The DAQ (Data Acquisition) system for CDEX-1

- DAQ requirement
- The design of DAQ for CDEX-1
- DAQ test
- the running status of 20g ULEGe & anti-Compton system

CDEX Collaboration

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Purpose

This DAQ is for 20g-ULEGe/1kg-PPCGe & NaI(Tl) anti-Compton

- Record pulse shape
- Record the event time
- Synchronize all the VME modules
- Have a good reliably and stability

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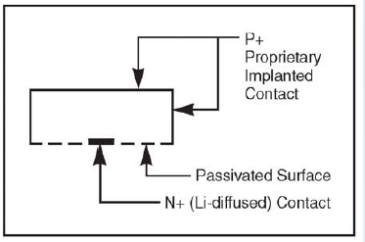
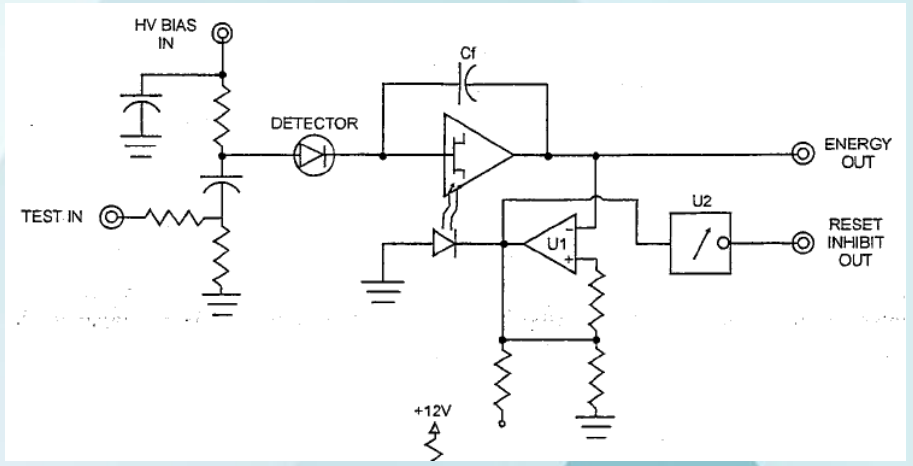
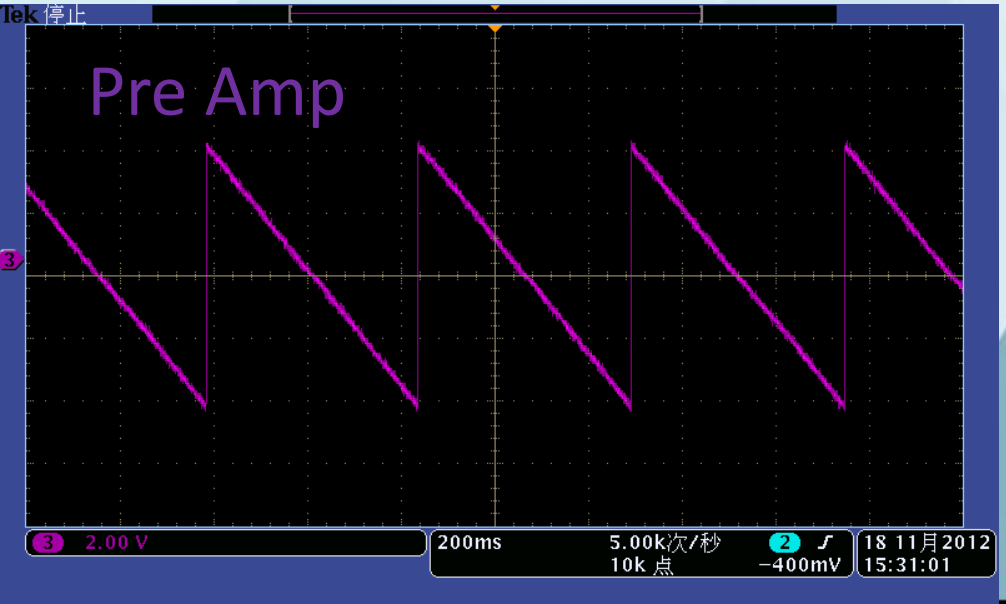
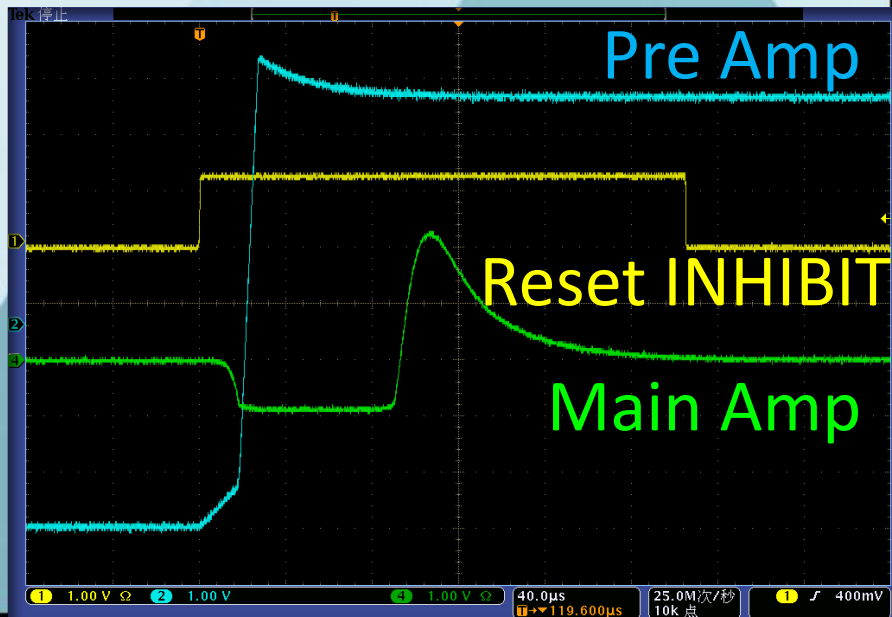
ULEGe: Ultra Low energy threshold Germanium
PPCGe: P-type Point Contact Germanium

