

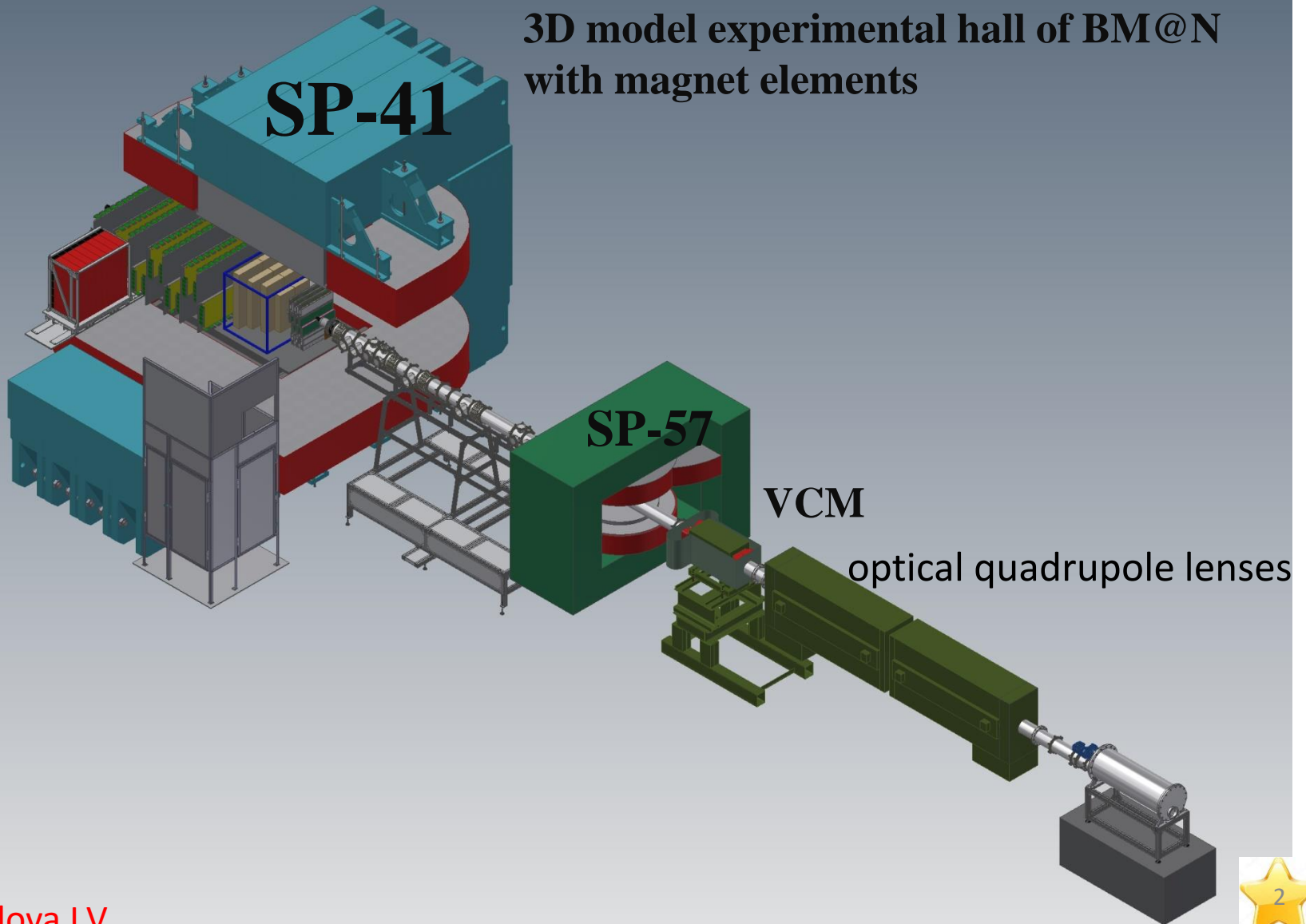
# VACUUM BEAM PIPE DEVELOPMENT AND PRODUCTION STATUS. ENGINEERING UPGRADE OF THE BM@N SETUP

Piyadin S.M.

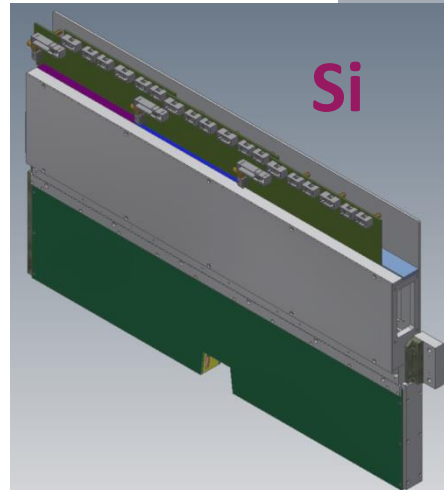
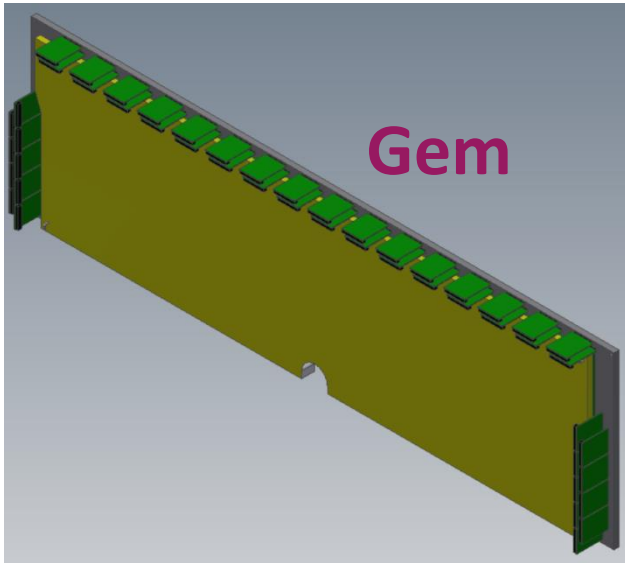
on behalf of BM@N Collaboration



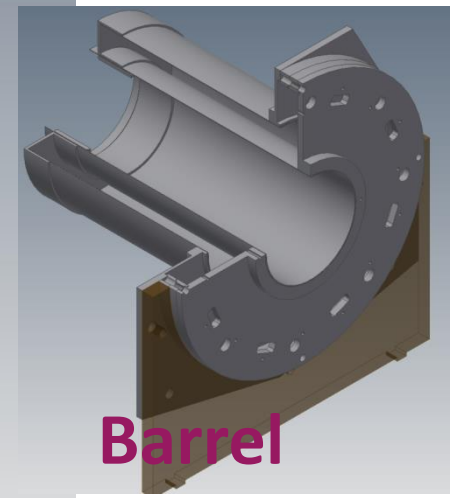
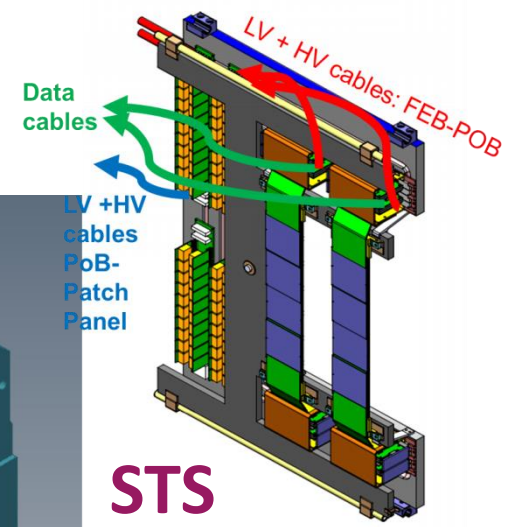
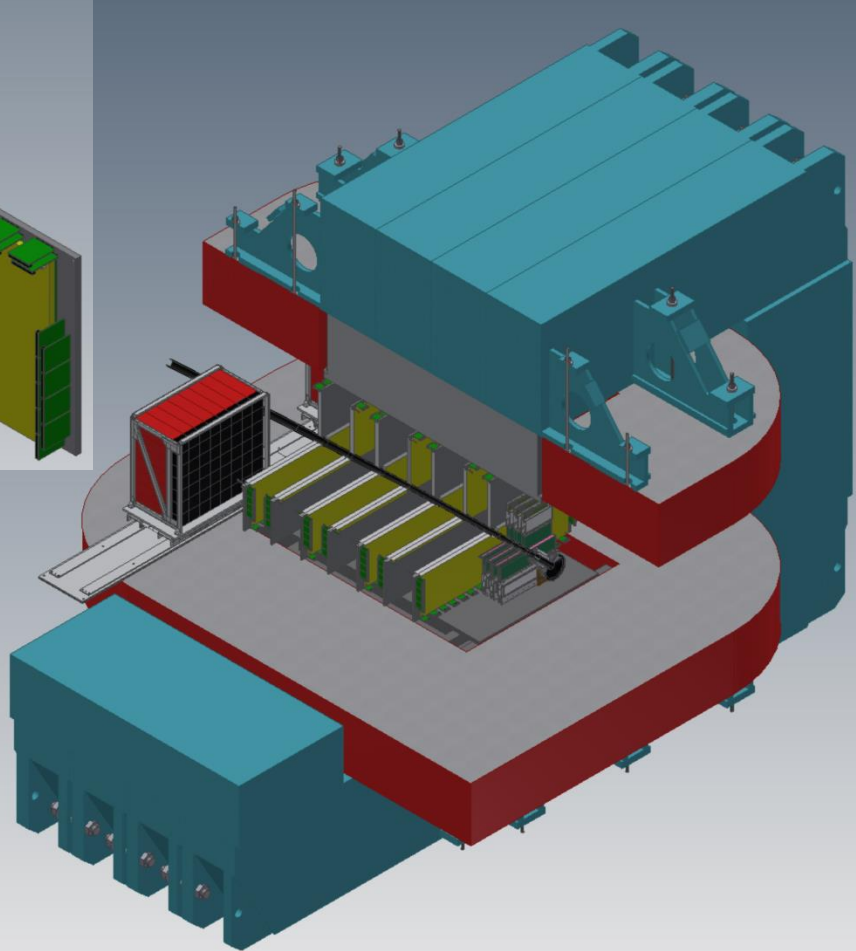
3D model experimental hall of BM@N  
with magnet elements



