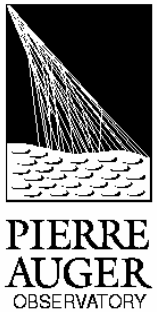


The Auger Observatory

The origin and nature of cosmic rays above 10^{19} eV is not known.

The Auger Observatory plans to study this phenomenon in a comprehensive way.

A new laboratory is being built to make a high statistics study of the energy spectrum, direction, composition of cosmic rays above 10^{19} eV.

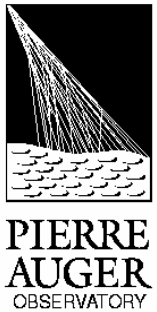
Two large air shower arrays in:

Mendoza, Argentina (construction underway)
Utah or Colorado, USA (in planning)

*****

Our presentation:

The Status of the Auger Project – P. Mantsch
The Performance of the detectors – J. Cronin
Plans for Auger North – K. Arisaka



The Auger Collaboration

Participating Countries - 50 Institutions, >250 Scientists

Argentina
Australia
Bolivia*
Brazil
Czech Republic
France
Germany
Greece
Italy
Mexico
Poland
Slovenia
Spain
United Kingdom
USA
Vietnam*

****Associate***

Participating US institutions:

UCLA
Case Western
Chicago
Colorado
Colorado State
Fermilab (and ANL)
Louisiana State
Michigan Tech
Minnesota
Nebraska
New Mexico
Northeastern
Penn State
Utah

The Auger Observatory

The Auger Observatory combines the strengths of

Surface Detector Array
and
Air Fluorescence Detectors

- **Independent measurement techniques allow control of systematics**
- **More reliable energy and angle measurement**
- **Primary mass measured in complementary ways**

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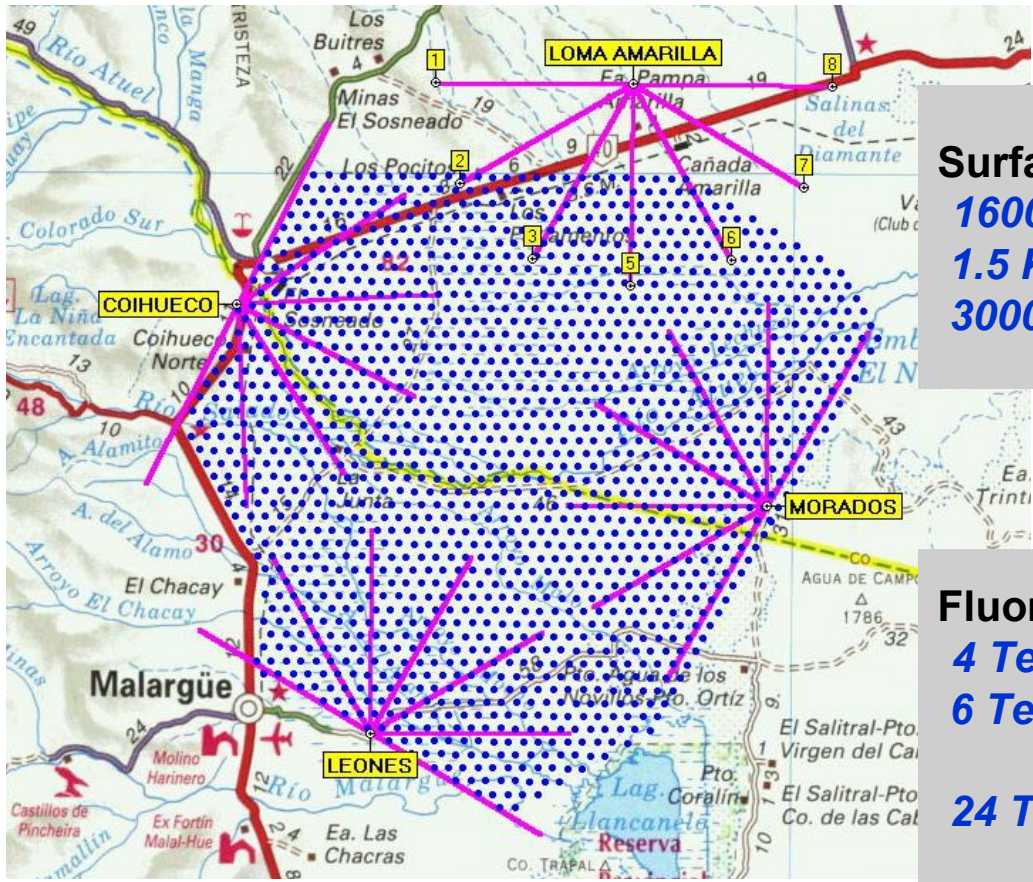
The Observatory Plan



