

Pierre Auger Project Progress Report

Summary (photo album)

The continuing operation of the 18 telescopes in the three FD buildings has resulted in a marked increase in the number of valuable hybrid events and even a few triple stereo hybrids. Corrector rings for all of these telescopes have been finished and last of them are on the way to Malargüe.

Deployment operations are back to normal (for the winter) after an 80 cm show fall in late August. The delivery of tanks from the new Brazilian vendor has begun. The new tanks are of high quality at an attractive price. A combination of funding shortages and the process of qualifying the new vendor had until recently brought the delivery of tanks to stop. Deployment is moving steadily, if slowly, to the areas accessible this time of year. Agreements with land owners are being made just ahead of our need for more deployment sites. A recent milestone was reached with the deployment of 800 E-kits. A major activity is maintaining the supply of components for the final push to complete the array in 2006.

An intense effort is underway in the FD groups to resolve a verity of software problems that have slowed data taking and calibration runs. The most intractable of these problems is a communication problem between the mirror PC and the camera crate and has proven extremely hard to locate. Resolving this problem has the highest priority.

Surface array data taking operation including the communications system and CDAS has also been unstable for the past few months. This instability together with a small but continuing rate of failures in the field has reduced data taking efficiency.

Now that the analysis of the first data set and presentations at ICRC 2005 are behind us, we intend to make a determined effort to put the data taking operations on a smoother, more efficient footing. This effort will necessarily require a greatly increased participation in the observatory operations by the members of the collaboration.

Plans for the Auger Celebration are developing well. The activities will include a reception on the evening of 9 November, a symposium, monument presentation and asado on 10 November, tours for our guests and a science fair on 11 November and the inauguration of the James Cronin School on 12 November. We have had a remarkable response and expect a large number of important scientists and government officials to attend.

WBS 1.2 FD digital electronics and readout systems (Matthias Kleifges – IPE)

Progress of the Slow Control System (SCS): (by K. Daumiller)

During the recent month there were a lot of smaller changes and bug fixes in the SCS, even though these are not visible to the user. The most important points are:

- Starting from the next shift (September 2005) the shift crew will hear an audio alarm in case the SCS is changing the operating state to fulfil safety requirements. Thus the crew is aware of closing shutters due to increased wind speed or falling rain and switched-off HV due to over-voltages, over-currents or light inside the bays. The software will be installed; Primo and Ruben have already wired the loudspeaker in CDAS.
- The Wuppertal group (M. Barkhausen) has provided software for the OPC-XML gateway which is currently under test. This software will (hopefully) solve the long-lasting problems of how the SCS can communicate with the DAQ software.
- A watchdog plug-in PC card is in use to monitor the SCS activity. In case of a hung-up of the SCS FieldPC the watchdog will enforce a secure state of the SCS. Our experience shows that the FieldPCs are not as reliable as expected. We are therefore looking for alternative 19" PC (with standard components) as long term replacement.
- Kai fixed other minor bugs, especially to improve the communication with the CAEN HV main frame. The HV systems frequently reports fake channels in current overflow, a problem under investigation by the Catania group and CAEN. To improve the system stability and support the monitoring Kai has written programs which automatically convert messages of the SCS logfiles into a SQL data base. The data can be access via the link <http://www.auger.de/~kai/Auger/SCS/logbrowser.php> after 1 day.
- The program Quickmon parses through logfiles of the DAQ and displays current trigger- and hitrates of the telescopes in the DAQ chain.
- A main new release of the SCS is going to be installed in November, but bug fixes are implemented on a smaller time scale.

Progress in DAQ and related software: (by H.J. Mathes and A. Kopmann)

The DAQ and related software undergo permanent improvements and bug fixes. Most important changes are:

- Defects in the former build system (based on intake) forced investigations of alternative build systems for the FD DAQ software. We have selected (and since late May 05 in use) the scon build system (www.scons.org) which however made a complete change of every line of the former Makefiles/Imakefiles necessary. The packages of the FDEventLib are now been built using the GNU autotools systems – the same as used by the AUGER Offline software.
- Circular dependencies in the FD-DAS source tree have been found and resolved. This lead to a new name in the CVS repository: FD-DAS3.
- Bugs in the communication interface FD-T3 to LIDAR/CDAS have been corrected. Both communication interfaces are now identically implemented, asymmetries have been removed.
- An alternative variant to veto bursts of trigger signals is implemented.
- The compressing and archiving of log files is automated to avoid wasting of disk space.
- Some bugs in the online systems are fixed as described in the ELog book.
- At the end of 2005 there will be the next leap second. The routines for time conversions are updated by an extendable table to reflect this change.
- The FDEventLib v2r7 was released. We have announced a new version v3r0 to be released soon, which will include fields to account for DAQ dead time and vetoed triggers as well as a new format of SLT multiplicity data.

