DAΦNE present plan

KLOE => FINUDA (2nd run) (Apr ÷ Jul 2006)

FINUDA => SIDDHARTA (half 2007)

SIDDHARTA => FINUDA (3rd run) (spring 2008)

During the shutdown for the FINUDA installation several upgrades are going to be implemented relying on:

the experience coming from the DAFNE operation
the good achievements in term of Luminosity:

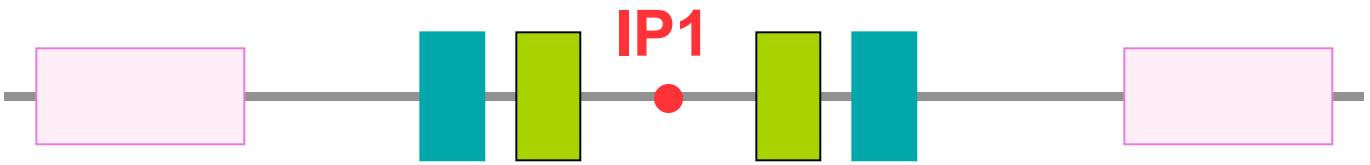
$L_{peak} = 1.53*10^{32}\ cm^{-2}\ s^{-1}$
$L_{\int day} = 10\ pb^{-1}$
$L_{delivered} = 2\ fb^{-1}$ KLOE run May 2004 ÷ Nov 2005

Upgrades

- Ion-Clearing-Electrodes
- Wires for PCs compensation
- New Injection Kickers
- Longitudinal Feedback
- Titanium evaporation
- Wiggling Wiggler

- FINUDA installation
- KLOE symplified IR

Simplified KLOE Interaction Region



- KLOE detector removed from IR1
- 4 electromagnetic QUADs
- Compensator solenoids off

Motivation

To have a more flexible lattice in order to:

release the low beta configuration @ IP1

have a more efficient beam separation

Wires for BBLR compensation

Install current-carrying wires in the FINUDA interaction region

Motivation

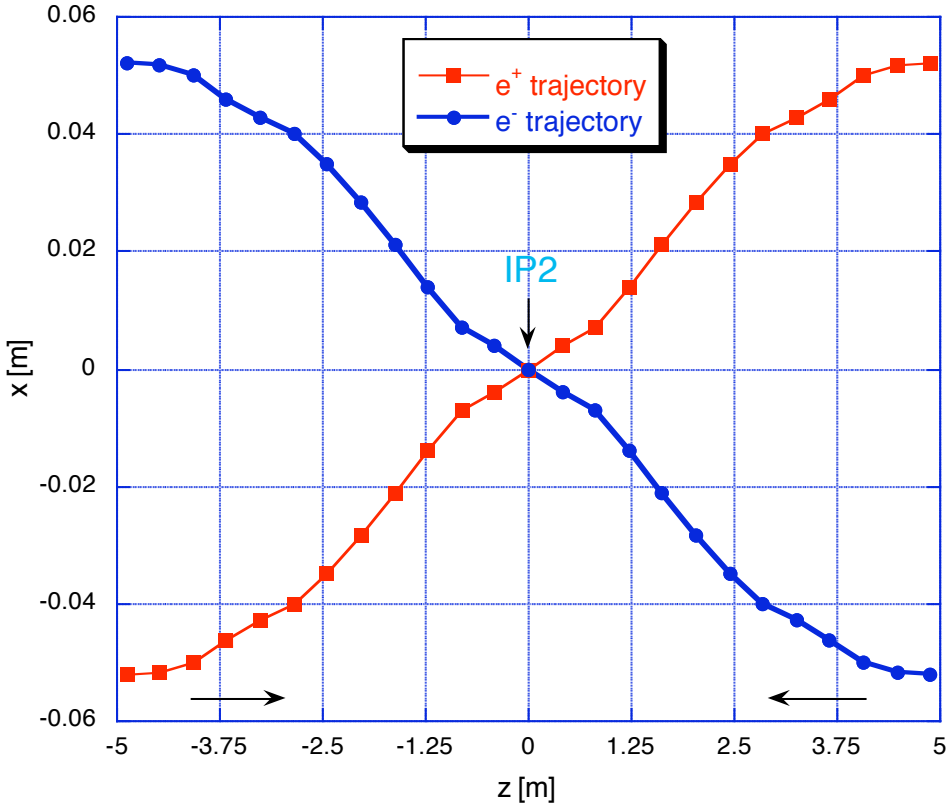
minimize the effects of Beam Beam Long Range interactions
(parasitic crossing)

Benefits:

higher lifetime
beam lifetime independent from the other beam current
less beam-beam blow up

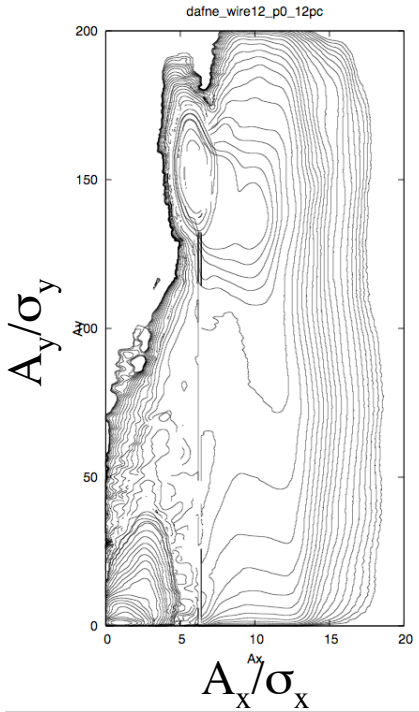
Parasitic Crossings compensation in the DAFNE Interaction Region

In the DAFNE Irs the beams experience 24 Beam Beam Long Range interactions limiting the maximum storable current.

