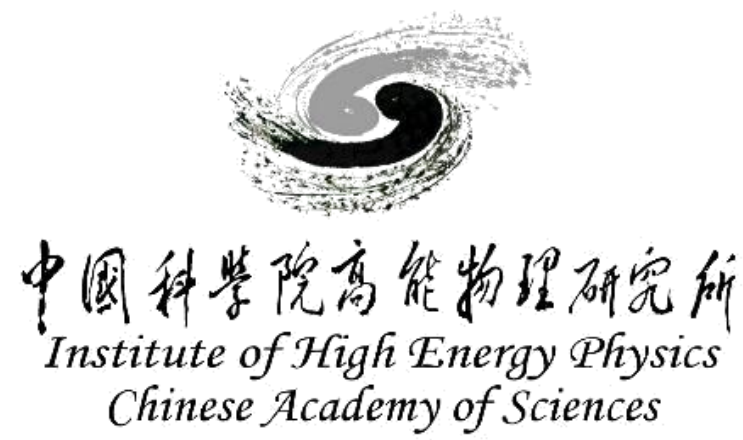


Electromagnetic and Quench Characteristics of the CEPC Detector Superconducting Magnet



Menglin Wang¹, Feipeng Ning¹, Ling Zhao¹, Zhilong Hou¹, Yatian Pei¹, Yingshun Zhu¹, Jieru Geng¹, Qingjin Xu¹

¹Institute of High Energy Physics (IHEP), Chinese Academy of Sciences (CAS), Beijing, China

