Studies of Cosmic Ray Anisotropies with DAMPE

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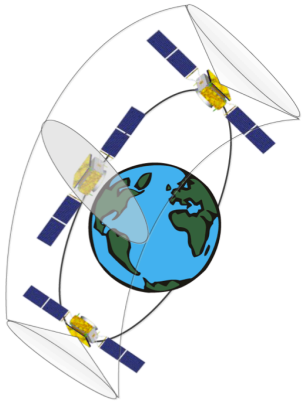
DAMPE Satellite, Detector and Data

DAMPE was successfully launched on December 17, 2015 from the Jiuquan launch base (←left picture). DAMPE is operating in a sun-synchronous orbit at the altitude of 500 km and in a survey mode so that the detector top always pointing to the local zenith (→ right plot).



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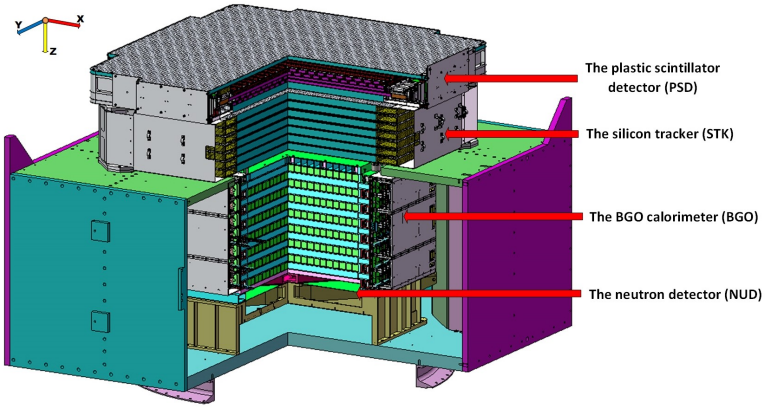
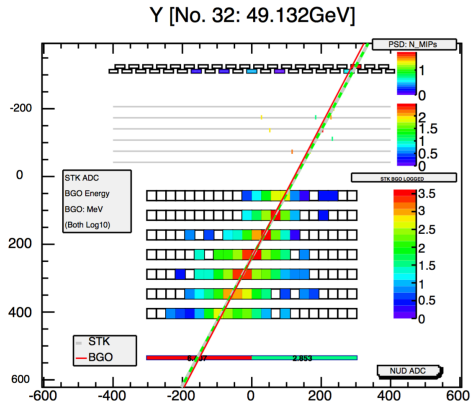


DAMPE consists of four sub-detectors (←left plot) and is able to measure the charge, direction, and energy of the incident cosmic ray particle, together with electron/hadron discrimination (→right plot). DAMPE accumulates more than 10 billion events up to now.



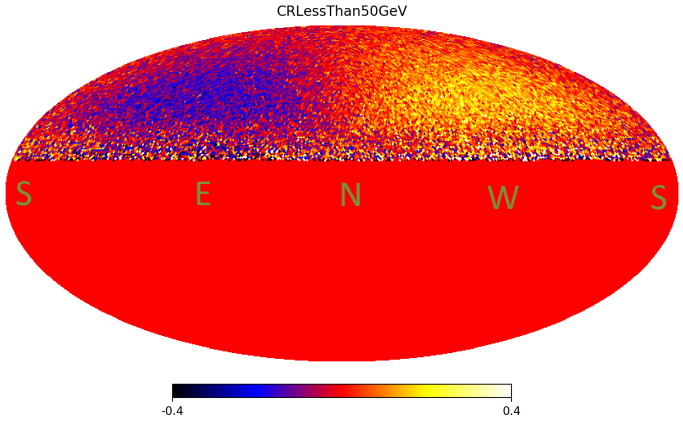
Events Selection Criteria

- To minimized the tail in the STK PSF:
  - The Best STK track within 15° of the BGO track

