Search for Cosmic-Ray Antiparticles with Balloon-borne Experiments

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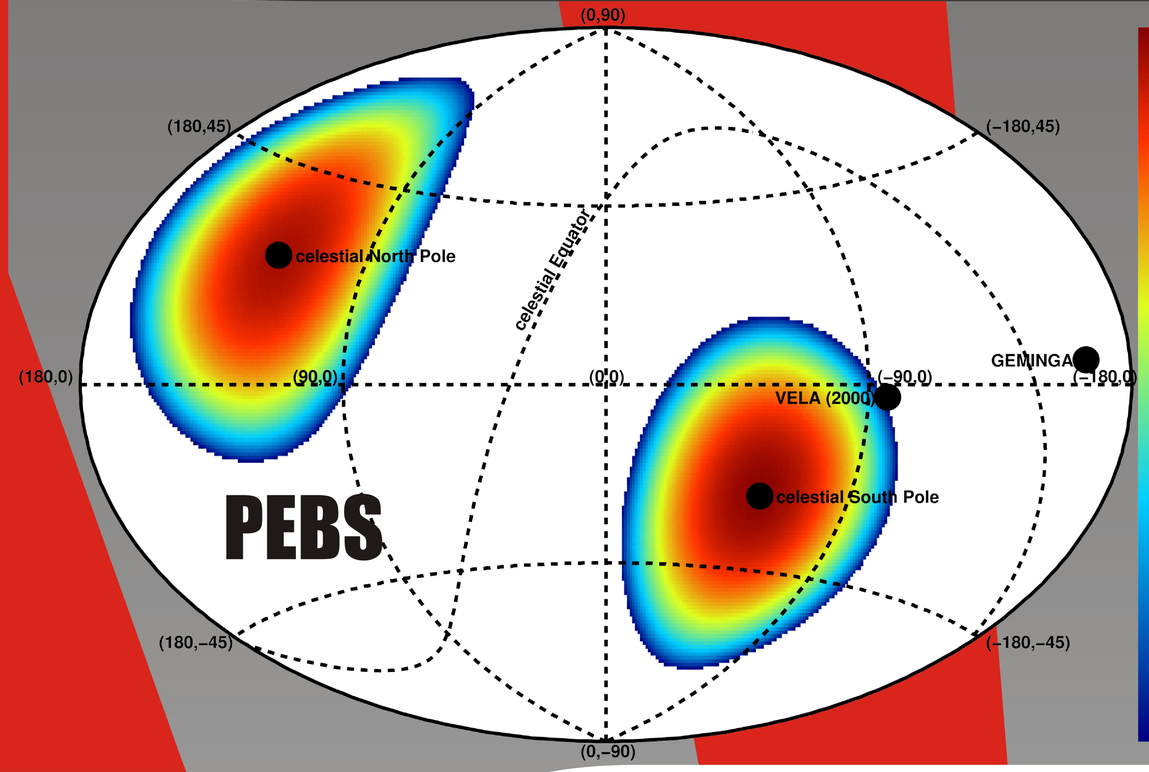
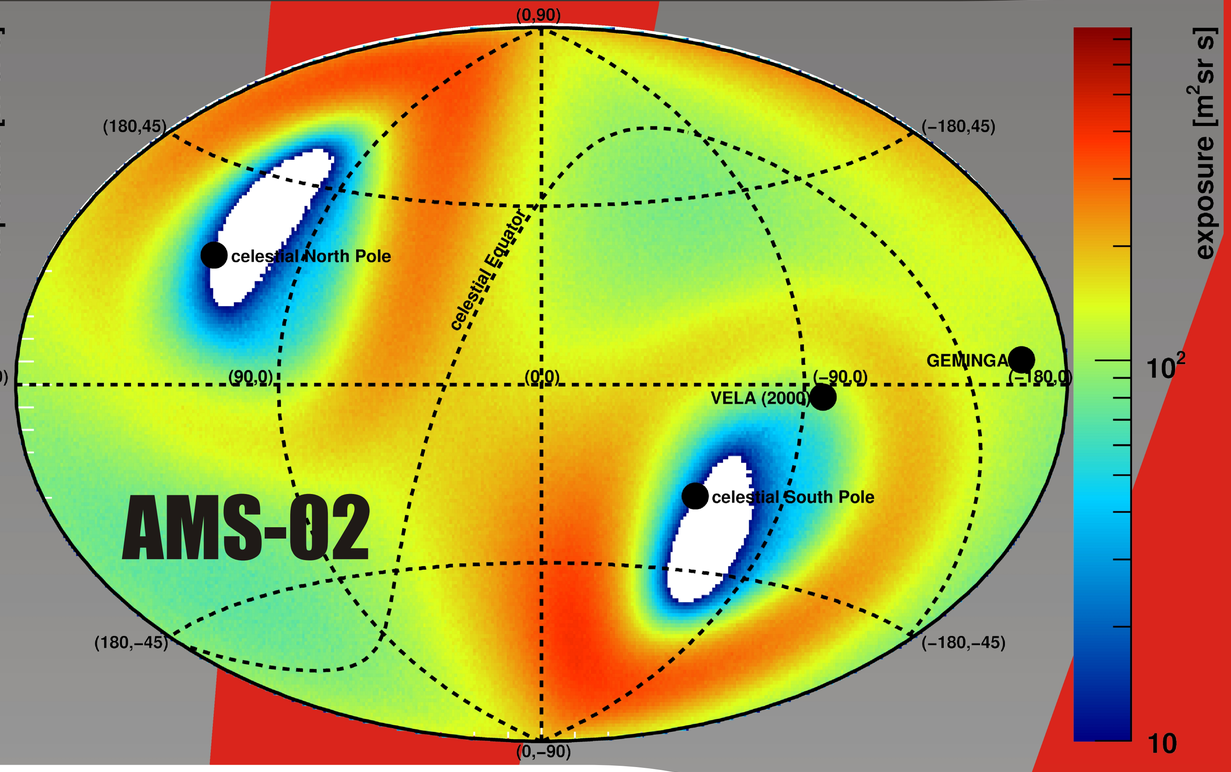
This poster presents the prospects of antiparticle flux measurements with the proposed PEBS detector. The project foresees long duration balloon flights at one of Earth's poles at an altitude of 40km. The sky coverage of flights at the poles is presented. In addition, cosmic-ray measurements at the poles (small rigidity cut-offs) give the possibility to study solar modulation effects down to energies of about 0.1GeV. Furthermore, systematic effects due to interactions of cosmic rays in the atmosphere are important. These effects were studied with the Planetocosmics simulation software based on GEANT4 in the energy range 0.1 - 1000GeV.



