High Energy Physics Activities at University of Granada

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University of Granada

Restricted ECFA Meeting

Barcelona

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University of Granada

Experimental High Energy Physics in U. Granada

- New experimental group
  - → Starting date: October, 2002
- Physics project approved for the period 2002-2005
  - → Funds coming from I+D National Plan FPyGA
    - ➢ Project number FPA2002-01835
  - → Recognized research group by Andalusian Regional Government
    - ➢ Additional funding (mobility, grants for students)
  - → Collaboration with Gran Sasso Lab in the framework of CICYT-INFN Cooperation
    - ➢ Mobility funds approved for 2003

High Energy Physics in Spain

Group Members

- Two senior researches
  - → Associated Professor (A. Bueno)
  - → Ramón y Cajal Researcher (S. Navas)
- Three Ph.D. students
  - →One F.P.U. student
  - →Two students awaiting grants from Andalusian Regional Government
- Posts to be filled…
  - →One F.P.I. grant to be assigned next autumn
  - →Approved project foresees money to hire additional students or technicians

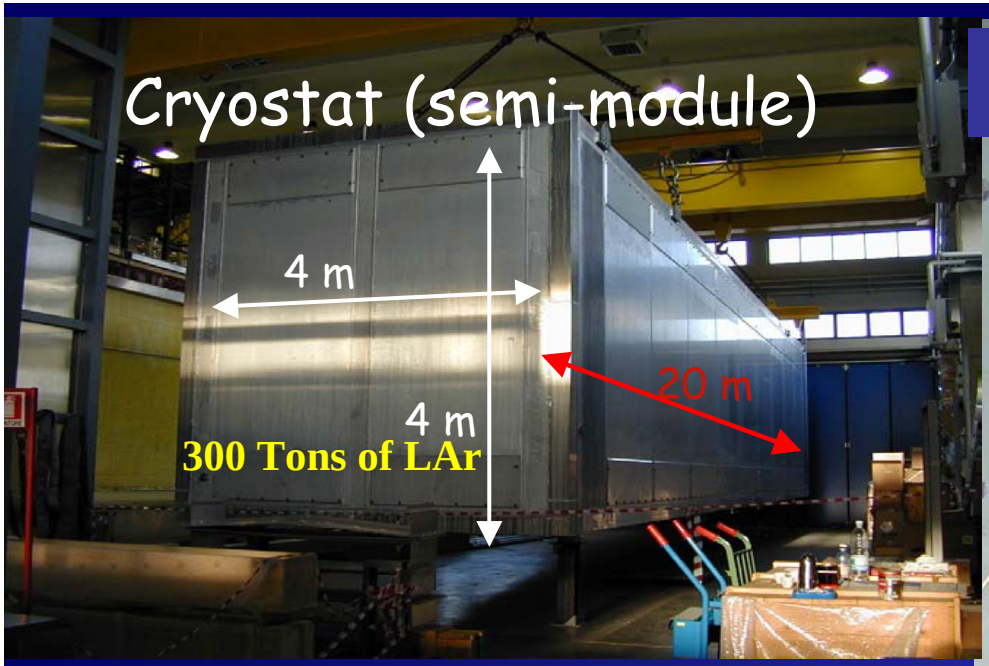
Relationship with the University

- Full support from our Home Institution
  - ➞Available space to start a High Energy Lab
  - ➞Departments of *Electronics, Informatics and Engineering showed interest in starting a joint venture*
  - ➞Teaching duties
    - ➢Course on Particle Physics for last year students
      - – Close contact with Physics students ⇒ Main source for group enlargement

