

IACHEC 2012, Napa, California
26th - 29th of March 2012

HXMT/LE development and calibration status

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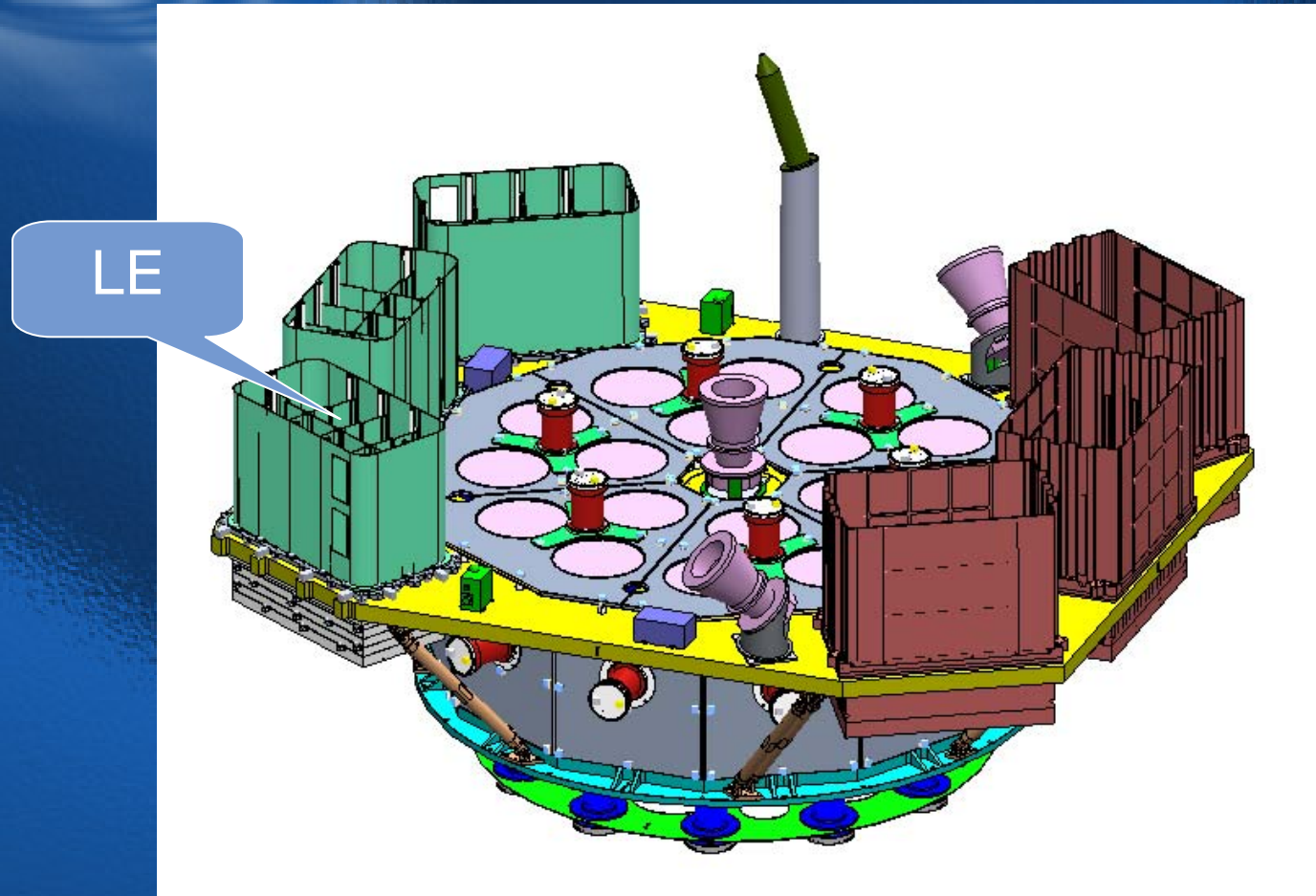
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Outline

- ◆ Introduction of LE
- ◆ Calibration of LE
 - PSF (Point Spreading Function)
 - RMF (Redistribution Matrix File)
 - Radiation damage
- ◆ Summary

