Operation of the Pierre Auger Observatory:
It’s a tough job, but somebody’s got to do it...

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The Observatory

- 1600 surface detectors
- 27 fluorescence detectors
- 4 LIDAR stations
- Laser facilities
- Weather stations & cloud cameras.
How do we operate the Observatory?

- Point-to-point microwave connection between each FD building and the central campus in Malargüe.
- Wireless LAN to connect SD tanks with the closest FD building (4 groups).
- SD, FD and atmospheric data are transmitted to the Central Data Acquisition System.

If you are interested in the details of the trigger system, contact me...
The Present Situation
Surface Detectors

✦ Operation has always been automatic.
✦ Maintenance is complicated, due to the size of the array.
✦ It is not possible yet to prevent failures. SD SOC decides the priority of repairs.
The Present Situation
Surface Detectors

- Monitoring: based on alarms
- Temperature in PMT bases, batteries, electronics, voltages on solar panel and batteries, trigger rates.
- Self-calibration using atmospheric muons.
- Data quality (done off-site)
The Present Situation
Fluorescence Detectors

➲ Operated by volunteers on site (17-night long shift every month)
➲ Stable operation, which gives plenty of time for shifters to monitor and analyse data.
➲ Regular maintenance.
The Present Situation

Fluorescence Detectors

- People are trained by the FD SOC (FD Observer is the backup) on site.
- Detailed step-by-step documentation available (wiki page to make it dynamic).
- Permanent support to people on shift (on site or by phone)
- Reported problems are solved quickly.
- Still depending on external experts to solve some software problems (FD Observer started training)
The Present Situation

Fluorescence Detectors

➲ Monitoring: useful during the data taking shifts and for experts.
➲ Absolute calibration corrected every night using LED shots.
➲ Data quality (done off-site)
The Present Situation
Atmospheric Monitoring

- LIDAR operated every night of FD data taking.
- Automatic laser operation + “roving laser”
- Regular balloon flights
- “Balloon the shower” (until end of 2010)
How did we get here?

- After many years of work, we are now in a situation where operation is stable and only affected by external factors.
- We understand the hardware, the software is fine-tuned and the monitoring systems are continuously improved.
- It was a combination of hard work, passionate people, ability to solve totally new problems and support from everybody in the collaboration and in Malargüe.
As an example... we went from this

NIGHT SHIFT!

23/05/2004  1:30

We tried to open & close the bay 4 shutter with slow control, but motor right side got stuck. Manually open!

Several tries, now shutter closed ⇒ We start to measure dark conditions.

2:00 HV turned on, normal values ✓

Weather conditions: clear dark night, wear winds

Some clouds, but not in field of view.
To this...
Long-term goal
(~ 1 year from now)

- Make the operation fully automatic, with minimum intervention.
- Full remote access, so experts can be part of the data taking from their home institutions.
- Different monitoring levels, including data taking, alarms and data quality.
- We still want to have shifters!
Main problems
Surface Detectors

- Birds
- Intentional fires (landowners don't mean to harm Auger, but they do...)
- No preventive maintenance (yet...)
Main problems
Fluorescence Detectors

- Weather
- Power outages
- Smoke from fires (calendar to landowners)
- People to serve on shifts (number proportional to amount of authors in the articles)

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Example
Main problems
Atmospheric Monitoring

- Weather, specially extreme cold.
- Regular operation is easy, solving problems could be tricky sometimes (requires intervention from experts)
Uptime

➲ FD: we compare the optimal data taking time with the real one. Usually above 90%.
➲ Limited to avoid overexposure of the PMTs
➲ SD: at least 98% of the array is always taking data.
Monitoring

- Developed to report the status of each part of the PAO in a standard way
- Extremely useful during FD data taking
- Alarm system to identify failures and solve them as fast as possible.
- Next: data quality monitoring on-site (helps discovering problems...)
Remote Operation

- AugerAccess: higher bandwidth internet connection (partially supported by EU)
- Reduce the number of people traveling to Malargüe.
- Let the experts participate in the FD shifts and FD/SD data quality analysis from their home institutions.
- Already being tested using a simulated environment.
Summary

- Stable operation and correct understanding of the detector.
- Some (external) problems left, on their way to be solved.
- Automatic operation in the near future. Still looking for shifters for control (and educational) purposes.
- Data quality on site (soon)
- Remote operation and monitoring (very soon)