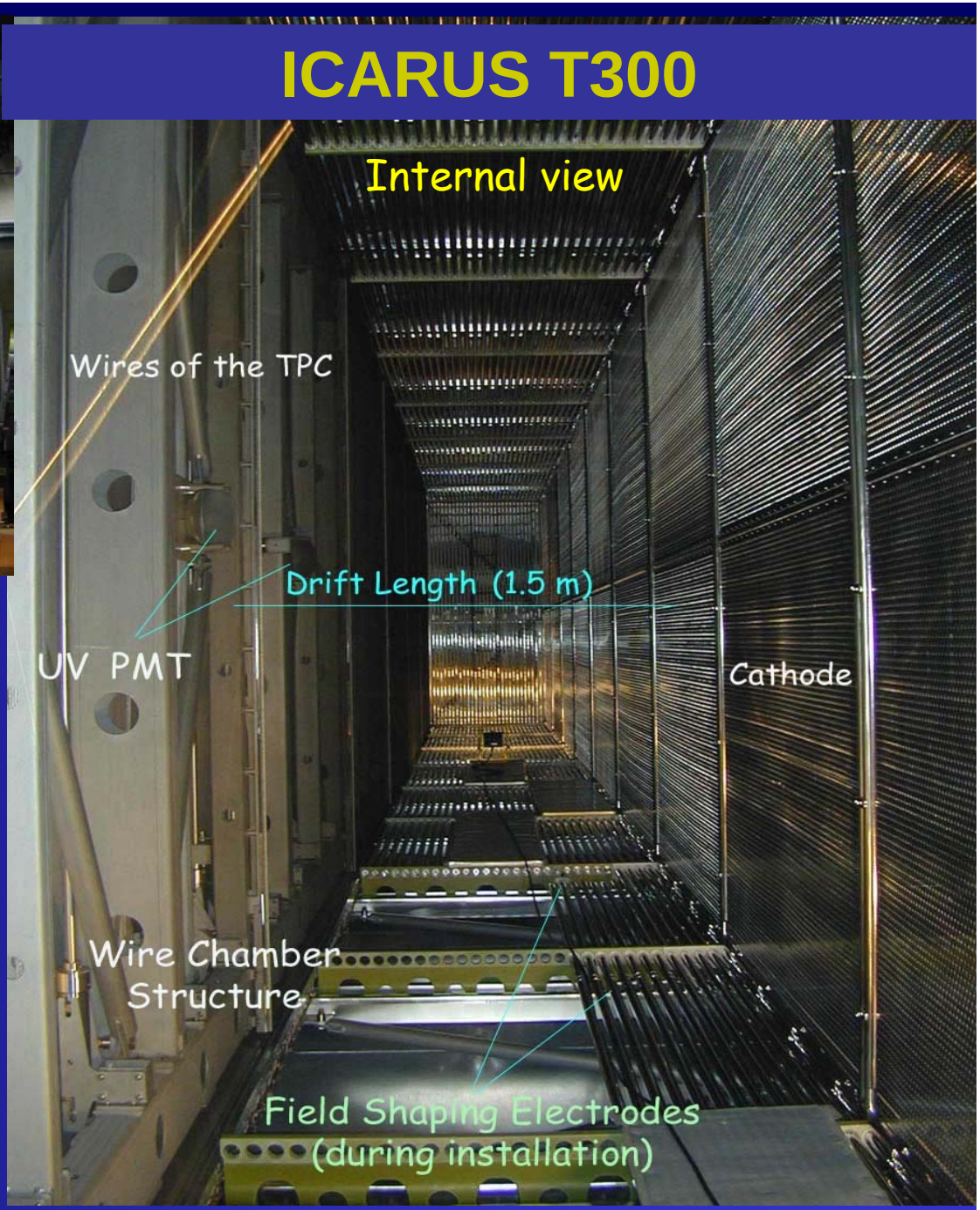
Physics Interests

- Our interest focused on **Neutrino Physics**
  - → Excellent research perspectives: the only sound experimental clue pointing to *Physics beyond the Standard Model*
  - → Ample experience in the field: before joining Granada University, active participation in *NOMAD*, *ANTARES*, *ICARUS*
  - → Small experimental neutrino community in Spain
    - ➢ Join the effort to enhance Spanish visibility/contributions in this field
  - → Spain contributes to the construction of the CNGS beam line
    - ➢ We are an official member of the ICARUS Collaboration
    - ➢ No other Spanish institution involved in CNGS experiments

