

# CYGNO simulation plans

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Giulia D'Imperio

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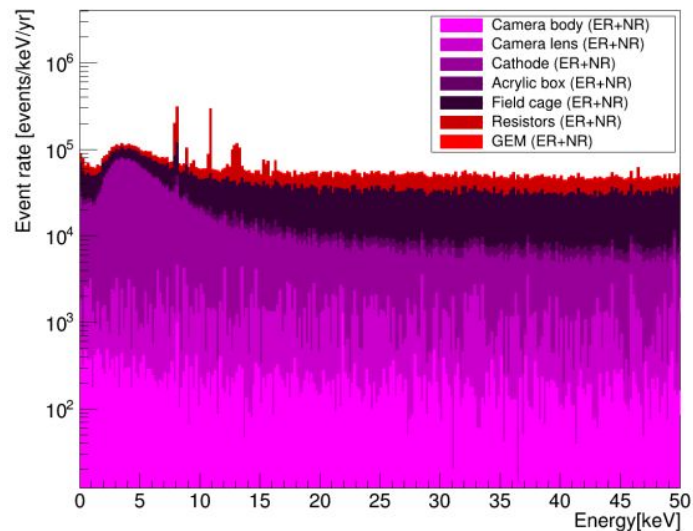
CYGNO simulation meeting

# Simulation progress of last months

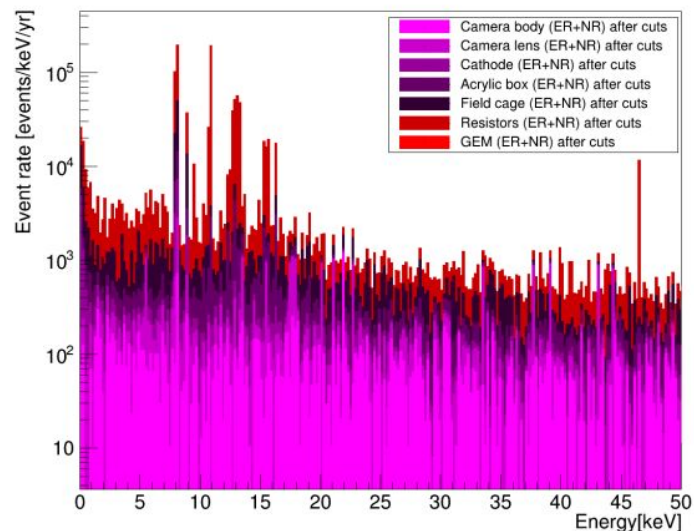
- LIME background simulations
  - finalized shielding design for LIME underground
  - completed background simulations (energy spectrum + hits information)
  - finalized plans for LIME measurements and MC validation
- CYGNO background simulations and ER simulations
  - full simulation for CYGNO 1m<sup>3</sup>, background for CYGNO\_04 estimated from scaling
- NR simulations
  - completed framework ready using SRIM
  - improved QF simulation
- Digitization
  - introduced saturation
  - done many data/MC comparison and found the best set of parameters to reproduce data
  - improved/optimized the code

# LIME simulations

## Internal background



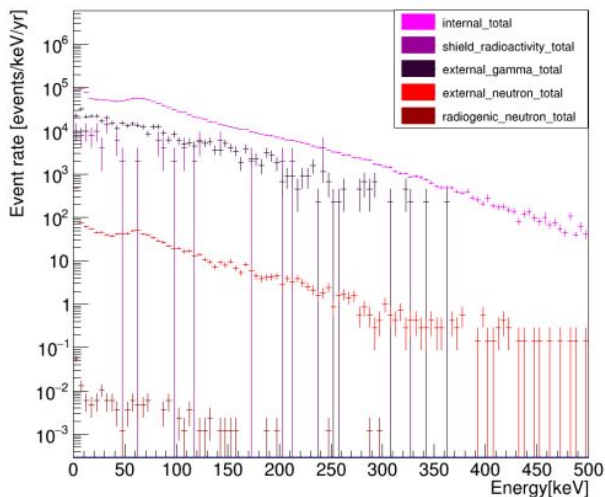
$7.4e6$  events/yr in whole range  
 $7.3e6$  events/yr above 1 keV  
 $5.7e6$  events/yr above 20 keV