1. Introduction of LE

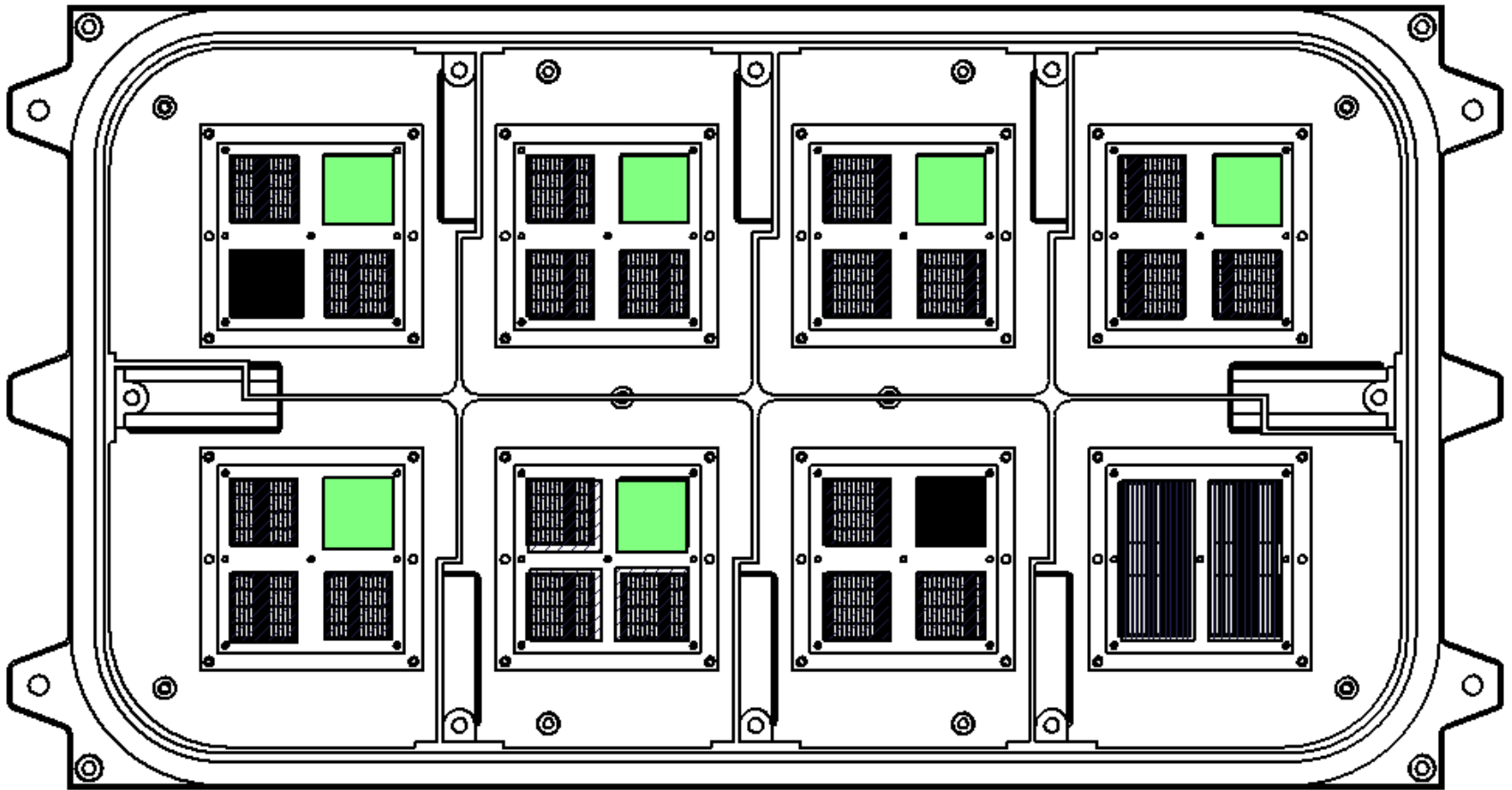






Scientific objectives of LE

- ◆ High energy resolution soft X-ray all sky survey as well as the Galactic plane survey.
- ◆ Cosmic X-ray background.
- ◆ Spectral and timing study of X-ray binaries and AGNs together with HE and ME.

Parameters of LE

- ◆ **Detector: SCD (Swept Charge Devices)**
- ◆ **Energy range: 1-15 keV**
- ◆ **Detector area: 384 cm²**
- ◆ **Energy resolution: FWHM 150 eV @5.9 keV**
- ◆ **Time resolution (frame readout time): 1 ms**
- ◆ **FOV: 1.6° × 6° ; 4° × 6° ; 63° × 3° ; blind field**
- ◆ **Total mass: 111 kg**
- ◆ **Total power consumption: 120 W**
- ◆ **Detector operating temperature: -42°C ~ -80°C**
- ◆ **Data rate: 3 Mbps**
- ◆ **Mission lifetime: 4 years**



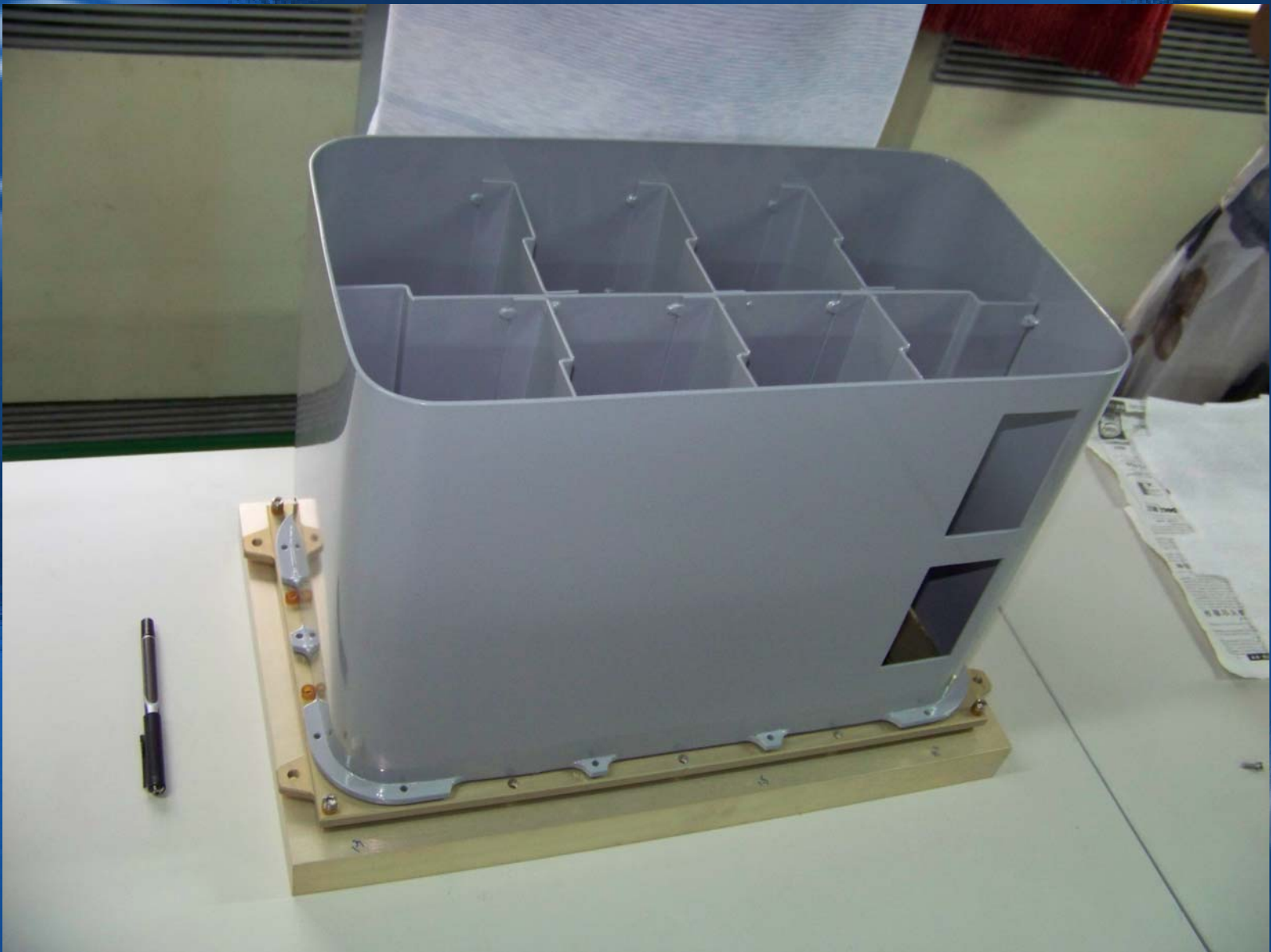
-  : 1.6*6 FOV
-  : Blind field
-  : 4*6 FOV
-  : 63*3 FOV

