Test Result for the bar-type Neutron Detector omitting "Coincidence Part" in the original Experimental Set-up

Lab Meeting

2013/05/16

Thursday

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Overview

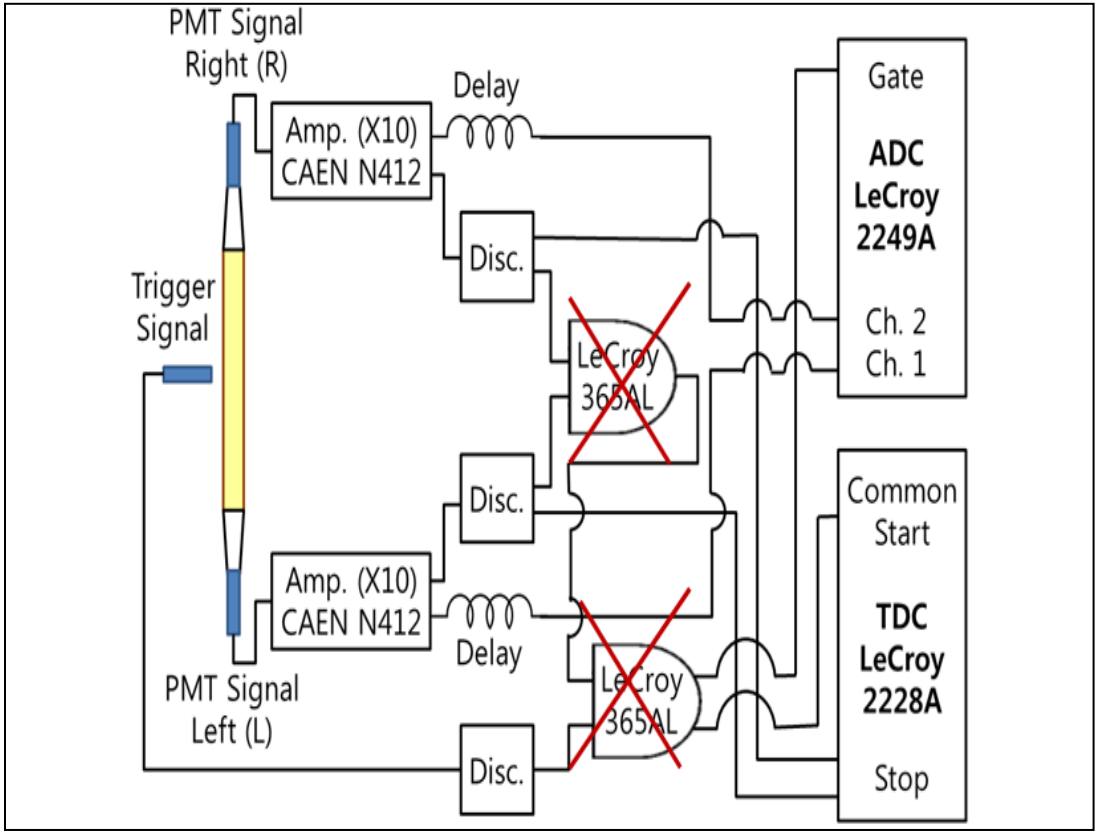
- Further test for the bar-type neutron detector with a different electronic set-up.
- Got rid off the “coincidence” between the trigger and the scintillator bar in the current test.
- Threshold setup identical to the previous set-up
- Voltages for left and right scintillator PMTs were maintained while the trigger PMT was fed with a voltage reduced to 1820 V (current set-up) from 1870 V (previous set-up).

Objective

In the absence of the "coincidence" between the trigger and the scintillator bar, we aimed to study the performance of the neutron detector in terms of:

- Time resolution.
- Position resolution.
- Time of flight distributions.

