Cryogenic system of SPD

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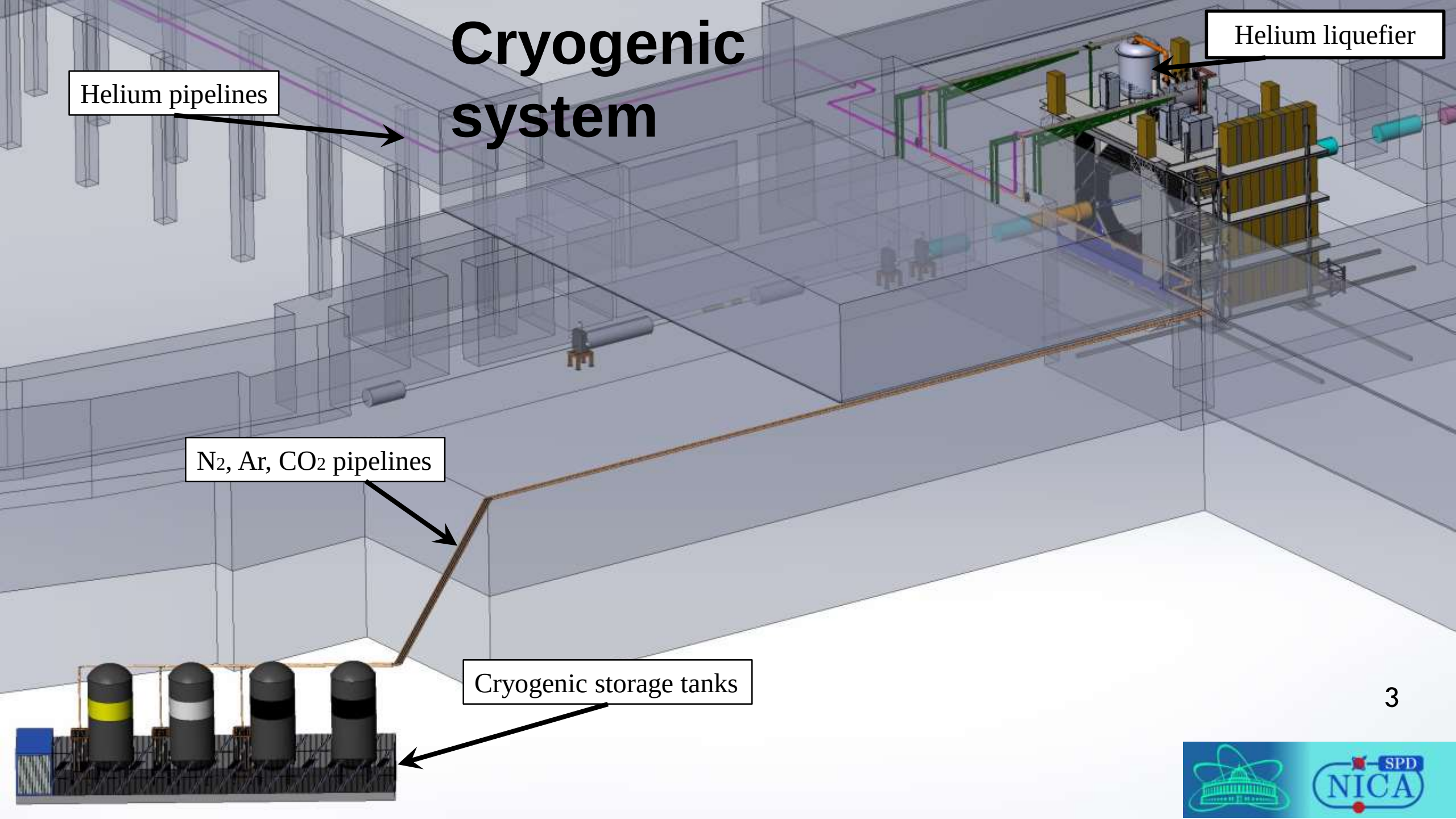
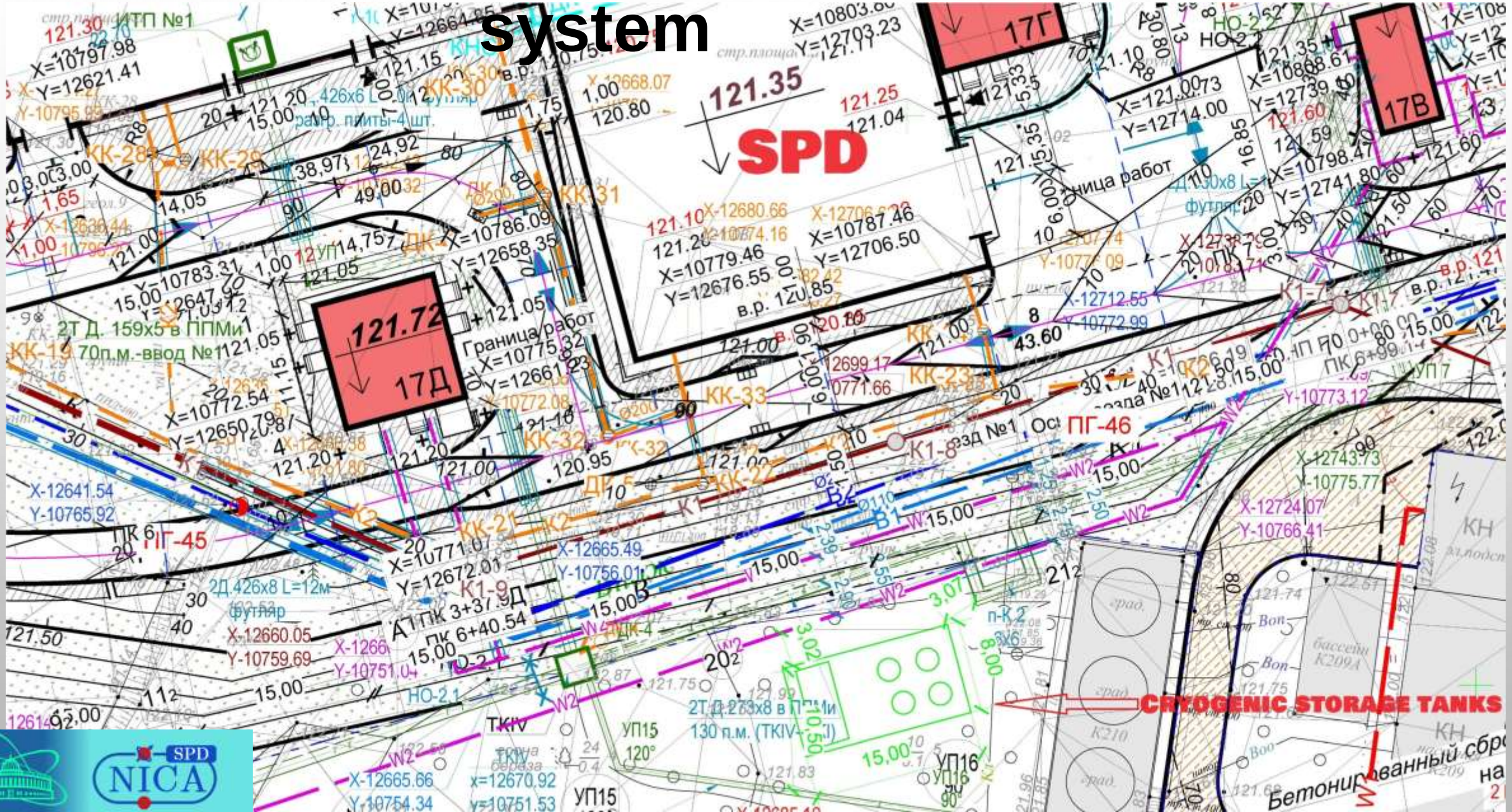
Outline