Surface Array

1600 detector stations

1.5 Km spacing

3000 Km^2

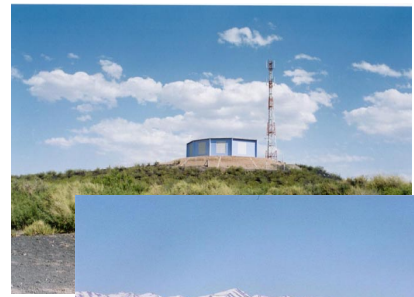
Fluorescence Detectors

4 Telescope enclosures

6 Telescopes per enclosure

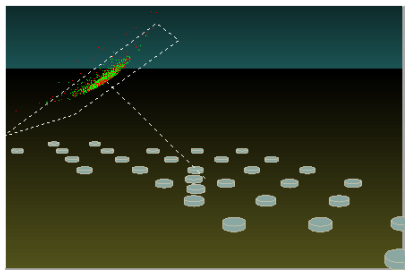
24 Telescopes total

Construction Plan



Years 2000 & 2001

Engineering Array (32 surface detector stations/2 prototype fluorescence detectors)



Validated observatory design

Tested performance of all systems in the field

Provided a basis for refinements in the design, cost and schedule.

Year 2002 – 2003

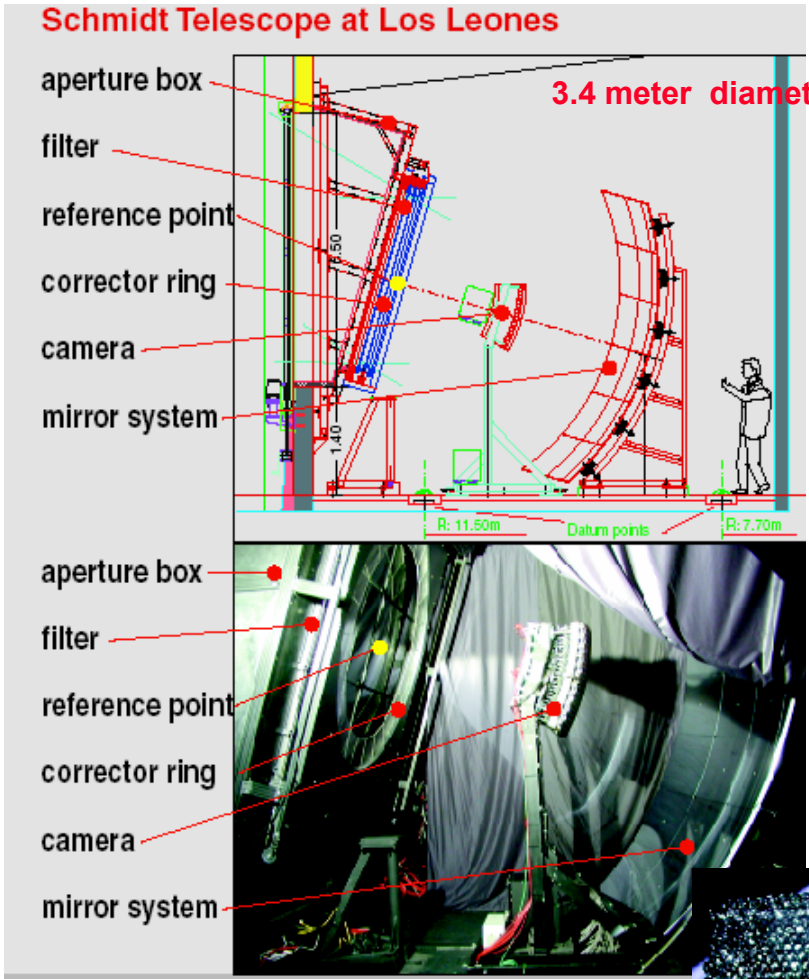
Pre-production

Qualified production vendors for dependability and quality.

Year 2003 – 2005

Full production and deployment

The Fluorescence Detectors



440 pixels per camera

Los Leones

Coihueco

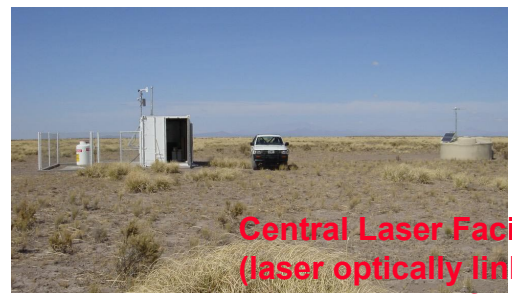
Los Morados – under construction

Atmospheric Monitoring and Calibration

To realize the full advantage of the calorimetric fluorescence measurement, absolute calibration and careful atmospheric measurements are necessary.

- **Atmospheric Monitoring**
  - ***Lidar for atmospheric profiling and "shooting the showers" (atmospheric measurement along the shower path).***
  - ***Fixed vertical and steerable lasers at array center for atmospheric monitoring, timing and calibration checks.***
  - ***Continuous horizontal attenuation monitors.***
  - ***Balloon borne atmospheric measurements.***
- **Absolute Calibration**
  - ***End to end absolute calibration***

Lidar at each Fluorescence



Central Laser Facility (laser optically linked to adjacent surface detector tank)

Drum for uniform illumination of each fluorescence camera – part of end to end calibration .

Year around balloon borne atmospheric measurements.

