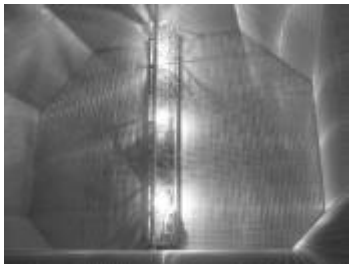
Expert in LNG

Membrane cryostats for large volume neutrino detectors

European cryogenic days







June 9th, GENEVA

Disclaimer

Agenda

- ▶1- Company overview
- ▶2- A first prototype: 17 m³ LAr tank
- ▶3- Two new 600 m³ LAr tanks
- ▶4- Next step

1 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)

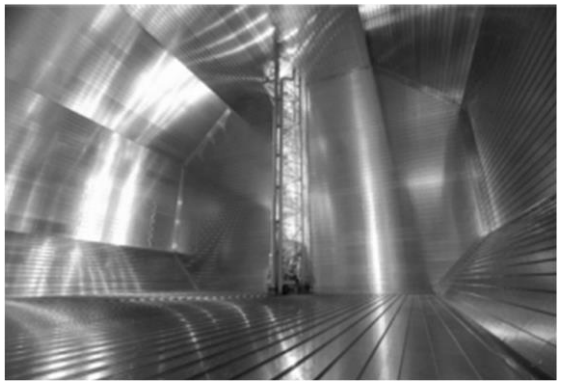
- About 120 ships and onshore tanks currently on order

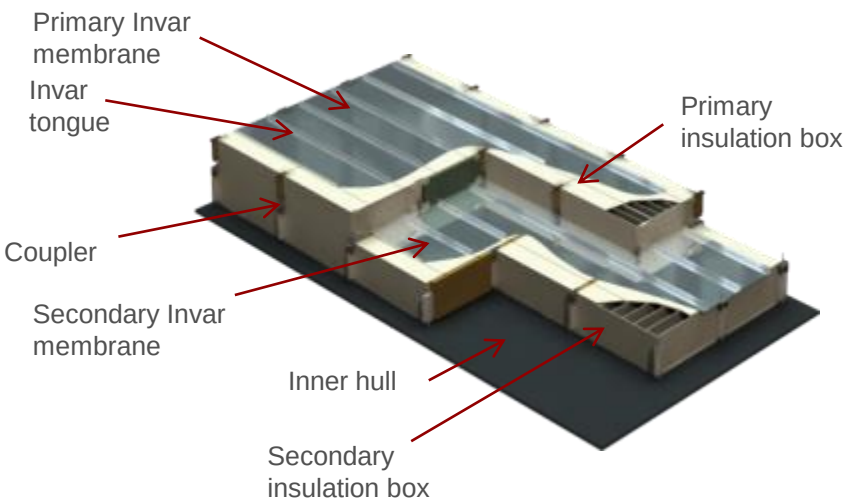
- Around 380 highly qualified people, mainly at head office, but also present worldwide

