Prospects of γ-γ physics at DaΦne-2

Dario Moricciani on behalf
of KLOE-2 collaboration

Summary of the talk

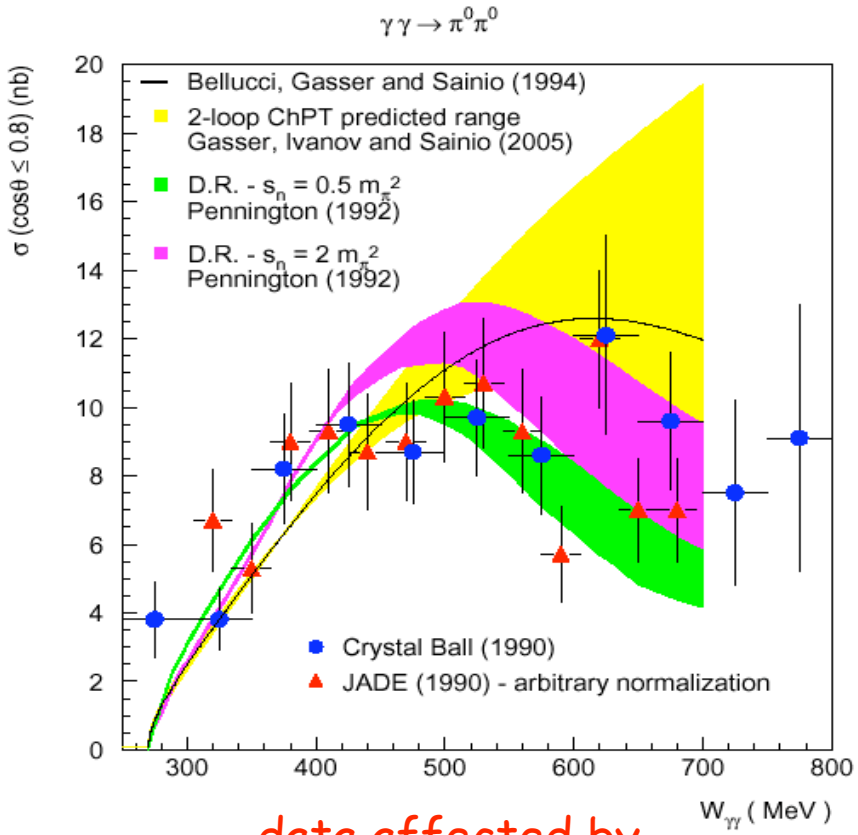
- Physics motivation
- DaΦne-2 constraint
- Tagger requirement

- Conclusion

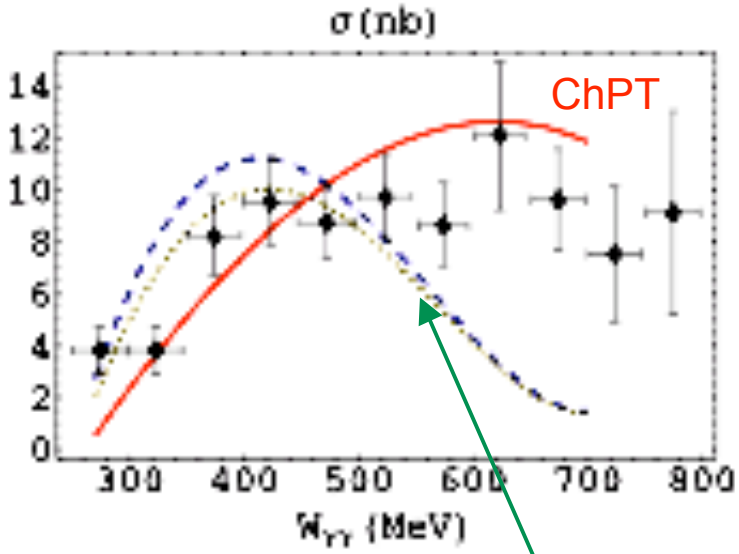
The σ meson case 1/2

cleanest channel to assess existence & nature

(2q vs 4q) of the σ is $\gamma\gamma \to \pi^0\pi^0$ at low energy



data affected by large uncertainties



resonant contribution

$\gamma\gamma \to \sigma \to \pi^0\pi^0$

Nguyen, Piccinini, Polosa, EPJC **47**, 65 (2006)

The σ meson case 2/2

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Mass and Width of the Lowest Resonance in QCD

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(Received 29 December 2005; published 5 April 2006)

We demonstrate that near the threshold, the $\pi\pi$ scattering amplitude contains a pole with the quantum numbers of the vacuum—commonly referred to as the σ—and determine its mass and width within small uncertainties. Our derivation does not involve models or parametrizations but relies on a straightforward calculation based on the Roy equation for the isoscalar S wave.

$$M_\sigma = 441^{+16}_{-8}\ \text{MeV}, \qquad \Gamma_\sigma = 544^{+18}_{-25}\ \text{MeV}. \quad (9)$$

Why we need tagging … at 510 MeV

Estimated yields

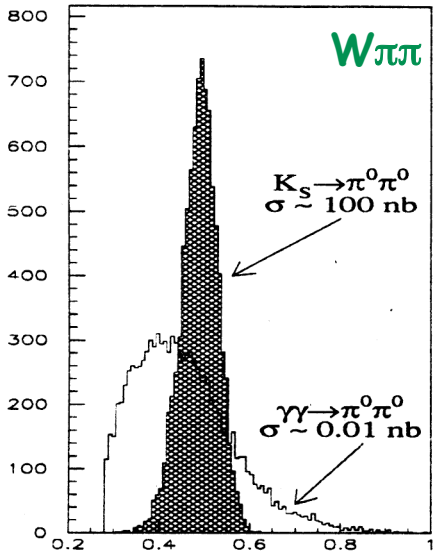
channel	Total Production ($\mathcal{L}$ = 10 fb^{-1})
$e^+ e^- \to e^+ e^- \pi^0$	4×10^6
$e^+ e^- \to e^+ e^- \eta$	10^6
$e^+ e^- \to e^+ e^- \pi^+\pi^-$	2×10^6
$e^+ e^- \to e^+ e^- \pi^0\pi^0$	2×10^4

