



Istituto Nazionale di Fisica Nucleare  
Laboratori Nazionali del Gran Sasso

# BULLKID-DM

## Kickoff-meeting

Antonio D'Addabbo  
LNGS-INFN, 19 March 2023





National Institute for Nuclear  
Physics (INFN) was funded  
in 1951

collecting the glorious science  
tradition starting from Enrico Fermi  
and the Via Panisperna boys

# INFN mission

- INFN performs **scientific research** in the fields of nuclear, particle and astroparticle physics
- INFN scientific research is performed in **international competitions** and in **partnership** with academic and research institutions worldwide
- INFN promotes **scientific dissemination** and develops **frontier technologies** to perform its research



# INFN infrastructures

- 4 Laboratori Nazionali
- 20 Sezioni
- 6 Gruppi associati
- 3 Centri Nazionali e Scuole
- 1 Consorzio internazionale



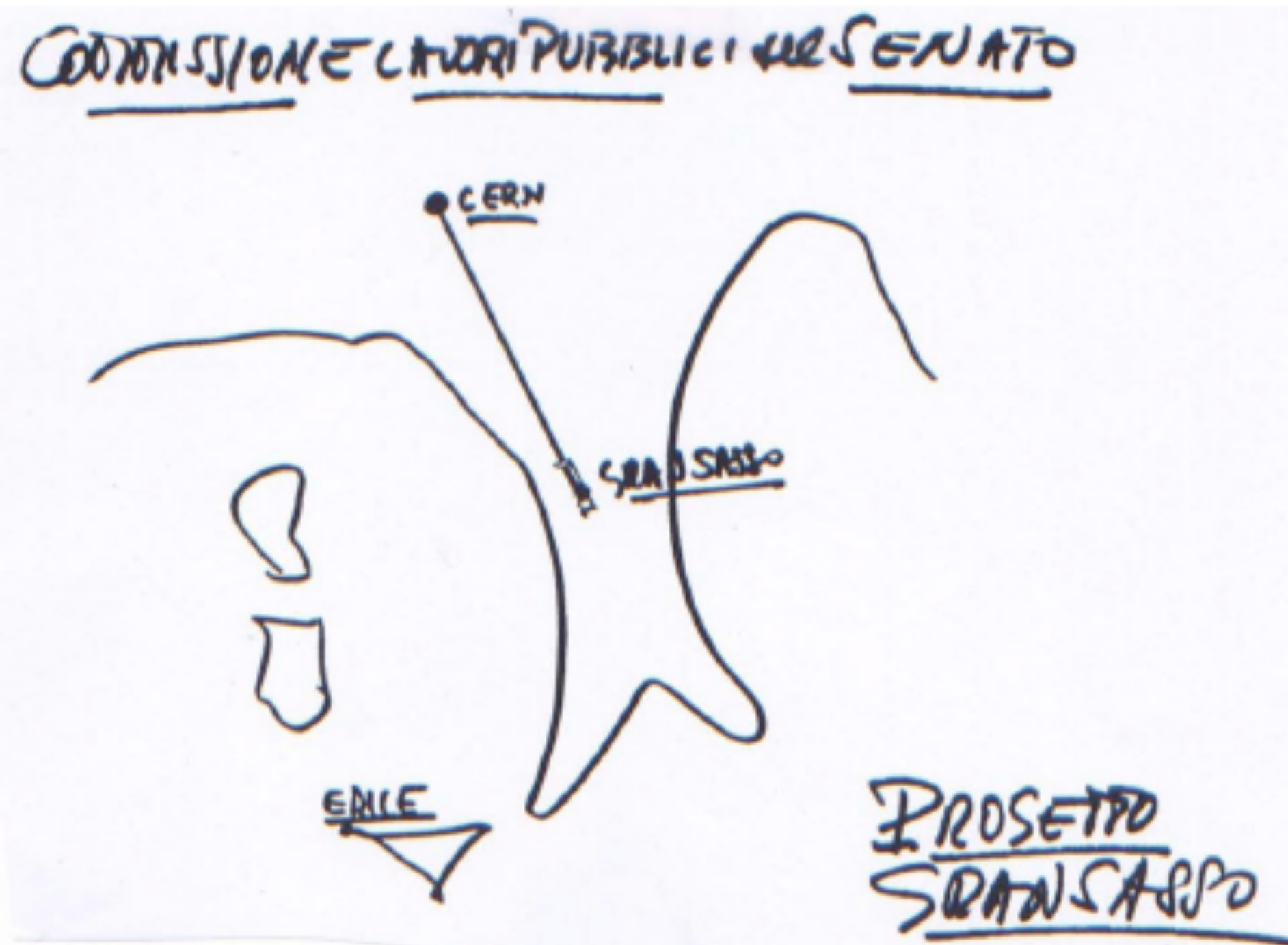


Laboratori Nazionali  
del Gran Sasso



Located in the heart of Gran Sasso Mountain, in the Italian central Appennini, in the National Park of Gran Sasso and Monti della Laga

