Background Issues at DAFNE

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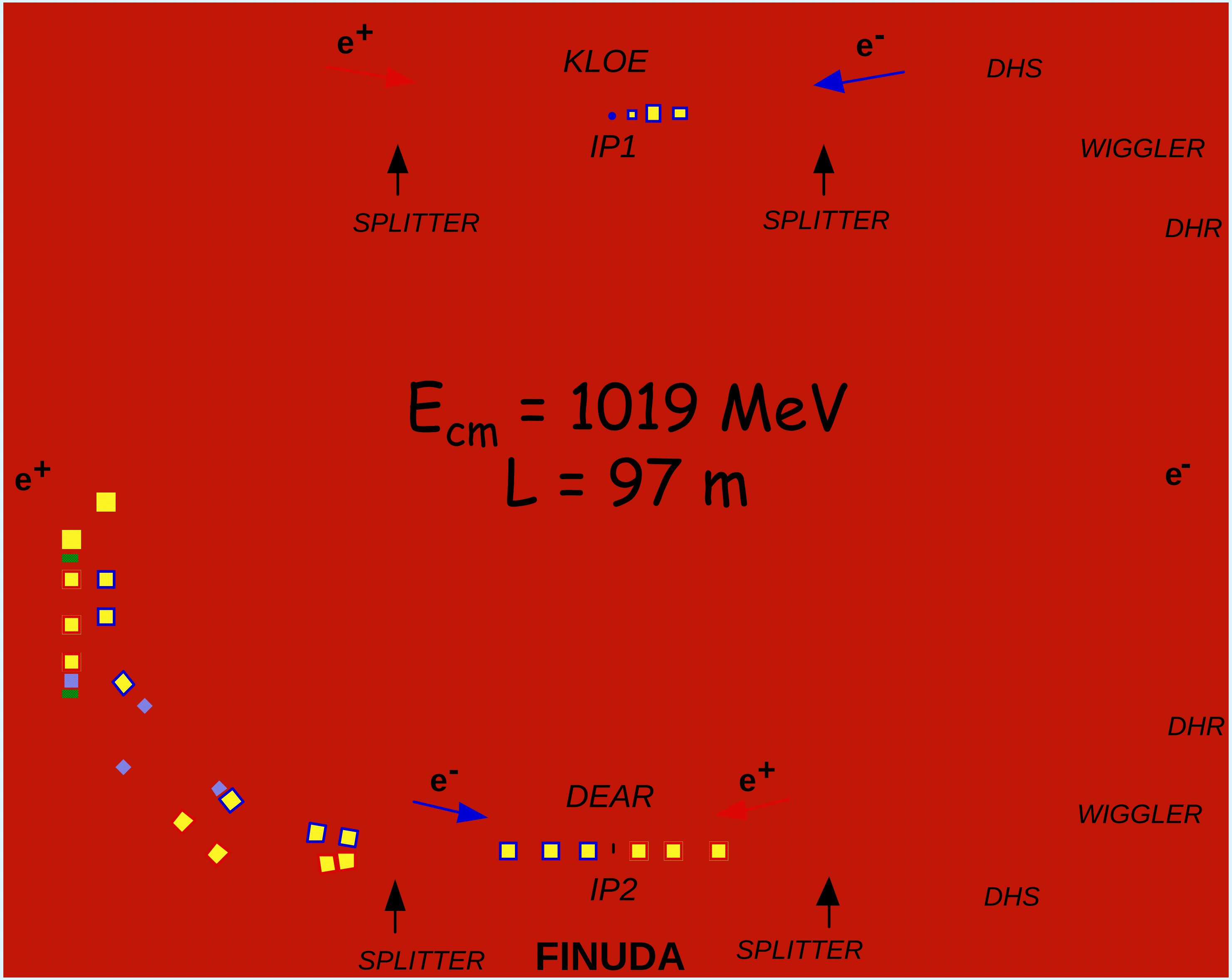
for the DAFNE Team

Outline

DAΦNE background and beam lifetime are dominated by Touschek scattering, as typically happens in low energy rings

- DAΦNE
- Experimental knobs used to control backgrounds in the detectors
- Simulation Studies
- Comparison between simulation and measurements
- Studies with the crab waist scheme
- First studies for the LER of the SUPERB Factory

KLOE
solenoid



e^+

KLOE

e^-

DHS

IP1

WIGGLER

SPLITTER

SPLITTER

DHR

$$E_{cm} = 1019 \text{ MeV}$$

$$L = 97 \text{ m}$$

e^+

e^-

DHR

e^-

DEAR

e^+

WIGGLER

IP2

DHS

SPLITTER

FINUDA
solenoid

SPLITTER

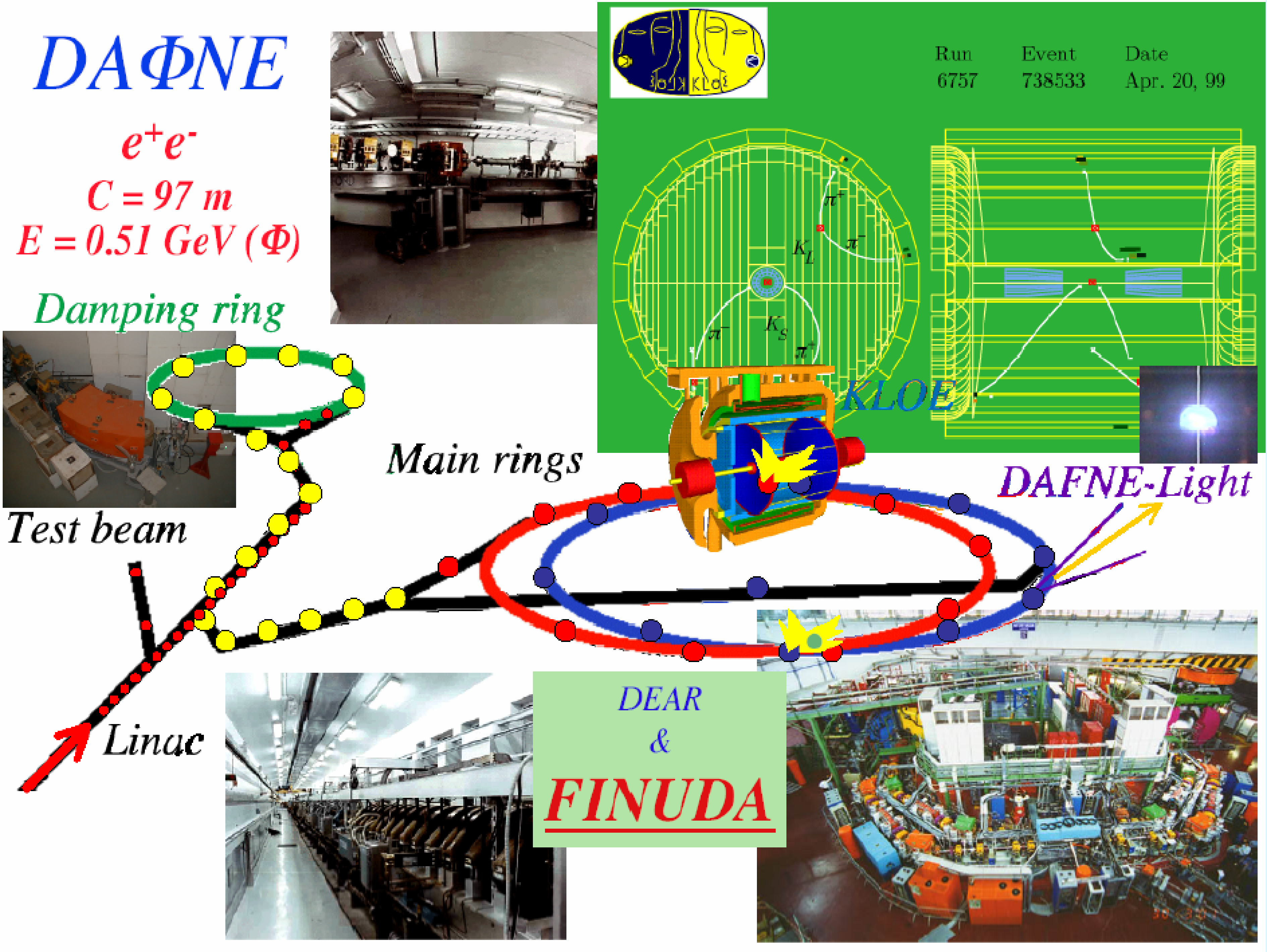
M. Boscolo- March 10th 2008

DAΦNE

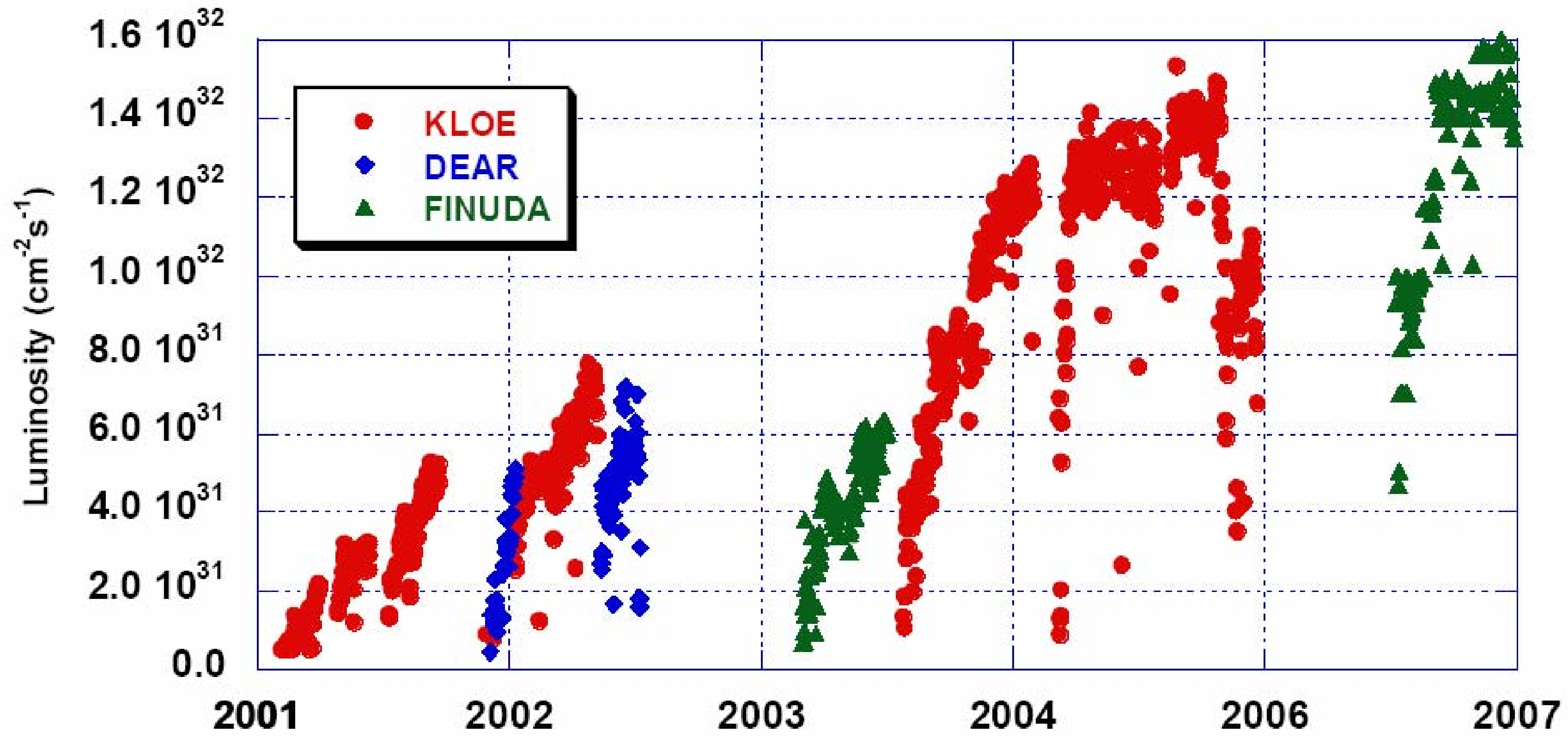
e^+e^-

$C = 97\ m$

$E = 0.51\ GeV\ (\Phi)$



DAFNE peak luminosity for KLOE (red) DEAR (blue) and FINUDA (green)



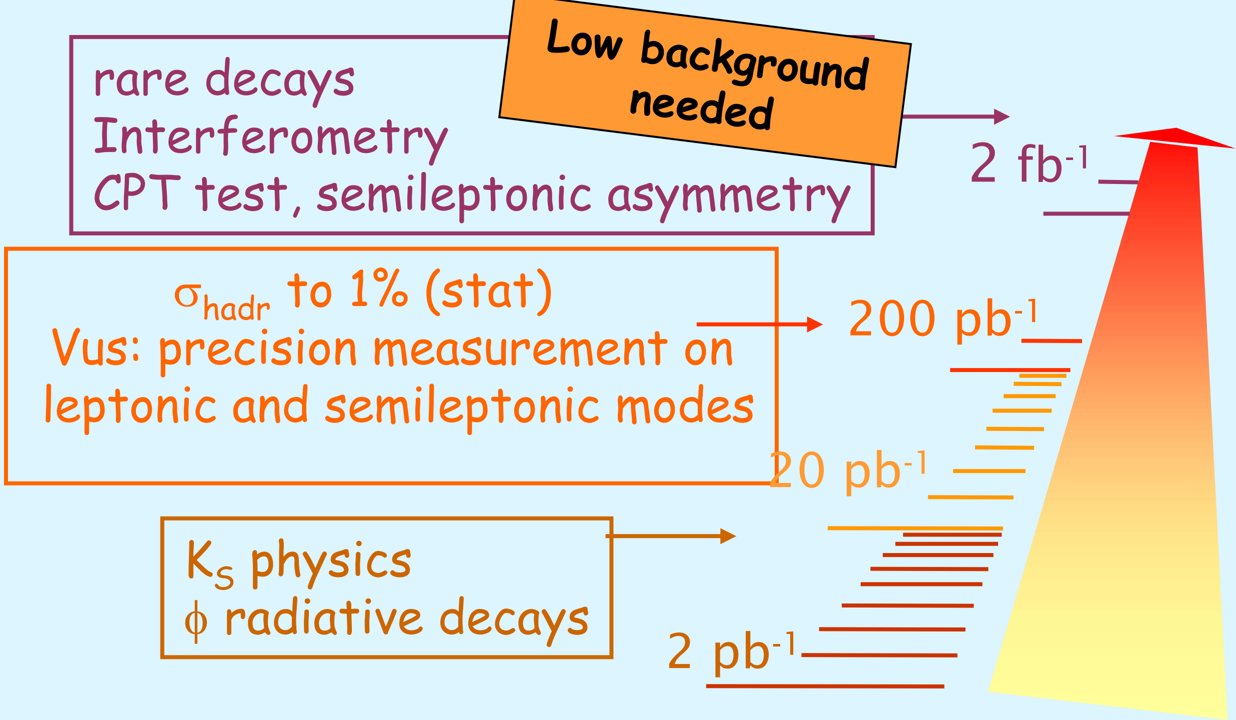
crab waist test (Siddharta)

2008

	KLOE **May 04** **Nov 05**	**FINUDA** **Nov 06** **Jun 07**
L_{peak} [cm^{-2}s^{-1}]	**$1.53 \cdot 10^{32}$**	**$1.6 \cdot 10^{32}$**
$L^{MAX}_{\int day}$ [pb^{-1}]	**9.8**	**9.4**
$L^{MAX}_{\int month}$ [pb^{-1}]	**209**	**226**
I^{-MAX}_{coll} [A]	**2.2**	**1.5**
I^{+MAX}_{coll} [A]	**1.35**	**1.1**
$n_{bunches}$	**111**	**110**
$L_{\int logged}$ [fb^{-1}]	**2**	**0.966**
β_x^* [m]	**1.5**	**2.0**
β_y^* [m]	**0.018**	**0.019**
ε_x [10^{-6} m rad]	**0.37**	**0.37**
κ (%)	**1.5**	**1.5**

Experiments at DAFNE

KLOE Physics



Low background needed

rare decays
Interferometry
CPT test, semileptonic asymmetry

σ_{hadr} to 1% (stat)
Vus: precision measurement on leptonic and semileptonic modes

K_S physics
ϕ radiative decays

DEAR (DAΦNE Exotic Atoms Research) and **SIDDHARTA**
their goal is to study the creation of exotic atoms, where the charged K mesons produced in the Φ resonance decays are captured in the electronic shells.

FINUDA (Fisica Nucleare a DAΦNE)
was an experiment dedicated to the study of hypernuclei

The detector is embedded in a SC solenoid with the same field integral as KLOE (2.4 Tm)

Detectors Sensitivity to Backgrounds

- KLOE suffered from 'high' energy particles (E> 10 MeV) – seen in overlap with physics (accidentals)

  also important higher energy products with E>150MeV (endcap trigger threshold)

  4π acceptance- difficult shielding

- DEAR suffered from low energy photons (O(100) keV)-

  no trigger, but small gas target detector could be shielded by lead all around

- SIDDHARTA is a gas target detector with trigger, shielded by lead

At the beginning of data taking, all these experiments suffered from large background.

DAFNE machine background and lifetime dominated by Touschek effect:

elastic Coulomb scattering of pairs of particles within a bunch

The two emerging particles have the same momentum deviation ε: one gains and the other looses it.

They start to oscillate with a betatron amplitude:

$$\mathbf{A} = \varepsilon\sqrt{\mathbf{H}\beta(\mathbf{s})} \qquad \text{where} \qquad \mathbf{H} = \gamma_x D_x^2 + 2a_x D_x D_x' + \beta_x D_x'^2$$

Off-momentum particles can exceed the momentum acceptance given by the RF bucket, or may hit the physical aperture when displaced by dispersion.

A betatron oscillation is excited if the momentum change happens in a dispersive region.

SCALING of Touschek loss rate dN/dt and lifetime τ with beam parameters

$$\frac{1}{\tau} = \frac{1}{N}\frac{dN}{dt}$$

The Touschek part. loss rate is approximately $\dot{N} \propto \frac{N^2}{\gamma^3 \varepsilon^2 V}$

N particles/bunch
V bunch volume
ε momentum acceptance

Touschek effect is determined by momentum acceptance and bunch density integrated over the lattice structure.

Lifetime $\tau \propto \frac{\sigma_x \sigma_y \sigma_z}{I}$ where $\sigma_z \propto I^{1/3}$

$$\tau \propto I^{-2/3}$$

$$dN/dt \propto I/\tau \propto I^{5/3}$$

$$\frac{dN}{dt} \propto 1\Big/\sqrt{\kappa} \qquad \kappa = \varepsilon_y \Big/ \varepsilon_x$$

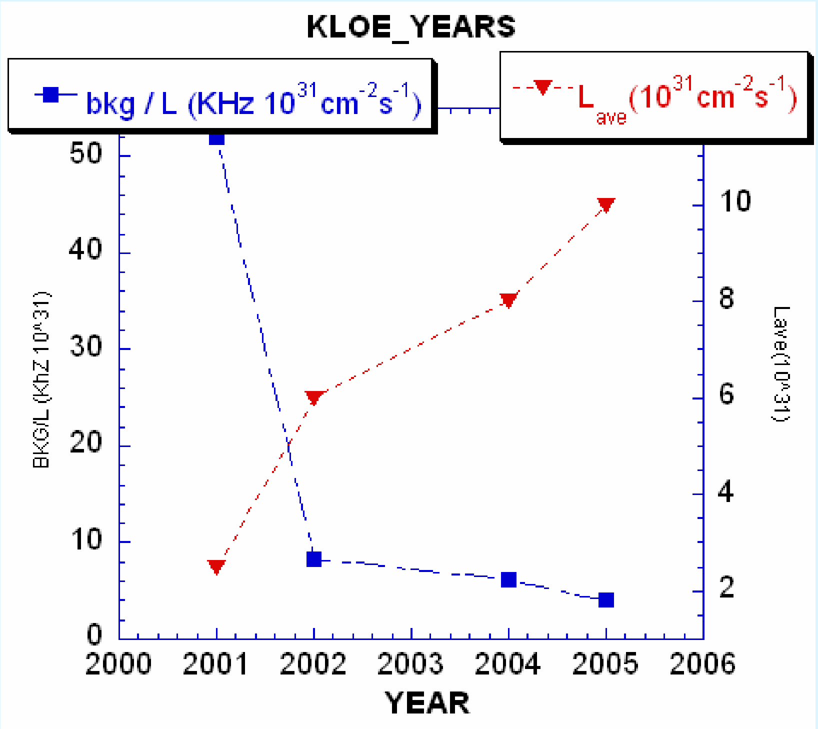
Background Handling

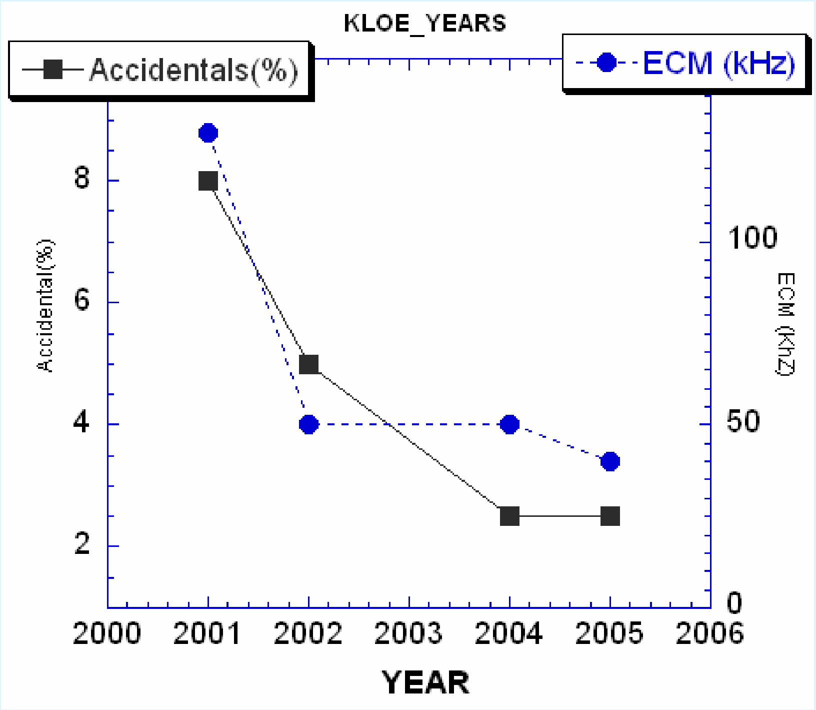
- Tracking studies/measurements and comparisons have been performed to reduce these backgrounds rates
- Additional **collimators** inserted,

  shape of existing and new ones optimized
- **Low-β quads** in KLOE IR: from triplet to doublet
- **Shielding** implemented between pipe and KLOE low-β quads, lead around gas target detectors
- **Optics Adjustments**:
  - orbit optimization,
  - Sextupoles Optimization
  - Octupoles Optimization
  - Improved linear and non-linear knowledge of the machine
  - Increased Dynamic aperture

    with better βs on Sexts and Wigglers

Backgrounds and Luminosity versus years of KLOE data taking





	L_{ave} (10^{31} cm^{-2}s^{-1})	Bkg_{ave} (kHz)	Bkg/L (kHz 10^{31} cm^{2}s^{1})	Accidental probability
2001	2.5	130	50	8%
2002	6	50	8.3	5%
2004	8	50	6.25	2.5%
2005	10	40	4	2.5%

Program Flow Touschek simulation

Optics check

(nonlinearities included)

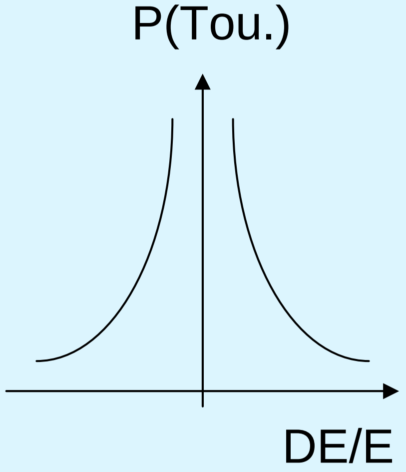
Beam parameters calculation
(betatron tunes, emittance, synchrotron integrals, natural energy spread, bunch dimensions, optical functions and Twiss parameters all along the ring)

Calculation of **Touschek energy spectra** all along the ring averaging Tousc. probability density function over 3 magnetic elements

Tracking of Touschek particles:
Start with transverse gaussian distribution and proper energy spectra every 3 elements: track over many turns or until they are lost

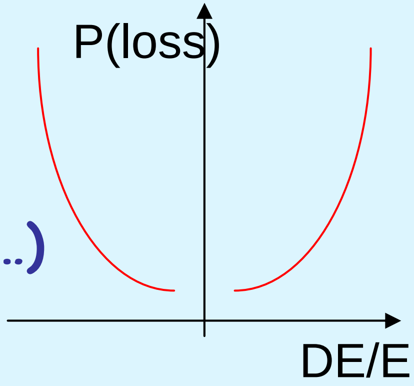
- Estimation of **IR and total** Touschek particle **losses** (rates and longitudinal position)
- Estimation of Touschek **lifetime**

Touschek energy spectra related mostly to beam parameters (i.e. bunch volume, ε, σ_p, bunch current…)



With a given energy spectrum P(E)
(see next slide) one can:
1. extract according to P(E) or
2. Use a uniform extraction and use P(E) as a weight

Particle losses related mostly to machine parameters/optics (i.e. physical aperture, phase advance, dispersion, …)



We use 2. to cope with tails of both distributions

Calculation of energy spectra

Starting formula:

Integrated Touschek probability

$$\frac{1}{\tau} = \frac{\sqrt{\pi} r_e^2 c N}{\gamma^3 (4\pi)^{3/2} V \sigma'_x \varepsilon^2} C(u_{\min})$$

$$\frac{1}{\tau} = \int_{\varepsilon}^{\infty} P_{Tou}(E) dE$$

$$\varepsilon = \frac{\Delta E}{E} \qquad u_{\min} = \left(\frac{\varepsilon}{\gamma \sigma'_x} \right)^2$$

$$\sigma'_x = \sqrt{\frac{\varepsilon_x}{\beta} + \sigma_p^2 \left(D'_x + D_x \frac{\alpha_x}{\beta_x} \right)^2}$$

V = bunch volume= $\sigma_x \cdot \sigma_y \cdot \sigma_l$

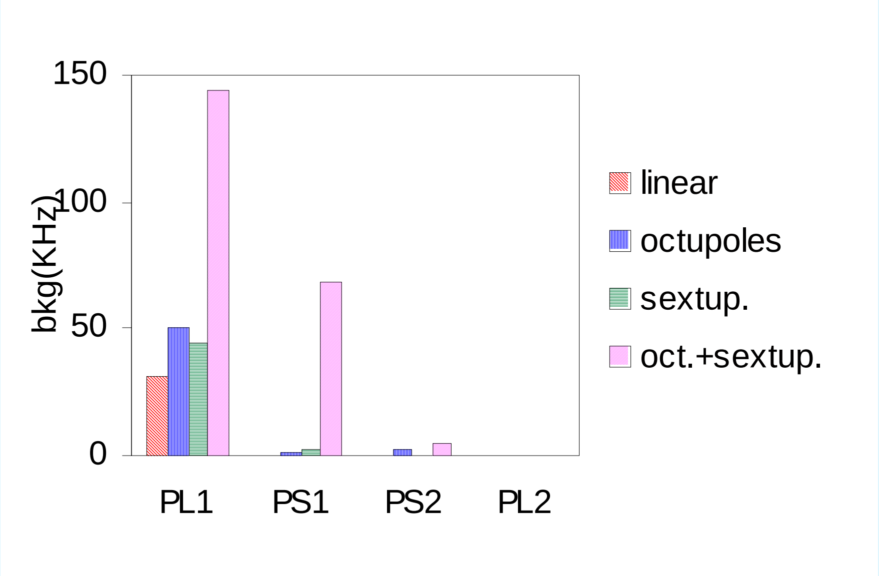
C(umin) accounts for Moller x-section (polarization is included) and momentum distribution

For a chosen machine section the Touschek probability is evaluated in small steps (9/element) to account for the beam parameters evolution for 100 ε values.

