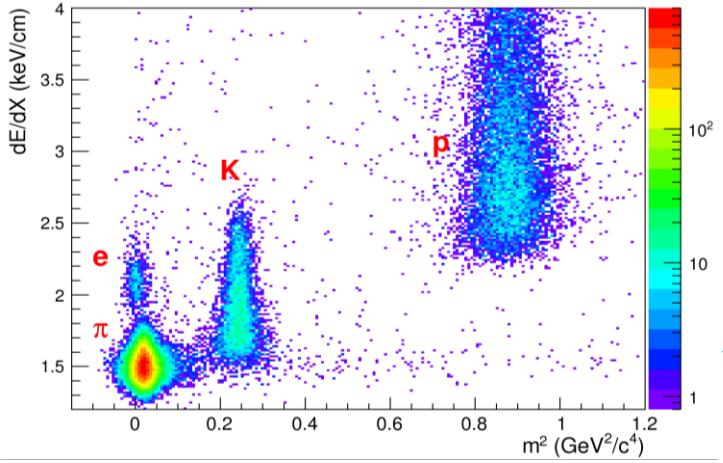
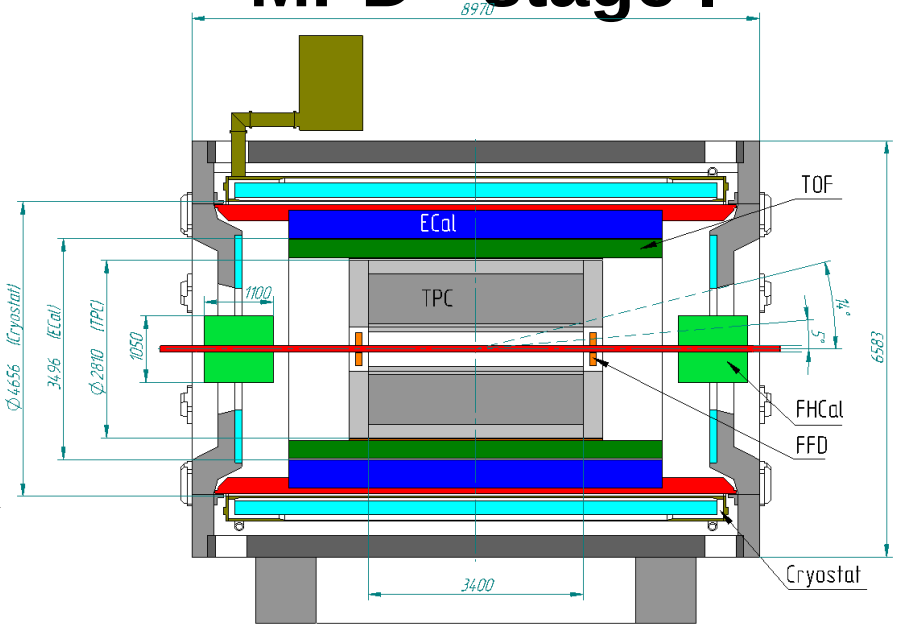
Status of the MPD integration

Viacheslav Golovatyuk
(JINR)

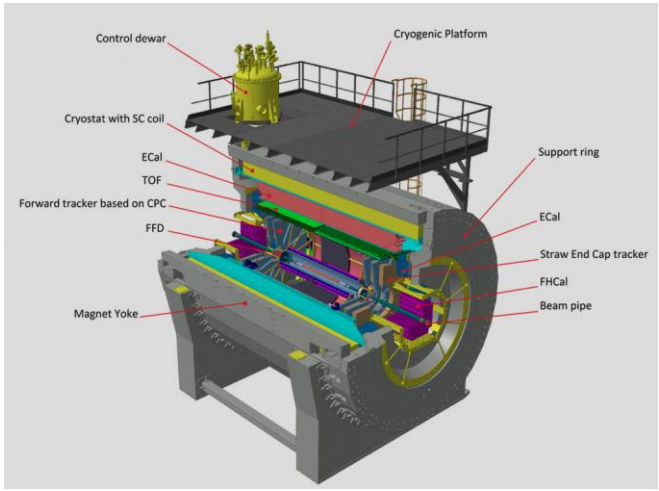
MPD - stage I

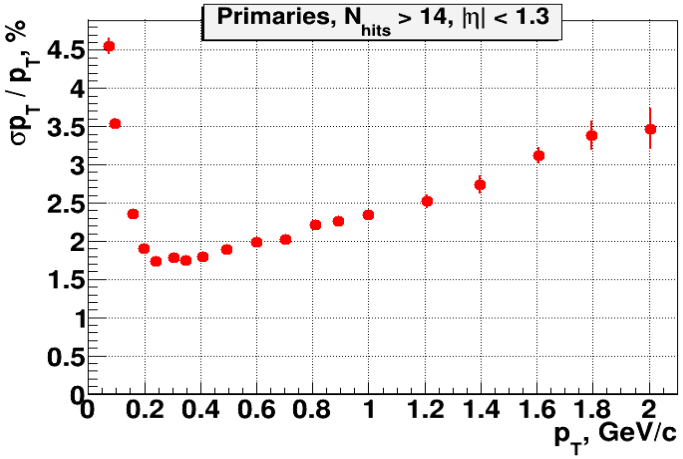


Particle identification with TPC, TOF & ECal



MPD - Stage II





Momentum resolution with TPC

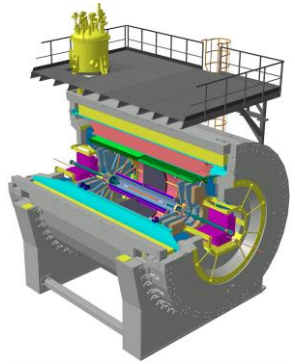
Structure of the MPD Complex

Detectors:
TPC, TOF, Ecal, FFD, FHCal and Luminosity detector,
DAQ and Slow Control

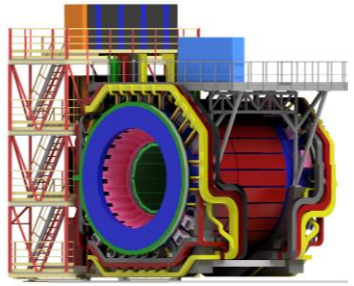
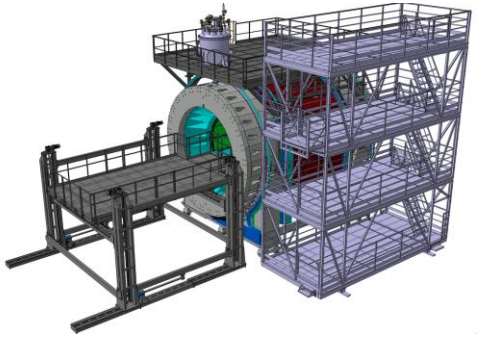
Magnet:
Iron Yoke, Solenoid, Cryogenic system,
Correction Coils, power Supplies,
B field mapper