# History of LNGS

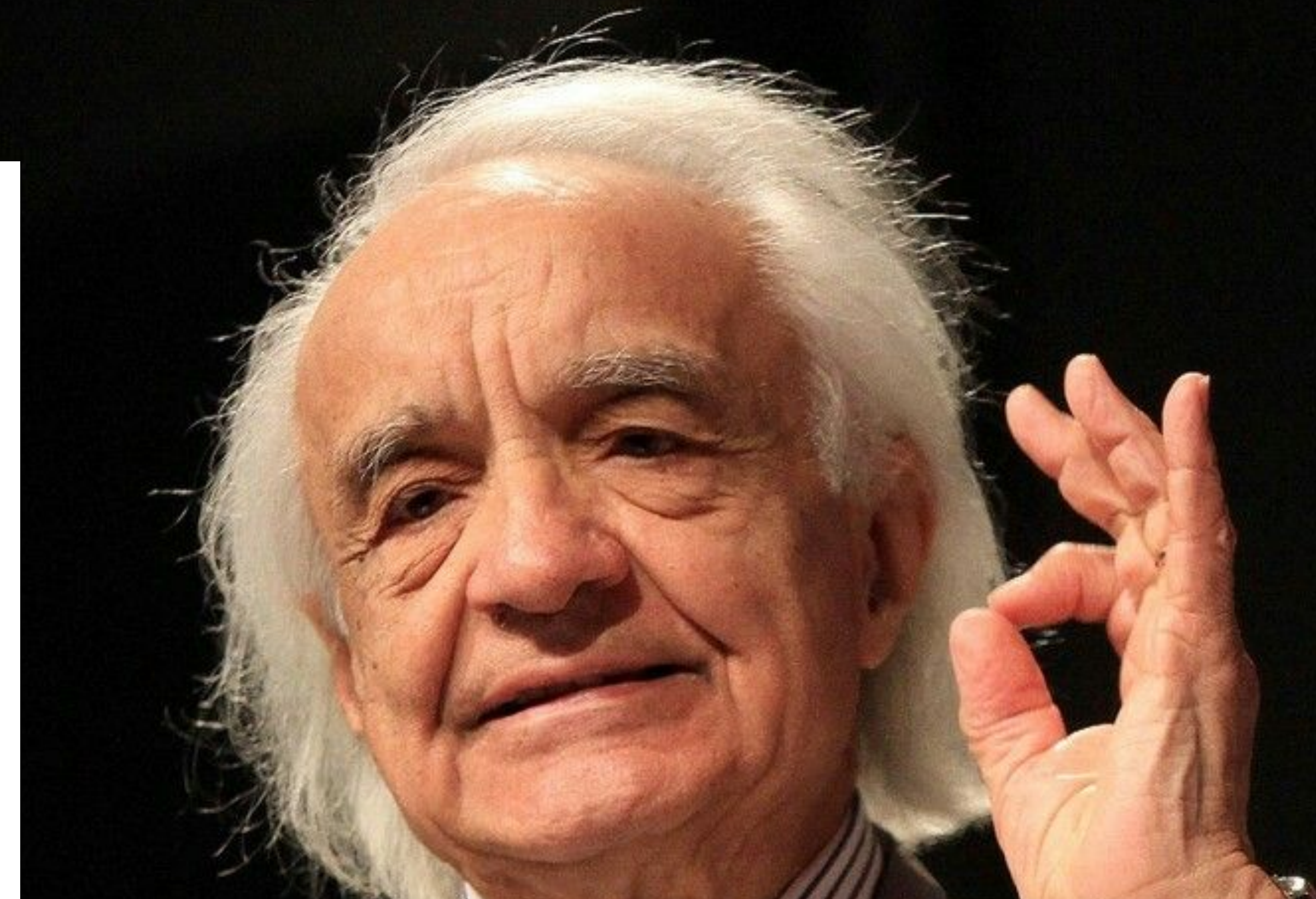


Note manoscritte di A. Zichichi presentate nella Seduta della Commissione Lavori Pubblici del Senato convocata con urgenza dal Presidente del Senato per discutere la proposta del Progetto Gran Sasso (1979).

