

MDI meeting, CERN
03/04/17

G4 implementation of new IR design & first results on pair background

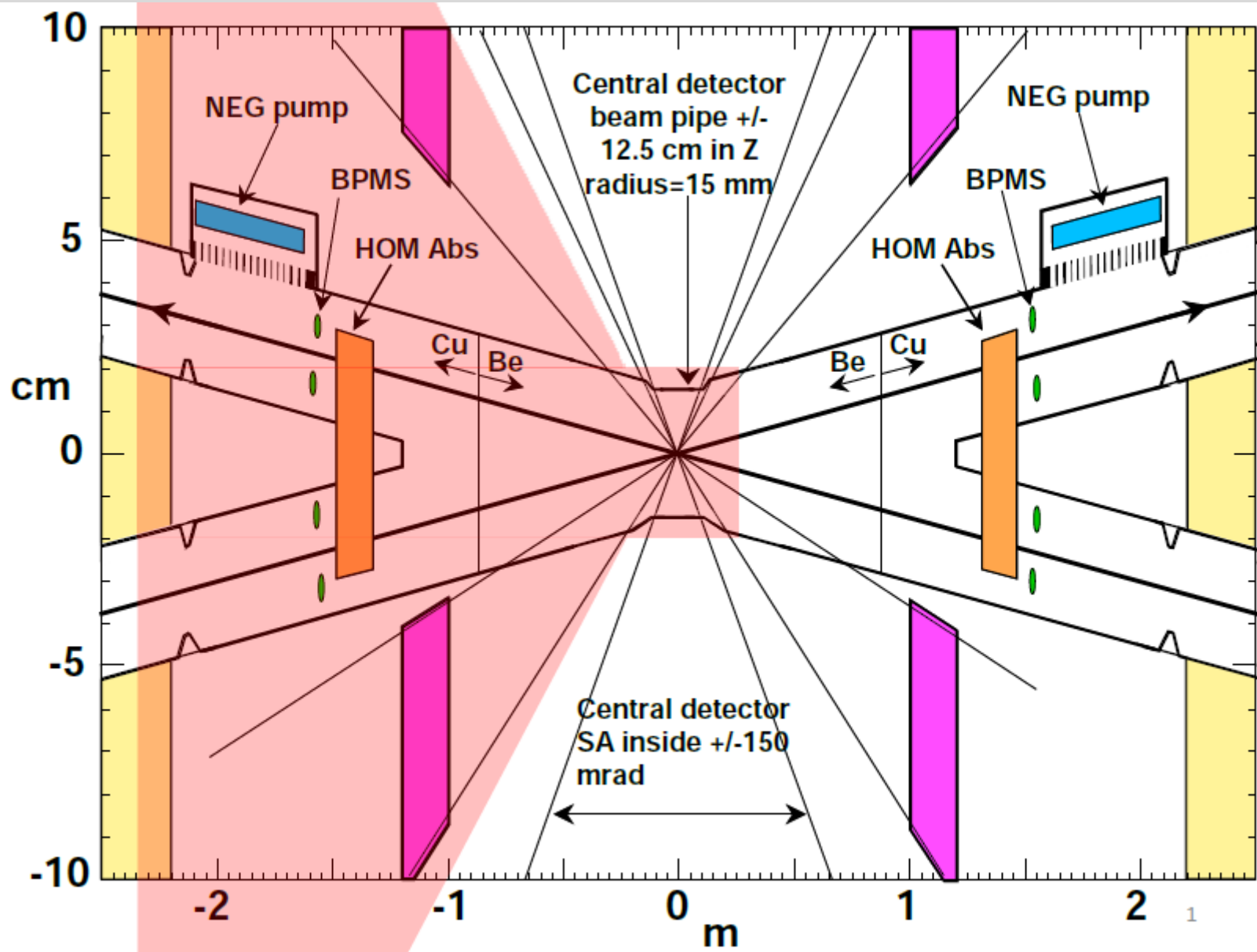
E. Perez, Y. Voutsinas

Outline

