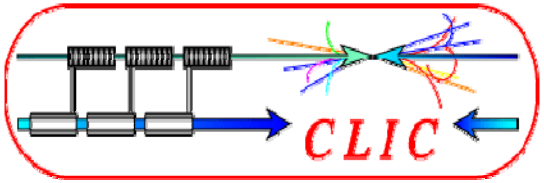


Feedback from the FCAL collaboration meeting in Belgrade, Sept 22-24

http://www.vin.bg.ac.yu/hep/FCAL/

FCAL collaboration

http://www-zeuthen.desy.de/ILC/fcal/

~17 laboratories
Spokesperson: Wolfgang Lohmann

Working on Forward Region studies for e+e- colliders

•Simulation studies
•Hardware development
- Radiation-hard sensors (silicon/diamond)
- Electronics development (non radiation-hard)
- LumiCal and BeamCal detector concepts
- Integration studies (limited effort)

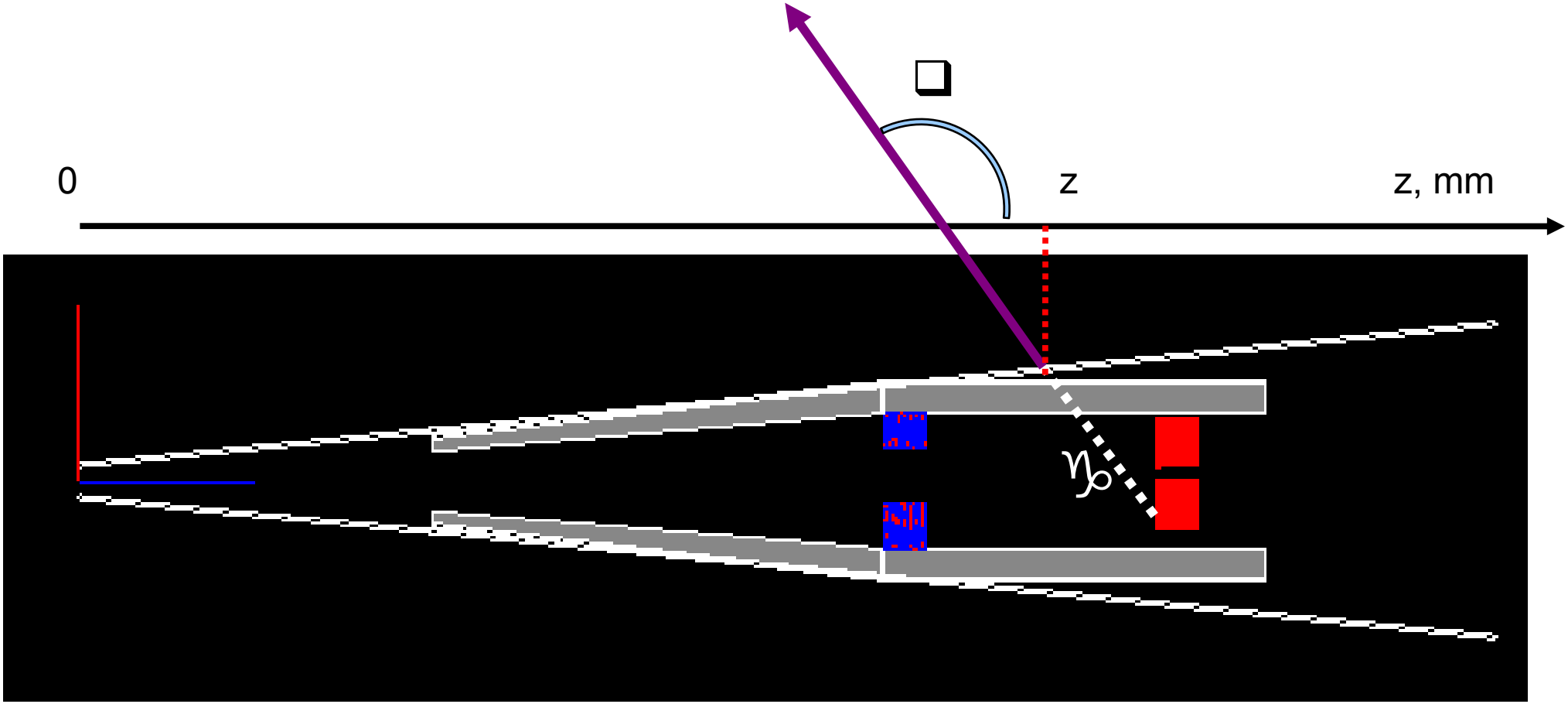
At present, the collaboration concentrates a good part of its efforts towards the LoI for the ILD concept.
The SiD forward region concept is also largely based on the FCAL work.

Attendance at Belgrade: ~35 persons

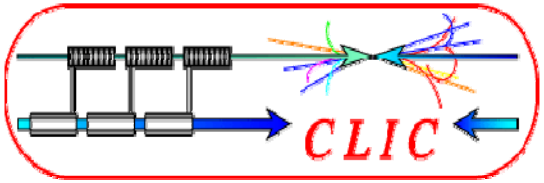
CLIC participation in Belgrade

Ariella Cattai and Lucie Linssen attended for CLIC

We presented the status of our studies of the CLIC Forward Region on behalf of Andrey Sapronov



Summary/conclusions of CLIC work done



- **Geant4 simulation** for forward region of the CLIC detector was set up
- It can be configured with relatively **variable geometry settings**

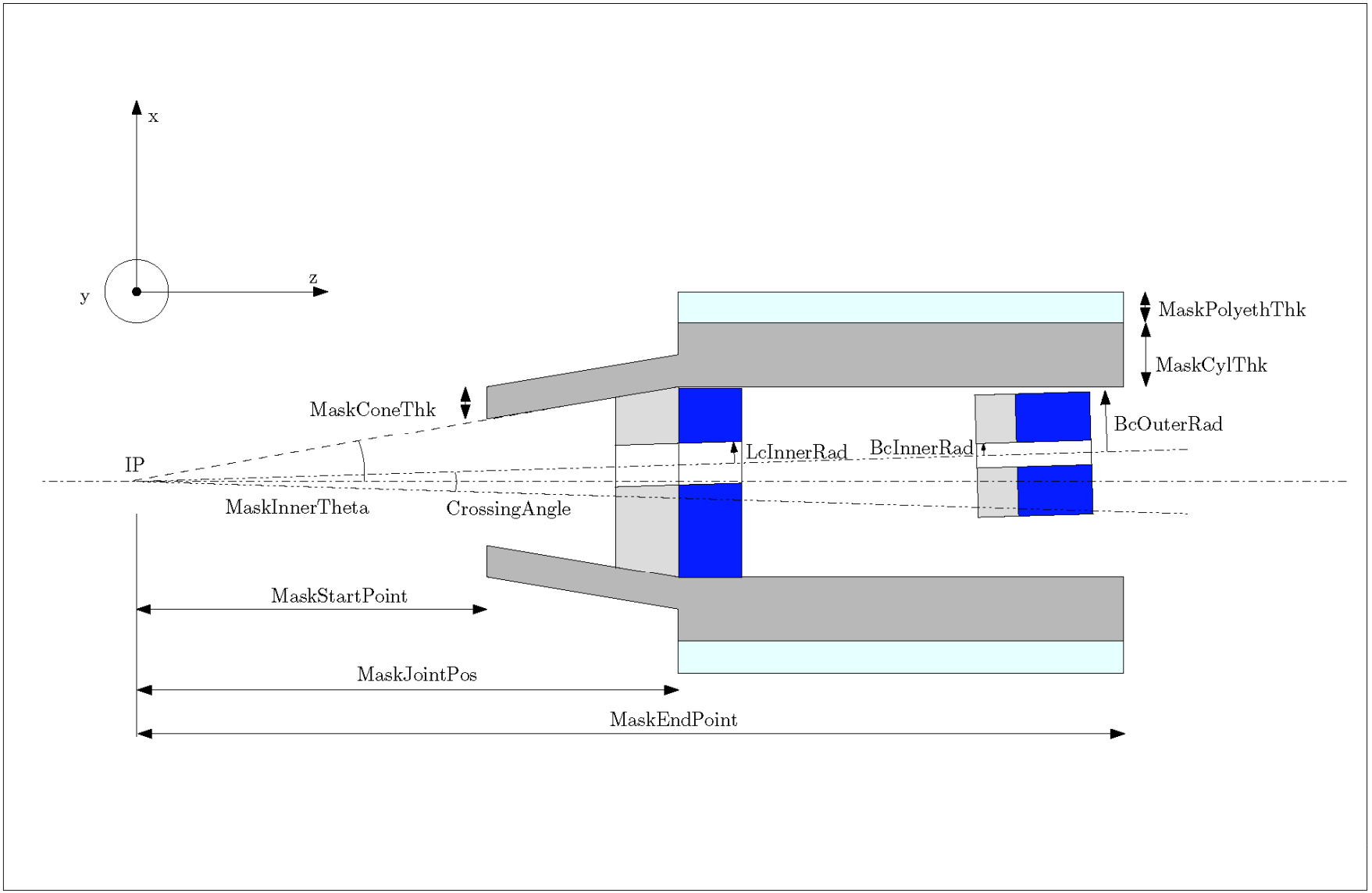
- **Preliminary background estimates** were made:
- The main tracker background goes through the mask opening, the rest can be stopped with much less material than intended.
- The EM compound of the background in calorimeters may be reduced relatively well, whereas the neutron shielding is not as effective.

