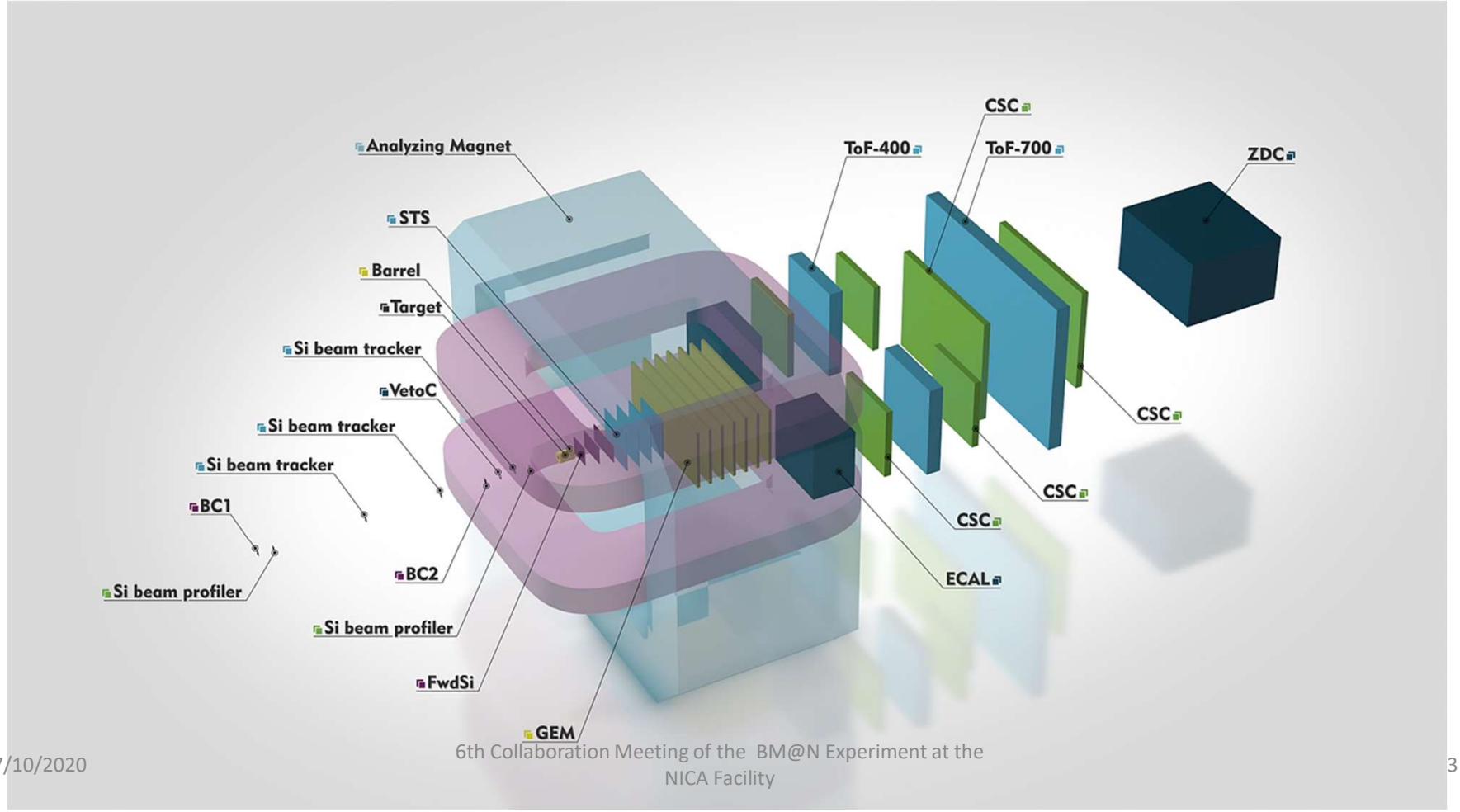
BM@N STS Mechanics. Status and plans

Mikhail Merkin (SINP MSU)
for CBM-BM@N STS group

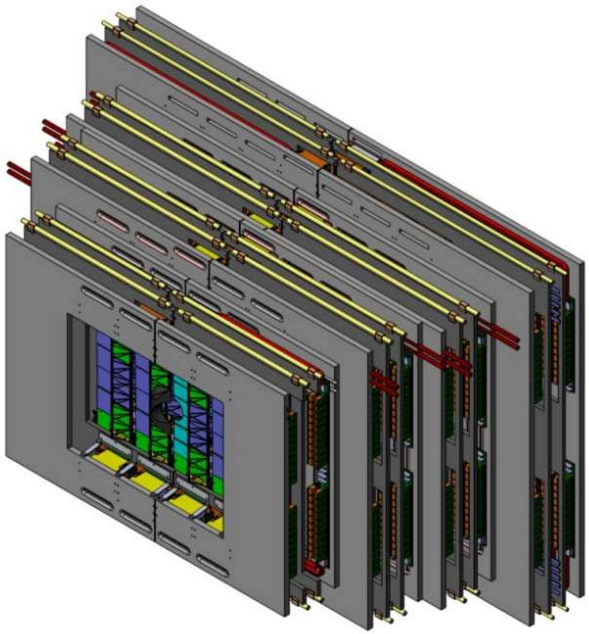
Outline

- Central sensors
- Main frame
- Carbon C-frame and Al C-frame with cooling
- FEB, FEB box, FEB connectivity
- Cable routing
- Plans
- Progress in preparations for the BM@N STS ladder assembly
- Status of the BM@N STS module assembly

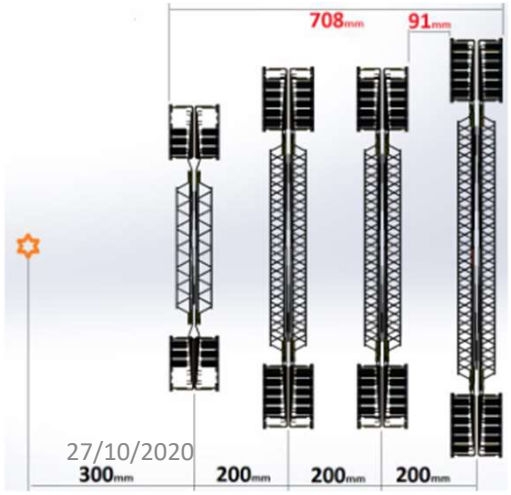
BM@N experiment

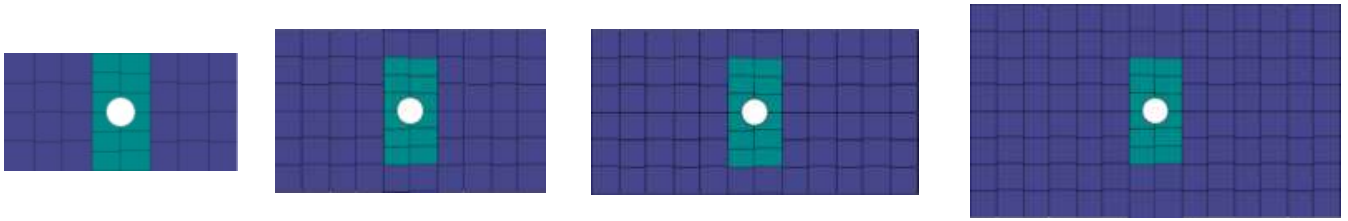


Layout of BM@N STS

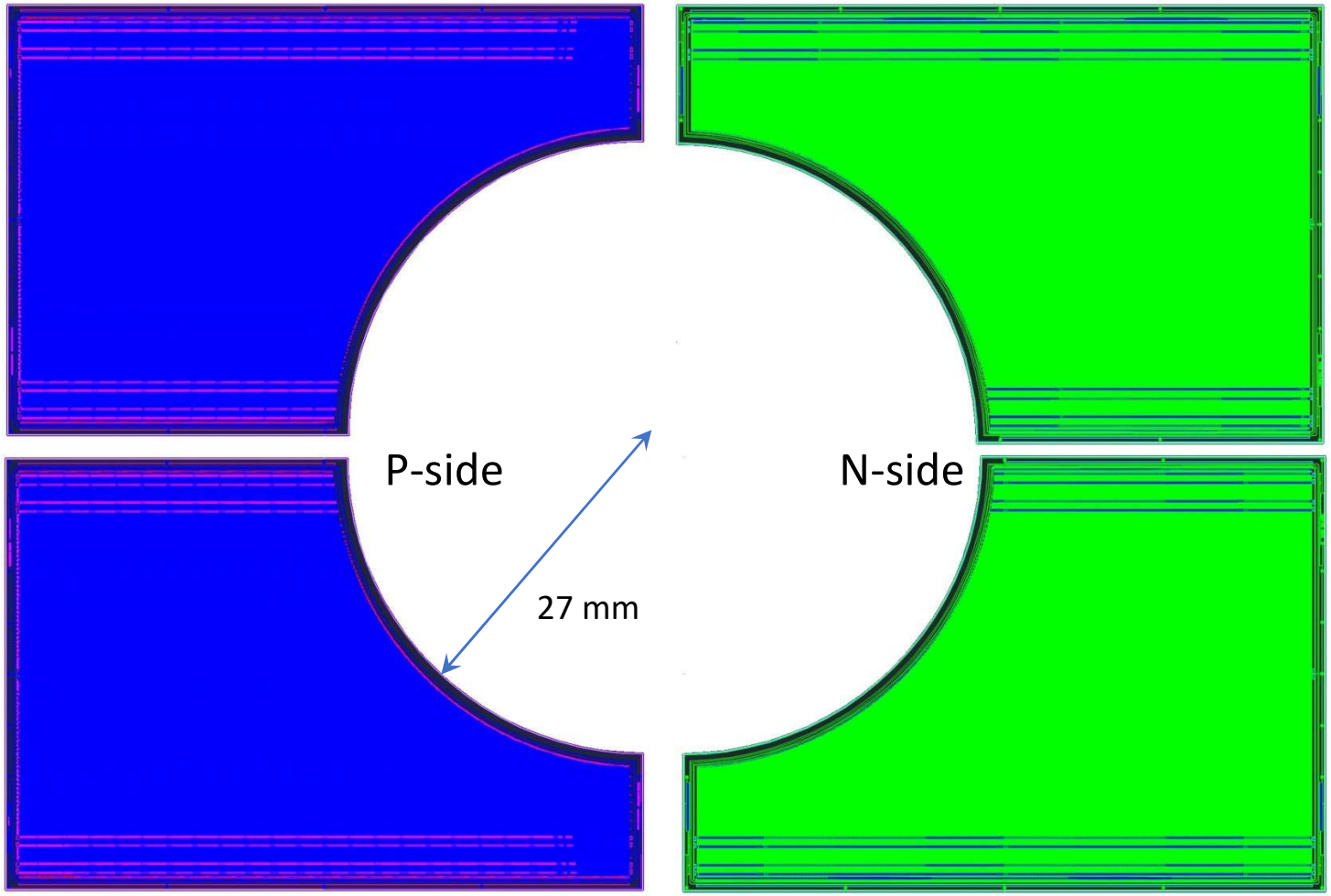


- Four stations are based on CBM-type modules with double-sided microstrip silicon sensors
- Number of modules: 292
- Number of channels: ~600k
- Power consumption: ~15 kW