Introduction

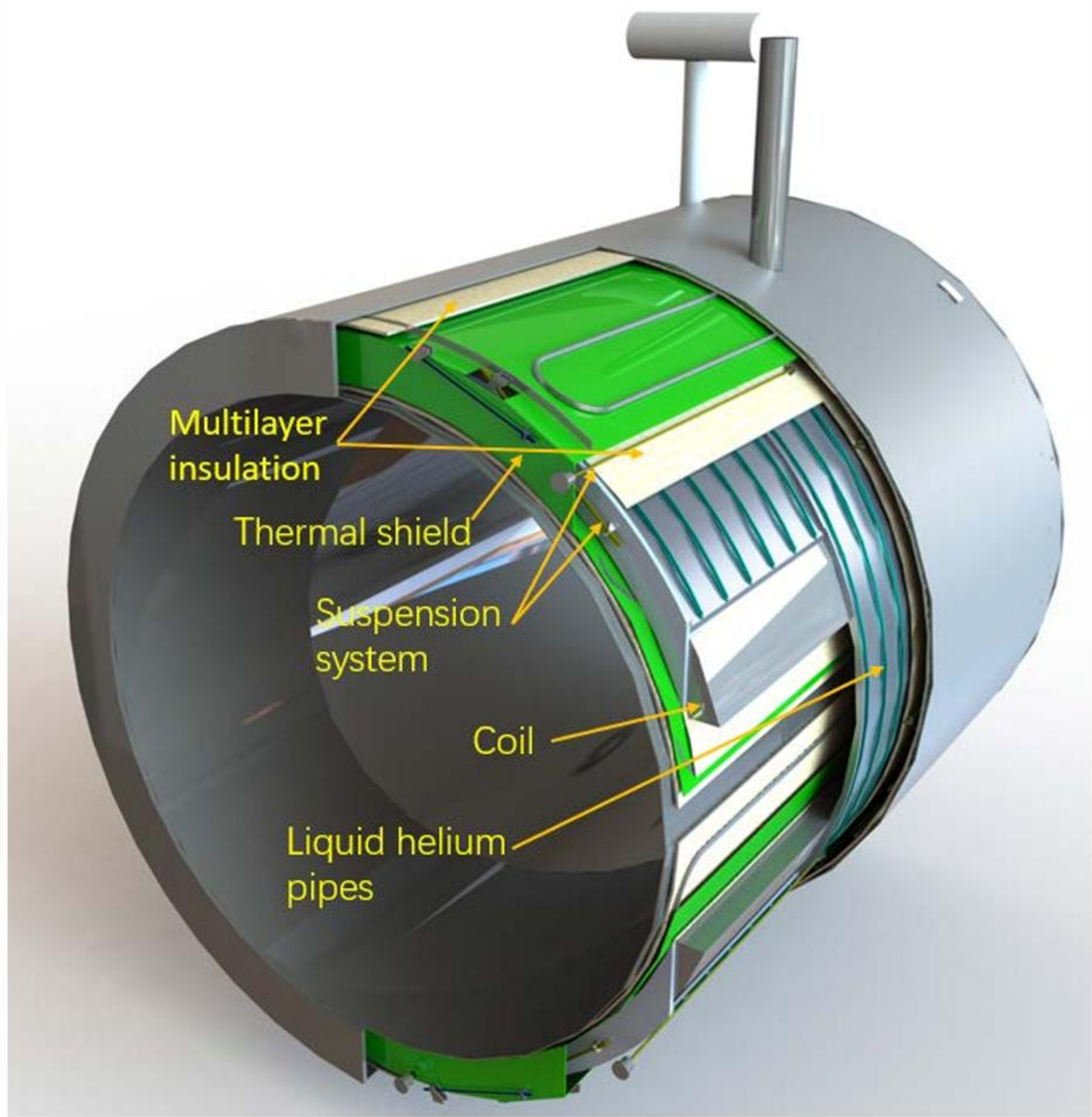
CEPC Detector Superconducting Magnet

- Coil:** 4 layers *700 turns, center field 3T@17kA
- Cable:** Al-stabilized NbTi/Cu Rutherford cable, double-coated aluminum Box type
- Cooling:** Thermosyphon cooling method with a small temperature difference, the operating temperature is 4.2K
- Support:** Suspension system composed of titanium alloy rods
- Quench protection:** Based on the dump resistor



