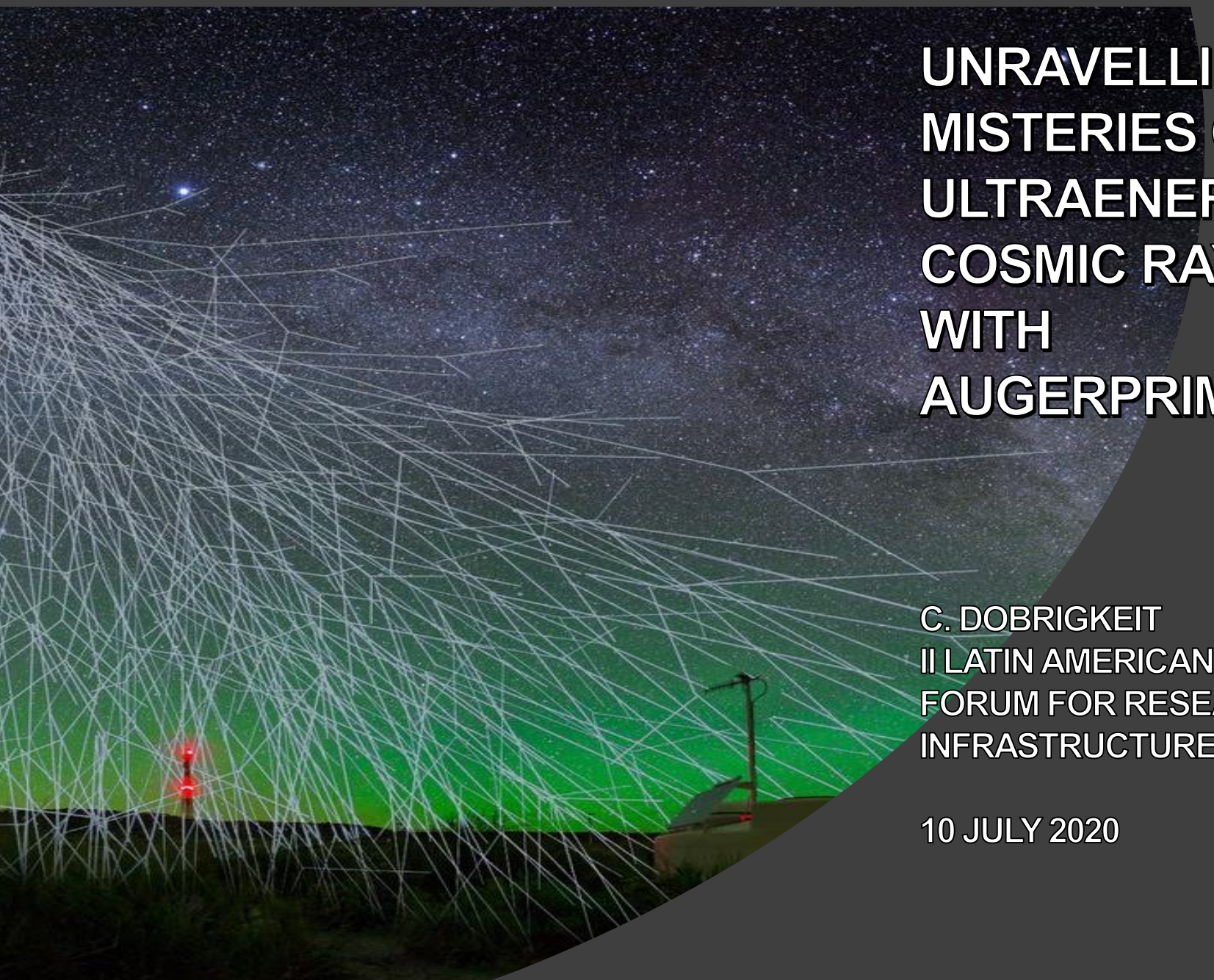


UNRAVELLING THE MISTERIES OF ULTRAENERGETIC COSMIC RAYS WITH AUGERPRIME

C. DOBRIGKEIT

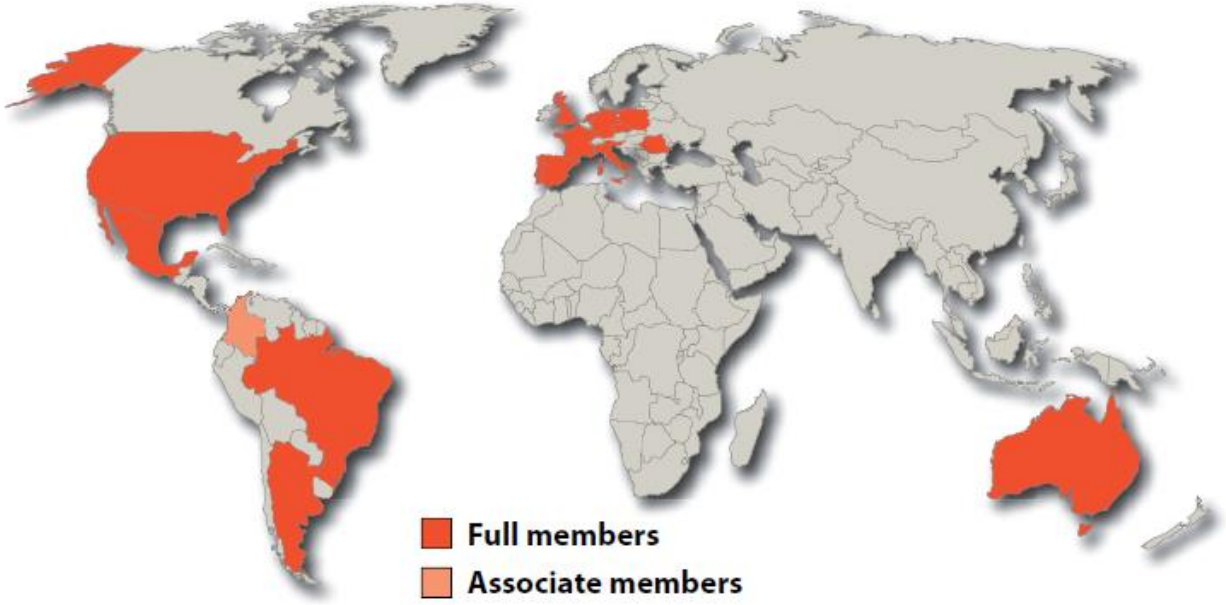
II LATIN AMERICAN STRATEGY FORUM FOR RESEARCH INFRASTRUCTURE

10 JULY 2020

The Pierre Auger Collaboration

More than 450 collaborators from
90 institutions in 16 countries

