

Young Scientist Plenary Session

Wednesday, September 25th 2019



MT 26
**International Conference
on Magnet Technology**
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Electro-Mechanical Characterization of HTS Tapes and Conductors for the Next Generation High-Field Magnets

Federica Pierro

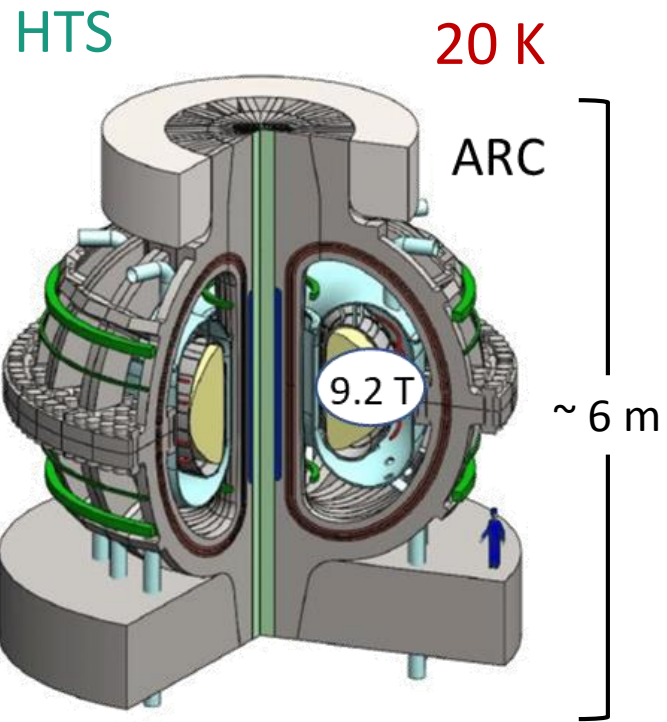
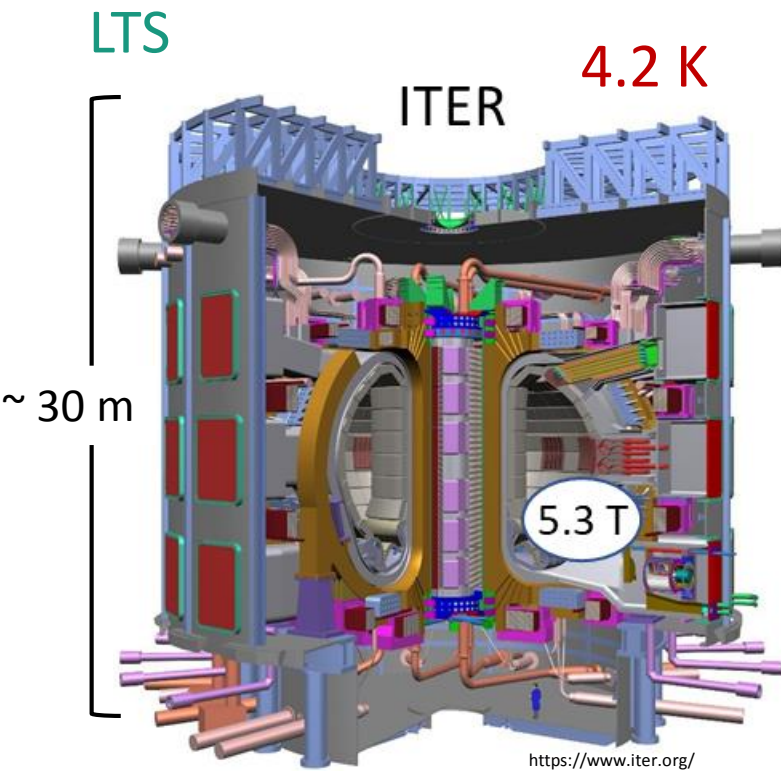
Department of Mechanical Engineering