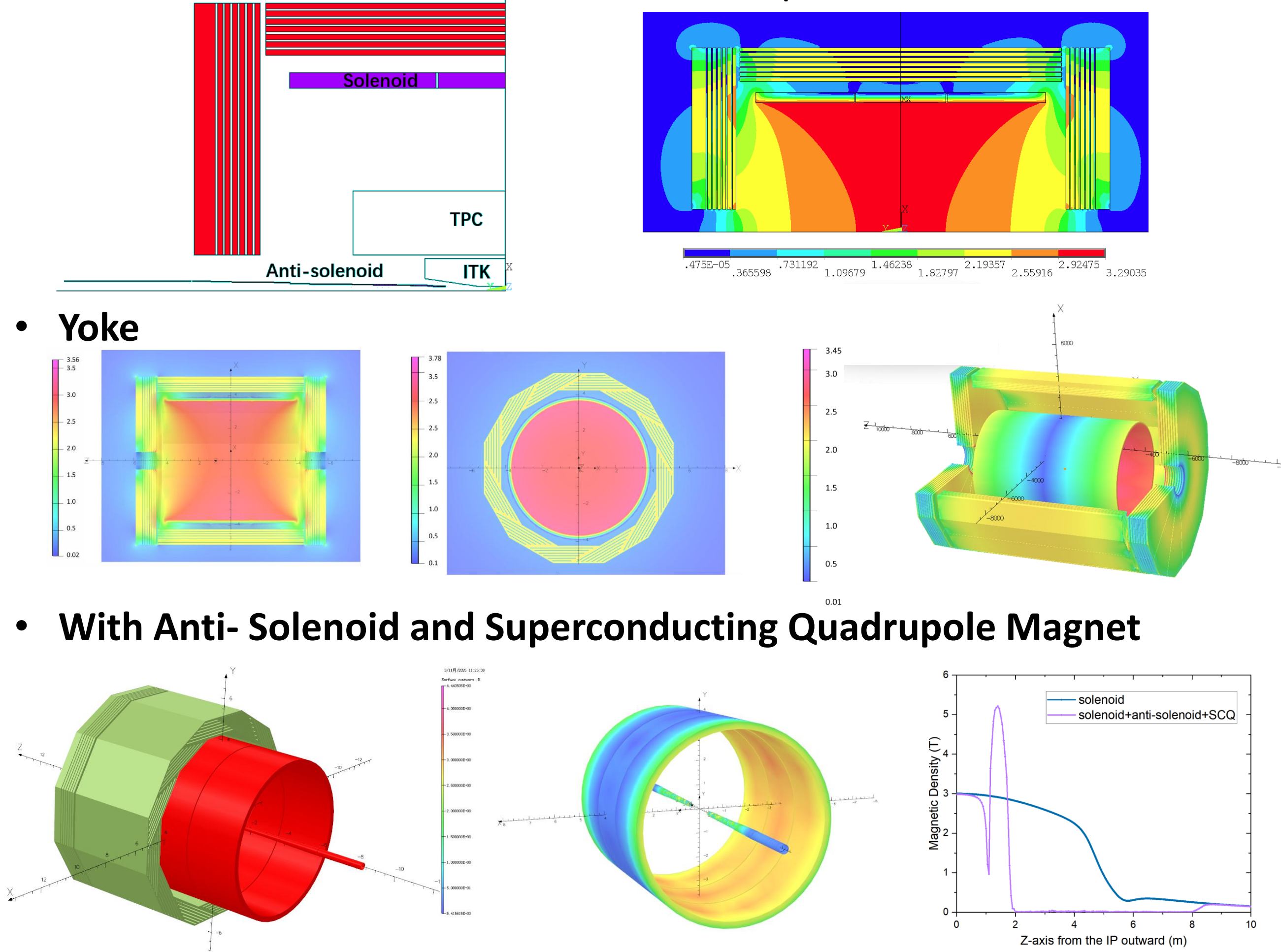
Layout and parameters

Parameters	Value	units
Coil Inner diameter	7300	mm
Coil Outer diameter	7916	mm
Coil length	8150	mm
B@(0,0,0)	3 T	T
Operating current	17	kA
Coil Module gap	50	mm
Inductance	11	H
Stored Energy	1.54	GJ
Cable dimension	56*22	mm
Number of strands	32	
Coil length	8150	mm
Cable critical current@4.2 K, 5 T	51	kA

