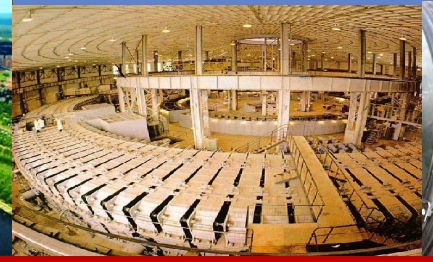

Engineering Support

For the NICA Project

Speaker:
Krystian Roslon
WUT, JINR

Marek Jerzy Peryt
Warsaw University of Technology
Joint Institute for Nuclear Research
Engineering Support for NICA
Marek.Peryt@pw.edu.pl

TOPIC OF MY TALK

PLATFORM MPD-NICA and Electrical Power Distribution

V. Golovatyuk [1], M. J. Peryt [1], [2], S. Piyadin [1];

[1] JINR (RF), [2] Warsaw University of Technology (PL)

Engineering Support for Great Physics Experiments

PLATFORM for MPD-NICA

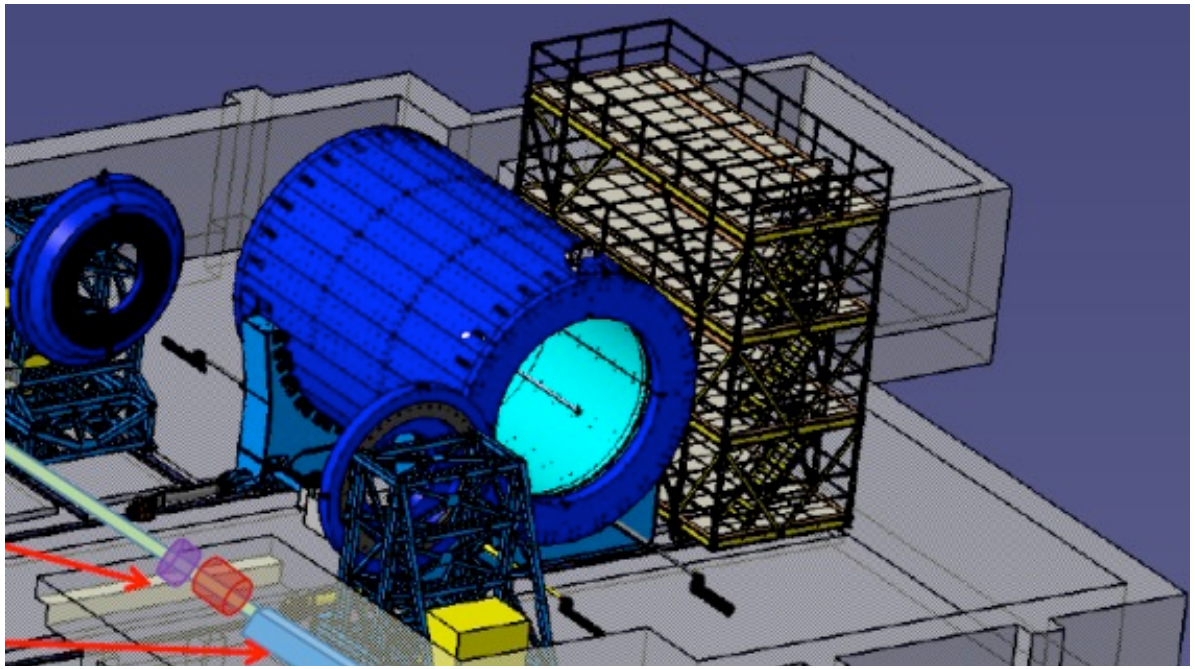

Figure 1; Detector MPD-NICA and PLATFORM (V. Golovatyuk)

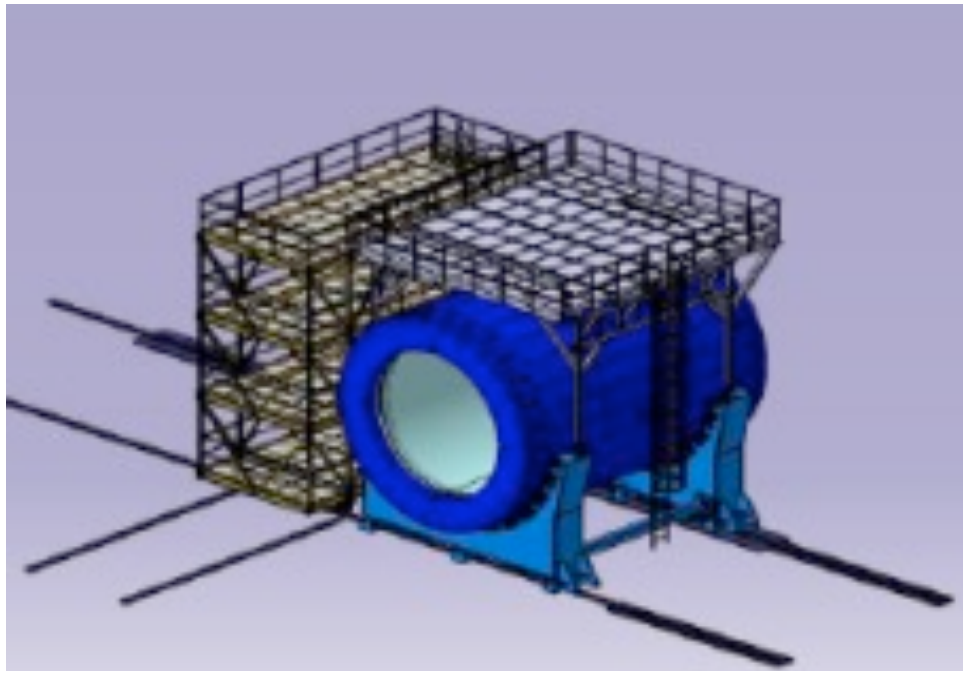

Figure 2; PLATFORM for MPD-NICA (V. Golovatyuk)

PLATFORM MPD

- The PLATFORM is designed as a mobile design that is associated with MPD and is able to move,
- PLATFORM will have three or four levels (floors),
- The lowest, first level, is designed for power equipment, another two or three, for electronic equipment,
- including the MPD Slow Control System (SCS) and Detector Control System (DCS).

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PROJECT: DEFINES the MAIN COMPONENTS, the MECHANICAL PART STRUCTURE:

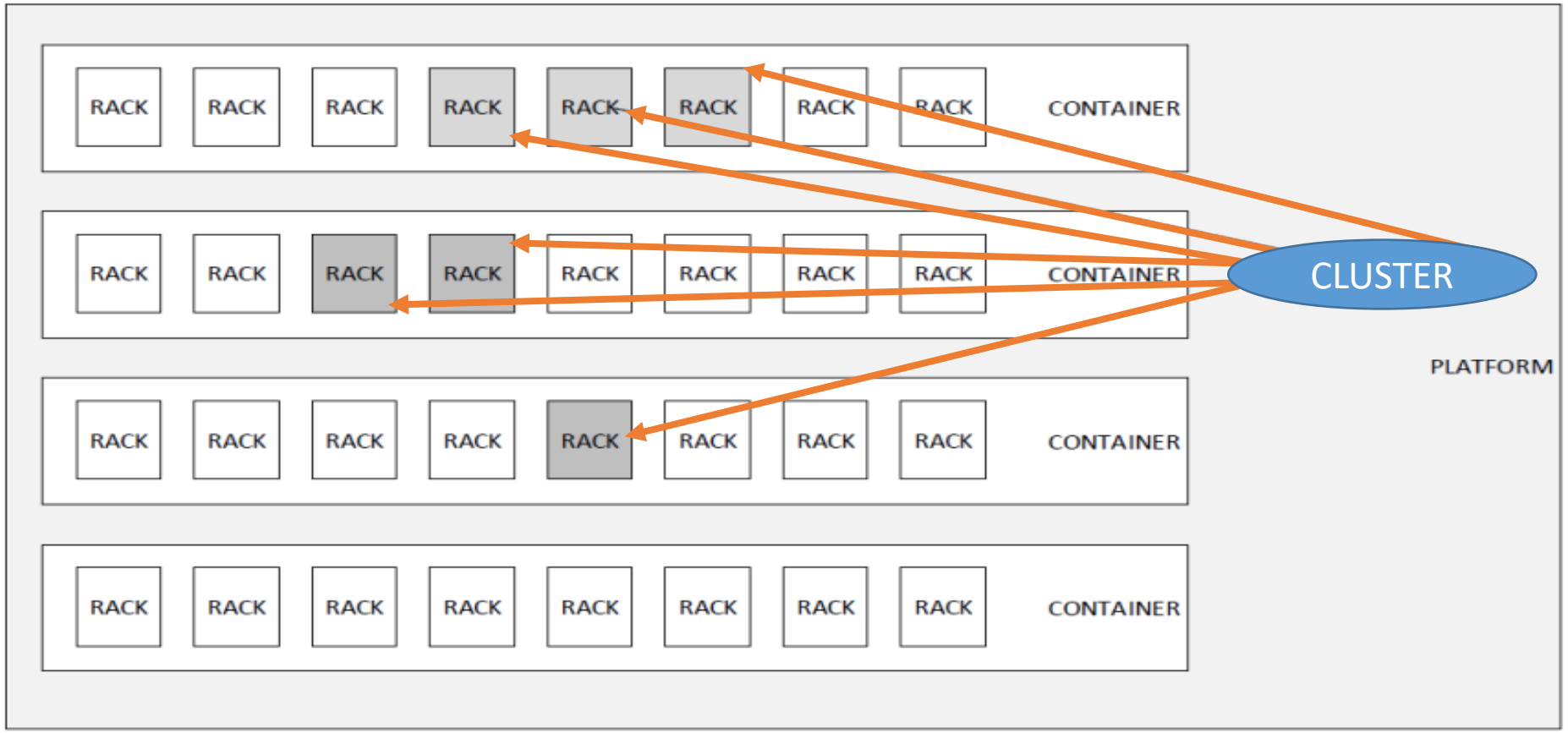
- **RACK**
- **CONTAINER**
  (8 RACKS)
- **PLATFORM**
  (4 CONTAINERS)

