4 - 22   A Charge Sensitive Spectroscopy Amplifier for Position Sensitive Micro-channel Plate Detectors

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Position sensitive Micro-Channel Plate (MCP) detectors are widely used for detection of particles like electrons and ions[1]. A previous work shows that integrating the electronics into an MCP detector is an optimal noise reduction method[2]. In this paper, we present a compact, low noise charge sensitive spectroscopy amplifier which could be integrated into MCP detectors for charge divide readout schemes.

A logic diagram of the spectroscopy amplifier is shown in Fig. 1. It is composed of a charge sensitive preamplifier (PA), a pulse shaper (PS) and a liner amplifier (LA). The PS is implemented with a four stage Bessel low pass active filter in a Sallen-Key topology[3].
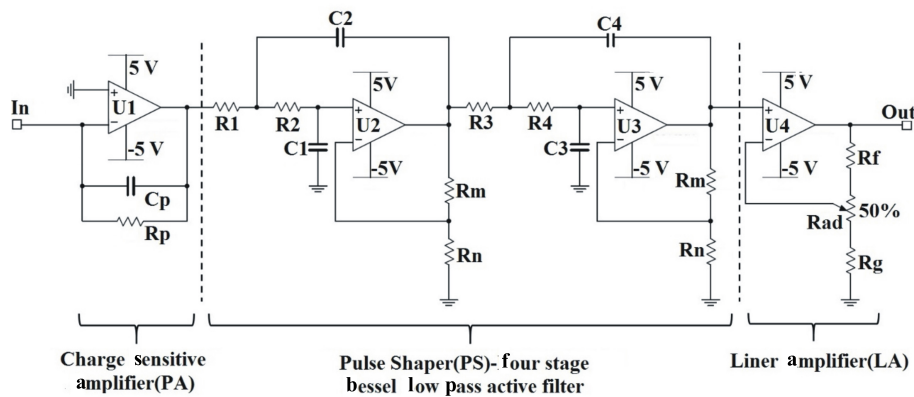

Fig. 1   Logic diagram of the spectroscopy amplifier. It is composed of a charge sensitive preamplifier, a pulse shaper implemented with a 4th stage Bessel low pass active filter, and a liner amplifier.

Fig. 2 shows the layout of the spectroscopy amplifier, which combines the PA, the PS and the LA in a four layer printed circuit board (PCB) with a size of 42 mm×44 mm. We reserve some parallel resistors on the board for adjusting the time constant τ_p and the poles and zeros of the PS.

The amplifier is tested by a chevron configured MCP detector with a parallel strips resistive anode[4] which irradiated by a ^{241}Am α-source in vacuum. Fig. 3 shows a typical amplified pulse produced by MCP. The amplitude, shaping time and full width of the output are about 1.2 V, 700 ns and 3 μs respectively.
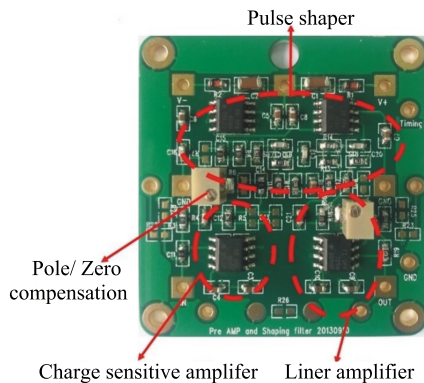

Fig. 2   (color online) A photograph of the spectroscopy amplifier within a PCB of a size of 42 mm× 44 mm.
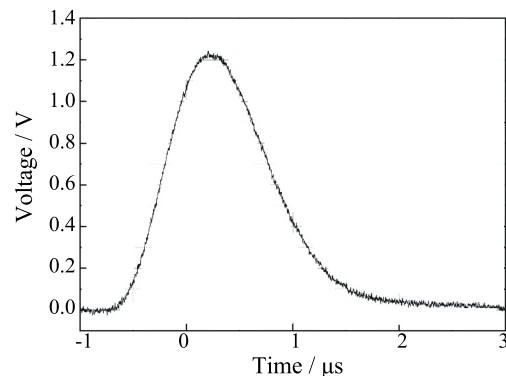

Fig. 3 An MCP pulse amplified and shaped by the spectroscopy amplifier. The detector was irradiated by a ^{241}Am α-source. Obtained with a 1 GHz Tektronix OPO5104 oscilloscope.

References

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