MUon collider STrategy network - MUST

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for the MUST team
INFN - CERN (+BINP) – CEA – IJCLAB – KIT – PSI – UKRI – (BNL-USA not beneficiary)

Task 5.1

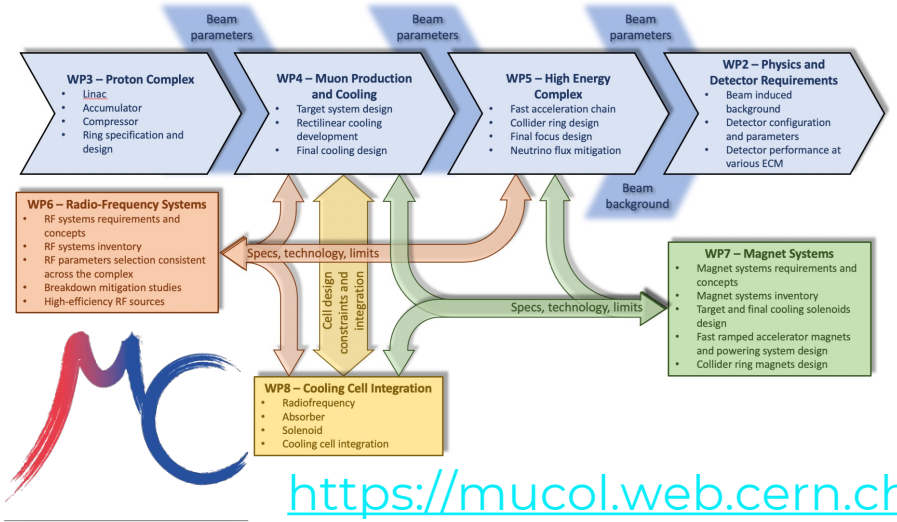
…. *the **international muon-collider collaboration is growing!***
https://muoncollider.web.cern.ch

MUST** will support to establish an **international collaboration** and develop an **optimized R&D roadmap** towards a future muon collider, including the definition of **optimum test facilities and possible intermediate steps

- **MS15:** International workshop on muon source design **M18** ➔ *Report*
- **MS16:** International workshop to **define R&D plans** **M36** ➔ *Report*
- **D5.1:** International collaboration plans towards a multi-TeV muon collider **M46**

Progress since the last Annual meeting

MuCol – EU INFRA-DEV project
A Design Study for a Muon Collider complex at 10 TeV center of mass



MuCol

https://mucol.web.cern.ch/

Tentative parameters available

Strong commitment of the International Community to:

- ✓ consolidate the baseline design of the facility at 10+ TeV
- ✓ design/optimize the facility and the experiment: **R&D plan**
- ✓ identify priorities and synergies

Accelerator R&D Roadmap
implementation
Detector R&D Roadmap
implementation ➔ R&D collaborations

