

The **LSC** in the **LAGUNA** project

Current Status

What is **LAGUNA** ?

- The current European approach to the next generation, liquid [Mt-like], p-decay and neutrino detectors

- It considers seven candidate sites:

CUPP @ Pyhäsalmi mine, Finland

IUS @ Boulby mine, UK

SUNLAB @ Sieroszowice mine, Poland

IFIN-HH @ Unirea mine, Romania

LSM @ Frejus tunnel, France

New-Italian-Site @ CNGS beam halo, Italy

LSC @ Canfranc RW tunnel, Spain

- It considers three different detector technologies:

- Water-Cherenkov: ~ 1 Mt
- Liquid-Argon TPC: ~ 0.1 Mt
- Liquid-Scintillator: ~ 0.05 Mt



What is LAGUNA ? (II)

- a pre-Collaboration is formed. It did apply for 5 M€ funding to the EU within the program FP7-INFRASTRUCTURES-2007
- Only 1.7 M€ were granted. The explicit request by the EU was to focus in the Feasibility Study (FS), mainly Geotechnic, of the 7 candidate sites.
- LAGUNA has assigned 145 K€ for the FS of the LSC
- As the LSC has not Geotechnic Department, the technical part has to be subcontracted.
- The coordinator of the LSC-FS is L. Labarga (UAM), who has the help of our geotechnic engineer J. Jimenez