ICARUS T300

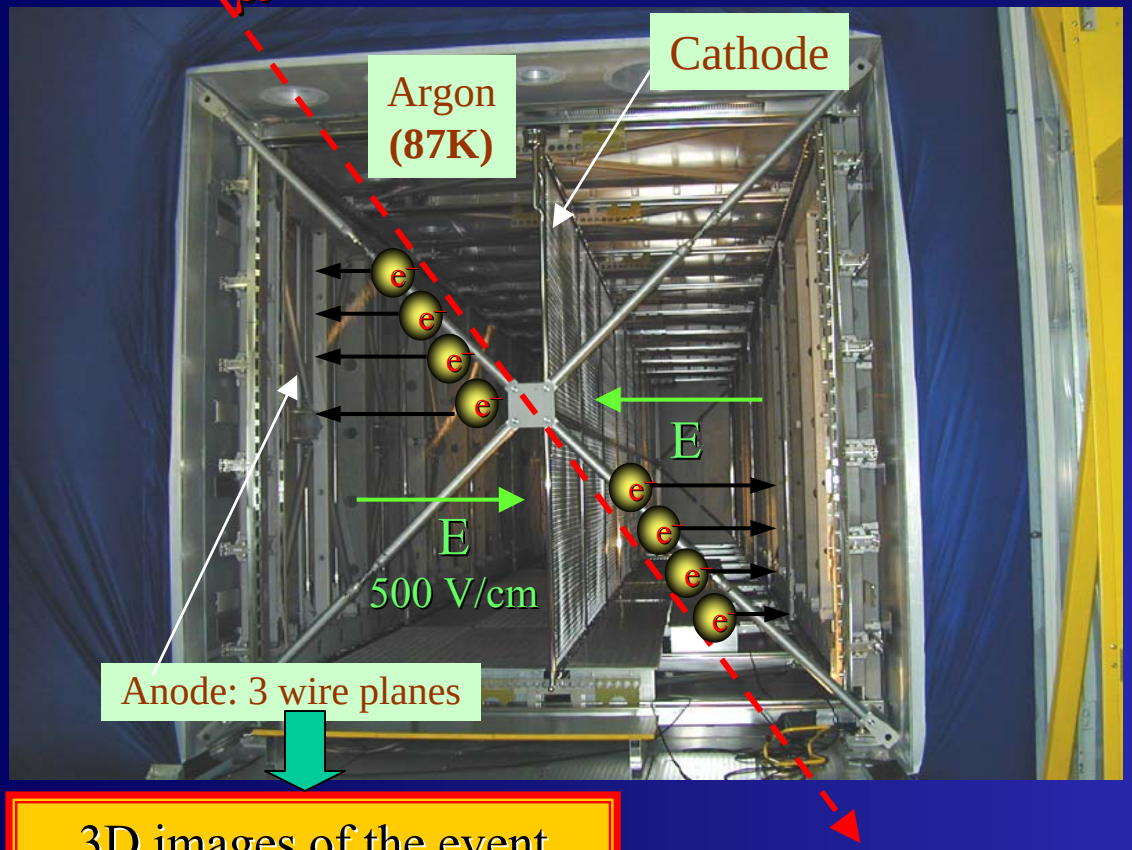

Cryostat (semi-module)
4 m
4 m
20 m
300 Tons of LAr


Readout electronics
≈ 54000 channels


Internal view
Wires of the TPC
Drift Length (1.5 m)
UV PMT
Cathode
Wire Chamber
Structure
Field Shaping Electrodes
(during installation)