Modified Electronic Set-up



Test with ^{252}Cf and ^{60}Co sources

- ^{252}Cf for neutron measurements
- ^{60}Co for time resolution measurements

- CFD(C.A.E.N. Mod. N415A)
- Threshold for signal: 35 mV/ns
- Threshold for trigger: 5 mV/ns

Fig.1: Modified electronic setup

^{60}Co Source Electronic Setup

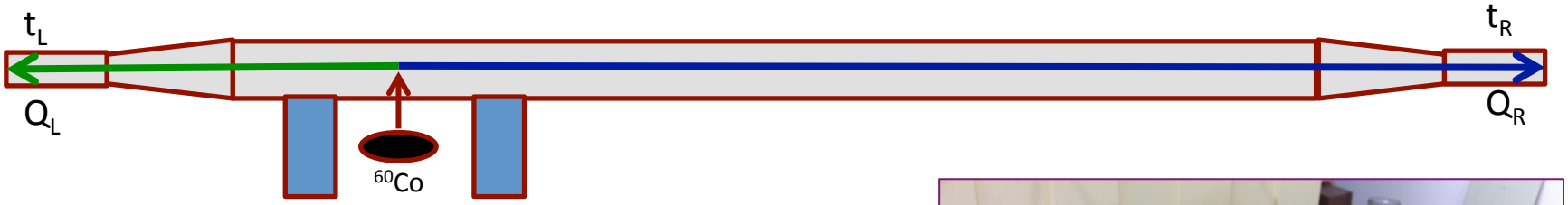


Fig.2: 2 m-long neutron detector bar

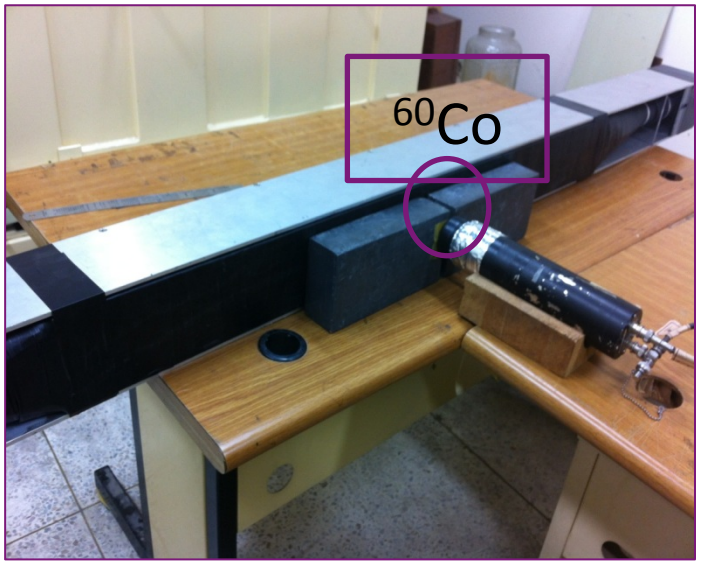


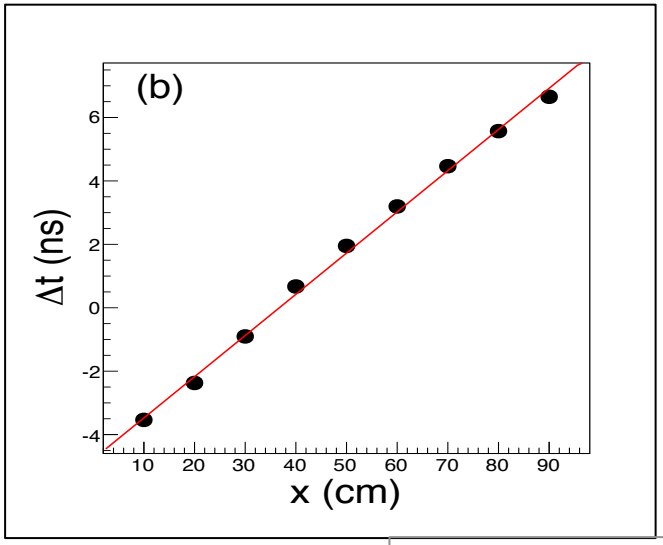
Fig. 3: Expt. set-up with ^{60}Co

- Determine hit position using time difference of two signals.

- Measurements carried out at 10 cm step from left.

