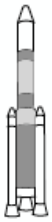

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Particle flow algorithm for long crystal bar electromagnetic calorimeter

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Future electron-positron collider experiments necessitate an exceptional jet energy resolution to enable precise measurements of the Standard Model particles and searching for new physics. The Particle Flow Approach (PFA) is regarded as a promising solution to achieve an unprecedented jet energy resolution. The Particle Flow oriented calorimeter requires an impact shower and high granularity readout channels.

A novel electromagnetic calorimeter (ECAL) with orthogonally arranged crystal bar has been proposed to achieve high intrinsic energy resolution and reduce the number of readout channels by approximately an order of magnitude compared to high granularity calorimeters. The primary challenges of this new design include the ambiguity problem arising from the perpendicular arrangement of crystal bars when multiple particles are injected simultaneously, and the shower overlap resulting from the larger Moliere radius of the crystal.

This report will present recent progress for feasibility analysis of this ECAL design. A new PFA with several sub-algorithms has been developed to address aforementioned issues. The ambiguity problem has been resolved through the implementation of multiple optimized pattern recognition approaches, while the issue of shower overlap has been mitigated by an energy splitting module. Performance validations have yielded promising results in the Circular Electron Positron Collider (CEPC) experiment. These results indicate that the proposed ECAL design and the novel PFA approach will broaden detector options and reconstruction methods for Future electron-positron collider experiments.

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