JOINT INSTITUTE
FOR NUCLEAR RESEARCH

NICA MPD

DEVISION OF AUTOMATED SYSTEMS FOR EXPERIMENTAL FACILITIES

Baldin Nikita,
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SALUTATION

I am Nikita Baldin

I have the **education** of an accelerator technology automation engineer Moscow Engineering Physical Institute (MEPhI).

More than 10 years I worked for large **system integrators** of full-scale DCS in the power plant industry in Russia.

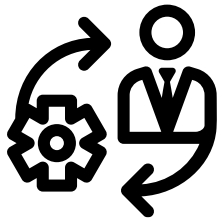
project in science that I did was automation of cryogenic liquefaction plants at the **NICA project in home institute JINR**, Dubna, Russia.

project in science that I did was DCS (detector control system) of ITS (inner tracker system) at **ALICE experiment In CERN** Geneve, Switzerland.

Automation - common terminology

DCS
Distributed Control System

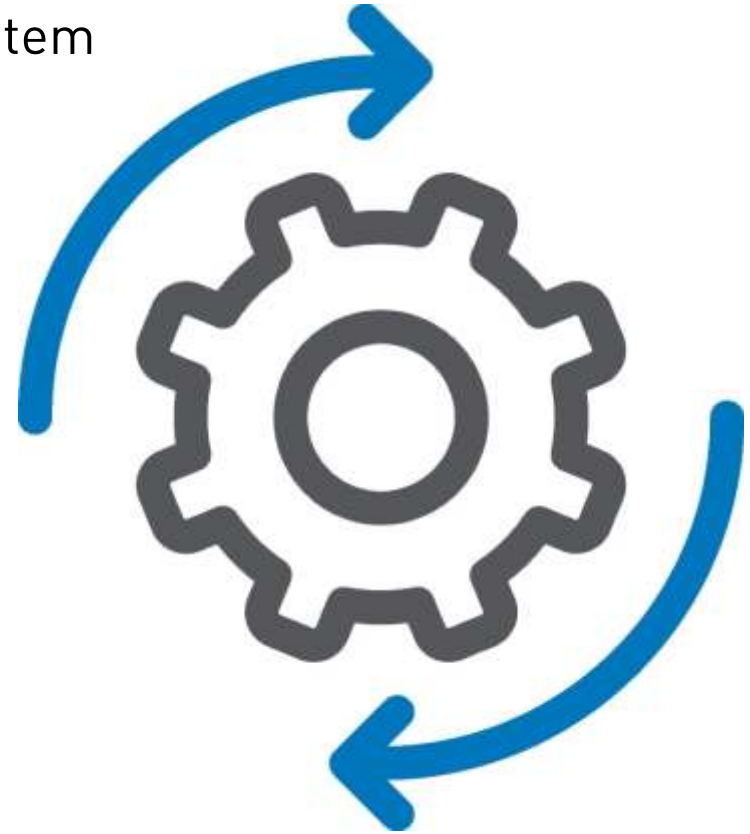
РСУ
Распределенная Система Управления



АСУ ТП
Автоматизированная Система Управления Технологическими Процессами

САУ
Система автоматического управления

Automation

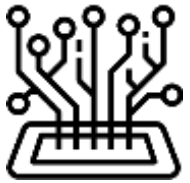


Система мониторинга

Slow Control

FSM
Finite State Machine

DCS
Detector Control System



AUTOMATION - centralization of data & control

A MAJOR MULTI-LEVEL DCS PROJECT ON SCADA WINCC OA AT CERN ON LHC

5
CONTROL ROOMS

over **680**
SUBSYSTEMS

over **45 mil.**
PARAMETERS

over **1400**
DEVELOPERS

Hierarchy of automated systems

detailed planning, inventory management, sales, finance, purchasing

monitoring the status and allocation of resources, process quality, performance analysis

process control and management, production dispatching

primary signal processing and logic of algorithms for automatic control of equipment