# Beam pipe configuration for tracking system

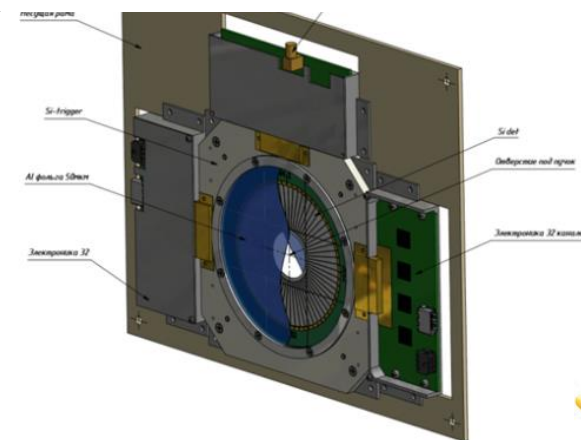
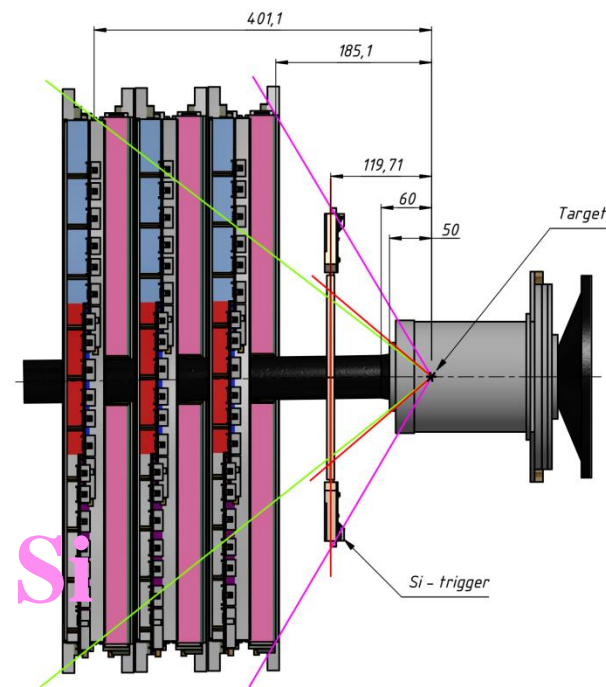
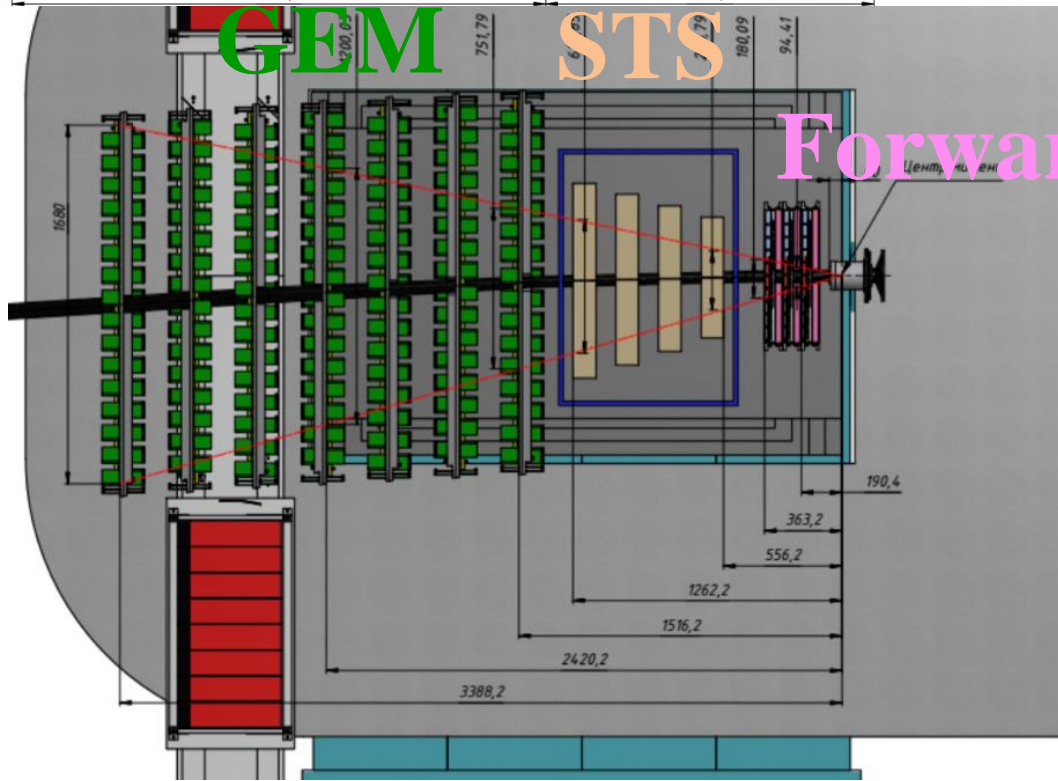
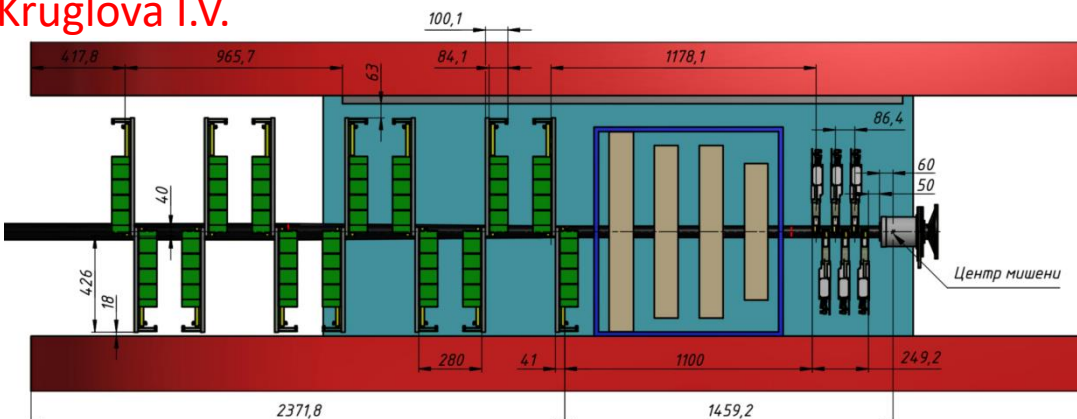


Kruglova I.V.