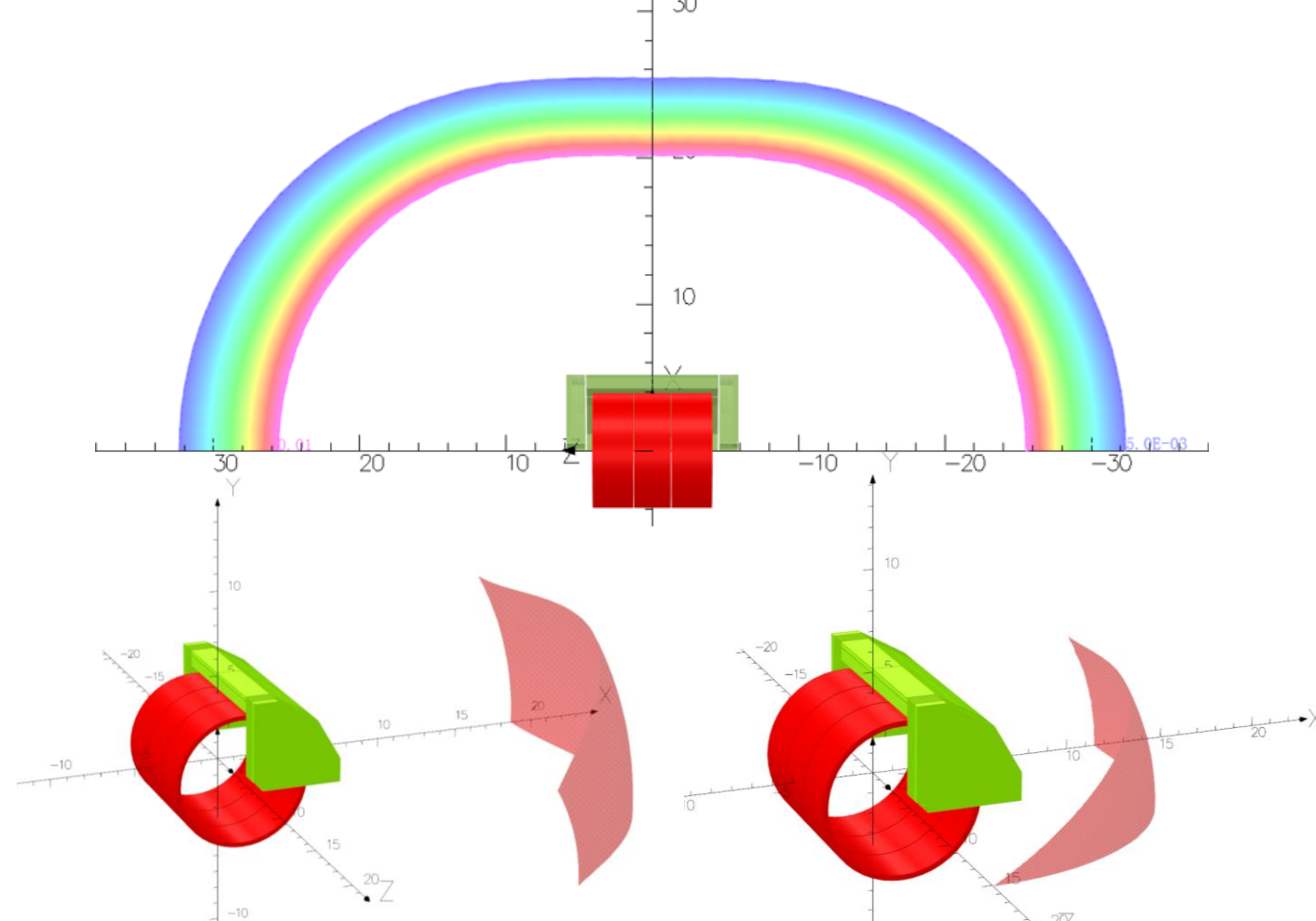


Magnetic field design

- Detector magnet: Solenoid:** B_{center} is 3 T, B_{peak} in coil is 3.8 T

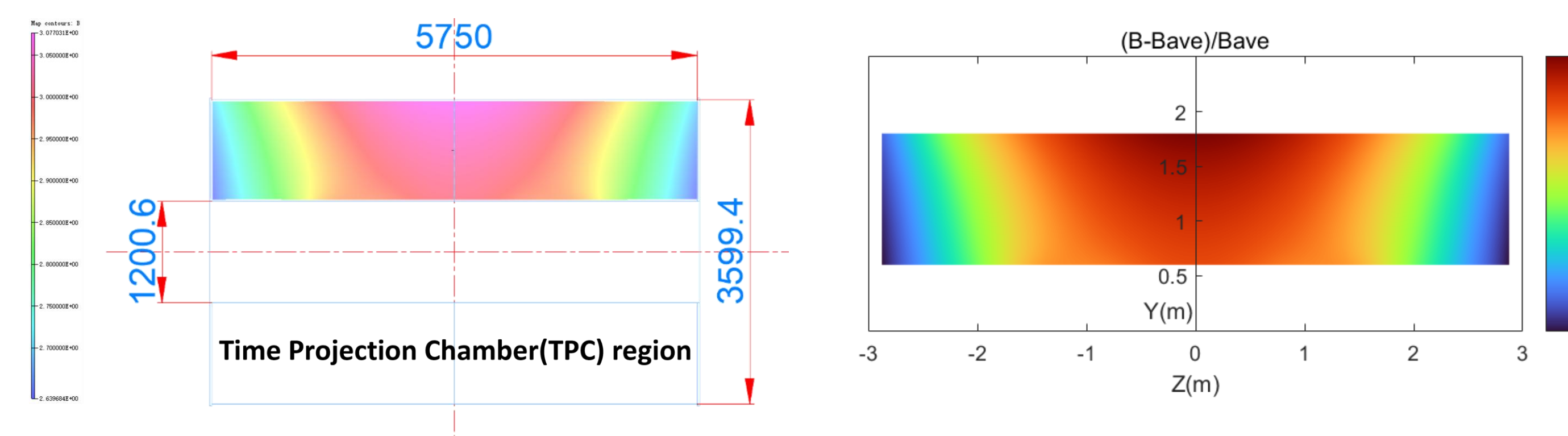


- Stray field**



	Stray field	Position
50 Gs	R direction	25.4 m
	Z direction	32.3 m
100 Gs	R direction	20.2 m
	Z direction	25.6 m

