

# **Pierre Auger Project Progress Report February & March 2006**

## **Summary (photo album)**

There has been substantial improvement in the operation of the fluorescence detectors during the March/April shift. FD software and hardware experts on shift were able to find and solve a number of problems.

The Loma Amarilla fluorescence building construction is moving ahead well as can be seen in photo album.

The land access problem for surface detector stations is still with us. As a result the detector and water deployment effort has been concentrated in marginal areas. It is a tribute to determination of the deployment crew that they have been able to install and fill tanks in the very wet area just north of the Atuel River. Not only is the area generally wet but is filled with large sink holes and streams.

The production of tanks is progressing well and is currently ahead of our needs. The last load of tank resin will arrive in Brazil in late April.

The lack of batteries has slowed the deployment of electronics. A large shipment of batteries from Brazil is several months late because of a verity of importation related problems. The focus of the SDE group and electronics staff has shifted to uncovering and analyzing the few percent of failures in the field.

There is an increasing level of outreach activity associated with the Auger North site in Colorado. Plans are being made to bring tanks from Brazil and install three detector stations in the Lamar area both for display and to monitor the water temperature over the next year.

## **WBS 1.1 Fluorescence Detector (Jonny Kleinfeller – Karlsruhe)**

The work on the Shutters at Coihueco has been completed, at Los Leones this work will finish soon. If the weather permits, the last Brazilian shutter will be replaced by the end of April.

The uv-filters have been cleaned at Coihueco and Los Leones.

The slow control software has been updated, several bugs were identified and removed during the last shift, and the new interface has been improved.

A new firmware has been installed in the electronics crates; two bugs in the initialization of the crates have been eliminated. The start up procedure has been streamlined during the last shift.

Several dead pixels (due to defective electronic components) have been revived by Matthias and Primo.

A new bug, which was previously undetectable due to the FireWire bug, has been discovered by the experts on duty during the last shift. This bug is similar to the FireWire bug, it crashes the second level trigger readout, but it is by far less frequent.

Unfortunately, it is not easy to detect by an inexperienced shifter. An expert, who knows where to look, would have no problem to find it. It can stay undetected for quite a while, if regular check routines are skipped during data taking. Matthias' team is working on a solution.

The concept of having at least one expert present during the shift pays off; we are quite successful debugging hardware and software.

The last shift went altogether smoothly.

### **WBS 1.1 Fluorescence Detector cont. (Jan Ridky –FZU)**

February had some bad weather, wind and/or clouds

A surge protection has been installed in all FD buildings, this should reduce the trips of the differential switches. All 18 telescopes, since February, have corrector ring lenses installed. After solving the 'fire wire' problem we have moved further, although this has shown some other problems with calibration screened before by fire wire. A lot of activities behind the scenes in FD monitoring, hopefully results will be visible before long.

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

#### **Raman Lidar** (reported by Vincenzo Rizi)

Due primarily to the installation of a High Repetition Laser in Los Leones too, (this laser is unsuited for Raman operation); and with the goal of optimizing the Big-Sky laser operations and for a better performance of the Raman lidar vertical sounding at short range (where most aerosols are), we have installed in the period from March 8 to March 15 a new telescope. The telescope is a 50cm diameter astronomical quality parabolic mirror, 1.5 m focal length, placed vertically under the lidar cover in LL (see photo album).

The Big Sky laser has been placed inside the lidar shelter, with a steering mirror which deviates vertically the beam through an optical window (see photo album). With this configuration we should measure meaningful lidar returns from about 400-500m range.

We have also installed a slightly different running procedure. We had not much time to optimize the system, which, with the invaluable help of Jorge Rodriguez and mostly (in the last period) Guillermo Sequeiro, is still in a testing phase. The signals confirm expectations as for the

overlap, but reveal that the optical fiber collecting the return light over the telescope is out of focus. This will be fixed in the next days.

In diagram 1 and 2, we show the raw signals for the air/elastic, N<sub>2</sub>/raman and O<sub>2</sub>/raman channels taken the night of April 2. The presence of a huge cloud is clearly visible in the air signal (increasing in backscattering), and also in the Raman signals for both N<sub>2</sub> and (marginally) O<sub>2</sub> channels (increasing in the attenuation of the lidar return), although the signals are degraded by the un-focusing quoted above.