PROJECT: DEFINES the MAIN LOGICAL COMPONENTS of the PLATFORM:

- **CLUSTER**

  a group of RACKS with similar functionality.

ARCHITECTURE of the PROJECT



- RACK
- CONTAINER
- PLATFORM
- CLUSTER

8 x RACK = CONTAINER
4 x CONTAINER = PLATFORM

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EQUIPMENT LOCATED at DIFFERENT LEVELS of the PLATFORM:

- **Level 1:**

  Distribution equipment for two 0.4 MW three-phase power supply lines together with an intelligent power distribution system for Project MPD-NICA devices.

- **Levels 2 and 3 (or later):**

  Devices from the SCS and DCS group for the MPD-NICA Project.

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RACK 19”47U (1U=1,75”); FRONT VIEW 800x1000x2426; STANDARD EQUIPMENT

Figure 4; RACK 19" RAL 9005

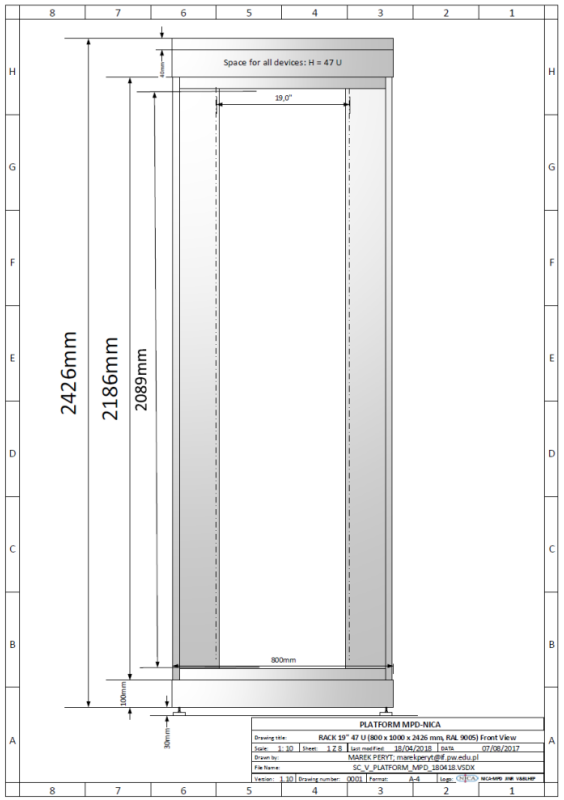

Figure 7; RACK 19" 47 U - Front View, 800 x 1000 x 2426, RAL 9005

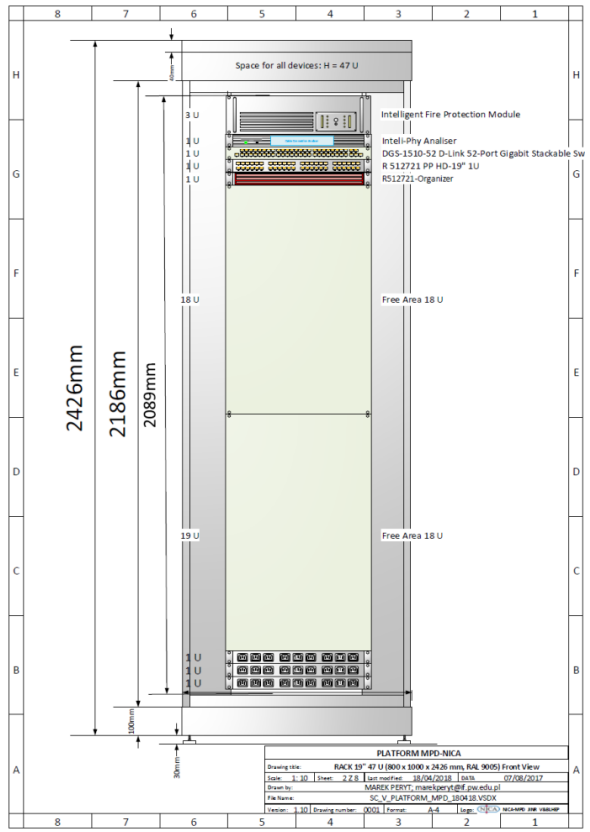

Figure 8; RACK 19" 47 U, Visualization of Standard Equipment.

CONTAINER: RACKS POWER SUPPLY 3x380V, 800A, TWO LINE, PLATFORM LEVEL 1

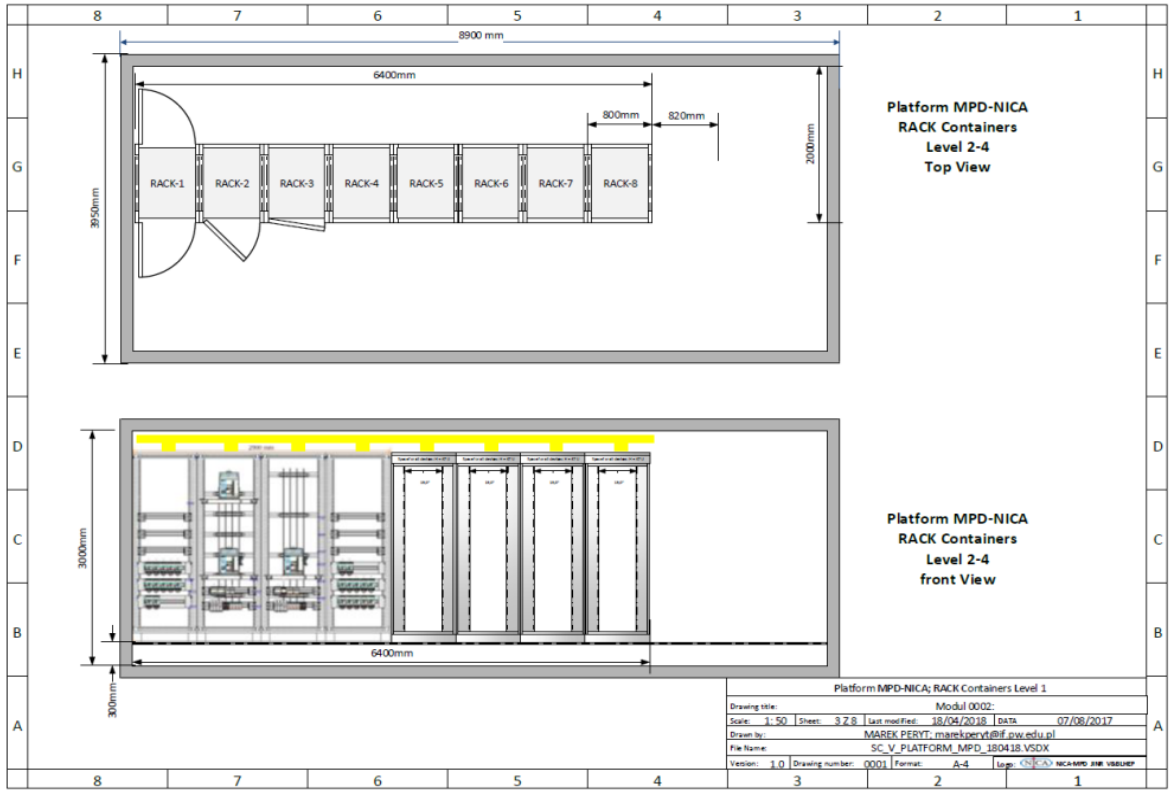

Figure 13; CONTAINER; RACK Slow Control System; Platform Level 1.