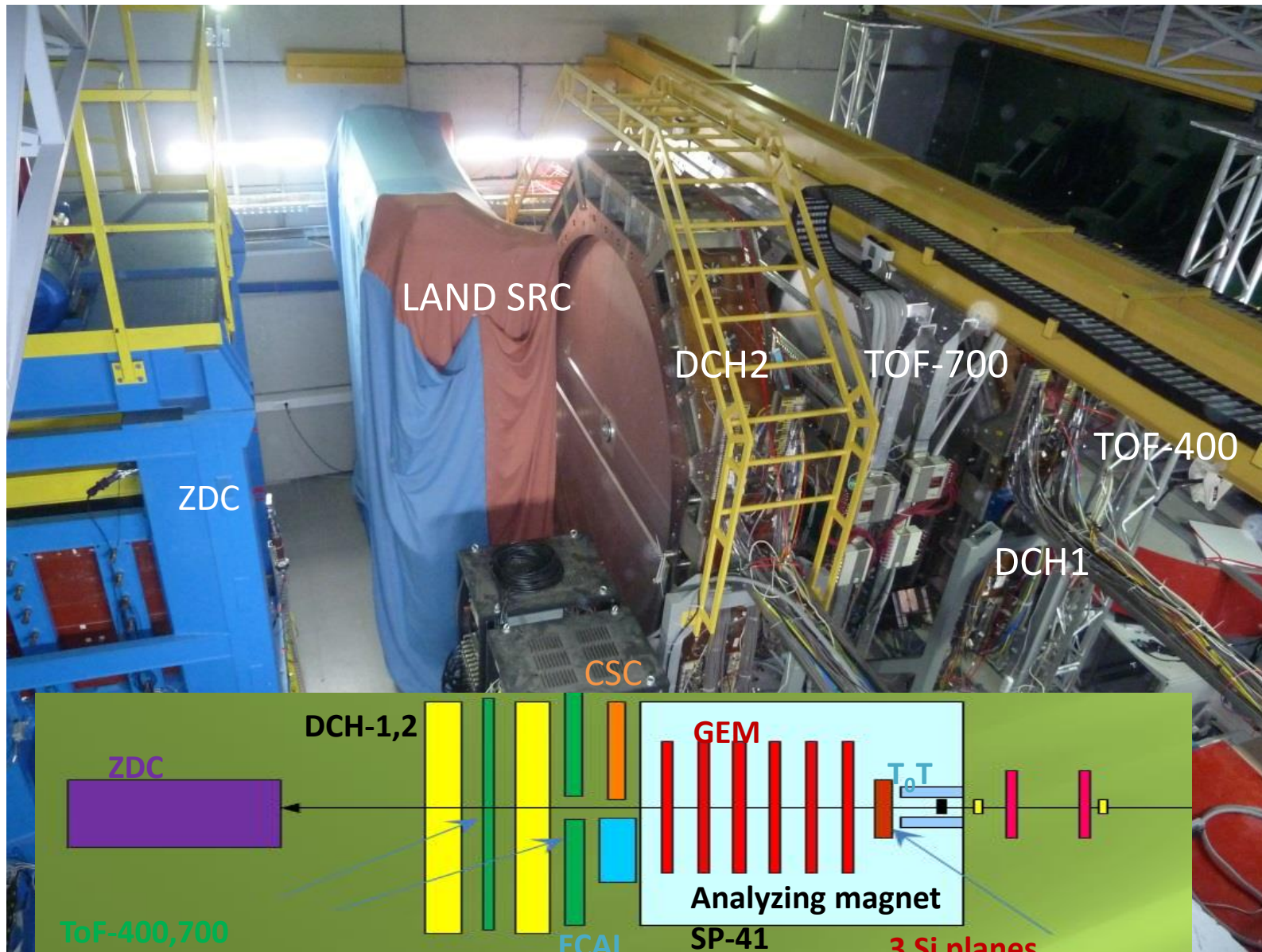


# Beam pipe configuration for tracking system

Kruglova I.V.

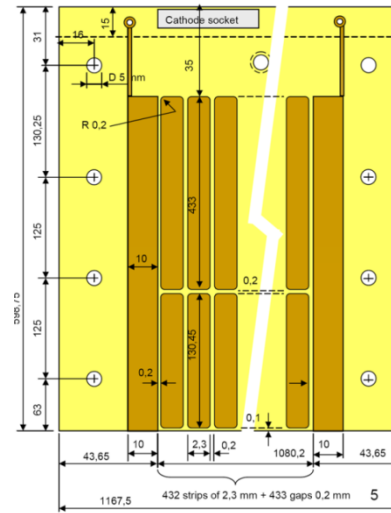
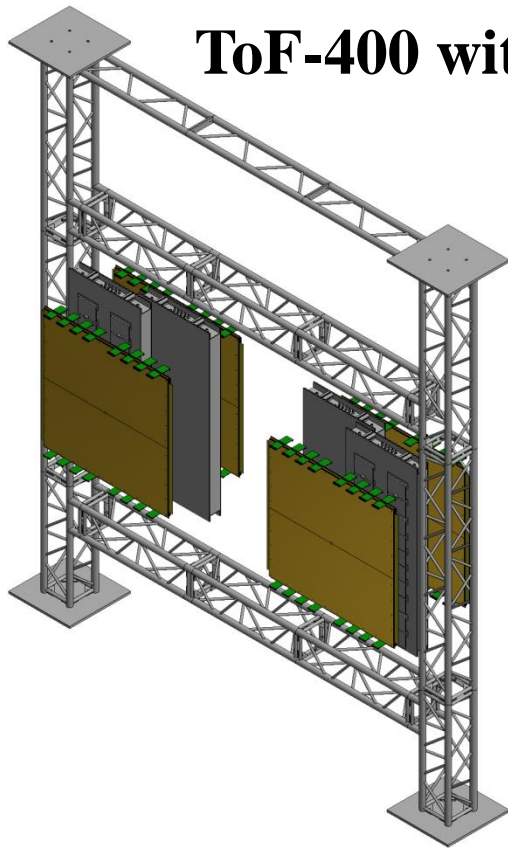


# BM@N setup behind magnet, March 2018

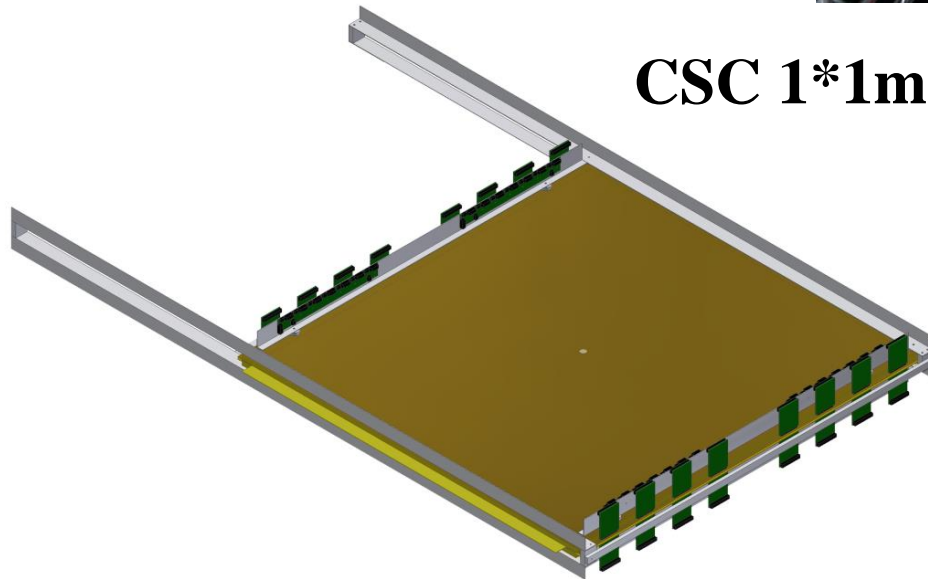


# Detector systems after the analyzing magnet.

## ToF-400 with 4 CSC 1\*1m



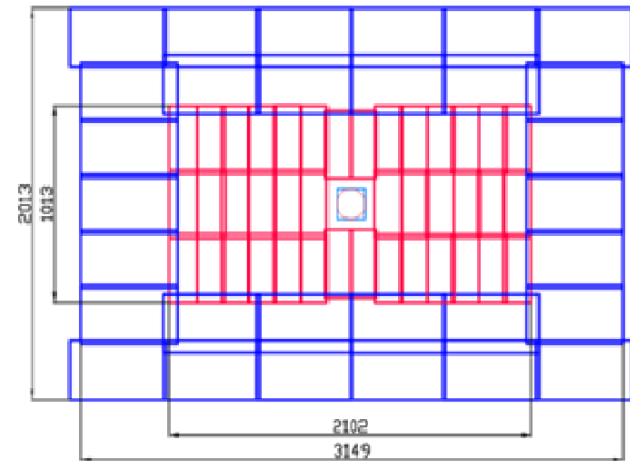
## CSC 1\*1m



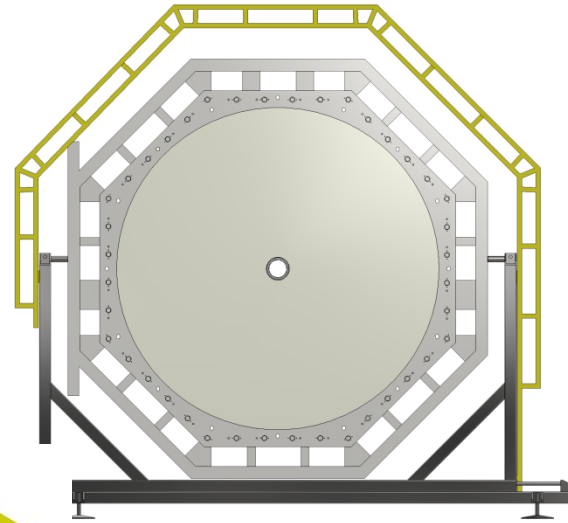
Kruglova I.V.

Novogilov S.V.

