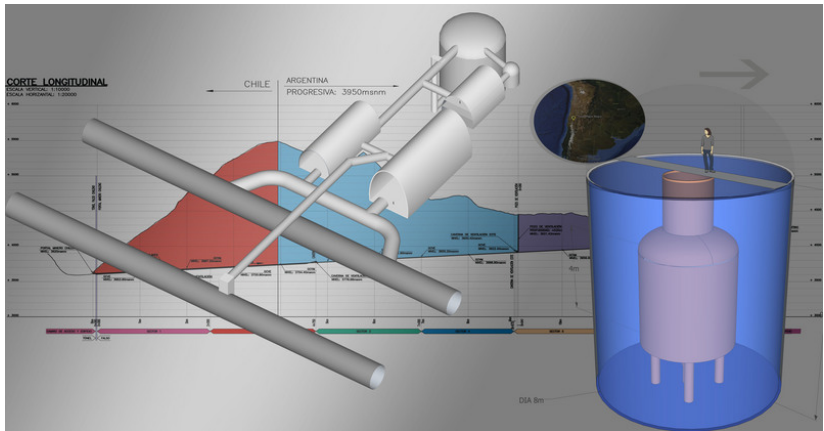


# The ANDES Deep Underground Laboratory Summary and Status

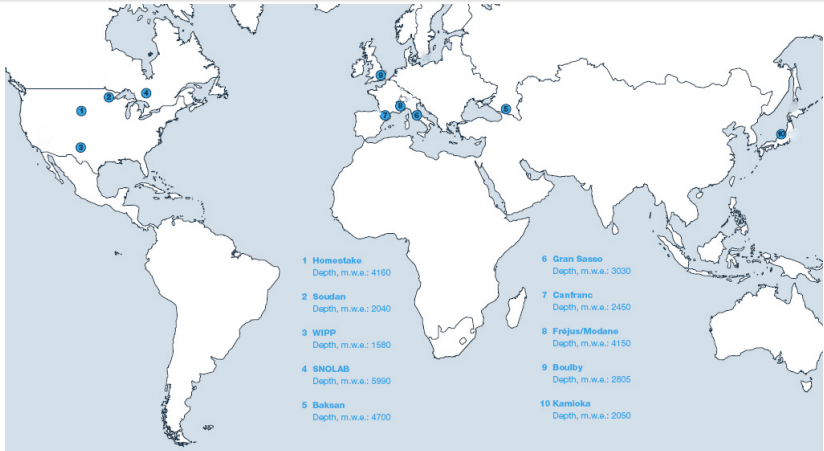


X. Bertou

CNEA/CONICET, Centro Atómico Bariloche, Argentina

3<sup>rd</sup> ANDES Workshop - Valparaiso - 11 January 2012

# Deep Underground Laboratories



+ China, Korea, India

▶ None in the southern hemisphere

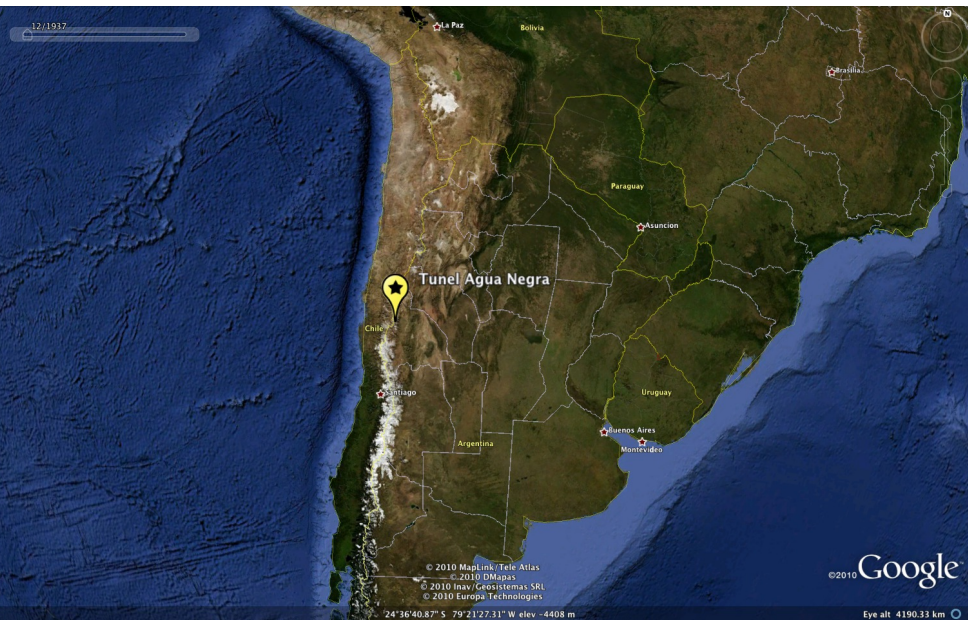
▶ Plan to build the first deep underground laboratory in the southern hemisphere

