Study Report

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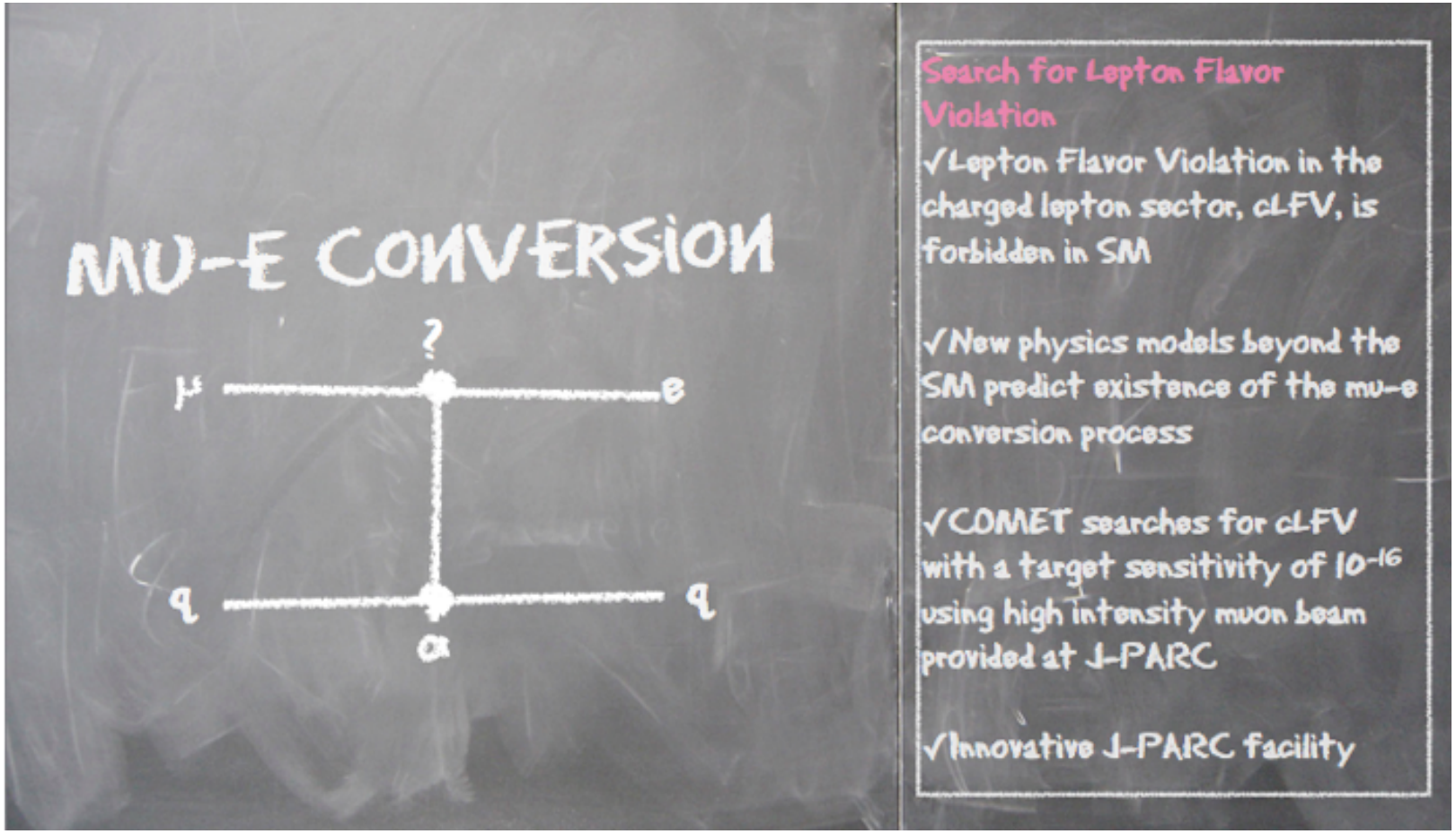
COMET


MU-E CONVERSION
?
μ
e
q
q
α
Search for Lepton Flavor Violation
✓Lepton Flavor Violation in the charged lepton sector, cLFV, is forbidden in SM
✓New physics models beyond the SM predict existence of the mu-e conversion process
✓COMET searches for cLFV with a target sensitivity of 10-16 using high intensity muon beam provided at J-PARC
✓Innovative J-PARC facility