technological equipment, facility, sensors, actuators

GOALS AND OBJECTIVES

1. Provide stable units operation

2. Ensure safety equipment

Experimental data

Education activity

3. Achieving highest output quality

4. Providing an optimal operational mode

CERN STYLE DECOMPOSITION

Detector Control System

- Status equipment
- Parameters technology process
- Equipment modes

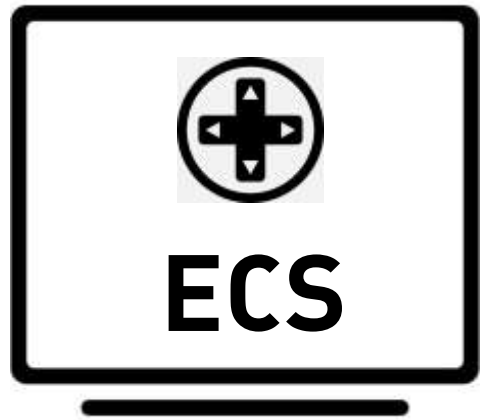
Detector Safety System

- Interlocks
- Setpoints
- Process protection
- Locks and blocks

Data Acquisition System

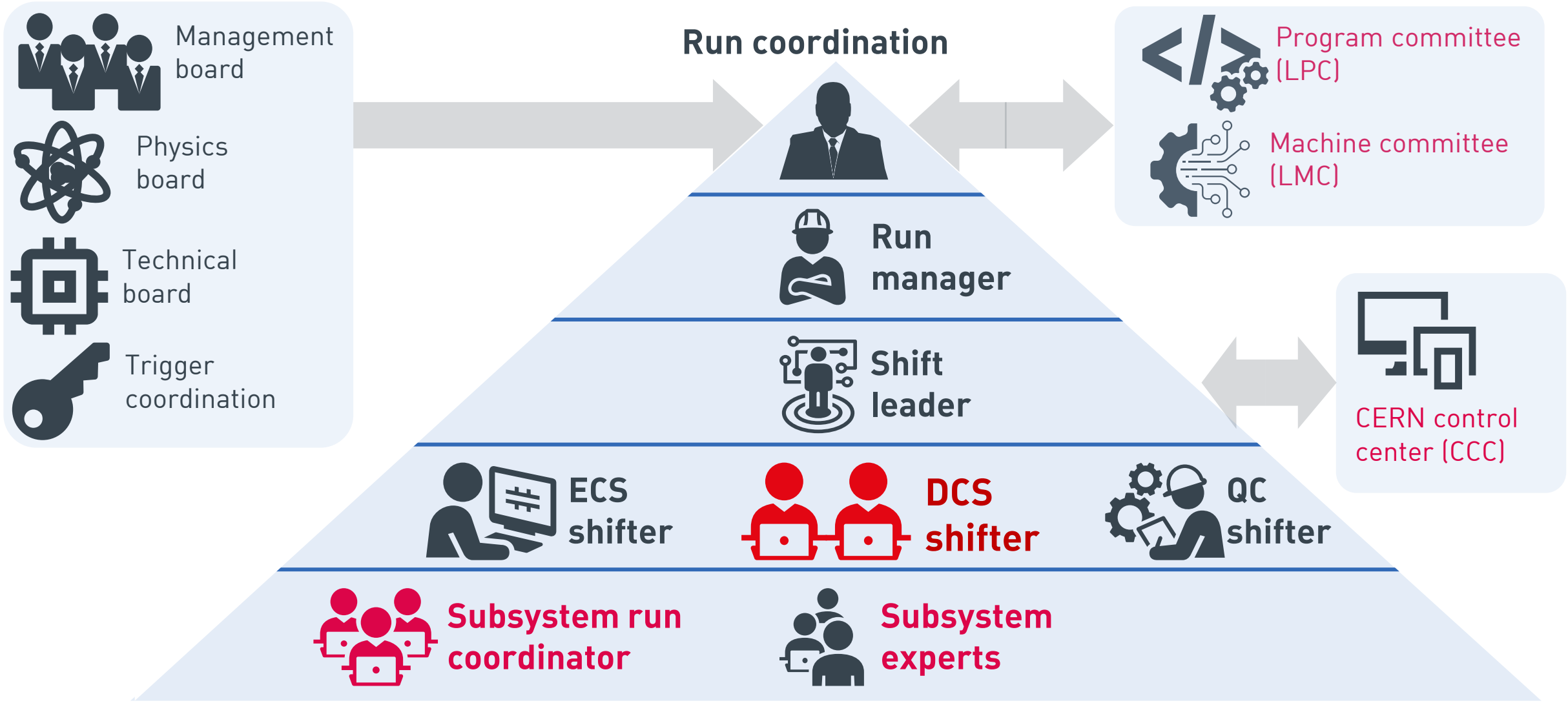
- RAW data science
- Quality control
- Correct data