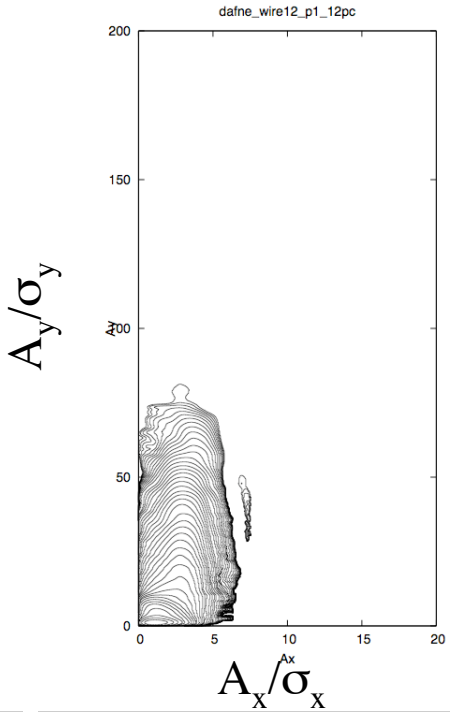


Numerical simulations show that BBLR interactions can be compensated by current-carrying windings

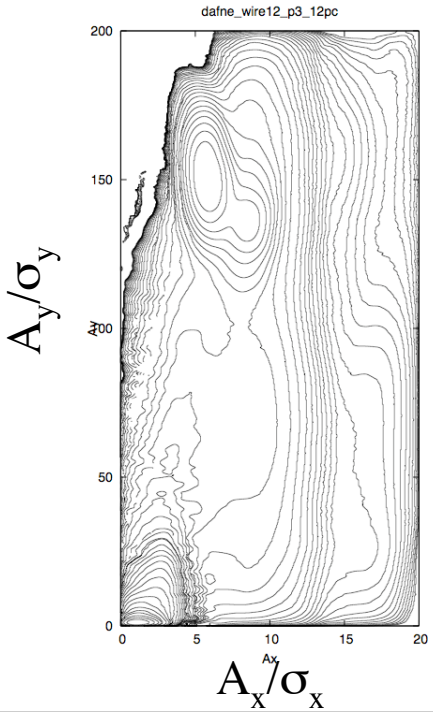
Particle equilibrium density in the transverse space of normalized betatron amplitude



