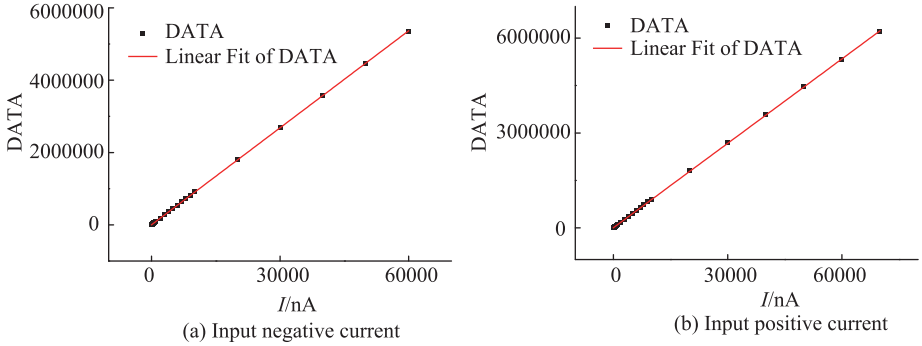

Fig. 3 (color online) Linear fitting of circuit with precision of 10 pC/pulse.

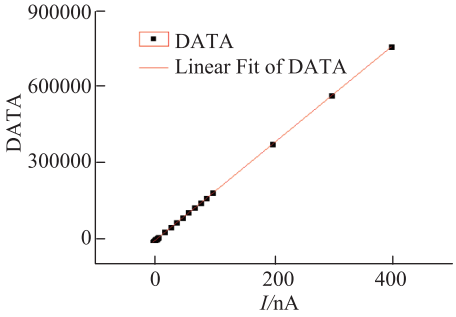

Fig. 4 (color online) Linear fitting of circuit with precision of 0.5 pC/pulse.

5 - 14 Development of the Readout Electronics System for the Prototype of TOF-PET

Yang Haibo, Kong Jie, Yan Junwei and Su Hong

As the disadvantages of large scale, complex circuit, high power consumption, the traditional readout electronics system formed by discrete modules is not suitable for the TOF-PET system, a nuclear medical imaging system. Therefore, it is necessary to design and develop a new high integration and low cost readout electronics system for TOF-PET. A readout electronics system for our prototype of TOF-PET has been developing on the basis of application requirements. The principle architecture of prototype of TOF-PET is shown in Fig. 1. There are five parts mainly in the system: the detector unit, the front-end electronics module (FEM), signal processing board (SPB), Coincidence Interface Board (CI), and PC. The FEM and SPB boards developed until now are mainly introduced in this paper.

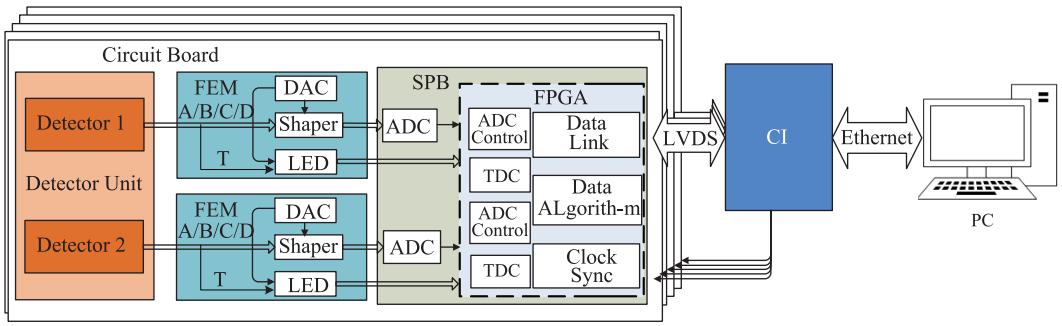

Fig. 1 (color online) The TOF-PET system architecture.

The analog front-end with five channels is hosted in a module called a FEM, the FEM can process signal from each channel independently, the filter, shaping, amplify, discrimination, *etc.* are implemented by FEM. The prototype of FEM board is shown in Fig. 2. The output signals of FEM are formatted and sent through a LVDS bus to a module called SPB, one SPB can face two FEMs. The prototype of SPB board is shown in Fig. 3. The energy signal from FEM tells how much energy deposits into the crystal when the crystal is hit by photon. It is

often used for position calculation. The energy signal is digitalized with a fast ADC, the digitized energy signals from eight channels are sent to a field programmable gate array (FPGA) to extract pulse height information for calculating hit position. The leading edge discriminators on SPB board discriminate the signals from FEM and create timing signals, the timing signals can be extracted from the detector signal directly. The timing signal is sent to a time-to-digital converter (TDC) constructed inside the FPGA for measuring the time of photon flight. Also, the timing signal can be used to trigger SPB or coincidence circuit on CI board. The data in the FPGA on SPB board can be pre-processed depending on the algorithm selected, the crystal, energy and timing relationship are acquired, and related corrections is performed if it is needed. The data from SPB board is then sent out to a PC for further processing.

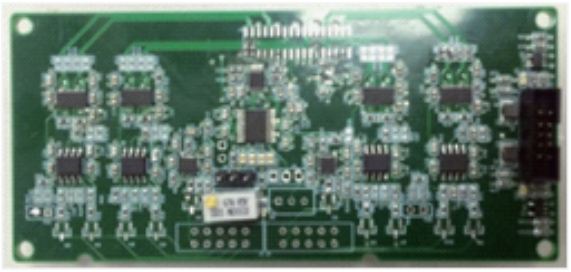

Fig. 2 (color online) The prototype of FEM board.

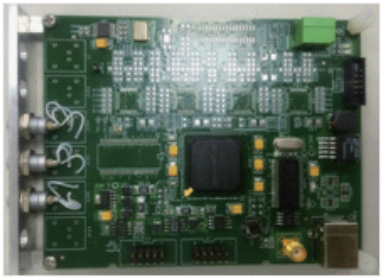

Fig. 3 (color online) The prototype of SPB board.

5 - 15 Progress in System of Heat Transfer for ADS Spallation Target Annual Report

Duan Jizheng, Wang Huiqiao and Yang Lei

Fig. 1 (color online) Cold state mechanical hoist and chute flow meter, screening device.

ADS (accelerator driven subcritical system) is composed of a linear accelerator, a spallation target and a reactor. The Strategic Priority Research Program of the Chinese Academy of Sciences propose a new concept target, the gravity-driven dense granular-flow target(DGT), which combines the advantages of solid target and liquid target and has a compact structure and the potential of high power operation. In 2016, the experimental measurement and related device technology verification were complated (Fig. 1).

The optimization design of the components of the spalling target heat exchanger is completed, and the optimal design report of the key components of the fluidized solid particles is presented. Complete advanced heat transfer medium principle experiment platform for further study on key technology of advanced heat transfer mechanism of medium and lay the Foundation for improved given advanced heat transfer medium, as well as key technical study. Complete the core transient analysis program and report, the core circuit accident analysis report and the target reactor coupling accident analysis reference program. The simulation approximation algorithm for beam - coupled energy deposition based on GPU parallel architecture are realized. The phenomenon of energy deposition and heat transfer between particles can be simulated in real time. Compared with MCNP and CPU algorithm, the GPU parallel algorithm has been greatly improved.