Microservices for Systematic Profiling and Monitoring of the Refactoring

CERN

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LHCb

1. LHCbPR

LHCb Performance and **R**egression Tests (LHCbPR) - systematize profiling that helps developers to evaluate how their recent **code changes** behave in provided test cases for **different setup environments**.

Main use cases

- Physics performance
  - Histogram comparison
  - Trend analysis for selected attribute.
- Monitor regression in memory and CPU consumption

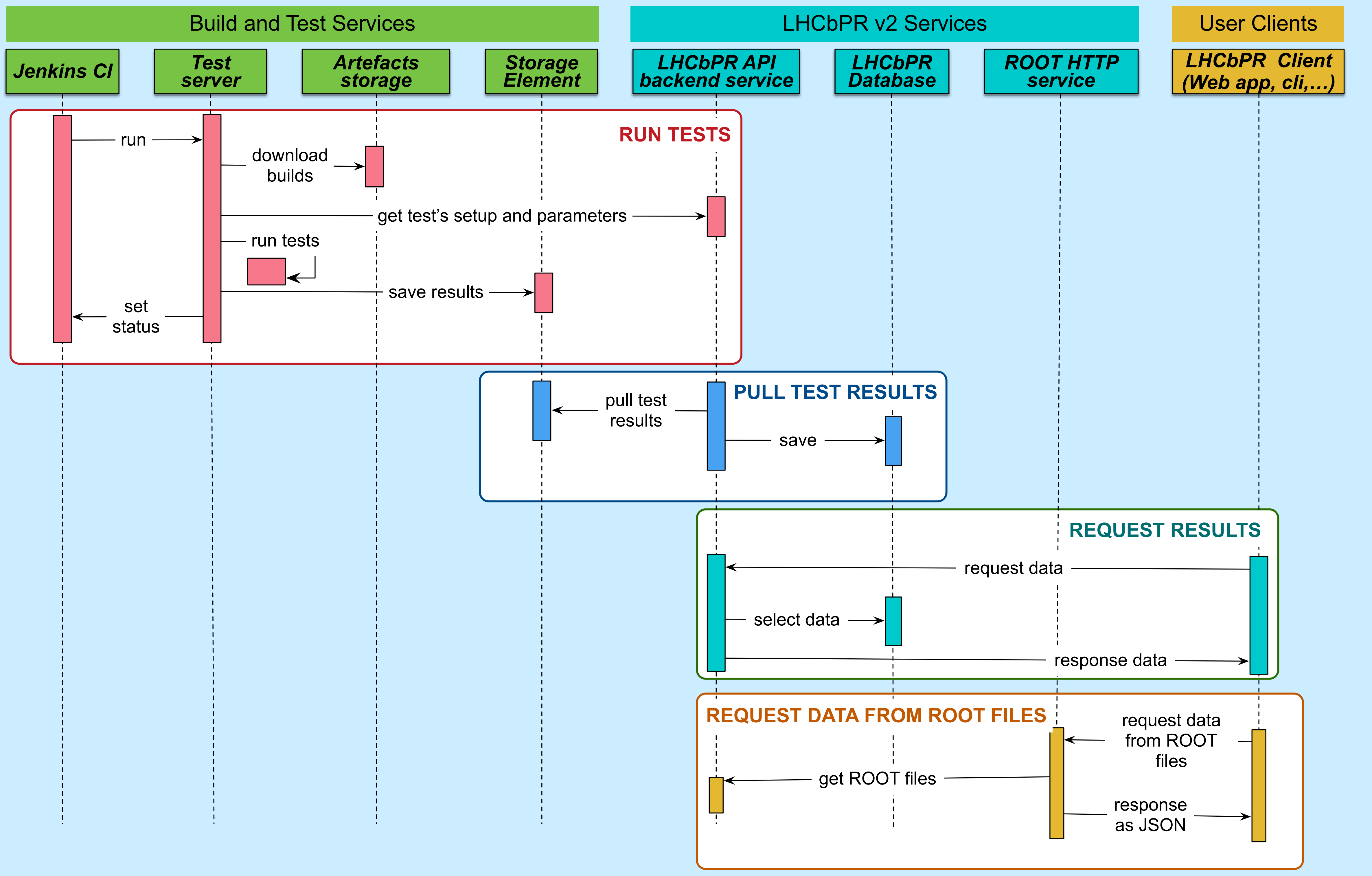
Possible setup environments

- Versions of application
- Compiler versions
- Operating Systems (SLC6, CentOS7)
- Architecture (x86_64, x86)
- Build system (CMT or CMake)

