

Pierre Auger Observatory Public Data

The Pierre Auger Observatory

Country: *Argentina*

Town: *Malargüe*

Operational: *2008 – Now*

Effective Area: *3000 km²*

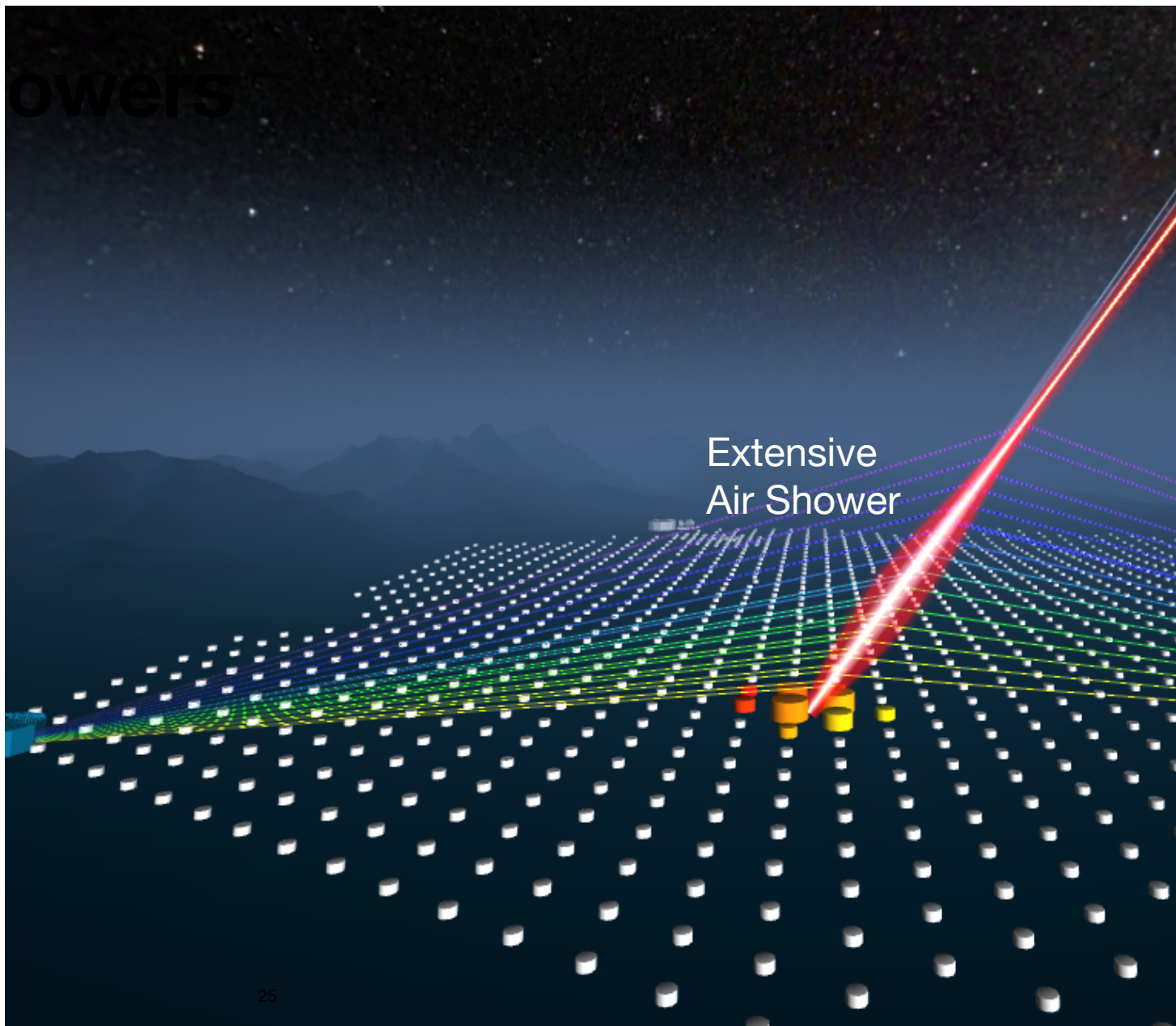
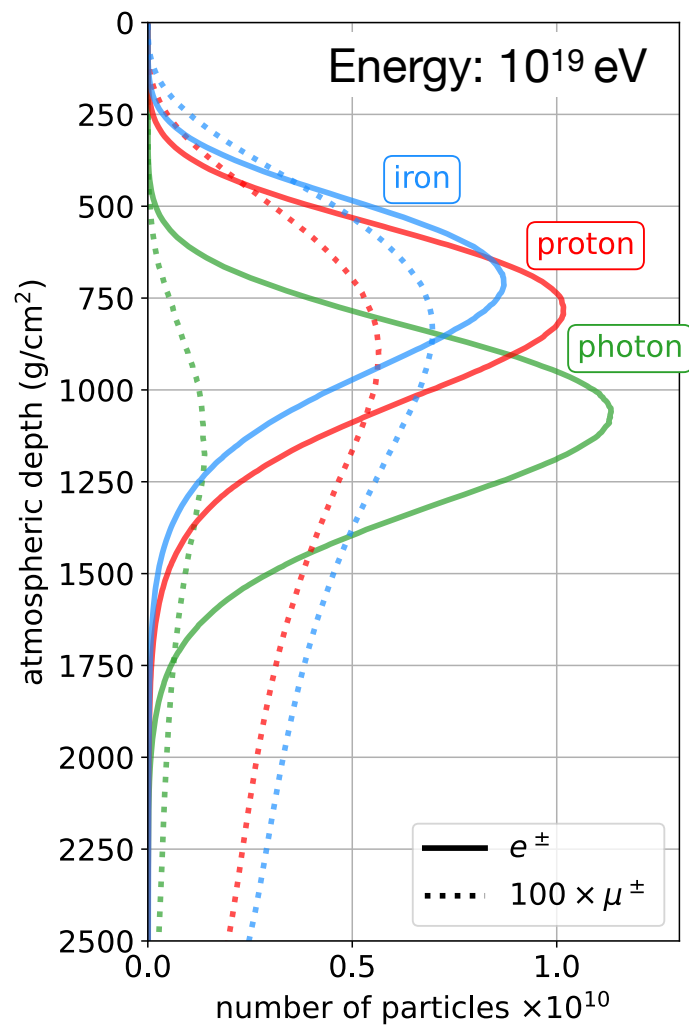


