

Conduction Cooled HTS Current Leads for the SIS100 Corrector Magnets

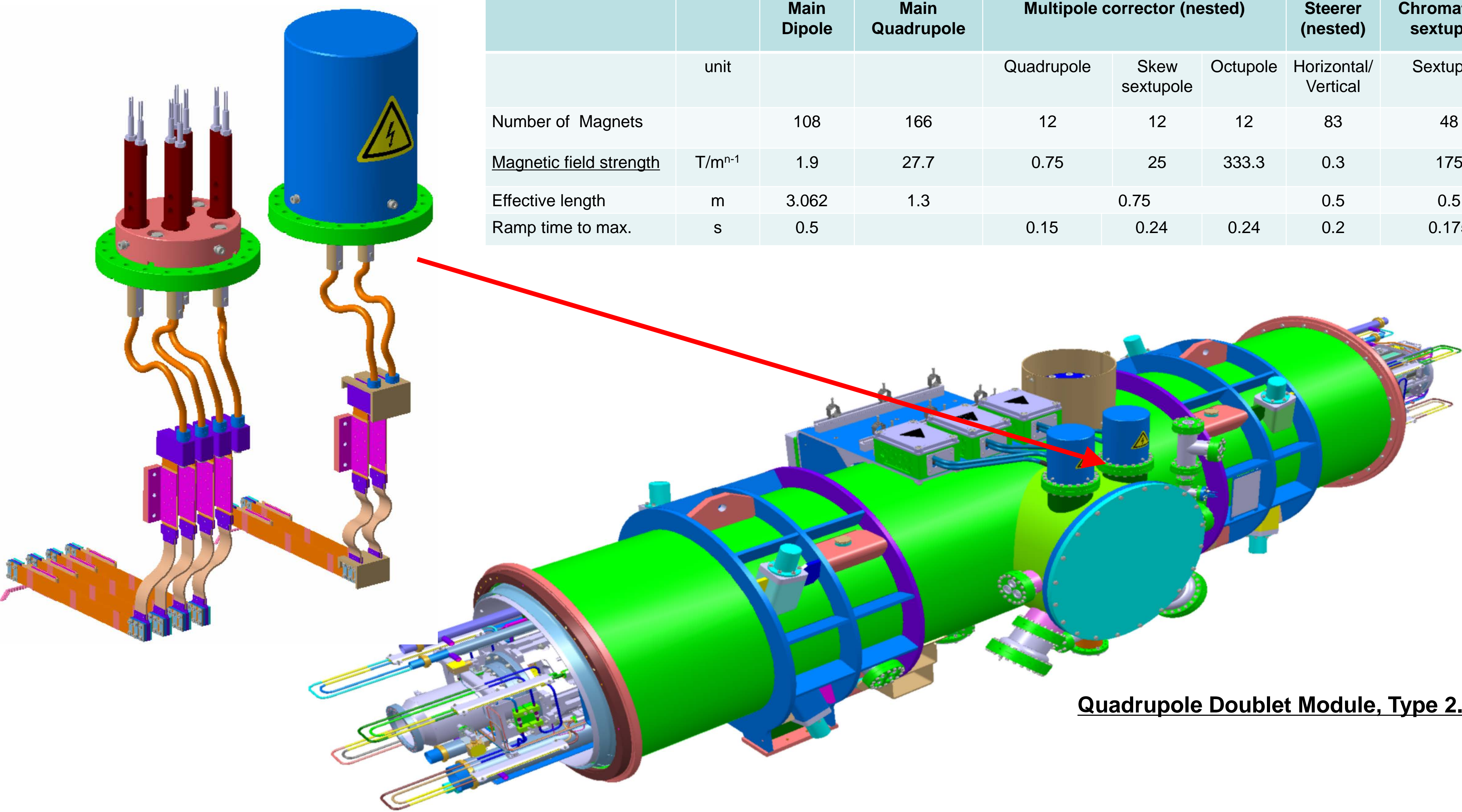
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Abstract – The superconducting synchrotron SIS100 for the FAIR accelerator project requires 137 superconducting corrector magnets: chromaticity sextupoles, steerers and multipole correctors. These corrector magnets are distributed along a circumference of 1083.60 m. The coils of the corrector magnets are individually powered and require all together 244 pairs of current leads with the rated current of 250 A DC. To reduce the heat load to the cold mass of the superconducting ring the current leads will be de-signed by use of the HTS material with a heat sink at the temperature level of 50 - 80 K. Modern 2G HTS tapes with low thermal conductivity and high current density enable a compact design of the current leads cooled entirely by the thermal conduction of the copper parts. The first pair of the current leads has been fabricated and successfully tested at the GSI magnet testing facility. The experimental data are in good agreement with the calculated values. The design of the current leads is presented as well as the measured data.

- Conduction Cooled Local Current Leads for the SIS100 corrector magnets**
- Operating current up to 250 A DC;
 - Pulsed mode operation between – 250 A and +250 A at 3 Hz repetition frequency;
 - Short term operation at up to 300 A (magnet training);
 - Low heat impacts to the cold mass at 4.5 K and to the thermal anchor;
 - Thermal anchor temperature between 50 K and 80 K depending on the location in the tunnel;
 - High voltage up to 1.1 kV, no degradation of insulation during long periods;
 - Geometrical constrains: length, position of the thermal anchor in the cryostat;
 - Compensation of the mechanical movement of the current lead assembly at cool down and warm up;
 - Safe, easy and reliable assembly-disassembly within restricted tunnel conditions;
 - at least 30 years operation time;

Calculated Heat Load	I = 0 A	I = 250 A DC
at 50 K	8.5 W	14.0 W
at 4.5 K	0.1 W	0.2 W



Parameters of the SIS100 sc- magnets

		Main Dipole	Main Quadrupole	Multipole corrector (nested)			Steerer (nested)	Chromaticity sextupole
	unit			Quadrupole	Skew sextupole	Octupole	Horizontal/ Vertical	Sextupole
Number of Magnets		108	166	12	12	12	83	48
Magnetic field strength	T/m ⁿ⁻¹	1.9	27.7	0.75	25	333.3	0.3	175
Effective length	m	3.062	1.3		0.75		0.5	0.5
Ramp time to max.	s	0.5		0.15	0.24	0.24	0.2	0.175

