Geometry Database for the CBM Experiment

Akishina E.P.[1], Alexandrov E.I.[1], Alexandrov I.N.[1],
Filozova I.A.[1], Friese V.[2], Ivanov V.V. [1,3]

[1]JINR, Dubna
[2]GSI, Darmstadt
[3]MEPhi, Moscow

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Motivation

- Variety of detector modules
- Flexibility: combine the modules for different setups
- Each module can be located in different placement
- Evolution of geometries in accordance with the phases of experiments
- Administration of the geometries variety 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
- Support different versions of setup

Basic terms

Geometry Module

File in ROOT format with content of detector geometry

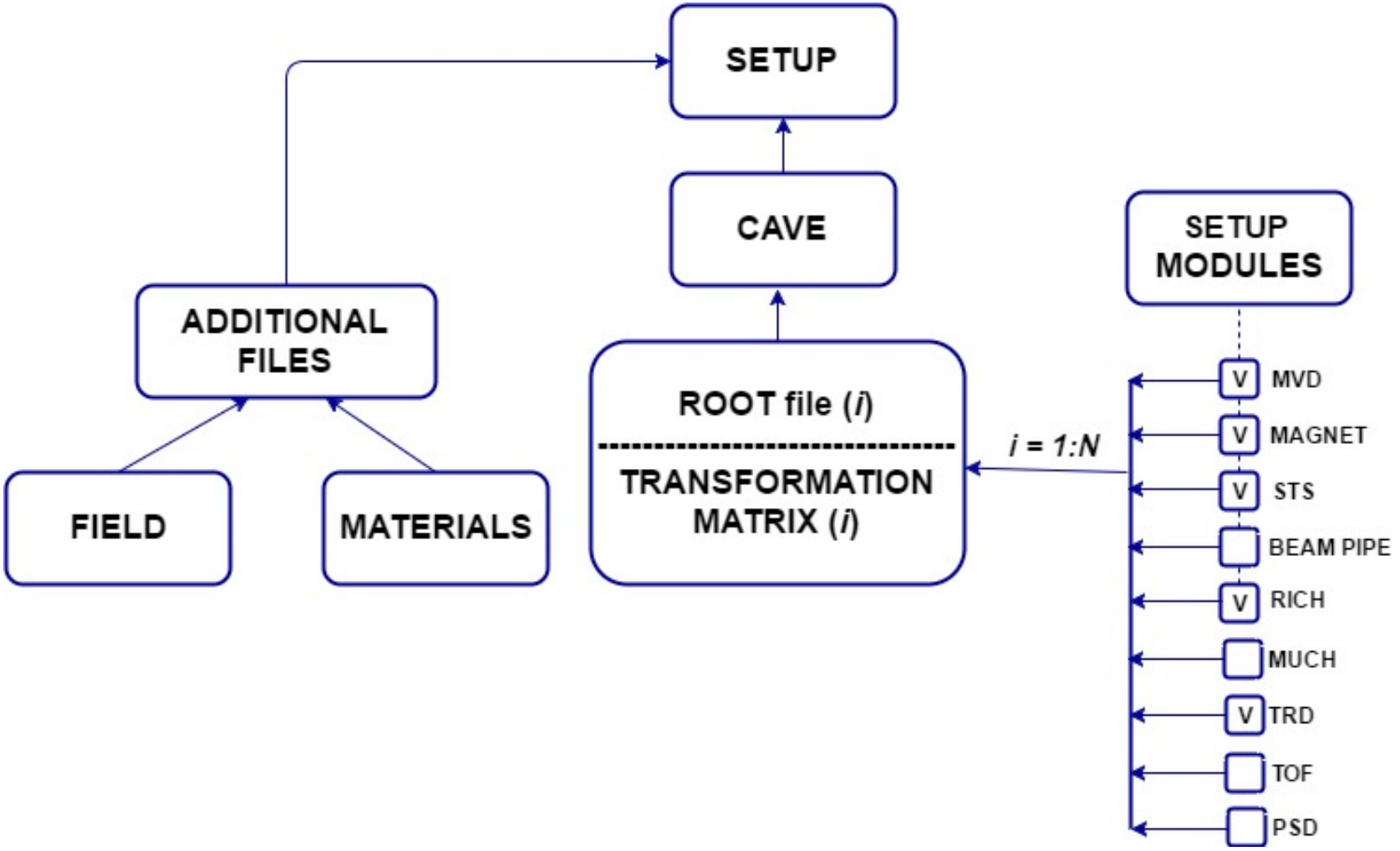
Setup Module