# Detector systems after the analyzing magnet



**ToF-700**



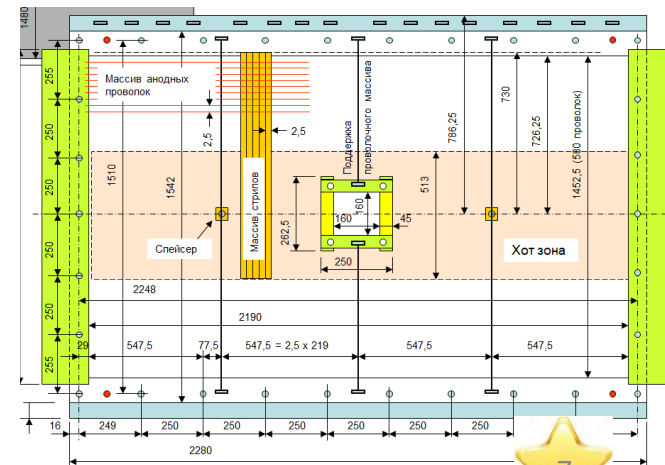
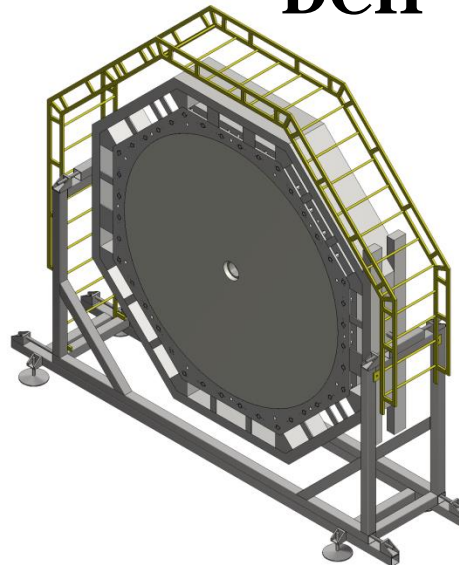
**DCH**



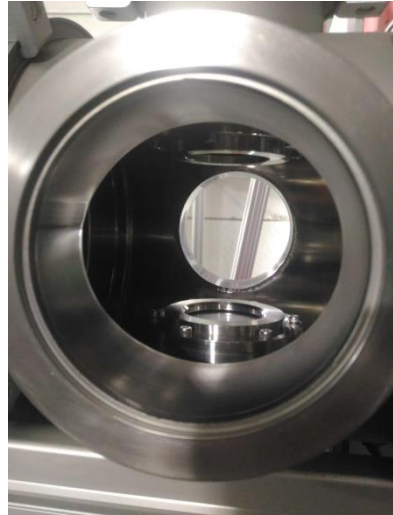
**CSC 1.5x2m**



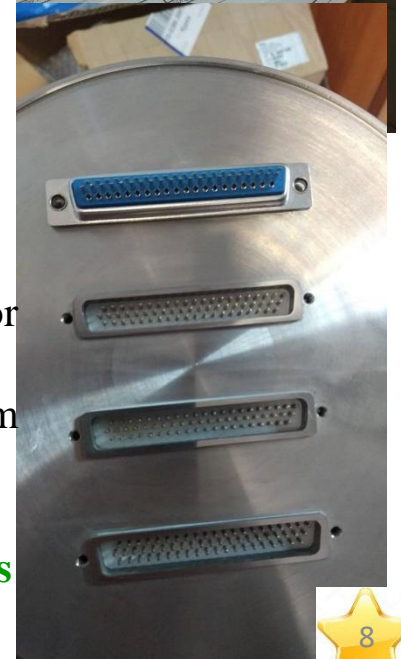
Kruglova I.V.  
Novogilov S.V.



# Beam pipe upstream the target



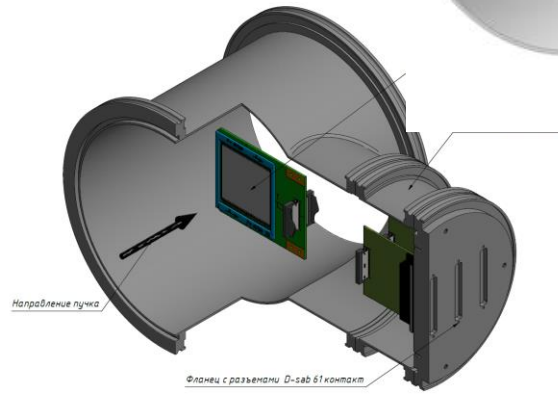
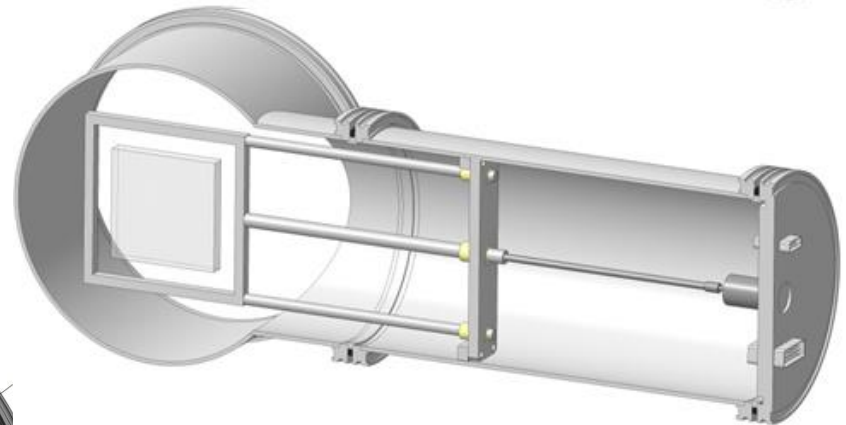
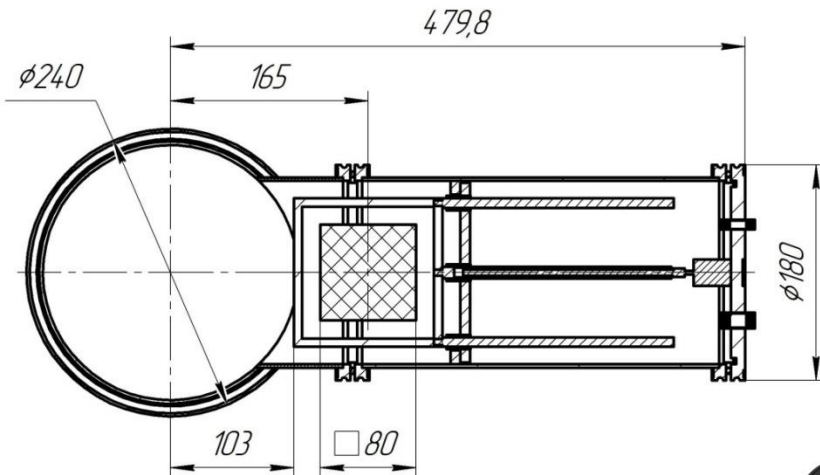
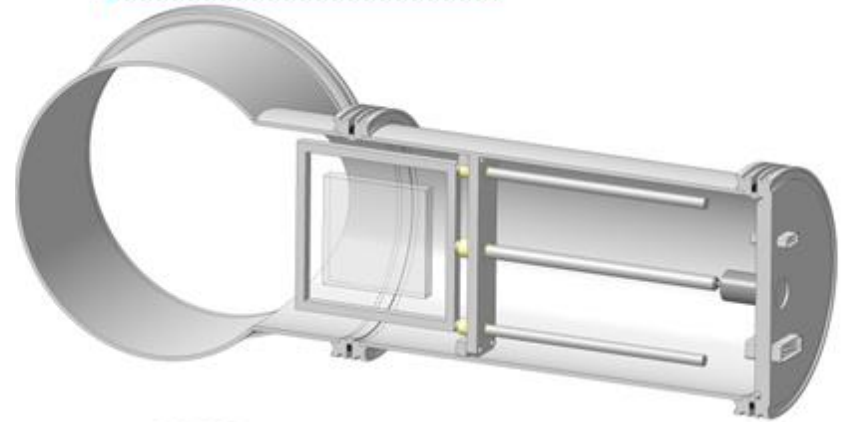
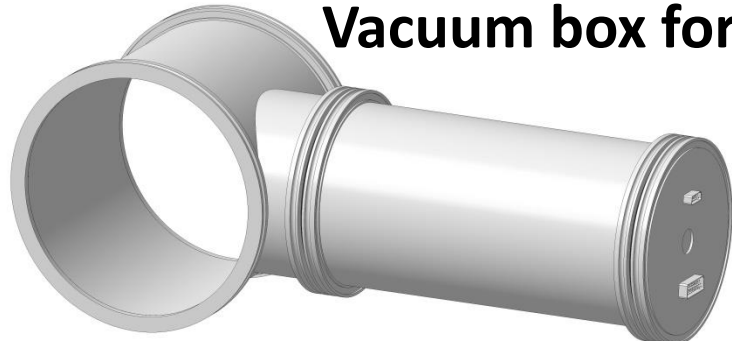
Beam pipe upstream the target with vacuum box for trigger and Si detectors. This configuration of beam pipe manufactured and tested **LLC Vacuum systems and technologies**



