

HTS solutions for FCC magnets and power infrastructure

SuperOx

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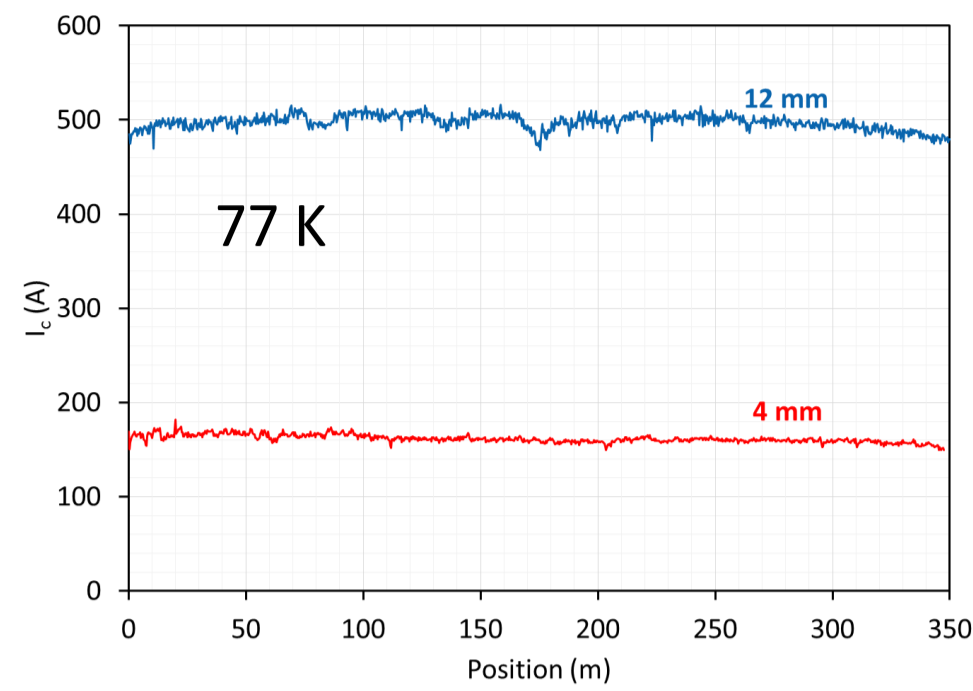
V. Vysotsky
VNIIPK, Podolsk, Russia



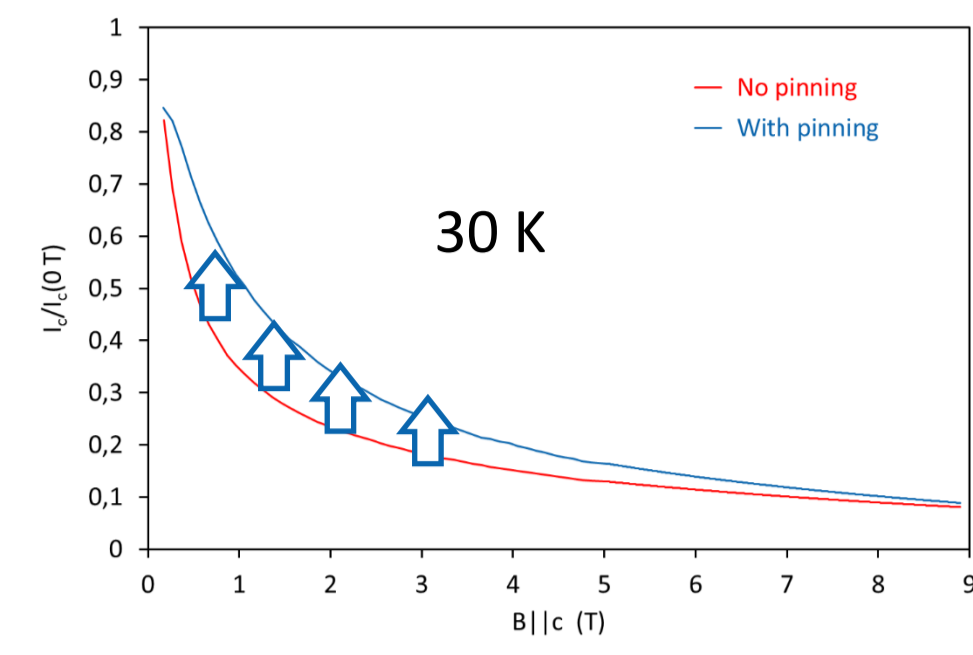
S. Kozub
IHEP, Protvino, Russia

2G HTS wire

Production



R&D: enhanced in-field performance



Customisation

Customised Finish	Ag	Cu	Kapton tape wrap	Polyimide varnish	Lamination	Solder plating	Stacks	Composite bulk	Filaments
FCL	+								
AC cable	+	+							
DC cable	+	+							
Current leads	+								
Magnet coil	+	+							
MagLev	+								
Field shield	+								