Goal

- Detect the cosmic ray by using MPPC

Introductions to Plastic Scintillator

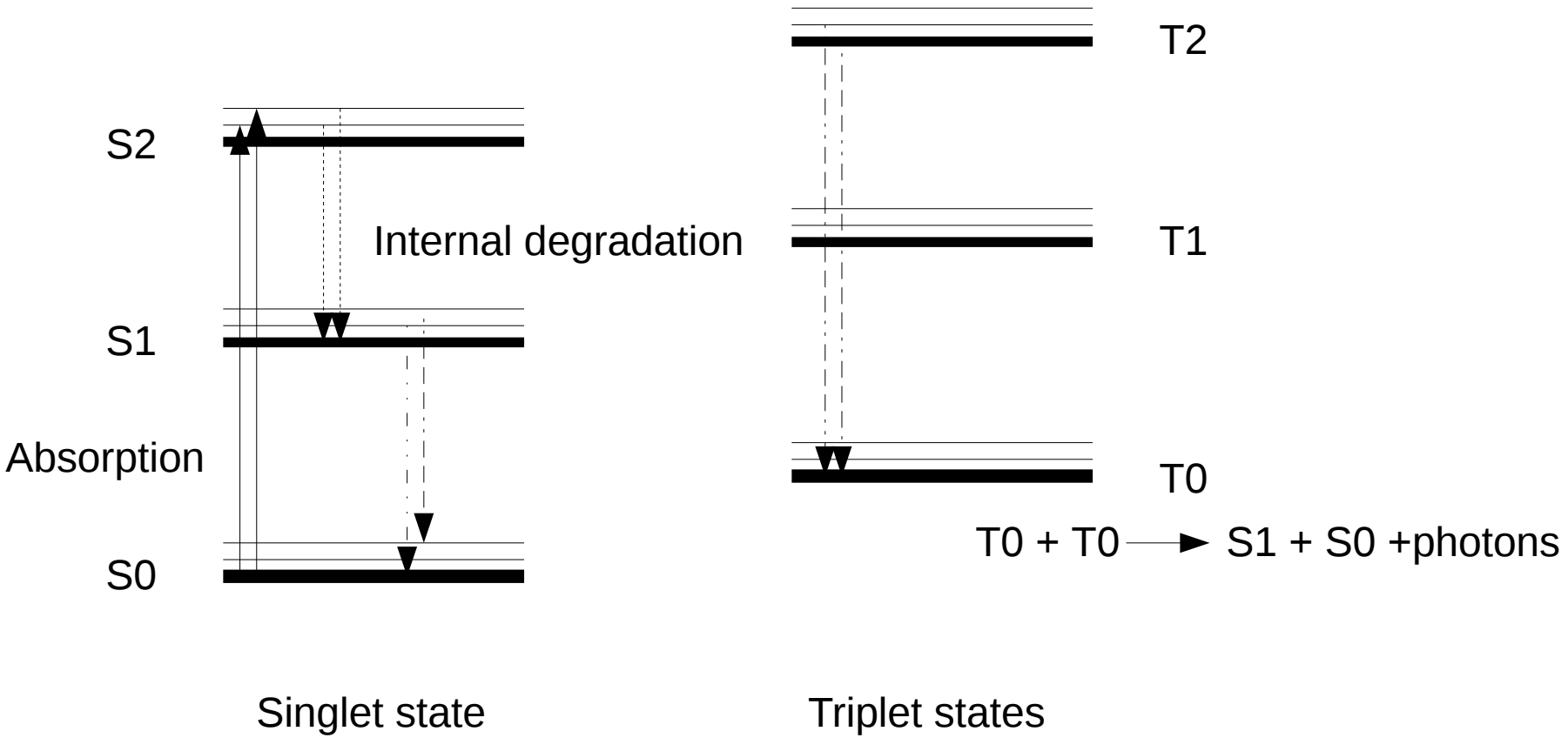
A kind of organic scintillator

Free valence electrons of the molecules in the plastic scintillator are responsible for the scintillation light

The molecules have two types:

singlet and triplet

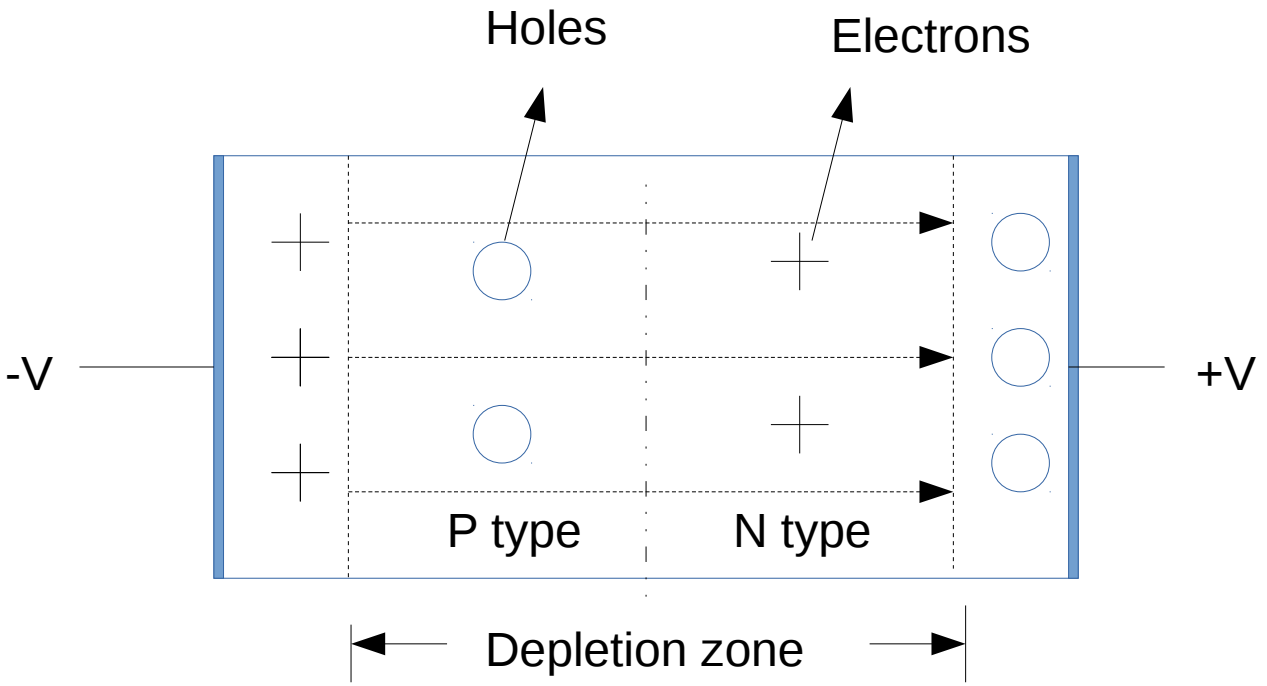
Introductions to Plastic Scintillator



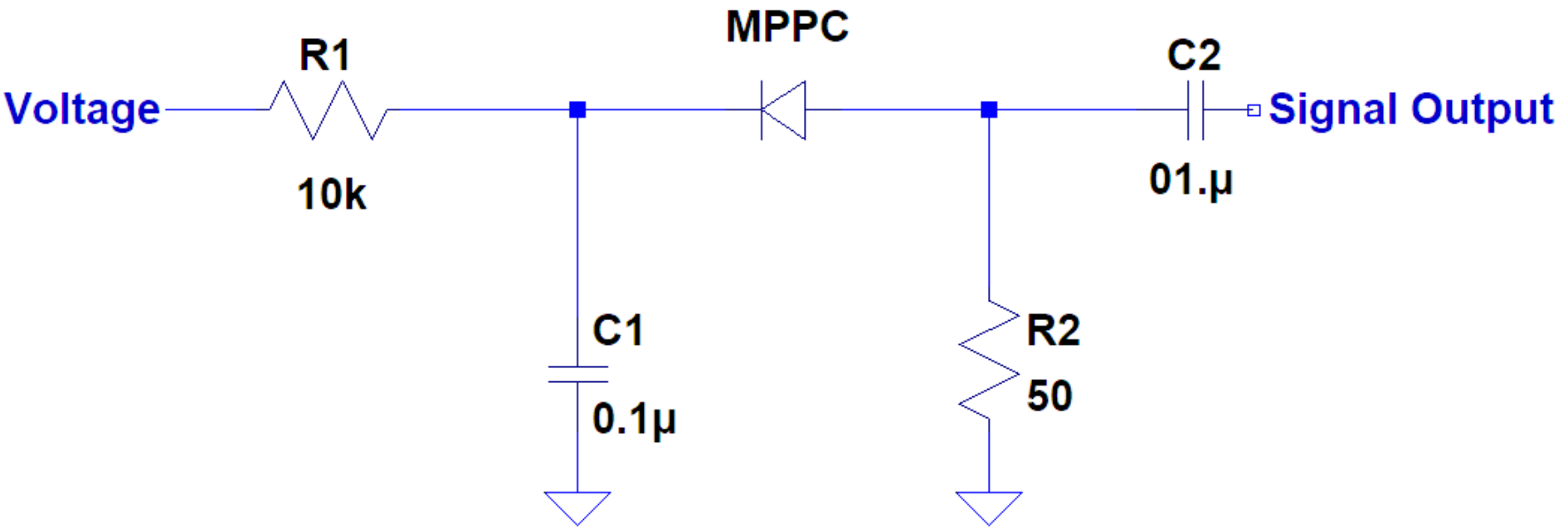
Introductions to Multi Pixel Photon Counter

A matrix of Avalanche Photon Diodes(APDs)

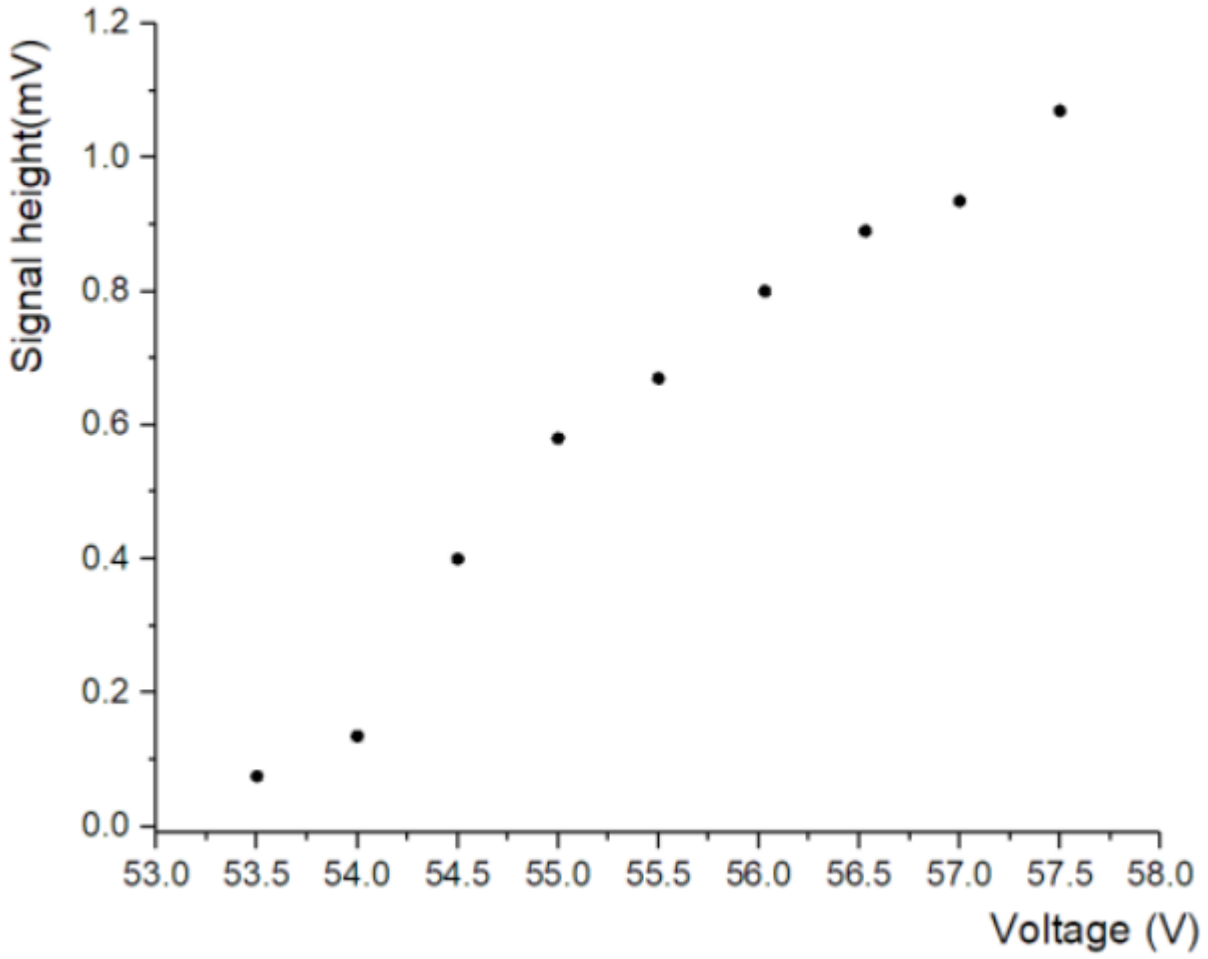
Avalanche Photon Diode:



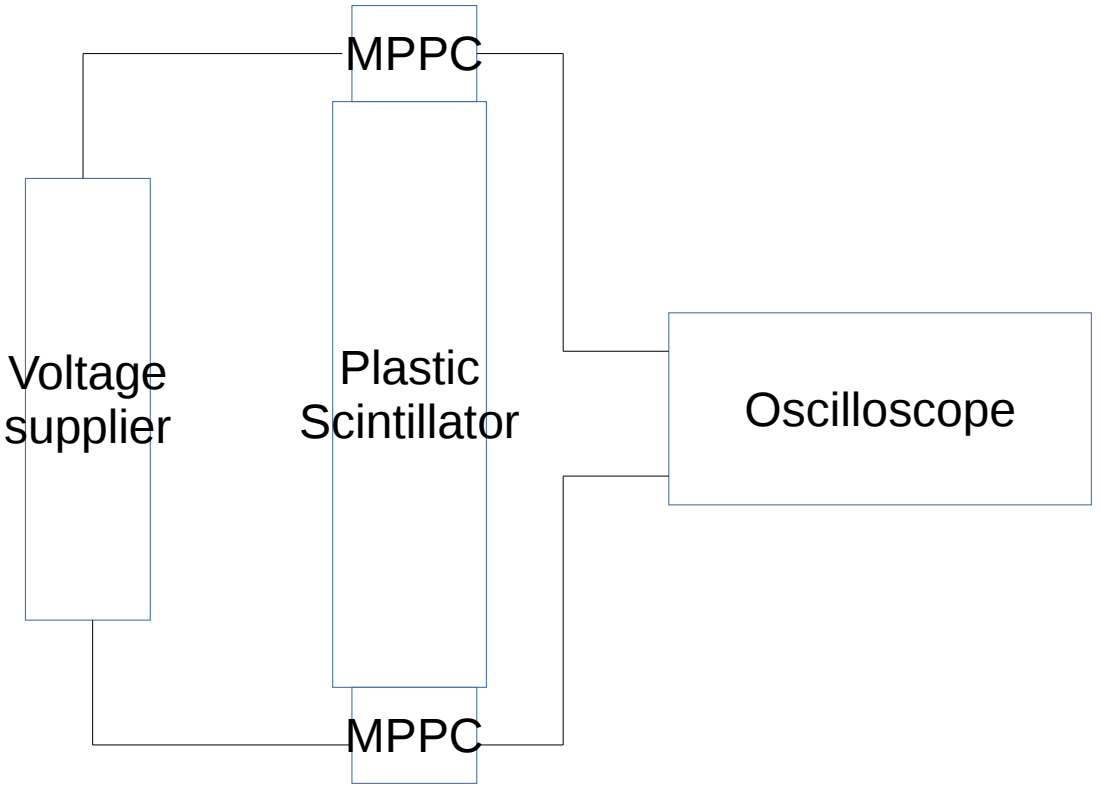
The MPPC readout circuit



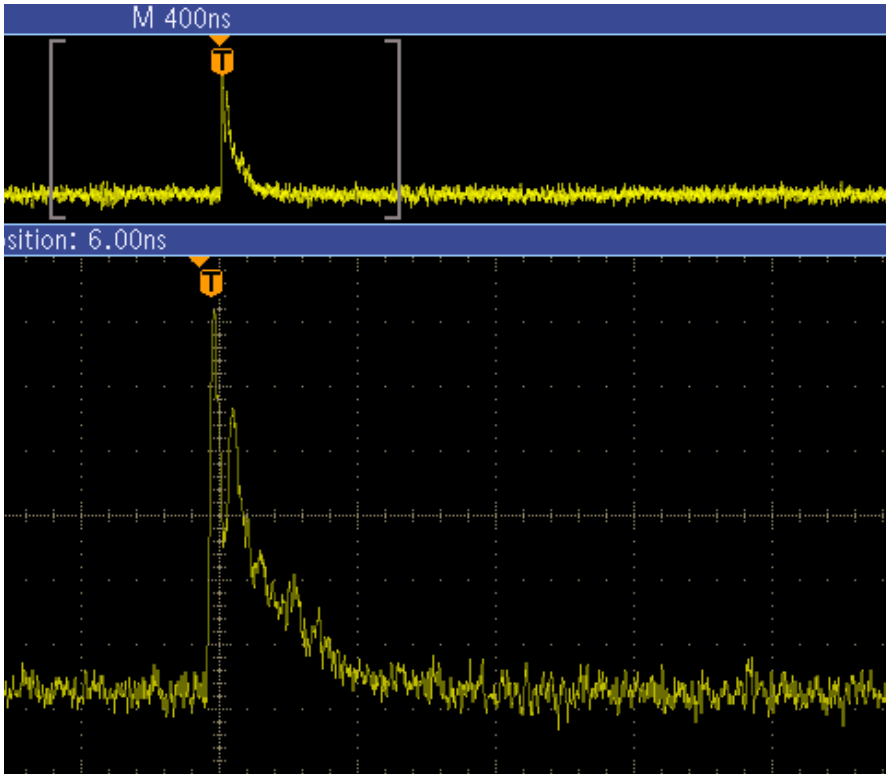
- The relation between the supplied voltage and the signal height:

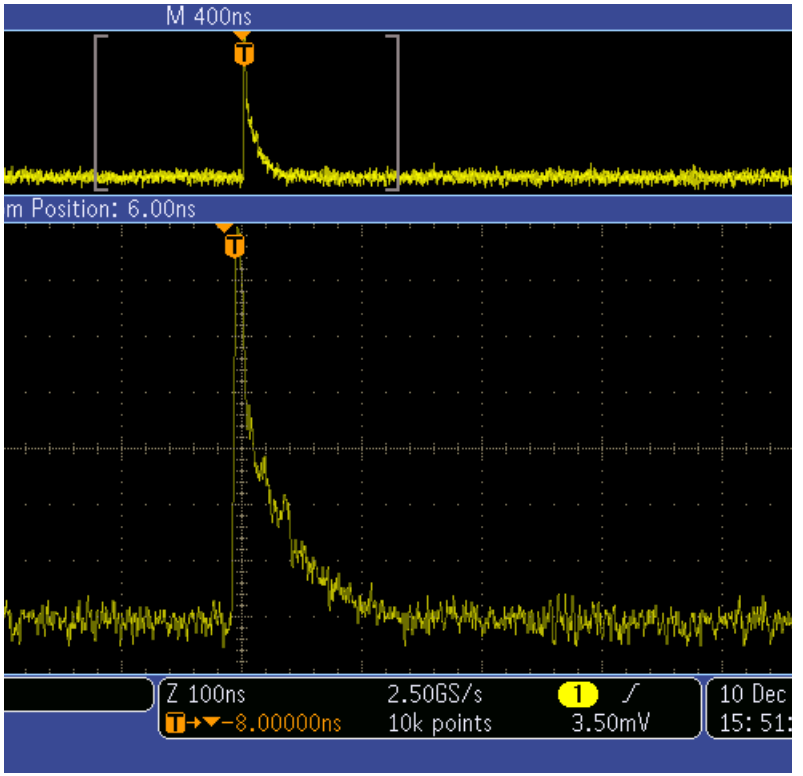


- The set up schematic:



The Signal getting from the MPPC:





Fluctuation:

1. Statistical uncertainty 2. After pulse

The wave form analysis

Photons are emitted by the plastic scintillator.

Photons are detected by the MPPC.

