



Contribution ID : 404

Type : Oral talk

Developments of Geant4 physics models and user applications

Friday, 30 October 2026 17:00 (20)

We report results of developments carried out in the framework of project of Tomsk State Research University supported by the Government of Russian Federation. The Geant4 toolkit is widely used in HEP and in other application domains including space science and radiation medicine. For the Geant4 electro-magnetic physics two new processes we provided: muon pair production by relativistic muons; positron annihilation into 2 or 3 gamma quanta considering radiative corrections and formation of a positronium state at rest. The last process is important for simulation of PET tomography, in the new model a linear polarization of photons and Doppler broadening are implemented. For prediction of radiation effects in space and for study of radiation therapy we contributed to Geant4-DNA project devoting models for protons and ions interaction with liquid water and comparisons of these results with experimental data.

For hadronic physics of Geant4 a general method to compute hadronic cross sections was developed based on Glauber theory with Gribov corrections and on experimental data. Provided cross sections are applicable to any energy of any hadron. We study and improve low-energy cross sections of low energy neutrons starting from kinetic energy 1 eV. We improved Geant4 pre-compound model and de-excitation module. Results of validation versus experimental data will be presented.

Several specific applications of Geant4 were developed. A possibility of using an accelerator-driven system of the Prometheus proton therapy complex to obtain medical isotopes was studied. An accelerator-driven system with uranium target was simulated in Geant4 software.

We have developed a new portal GEANT4RU for education purpose, and for use in researches in various application domains. In this work we present this software for the first time.

Primary author(s) : Prof. IVANTCHENKO, Vladimir (Tomsk State Research University)

Co-author(s) : Dr. BAGULYA, Alexander (Lebedev Physics Institute); BERNGARDT, Andrei (Tomsk State Research University); CHALYI, Nikita (Tomsk State Research University); Prof. GRICHINE, Vladimir (Lebedev Physics Institute); VOLOGZHIN, Matvey (Tomsk State Research University)

Presenter(s) : Prof. IVANTCHENKO, Vladimir (Tomsk State Research University)

Session Classification : High energy physics: experiment

Track Classification : High energy physics: experiment