Use an interpolation between the calculated ε values according to the Touschek scaling law: $A_1 \cdot \varepsilon^{-A_2}$

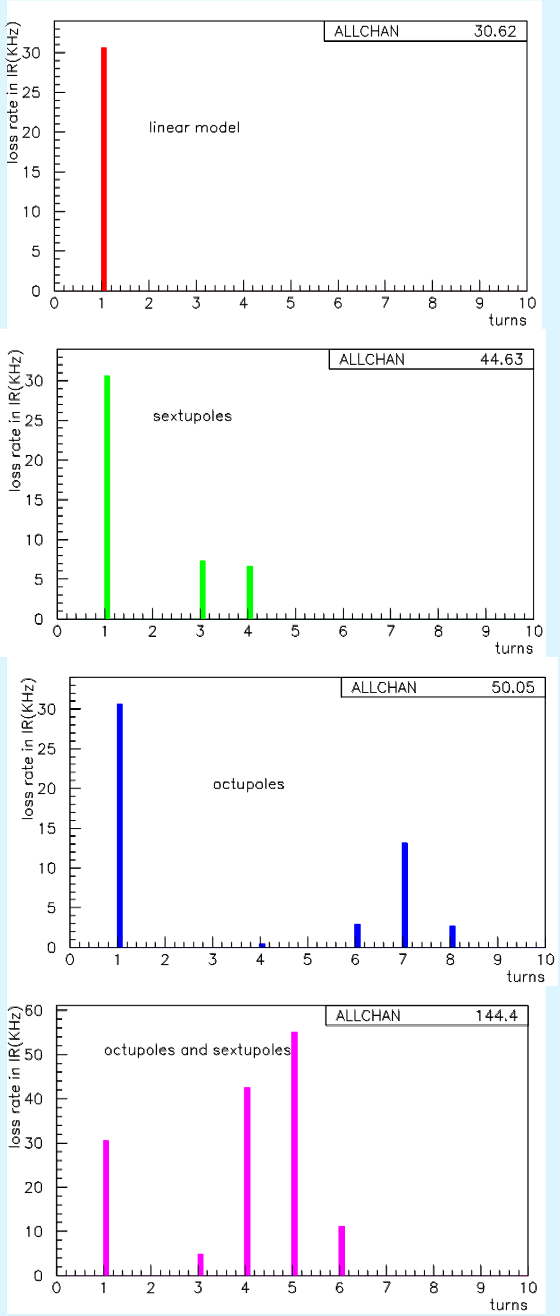
Effects of non linearities on Touschek particle losses

Tracking includes non linearities: sextupoles and octupoles relevant to account for the correct dynamical aperture



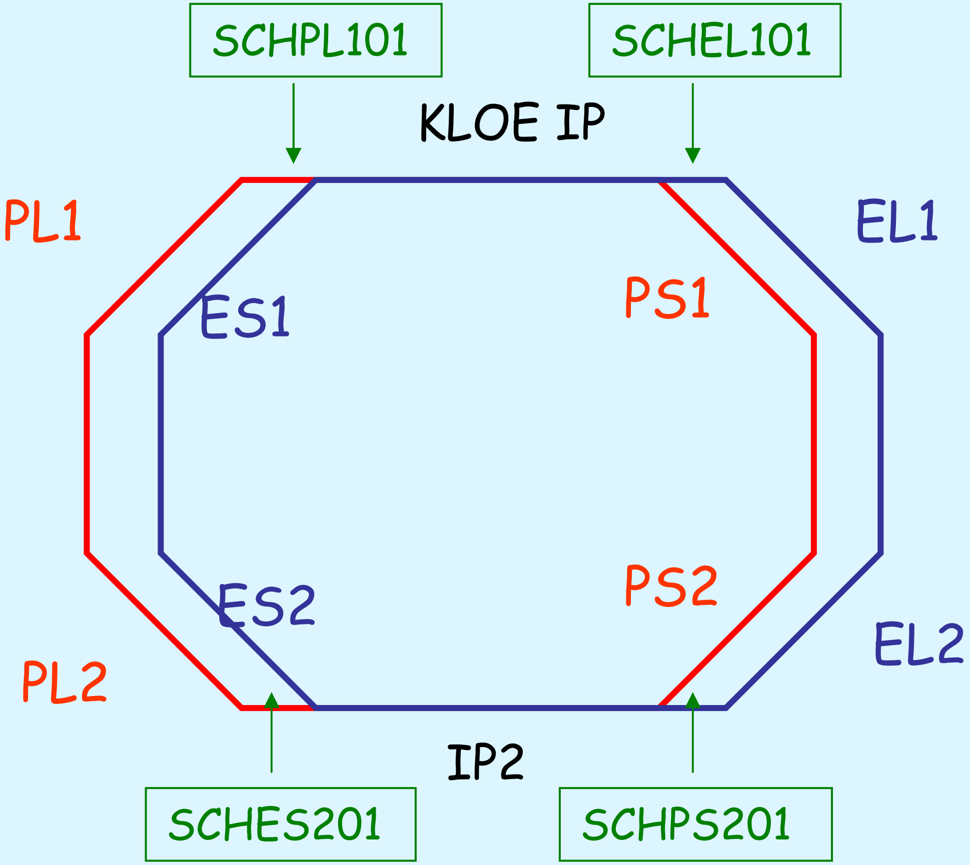
Expected beam losses at the KLOE IR for one bunch of 10 mA: contributions change when nonlinearities are taken into account

Distribution of particles scattered in the high dispersive region before IR and lost at the KLOE IR versus the machine turns

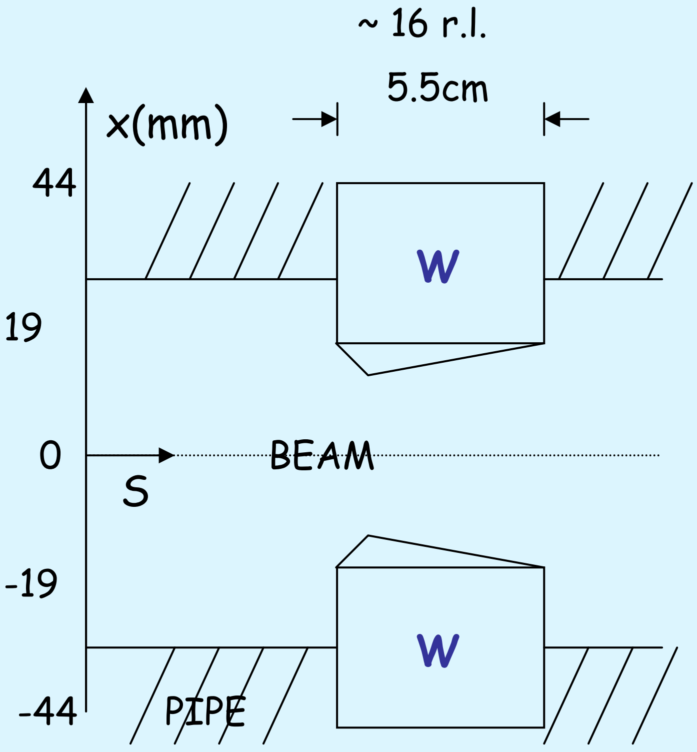


Collimators and shieldings

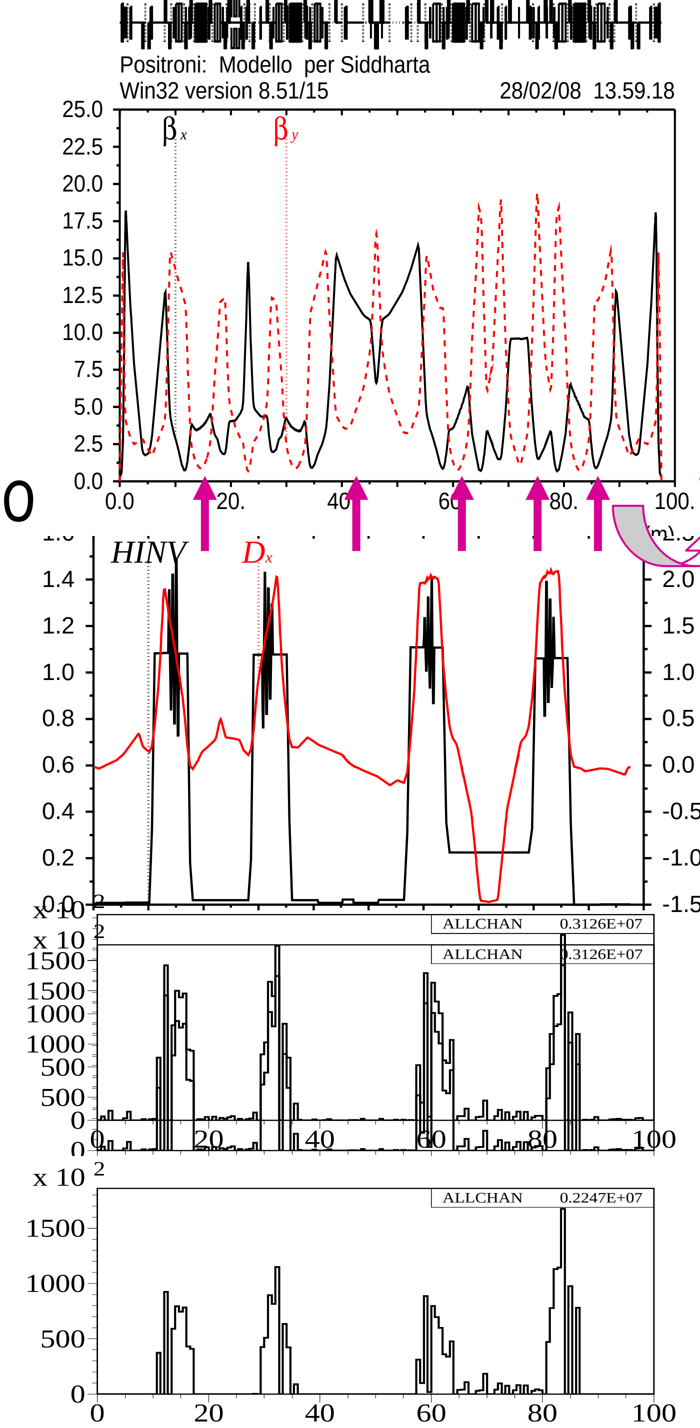
In order to protect the detectors of the experiments from off-momentum particles remote controlled collimators have been installed for the incoming beams on either side of each experiment. They were placed before the splitter magnets, about 7.0m from the IP



Two horizontal jaws external and internal, are used to intercept the two off-energy particle families.



β_x, β_y, H and dispersion functions for the DAFNE crab waist configuration



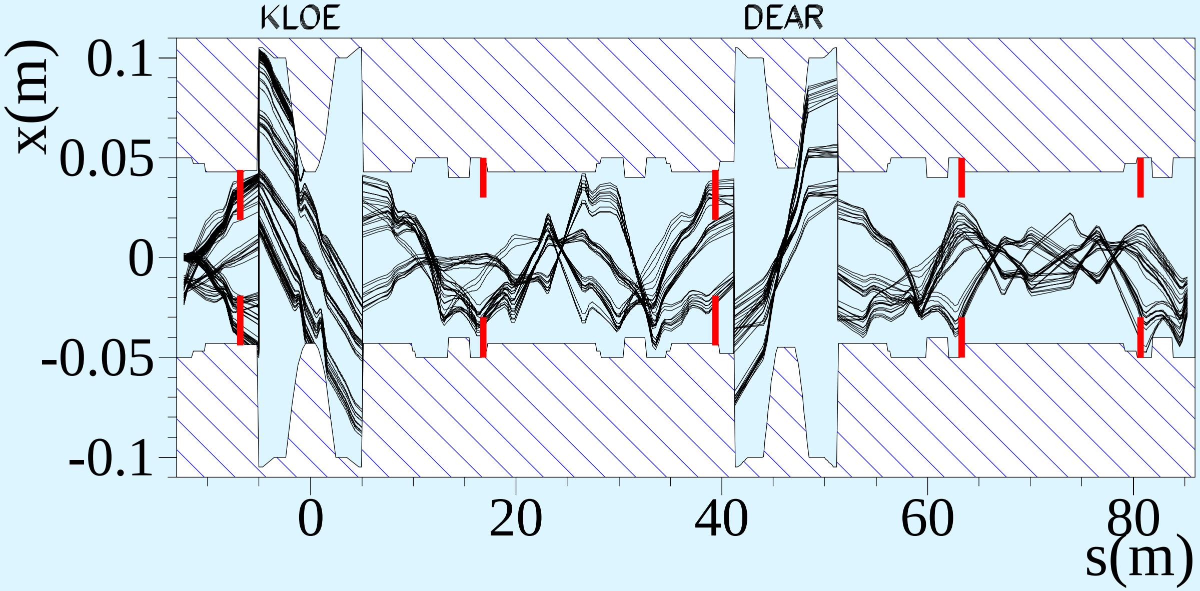
IP at s=0

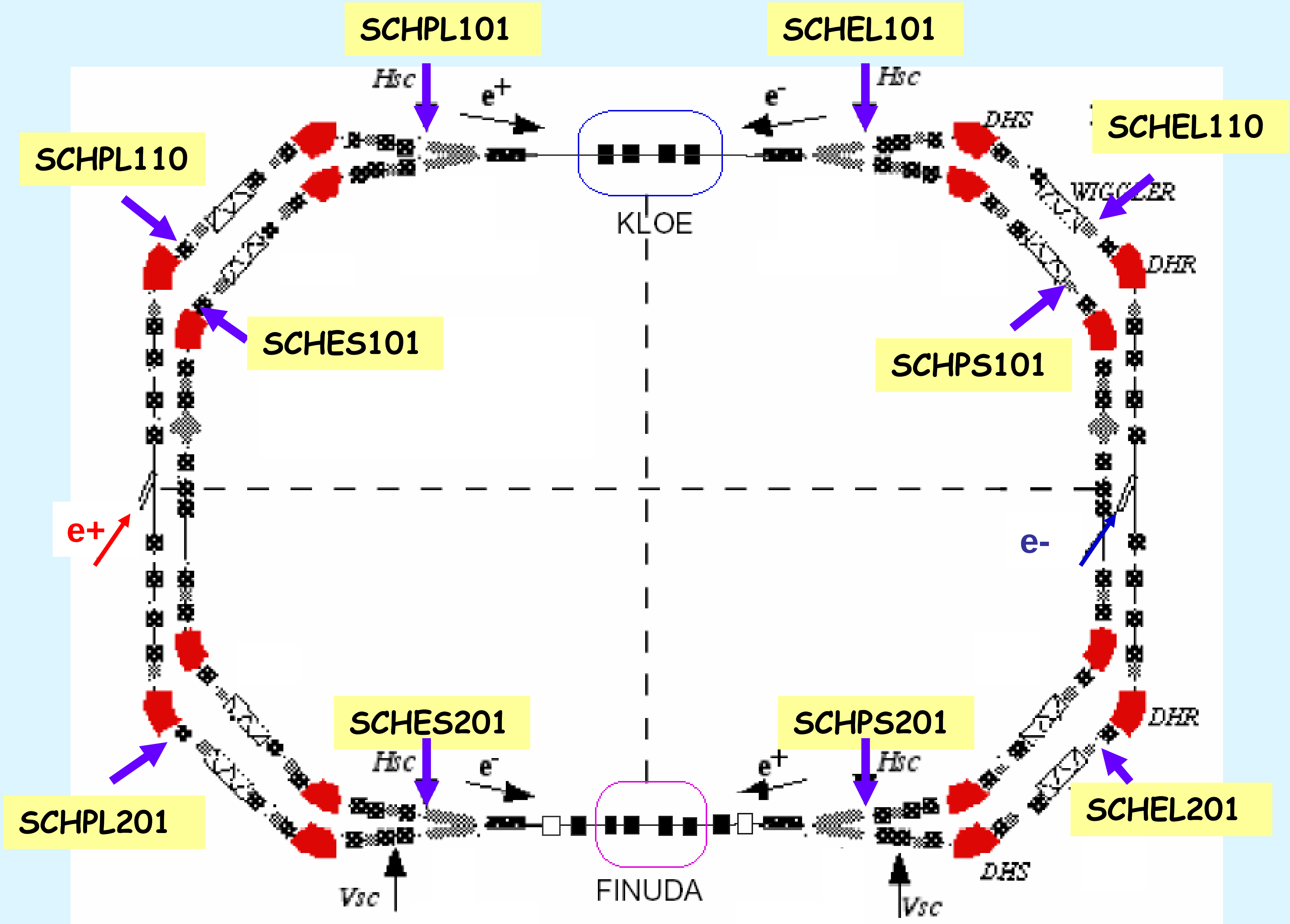
Collimators

Touschek particles that get lost are scattered in high dispersive regions

Distribution of Touschek scattering position for losses all over the ring (upper plot) or only at the IR (lower plot).

Optimal position for collimators along the rings





SCHPL101

SCHEL101

SCHPL110

SCHEL110

SCHES101

SCHPS101

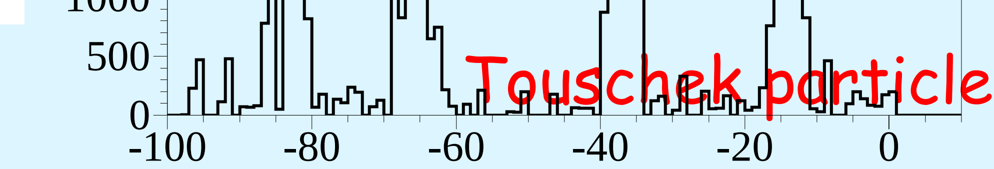
SCHES201

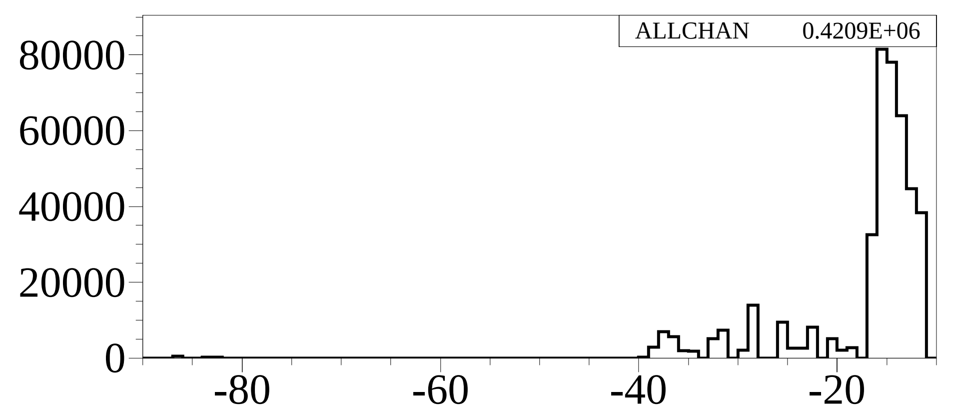
SCHPS201

SCHPL201

SCHEL201

Touschek particles lost at the IR





when all collimators are inserted only Touschek particles scattered in the closest arc before the IP are lost at the IR

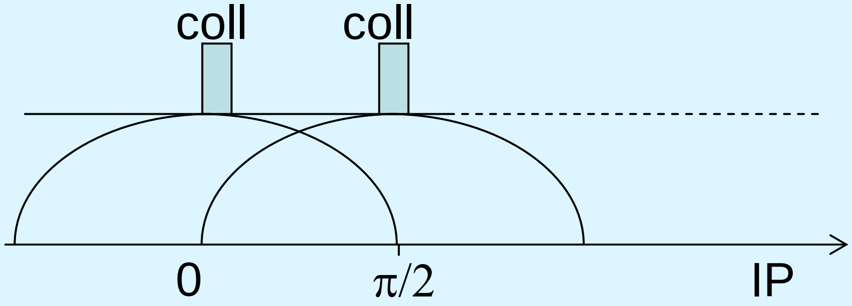
In DAFNE IP very close to last high dispersive region, about 10 m

collimators needed close to the IP

careful study of collimator shape to avoid background generation

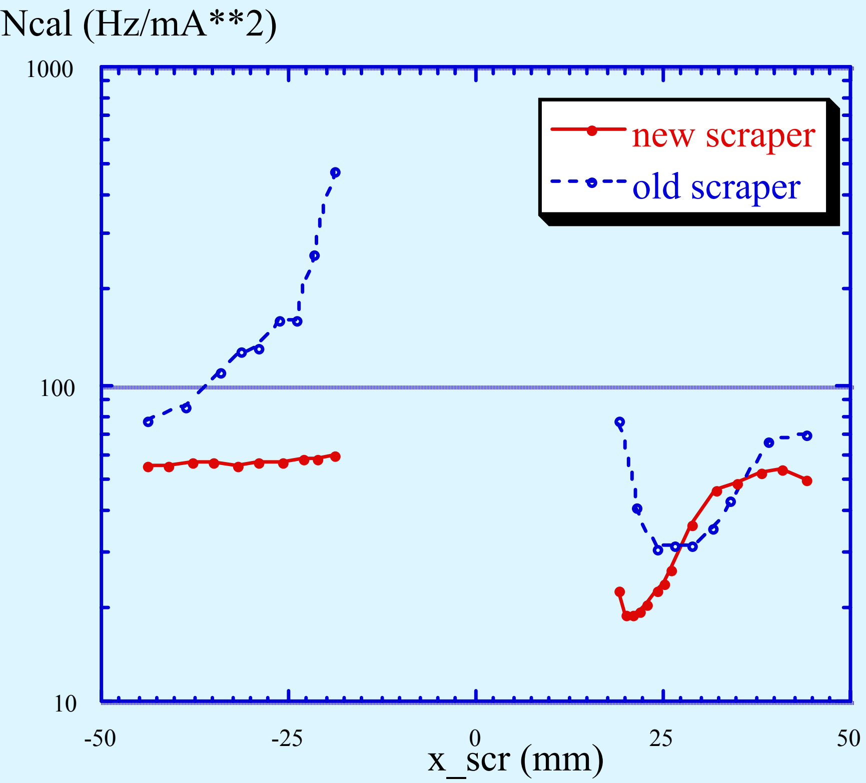
phase advance between collimators and IR

in order to stop particles that get lost at IR, phase advance between collimator and QF should be ~ $\pi/2$



Typical behaviour of the measured background rate as a function of collimators openings

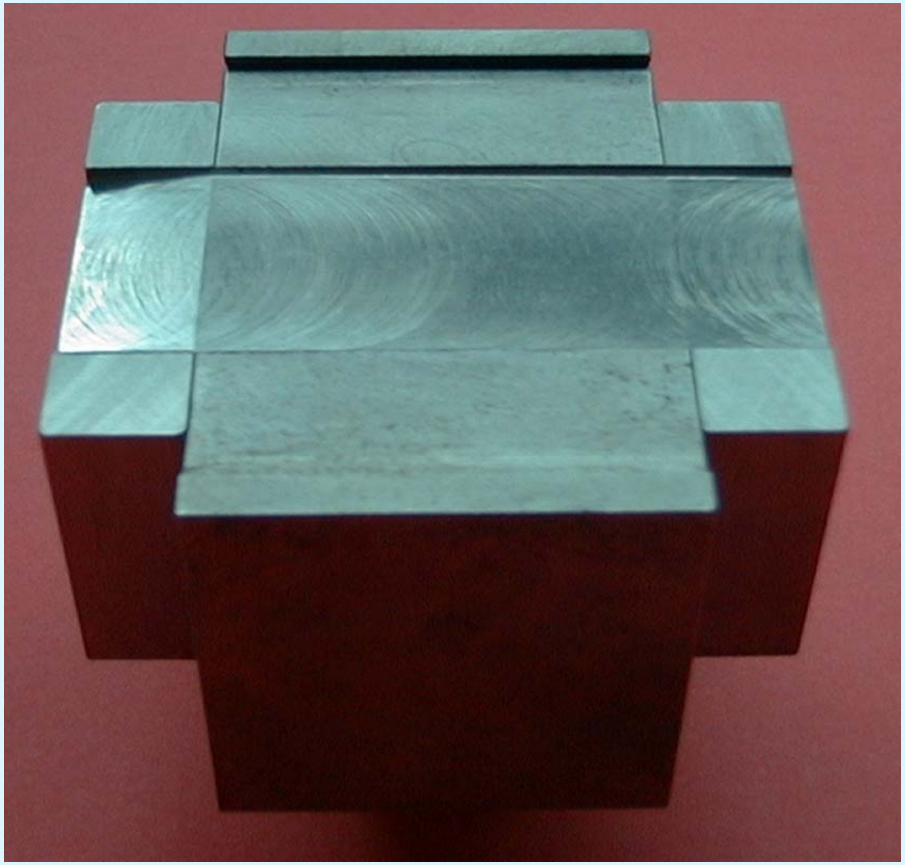
The background rate measured by KLOE for an electron beam as a function of the KLOE collimator setting



(dashed blue line):
the external jaw reduces the background by about a factor of 2.3 at a distance of ≈25 mm from the beam axis, while the closed orbit was measured at -2.7 mm from the center of the chamber. A steep increase of the background rate is observed when collimators are closed to less than about 23 mm ($9\sigma_x$) from the closed orbit position. Apparently, from this moment on, collimators are producing more background particles than they are stopping.

