Luminosity Backgrounds

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SuperB Backgrounds

- Super*B* widely perceived as a low background environment:
  - Small beams currents << 10 A
  - ~~Dipoles near IP for beam separation~~
- Not for free to make this promise comes true
  - Lower emittance ⇒ higher Touschek background
  - Larger beta function @ QD0/QF1 ⇒ higher beam-gas background
  - Higher luminosity ⇒ higher luminosity background

Mini MAC requirements

- Asses (and mitigate) the impact of backgrounds on the detector
  - Occupancies (Particles flux rate)
  - Performances degradation
  - Doses

SuperB backgrounds

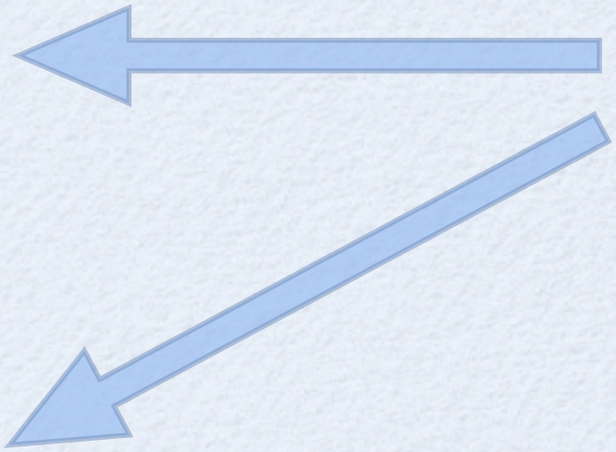
- Assessment of the background effects
  - Primary particles generators
    - Touchek, beam gas (Manuela)
    - Synchrotron radiation near IP (Mike)
    - Beamstrahlung, pairs production (standard HEP generators)
  - Secondaries generation: Bruno (Andrea di Simone)
  - Farm in Padova for data production and distribution
    - Roberto Stroili, Giuliano Castelli

Organization

- Who is responsible of what?
  - Primary particles generators
  - IR GDML design
  - Machine Detector Interface
  - Subdetectors GMDLs
  - C++ subdetector Code
  - Overall geometric assembly
  - C++ framework Code
  - Data production & distribution
  - Subdetector Data analysis
    - Task force of ~10 people?

The machine side

The subdetector side



...no, we haven't simulated 100x

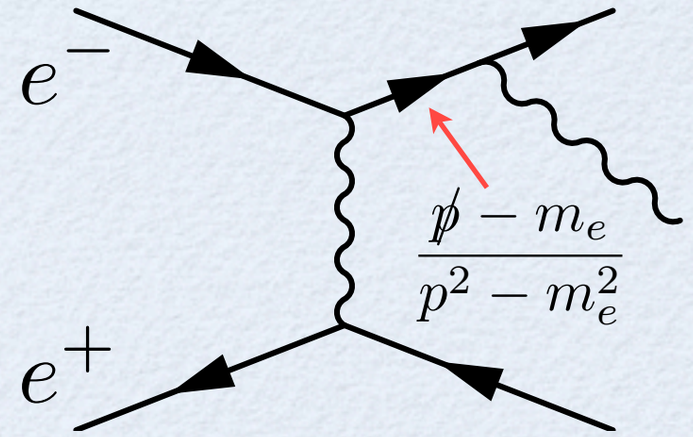
- My fault, I apologize.
  - Schedule too tight
  - Severe underestimate of the time needed to assemble the geometry
- Short time from here to CDR finalization
- We have to define an effective way to cooperate: clear assignment of responsibilities, interfaces, etc.