Report on geant4 implementation of new IR design

First results on pair background full simulations

The new interaction region design



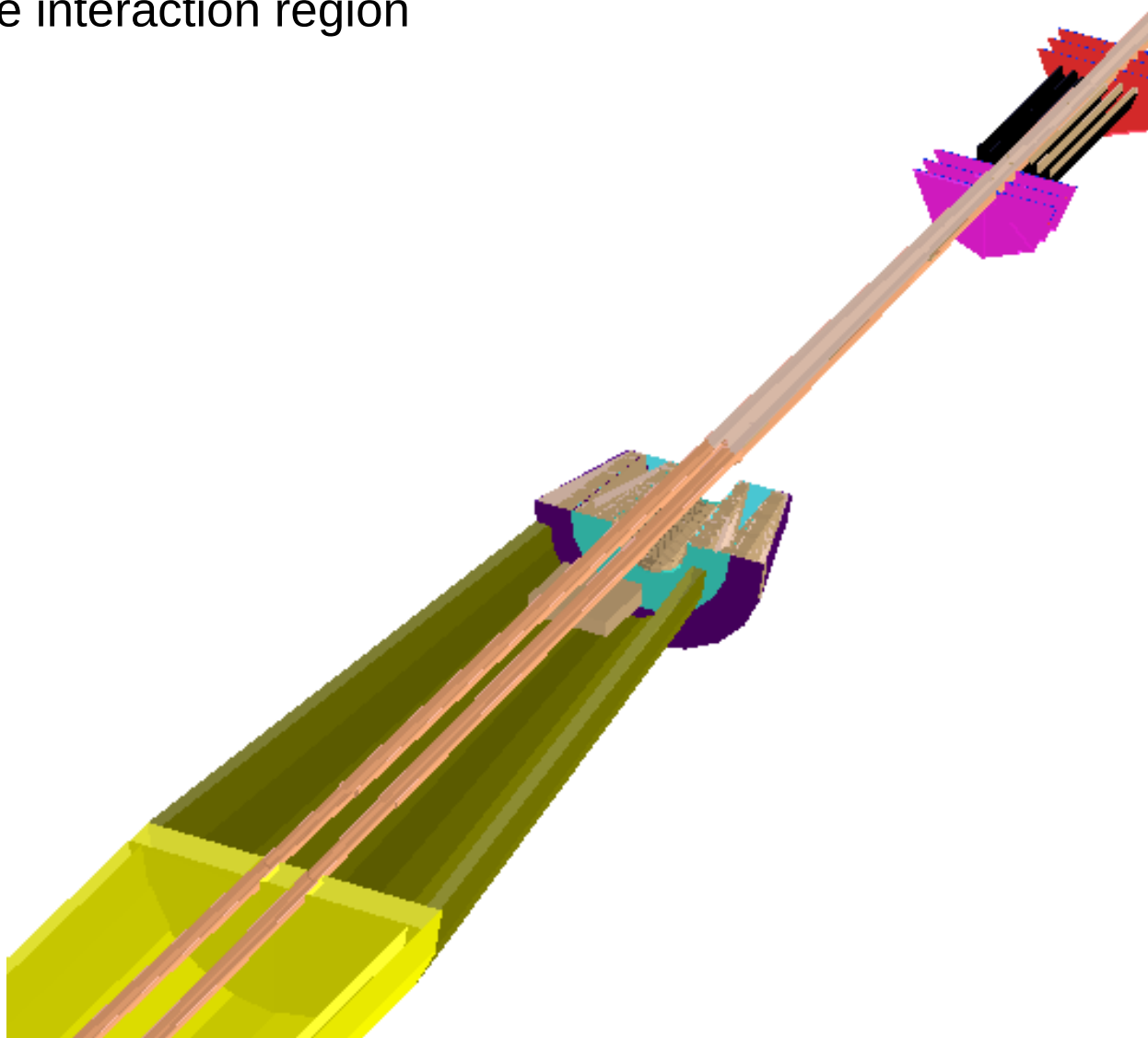
As was decided in MDI workshop of January