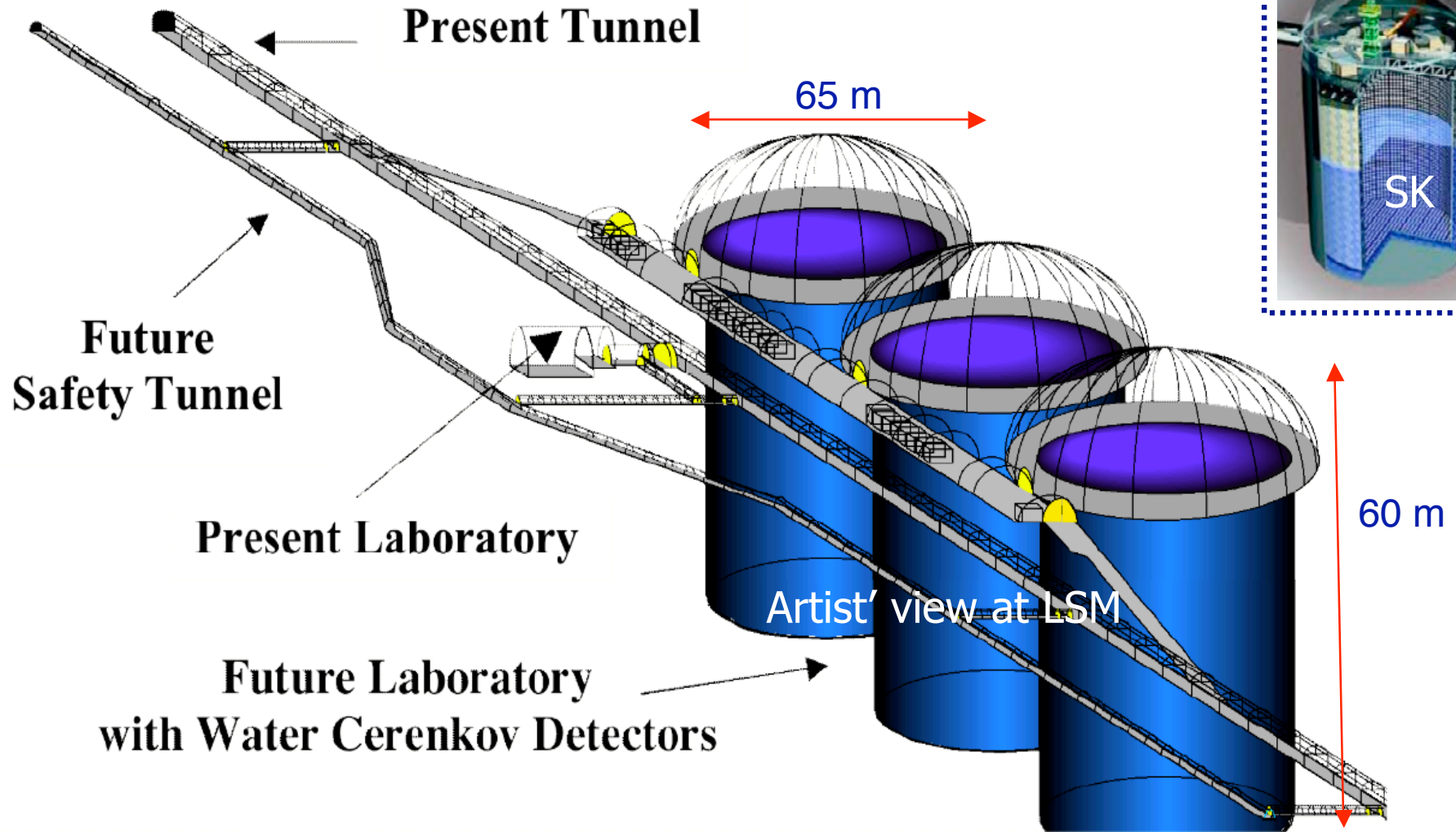
LAGUNA Governance structure

v2.0 / 14/10/08

| | |
|--|-------------------------------|
| Coordinator | A. Rubbia |
| Deputy-Coordinator | ?? |
| Governing Board | |
| <i>Coordinator</i> | A. Rubbia |
| <i>Deputy-coordinator</i> | ?? |
| <i>Administrator</i> | F. Petrolo |
| <i>WG2 coordinator</i> | F. von Feilitzsch |
| <i>WG3 coordinator</i> | N. Spooner |
| <i>WG4 coordinator</i> | A. Zalewska |
| <i>Academic partners' representatives</i> | |
| ETH Zurich | A. Marchionni |
| U-Bern | A. Ereditato |
| U-Jyväskylä | J. Maalampi |
| UOULU | T. Enqvist |
| CEA | M. Zito |
| IN2P3 | Th. Patzak |
| MPG | M. Lindner |
| TUM | L. Oberauer |
| IFJ PAN | Jan Kisiel - US (for IFJ PAN) |
| LSC | A. Bettini ← |
| UAM | L. Labarga ← |
| UDUR | S. Pascoli |
| USFD | P. Lightfoot |
| AU | H. Fynbo |
| IFIN-HH | R. Margineanu |
| <i>Industrial partners' representatives (ex-officio)</i> | |
| Rockplan | G. Nuijten |
| KGHM CUPRUM | W. Pytel |
| IGSMiE PAN | K. Slizowski |
| Technodyne | J. Thompson |
| AGT | M. Temussi |
| Lombardi | P.F. Bertola |

The **LAGUNA** detector-technology approaches

Water-Cherenkov \Rightarrow MEMPHYS



- tank size limited by light attenuation length ($\lambda \sim 80\text{m}$) and pressure on PMTs
- readout : $\sim 3 \times 81\text{K}$ 12" PMTs, 30% geom. cover

Liquid Scintillator ⇒ LENA

DETECTOR LAYOUT

~ 50 kt Liquid Scintillator

Cavern

height: 115 m, diameter: 50 m
shielding from cosmic rays: ~4,000 m.w

Muon Veto

plastic scintillator panels (on top)
Water Cherenkov Detector
1,500 phototubes
100 kt of water
reduction of fast
neutron background

