Dual-readout calorimetry — RD52 — CERN

Participating Institutes Texas Tech University, Iowa State University, Korea University, Kyungpook National University, INFN (Pavia, Pisa, Cagliari, Rome, Cosenza, Lecce), Tufts, LIP Lisbon, CERN

Description/Concept Measure scintillation and Cerenkov light independently in optical fibers and measure neutron content event-by-event. Current small modules are dominated by lateral leakage.

Milestones Twentry nine papers published in NIM on all aspects of dual readout calorimetry, including crystal dual readout. GEANT (FTFP_HP) simulations of a large copper module yield an energy resolution approximately represented by $\sigma/E \approx 30\%/\sqrt{E}$ for pioninduced showers.

Future Activities/Priorities Measure the difference between pion-induced and proton-induced hadronic showers; measure the time history of light at 5 GHz. Build a large module 4 ton for final test of hadronic performance.

GEANT4 simulations of 100 GeV π

RD52_Cu 65 x 65 cm² 450 800 Entries 5820 **Entries** 4310 a)b) Number of events per bin 400 Mean 95.59 ± 0.04 Mean 90.17 ± 0.07 700 Sigma 3.073 ± 0.031 Sigma 4.123 ± 0.061 350 600 $100 \text{ GeV } \pi$ $100 \text{ GeV } \pi$ 300 $\sigma/E = 3.2\%$ 500 $\sigma/E = 4.6\%$ 250 400 200 FTFP BERT HP BERT 300 150 200 100 100 50 120 80 100 Calorimeter signal (em GeV) Standard hadronic High precision shower simulation simulation package package (neutrons!!)

Figure 1: The raw pulse height distribution simulated from two GEANT4 physics lists. The latter one does a more correct treatment of the neutrons in the hadronic cascade and, therefore, better represents the dual-readout response of a hadronic calorimeter.

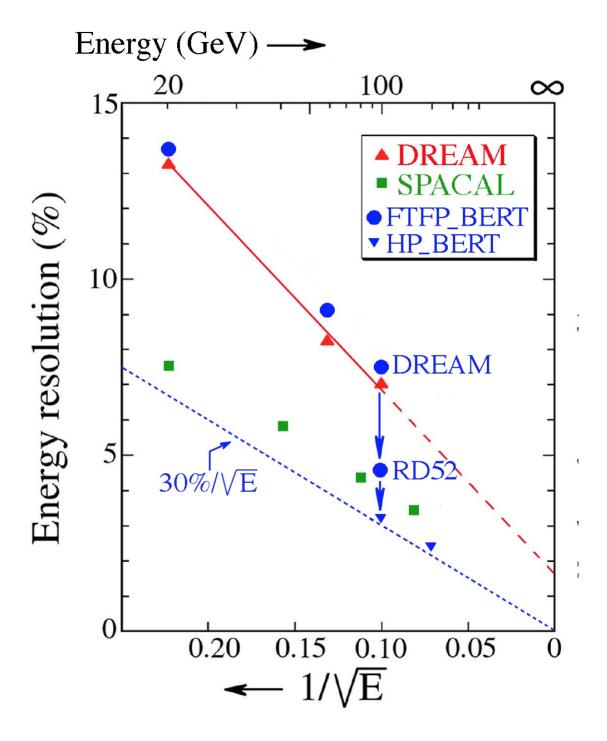


Figure 2: The Gaussian-fitted energy resolution of compensating and dual-readout fiber calorimeters. The RD52 copper-fiber dual readout energy resolutions at 100 GeV and 200 GeV energies for incident pions are shown as the inverted blue diamonds with the label caption "HP_BERT". The dotted line is a resolution of $\sigma/E=30\%/\sqrt{E}$ with zero constant term. The GRANT result seems to have a constant term of about 0.5%.