

# Experience of the Development of the Geometry Database for the CBM Experiment

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## *Motivation*

- Variety of detector modules;
- Flexibility: combine different modules for different setups (e.g., sis100\_electron, sis100\_muon);
- Evolution of geometries and variants in particular in the design and construction phase of the experiment;
- The same module can be used in different contexts / setups with different placements;
- Necessity to administer this variety and flexibility and the evolution of geometries in a fail-safe, reproducible and transparent way.

## *Tasks*

- Store the modules of CBM;
- Load the geometry modules for setup construction;
- Construct setup from the stored modules;
- Show the CBM setup;
- Support different versions of setup.

# Basic Definitions

## Geometry Module

File in ROOT format with content of detector geometry

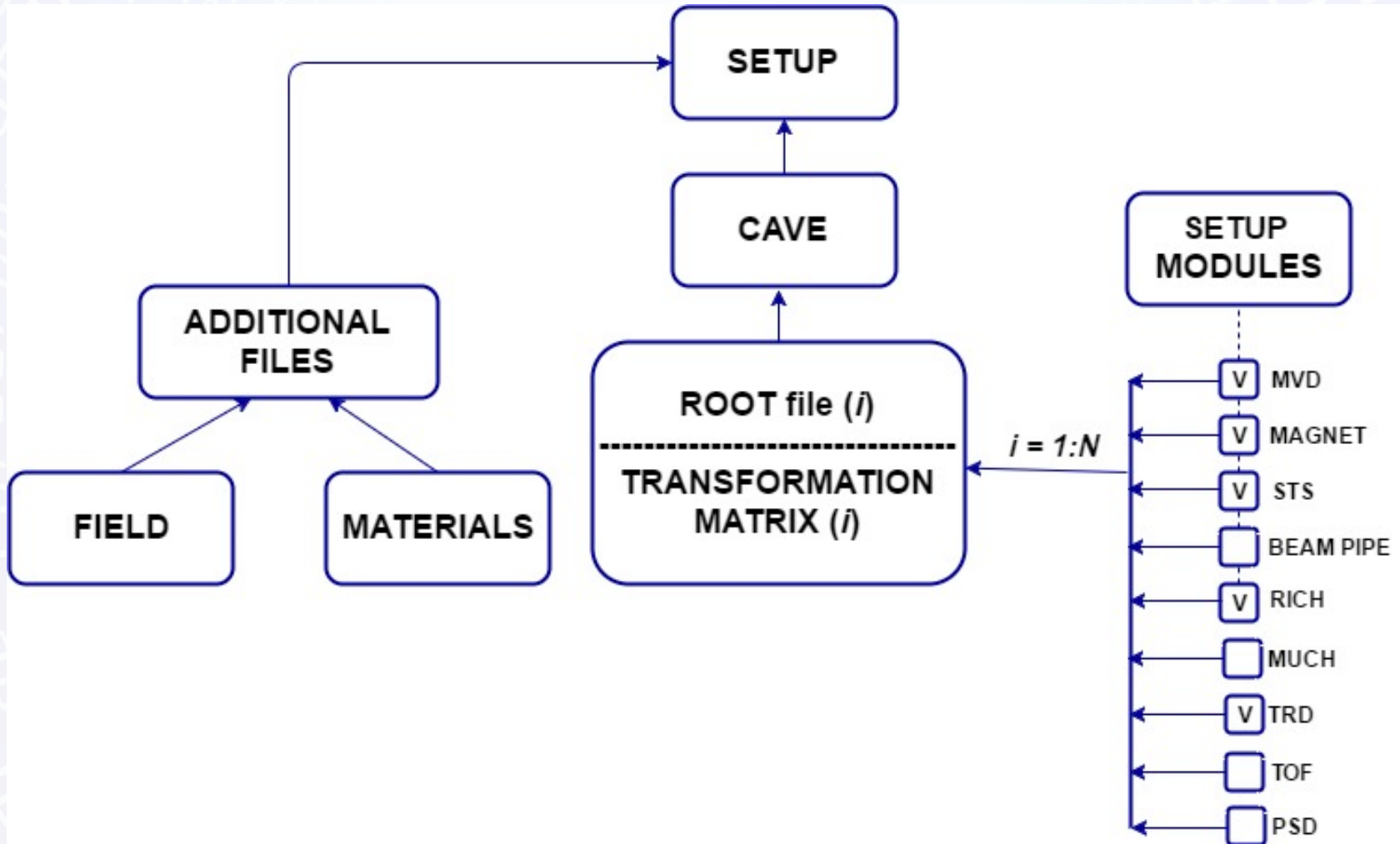
## Setup Module

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

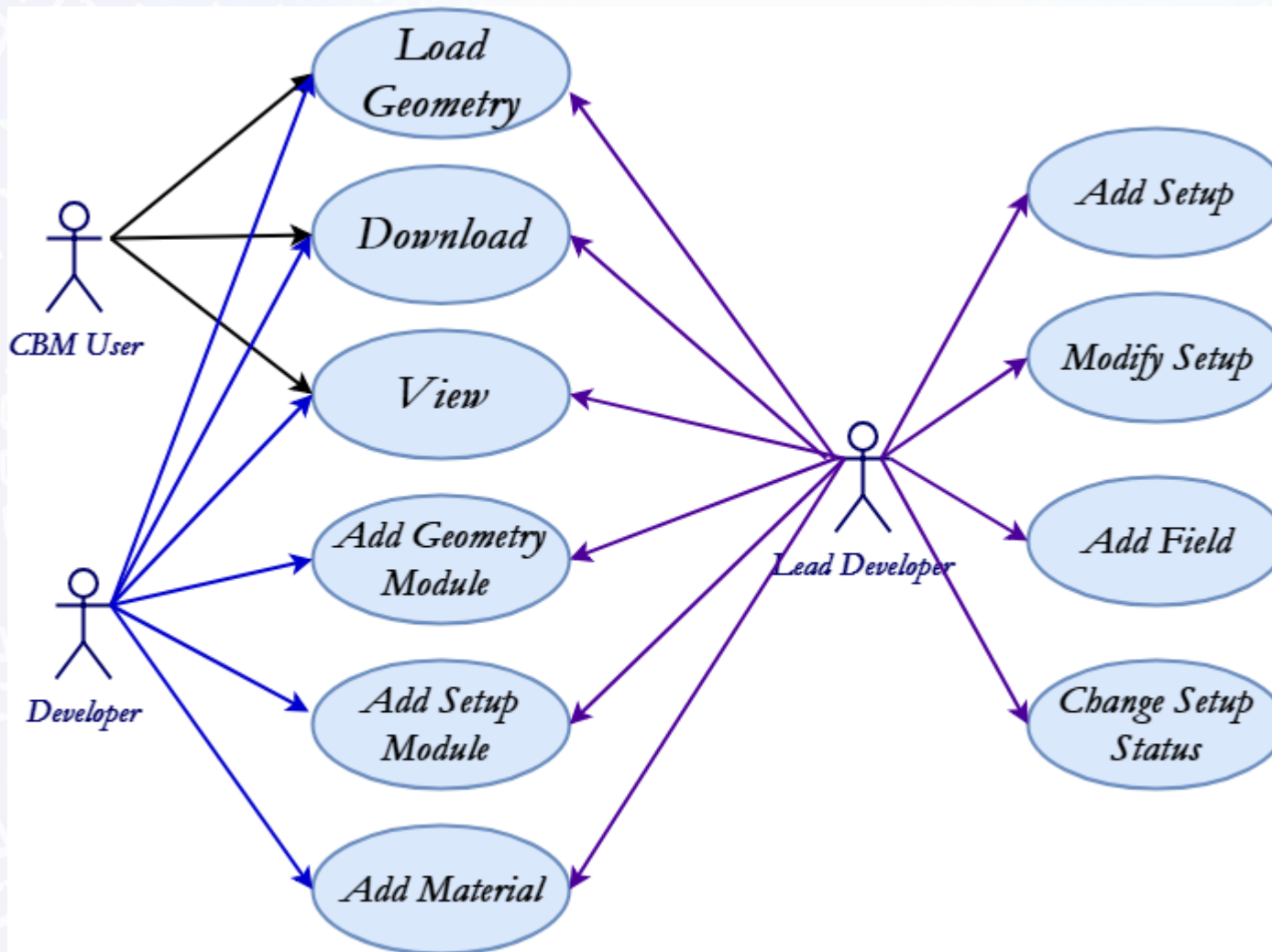
## Setup

Combination of setup modules which represents the full CBM geometry

# Setup Structure



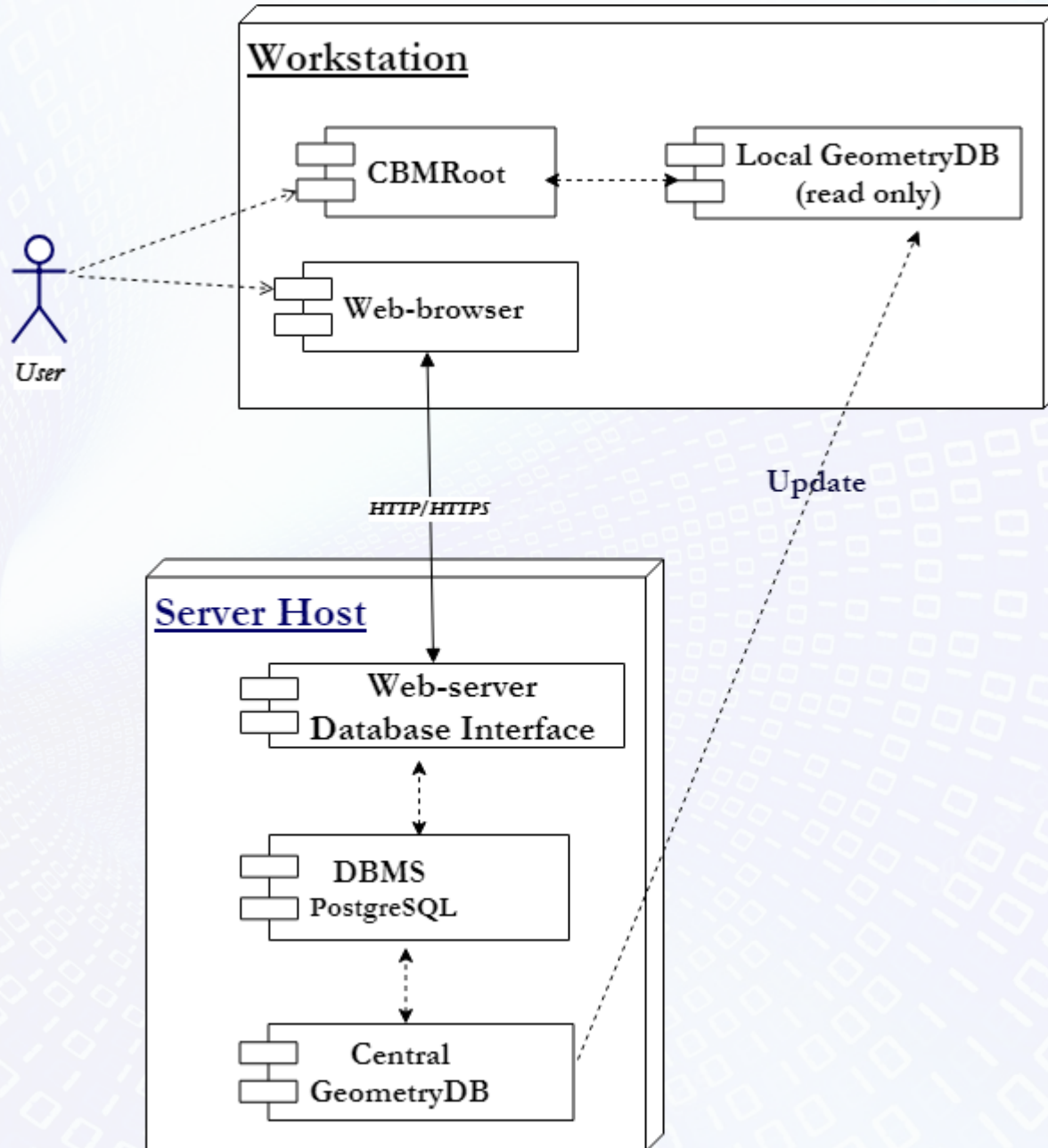
# Geometry Database. Use Cases



The Geometry DB is used:

- to provide interfaces to view, retrieve and update modules and setups
- to store setups as combination of setup modules, magnetic fields and materials
- to store setup modules as ROOT files and Transformation matrix

# Component Diagram



# The implementation

- **GUI (Graphical User Interface)** implemented as Web-interface.
  - View;
  - Edit;
  - Download.
- **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.

# Web-interface. Configure Access

[Configure WebAccess](#)

Code	Name	Actions	Users