Image from M. Sullivan

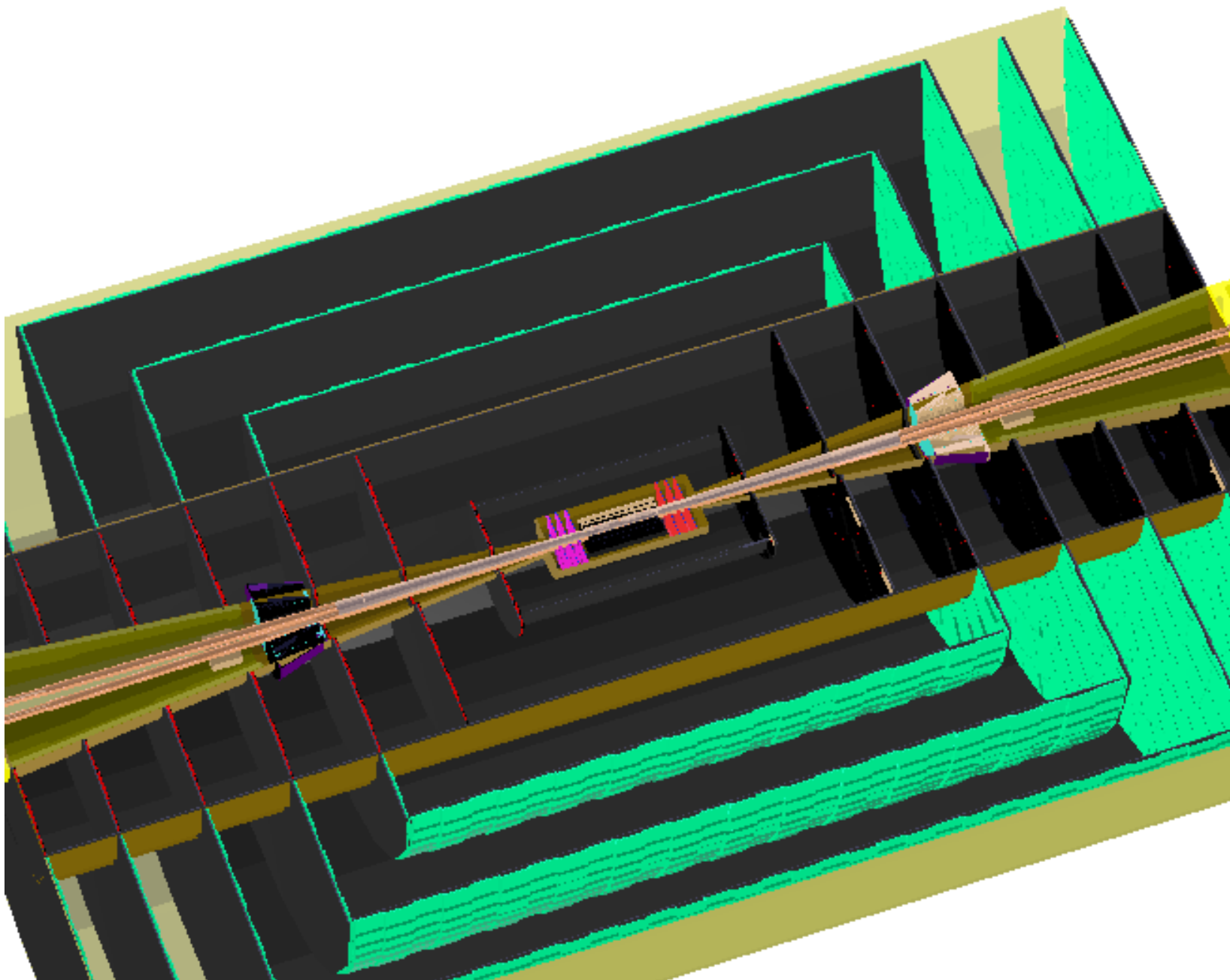
Implementation in geant4

CLIC detector model, with the new IR design & 2T field: FCCee_o4_v01

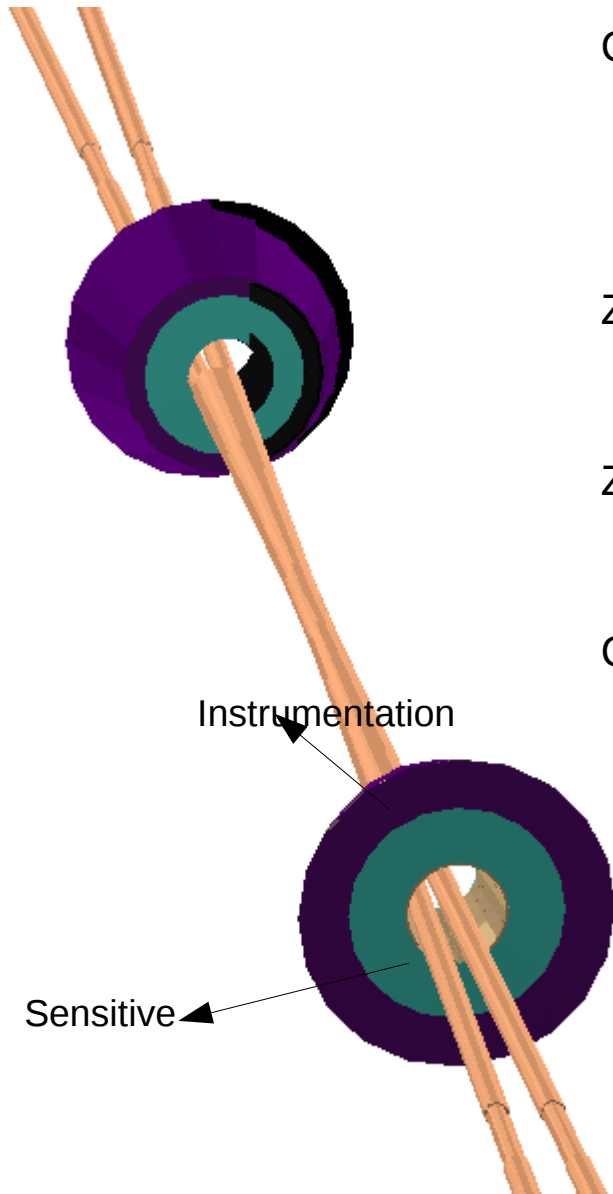
- Overview of the interaction region



Overview of the detector



Beam pipe and LumiCal



Central beam pipe

- R_{inn} 15mm $12.5\text{cm} > Z > -12.5\text{cm}$
- 1.2mm of Be (cooling incl.) + 5μm of Au coating

