

ALPACA

Andes Large area Particle
detector for Cosmic 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,
presented by its Director, Professor Saburo Miyake, with the characteristics
an inter-university center for cosmic-ray research in Japan, and the
Instituto de Investigaciones Fisicas of the Universidad Mayor de San Andres,
presented by its Director, Professor Manuel Arellano Ramirez, considering that,
The Air Shower Experiment started in 1961 as an international collabora-
tion 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 Centro
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 negotiate the necessary
budget for the collaboration 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.

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.



研究所紹介
About ICRR

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東京大学宇宙線研究所

Institute for Cosmic Ray Research University of Tokyo

MENU

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Observatories and Research Centers

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Observatory

Akeno
Observatory

Kamioka
Observatory

Research Center for
Cosmic Neutrinos

Project Office

About ICRR

History

The Institute for Cosmic Ray Research (ICRR) conducts observations and studies cosmic rays from various aspects.



Its predecessor was a lodge for research, called Asahi Hut, built on Mt. Norikura based on an Asahi Academic Grant. In 1953, it was transformed into the Cosmic Ray Observatory of The University of Tokyo. This observatory was Japan's first research facility for nationwide joint use. In 1957, it participated in worldwide observations of the International Geophysical Year (IGY), pioneering international activities. In the same year, it embarked on the observations of air showers, and in 1958, it started using an emulsion chamber for observations. Since then, the observatory has continued steady observations with these instruments.

In 1972, the construction of Mutron (electromagnetic spectrometer) was commenced, improving the facilities for experiments. In 1973, two international projects of the Japan Society for the Promotion of Science were incorporated into the research of this institute. One project was a deep underground experiment at Kolar Gold Mine in India, and the other was a high-altitude experiment on Mt. Chacaltaya in Bolivia. In 1975, the Mutron was completed, and then the construction of Akeno Observatory was started.

The current collaboration framework



IIF, UMSA, Bolivia

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Mirko RALJEVICH, Javier QUISPE, Pedro MIRANDA

Faculty of Education, Utsunomiya Univ., Japan

Naoki HOTTA

Japan Atomic Energy Agency, Japan

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Faculty of Engineering, Aichi Inst. of Tech., Japan

Hiroshi KOJIMA

Graduate School of Science, Osaka City Univ., Japan

Shoichi OGIO, Yoshiki TSUNESADA

Looking for the right site

Mt. Chacaltaya

**Cerro
Estuquería**

16° 23' S 68° 08' W

4740 m a.s.l.

