



HTS machine laboratory prototype

Mijatovic, Nenad; Jensen, Bogi Bech; Træholt, Chresten; Abrahamsen, Asger Bech; Rodriguez Zermeno, Victor Manuel; Pedersen, Niels Falsig

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HTS machine laboratory prototype

Nenad Mijatovic¹, Bogi B. Jensen¹, Chresten Træholt¹, Asger B. Abrahamsen², Victor M.R. Zermeno³, Niels F. Pedersen³

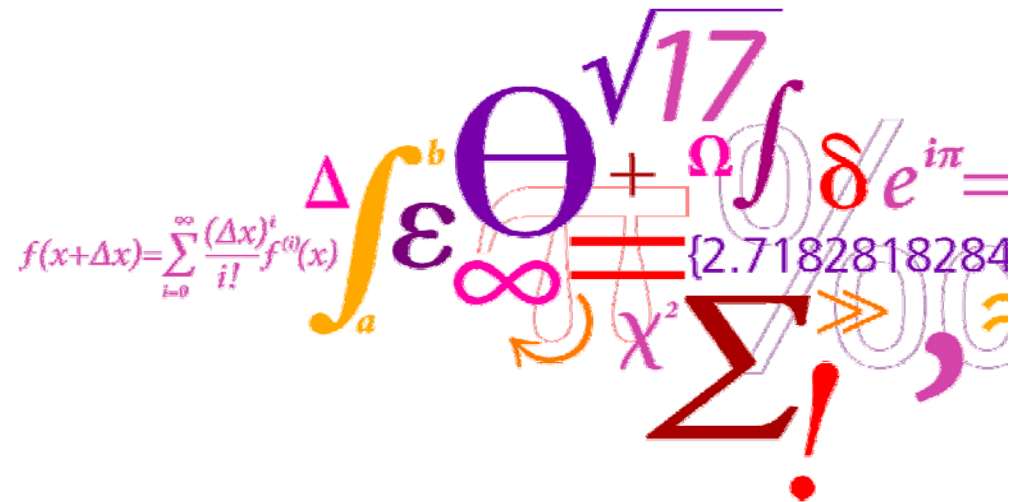
¹ Department of Electrical Engineering, Centre for Electric Technology DTU

² Department of Material Science, National Laboratory for Sustainable Energy DTU-RISØ

