

Energy-efficient Magnetic Heater Project RoWaMag

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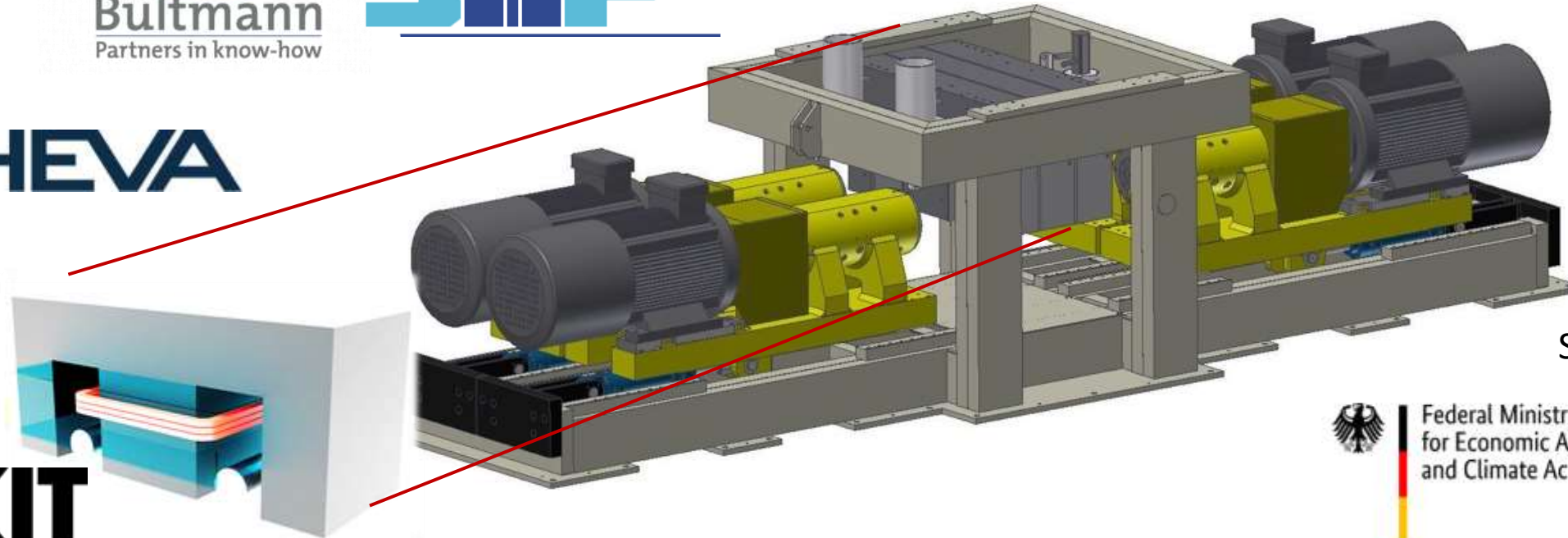
Project team

April 2019
Project Start

June 2022
Installation of the magnet
into the billet heater

November 2021
Completion and testing
of the magnetic coils

December 2022
Project finish



Supported by:



**Robuster und wartungsarmer Magnetheizer mit
Hochtemperatursupraleiter-Spulen für Warmumformprozesse**



Field of application

Hot working of non-ferrous metals: extrusion moulding, forging, hot rolling



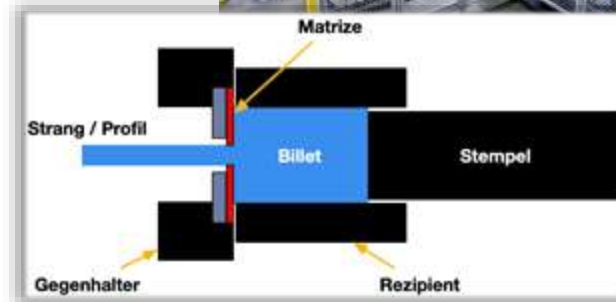
Heating the billet

aluminium: 500°C

copper: up to 1000°C



Extrusion Moulding



160 extrusion moulds in germany process
800.000 t of aluminium every year

Heating to 500°C requires an energy
of **97 GWh/a.**

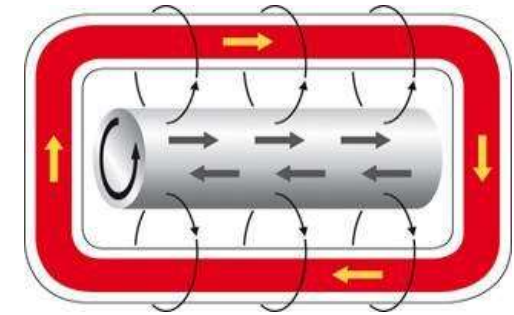
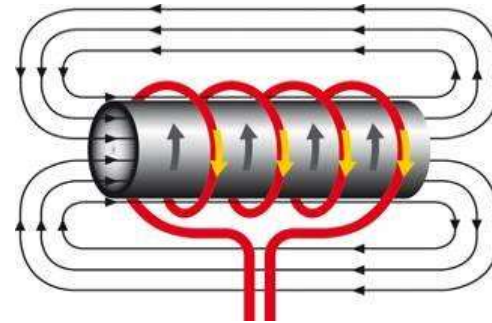
Using HTS can save **55 GWh/a,**
corresponding to **27.500 t CO₂.**



