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The PicoCal calorimeter of LHCb Upgrade II

The LHCb experiment aims to collect a dataset of 300 fb⁻¹ in its high-luminosity phase. Such an objective calls for challenging upgrades of all the detector systems to successfully operate at a peak luminosity of $1.5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$. The future electromagnetic calorimeter, named PicoCal, will have to face a high radiation dose and mitigate a harsh occupancy, keeping the current energy resolution. To cope with these requirements, a new design of the calorimeter regions with finer granularity, longitudinal segmentation, and timing resolution of about 20 ps is crucial. A first enhancement of the calorimeter is already expected during the LHC LS3 to reduce the occupancy and mitigate substantial ageing effects in the central region after Run 3.

The candidate technologies are Spaghetti calorimeter (SpaCal) with garnet scintillating crystals and tungsten absorber in the innermost region, SpaCal with scintillating plastic fibres lead absorber in the intermediate area, and Shashlik with polystyrene tiles, lead absorber, and fast WLS fibres in the outer part. The possibility to include also a timing layer, either based on microchannel plate or silicon technology, is also being under study. This poster illustrates the proposed new features and documents the status of the art of the R&D project with results from detailed simulations and test-beam activities.

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