(full red line)
It is shown the behaviour of the **modified** collimator. The external jaw reduces the background by a factor 2.9 at a distance of ≈20 mm from the chamber axis. No background reduction is found when moving in the internal jaw, however, the previously observed strong increase is no longer present (dashed line), indicating an improved stopping efficiency of the scraper blocks.

Modified Collimator



The inner surface of the modified collimator blocks has been divided into two flat parts.

A first 1 cm long section has a slope of 100 mrad towards the beam, in order to **increase the impinging angle** into the block for most particles.
This is followed by a second section of 4.5 cm length with a slope of 10 mrad in the opposite direction to **avoid foreward scattering** of electrons back into the beam pipe.

The total scraper thickness of now 5.5 cm (about 16 r.l.) is reducing the punch through probability of 500 MeV electrons to below 10^{-6}.

Collimators Modeling

- Perfectly absorbing collimators
- No width

collimators assumed perfectly absorbing and infinitely thin

actual behaviour is reproduced but

Edge effect is missing

It has been found that most of the particles are scattered by the collimator edge, instead of being absorbed, thereby producing additional background to the experiments.

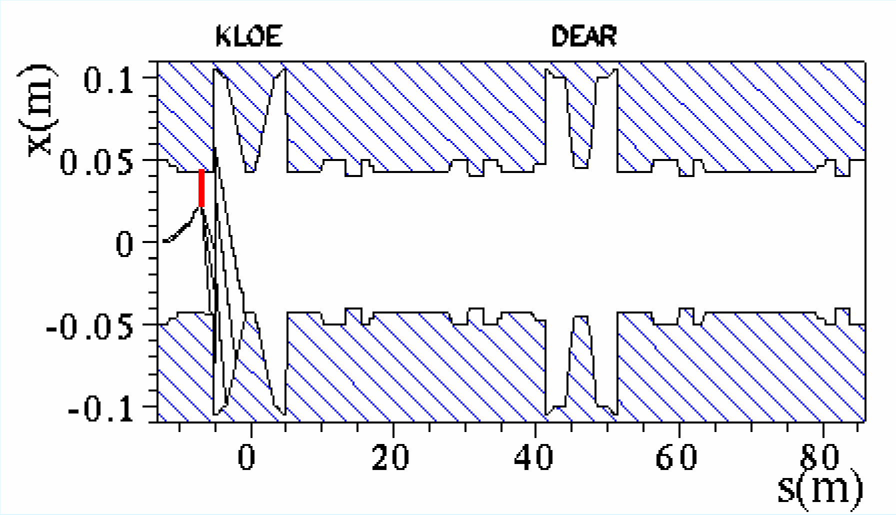
real collimator shape included in simulation

and edge effect has been simulated

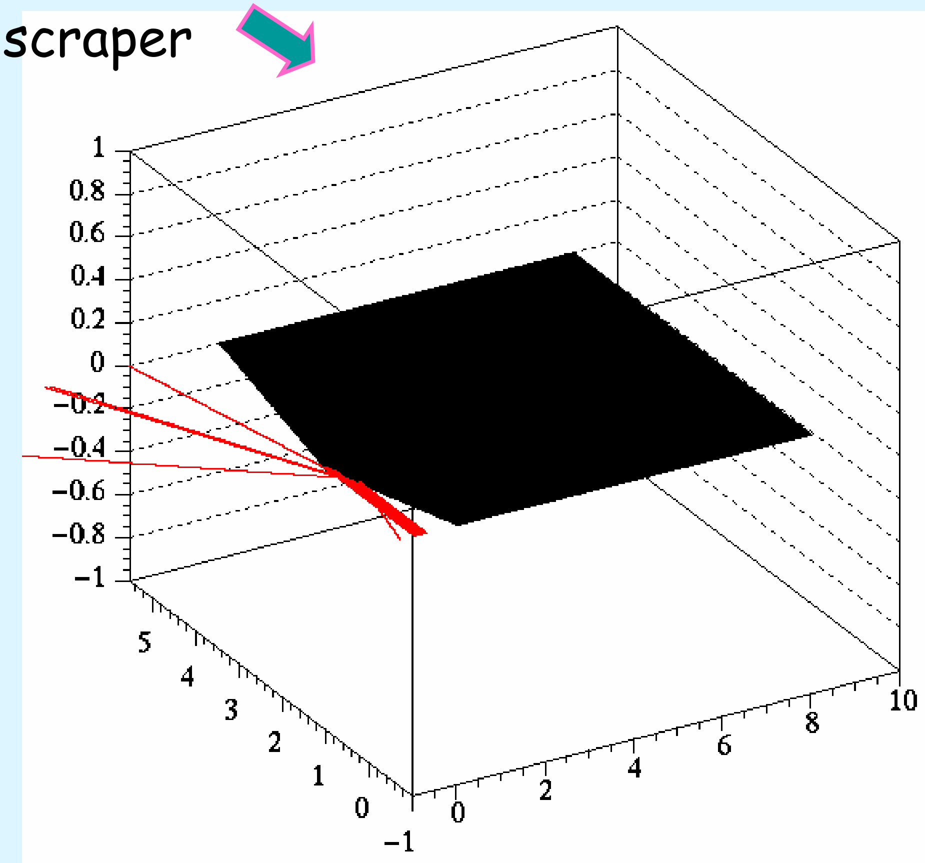
Simulation results with real collimator

Electron interactions at collimator edge

Electron interaction:
Multiple scattering,
Bremsstrahlung, de/dx
simulated by a toy MC



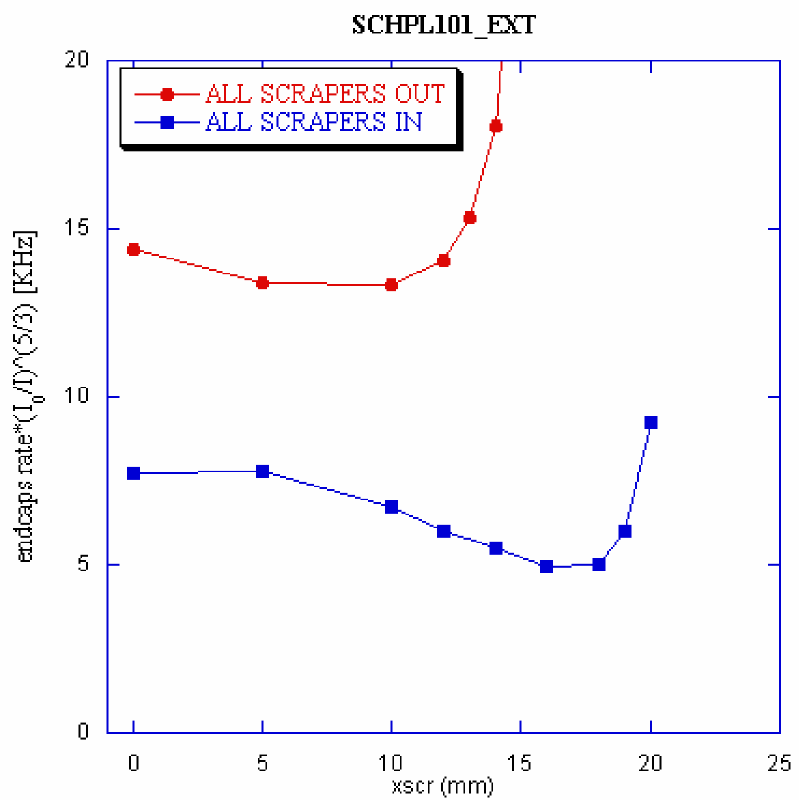
Zoom at scraper



Only additional background to KLOE IR from edge effect displayed

IR collimator more effective with other ones in

In addition to a direct background reduction the collimators added in dispersive regions helped in making the collimator upstream the experiment more effective. In fact, they stop particles that would be just deviated by the IR collimator and eventually lost at the experiment.



Scan of the normalized background rate in the KLOE forward calorimeter versus position of the external jaw of the positron beam **KLOE collimator with all other ones** **out** (red dots) and **in** (blue squares).

A factor 1.6 is gained due to the fact that it can be inserted closer to the center of the pipe.

Collimators on/off measurements

at the end of the KLOE data taking -in optimized conditions in terms of L/bkg ratio and of vacuum conditions- (March 06)

105 bunches, I_{bunch}=5mA

e-

scrapers	I[A]	σ_x	σ_y	τ[s]	ECM2 [KHz]
All OFF	474	1.30	0.15	3561	252.3
All ON	461	1.27	0.13	3125	12.5

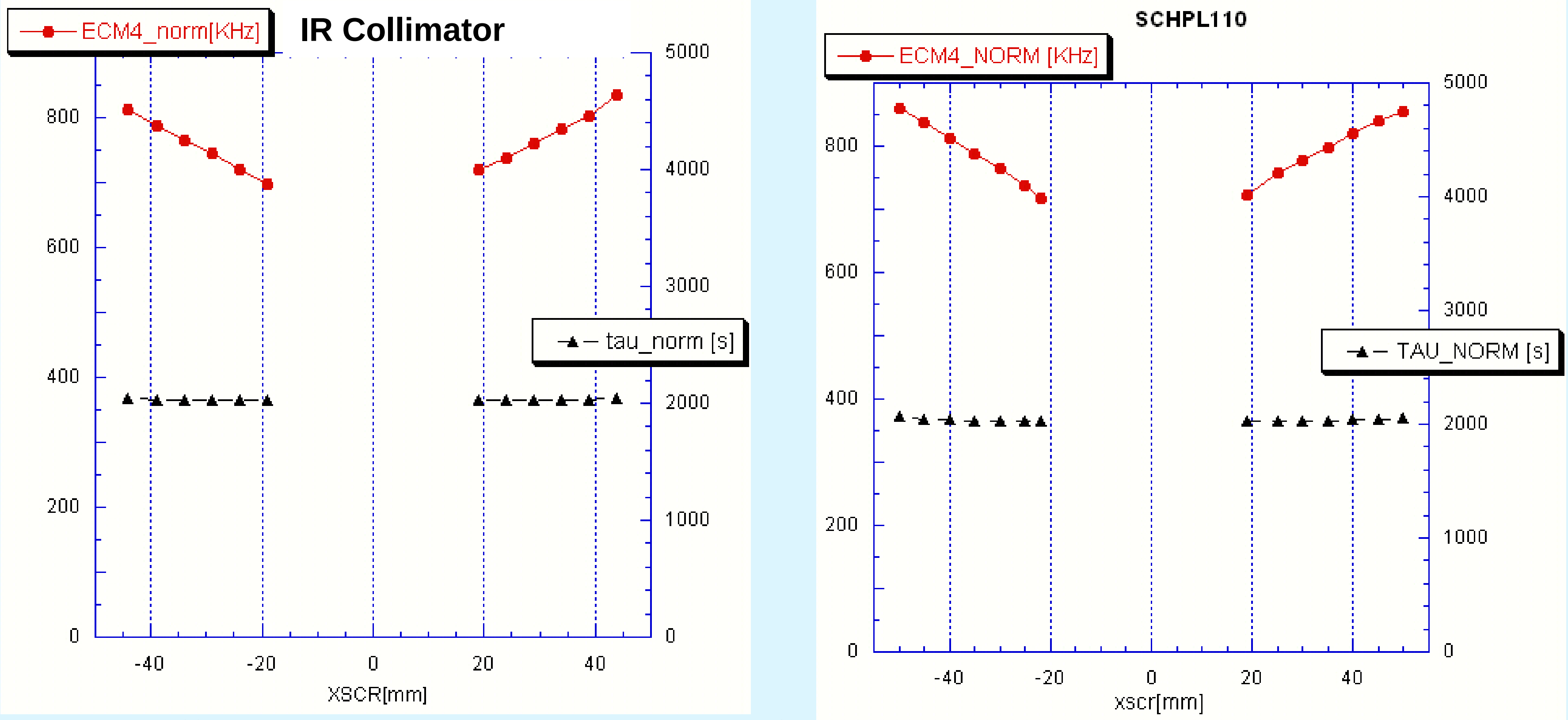
$$\frac{\text{scr.OFF}}{\text{scr.ON}} = 20$$

e+

scrapers	I[A]	σ_x	σ_y	τ[s]	ECM4 [KHz]
All OFF	524	1.12	0.21	2378	946.4
All ON	524	1.08	0.20	1959	19.4

$$\frac{\text{scr.OFF}}{\text{scr.ON}} = 49$$

20/03/2006 measurement e+



Collimator behavior differently with respect to past now they are very efficient:

In 2002 collimators were set not so inside the pipe,

Efficiency was not so high

In 2006

- Most of them were at maximum inner positions, reducing continously hot rates at calorimeter
- never reduce lifetime
- never enhance backgrounds

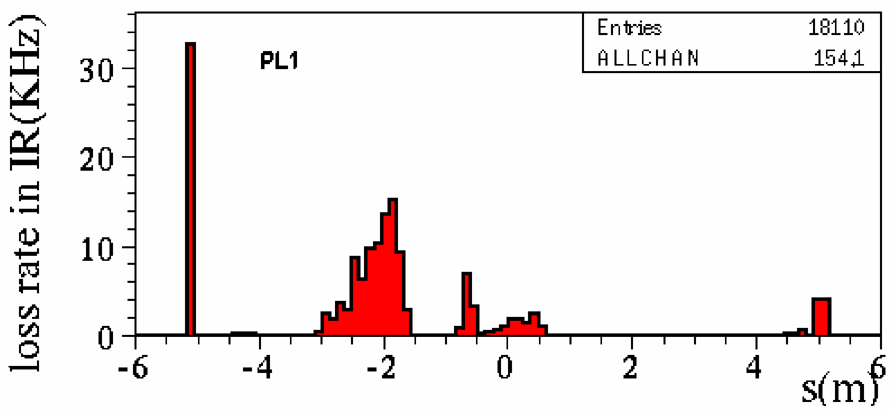
⇨ Collimator need to be VERY clean in order to be efficient- very slow process;

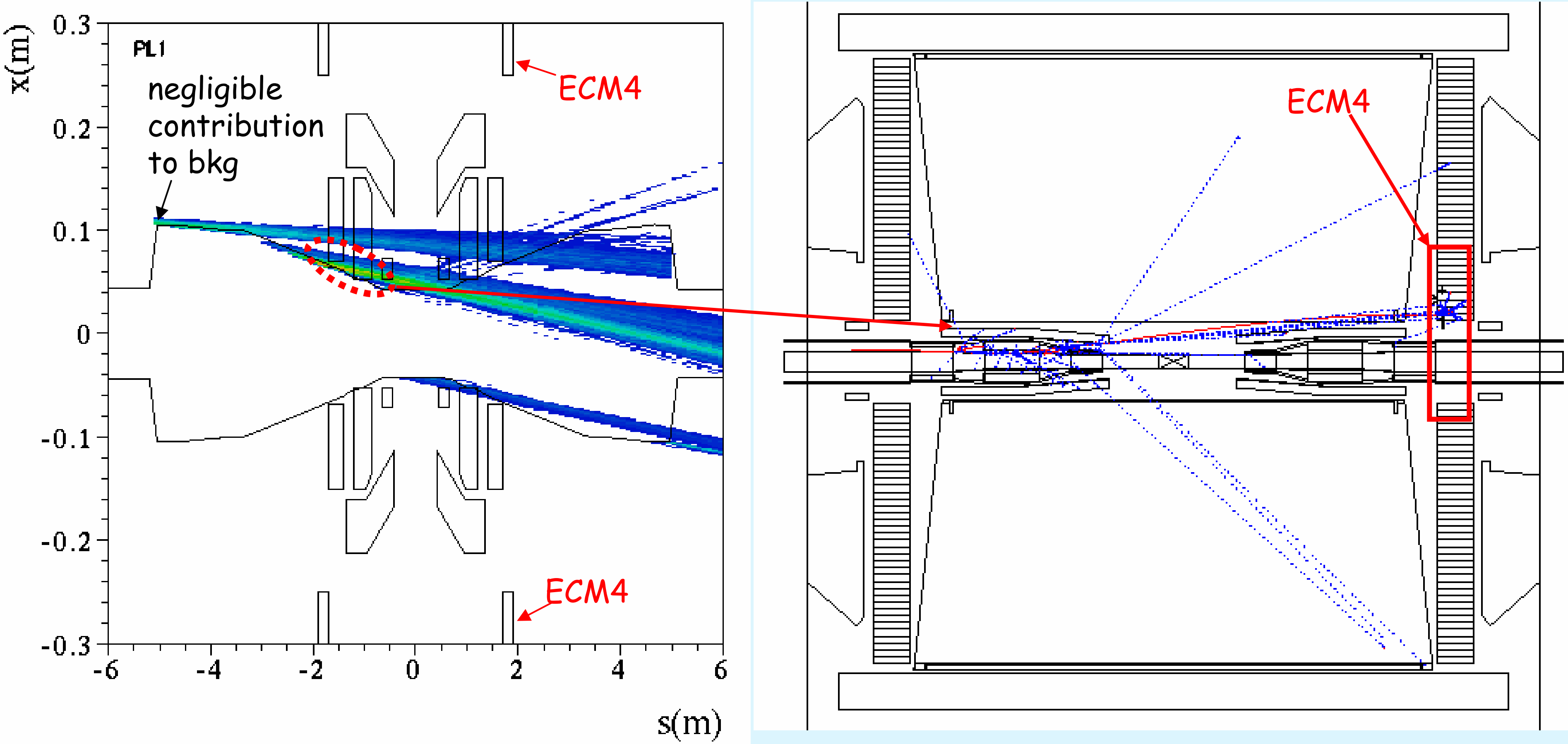
⇨ Emittance decreased by a factor 2

⇨ Copper tapering for preventing discontinuity in the pipe for impedance reasons has been removed from borders of collimators

KLOE IR

evaluation of detector acceptance is essential for a comparison between measured and simulated background rates

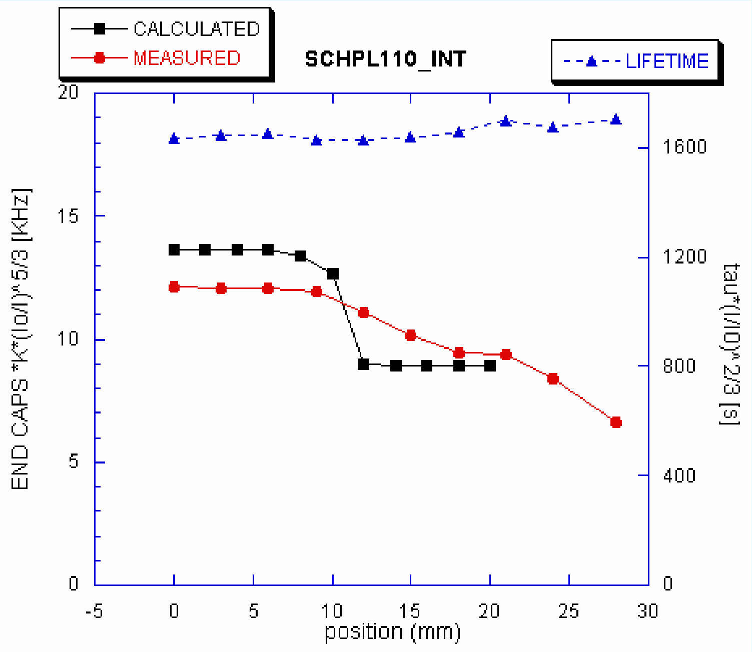



negligible contribution to bkg

Comparison between measured and calculated effectiveness of collimators

The calculated rate is evaluated by tracking Touschek scattered particles from their loss point in the pipe into the KLOE detector. The endcap acceptance has been taken into account by means of full detector simulation including the geometrical details of the IR.

There is a qualitative agreement between measurement and simulation.



Scan of the background rate in the KLOE forward calorimeter versus position of the internal jaw of a collimator:

measured normalized rate in red dots,

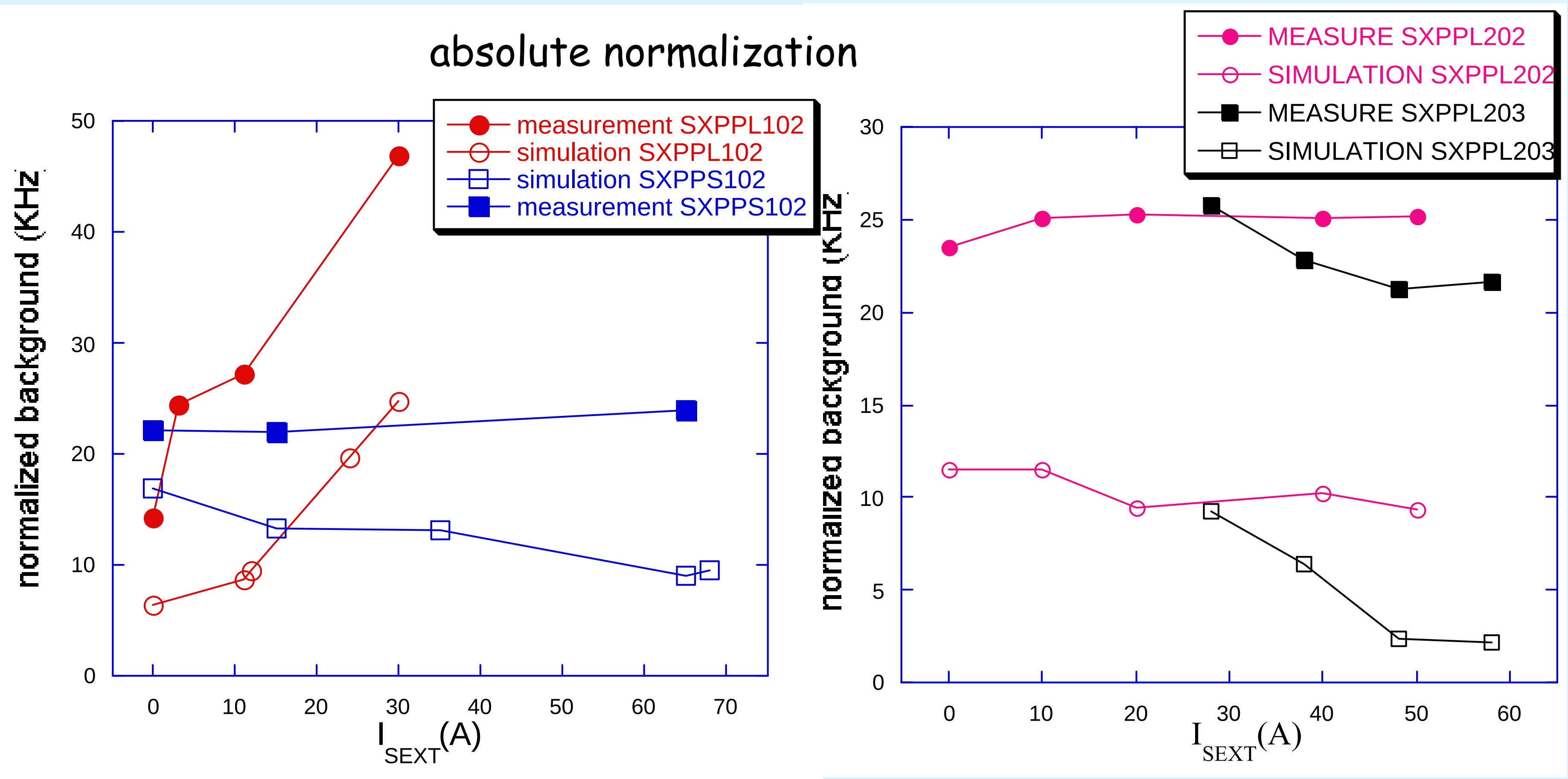
calculated normalized rate in black squares and

normalized lifetime in blue triangles.