Fluorescence
Telescopes

Extensive
Air Shower

Particle
Detectors

Extensive Air Shower

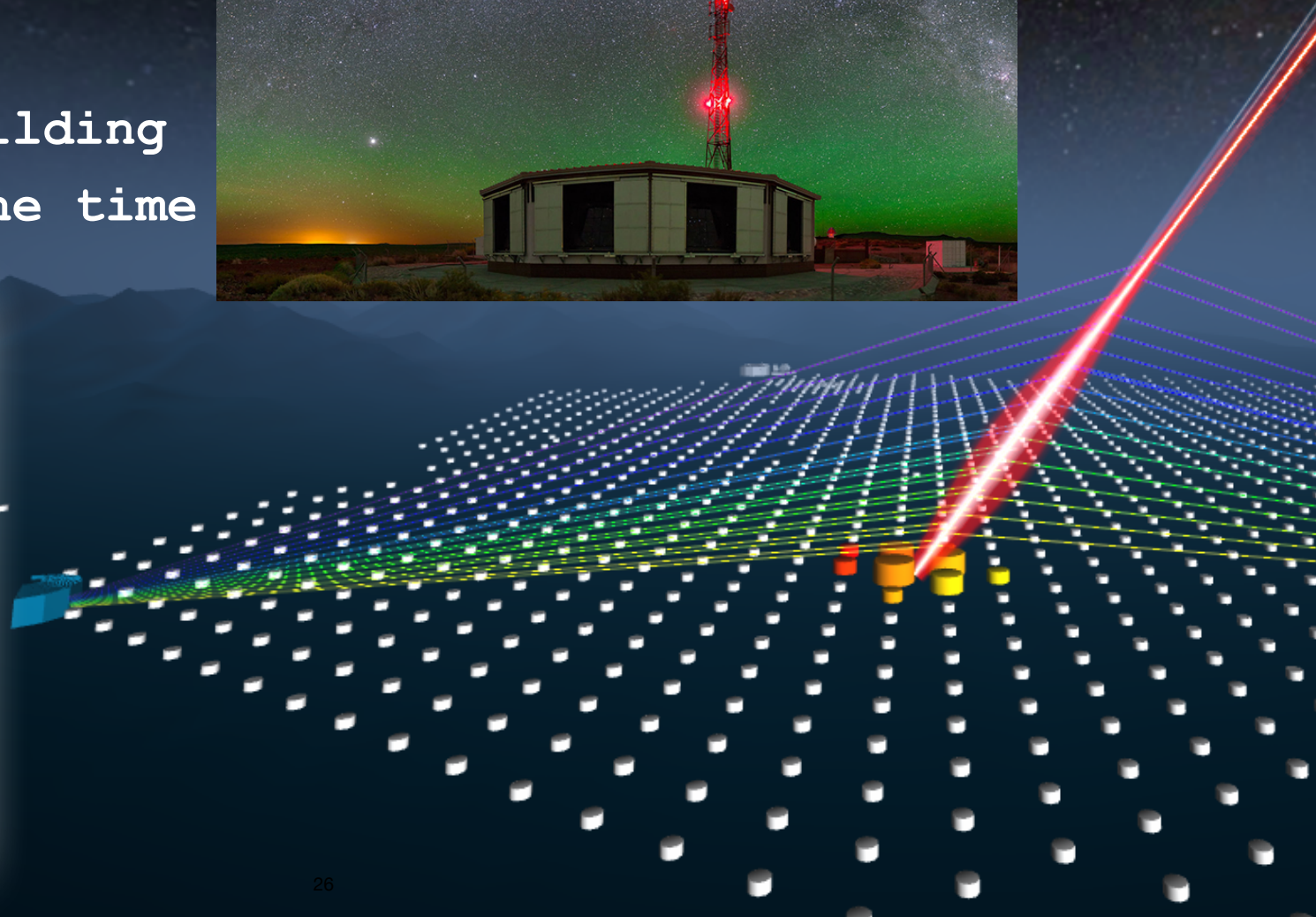
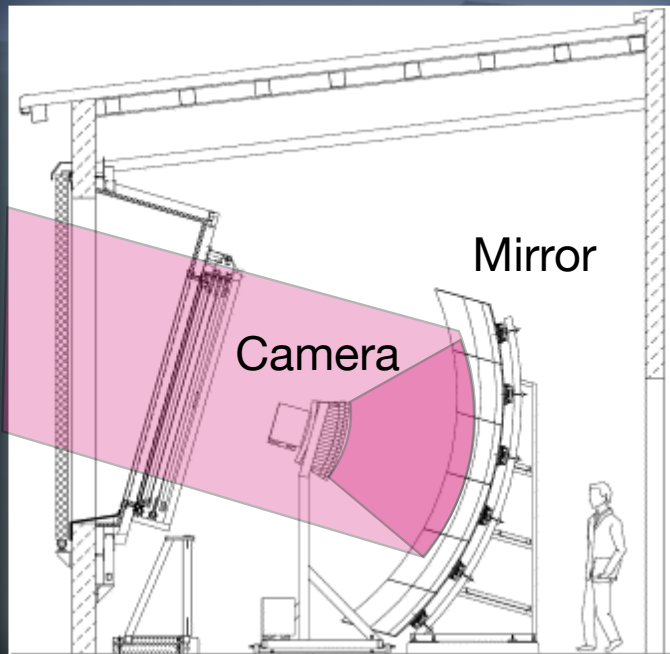