To summarize, the scientific aims of the "Gran Sasso" laboratory are the study of:

- 1) nuclear stability;
- 2) neutrino astrophysics;
- 3) new cosmic phenomenology;
- 4) neutrino oscillations;
- 5) biologically active matter;
- 6) ground stability.

NOT only  
 $\tau_p \neq \infty$

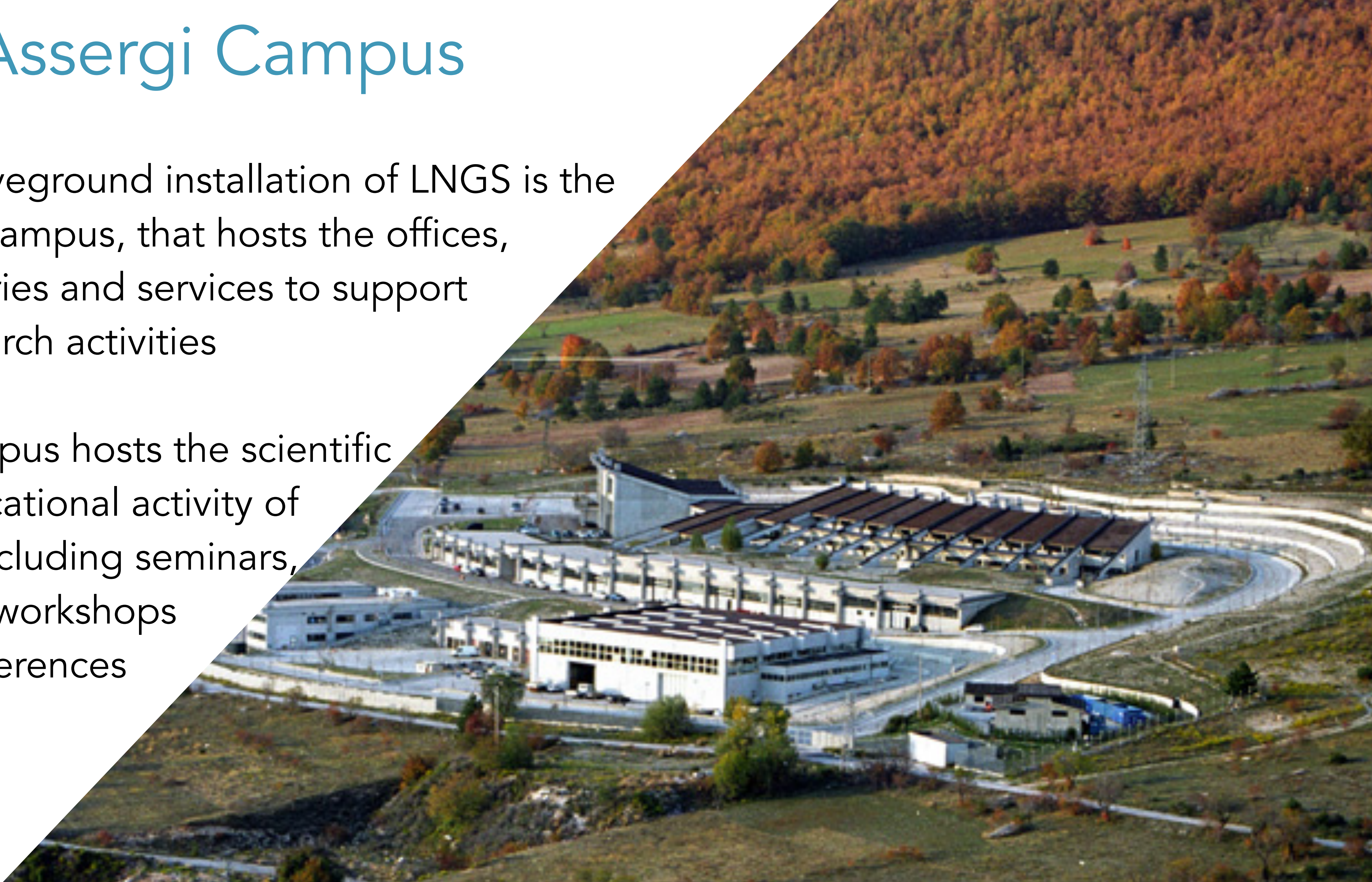


- 1979: proposal by A. Zichichi to Italian Parliament
- 1982: Approval of LNGS construction
- 1987: construction completed
- 1989: Start data taking of first large experiment (MACRO)

