



HFM
High Field Magnets

Work Package WP2.5

(HTS coils)

Author: Christian Barth on behalf of the TE-MS-C-HSD section

Date: 02.05.2023



Introduction

Objective:

Demonstrator of **5 T** in a background field of **15 T**

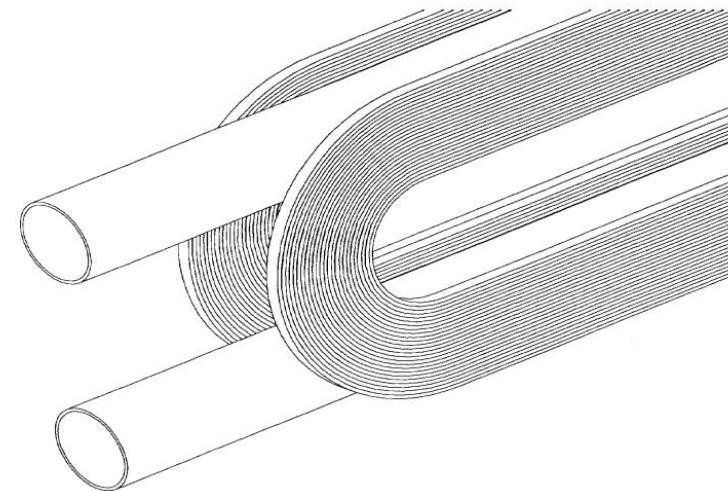
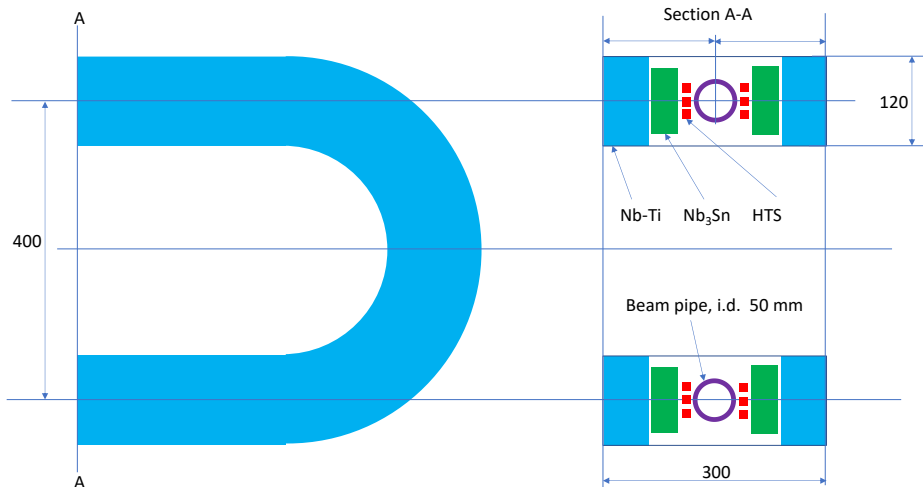
Work Package 2.5:

- Test different **cable layouts** in a coil configuration;
- Study **field quality & validate modelling**;
- Study **quench detection and quench protection aspects** – and test/implement technological solutions;
- Demonstrate **field capability**;
- Validate **technological aspects**, e.g. windability, electrical high-current splices, impregnation and insulation



Scope of Work Package 2.5 #1

- REBCO racetrack coils for common coil dipole magnet
 - ideal geometry for tapes, no in-plane bending
 - hybrid (NbTi, Nb₃Sn, REBCO) for cost minimization
 - target for REBCO coil is 5 T in 15 T background field

