# Light detectors at Orsay (and Insubria)

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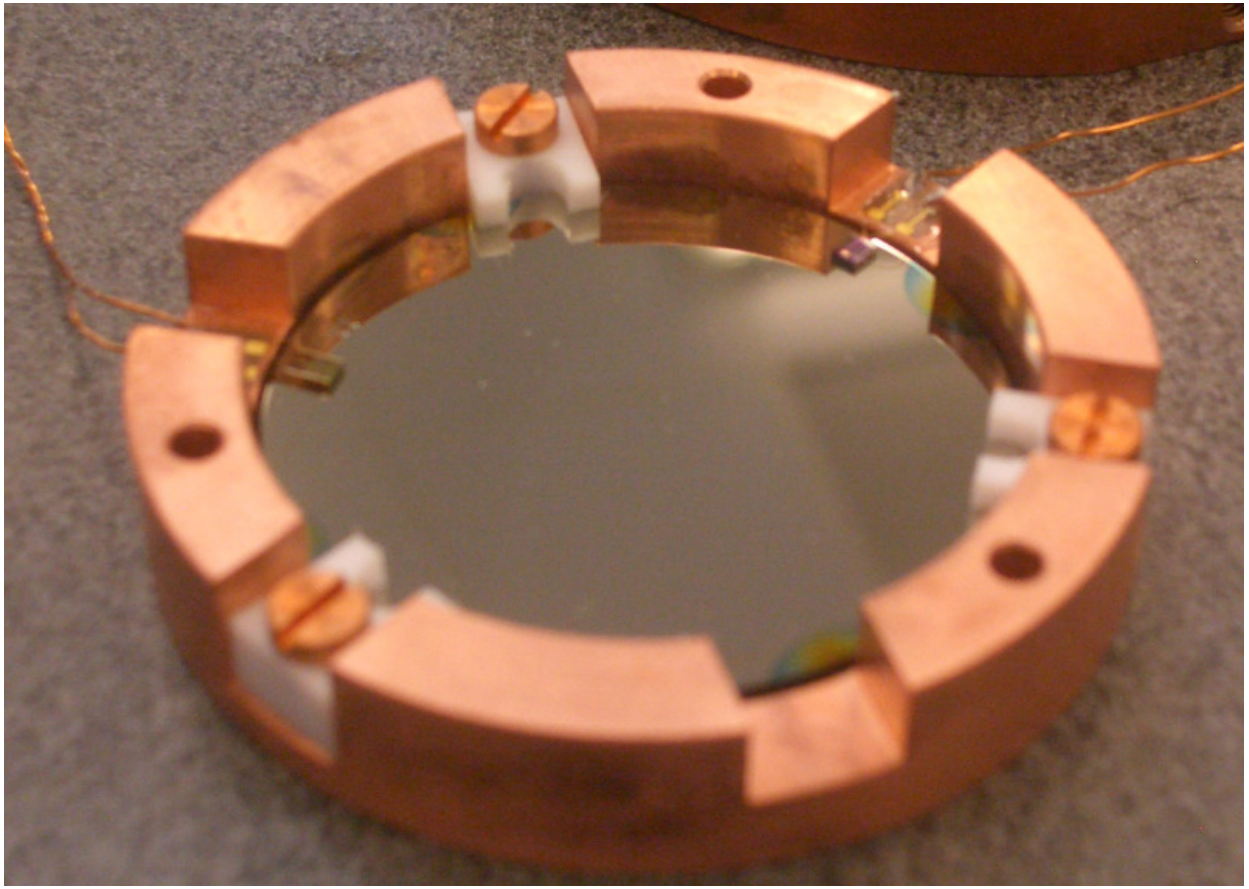
## Summary of the activities:

We have produced:

- 4 light detectors 2'' diameter (bare) (used for Modane and LUMINEU crystals)
- 1 Luke effect light detector 2'' diameter (discussed in previous ISOTTA meeting)
- **3 light detectors 44 mm diameter** (« LUCIFER ») (with SiO coating)
- **1 Luke effect light detector 44 mm diameter** (discussed here)
- Several small square light detector with 15 mm side (bare, SiO2 and **SiO coating**)
- 1 Luke effect square light detector with 15 mm side (discussed in previous ISOTTA meeting)

# 3 light detectors 44 mm diameter (named LT11, LT12, LT13)



NTD with $T_0$=3.8 K

In two detectors,
NTD size is ~1x1x3
One 1mm ∅ glue spot

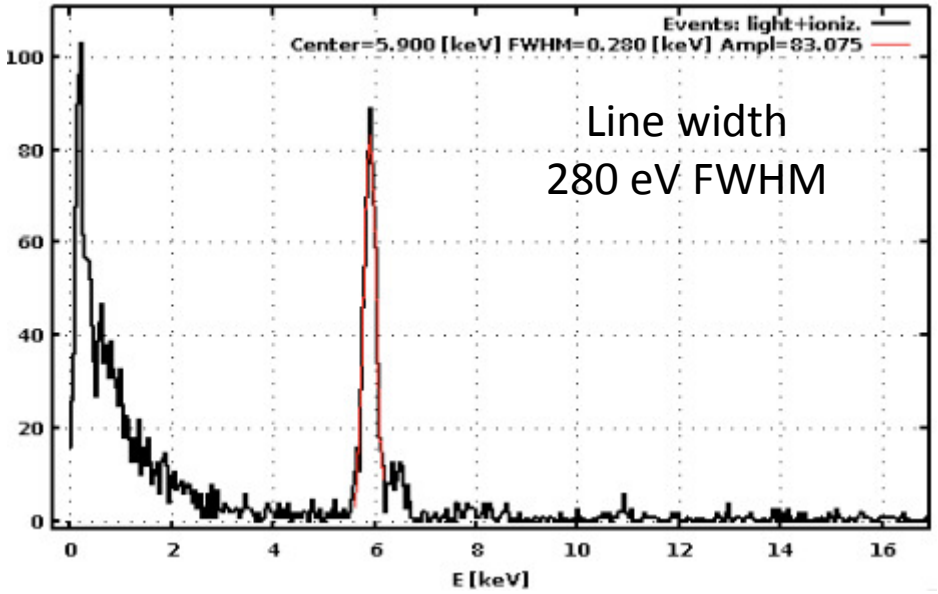
In one detector,
NTD size is ~0.6x2.2x3
One 1mm ∅ glue spot