Windings OFF



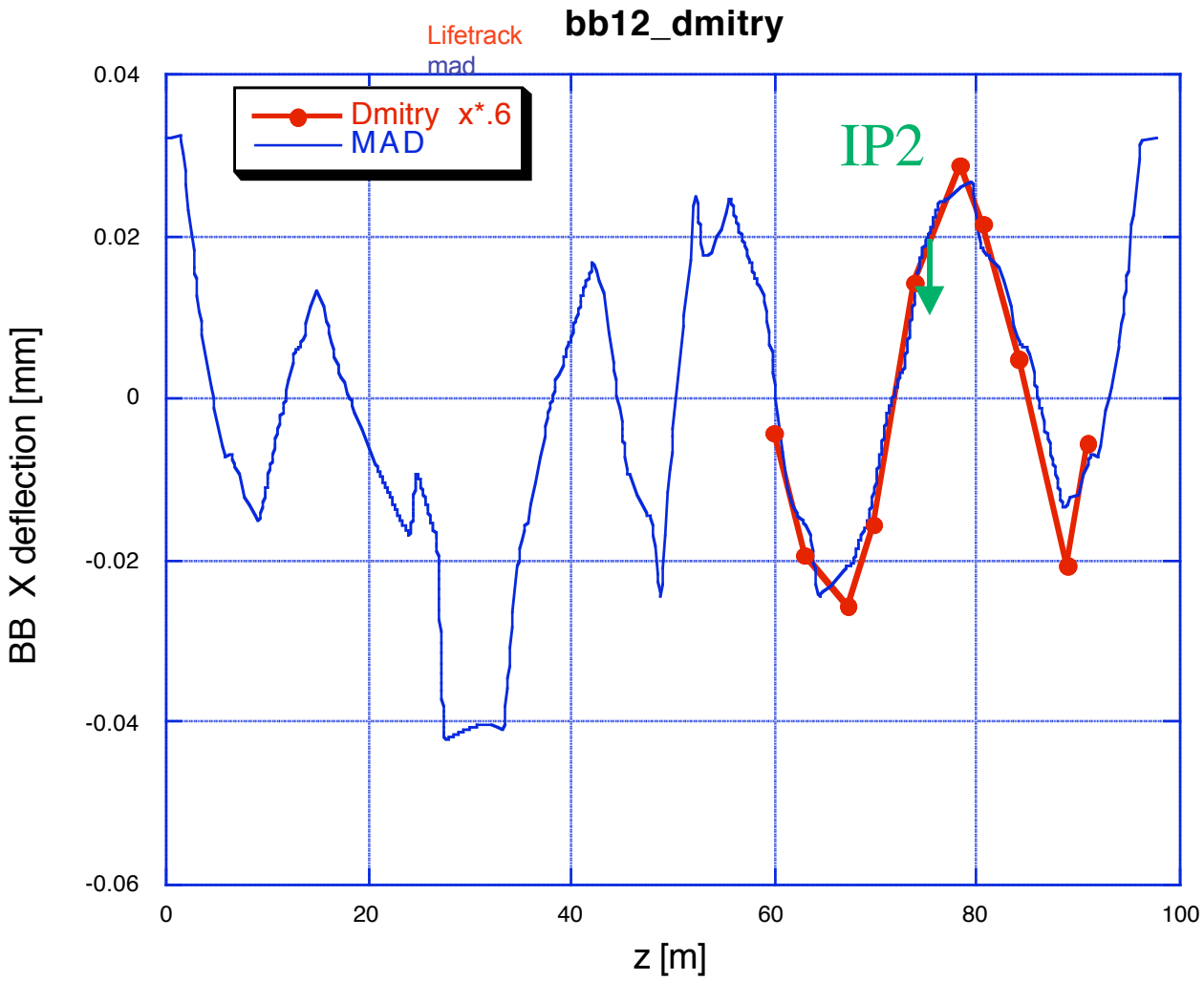
Windings ON



Windings ON
(wrong polarity)

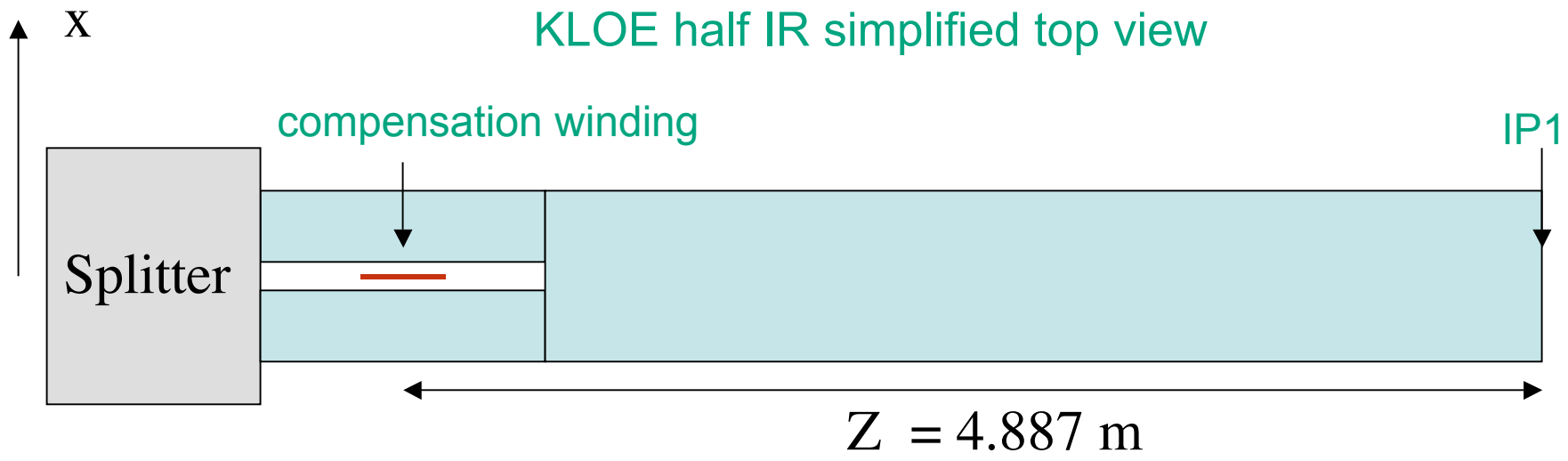
(M. Zobov, D. Shatilov)

Horizontal orbit deflection due to the 24 Parasitic Crossings

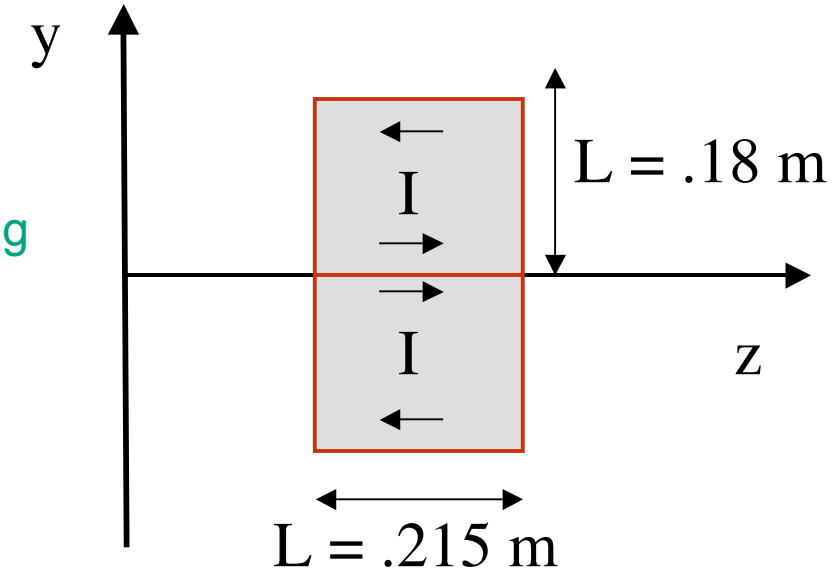


REALIZATION:

- Windings installed in the KLOE Interaction Region

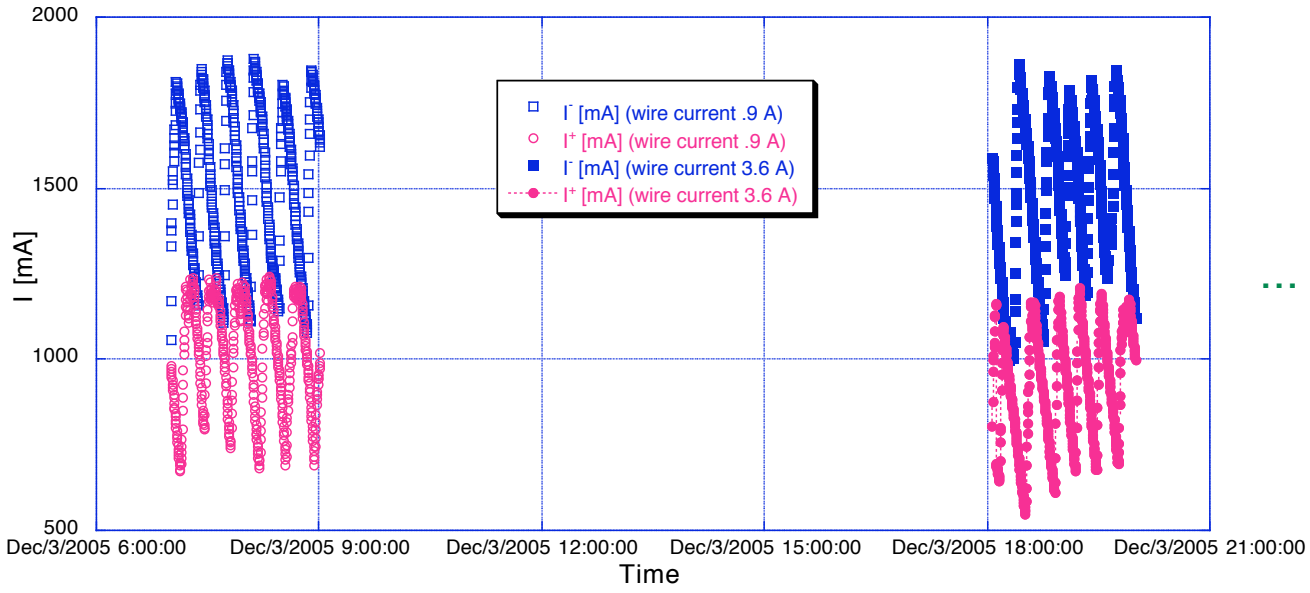


compensation winding
(20 coils)

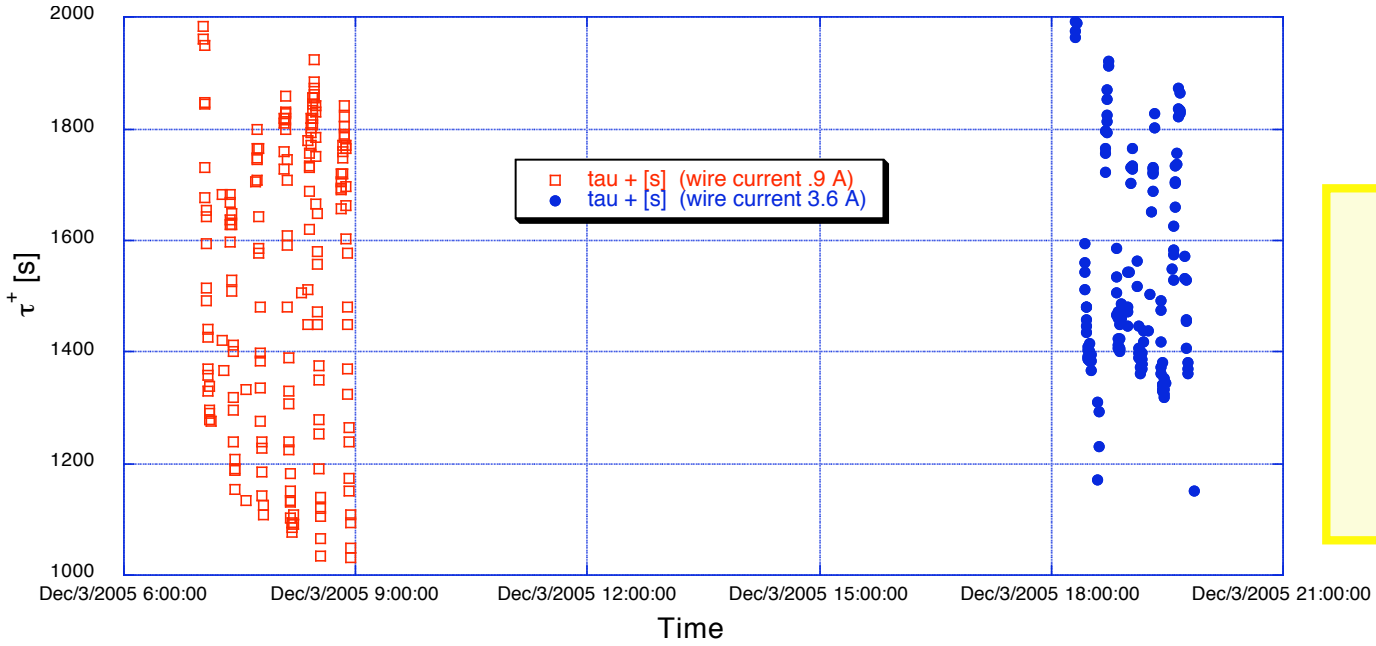


(G. Sensolini, R. Zarlenga)

First results from BBLR compensation windings @ IR1



... with the same currents



τ^+ improves

τ^+ affects:

- I^+_{MAX}
- $\mathcal{L}_{int}$
- background

BBLR compensation more demanding @ FINUDA

KLOE optics

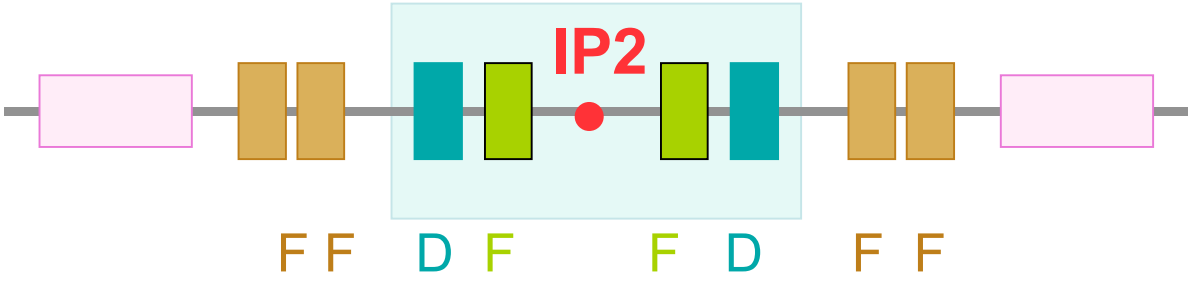
$\Delta x \sim 15\ \sigma_x$ @ 1st parasitic crossing

$\theta_x \sim 30$ mrd

Finuda optics

$\Delta x \sim 9\ \sigma_x$ @ 1st parasitic crossing

$\theta_x \sim 22$ mrd



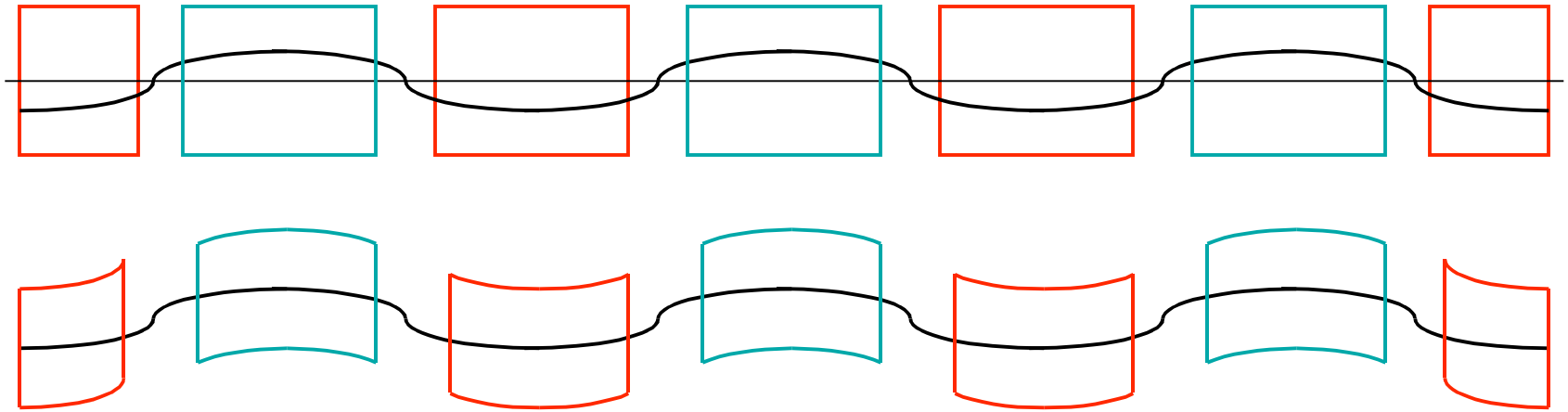
FINUDA IR

- $\int B\,\delta l = 2.4$ Tm
- 2 superconductive compensator solenoids
- 4 permanent magnet QUADs
- 4 electromagnetic QUADs
- Independent QUADs rotation

Wiggling Wiggler

Motivation

Build wiggler poles symmetric with respect to the beam orbit in order to reduce unwanted non-linear terms affecting beam dynamics



Benefits:

Improved beam stability
higher lifetime

Approach to the wiggler modification

(in collaboration with CERN)

Field map computation using the 3D code TOSCA

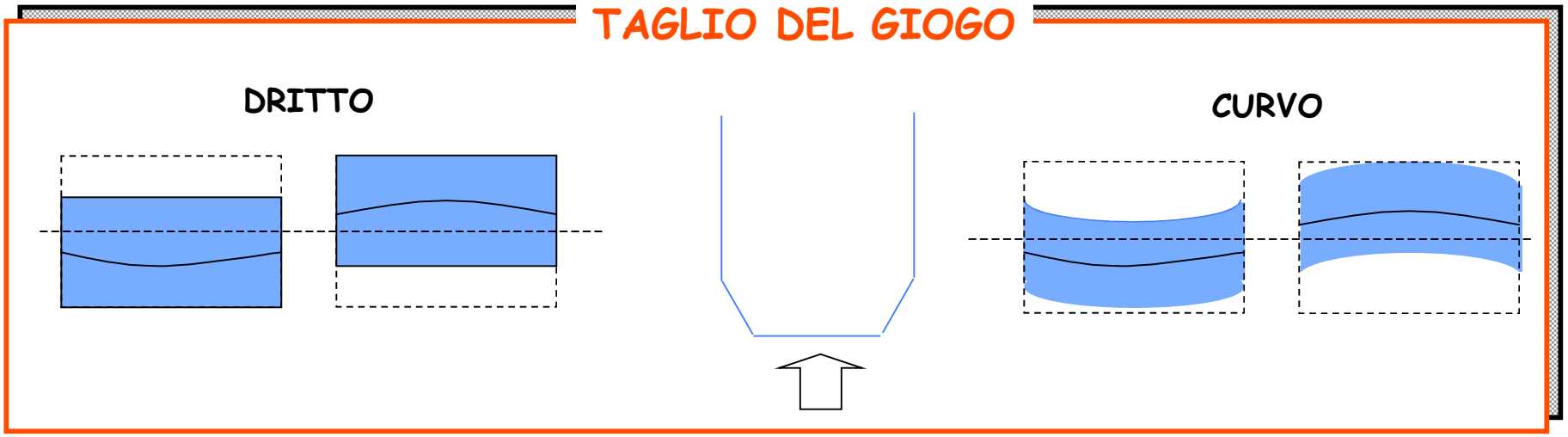
Impact of the non-linear term on the beam dynamics

