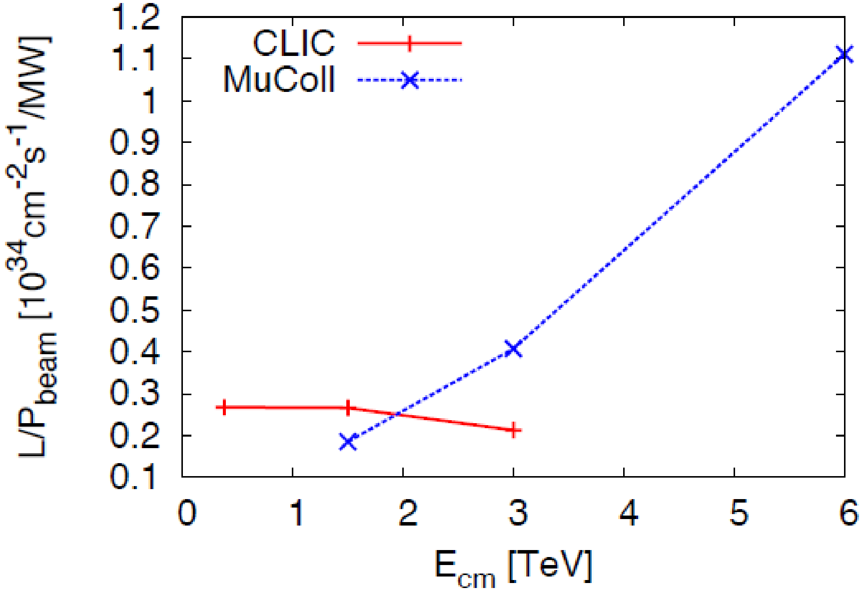
Why a multi-TeV Muon Collider?