1. Cryogenic system
2. Helium system
3. Nitrogen system
4. Steps of creation
5. Conclusions

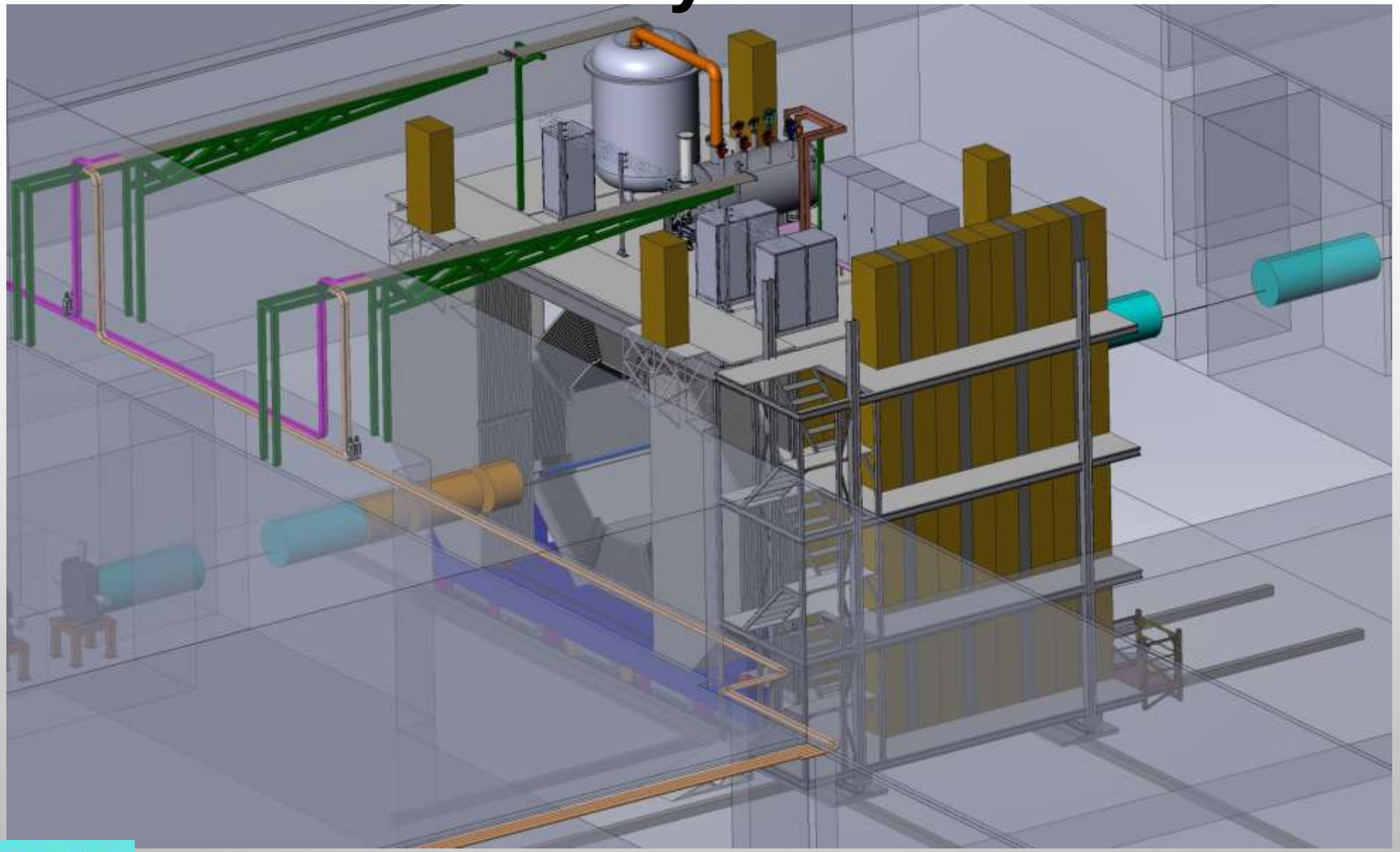
Cryogenic system



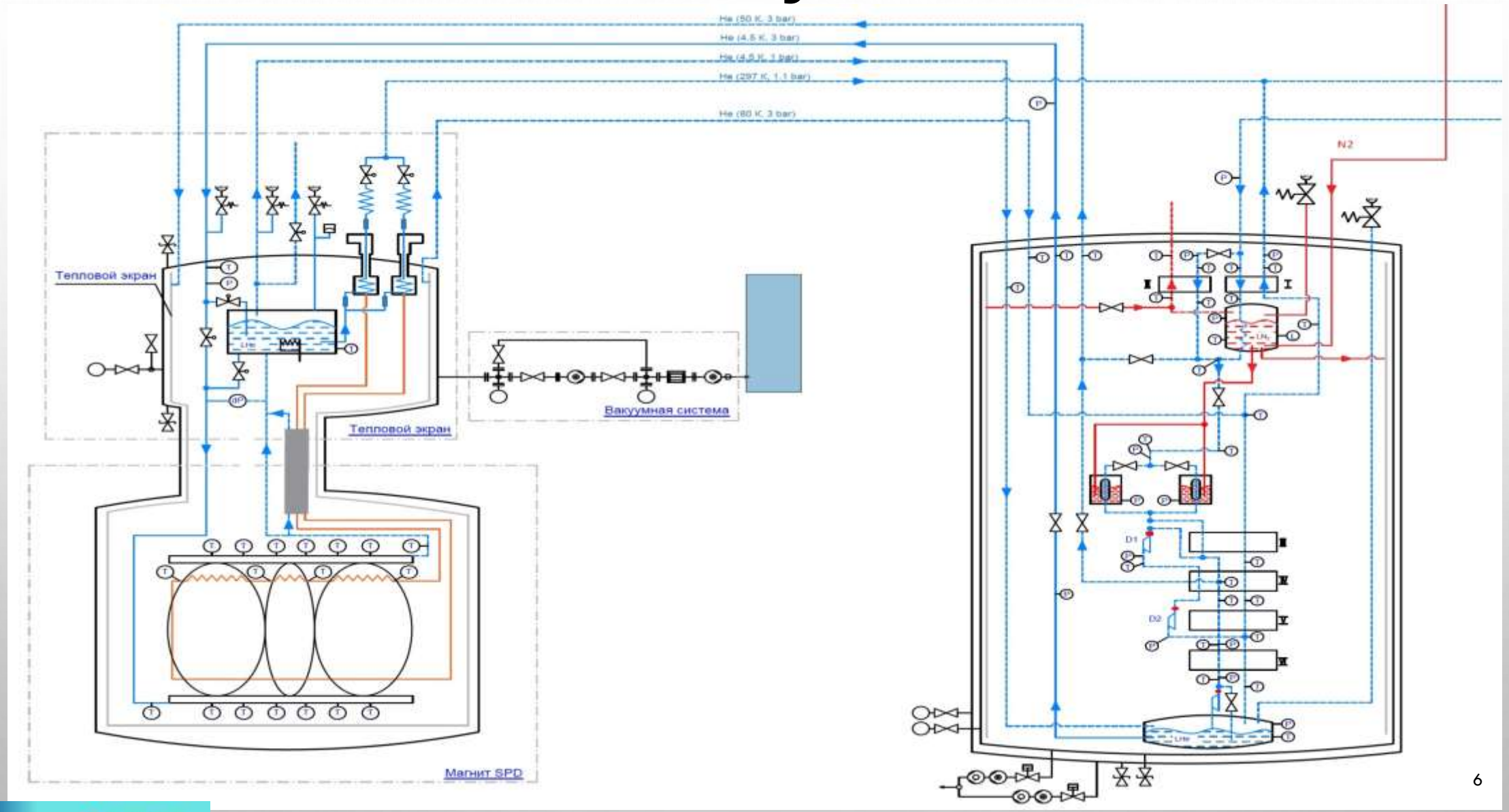
Cryogenic system



Helium system



Helium system

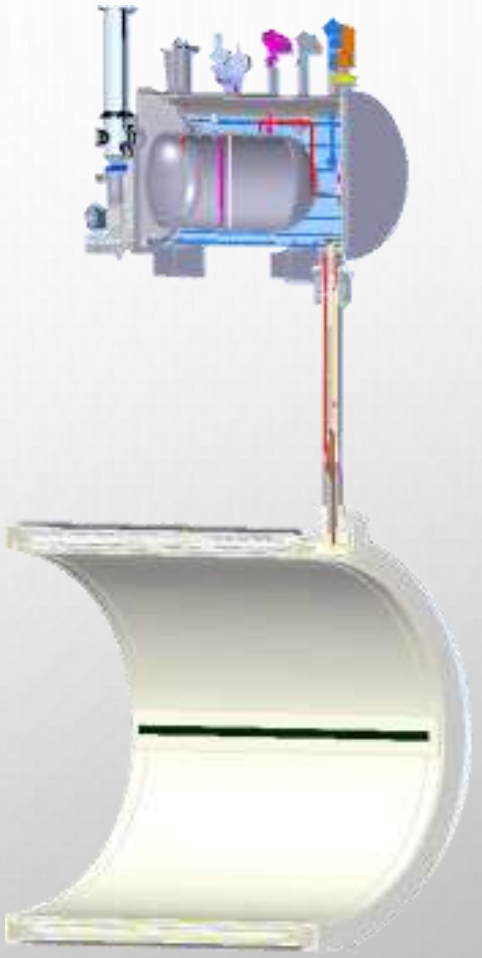


Helium system

	Operating parameters	Unit
1	Cooling capacity (for 4.5 K)	100 - 130 l/h
2	Cooling capacity (for 50 K)	150 W
3	Temperature of outlet flow from the SPD	4.3 K (1.05 bar)
4	Temperature of inlet flow from the SPD	4.5 K (1.15 bar)
5	Hydraulic resistance of the SC coil	0.1 bar
6	Cold weight	5200 kg
7	Maximum pressure in coil	5 MPa
8	Heat load	60 – 80 W
9	Equipment Requirement	Maximum reliability, energy efficiency, compactness, automatic mode
10	Interval of repair/regulatory work of the plant	Not more than once a year

