

# Outreach and Open Data with the Pierre Auger Observatory

The Pierre Auger Collaboration

JENA Computing Workshop

Bologna, 12-14 June 2023

# Summary of Outreach and Open Data at the Pierre Auger Observatory

**Disclaimer:**

This presentation contains (probably a personally biased) summary of several of our activities done for Outreach and Open Data.

Not all activities done by the Outreach and Open Data tasks are represented here.

The slides presented in this talk are a collection of slides from several colleagues

- I hope to convey the right message to you
  - All errors and omissions are mine



# Pierre Auger Observatory



Visitor's Center and CDAS



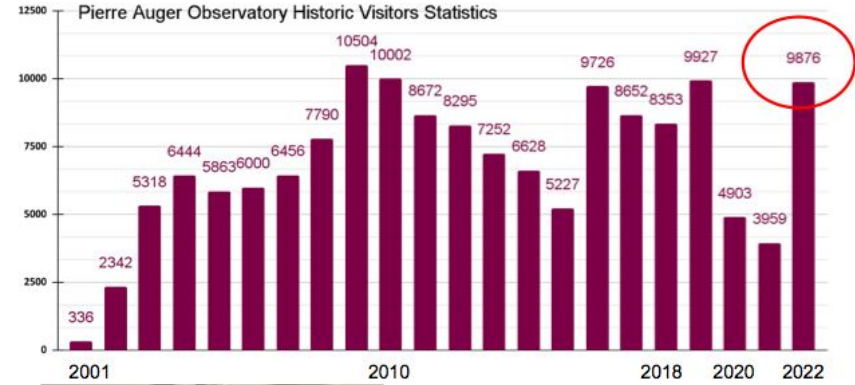
One SD station and one FD site



Malargüe main avenue



# Pierre Auger Observatory renewed Visitor Center



Thanks to R. Sarmento



# Pierre Auger Observatory annual Science Fair

**¡PRESENTÁ TU PROYECTO y VIVÍ una gran experiencia científica junto al equipo investigador del Observatorio Pierre Auger!**

**16 y 17 de noviembre de 2022**

**Ejes temáticos**  
Los objetivos de desarrollo sustentable establecidos por las Naciones Unidas.



Los grupos cuyos trabajos sean preseleccionados recibirán apoyo económico para su estada en Malargüe.

**Escuelas de nivel primario y secundario INSCRIPCIONES HASTA EL 21/10/2022**

**8<sup>o</sup> Feria de Ciencias**  
OBSERVATORIO PIERRE AUGER

**CONTACTO** [feria@auger.org.ar](mailto:feria@auger.org.ar)  
**+ INFO** <https://visitantes.auger.org.ar>

INSTITUTO NACIONAL DE INVESTIGACIONES CIENTÍFICAS MALARGÜE

PIERRE AUGER OBSERVATORY



Thanks to R. Sarmento

# @Pierre Auger Observatory goes to the School



Selected schools on Malargue Map: red: just visited!

Thanks to B. Garcia and K. Caballero Mora



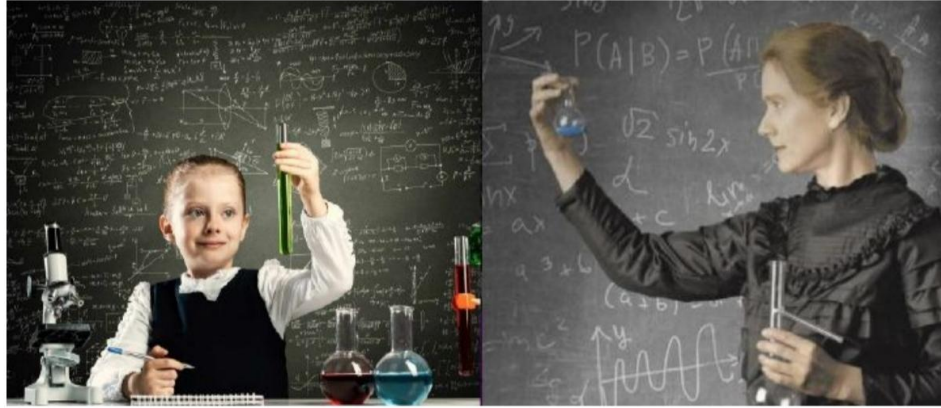
# @Pierre Auger Observatory goes to the School



El Chacay school: students from 11 to 13 years, their teachers and Pedro Barraza!!