cost-effective and unique opportunity

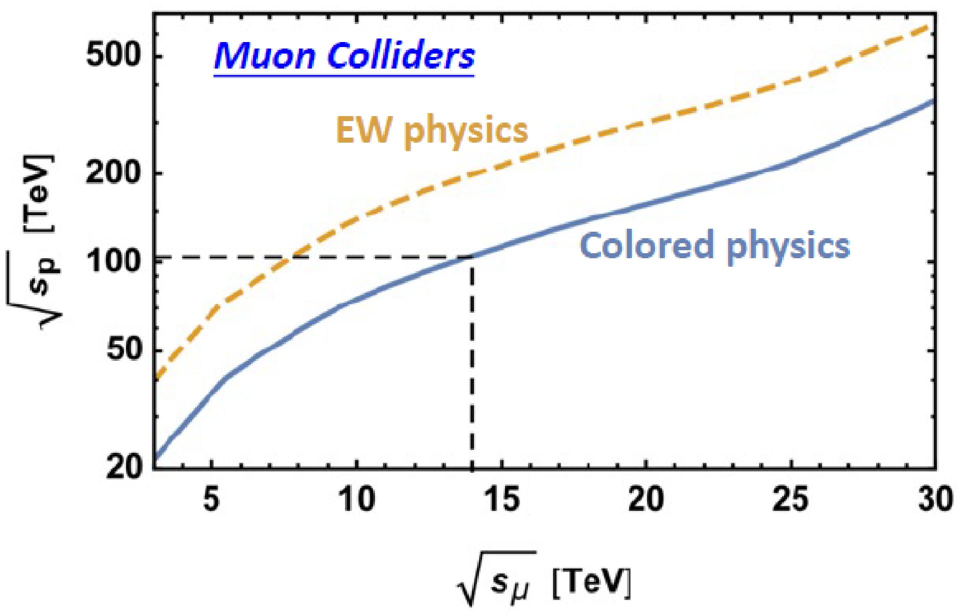
for lepton colliders @ Ecm > 3 TeV

Energy Efficiency



sufficient luminosity required

Energy at which σ_{pp} = $\sigma_{\mu\mu}$



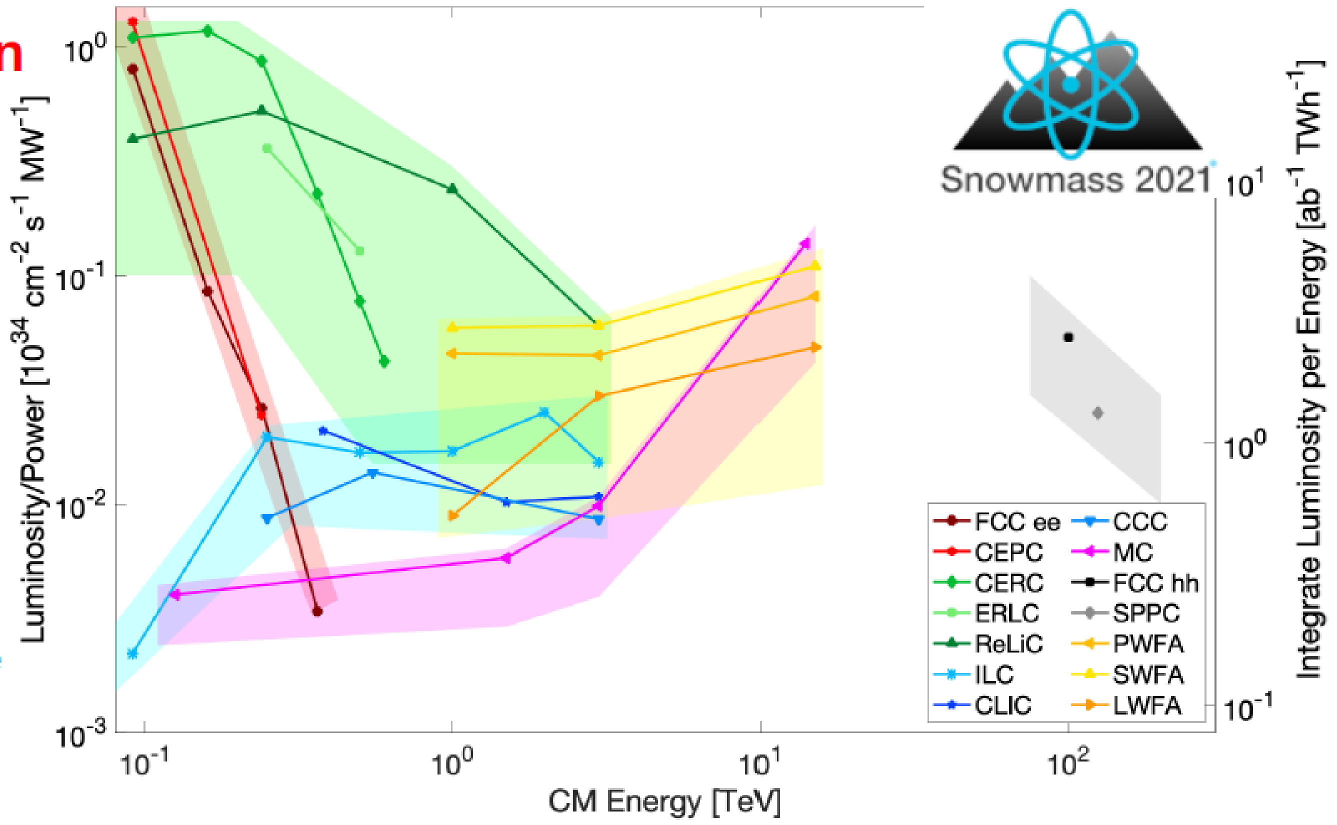
Strong interest to reuse existing facilities and infrastructure (i.e. LHC tunnel) in Europe

Energy efficiency of present and future colliders

Thomas Roser et al. **Aug 2022**
[Report of the Snowmass 2021 Collider Implementation Task Force]

Luminosity per power consumption

- Figure-of-merit Peak Luminosity (per IP) per Input Power and Integrated Luminosity per TWh.
- Luminosity is per IP and integrated luminosity assumes 10^7 sec/year
- Data points are provided to the ITF by proponents of the respective machine
- The bands around the data points reflect approximate power consumption uncertainty for the different collider concepts.



