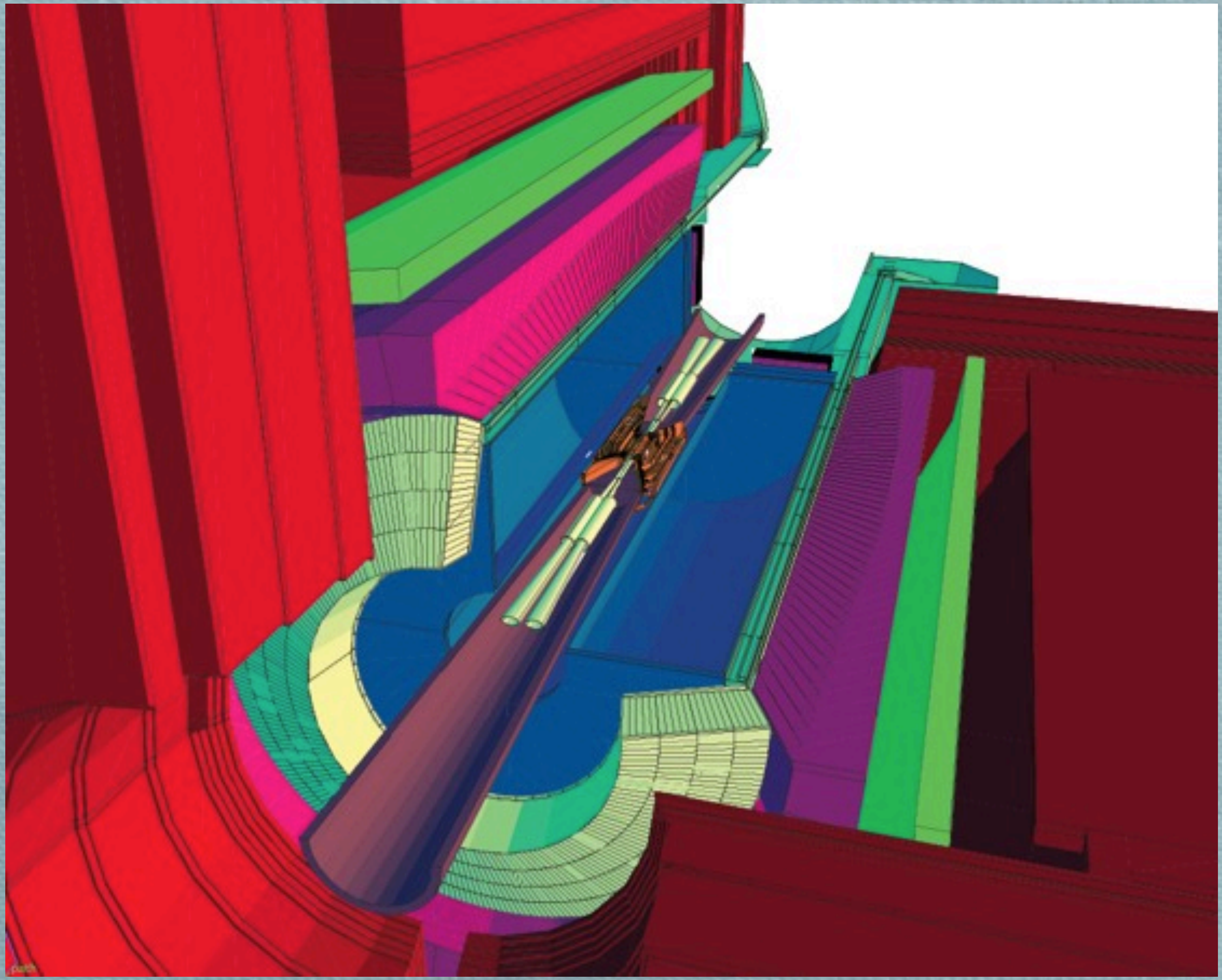


MDI Report From the Detector Land

Machine Detector Interface

Talk outline

- A small introduction for the newcomers
  - MDI group now
  - Present status and activities (from the detector side)
- MDI mission from now on: a cartoon to trigger some discussion

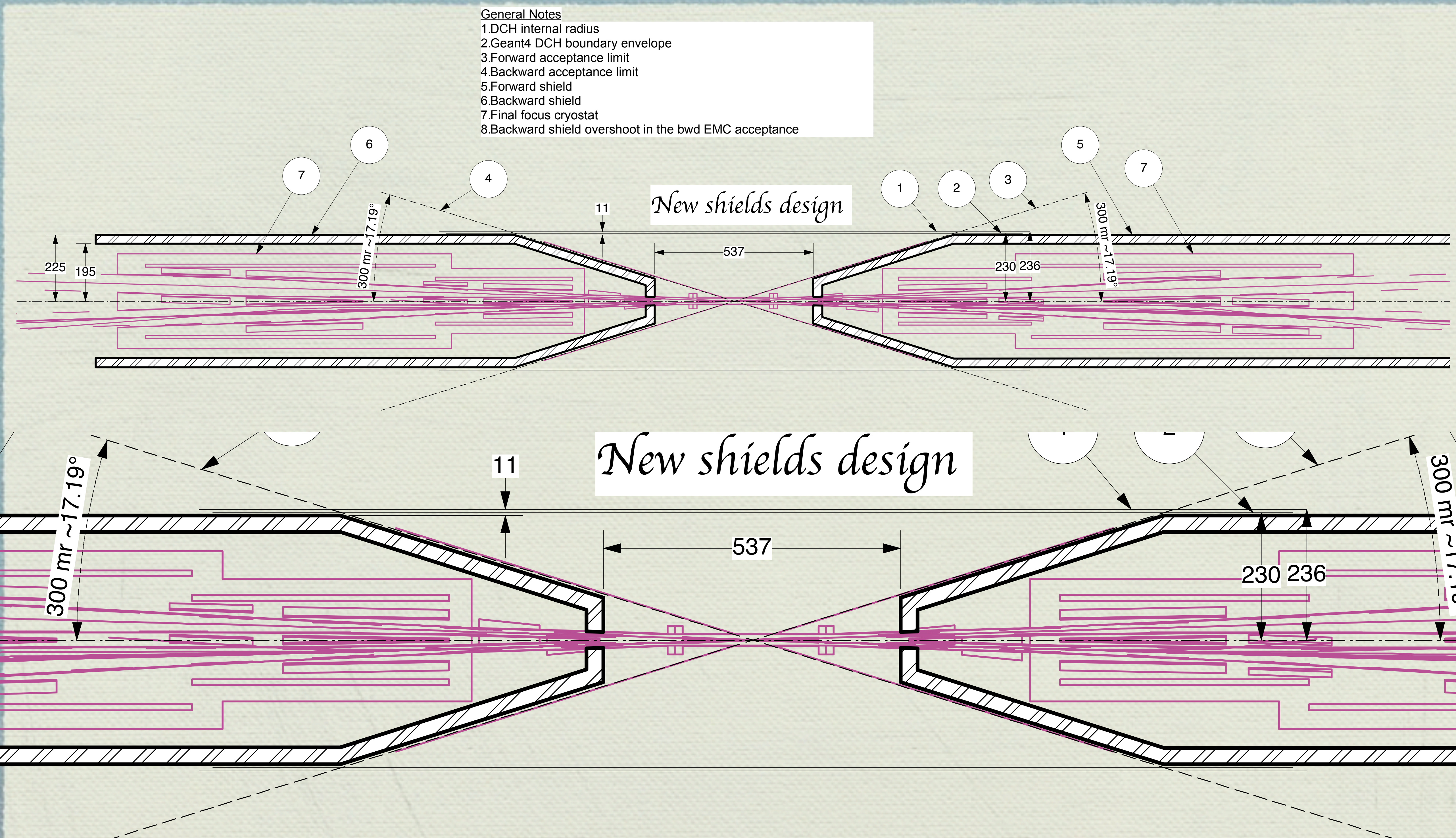
The MDI group now

- Mike Sullivan (SLAC). Reference person from the Machine.
  - IR mechanical layout design (magnets , pipe, synchrotron radiation, supports)
- Manuela Boscolo (LNF). Reference person for the evaluation of the Touschek and beam gas loss rates + beam scraping placement.
- Eugenio Paoloni (Pisa). “Machine Detector Messanger”
  - Geant4 backgrounds simulations + final focus SC quadrupoles (Air core option)
- Alejandro Perez (Pisa).
  - Geant4 model of the beam pipe, software tools to validate the Geant 4 beam line model
- Filippo Bosi (Pisa). Reference person for the mechanical interface with the innermost vertex detector.
- Riccardo Cenci, Dana Lindemann, Stefano Germani, Leonid Burmistrov, Gigi Cibinetto: Reference persons from the subdetector lands (SVT,DCH, etc. etc.)