Aluminium profile



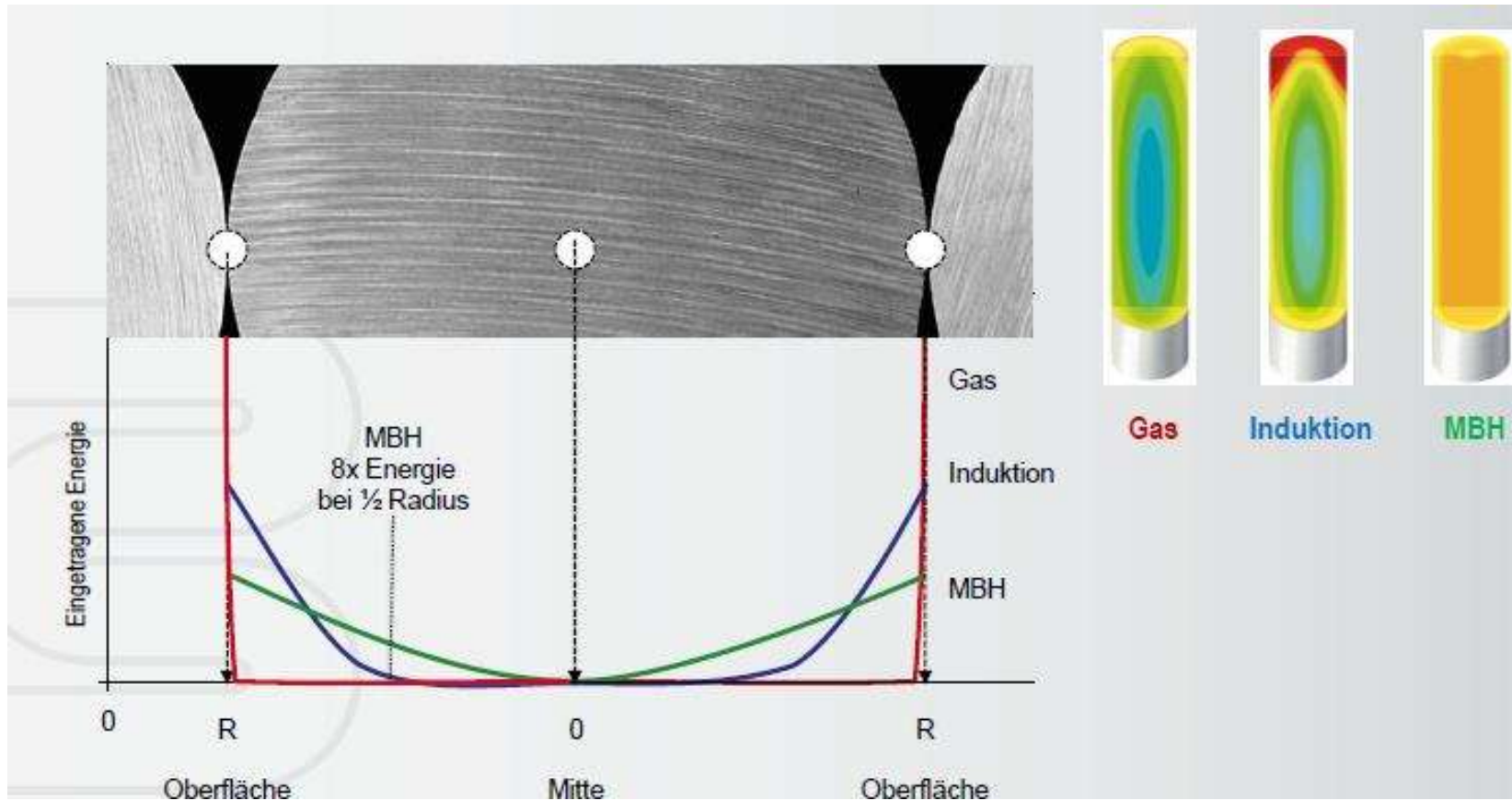
Comparison of heating concepts



	Oven operating on fossil fuel	Induction heater	Magnetic heater
Efficiency	20-40%	50-60%	70-80%
temperature homogeneity	--	o	+
heating time	30-120 min	wenige Minuten	wenige Minuten
operational cost	+	-	o
productivity	-	o	+

