



Fermilab Program Advisory Committee

Status and First Data

Pierre Auger Southern Observatory

Malargüe, Mendoza, Argentina

Carlos Hojvat, Fermilab

April 8, 2004

“Tengo los ojos llenos de polvo de estrellas.”

Cyrano de Bergerac

Contents

- **Short Introduction**

(Please refer to last presentation for further details)

- **First data to be presented at ICRC 2005
August 2005**

The Auger Collaboration

Argentina

Australia

Bolivia*

Brazil

Czech Republic

France

Germany

Italy

Mexico

Poland

Slovenia

Spain

United Kingdom

United States

(Project Management at Fermilab)

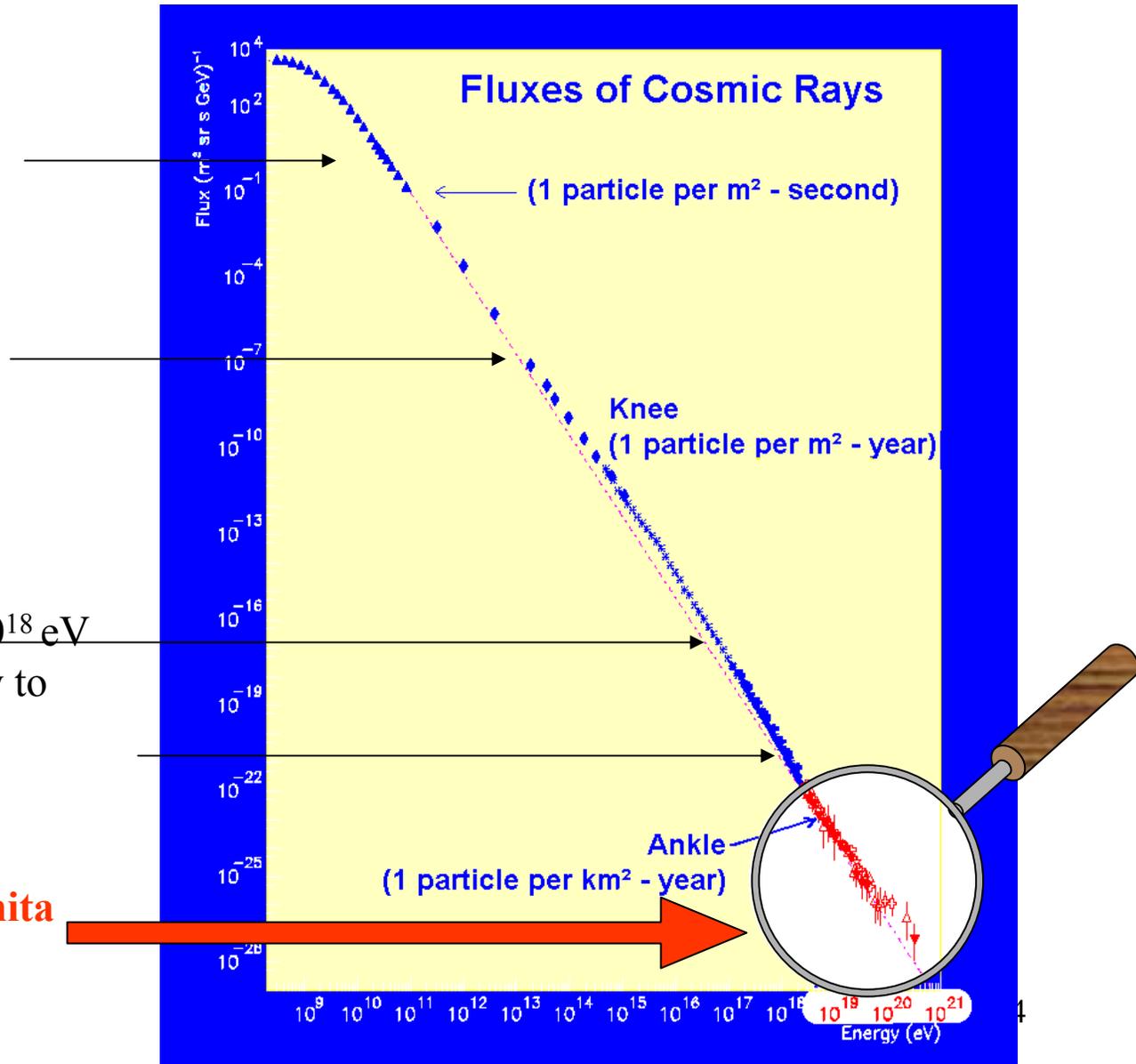
Vietnam*

*Associate

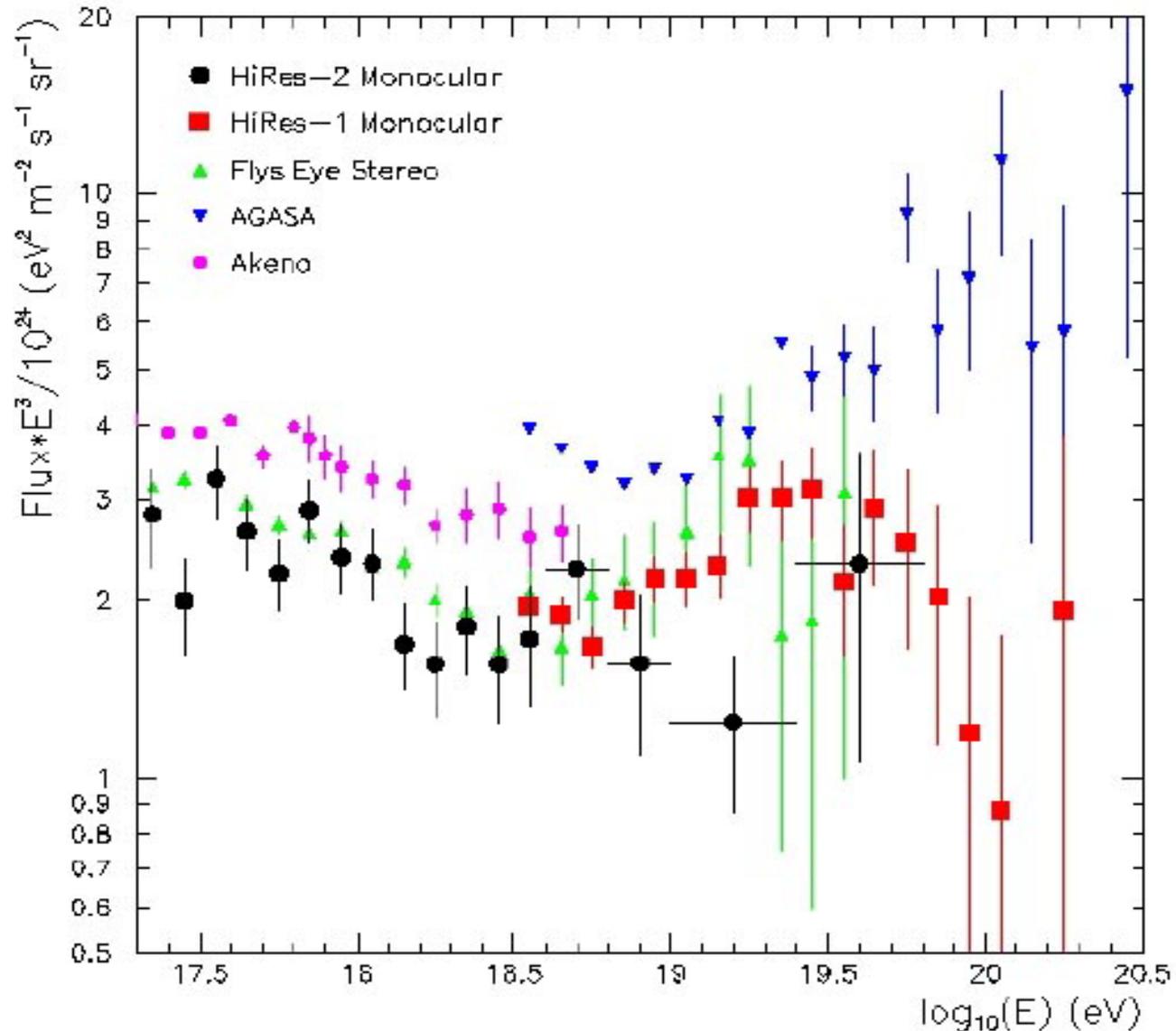
Cosmic rays spectrum

Origin ?