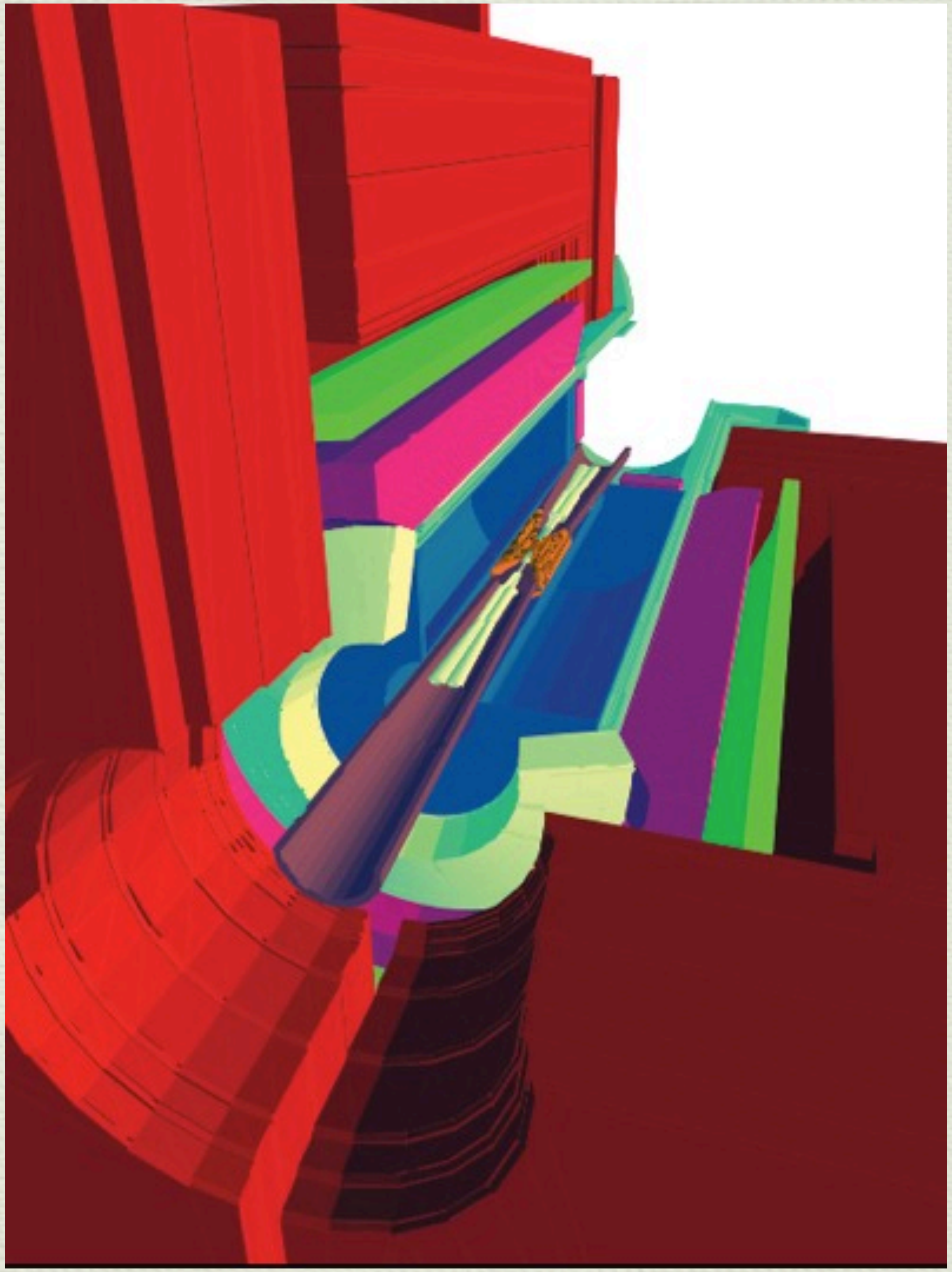
MDI activities

- The focus of the MDI group up to now was on the IR design
  - Beam line up to +/- 15 m from the IP
  - Mechanical interface among machine and detector
  - Background simulations

Mechanical interface: boundaries



Quick access to the L0

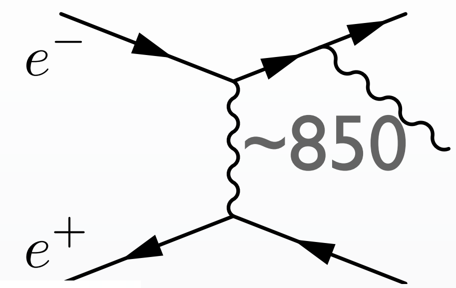
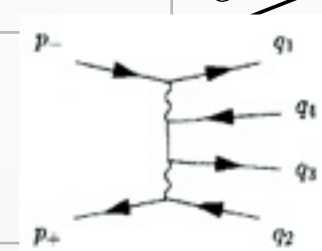


- One of the requirements from the detector side is to provide a quick access to the innermost vertex detector (SVT L0)
  - Quick means: a few weeks long shut down
  - How to slide the beam line back and forth from the detector in a few hours/days?

Background estimates

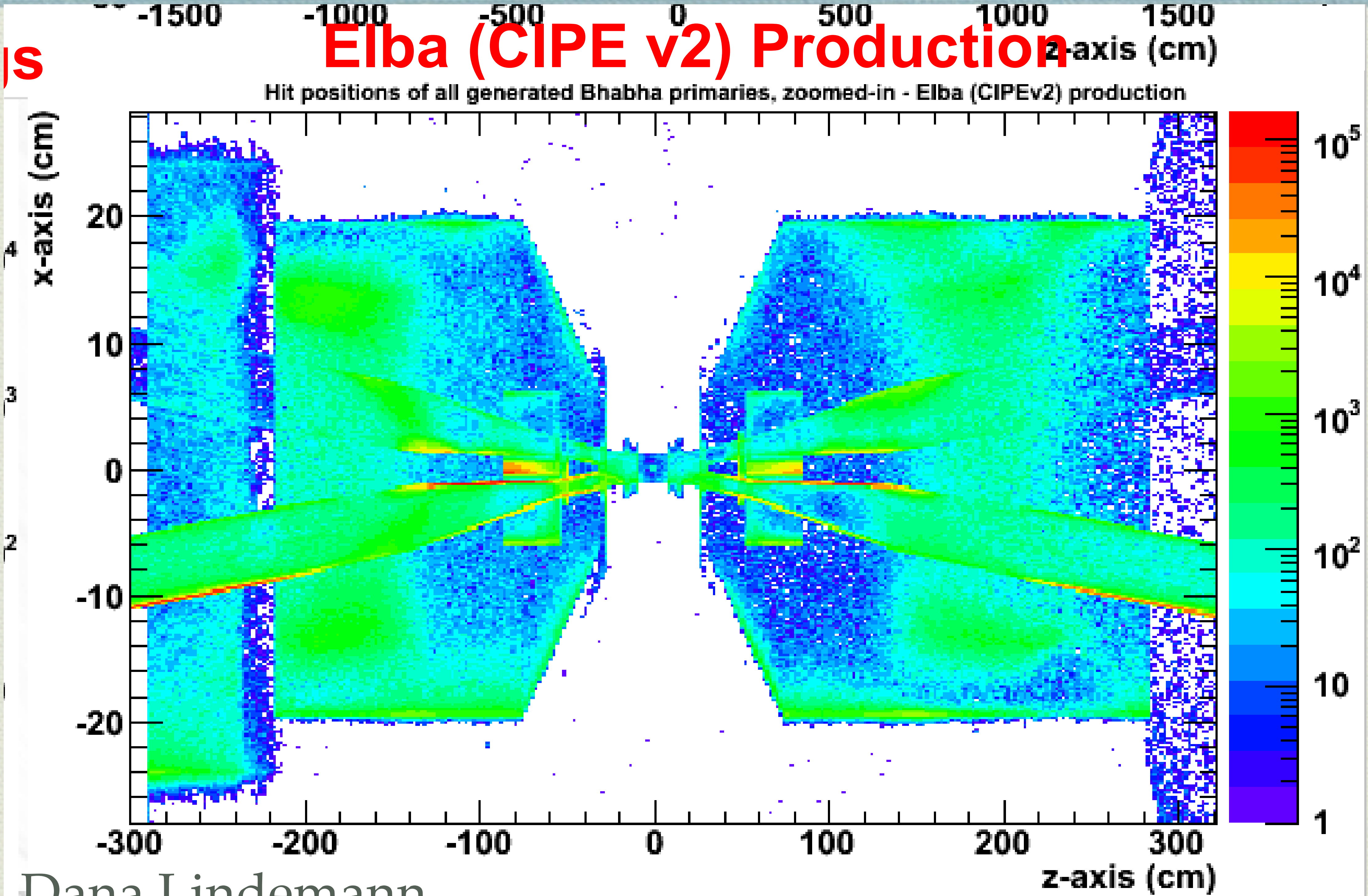
- Geant 4 model of the beam transport system from the IP up to the first dipoles (magnetic fields, beam pipes)
- Geant4 model of the detector
- Primaries generation:
  - BBBrem (Radiative Bhabha)
  - Diag36 (pairs production)
  - Star (M. Boscolo) Touschek and Beam gas

Loss rates

	Cross section	Evt/bunch xing	Rate
Radiative Bhabha	~340 mbarn (Eγ/Ebeam > 1%)	 ~850	0.3THz
e^+e^- pair production	~7.3 mbarn	 ~18	7GHz
e^+e^- pair (seen by L0 @ 1.5 cm)	~0.3 mbarn	~0.8	0.3GHz
Elastic Bhabha	O(10^{-4}) mbarn (Det. acceptance)	~250/Million	100KHz
$\Upsilon(4S)$	O(10^{-6}) mbarn	~2.5/Million	1 KHz
	Loss rate	Loss/bunch pass	Rate
Touschek (LER)	14kHz / bunch (+/- 2 m from IP)	~7/100	14 MHz

