

# Background Studies

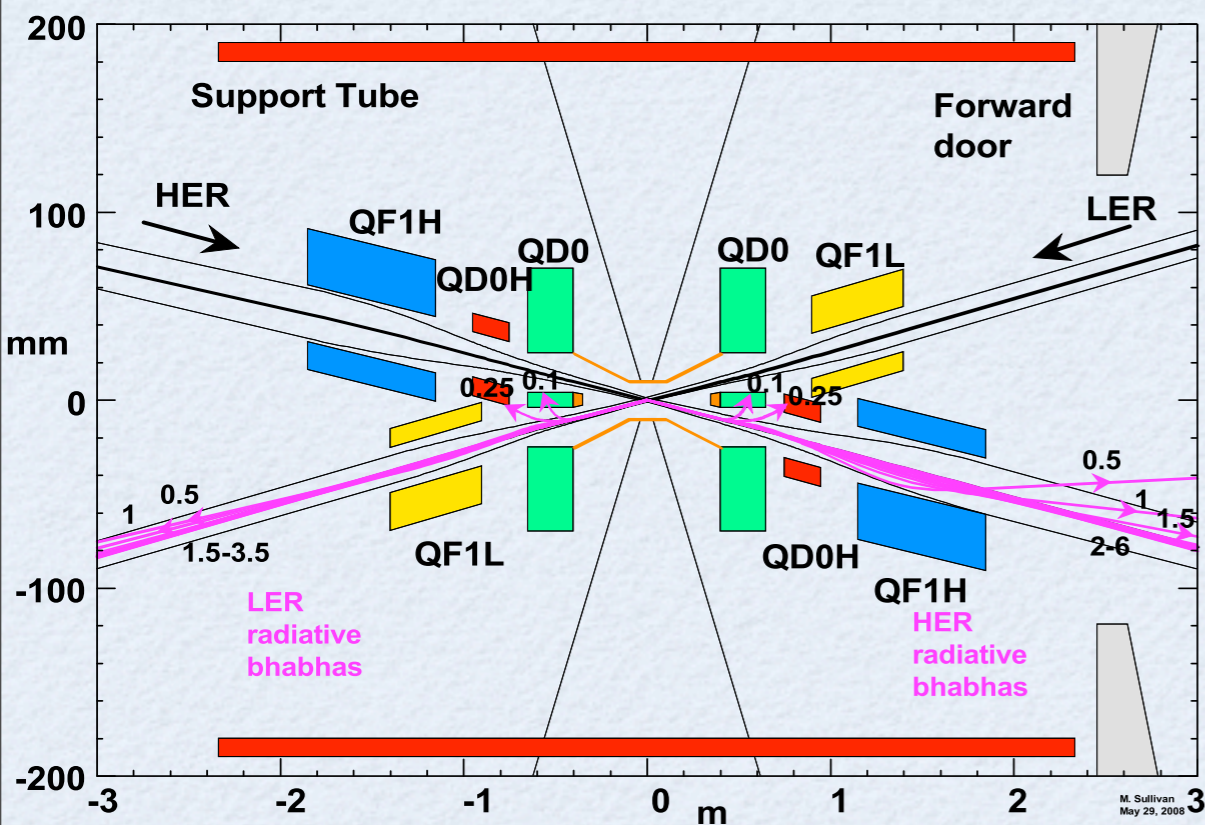
Eugenio Paoloni INFN Pisa, for the superb Background simulation group.

