ALICE Diffractive Detector Control System for RUN-II in the ALICE Experiment

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INTRODUCTION

The ALICE Diffractive (AD0) detector has been installed and commissioned for the second phase of operation (RUN-II). With this new detector will be possible to achieve better measurements by expanding the range of pseudo-rapidity in which the production of particles can be detected. Specifically the selection of diffractive events in the ALICE experiment which was limited by the range over which rapidity gaps occur. Any new detector should be able to take the data synchronously with all other detectors and being operated through the ALICE central systems. One of the key elements that to be developed for the AD0 detector is the Detector Control System (DCS). The DCS is designed to operate safely and correctly this detector. Furthermore, the DCS must also provide optimum operating conditions for the acquisition and storage of physics data and ensure these are of the highest quality.

AD0 DETECTOR

The AD0 detector consists of two sub-detectors called ADA and ADC. Each of them comprises two detector layers, and each one is formed by four scintillator modules arranged around the LHC beam pipe. The ADA and ADC designations refer to the positions where they are installed at both ends of the ALICE experimental site with respect to the interaction point (IP). The positions of ADA and ADC in the ALICE reference frame and the nomenclature for layers and modules are shown in Fig. 1.

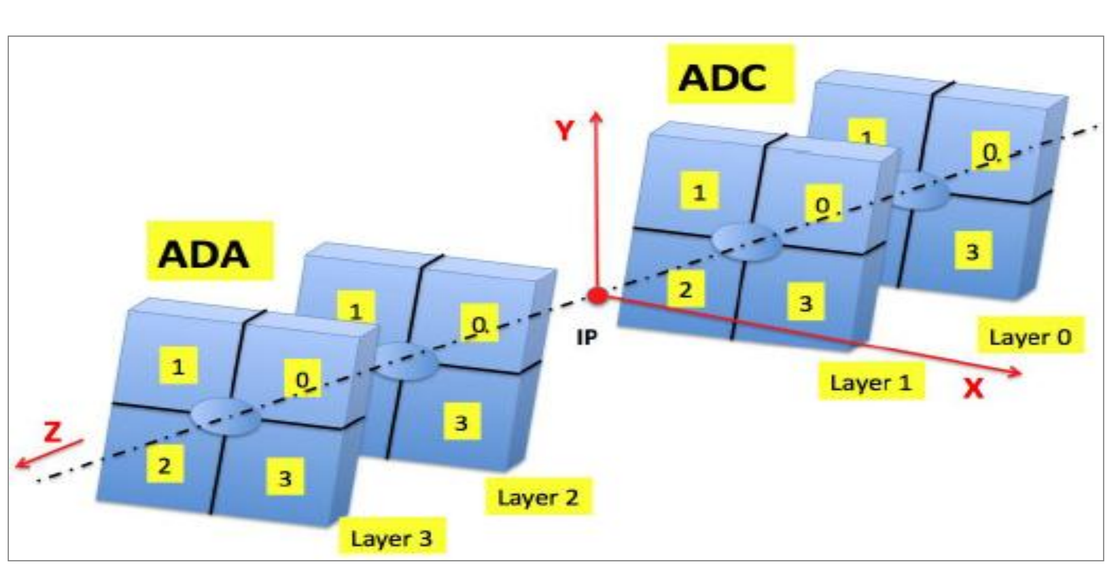

Fig. 1 ADA and ADC sub-detectors nomenclature in the ALICE cavern

DETECTOR CONTROL SYSTEM (DCS)

The DCS is responsible for controlling, monitoring and configuring the AD0 detector equipment among which there are commercial hardware devices like power supplies, voltage cards, crates, etc. as well as specific custom equipment akin to the Front-End Electronics (FEE). These tasks are accomplished mainly by sending commands and reading the status from the equipment. The control systems in ALICE are developed using a Supervisory Control and Data Acquisition (SCADA) platform called WinCC Open Architecture (OA) ® (formerly PVSS) from ETM Company [1].

The ADO DCS is integrated to the global control system of the ALICE Experiment.

Also all relevant parameters for the offline analysis of physical data are configured in the AD0 DCS to be archived periodically in the central database of ALICE [2].

ADO DCS Software Architecture

The software architecture is a tree-like hierarchy that models the structure of the hardware sub-systems and devices. The performance and functionality of each node in the tree hierarchy is implemented as a Finite State Machine (FSM) [3]. Fig. 2 shows the simplified software architecture in the AD0 DCS where the main subsystems are shown.

