Membrane cryostats for large volume neutrino detectors

European cryogenic days

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Agenda

1- Company overview

2- A first prototype: 17 m³ LAr tank

3- Two new 600 m³ LAr tanks

4- Next step
Company overview
GTT in brief

► An engineering company with more than 50 years of experience in the design of the Membrane Cargo Containment Systems for cryogenic liquids

► GTT is a public company listed on the Euronext Stock Exchange (Paris)

► About 120 ships and onshore tanks currently on order

► Around 380 highly qualified people, mainly at head office, but also present worldwide

► One project already designed for CERN and two others ongoing
GTT membrane technologies

**NO96 system**

- Primary Invar membrane
- Invar tongue
- Coupler
- Secondary Invar membrane
- Inner hull
- Secondary insulation box
- Primary insulation box

**Mark III system**

- Primary stainless steel membrane
- Corner panel
- Hard wood key
- Top bridge pad
- Metallic insert
- Insulation panel
- Resin ropes
- Composite secondary membrane (Triplex)
- Inner hull
A first prototype: 17m$^3$ Lar tank
Context

- **Main targets of the « prototype », a 17m³ tank containing liquid Argon**
  - Approving membrane technology in contact with Argon (keep the Argon very pure)
  - Approving the thermal efficiency of the insulation system
  - Approving the instrumentation system developed to detect neutrinos
A real challenge for GTT

First time for GTT to design container for Liquid Argon:
- Argon specificities
  - -188° C
  - 1400 kg/m³
- Keep an high purity of the stored Argon (no pollution from containment system)
- Tightness of the primary container reaching 10⁻⁹ mbar.l.s⁻¹

Tank: Three liners of insulation (1m)
- Thermal flux limited to 5W/m²
- Foam density: 70kg/m³

Top cap
- about 20 crossing pipes in 6m²
- Removable element
An innovative solution

- **Adapted to CERN needs:**
  - 3 isolating layers: 400mm + 2*300mm
  - Specific panels arrangement
  - Double containment

- A mix between two insulation systems made of:
  - Stainless steel (tank)
  - Invar (Top Cap)

- Dedicated corrugation arrangement (1.2m high) in upper part of the tank
Construction already completed

- **Containment system for tank:**
  - Built at CERN premises
  - By GABADI, a company specialized in the GTT's membrane system installation

- **Containment system for top cap:**
  - Built at GABADI premises
  - Already delivered at CERN

- **Next steps:**
  - Instrumentation installation is ongoing
  - Top cap installation scheduled during summer
  - Cool down of the tank in the second half 2016
Two new 600 m³ LAr tanks
CONTEXT: Two different detectors

- GTT’s system has been selected for this new step of development

- NP02 tank:
  - Double phase TPC (Time Projection Chamber) as a prototype for the DUNE experiment

- NP04 tank:
  - Single phase TPC as a prototype for the DUNE
A new challenge for GTT

- Two liners of insulation (0.8m)
  - Triple containment system
  - Foam density: 90kg/m³

- First time for GTT to design:
  - Pipes crossing 3 liners
  - High density of crossing pipes (mainly on top side)
    - About 60 elements from Ø30 to 700mm
Next step
Final goal?

LBNF/DUNE project
Thank you for your attention

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