

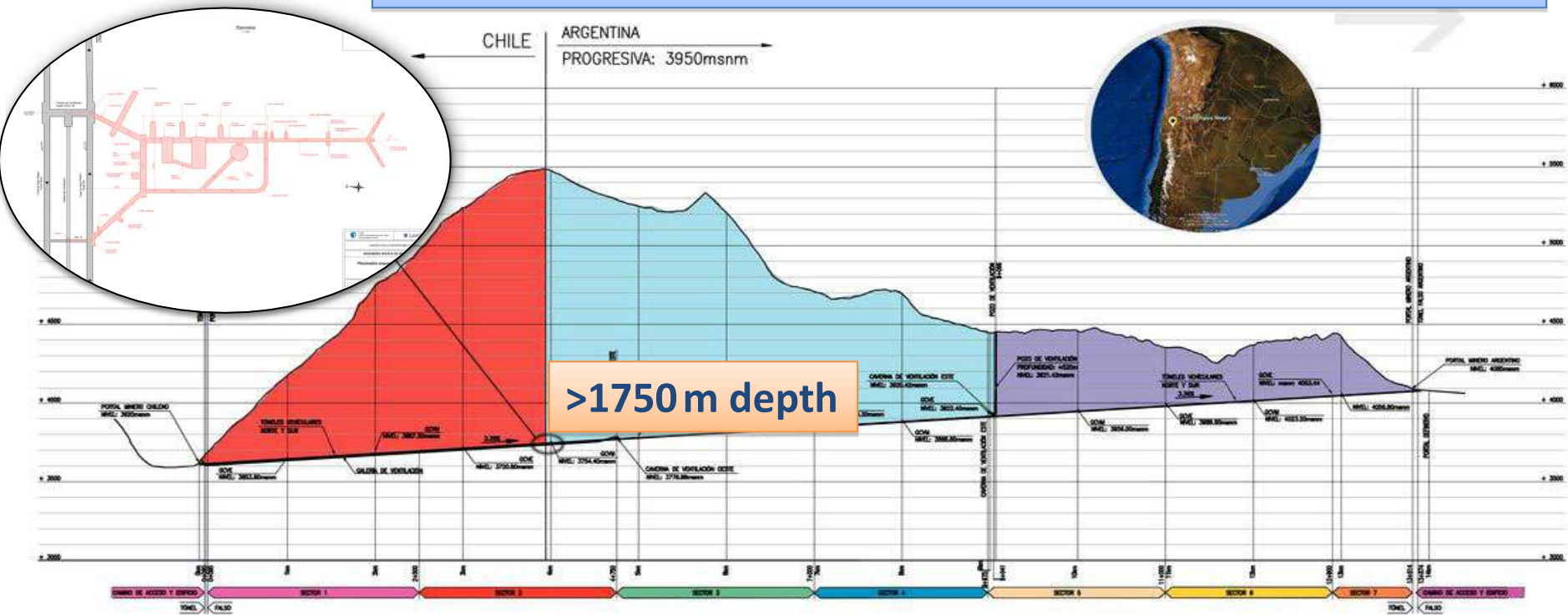
# ANDES

## The Agua Negra deep underground laboratory



- Agua Negra tunnel between Argentina and Chile
- Tunnel financed by Inter-American Development Bank; construction: 2021-2029
- Horizontal access, size of  $\sim 4\,000\text{ m}^2$  and  $\sim 70\,000\text{ m}^3$  in various halls and pits
- ANDES will be run by an international consortium

