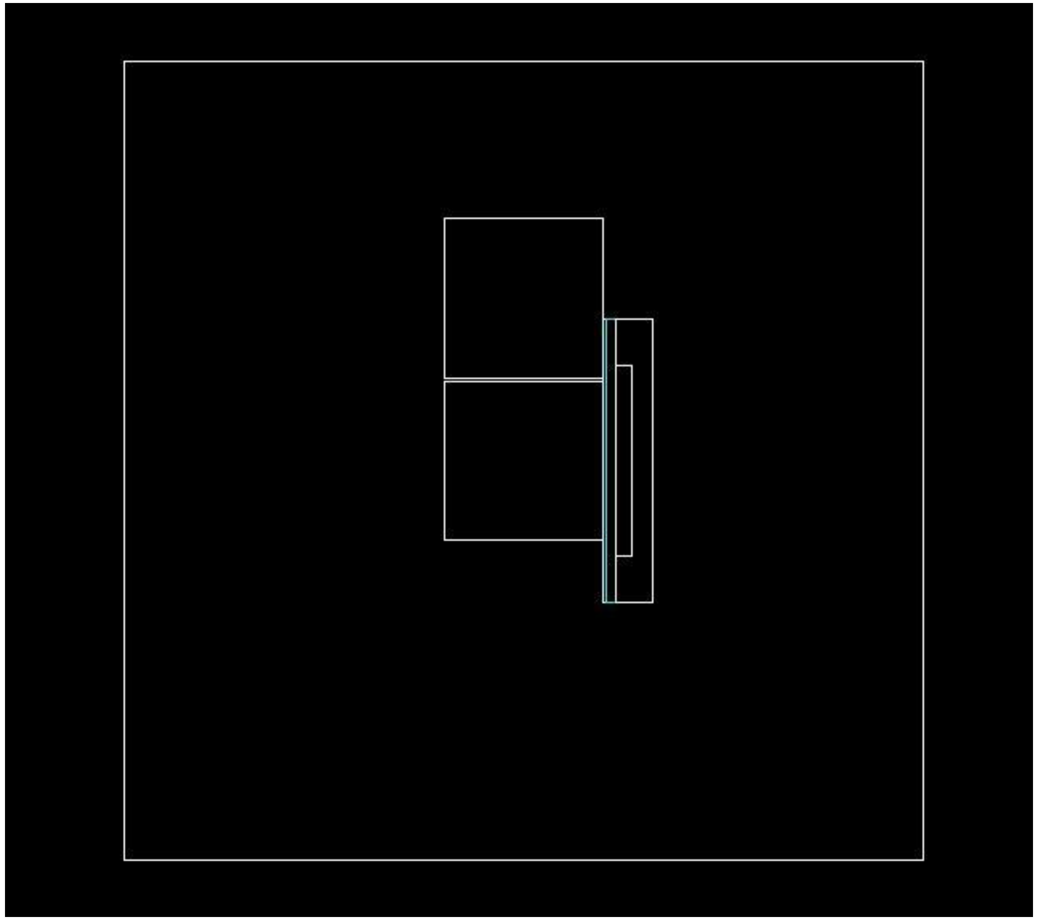
Scintillation yield

최재민

Simulation Geometry



- There are two 5mm scintillators.
- The lower one is a scintillator to check the scintillation yield.
- And the upper one is used as a trigger.
- There is an optical cement and a window between the scintillator(Epoxy resin) and the MPPC photosensitivie part.

The shape of the energy distribution

- Strontium decays the yttrium, which in turn decays to zirconium.
- The maximum kinetic energy of electron form Sr is 0.546 MeV, and one from Y is 2.28 MeV.
- Distribution of kinetic energy is shown on the right