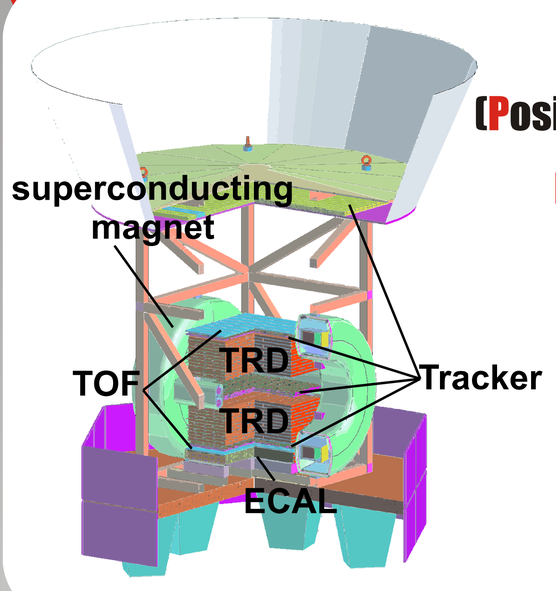


Sky Coverage

It is interesting to map the galactic sky with charged particles in the TeV range to look for anisotropies due to local sources. The **exposures** are shown for PEBS with two flights (North and South Pole, 50 days each) and for AMS-02 at ISS orbit for three years. Only both experiments together are able to deliver a **complete picture of the sky**. These pictures can be interpreted as the expected diffuse charged particle background.

PEBS

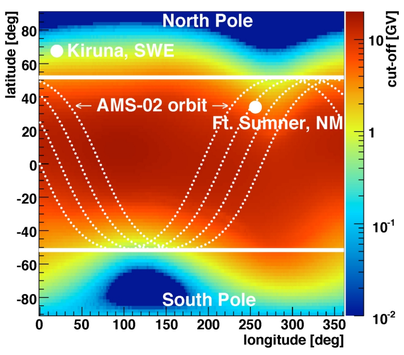
(Positron Electron Balloon Spectrometer)

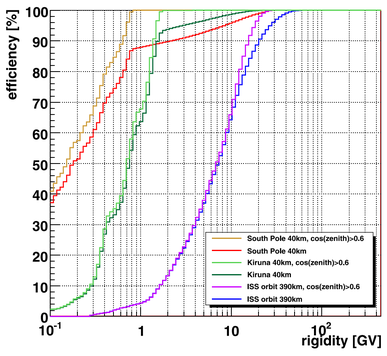


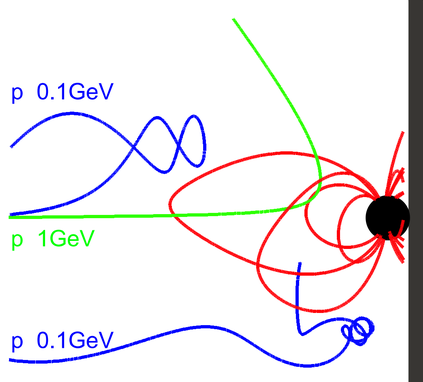
Properties:

- planned balloon flight at the North and South Pole in Earth's atmosphere
- flights at 40km altitude
- total flight time: ~100 days
- acceptance: $0.3 m^2 sr$
- momentum resolution at 1TeV is 18%