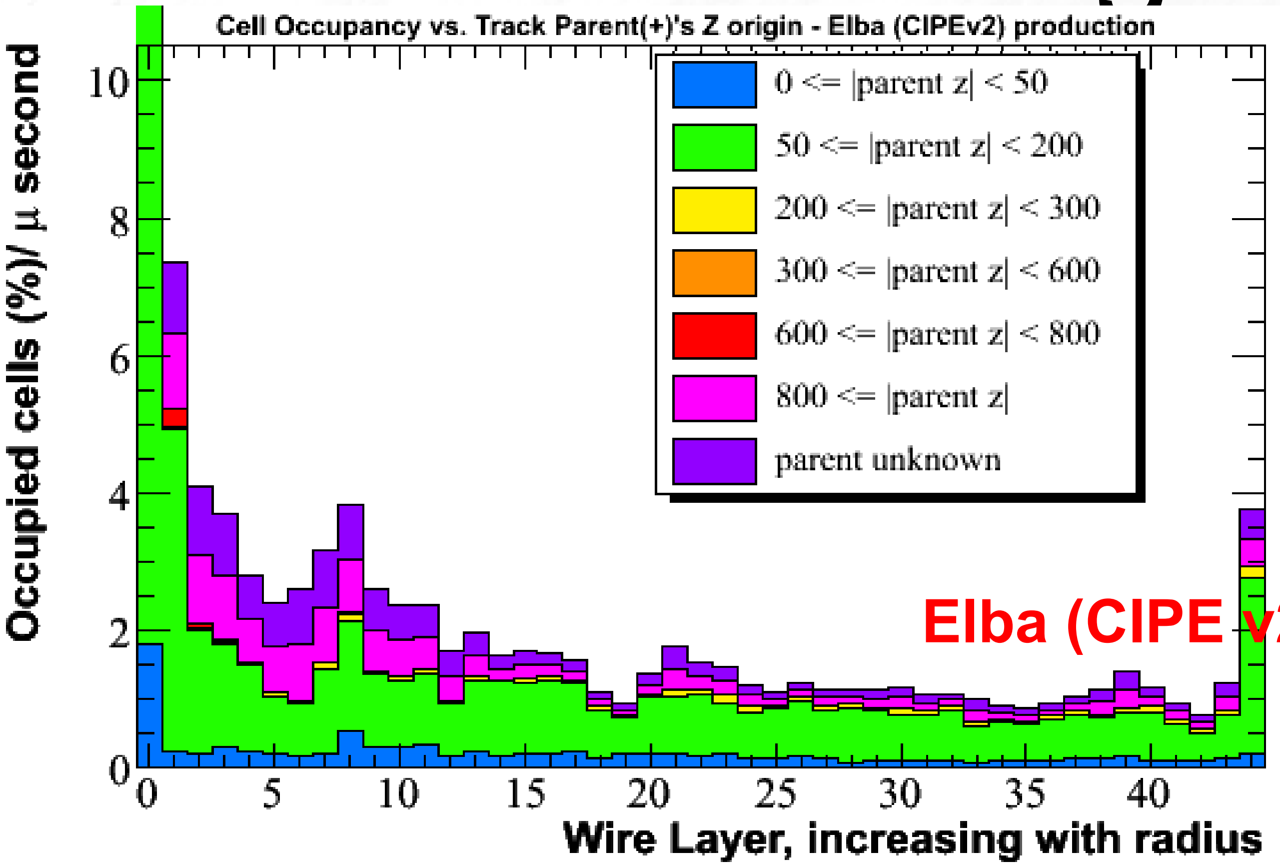
Radiative Bhabha

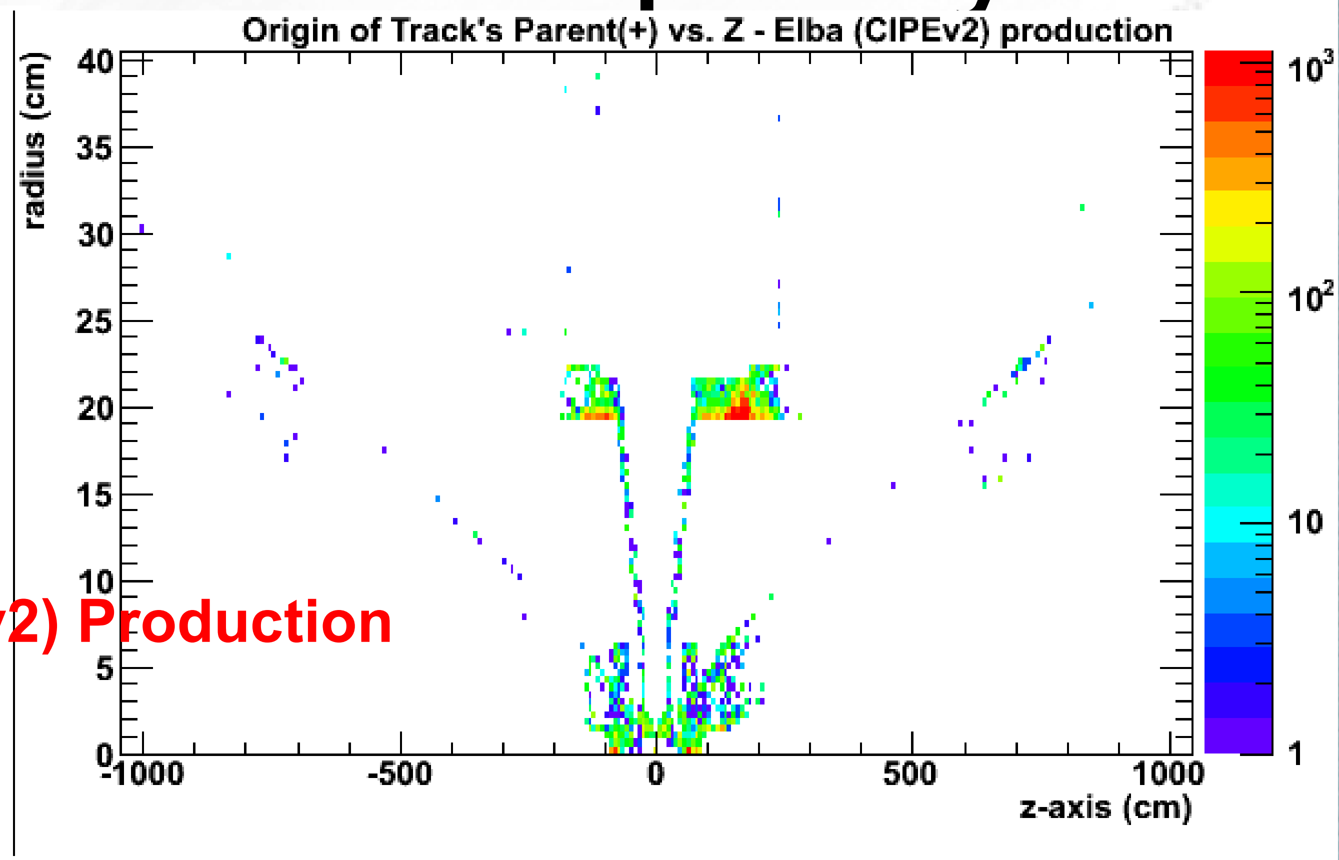
Where the showering occurs



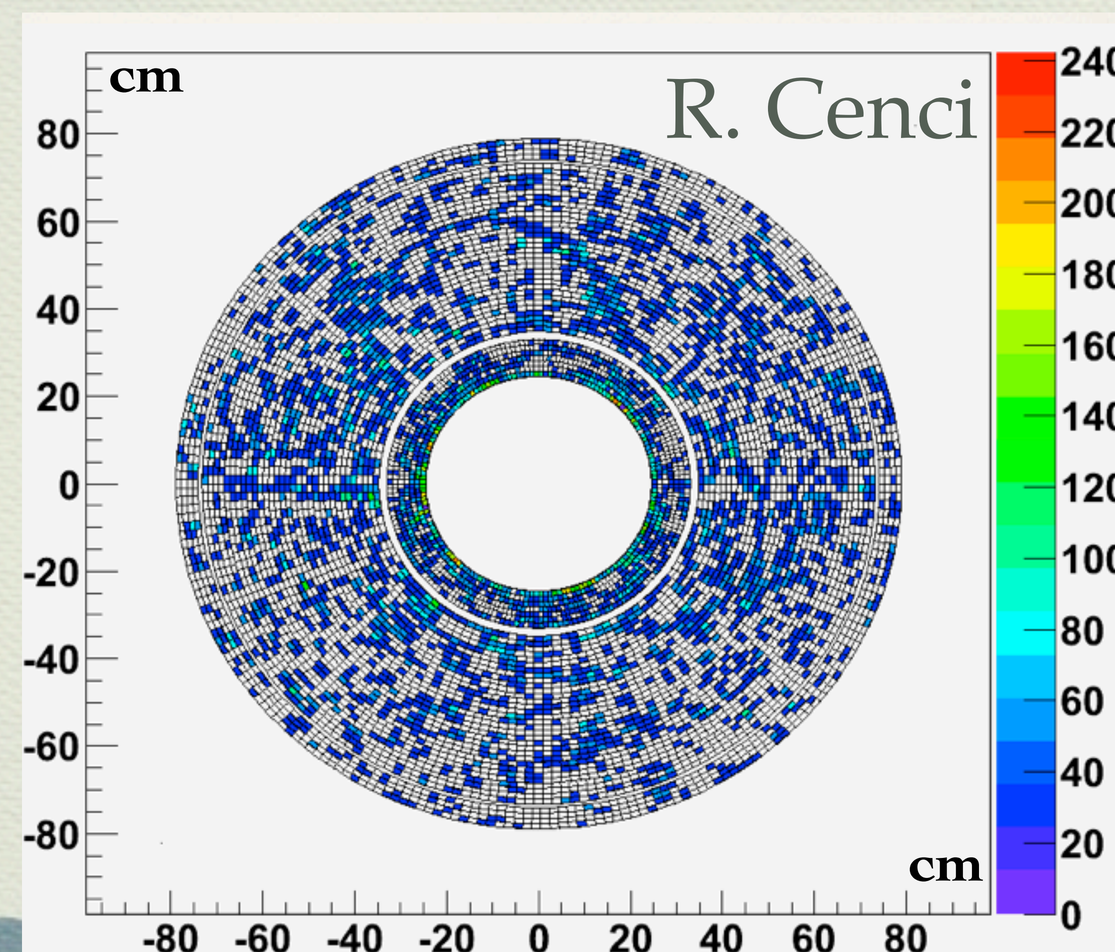
Dana Lindemann

Parent's Z origin vs. Occupancy



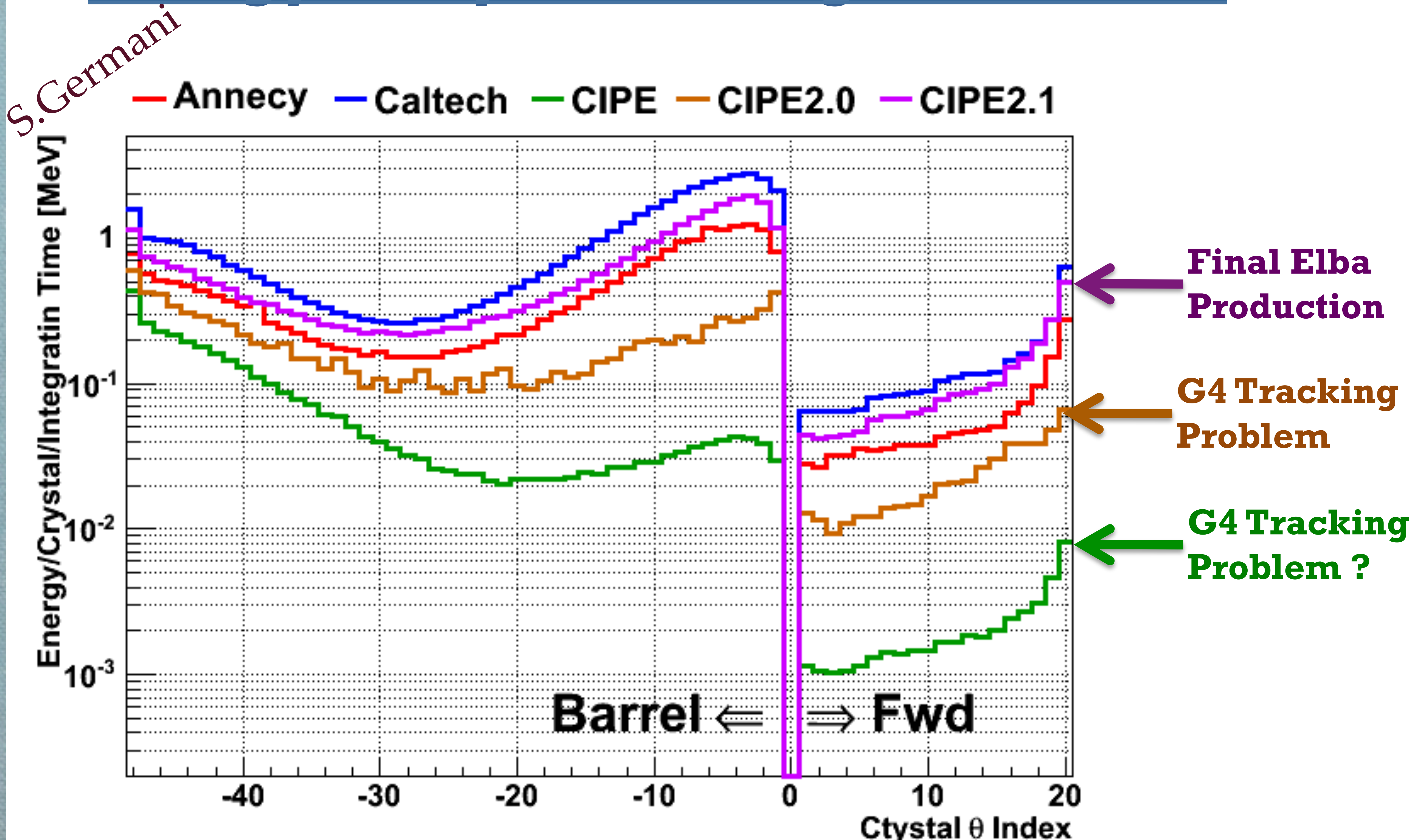


- It seems that an increase of the tungsten thickness in the forward region hot ring can significantly reduce the background rate, but the space is a precious and limited resource: cryostats in the interior are asking for more space.