Luminosity Backgrounds

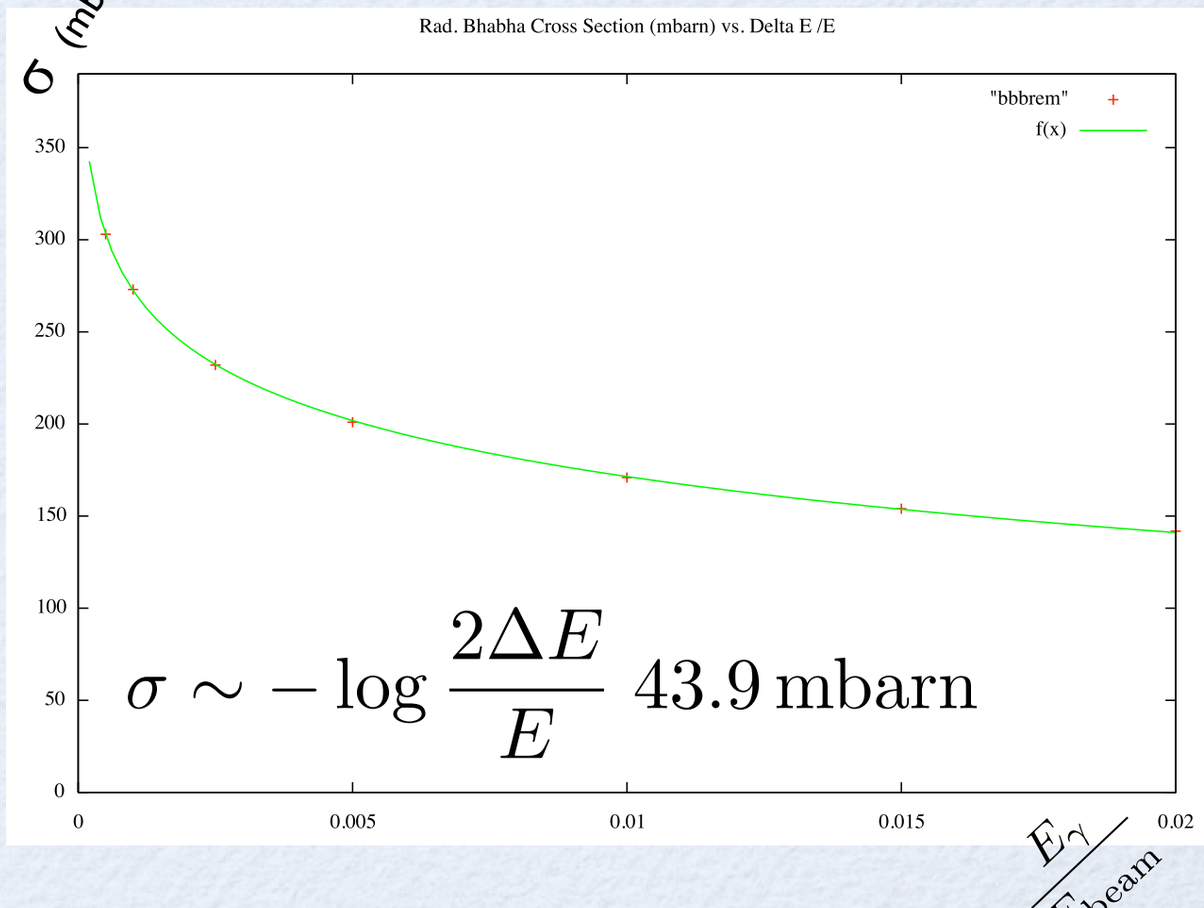
	Cross section	Evt/bunch$_{xing}$	Rate
Beam Strahlung	~ 340 mbarn (Eγ/Ebeam > 1%)	~680	0.3THz
	~ 40 mbarn (Eγ/Ebeam > 50%)	~80	35GHz
pair production	~7.3 mbarn	~15	7GHz
Elastic Bhabha	O(10^{-4}) mbarn (Det. acceptance)	~200/Million	100KHz
$\Upsilon(4S)$	O(10^{-6}) mbarn	~2/Million	1 KHz