LDV	Lead Developer	Full Set	<a href="#">Grant / Revoke</a>
CBM	CBM User	Read Only	<a href="#">Grant / Revoke</a>
DVP	Developer	MVD	<a href="#">Grant / Revoke</a>
DVP	Developer	PIPE	<a href="#">Grant / Revoke</a>
DVP	Developer	STS	<a href="#">Grant / Revoke</a>
DVP	Developer	RICH	<a href="#">Grant / Revoke</a>
DVP	Developer	MAGNET	<a href="#">Grant / Revoke</a>
DVP	Developer	TRD	<a href="#">Grant / Revoke</a>
DVP	Developer	TOF	<a href="#">Grant / Revoke</a>
DVP	Developer	PSD	<a href="#">Grant / Revoke</a>
DVP	Developer	PLATFORM	<a href="#">Grant / Revoke</a>

Connect user to role Developer

Select user:

Connected users to role Developer MVD:  
are absent!

Found 2 matching users:

ID	email	Developer/PIPE/
3	axion2rv@gmail.com	<a href="#">Revoke</a>
15	wwq21@yyyyyy.com	<a href="#">Revoke</a>

**WebAccess Admin**

**Selection for WebAccess Admin**

**Role Area** - To configure administration rights and authorization rules.

**User Area** - To configure administration rights for the users.

**Manage Accounts** - To manage user accounts

**Accounts Overview**

**Create New Account**

**Edit Account**

User Administration

Enter part of the user Nickname or Email:

Found 5 matching users:

ID	email	Nickname	Role
1	fia@jinr.ru	adms	<a href="#">show details</a>
4	aleksand@jinr.ru	susu	<a href="#">show details</a>
10	axion2rv@gmail.com		<a href="#">show details</a>
12	fira@cv.jinr.ru		<a href="#">show details</a>
14	ivanov@jinr.ru	Ivanov	<a href="#">show details</a>

Roles connected to user *aleksand@jinr.ru*:

Code	Name	Actions	Role
LDV	Lead Developer	Full Set	<a href="#">Revoke</a>
CBM	CBM User	Read Only	<a href="#">Revoke</a>
			<a href="#">Grant</a>



# Web-interface. View Mode



## Available Setups

- View Setups
- View Setup Modules
- View Files
- View Materials
- View Fields
- Download GeometryDB