Shim cut

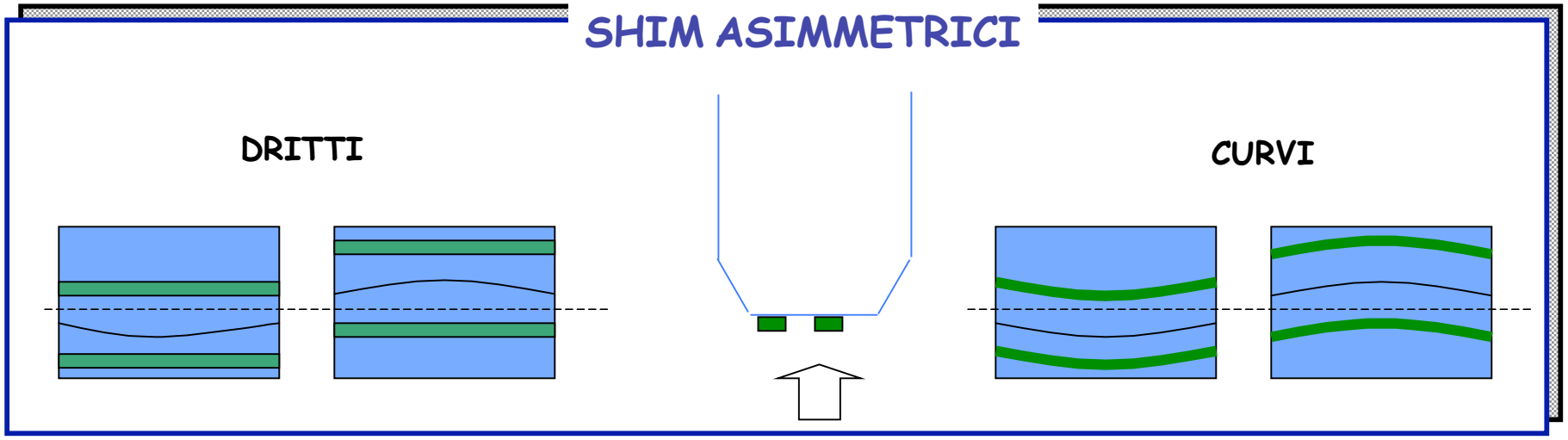
Shim installation

Test with the beam

Possibili modifiche per azzerare b_4 sulla traiettoria



(S. Bettoni CERN)



Measurements (fall 2000)

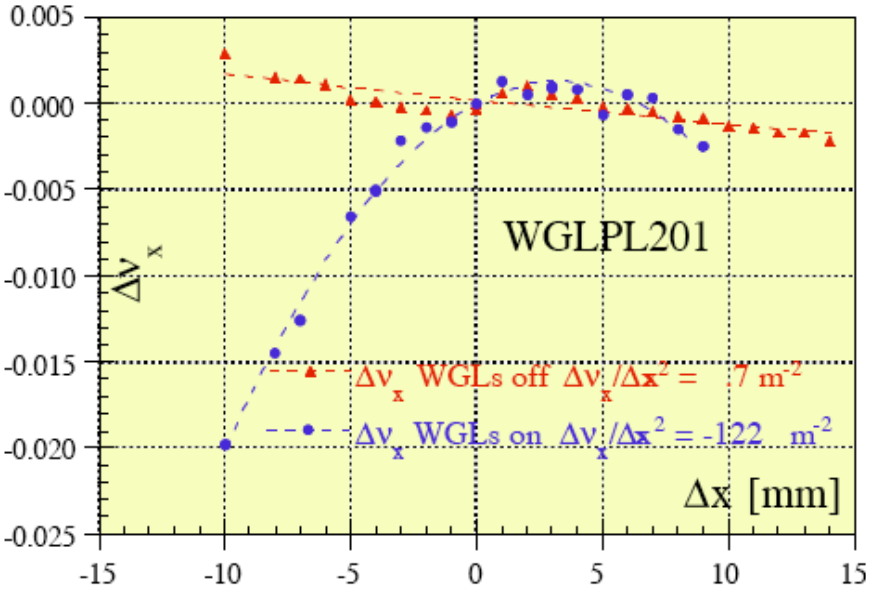


Figure 3: Horizontal tune shift versus horizontal closed orbit bump measured with the wigglers off and on.