HEAT LOADS

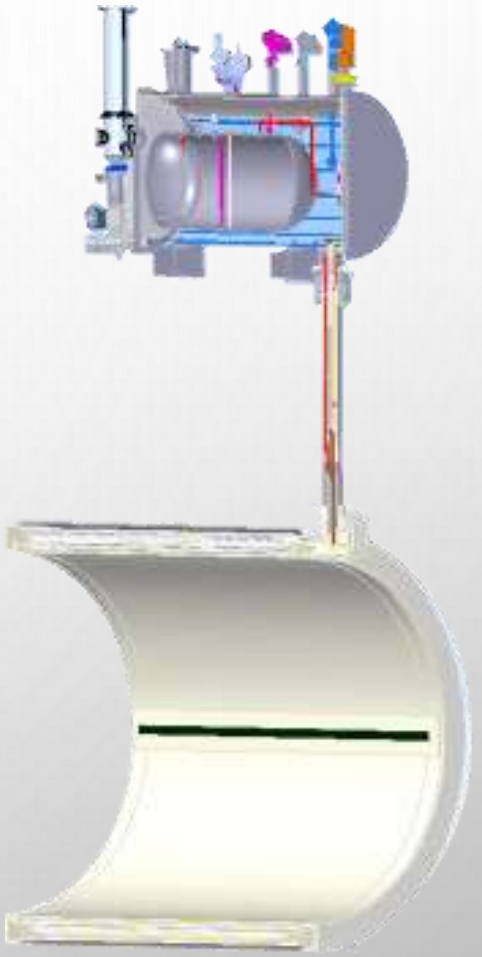
T=4.5K	Heat loads, W		
	Normal condition	Without magnetic field	Current ramping
Cryostat			
radiation	7,80	7,80	7,80
supports	3,60	3,60	3,60
eddy current loss in cold mass*	-	-	11,50
eddy current loss in conductor*	-	-	0,09
current leads, 4.5kA B=1*	10,00	8,00	8,00
Control Dewar			
radiation	0,50	0,50	0,50
supports	0,26	0,26	0,26
cold valves	0,93	0,93	0,93
safety relief valves	4,30	4,30	4,30
vacuum barrier	0,35	0,35	0,35
Transfer line			
radiation	0,12	0,12	0,12
supports	0,32	0,32	0,32
Total	**28,18**	**26,18**	**37,77**