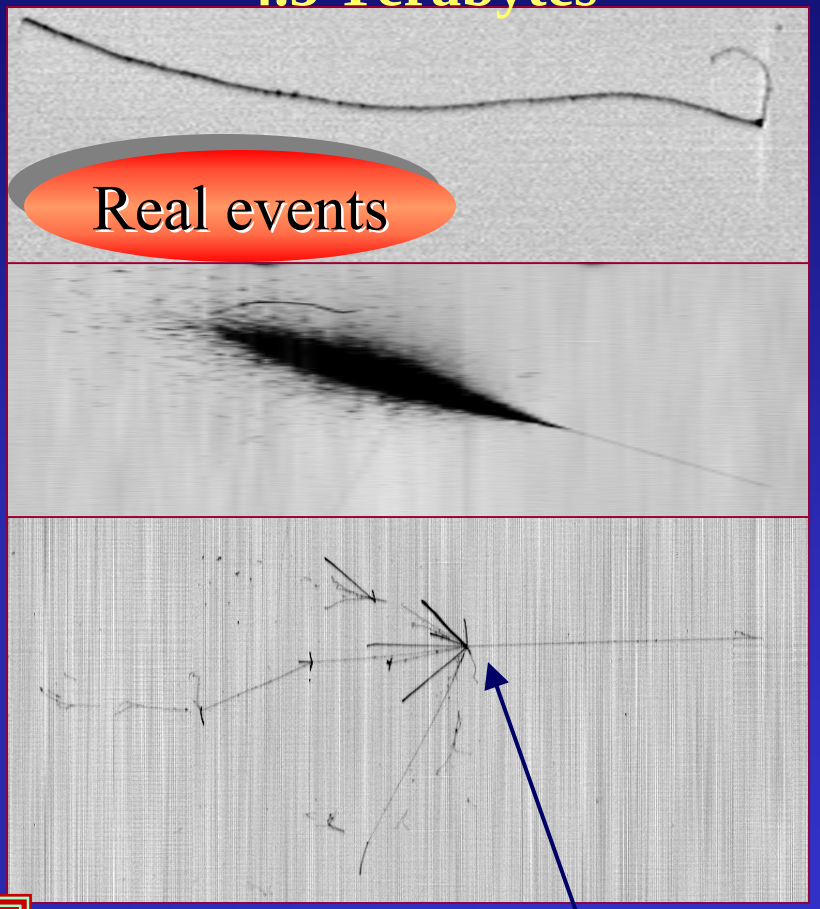
ICARUS T600 Cosmic Ray Technical Run

Liquid Ar used as `target` and `detection` medium



3D images of the event

Data taking: Summer 2001
≈ 28000 triggers
≈ 4.5 Terabytes



Energy measured in every point
(bubble size ≈ **3 x 3 x 0.2 mm^3**)

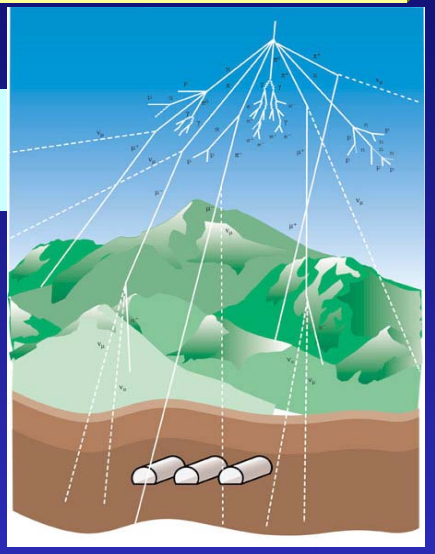
Successful operation of the T600

ICARUS Physics Program

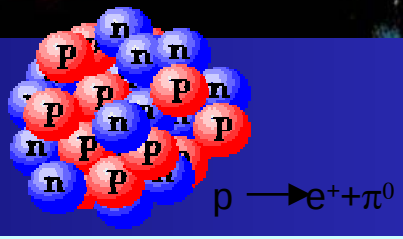
Liquid Ar TPC technology is now **mature**, it is thus possible to construct very ***massive detectors relevant for Neutrino Physics***

