



# SIS300 Cooling System

A. Ageyev, S. Kozub, S. Zinchenko, V. Zubko  
IHEP, Protvino

**Work is executed under the contract with Rosatom**

Sergey Zinchenko, RuPAC-2010, 30.09.2010

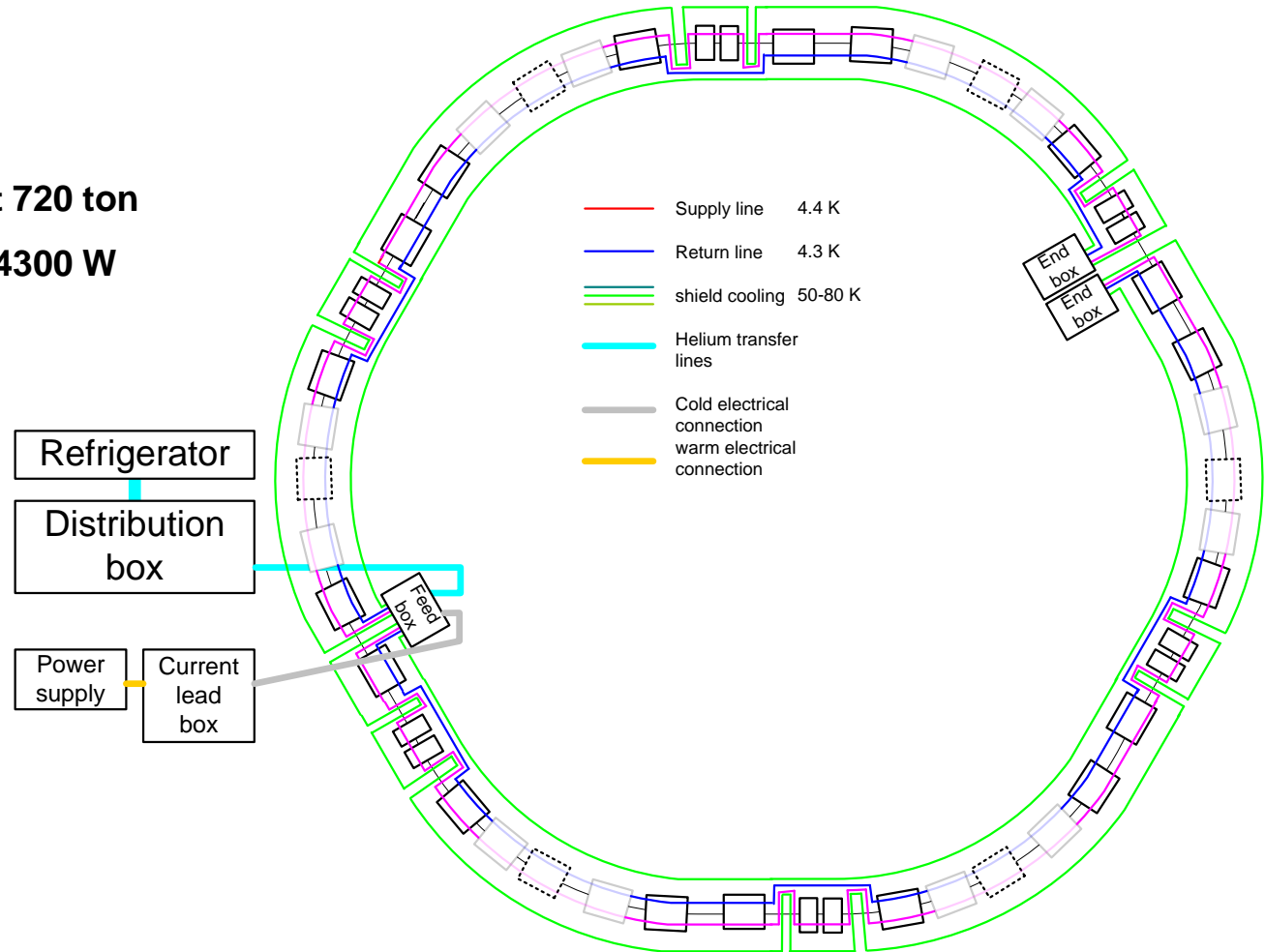
# SIS300 Cryogenics Flow Diagram

Six magnetic periods

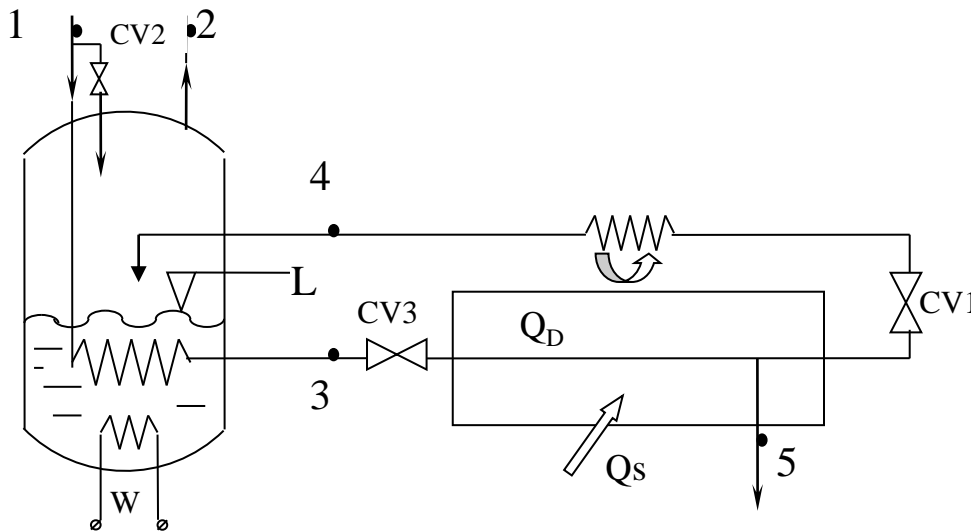
Perimeter ~1100 m

Cold mass at T=4.5K about 720 ton

Heat load at T=4.5K about 4300 W



# Magnet String Flow Diagram



<b>Power W, W</b>	<b>0</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>200</b>
