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Luminosity measurement at muon collider

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The precise determination of the luminosity in a collider is of crucial importance for any physics cross sections measurement since it directly translates to the precision of the cross section determination.

In a muon collider dense muon beams are necessary to achieve the target luminosity, these beams generate very high fluxes of particles coming from the muons decay along the beam pipe.

Due to the presence of ad-hoc shielding structure, designed to mitigate the effect of the beam-induced background, the forward region of the detector cannot host instrumentation for the determination of the luminosity, as in standard methods adopted by the LHC experiments.

In this poster an alternative way to determine such a fundamental parameter is proposed, taking inspiration from flavour factories such as Belle2 and BES, where the luminosity is measured by counting $e^+ e^- \rightarrow e^+ e^-$ Bhabha events, whose cross-section is theoretically known with high precision.

The reconstruction efficiency of large angle muon Bhabha ($\mu^+ \mu^- \rightarrow \mu^+ \mu^-$) events at 1.5 TeV center of mass energy is estimated at muon collider via full detector simulation, taking into account the beam-induced background effects.

Kinematic requirements are defined to optimize the signal to physics background ratio and the statistical uncertainty on the muon collider luminosity measurement that can be reached with this method is estimated.

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