Beam Strahlung

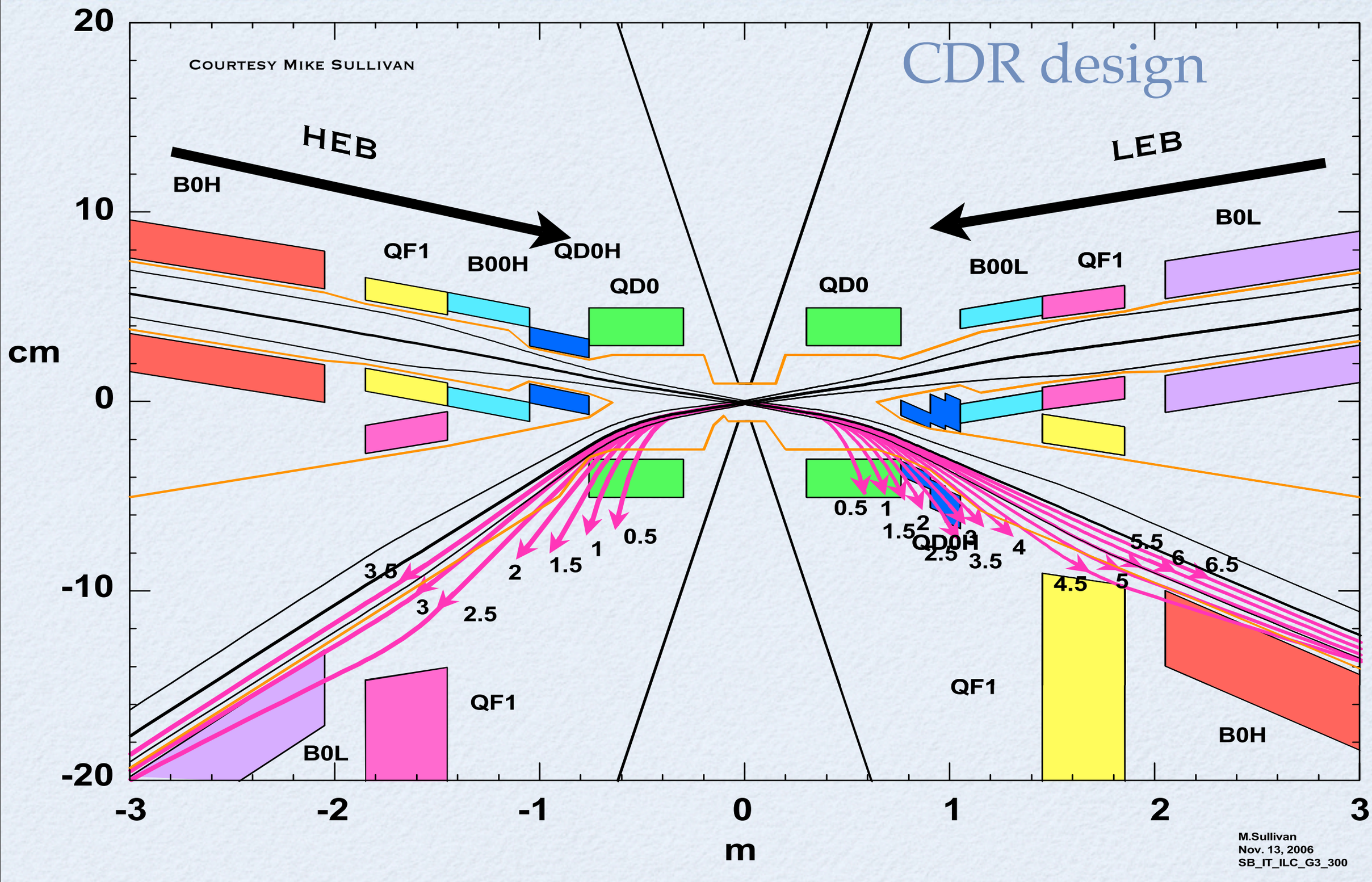
$$e^+e^- \to e^+e^-\gamma \quad (\gamma \sim\!\!\parallel e^-)$$



- Quasi elastic Bhabha of the electron on the positron followed by the emission of a photon
- The virtual photon and the virtual electron are almost on mass shell:
- the amplitude pinch both poles of the propagator
- Monte Carlo generator: BbbRem

