Status and work plans at the BM@N setup

Piyadin S.M.

08.10.2024

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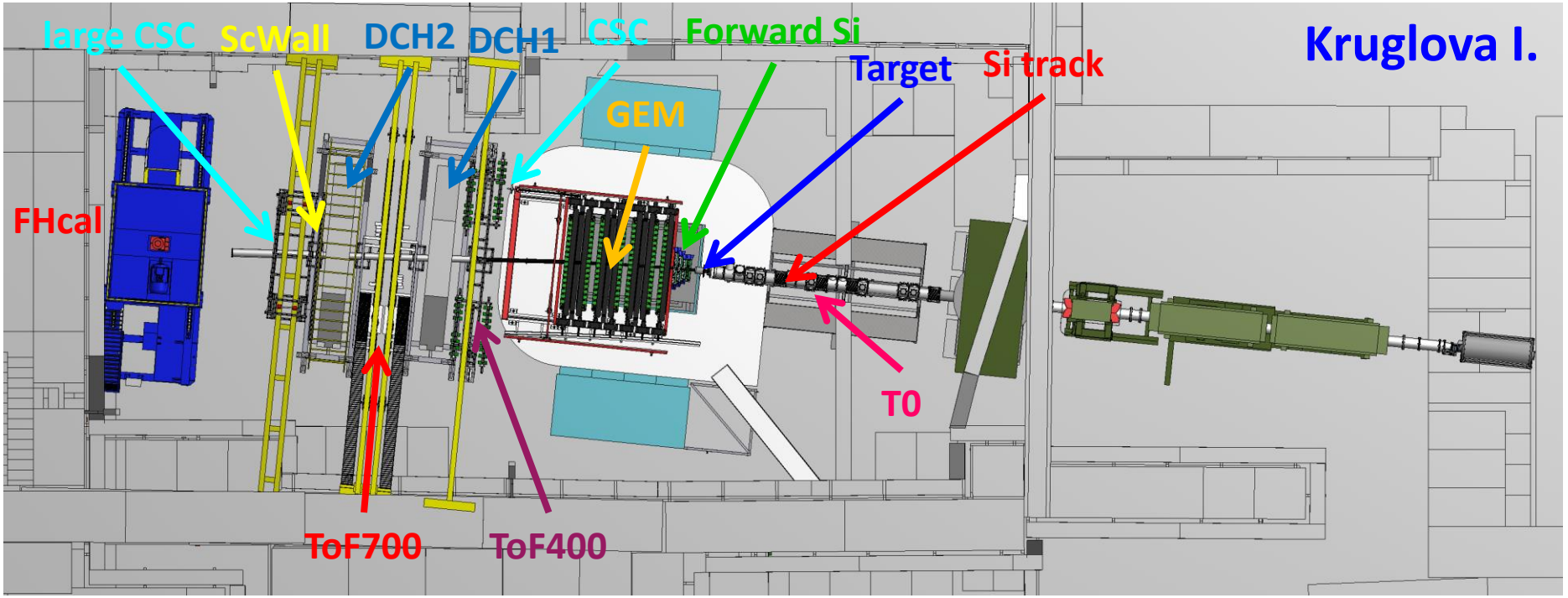
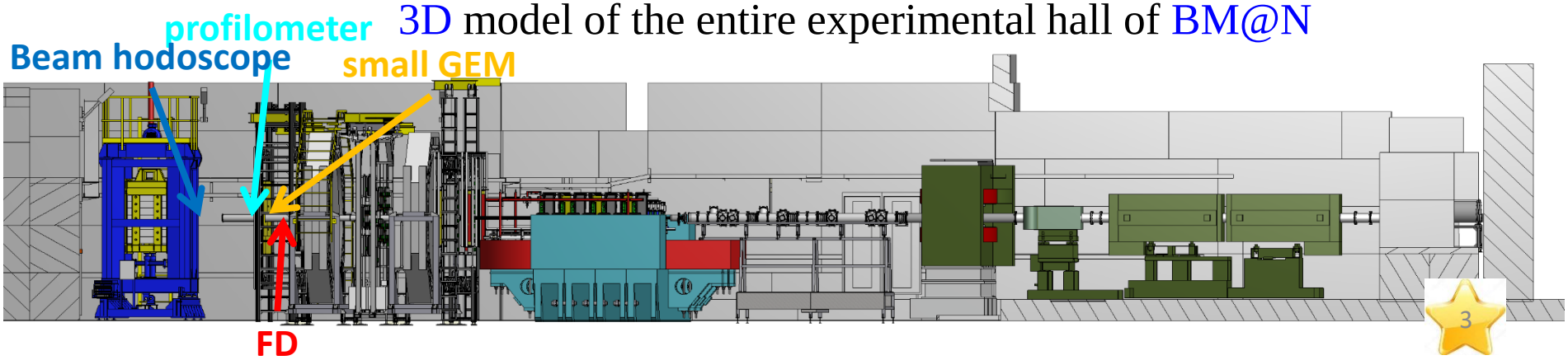
Detector installation in BM@N experimental hall for Xe run



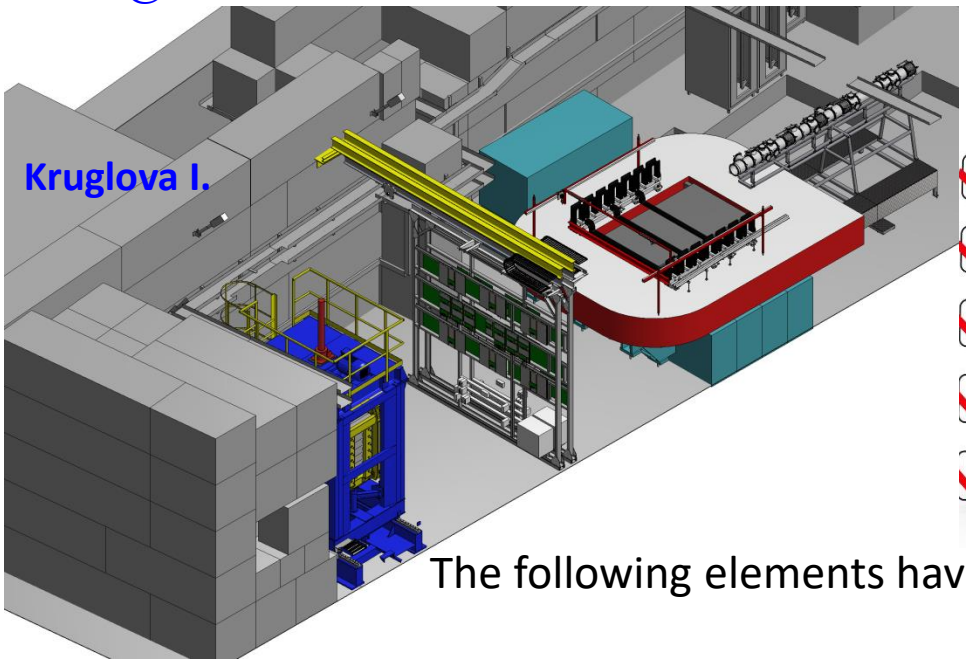
3D model of the entire experimental hall of BM@N



BM@N experimental hall. Preparation for modernization of detectors

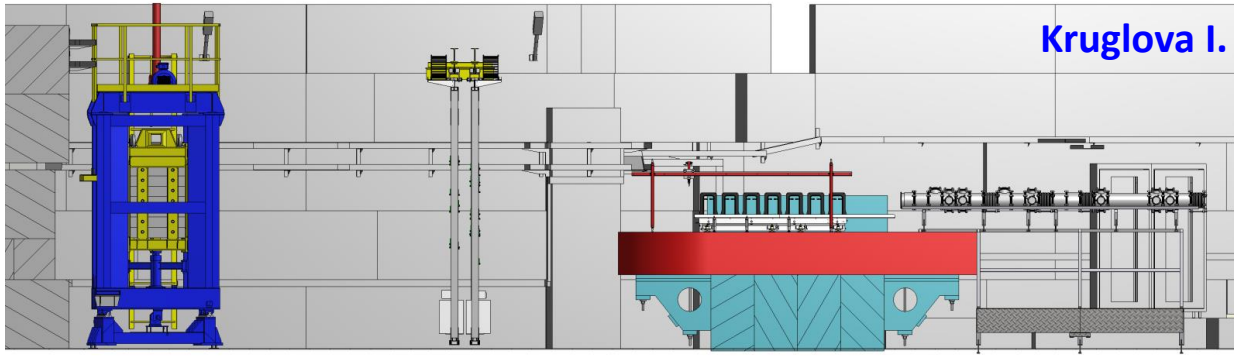
The following elements of the BM@N installation were removed after Run 8:

1. 4 detectors ToF400;
2. 4 detectors CSC 1x1m;
3. CSC 1,5x2m;
4. FD;
5. small Gem;
6. Aluminum beam pipe;
7. SiMD;
8. 8 planes forward Si;
9. 14 Gem;
10. Carbon beam pipe;
11. DCH1;
12. DCH2;
13. ScWall;
14. Target Station;
15. BC1;
16. BC2;
17. VC.



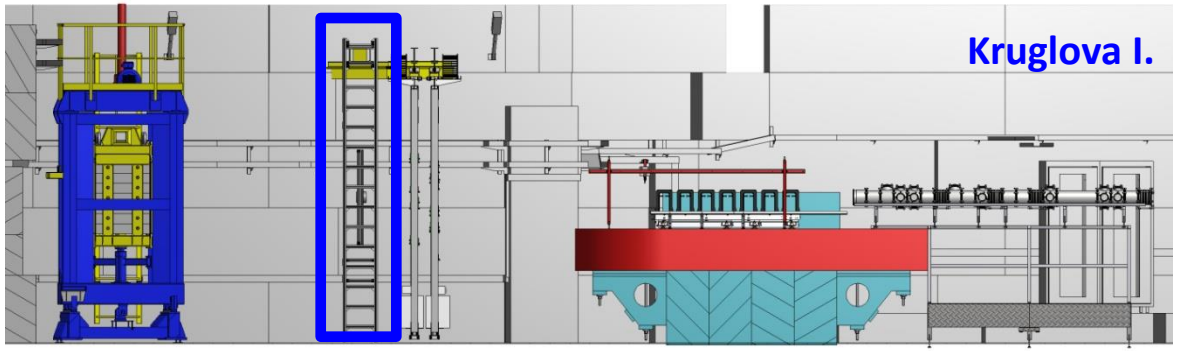
The following elements have not been deleted:

1. Barell;
2. ToF700;
3. BH;
4. FHcal.

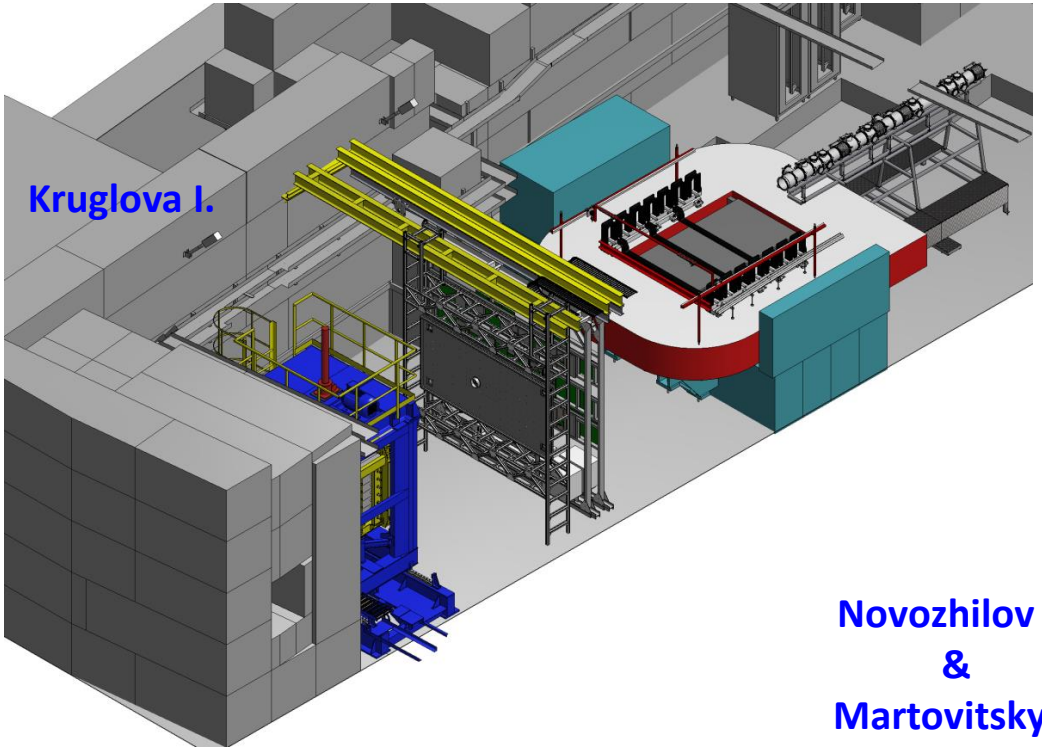


Installation of ScWall detector

The following mechanical support elements have been prepared:



1. Mechanical support materials: **Yes**
2. Supporting structure for mechanical support : **Yes**
3. Brackets for fastening the supporting structure : **Yes**
4. Mechanical Support Project: **Yes**
5. The detector is ready for installation: **Yes**

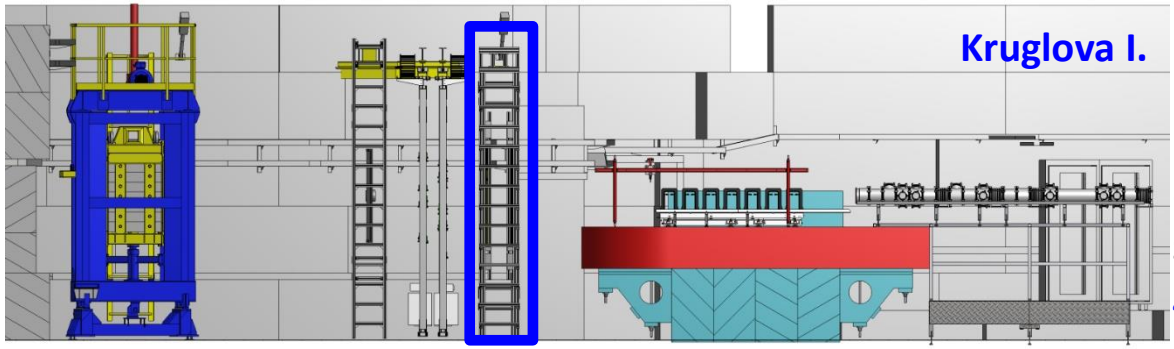


ScWall is completely installed in the experimental hall now

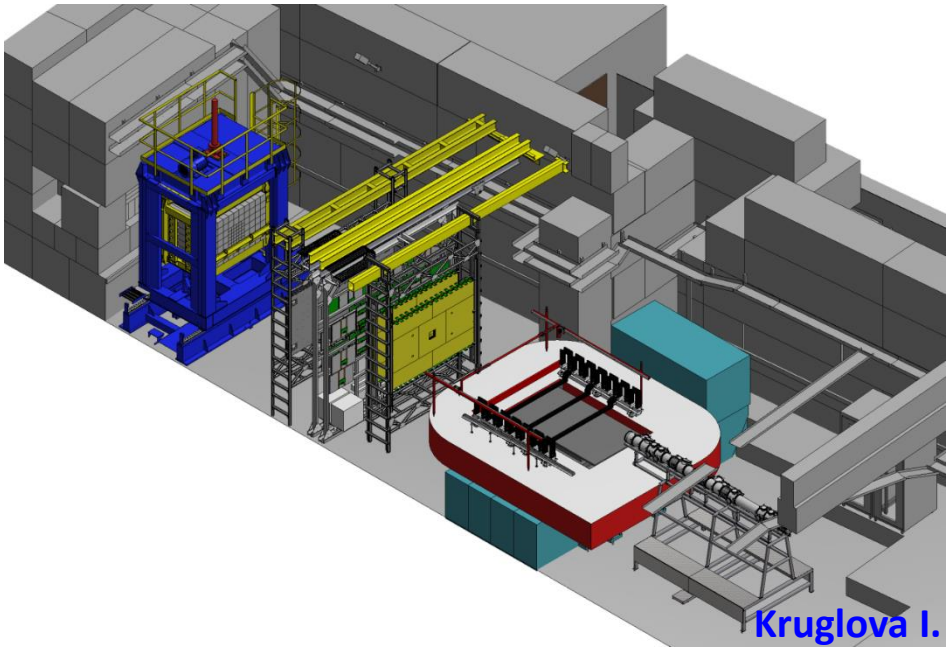
Novozhilov S.
&
Martovitsky E.

Installation of 2 CSC big detectors

The following mechanical support elements have been prepared:



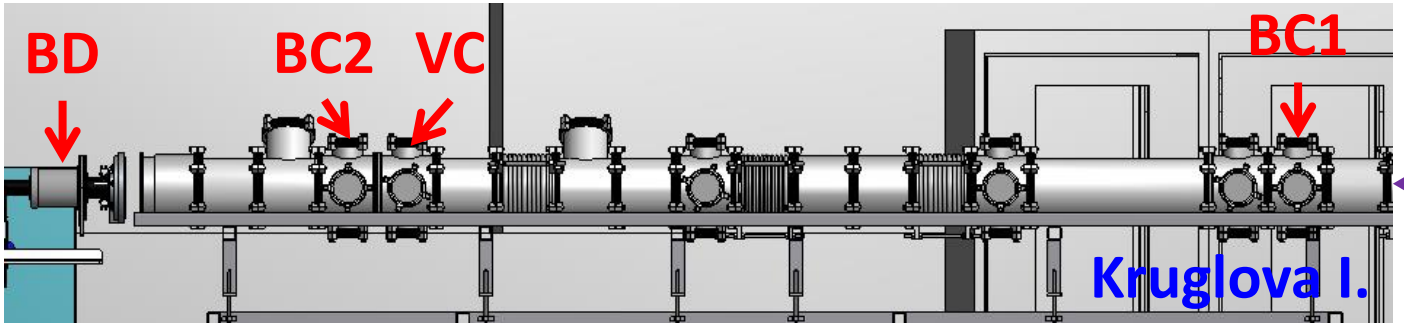
1. Mechanical support materials: **Yes**
2. Supporting structure for mechanical support : **Yes**
3. Brackets for fastening the supporting structure : **Yes**
4. Mechanical Support Project: **Yes**
5. The detector is ready for installation: **Yes**



2 CSC big are completely installed in the experimental hall now

Novozhilov S.
&
Martovitsky E.

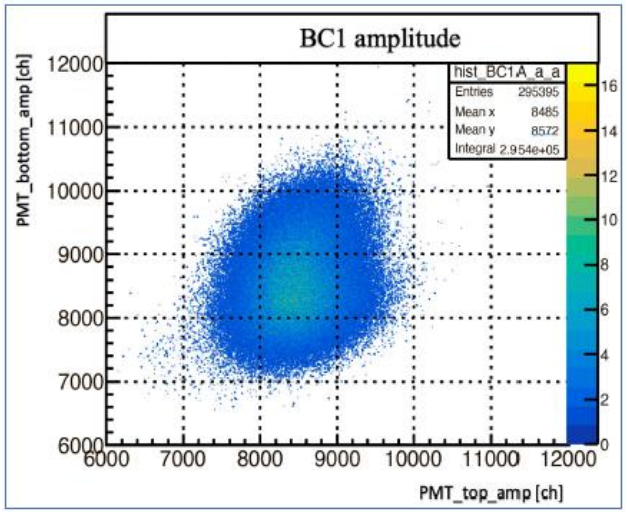
Beam pipe upstream the SP-41
Trigger detectors



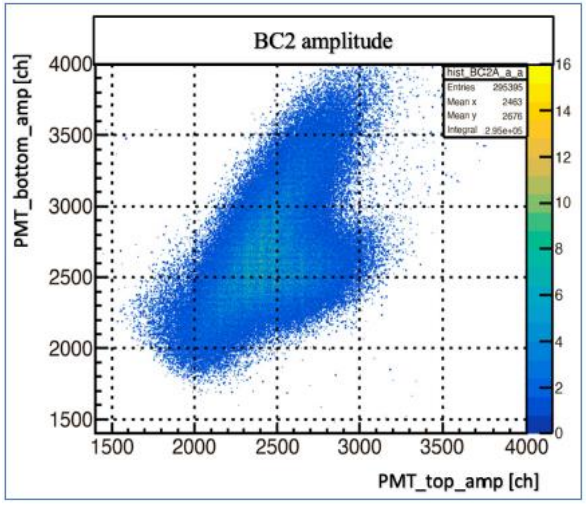
The position of the trigger detectors in a complete vacuum beam pipe configuration

