An integrated system for data quality and conditions assessment for the ATLAS Tile Calorimeter

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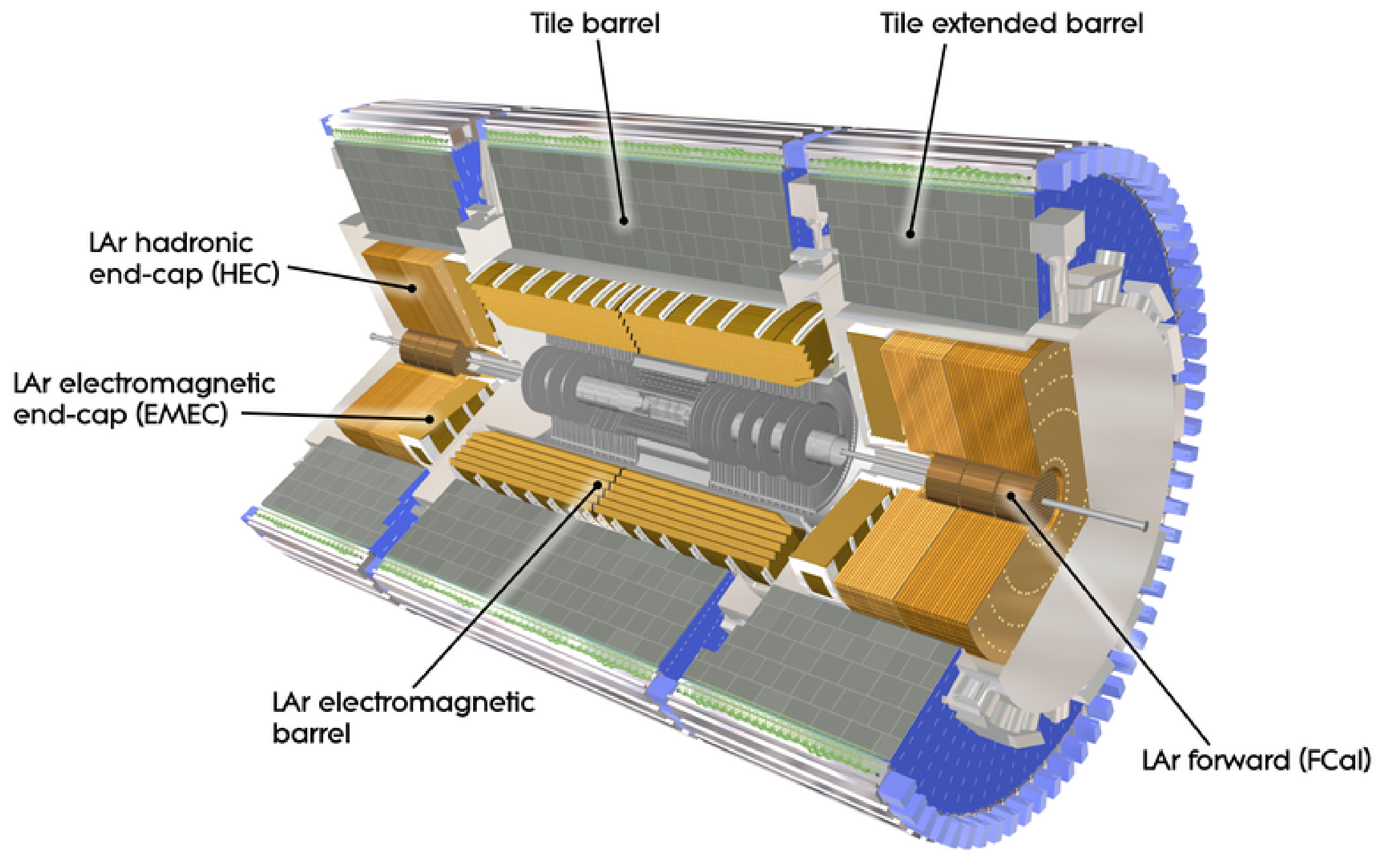
ATLAS Tile Calorimeter


Tile barrel
Tile extended barrel
LAr hadronic end-cap (HEC)
LAr electromagnetic end-cap (EMEC)
LAr electromagnetic barrel
LAr forward (FCal)

ATLAS [1] is one of the two large general-purpose detectors at the Large Hadron Collider (LHC) at CERN. The LHC started its operation in 2008 and since then it has gone through several gradual upgrades of beam energy and luminosity.

