

Design and Test of SiPM Readout Circuit

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Motivation

The quenching resistor and capacitor inside SiPM will lead to a longer recovery when a photon causes avalanche inside SiPM, and then the pulse generated always has a much longer fall time than PMT.

1. Introduction of SiPM

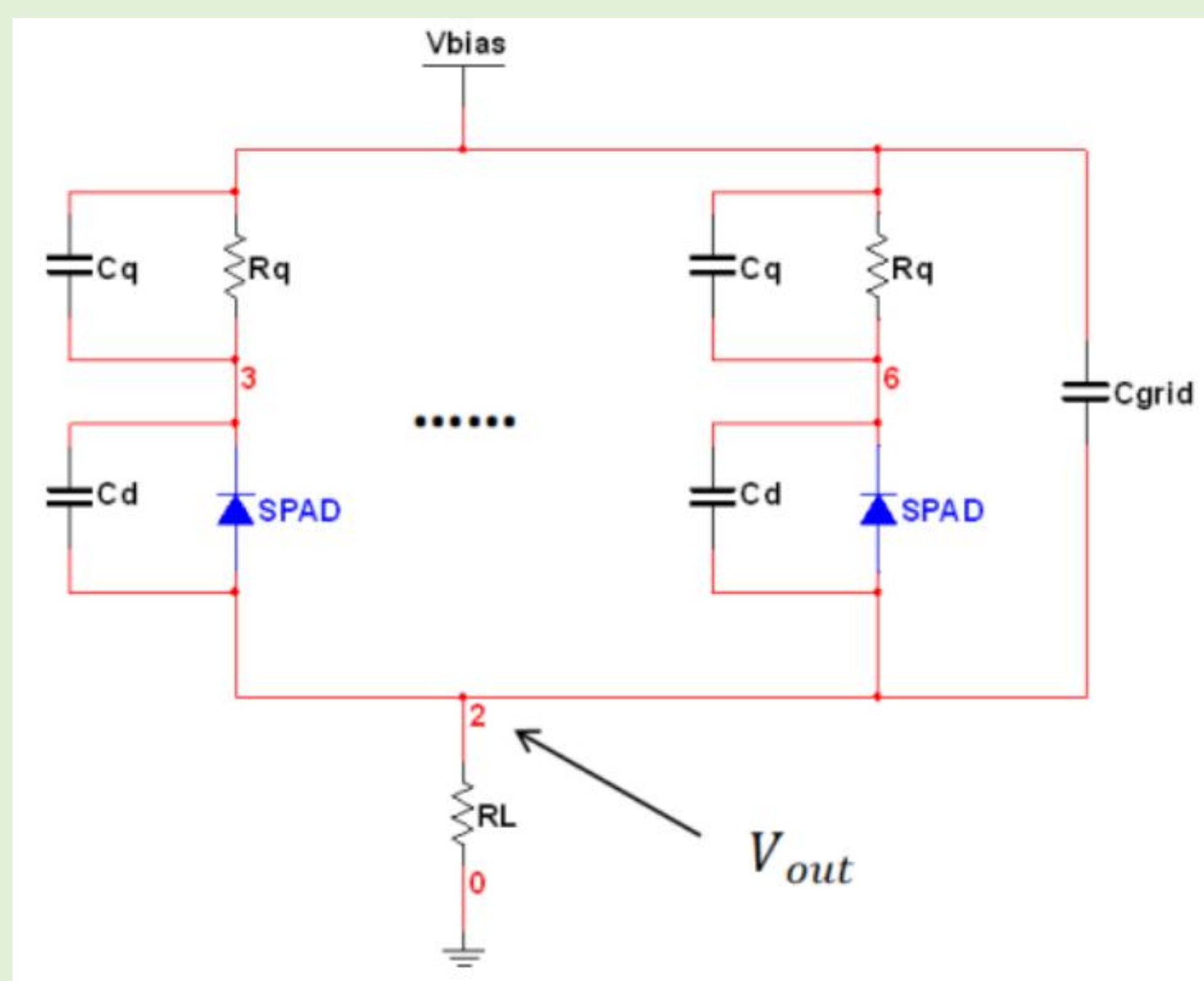


Fig.1 SiPM equivalent circuit model composed of SPADs.