Interim Report in preparation by Feb '24

Exploring the Quantum Universe

https://www.usparticlephysics.org/2023-p5-report/

Now preparing for formal U.S. Community engagement after P5 Report

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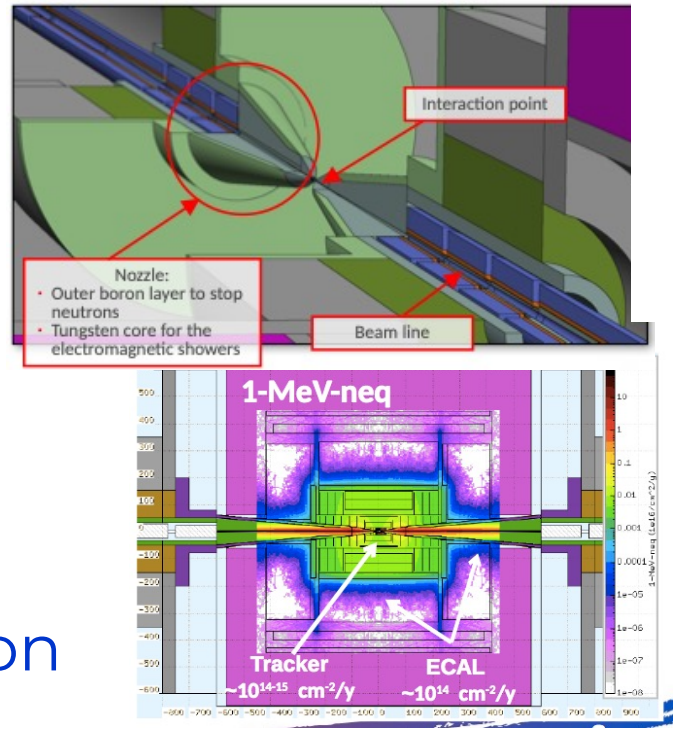
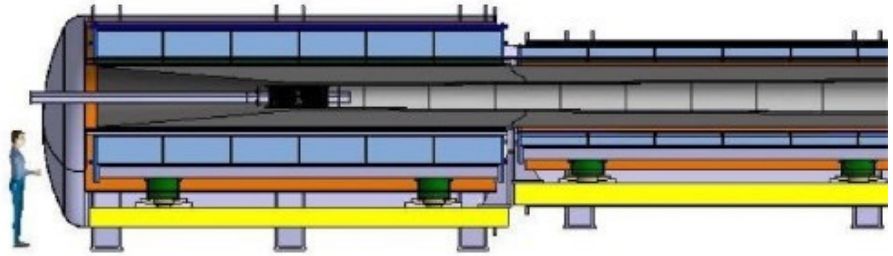
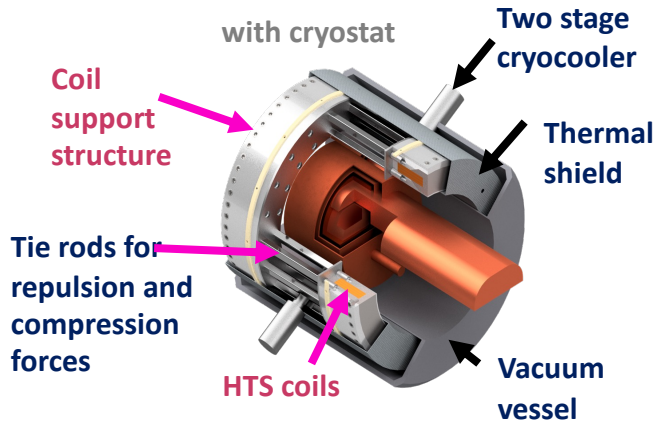
Summary of activities towards R&D plans

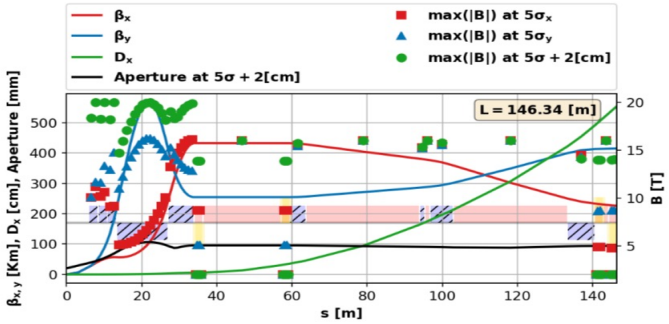
Each WP is working to identify challenges and R&D plans towards a baseline design:

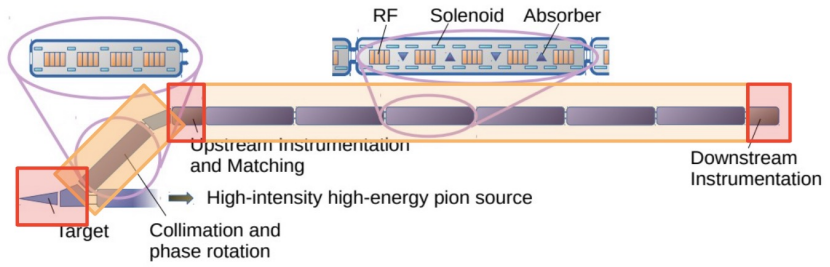
- Physics and MDI
- Proton complex
- Target design
- Muon Cooling
- Accelerator Complex
- Collider Ring
- RF Technology
- Magnet Technology
- Cooling cell integration
- Demonstrator

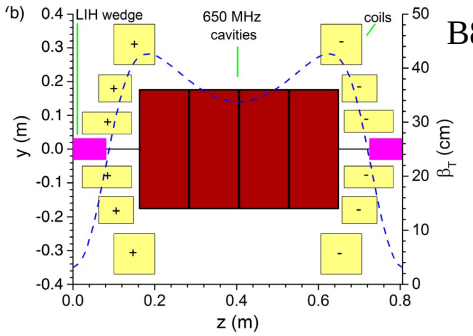












R&D plans International workshop

Fully included in the agenda of the next

International Annual Meeting @ CERN March 12-15, 2024

➔ **MDI workshop** @ CERN March 11-12, 202

➔**first lattice at the 10 TeV centre of mass energy ➔ Machine Detector Interface** (MDI)

➔**RF and magnet technology (including HTS) plans are on-going**

➔**Integration of a cooling cell ➔ Planning for a demonstrator is mandatory**

➔**MuCol Cooling cell Workshop** @ CERN January 18-19, 2024

➔Interim Report @ Accelerator R&D Roadmap and MuCol

➔ All progress on technology studies, design study of each component and first lattice @ 10 TeV