Example of regression tests matrix

	Geant v96r4	Geant v10r2
CMT	x	x
CMake	x	x
SLC6	x	x
CentOS7	x	x
X86_64 optimized	x	x
X86_64 debug	x	x

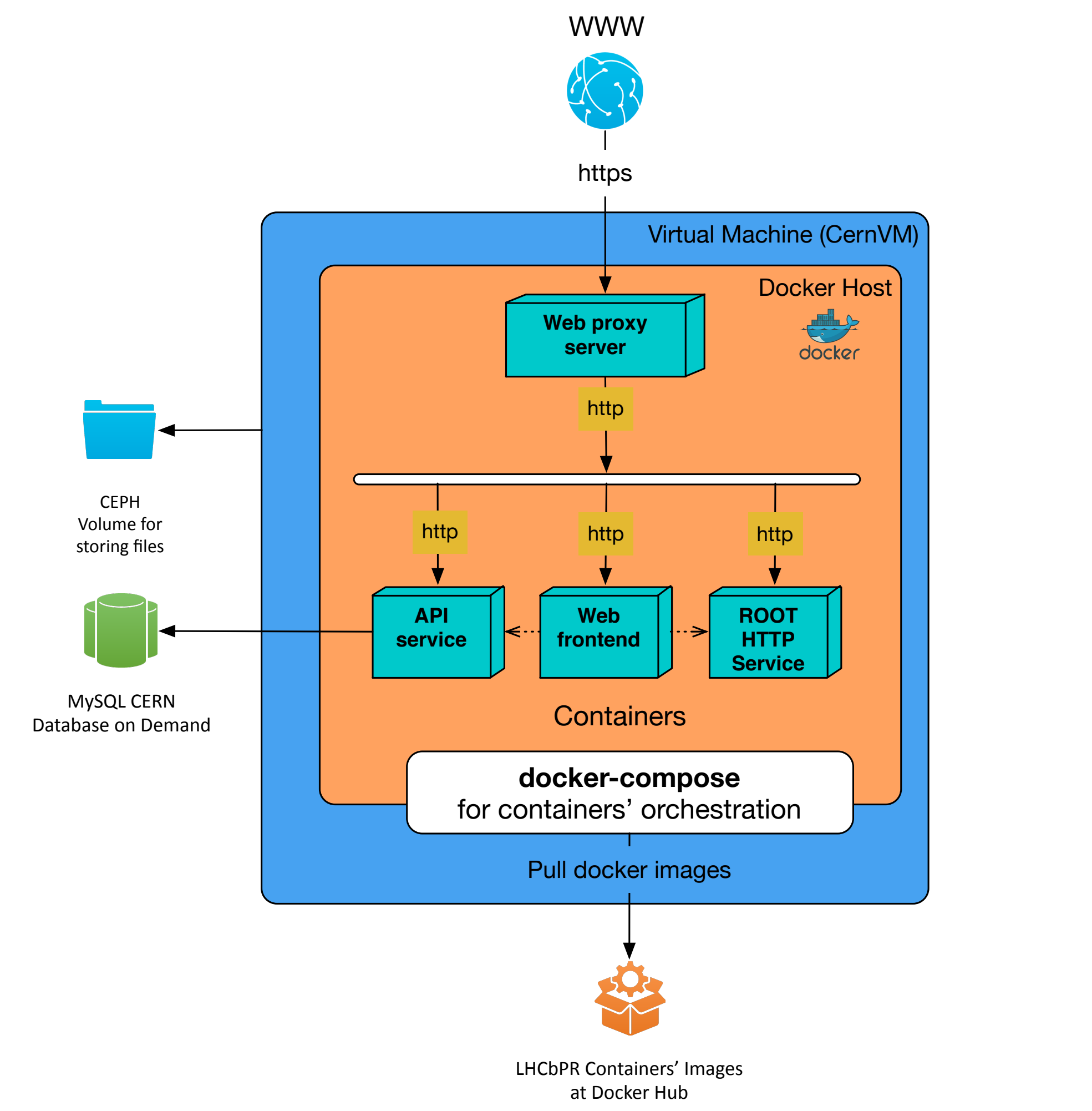
2. LHCbPR Workflows



3. Components

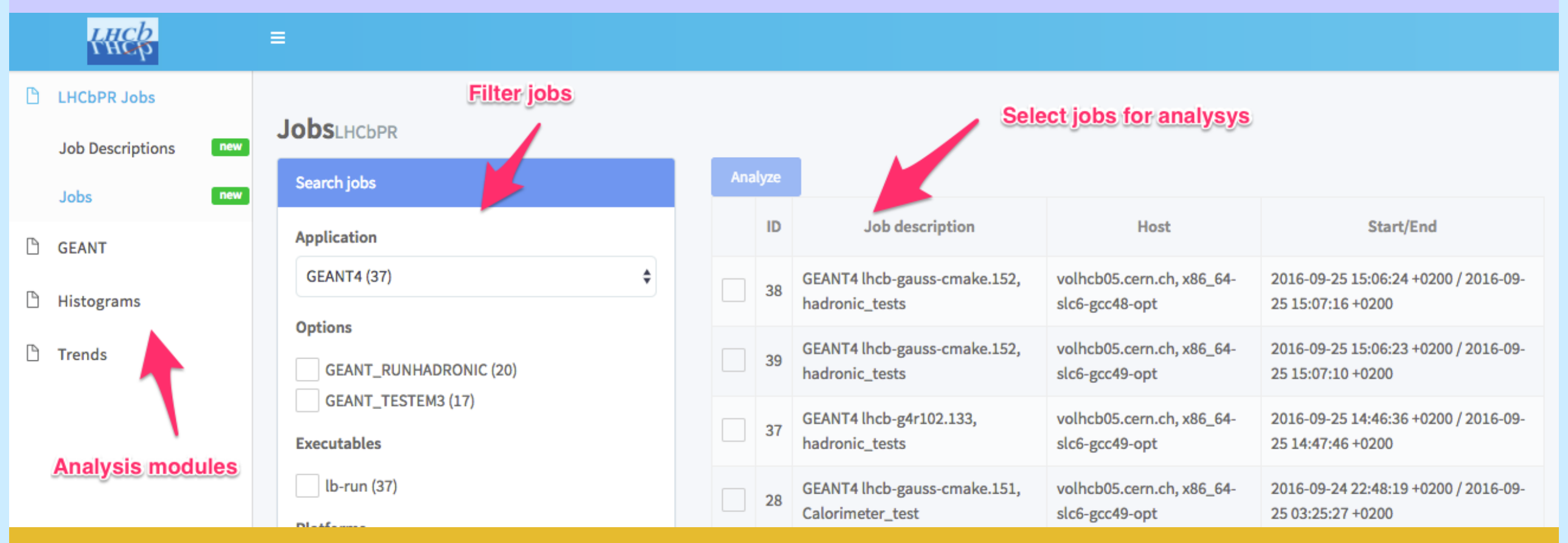
1. **Build and Test Services**
   - **Continuous Integration (CI) Service** – schedule and initiate test runs
   - **Artifacts Storage**– store projects builds for different configurations
   - **Test service** – read LHCbPR configuration for tests, download the corresponding builds, execute tests and transfer it to the Storage Element
   - **Storage Element** – virtual storage for jobs output with the interface to quite diverse real storage systems like grid storage.
2. **LHCbPR v2**
   - **Database –** relational database for job descriptions and job outputs. We use **MySQL**, but it can be any other.
   - **REST API service** – provides REST access to the database and adds some business logic for special API requests. Technologies: **python**, **Django** + **REST Framework**.
   - **ROOT HTTP service –** helper service for returning content of ROOT files in JSON format. Relies on ROOT TBufferJSON.ConvertToJSON functionality. Technologies: **Flask** , **ROOT**.
3. **User Clients**
   - Users can create any data handling client that use LHCbPR REST API: web applications, scripts
   - We created web frontend for visualizing regression tests' results. Technologies: **javascript**, **angular framework; nodejs and gulp** for development.