Steel Cylinder

height: 100 m, diameter: 30 m
70 kt of organic liquid
13,500 phototubes

Buffer

thickness: 2 m
non-scintillating organic liquid
shielding external radioactivity

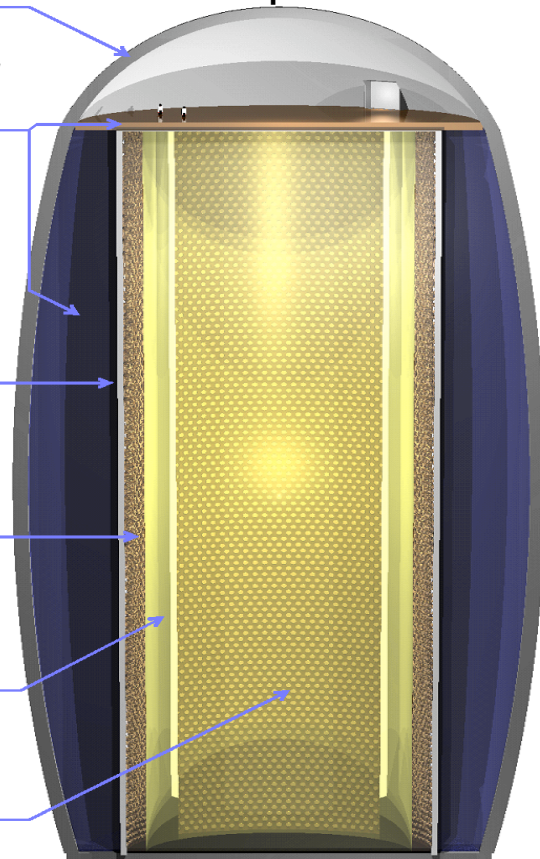
Nylon Vessel

parting buffer liquid
from liquid scintillator

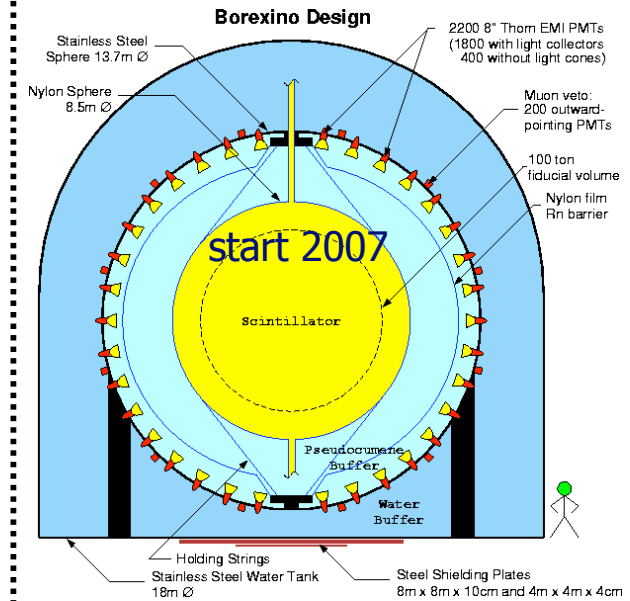
Target Volume

height: 100 m, diameter: 26 m
50 kt of liquid scintillator

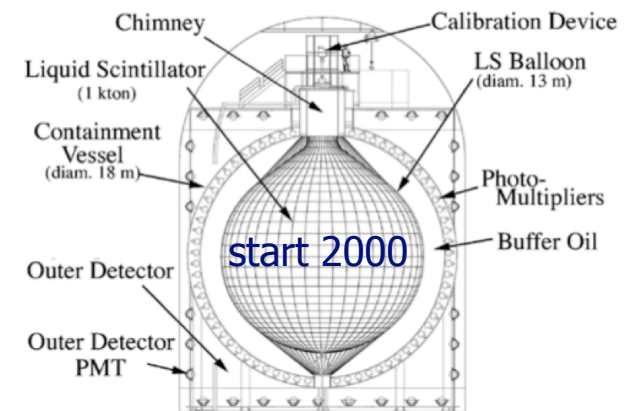
vertical design is favourable in terms of rock pressure and buoyancy forces



Borexino (LNGS):
LSci fiducial/tot vol.: 100/300 t
Buffer UP-org/water: 1k/2.4k t