All elements counter BC2

Amplitude correlation from two PMTs BC1 counter

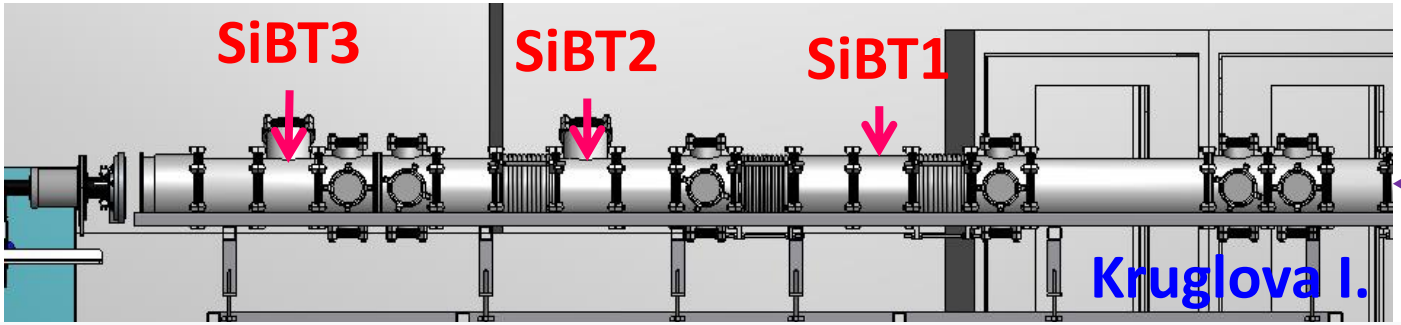


Amplitude correlation from two PMTs BC2 counter

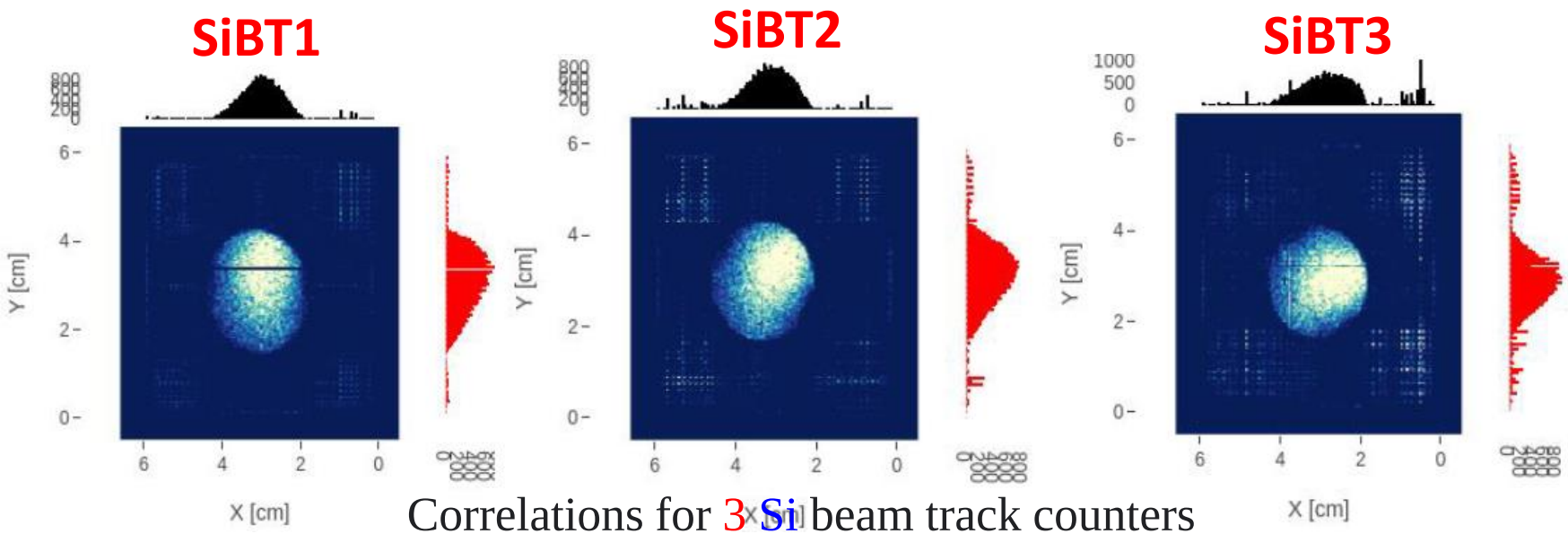


S.Sedykh will talk in more detail about the operation of trigger detectors

Beam pipe upstream the SP-41
Si Beam Tracker detectors



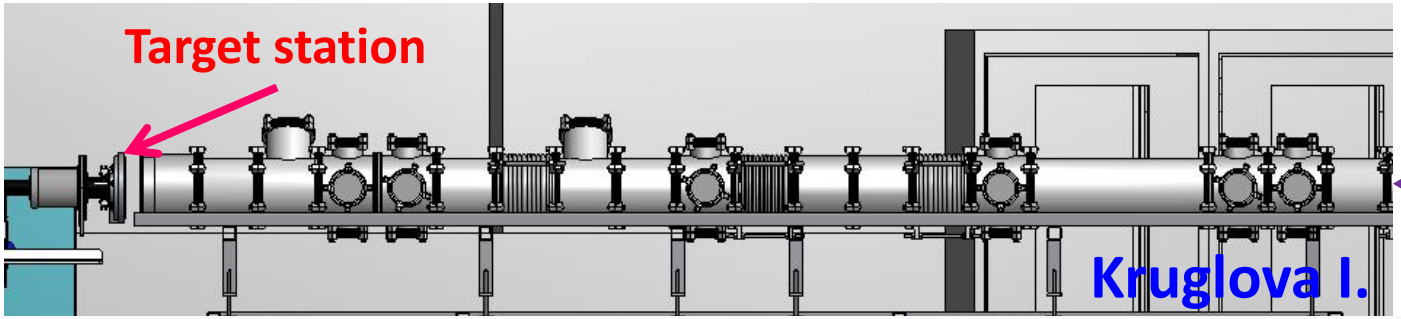
The position of the Si beam track counters in a complete vacuum beam pipe configuration



Correlations for 3 Si beam track counters

D.Chemezov will talk in more detail about the operation of Si beam tracker detectors

Beam pipe upstream the SP-41 Target Station



The position of the Target Station in a complete vacuum beam pipe configuration

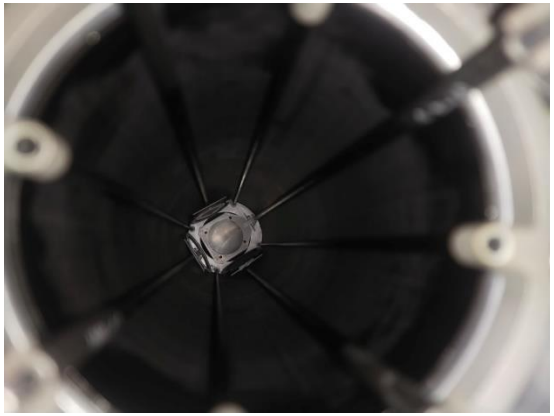
Target station with pneumatic motors:

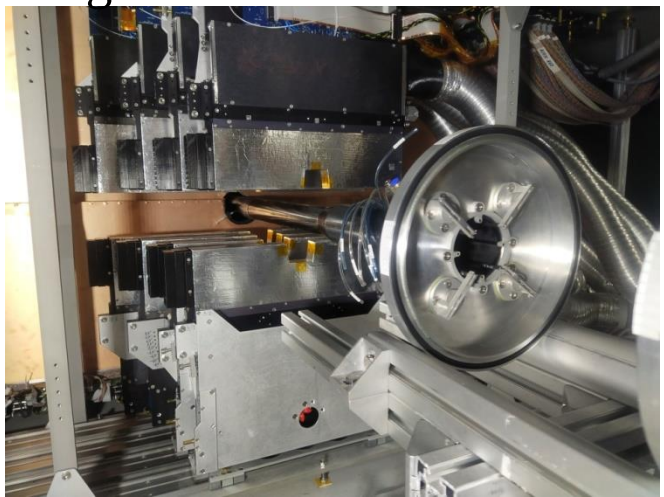
3 target + 1 without target for evaluating background;

Drive: pneumatic motors;

Target elements: use with non-magnetic materials;

Target installation control: KTIR0411S optocoupler (4 pcs.).

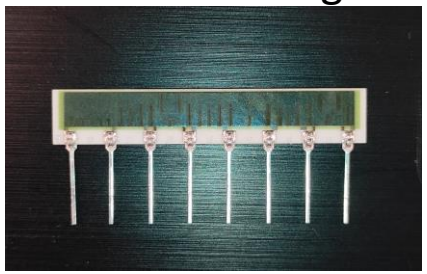




Currently, the design of a target assembly made of heat-conducting materials in the same design is being discussed.

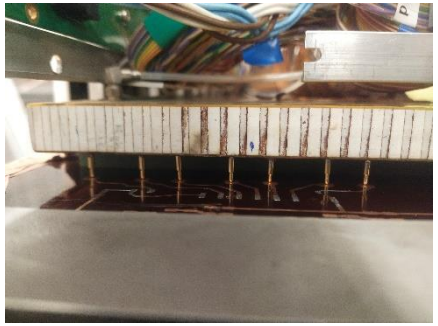
GEM modernization

Divider old configuration

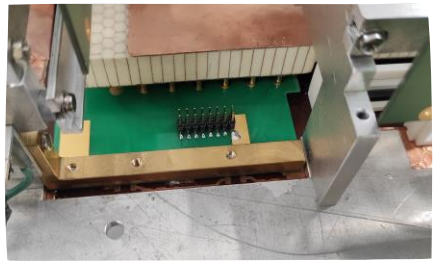


Location of the old divider on the Gem detector

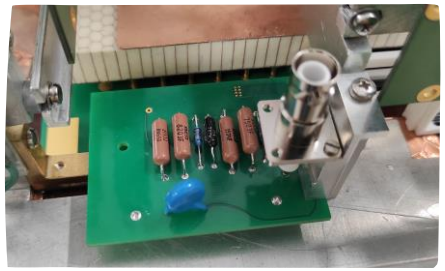
High voltage pin old configuration



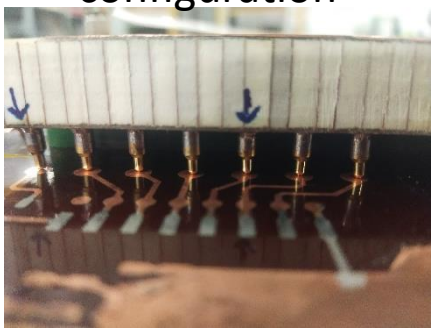
The board on the detector



Divider new configuration



High voltage pin new configuration



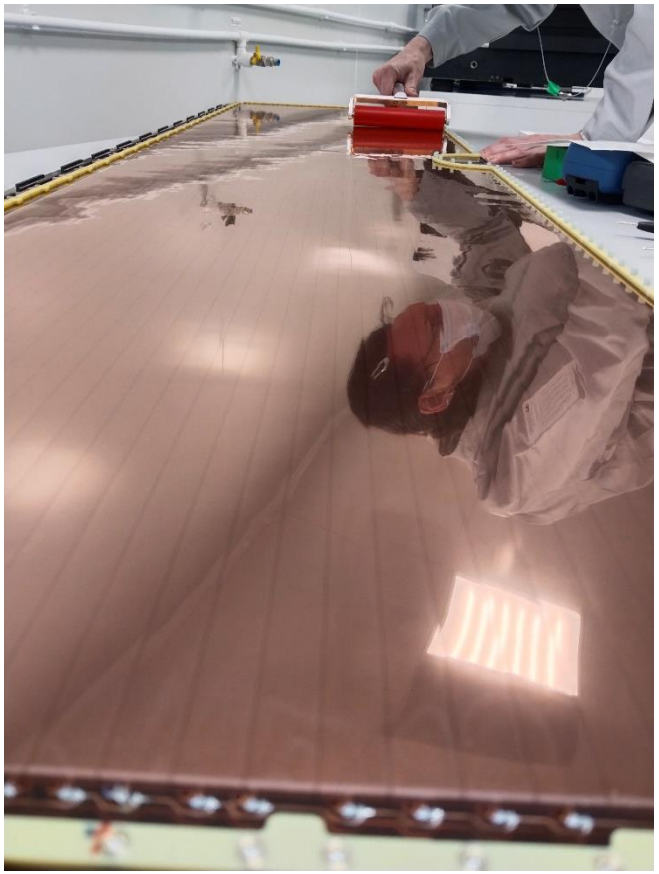
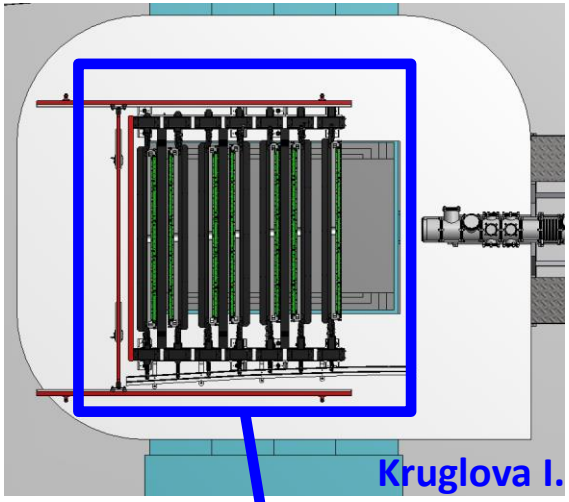
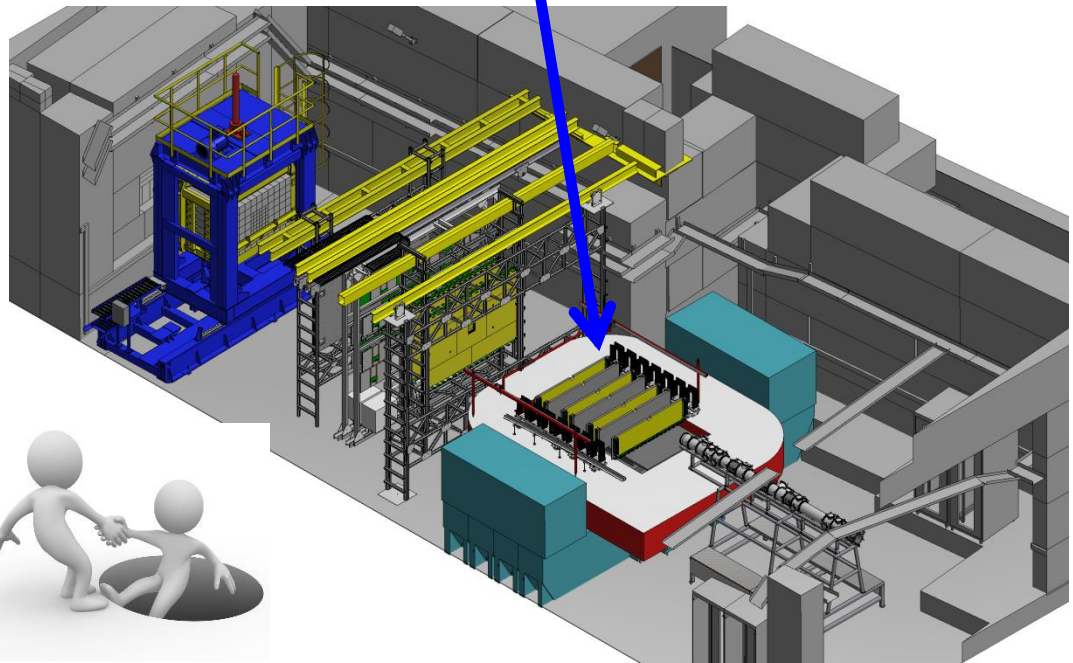


