



JOINT INSTITUTE  
FOR NUCLEAR RESEARCH



# Life cycles of Automation systems in Experimental facilities

— Baldin Nikita,  
Dubna, February 2024



## 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**.



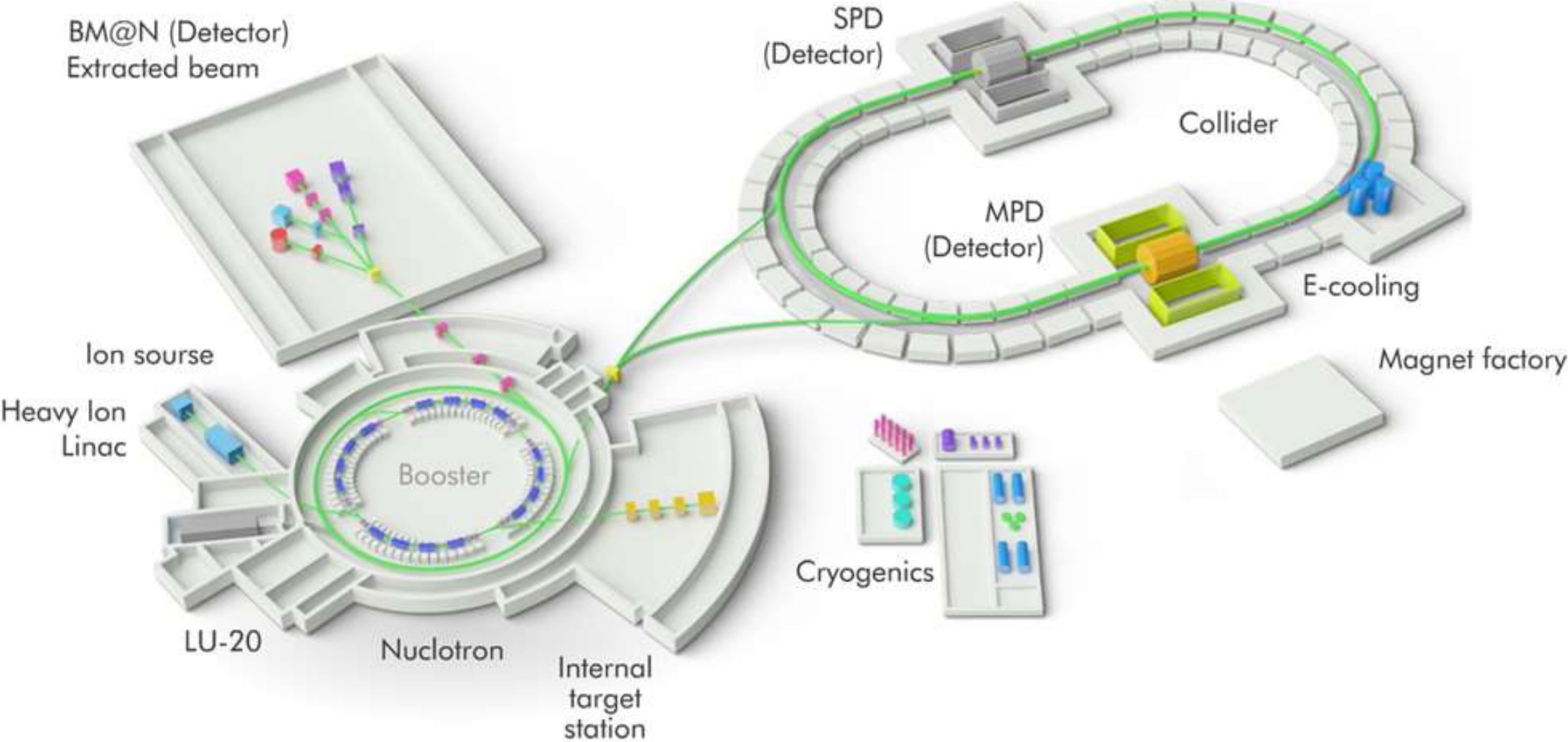
Dubna, Russia.

project in science that I did was DCS (detector control system) of ITS (inner tracker system) at **ALICE experiment**