# The Assergi Campus

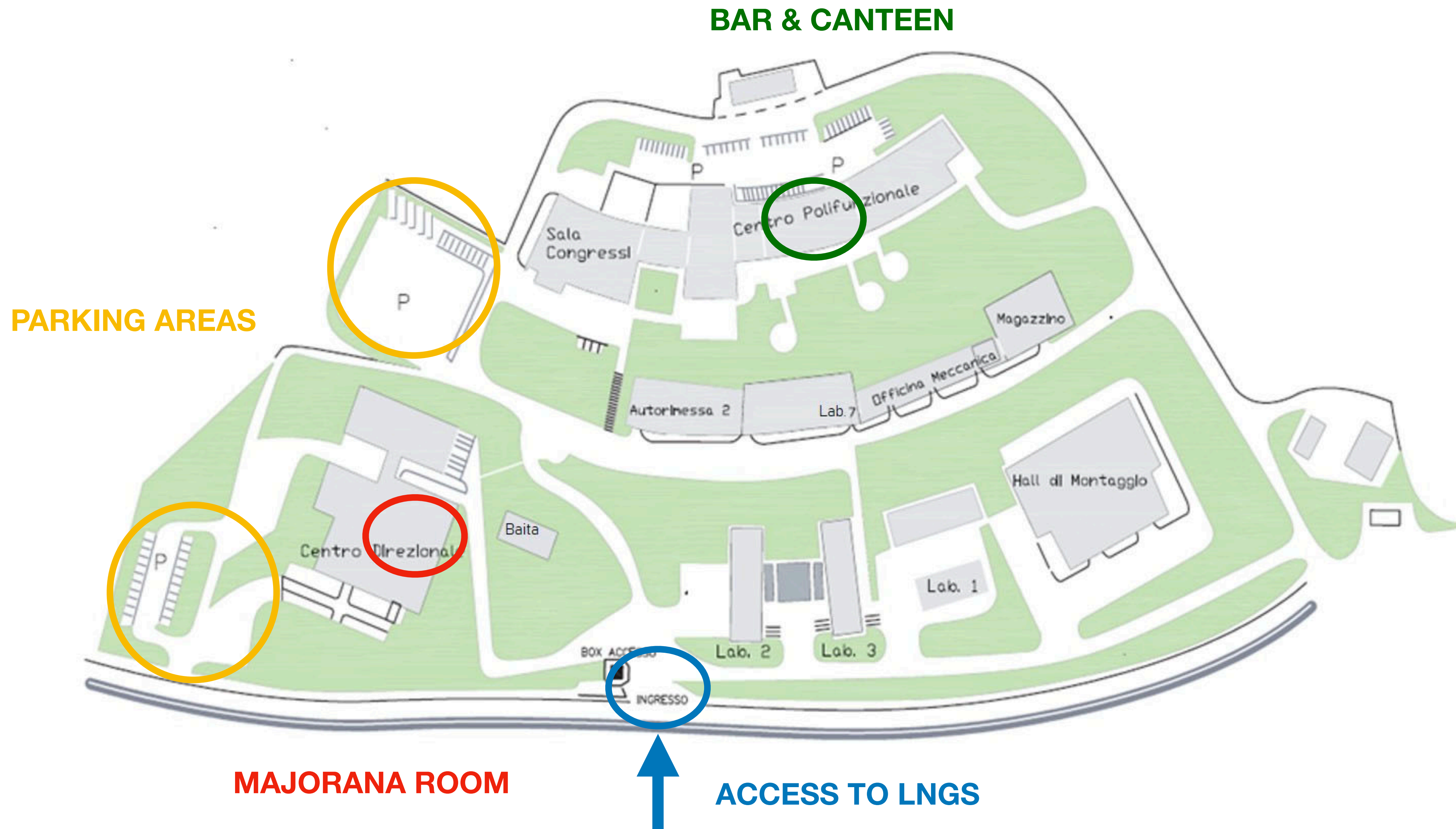
The aboveground installation of LNGS is the Assergi campus, that hosts the offices, laboratories and services to support the research activities