20g ULEGe detector

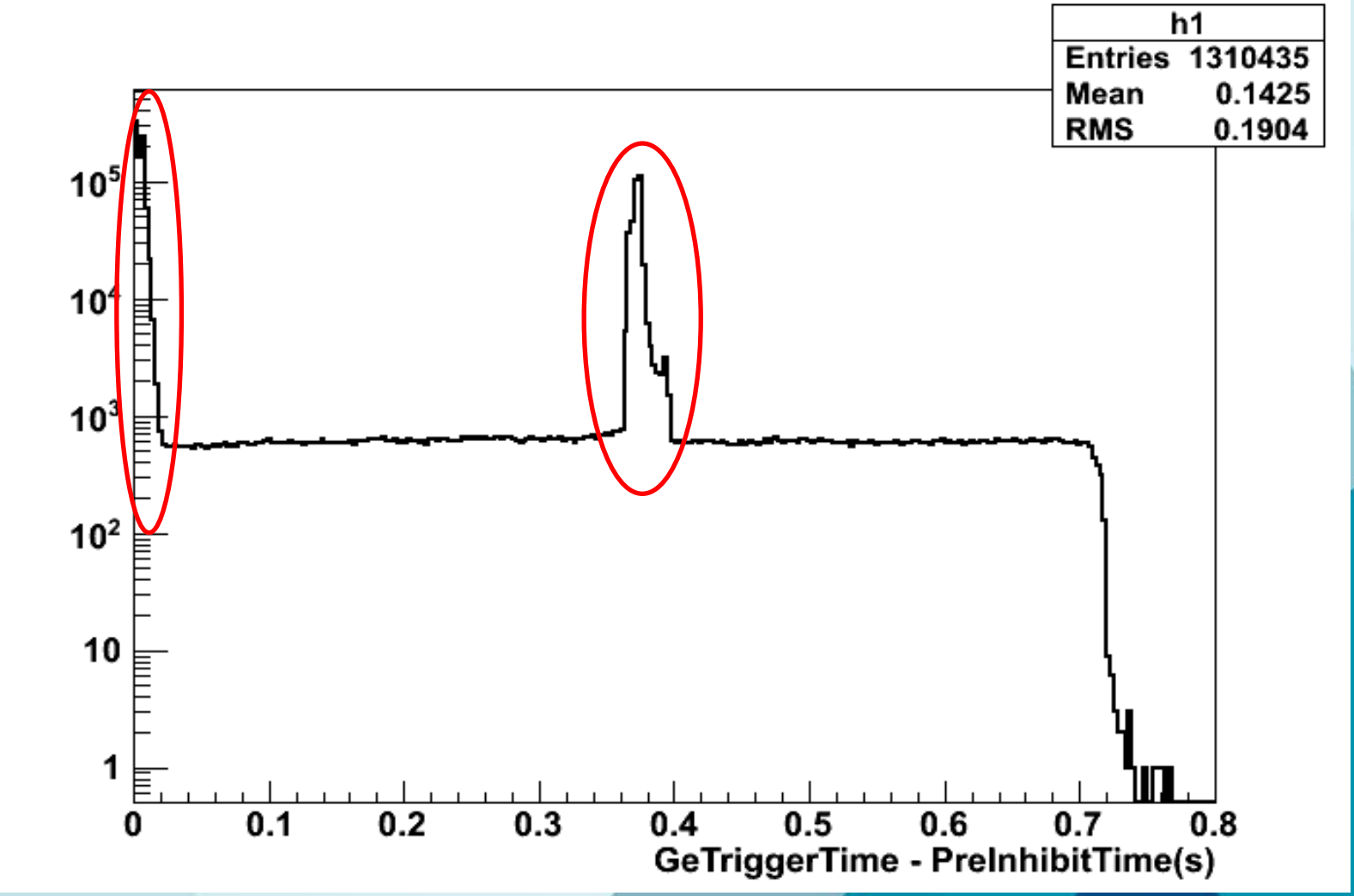




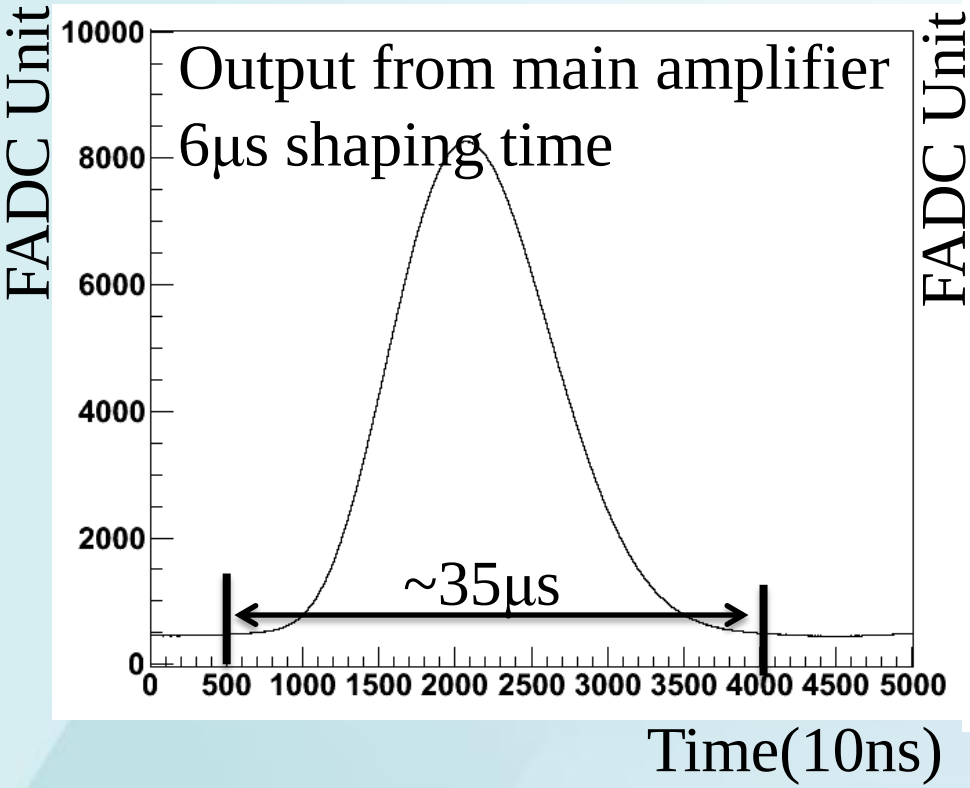


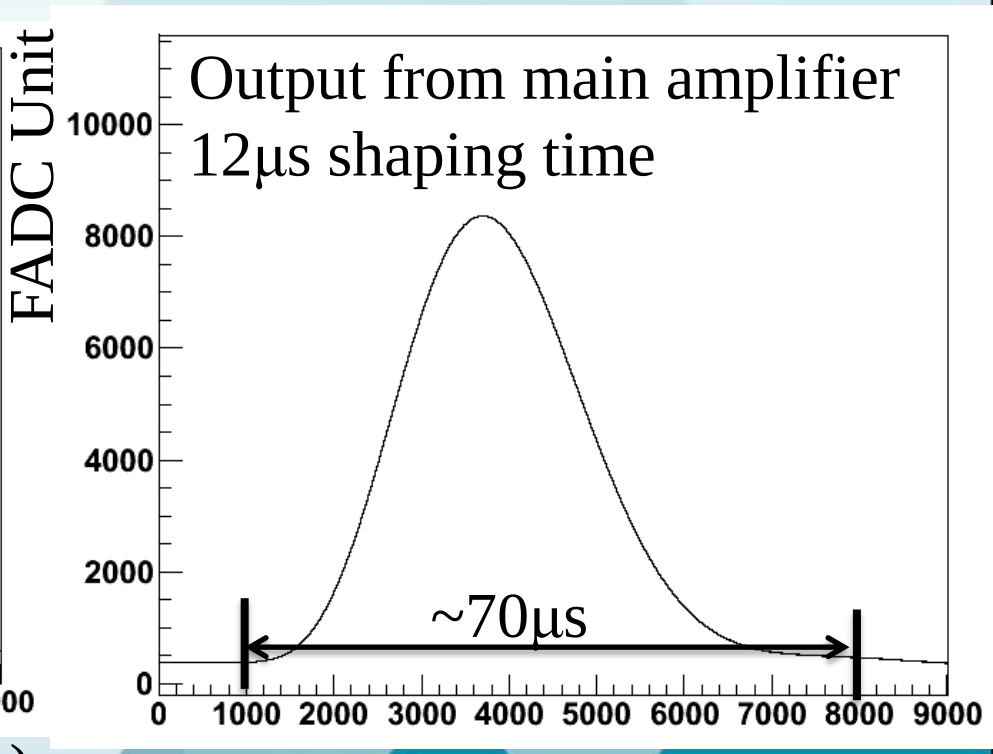


The time correlation between Ge trigger and Inhibit