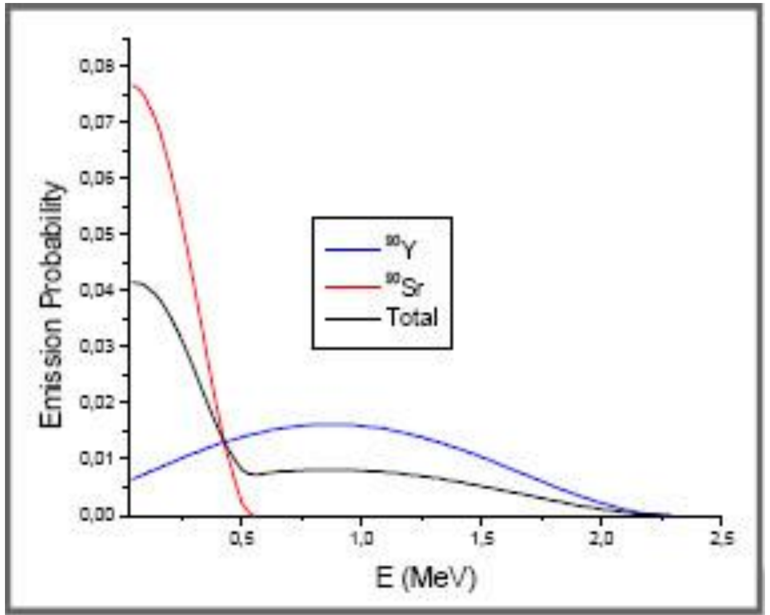
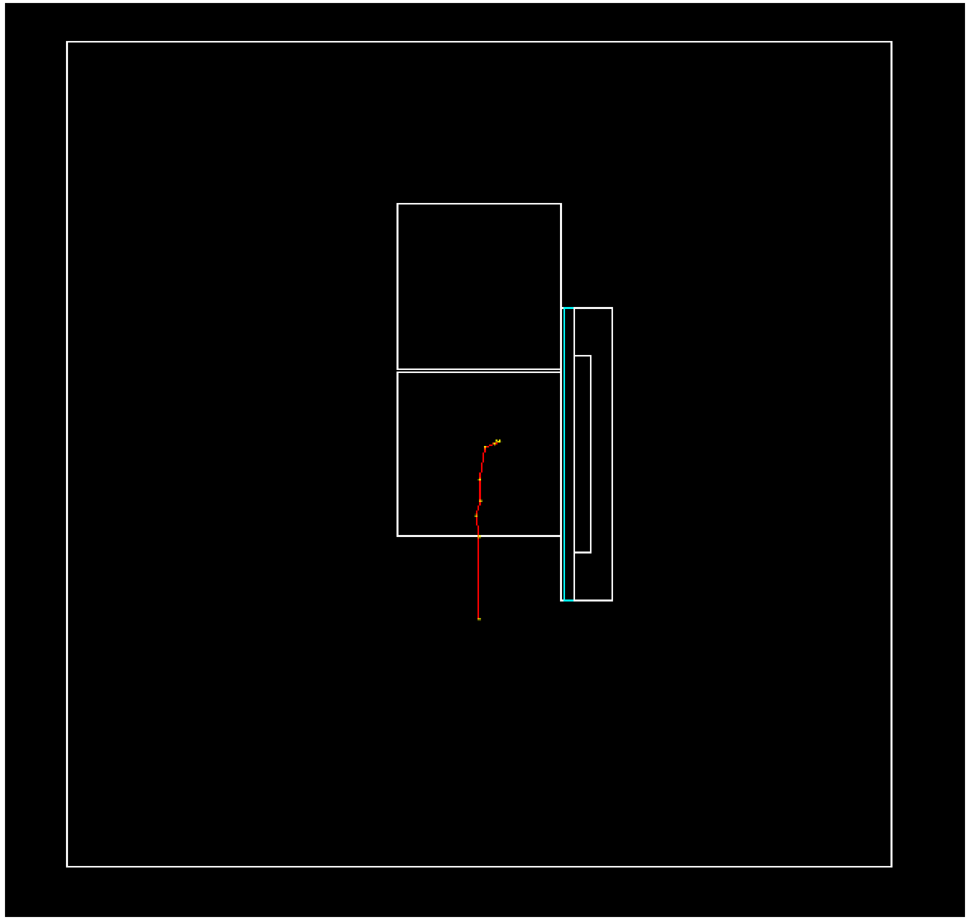