Experiment Control System



- Run start/stop
- Run coordination
- Run processing

ALICE run coordination



Experimental physics terminology

ALICE

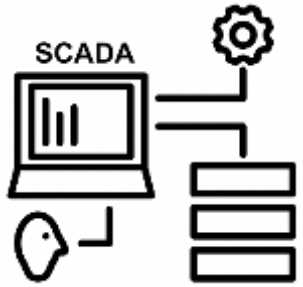
"Data Acquisition, Control and Trigger"

ATLAS EXPERIMENT

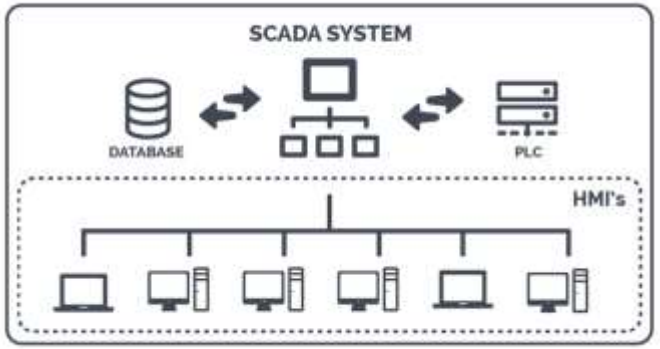
"High-Level Trigger, Data Acquisition and Controls"

Trigger + **Data Acquisition** + **Controls**

SCADA Abbreviation



SCADA



Supervisory, control and **data acquisition**

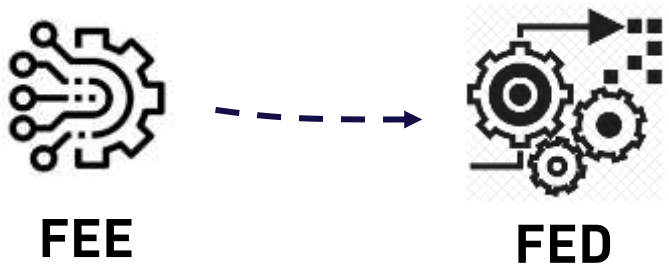
Supervisory

Control

Data Acquisition

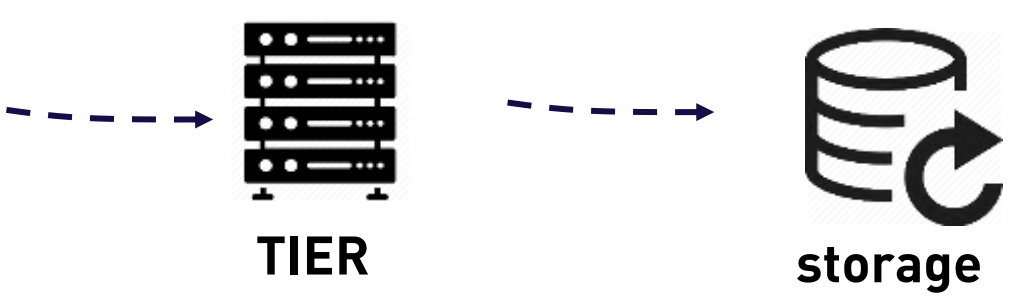
Boarder between DAQ and Computing

DAQ



- Filtering by trigger conditions
- Readout, aggregation,
- split into Sub-Time Frames
- Local pattern recognition and calibration
- Local data compression
- Quality control

Computing



- Event extraction
- Event reconstruction

Subprojects portfolio

Есть ли на данный момент понимание, на какие **автоматизированные подсистемы** будет разделён MPD

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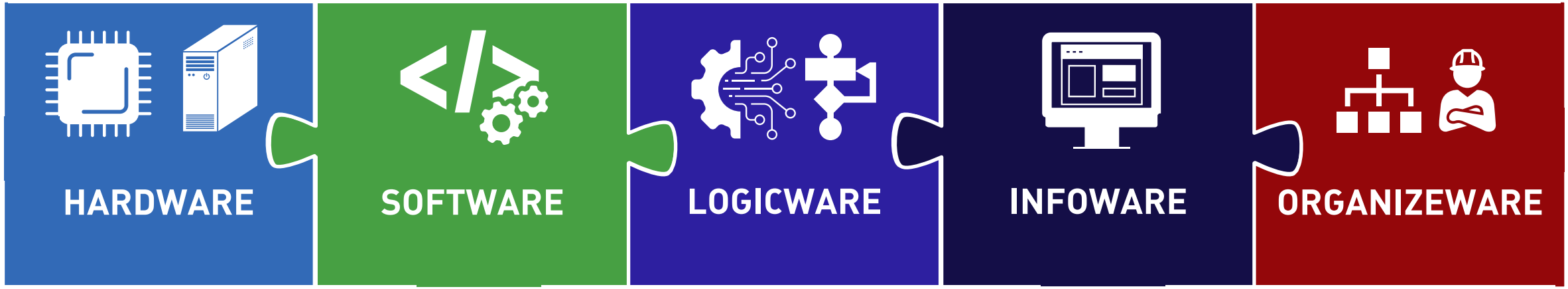
Thank you !!!

