# ALPACA

## Andes Large area PArticle detector for Comic ray physics and Astronomy

http://www.alpaca-experiment.org/

V Congreso Latinoamericano de Física
Puebla, México
9 de octubre de 2018

**Martin A. Subieta V.**





# How started the project?

# Prof. Kajita visit Bolivia promoting ALPACA

# Long collaboration tradition between IIF-UMSA and ICRR-Japan

AGREEMENT BETWEEN THE INSTITUTE FOR COSMIC RAY RESEARCH, UNIVERSITY OF TOKYO, AND THE INSTITUTO DE INVESTIGACIONES FISICAS, UNIVERSIDAD MAYOR DE SAN ANDRES, ON THE SCIENTIFIC COLLABORATION IN THE FIELD OF COSMIC RAY PHYSICS

The Institute for Cosmic Ray Research of the University of Tokyo, Japan, esented by its Director, Professor Saburo Miyake, with the characteristics n inter-university center for cosmic-ray research in Japan, and the ituto de Investigaciones Fisicas of the Universidad Mayor de San Andres, esented by its Director, Professor Manuel Arellano Ramirez, considering that, The Air Shower Experiment started in 1961 as an international collaboration between universities and research institutions in Japan and the Instituto de Investigaciones Fisicas (then Laboratorio de Fisica Cosmica), and it has brought about remarkable contributions in the field of cosmic-ray physics from the experimental observations at Mount Chacaltaya. The Japan-Brazil collaboration between universities in Japan and Cebtro Brasileiro de Pesquisas Fisicas, and Universidade Estadual de Campinas in Brazil has exposed large emulsion chambers at Mount Chacaltaya starting in 1962 with the collaboration of the Instituto de Investigaciones Fisicas, and found a number of new types of nuclear interactions by high-energy cosmic rays.

in order to,

Make Continue the collaborations mentioned above and make the development of the scientific research successful.

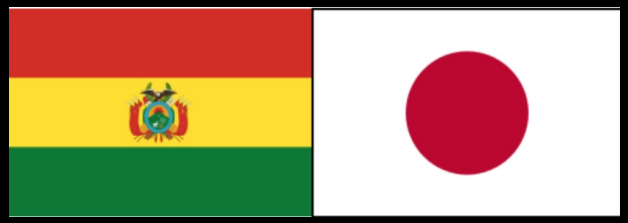
ded to sign the present agreement with the following articles:

The Institute for Cosmic Ray Research and the Instituto de Investigaciones Fisicas will discuss the scientific program and negociate the necessary budget for the collaborations mentioned above, several months before every fiscal year of each institution.

Both institutions will make a joint effort to obtain funds from sources in both countries and also from international organizations, for the further development of the existing research programs.

f) Both institutions will seek the exchange of physicists, engineers and technicians in the field of cosmic ray physics through the appropriate organizations in each country as well as through international organizations.

# The current collaboration framework



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**Graduate School of Science, Osaka City Univ., Japan**
Shoichi OGIO, Yoshiki TSUNESADA