The Fluorescence Telescopes

4 buildings

6 telescope per building

Operation 12% of the time



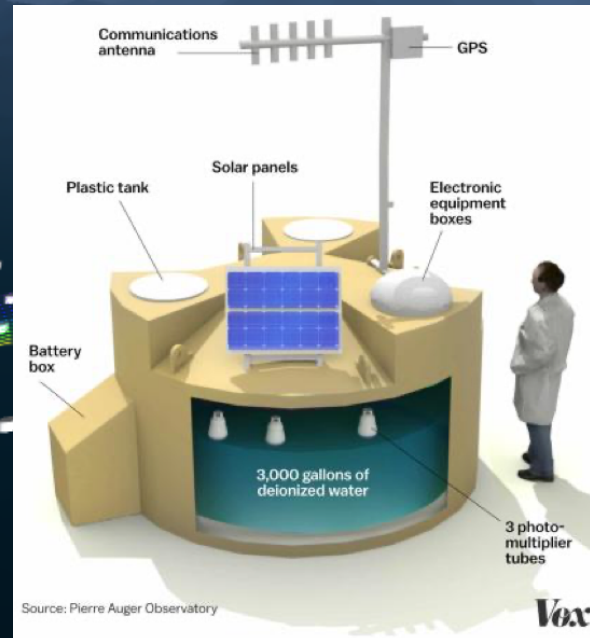
The particle detectors

1660 distributed over 3000 km²

Spacing: 1.5 km

Water Cherenkov Detector

Operational all the time



Let's get started: <https://opendata.auger.org/>

*It works nicer if you make an account on [kaggle.com](https://www.kaggle.com)



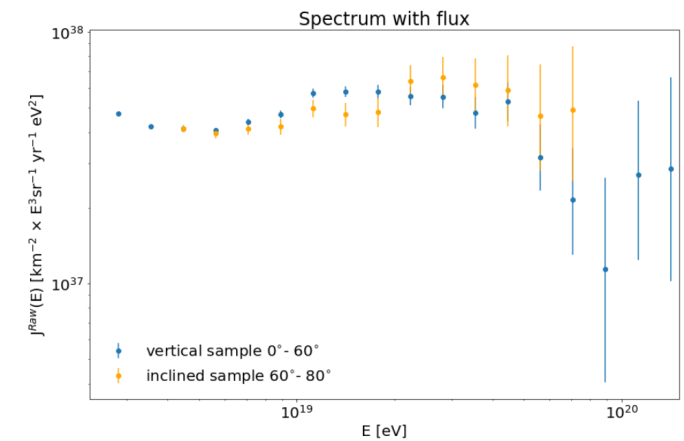
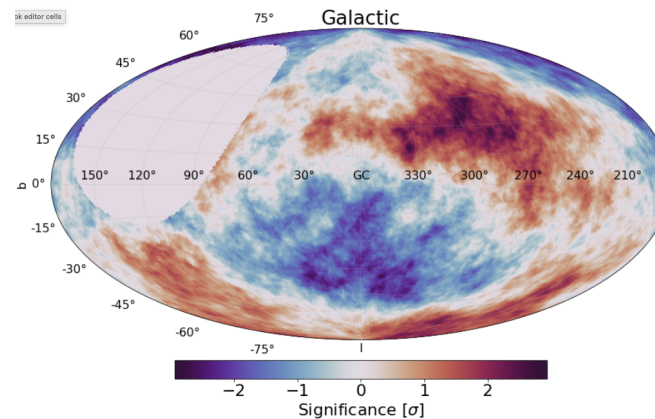
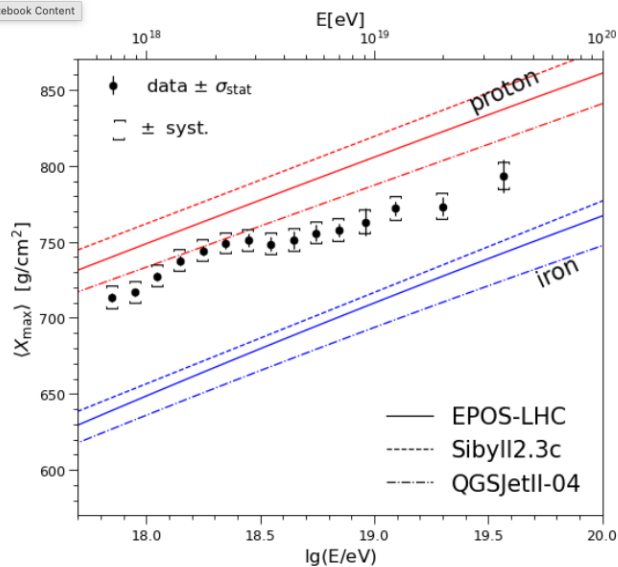
[The depth of the shower maximum](#)