The collimator opening is measured from the beam pipe edge.

Comparison between expected and measured background rates at the KLOE calorimeter versus sextupoles strengths

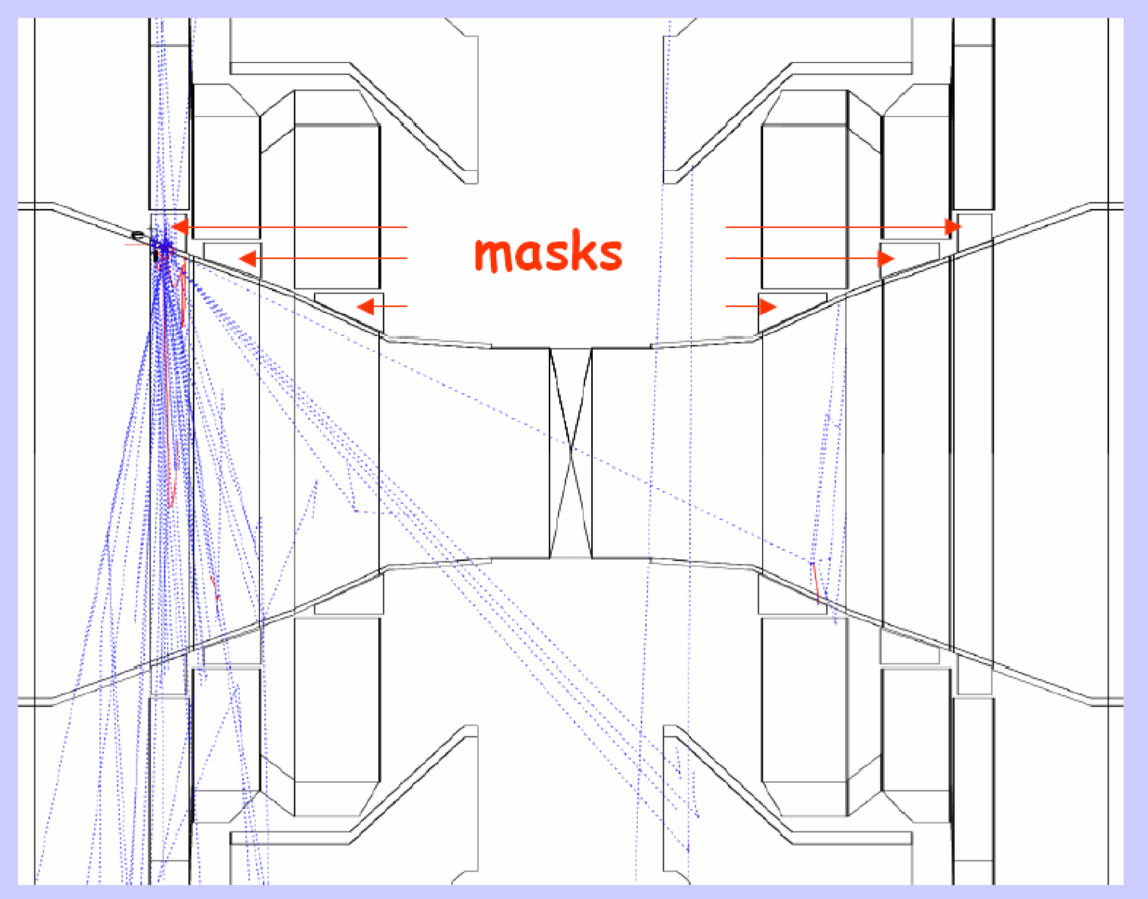
The MC reproduces actual behaviour of background vs sextupoles strengths


absolute normalization

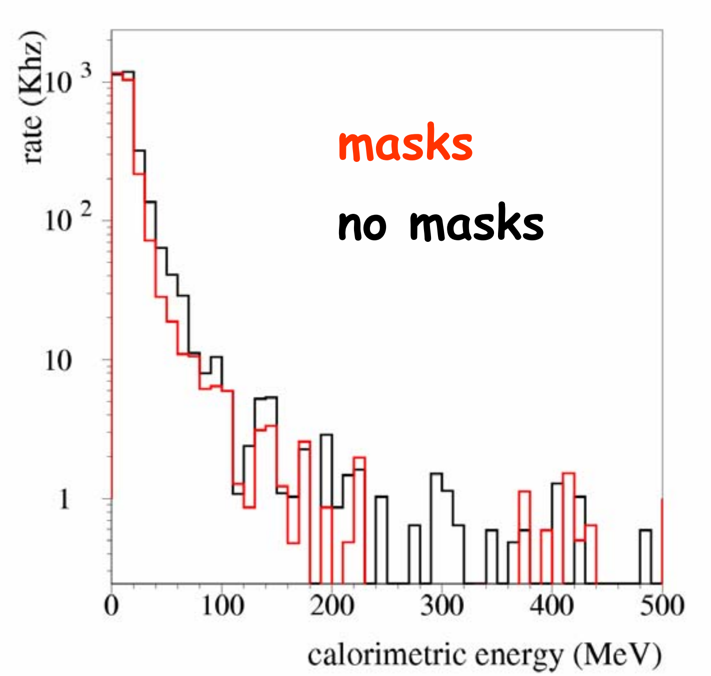
Simulated loss rates have been normalized to measurement (27/09/01):
nb=47 ; Ibunch=5mA (Itot=100mA) and normalization is made for R=0.1 ($R=\sigma y/\sigma x$)

Masks added between pipe and low-β quads

IR layout + background event x-s view



Masks effectiveness

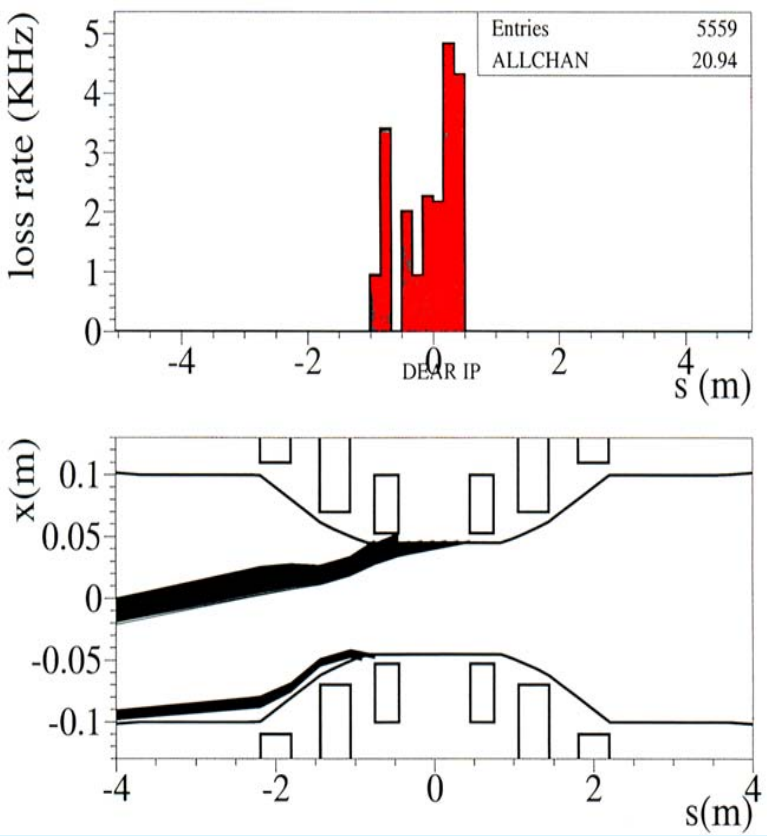


Low βx in Dear

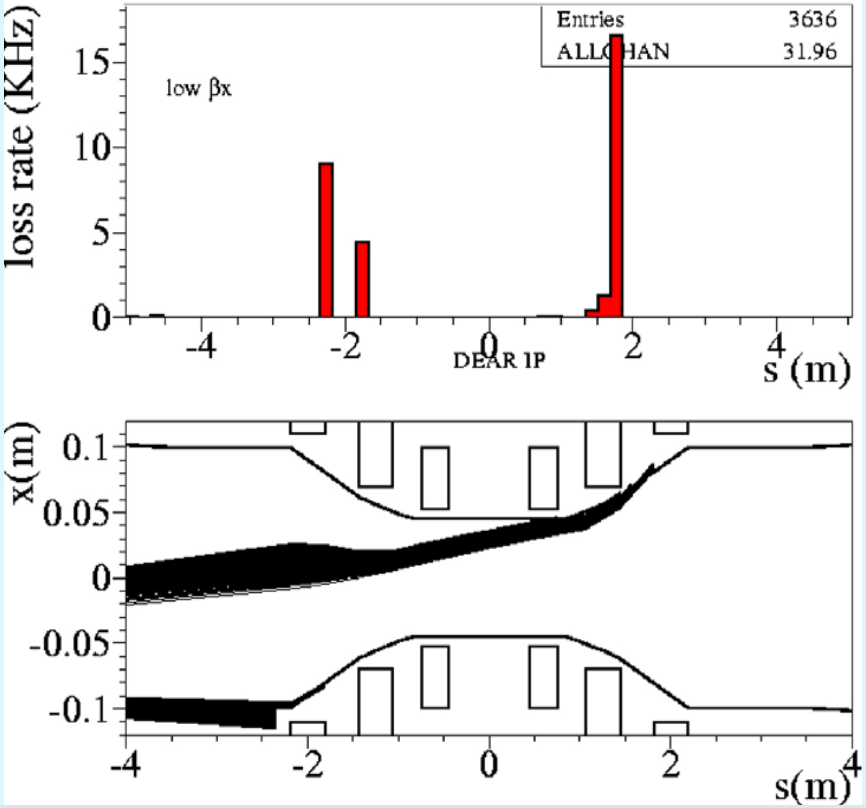
βx=4.4m in December βx=1.7m in April

Touschek particles trajectories at DEAR IR

calculated background
With last December 2001 optics

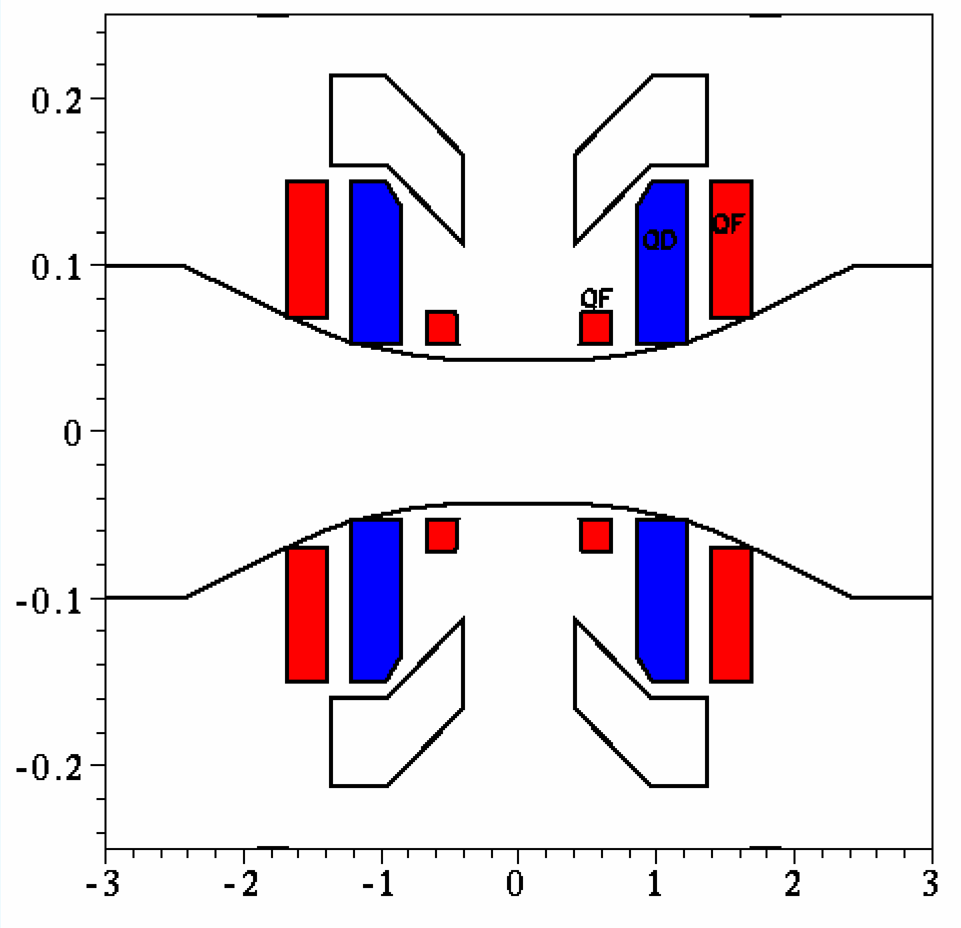


calculated background
with April 2002 optics
(low-β_x at IP and at first quad-F)

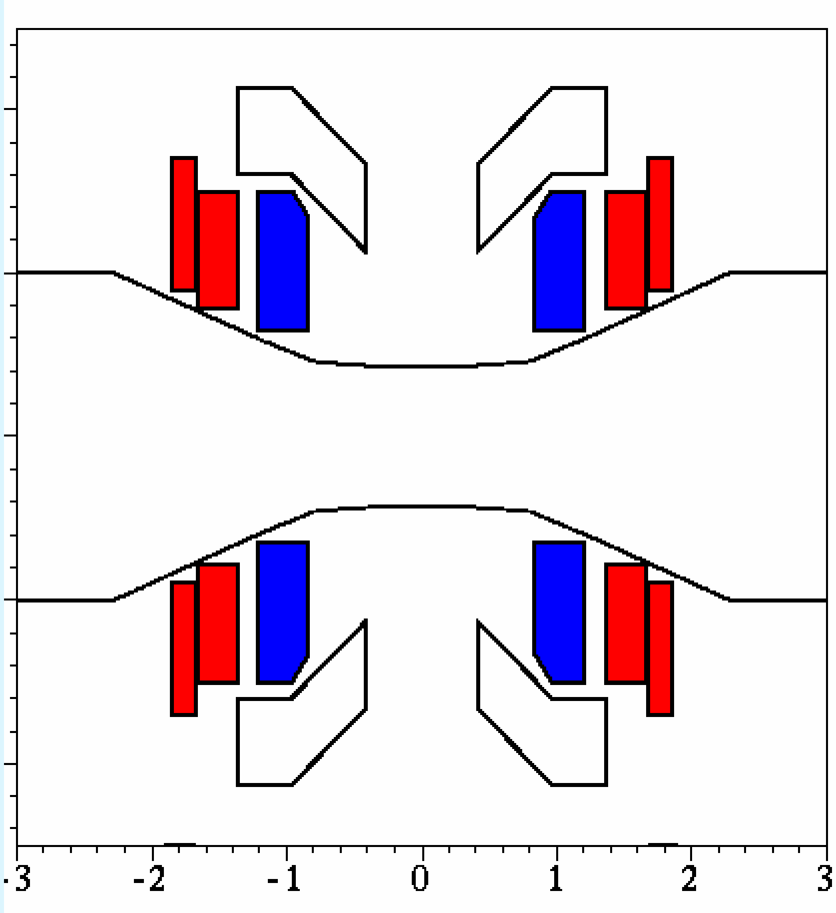


Studying the particles distribution at DEAR IR improved background rates both by the indication of lowering the βx-function at the closest quad to IP2 and by shielding at the calculated position

TRIPLET
KLOE IR

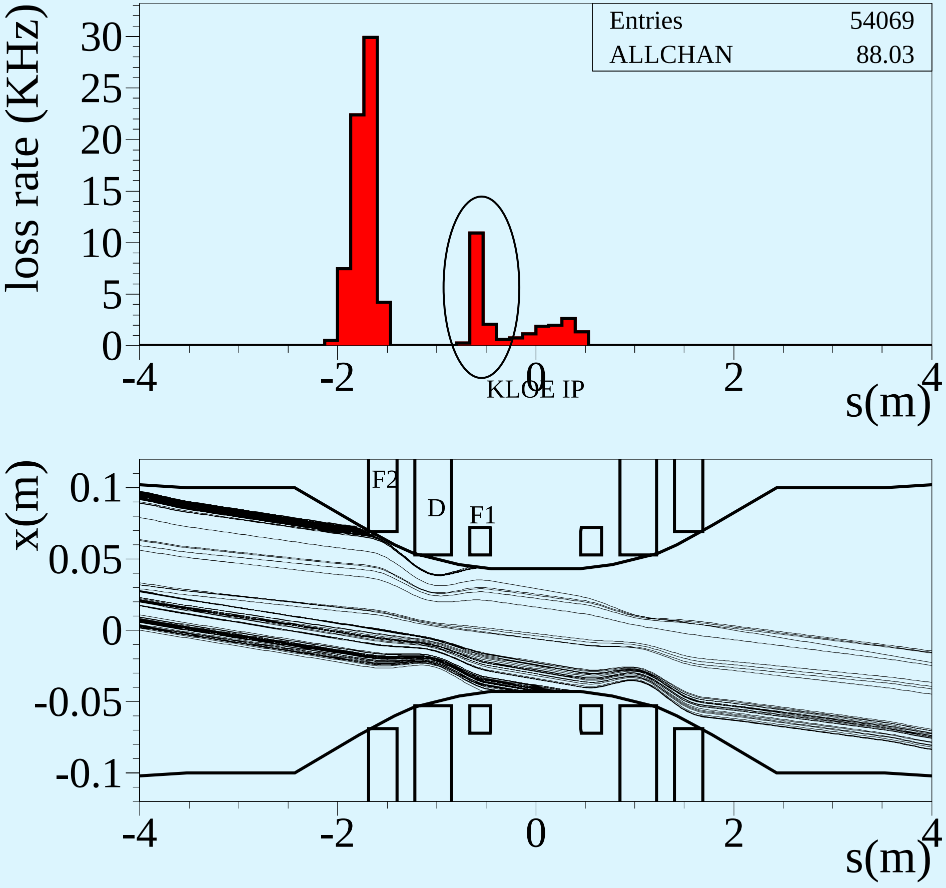


DOUBLET
KLOE IR

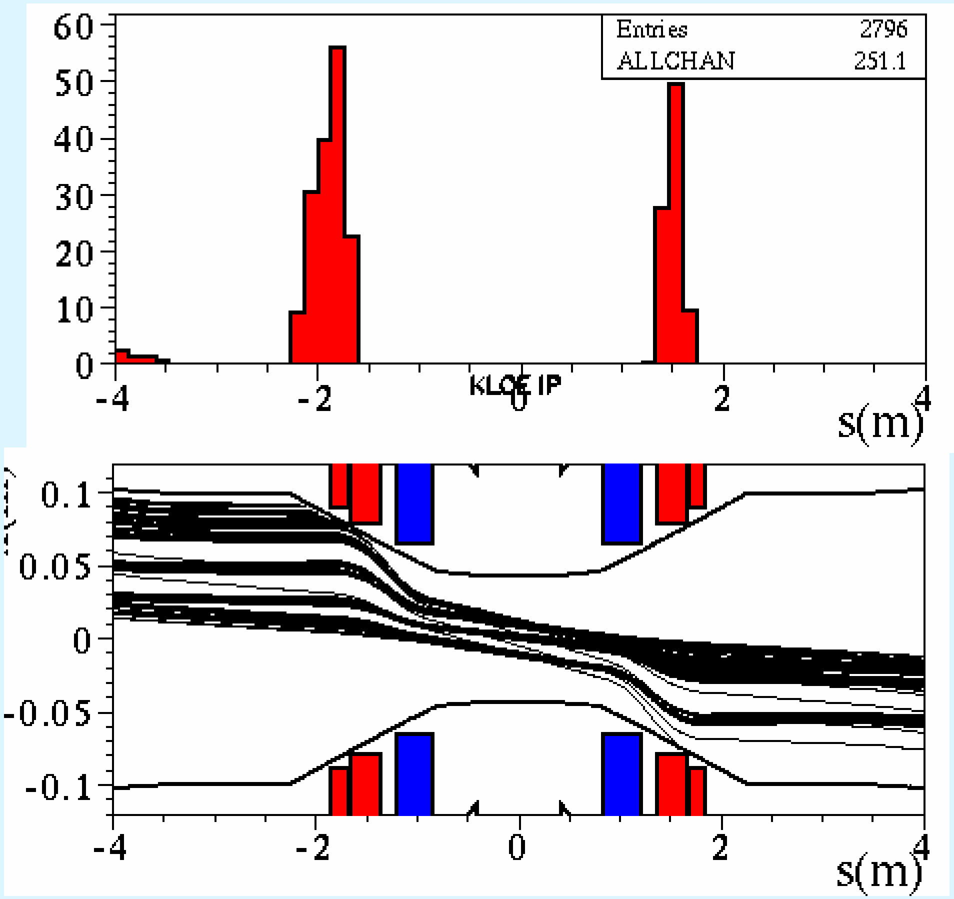


Touschek particles trajectories at KLOE IR

triplet FDF low-β quads



doublet low-β quads

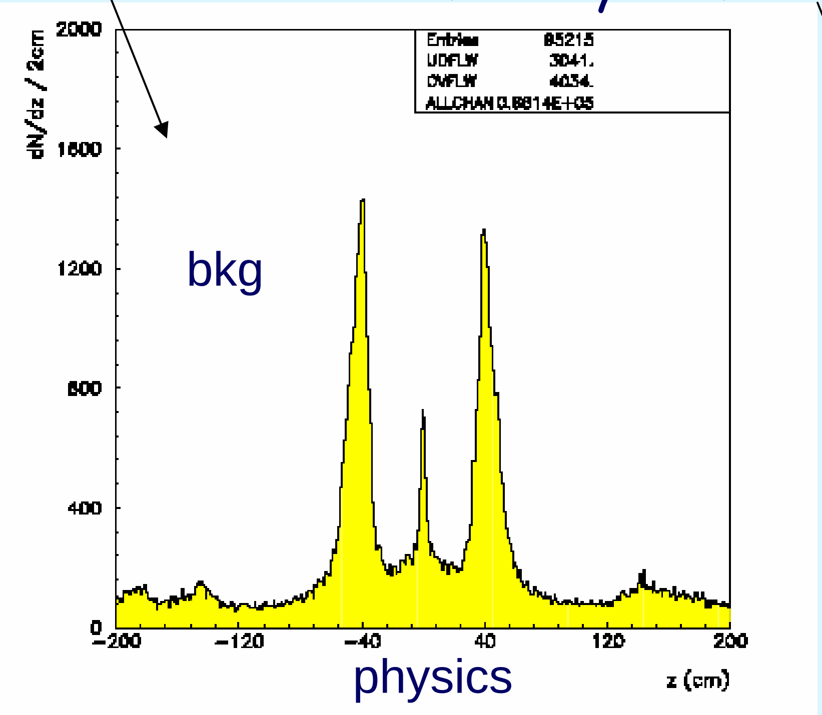


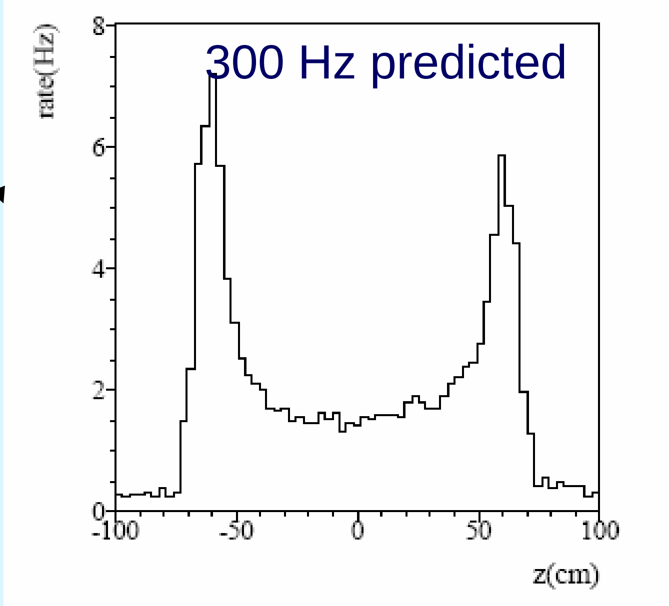
Touschek Backgrounds view from the experiments- an example