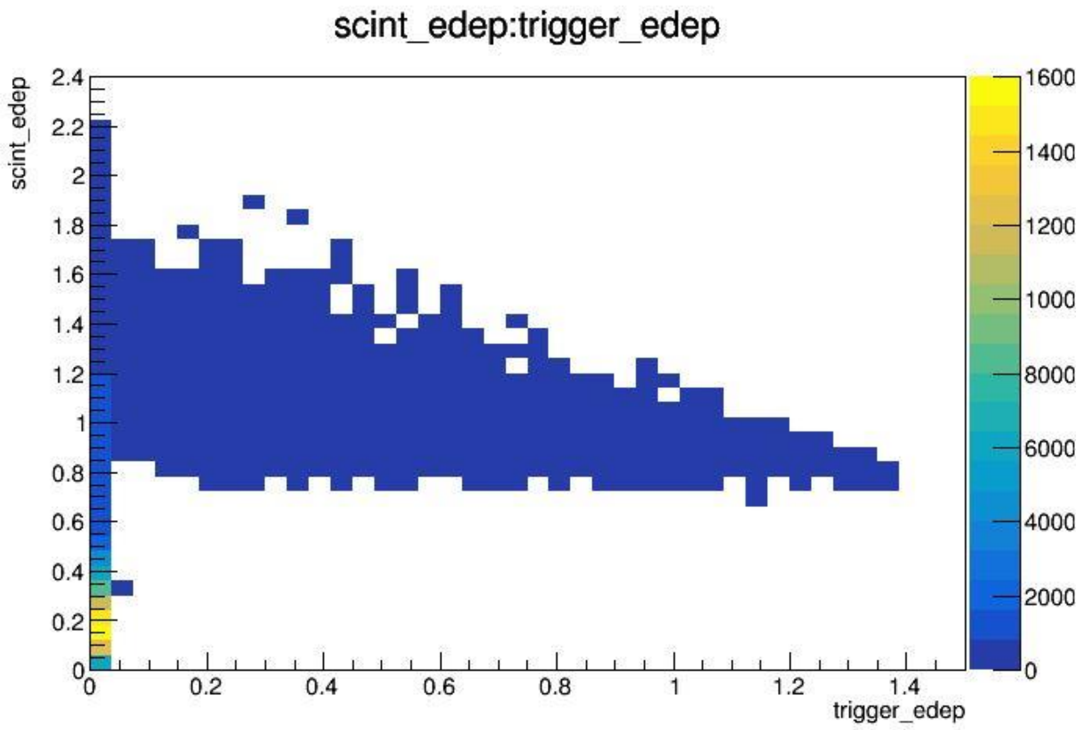
Figure 2. Energetic spectra of emission probabilities.