# Background team turn-over

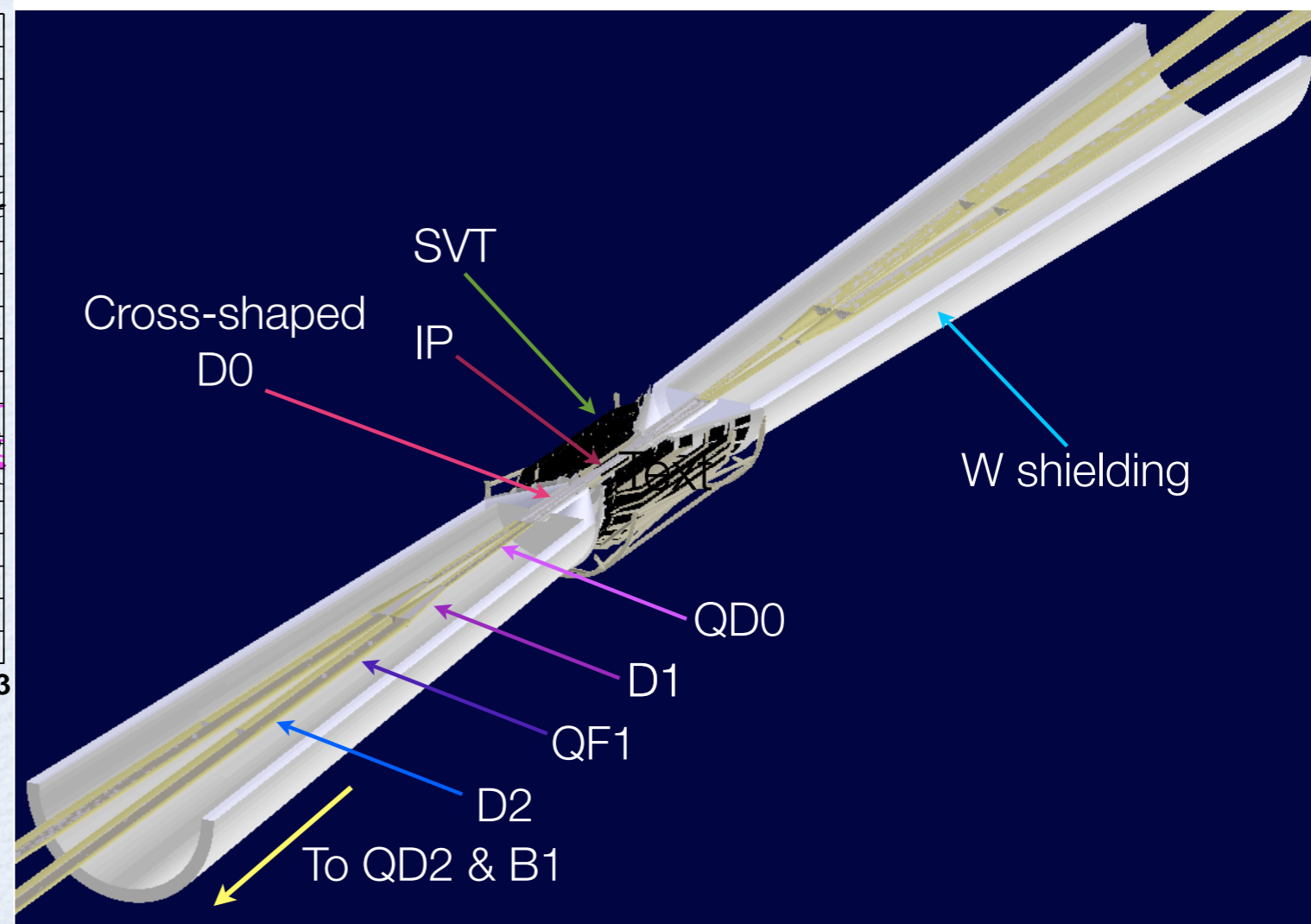
	he/she was	Now she/he is
Group coordinator	Giovanni Calderini	Eugenio + Marica
SVT	Giovanni Calederini, E.P. G.M.	Giovanni Marchiori E. P.
DCH	Aaron Roodman	Matteo Rama
EMC	Steve Playfer	Claudia Cecchi Stefano Germani
IFR	Gianluca Cavoto	Gianluigi Cibinetto Marcello Rotondo Mauro Munerato
SuperB/Touschek	Manuela Boscolo	Manuela Boscolo

We have a brand new top notch team. PID will shortly be here too.