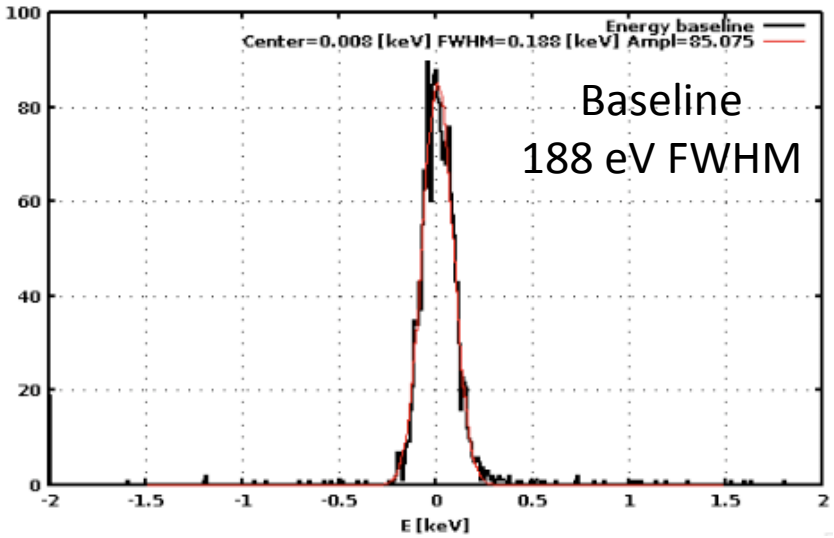
LT11 was tested in the wet cryostat
LT12 and LT13 were tested in the dry cryostat

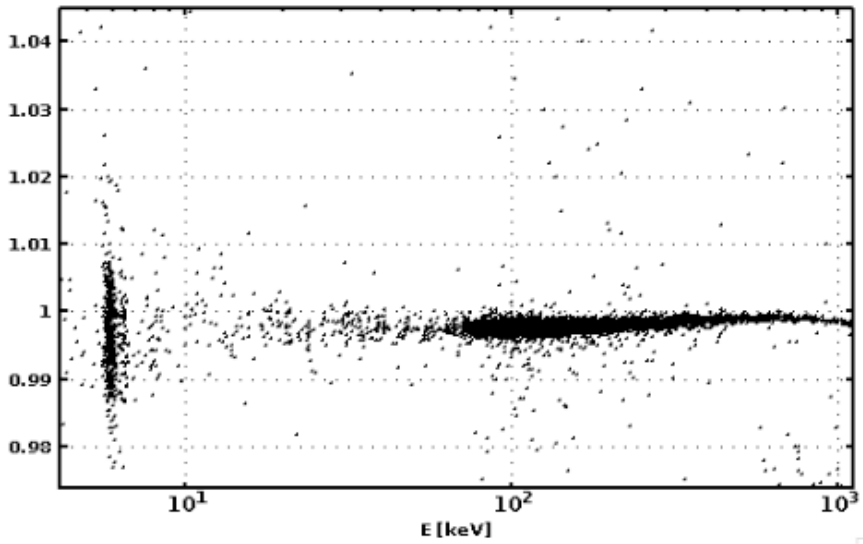
# LT11 performance

Wet cryostat, AC bias
No coupling to scintillator
25 mg liquid Fe-55 source

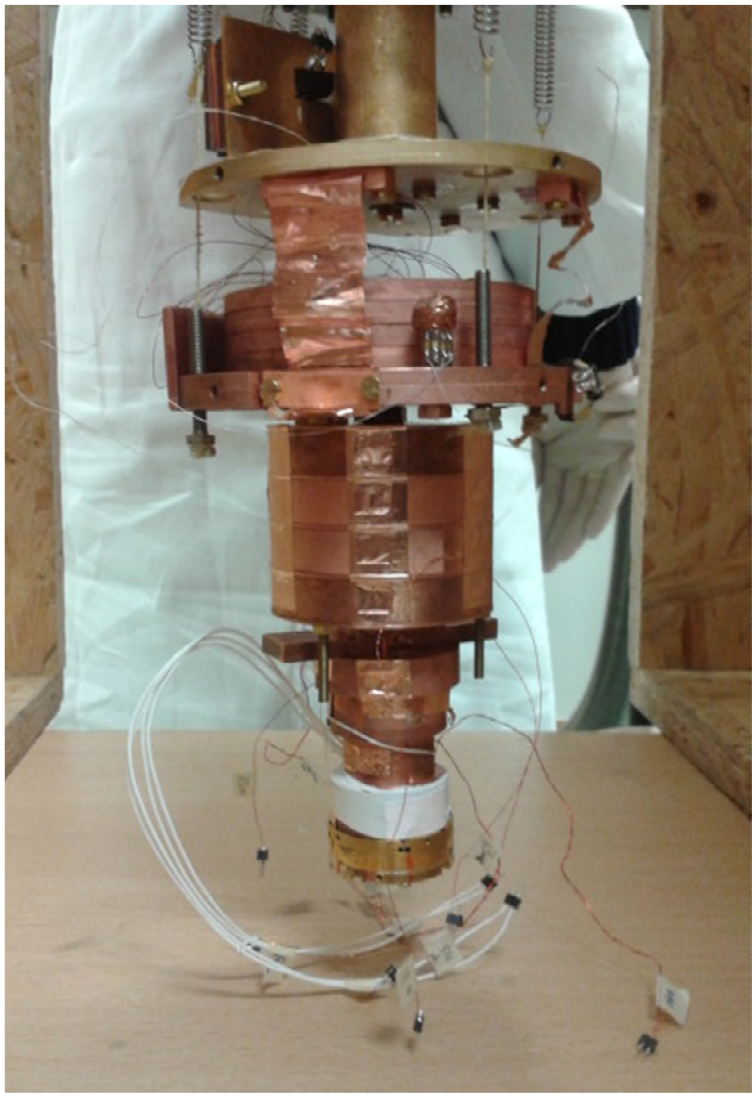
Tmc=17.5 mK
R=1.6 MΩ
Ibol=1.6 nA – Vbol = 2.56 mV
Sensitivity = 1 µV/keV
Baseline = 280 eV FHWM