CONSTITUTION OF AUTOMATED SYSTEMS



- Front-end electronics
- i/o modules
- PLC
- Servers
- ARM

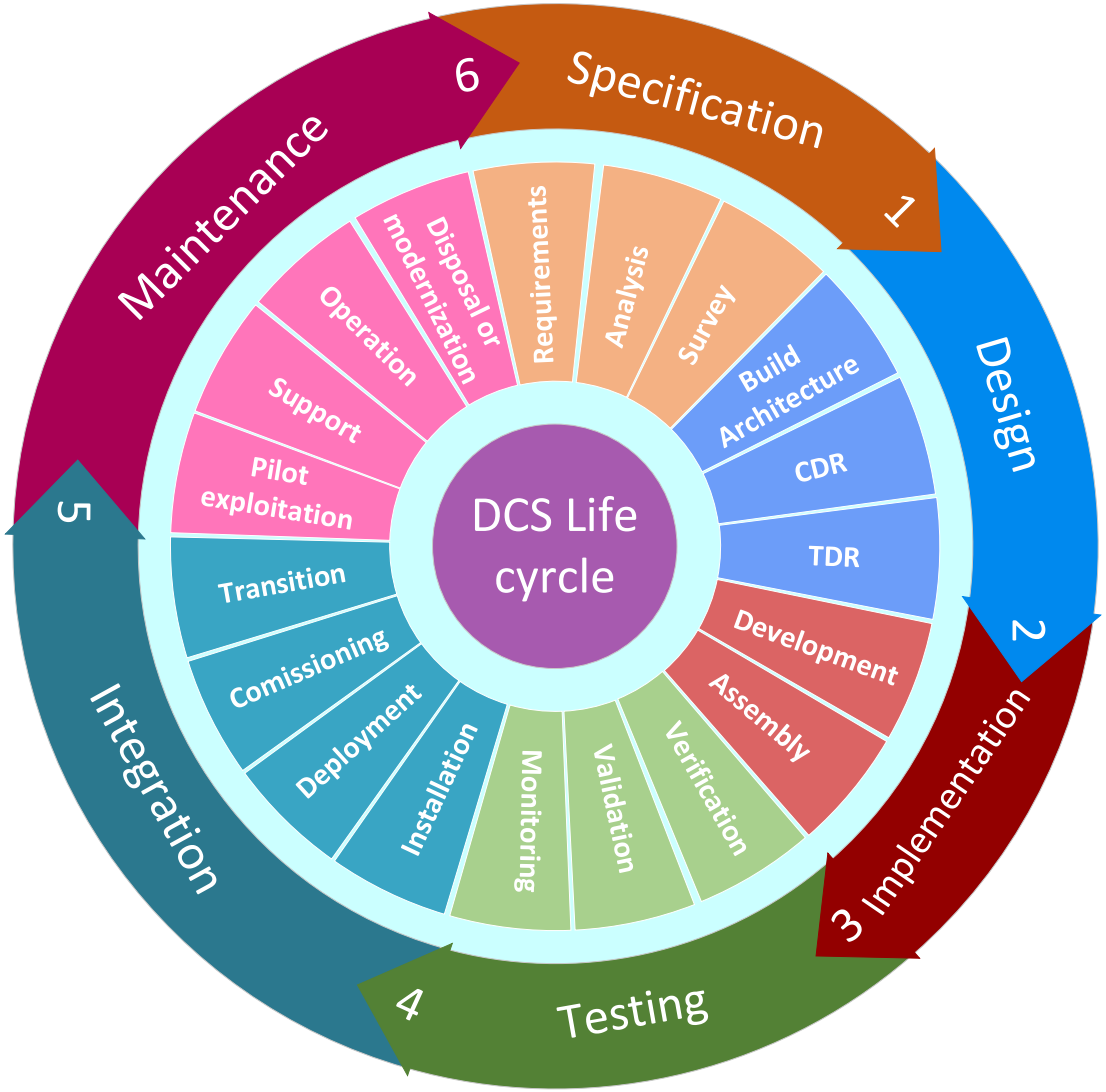
- Operation systems
- Protocols
- SCADA
- Developing studio