Flat surface

~250000 m²



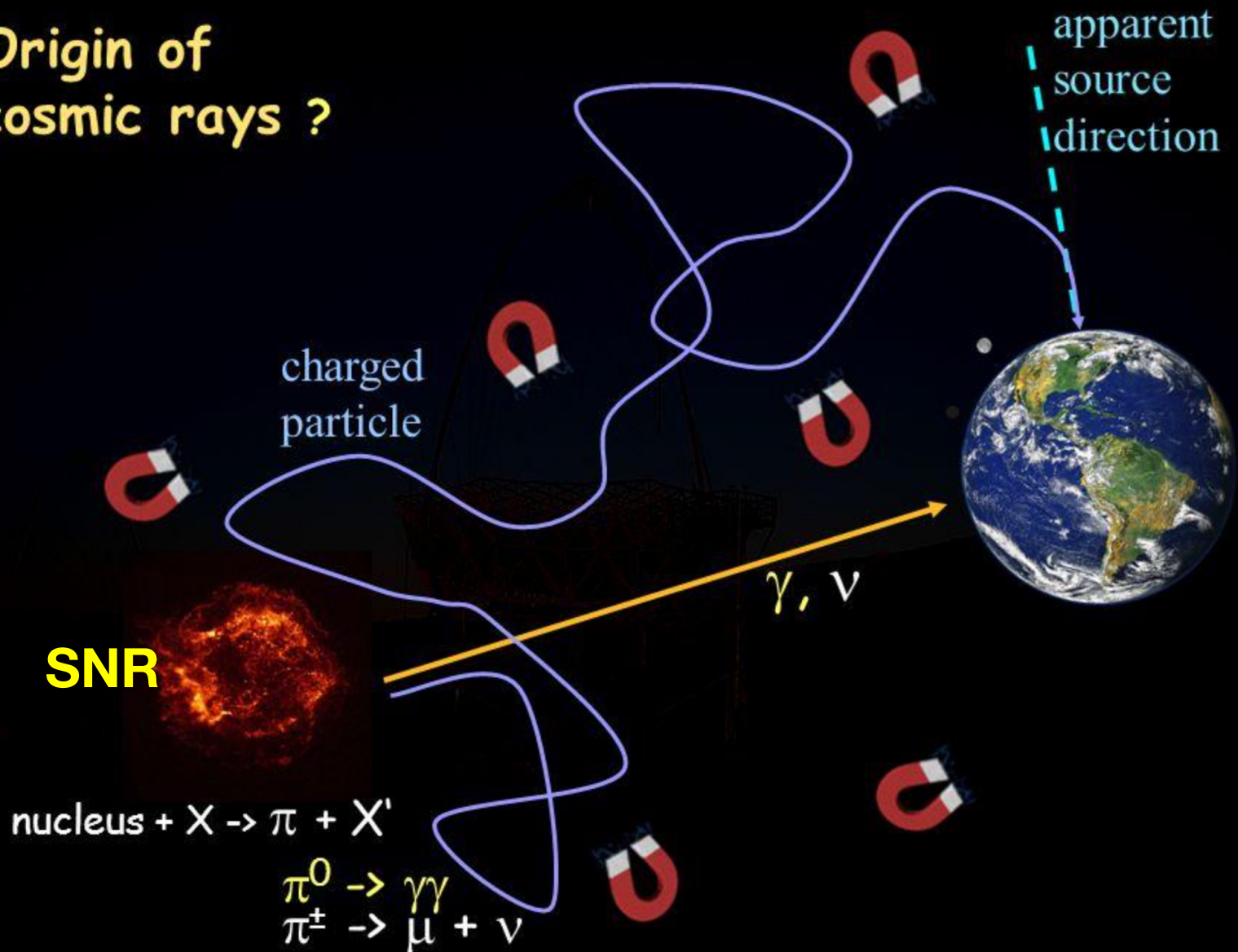
Physics motivations

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?

Origin of
cosmic rays ?