20g ULEGe pulse shape from different shaping time configuration





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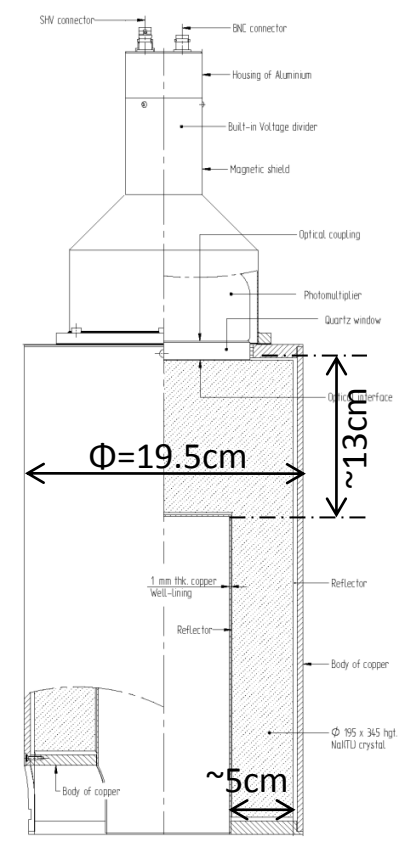
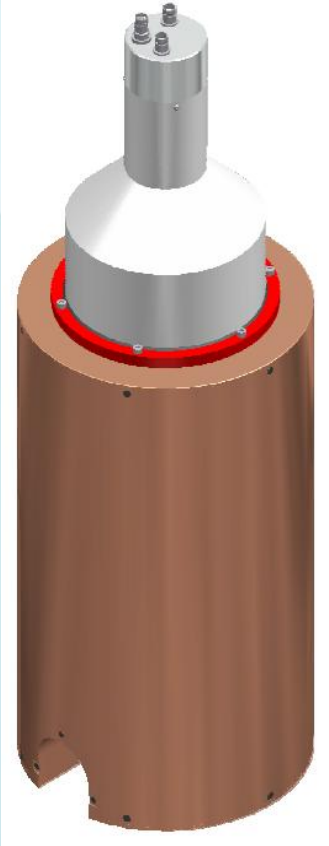
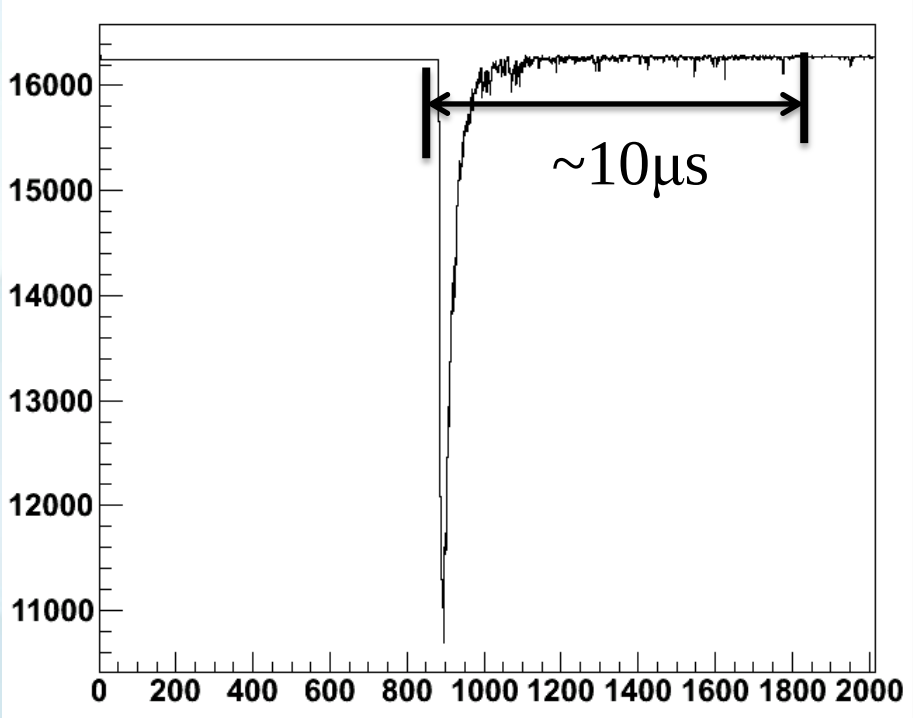
NaI(Tl) detector