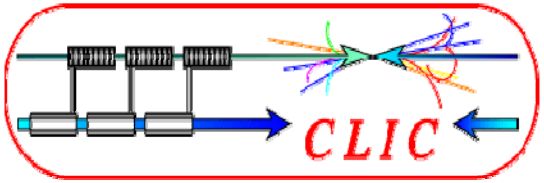
Following first results, modifications to software were implemented:

•New mask geometry

•Carbon layer (5 cm) at front face of BeamCal

On the basis of the conclusions of his study, Andrey changed the geometry of the mask.
He also added 5 cm graphite in front of BeamCal





Next steps for CLIC, as presented by us at the FCAL meeting:

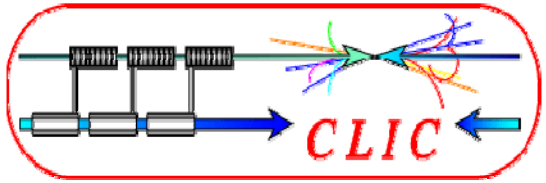
- Continue the **background studies with the new mask geometry**
  - Perform studies as a function of polyethylene coating thickness
  - Numerical results (absolute values of reduction and of #background left, occupancy)
  - Look into optimal extension of conical part to protect the vertex detector
  - Remnants at high-z values. Do they affect accelerator instrumentation?
  - Vary the inner radius of BeamCal (10 mrad?)
  - Include the beam pipe

- The spatial energy distribution of the **beamstrahlung background at the BeamCal face** plane for different magnetic field types at 20 mrad crossing angle/ Will allow to see whether there is a lot of background in the incoming beam region and how it is distributed.

- Can **BeamCal** be used **for machine/luminosity feedback at CLIC ?**

- Functionality and optimisation of **LumiCal at CLIC**

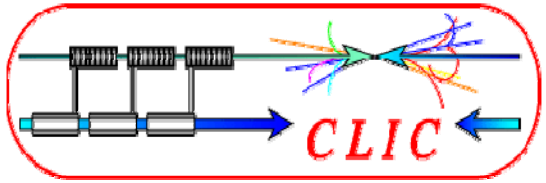
What else did we pick up from the workshop?



In arbitrary order:

- **In between LumiCal en BeamCal there is still 3000 kg of a forward HCAL module !**
  - ILD concept
  - Not included in our simulations
- **2 simulation studies on the influence of the beam pipe were presented**
  - Cylindrical beam pipe => further increase in background rates
- **Alignment between left and right arm needs to be addressed**
  - Not yet addressed convincingly by FCAL collab.
- **2 possible BeamCal concepts**
  - Single calorimeter structure
    - Measure integrated energy profiles => beam feedback
    - Measure individual high energy depositions => lepton veto
  - Presampler + calorimeter
    - Measure integrated energy profiles in the presampler
    - Measure individual high energy deposits in the calorimeter part

What else did we pick up from the workshop?



Suite….:

- **Radiation levels in BeamCal look at least equal to SLHC vertex**
  - 1 to 10 MGy/year
  - We have to try to understand this better
    - Difference between “electron” and “hadron” damage

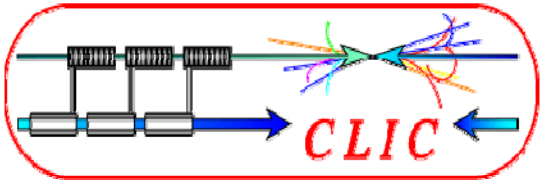
Collaboration issues

CLIC forward region studies will continue in the framework of the FCAL collaboration

We have been discussing with/about 3 young persons from FCAL, who would possibly come to CERN to repeat their ILC studies at 3 TeV.

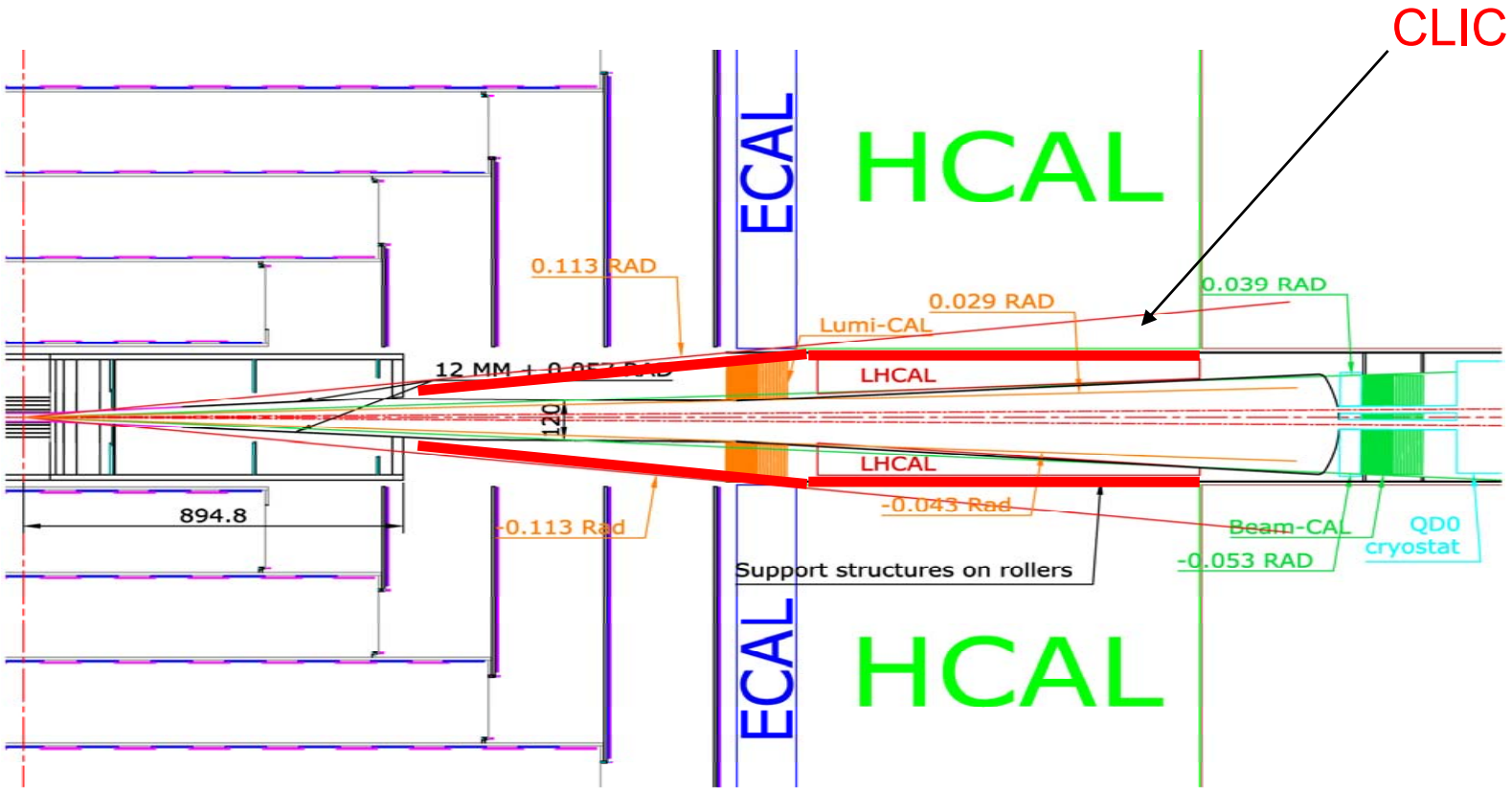
Klaus Monich identified a student from Desy Zeuthen with ILC/FCAL experience, who is willing to come to CERN as a DOCT (possible financed by Germany)

