Infrastructure developments including the Nuclotron

Outline

Modernization of power main transformer station ”Dubna” (110/6 kV)

Upgrading of plants for liquid helium and nitrogen production

Construction of new collider building 17

Modernization of the Main Transformer Station GPP1

The existing power of the transformer station is 22 MW. This capacity is almost completely used.

After modernization, permissible load will be grown up to 40,8 MW.

The required capacity of the station GPP1 will be provided by two new transformers 1 and 2 manufactured by the branch of Siemens company in Voronezh.

Power distribution of the Transformer Station GPP-1

	Consumer	Power, MW
1	Booster	1.6
2	Collider	11.0
3	New compressor hall	7.6
4	Computer cluster	1.0
5	Nuclotron	1.4
6	Channels of the bld. 205	1.6
7	Facility for assembling and cryogenic tests of the SP magnets bld. 217	1.1
8	VBLHEP infrastructure	4.4
9	East thermal station	0.8
10	NICA centre	1.8
11	Consumers in the city	8.5
	TOTAL	**40.8**

Modernization of GPP1 station

The reconstruction is carried out by the subdivision of JSC Electrocentromontazh from the town of Kostroma. The deadline for completion of works in accordance with Contract No. 900-017/30 and Additional Agreements is 31.05.2023, the cost is 416 079 498 Rubles.

The cost of work performed in accordance with the signed Acts is 324 147 392 Rubles (78%)

Rated power, MVA	40
Maximum rated voltage, kV	126
Total mass with oil, t	52
Mass of oil, t	11
Shipping weight, t	45
Dimensions, m	5.5x3.5x5.0

Two transformers **2x40 MW**

Cos (*f*)=0.85 → *2x34* MW

II category of reliability, i.e. up to 60% of the nominal value

→ *2x20.4 MW*

Total possible load of the transformer station

41 MW

Modernization of GPP1 station

New transformers T1 and T2 have been installed.

For these transformers, the equipment of external switchgears with a voltage of 110 kV has been mounted.

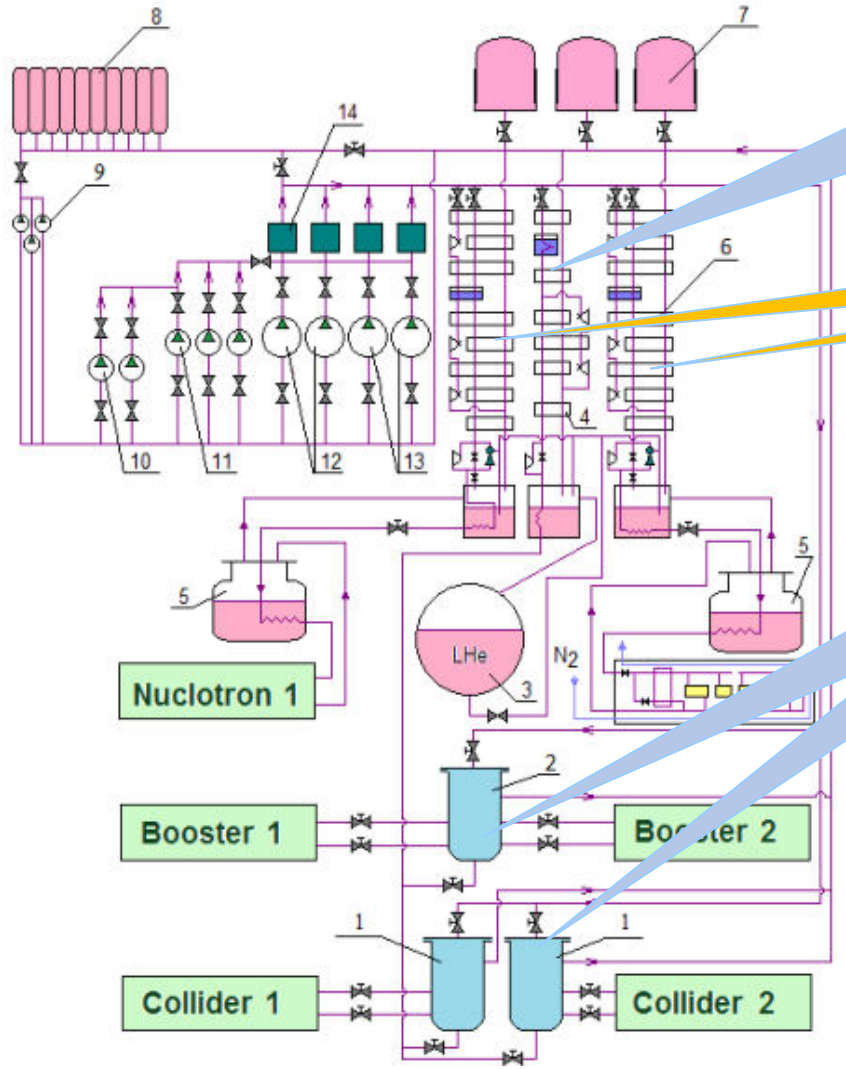
The equipment of 6 kV switchgears inside the building has been installed.

