Project Title:

Neutrino Simulation for the JEM-EUSO Mission

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Background and purpose of the project: JEM-EUSO (Extreme Universe Space Observatory on board the Japanese Experiment Module) is an international collaboration aiming to deploy a space based ultra high energy cosmic ray (UHECR) and neutrino detector on board the International Space Station (ISS). These so called primary particles induce extensive air showers (EAS) inside the Earth's atmosphere. Their effects can be observed by a JEM-EUSO-like detector from the ISS. ESAF (EUSO Simulation and Analysis Framework) is the core software simulating the instrument and it's interactions with fluorescence and Cherenkov photons. This project is concerned with the simulation of neutrino induced EAS and the feasibility of detecting the corresponding primary particles.

Usage status of the system and calculation method:
During FY 2013 no RICC computing time was used. Instead two new steps - the event generation with PYTHIA (Sjöstrand, Mrenna, Skands. "Pythia 6.4 Physics and Manual". hep-ph/0603175) and the shower development in the atmosphere with CONEX (Bergman et al. "One-dimensional Hybrid Approach to Extensive Air Shower Simulation". astro-ph/0606564) - were added to the simulation cycle. Thus completing it. The first simulations testing the whole process were carried out using local resources.

Result:
Some first samples of electron neutrino (and antineutrino) induced showers were generated and basic trigger efficiency statistics were compiled for different primary inclination angles and energies.

Conclusion:
A complete path from the first interaction of a neutrino primary particle with a nucleon in the atmosphere to the triggering of the instrument was established.

Schedule and prospect for the future:
As the development of the JEM-EUSO mission progresses new assignments requiring computing power appear. In the course of FY 2014 we plan to extend the work done so far by creating extensive trigger efficiency statistics. Furthermore we are going to need machine time to calculate the exposure and sensitivity of the JEM-EUSO telescope to neutrino EAS. We are hoping to be able to do these calculations on the RICC utilizing a "Quick Use" account.

Why no job was executed on the RICC:
In the scope of this project during FY 2013 a bachelor thesis was written consisting of work which did not depend on tremendous amounts of computing time. Thus the simulations necessary were entirely run on local machines instead of on the RICC.

Fiscal Year 2013 List of Publications Resulting from the Use of RICC

[Proceedings, etc.]

Guzman, A. et al., "A study on JEM-EUSO's trigger probability for neutrino-initiated EAS", Proceedings of 33rd International Cosmic Ray Conference (Rio de Janeiro), ID0533, July 2013.