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

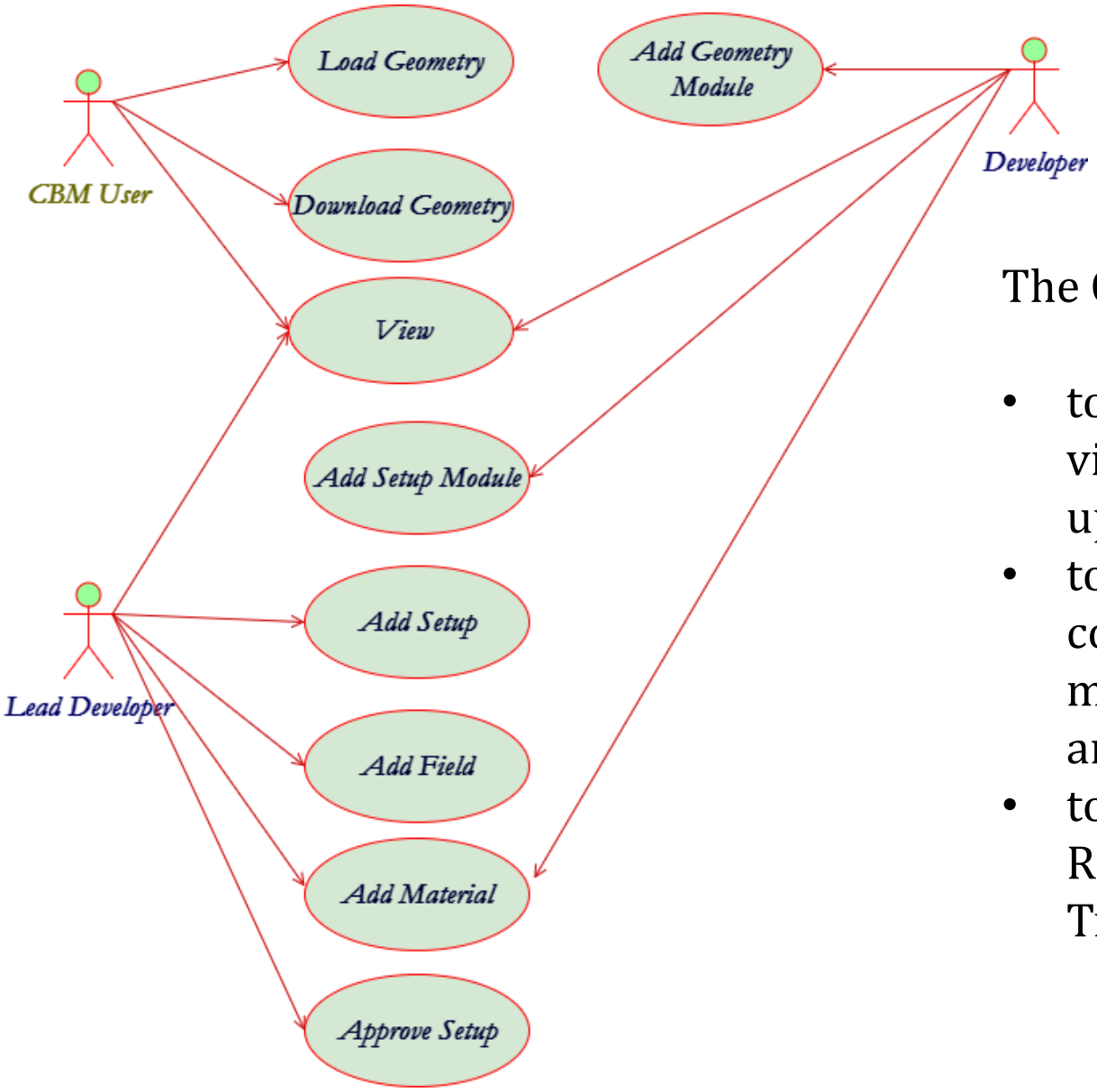
Setup

Combination of setup modules which represents the full geometry

CBM Setup Structure



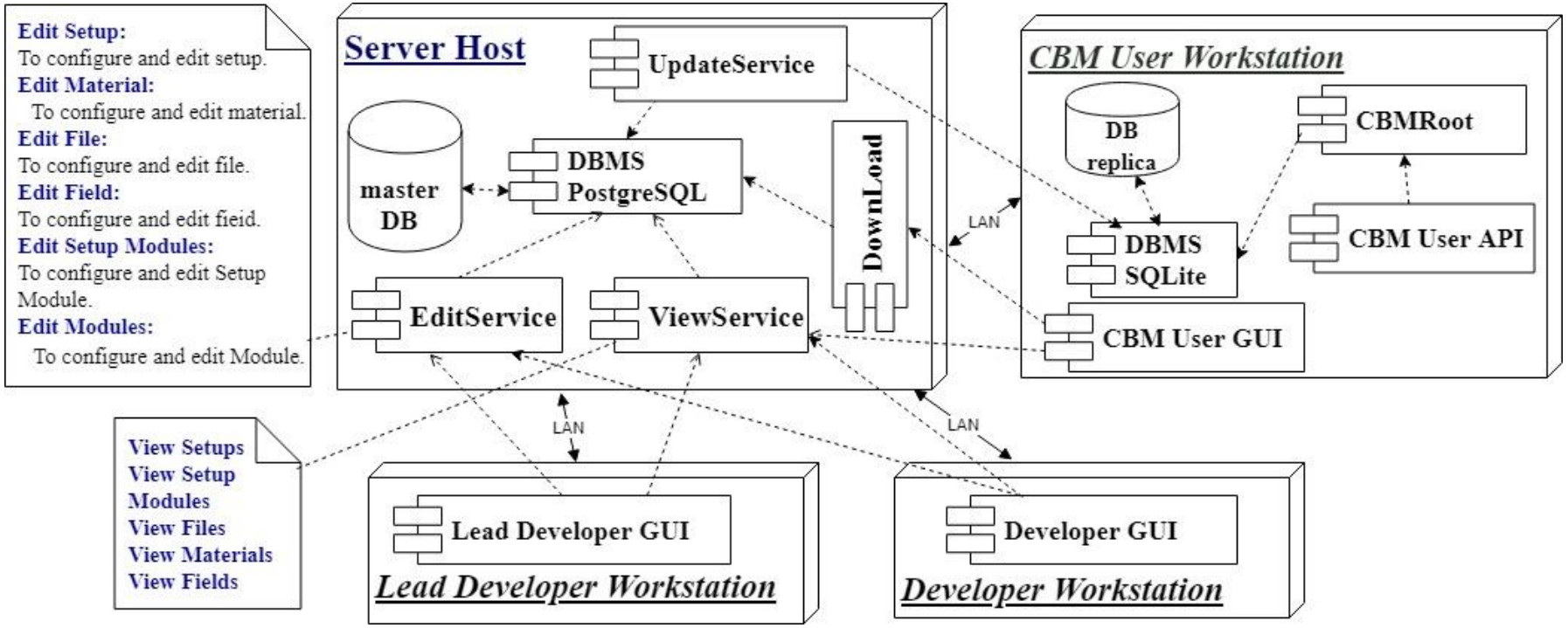
Geometry Database. Use Cases



The Geometry DB is used:

- to provide interfaces to view, retrieve, load 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.