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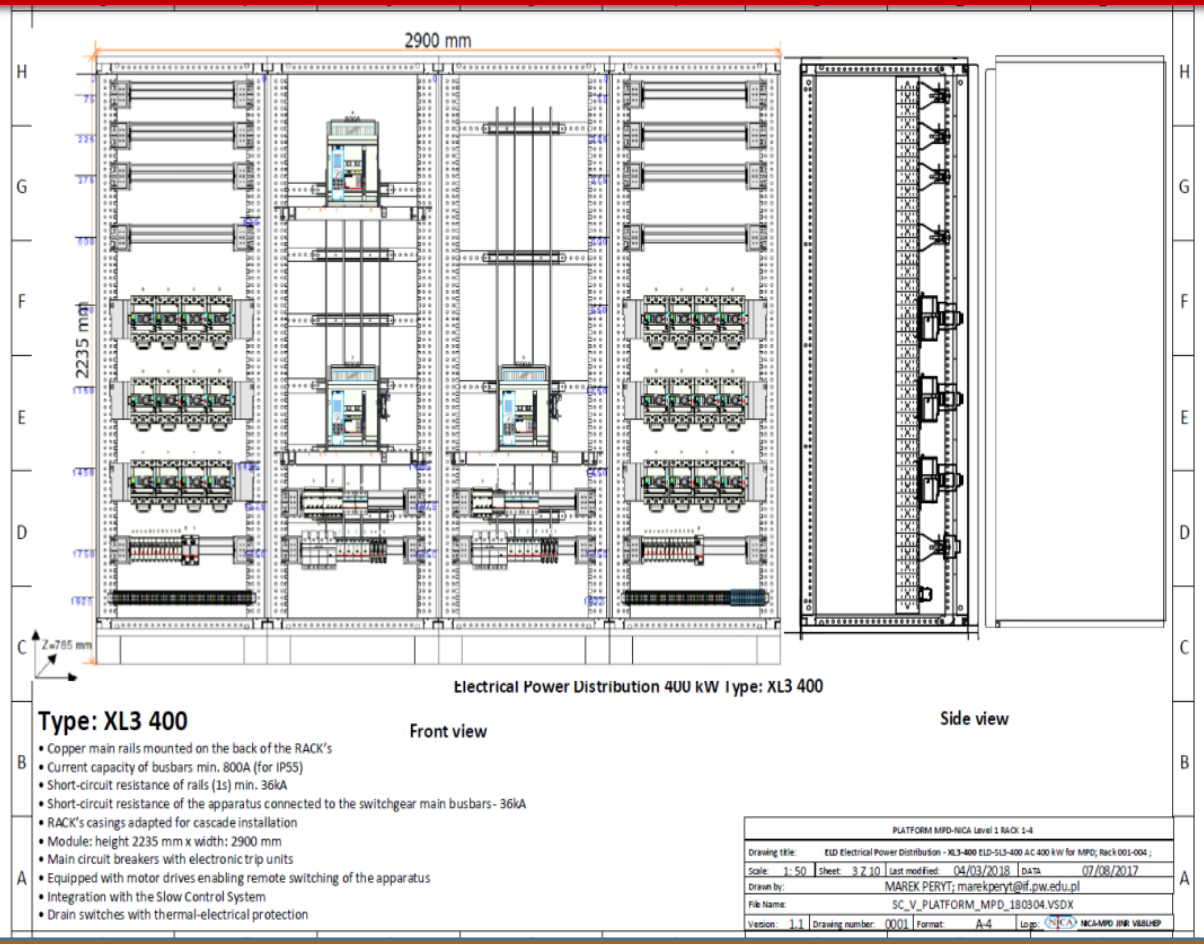
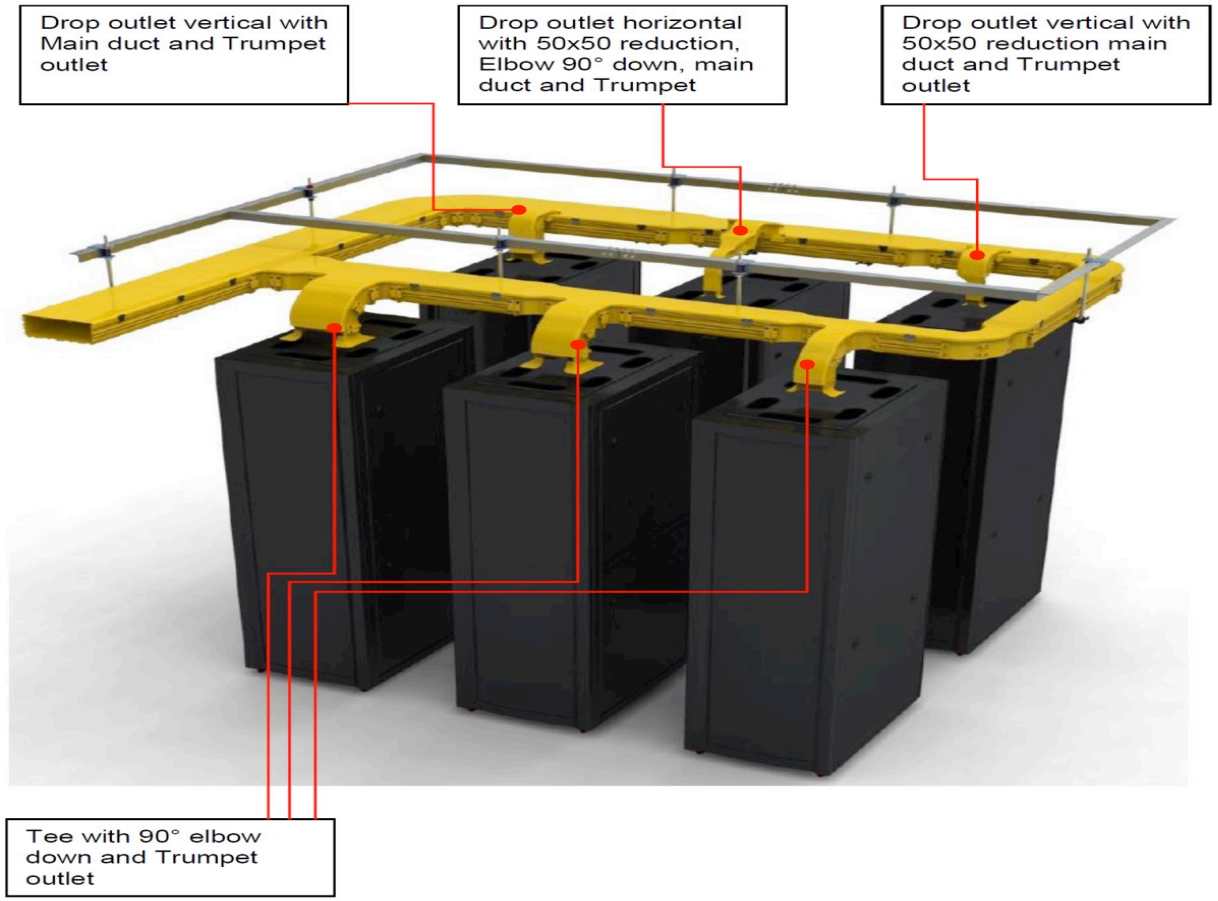
PLATFORM MPD, LEVEL 1 - 4