The Campus hosts the scientific and educational activity of LNGS, including seminars, schools, workshops and conferences





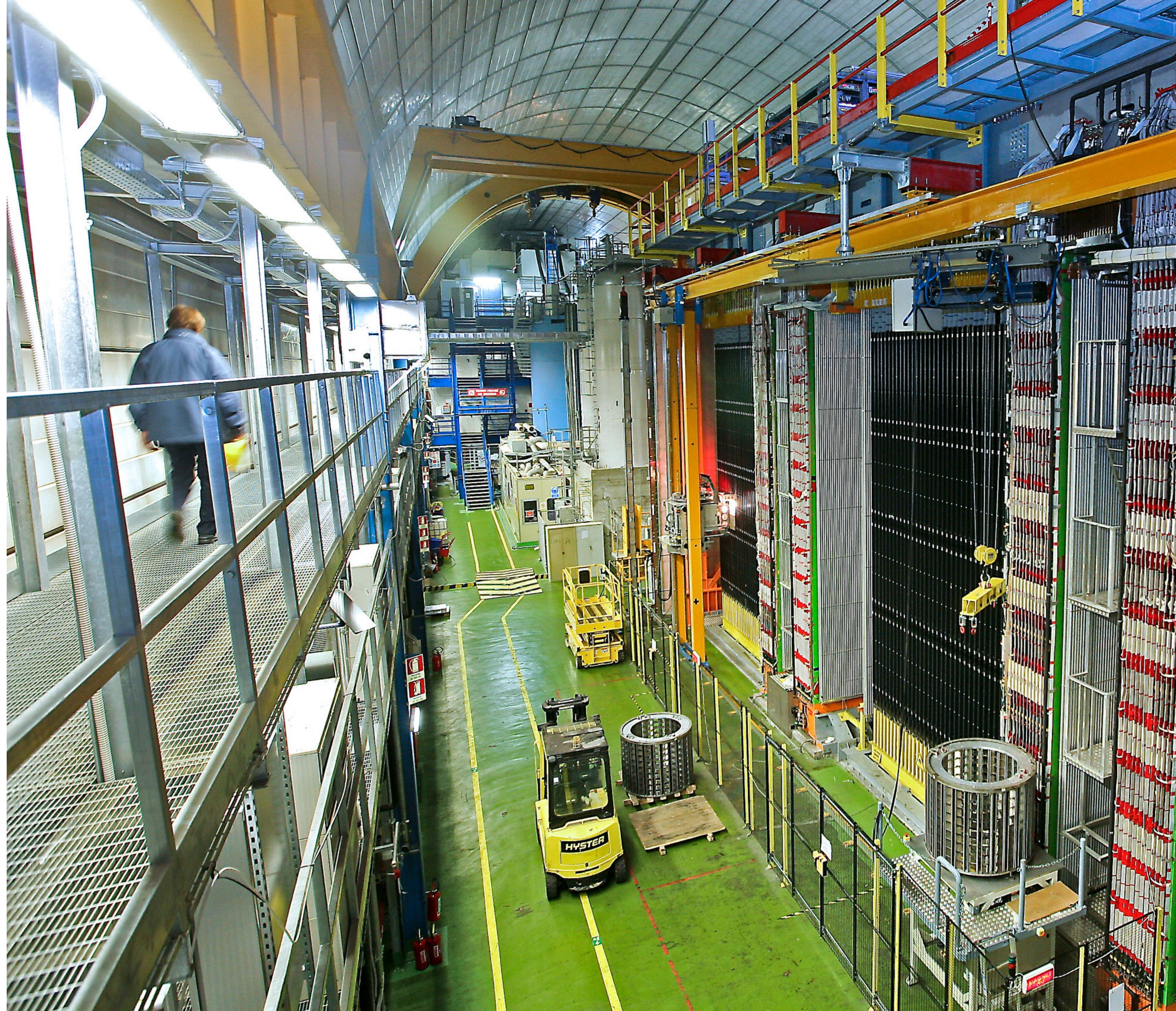
# The Assergi Campus



# Into the mountain

The heart of Laboratori Nazionali del Gran Sasso is the huge Underground Laboratory (180.000 m<sup>3</sup>)