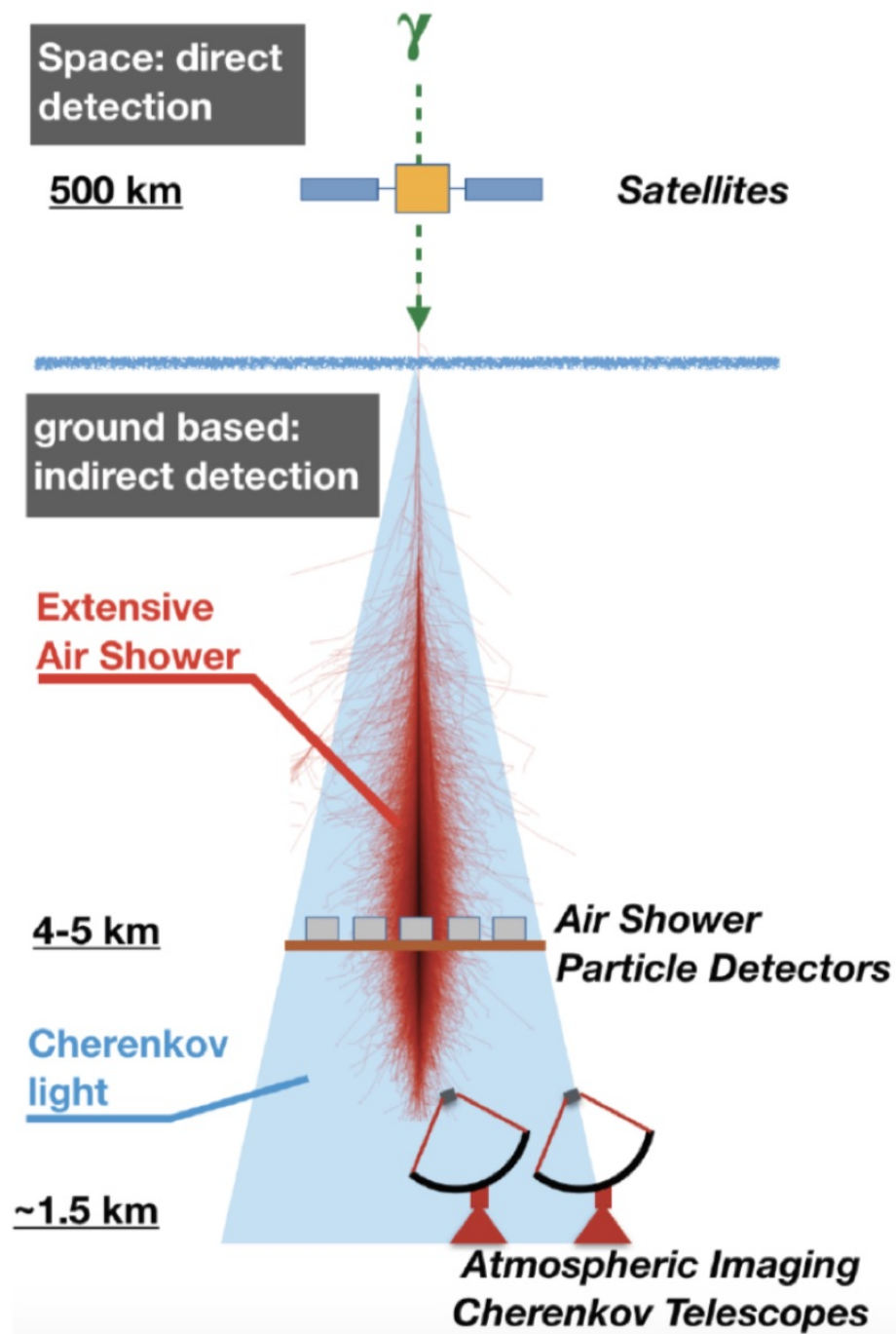


Gamma rays sources?

- 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**

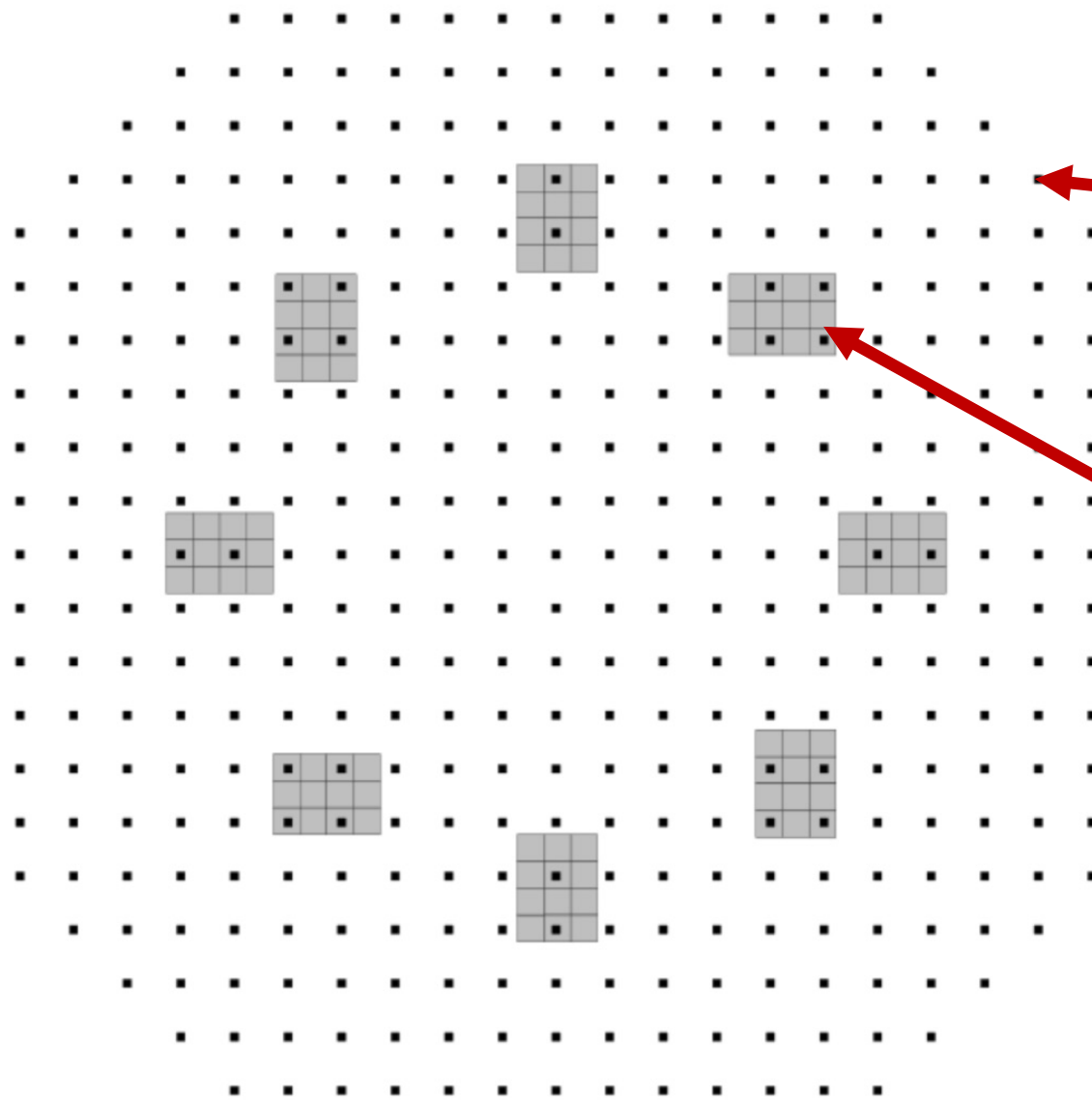
[1] F. Aharonian et al., *A New Population of Very High Energy Gamma-Ray Sources in the Milky Way*, Science, 307, 1938–1942 (2005)