the Agua Negra tunnel

## Agua Negra tunnel context

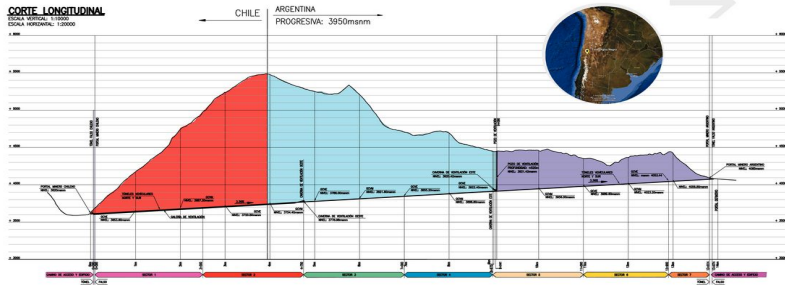
- ▶ It is of strategic importance for the region to increase commercial interchanges with the Asian market
- ▶ Argentina, Brazil and Chile have been looking for years at an alternative to the Cristo Redentor (Mendoza - Santiago) high altitude tunnel
- ▶ The Agua Negra (San Juan - Coquimbo) option is the most advanced (started 2005, final engineering study ready)
- ▶ Total cost is estimated to about 850 MU\$D
- ▶ A reserve of 800 MU\$D has been approved in the 2012 Argentina budget for the tunnel financing
- ▶ Waiting for an official announcement by Argentina and Chile presidents (postponed this month)
- ▶ Tender to start soon, construction in 2013

# Location of the Agua Negra pass



# Tunnel proposed

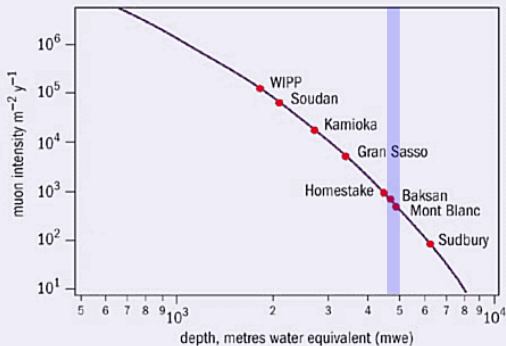
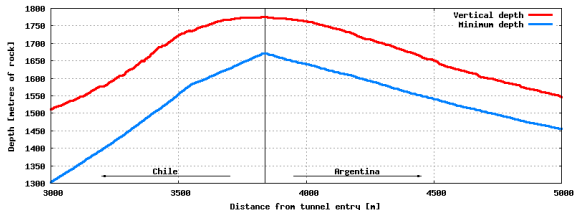
- ▶ 2 tunnels, 12 m  $\varnothing$  each, separated by 60 m,  $\approx$  14 km long
- ▶ Argentine entry point at the Quebrada San Lorenzo, 4085 m a.s.l.
- ▶ Chilean entry point on a ridge, at  $\approx$  3600 m a.s.l.
- ▶ Internal connexion galleries every 500 m
- ▶ Deepest point at  $\approx$  1750 m depth



