PROCEEDINGS OF SCIENCE

# Collection of web tools for ATLAS Tile Calorimeter data quality tasks

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The ATLAS Tile Calorimeter (TileCal), as a substantial part of the hadronic calorimeter system of the ATLAS detector, records energy deposits and jointly with other calorimeters reconstructs hadrons, jets, tau-particles and missing transverse energy. It also assists in muon identification. The TileCal is constructed out of alternating steel absorber layers and active scintillating tiles and covers region $|\eta| < 1.7$. Its operation is closely monitored by several systems, which were independently developed to meet distinct collaboration requirements. Any problem or indication of a problem is reported and immediately investigated, which resulted in data quality (DQ) efficiency close to 100% in the last several years. Although the TileCal tools are maintained and still being developed, the underlying technologies on which they were developed, especially web related tools, are becoming gradually outdated.

The goal of the Tile-in-One (TiO) web platform is to integrate all the different TileCal DQ tools, independently developed over long period of time by different groups and individuals into one cohesive system without any non-necessary overlap in functionality. It is implemented as a collection of relatively small independent web applications designed for one specific task accessed through the main TiO server, which handles the authentication. Every application is isolated in its own virtual machine and is called plugin. Currently, the platform operates with several plugins in various stages of development and focuses not only on reimplementation of the old tools but also on creation of new ones. The implementation details of the Tile-in-One web platform, as well as a selection of plugins will be presented.

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## 1. Tile Calorimeter

The ATLAS Tile Calorimeter [1] constitutes the outermost layer of the ATLAS Calorimeter System of the ATLAS detector [2], see Fig. 1. It detects hadrons, jets and taus, while also contributing to the jet energy and missing transverse energy reconstruction. In addition, it assists the muon spectrometer in the identification and reconstruction of muons. The calorimeter central (barrel) part covers the pseudorapidity region $|\eta| < 1.0$, while its two extended barrels cover the range $0.8 < |\eta| < 1.7$ on each side. TileCal is a sampling calorimeter using plastic scintillating tiles as the active medium and steel plates as absorber. The total number of calorimeter cells is 5182, while the number of channels is around 10000, as most cells are read by two photomultiplier tubes.

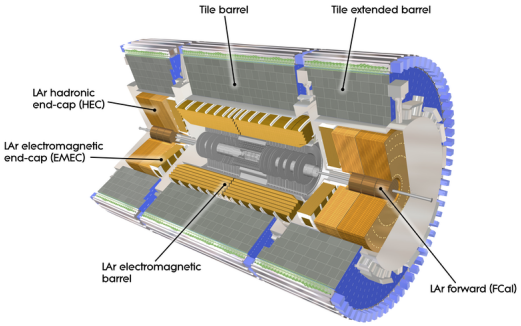


**Figure 1:** The ATLAS Calorimeter System with the Tile Calorimeter shown in gray.

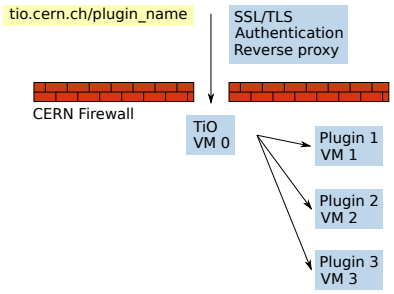


**Figure 2:** The architecture of the Tile-in-One web platform.

## 2. Tile-in-One Platform

The Tile-in-One web platform is a collection of small to medium sized independent web applications called plugins, which are accessed through main server hosted at https://tio.cern.ch, see Fig. 2. Its main purpose is to provide data quality assessment tools for the TileCal Collaboration. The collaboration already has several web based tools, but they start to be gradually outdated. Therefore, the plugin development focuses, apart from development of completely new plugins, on reimplementation or integration and improvement of existing ones.