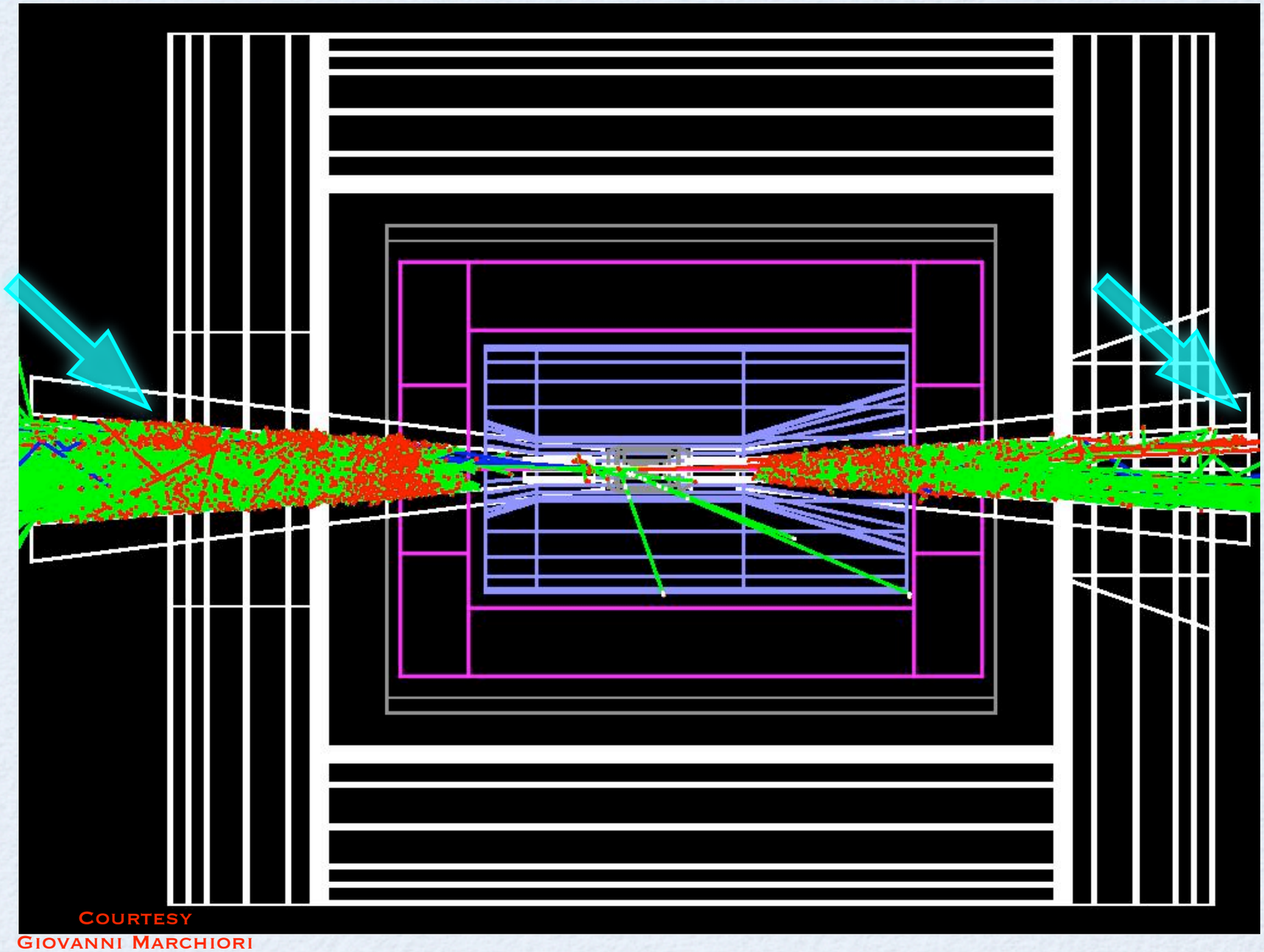


Shared Quadrupole Design



Massive (10^6 €) Shieldings

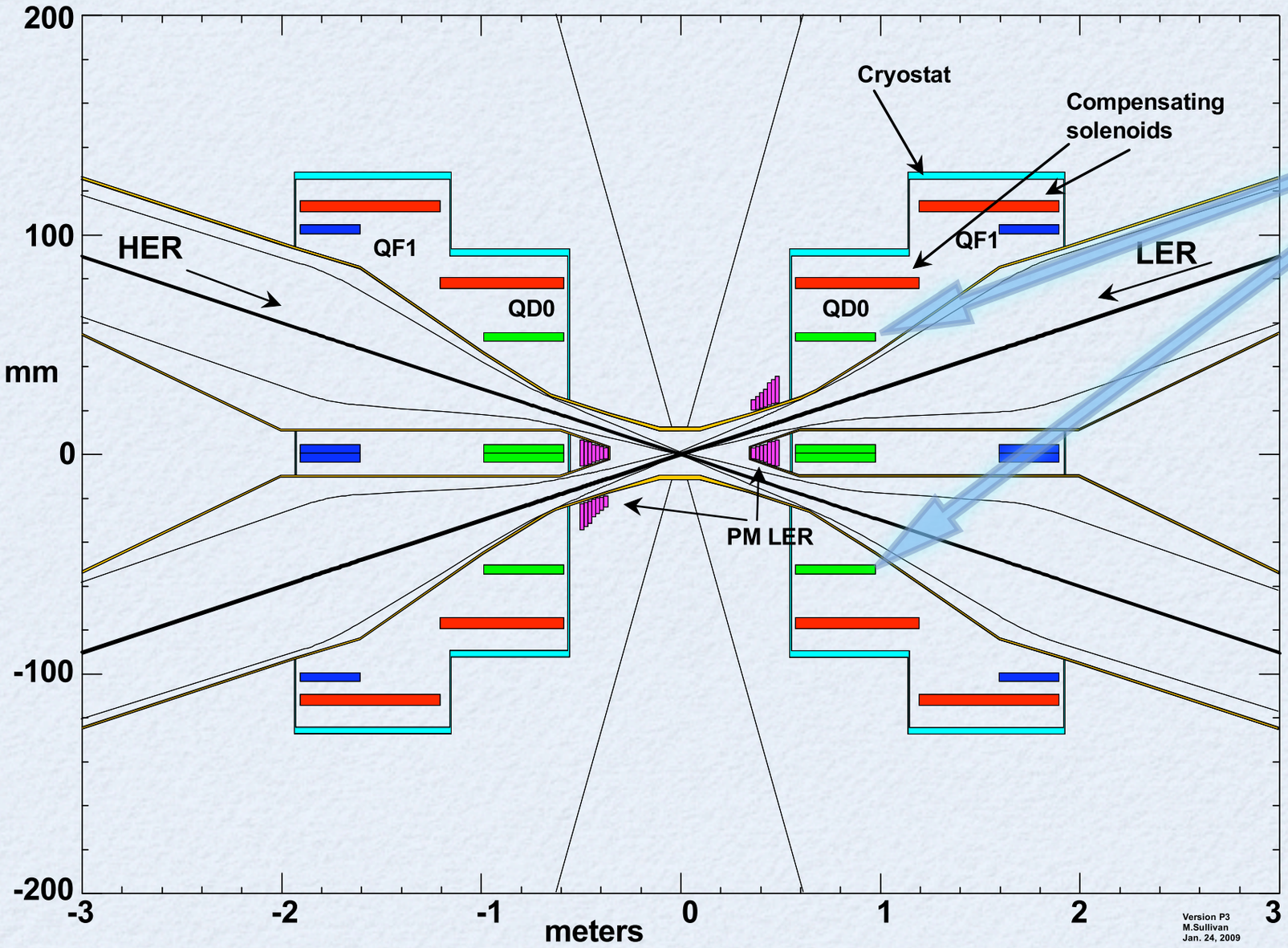
Tungsten shielding



Courtesy
