Sites for the SGSO observatory ALMA in Chile and LLAMA Argentina

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Atacama Large Milimeter Array



ALMA

- The largest observatory ever built!
- In the Atacama desert in northern Chile.
- Observatory is at 5,000 m.a.s.l.
- they have 66 (mm, sub-mm) radio antennas that work together as an interferometer
- 54 having 12 m diameter dishes, 12 of 7 m weighting over 100 tons
- Distances vary between 150 m to 16 km and they are being constantly reconfigured

Partners

CONICYT (Chilean Funding Agency)



How to get there? Fly Santiago-Calama 2h about 20 flights daily Drive to San Pedro de Atacama 100 km Drive 15min to the ALMA gate Drive 15 min to the OSF site at 3,000 m.a.s.l. Drive an other 30 m to the ALMA site at 5,000 m.a.s.l.





The Atacama desert



Atacama Astronomical Park, 364 km²





ALMA Gate at 2,400 m it is 15 min drive from San Pedro de Atacama



ALMA rule

- Those that work at 5,000 m have to live at 3,000m
- They have created a village OSF, Operations Science Facility, where between 150-200 people live and where all the telescopes were built before being transported to the high plateau

OSF @3,000 m 150-250 people live and work there



assembly halls, workshops, laboratories, living quarters, cafeteria, hospital,...



High Plateau AOS (Array Operation Site)





Some considerations for SGSO

- We built HAWC with 300 large Water Cherenkov detectors (WCD) at 4,100 m with 10-20 workers and 2-10 scientists in 2 years.
- It was not easy but doable.
- To build a larger SGSO detector at 5,000 m is an other song.
- Lack of oxygen **REALLY** affects your brain and there is serious risk of mountain sickness

Implications

- The detectors have to be modular
- The detectors have to be assembled at lower altitude, fully instrumented and then transported to the high altitude site.
- Once installed they have to be filled with high quality water is they are WCD and commissioned on site.
- This is following the ALMA solution!

An other consideration

- To be able to have hadron/gamma discrimination the detectors have to be sensitive to muons with a clear signal
- To obtain a clear muon signal the muon detector has to be at > 4m depth to avoid EM punch thru
- Implication: the WCD have to be big.

ALMA is prepared to accept other projects at the site



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What they would offer

- Access to the site
- security, emergency medical services
- optical fiber connection
- power at 400V 3 phases
- space for buildings
- the site for the Observatory at 5000 m

Power

- They produce their own power having 3 gas turbines, 2 for continuous use 1 spare
- 2 of them produce 7 MW/h. They only need one at the moment. The natural gas is trucked but now ALMA will connect to a gas pipeline that goes from the Pacific coast to Argentina
- Power is distributed at 23 KV and transformed down to 400 V three phases at each antenna.

Water

- There are two rivers at the valley that have water all year.
- in January February they overflow
- But ALMA trucks ~100 m³ of potable water from 100 km each day



Sites 1 and 3 and 360m r circle



Site 1

- altitude 5,018 to 5,033 m
- Circle of 250m r
- soft volcanic ash



site 2



Site 2

- altitude 4,993 to 5,033 m
- 200 m radius
- near transformer
- soft soil with some rocks



Site 3

- altitude 5,038 to 5041 m
- 300 m radius
- very flat





1 km r site near Hwy 27



Biggest problem for several months are the low temperatures at the site



the Weather is the problem



Advantages ALMA site

- The detectors can be assembled at low altitude and trucked up!!!
- All infrastructure available: roads, power, optical fiber, medical attention,
- Large community working at the site with lots of expertise
- Political and logistic problems solved
- Very close to a large town with many resources

Contacts (need update for 2019)

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