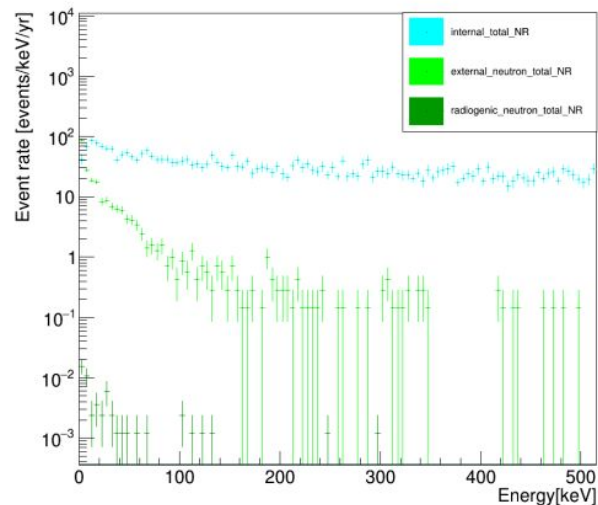
$2.8e5$  events/yr in whole range  
 $2.6e5$  events/yr above 1 keV  
 $5.2e4$  events/yr above 20 keV

# LIME simulations

## Third phase: 10 cm of copper

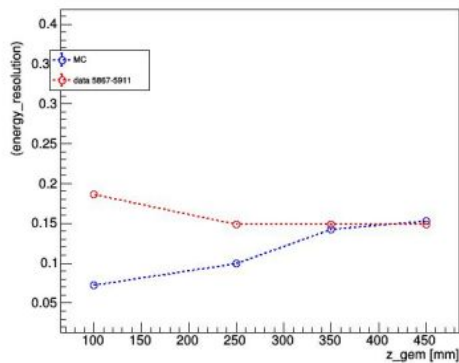
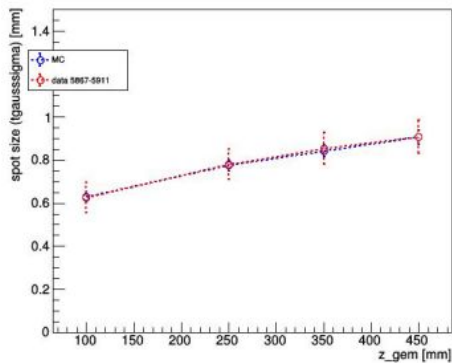
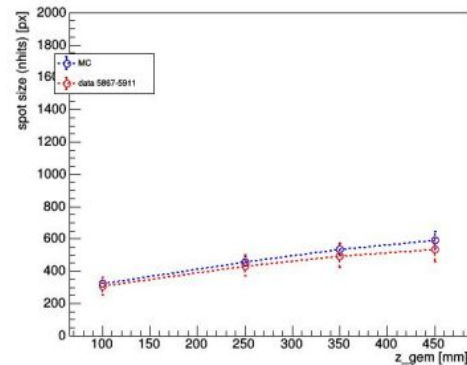
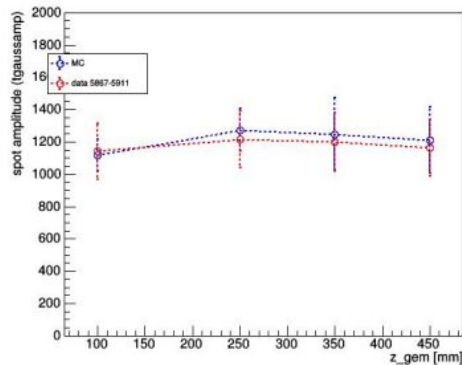
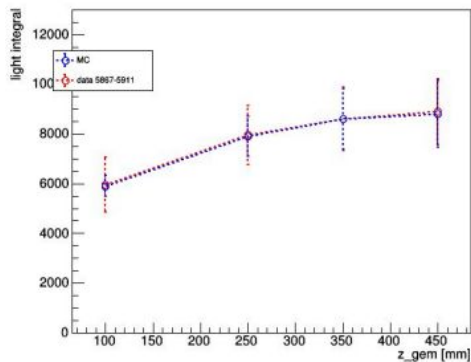


