

TileCalibWeb Robot tool for ATLAS Calorimeter conditions and calibrations data handling in Run 3

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Abstract. Every sub-detector in the ATLAS experiment at the LHC, including Liquid Argon and TileCal, writes conditions and calibration data into an ORACLE Database (DB). In order to provide an interface for reliable interactions both with the Conditions Online and Offline DBs a unique semiautomatic web based application, TileCalibWeb Robot, has been developed. TileCalibWeb is being used in LHC Run 3 by ATLAS Calorimeter data preparation, data quality and calibration experts as well as by shifters on duty. The architecture and functionality of the tool is discussed. Use cases for updating the conditions data of various types and formats are presented. The interface provides the user with the option to choose the strategy of the DB update. Options include a short text input typed directly into the browser as well as more complicated methods using data files prepared in advance. TileCalibWeb significantly simplifies the procedure of the preparation and writing of conditions and calibration data both into Online and Offline DBs in parallel, verifies user input and automatically publishes bookkeeping records.

1 Introduction

ATLAS is the general purpose detector [1] operating at the Large Hadron Collider (LHC) at CERN. The calorimeter system of ATLAS covers the pseudorapidity range $|\eta| < 4.9$ and it is comprised by five sub-detectors shown in Figure 1.

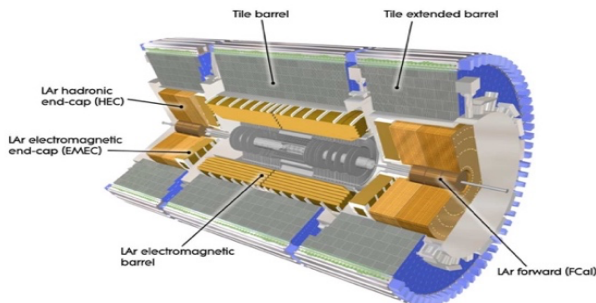


Fig. 1. Layout of ATLAS Calorimeter systems including TileCal (Tile) and Liquid Argon (LAr). Figure is taken from Ref. [2].

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ATLAS uses a right-handed coordinate system with its origin at the nominal interaction point (IP) in the center of the detector and the z-axis along the beam pipe. The x-axis points from the IP to the center of the LHC ring, and the y-axis points upward. Cylindrical coordinates (r, φ) are used in the transverse plane, φ being the azimuthal angle around the z-axis. The pseudorapidity η is defined in terms of the polar angle θ as $\eta = -\ln \tan(\theta/2)$. Within the region $|\eta| < 3.2$, electromagnetic calorimetry is provided by barrel and endcap high-granularity lead / liquid-argon (LAr [2]) calorimeters, with an additional thin LAr presampler covering $|\eta| < 1.8$ to correct for energy loss in material upstream of the calorimeters. Hadron calorimetry is provided by the steel / scintillator-tile calorimeter (TileCal [3]), segmented into three barrel structures within $|\eta| < 1.7$ (the long central barrel covering the pseudorapidity region $-1.0 < \eta < 1.0$ divided into two partitions LBA and LBC, and the extended barrels EBA, EBC cover the region $0.8 < |\eta| < 1.7$), and two copper / LAr hadron endcap calorimeters. The solid angle coverage is completed with forward copper / LAr and tungsten / LAr calorimeter modules optimized for electromagnetic and hadronic energy measurements respectively. The calorimeters play an important role in the reconstruction of physics objects such as photons, electrons, τ -leptons and jets, as well as event-level quantities such as missing transverse momentum.

Total number of channels in all calorimeters is about 200,000, most of them are in LAr EM calorimeters which has 4 times higher granularity than hadronic calorimeters. TileCal has only 9852 readout channels.

Several calibration constants and other parameters (e.g. noise level, bad status) are associated with every calorimeter channel. All of them have to be stored in Conditions Database. The data in Conditions DB is organized in folders (tables), every folder contains one specific type of constants for one calorimeter sub-detector. Total number of such folders for all calorimeters is about 50. The procedure to update calibration constants usually consists of 4 steps:

- 1) Run analysis program which calculates new constants,
- 2) Perform conversion from intermediate format (text file or ROOT file) to Sqlite file,
- 3) Validate new constants, compare with previous constants stored in ORACLE to make sure that there are no mistakes,
- 4) Load Sqlite file to different ORACLE COOL [4] DB (online and offline) and also with different "tags" for various rounds of reconstruction.