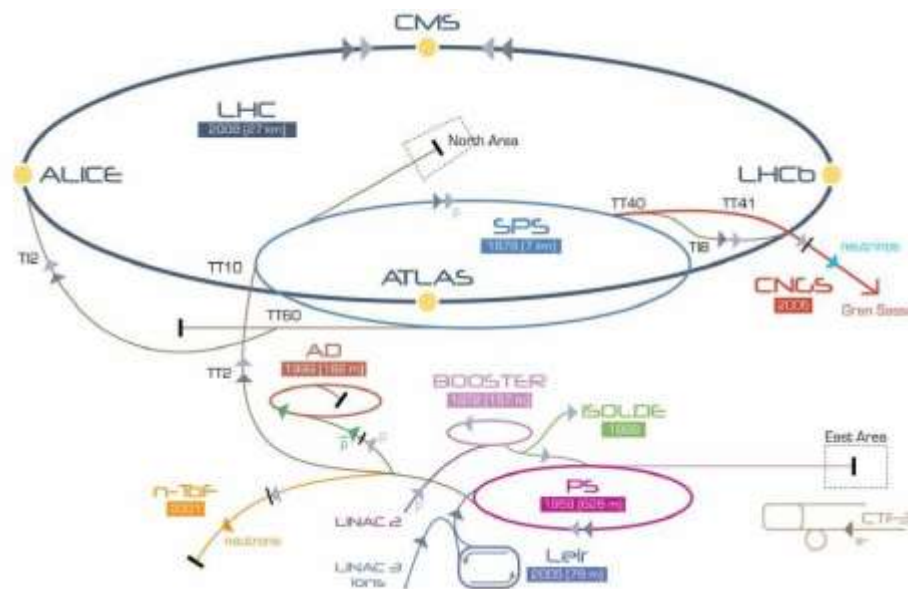
**In CERN**



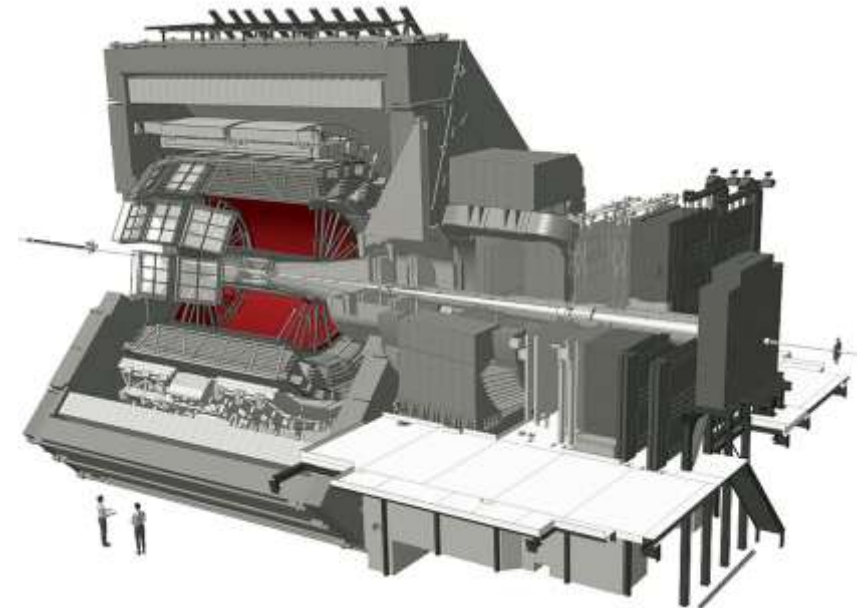
Geneve, Switzerland.