³ Departments of Mathematics, DTU

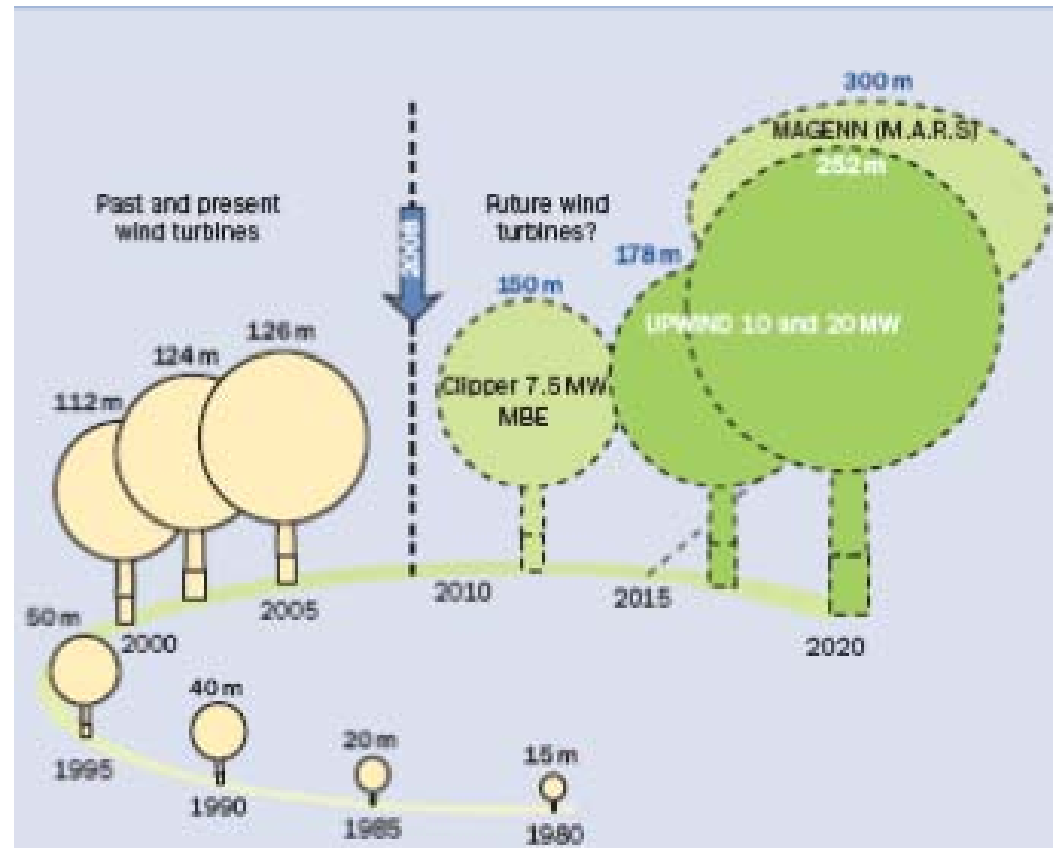
19. September 2011

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Outline

- Motivation
- Superwind platform
 - HTS machine concept
 - Cryostat
 - HTS field winding
 - HTS coils
- Results
- Conclusion



Superwind platform

- HTS machine platform for evaluating HTS racetrack coils

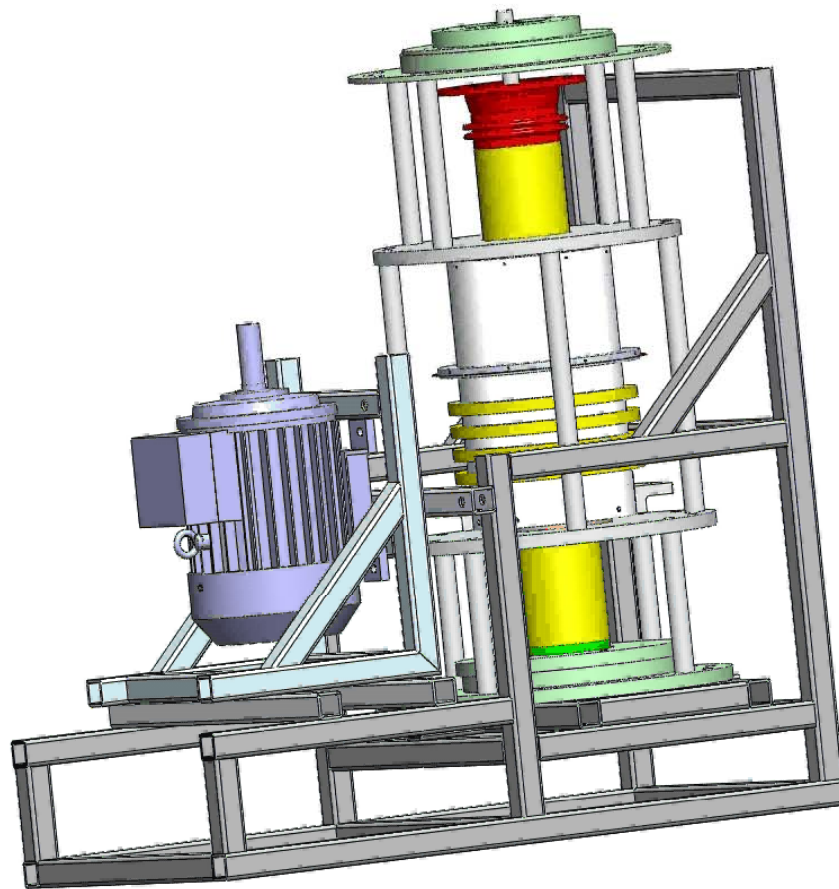
- Operating temperature: 'open LN2 bath' 77K (with closed LN2 system down to 64K)

