Project Title:

Simulation of Ultra High Energy Cosmic Rays for a space-based telescope

Name: Mario Bertaina
Laboratory at RIKEN: Computational Astrophysics Laboratory,
RIKEN Advanced Science Institute, RIKEN Wako Institute

Description of the project

1. In the present project I have used the ESAF (Euso Simulation Analysis Framework) to estimate the performance of the JEM-EUSO instrument to detect the fluorescence light produced by Extensive Air Shower (EAS) developing in atmosphere, produced by the interaction of an Ultra High Energy Cosmic Ray with air.

2. In particular the RICC system has been used to study the performance of a pattern recognition algorithm, whose objective was to recognize the track of an EAS from the fluctuations of the typical nightglow background expected on the detector. The scheme adopted is based on the definition of a box of few pixels side that moves on the Focal Surface of the telescope as a function of time trying to maximize the signal over noise ratio inside the box. The track is identified by selecting the direction in which the excess of signal on the Focal Surface is maximized.

3. The analyses performed on the RICC system have shown that the algorithm is able to recognize the location of more than 90% of the signal using a box of about 25 pixels.

4. This result is important because it allows more easily making a second screening on the pixel data inside the box to separate more efficiently the true signal.

5. Extracting with limited uncertainty the real track of signal on the focal surface of the telescope will allow getting the most important parameters of the EAS: energy and direction.

6. I intend to use again the RICC system as a Quick User during the occasions in which I will be at RIKEN as a Visiting Scientist in the next fiscal year. The future activity will finalized to the fine-tuning of the algorithm described before, based on the results of the reconstruction of the shower parameters (energy, direction) that now will be performed on the basis of the signal extracted through the technique herein described.

7. The analysis was conducted in the period December 2011 – January 2012. Due to the limited time used for the analysis no publication has been achieved yet. A publication is expected to come in the next fiscal year when the analysis on the energy and direction estimation based on the above pattern recognition will give the first results. Therefore, no H-2 documents will be filled.