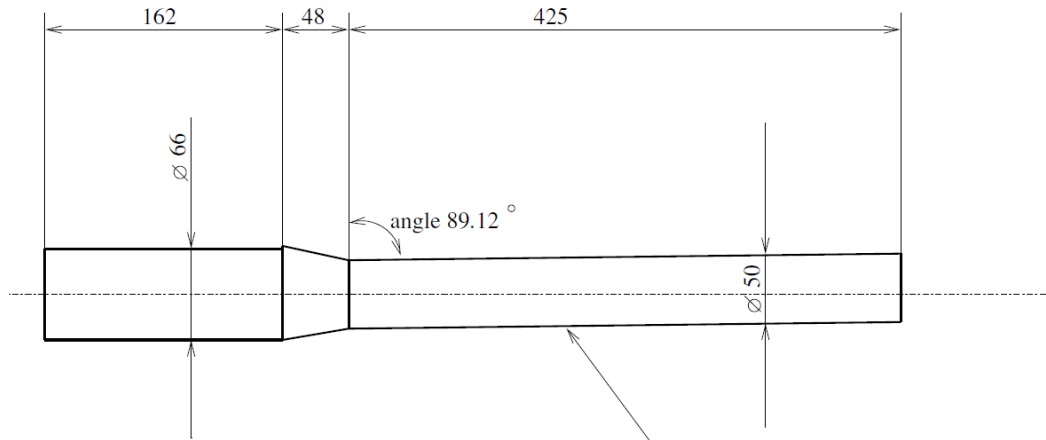


# Beam pipe before target

## Vacuum box for Si detector - profilometer



# Target station and beam pipe configuration for tracking system



material carbon with wall thickness 1.0 mm

pipe rotation relative to Z axis 0.88 degrees

Material carbon with wall thickness 1.0 mm

Spaskov V.N.

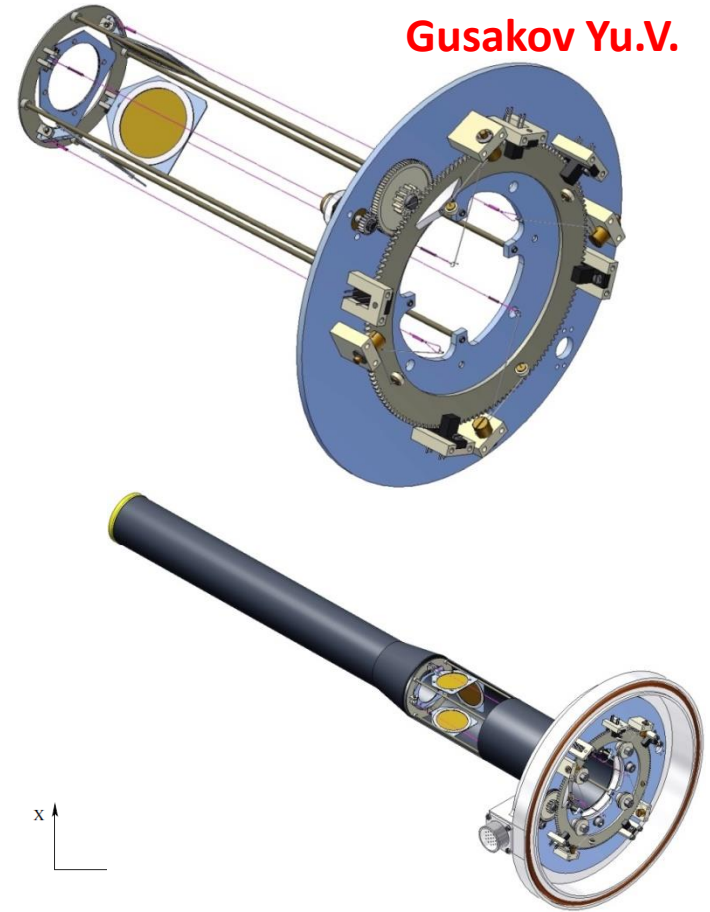
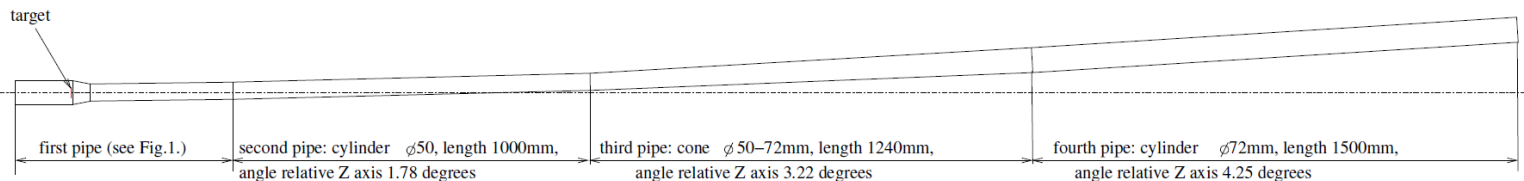
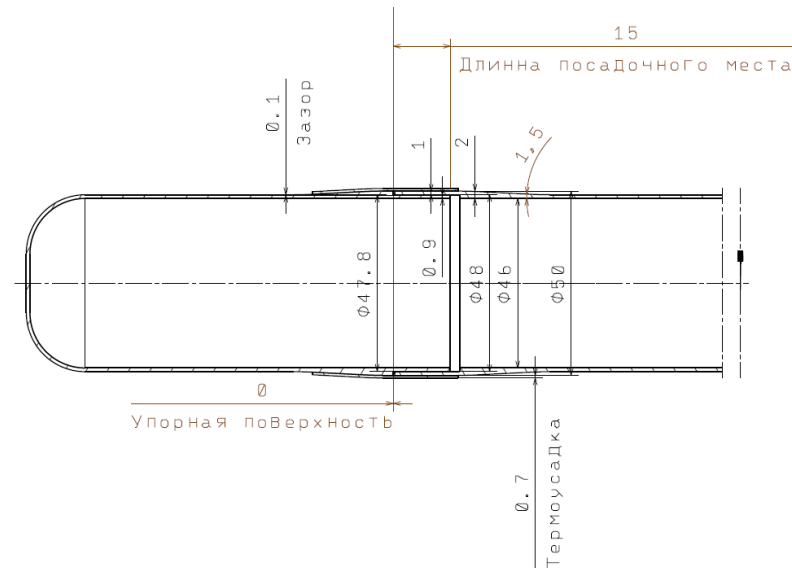
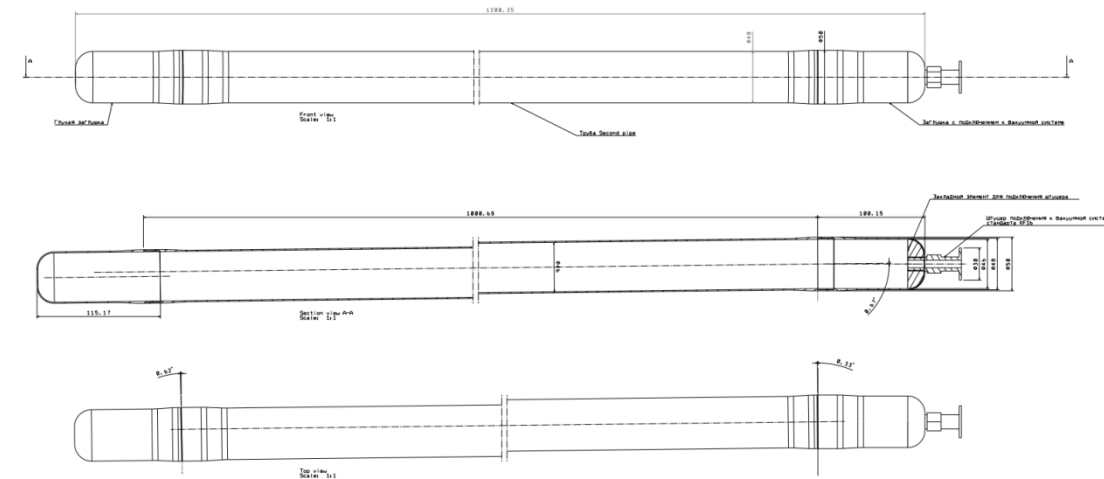
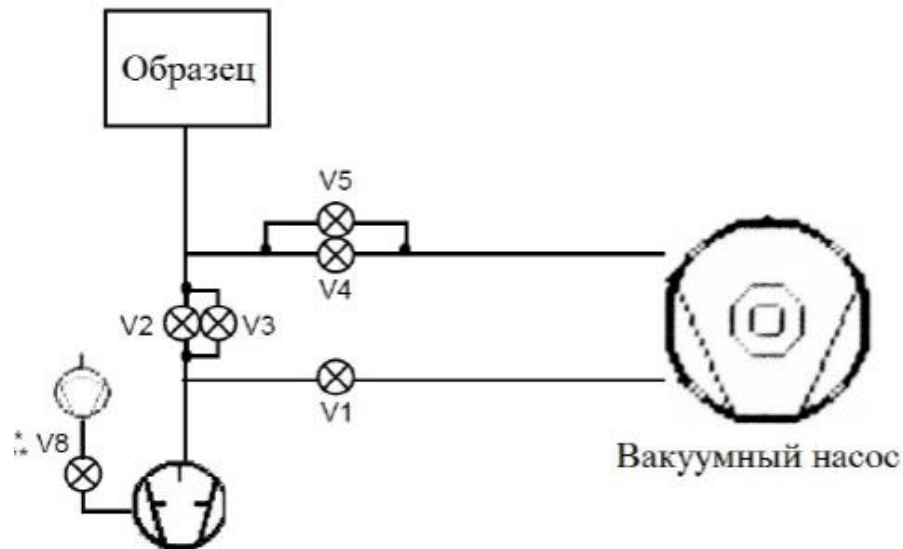
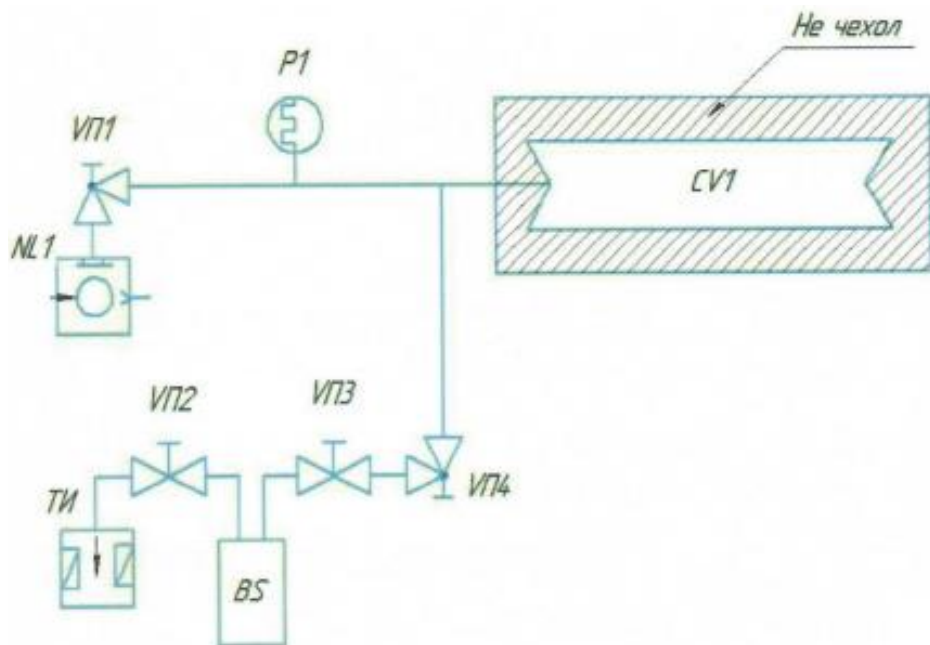