- The access of the DAQ to the GPS clock was changed to allow reprogramming of the GPS gate generators through users without resetting the DAQ.
- The most severe problem of the DAQ is an unsolved communication error between the MirrorPCs and the FD sub-rack on the FireWire (FW) link. The problem is encountered frequently on site during calibration, but also seldom during shower recording. Normally the communication of individual telescopes stops, the telescope falls out of the DAQ and the MPC has to be rebooted. The problem was also found on the test system in Karlsruhe, but very, very scarce (once every few days) that makes it cumbersome to find the problem. To track the problem we have modified the FW access library to provide debug information and we have made tests with different kind of FW cards (equipped with different FW ICs). However, the tests are inconclusive and have to be continued.
- The Auger hardware library fdhwlib was revised to separate Auger specific functions from more general functions. The objective is to implement an interface which defines the data to be exchanged together with the data structure. In this way, the library can be used for other experiments using the Auger front-end cards (like KATRIN) as well.

Progress in Calibration routines: (by A. Menshikov)

Up to recently calibration data was recorded each night, but not analysed on site instantly. Since the August 2005 shift the SW package called Calprog is installed on all FD sites. The package consists of several routines to

- a.) perform prompt tests of all electronic channels using the electronic test pulser,
- b.) measure the current gain ratio between normal channel and virtual channel, and
- c.) analyse the data recorded by relative calibration A, B and C. For each calibration the relative gain is calculated (at different wavelength or amplitudes for the Xe-flasher system) and saved in a set of files, whose structure and format is published in a recent GAP note and approved by FD calibration community.
- d.) Special programs analyse the data recorded by the drum and propose changes in the HV settings and the electronic gain settings in order to achieve a flat field response.

The routines were successfully tested at the end of the August shift and allow the crew to recognise FD hardware failures (PMTs or front-end boards) before the data taking starts.

Other activities:

IPE and IK are developing a balloon- born light flasher which will provide an independent test of the telescope alignment and calibration. A first version of the flasher was tested (see report of March 05) successfully, but the intensity and wavelength of the LED lamps will be changed with a new design. We also plan to equip the next flasher version with a Motorola GPS module (replacing the module coming with weather balloons) and transmit the flasher position to ground by radio.

WBS 2.1 SD (Ingo Allekote – Instituto Balseiro and Meter Mazur - Fermilab)

Routine production of water tanks for surface detectors at Rotoplastyc in Brazil has begun and more than 70 tanks have been completed. The first shipment of 24 tanks has arrived in Malargue, and we expect an additional shipment of 24 tanks to arrive every two weeks for the indefinite

future. The quality of these tanks is exceptionally good and the latest production is of consistently high quality. This company will provide the majority of tanks for deployment in the immediate future. Production of tanks by Mexico at Rotoplas near Buenos Aires is expected to begin when resin becomes available.

Resin for about 100 more tanks is now in Brazil. Fermilab has purchased additional resin which is now at sea on the way to Argentina and Brazil: Resin for 85 tanks (to be used for making Mexican tanks at Rotoplas) is on the way to Argentina; resin for approximately 210 tanks is on the way to Brazil for making the tanks at Rotoplastyc; and resin to complete battery box production is on the way to Argentina. Resin delivery is expected in mid-September.

Detector deployment and commissioning has been below expectation in this period due to the unavailability of tanks. 48 surface detectors were deployed in the field, 58 were filled with water and 46 were equipped with E-kits. To achieve this, most of the Engineering Array tanks were recovered from the field and refurbished. All recovered EA tanks could be re-used for the production stage.

WBS 2.2 Surface Detector Electronics (Jim Beatty – Ohio State)

A significant milestone was recently passed with deployment of the 800th E-kit. As of the time this report was prepared, 826 tanks were taking data.

The major activities at present are maintaining the supply of components arriving in Malargue to support deployment, addressing problems with the system as they arise, and making the transition to the use of front-ends from the Wuppertal-Siegen-Aachen groups and TPCBs from the Dutch groups.

The new Cyclone-based front end successfully completed a critical design review at the June analysis meeting, Procurement of long-lead time components is now underway, and ten prototypes of the final design will be completed in early September. 100 preproduction boards will follow in October, with the full production to follow shortly thereafter. The German groups have kindly agreed to fund production of 100 additional boards of the original design to ensure continuous availability of front ends for deployment.