## Acceleration complex



## Experimental facility



# Control center - AUTOMATION AT CERN

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

**5**  
CONTROL ROOMS

over  
**680**  
SUBSYSTEMS

over  
**45 mil.**  
PARAMETERS

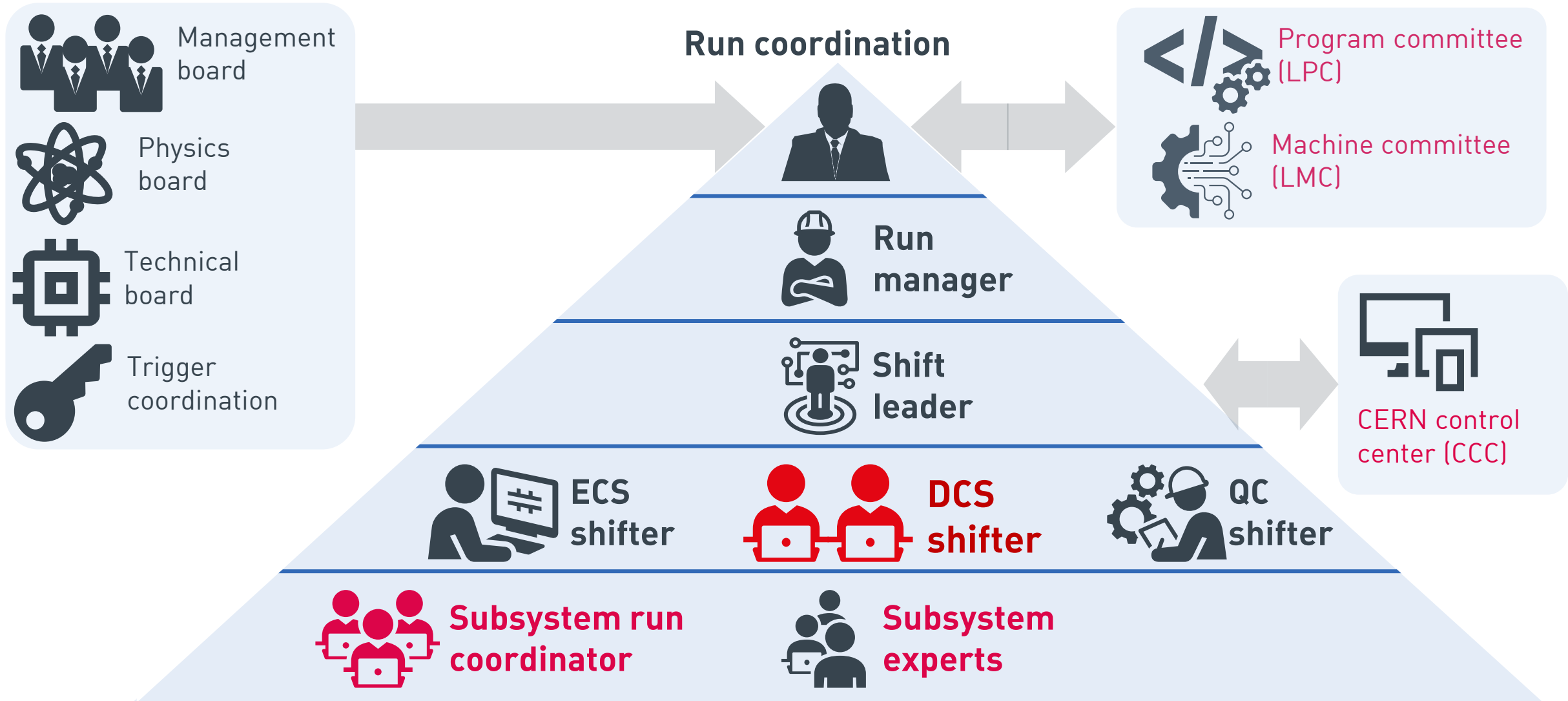
over  
**1400**  
DEVELOPERS



# Раст Синхрофазатрон control room



# Example - ALICE run coordination



1.

Provide stable units operation



Ensure safety equipment

2.



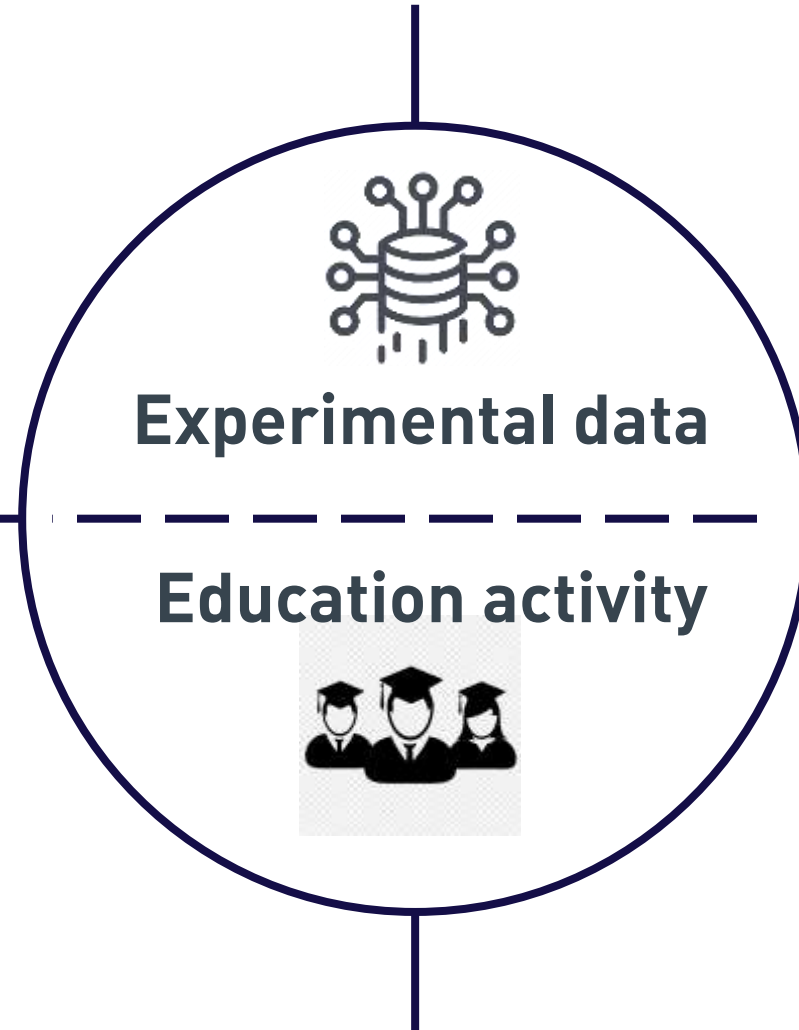
3.