Argentina – Australia – Brazil – Colombia – Czech Republic – France – Germany – Italy – Mexico – Netherlands – Poland – Portugal – Romania – Slovenia – Spain – United States



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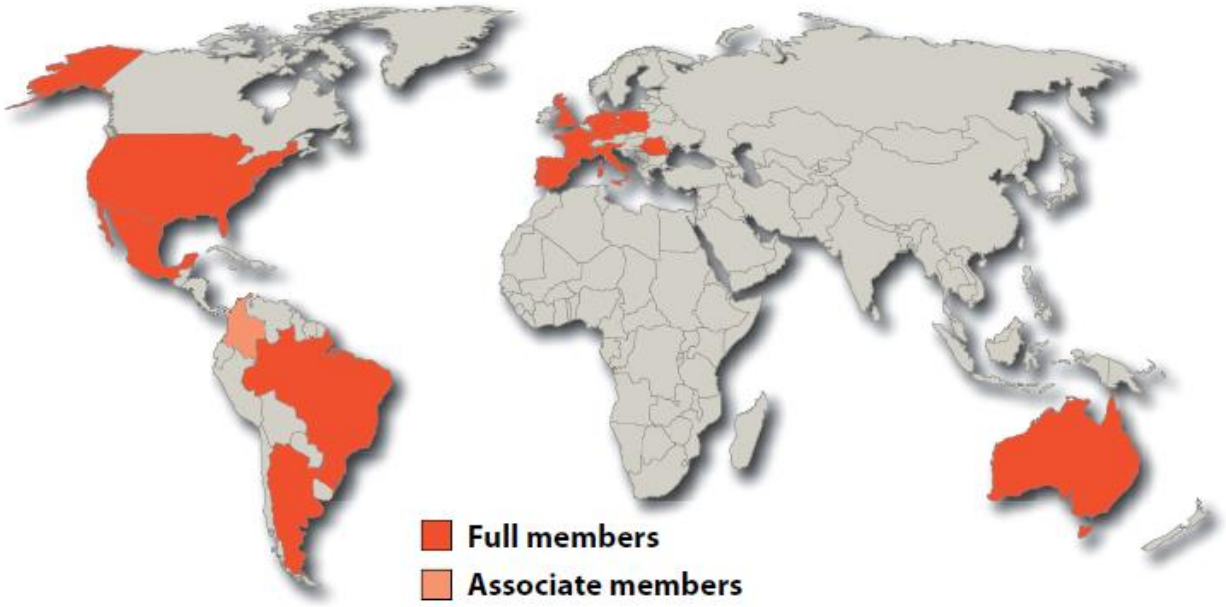


Latin-America in Auger:

- Argentina: 11 institutions, 70 members
- Brazil: 12 institutions, 26 members
- Colombia: 2 institutions, 6 members
- México: 5 institutions, 13 members

