Simulation of the DAMPE detector

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(on behalf of the DAMPE collaboration)

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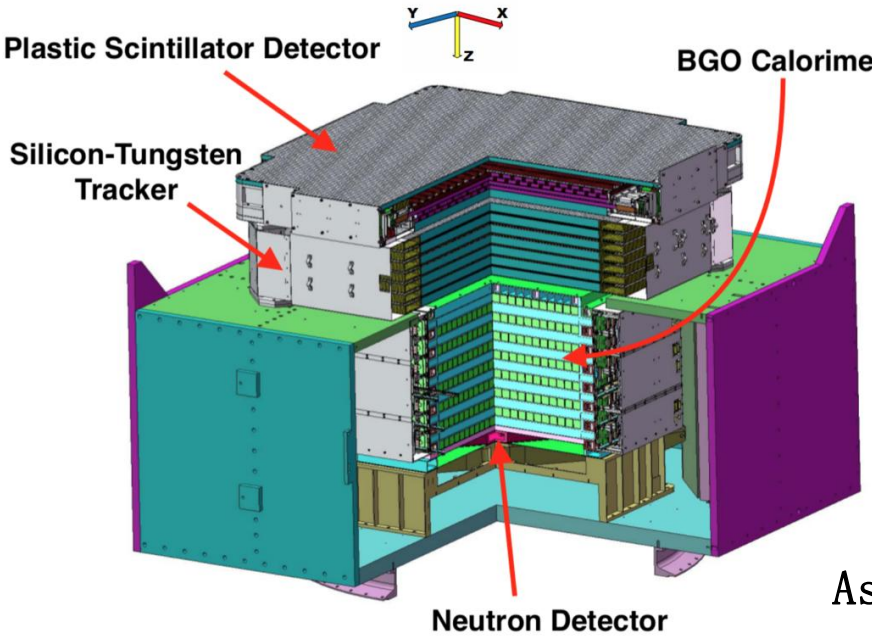
Dark Matter Particle Explorer (DAMPE)



Orbit Information:

Sun-synchronous Orbit
Altitude: ~ 500 km
Inclination: ~ 97 deg
Launch Date: Dec.17th, 2015

Astropart. Phys., 95, 6(2017)

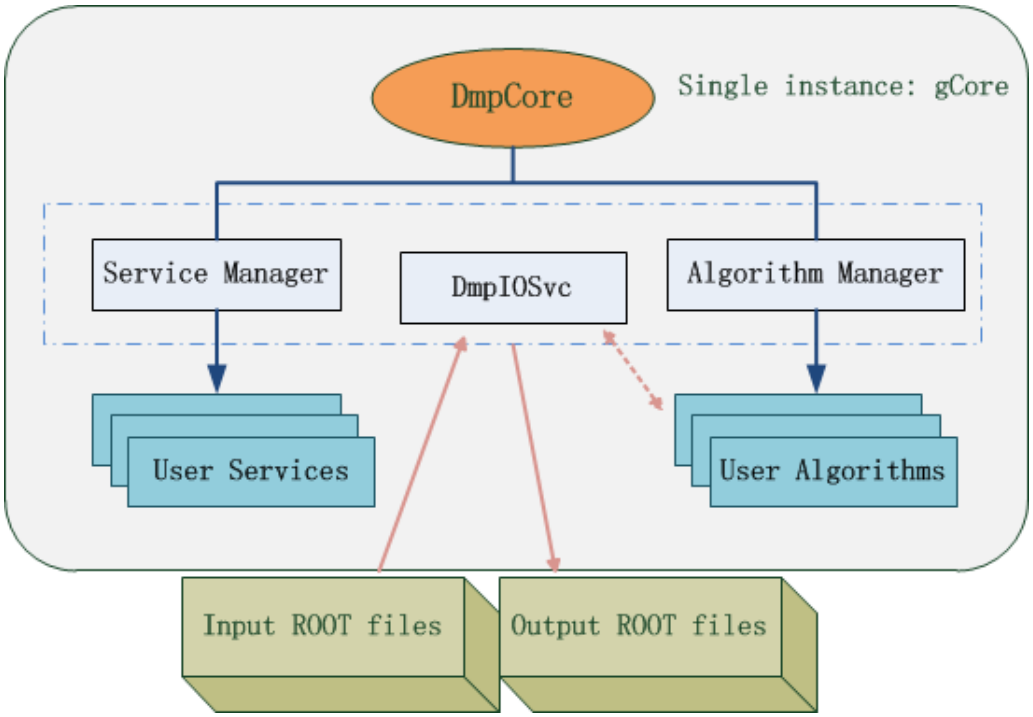
Main Scientific Goals:

Origins and Propagations of Cosmic-Rays
Dark Matter Indirected Detection
High Energy Gamma-ray Astronomy

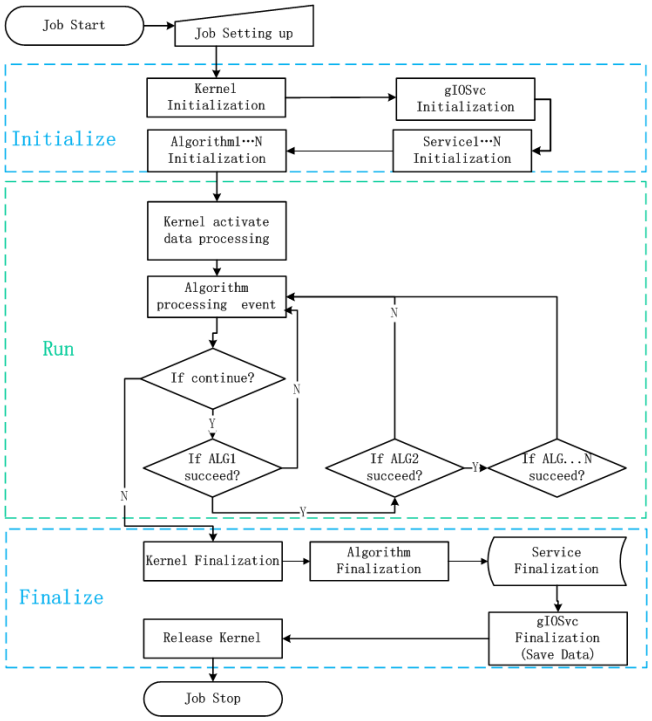
- Charge measurement (dE/dx in PSD, STK and BGO)
- Gamma-ray converting and tracking (STK and BGO)
- Precise energy measurement (BGO Crystals)
- Hadron rejection (BGO and Neutron Detector)

Extensive Monte Carlo (MC) simulations of detector are essential for scientific research

DAMPE Offline Software



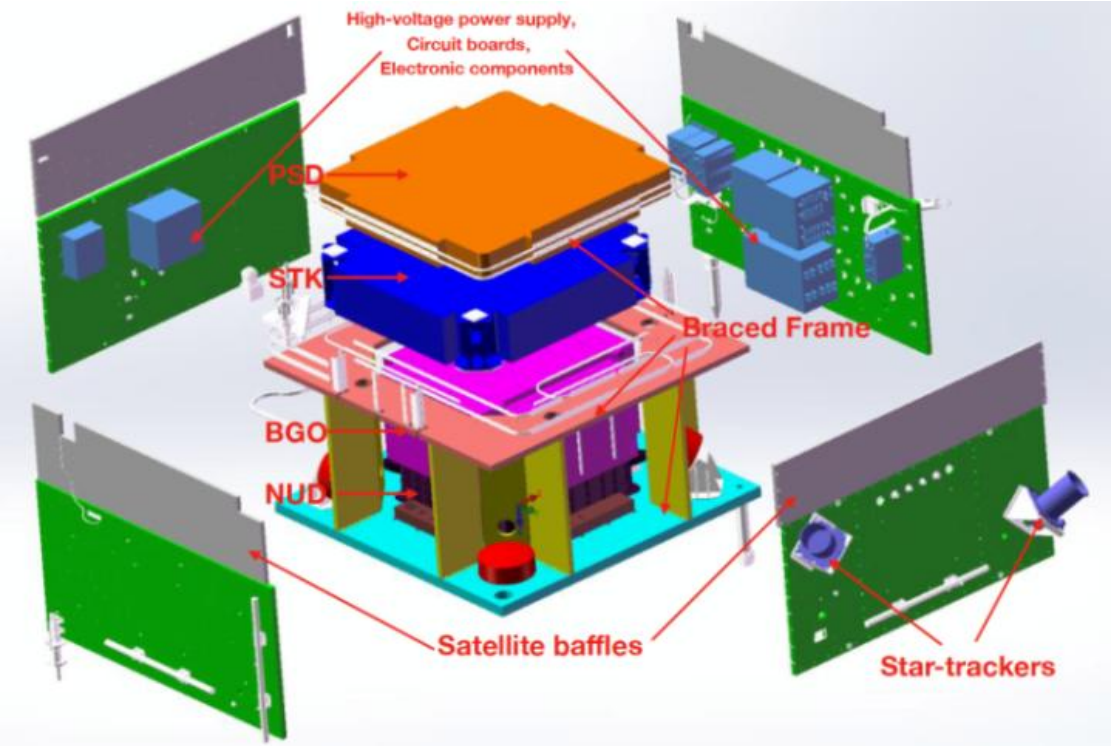
Core of DAMPE framework



Execution sequence of a job

The simulation is integrated in the software based a light-weight, functional and flexible framework

Detector Simulation



The visualization of the geometry of the DAMPE detector for MC simulation, including the payload and the satellite platform.