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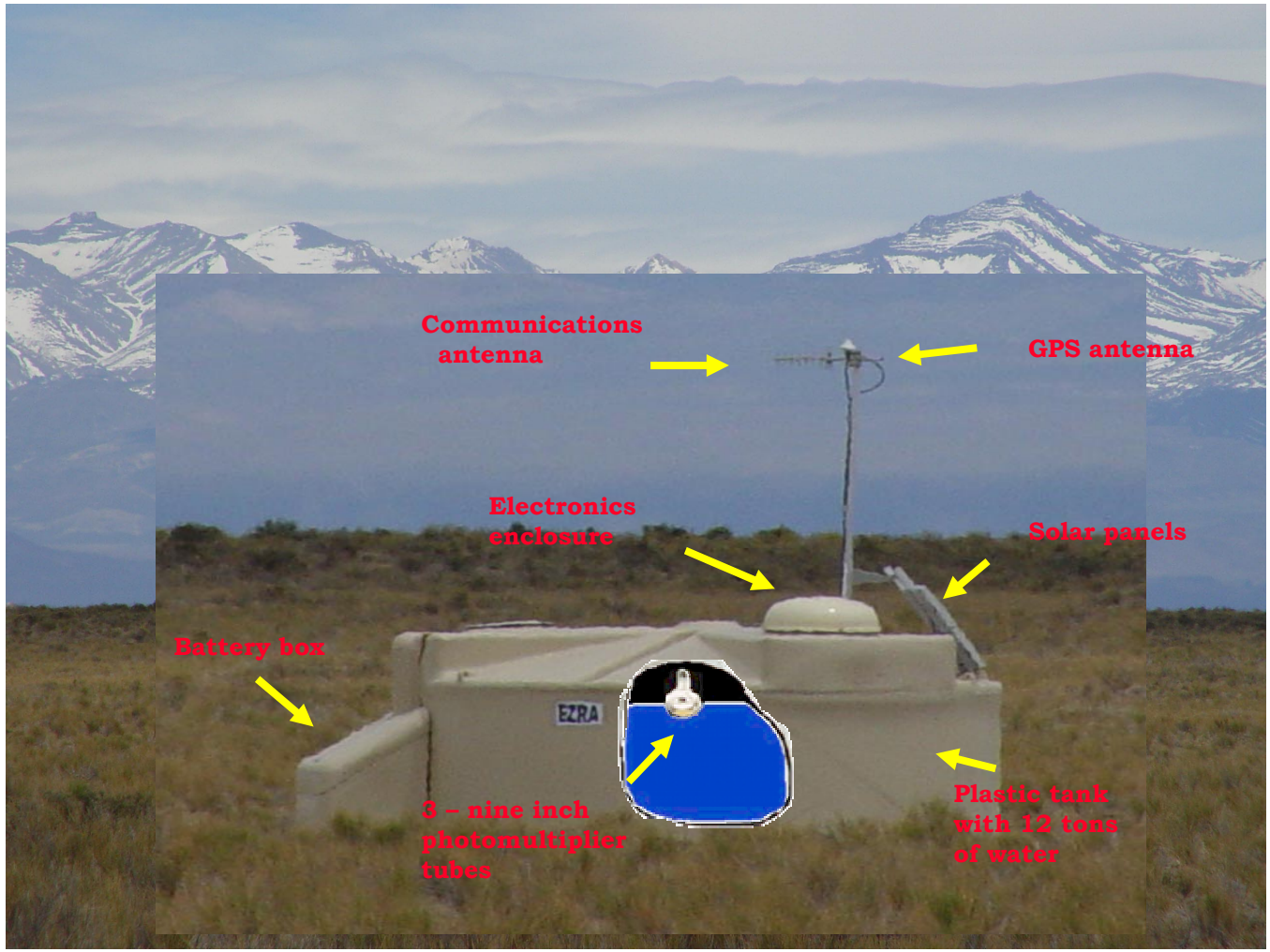