Currently it provides collisions at center of mass energy of 13 TeV with instantaneous luminosity reaching 2.06×10^{34} cm^{-2}s^{-1} [2]. The ATLAS detector investigates a wide range of physics, from the Higgs boson and other Standard Model studies to the searches of the extra dimensions and particles that could make up the dark matter.

The Tile Calorimeter (TileCal) [3] is located in the central section of the ATLAS hadronic calorimeter. It detects hadrons, jets and taus, while also contributing to the jet energy and missing E_{T} reconstruction, as well as assisting the spectrometer in the identification and reconstruction of muons.

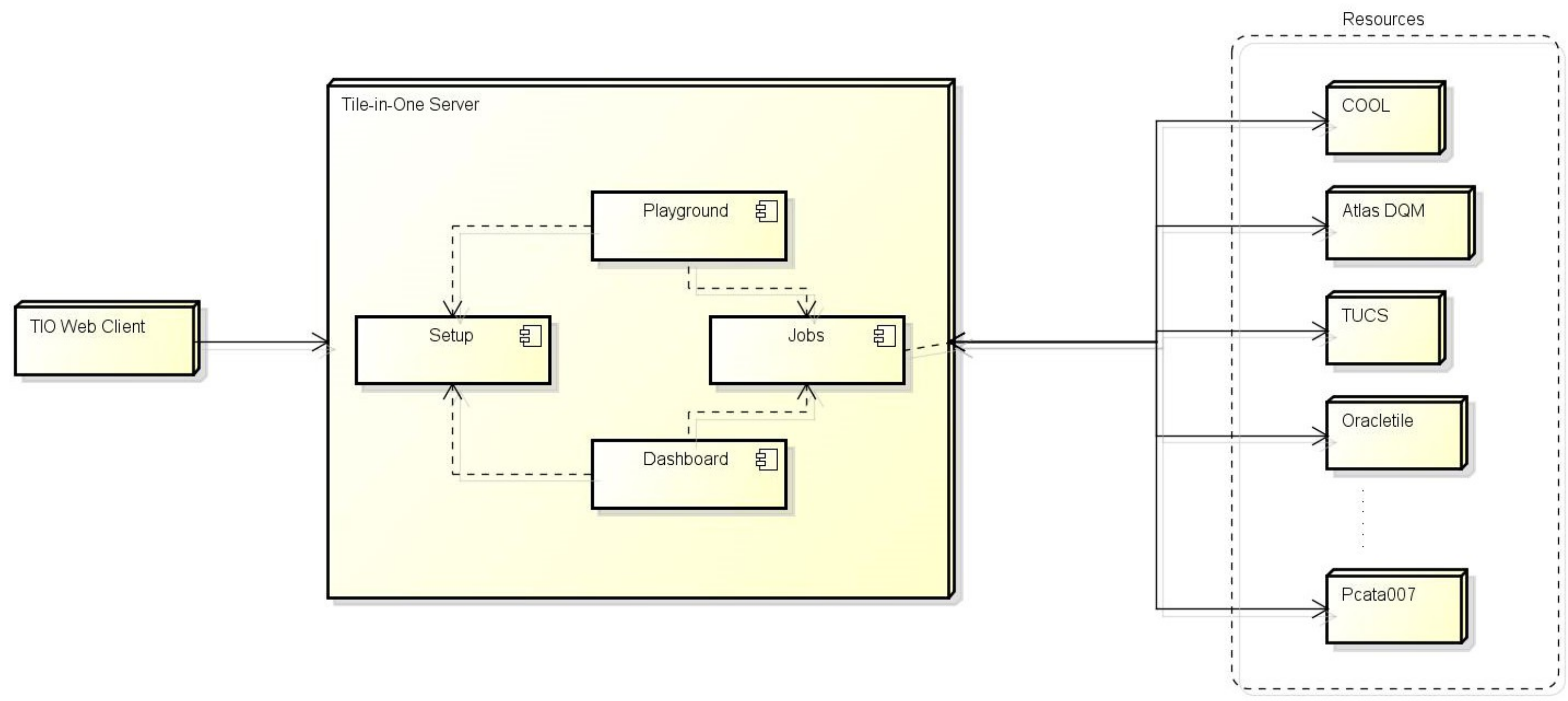
TileCal is a sampling calorimeter using plastic scintillating tiles as the active medium and steel plates as the absorber. It covers the pseudorapidity range up to $|\eta| < 1.7$ with one central Long Barrel (LB) and two Extended Barrels (EB). The total number of cells is 5182, while the number of channels is ~10000, as most cells are read by two PMTs.