# LT12 and LT13 assembly in the dry cryostat

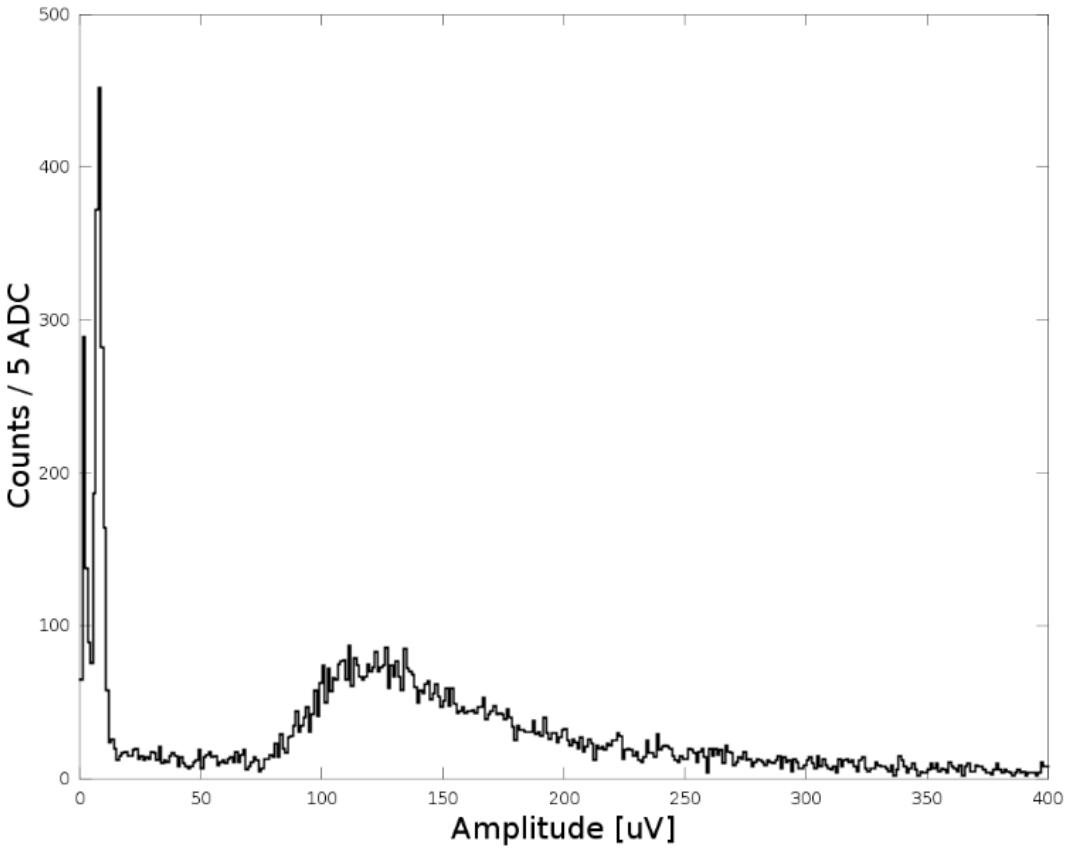


# LT12 performance

Dry cryostat, DC bias
No coupling to scintillator
25 mg liquid Fe-55 source

Tmc=16 mK
R=1.23 M
Ibol 2.5 nA = – Vbol = 3.1 mV
Sensitivity = 1.36 µV/keV
Baseline = 3.1 keV FHWM

Heavy microfonic noise
Srews not tigthen

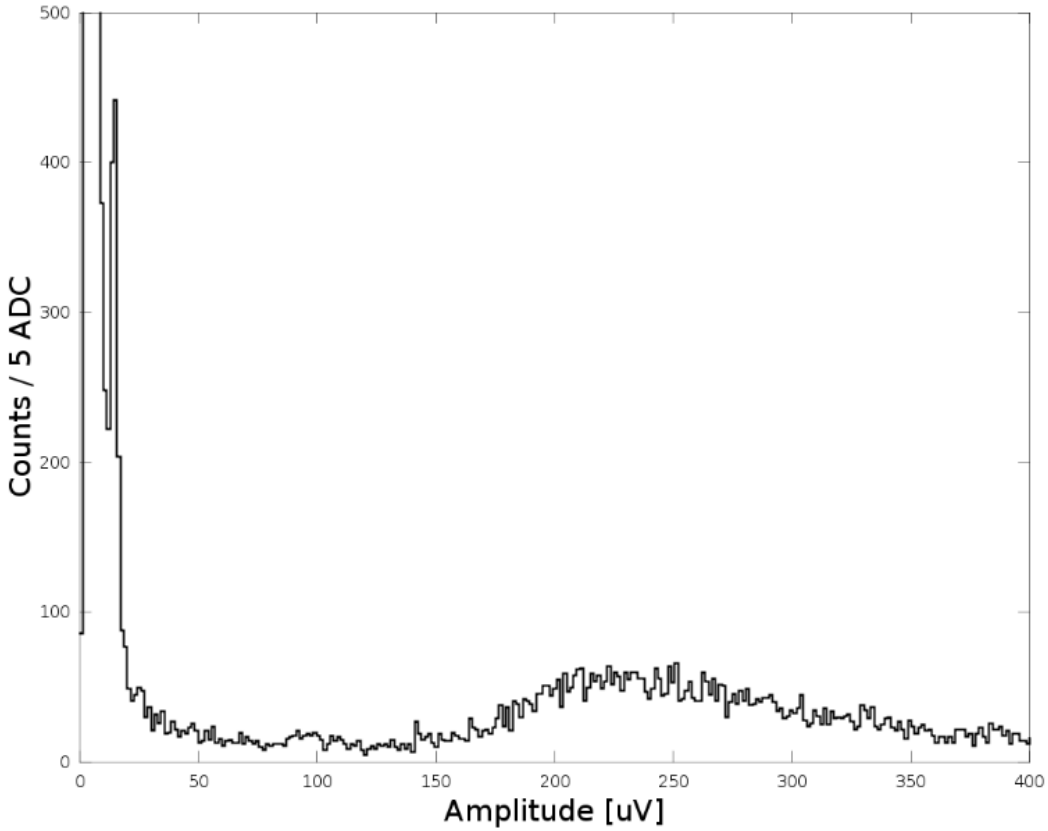


# LT13 performance

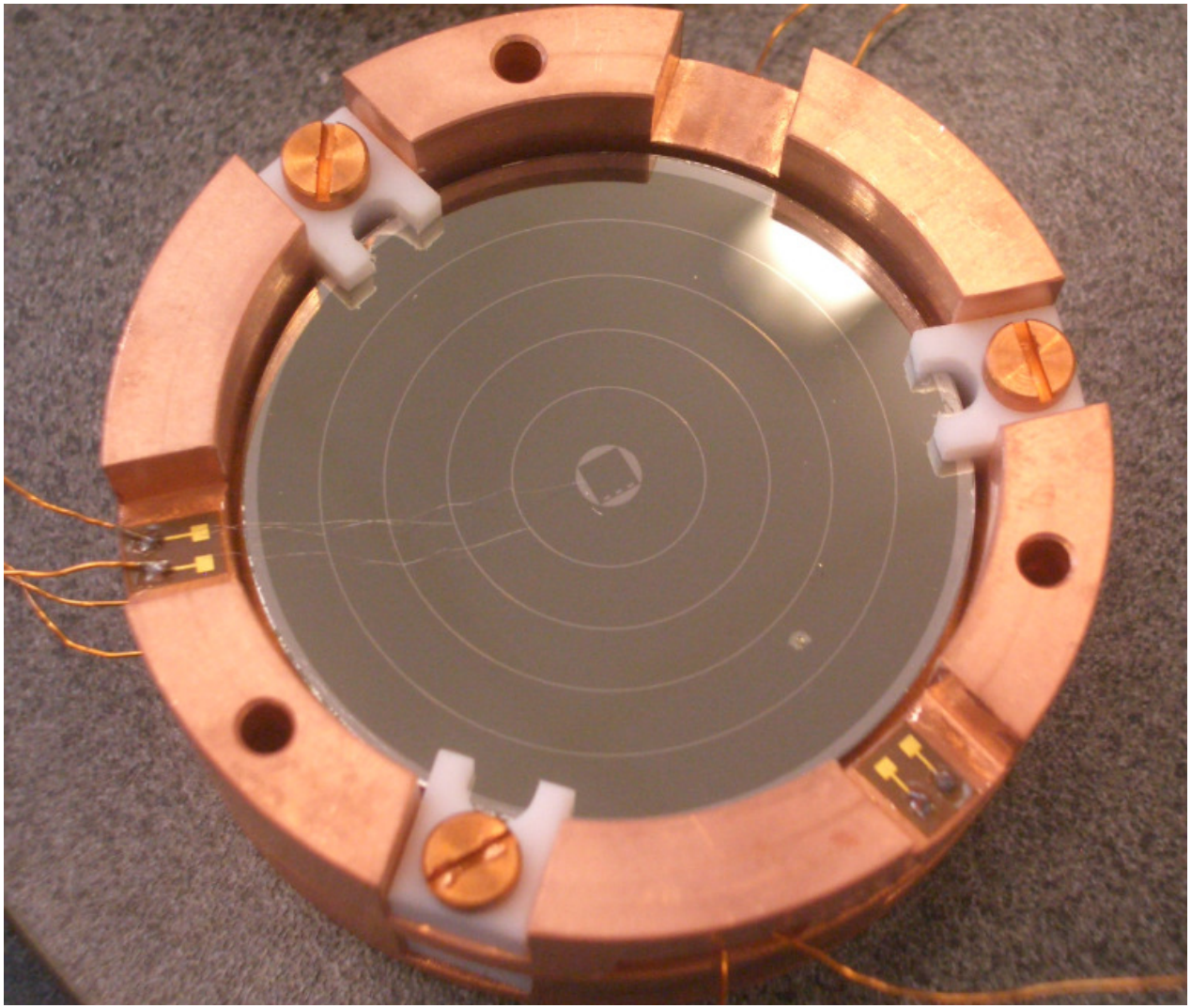
Dry cryostat, DC bias
No coupling to scintillator
25 mg liquid Fe-55 source