- Compact structure
- High gain at low bias voltage
- Wide spectral response range
- High photon detection efficiency

2. Experimental design

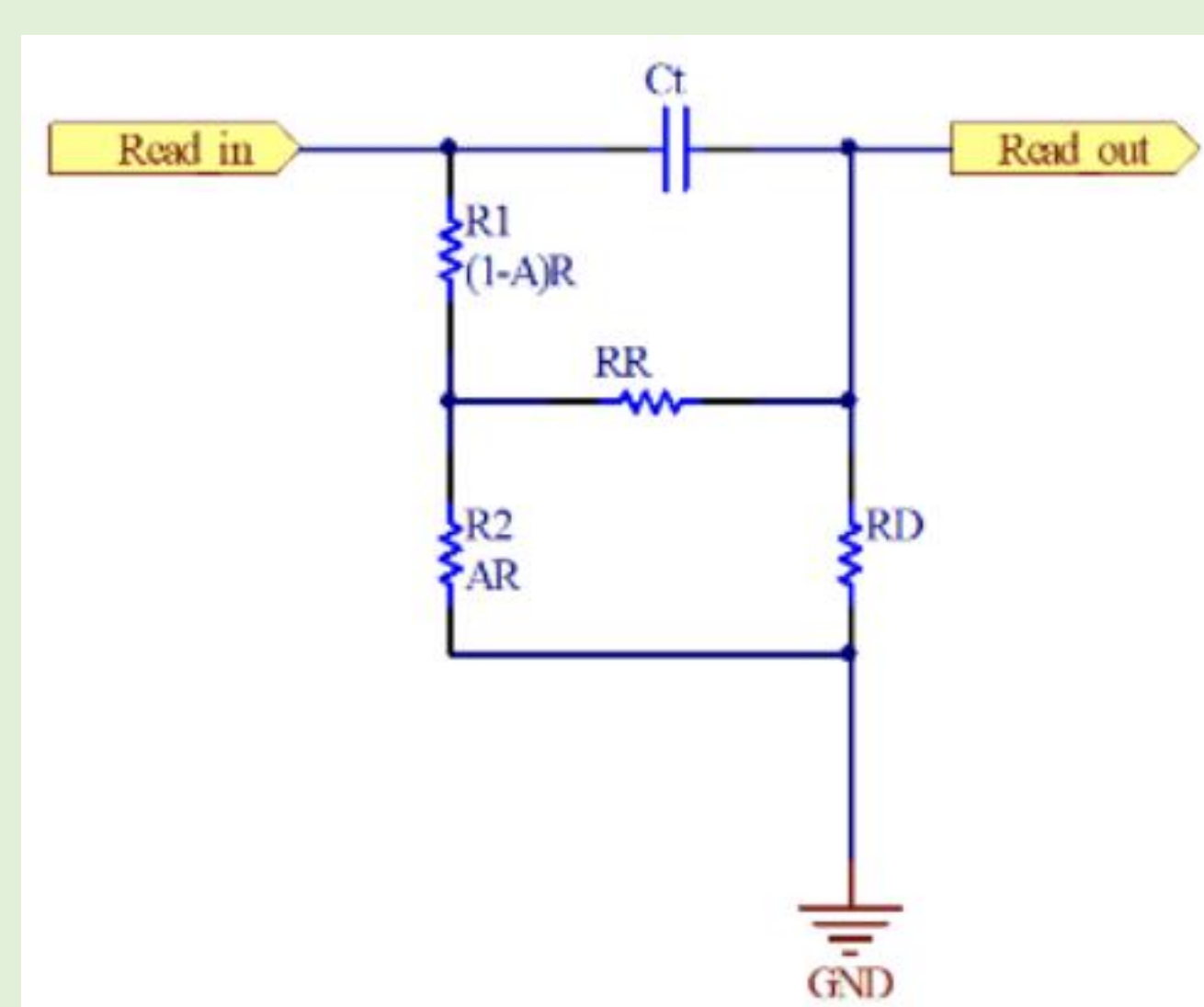


Fig.2 Schematic diagram of pole zero cancellation

- No overshoot
- Simple circuitry and adjustable parameters
- Fulfillment of subsequent circuit requirements
- Change the shape of the input signal Damping system
- Passive circuits do not add additional power consumption