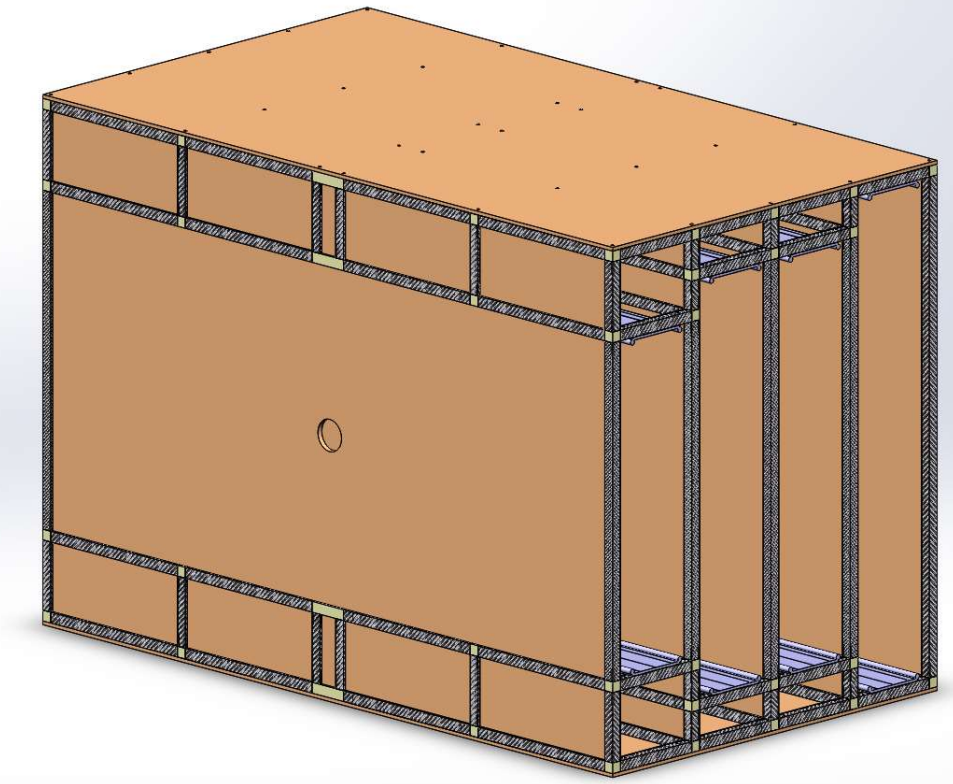




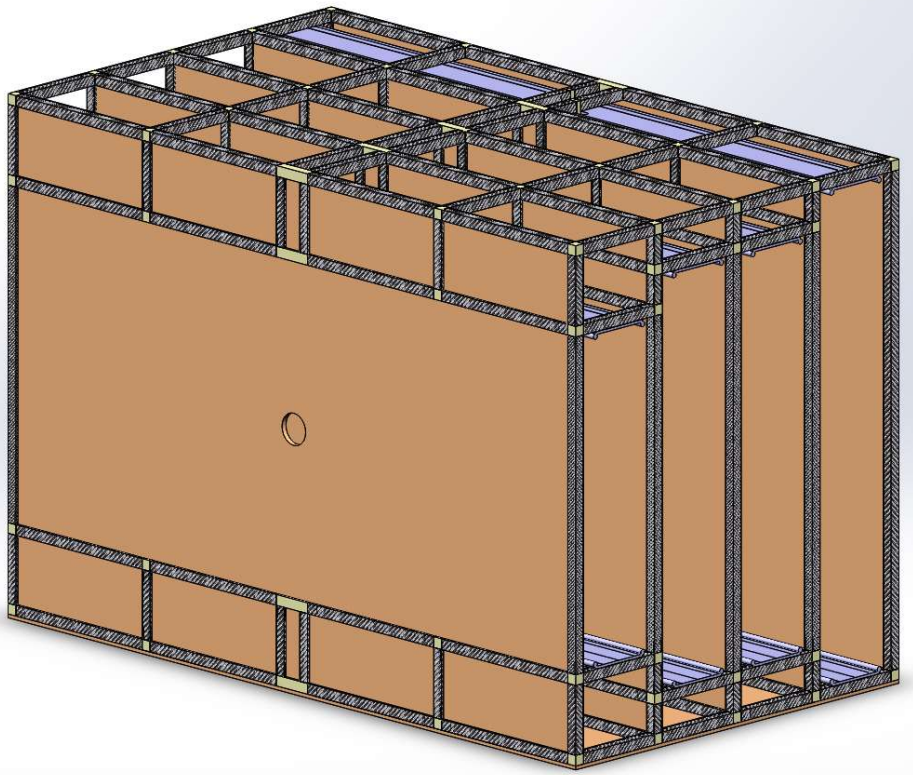
Central Sensors



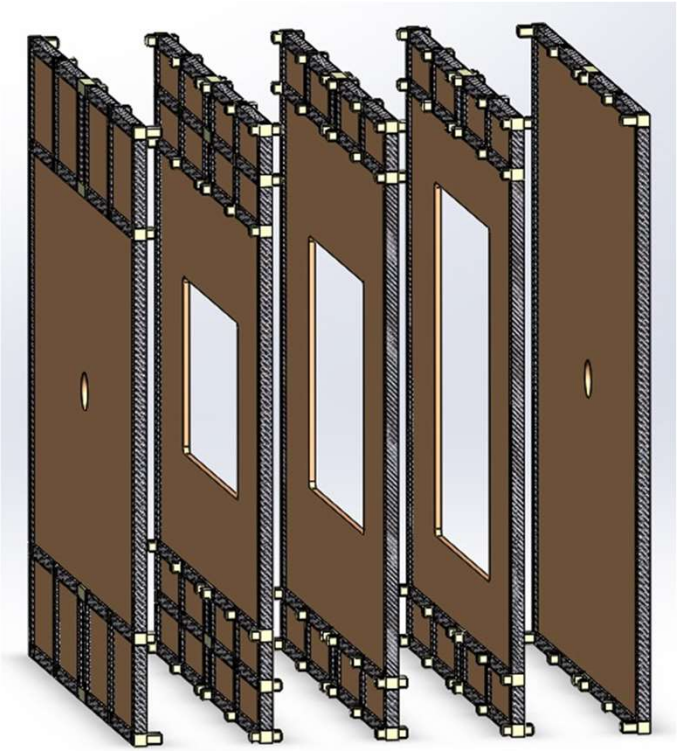
Mainframe

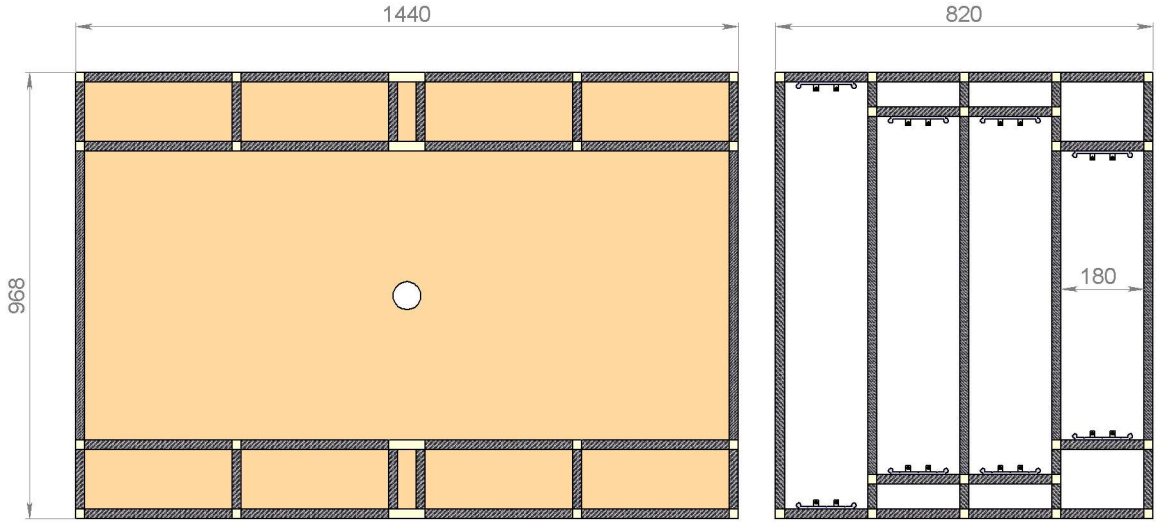


Mainframe

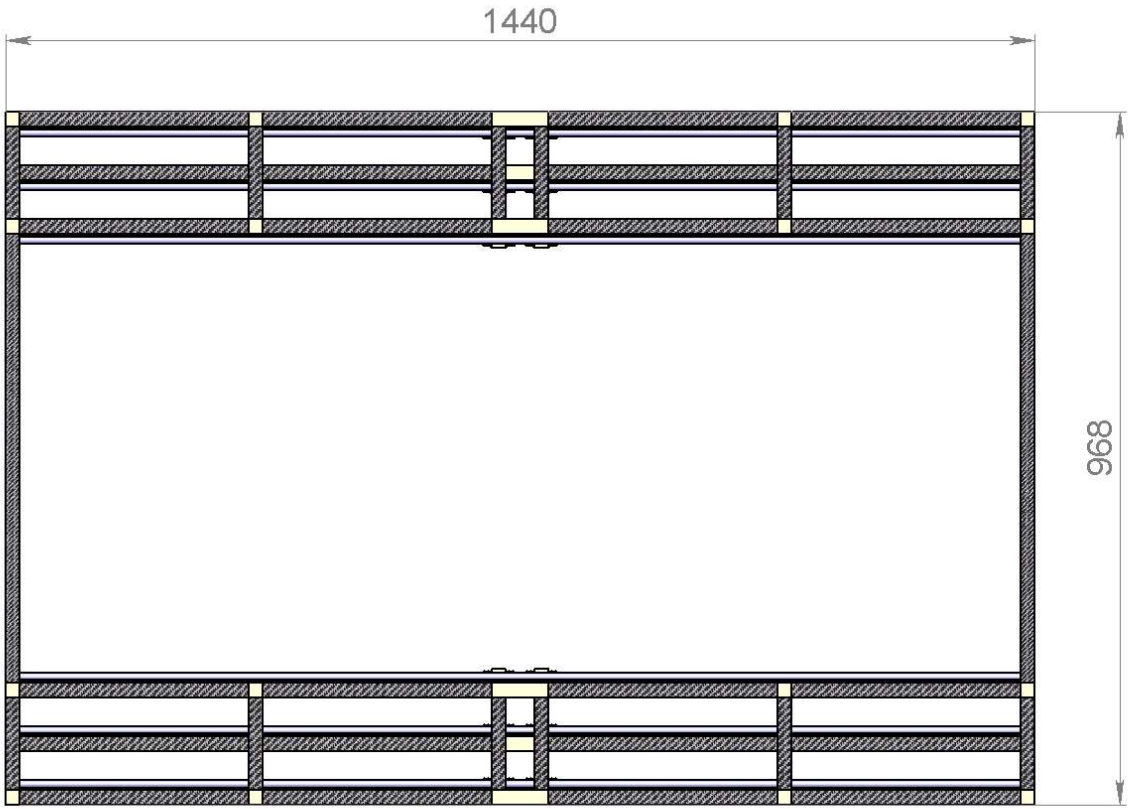


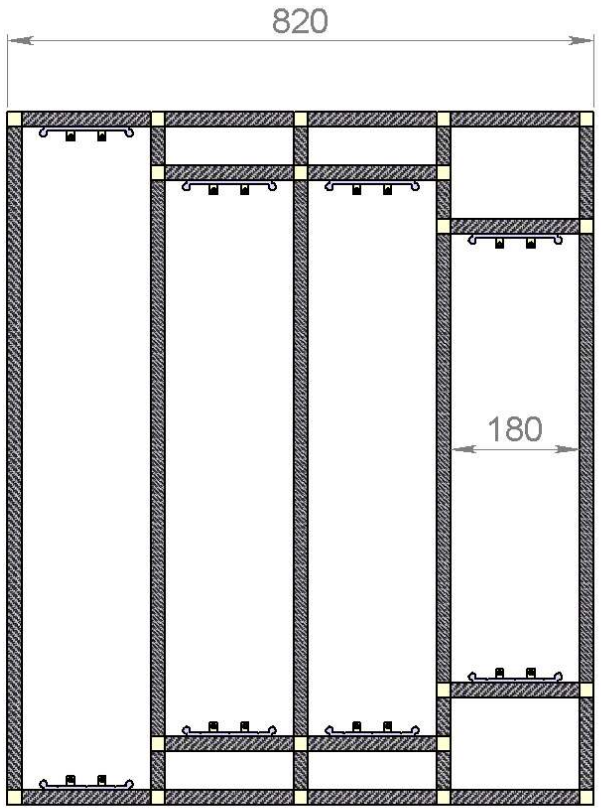
Mainframe details



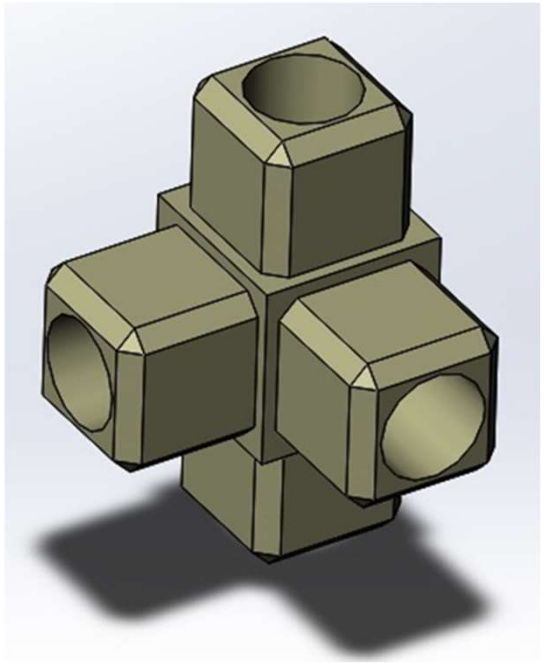