Supernova Neutrinos

Atmospheric Neutrinos



Solar Neutrinos



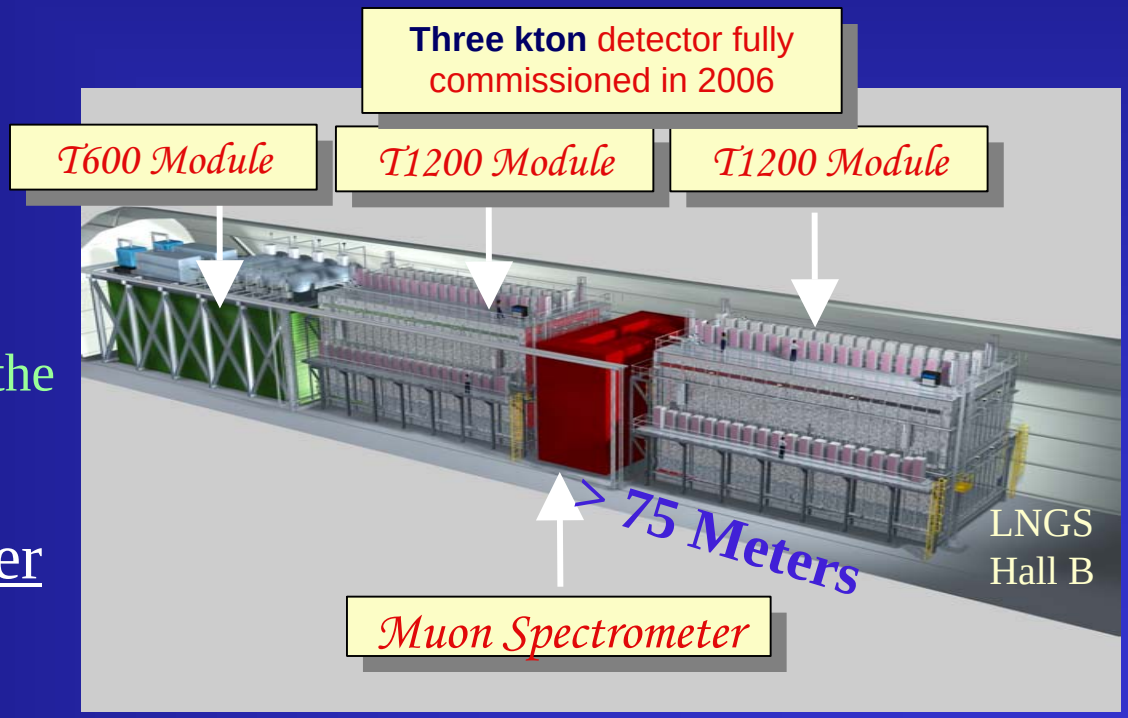
Matter Stability

Long Baseline Neutrinos

$L_{CERN\text{-}Gran\ Sasso} = 730$ km

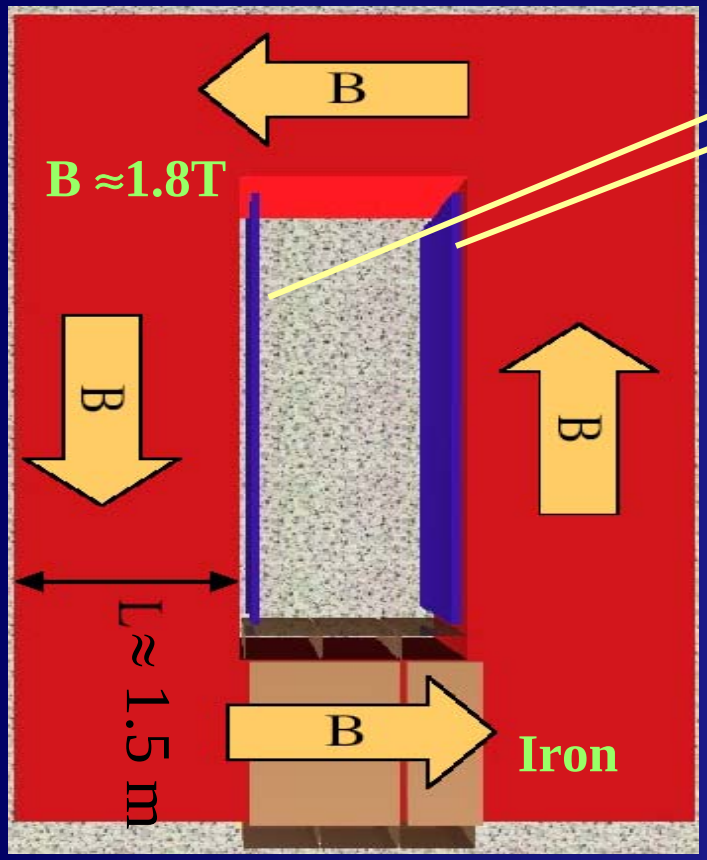
Physics Activities

- Software
  - ➞Reconstruction software
  - ➞Measurement of the muon momentum by means of multiple scattering
    - ➢ Relevant for atmospheric neutrinos
  - ➞Studies on $\nu_\mu \rightarrow \nu_\tau$ & $\nu_\mu \rightarrow \nu_e$ appearance searches