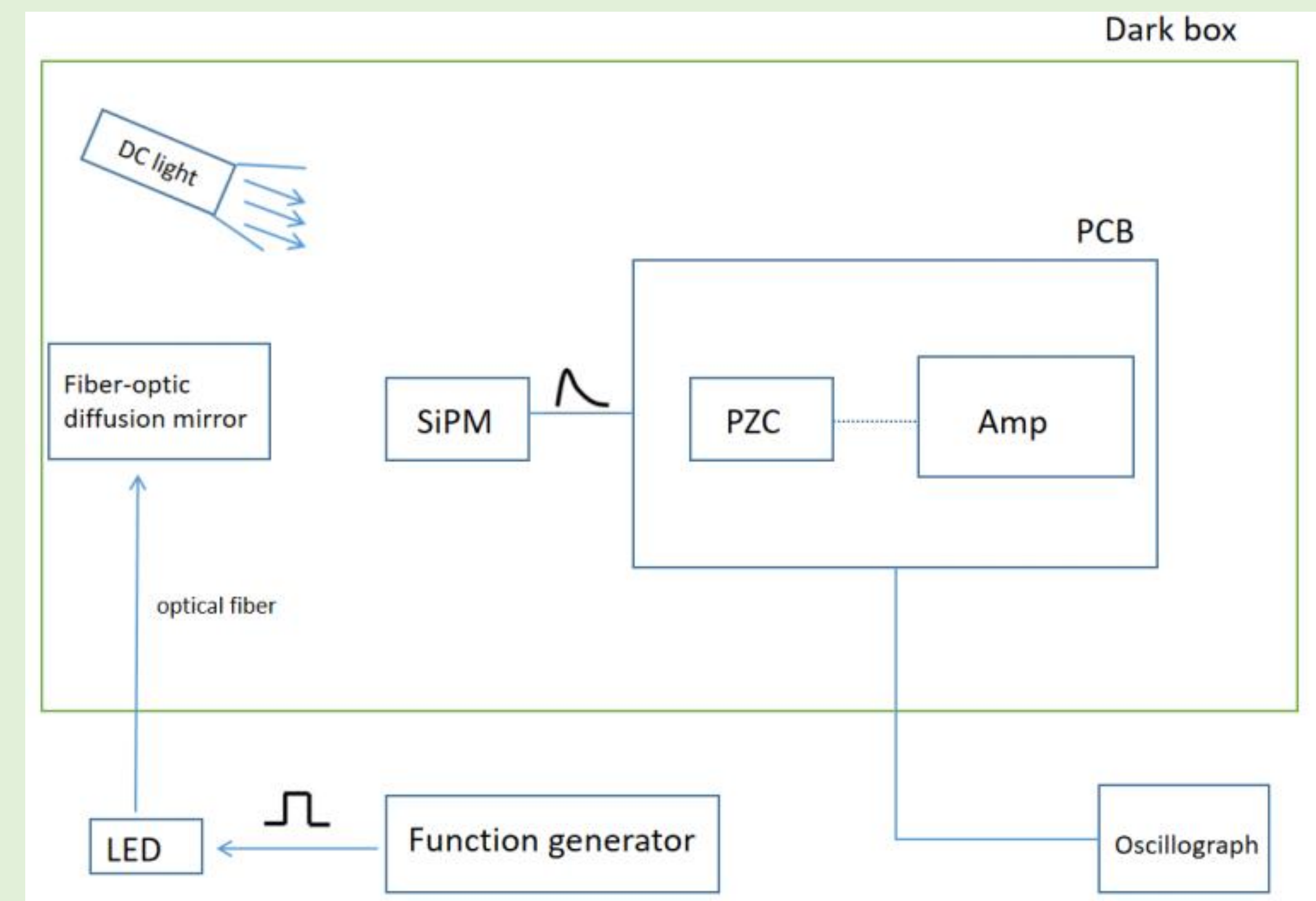


Fig.3 The block diagram of the experiment.

