Need a logo

LArIAT Notes

August 23, 2012

Karol Lang

University of Texas at Austin

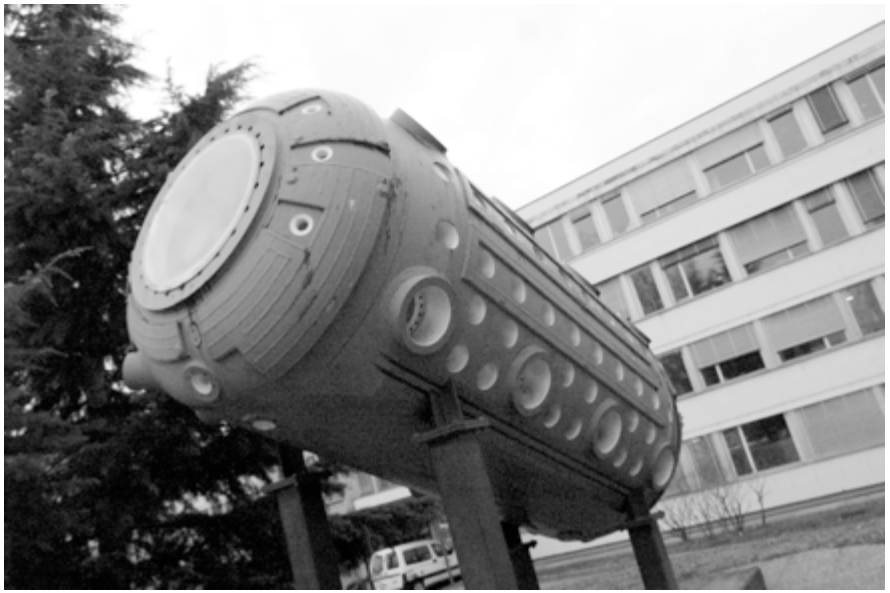
Outline

1. Historical perspective
2. Cost drivers
3. Size optimization

Need a logo

Historical perspective

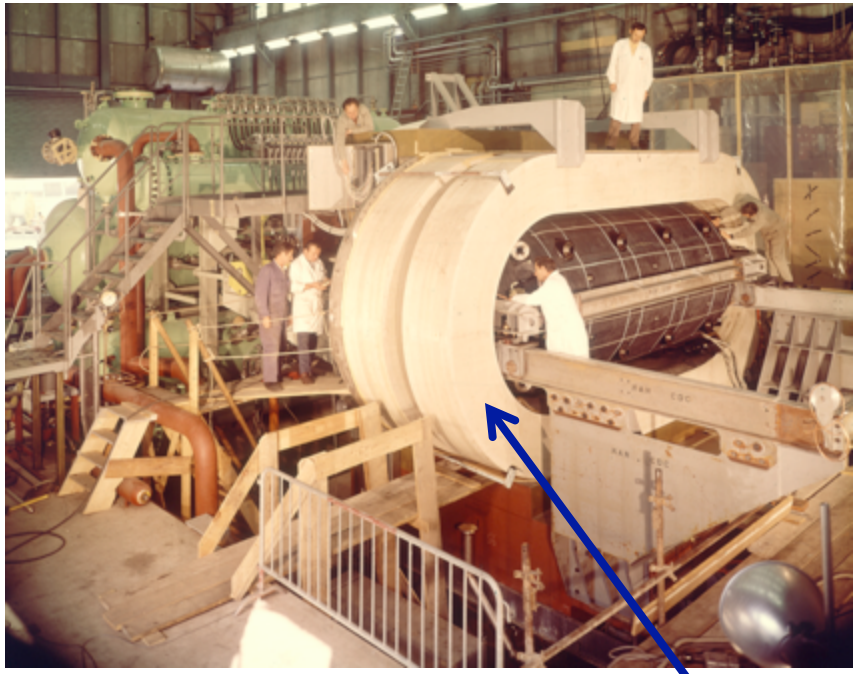
- LAr TPC's are often advertised as modern bubble chambers.
- From Wikipedia:
  - **Gargamelle** was a giant bubble chamber detector at CERN, designed mainly for the detection of neutrino interactions. Built in France, with a diameter of nearly **2 meters and 4.8 meters** in length, Gargamelle held nearly **12 cubic meters** of freon (CF_3Br). The usage of a heavy liquid, rather than the more typical liquid hydrogen, meant higher neutrino interaction probability, as well as easier identification of muons versus pions.
  - Gargamelle operated from 1970 to 1978 with a muon neutrino beam produced by the CERN Proton Synchrotron. These experiments led to one of the most important discoveries ever made at CERN: the experimental observation of the weak neutral currents was announced in July 1973,[1] shortly after their theoretical prediction.
  - For the experiment, approximately 83,000 neutrino events were analyzed, and 102 neutral current events observed. The signature of a neutral current event was an isolated vertex from which only hadrons were produced.