- The stationary cryostat: custom design, 10mm equivalent magnetic gap

- The rotating armature: conventional 22kW, 50Hz, 2 pole, 3 phase winding

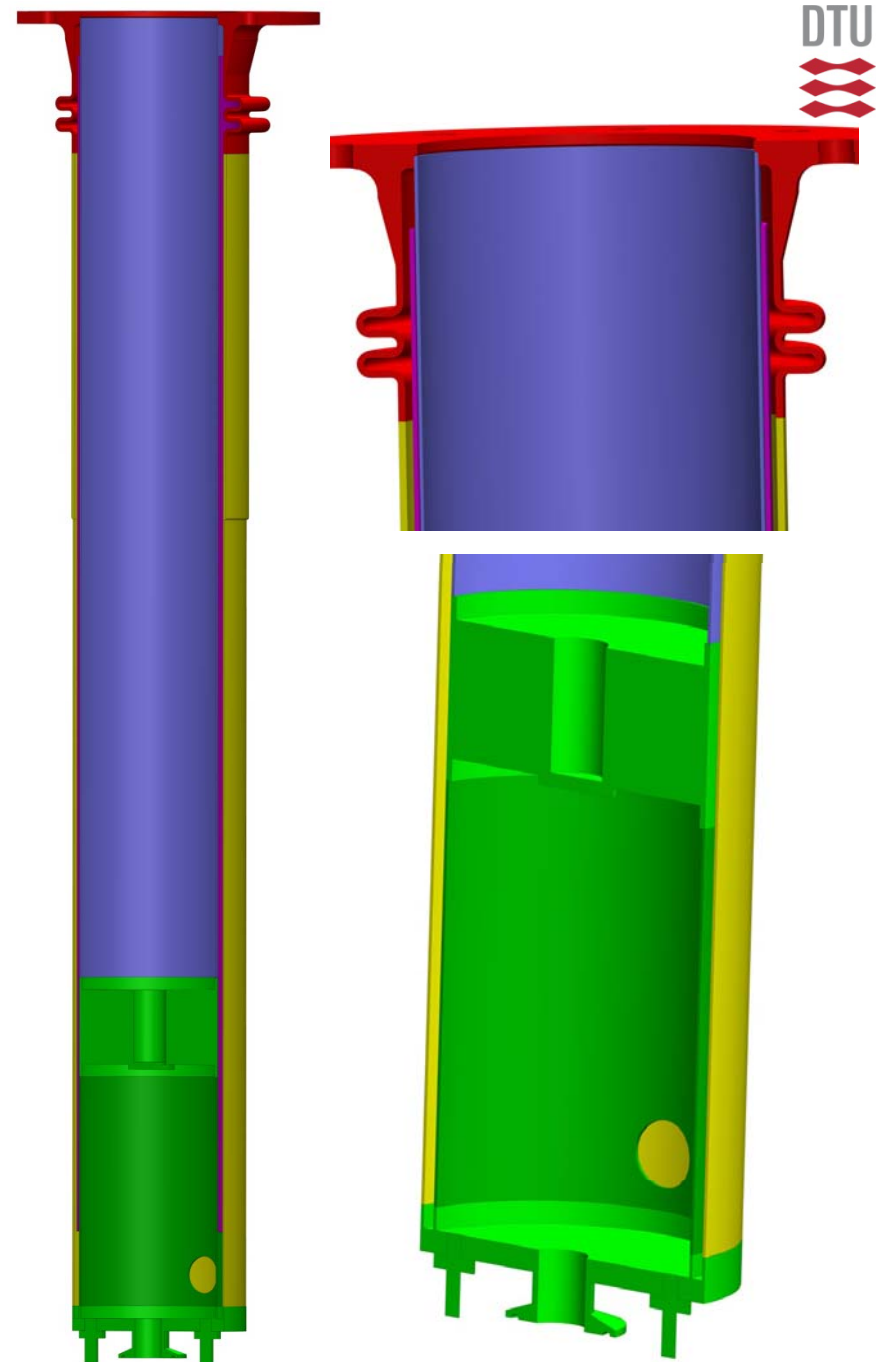


Superwind-HTS machine