- Weight: ~40kg

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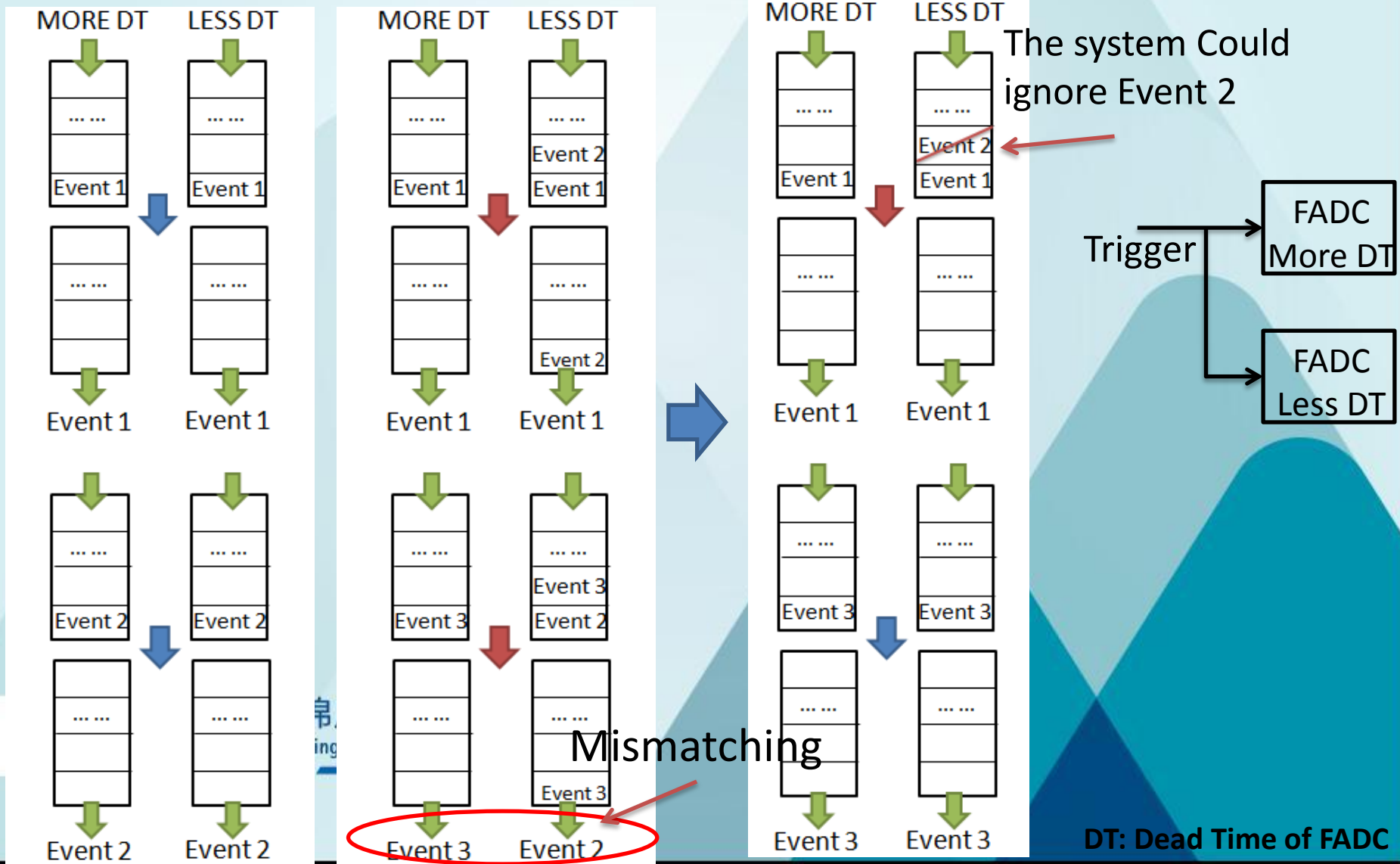
Mismatching phenomenon of different FADCs



Requirements

- pulse record: need different time window width FADCs
- Record some necessary time: the system tirgger, Ge trigger, NaI(Tl) signal, Reset Inhibit
- Synchronize all the modules

  a mechanism must be made to synchronize all the VME modules to record the same event at the same time

NIM modules

Amplifier

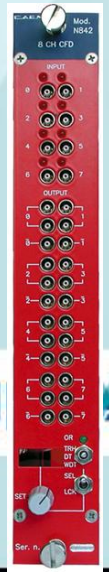
CANBERRA 2026
Spectroscopy Amplifier
Gaussian shaping

CANBERRA 2111
Timing Filter Amplifier

Timer

CAEN N93B
Dual Timer

Discriminator



CAEN N840/N842
Leading edge discriminator

Logic unit

CAEN N405
3 fold logic unit

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VME modules

FADC

CAEN V1724
8 channel 14 bit
100MHz Digitizer

TDC

CAEN V1290N
16 channel Multihit TDC
52µs full scale range
25 ps precision
32k * 32bit output buffer

Scaler

CAEN V560N
16 Channel scaler
32 bit deep counting channels
100MHz counting frequency