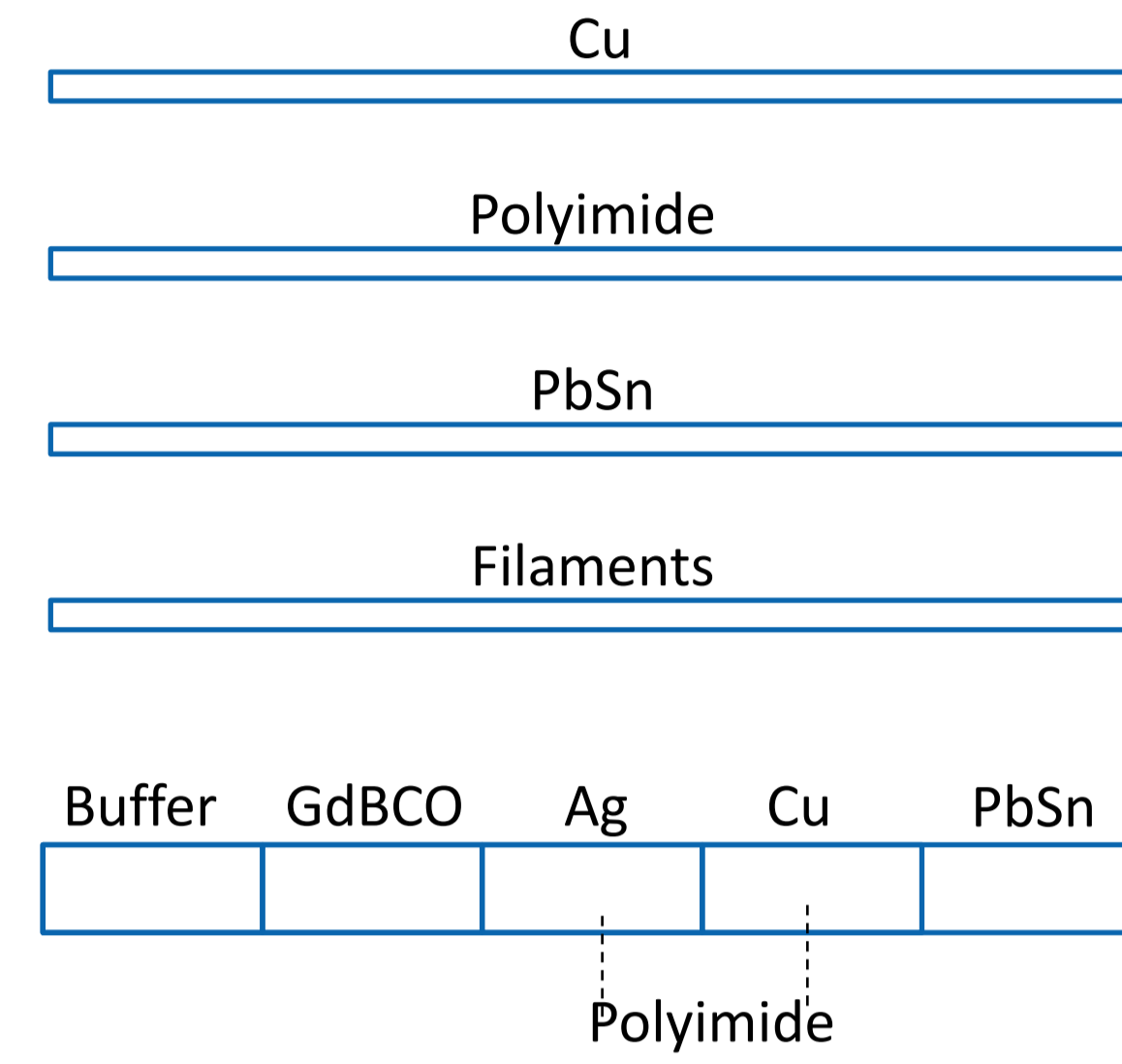
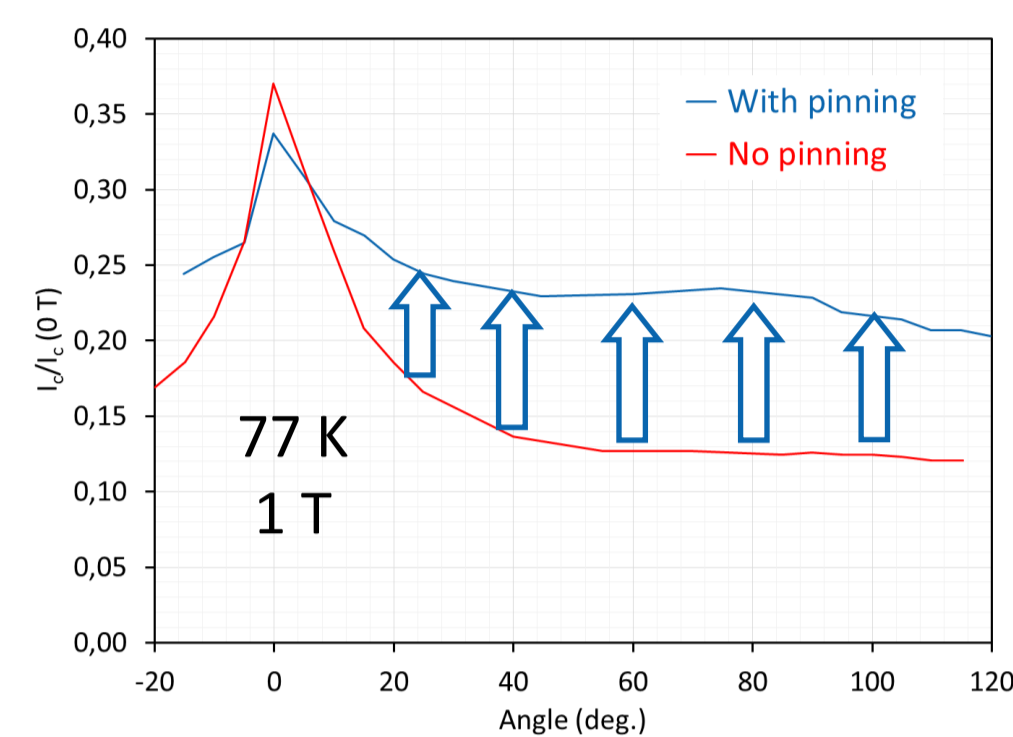
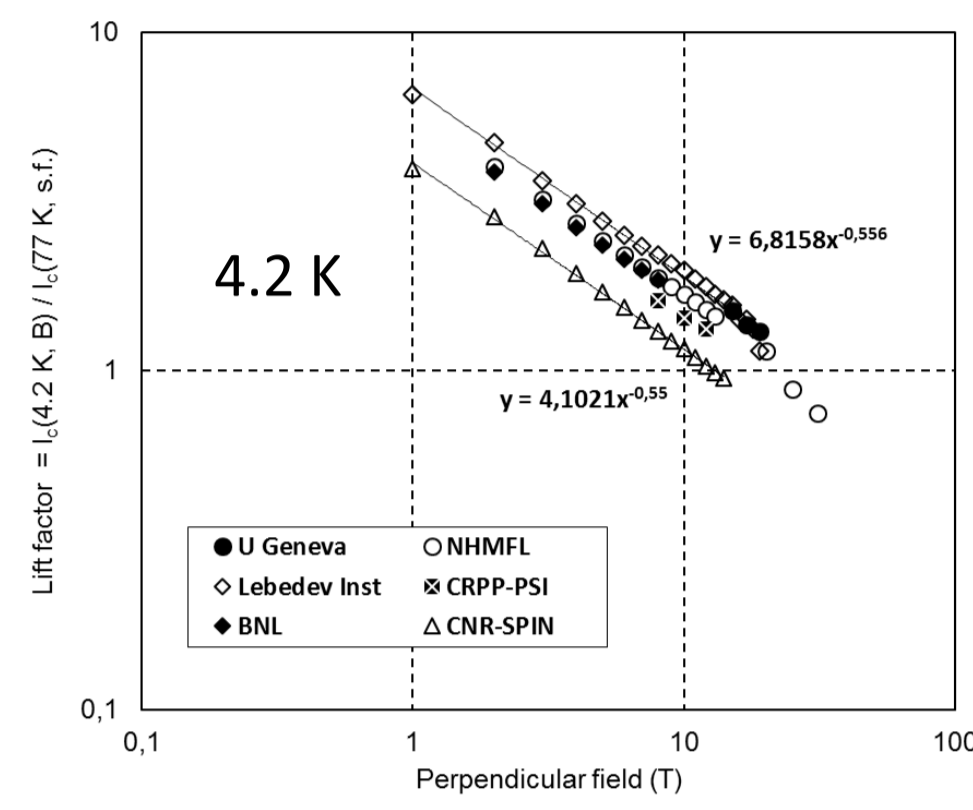
Production development

Originally: 2011-2015						
Moscow	Substrate			Ag	Cu	Finish
Tokyo		Buffer	HTS	Ag		

Ultimately						
Moscow	Substrate	Buffer ₂₀₁₆	HTS ₂₀₁₆	Ag	Cu	Finish
Tokyo	Substrate...	Buffer	HTS	Ag	Cu ₂₀₁₆	Finish...



