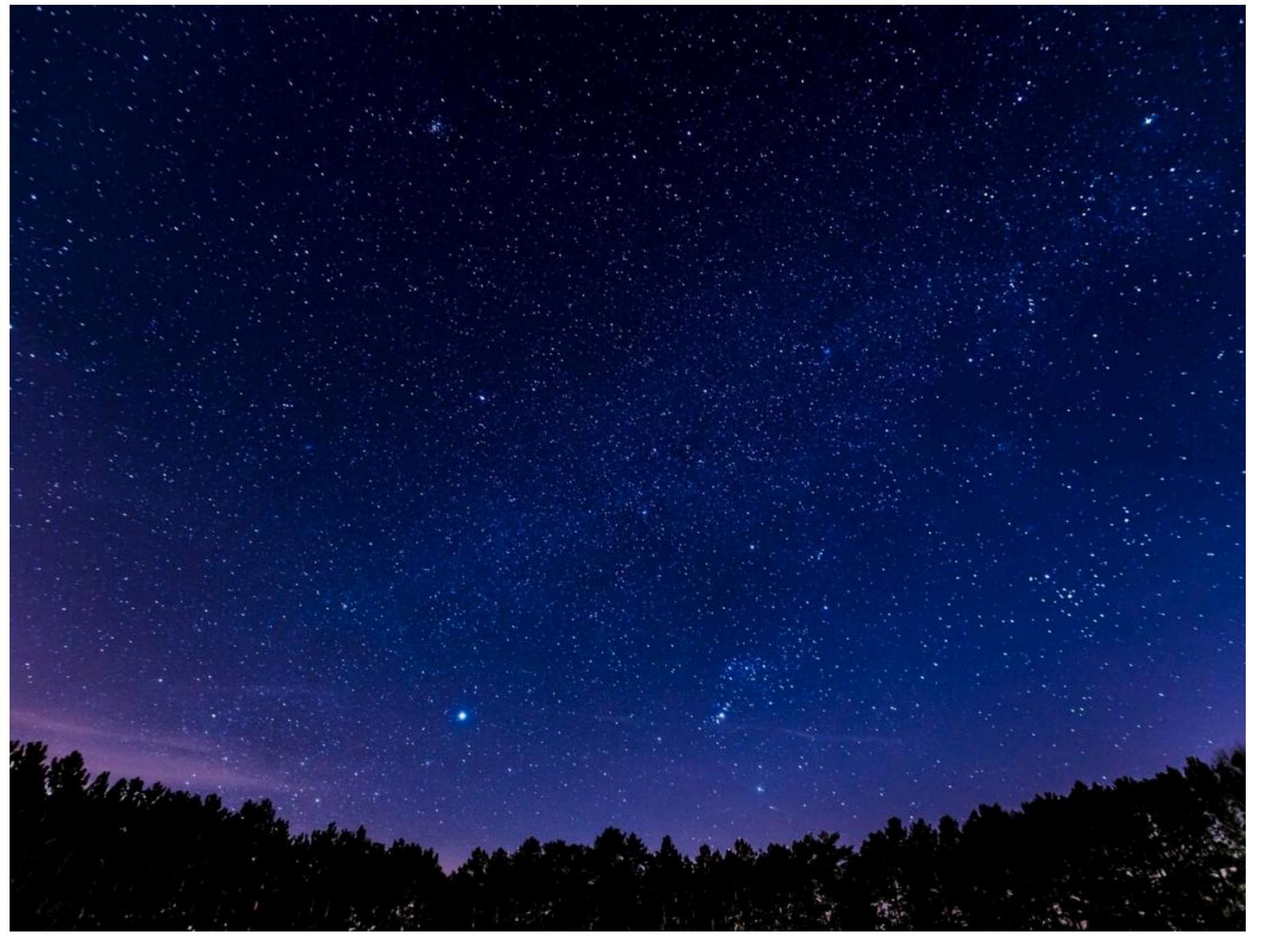


Proton and Helium flux measurements at TeV-PeV energies at the DAMPE experiment

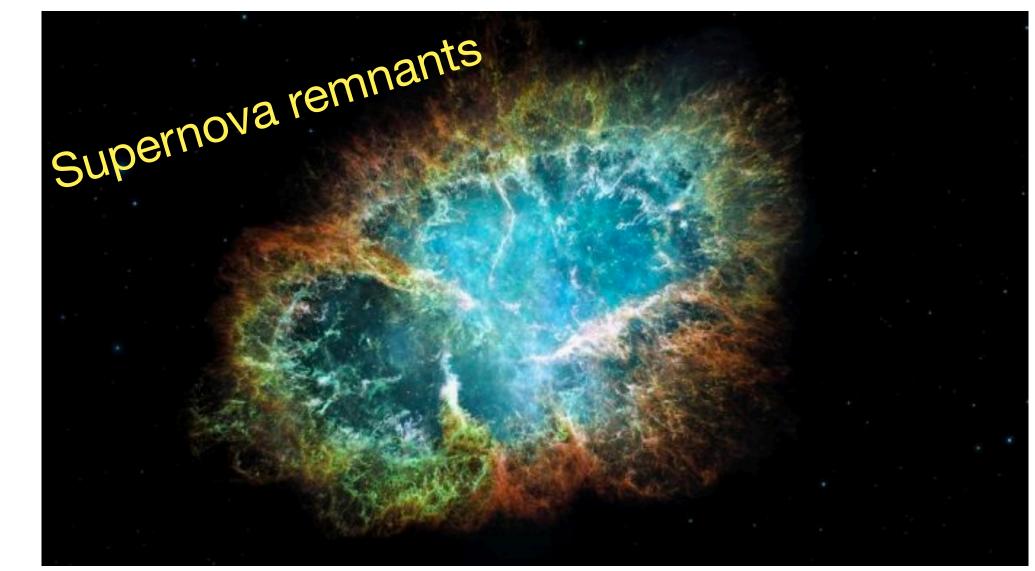
Young researcher day, 16 of September 2022