Control Cryostat

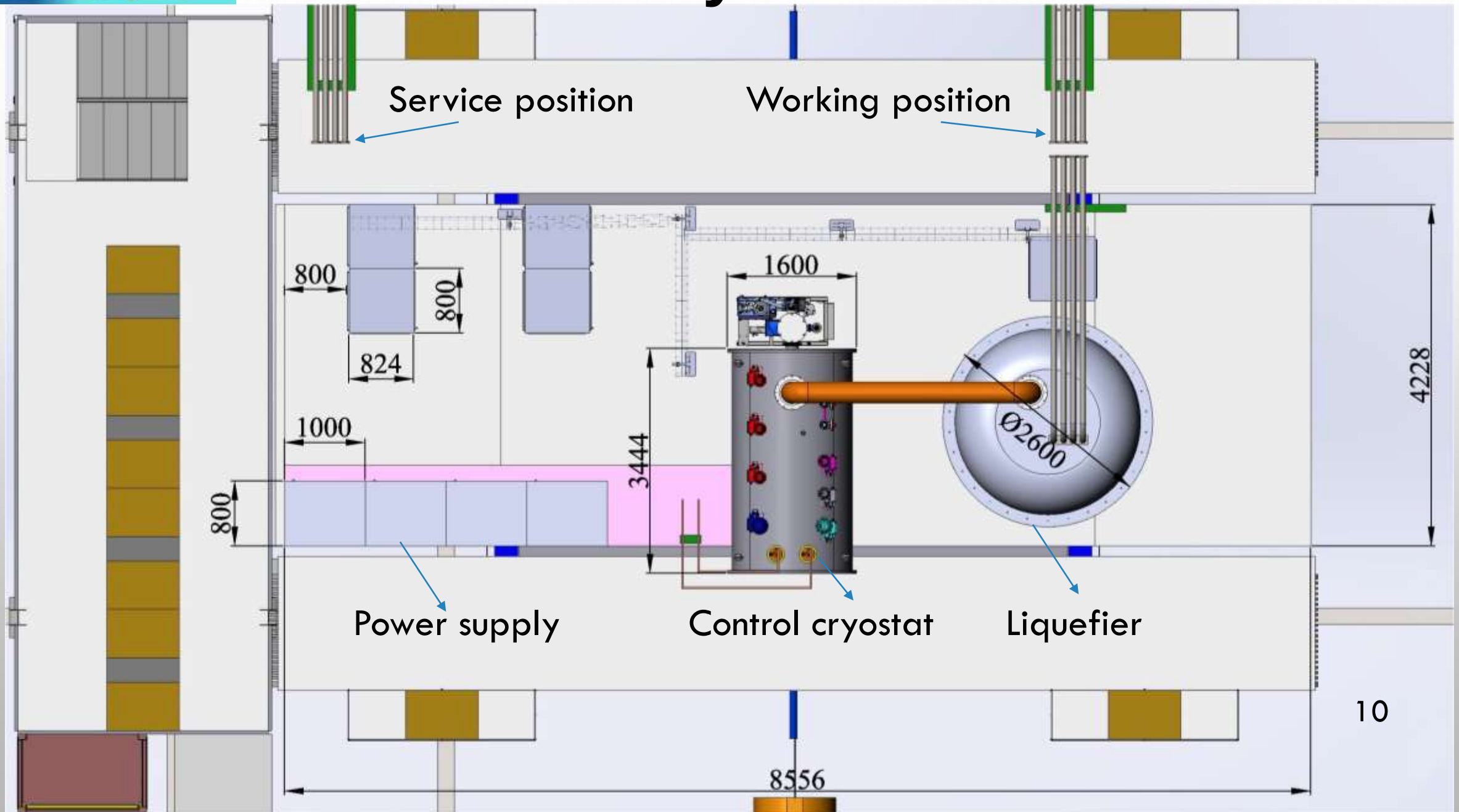
HEAT LOADS

T=60K	Heat loads, W		
	Normal condition	Without magnetic field	Current ramping
Cryostat			
radiation	160,00	160,00	160,00
supports thermal shields	12,00	12,00	12,00
eddy current loss in thermal shields	-	-	47,00
Control Dewar			
radiation	11,60	11,60	11,60
supports thermal shields	6,50	6,50	6,50
supports Helium vessel	9,12	9,12	9,12
cold valves	9,50	9,50	9,50
safety relief valves	1,10	1,10	1,10
vacuum barrier	1,18	1,18	1,18
Transfer line			
radiation	1,05	1,05	1,05
supports	2,35	2,35	2,35
Total	**214,40**	**214,40**	**261,40**



