Cosmic-Ray Source Generator

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Cosmic-Ray Source Generator is required for (Simulator)

Balloon Flight Calibration
to predict a counting rate of $\pi^0$ decay Gamma-ray and Background

Science Analysis after launch
to simulate and estimate the onboard background especially for

study of diffuse gamma-ray emission
detection of faint gamma-ray sources
Cosmic-Ray

accelerated by young SNRs, Pulsars, or other sites
propagate in the interstellar space
modulated by Solar Wind
cut-off by magnetic field of the Earth
Generation of secondary components in the Air

inject into satellites or balloons
become the residual background by primary electrons or secondary particles and gamma-rays
Protons

AMS Measurements ..... Primary and Secondary for various geomagnetic latitude
$40 \cdot 10^{-2.79} \exp\left(-\frac{E}{20}\right)^{-0.1} \left(\frac{E}{3.96}\right)^{-2.5}$

Primary

$3 \cdot 10^{-3} \cdot 10^{-2.5} \exp\left(-\frac{E}{0.16}\right)^{-1}$

Secondary

Hiroshima University, ISAS
Electrons

Information is not so enough as protons

Primary Electrons

Secondary

Komori et al. 1999

Verma et al. 1967

Hiroshima University, ISAS

GLAST
Primary: Komori 1999

Solar modulation formula

\[ 0.723(E+1.1)^{-3.33} \times \frac{(E+mc^2)^2-(mc^2)^2}{(E+mc^2+(1.1)^2)/(1+(E/4.27)^{-12.0}} \]

Secondary: Verma et al., modified

geomagnetic cutoff

\[ 0.028E^{-1.44}/(1+(E/0.90)^{1.35}) \text{ ... re-entrant} \]

\[ 0.073E^{-1.29}/(1+(E/0.90)^{1.50}) \text{ ... splash} \]
Incident Angle Distribution

\[(1 + 0.6 \sin(\theta)) \sin(\theta) d(\theta)\]

Primary … \(\theta < 90^\circ\)
Summary

Current Status
Supporting the Balloon Flight experiments
(various parameters are fixed for the balloon).

Further developments  
Support arbitral solar modulation and geomagnetic cutoff.
Include Helium and other ions.
Improve the incident angle distribution (theta, phi).
Improve the secondary components (intensity etc)

Parallel Studies
Residual background due to the cosmic-rays

Hiroshima University, ISAS