- Various light parameters can be adjusted
- Dark environment test

3. Test of the SiPM read-out circuit

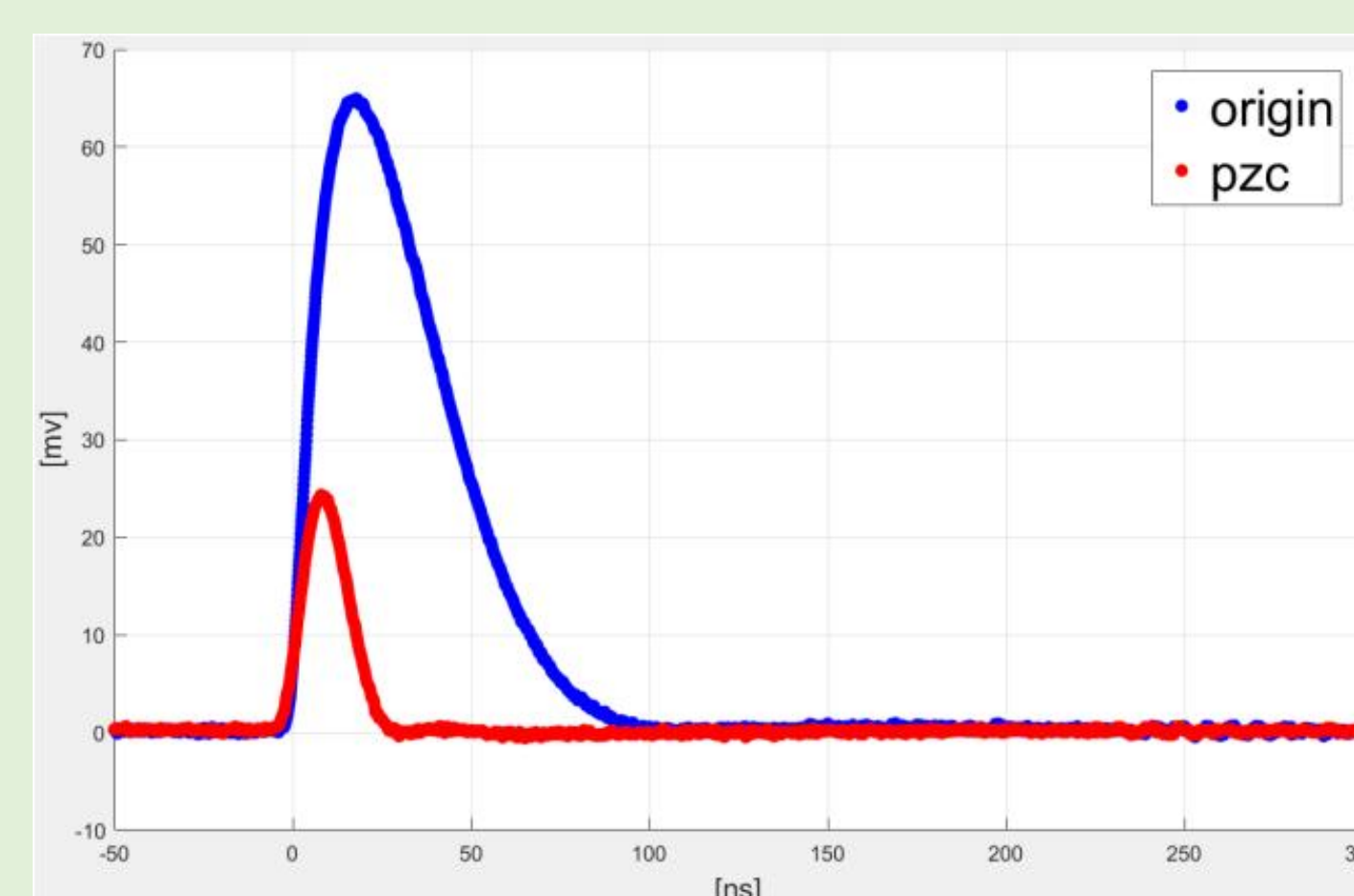


Fig.4 Original pulse (blue) and read-out pulse (red))

