News on organization

- ✓ **MuCol WP8 Demonstrator workshop**
  CERN – January 18-19, 2023 https://indico.cern.ch/event/1335151/

- ✓ **MDI workshop CERN – March 11-12, 2023**

- ✓ **Annual Meeting CERN – March 12-15, 2023**

- ✓ **Parameters document**: MuCol milestone https://mucol.web.cern.ch/
  https://cernbox.cern.ch/s/NraNbczzBSXctQ9

- ✓ **Interim Report**

Interim Report Key Messages

- Strong interest in the collaboration
  - E.g. US P5 ask
- Substantial increase in resources
  - Thanks to EU Design Study
  - More resources in institutes (e.g. CERN MTP)

- Good progress in studies
  - Many examples

- Still not at required level
  - Manage expectations for 2025/2026

- Synergies
  - Strong synergies exist, in particular for HTS magnet development, strong impact on society

- What will we need in the future?
  - RF test stand, demonstrator etc.
  - Technology developments

Interim Report

Interim Report Structure

Executive Summary (Daniel, Nadia Pastrone, Steinar Stapnes)

Implementation Considerations
- Staging
- Maturity
- Timeline considerations
- Reuse of existing infrastructure, Europe and US, site considerations

Physics Potential (Andrea Wulzer)
- Also synergy physics case

Physics, Detector and Accelerator Interface
- Physics and detector needs (Patrick Meade, Simone Pagan Griso, Federico Meloni)
- MDI (Anton Lechner)

Detector (Donatella Lucchesi)
- Concepts (Lorenzo Sestini)
- Technologies (Nazar Bartosik)
- Performance (Massimo Casarsa)

Accelerator design (Christian)
- Overview
- Proton complex (Natalia Milas)
- Muon production and cooling (Chris Rogers)
- Acceleration (Antoine Chance, Heiko Damerau)
- Collider ring (Christian Carli)
- Collective effects (Elias Metral)

Accelerator technologies (Luca)
- Magnets (Luca Bottura)
- Power converter (Fulvio Boattini)
- RF (Dario Giove, Alexej Grudiev)
- Target (Marco Calviani, Anton Lechner)
- Shielding and Absorbers (Anton Lechner, Rui, Jose)
- Muon cooling module (Lucio Rossi, Roberto Losito)
- Cryogenics (Rob, Patricia)
- Vacuum (Jose)
- Instrumentation (Thibaut?)
- Radiation and protection (Claudia)
- Civil engineering (Yuri, John)
- Movers (Antii, Carlotta)
- Other technologies, Electric supply, HVAC, … (Roberto)
- General safety considerations (Claudia to coordinate)

Synergies (Chris)
- Technologies (Luca Bottura, …)
- Facilities (Chris Rogers)

R&D programme development (Roberto)
- Demonstrator (Roberto Losito, Chris Rogers)
- RF test stand (Dario Giove, Alexej Grudiev)
- Magnet test facility (Lucio Rossi, Luca Bottura)
- Other test infrastructure required (HiRadMat, …) (Roberto Losito)

Collaboration Development (Steinar Stapnes, Nadia Pastrone, Daniel Schulte, also Mark Palmer, Sergo Jindariani, Diktys Stratakis)
- Members, contributions, MuCol, US plans

Next steps – plans for dedicated meetings

- National Muon Collider workshop – spring ?
- Demonstrator:
  - cooling cell – test facility
  - detector R&D synergies
  - physics synergies
- Experiment design @ 10 TeV including magnet
- Accelerator technology – ESPP

Sommario persone/sedi coinvolte e attività

SEDE		FTE	MuCol	AIDA	PNRR	ATTIVITA'				
		*100		I.FAST	IRIS	FISICA/SIMUL	DETECTOR	ACCELERATOR	COMMENTO	PRIN
		RD_MUCOL		aMUSE						
BA		230				x	x		Fisica HCAL (DRD1/DRD6) HPTPC (DRD1)	Calo
BO	DTZ	125				x		x	Fisica teo e Fast ramping Magnets	
FE	DTZ	50					x		Cristalli manipolazione fasci mu e Calo	
GE	DTZ	95	45					x	Magneti	
LNF		300					x		CRILIN (DRD6)	Calo
LNL	DTZ	5	5					x	RF +(bersagni sottili)	
LNS	DTZ	0	20					x	RF	
MI		145	90		80			x	Magneti e RF (40 sj)	
MIB	DTZ	30					x		Test facility-dimostratore	
NA	DTZ	20						x	RF	
PD		325	20			x	x		Fisica Detector Calcolo MDI Dimostratore	
PV		185		30		x	x		Fisica e picosec+ generatori teo	gas
RM1		260	20	10		x			MDI fisica e bersagli/materiali	
RM3	DTZ	50				x			fisica - bersagli e finestre sottili	
TO		215	20	6		x	x	x	fisica R&D det (DRD3) MDI e cooling cell	gas - tracker
TS	DTZ	5	20	5		x	x		fisica e ricostruzione	

Sinergie su fondi esterni EU e MUR dedicati ➔ contribuiscono a definire sedi con **FTE** $\geq$ **2**

TOT FTE	RD_MUCOL	MuCol	I_FAST	AIDAinnova	PNRR-IRIS	PRIN
24,11	20,40	2,40	0,15	0,30	0,80	inclusi RD_MUCOL