high rate 200 Hz of localized 1-track (protons) in KLOE until 2001

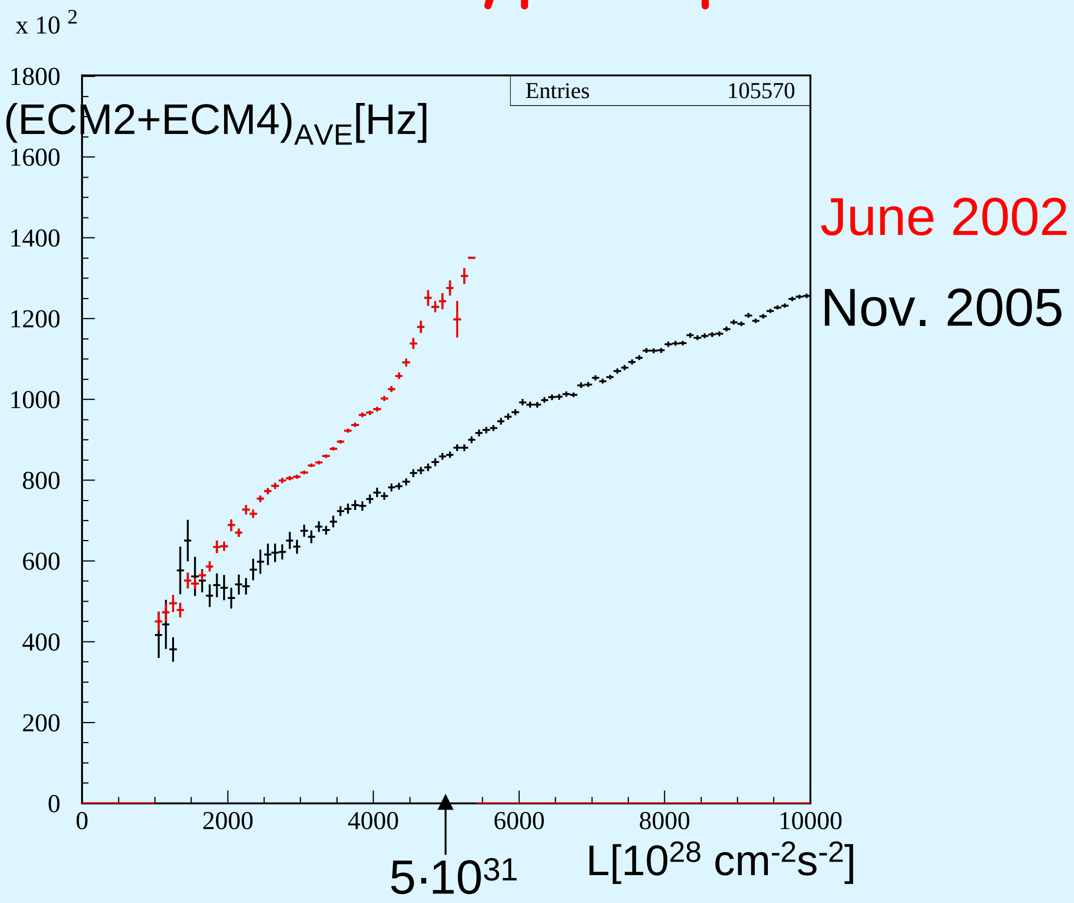
understood as photoproduction (ep(n)→Λe → pπ⁰(π⁻)e)

induced by Touschek particles hitting beam pipe support



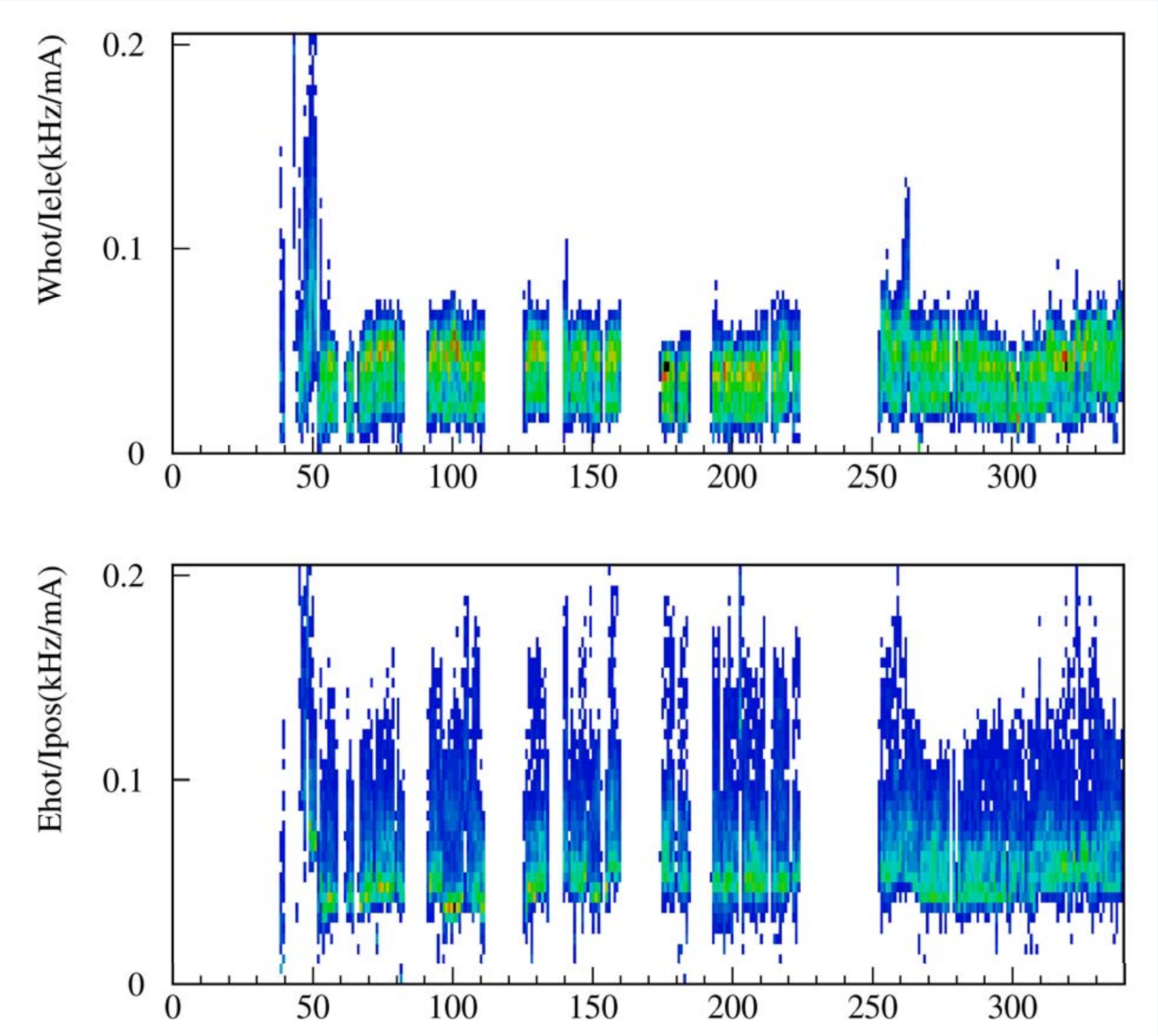


Backgrounds versus Luminosity in two typical periods of KLOE data taking



It is not easy to quantify reduction factor of the different actions

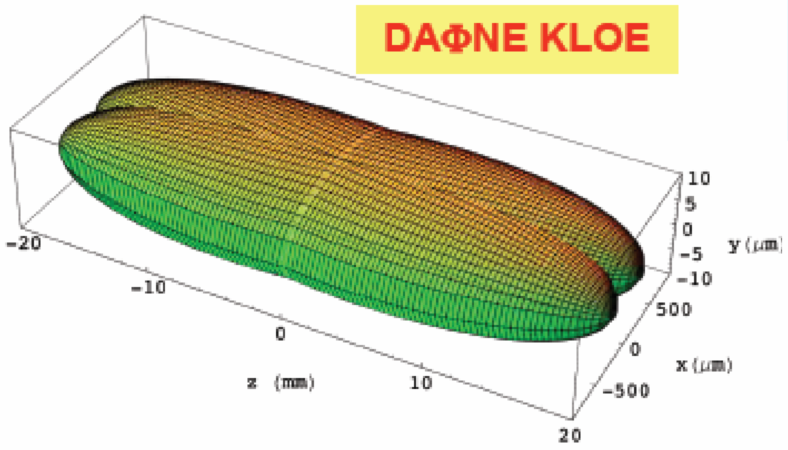
2005 KLOE run:
background rate/current vs day

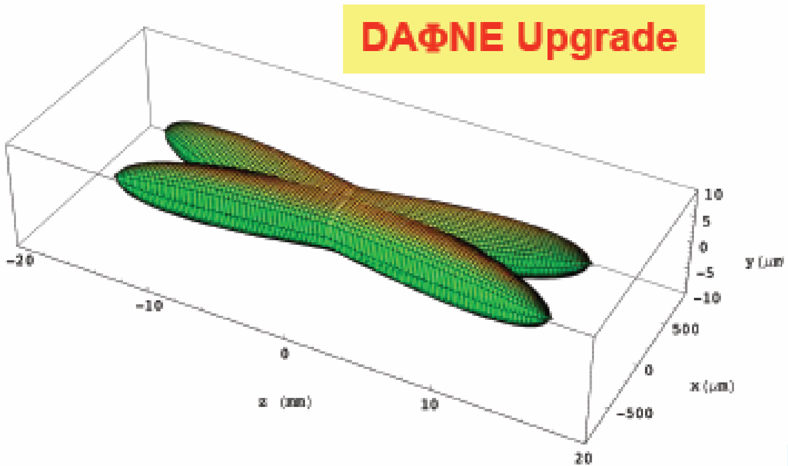


Touschek Backgrounds for the Crab waist scheme at DAFNE

Energy deviat.	0.003 -0.02
σ_p/p	4 e-4
ε_x(m rad)	$0.2\cdot10^{-6}$
coupling	0.005
N_p	$2\cdot10^{10}$
I_{bunch}(mA)	10

BEAM DISTRIBUTION AT IP


DAΦNE KLOE


DAΦNE Upgrade

	DAΦNE KLOE	DAΦNE Upgrade
I_{bunch} (mA)	13	13
N_{bunch}	110	110
β_y^* (cm)	1.7	0.65
β_x^* (cm)	170	20
σ_y^* (μm)	7	2.6
σ_x^* (mm)	0.7	0.2
σ_z (mm)	25	20
$\theta_{cross}/2$ (mrad)	12.5	25
$\Phi_{Piwinski}$	0.45	2.5
L ($cm^{-2}s^{-1}$) $x10^{32}$	1.6	>5

Collision scheme with large Piwinski angle and Crab Waist

- Large Piwinski angle Φ by:
  - smaller σ_x
  - larger θ

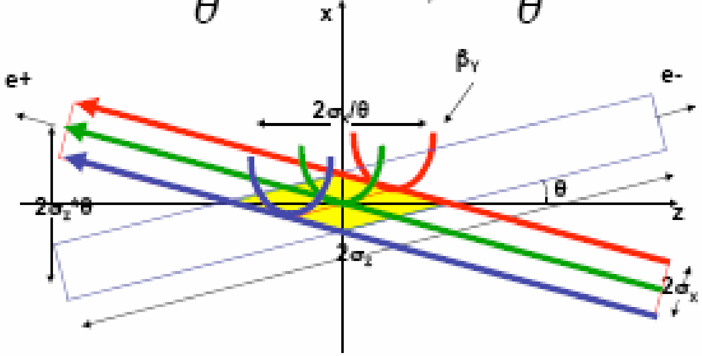
$$\Phi \approx \frac{\sigma_z}{\sigma_x}\frac{\theta}{2}$$

$$\xi_y \propto \frac{N\sqrt{\beta_y}}{\sigma_z\theta} \qquad \xi_x \propto \frac{N}{(\sigma_z\theta)^2} \qquad L \propto \frac{N\xi_y}{\beta_y}$$

- $L_{\mathrm{geometric}}$ gain
- low ξ_x

- colliding beams overlap Σ becomes:

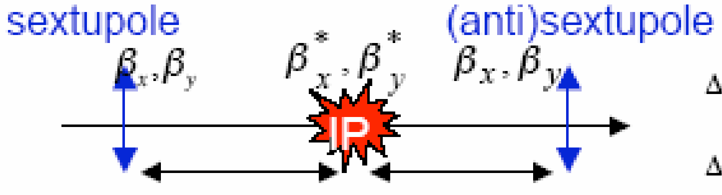
$$\Sigma \propto \frac{\sigma_x}{\theta} \qquad \beta_y \propto \frac{\sigma_x}{\theta}$$



- $L_{\mathrm{geometric}}$ gain
- low ξ_y
- lower β_y ($\beta_y \sim \sigma_z$)
- Y synchro-betatron resonance suppression

- Crabbed waist transformation

$$y = \frac{xy'}{2\theta}$$

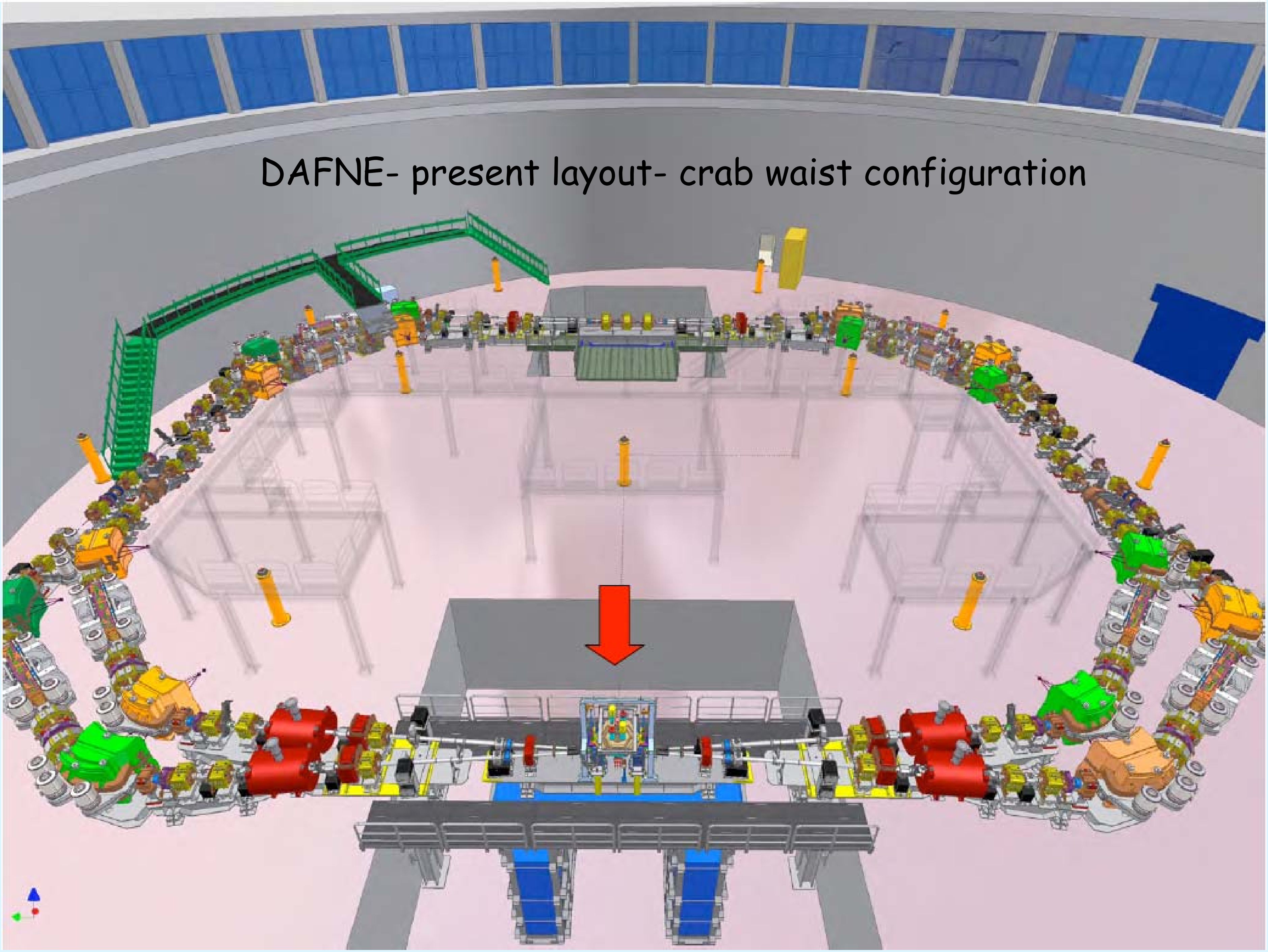


$$\Delta\nu_x = \frac{\pi}{2}$$

$$\Delta\nu_y = \frac{3\pi}{2}$$

- $L_{\mathrm{geometric}}$ gain
- X-Y betatron and synchro-betatron resonances suppression

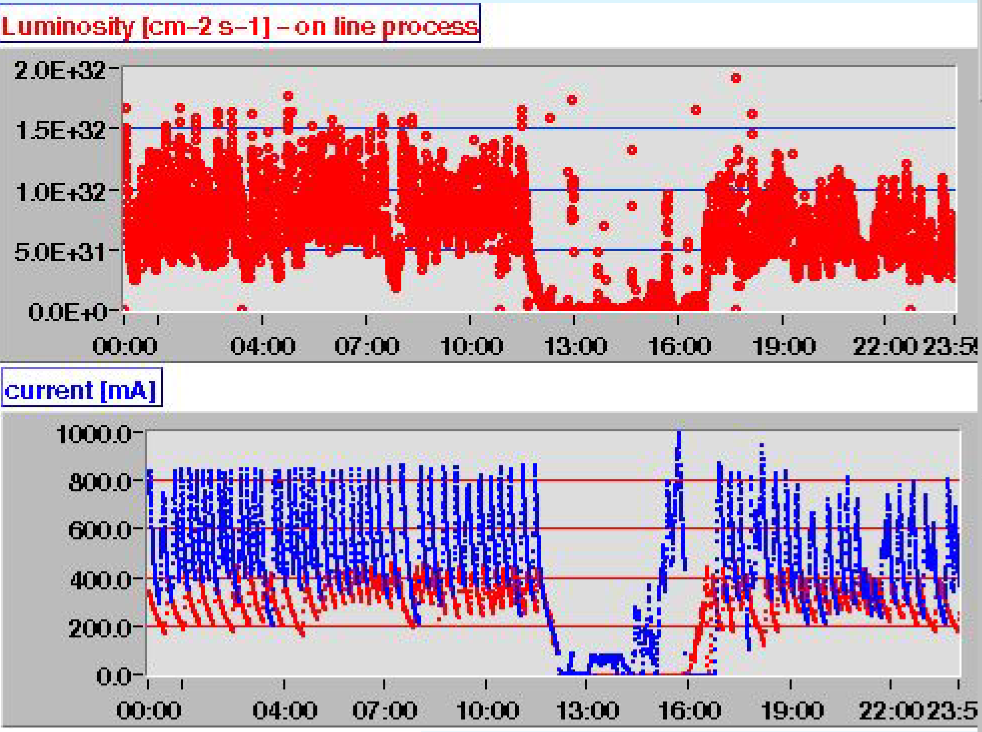
DAFNE- present layout- crab waist configuration



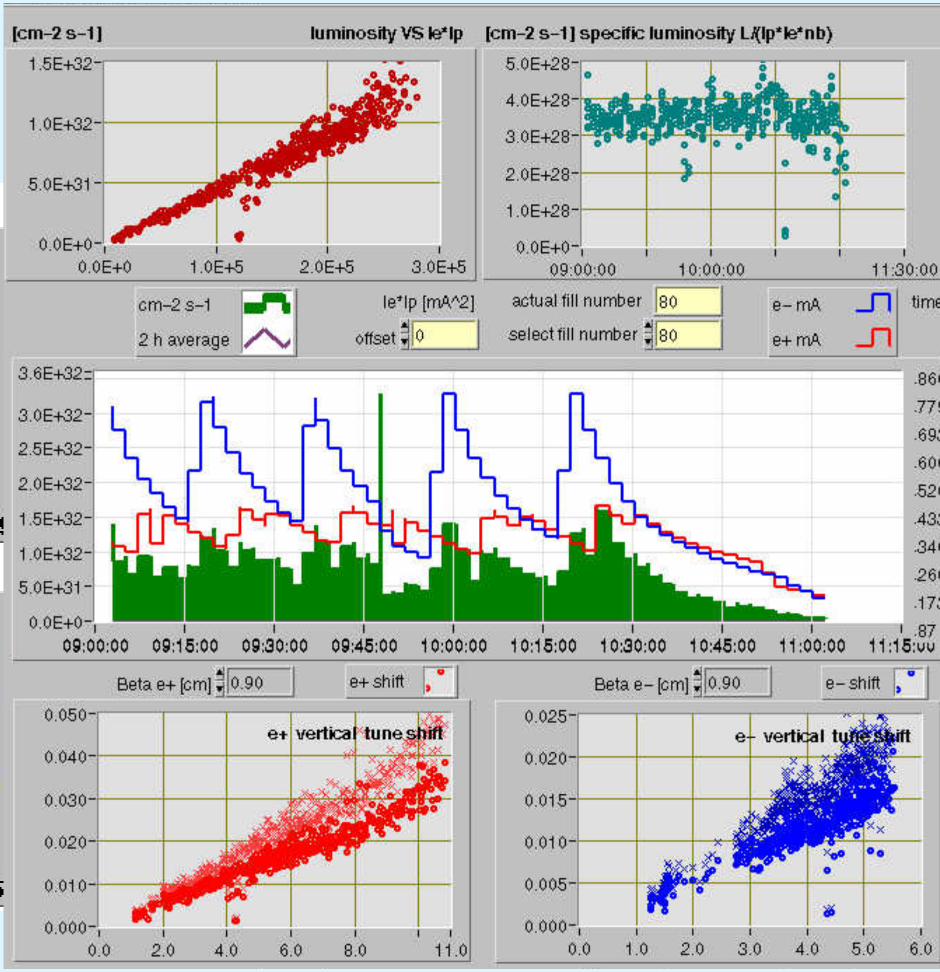
Commissioning with Crab Waist scheme started last December