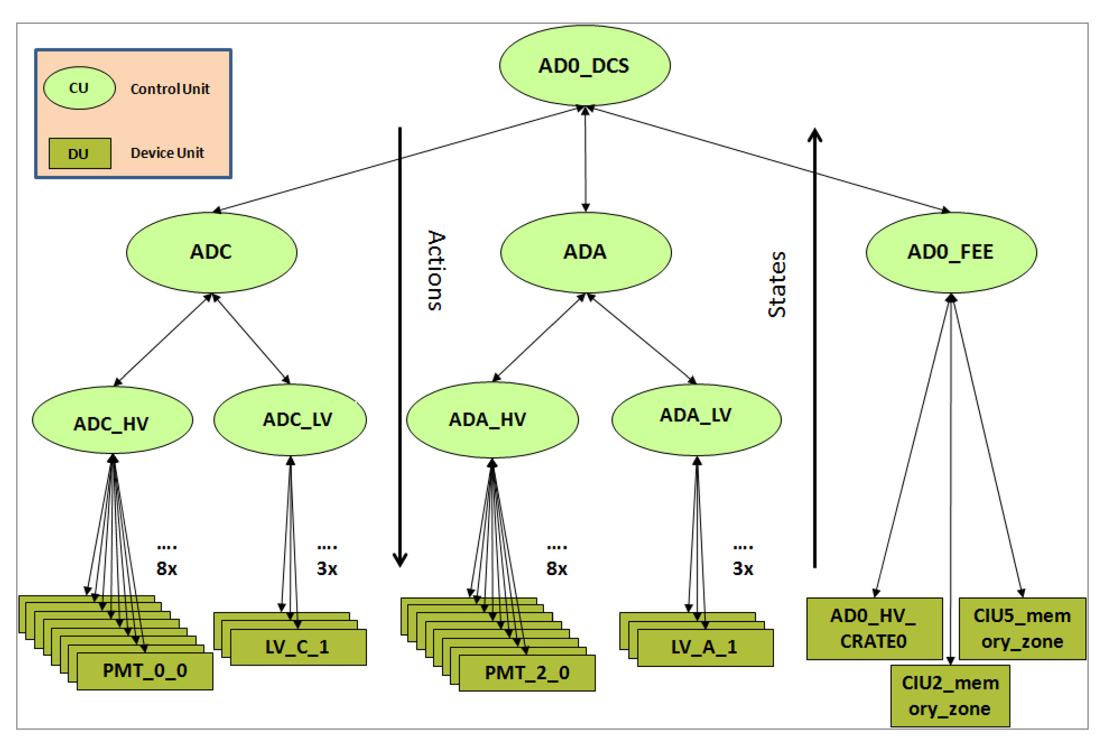

Fig. 2 AD0 DCS Software Architecture

ADO DCS Software Architecture

AD0 DCS has an architecture compatible with other hardware architectures in the ALICE experiment which are subdivided into three layers; a) supervision, b) process control and c) field layer [2]. The AD0 detector hardware architecture is described in Fig. 3.