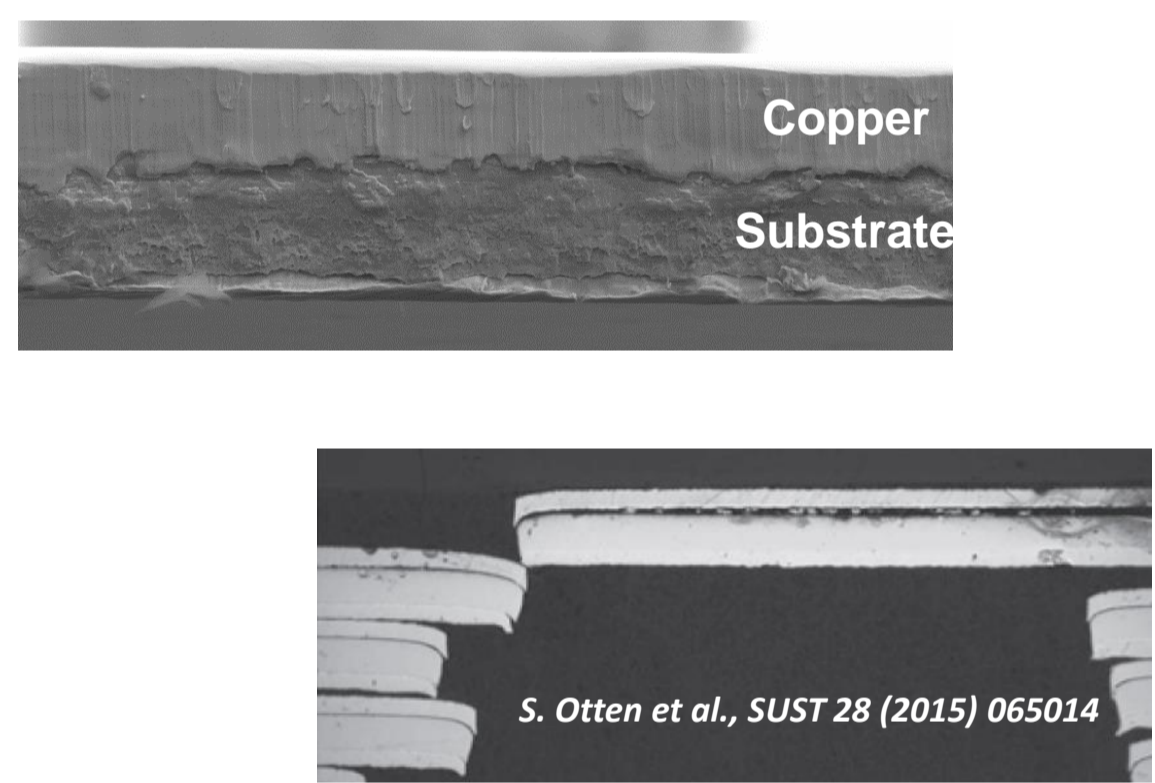
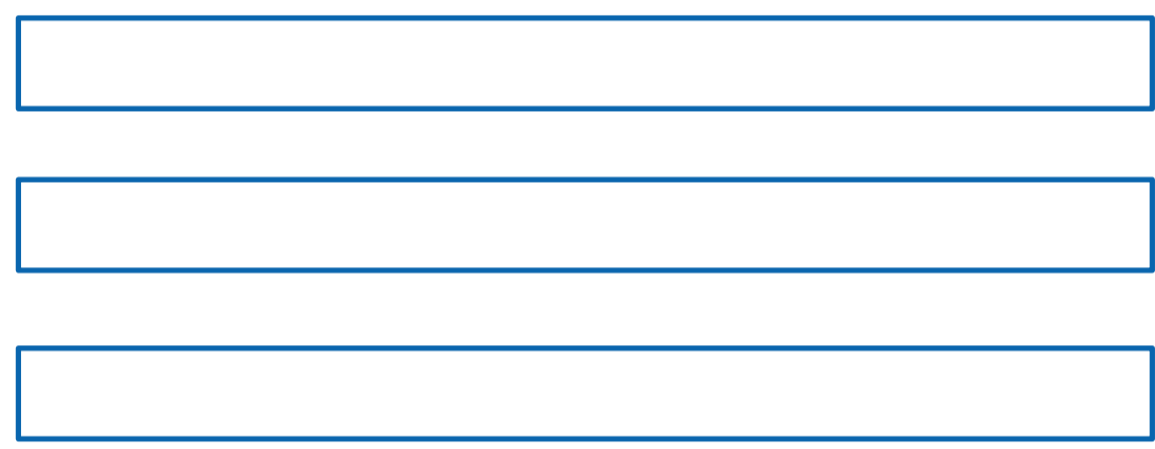
New buffer layer deposition line commissioned in Moscow PLD-HTS system to be commissioned by the end of 2016