4. Deployment



- **Docker** is used to manage applications' containers and **docker-compose** is used for orchestrate containers in different environments.
- The same applications' images are used for **production** and **development** environments that allow quickly test and deploy new versions of services.
- Images are publicly accessible at the **Docker Hub** registry.
- Current infrastructure relies on **CERN services** like OpenStack Cloud, Database On Demand and Foreman for control virtual machines

5. Web Application



JobsLHCbPR

Application: GEANT4 (37)

Options

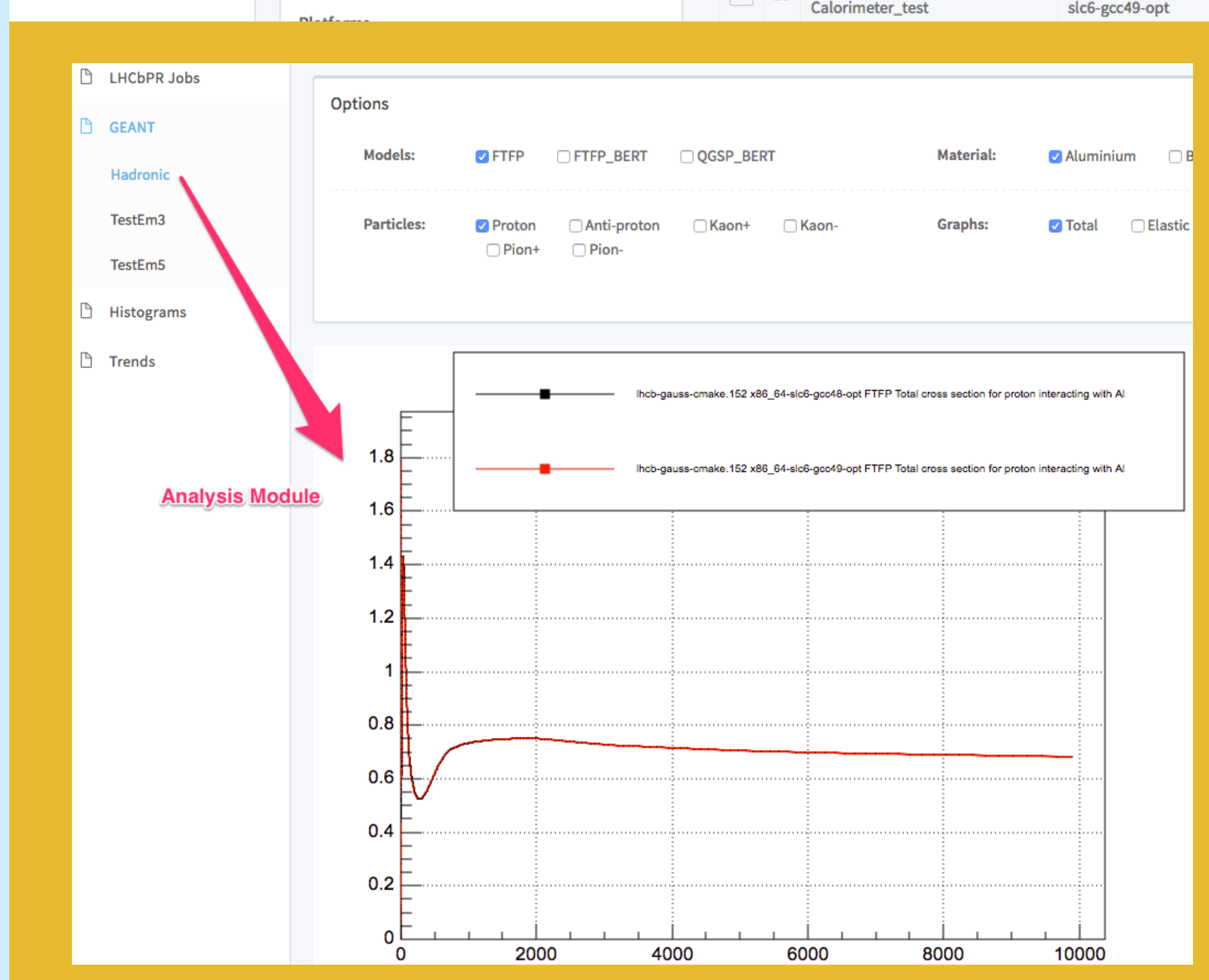
□ GEANT_RUNHADRONIC (20)

