# Report of the technical coordinator

Alexander Korzenev, JINR LHEP

SPD Collaboration Meeting
Dubna, Nov 5, 2024

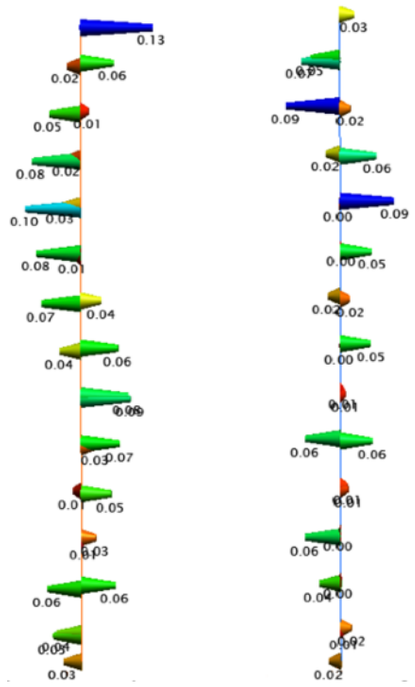
## Outline

- Infrastructure
  - Construction work in the SPD hall
  - Installation of rail system
- Progress on
  - Magnetic system
  - Range System (RS)
  - Straw Tracker (ST) barrel & endcaps
  - MicroMegas (MM)
  - EM calorimeter (ECal)
  - Beam-beam-counter (BBC)
  - Detector cooling system
  - Zero Degree Calorimeter (ZDC)
  - Time-of-Flight (TOF)
  - Focusing Aerogel RICH (FARICH)
- Conclusion

# Construction work in the SPD hall

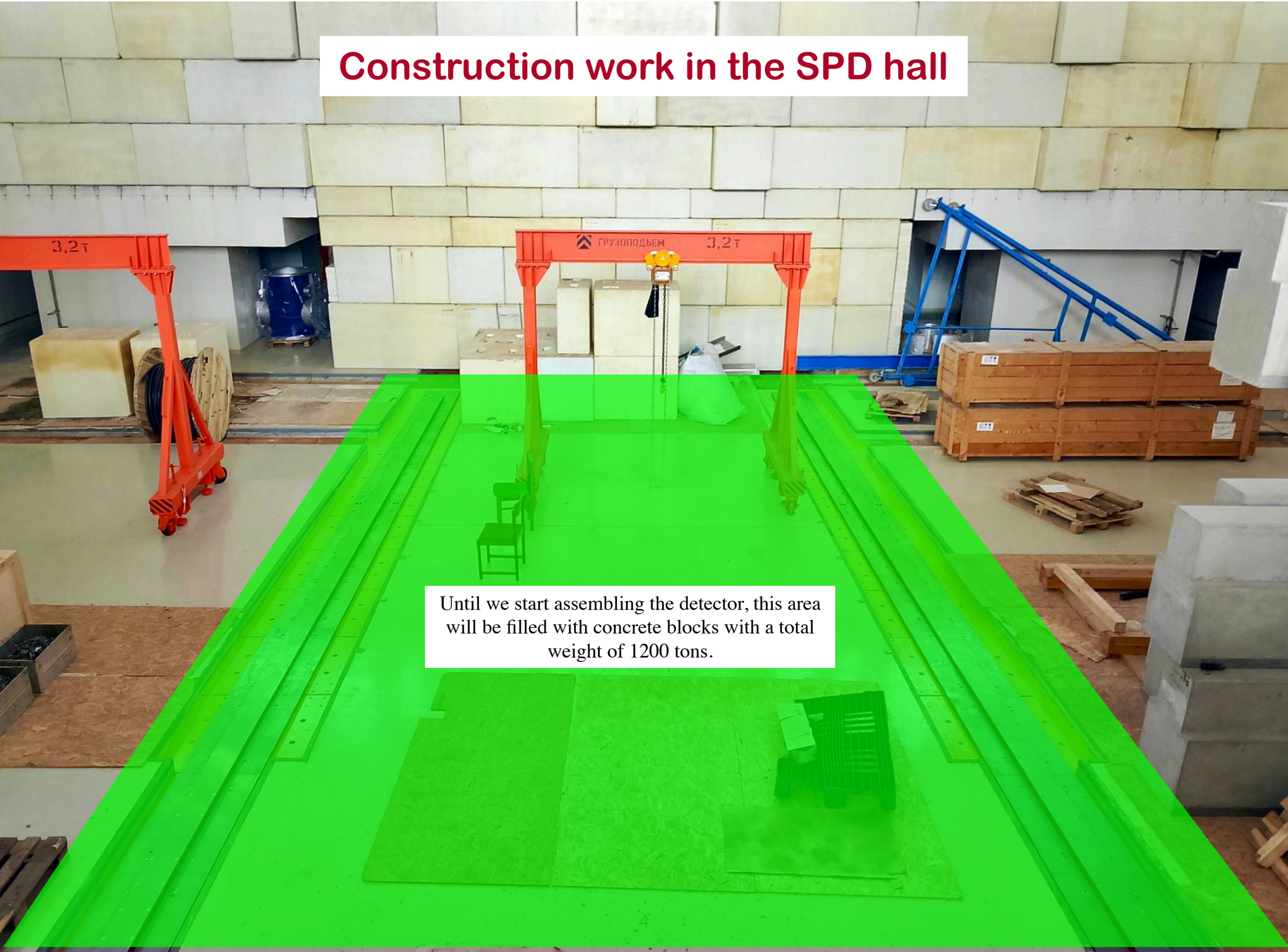
# Construction work in the SPD hall

Rail positioning accuracy measured in October in mm:



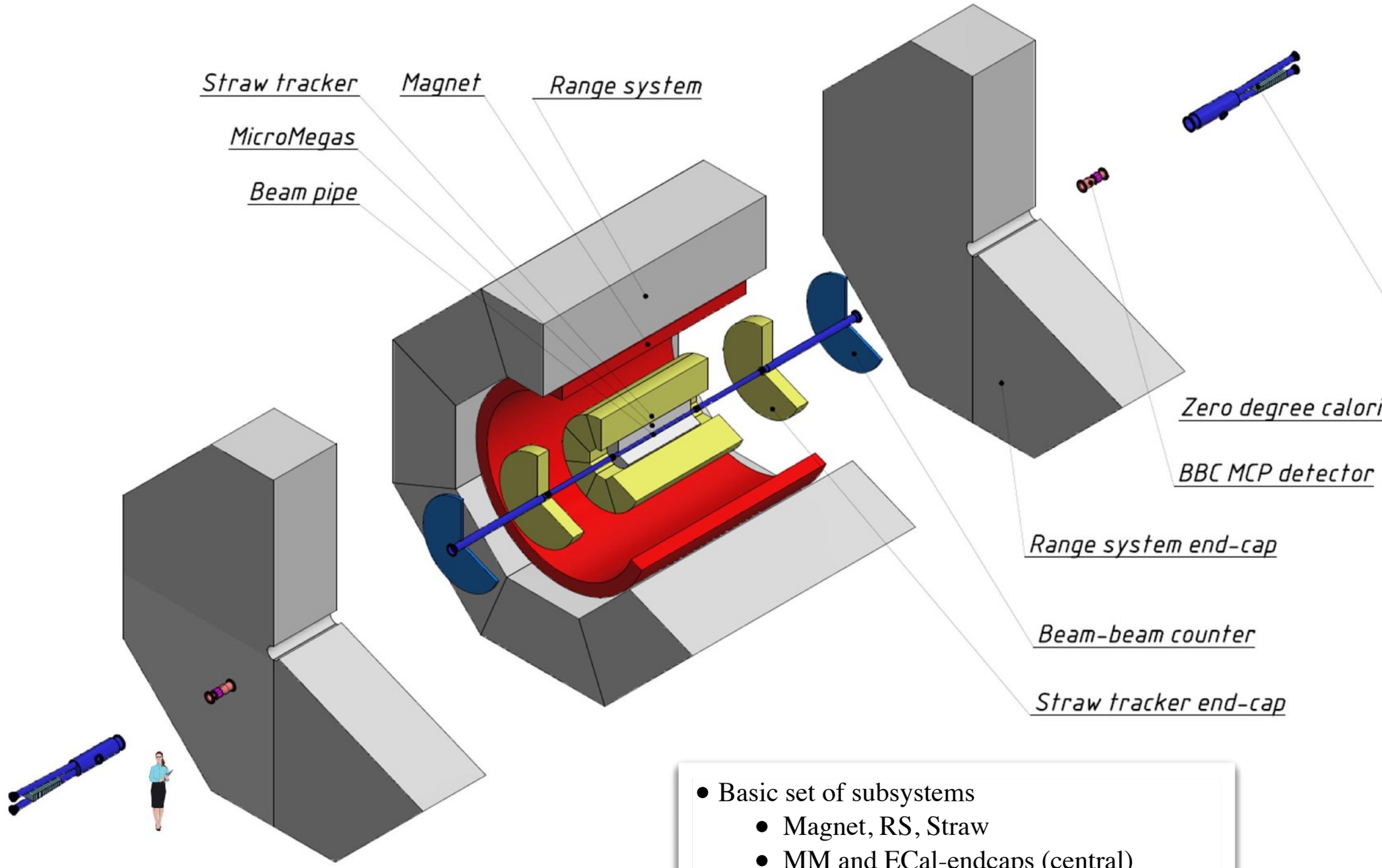

Requirement for the smooth motion of roller skates: ±0.5 mm

# Construction work in the SPD hall




Until we start assembling the detector, this area will be filled with concrete blocks with a total weight of 1200 tons.

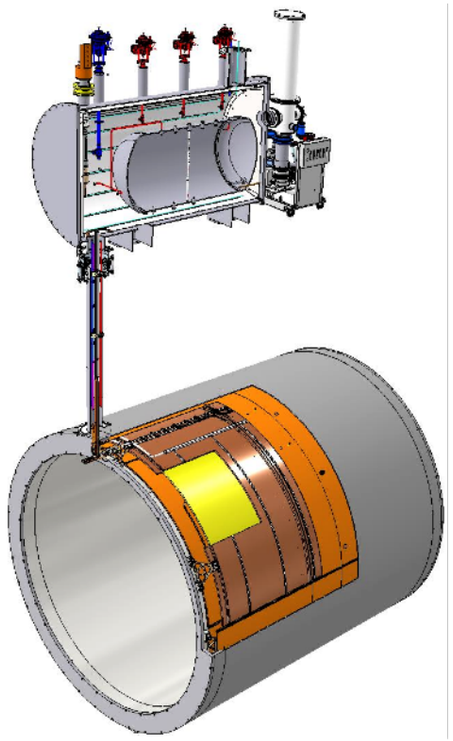
# Stage-1 of the experiment (readiness by 2030)




- Basic set of subsystems
  - Magnet, RS, Straw
  - MM and ECal-endcaps (central)
  - BBC, MCP, ZDC
- No PID detector (TOF, FARICH), no ECal, no SVD
- p-beam: $\sqrt{s} \lesssim 13$ GeV, $\mathcal{L} \lesssim 10^{30}$ s$^{-1}$cm$^{-2}$

## Solenoid+Dewar, BINP responsibility

(the TDR contract was signed earlier this year)



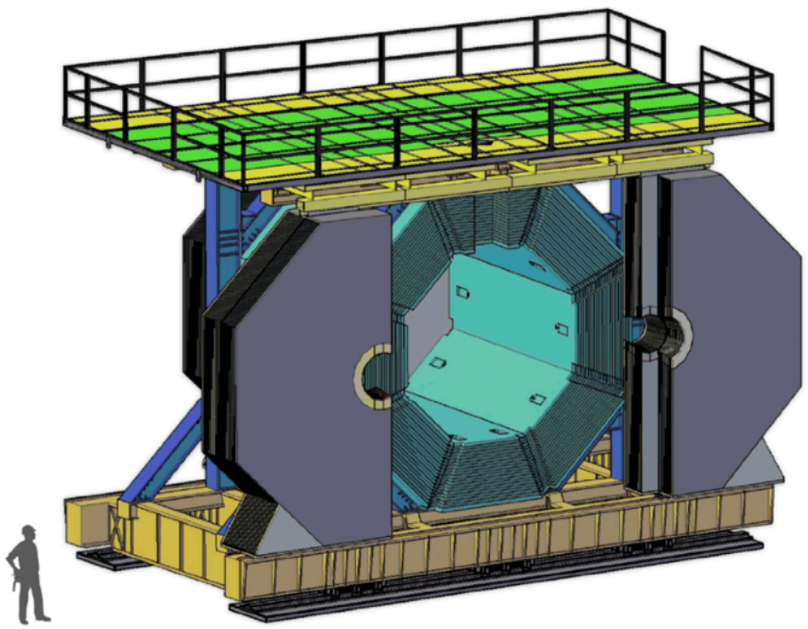
## LHe supply system, JINR responsibility

(contract for development next year)

**Magnetic system**

## Flux return yoke, JINR responsibility

(is being designed, production in 2026)

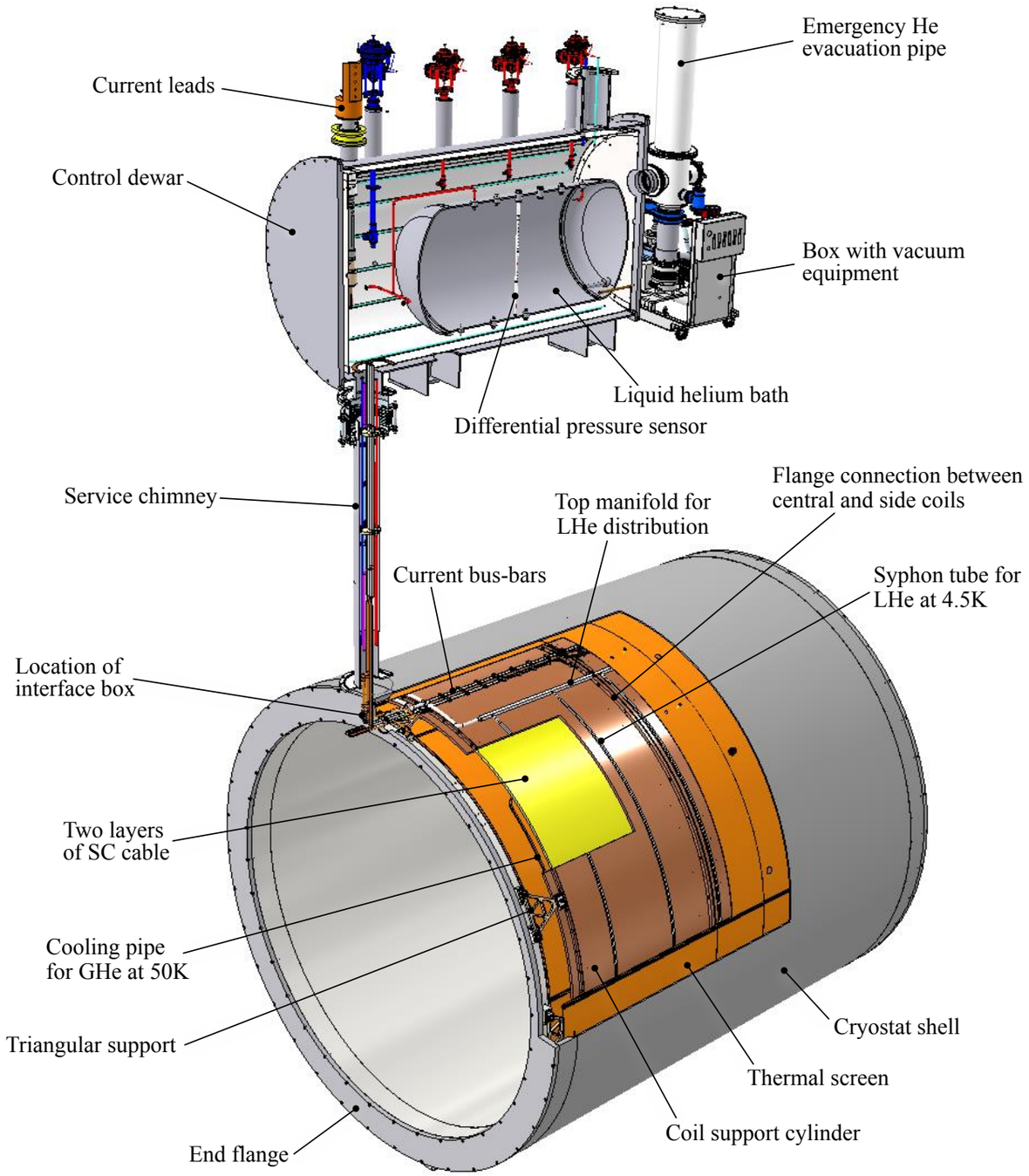


## Cryocomplex, JINR responsibility

(foundation installation next year)

*Pyata E., Antokhin E.,*
*Bedareva T., Bragin.A.,*
*Pivovarov S.*

# Progress on superconducting solenoid

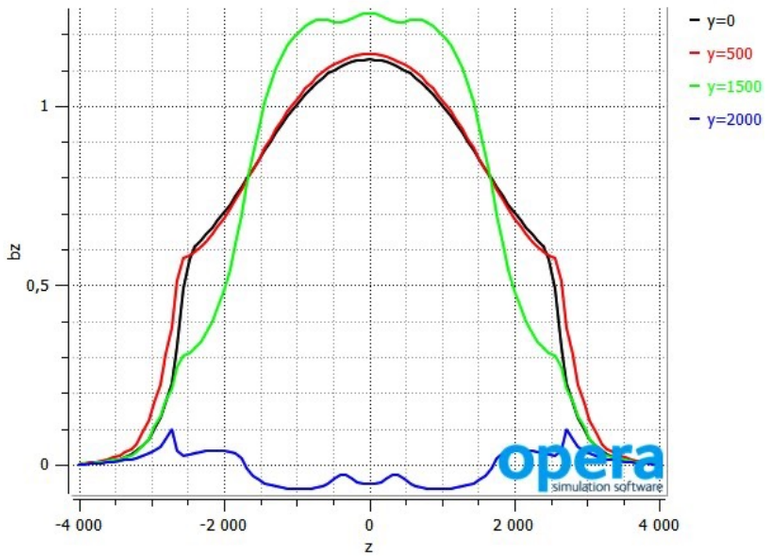



- Calculations were made for the transition of the solenoid to a superconducting state:
  - the maximum possible temperature with a superconducting winding and internal electric voltage were obtained
  - the contribution to the winding protection from the support cylinder and aluminum strips made of ultra-pure aluminum was estimated
- Design of the coils, proximity cryogenics, power supply system is in progress
- Uncertainties related to magnetic forces were clarified.