# Looking for the right site


**16° 23’ S 68° 08’ W**

**4740 m a.s.l.**

**Flat surface**

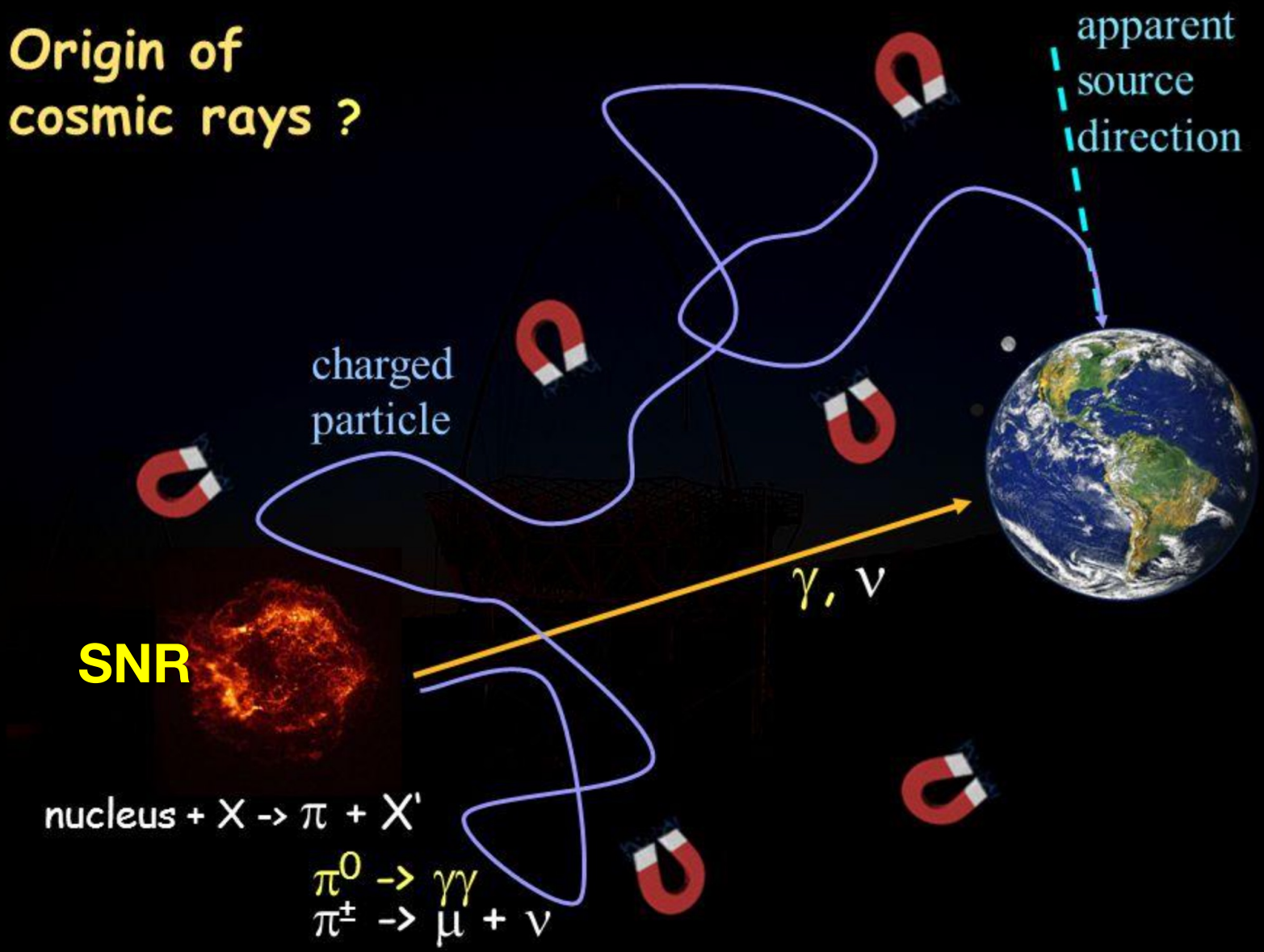
**~250000 m$^2$**

# Physics motivations

# Main goals of ALPACA

1. **Measuring of cosmic gamma rays within (5 TeV – 1 PeV)**
2. **Measuring of cosmic rays energy spectrum (100 TeV – 100 PeV)**
3. **Study of cosmic rays anisotropy above 5 TeV**
4. **Study of “Cosmic Ray Sun Shadow” above 5 TeV**

