

CDEX-10 test results

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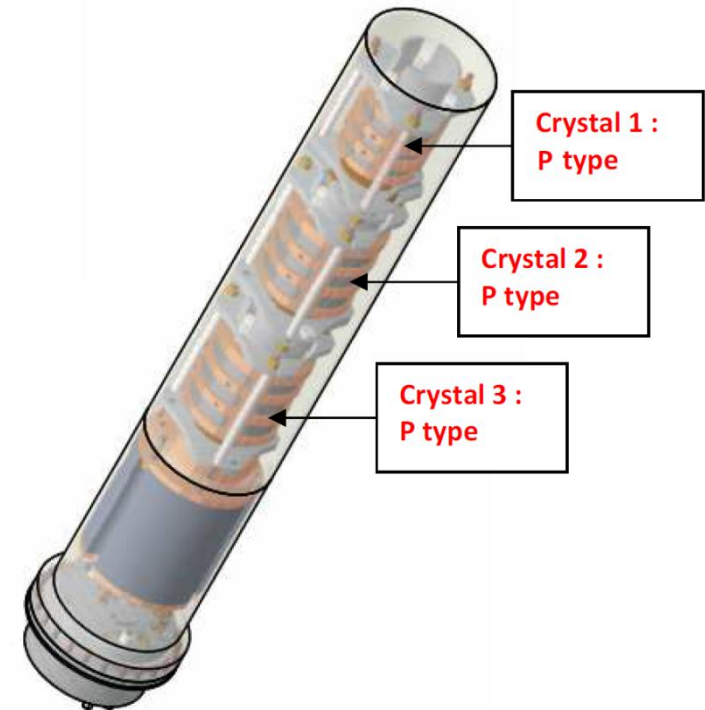
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China Jinping Underground Laboratory



Outline

- Introduction of CDEX-10 detectors
- Shielding and Facilities
- Performance of the detectors
- Summary

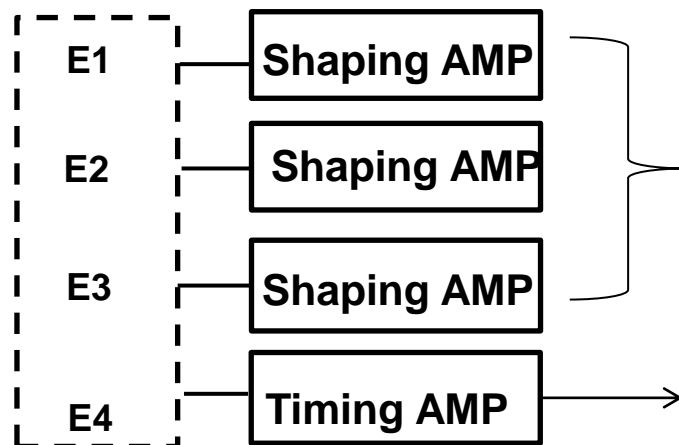
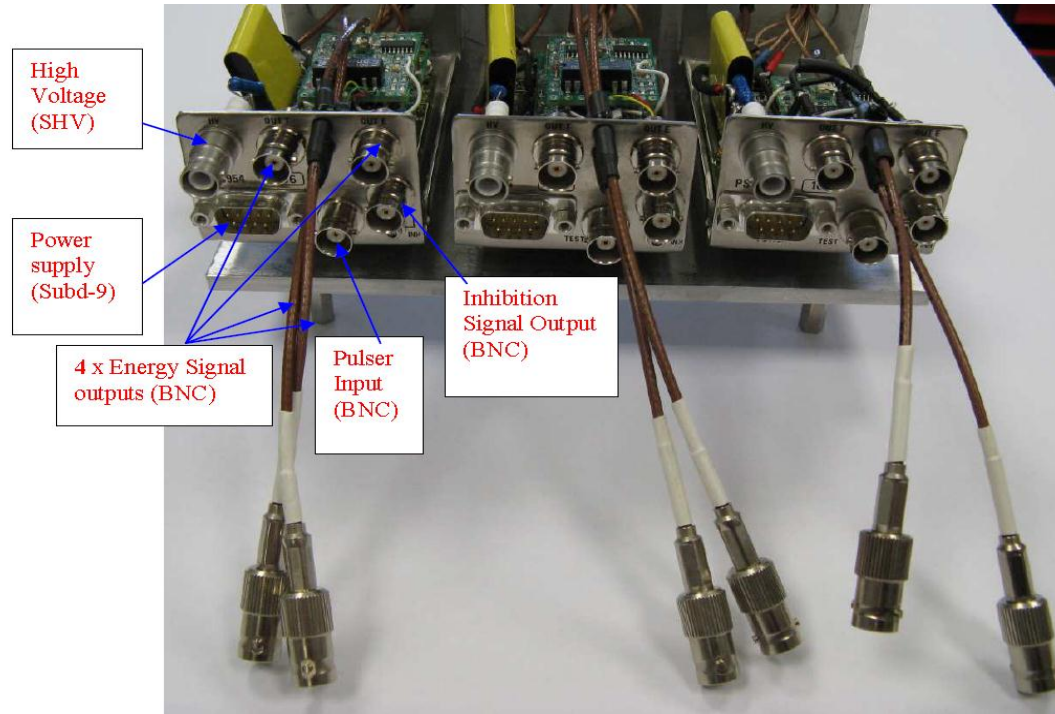
Introduction of CDEX-10 detectors