TileCal Software

Over the years, several tools were developed during commissioning and run by different groups to support several TileCal data monitoring and maintenance activities. However, those tools make use of distinctive technologies, data sources require different forms of data recovery, collaborators have to browse among several tools in order to perform a given task, and documentation is not well consolidated.

Thus, the use, maintenance and enhancement of existing functionalities becomes time consuming and costly work. Tile-in-One (TiO) aims to integrate different Tile tools, sharing the same infrastructure and accessing common services, such as: access to different databases, user authentication, commonly used libraries, and software infrastructure to allow collaborators to integrate their own tools.

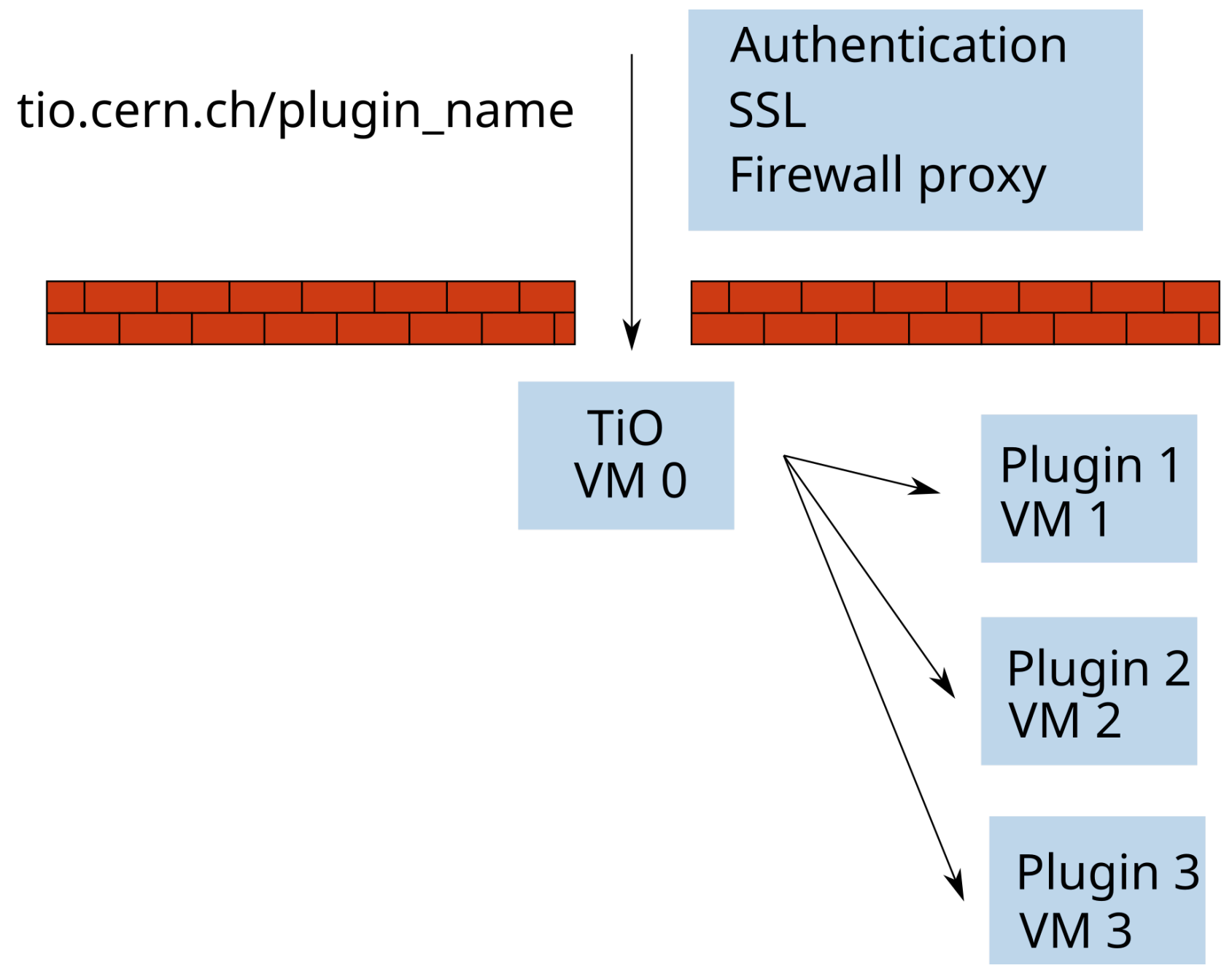
Current Approach



The history of the current Tile-in-One (TiO) spans several years and shows signs typical of projects with lack of manpower. The proposed functionality requires far more resources than what can be provided by TileCal. It is described as follows. The hardware infrastructure of TiO is composed of three different nodes: the TIO Web Client, a user web based application running on an ordinary workstation; the Tile-in-One Server, which supplies broker functionality between the client demands and the services availability; the Resources, services from third-part servers. This approach, if properly executed, could offer lot of advantages, however in the case of TiO has several problems

- Slow communication between master and slaves
- Transferring of large files between master and slaves
- No possibility of multi-user (a plugin can not be used by more than one person at a time)
- Unnecessary caching of jobs
- Need for micromanaging everything and even adding on non-crucial features requires changes into the whole architecture
- All system parts are custom-made
- The plugins are not maintained (as of now 9 out of 16 are not working)