HTS Roebel cables for 20 T dipoles

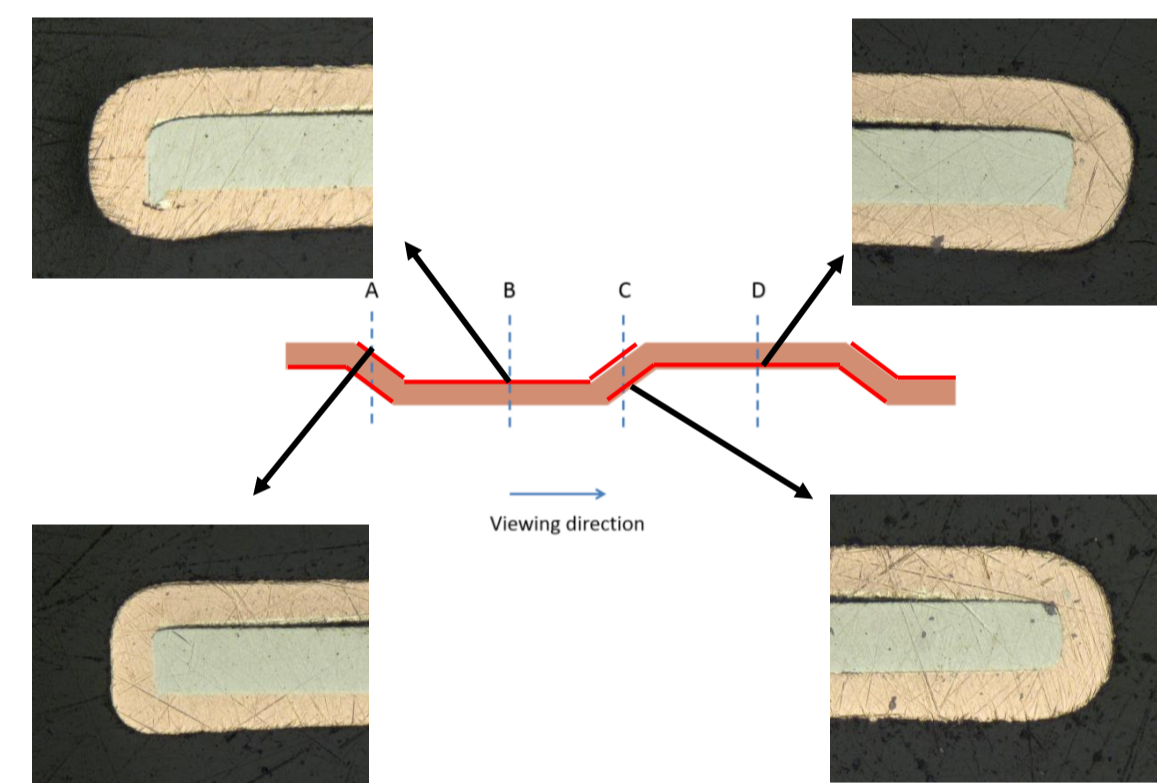
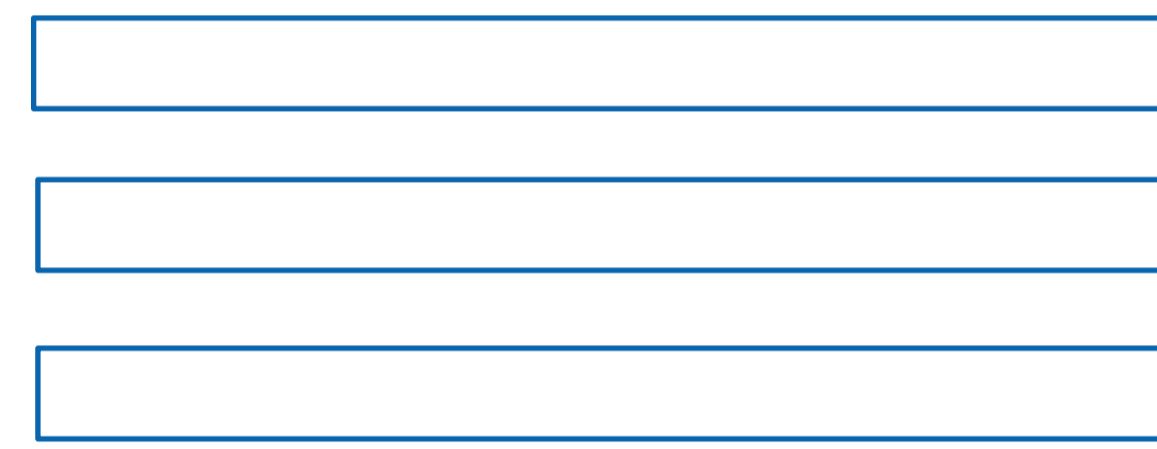


