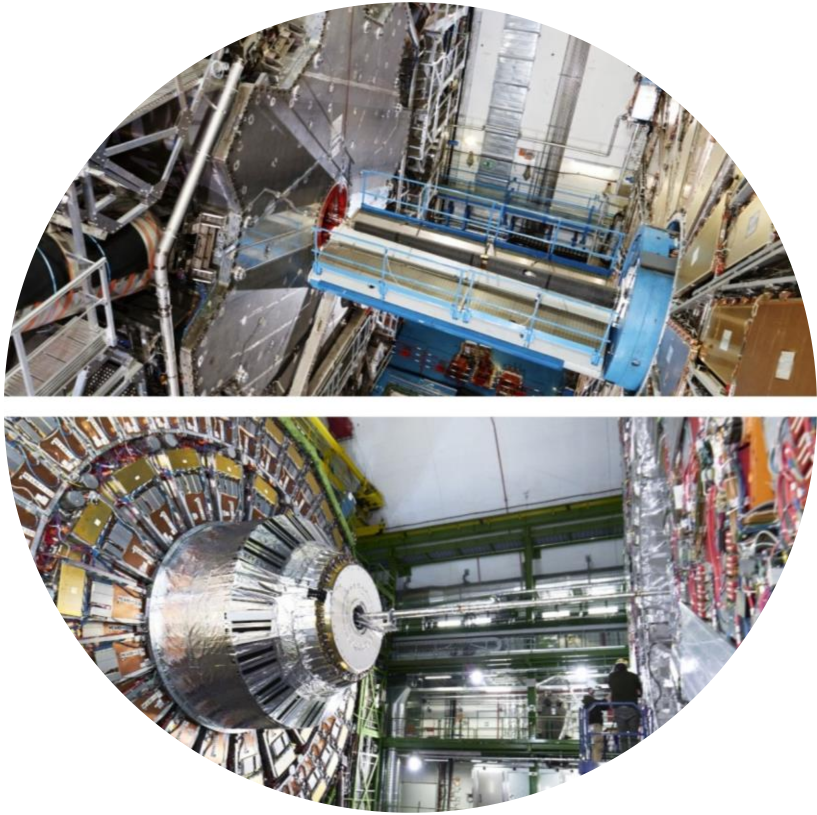
01. ATLAS



1.1 Systems

TDAQ

Responsible for selecting and storing interesting physics reactions from the plethora of data produced by the proton-proton collisions in the Large Hadron Collider (LHC).It filters vast amount of data to identify potentially significant events for further analysis

→

DSS

Has the mandate to put the detector in a safe state in case an abnormal situation arises which could be potentially dangerous for the detector

→

Online System

Responsible for all aspects of experimental and TDAQ operation and control during data-taking , and during testing and calibration run

→

DCS

Responsible for coherent and safe operation of Atlas detector, as well as the interface with external systems and services including LHC

1.1 TDAQ

1.LVL1 Trigger: A hardware-based system that rapidly processes the raw data from the detector. This reduces the data rate from the initial 40 MHz frequency of the LHC to a more manageable level.

2. HLT: These are software-based systems that further scrutinize the events passed by the LVL-1 Trigger. They run complex algorithms to determine if an event should be kept for detailed analysis, further reducing the rate of stored events to several hundred Hz.

3.Data Acquisition: The selected events are then read out, formatted, and conveyed through the data-flow system. This system is responsible for the event building and saving the chosen events into mass storage for subsequent analysis.