<b>Quality factor at point 4</b>	<b>0.95</b>	<b>0.93</b>	<b>0.91</b>	<b>0.89</b>	<b>0.87</b>

CV1 - CV3 – valves; L– level meter; W – electric heater;  $Q_s$  – static heat leak;  $Q_D$  – dynamic heat load

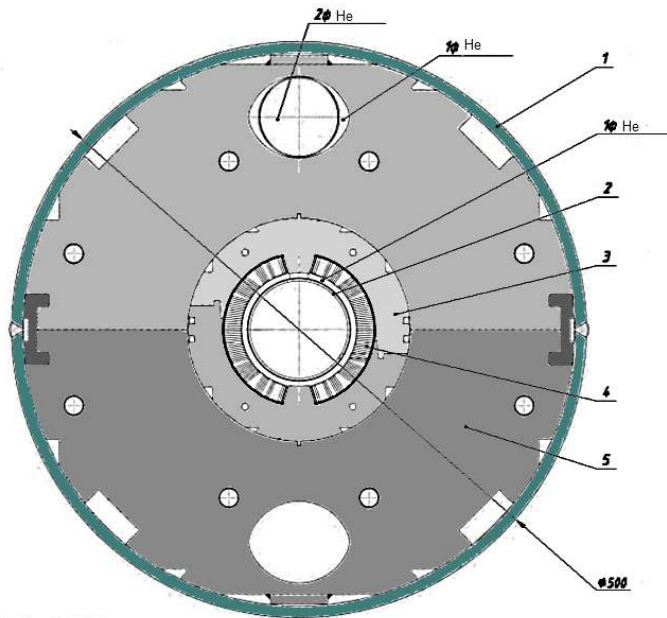
SIS300 helium flows parameters

Total SIS300 heat load at T=4.5 K

AC losses	2472 W
Ambient heat leak	1367 W
Beam pipe RF mirror current heat release	450 W
Total heat load	4289 W
Flow rate of liquid helium for cooling the current leads	4.53 g/s