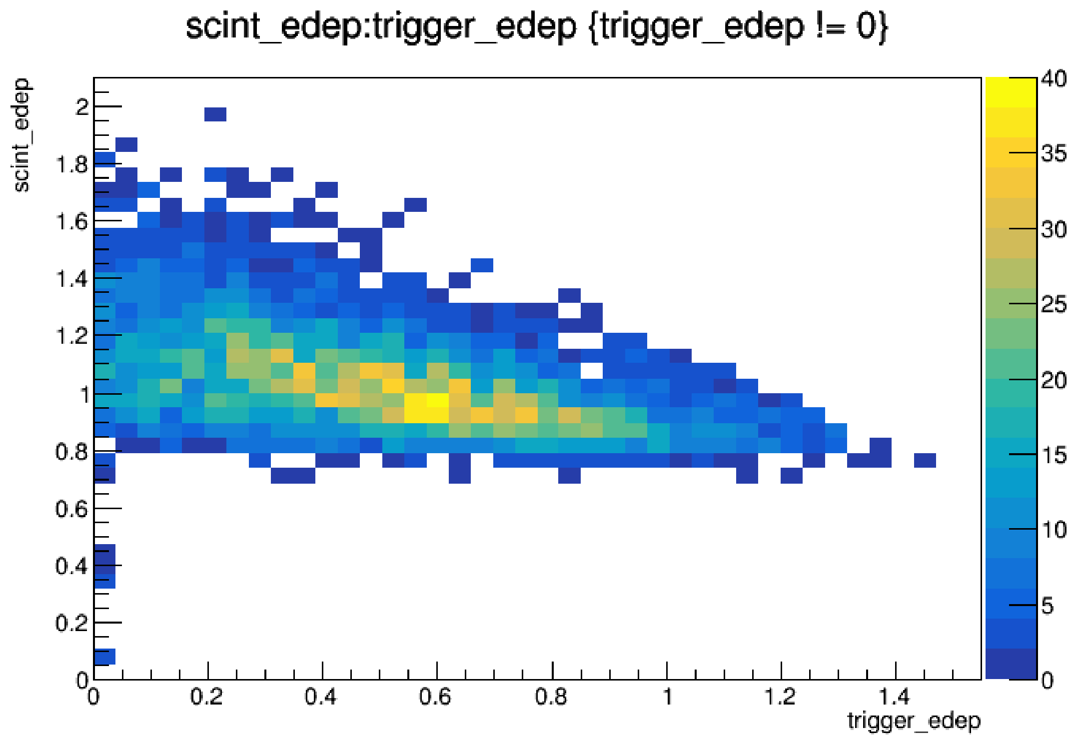
Vizualization



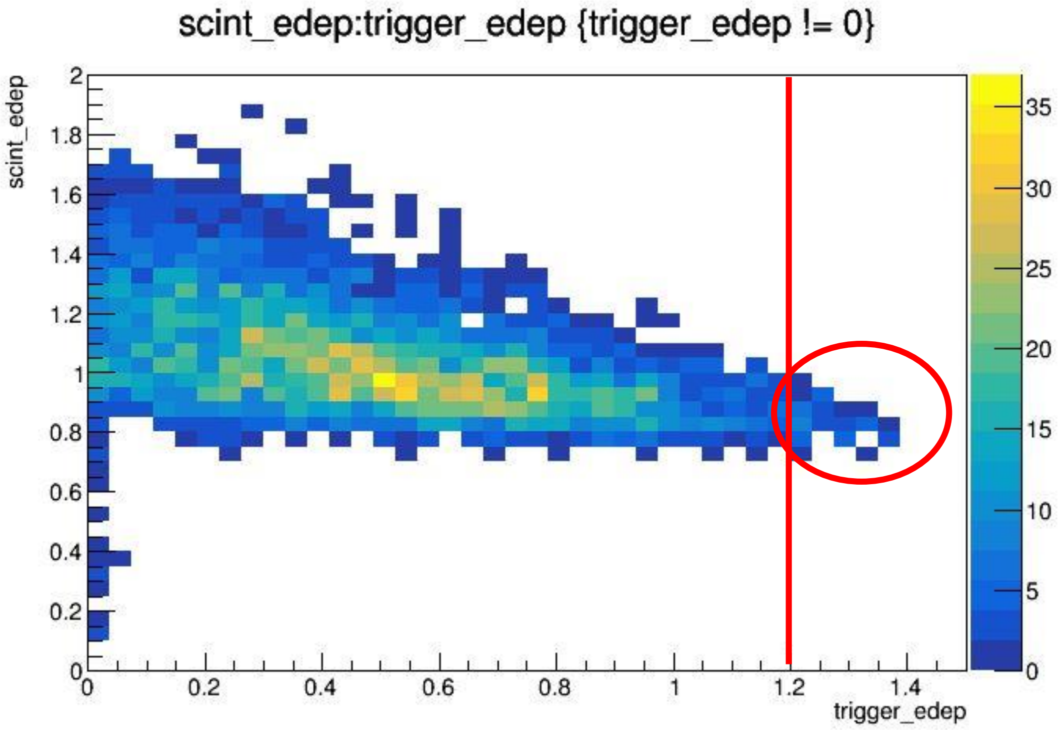
- The results of shooting the electron with random energy that satisfies the kinetic energy distribution in previous slide is shown on left.
- Many electrons have energy less than 1 MeV, so most of them cannot reach the trigger and disappear.

Energy deposit ratio(5mm)