Many factors like afterpulse contributes to the wave form noise

The wave form fitting can be very difficult

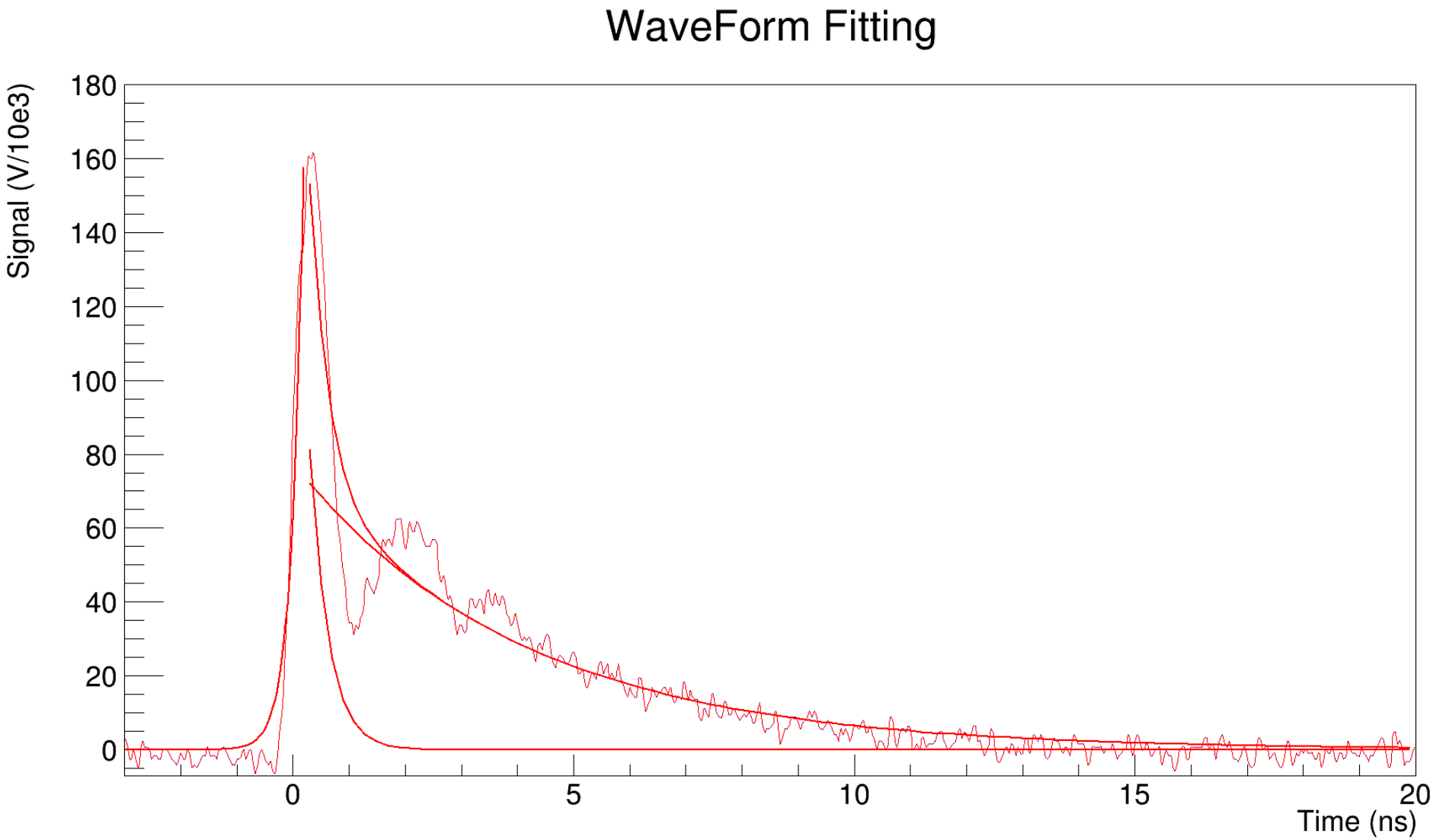
The wave form analysis

Trying to fit the wave form by using exponential function

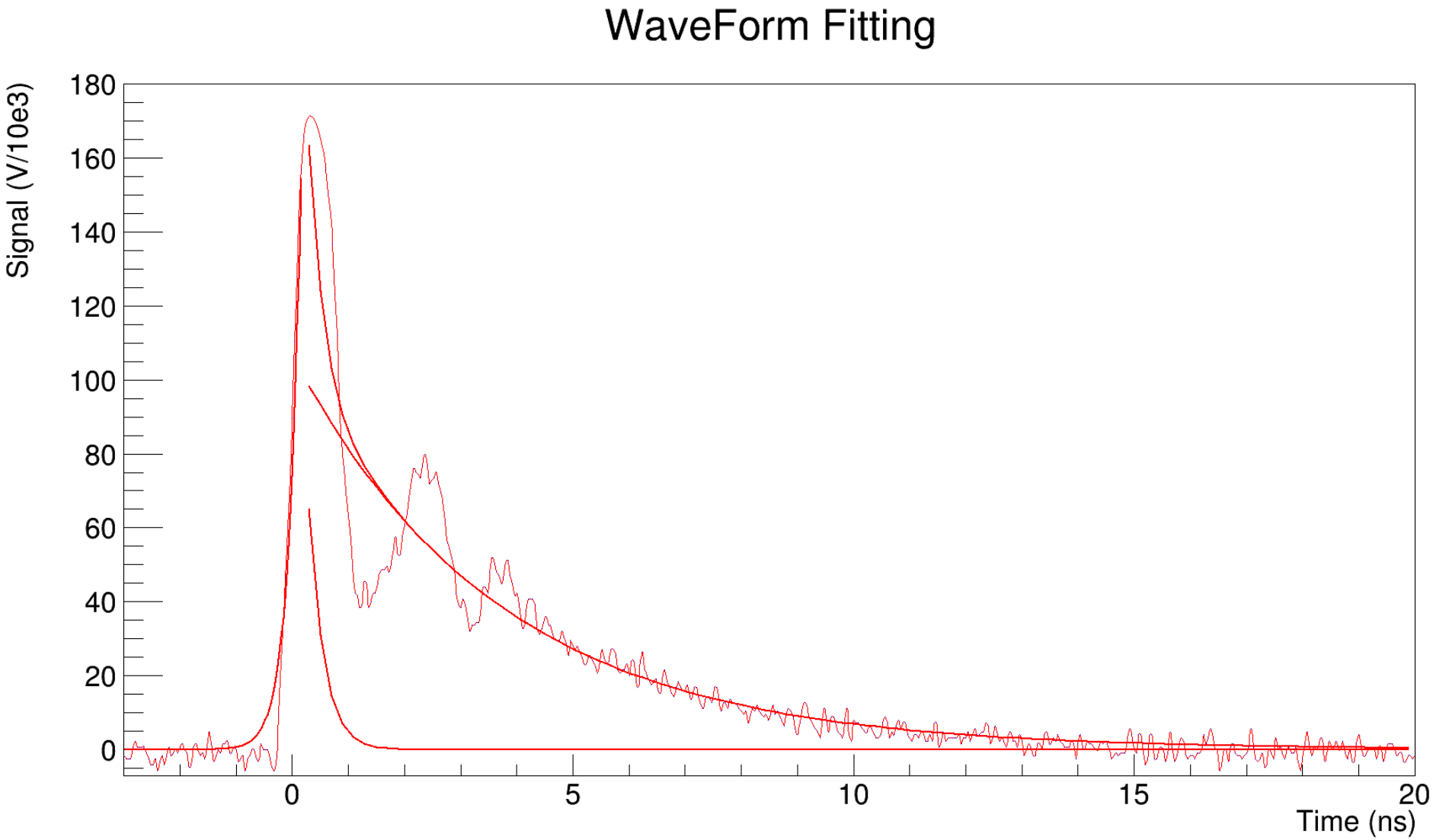
$$N = N_0 \cdot \exp\left(\frac{-t}{t_0}\right)$$

$$N = A \cdot \exp\left(\frac{-t}{t_f}\right) + B \cdot \exp\left(\frac{-t}{t_s}\right)$$