Comparison of heating concepts

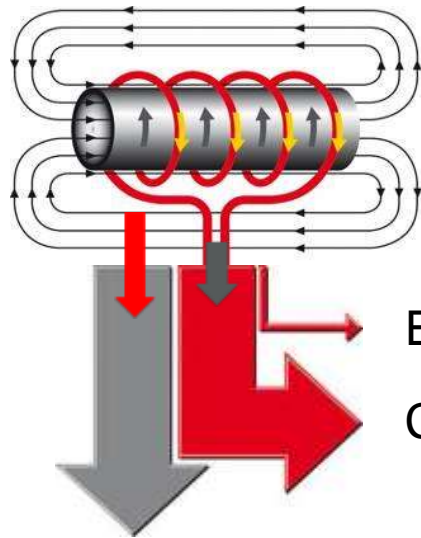
Temperature homogeneity



Comparison heating concepts

Energy efficiency

Induction heater

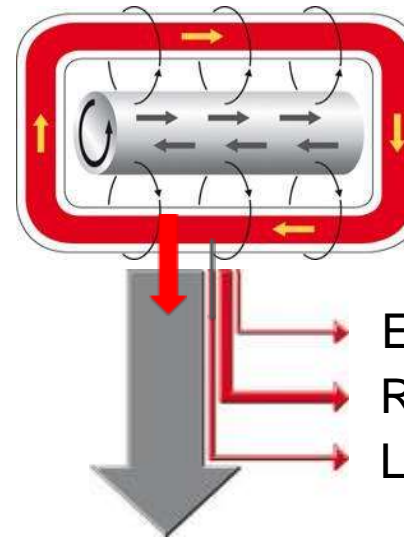


Electronic losses

Coil losses

50-60%

Magnetic heater using HTS



Electronic losses