- One project already designed for CERN and two others ongoing

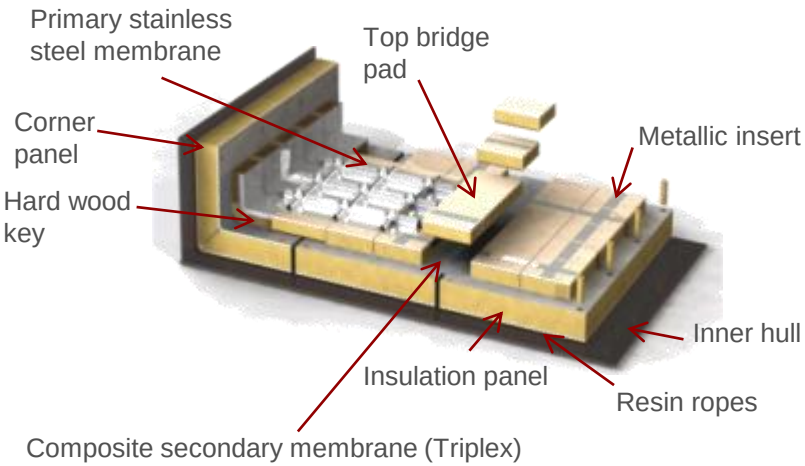
GTT membrane technologies

NO96 system





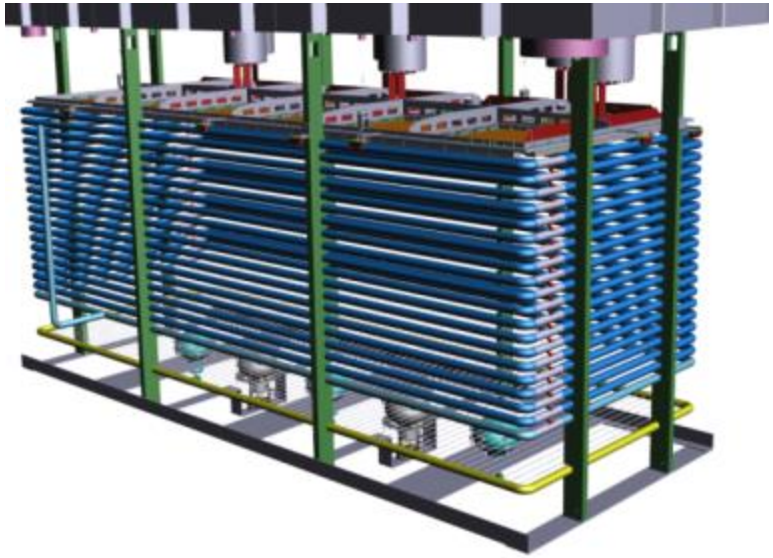
Mark III system



2 A first prototype: 17m³ 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

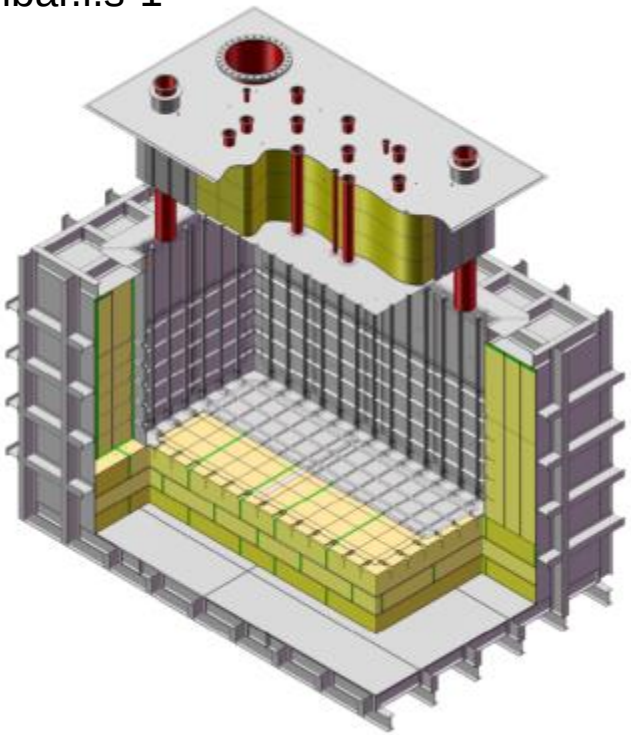


A real challenge for GTT

- **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

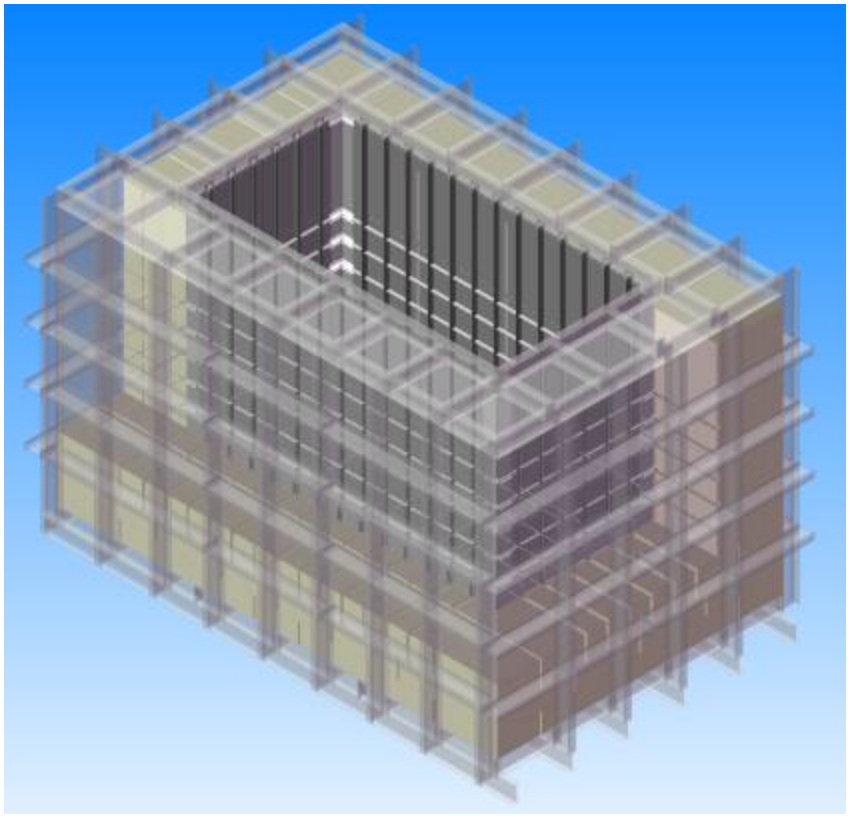
- **Tank: Three liners of insulation (1m)**
  - Thermal flux limited to 5W/m²
  - Foam density: 70kg/m³