Tmc=16 mK
R=3.35 M
Ibol 1.25 nA = – Vbol = 4.2 mV
Sensitivity = 2.48 µV/keV
Baseline = 802 eV FHWM

Tighten screws
Residual excess noise of unknown origin
Under investigation



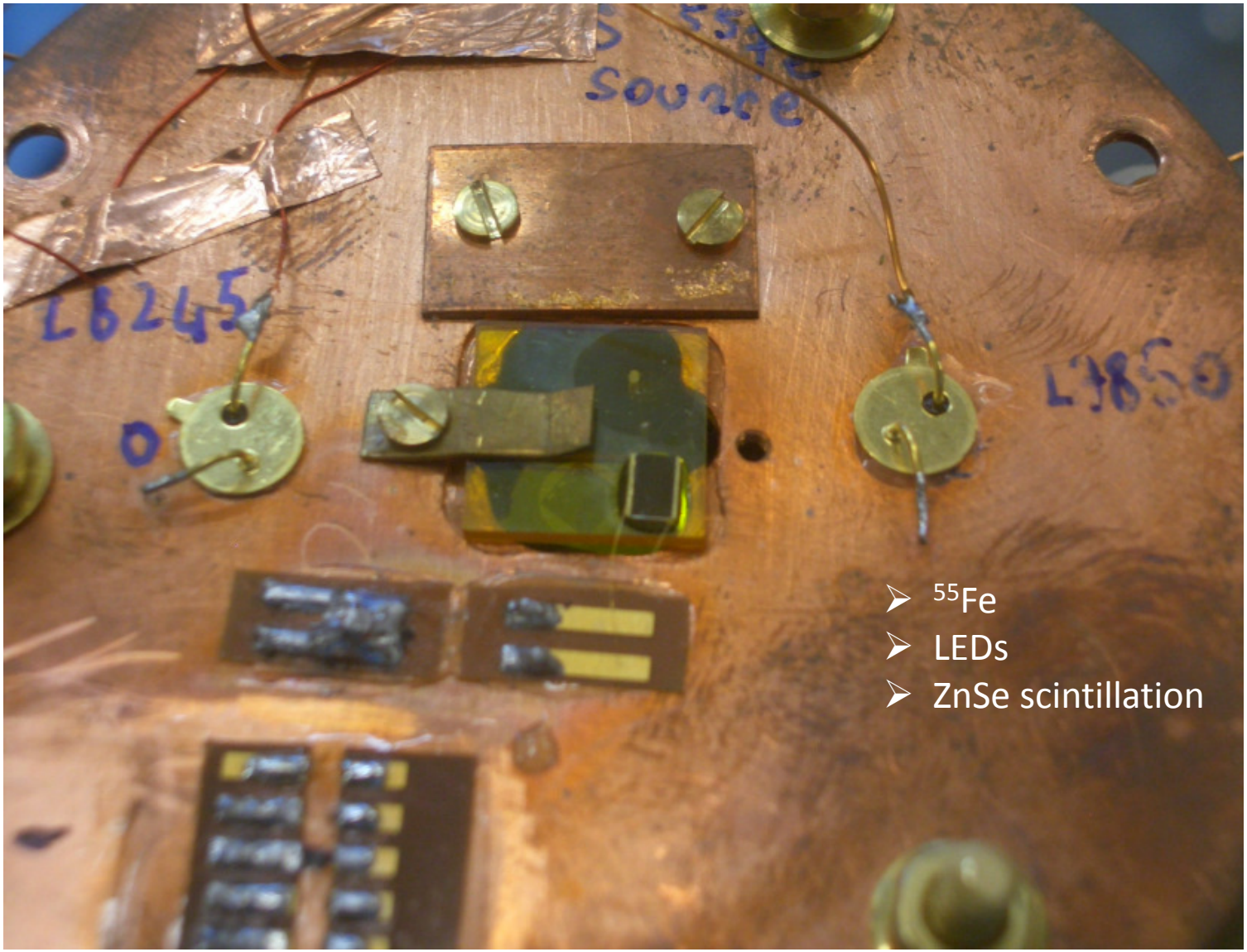
# Luke effect 44 mm light detector



NTD size is ~0.6x2.2x3