# Beam line modeling: Giovanni Marchiori



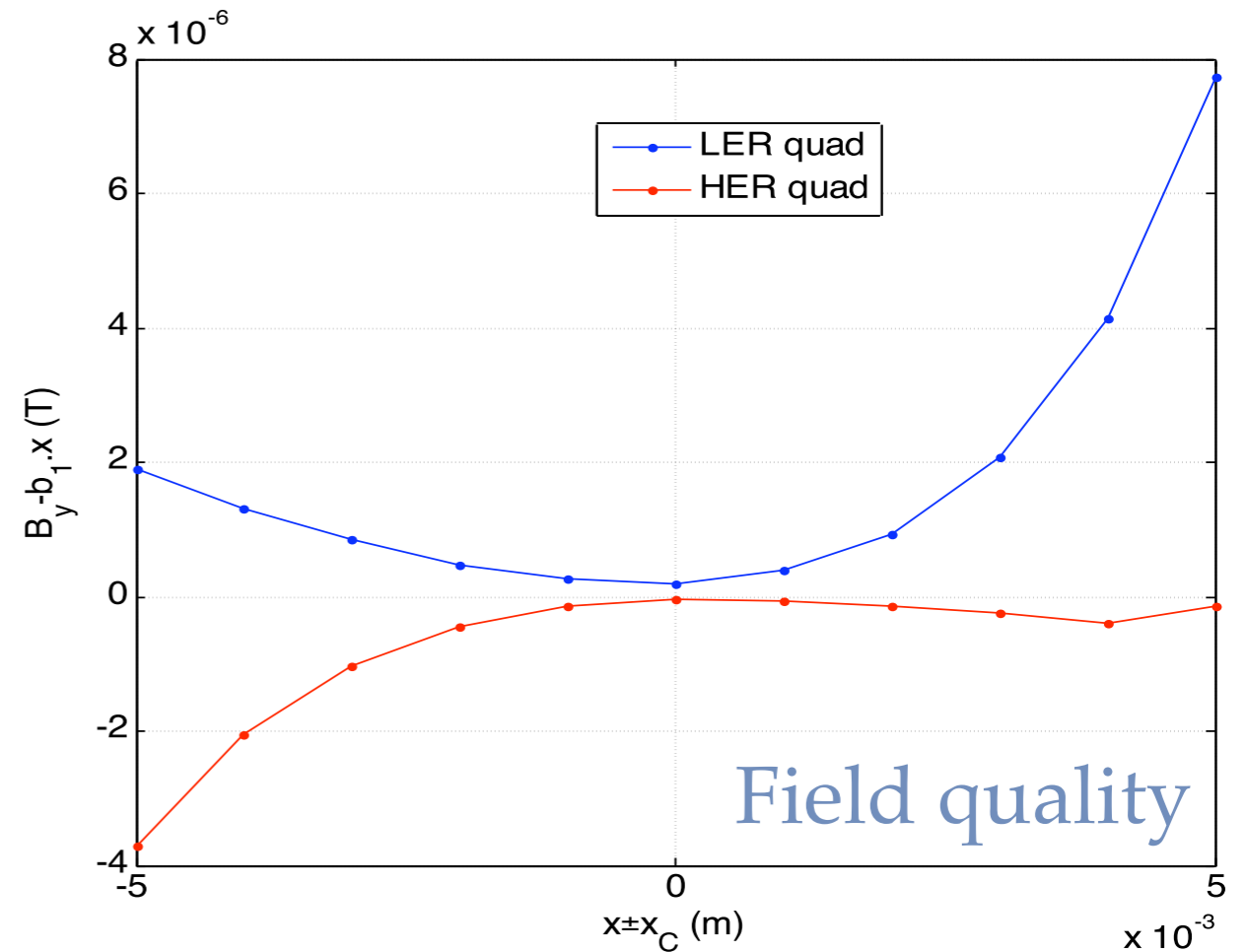
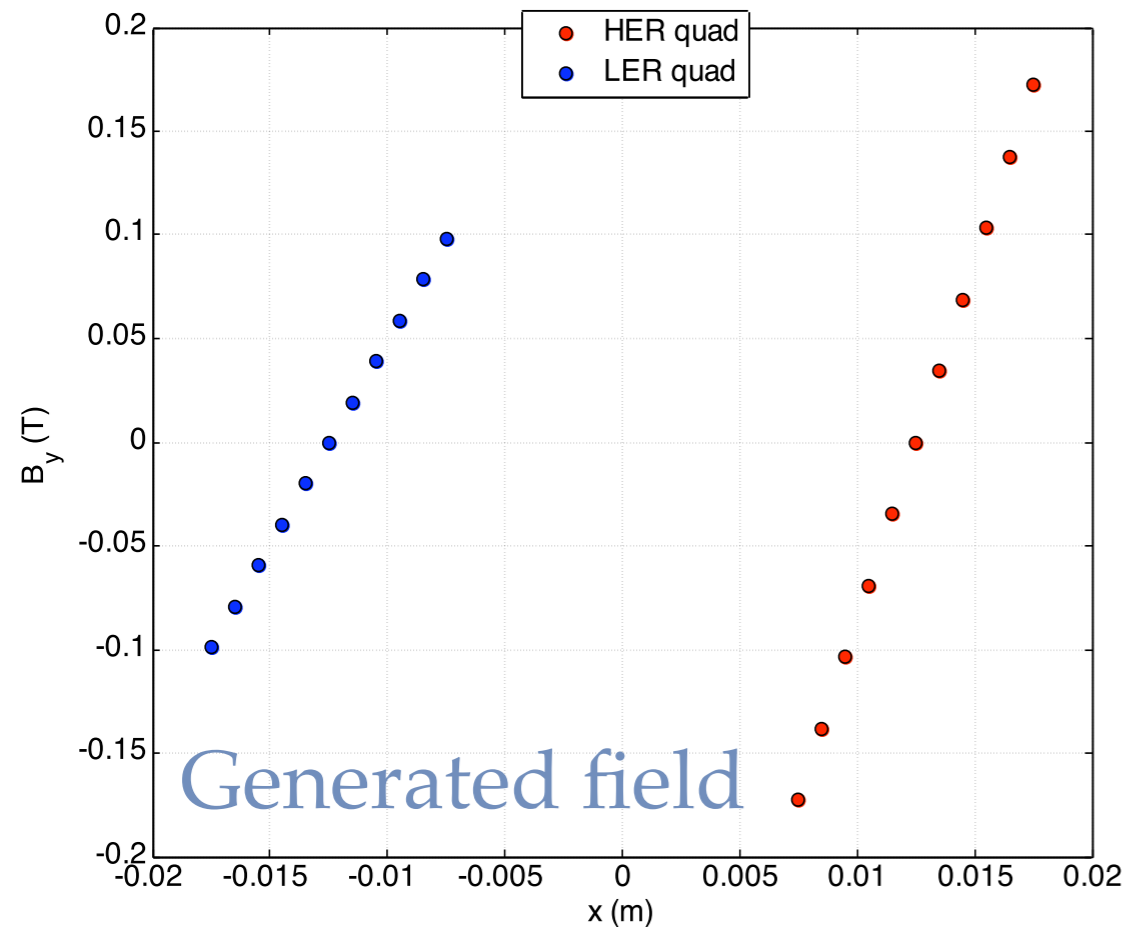
Mike Sullivan IR design