I/O Register

CAEN V262

VME Controller

CAEN V2718
VME-PCI Optical link bridge

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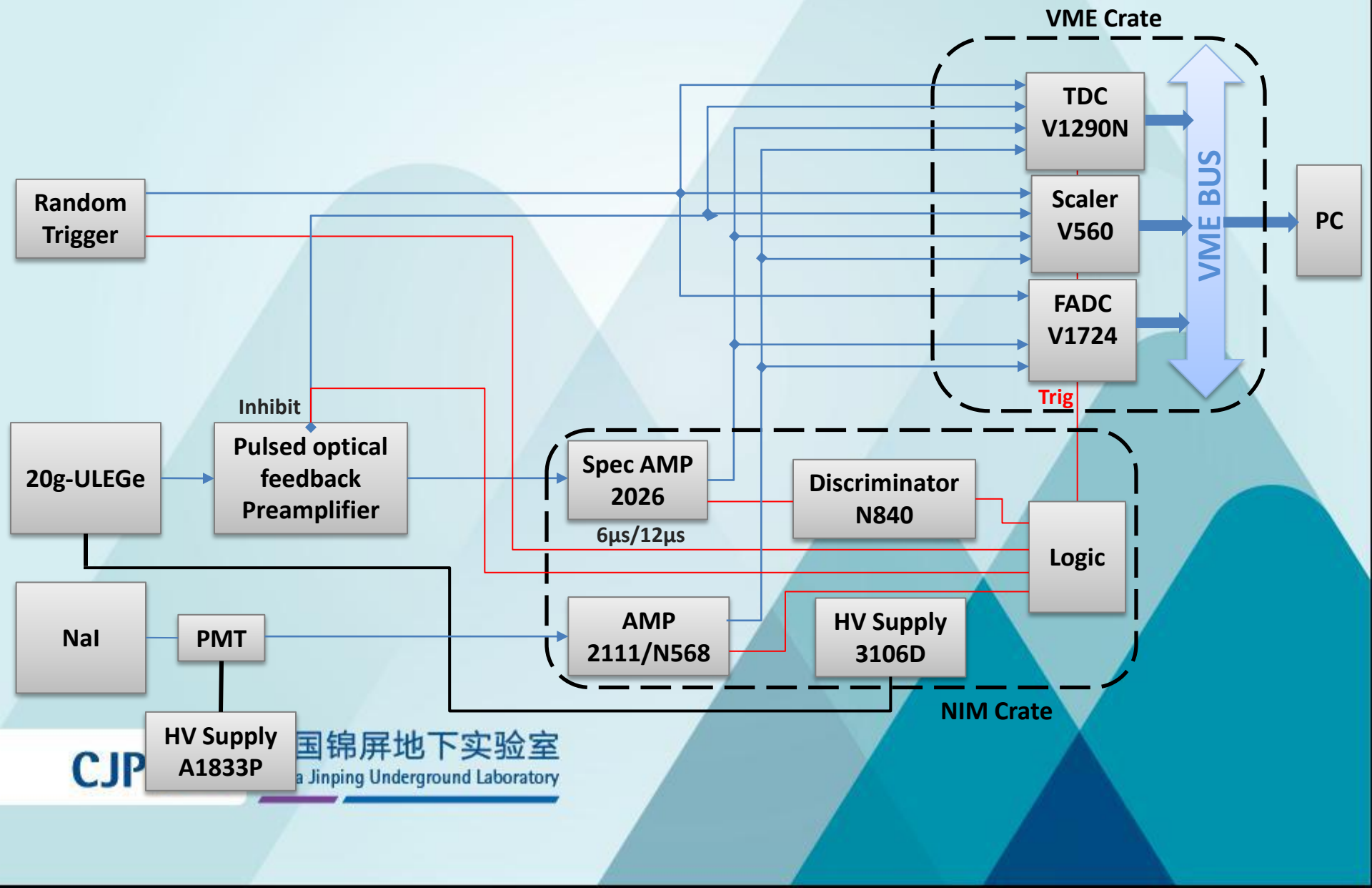
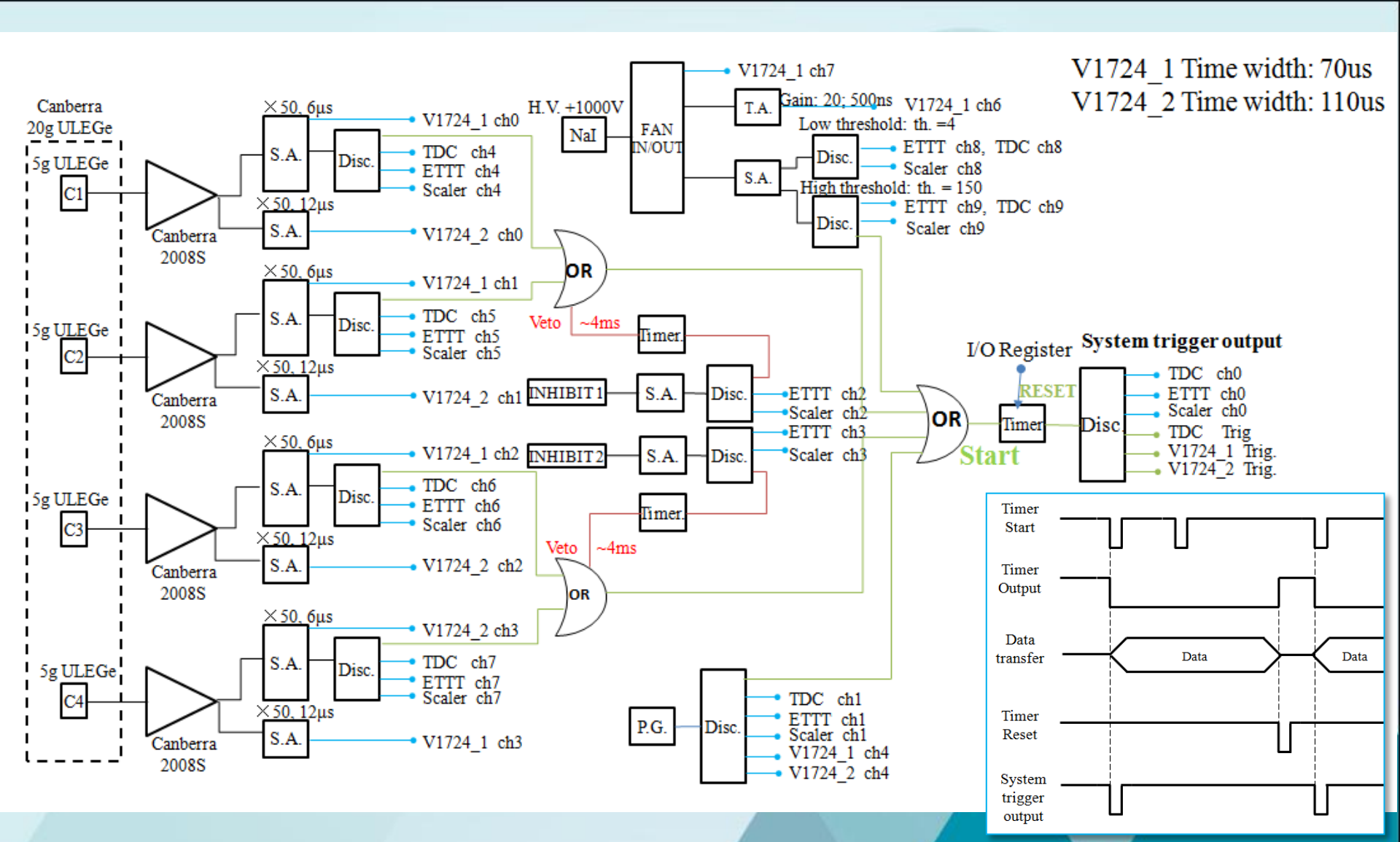
The DAQ for 20g ULEGe with anti-Compton detector





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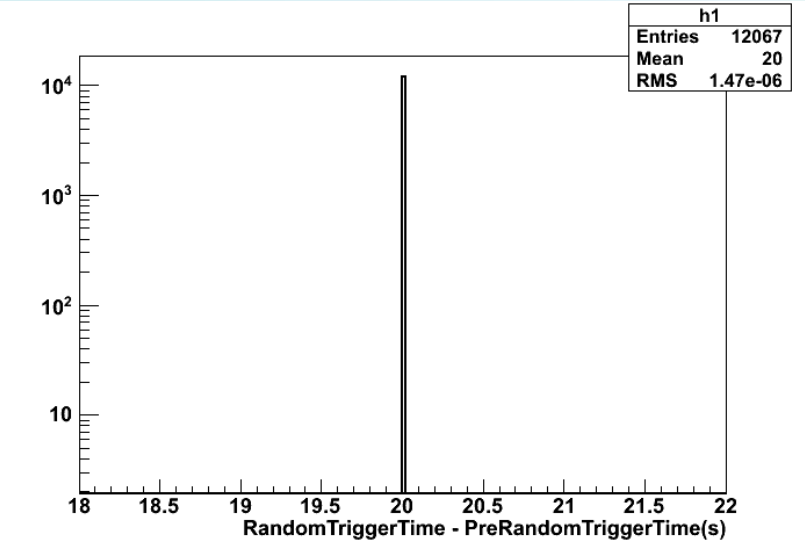
S.A.: shaping amplifier CANBERRA 2026
Disc.: discriminator
Timer: N93B
P.G.: Pulse generator
ETTT: Extended Trigger Time Tag TDC