The FOV of LE collimators

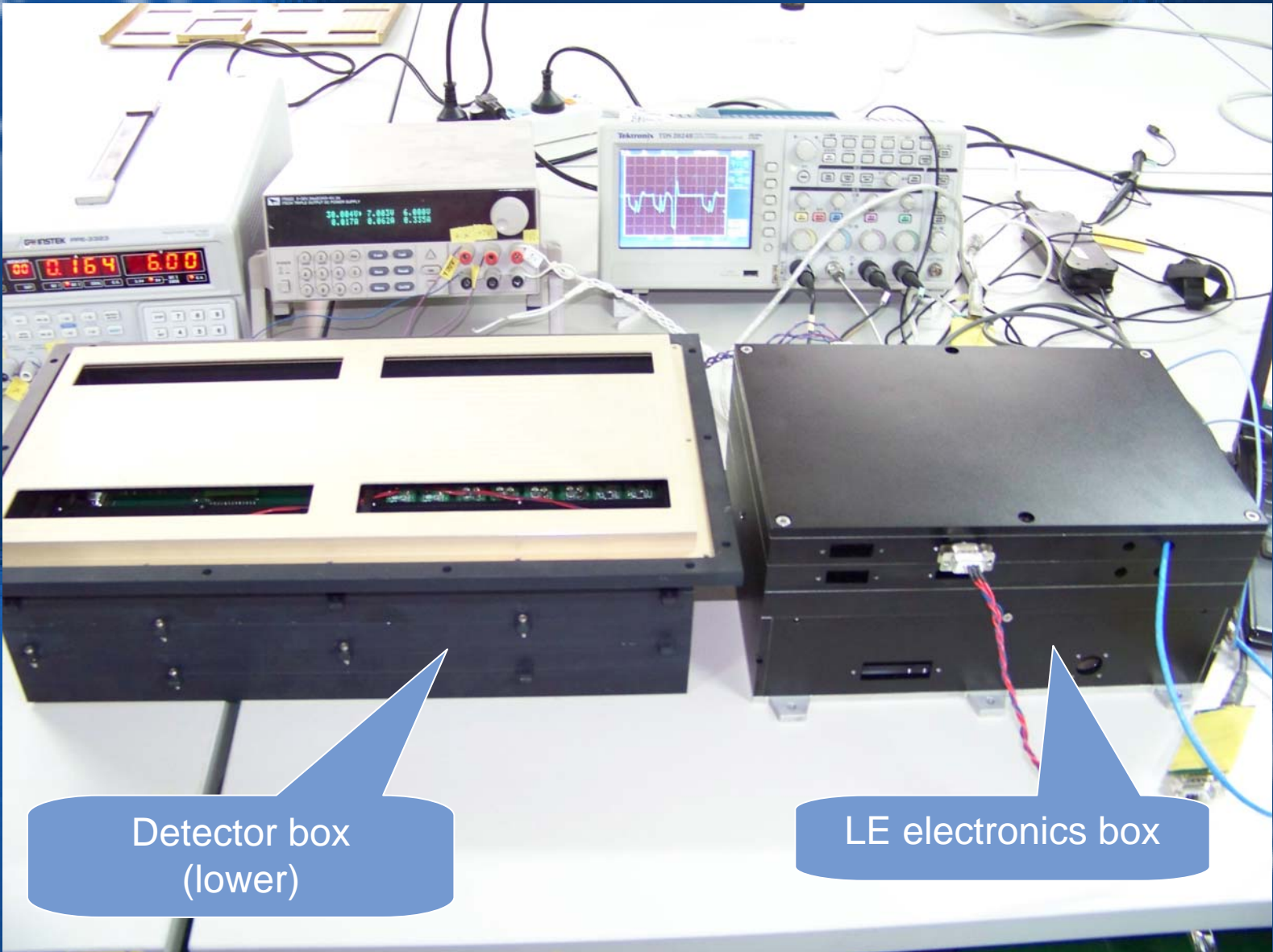
Grasp of LE compared to other instruments

Satellite/payload	XMM-Newton (pn+MOS)	Chandra (ACIS-I)	IXO (WFI)	MAXI (SSC)	eROSITA	LE
Grasp (FOV*effective area; cm ² deg ² , @2keV)	300	28	800	675	700	3000

LE is very powerful for the cosmic soft X-ray background study.



Prototype of light shield and detector box (upper)



Detector box
(lower)