Luminosity monitor under debugging

L measured with an uncertainty of ±30%



March 2, 2008



Ie*Ip [mA^2] offset 0

actual fill number 80

select fill number 80

Beta e+ [cm] 0.90

Beta e- [cm] 0.90

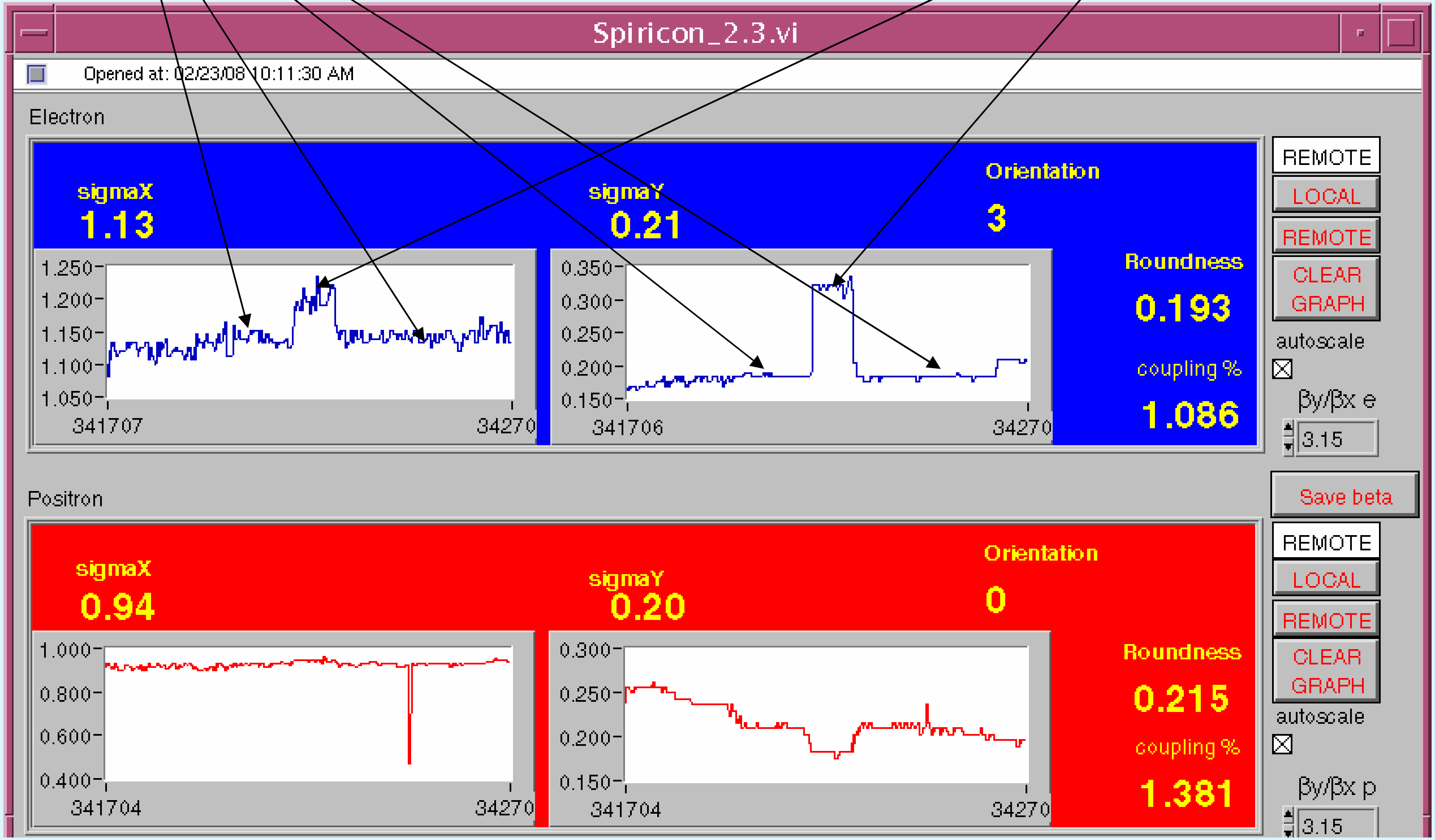
Peak Currents

$I^- \approx 1$ A, $I^+ \approx 0.6$ A

Beam sizes

Crab On

Crab off



Spiricon_2.3.vi

Opened at: 02/23/08 10:11:30 AM

Electron

sigmaX 1.13

sigmaY 0.21

Orientation 3

Roundness 0.193

coupling % 1.086

autoscale ☒

βy/βx e 3.15

Positron

sigmaX 0.94

sigmaY 0.20

Orientation 0

Roundness 0.215

coupling % 1.381

autoscale ☒

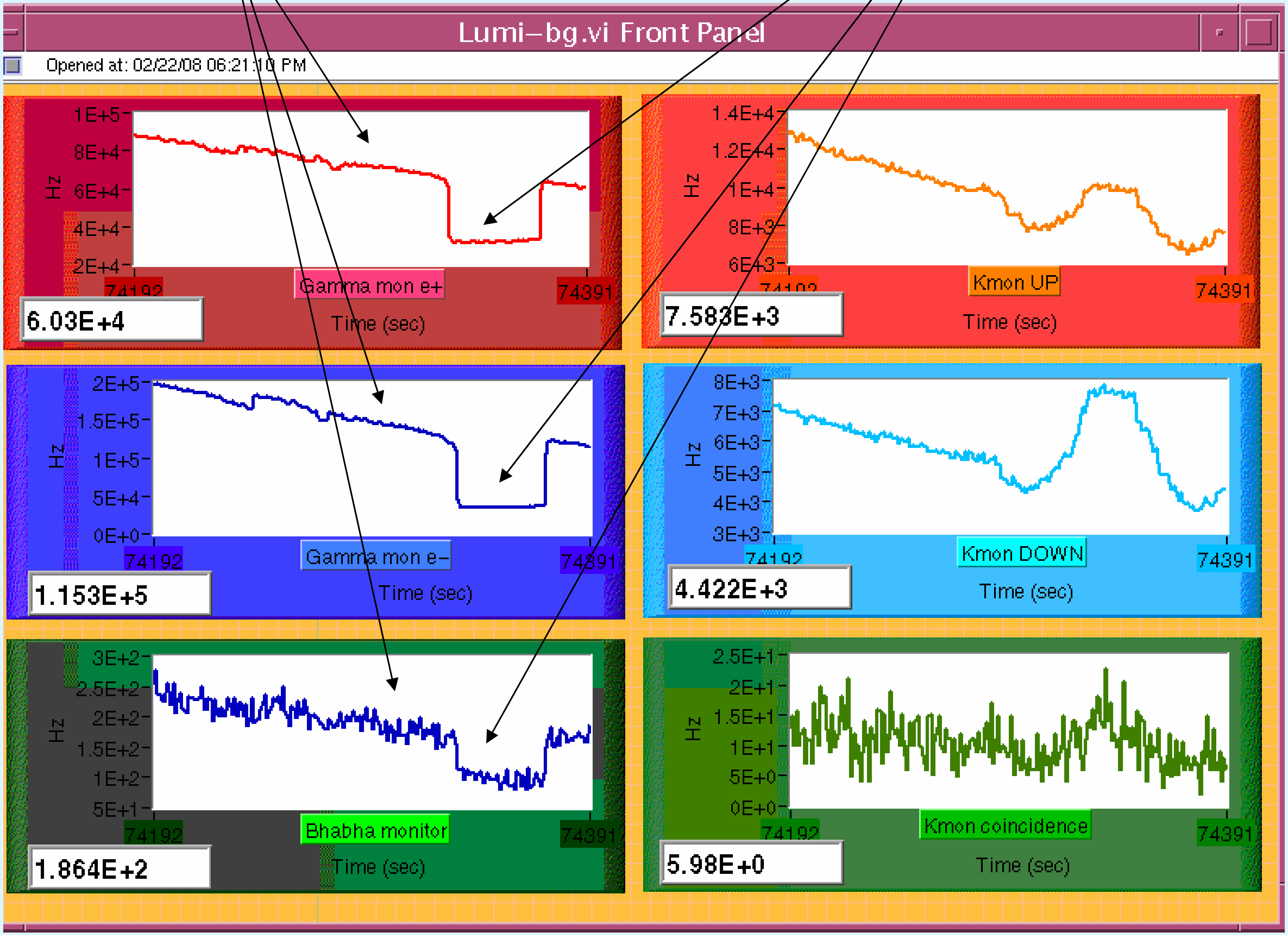
βy/βx p 3.15

As expected, vertical beam size shrinks

two luminosity monitors

Crab on

Crab off



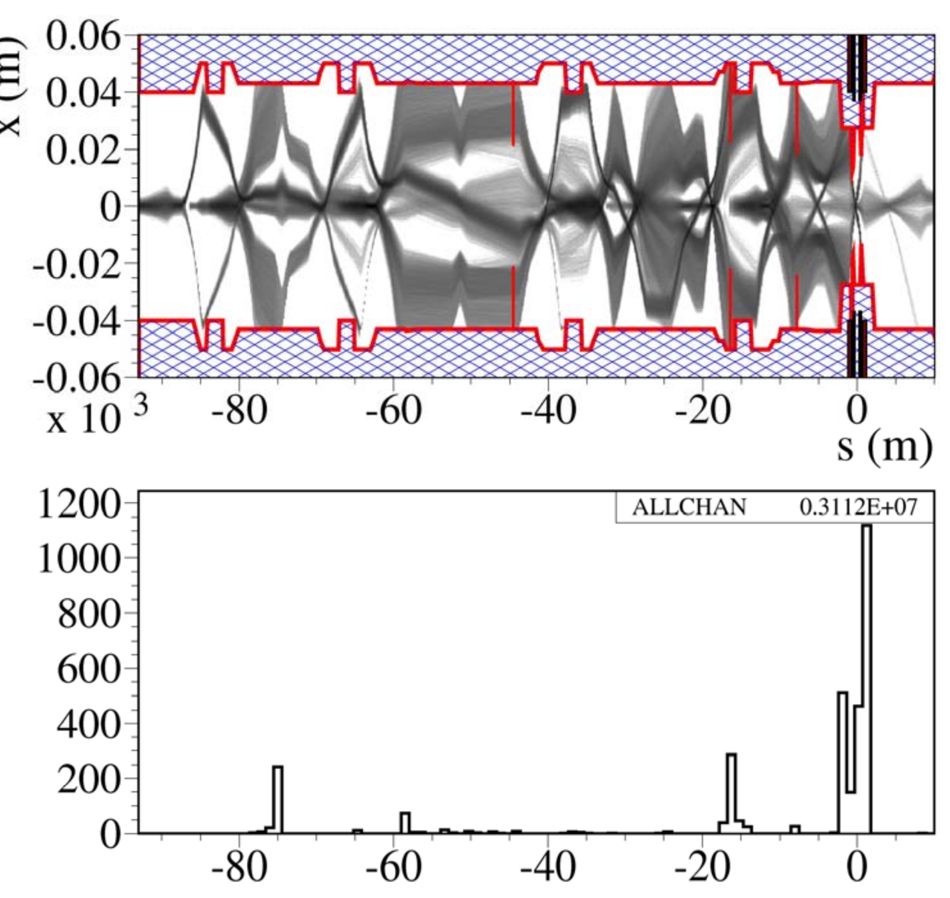
Benefits of crabbed waist scheme –measurements:

- synchrobetatron resonances suppression with fine tune scans
- shrinking of vertical beam size switching on crab sextupoles
- luminosity increase by a factor 2

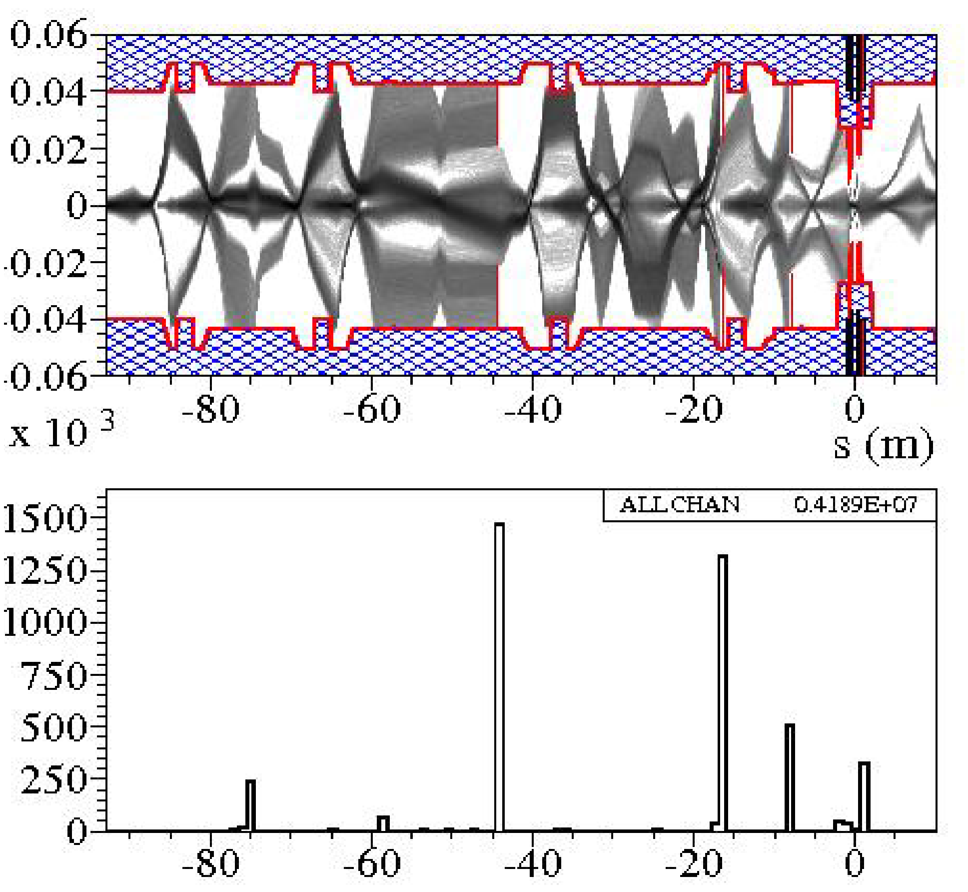
In progress

- Coupling minimization by careful rotation IR QUADS done,
- orbit tuning, nonlinearities optimization
- Minimization of initially very high background rates in calorimeter and Kaon monitor: lead shieldings added, with collimators in
- Short Lifetime due to initially bad vacuum, now investigating possible scrapering somewhere along the rings

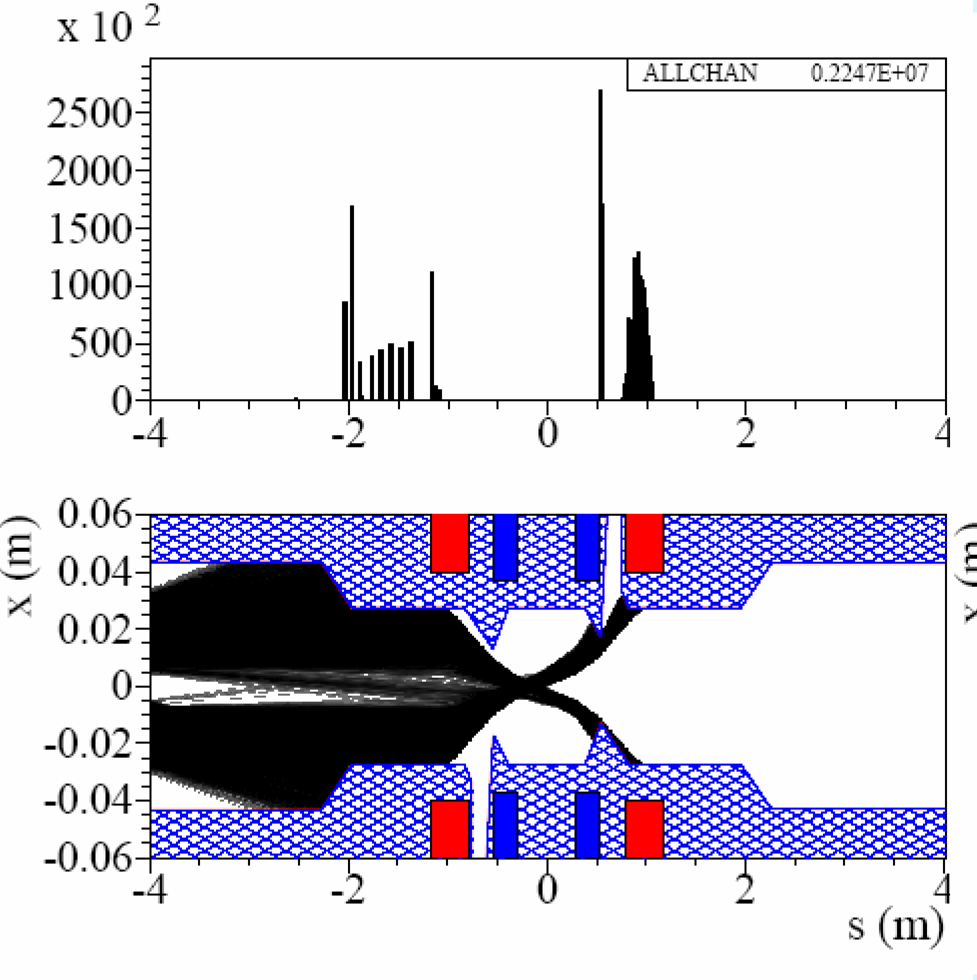
no collimators inserted in simulation



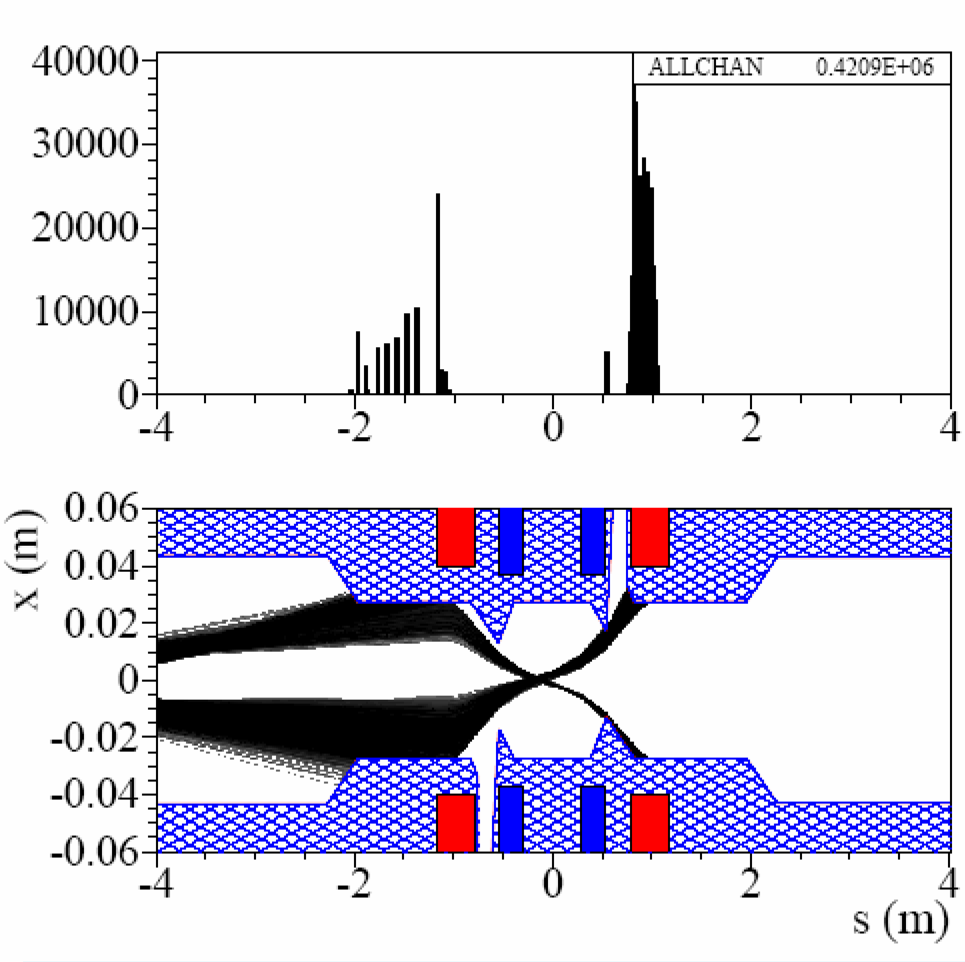
with collimators inserted in simulation



no collimators inserted in simulation



with collimators inserted in simulation



about a factor 5 with collimators inserted at present machine set, in agreement with measurements

collimators on/off

measurements 26/2/08

e-

$$\frac{\gamma^{+}(\text{scr.OFF})}{\gamma^{+}(\text{scr.ON})} = 5.2$$

$$\frac{K^{+}(\text{scr.OFF})}{K^{+}(\text{scr.ON})} = 4.9$$

e+

$$\frac{\gamma^{-}(\text{scr.OFF})}{\gamma^{-}(\text{scr.ON})} = 7.35$$

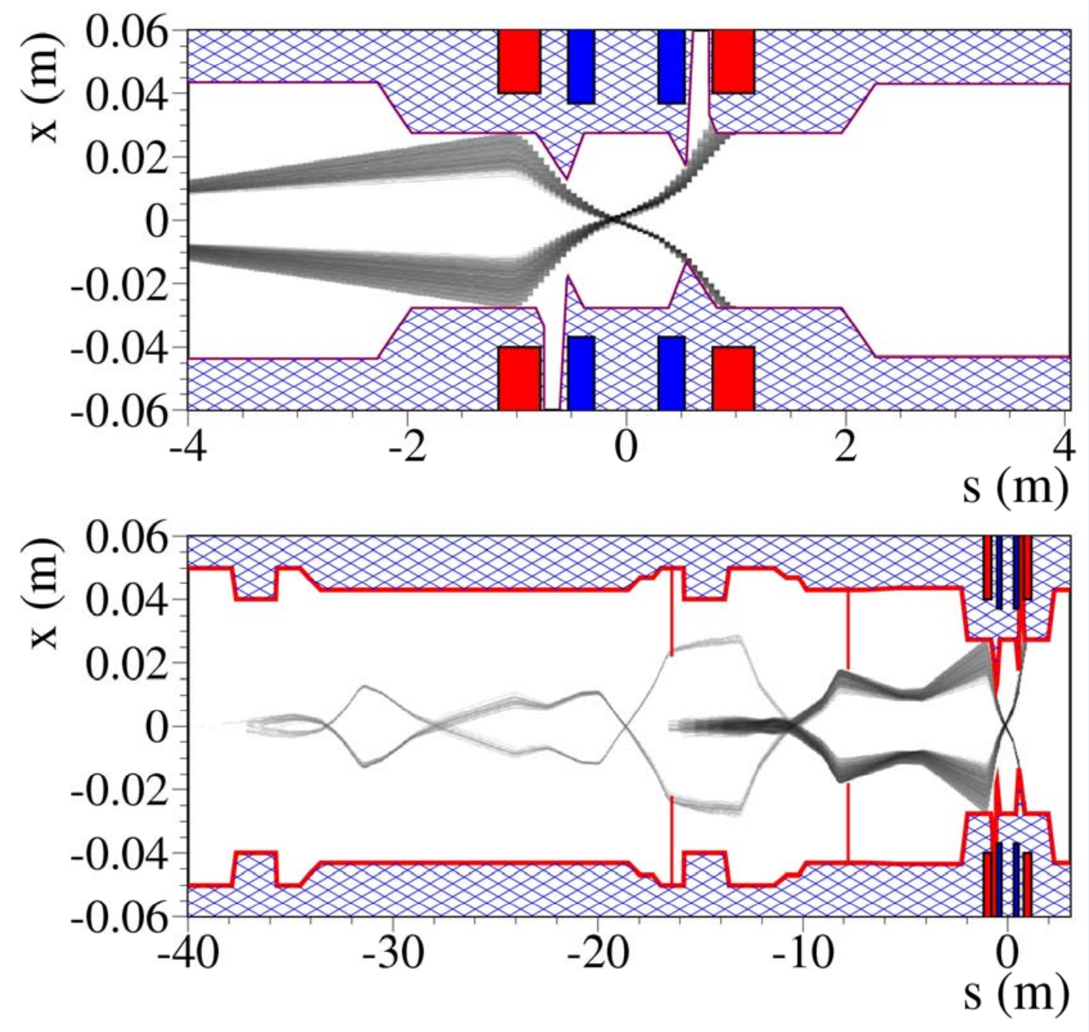
$$\frac{K^{-}(\text{scr.OFF})}{K^{-}(\text{scr.ON})} = 7.4$$

simulations

$$\frac{\dot{N}(\text{scr.OFF})}{\dot{N}(\text{scr.ON})} = 5.5$$

10 mA, 1bunch	lifetime
NO SCRAPERS	3220 s
WITH SCRAPERS	2410s

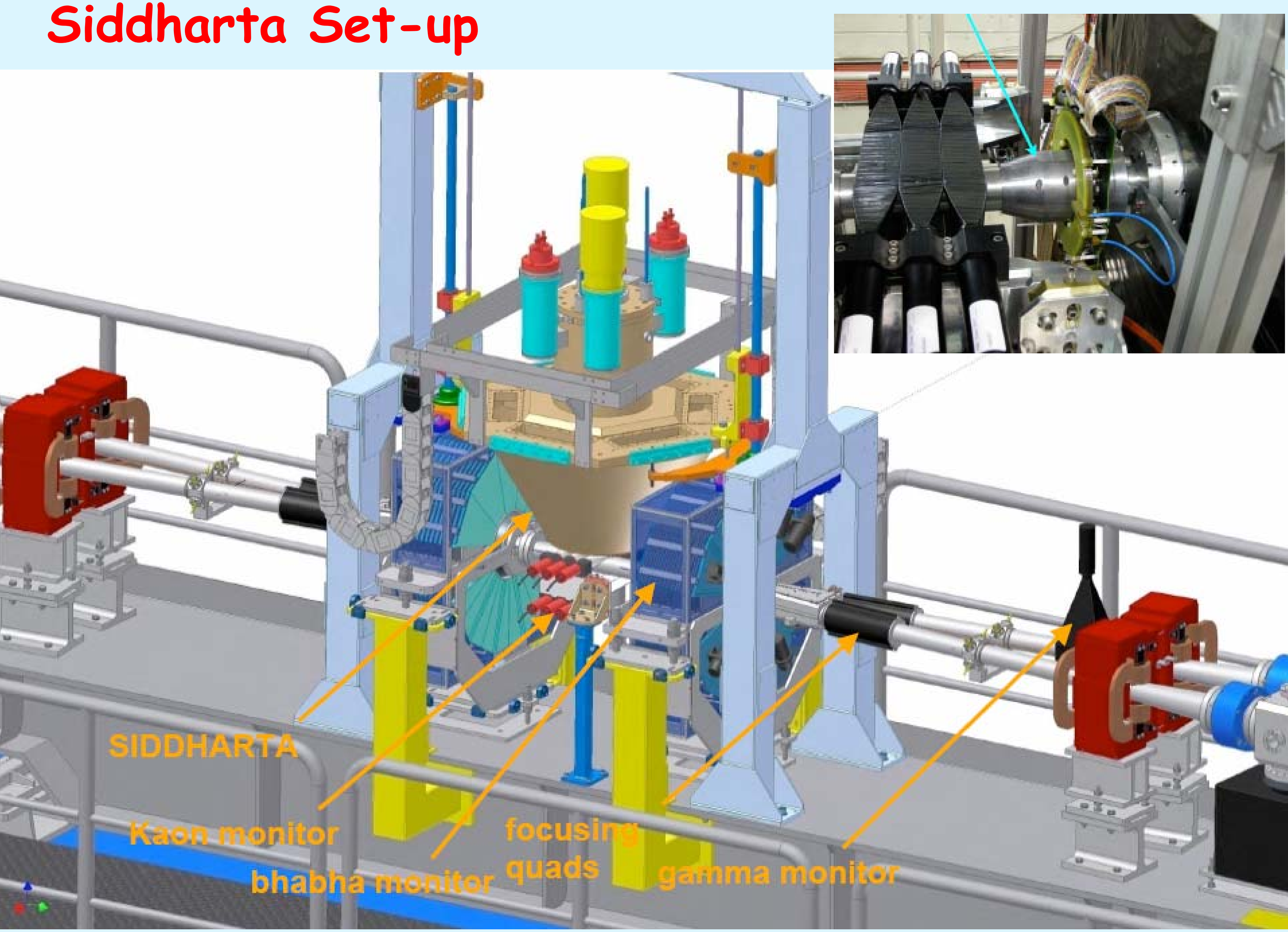
Investigation of losses downstream the IP