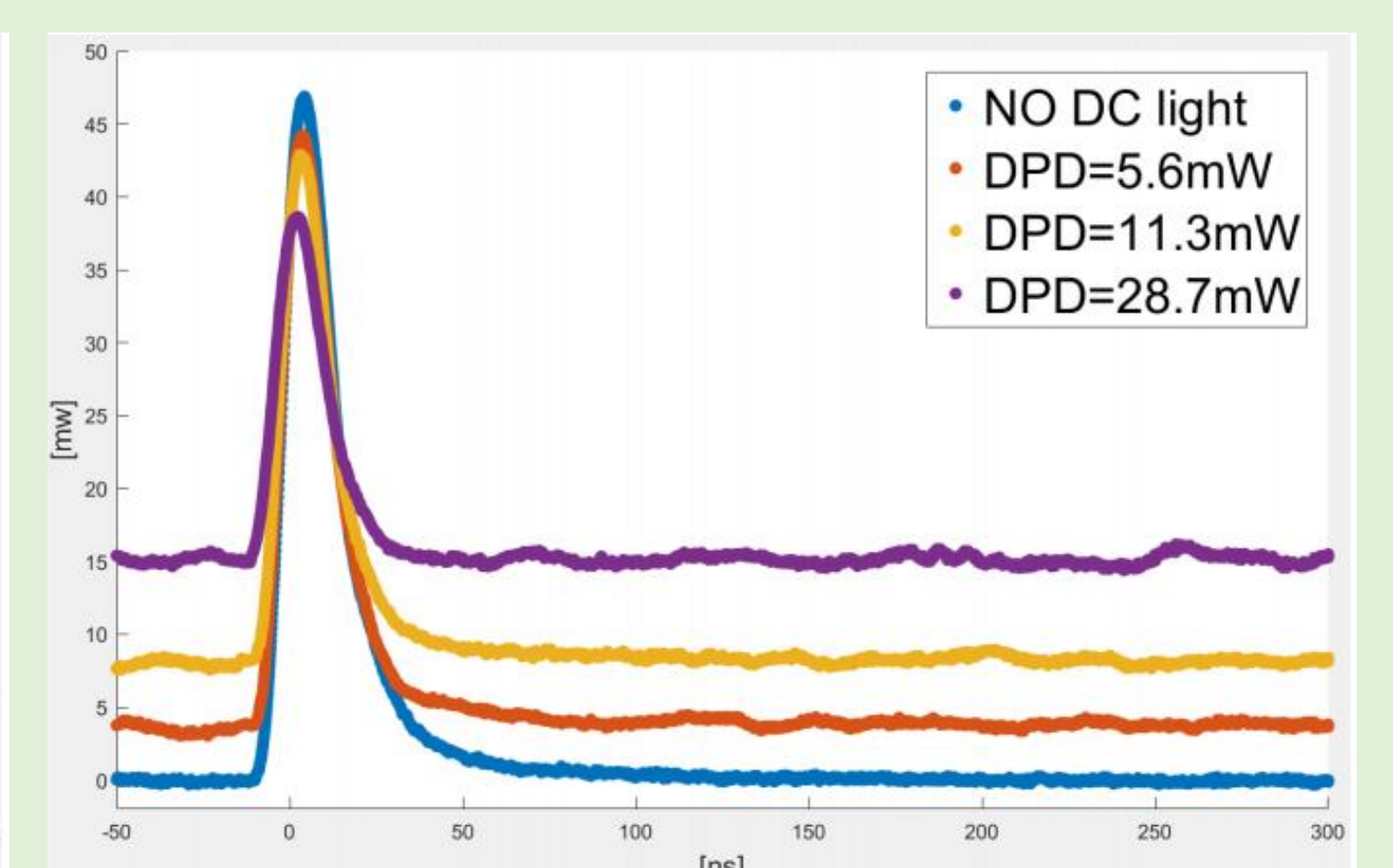


Fig.5 Readout circuit response to different intensities of direct current light

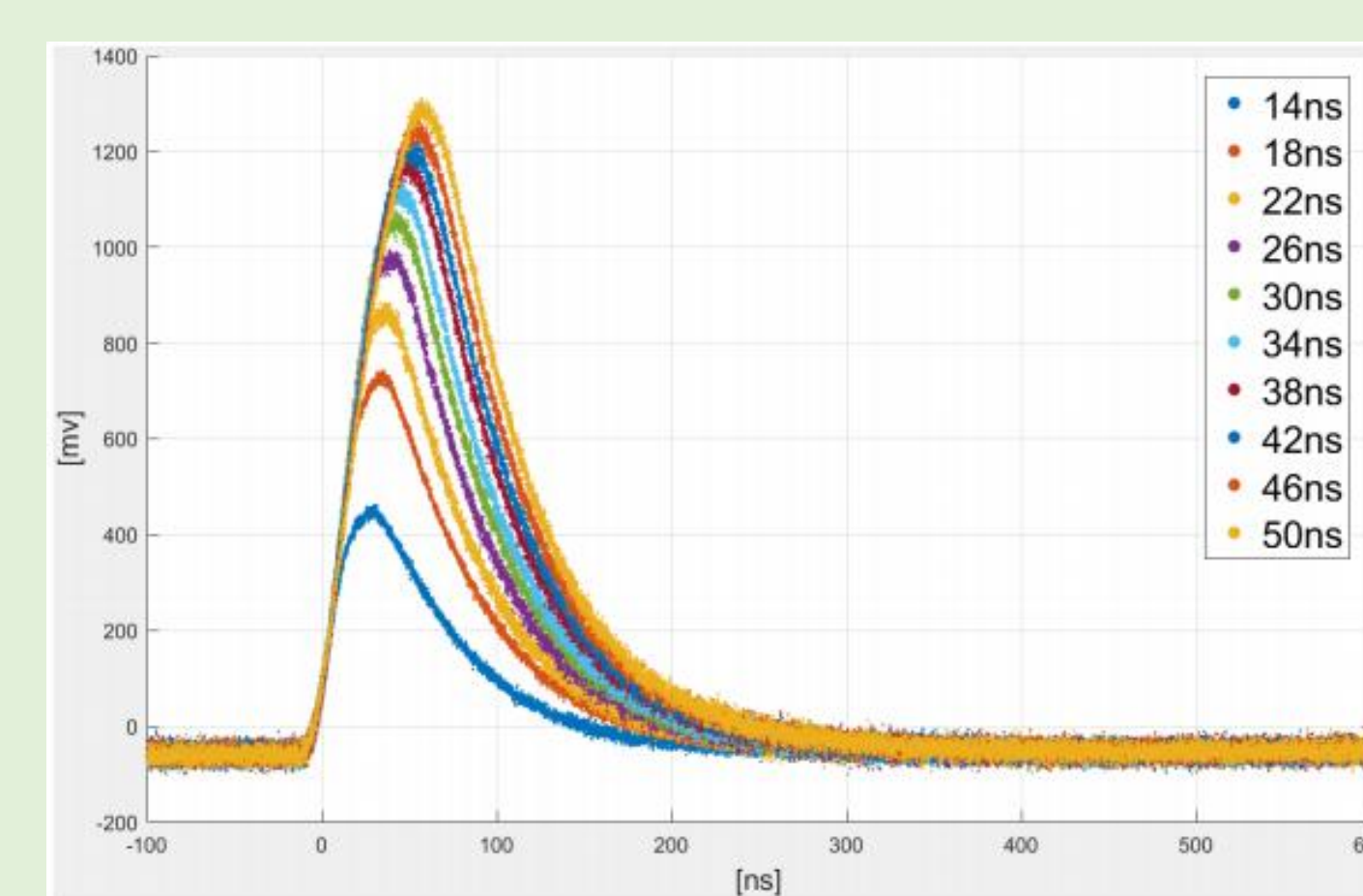


