Pierre Auger Project
Progress Report
October/November, 2000

Progress Report Summary:

We are pleased to welcome our new part time secretary, Rosa Pacheco, to the Observatory Office. The Observatory office, now in the Galpon/casa will be transferred to the Assembly Building in mid January.

The recent gift of one million dollars from the University of Chicago will allow us to begin the construction of the Central Campus office building early in 2001. The Chicago funds will cover both the office building and equipment for the visitor's center located on the ground floor.

The shutter for one of the Fluorescence Detector building aperture windows arrived from Krakow just before the holidays and installation will begun on the first of the year. The temporary covers for the other aperture windows are being fabricated. Some finishing work remains on the building before it will be delivered to us by the contractor.

A total of 13 Engineering Array surface detector station tanks have been deployed at the site. An additional six tanks are being prepared for placement. The water purification plant is nearing completion and is scheduled for installation in the Assembly Building on January 10. We plan to begin delivery of water to the detectors in the second half of January.

During November the communications group installed equipment on the towers at Los Leones and the Central Campus.

Equipment for the central data acquisition system has arrived at the site. Installation will begin in early January.

A successful collaboration meeting was held in Malargüe in November. During the week of the meeting the new detector Assembly Building was inaugurated. Following the inauguration we invited the Malargüe community to an open house. The open house was well attended by the community.

Fluorescence Detector

1.1.3.1.3.1 Lidar Subsystem (Jozef Stefan Institute - Andrej Filipcic)

According to the decisions made at the Atmospheric group meeting held in Malargüe in November 2000 we have visited the University of Torino / INFN at 30th of November to jointly evaluate formal, informal and technical aspects of the possible use of the EAS-TOP Cherenkov telescopes as a part of P. Auger LIDAR system. After a whole day discussion following conclusions were reached:

1.) The EAS-TOP Cherenkov telescopes are in good technical condition and can be used as a part of Auger LIDAR system.

2.) There is a solid interest in Gianni Navarra's and Rosana Cester's group to collaborate in the construction of the final Auger LIDAR system. This interest is a basement for the initiation of informal collaboration.

3.) The framework of the formal collaboration will be discussed at Torino INFN section meeting to be held at 15-th of January 2001.

It was also decided that due to tense FD dead lines the work should start immediately in the following steps:

1.) Shipment of the mirrors and support platform to Politehnika NG for the laser mounting, alignment and preliminary measurements in December.

2.) Shipment of one fully equipped FD hexagonal photomultiplyer to Politehnika NG for LIDAR to FD impact measurements in January.

3.) Choice of the place in Torino (Oservatorio astronomico di Torino, or INFN workshop) where the full system will be equipped and operated. The system is planned to be finished by May 2001 and expected to be delivered to the site in summer, possibly at the same time as remaining fluorescence detector components.

1.1.3.1.3.1 Lidar development (University of Utah - Paul Sommers and Brian Fick)

We are working on lidar on two fronts. The baseline Auger lidar system is now expected to involve the deployment of an EAS-TOP Cherenkov telescope from Torino. We are helping to coordinate efforts with Torino, Ljubjana, TANDAR, and New Mexico. A portable lidar system is also being developed here in conjunction with the laserscope system. We have implemented a PC-based oscilloscope card which will give us 14-bit dynamic range resolution, and we have spent considerable time on the software for this.

1.1.3.1.3.2 Horizontal Attenuation Monitor (University of Utah - Paul Sommers and Brian Fick)

The first horizontal attenuation monitor was completed in early November and prepared for shipping to the site. It was dispatched on November 7 in hopes that we would be able to install it during the collaboration meeting. It suffered serious delays en route, however, and arrived at the site several weeks after we had returned. We are still trying to discern the lessons that should be learned from this experience.

1.1.3.1.3.3 Star Photometry Atmospheric Monitor (Michigan Technological University - David Nitz)

Following the November collaboration meeting a discussion has arisen in the FD atmospheric monitoring group regarding whether we should supply both a fixed and a tracking monitor. In this scenario the fixed monitor would continuously monitor all or most of the sky in the V band, while the tracking monitor would track and measure the brightness of stars in the same band as the FD into the FD aperture and provide an absolute calibration of the FD. Discussions are continuing to solidify these ideas.

Apogee Instruments has not been able to deliver the original CCD ordered. They have now promised to ship higher quality thinned CCD instead, which has better efficiency in the U band. This would be ideal for the tracking monitor.

Coding continues on routines for the all sky photometry.

1.1.3.1.4.2 Laserscope control (University of Utah - Paul Sommers and Brian Fick)

We have also been developing a user-friendly computer interface for the laserscope. The computer reads out the optical encoders to determine and display the laserscope pointing direction. It will eventually construct information packets with shot time, location, pointing direction, and pulse energy to be transmitted for inclusion in real-time DAQ at Los Leones.

1.2.1.1.1 FD Computing Facilities (HPE/IK - Matthias Kleifges)

We have ordered 3 mirror PC's (1.2.1.1.1.2) , 1 eye PC (1.2.1.1.1.1) and a printer.

Cables and sockets for the LAN in Los Leones (1.2.1.1.1.4) were shipped together with a transport from IK.