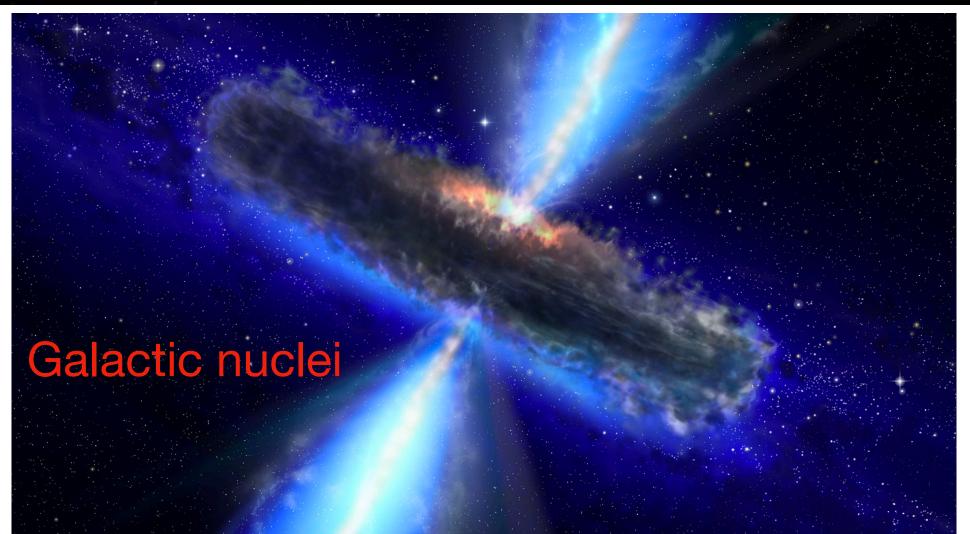
Andrii Kotenko (PeVSPACE group: Andrii Tykhonov and Paul Coppin)

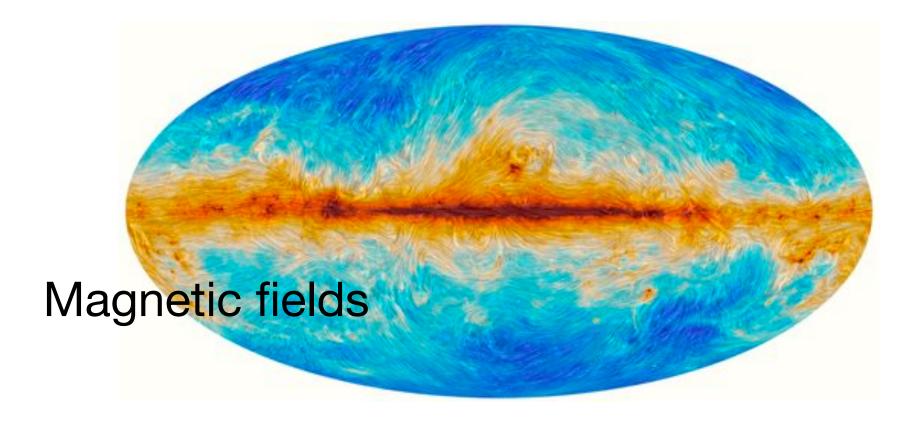


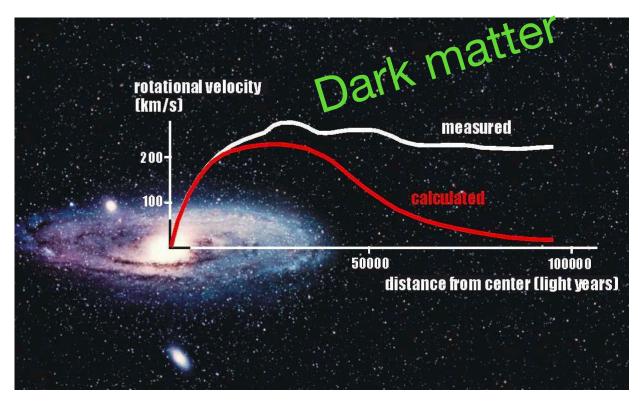
Taken from: https://vinsweb.org/investigating-the-night-sky/

Laboratory of unimaginable scale!











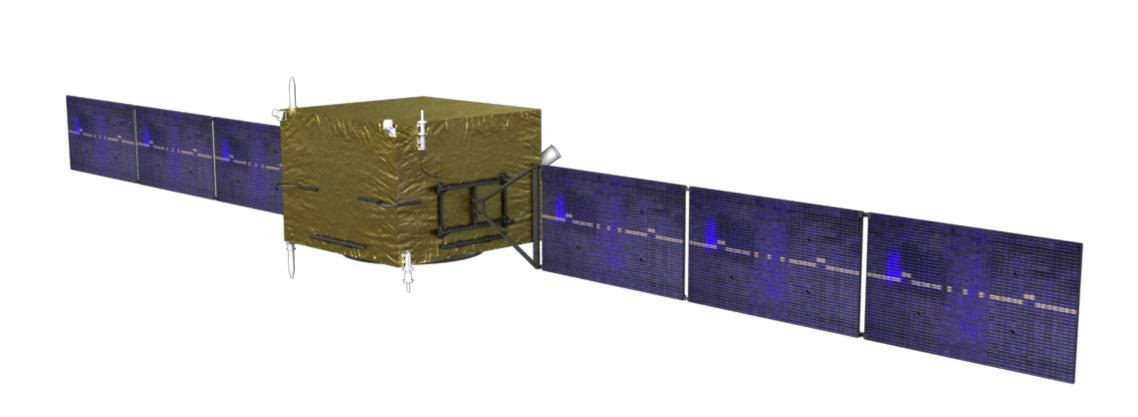
DAMPE experiment

DArk **M**atter **P**article **E**xplorer is a space experiment for direct cosmic and gamma ray detection.

Collaboration consists of Chinese, Italian and Swiss institutions.

Launched on 17th of December 2015.

Sun-synchronous orbit at the altitude of 500km.