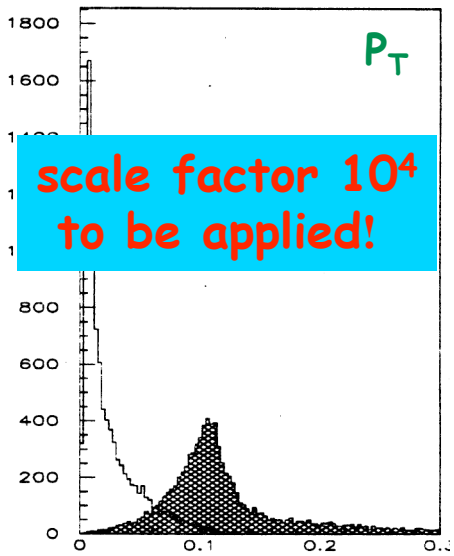
Background from ϕ decays

decay mode	esc.particle	events	bckg to:
$K_S(\pi^0\pi^0)\, K_L$	K_L	~ 10^9	$\pi^0\pi^0$
$K_S(\pi^+\pi^-)\, K_L$	K_L	~ 2×10^9	$\pi^+\pi^-$
$\pi^+\pi^-\pi^0$	π^0	~ 10^9	
$\eta(\gamma\gamma)\, \gamma$	γ	~ 10^8	η
$\pi^0(\gamma\gamma)\, \gamma$	γ	~ 5×10^8	π^0

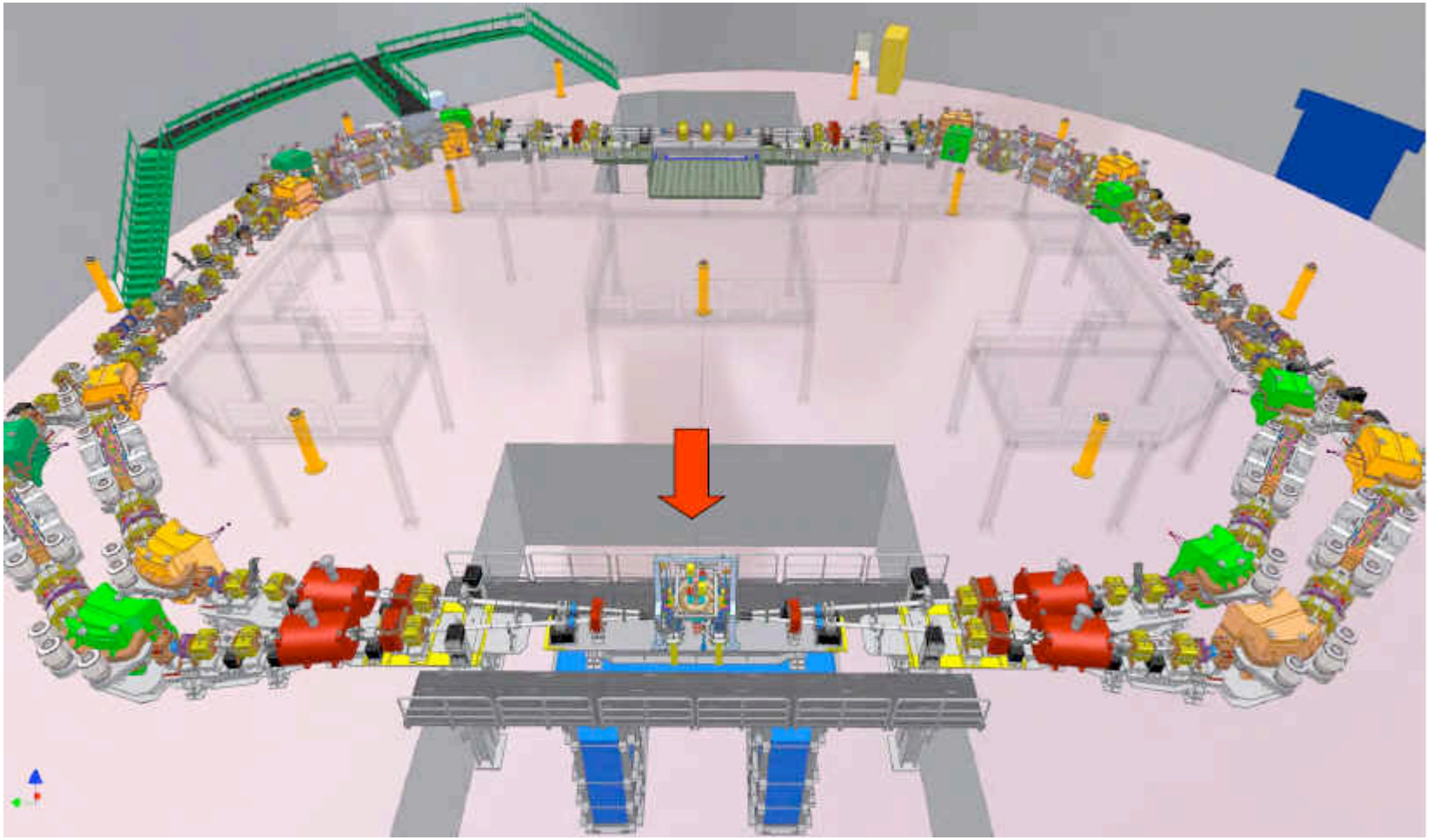
- additional (sizable) bckgs from non ϕ decays (ISR and continuum processes)
- kinematics cut (mainly from P_T of $\pi\pi$) → rejection factor < 100