Diagram 1

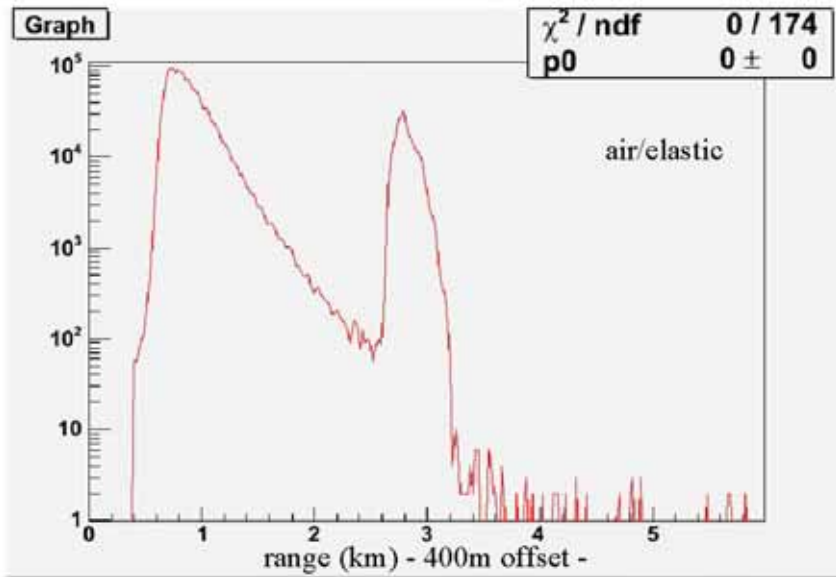
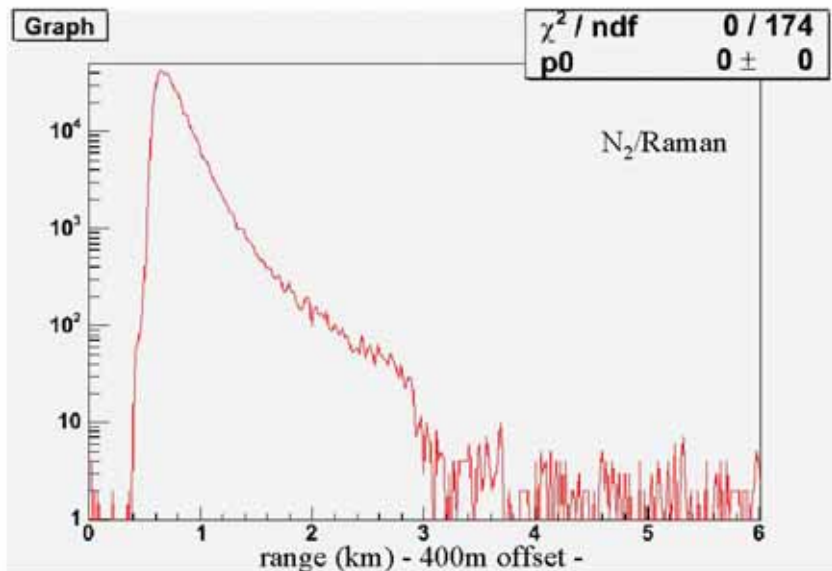


Diagram 2



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

During the last two months we concentrated our work on “debugging” the system for improved system stability and on simplification of the handling to ease the shift procedure. Therefore experts from Karlsruhe - Andreas Kopmann for hardware near software, Kai Daumiller for slow control and I for FE hardware - were on shift in the March / April period to learn more on actual problems and how to solve them. We were supported by the non-expert, but motivated and experienced team of Rossella, Elisabetta, Domenico and Jaime as shown on attached photo.

Our group implemented following important improvements /solved following problems:

- The newest release of the SCS software supports the hardware changes on shutters and curtains, i.e. the replacement of these components with a unique German design. There is now also a new web-based GUI available, which can be used from CDAS on Linux PCs and allows the operation of **all FD buildings** inside one user interface.
- The interaction of the DAQ with the UNM calibration system was fixed. Even though the calibration B and C with use the UNM system are performed only at 3 nights (at the start, the end and in the middle of the shift), we didn't find any problem.
- The firmware for the LCU (LED control unit for calibration A) is upgraded to better support the Ethernet protocols (DHCP, ICMP, TCP/IP). Due to the DHCP service, the firmware is now identical for all FD buildings.
- We have found the reasons for the “create not responding” problem and the hitrate overflows in column 1 and 2. These had been the most annoying problems in the previous shifts (besides the FW bug), which are now solved with the newest release of the SLT/FLT firmware.
- The release v3r2 of the FDEeventLib will contain a number of modifications to prepare for new features in future. It will e.g. allow to use /test new FD trigger algorithm in the PAO Offline software for the FSimulation and to write DAQ information in the monitoring data base.
- Many of us work for the realization of the FD monitoring scheme. Kai commissioned a MySQL 5.0 server on Gina (CDAS) and on the Los Leones EyePC. He tried the replication mechanism of DB from LL to CDAS with background data written from a test version of the FShell program. The replication mechanism worked well, but details of the configuration have to be defined. Due to extensive log-files (of the replication) the amount of disk space will be higher than expected.
- The monitoring DB structure is now defined for the calibration data resulting from the calibrations A, B, C. In addition, the structure of the DB for DAQ and logging data is defined in a first iteration (see FD Wiki pages). The DB can also be filled with the current DAQ version under development.
- We implemented many minor bug fixes and improvements in the software for the *gpsserver*, the *fdhwlib*, and the *feshell*. As part of our effort to ease the handling we have extended the

feshell to access all 24 telescopes (at different buildings) from within a single program instance.