From external gammas:  $1.98(5)e6$  ER/yr  
From shielding:  $5.7(7)e5$  ER/yr



From external neutrons:  $1.13(3)e3$  NR/yr  
From radiogenic neutrons:  $0.29(4)$  NR/yr

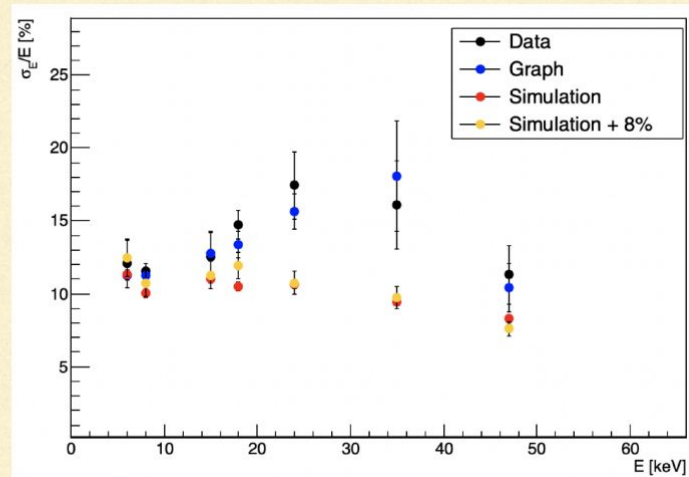
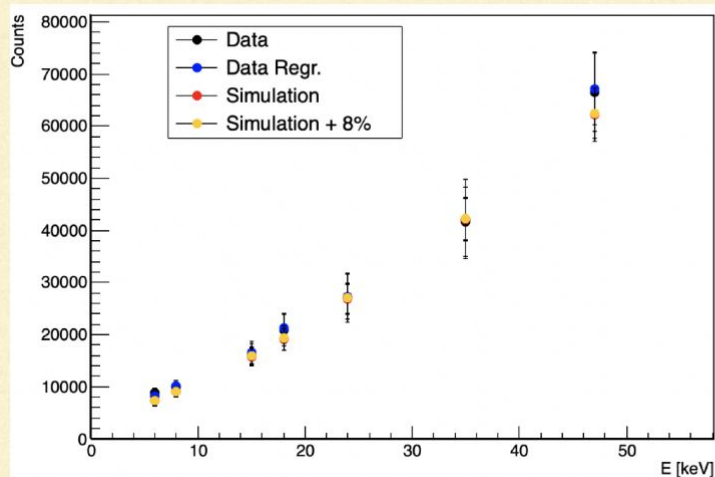
# Comparison with $^{55}\text{Fe}$ data z scan



Best digitization parameters  
(z\_rand=0 mm)

# Comparison vs data xray sources

- Data < 300 px
- Regressed data < 300 px
- Simulation with fluctuation before sensor + vignetting < 300 px
- Simulation with fluctuation before sensor + vignetting + 8% gaussian fluctuation on electron exiting from GEM 3 (overall fluctuation to take into account variation on GEM 2 and GEM 3)



# Plans & to do

- LIME background simulations
  - to be validated with LIME data underground
  - full simulation of tracks (including hits info in the output file + digitization)
- CYGNO background simulations and ER simulations
  - to do full background simulation using latest design
- NR simulations
  - produce high statistic samples to study CYGNO performance
  - data/MC comparison as soon as available (AmBe, ?)
- Digitization
  - produce high statistic samples to study CYGNO performance
- PMT simulations
  - finalize PMT simulations and integrate in digitization code

Flaminia + ?

Giulia + ?

Flaminia + Atul + ?

Samuele + ?

Mariana, Rafael + ?

**...new people welcome!**

# INFN Cloud

- We should move simulation workflow to INFN cloud
  - in principle easier to upgrade resources (cpu, storage)
- Geant4 simulation tested on cloud and working
- Condor queues tested and working
- Digitization not yet tested but in principle possible
- Reconstruction tested...?

The best is to do all the steps (simulation+analysis) on the cloud