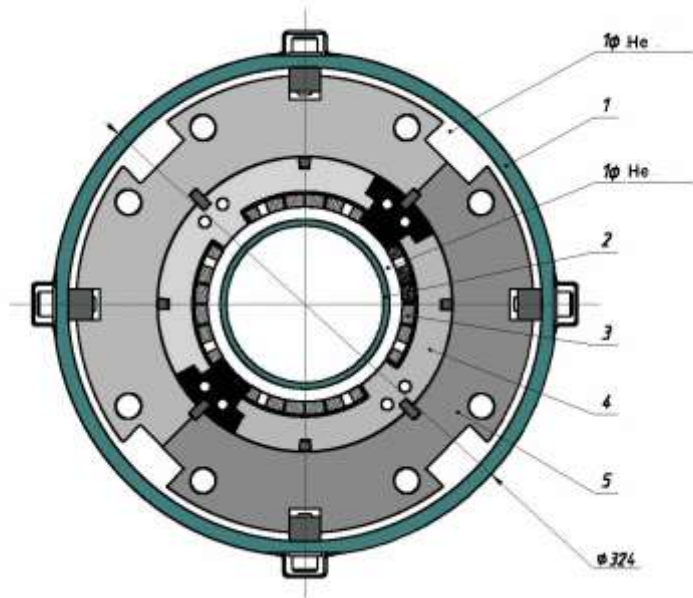
Pressure of supercritical helium at the entrance into the string of magnets	3 bar
Temperature of supercritical helium at the entrance into the subcooler of the string of magnets	4.6 K
Temperature of supercritical helium at the entrance into the string of magnets	4.35 K
Pressure of two-phase helium at the exit from the string of magnets	1.105 bar
Temperature of two-phase helium at the exit from the string of magnets	4.3 K
Two-phase helium flow quality factor at the exit from the string of magnets	$\leq 95\%$

## Cold masses cross sections of the dipole



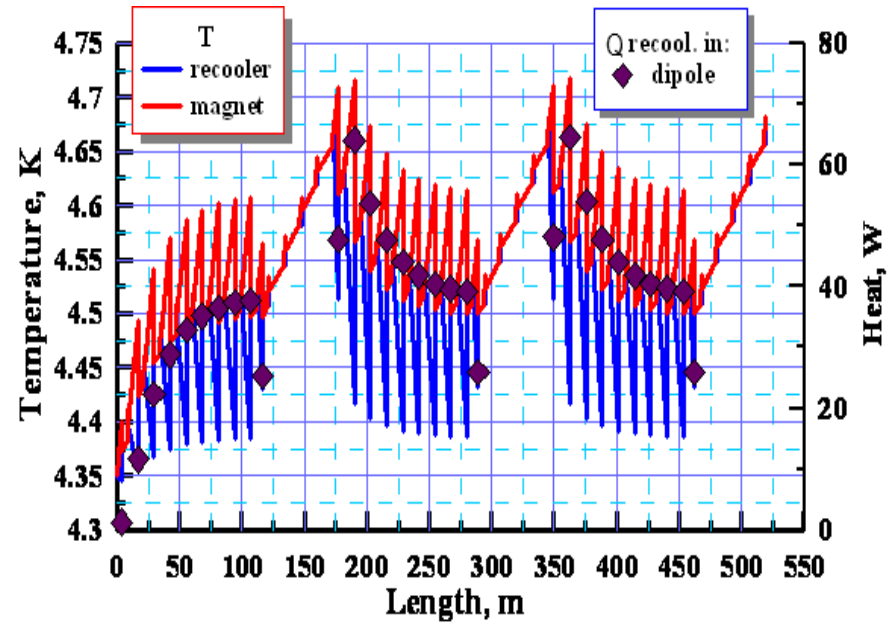
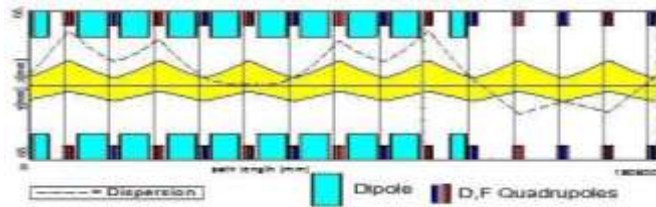
**1. Helium vessel external shell. 2. Beam pipe. 3. Stainless steel collar. 4. Superconducting coil. 5. Iron yoke. 1Ø – single-phase helium. 2Ø – two-phase helium.**