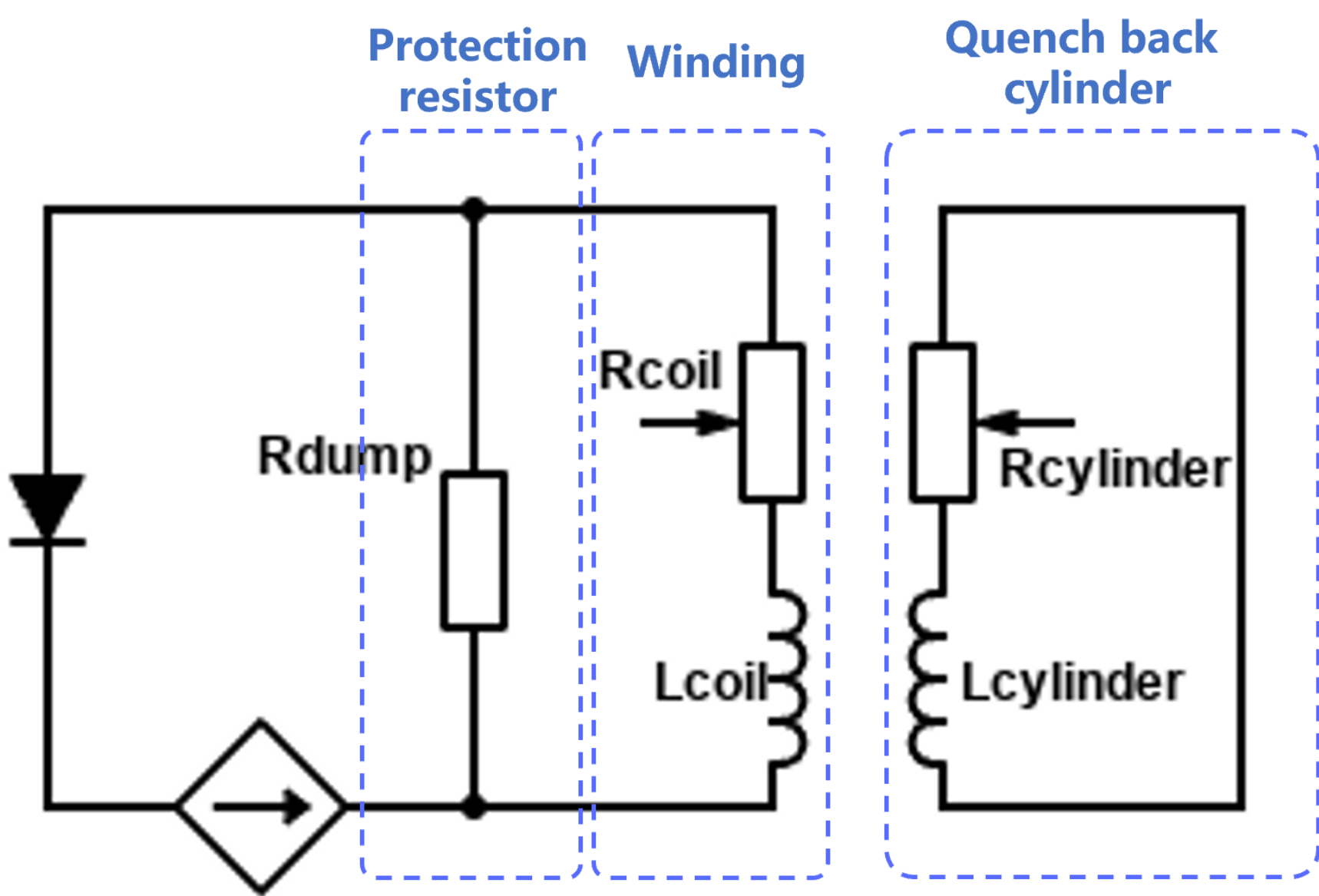
- Field Uniformity in TPC region**



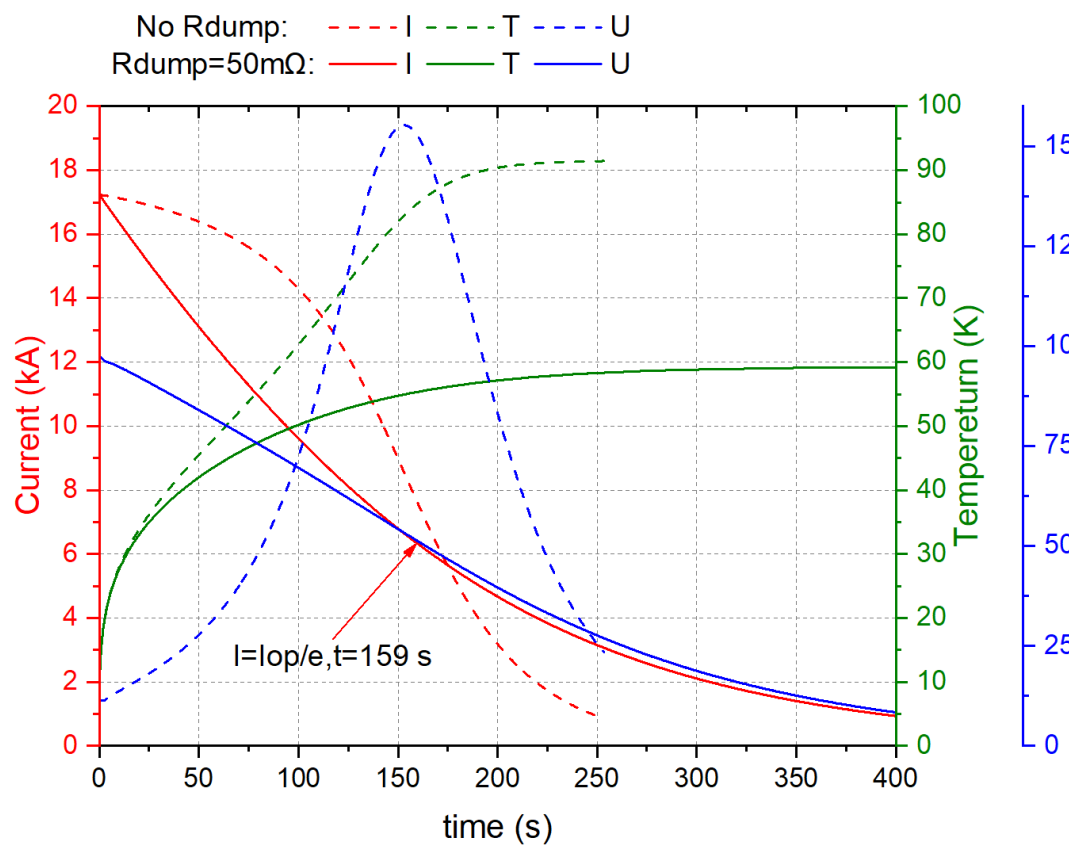
Quench Characteristics

Quench detection and protection