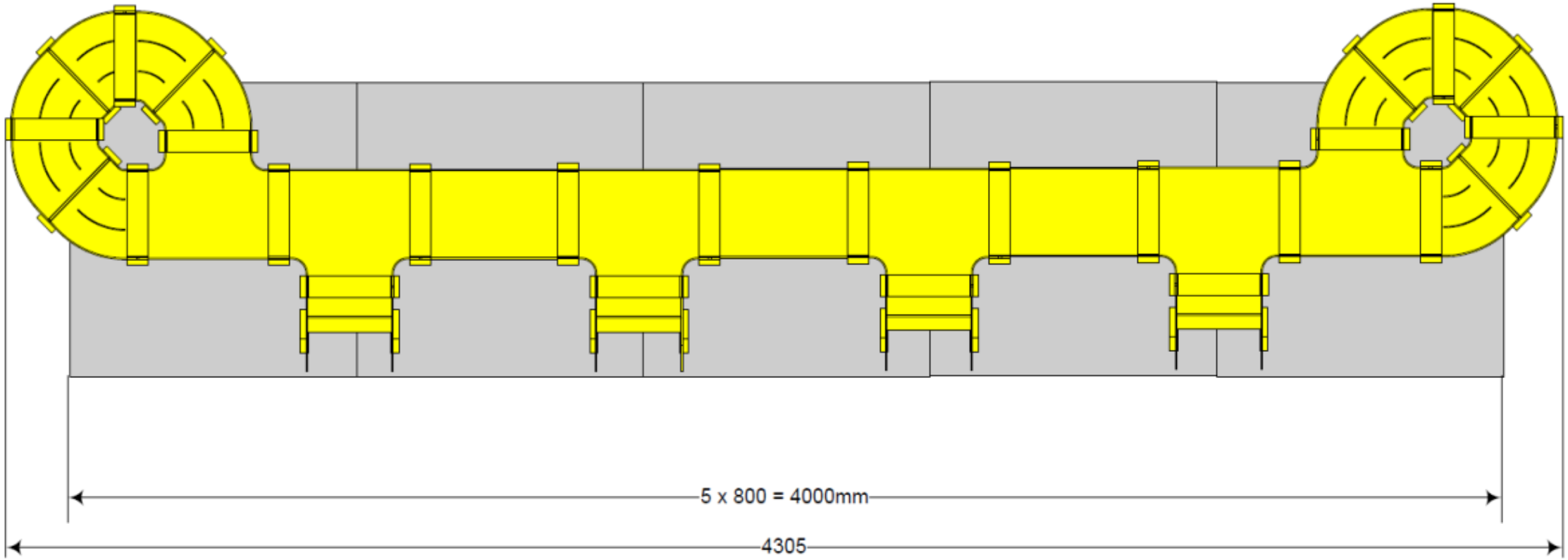
UNIT: SWITCHGEAR CAMERA VISUALIZATION, PLATFORM LEVEL 1



RACE WAY SYSTEM for FIBER OPTIC CABLE, Example of use Drop Outlet



Example of fiber optic storage technology in RaceWay, Main Duct (R&M)



STRUCTURE: HIERARCHICAL and LOGICAL

Hierarchical structure:

- MASTER RACK
- RACK SLAVE
- MASTER RACK manages a group consisting of a SLAVE RACK.

Logical structure: Creating a system and mutual logical relations of the components that make up the expected functional whole, we propose the following logical structure of the MPD-NICA PLATFORM:

- CLUSTER is a virtual group.
- CLUSTER is a STOCK group with similar functionality, logically controlled by software that manages such a CLUSTER group.
- CLUSTER does not require a separate physical location. CLUSTER can be created by the system administrator. The CLUSTER configuration is stored in the EqDb Equipment database Database.

STANDARD EQUIPMENT: MAIN FUNCTIONAL COMPONENTS of the PLATFORM

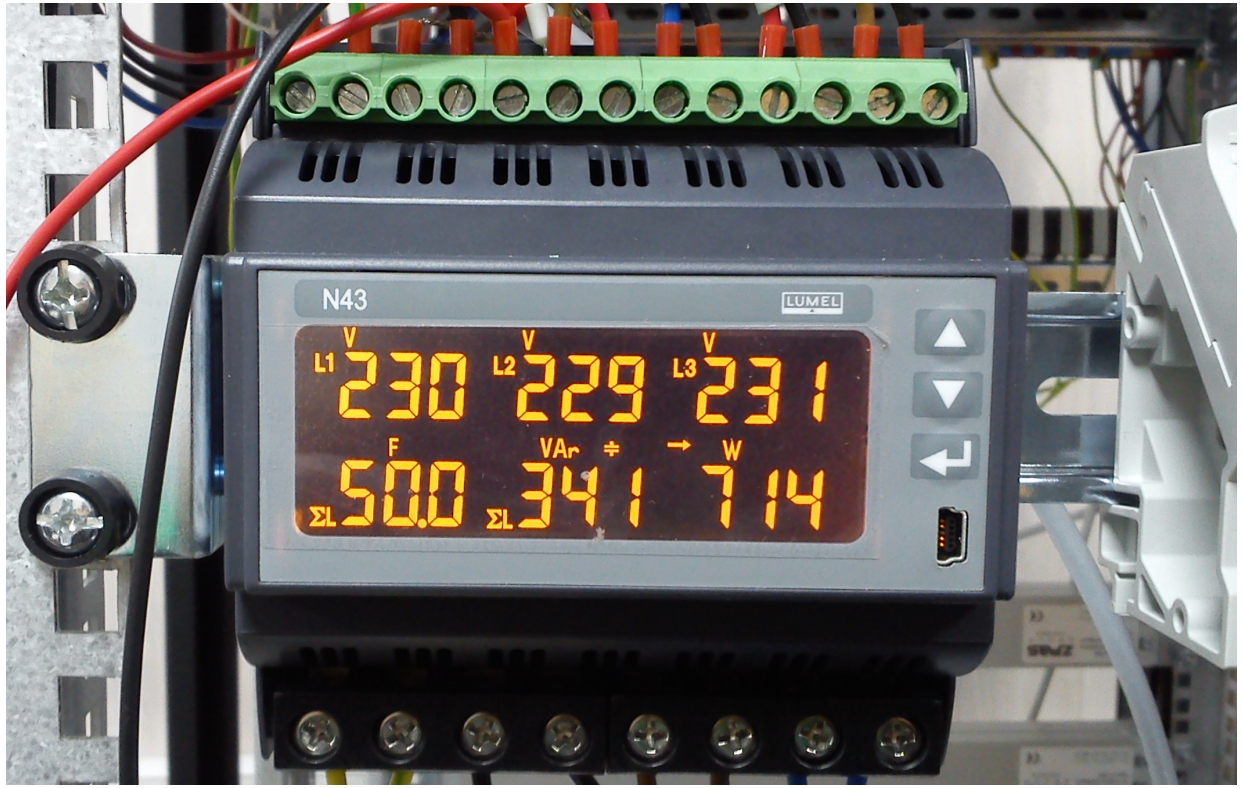
- FAS Fire Alarm System,
- PLSD Power Line Switch Distributor,
- CRWS Cable Race Way System,
- IPD Intelligent Power Distributor,
- HVAC Heating Ventilating and Air Conditioning,
- CCAS Cable Connection Authorization System,
- ACS Access Control System,
- CCTV Closed Circuit TeleVision,
- SAS Sound Alert System,
- SES Smoke Extraction System,
- ESSCS Engineering Support Slow Control System,
- FS36 Free Space 36U for User

RACK: TECHNICAL DESCRIPTION

- RACK (STAND) is a steel structure designed to assemble elements of a system for any purpose.
- Architecture and Mechanical Construction
- **Standard RACK: Typ WZ SZBSE XXX - XXXX - XX - XXXX - X - XXX**
- **with dimensions: (800 x 1000 x 2426) mm 19 "47 U (U = 1.75 inches, inch = 254 mm),**
- The selected version of the RACK 19 "47 U.
- The mechanical design of the RACK is collapsible and open.
- The RACK is made of steel, powder coated in black RAL 9005.
- It has two doors to open (front and rear), easily removable from the hinges.
- **The door is equipped with an electric and mechanical lock, OPEN by the application from a smartphone or a mechanical key.**
- **The RACK is mounted on a steel pedestal (800 x 1000 x 100) mm.**
- The ceiling of the RACK is made in the same way, in the form of a steel plate (800 x 1000 x 100) mm with baseboard,
- it closes the structure from above.
- The RACK allows to install devices up to 47 U in size.
- The total mass of the structure with embedded devices should not exceed 1,360 kg.
- All movable elements of the RACK, (opening doors) are connected by protective conductor "PE" <PE> (Protective Earth or Protective conductor), with mechanical structure of the RACK and grounded by additional flexible "PE" conductor.

