Pierre Auger Project
Progress Report

July/August, 2001

Summary

(photo album:
http://www.auger.org/admin/Reports/jul-aug01/photo_album_for_july_aug.html**)**

The camera for the second prototype telescope for the Los Leones Fluorescence Detector building has arrived in Argentina. The mirror, the shutter, most of the electronics and slow control are ready for the camera installation in bay five. A new version of the data acquisition software is being installed.

The surface detector has now recorded four and five fold air shower events. Steady progress is being made in debugging the surface array hardware and software. There are currently 17 stations sending level two triggers to the data acquisition system. The problems range from faulty electronics to dying phototubes to cow damage.

The Auger Center Building is finished and ready for occupancy. This completes construction at the Auger Campus for the foreseeable future.

The Auger Collaboration made an impressive showing at the International Cosmic Ray Conference in Hamburg in August. The Conference heard a number of excellent presentations demonstrating our progress.

Two Task Group workshops were held recently. One was the Fluorescence Workshop in Moravia, the Czech Republic in August and the other was a Surface Detector Electronics Workshop in Orsay in September. The Moravia workshop included the critical design review for the Fluorescence Detector systems.

An electronic log book has been installed at the site. We have asked the groups at the site to update the log book with a daily summary of their activities. The electronic log may be found at www.auger.org.ar/Elog.

Fluorescence Detector

WBS 1.1.3.2 (Fluorescence Calibration – Paul Sommers – Utah)

The laser shots recorded on June 26-28 have been analyzed for a variety of purposes: relative and absolute detector calibration, profile

reconstruction, shower-detector plane reconstruction accuracy, size of the optical spot on the camera, and detector trigger sensitivity. Some results were mentioned at the Moravia workshop. Numerous technical notes can be found at the "fluorescence detector technical papers" section of the old FD web site (http://www.physics.utah.edu/~sommers/hybrid/papers/).

Nightly data files from the weather station at Los Leones are now transmitted to Utah and can be accessed via http://casab.physics.utah.edu/. The data include Air Temperature [C], Relative Humidity, Windspeed [km/hr], Ave Windspeed, Wind Direction, Solar Radiance, Barometric Pressure [mm Hg], and various running averages and extreme values.

Data from the horizontal attenuation monitor are also being transmitted daily to Utah and analysis of the CCD images is underway.

1.1.1.2.1 Optical Filter and Frame (National Technical University of Athens-University of Athens - Fokitis Emmanuel)

1) Continuation of the Optical filter evaluation work. There have been numerous measurements of measurements of a small fraction of the production of 74 pieces of 170mm x 170mm optical filters (called OCJ-version 2). The results are on "improvement factors" and " minimum EAS signal required to trigger the FD detector under typical atmospheric and optical noise conditions" . Comparative performance in terms of these quantities were given for samples of OCJ-v2 and MUG-6 has been presented in the Collaboration Meeting of AUGER in Malargue (May 2001) and in the Fluorescence Detector Workshop in Czech Republic (August 2001). In parallel, a simulation ray-tracing program has been developed (S. Maltezos, NTUA) for comparing the "angle of incidence distributions on the pmt surfaces" of the FD, and taking into account the presence of Merzedes to evaluate the relative performance of optical filters (absorption vs. interference type) placed on the diaphragm or on the camera. The combined work of studying the experimentally the improvement factors and understanding the distribution of incidence angles of rays on the pmt surfaces gives a very good tool for defining the "required optimum optical spectral transmittance of the interference or the absorption filters". In particular, the OCJ-V2 filter samples, having a cut-off at around 408 nm appear (when placed on the camera) to have higher improvement factor and or "minimum EAS signal required to trigger the FD detector under typical atmospheric and optical noise conditions". However, more conclusive results can be obtained when the corrector plate effect on the ray-tracing simulation program will be taken into account.

In the Moravia FD meeting, a proposal have been made to consider "extending the duty cycle of the FD operation " by using combined optical filter, i.e. absorption filter in the diaphragm and interference filter on the camera plane only during the period of crescent moon. The Greek group will study the feasibility of such a type of operation at least when the first 3 telescopes are commissioned.
In addition, some optical filter design, with cut-off wavelength at normal incidence at 420 nm instead at the present 406 nm is expected to give better performance, exists and some 20 such pieces 17cm x 17cm are expected to be ordered in order to be tested.