Ariella has already taken up contact with an LHC expert on detector (laser) alignment



Spare slides

use SiD design for CLIC detector:

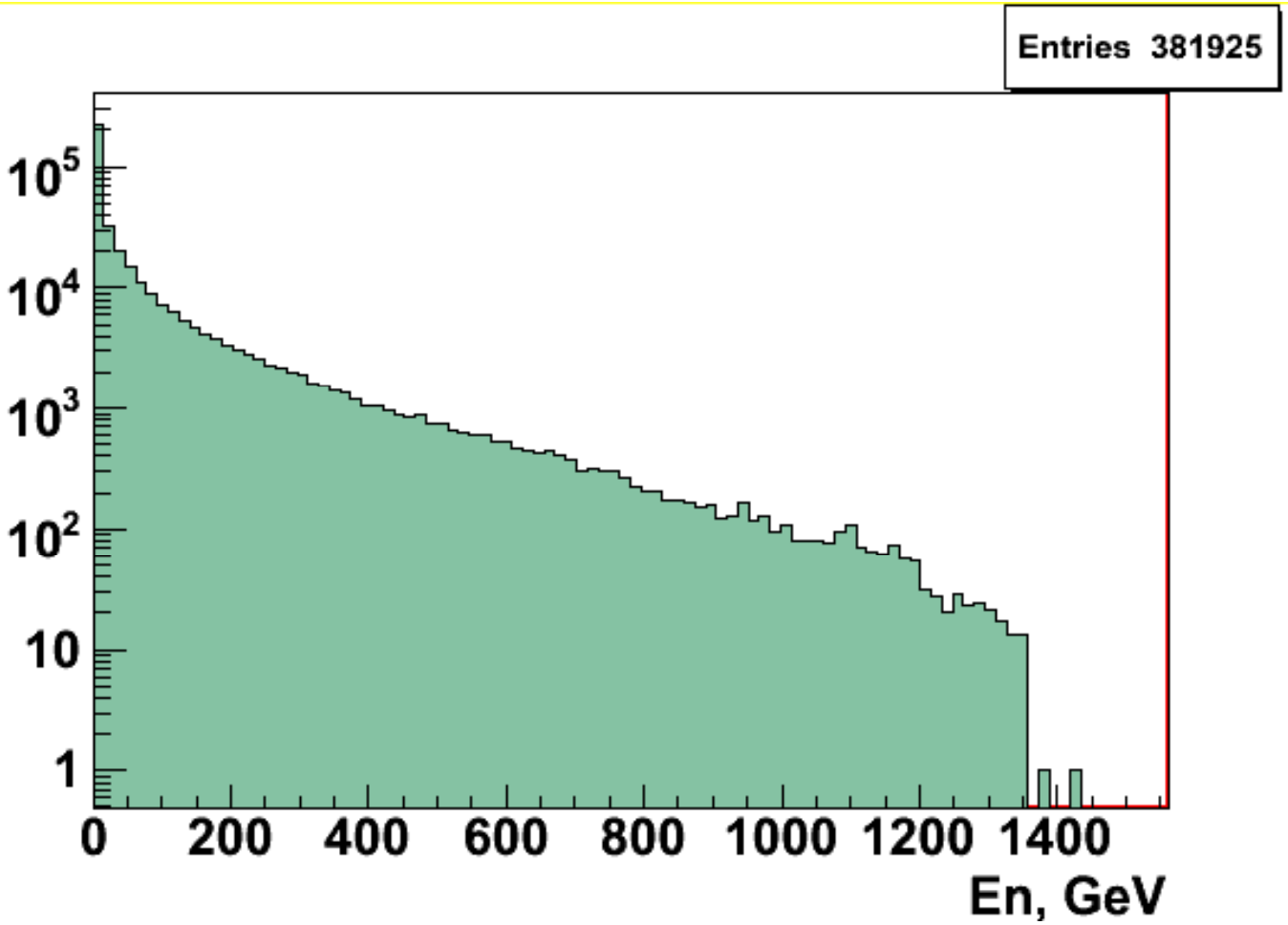


High levels of backscattered beamstrahlung background ➔ need for **mask** to protect tracker and calorimeters.

- Simulate the forward region
- Perform background estimation
- Optimize the mask parameters for effective shielding

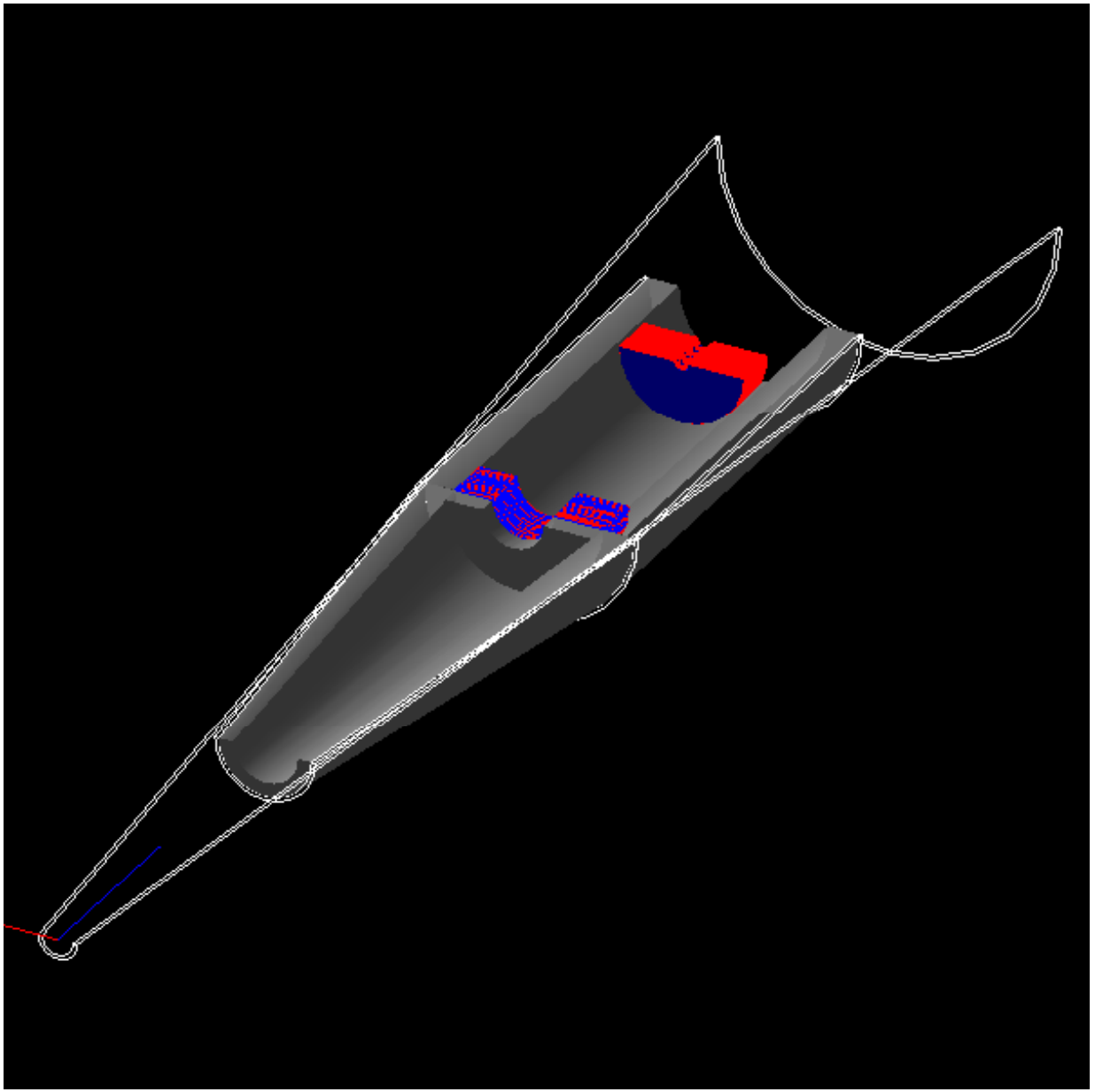
The dangerous background are mainly the backscattered photons, e+- and neutrons. They are produced from the e+- pairs compound of the beamstrahlung which collide with forward region detectors.