Giovanni Geant 4 Model

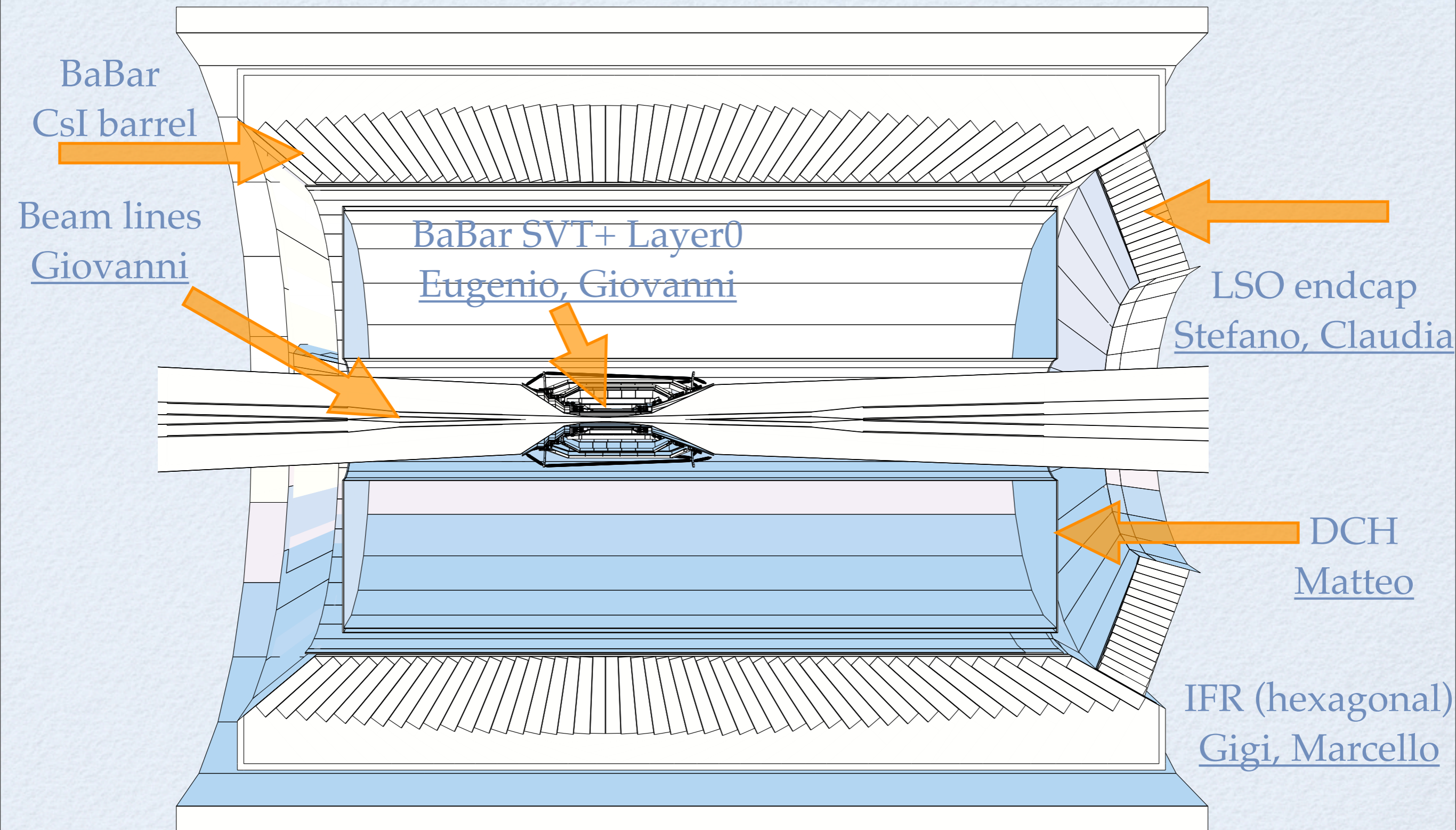
- New “Siamese Twin” QD0 beam line simulated
- Tungsten shielding 3 cm thick (CDR: 6 to 18 cm)

# “Siamese Twin” QDO: Simona



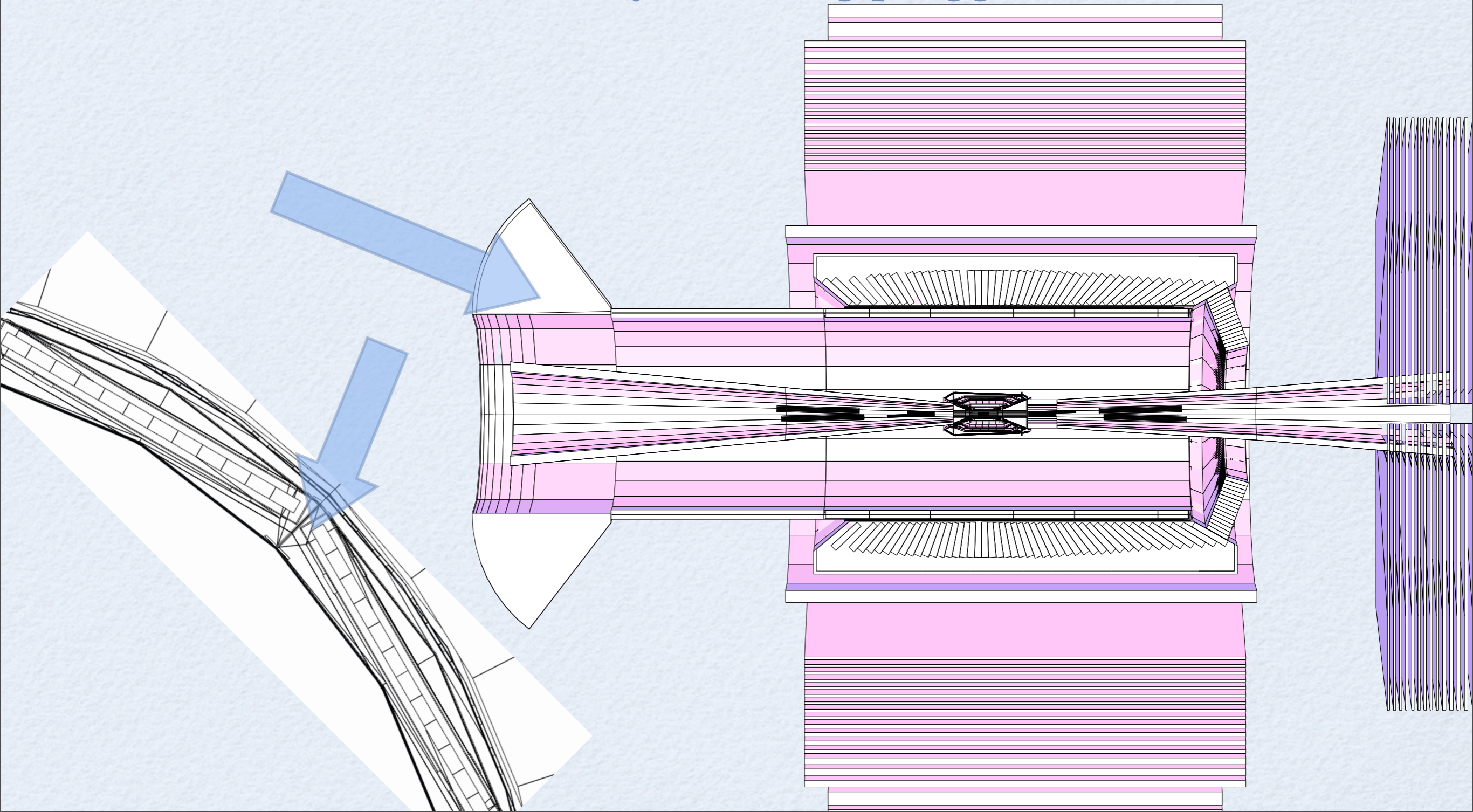
- New conceptual design proposed to build a SC QDO needed to implement Pantaleo (FF) and Mike (IR) design
- Field quality seems not a problem, field gradient needs some compromise: Mike, Simona, Panta etc. etc. working on it, promising news