hopeless w/o tagging of the scattered $e^\pm$

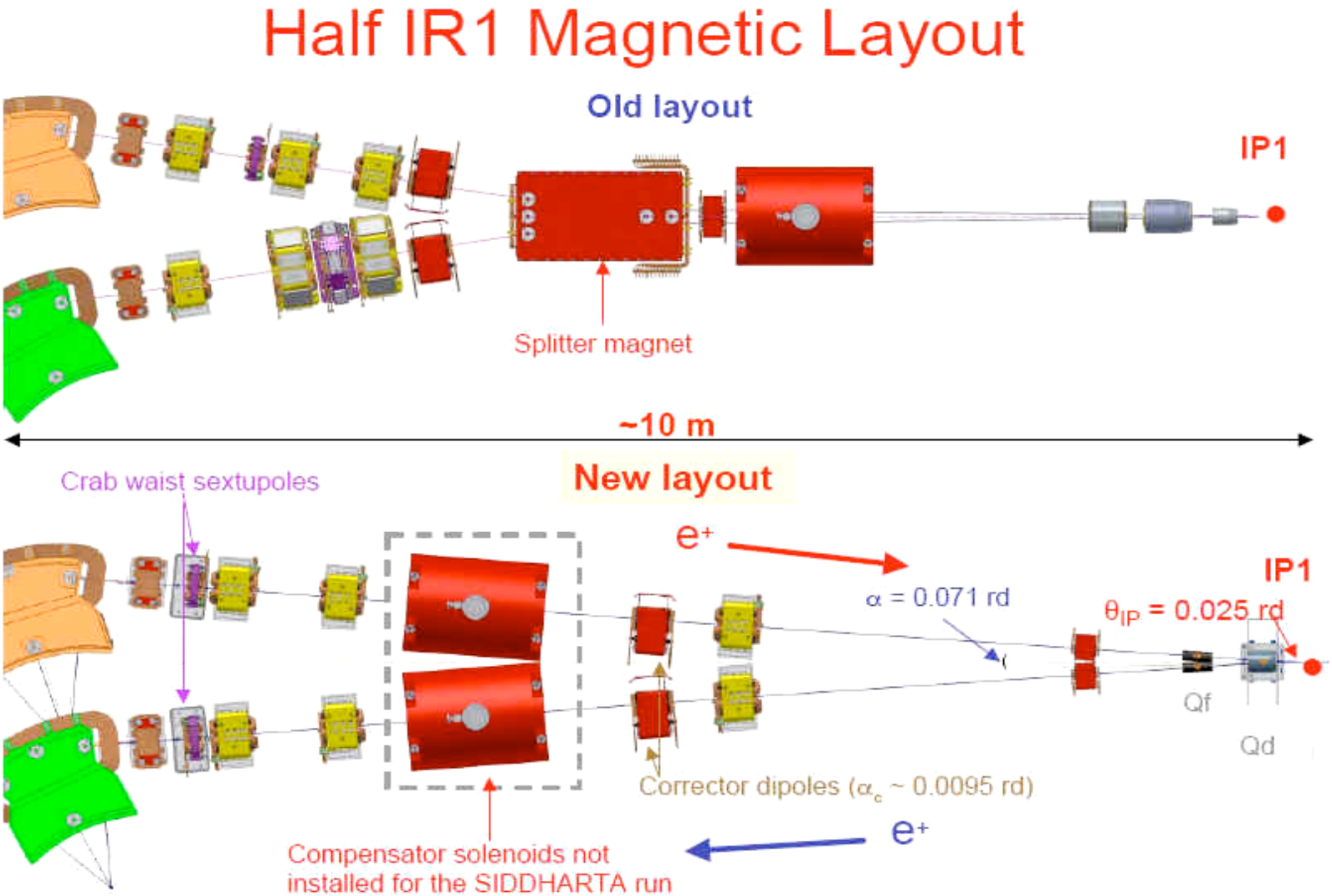




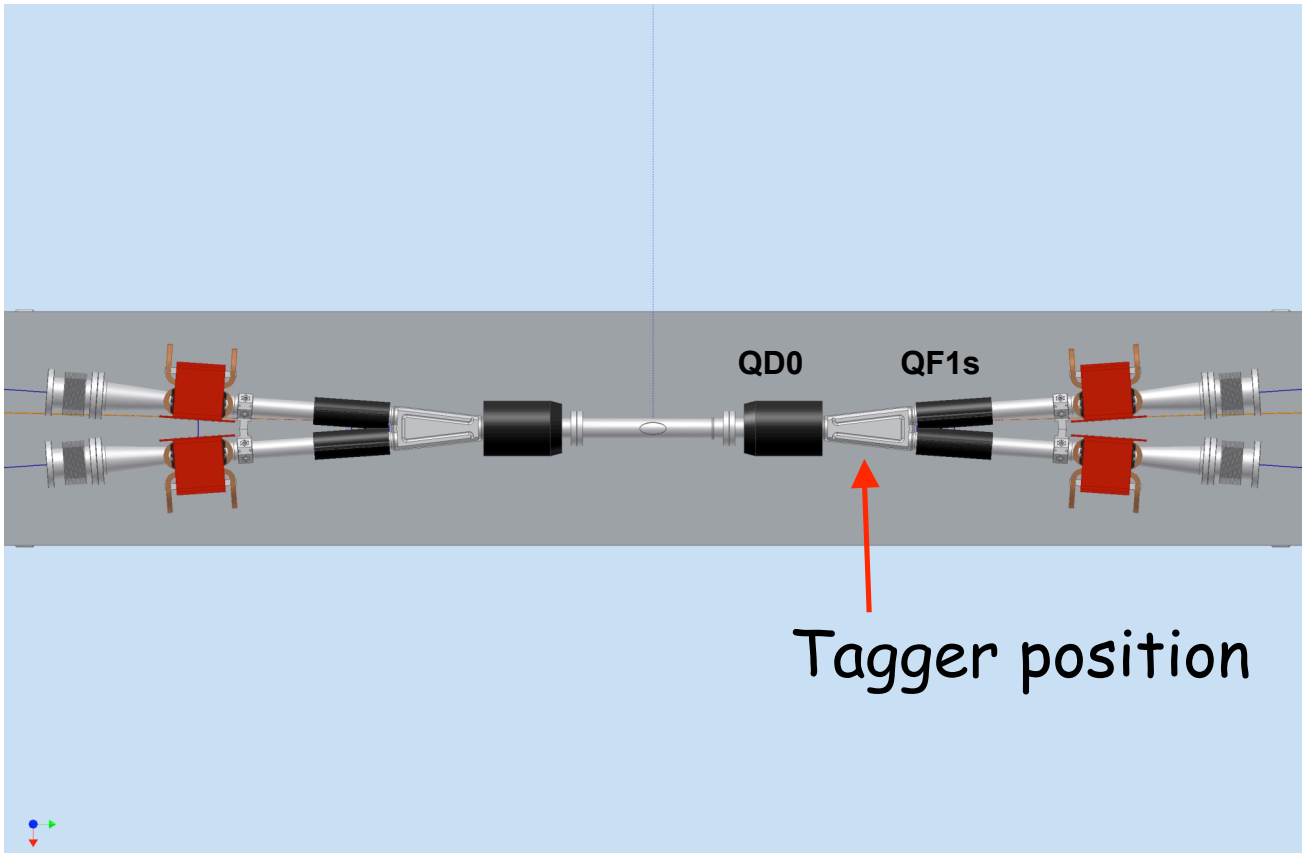
DaΦne-2 for Siddharta run



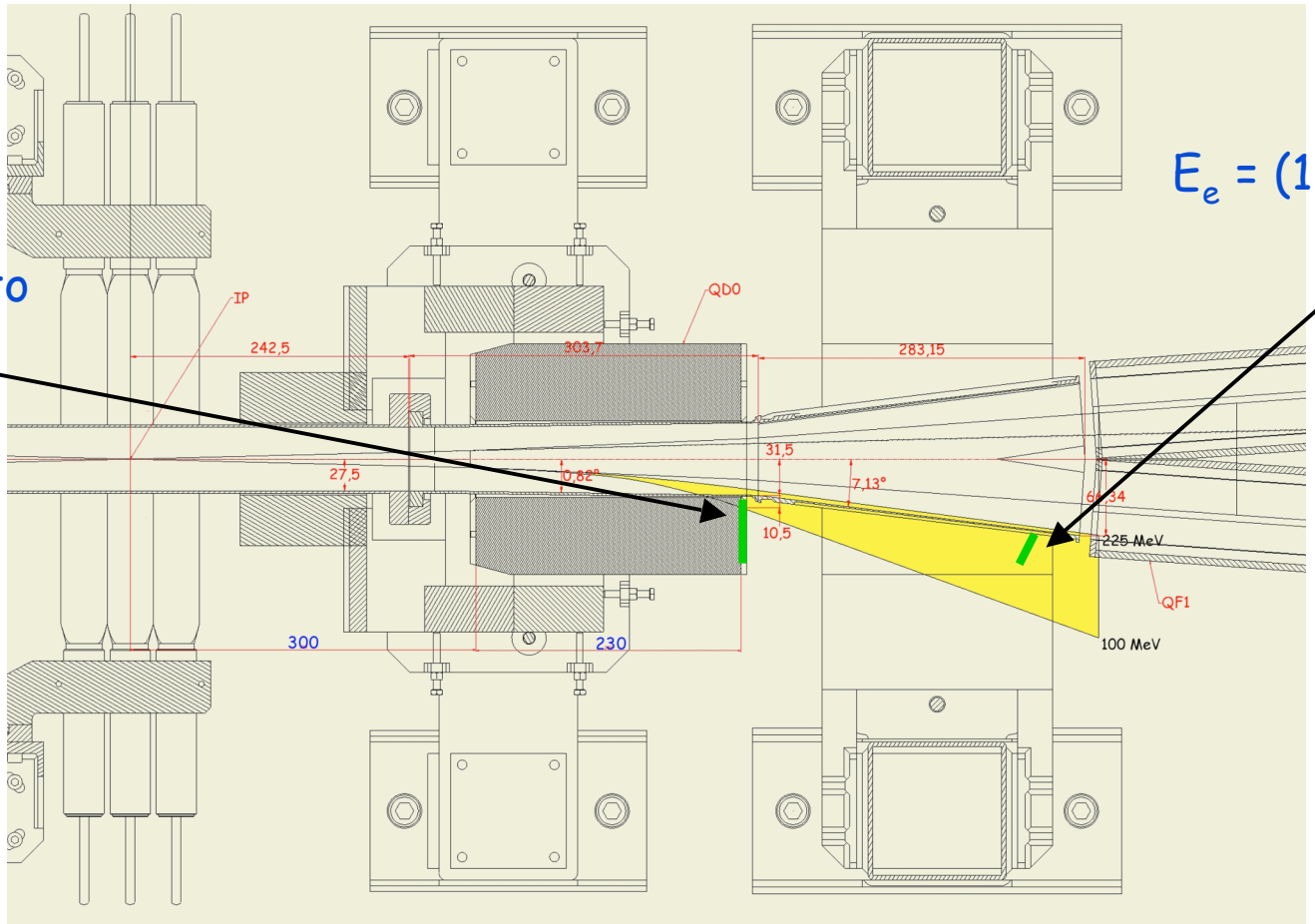