LE electronics box

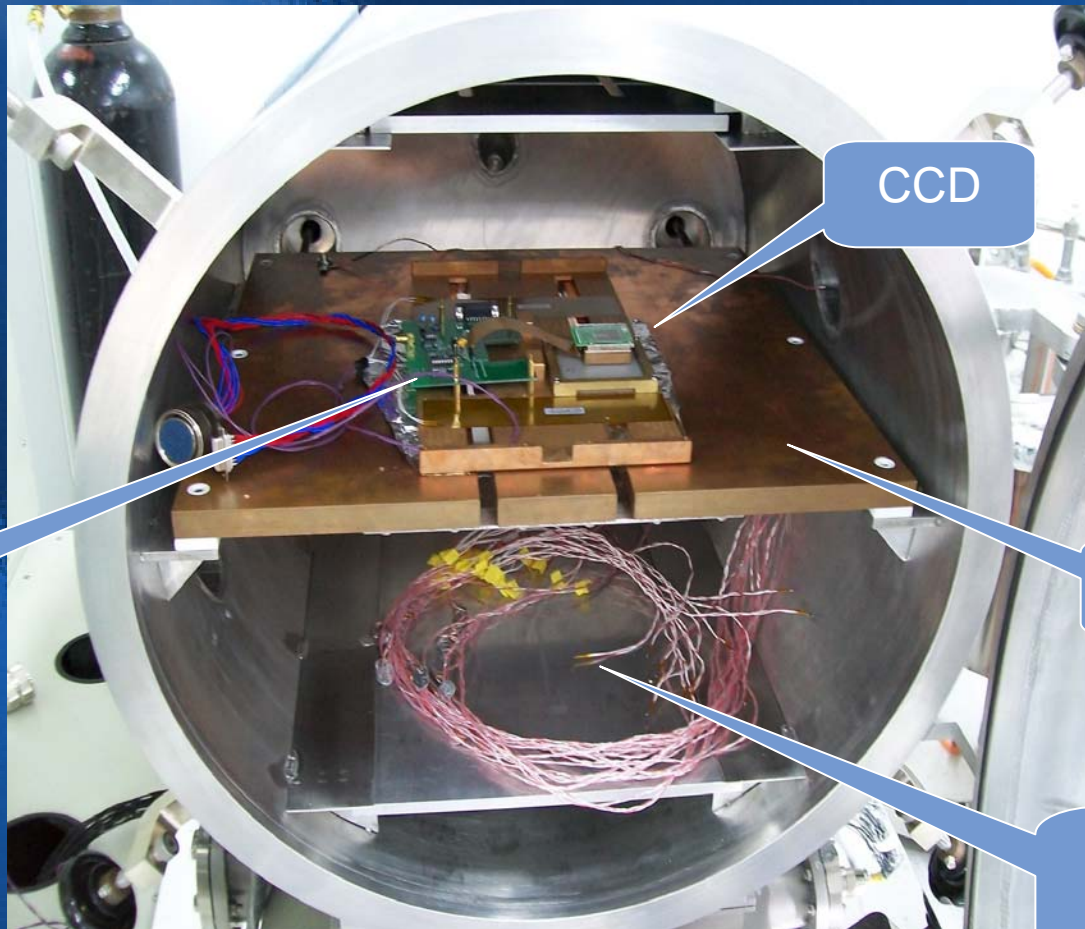
LE prototype

2. Calibration of LE



LE vacuum testing facility

Inside of LE vacuum testing facility



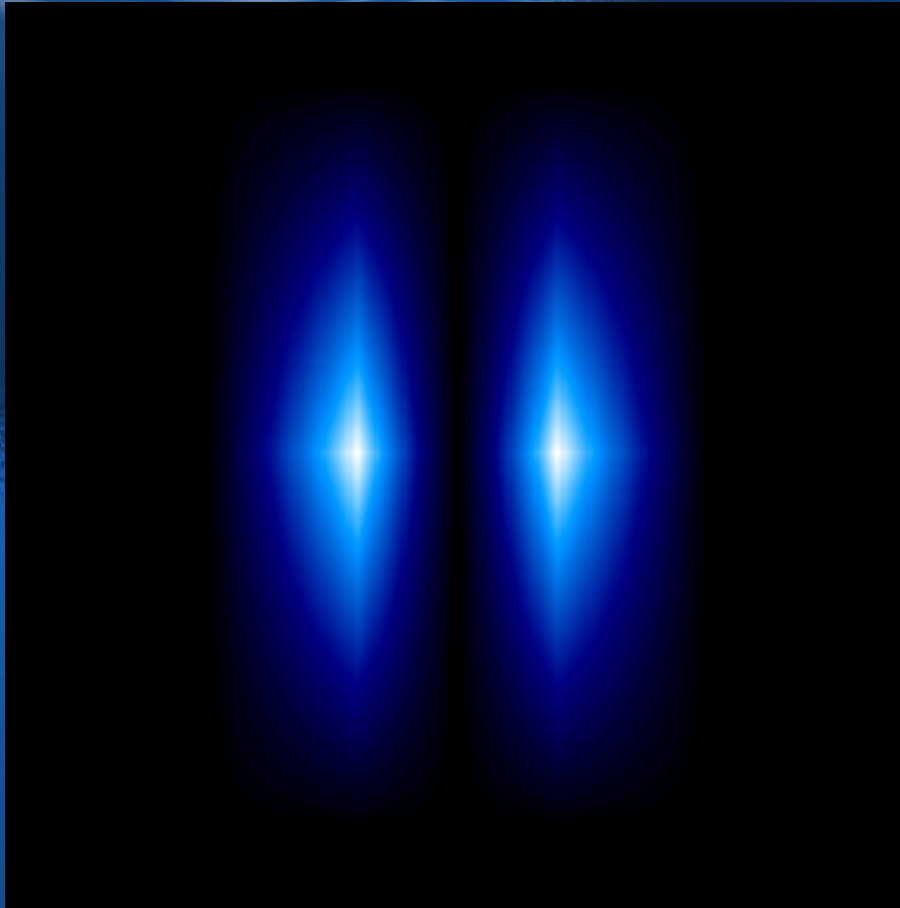
electronics

CCD

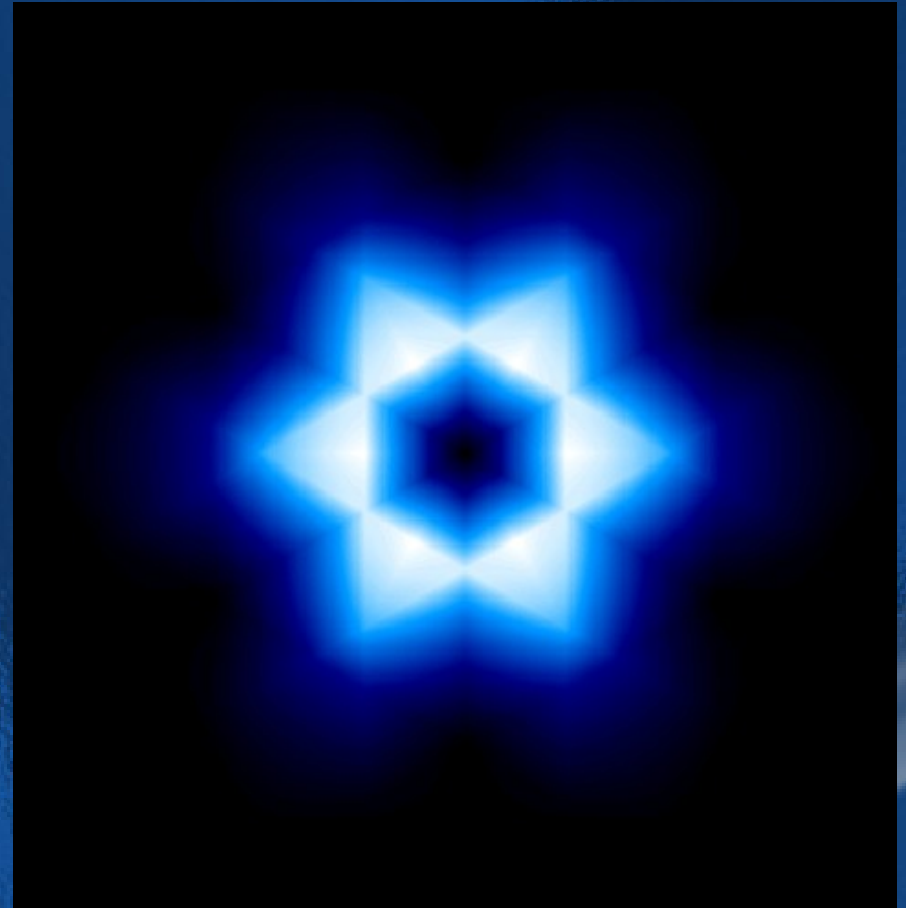
Cold plate

Pt resistance
thermometer

PSF



single module