4 glue spots

Al electrodes
Anular structure
Photolitography

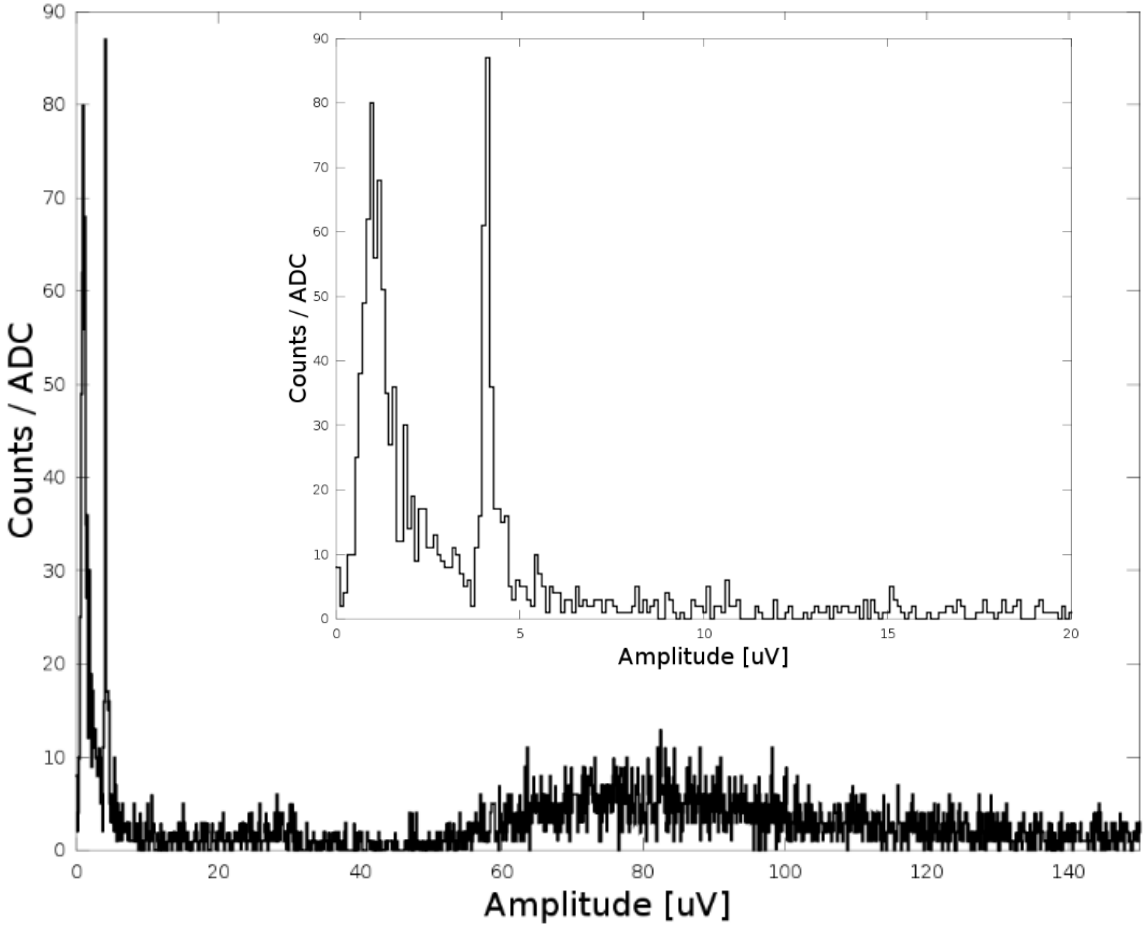
# Sources for the Luke light detector



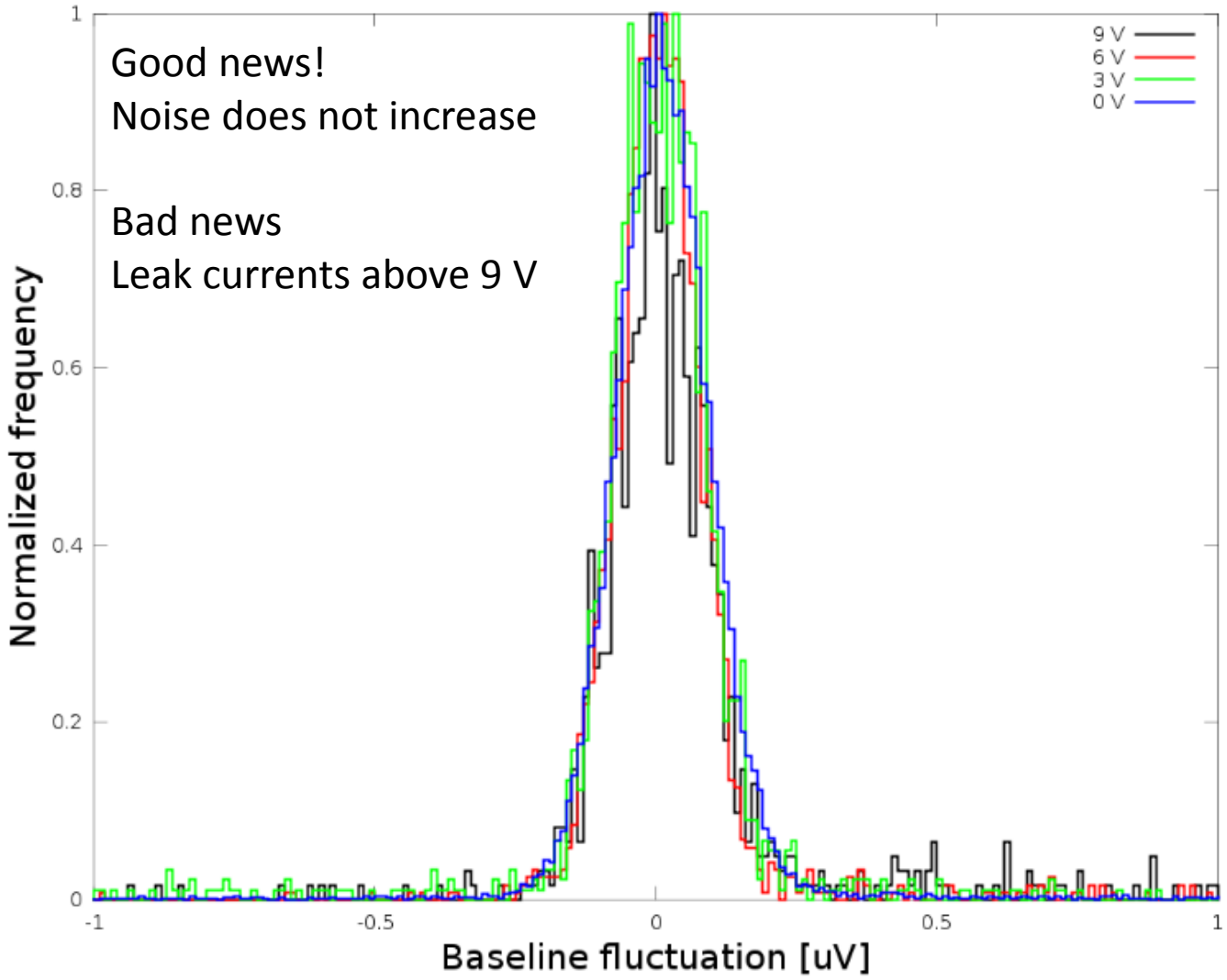
# Luke effect performance at Luke bias = 0