Tufts University

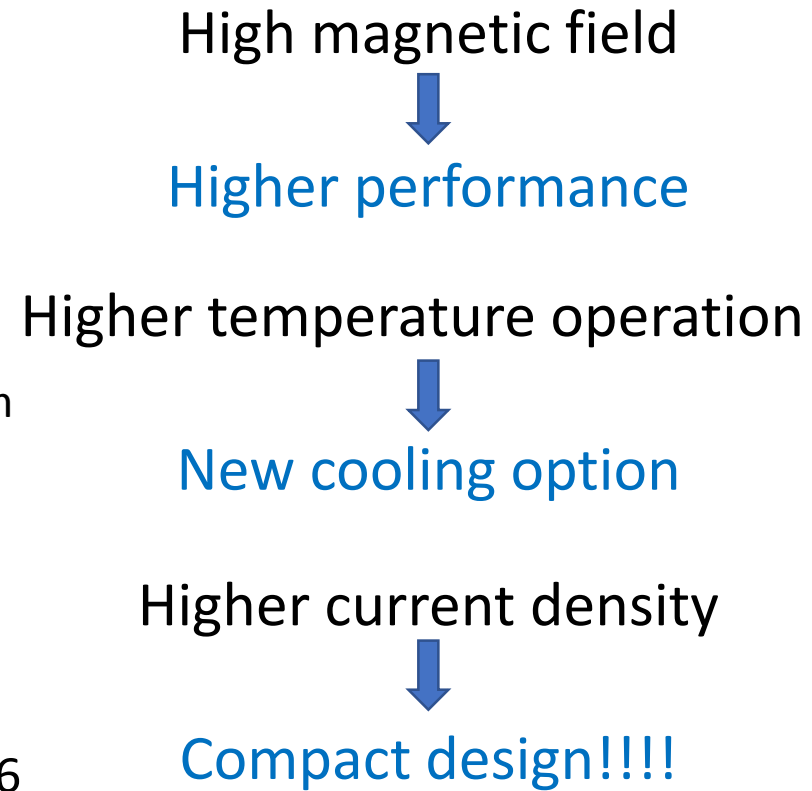


School of
Engineering

REBCO Conductors for Future Fusion Magnets



B. Sorbom, Fri-Mo-PL6-01, MT26

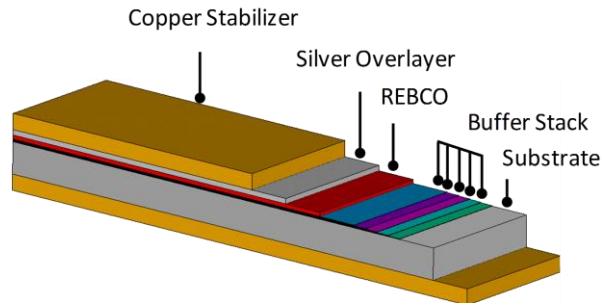
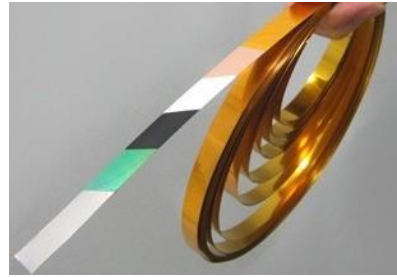


Fusion can change the world producing CLEAN, SAFE and ABUNDANT energy!!!

HTS performance affected by mechanical strain!

Sources of strain from tape to magnet

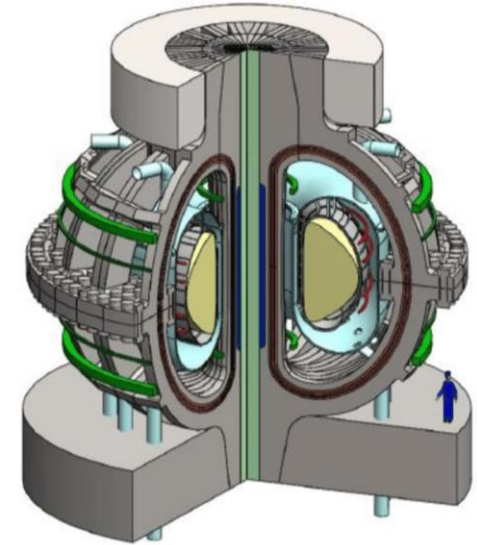
REBCO coated conductor



Cable-in-Conduit



Magnets



SCOPE: *predicting the electrical behavior of cables in high field magnets using mechanical and electrical properties of individual tapes*

