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Development of highly granular calorimeters in CALICE

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The design of calorimeter systems for a detector at a future Linear Collider (ILC, CLIC) is largely driven by the requirements of jet reconstruction. The particle flow technique has been shown to be capable of achieving an energy resolution ˜30%/sqrtE, permitting the discrimination of W and Z bosons in their hadronic decays. Such performance requires the separation of neutral and charged energy deposits in the calorimeters, which in turn demands that they have high spatial granularity both transversely and longitudinally, and be placed within the magnet coil.

CALICE has been developing prototype calorimeters to meet these requirements. The electromagnetic calorimeter is based on tungsten absorber read out using either silicon pads of ˜5x5 mmˆ2 and/or crossed short scintillator strips of ˜5x45 mmˆ2. The hadronic calorimeter could use iron or tungsten absorber, sampled using either scintillator tiles of ˜3x3 cmˆ2 or gaseous detectors with ˜1x1 cmˆ2 readout. The scintillator option uses analogue readout, while the gas detectors (RPCs, Micromegas or GEMs) use either digital (1 bit) or semi-digital (2 bit) readout. All these options are being pursued in CALICE. Key issues include: extreme compactness (so that the calorimeters can be located inside the magnet), hermeticity and scalability, power cycling (exploiting the time structure of the accelerator to minimise the need for cooling), and precise timing (especially for CLIC applications). We report on recent R&D and test beam activities from CALICE which address all these key questions.

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