Wet cryostat, AC bias
No coupling to scintillator
25 mg liquid Fe-55 source

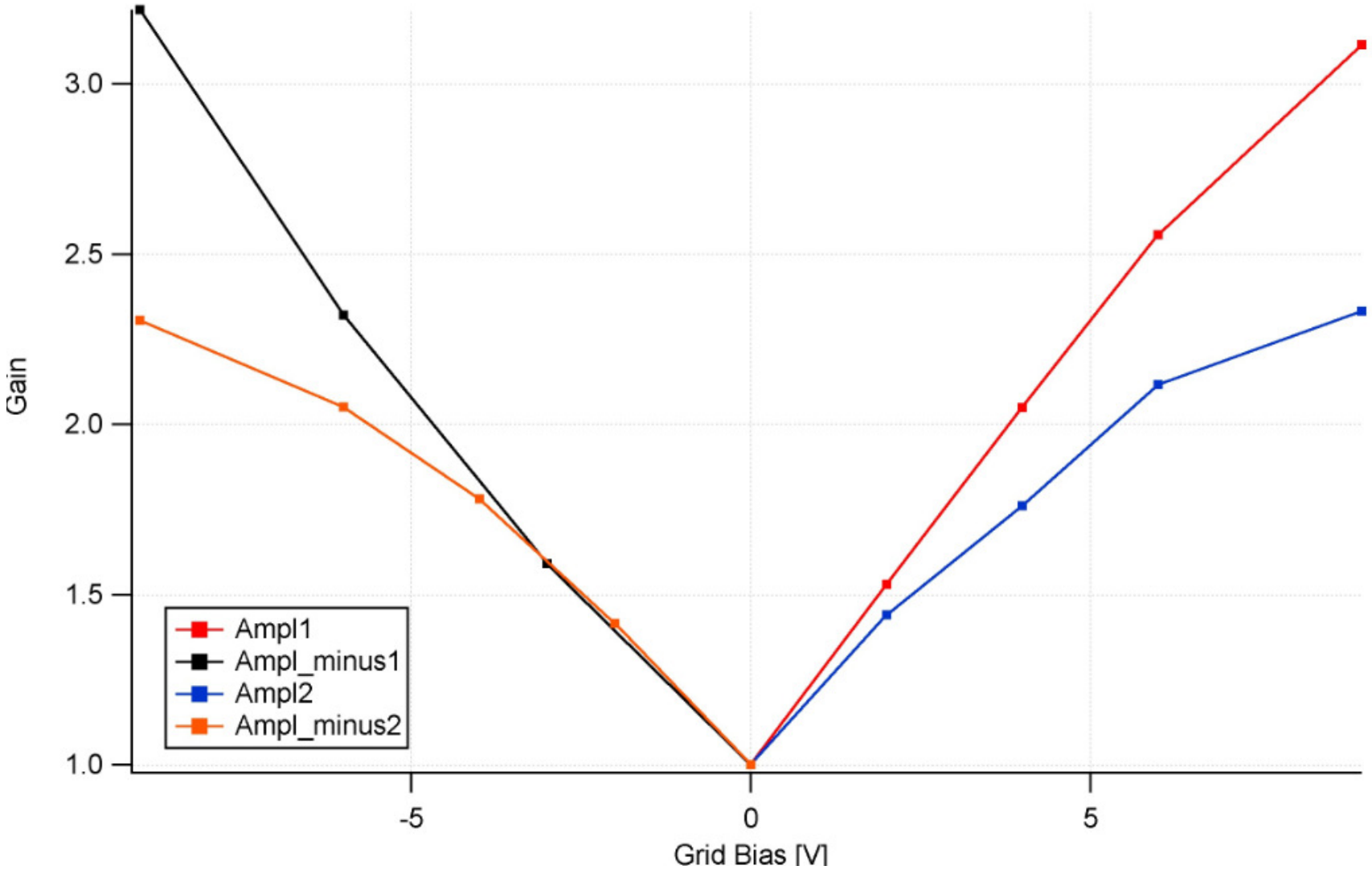
Tmc=17.5 mK
R=1.3 MΩ
Ibol=1.6 nA – Vbol = 2.15 mV
Sensitivity = 0.7 µV/keV
Baseline = 200 eV FHWM



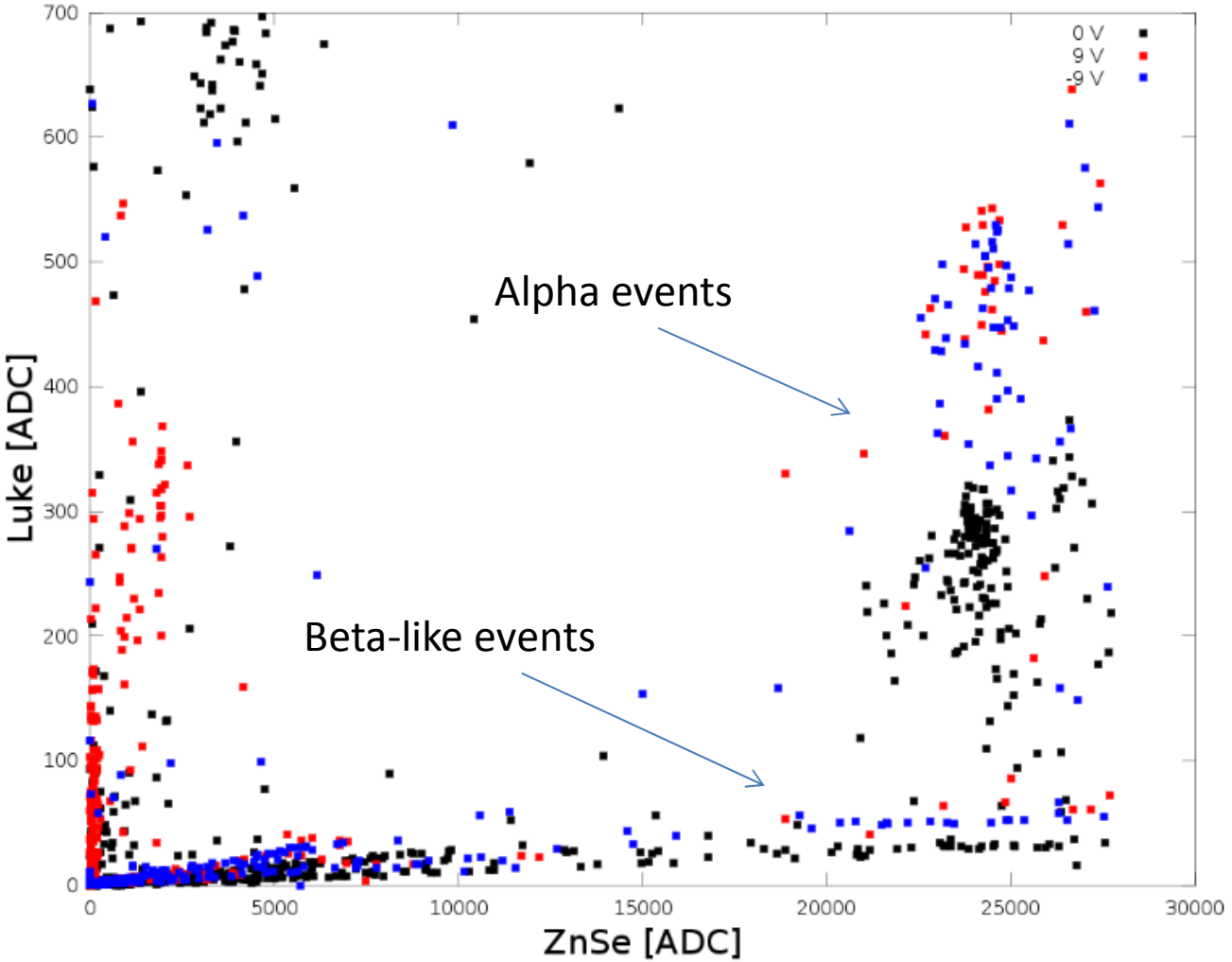
# Absolute noise when increasing Luke bias



