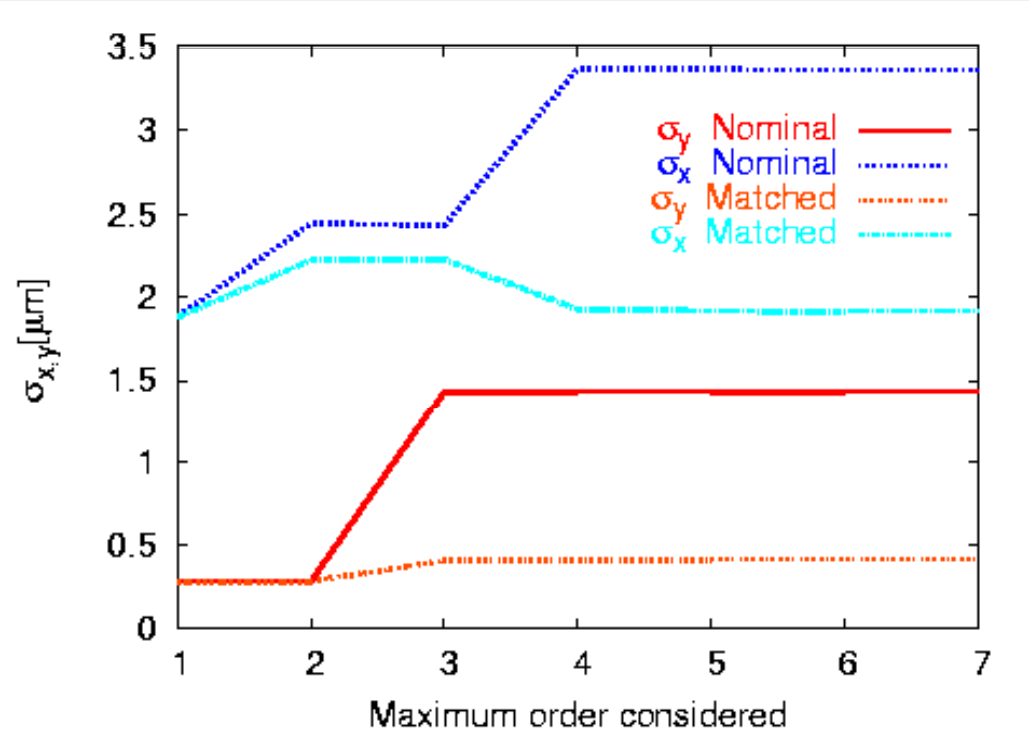
The integral is performed depending on ρ and the x_{jklmn} are obtained to **arbitrary order from MADX-PTC***

*R. Tomás, Non-linear optimization of the BDS using MADX-PTC, EUROTeV CLIC Beam Dynamics meeting, February 2006.

MADX-PTC (Polymorphic Tracking Code)