Transformer T1 is in operation. After receiving permission from Rostechnadzor, the transformer T2 commissioning is scheduled for February.

80% of the interior work inside the building have been completed.

Equipment of the upper level of the automated system of dispatching control

Helium Cryogenic System of the NICA Complex



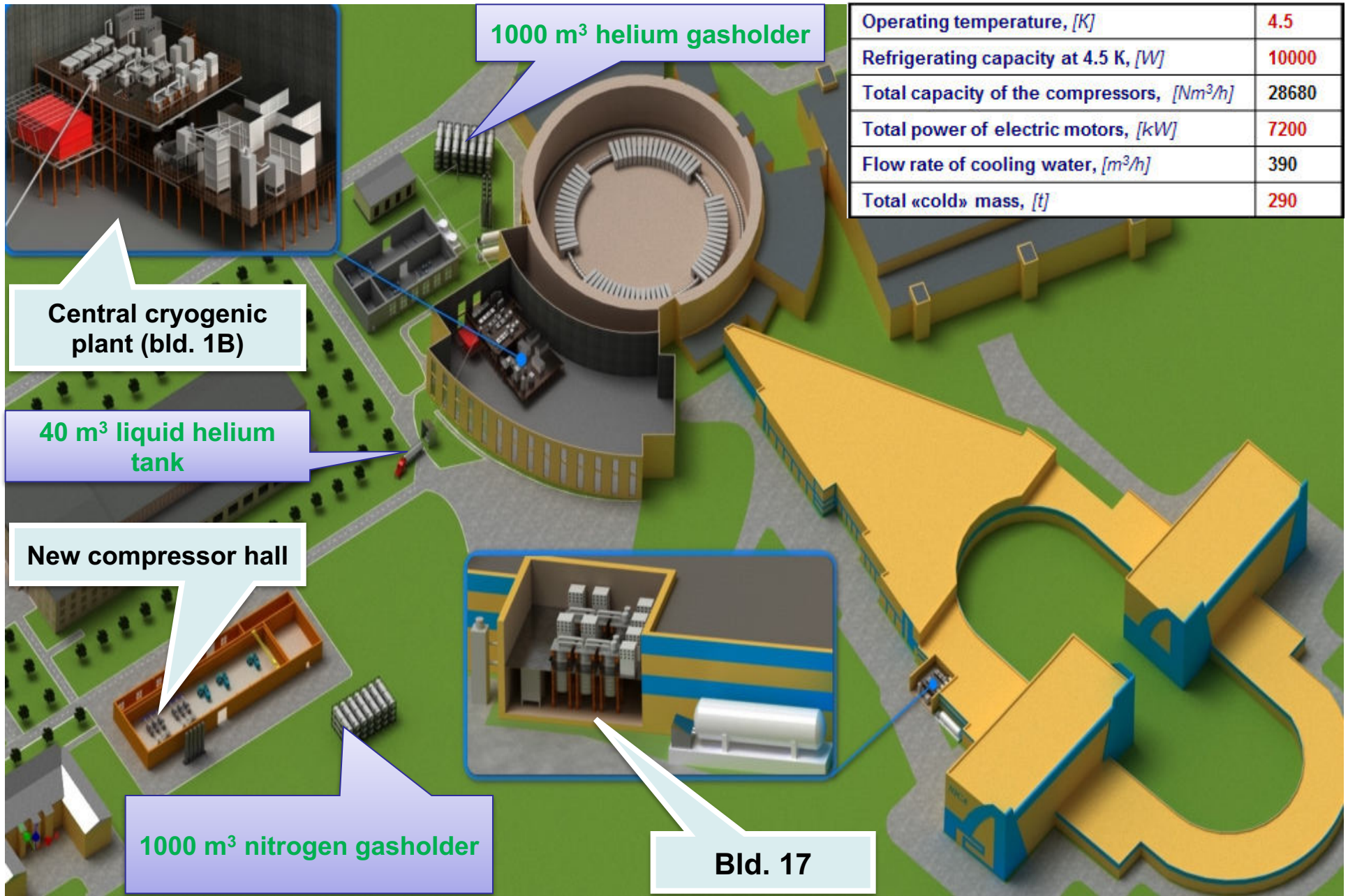
Liquefier OG–1000
1000 l/h

Refrigerators
KGU–1600/4.5
2×2 kW@4.5 K

Satellite Refrigerators
RSG–2000/4.5
3×2 kW@4.5 K

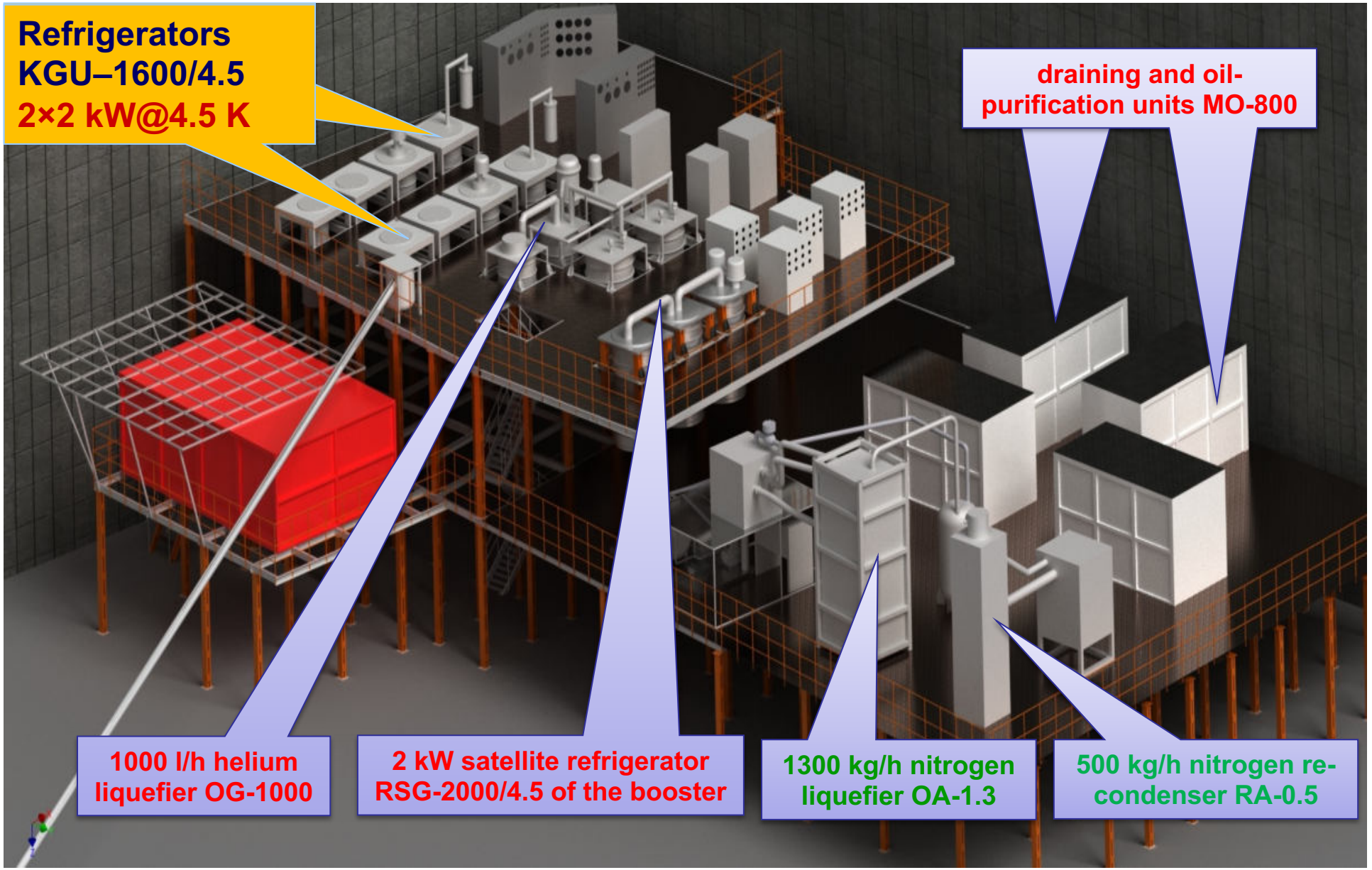
1 – RSG–2000/4.5 "satellite" refrigerators of the collider; 2 – RSG–2000/4.5 "satellite" refrigerator of the booster; 3 – 40 m^3 liquid helium tank; 4 –1000 l/h helium liquefier OG–1000; 5 – liquid helium separators; 6 – KGU–1600/4.5 helium refrigerators; 7 – 1000 m^3 gas-holder; 8 – 20 m^3 compressed-helium reservoirs; 9 – 120 Nm^3/h piston compressors 6GSh-1.6-2/1.1-200-1; 10 – 840 Nm^3/h piston compressors 2GM4-12/31; 11 – 1200 Nm^3/h piston compressors 305NP–20/30; 12 – 6600 Nm^3/h screw compressors "Kaskad–110/30"; 13 – 5040 Nm^3/h screw compressors "Kaskad–80/25"; 14 – draining and oil-purification units MO-800.

