Performance test of a lead-tungstate EM-calorimeter readout with an avalanche photodiode

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A 3 by 3 array of the ALICE spec. lead-tungstate ($PbWO_4$) crystals ($22x22x180mm^3$), each read out by a Hamamatsu S8664 avalanche photodiode (sensitive area $5x5mm^2$) coupled with a charge sensitive preamplifier (Hiroshima ver.2), was assembled for the T564 experiment. The array was placed under the temperature controlled circumstance at zero degree to enhance the light yield from crystals and to reduce noises from APD's. The array was irradiated at the T1 beam-line with negative charged particles at the momentum range from 0.5 to 2.0 GeV/c, with tagging and online enrichment of electrons by the beam-line gas-Cerenkov detector.

The energy sum of 9 crystals shows a clear peak as requiring electrons impinging on the center of array. The energy resolution for 1 GeV electrons was evaluated to be $\sigma/E=5.3\%$, including a considerable amount of intrinsic beam-momentum-spread of around 3%. Another performance test at a high-momentum beam line is planned.