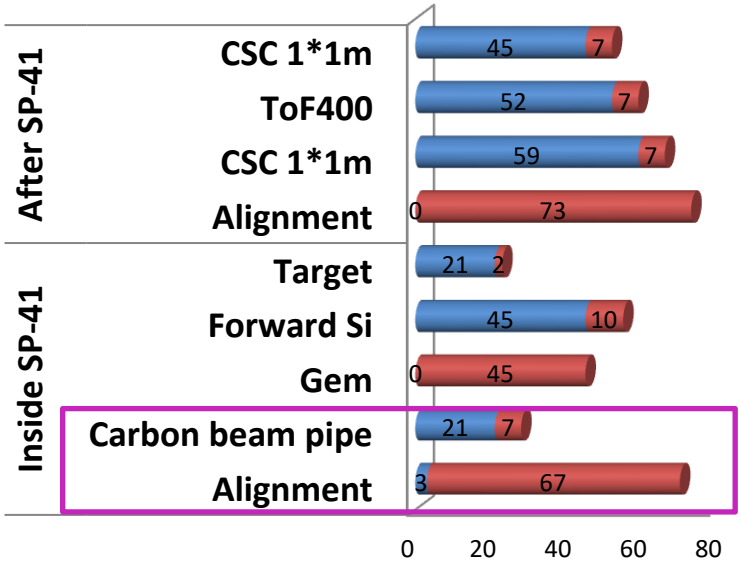
Photo of Gem repair

Installation of 7 GEM detectors





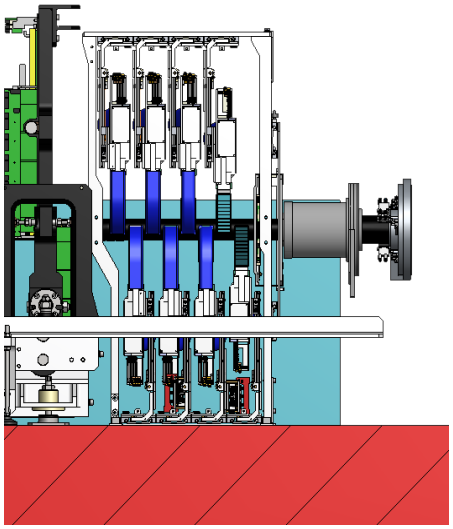
1. Mechanical support : **Yes**
2. The detector is ready for installation: **Yes**



Only after installing all GEM we will be able to complete the installation of CSC and TOF400

We installed 7 bottom GEM detectors.