Giovanni Marchiori

- A very thick (~ 10 cm) tungsten shielding is needed to contain electromagnetic showers: 2 x ~300 k€

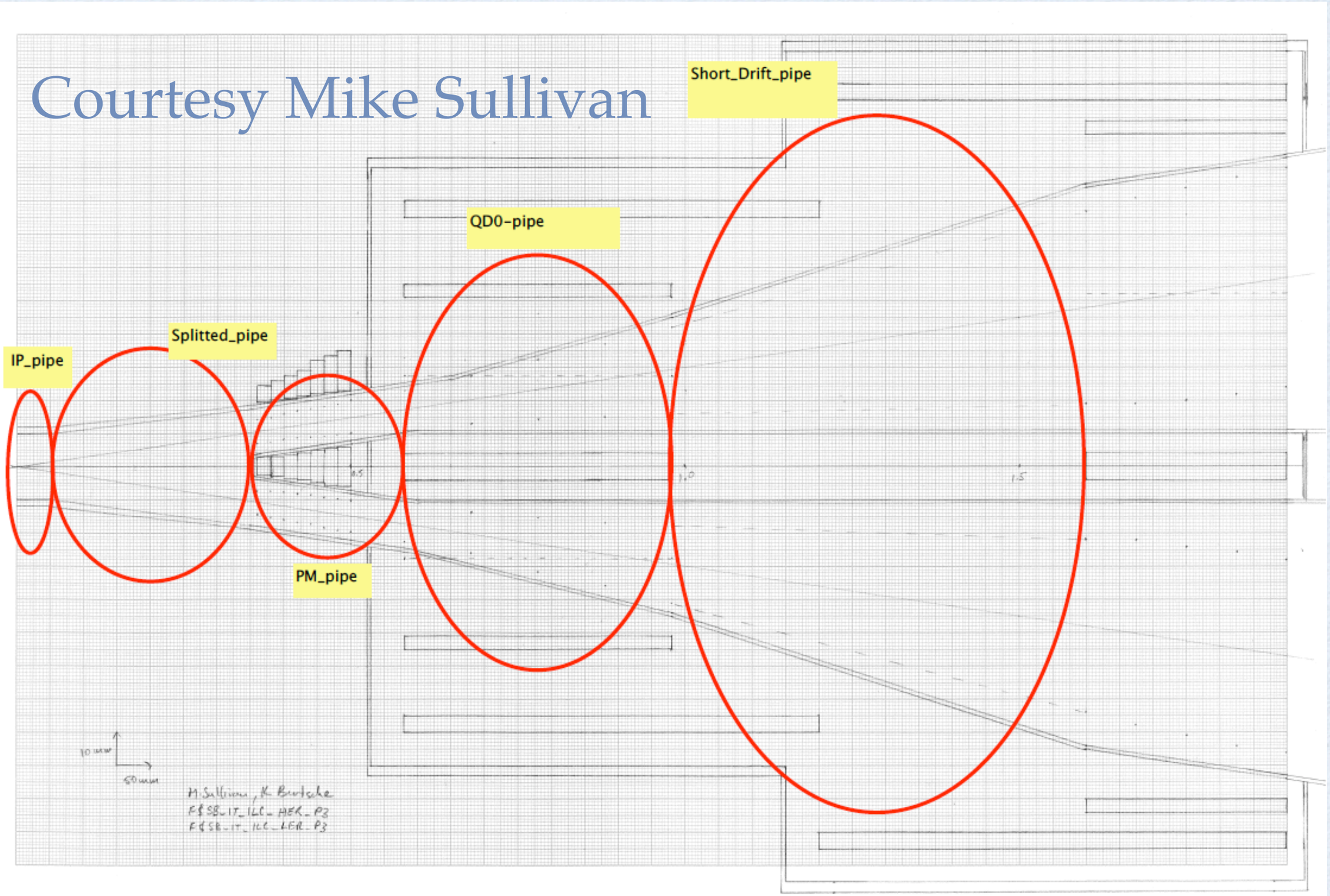
NEW IR design !