Engineering systems
Support Frame
Beam pipe
Electronics Platforms
Detectors Cooling systems
Cable ducts
Integration equipment (Lifting platform, Insertion tools of TPC,TOF,Eal)

MPD Hall
Crane
Electrical and Ventilation systems
Control Room, Server of DAQ
Cryogenic pipes: LHe and LN2, liquid He tank
Radiation shields

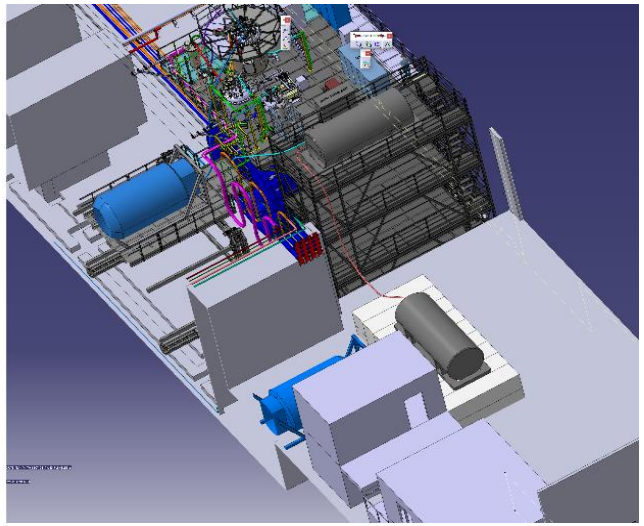




The Magnet of MPD

Konstantin Mukhin (JINR)



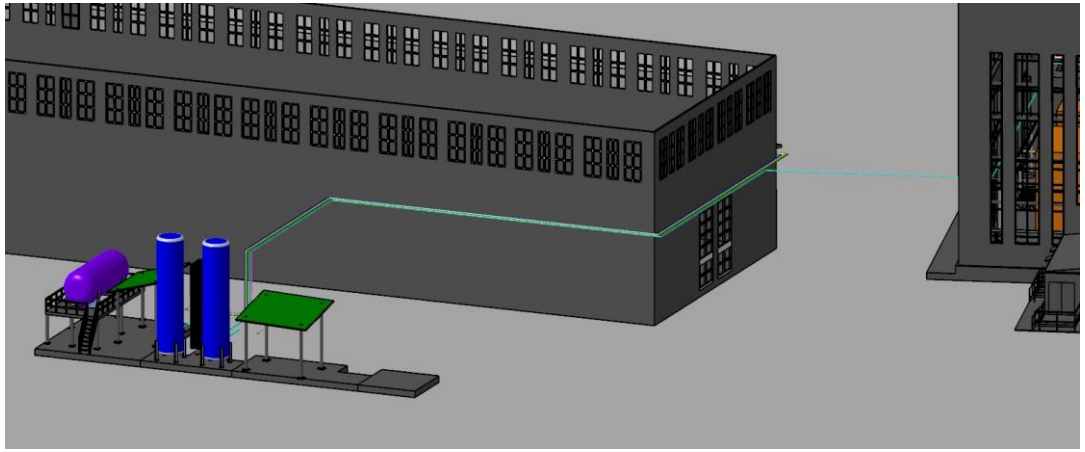
The Layout of Solenoid cooling in temporary scheme

The magnet consists of Solenoid inside Iron Toke and two correction coils inside of Endcaps

Total length ~ 400 m

Direct and return gas He lines, GN_2 line and pressured air line are completed and tested.

Cryogenic platform with Satellite refrigerator and Control Cryostat

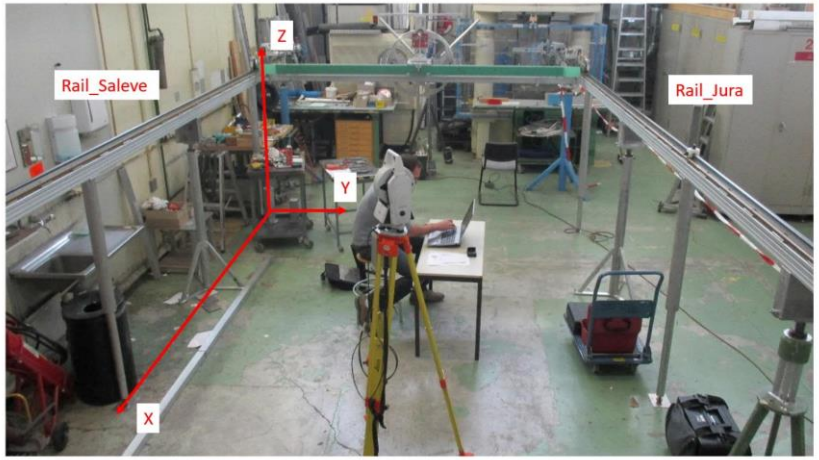


The long cryogenic lines for liquid Nitrogen from container to the MPD hall

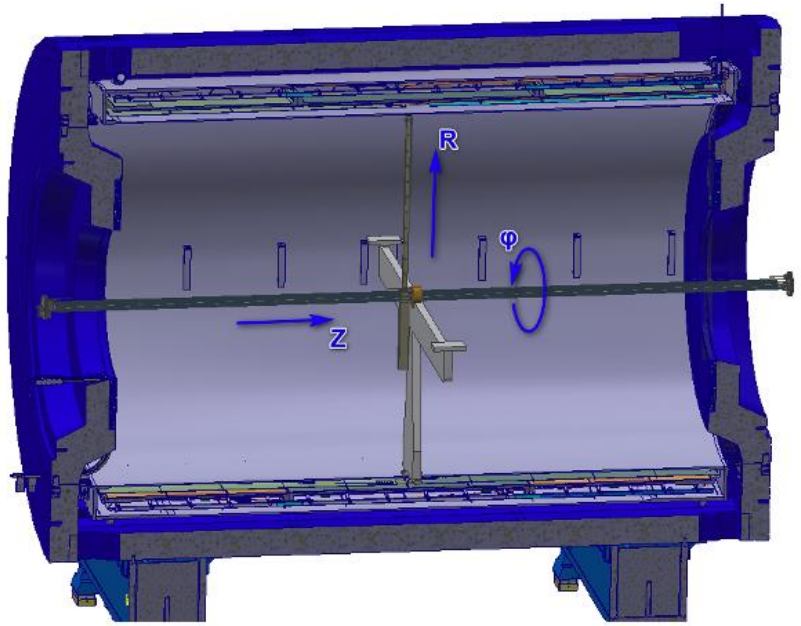
Strings for cryogenic pipes and cables hold

