High Counting-rate Data Acquisition System for the Applications of PGNAA

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> The shaping circuit transforms the impulse signal outputted by the PMT into a quasi Gauss pulse, in order to improve the SNR and reduce the effect on energy resolution of the electric noise.

> This system uses a 14 bits high speed FADC circuit, which has a sample rates of up to 250 MSPS. Furthermore, the analog-to-digital converting, peek seeking and multi-channel analysis are operated as a pipeline.

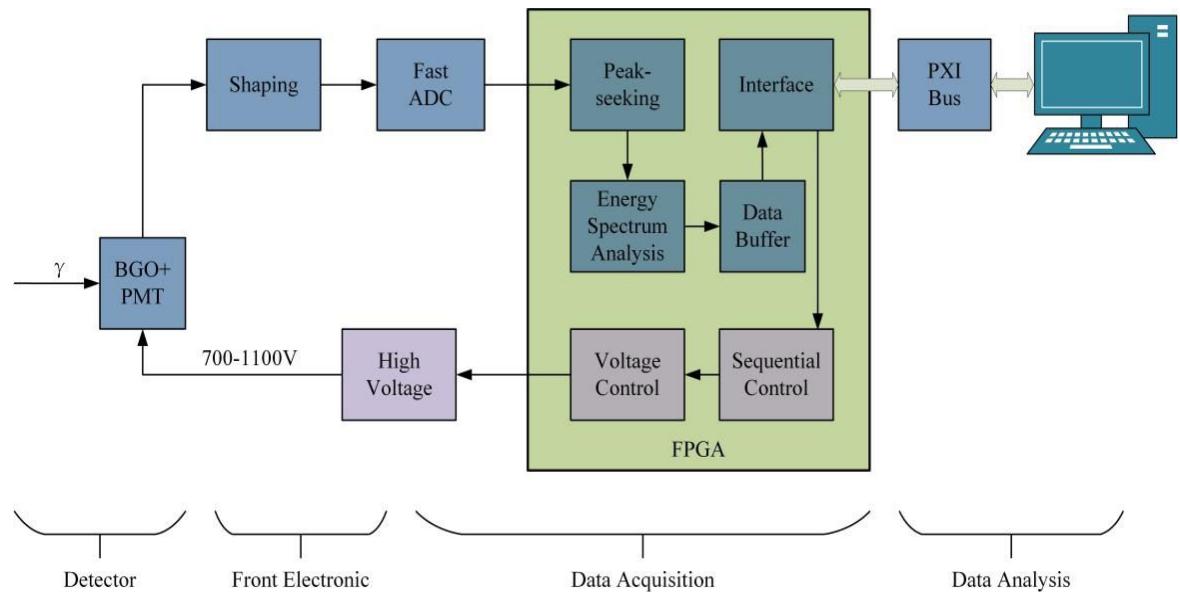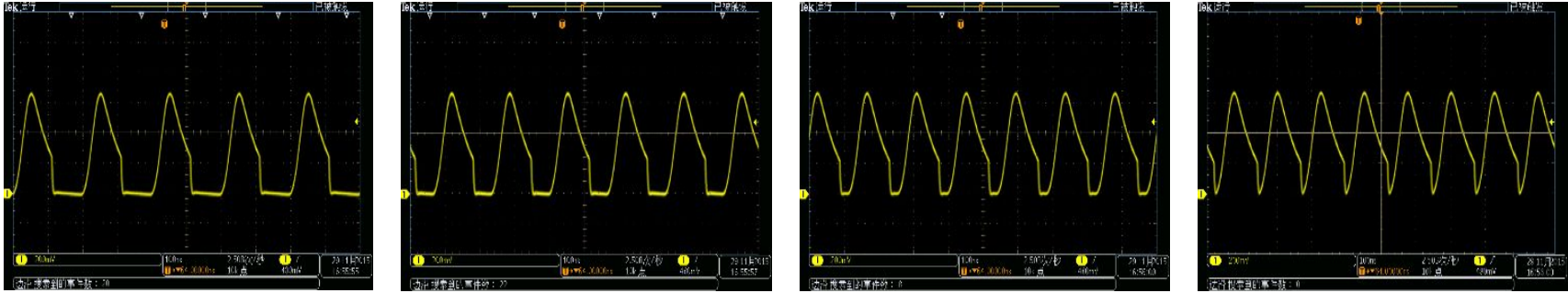Fig.1 Block Diagram of PGNAA Readout System.

Electronic Tests

a   b   c   d

Fig.2 The signal outputted by the shaping circuit, a 5MHz, b 6MHz, c 7MHz, d 8MHz.

