Muon Collider WP7-Task 2 Target, Capture and Cooling Magnets workplan

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Outline

- Goals and outline
- Schedule
- Conclusion

Program goals and broad outline

- What is the maximum field that can be achieved in HF (target 20 T) and UHF (target 40…60 T) solenoids?
- What is the R&D required to reach such field levels?
- Can we increase the sustainability (decrease electrical consumption, minimal cryogen use) of such devices?

A - Review concepts and options for the target and final cooling solenoid (Hybrid/HTS only – Is Bi-2212 an option?) and produce preliminary design of solenoid families

B - Establish mechanical and protection limits of HF and UHF solenoids, in particular HTS tapes (internal adhesion, internal resistance, mechanical properties, radiation resistance)

- Instrument and test crucial properties on existing or new set-ups in order to establish the “technology reach”

Collaboration with high field insert tests in the range of 30 T - 40 T

Solenoid Conceptual Design

- Study various configurations
  - Hybrid LTS-HTS / all-HTS
  - Coil winding and supports
  - Operation temperature
- Answer the question: is Bi-2212 an option?
- Exploit collaboration in design and commissioning of high field inserts (gather precious experience and first hand information)

- Where?
  - CERN-EP, LNCMI, PSI, INFN LASA, Uni Southampton, CEA

HTS experiments

HTS measurements

- Where ?

PSI – UniGe – LASA – Uni Southampton – Uni Twe

- What ?

TBD, however…

- We need a minimal set of properties necessary for design and result analysis (every tape is, unlikely, still different)
- We need to find a smart configuration to probe identified limits

We design for > 40 T! Where can we test at very high field?

- LNCMI Grenoble?
- MagLab Tallahssee?

Proposed schedule task 7.2

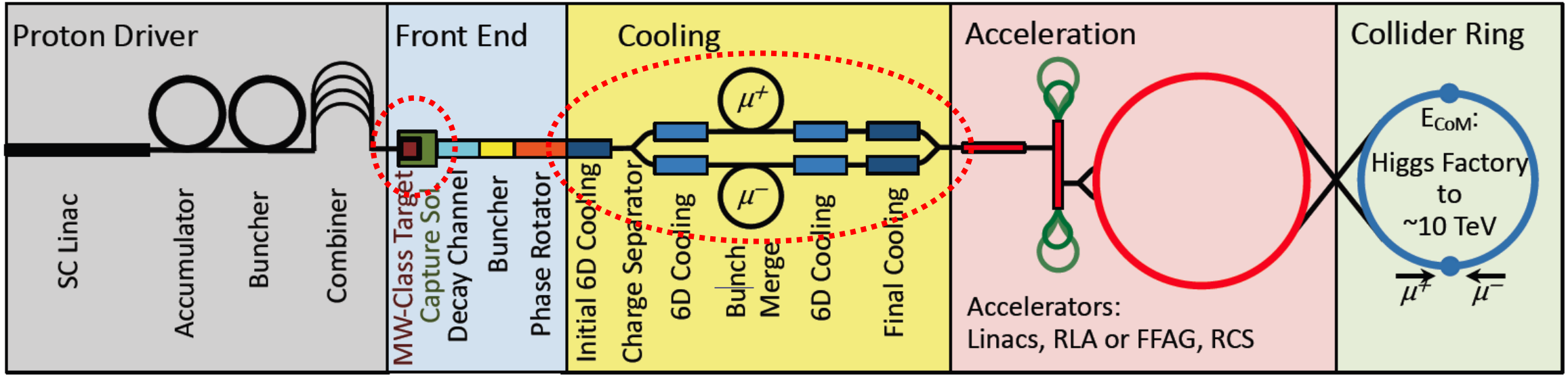
- T_0 Jan 1st 2023
- T_0+ 6 months review and preliminary design of solenoids
- T_0+ 9 months define R&D tests on conductors (TPL)
- T_0+ 20 months M7.3 Workshop on Ultra High Field Solenoids
- T_0+ 33 months D7.1 Intermediate Report
- T_0+ 45 months D7.2 Consolidated report