Tag	Date	Description	Status	Author	Download
fake_setup_test1	2018-01-31	Fake setup as test setup object.	Approved	alexand@jinr.ru	
test2 setup	2018-02-01	rrr	Approved	alexand@jinr.ru	
sis100_electron	2018-03-07	sis100_electron	Approved	aleksand@jinr.ru	

	Tag	Date	Status	Author	Description
Setup	test2 setup	2018-02-01	Approved	alexand@jinr.ru	rrr

	Tag	Date	Author	Description
sts	STS fake_test1	2018-01-30	alexand@jinr.ru	Fake test root file for sts
Field	v12b	2017-11-30	aleksand@jinr.ru	Field for sis100_electron
Material	MATERIAL_test1	2018-01-30	alexand@jinr.ru	

### Field Tag: v12b

X	Y	Z	Scale
0.000	0.000	40.000	1.000

# Web-interface. Edit Mode

**Available Setups**

Tag	Date	Description	Author	Status	Last Modified	Admin Tools
mytest	2018-03-14	test! abc <input type="text"/> OK!	fia@jinr.ru	Approved		
sis100_electron	2018-03-07	test! abc <input type="text"/> OK!	aleksand@jinr.ru	Approved		
test_002	2018-06-06	Test setup again <input type="text"/> OK!	fia@jinr.ru	Created		
test_001	2018-03-15	test! <input type="text"/> OK!	fia@jinr.ru	Created	2018-06-06	

Cancel

Please, enter new value for tag:

- Delete this setup: *make this setup unavailable for usage*
- Approve this setup: *change the status to Approved*
- Modify this setup: *go to modification form*

## Edit Admin Interface

### Selection for Edit Admin

- Edit Setup**  
To configure and edit setup.
- Edit Material**  
To configure and edit material.
- Edit File**  
To configure and edit file.
- Edit Field**  
To configure and edit field.
- Edit Setup Modules**  
To configure and edit Setup Module.

Go to the Form for Setup  
Compiling →

# Web-interface. Setup Compiling (Add New Setup)

Setup Tag:  
test\_003

Description:  
description for test\_003

Author:  
fia@jinr.ru

## Available Setup Modules

Type	Tag	Date	Author	File Tag	Transformation	Translation	Parent	Description	
<input checked="" type="radio"/>	sts	v16x	2017-12-21	aleksand@jinr.ru	v16x_file	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 65.000	cave	use STS v16x as new default, see issue #647
<input type="radio"/>	sts	STS_fake_test1	2018-01-30	alexand@jinr.ru	root_fake_file_sts_t	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 0.000	cave	Fake STS module for test

## Available Fields

Tag	Date	Author	X	Y	Z	Scale	Description	
<input checked="" type="radio"/>	v12b	2017-11-30	aleksand@jinr.ru	0.000	0.000	40.000	1.000	Field for sis100 electron
<input type="radio"/>	TESTER	2018-04-02	fia@jinr.ru	1.000	1.000	1.000	2.000	terter description
<input type="radio"/>	v13b	2018-04-02	fia@jinr.ru	2.000	2.000	2.000	3.000	new field
<input type="radio"/>	TESTER2	2018-04-02	fia@jinr.ru	2.000	2.000	3.000	5.000	dfsdfsdfs
<input type="radio"/>	34534534535	2018-04-09	fia@jinr.ru	1.000	1.000	1.000	1.000	trytrytrytrytry
<input type="radio"/>	34534534535	2018-04-09	fia@jinr.ru	1.000	1.000	1.000	1.000	test

## Available Materials

Tag	Date	Author	Description
<input checked="" type="radio"/>	1.10	2017-11-30	aleksand@jinr.ru // Revision 1.10 2006/09/12 07:27:58 kresan // media file for new TOF geometry
<input type="radio"/>	MATERIALTEST	2018-04-02	fia@jinr.ru MATERIALTEST_EDIT
<input type="radio"/>	MATERIAL_test1	2018-01-30	alexand@jinr.ru Test material, can not be used for real setup.EDIT

Cancel Add Setup

# Web-interface. Setup Modifying (Change the Selected Setup)

Setup Tag:  
test\_001

Description:  
test!

