

INTERNATIONAL COSMIC DAY

SEASONAL FLUX OF MUONS

Liceo Scientifico Internazionale

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Who are you?

We are four ESABAC students, Sofia Gardosi, Isabella Merli, Caterina Robinson, Elena Zuccarelli. Our international school has been involved in the Extreme Energy Event (EEE) project since 2006 and this year we took part in the EEE-ICD event <https://agenda.centrofermi.it/event/174/> alongside 380 participants.

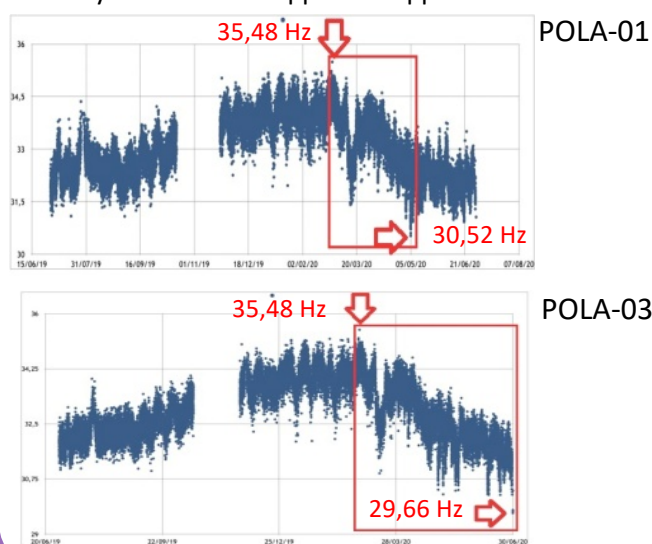
What have you done?

First of all we collated data from the POLA-01 and POLA-03 detectors, collected in the period between July 2019 and July 2020. Then we converted the data into the correct rate and studied the flux of muons to measure their variation in the different seasons of the year. We applied the correction for barometric effect, assuming a coefficient equal to -0.002 mbar^{-1} and a reference atmospheric pressure, 1010 mbar : $f = f_{misurato} e^{-0.002 \cdot \Delta p}$
We obtained the following results:

- the maximum flux value are:
for POLA-01 $f_{max}^{POLA-1} = 35.48 \text{ Hz}$
for POLA-03 $f_{max}^{POLA-3} = 35.48 \text{ Hz}$
- The minimum flux value are:
for POLA-1 $f_{min}^{POLA-1} = 30.52 \text{ Hz}$
for POLA-3 $f_{min}^{POLA-3} = 29.66 \text{ Hz}$
- The mean values are:
for POLA-1 $f^{POLA-1} = 33.00 \text{ Hz}$
for POLA-03 $f^{POLA-3} = 32.57 \text{ Hz}$
- The percentage variation are:
 $\frac{\Delta f^{POLA-1}}{f^{POLA-1}} \times 100 = 15\%$ $\frac{\Delta f^{POLA-3}}{f^{POLA-3}} \times 100 = 18\%$

What did you find out?

In a context of low energy muons, the flux of cosmic rays measured on Earth is variable and reaches minimum values in summer months and maximum values in winter months. The variation depends on the temperature and atmospheric pressure: being warmer in summer, the atmosphere undergoes greater expansion. Subsequently, the swarms of cosmic rays begin at higher altitudes and find it harder to reach the Earth as they have more time to decay. In winter the opposite happens.



What's your take-home message?

We discovered that there is a seasonality in the flux of muons, due to temperature and pressure as they affect the expansion of the atmosphere. In particular, we observed a maximum flux during winter and this means that there are muons of low energy about 1GeV. Our results are in line with those of the other groups.