## of the quad

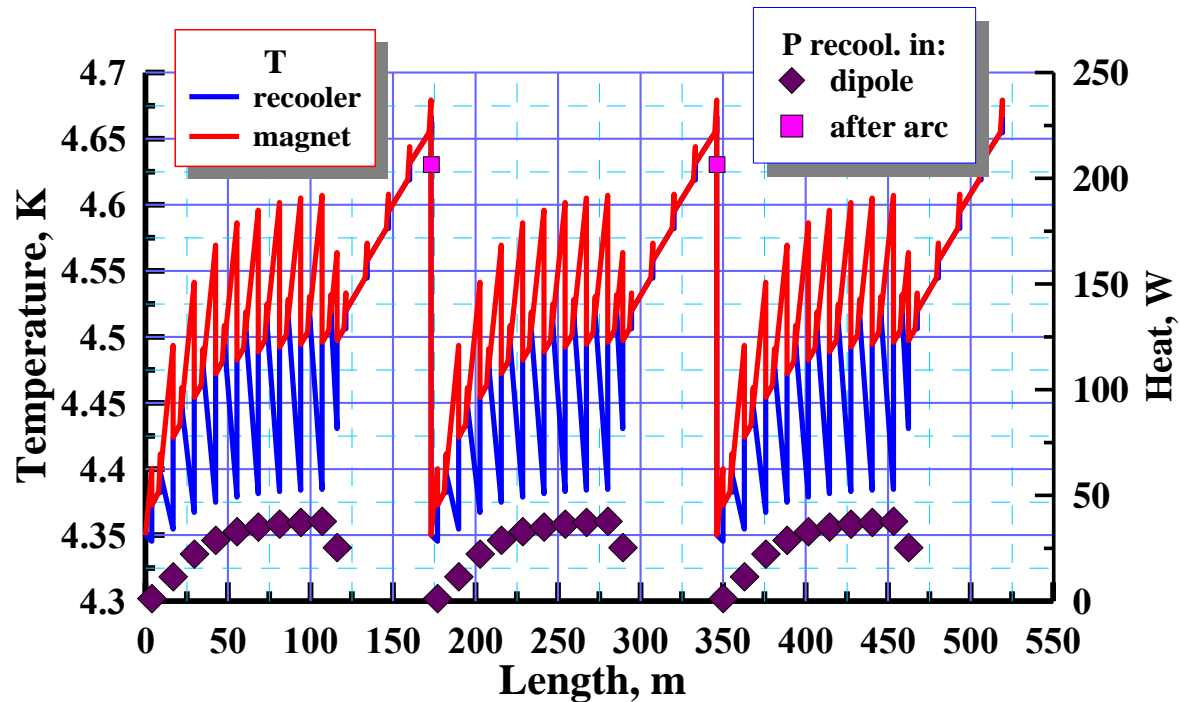


**1. Helium vessel external shell. 2. Beam pipe. 3. Superconducting coil. 4. Stainless steel collar. 5. Iron yoke. 1Ø – single-phase helium.**