Coat-and-punch

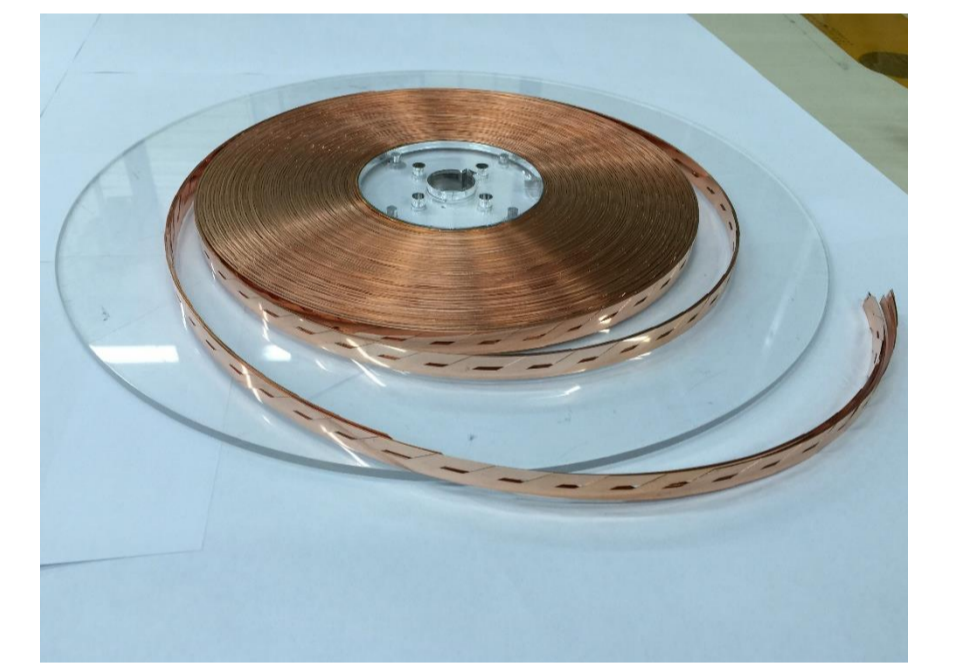
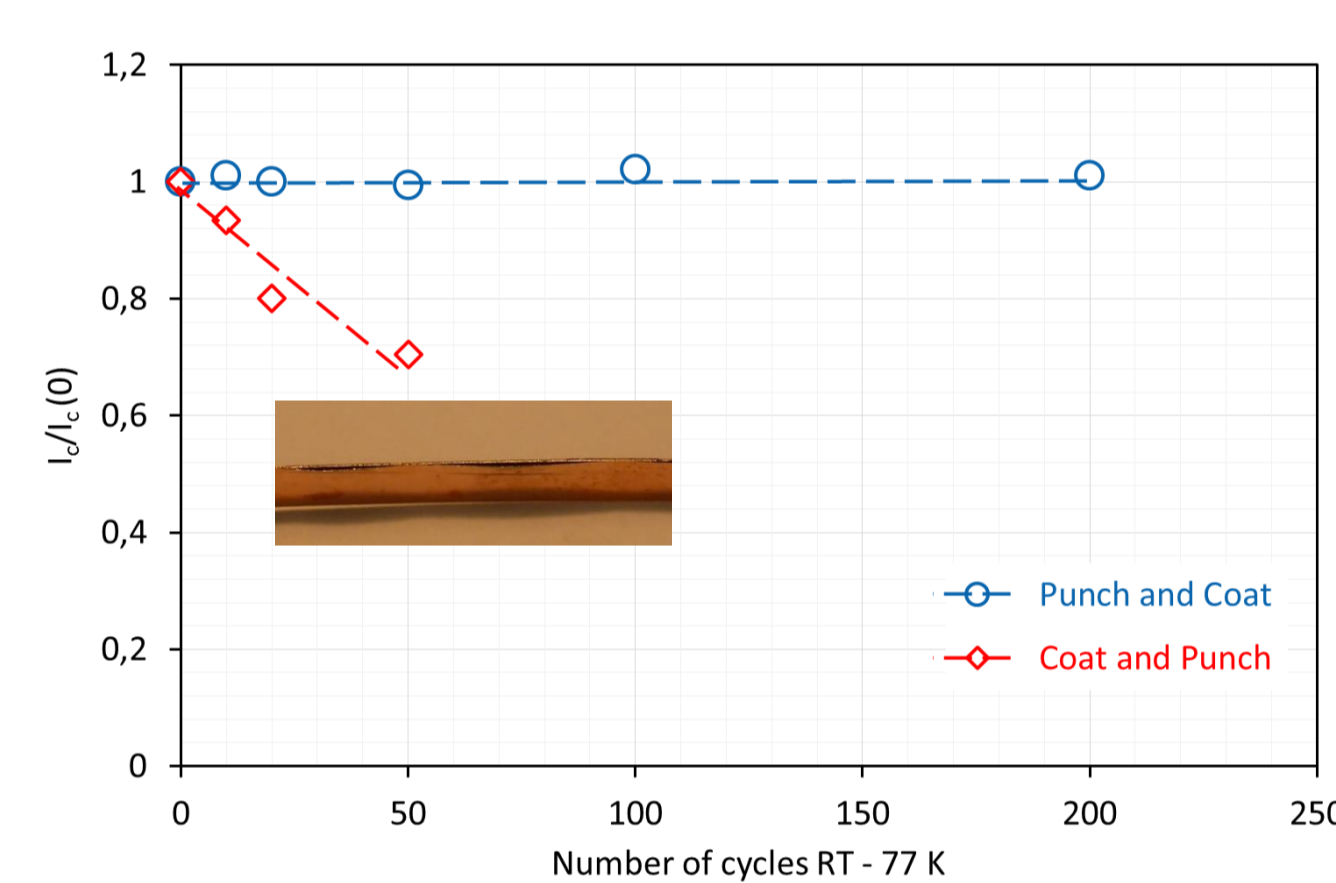
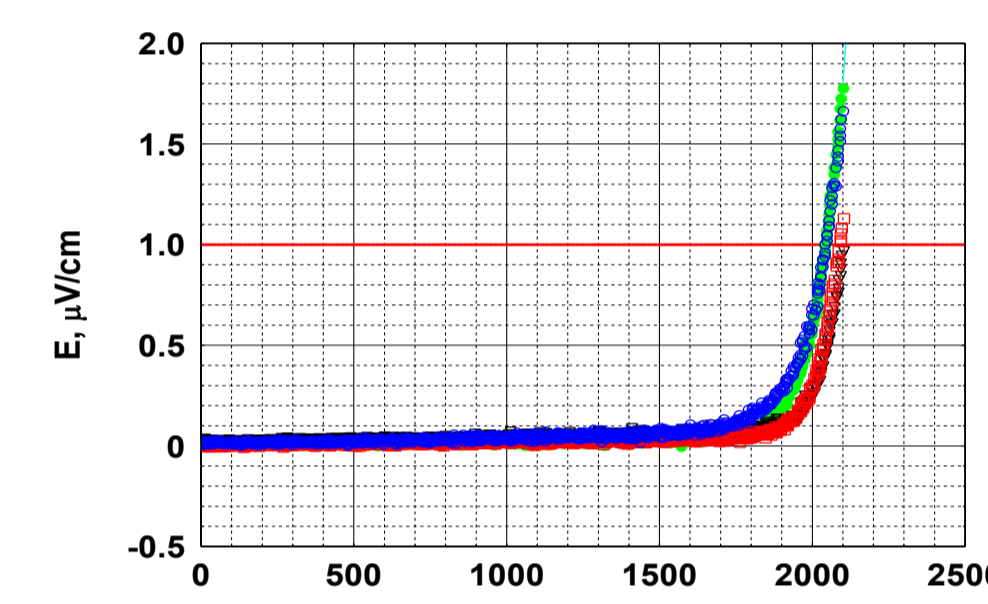


Tape is exposed at the edge and may delaminate Sharp punch burr can damage adjacent strands

