The IDEA Dual-Readout Calorimeter Simulation

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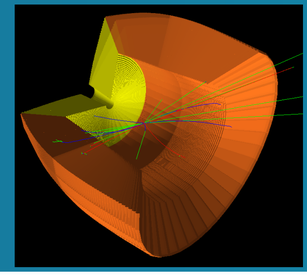
on behalf of The IDEA Collaboration

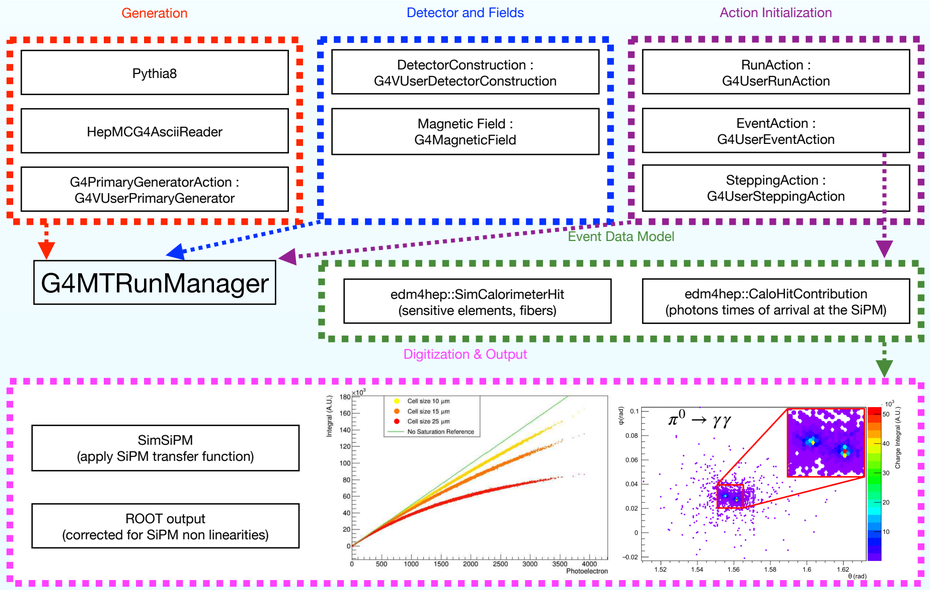


① Introduction

The IDEA Detector concept is designed for post-LHC high-luminosity electroweak factories. To match the precision physics program requirements envisaged, it adopts an ultra-light drift chamber, followed by an ultra-thin solenoid and a highly-granular tower-based optical-fiber dual-readout calorimeter.

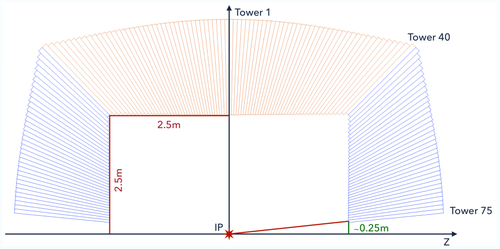
The Cherenkov and scintillation lights produced in the showers development are used to achieve the benefits of compensating calorimetry. Eventually, the unsegmented calorimeter can be combined with a dual-readout crystal electromagnetic section for superior performance in photon detection.

② Code

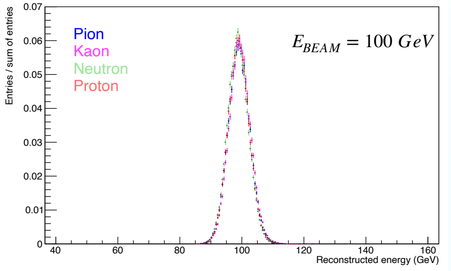


③ Selected Results

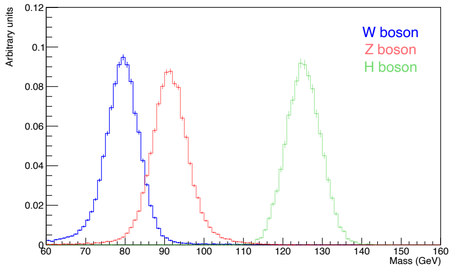
Geant4 fiber calorimeter detector description



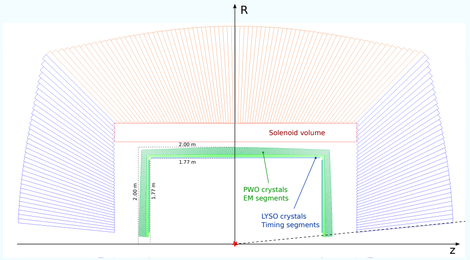
Response to hadrons automatically equalized with the dual-readout correction



W/Z bosons separation through invariant mass measurements in 2-jet final states



Geant4 hybrid calorimeter DR fibers + DR crystals



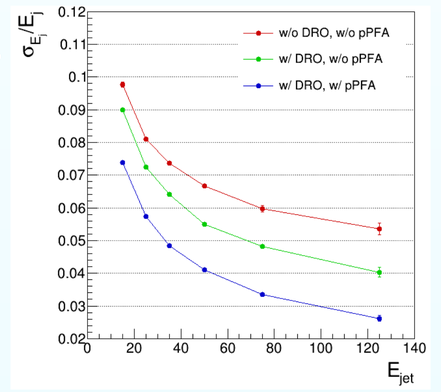
Combine DR crystals and fibers for energy measurements

$$E_{HCAL} = \frac{S_{HCAL} - \chi_{HCAL} C_{HCAL}}{1 - \chi_{HCAL}}$$

$$E_{ECAL} = \frac{S_{ECAL} - \chi_{ECAL} C_{ECAL}}{1 - \chi_{ECAL}}$$

$$E_{tot} = E_{HCAL} + E_{ECAL},\ \chi = (1 - h/e_S)/(1 - h/e_C)$$

Apply proto-Particle-Flow approach to match tracks and calo clusters



④ Conclusions and Contacts

The IDEA Calorimeter Group provides a Geant4-based full simulation of a fully-projective DR calorimeter. First results indicate a major improvement with respect to standard calorimeters in suppressing response variations to different particles and in jet-final-state reconstruction.

More @EPS2021: M. Lucchini, *Combining Dual-Readout Crystals and Fibers in a Hybrid Calorimeter for the IDEA Experiment*
Join us at idea-dualreadout@cern.ch and indico.cern.ch/category/10684/