- Three strings of PCGe detectors.
- Three PCGe detectors of each string.
- Developed from CDEX-1B detector.
- Crystal type: 8 p-type 1 n-type
- Geometry: $\phi 62 \times 62$ mm(p-type)
 $\phi 50 \times 50$ mm(n-type)

- Crystals were encapsulated into the copper vacuum tube.
- Totally immersed by LN₂/Lar

Introduction of CDEX-10 detectors

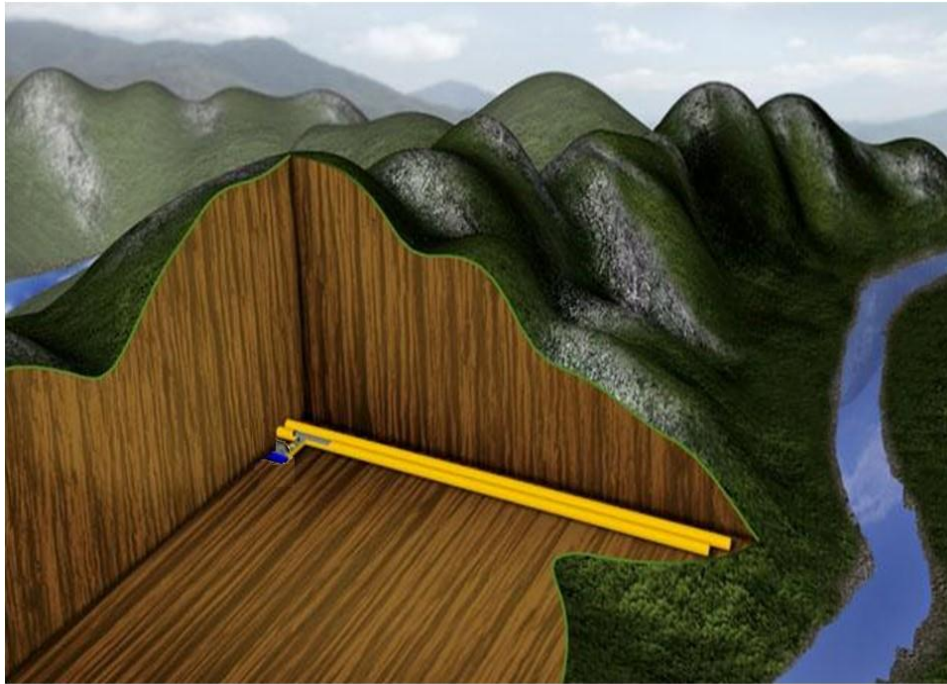


At different gains to cover different energy ranges

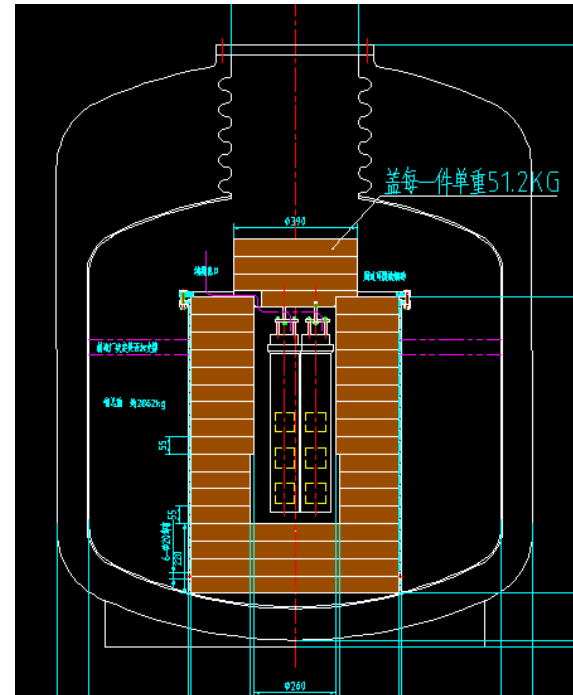
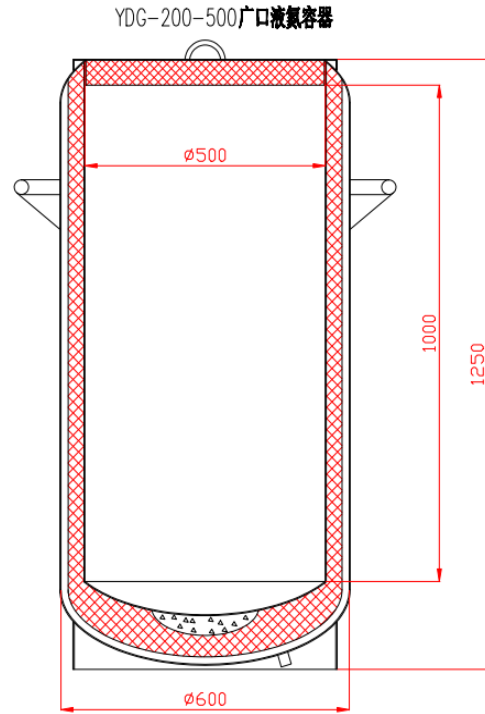
Get more information (eg. rise-time) from the raw pulses.

Shielding and Facilities

- 1、2400m of rock overburden in CJPL
- 2、1m thick PE room



Shielding and Facilities



Two tanks:

a small tank with no copper shielding

a big tank with 20 cm thick copper shielding

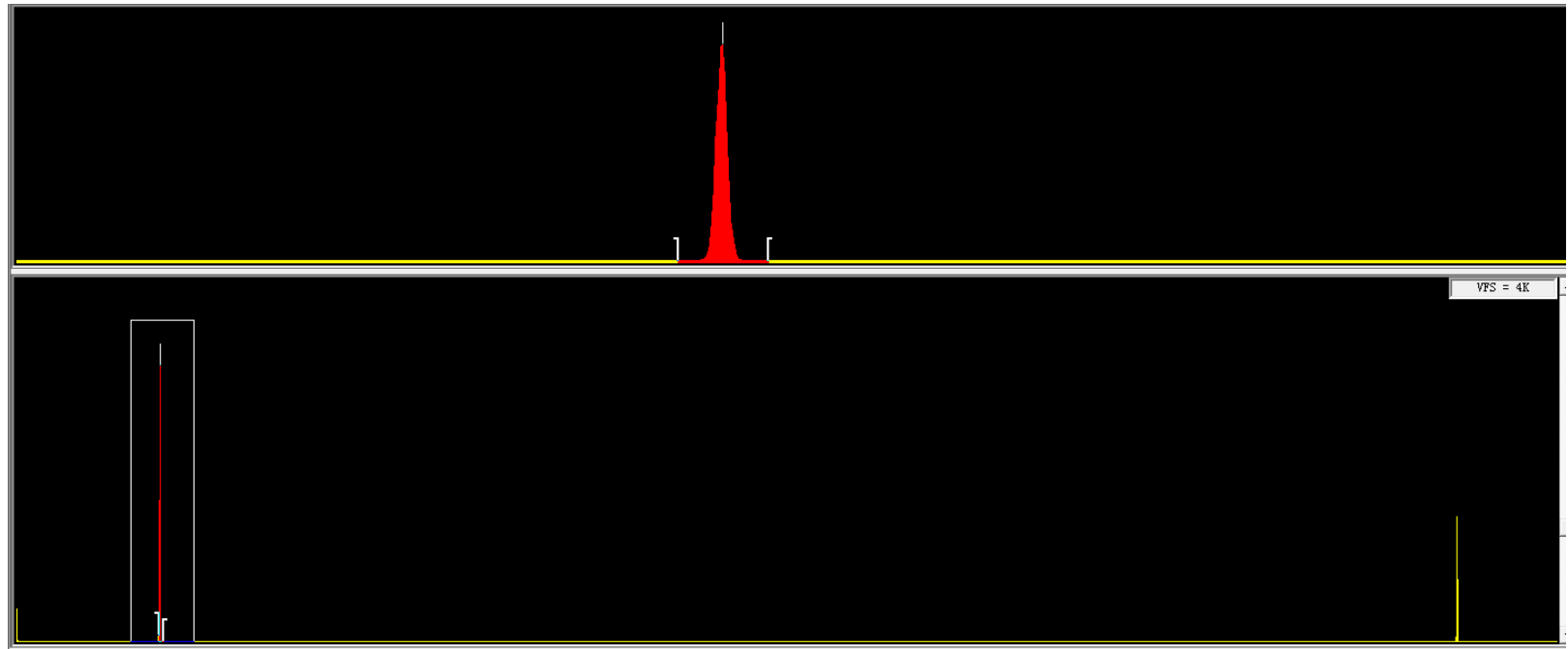
Three steps of test:

small tank & outside PE room: test the pulser and source resolution

big tank & outside PE room: test the performance of detector in low background

big tank & inside PE room: compare the result

Performance of the detectors in small tank outside the PE room



Crystal	1	2	3
Pulser result in CJPL (eV)	<100	<100	<100
FWHM at 662keV(keV)	1.4	1.5	1.7

A 814FP signal generator was used to test the pulser resolution.

Then, the detector was moved to the big tank.
Crystal-2 and Crystal-3 will do some adjustments in preamplifiers
Crystal-1 worked well.
We got some test results of Crystal-1 detector.