DAMPE detector

Plastic Scintillator Detector (PSD):

82 plastic scintillator bars arranged in 2 double-layer planes

Silicon-Tungsten Tracker (STK):

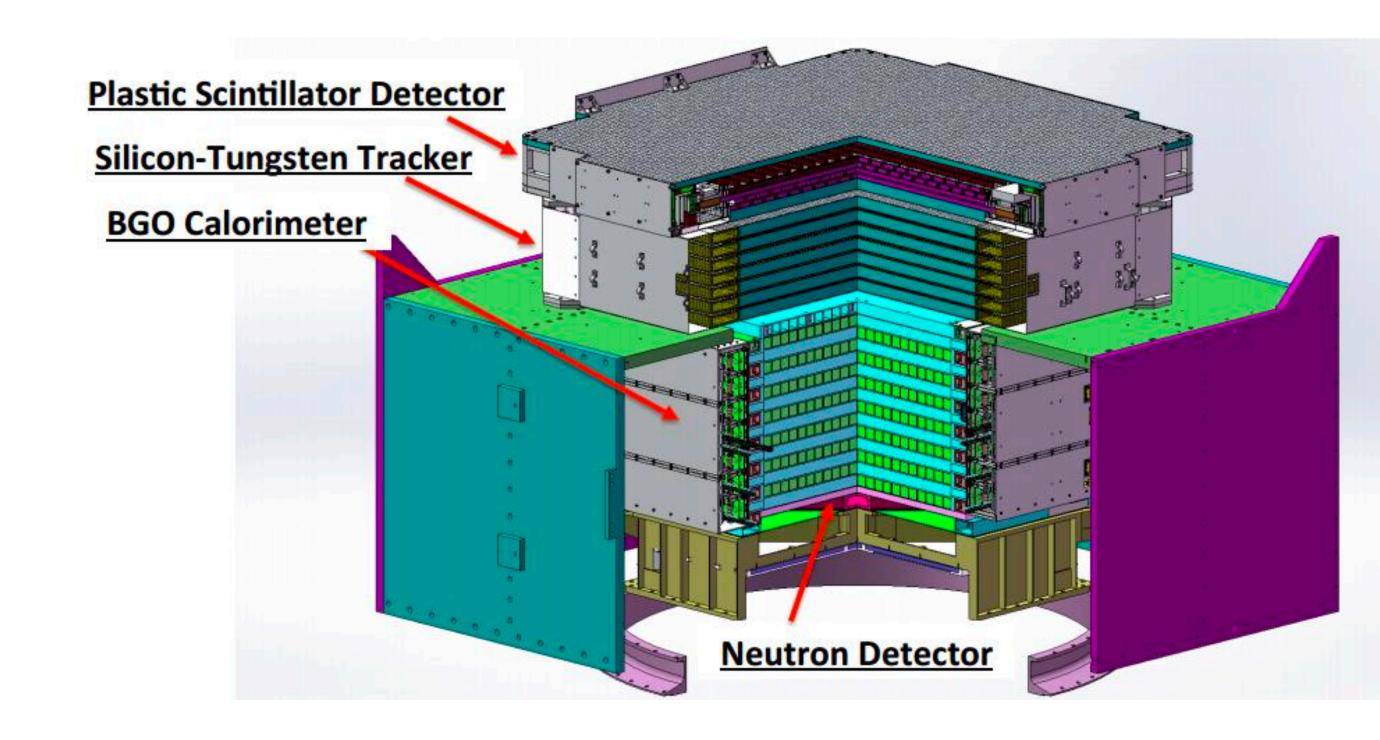
- 6 double-layers with <80 μm resolution
- 3 tungsten conversion plates

BGO calorimeter:

- 14 layers 22 bars each arranged hodoscopically
- 32 radiation lengths, 1.7 interaction lengths

Neutron Detector (NUD):

• 4 plates of boron-loaded scintillator



The biggest calorimeter currently in space!

DAMPE detector

Plastic Scintillator Detector (PSD):

Charge measurement

Silicon-Tungsten Tracker (STK):

Trajectory reconstruction

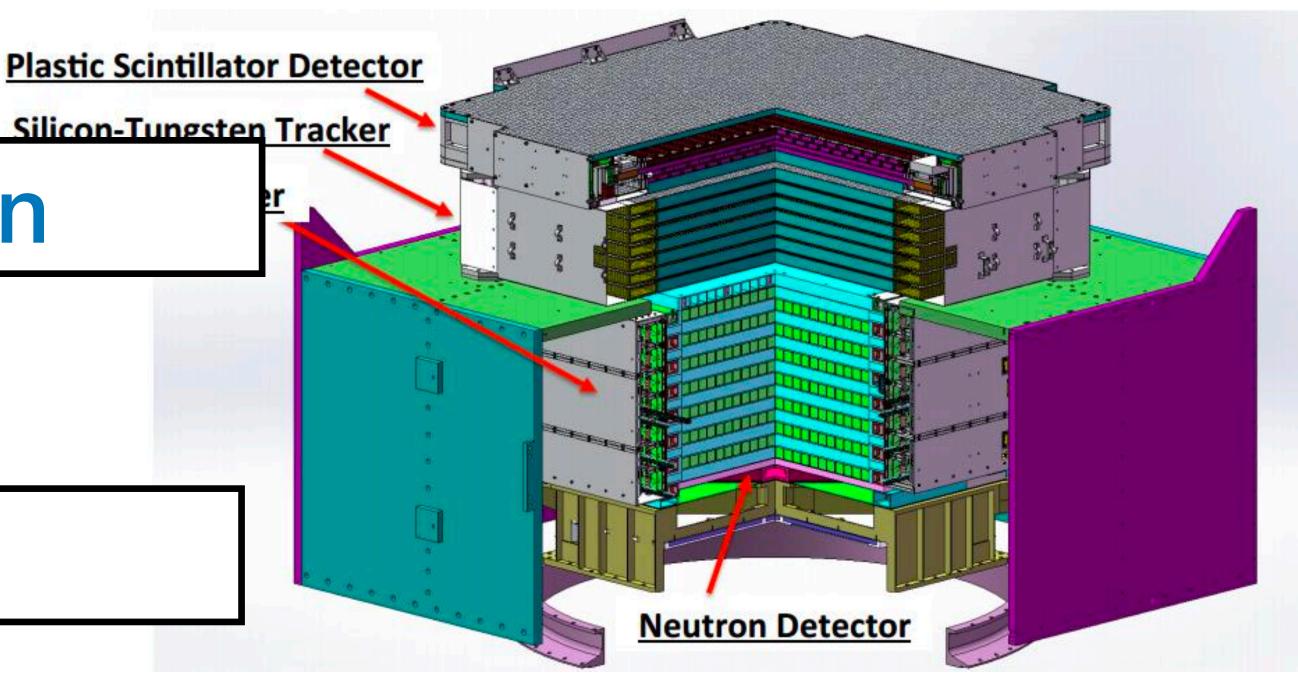
, cangoton convertion piate

BGO calorimeter:

14 lavers 22 bars each arranged

Released energy image

lengths



Hadron or not?

t calorimeter currently in space!