APPROACH

Critical current characterization
of single **REBCO tapes**

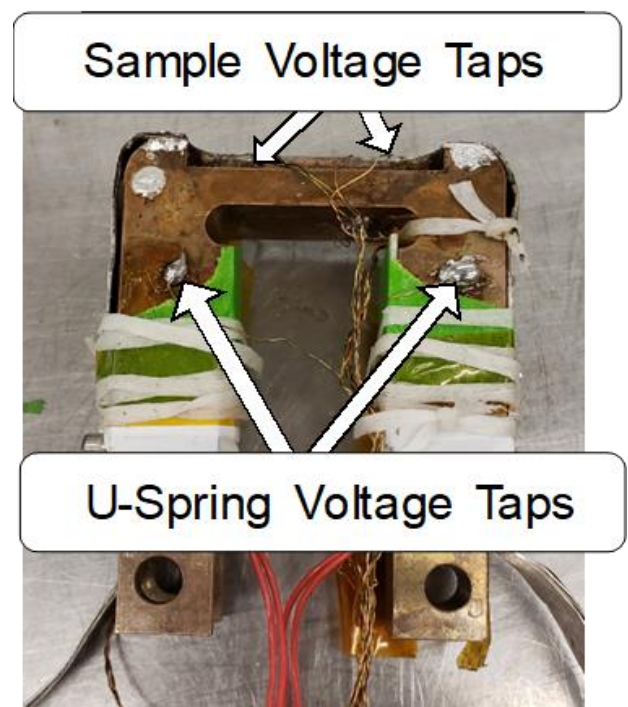


Structural simulations
of REBCO **Cables**

Electro-mechanical characterization of REBCO tapes: experiments

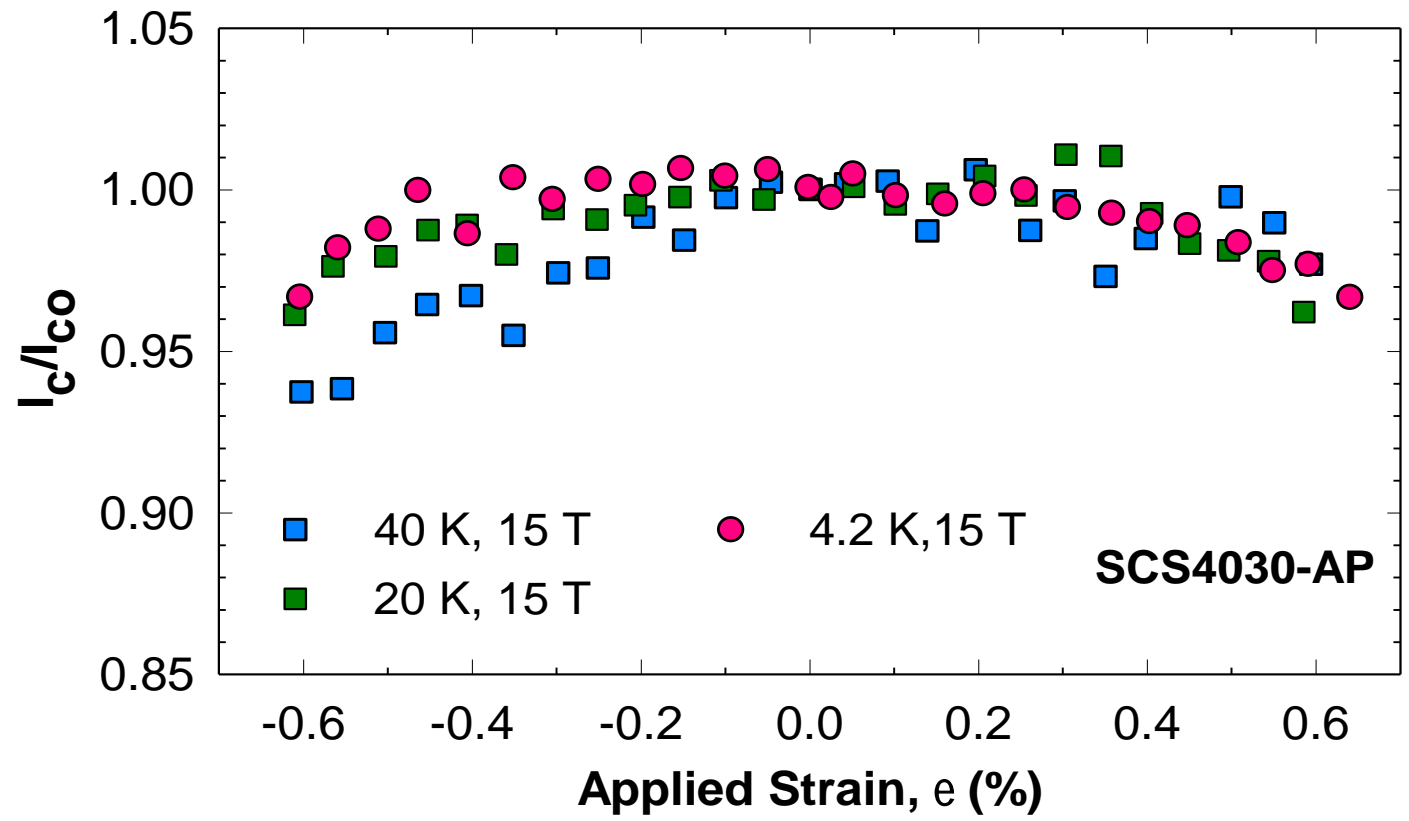
Measure the **strain dependence of I_c** at different **temperature and fields relevant to fusion magnets**

