# ICARUS

## Imaging Cosmic And Rare Underground Signals

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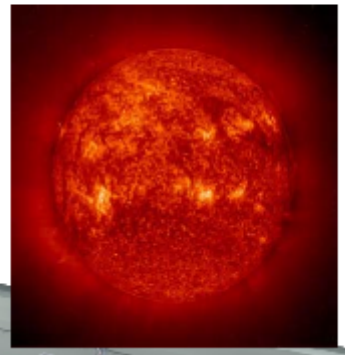
# Physics aims

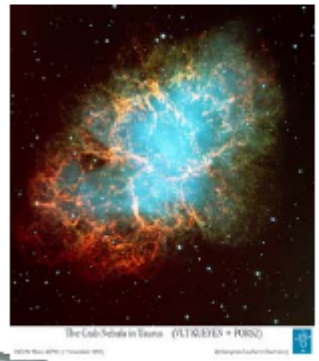
**Physics program:**

**A second generation proton decay experiment and neutrino observatory at the Gran Sasso Laboratory**

Solar ν's



Supernova ν's

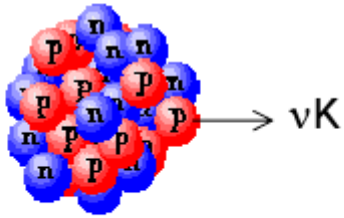





Atmospheric ν's



Nucleon decay

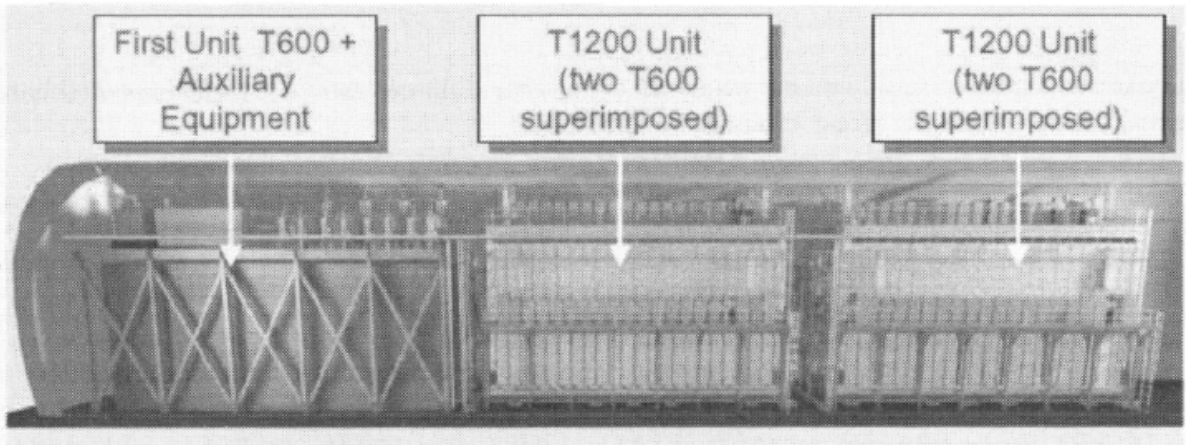



CNGS ν-beam

# Construction

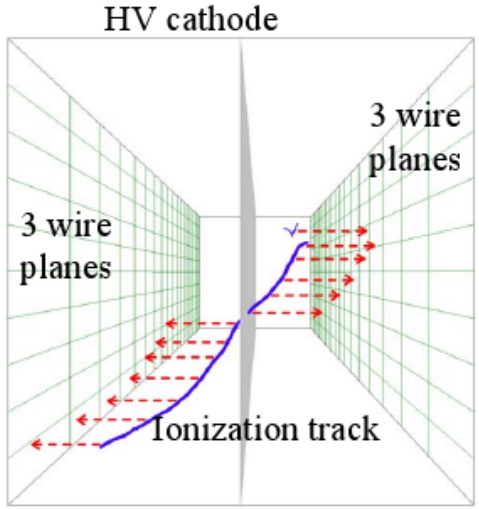
## ICARUS T600

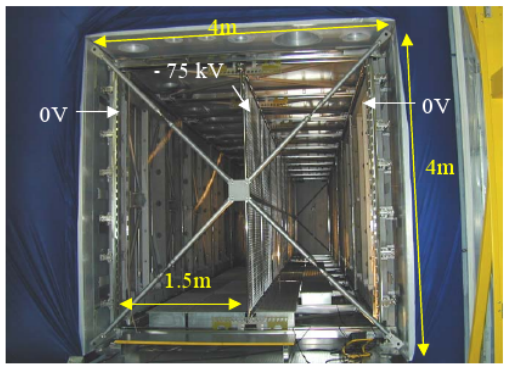
- Technology first proposed by C. Rubbia in 1977
- First proposal 1985, first test run 2001 (half T600)
- In principle it is EM calorimeter
- Underground
- Large cryostat divided in 2 identical, adjacent half-modules
- Internal dimensions $3.6 \times 3.9 \times 19.9\,\mathrm{m}^3$ per module
- 300 t of liquid argon (LAr) per module



# Basic principles

- Large volume of LAr ensures that most of charged particles are stopped
- If particle (e.g. $\mu$) is not stopped, momentum is measured using multiple scattering and $\mathrm{d}E/\mathrm{d}x$ capability of TPC is used
  - Energy resolution (T1800)
    - $\frac{\sigma}{E} = \frac{11\ \%}{\sqrt{E\ (\mathrm{MeV})}}$ for $E < 50$ MeV
    - $\frac{\sigma}{E} = \frac{3\ \%}{\sqrt{E\ (\mathrm{GeV})}} \oplus 1\ \%$ for EM showers
  - Momentum resolution is about 20 % for 10 GeV muons
- Tracking is provided by a suitable set of electrodes (wires) at the end of drift path
  - Wire pitch 3 mm
  - Resolution 250 $\mu$m along drift direction and 1 mm for other directions



# Advantages

- Argon is easily available, has high electron mobility and possibility for purification
- Calorimetry and tracking
- Fully electronic
- Large homogenous tracking medium
- Wide neutrino energy range
- Electron lifetime longer than maximal drift time

# Disadvantages

- EM calorimeter only
- Some particles escape from the volume
- Not completed ($2 \times 2$ T600 modules missing)