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Highly Granular Calorimeters - Impact of different Higgs Factory Options

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Calorimeters optimised for particle flow feature a high segmentation in both longitudinal and transversal direction. The tendency for future Higgs factories is an increase of the beam collision frequency compared to the case of the International Linear Collider (Bunch trains with a repetition rate of 5-10 Hz). For example at circular $e+e-$ colliders as the FCCee the envisaged bunch distance is around 35ns at the Z pole and around 1us for HZ-running. The continuous beam will not allow for the application of power pulsing.

On top an improved timing resolution will yield an increase of the power consumption of the front-end electronics. In addition, the compactness of the readout electronics must remain at the same level as today while being able to cope with significantly increased data fluxes. The R&D for power and space economic solutions for the front-end electronics has to be carried in close coordination with the R&D on cooling systems that may become unavoidable in case of high collision frequencies. A full system study has to include the optimal number of layers and cell sizes that allow for keeping cooling needs at an acceptable level. The integration of cooling systems will likely compromise the acceptance of the detector. The impact on the physics performance will have to be evaluated. Processes that are particularly affected by a lack of acceptance would be events with missing energy such as invisible Higgs decays. The actual data rate will also depend on the corresponding cross-sections and angular distributions of the relevant physics processes. This may allow for different designs in different angular regions.

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