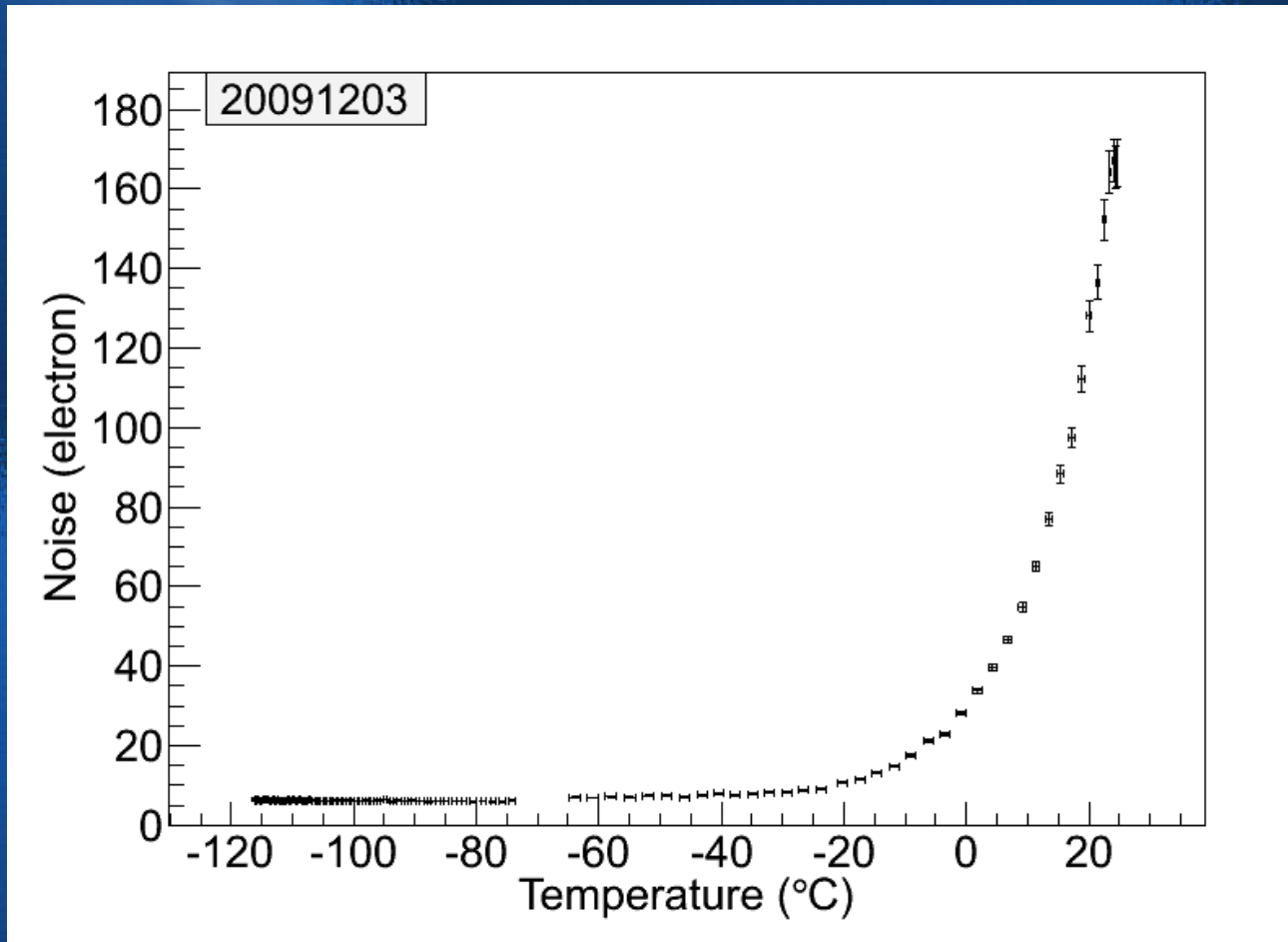


three modules

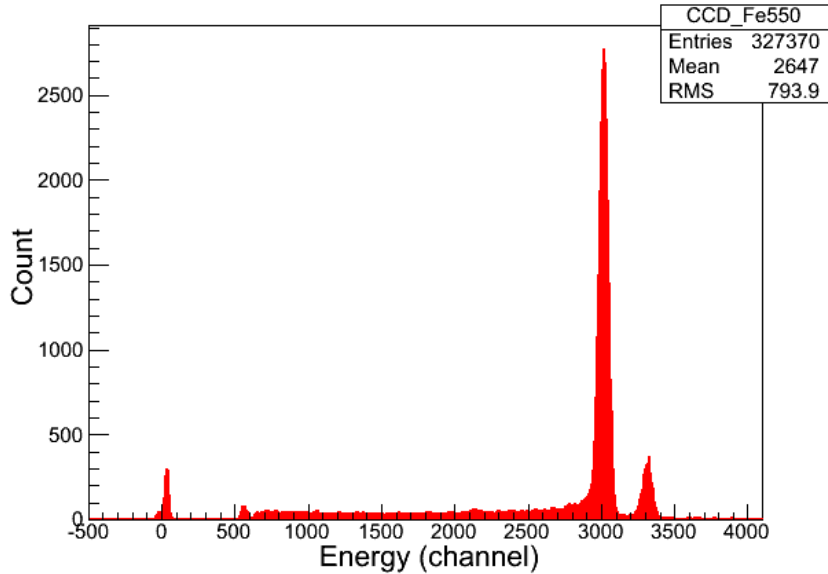
LE PSF for diffuse emission

RMF

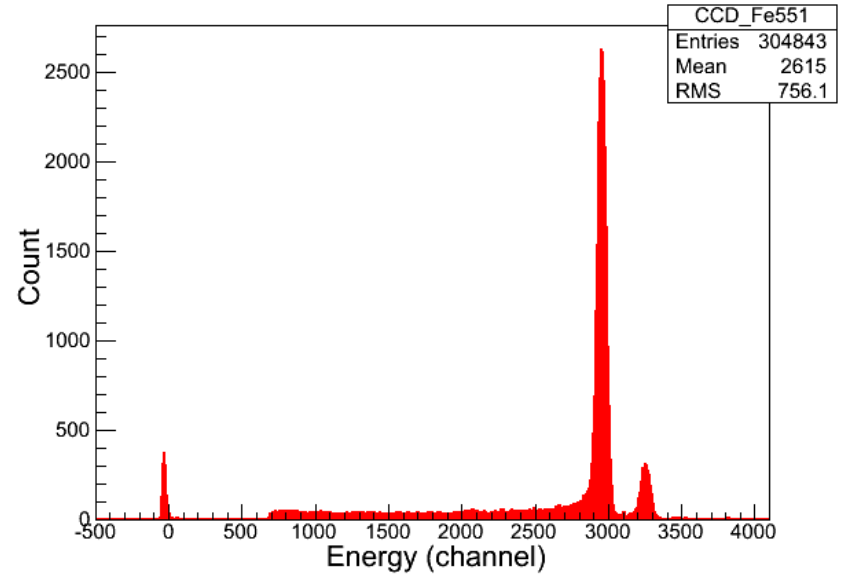
- ◆ Total readout noise is about 5 electrons when temperature is below -50°C



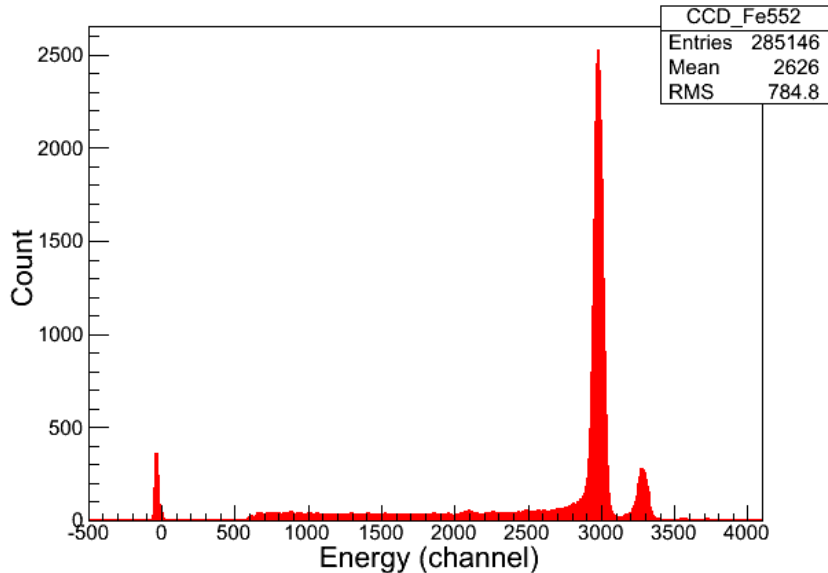
20120314-151011 Fe55 Peak Temperature Chn0 -100.5 °C