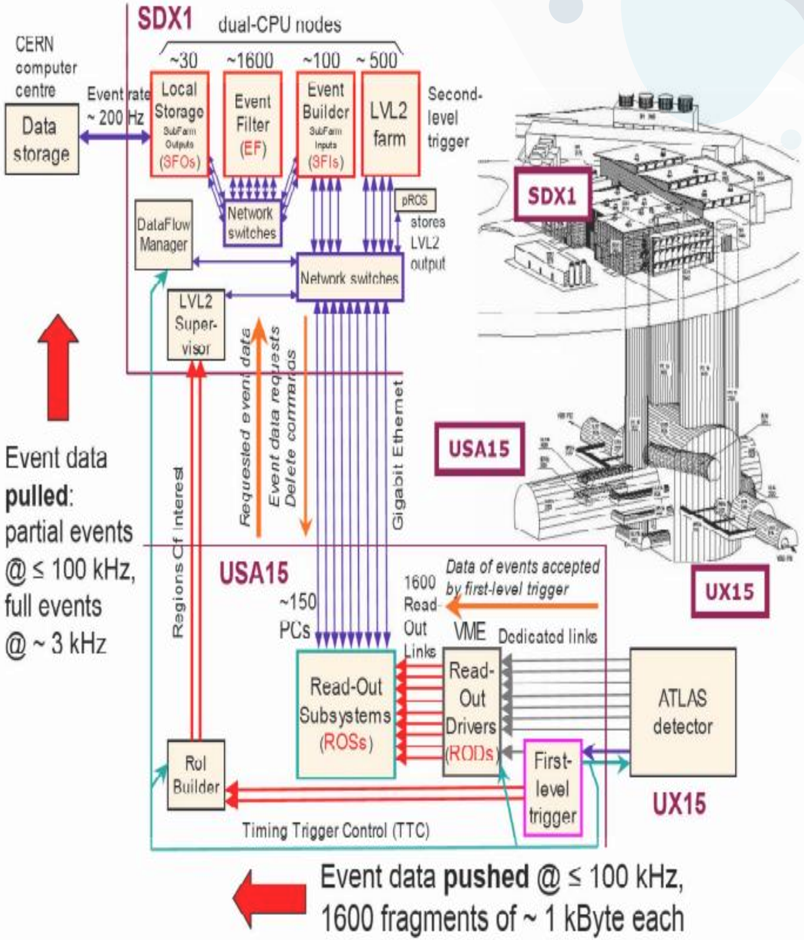


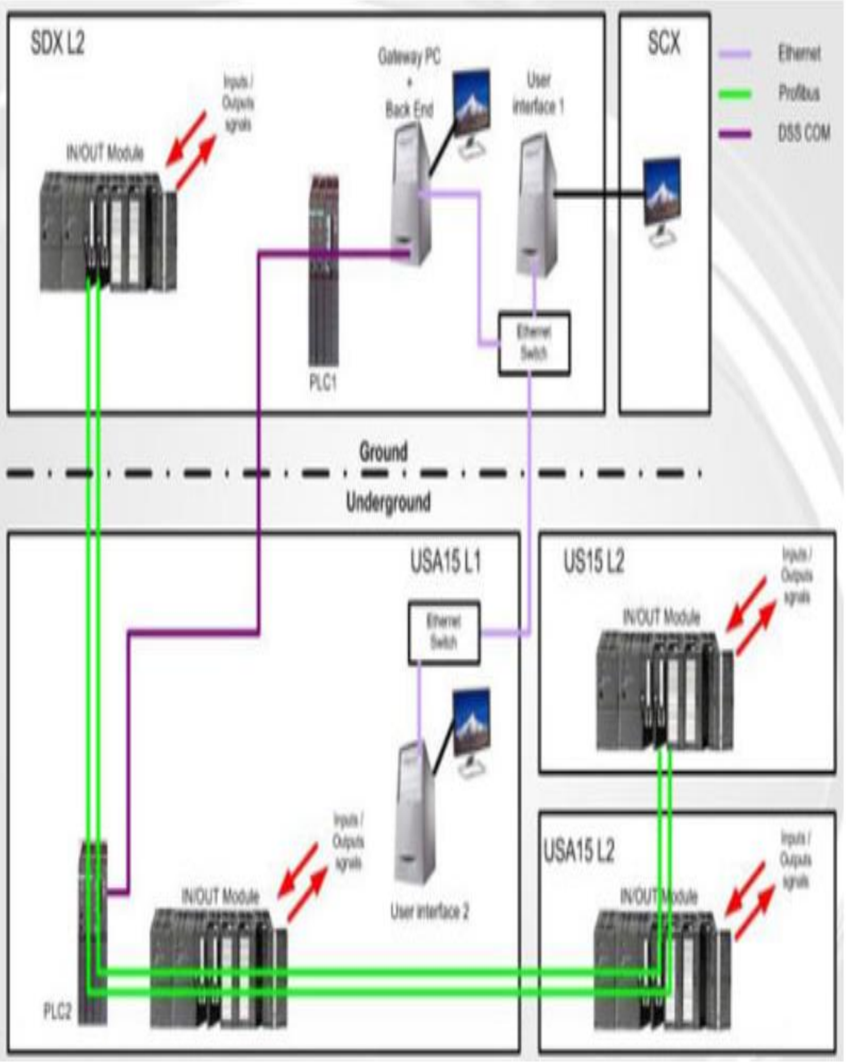
Fig. 1. ATLAS Trigger/DAQ System Overview

1.2 DSS

DSS works independently and hence complements the Detector Control System. It covers the cern alarm severity levels 1,2, and 3

Dedicated sensors detect safety hazards are connected to the DSS I/O racks, which are located in each ATLAS counting room. Information from any of these sensors, which are distributed over all of ATLAS, can be combined into alarms which in turn can trigger actions on the detector to bring it in a safe state.