- 10^9 eV
Galactic
- 10^{15} eV
Galactic
- 10^{15} eV to 10^{19} eV
Not clear,
some hints of:
galactic anisotropy at 10^{18} eV
composition from heavy to
light
- **Above 10^{19} eV,
UHECR, terra incognita**

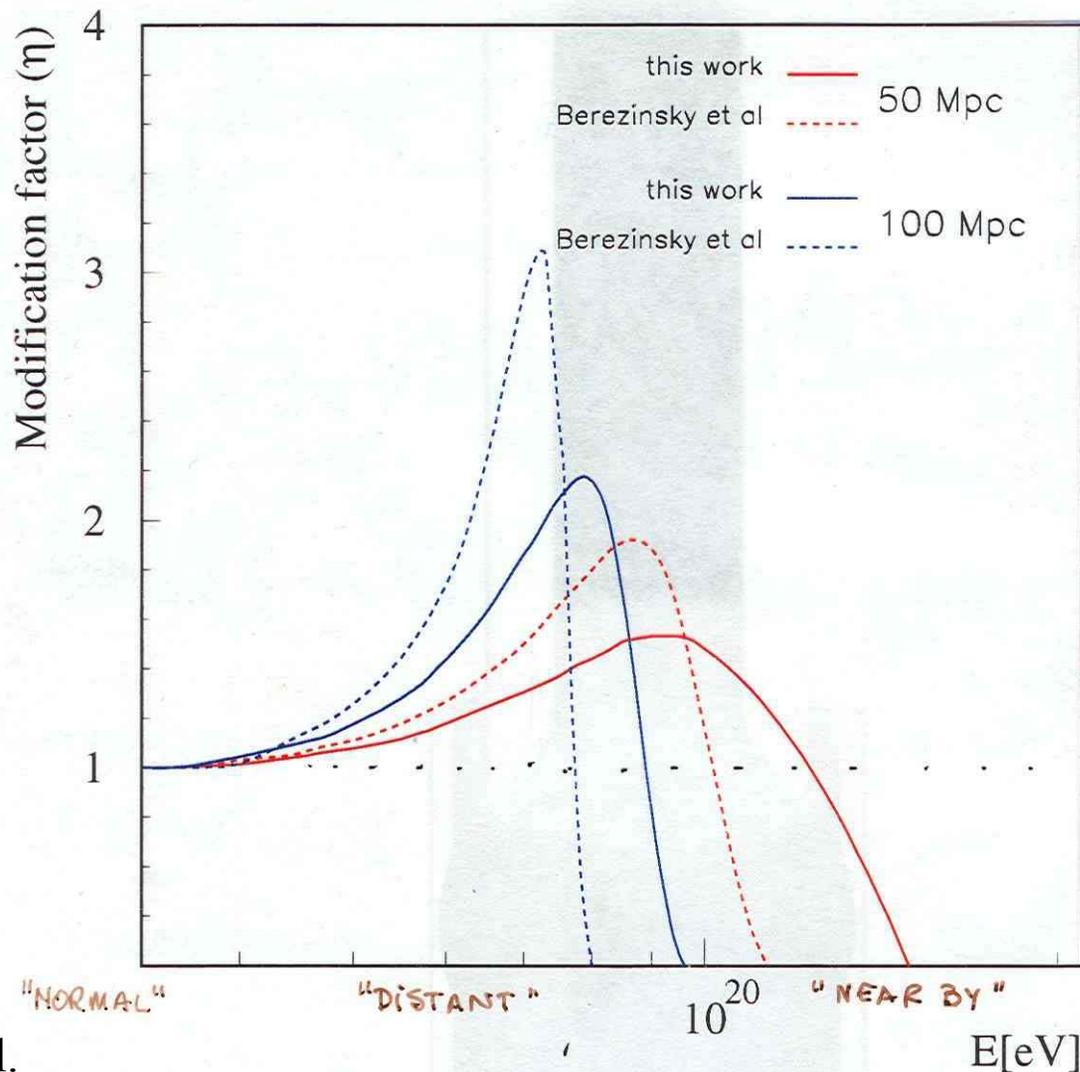


Comparison of UHECR Measurements



GZK Spectra Modification

NOT A PARTICLE LOSS MECHANISM



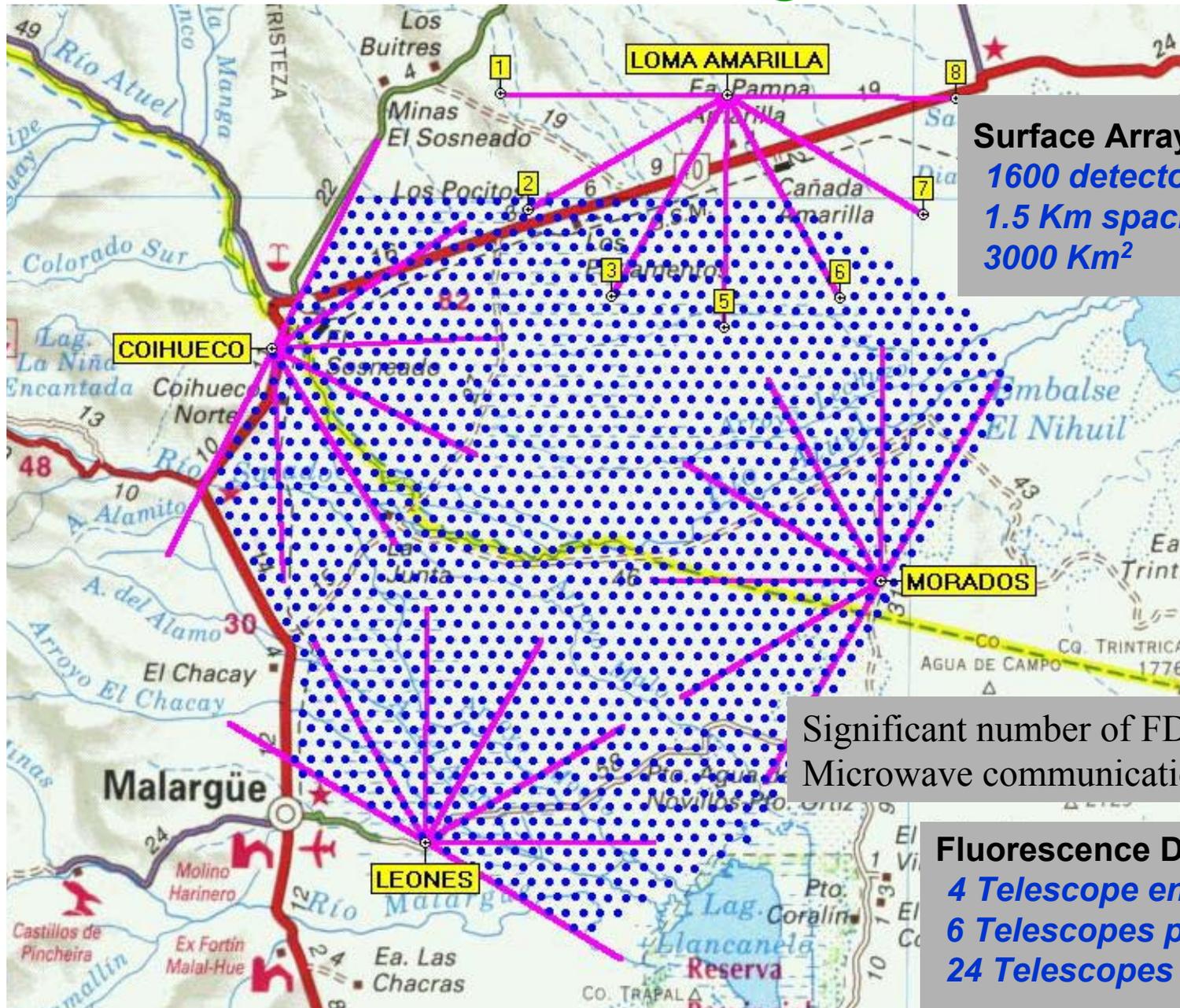
Why is $\sim 10^{20}$ eV so special?

- Protons should appear at a lower energy from $>100\text{Mpc}$ at $E > 10^{20}\text{eV}$ due to energy loss to the CMB.
 - GZK Cut-off
- Protons trajectories less affected by inter-galactic magnetic fields.
 - Charged-Particle Astronomy
 - New Window to the Extreme Universe
- Difficult to accelerate beyond 10^{20}eV .
 - Top-down Mechanism?