$Z < 90\text{ cm}$

- 0.015rad angle, 1mm of Be + Au

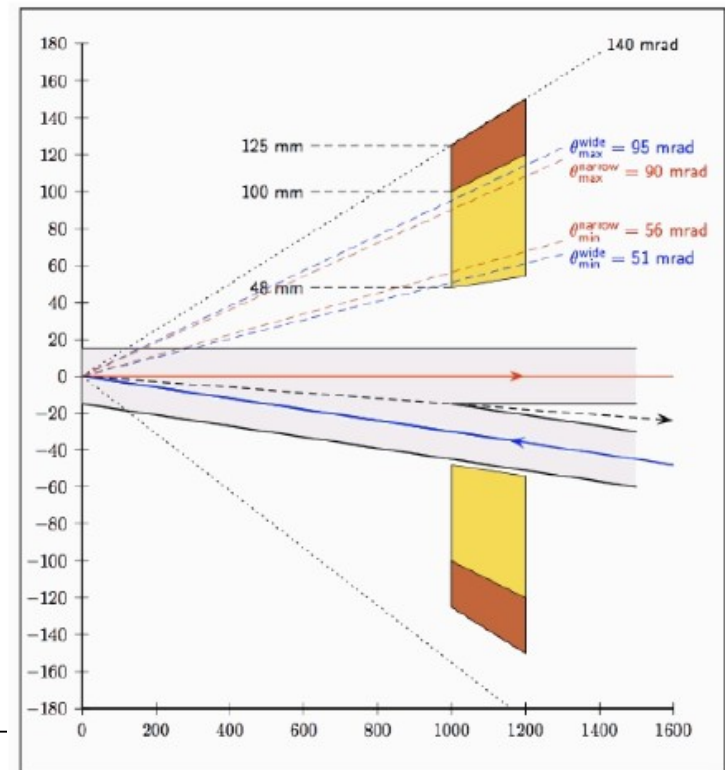
$Z > 90\text{ cm}$

- 1mm of Cu, no gold coating, $R=15\text{mm}$

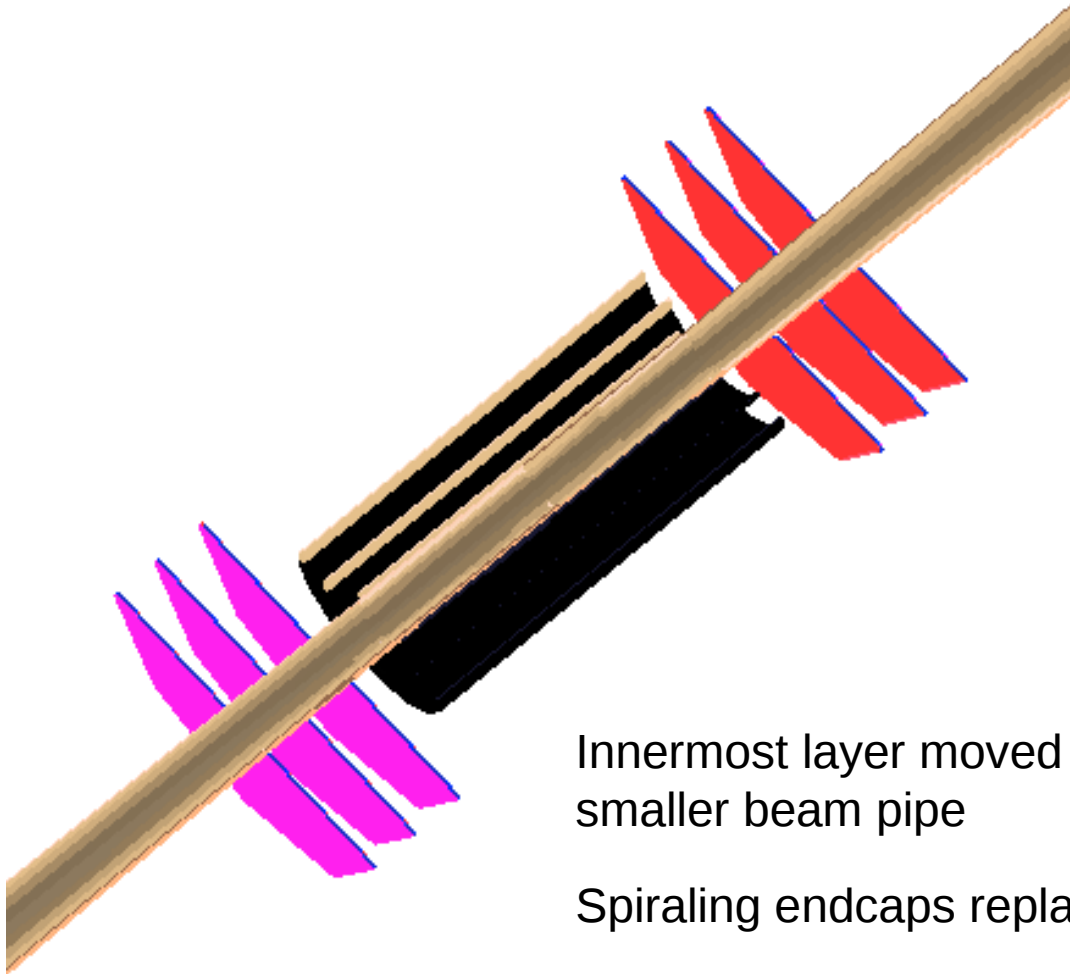
Conical shaped LumiCal

- 40 layers – 40 radiation lengths
- + silicon made instrumentation

From Mogens



Vertex detector



Innermost layer moved from radius 22 mm to 17.5 mm to profit from smaller beam pipe