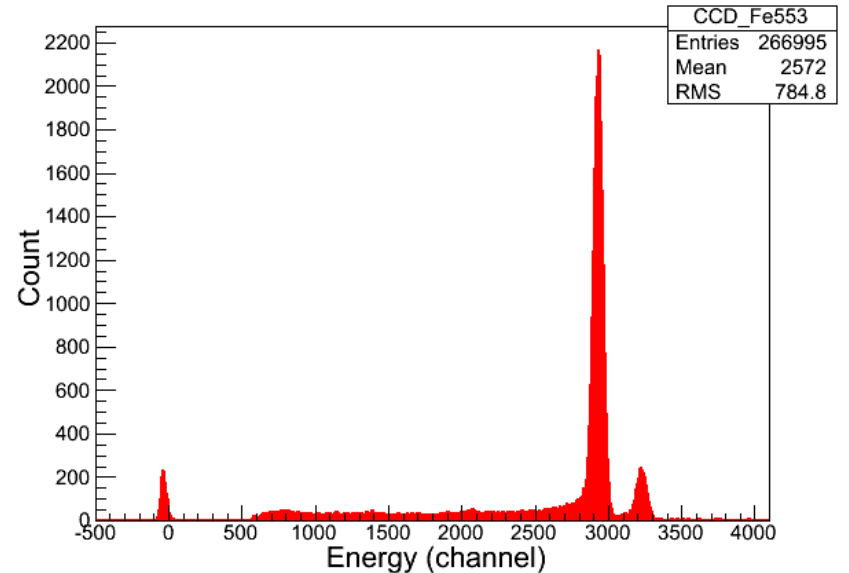
20120314-151011 Fe55 Peak Temperature Chn1 -100.5 °C