To simplify the process of updating calibration constants, TileCal community developed a special web based tool called TileCalibWeb Robot. It allows us to perform steps 2) (only from text to Sqlite), 3) and 4), and it simplifies a lot manipulation with DB, especially for non-experienced users. Initially it was used only for updates of TileCal-specific calibration constants, but recently the functionality has been extended to perform also updates for the constants which are common with LAr calorimeter.

2 TileCalibWeb Robot design

In Run 3 we use four Robot hosts: two production and two development servers at CERN running on Virtual Machines (VM) to provide a reliable communication both with ATLAS COOL Offline and Online ORACLE Conditions Databases. Details of the Tile Calorimeter COOL Conditions DB structure is described in [5]. An architecture of TileCalibWeb Robot is presented in Figure 2.

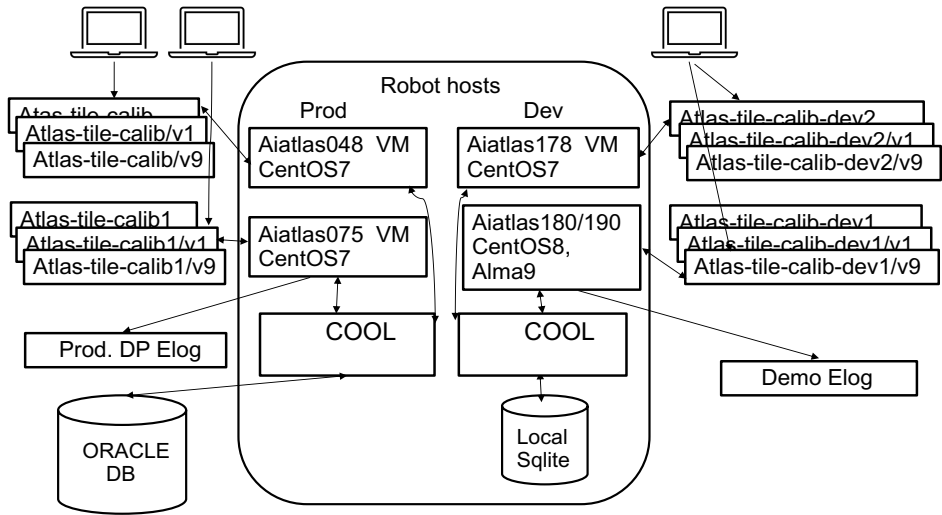


Fig. 2. Schema of TileCalibWeb Robot tool and communication with Database.

Each Robot node can work with 10 users simultaneously through 10 corresponding different URLs shown on the left and right hand sides of the Figure 2. If the user works with one of the production instances then the DB update goes directly into ORACLE COOL DB. Development instances use the local Sqlite DB replica to store the conditions data. Development nodes allow us to debug and test new software improvements, validate the most recent versions of Operation Systems in our environment before bringing them to production. Each conditions DB update completes with an automatic bookkeeping Elog record publishing. Two separate bookkeeping catalogues for production and development DB updates are configured and supported in Run 3.

3 TileCalibWeb Authentication and Authorization

For getting access to TileCalibWeb Robot tool we use standard CERN Single Sign-On (SSO) interface in the same way as many other web based tools and applications. In our application every authorized user can receive a special role from the following list: *DQ leader*, *CIS expert*, *Laser expert*, *Cesium expert*, *Timing expert*, *Noise expert*, *Online expert*, *TMDB expert*, *Trigger expert* and *Super expert (administrator)*. The user role can be assigned in accordance to the user e-mail address officially registered in CERN Phonebook tool. To communicate efficiently with Calorimeter (TileCal and Calo) Conditions DB in terms of read and write/update operations the user can see and update only DB folders associated with the role. So all other unnecessary DB information will be hidden in the particular user's view, which activates in the browser after clicking on the "robot" icon shown in red circle in Figure 3.

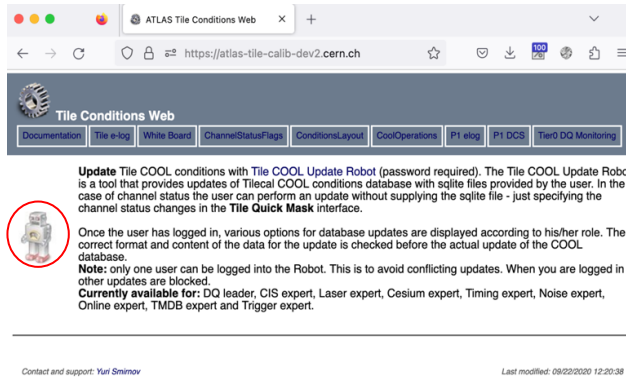


Fig. 3. TileCalibWeb Robot original view activation in the browser.

