

Pierre Auger Project Progress Report April & May 2007

Summary (photo album)

http://www.auger.org/admin/Reports/Monthly_Report_Apr_May_2007/Photo_Album.htm)

We have now recorded the first shower observed simultaneously with all four of the fluorescence detectors! With the fourth and last fluorescence building at Loma Amarilla recently brought into operation, it was just a matter of time until we captured a four fold fluorescence event. See the event in the photo album.

As of the end of June there are 1430 surface detector stations deployed with 1340 stations taking data. Our determined staff continues to deliver tanks, water, electronics kits and batteries to the field in spite of recent snows and cold weather. There was an unexpected reward for this hard work. The technicians recently opened one of the battery boxes to find that bees had filled the box with combs containing 10 kilos of honey. They reported the honey to be very tasty (see photos).

In the next few days we will begin to deploy tanks in the eastern end of the array. This leaves only one large area in front of the Coihueco fluorescence building where we have not yet gained access. Negotiations are underway.

The off-line group continues to relentlessly update and improve the reconstruction package. At the same time, systematic uncertainties are being reduced by the use of more precise calibration constants.

Important new physics results will be presented to the International Cosmic Ray Conference in Merida, Mexico in July. Thirty eight talks and posters will be presented.

At the time of the ICRC meeting the collaboration will announce that one percent of the Auger events will be released for outreach and education.

WBS 1.1.3 Fluorescence Detector Calibration (Jeff Brack – Colorado – Boulder)

The FD absolute calibration has recently seen progress on several fronts. A key element in this process has been the first use of the analysis of the nightly relative calibration data from each FD to adjust the absolute calibration, allowing it to track observed changes in sensitivity due to exposure and seasonal effects. Based on this analysis, 14 epochs of approximately stable FD response have been chosen, covering the period from December 2004 to March 2006, and the corresponding new sets of calibration constants have been loaded into the offline database for use in physics analysis. This calibration includes for the first time an absolute calibration for the Los Morados FD, greatly increasing the number of events available for analysis.

The absolute calibration group has recently released two technical notes. The first documents the

results of measurements of FD response at 5 wavelengths between 320 and 405 nm. These results are now available for use in physics analysis. The second describes the recent use (August 2006) of vertical laser shots to cross check the absolute calibration for a few pixels. The good agreement between the results of this technique and those from the usual drum light source calibration give us added confidence in the stated absolute calibration uncertainties.

WBS 1.1.3.3 Fluorescence Detector Atmospheric Monitoring (Stefan Westerhoff – Columbia)

FRAM (reported by M. Prouza)

On FRAM, a script for automatic photometric analysis of wide-field CCD images was installed and tested. With this script, we will be able to reliably filter out data taken in poor atmospheric conditions (e.g. data contaminated by clouds), and therefore to improve the reliability and the precision of our analysis.

Lidar

Lidar cloud data are now available in the lidar database, and the cloud camera and lidar databases are being integrated together in the Offline to provide vetoes for FD pixels that are contaminated by clouds.

Weather Station at Los Morados (reported by Bianca Keilhauer)

In April 2007, a ground-based weather station has been installed at the FD building Los Morados. The station is located adjacent to the communication tower at the back of the FD building, slightly upwards the hill. The weather station takes data continuously, as the stations at Los Leones and at the CLF, so every 5 minutes. Temperature, pressure, relative humidity and the wind speed are stored. The data are available in the database *Atm_Molecular_0_A* like the other weather station data. The ASCII tables will be available in Lyon within the next days at */sps/pauger/Malargue/Raid/monit/Weather/yyyy/mm* (e.g. yyyy = 2007, mm = 05 for May). The naming scheme of the files is like for the other stations (e.g. *wlm_2007_04_30_00h00.dat*). The data format for those ASCII files is like:

0111 = flag for correct data

2007 = year

04 = month

29 = day

23 = hour

10 = minute

00 = second

44 = data record number

856.1223 = pressure in hPa

13.32 = temperature in °C

56.17 = relative humidity

7.912 = wind speed in m/s

WBS 1.2 Fluorescence Detector Electronics digital electronics and readout systems (Matthias Kleifges – FZK-IPE)