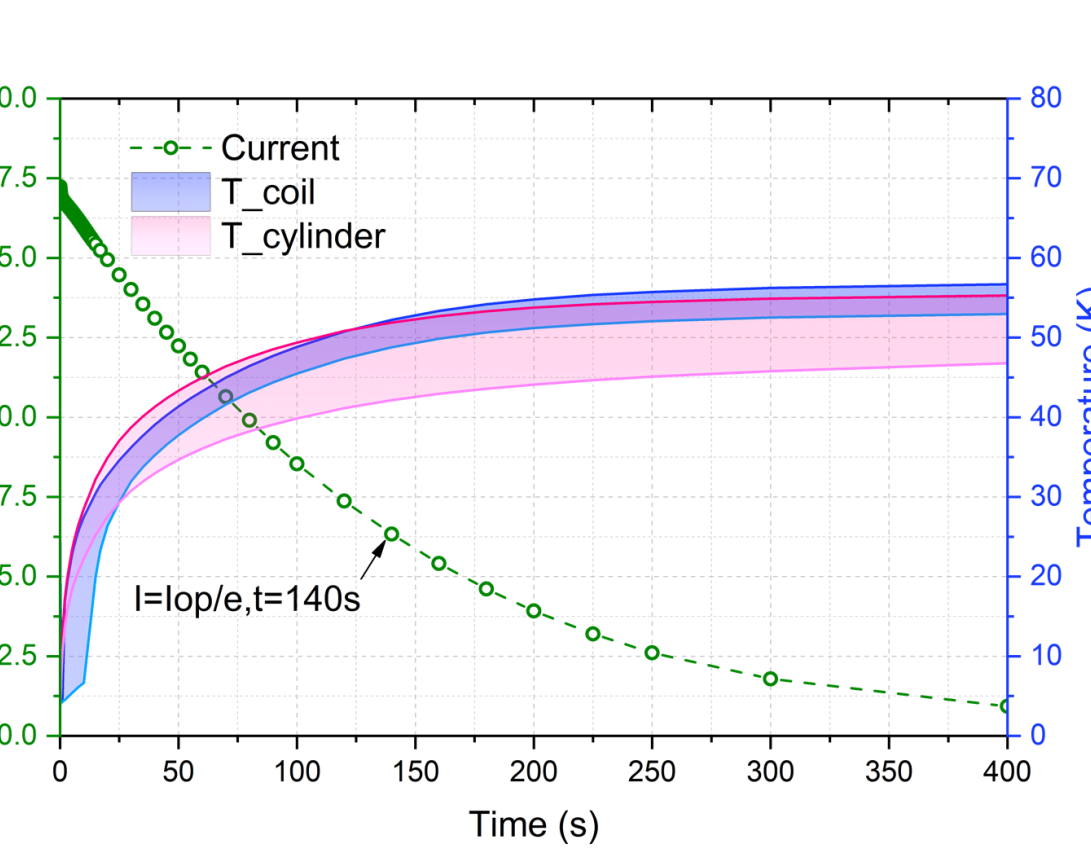
- Quench detection :** Voltage of the coil
- Quench protection :** dump resistor + quench back cylinder