B-field Mapper

Evgeny Antokhin, INP Novosibirsk



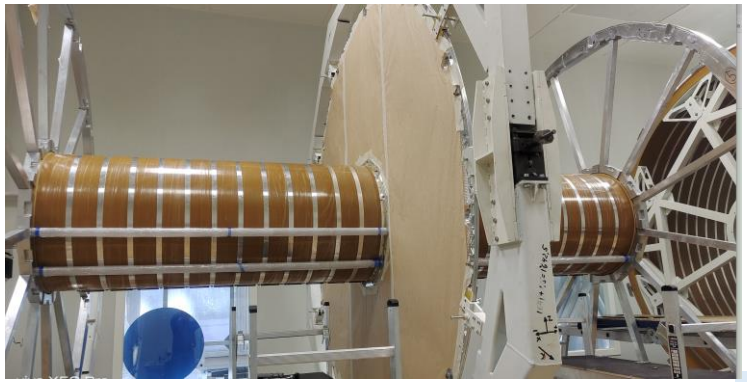
CERN design of mapper :
58 Hall probes move in z and φ directions
Accuracy – 1.5-2.0 Gs
Range of fields 0.57 -0.5 T

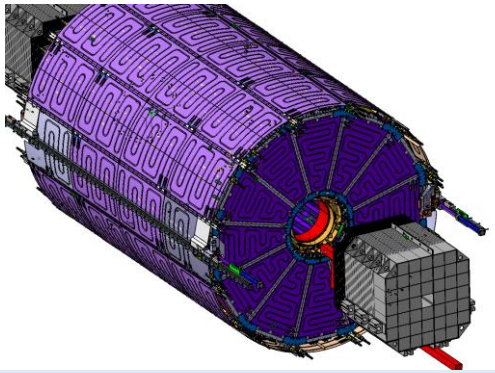


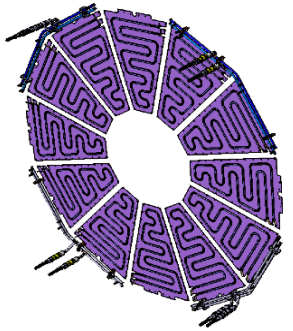
Concept of Novosibirsk INP mapper:
1 Hall 3D probe moves in 3 directions: z , R and φ
Accuracy: 0.3 – 0.5 Gs
Range of fields: 0.2-0.57 T
Range of measurement: from R = 0 cm to 2,0 m
(It is able to do measurements in the volume of TPC when Ecal and TOF are mounted in the Support structure inside of the Magnet Yoke

Time Projection Chamber

Sergey Movchan (JINR)







Two cooling area of TPC: 1- front end electronics, 2 - gas volume (body) of TPC – homogeneous temperature field – $0{,}5^0$ C

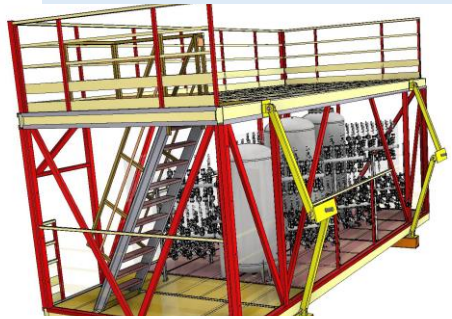
(C1-C2) + flanges + HV membrane - assembled

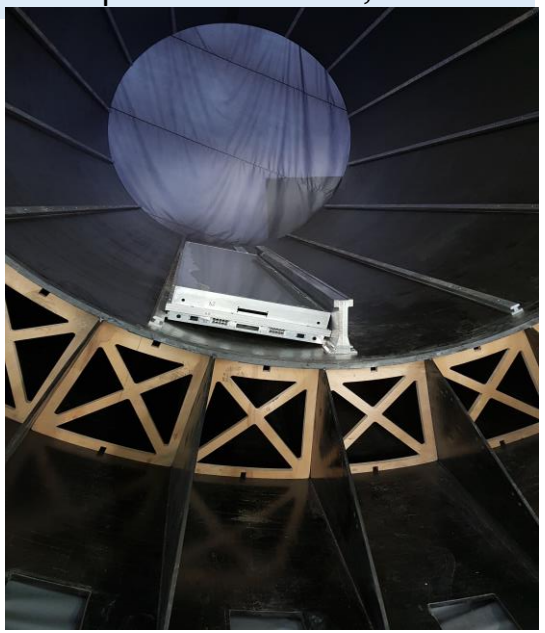
2 service well - *assembled*

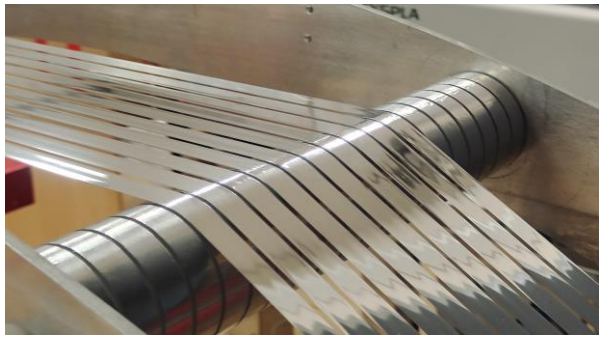
ROC chambers:

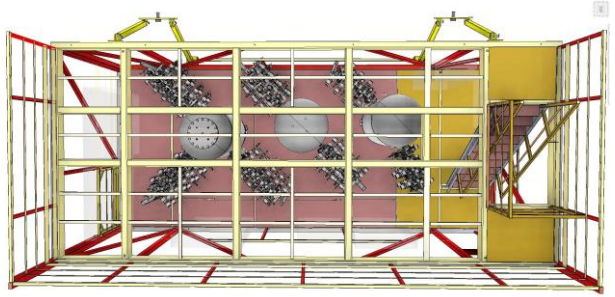
28 pc are ready

FE – 70% manufactured









Critical items:
Roads D=60 mm – manufacture started

TPC + ECAL cooling systems, Ready – Sept 2024

Rails installation into Support Frame, - November 2023

TOF MPD assembling status

Vadim Babkin (JINR)