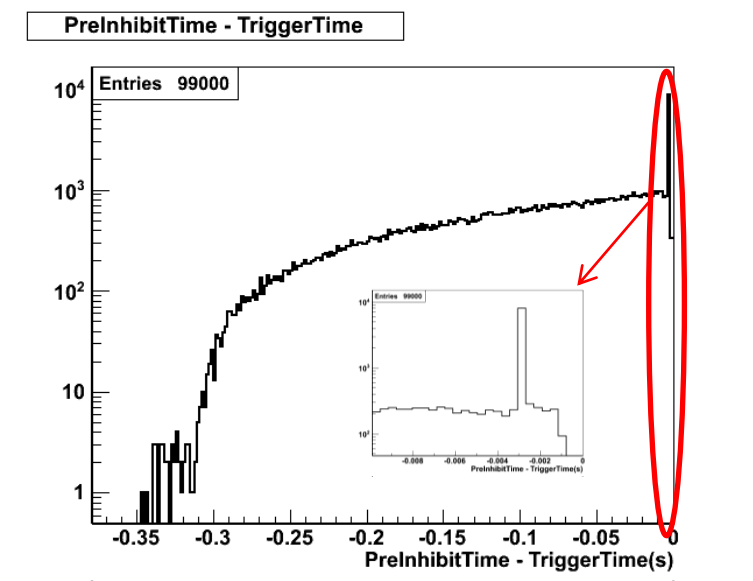
Time recording

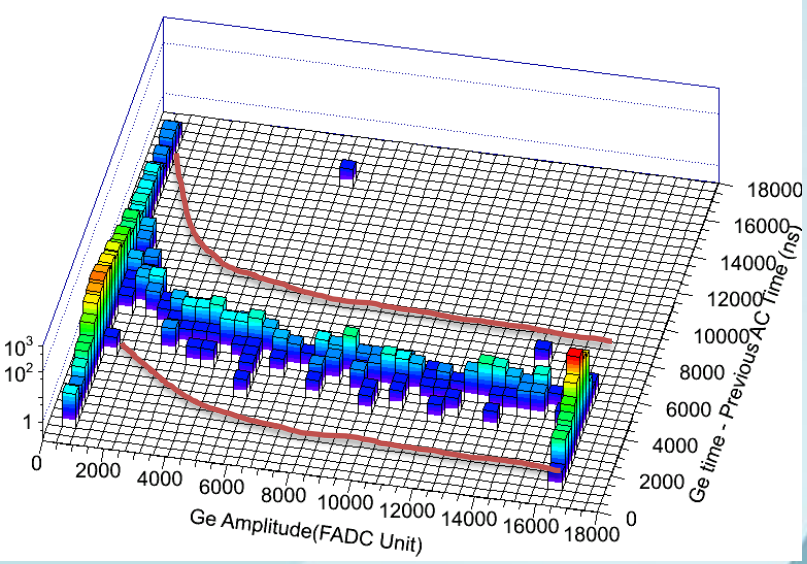
	Module type	Time precision	Need system trigger?	Recording time range
Computer	Computer	~ms	Yes	System trigger time
FADC	V1724	20ns	Yes	System trigger time
TDC	V1290N	25ps	Yes	Hits between 51μs before trigger time and 1μs after trigger time
ETTT	V1290N	800ns(25ps)	No	Full time scale range