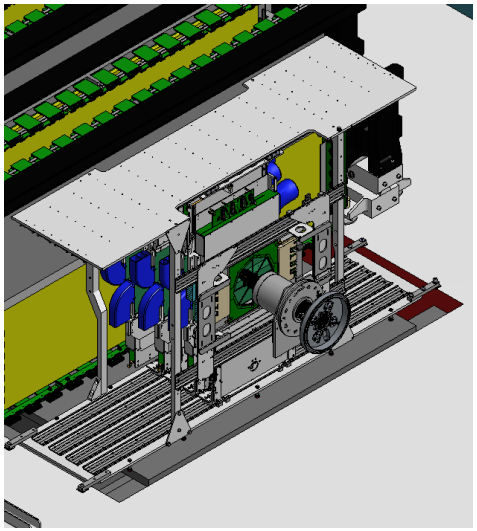
Installation of Forward Si detectors

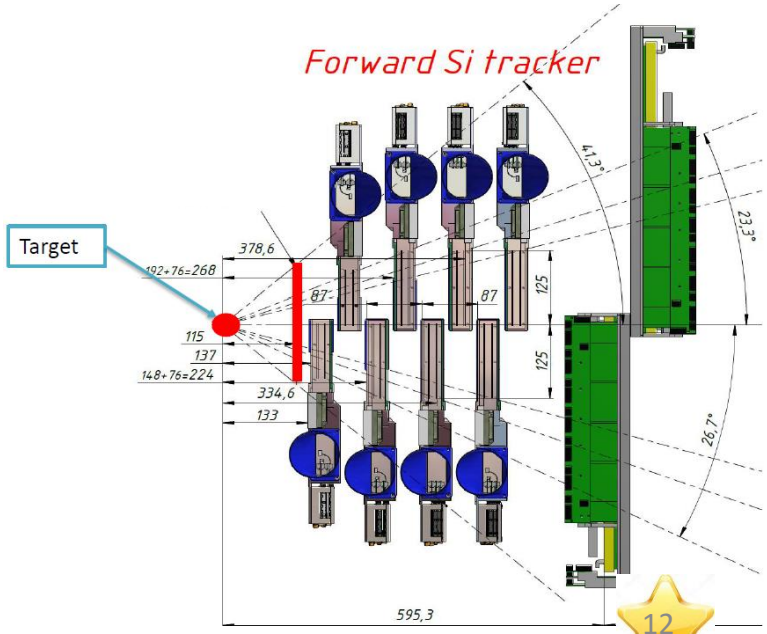


N.Zamyatin will talk in more detail about the operation of Si detectors

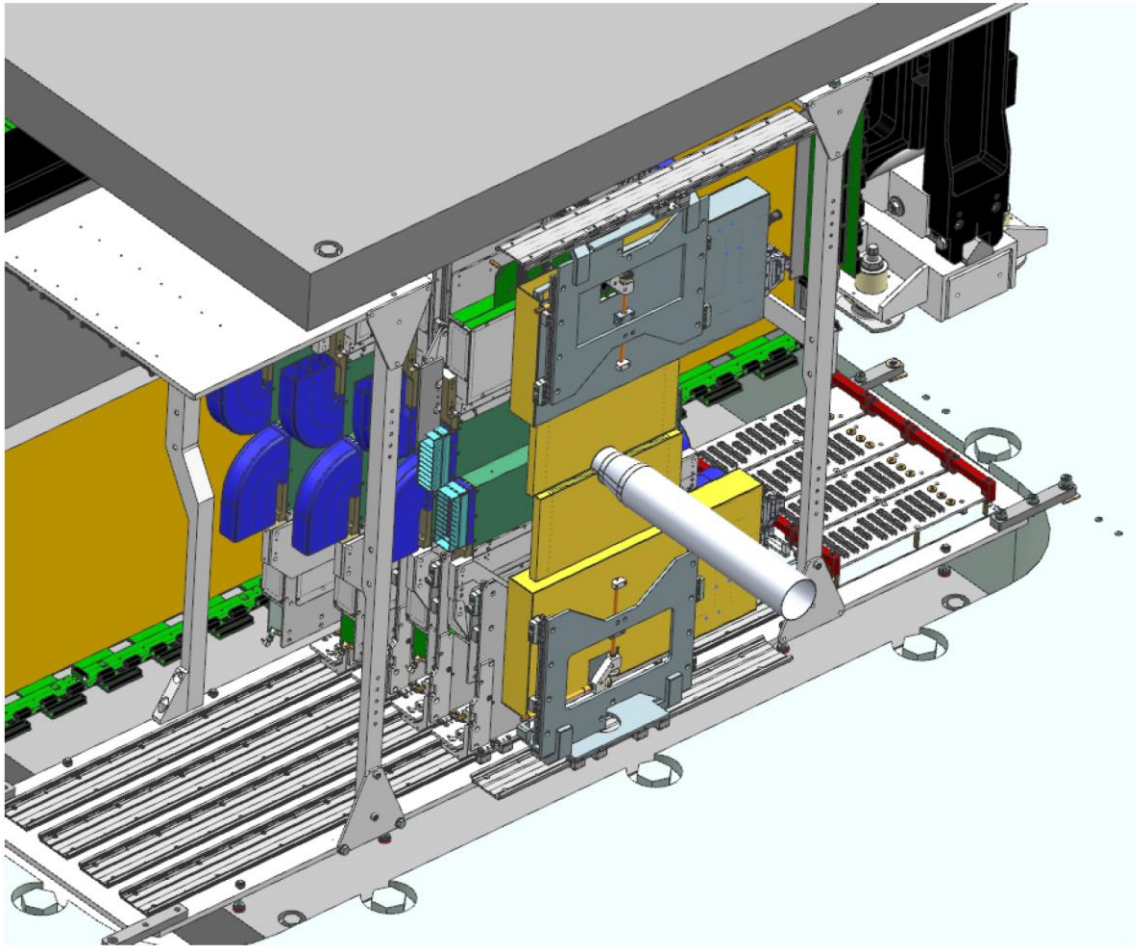
forward SI installed in BM@N

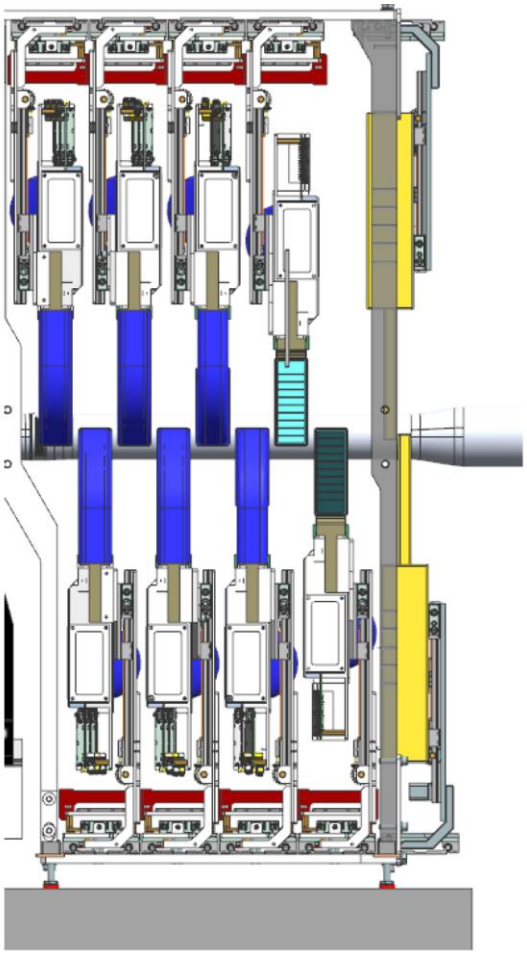
3D view of forward Si





Installation of Si-station based on STS modules

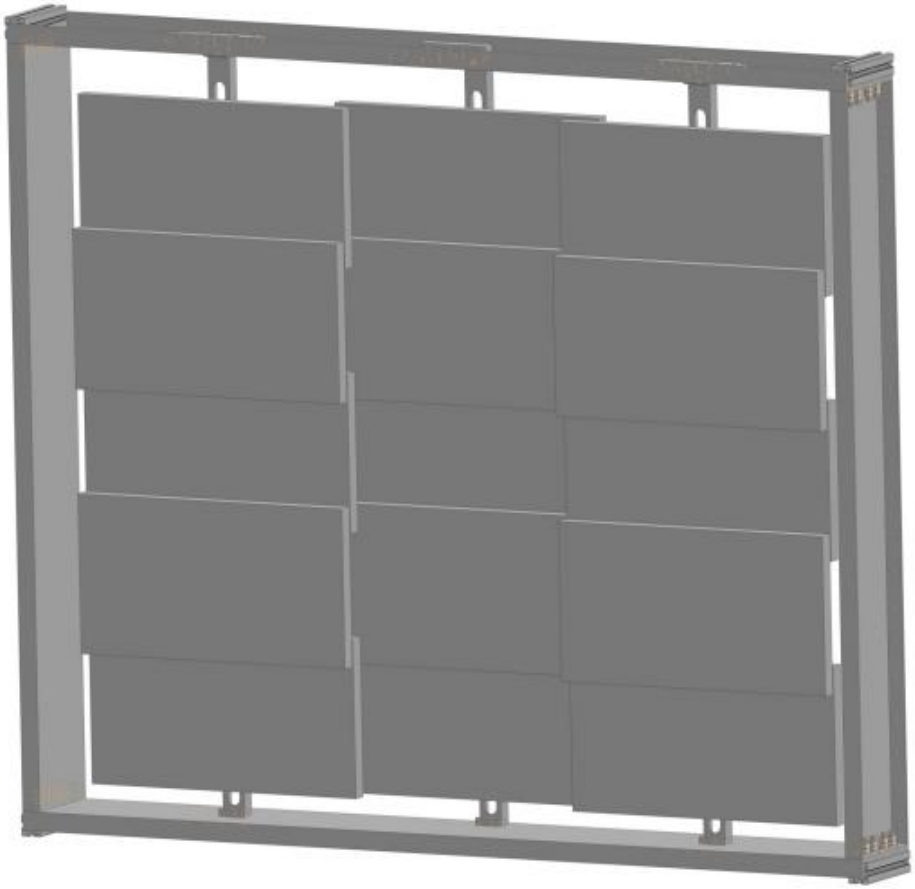




A. Sheremetev will talk in more detail about the operation of Si-station

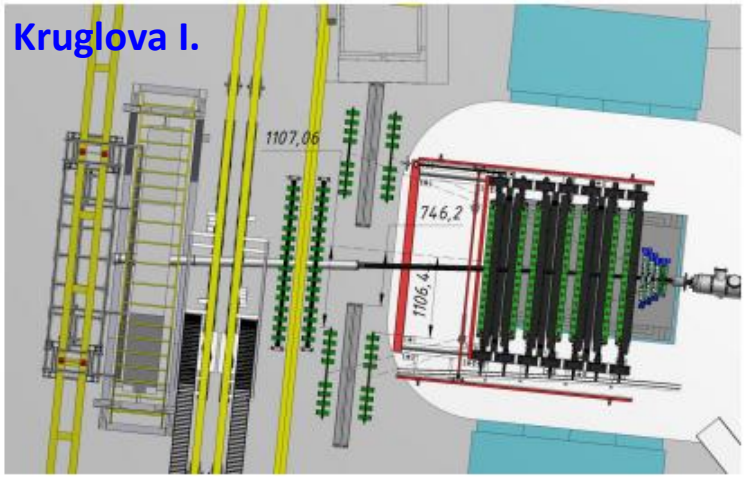
ToF400 modernization

We decided to expand ToF400 acceptance.
To do this we will have to change the detector boxes.



Box size - ~1,5*1,8 m^2
Material — aluminium
Minimizing material budget near to beam axis

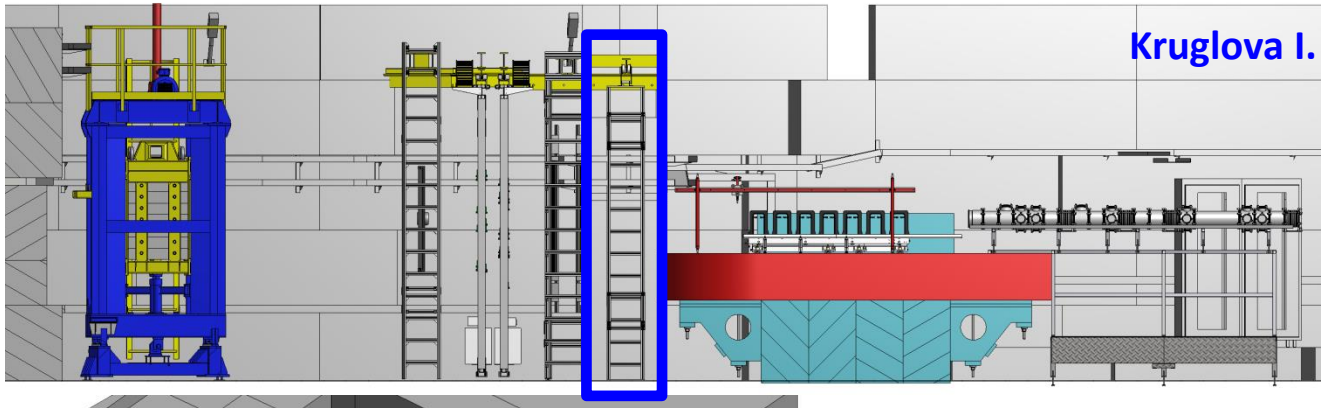
The aluminum box guides are currently fully manufactured

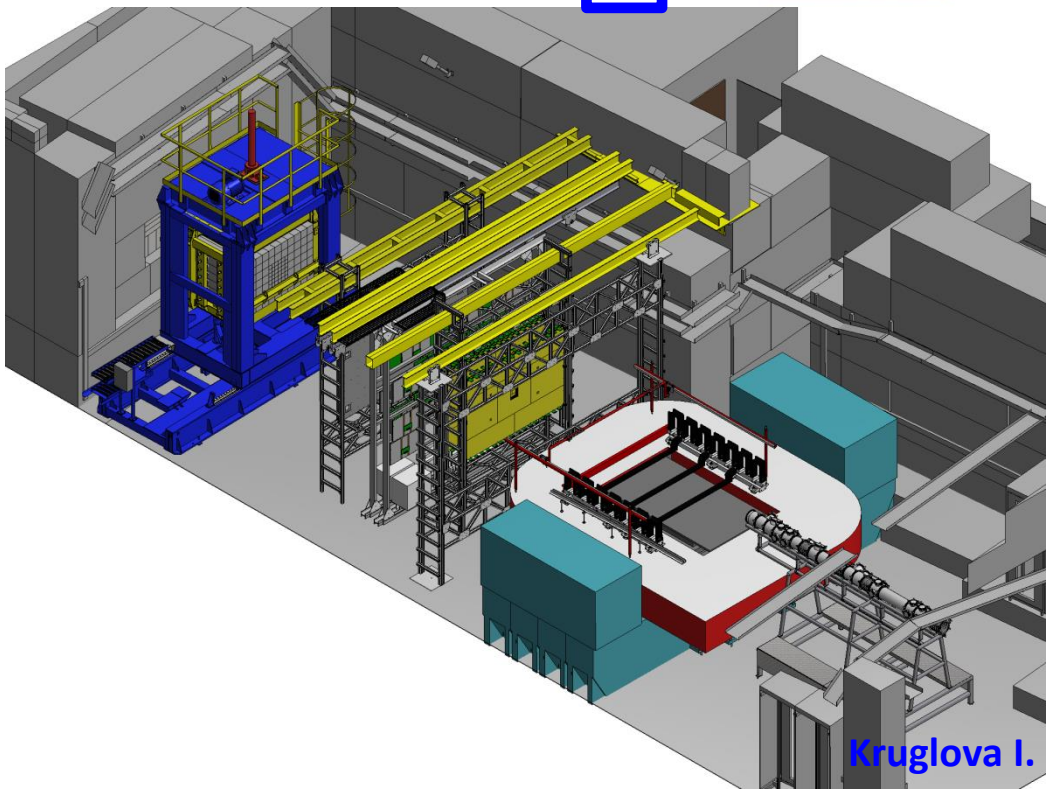


M. Rumyantsev will talk in more detail about the operation of ToF400.

Assembled detectors will be ready by 15 November 2024.

Installation of 2 new ToF400

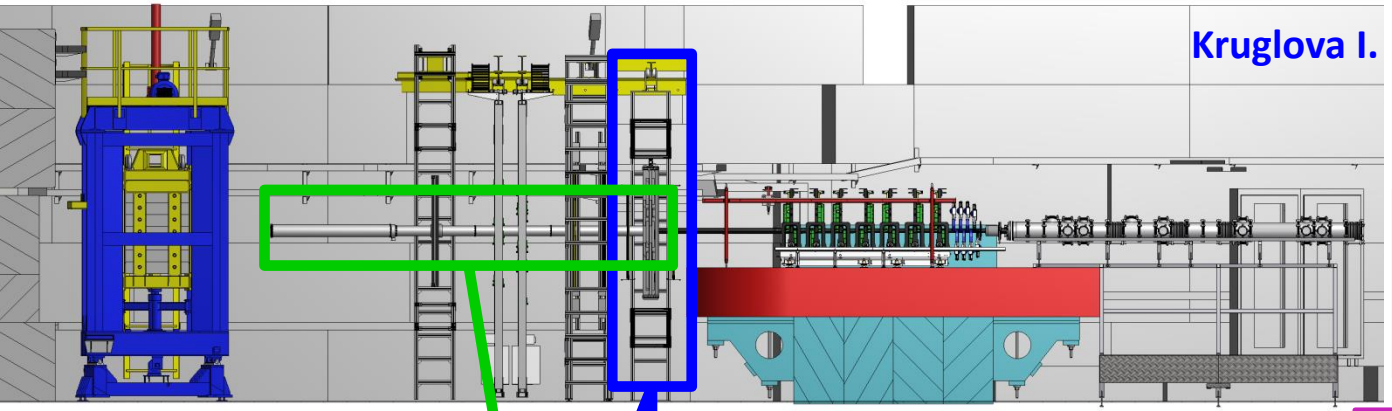




1. Mechanical support materials: **Yes**
2. Supporting structure for mechanical support : **Yes**
3. Brackets for fastening the supporting structure : **Yes**
4. Mechanical Support Project: **Yes**
5. The detector is ready for installation: **No (Modernization now)**

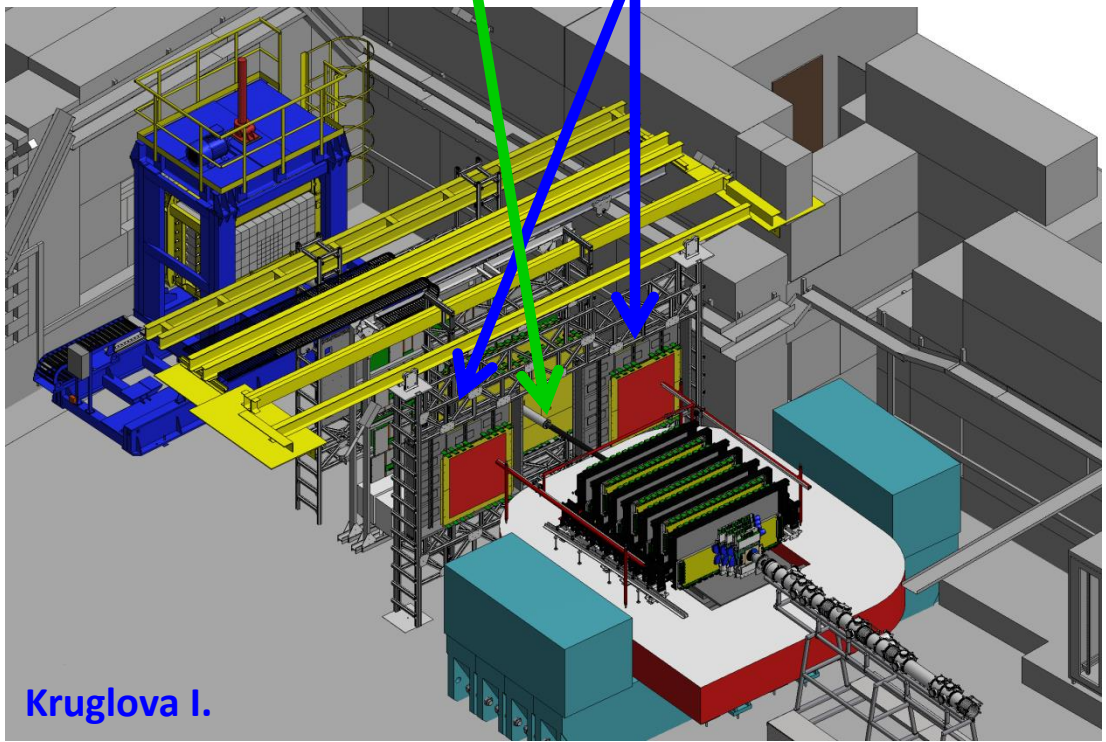
Mechanical support for new ToF400 modules installed in the experimental hall