Architecture of the Geometry DB

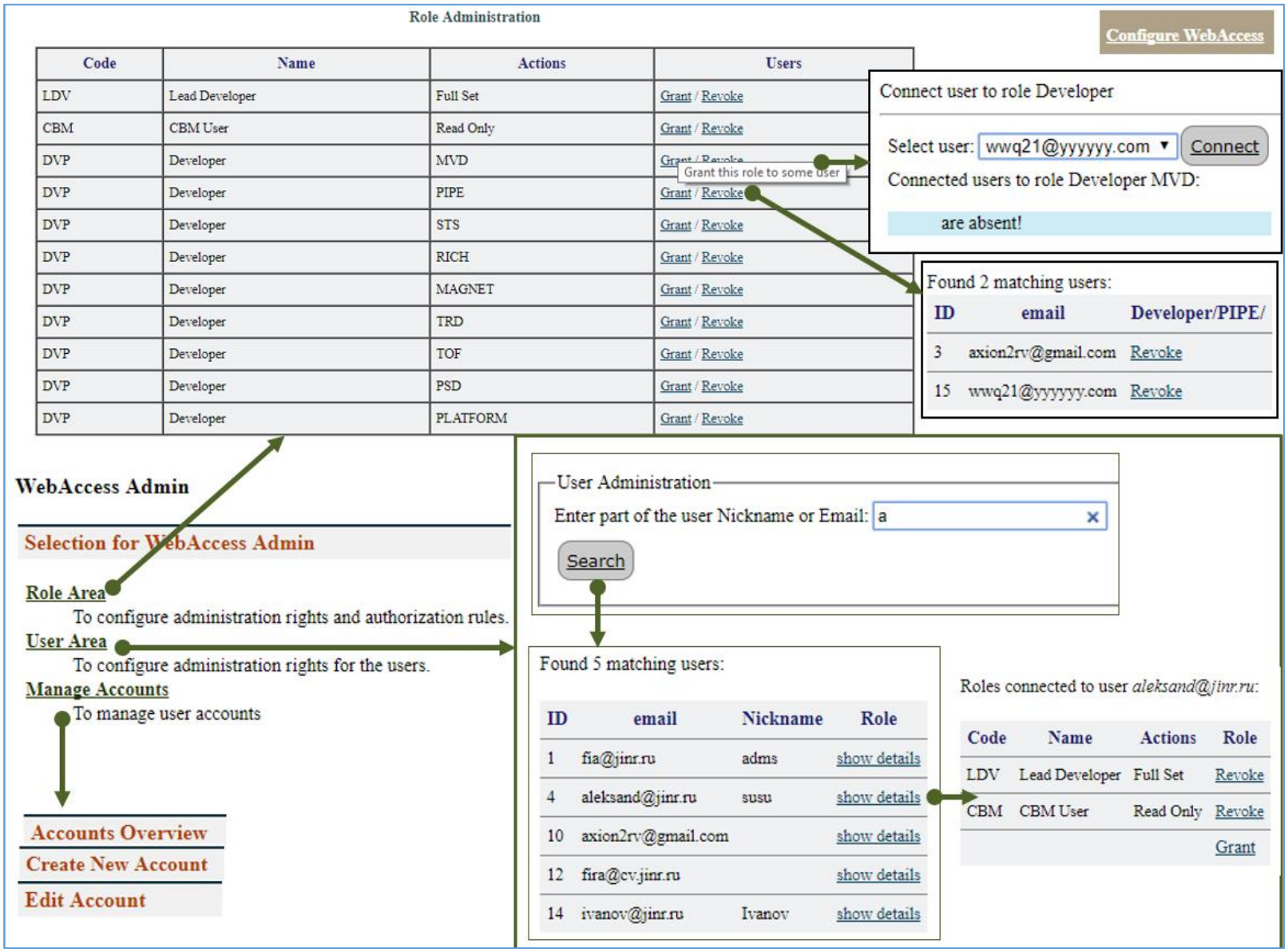


The implementation

- **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



Web-interface. View Mode

Available Setups

Tag	Revision	Date	Description	Status	Author	Download
sis100_electron	14985	2019-09-19	version 18.09.2019	Approved	aleksand@jinr.ru	
sis100_electron	2	2019-02-26	version 25.02.2019	Approved	aleksand@jinr.ru	
sis100_electron	1	2018-03-07	test! abc	Approved	aleksand@jinr.ru	

magnet	v18a	2019-09-19	aleksand@jinr.ru	unknown
pipe	v16b_1e	2017-12-21	aleksand@jinr.ru	Exists only old version description
mvd	v17a_tr	2019-02-26	aleksand@jinr.ru	v17a_tr_file
sts	v19a	2019-09-19	aleksand@jinr.ru	unknown
rich	v17a_1e	2019-02-26	aleksand@jinr.ru	v17a_1e
trd	v17n_1e	2019-02-26	aleksand@jinr.ru	v17n_1e
tof	v16c_1e	2019-02-26	aleksand@jinr.ru	v16c_1e
psd	v18e	2019-02-26	aleksand@jinr.ru	v18e
platform	v13a	2017-12-21	aleksand@jinr.ru	2016-05-19 - VF - Add platform module
Field	v18a	2019-09-19	aleksand@jinr.ru	sis100_electron 19.09.2019
Material	1.10	2017-11-30	aleksand@jinr.ru	