Twin Quads
(S.Bettoni talk)

~~Shared quadrupoles~~

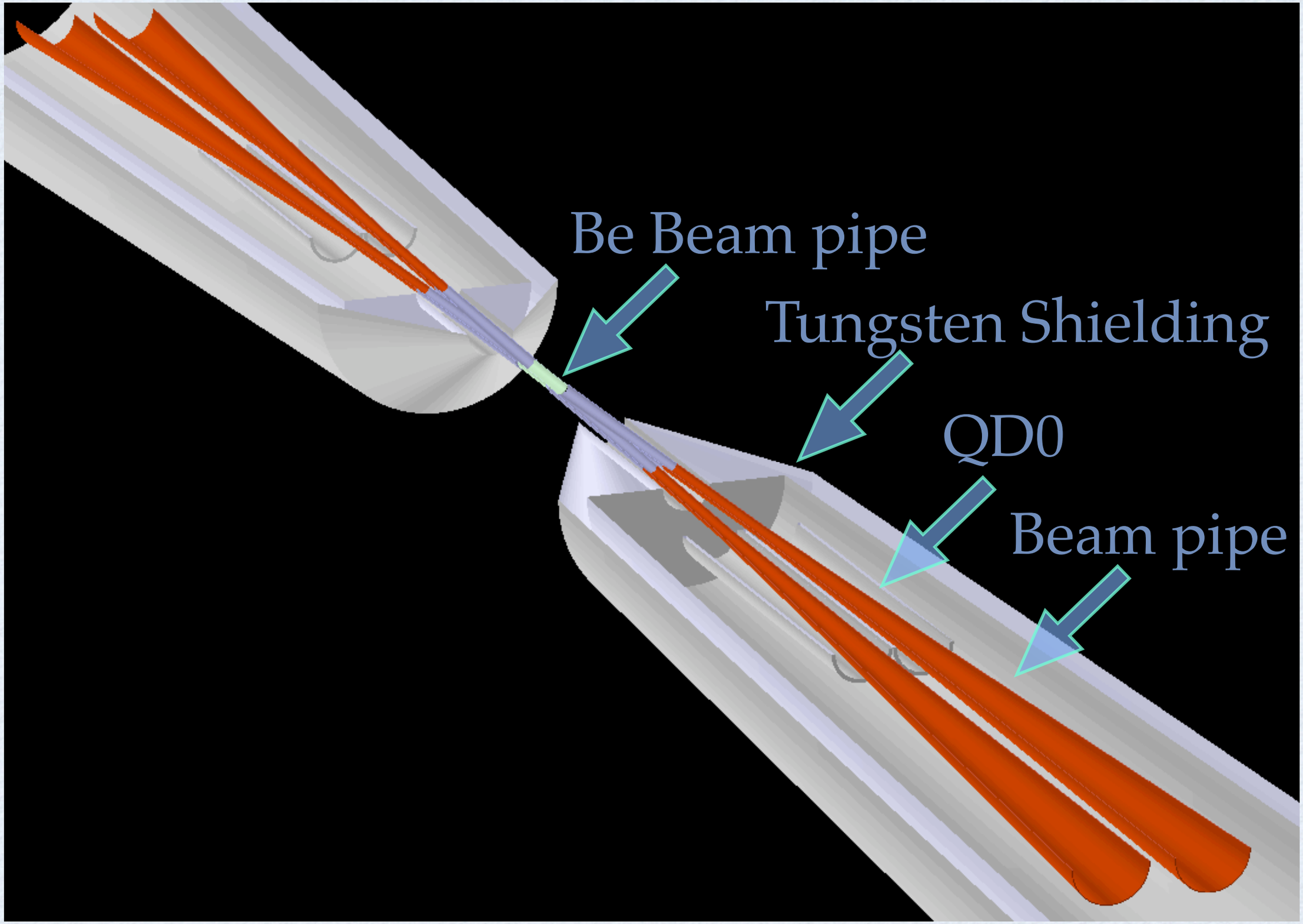
New Interaction Region



No Automated Tool

- The union of two beam lines coded by BDSIM usually produces Overlaps, Geant4 complains.
- Anyway BDSim cannot handle Mike geometry
- Hand made GDML for the IR