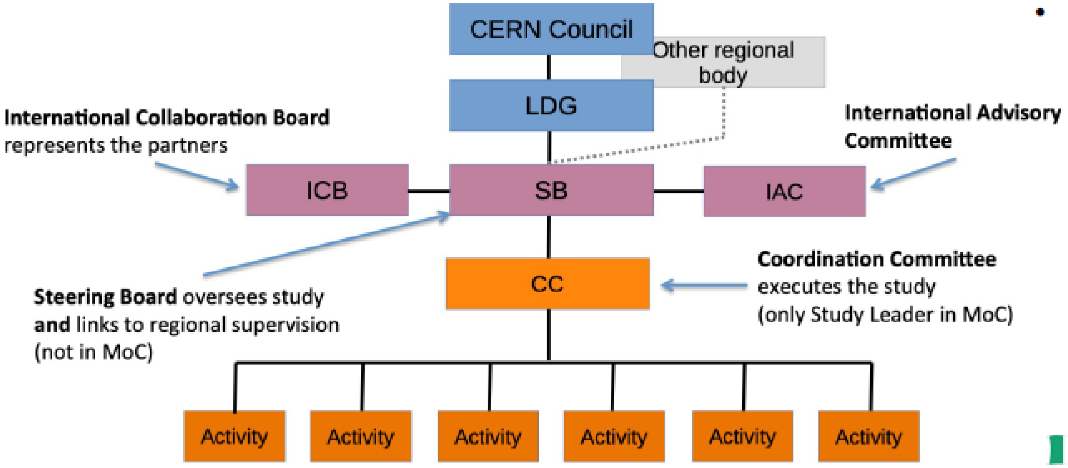
The effective energy reach of hadron colliders (LHC, HE-LHC and FCC-hh) is approximately a factor of seven lower than that of a lepton collider operating at the same energy per beam

Organization after the Roadmap

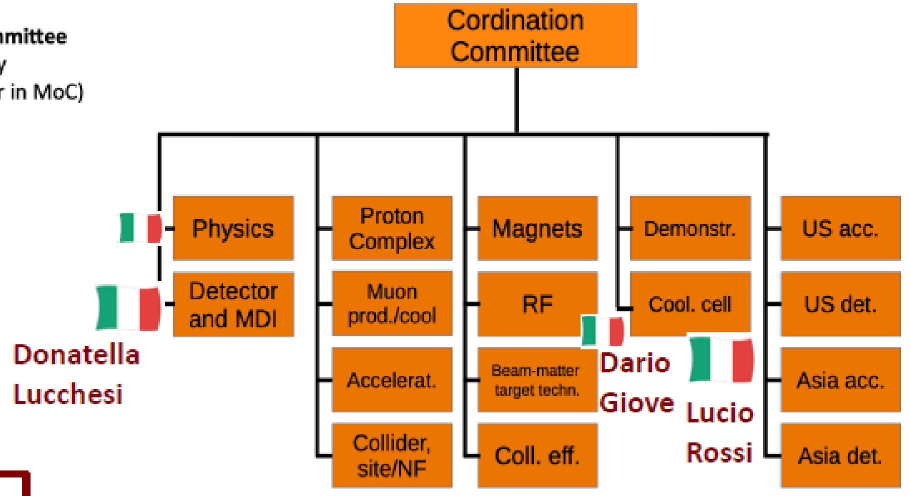
- Study Leader **Daniel Schulte**
  - Deputies: **Andrea Wulzer, Donatella Lucchesi, Chris Rogers**

- **Collaboration Board (ICB)**
  - Elected chair : **Nadia Pastrone**
- **Steering Board (SB)**
  - Chair **Steinar Stapnes**,
  - CERN members: Mike Lamont, Gianluigi Arduini,
    + ICB representatives, ICB chair and SL and deputies
- **International Advisory Committee (IAC)** *still to be formed*