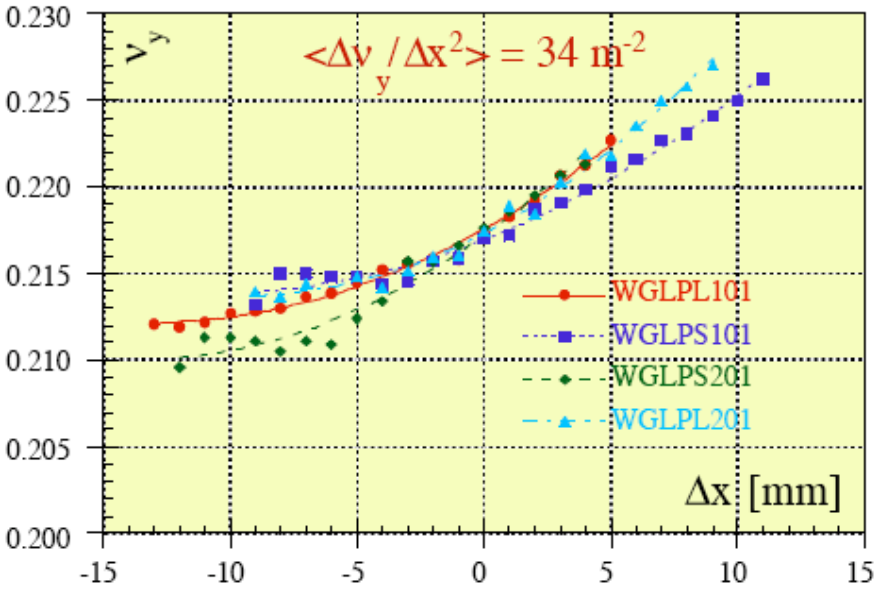
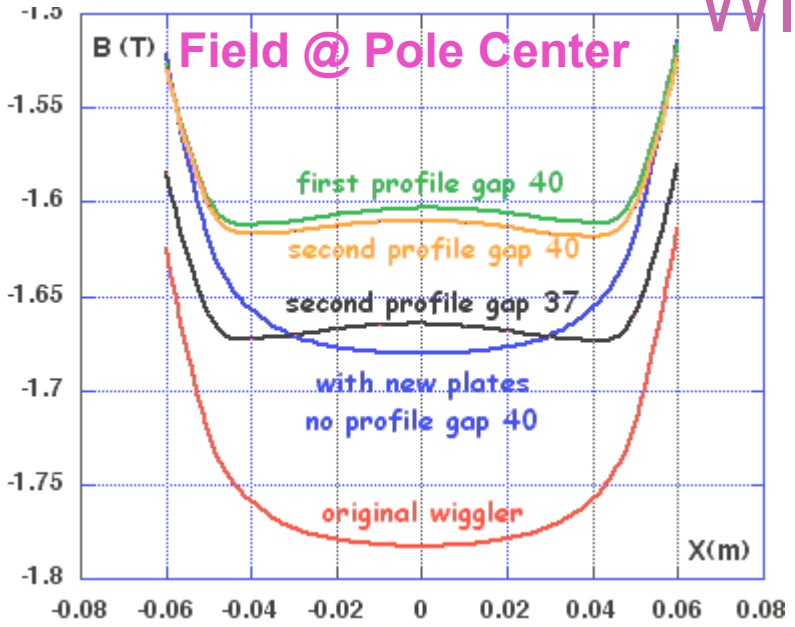


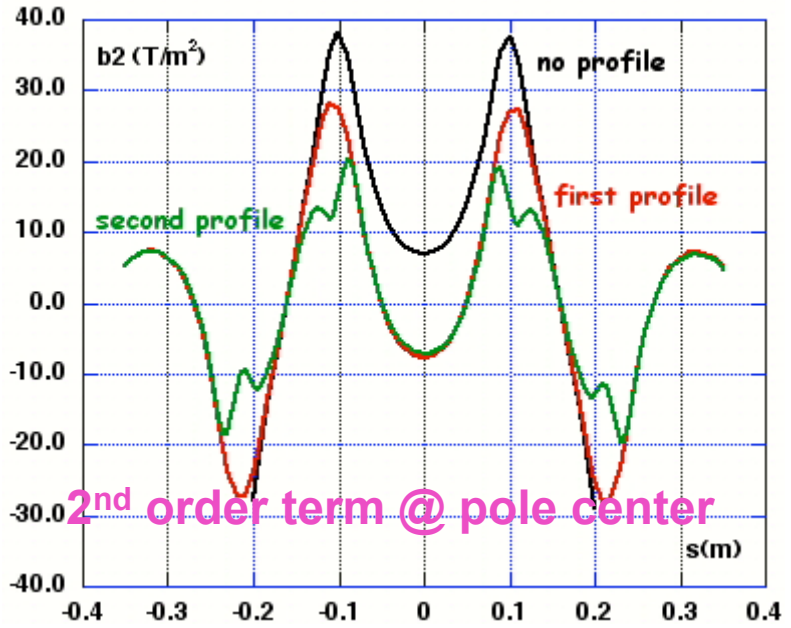
Figure 4: Vertical tunes versus horizontal closed orbit bump at each wiggler in the positron ring.