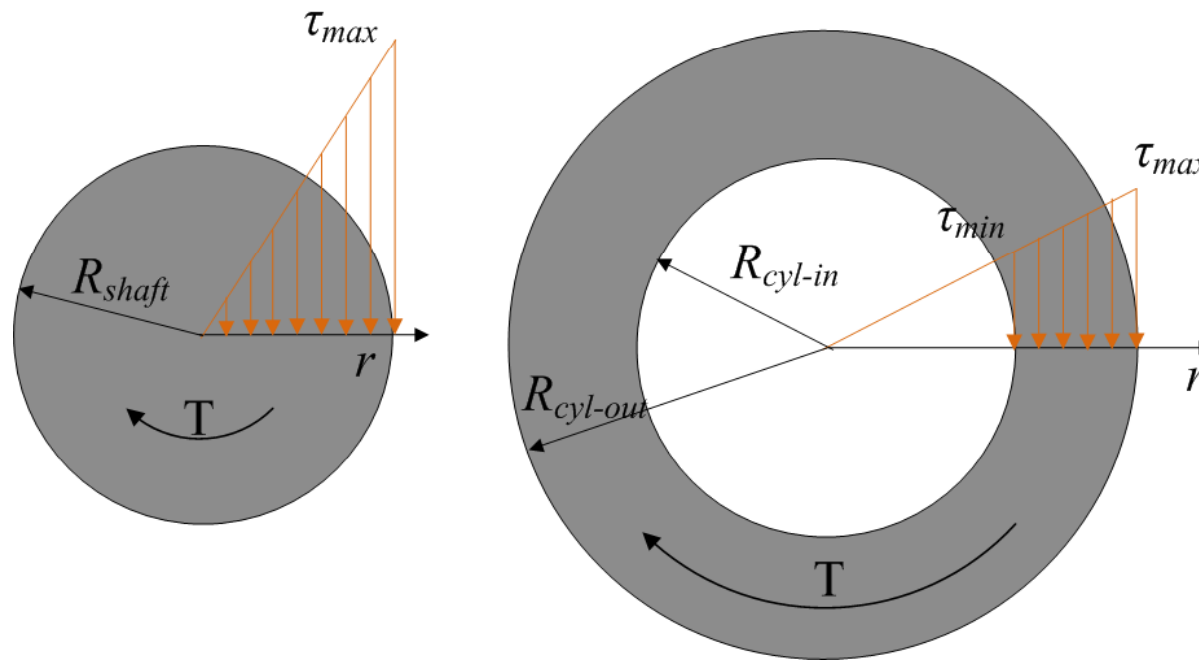


Superwind-Cryostat

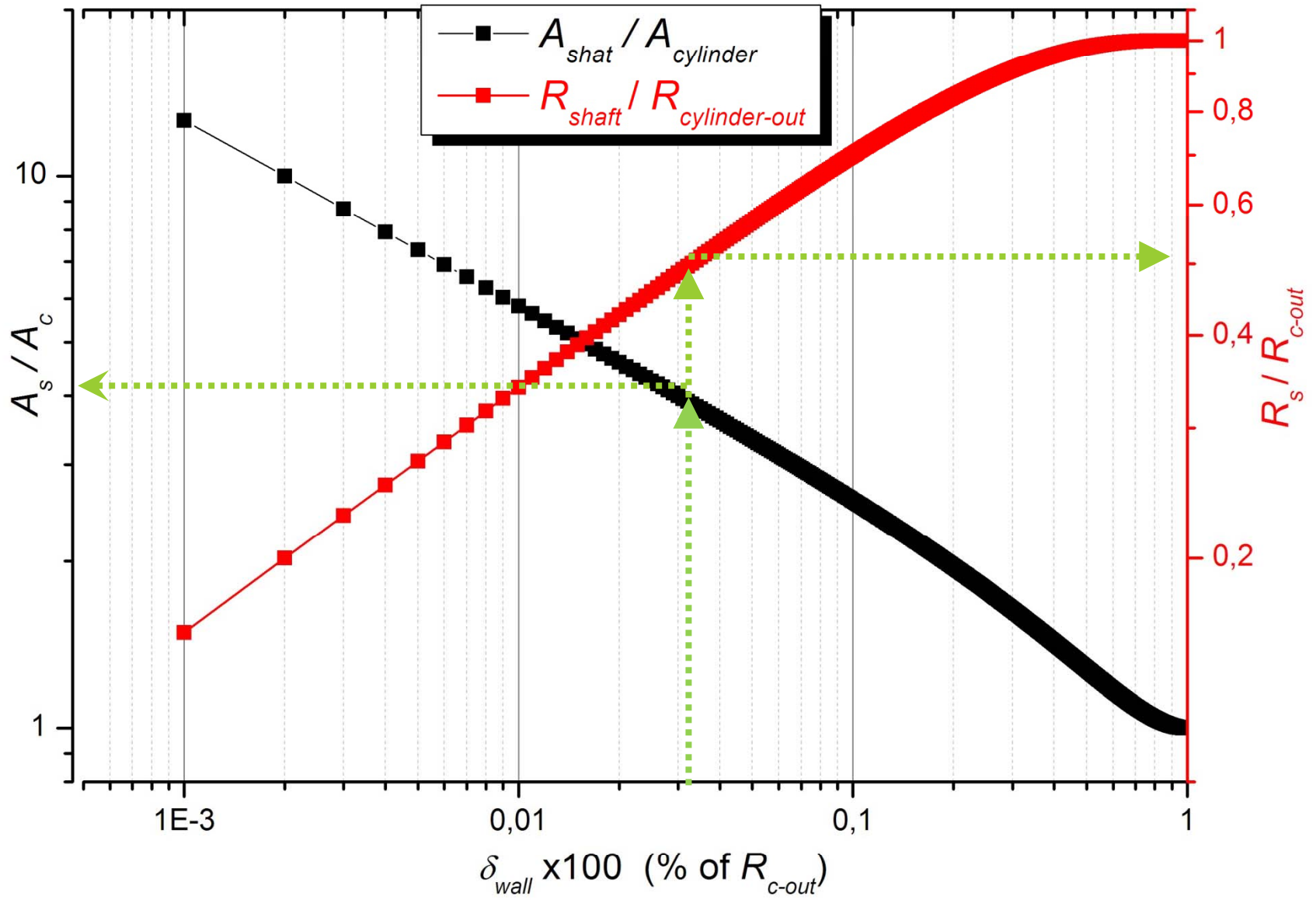
- Material: SS316L sheets
- Thermal design features: Vacuum insulation ($<10^{-4}$ mbar) and radiation shield.
- Radial constraints: Equivalent magnetic air gap 10mm. No strict constraints for axial length.
- Torque transfer element (TTE) integral part of the cryostat
- ~20W@77K 'open Ln2 bath' evaporation test