Geomagnetic Cut-Off

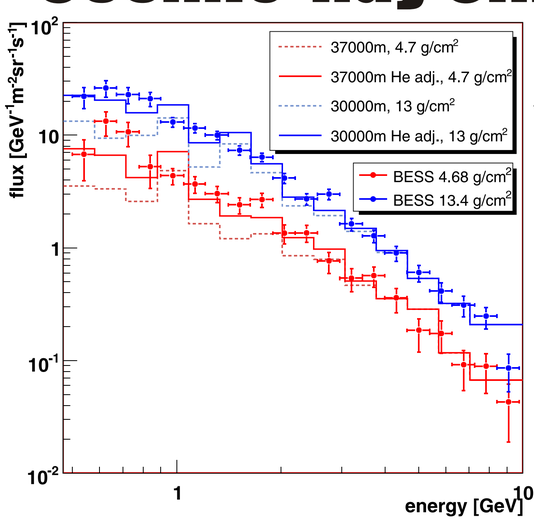


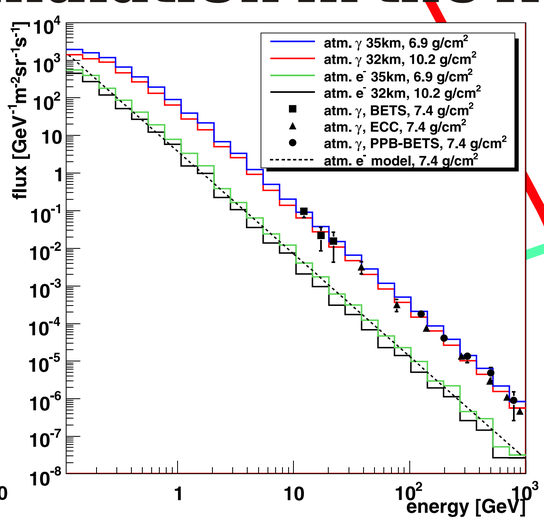




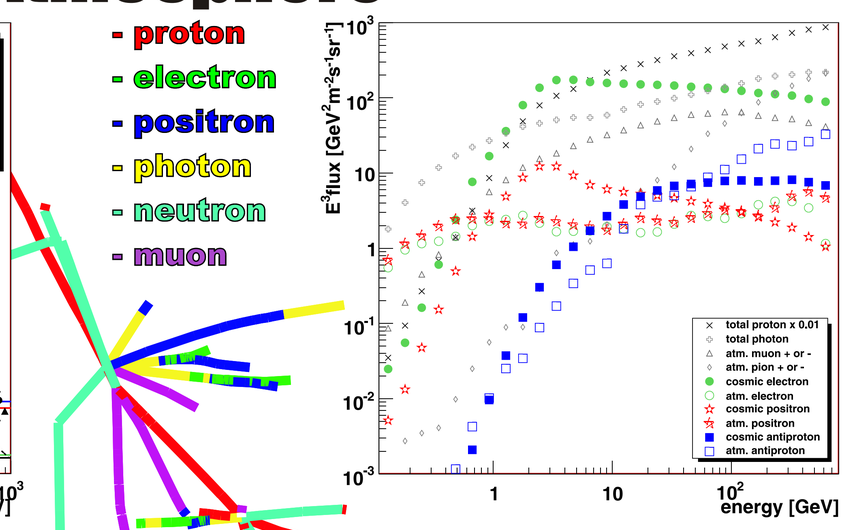
The probability for a certain **geomagnetic cut-off** as a function of detector trajectory at the poles and at ISS orbit were calculated by tracing particles back to the outside of Earth's magnetosphere. PEBS will be able to measure cosmic rays to lower energies than AMS-02 which is important to investigate **solar modulation**.

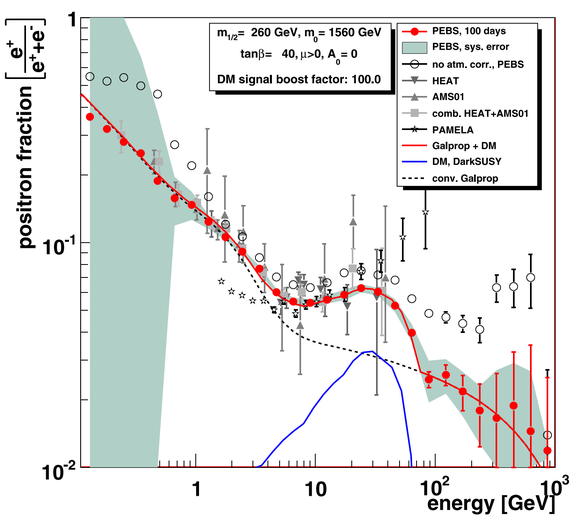
Cosmic-Ray Simulation in the Atmosphere





- proton
- electron
- positron
- photon
- neutron
- muon





Comparison of **PLANETOCOSMICS (GEANT4) simulations** with measured atmospherically induced fluxes (muon, photon) and the atmospheric electron model used for the PPB-BETS experiment show **good agreement**.

The secondary production of positrons below 1GeV is strong, ~15% atmospheric positrons are expected up to energies of 100GeV. The spectrometer resolution (MDR 6 TV) allows a measurement of the **positron fraction up to TeV energies**.