The Pierre Auger Observatory

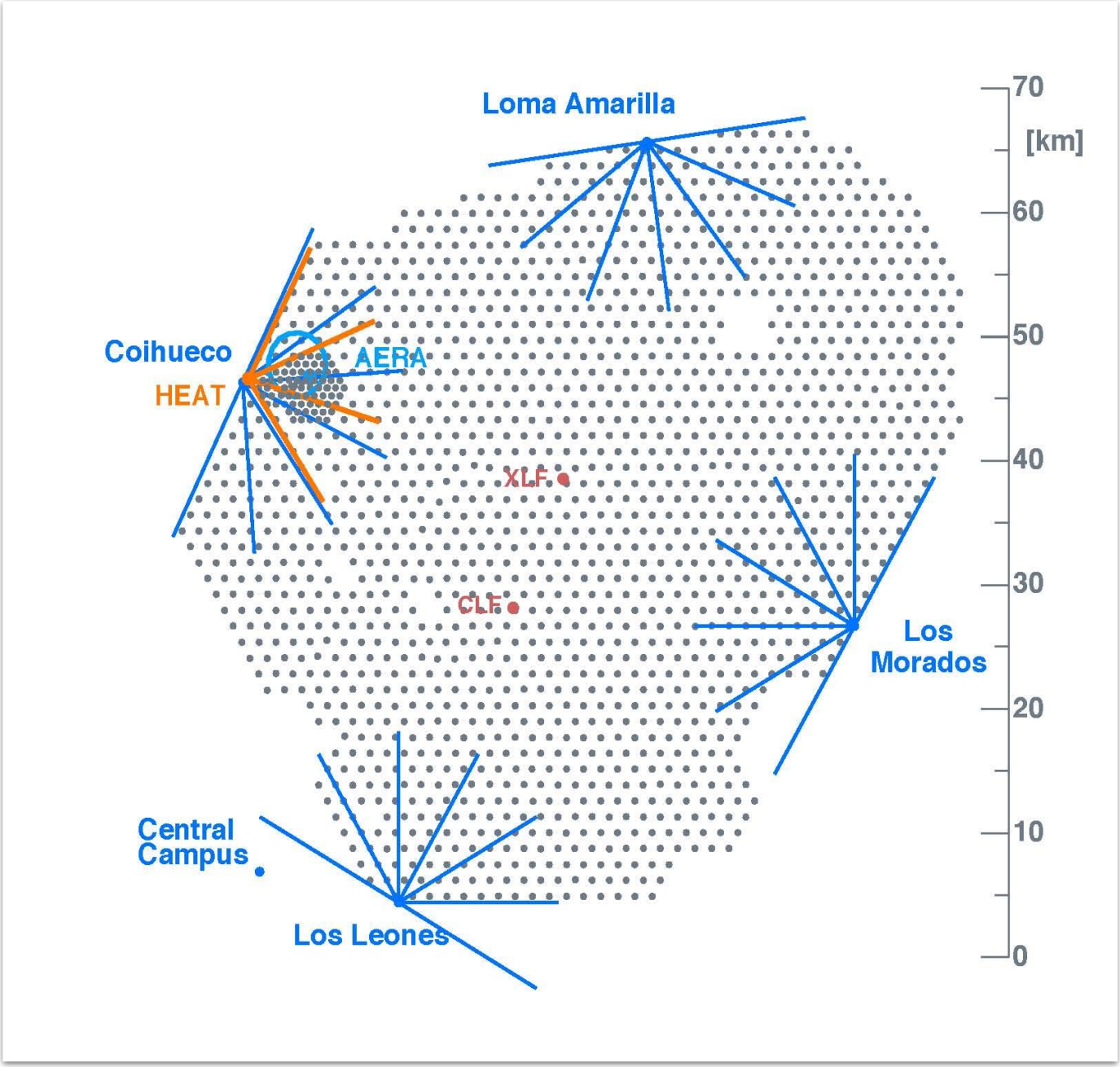
- The Auger Observatory was built twenty years ago to study the most energetic cosmic particles that reach the Earth, those with energies above 10^{17} eV.

- The Observatory has been collecting data now for over more than 16 years, accumulating the world's largest exposure to ultrahigh-energy cosmic rays. Data taken over these years have already led to major breakthroughs in the field.