This can be accompanied by informing people by SMS or e-mail, but **no manual action is required**. When the problem has been understood and solved, the operator can re-arm DSS and only then the equipment can be switched on again. The picture shows the main status display



1.3 Online Software Systems

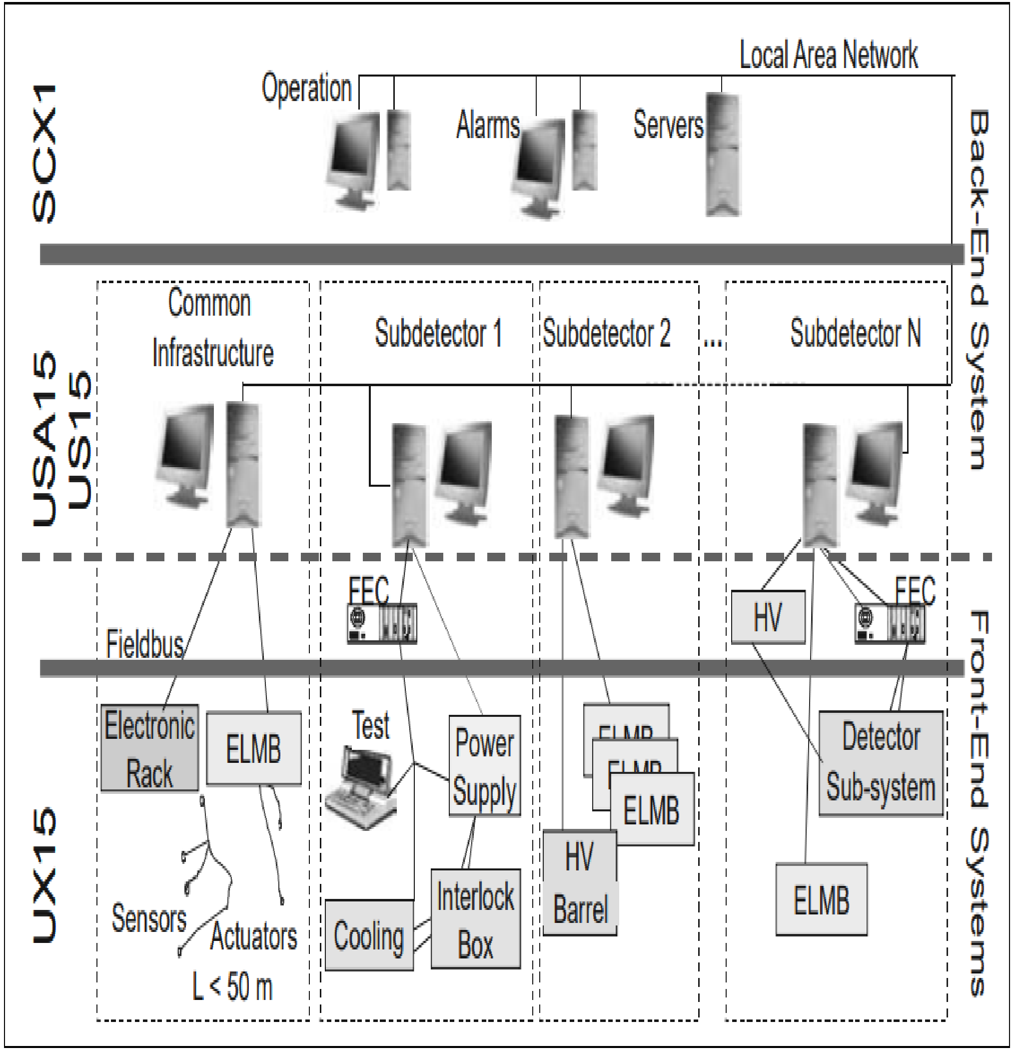
The Online Software system is responsible for configuring, controlling, and monitoring the TDAQ system, but excludes any management, processing, or transportation of event data. It is a framework which provides the glue between the various elements of the DAQ, HLT and DCS systems, and defines interfaces to those elements. It also includes information-distribution services and access to configuration and other meta-data databases.

An important part of the Online software is to provide the services that enable the TDAQ and detector systems to start up and shut down. It is also responsible for the synchronization of the the entire system, and the supervision of processes. Verification and diagnostics facilities help with the early detection of problems.

1.4 DCS

The DCS is the central nervous system of ATLAS. It ensures the safe and coherent operation of the entire experiment.