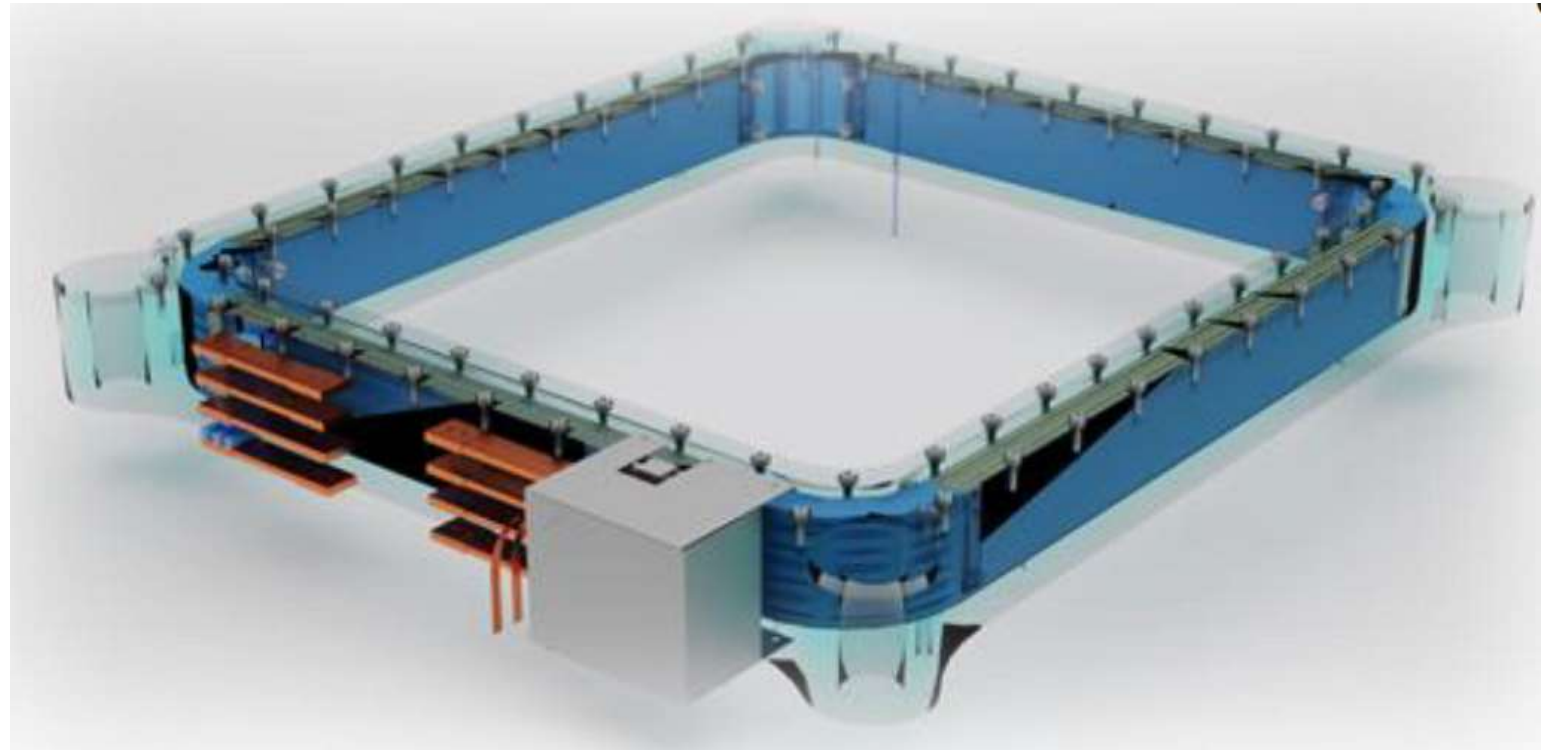
Rotating machinery losses

Losses due to coils and cooling

70-80%

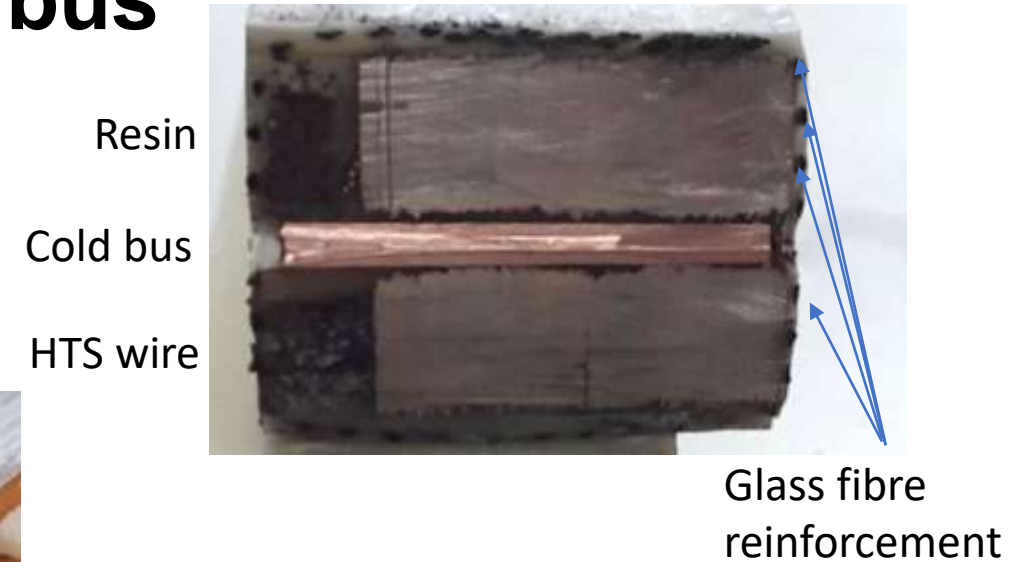
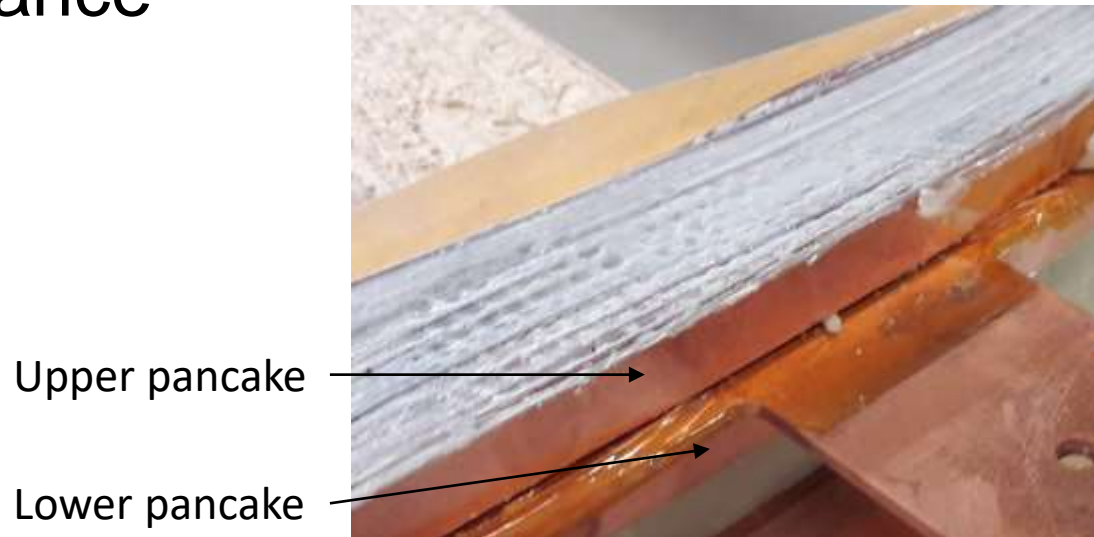
Magnetic coil - design

- 3 double pancakes
- 127 turns per coil
- Operating current: 505 A
- HTS tape length: 3110 m
- Working field: 700 mT



