Gamma Spectrum with Liquid-Xenon

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1. Introduction

We have measured gamma spectrum with Liquid-Xenon scintillator from last year. This is the experiment for Liquid-Xenon TPC and the purpose is measuring Energy Resolution of Liquid-Xenon. Last year, we obtained the spectrum and Energy Resolution. But, regardless of predicting Liquid-Xenon has 10% Energy Resolution, the result was 18%. So, we aim to obtain higher Energy Resolution.

2. Setting up

To detect the scintillation light, we used PMT(R7600 1inch square) and Teflon reflectance block for gathering the scintillation light. These are shown as FIG0.

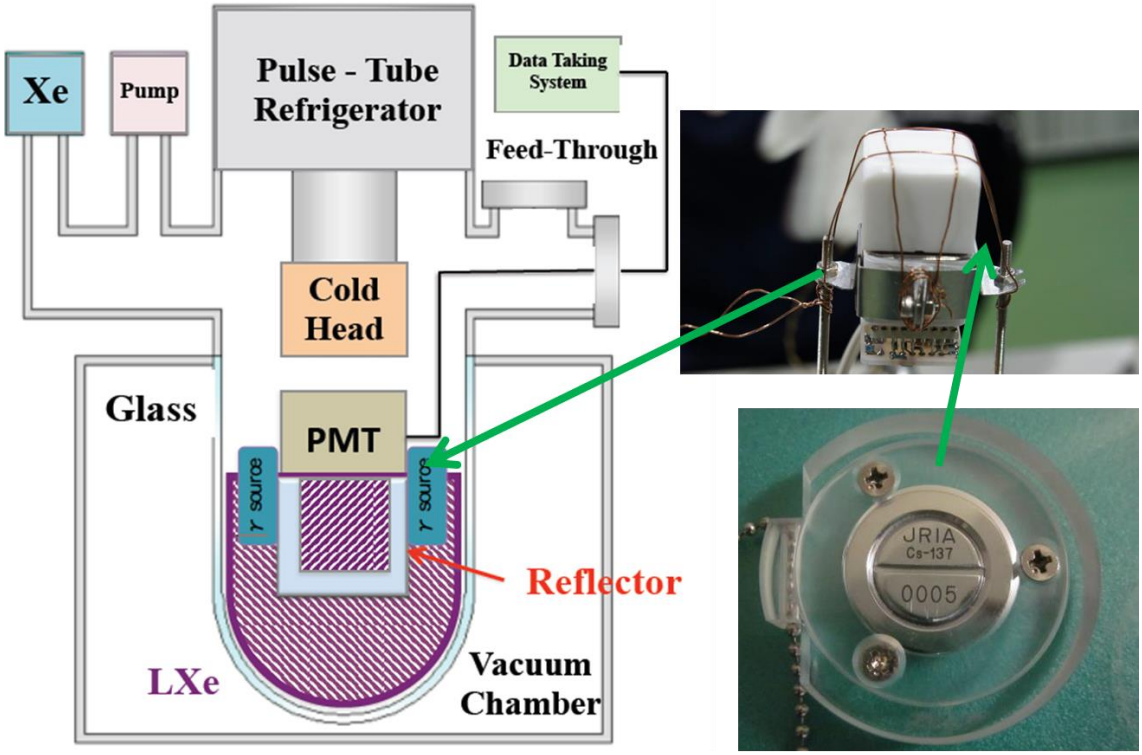

Fig0. Setting up

This time, we used $^{137}Cs(E_0=662\ keV)$, $^{60}Co(E_0=1173, 1332\ keV)$ and $^{22}Na(E_0=1274\ keV)$ separately as gamma sources.

3. Point of improvement

Last year, we used only 10times amplifier as data acquisition circuit without preamplifier and shaping amplifier. This time, we used preamplifier(Ortec142AH) and main amplifier(Ortec570), shown in Fig1.

