Geant-val: a web application for validation of detector simulations

L. Freyermuth\textsuperscript{1, 2}, D. Konstantinov\textsuperscript{3}, G. Latyshev\textsuperscript{2}, W. Pokorski\textsuperscript{1}, A. Ribon\textsuperscript{1}

\textsuperscript{1}CERN, \textsuperscript{2}IHEP (Protvino, Russia), \textsuperscript{3}EISTI (Cergy, France)

Abstract

One of the key factors for the successful development of physics Monte-Carlo is to properly organize regression testing and validation. Geant4, the world-standard toolkit for HEP detector simulation, heavily relies on this activity. The CERN/SFT group, which contributes to the development, testing, deployment and support of the toolkit, is also in charge of running on a monthly basis a set of community-developed tests using the development releases of Geant4. We present the Web application geant-val developed for visualizing the results of these tests so that comparisons between different Geant4 releases can be made. The application is written using Express.js, Node.js and Angular frameworks, and uses PostgreSQL for storing test results. Test results are visualised using ROOT and JSROOT. In addition to pure visual comparisons, we perform different statistical tests (chi squared, Kolmogorov-Smirnov, etc) on the client side using Web Workers (JavaScript).

NodeJS/Express server

This server is the core of the geant-val system.
- Provides a web API:
  - allowing clients to access the database,
  - responding to the Angular app’s requests.
- Generates high quality plots on the fly using ROOT whenever they are requested.

Angular application

The main interface users will interact with:
- Allows statistical comparison of histograms to be performed.
- Allows visual comparison of plots:
  - using a selection menu.
  - using pre-defined templates.
- Clows produced plots in PNG, ROOT and EPS formats to be downloaded.

Statistical comparison

χ² and Kolmogorov-Smirnov statistical tests allows test results for different versions of Geant4 to be compared. The calculations are performed on the client side using JavaScript workers. χ²/NDF, χ² probability, KS Max(D) and KS probability are displayed.

User layouts

User-defined layouts can be used for fast visual validation of Geant4. Some predefined templates are already available in the application. User can define their own XML template to generate the plots and the layout they need.

Available tests

At the moment the project uses results produced by 11 tests. They are used for reference and stable release validation of Geant4.

Contact us:
geant-val-dev@cern.ch