Large and deep underground laboratory in the southern hemisphere



# ANDES: Agua Negra Deep Experiment Site

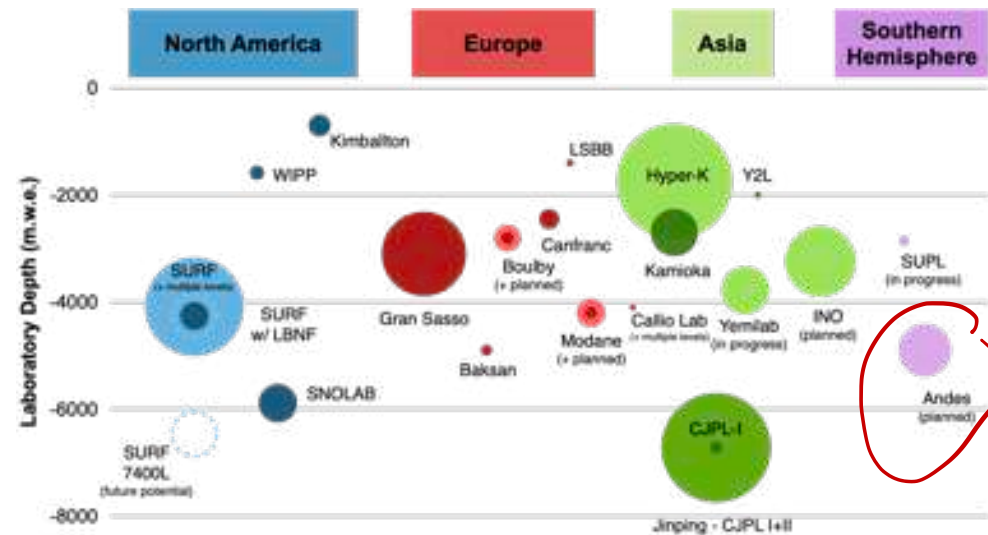
## Underground Facilities – Worldwide



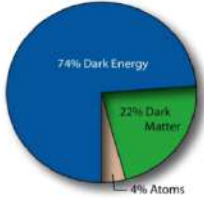
# ANDES: Agua Negra Deep Experiment Site

## Underground Facilities – Worldwide

- Underground facilities provide infrastructure to support a wide range of efforts (incl rare-process physics topics)
- Rich suite of facility options currently exists
- Many facilities are crowded. While there are exciting developments in the near term, they are largely earmarked for specific projects
  - Important decisions regarding  $0\nu\beta\beta$  soon?
- Growing number of networks and good examples of cooperation between UG facilities
- Science programs range from specific to broadly multi-disciplinary
- Strategic planning is active in many jurisdictions (e.g., Snowmass→P5) and include a strong facilities component

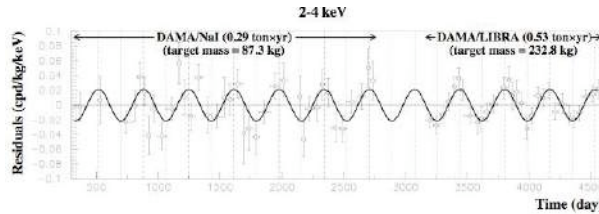


# ANDES: Agua Negra Deep Experiment Site



## Dark Matter

DAMA/LIBRA yearly modulation, to investigate in Southern hemisphere

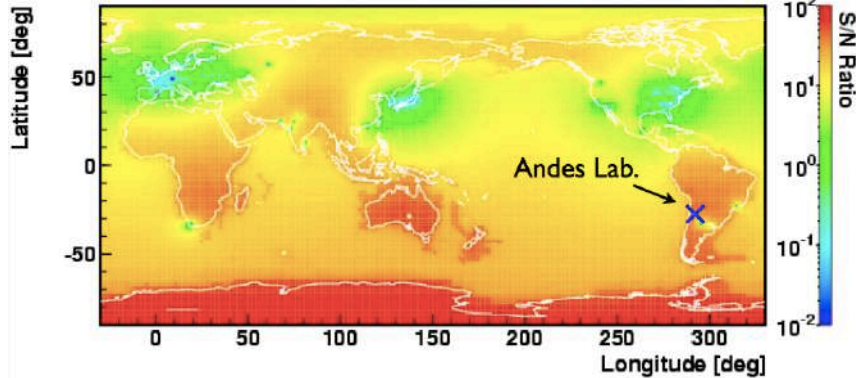


Host 4<sup>th</sup> gen. direct search experiments, large directional one



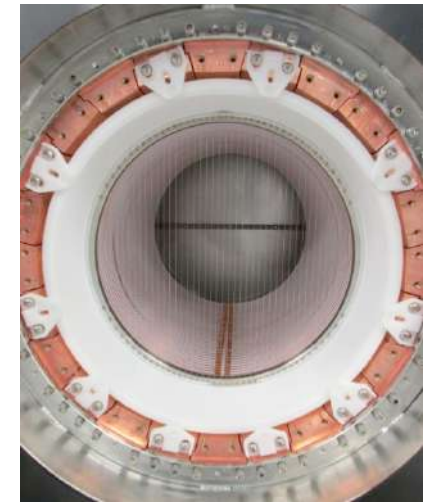
Use new particle detection techniques, ex: skipper CCD

S/N Ratio: (Crust + Mantle) / Reactor



## Neutrinos

- Geo-neutrinos (benefit from unique location)
- Build a low energy neutrino flagship experiment
- Host neutrinoless double beta decay experiments

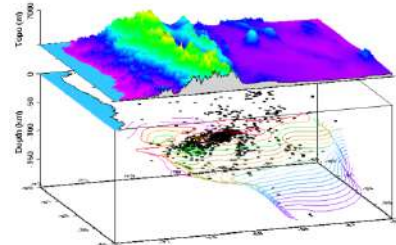


## Ultra low radiation clean lab

Environmental measurements, material selection...