Why we (well, scientists) care about proton(hydrogen) or helium flux?

university of geneva







Welcome to the University of Geneva

39,987 views Jul 17, 2017 This movie has been shown on the occasion of the Ceremony of Dies academics 2016.

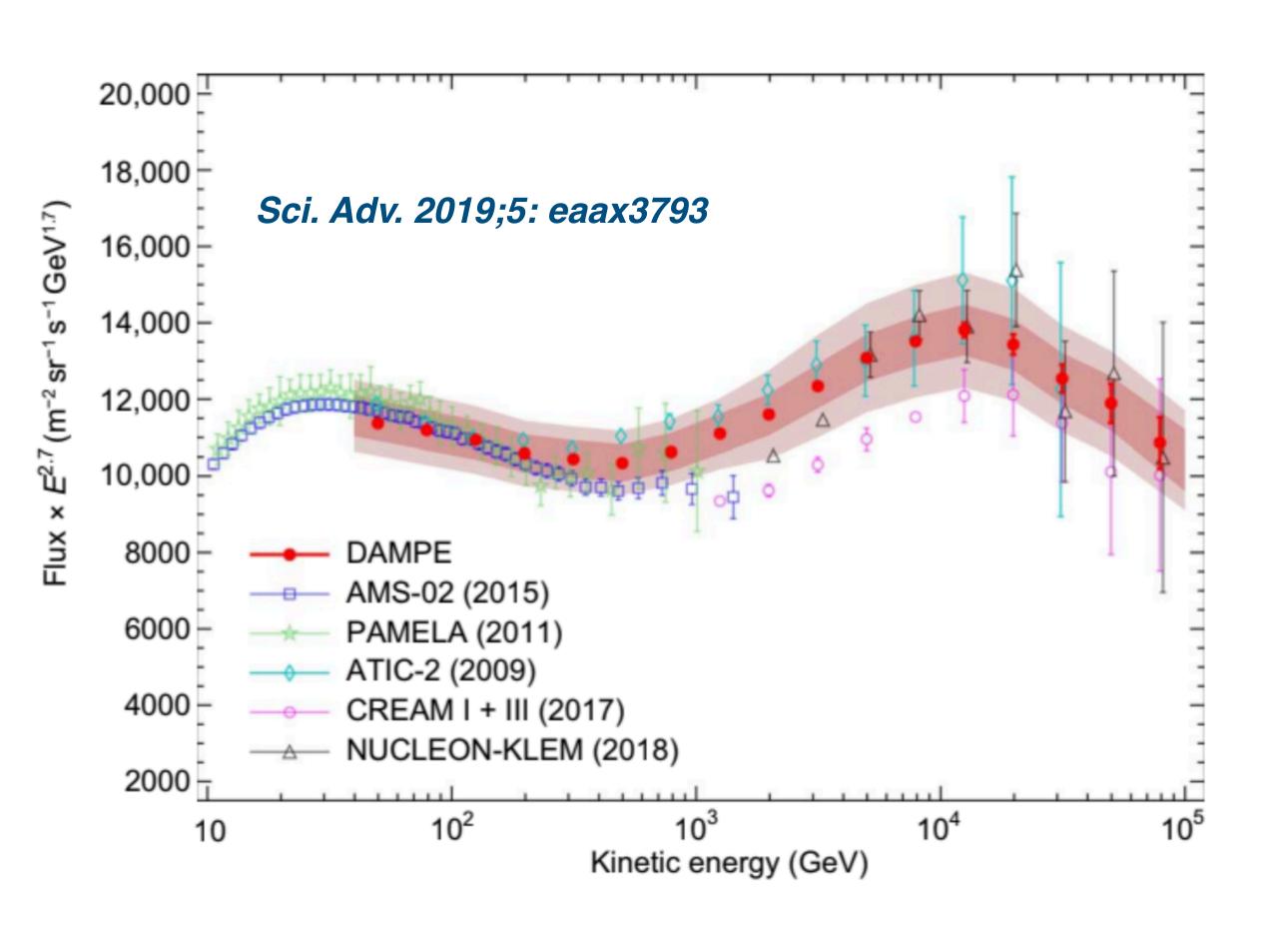
Why do we (scientists) care about p/He?

- Understanding cosmic ray acceleration (SNR, acceleration threshold charge dependent etc)
- Understanding cosmic ray propagation (distribution of matter and fields in Galaxy)

