

Minutes of first GRAIN Working Group

22 September 2022

Lea Di Noto, Alessandro Montanari

The Zoom meeting starts a few minutes after 11:00 AM CET.

The agenda of the meeting foresees an open discussion on the status and plans of simulation of GRAIN.

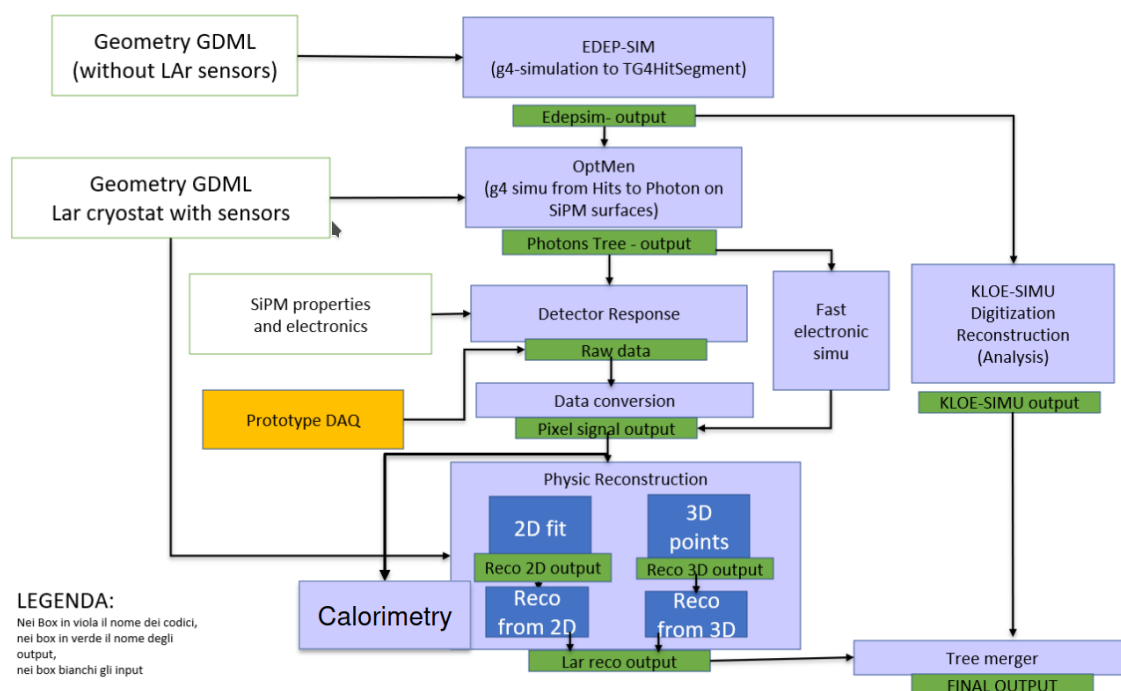
In order to trigger the discussion A.M. shows some slides, where the following points are raised.

- In order to define requirements for the readout electronics (ASIC) it is necessary to know the arrival times of photons to the sensor during the spill, taking into account the background, scintillation properties of LAr (eventually plus Xenon doping).

- Besides, still unknown items of the mechanics depend on the readout electronics like the number of feedthroughs, power consumption, supports for the detectors.

- For all these reasons, an accurate simulation is needed, starting from the neutrino interaction and background, scintillation process, photons propagation taking into account Raileigh scattering sensor response and frontend electronics.

A diagram by Valentina C. with the status of simulation with the various blocks is shown:



Three main tasks are identified:

- 1) Implement the new geometry of internal and external vessel.

Gianluigi Piazza will provide a step file with the new geometry and structure of the internal vessel. Gianfranco Ingratta proposes to implement the geometry in the Geant4 simulation suite.

- 2) Study time distribution at the output of OptMem simulation module (different types of neutrino interactions plus background) inside a spill (10 usec).

Gianfranco Ingratta is already studying the time distribution of tracks in GRAIN, by studying the edep-sim output.

A simulation of the photons impinging on the photosensor during a spill is necessary. It is not trivial to run Optmen for all the event in the spill and not for a single event.

A study of the time distribution of photons impinging on the photosensor is necessary both for single neutrino interaction event in GRAIN and for a full spill simulation in order to optimize the electronics readout.

A production of single neutrino interaction in GRAIN and a spill simulation is planned. Both the data set have to be produced with the more recent geometry and after checking that the scintillation properties are set correctly in edep-sim. Gianfranco with the support of Matteo V. is devoted to work on these items.

- 3) Detailed simulation of frontend electronics : charge integration, time-over-threshold, TDCs...

Valentina Cicero, with the help of Nicolò Tosi, has already implemented a model of the SiPM and the frontend electronics based on time-over-threshold circuit as the Alcor ASIC from INFN-Torino. This model will be useful for simulating the data we are planning to collect in ARTIC with the first prototype and it will be a possibility for the final design of the ASIC for GRAIN.

The possible architectures which can be exploited for the ASIC of GRAIN are:

- *Switch capacitors waveform generators*
- *rising edge (CITIROC)*
- *Alcor based on Time-Over-Threshold*

After analyzing the results from the study of the time distribution of photons and on the Alcor prototype, we will optimize the readout electronics for GRAIN.

The people interested on working on this item are: Alessandro Montanari, Valentina Cicero, Nicolò Tosi, Michele Pozzato, Lea Di Noto

At the end of the meeting at 12:30 , Lea proposes to move GRAIN simulation meeting to Thursday morning at 11:00, in alternance with the GRAIN Working Group meeting every other week. The proposal is accepted by participants.