There are a few known problems (problem of inaccessible SLT, missing second in SLT clock) left, which are under investigation. We also continue our design study for Auger enhancement and Auger North.

## **WBS 2.1 SD (Ingo Allekote – Instituto Balseiro)**

During this period, 33 tanks arrived to the AB (of which 9 were recovered engineering array tanks). 55 tanks were assembled and 48 positioned, including one tank that had been recovered for the field for an apparent liner leak. 14 detectors were filled with water.

So as of April 1st 2006, the deployment team has deployed 1128 tanks and filled 1093 with pure water.

No new electronics deployment took place. Batteries expected from Brazil were not delivered to Malargue yet due to a shipping mistake done by the provider, who by dividing the shipment in various batches invalidated the corresponding customs waiver.

The most remarkable achievement in this period is the fact that detectors could be deployed and filled with pure water in extremely difficult areas, such as the locations just north of the Atuel river. These positions are in very wet areas, which also exhibit so-called "volcanoes" (big holes that open up under the ground), heavy cortadera-grass and many minor river beds. The construction of provisory bridges was required.

A "task force" composed by Alberto Etchegoyen, Jim Cronin and Giorgio Matthiae has been appointed to deal with the still unsolved landowners issues.

Tank production is continuing at Rotoplas after a delay due to mechanical problems with the molding equipment. between six and twelve tanks per week are now being sent to Malargue and this is expected to continue (or even increase to a steady 12 tanks/week, if possible) until production at Rotoplas is complete. The last of the resin, which has been stored at and managed by Tandar, was transported to Rotoplas.

Tank production at Rotoplastyc in Brazil continued and 135 tanks are ready for shipment. It does not seem possible to ship eight tanks per truck any more and still meet Argentine highway regulations. However, a method for mounting six tanks does, apparently, meet the legal requirements. The fixtures to mount the six tanks have been designed and constructed for two trucks, the permits are in place, and this first 2006 shipment of 12 tanks should leave the Rotoplastyc factory about April 17. If this is successful, one or two more trucks will be prepared so that shipment of 18-24 tanks at a time is possible.

The final shipment of resin from Canada to Brazil is at sea and is expected to dock at the port of Rio Grande on April 21.

## **WBS 2.2 Surface Detector Electronics (Tiina Suominen – IPN Orsay)**

The rate of electronics deployment over the past several months has slowed, as we have been waiting for batteries, TPCBs, and front ends to be delivered. We have taken advantage of this period to conduct a campaign of maintenance and failure analysis. Walter Fulgione (Torino) and Gerard Tristram (CdF) are the subtask leaders for this effort, and work closely with the local staff (including Javier Alcaya and Fabian Lemos) and with SOC Ricardo Sato to identify problem tanks.

The two main classes of problems are failures of tanks to join the array ('black tanks') and PMT problems. The problem of 'black tanks' discussed at the November collaboration meeting has been largely solved. Ninety percent of black tank problems were corrected with a single visit to the tank. There were about 2700 PMTs in operation and there were 201 in alarm status. About 70% of PMT+base+cable problems have been solved with a single visit. About 3/5 of these problems were corrected by replacing a PMT, 1/5 by replacing a connector or changing out the E-kit, and 1/5 disappeared without action. Sixty alarms remain open. In some cases these alarms reflect unusual temperature dependent of the PMT gain which are not yet understood but which do not prevent useful operation of the tank in question.

We are continuing to investigate the problem of persistently elevated ToT rates in some tanks with ID greater than about 700. The problem seems to be related to the presence of one or more unstable PMTs in the affected tanks. The origin of the PMT problems and fixes and workarounds for the problem are being vigorously investigated.

The Dutch TPCBs and German Cyclone-based front ends are now being delivered to Malargue. Both are functioning well and we envision no further logistical difficulties preventing SDE deployment.

UB spare parts and some UB maintenance activities have been transferred to Malargue. The change of the UB fuse from 500 mA to 750 mA appears to have solved the problem of fuse failures.

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

The Offline team released a first production version (2.0) in February, after a period of testing involving a number of collaborators. New features are described in the CHANGES file, available at <https://www.auger.unam.mx/AugerWiki/LastChanges>.

Since the release, we have been preparing for a fairly major reorganization of the build and distribution system. This involves a migration from CVS to SVN, which will allow for more flexible modification of the repository in the future and will support our planned automated checkout, build and test system. Further, we are preparing a rearrangement

of the module distribution scheme as well as new code to support dynamical module loading; this will make it simpler to make new module available to the collaboration, and should solve some of the nagging problems we have building on Macintosh computer.