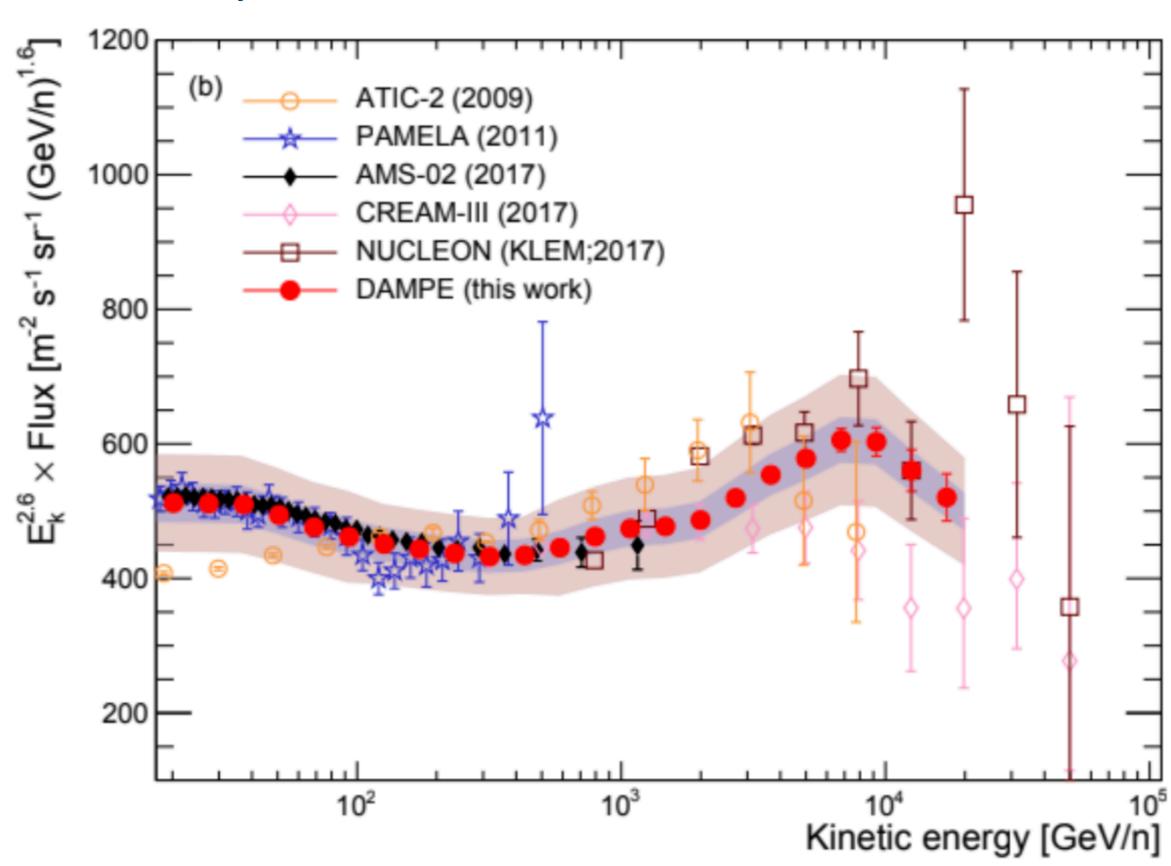
Why do we (scientists) care about p/He?

- Understanding cosmic ray acceleration (SNR, acceleration threshold charge dependent etc) TeV-PeV energy range is extremely important
- Understanding cosmic ray propagation (distribution of matter and fields in Galaxy)

Published DAMPE p/He fluxes



Phys. Rev. Lett. **126**, 201102



Published DAMPE p/He flux

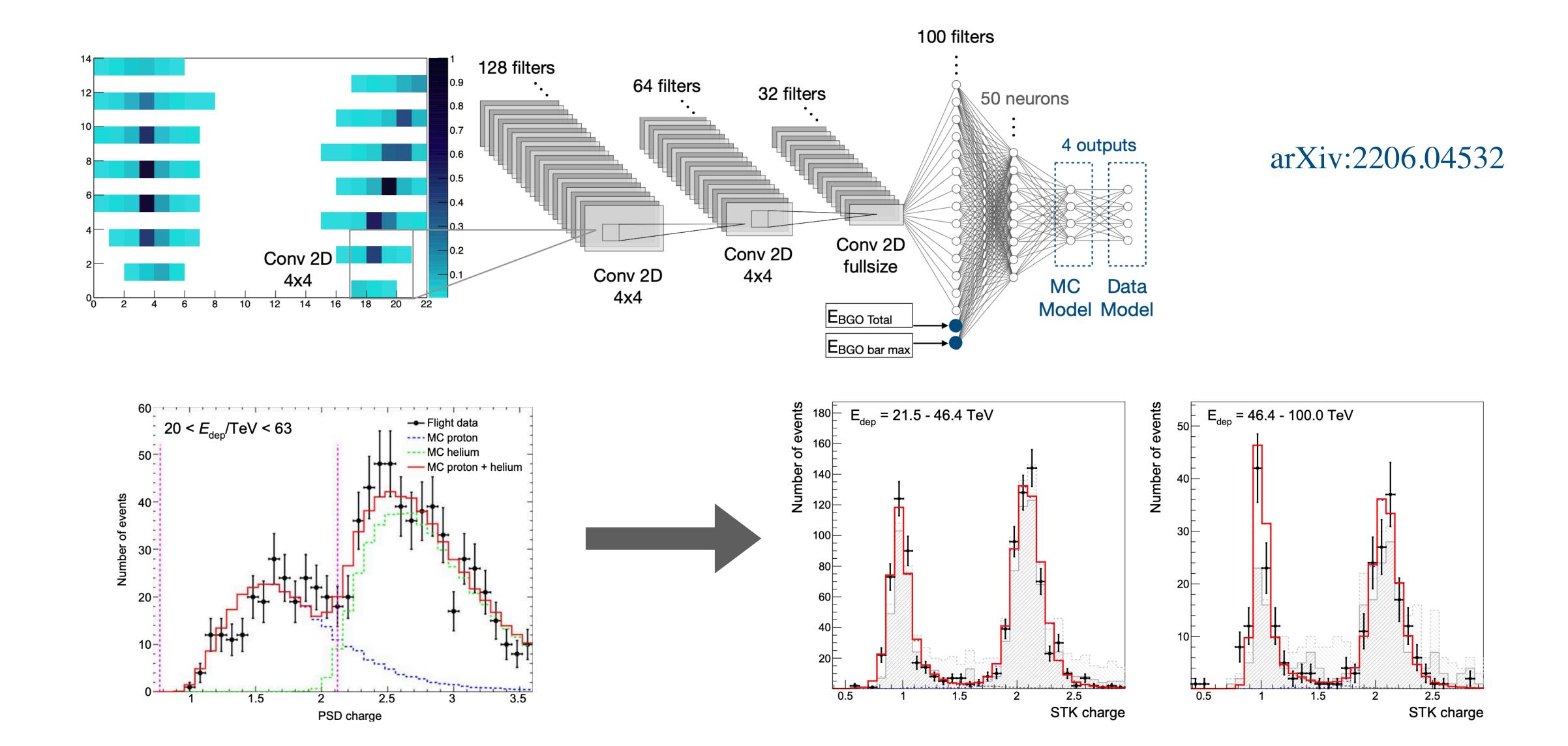
- High statistics for a direct measurement experiment
- Confirms previously measured spectral features and reveals new!
- Dominated by hadronic physics simulations uncertainty