Fig.6 Original pulse generated by SiPM

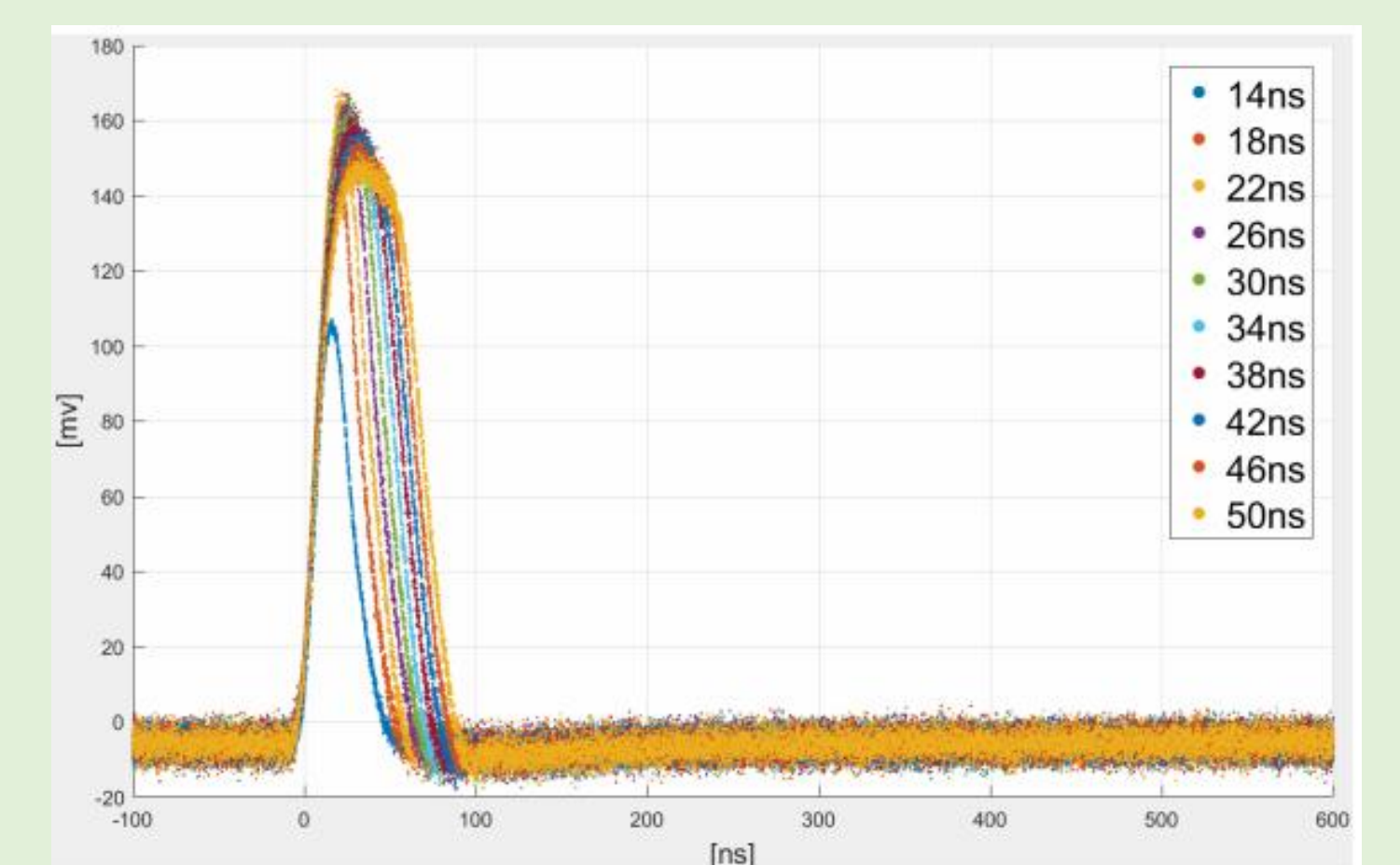


Fig.7 The pulse after the pole-zero canceling circuit

- Shorten pulses to less than 50 ns
- Good compatibility with fibers with different luminescence duration times
- Night sky background study is feasible