Energy linearity with X-rays on LIME (yet another point: Titanium)

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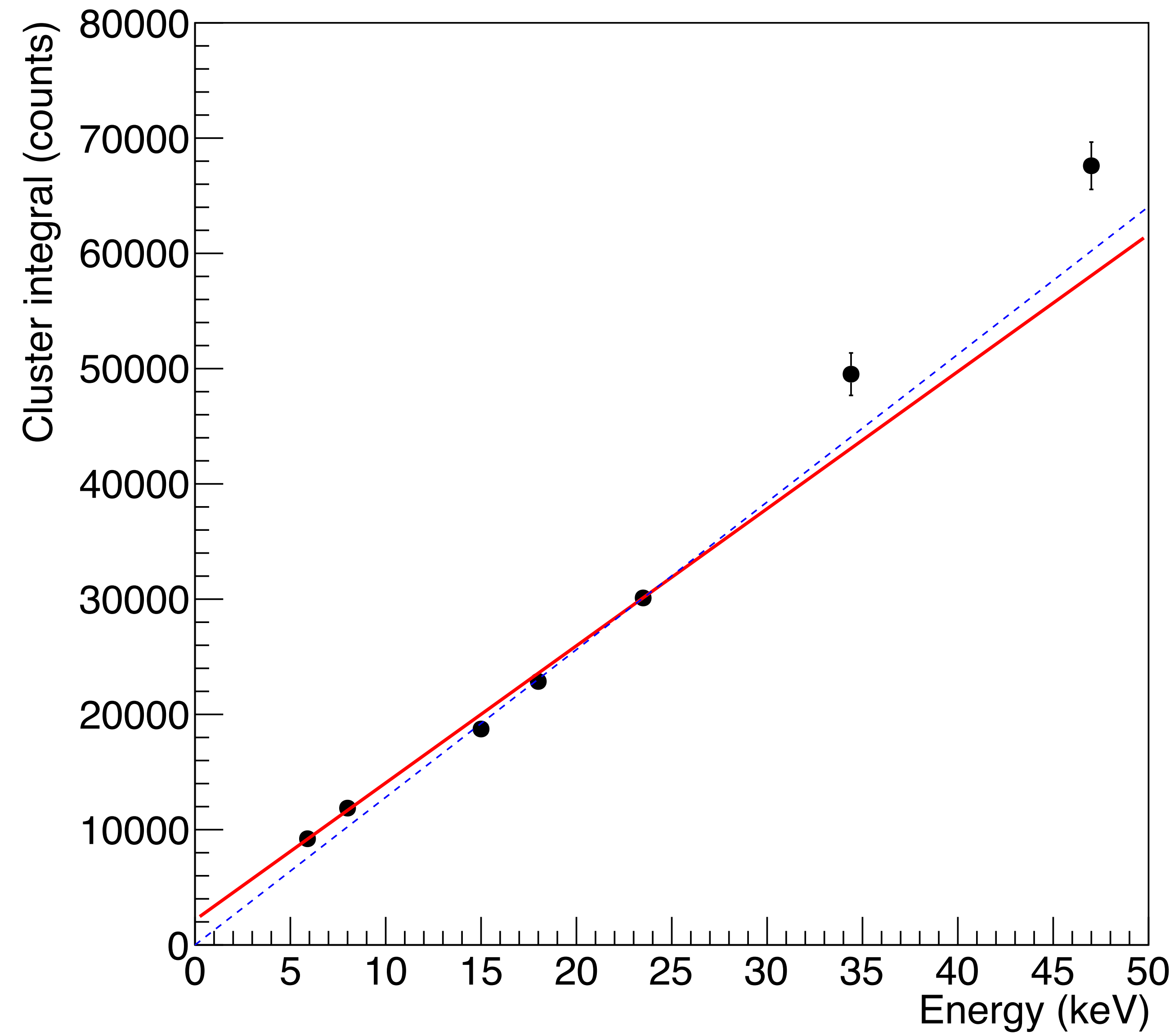
X-rays sources

LIME energy linearity with X-rays from 5.9 keV (^{55}Fe) up to 44 keV (Tb) presented on Oct. 14th presentation (link)

Target Selected	Energy (keV) K_alpha	K_beta	Photon Yield (#/sec/steradian)
Cu	8.04	8.91	2,500
Rb	13.37	14.97	8,800
Mo	17.44	19.63	24,000
Ag	22.10	24.99	38,000
Ba	32.06	36.55	46,000
Tb	44.23	50.65	76,000



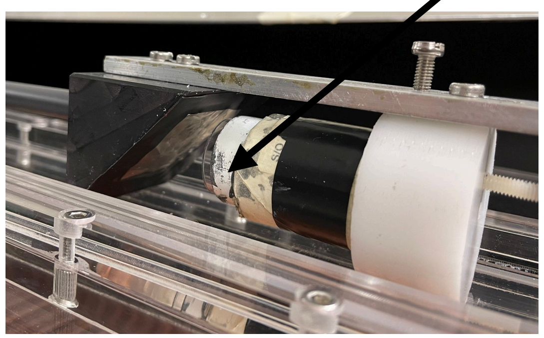
Several high-E sources useful to assess linearity.

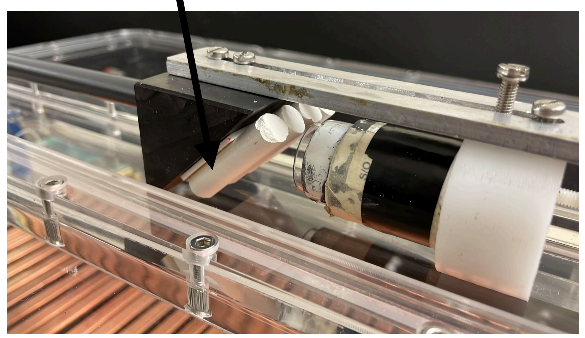
Can we go below E=5.9 keV (our interesting region)?