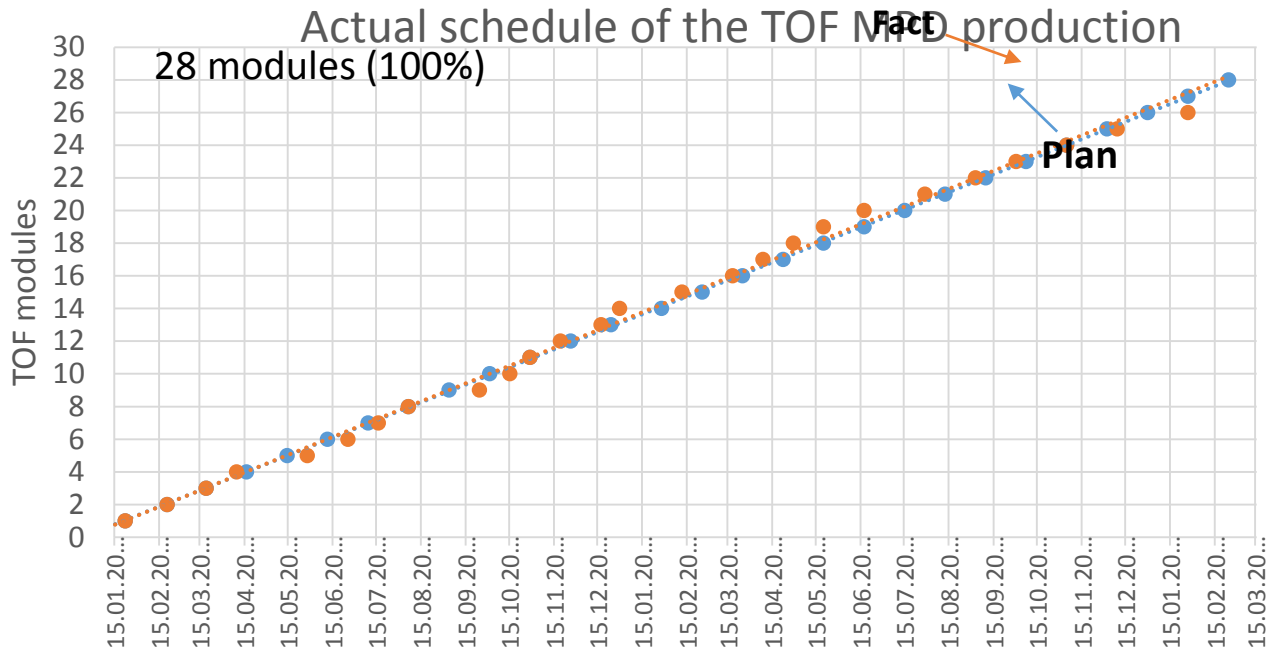
The assembly of MRPC detectors for the TOF MPD was finished in September 2022. Totally available 300 (107%) fully tested detectors.

28 (100%) TOF modules are assembled

The equipment for installing the modules is ready for use and stored in the laboratory. Rails for TOF have been installed in to the power frame in May 2023.

The assembly of the TOF gas system began in the MPD hall in September 2022. It should be finished in December 2023.

Due to the fact that there was extra time, it was decided to produce spare TOF modules. Now we are looking for potential manufacturers.



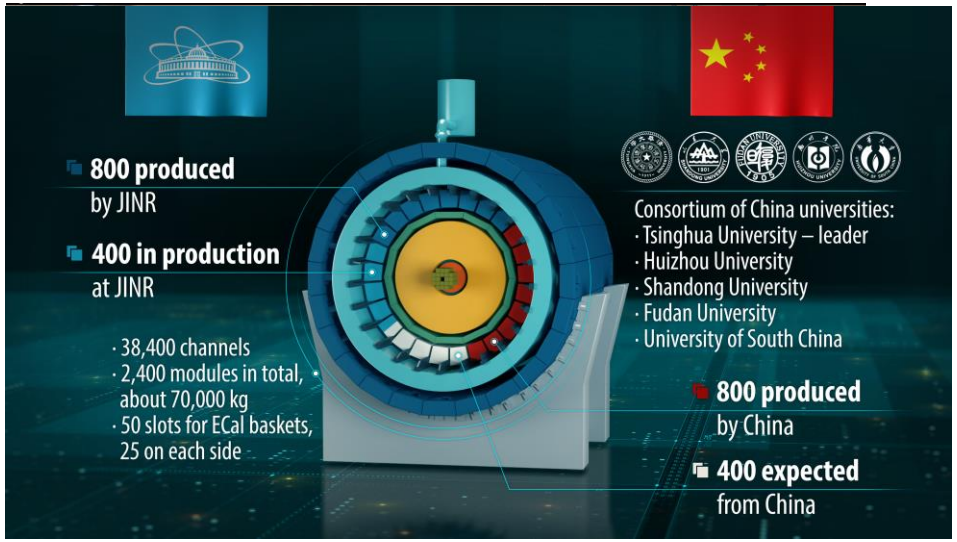
Store of tested TOF modules

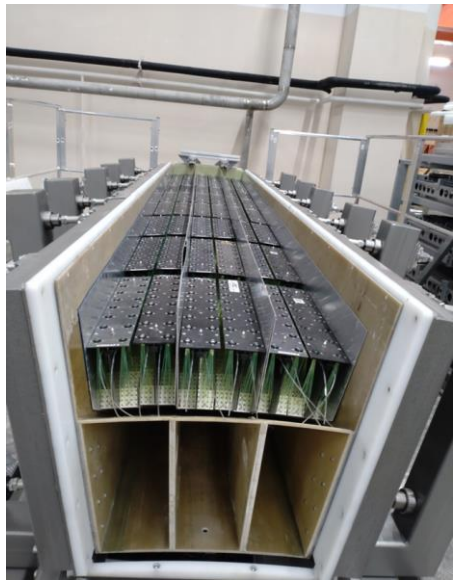
Gas system assembling at the MPD hall

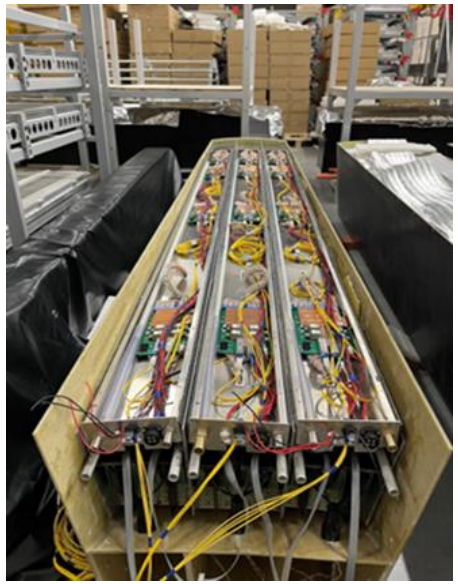
The TOF installation bench in LHEP

Electromagnetic Calorimeter (ECal)

Igor Tyapkin (JINR), Yi Wang (Tsinghua University)







ECal – Tsinghua University., Yi Wang
Shandong University
Fudan University
South China University
Huzhou University
JINR – production in IHEP (Protvino) and Tenzor (Dubna)

ECal consist of 50 baskets (2400 modules)

At the moment 1600 modules out of 2400 have been produced (66%) by JINR and China (Tsinghua – supervisor)
Production of additional 400 modules in Russia is going on.
For these modules we use Russian made wave shifters which have acceptable characteristics

A mass assembly of half-sector baskets has begun.
About 10 half-sectors per month is a production rate.