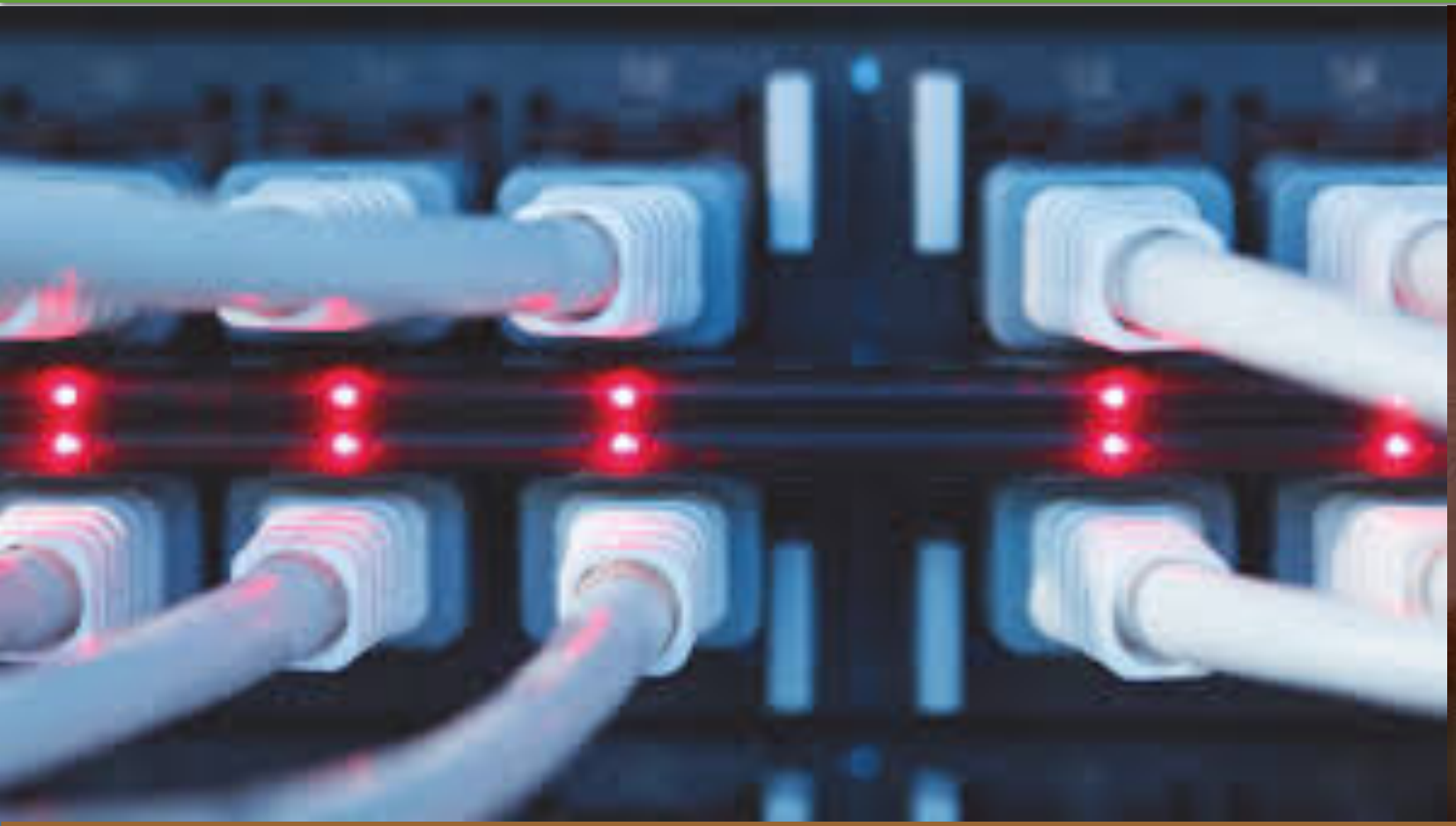
RACK STANDARD EQUIPMENT: FAS Fire Alarm System

POWER DISTRIBUTION 3 x 380/220 V 63 A 50 Hz



Power Network Analyzer module 3 x 380/220 V, 63 A, 50 Hz

RFID TAGS for CABLE CONNECTION AUTHORIZATION



RACK STANDARD EQUIPMENT: INTERFACES…

Each RACK is designed to connect measuring and control equipment in accordance with the standards for basic interfaces:

- Ethernet (FO-Cu)
- RS-485
- RS-232
- USB
- GPIB

And additionally:

- VME, PXI-e, c-RIO, CAMAC

The basic wiring of the RACK is controlled using an on-line CCS Cable Connection System with EqDb (Equipment Database at ORACLE).

INTERESTING FACTS

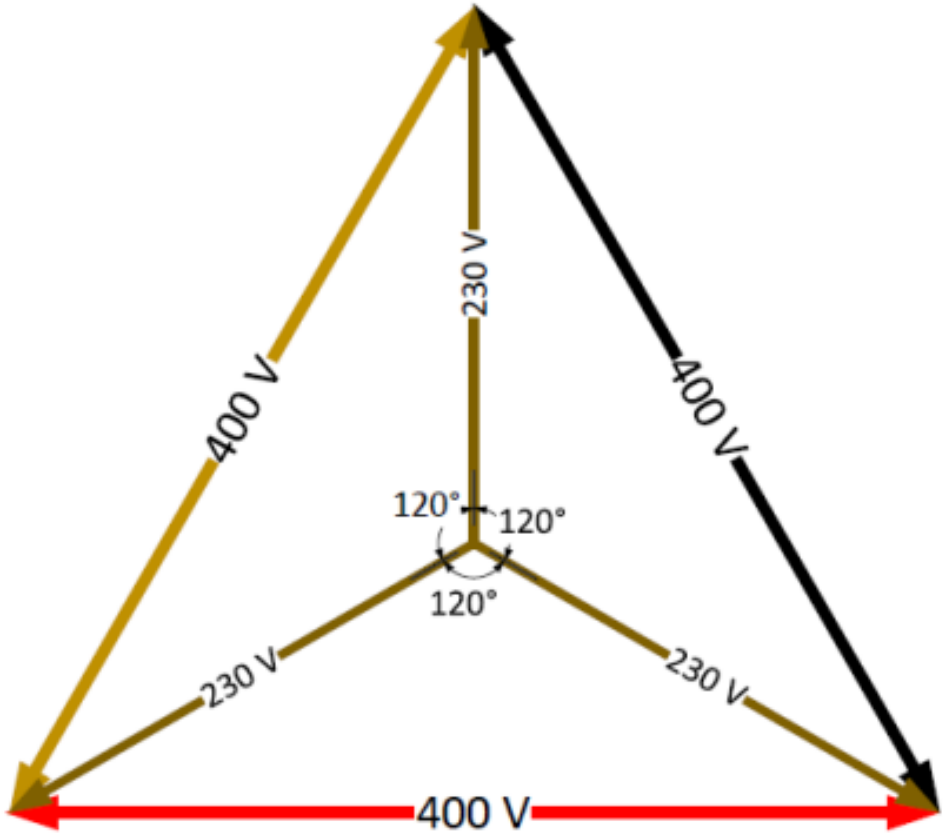


Figure 27; Voltage triangle. 230 V: Phase line - Neutral, 400 V: Phase line - Phase line,