Detection technique



The detector array

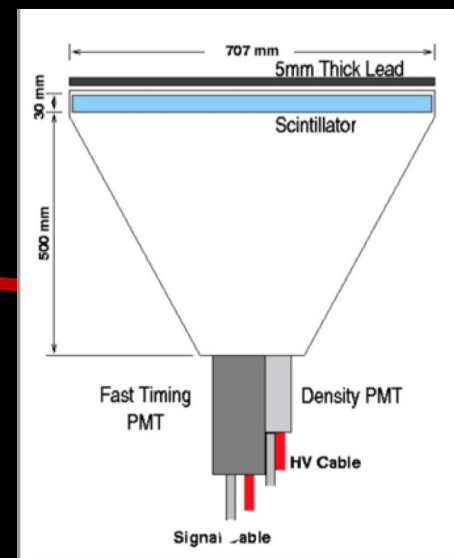
ALPACA AS and MD



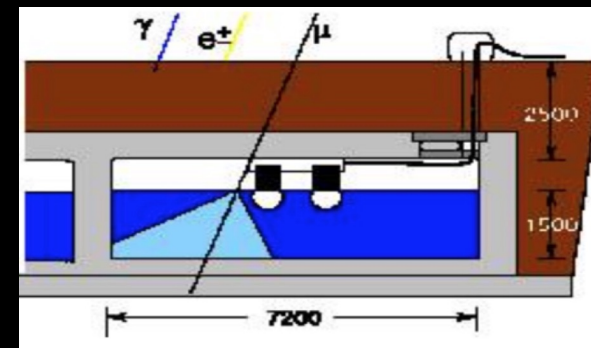
300 m

■ 1 m² AS Detector x 401 (82,800 m²)

■ 56 m² Muon Detector x 96 (5,400 m²)