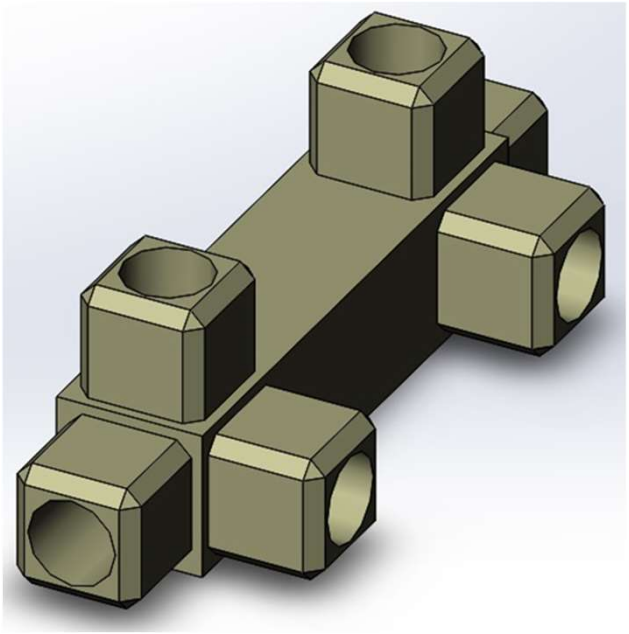
Mainframe



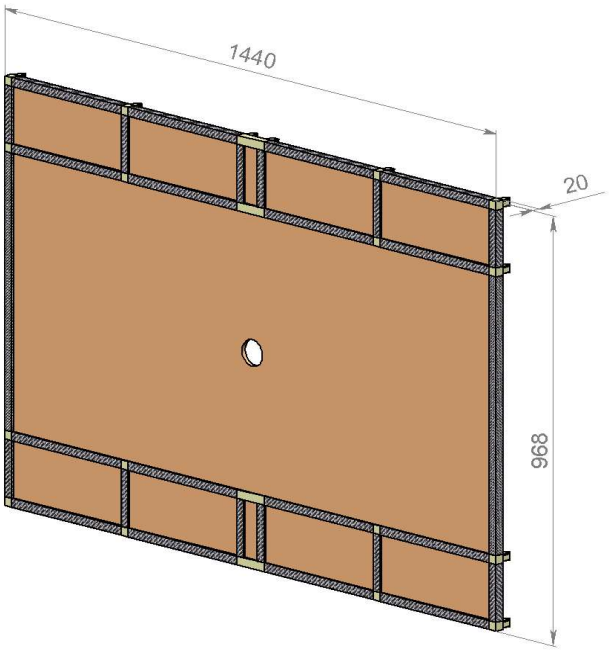


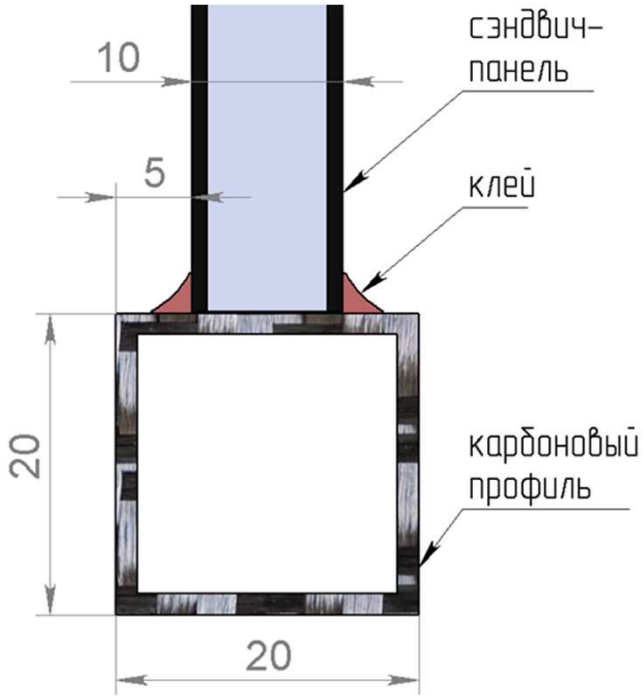
Mainframe details



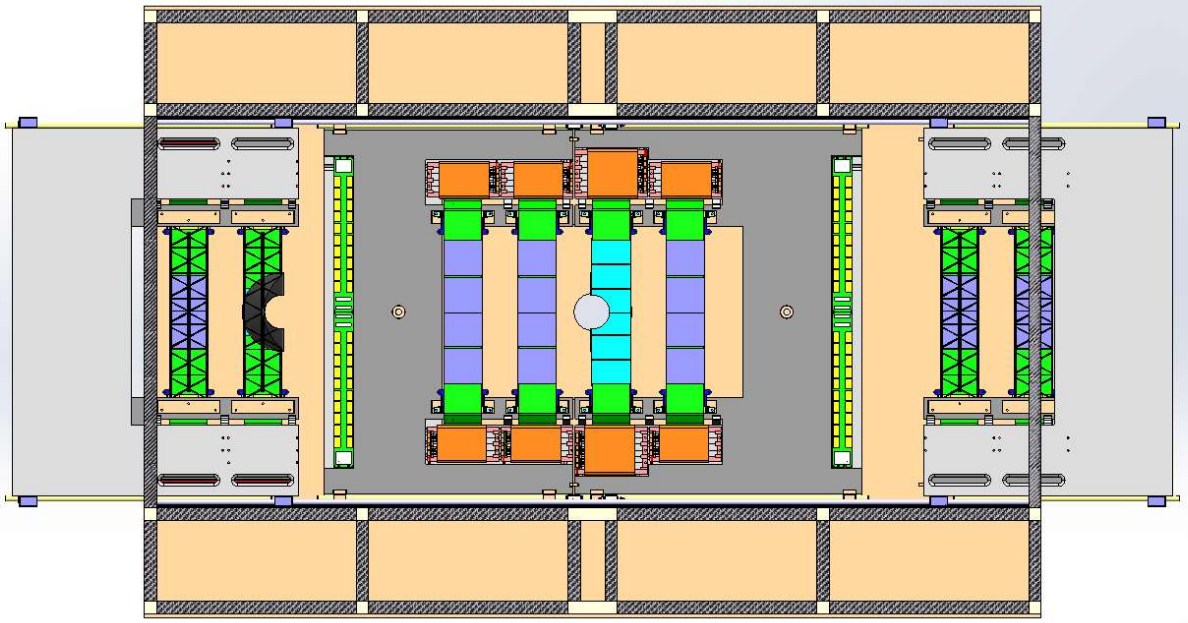


Mainframe details

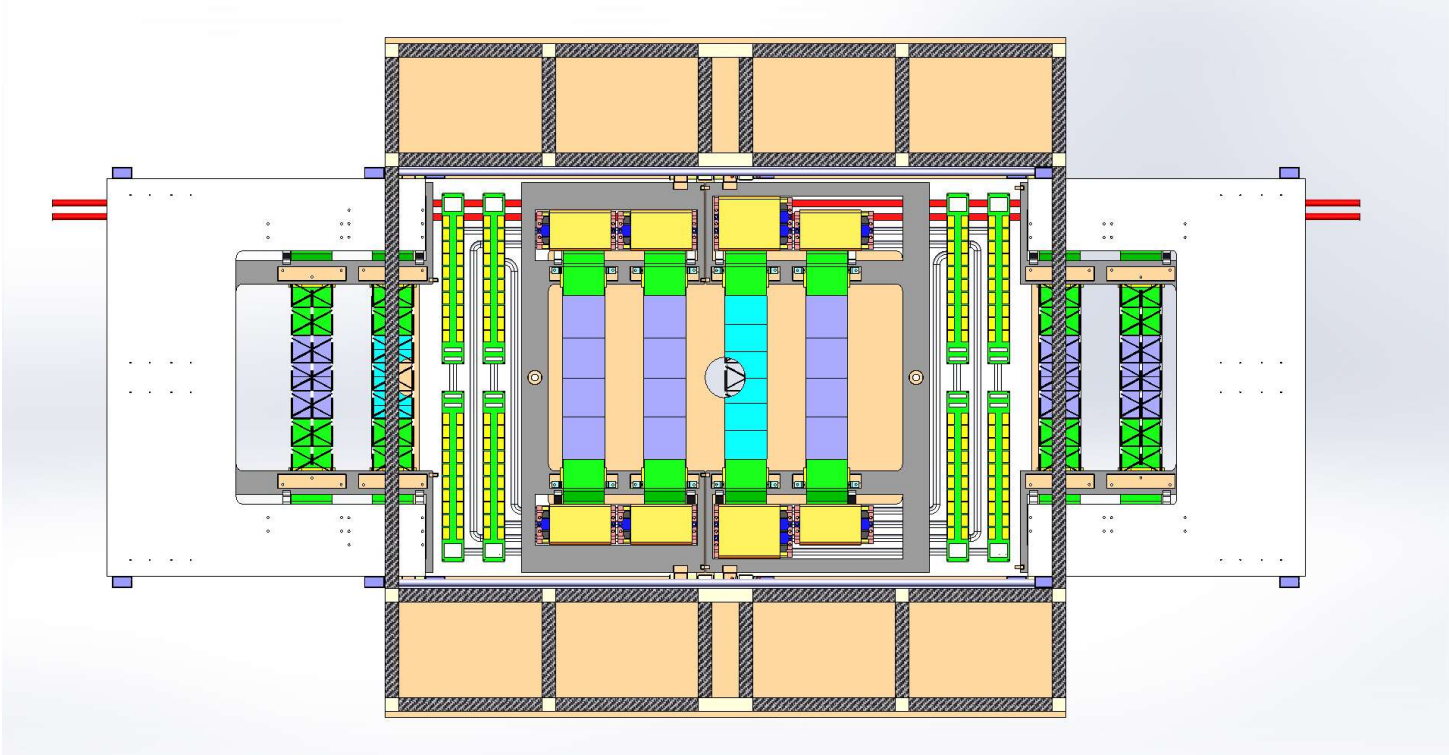




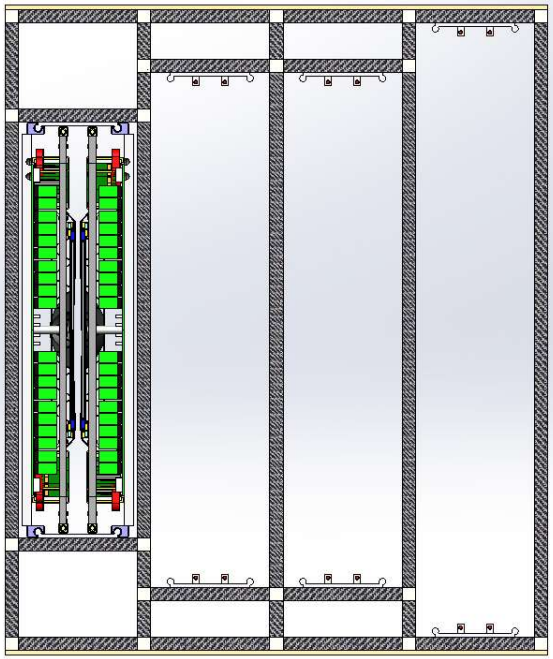