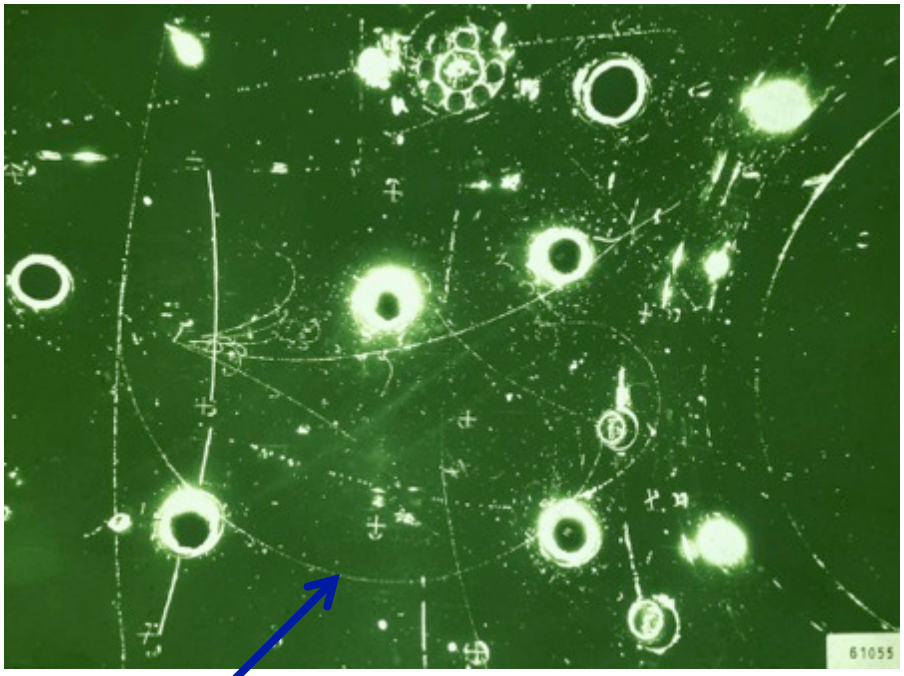


Properties	
Molecular formula	$CBrF_3$
Molar mass	148.91 g mol^{-1}
Appearance	Colorless gas
Density	1.538 g/cm^3 (–58 °C)
Melting point	–167.78 °C
Boiling point	-57.75 °C
Solubility in water	0.03 g/l (20 °C)
log P	1.86
Vapor pressure	1434 kPa (20 °C)