The main characteristics of the TiO platform are as follows: the main server is a reverse proxy (Nginx [3]), which provides authentication of the users for all plugins behind it, using oauth2_proxy [4] together with CERN OAuth2 Service. Plugins are separated in their own Virtual Machines hosted on CERN's OpenStack [5] instance. Usually, new plugins are based on a template provided by the platform, built with the help of Bottle [6] and Bootstrap 4 [7] frameworks. Source code is version controlled using Git and hosted on CERN's GitLab [8] instance. Finally, it is required that each plugin has clearly defined person or group responsible for it.

## 3. Tile-in-One Plugin Examples

Currently, the development of the TiO platform itself is finished and focus is moved towards the plugins, where more than 10 plugins are being worked on. There are several plugins which complement the TiO platform, examples of which are shown in Fig. 3 and 4. The first figure

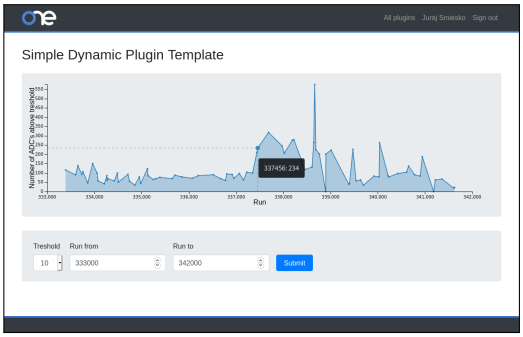


**Figure 3:** The Tile-in-One plugin template.

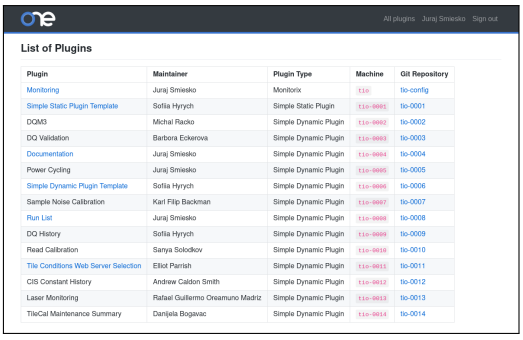


**Figure 4:** The Tile-in-One documentation plugin.

shows TiO plugin template on which new plugins are usually based. Its purpose apart from being a template is to provide an example for the plugin developer. Documentation plugin, shown on the second figure, uses simple Markdown files, and shows list of plugins currently worked on. Examples of plugins intended to be used for the data quality assessment are shown in the Fig. 5 and 6. Here, first figure shows the Tile Powercycling plugin, which shows how many times there was a power cycle over a defined period of time. Finally, second figure shows DQ Validation plugin, which helps with comparison of data quality histograms between different runs.

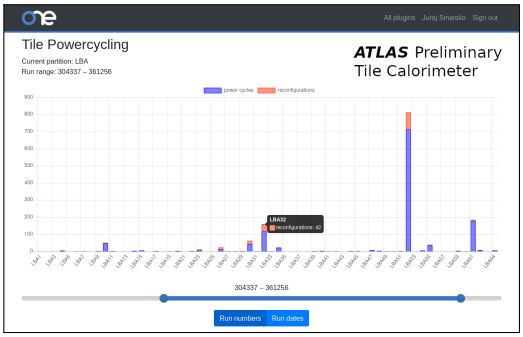


**Figure 5:** The Tile Powercycling plugin.

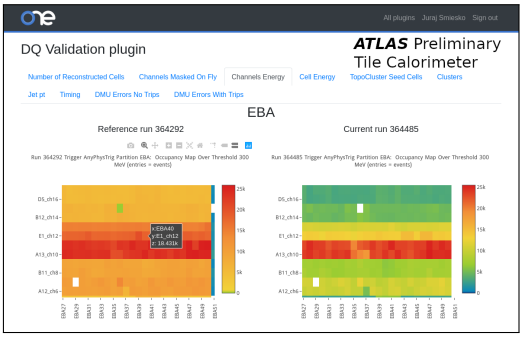


**Figure 6:** The Tile DQ plugin.

## References

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