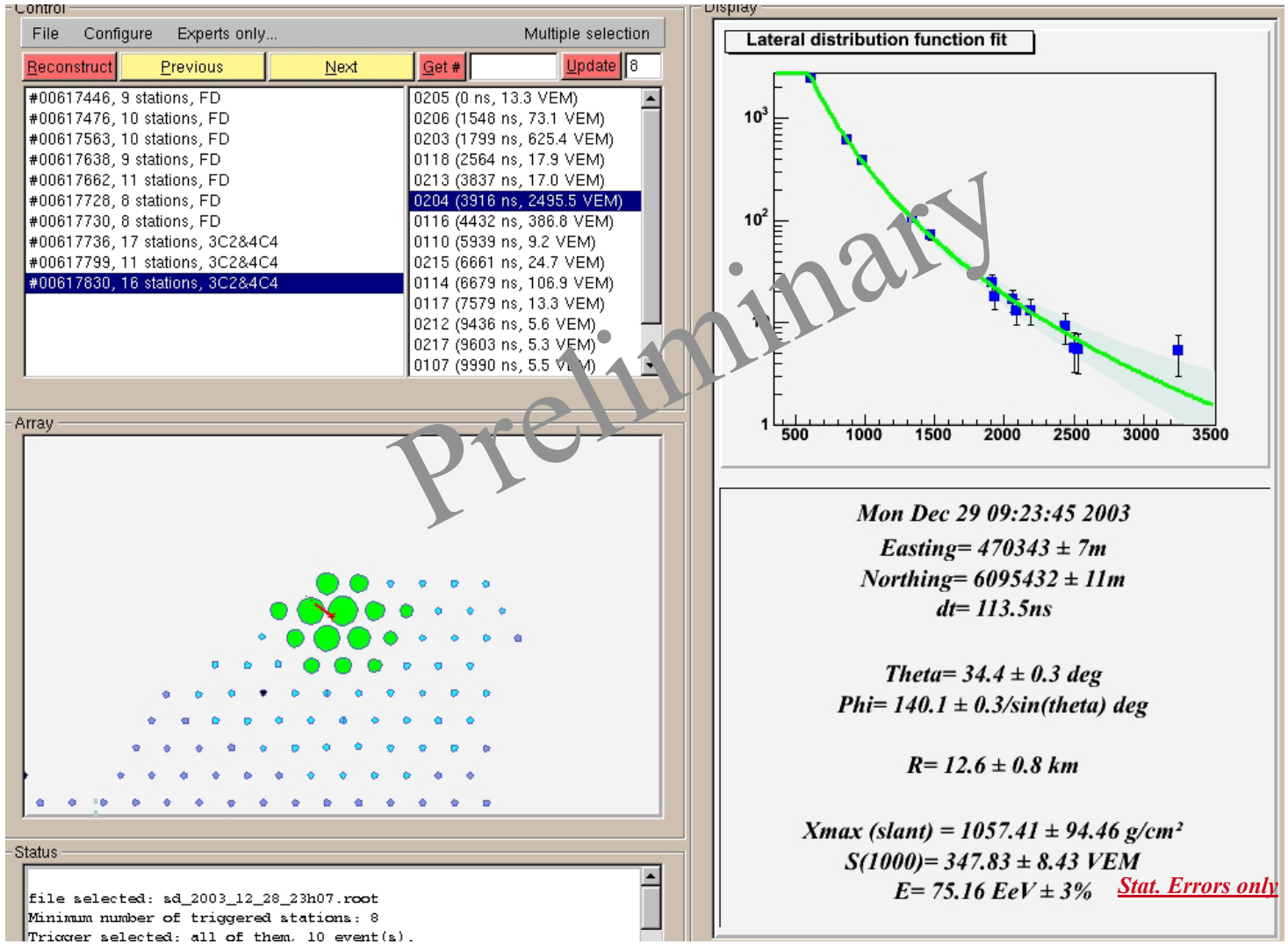
The Surface Array