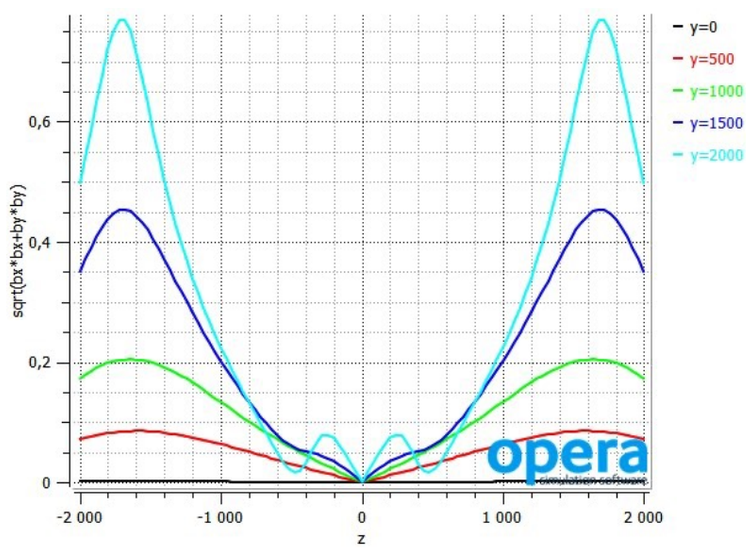
*P.Akishin (LIT)*

# Cross-check for the magnetic field and forces

*Bz vs Z*




*Br vs Z*

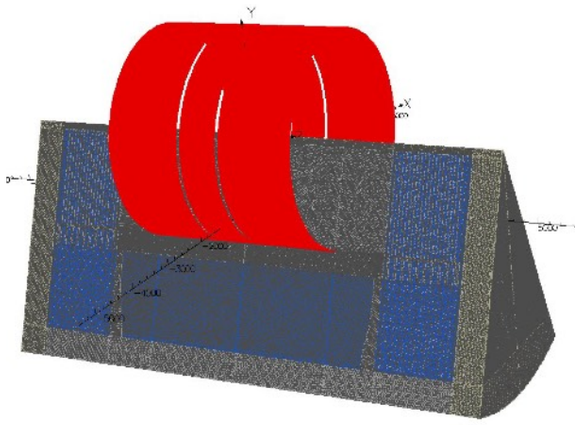



## Magnetic field calculation

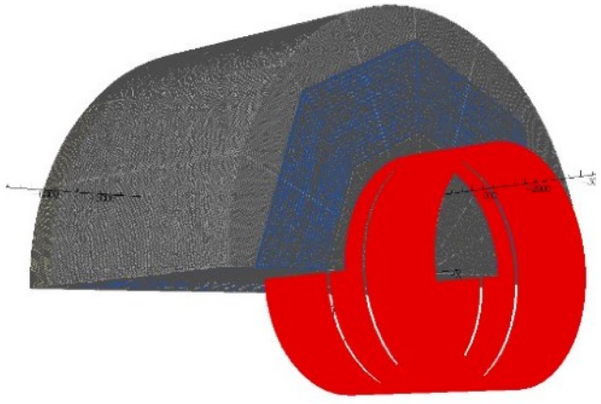
- 16 symmetries in 3D modeling construction are used to reduce the computational complexity
- There were 5’961’201 nodes in the 1/16 part of the magnet
- Consistent with results obtained by BINP group

## Forces acting on the coils were determined using Maxwell Stress calculations

***Longitudinal Z+5mm displacement:***
*1/8 partitioning of the magnetic system, 11’935’969 nodes*



***Transverse X+5mm displacement:***
*1/4 partitioning of the magnetic system, 23’819’810 nodes*



| Offset value | Force component | Left coil | Central coil | Right coil |
|---|---|---|---|---|
| 0 mm | Fy | 0 | 0 | 0 |
| Z+5mm (longitud.) | Fz | 5.16 MN | 1.9 kN | -5.15 MN |
| X+5mm (transverse) | Fx | 6.3 kN | 1.4 kN | 6.3 kN |

Forces are within the elastic deformation limits of the supports holding the “cold mass”

*E.Pyata, March 2024*

# Schedule for Solenoid+Dewar production

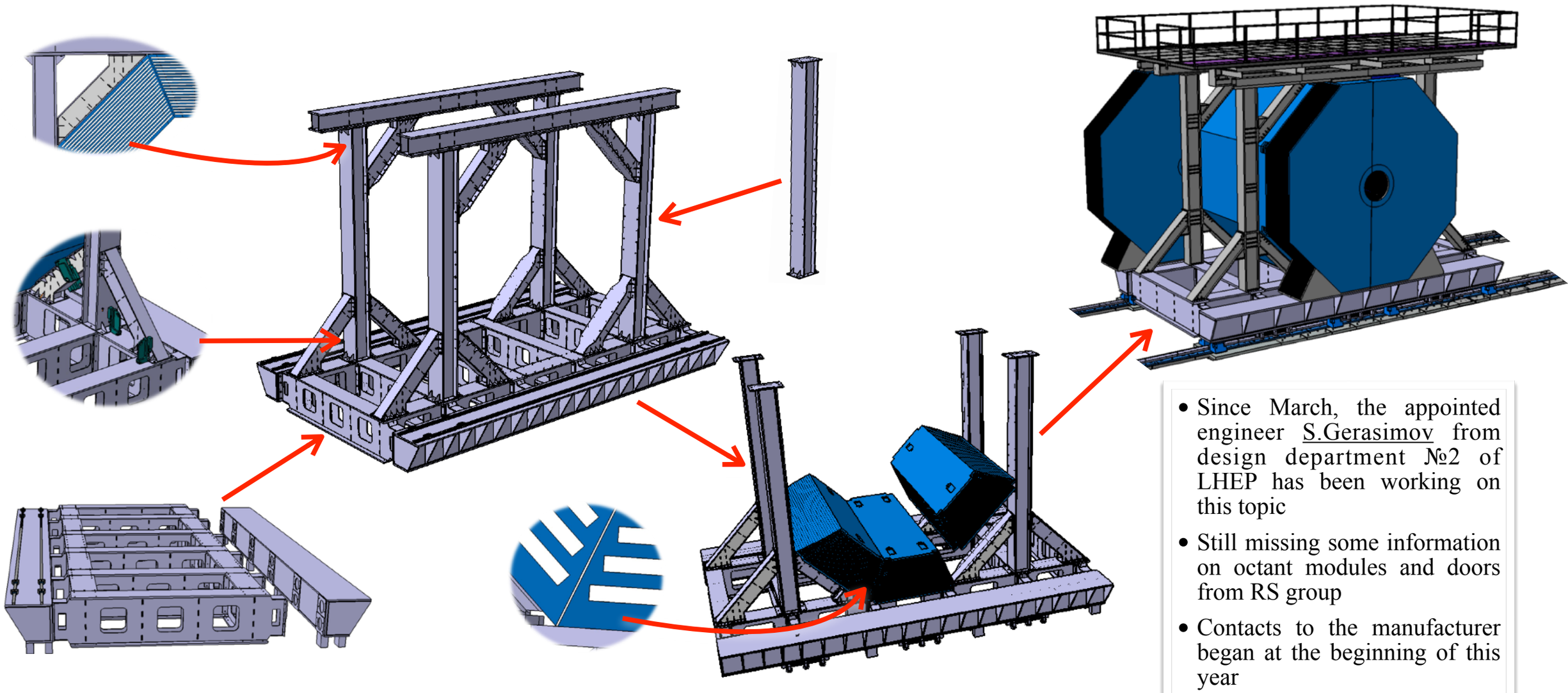
| | 2024 | | | | 2025 | | | | 2026 | | | | 2027 | | | | 2028 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project management and testing** | | | | | | | | | | | | | | | | | | | |
| TDR | | | | | | | | | | | | | | | | | | | |
| Plan Review | | | | | | | | | | | | | | | | | | | |
| Prelim. Design Review | | | | | | | | | | | | | | | | | | | |
| SAT full solenoid | | | | | | | | | | | | | | | | | | | |
| **Conductor** | | | | | | | | | | | | | | | | | | | |
| Contract with external firm | | | | | | | | | | | | | | | | | | | |
| FDR conductor | | | | | | | | | | | | | | | | | | | |
| Production by exter. firm | | | | | | | | | | | | | | | | | | | |
| FAT conductor | | | | | | | | | | | | | | | | | | | |
| **Cryostat and cold mass** | | | | | | | | | | | | | | | | | | | |
| Cryostat design | | | | | | | | | | | | | | | | | | | |
| FDR cryostat | | | | | | | | | | | | | | | | | | | |
| Procurement & production | | | | | | | | | | | | | | | | | | | |
| FAT cryostat | | | | | | | | | | | | | | | | | | | |
| SAT cryostat | | | | | | | | | | | | | | | | | | | |
| **Control dewar and corresponding cryogenics** | | | | | | | | | | | | | | | | | | | |
| Dewar design | | | | | | | | | | | | | | | | | | | |
| Dewar vacuum equipment | | | | | | | | | | | | | | | | | | | |
| FDR cryostat | | | | | | | | | | | | | | | | | | | |
| FAT dewar | | | | | | | | | | | | | | | | | | | |
| SAT dewar | | | | | | | | | | | | | | | | | | | |
| **Electrical components** | | | | | | | | | | | | | | | | | | | |
| Contract elec. component | | | | | | | | | | | | | | | | | | | |
| FDR elec. component | | | | | | | | | | | | | | | | | | | |
| Procurement | | | | | | | | | | | | | | | | | | | |
| FAT elec. component | | | | | | | | | | | | | | | | | | | |
| **Magnet alarm safety system** | | | | | | | | | | | | | | | | | | | |
| FDR safety system | | | | | | | | | | | | | | | | | | | |
| Procurement | | | | | | | | | | | | | | | | | | | |
| FAT safety system | | | | | | | | | | | | | | | | | | | |
| **Coil winding** | | | | | | | | | | | | | | | | | | | |
| Design coil winding | | | | | | | | | | | | | | | | | | | |
| Tooling design | | | | | | | | | | | | | | | | | | | |
| FDR coil | | | | | | | | | | | | | | | | | | | |
| Procurement | | | | | | | | | | | | | | | | | | | |
| FAT coil winding | | | | | | | | | | | | | | | | | | | |
| Cold mass integration | | | | | | | | | | | | | | | | | | | |

*FDR - Final Design Review*
*FAT - Factory Acceptance Test*
*SAT - Site Acceptance Test*

** Transportation time is not taken into account*

# Developing the power structure of the yoke

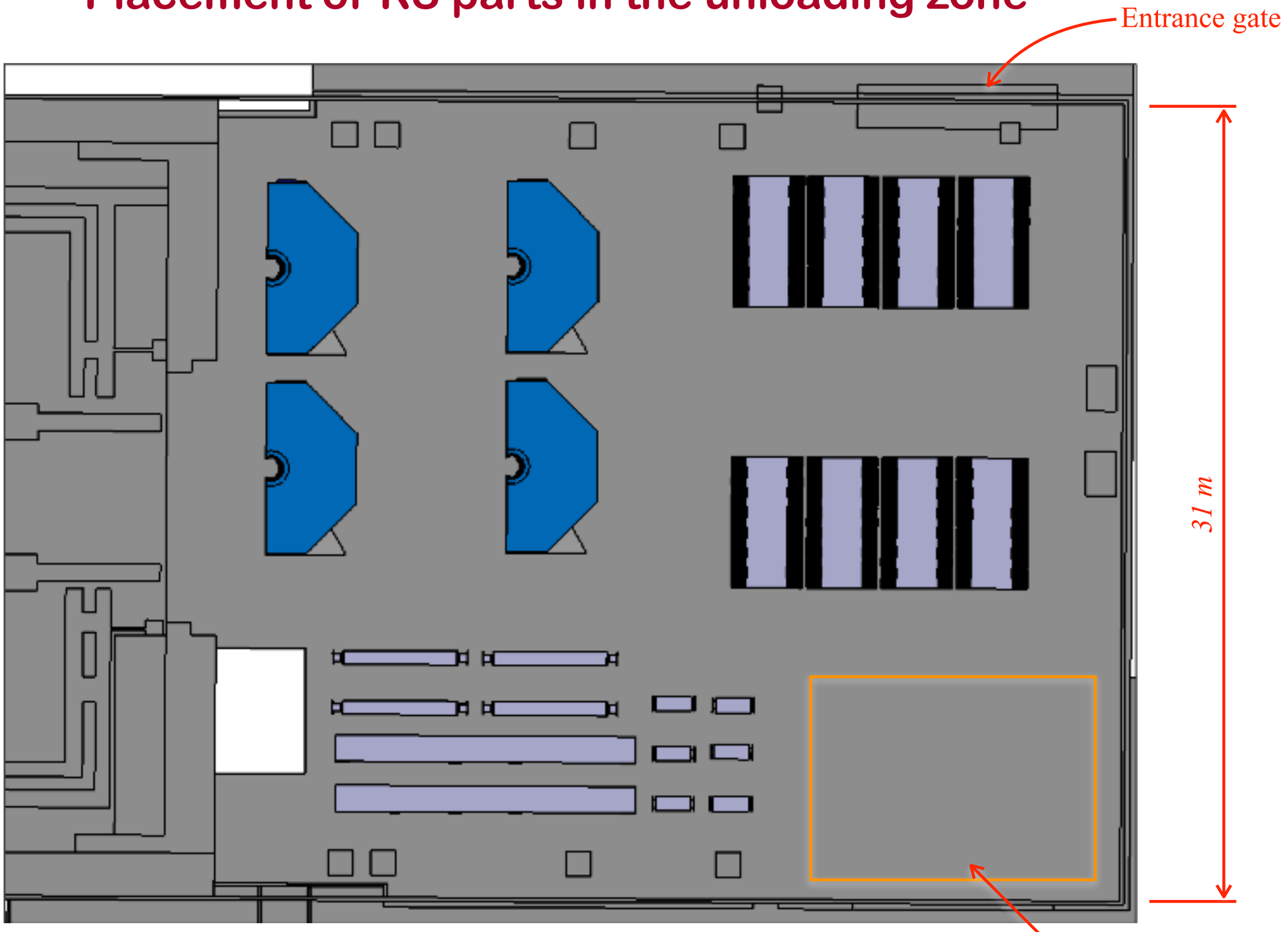
*S.Gerasimov*



- Since March, the appointed engineer S.Gerasimov from design department №2 of LHEP has been working on this topic
- Still missing some information on octant modules and doors from RS group
- Contacts to the manufacturer began at the beginning of this year

| | 2024 | | | | 2025 | | | | 2026 | | | | 2027 | | | | 2028 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3D model development | | | | | | | | | | | | | | | | | | | | |
| Preparation of design documentation | | | | | | | | | | | | | | | | | | | | |
| Supplier search, tender, contract signing | | | | | | | | | | | | | | | | | | | | |
| Production | | | | | | | | | | | | | | | | | | | | |
| Shipment to Dubna | | | | | | | | | | | | | | | | | | | | |
| Installation in SPD | | | | | | | | | | | | | | | | | | | | |

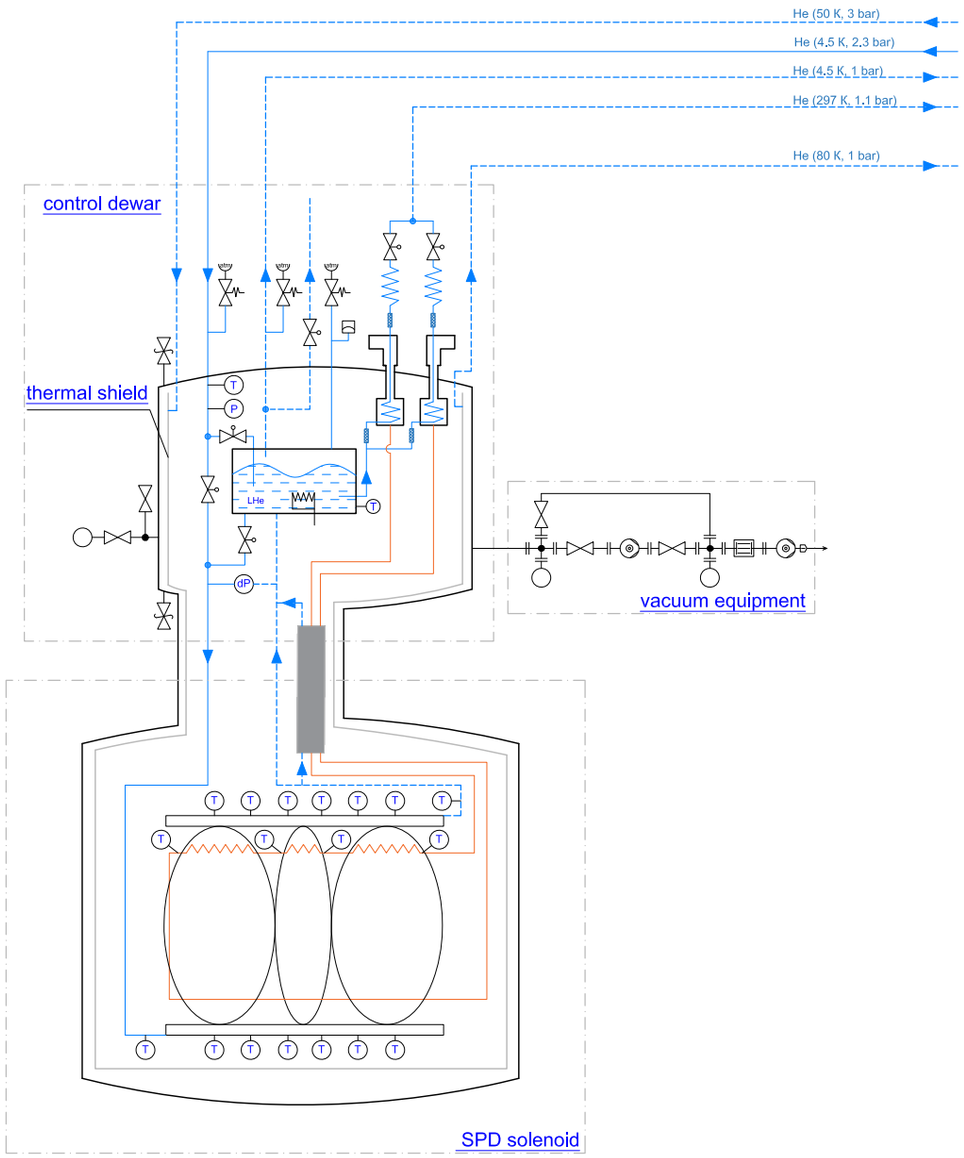
# Placement of RS parts in the unloading zone