A procedure for the mass installation of electronics in half-sectors is under development now.

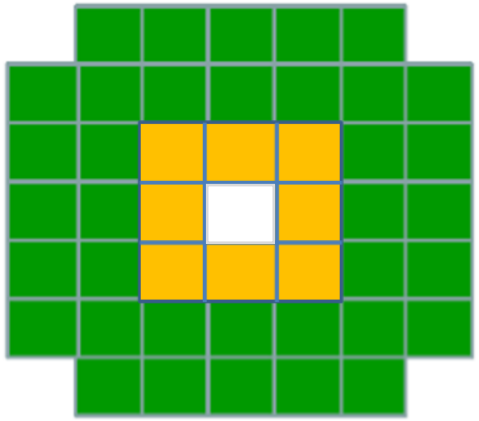
Anyway 83% of calorimeter will be ready till September of 2024 (maybe earlier)

If the Chinese consortium manages to find funds for the production of the remaining 400 modules, it will be on a parity basis with JINR, and we will have a complete set of Ecal sectors (100%).

FHCal integration status

Aleksandr Ivashkin (INR, Russian Academy of Science)

- 90 modules are ready for shipment to JINR.
- 100 Front-End-Electronics (FEE) boards are tested and ready for the installation in calorimeter.

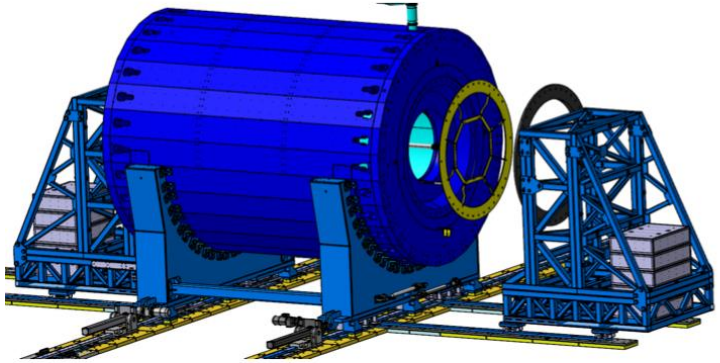


- Mechanical platform is designed. All elements are in production
- FHCal assembly begin in ~~October~~ December 2023.

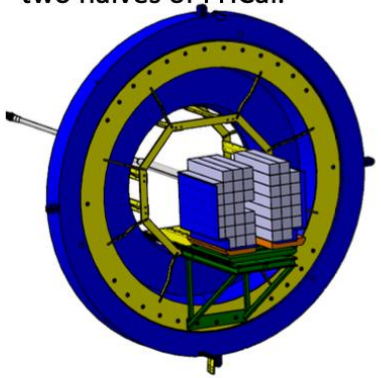
FHCal integration in MPD

(Concept of installation)

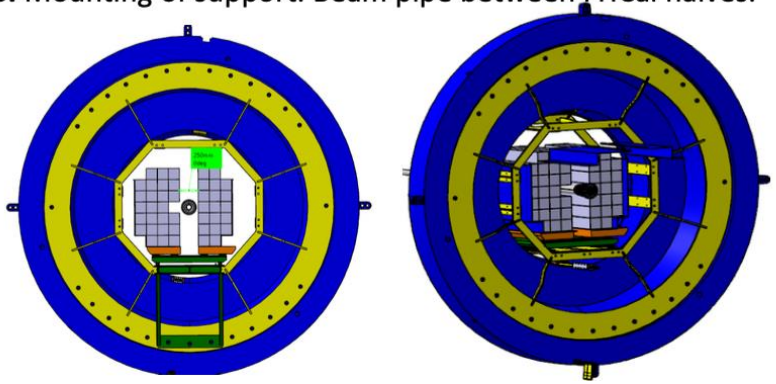
1. Installation of flange



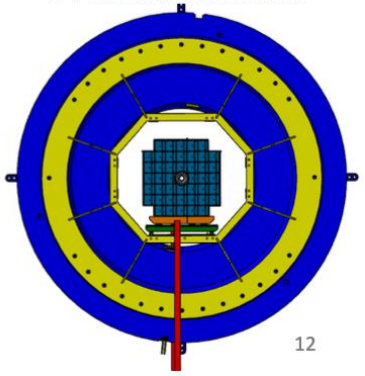
2. Iinstallation of platform and two halves of FHCal.



3. Mounting of support. Beam pipe between FHCal halves.



4. FHCal assembled.



12

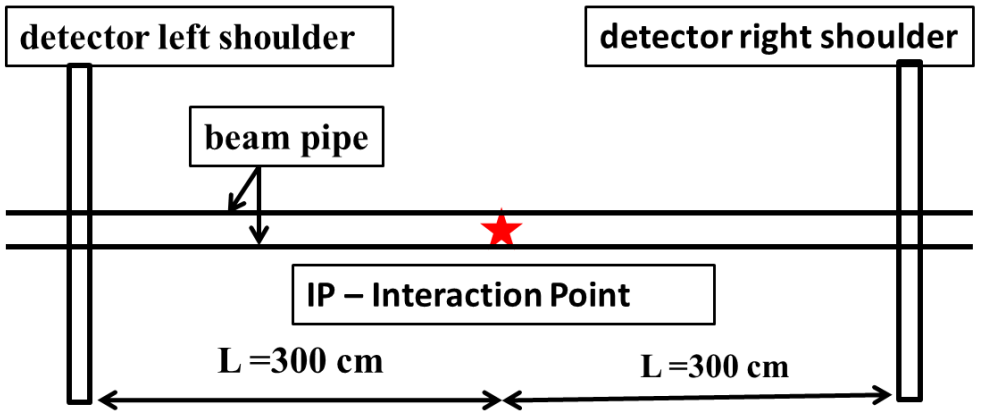
Space in the Endcap support for the FHCal installation

