# Implementation of the DCS System of the new MDT BIS78 Chambers for the upgrade of the muon system of the ATLAS Experiment

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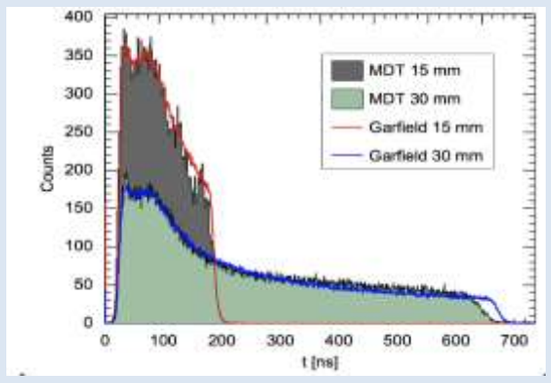
## Introduction

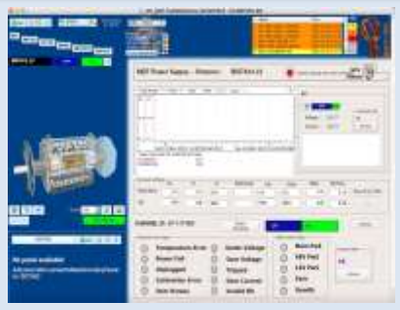
New chambers were constructed and tested in order to improve the rate capability of the MDT system, especially when the LHC luminosity is increased. These new chambers will increase the precision of the muon momentum measurements and the triggering. One of these new type of chambers are the small diameter Monitored Drift Tube (sMDT) chambers located in Barrel Inner area(BIS). In this work will be presented the Detector Control System (DCS) for the monitoring and operation on these chambers.

## BIS78 Project


- BIS integrated with the new RPCs (trigger).
- 16 new muon stations of one small (sMDT) chamber and two RPC triplets.
- BIS chambers are operated with Ar:CO2 gas mixture at 3 bar and at 2730 V.
- Provide lower background detector occupancy compared to the MDTs.
- Electronics dead time decreased from 750 ns to 175 ns.

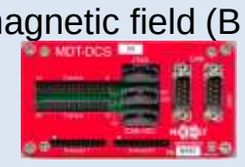
## Power Supply



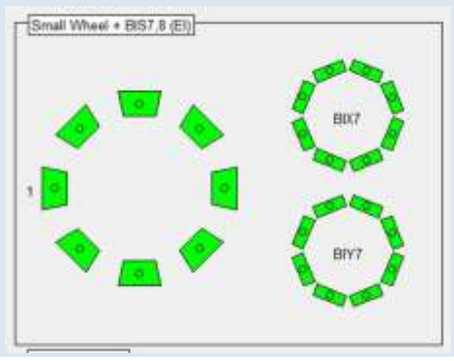
- Additional hardware has been installed in order to supply the new chambers.
- Due to the required technical specifications of the LV system, different chambers' CSMs share the same channels. Hence a remapping of these channels have been applied and displayed on panels accordingly in order to facilitate the work of the users/experts.
- BIS chambers have been included under the Finite State Machine (FSM) tree with a dedicated Graphical User Interface (GUI) has been developed in order to facilitate the user's operation.

## MDM Project

- MDM stands for MDT-DCS-Module, Readout with the embedded local monitoring board (ELMB) that provides initialisation of the Chamber Service Module (CSM) and give information about parameters like temperature (T Sensors) and magnetic field (B Sensors).

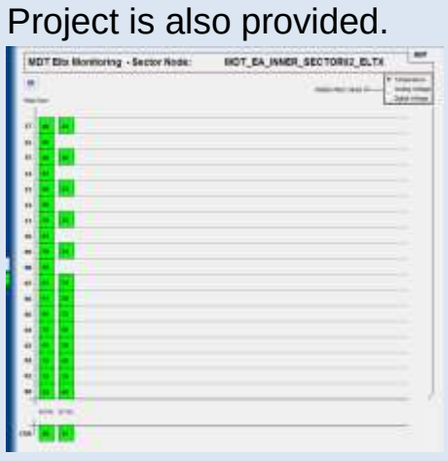



- BIS have 2 CSMs so 2 different Data Points are created (BIX BIY stands for these two types of CSM).
- Load the configurable parameters to the on-chamber electronics, on each mezzanine card as well as to a chamber's CSM.

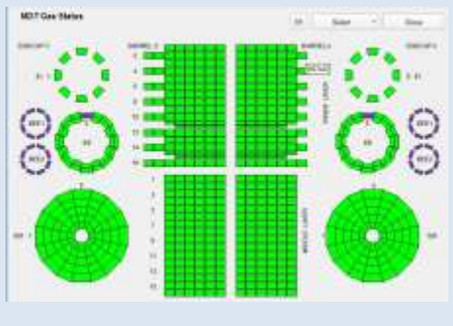



## ELTX Project

- The Frontend Electronics Monitoring (ELTX) safely supervise and operate the basic elements of the electronics chain.
- Mezzanine boards and CSM chips are constantly monitored in order to validate their behaviour.
- Alarm details on Voltage and Temperature.
- Connection and easy navigation from/to the Power Supply and MDM Project is also provided.



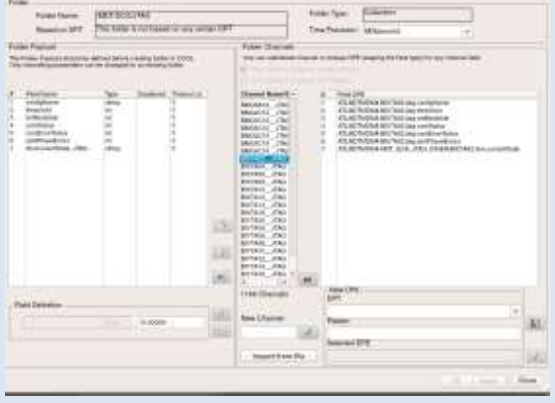
## BIS78 Gas Project



- Modified the BIS device Gas parameters and removed the disused BIS8 Chambers.
- Expanded the graphical user interfaces to monitor the sMDT.
- Data exchange pipeline has been established between Power Supply and Gas Project.
- Upload all the newly created parameters to the Database.
- Include the BIS into the Interlock mechanism.

## BIS78 P2C Project

- P2C Project establishes connection between DCS and Cool DataBase.
- Cool DataBase has details for the offline Data Quality and the Athena such as the High and Low Voltage and Jtag.
- BIS has been added under the P2C schema following the official conventions.



| # | Field Name | Type | Deadband | Timeout (s) |
|---|---|---|---|---|
| 1 | iMon_ML1 | float | | 0 |
| 2 | v0set_ML1 | float | | 0 |
| 3 | v1set_ML1 | float | | 0 |
| 4 | chanErrorFlag_ML1 | bool | | 0 |
| 5 | IOffset_ML1 | float | | 0 |
| 6 | IScale_ML1 | float | | 0 |
| 7 | iMon_ML2 | float | | 0 |
| 8 | v0set_ML2 | float | | 0 |
| 9 | v1set_ML2 | float | | 0 |
| 10 | chanErrorFlag_ML2 | bool | | 0 |
| 11 | IOffset_ML2 | float | | 0 |
| 12 | IScale_ML2 | float | | 0 |
| 13 | fsmCurrentState_ML1 | string | | 0 |
| 14 | fsmCurrentState_ML2 | string | | 0 |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