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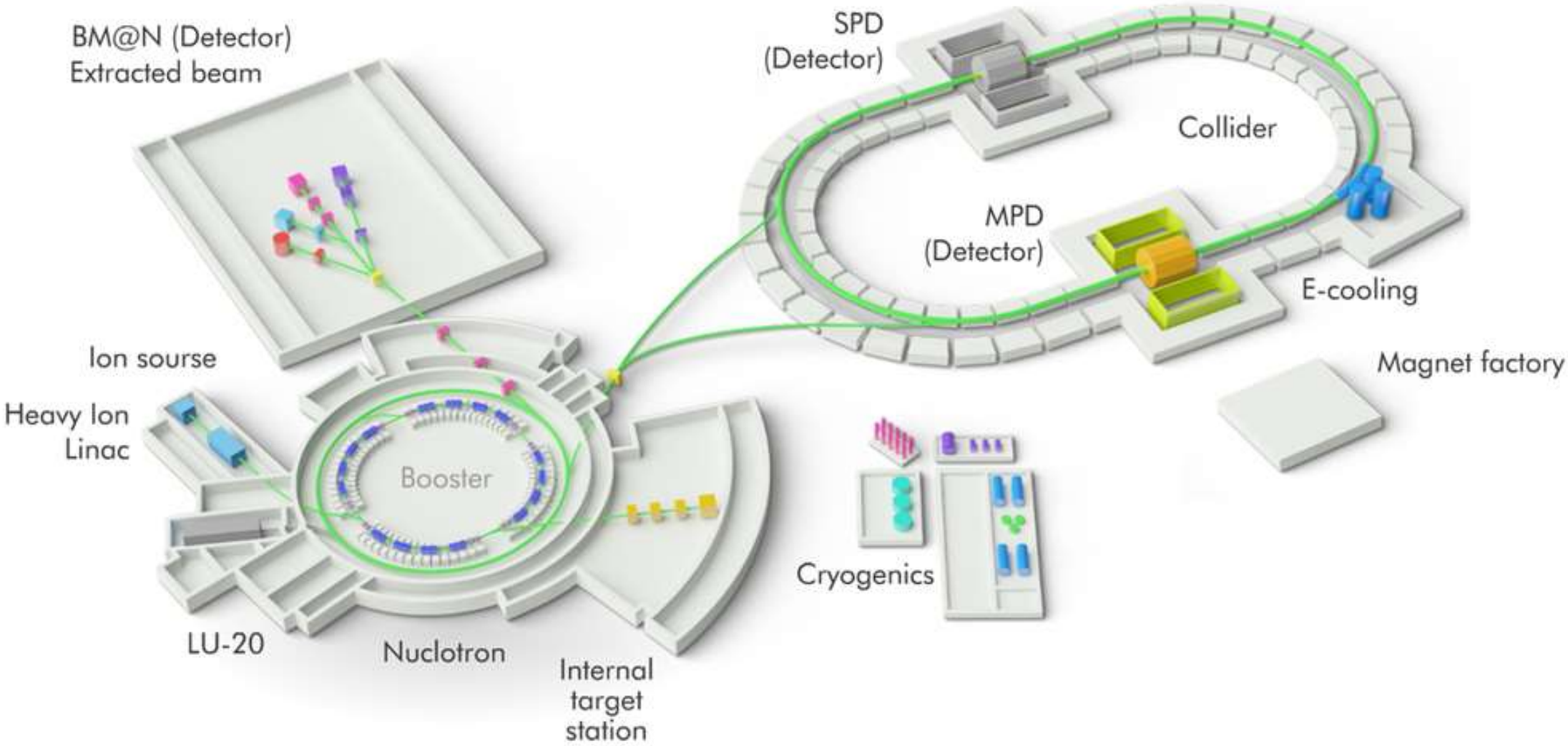
FOR NUCLEAR RESEARCH

