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Development of a novel highly granular hadronic calorimeter with scintillating glass tiles

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Based on the particle-flow paradigm, a novel hadronic calorimeter (HCAL) with highly granular scintillating glass tiles is proposed to address major challenges from precision measurements of jets at future lepton collider experiments, such as the Circular Electron Positron Collider (CEPC). Compared with the plastic scintillator option, the scintillating glass HCAL design aims for further significant improvements of the hadronic energy resolution as well as the particle-flow performance, especially in the low energy region (typically below 10 GeV for major jet components), with a notable increase of the energy sampling fraction due to its high density.

A Geant4 full simulation model has been established to study the hadronic energy resolution of single hadrons and the impacts of key parameters (e.g. density, doping, intrinsic light yield, energy threshold, etc.) of scintillating glass. Physics benchmark potentials with jets in the final state are also being evaluated using a Particle-Flow Algorithm (PFA), named "ArborPFA".

On the other hand, developments of new scintillating glass materials are ongoing since 2021 within a collaboration of research institutions and companies in China. The goals of the scintillating glass focus on the high light yield, high density, good transparency to scintillation light and cost-effectiveness. First batches of small-scale glass samples have been produced, followed by comprehensive characterisations using dedicated experimental setups to extract key properties (e.g. intrinsic light yield, emission and transmission spectra, scintillation decay times, etc.), which would provide crucial inputs to the HCAL design and optimisations.

For the highly granular HCAL with scintillating glass tiles, highlights of the expected detector performance with single hadrons and jets will be presented in the contribution. In addition, latest developments of scintillating glass and the measurements will also be included.

In-person participation

No

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