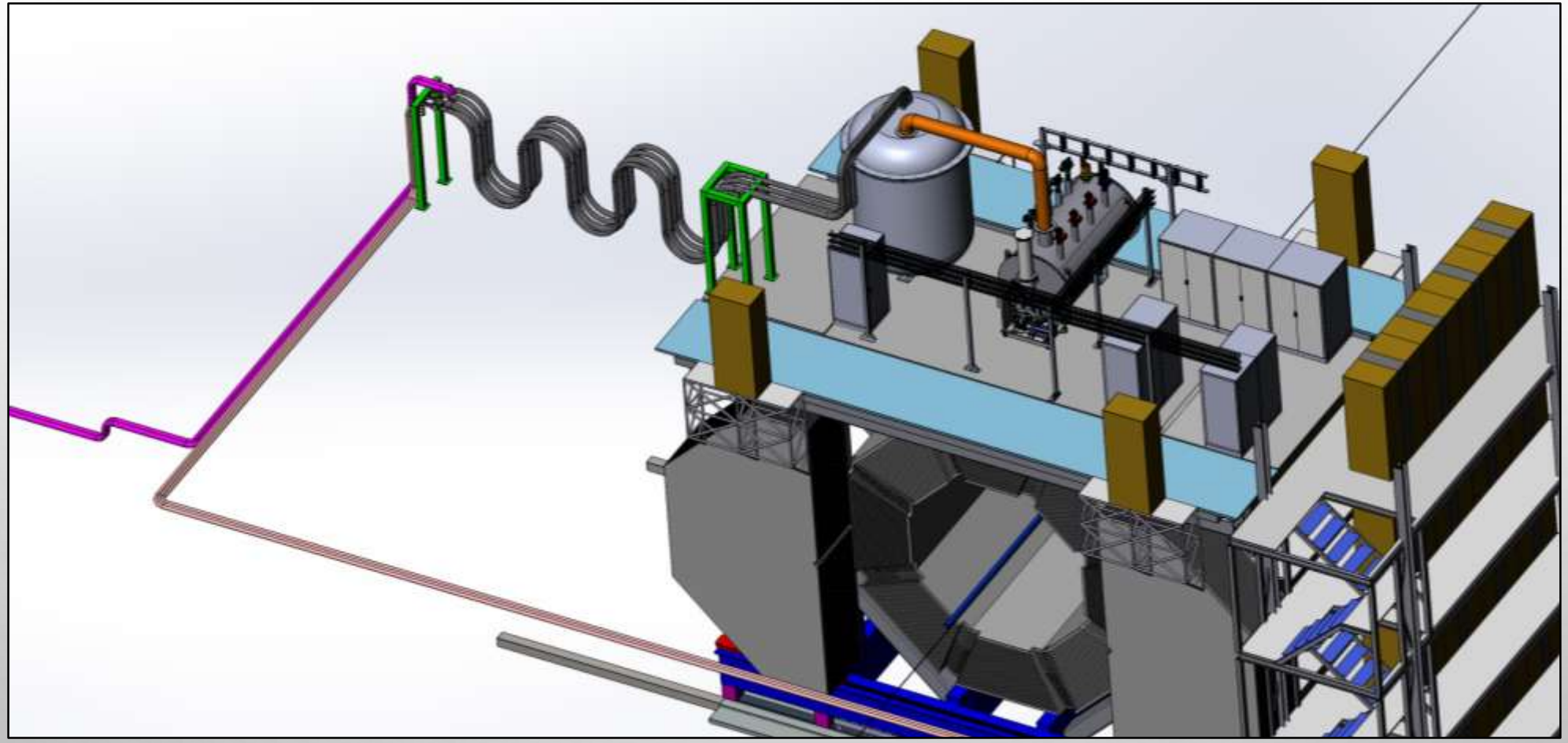
Control Cryostat

Helium system



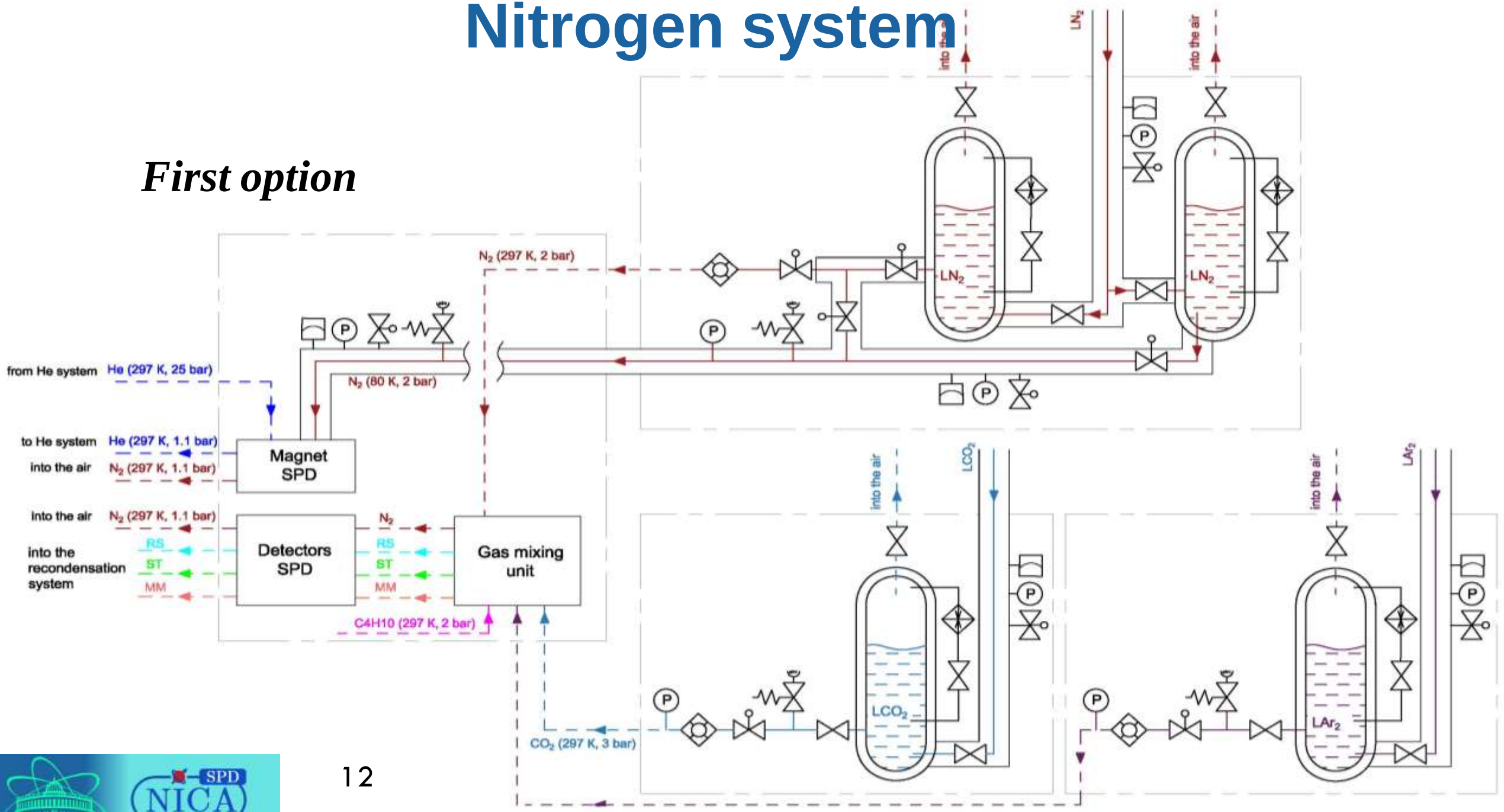
Helium system

First option

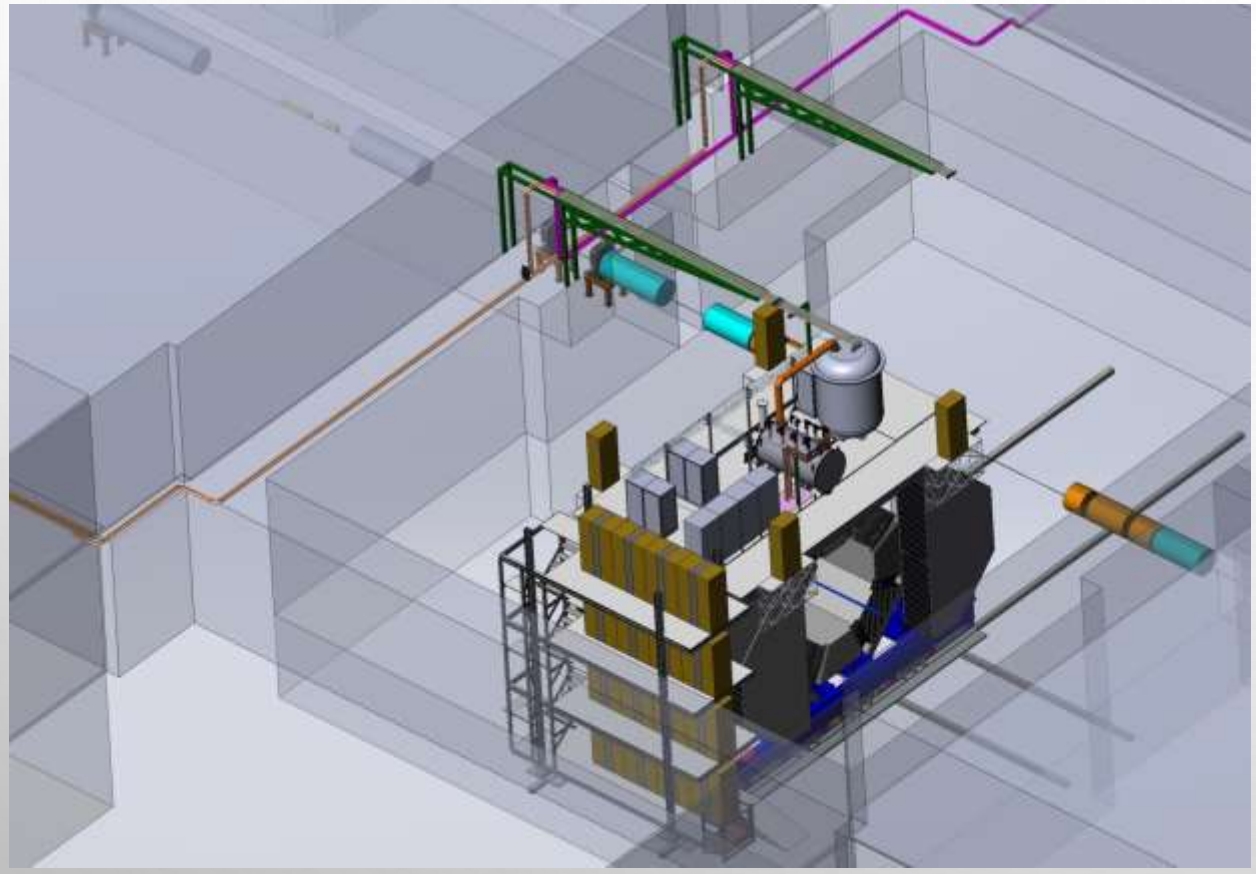


Nitrogen system

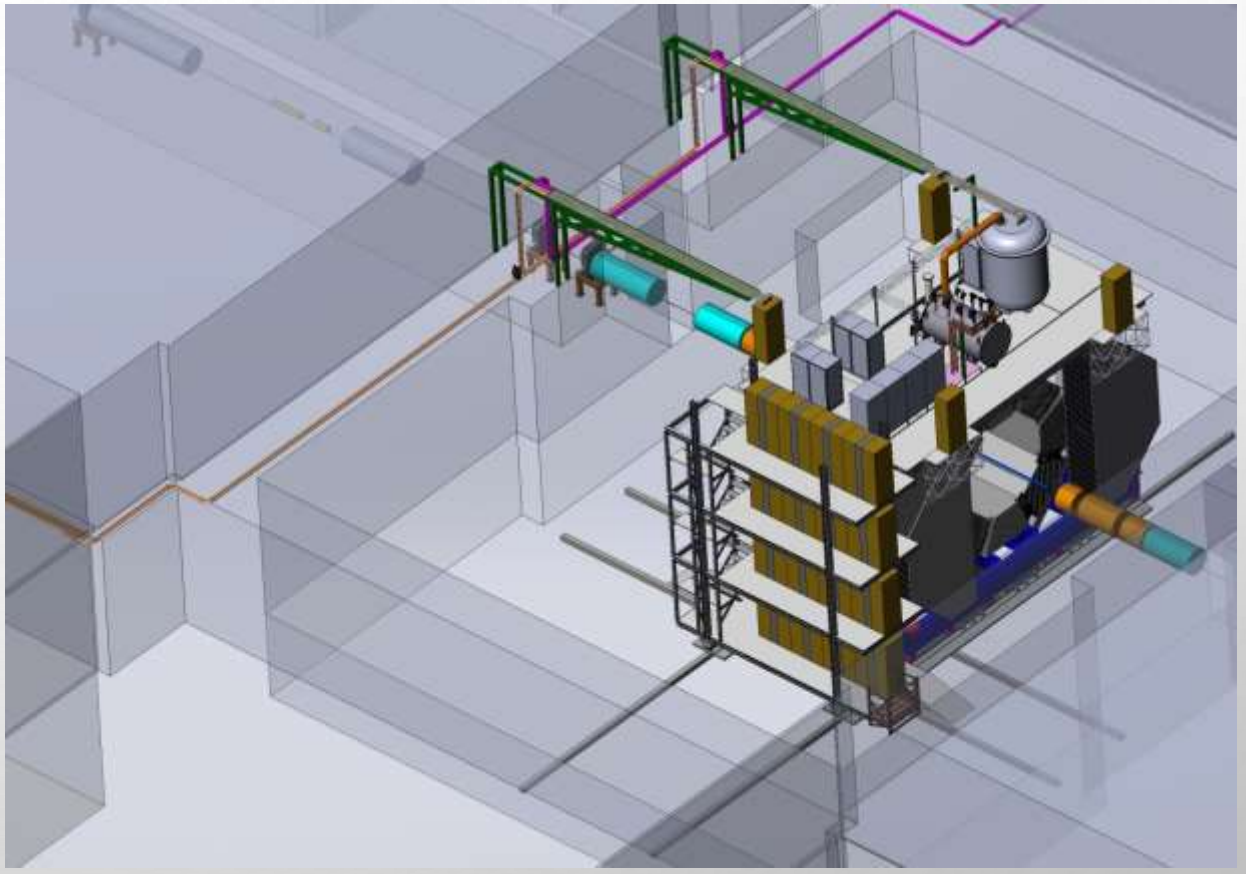
First option



Helium system



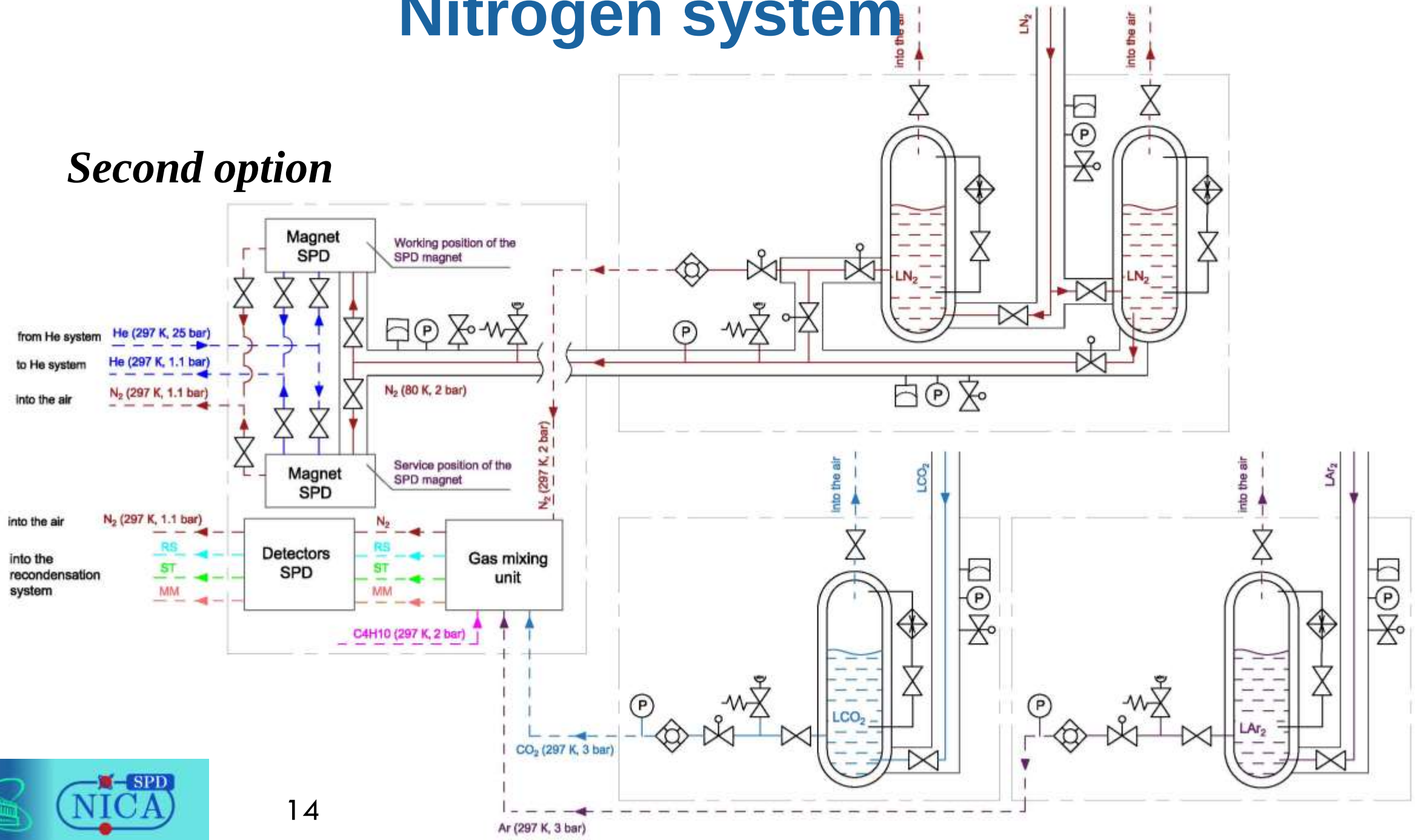
Service position



Working position

Nitrogen system

Second option



Nitrogen system

Gas consumption for SPD detectors during 1 month of operation

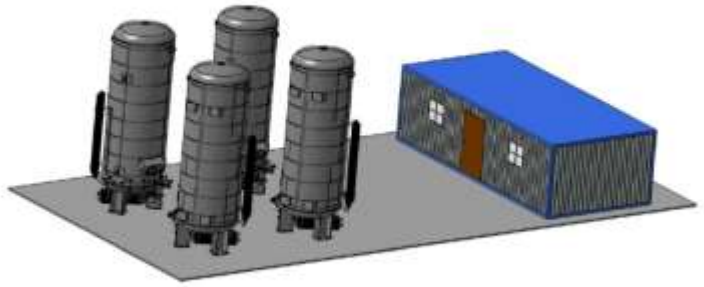