Cryogenic Equipment of the NICA Complex



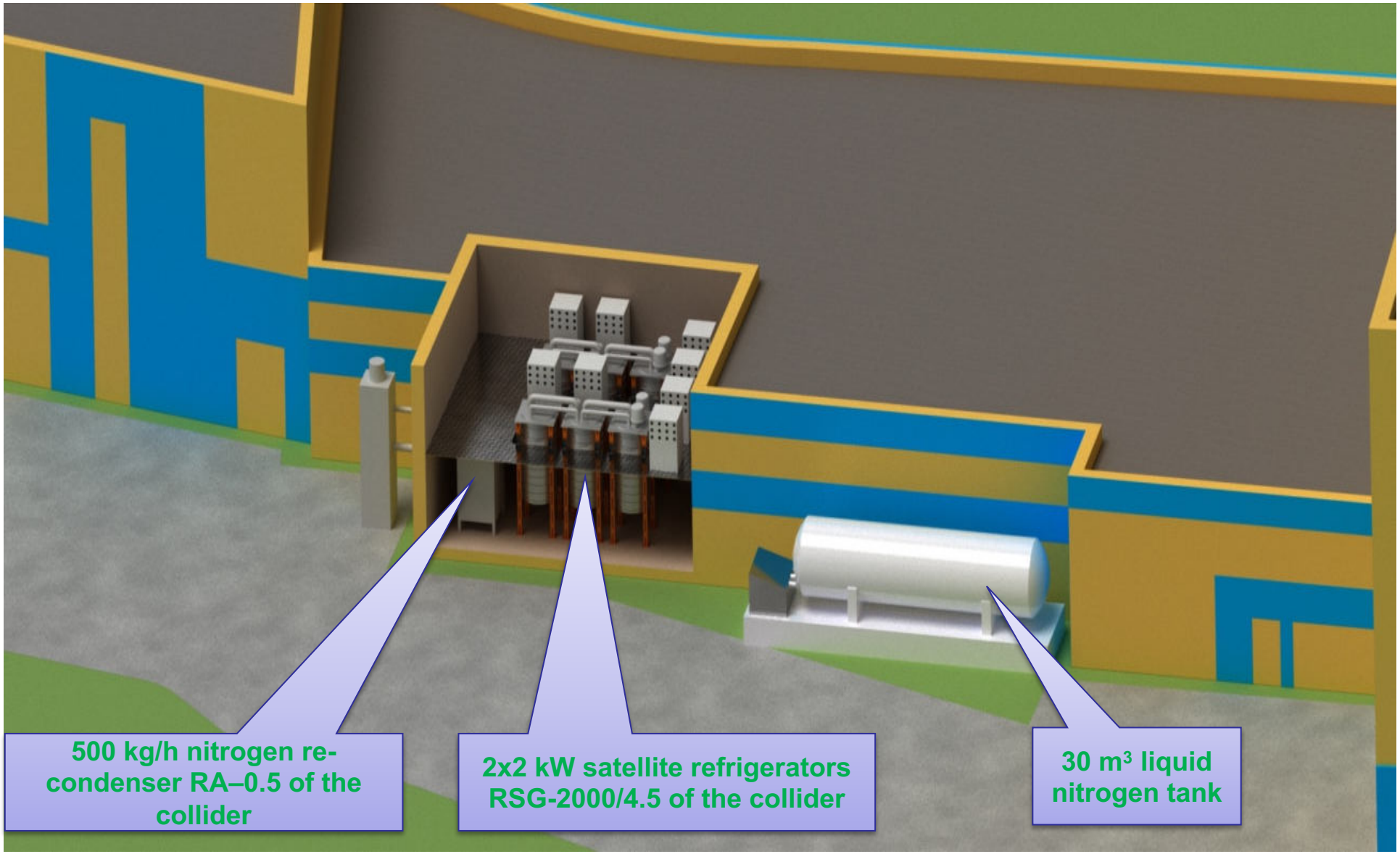
Operating temperature, *[K]*	4.5
Refrigerating capacity at 4.5 K, *[W]*	10000
Total capacity of the compressors, *[Nm³/h]*	28680
Total power of electric motors, *[kW]*	7200
Flow rate of cooling water, *[m³/h]*	390
Total «cold» mass, *[t]*	290