Fig. 2. Schematic view of the BM@N beam pipe

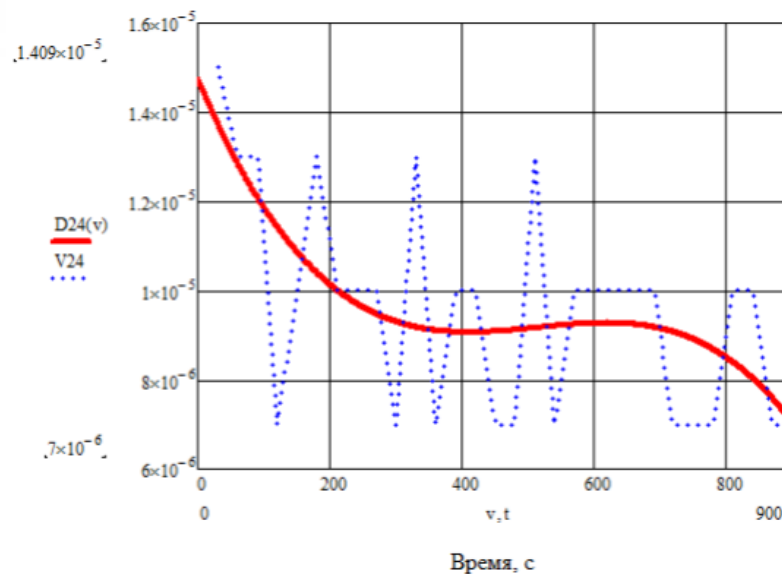
# Prototype of carbon beam pipe



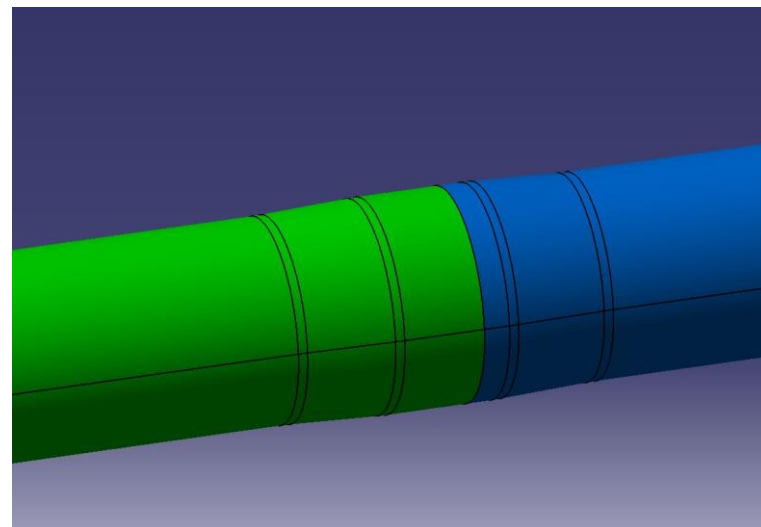
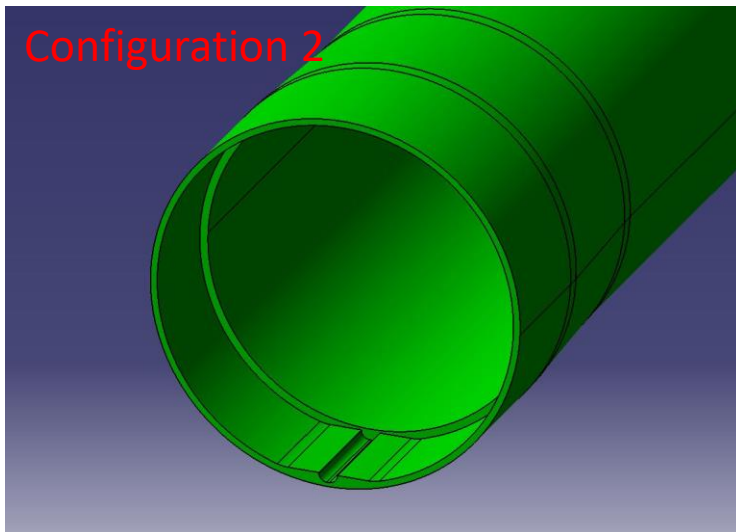
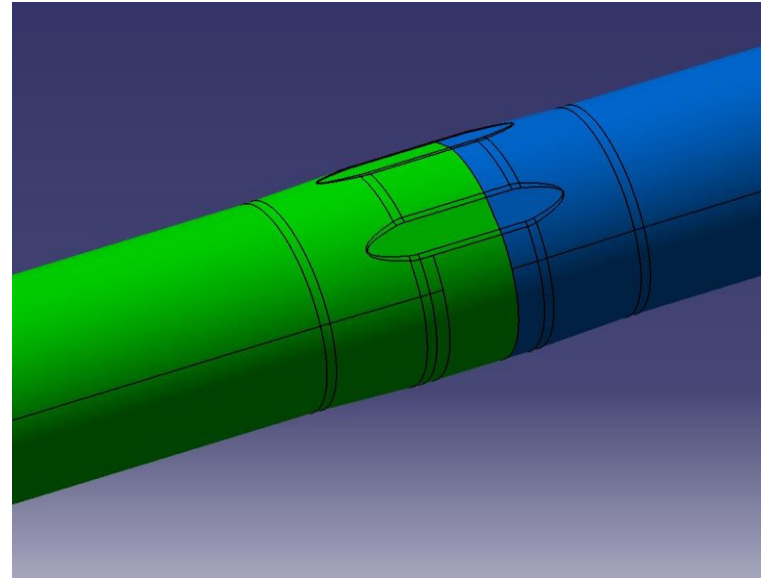
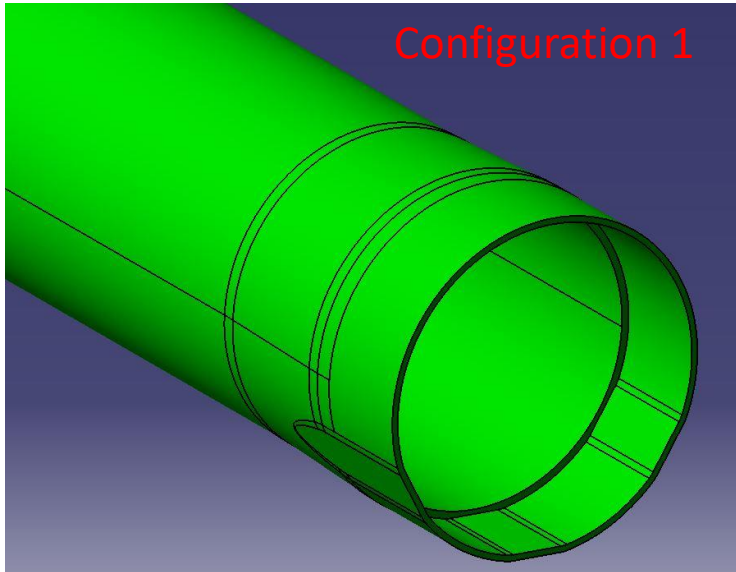
# Results of tests for prototype of carbon beam pipe