Detectors/Gas	N2	Ar	CO2	C4H10
RS	0,4 t	0,9 t	0,4 t	-
ST	-	4,5 t	2,1 t	-
MM	-	0,029 t	-	0,0045 t
Cryo plant	≈ 15 t	-	-	-
Total	15,4 t	5,429 t	2,5 t	0,0045 t

Technical specification for the design of the foundation for SPD equipment

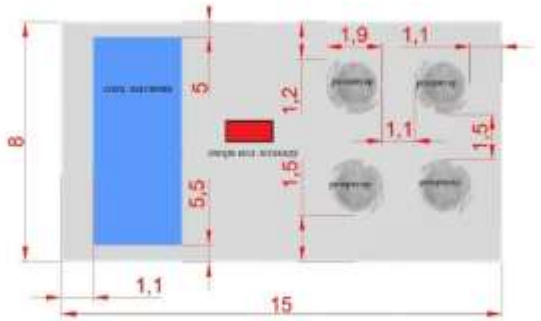
TECHNICAL SPECIFICATION

1. PURPOSE AND REQUIREMENTS TO THE PERFORMING WORKS
2. REQUIREMENTS TO INSTALLING EQUIPMENT ON A SINGLE SITE OF THE CRYOGENIC COMPLEX FOR SUPPORTING THE SPD MAGNET
3. COMPOSITION OF THE PERFORMING WORKS ON PLACING THE COMPLEX FOR CRYOGENIC EQUIPMENT FOR SPD
