
Laboratorio Subterraneo de Canfranc
DULIA-bio
13th, October 2015
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Raúl Sagredo

Welcome …

- **DULIA-bio 2015**
  - The first Workshop on biology in EUropean Deep Underground Laboratories (**EU DULs**)
    - Hope to collect an interested in a wide Community and go around the four EU DULs
  - Supported by APPEC, IFIC, DULs
  - Thank you to ALL speakers
  - Thank you to the LSC staff

  - Proposal:
    - Publish Workshop contributions on **Proceedings of Science** http://pos.sissa.it

DULs

- In Europe four underground infrastructures
  - **Boulby**, UK: www.boulby.stfc.ac.uk/Boulby
  - **Canfranc**, Spain: www.lsc-canfranc.es
  - **Gran Sasso**, Italy: www.lngs.infn.it
  - **Modane**, France: www.lsm.in2p3.fr

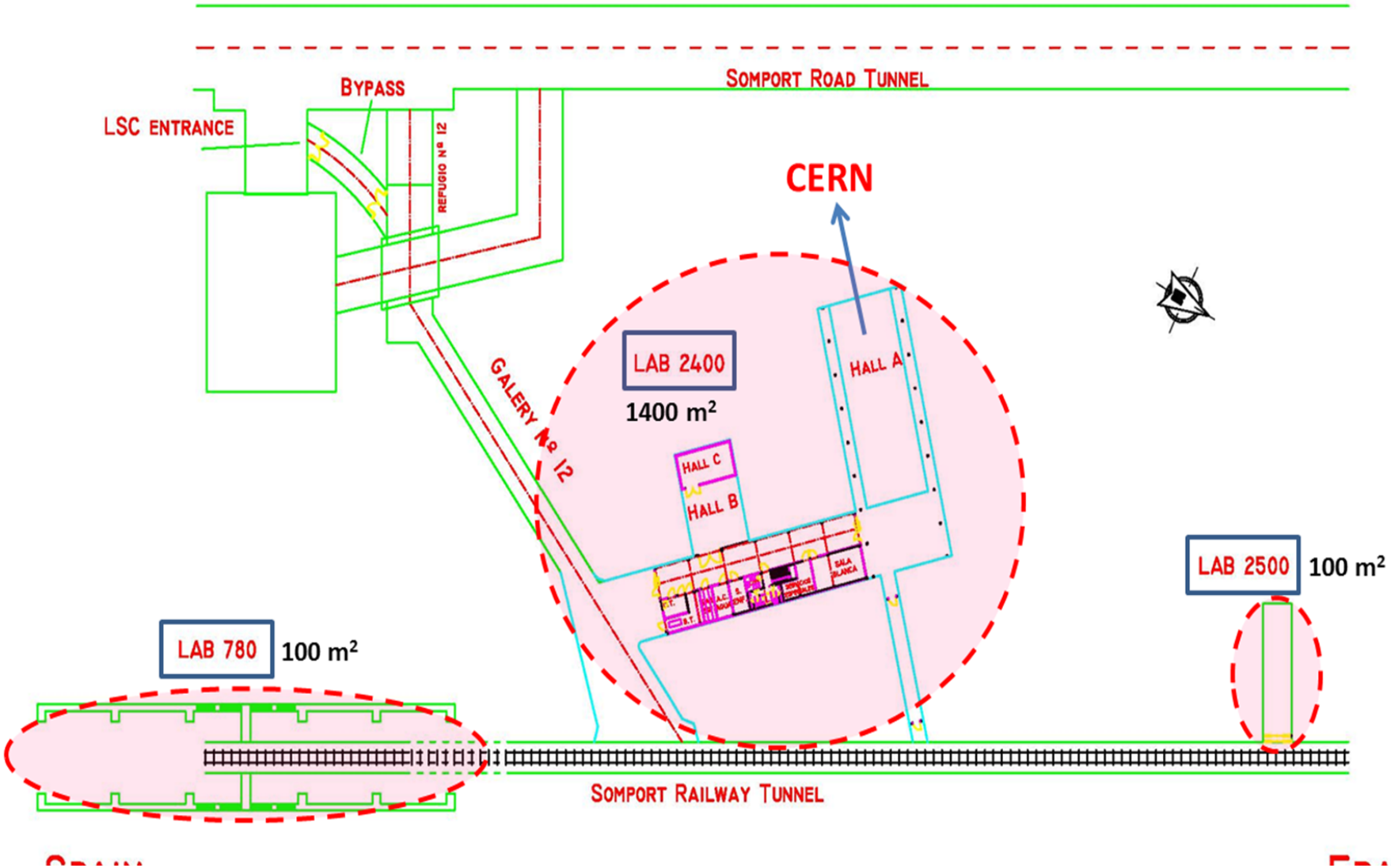
- **DULs are multidisciplinary research facilities**:
  at this Workshop we deal with Biology
  - DULs offer an environment with low background wrt surface facilities
    - From cosmic rays
    - From natural radioactivity (with the exception of radon)
    - Low seismic noise
  - At first main research activities in DULs were
    - Neutrino physics
    - Dark Matter
    - Double beta decay
  - Geology also carried out in DULs
  - Outreach

