OS EXPERIMENTOS protoMIRAX e MIRAX

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Workshop da Divisão de Astrofísica

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O protoMIRAX/MIRAX

Mask

Collimator

Pb
Sn
Cu

Shielding

Detection plane

Rear shielding

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Componentes do ruído

Atmospheric γ-ray photons

- 0 - 65°
- 65 - 95°
- 95 - 130°
- 130 - 180°

Electrons

Neutrons

Protons

Primary protons
Secondary protons
Cosmic diffuse $\gamma$-ray background

Albedo photons

Galactic cosmic rays

Trapped protons

Neutrons
Normalização

\[ N = \int I_N \cos \theta \, d\Omega \, dA \, dt \, dE, \]

\[ N = \pi A T \int I_N \, dE, \]

\[ d\Omega = d\phi \, \sin \theta \, d\theta \]

\[ dA = R^2 \sin \alpha \, d\alpha \, d\Phi \]
Contribuição do ruído

protoMIRAX Background

MIRAX Background

Counts cm² s⁻¹ keV⁻¹ (× 10⁵)

Energy (keV)

Total background

Neutrons

Gamma

Protons

Electrons

Counts cm² s⁻¹ keV⁻¹ (× 10⁵)

Energy (keV)

Total background

Albedo photons

Galactic Cosmic Rays

Cosmic diffuse γ-ray radiation

Trapped protons

Neutrons

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Distribuição espacial

- Counts s⁻¹
- Detector number

γ-ray background: 0° - 65°

γ-ray background: 65° - 95°

γ-ray background: 95° - 130°

γ-ray background: 130° - 180°

Primary Protons

Secondary Protons

Electrons

Neutrons
Counts $s^{-1}$

- Cosmic diffuse $\gamma$-ray radiation
- Galactic Cosmic Rays
- Albedo photons
- Neutrons
- Trapped protons
- Total background
Reconstrução de imagens

para o protoMIRAX

\[ F(E) = F_0(E) e^{-\frac{\mu}{\rho}(E) \times \sec(z)} \]

\[ \cos z(t) = \sin \varphi \sin \delta + \cos \varphi \cos \delta \cos(t - \alpha) \]

\[ N = \int_S \int_{E_{\text{min}}}^{E_{\text{max}}} \int_0^T F_0(E) e^{-\frac{\mu}{\rho}(E) \times \sec(z(t))} \, dt \, dE \, dS \]
Imagem reconstruída

Crab - MIRAX - 4h

Crab - protoMIRAX - 4h

INPE

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Figura: 1E 1740.7–2942 e GRS 1758–258
Background and Imaging Simulations for the Hard X-Ray Camera of the MIRAX Mission

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ABSTRACT

We report the results of detailed Monte Carlo simulations of the performance expected both at balloon altitudes and at the probable satellite orbit of a hard X-ray coded-aperture camera being developed for the MIRAX mission. Based on a thorough mass model of the instrument and detailed specifications of the spectra and angular dependence of the various relevant radiation fields at both the stratospheric and orbital environments, we have used the well-known package GEANT4 to simulate the instrumental background of the camera. We also show simulated images of source fields to be observed and calculated the detailed sensitivity of the instrument in both situations. The results reported here are especially important to researchers in this field considering that we provide important information, not easily found in the literature, on how to prepare input files and calculate crucial instrumental parameters to perform GEANT4 simulations for high-energy astrophysics space experiments.

Key words: instrumentation; detectors – methods: numerical – atmospheric effects – balloons - space vehicles: instruments – techniques: image processing