■ The highest counting rate is consistent with the frequency of the signal generator when the pulses becoming connected together. As is shown in Fig. 2, the highest counting rate reaches 8Mc/s.
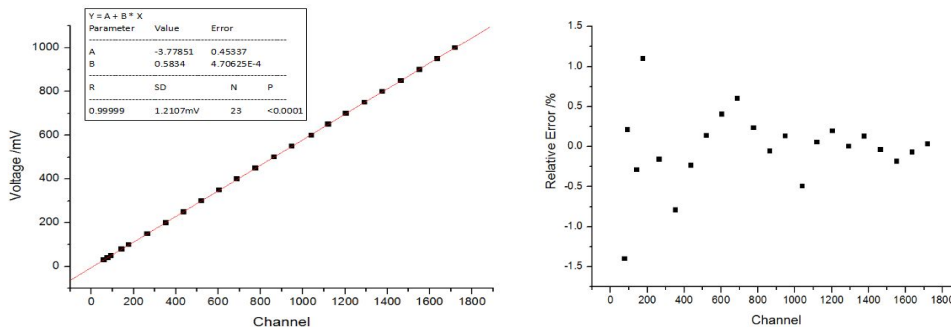

Fig.3 The linearity (left) and the relative error (right) test of the readout system.

■ The standard deviation of liner fitting of non-linearity test is 1.23mV, while the relative error is lower than ±1.5%, which is lower than ±0.5% in the middle and high channel range.

Experimental Results
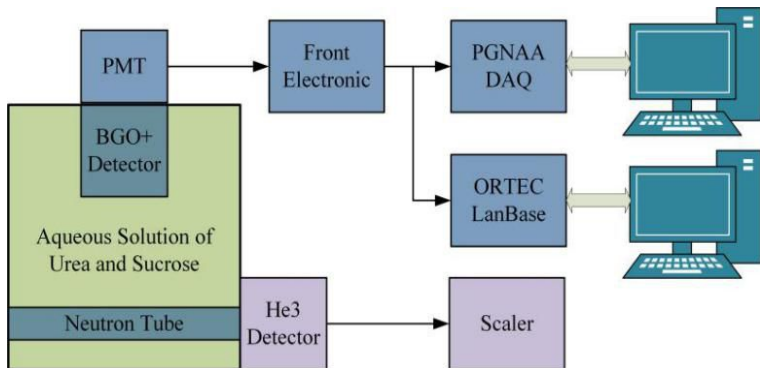
Fig.4 The sketch map of the energy spectrum acquiring experiment

■ The output signals of PMT is shaped by the front electronic circuit. Then the voltage signals outputted from the front electronic circuit are transmitted to both the DAQ system and the ORTEC LanBase commercial multi-channel analyzer. The energy spectrum acquired by both analyzer are shown below.
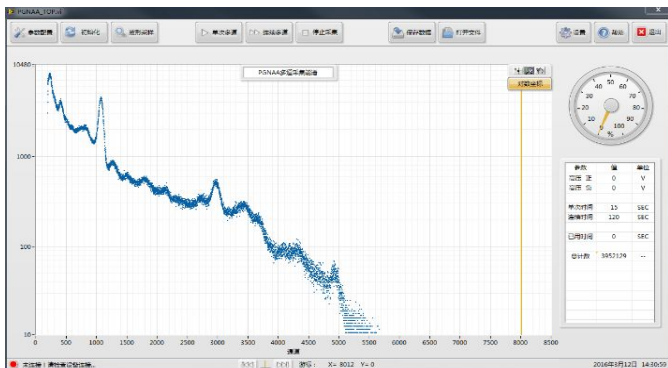
Fig.5 The energy spectrum acquired by PGNAA DAQ.

Hydrogen Peak

Resolution
8.9%   :   9.3%

Counting Rate
40.5K/s : 37.4K/s

Dead Time
<1%   :   14.7%
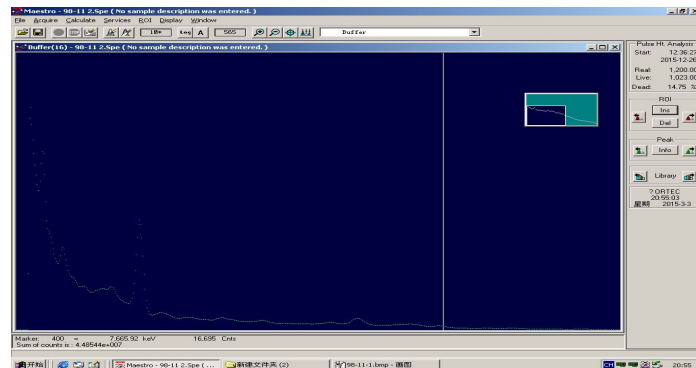
Fig.6 The energy spectrum acquired by ORTEC LanBase

■ The result of this experiment indicates that the PGNAA DAQ system can achieve a higher counting rate with much less dead time and guarantees a good accuracy in the same condition.

Poster

Introduction

Shaping Principle

System Design

Electronic Test

Experimental Results