U-spring bending device



<https://doi.org/10.1063/1.1819384>

CuNi₃Si alloy

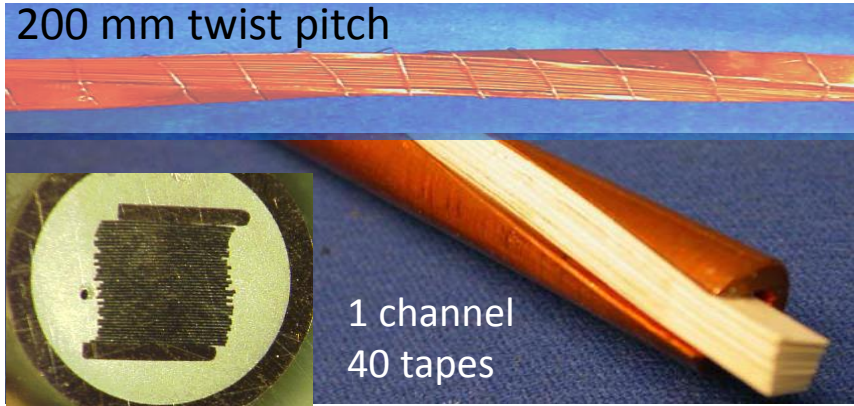


Finite Element Analysis of HTS Cables

Twisted Stacked-Tape Cable (TSTC) subject to electromagnetic **Lorentz loads**

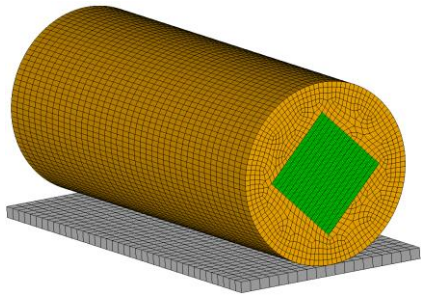


