

Funding & Collaboration growth discussion

- ➔ *national/regional funds - how do we better coordinate?*
- ➔ *how to contact new institutes/countries? Synergies?*
- ➔ *how to be more inclusive, encourage community growth and access new resources?*

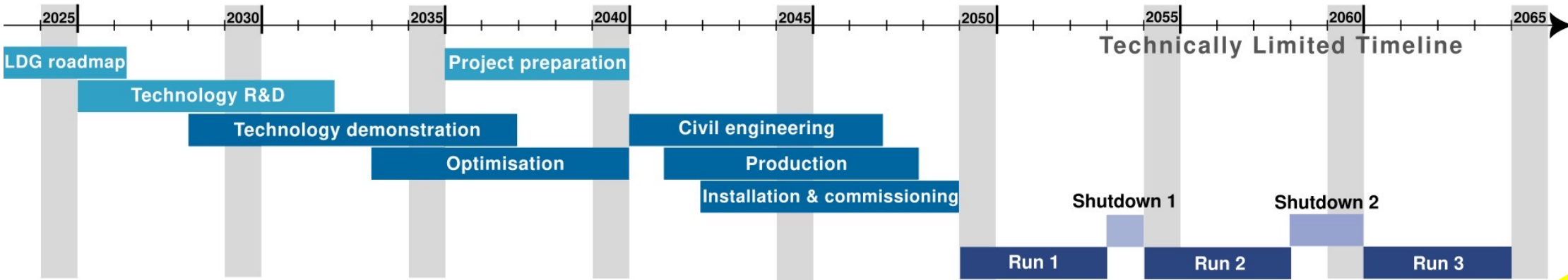
Nadia Pastrone



Timeline & R&D Resources need



Muon Collider



Accelerator R&D Roadmap

Year	I	II	III	IV	V	VI	VII	VIII	IX	X
Accelerator Design and Technologies										
Material (MCHF)	1.6	3.2	4.8	6.4	9.6	10.8	12.0	12.0	12.0	12.0
FTE	47.1	60.6	75.0	85.0	100.0	120.0	150.0	174.6	177.2	185.1
Demonstrator										
Material (MCHF)	0.6	2.2	3.9	5.4	7.8	15.1	25.9	32.4	31.8	12.6
FTE	9.5	11.0	12.5	29.2	29.7	30.5	25.5	27.7	26.7	25.5
Detector										
Material (MCHF)	0.5	1.1	1.6	2.1	2.1	2.1	2.1	2.6	3.1	3.1
FTE	23.4	46.5	70.0	93.0	93.0	93.0	93.0	116.4	139.5	139.5
Magnets										
Material (MCHF)	3.0	4.9	10.1	10.0	11.0	13.4	11.7	7.2	6.6	4.7
FTE	23.3	28.4	36.4	40.9	44.3	47.1	46.2	37.7	36.1	29.4
TOTALS										
Material (MCHF)	5.7	11.4	20.3	23.9	30.6	41.4	51.7	54.2	53.5	32.4
FTE	103.3	146.5	194.0	248.1	267.0	290.6	314.8	356.3	379.4	379.6

From LDG Review - February 2025

Conduct an Independent Review of Scope, Schedule, and Costs: An urgent, independent evaluation is needed to assess the overall scope, timeline, and budget of the Muon Collider R&D program for the **period 2026-2036**. This review will be crucial to ensure that funding requests for this R&D phase are well-justified and aligned with project objectives.