Starting Over

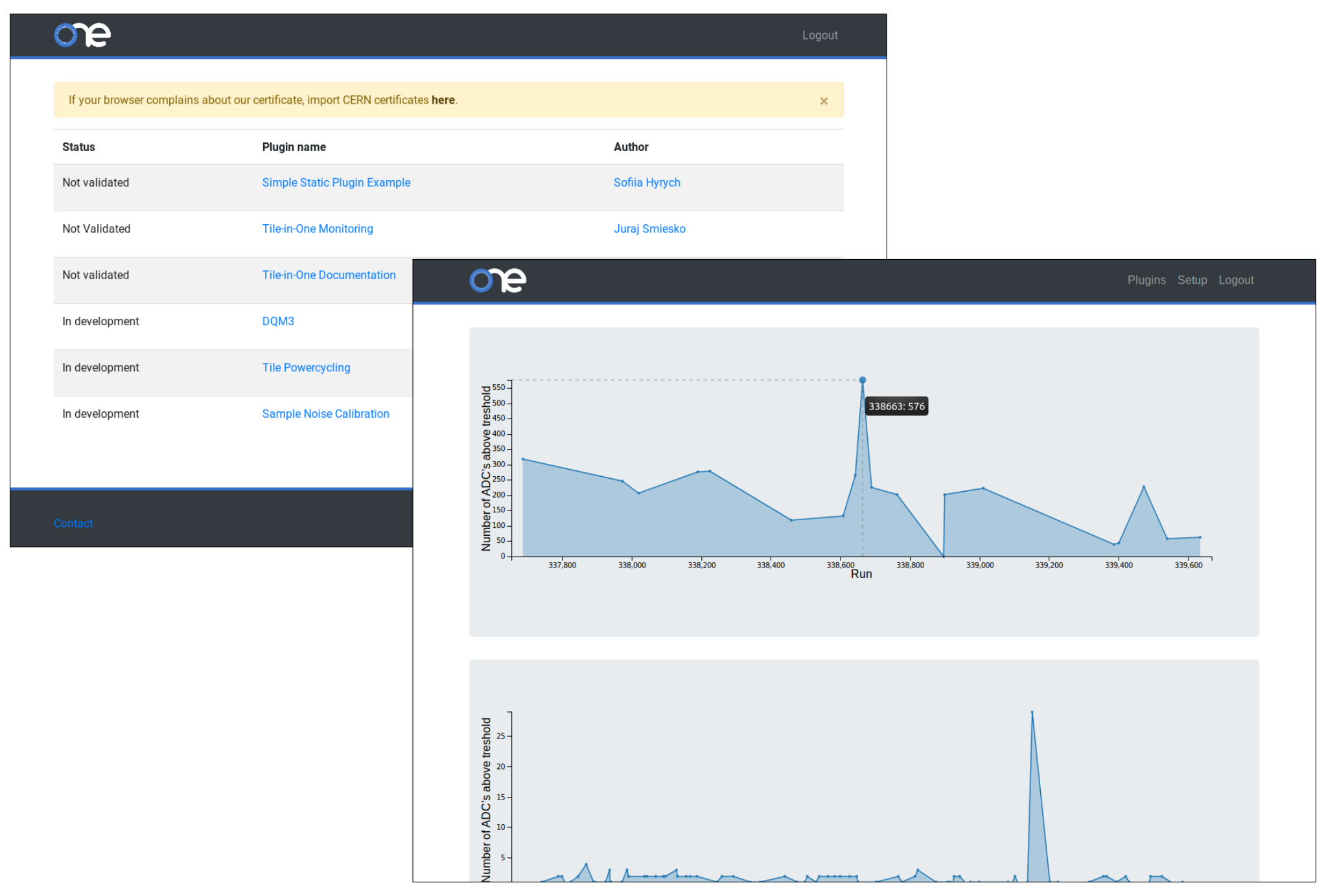


The idea of Tile-in-One is still deemed to be valuable for TileCal, that is why the project is being rebooted. This time, however, it will function just as a simple bridge or gatekeeper (with authentication/authorization), and all the other components needed will have to be provided by the plugin itself. Here is short description:

- Main server is just a bridge
- Every plugin is a small independent web application
- Due to requirements on different data sources every plugin is in its own VM
- Plugins are based on one of the three templates
- All the source code for the plugin is stored in Git repository
- There will be a person or a group responsible for the maintenance of the plugin

The platform provides the following templates since the majority of plugin developers are not skilled in web development:

- Simple static plugin
  - Dynamic elements on the user side (JavaScript)
  - Server could regularly run cron jobs to update data files (for example file.csv)
  - Implemented with HTML, CSS, JavaScript
- Basic dynamic web application
  - All of the above
  - Can process parameters on server site
  - Implemented with Python and Bottle
- Full size web application with database
  - All of the above
  - Can store web page data in database
  - Implemented with Python, Django