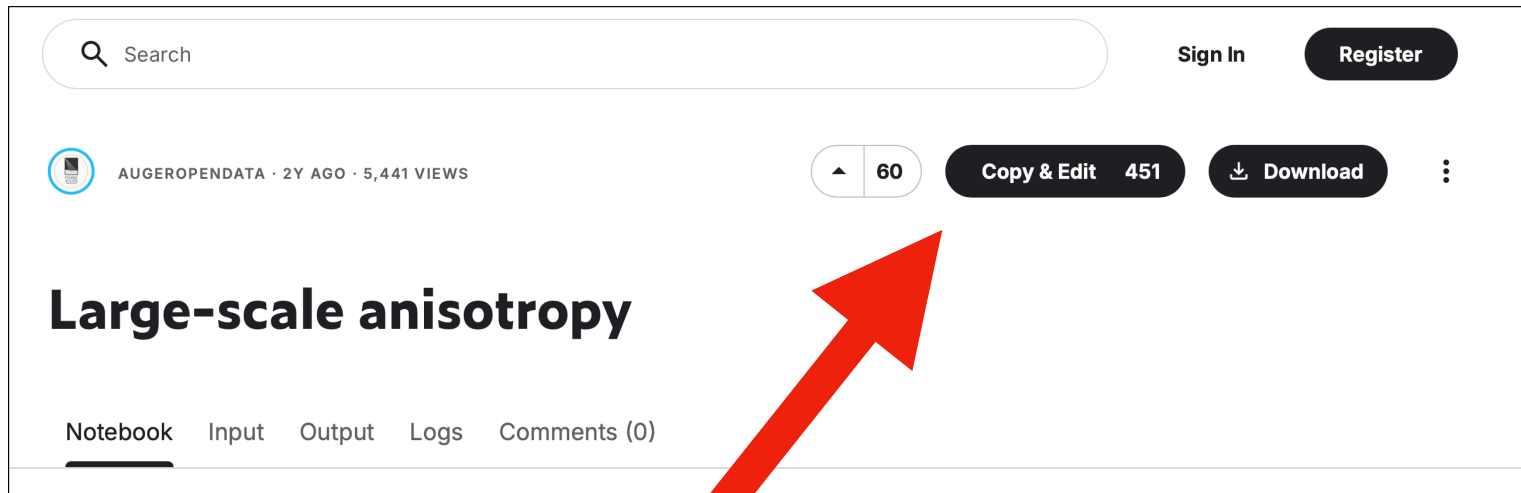
[The UHECR sky](#)



[The energy spectrum](#)



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Hit that button

Challenge A

Understand the Ultra-high-energy sky analysis

Make new sky maps that might reveal something interesting based on motivated selection criteria.

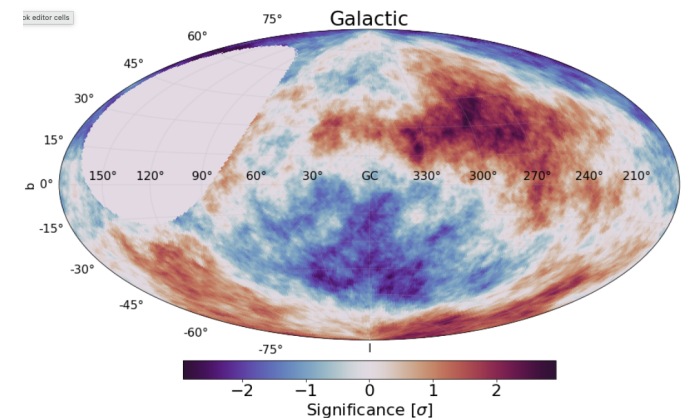
For example:

- look at changes in energy spectral features and composition.
- Does it make sense to change the smoothing radius?
- What about the highest energy events, do you observe clustering?