Science Objectives

- Nature, origin and propagation of UHECR
 - Point sources or isotropic
 - Spectrum at Ultra High Energies?
 - Near by or far away (GZK Cut-off?)
 - Primary type
 - Exotics ?
 - Neutrino Studies

The Southern Pierre Auger Observatory



Surface Array
1600 detector stations
1.5 Km spacing
3000 Km²

Significant number of FD stereo events
Microwave communications backbone

Fluorescence Detectors
4 Telescope enclosures
6 Telescopes per enclosure
24 Telescopes total

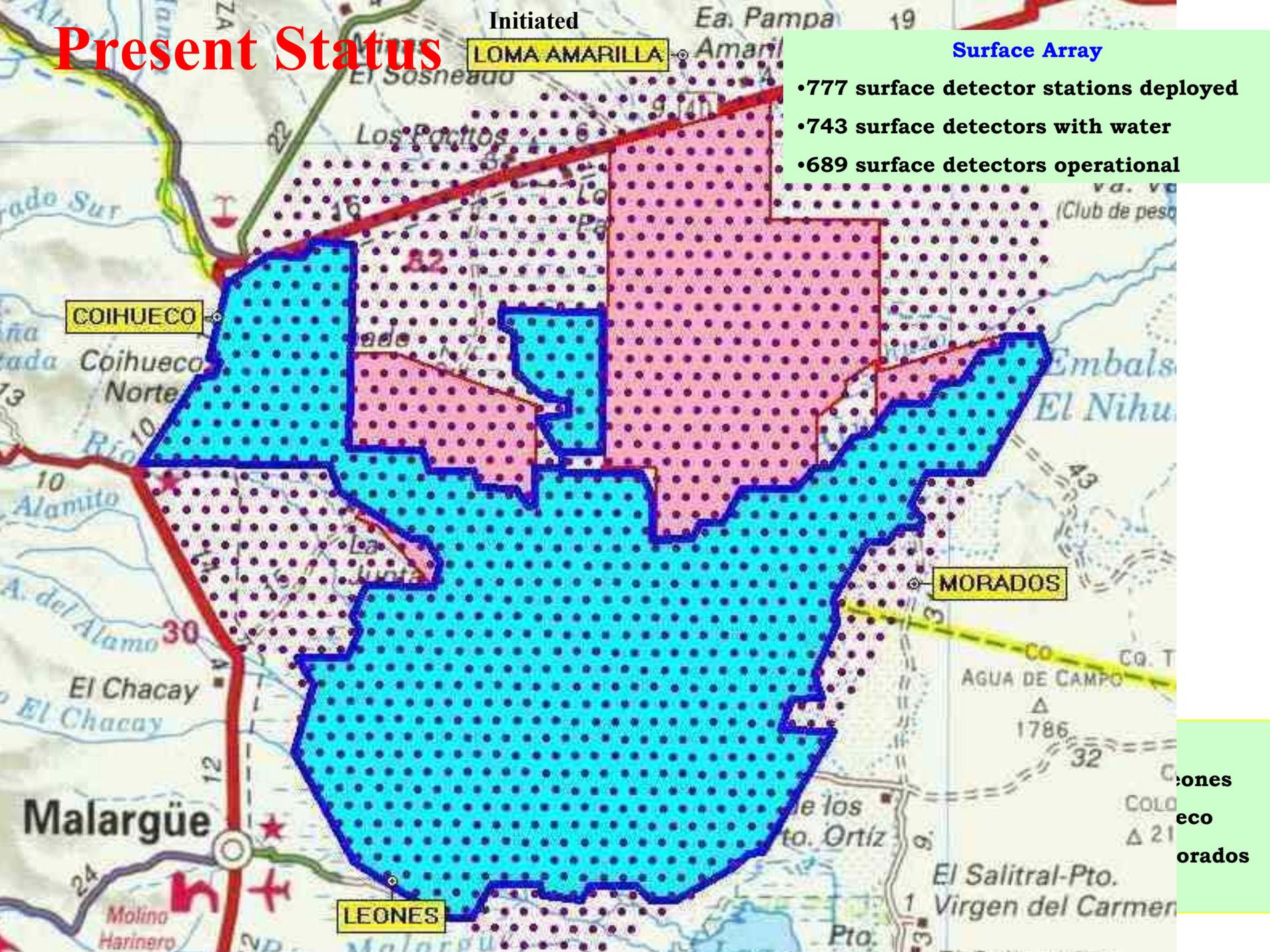
Present Status

Initiated

LOMA AMARILLA

Surface Array

- 777 surface detector stations deployed
- 743 surface detectors with water
- 689 surface detectors operational