Control of luminosity at the interaction points in the collider NICA

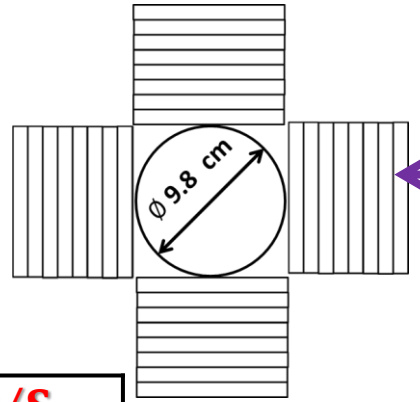
A.Litvinenko ,JINR
and working group

Tasks which have to be solved by the detector

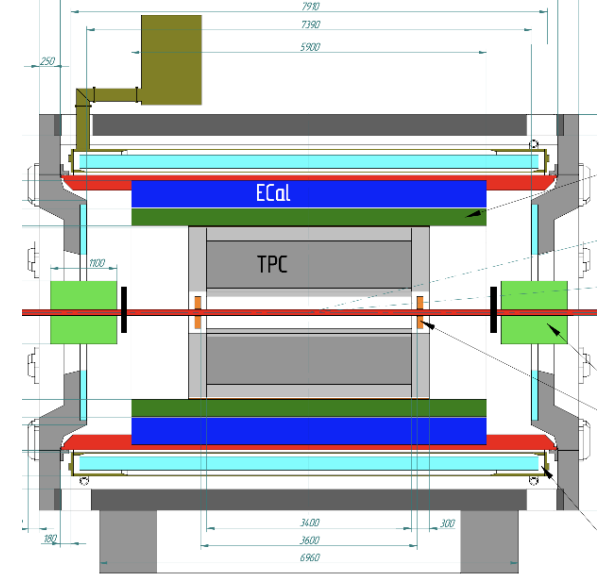
1. Assistance in controlling the transverse sizes of the bunches
2. Assistance in setting up transvers convergence of bunches
3. Assistance in setting up longitudinal convergence of bunches
4. Control of the distribution of vertices in the longitudinal direction.

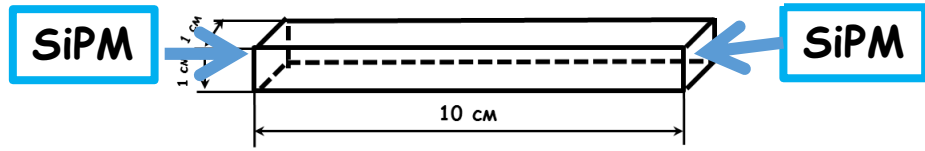


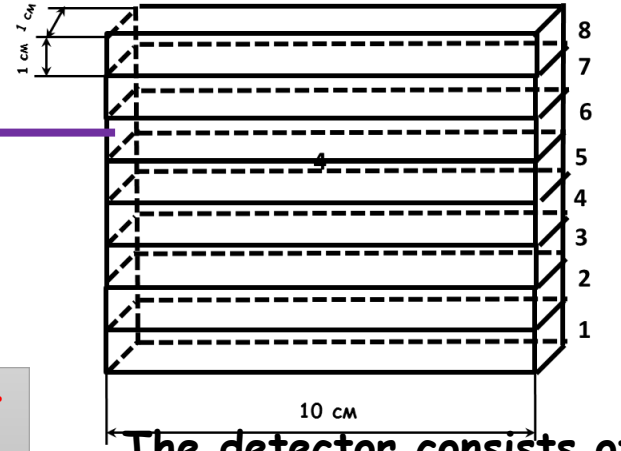
$I_b(1/bunch)$	$\mathcal{L}\ (cm^{-2}s^{-1}$	$N_{AuAu}(1/s)$	$N_{\mathcal{L}D}\ (1/s)$	B/S
$2\cdot10^9$	10^{27}	6000	4900	$<10^{-5}$
$2\cdot10^8$	10^{25}	60	49	$<10^{-4}$
$2\cdot10^7$	10^{23}	0.6	0.49	$<10^{-3}$
$2\cdot10^6$	10^{21}	0.006	0.0049	$<10^{-2}$



Detector circuit one shoulder front view





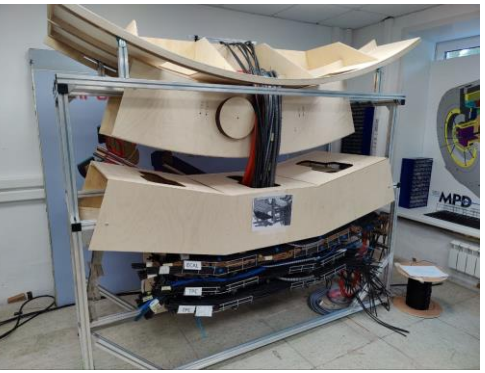


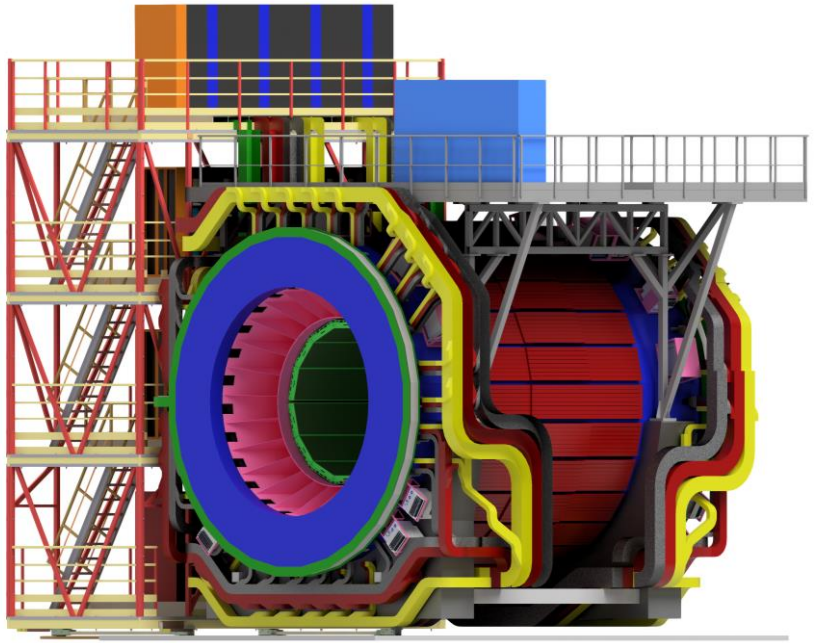
The detector consists of $100x10x10\ mm^3$ plastic scintillator strips viewed from both sides with silicon photomultipliers (SiPM)

Electronics Platform with Rack clean rooms and Cable routs to go inside of magnet yoke