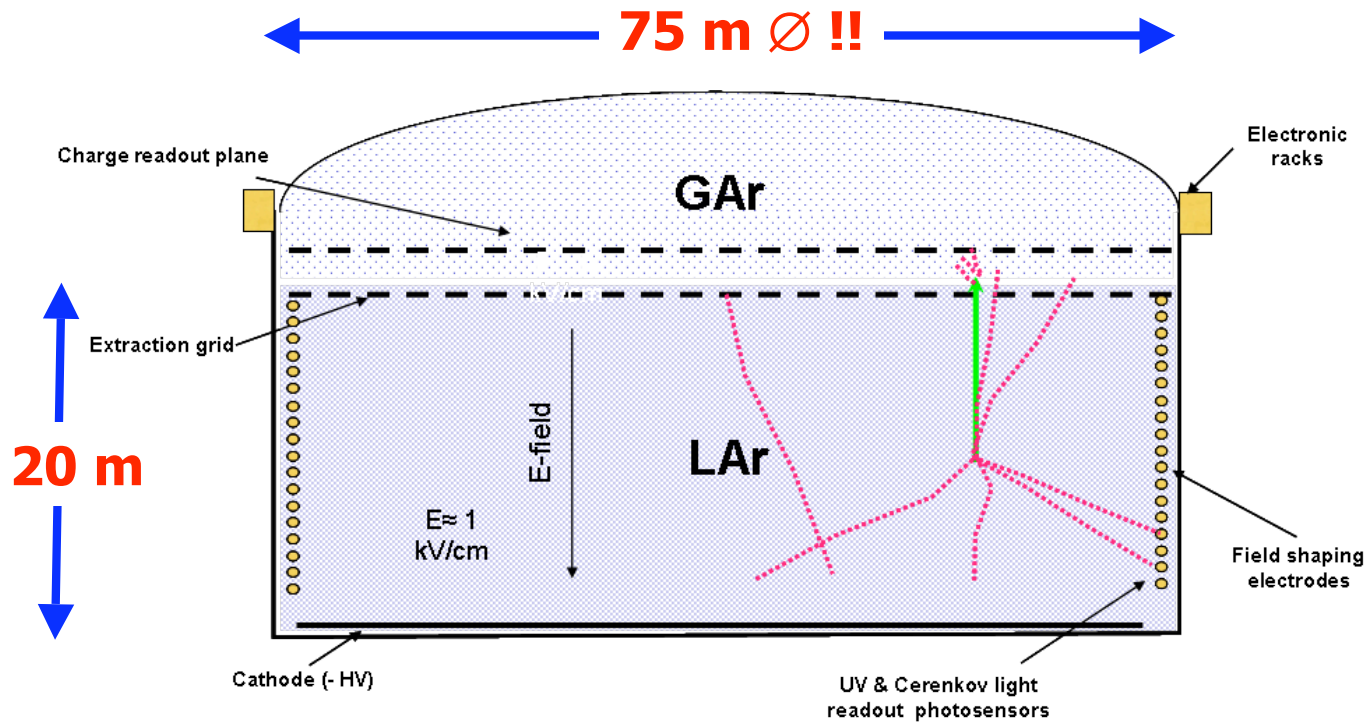


KamLand (Kamioka):
LSci fiducial/tot vol.: 400/1k t
Buffer UP-org/water: 2k/3k t

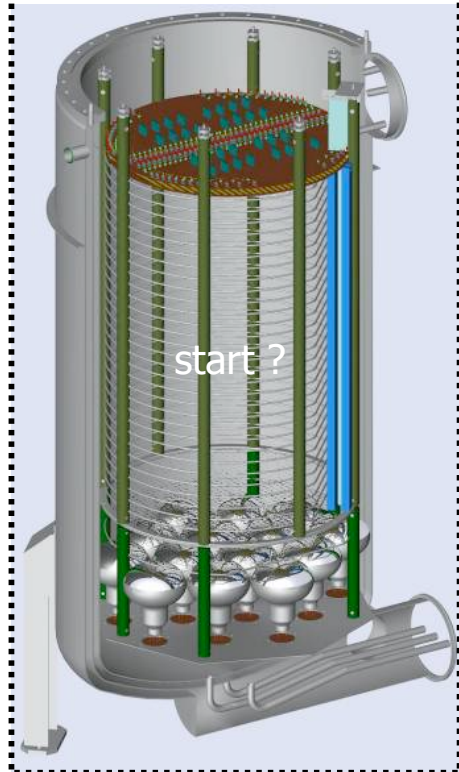


Liquid Argon \Rightarrow GLACIER