Case study: shaft vs. cylinder as TTE

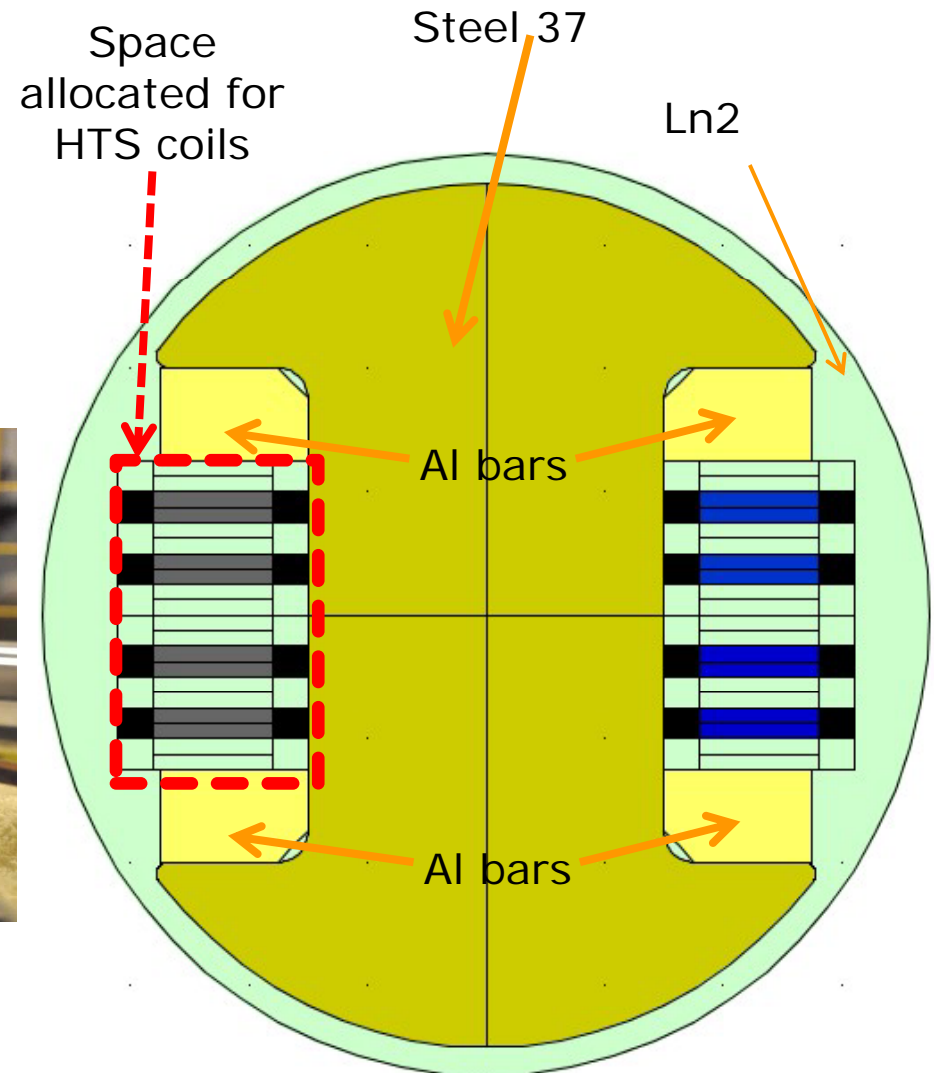


$$T = \int r dF = \int r \tau dA = \int r \underbrace{\frac{r}{R} \tau_{max}}_{\tau} dA = \frac{\tau_{max}}{R} \int r^2 dA = \frac{\tau_{max}}{R} J$$



Superwind - The HTS field winding

- 'Lego concept' HTS filed winding design highly flexible
- Cold Steel or 'Air core' concept
- Max 8 HTS coils