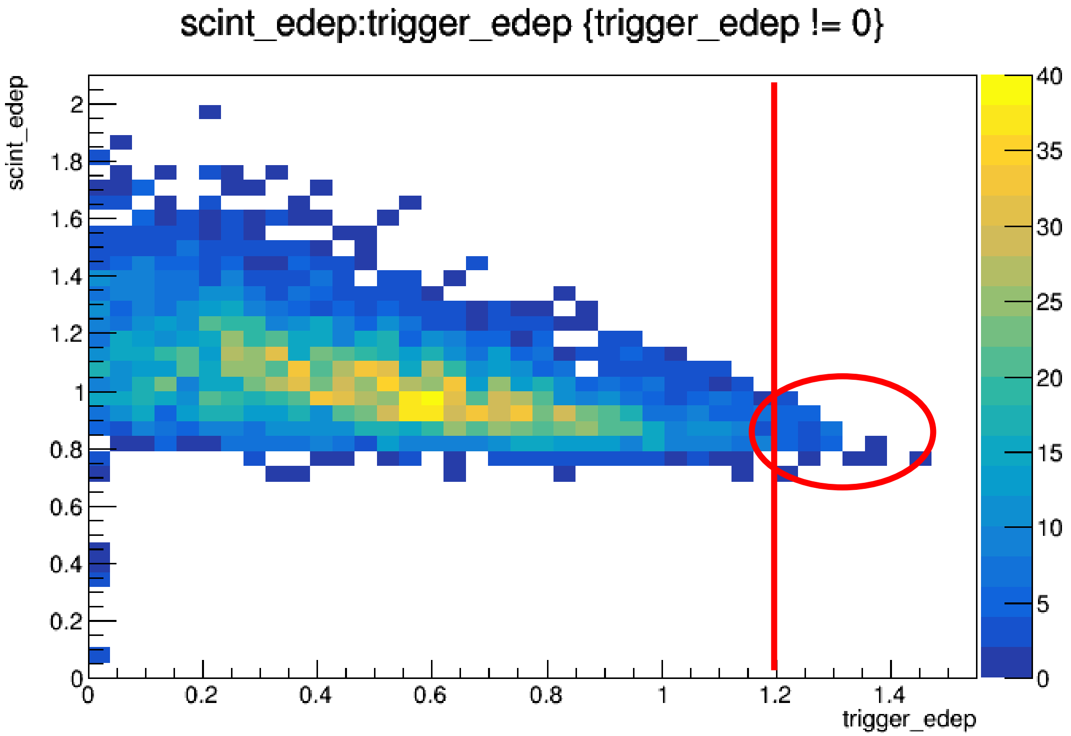




Energy deposit and width



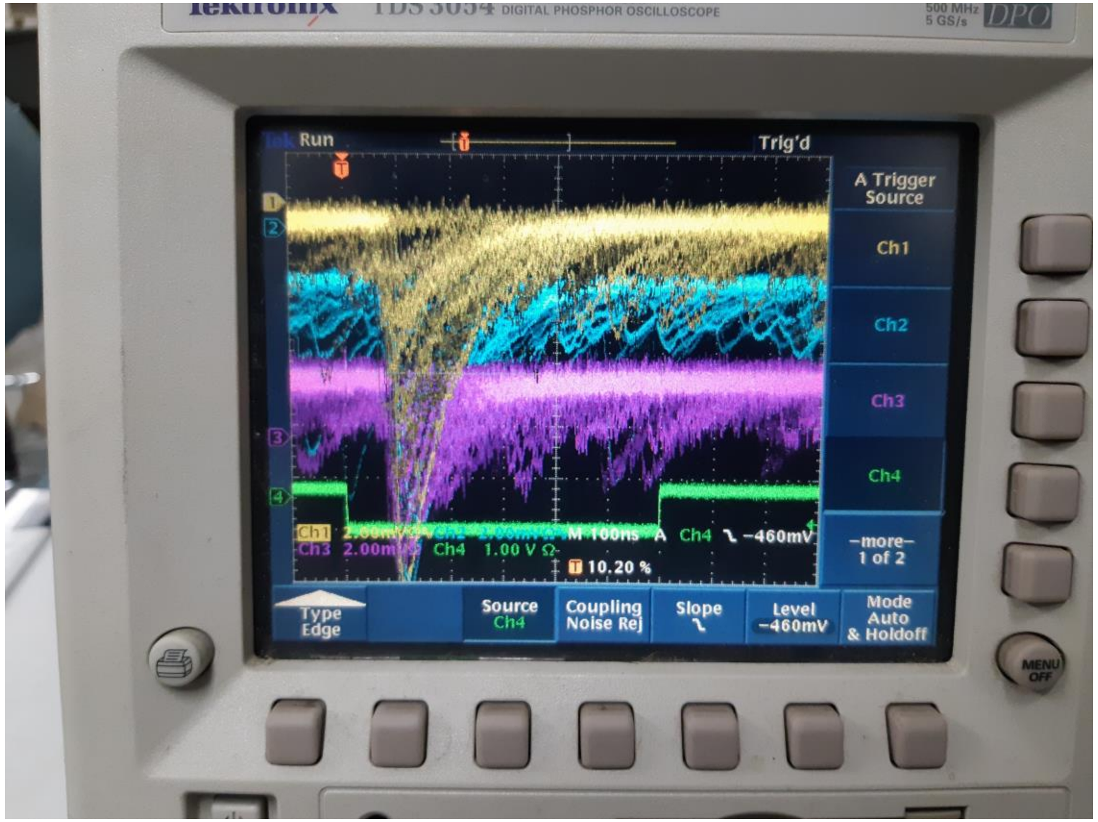
3mm scintillator trigger



5mm scintillator trigger

MPPC signal

Single photon signal



- The photo on the left is a single photon signal viewed with an oscilloscope by hong min Kim.
- The x-axis is time and y-axis is voltage.
- One cell of x-axis is 100ns.
- One cell of y-axis is 2.00mV.
- According to this oscilloscope photo, rise time is about 20ns, decay time is about 160ns, and height is 2mV.