4. STAGES AND PHASES OF DEVELOPMENT
5. REQUIREMENTS TO REPORTING DOCUMENTATION
6. CONTROL AND ACCEPTANCE PROCEDURE
7. REQUIREMENTS TO THE PERFORMER
8. INITIAL DATA FOR DESIGNERS

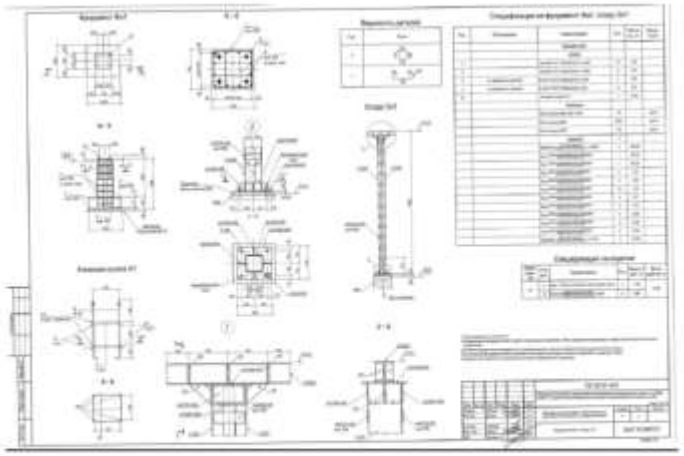
General view of the arrangement of tanks on the foundation of the SPD cryogenic complex



Location of cryogenic tanks on the foundation of the SPD complex



Example of a trestle for tracing pipelines to the SPD pavilion



Scientific and production association «GELIYMASH»

Conclusions:

1. The manufacturer of the SPD magnet and the type of cryogenic plant were determined.
2. The location of cryogenic tanks, their volumes and gas consumption for SPD were determined.
3. The maximum cooling capacity of the cryogenic plant is calculated.
4. The development of technical specifications for a cryogenic plant and a platform for cryogenic tanks is in an active phase.
5. The work is being carried out in accordance with the plan.

Thank you for your attention!