Outline:

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  • Status of DoSSiER
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• Summary and conclusions
The Geant4 collaboration regularly performs validation and regression tests where results obtained with a new Geant4 version are compared to data obtained by various HEP experiments (validation) or the results of previous releases (regression). As the number of regularly performed validation tests increases and the collection of results grows, storing them and making them available to the collaborators and users community becomes a challenge. We decided to organize the materials in one central repository and to make this data easily available via a web application. Project is not unique to Geant4. GENIE is another example where DoSSiER will be used.
Provide guidance to experimenters and answers to questions like:

- What data is used to validate Geant4/GENIE/… physics?
- How well does the Geant4/GENIE/… simulation describe the data of interest for the experiment?
- Which model provided by Geant4/GENIE best describes the data of interest for the experiment?
- What are the benefits of switching to the latest version of Geant4/GENIE/…?
- What systematic uncertainties are involved?
Requirements

- Modern look, meaningful search, easy to navigate menus.
- Based on modern internet technology and industry standards.
- Secure!
- Provide repository:
  - to store experimental validation data as raw data,
  - to store simulation results as raw data and as static plots.
- Provide display web-application which:
  - allows to select and overlay compatible tests,
  - allows to overlay experimental data,
  - allows automatic upload into repository,
  - allows to display static images,
  - provides search functions and easy navigation.
- Provide REST-ful Web service which:
  - allows programmatic access to the data
Components:

- **Validation Database**
- **Connection Pool**
- **JAVA_API**
- **Web Application**
- **Web Service**
- **Glassfish**
- **PostgreSQL**
- **Clients:**
  - C++
  - Java
  - Python
  - ...

- **C++ API**
  - Direct or via web service
- **C++ Client**

- **Web Browser**

**Fermilab**

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Hans Wenzel  ICHEP August 3 – 10, 2016 Chicago
## Choice of technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PostgreSQL</td>
<td>Open source relational data base, hosted by Fermilab data base group.</td>
</tr>
<tr>
<td>Glassfish</td>
<td>Web Application server hosted on fermicloud</td>
</tr>
<tr>
<td>Primefaces JSF</td>
<td>(Java Server Faces) based framework to create modern looking web pages and easy to navigate menus.</td>
</tr>
<tr>
<td>NetBeans</td>
<td>Integrated Development Environment</td>
</tr>
<tr>
<td>Java</td>
<td>Java programming language, JAVAAE, JAX-RS</td>
</tr>
<tr>
<td>Google Charts</td>
<td>JavaScript library used to create interactive graphs</td>
</tr>
</tbody>
</table>
Meta data to classify a result

\( n \) (500 MeV) \[ \rightarrow \] \( p \)

**Beam:** mono energetic neutrons  
**Target:** Carbon.  
**Secondary:** protons.  
**Observable:** differential cross section  
**Reaction:** particle production  
**MC detail:** e.g. BIC, geant4.10.1.p02

In addition parnames/parvalue pairs can be added

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**Example:** \( n \) induced \( p \) production

**Note:**  
- Values for metadata stored in dictionaries:  
  (Beams, Materials, Particles, Observable, Reaction, MC details…).  
- Meta data used to match experimental and simulated results.  
- Complicated Beams (e.g. neutrino flux files, test beams consisting of many particles can be described by the schema).  
- Ditto for Materials (e.g. Target test beam Calorimeter).  
- Dictionaries can evolve as needed.
Ancillary Tools

A set of stand-alone python based tools, integrated with DoSSiER are being developed to:

- allow for interaction from command-line or in applications with validation data.
- perform comparisons between results and simulations independently of web-application.
- integrate DoSSiER into Geant4 semi-automatic testing.

Focus is on simple and portable command line applications
Conversion and Statistical Testing Tool

Conversion Tool:
Python program to read and convert histograms from/to different formats: ROOT, ASCII, JSON
- Download from and upload to DoSSiER
- Inspect and interact with histograms (matplotlib)
- CLI (script integration) or API (integration in python programs) are available

Actions:
- Upload*
- Download
- Convert
- Save*
- Plot

* Not yet available

Supported Formats
- ROOT
- CSV

StatTest:
Performs automatic statistical testing on two histograms
- e.g.: reference from DoSSiER against Geant4 application

Output of StatTest is a simple “flag”: Passed/Failed/NeedsAttention
Status: G4WebAppNG (predecessor of DoSSiER)

Can be found at the following URL:
http://g4validation.fnal.gov:8080/G4WebAppNG/
This allows to select Geant4 simulation results of interest, and to compare them to the experimental data as applicable. Shown on the right is neutron induced deuteron (default selection).

Different Models:
• BIC(blue),
• Bertini (red)
• INCL++(magenta)
• Experimental Data (green)
G4WebAppNG: Experimental data Browser

In addition to showing data as plots, one can select "Display data table", to extract the data in a tabulated form that is easy to cut and paste.
Currently:

- Based on new JAVA API and database schema.
- Can display exp. Data.
- Displays dictionaries.
- Displays statistics.
- Allows uploads using json/xml file formats.

But many features still missing, need porting from prototype (G4WebAppNG).
The Web service

- Based on: Java API for REST-ful (Representational State Transfer) Services (JAX-RS)
- Deployed on the development server: [http://g4devel.fnal.gov:8080/DoSSiER_WS/json/result/181](http://g4devel.fnal.gov:8080/DoSSiER_WS/json/result/181)
- Allows to programmatically retrieve results in json or xml format (with dictionaries expanded or not) these are the same formats used for uploads!
- C++ clients already used by selected Geant4 validation jobs!
- Planned:
  - Search functions like in INSPIRE/SPIRES.
  - Programmatic upload to database.
Summary and Conclusions

- **DoSSiER:** Database of Scientific Simulation and Experimental Results is actively being developed with participation by Geant4 groups at CERN, Fermilab and SLAC.
- GENIE group is providing input and requirements.
- Experimental data and results from simulation (Geant4, GENIE) are stored in a relational database.
- Data can be imported and exported using json/xml formats. (scripts are provided to extract data from root files or ASCII tables and convert to json/xml.)
- Web application:
  - allows to select and search.
  - allows to overlay experimental and simulated data.
  - authentication is necessary to have access to internal data and functions (e.g. upload, edit, delete).
- Web service: allows to programmatically access the repository.
Backup
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