NICA MPD

issue of automation in high-energy physics

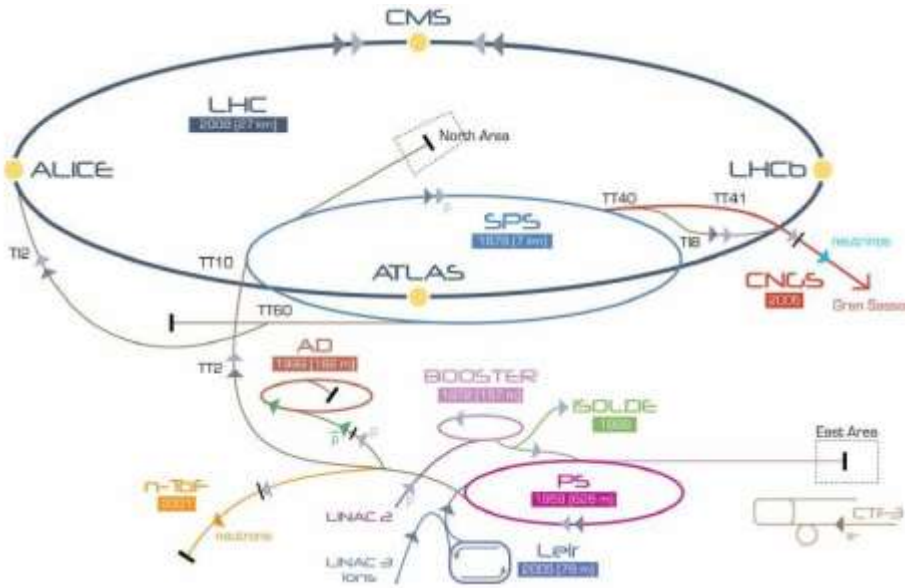
Baldin Nikita,
Dubna, October 2023

NICA Project at JINR

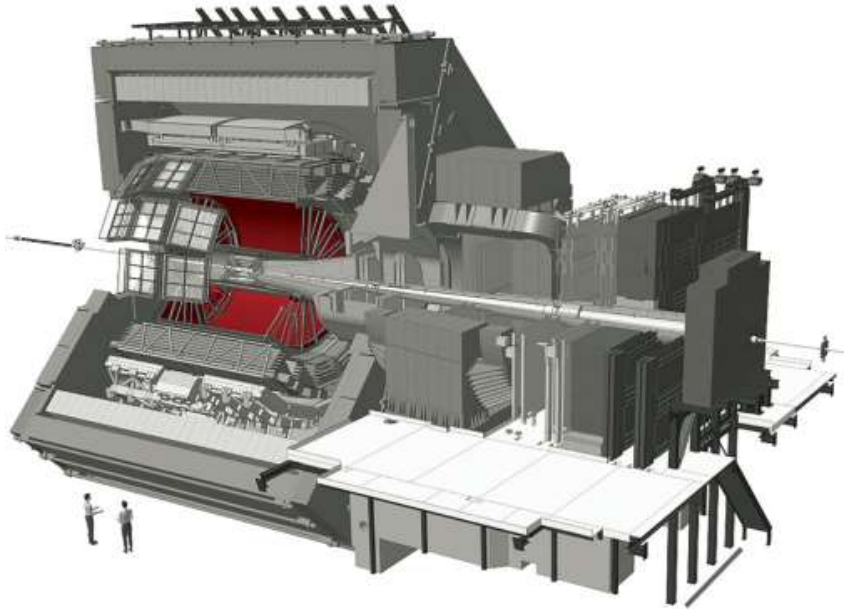


Main types of subprojects

Acceleration complex



Experimental facility



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

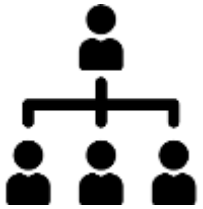
over **1400**
DEVELOPERS

Past Синхрофазатрон control room

Work environment

Physical Organization

- Размещение оборудования в различных зданиях
- Размещение пультовых и местных пультов управления
- Эргономика, освещение, климатические условия



Work organization

- Управление рабочим процессами
- Инструкции и руководства пользователей
- Обучение и проверка знаний

Supervision and control

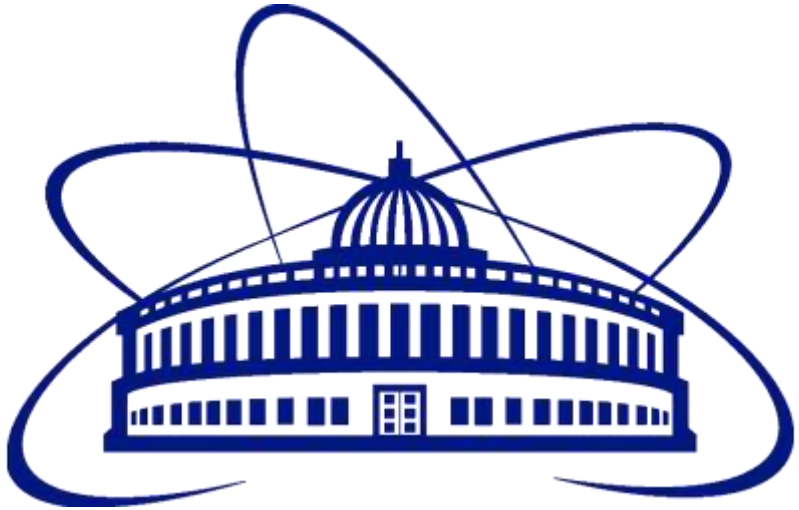
- Автоматизированные и не автоматизированные функции
- Интерфейс пользователя
- Функции управления и настройки