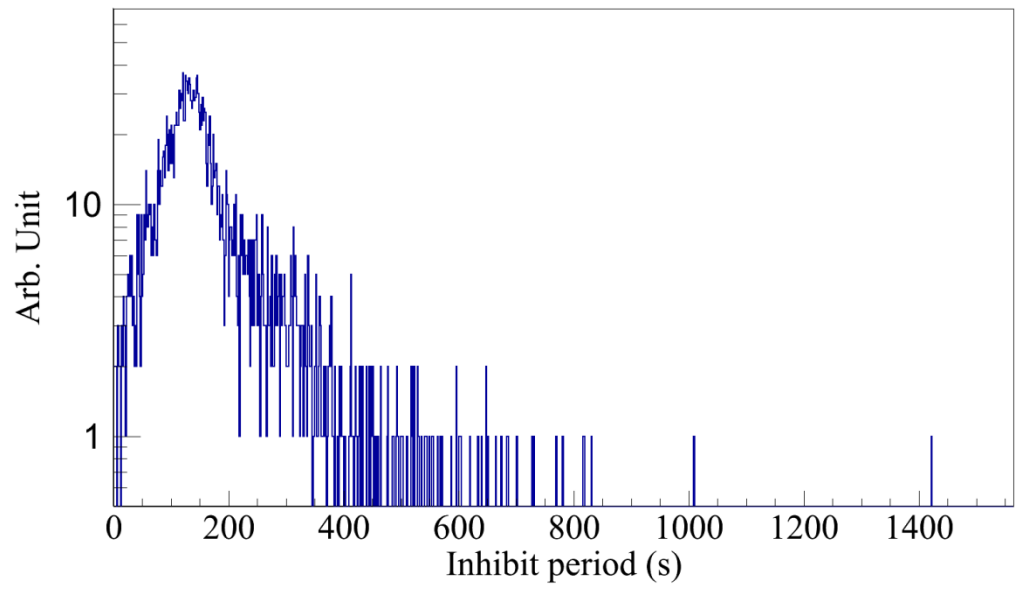
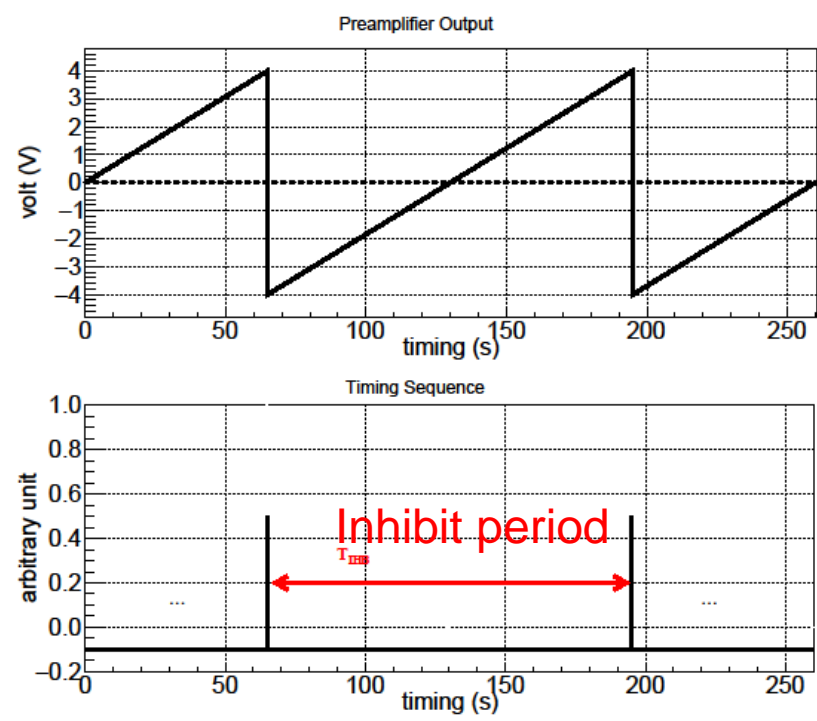
System Installation



Two copper cylinders were used to keep balance.
Three holes at the top of the copper shielding
were used to put the source inside.