# Laboratory geology studies

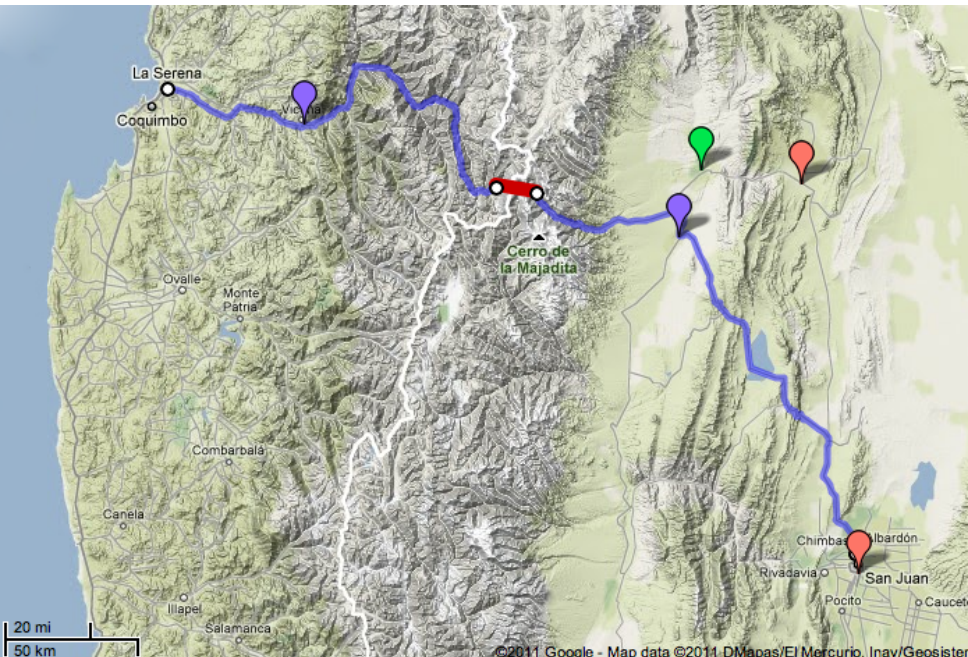
- ▶ data from 8 main perforations of up to  $\approx 600$  m deep

- ▶ Andesite
- ▶ Basalt
- ▶ Dacite
- ▶ Rhyolite
- ▶ Trachyte



4600-5000 mwe

# Agua Negra surroundings





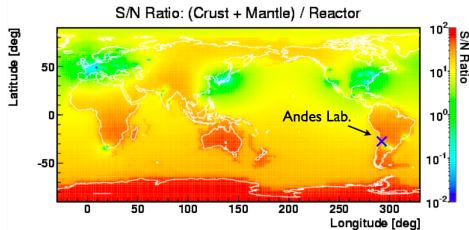
# The ANDES laboratory

(Agua Negra Deep Experiment Site)

# What makes ANDES special?

*(in addition, for us, of being in Latin America)*

- ▶ Only deep underground laboratory in southern hemisphere
  - ▶ Opposite weather induced DM signal modulations
- ▶ Low reactor neutrino bkg
  - ▶ Embalse: 2.1 GWt, 560km
  - ▶ Atucha: 1.2 GWt, 1080km (Atucha II: 2.1 GWt)
- ▶ Geoactive region
  - ▶ geophysics underground laboratory
- ▶ Very long baselines:
  - ▶ CERN: 9920 km
  - ▶ Fermilab: 7640 km (“magic” baseline)
  - ▶ KEK: 12425 km (crosses the core, 1500 km from Earth center)



# ANDES Initial Scientific Programme

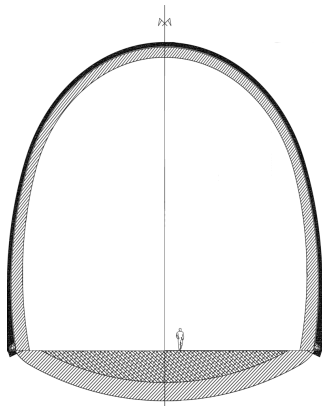
- ▶ Neutrino
  - ▶ large Latinamerican neutrino detector
    - ▶ KamLAND/Borexino style
    - ▶ focus on low energy
    - ▶ solar/SN/geo neutrinos
  - ▶ host double beta decay experiments (SuperNEMO?)
- ▶ Dark Matter
  - ▶ modulation measurement
  - ▶ new technologies
- ▶ Geophysics
  - ▶ link Argentine and Chilean seismograph networks
- ▶ Low Background measurements
- ▶ Biology
- ▶ Underground accelerator
  - ▶ Nuclear Astrophysics
  - ▶ DAR neutrino beam?