$P = 8.2 \cdot 10^{-1} \text{ Pa}$   
 $Q = 3.8 \cdot 10^{-10} \text{ Pa} \cdot \text{m}^3/\text{s}$   
 After 23 min with He  
 $P = 7.4 \cdot 10^{-1} \text{ Pa}$   
 $Q = 1.6 \cdot 10^{-8} \text{ Pa} \cdot \text{m}^3/\text{s}$

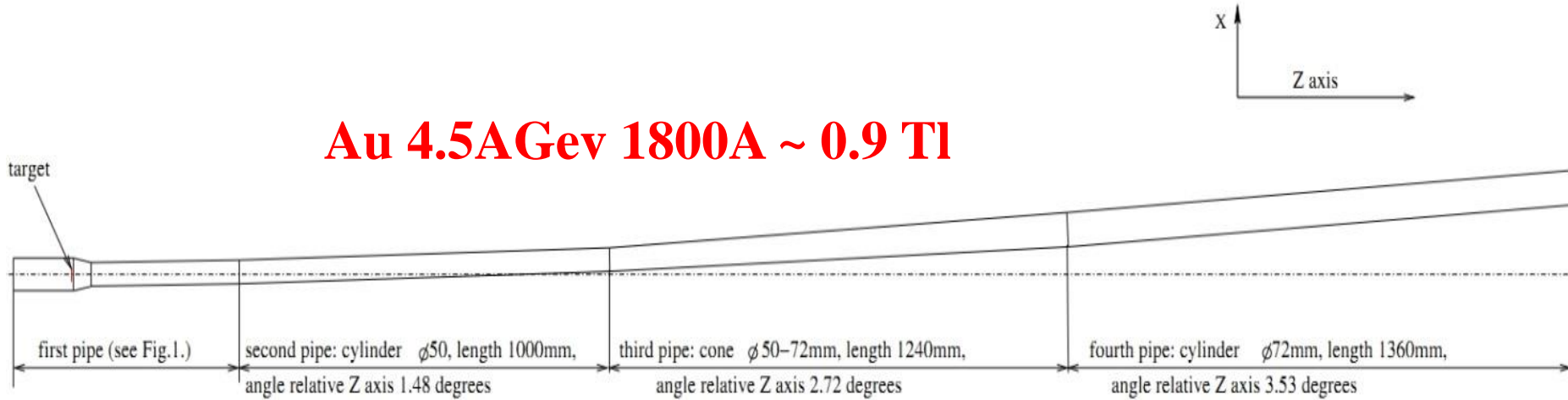


# Different flangeless design for carbon beam pipe

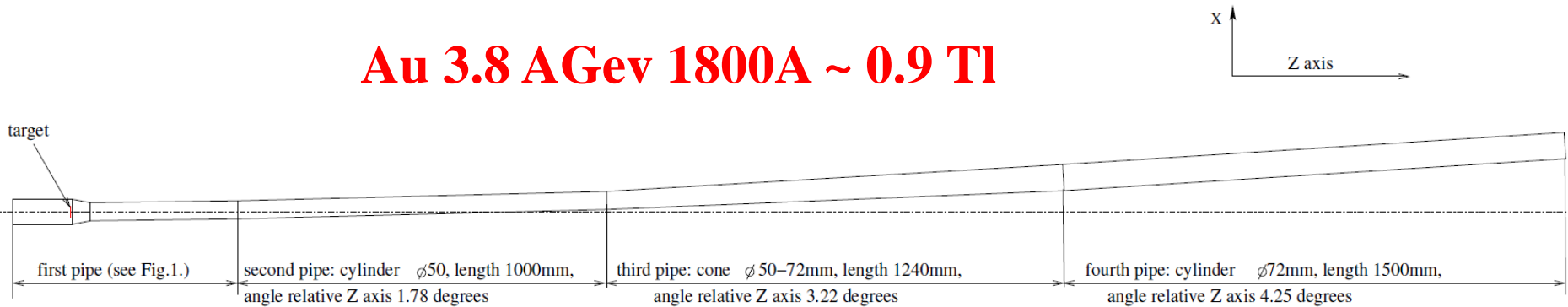


# New beam pipe configuration for tracking system

**Au 4.5 AGeV 1800A ~ 0.9 TI**



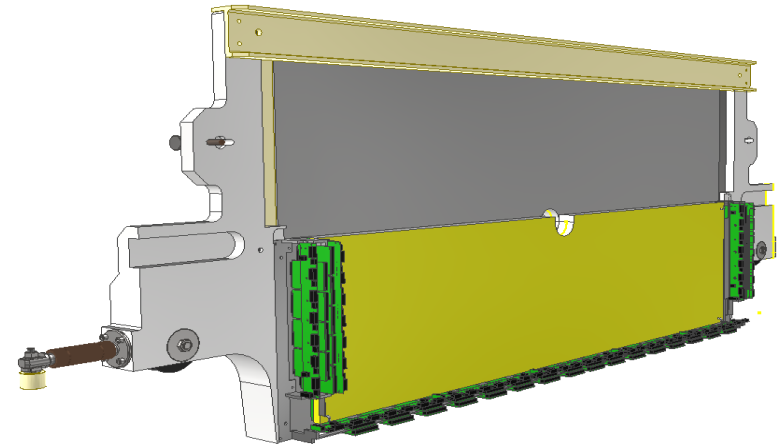
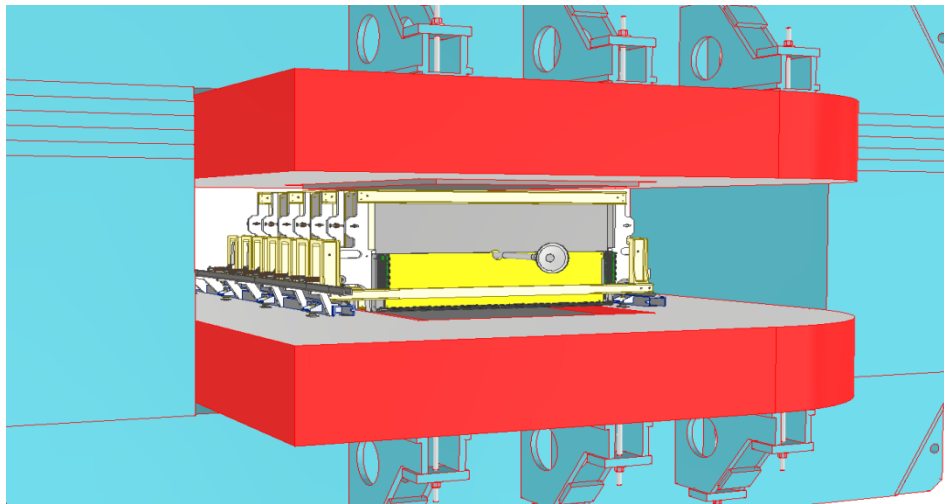
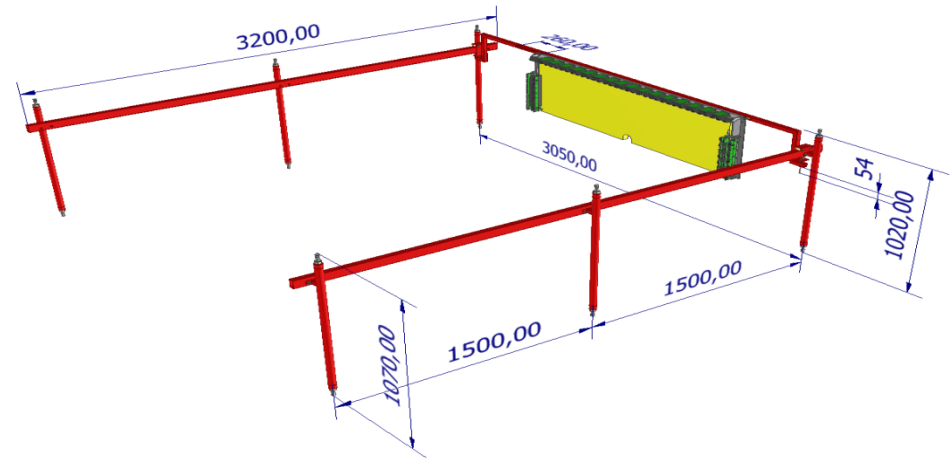
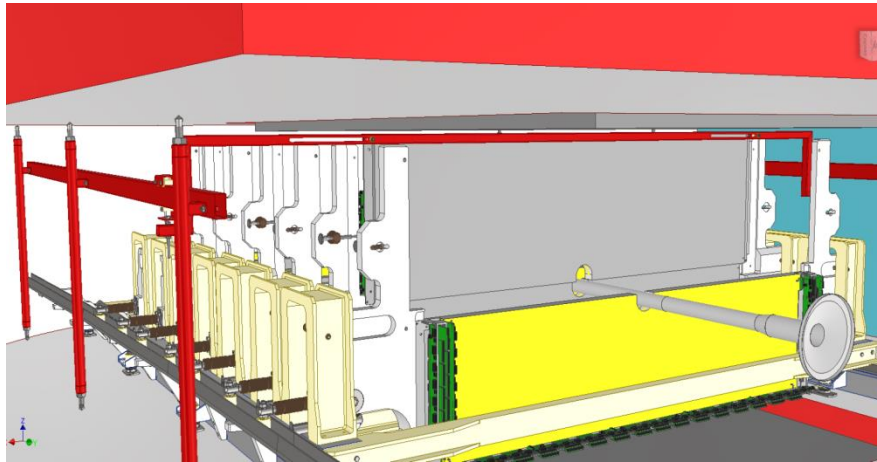
**Au 3.8 AGeV 1800A ~ 0.9 TI**