Performance of the detectors in big tank outside the PE room

The inhibit period of Crystal-1 detector

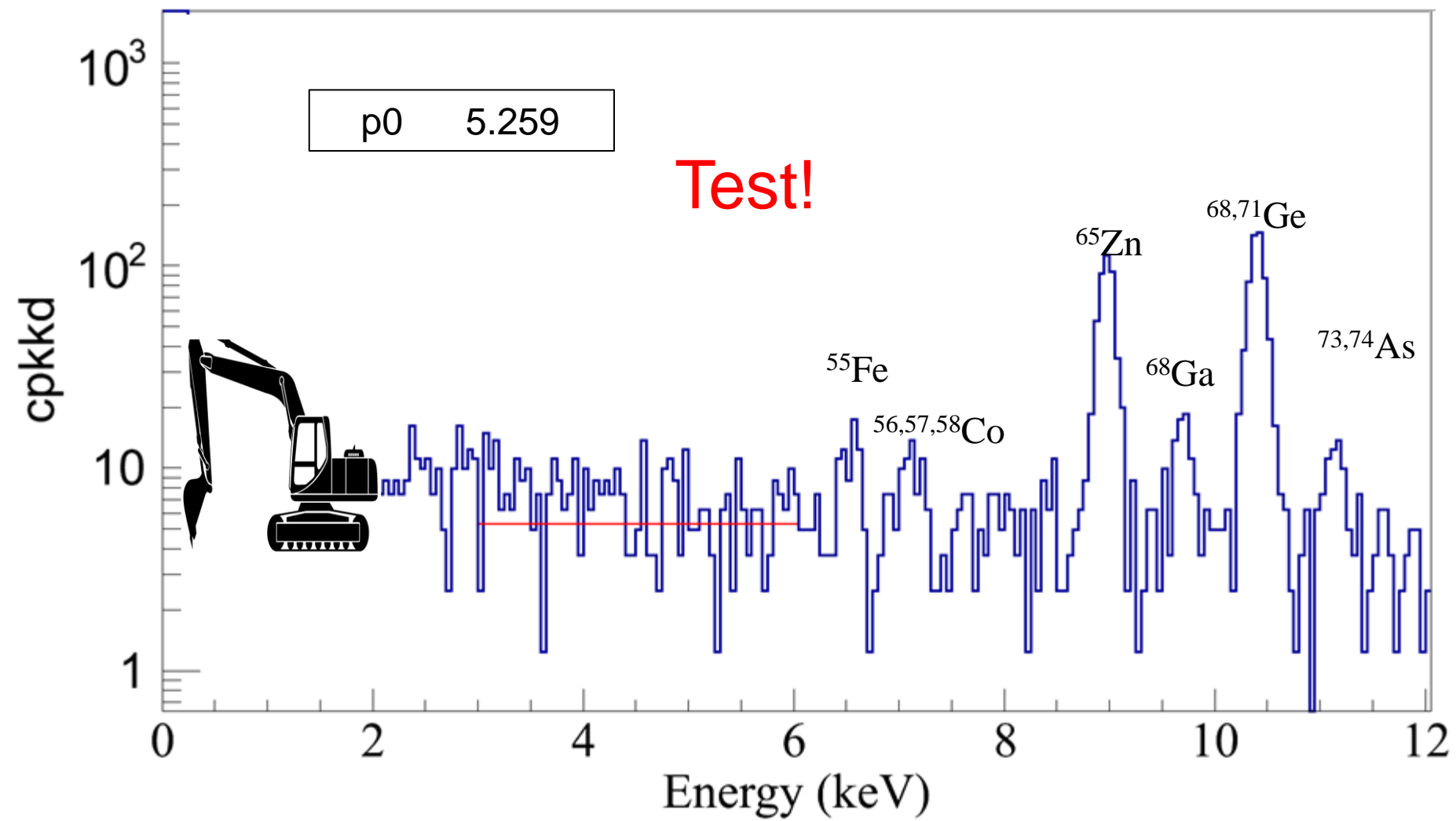


Detecotr	C1A	C1B	CDEX10*
inhibit period/s	~1	~0.5	~130