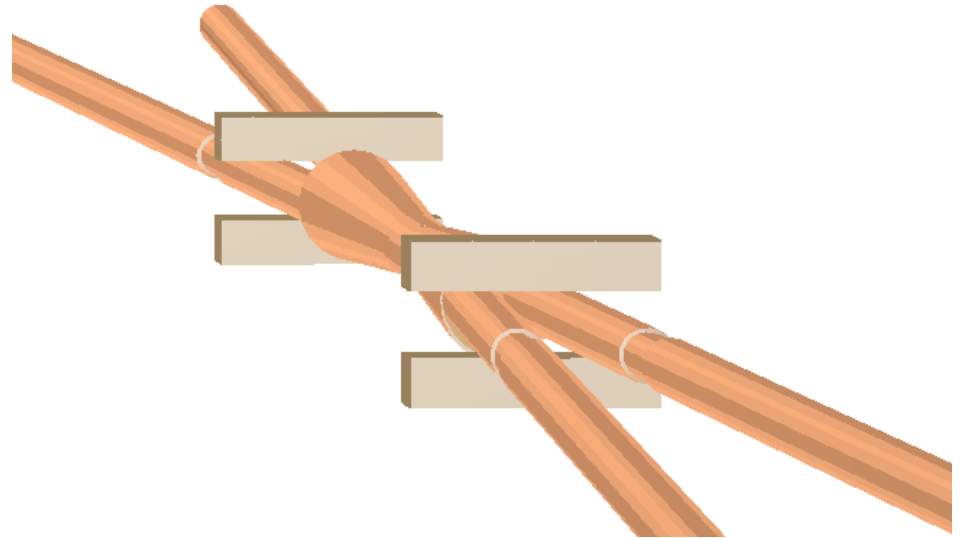
Spiraling endcaps replaced by simpler disk like endcaps

Optimisation concerning material budget is on going (our CLIC colleagues)

Open issues

HOM absorbers

- Expected to contribute to the hits coming from backscattered particles
- Work on going
- Not included in the simulations yet



Tantalum shield

- Not yet implemented
- Some more info needed

Beam pipe radius at split vacuum chamber

- At $z \sim 1\text{m}$, the 2 beam pipes not separated enough to accommodate 15mm radius & 1mm thickness
- Hence, we have kept for the while what we had before, radius of the separated BP to 12mm