Beamstrahlung pairs energy distribution



Simulation: Geant4.9.0p01

Physics list: QGSP_BERT_HP
(quart-gluon string compound,
Bertini cascade High precision)

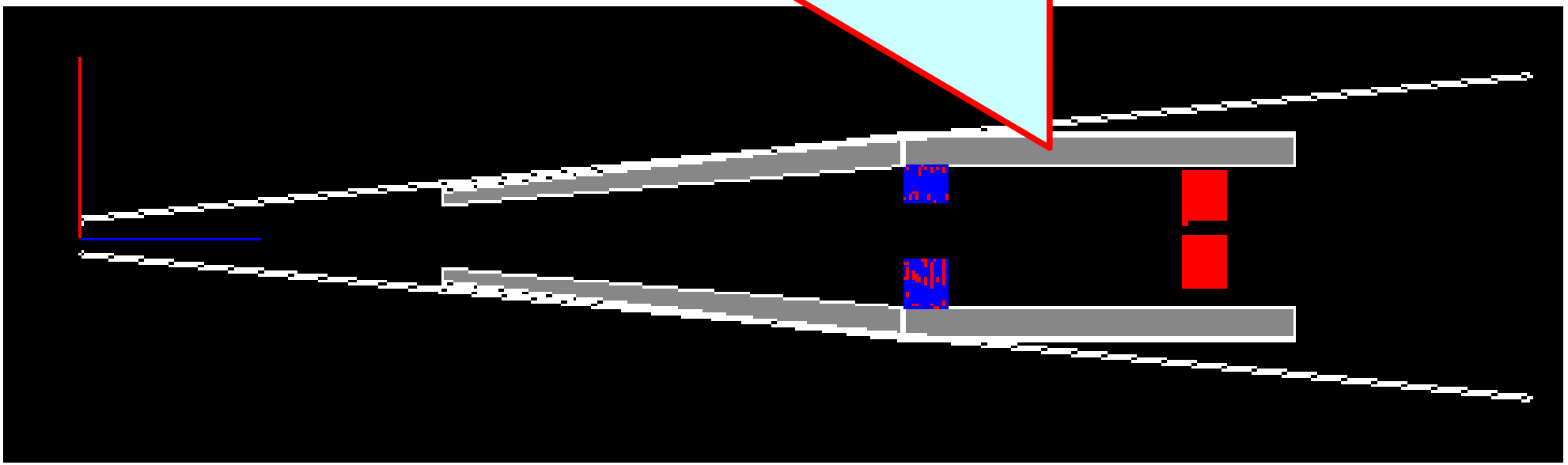


Geometry:

- Defined in config file
- Variable crossing angle
- Several magnetic field options: solenoid, (anti)DiD, fieldmap (so far only ILC format)

Mask parameters

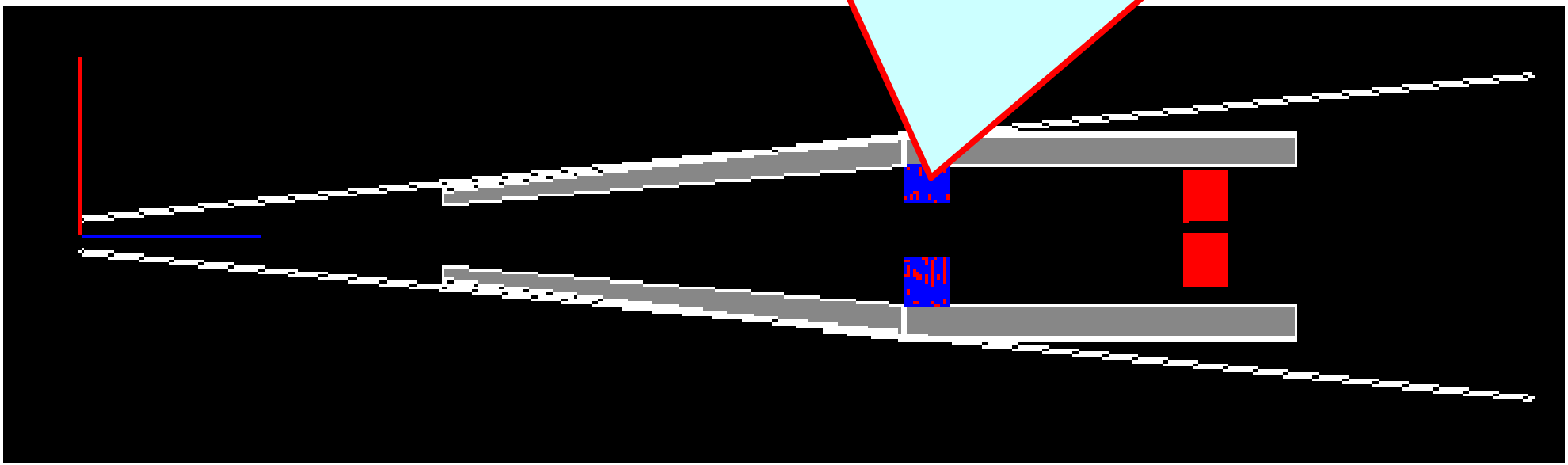
- aligned to z (detector) axis
- starting point, z_start 1000 mm
- joint position, z_joint 2270 mm
- end point, z_end 3350 mm
- inner angle, theta_i 85 mrad
- outer angle, theta_m 120 mrad
- material: tungsten + polyethylene coating



Geometry:

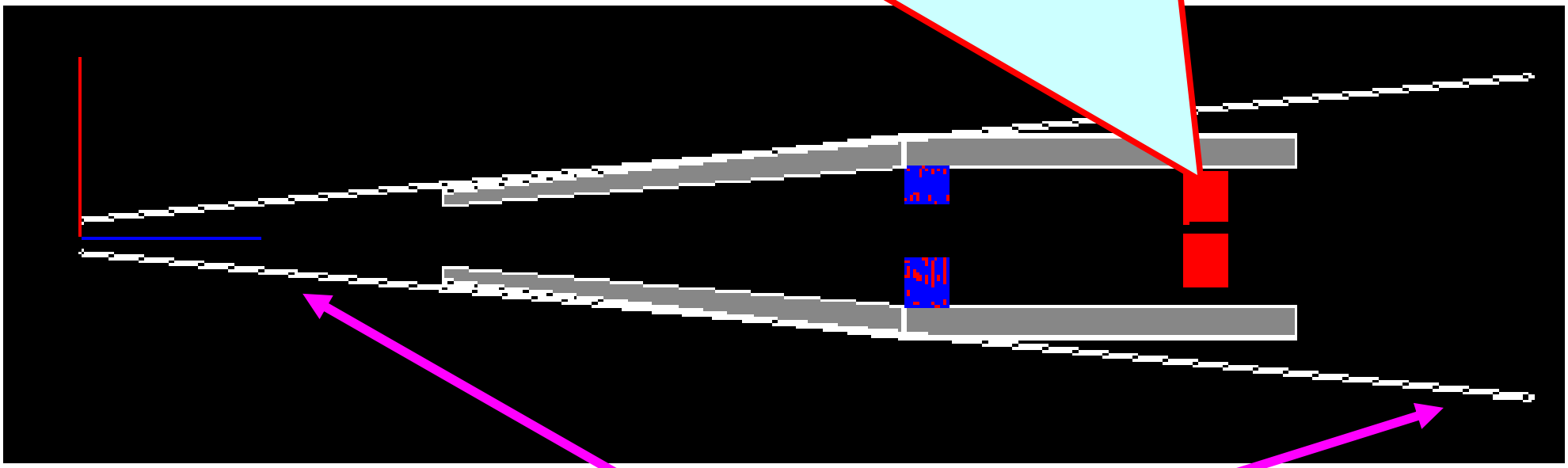
LumiCal parameters

- aligned to outgoing beam axis
- 5 cm of graphite in front
- number of layers n_lrs 30
- inner radius, r_inner 80 mm
- outer radius, r_outer limited by mask
- absorber thkns, d_abs 3.5 mm
- sensor thkns, d_sens 0.5 mm
- material: tungsten / silicon



Geometry:
BeamCal parameters

- aligned to outgoing beam axis
- number of layers, n_lrs 30
- distance from ip, z_pos 3100 mm
- inner radius, r_inner 20 mm
- outer radius, r_outer 160 mm
- absorber thkns, d_abs 3.5 mm
- sensor thkns, d_sens 0.5 mm
- material: tungsten / diamond

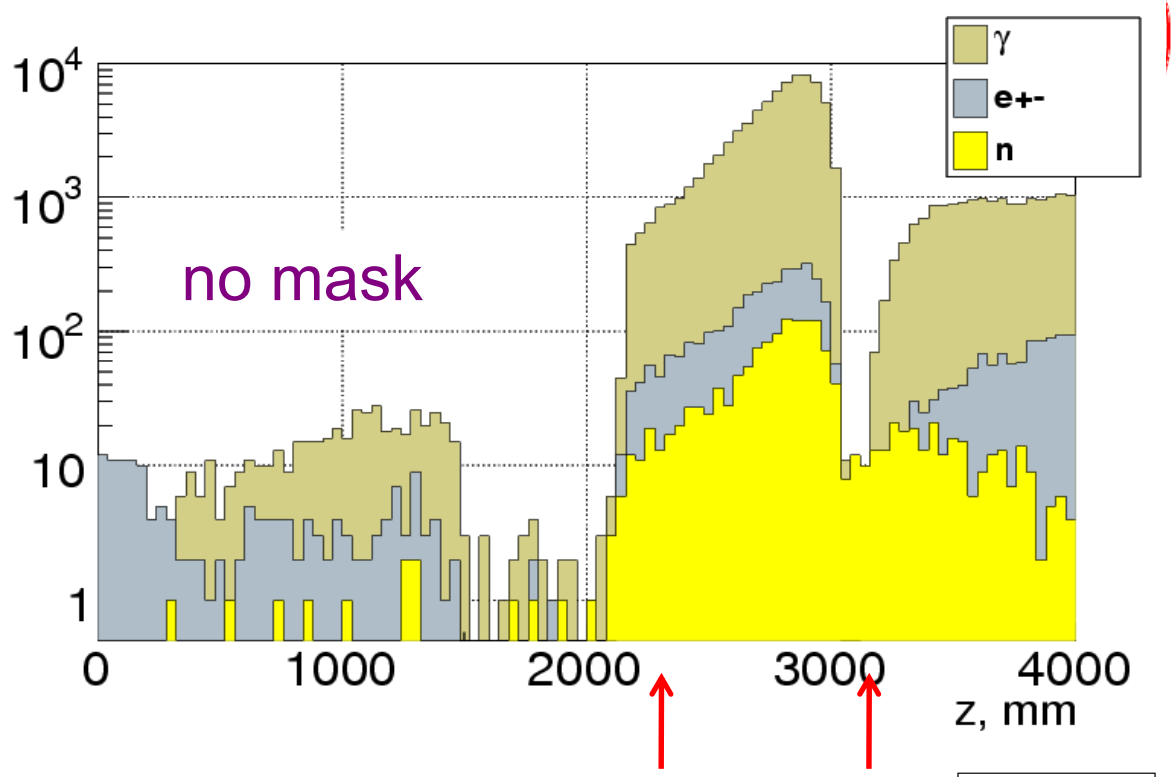


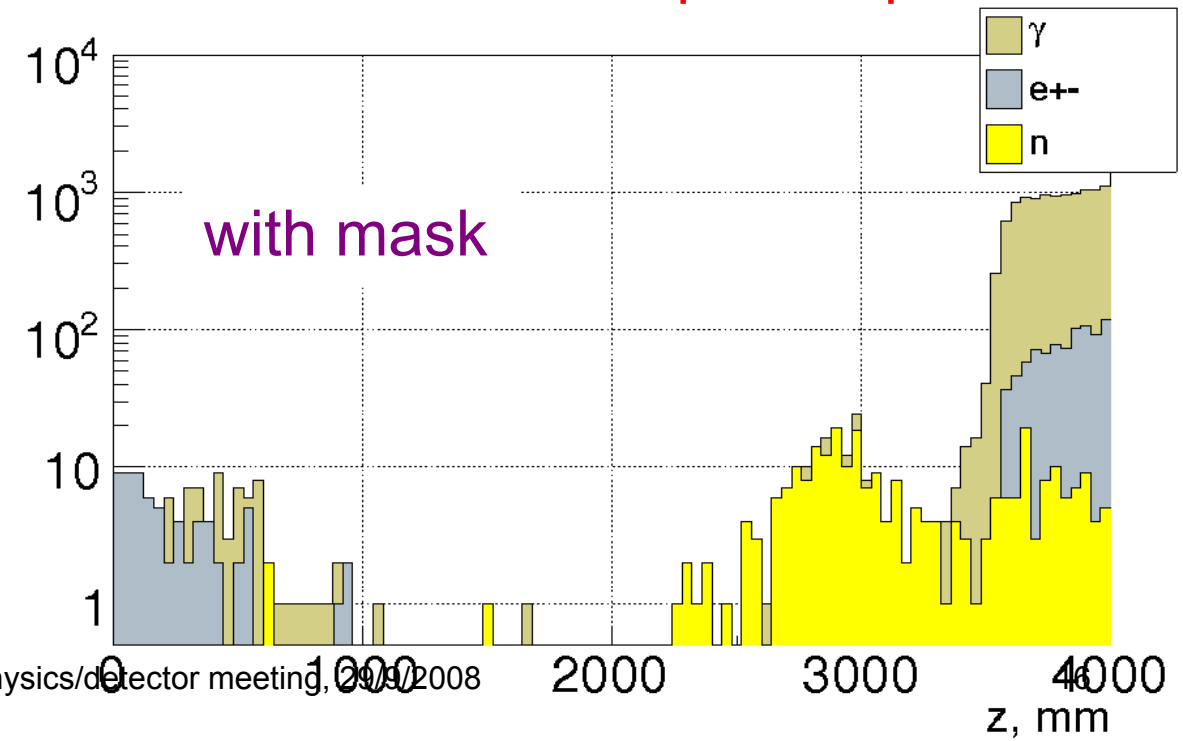
+ dummy volume to catch the particles directed to tracker and calorimeter endcaps

Preliminary background studies:

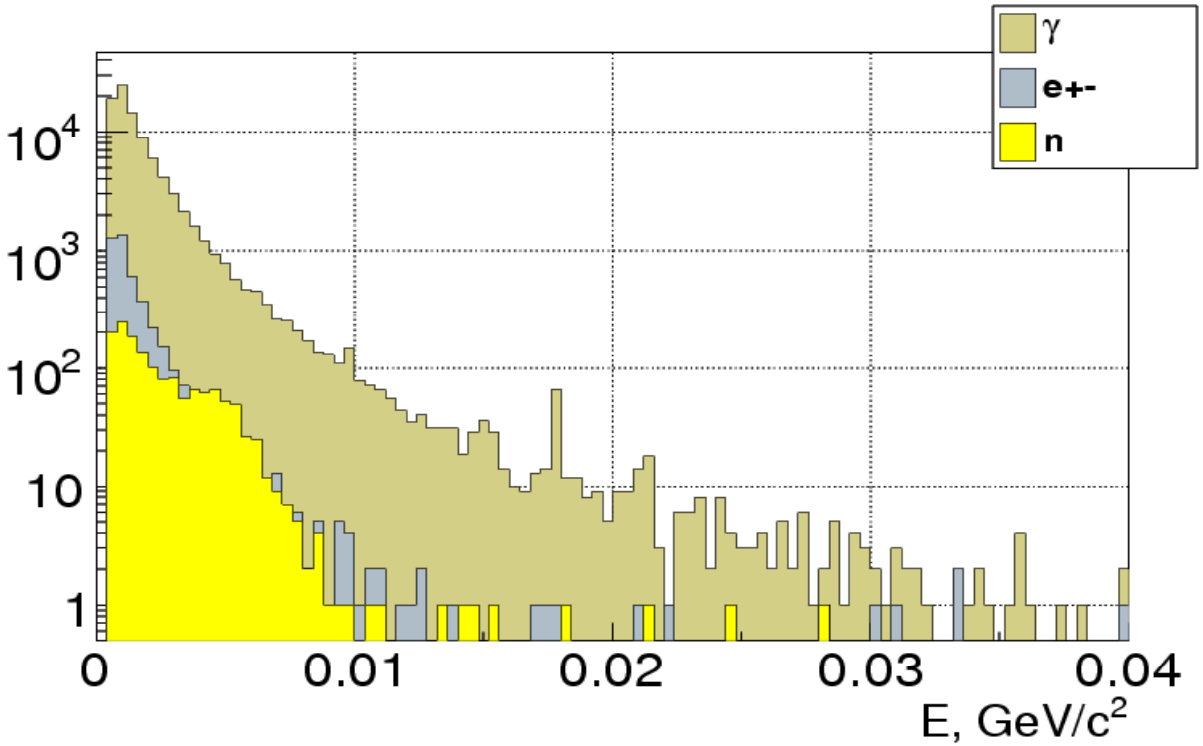
mask effectiveness,

spatial distribution of background hits in the dummy volume:



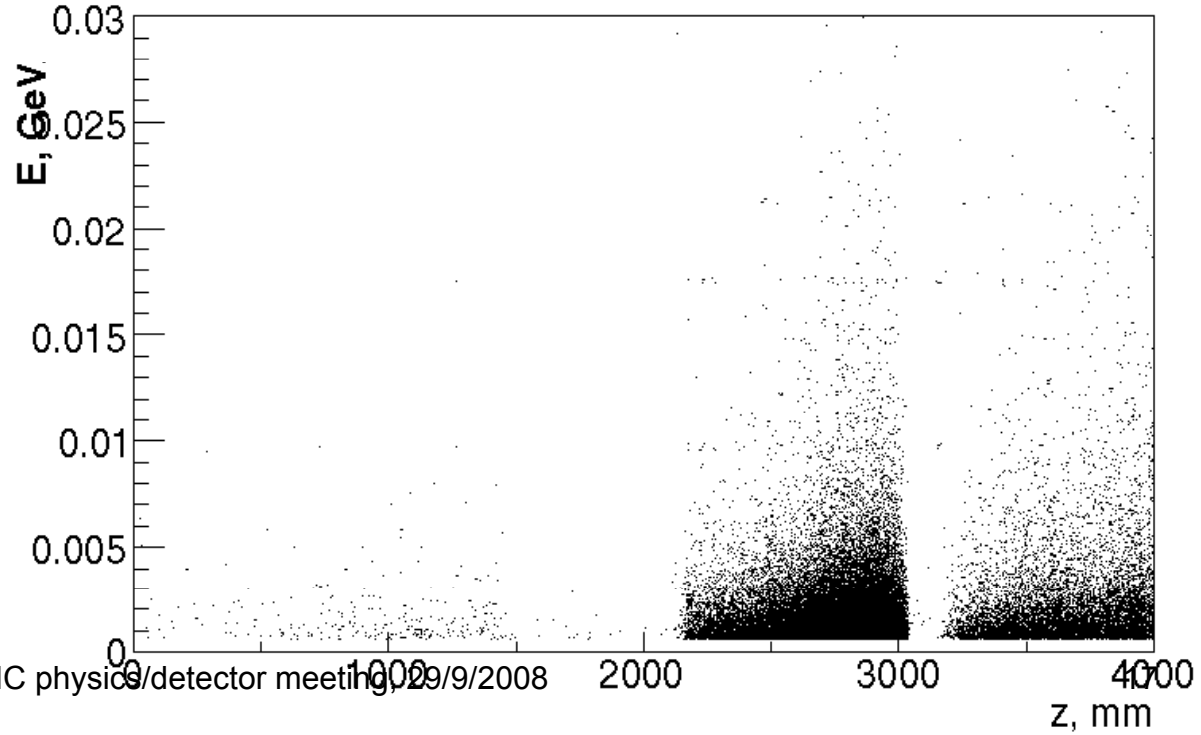


Background energy spectrum (without mask)