Published DAMPE p/He flux

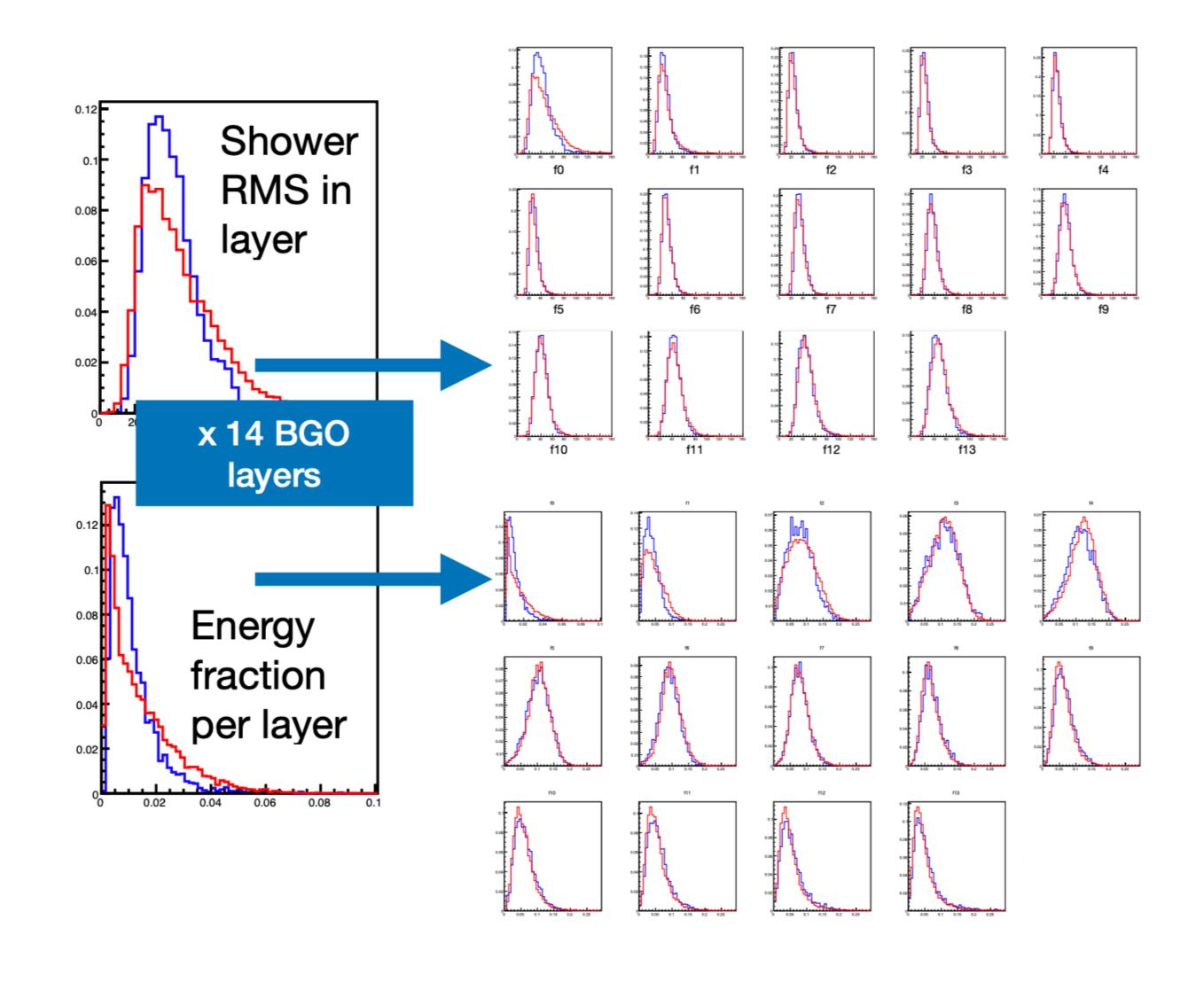
- High statistics for a direct measurement experiment
- Confirms previously measured spectral features and reveals new!
- Dominated by hadronic physics simulations uncertainty

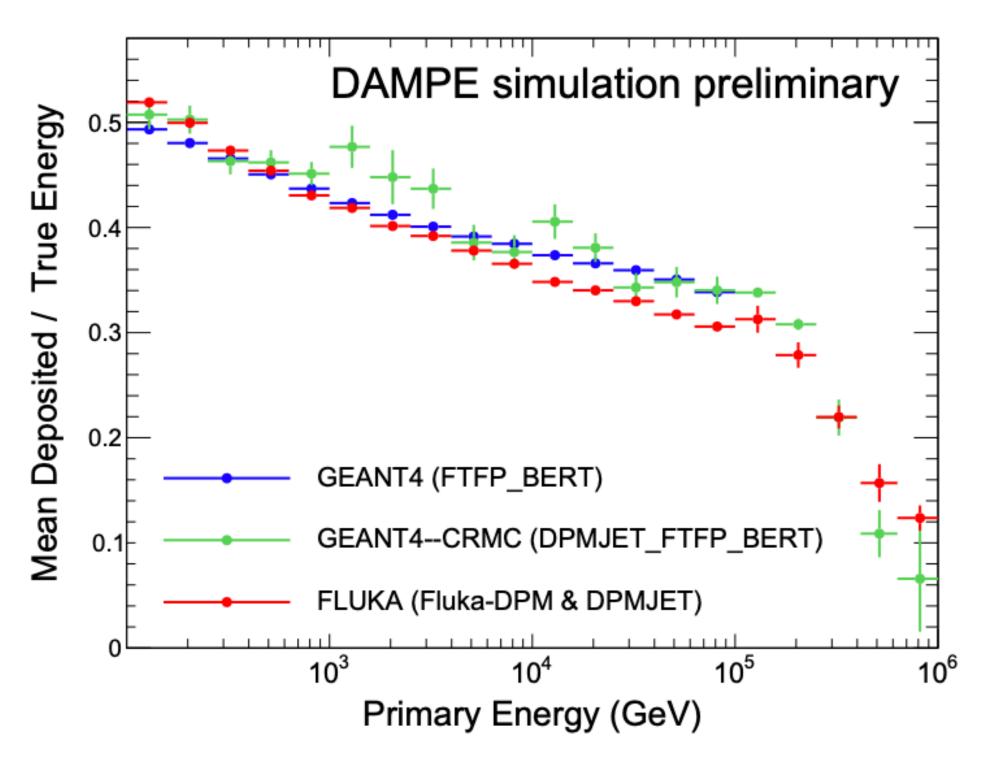
Task: to extend measurements to higher energies and reduce hadronic physics uncertainty