## Dedicated biology lab

Radiation impact on cells...



Furlani & Triep 2007

## Geology/Geoscience laboratory

Local active region, Flat slab region, Seismograph network junction (Argentina + Chile), Magnetic and Gravimetric studies. Dedicated area in the laboratory

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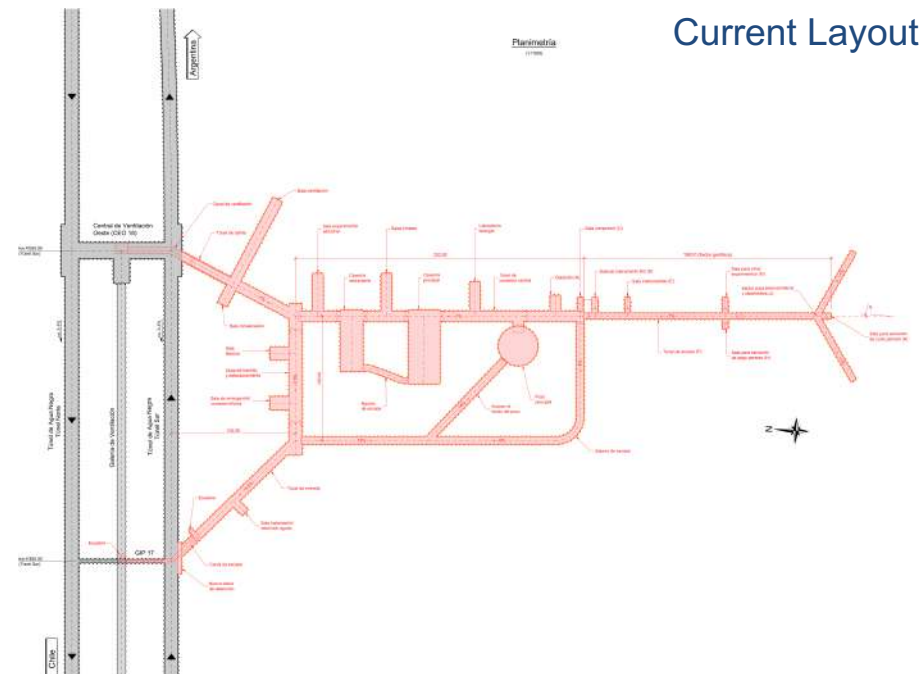
- Main hall  
(21 m x 23 m x 50 m)
- Secondary hall  
(16 m x 14 m x 40 m)
- Offices and small labs
- Large single experiment pit  
(~  $\varnothing$  30 m, 30 m tall)
- Geoscience area
- Vertical depth: 1775 m,  
omnidirectional: 1675 m
- Total: 70 000 m<sup>3</sup> laboratory volume  
(+ 35 000 m<sup>3</sup> access tunnels)

Rock Studies  
(from test samples  
~ 600 m deep)



Preliminary data (Bq/kg)

	Basalt	Andesite	Rhyolite 1	Rhyolite 2
<sup>238</sup> U	2.6 ± 0.5	9.2 ± 0.9	14.7 ± 2.0	11.5 ± 1.3
<sup>232</sup> Th	0.94 ± 0.09	5.2 ± 0.5	4.5 ± 0.4	4.8 ± 0.5
<sup>40</sup> K	50 ± 3	47 ± 3	57 ± 3	52 ± 3



- ✓ Final exact location to be determined once geology is better known
- ✓ Proposed as an Internationally run laboratory
- ✓ Conceptual study finished by Lombardi in January 2015
- ✓ Detailed engineering design (0.5 M\$) finished May 2019

# ANDES: Agua Negra Deep Experiment Site

More than 70 documents to support ANDES:

- EBITAN (Entidad BI-nacional Túnel Agua Negra)
- CONICET/CNEA/Gob San Juan/MinCyT in Argentina
- CONICYT/CCHEN/Gob Coquimbo/MinRel in Chile
- Many underground lab directors, experiments, 2 Nobel laureates
- List at <http://andeslab.org/support.php>

ANDES exists as a CLAF Unit since 2014

- Legal existence as part of a class II UNESCO Institute
- Contractor for ANDES IBA to Lombardi
- Bases for future ANDES Consortium
- Plus complementary structures in countries

ANDES foreseen as a structure similar to SESAME

- Strong Latin-American membership but not only
- Host to international experiments but also international laboratory

Could be a flagship for Latin-American HEP research infrastructure

Political green light for ANDES but depends on Agua Negra tunnel status