- √ View Setups
- View Setup Modules
- View Files
- View Materials
- View Fields
- Download GeometryDB
- User Guide

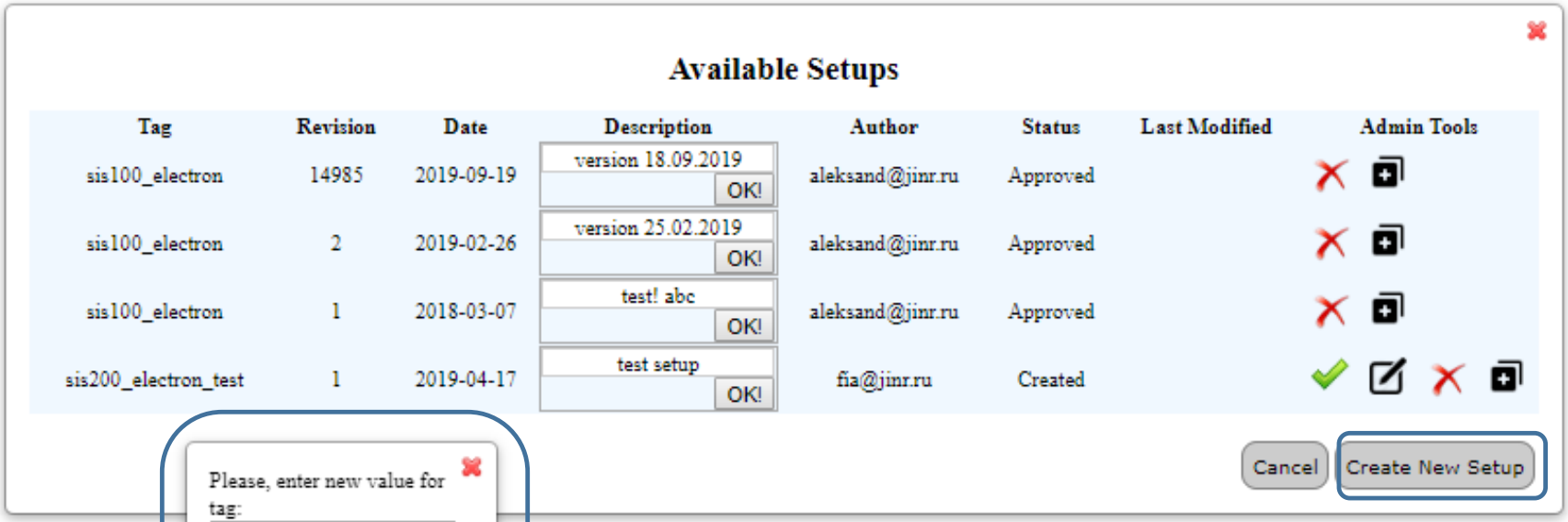
tof / v16c_1e

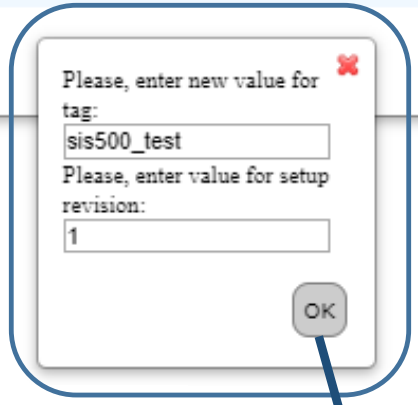
Transformation	Scale	Translation	File Tag
1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	1.000; 1.000; 1.000	0.000; 0.000; 0.000	v16c_1e_file

Field Tag: v18a

X	Y	Z	Scale
0.000	0.000	40.000	1.000

Web-interface. Edit Mode





Delete this setup: *make this setup unavailable for usage*

Approve this setup: *change the status to Approved*

Modify this setup: *go to modification form*

Make a copy of this setup: *go to modification form*

Edit Admin Interface

Selection for Edit Admin

√ **Edit Setup**
To configure and edit setup.