Single photon signal

$$V(t) = polarity \times F_1 \times F_2 \times (F_3 + aF_4)$$

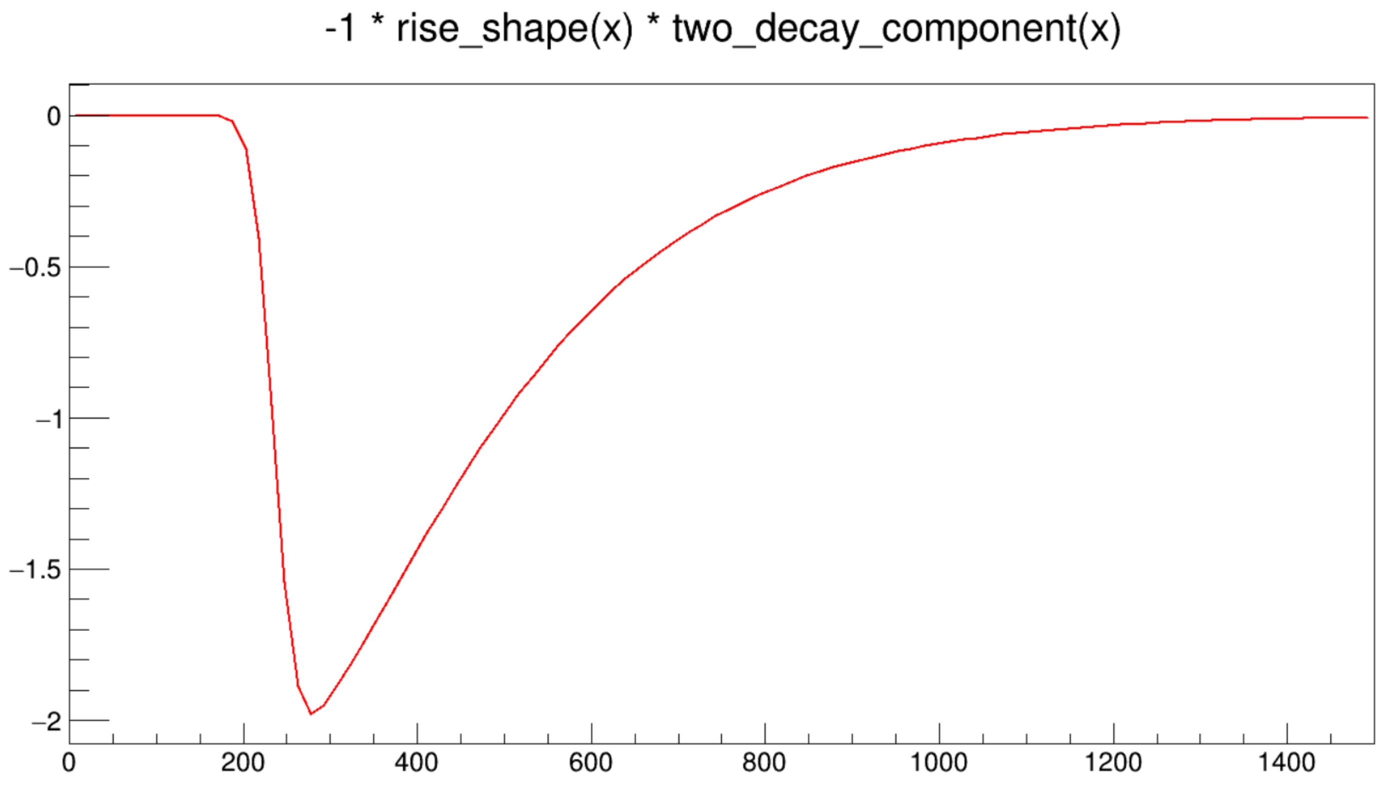
$$F_1 = Freq\left(\frac{t-(t_0+t_d)}{t_r}\right)$$