# ANDES Laboratory proposal

## Located at km 3.5-5

- ▶ main hall
  - ▶  $(21 \times 23 \times 50) \text{ m}^3$
- ▶ secondary hall
  - ▶  $(16 \times 14 \times 40) \text{ m}^3$
- ▶ office and multidisciplinary experiment hall
  - ▶  $(17 \times 15 \times 25) \text{ m}^3$ , on up to 3 floors (up to  $1200 \text{ m}^2$ )
- ▶ ultra-low radiation pit ("submarine" design)
  - ▶  $\varnothing 8 \text{ m}$ , 9 m depth
- ▶ single large experiment pit
  - ▶  $\varnothing 30 \text{ m}$ , 30 m depth

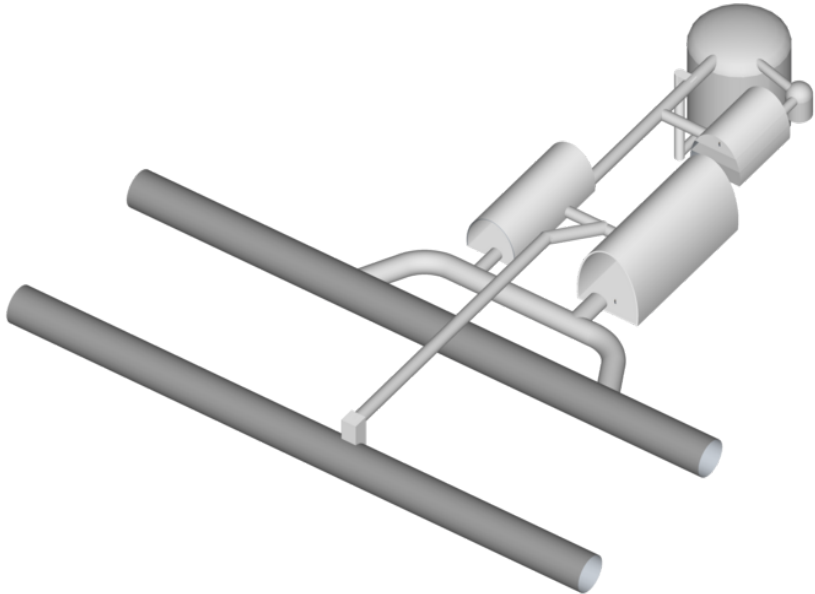
Linear tunnel for interferometer



**Total civil work cost  $\approx 15 \text{ MU}\$$**

- ▶ + underground lab equipment
- ▶ + 2 external labs
- ▶ + experiments cost

# ANDES Laboratory concept



# The Latinamerican Consortium for Underground Studies (CLES)

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- ▶ The MERCOSUR (UNASUR) aspect of the Agua Negra tunnel can be naturally extended to the ANDES laboratory
  - ▶ Excellent opportunity to have an international laboratory, not only international experiments
  - ▶ The CLES would be our “seed” for a small CERN with respect of underground science (not only high energy: geology, biology, technology...)
- 
- ▶ Common participation for the ANDES laboratory operation and operating funds
  - ▶ CLES forms the Scientific Committee to manage the ANDES laboratory
  - ▶ Current interested participating countries: Argentina, Brazil, Chile, Mexico

# Conclusions and prospects

## Unique opportunity for a Latinamerican Consortium

- ▶ Argentina, Brazil, Chile, Mexico
- ▶ Participation to the Scientific Committee
- ▶ Contribution to Operating Costs
- ▶ Latinamerican neutrino flag experiment

## Project status

- ▶ Scientific support
- ▶ Political support
- ▶ Finish Feasibility and engineering study
- ▶ Work on including the lab in the tunnel tender
- ▶ Work on science and lab white papers

## Open laboratory

- ▶ Natural integration with other labs/experiments
- ▶ Host large 3-gen double beta decay/dark matter exp.
- ▶ Students/posdocs formation phase for 7 years

Web page: <http://andeslab.org/>

Thank you!



<http://andeslab.org/>