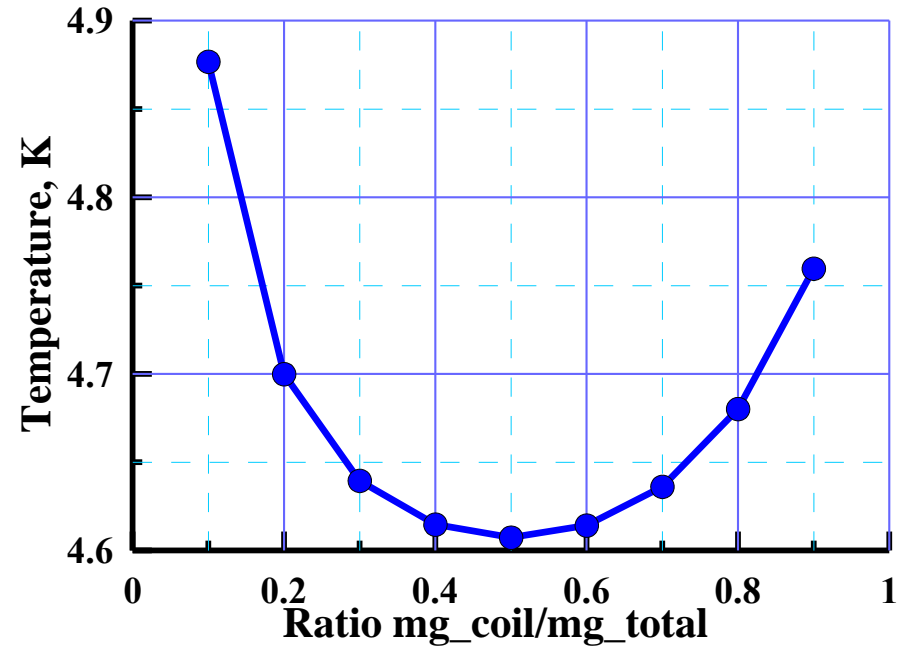
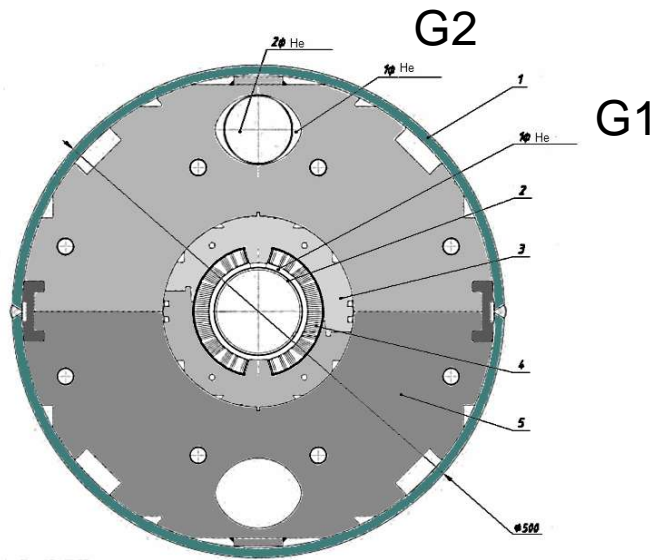
# SIS300 Lattice



# Temperature along the magnet string with additional heat exchangers



$G=G1+G2$  - total single phase helium flow along the string



Dependence of the maximum temperature of single-phase helium on the  $(G2/G)$  ratio

## **SIS300 cooling system is proposed and calculated.**

### **Further steps.**

- \* SIS300 cooling down analysis.
- \* Quench process analysis and after quench recovery.
- \* Warming up for repair works and recovery of the nominal cooling mode.
- \* Technological scheme of the SIS300 cooling.
- \* Development of the draft design of the four additional heat exchangers.