Central Cryogenic Plant



Central Cryogenic Plant

Cryogenics in the building 17



Cryogenic plant for collider in building 17

NICA cryogenic equipment in the open air

1000 m³ nitrogen gasholder

1000 m³ helium gasholder

40 m³ liquid helium container

30 m³ liquid nitrogen containers equipped with pumps

New Compressor Building

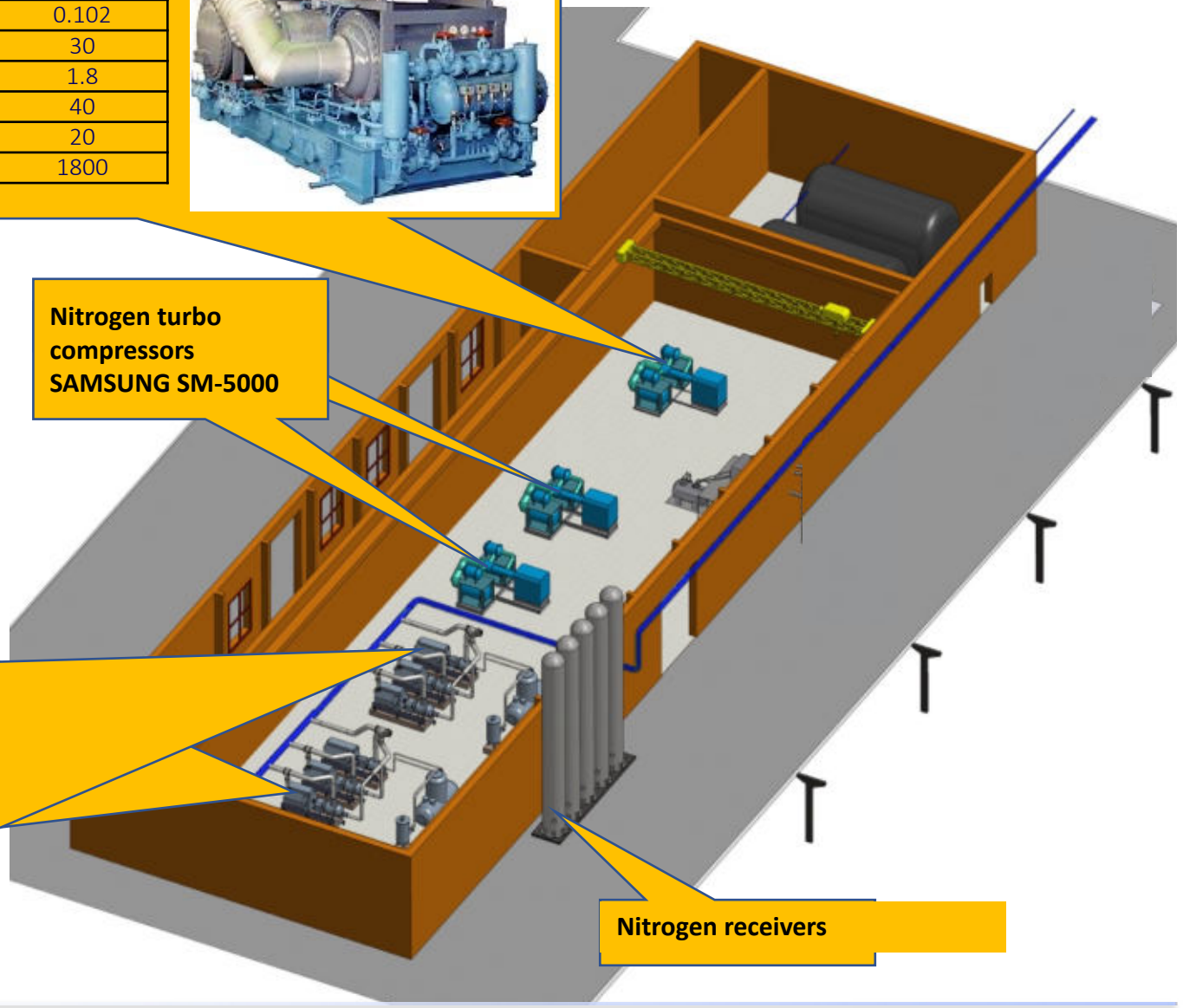
Nitrogen turbo compressor “Aerocom2-179/18”