*Crystal-1 of CDEX-10 detector

Performance of the detectors in big tank outside the PE room

The background level of Crystal-1

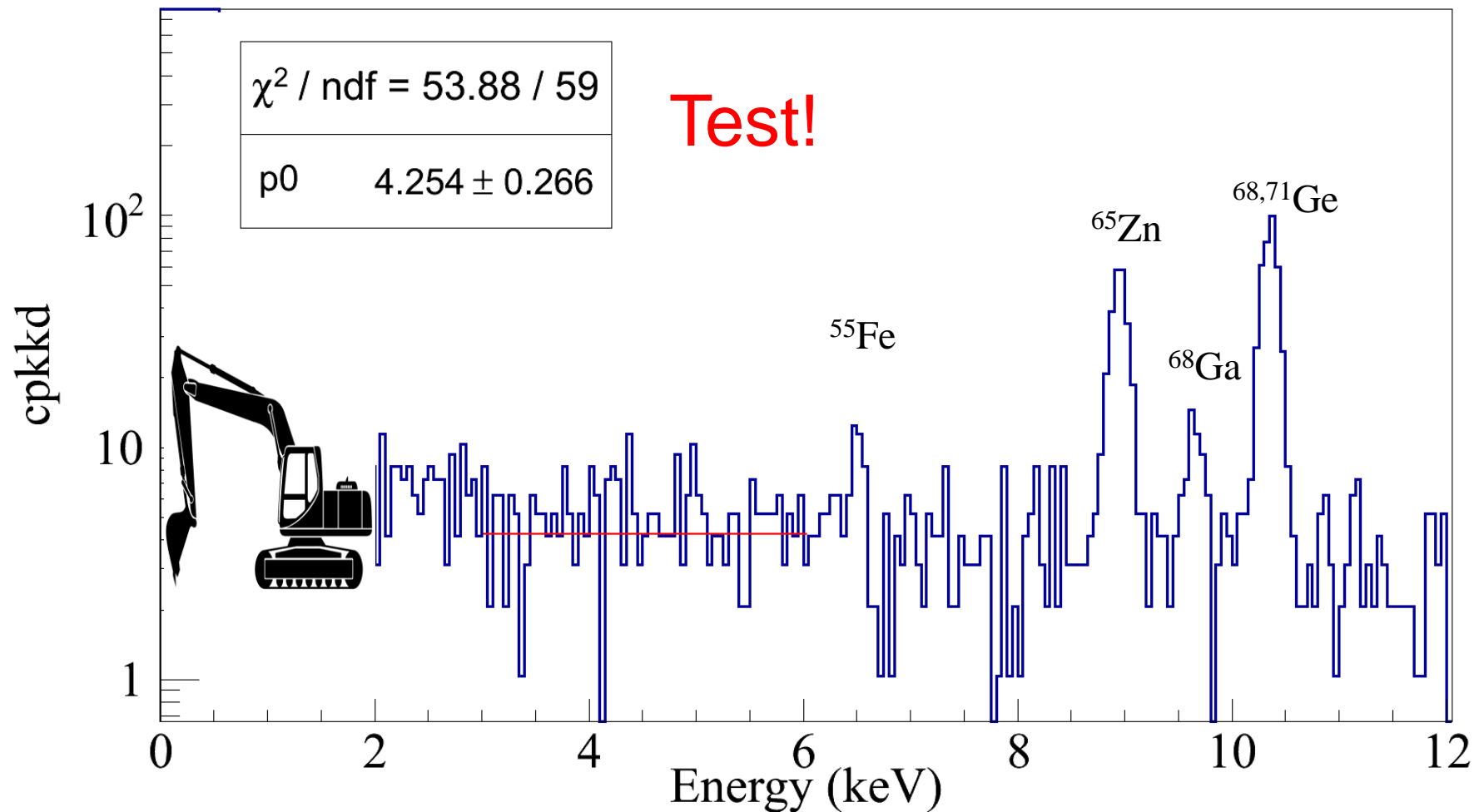




The big tank was moved to the PE room in May 2015.

