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The impact of crystal non-proportional light yield on the calibration of space calorimeters.

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Recent experiments measuring cosmic rays have shown discrepancies in the spectra among different observations. The electron spectrum in the region of hundreds of GeV and Carbon and Oxygen spectra were found to differ mostly in flux normalizations, and the discrepancies are larger than the reported experimental errors. Understanding the reasons for these differences is crucial for improving our understanding of cosmic rays and developing future experiments.
One potential source of systematic errors is the calibration of the absolute energy scale of space calorimeters. During on-orbit operations, space calorimeters are typically calibrated using minimum ionizing particles (MIPs), which can lead to uncertainties related to the energy scale due to the non-linearity of the scintillating crystals light yield. This non-linearity is mainly related to the different ionization densities that MIPs produce compared to high-energy showers.
To address this issue, the CaloCube collaboration exposed to ion beams various crystals (including BGO, LYSO, CsI(Tl), and others). A simplified model of the crystals light emission, tuned on ion
beam data, was then included in Monte Carlo simulations of typical space calorimeters. The impact of the crystal response non-proportionality on the energy scale was evaluated, and the results suggest that if the non-proportionality is not properly accounted for, there could be a significant systematic error in the measurements of proton and electron flux.

Eligibility for ”Best presentation for young researcher” prize

No

Author: PACINI, Lorenzo (Universita e INFN, Firenze (IT))

Presenter: PACINI, Lorenzo (Universita e INFN, Firenze (IT))

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