$$F_2 = \frac{t-t_0}{t_r^2}$$

$$F_3 = e^{-\frac{t-t_0}{t_1}}$$

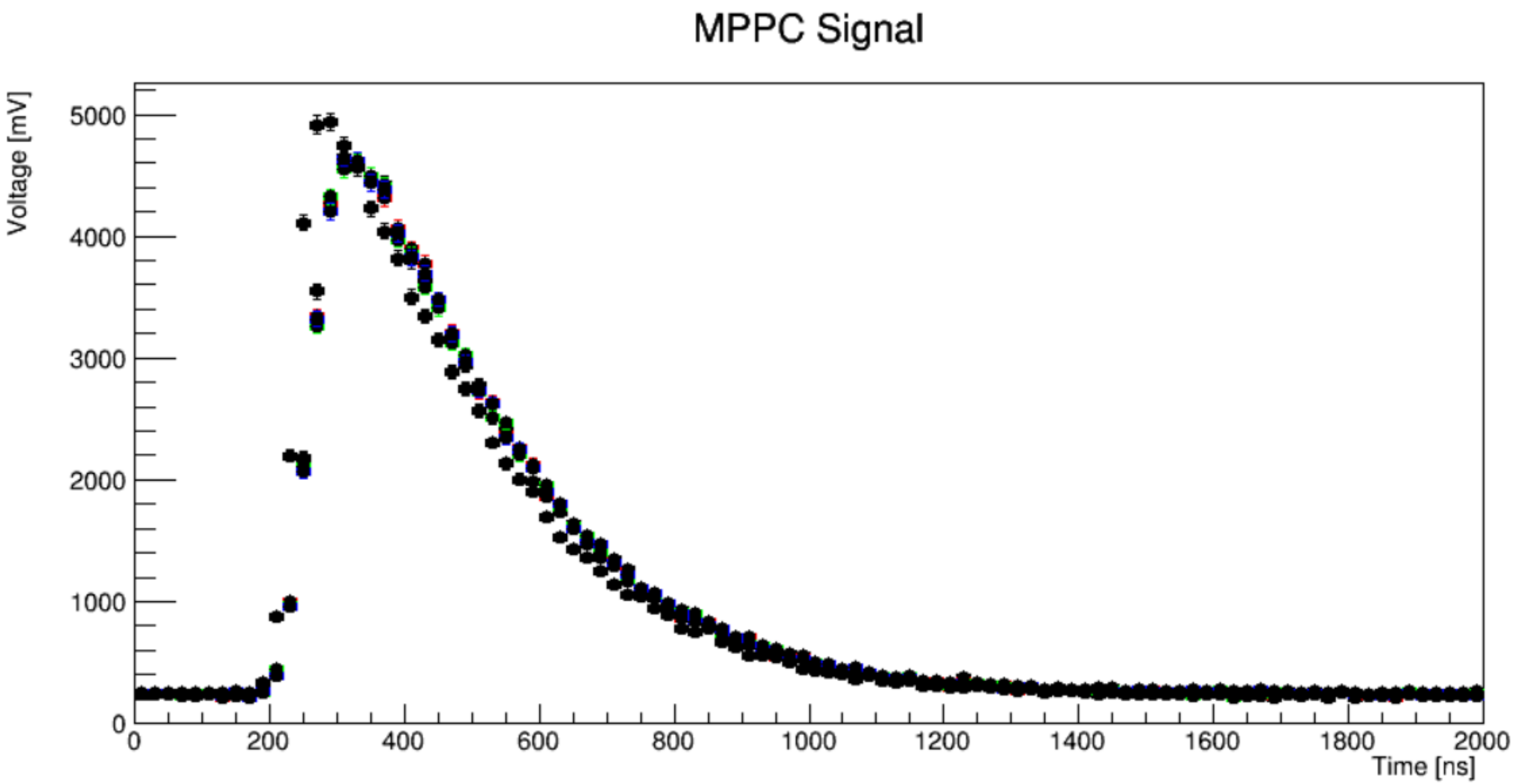
$$F_4 = e^{-\frac{t-t_0}{t_2}}$$

Single photon signal



- Single photon signal for MPPC used in DCV

DCV signal by MPPC



- By making use of convolution, we can make DCV signal with signle photon signal and arriving time.(However, rising time is not implemented)