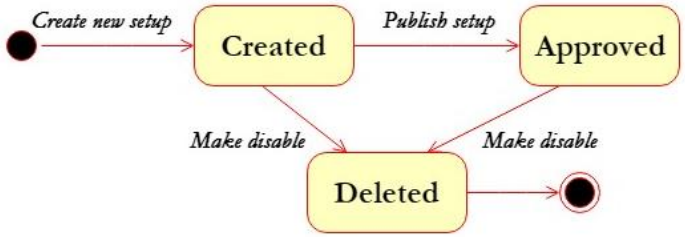
Edit Material
To configure and edit material.

Edit File
To configure and edit file.

Edit Field
To configure and edit fieid.

Edit Setup Modules
To configure and edit Setup Module.

Go to the Form for Setup Compiling →



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

Setup Tag: sis500_test

Revision: 1

Description:* test

Author: fia@jinr.ru

Available Setup Modules

- magnet
- pipe
- mvd
- sts

	Type	Tag	Date	Author	File Tag	Transformation	Translation	Parent	Description
○	sts	v16g	2019-02-26	aleksand@jinr.ru	v16g_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	v16g
○	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	v19a	2019-09-19	aleksand@jinr.ru	v19a_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	pipe	Unknown

- rich
- trd
- tof
- psd
- platform
- much

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
⊕	v18a	2019-09-19	aleksand@jinr.ru	0.000	0.000	40.000	1.000	sis100_electron 19.09.2019

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

Cancel | Add Setup

Web-interface. Creation of a new setup from existing

!Mode: Create a new setup from existing

Setup Tag: sis100_electron

Revision: 14987

Description:* version 18.09.2019

Author: aleksand@jinr.ru

List of Setup Modules

magnet

	Type	Tag	Date	Author	File Tag	Transformation	Translation	Parent	Description
○	magnet	v15a	2017-12-19	aleksand@jinr.ru	v15a_file	1.000 0.000 0.000 0.000 1.000 0.000 0.000 0.000 1.000	0.000 0.000 40.000	cave	magnet v15a is v12b with correct keeping volume hbvnb material
◉	magnet	v18a	2019-09-19	aleksand@jinr.ru	v18a_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	Magnet Unknown

pipe

	Type	Tag	Date	Author	File Tag	Transformation	Translation	Parent	Description
◉	pipe	v16b_1e	2017-12-21	aleksand@jinr.ru	v16b_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	magnet	Exists only old version description