DaΦne --> DaΦne-2



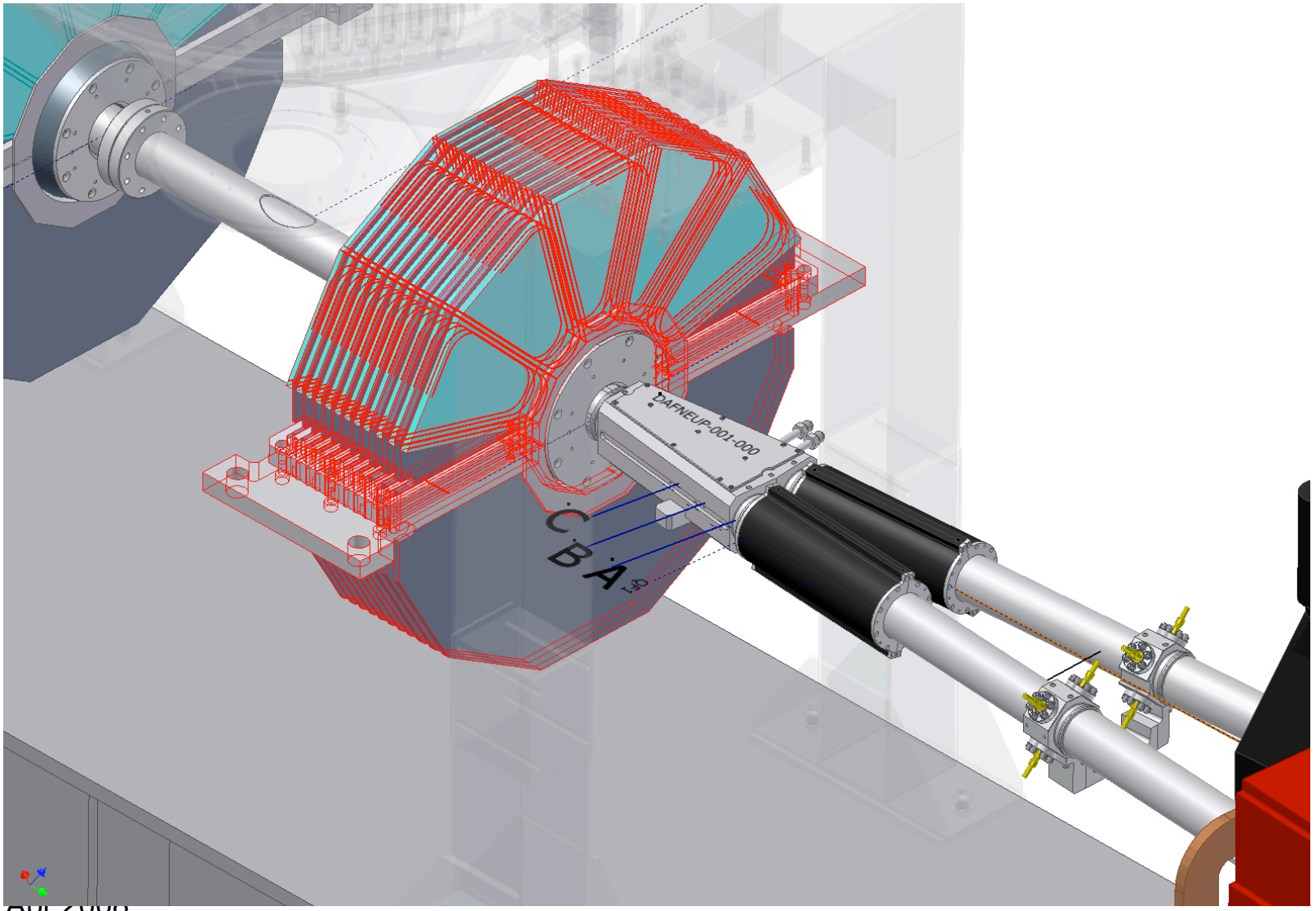
Interaction point for Siddharta run



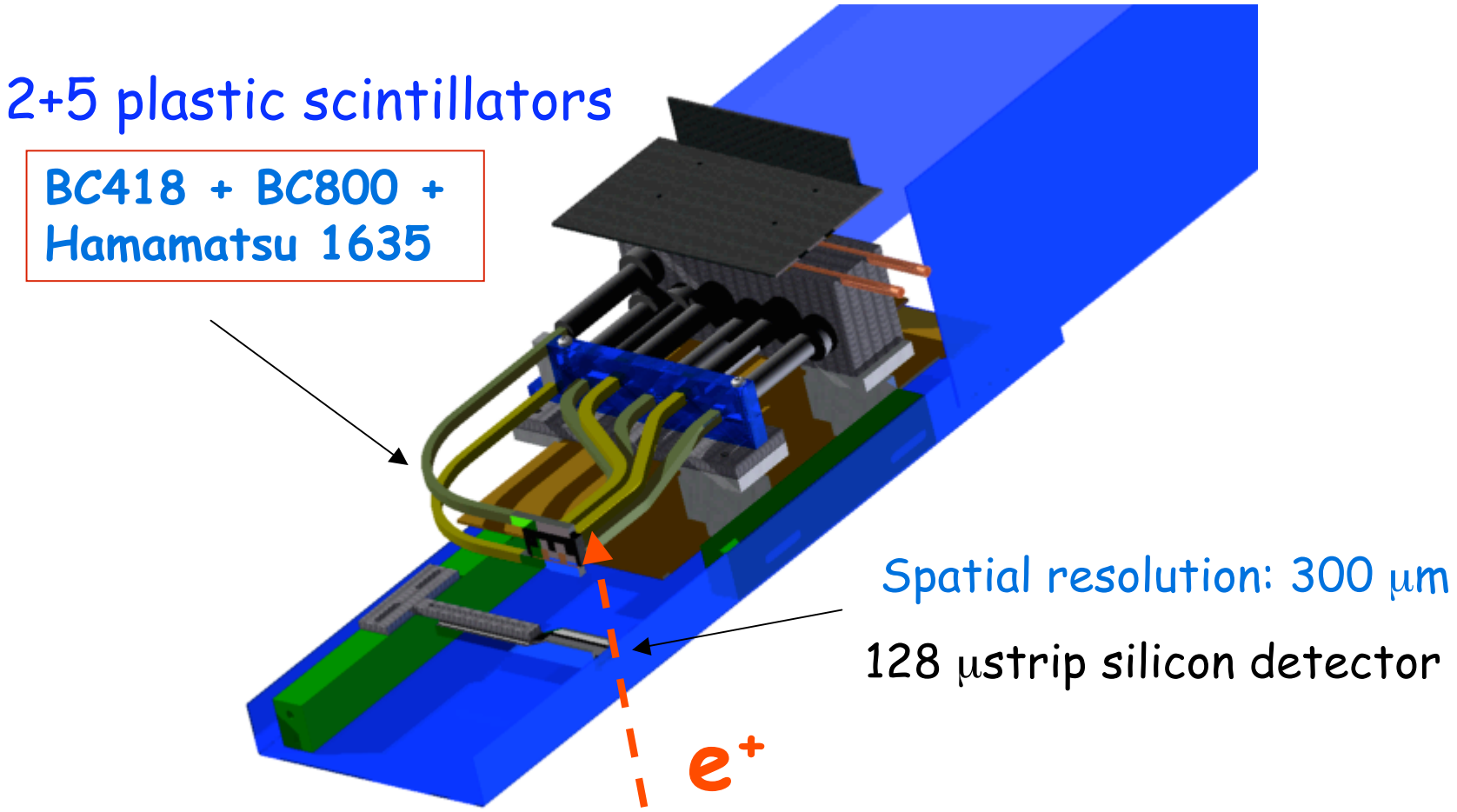
Schematic view for next test