- Hardware
  - ➞Addition of a muon spectrometer to the Liquid Argon detector
    - ➢ Proposal to be submitted to the SPSC
  - ➞Our group responsible for construction of spectrometer sensitive part
    - ➢ Drift tubes



Muon Spectrometer

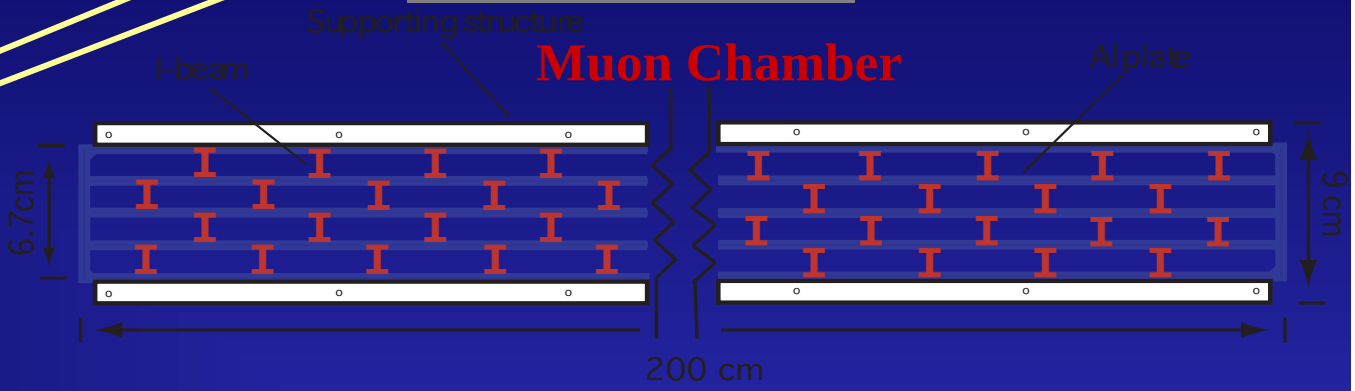
Spectrometer top view



Magnet Cross Section:

8.5 (w) x 9.5 (h)

Drift Tubes



Spectrometer made of two muon stations
20 muon chambers in total
Total weight ~ 3 Tons
Total number of channels 3840