A first batch of Dutch TPCBs has been completed and is now being tested. Once testing has been completed, production of the remaining TPCBs for the full array is expected to be completed rapidly.

We congratulate the PMT test leader in Malargue, Federico Suarez, who has obtained a fellowship from Italy to work with Gianni Navarra for a period of two years. Federico will help in monitoring the performance and failures of the SDE in Malargue. He will still be in charge of the PMT house but will no longer participate to the daily work of testing and potting the PMTs. We plan to hire a new staff member to take over this work.

WBS 3.0 Comms (Paul Clark – Leeds)

Deployment of antennas and preparation of antenna kits has continued well with the deployments passing half-way (>800 tanks) recently during this period.

Surface Detector Antenna System preparation and deployment - Jorge Abraham

- 25 Kits were mounted during June 2005 and 33 during July 2005.
- There are 216 Kits ready to install. Total prepared: 1124
- Antennas for more than 120 Kits were tested.
- 913 antennas have now been mounted. (Rate ~ 44/Month)
- The last 70 Antennas will arrive on-site During August.
- Stock of some loose parts for the antenna kits has reached zero in Malargue and no more kits can be prepared at the moment. These parts should be on their way from the US in the next few weeks. Note that, there are a large number of prepared kits (200+) available so this shortfall should not affect deployment.

Surface Detector Antenna System Commissioning and Maintenance – Jorge Abraham/P Clark

- Antenna reorientation plan and the UV protection programme. We are working altogether with the Observatory tasks groups. This is SD, SDE, Water. They include it in their tasks to the field.
- A recent new task for Jorge is to monitor the quality of the radio link established to any newly deployed tank. If the link quality is poor, he has a number of remedial options open to him; the simplest of these is to try the tank on a different BSU sector.

Jorge: "I make a control periodic of the SD Signal quality. Later I indicate the changes to make to solve the problems.

In these conditions, from the first analysis, we have corrected more than 6 SD-Signal with no need to go to the field to do it. (Configuration SU/BSU was modified only)."

This essential task is now well under control.

- Antenna reorientation tasks will be undertaken in the field during August.

Comms Upgrades

We have been trying to get some new NetMon PC Servers* to the site since March. We have finally been successful and the equipment is now in transit to Malargue. The current machine is thoroughly overloaded and unstable and is preventing us from doing other comms software upgrades. Once it is installed we can move forward again with other upgrade work.

*These machines control and monitor the comms radio network.

It is likely that all the final comms components will arrive in Malargue during the next period.

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

This period was a busy one, with most effort concentrated on the analyses presented at the ICRC. Contributions were made by many people to the energy spectrum analysis, to the photon upper limit analysis, and to characterization of the detector aperture and reconstruction quality.

The Offline framework worked well for all this work, and we are continuing to work on improvements. Apart from continued improvement and bug fixing, our major software thrust before November is hybrid simulations/reconstruction, with particular reference to the elongation rate and photon limit studies. After several false starts, we are also getting underway with production runs of fully simulated SD events.

The core framework is undergoing further extensions and optimizations. A 10 day software meeting has been scheduled for October, to be hosted by CBPF, and will give the developers an opportunity to work together on some of the most important framework issues.

The aerosol and atmospheric quality databases have been populated, and high-level interfaces for access to these data are currently in preparation. Information on station positions and deployment times have been moved from static files to a database, so users will have information on new stations soon after that information appears in the PMS. Two new Fermilab personnel (Paul Lebrun and Patricia McBride) have also joined the experiment and are planning to contribute to the offline code. We are currently working with Paul to set up a master database mirror at Fermilab.

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

Problems with DAQ hardware continued during this period. Los Morados was especially unstable, which is clear from the very short runs available in the data set. Problems will be hopefully solved soon, since H-J. Mathes, from Karlsruhe, will spend some time in Malargüe trying to fix them. Interaction between the DAQ and the relative calibration system is also not always smooth. There are many references in the e-log to failed calibration runs. This problem should also be investigated by the responsible of the system. Weather was not very good during June and slightly better during July, leading to a large dead time.

Data quality is regularly reported by using an off-line filter and other tools. The description of these tools can be found in:

<http://calib.auger.org.ar/quality/general.html>

The results of the analysis are available at:

http://calib.auger.org.ar/quality/FD_quality_reports.html

Volunteers are needed to regularly look at these data, evaluate the quality of the FD events and the general status of the telescopes. It could be useful to implement a system where different institutions take turns to analyse the data and report their results.