Technical Support

- Регламентное обслуживание
- интеграция
- Надежность составляющих

1-st group task

A comparative of **work environment**
at the LHC and the NICA acceleration complexes

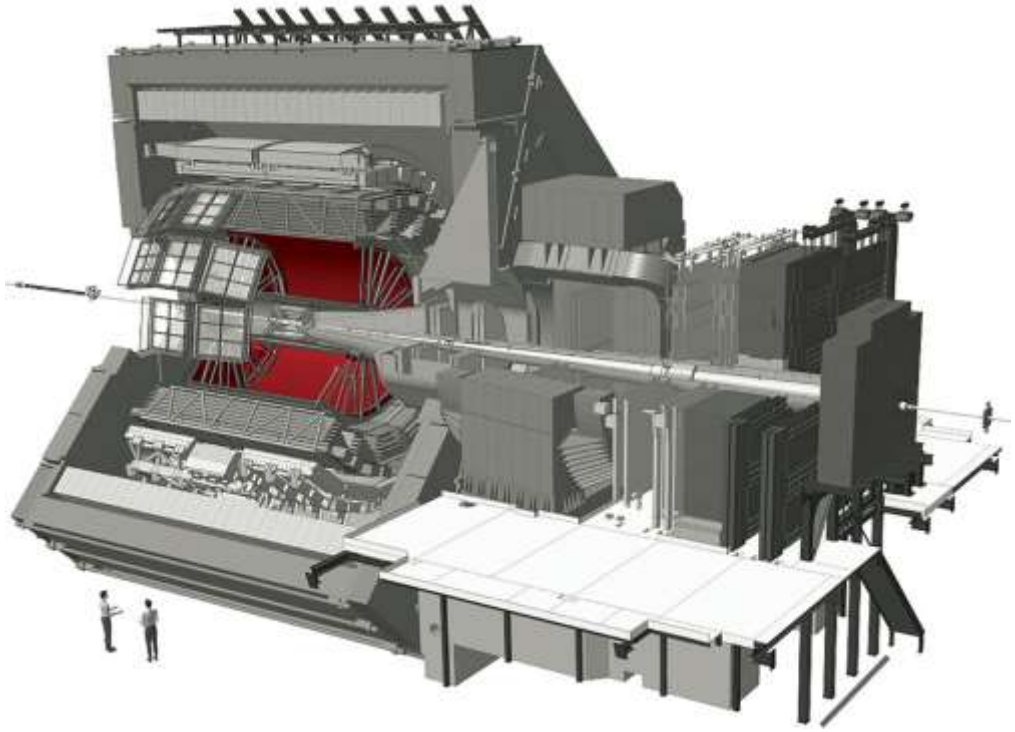


NICA
acceleration complex

LHC
acceleration complex

Automation scale of ALICE at CERN

ALICE at CERN



Quantitative measures:

- 1 control room
- 100 servers (WinCC OA)
  *12 TPC servers
- 270 crates
  *more 60 cabinets
- 1.200 network-attached devices
- 3.000.000 parameters
  *ATLAS 12.000.000

Hierarchy of automated systems

Enterprise Level	detailed planning, inventory management, sales, finance, purchasing
Management Level	monitoring the status and allocation of resources, process quality, performance analysis
Supervision Level	process control and management, production dispatching
Control Level	primary signal processing and logic of algorithms for automatic control of equipment
Field Level	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