The experiment comprises **nine specialized sub-detectors**, each with distinct tasks and operational requirements. These sub-detectors must work seamlessly together



Key aspects of the DCS integration include:

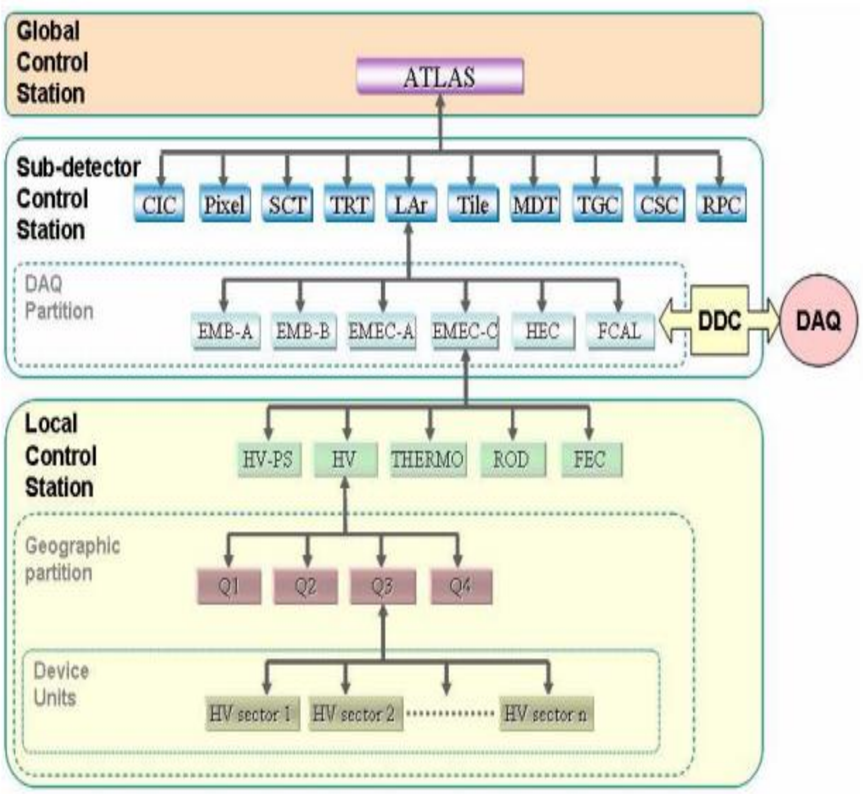
- Back-end organization: Structuring the control system efficiently.
- Process model identification: Understanding the behavior of different components.
- Fault detection: Ensuring robustness and reliability.
- Synchronization with external systems: Coordinating with other experiment components.
- Automation of processes: Streamlining operations.
- Supervisory control: Overseeing the entire experiment.

DCS BE Architecture

In the top layer, there will be a Global Control Station (GCS) which is in charge of the overall operation of the detector. It provides high level monitoring and control of all sub-detectors, while data processing and command execution are handled at the lower levels. The GCS will be able to access all stations in the hierarchy

The Sub-detector Control Stations (SCSs) form the middle level of the hierarchy. Each sub-detector has its own station and an additional one will exist to handle the Common Infrastructure Controls (CIC). The SCS allows the full local operation of the sub-detector by means of dedicated graphical interfaces. At this level in the hierarchy, the connection with the(DAQ) system takes place in order to ensure that detector operation and physics data taking are synchronized.

The bottom level of the hierarchy is made up of the Local Control Stations (LCSs), which handle the low level monitoring and control of instrumentation and services belonging to the sub-detector.



2.SPD

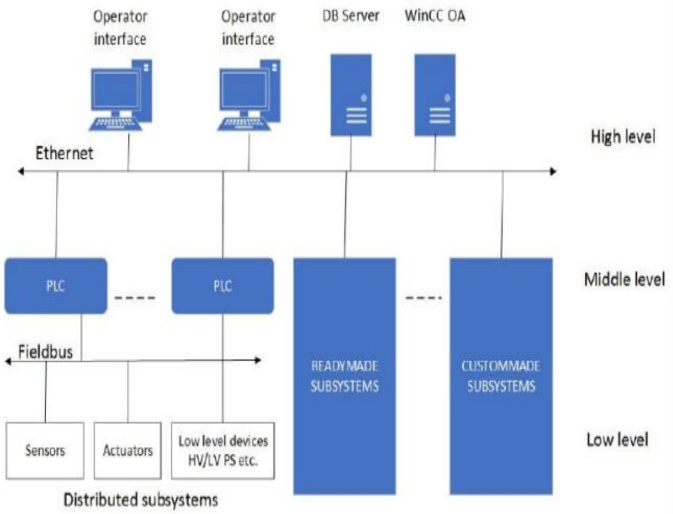


Figure 18.2: SPD detector control system architecture.