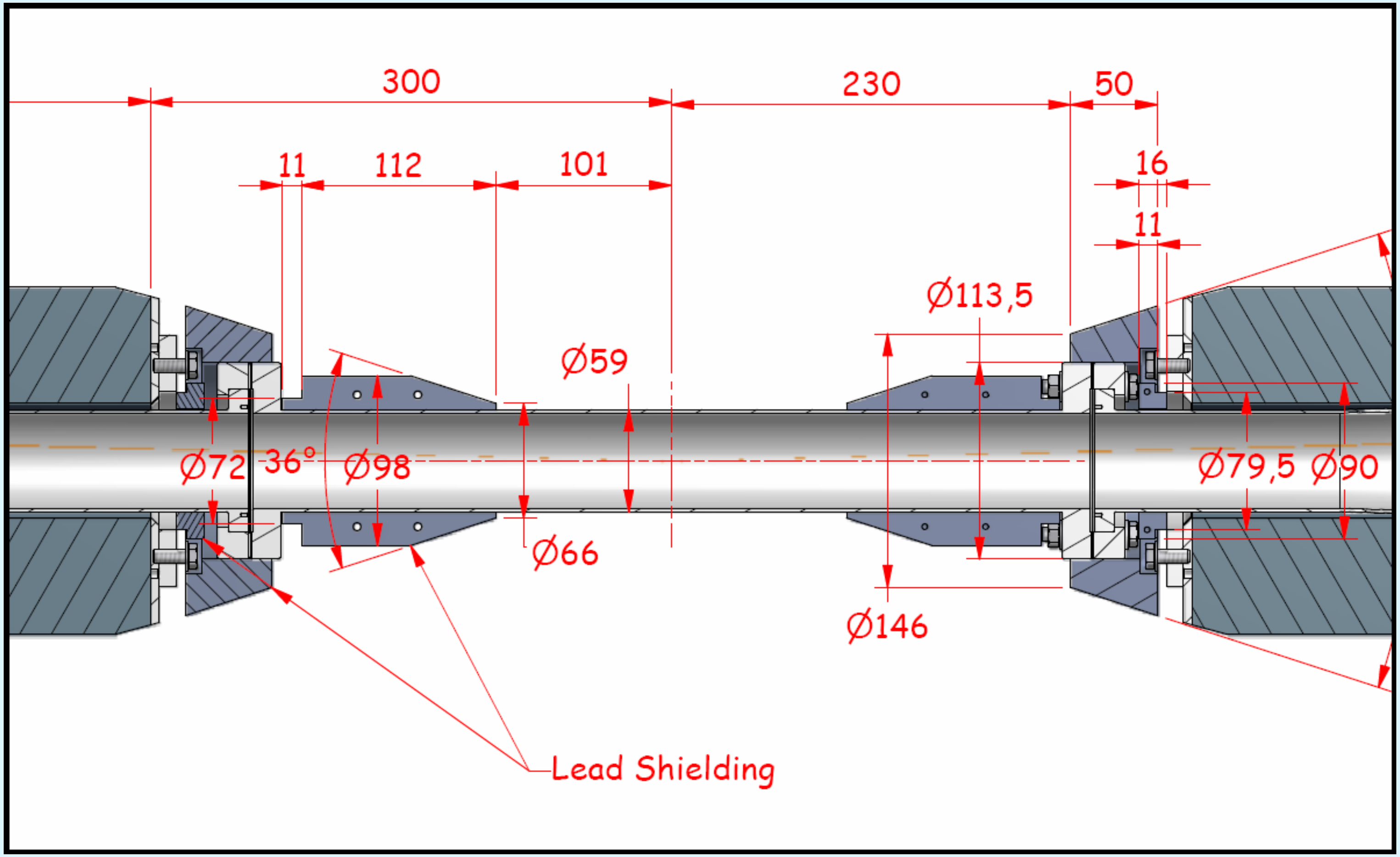
particles lost downstream the IP, at the QF0, are Touschek scattered in the closest arc before the IP and cannot be stopped by IR collimator

these particles, as well as upstream ones can produce high showers in the close-by calorimeter, lead shielding has been put to protect calorimeter and SIDDHARTA detector

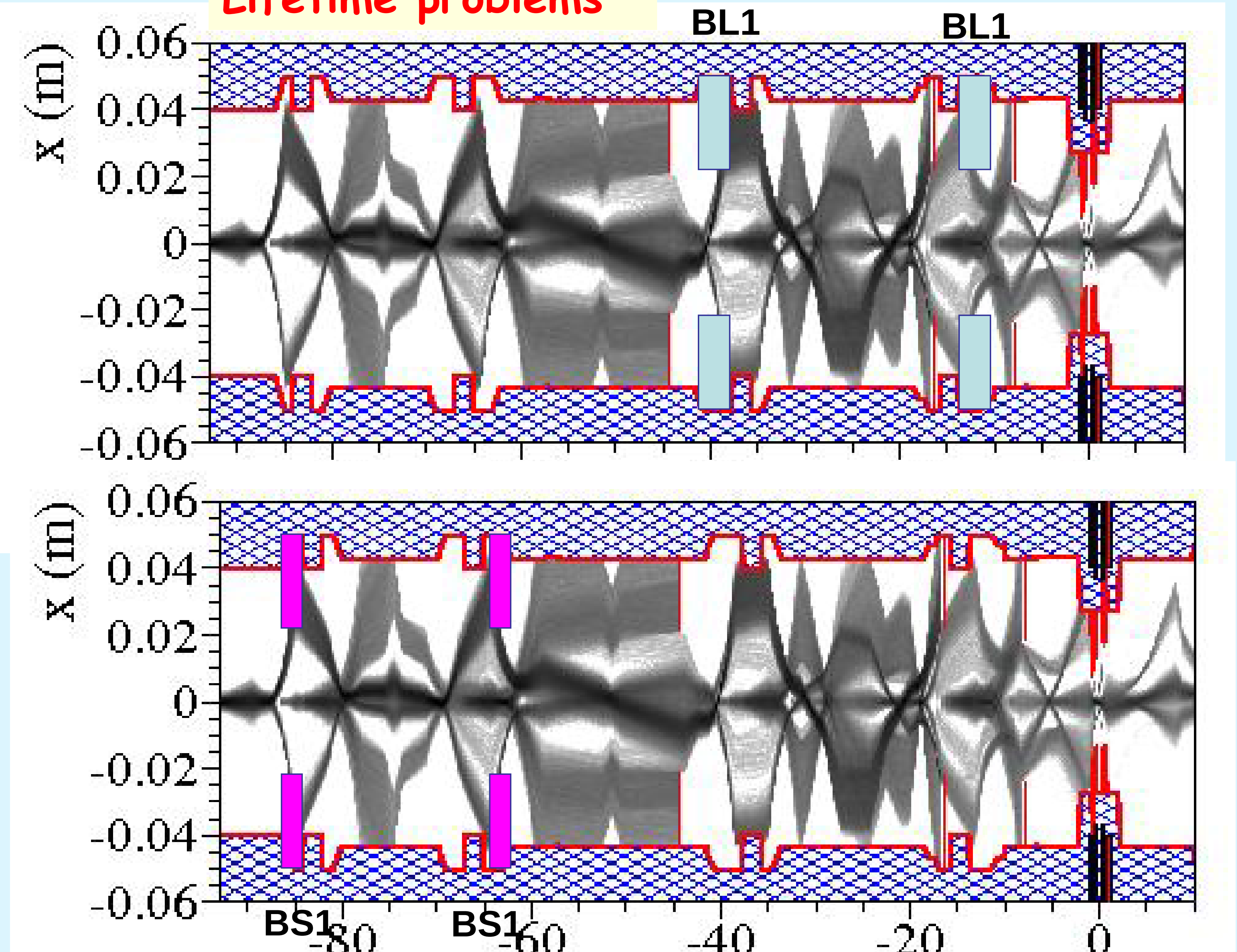
Siddharta Set-up



soyuz

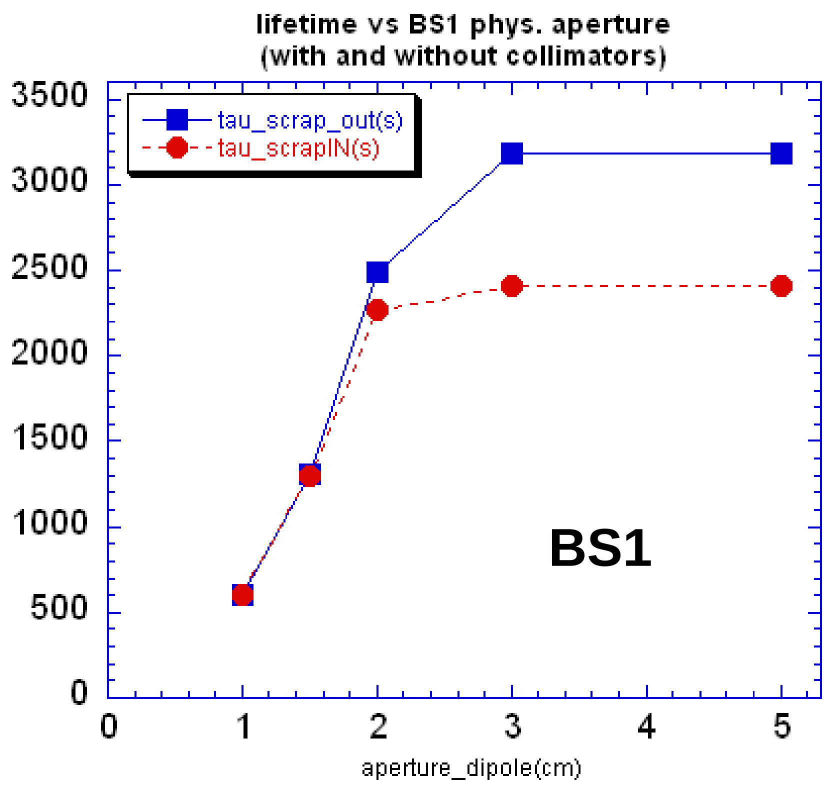

300
230
50
11
112
101
16
11
Ø113,5
Ø59
Ø72
36°
Ø98
Ø66
Ø146
Ø79,5
Ø90
Lead Shielding

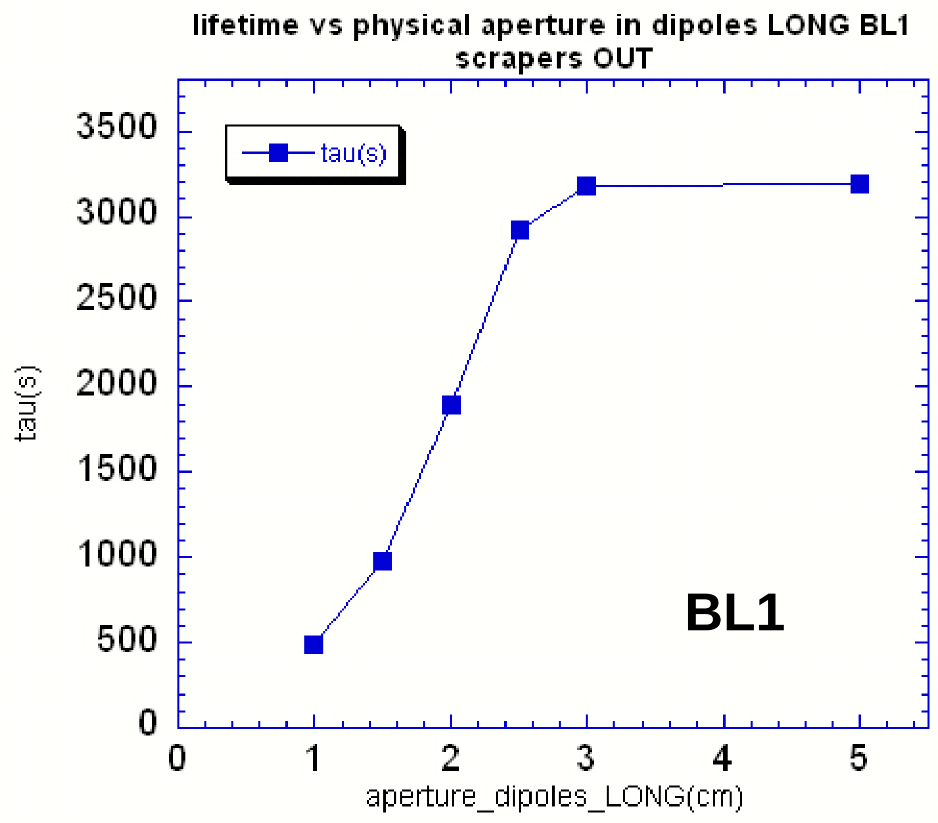
Lifetime problems



Investigations on short beam Lifetime

Assuming a smaller physical aperture in dipoles we check Touschek lifetime to estimate if it can be that we are scrapering the beam at dipoles

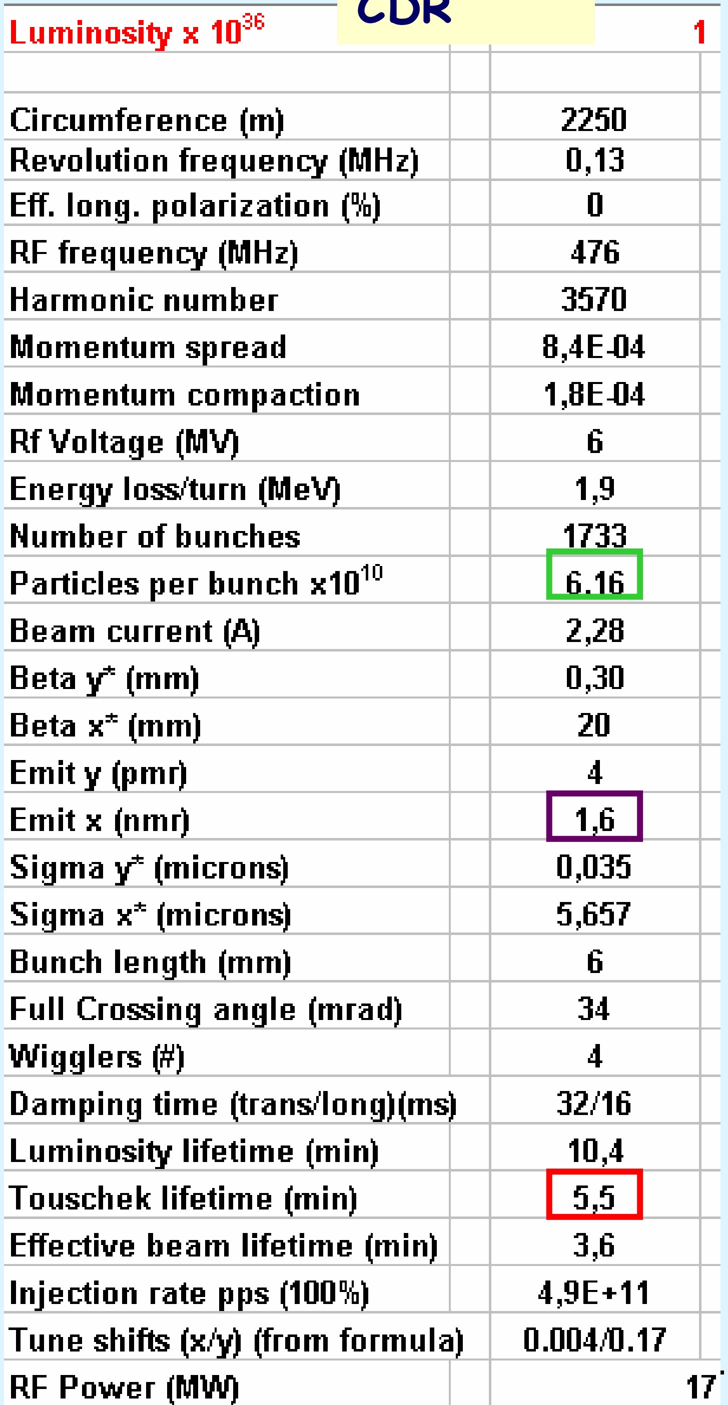




Touschek Background at the LER of the SUPERB Factory

M. Boscolo- March 10th 2008

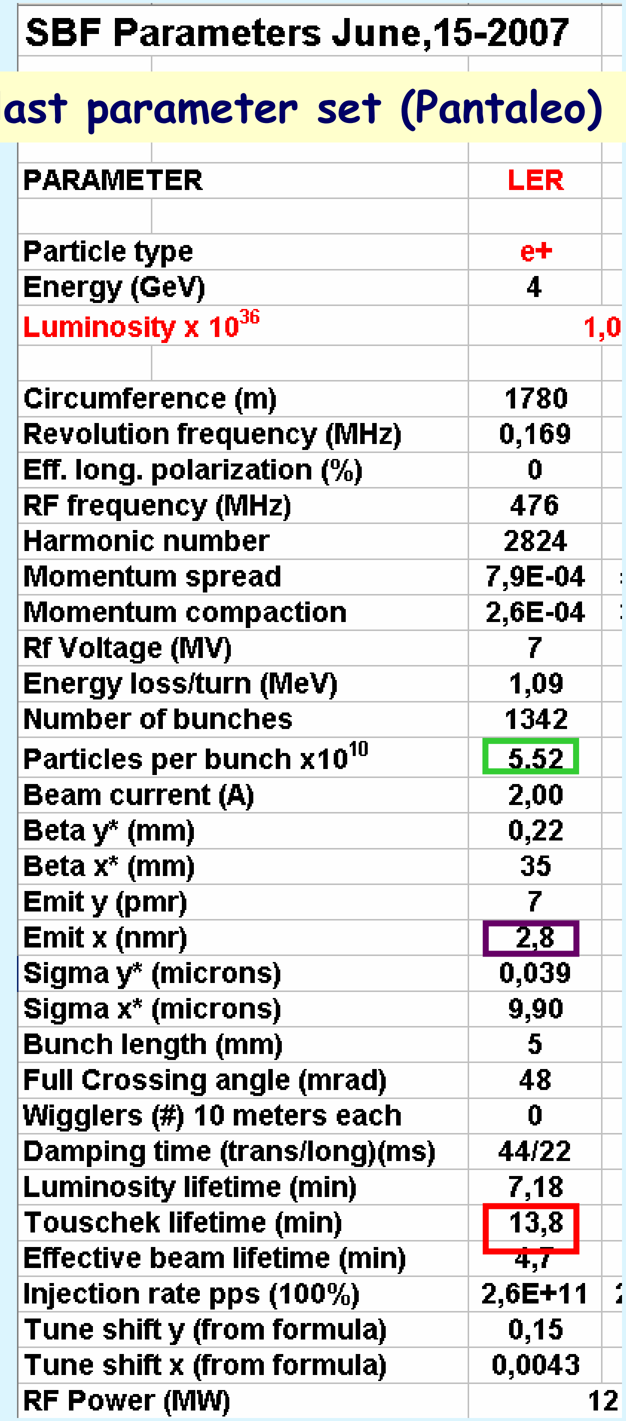
CDR



Luminosity x 10^{36}	1
Circumference (m)	2250
Revolution frequency (MHz)	0,13
Eff. long. polarization (%)	0
RF frequency (MHz)	476
Harmonic number	3570
Momentum spread	8,4E-04
Momentum compaction	1,8E-04
Rf Voltage (MV)	6
Energy loss/turn (MeV)	1,9
Number of bunches	1733
Particles per bunch x10^{10}	6,16
Beam current (A)	2,28
Beta y* (mm)	0,30
Beta x* (mm)	20
Emit y (pmr)	4
Emit x (nmr)	1,6
Sigma y* (microns)	0,035
Sigma x* (microns)	5,657
Bunch length (mm)	6
Full Crossing angle (mrad)	34
Wigglers (#)	4
Damping time (trans/long)(ms)	32/16
Luminosity lifetime (min)	10,4
Touschek lifetime (min)	5,5
Effective beam lifetime (min)	3,6
Injection rate pps (100%)	4,9E+11
Tune shifts (x/y) (from formula)	0.004/0.17
RF Power (MW)	17

SBF Parameters June,15-2007

last parameter set (Pantaleo)



PARAMETER	LER
Particle type	e+
Energy (GeV)	4
Luminosity x 10^{36}	1,0
Circumference (m)	1780
Revolution frequency (MHz)	0,169
Eff. long. polarization (%)	0
RF frequency (MHz)	476
Harmonic number	2824
Momentum spread	7,9E-04
Momentum compaction	2,6E-04
Rf Voltage (MV)	7
Energy loss/turn (MeV)	1,09
Number of bunches	1342
Particles per bunch x10^{10}	5,52
Beam current (A)	2,00
Beta y* (mm)	0,22
Beta x* (mm)	35
Emit y (pmr)	7
Emit x (nmr)	2,8
Sigma y* (microns)	0,039
Sigma x* (microns)	9,90
Bunch length (mm)	5
Full Crossing angle (mrad)	48
Wigglers (#) 10 meters each	0
Damping time (trans/long)(ms)	44/22
Luminosity lifetime (min)	7,18
Touschek lifetime (min)	13,8
Effective beam lifetime (min)	4,7
Injection rate pps (100%)	2,6E+11
Tune shift y (from formula)	0,15
Tune shift x (from formula)	0,0043
RF Power (MW)	12

Touschek particles lost at IR

Rates are given for 1 bunch with I_{bunch} =1.49 mA

$\Delta E/E$ = 0.1% - 4%

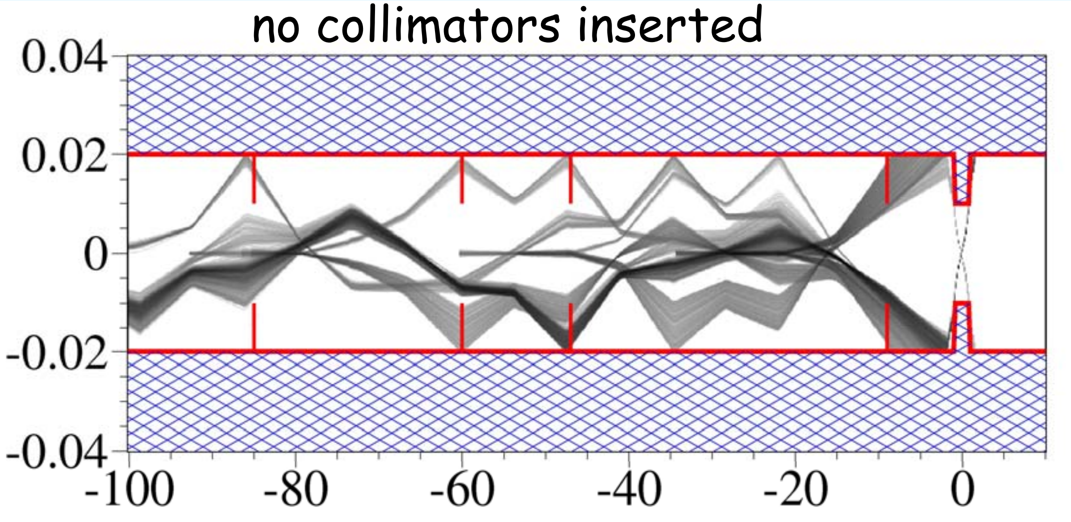
rf accept. =2.9 %

machine turns = 5

K=0.25%

ε_x=2.8 nm ; σ_z=5 mm

no collimators inserted



IR Losses = 1.7 MHz

Tou. lifetime ≈ 24 min

with a collimator before IR inserted

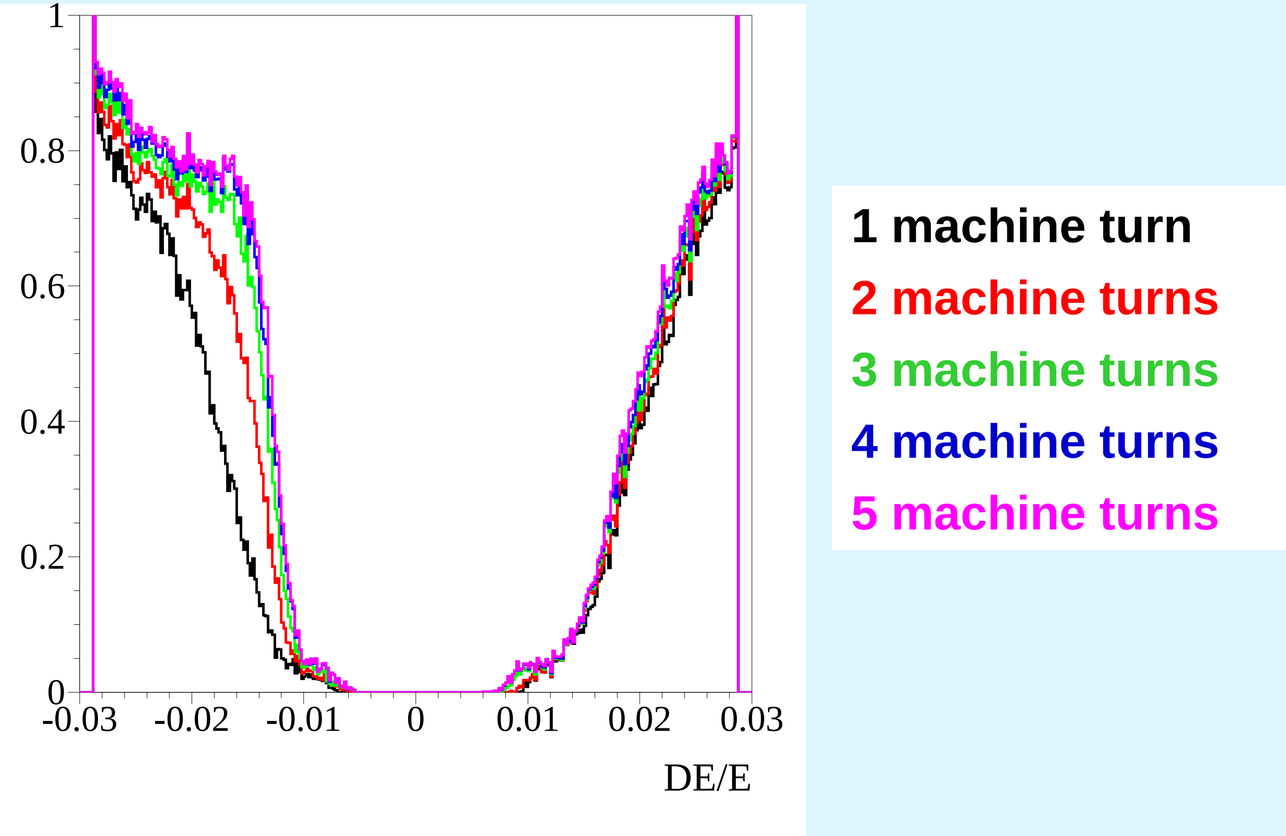
Losses= 4 kHz

Tou. lifetime ≈ 20 min

work in progress to optimize collimators

for best longitudinal position along the ring and best trade-off between IR losses and lifetime