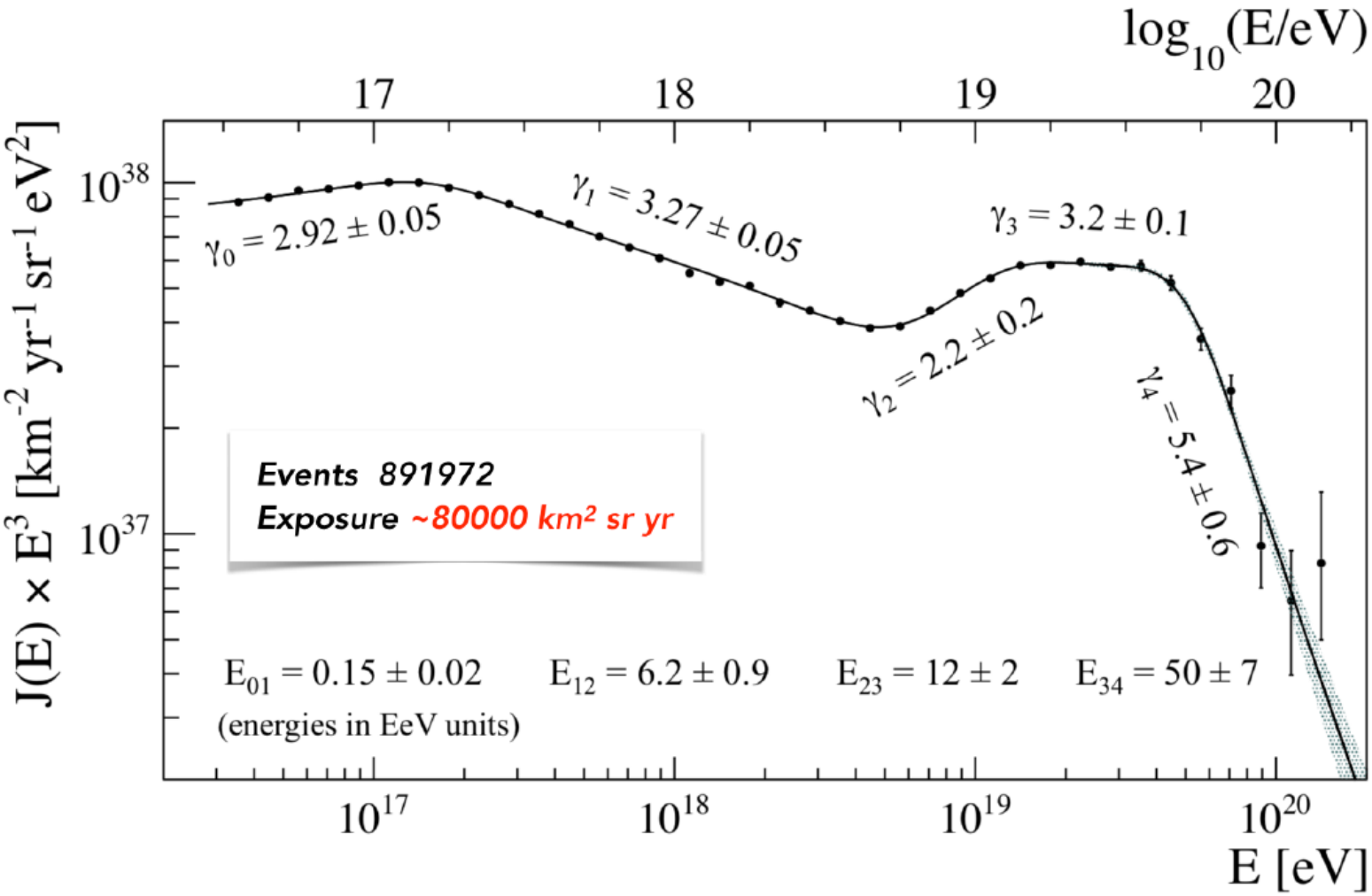
- In the last four years, the Auger Collaboration began an effort dubbed AugerPrime, aiming to improve the determination of the primary mass composition.

The Auger Observatory: 3000 km^2

- 1660 water-Cherenkov surface detectors
- 27 fluorescence telescopes
- 7 underground muon detectors
- Array of radio antennas
- Atmospheric monitoring devices (CLF, XLF, Lidar,..)