European DULs geography

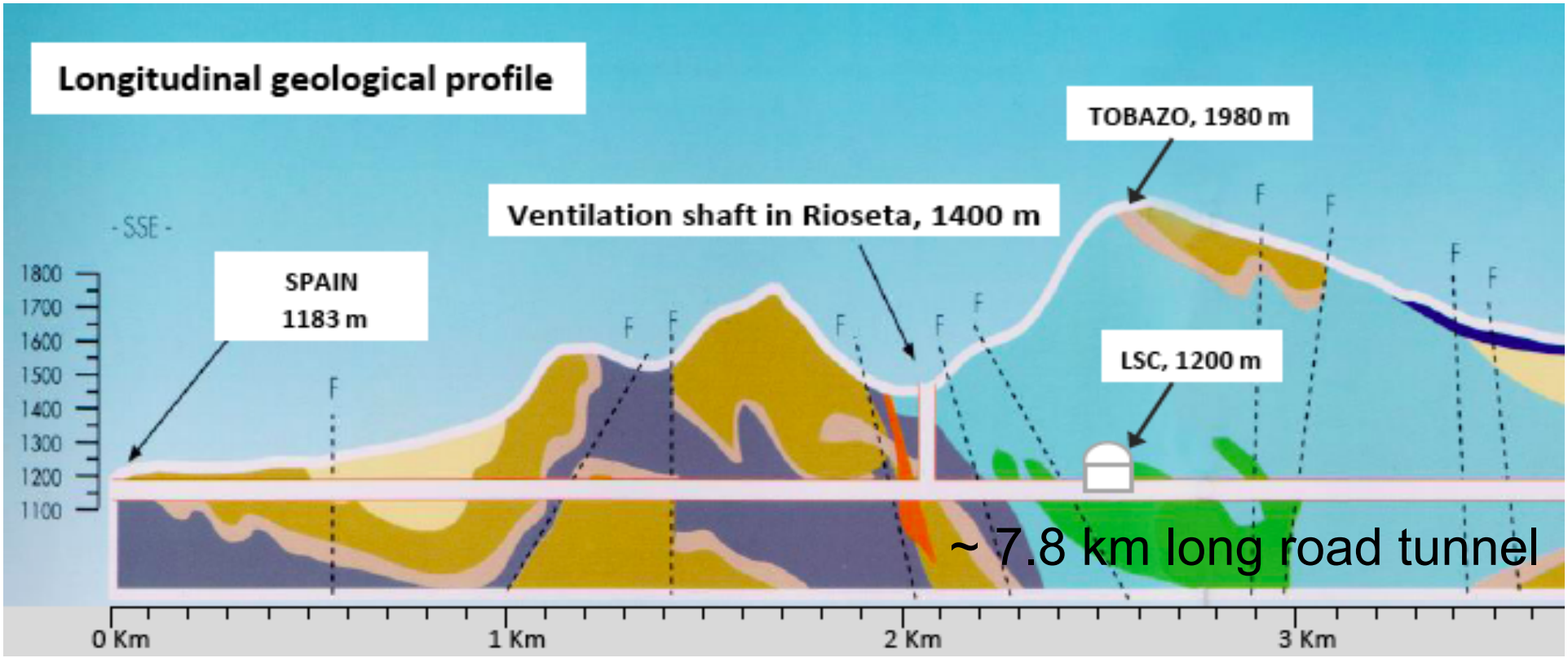
Canfranc Laboratory

- **1985**, Angel Morales and collaborators from the University of Zaragoza started using abandoned space in the train tunnel
- **1994**, during the excavation of the road tunnel a cavity of 118 m^2 was made for research activities: LAB2500
- **2006**, a large excavation of 1600 m^2 is done: LAB2400. Canfranc becomes an international research infrastructure