The main challenge of the present work in Greece is that a credible mounting method for the optical filter pieces to ensure minimum obscuration and possible trigger bias due to the shading of the mounting frame. Three alternatives are being considered: a) Trapezoidal shape flat filter pieces to approximate areas defined by meridians and circles of given latitude. b) Hexagonal pieces to be placed on an approximately spherical surface with radius around 1760 mm, and c) A set of 17cm x 17cm filter pieces to be placed on a planar array. The mechanical, optical and cost properties of each of the above solutions are being considered. Arrays based on glass uncoated surfaces, to test the mechanical properties of such structures are being assembled.

Roving Monitor/flasher WBS 1.2.2 and
Aerosol Phase Function WBS 1.3.5.1

Some R&D on a Nitrogen laser system has been conducted. It will be of minimum energy of each pulse (at 337 nm). There has been a construction of a HV power supply for an existing N2 laser (home made by Alex Serafetinides of NTUA). The HV can be operated by an automobile type 12 V battery. The latest results of this work were presented at the FD Moravia Meeting this August. The laser system is operational and laser pulses of around 1.5 mJoule/pulse were achieved. A parallel beam can be achieved by use of a simple spatial filter at the cost of a moderate reduction of the energy per pulse. There are certain fluctuations on the energy delivered in each pulse but this fluctuation is well known from the N2 laser theory. By integrating over several pulses and recording data with an FD telescope pixel, it is hoped that useful calibration and electronics test of the FD may be obtained. An analysis of the beam profile will be carried out. There will be an effort to further improve the beam profile characteristics (if needed) by use of appropriate UV diffuser between the spatial filter and laser head.

A further consideration on the use of this type of laser is for the measurement of the aerosol phase function (APF). An advantage of using

such a laser is that a value of the APF at an exact wavelength in which atmospheric fluorescence exists and is therefore related with the effects of scattering of EAS signals. By using another laser line such as 355 nm of Nd:YAG triple harmonic, one gets very useful information on the scattering properties of Cerenkov radiation from aerosols. Thus, the two laser sources may be complementary to each other. The progress of this work with the N2 laser will depend decisively by the opinion of the FD group and management whether it is worth pursuing this further.
We would be happy to have feedback on our presentation from FD colleagues and the estimate of experts on the capabilities and limitations for APF measurements with a laser of such energy per pulse and pulse duration around 15 nsec.
(Fokitis E, S. Maltezos, P. Moyssides, B. Klinkenberg, A. Geranios, A. Petrides)

1.3.1.1 Lidar Subsystem (Ljubljana – Andrej Filipcic)

The components for the prototype LIDAR system are available in Ljubljana since August. Those are 3-channel LICEL digitizer with 16k sampling points and 40Mhz sampling rate, and 3 Hamamatsu R7400U 06 phototubes mounted on 80cm parabolic mirrors. Tests with the new 3-channel system were performed in the beginning of August and first results have been presented at Moravia meeting, where the building for the prototype system in Malargue was approved. Next week, the prototype will be transferred to Torino, where all the components will be merged together. The system is expected to be delivered to Argentina at the end of the year.

Surface Detector

WBS 2.1.10 (Deployment – Ingo Allekotte – Instituto Balseiro)

- The capacity of our water transport tank has been measured to be below 12000 litres. It has been sent to the company that fabricated it to verify it and to enlarge it. They have finished the work and will send us back the trailer and enlarged tank in the next days.

-A CNEA-internal call for 2 technicians (one electromechanical, one electronic) is being prepared and will open soon.

WBS 2.1.10 (Deployment Status – Laudo Barbosa - CBPF)

STATION STATUS (September 18th, 2001**)**

AGUA TERRITORIAL	Electronics not installed
AONIQUEN	Electronics/cabling not installed

CACH	Has been working (FE removed for diagnosis on Sept. 12th))
CARMEN	Working
CAROL	Working (Elect. checked at AB. PMT's should be recalibrated)
CAULLA ANTU	Electronics/cabling not installed
CHIGUA	Electronics/cabling not installed
CLARA	Working (sending only T2's up to Sept. 10th, now?)
CLAUDIA	Electronics/cabling not installed
DANIELA	Working
EL ALAMBRADO	Working
FABIA	Has been working, died after cable removal by animals
FLAVIA	Electronics brought back to AB on Sept. 11th
HUARA	Electronics/cabling not installed
HUENU LEUFU	Electronics/cabling not installed
HURON	Electronics brought to the AB for FE diagnosis
J. KEPPLER	Electronics not installed
JOSE RIOS	Electronics/Cabling not installed
KIAM WAH	Electronics/cabling not installed
LAURA	Working
LEILA	Working
LUCIANA	PMT's/Electronics have to be checked
MAGALE	Works, but not transmitting data until Sept. 10th
MAPU-LUFKE	Working
MIDORI	Electronics/cabling not installed
MILENA	Works, but not transmitting data until Sept. 10th
MIRANDA	Working
NEGMEN	Electronics/cabling not installed
NEYU MAPU	Electronics/cabling/PMT's not installed
NIÑA ENCANTADA	Electronics/cabling not installed
PALAU-CO	Electronics/cabling not installed
PAULA	Not transmitting data (PMT3 removed for diagnosis)
PEDRO	Electronics/cabling/PMT's not installed
PEHUENCHE	Electronics has to be checked
PEUL TUWE	Electronics/cabling not installed
PRISCILA	Electronics/Cabling not installed
SEBASTIEN	Working (?)
SUSANA	Working
TAMARA	Electronics has to be checked
UNCA	Electronics/cabling not installed, solar panel has to be replaced