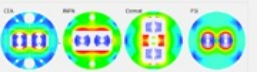




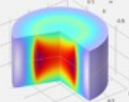

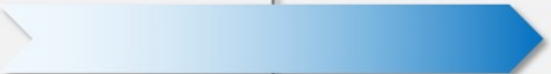
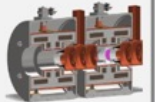






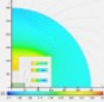
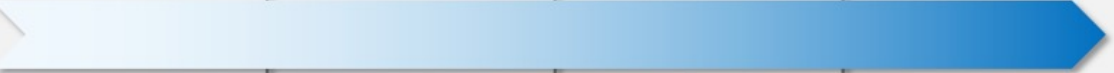
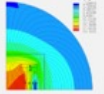


Totals:
Duration 10 years

Accelerator: 300 MCHF material, 1800 FTEy
Detector: 20 MCHF material, 900 FTEy

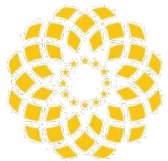
POINTS TO BE NOTED:

- Our present estimate require careful revision/planning
➔ how to we face/collect the estimated needed resources?

Magnet R&D impact - Luca Bottura talk

	HEP and NP 	High-field science 	NMR 	MRI	Fusion 	Motors/generators 
TM1 20@20 		High field, low consumption			High-field, large bore and large stored energy	
TM2 SOLID 		High field, low consumption		High-field large bore, cryo-free technology		
TM3 UHF-DEMO 	FCC-ee, CLIC (e+ source)	Ultra-high-field	Ultra-high-field			High-field, compact windings
TM4 RCS-String		High pulsed power and energy recovery			High pulsed power and energy recovery	
TM5 MBHY	FCC-hh, SppC					
TM6 MBHTS 	FCC-hh, SppC					3D, compact pole winding
TM7 MBHTSY 	FCC-hh, SppC					3D, compact pole winding
TM8 MQHTSY	FCC-hh, SppC					3D, compact pole winding

PRACTICAL IMPACT EXAMPLES



- **Fusion for Energy** (ITER EU Domestic Agency)
 - Framework agreement and first addendum in final negotiation
 - Contribution to the design of the HTS target solenoid, relevant to the central solenoid of DTT
- **EUROFusion** (next step European fusion reactor)
 - Framework agreement signed in 2023, first addendum signed in 2024
 - Contribution to the design of the HTS target solenoid, relevant to the magnets of a Volumetric Neutron Source proposed as next step in the European fusion strategy
- **Gauss Fusion** (one of the leading EU fusion start-ups)
 - Consultancy agreement signed in 2023
 - CERN contribution to the design of the LTS/HTS GIGA stellarator magnets, based on advances in the HTS target solenoid
- **ENI** (oil and gas energy giant)
 - Framework agreement and first addendum signed in 2024
 - Collaboration on the conceptual design and project proposal for the CERN construction of a large bore HTS solenoid (20@20 model coil) relevant to the muon collider and fusion
- IFAST-2 proposal to **INFRA-2025-TECH-01-02** (CERN, INFINEON, PSI)
 - Proposal of fast pulsed power cell + magnet system sent to IFAST-2 coordination for ranking at TIARA
 - Industrial interest in rapidly pulsed and large energy/power supplies

Example Prospective Resources

Already successful

- MuCol, IFAST, MUSIC, ...
- Fermilab site study
- Grants for US detector work
- DoE grant for RF test stand at SLAC
- ...



LDG might

- Integrate final cooling solenoid in the HFM programme
- Strengthen the HFM programme contribution to magnet protection studies
- Explore RF panel contributions

Other grant requests

- E.g. one for MUSIC calorimetry

Other sources to try

- Increased contributions from partners
- More grants
- ...

EU co-funding request via IFAST2

- Power converter (PSI, CERN and Infineon)
- FFAG (UKRI and ESS)
- Modulator for klystron (INFN and Scandinova)
- Mover system (CERN and ?)

Collaboration on target solenoid with fusion magnet technology

F4P

EUROFusion

ENI

Gauss Fusion



Physics case for intermediate facilities

- Could leverage extra funding

Will try to collect this centrally

National/Regional funds - how to coordinate?



NATIONAL FUNDS:

- ✓ Funding Agency
- ✓ Government
- ✓ Private

REGIONAL/INTERNATIONAL FUNDS:

- ✓ European calls
- ✓ Across regional funds (i.e. RISE) → **NETWORKS FUNDS: for graduate students/ postdocs / anybody**
- ✓ ????