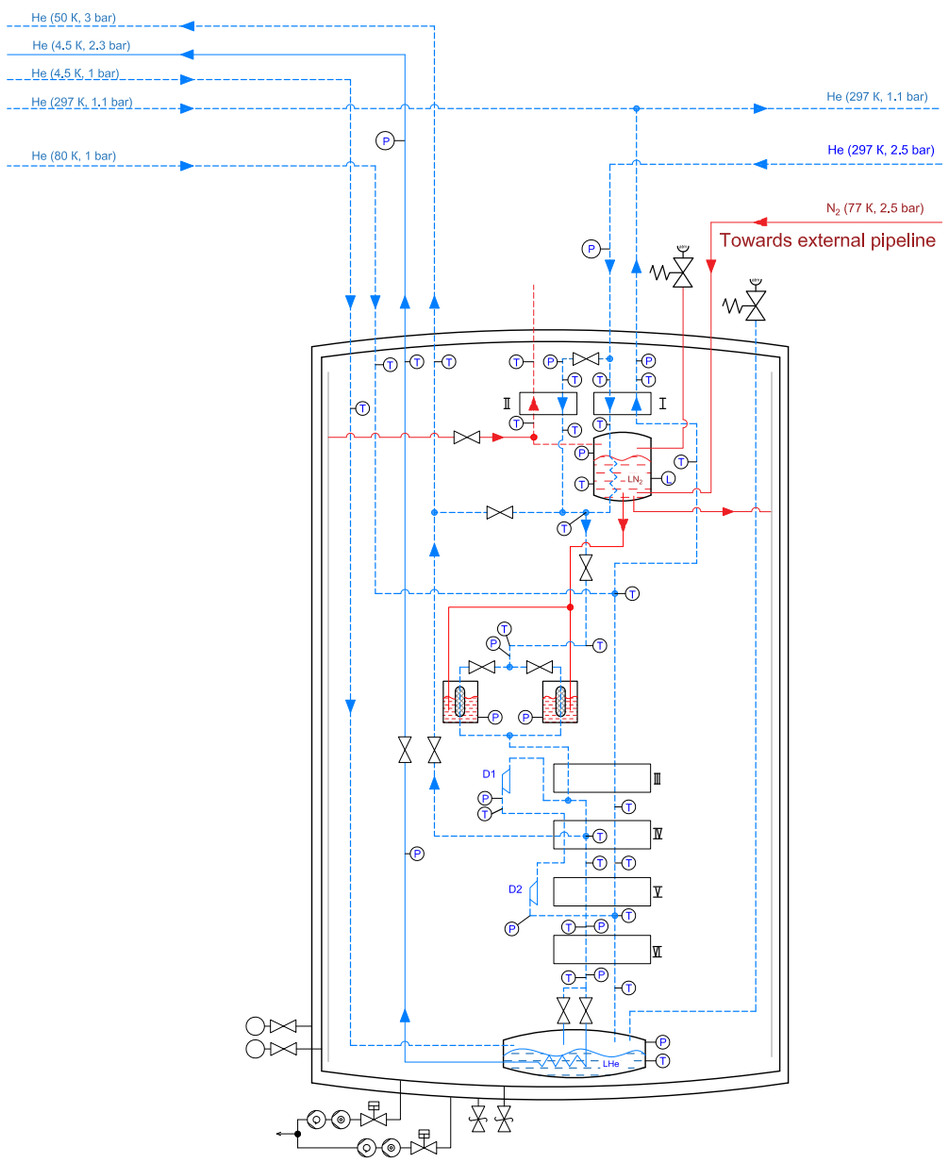
*D.Nikiforov*

# Helium supply cryogenic system

*Solenoid+Dewar, responsibility of BINP*

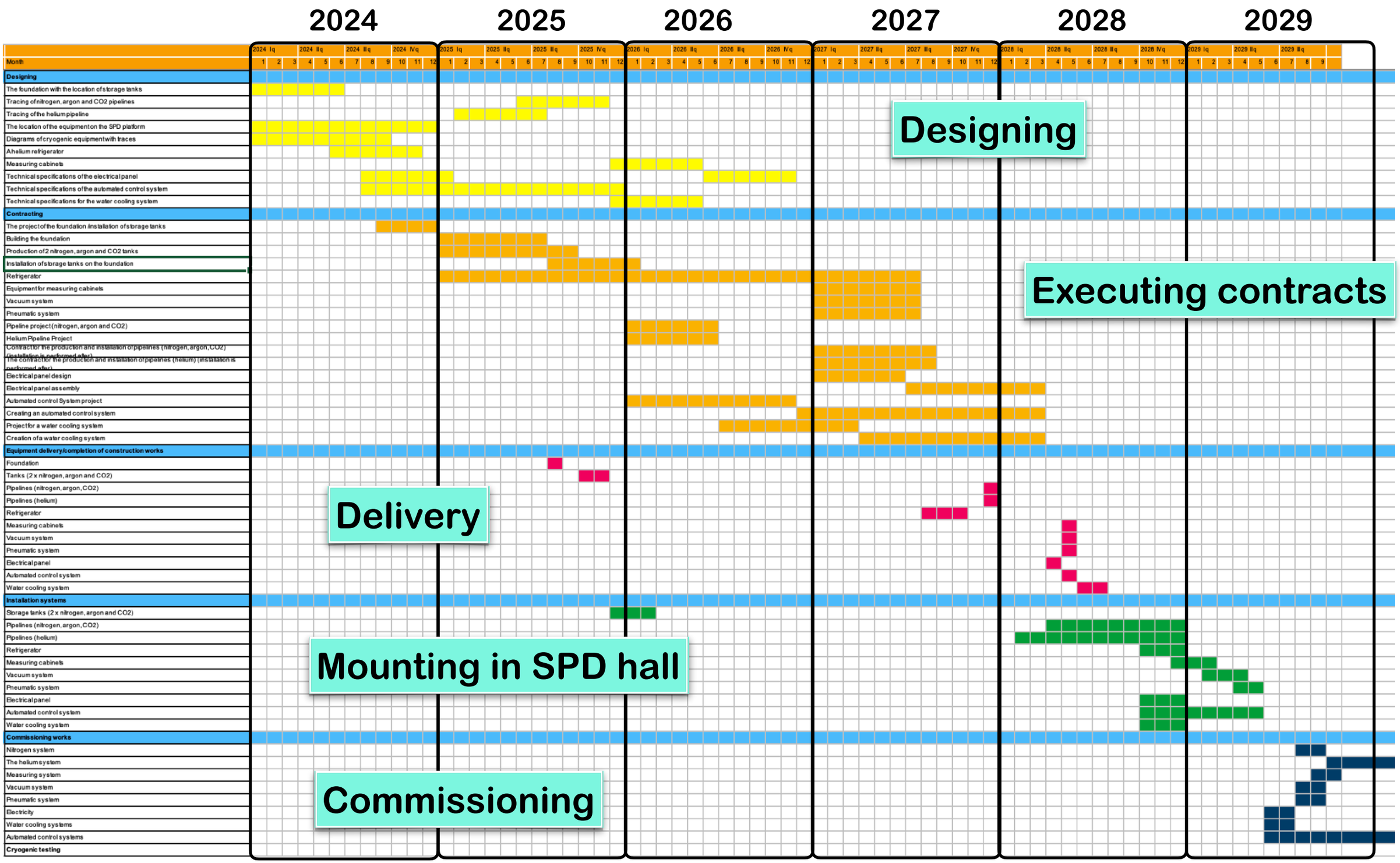



*Refrigerator (He liquefier), responsibility of JINR*



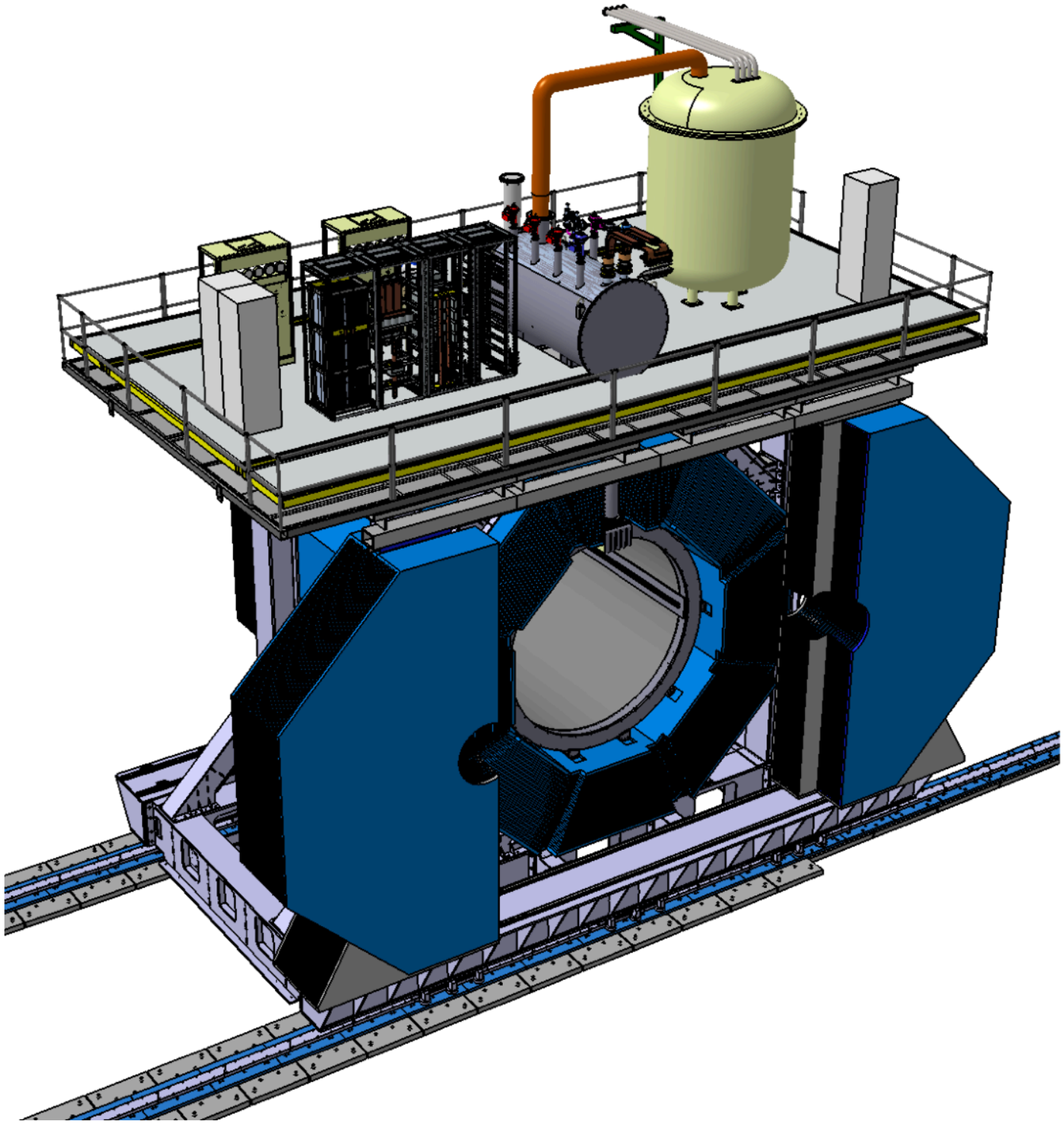

- Unlike the MPD, the liquid helium supply system SPD is planned to be designed as autonomous.
- Contract for design work will be signed next year. See talk of A.Ponamarev tomorrow.

# LHe cryogenic system, cryocomplex, pipelines




** Commissioning is only possible with the magnetic yoke installed.*

# SPD magnetic system



- According to present (optimistic) estimates:
  - Solenoid + Dewar ready in 2029
  - Magnet return yoke ready in 2028
  - He cryogenic system ready in 2029
  - Cryocomplex ready in 2026
- Commissioning in 2029-2030

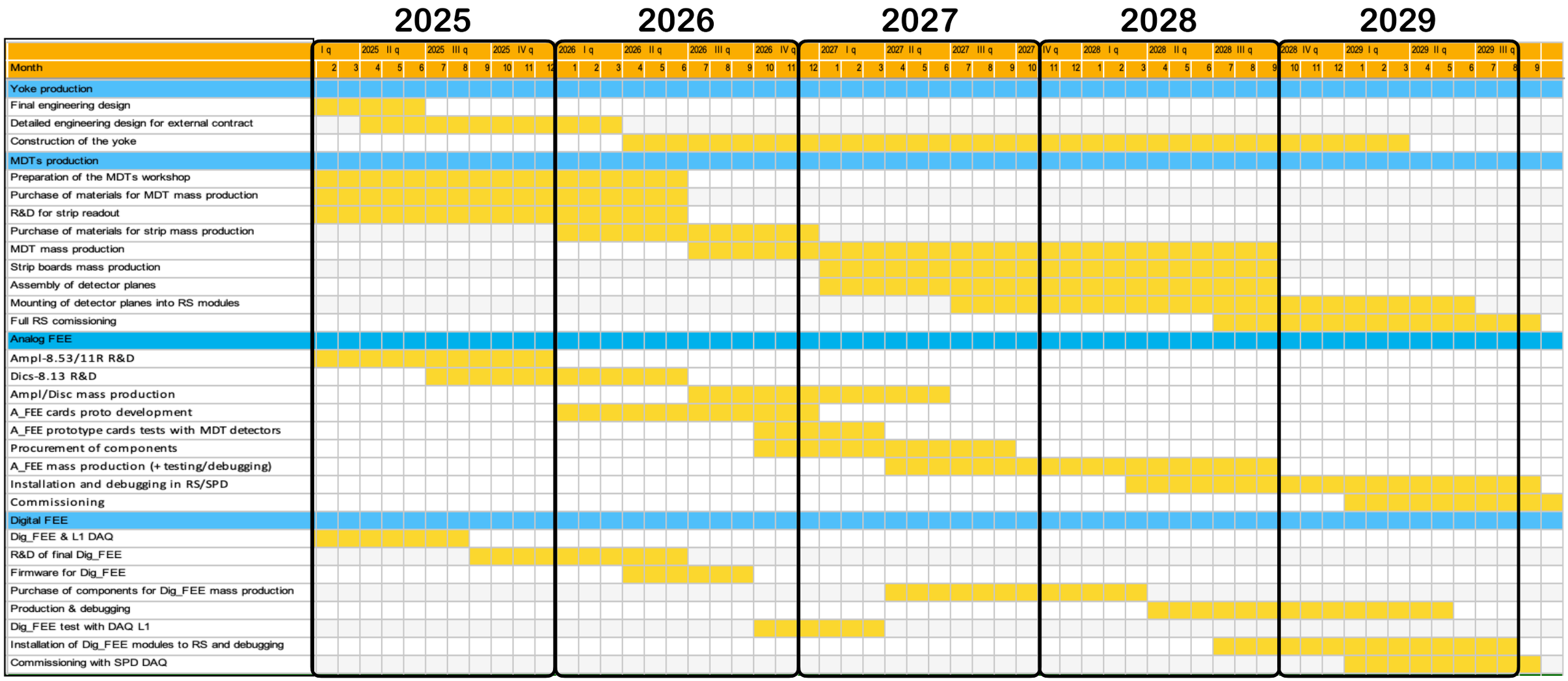
- Publication of the concept of the SPD magnetic system is being prepared. It will be submitted to the journal later this year.

Session on Wednesday morning

| | | |
|---|---|---|
| 10:00 | **Status of the SPD Solenoid Magnet Development** | *Sergey Pivovarov* 10:00 - 10:30 |
| | **Quench Analysis of the SPD Solenoid** | *Alexey Bragin* 10:30 - 10:50 |
| | **Control Dewar design** | *Tatiana Bedareva* 10:50 - 11:10 |
| 11:00 | **Cryogenic system** | *Mr Sergey Vizgalov* 11:10 - 11:30 |

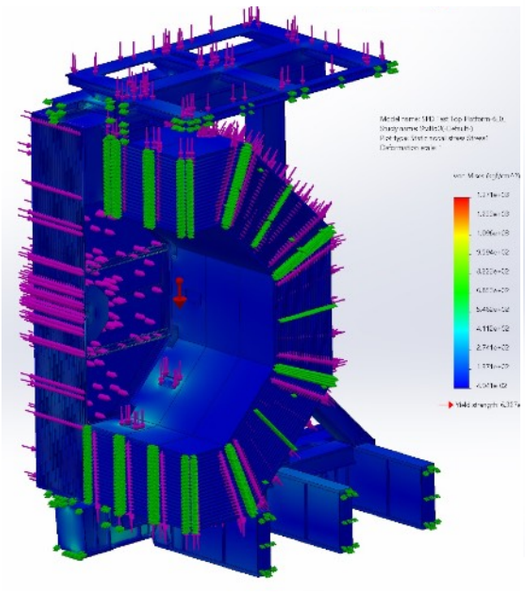
# Range (muon) System project

| **Project leader** | JINR: G.Alexeev |
|---|---|
| Magnet yoke design and MDT detecting planes assembling and mounting into slots of the yoke | JINR: A.Samartsev, E.Boltushkin, S.Kakurin, S.Gerasimov |
| Gas system (as part of DCS) | MSU: K.Korolev + 1 |
| Analog and digital electronics | JINR: N.Zhuravlev + 4<br>Minsk: M.Baturitsky + 3, A.Solin +1<br>MSU: A.Chepurnov, A.Nikolaev, A.Aynikeev + 3 |
| MDT detectors and strip boards production and assembling | JINR: V.Abazov, A.Piskun, S.Kutuzov, I.Prokhorov, Yu.Vertogradova |
| Software and analysis | JINR: A.Verkheev, L.Vertogradov. MEPhI: A.Osterov. |