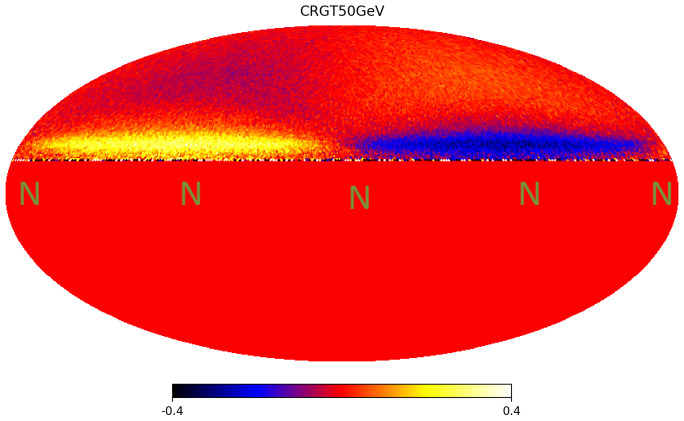
- To minimized the effect of the geomagnetic field:
  - A minimum BGO energy deposition of 100 GeV
  - A maximum off-axis angle of 55°

- To maximize the sample volume
  - No particle discrimination

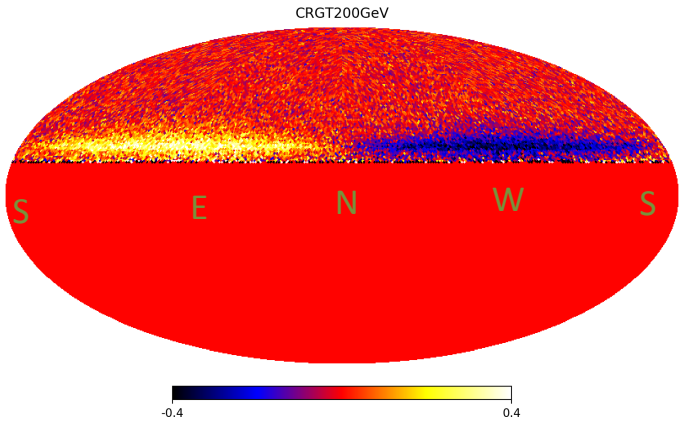
The “east-west” effect in the altitude-azimuthal coordinate



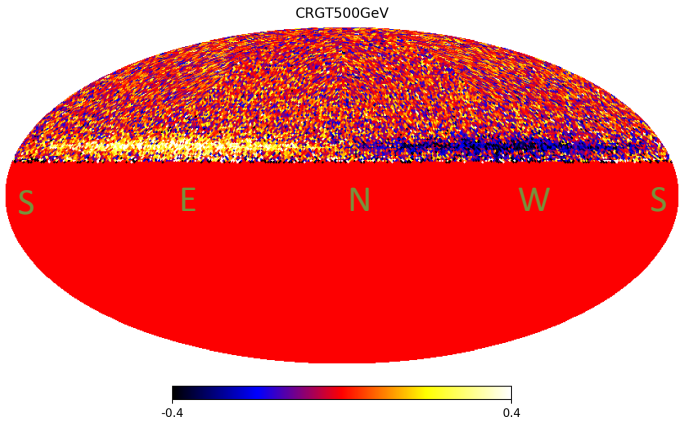
E<50 GeV



E>50 GeV

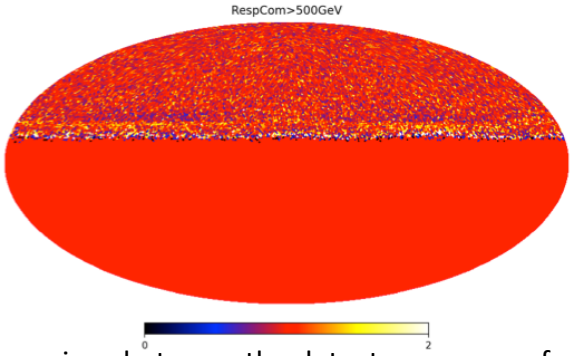


E>200 GeV

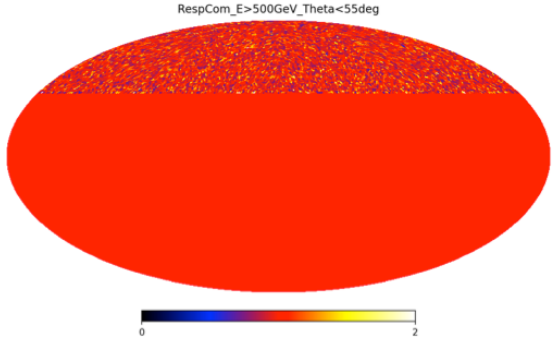


E>500 GeV

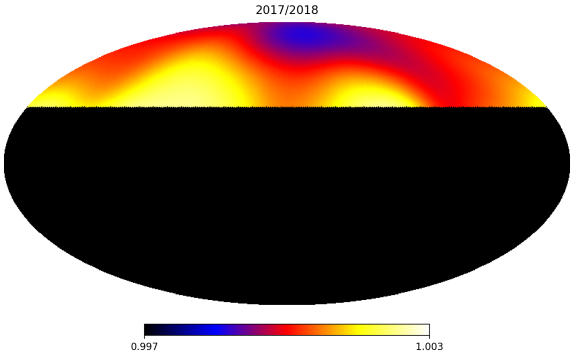
Position and time dependence of the detector response in detector coordinate