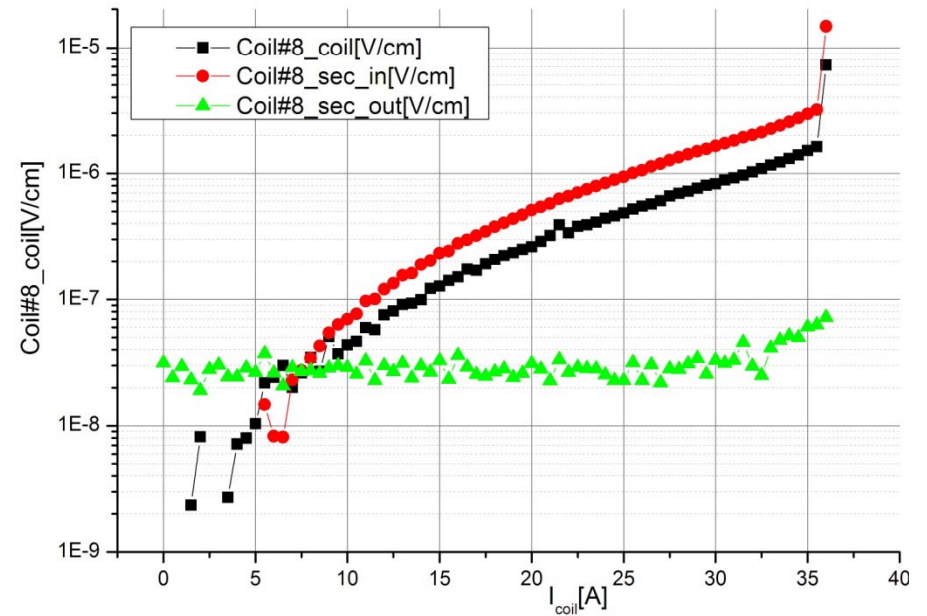
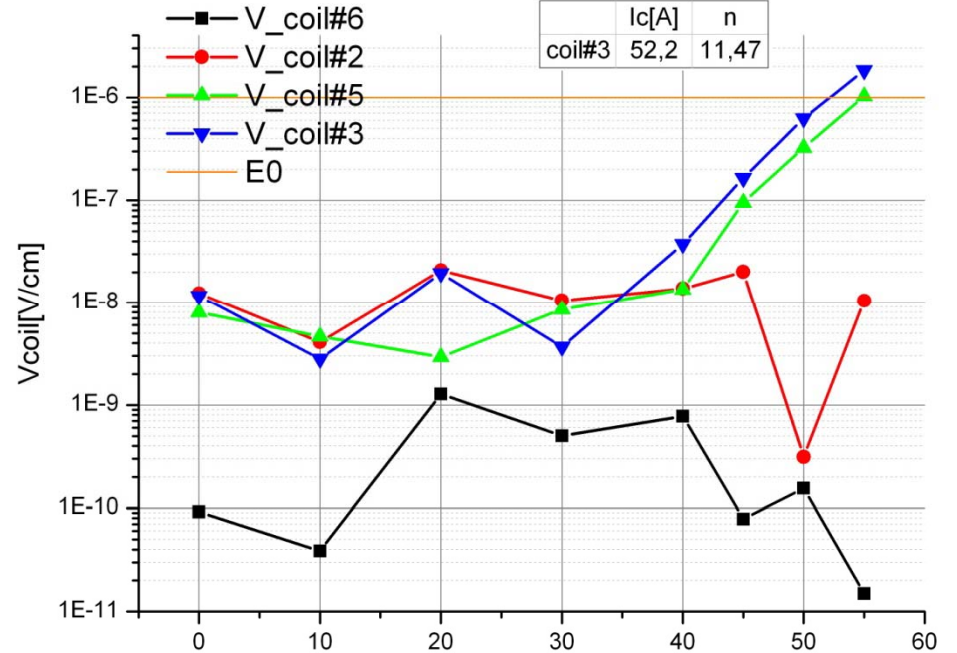
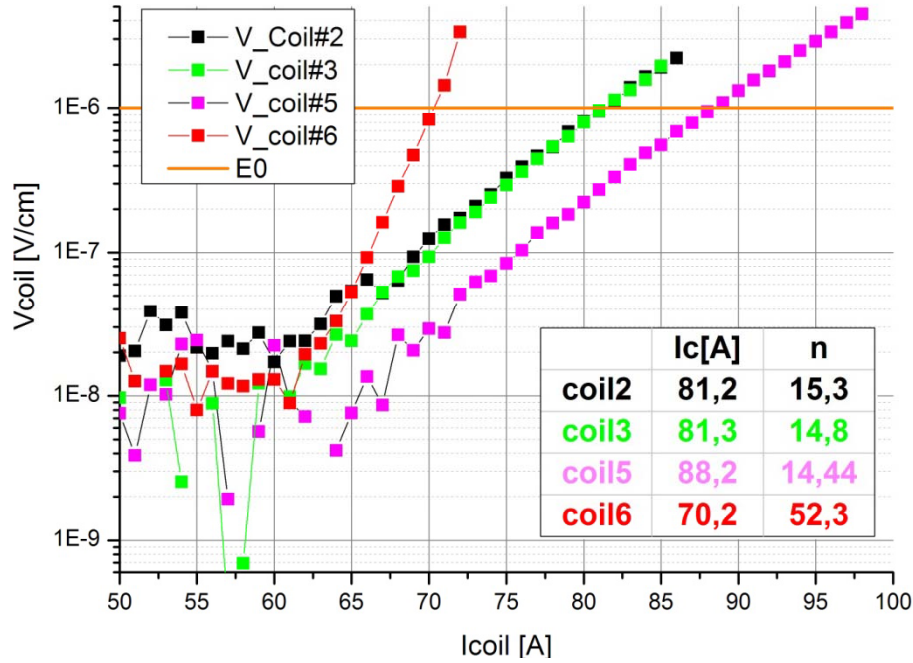


Superwind - The HTS coils

- Uniform geometry for all coils
- SS frames, wounded coils impregnated with epoxy
- Constructed 8 coils: 3 -2G, 5-1G
- Three HTS tape types (1G and 2G) and two types of electrical insulation
- PCB with access points for monitoring the voltage