Station in Mainframe



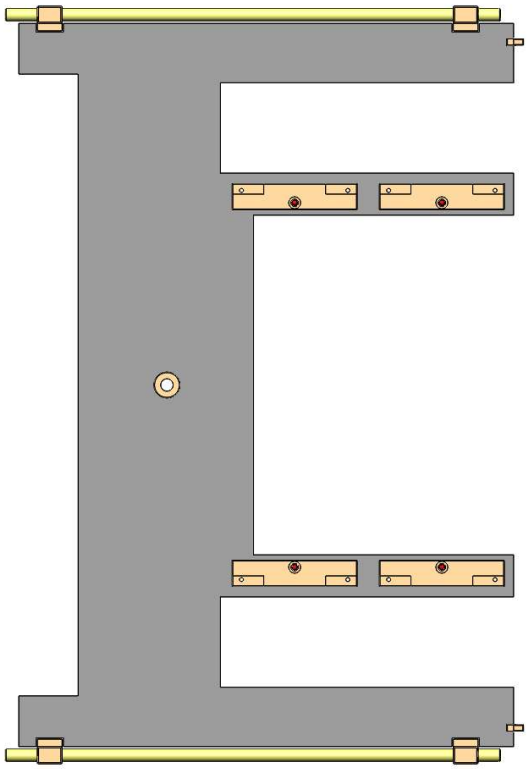
Station in Main frame



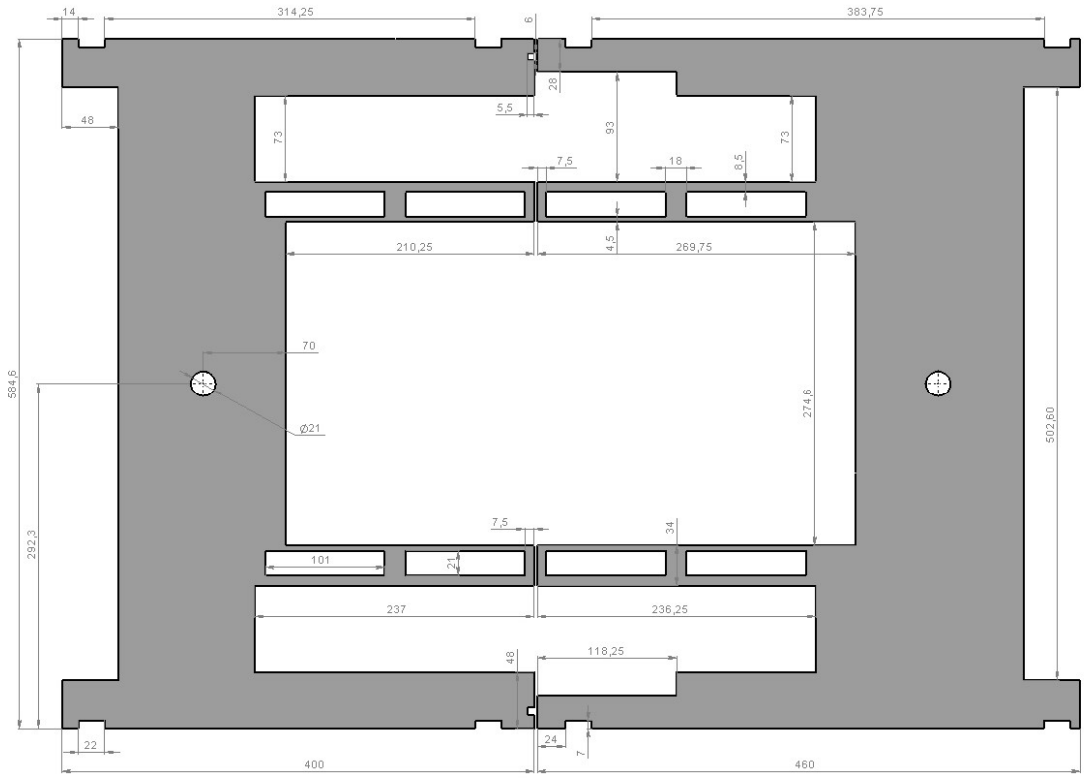
1-st station Main frame (side view)



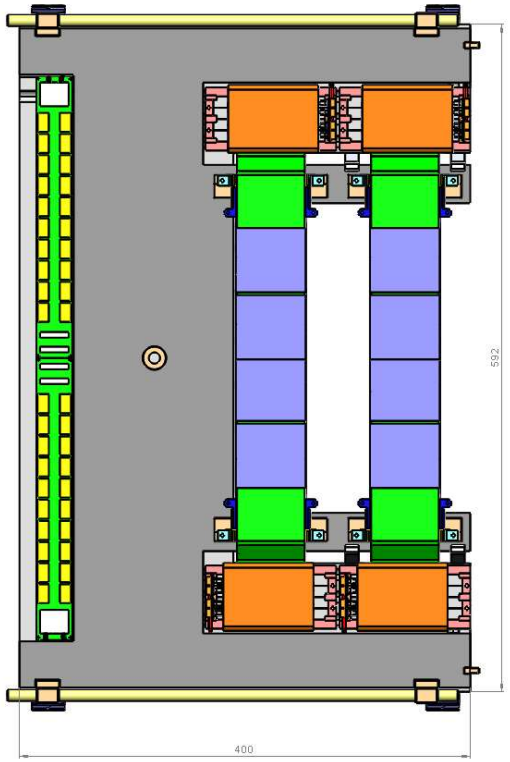
Carbon (sandwich panel) C-frame 1-st station



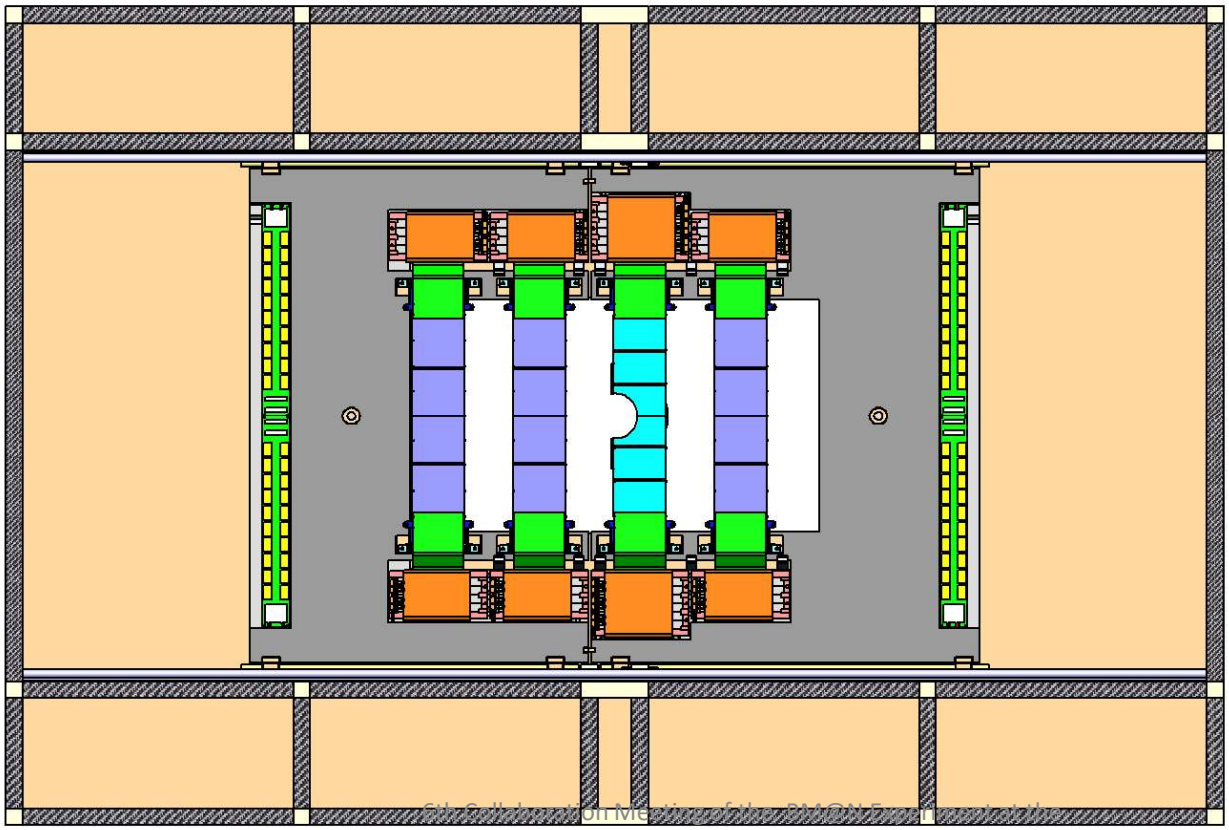
Carbon (sandwich panel) C-frames 1-st station