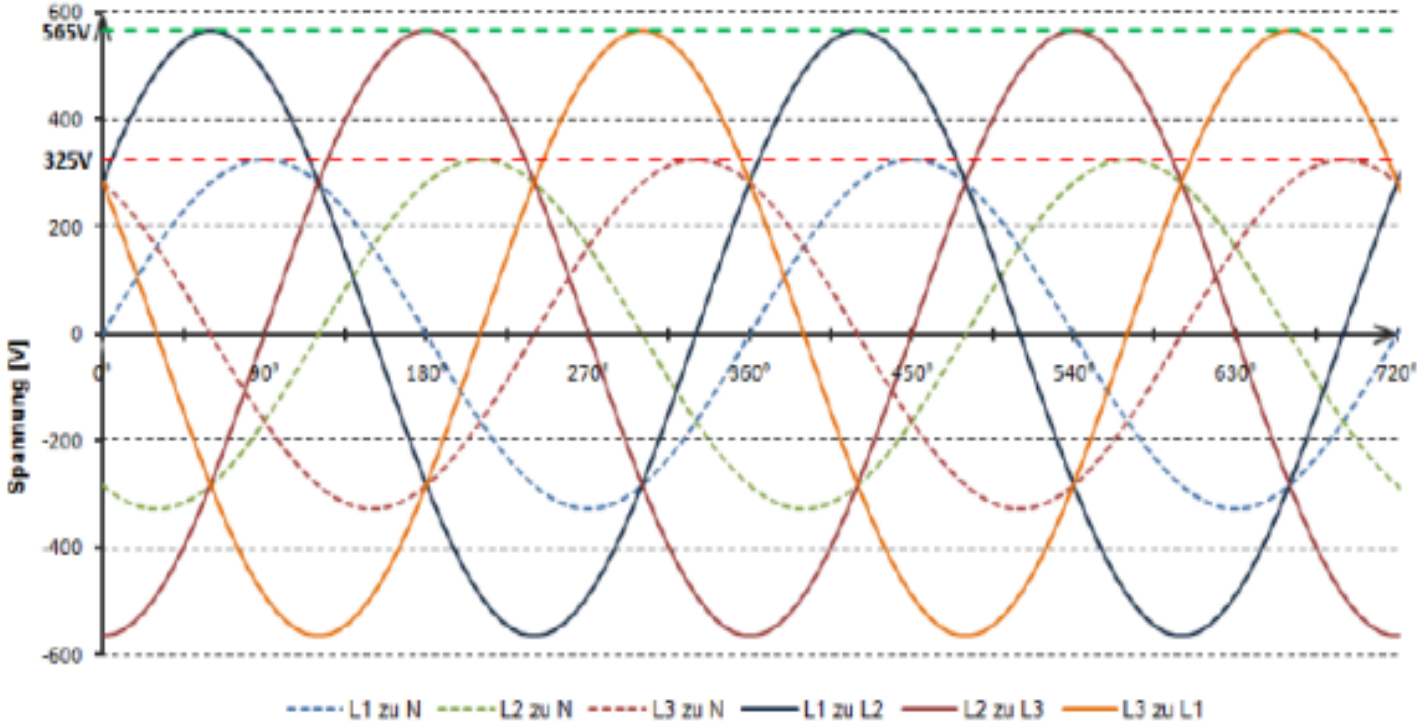


Figure 28; Time diagrams of sinusoidal voltages of a three-phase generator

INTERESTING FACTS

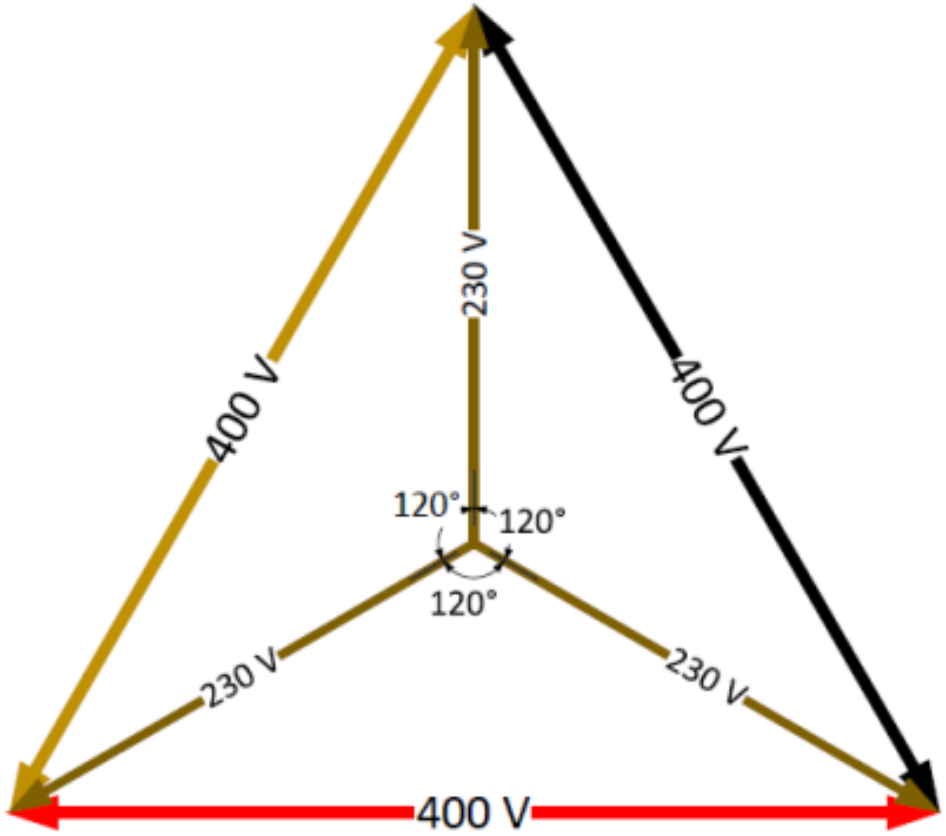


Figure 27; Voltage triangle. 230 V: Phase line - Neutral, 400 V: Phase line - Phase line,