Predict **the stress** in the stack to **inform the conductor design process**

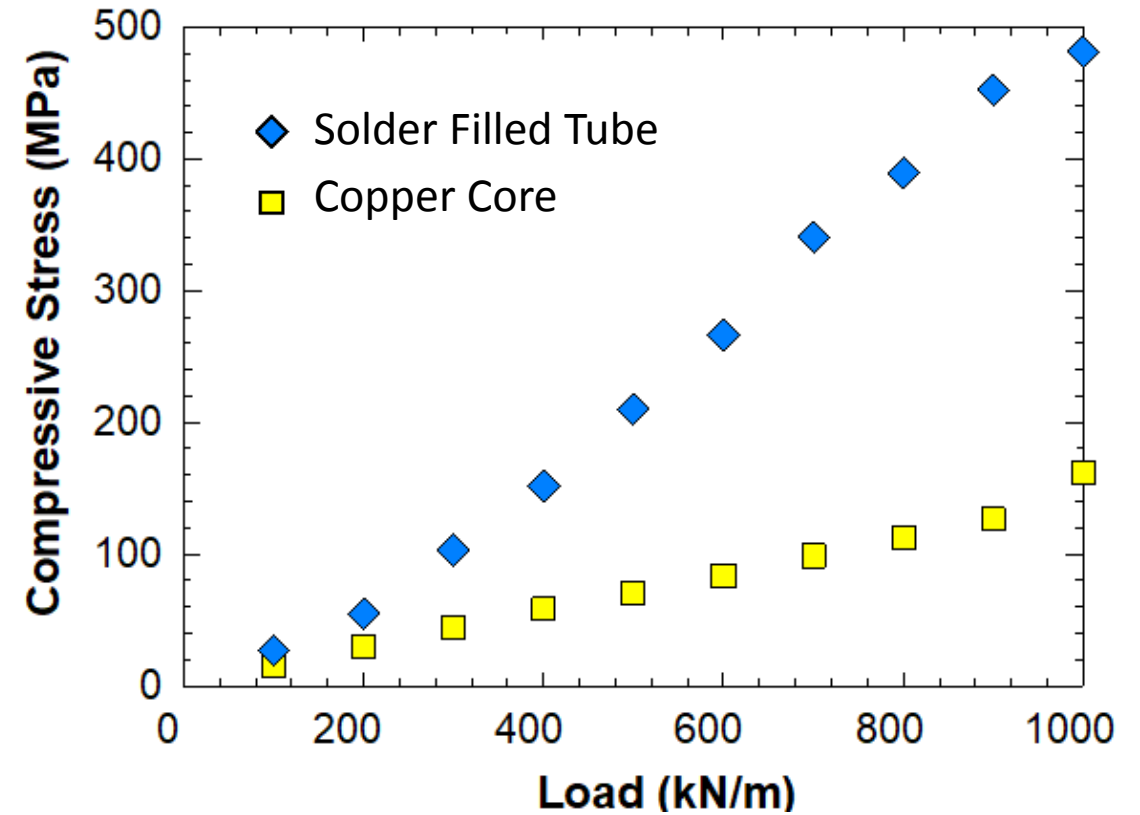
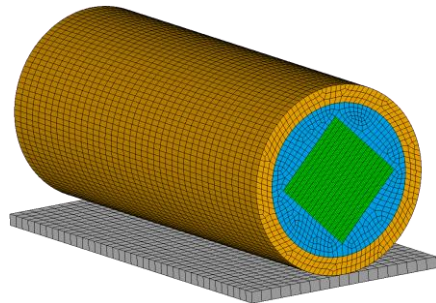


Support Structure

Copper Core

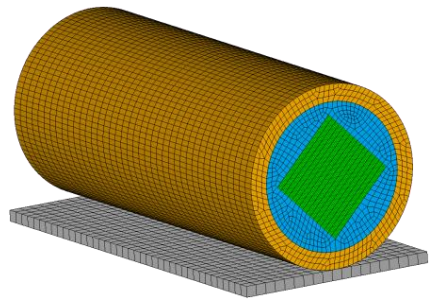


Copper Tube filled with Solder

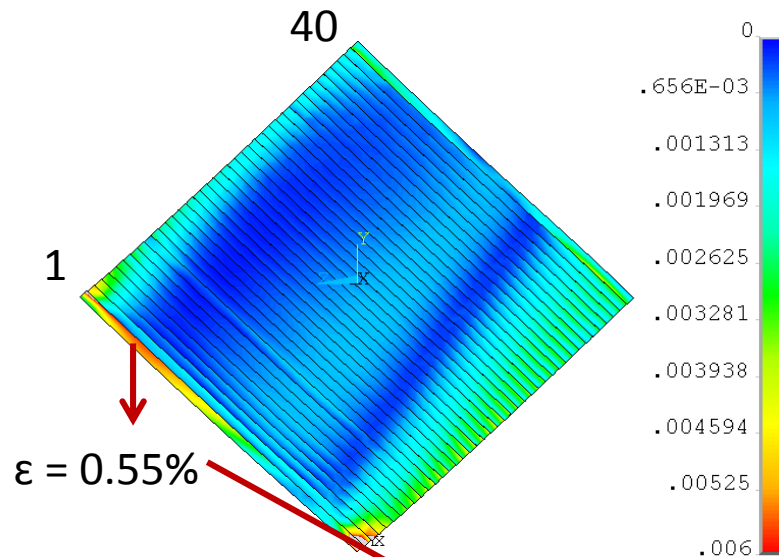


There are techniques to improve the performance!