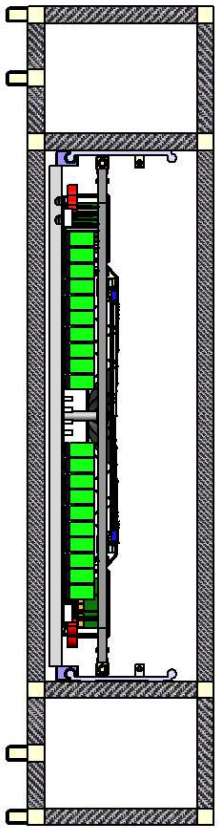


¼ of the 1-st station

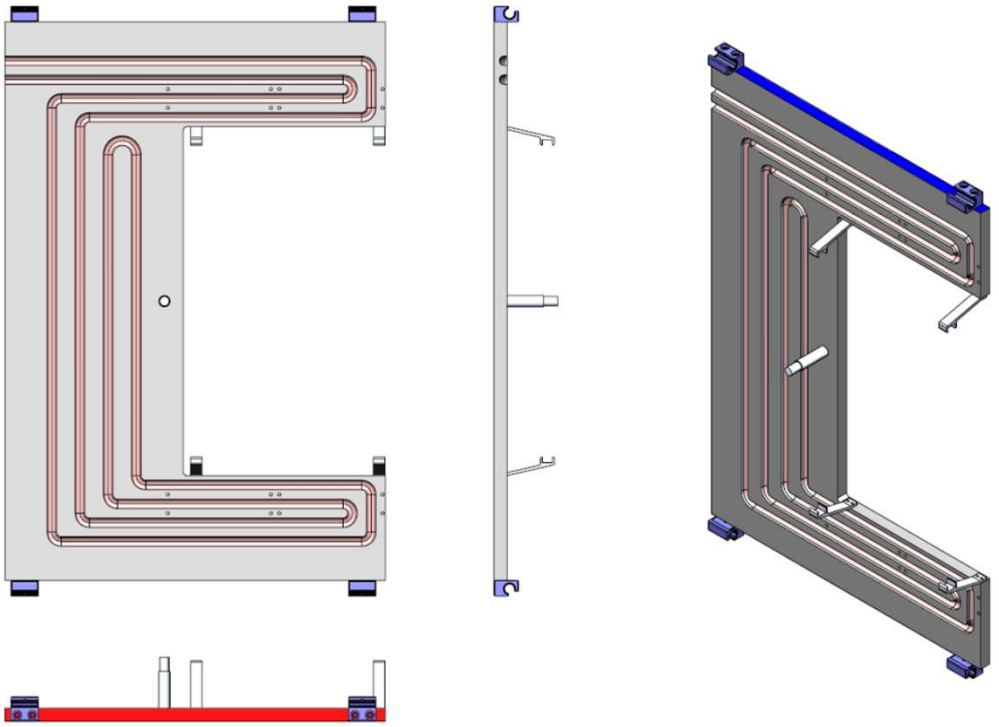


½ of the 1-st station in Main frame

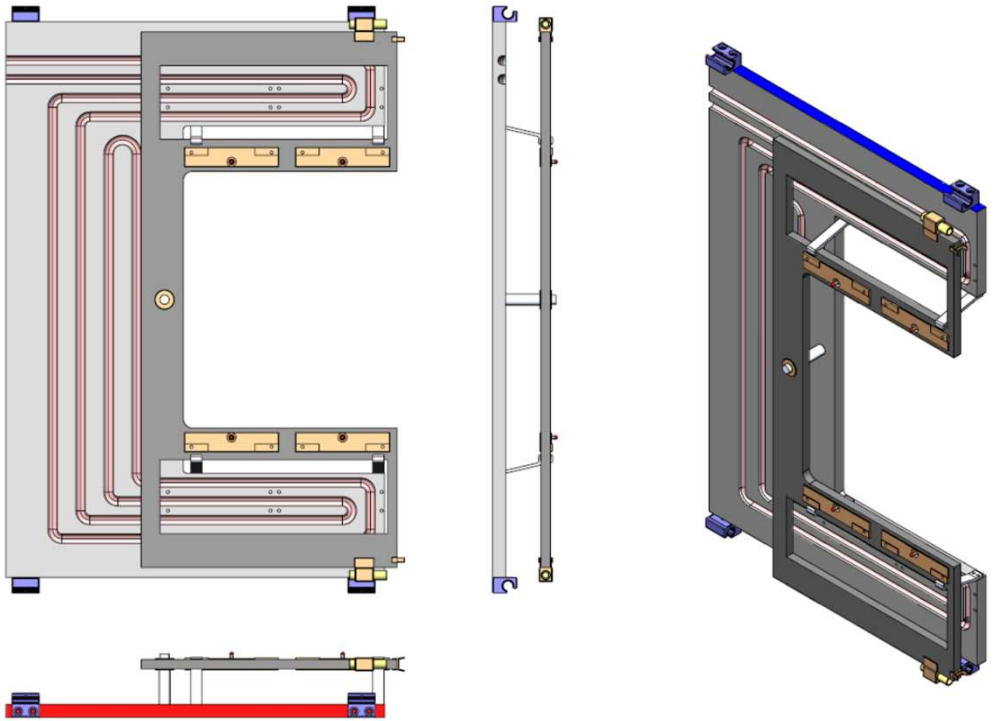




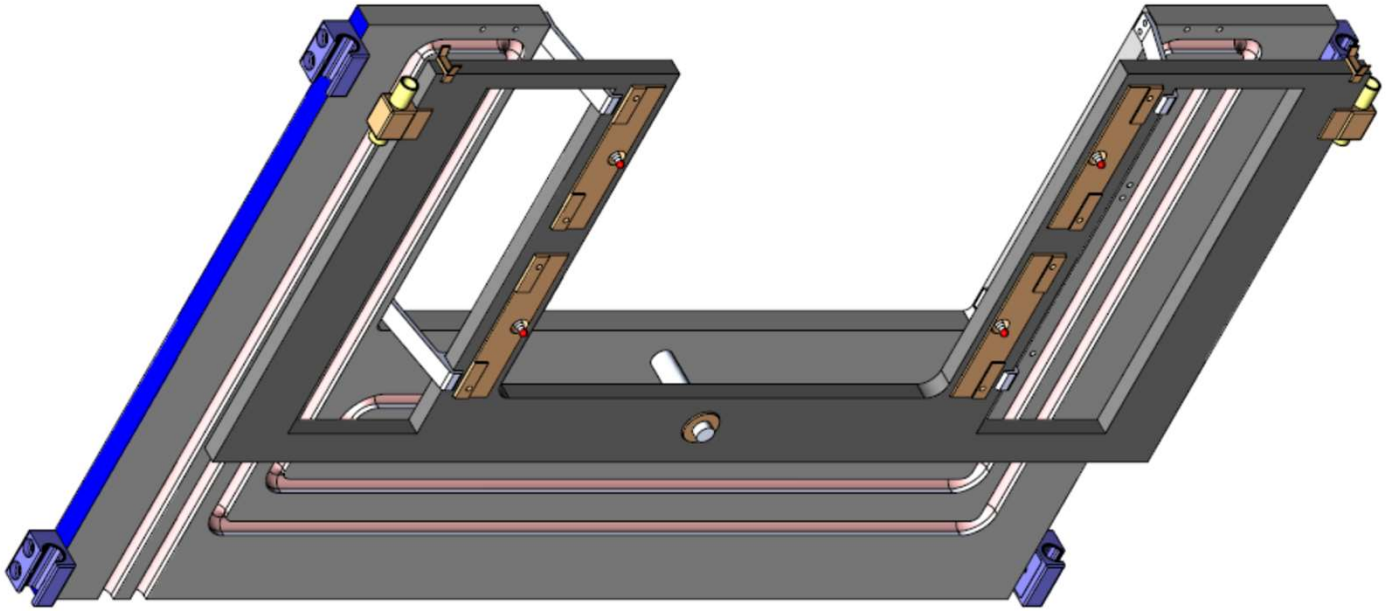
Al c-frame



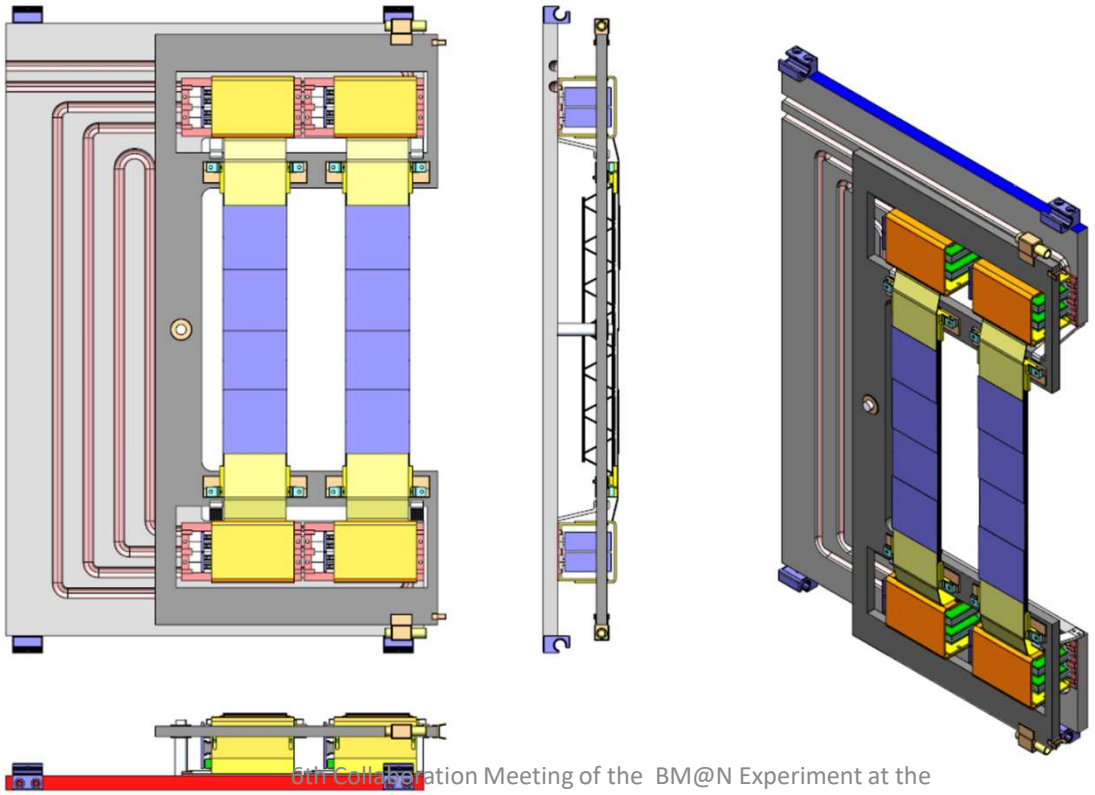
Al c-frame and carbon c-frame



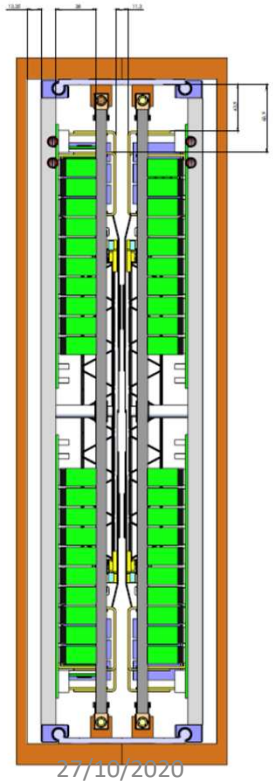
Al c-frame and carbon c-frame

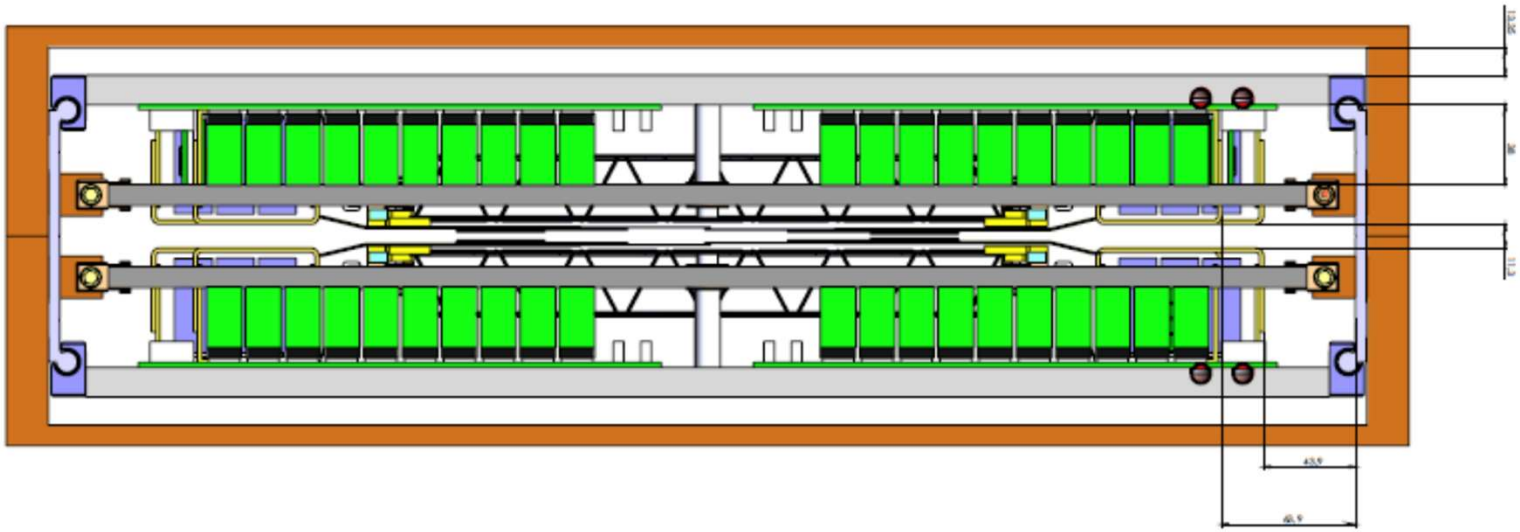


¼ of the 1-st station

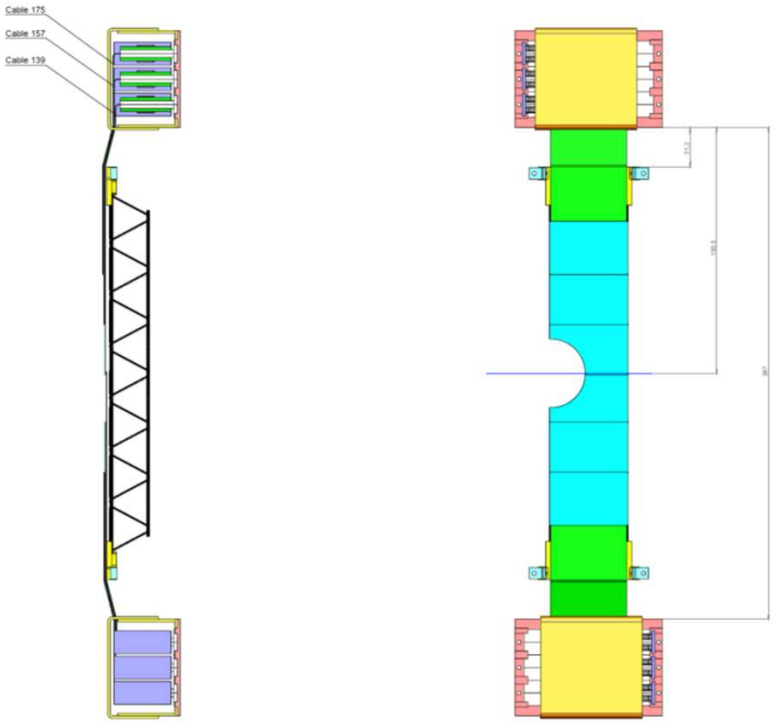


The 1-st station in Main frame

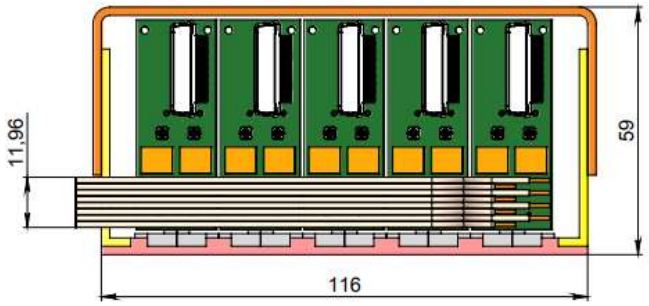


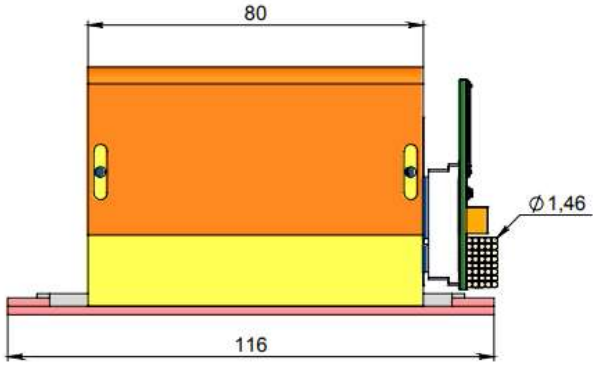


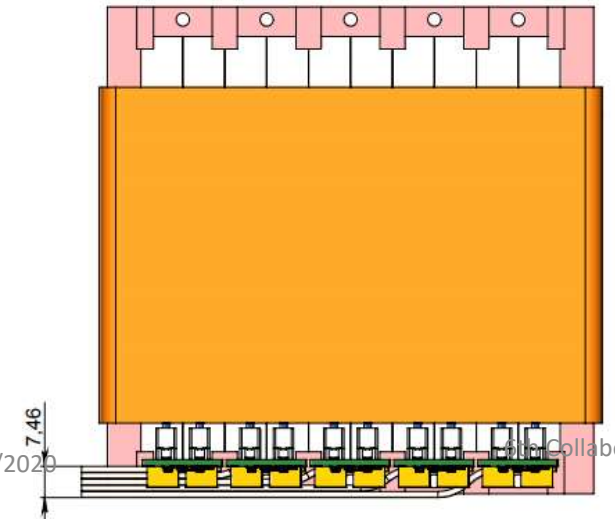
Central Ladder for the 1-st station