Capacity of compressor, Nm³/h	10740
Inlet pressure, MPa	0.102
Inlet temperature, ° C	30
Outlet pressure, MPa	1.8
Outlet temperature, ° C	40
Temperature of cooling water, ° C	20
Installed power of electric motor, kW	1800

Helium screw compressors “Kaskad-110/30”

Capacity (Nm³/h)	6600
Outlet pressure (MPa)	3.0
Total power of electric motors (kW)	1600
Voltage (V)	6000
Number of compression stages	2
Speed (rpm)	2970
Flow rate of cooling water, m³/h	78

Nitrogen turbo compressors SAMSUNG SM-5000



Nitrogen receivers

New compressor building

New Compressor Building

Currently underway:

- By JSC MONTAGSPECSTROY installation of heat supply, ventilation and water-cooling systems, fire protection of metal structures

- by JSC EPP-T installation and commissioning of electrical and automation systems

- by CRYOGENMONTAG installation of main pipelines between buildings

Civil construction will be finished by JSC STROY IST INWEST

New Compressor Building

Cooling tower of the water cooling system after installation on the roof of the compressor building (December 2022)

Overpasses for pipelines to connect compressors and refrigerators of the cryogenic complex

Collider building 17 - STRABAG (General Contractor from 18/09/2015).

On December of last year , Agreement number 9 was signed on the conditions for the continuation of work in 2023 . The contract is scheduled to be completed on July 31.

The history of contract changes

#	Contract	Date	Item / changes	Cost, MRub	Completion
0	Master Contract	18.09.15		3 620,2	01.06.2019
1	Add. Agreement 1	23.06.16	Networks relocation	+ 111,4	done
2	Add. Agreement 2	21.03.17	Networks relocation	+ 30,5	done
5	Add. Agreement 5	01.01.21	• cost of the Contract; • deadlines for each Stage	7 335	27.12.2021
9	Add. Agreement 9	26.12.21	• cost of the Contract; • deadlines for each Stage •Non-delivery of equipment due to export/import restrictions	7 398	31.07.2023

