What is different for a muon collider detector?

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Muon decay induced background is critical

❑ Magnets, they need to be protected
  ▪ Problem already studied by MAP

❑ People, off-site neutrino-induced radiation can cause significant radiation problems even at very large distance from the machine.
  ▪ Study performed by MAP determined a limit on the center of mass energy at ~ 10 TeV
  ▪ Study with the new beams configuration is in progress, *Muon Collider neutrino induced radiation hazard and FLUKA simulations* **P. Sala**

❑ Detector, the performance depends on the rate of background particles arriving to each subdetector
  ▪ just a back of the envelope calculation:
    beam 0.75 TeV $\lambda = 4.8 \times 10^6$ m, with $2 \times 10^{12} \mu$/bunch $\Rightarrow 4.1 \times 10^5$ decay per meter of lattice
    therefore the number and the distribution of particles at the detector depends on the lattice

Setting the scene

- Electrons from muon decay inside the ring magnets radiate energetic synchrotron photons tangent to the electron trajectory.
- Electromagnetic showers induced by electrons and photons interacting with the machine components generate hadrons, secondary muons and electrons and photons.
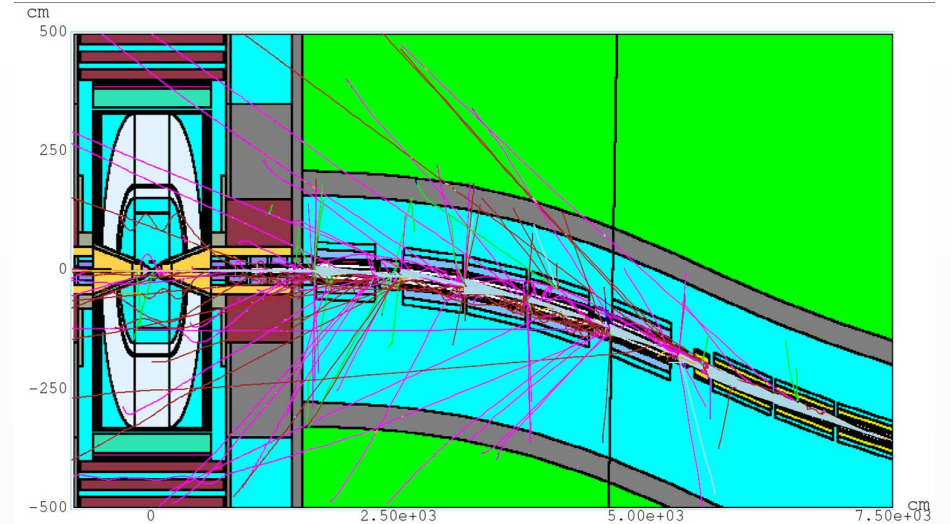
Muon Collider physics reaches can be obtained only tacking into account this machine background

Which Background on which detector

MAP Collaboration studied and mitigated the background contributions with
- High-field SC dipoles, interlaced with quadrupoles and tungsten shields implemented in the final focus region
- Tungsten Nozzles with proper angles depending on beam energy very close to the Interaction Region

In our studies we use:
- ❑ MAP MDI configuration
- ❑ MAP background files generated for $2\times10^{12}\mu$/bunch at $\sqrt{s}$=1.5 TeV using MARS
  LEMMA expects $\sim10^{9}\mu$/bunch and higher $\sqrt{s}$ ➡️ lower background
- ❑ MAP detector design

Thanks to the MAP collaboration for their willingness to collaborate and for sharing with us their tools and their knowledge

- ▪ This is just the first step, much more work and optimization are needed!
- ▪ In the future we are planning to simulate background with FLUKA using the MAP MDI and detector
- ▪ A new, dedicated detector for high energy muon collider with the most up to date technology should be designed to exploit the machine potentiality

This session presentations

Muon Collider neutrino induced radiation hazard and FLUKA simulations		*Paola Sala*
503-1-001 - Council Chamber, CERN		*15:30 - 16:00*
Coffee/tea break		
503-1-001 - Council Chamber, CERN		*16:00 - 16:30*
Machine Background Studies		*Massimo Casarsa*
503-1-001 - Council Chamber, CERN		*16:30 - 16:50*
Detector performances and Object reconstruction		*Nazar Bartosik*
503-1-001 - Council Chamber, CERN		*16:50 - 17:10*
Physics Studies with realistic detector		*Lorenzo Sestini*
503-1-001 - Council Chamber, CERN		*17:10 - 17:30*
Discussion		
503-1-001 - Council Chamber, CERN		*17:30 - 18:30*

Time markers: 16:00, 17:00, 18:00