# Why gamma rays?

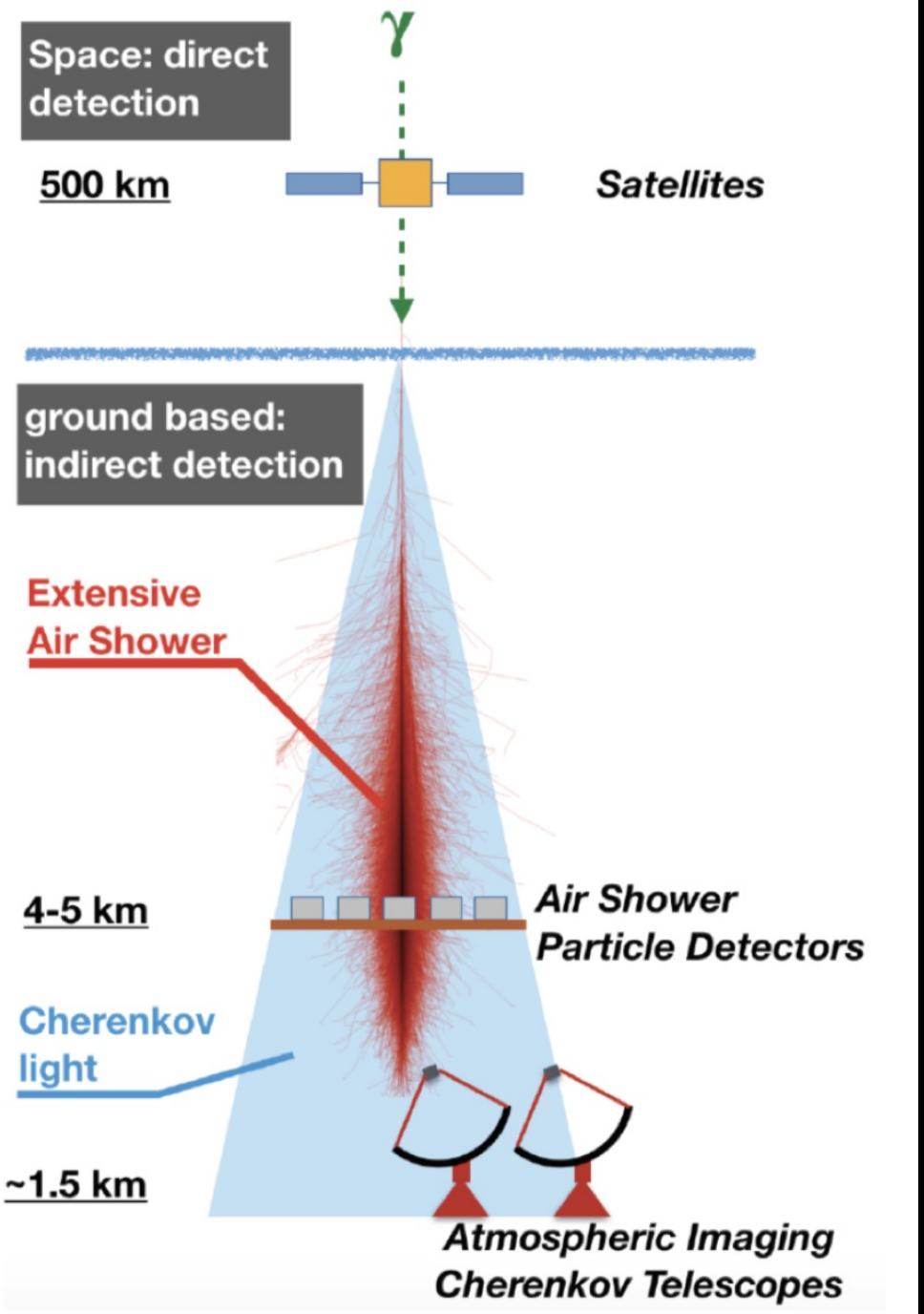


# Gamma rays sources?

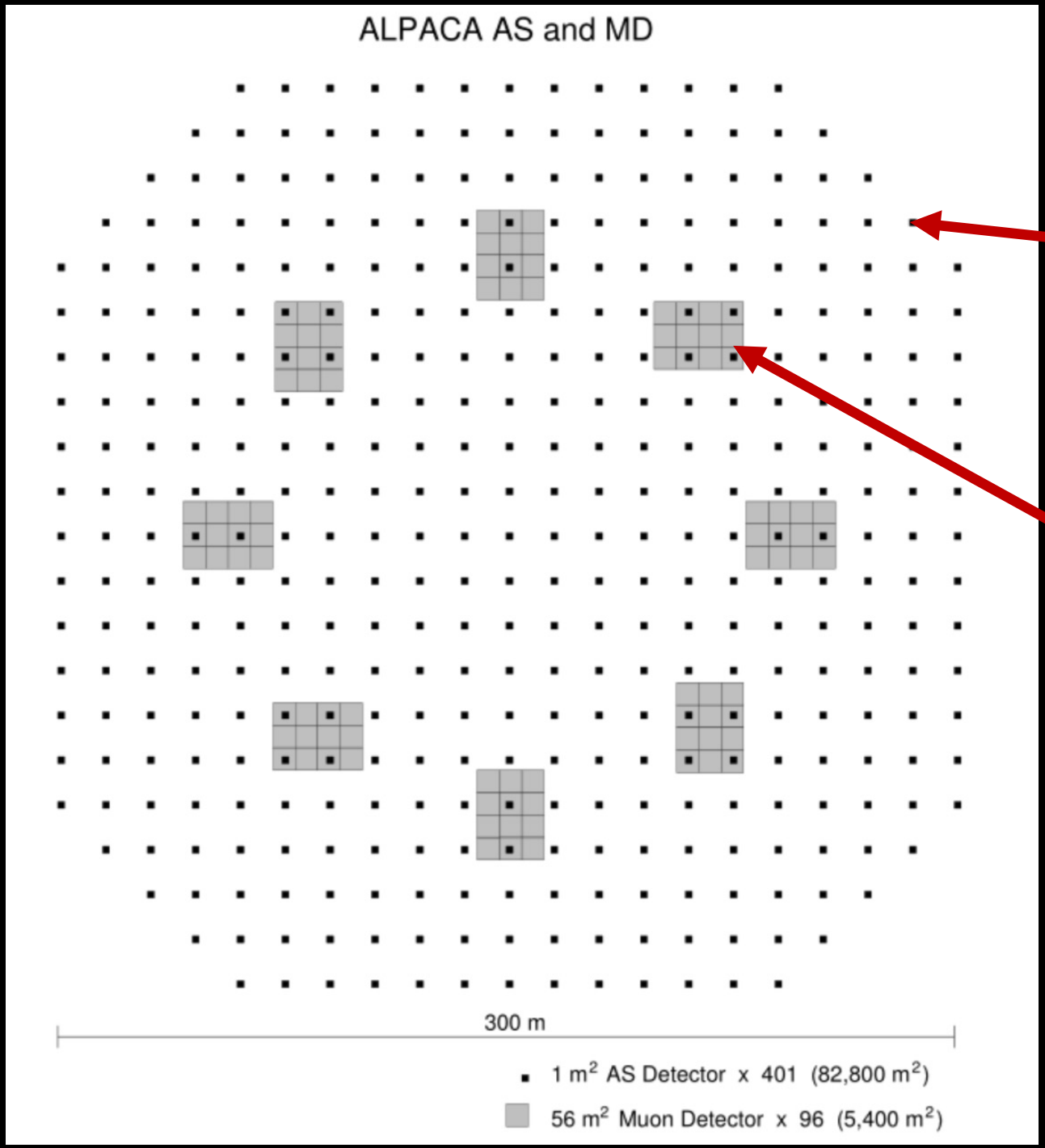
1. **In 2005 H.E.S.S confirmed 14 new sources on the galactic plane at the south hemisphere [1]**
2. **What kind of sources are? Possible PeVatrons?**
3. **Nowadays more than 200 sources discovered**
4. **Observations from the south hemisphere are needed**

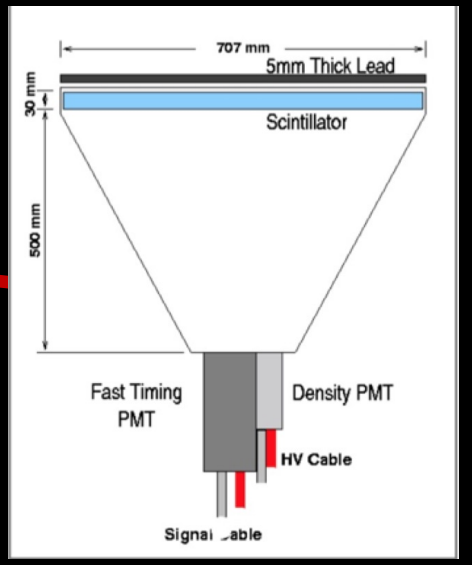
[1] F. Aharonian et al., *A New Population of Very High Energy Gamma-Ray Sources in the Milky Way*, Science, 307, 1938–1942 (2005)