STATUS OF WORKS REQUIRING TO COMPLETE

1. Electric lighting ..... 60 %

2. Installation of heat supply systems, compressed air, fire-fighting water supply, plumbing..... 37 %

3. Refrigeration systems and water cooling for electrophysical equipment.....41 %

4. General exchange and fire-fighting ventilation systems.....38 %

5. Automation and dispatching systems of engineering equipment.....0 %

6. 400 V power supply systems inside building.....21 %

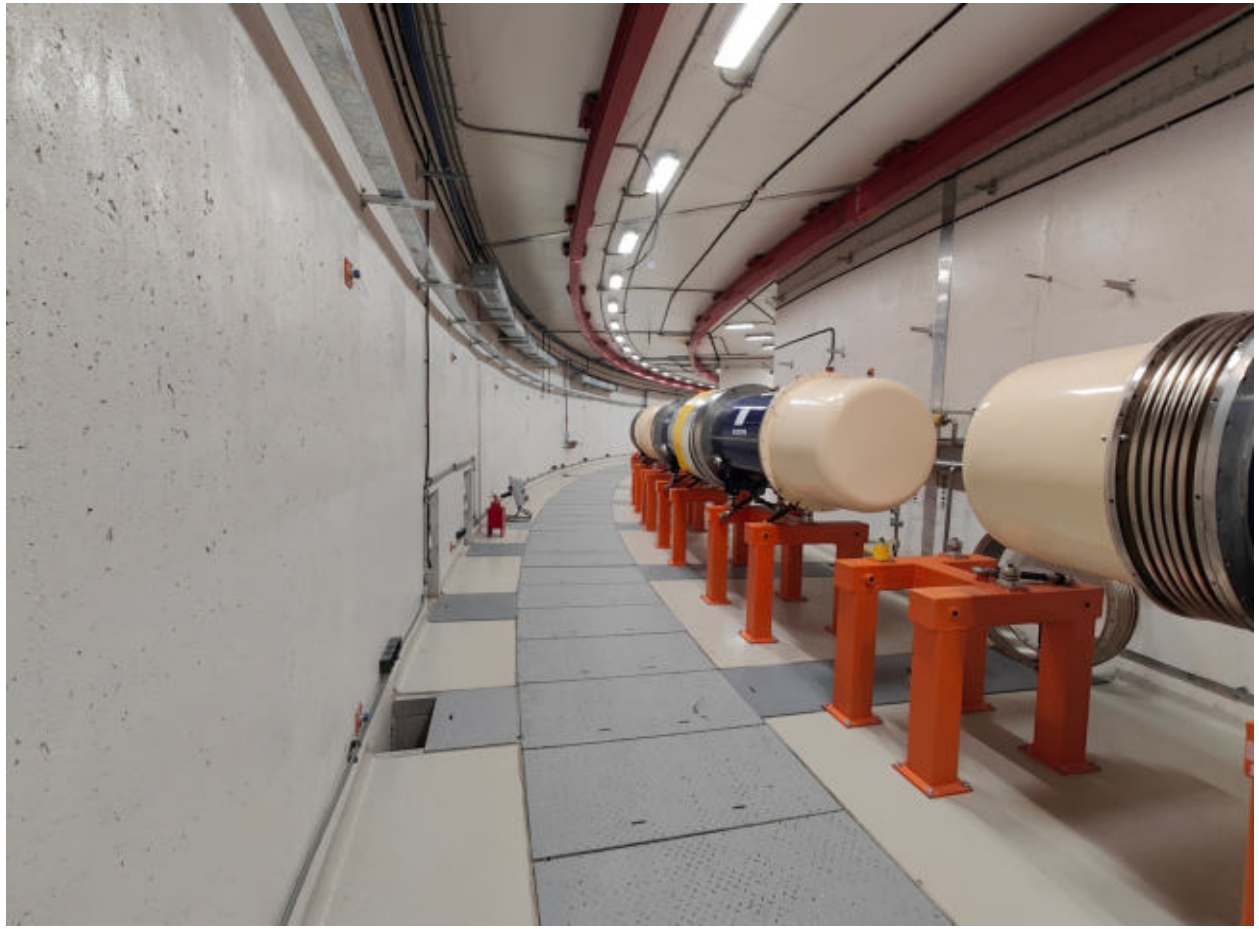
7. Low-current systems.....77 %

Terms of readiness of 41 priority premises of the Collider building for the installation of physical equipment