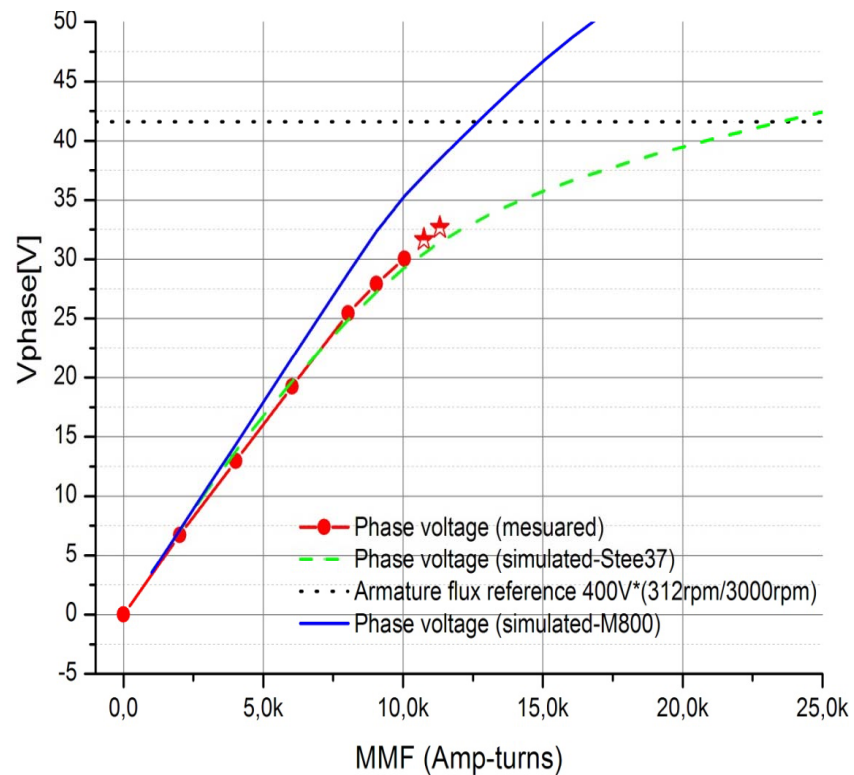


Result -IV curves

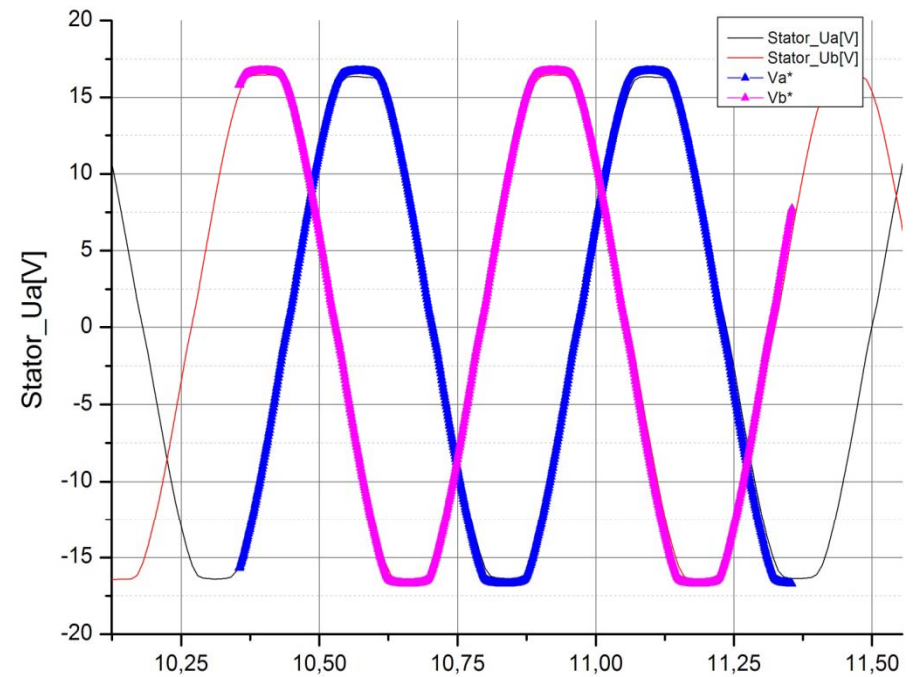


Results – No Load Voltage

Experimental data



Validation of FE model



Conclusion and *future work*

- Focus of the setup on the HTS winding evaluation
 - An HTS tapes and coils performance, the coil design...
 - Interaction between the HTS field and the armature winding

- *AC loss investigation, Operation of the HTS machine...*

Thank you!