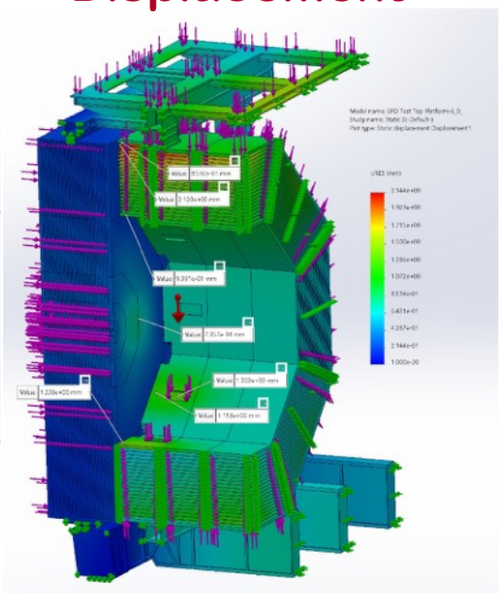


## Work is finalized on:

### Stress



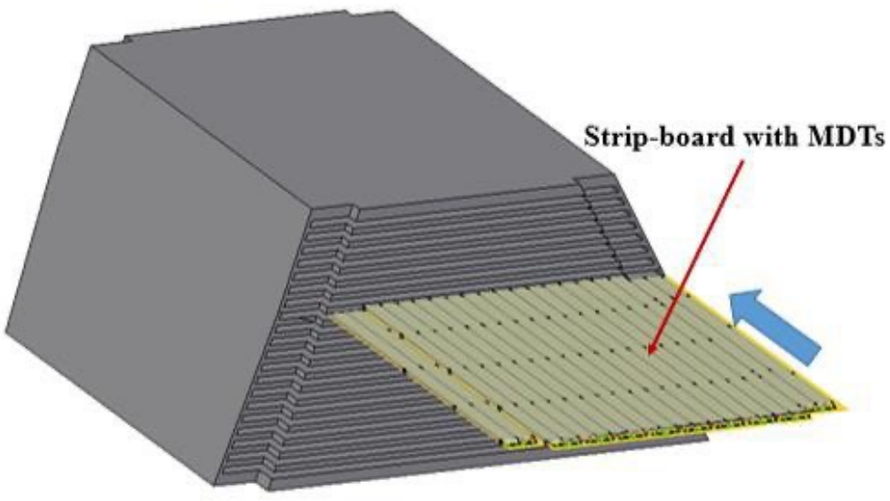
### Displacement

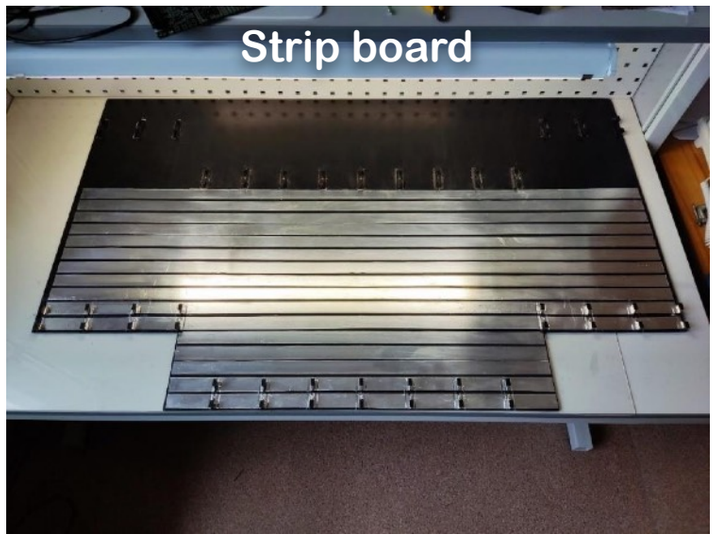


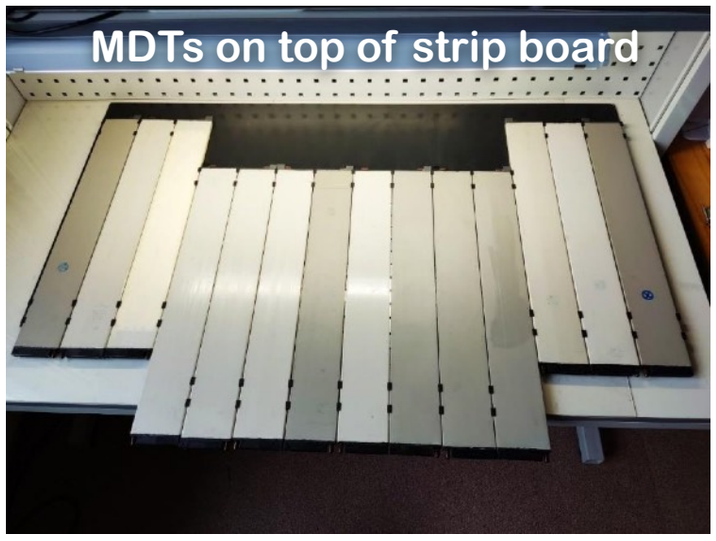
## Current RS group activities

- RS prototype is mounted in beam position on support/transportation system at Nuclotron test beam area
- Design of detecting plane (new strip board concept) is developing
- Amplifier chip (Ampl-8.53) preproduction at INTEGRAL (Minsk) is being monitored
- Currently working on establishing connection of RS prototype digital module with prototype L1/DAQ concentrator
- Preparations for deployment of equipment for MDTs mass production – area for tuning the equipment is found
- Participation in development of PID algorithms for pion-to-muon separation

## Mockup of detecting plane (MDTs, FEE cards, power distribution fiberglass board, cables) is assembled



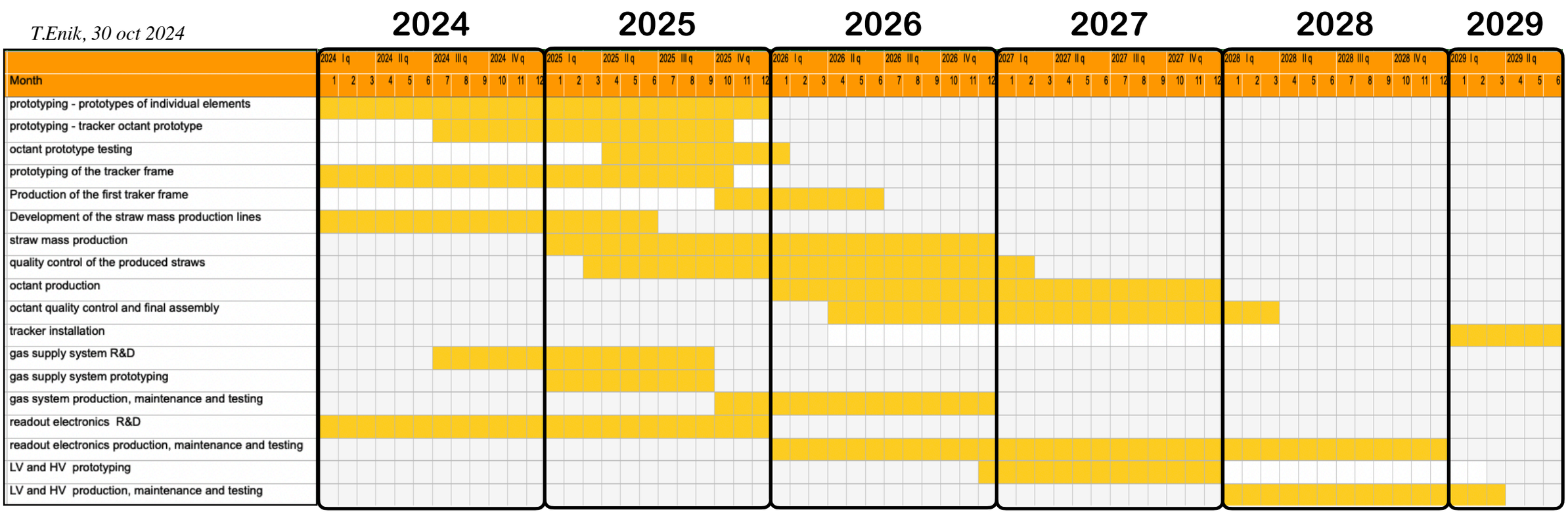



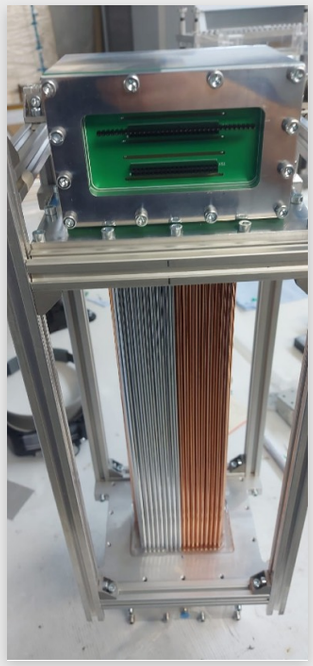
# Straw-barrel project

| | |
|---|---|
| Project leaders | **T.Enik (JINR)**, E.Kuznetsova (PNPI), Y.Mukhamejanov (JINR, INP). |
| Power frame and assembling procedure | JINR: K.Basharina, Y.Ershov, A.Salamatin, S.Sukhovarov. |
| Gas system | JINR: V.Perelygin, V.Karjavine, D.Kozlov. |
| Electronics | JINR: V.Bautin, M.Buryakov, N.Gorbunov, A.Golunov, V.Karjavine, S.Kochepasov, O.Minko, K.Salamatin<br>BSU: A.Solin, A.Solin. |
| Tube production and assembling | JINR: Y.Kambar, S.Romakhov, A.Rymshina.<br>INP: O.Kalikulov, N.Yerezhep, S.Shinbulatov, Sh.Utei, A.Baktoraz, S.Adilkhan |
| Software and analysis | JINR: R.Akhunzyanov, A.Chukanov, A.Lapkin, A.Mukhamejanova (JINR, INP), D.Myktybekov (JINR, INP), O.Samoylov, D.Baigarashev (JINR, INP), D.Kereibay (JINR, INP)<br>PNPI: S.Bulanova, E.Mosolova, D.Sosnov, A.Zelenov. |

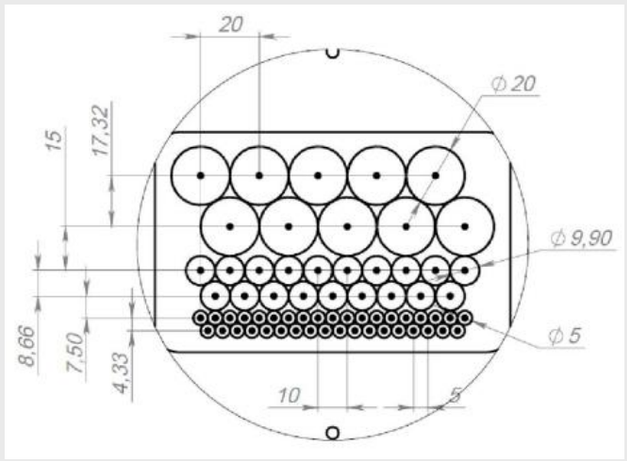
*T.Enik, 30 oct 2024*

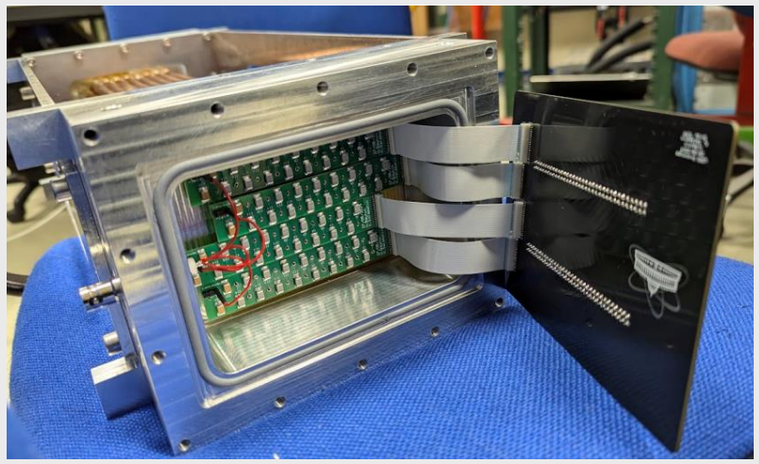


# Progress on Straw-barrel



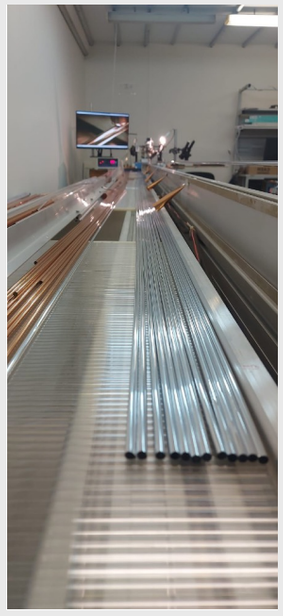
## Multiple beam-tests in CERN to check various configurations of straw and electronics

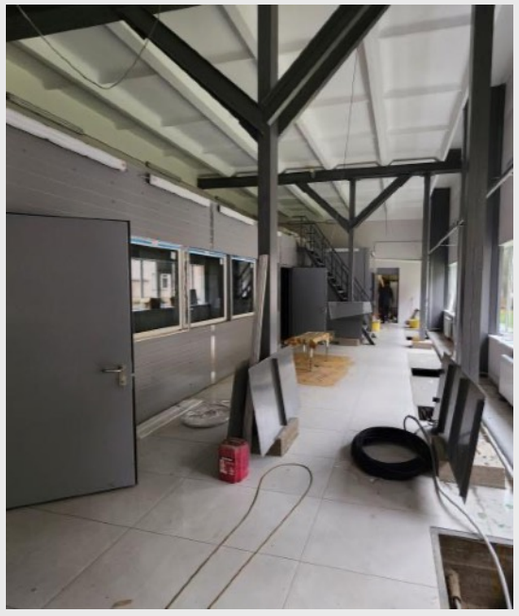


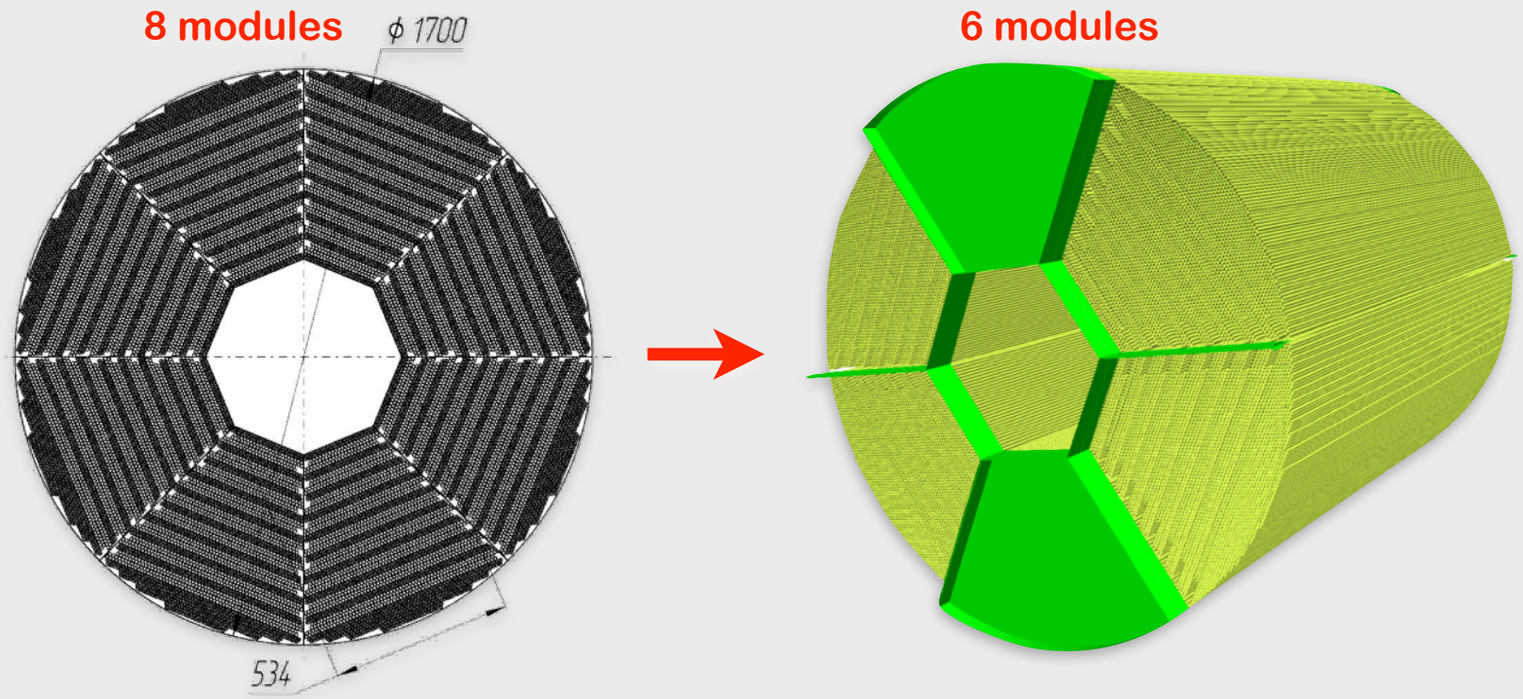
## Production line and assembling place

- Area ~200 m², clean room ~100 m²
- Production line length ~12 m
- Completion date: end of 2024
- Commissioning works begins in early 2025
- All necessary materials and equipment have been purchased
- Straw production speed ~1 m/min



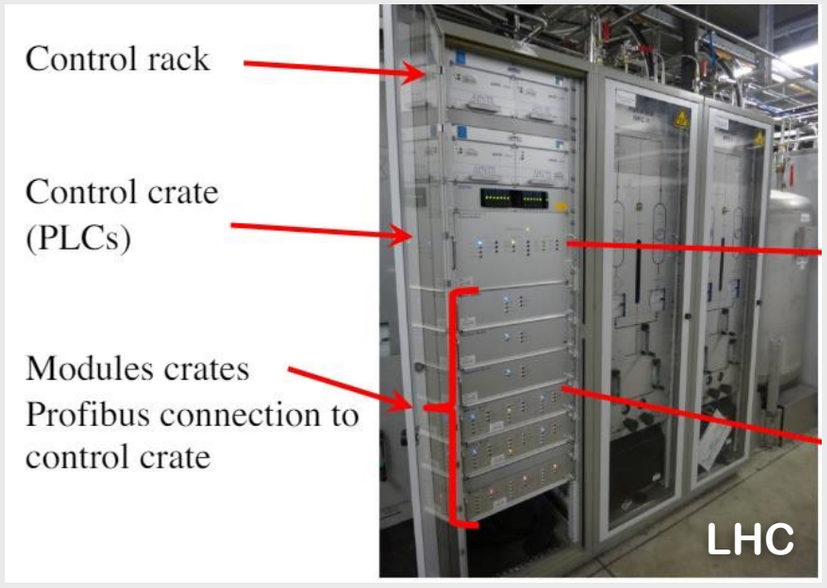


# Issues that have to be solved




- Octants are changed to sextants, as it is in the straw detector of PANDA (better packing factor?)
- Radial ribs can be omitted
- Still, the assembling procedure is missing
- It will be very useful to make a real-size mockup (~4k channels) with shorter tubes

- Gas system suitable for operating a large size detector to be developed
- Regulation of the differential pressure and composition of the mixture while monitoring its temperature, oxygen and water vapor contents.
- This can be a serious problem, since many components have to be ordered from abroad




*G.Kekelidze*
*V.Kramorenko*

# Progress on Straw-endcap

**Small scale prototype, ∅=1 m**

- The purpose of building the prototype with 80 tubes and aluminum frame is to test the assembly technology:
  1. stretching straws before gluing them to the frame
  2. keep straws in a humid environment before gluing
- Behaviours of the tubes will be studied throughout the year in order to choose the best technology

**Full scale prototype, ∅=1.6 m**

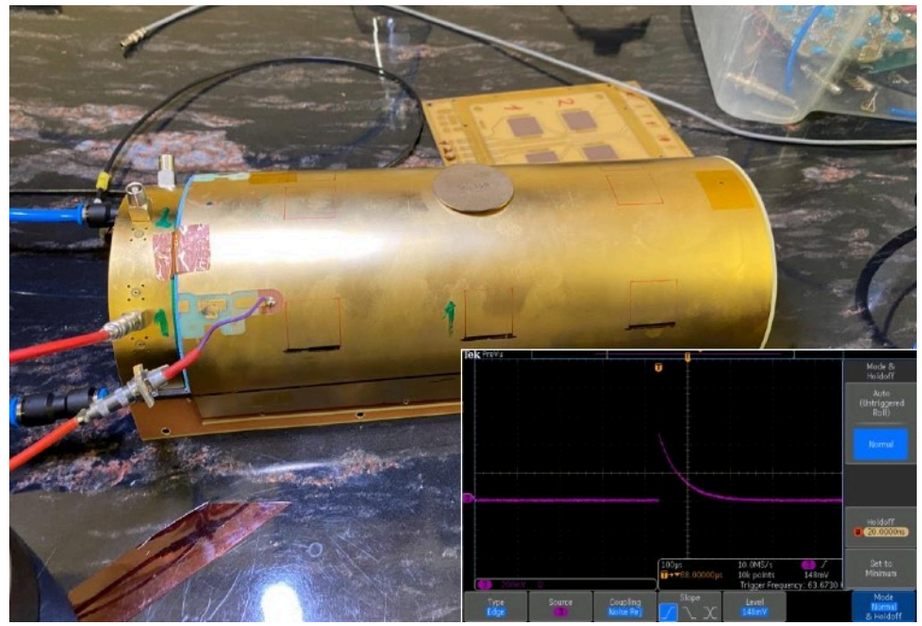
- Fiberglass frame of full size with mounted lodgements for tubes will be delivered by the end of this year
- Electronics, plugs, pins, films have been ordered and are being produced.

