Parallel sessions on cooling the ET Cryo-Mirror

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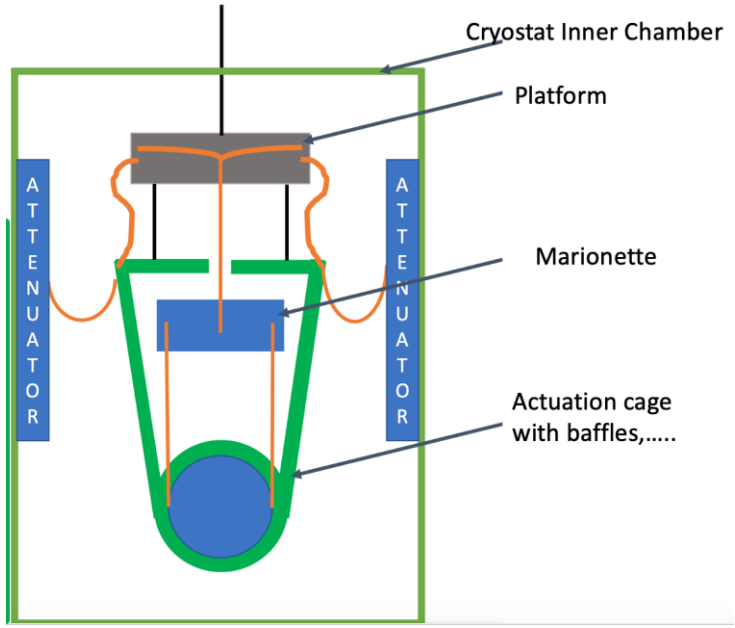
Parallel session: first round

Outcome of the parallel session on Tuesday



Values can be stored in the ET wiki page, but we need to add clearly the caveat that these numbers concern a long term vision on the use of the cryostat https://wiki.et-gw.eu/ISB/MaterialsDatabase/WebHome

To design the cryostat we refer to a long term vision of the future payloads

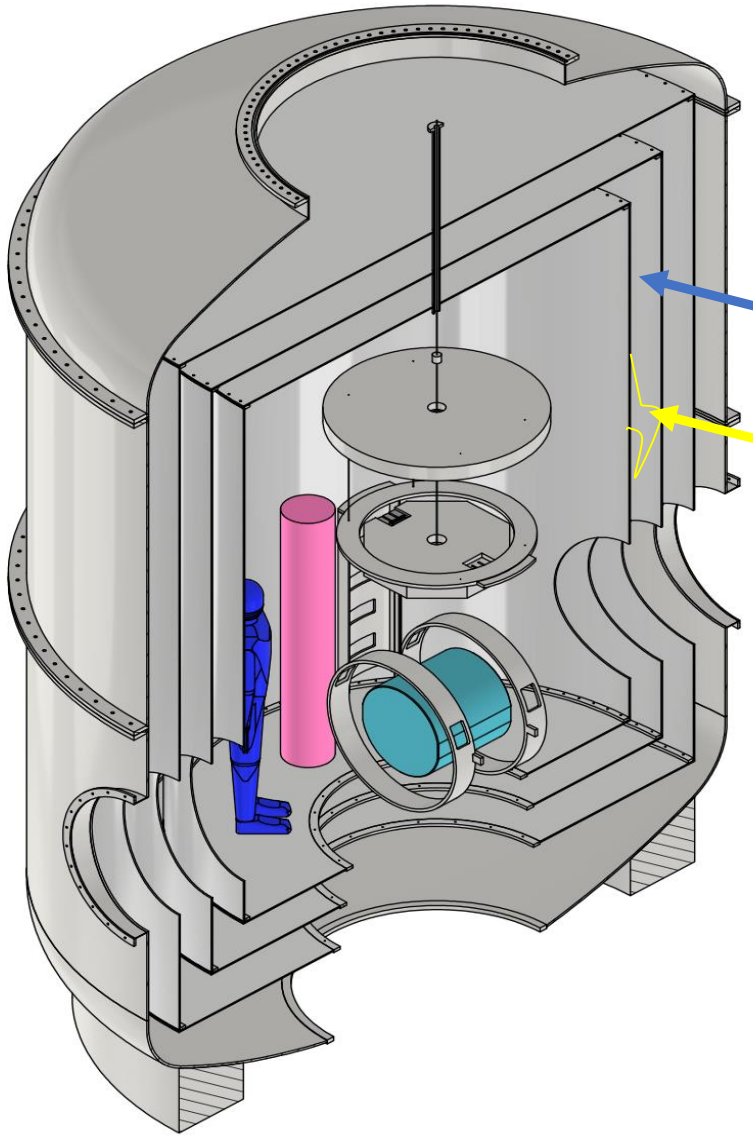
We assume a double pendulum configuration (this assumption influences the slope of the suspension thermal noise).

Payload geometry ➔ Values are assumed on base of our guess on the future technological developments
e.g.
Maximum diameter of the mirror to be hosted in the cryostat 600 mm
Maximum length of the suspensions (1.2 m from mirror to marionette – 1 m from marionette to platform)
Maximum heat load assume to design the cryostat: 0.5 W
This is a conservative assumption and the value includes necessary safety margin based on the usual approach of the cryogenic engineering.

For the time being these values will stored in the LF payload wiki page by stating clearly that we are referring on our vision of the long term evolution of the technology. Than we will move it in the new data base

Include in the thermal simulation the effect of the thermal conductivity of the bonding (Glasgow can provide reference values in [W/K m]) and the educated gues fr the contact resistences

Cryostat design



How to cool the inner chamber?

Using supercritical He we can cool the second shield. Then we extract the heat from the inner shield via radiation and conduction by coupling the two shield with Al6N braids.

We must to evaluate the residual noise generated by the flow of the supercritical He on the second thermal shield. (Alternative approach is the use of HeII)

Measurement of the thermal and the mechanical transfer functions of Al6N braids are needed
Measurements in KAGRA availble are and in Rome/LNGS (Angelo Cruciani)

Parallel session: second round

Outcome of the parallel session on Thursday (1/2)

- Cryogenic infrastructure
  - Surface building requirements to be refined
  - Space needed close to the ET-LF cryostat for cryogenic supply components
  - Coldboxes in/near vertex caverns:
    acoustic noise generation (high-frequency turboexpanders) to be investigated
  - Underground safety measures due to presence of cooling fluid(s):
    requests to infrastructure division to be worked out
    (N_2 potentially more impactful)

- Cooling of warm/hot equipment via chilled water only:
  requirements for civil infrastructure to be specified

Outcome of the parallel session on Thursday (2/2)

- Payload design
  - Total payload mass ≈ 800 kg
    (TM ≈ Marionette ≈ Cage ≈ Platform ≈ 200 kg)
  - Cage design: investigate possibility to increase view angle
    TM ↔ shield to support cool-down
    (shift Cage mass towards top)
  - Multiple soft thermal links (Al6N) for better thermal connection advised between Platform and Cage for cool-down