- Dump resistor:** Extracts energy to the outside

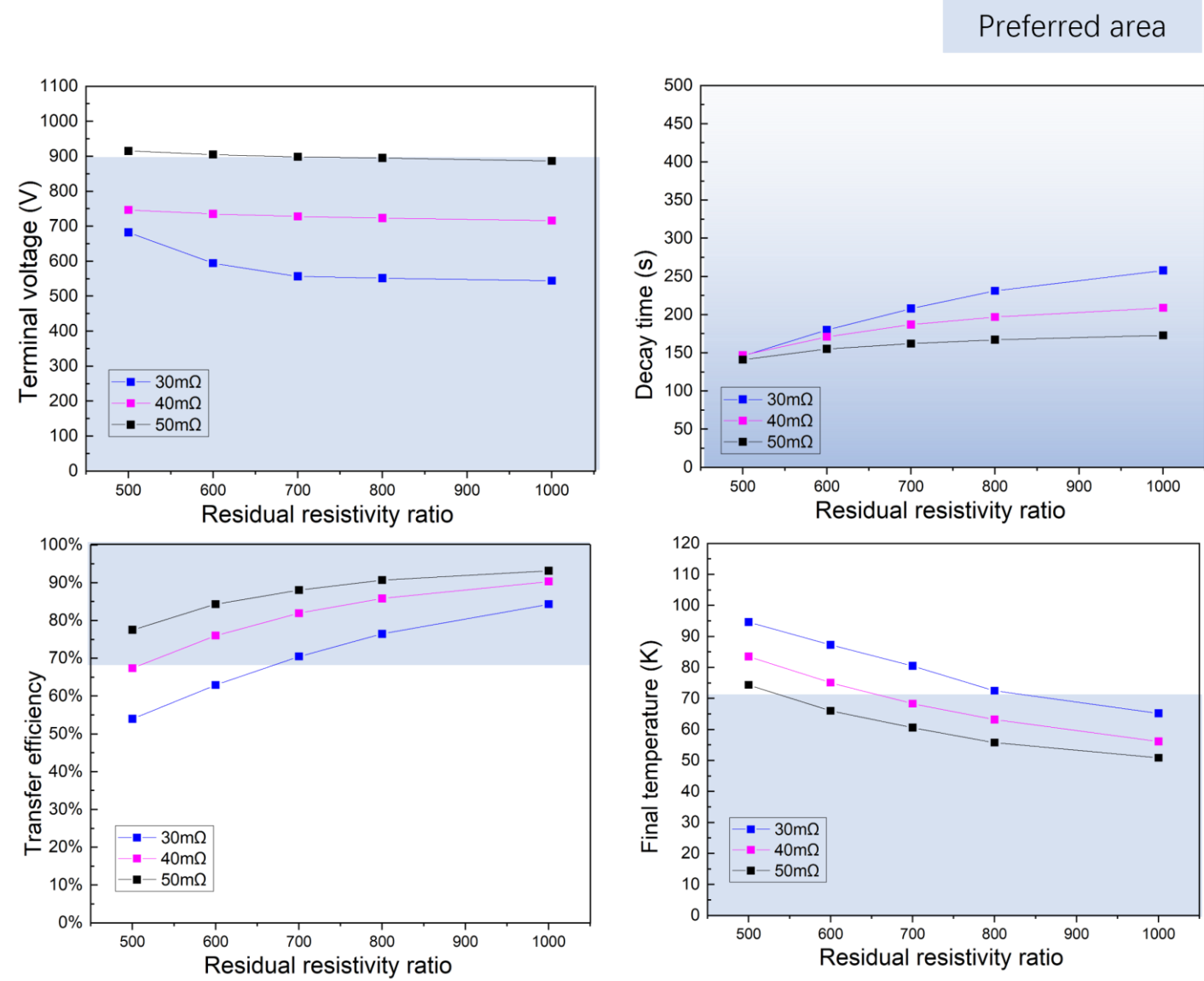


- Al cylinder :** Eddy losses reverse heating coil

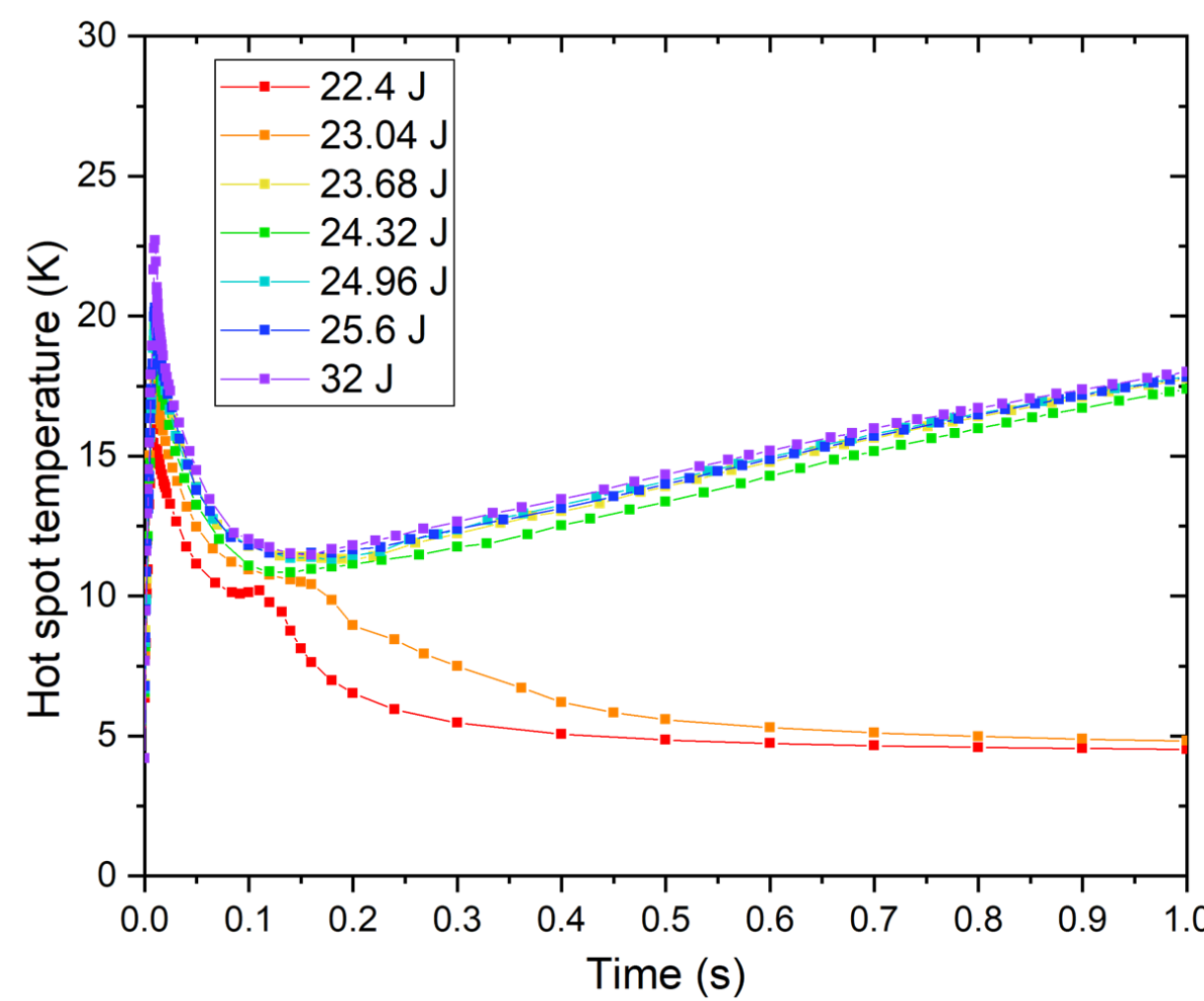


Quench parameters

- The RRR of the Al stabilizer: > 600 is better**



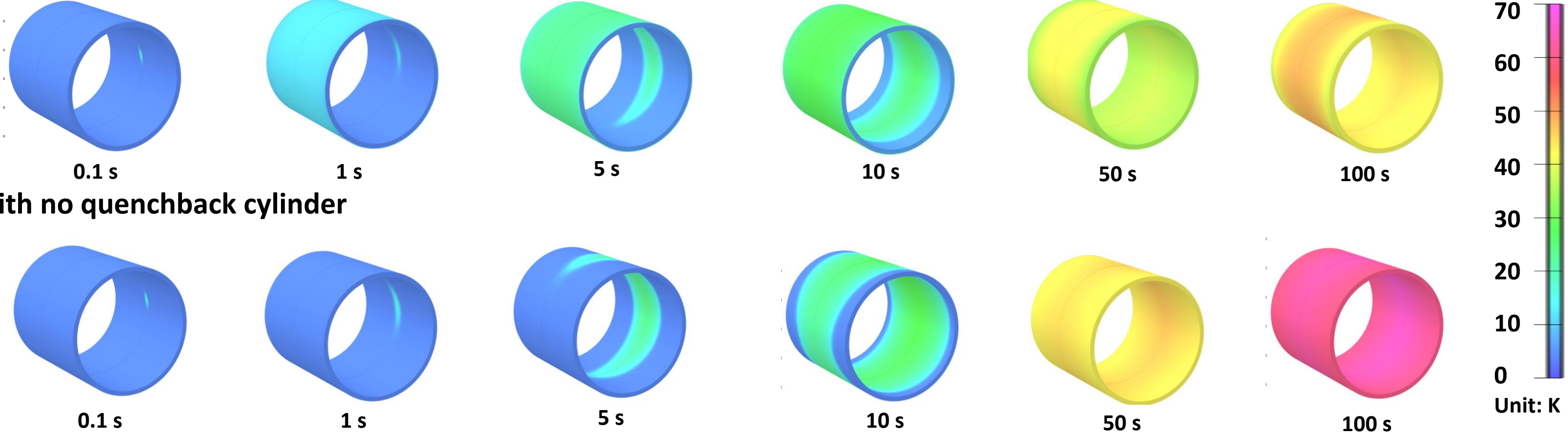
- Minimum energy energy and quench propagation speed**



- Along the cable:** 2.514 m/s
- Axially:** 0.089 m/s
- Radially:** 0.139 m/s
- MEQ:** ~24.96J

- The coil temperature after quenching triggered from the innermost turn**

- With Dump resistor and quenchback cylinder, delay time = 0 s**



- With no quenchback cylinder**