PERSONE	RD_MUCOL	MuCol	I_FAST	AIDAinnova	PNRR-IRIS	PRIN
116+2	106	4	-	1	5	inclusi RD_MUCOL

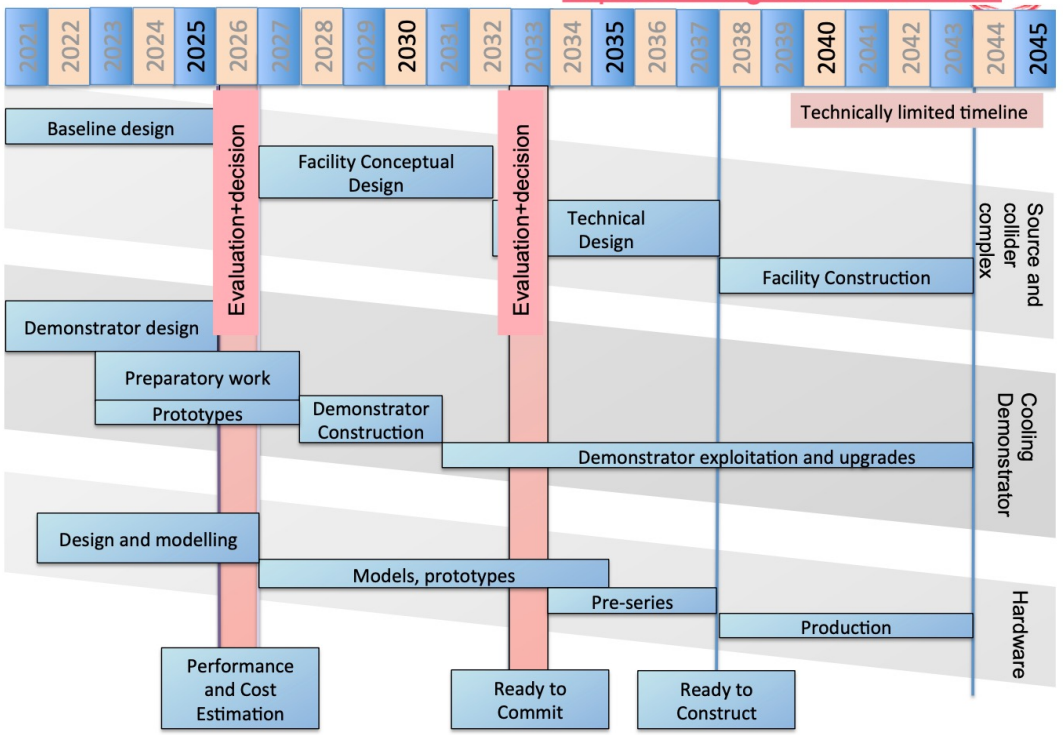
IMCC plans

Accelerator R&D Roadmap

Main goal is **10 TeV** collider
Potential initial stage **3 TeV**

- For **fast implementation**, e.g. directly after HL-LHC
- Compromises will be made as required
- Physics case already good

http://arxiv.org/abs/2201.07895



Deliverables by next ESPPU/other processes

- **Project Evaluation Report**
- **R&D Plan**

Allows to make **informed decisions**

Interim report by end of 2023

Currently resources start approaching minimal scenario

Scenario	FTEy	M MCHF
Full scenario	445.9	11.9
Reduced scenario	193	2.45

Plan

The panel has identified a development path that can address the major challenges and deliver a 3 TeV muon collider by 2045

[Accelerator R&D Roadmap]
[Detector R&D Roadmap]

Scenarios

Aspirational		Minimal	
[FTEy]	[kCHF]	[FTEy]	[kCHF]
445.9	11875	193	2445

~70 Meu/5 years

Label	Begin	End	Description	Aspirational		Minimal	
				[FTEy]	[kCHF]	[FTEy]	[kCHF]
MC.SITE	2021	2025	Site and layout	15.5	300	13.5	300
MC.NF	2022	2026	Neutrino flux mitigation system	22.5	250	0	0
MC.MDI	2021	2025	Machine-detector interface	15	0	15	0
MC.ACC.CR	2022	2025	Collider ring	10	0	10	0
MC.ACC.HE	2022	2025	High-energy complex	11	0	7.5	0
MC.ACC.MC	2021	2025	Muon cooling systems	47	0	22	0
MC.ACC.P	2022	2026	Proton complex	26	0	3.5	0
MC.ACC.COLL	2022	2025	Collective effects across complex	18.2	0	18.2	0
MC.ACC.ALT	2022	2025	High-energy alternatives	11.7	0	0	0
MC.HFM.HE	2022	2025	High-field magnets	6.5	0	6.5	0
MC.HFM.SOL	2022	2026	High-field solenoids	76	2700	29	0
MC.FR	2021	2026	Fast-ramping magnet system	27.5	1020	22.5	520
MC.RF.HE	2021	2026	High Energy complex RF	10.6	0	7.6	0
MC.RF.MC	2022	2026	Muon cooling RF	13.6	0	7	0
MC.RF.TS	2024	2026	RF test stand + test cavities	10	3300	0	0
MC.MOD	2022	2026	Muon cooling test module	17.7	400	4.9	100
MC.DEM	2022	2026	Cooling demonstrator design	34.1	1250	3.8	250
MC.TAR	2022	2026	Target system	60	1405	9	25
MC.INT	2022	2026	Coordination and integration	13	1250	13	1250
			Sum	445.9	11875	193	2445

extras