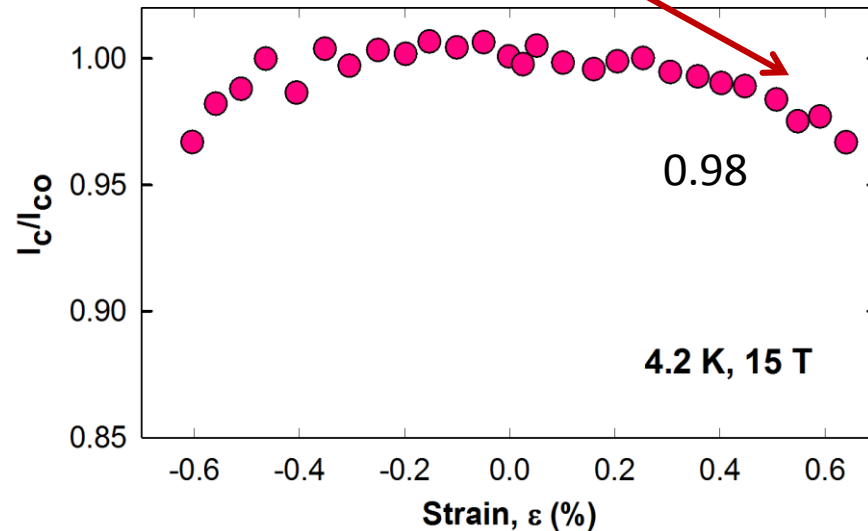
Critical current prediction in HTS cables



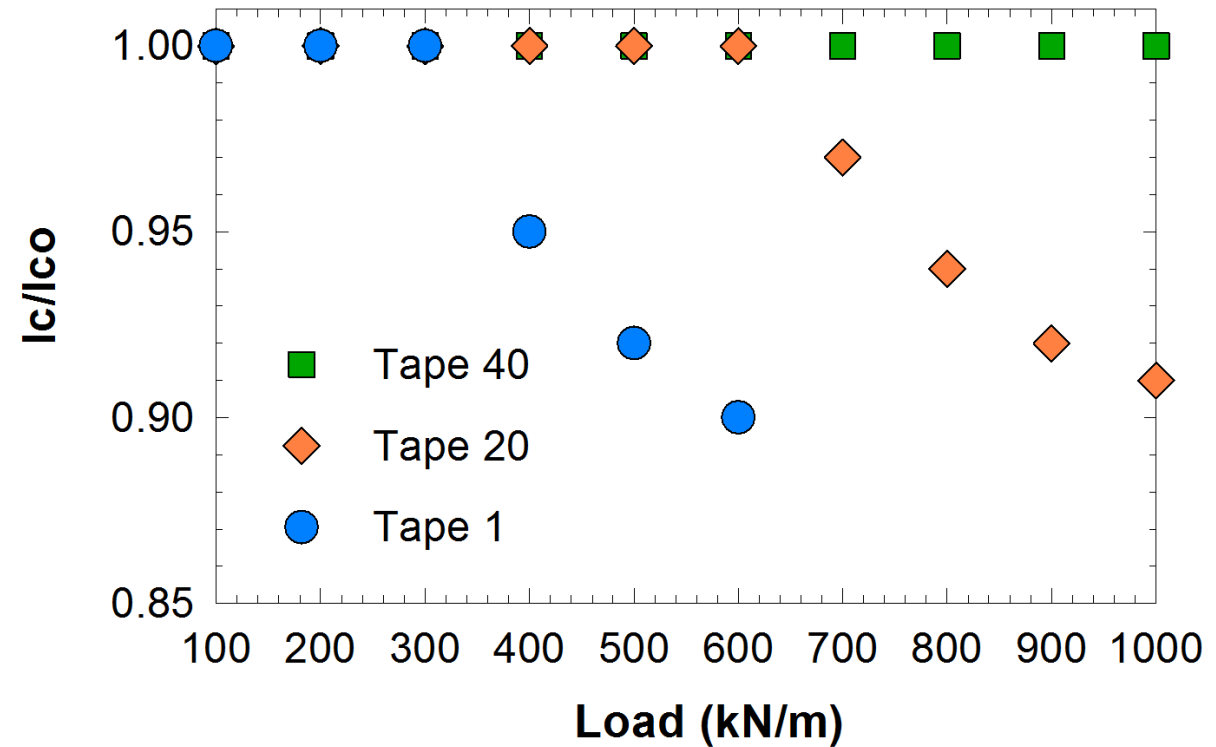
Loads varied between 100 and 1000 kN/m



Using experimental data on single tapes



Predict the cable electrical performance



In conclusion...

We use *experimental techniques* and *FEA tools* to predict the electromechanical behavior of HTS cables starting from single tapes

The results of the work are critical *to develop a tool* to *improve HTS cable* design, *accelerating the design* process and *implementation of HTS* in future magnets

Thank you for your attention!

Come see me if you have more questions

A special thank to Prof. Luisa Chiesa and the all team!!!