- **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

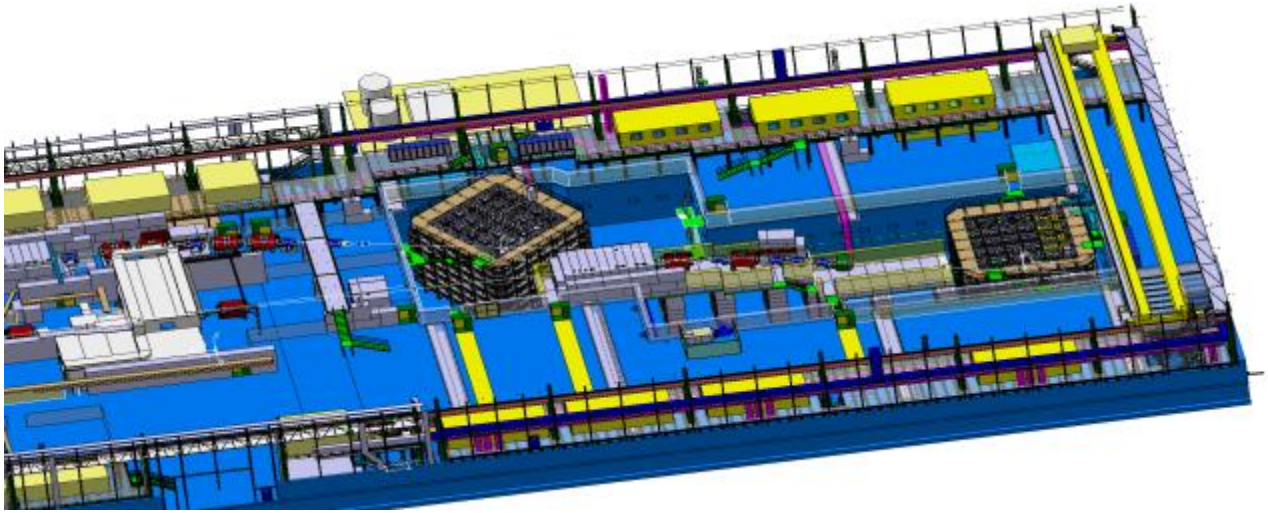
3 Two new 600 m³ LAr tanks

CONTEXT: Two different detectors

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

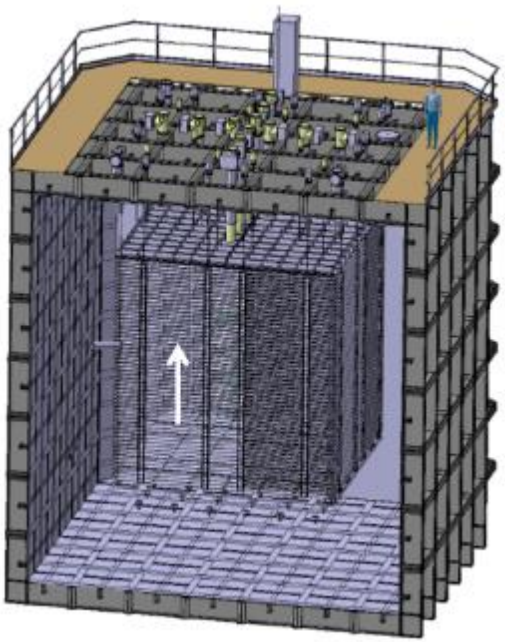
- **NP02 tank :**
  - Double phase TPC (Time Projection Chamber) as a prototype for the DUNE experiment