Need a logo

More Gargamelle



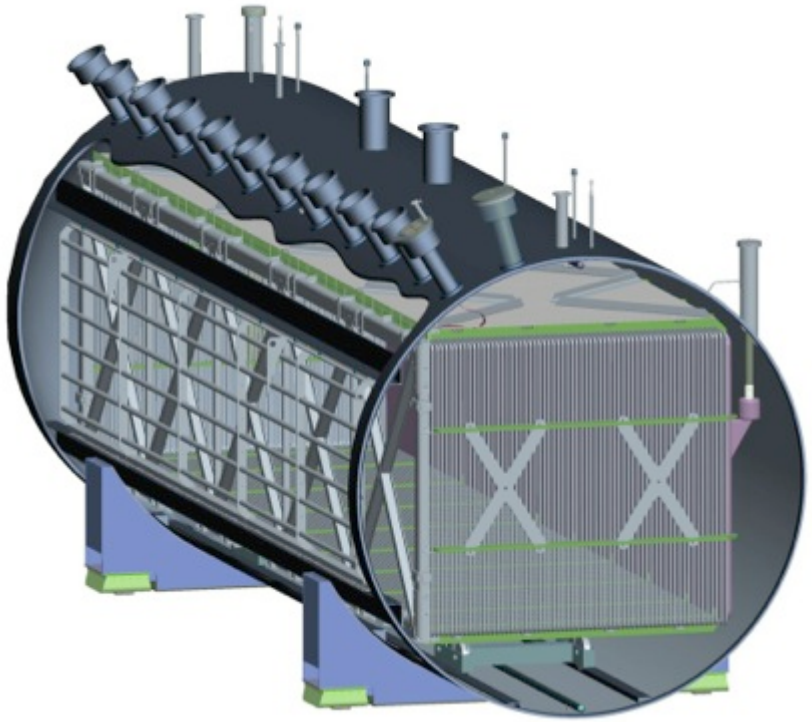


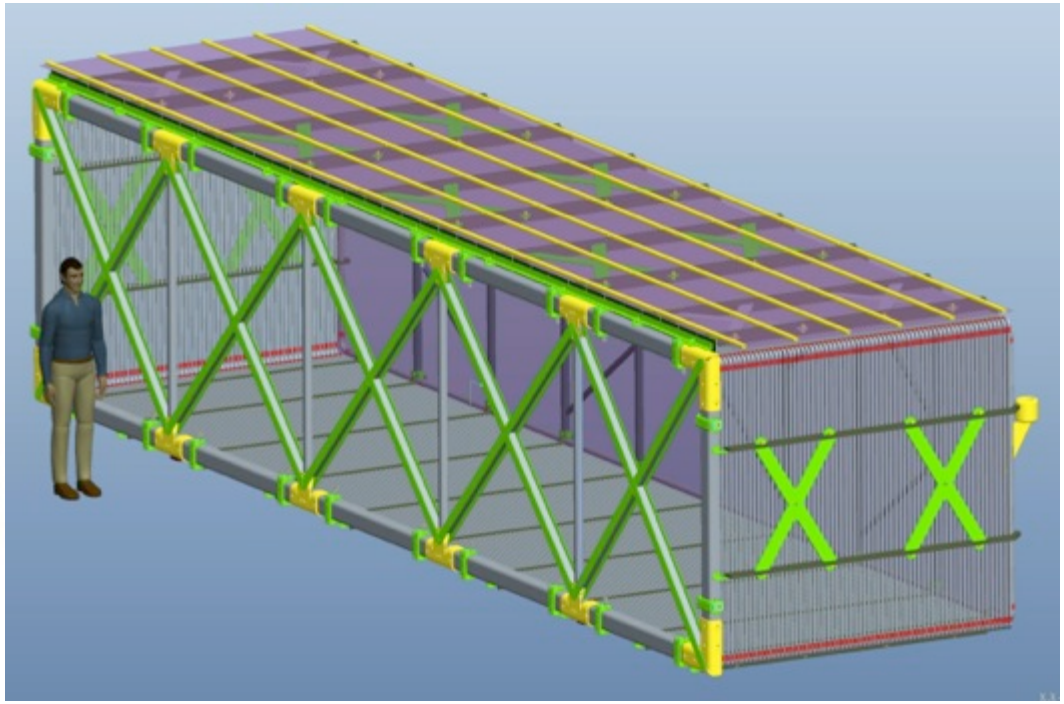
B field !

Hm… naa…

Need a logo

From Gargamelle to microBooNE





2.3250 m (vertical)
2.5604 m (horizontal)
10.3680 m (length) → 61.72 m^3

- Twice the length of Gargamelle
- No B field

3mm wire pitch → 9.5k channels

Need a logo

Cost drivers for a test beam

- Cost drivers (after uB and assuming the test beam is provided by Fermilab)
  - Cryo (Fermilab)
  - Front-end $200/channel
  - TPC (see below) $1M/10k ch → $100/channel
  - Everything else (~20%)
- **Proposal cost goal: possibly < $1M (or "dead on arrival") !**
- So strive for a minimal detector (it will cost quite a bit anyways)
- Suggest to build a "1/10 uB replica"
  - E.g., 1.5 x 1.5 x 2.75 m^3 →6.2 m^3 (uB is ~62 m^3)
  - Maximize (at least initially) granularity of readout (but not the detector) by ganging channels together
  - **E.g., 0 – 90 cm → U,Y,V readout → 300 x 3 views = 900 channels**
    90-150 cm → → 200/2 x 3 views = 300 channels (2 fold multiplexing)
    150-273 cm → → 410/3 x 3 views = 410 channels (3 fold multiplexing)
- Play creative "games" during data taking
  - E.g., moderate muons
  - Future upgrades (more electronics, larger cage, …)

Need a logo

Conclusions

- September 10 is the deadline
- Counting backwards, to be prudent: must have text and budget by September 1
- We have started writing and preparing the budget but **need help**.

- Need to work hand-in-hand with Fermilab to carve out
  - What can be done by the lab
  - What must be done by the collaboration (thus included in the proposal)
- Must start specific institutional commitments!
- How to divide the budget