Software progress

- The EU supported task Auger-ACCESS aims to improve the internet connection to Malargüe and to allow monitoring and operation by secure access from outside Argentina. Within this context, various serialisation mechanisms were tested as well as a simple communication protocol with the FD run control.
- Cables between adjacent electronic crates allow triggering of the left or right telescope in case the SLT finds tracks with pixels in the outermost column. Since the June 07 shift the DAQ software handles these ‘inter-camera triggers’ which will not improve directly the trigger efficiency, but recorded tracks will not suffer from missing pixels at the tail.
- The latest DAQ version 3.2.4 (June shift) supports also the readout of auxiliary event data if the event doesn’t hold any triggered pixel. The table `MirrorRunInfoTab` contains now the version of FLT and SLT. In the intermediate DAQ version 3.2.3 (May shift, except LA) H.J. Mathes improved several parts of the readout and the communication to Lidar and calibration PC. This fixed bugs # 701, # 703 and # 704 in bugzilla.
- We have written scripts and to check the integrity of FD monitoring data base (and to try a repair it) as well as for purging it after the shift. The EyePC will hold monitoring data from at most 2 FD shifts.

R&D for Auger North and the HEAT proposal

- The development and production of components for the HEAT electronics proceeded. At present, we have a first SLT board and a crate of the new electronic under test. The PCB design of the SLT is completed and also the design of the AB from Naples.
- The next important milestone is to produce components for a full crate and validate its performance.
- The slow control for the HEAT enclosures has passed the design phase. It will be tried out with one system in Karlsruhe before shipment.

WBS 2.1 SD (Ingo Allekote – Instituto Balseiro)

In the period April - May 2007 the following tasks have been accomplished:

- Tanks received and inspected in Malargue: 0
- Detectors assembled: 12
- Detectors positioned: 119
- Detectors filled with water: 89
- E-kits installed: 95

As of May 31st, 2007:

- Total SD in the field: 1416
- Total SD with water: 1361
- Total SD with e-kit: 1310

Thanks to the good autumn weather this year, deployment and commissioning proceeded smoothly. Most of the detectors in the Rufinelli land have been deployed, although some remain to be positioned and filled in the southern part, which is flooded at this time of the year. The construction of a small bridge of steel pipes is required and has been started in June.

The surveyors are marking the positions in the field of the Italians. Contracts have been signed for access to the land of Macias-Franchetti (north of Route 40, next to Loma Amarilla) and most of the tanks are deployed in that land (although not filled with water yet).

Detector Selassie, which had a strong warping from manufacture, was repaired by welding stiffening ribs made of hatchcover material. It was successfully deployed (it should be renamed to "Adidas" now).

A new battery testing method, proposed by Iago Rodriguez, has been implemented as it shortens the testing time considerably.

WBS 2.2 Surface Detector Electronics (Tiina Suomijarvi – IPN Orsay)

There are currently more than 1300 Ekits deployed to the field.

The Torino group has now fabricated 160 extra bases ordered by Fermilab. These bases are ready to be sent to Malargue. The Grenoble group is setting up a soldering station for the bases to be later installed to Malargue.

10 kg of honey was recently found inside the battery box!!

WBS 3.0 Comms (Corbin Covault - CWRU)

The Comms system for Auger South continues to perform well, generally. The overall error rate (percentage ARQ) is generally found to be between 0.03 and 0.06 percent. We have begun a systematic effort to monitor the performance of Comms, with the eventual goal of merging with the work of the Monitoring task. The Little Brother system provides an excellent snapshot of the Comms performance at any one time, but we are developing a package to follow performance trends over longer periods of time to identify receivers with increasing

error trends using the daily summaries provided by the Comms control system. Meanwhile Paul LeBrun has also completed a very nice independent analysis of this data already, looking for trends in the ARQ rate that might correlate with other factors such as lightning.

Jorge Abraham continues to oversee the Comms sub-task to complete antenna kit assembly and deployment, finish the program to place UV protective tape over non-resistant heatshrink on some deployed station antennas, and to investigate a number of the most poorly performing individual receivers in the field.

A continuing concern is the issue of spares and costs associated with obtaining spares and repairing components. Of particular concern are the low number of spares radio receivers (SUs) for deployment to tanks in the field, and spares for critical components on the microwave backbone system.