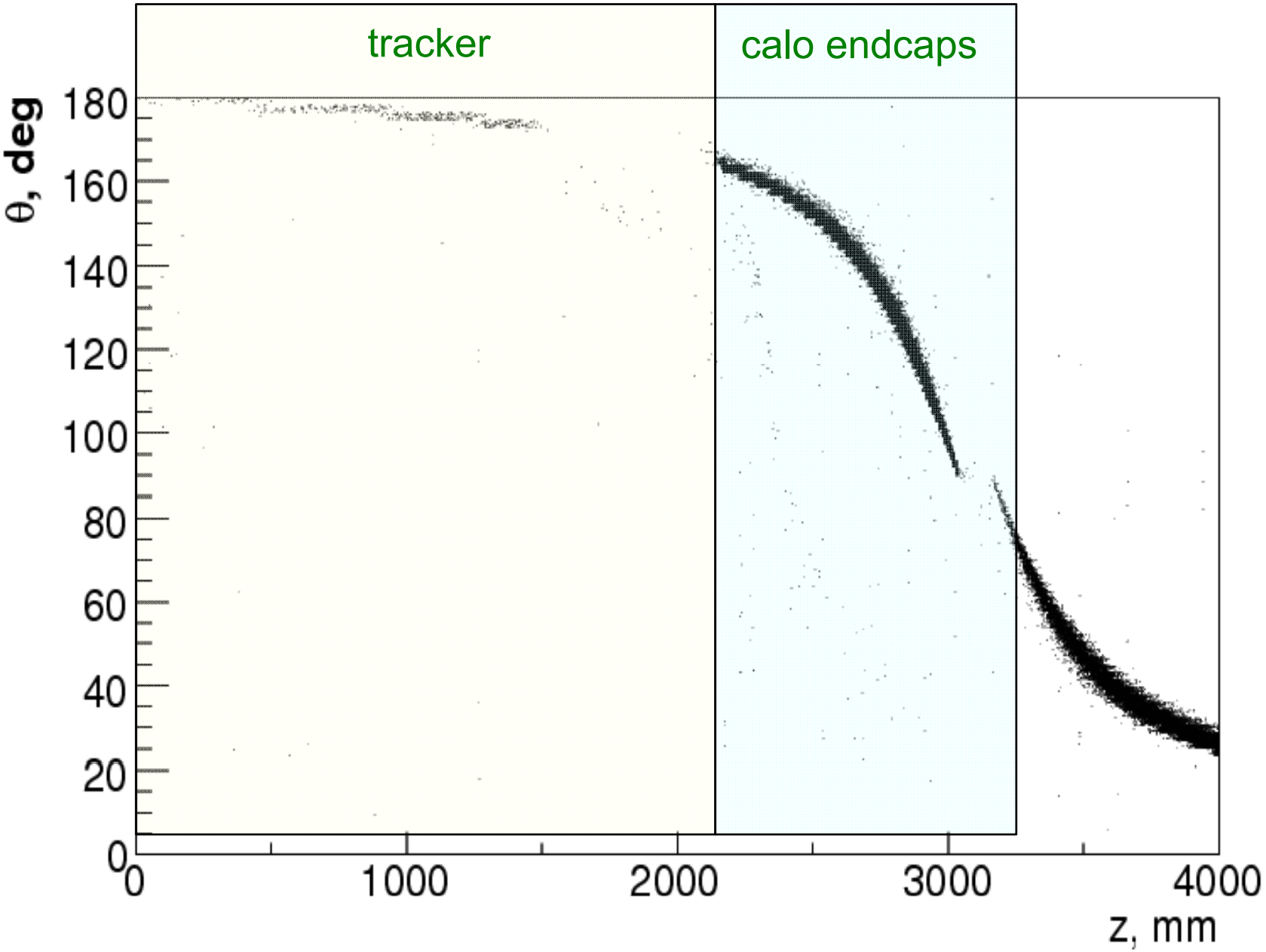


Energy vs Z

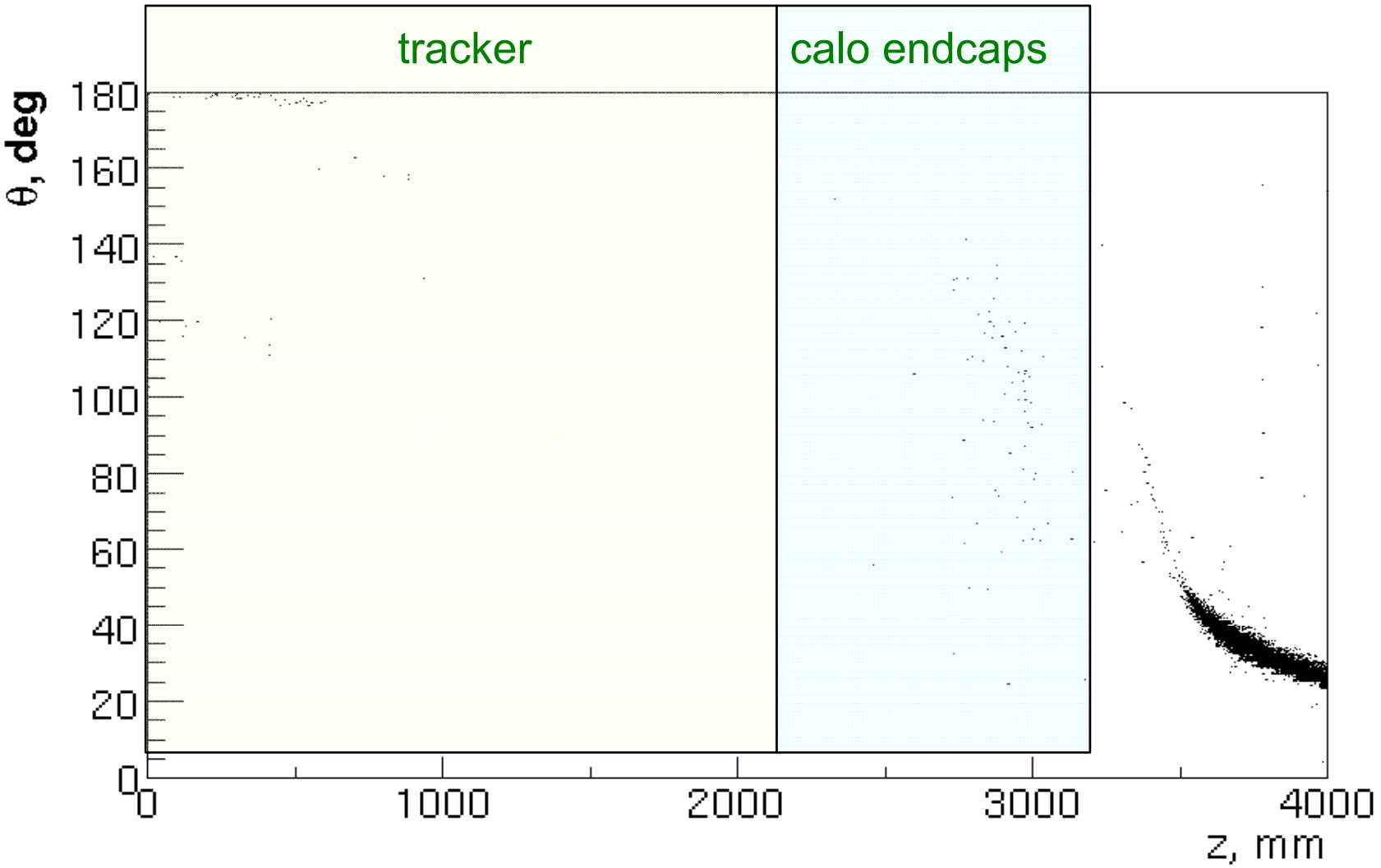
Photons (no mask)