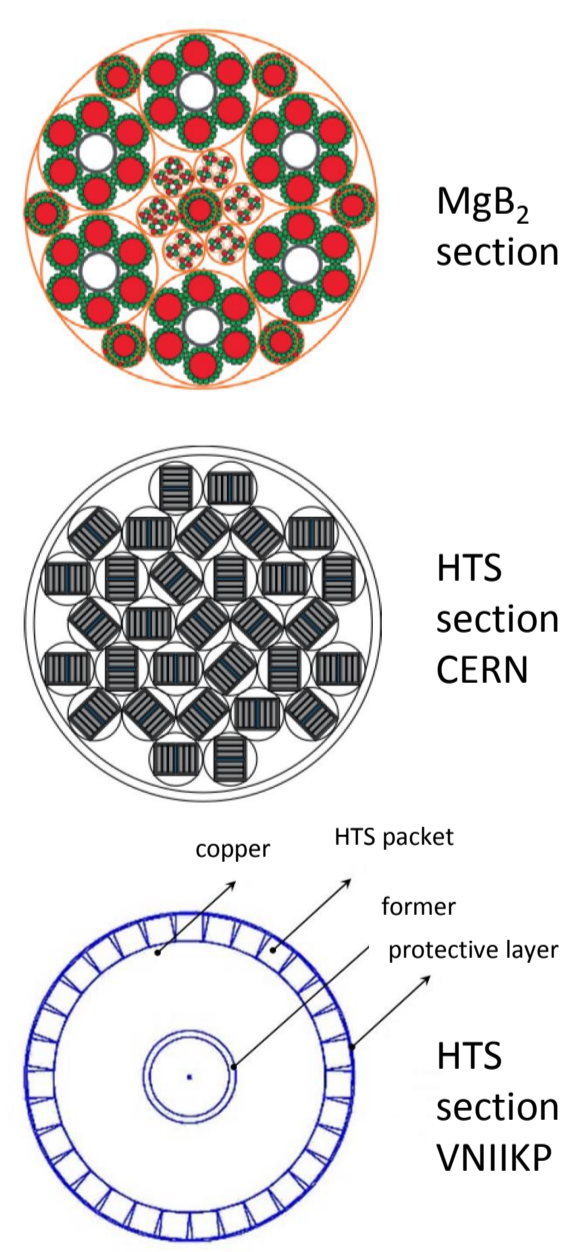
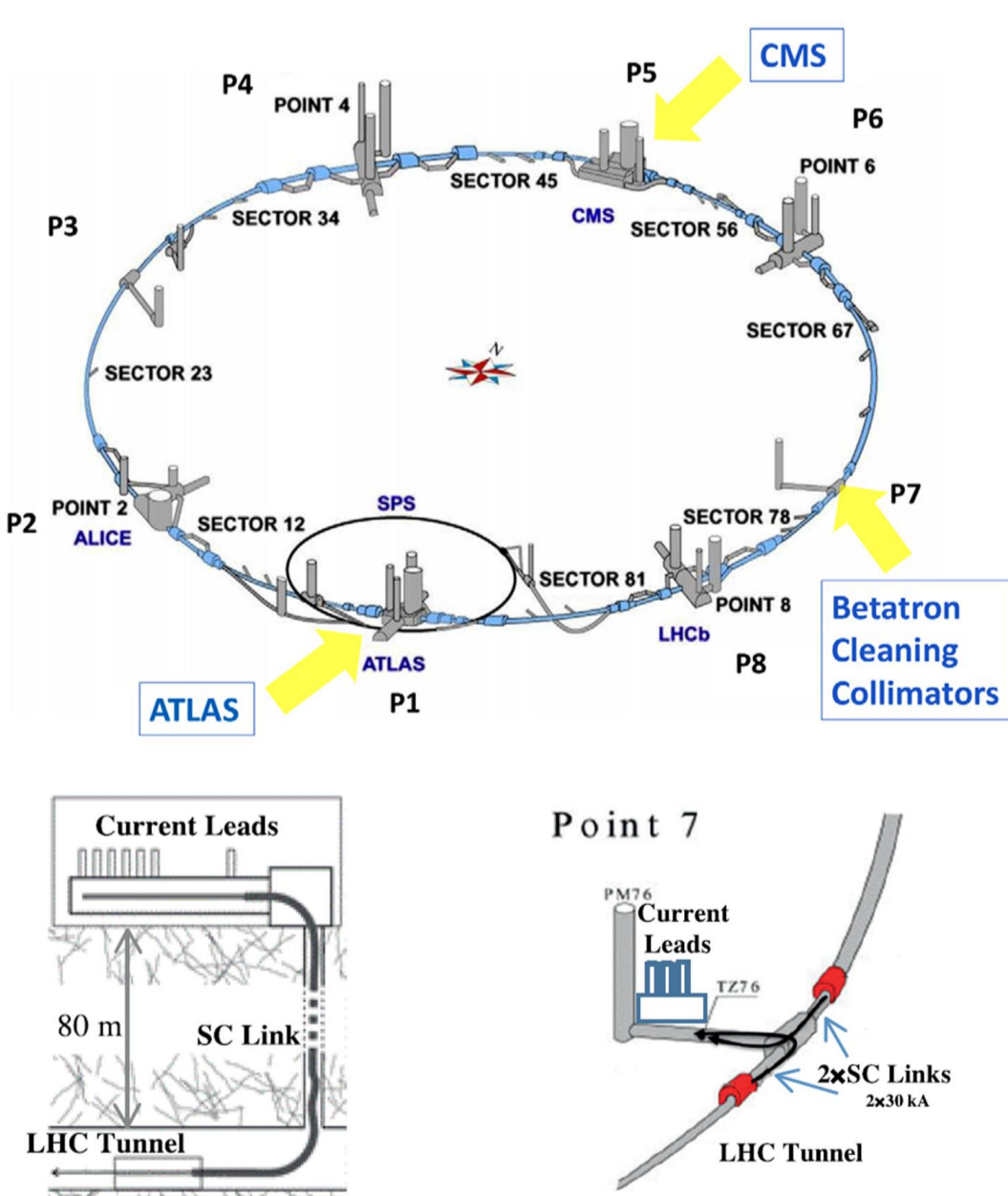
Punch-and-coat