4 Procedure of Conditions Database update

There are two types of TileCal Conditions DB updates, which we use in Run 3 operations. The first type is a large DB update (such as for instance updating multiple calibration constants for all TileCal modules) and can be performed by uploading the corresponding Sqlite file prepared in advance by the expert. The second type of update is a minor correction of one or a few COOL channels (for example masking or unmasking the bad channels or cells) in TileCal. Such an operation can be easily done by adding a new Interval of Validity (IOV) to the existing tag directly from the custom TileCalibWeb Robot interface by the DQ shifter on duty having the corresponding authorization. TileCal DB software allows us to optimize and automatize the procedure of the conditions and calibration data, preparation, validation and uploading to ORACLE COOL DB. Usually we have 3 different scenarios of DB updates using Robot:

- a) **masking of bad channels** - we choose module/channel, then one of predefined statuses from the list and specify run number and lumiblock for beginning of a new open-ended IOV.
- b) **update of calibration constants** - we choose module/channel and provide arbitrary values for calibration constant(s) or keep some constants unchanged: *EBA30 30 -1 keep 1.2 700*. This means in the EBA30 module channel 30 both gains keep Value1 unchanged, set Value2 to 1.2 and Value3 to 700 (format of the line is: Module Channel Gain Value1 Value2 Value3...). Also run and comment is specified in a separate field.
- c) **timing jumps correction during the run** (i.e. change of constant to the new value and then back to the original value) run number and range of lumiblocks is specified as well as a relative change with respect to the previous value stored in DB: *432102 LBA16 ch 12-17 +9.4 ns lb 0-22*. In this case short IOV [432102,0]-[432102,22] is created with time constant shifted by +9.4 ns in channels 12 to 17 in a module LBA16.

An example of using Robot web interface in the **scenario a)** update is described in details below.

On every Robot node user is allowed to choose one of 10 different URLs. If the current URL slot is occupied by another physicist, the user can try a new non-occupied URL from the list of 10. For that purpose the expert just adds any of /v1, /v2, ... /v9 at the

end of the default Robot URL. Then user can scroll to the right of the screen and click on the button “ADC_UPD4_UPD1_ONL” as shown in Figure 4.

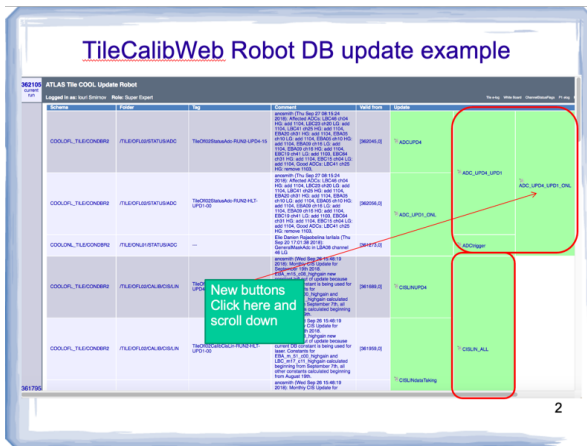


Fig. 4. Button for bad channel ADC Status update.

The user scrolls down and follows the instructions at the bottom of the screen to type the changes for ADC status directly in the browser as presented in Figure 5. A new pop-up window will appear.

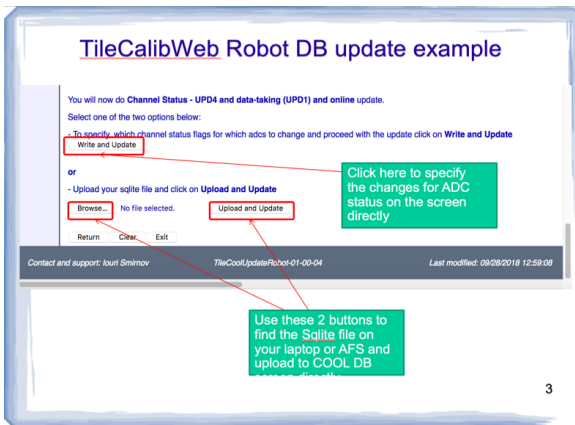


Fig. 5. Choosing status update on the screen

User fills in “Request” the data for masking, for instance *EBC64 chn 47 Low and High add GeneralMaskAdc* and press “Add to list” button, see Figure 6. Robot adds user’s request to the list, and the new next window appears.