□ GEANT_TESTEM3 (17)

Executables

□ lb-run (37)

	ID	Job description	Host	Start/End
□	38	GEANT4 lhcb-gauss-cmake.152, hadronic_tests	volhcb05.cern.ch, x86_64-slc6-gcc48-opt	2016-09-25 15:06:24 +0200 / 2016-09-25 15:07:16 +0200
□	39	GEANT4 lhcb-gauss-cmake.152, hadronic_tests	volhcb05.cern.ch, x86_64-slc6-gcc49-opt	2016-09-25 15:06:23 +0200 / 2016-09-25 15:07:10 +0200
□	37	GEANT4 lhcb-g4r102.133, hadronic_tests	volhcb05.cern.ch, x86_64-slc6-gcc49-opt	2016-09-25 14:46:36 +0200 / 2016-09-25 14:47:46 +0200
□	28	GEANT4 lhcb-gauss-cmake.151, Calorimeter_test	volhcb05.cern.ch, x86_64-slc6-gcc49-opt	2016-09-24 22:48:19 +0200 / 2016-09-25 03:25:27 +0200



LHCbPR Jobs
GEANT
Hadronic
TestEm3
TestEm5
Histograms
Trends
Analysis Module
lhcb-gauss-cmake.152 x86_64-slc6-gcc48-opt FTFP Total cross section for proton interacting with Al
lhcb-gauss-cmake.152 x86_64-slc6-gcc49-opt FTFP Total cross section for proton interacting with Al
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
2000
4000
6000
8000
10000