No exposed edge: fully enclosed in copper Burr is smoothed by copper overcoat

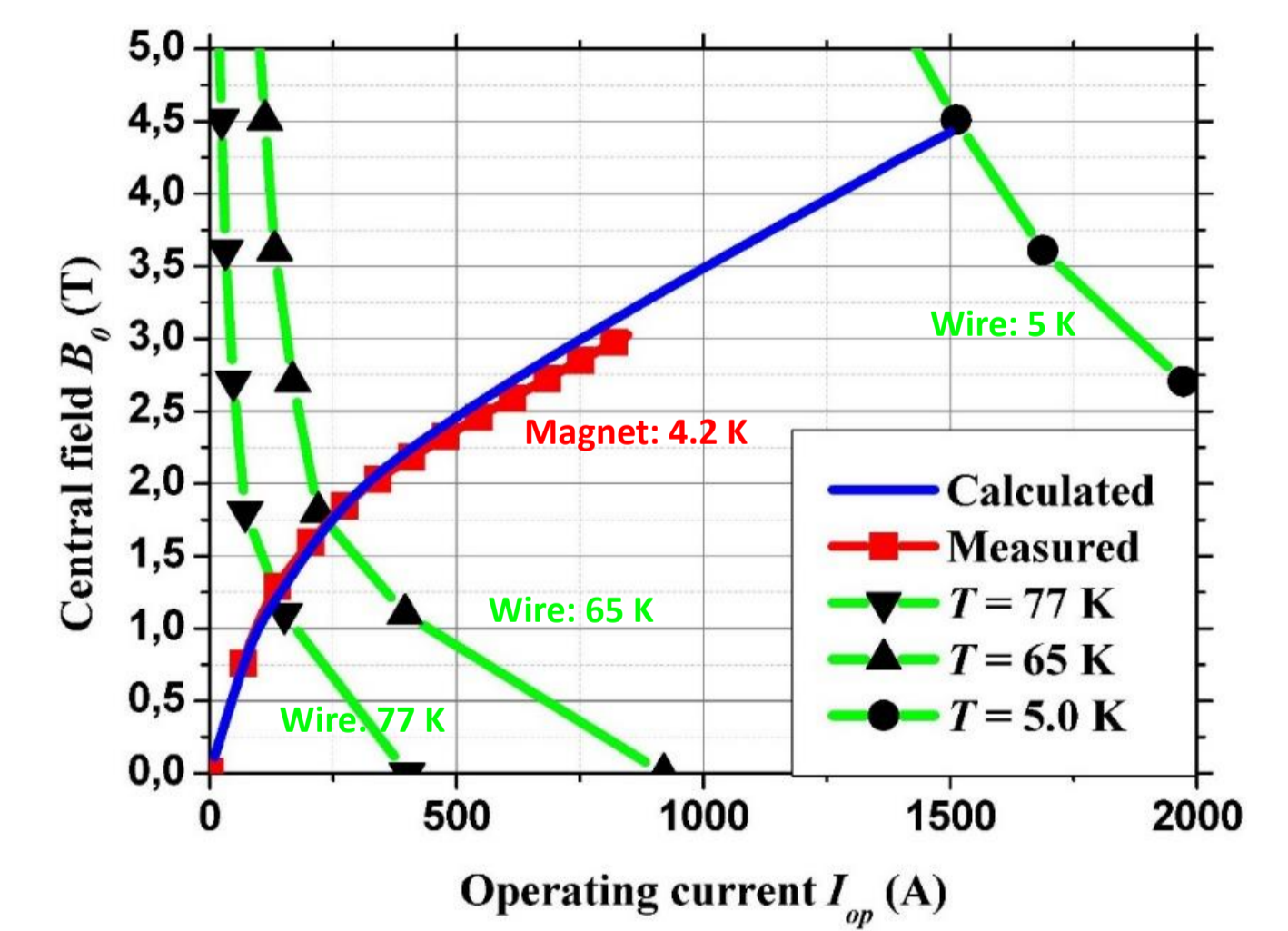
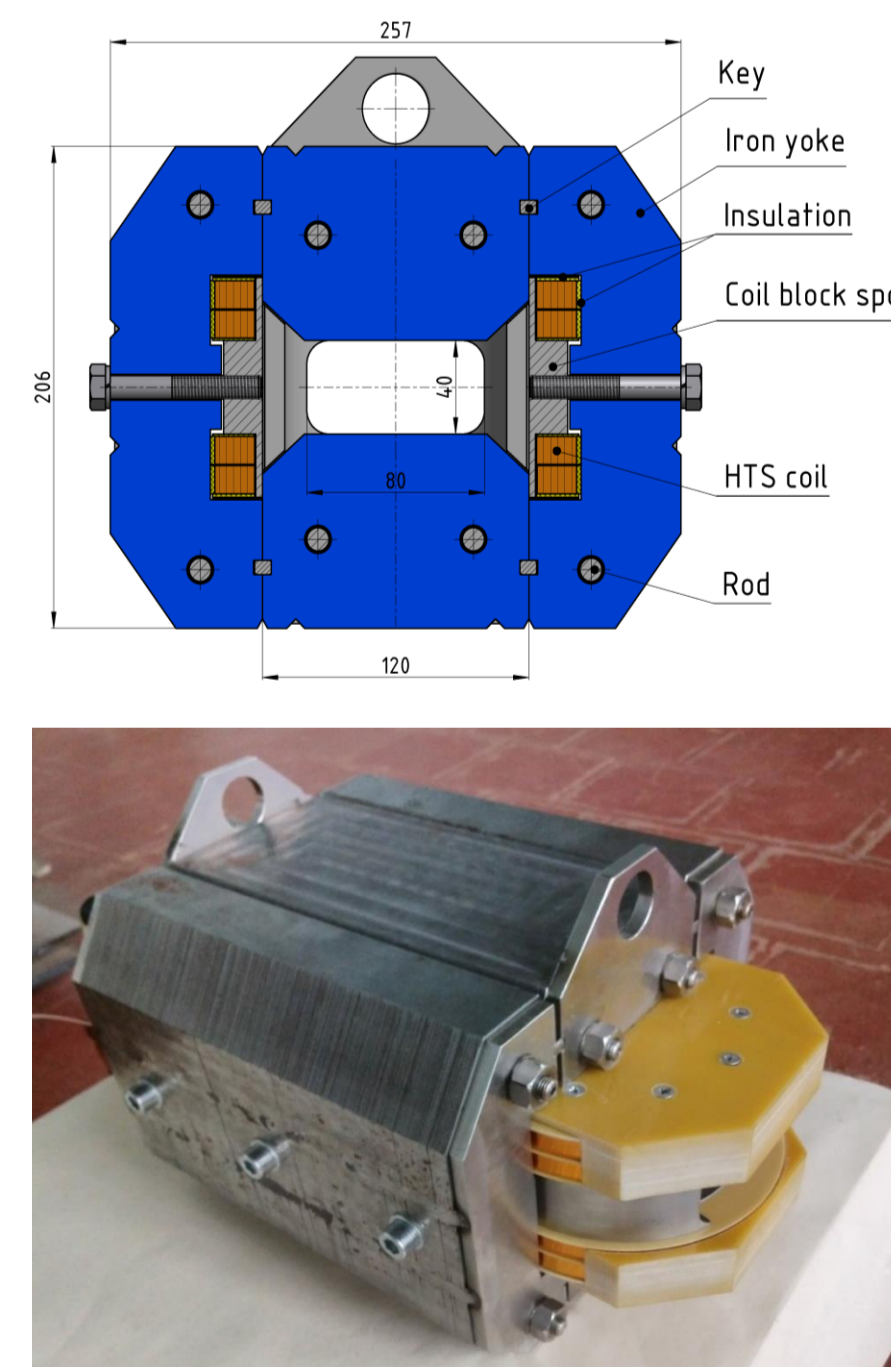


