RICC Usage Report for Fiscal Year 2013

Project Title:

Simulations for the JEM-EUSO Mission

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1. **JEM-EUSO** (Extreme Universe Space Observatory onboard the Japanese Experiment Module) is a space borne ultra high energy cosmic ray (UHECR) detector. It will be launched in 2017 and attached to the Japanese module of the international space station (ISS). ESAF (EUSO Simulation and Analysis Framework) is a software designed to simulate the JEM-EUSO instrument. With ESAF we simulate the entire chain of events during the measurement of UHECR with the JEM-EUSO detector. This is important to estimate the expected performance of the instrument and to check its design and technological components.
2. The ESAF software is an object oriented c++ code which is based on ROOT (root.cern.ch). The physics and hardware simulations include several analytical and numerical techniques.
3. The software is still under development. During the fiscal year 2013, the granted computation time could not appropriately been used. This was due to the fact, that the small scale calculations could be performed at local clusters. The usage of the RICC system was not applicable.
4. ESAF is an important tool to estimate the expected performance of the JEM-EUSO mission. It is still under development, however we believe that in 2014 we are ready to extensively use the computation time granted to perform large-scale simulations.
5. During the year 2014 we will carry out massive simulations for the JEM-EUSO mission.
6. Due to technical issues with the code, so far the provided computing time has not been used. After an extensive debugging phase we are now confident start a large number of simulations. In the next usage term simulation will cover the entire event reconstruction in terms of air shower resolution. A focus will be the angular reconstruction capability of the JEM-EUSO instrument as well as the energy and Xmax resolution, especially in cloudy sky conditions. Therefore extensive computing time for the Montecarlo simulations in atmosphere will be required.

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

[Publication]

Adams, J.H. Jr et al. for JEM-EUSO Collaboration, "Performances of JEM-EUSO: angular reconstruction", Experimental Astronomy, Special Issue (Published online: 03 Feb. 2014).

Bertaina, M. et al. for JEM-EUSO Collaboration, "Performance and air-shower reconstruction techniques for the JEM-EUSO mission", Advances in Space Research (accepted, Feb. 2014).

Acknowledgement of RICC utilization has been omitted in the second article due to collaboration policy. The second paper is still in print. A copy is therefore not attached in the present report.

[Proceedings, etc.]

Mernik, Thomas et al for the JEM-EUSO Collaboration
"Simulating the JEM-EUSO Mission: Scientific Objectives and Expected Performance"
Proceedings of the 33rd International Cosmic Ray Conference, July 2013, Rio de Janeiro, Brazil

Mernik, Thomas et al for the JEM-EUSO Collaboration
"ESAF-Simulation of the EUSO-Balloon"
Proceedings of the 33rd International Cosmic Ray Conference, July 2013, Rio de Janeiro, Brazil

[Oral presentation at an international symposium]

Annual Meeting of the Deutsche Physikalische Gesellschaft (German Physical Society), March 2013, Dresden, Germany
Overview Talk: "The JEM-EUSO Mission: Perspectives and Detector Design"

[Others]