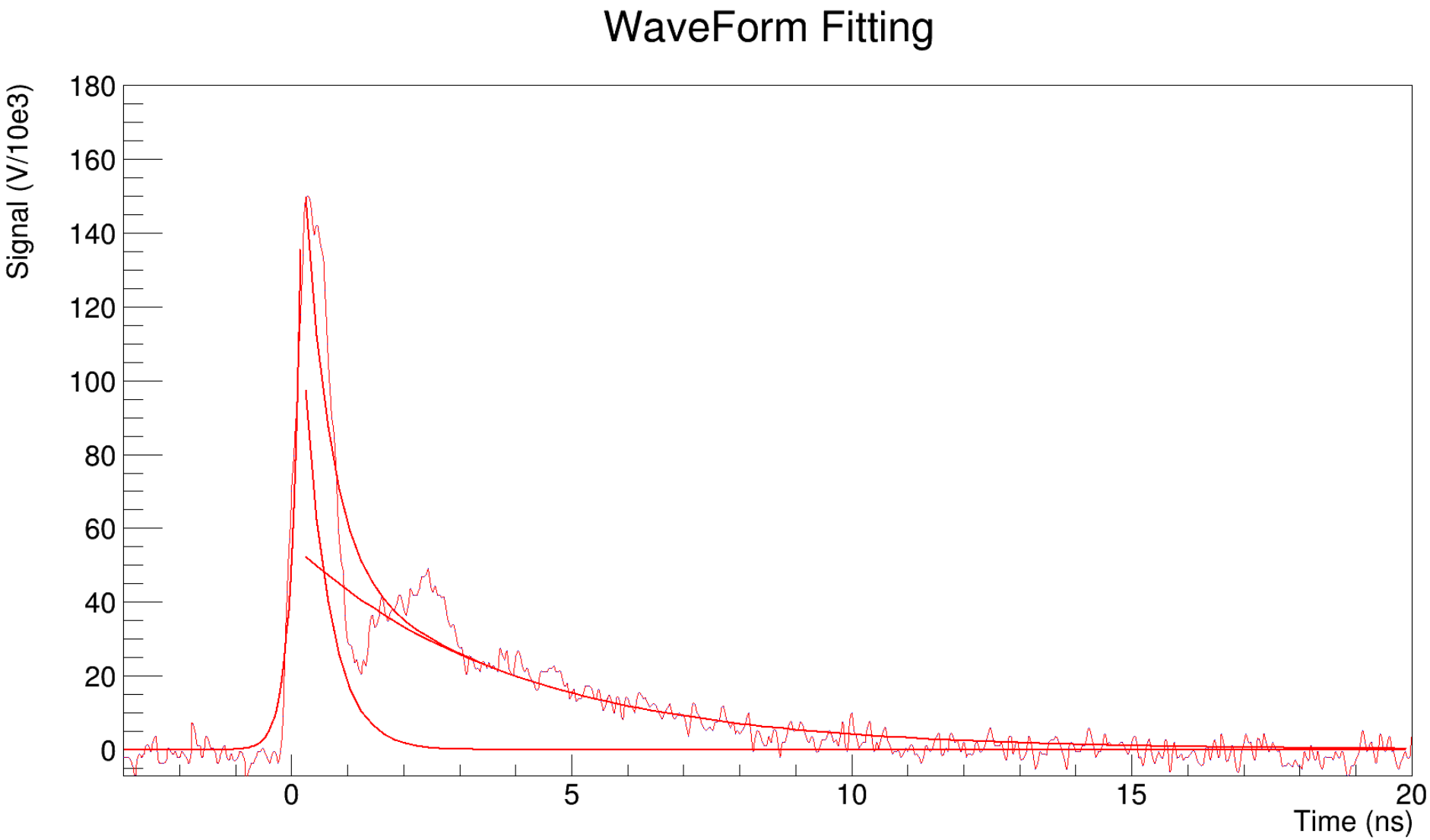
Wave form fitting result:



The wave form analysis:

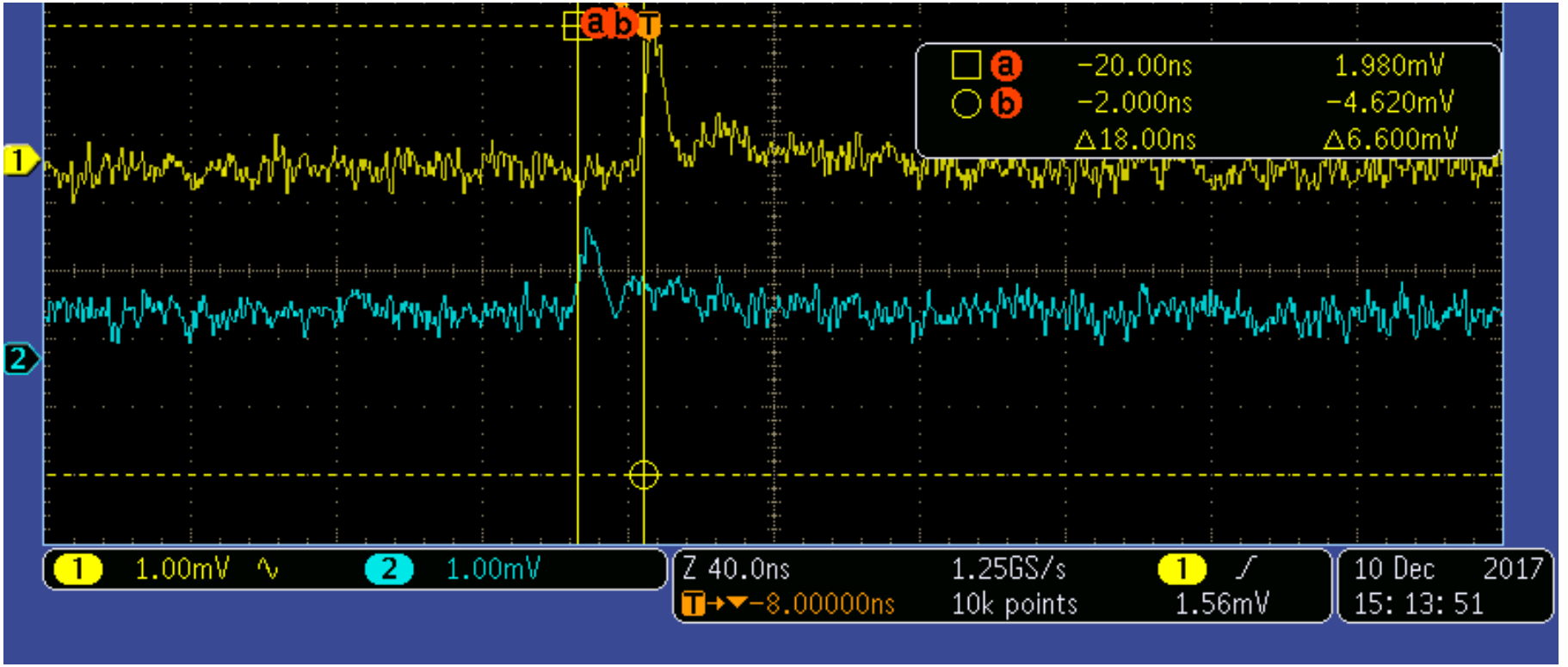


The wave form analysis:



The signals from the two MPPCs:

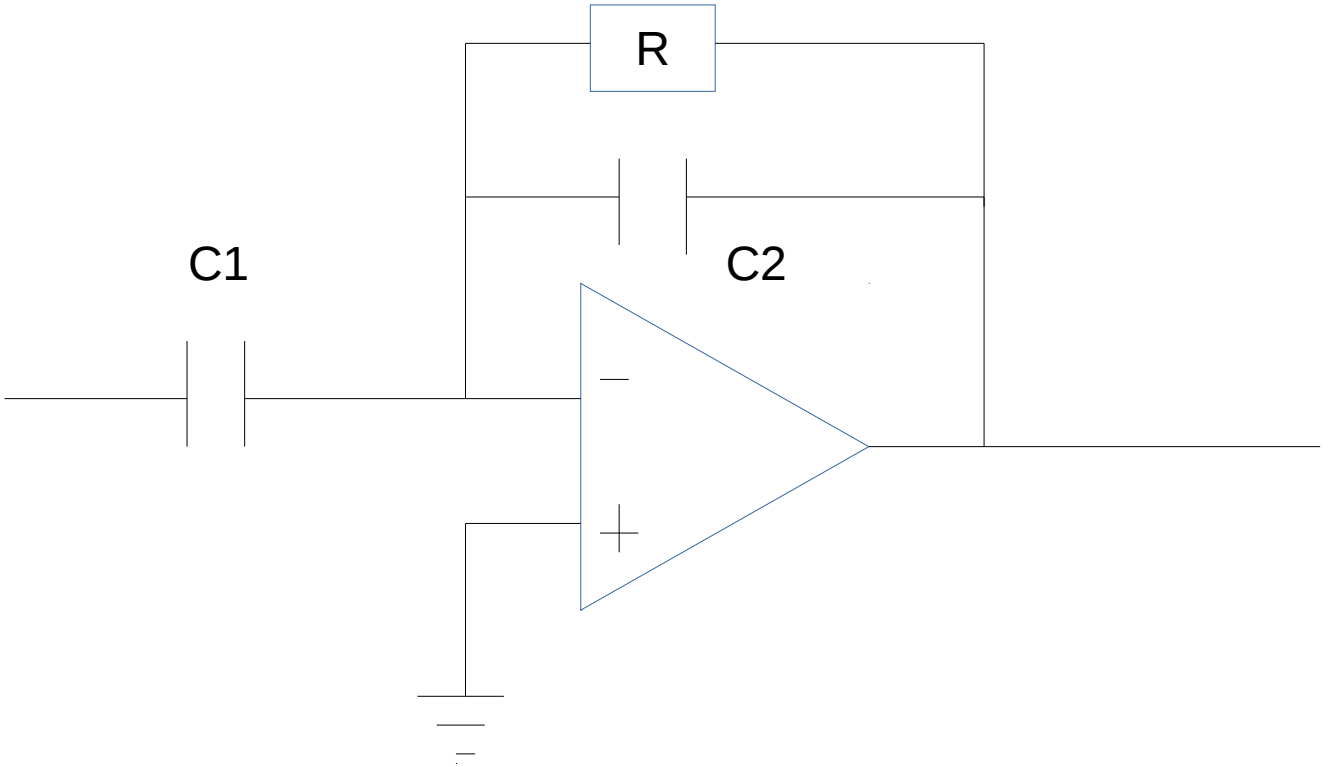
The different time when we get the signals from the two MPPCs indicates where the cosmic rays come to the plastic scintillator



Charge sensitive preamplifier is needed for the following experiment because of the following three reasons:

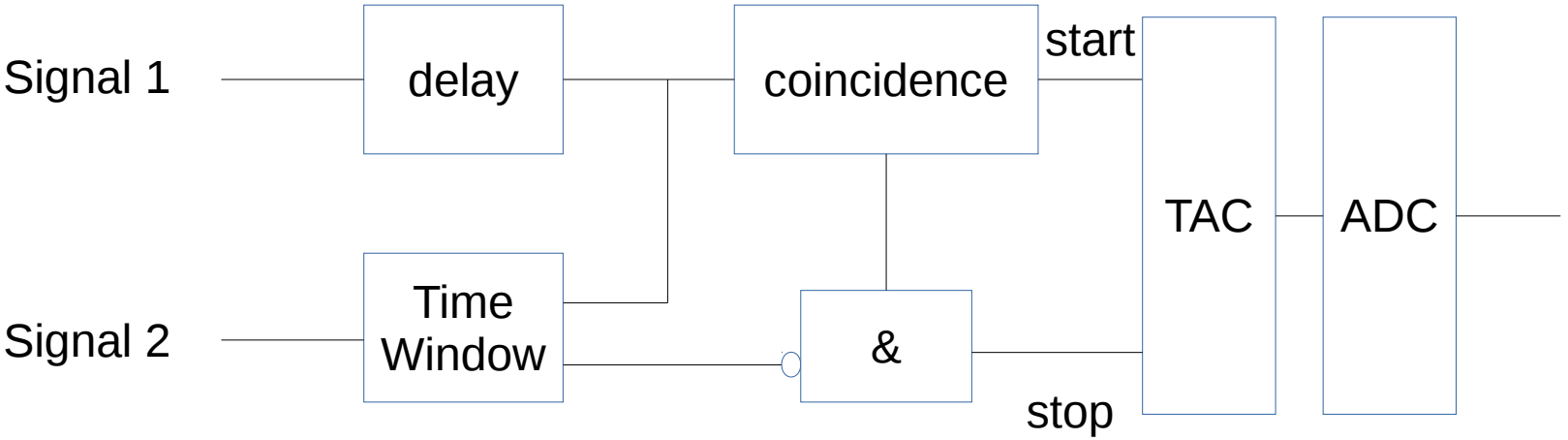
1. invert the positive signal type to the negative type
2. amplify the signal
3. semiconductor is sensitive to the temperature

- Schematic for charge-sensitive preamplifier



$$Q=C1*U1=C2*U2$$

Possible Brief Schematic:



Summary

- Hardware related work – a new experience and good practice, interesting enough.

- Noise occurs.

- Thanks