Achieving highest output quality



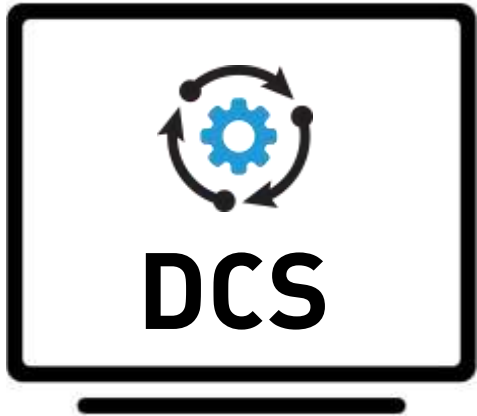
Providing an optimal operational mode

4.





## Detector Control System



**DCS**

- Status equipment
- Parameters technology process
- Equipment modes

## Detector Safety System



**DSS**

- Interlocks
- Setpoints
- Process protection
- Locks and blocks

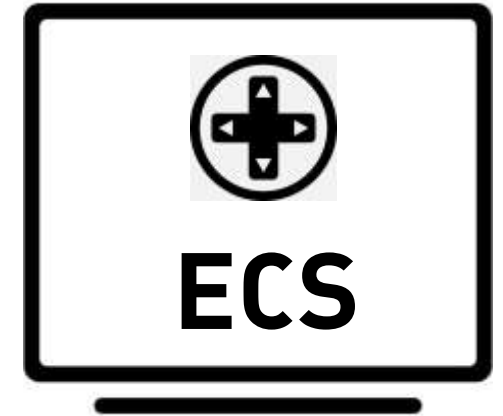
## Data Acquisition System



**DAQ**

- RAW data science
- Quality control
- Correct data

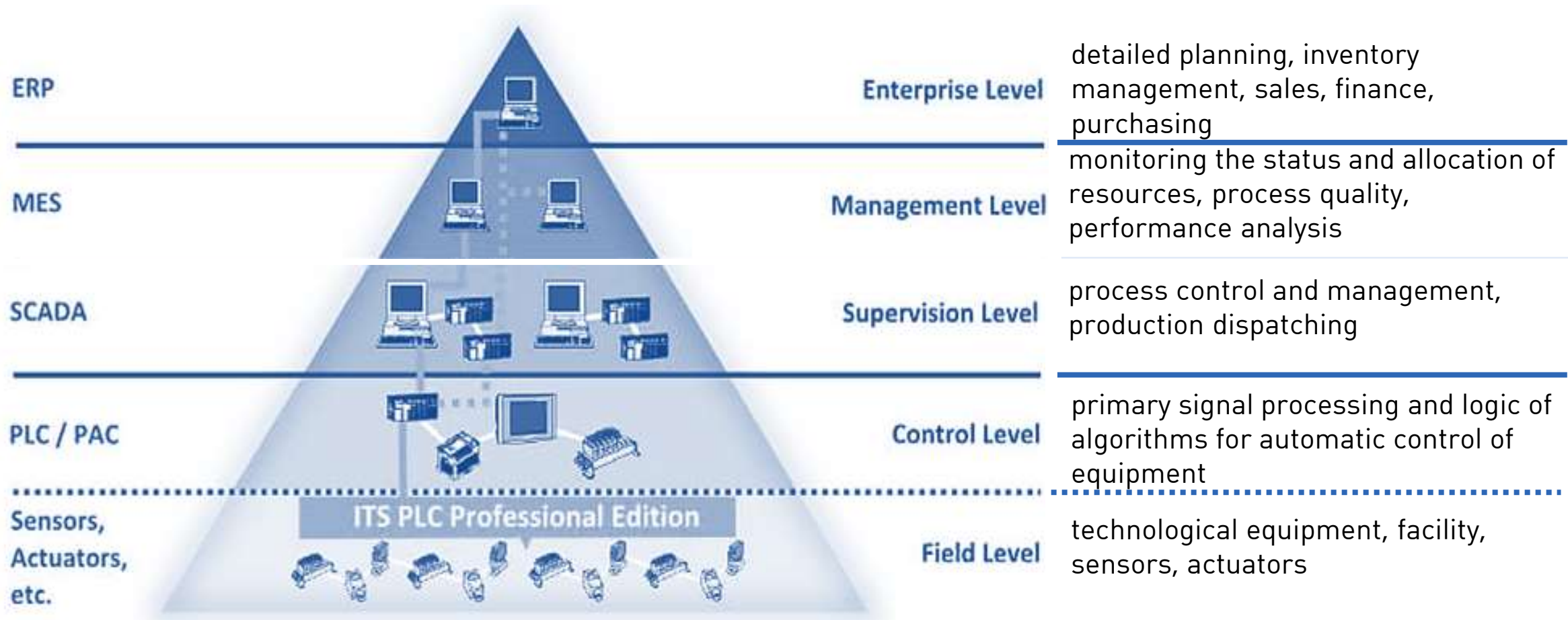
## Experiment Control System



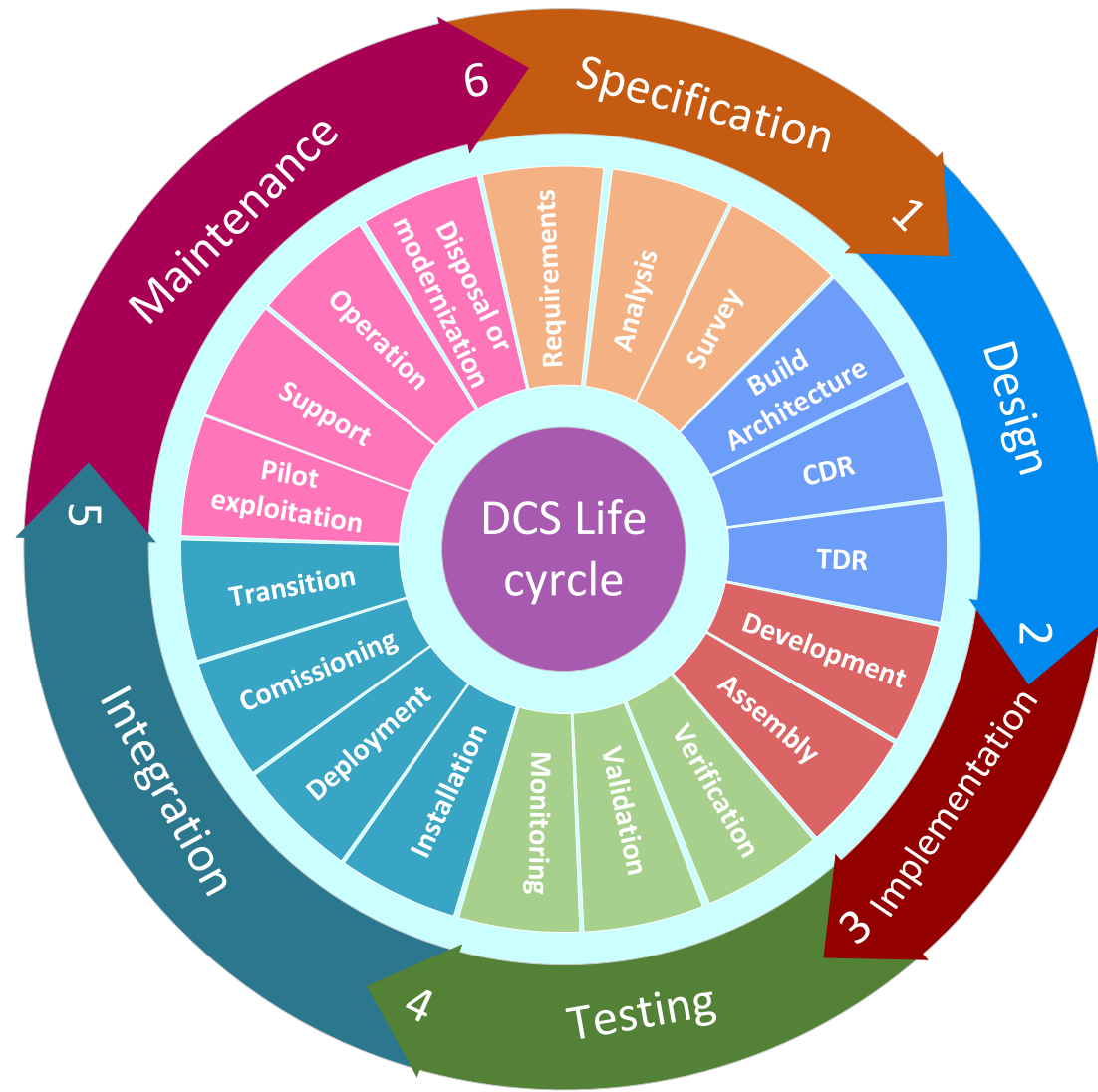
**ECS**

- Run start/stop
- Run coordination
- Run processing

# Hierarchy of automated systems

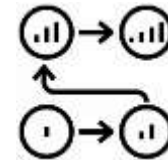