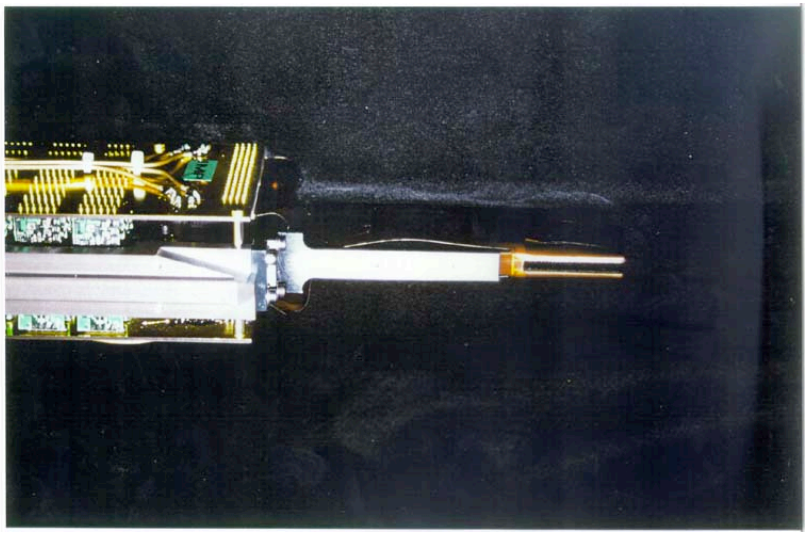
3D View

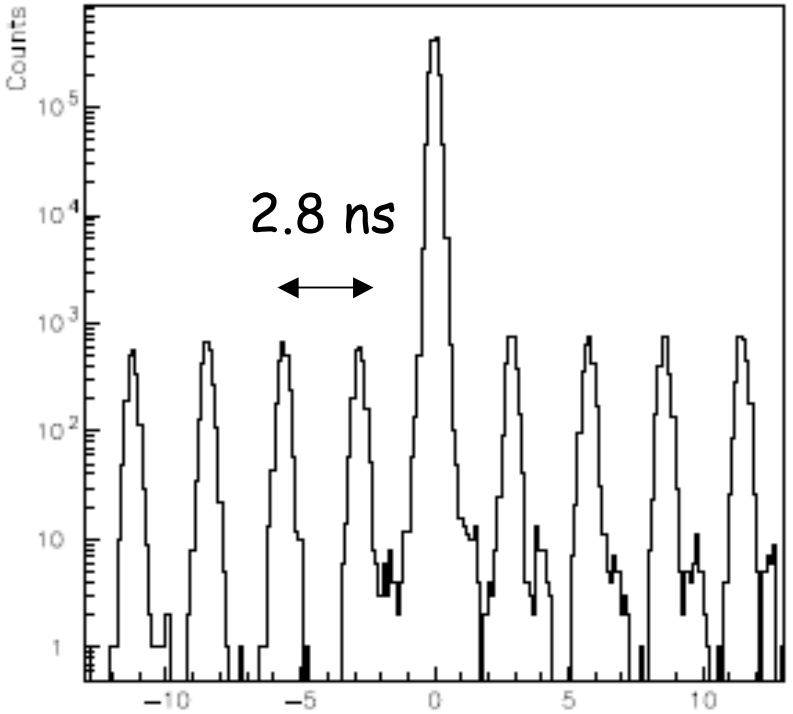


Tagging - by Graal experiment



Tagging characteristics





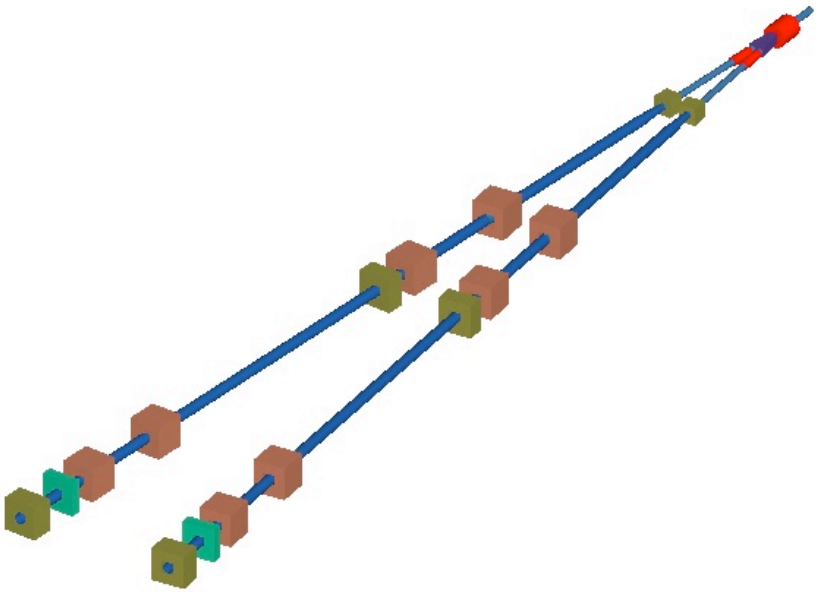
Spatial resolution: 300 mm