Expected Physics performance

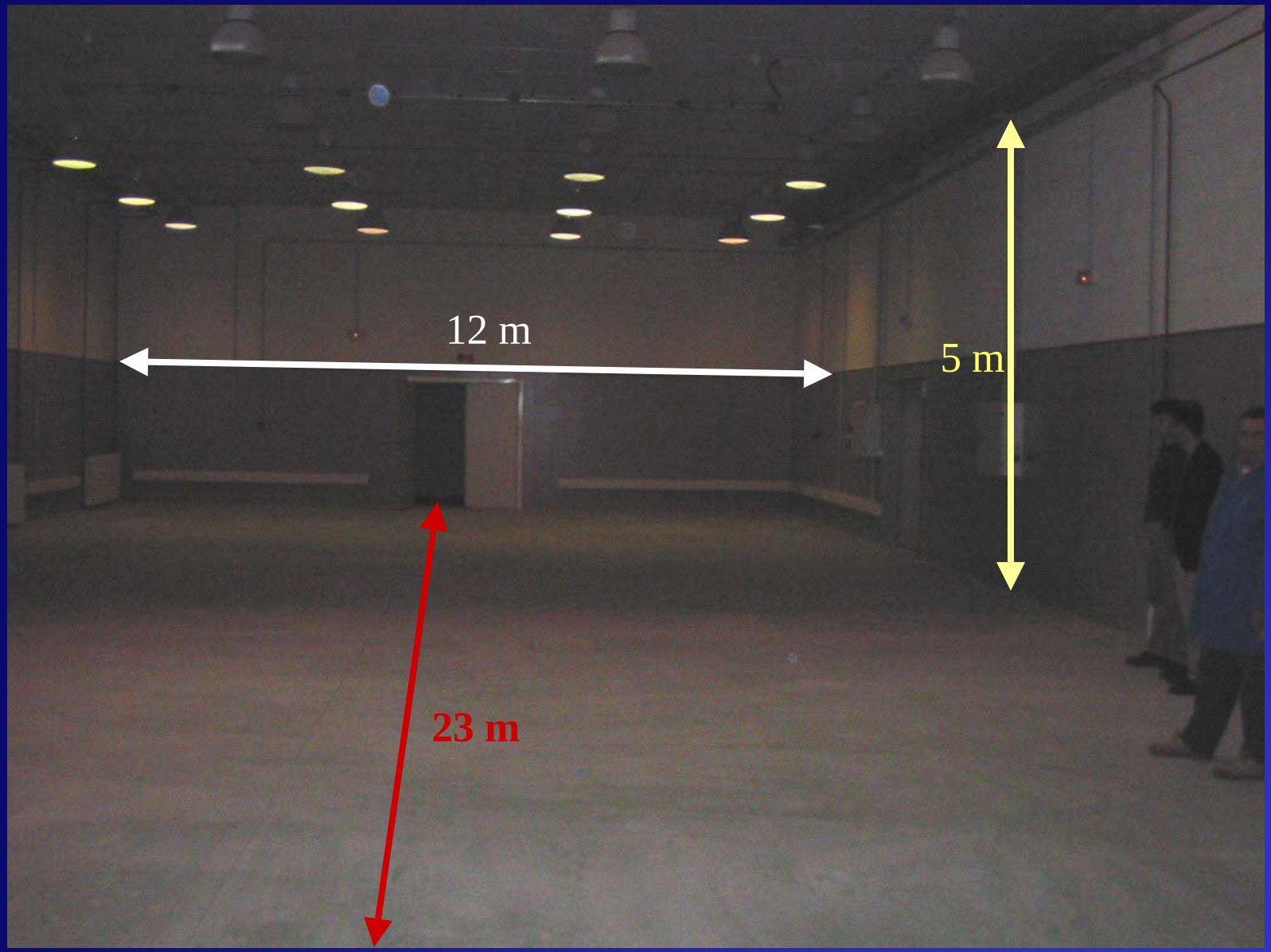
$\Delta p/p \approx 15\%$ for p>5 GeV
Wrong sign contamination $10^{-3} - 10^{-4}$