Obtaining the contributions to the beam size from each order with MADX-PTC

Example for the non-linear collimation system for CLIC*

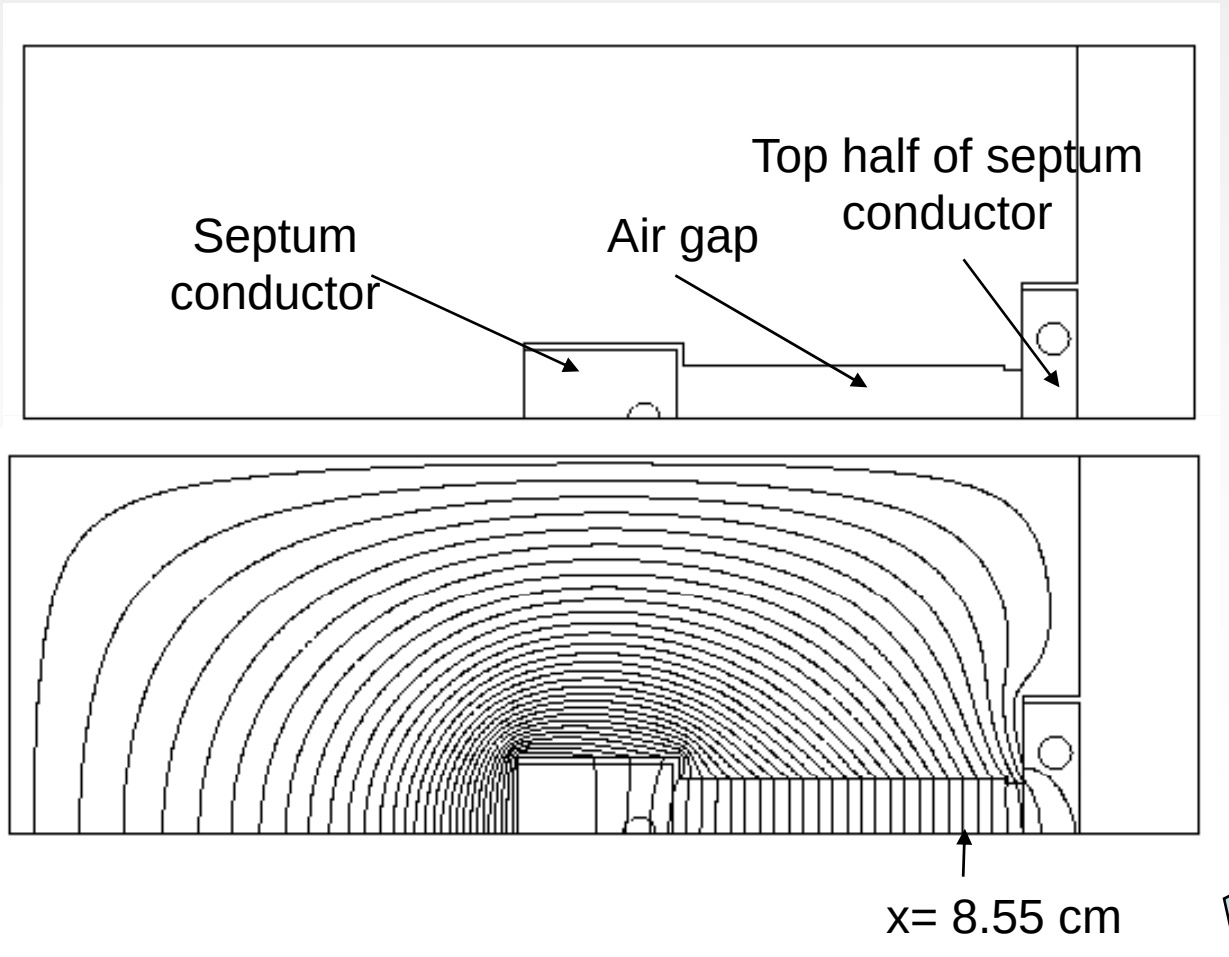


*J.Resta, A.Faus-Golfe, D.Schulte, R.Tomás, F.Zimmermann. Non linear energy collimation system for CLIC, EUROTeV CLIC Beam Dynamics meeting, February 2006.

Tracking studies

Tracking studies with MADX and PLACET:

- taking into account the multipole components and the impedances
- for different beam offsets



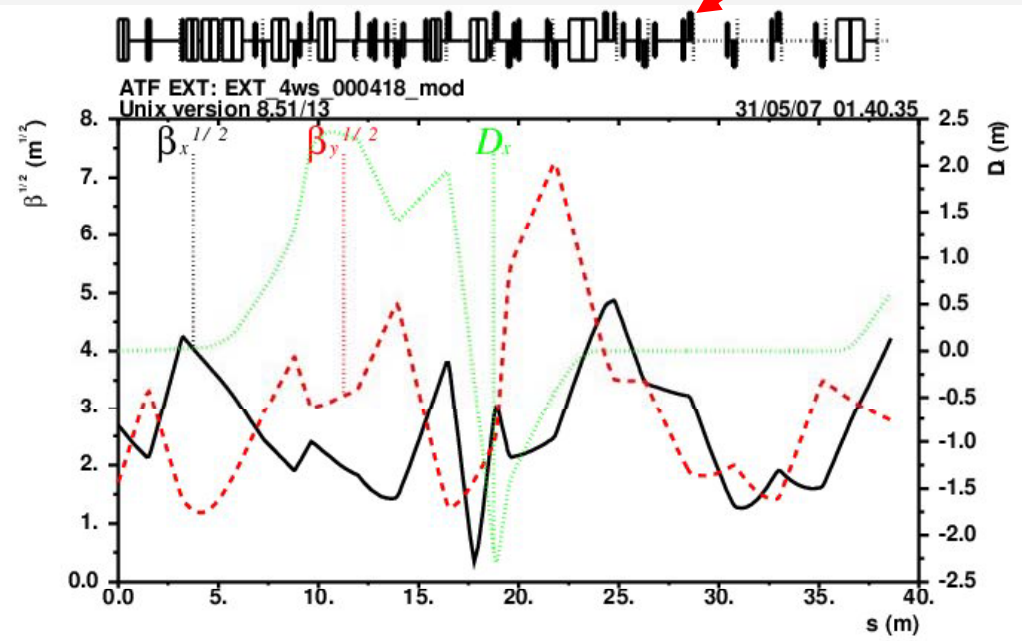
The beam passes off-axis through the septum (and the quadrupole QM7)