# Luke amplification with LEDs



# Luke amplification with ZnSe scintillation light

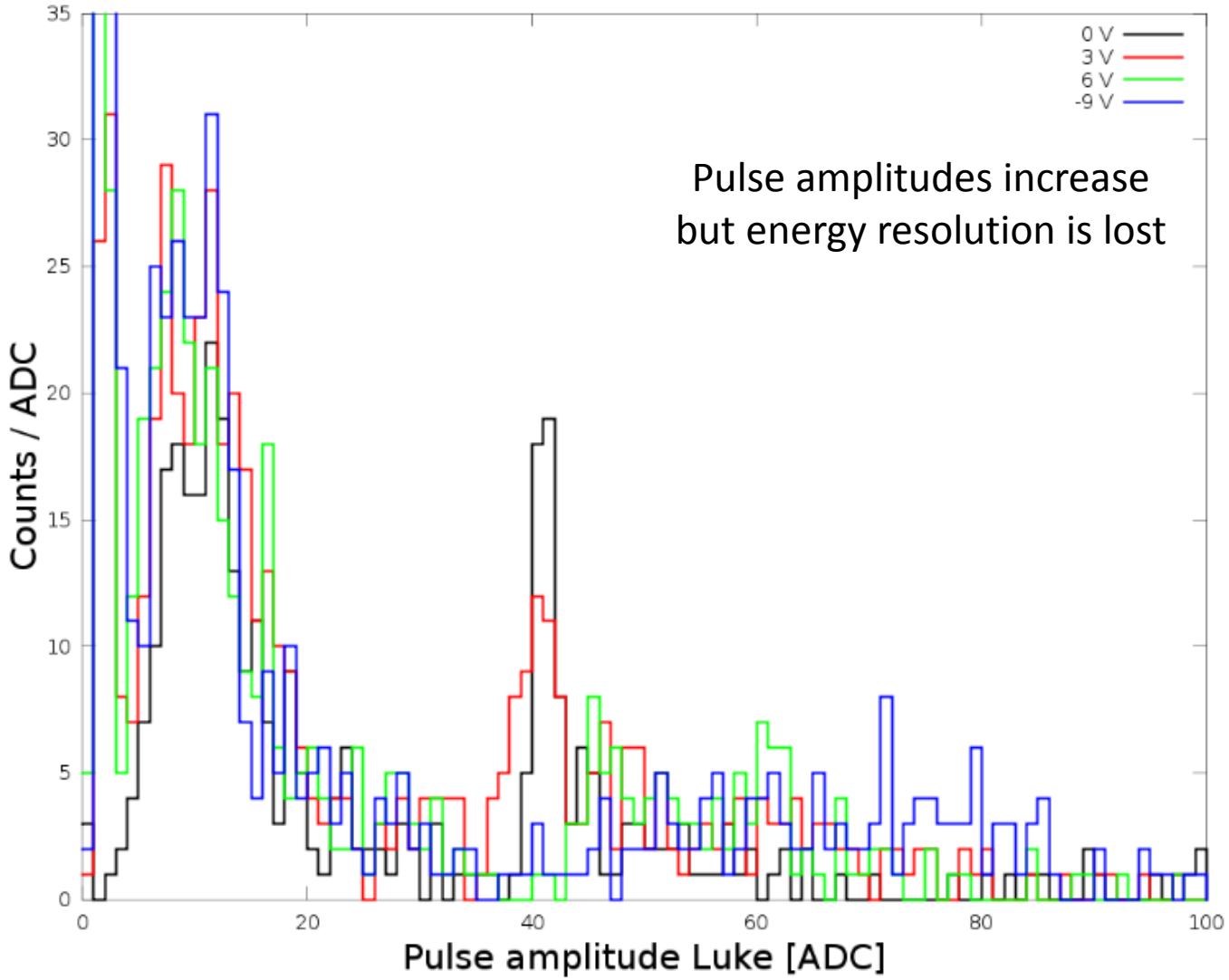



Gain ~ 1.7

Vluke=0 V

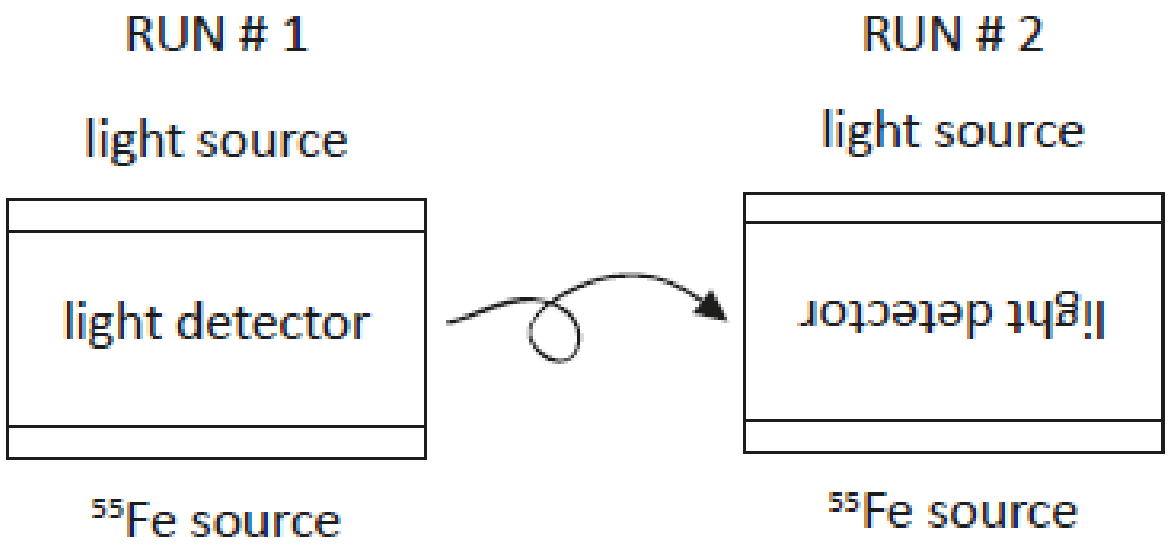
Vluke = 9 , -9 V

# Luke amplification with $^{55}Fe$

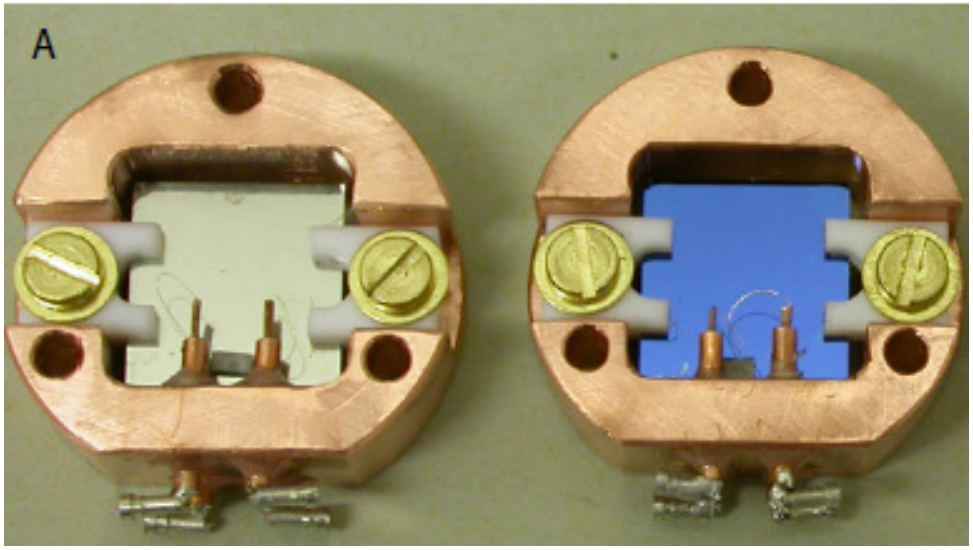


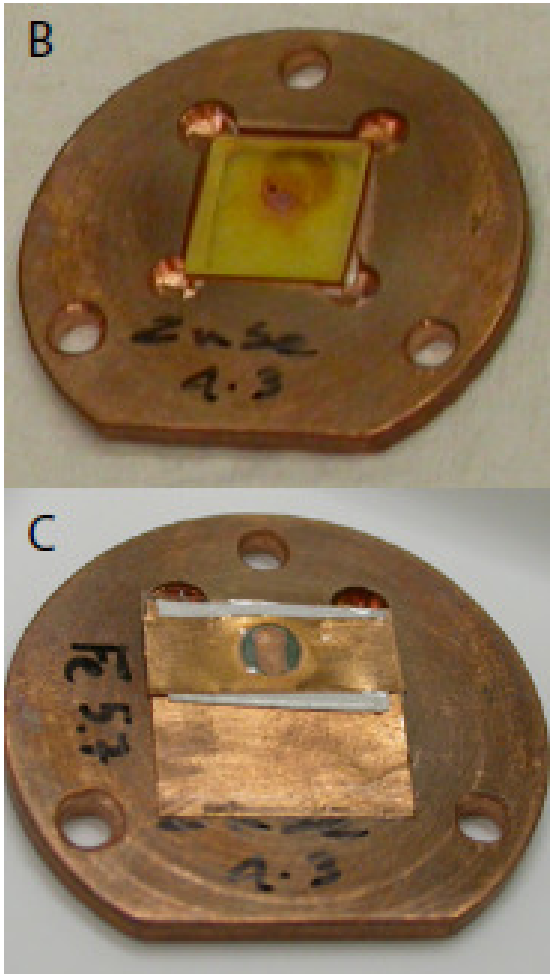
# Small square detectors to evaluate effect of SiO coating

Rationale of the measurement