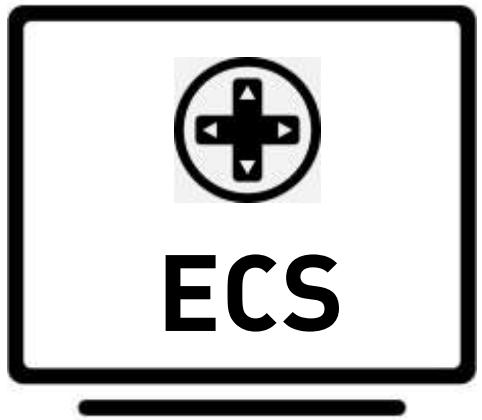
Detector Safety System

- Interlocks
- Setpoints
- Process protection
- Locks and blocks

Data Acquisition System

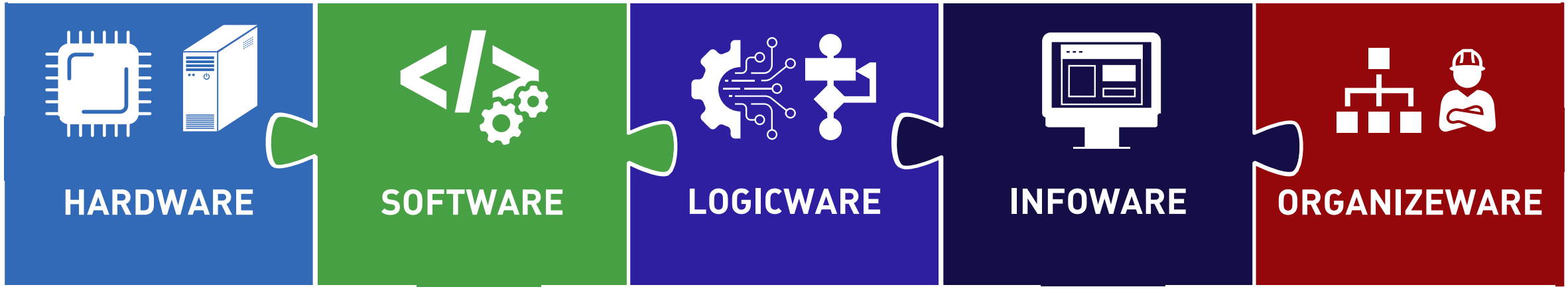
- RAW data science
- Quality control
- Correct data

Experiment Control System



- Run start/stop
- Run coordination
- Run processing

CONSTITUTION OF AUTOMATED SYSTEMS



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

- Operation systems
- Protocols
- SCADA
- Developing studio

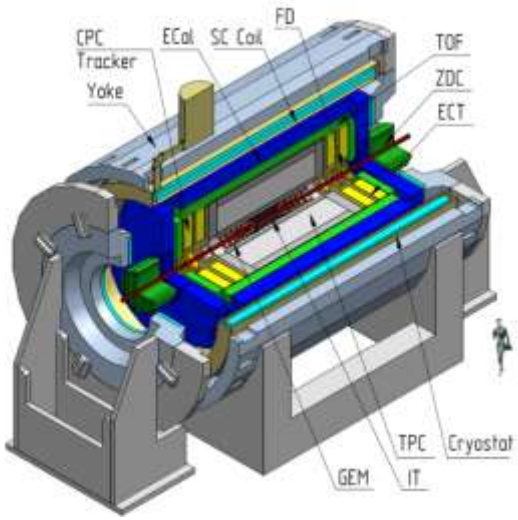
- Firmware
- Logical components
- Algorithms
- Procedures
- Technological functions

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

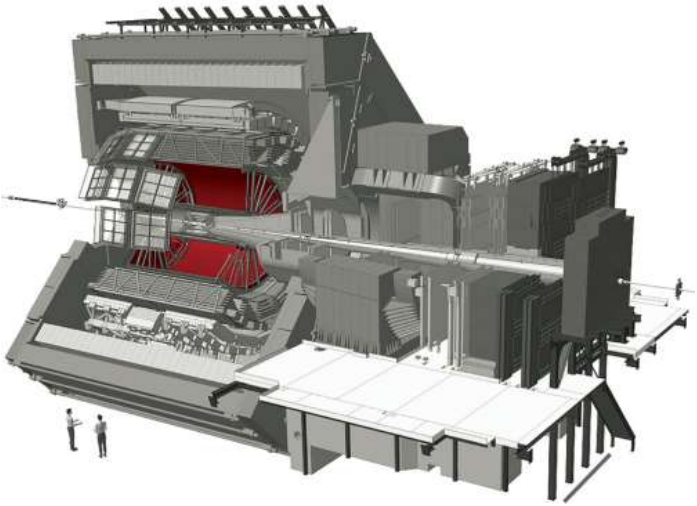
- Organization structure
- Personnel tasks
- Duties
- Rights
- Responsibilities
- Instructions
- User manual

2-nd group task

A comparative of **Detector Control Systems**
of the BM@N at JINR and the ALICE at CERN experiments



BM@N
Experimental facility



ALICE
Experimental facility

FIRST TASKS

What to do

1.

For comparative of work environment

- Find standards around topic
- Find any examples of this type of comparison
- Describe decomposition to
- Create list of comparable parameters

2.

For comparative of Detector Control System

- Find standards around topic
- Find any examples of this type of comparison
- Describe decomposition to
- Create list of comparable parameters

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Thank you !!!

LIFE CYCLES OF AUTOMATED SYSTEMS