We have also begun work to improve the interfaces to the offline database, to speed up access to the databases, and to migrate the master server to the FNAL computing center.

The production version (2.0) is used to produce ASCII-files with processed SD/Hybrid events including basic reconstruction properties. The data can be found at <http://AugerObserver.fzk.de>.

The activities improving the FD simulation chain are now strengthened by Ralf Ulrich and Michael Unger, who take over responsibilities in the code development.

## **WBS 8.0 Education and Outreach (Greg Snow – University of Nebraska)**

### **Northern Site Outreach**

Lamar Community College (LCC) hosted the 2006 Southeast Colorado Regional Science Fair on March 1. The Science Fair attracted 137 projects presented by elementary through high school students from many of the towns surrounding the planned Northern Site. Four Auger collaborators (J. Chirinos, J. Harton, F. Sarazin, G. Snow) attended the event and mounted a display about the Auger Observatory to provide information to students, teachers, and the public. The Auger display featured an SD detector model, scintillators and oscilloscopes to view cosmic ray muons, Geiger counters, posters, and information brochures to hand out. Many visitors to the Science Fair stopped by the Auger display and discussed the project with the Auger members. Harton and Snow had the opportunity to address the assembly of about 400 people during the awards ceremony of the Fair. From interactions with the public, it is clear that people in southeast Colorado are aware of and curious about the Observatory. LCC instructors Rebecca Burke and David Northrup, mentioned in the December-January bimonthly report, were on hand for discussions about outreach related to the Northern Site. The day before the Science Fair, Johana Chirinos met with a number of LCC students to discuss their participation in her star monitoring program. Several photos from the Lamar visit appear in the photo gallery of this report.

### **Malargüe Visitor Center Statistics**

Analía Cáceres continues to keep records on the number and origin of visitors coming to the Visitor Center in Malargüe. From the beginning of January through the middle of March, there were 1547 visitors, bringing the total number of visitors to 21,850 since the Visitor Center opened in 2001. The vast majority of visitors continue to be from Argentina, with the provinces of Mendoza and Buenos Aires dominating. People from 37 other countries have been to the Visitor Center, with Chile, Germany, Brazil, and the United States dominating the non-Argentine countries.

### **Progress on James Cronin School in Malargüe**

The construction of the James Cronin School in Malargüe is nearing completion and the school is being prepared for occupancy by students, teachers, and staff. Photos of the furnished interior and exterior are in the photo gallery of this report. Some work remains to complete the landscaping and sports field outside the school. This work will be completed soon, and an official inauguration ceremony is foreseen to be held at the end of May or early June.

### **Radio Interview in San Rafael**

Greg Snow and Arnulfo Zepeda were interviewed by telephone on the morning of Saturday, March 18, on the municipal radio station in San Rafael. The interview lasted about 30 minutes. Greg and Arnulfo answered many general questions about the Observatory and advertised the Auger Visitor Center in Malargüe.

### **Plans for November 2006 Collaboration Meeting**

The outreach task plans to continue its series of presentations for the general public during the November 2006 collaboration meeting in Malargüe. These will be scheduled in the evenings at the Convention Center. One of the presentations will be in English, and invitations will be coordinated through the teachers at the municipal English academy. The collaboration also plans to continue its tradition of participating in the Malarge Day Parade that is scheduled for Thursday, November 16, this year.

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

The FD shift beginning in February still suffered from the last part of the storm season. In any case, the system was working in a much more stable way than before and the data taking was smooth. Some problems with the power line made it impossible to operate Los Morados for several days. Everything is back to normal now, thanks to the quick and effective response of the local team.

The shift spanning over March and April was generally very good, with few bad weather nights and mostly problem-free runs.

During the collaboration meeting a new system to fill the FD shifts was discussed. The representatives of all the participating institutions will be contacted by G. Matthiae and J. Ridky to obtain their compromise to send enough people to cover all vacant places.

The absolute calibration of all telescopes was done between March 10<sup>th</sup> and 12<sup>th</sup>. Please check the details in:

<http://www.auger.org.ar/cgi-bin/Elog/det-system-elog.pl?nb=fd&action=view&page=68>

We had some problems with calibrations B and C. The control software in the calibration PC was updated on March 30<sup>th</sup>, which should fix the problem. Some adjustments need to be made to correct light overflow in calibration B and a misalignment of the fibers for calibration C.

Generally speaking, the job done by the Karlsruhe group during the last months is paying off. The system is much more stable, several bugs have been fixed and the general rule is that the runs are only stopped due to moonlight and not due to hardware/software problems. And the drum calibration could be performed in a record time of three eyes in one weekend! Thanks a lot to all people involved.