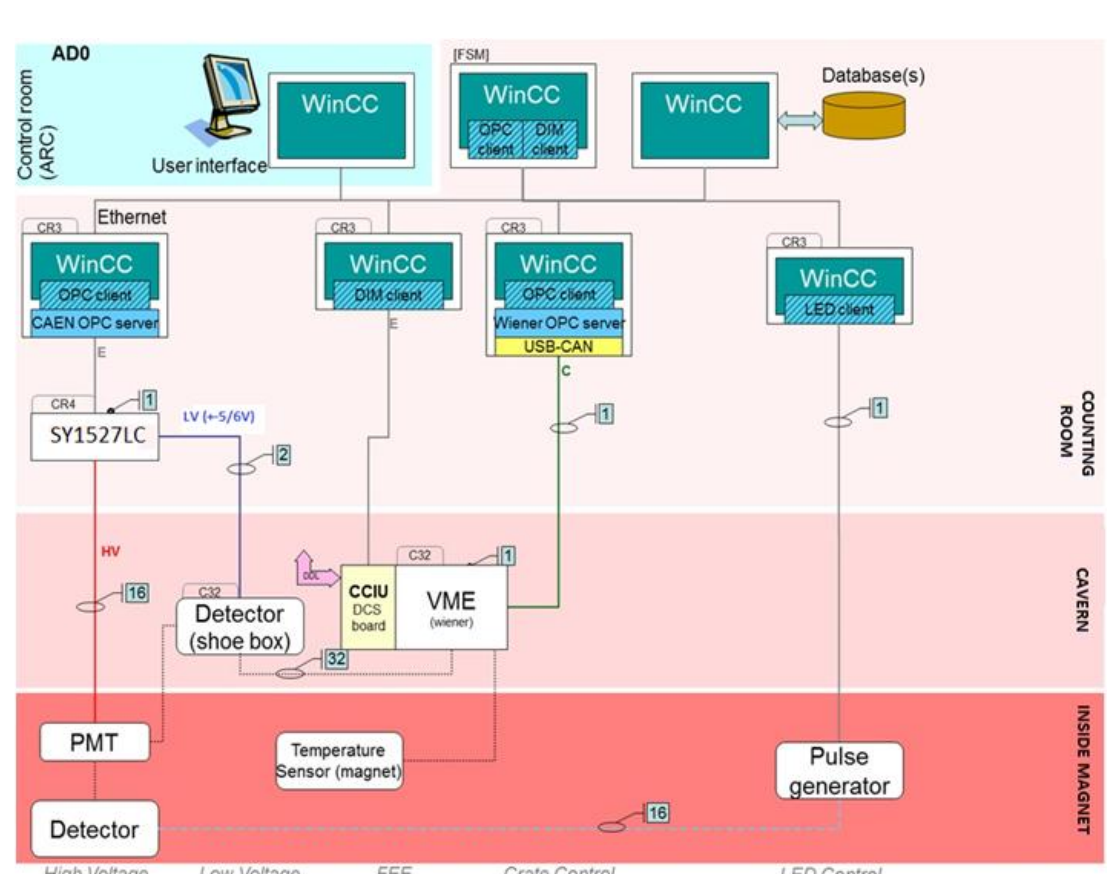

Fig. 3 AD0 DCS Hardware Architecture

Implementation of ADO DCS

The Control Unit (CU) and Device Unit (DU) nodes in the control hierarchy of AD0 are implemented as finite state machines. The FSM tool built into the framework is based on the SMI++ (State Machine Interface) language. The FSM Framework component allows the description of any sub-system as a collection of FSM objects [2]. The FSM state diagram for the AD0 DCS top node is shown in Fig. 4.