LINE 1 (R) → I_R

LINE 2 (S) → I_S

LINE 3 (T) → I_T

NEUTRAL 4 (N) → $I_N = I_R + I_S + I_T$; Recommended $I_N = 0$

GROUND 5 (PE) → $I_{G\,(PE)} = 0$,
Only charge neutralization

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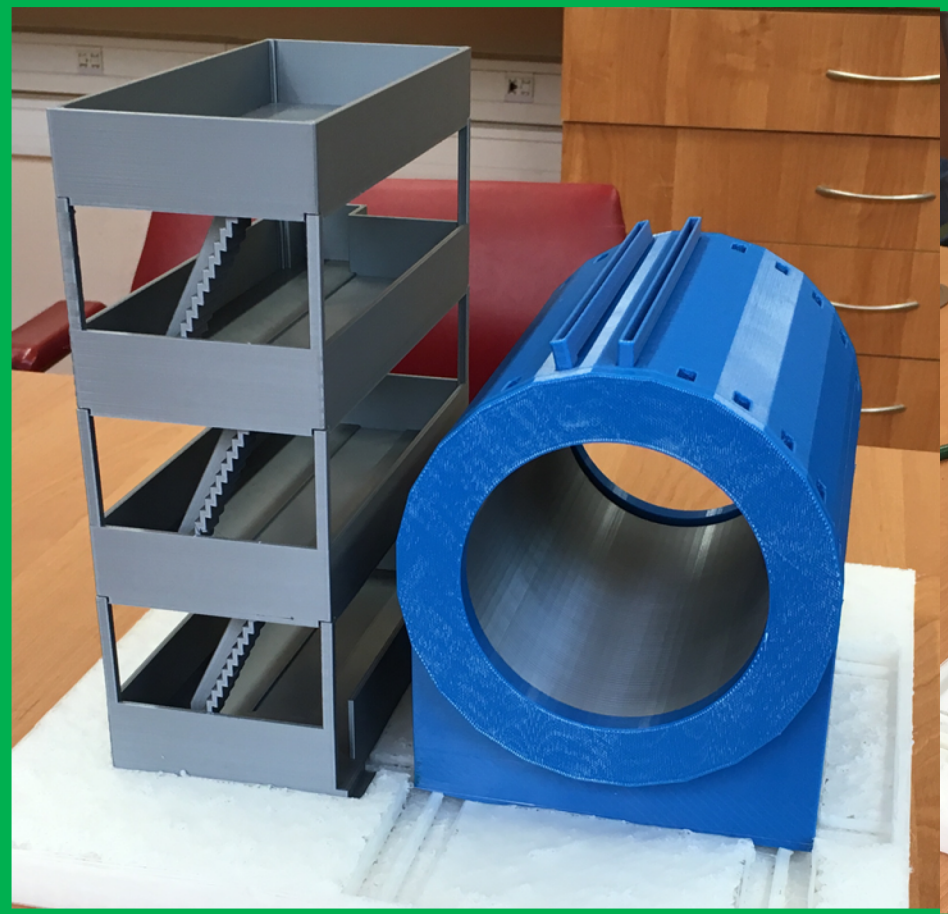
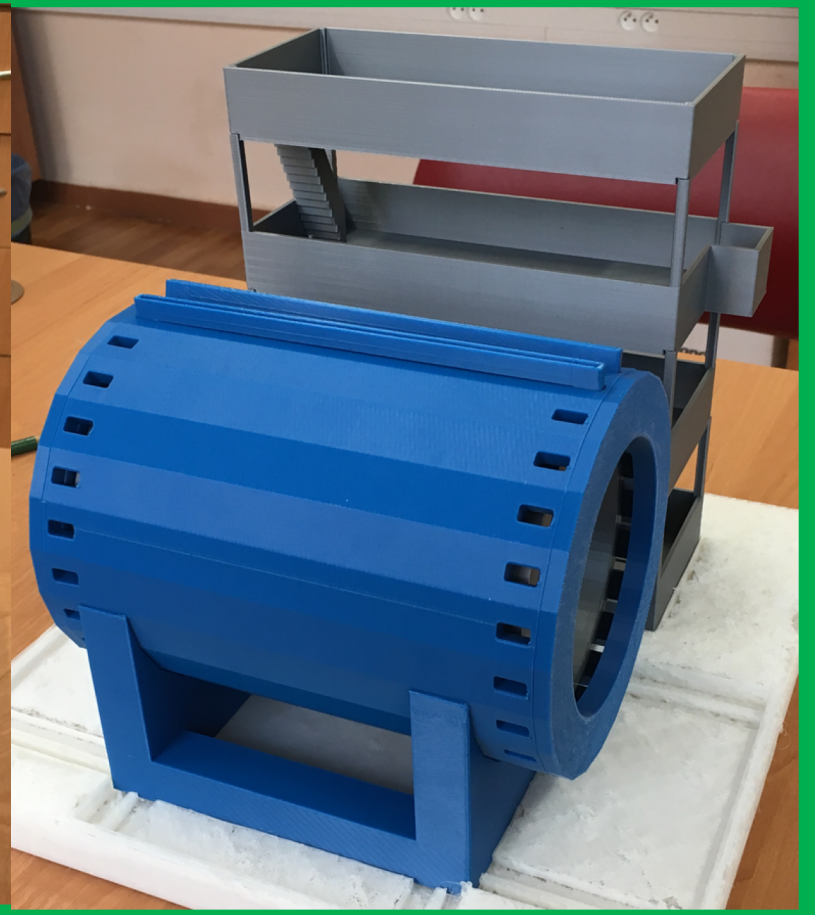
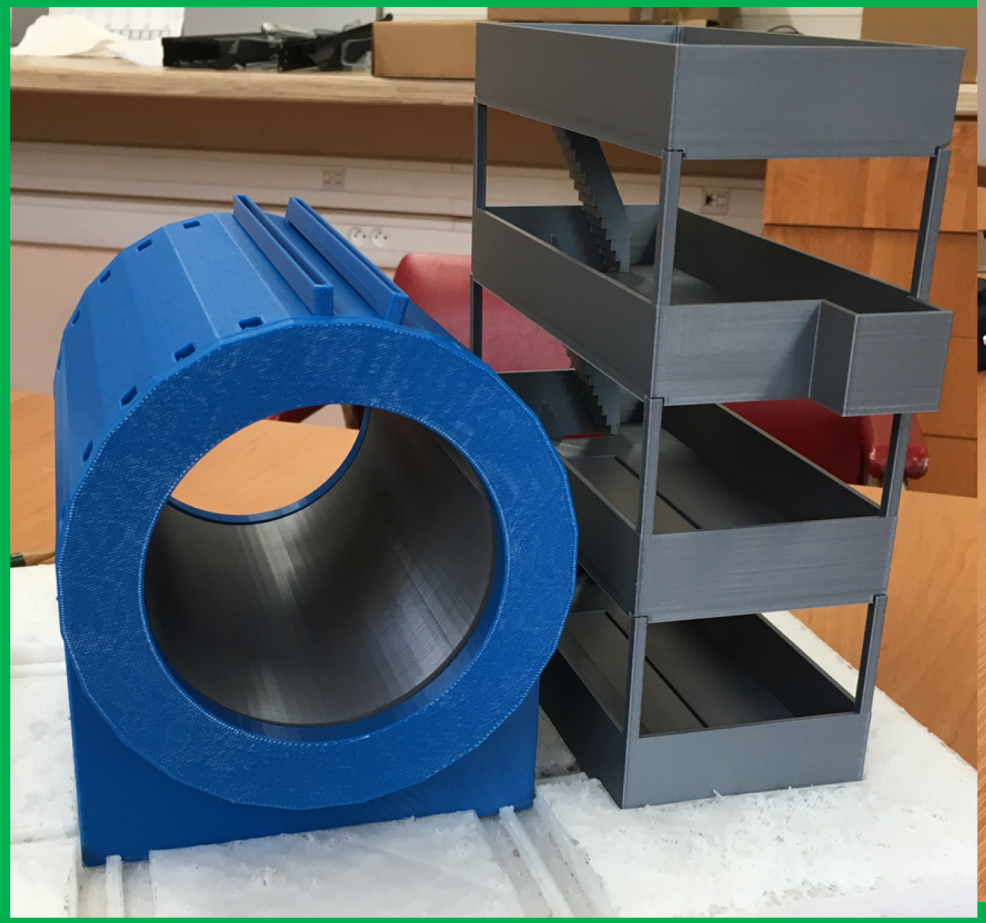
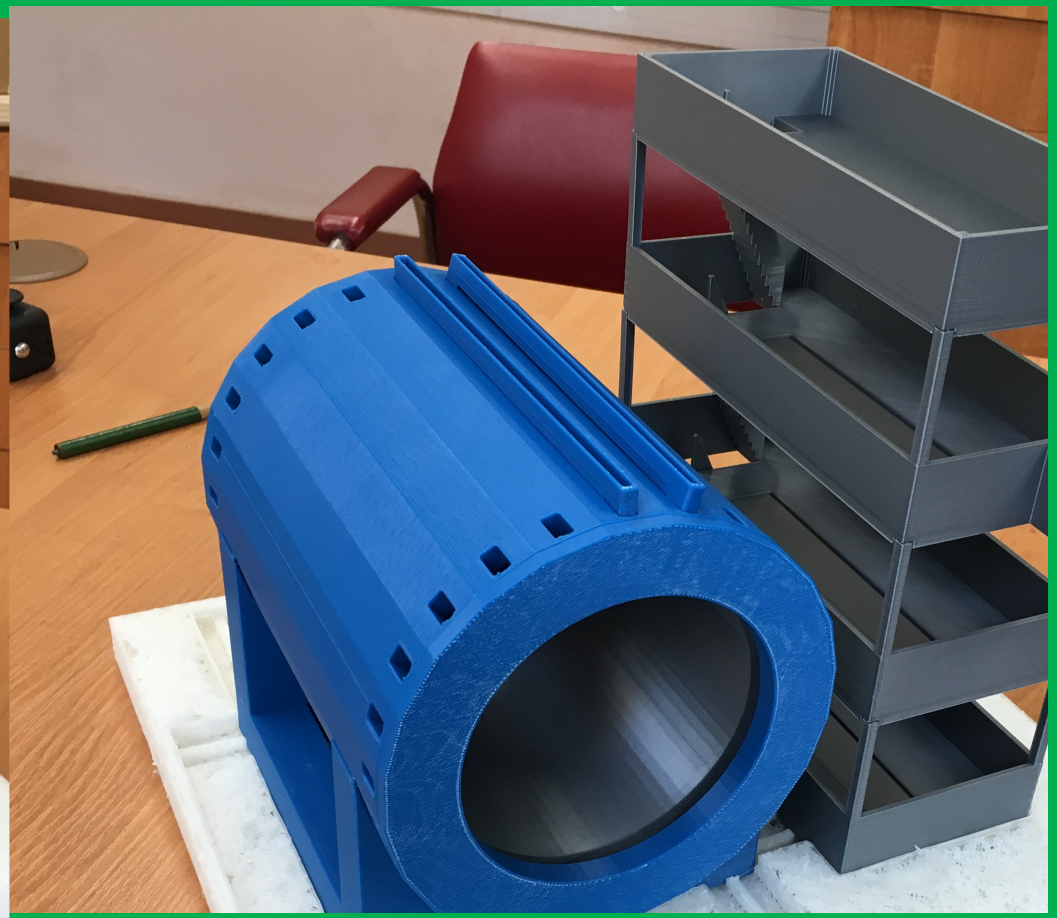
PLATFORM and MPD 3-D Print