Position and Time Resolutions

Current CFD result



Previous CFD result

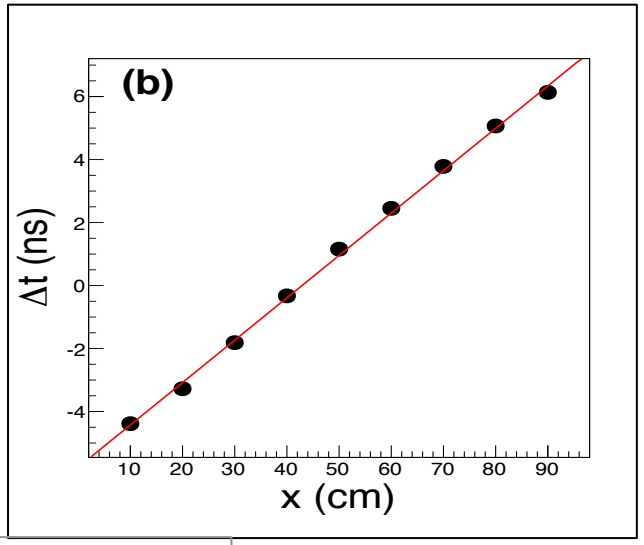


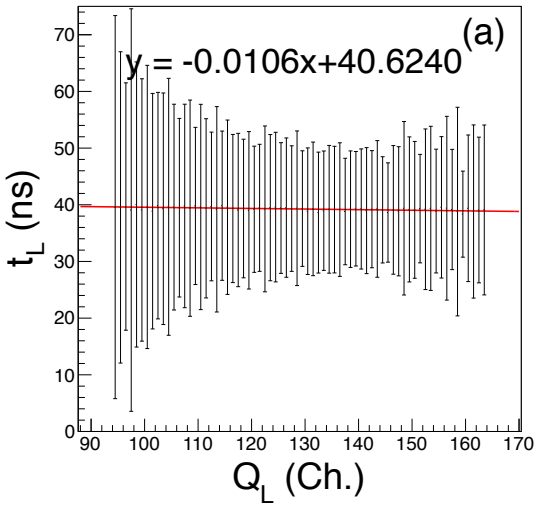
Fig. 4: Time difference between two scintillator PMTs as a function of the hit position of gammas.

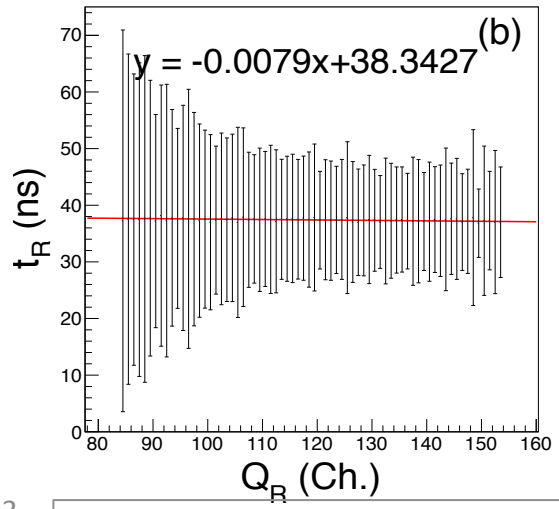
	$\alpha(cm/ns)$	$\beta(cm)$	$\sigma_x(cm)$
Current CFD result	7.70 ± 0.03	-1.74 ± 0.20	9.66
Previous CFD result	7.43 ± 0.01	-1.71 ± 0.09	7.79

Table 1: Fitting parameters for the linear functional form $(x = \alpha\Delta t + \beta)$ in Fig. 4 above.

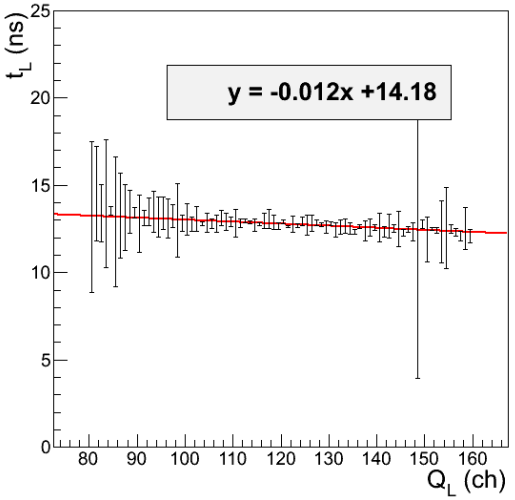
Slewing Effect (Time-walk)

