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5 - 10 Investigation of the Digital Waveform Sample Techniques for the decetor

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In order to satisfy high precision requirement for the modern nuclear physics experiment detectors and radiologic imaging technology equipments, we do some researches in the $LaBr_3$ detector with digital waveform application research techniques. The DRS4 board and digital waveform methods substantially reduce the power consumption, which also are beneficial to the miniaturization of the data acquisition for large experiments, and to reduce the building cost.

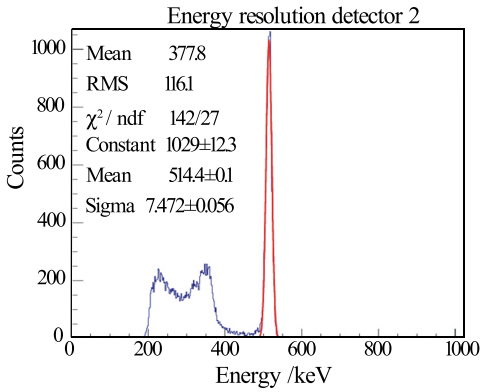

Fig. 1 (color online) The energy resolution obtained by DRS4 acquisition system.

In our study, the 8+1 channels DRS4 board was used to be as the data acquisition system. The system could process the digital sampling signals from the Detector consisting of PMT XP20D0 and $LaBr_3$ scintillator. The ^{22}Na source with 511 keV γ ray was used in the research. The energy resolution of 3.42% is obtained by DRS4 (as shown in Fig. 1), which was better than 4.2% obtained by CAMAC system for 511 keV γ rays. The results show that DRS4 system have good energy resolution，which can conform to the requirements of the new data acquisition system.

5 - 11 Incore Neutron Monitoring Techniques for Accelerator Driven Sub-critical Facility*

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In an accelerator driven sub-critical (ADS) facility, a sub-critical reactor is driven by an intense external neutron source provided by an accelerator coupled to a spallation target. The real-time measurement of incore neutron flux in an ADS facility is necessary for the commissioning measurements of the beams from the accelerator, for the routine verification of control rod positions, and for the calibration of the excore power range nuclear instruments. In a commercial reactor used in nuclear industry, several incore neutron detectors are used commonly to measure radial neutron flux profile at different radial locations within the reactor core. In an ADS facility, we propose that not only radial neutron flux profile but also vertical flux profile should be measured at different locations, because the incore neutron flux is affected dramatically by the neutrons from the spallation target.

To observe the vertical incore flux profile in the ADS facility, we have studied the neutron production from spallation targets with the Geant4-based Monte Carlo simulations. In the simulations, a heavy metal spallation target, located vertically at the centre of a sub-critical core, has a cylindrical shape with the radius of 10 cm and the length of 30 cm. The proton beam with the energy of 250 MeV and the current of 10 mA vertically impinges on the top of the cylindrical target. As shown in Fig. 1, the vertical coordinate is taken as z-axis and the centre of the target is taken as the coordinate origin. The neutron detector with a length of 10 cm moves vertically from the top to the bottom within the reactor core to measure the incore neutrons at seven locations from the top to the bottom, *i.e.* z= -90, -60, -30, 0, 30, 60, and 90 cm. The distance R between the detector and the z-axis is 20 cm. Although there may be some containers for the detector and the target, we do not consider any neutron absorption of these container materials.

Fig. 2 shows the neutron flux in 7 locations for 250 MeV proton beam with the current of 10 mA on lead and bismuth targets. The numbers from no. 1 to 7 in the x-axis correspond to the seven locations from the bottom