1.2.2.1 Hardware (EA), Digital Electronics (HPE/IK - Matthias Kleifges)

We concentrated our effort on the design of the FLT modules Vers. 2 for the EA (1.2.2.1.3). The firmware of the FPGA was extended with additional features:

- **implementation of a 2 words/cycle readout of ADC data,**
- **using the internal FPGA memories for the calculation of moving sum of 5..16 ADC words,**
- **calculation of statistical data n, Σx, Σx^2 of up to 1000 ADC words to derive the DC- light level from the statistical fluctuations.**

The PCB layout of the 10-layer boards was designed, 54 boards were delivered by an external company.

The PCB design for the Clock & Control Modul (CCB) Vers. 2 was finished, which now can be used to distribute the GPS signals of up to 6 telescope stations. 7 PCB's were ordered.

From 10. October until 10. December Primo Gomez Vitale from Mendoza joined the HPE group. Originally, he should help us to test the FLT boards, but as the production was delayed he took over the responsibility for crate mechanic (1.2.2.1.9) and the low voltage supply. He assembled 3 crates (2 for EA, 1 spare at FZK) and mounted the analog and digital backplanes. With the EA we test 2 alternative designs to cool the crates with fans. Primo assembled and tested also the DC-DC modules for the +5V, +5.2V, -5.2V, –12V, +3.3V and +2.5V power supply (1.2.2.1.8.2).

The discussion in Malargüe (November 00) revealed that the analog boards (1.2.2.1.2) will not be ready in FZK before 15. February 01. To have an independent possibility to test the FLT boards we have started the design of an analog test board (ATB) version 2. Components were ordered and the circuit diagram drawn.

1.2.3.1 Software (EA) (HPE/IK - Matthias Kleifges)

The progress of the Hardware Level Software (1.2.3.1.1) (HWL) include the upgrade of the C++ library necessary to access the new features of

the FLT firmware version 2 (see above). The documentation (1.2.3.1.12) for the Hardware Level Software was updated accordingly.

For the communication with the slow control PC (1.2.4.1.2) an OPC – client for Linux was installed and tested. Most of our software for maintenance and tests (1.2.3.1.8) was written for a PC under NT as only drivers for NT were available at the beginning. For the continuous use of this software from e.g. a service laptop we have developed and tested the 'PBUS daemon' software. It allows the access of service computers (NT or Linux) via the LAN to the hardware interface of the mirror PCs.

The 'interrupt dispatcher' program was finished and tested. This software part distinguishes different interrupt sources, issues the interrupt acknowledge cycle and sends a message to the responsible interrupt service routine (1.2.3.1.1).

2.2.3.1.1.2.1 Trigger ASIC (Michigan Technological University - David Nitz)

Fifteen trigger boards were constructed and have been undergoing testing. Four of these boards were successfully integrated with a station controller in the Galpon. Others have been successfully exercised on the test rig at LSU. A few boards failed initially due to bad solder joints. These have been repaired. Diagnosis of the other boards is continuing at LSU in consultation with Zbigniew.

The Rev 1 trigger board had a few minor problems: 1 missing trace on the PLD programming connector, one miss-label on the silk screen, and one rotated pad. These were easily corrected in when stuffing the boards. A Rev. 2 layout has been generated which fixes these problems and an order for additional boards to populate the EA will be released shortly.

A simple test board has been designed and constructed to allow us to do a subset of tests at MTU. This will allow us to check and repair some types of problems before sending boards to LSU for more detailed testing. It is envisioned that this board will become part of the burn-in test rig for the production chips. Currently the board has been stuffed and appears to operate properly. Work is now underway to put together a LabWindows program to control the test rig and download test vectors to our waveform generator.

In the process of testing the boards at the Galpon, which was our first chance to see a station controller in operation, the DMA readout signals from the PPC403 were observed to have unexpected interruptions.

At present it is not clear at what point data is strobed into memory adjacent to the interruptions. Groups with station controllers (CDF, PSU) are continuing to investigate the situation. D. Nitz and Z. Sadkowski will visit Penn State in early January to further resolve this problem.

During final tweaks to the phase 1 ASIC design and layout we added an ID register so that the station controller can query the chip for its identification, and added 2 test modes to shorten the time required for analog simulations. Extensive digital simulations have been performed. We have now managed to work around problems with analog simulations of the phase 1 trigger ASIC crashing. A fairly extensive set of analog simulations has now been completed. Initial simulations indicated the need for additional buffering of certain signals. These have been added as required. The chip now passes the analog simulations. The planned December chip submission was deferred pending resolution of the DMA specifications mentioned above.

Study of the test chips is basically complete. No additional surprises have been discovered.

5.1.1.3.2 Reconstruction software (University of Utah - Paul Sommers and Brian Fick)

An initial version of the geometrical reconstruction software has been completed, and its performance has been tested using Monte Carlo simulation data. Results were presented at the collaboration meeting in Malargüe. This version of the software has been documented, and it is available for general use. Access to the documentation and source code is through the "Life of an Event" document in the "Detector specifications" page of the FD web site.

5.1.1.4.2 Software Library (Universidad Nacional Autonoma de Mexico (UNAM) - Lucas Nellen)

We have a first version of the serial number checksum generation and verification software available. More information is on http://www.auger.unam.mx/software/**. The software is also in the DPA software repository at Lyon.**

Millard County site survey (University of Utah - Paul Sommers and Brian Fick)

Brian Fick has accompanied members of the TA and HiRes collaborations on trips to Millard County to evaluate the suitability of various potential FD sites. The TA proposal is being reviewed, and they need some sites ready for construction if/when their proposal is approved. Three sites have been identified in Millard County which would not need extensive environmental study and which would provide fluorescence coverage of the Auger array.