Performance of the detectors in big tank in the PE room

The low energy spectrum of Crystal-1

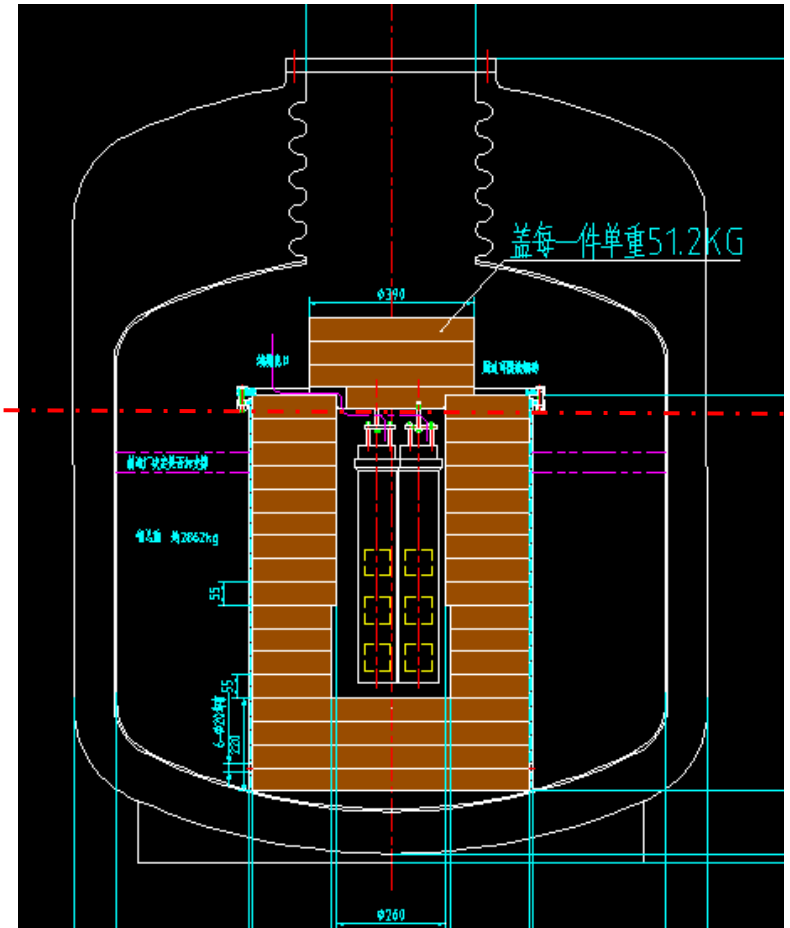
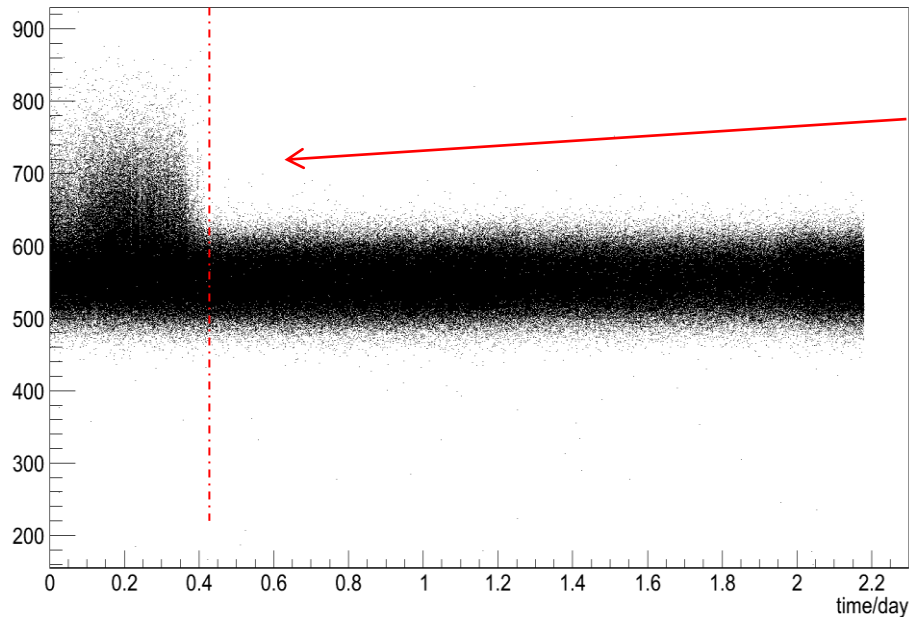


Detector	Background level at 3~6keV without AC detector (cpk/d)	Background level at 3~6keV with AC detector (cpk/d)	Pulser resolution/eV
C1A	~8	~5	~150
C1B	~8	~5	<100
CDEX-10*	~4.3		<100

*Crystal-1 of CDEX-10 detector

Performance of the detectors in big tank in the PE room

The pedestal distribution with time



While the liquid nitrogen evaporate to a certain level, the noise decreased.
A cryogenic refrigerator was used to maintain the liquid nitrogen level.

Summary

- 1、 The pulser resolution is $\sim 100\text{eV}$.
- 2、 The inhibit period of Crystal-1 is about 130 seconds.
- 3、 The background level of Crystal-1 in a 20cm copper shielding outside PE room is $5.3\text{ cps}@3\sim 6\text{keV}$.
- 4、 The background level of Crystal-1 in a 20cm copper shielding in the PE room is $4.3\text{ cps}@3\sim 6\text{keV}$.
- 5、 The level of liquid nitrogen affect the noise of the detector.

Thanks!