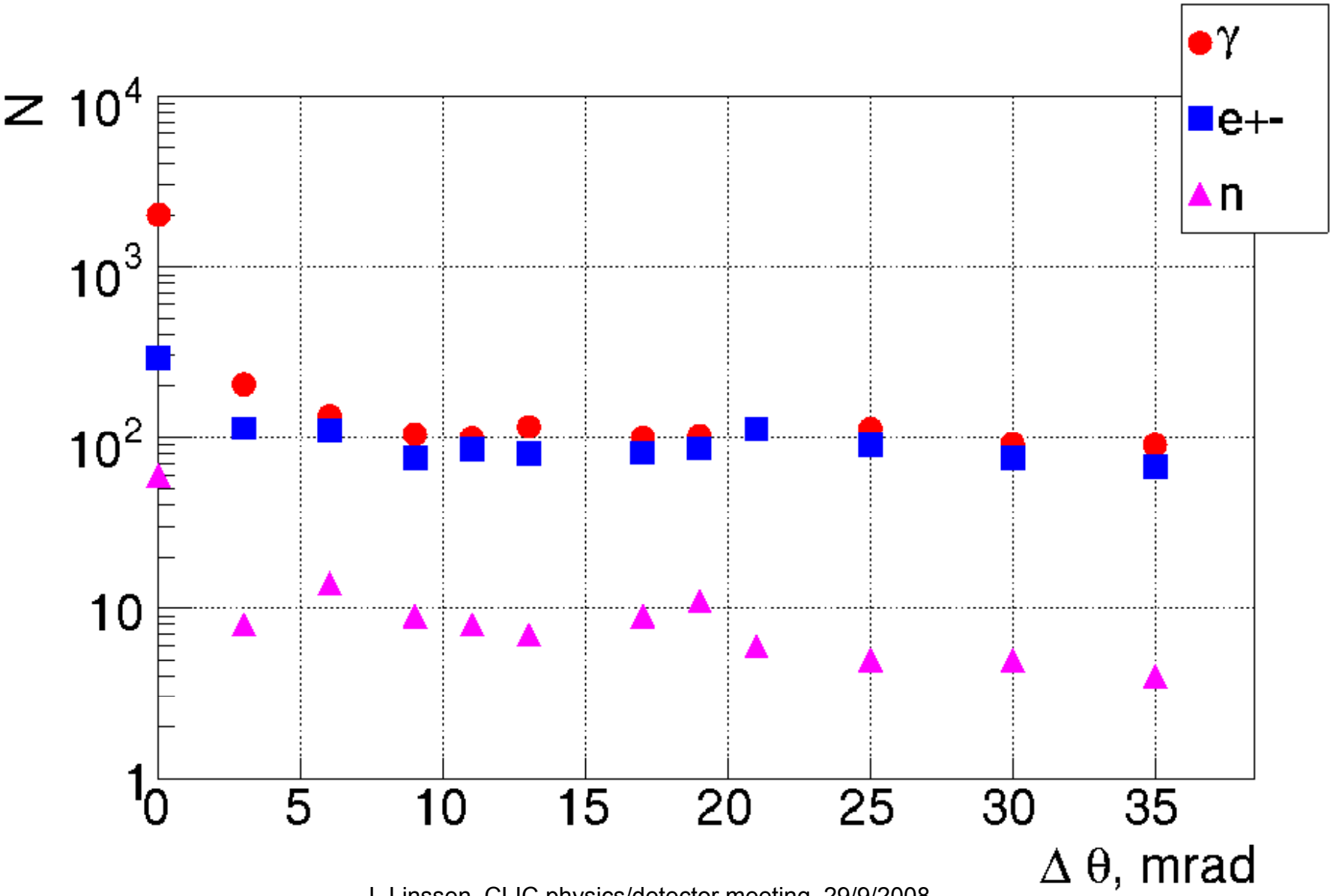
Theta-z scatterplot for photons no mask



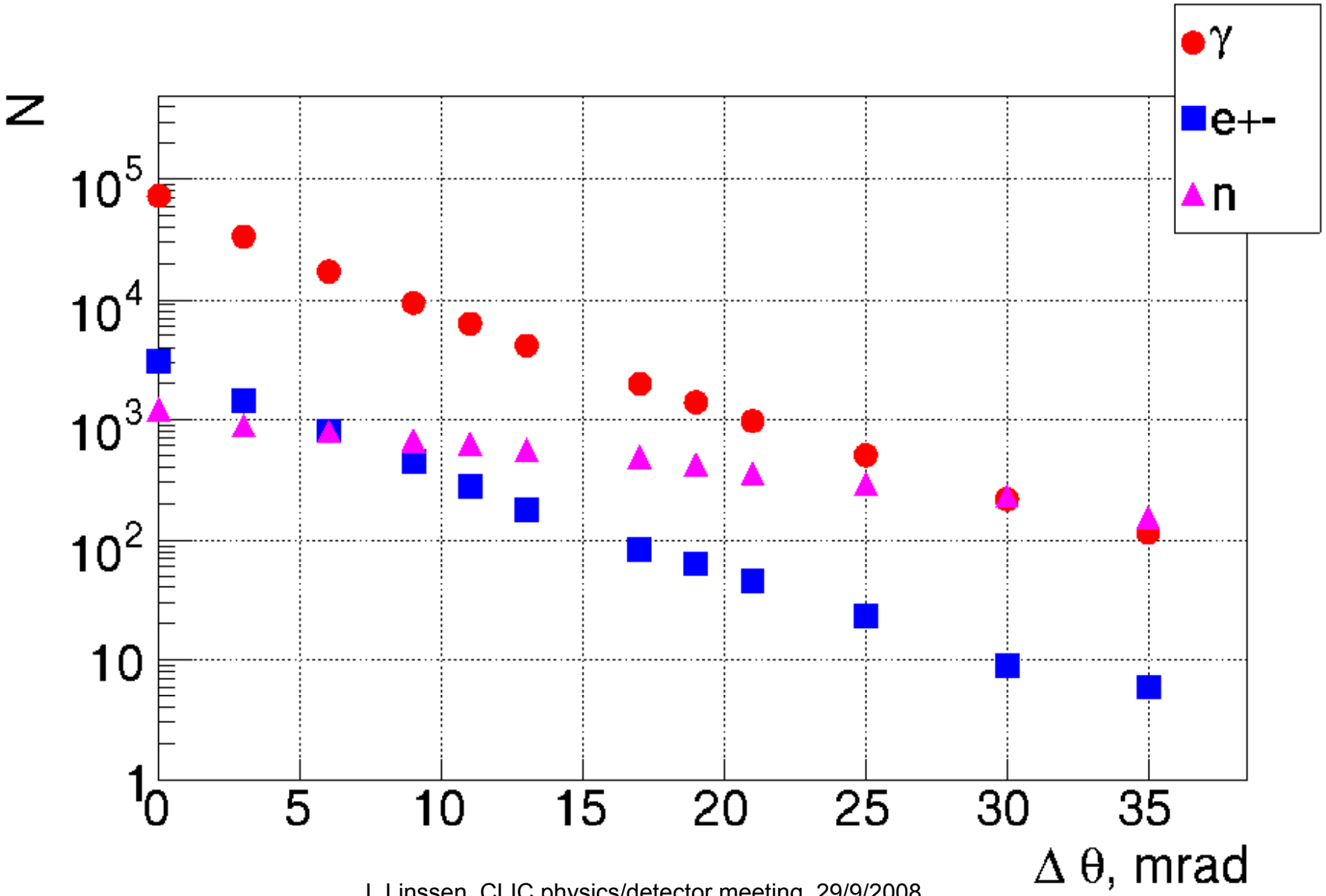
Theta-z scatterplot for photons with mask



Number of particles going to the **tracker** depending on the mask opening angle ($\tilde{\theta}_{out}\theta_{in}$)

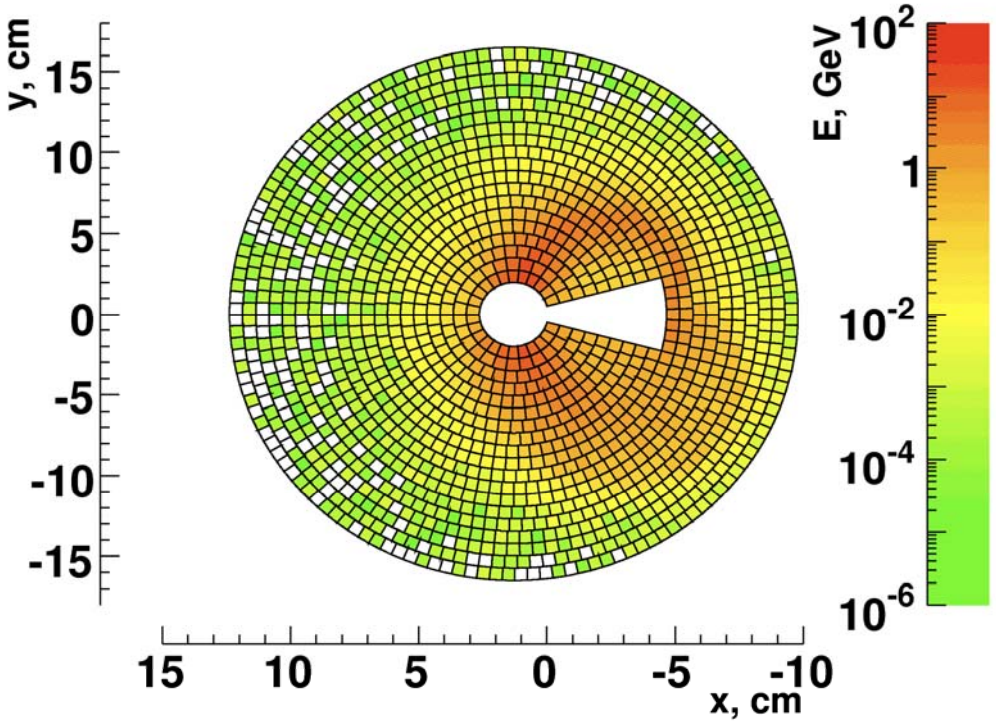


Number of particles going to the **calorimeter** depending on the mask opening angle ($\tilde{\theta}_{out}\theta_{in}$)



ILC example

20 mrad, DiD



14 mrad, antiDiD