Current CFD Result





Previous CFD Result



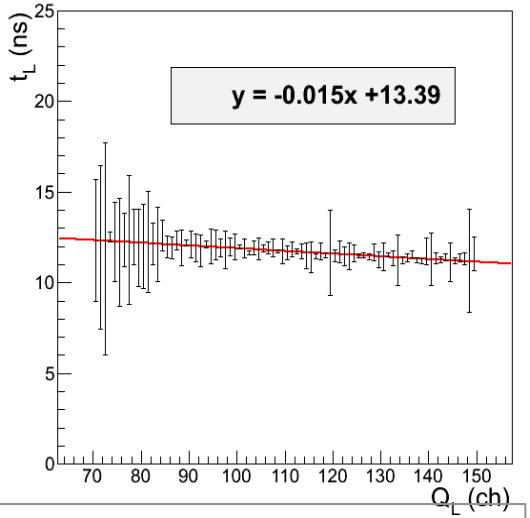
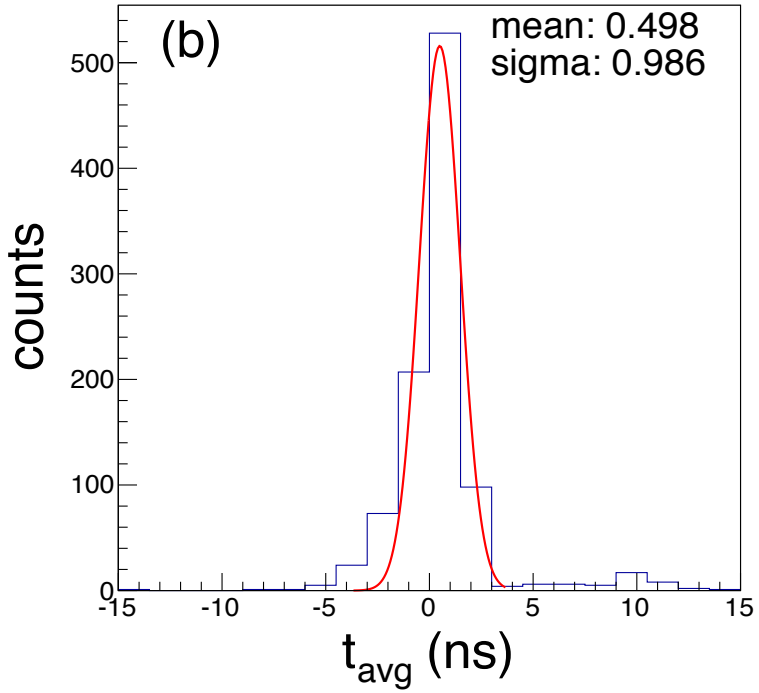