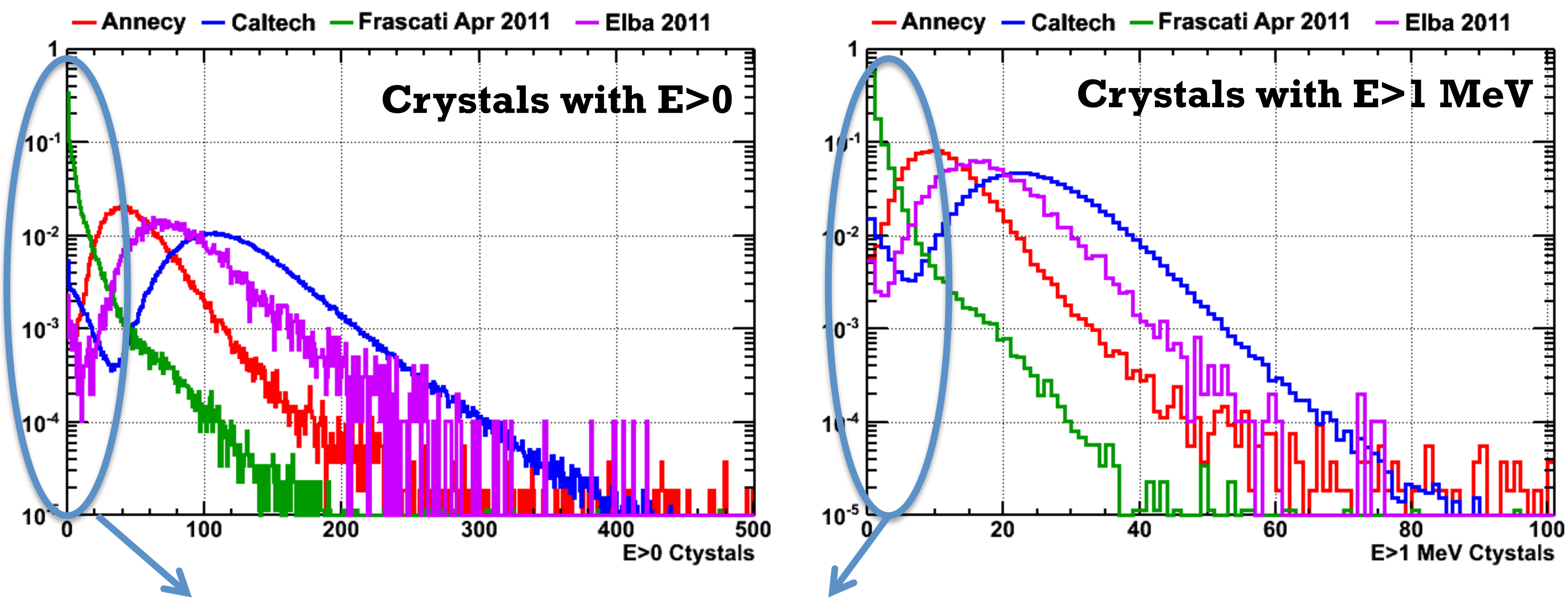


Backgrounds as seen from the EMC

Energy / Crystal / Integration Time



Number of EMC Hits / Bunch Crossing

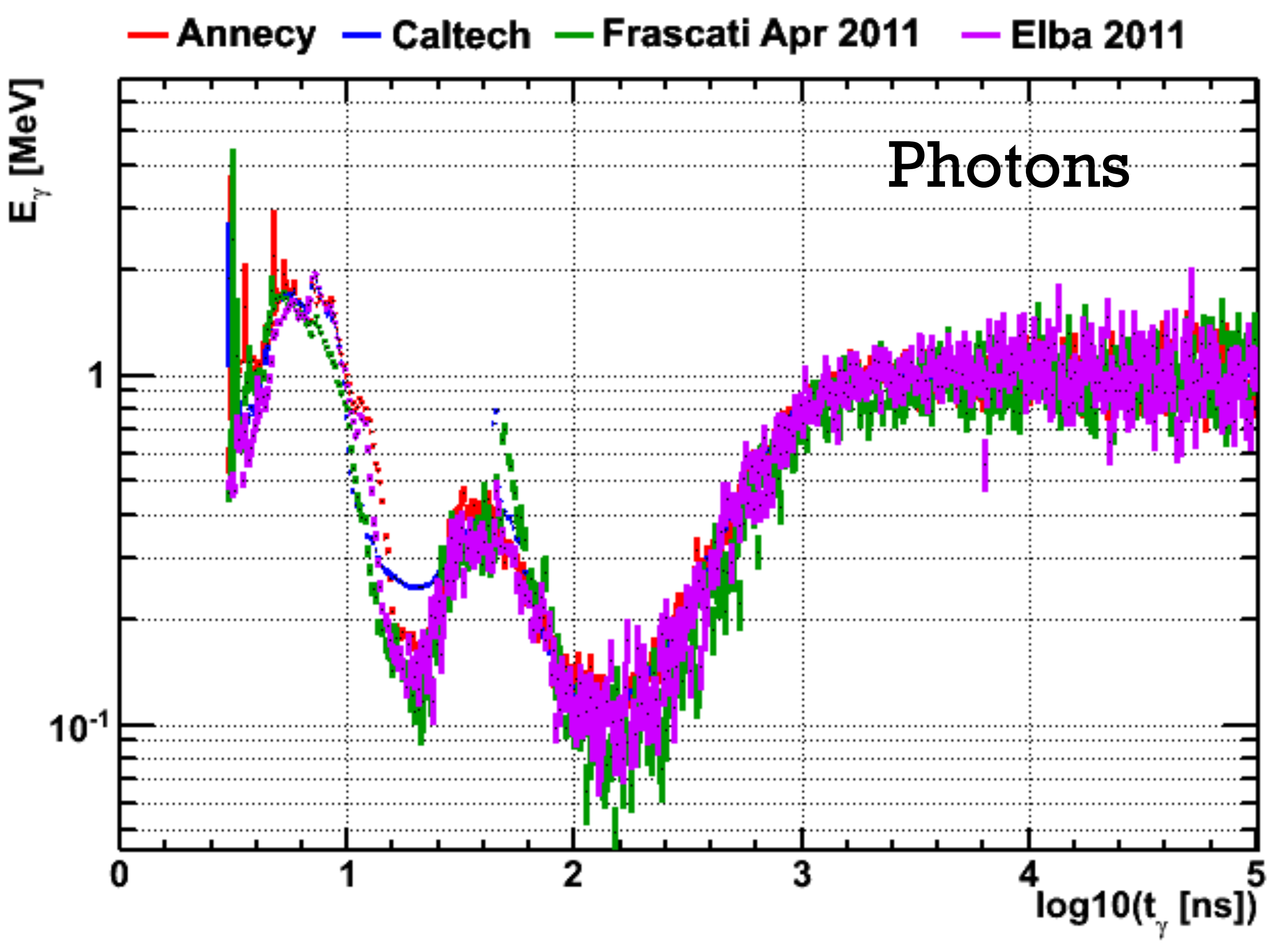


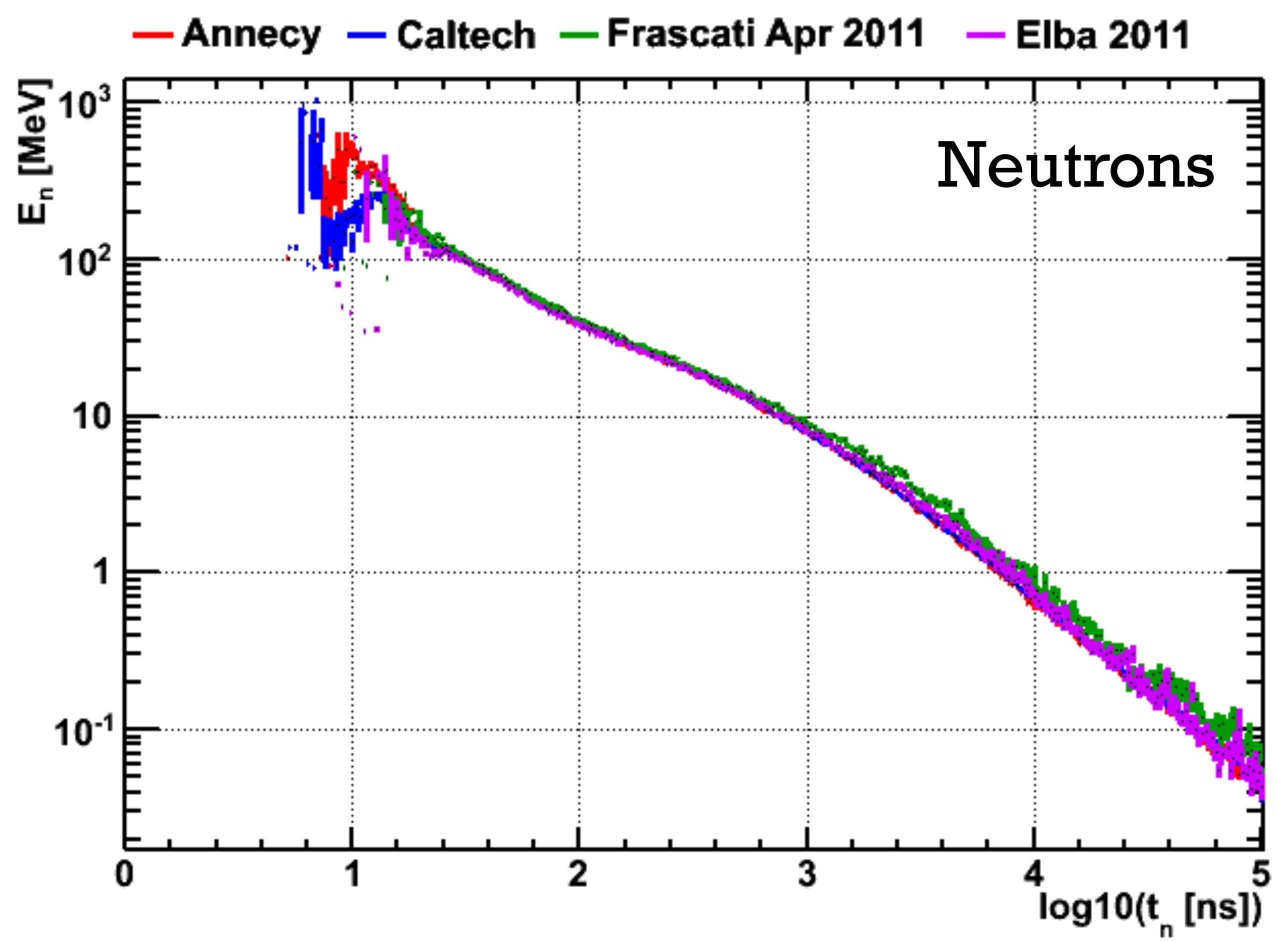
This low multiplicity events behaviour was never really understood
My GUESS is they are realted to the Genat4 crach issue.
Need to be investigated

A Dangerous Signal...