Author:  
fia@jinr.ru

## List of Setup Modules

Type	Tag	Date	Author	File Tag	Transformation	Translation	Parent	Description
sts	v16x	2017-12-21	aleksand@jinr.ru	v16x_file	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 65.000	cave	use STS v16x as new default, see issue #647
sts	STS_fake_test1	2018-01-30	alexand@jinr.ru	root_fake_file_sts_t	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 0.000	cave	Fake STS module for test
tof	v16a_1e_tof	2017-12-21	aleksand@jinr.ru	v16a_1e_file	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 0.000	cave	No any comments

## Available Fields

Tag	Date	Author	X	Y	Z	Scale	Description
v12b	2017-11-30	aleksand@jinr.ru	0.000	0.000	40.000	1.000	Field for sis100 electron
TESTER	2018-04-02	fia@jinr.ru	1.000	1.000	1.000	2.000	terter description
v13b	2018-04-02	fia@jinr.ru	2.000	2.000	2.000	3.000	new field
TESTER2	2018-04-02	fia@jinr.ru	2.000	2.000	3.000	5.000	dfsdfsdfs
34534534535	2018-04-09	fia@jinr.ru	1.000	1.000	1.000	1.000	trytrytrytrytry
34534534535	2018-04-09	fia@jinr.ru	1.000	1.000	1.000	1.000	test

## Available Materials

Tag	Date	Author	Description
1.10	2017-11-30	aleksand@jinr.ru	// Revision 1.10 2006/09/12 07:27:58 kresan // media file for new TOF geometry
MATERIALTEST	2018-04-02	fia@jinr.ru	MATERIALTEST_EDIT
MATERIAL_test1	2018-01-30	alexand@jinr.ru	Test material, can not be used for real setup.EDIT

Cancel Save Setup

# Macros

<i>Signature</i>	<i>Description</i>	<i>Call Example</i>	<i>Comment</i>
<code>void getSetupList();</code>	<b>Get the list of available setups.</b> Print the list of available setups including tag, date of creation, author and description parameters for each approved setup.	<code>getSetupList.c();</code>	Return the available setups' list
<code>bool loadSetup(const char* setupTag, const char* moduleName);</code>	<b>Load setup into the CBM ROOT framework.</b> The Geometry can be used in ROOT framework afterwards. Return FALSE if setup is not loaded, and TRUE if the loading is successful.	<code>bool res = loadSetup("sis100_ electron", "*");</code>	"*" – all setup modules to be loaded
<code>bool loadSetup(const char* setupTag, int moduleId);</code>	<b>Load setup into CBM ROOT environment by module Id</b> to load setup into the CBM ROOT framework. The Geometry can be used in ROOT framework afterwards. Return FALSE if setup is not loaded, and TRUE if loading is successful.	<code>bool res = loadSetup("sis100_ electron",-1);</code>	
<code>bool loadSetup(const char* setupTag, const char* moduleName, const char* xml);</code>	<b>Load setup into the ROOT environment.</b> Geometry can be used in the ROOT environment after this operation. User can use xml file in order to move any setup module during loading. Return false if setup was not loaded because of errors and true if load is successful.	<code>loadSetup("sis100_ electron", "*", "local.xml")</code>	xml file contains information on the setup modules and their shifts.

# Conclusion and Next Steps

Geometry DB prototype for storing and retrieving the geometry of CBM modules has been developed:

- DB (DBMS PostgreSQL, SQLite);
- GUI (Graphical User Interface) tools;
- API (Application Programming Interface) tools as a set of ROOT macros;
- Beta Testing.

- Continue filling DB
- Preparing to include into CBMRoot release

***Thanks for your attention!***