



Contribution ID: 426

Type: **Experimental poster**

## The LHCb Muon Detector at Upgrade II

*Thursday, 10 June 2021 18:45 (1 hour)*

The LHCb experiment is a b-physics dedicated experiment at the LHC collider. It has a wide physics program, covering different fields of interest: among others, precise measurements of the CKM matrix elements and the search for lepton flavour violation and beyond Standard Model physics.

The LHCb detector has successfully performed during the Run 1 and Run 2 of the LHC, leading to important contributions in the field of flavour physics as well as physics in the forward region. Now, it is being upgraded in a first step - Upgrade I - to run at a luminosity of  $2 \times 10^{33} \text{cm}^{-2}\text{s}^{-1}$ . An Upgrade II phase has been proposed, aiming at a full exploitation of the flavour physics potential of the High Luminosity LHC operational period. LHCb Upgrade II will run at instantaneous luminosities of up to  $2 \times 10^{34} \text{cm}^{-2}\text{s}^{-1}$  and accumulate a data sample corresponding to a minimum of  $300 \text{fb}^{-1}$ .

New design options for the Muon Detector at Upgrade II are under study, in order to deal with the increase in luminosity and readout rate, while preserving the stable operation of the detector and its highly efficient  $\boxtimes$  detection capability. Due to the high variability of the expected particle rates, ranging from several  $\text{kHz}/\text{cm}^2$  in the external regions up to several  $\text{MHz}/\text{cm}^2$  in the inner ones, different sub-detector technologies that could replace or simply complement the old ones are under investigation, with the aim to choose the best option in terms of granularity, radiation hardness and effective spark quenching up to integrated charges of  $\text{O}(\text{C}/\text{cm}^2)$ . An overview of the state of the art of the Muon Detector design for the LHCb Upgrade II will be here presented.

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**Session Classification:** Poster Session

**Track Classification:** Top physics