Particles energy vs time

Mean energy vs time for particles crossing the EMC volume boundary

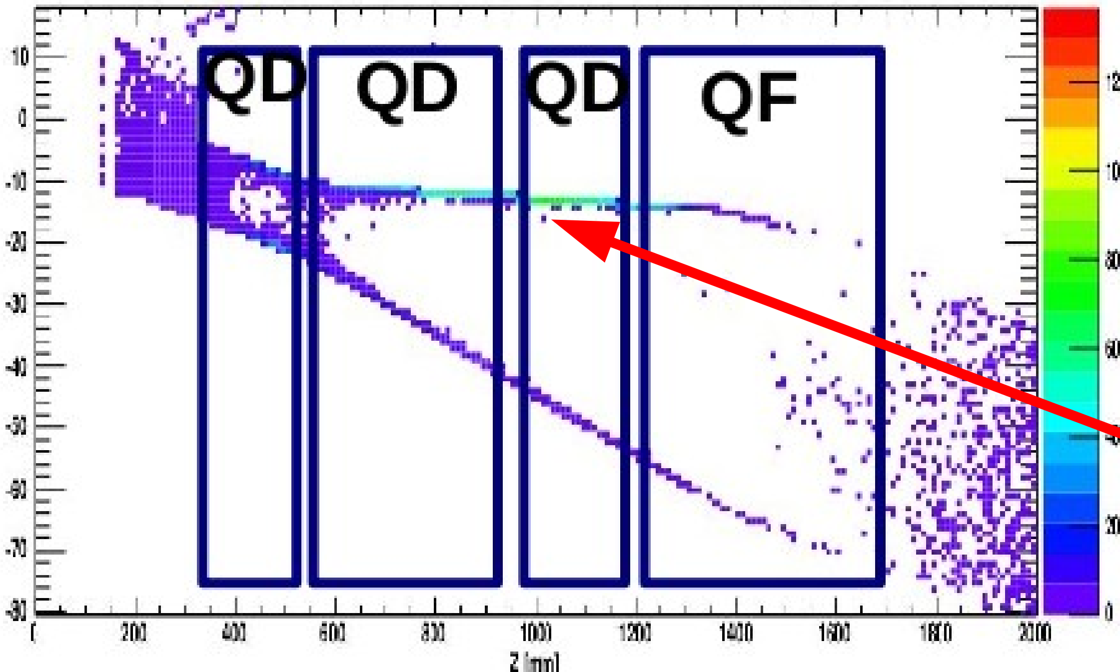




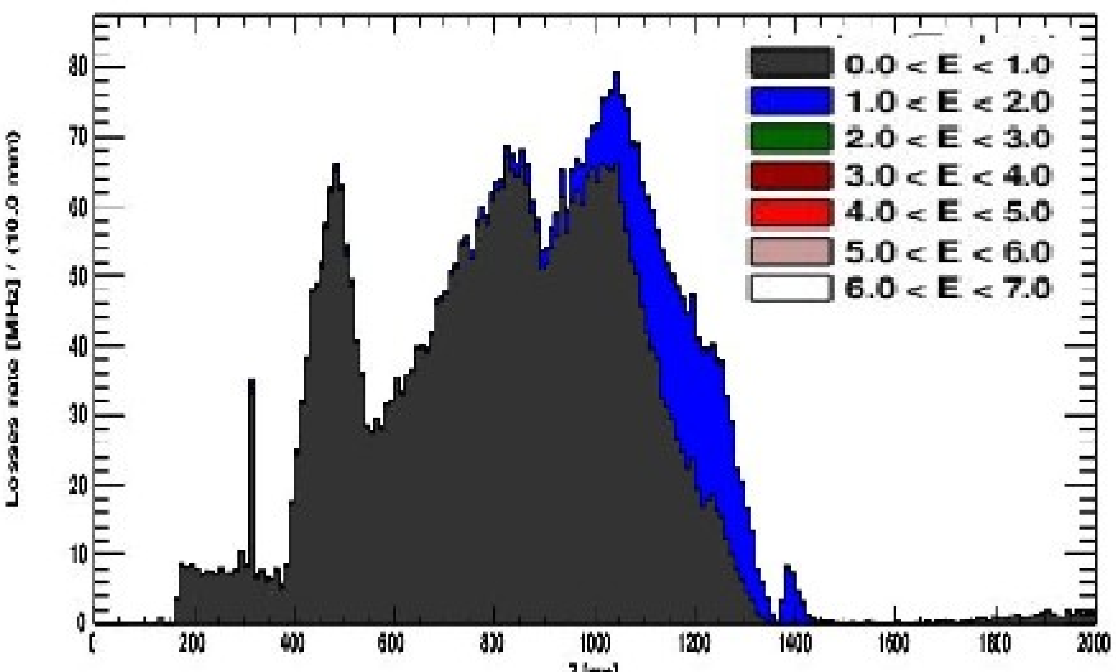
L. Burmistrov

Hot spot caused by Radiative BhaBha effect

Positron losses along beam pipe



z ~1m from IP

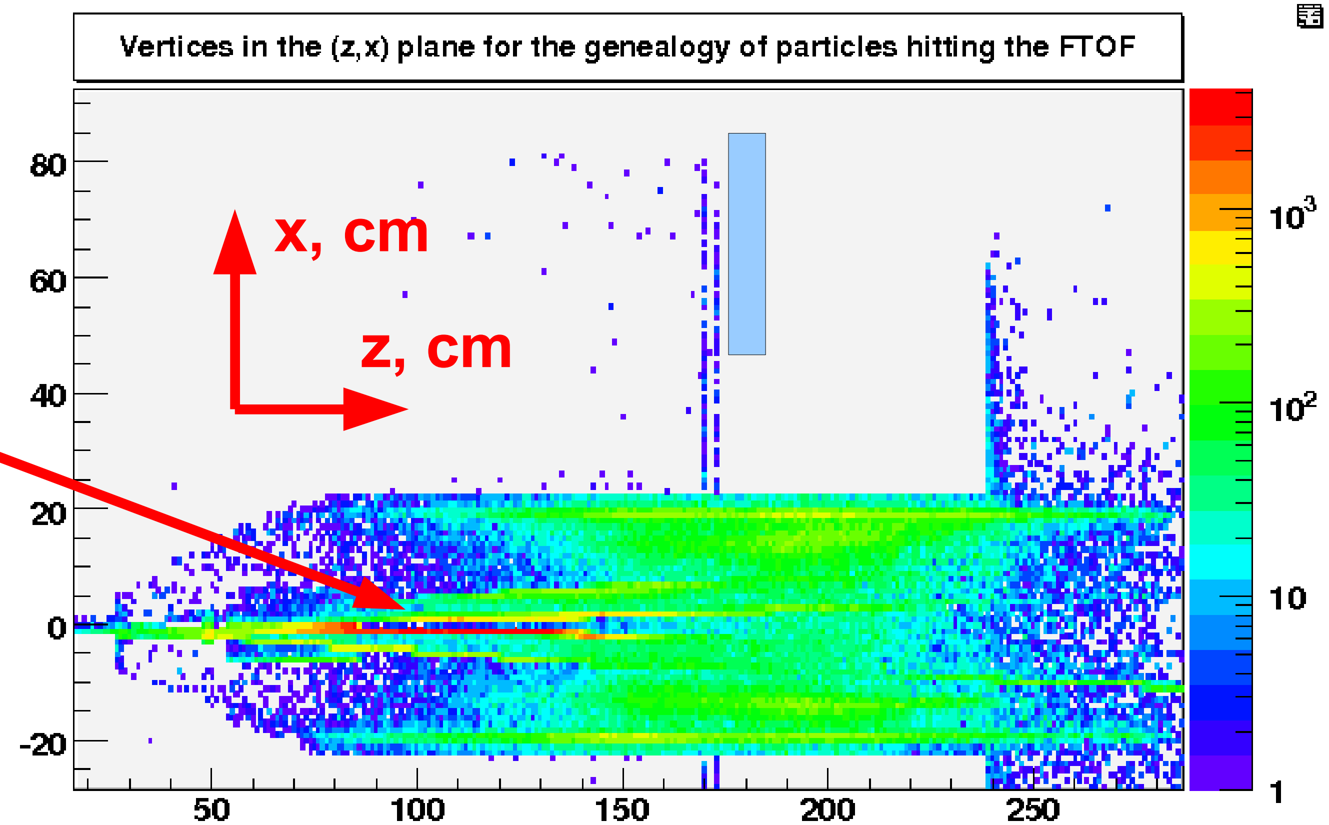


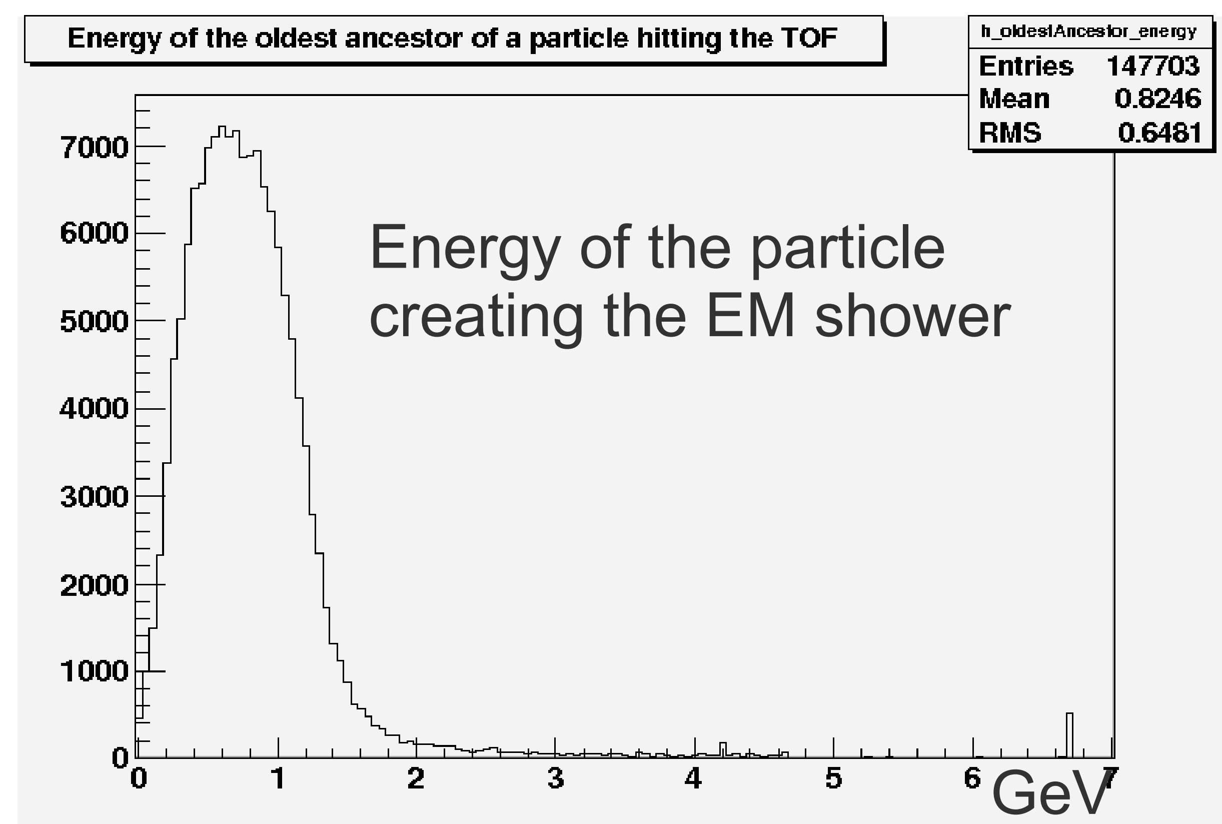
See this presentation (page 7)

http://agenda.infn.it/getFile.py/access?contribId=6&resId=0&materialId=slides&confId=3808