Energy acceptance



no collimators

Conclusions

In DAFNE a lot of effort has been put in the backgrounds minimization

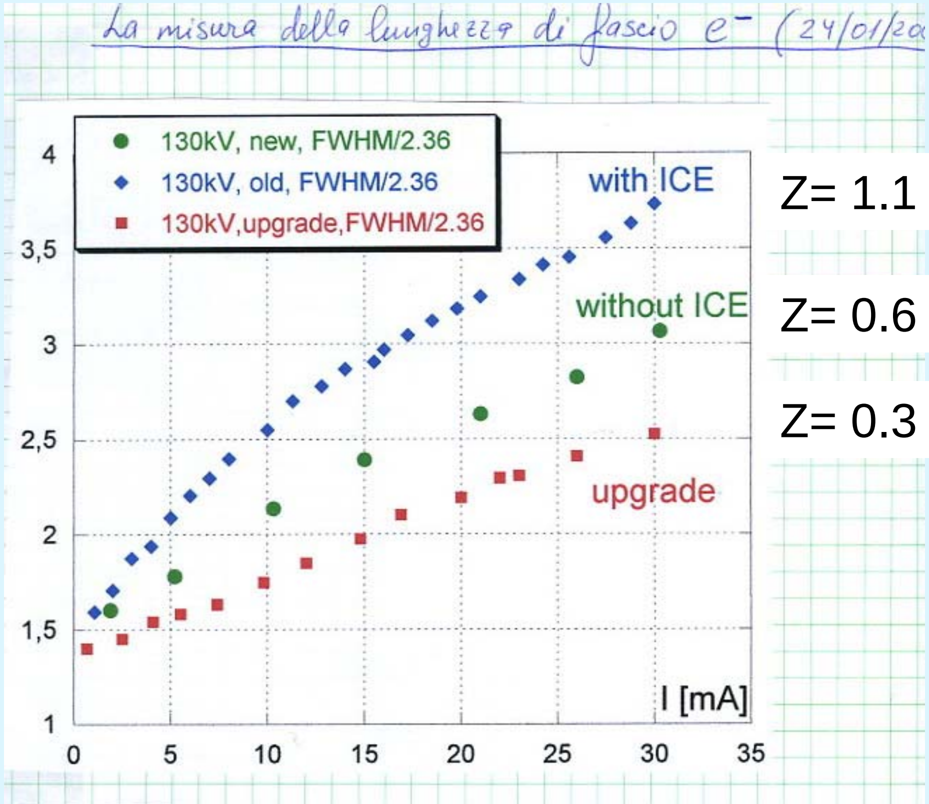
being extremely high at the beginning of each run.

DAFNE background is essentially Touschek

- **Collimators**: position and shape crucial
- **Shieldings**: very useful for small experiments
- **Optics**: IR design critical, small β_x required (synergy with L), nonlinearities and dynamic aperture optimization, as well as fine tuning of orbit at the IR

Back-up slides
DAFNE

Bunch length measurement

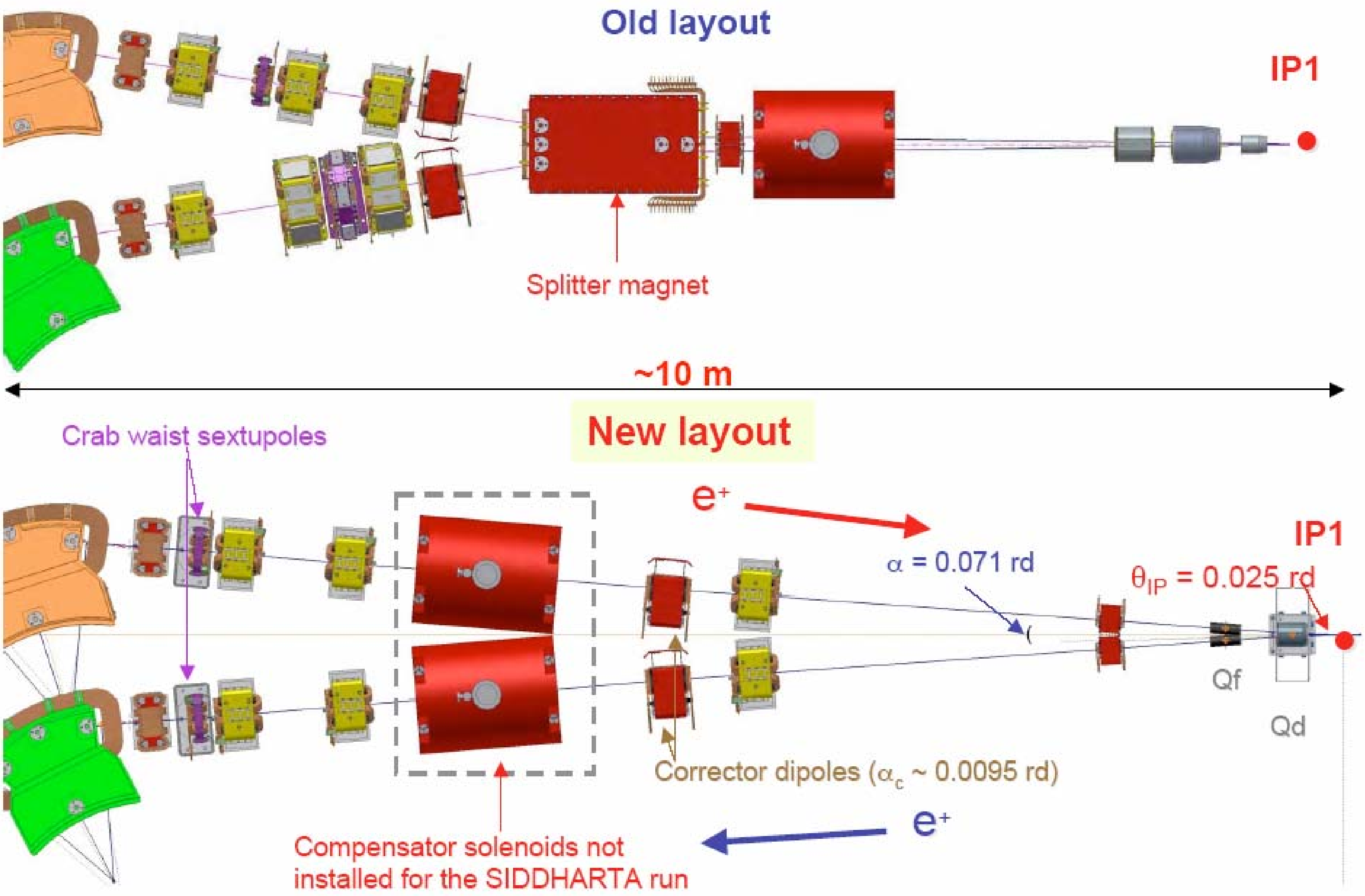


Z= 1.1 Ohm

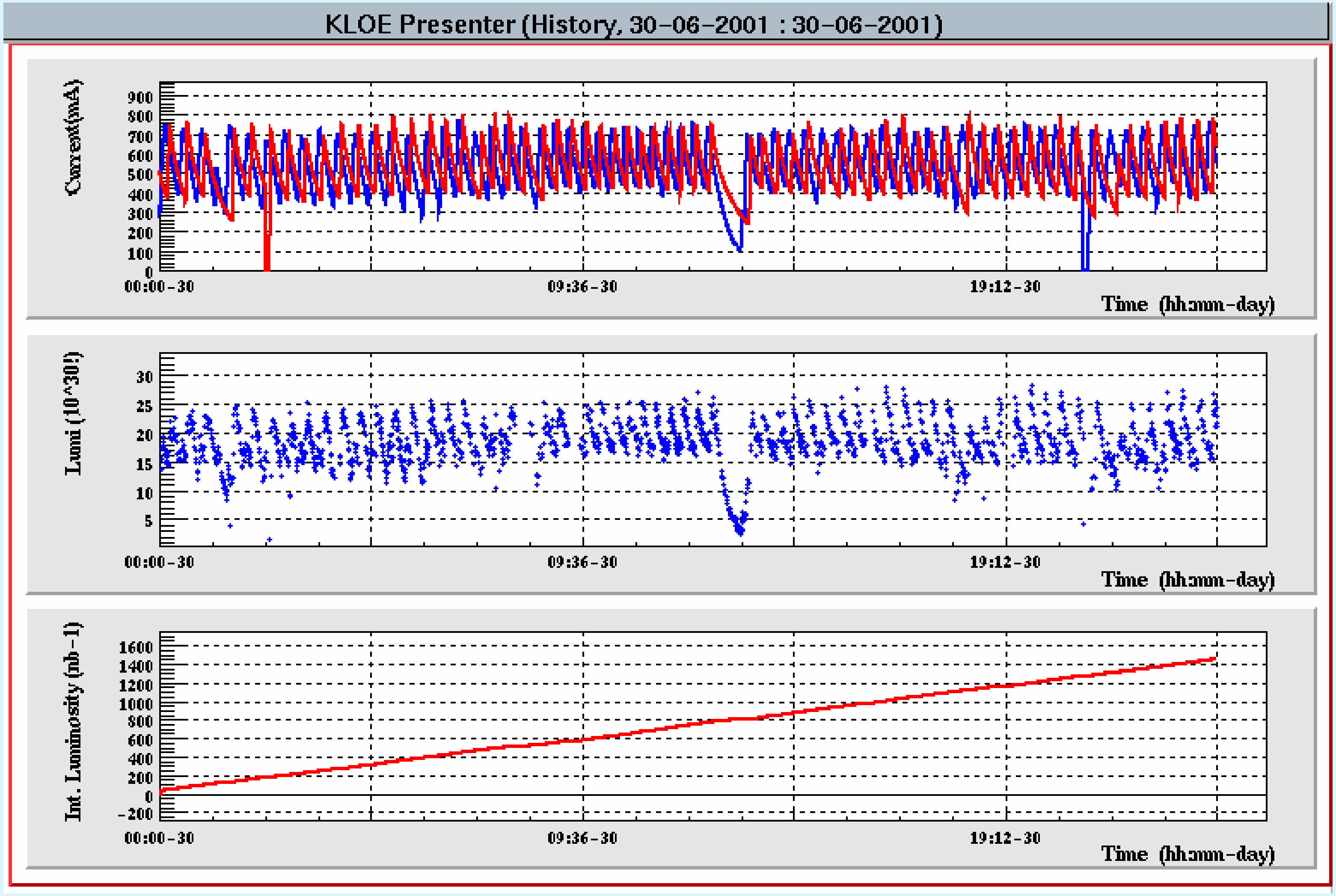
Z= 0.6 Ohm

Z= 0.3 Ohm

Half IR1 Magnetic Layout



June 30th 2001: 24hours KLOE data taking



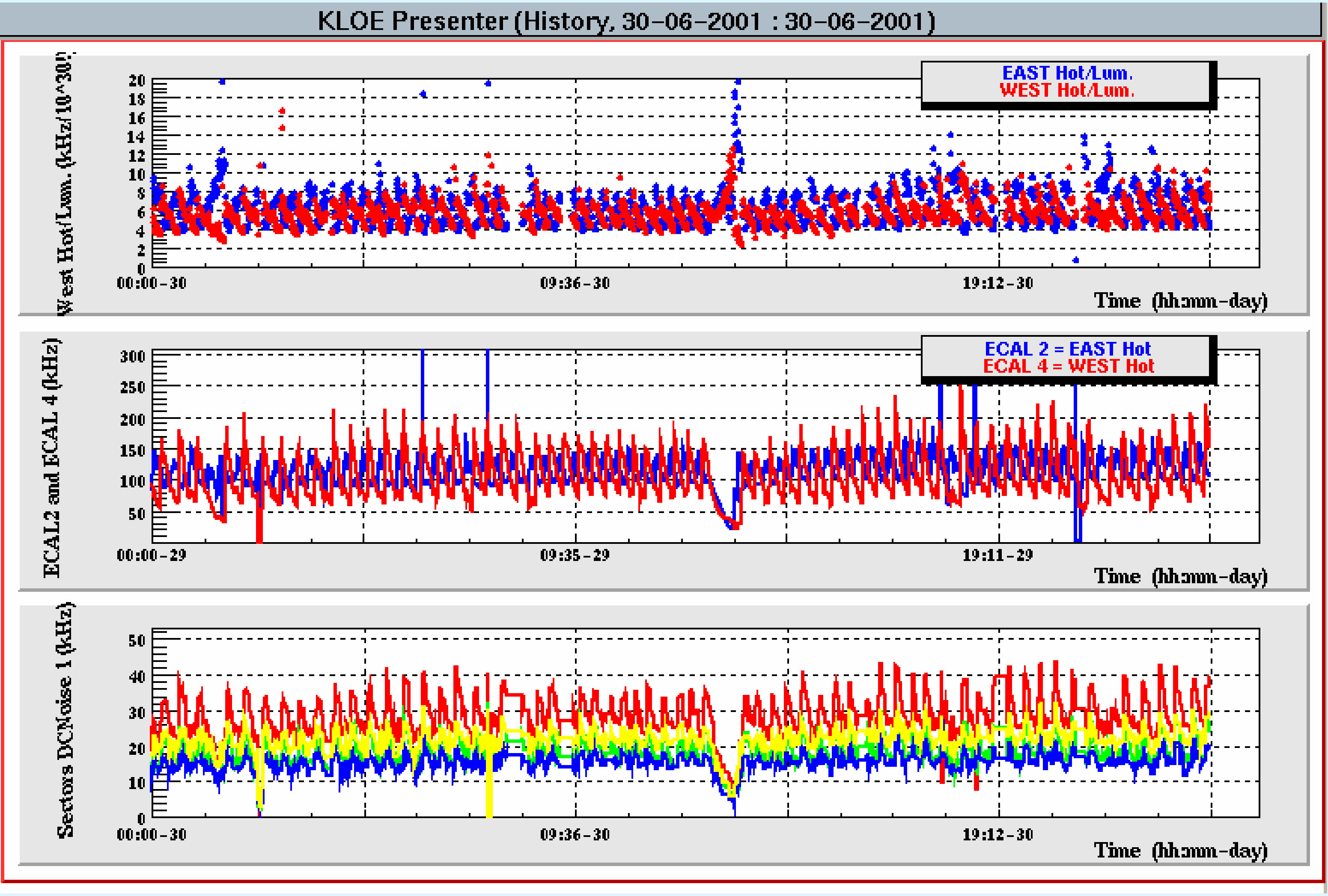
e+ current

e- current

$L(10^{30})$

L_{int}

June 30th 2001: 24hours KLOE data taking



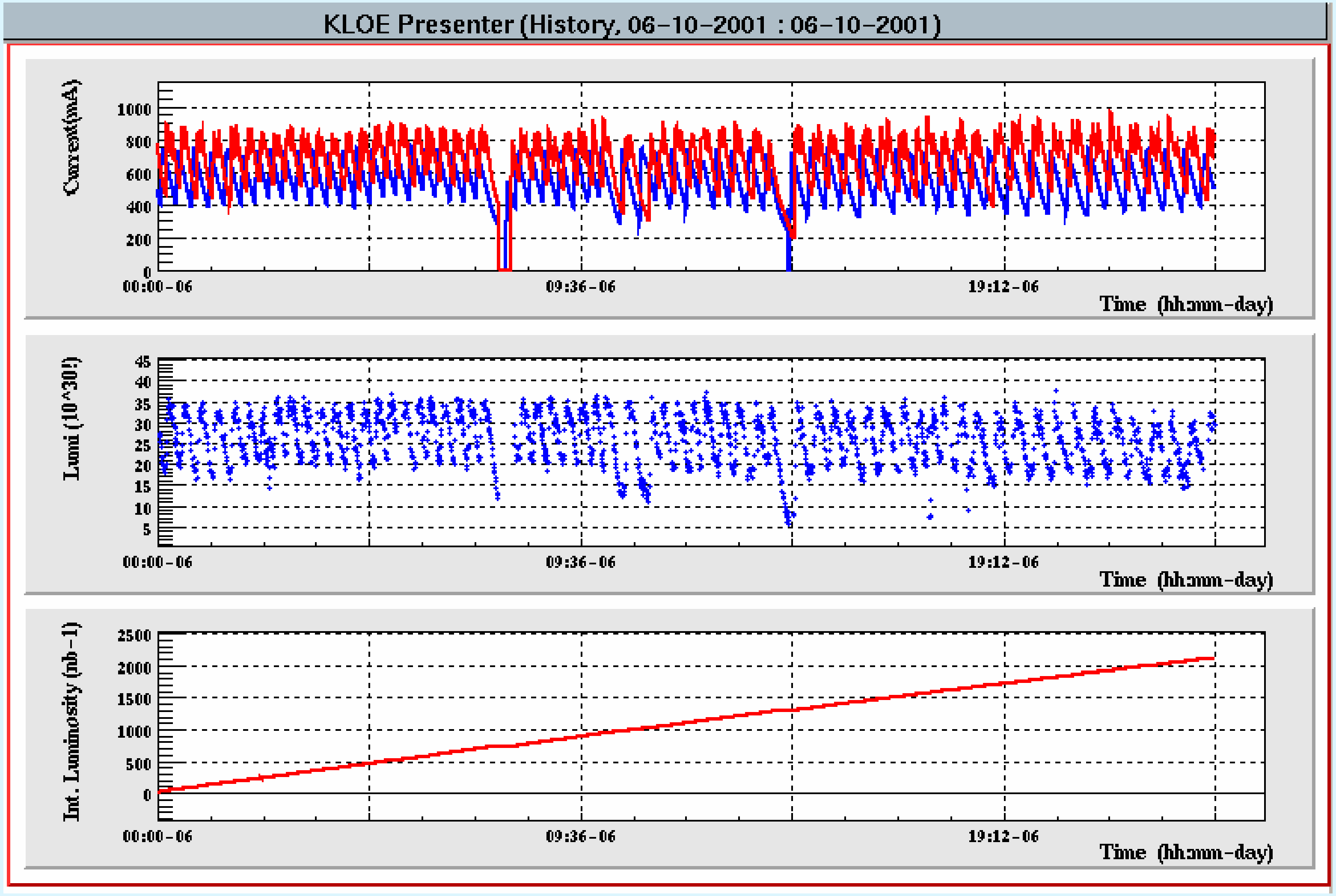
e+
(BKG/L)~4-8

e-
(BKG/L)~4-10

e+
BKG~50-200KHz

e-
BKG~100-150 KH

October 6th 2001: 24hours KLOE data taking



KLOE Presenter (History, 06-10-2001 : 06-10-2001)

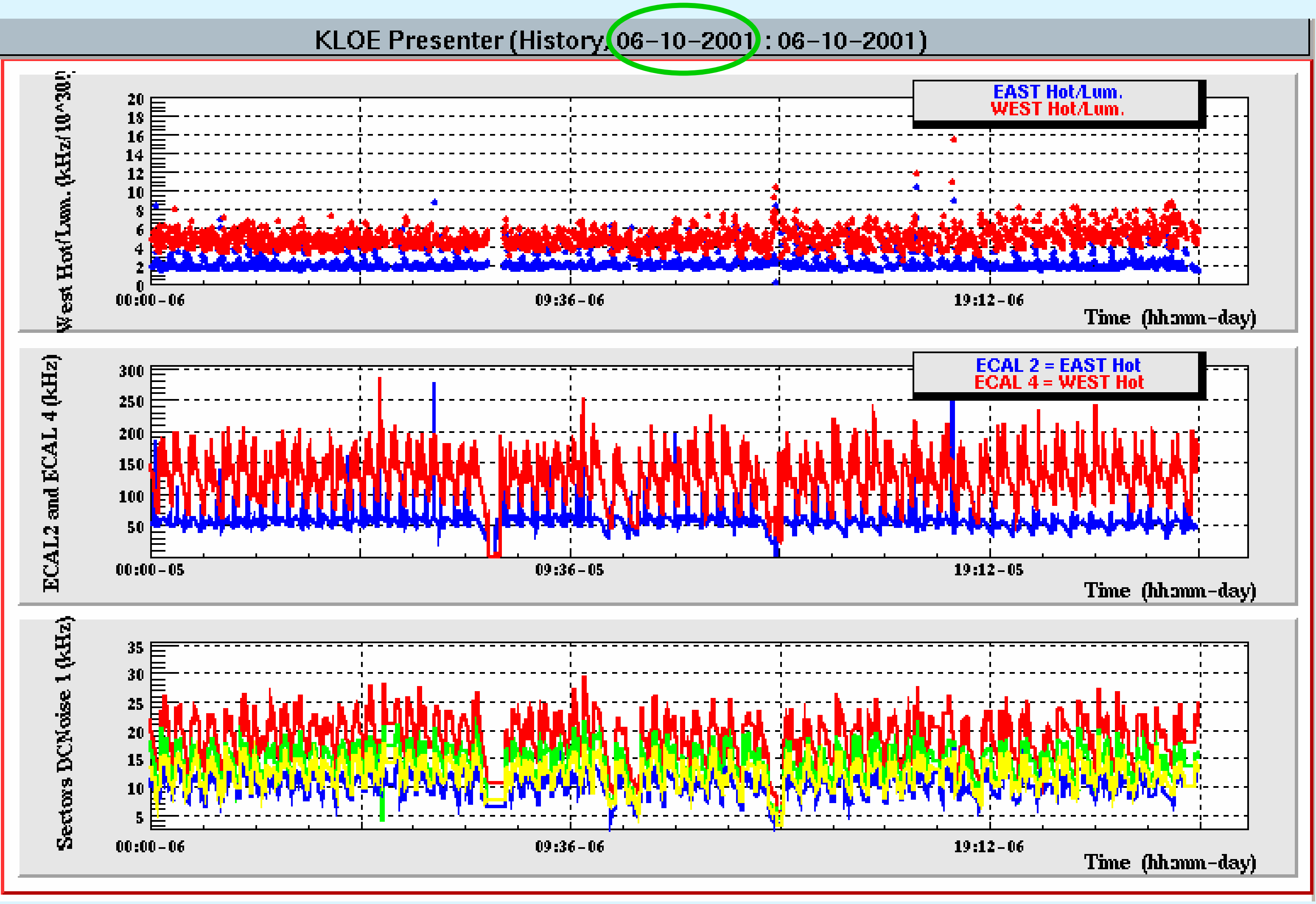
e+ current

e- current

$L(10^{30})$

L_{int}

October 6th 2001: 24hours KLOE data taking



e+

(BKG/L)~5

e-

(BKG/L)~2

e+

BKG~100-200KHz

e-

BKG~50KHz