

Project Title:

**Generation of cosmic ray air showers at large statistics**

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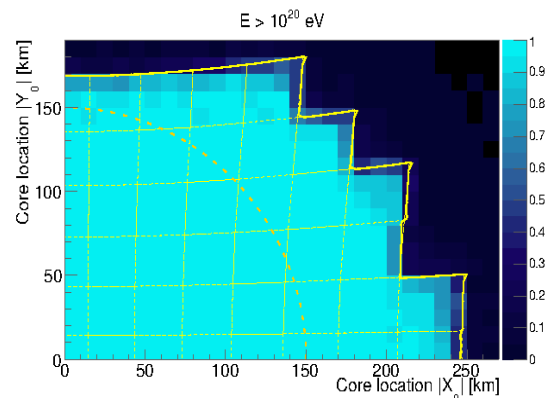
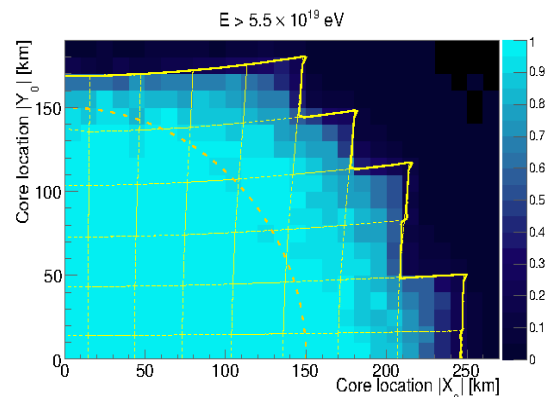
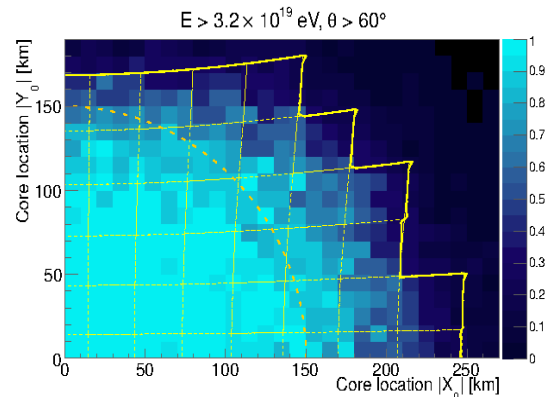
1. JEM-EUSO mission is the novel ultra-high energy cosmic ray (UHECR) observation project that under development phase promoted along with international collaboration under leadership of EUSO Team. The observation of UHECRs is highly dependent upon the indirect measurements of extensive air shower (EAS) phenomenon initiated by their arrivals to Earth. The EAS phenomenon of our interest involves an order of trillions of particles that result in the production of  $\gg 10^{15}$  photons in the atmosphere. These properties highly vary according to the still unknown nature of UHECRs. The elaborate simulations study therefore essentially require large CPU-time.

2. In the project, we installed ROOT-based simulation package EASF (Euso Simulation and Analysis Framework) in RICC and generated a large amount of EASs with variety of initial conditions. In parallel, we produced the simulation code for JEM-EUSO telescope responses including optics, particle detector, trigger and processing electronics. We as well developed the analysis algorithms for the data obtained by the simulation studies.

3. To estimate the exposure of the UHECR observation by JEM-EUSO telescope, a key parameter of the mission performance, we generated an order of million EAS phenomenon including test runs. The UHECR observation efficiency has been evaluated as a function of UHECR energy. The figure shows an example of the detection (trigger) efficiency for UHECRs. Of different conditions.

4. From those dataset, we estimated the exposure of the UHECR observation by the JEM-EUSO mission. The results have been submitted as a full paper to Astroparticle Physics and successfully accepted.

5. The study made in this fiscal year was focused on the particular case of JEM-EUSO observation mode (nadir observation). In the following year, we extend simulation studies including other modes by RICC under Quick Use category.



RICC Usage Report for Fiscal Year 2012

**Fiscal Year 2012 List of Publications Resulting from the Use of RICC**

**[Publication]**

Adams J. Jr. et al. (JEM-EUSO Collaboration), "An evaluation of the exposure in nadir observation of the JEM-EUSO mission" Astroparticle Physics (accepted; online version

<http://dx.doi.org/10.1016/j.astropartphys.2013.01.008>

(Due to collaboration rules, acknowledgement has been omitted as well as other institution's computing contribution)