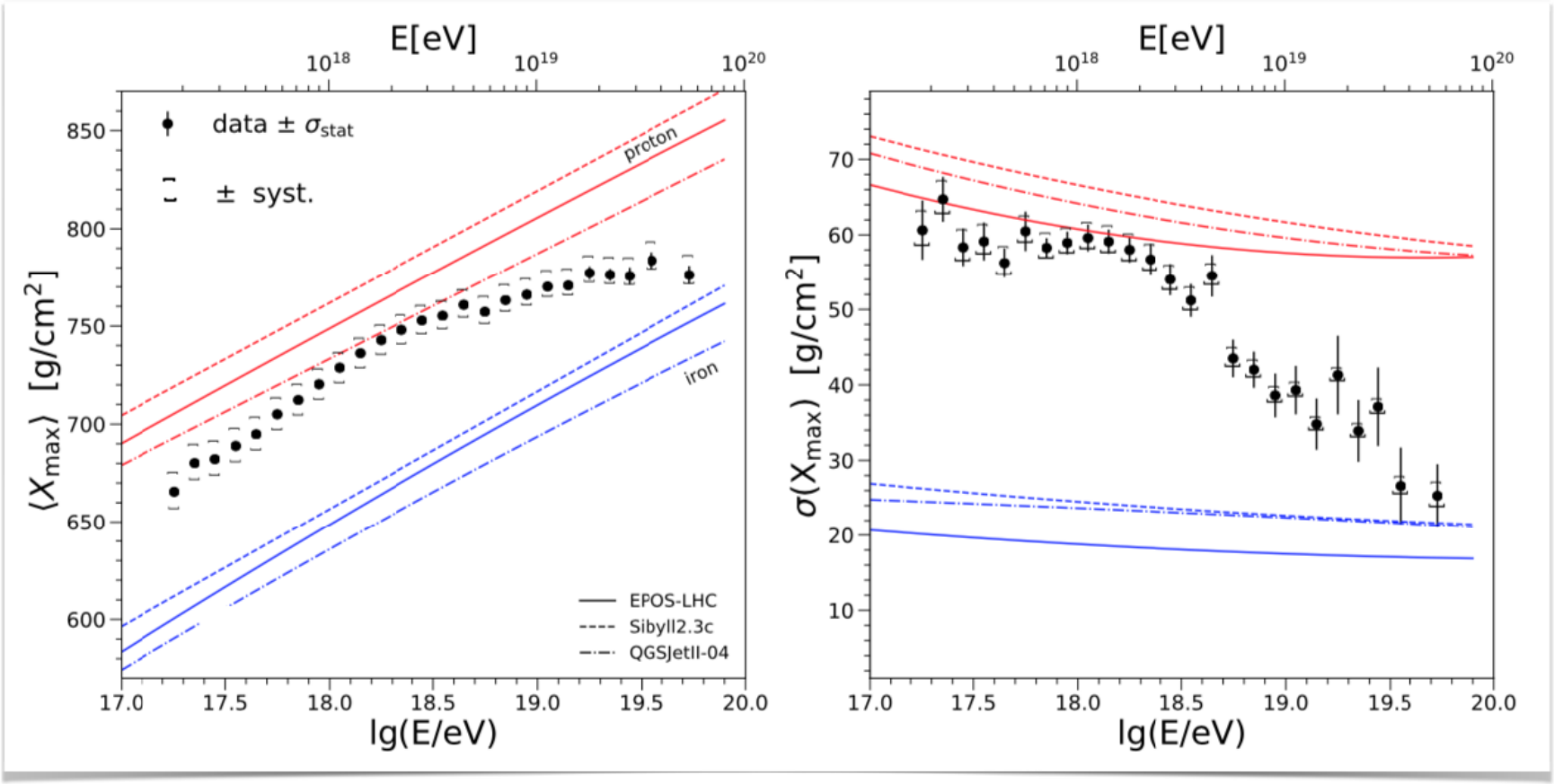


The energy spectrum



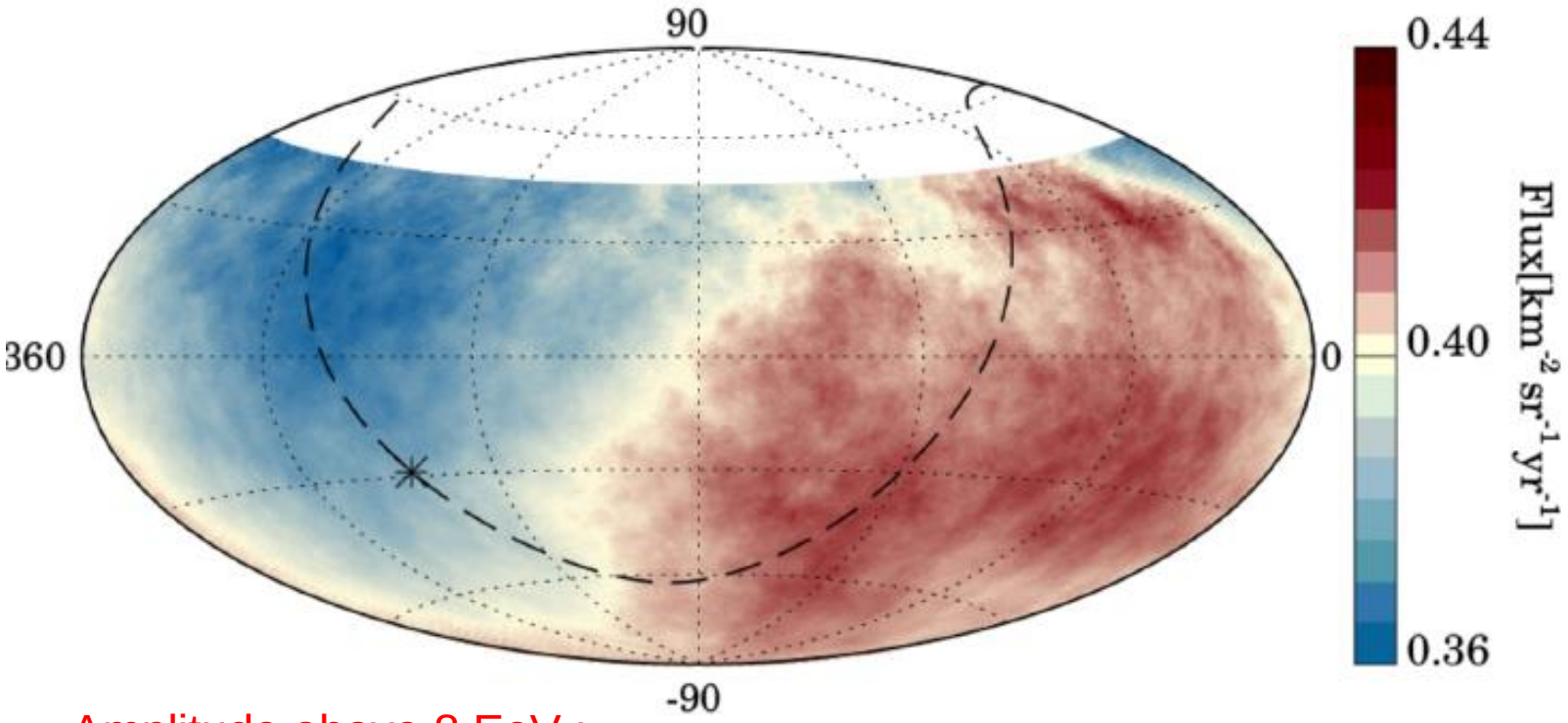
Auger Collaboration, ICRC(2019)