20120314-151011 Fe55 Peak Temperature Chn2 -100.5 °C

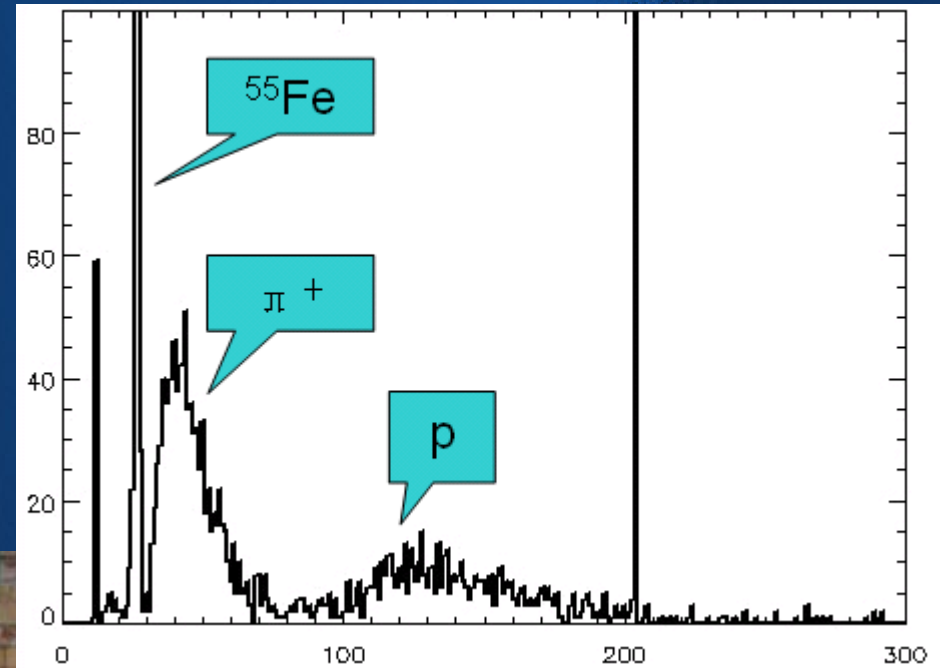


20120314-151011 Fe55 Peak Temperature Chn3 -100.5 °C

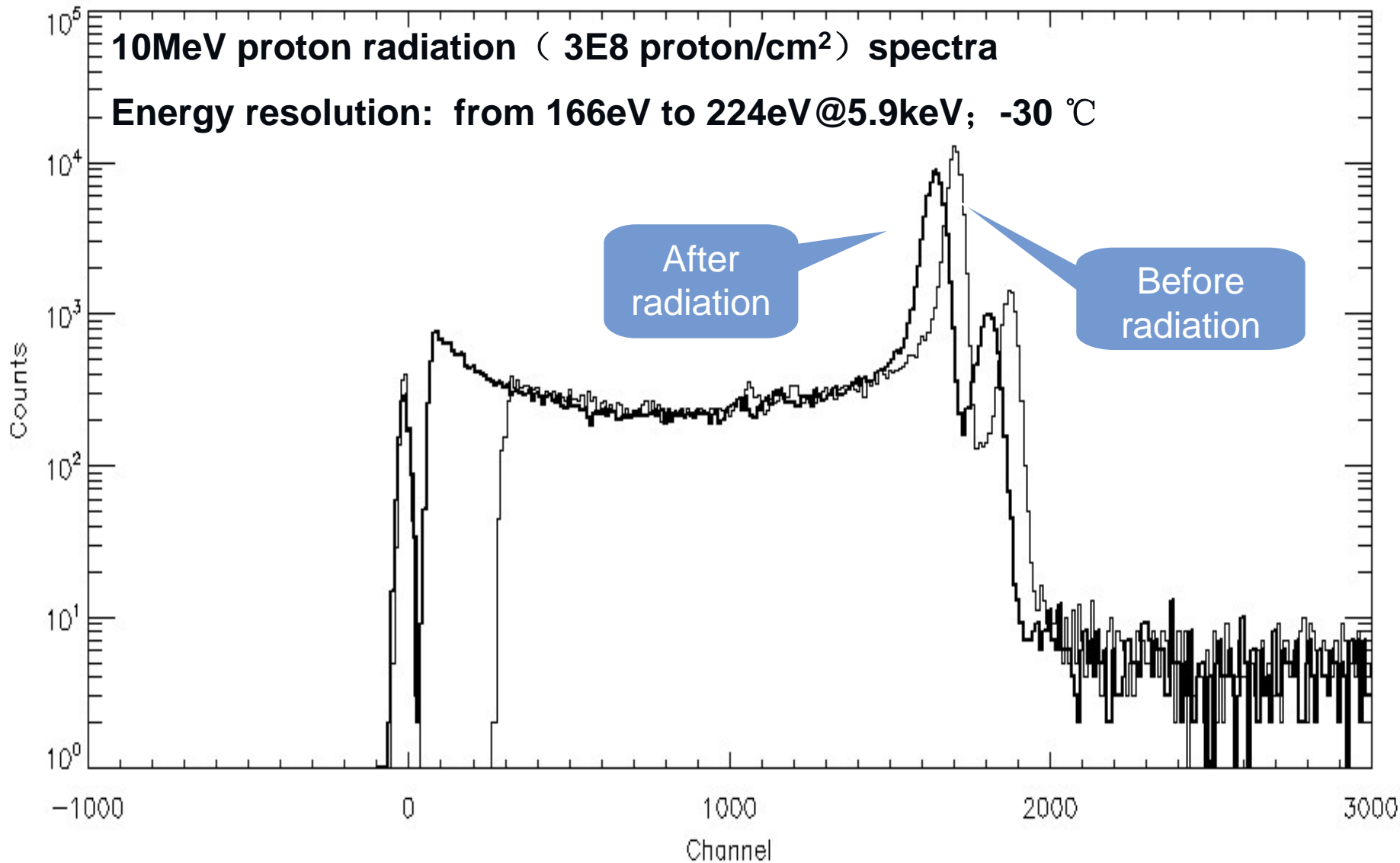


⁵⁵Fe spectra of LE primary modules

Particle responds

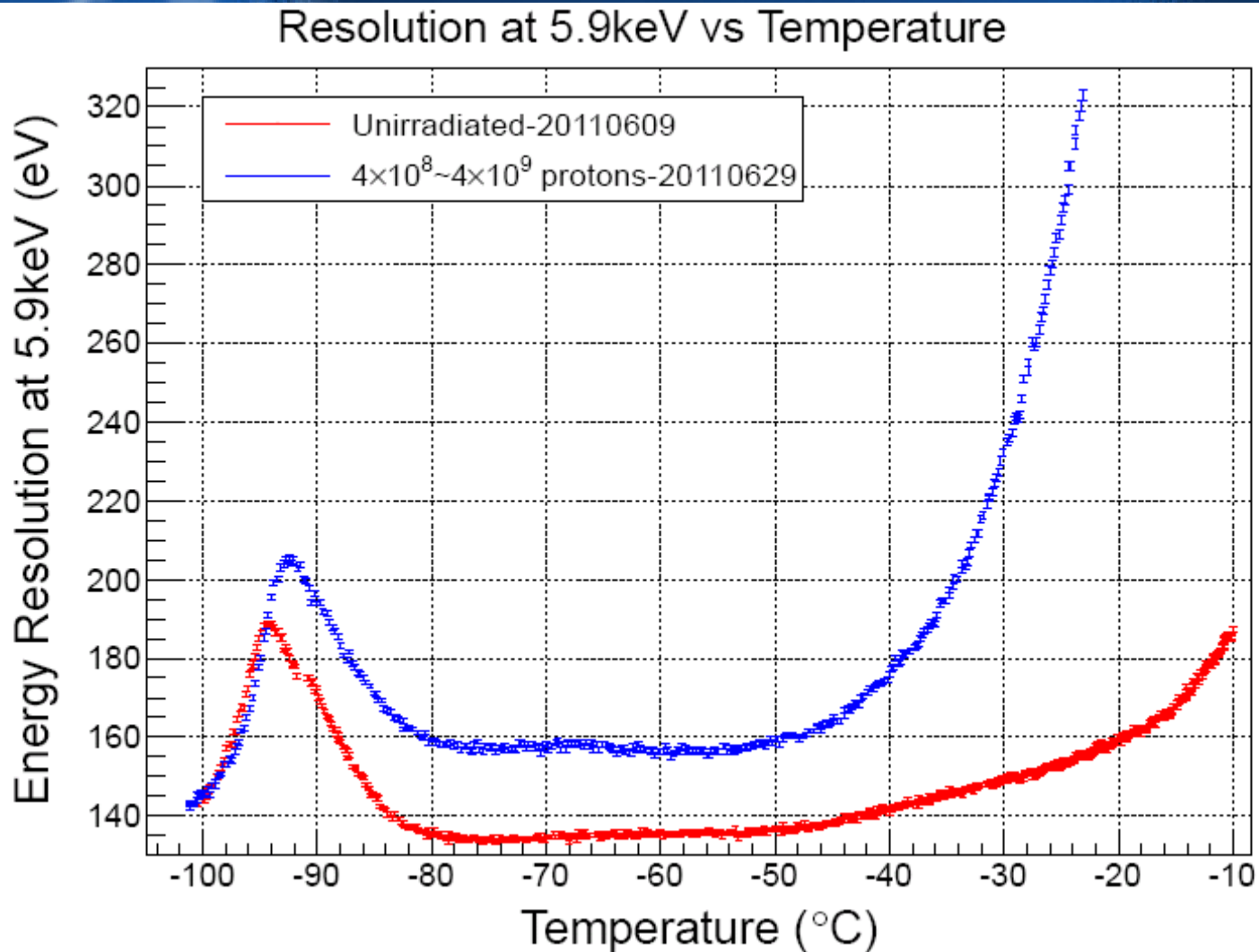


Spectrum of
500MeV π^+ 、 p
with the testing
beam in IHEP.



