

Development of Amplifier and Shaper for High-Rate MWPC

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A multi-wired proportional chamber (MWPC) will be installed as an in-beam charged particle detector for J-PARC E14 (KOTO) experiment aiming at the discovery of CP-violating rare decay, $KL \rightarrow \pi^0 \nu \nu$. The counting rate of the MWPC is expected to be 1 MHz per channel due to high neutron and gamma flux, 1 GHz for 30 x 30 cm² area, respectively. An amplifier and shaper to cope with such high counting rate are necessary.

A prototype of such amplifier and shaper has been developed with enough S/N to achieve required chamber efficiency (99.5%). It reduces a characteristic signal tail of the MWPC, typically hundreds of microseconds, to several tens of nanoseconds. Figure 1 shows the schematic diagram of the prototype. The preamplifier part is a charge sensitive amplifier with a time constant of 50 ns, followed by a pole-zero cancellation part to shorten its time constant to 5 ns. It is directly connected to a double pole-zero cancellation network[1] to cancel the 1/t tail of the MWPC. Fast-FET operational amplifiers with a gain-bandwidth product 410 MHz are used for all the amplifying stages, which enables fast pulse shaping.

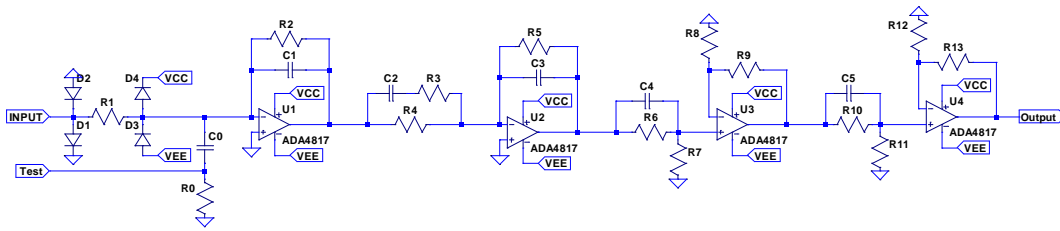


Fig. 2 Schematic diagram of the prototype amplifier and shaper.

References

- [1] R. A. Boie, A. T. Hrisoho, and P. Rehak, IEEE Trans. Nuc. Sci. NS-28, No.1, Feb. (1981) 603