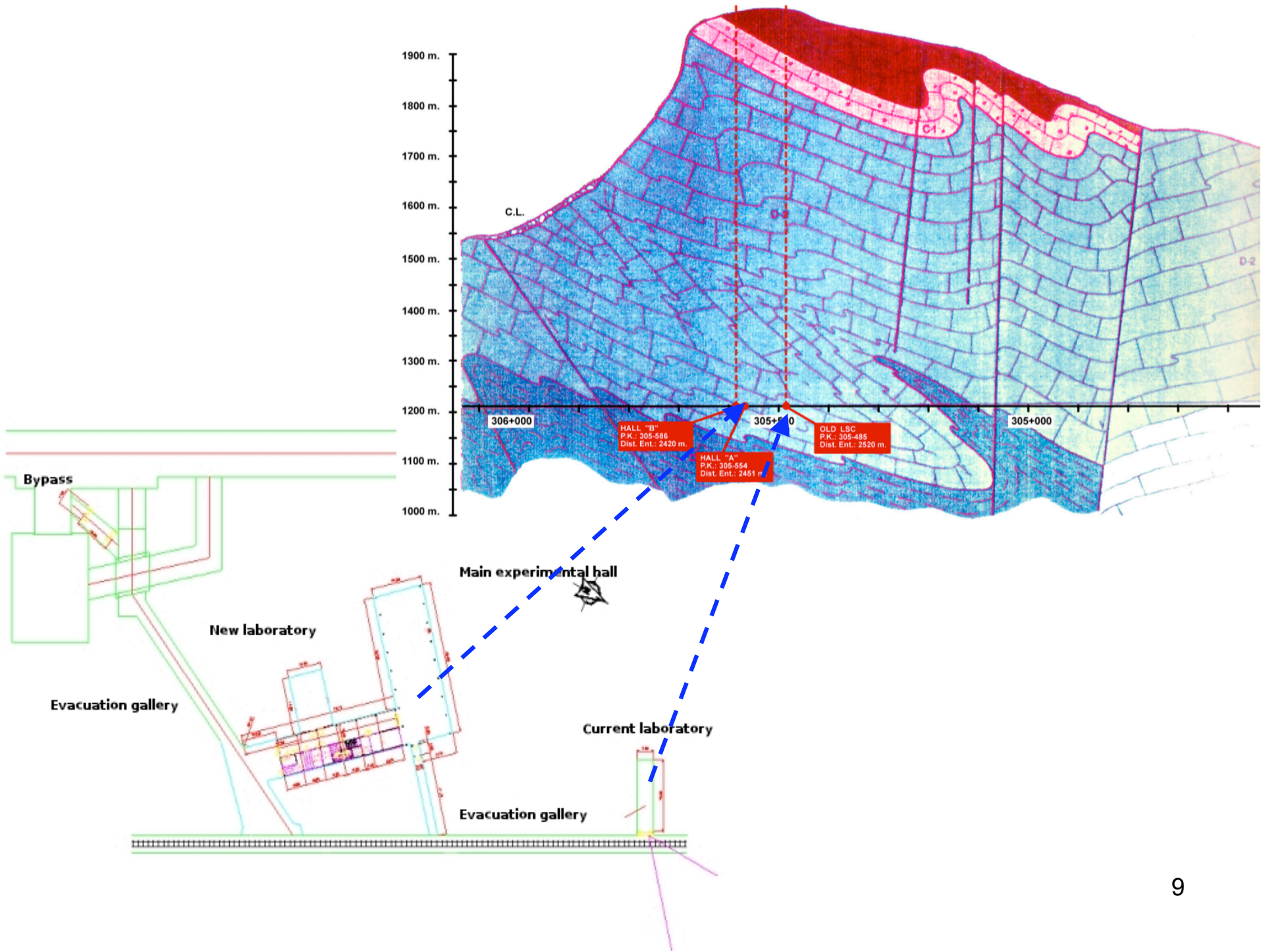
- LAr storage based on LNG tank tech.
- Double - Phase LEM readout (gain $\sim 10^4$)
- Cockcroft-Walton (Greinacher) Voltage Multiplier (~ 1 kV/cm)
- Very Long drift distances (~ 20 m)