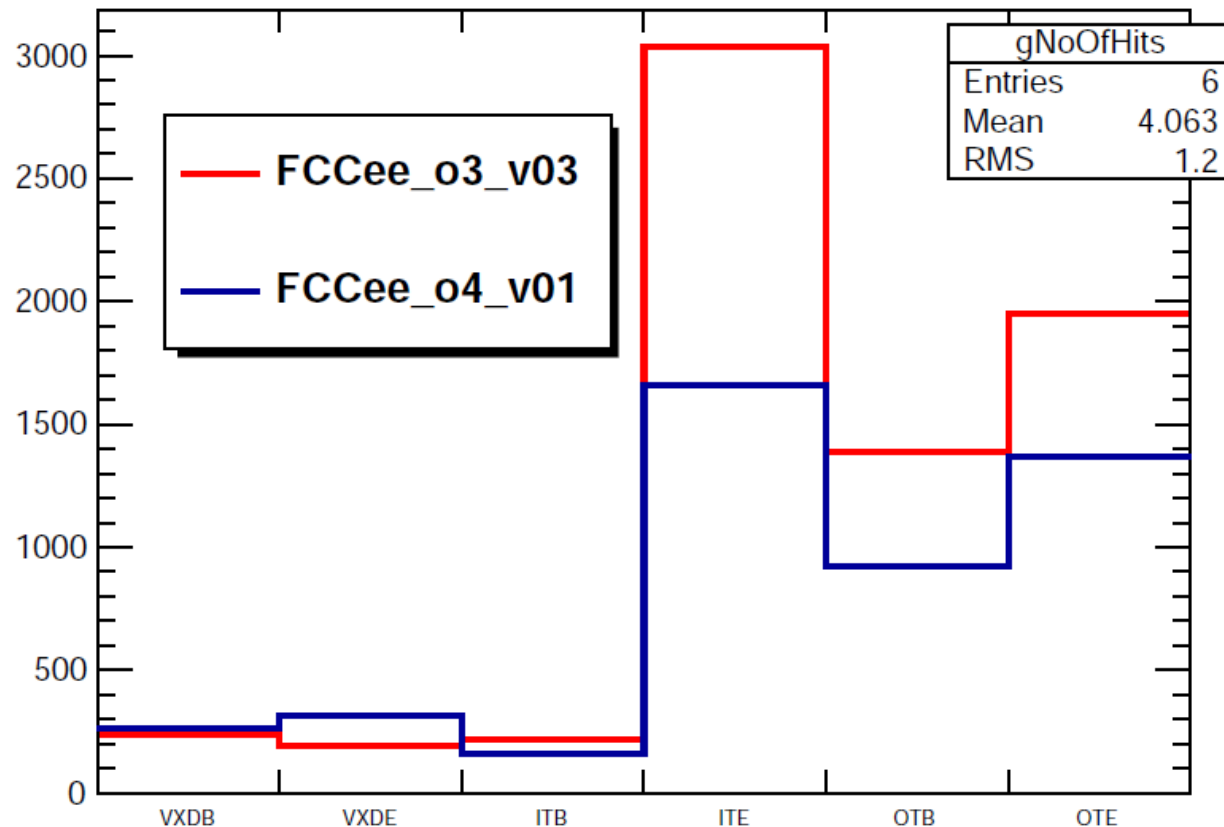
Pair background simulations

Pair background simulations, top energy

50 BXs of pair bkg generated with guinea pig

Full simulation with g4 model using ILCSoft

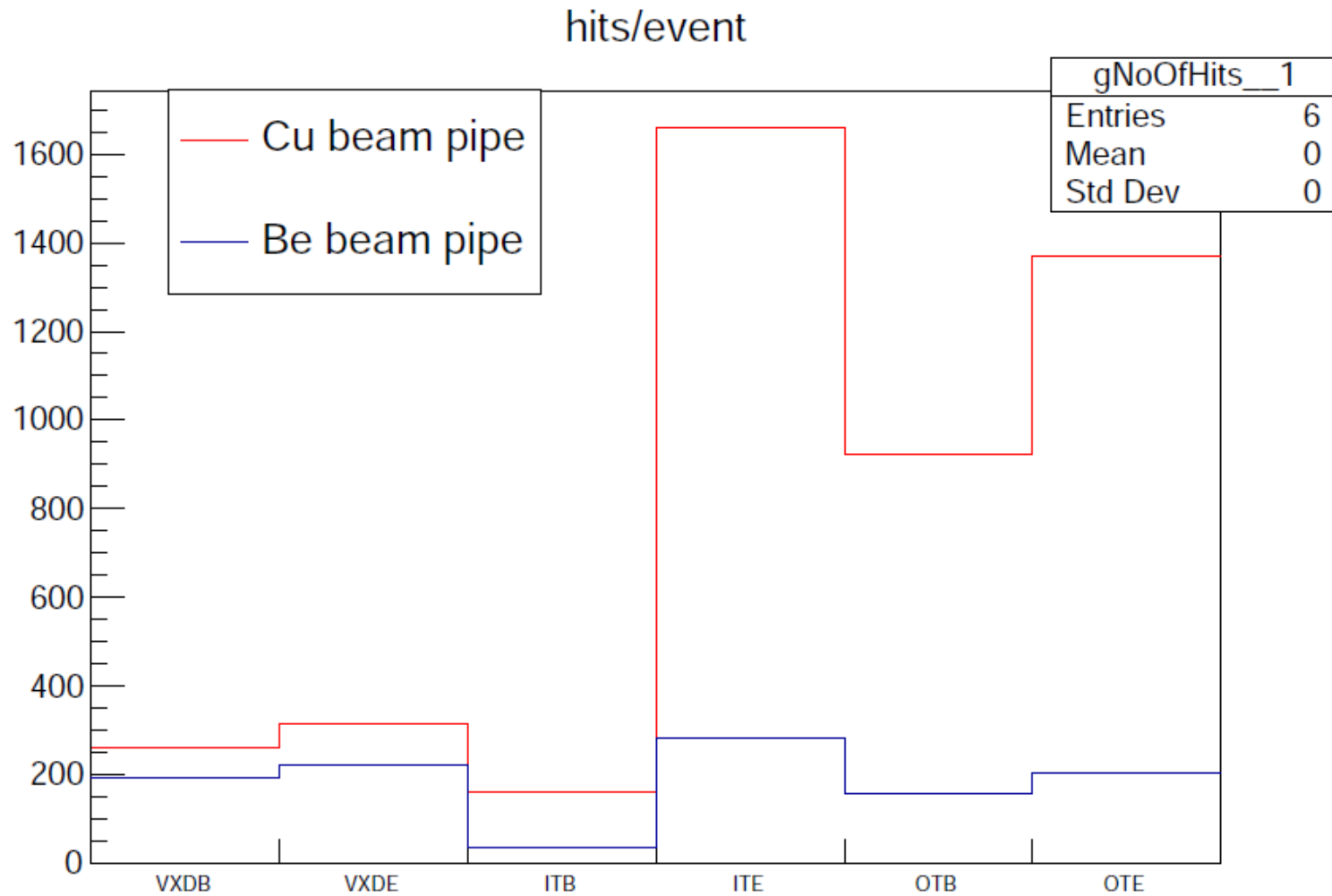
- Comparison between FCCee_o3_v03 (previous) and FCCee_o4_v01 (new) detector models (hits / BX)