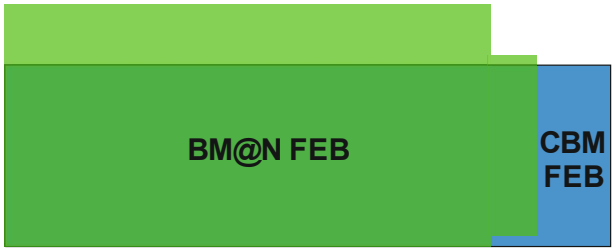
FEB box



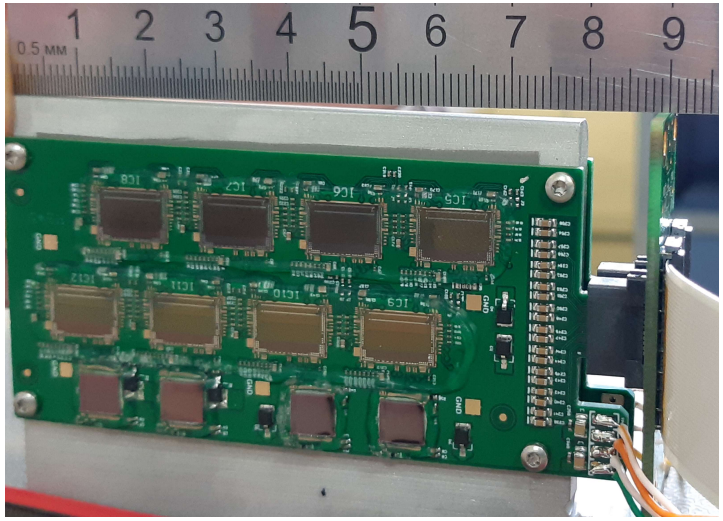




BM@N Front-end Boards



Comparison of two FEB geometries



Prototypes of FEB with FEB-panel

Features:

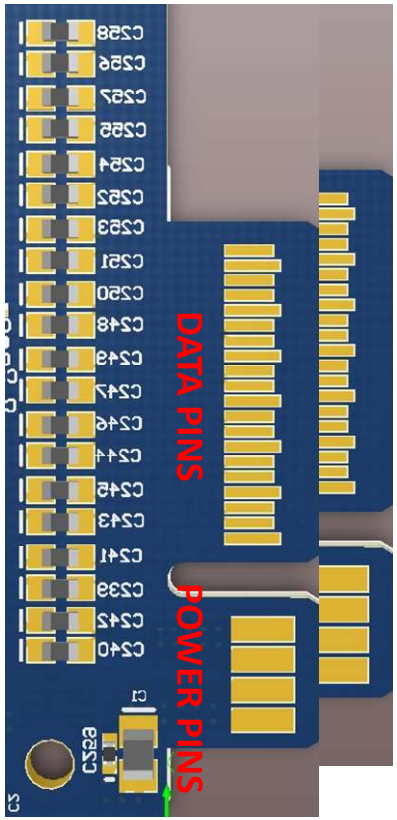
- Size: 87*40 mm^2;
- Thickness with components: 3 mm;
- Edge-type connector with two pin groups: [HV, LV] & [DATA]

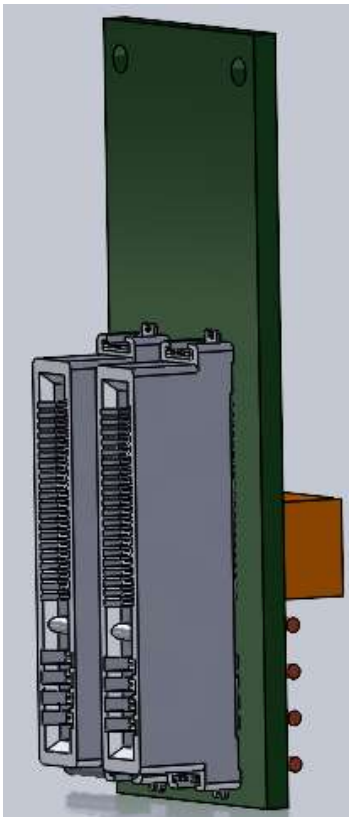
Advantages:

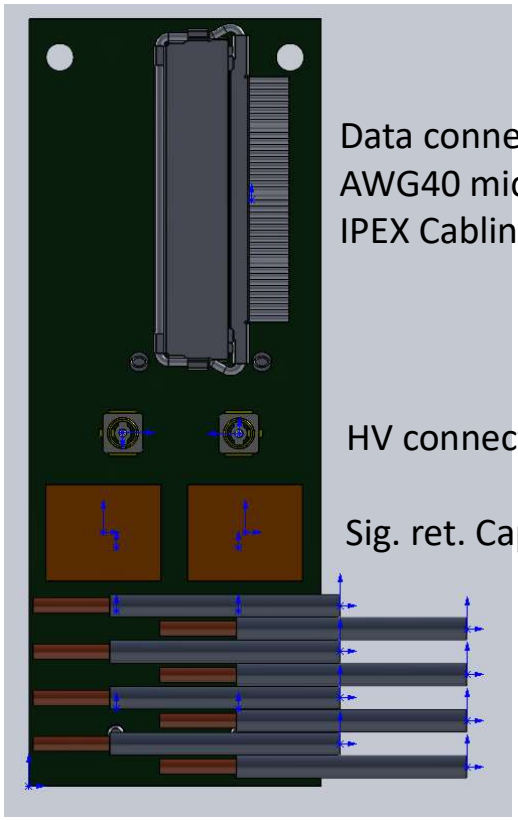
- Increased space for the cabling between FEB-boxes;
- 90 bending of cables is not needed ;
- Easy connectivity with a FEB-panel;
- Low thickness of the board allows to increase thickness of the cooling fin for one FEB up to 3 mm.