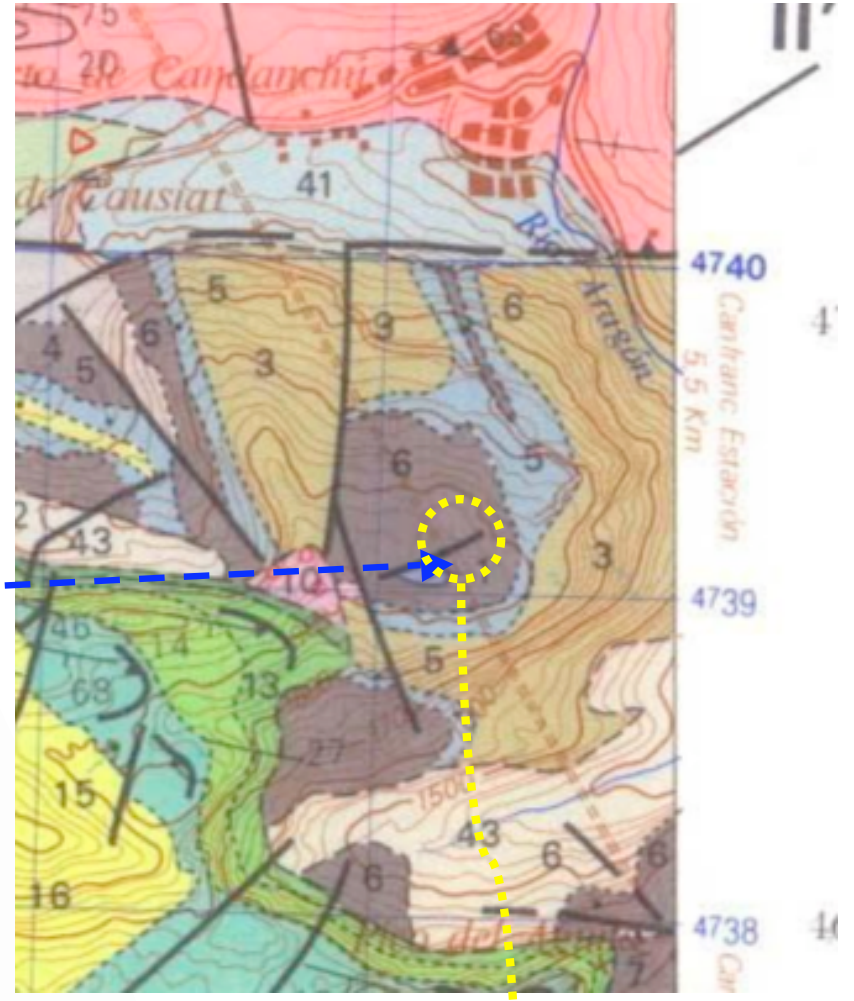
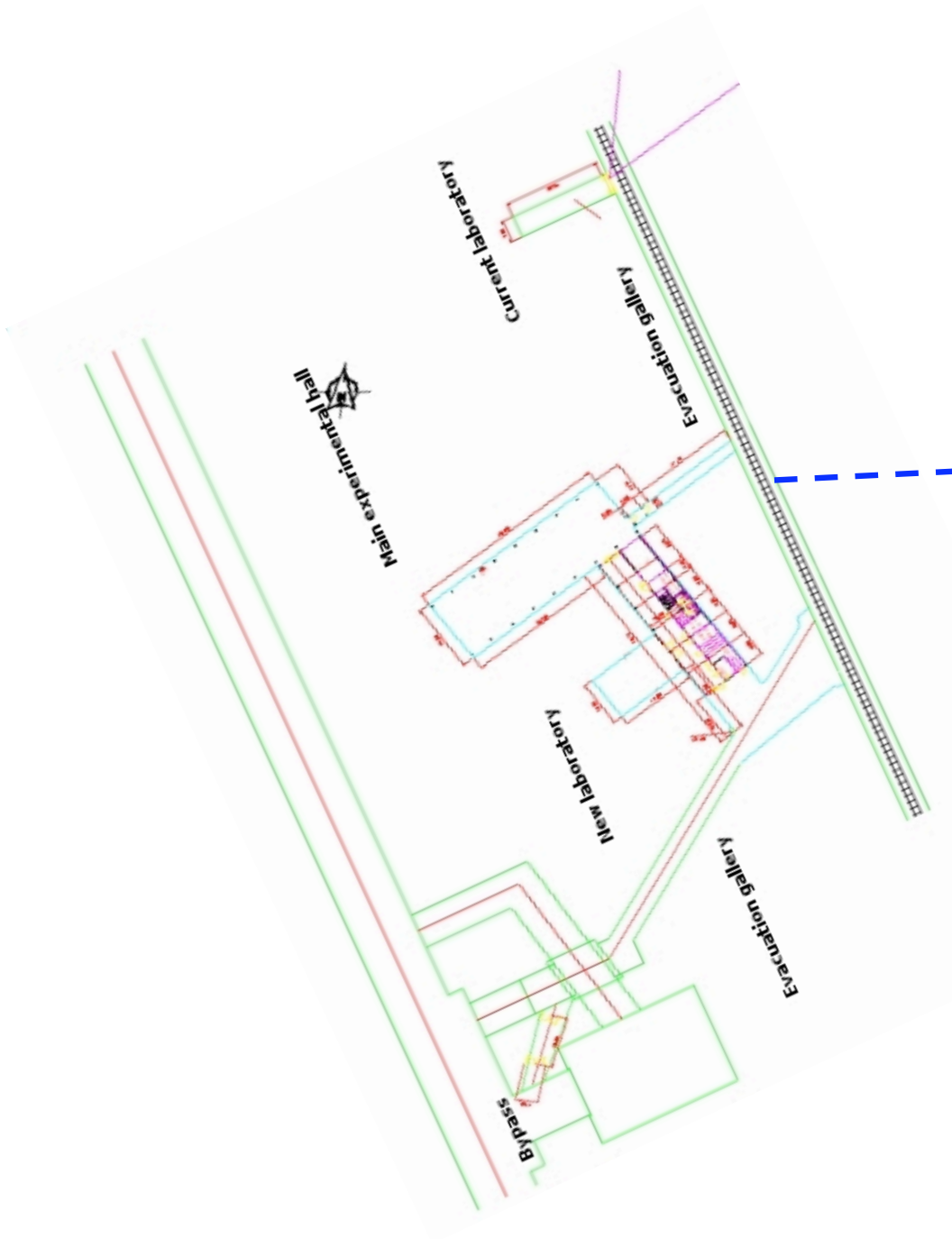


ArDM (LSC ?)
1 t LArg



The **LSC** and **LAGUNA**





possible place
for LAGUNA

Rough SCHEDULE

- July -> December 2008:
Contact, discussions and (private)pre-selection of Geotechnic Companies candidate to carry out the Feasibility Study for the LSC
- January -> March 2009:
Administrative and legal procedure to select the Company.
- March, 15th:
The contract is signed and the selected Company starts working
- December 2009:
The Company delivers the main document basis of the WP2 deliverable "Interim Report for the LSC"