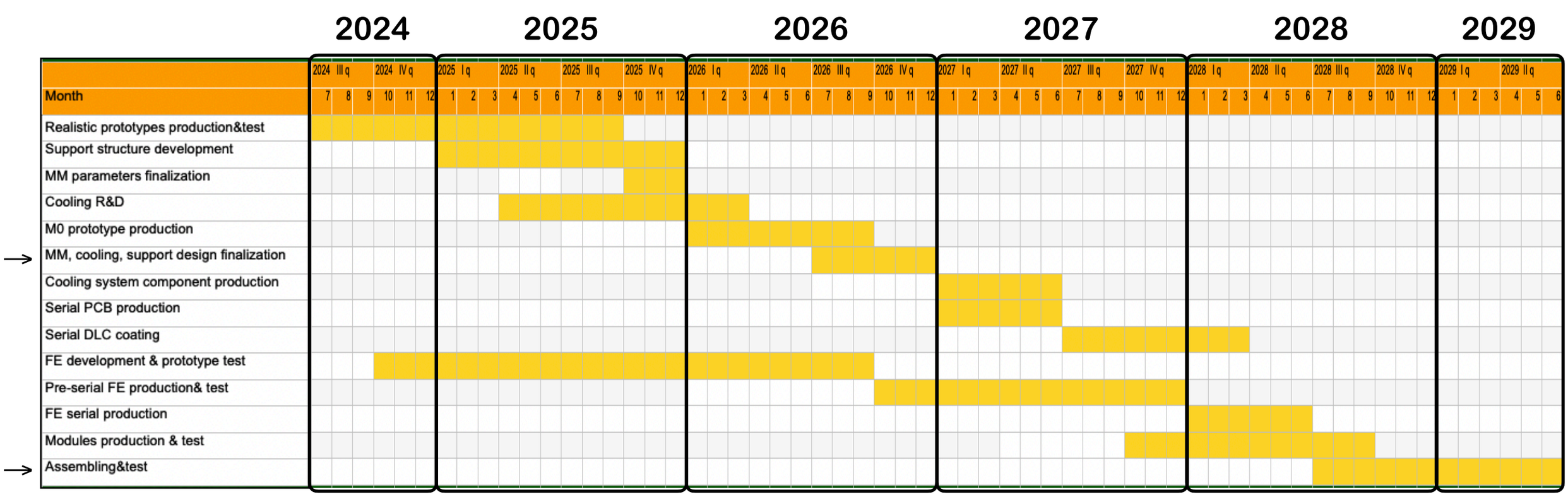
| | 2024 | | | 2024 | | | 2025 | | | 2025 | | | 2025 | | | 2025 | | | 2026 | | | 2026 | | | 2026 | | | 2026 | | | 2027 | | | 2027 | | | 2027 | | | 2027 | | | 2028 | | | 2028 | | | 2028 | | | 2028 | | | 2029 | | | 2029 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | III q | | | IV q | | | I q | | | II q | | | III q | | | IV q | | | I q | | | II q | | | III q | | | IV q | | | I q | | | II q | | | III q | | | IV q | | | I q | | | II q | | | III q | | | IV q | | | I q | | | II q | | |
| | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| End-plug production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pin production (12 000 pcs.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Purchase of polyimide film 40 kg | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Polyimide film processing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production of 2 1-meter prototypes (no FEE) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Development of FFE for full-scale prototype | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production of frame for full-scale prototype | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Изготовление строу 6000 x 2,5 м | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production of full-scale prototype | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Update of technical documantation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Production of the detector frames | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Development of technological tools | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fabrication of technological tools | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Detector mass production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frame assembling | | | | | | | | | | | | | | | | | | | | 1 | | 2 | | 3 | | 4 | | 5 | | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | | 12 | | 13 | | 14 | | 15 | | 16 | | | | | | | |
| Straw installation to the frame | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Straw cutting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Installation of spacers to wires | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Installation of wires into detector | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gluing of end plugs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Connection to the gas system | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| leak test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Installation of FEE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Soldering of chambers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fe-55 test of chambers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chambers full testing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FEE development and production | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Assembling of chambers into blocks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

# MicroMeGaS-based central tracker

| | |
|---|---|
| **Project leader** | JINR: D.Dedovich |
| Micromegas detector production | JINR: A.Gongadze, I.Liashko, N.Koviazina |
| Micromegas PCB development | JINR: U.Kruchenak |
| Detector simulation | JINR: N.Koviazina |
| Software and analysis | JINR: D.Dedovich, N.Koviazina |
| FE electronic | JINR: A.Boikov, Svetlana Tereshchenko |
| ASIC sertification | TSU:  S.Filimonov +3 |

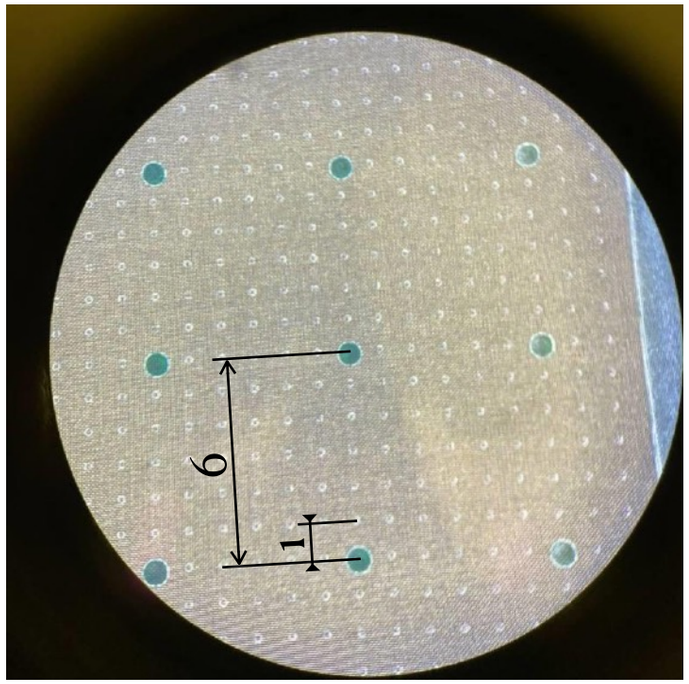
*First prototype of cylindrical MM chamber (early 2024)*

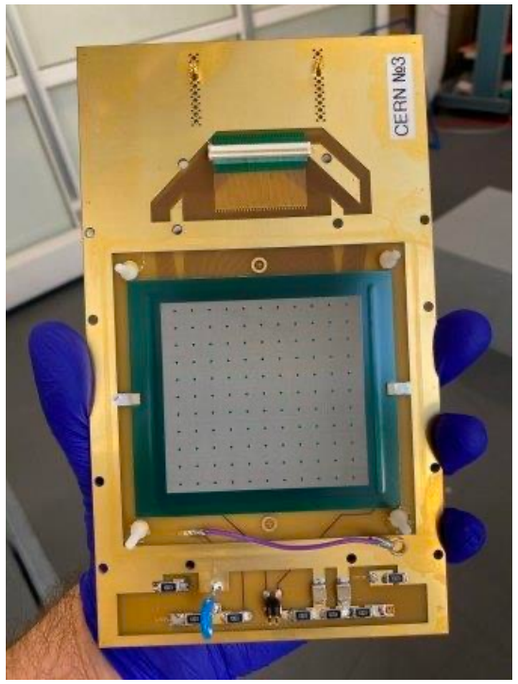


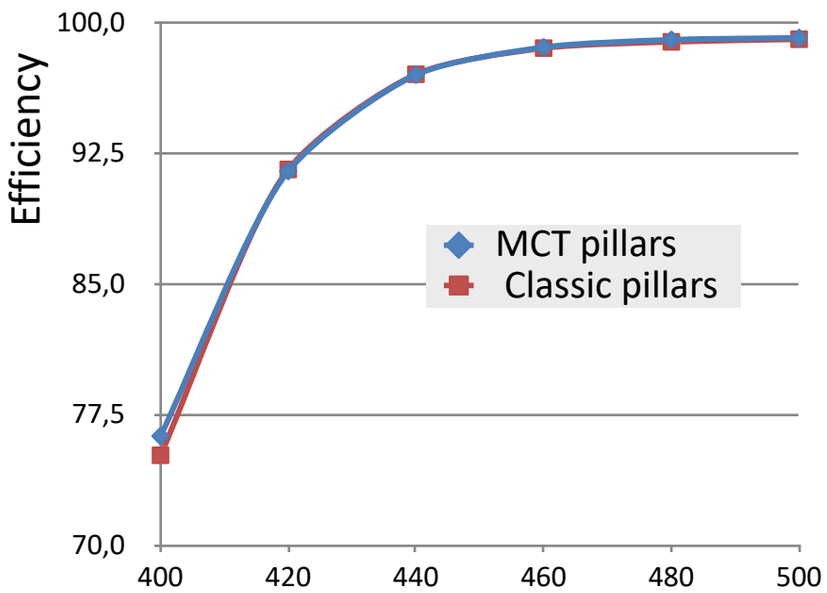


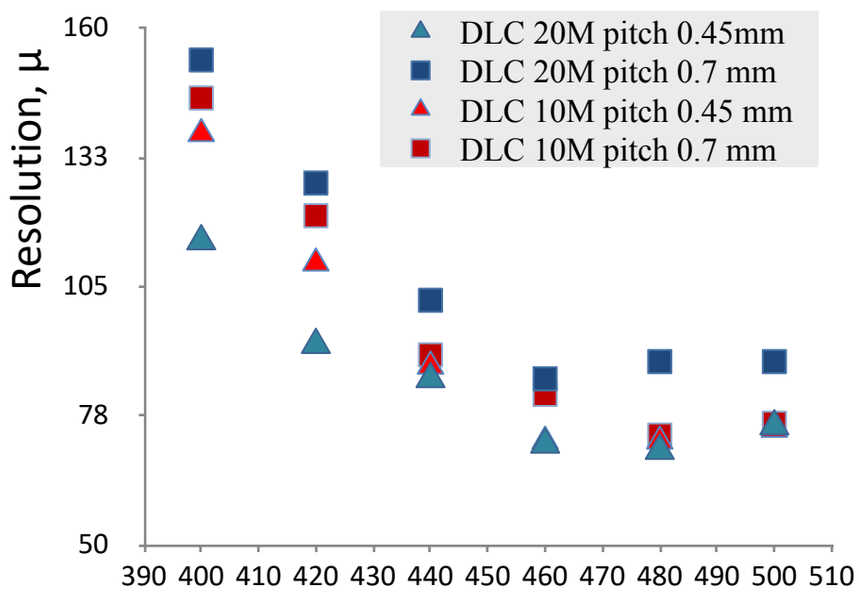
# MicroMeGaS prototype results obtained in PS/T9

- First experience of using prototype with multichannel electronics: efficiency, coordinate resolution, real noise, homogeneity of properties, cluster size, etc.
- Study of the influence of pillar geometry on efficiency and resolution
- Study of the effect of strip pitch and DLC coating resistance on resolution: 2 pitch options and 2 DLC coating options



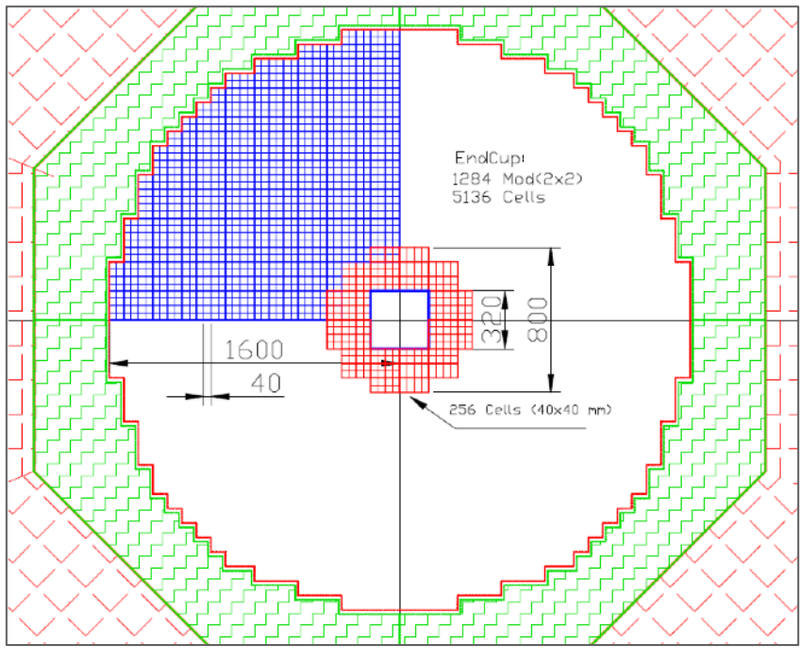




- Intrinsic efficiency and resolution of Dubna MM chambers are excellent
- 1 mm pitch pillar structure does not compromise MM efficiency and resolution

*LHEP team of O.Gavrishchuk*
*LNP team (participants TBC)*

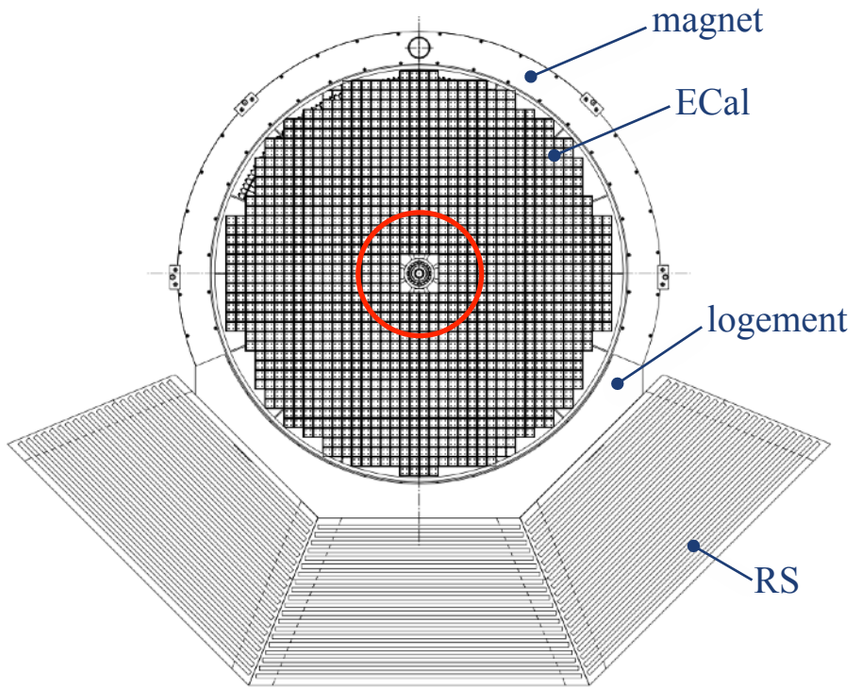
# Progress on ECal (1-st stage, 256 cells)




This Figure shows in red 64 modules, consisting of 4 cells each. The weight of this assembly is 597 kg. This will require 130 kg of polystyrene, 465 kg of lead, as well as additives: 1.95 kg of P-terphenyl and 65 g. POPOP, and 2000 meters WLS fiber type Y-11.

**It is 1/20 part of end-cap and taken time of 36 Days to prepared 51200 scintillator plates.**

To read this setup, we need four ADC64 - 64-channel amplitude encoders, as well as 16 boards of 16-channel amplifiers and bias voltage regulators.