LSC Underground Layout



LSC Mountain Profile



850 m under mount Tobazo (~ 2500 m.w.e)
Muon flux ~ 4×10^{-3} m^{-2} s^{-1}
Inlet air flux ~ 20000 m^3/h
Radon level 50 - 80 Bq/m^3
Neutron (<10 MeV) ~ 3.5×10^{-6} $n/(cm^2\ s)$
Gamma rays flux ~ $2/(cm^2\ s)$

Experiments @ LSC

- ✓ ANAIS **DarkMatter** (NaI(Tl), Annual modulation - operational)
- ✓ ROSEBUD DarkMatter (Scintill. Bolometers – stopped)
- ✓ ArDM **DarkMatter** (2phase LAr TPC – operational)
- ✓ NEXT **0ν2β** (Enr ^{136}Xe gas TPC – demonstrator commissioning)
- ✓ BiPo **0ν2β** (specialized facility for SuperNEMO – operational)
- ✓ Muons cosmic rays monitoring underground operational)
- ✓ SuperK-Gd screening for SuperKamiokande-Gd – operational)
- ✓ GEODYN Geodynamics – operational)

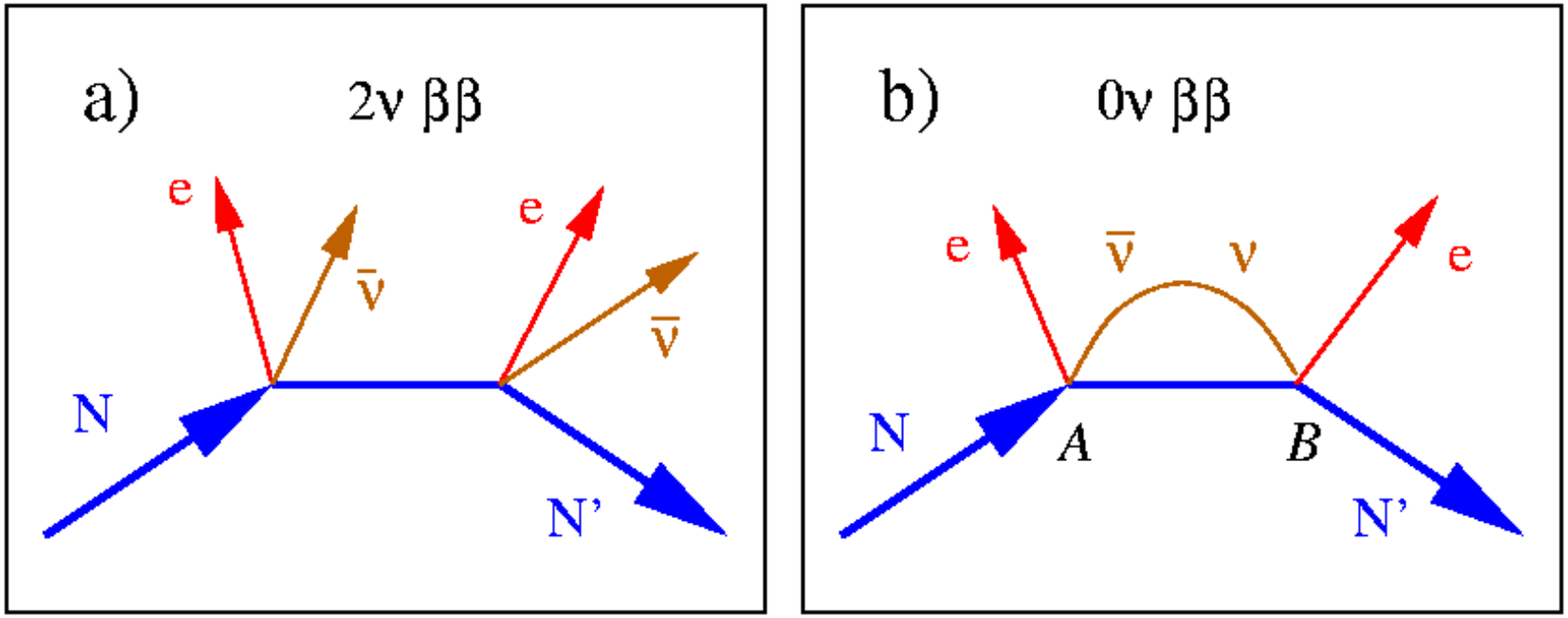
Expressions of Interest under review

✓CUNA Nuclear astrophysics

✓New 300 m^2 facility feasibility study

✓GOLLUM deep-life: characterize microbial communities by extraction of DNA in rock samples

