# MINUTES FROM GRAIN WORKING GROUP MEETING MAY 5th 2022

Attendance:

Lea Di Noto, Alessandro Montanari, Giuliano Laurenti, Nicolò Tosi, Alessandro Ruggeri, Gabriele Sirri, Gianluigi Piazza, Giovanni De Matteis, Matteo Vicenzi. Matteo Tenti, Michele Pozzato, Paolo Bernardini, Valerio Pia, Marco Guerzoni.

## Talk from G. Laurenti about the current cryostat design:

The current design has the following dimensions:
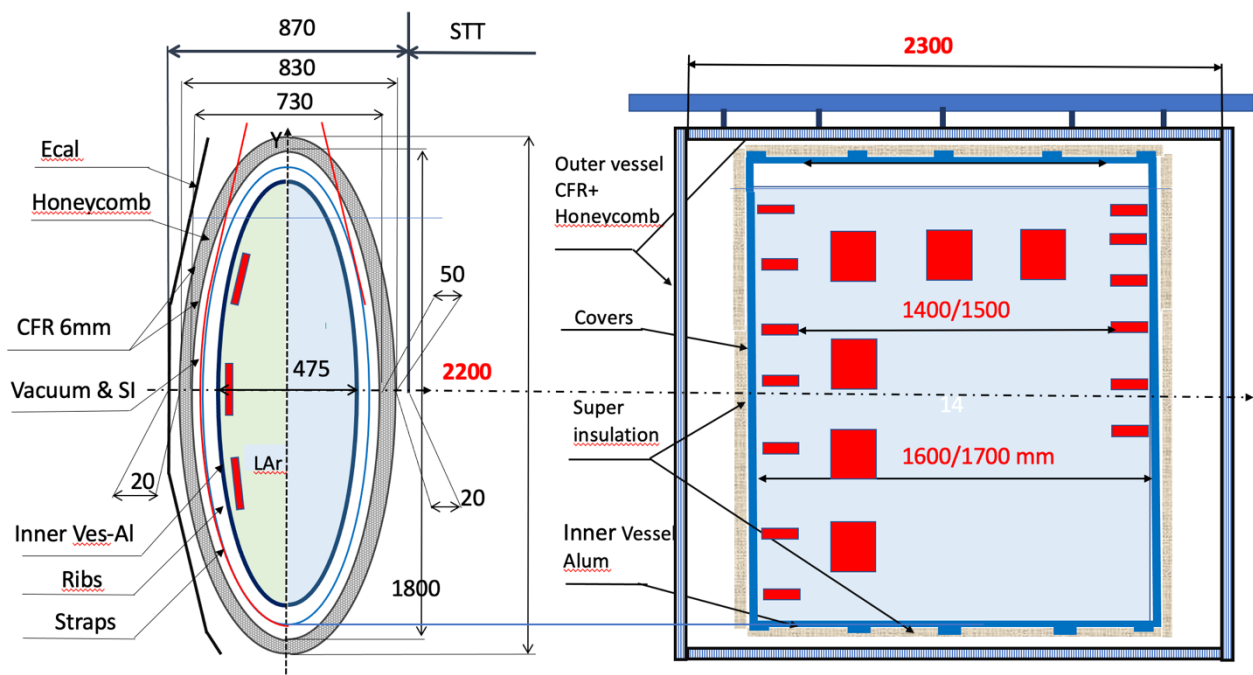
Grain Cryo 1 ton Lar fiducial volume - tentative dimensions

This drawing was guided by the requirement on the thickness: 12 mm for the inner cryostat in aluminum

The external cryostat is made by two external layers of 6 mm carbon fiber with honeycomb inside (40 mm width).

Outer Vessel · CFr Skins 6mm · Honeycomb
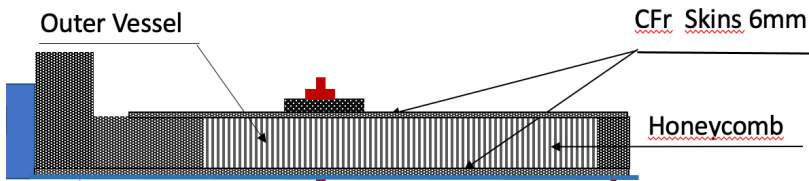
The total available volume is 0.7 m^3

The current dimension along the X is 1300 mm and the mechanics group is investigating the possibility to extend the X dimension to 1600-1700, to compensate the space needed by the lens sensor (110 mm between SiPM sensors and the outer surface of the lens) for keeping the total effective volume close to 1 ton.

If the inner vessel dimension is extended to 1600 / 1700mm, the outer vessel inner dimensions will be about 2300 mm along the X axis, 730 along Z and 2200 along Y.

The current design was checked by simulations performed by an external company, who stated that the design is quite conservative and there are some margins.

Discussion:

For improving the design, some further information is necessary:

- which feedthroughs are we planning to use for the sensor readout?   (G. Laurenti)

- which amount of heat loss can be tolerated?   (G.Laurenti)

- which geometry for sensors can we use?   (A.Montanari)

　　for lenses, you can consider the geometry shown in the meeting of 7th April, for mask we have to finalize that

-the next goal is to design a cryostat with an effective volume of 0.7 m^3, also considering the gas volume (15 cm from the top of the cryostat) and the lens dimensions (110 mm from SiPM surface)

Thinking to optimize the cryostat dimension:

-for the robustness of the design, an aspect ratio of the ellipse axis closer to 1 is favored

- if we want to decrease the thickness along the neutrino axis, the X dimension must be increased for keeping 1 ton LAr mass, but this will probably increase the vessel thickness dimensions. The current thickness of 12 mm was a first guess, the simu/physics group can check this number, together with the total cryostat thickness along the Z axis. How much do we gain for neutrino interaction reconstruction if the cryostat has thicker surfaces but smaller width along the Z dimension?

The figure of merit for this study is related to the SAND physics and to the SAND performance for neutrino interactions in LAr, in ECAL and in STT.

The mechanics group can investigate other solutions when this point is clarified. If the X dimension is increased, the outer cryostat is more critical than the inner cryostat, more ribs must be added.

How is it designed the opening procedure?

The inner cryostat will be opened from one side with an aluminum elicoflex. This method was already used in other cryostats at CERN.

The outer cryostat will be opened by the same side of the inner cryostat, with a CF viton-oring flange (see image below).

Grain Cryostat Schematic cross-section

Final discussion about other items

1. The table provided by Claudio Montanari concerning the future deliveries related to the GRAIN detector, which are expected by the DUNE collaboration, was discussed, and uploaded on the indico page

2. The planned talk for the upcoming DUNE general meeting will be focused on:
   - Lens simulations and reconstruction performances,
   - Matrix simulations and reconstruction performances.

   The results about track reconstruction with images achieved by the LECCE group are still preliminary and they will be shown at the next general meetings.