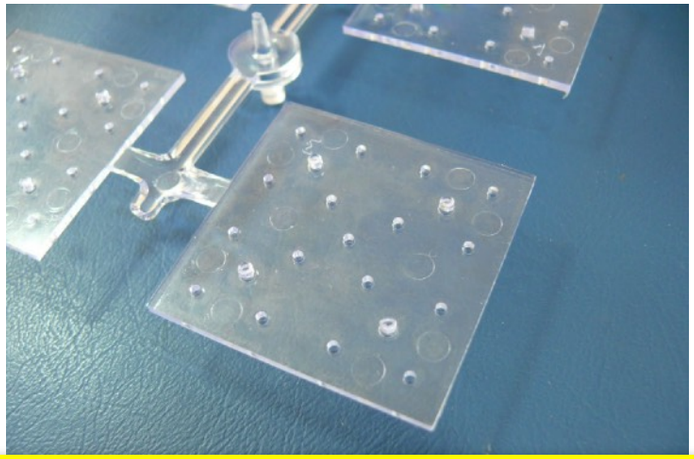



**Estimate for endcaps only, O.Gavrishchuk*

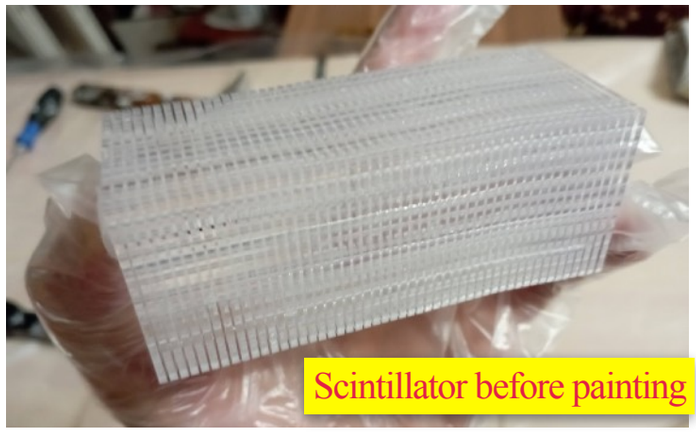
| Year: 20++ | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Power frame | | | | | | | | | | |
| Design Frame | | | | | | | | | | | |
| Frame production | | | | | | | | | | | |
| | Electronics | | | | | | | | | | |
| ADC R&D | | | | | | | | | | | |
| ADC Production | | | | | | | | | | | |
| ADC Cooling | | | | | | | | | | | |
| Slow Control | | | | | | | | | | | |
| | ECal module production | | | | | | | | | | |
| WLS purchase | | | | | | | | | | | |
| MPPC purchase | | | | | | | | | | | |
| Modules R&D | | | | | | | | | | | |
| Scintillator.Product. | | | | | | | | | | | |
| Lead Abs. Production | | | | | | | | | | | |
| Mod. Assembling | | | | | | | | | | | |
| Modules Testig | | | | | | | | | | | |
| ECAL installation | | | | | | | | | | | |
| Comissioning | | | | | | | | | | | |

*O.Gavrishchuk*

# Progress on ECal (endcaps, 1-st stage)

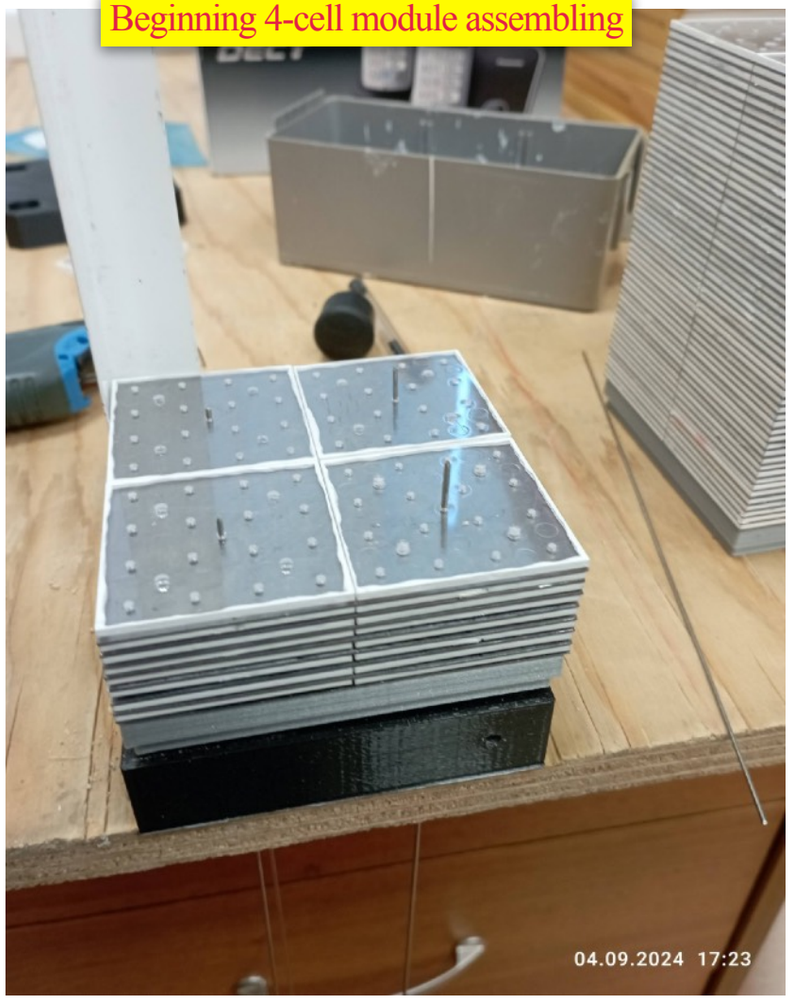


4 scintillator plates after injection molding machine



Scintillator before painting

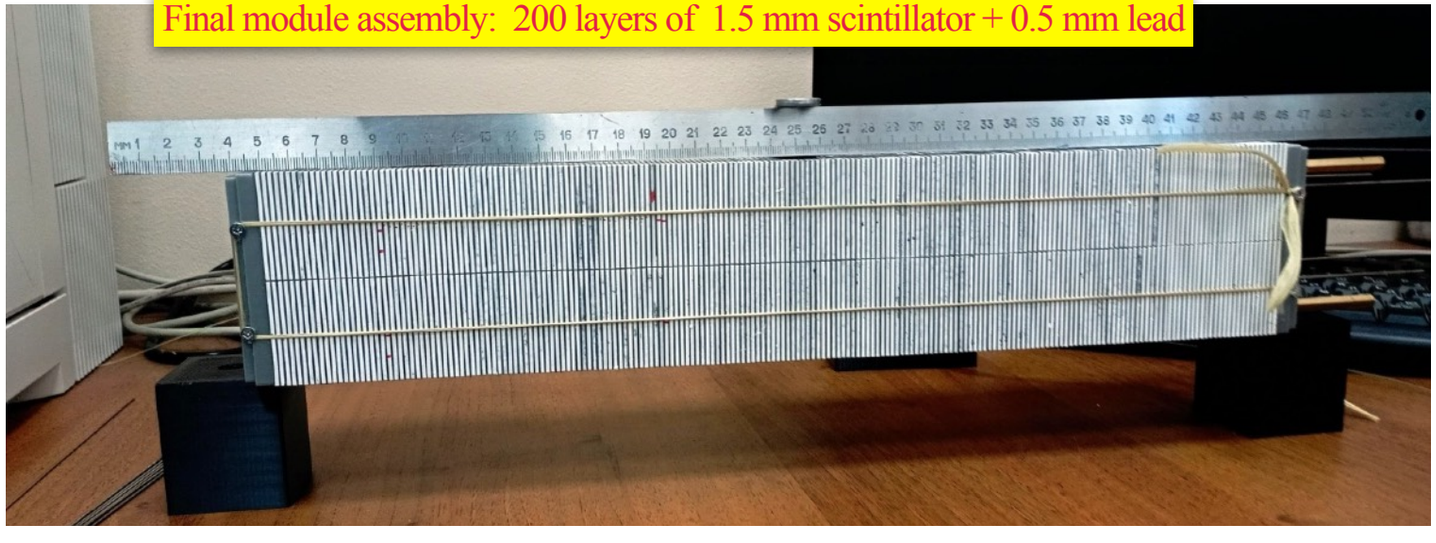
Beginning 4-cell module assembling




Lead plates (80×80 mm²) will be stamped in Vladimir


Scintillators painting in bld 205

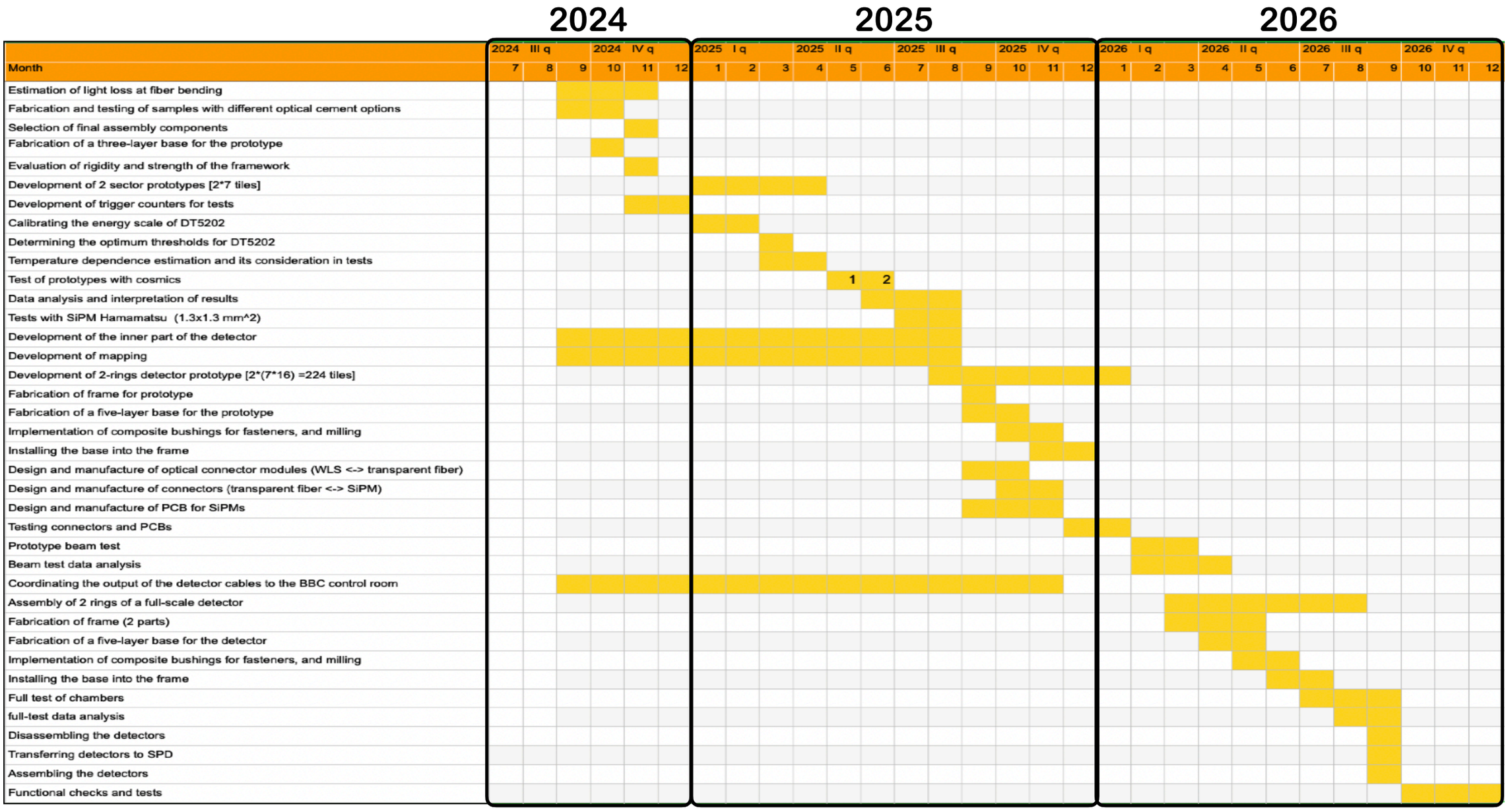

Final module assembly: 200 layers of 1.5 mm scintillator + 0.5 mm lead



# Beam-Beam-Counter (BBC) project

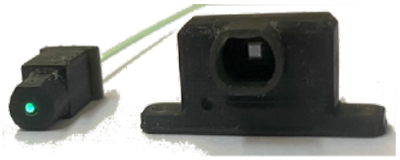
| | |
|---|---|
| **Project leader** | V.Ladygin (JINR) |
| **Deputy** | P.Teterin (MEPhI) |
| Manufacture, tests, assembling | MEPhI: A.Zakharov, Ph.Dubinin, P.Teterin<br>JINR: Yu.Gurchin, A.Tishevsky, A.Livanov |
| FERS5200 based FEE&DIGI&DAQ (Phase0) | JINR: A.Isupov, S.Reznikov, I.Volkov |

| | |
|---|---|
| FEE, FPGA based TDC design and tests | MEPhI: P.Nekrasov, A.Melekesov<br>JINR: A.Isupov, S.Reznikov, A.Tishevsky, I.Volkov |
| BBC interface to SPD DAQ | JINR: A.Isupov |
| Express off-line and data analysis | JINR: I.Volkov, K.Volkova<br>MEPhI: E.Soldatov |
| Simulation | JINR: A.Terekhin, K.Volkova<br>MEPhI: A.Durov, A.Levkov, E.Soldatov |

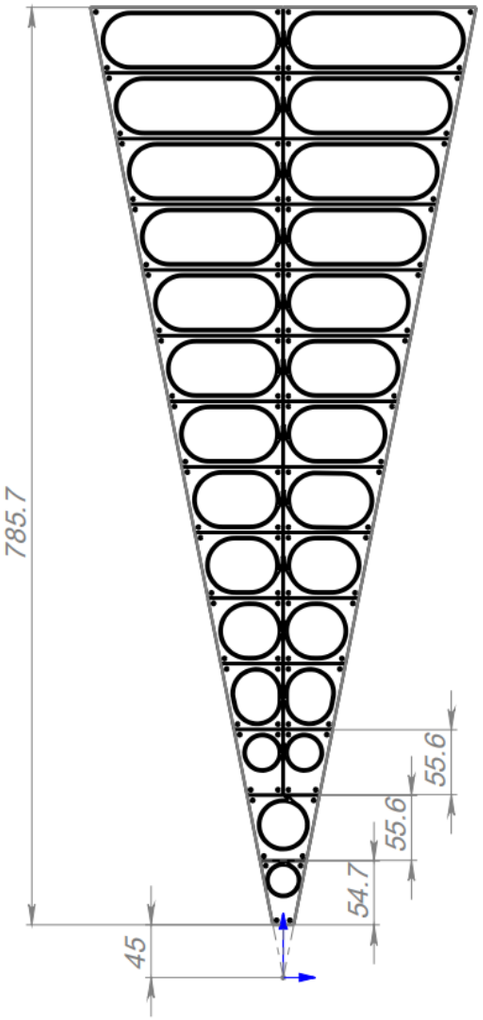


*A.Tishevsky*

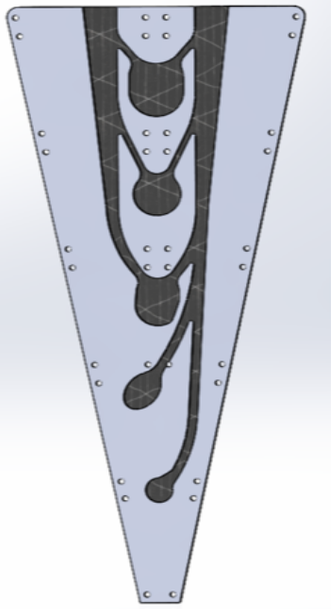
# Progress on BBC prototyping



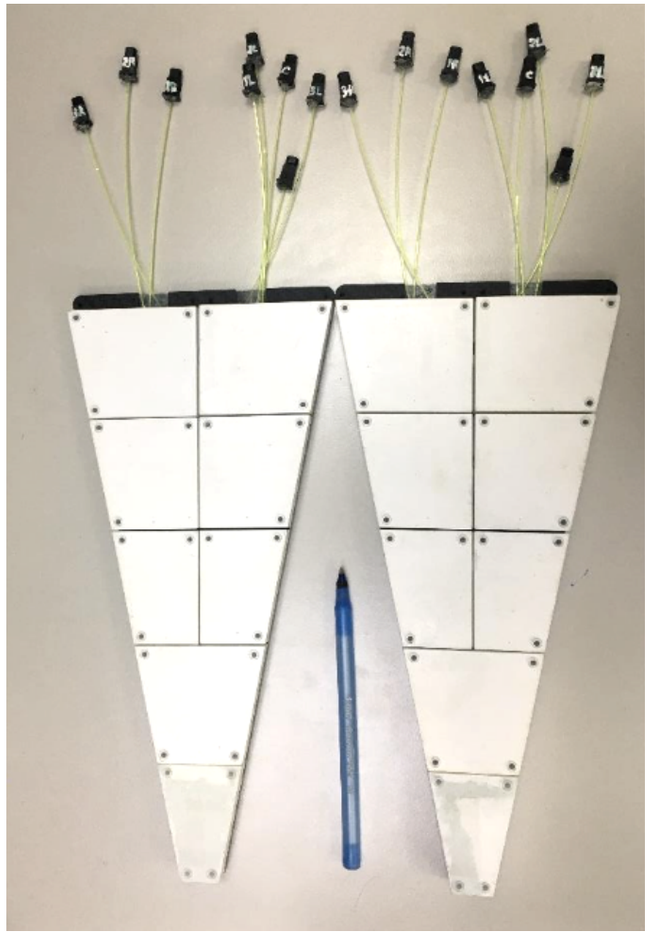
WLS-SiPM test connector couple



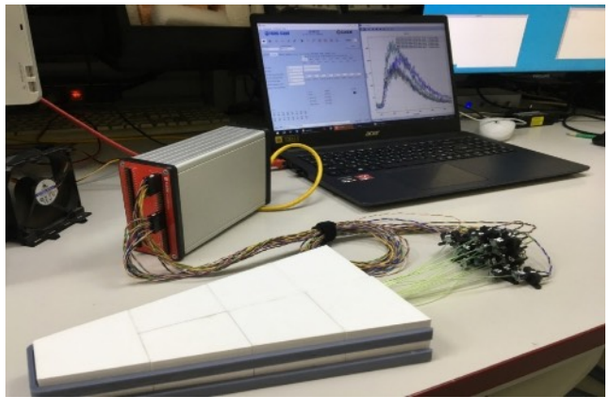

BBC Sector (1/16 of wheel) design



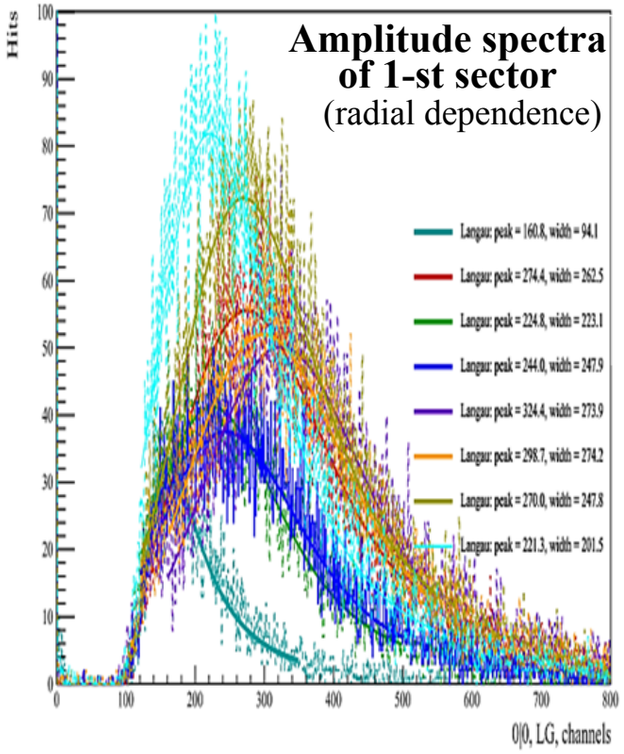
Grooved carbon fiber backplate v1 prototype and updated design