Physics modes for simulation:

➢ GEANT4

- **QGSP_FTFP_BERT**: recommended for electromagnetic processes
- **FTFP_BERT**: hadronic model up to 100 TeV
- **FTFP_BERT_HP**: High Precision neutron modes
- **EPOS_LHC**: hadronic model up to 1 PeV, calling CRMC-GEANT4 interface

➢ FLUKA

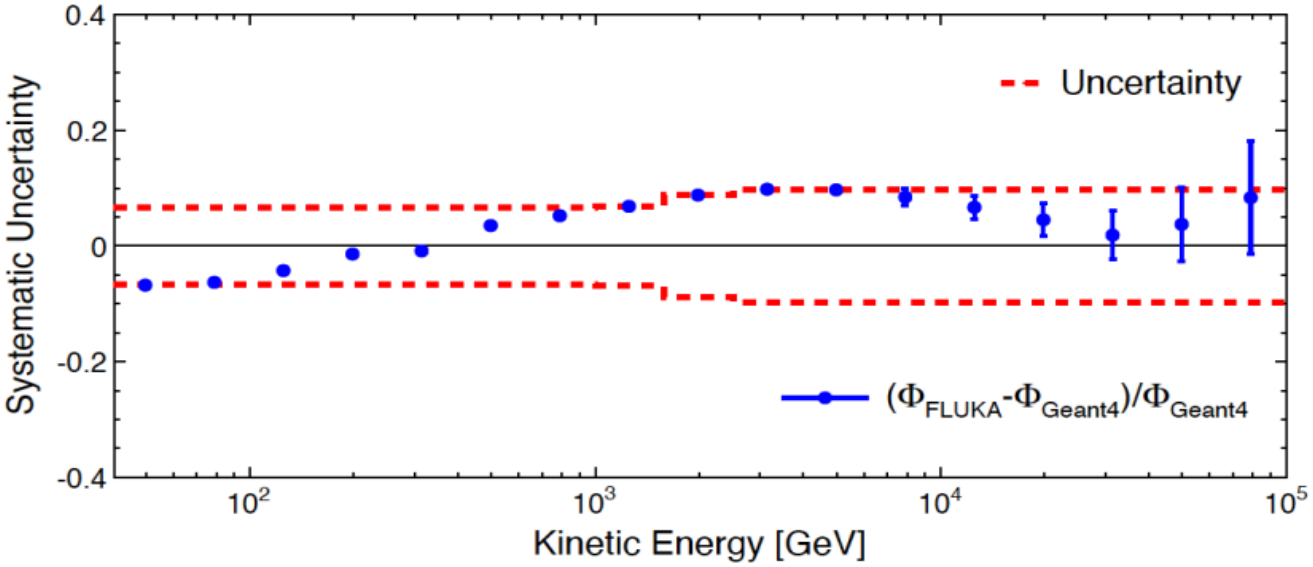
- **PEANUT**: default configuration
- **RQMD**: hadronic model for energy above 0.125 GeV
- **DPMJET-III**: hadronic model for energy from 5 GeV up to 1 PeV

Computing Farms

Site	Computing Resource
Purple Mountain Observatory	2000 CPUs/day
Sunway Taihu Light	4000 CPUs/day
Beijing Super Cloud Computing Center	Flexible, up to 10000 CPUs/day
CNAF Tier 1	300 CPUs/day
Bari Tier 3	700 CPUs/day
Baobab and Yggdrasil at University of Geneva	170 CPUs/day
Swiss National Supercomputing Centre	Flexible
Summary	7170 CPUs/day and more flexibility

MC Data Comparison

Systematic uncertainty for proton spectrum from the hadronic interaction models



Energy dependence of the proton flux difference between GEANT4 and FLUKA. The blue points show the difference of measured proton spectrum assuming FLUKA simulation with respect to the spectrum based on GEANT4 simulation.

Thank you!