You can take the slides by Teresa, publications, or the other notebooks to make your motivations.



[The UHECR sky](#)



Challenges

Team presentations: Wednesday 15:00-17:00

Analyse the Pierre Auger
Observatory data

Present a brief summary of the standard
analysis

Do your own analysis, and reflect on it!

For literature look at (or do your own research):

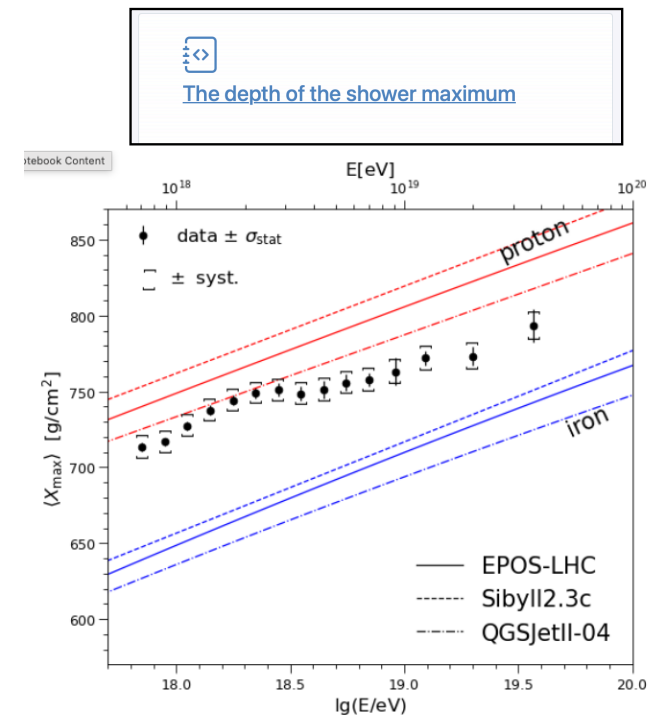
<https://auger.org/science/publications/journal-articles>

Challenge B

Understand the depth of shower maximum analysis

Select from the data set, a small subset of events (<5), that are the best candidates to be a **photon**. Reflect on the likelihood that they are real photons.

Are there astrophysical reasons why these events could be photons? (i.e. where are they on the sky, and when were they recorded — was something interesting happening at that moment and/or location?)



Challenge C

Understand the energy spectrum analysis

Produce the spectrum on different location on the sky

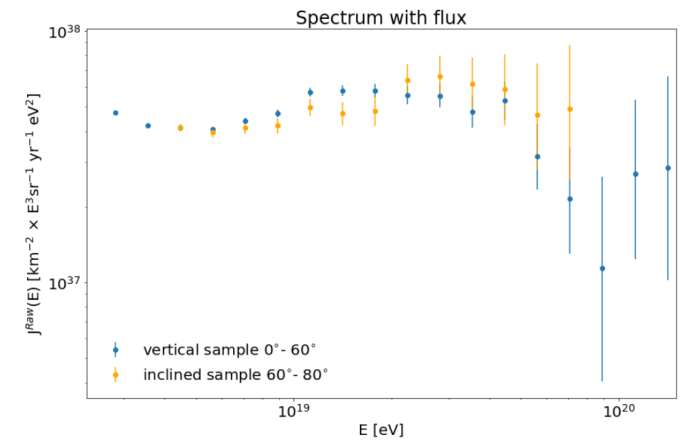
For example:

- *Bin the data in declination*
- *Select events around the galactic plane*
- *Select event around the maximum of the dipool*

What does literature says in this?



[The energy spectrum](#)



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 Physics analysis notebooks

 The UHECR sky	 The energy spectrum
 The depth of the shower maximum	 The measurement of the p-air cross-section
 The energy calibration	 The weather correction of the energy estimator