- 30.12.2022
- 20.01.2023
- 20.02.2023

The tunnels for the left and right beam transportation channels from Nuclotron to Collider

The tunnel of the Collider eastern half ring

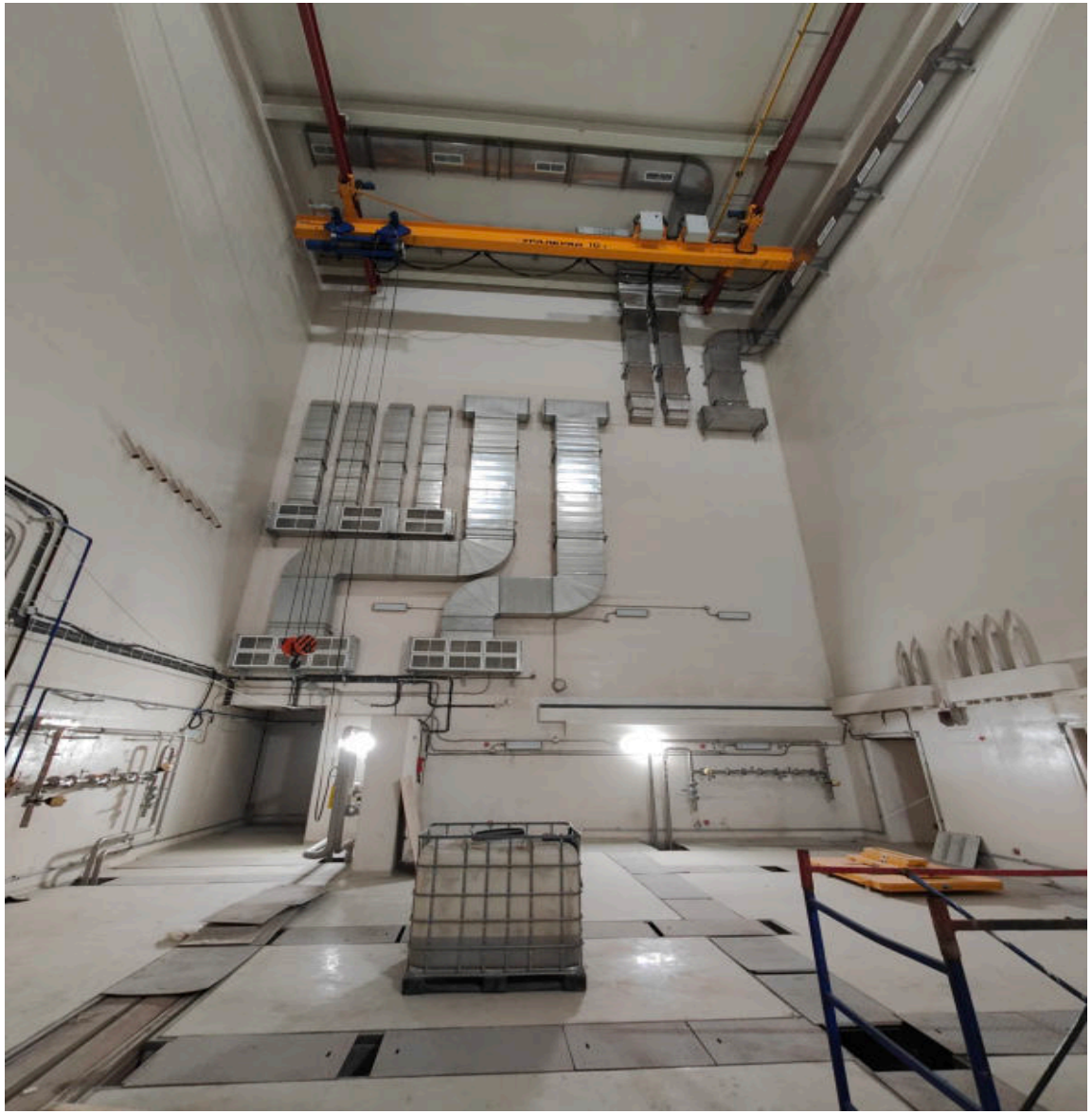


The tunnel of the Collider western half ring

MPD hall

Hall for Electron cooling system

SPD hall



Thank you for your attention!