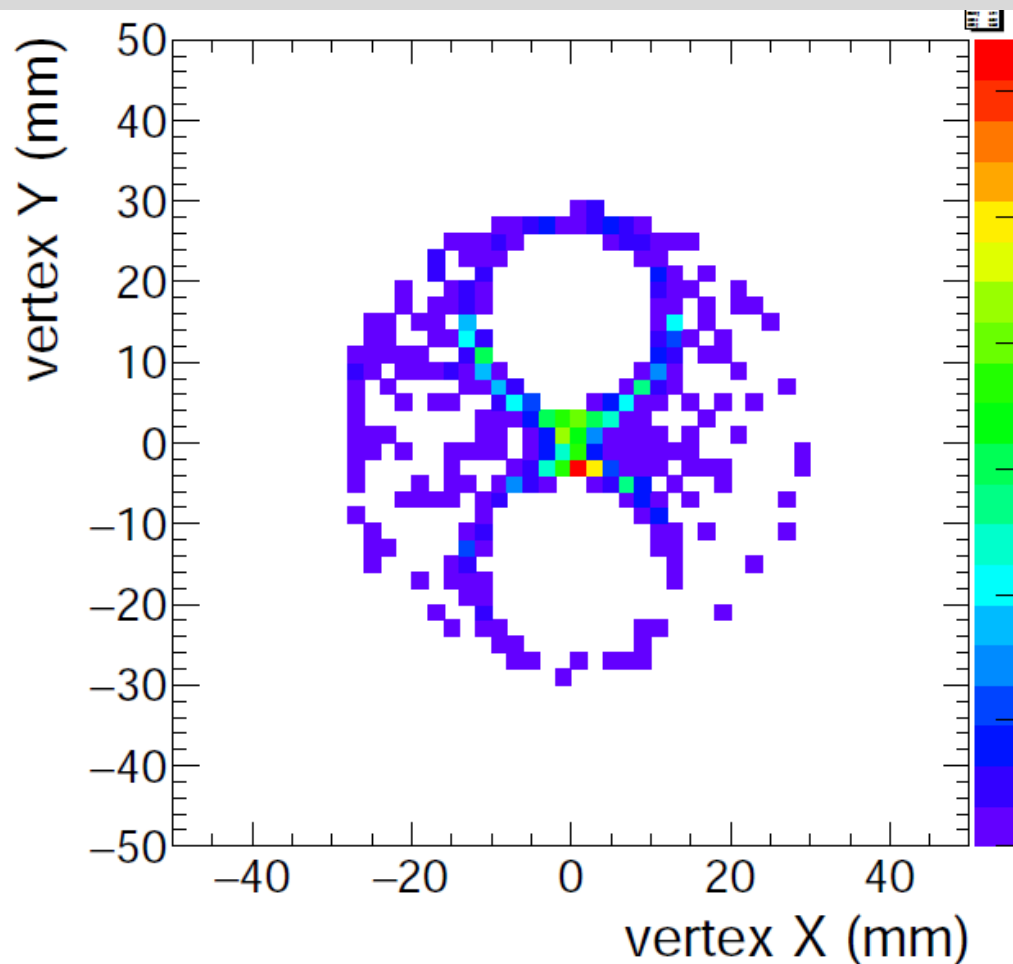
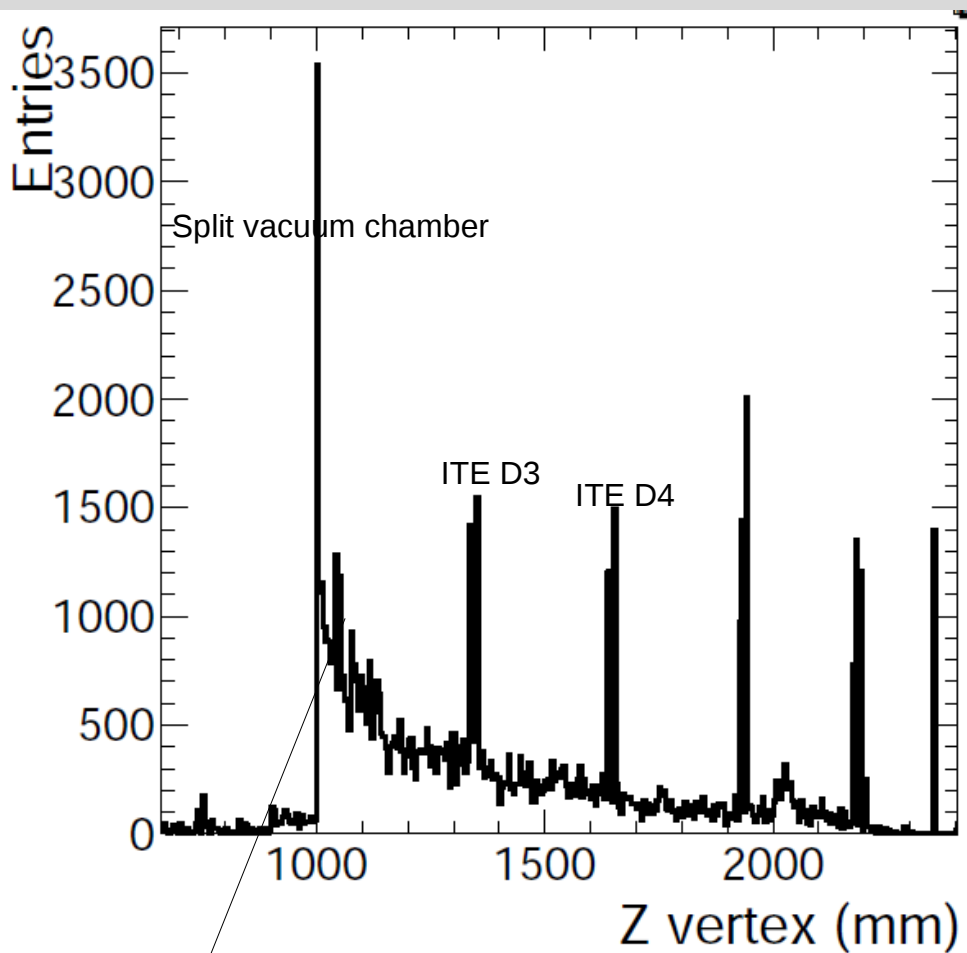
Understanding the differences