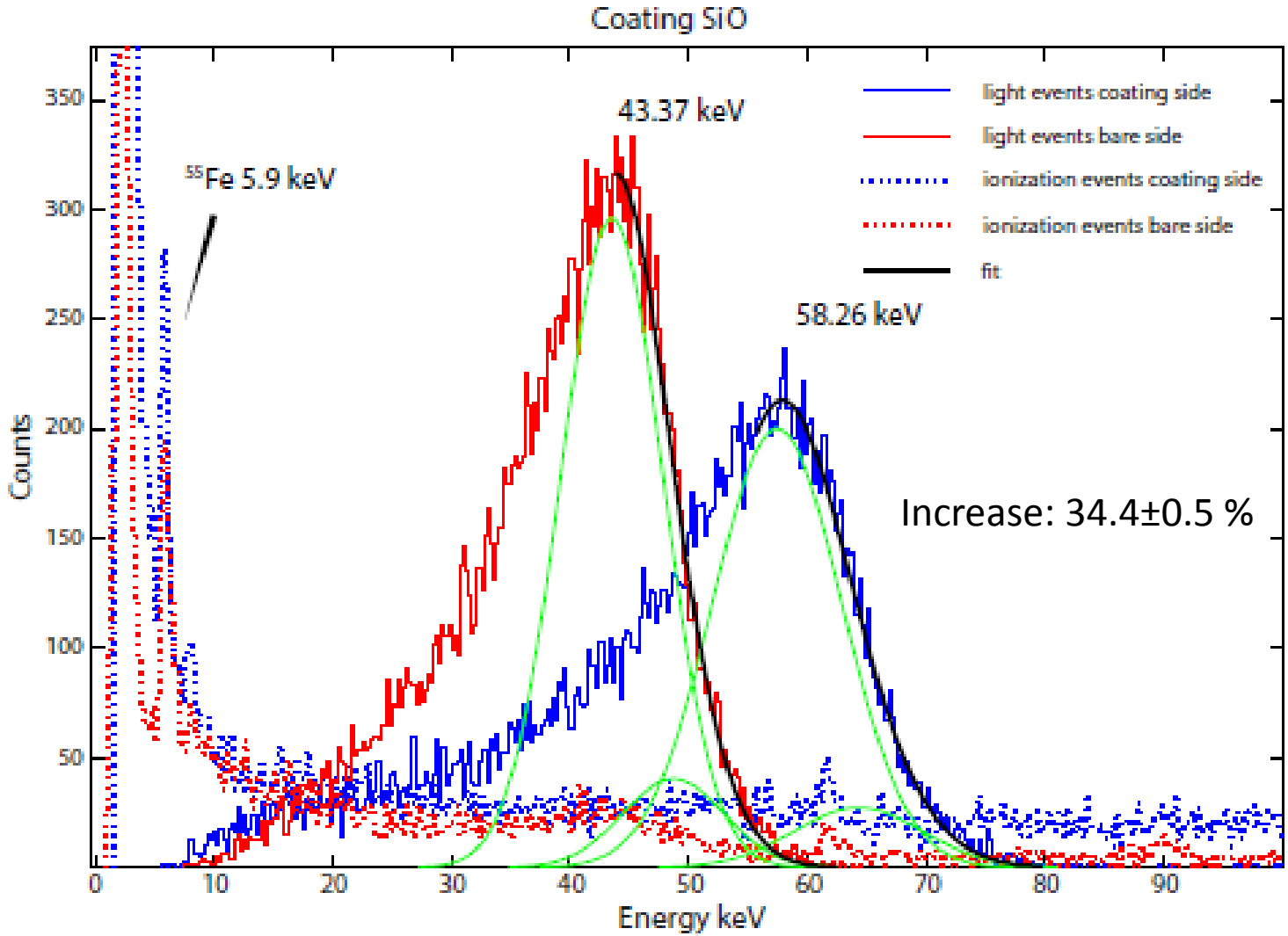


# Light detectors and sources



# Results


Coating SiO
43.37 keV
$^{55}$Fe 5.9 keV
58.26 keV
light events coating side
light events bare side
ionization events coating side
ionization events bare side
fit
Increase: 34.4±0.5 %
Counts
Energy keV
0
10
20
30
40
50
60
70
80
90
50
100
150
200
250
300
350