# Detection technique

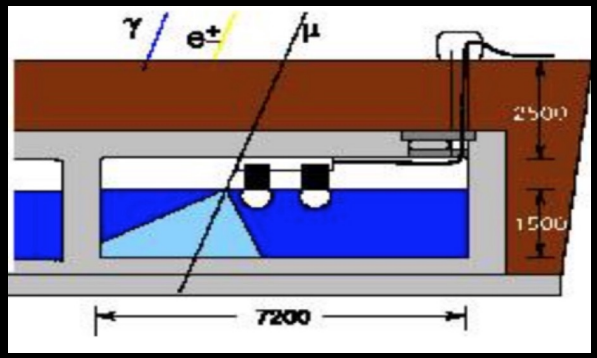

Space: direct detection
γ
500 km
Satellites
ground based: indirect detection
Extensive Air Shower
4-5 km
Air Shower Particle Detectors
Cherenkov light
~1.5 km
Atmospheric Imaging Cherenkov Telescopes

# The detector array



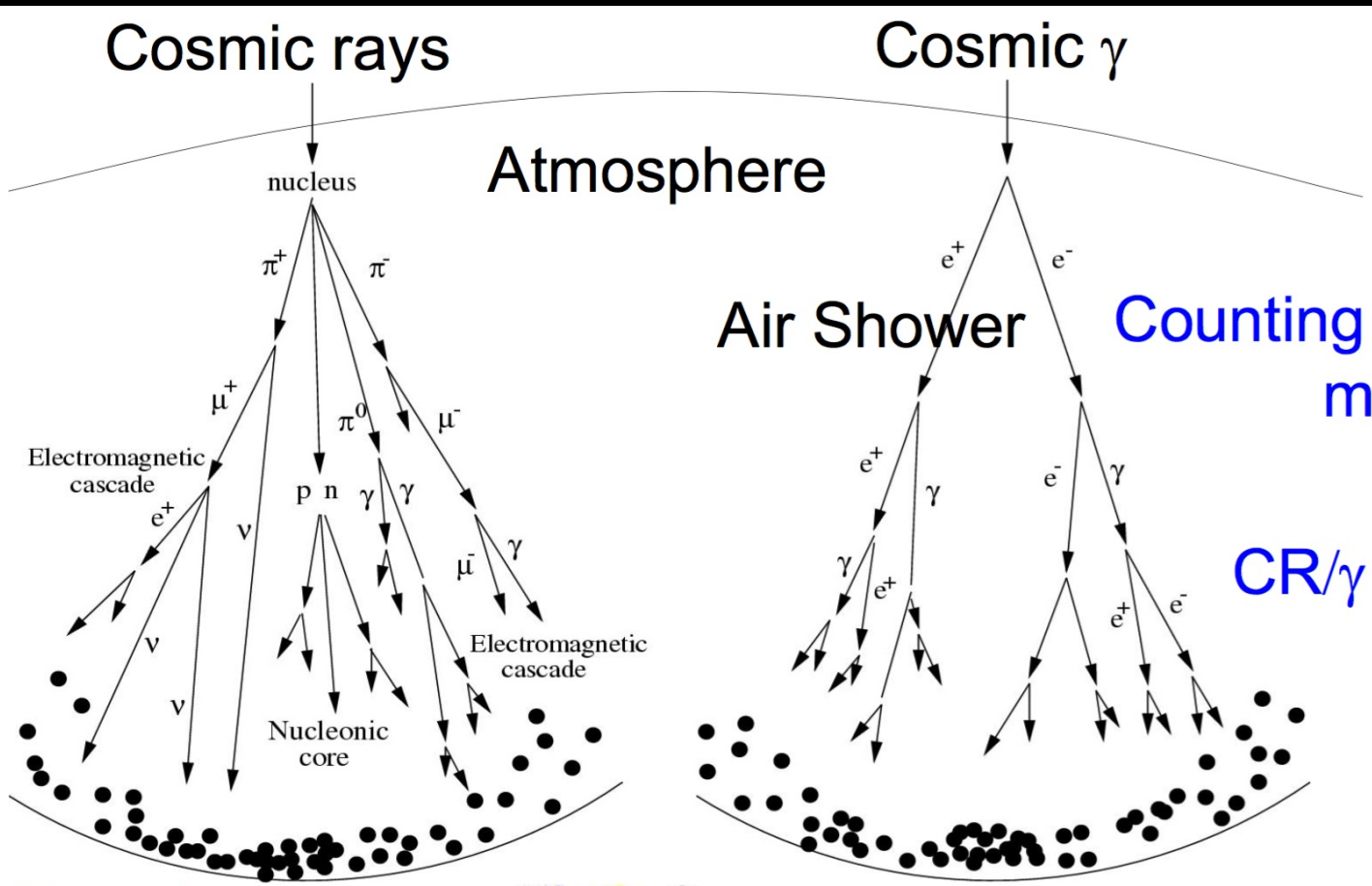




**Scintillation detectors 15 m separated**




**Cherenkov Underground muon detector**

# How do discriminate cosmic gammas?





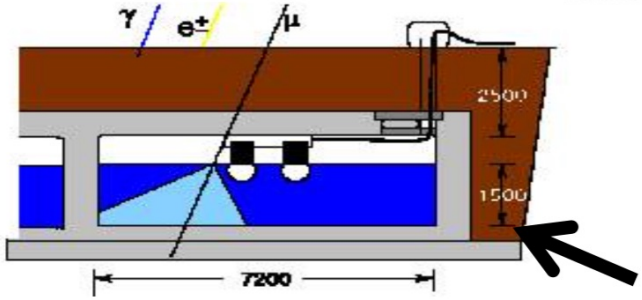


Counting number of muons

➡