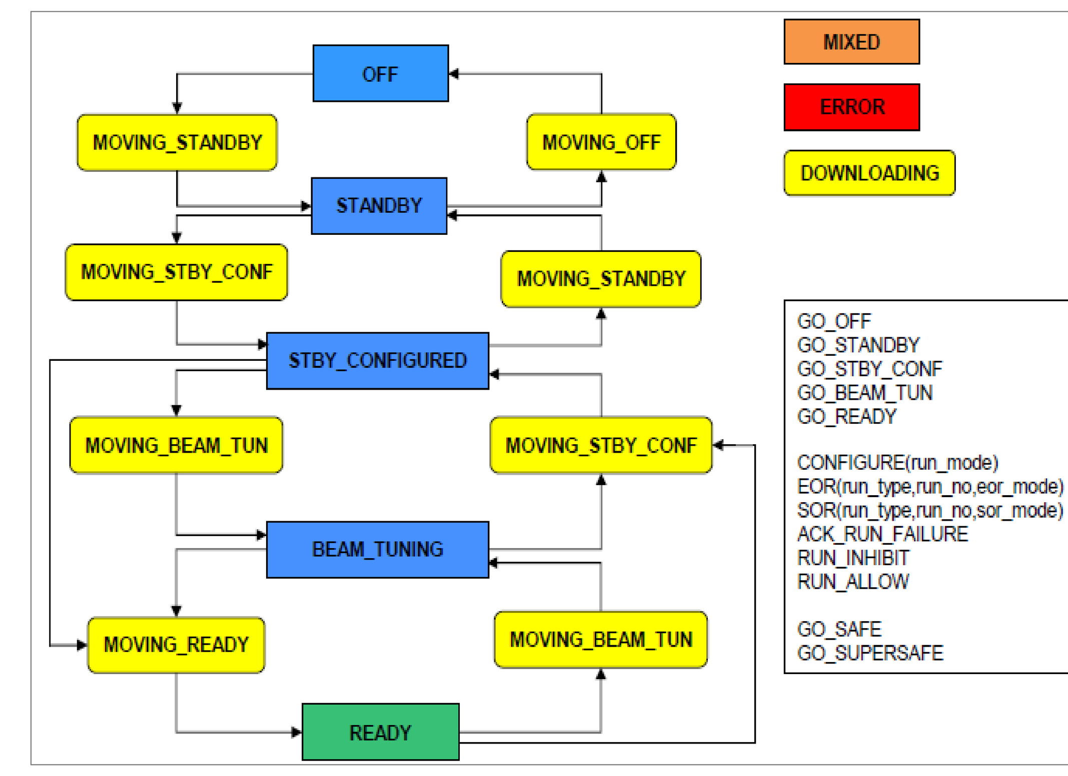

Fig. 4 FSM state diagram of the AD0 top node

DCS User Interface (UI)

The framework FSM component allows associating the custom user interfaces (panels) with any CU or DU in the hierarchy. Commands can be sent, and states can be shown graphically from these interfaces. The user can also navigate through the hierarchy and display the operation panel for each node. The user interface of the AD0 DCS top node is shown in Fig. 5.

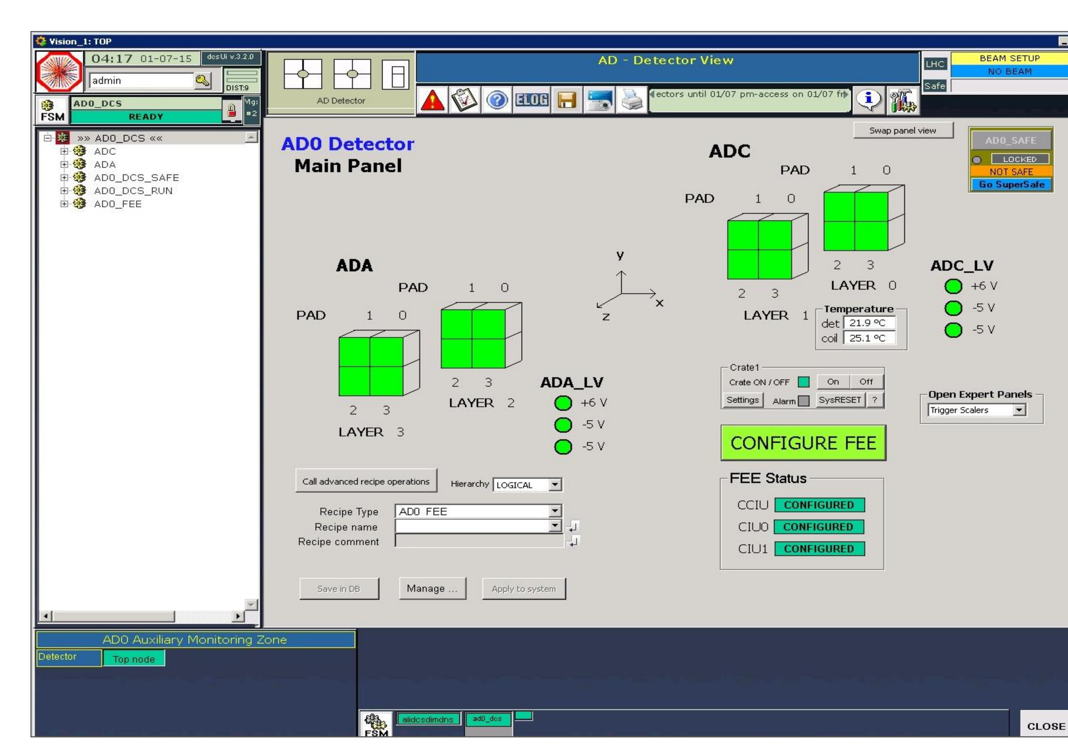

Fig. 5 AD0 DCS main user interface

RESULTS

- Detector Control System for the AD0 detector successfully developed and integrated in ALICE.
- Operational for data taking since beginning of 2015.
- LHC running period known as RUN II.
- Continuously maintained and updated following ALICE mainframe requirements.
- Friendly interfaces with the detector expert.
- Stable control system in ALICE central DCS.

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