CBM Geometry Database

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Geometry Database Requests

• Store and retrieve the geometry of the CBM modules in TGeo format (binary);

• No need to be more granular (within module geometry)
  – typical size of ROOT file is small (several 10 kB);

• Two-dimensional versioning (time, context);

• Manage setups (combinations of module geometries);

• Direct interface to CBMRoot for geometry building;

• High availability, good performance for online access (during CBMRoot run);

• Possibility to create a full TGeo file for a given setup (for offline use). Can be also realized within CBMRoot;

• Modular access patterns (read/write) on group/user levels.
Geometry Database

Geometry Database is the information system to:

- store the modules of CBM;
- load the geometry modules for setup construction;
- construct setup from the stored modules;
- support different versions of setup.
Geometry DB. User Requirements

Basis for Geometry DB development:

*User Requirements Document of Geometry DB for the CBM experiment*

Basic definitions

Geometry Module
File in ROOT format with content of detector geometry

Setup Module
Geometry module, link to the mother geometry module, its placement in the mother module (transformation matrix or object of class TGeoMatrix)

Setup
Combination of setup modules which represents the full CBM geometry
Setup Structure

- **Setup**
  - **CAVE**
  - **Root file (i)**
  - **Transformation matrix (i)**
  - **Additional files**
    - **Field**
    - **Materials**
  - **Setup modules**
    - MVD
    - Magnet
    - STS
    - Beam pipe
    - Rich
    - Much
    - TRD
    - TOF
    - PSD
Users

- **Lead Developer**
  coordinator and responsible person for the entire CBM geometry

- **Developer**
  the responsible developer for one of modules

- **CBM user**
  CBM user can only read data. CBM user can be a human using GUI or an application using API
Permissions inheritance of roles

**Lead Developer:**
- Add/Edit/Approve/Delete Setup;
- Add/Edit/Delete Field;
- Add/Edit/Delete Material.

**Developer:**
- Add/Edit/Delete Geometry Module;
- Add/Edit/Delete Setup Module.

**User:**
- Load Geometry;
  - Download Geometry;
  - Web View.
## Status of development

### Operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Geometry</td>
<td>Implemented</td>
</tr>
<tr>
<td>Download Geometry</td>
<td>Implemented</td>
</tr>
<tr>
<td>Web View</td>
<td>Implemented</td>
</tr>
<tr>
<td>Add/Edit/Delete Geometry Module</td>
<td>Not Implemented</td>
</tr>
<tr>
<td>Add/Edit/Delete Setup Module</td>
<td>Not Implemented</td>
</tr>
<tr>
<td>Add/Edit/Delete Setup</td>
<td>Partially Implemented</td>
</tr>
<tr>
<td>Approve Setup</td>
<td>Partially Implemented</td>
</tr>
<tr>
<td>Add/Edit/Delete Field</td>
<td>Not Implemented</td>
</tr>
<tr>
<td>Add/Edit/Delete Material</td>
<td>Not Implemented</td>
</tr>
</tbody>
</table>
Component Diagram

Server Host
- Web-server
- DBMS PostgreSQL
- Central GeometryDB

CBMRroot
- Local GeometryDB (read only)

Update

TCP/IP

Lead Developer

Developer

CBM User
The implementation of GUI and API

All type of Users can view the information from Geometry Database. **Lead Developer** and **Developer** use Database to update data files corresponding to any object of Geometry DB. They can use:

- **GUI (Graphical User Interface)** - supported through Web-Server that is implemented by Apache server and PHP scripts.

- **API (Application Programming Interface)** - implemented as macros of the ROOT environment. Any macro can be used as executable file or can be called from other ROOT macros. There are 2 types of macros: **Upload** and **Download**.
Web-interface View Mode.

### Available Setups

<table>
<thead>
<tr>
<th>Tag</th>
<th>Date</th>
<th>Description</th>
<th>Status</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>sis100_electron</td>
<td>2016-06-23</td>
<td>sis100_electron test</td>
<td>Created</td>
<td>evgeny</td>
</tr>
<tr>
<td>sis7888999</td>
<td>2016-11-22</td>
<td>test test</td>
<td>Created</td>
<td>superuser</td>
</tr>
</tbody>
</table>

### Setup Details

**Setups:**

- sis100_electron

**Tags:**

- v15a
- v141
- mvd_v15a
- rich
- trd
- tof
- psd
- Field Mvd
- Material

**Field:**

- v12b

### Transformation Details

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Scale</th>
<th>Translation</th>
<th>File Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 010 001</td>
<td>1,1,1</td>
<td>0,0,0</td>
<td>v15a</td>
</tr>
</tbody>
</table>

**Field Tag:** v12b
Web-interface. Edit Mode.

Edit Admin Interface

Selection for Edit Admin

Edit Setup
To configure and edit setup.

Edit Material
To configure and edit material.

Edit Field
To configure and edit field.

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Form for Setup Compiling
Web-interface. Setup Compilation.
Upload Type Macros

API is implemented as macros of the ROOT environment.

*Upload* type macros can be used by **Lead Developer** and **Developer** to load the geometry into the Central Geometry DB according to access privileges.
Download Type Macros

*download* macros are used by CBM users to obtain information about existing Setups and to load the needed Setup from Local Geometry DB into the memory of applications.

```
$root -b -q 'getSetupList.C("test2.db")'
```

Setup list:

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</thead>
<tbody>
<tr>
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<td>23.06.2016</td>
<td>evgeny</td>
<td>desc sis100_electron</td>
</tr>
</tbody>
</table>
Load Setup Macro

gROOT->LoadMacro("loadSetup.C");
loadSetup("sis100_electron");
Conclusion and Next Steps

- Geometry DB for storing and retrieving the geometry of CBM modules is developed in PostgreSQL DBMS
- Most of GUI (Graphical User Interface) tools were implemented
- Most of API (Application Programming Interface) tools as a set of ROOT macros (Upload and Download) were implemented

- To develop GUI and API:
  - Approve Setup
- To upgrade GUI:
  - Add/Edit/Delete Geometry Module
  - Add/Edit/Delete Setup Module
  - Add/Edit/Delete Field
  - Download Geometry
- Improve web-interface