The DAQ test results for 20g ULEGe & AC

- The test results for time recording

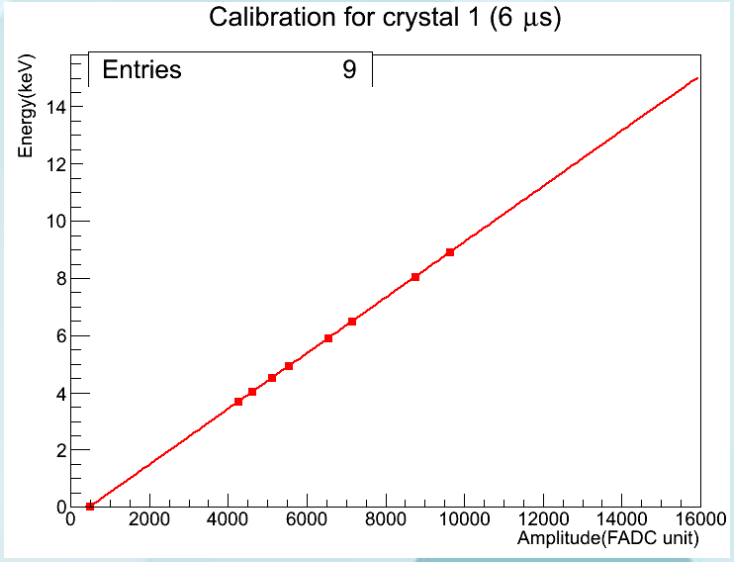


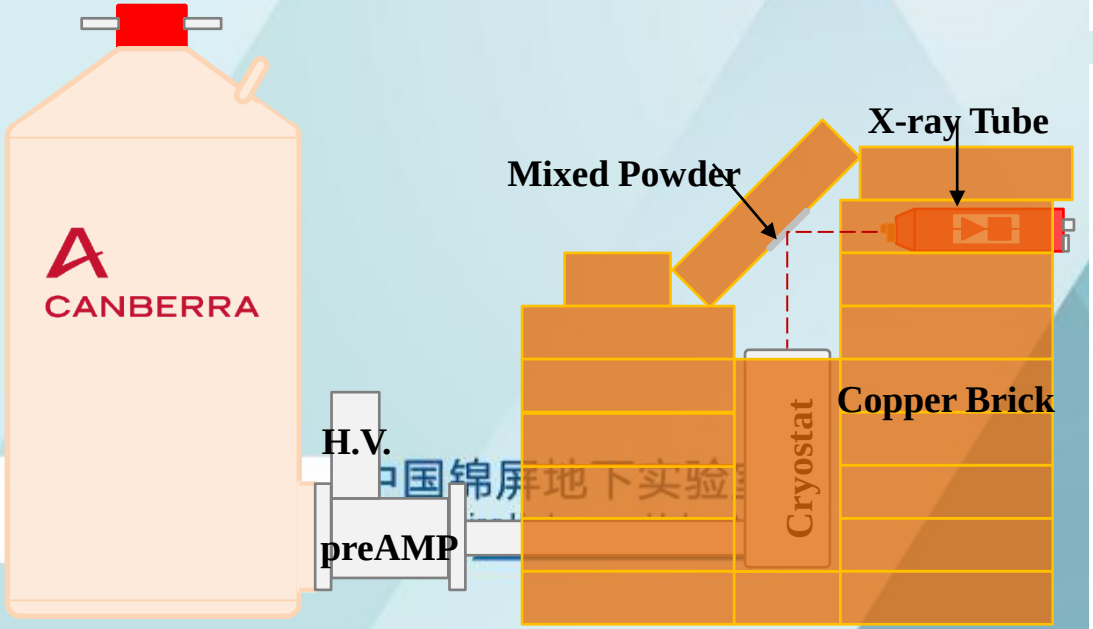


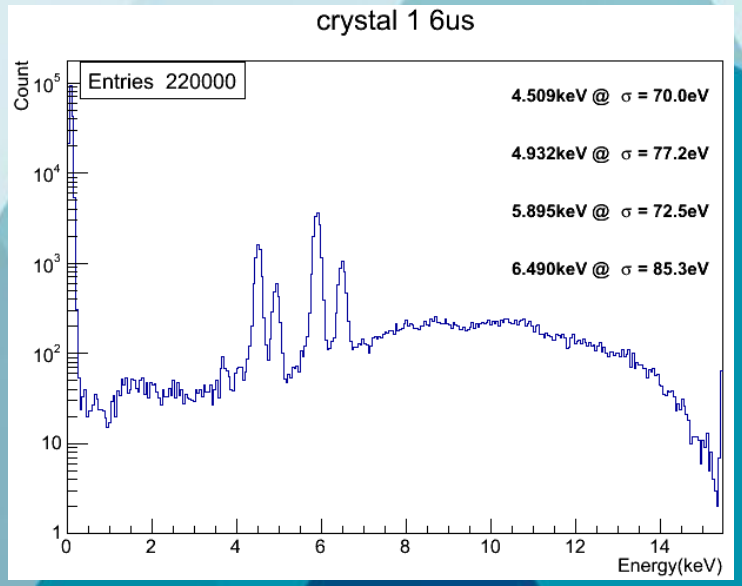


Detector Calibration

	E/keV
RT	0
Ca	3.69
	4.01
Ti	4.51
	4.93
Mn	5.90
	6.49
Cu	8.05
	8.90

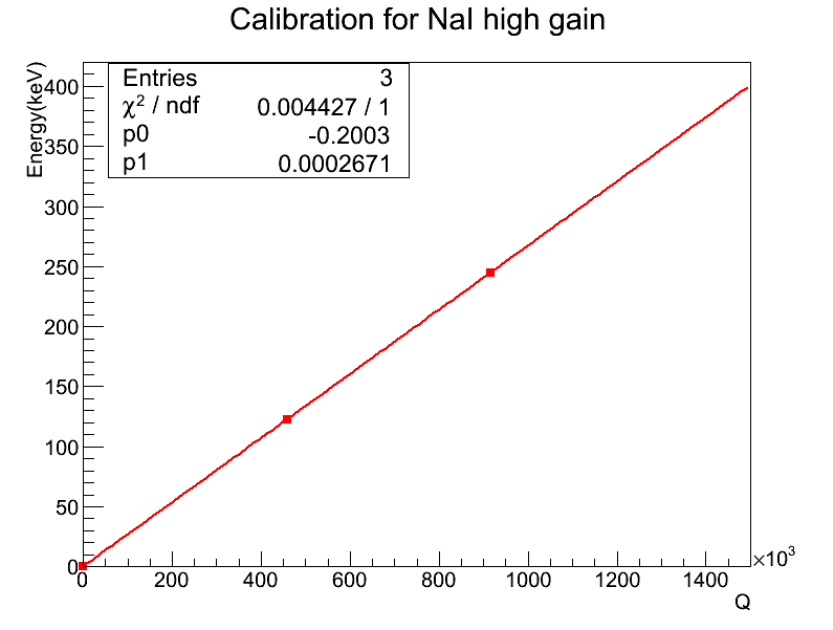


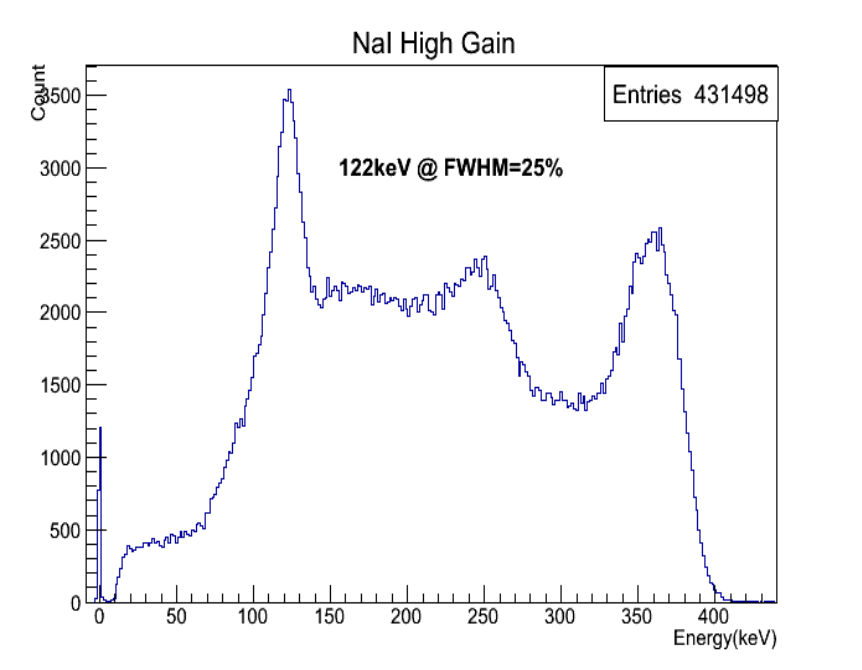




NaI(Tl) Detector Calibration

^{152}Eu sample





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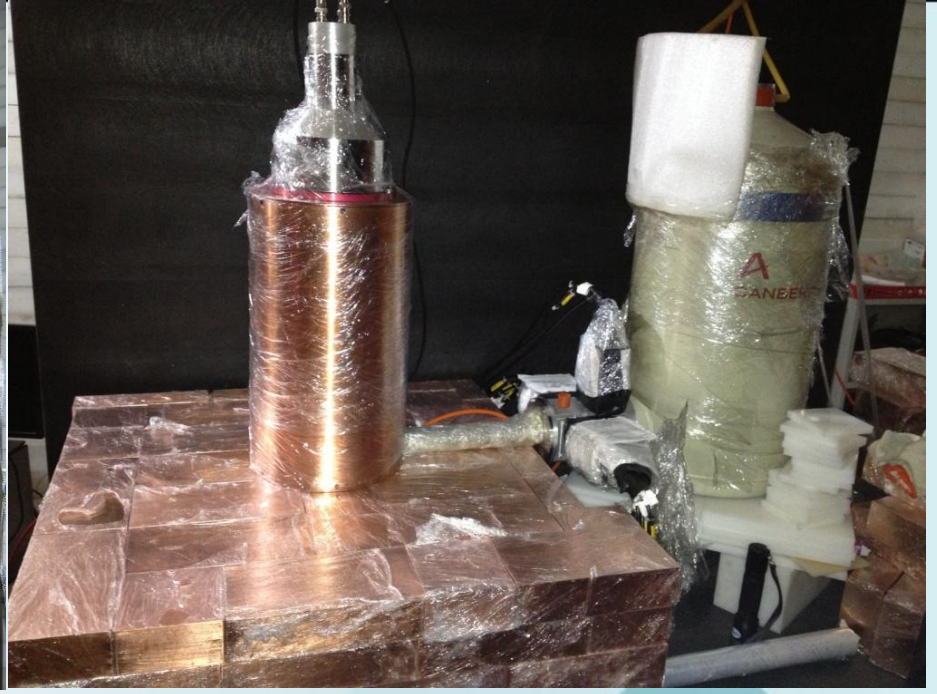

