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Development of a new inorganic crystal GAGG for the calorimeter capable of the separation between neutrons and gammas

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A new inorganic crystal Gd3Al2Ga3O12(GAGG) is being developed. This crystal is suitable for the electromagnetic calorimeters used in high energy physics experiments because the constant of light emission is short (- 90ns) and the light yield is as high as that of NaI(TI) crystals. In addition, the response of the crystal can be faster by doping materials.

By using GAGG crystals, we aim at developing an electromagnetic calorimeter which can distinguish neutrons from gammas. One possible method for the separation between neutrons and gammas is to use the difference of the pulse shapes. The difference between the signals from gammas and alpha particles were already reported for GAGG crystals. So the signals of gammas and neutrons may be discriminated with the pulse shape. In addition, Information on the depth of interaction positions in the crystal can be used due to the short radiation length (1.6cm) and large interaction length (27cm). We fabricated a prototype detector, in which two GAGG crystals with different doped materials and different constants of light emission were glued to measure the interaction positions from observed pulse shapes.

We carried out a series of beam tests by using neutron and positron beams and evaluated the performance of the prototype. In this talk, results of the beam tests are presented and the expected performance to distinguish neutrons from gammas is evaluated.

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