The international collaboration

Crucial/Strategic time to
enlarge and strengthen the **collaboration!**



We have a lively interested community contributing at different level with the ESPPU ahead

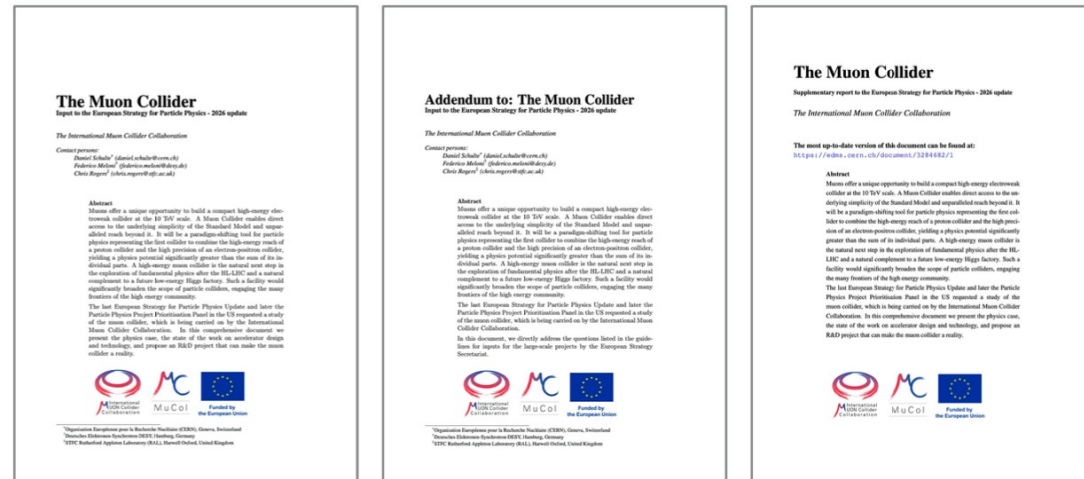
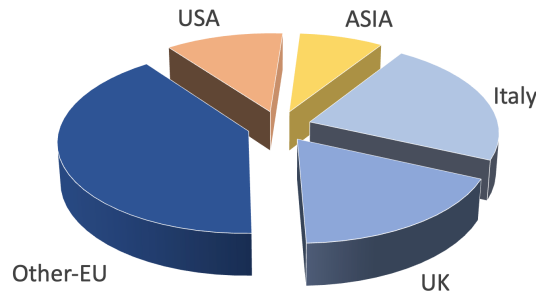
Submitted ESPPU input as large project

Proposed an R&D plan that can make a muon collider reality by 2050

- 406 pages supplementary "backup" document, ~450 authors and supporters

22 COUNTRIES

~ 85 institutes joined so far IMCC



<https://doi.org/10.48550/arXiv.2504.21417>

450 authors: 26 COUNTRIES → 131 institutes

➔ how to be more inclusive and exploit new resources?

Memorandum of Cooperation
will be signed by a few more institutes
~ 75% of the total interested to join
REVISION on-going

Essentials

2026 UPDATE
OPEN SYMPOSIUM
**European Strategy
for Particle Physics**

23-27 JUNE 2025



- ✓ the **international community** working together is steadily growing and focusing on priorities which needs to be coherently shared by all countries contributing to the ESPPU
→ **over 6 years!** **How can we improve?**
- ✓ the **international collaboration** established after the LAST ESPPU recommendation, evolved in the IMCC with a **Memorandum of Cooperation** expected to be signed by joining Institutes
→ **resources allocated by CERN MTP since 2021 are complemented by institutes/FA**
→ **resources** **How can we improve?**
- ✓ Accelerator R&D Roadmap in EU and Snowmass21 in US processes, **strengthen the community**, leading to define resources needs and priorities on different activities
→ **NEW EU ESPPU input documents**

How can we prepare to support our project along the EU ESPPU on-going process?

Support MuC R&D?