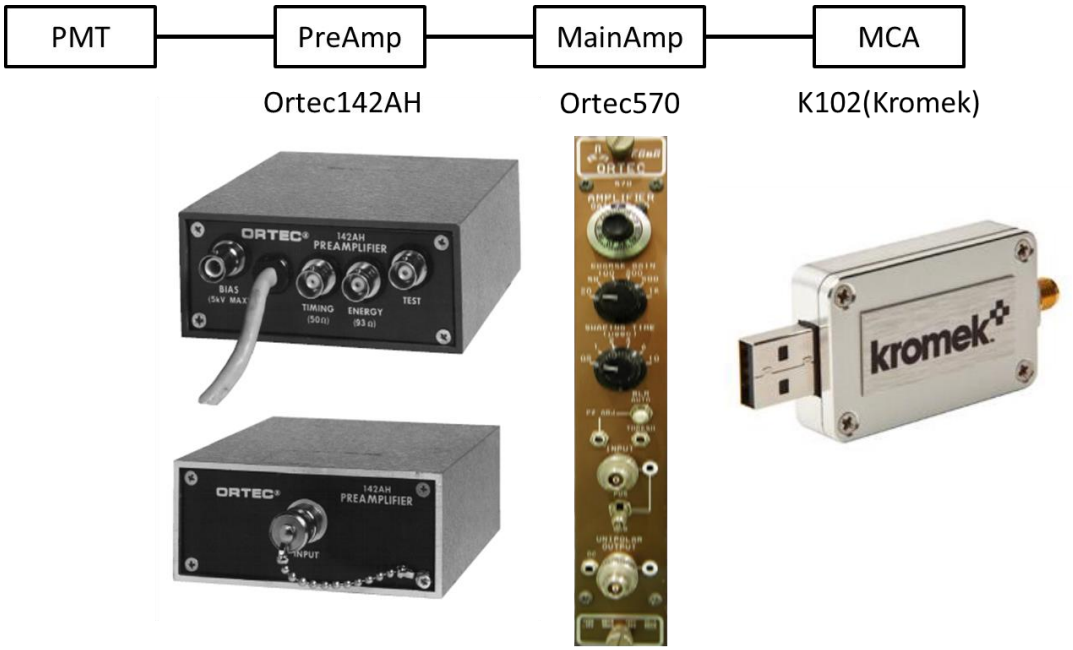

Fig1. implements

And, Fig2 shows the signal after PMT, Fig3 shows the signal after preamplifier, and Fig4 shows the signal after main amplifier. We obtained signal Fig4 by K102(Kromek).