The current work by LSC+UAM

- It can be summarize as:
 - **contact** and discuss with potentially interested and capable **companies**
 - ⊗
 - **prepare** the most important legal/technical doc. of the “Call for Tenders”:
the “**T**echnical **R**equirements and **W**ork to be **D**one” (TR-WtbD)
- With the dead-line of: TR-WtbD ready by Dec. 31st
- A very important step forward have been given during the last weeks by achieving the almost completion of the pivotal files so-called
 - “**B**asic-**I**nput-Data-For-The-3-Technologies”
 - “**M**ain-**O**utput-DataForThe3Technologies”

Companies which have showed explicit interest

STMR S.L./U.P.V.:

It has participated in some crucial phases of the construction of the LSC.

OBRAS SUBTERRANEAS:

Construction of large tunnels and underground facilities for rail-way, metro and hydraulic power plants.

GEOCONTROL S.A.:

Construction of large tunnels and underground facilities for rail-way, metro etc. In particular it accredits the design of large caverns for several hydraulic power plants both in Spain and Portugal.

GEOCONSULT España S.A.:

It accredits the design and construction-supervision of large caverns, some with volumes of the same order of magnitude as required for LAGUNA.

INGEOSOLUM/PROMINOR:

Two different companies (engineer/construction) working together in several projects of infrastructures for communication in Spain. The "joint-venture" is lead by one of the most experienced geotechnic engineers of PROMINOR.

Some example information about some of the companies follows:

GEOCONSULT España S.A.

- relevant example of their works:

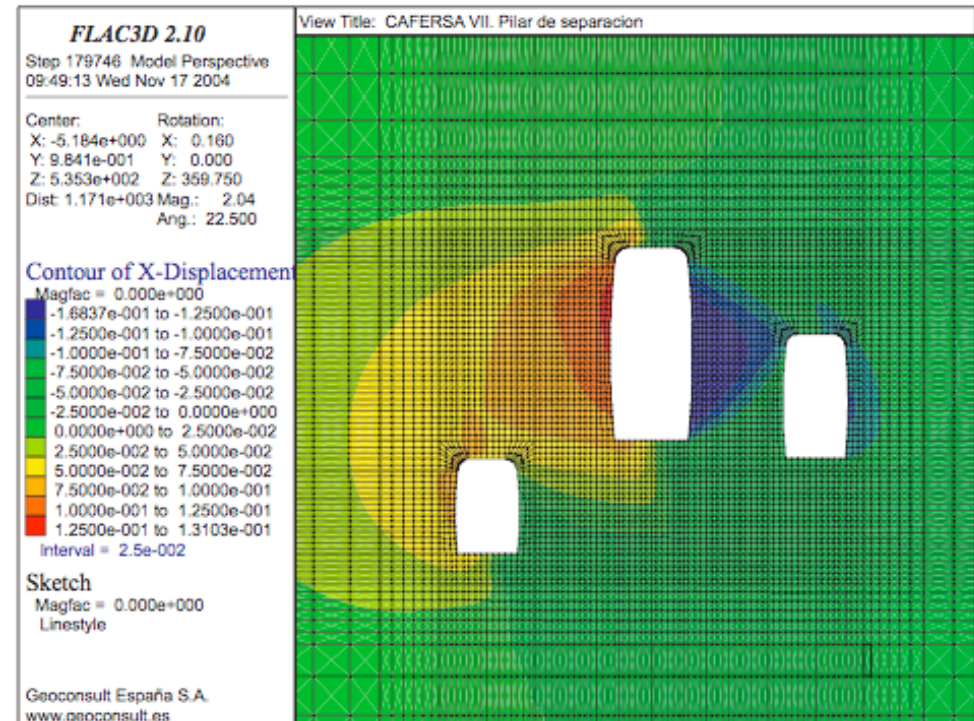
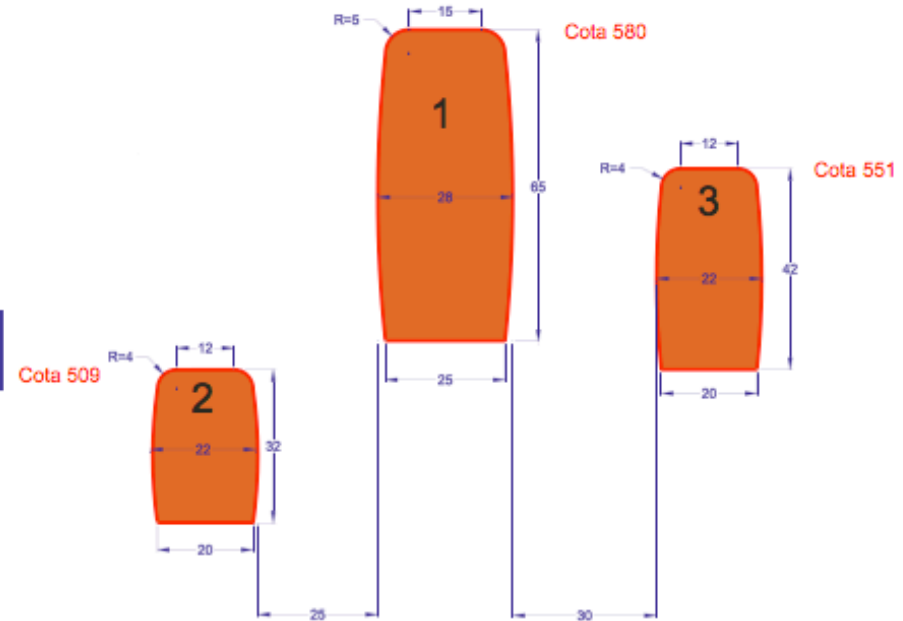
CAVERNA SUBTERRANEA «A FRAGUIÑA»