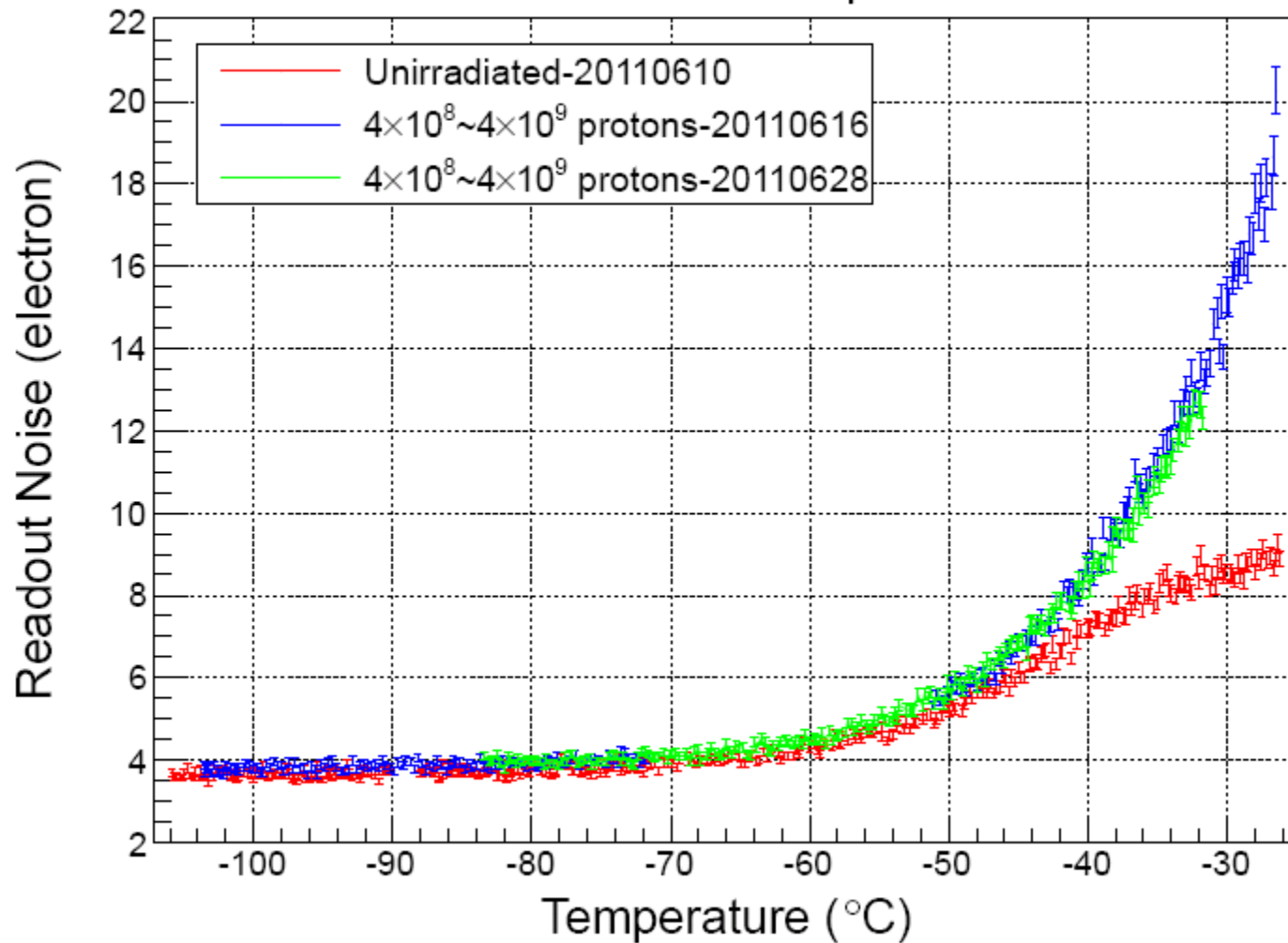
Performed on the 6MV EN tandem
accelerator in Peking University

Proton radiation damage

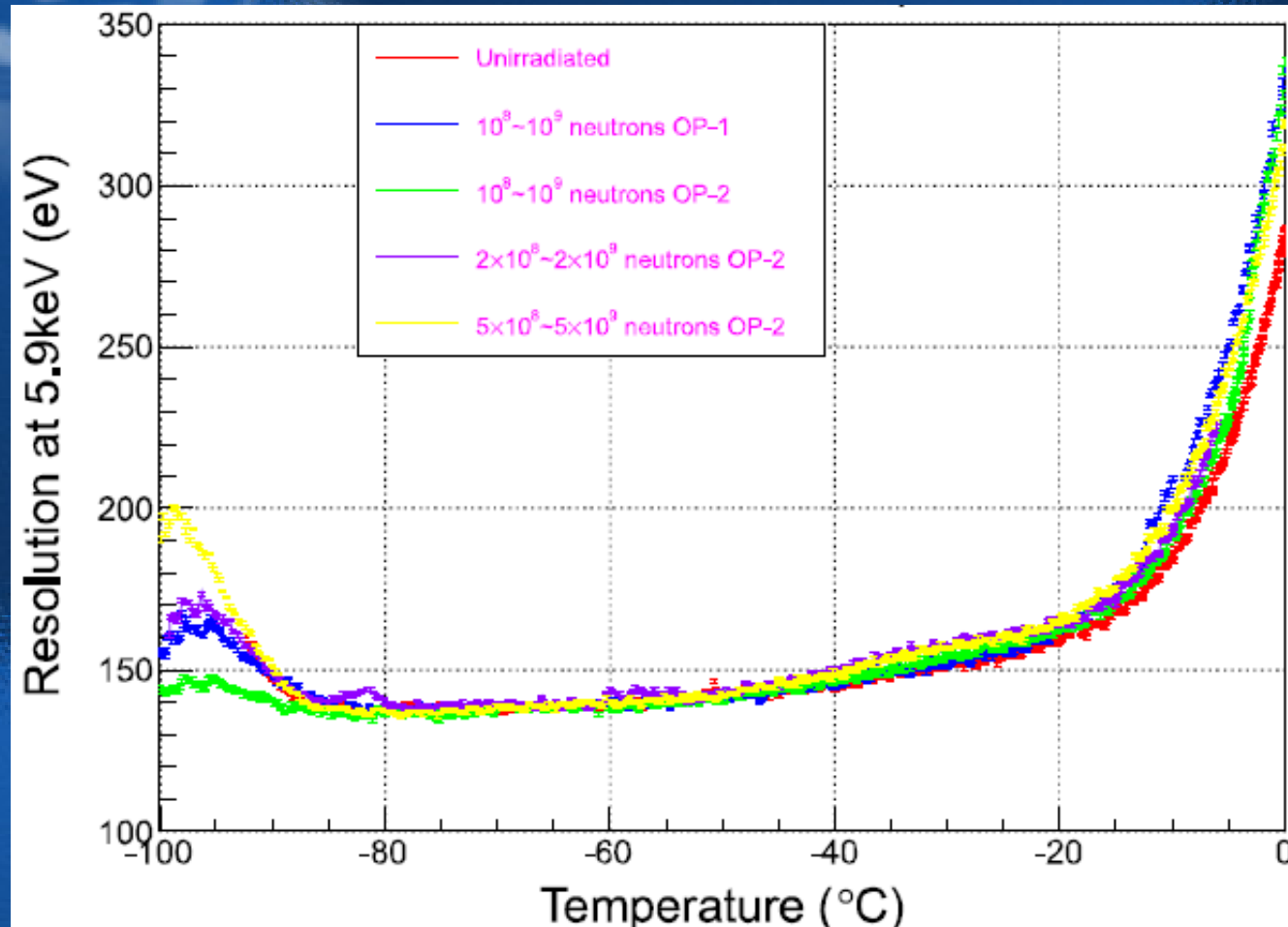


LE detector with baseline restoration circuit

Readout Noise vs Temperature



neutron radiation damage



3. Summary

- ◆ LE
 - 384cm²; 96 CCD chips
 - large grasp value
 - no pileup
- ◆ LE calibration:
 - PSF, RMF, radiation damage



Thanks!