GDML model (snapshot)



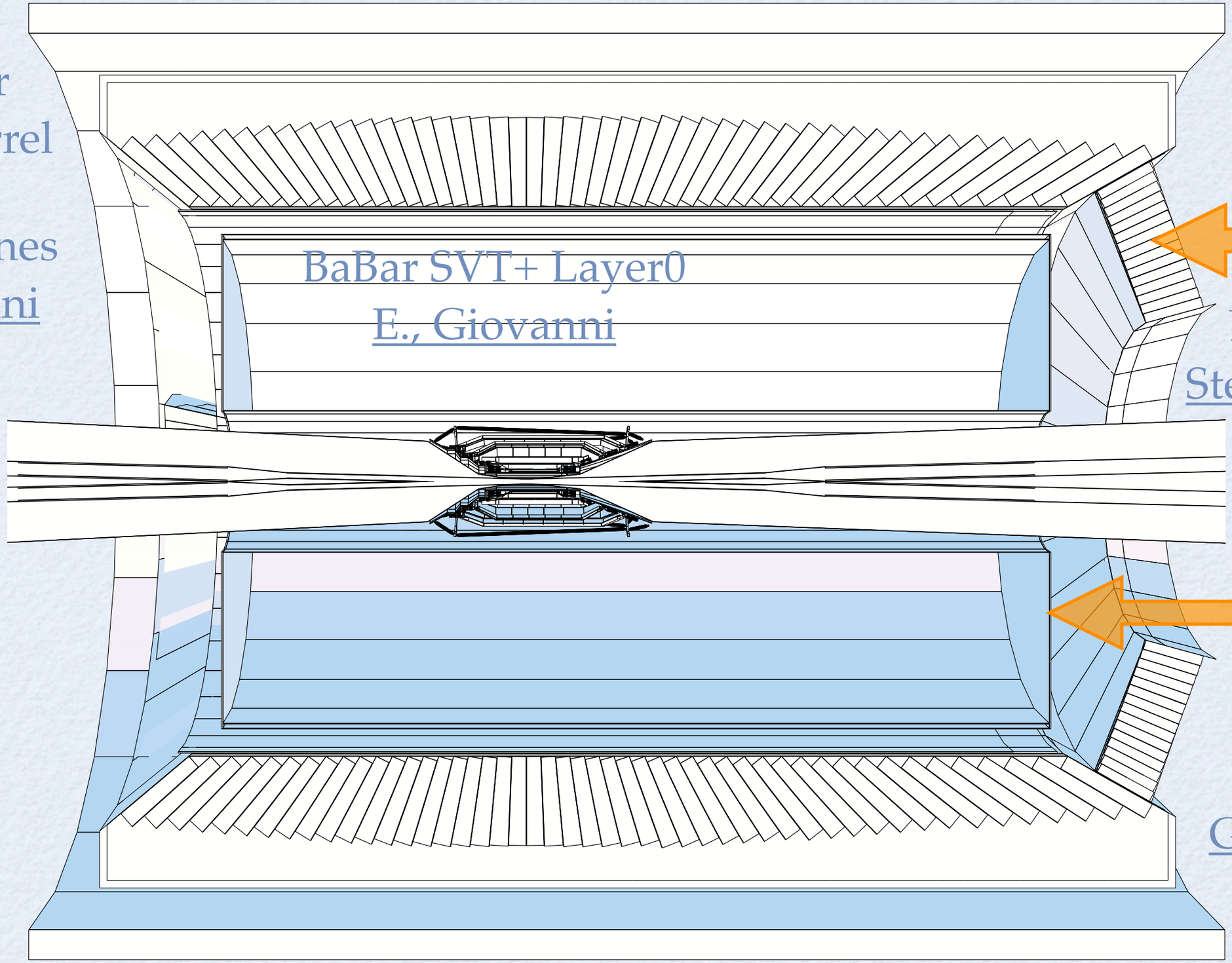
GDML 2.10

- GDML 2.10 cannot handle elliptical cones :((
- We have to accelerate the migration to GDML 3.0 (now included in the last Geant version)
  - Or texelize the Pipe (waste of computing time & tantalizing GDML coding)

GDML detector Model

BaBar
CsI barrel

Beam lines
E.Paolini



LSO endcap
Stefano, Claudia

DCH
Matteo

IFR
Gigi, Marcello, Mauro

Magnetic Field (Nightmare)

- Present classes doesn't handles:
  - tilted & displaced quadrupoles
- Magnetic field evaluator assigned per Logical Volume: i.e. beam pipe segmented at each magnetic element boundary...