Typical Event



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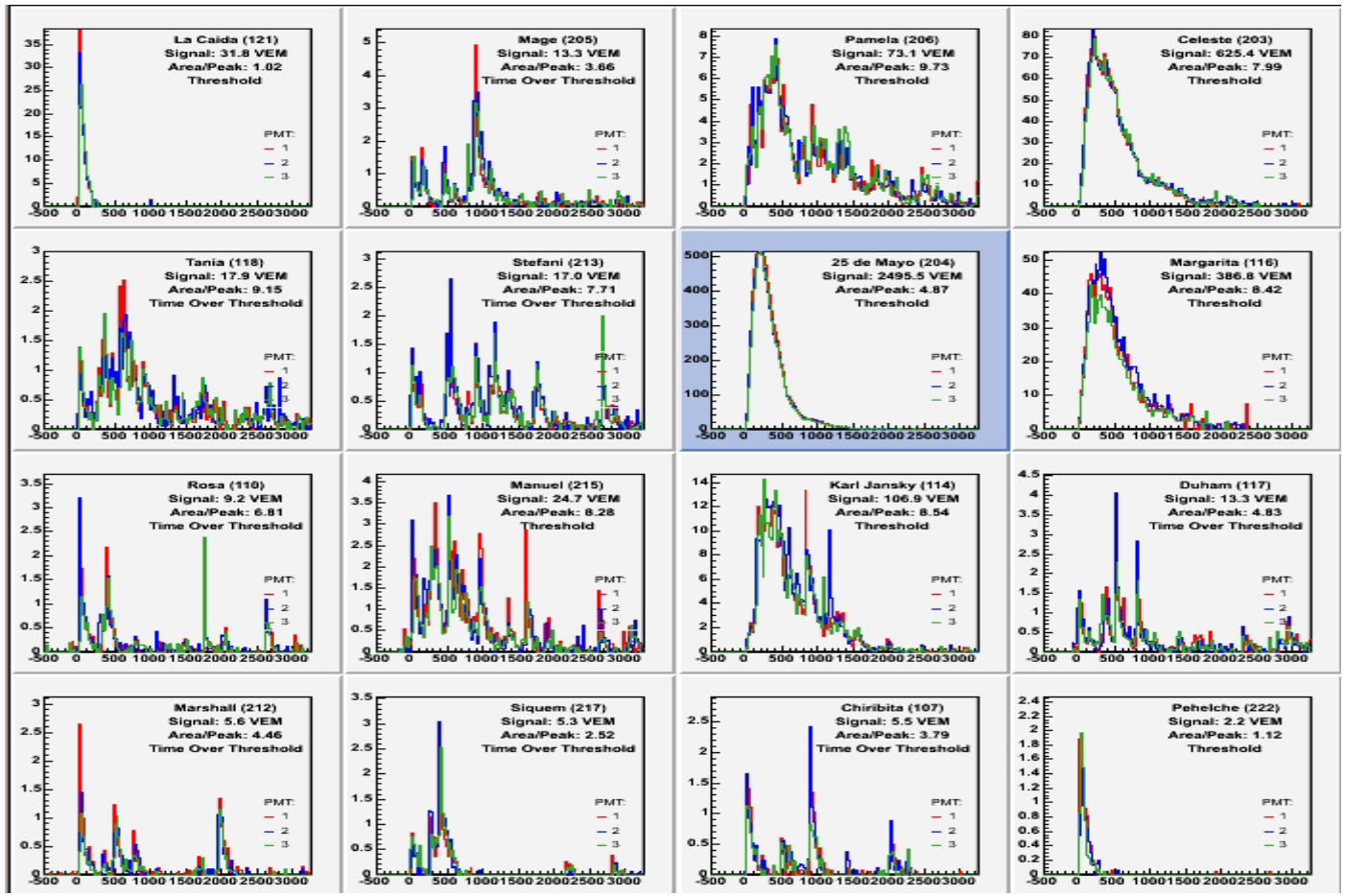
Typical Event Con't



