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Digital Electromagnetic Calorimetry at the FCC-hh

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The number of particles in an electromagnetic shower is proportional to the incident particle energy. A Digital Electromagnetic Calorimeter (DECAL) is a highly granular device that counts the number of particles in a shower rather than the total energy deposited. An improved energy resolution is possible compared to an analogue calorimeter as this should be less sensitive to Landau fluctuations on single particle energy deposits. Ultra high granularity can be achieved using radiation hard CMOS sensors. Pixels can then be grouped together in cells for which the hit count is then output every beam crossing. Even in today's technology, sufficient granularity and radiation hardness can be demonstrated to meet the requirements of future experiments. However, a key argument for this approach is that by working with mainstream CMOS imaging sensor suppliers and keeping relatively simple in-pixel logic, it should be possible over a decade timescale to take advantage of the huge size of this market to give an extremely cost-effective solution for a Particle Flow based ECAL suitable for the FCC. At the same time, by making the pixel cells reconfigurable, it is possible to implement outer tracker short strip ("strixel") layers using identical technology allowing a seamless transition from outer tracking to pre-shower to ECAL.

We will present the optimisation of a DECAL for the FCC-hh as an alternative technology to the baseline LArPb ECAL within FCCSW. Particular focus will be on single particle resolutions, the impact of pile-up and its reduction, and reconstruction algorithms to extract the detailed shower development information available from such a highly segmented detector. We will also present an overview of a radiation hard CMOS device designed for such a purpose. Finally, if time permits, we will present results on the impact of a DECAL on the physics at the FCC-hh.

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