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 financiation
- 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 Ø each, separated by 60 m, ≈ 14 km long
- Argentine entry point at the Quebrada San Lorenzo, 4085 m a.s.l.
- Chilean entry point on a ridge, at ≈ 3600 m a.s.l.
- Internal connexion galleries every 500 m
- Deepest point at ≈ 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?
Located at km 3.5-5

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

Linear tunnel for interferometer

Total civil work cost \(\approx 15\) MU$D

- + underground lab equipment
- + 2 external labs
- + experiments cost
The Latinamerican Consortium for Underground Studies (CLES)

- 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/