NEWS

20th of May 2021

Meeting with referees

Status report with referees last week:

This project, has now almost **50 collaborators**, from **8 Institutions** in **4 Countries**

Recent results were presented:

- electroluminescence, hydrocarbon and resistive foil FC R&D;
- saturation and signal simulations;
- studies on directionality sensitivity;
- progress on DAQ and trigger systems;
- test of GAS system and development of filtration stage;
- preliminary results AmBe-LIME analysis;

Meeting with referees

An important part was devoted to LIME situation:

- performance with ^{55}Fe;
- hint about PMT issues and studies of fast signals;
- status and plans about the underground lab civil works;
- ongoing commissioning and plans for LIME characterisation before the installation at LNGS;

All activities on these different items were appreciated and the report had a positive feedback;

Meeting with referees: documentation

INFN is trying to standardise the communication with experiments;

Collaborations will be required to use standard templates to submit CDR, TDR and periodical status reports to referees;

Our referees agreed that our CDR (https://doi.org/10.15161/oar.it/73356) is fine for this phase;

Two steps are needed:

1. submit a progress report by July;
2. submit a complete TDR describing the final demonstrator when final decisions will be taken about all details;

Other documentation

In order to being able to write the TDR, we should know what will be the room available at LNGS;

To make a proper request:

- we should decide what we really want and what is financially possible;

- write a CDR++ (or TDR- -) to submit (exploiting the the experience gained with LIME);

- **tentative schedule**: CDR++: submit Feb-22, Approval June-22, TDR submit Sept/Dec-22

In the meanwhile we are finalising “the CYGNO paper” (thanks to Elisabetta and Giorgio!), soon to start the internal review; it will be useful as a basis for the general part of the CDR++;

Simulation: LIME shield

Flaminia is working at LIME Shield simulation: can we use Opera Lead to make 5 cm Cu + 5 cm Pb?

Background rates

PRELIMINARY

- **40cm water + 10cm copper**

External gammas (0.56 cm^{-2} s^{-1})
(ER): (2.05±0.10)×10^5 events/yr (total)
(ER): (4.0±0.4)×10^4 events/yr (0-20 keV)

External neutrons (2.7×10^{-6} cm^{-2} s^{-1})
(ER+NR): (23.6±0.6) events/yr (total)
(ER+NR): (9.9±0.3) events/yr (0-20 keV)
(Only NR): (4.7±0.1) events/yr (total)
(Only NR): (3.2±0.1) events/yr (0-20 keV)

With Cu: 4.0×10^4 ER/yr (0-20keV)
With Pb: 4.5×10^4 ER/yr (0-20keV)
Internal background:
0.5-1.0×10^5 ER/yr (0-20keV)

- **40cm water + 5cm lead + 5cm copper**

External gammas (0.56 cm^{-2} s^{-1})
(ER): (1.8±0.5)×10^5 events/yr (total)
(ER): (3.9±2.2)×10^4 events/yr (0-20 keV)

External neutrons (2.7×10^{-6} cm^{-2} s^{-1})
(ER+NR): (30.1±0.3) events/yr (total)
(ER+NR): (12.1±0.2) events/yr (0-20 keV)
(Only NR): (4.38±0.09) events/yr (total)
(Only NR): (2.66±0.07) events/yr (0-20 keV)

Radioactivity from 210Bi*:
(ER): (2.47±0.05)×10^4 events/yr (total)
(ER): (6.2±0.3)×10^3 events/yr (0-20 keV)

*(80Bq/kg×5658.7kg of lead = 452693 Bq)

If confirmed difference in background rate between copper and lead configurations is small – using lead might be a good choice

To be cross-checked

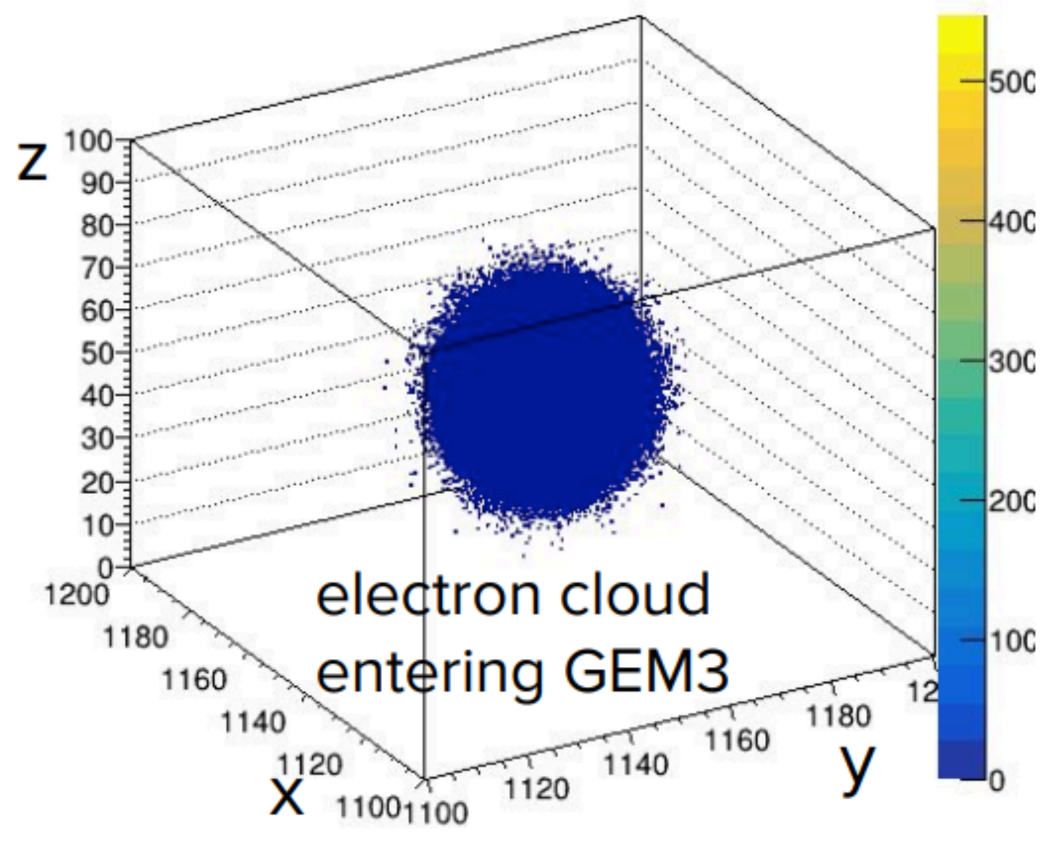
Simulation: Saturation

Method:

- Add absorption length parameter for e- in the gas λ: $n = n_0 \exp(-z/\lambda)$
- Only GEM3 saturated, G1 and G2 simulated as before
- Simulate the 3D cloud of electrons entering GEM3:
  - spatial smearing given by σ_{0T}, σ_T and σ_{0L}, σ_L and drift distance z
  - divide electron cloud in voxels 160(x) x 160(y) x 100(z) μm^3
  - apply formula of saturated gain in each voxel

$$G = A \frac{g}{1 + \frac{n}{n_h}(g-1)}$$

- Conversion to number of photons as before



Giulia introduced:

- electron absorption in gas;
- gain saturation on the last GEM;
- behavior of GEM gain and $\epsilon = \epsilon_{extr} \times \epsilon_{coll}$