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ICRC – 2005

India

- One general paper on the Engineering Array Published
- Publications to follow conference at an appropriate time

ICRC 2005 - General papers

Performance of the Pierre Auger Observatory surface array (Speaker: X. Bertou) (ORAL)

Performance of the Pierre Auger Observatory fluorescence detectors
(Speaker: J. Belido) (ORAL)

Hybrid performance of the Pierre Auger Observatory
(Speaker: M. Mostafa) (ORAL)

Statistical and systematic uncertainties in the event reconstruction, S(1000) and energy determination by the Pierre Auger surface detector
(Speaker: P.L. Ghia) (ORAL)

ICRC 2005 – Science papers

Upper limit on the primary photon fraction from the Pierre Auger Observatory

(Speaker: M. Risse) (ORAL)

First estimate of the primary cosmic ray energy spectrum above 3 EeV from the Pierre Auger Observatory

(Speaker: P. Sommers) (ORAL)

A description of some ultra high energy cosmic rays observed with the Pierre Auger Observatory

(Speaker: M. Ave) (ORAL)

Detection of very inclined showers with the Auger Observatory (Speaker: L. Nellen) (ORAL)

Anisotropy studies around the galactic centre at EeV energies with Auger data

(Speaker: A. Letessier-Selvon) (ORAL)

Search for localized excess fluxes in Auger sky maps and prescription results

(Speaker: B. Revenu) (ORAL)

ICRC 2005 – Technical papers - SD

Observing muon decays in water Cherenkov detectors at the Pierre Auger Observatory

(Coordinator: N. Busca) (POSTER)

M. Calibration of the surface array of the Pierre Auger Observatory

(Coordinator: P. Allison) (POSTER)

Response of the Pierre Auger Observatory water Cherenkov tanks to shower particles

(Coordinator: T. Suomijarvi) (POSTER)

Observation of long term stability of water tanks in the Pierre Auger surface detector

(Coordinator: K. Arisaka) (POSTER)

ICRC 200 - FD - 1

FD aperture and hybrid aperture in Auger

(Coordinator: S. Petrera) (POSTER)

The performance of the corrector lenses for the Auger fluorescence detector

(Coordinator: C. Escobar) (POSTER)

Impact of a new Cherenkov light parameterisation on the reconstruction of shower profiles from Auger fluorescence data

(Coordinator: F. Nerling) (POSTER)

Relative calibration and stability monitoring for the Auger fluorescence detector

(Coordinator: A. Insolia) (POSTER)

Absolute calibration of the Auger fluorescence detector (Coordinator: J. Brack) (POSTER)

ICRC 200 - FD - 2

Quality studies of the data taking conditions for the Auger fluorescence detector

(Coordinator: J.R. Martino) (POSTER)

Measurement of the sky photon background flux at the Auger Observatory

(Coordinator: S. Petrera) (POSTER)

The central laser facility at the Pierre Auger Observatory (Coordinator: L. Wiencke) (POSTER)

Molecular atmospheric characterization

(Coordinator: B. Keilhauer) (POSTER)

Atmospheric aerosol monitoring at the Pierre Auger Observatory

(Coordinator: M. Roberts) (POSTER)

ICRC 2005 - Analysis - 1

Using the single particle technique to detect GRBs in the Pierre Auger Observatory

(Coordinator: X. Bertou) (POSTER)

Angular resolution of the Pierre Auger Observatory

(Speaker: C. Bonifazi) (ORAL)

Measurement of the lateral distribution function of UHECR air showers with the Auger Observatory

(Coordinator: P. Bauleo) (POSTER)

Validation of the real and simulated data of the Pierre Auger fluorescence telescopes

(Coordinator: K.-H. Kampert) (POSTER)

Lateral width of shower image in the Auger fluorescence detector

(Coordinator: V. de Souza) (POSTER)

ICRC 2005 - Analysis - 2

Determination of the acceptance of the surface detector of the Pierre Auger Observatory

(Coordinator: E. Parizot) (POSTER)

Primary composition studies using signal waveform analysis

(Coordinator: J. Matthews) (POSTER)

Coverage and large scale anisotropies estimation methods for the Pierre Auger Observatory

(Speaker: J.-C. Hamilton) (ORAL)

Timing calibration and synchronizations of the Pierre Auger Observatory surface detectors and fluorescence detectors

(Coordinator: C. Covault) (POSTER)