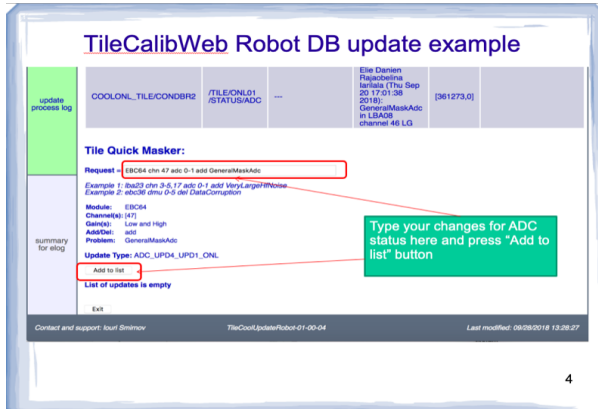


Fig. 6. Adding the request to the list.

User adds into "Comment" an information about the action. In "Valid from Run" field the user can write the run number, set "Lumblock" value and press "Merge to COOL" button as shown in Figure 7.

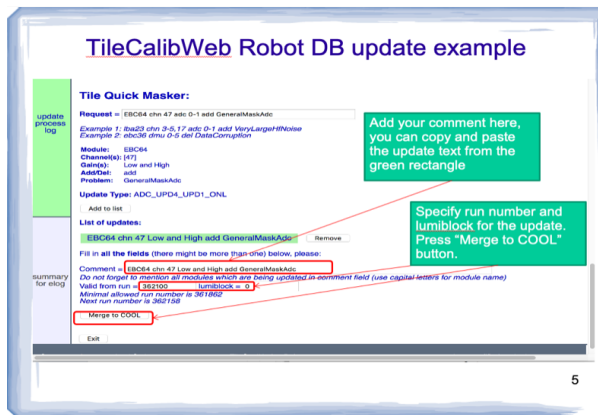


Fig. 7. Filling in the comment, run, lumblock.

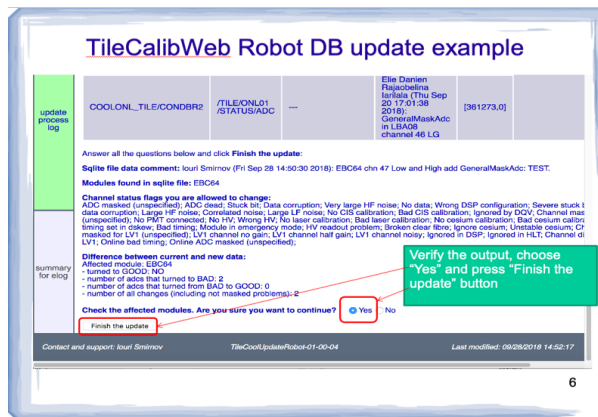


Fig. 8. Checking the result and completing the update.

TileCalibWeb Robot can be chosen either directly by the URL in user's browser (we recommend to work with Firefox or Chrome on MAC OS, Linux or Microsoft platforms), or also from Tile-in-One tool [6] as a special plugin. Robot allows us to update 2 different types of conditions tags in the Offline DB: UPD1 (used for express stream data processing at Tier0) and UPD4 (used for bulk reconstruction and data reprocessing), as well as the single version tag for the Online DB. Four types of DB updates can be executed with different Robot tool buttons in Run 3: a) single update of one tag, b) double: update of 2 tags in the DB folder, c) update of 3 tags in parallel, d) update of 4 tags for noise (3 for Tile and 1 for CALO). Such an implementation of the new Robot buttons capable to produce simultaneous updates of several tags in parallel allowed us to decrease significantly (approximately by 40%) the amount of the necessary regular manual DB updates in Run 3 executed by the shifters on duty and Calorimeter experts.

6 Conclusions

Web based application TileCalibWeb Robot significantly simplifies and automatizes the procedure of the preparation and writing of the Calorimeter conditions and calibration data both into Online and Offline ORACLE COOL DBs simultaneously in Run 3 data taking period. Originally written for TileCal support only the functionality of this tool has been recently extended to work with the Conditions DB schema used in the whole ATLAS Calorimeter system.

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