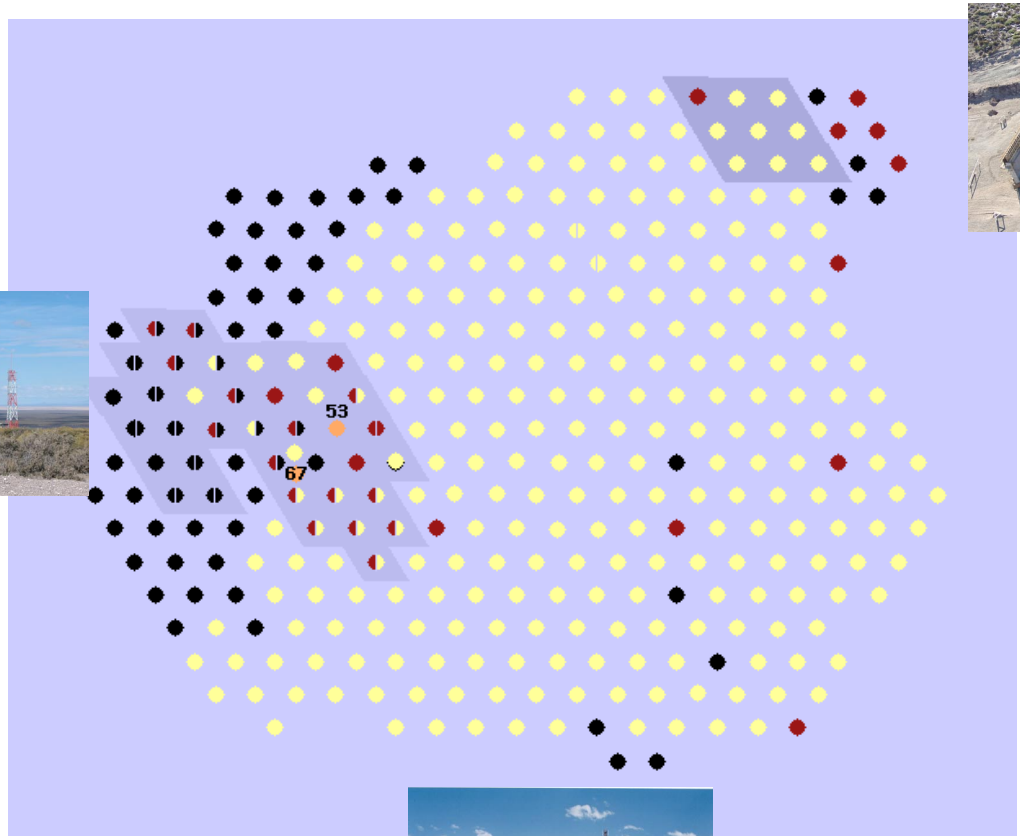
PRELIMINARY analysis shows

zenith angle 34º, energy 75 EeV

Status

Los Morados

Coihueco



Los Leones

Surface Array

- 350 surface detector stations deployed
- 270 surface detector stations have electronics and are operational – *World's largest array!*

Fluorescence detectors

- 6 telescopes operational in Los Leones
- 2 telescopes operational in Coihueco

PIERRE AUGER OBSERVATORY

Progress

All of the observatory systems have met or exceeded our expectations –

- **Fluorescence**
  - ***Hybrid reconstruction works better than anticipated.***
  - ***Double (stereo) and triple hybrid events at high energy add precision and systematic checks.***

- **Surface Array**
  - ***Lower threshold – greater sensitivity***
  - ***Anisotropy studies possible well below 10^{19} eV.***
  - ***Reconstruction possible for events to zenith angles of almost 90 degrees***
    - Greater Aperture (~x1.5 compared to aperture below 60 degrees)
    - Extends sensitivity to neutrinos and possibly exotics at high zenith angle.

Cost and Funding

Auger South Total Project Cost:

March 99 - $54.6M

October 01 - $53.8M

January 04 – $47.5M

However, available funding reduced by about $10M as a result of the collapse of the Argentine economy as well as financial problems in Brazil and Mexico.

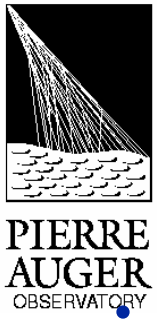
The participating countries have been asked to make up this shortfall – In hand - $2M, likely additional - $6M, requests pending - $2M

Connecting Quarks with the Cosmos (NAS – Turner Report):

Eleven Science Questions for the New Century – Recommendation:

"Determine the origin of the highest energy gamma rays, neutrinos and cosmic rays.

The Committee supports the broad approach already in place, and recommends that the United States ensure the timely completion and operation of the Southern Auger array….."



Summary

- We have formed a broad international collaboration that has successfully begun the construction of the Southern site of a new cosmic ray air shower observatory at a remote location in Argentina.
- The Auger Observatory uses a unique and powerful hybrid technique to address one of the important science questions of our time.
- The detectors have demonstrated performance beyond our expectations.
- With adequate funding the observatory will be complete at the end of 2005.