Tantalum shield can increase hits by a factor > 2

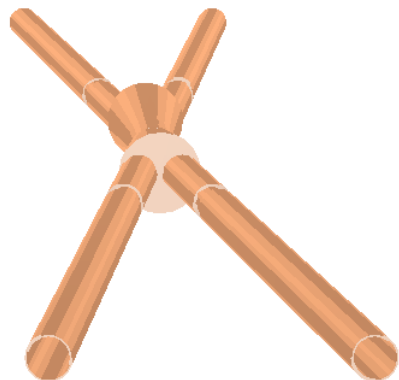
Beam pipe material also plays important role



Origin of the bkg hits

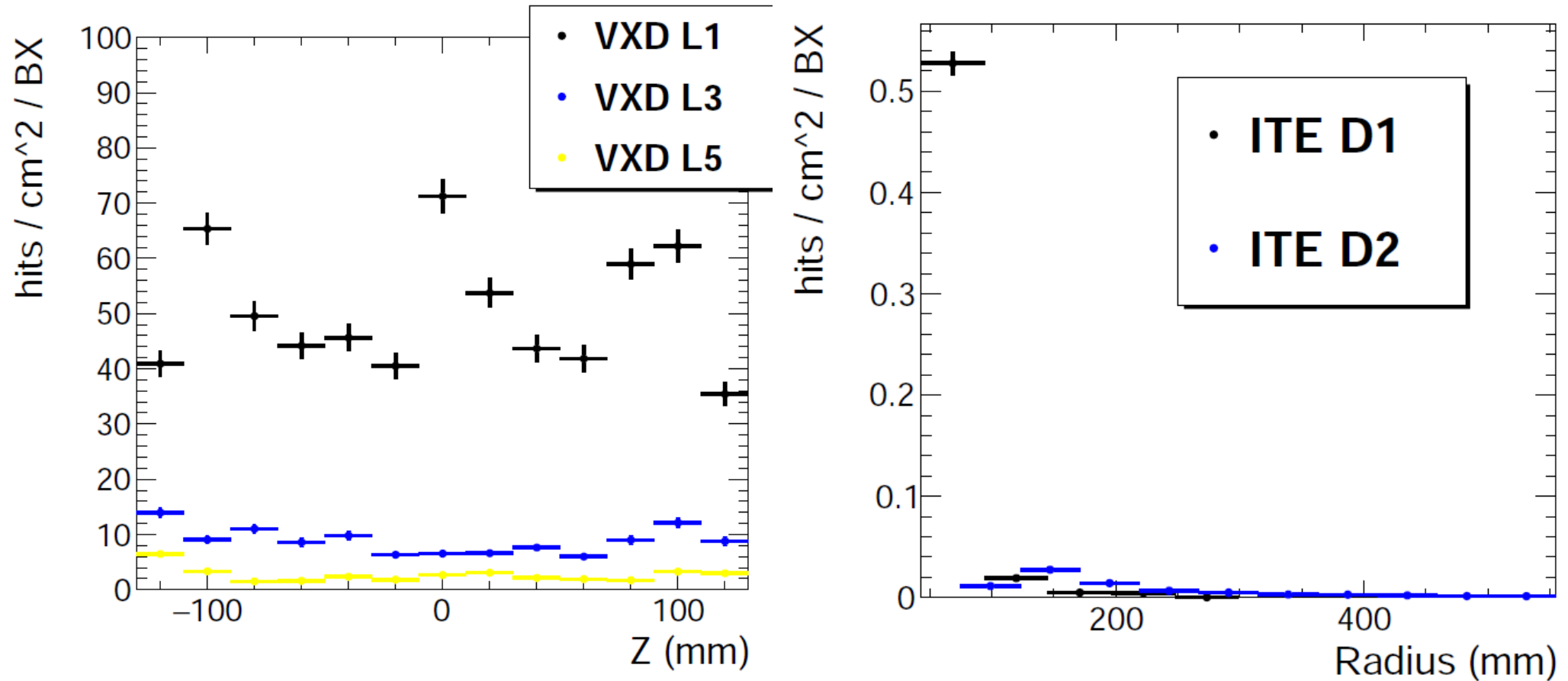


LumiCal



$R\phi$ profile of creation of secondaries at split vacuum chamber

Hit densities



Crude approximation of occupancy in VXD L1: $\sim 0.7 \times 10^{-3} \%$

- Assuming pixel pitch $20\mu\text{m}$, 5 pixels / cluster, $700\mu\text{m}$ range cut

In ITE D1, for small radius can reach

- $\sim 0.35 \%$ case of strips
- $\sim 10^{-3} \%$ case of pixels