Studying mass composition through the X_{max}



Auger Collaboration, ICRC(2019)

Large scale anisotropy



Amplitude above 8 EeV :

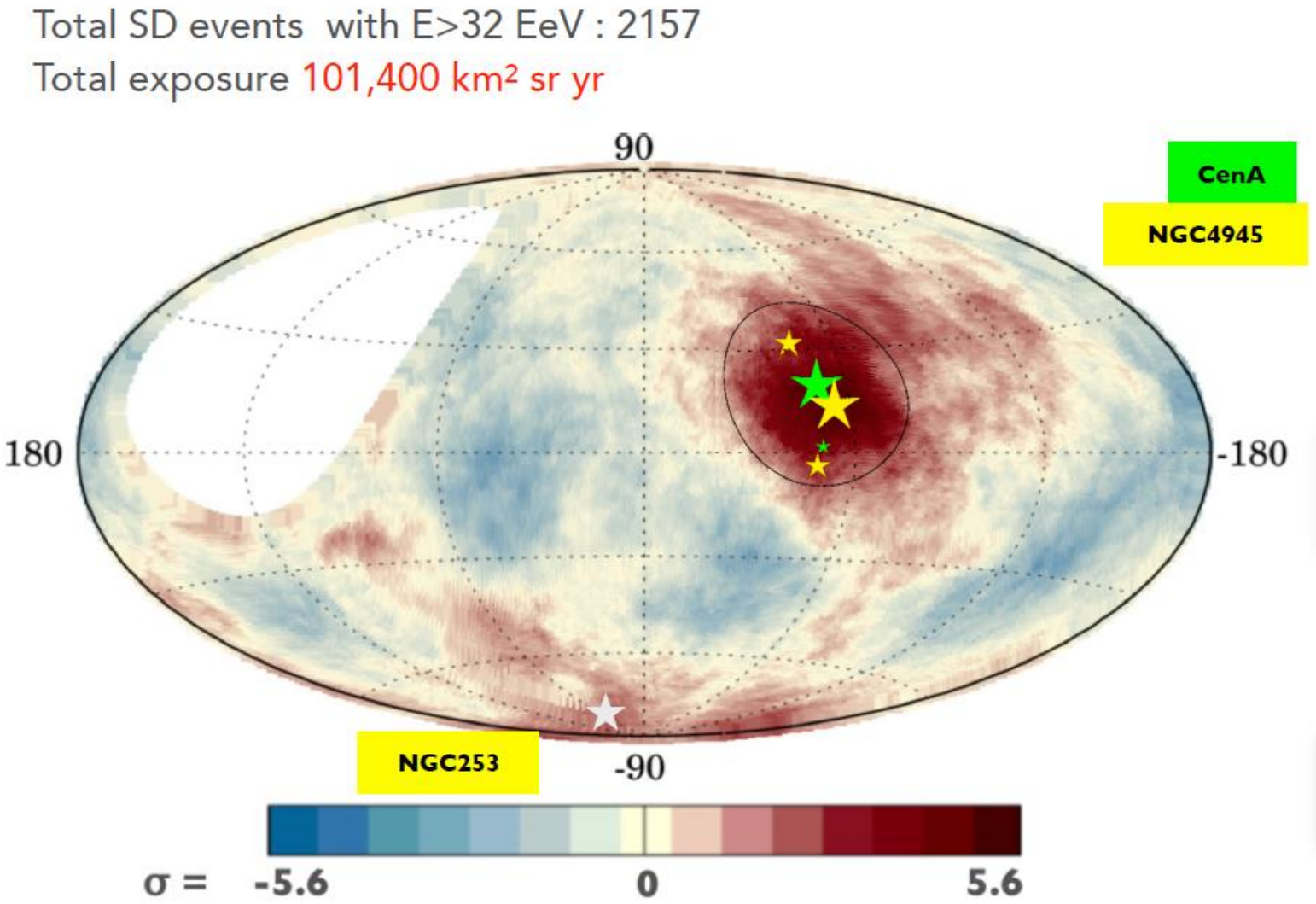
$(6.6^{+1.2}_{-0.8})\%$

$(\alpha, \delta) = (98°, -25°)$

125° off the Galactic center

Auger Collaboration, ICRC(2019)