128 mstrip silicon detector

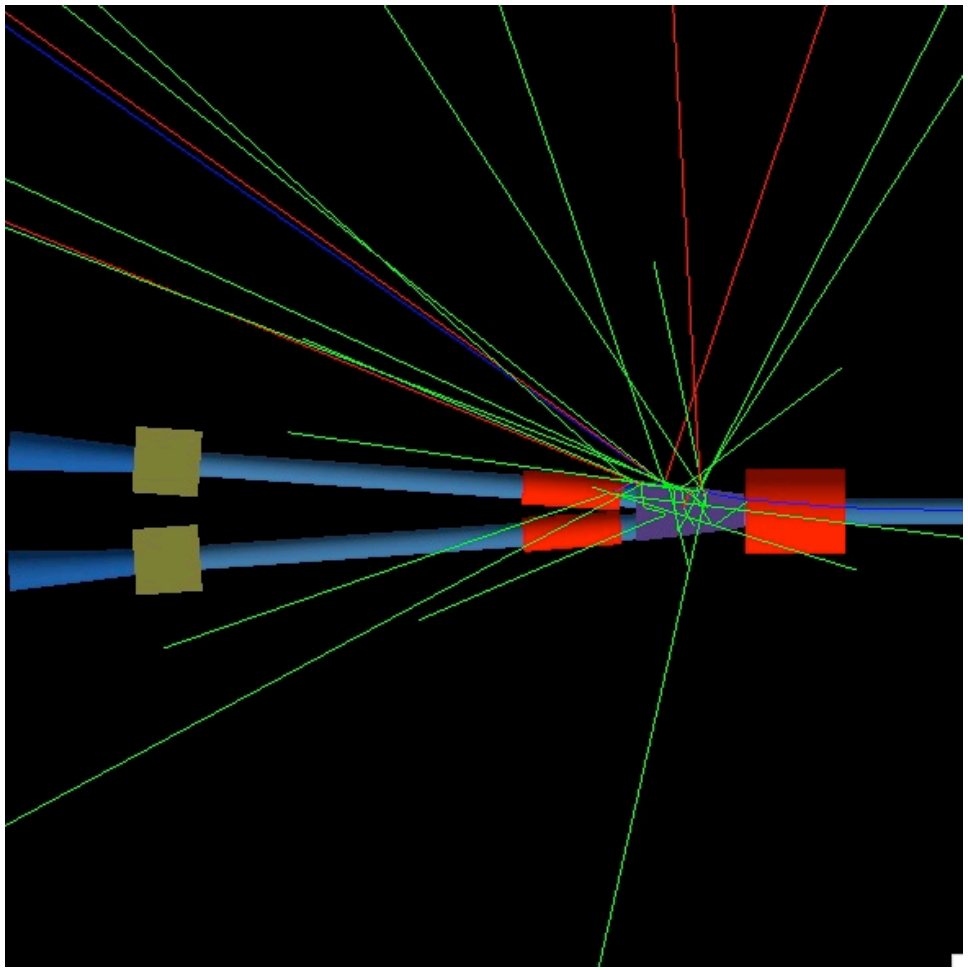
Final time resolution ≈ 600 ps

10 plastic scintillators

Montecarlo study about tagging possible location (by BDSIM)