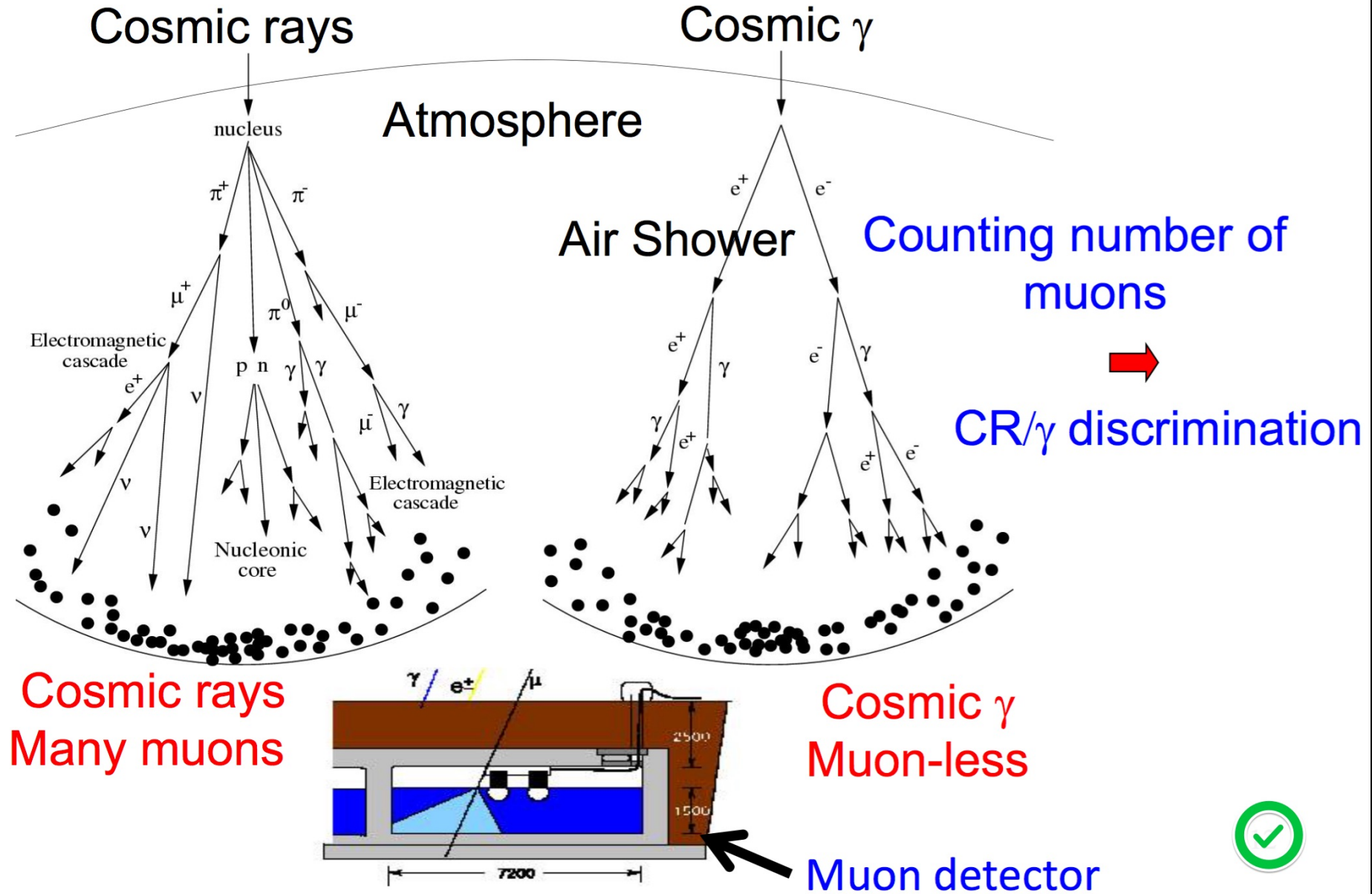


**Scintillation detectors
15 m separated**



**Cherenkov
Underground muon
detector**

How do discriminate cosmic gammas?