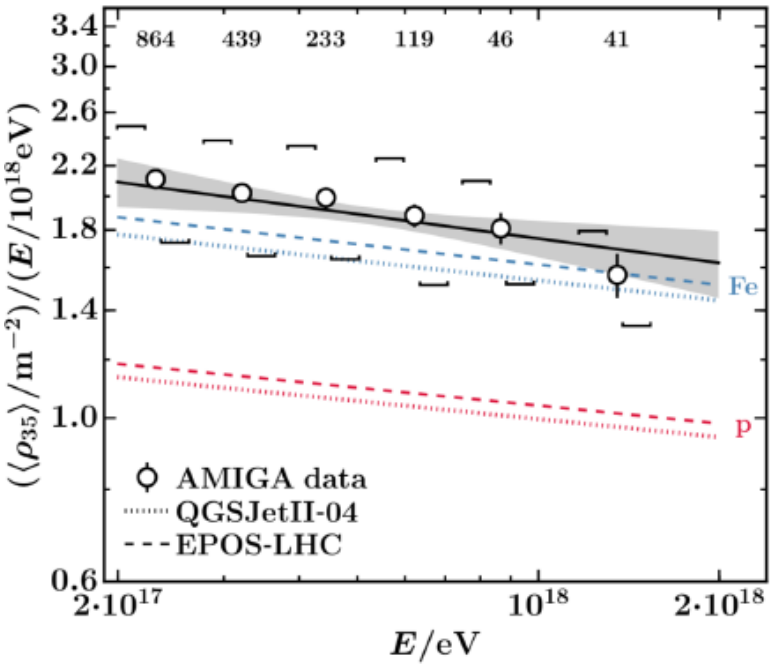
Intermediate scale anisotropy

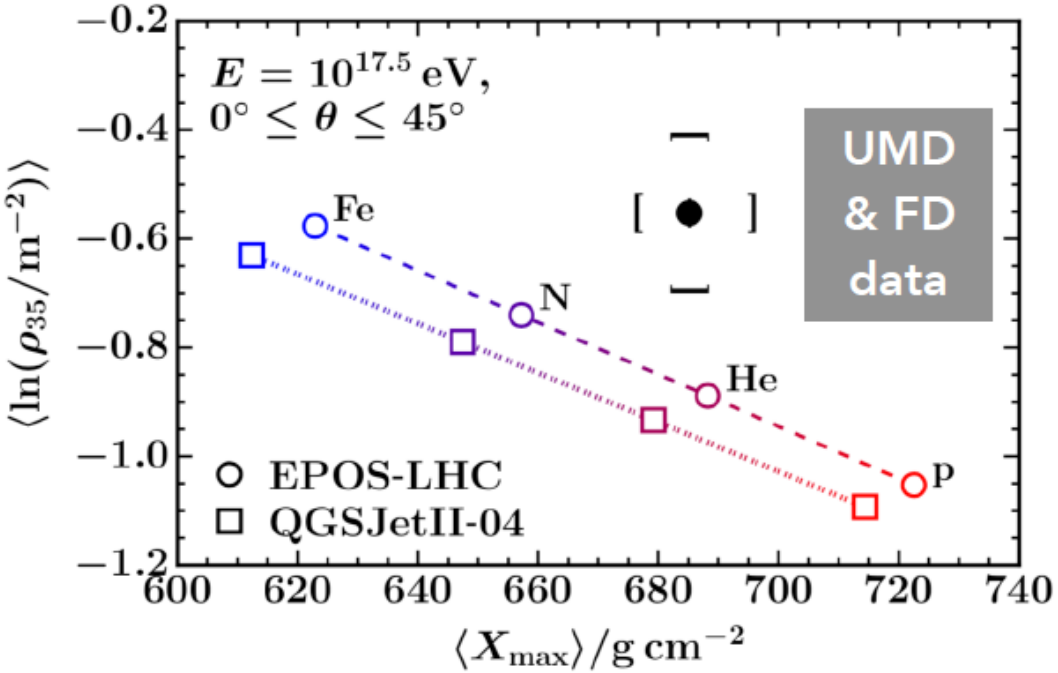


Auger Collaboration, ICRC(2019)

Muon content in air showers

(UMD = Underground Muon Detector)





Simulations fail to reproduce the data in the energy range 3×10^{17} eV to 2×10^{18} eV.