# Detailed Detector Model



# DIRC

- DIRC are at hand ready for being plugged in



# What the group showed before this Meeting

	Radiative Bhabha	Pairs production	Touschek	Single beam (non Toushek)
SVT	Done	“Done” without Geant4 simulation*	“Done” with limited statistic LER only, beam line unrealistic*	To do
DCH	Done	To do	To do	To do
EMC	Done	To do	To do	To do
IFR	Done	To do	To do	To do

# Presented at this Meeting (new IR & Det.)

	Radiative Bhabha	Pairs production	Touschek	Single beam (non Toushek)
SVT	Done	Work in progress (unexpected result)	Done	To do
DCH	Done	Done	Done	To do
EMC	Done	To do	To do	To do
IFR	Work in progress	To do	To do	To do

Caveat: limited statistic (1/10 of the CDR...), preliminary studies



# SVT: Giovanni Marchiori

## Rad. Bhabha

- With the current FF (stat. errors only, due to limited MC stat.):

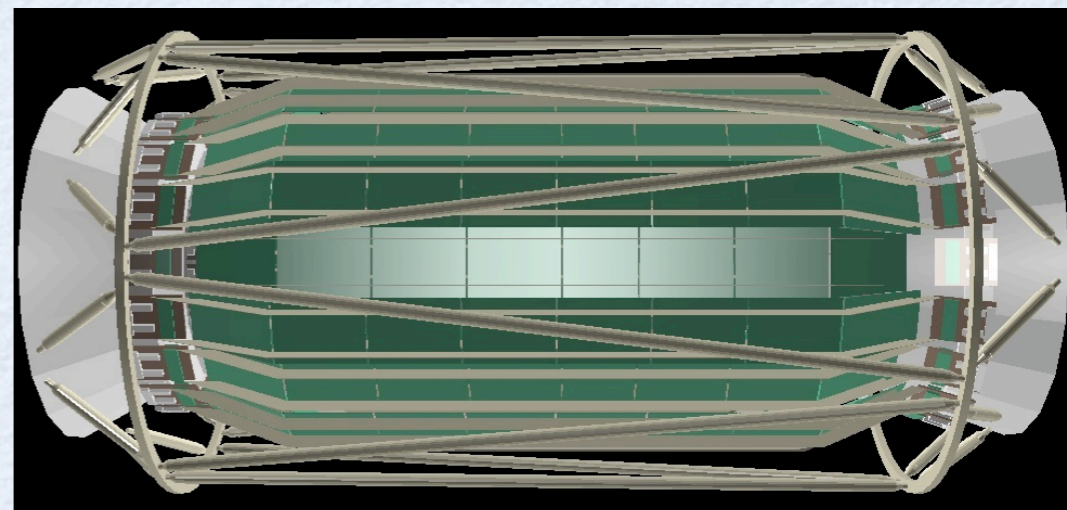
Layer	Rate e-	Rate e+
0	1.0±0.5 MHz/cm <sup>2</sup>	1.5±0.6 MHz/cm <sup>2</sup>
1	negligible	negligible
2	negligible	negligible
3	negligible	negligible
4	negligible	negligible
5	negligible	negligible

- higher in L0, but tolerable

- more stat. needed

- investigate shielding close to L0

## Actual model we are using



Manuela  
efforts to optimize  
HER Touschek  
preliminary but  
encouraging

- With CDR FF, expected rate in L0 was 23 MHz/cm<sup>2</sup>! With new FF and scrapers:

Layer	e- from LER	e+ from LER
0	12.8±1.4 kHz/cm <sup>2</sup>	1.3±0.1 kHz/cm <sup>2</sup>
1	5±2 Hz/cm <sup>2</sup>	2.9±1.5 Hz/cm <sup>2</sup>
2	6±2 Hz/cm <sup>2</sup>	2.9±1.3 Hz/cm <sup>2</sup>
3	324±80 Hz/cm <sup>2</sup>	8.4±1.5 Hz/cm <sup>2</sup>
4	127±35 Hz/cm <sup>2</sup>	0.05±0.01 Hz/cm <sup>2</sup>
5	19±5 Hz/cm <sup>2</sup>	5±1 Hz/cm <sup>2</sup>

**preliminary**

e- from HER	e+ from HER
537±17 kHz/cm <sup>2</sup>	170±10 kHz/cm <sup>2</sup>
50±3 kHz/cm <sup>2</sup>	20±2 kHz/cm <sup>2</sup>
16±1 kHz/cm <sup>2</sup>	7.2±0.9 kHz/cm <sup>2</sup>
6.4±0.5 kHz/cm <sup>2</sup>	0.8±0.1 kHz/cm <sup>2</sup>
1.2±0.1 kHz/cm <sup>2</sup>	0.12±0.03 kHz/cm <sup>2</sup>
0.56±0.06 kHz/cm <sup>2</sup>	~0 Hz/cm <sup>2</sup>

- IR design very promising
- More work needed on this

- Recently simulated 700 events (~100ns) (interface to Diag36 by EP)

- bkg mainly due to electrons (positrons annihilate before hitting the SVT)

- between O(100) and O(5) kHz/cm<sup>2</sup> in L1-5

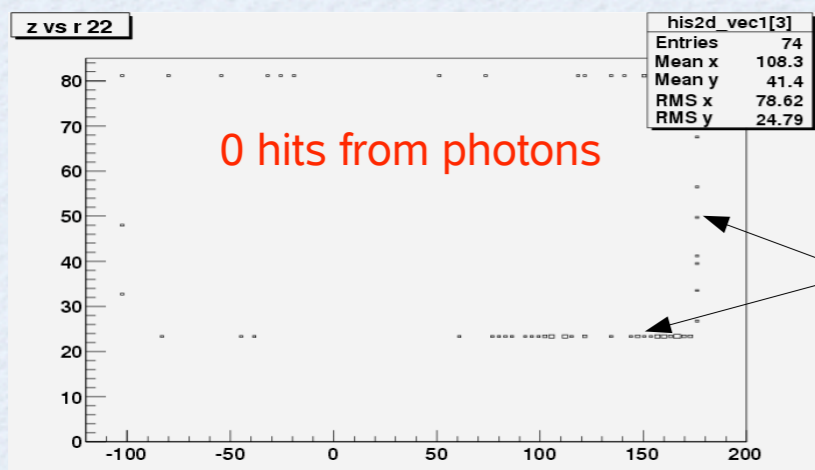
- discrepancies between the expected rate and momentum distribution of incident particles in L0 currently not understood

# DCH: Matteo, Marcello, Giuseppe

- Three geometries implemented:
  - BaBar like, KLOE like, Conical hole KLOE like

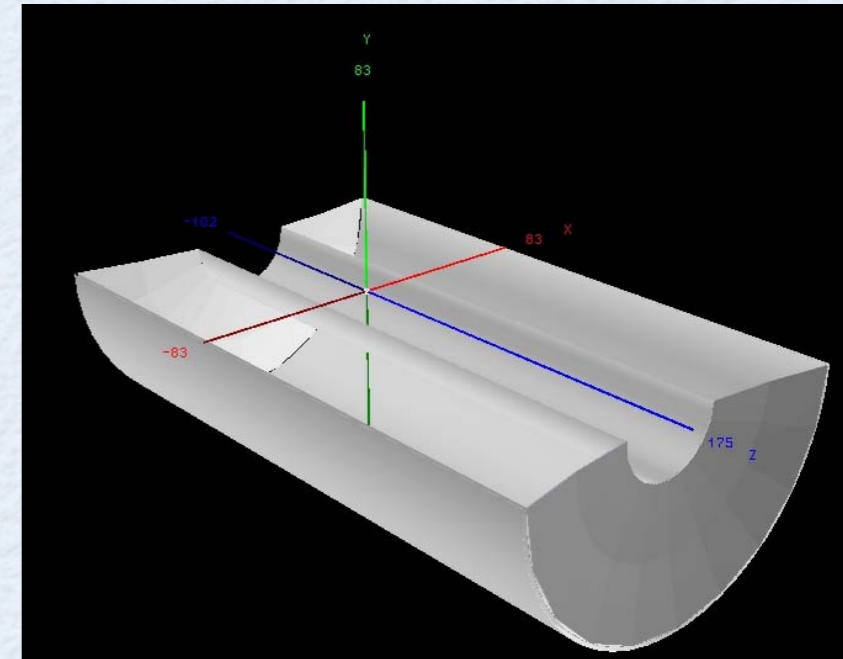
## Radiative Bhabha's (I)

- $e^+e^- \rightarrow e^+e^-\gamma$
- 10 bunch crossings with  $E_\gamma > 10\%$  Ebeam. Crossing freq=209MHz.  $\Rightarrow \Delta t \sim 50\text{ns}$ .
- $e^\pm$ : 3 hits.  $\gamma$ : 0 hits



r,z view of hit map  
(rmin=23.6cm  
rmax=80.9cm)