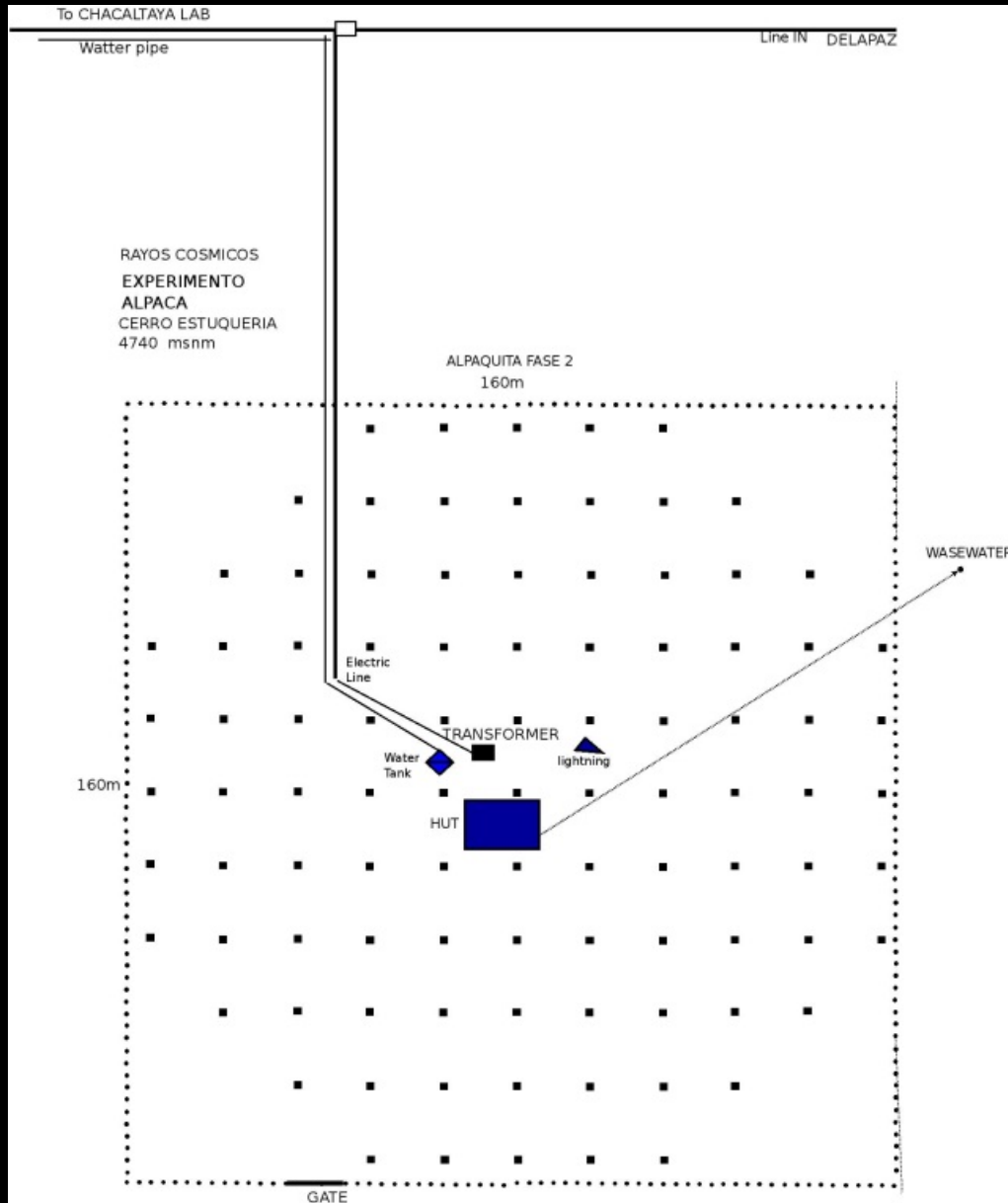


Current status

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 $\sim 8,000 \text{ m}^2$, ALAQUITA observes ~ 150 air shower events per second.
- Budget $\sim 111553 \text{ USD}$
- Building starts on late October
- Detectors arrive on late December

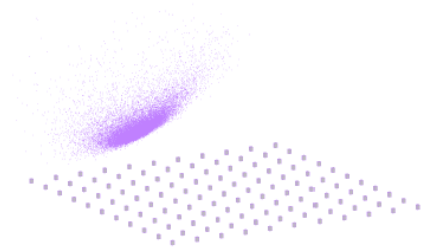
ALPAQUITA as 1st phase



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FACULTAD DE CIENCIAS PURAS Y NATURALES
CARRERA DE FISICA
INSTITUTO DE INVESTIGACIONES FISICA
LA PAZ BOLIVIA
www.fumsa.edu.bo

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?

Possible view of ALPACA