➔ Machine Detector Interface (MDI) Design ➔ Beam Induced Backgroud mitigation

➔ **Experiment Design @ 10 TeV ➔ Detector Magnet choice and design under study**

➔ Detector R&D and Full simulation studies

Towards a Muon Collider *Eur.Phys.J.C* 83 (2023) 9, 864

International MUON Collider Collaboration

MuCol

Funded by the European Union

CERN

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Supported by MUST (MUon collider STrategy network), part of I.FAST EU Project

IMCC and MuCol Annual Meeting 2024

12-15 March 2024, CERN

Info & Registration

indico.cern.ch/event/1325963/

Scientific Program Committee - Chairs: L. Bottura & C. Carli (CERN)
Members: M. Casarsa (INFN), A. Chance (CEA), R. Franqueira Ximenes (CERN), S.Gilardoni (CERN), D. Giove (INFN), A. Grudiev (CERN), S. Jindariani (FNAL), A.Lechner (CERN), R. Losito (CERN), D. Lucchesi (INFN), E. Metral (CERN), N.Milas (ESS), M. Palmer (BNL), N. Pastrone (INFN), L. Quettier (CEA), C. Rogers (STFC), D. Schulte (CERN), A. Wulzer (IFAE/ICREA), A. Yamamoto (CERN).

CERN Organising Committee : D. Schulte (Project Leader), A. Augier, M. Lancellotti.

Funded by the European Union (EU). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the EU or European Research Executive Agency (REA). Neither the EU nor the REA can be held responsible for them.

Poster design by R. Taylor

Looking forwards to synergies in R&D

Thanks for your attention!

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No101004730

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Key Challenges of the facility

- **Focus on two energy ranges:**
  - **3 TeV** technology ready for construction in 10-20 years
  - **10+ TeV** with more advanced technology

$\sqrt{s}$	$\int \mathcal{L} dt$
3 TeV	1 ab^{-1}
10 TeV	10 ab^{-1}
14 TeV	20 ab^{-1}

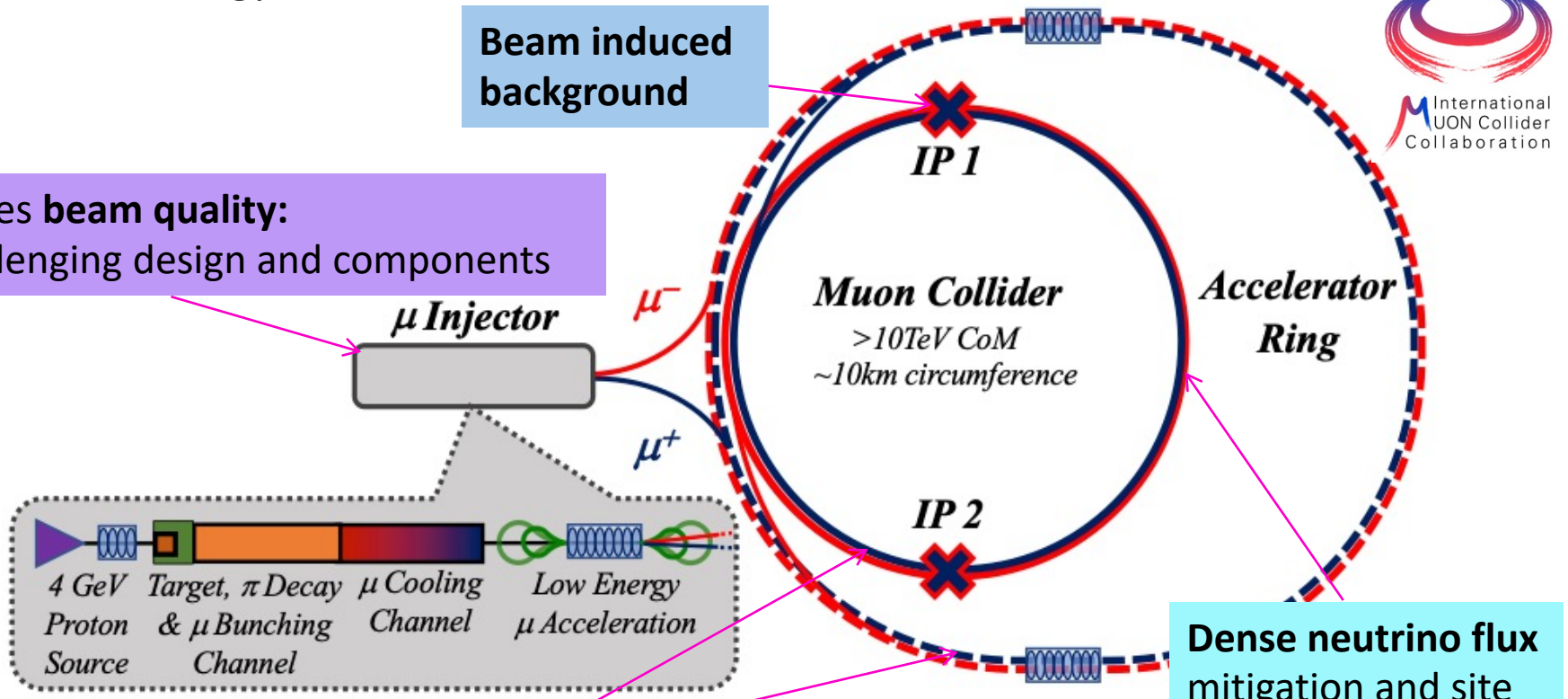
10+ TeV completely new regime to explore!