This part is connected with RFBR grant 18-02-40047

FEB connectivity







Data connector
AWG40 microcoax cables
IPEX Cabline connector

HV connectors

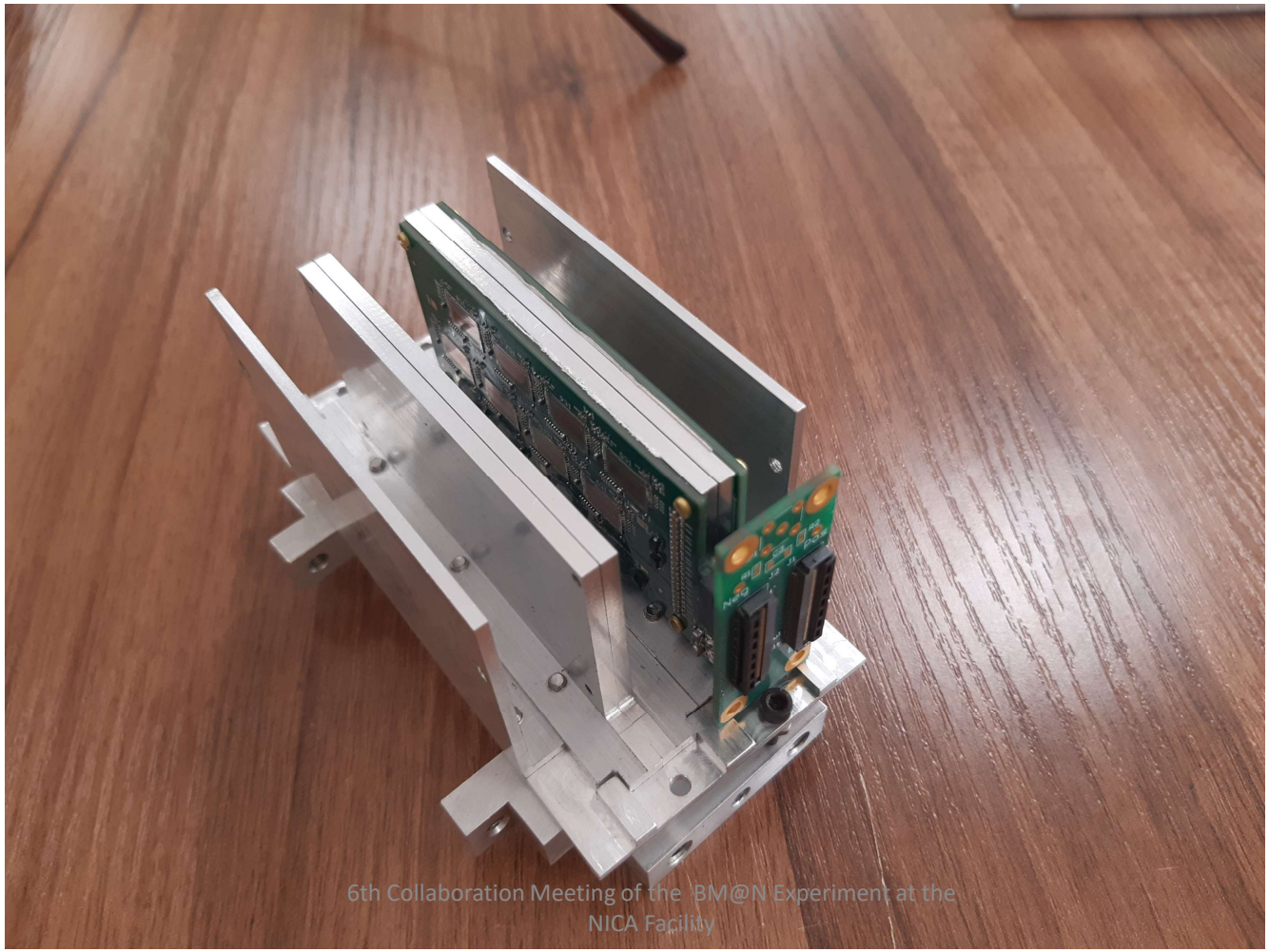
Sig. ret. Caps

20 AWG
power cables

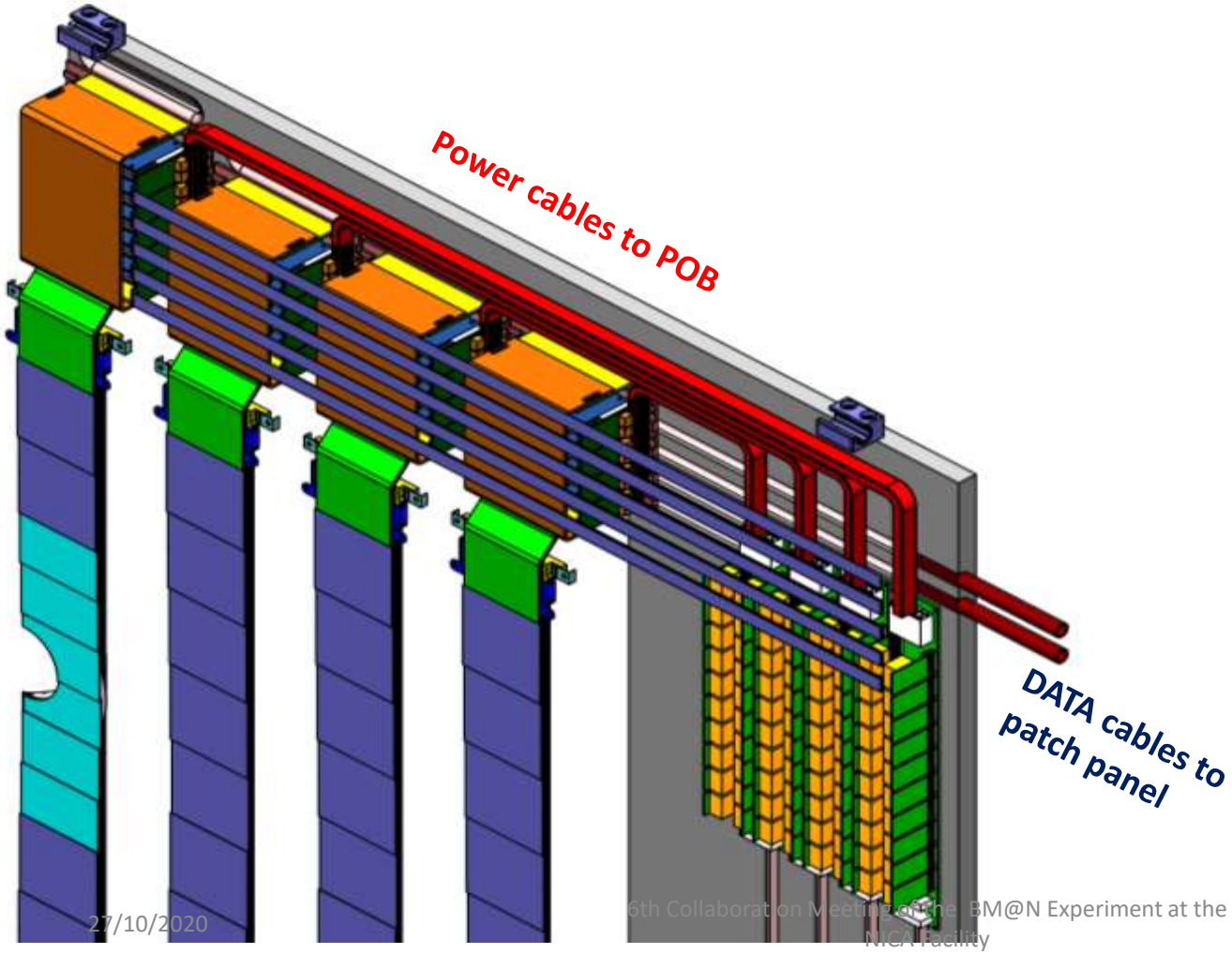
2× FEBs

FEB panel

FEB box prototype



Cable routing



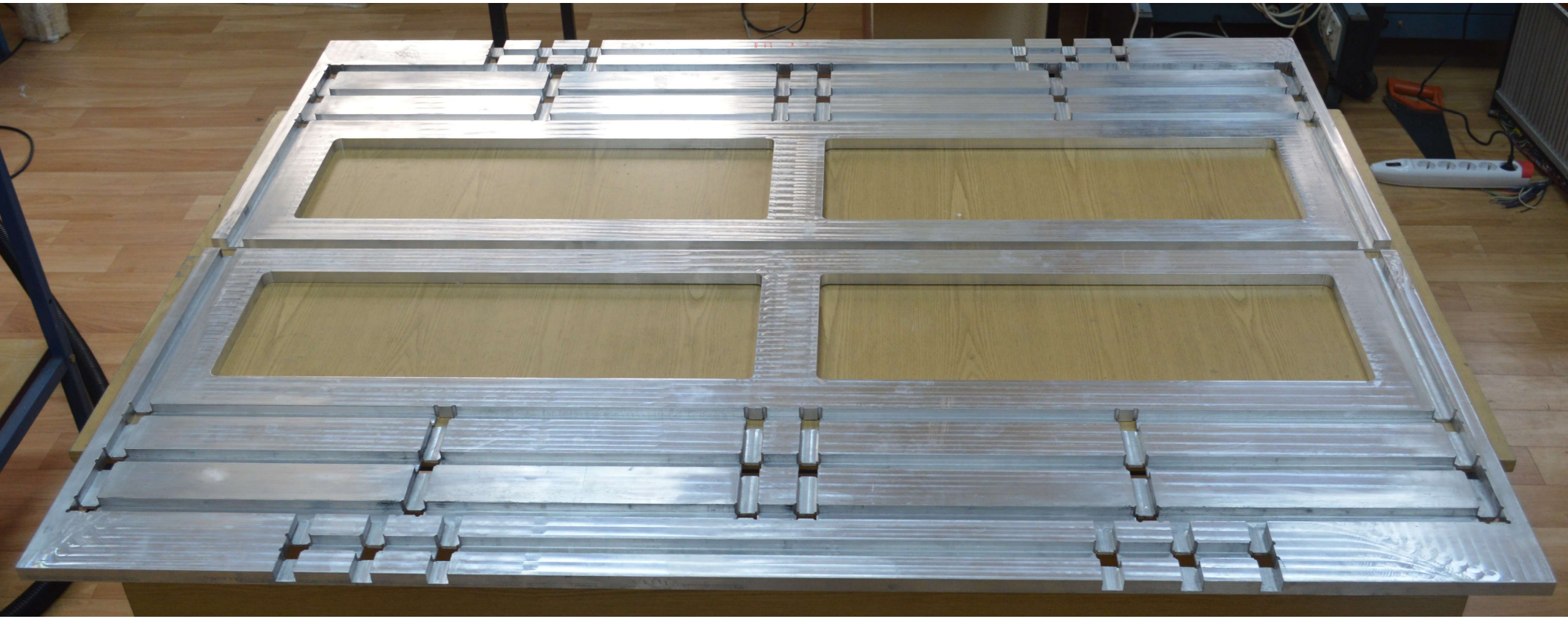
Plans for the construction of the STS mechanics

- Prototype tooling for manufacturing a main frame.
- Production of a prototype C-frames without cooling system for the 4-th station.