- Firmware
- Logical components
- Algorithms
- Procedures
- Technological functions

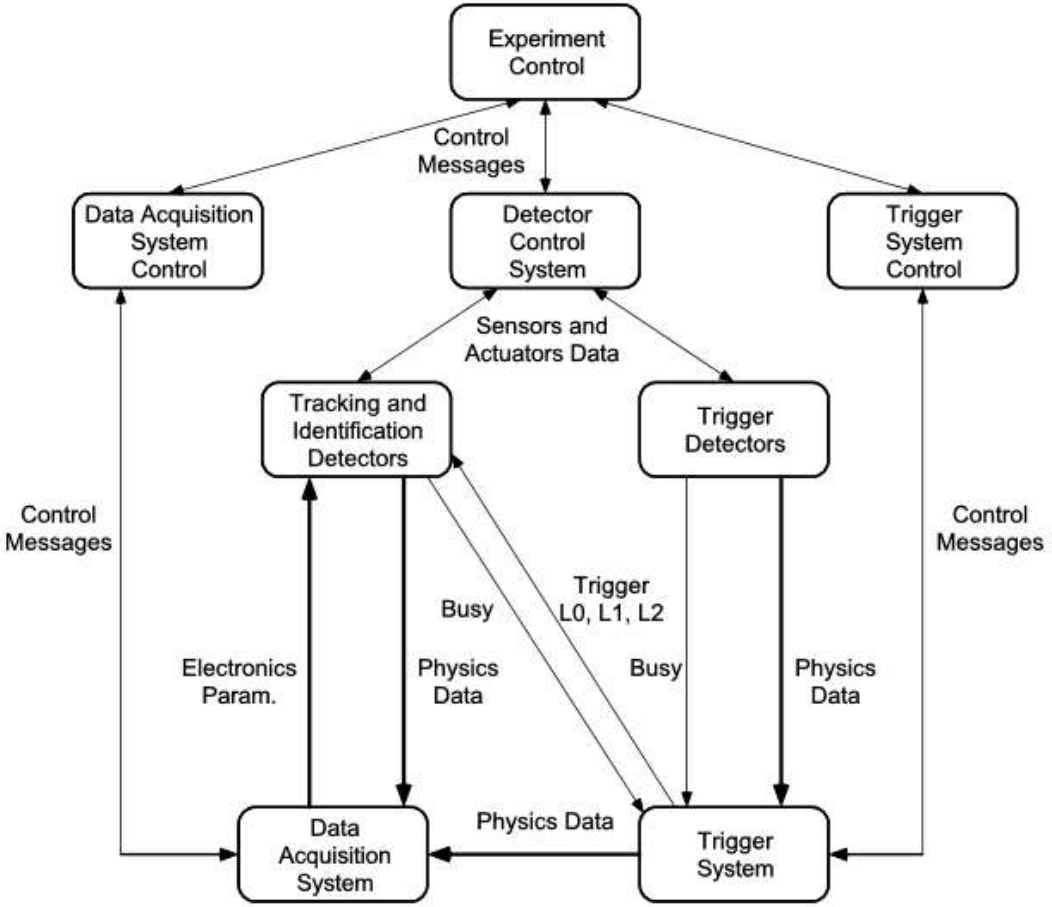
- User interface
- MIMICS
- Graphical panels
- Graphics, trends
- Alarm table