Available Fields

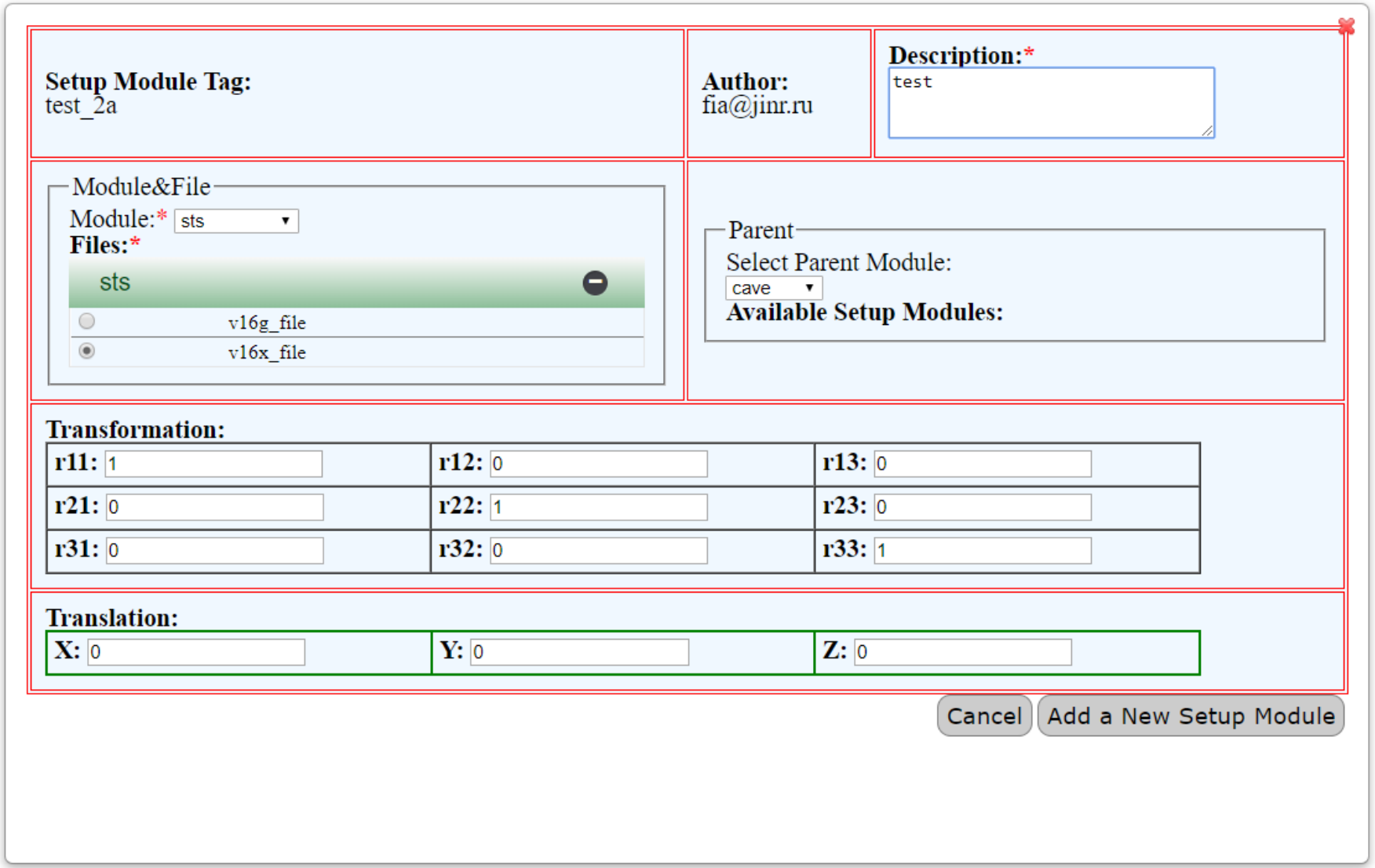
	Tag	Date	Author	X	Y	Z	Scale	Description
○	v12b	2017-11-30	aleksand@jinr.ru	0.000	0.000	40.000	1.000	Field for sis100_electron
◉	v18a	2019-09-19	aleksand@jinr.ru	0.000	0.000	40.000	1.000	sis100_electron 19.09.2019

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

Cancel Save Setup

Web-interface. Add/Edit Setup Module



Macros (1)

Signature	*Description*	*Call Example*	*Comment*
`void getSetupList();`	***Get the list of available setups.*** Print the list of available setups including tag, date of creation, author and description parameters for each approved setup.	getSetupList.c();	Return the available setups' list
bool loadSetup(const char* setupTag, const char* moduleName, long revision);	***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 the loading is successful.	bool res = loadSetup("sis100_electron", "*", 14985);	"*" – all setup modules to be loaded
bool loadSetup(const char* setupTag, int moduleId, long revision);	***Load setup into CBM ROOT environment by module Id*** 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.	bool res = loadSetup("sis100_electron",-1,-1);	Revision '-1' – get number of revision from local svn or last (if svn not exists).
bool loadSetup(const char* setupTag, const char* moduleName, long revision, const char* xml);	***Load setup into the ROOT environment***. 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.	loadSetup("sis100_electron", "*", -1,"local.xml")	xml file contains information on the setup modules and their shifts.

Macros (2)

Signature	*Description*	*Call Example*	*Comment*
bool loadSetupByURL(const char* setupTag, const char* moduleName, long revision, const char* url);	***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 the loading is successful.	bool res = loadSetupByURL("sis100_electron", "*", 14985, "http://cbmdb.jinr.ru/geometry/");	**Can load not improved setup**

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;
- Preparing to include into CBMRoot release;
- Beta Testing of CBM database.

- Continue filling the DB,
- Macros for installing DB.

Thanks for your attention!