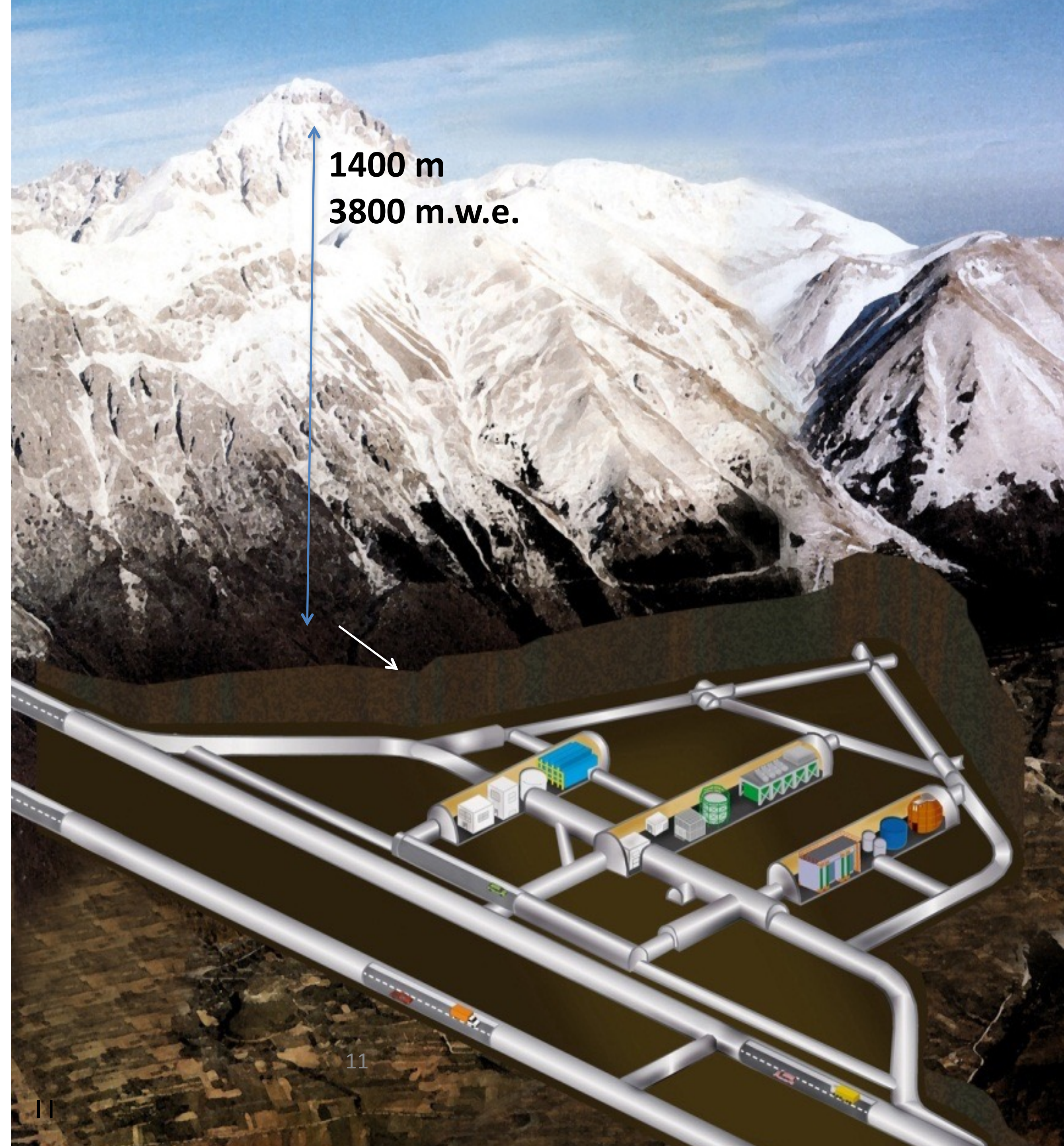
Every year over 1000 scientists from the top international science institutions choose LNGS to carry on their research projects



