Exploring new Technologies for the Cooling Cell of the Muon Collider

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Place of thesis work: Milano at the LASA Laboratory of University and INFN

The Muon Collider is the raising hope for a energy-frontier collider: it can deliver **both high energy and high precision**

It si fully driven by muon lifetime: 2.2 μs at rest!!! And by the necessity to cool it quickly and efficienty!
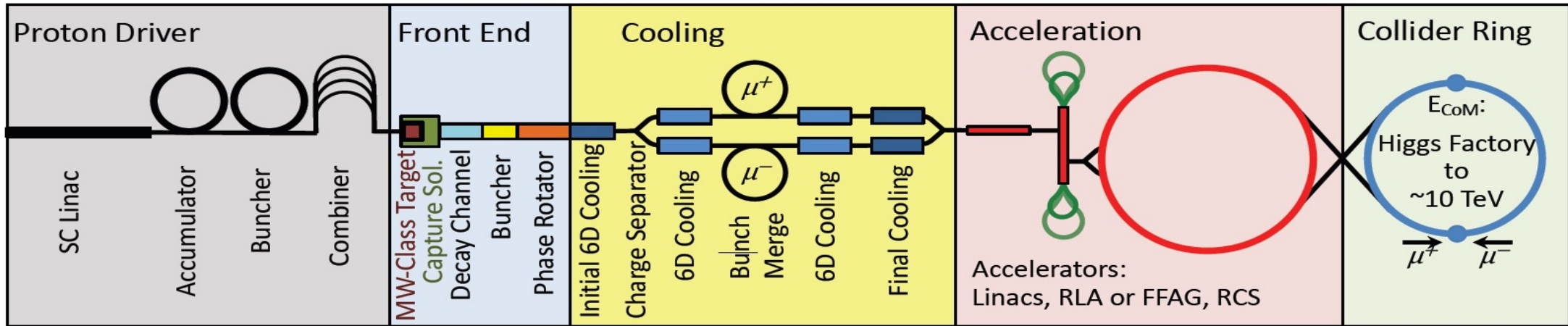
Short intense proton bunches produce muons that are captured

6D - Ionisation cooling of muon in matter

Acceleration to collision energy

Collision

Fast and efficient cooling of the Muons is necessary in order to pass from a "cloud of particles" to a cold beam.
The cooling Cell is maybe the most critical element of the accelerator: no cooling, no muons to collide…
The coling is obtained by absorbing energy in all direction and giving back energy inone direction:
Efficient eabsorber; large acceptance RF Cavity; Strong, **very large acceptance Supercond. Magnets for focusing**

Magnet zoo for the Cooling cell …

Unique challenge: Magnets and RF cavity must overlap (very unusual)

absorber coil cavities — TOP VIEW

SIDE VIEW

Ø140

20   70
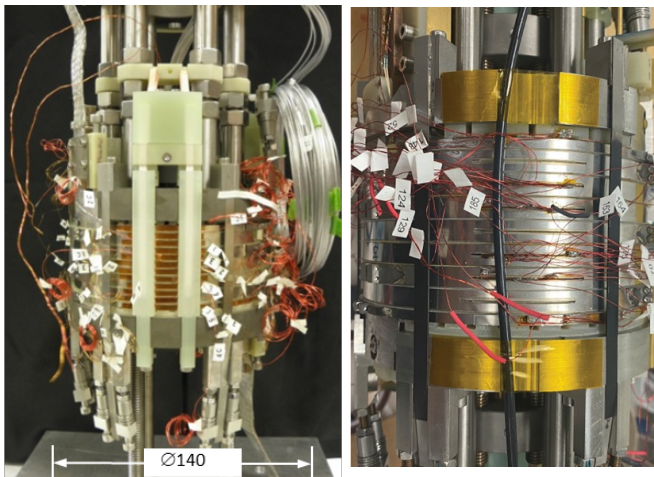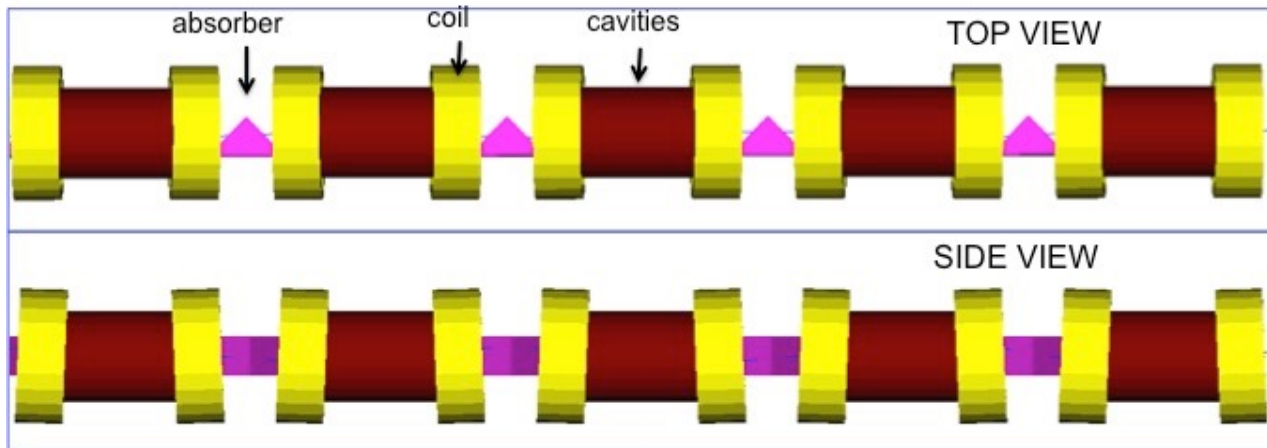
← Proto of small high field SC solenoid in HTS (USA)

← Exploring non-insulated technology has never bene done on such scale.

← Possibility to learn on subscale coils, development of multiphysics modelling: Electromagnetic, thermo-mechanical, optical and integration

PhD Thesis work:
Design of very high fields (3- 30 tesla!!) Solenoids
Exploring brand new technologies:
Non-Insulated coil with HTS (high temperature superconductor)
Construction of a prototype for 3-5 T an then design of a proto of 20+ T
Experimental test of a solenoid (3-5 T) couple with 650 or 1300 MHz Cavity.
Study of the best optical configuration for maximum performance.
Design of prototype Full Cell, solving integration issues , for the CCC (CERN Cooling Cell) demonstrator