Double Beta Decay



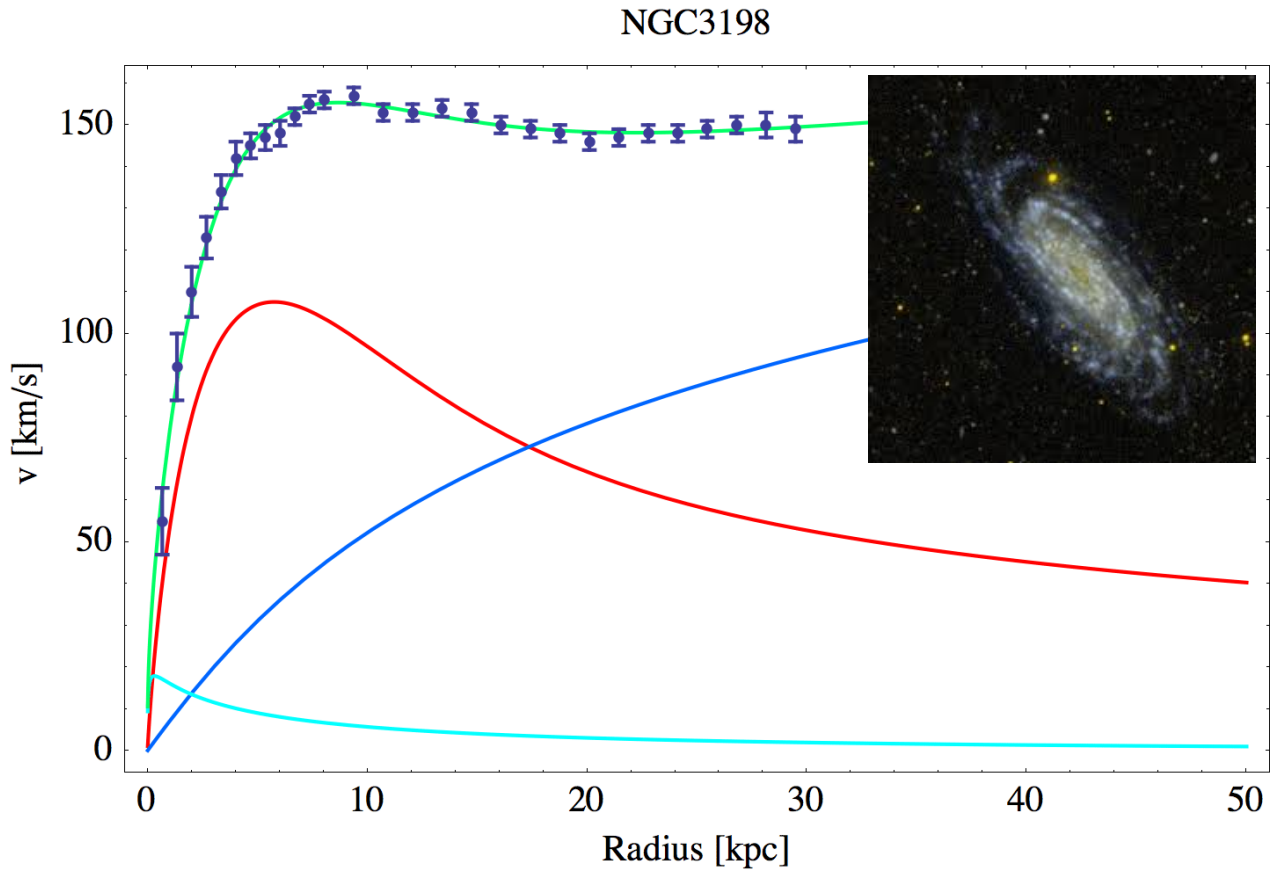
Second-order nuclear decay with very low probability