2 × reduced sector prototype

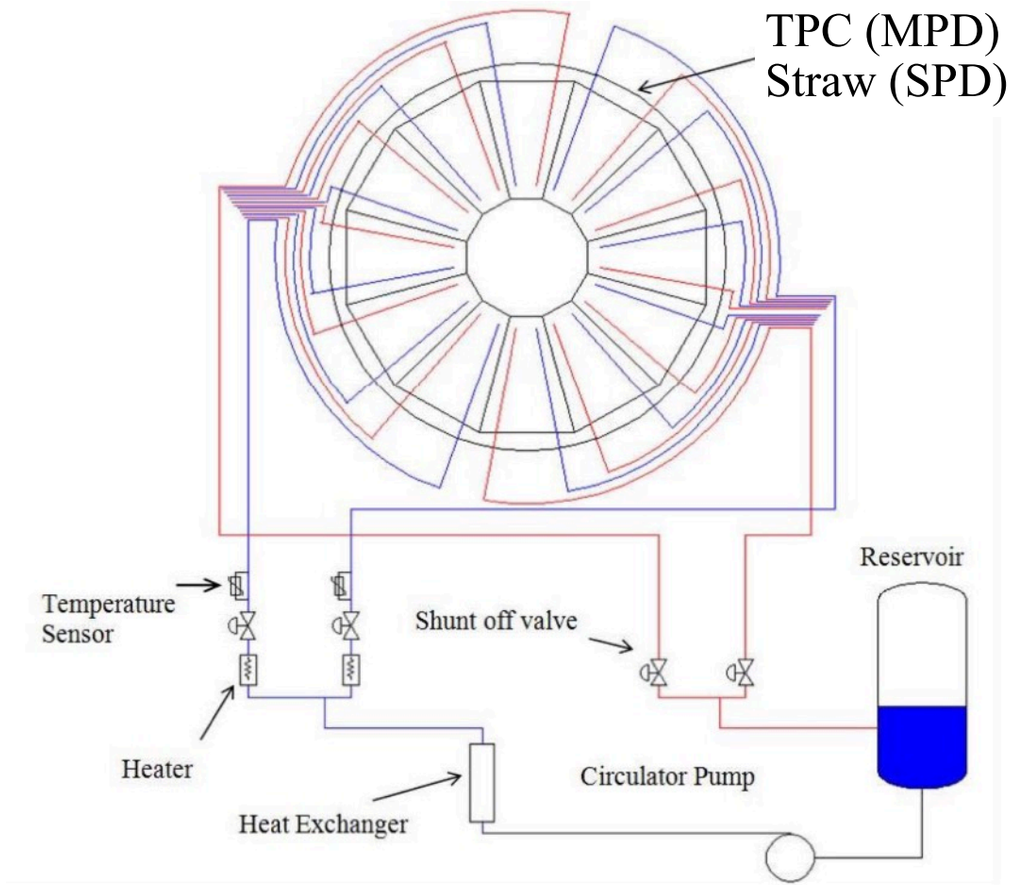


Prototypes test with CAEN FERS-5200



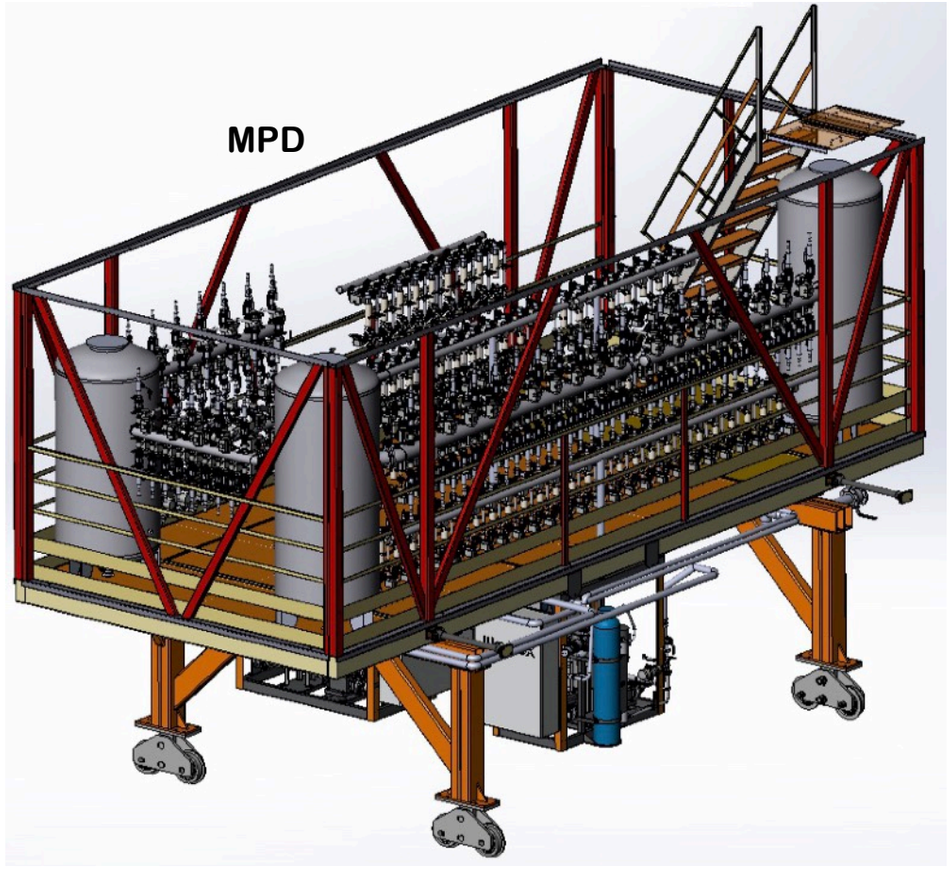

- Currently we have in hands 2 small sector prototypes of 8 tiles with CKTN B and SG BCF92 fiber assembled on carbon fiber backplate
- We plan to produce a full wheel with reduced sectors in the middle of 2025

# Detector cooling system



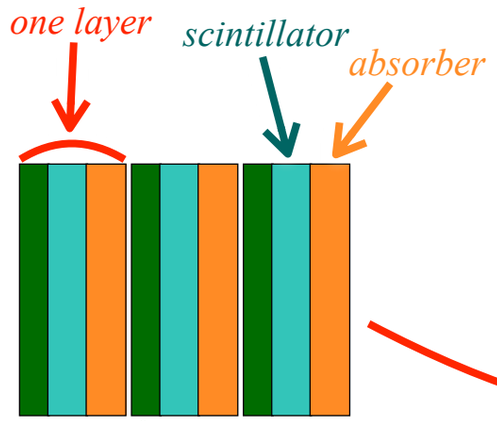

- Goal is to ensure cooling of the electronics and thermal stabilization of the working volume of gas.
- Leakless regime of operation: absolute pressure in pipes lower then 1 atm.
- Next year we plan to start working with the INP BSU team (A.Fedotov, I.Zur and others), which is charge of the MPD cooling system.
- Advantage of a later commissioned SPD is the ability to eliminate weak points in the MPD design.

- Water tanks, manifolds, pump modules to be installed on a platform, on the opposite side from the electronics one
- Design of supporting platforms (for electronics and water cooling) will begin after magnet design is completed.

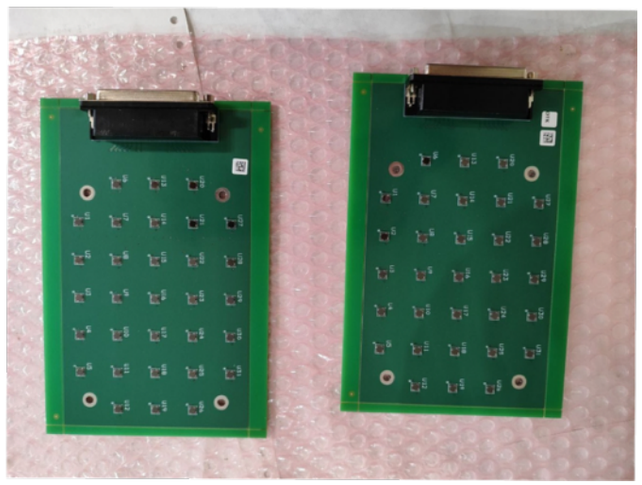


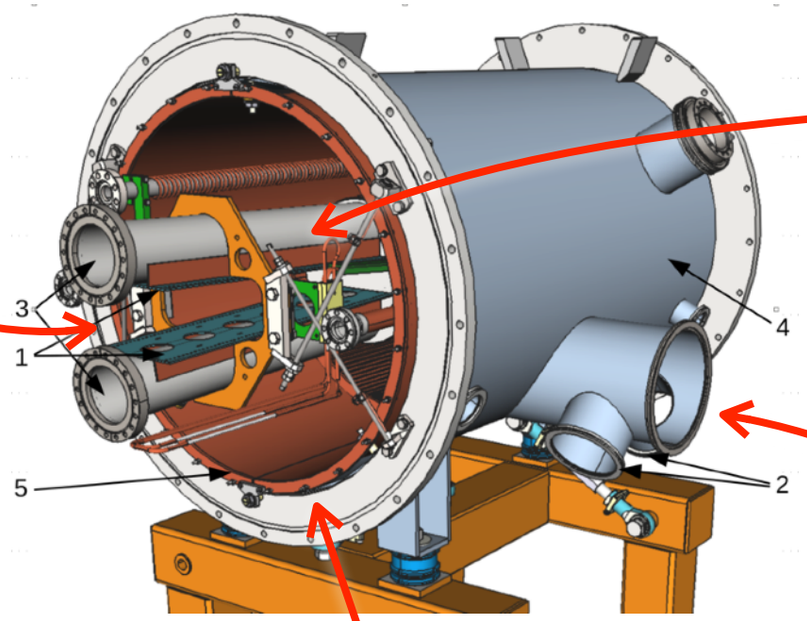
*ITEP: I.Alekseev +4*
*JINR: S.Shimanskiy, V.Poliakov*

# Progress in developing the ZDC detector

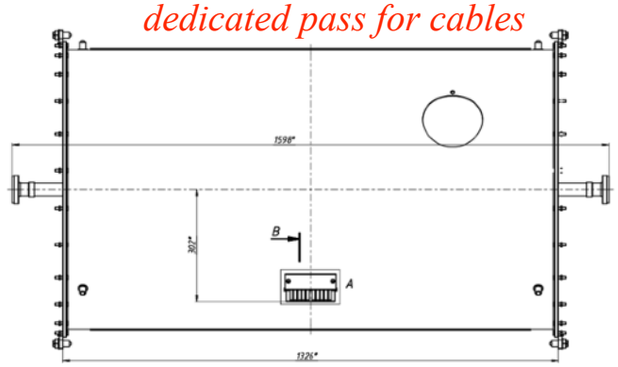



*31-SiPM boards*

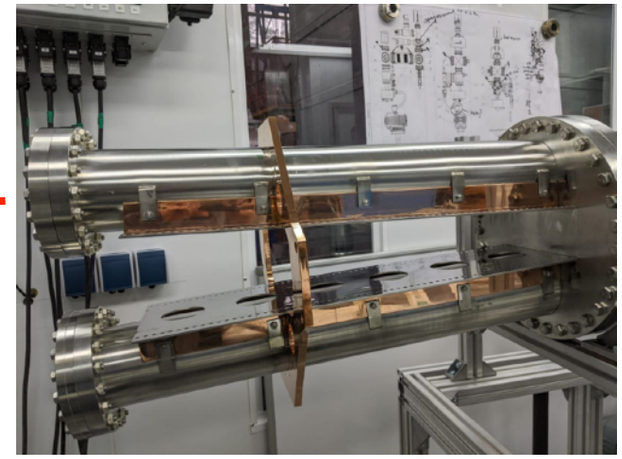




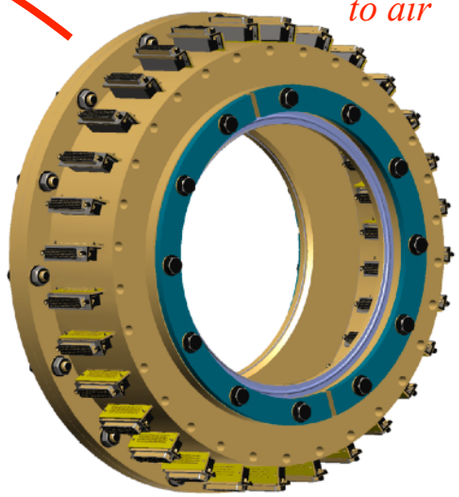

*Thermal screen with a dedicated pass for cables*



*Y-chamber with a table for ZDC*



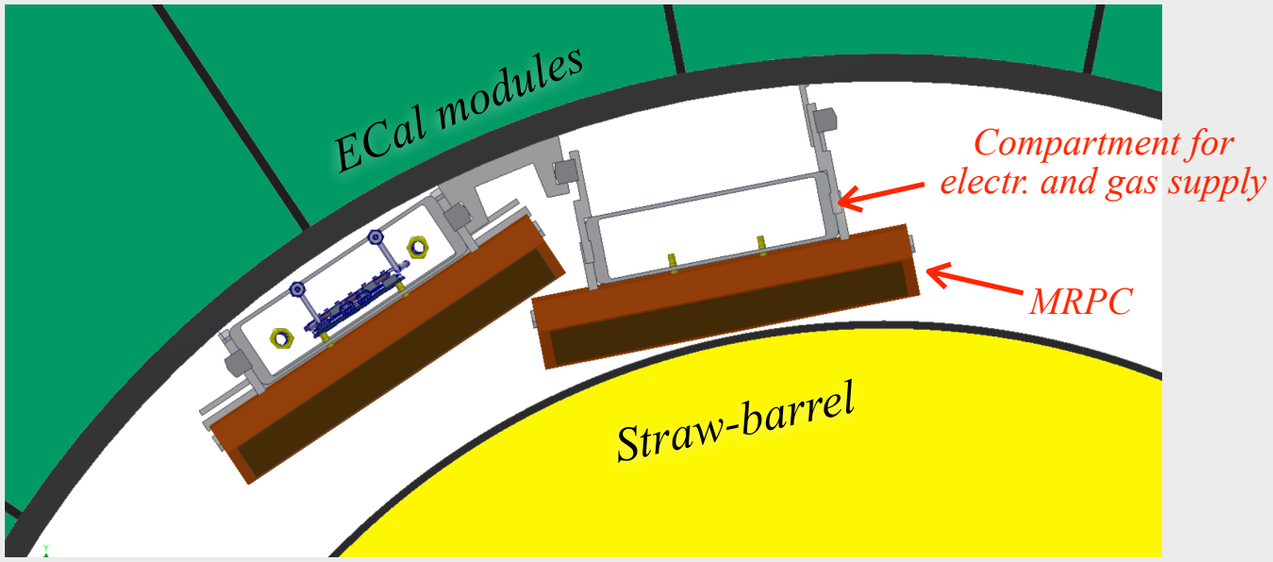
*Barrel with connectors for transmitting signals from vacuum to air*

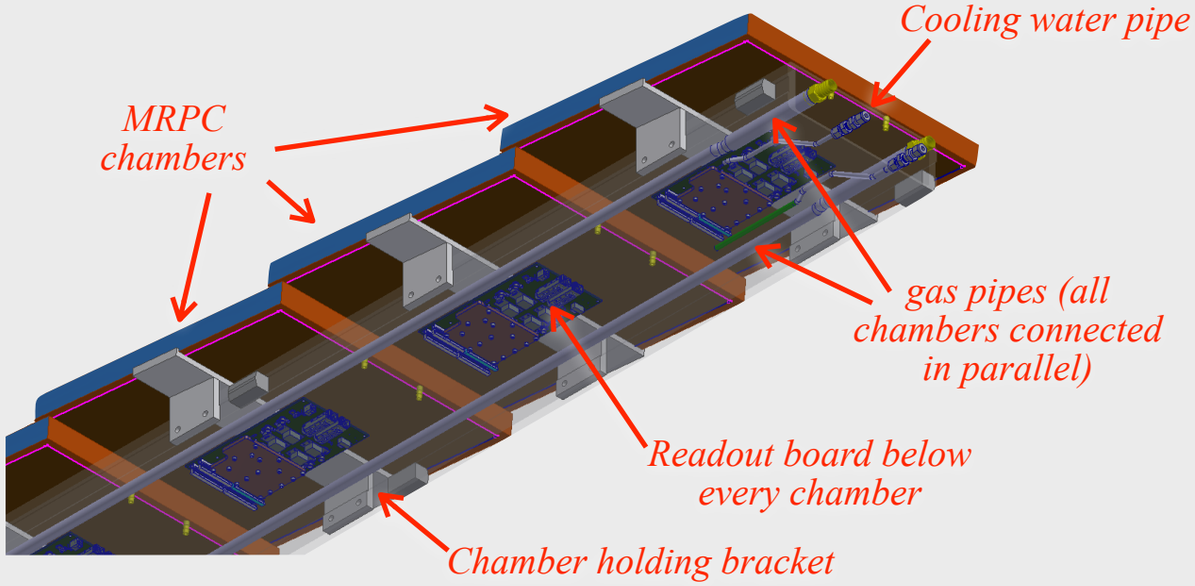


- Original plan for the first stage of ZDC was:  6 planes with trapezoid geometry and 320 mm thick copper radiator. It was supposed to be prepared for installation by summer 2025.
- Could be done by March:  a compact version with the same as in test SiPM boards, 3 layers with a copper or stainless steel radiator about 3x3cm = 9cm total thickness