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Status	Plugin name	Author
Not validated	Simple Static Plugin Example	Sofiia Hyrych
Not Validated	Tile-in-One Monitoring	Juraj Smiesko
Not validated	Tile-in-One Documentation	
In development	DQM3	
In development	Tile Powercycling	
In development	Sample Noise Calibration	

The new implementation of TiO platform relies on several open source projects as well as services already used at CERN and was designed to use as much existing software and services as possible. In the future we would like to transfer tasks related to the creation of new plugins into GitLab's CI/CD environment.

Provided by platform	Technology	Status
Secure connection	CERN CA	Works
Firewall proxy	Nginx	Works
Routing of requests	Nginx	Works
Authentication	OAuth2	Works
User management		Not implemented
Common place for tile related web applications	CERN GitLab	Works
Web application templates	Bottle, Django	Partially works
Monitoring	Monitorix	Works
VM images (install scripts)	OpenStack	Partially works

References & Contact

1 ATLAS Colaboration. In: JINST 3 (2008), S08003.
2 `https://home.cern/about/updates/2017/11/record-luminosity-well-done-lhc`
3 Tile Calorimeter Technical Design Report, CERN/LHCC/96–42

If you are a CERN personel, you can visit us at `https://tio.cern.ch` or send us an email to `tileweb@cern.ch`

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