# The LNGS Underground Laboratory in numbers

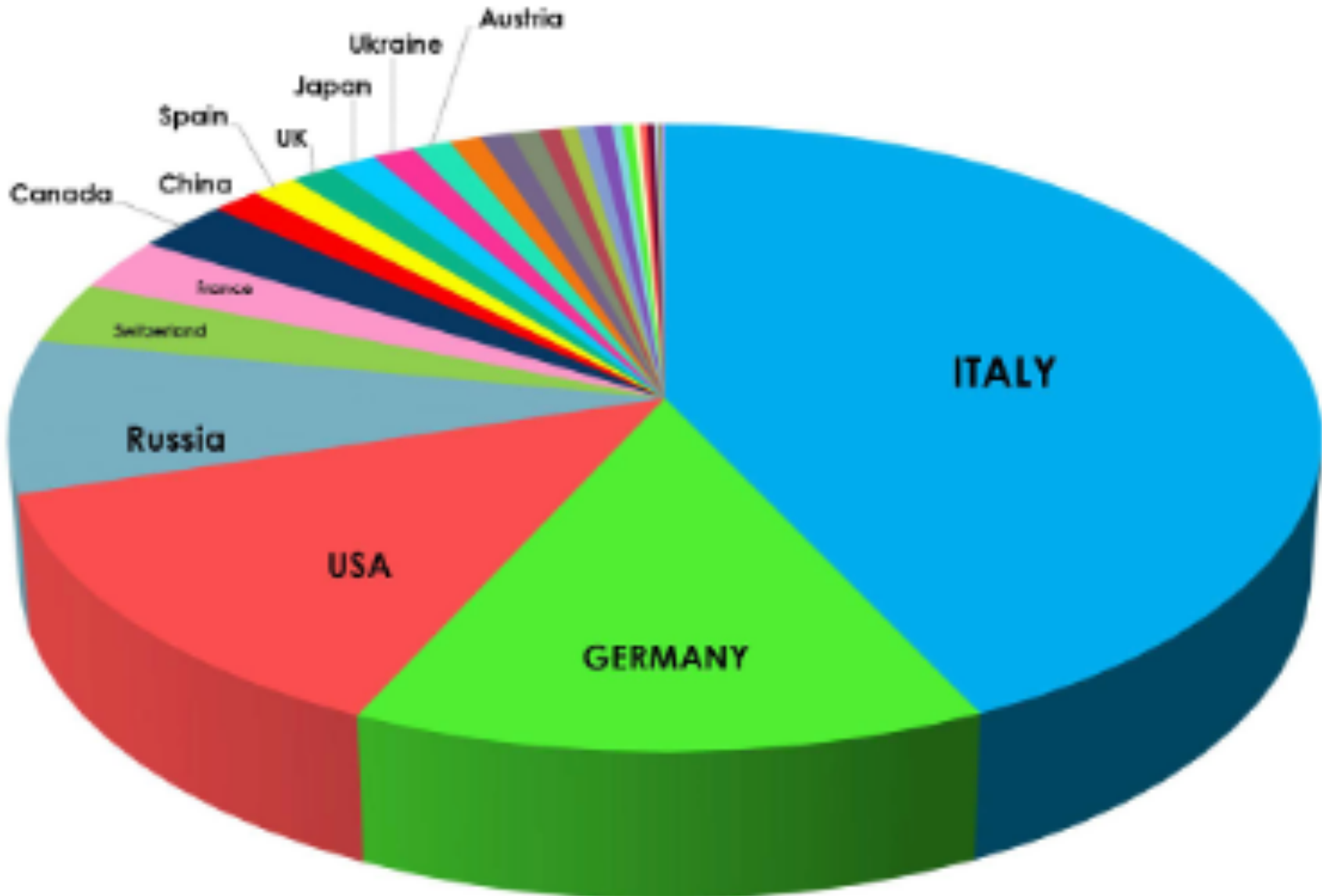
- 1400 m (3800 m.w.e. vertical depth)
- Surface: 17 800 m<sup>2</sup>
- Volume: 180 000 m<sup>3</sup>
- Ventilation: 1 vol / 3 hours
- 3 experimental halls (~100x20x18 m<sup>3</sup>)
- 22 experiments currently running
- Easy access through highway tunnel

