Modelling and computer simulation of particles and nuclides passage through matter and magnetic field, with Geant4 as example

3-7 September 2018

Introduction

The Course concerns the following topics: Introduction to simulation of elementary particles and nuclides passing through and interacting with matter; structure of a simulation program based on object-orientation; definition of realistic geometry including magnetic field; primary particles and interfaces to generators; electromagnetic and strong interaction physics processes; user interfaces; visualization; event biasing; simulation examples from subatomic physics, space science and medical applications.

We organize a one-week intense course the 7-11 April 2014, to train PhD students, and more experienced researchers, in this area: http:/indico.lucas.lu.se/e/Geant4_Lund_2018

Teachers: Makoto Asai (Stanford), to be confirmed: Alberto Ribon (CERN), Marc Verderi (IN2P3/LLR), Vladimir Ivanchenko (CERN).

Course coordinator: Luis SARMIENTO PICO

Register for the course using the form at the URL above. Please also fill out the COMPUTE course registration form, which can be downloaded from http://cbbp.thep.lu.se/compute/index.php.

Geant4

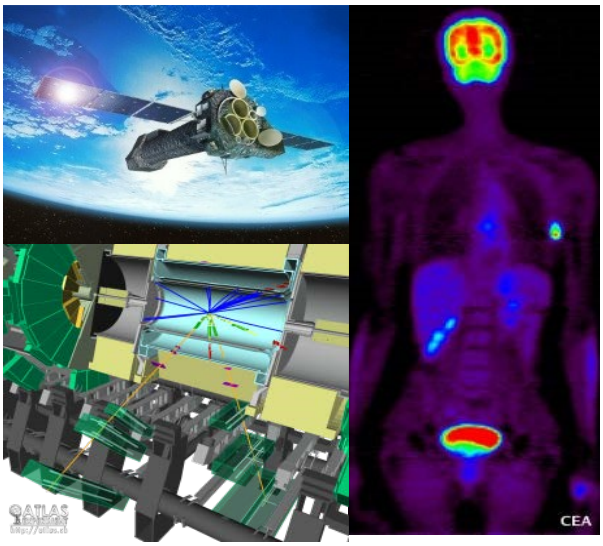
Geant4 is a toolkit for simulating the passage of particles through matter. It is the reference simulation engine in many areas.

Geant4 covers all relevant physics processes, electromagnetic, hadronic, decay, optical, for long and short lived particles, for energy range spanning from tens of eV to TeV scale. The transport of low energy neutrons down to thermal energies is also be handled. The software can also simulate remnants of hadronic interactions, including atomic de-excitation and provides extension to low energies down to the DNA scale for biological modelling.

The software is based on a sound object-oriented design which favours a variety of application development by the community, like for example the propagation of acoustic phonons in cryogenic crystals, the Geant4 Application for Tomographic Emission (GATE), the beam line simulation (G4BEAMLINE) and others

Applications

- Radiation shielding
- Calorimetry
- Cosmic rays
- Neutrino physics
- Dosimetry
- Radiotherapy
- Biological damage studies
- Particle Physics experiments and detector design
- Assessment of radiation damage to the electronics of satellites
- Study of the radiation environment of planets



Advantages

State-of-the-art physics models, regularly checked and validated against experimental data, combinable to achieve the highest simulation quality.

Support for complex 3D geometries such as the detectors of the LHC experiments and models in motion of the human body.

Geometry modeller able to efficiently track particles within complex geometries ranging from the molecular scale to the size of a planet.

Full description of materials making up specific setups in terms of their elements and isotopes.

Biasing techniques to reduce computational time for intensive applications including 'reverse Monte Carlo' techniques for concentrating the radiation effects on very small targets and a framework for combining detailed and fast/parameterised simulation.

Easily extendible and adaptable to external software frameworks.

Powerful user interface and visualisation engine.

Platforms

Geant4 is written in C++ and runs on Linux, Mac OS, and different types of UNIX flavours, 32 or 64 bits, and on modern parallel architectures.

User support is provided through the Geant4 website where documentation is available as well.

Interesting Links:

http://geant4.web.cern.ch

http://geant4.web.cern.ch/support/user_documentation

http://hypernews.slac.stanford.edu/HyperNews/geant4/cindex