Thanks to B. Garcia and K. Caballero Mora

# Women and Girls in Science



**Art and Science contest** deadline Oct 1st, 2023

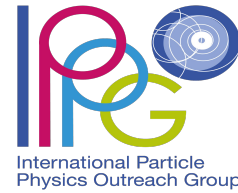
*Drawing and painting contest “Women and Girls in Science 2023”, select 13 works to identify the months of the year 2024 (plus one, which will be on the cover), in a special edition of the Pierre Auger Observatory Calendar.*

<https://visitantes.auger.org.ar/index.php/dia-internacional-de-las-mujeres-y-las-ninas-en-ciencias/>

Thanks to B. Garcia and K. Caballero Mora



# International Masterclasses on particle physics



<http://physicsmasterclasses.org>

- Every year ~13000 high-school students from 60 countries
- “Scientists for one day with the hands on particles”
- Typically between February and April



Thanks to R. Sarmento

March 18

# Auger Masterclasses events at IMC 2023

- 3 Masterclass events!
- ~550 students at 12 institutions



March 24



April 4





# Open Science @ the Pierre Auger Observatory

- An open history: following the FAIR principle
  - Since 2007 1% data available in simplified format for outreach purposes
- An open present: since Feb 2021 release of 10% cosmic-ray data
  - Auger Open Data portal <https://opendata.auger.org/>  
(Description of the Observatory and how data are collected and reconstructed)
  - Diverse outreach and public engagement activities  
(International Cosmic day, International Master Classes, ...)
- An open future:
  - In 2024 increase fraction of open access data to 30%
  - participate in inter experiment consortiums for data sharing
  - combined analyses and multi-messenger studies (AMON, GCN alerts, ...)



<https://opendata.auger.org>

DOI:10.5281/zenodo.4487612

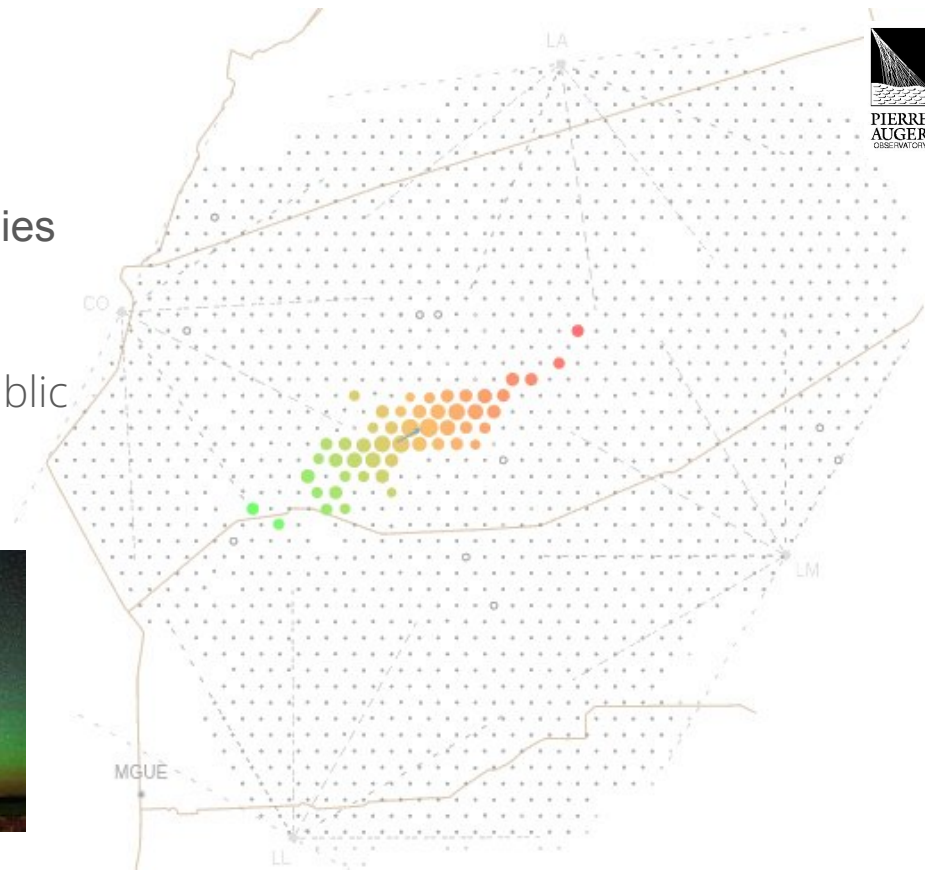
Thanks to V. Scherini and M. Buscemi

# The Auger Open Data Portal

- 10% of Cosmic Ray data in portable format
- ~ 30000 events above  $2.5 \times 10^{18}$  eV
- 100% low energy data for space-weather studies
- Software & Visualization tools
- Outreach section dedicated to the general public



[Open Data portal](#)



Thanks to V. Scherini and M. Buscemi



# Open Data: file format

- Standard format for open data
  - Adaptable & portable
- close to raw data in JSON format
  - headers metadata
  - detectors sections
  - reconstructed and close to raw data
- High level info in CSV summary file
- Detailed description of data content

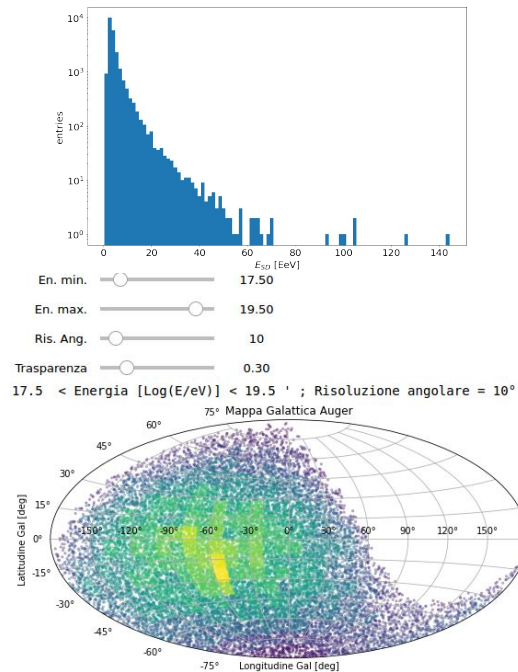
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Save	Copy	Pretty Print