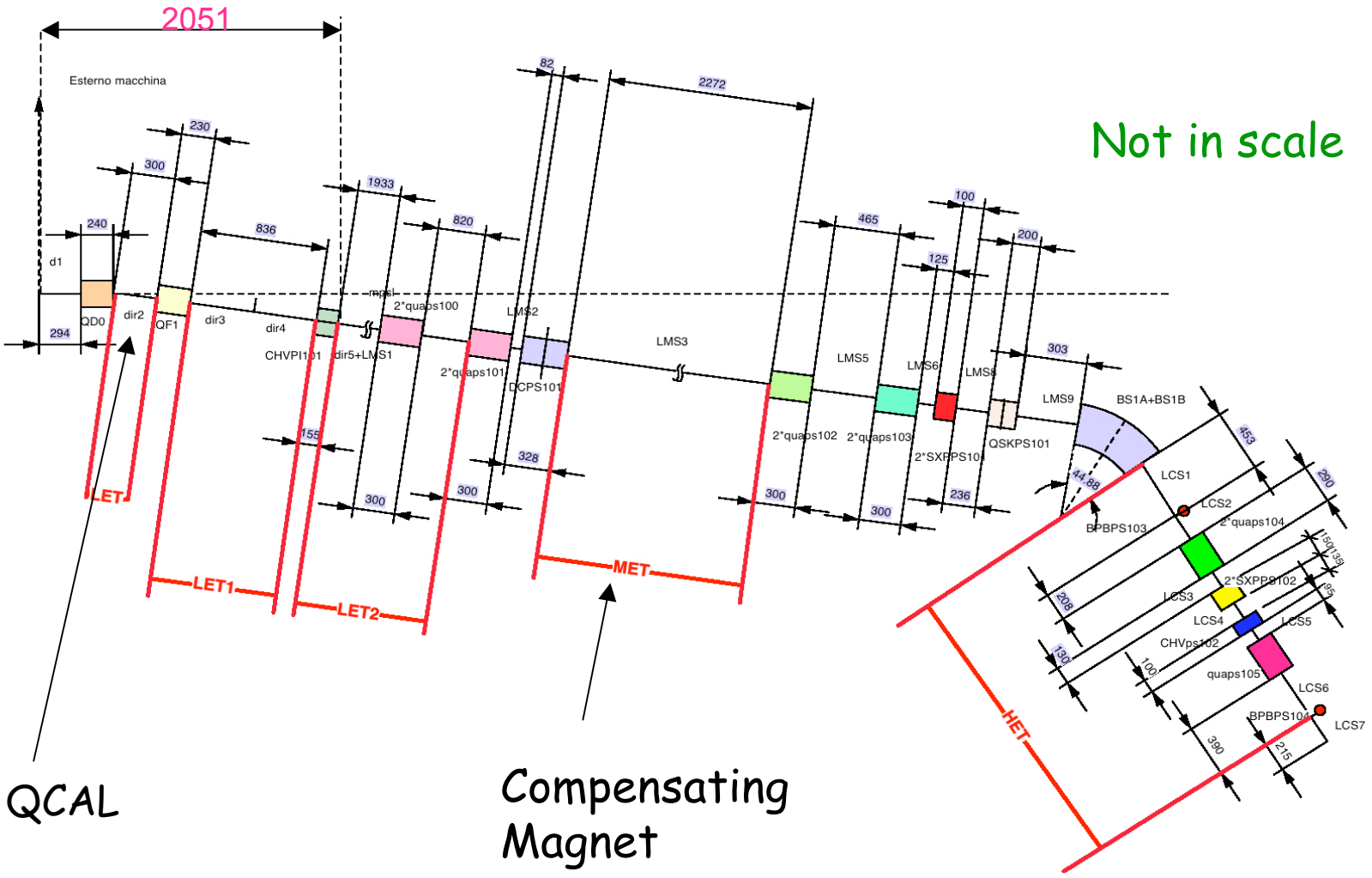
Magnetic lattice



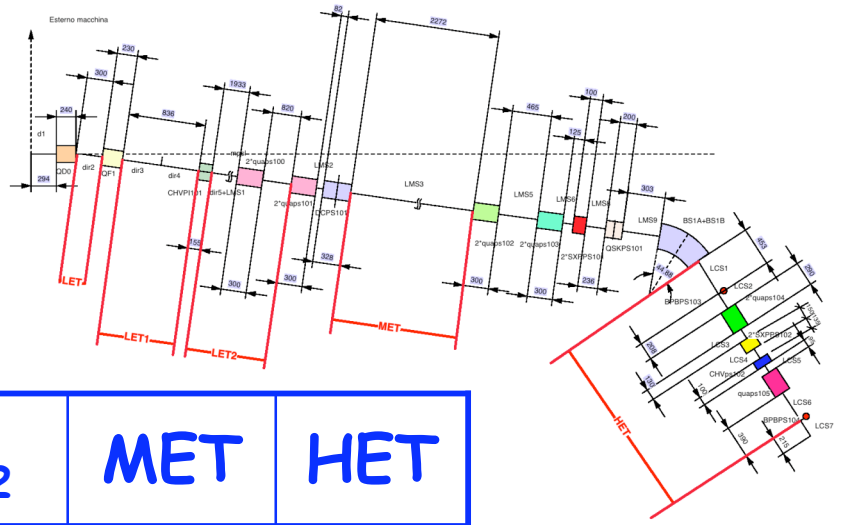
200 MeV e^+

Tagging possible location

KLOE

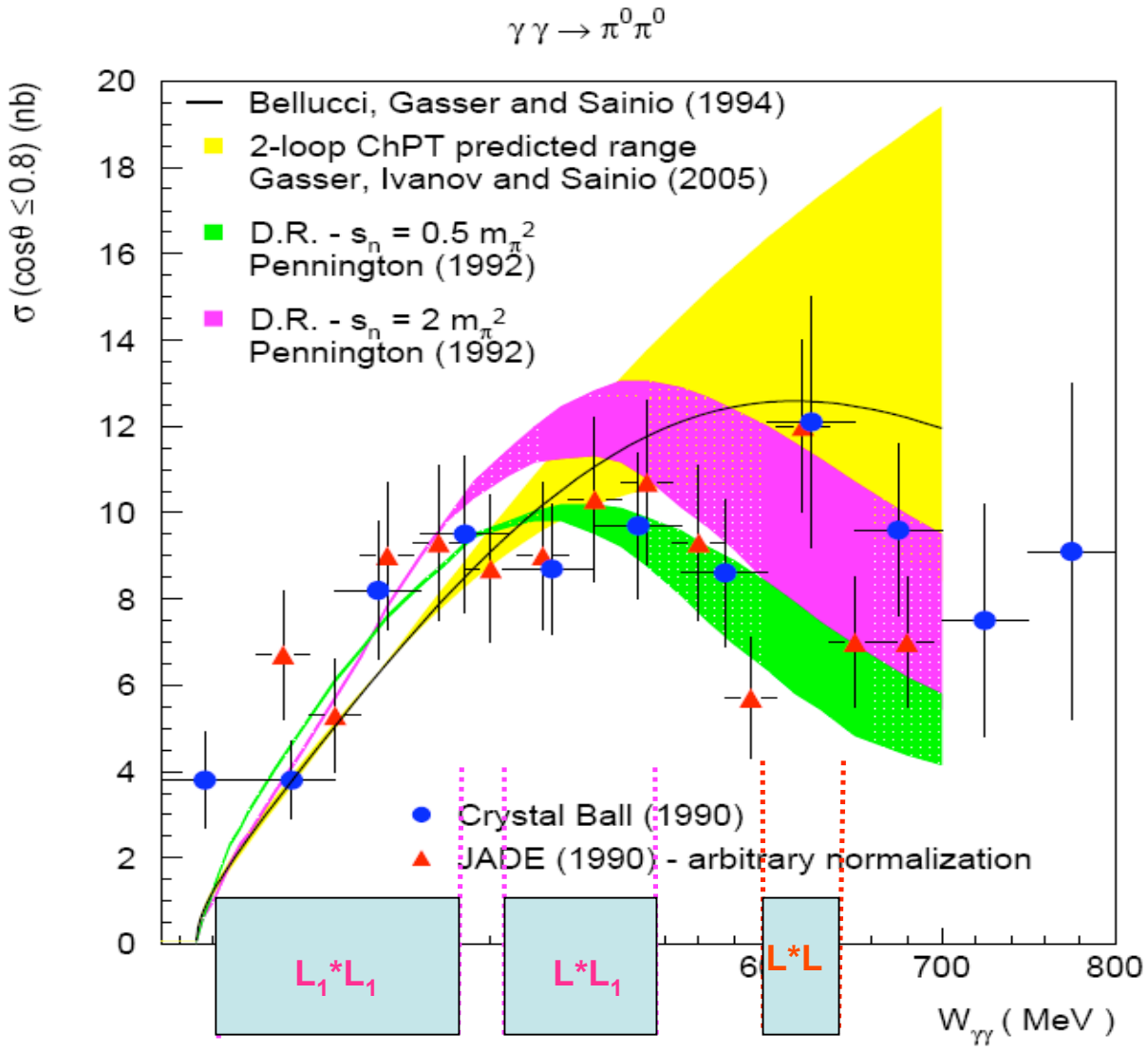


Wγγ in various region



	LET	LET_1	LET_2	MET	HET
LET	600 - 640	-	-	-	-
LET_1	440 - 530	280 - 420	-	-	-
LET_2	400 - 440 375 - 405	240 - 330 215 - 295	200 - 240 150 - 170	-	-
MET	340 - 380	180 - 270	140 - 180 115 - 145	80 - 120	-
HET	300 - 350	140 - 240	100 - 150 75 - 115	40 - 90	0 - 60

LET and LET_1 could be enough ?



Conclusion

- Prototype construction almost completed
  - Installation expected for next month
- Integration with QCAL under study
  - Different detector for tagging
- Particle tracking in progress
  - Interaction point
  - Emission angle
- Data analysis of data taken at $\sqrt{s}$ = 1 GeV during
- KLOE run is in progress