CERN is host organisation, can be transferred to other partner on request of CERN and with approval of ICB
Will review governance in 2024, US could join at that time



Coordination Committee



MoC signed by CERN CEA INFN STFC-RAL ESS IHEP and different universities in EU, US, China

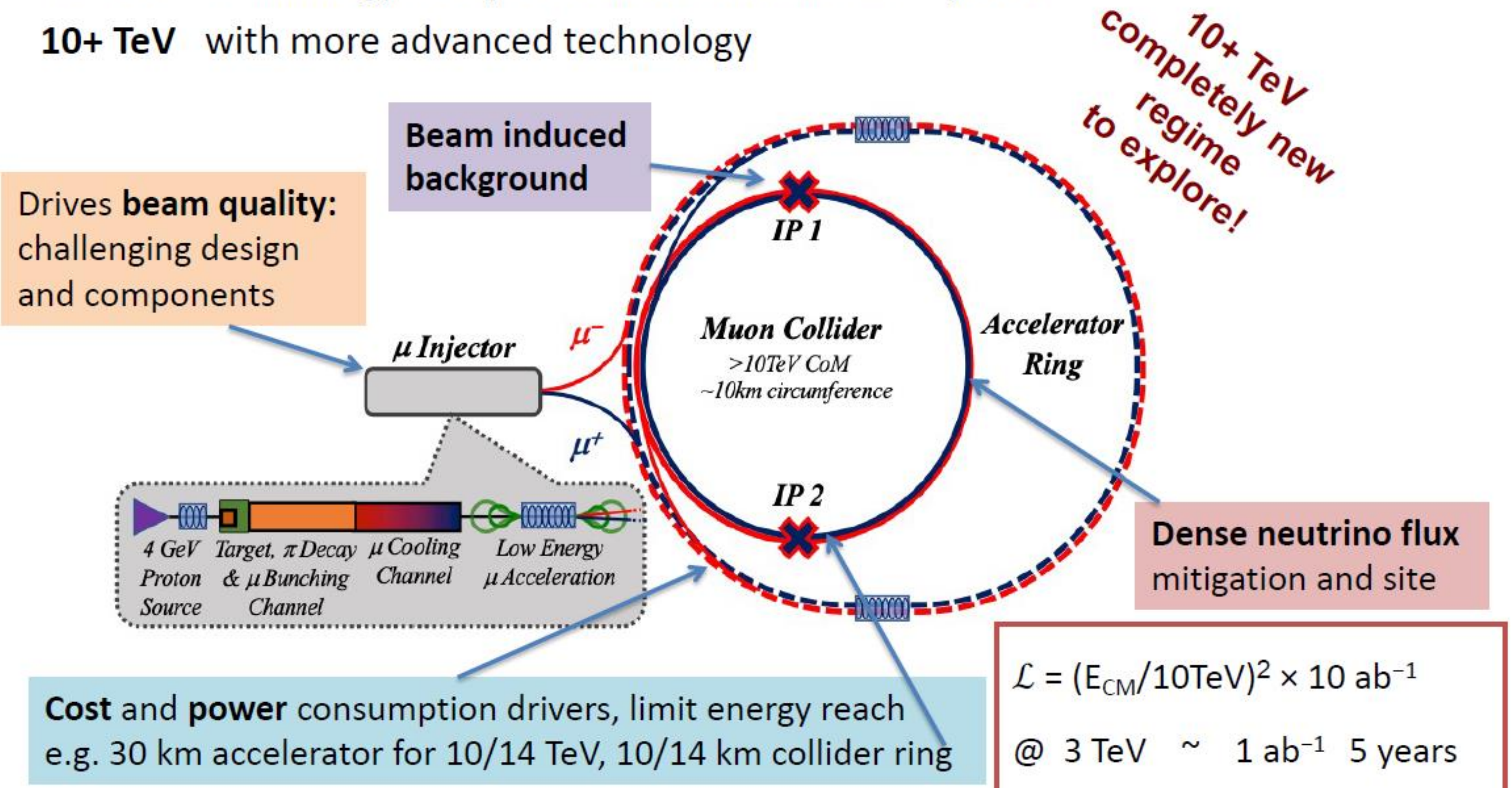
International Design Study facility

Proton driver production as baseline

- **Focus on two energy ranges:**

3 TeV technology ready for construction in 10-20 years

10+ TeV with more advanced technology

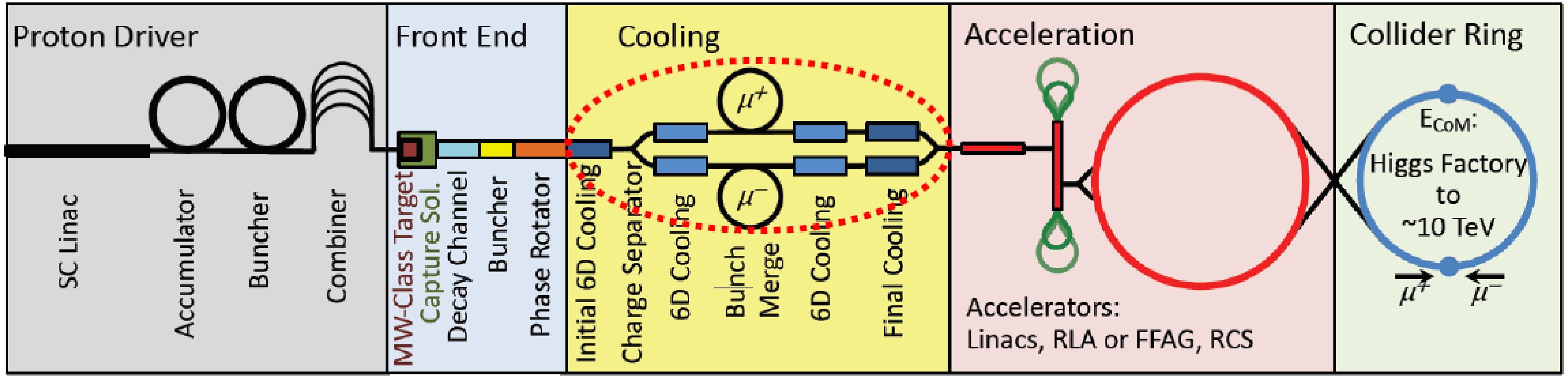


$\mathcal{L} = (E_{CM}/10\text{TeV})^2 \times 10\ ab^{-1}$

@ 3 TeV ~ 1 ab^{-1} 5 years

@ 10 TeV ~ 10 ab^{-1} 5 years

Proton-driven Muon Collider Concept



Short, intense proton bunches to produce hadronic showers

Pions decay into muons that can be captured

Muon are captured, bunched and then cooled

Acceleration to collision energy

Collision

MICE 4D ionization cooling experiment

1-4 MW proton beam @ **5-20 GeV**,
compressed to **1-3 ns** bunches at a **5-10 Hz** frequency

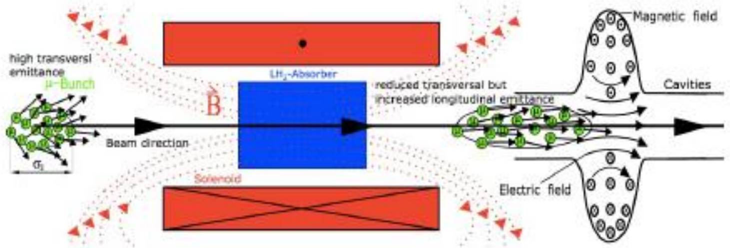
U.S. Muon Accelerator Program (MAP)