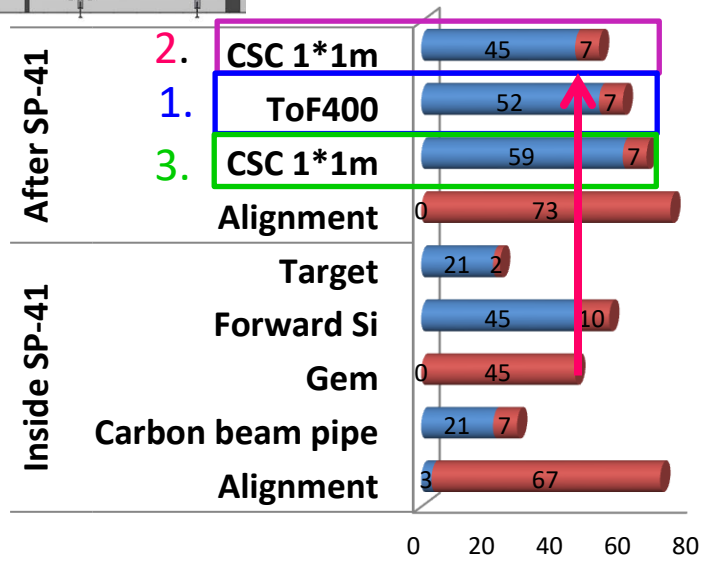
Installation of 2 ToF400 & 4 CSC & aluminum beam pipe



1. After installing all GEM detectors, 2 new ToF400 will be installed.

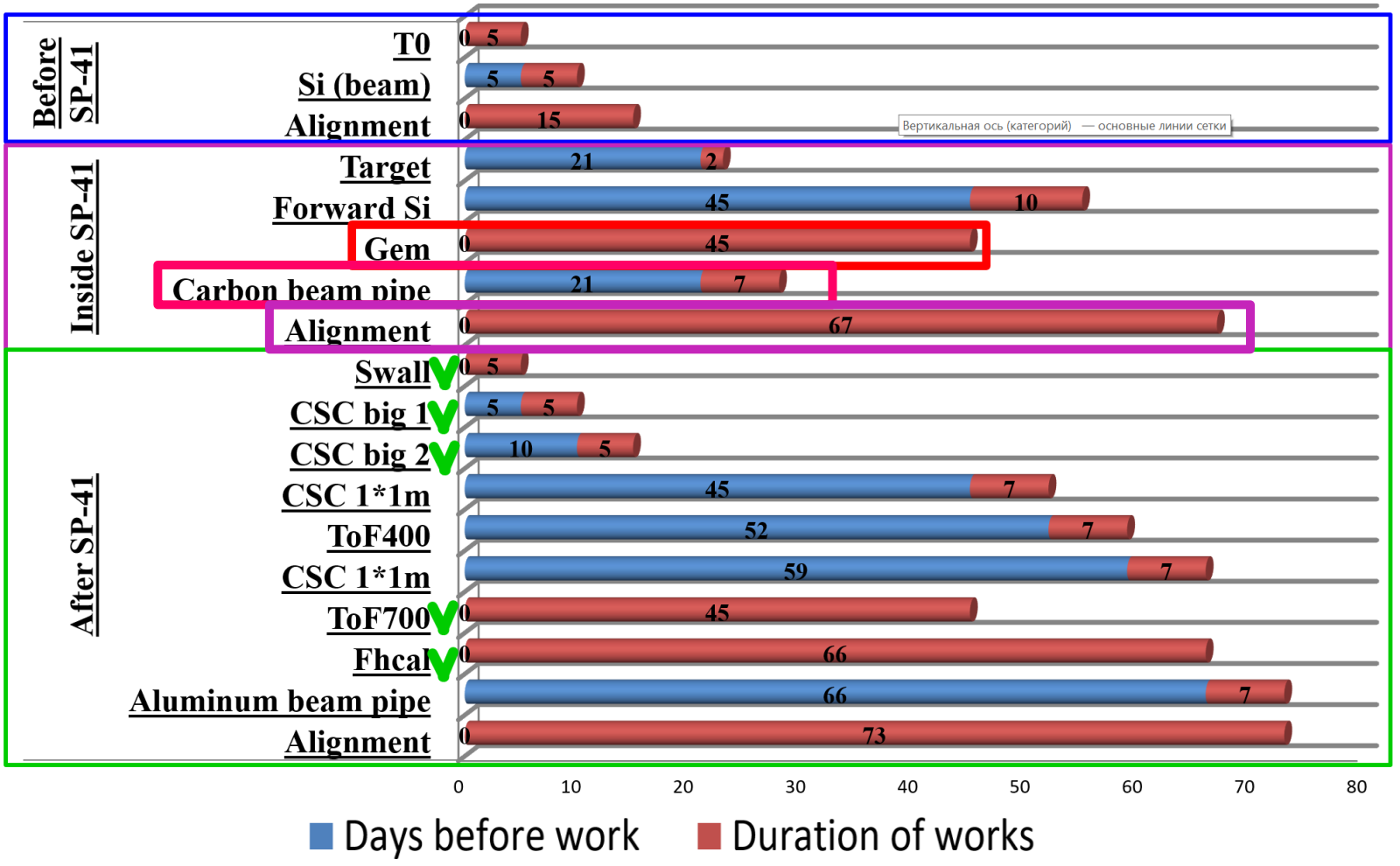
2. The next stage will be the installation of 4 CSC 1x1 m.





We will be able to install the last 4 CSC only after the 2 ToF400 detectors are fully installed.

Installation timetable

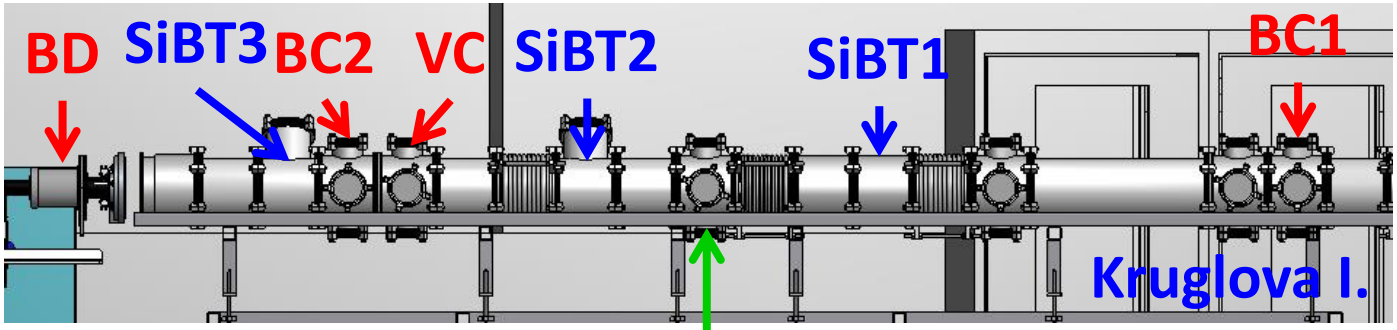


The table is divided into 3 zones.

In zone 3, work can be carried out in parallel.

But work on installing TOF 400 and GEM can only be carried out one after the other.

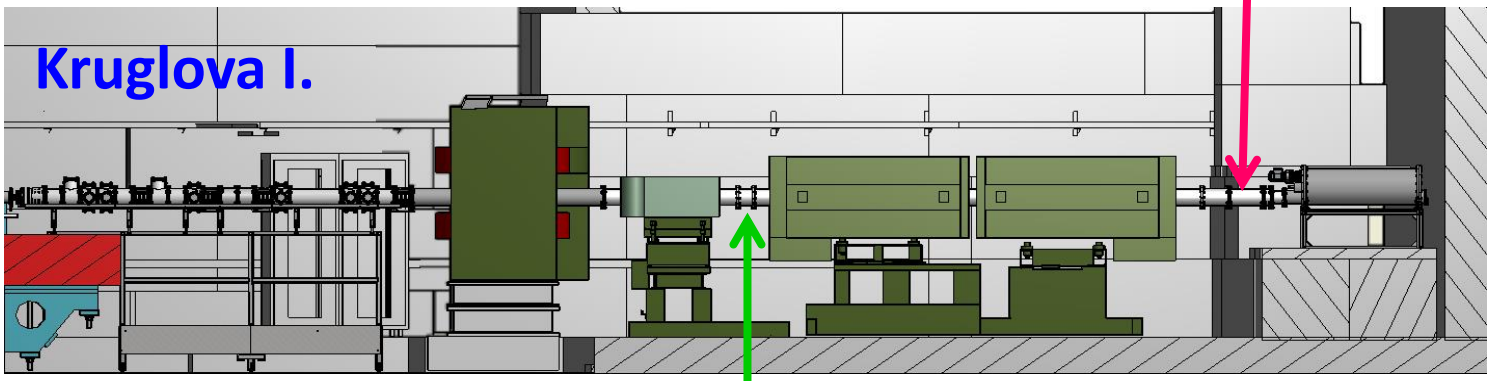
The location of new vacuum boxes to the target of the BM@N setup



Box for profilometer size 128x128mm

The contract for the production of this box has already been drawn up.

box for scintillation detector



Box for profilometer size 200x200mm

New configuration of vacuum boxes for profilometer

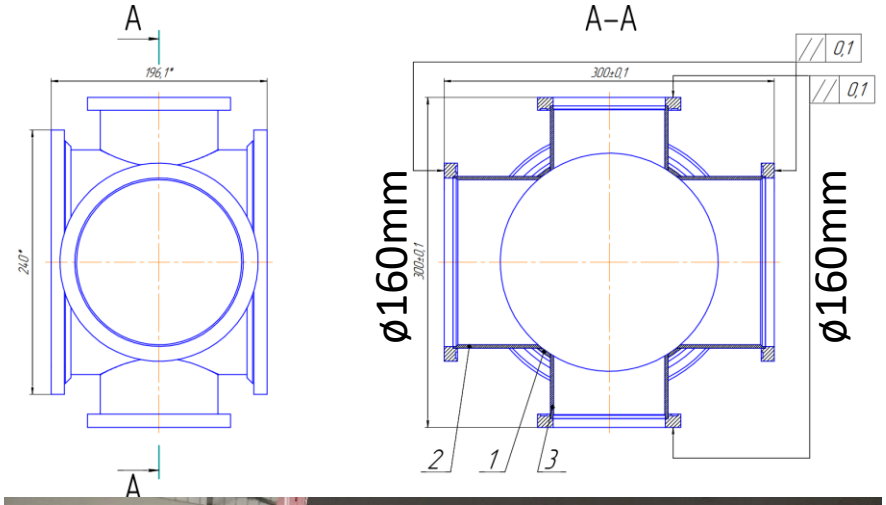
Novozhilov S.
&
Martovitsky E.

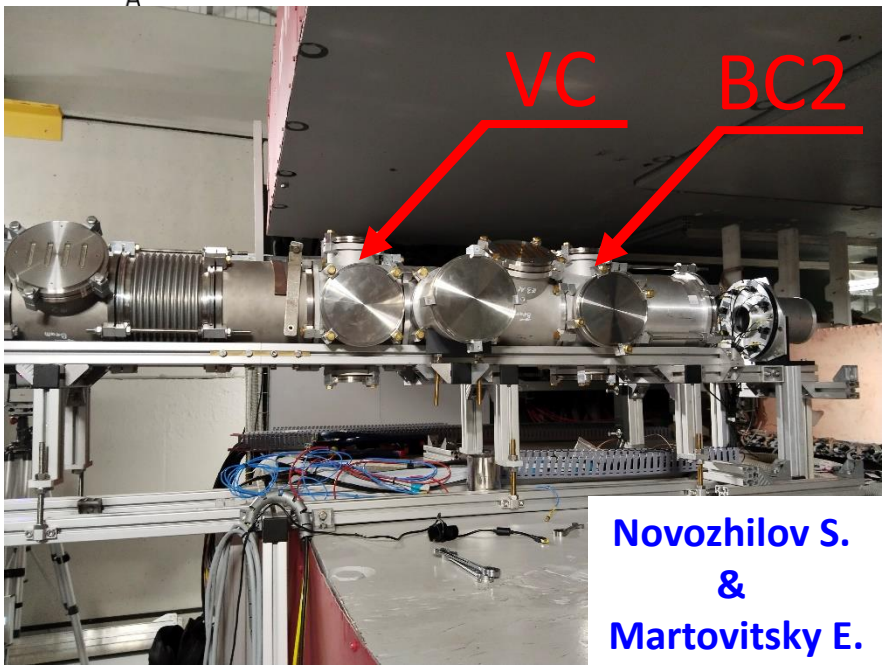
The vacuum box for the profilometer is installed between the quadrupole lenses K200 and the VKM magnet.