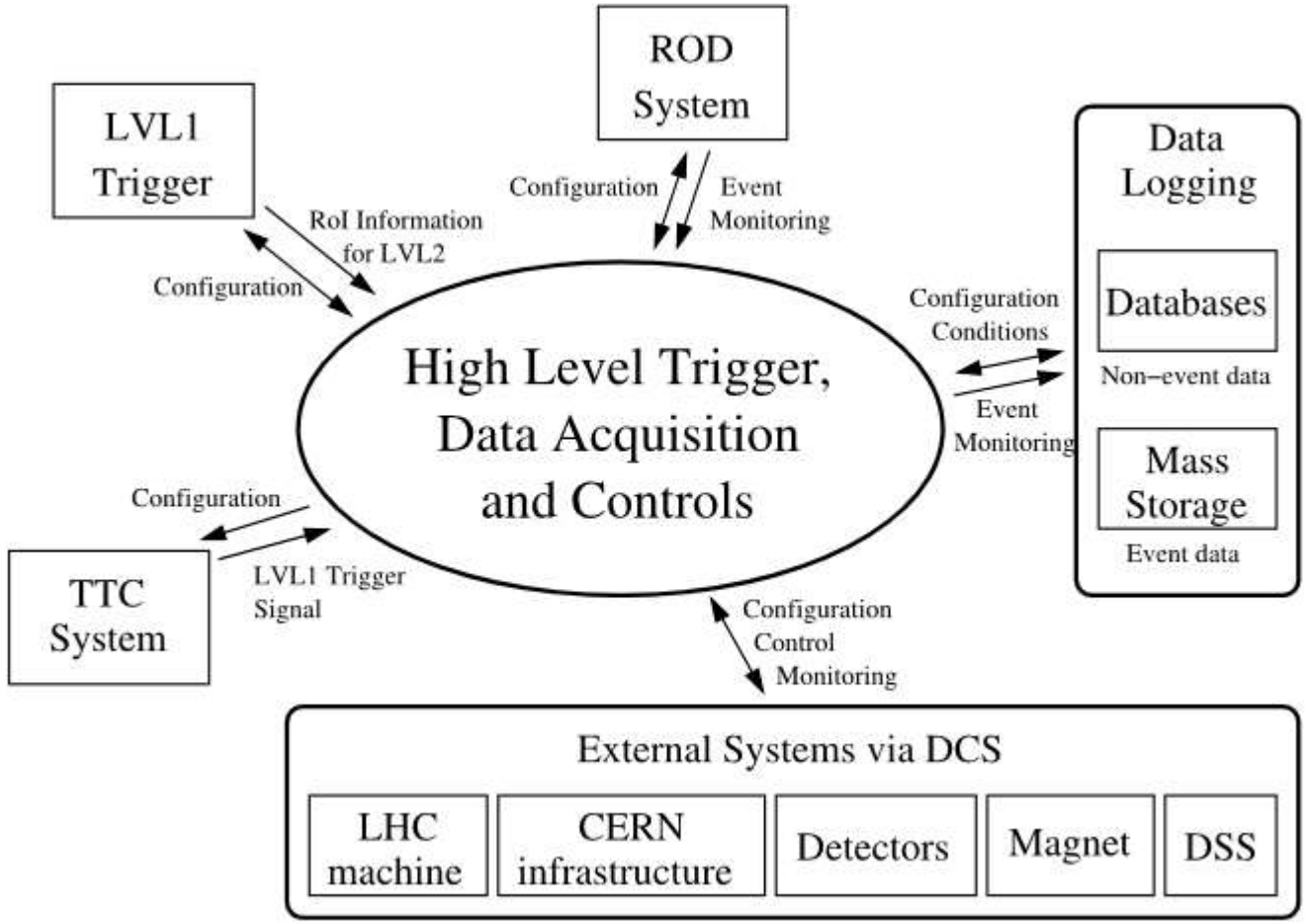
- Organization structure
- Personnel tasks
- Duties
- Rights
- Responsibilities
- Instructions
- User manual

LIFE CYCLES OF AUTOMATED SYSTEMS



ПРИМЕР СХЕМ


Experiment Control
Control Messages
Data Acquisition System Control
Detector Control System
Trigger System Control
Sensors and Actuators Data
Tracking and Identification Detectors
Trigger Detectors
Control Messages
Control Messages
Busy
Trigger L0, L1, L2
Electronics Param.
Physics Data
Busy
Physics Data
Physics Data
Data Acquisition System
Trigger System


ROD System
LVL1 Trigger
Configuration
Event Monitoring
RoI Information for LVL2
Configuration
Data Logging
Databases
Non–event data
Configuration Conditions
Event Monitoring
High Level Trigger, Data Acquisition and Controls
Mass Storage
Event data
Configuration
TTC System
LVL1 Trigger Signal
Configuration Control Monitoring
External Systems via DCS
LHC machine
CERN infrastructure
Detectors
Magnet
DSS