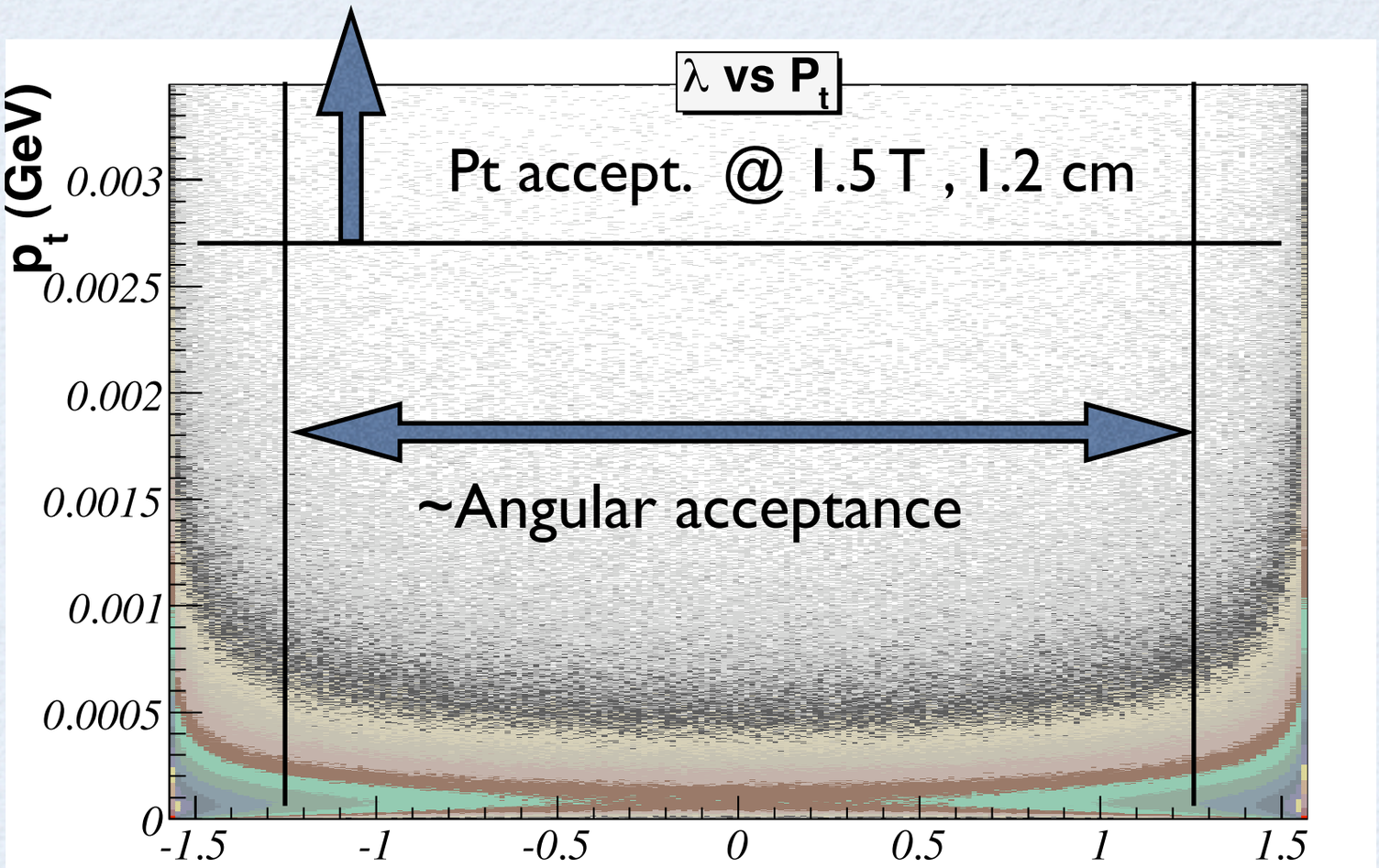
GDML To Do list

- Elliptical beam pipe
- Permanent magnets
- Cryostat
- QF1
- Dipoles
- Beam Scrapers
- PID, backward calorimeter (?)

Pair Generation: e+ e- to 2 x(e+ e-)

$$\sigma \sim \frac{\alpha^2 r_e^2}{\pi}\left(\frac{28}{27}\ln^3\frac{s}{m^2} - 6.59\ln^2\frac{s}{m^2} - 11.8\ln^2\frac{s}{m^2} + 104\right)$$

- 7.3 mbarn @ 10.58 Gev



Most of the primaries particles are outside det. accept.

Conclusions

- Computing infrastructure in place
- Almost complete geometrical model of the detector
- Unforeseen stopper on the GDML IR side
  - Work in progress
- We should be able to have the numbers ready by march.

Thank you for the

attention