  The goal is to test the possibility of positioning, evaluate accuracy.
- Production of a prototype C-frame without cooling system for 1-st station

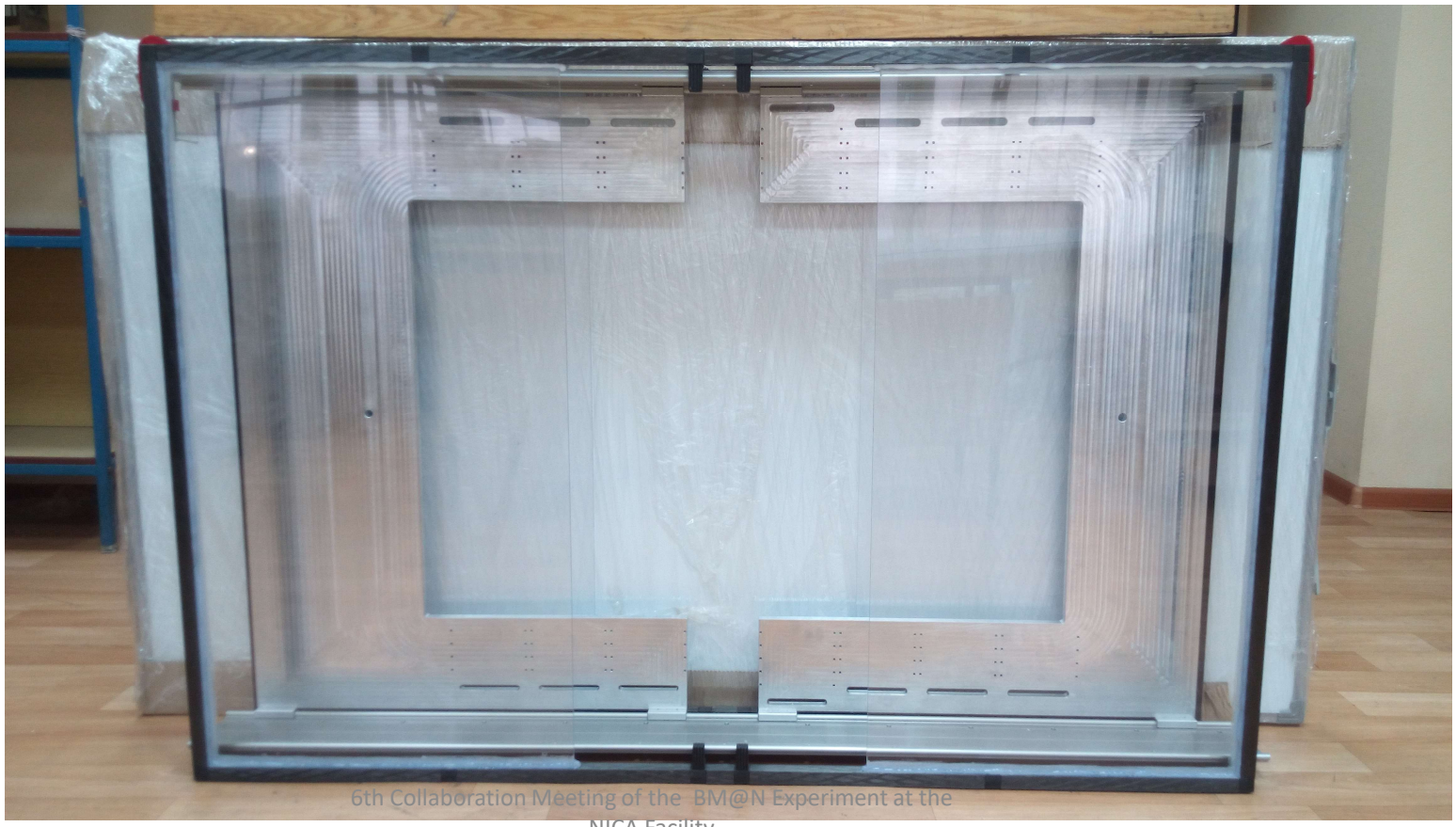
  The goal is to develop the assembly of ladders and its installation on the C-frame
- Purchase of sandwich panels.
- Production of a prototypes of radiators.
- Prototype of ¼ Mainframe

Mainframe assembly tool



Mainframe prototype

Mainframe with two Al C-frames

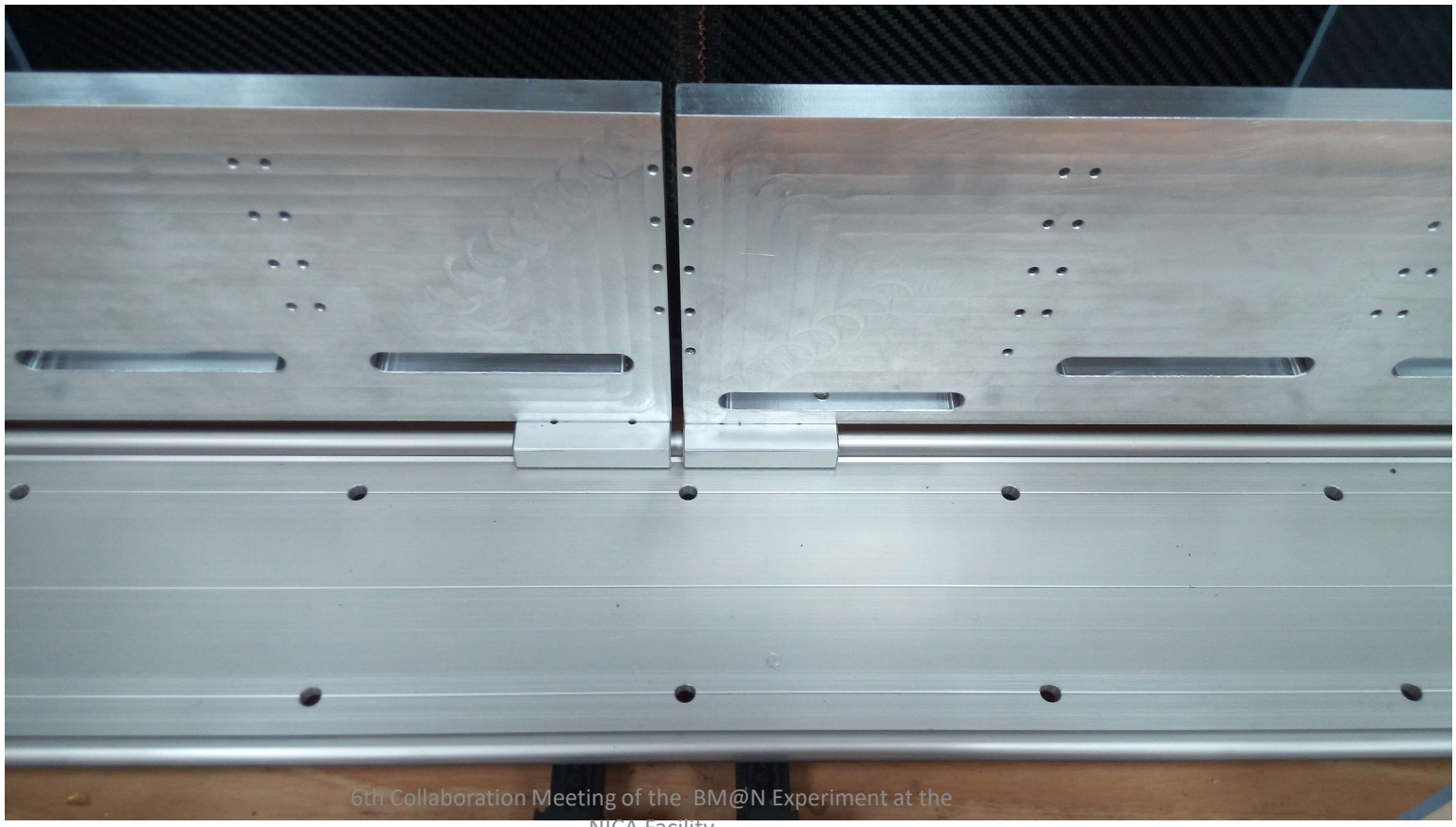


Mainframe, rails, Al C-frame with bearing - top

Mainframe, rails, Al C-frame with bearing - bottom

Mainframe, rails, Al C-frame with bearing - bottom

Al C-frames on rails



Gas Cooling CBM vs BM@N

From H.R.Schmidt

CBM
- environmental temperature -10 deg C
- additional cooling of inner sensors (radiation damage compensation) by gas stream (-40 deg C)
- gas flow 1200 l/min
- RH << 1% @20 deg C (dew point < -40 deg C = T of liquid cooling - NOVEC)

BM@N
- environmental temperature +15 deg C
- temperature homogenization in box by gas stream (+15 deg C)
- gas flow ?
- RH < 50% @ 20 deg C (dew point < 10 deg C = T of liquid cooling – H2O)

Both experiments need (though with different operational parameters):
- gas cooler/heat exchanger
- gas drying plant
- gas distribution system

Ladder assembly technology

- Starting technology for building ladders was created.
- The first experiments were conducted and the results were obtained confirming the possibility of assembling ladders on existing equipment.
- It is necessary to continue to improve the technical process, equipment and software.
- For this purpose, it is planned to build 3 mockups of ladders this year.
- Next year, it is planned to measure the position of modules on mockups and start to the assembly of real ladders.

Module assembly

- Assembly workflow has been developed and tested
- Workplaces and testbenches for key technological operations has been prepared
- Set of bonding tools for assembly was designed and manufactured
- QA procedures for all components and steps of the assembly has been developed
- Technological documentation and Electronic logbook customize design has been development to store data during modules assembly
- Five modules have been assembled at JINR lab, still more components for assembly of 20 modules are required to estimate production yields for mass production

Thank you !