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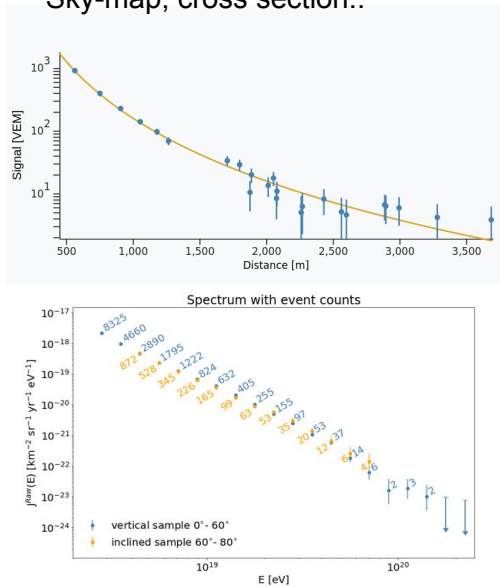
# Data handling tools

Exemplary-code based on Python Notebooks available on Kaggle

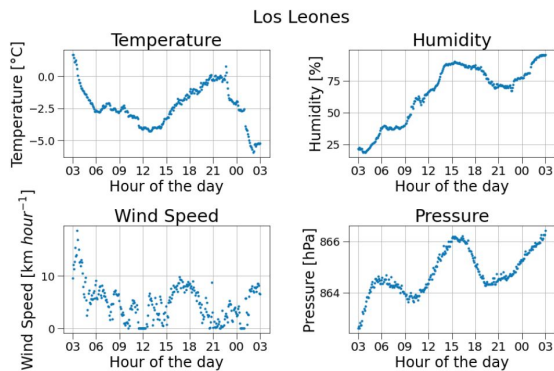
Simplified notebooks for exploring data and plotting variables



Advanced notebooks following the main physics results  
energy spectrum and calibration,  
Sky-map, cross section..



Outreach section dedicated  
to general public  
Understand physics results  
develop their own enquiries

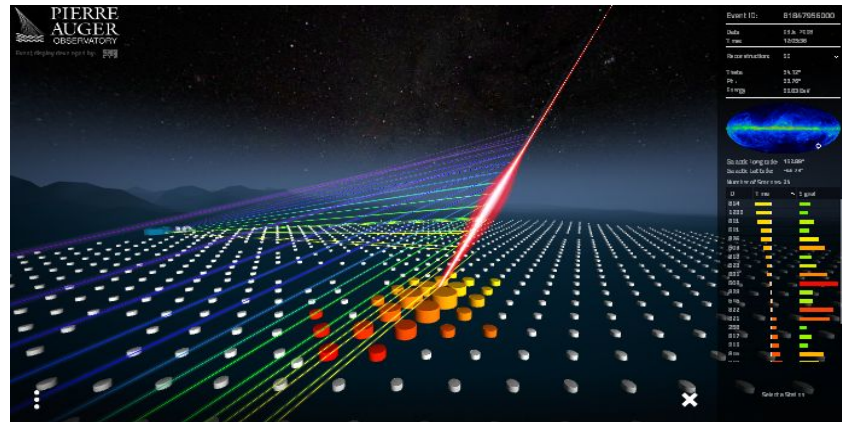


Thanks to V. Scherini and M. Buscemi

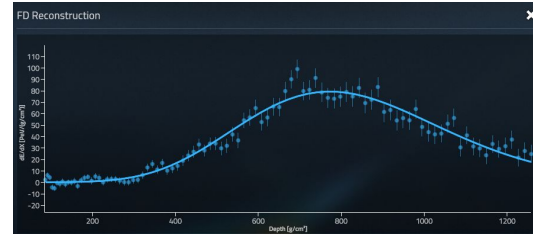
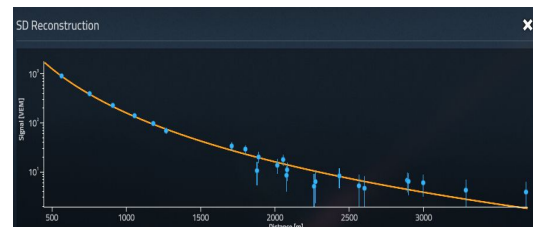


# Open data: visualization

- Immersive 3-dimensional viewer for each event
  - Interactive Observatory map
  - Event reconstruction
  - Sky-map



Sky map in galactic and equatorial coordinates



Lateral and longitudinal profiles

Built with  


Thanks to V. Scherini and M. Buscemi