Astrophysics - Pierre Auger Project

The Pierre Auger Project aims at studying a foremost issue in astrophysics today, the origin of the most energetic cosmic rays with energies in the range $10^{18} – 10^{20}$ eV. The flux of the latter cosmic rays is roughly estimated to be less than $3/km^2$/century and due to this, an International Collaboration spanning institutions in 14 countries has been formed in order to build two similar observatories 3,000 km^2 each, one in the southern hemisphere (in Malargüe, Province of Mendoza, Argentina) and one in the northern hemisphere (in USA).

Two experimental techniques are used: surface detectors and fluorescence telescopes. Such hybrid approach diminishes systematic errors and allows to measure both lateral and longitudinal shower profiles, respectively. The construction of the southern observatory has begun and a first step, called the Engineering Array phase, consisting in 32 surface detectors, two fluorescence telescopes, telecommunications and Central Station buildings finished in 2002. Full construction started in 2003.

CNEA leads the Project in Argentina and, alongside with the Province of Mendoza, has undertaken the following responsibilities (many tasks with the help of Centro Atómico Constituyentes/Balseiro, Complejos Fabriles San Rafael y Malargüe, Universidad Tecnológica Nacional – Mendoza/UTN), and Universidad Nacional de Cuyo.

Our work mainly concentrates on the surface detectors and during 2003 we tried to speed up the production, deployment, and commissioning of these detectors. Actually, starting from the 32 Engineering Array detectors we ended 2003 with 208. More than half of the newly installed tanks were manufactured in this country. All battery boxes, aluminum brackets for the solar panels, Yagi antennae, tank liners were of our responsibility.

In this period, 166 tanks were filled with hiperpure water, provided by a water plant installed at the Observatory Central Station. A new water transportation tank was designed and commissioned. The water quality is routinely monitored in order to check for any bacterial growth by performing biochemical test in San Rafael city.

The liners are routinely tested at Malargüe for which purpose a warehouse was conditioned. The tests consist in searches for light and bubble leaks. These tests are also performed at the Technological University in Mendoza but need to be redone in order to double check on the production system and transportation. The liner tops have three windows over which the three photomultiplier tubes are assembled. Phototube testing is under our shared responsibility and it is performed in a reconditioned housed provided by CNEA.

On April 25th the telescope building at Cerro Coihueco was inaugurated, this building was financed by CNEA, Universität Karlsruhe and Forschungszentrum Karlsruhe-Germany. We started a collaboration for the construction of the 4th LIDAR system at Loma Sola.

In relation to data analysis, we carried on with the following:

- Acceptance and trigger efficiency of the surface array (simulations and data

analysis). Also fluorescence telescopes at for Los Leones-Coihueco (only simulations).

- Possible anisotropy in 10^{18} eV cosmic ray arrival directions.
- Semi-analytical, simulation, and data-analysis of signals from muon traversing a tank.
- Studies of collected charge vs. time in surface detectors.
- LIDAR data analysis.
- Infill and muon detector project as a further complement for Auger