28.05.2011

Vertices of the genealogy of particle hitting the FTOF

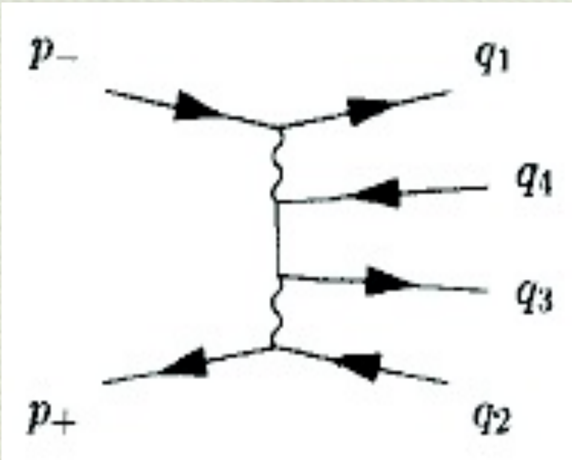


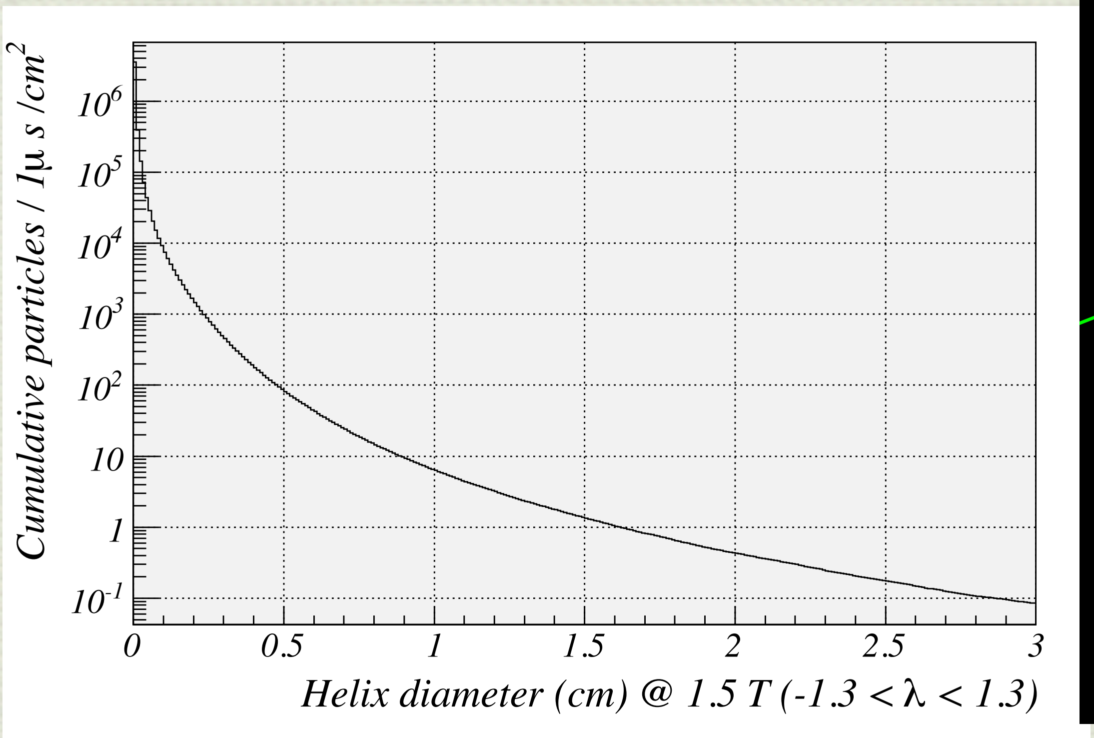


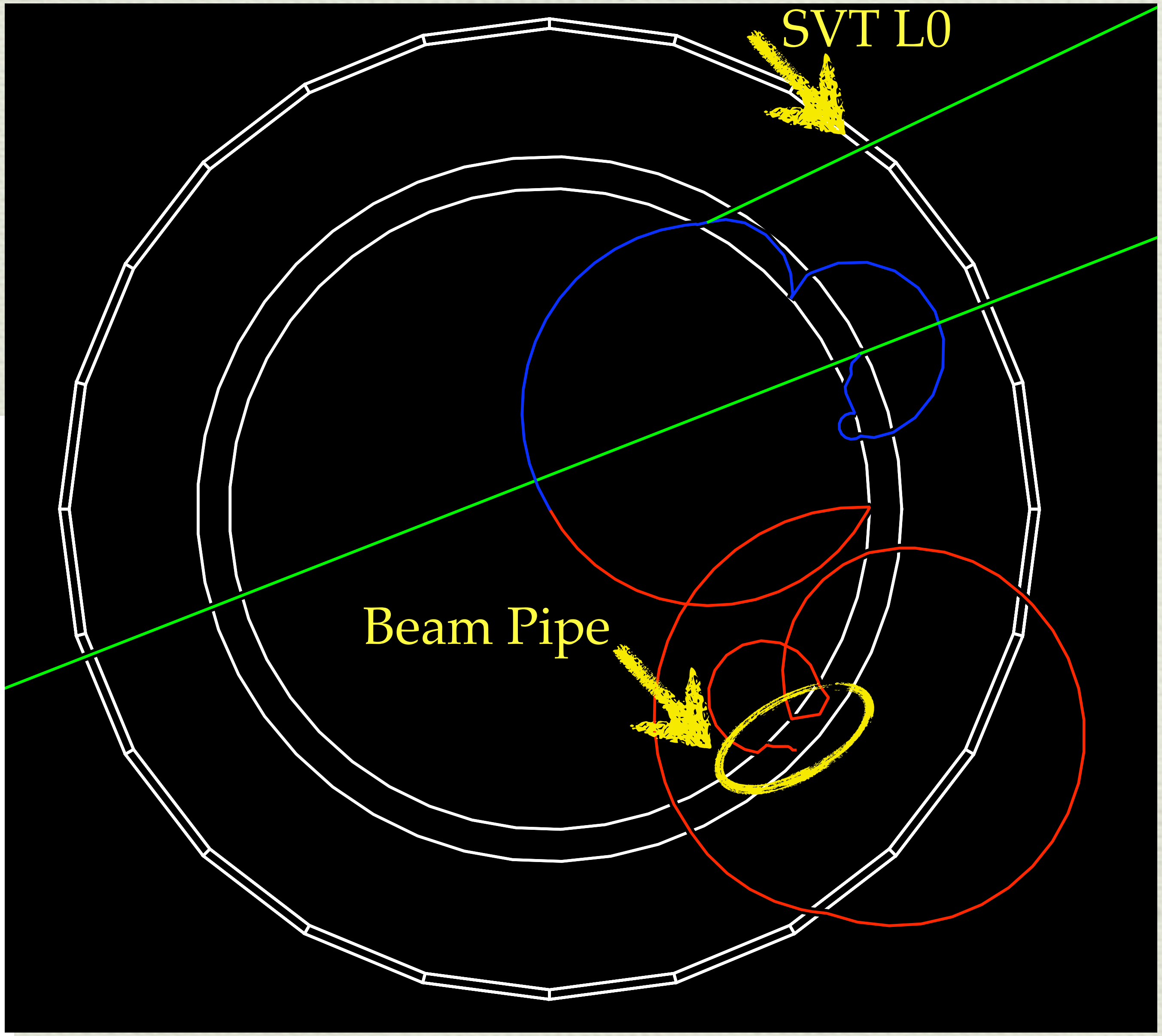
Pairs Production

SVT L0 bkg. Pairs production

Track rate: Geant4 sim. ~ 6.5 MHz/cm^2





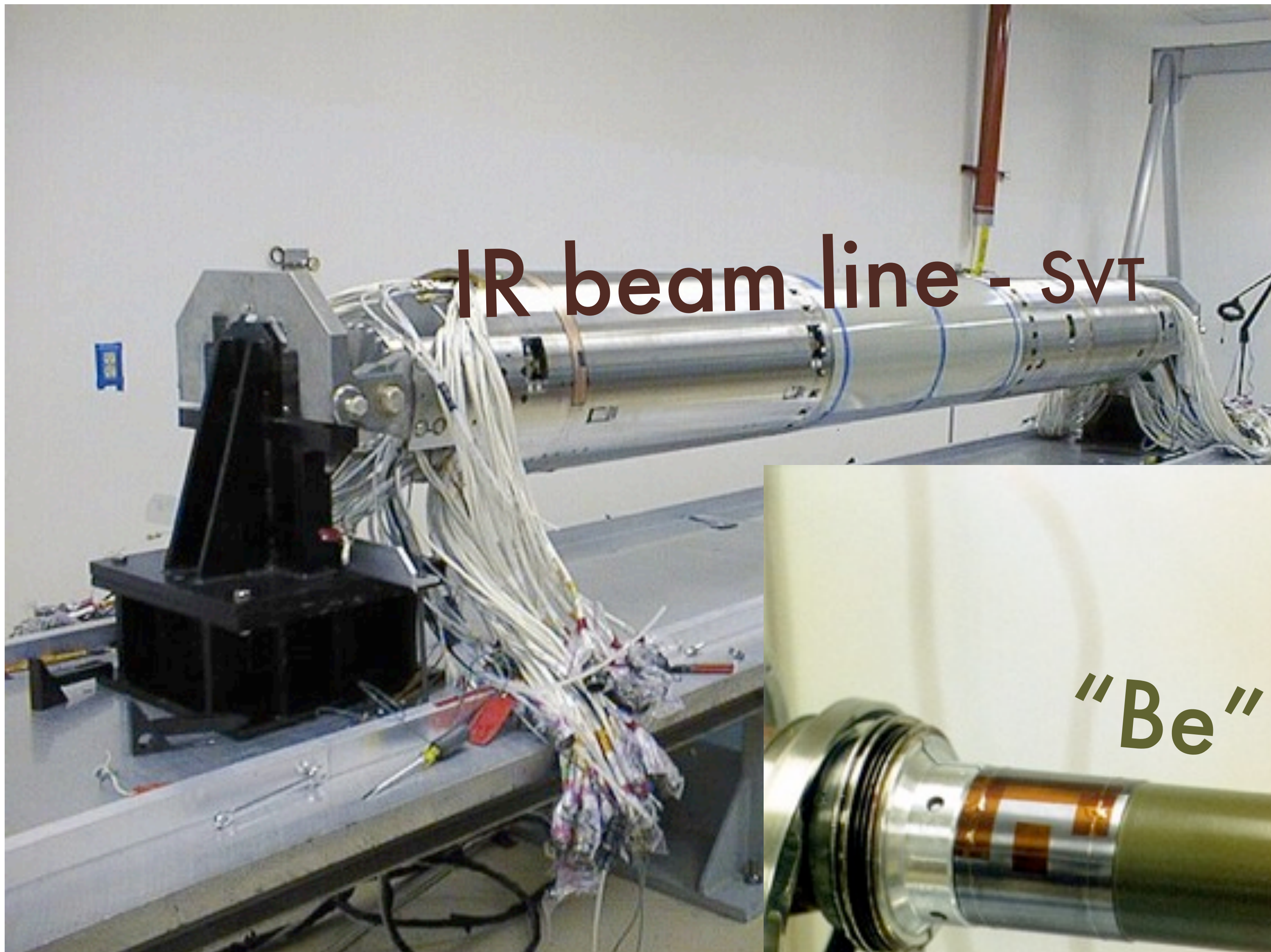


SVT L0: SuperB - SuperBelle

- SuperBelle claim that the pairs rate @ L0 is way smaller
- The distribution at Monte Carlo generator level of SuperB (Diag36) & Belle-II (BDK) are not in agreement
- Diag36 is BDK rebranded, i.e. same original fortran code
- ???
- A dedicated joint SuperB - Belle II should be formed to investigate on that

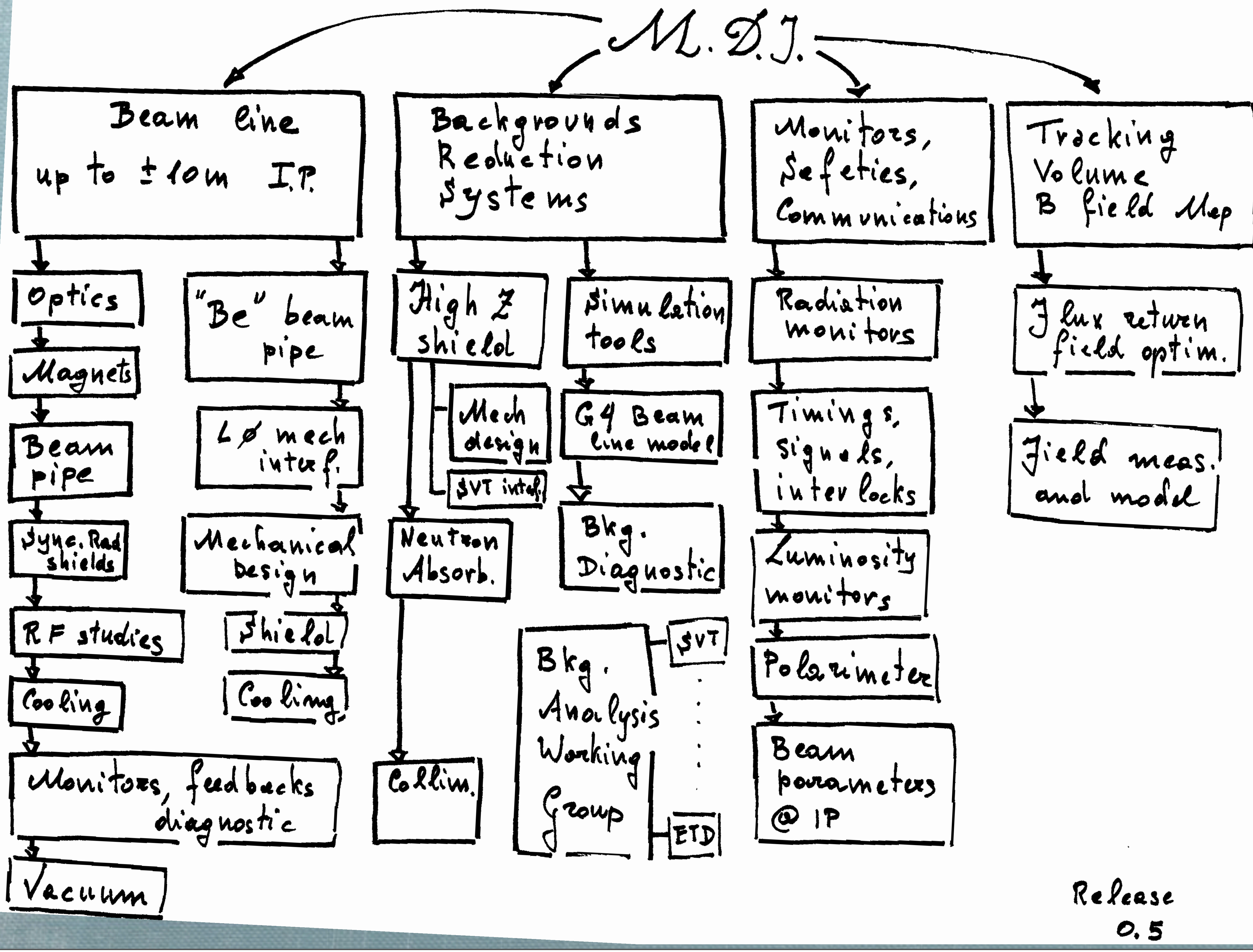
Notables MDI deliverables

Inspired by BaBar
(courtesy Bill Dunwoodie)



MN_117 ST 25: Completed Near IR

MS_175 Epoxy coated Be beampipe with Ta Shields 06/25/98


M.D.I.
Beam line up to ±10m I.P.
Backgrounds Reduction Systems
Monitors, Safeties, Communications
Tracking Volume B field Map
Optics
Magnets
Beam pipe
Sync. Rad shields
RF studies
Cooling
Monitors, feedbacks diagnostic
Vacuum
"Be" beam pipe
L0 mech interf.
Mechanical Design
Shield
Cooling
High Z shield
Mech design
SVT interf.
Neutron Absorb.
Collim.
Simulation tools
G4 Beam line model
Bkg. Diagnostic
Bkg. Analysis Working Group
SVT
ETD
Radiation monitors
Timings, signals, interlocks
Luminosity monitors
Polarimeter
Beam parameters @ IP
Flux return field optim.
Field meas. and model
Release 0.5

Backgrounds Reduction Systems I

- High Z (tungsten at present) shield (needed for sure)
    - Mechanical design:
        - How will it be builded?
        - How will it be kept in place?
        - How will it support SVT ?