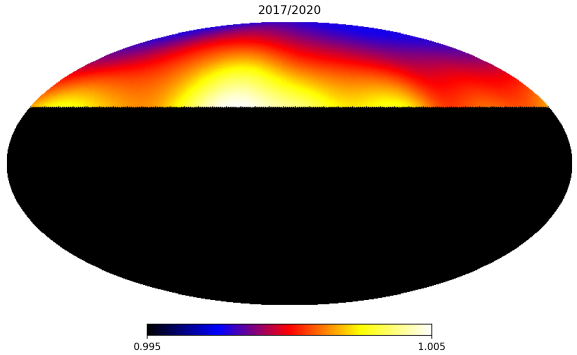
A comparison between the detector response for particles with BGO energy >50 GeV at high latitude (satellite position within 20° of the north and south pole) and that at low latitude (satellite position within 20° of the Equator) results into this map, in which clear difference is still visible at large off-axis angel.



Same as the map on the left, but applying a maximum off-axis angle of 55° to mitigate the position dependence of the detector response. A stable response with no position dependence is a fundamental assumption in producing effective reference map.

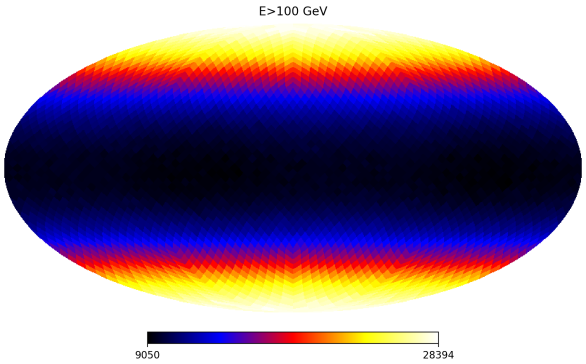


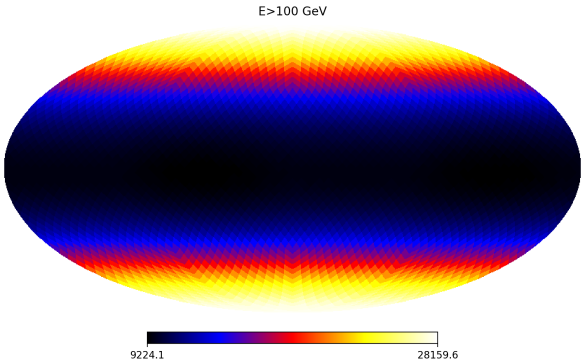
Comparing the detector response of two consecutive 1-year periods shows a difference of ~10^{-3}.

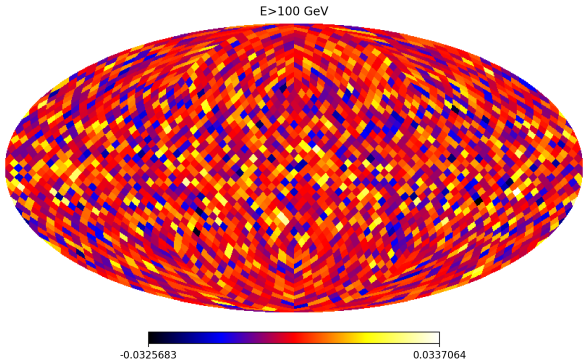


The difference in the detector response of two 1-year periods 4 years apart is ~4×10^{-3}.

Preliminary Results







Data (left) and reference sky map (middle) in equatorial coordinate (J2000) for all events in the date set. A comparison of the two maps results into the sky map of relative intensity (right). Spherical harmonic analysis shows that the result is consistent with a null hypothesis, i.e., isotropic sky, and provides a 95% CL upper limit on the dipole amplitude at a minimum BGO energy of 100 GeV of 1.2×10^{-3}.