Improving charge identification using ML

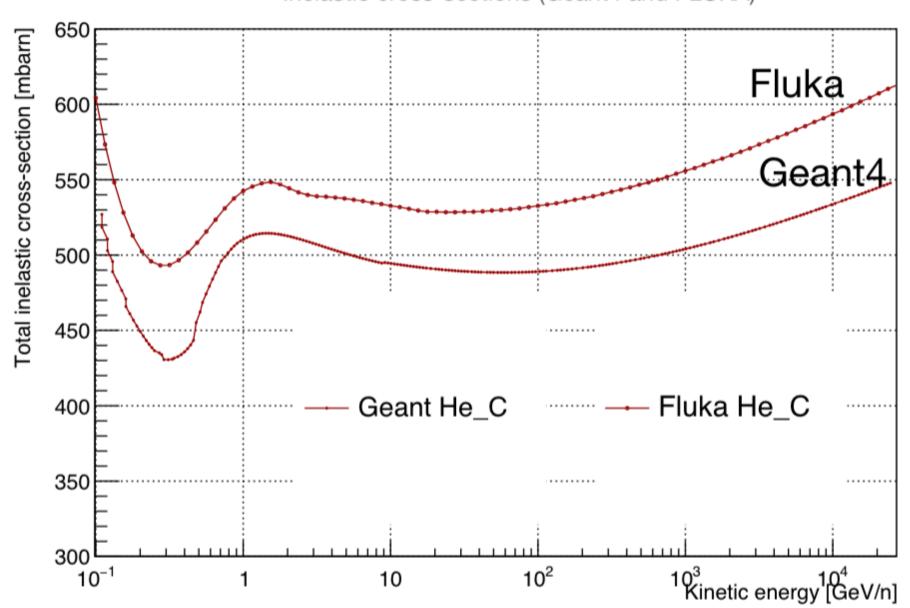


Hadronic uncertainty







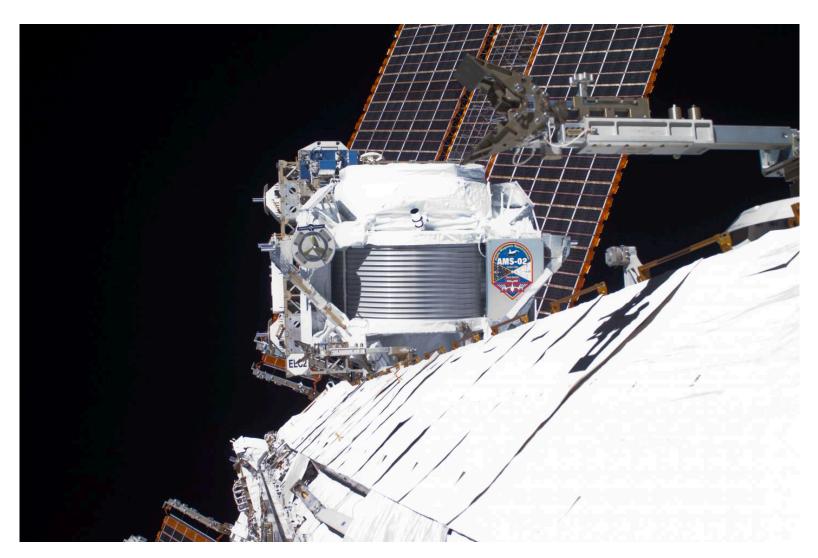


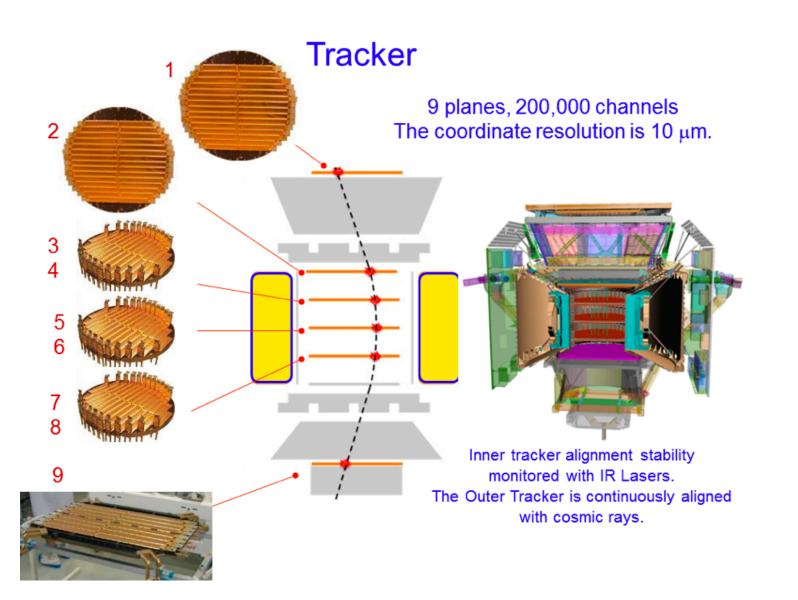
Questions!(?)