**Spaskov V.N.**

Fig. 2. Schematic view of the BM@N beam pipe

# New mechanical wall for Gem central tracking system



Mechanical wall for Gem central tracker system included all configuration



# Electrical upgrade all elements BM@N experiment

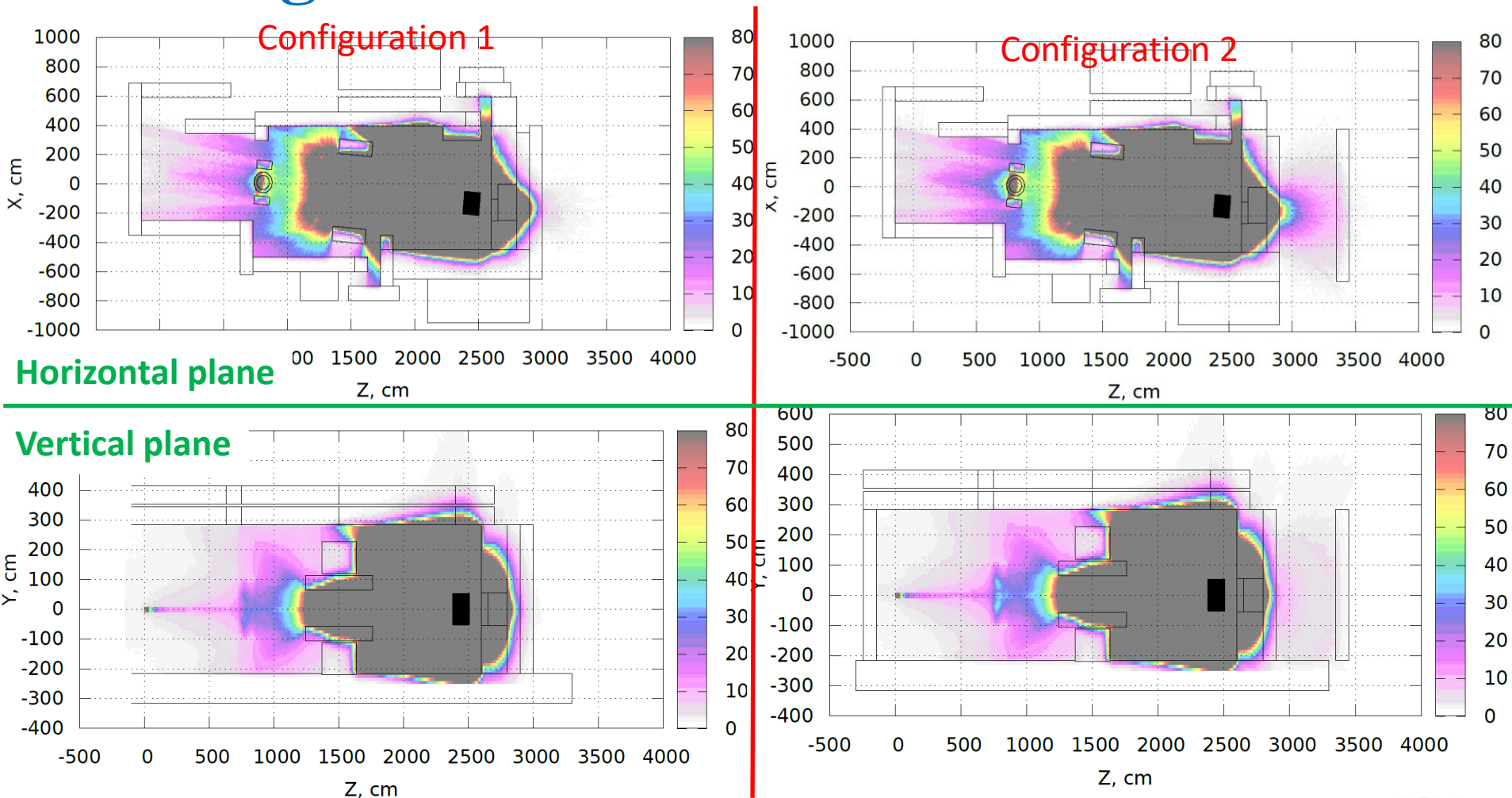


Serial number	Subsystem BM@N setup	220V (kW)	380V (kW)	UPS (kW)	Total (kW)
1	T0	3.5	-	-	3.5
2	Forward SI + trigger SI + Si prof	5	-	-	5
3	GEM	7	-	-	7
4	Ecal	4.6	-	10	14.6
5	ToF400	2.2	-	1.5	3.7
6	CSC	5	-	-	5
7	DCH	14	-	-	14
8	ToF700	25	-	-	25
9	Gas system	1	-	-	1
10	STS	-	20	14	20/14
11	For SRC experiment program	~5	-	-	5
12	Cryogenic target	2	10	-	5
13	DAQ	21.3	-	-	21.3
14	Slow Control	1	-	-	1
15	FHCall	1	-	-	1
16	Control Room	7	-	5	12
17	Clean Room	6	-	-	6
18	Experimental Hall	5	40	-	16/40
19	Room for GAZ system	5	-	-	5
20	Net	16	-	16	32
21	CUBiC	-	50	-	50
<b>Total</b>		<b>136.6</b>	<b>120</b>	<b>46.5</b>	<b>183.5/120</b>





## for different configurations of the biological contour of the BM@N hall



Au\*Au 3.8 AGeV with intensity of beam  $2 \cdot 10^6$  nucleon (94 kEvents)

## Carbon beam pipe:

1. Conduction of final tests to measure the accuracy of the prototype geometry ([April 2020](#))
2. Development of a complete technical task for the entire carbon beam pipe section. ([April-May 2020](#))
3. Development and production of carbon beam pipe in [KB Arkhipov](#) ([May 2020](#))

## Beam pipe after analyzing magnet:

1. Completion of [3D](#) model rendering taking into account the geometry of the carbon beam pipe. ([April-May 2020](#))
2. Determination of geometric parameters of aluminum beam pipe based on paragraph 1 ([May 2020](#))
3. Development of a technical task for the production of this section of the beam pipe. ([June-July 2020](#)).

## Target Station:

1. Start of production of the target station elements ([preliminary end date end of May 2020](#)).
2. Test of the complete assembly of the target station with the control electronics ([June-July 2020](#)).

## Modernization of power supply of BM@N setup:

1. Engineering study of the installation - placement of all elements of the experimental subsystems, taking into account [SRC](#) experimental program and taking into account all planned modernization and replacement of subsystems existing today ([May-June 2020](#)).
2. Writing a technical task for designing an entire power supply system ([June-July 2020](#))
3. Design of the power supply system of the [BM@N](#) setup ([August - October 2020](#))
4. Upgrade according to the project documentation ([October – December 2020](#)).



**THANK YOU  
FOR YOUR  
ATTENTION**