Fig. 5: Correlations between time and charge values of two scintillator PMTs

Average Time distributions

Current CFD Result



Previous CFD Result

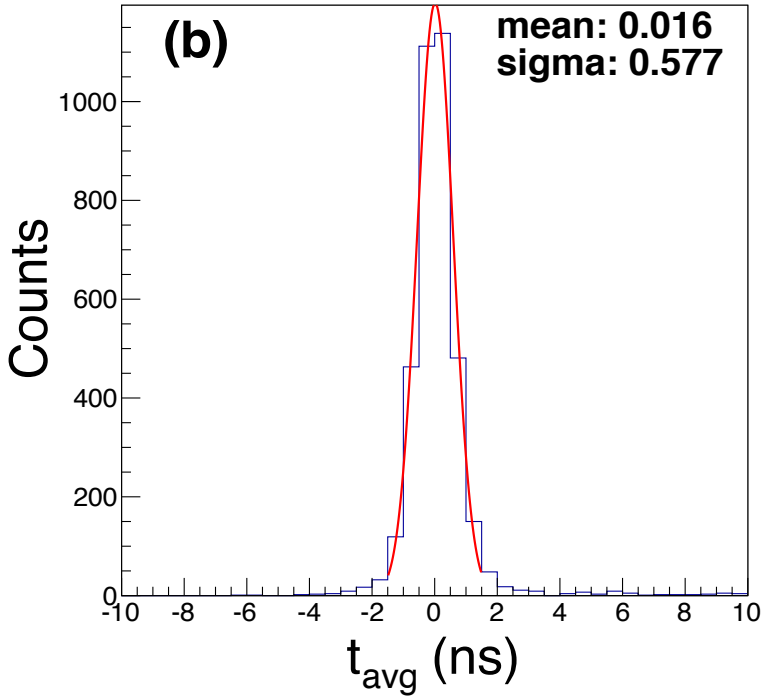


Fig. 6: Average time distributions of two scintillator PMTs after slewing effects are corrected.

^{252}Cf Experimental Setup

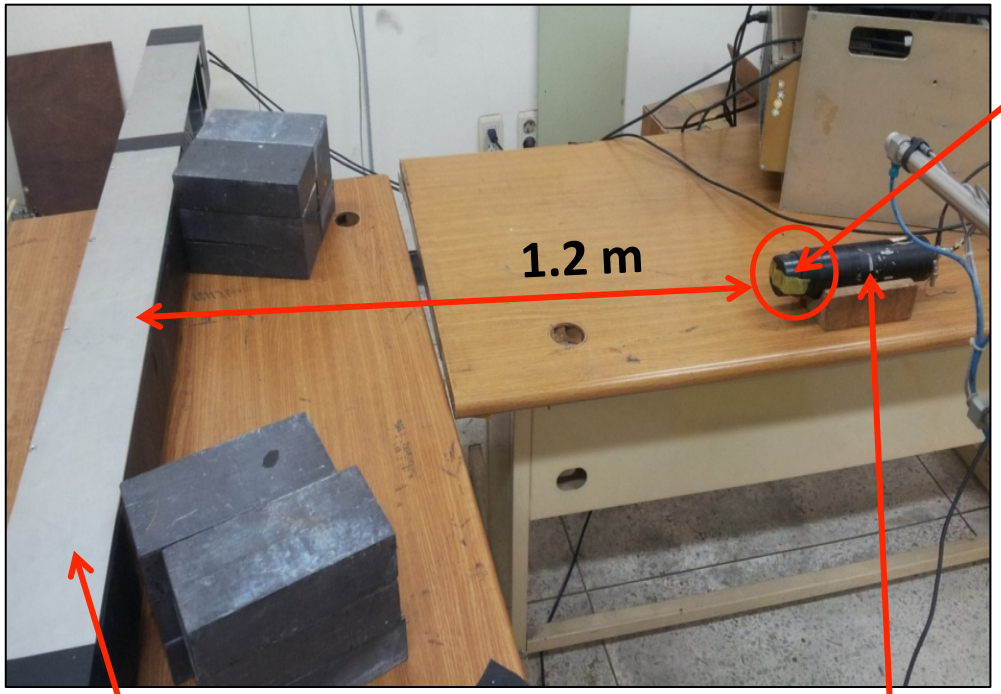
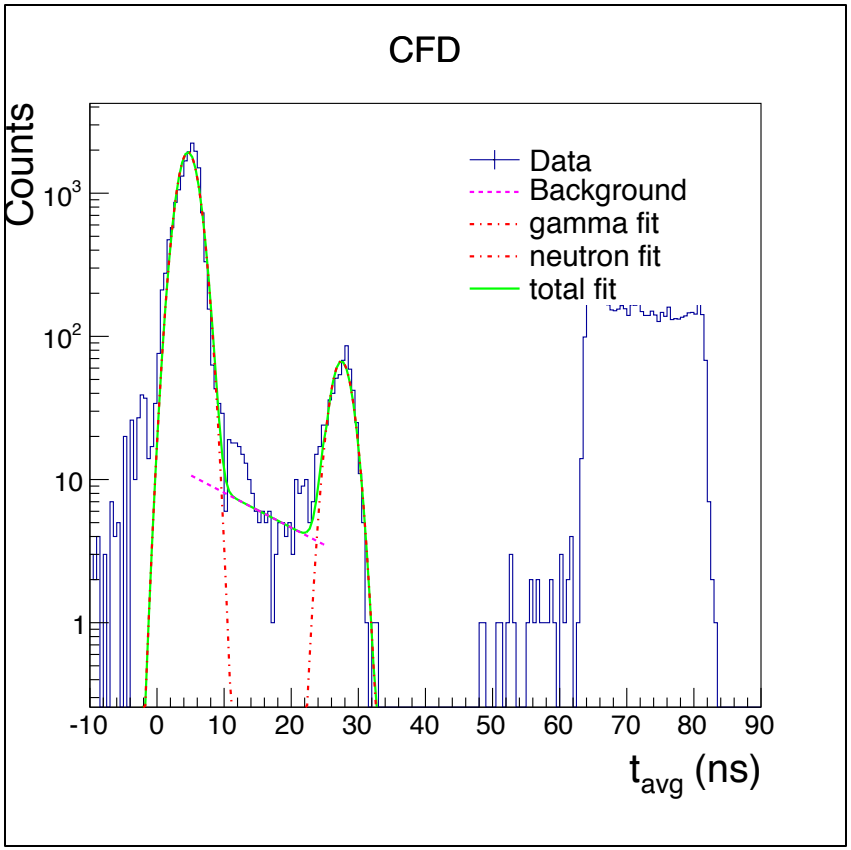