Auger Collaboration, ICRC(2019)

Motivation for the upgrade:

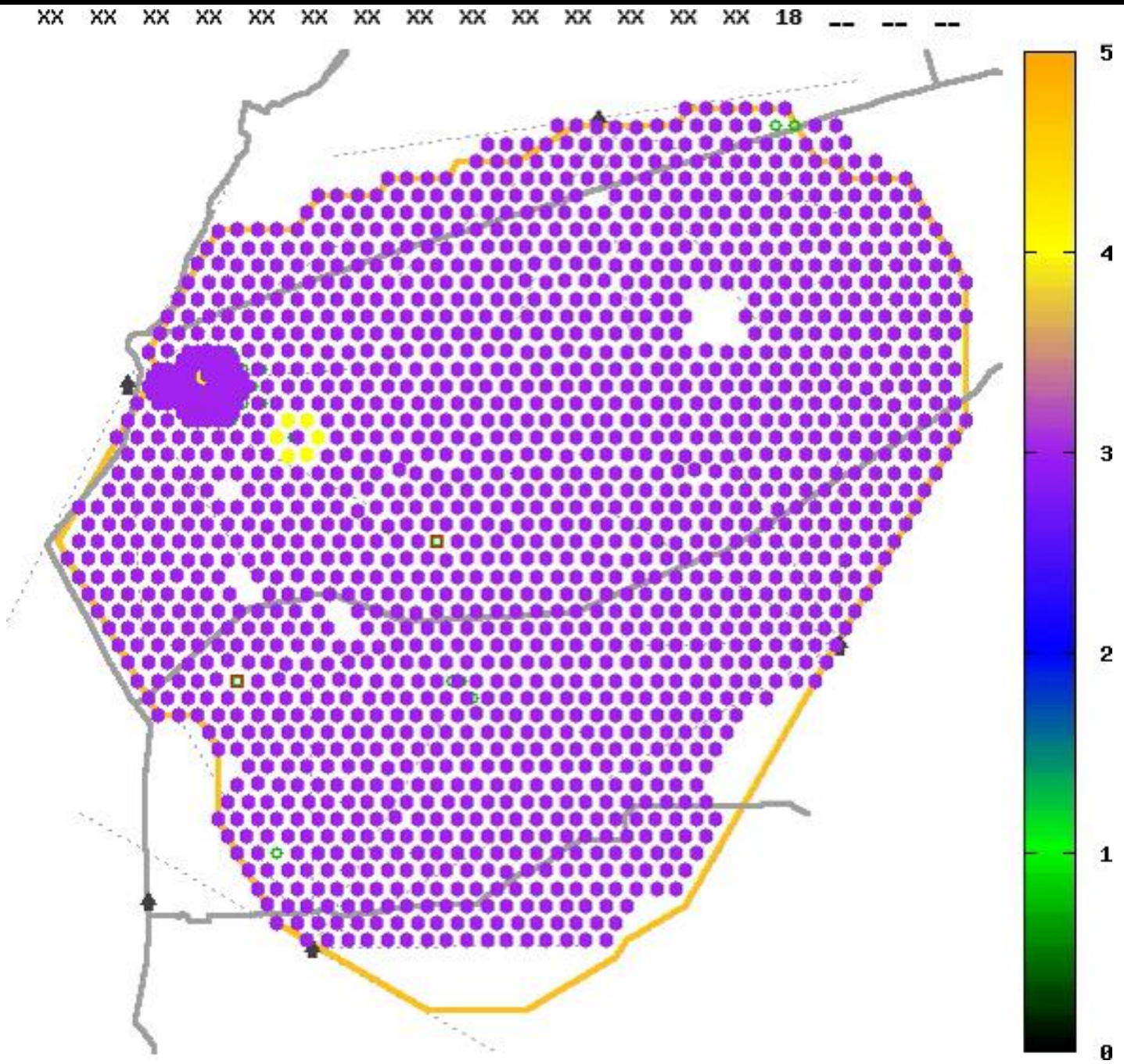
With the upgrade of the detectors we aim at:

- Studying the origin of the observed suppression in the energy spectrum at the highest energies,
- Select showers initiated by light particles to allow for the identification of sources and charged particle astronomy,
- Improve estimates of neutrino and photon fluxes,
- Improve measurements of shower components to study hadronic interactions at UHE and looking for Physics beyond the SM.

AugerPrime

The upgrade AugerPrime

- New plastic scintillator detectors on top of each existing water-Cherenkov station.
- Extension of underground muon detectors and of the array of radio antennas.
- Substitution of the electronics for faster data acquisition.
- Adding a fourth photomultiplier tube in the surface detector to prevent saturation of the signal of the high-energy showers.
- Extending the operation time of the fluorescence telescopes into periods with higher background light.
- Extending the data taking up to $\geq$ 2025.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In Brazil,

- Over the years, we could count with the continuous support of FAPESP, FAPERJ, CNPq, RENAFAE, and for our contribution to the construction of the Observatory, also from FINEP and MCTI.