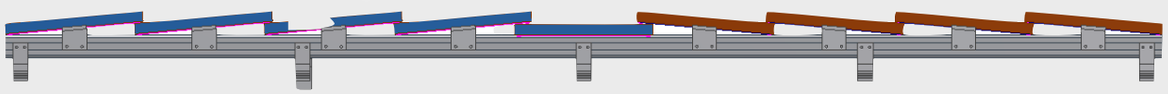
# Progress on TOF

## Mechanical structure of TOF (by V.Shetsov)



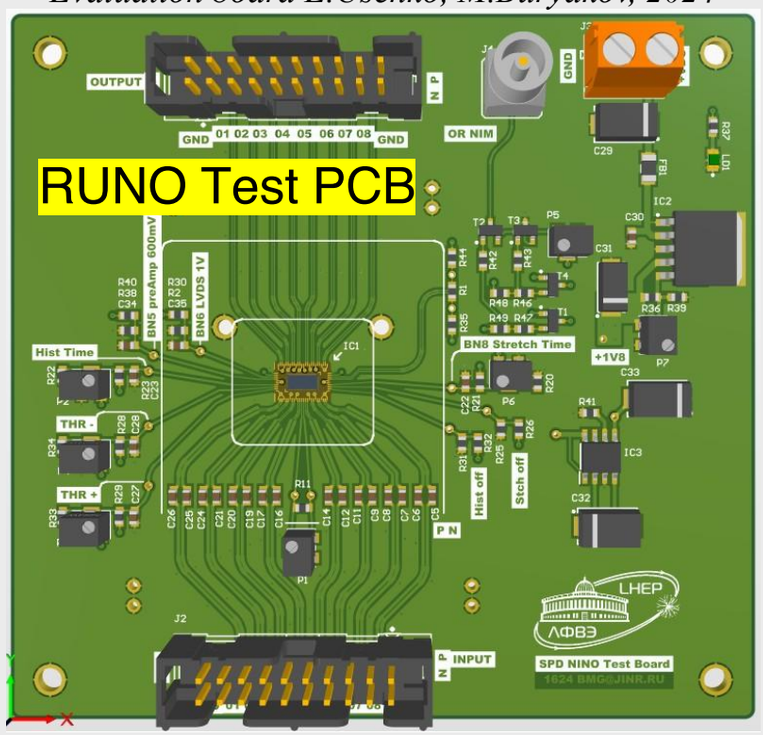

*One super-module with 9 MRPC chambers*

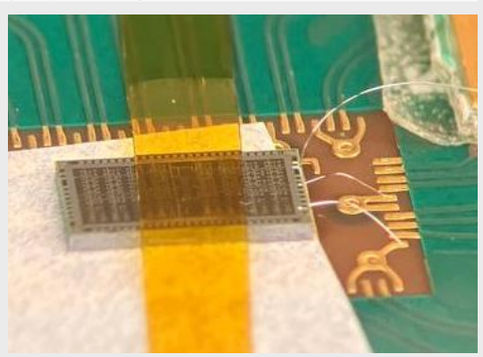


## RUNO chips have been produced

- Very low impedance chip for the MRPC readout, a complete analogue of the NINO chip
- Developed by MEPhI in collaboration with JINR (E.Usenko as a leader) in 2022
- In 2023, produced by "Mikron" as a part of MPW project for Russian universities
- Chips are received in 2024, tests are ongoing

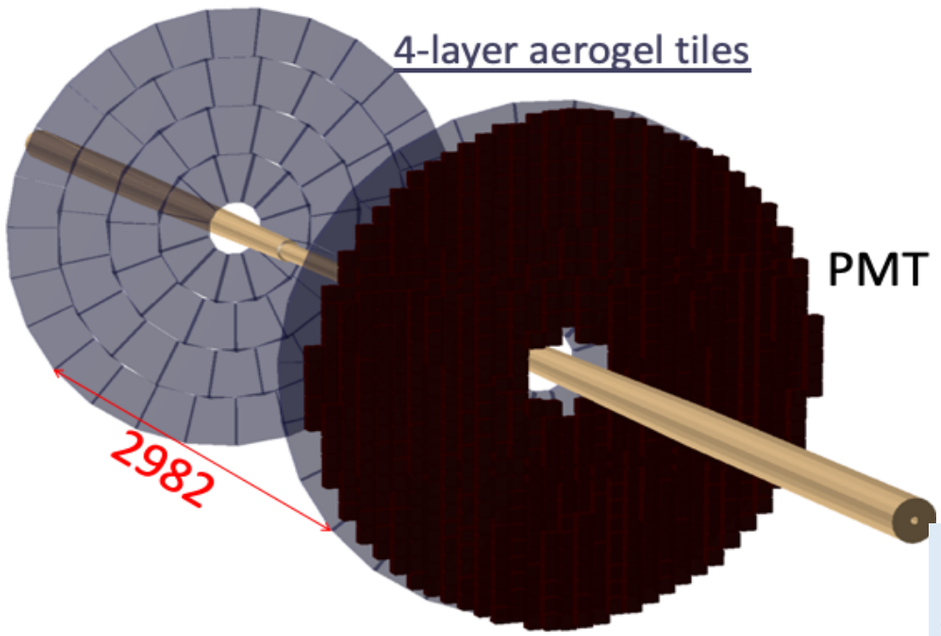
*Evaluation board E.Usenko, M.Buryakov, 2024*



*A.Barnyakov*

# FARICH system of SPD




## SPD – FARICH system concept

**Aerogel:**

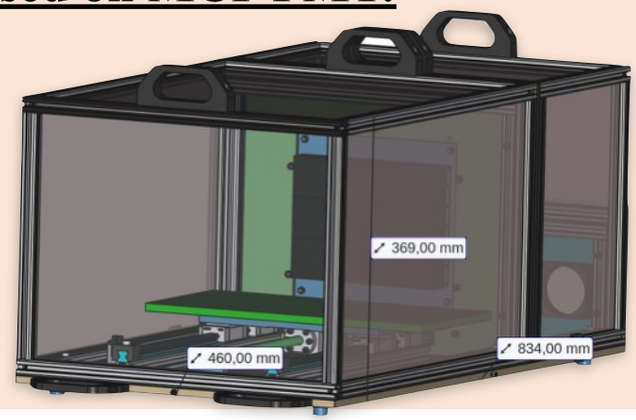
- 2 end-caps × 74 tiles (4 form-factors)
- 4-layer focusing aerogel:
  - $n_{max} \leq 1.05$ (to be optimized soon)
  - Total thickness 35÷40 (to be optimized)
  - Focus distance ~20 cm

**Position-sensitive MCP-PMT:**

- 2 × 550 PMTs ~51×51 mm² (pixel 6×6 mm²), i.e. N6021 (NNVT)
- 2 × 2200 PMTs ~33×33 mm² (pixel 3×3 mm²) from Ekran FEP (soon)

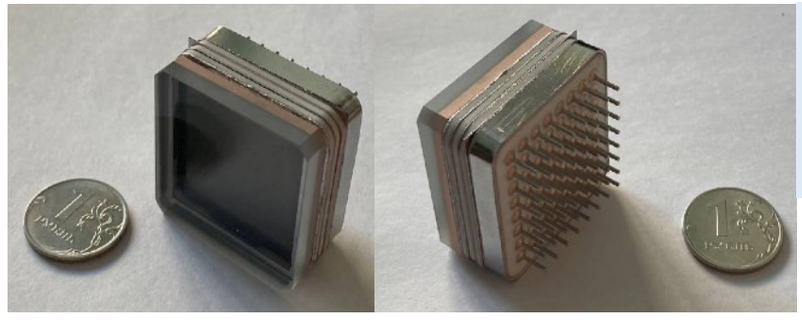
## FARICH prototype based on MCP PMT:

- Technical drawings are ready
- Materials, components and equipment are purchased
- Production was started at the BINP
- Readout system is ready
- 4-layer focusing aerogel is ready
- MCP PMTs are waiting soon!!!




## The first rectangular MCP PMT produced in Russia:

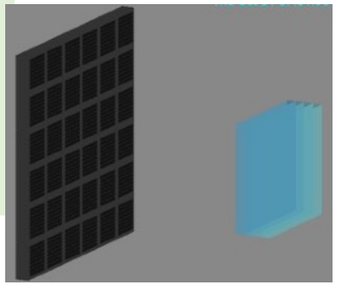
- Construction and design is developed
- All details and components are produced in Russia
- All technological processes are developed and realized
- First samples for test will be available until the end of 2024

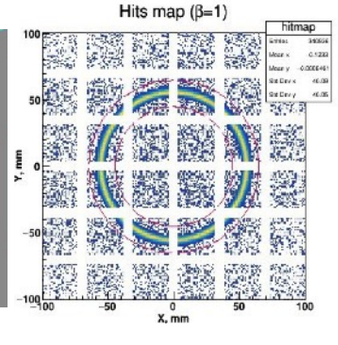


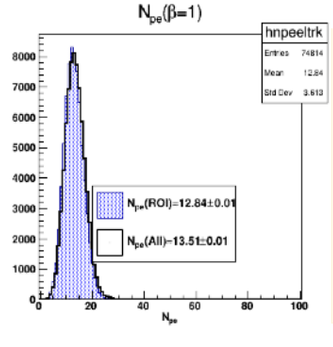
- 33×33 mm² total area
- 27×27 mm² sensitive area
- 8×8 pixels with 3×3 mm size

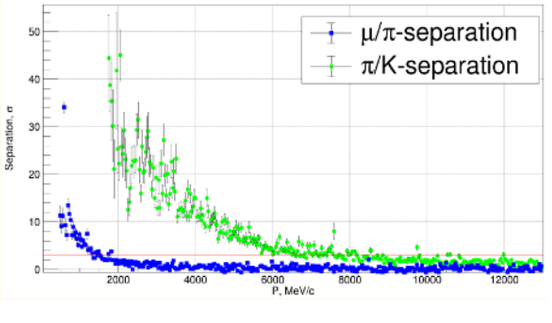
## Expected system parameters

(obtained in G4 simulation)





# FEE and DAQ on Tuesday

**15:00**

- **Current status of L1 concentrator** — *Александр Бойков*
- **L2 concentrator firmware** — *Vladislav Borchsh*
- **Status of BBC developments @MEPhI** — *Arseniy Zakharov*
  *LHEP-215/241 - video room, VBLHEP* 15:00 - 15:20
- **Status of BBC developments @JINR** — *Aleksey Tishevsky*
  *LHEP-215/241 - video room, VBLHEP* 15:20 - 15:40
- **Cofee break**
  *Conference Hall, Building 215, VBLHEP, JINR, Dubna* 15:40 - 16:10

**16:00**

- **Current status of TSS development. White Rabbit precisio…**
  *Olga Mamoutova*
- **WLS Studies** — *Filipp Dubinin*
  *LHEP-215/241 - video room, VBLHEP* 16:10 - 16:30
- **Current status of TSS development. TSS control protocol**
  *Dmitry Ryabikov*
- **TDC based on FPGA for BBC** — *P. Nekrasov*
  *LHEP-215/241 - video room, VBLHEP* 16:30 - 16:50
- **FEE for straw readout** — *Vitaly Bautin*
- **Application of DT5215 concentrator for BBC** — *Иван Волков*
  *LHEP-215/241 - video room, VBLHEP* 16:50 - 17:10

**17:00**

- **Development of ASIC** — *Alexander Solin*
- **Simulation of Xe124+W in fixed target mode for SPD BB…**
  *Ксения Волкова*
- **Simulation of pp and dd interactions for BBC prototype** — *Arkadiy Terekhin*
  *LHEP-215/241 - video room, VBLHEP* 17:30 - 17:50
- **Discussion &AOB**
  *LHEP-215/241 - video room, VBLHEP* 17:50 - 18:10

**18:00**

**Dense agenda for this meeting!**

# Magnet & detectors on Wednesday

**10:00**

- **Status of the SPD Solenoid Magnet Development** — *Sergey Pivovarov*
  10:00 - 10:30
- **Quench Analysis of the SPD Solenoid** — *Alexey Bragin*
  10:30 - 10:50

**11:00**

- **Control Dewar design** — *Tatiana Bedareva*
  10:50 - 11:10
- **Cryogenic system** — *Andrey Ponomarev*
  11:10 - 11:30
- **Coffee break**
  *Building 215, VBLHEP, JINR, Dubna* 11:30 - 12:00

**12:00**

- **RS status report** — *Gennady Alexeev*
  12:00 - 12:20
- **ECal status report** — *Dr Олег Гаврищук*
  12:20 - 12:40
- **MicroMegas status report** — *Dmitry Dedovich*
  12:40 - 13:00

**13:00**

- **Lunch**
  13:00 - 14:00

**14:00**

- **Straw-barrel status report** — *Temur Enik*
  14:00 - 14:20
- **Straw beam tests** — *Dmitry Sosnov*
  14:20 - 14:40
- **Straw-endcap status report** — *Victor Kramarenko*
  14:40 - 15:00

**15:00**

- **Join research and development AANL-BUDKER-NICA(SPD) for Aerogel Cherenkov detector** — *Arthur Mkrtchyan*
  15:00 - 15:20
- **Status of Cherenkov counters prototyping for the SPD experiment** — *Alexander Barnyakov*
  15:20 - 15:40
- **Coffee break**
  *Conference Hall, Building 215, VBLHEP, JINR, Dubna* 15:40 - 16:10

**16:00**

- **TOF status report** — *Валерий Чмиль*
  16:10 - 16:30
- **BBC status report** — *Aleksey Tishevsky*
  16:30 - 16:50
- **ZDC status report** — *Igor Alekseev*
  16:50 - 17:10

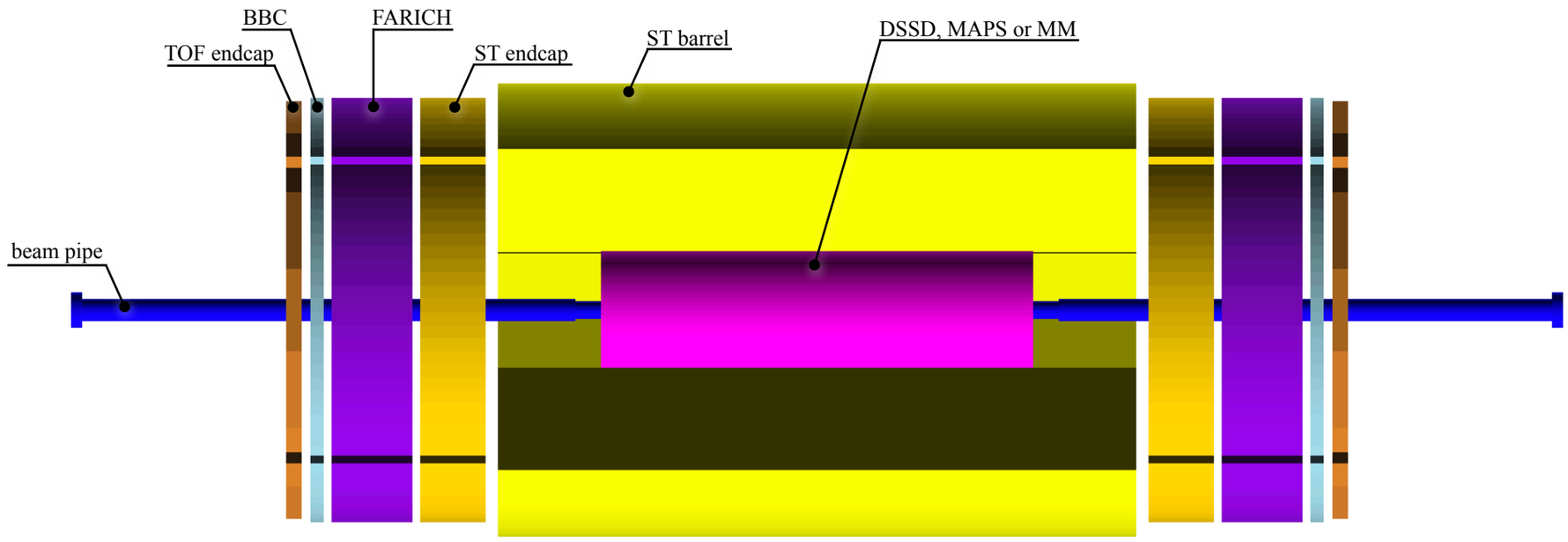
**17:00**

- **On possible development of monolithic active pixel sensors** — *Dr Sergey Vinogradov*
  17:10 - 17:30
- **Modernization and testing of a thermal chamber with an operating temperature range of -50 … + 50 C** — *Alexey Popovich*
  17:30 - 17:50

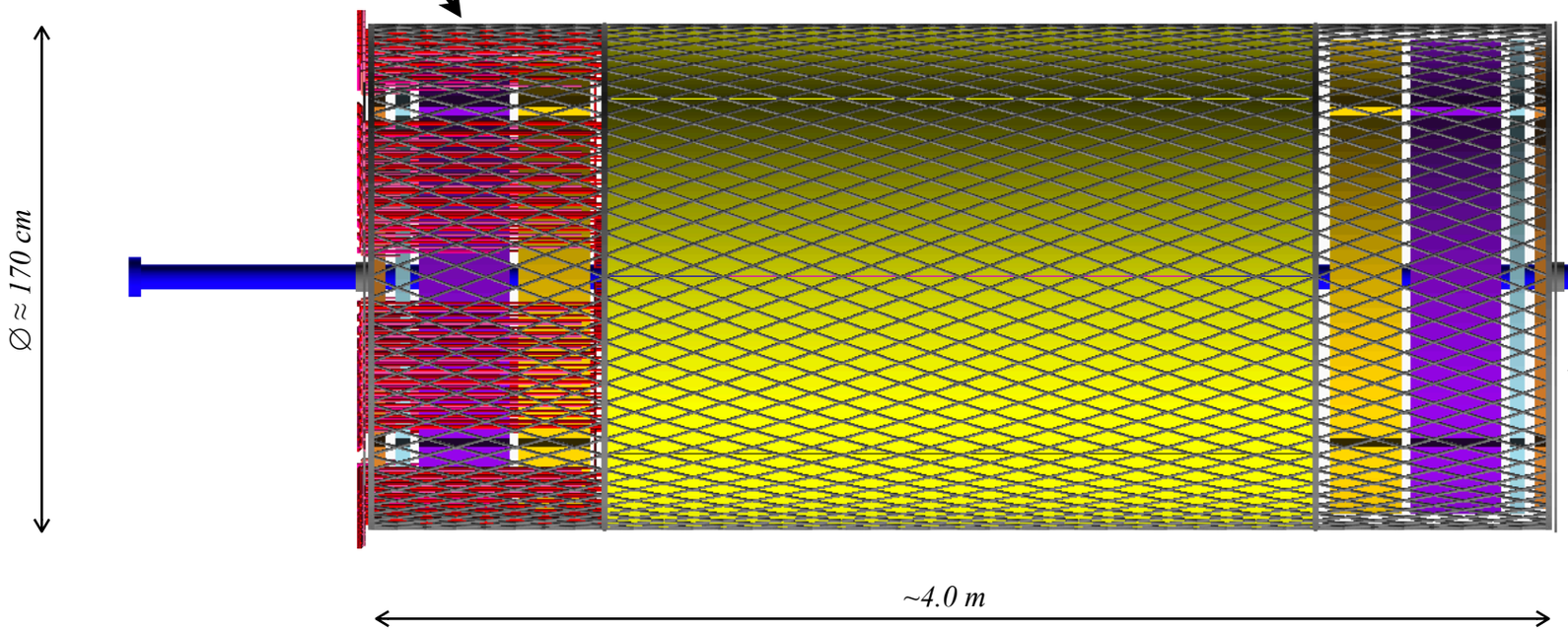
# Concluding remarks

- Some progress is being made in many subsystems
- Special attention should be paid to the detectors of the 1st stage of the experiment
    - *Lack of qualified engineering personnel* capable of doing the work
- According to present schedule we can have the 1-st stage detector by the end of this decade. Clear planning required from corresponding groups.

# backup




Каким образом вывести коммуникации со всех детекторов?




Каким образом устанавливать эндкапы, не повредив трубу ионопровода?

Кран подвесной
Q=3,2т

Приямок
1000x1000x800(h)

Сетчатое ограждение
h=2,5м

Приямок 1000x650x450(h)

Приямок
1000x950x450(h)

Приямок
1000x650x450(h)

Кран двухбалочный мостовой
Q=80(10-20т)