Fig. 7: Flight distance of 1.2m with ^{252}Cf experimental setup.

Test Results with ^{252}Cf

Current CFD Result



Previous CFD result

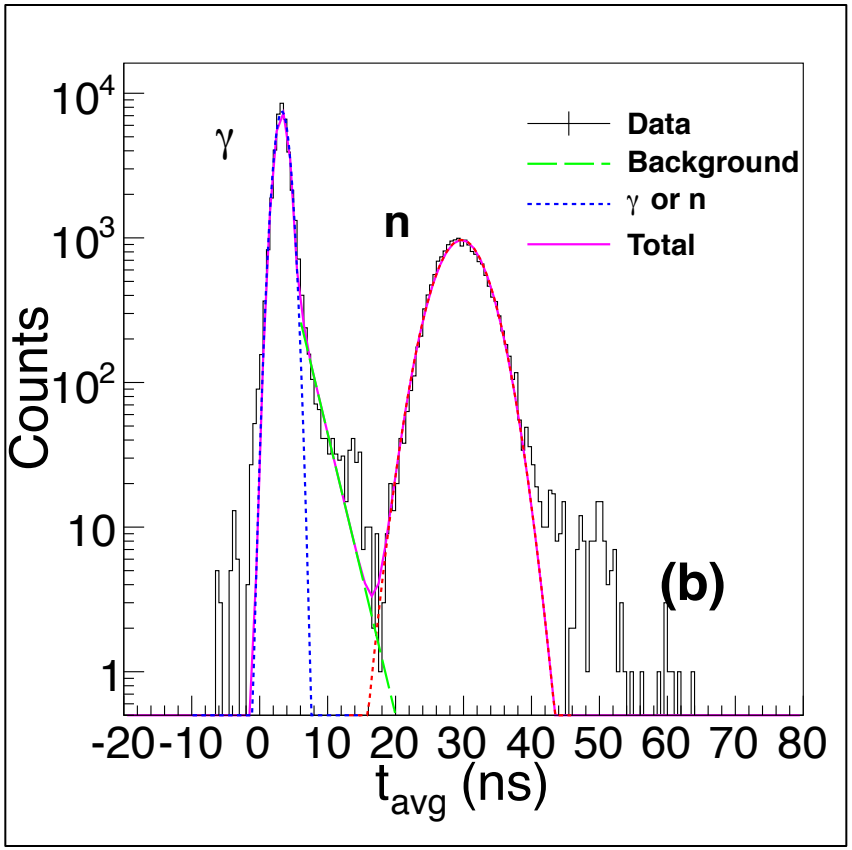


Fig. 8: Time of flight distributions for gamma and neutrons

To be done

Compute the total neutron energy and check how the current test result will compare with the previous result given below.