Options

Models: ☑ FTFP □ FTFP_BERT □ QGSP_BERT

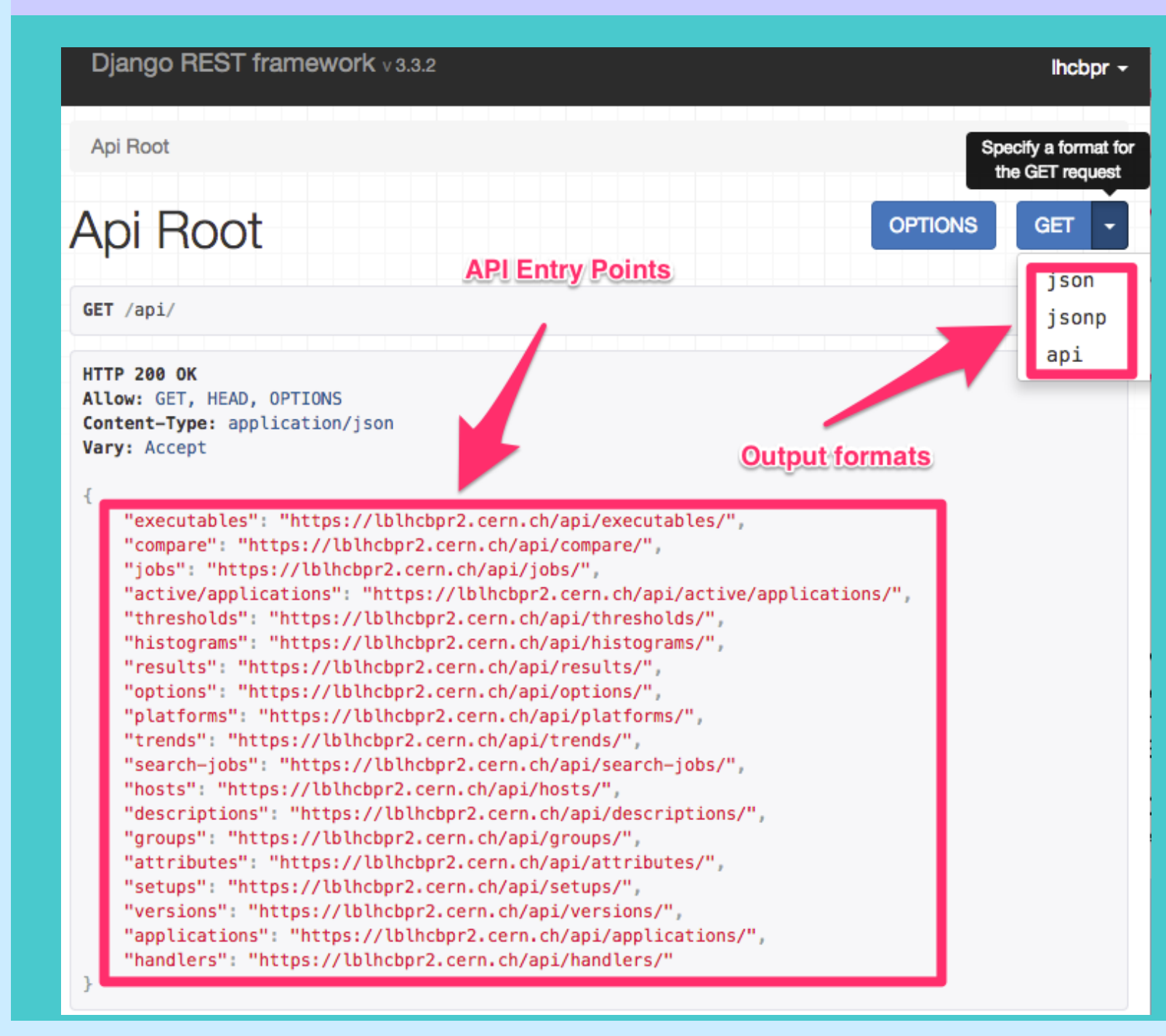
Material: ☑ Aluminium □ B

Particles: ☑ Proton □ Anti-proton □ Kaon+ □ Kaon- □ Pion+ □ Pion-

Graphs: ☑ Total □ Elastic

- Web frontend is a javascript single-page application that is composed of **analysis modules** for presenting specific logic and views for inspecting test results.
- Each analysis module is an **application extension** and can be simply added or removed without breaking the main application
- Common **web components** are provided for building modules. For example, search jobs and draw histograms.

6. API Service



Api Root

```
GET /api/

HTTP 200 OK
Allow: GET, HEAD, OPTIONS
Content-Type: application/json
Vary: Accept

{
    "executables": "https://lblhcbpr2.cern.ch/api/executables/",
    "compare": "https://lblhcbpr2.cern.ch/api/compare/",
    "jobs": "https://lblhcbpr2.cern.ch/api/jobs/",
    "active/applications": "https://lblhcbpr2.cern.ch/api/active/applications/",
    "thresholds": "https://lblhcbpr2.cern.ch/api/thresholds/",
    "histograms": "https://lblhcbpr2.cern.ch/api/histograms/",
    "results": "https://lblhcbpr2.cern.ch/api/results/",
    "options": "https://lblhcbpr2.cern.ch/api/options/",
    "platforms": "https://lblhcbpr2.cern.ch/api/platforms/",
    "trends": "https://lblhcbpr2.cern.ch/api/trends/",
    "search-jobs": "https://lblhcbpr2.cern.ch/api/search-jobs/",
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    "descriptions": "https://lblhcbpr2.cern.ch/api/descriptions/",
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    "attributes": "https://lblhcbpr2.cern.ch/api/attributes/",
    "setups": "https://lblhcbpr2.cern.ch/api/setups/",
    "versions": "https://lblhcbpr2.cern.ch/api/versions/",
    "applications": "https://lblhcbpr2.cern.ch/api/applications/",
    "handlers": "https://lblhcbpr2.cern.ch/api/handlers/"
}
```

- Provides access to the **application objects**
- Combines several sql queries into **one HTTP request**
- Output results in the desired format. Currently **JSON** and **JSONP** are supported.
- Automatic **Swagger/OpenAPI documentation** and test application generator
- Includes **CERN Single Sign-On** for authentication

- LHCbPR not coupled to the LHCb software stack and can be adapted for other experiments and projects
- We are working on extending repository of web components and analysis modules for web frontend.
- Easy to develop new clients for API service.

Resources

- **API service**: https://gitlab.cern.ch/lhcb-core/LHCbPR2BE
- **ROOT HTTP service**: https://gitlab.cern.ch/lhcb-core/LHCbPR2ROOT
- **Web application**: https://gitlab.cern.ch/lhcb-core/LHCbPR2FE
- **Tests' output handlers**: https://gitlab.cern.ch/lhcb-core/LHCbPR2HD
- **Proxy server and project builder**: https://gitlab.cern.ch/amazurov/LHCbPR2