# LIFE CYCLES OF AUTOMATED SYSTEMS





**Collaboratively write a review article on automated systems development life cycles**



## **Design Stages:**

- Stage types
- Industry Standards and Global Practices



## **Decomposition to Subsystem:**

- Necessity of Disassembling a Complex System
- Methods & Tools



## **Requirements Formulation:**

- Functionality
- Specifications
- Features and Characteristics



## **Documentation:**

- Types
- Content
- Compliance with Standards



## **Project Solution:**

- Utilized Technologies
- Architecture

## What to do



1.

**What stages of design can be? what's the paperwork rate?**

- CDR
- TDR
- ?

2.

**Google to find examples of projects we can take:**

- CERN LHC experiments: ATLAS, ALICE
- JINR NICA experiments: BMAN, MPD, SPD
- Other Worldwide?

3.

**Compose your initial presentation following these steps:**

- First slide - Introduce yourself
- Present you understanding of the task
- Ideas on how to achieve the objective
- Create planning/ scheduling and decomposition of work
- Ideas how to split tasks among other participants



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ALICE

“Data Acquisition, Control and Trigger”



“High-Level Trigger, Data Acquisition and Controls”

Trigger



+

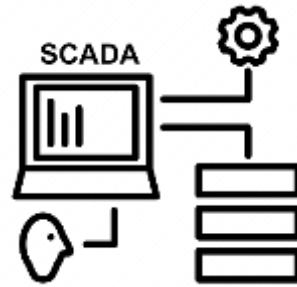
Data Acquisition



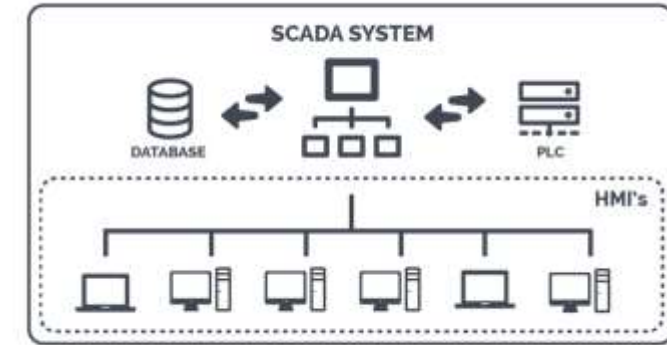
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Controls



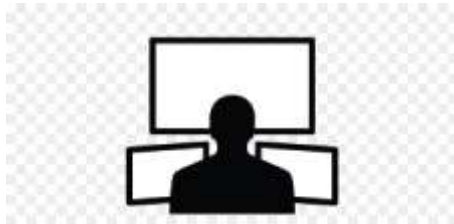


# SCADA



**Supervisory, control and data acquisition**

**Supervisory**



**Control**



**Data Acquisition**