- **NP04 tank :**
  - Single phase TPC as a prototype for the DUNE

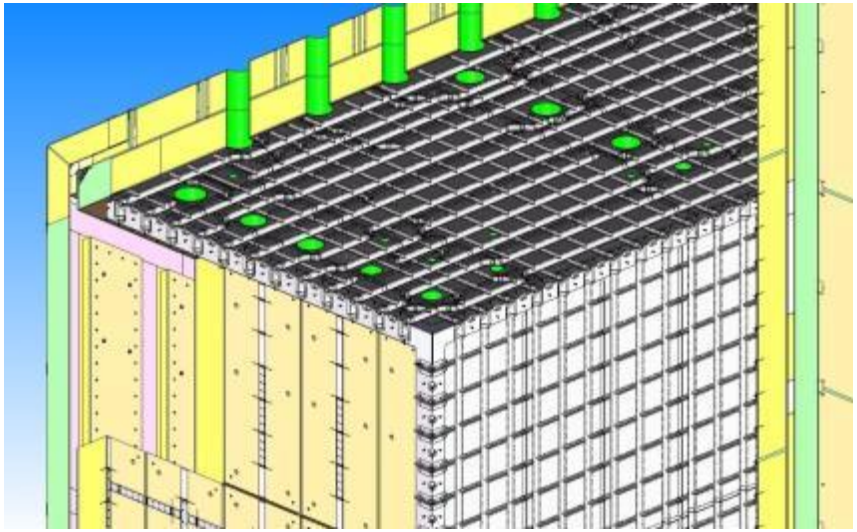


A new challenge for GTT

- **Two liners of insulation (0,8m)**
  - Triple containment system
  - Foam density: 90kg/m³

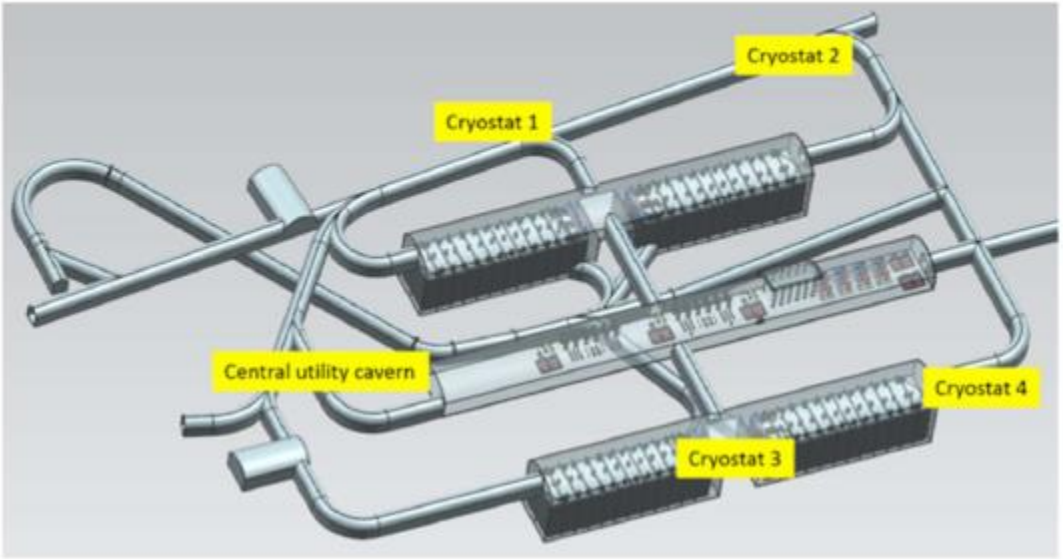


- **First time for GTT to design:**
  - Pipes crossing 3 liners
  - High density of crossing pipes (mainly on top side)
    - About 60 elements from Ø30 to 700mm



4 Next step

Final goal?



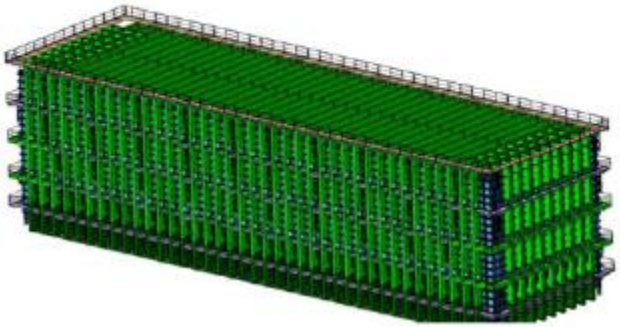
4 detectors in 4 caverns

1'500 m underground

~ 17'400 tons of LAr / detector

Inner dimension (liquid+gas):

- L = 62.00 m
- W = 15.10 m
- H = 14.00 m



LBNF/DUNE project

Thank you for your attention

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