        - Will it support the beam line? And if not: what else is going to hold the beam line?
        - How will the beam line be extracted to quickly access the SVT?
- Forward/backward end plug design

Backgrounds Reduction Systems II

- Beam collimators (needed for sure)
  - Collimation scheme design (Manuela)
  - The physical design of the collimators will be a Machine task: who?
- Neutron moderators and absorbers
  (Do we need them? Reliable neutron cloud simulations needed for sure)
  - Where to place it in the most effective way

Simulation tools

- Primaries generators
  - Luminosity scaling component:
    - Radiative Bhabha
    - Small angle "elastic" Bhabha
    - Pairs production
  - Density x Intensity scaling component
    - Touschek
  - Current scaling component
    - Beam gas
- Geant4 Beam Line model
- Synchrotron radiation shield validation ?

Background diagnostic

- Sometimes (every time?) real life is harder than predicted, real objects does not behaves as expected
- Strategies to identify the root of the problem
- Strategies to reduce the impact of the problem

Bkg. Analysis W.G.

- Representative from all the subsytems (SVT - DCH - DIRC+TOF - EMC+B.EMC - IFR - ETD)
- In charge to convert bkg. particle fluxes in relevant quantities i.e:
  - Rates/Occupancies/performances degradation
  - Radiation damages
- Finally give the green light to the background reduction systems design

Monitor Safeties Communications

- Radiation monitors: where? how many? what kind?
- M <-> D: timings, signals, interlocks
- Luminosity monitors
- Polarimeter
- Beam parameters @ IP measurements with SuperB Detector

Tracking volume B-field

- Flux return optimization (Fabbricatore?)
- Field measurements in tracking volume Solenoid + Beam line fringe field