Earlier in the year, the Leeds group coordinated a field test of a new version of the Base Station Unit (BSU), which acts to relay communications between Subscriber Units (SU) receivers on tanks and the main microwave backbone system to central campus. The new BSU should allow for a more efficient and reliable performance at this critical connection point. The test BSU worked very well for several days but eventually lost contact with some SUs in the field, and so has been removed from the array. Currently the results of this tests are being studied for consideration of a new test in the future.

Finally, Auger is moving forward to come into proper compliance with regards to radio licensing issues. Arrangement for licensing are being coordinated by Carlos Hovjat. It is very important that any Auger collaborator that is operating or planning to operate any kind of radio system in Argentina be in contact with the Comms Taskleader (Corbin Covault) regarding these operations. We have already contacted several collaborators directly, but if you have been and/or are considering obtaining or using any kind radio equipment in the array for any reason it is important that you contact Comms to make sure that your activities are documented and arranged to be in compliance with regulatory and licensing requirements. Thank you for your cooperation with this.

WBS 4.0 Online Monitoring (Cyril Lachaud – APC)

DataToXML

Benoît has adapted the software to the new CDAS environment.

Nagios

Antonio proposed to use Nagios to monitor the whole Observatory hardware. First work has been done in Malargüe by Richard and Ruben.

Web Interface:

A stable version will be provided soon both in Malargüe and on the mirror.

SD

Lot of works has been done to improve the analysis of the problems for the Local Stations (Alarm plots, history, standard plots) as well as to fix some bugs related to the T2 alarms. Alarm interface has been improved.

FD

Since the February '07 shift the filling of the database has been mostly completed.

In the following weeks the web-interface has been adjusted to the new data.

As a consequence a lot more information are now accessible online in the monitoring, i.e. slow-control and DAQ, and other parts are completed, like calibration.

A prototype of FD-alarm has been tested but still needs more development for stable release.

Since May some Lidar information is accessible.

Now the focus is shifted from pure database- and web-development towards increasing the usability for the shifter.

First feed-back from FD-shift is encouraging.

Hardware

We would like to thank our generous contributors (Spain and The Netherlands) for providing the funds to buy the required hardware for this task.

Now we've finally find the way to get the money from CERN.

A call has been done from CNRS to get the best possible price for the hardware (will be closed on Monday 18th of June).

The shipment will be done through our CNRS-IN2P3 platform.

We hope to have the hardware in Malargüe by the end of July.

WBS 5.0 DPA/Offline- (Bruce Dawson, Markus Roth and Tom Paul)

An Offline meeting was held after the April collaboration meeting, and was devoted to resolving some of most serious bugs and setting priorities for the upcoming months. Information on this and future meetings is available on the offline wiki.

The SD simulation sequence has been updated such that 'simulated' calibration constants are pre-computed and from read from file, rather than being recalculated at each run. An example has been added illustrating how to generate the calibration constants. Work is ongoing to bring both the calibration and trigger simulations up to date with the newer methods used by CDAS, including support for multiple T3s in an event. This requires both work on modules and on the framework. The Geant4-based tank simulations are undergoing significant cleanup.

On the FD side, a new hybrid axis finder from University of Utah has been included in the repository, as has all the code for the 'International Enquirer'. New FD calibration constants have been distributed through the database distribution system, and the expert calibration database has been moved from UNM to CSU.

A considerable amount of technical work is ongoing, including progress on the python bindings (though we would like help with this!), work on an interactive event display and configurator which is fully integrated with the framework, as well as updates to support Darwin systems.

Progress has also been made in grid-enabling the offline software. Some time ago the Czech groups set up and Auger VO, and at the April collaboration meeting we saw the first results of an Auger grid challenge using the offline framework. During our April Offline meeting, the developer team spent time with the grid experts to plan future activities, which will include, as a first step, shower simulations with using Corsika with EPOS. A presentation on ongoing work involving Auger and the grid was recently given at the EGEE user forum in Manchester, UK:

<http://indico.cern.ch/sessionDisplay.py?sessionId=24&slotId=4&confId=7247#2007-05-10>

WBS 9.0 Observatory Operations – (Julio Rodriquez Martino - INFN)

Data taking remained stable during the last months. The debugging of the system is still going on, but the number and importance of the bugs keeps decreasing.

The data taking shifts were covered with enough people to assure good data quality and to avoid an excess of working hours.