Magnetic coil – integrated cold bus

- Excellent heat contact
- Short heat conduction distance



Current leads

Current source: 505 A

300 K

Cold shield: 80 K

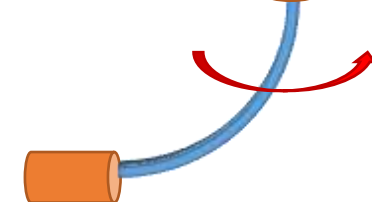
HTS bridge

Heat conduction

Coil assembly: 20 K

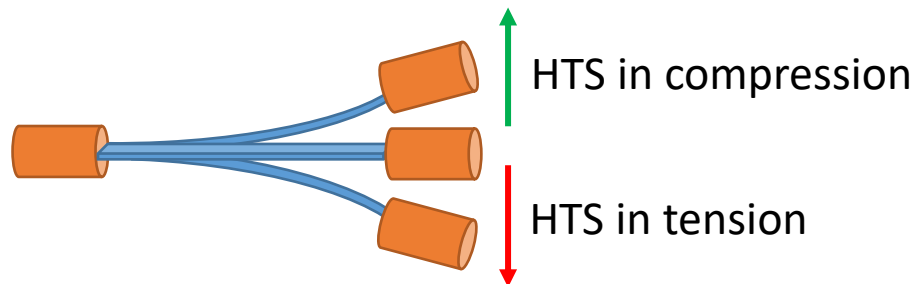


Introduced copper mesh to dampen vibration



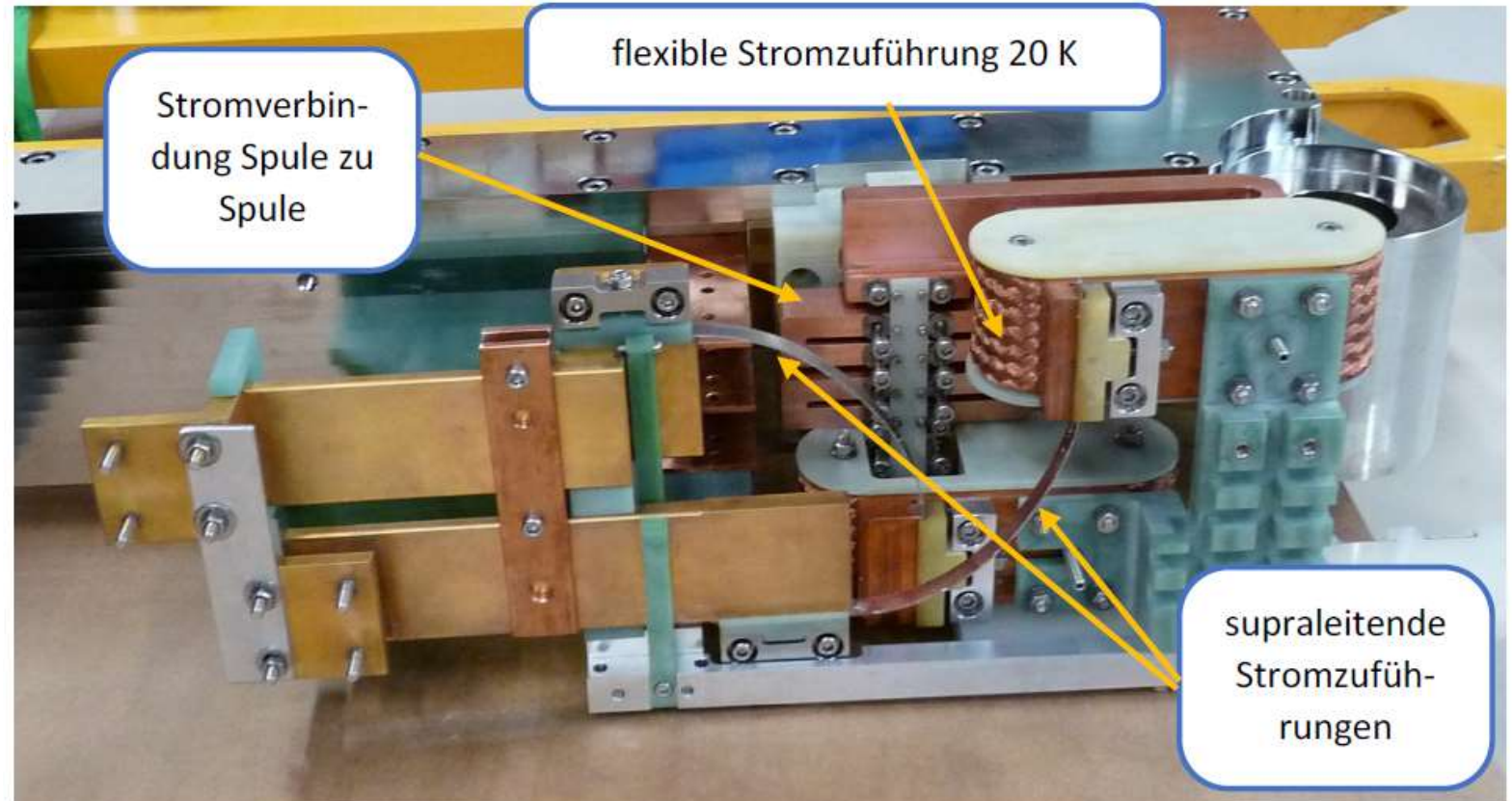
Vibration modes introducing shear forces on the HTS ceramic

- Heat influx
- vibration



Superconducting current lead (SCC)

- Small cross section
- Reduced heat influx
- Mechanical vibrations in all directions accounted for
- Temperature gradient in HTS 80K → 20K



Thank you!

Supraleitende Stromzuführung – Messung und Auswertung