Novozhilov S.
&
Martovitsky E.

The vacuum box for the profilometer is installed between the SP-57 correction magnet and the SP-41 analyzing magnet.

New configuration of vacuum boxes for BC0, BC1, BC2 & VC detectors





Novozhilov S.
&
Martovitsky E.

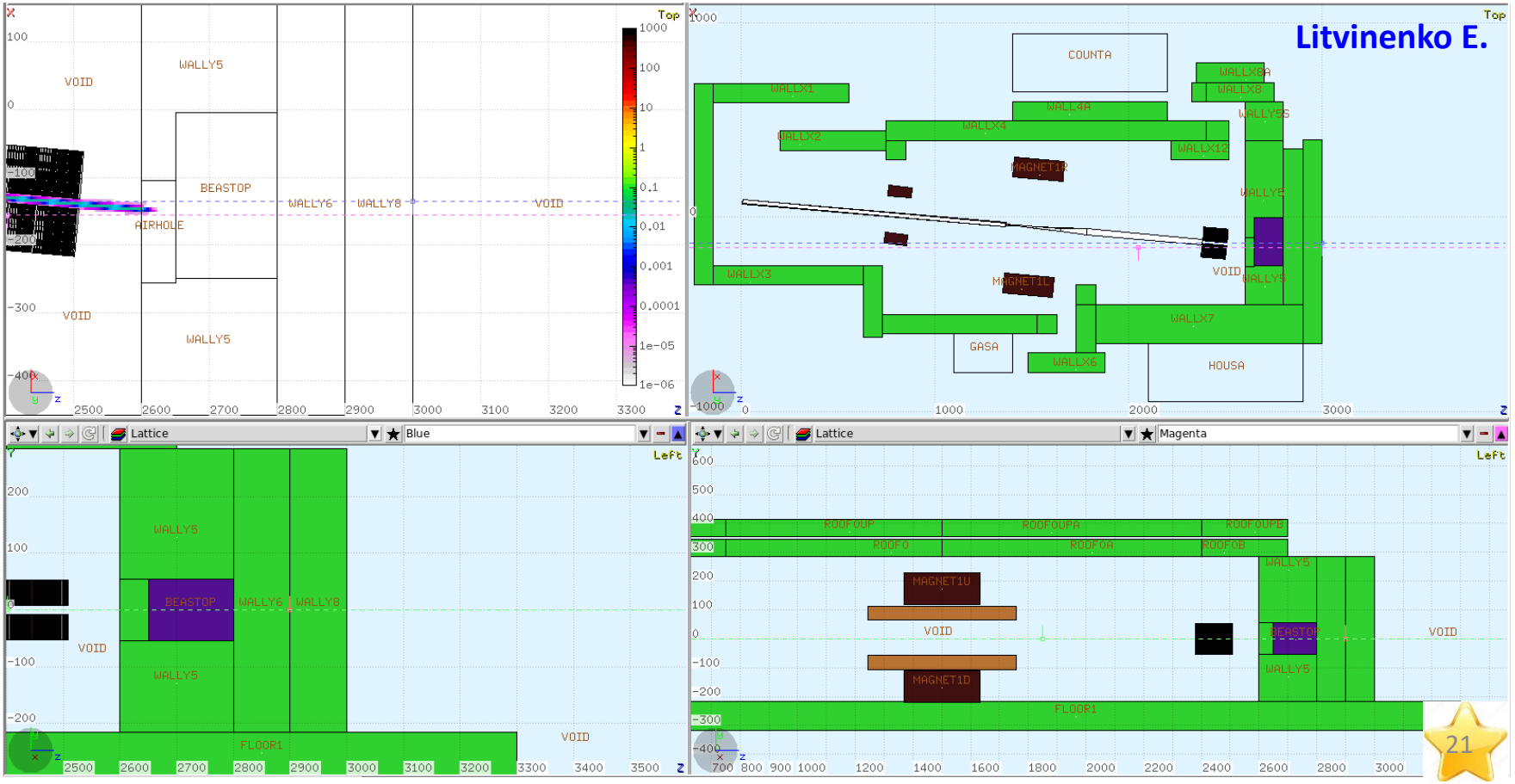
Novozhilov S.
&
Martovitsky E.

Vacuum box for trigger detectors installed in front of the target station

At the moment, the beam pipe to the target is being adjusted taking into account the installation and new configuration of the vacuum boxes.

New calculations of biological protection of the BM@N installation

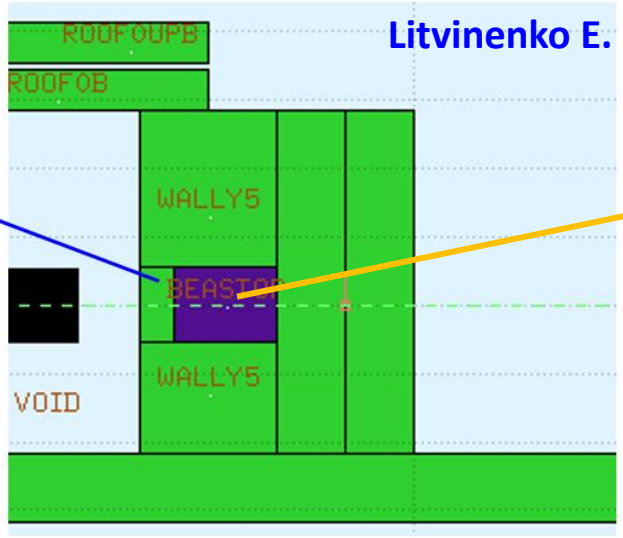
Statistically significant calculations of neutron flux and equivalent radiation dose rate in selected areas of the BM@N installation for a gold beam with an energy of 3.8 AGeV for final selection of the beamstop configuration performed using supercomputer Govorun and packages FLUKA/v2021.2.9 and FLUKA/v2023.3.2.



Different beam dump configurations

Litvinenko E.

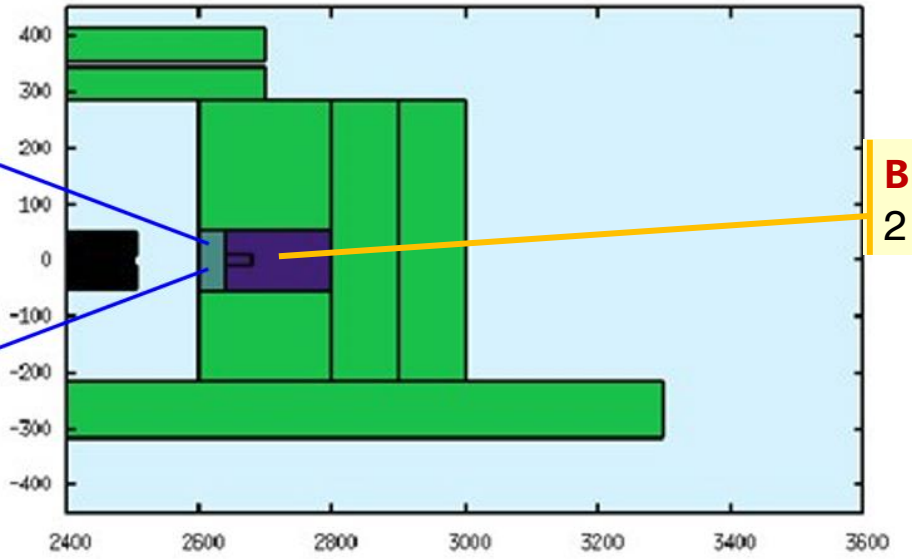
Conf12n:
Concrete



BEASTOP (Steel15)
244 x 110 x 150

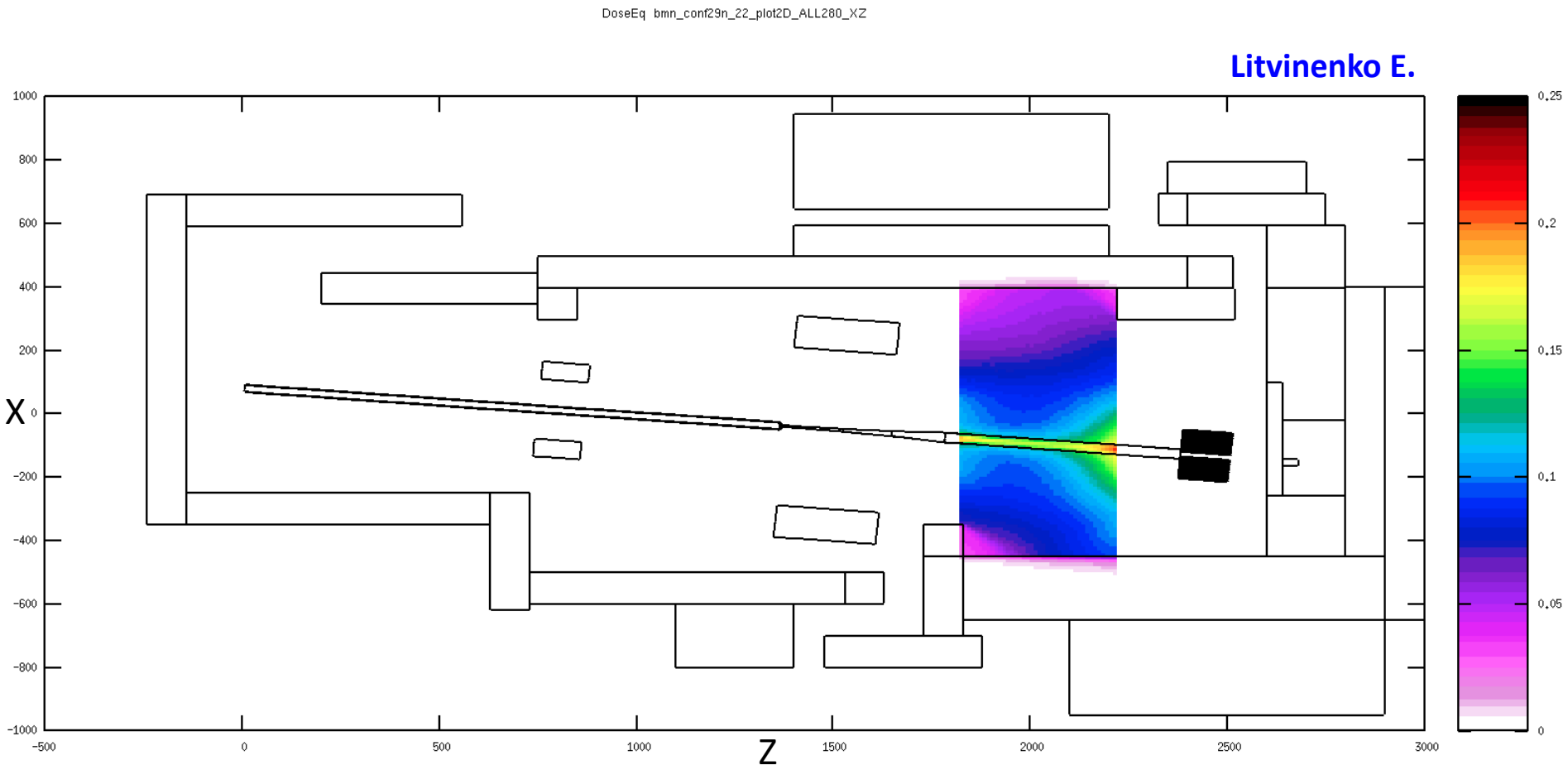
Conf29:
Polyethylene

Conf29n:
Boroned Polyethylene



BEASTOP (Steel15)
240 x 110 x 160

Definition of axes for biological protection calculations of the BM@N setup



The X axis is directed horizontally.