Web page:
http://muoncollider.web.cern.ch

Proton driver production
Baseline @ International Design Study

Beam induced background

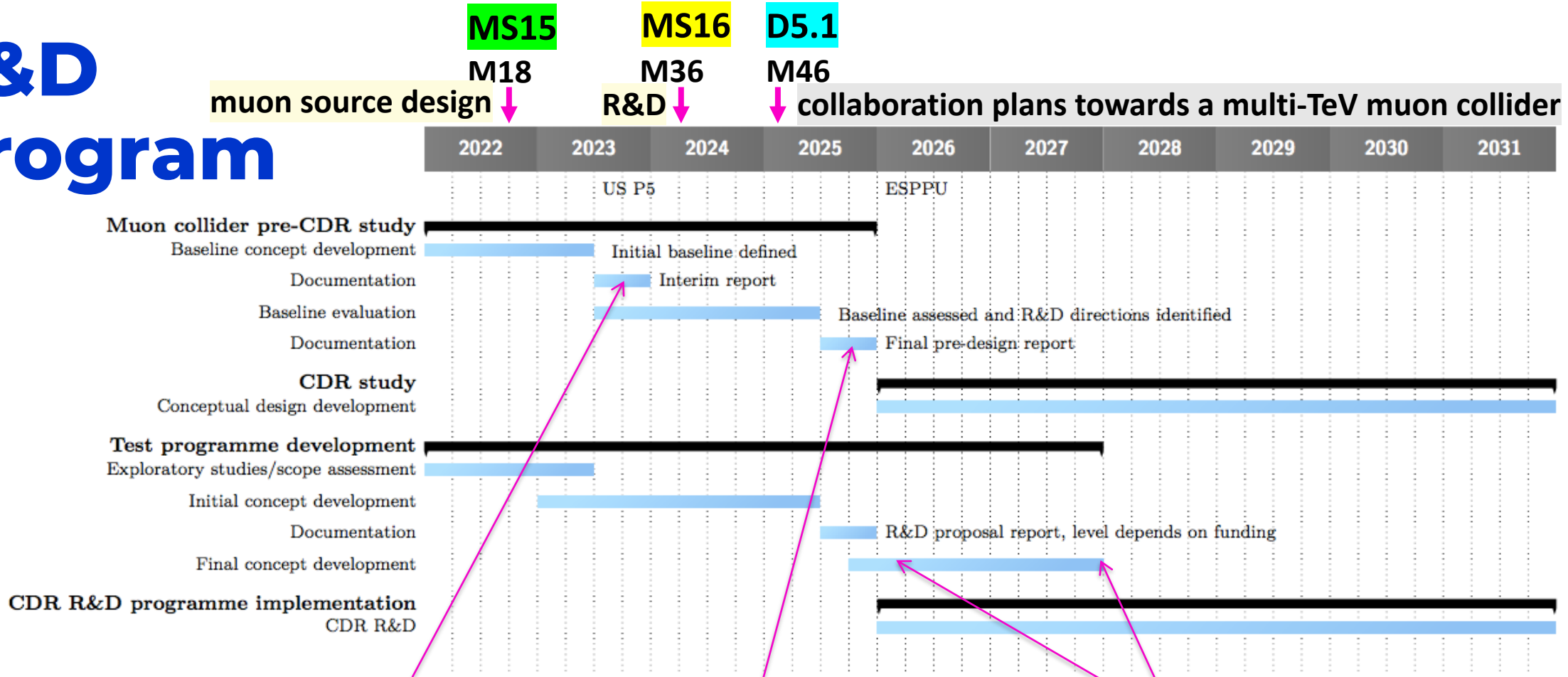
Drives **beam quality:**
challenging design and components



Dense neutrino flux mitigation and site

Cost and **power** consumption drivers, limit energy reach
e.g. 30 km accelerator for 10/14 TeV, 10/14 km collider ring

R&D Program



2023
Interim Report to gauge progress
Initial baseline defined

2025
Assessment Report

2025-2027
R&D plan will be refined