$T^{\beta\beta}_{1/2} > 10^{19}$ years

need to probe $T^{0\beta}_{1/2} > 10^{25}$ years

Dark Matter

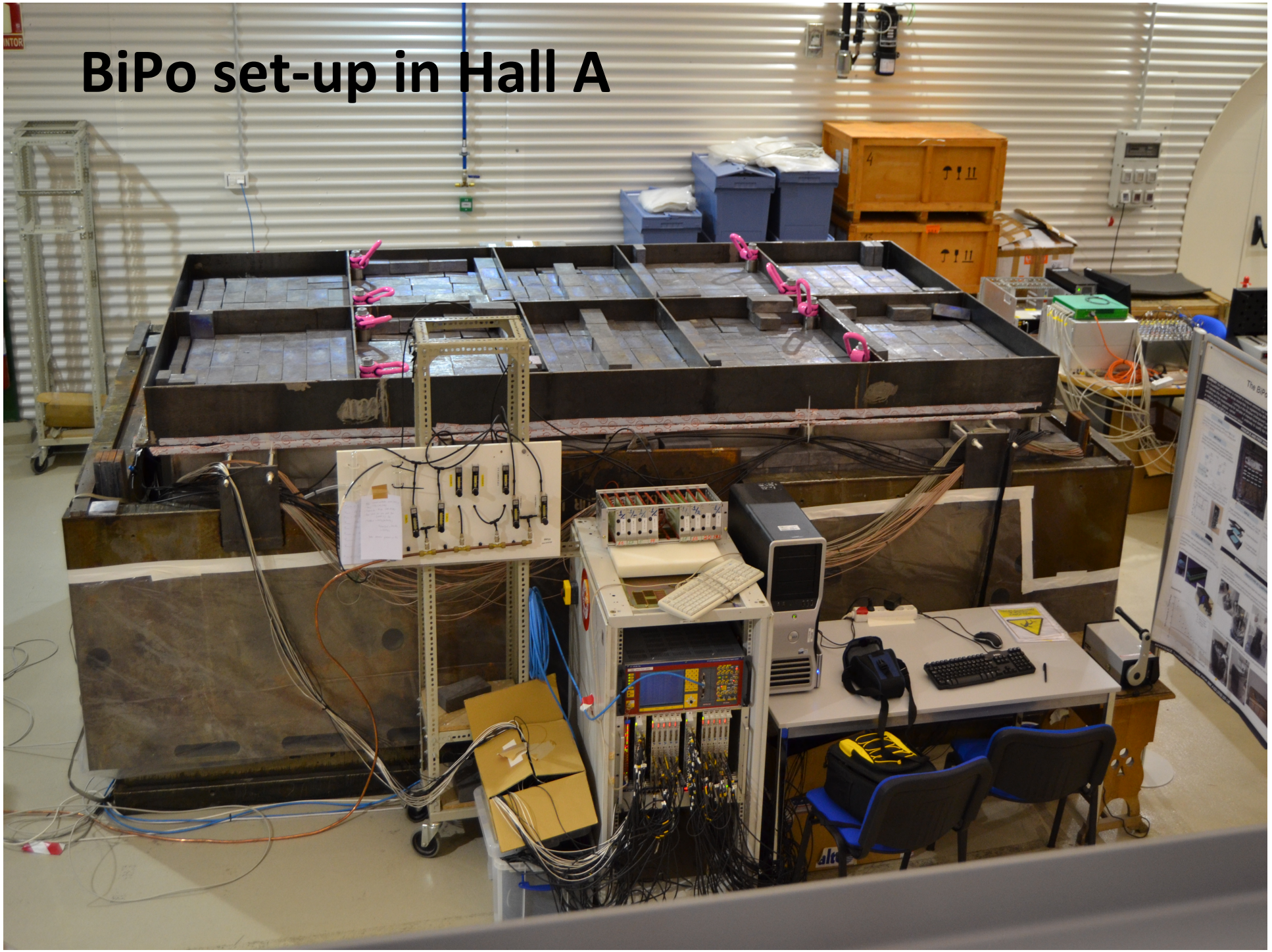
Galaxy rotation curve show existence of dark halo since 1930s