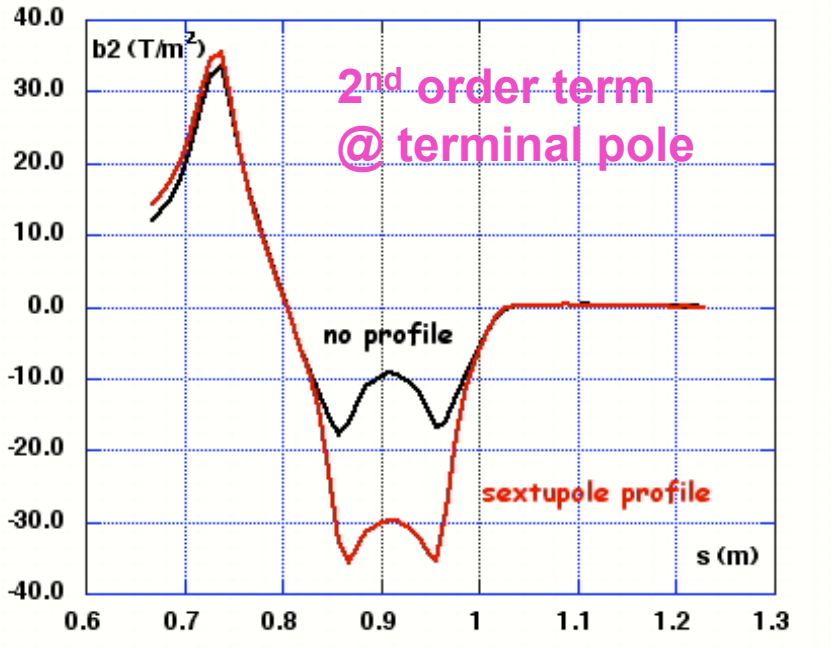
(C. Milardi et al. PAC 01)

What has been obtained upgrading the WIGGLER field quality



- Improves Dynamic Aperture & τ_{beam} by reducing: non linear terms
  2^{nd} order chromaticity



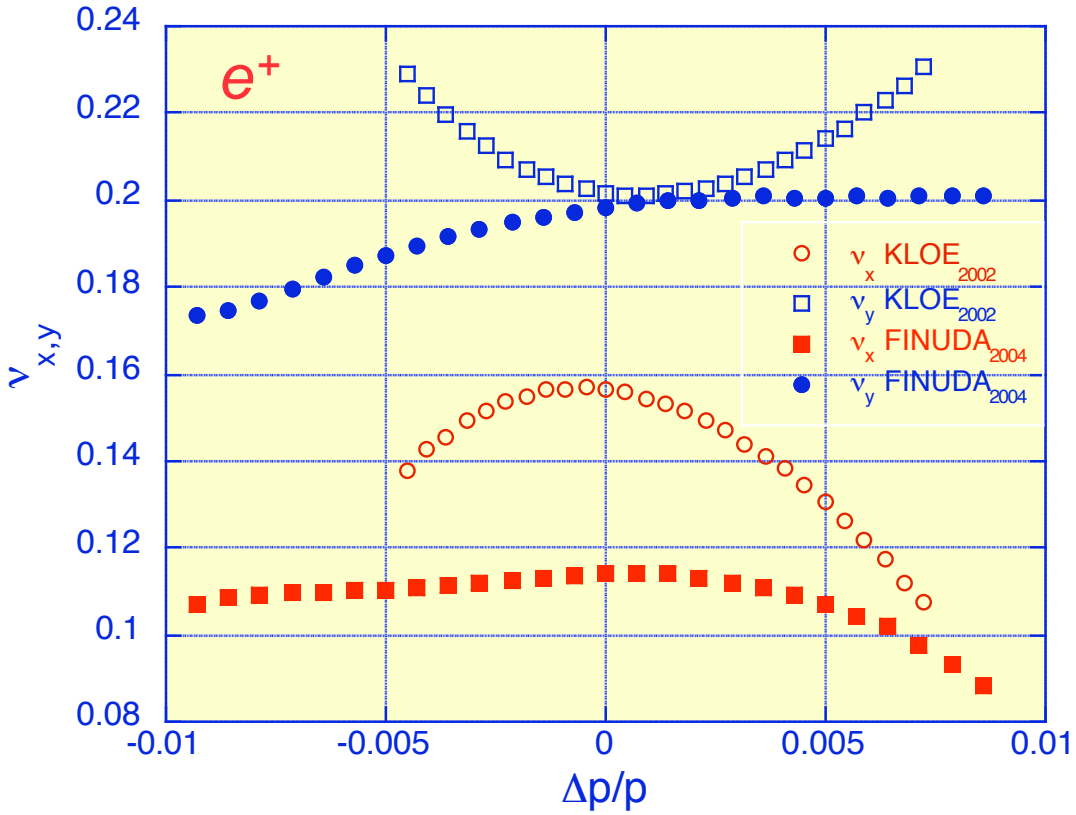


- Magnetic Measurements show:
  - 3rd order term reduced by 2.5
- Tests using the beam
  - confirm magnetic measurements
  - show a factor 2 in the energy acceptance

$$\nu_x = \nu_{x0} + m_{1x}\frac{\Delta p}{p} + m_{2x}\left(\frac{\Delta p}{p}\right)^2$$

$$\nu_y = \nu_{y0} + m_{1y}\frac{\Delta p}{p} + m_{2y}\left(\frac{\Delta p}{p}\right)^2$$

	m_{2x}	m_{2y}
KLOE 2002	-882	823
FINUDA 2004	-194	-144



Preliminary Multipole budget
(with respect to standard wiggler)

Quadrupole	**25%**
Sextupole	**55%**
Octupole	**15%**

(M. Preger)

Upgrades time table

- ICE shielding
- Test with the beam on one modified wiggler ??

Hopefully bf KLOE shutdown (March 2006)

- New KLOE IR
- ICE shielding & removal
- Wires for PCs compensation
- Longitudinal FBK
- Ti coating
- Injection kickers ??
- Modified Wigglers ??

KLOE -> FINUDA shutdown (Apr ÷ Jul 2006)

- Injection kickers
- Modified Wigglers ??

Christmas shutdown 2006 ÷ 2007