CR/$\gamma$ discrimination

Cosmic rays
Many muons




Cosmic $\gamma$
Muon-less

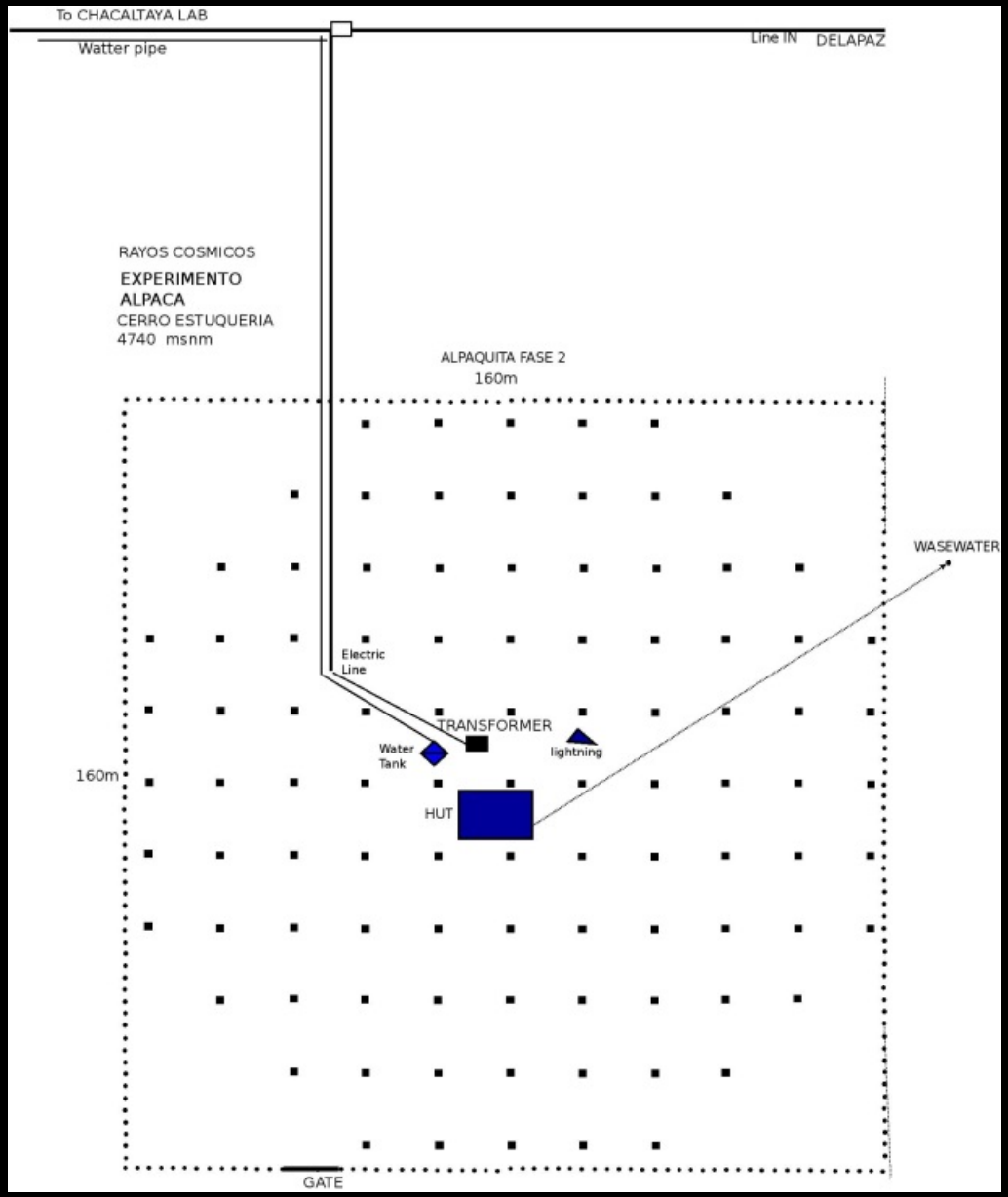
Muon detector

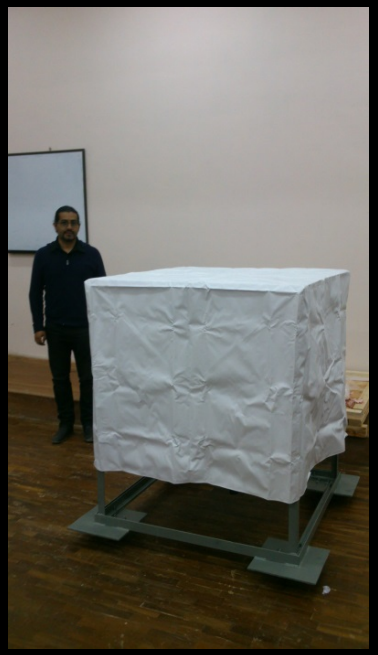
# Current status

# ALPAQUITA as 1st phase

- Prior to the ALPACA experiment, we are going to construct ALPAQUITA, a small-scale array of air shower detectors, at the site of the ALPACA experiment in 2017. ALPAQUITA consists of 96 detectors deployed at a 15 m grid spacing. These detectors are the same as the ones that will be used by the ALPACA experiment. With an effective area of ~8,000 $m^2$, ALAQUITA observes ~150 air shower events per second.
- Budget ~ 111553 USD
- Building starts on late October
- Detectors arrive on late December

# ALPAQUITA as 1st phase



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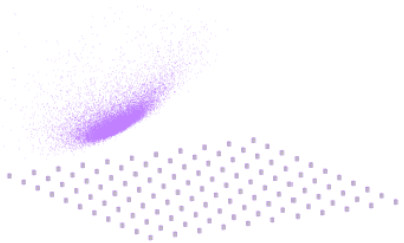
## PROYECTO ALPACA

CONSTRUCCION INFRAESTRUCTURA ALPAQUITA F2
DOSIER 1

Febrero 2018



Director IIF-UMSA, Ing. Pedro P. Miranda Loza
Director Proyecto ALPACA ICRC-U. TOKYO, Prof. Masato Takita

# Thank you for your attention
# Would you like to join us?