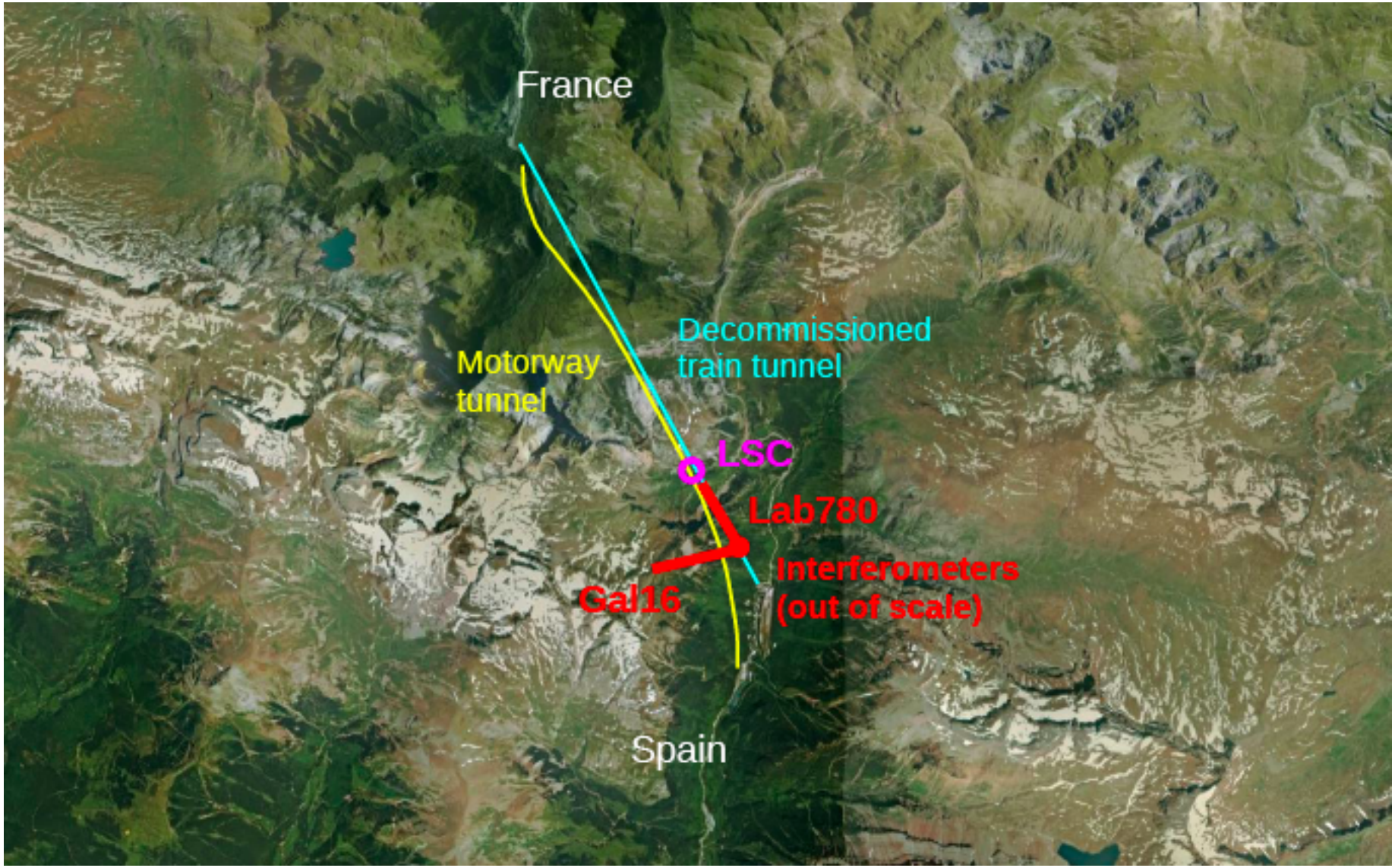


More evidence of dark matter from astrophysics and cosmology
Huge effort worldwide to look for unknown particles in the dark …


INDUSTRIAS
AJUSCAL S.L.
Tfno 976 790 610
10 Tm
CE
ArDM
NEXT

BiPo set-up in Hall A





L=70m, $\Delta L/L<10^{-12}$, bandwidth: 0 Hz to 200 Hz
for $\Delta L/L=10^{-9}$ $\Delta L=0.07\mu m$

Laser strainmeter in LAB780

Life in extreme environments

- GOLLUM at Canfranc Laboratory
  - See talk by C. Vilanova at this meeting

Drilling sites to probe deep-life

T.L.Kieft private communication on Workshop to develop deep-life continental scientific drilling projects

EU DULs could be part of this network for sample extraction and related studies ?

Thank you
Enjoy DULIA-bio @ LSC