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Background Simulations with Geant4 for the General Antiparticle Spectrometer (GAPS) Balloon Experiment

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The GAPS experiment is foreseen to carry out a dark matter search using low energy cosmic ray antideuterons (< 0.3GeV/n) at stratospheric altitudes using a novel detection approach. The theoretically predicted antideuteron flux resulting from secondary interactions of primary cosmic rays, e.g. protons, with the interstellar medium is very low. So far not a single cosmic antideuteron has been detected by any experiment. Therefore a crucial task during the development of the GAPS instrument is to gain a good understanding of the large gamma and particle backgrounds which could spoil the antideuteron identification. This background is mainly composed of three components: cosmic rays, products of cosmic-ray interactions with Earth's atmosphere and products of interactions with the detector material itself. To study atmospheric interactions of cosmic rays with the atmosphere an adapted Geant4 based Planetocosmics simulation was developed. In addition, the Planetocosmics framework was also used to study the geomagnetic influence on the background rates. The results of these simulations were fed into a standalone Geant4 instrument simulation which is used to carry out a full GAPS detector simulation and reconstruction.

This presentation will give an overview of the GAPS instrument and the different simulation issues. It will mainly concentrate on the atmospheric simulations and discuss e.g. the implementation of the particle gun for a fast simulation, validation of the simulations with existing data and the interface to the instrument simulation.

Primary author: Dr VON DOETINCHEM, Philip (UC Berkeley, Space Sciences Laboratory)

Co-authors: TAKADA, Atsushi (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); HAILEY, Charles (Columbia University, Astronomy and Astrophysics); GAHBAUER, Florian (University of Latvia, Atomic and Molecular Physics Laboratory); FUKE, Hideyuki (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); MOGNET, Isaac (UC Los Angeles, Physics and Astronomy); KOGLIN, Jason (Columbia University, Astronomy and Astrophysics); ZWEERINK, Jeffrey (UC Los Angeles, Physics and Astronomy); MORI, Kaya (Columbia University, Astronomy and Astrophysics); BANDO, Nobutaka (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); MADDEN, Norm (Columbia University, Astronomy and Astrophysics); ONG, Rene (UC Los Angeles, Physics and Astronomy); BOGGS, Steven (UC Berkeley, Space Sciences Laboratory); YOSHIDA, Tetsuya (Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency); ZHANG, Tracy (UC Los Angeles, Physics and Astronomy); ARAMAKI, Tsuguo (Columbia University, Astronomy and Astrophysics); CRAIG, William (Lawrence Livermore National Laboratory)

Presenter: Dr VON DOETINCHEM, Philip (UC Berkeley, Space Sciences Laboratory)

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