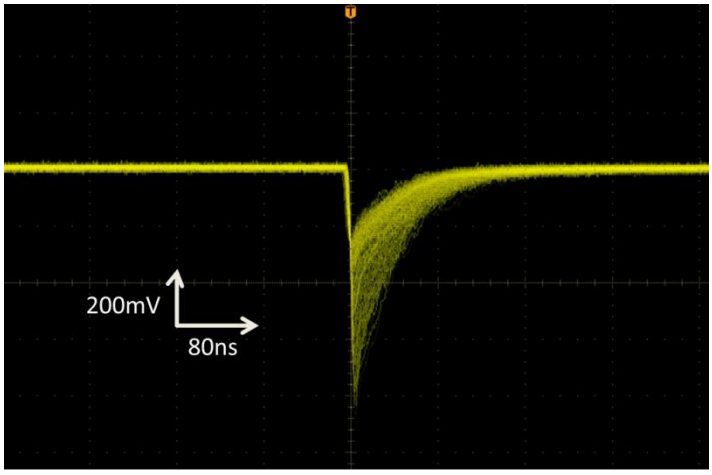

Fig2. signal from PMT

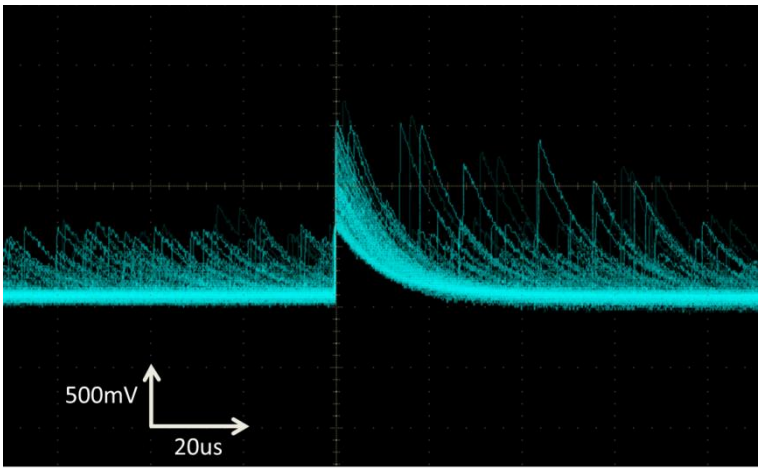

Fig3. signal from preamplifier

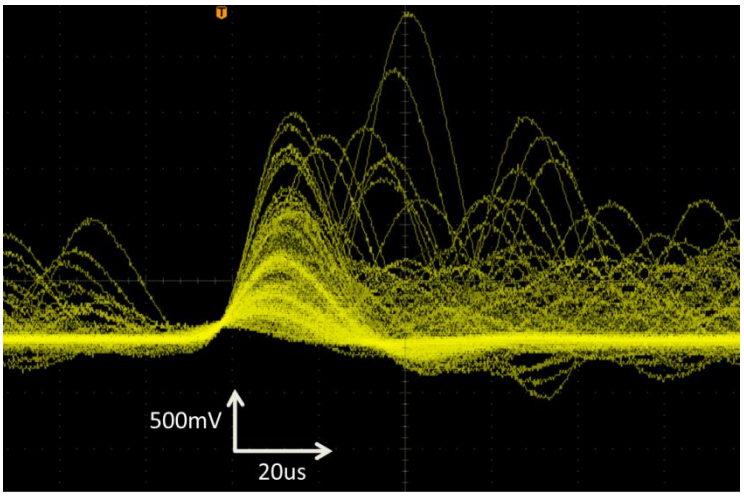

Fig4. signal from mainamplifier

4. Result

The gamma spectrum of ^{137}Cs is obtained over 50 minutes and the gamma spectrum of ^{22}Na is obtained over 60 minutes and the gamma spectrum of ^{60}Co is obtained over 60 minutes. These results are shown in Fig5.

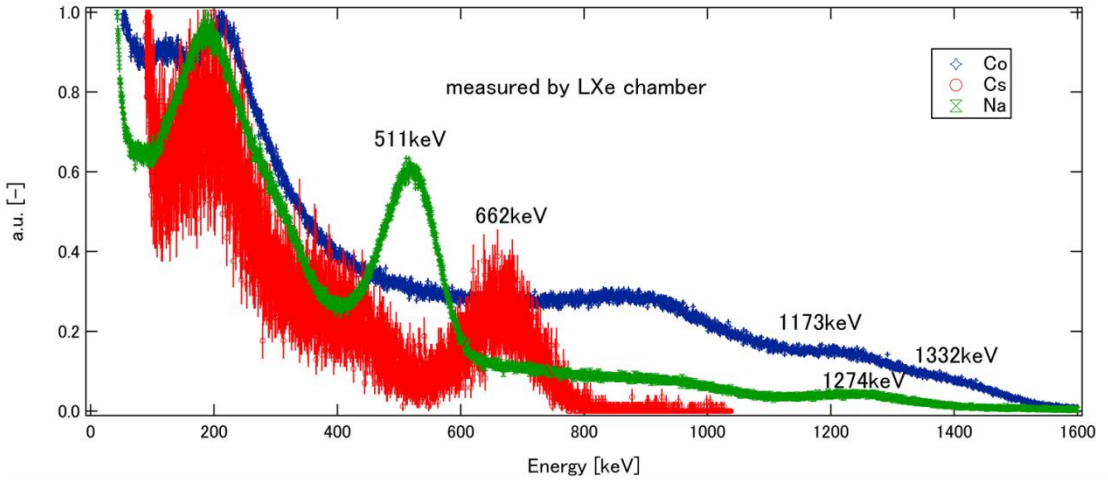

Fig5. Results of gamma(^{22}Na, ^{60}Co, ^{137}Cs) spectrum measurements

And, I calculated energy resolution from these results. Results of calculation are shown in the Table1.

Table1. Energy Resolution

source	Energy	Energy Resolution	error
Na	511	14.3%	0.683%
	1274	19.7%	3.70%
Cs	662	20.3%	19.5%
Co	1173	28.9%	14.7%
	1332	14.6%	8.91%

As shown in the Table1, I guess the errors of energy resolution is so large that results have no less reliable. In the future, I should consider how to fit the peak.