Backup

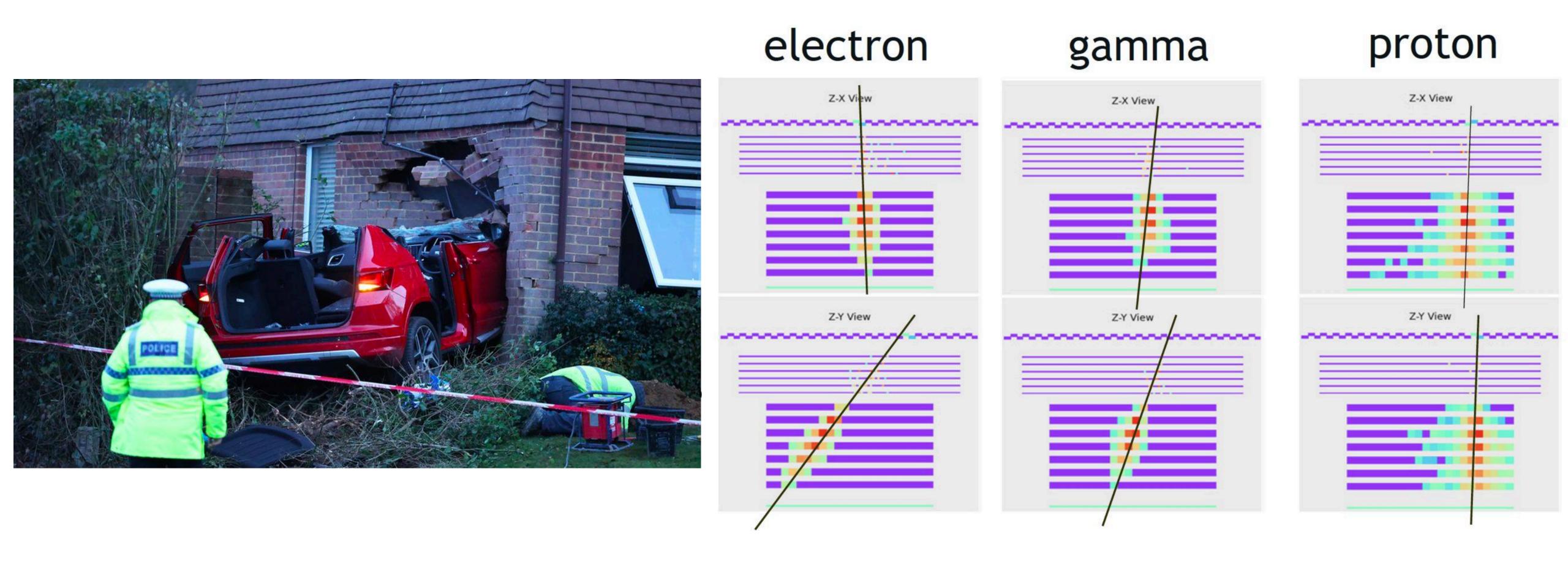
Spectrometric vs calorimetric experiment







Spectrometric vs calorimetric experiment



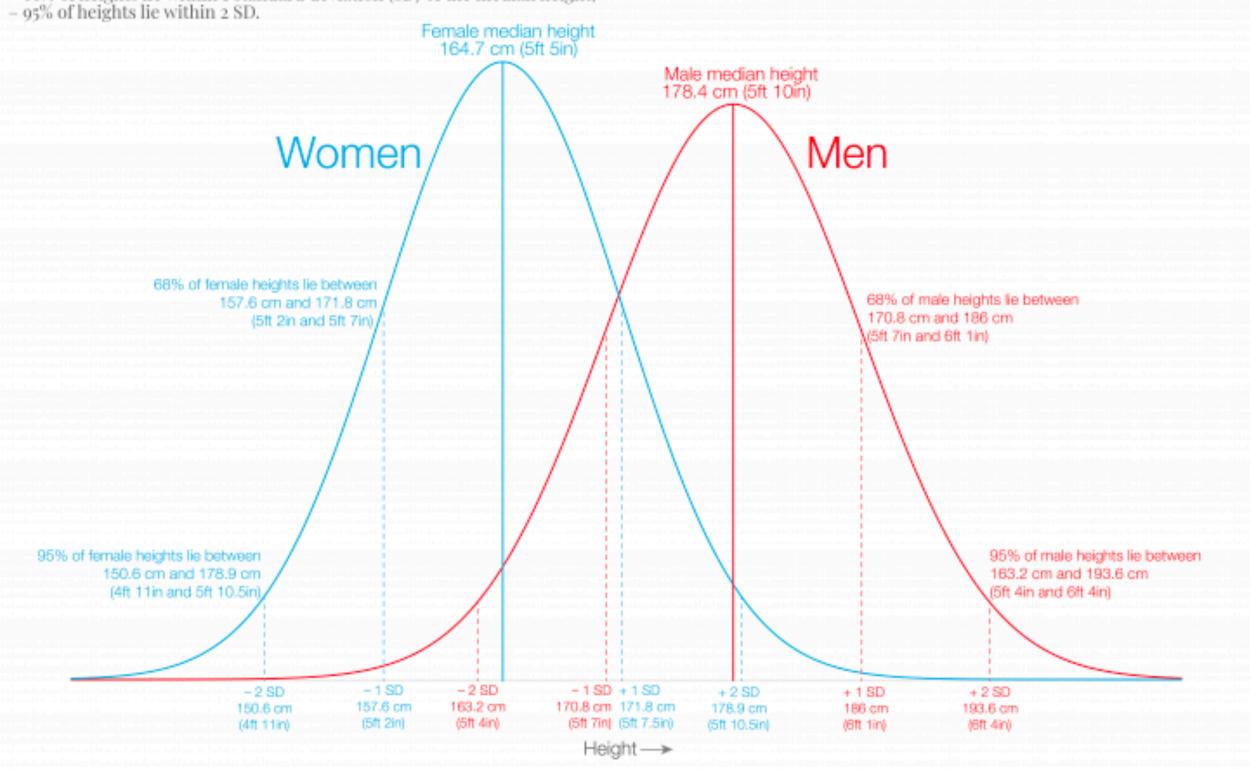
Particle identification

• Given persons height is 1.68m. Is it men or a woman?



The distribution of male and female heights

The distribution of adult heights for men and women based on large cohort studies across 20 countries in North America, Europe, East Asia and Australia. Shown is the sample-weighted distribution across all cohorts born between 1980 and 1994 (so reaching the age of 18 between 2008 and 2012).
Since human heights within a population typically form a normal distribution:
- 68% of heights lie within 1 standard deviation (SD) of the median height;



Note: this distribution of heights is not globally representative since it does not include all world regions due to data availability.

Data source: Jelenkovic et al. (2016). Genetic and environmental influences on height from infancy to early adulthood: An individual-based pooled analysis of 45 twin cohorts. This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.

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