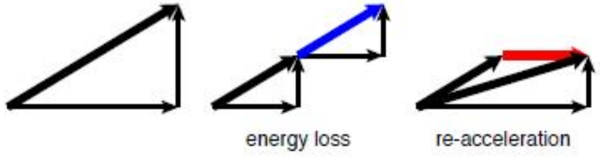
http://map.fnal.gov/

MUON JINST collection

Muon ionizing cooling

Integration of magnets, RF, absorbers, vacuum is an engineering challenge





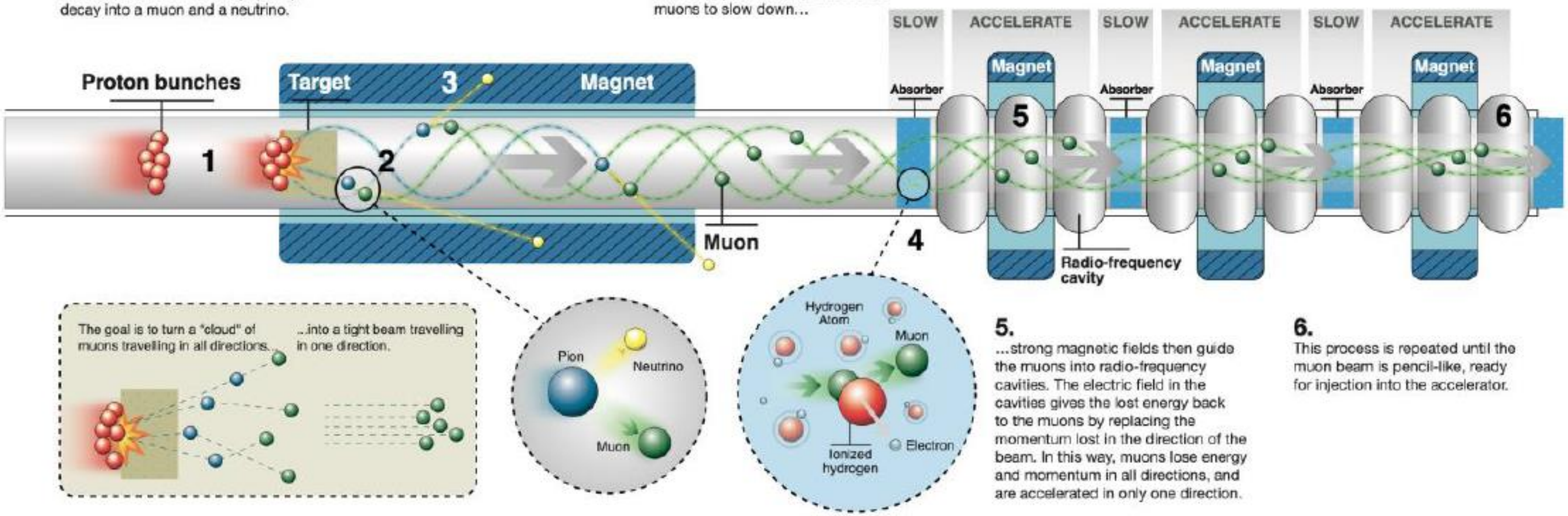


Fig. 3: Principle of the Muon Ionisation Cooling

RD_MUCOL: che fa Roma Tre?

- Studi di fenomenologia (R.Franceschini)

- Nel 2021-22 il laboratorio di fisica delle superfici ha fatto studi di danneggiamento dei target (articolo non ancora pubblicato ma non disperiamo)

- Ci sarebbe ampio spazio contribuire con studi dei materiali da utilizzare per le finestre del canale del muon cooling, ma al momento manca una persona che possa lavorarci……..

- Si potrebbe aprire la possibilità di collaborare allo sviluppo di detector di beam monitor nel muon cooling.

- Nel 2024 capire se riusciamo a contribuire o non ha senso continuare….

RD_MUCOL Roma Tre 2023

Anagrafica:

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Roberto Franceschini	0.1
Domizia Orestano	0.1
Antonio Passeri	0.1
Ludovico Tortora	0
Totale FTE	**0.4**

Richieste finanziarie:

Missioni:	3 k€	meeting ed eventuale partecipazione test beam
	3 k€	Conferenze fenomenologia Franceschini
Consumo:	3 k€	Metabolismo