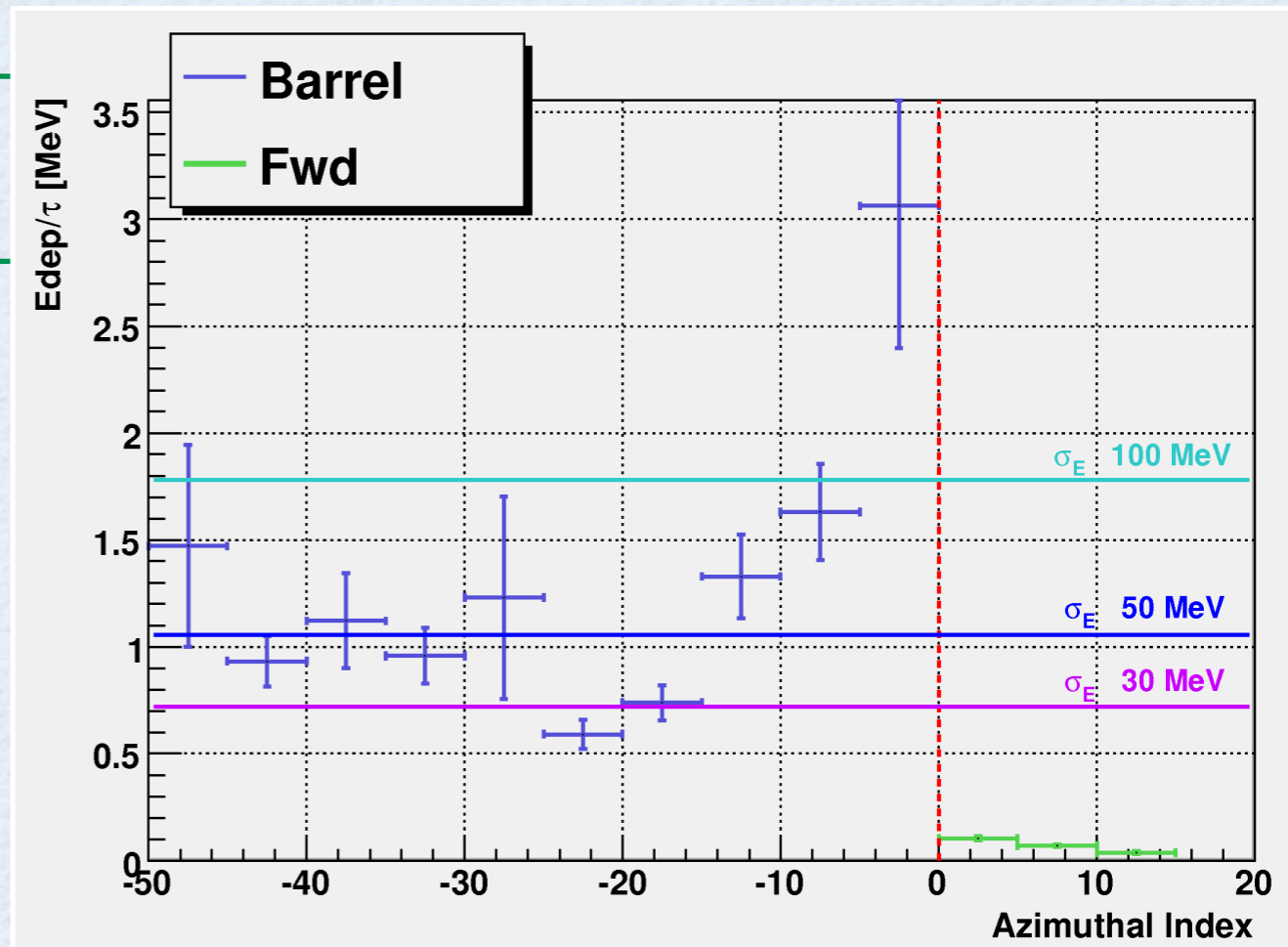
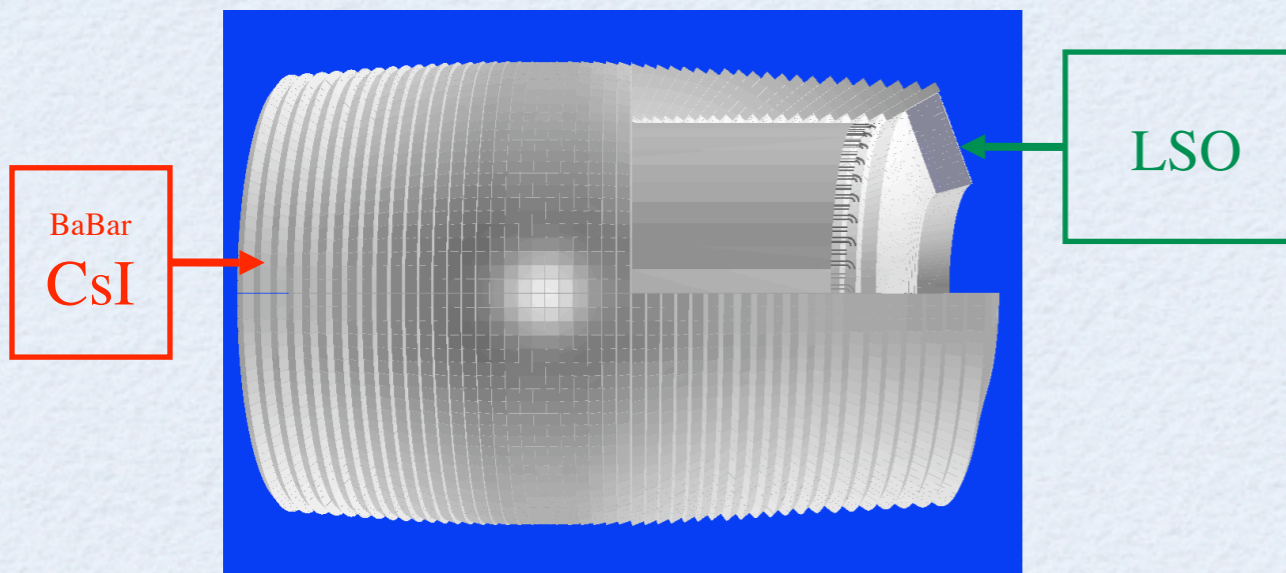
These hits have 0 deposited energy. They only mark the passage of photons.