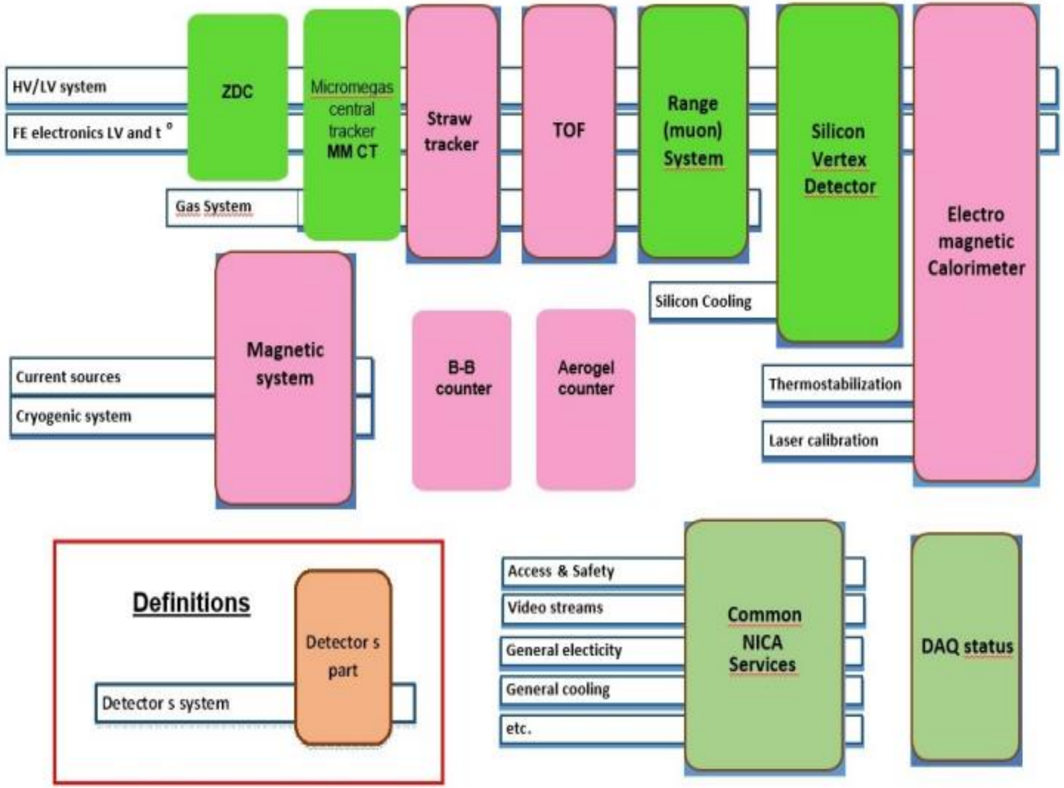


Figure 18.1: SPD detector control system layout.

The data acquisition system (DAQ) of SPD should provide a readout and a transfer of data from all detector subsystems. These include:

Vertex Detector (VD): a MAPS-based (or double-strip based) silicon tracking detector for precise determination of the primary interaction point and measurement of the secondary vertices from the decays of short-lived particles.

Micromegas-based Central Tracker (MCT): a tracking detector designed to improve the momentum resolution at the first stage of the experiment;

Straw Tracker: the main tracking detector for measurement of the primary and secondary particle momenta based on curvature of tracks in a magnetic field, and also for the ionization loss measurement.

particle identification detectors: i) time-of-flight resistive plate chambers (TOF) and ii) aerogel Cherenkov counters (Aerogel);

Electromagnetic Calorimeter (ECal) for measurement of the energy of gammas and electrons(positrons);

Range System (RS) for detection and identification of muons;

Beam-Beam Counters (BBC) for local polarimetry and monitoring of the beam collisions;

Zero Degree Calorimeters (ZDC) for local polarimetry using forward neutrons and for luminosity measurement.

Summary of detector outputs to DAQ at the first stage. Information type: T mea (or charge).

Sub-detector	Information type	Number of channels	Channels per FE card	Number of outputs
Micromegas Vertex	T + A	25600	128	200
Straw tracker	T + A	25904 + 4608	128	239
BBC (inner+outer)	T + (T + A)	(32 + 112)×2	32	2 + 8
Range system	T	130200	192	679
ZDC	T + A	1050×2	64	34
Total (max)		188556		1162