Conclusion

- Scope of the WP7 – task 2 is
  - Address feasibility and technology limits
  - Assess R&D activities
- Main challenges have been highlighted
  - Performance (magnetic field – mechanics and protection !) and feasibility
  - Cost optimization
  - Sustainibility
- Task 2 output
  - Preliminary design of the solenoids representing the main challenges. Final cooling, and, if resources allow, target and capture channel
  - R&D plan for the design of MuColl solenoids
  - Conceptual design of all solenoid families

THANKS

Motivation 1 - where



Scope of the WP8 – task 2

- address feasibility and technology limits
- Assess R&D activities

Partecipating institutes

CERN-EP, LNCMI, PSI, University of Geneva, INFN LASA, University of Southampton, University of Twente

CEA

Solenoid zoo

- Target solenoid

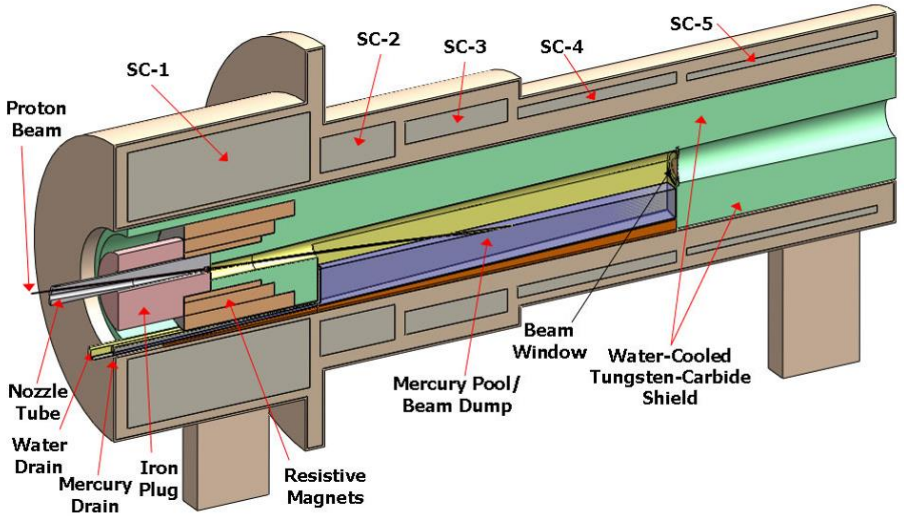
  1.5 m 20 T 2MW

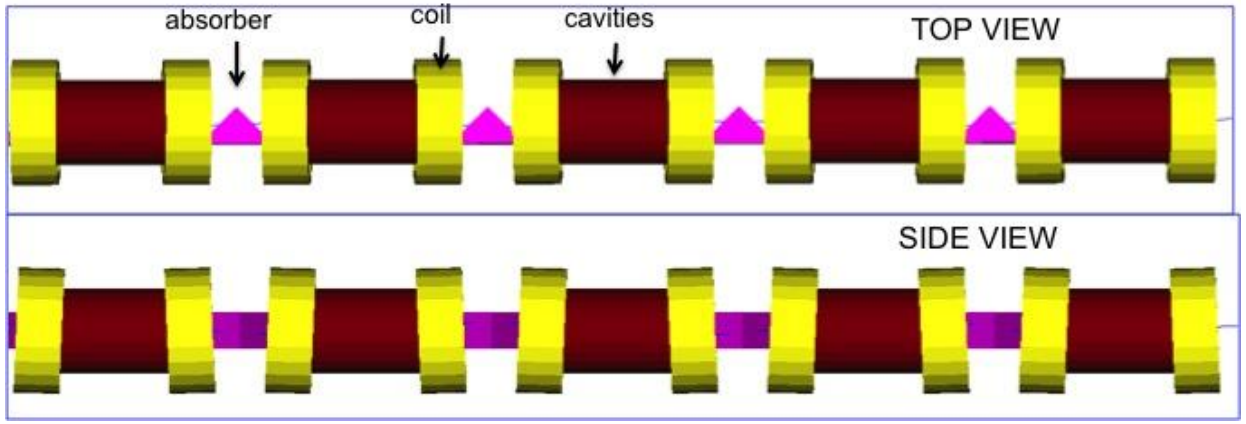
- Muon coolig

  1km 2 T to14 T

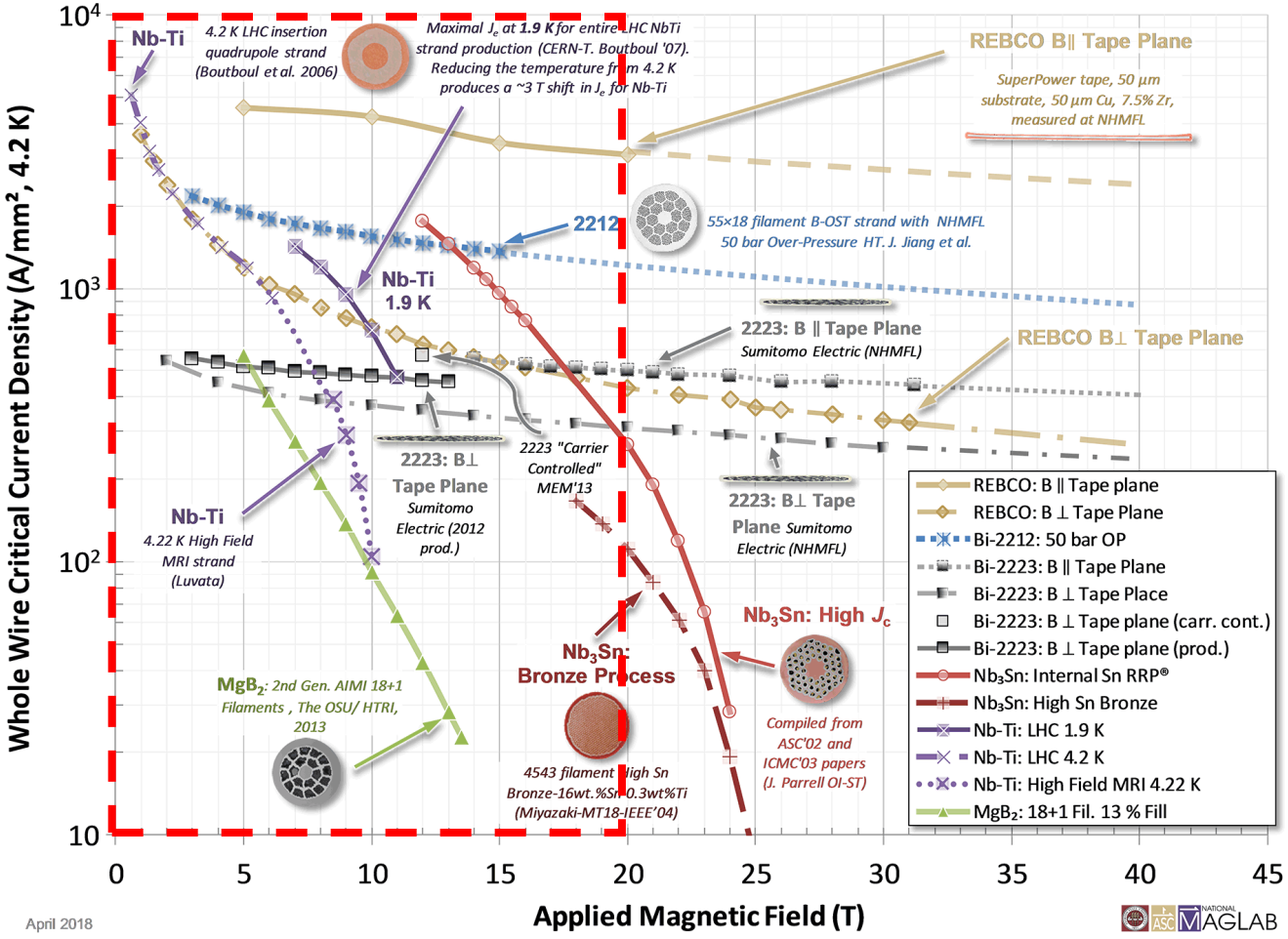
- Final cooling

  8.5 m – 40 T or 60 T





Challenges - final cooling solenoids



- Target field 60T (40 T baseline)
- Length 500 mm
- Inner diameter 60 mm

- **Will be HTS**
- **Mechanics and protection will most likely be the limit**

Ultra High Field tests

Collaboration to high field inserts for tests 30 T - 40 T