ICRC 2005 – Trigger – Off-line

The trigger system of the PAO surface detector: operation, efficiency and stability

(Coordinator: P. Bauleo) (POSTER)

The Offline software framework of the Pierre Auger Observatory

(Coordinator: T. Paul) (POSTER)

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

Year 2002 – 2003

Pre-production

Qualified production vendors

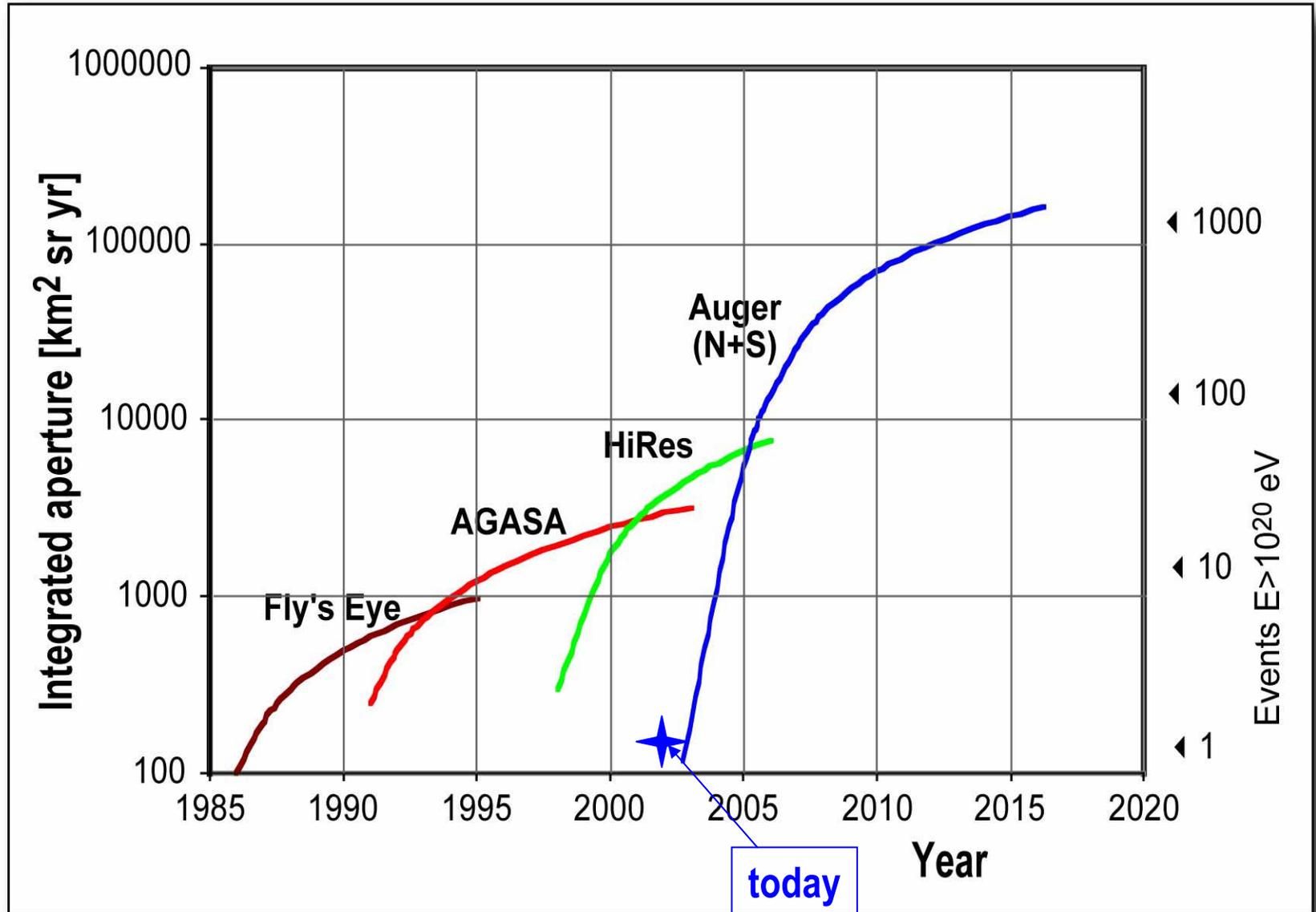
Year 2003 – 2006

Full production and deployment

Funding

Some Data taking Statistics

Integrated Aperture



Observatory Staff





Visitor Center