URSULA Working

WBS 2.2.1.2 (PMT testing – Arun Tripathi – UCLA)

We have finished detailed testing of the 15 new extended PMTs, 5 each from the three different vendors (ETL, Photonis and Hamamatsu). The quantities measured for each PMT are: gain, dark current, quantum efficiency, linearity, dark pulse rate and afterpulse ratio. The results have been written up into a GAP note, and the document is available on the web: http://www.physics.ucla.edu/~arun/NewPmtestResults.pdf

In July, together with Francois Montanet, we tested the new PMTs in the Fermilab water tank (FATII), using a prototype base from Orsay. We can observe a clear muon peak from the amplified dynode channel, at a gain of 2x10^5, the proposed operating gain in Auger. We did several other measurements as well, and a document describing the results will be available shortly.

The production test facility at UCLA is progressing. Cabling has been completed for a 16 PMT setup. We are able to measure single PE spectra, linearity and afterpulsing using the setup. Work is on to set up DC measurement equipment and software.

WBS 2.2.2.2 (Tube bases – Tiina Suomijarvi - IPN-Orsay – Torino/INFN

Base design:
The base design was reviewed during the SDE Workshop (September 17-19). Bases for the selected Photonis PMT for the pre-production run are currently under fabrication.

HV modules:
Administration procedures for the pre-production and production of the high voltage supplies are in progress (IPN-Orsay). 5 companies have sent prototypes. These prototypes will be tested following the tender specifications in the beginning of October (Torino/INFN).

Test bench:
The specification of the automated test procedures for the production and the associated test equipment is in progress.

Data Processing and Analysis

WBS 5.0 (Data Analysis – Clay, Dawson, Fick, Roberts, and Sommers – Adelaide, Chicago, New Mexico and Utah)

Co-authors Clay, Dawson, Fick, Roberts, and Sommers submitted a GAP note on the need for a prescription for anisotropy analysis. The note includes a strawman proposal for an initial anisotropy search to be conducted with a small data set taken during the first part of production. A prescription is needed to ensure that fluctuations in a finite sampling from an isotropic intensity are not mistaken for a genuine anisotropy. By explicitly specifying the trials that will be made in the search for anisotropy, the statistical penalty is rigorously defined and a referee need not imagine all the trials that could have been performed. Exploration of the data set beyond the prescription is certainly important, but unpredicted patterns should be used primarily to formulate hypotheses for testing with a subsequent data set. The objective of the GAP note is to introduce the need or an analysis prescription and to stimulate discussion about what it should contain.

Site Development

WBS 6.0 (Survey and Site issues) – Ingo Allekotte – Instituto Balseiro)

- A PC with a big monitor and large RAM memory has been purchased and installed at the AB in Malargue, for survey and site-related issues. It will be mainly used for mapping and down- and uploading data from the GPS-navigators.

- A SPOT-satellite image of the FULL site has been assembled by Martin Fernandez, a student from UTN-Mza. The image still needs some contrast improvement and georeferencing and will be made available soon on the web.

- Survey files (maps, calibration files, satellite images, etc.) have been transferred to the Malargue Site web-page (www.auger.org.ar) and will be updated there.

- A set of Ozi-Explorer files showing landowners and limits of individual lands for the EA ahs been prepared and is available on the web.

- Contact has been made with the landowner of Estancia El Alamo, who owns 150km2 of the site north of Estancia El Chacay. He expressed his willingness to sign the land access permit for Auger soon.

- Specifications for ground preparation, survey and position marking for the next 100 detectors (preproduction) have been circulated to interested companies. Some have already informed us about costs. Costs for

marking sites and surveying roads for preproduction are now estimated around $7500,- , much less than originally expected.

Project Management

WBS 7.0
The Auger Project Management Plan has been revised, approved by the collaboration board and placed on the Auger web page.