HTS cables for DC link



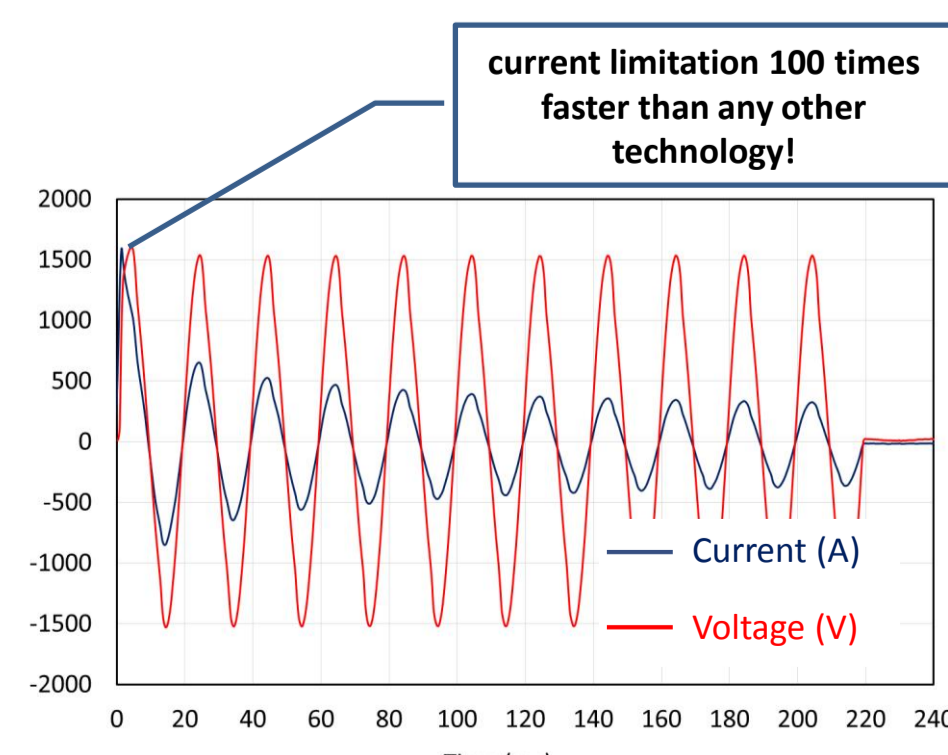
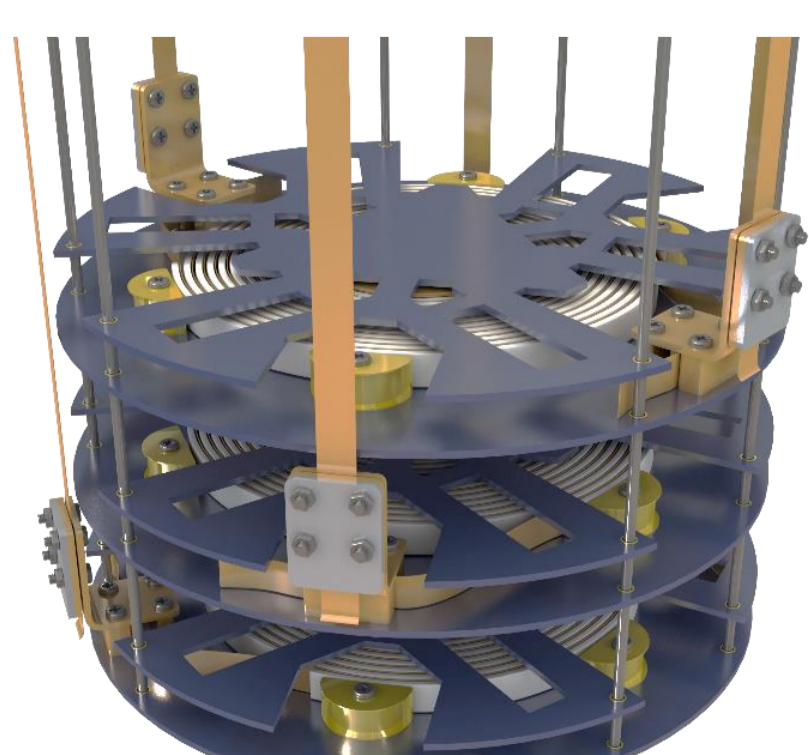
SuperOx-VNIIPK team is willing to make entire link cable: MgB₂ + HTS

HTS dipoles instead of Cu magnets

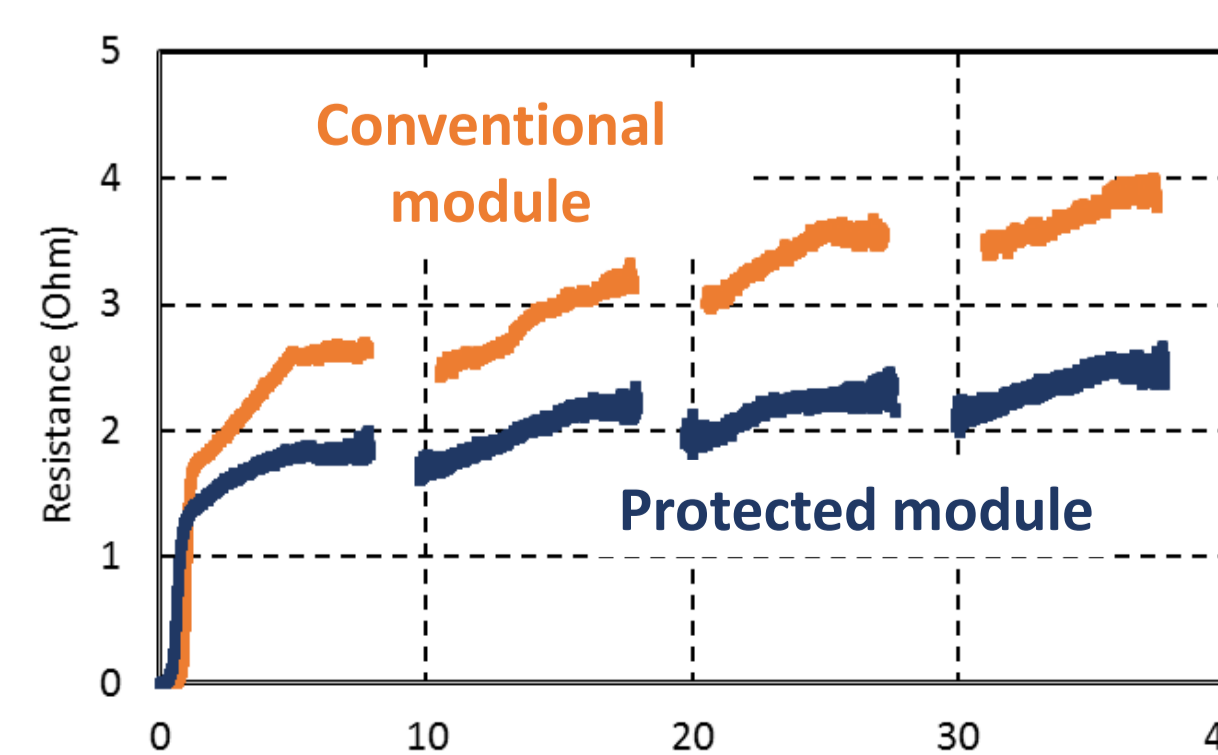


HTS Fault Current Limiters for power safety and efficiency

Modular design: from low to high voltage



Superior performance



Commercially available

Technical specs	Medium voltage	High voltage
Rated line voltage	up to 35 kV	110, 220 kV
Rated current (rms)	up to 5 kA	up to 2 kA
Actuation current (rms)	1 ... 7 kA	2 ... 5 kA
Impedance without fault	< 10 ⁻⁵ Ohm	< 10 ⁻³ Ohm
Impedance after fault	0.15 Ohm	> 20 Ohm
Insulation strength	IEC 62067:2011 IEC 62271-1:2011 1516.3-96 ISO	IEC 62067:2011 IEC 62271-1:2011 1516.3-96 ISO
Power consumption (cryocooler)	4 ... 10 kW	40 ... 100 kW
Weight	450 kg (3 kV/5 kA)	7,570 kg (110 kV/1.3 kA)
Dimensions	0.8 x 0.8 x 1.1 m (3 kV/5 kA)	3.6 x 1.76 x 3.85 m (110 kV/1.3 kA)