The first hybrid event seen by all fluorescence eyes took place on May 21st. Its energy was not large, but its main interest is to prove that we are able to register this kind of events, which can be accurately reconstructed. The geometry of such events is constrained by the multiple observations of all fluorescence eyes and the ground array.

WBS 9.0 Observatory Operations cont. – (Ricardo Sato – Southern Observatory)

The Surface Detector, in general, looks to work fine. However, there is always some few problems. Below a list of problems or comments of what happened during this period.

Loma Amarilla disconnection due to long period of raining days (4 days) during the end of march. That why we lost data of many stations during one or two days.

Complete stop of CDAS during FD data taking. During one night which had FD data taking, there was a power cut for few minutes. The UPS looks to work fine and could work without problem in this period. However, the power cut looks to damage one module of UPS (the UPS have three modules) and it works while have charge in the batteries (1.5 hours).

Lost communication with Coihueco microwave link. The problem have been fixed replacing the equipment in the Malargue tower. What I know, is that there is not any other spare of this equipment in Malargue.

In last few weeks we are facing a problem with Los Morados Tower. It maybe related with microwave link between Los Morados tower and Los Leones tower.

There was about 1290 (at end of 2007/May) stations working on 2007/Apr/01 there was 1146 stations working. The this progress comes from basically three different sources:

- + Large effort to put tanks in the field.
 - + some stations figures as not working because many of them didn't had information of the position (about 50 stations) and almost all of them have been fixed.
 - + Repair stations which stop to send data or which are going to have blown fuse.
- Today (2007/Jun/27) there is about 1330 stations working.

CDAS is working with new operational system (Ubuntu - 7.0). The work have done during the end of May and beginning of Jun. Every things looks to be working fine.

Beside the change, it is good to note that the core data acquisition is running with root-v3.05.07, although the new operational system doesn't support this root version (the root-v3.05.07 looks to be

not possible to be compiled by gcc-4.1.2 - default compiler of this Linux Distribution).

An old gcc compiler (gcc-3.3) has been installed to be able to make root-v3.05.07 working in this new system.

Radio Detection R&D – (Ad Van de Berg – KVI)

A lot of progress has been made by the team from the Netherlands using an additional set up near the Balloon Launching Station (BLS). This additional set up consists of two 0,5 m² plastic scintillator plates, which run in coincidence and serve as an external trigger for the radio detector system. This strategy allows us to reduce the trigger rate; while at the same time events induced by high-energy cosmic rays can be detected using the radio set up. Parallel to this cosmic-ray detection program, background measurements are being made continuously to survey the long-term behavior of the ambient noise levels (day and night variations, human-induced RFI, atmospheric disturbances). Near the BLS several antenna types have been used for this ongoing measurement campaign: logarithmic periodic dipole antennas of 3 different dimensions, and an inverted V-shape dipole antenna. In addition various filtering techniques have been tested to see the effect on noise reduction and to study the signal-to-noise ratios. Still these antennas (which are separated by about 100 m from each other) are connected by cables to the receiver units located inside the BLS. Using time stamps of the base-line detectors (SD-array) and the radio set ups, coincidences are made by analyzing both data streams. In this way, we find with the radio set up per day on the average 0.5 to 1 high-energy cosmic-ray events, which pass the Herald reconstruction of the events observed with base-line detectors. These systems are presently continuously taking data using UPS and automatic reboot after power failure.

The OSU/Leeds setup at the Balloon Launching Station continues to take data and correct operational problems. Events are being analyzed in the search for a radio/SD coincident event. Events are created based upon 3 different triggers. A locally generated time-coincident trigger between LPDA antennas, a CDAS generated T3 request involving the surrounding/infill SD tanks, and a randomly generated background trigger intended for a long-term RF background study. After a battery/solar power problem halted acquisition in March, the system was brought back on-line with a new battery system in April. This new system gathered data continuously for

2 weeks before encountering a new electronic issue bringing the collection to a halt. Another field trip is scheduled for July coinciding with the FD shift for that month.

Near the Central Laser Facility a set up of 3 fat dipole antennas is taking data. This set up has been upgraded by the team from France in April, because the first version installed in November 2006 did produce substantial RFI. The new system has a carefully designed shielding against self-generated RFI and uses less power. After starting this system near the CLF at the end of April, it appeared that after a few days some electronic problems occurred with 2 of the 3 stations. Therefore, another intervention is foreseen in July.