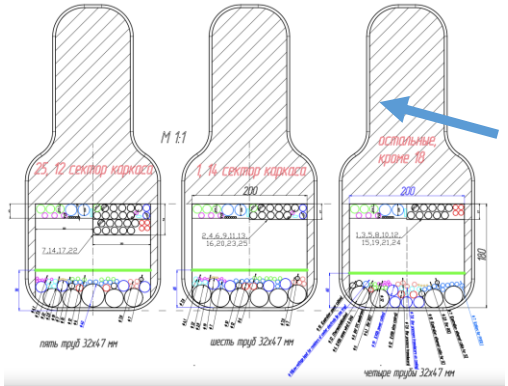
Aleksandr Fediunin (JINR)

Real scale modeling of Cable routs from detectors inside of the magnet Yoke to the Electronics platform

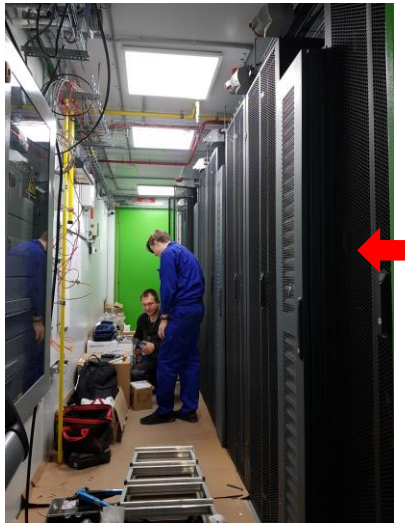




Cables and pipes routs around barrel iron yoke to the Electronics platform



Occupancy of the windows in magnet yoke after cables and pipes installation.
Cable and cooling water/air pipes distribution in the windows of barrel yoke plates

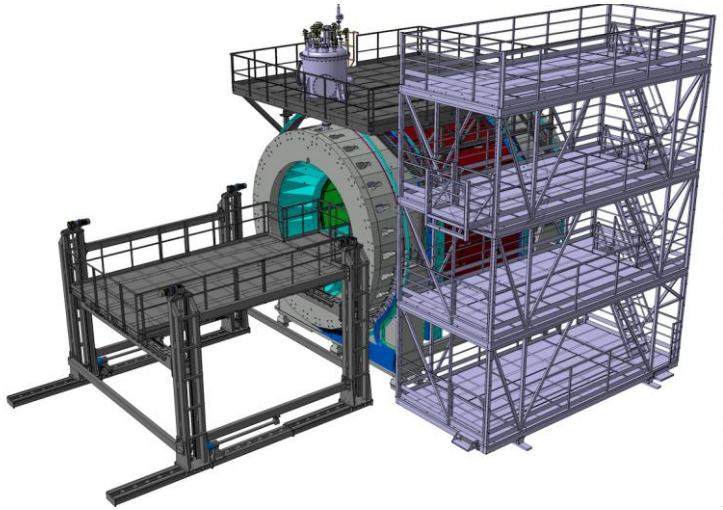


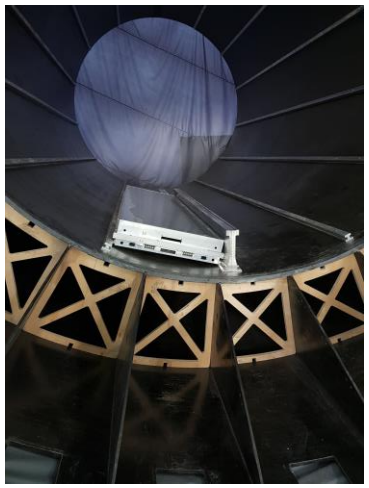
Containers with electronics on the Platform.

View inside of the container. Racks are installed, construction of electrical and cooling water systems.

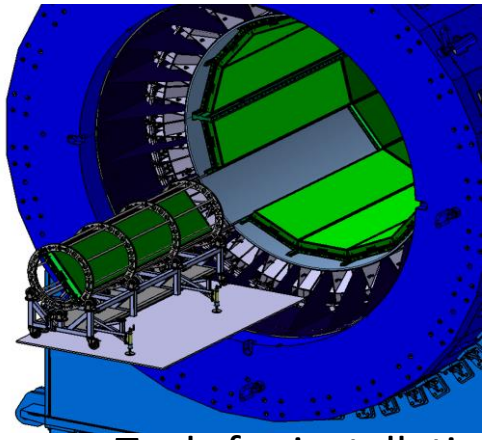
Tooling for subsystems integration

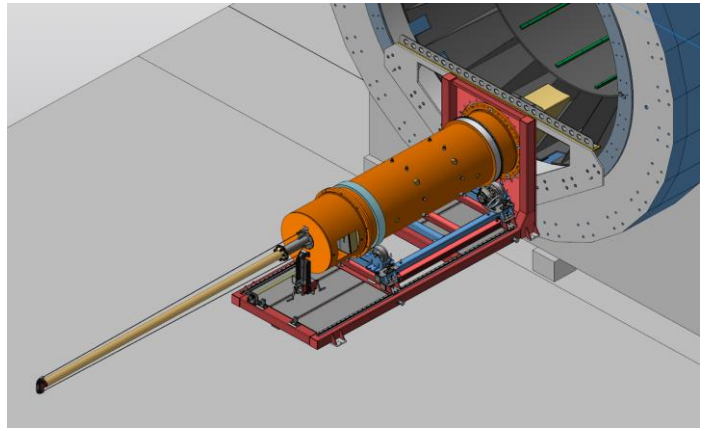
Dmitry Osipov (JINR)

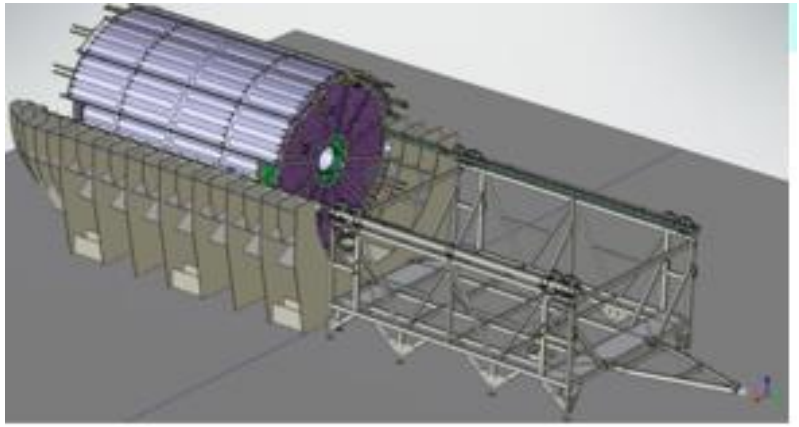




There is a plan to have two identical platforms from both sides of the Solenoid. The first one is ready and in the process of mounting in the pit. We will use it in the process of Solenoid cooling for liquid He tank lifting to the Satellite refrigerator on the cryogenic platform. Later when the liquid He line to the Refrigerator is ready we don't need the tank and will use platform for subsystem installation.