**Largest operational underground laboratory worldwide**



# An international Laboratory

Scientist working at LNGS



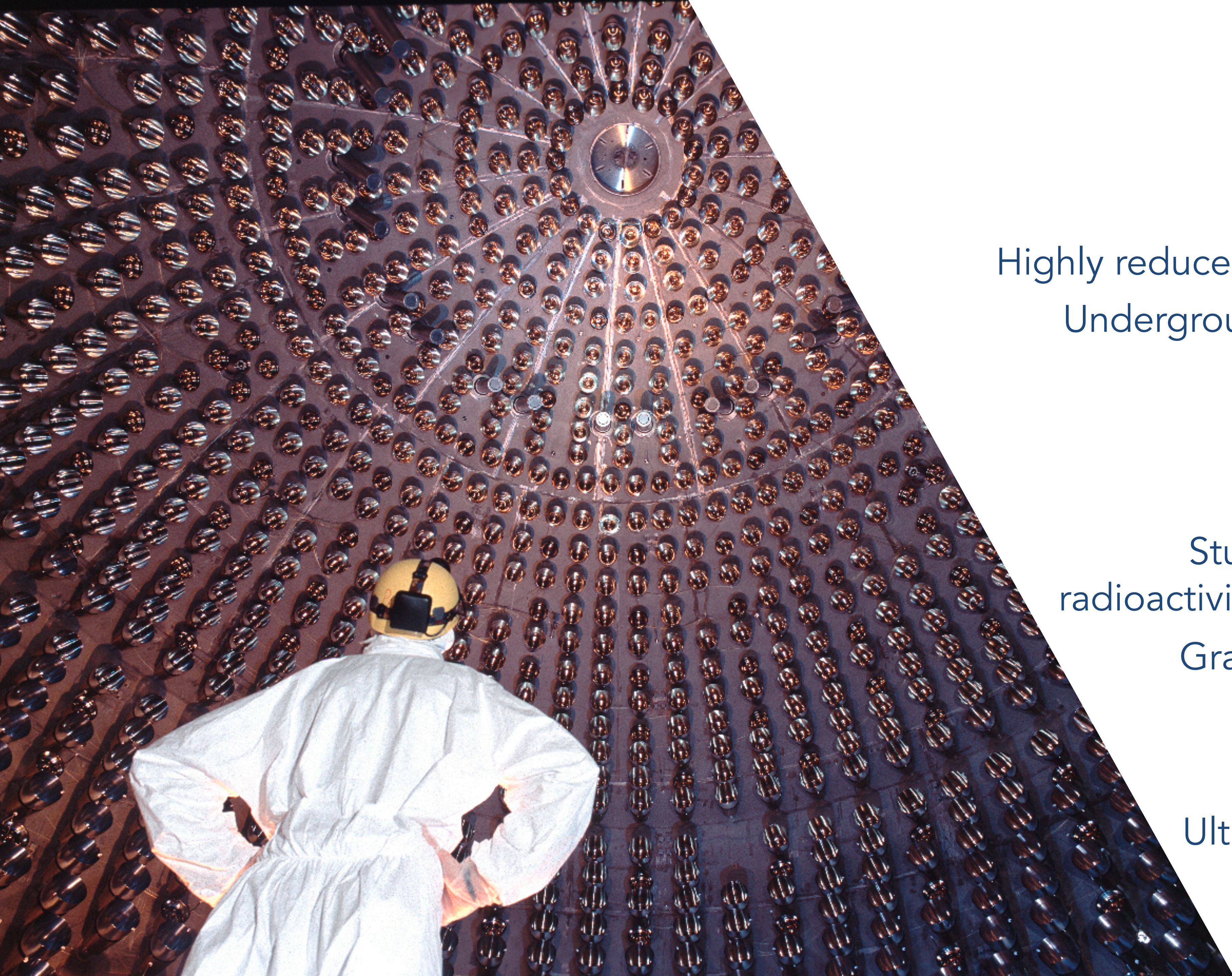
40% Italian  
60% international



# Research activity

- Neutrino Physics and Astrophysics
- Dark Matter searches: particle physics, astrophysics, cosmology
- Nuclear Astrophysics:
  - Study of Nuclear reactions relevant to Big Bang and Star Nucleosynthesis





...and more...

### **Geophysics and geology**

Highly reduced seismic noise environment

Underground water, trace radioactivity

Antineutrinos from the earth

### **Biology**

Study of the effects of very low  
radioactivity doses on living organisms

Gravitation and general Physics

### **Material science**

Ultrapure crystals and materials  
for DM and DBD

# Cryogenics at LNGS

Cryogenic applications are playing a major role in the development of the next generation of experiments

The advantages of low temperatures in particle detection and the quantum computing industry strongly boosted the millikelvin sector

LNGS is investing large economic and human resources to develop the Advanced Cryogenic Laboratory (see my talk tomorrow)



# LNGS group

Scientific collaboration in DBD and DM searches

Know-how in millikelvin sensors and detectors

Responsibility to operate kilo-channels detectors  
in large dilution cryostats

CryoVac service of LNGS

BULLKID-DM @ LNGS in 2024:

- Antonio D'Addabbo (20%)

LNGS service requirements:

- CryoVac           0.5 men year

- Mechanics        0.5 men year







Enjoy the meeting!