The Z axis is directed along the beam axis, but the origin of the axis coincides with the origin of the quadrupole lenses

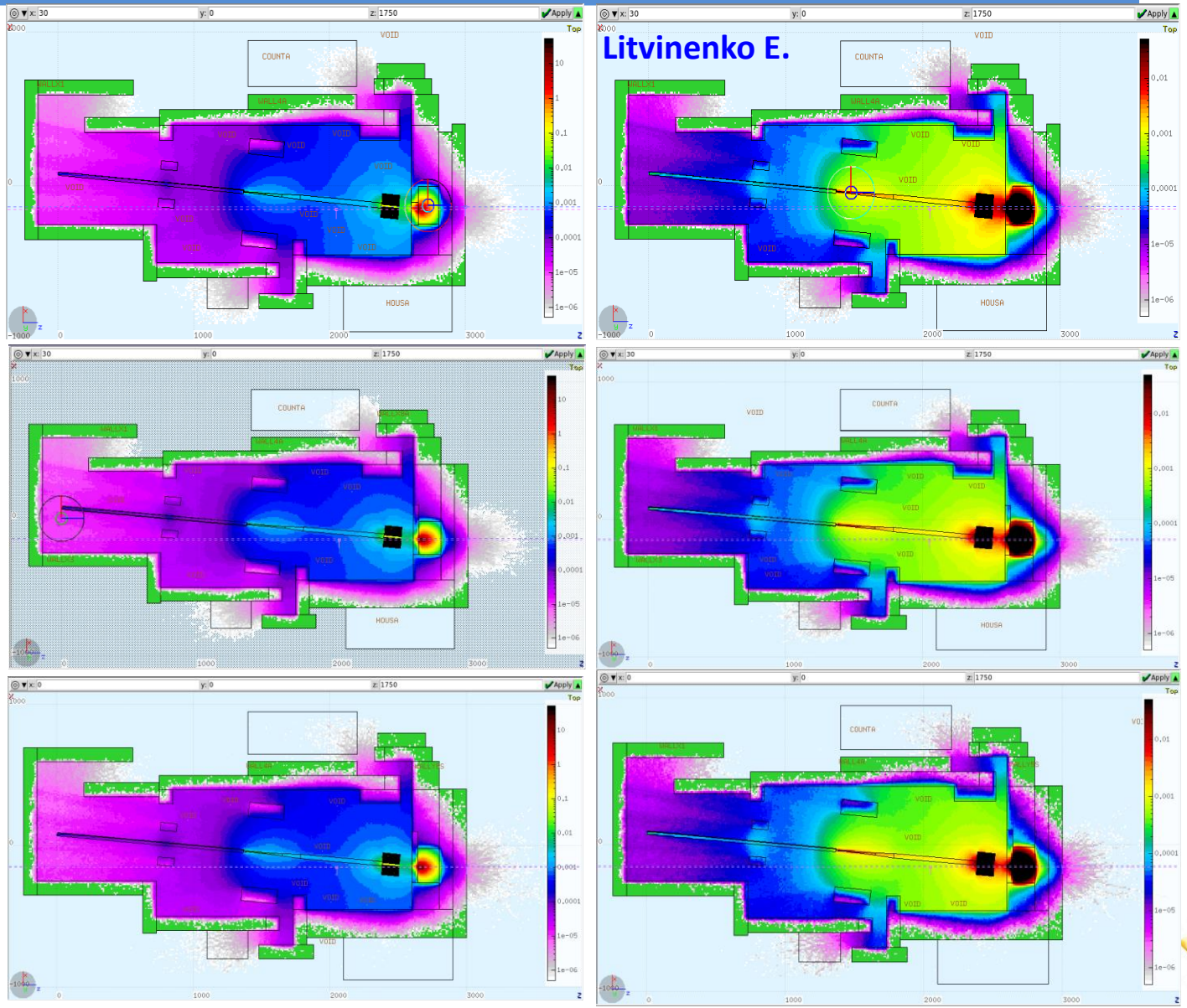
Distributions in the horizontal plane of the neutron flux at the beam pipe level

Litvinenko E.

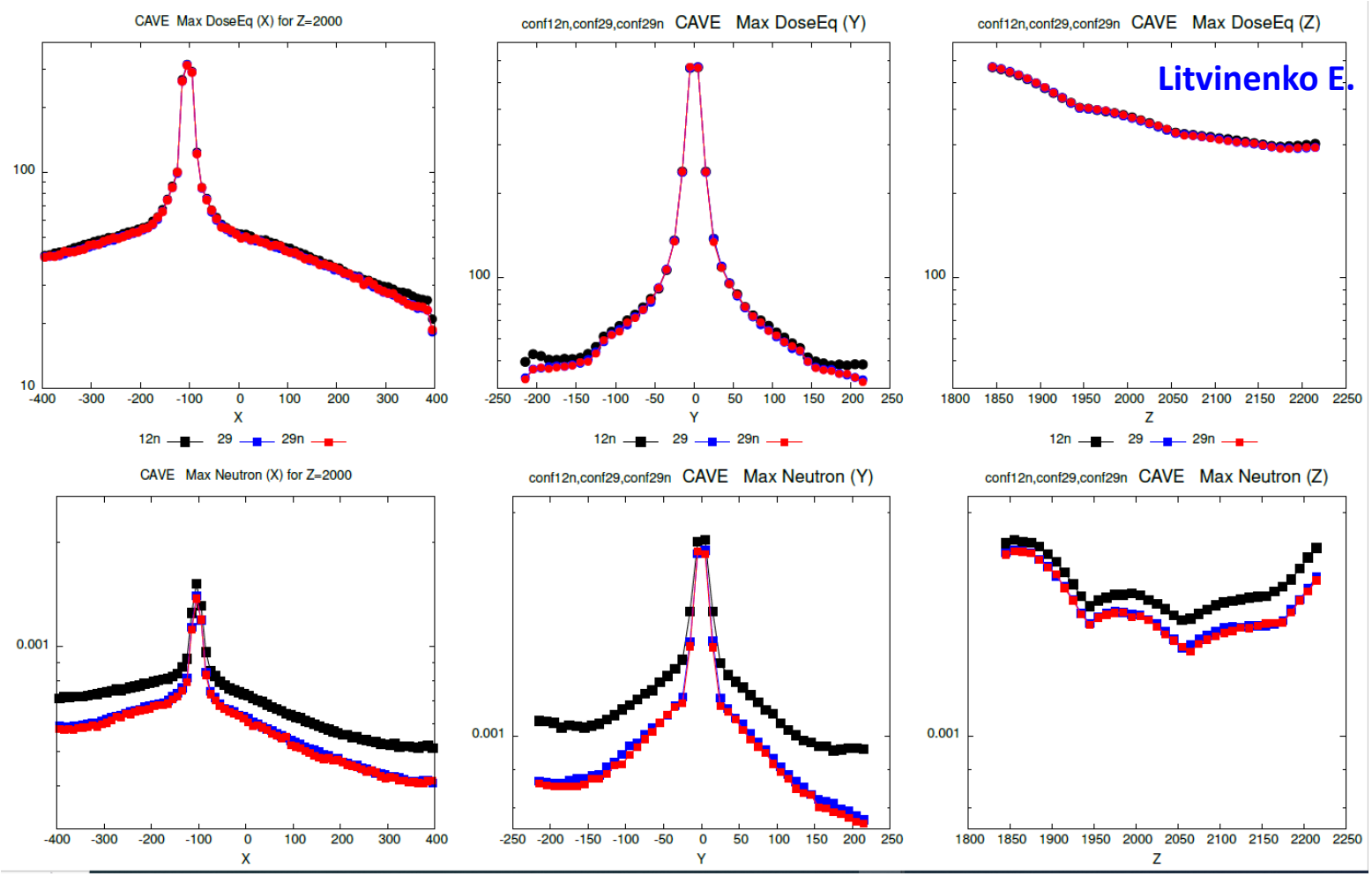
Conf12n neutron

Conf29 neutron

Conf29n neutron

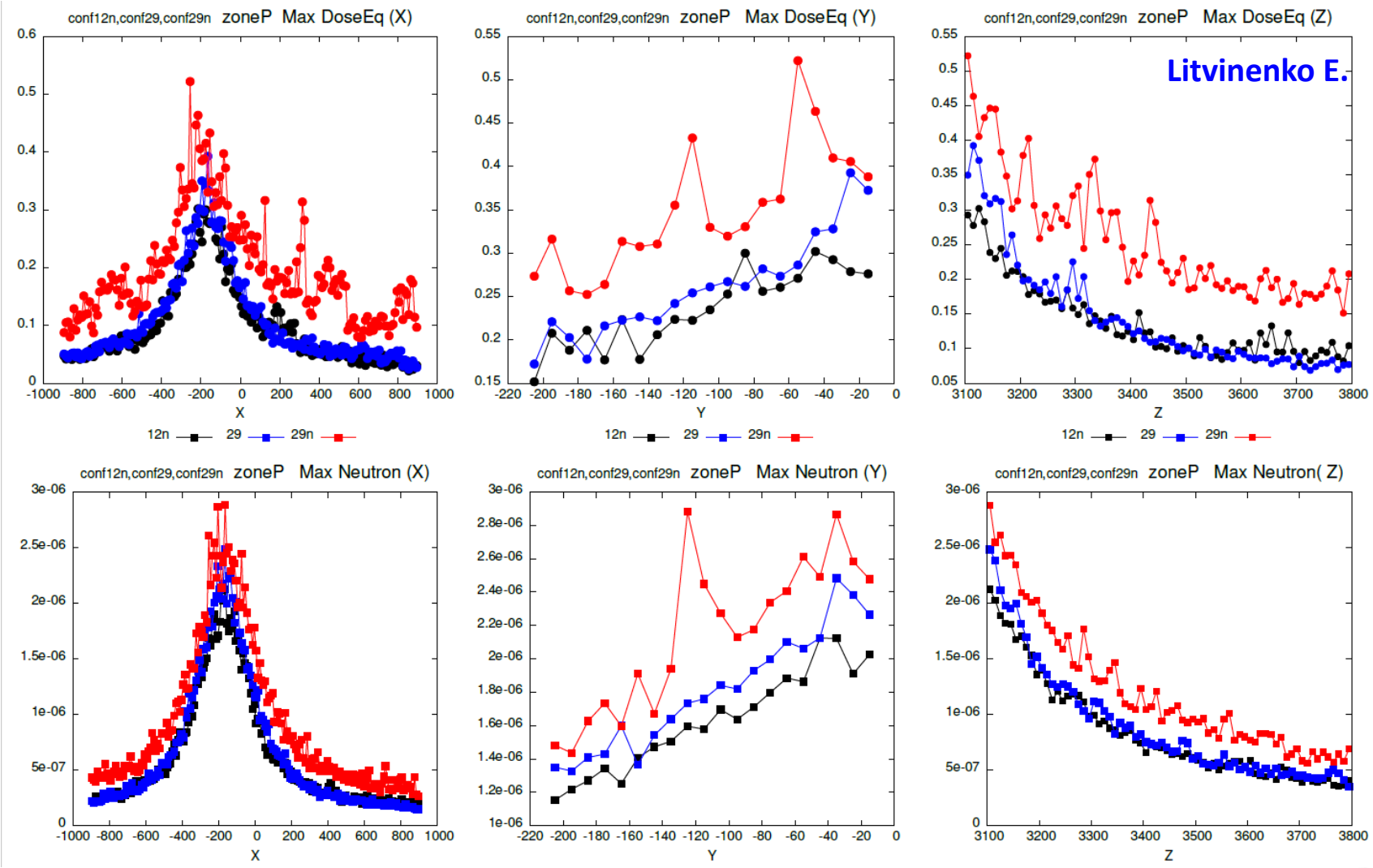


Distribution of equivalent dose rate (μSv/hour) in the CAVE zone



We observe that when using polyethylene in front of the beam stop, the neutron background inside the installation decreases.

Distribution of equivalent dose rate (μSv/hour) in the PASSAGE zone



A decrease in the neutron background is also observed behind the wall of the beam stop.

Conclusions

1. All work on the design and creation of mechanical supports was completed, taking into account the modernization of the external track system of the BM@N installation.
2. Installation of the central tracking system inside the SP-41 magnet began after the completion of the process of upgrading the detectors themselves. The bottom GEM detectors have been installed.
3. ScWall & 2 big CSC installed in the experimental hall of the BM@N installation.
4. Mechanical support for 2 new ToF400 & 4 CSC installed in the experimental hall.
5. New vacuum box elements for different detectors have been installed.

Work continues on upgrading the BM@N setup….

Baryonic Matter
BM@N
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THANK YOU FOR YOUR ATTENTION