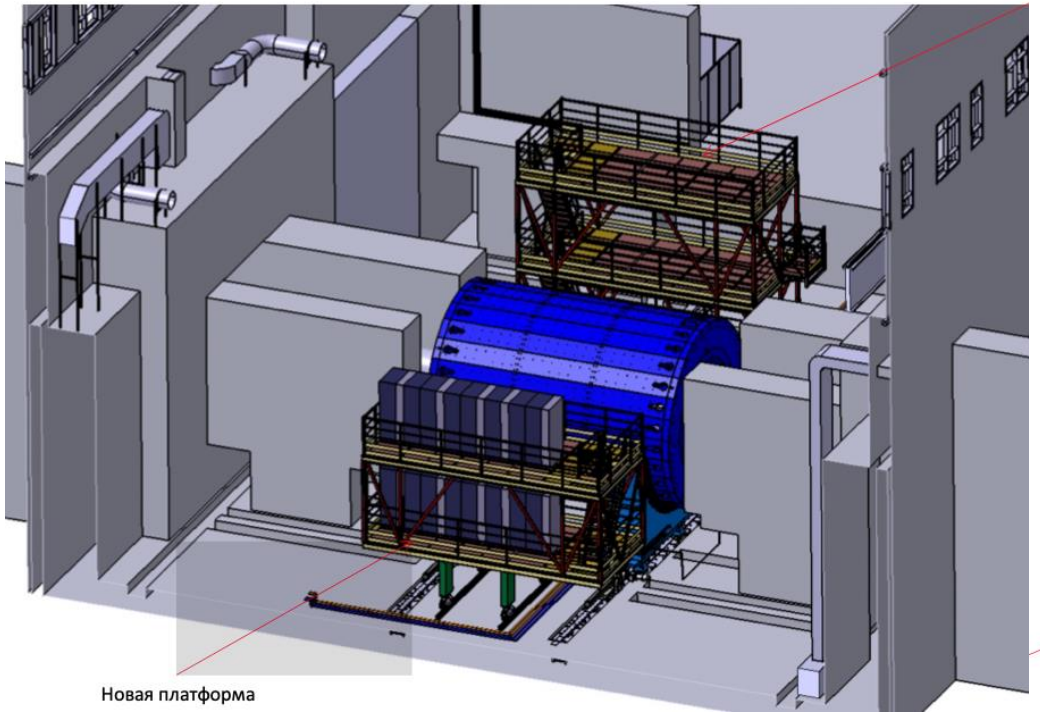


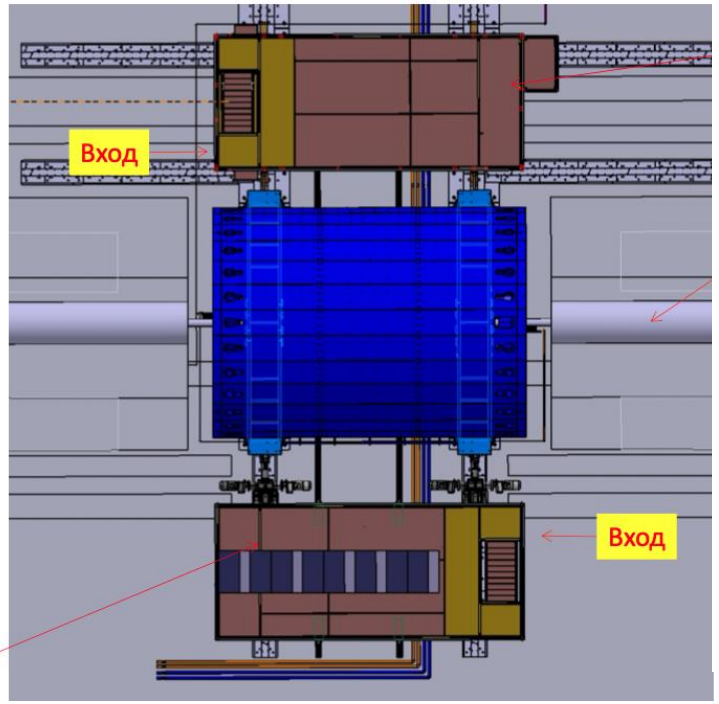


Tools for installation of Ecal, and TOF are ready and for TPC is in production

A new platform on the South side of MPD

Nikolay Topilin (JINR)





To provide optimal condition for the TPC cooling system we have decided to construct additional platform on the south side of MPD. Besides Cooling system of TPC one floor of this platform is planned for ITS electronics which is the second stage of detector (basic configuration).

Milestones of MPD assembling in 2020-2025

	Year 2021	
1	July-Aug	Solenoid installation into Iron Yoke and alignment
2	Aug - Dec	Electrical, pressure tests and vacuum tests
	Year 2022	
3	Jan 20 - April 30	Cables for Solenoid probes signals installation
4	May 16 - Dec 25th	Assembling Iron yoke, Cryogenic platform and Cryostat. New LHe and LN pipes ordering
5	Sept - Dec 30	Cryogenic infrastructure for cooling down by temporary scheme, power Supply and Control system preparation
6	Oct – February 15th , 2023	Preparation power supply and Solenoid Control systems
	Year 2023	
7	Jan 15 - April 15th	Preparation for Vacuum test of Solenoid with Cryostat
8	April 20 May 15th	Vacuum tests
9	June 15 – September 15	Activities in the MPD Hall are stopped
10	October – December	Cooling down to the Liquid N2 and further down to He temperature (-4K)
	Year 2024	
11	January - February 15	Supplying the current to the Solenoid and Correction coils, testing the hit evacuation system
12	March 15th - May 30	Magnetic Field measurements
13	June 1 - June 10	Support Frame installation
14	June 20 – August 30th	Installation ECal sectors
15	Sept 1 – September 30th	Installation TOF modules, FHCal into poles
16	Oct 1st - Nov 30	TPC installation
17	Sept 18 - Nov 30	Cabling
18	Dec 4 - Dec 25	Installation of beam pipe
	Year 2025	
19	Jan 10 - Feb	Move the MPD on Collider beam line, Commissioning

Summary

All components of the 1st stage detector advanced in production.
All efforts of the MPD groups are put on the execution of the schedule plan with minimal delays

Thank you