Only upper limits from other sources...  
a factor x 100 in statistic needed

Note: we can evaluate more precisely the average number of interacting photons from the number of entering photons and the cross section (as was done for the CDR)

# EMC: Stefano, Claudia



Impact on EMC energy resolution

- Results without tungsten shielding
- Statistic is too low with 3cm tungsten shielding:  
really good new

# IFR: Gígi, Marcello, Mauro

Small problems with the geometrical model, will be shortly solved

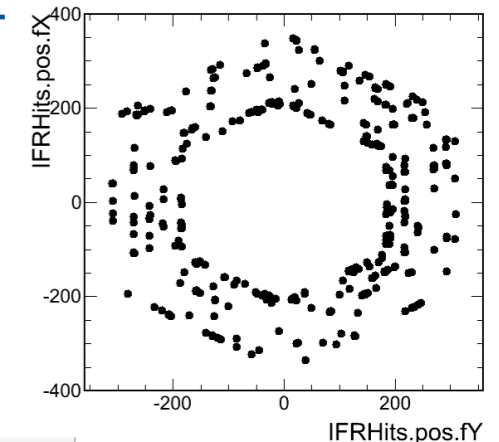
## Conclusions

- A first look at the background rootup exciting (few events and IFR not yet
- Main issues for the IFR:
  - Beam halo (mostly LER)
  - Innermost layers around the beam pipe
  - Neutrons
- Can we simulate these contribution to the background?  
What would be the time scale?

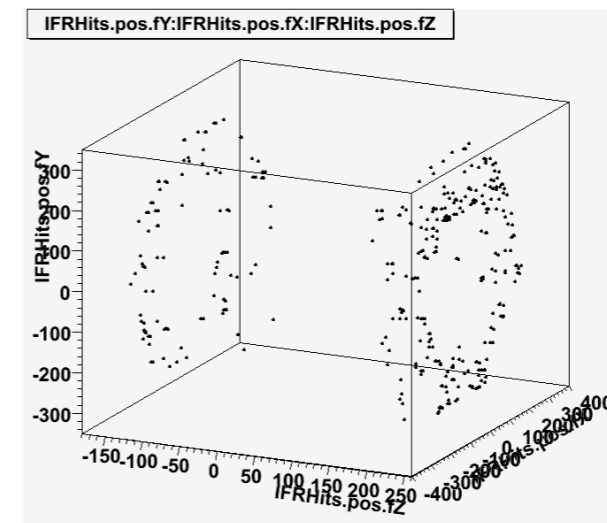
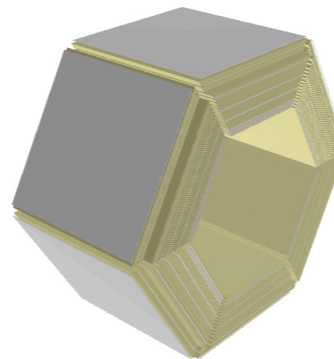
## First look at background events



- First checks have been done analyzing the first radiative Bhabha rootuples produced by Eugenio.
- Some endcap volumes are overlapping with other stuff: only the barrel in the simulation.



- Few events.



Without the endcaps, only the very forward and backward part of the barrel have been hit

G. Cibinetto

Elba - June 1, 2008

4

Small problems with the geometrical model, will be shortly solved

# To Do list

- Produce bigger samples: backgrounds and single particles event to validate the simulation
- **Simulate neutrons**
- **Validate the simulation against BaBar data**

# Next steps: Fabrizio

- Goal is to deliver tools to support the detector design and optimization
  - Complementary role respect to fast simulation
  - Comes into play when fast simulation is not enough
- Improve geometry description
  - Different options for new sub-detectors
- Use detailed simulation to inject realism into fast simulation
  - Estimate sub-detector response functions from detailed simulation and insert them into fast simulation
  - Generate Ghits with detailed simulation and feed fast simulation with them
    - Useful for background Ghits
  - Generate (simplified) digitization with detailed simulation and feed fast simulation with them

# Brain storming: Dave, Fabrizio, Mauro, Matteo....

- Derivation of fast simulation “Effective parameters” from the full simulation (svt radii, non active material, overlapping fraction... etc. etc.)
- EMC shower “catalogue” simulated with the full simulation and inserted in the fast one (more on next talk)
- Close interaction with GDML developers team
- Grid porting

# Conclusions

- The background team bootstrapped
- Lot of work done by dedicated, and over-committed, people
- We have a very detailed description of the detector to begin to play with
- We have a to-do list, and some plan to extend the functionalities of the full simulation
- Join us!