Drift Tube Construction

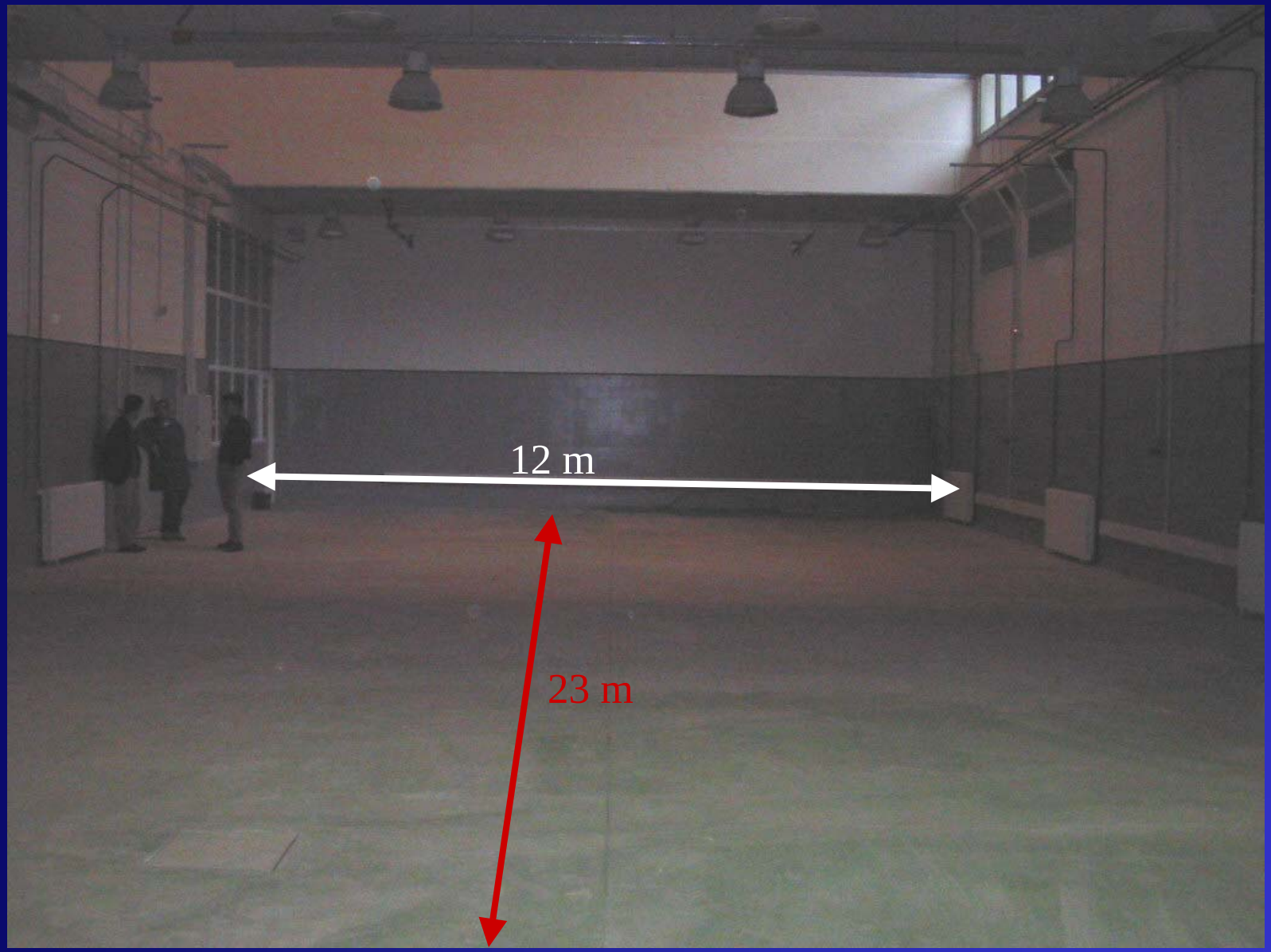
- Granada University
- CIEMAT
  - →Expressed interest in the project (*nowadays fully committed to CMS*)
  - →**"Know-How": CIEMAT group has a long experience in muon chamber construction**
  - →**Infrastructure and tools already available: Construction of CMS Barrel Muon Chambers well under way**

General strategy on task sharing for construction, testing and commissioning **under discussion**

High Energy Lab at Granada University



High Energy Lab at Granada University



High Energy Lab at Granada University