Dimensiones:

Caverna 1: 28 m Ancho, 65 m Alto y 120 m Largo

Caverna 2: 22 m Ancho, 32 m Alto

Caverna 3: 22 m Ancho, 42 m Alto



GEOCONTROL I

Geotechnic Engineering & Consulting



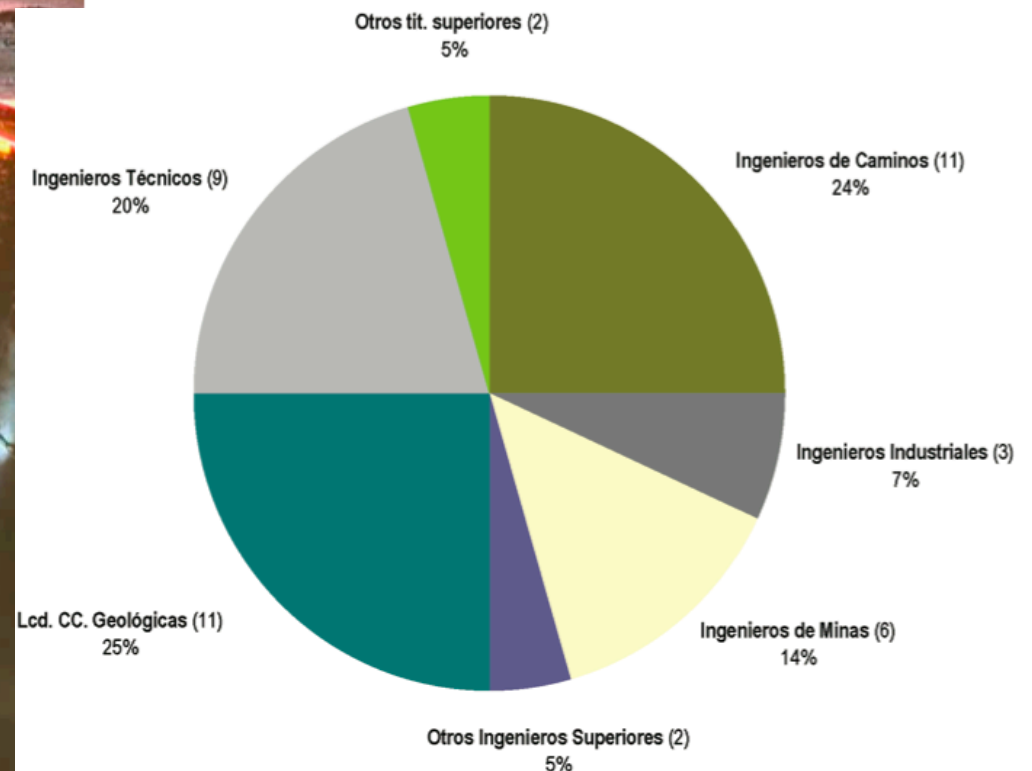
Linea 3
Metro de Barcelona

LÍNEA 3 METRO DE BARCELONA. GISA

During the last years specialized in large tunnels and ancillary caverns

however they have a lot of expertise

and a large team of engineers (22):



GEOCONTROL II

AND a superb knowledge of the zone: the engineer in charge, J. M. Galera, is the author of the Official Spanish Geological Map of the area