PLATFORM and MPD 3-D Print





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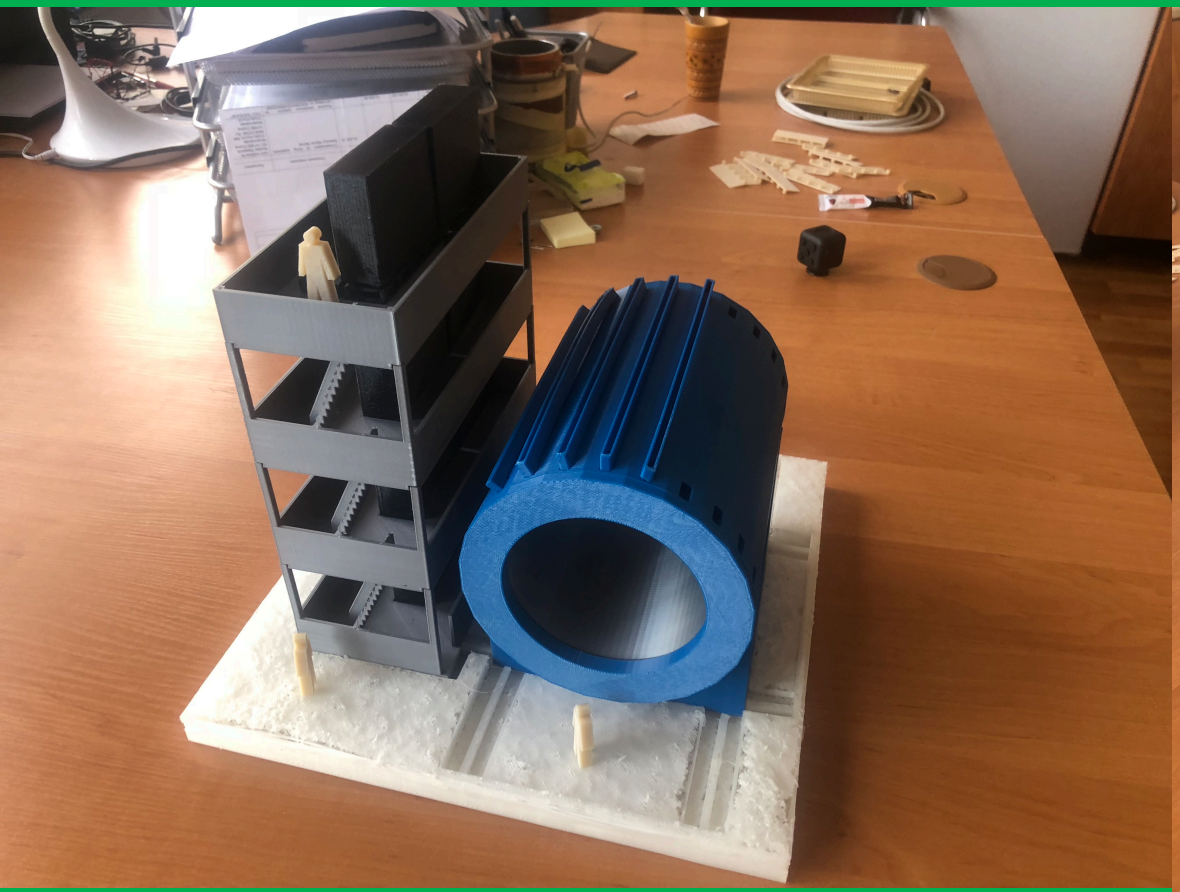
PLATFORM and MPD 3-D Print



CONCLUSIONS

- The Platform offers a 4th level, in every 8 RACKS
- Each RACK is equipped with 3x380/220V, 25 A Power Supply
- Each RACK has 36 U free space for development
- Each RACK is equipped with liquid and air cooling
- Each RACK is equipped with a cable management system coupled with EqDb

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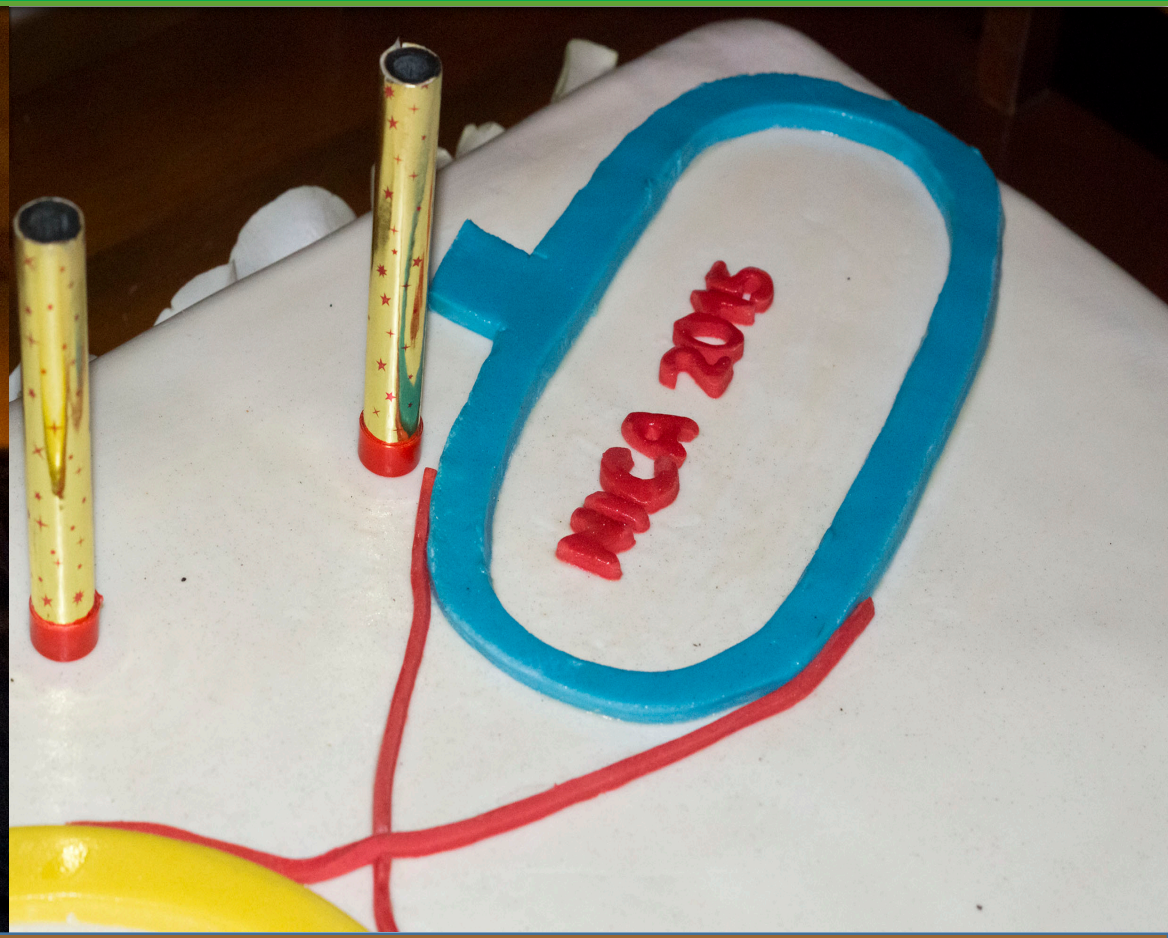
NICA Days 2015… NICA Days 2017… We invite you to NICA days 2019!!!



The results of Physicists

Engineering Support

Thank…

Thank You for Your Attention