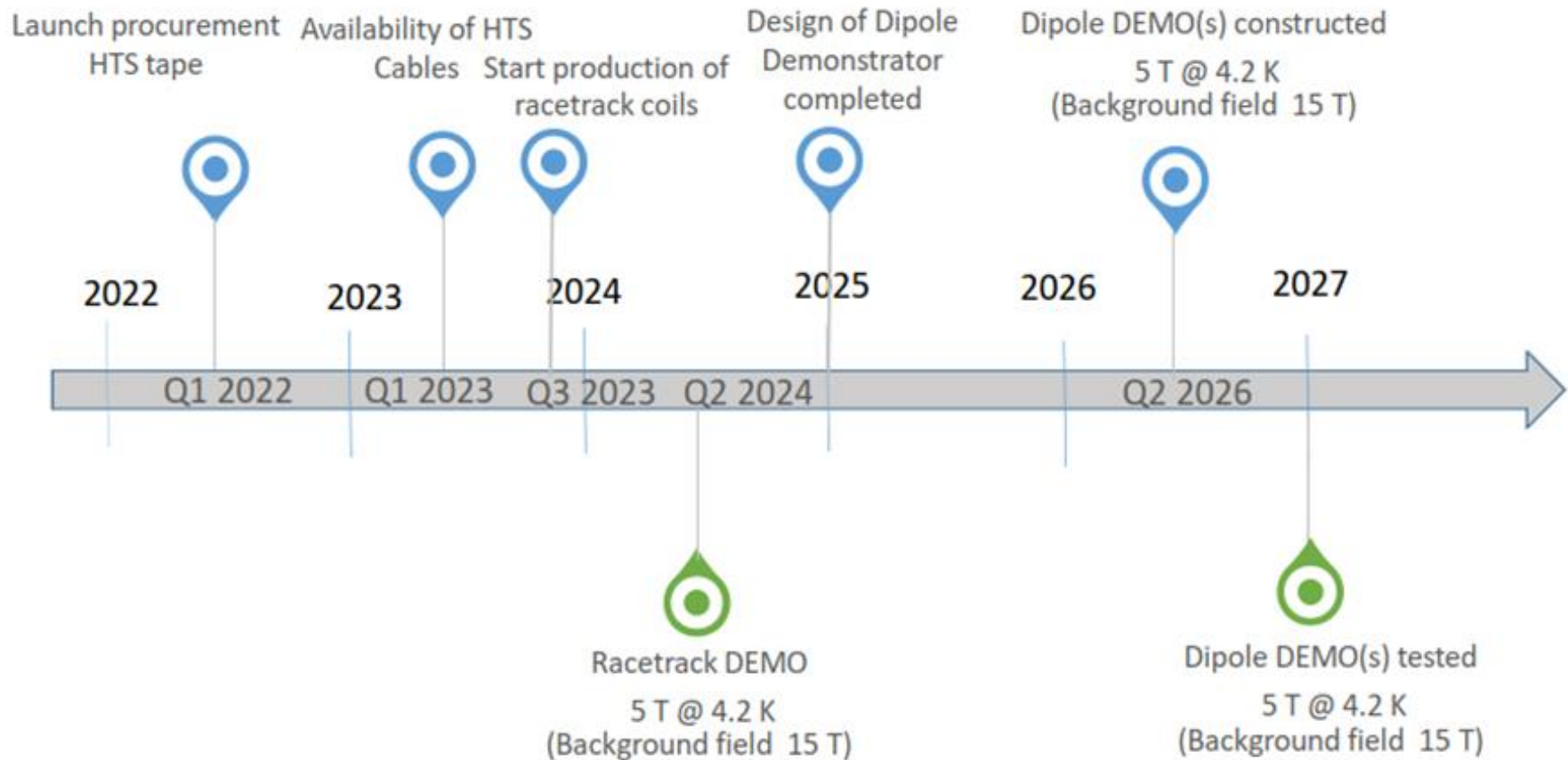


Scope of Work Package 2.5 #2

- Development of insulated REBCO racetrack coils as field boosters for common coil dipole magnets.
- Development in steps:
 - no-insulation solenoid pancakes (2022, also for WP2.6)
 - insulated trial racetrack coils (2023)
 - racetrack coil demonstrator (2024)
 - dipole demonstrator (2025-2026)

