Magnets WG

Introduction

Lionel QUETTIER

AGENDA

	Introduction and follow-up of last meeting *Zoom*	*Lionel Quettier* 14:30 - 14:50
	Current status of high field solenoids *Zoom*	*Lionel Quettier* 14:50 - 15:00
15:00	**vFFA magnet** *Zoom*	*Jean-Baptiste Lagrange* 15:00 - 15:10
	High frequency HTS magnet *Zoom*	*Vladimir Shiltsev* 15:10 - 15:20
	Combined function magnet options *Zoom*	*Toru Ogitsu* 15:20 - 15:30
	Stress management for High Energy Muon Collider's Storage Ring and IR Magnets *Zoom*	*emanuela barzi* 15:30 - 15:40
10 minutes break	**Discussion about technical issues and R&D timelines**	
16:00	*Zoom*	15:40 - 17:00
17:00	**Possible synergies and collaborators** *Zoom*	17:00 - 17:30

GOALS OF THE SECOND MEETING

Define the R&D (and prepare a first estimation of the associated resources), that has to be carried out before the next ESSU-PP to scientifically justify the investment into a full CDR for the muon collider and the corresponding demonstration program. (next 5 years)

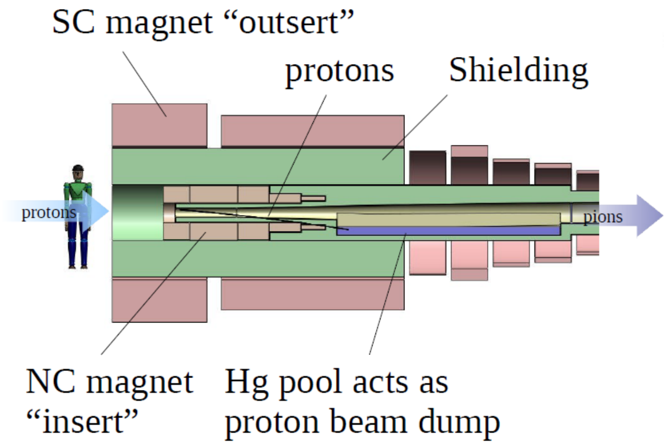
Targets should be realistic but ambitious for the performance goals of the different collider systems.

This includes R&D to develop a baseline collider concept, well-supported performance expectations and an assessment of the associated key risks, cost and power drivers. Also the working groups should consider what could be assumed for the demonstration program, i.e. **in one test facility starting in 2026**, as well what one can anticipate to be **available in 2035-2040 for** a first collider stage and in 2050 for an energy upgrade.

CHARGE

From the first meeting, it was clear that magnets are critical in the target/front end, cooling, acceleration, and collider ring areas

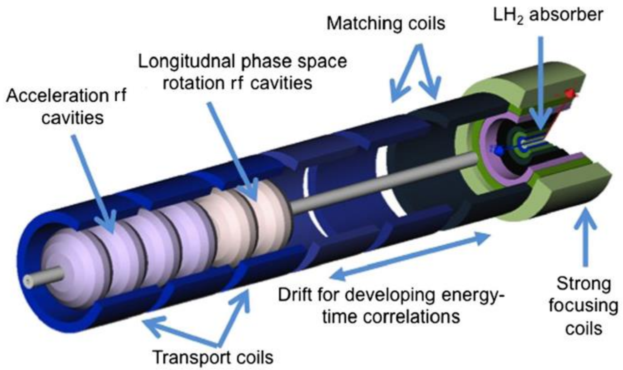
TARGET ENDS



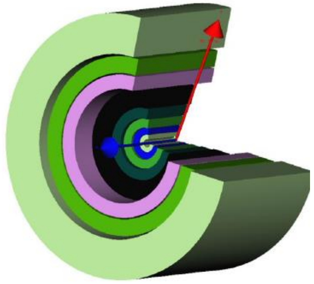
Hybrid design
(superconducting + conventionnal magnets)

- Target field from 15T to 20T, SC coil inner diameter up to 1.2m
- Strong effort needed to optimize the design; balance to be found between radiation loads, operating temperature, magnetic forces, stray field shielding…
- Specific R&D and prototypes ?

COOLING



Need of high field and very high field solenoids, as short as possible



- >30T, SC coil inner diameter of 50mm for the final cooling
- Huge forces
- Significant radiation loads
- Use of HTS materials: challenges with quench protection, stresses management

- Demonstrator performances ? Keep the aperture constraint, but lower the field?

ACCELERATION

Need of fast ramped magnets (+/- 1.8T @ 400Hk ?)

- AC losses management, large stored energy -> protection?
- Power converters (link with existing R&D at CERN)
- Continue the R&D existing at Fermilab (HTS magnet, 0.6T @ 20Hz)
- New demonstrator performances?

Vertical excursion FFA for muon acceleration Feasibility of magnets for vFFA as well as vFFA concept itself has to be demonstrated.

- At STFC/RAL, feasibility study on vFFA is going on and normal conducting prototype magnet is being designed.
- Magnets for vFFA muon accelerator may be realized as an extrapolation of the activity?
- R&D on vFFA magnets to build a scale down model of superconducting vFFA magnet ?

COLLIDER RING

- High field magnets (up to 10T) and high gradient (200T/m) with large apertures (80 mm to 160mm)
  - Combined functions
  - Geometry of combined function magnets (curved magnet such that dipolar field constant?)
  - Field quality requirements to be discussed, understood and defined
  - Open mid-plane magnets?

- Technical issues: mechanical forces, magnet protection (radiation losses management)

- Ideas for a demonstrator?

PRELIMINARY R&D LIST

- Strong design activity of SC magnets based on realistic performances and specifications

- R&D needed to address the key technical challenges:
  - Renforced NbTi/Nb3Sn conductors for large high field magnets,
  - Development of HTS material performances
  - Magnet protection again radiation heat loads, specially for HTS magnets, and accelerator magnets
  - Material aging against radiation
  - Material aging, power converter performances, AC losses for fast cycled magnets