Very preliminary results

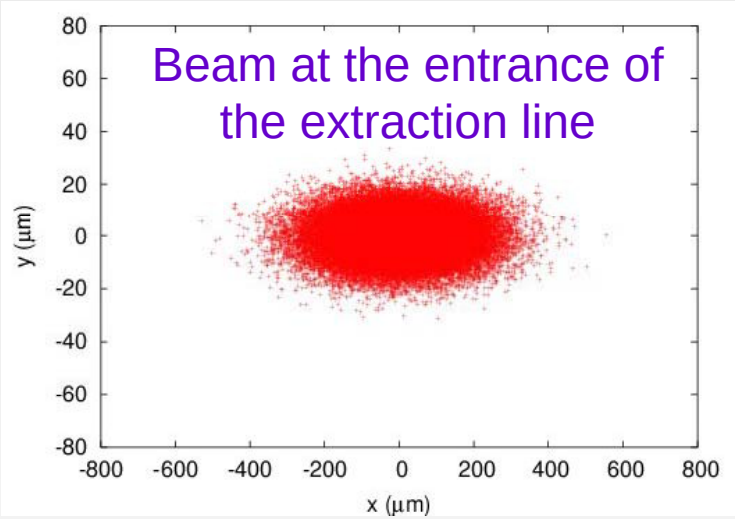
-Tracking with MAD8 (50000 particles)

-With multipole components for the septum

-Reading emittance in the first wire scanner (MW0X):



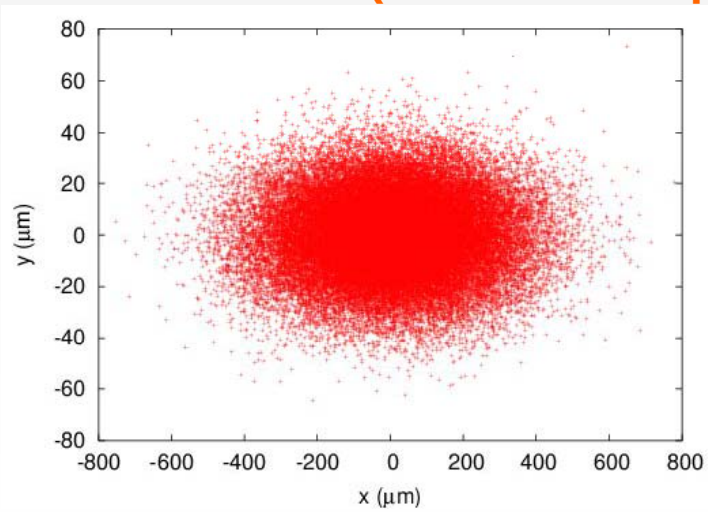
Very preliminary results



$$\gamma\varepsilon_x = 5.153\times10^{-6}\, m\cdot rad$$

$$\gamma\varepsilon_y = 5.096\times10^{-8}\, m\cdot rad$$

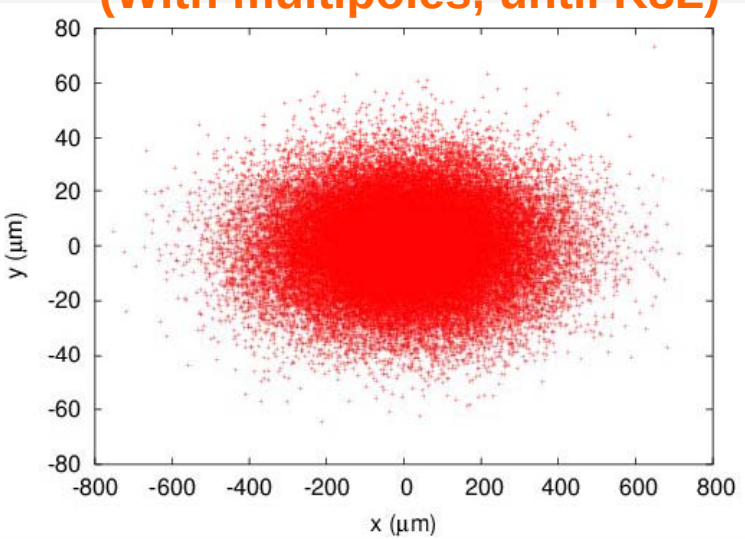
Beam at MW0X **(Without multipoles)**



$$\gamma\varepsilon_x = 5.163\times10^{-6}\, m\cdot rad$$

$$\gamma\varepsilon_y = 5.096\times10^{-8}\, m\cdot rad$$

Beam at MW0X
(With multipoles, until K8L)



$$\gamma\varepsilon_x = 5.167\times10^{-6}\, m\cdot rad$$

$$\gamma\varepsilon_y = 5.096\times10^{-8}\, m\cdot rad$$