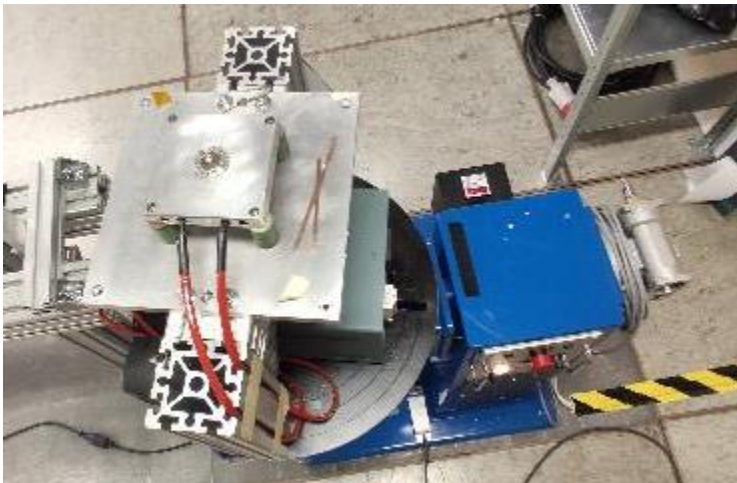


Scope of Work Package 2.5 #3



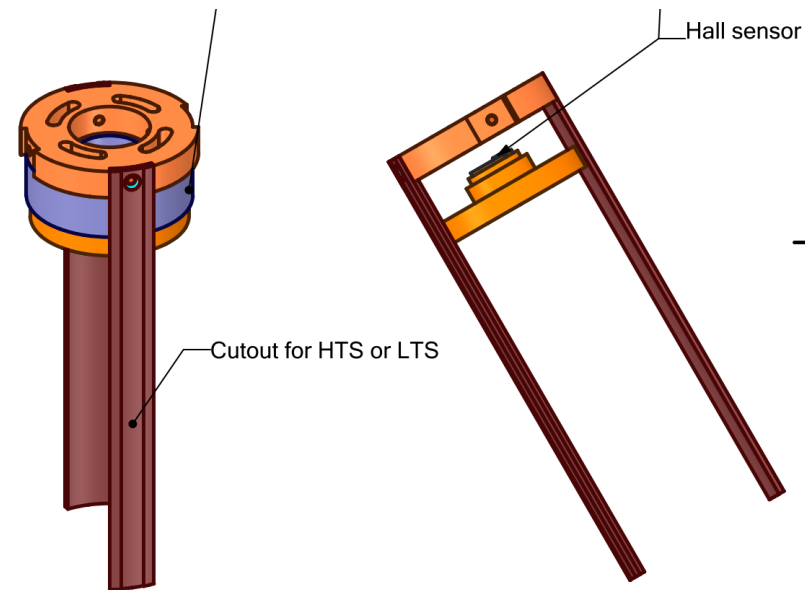
No-insulation solenoids #1

- Solenoid pancake winding machine constructed
 - winding table (adjustable speed) with heating system for in-situ soldering
 - tension control system for 2 tapes (stepper motor + magnetic brakes)



No-insulation solenoids #2

- Several coils made & characterized at 77K, s.-f.
 - field mapped with hall sensors; effect of insulation investigated
- Adapters for 4.2K, self-field & in-field characterization developed
 - in fabrication



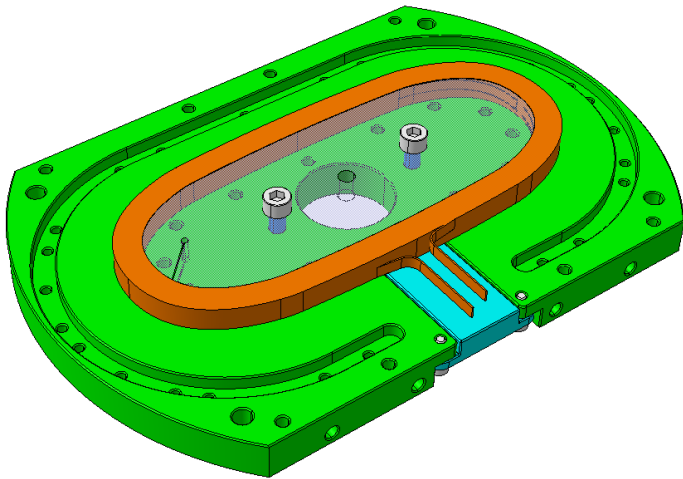
Insulated racetrack coils #1

- Double-pancake racetrack coil winding machine developed
 - 2 independent arms for double pancake winding
 - each with tension control system for 2 - 8 tapes or an insulated cable
 - in commissioning



Insulated racetrack coils #2

- Several insulated racetrack coils made
- Adapters for 77K, 4.2K, self-field & in-field characterization developed
 - in fabrication



Stacks of insulated tapes



Racetrack & dipole demonstrators

- Develop & construct racetrack coil demonstrators to be tested in external magnetic fields
- D1 HL-LHC superconducting magnet – 6 T in a bore of 150 mm diameter will be used for testing in 2024
- In following years, higher magnetic fields will also be accommodated for dipole demonstrator test