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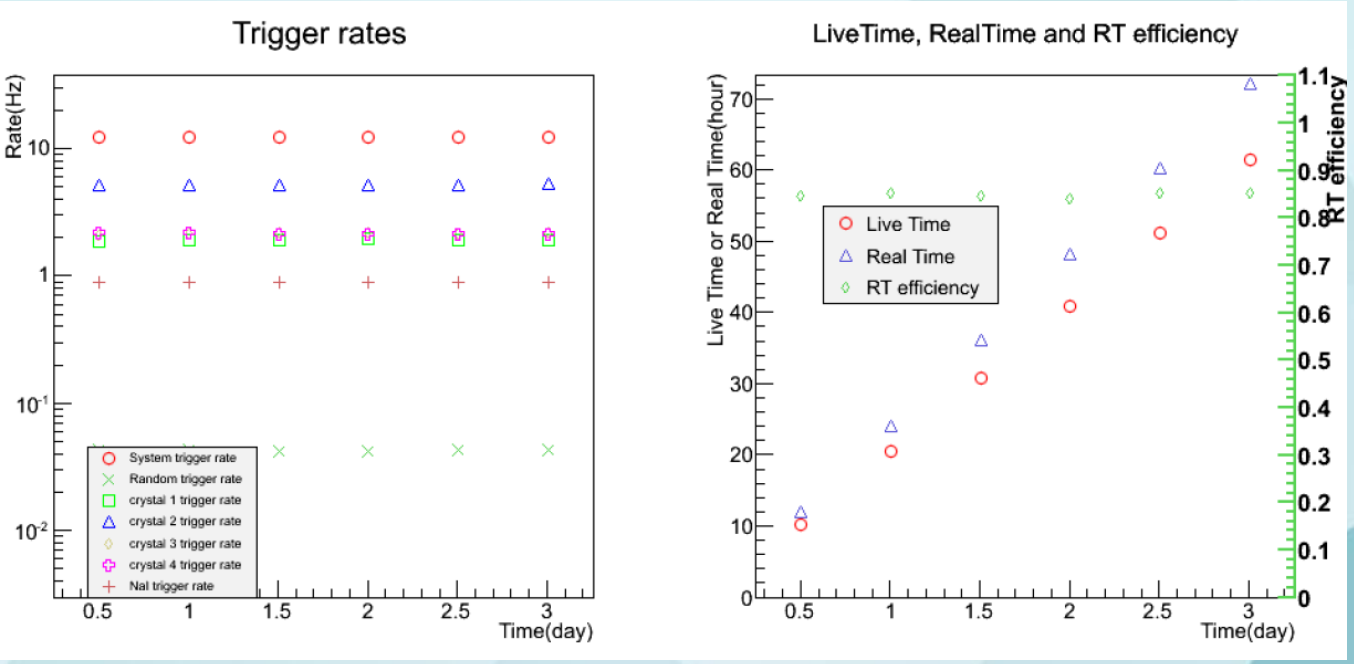
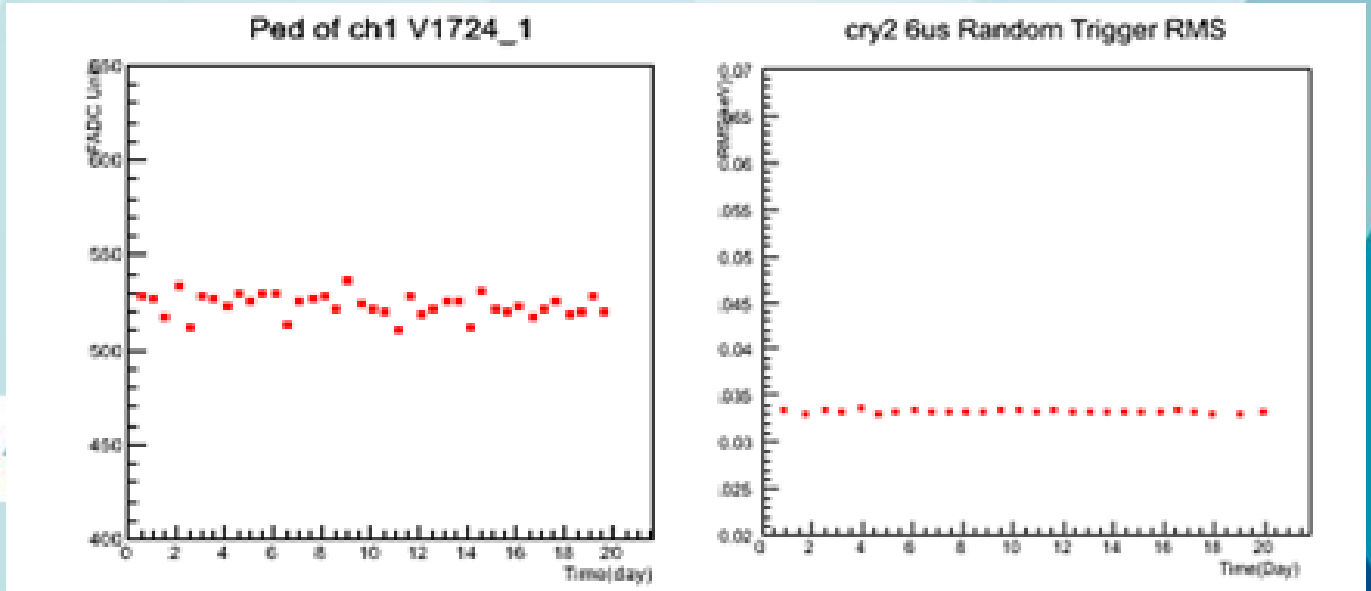
DAQ and data monitor





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Summary & outlook

- The new DAQ system for Ge & AC has been set up
- Set up the DAQ system for 1kg PPCGe & anti-Compton detector.
- Upgrade the DAQ system (FPGA)

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Thanks for your attention!

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