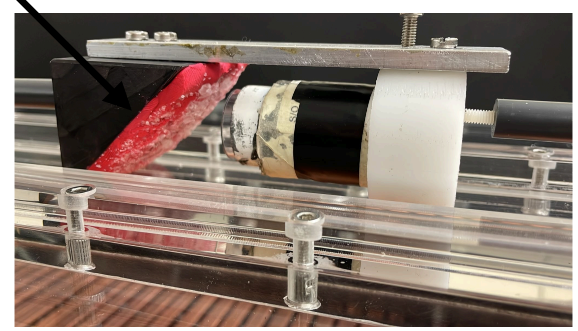
Low-energy X-rays

Suggestion from Cristina to use different materials excited by 5.9 keV X-rays from ^{55}Fe to produce low(er) energy X-rays

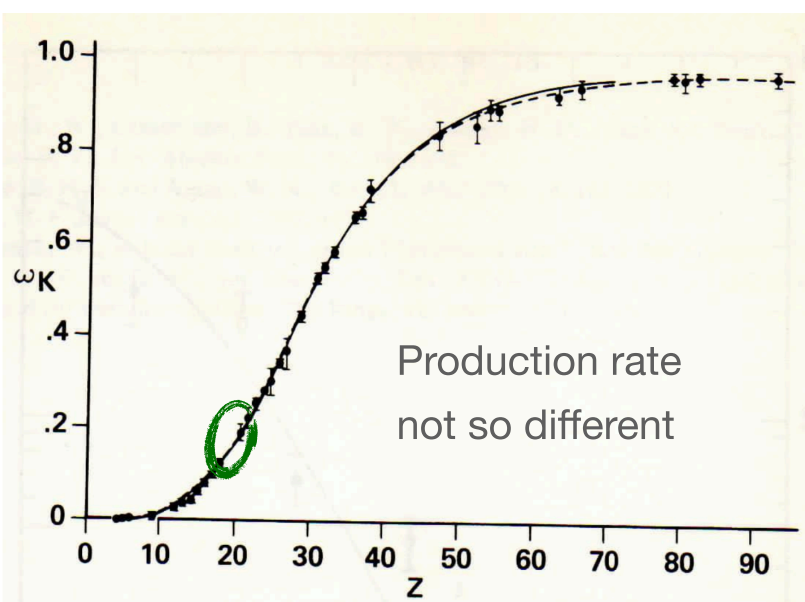
We tried Titanium, gypsum (Ca), salt (Cl)

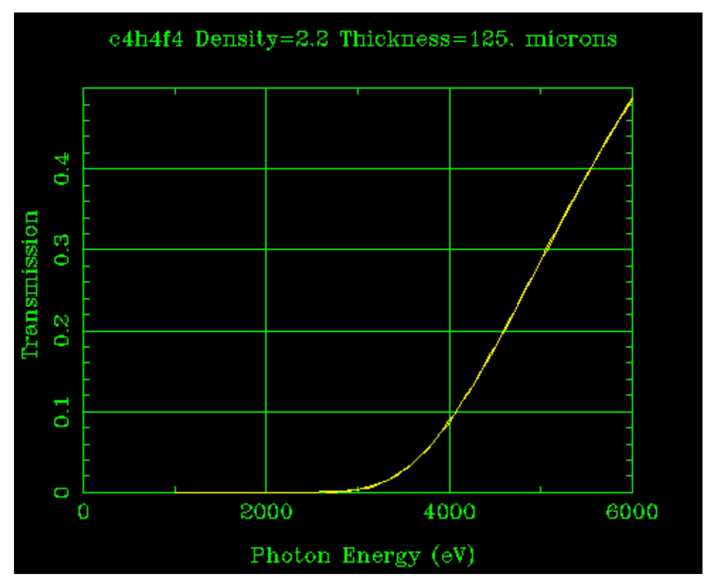


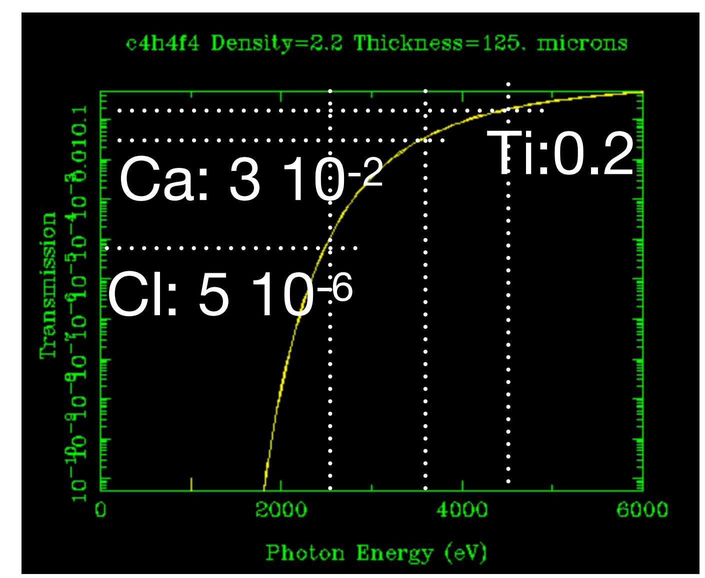




Elemento	Energia do raio X (keV)	
Si $K_{\alpha,\beta}$	1,74	
S $K_{\alpha,\beta}$	2,31	
Cl $K_{\alpha,\beta}$	2,62	z=17
K K_{α}	3,31	
Ca K_{α}	3,69	z=20
Ti K_{α}	4,51	z=22





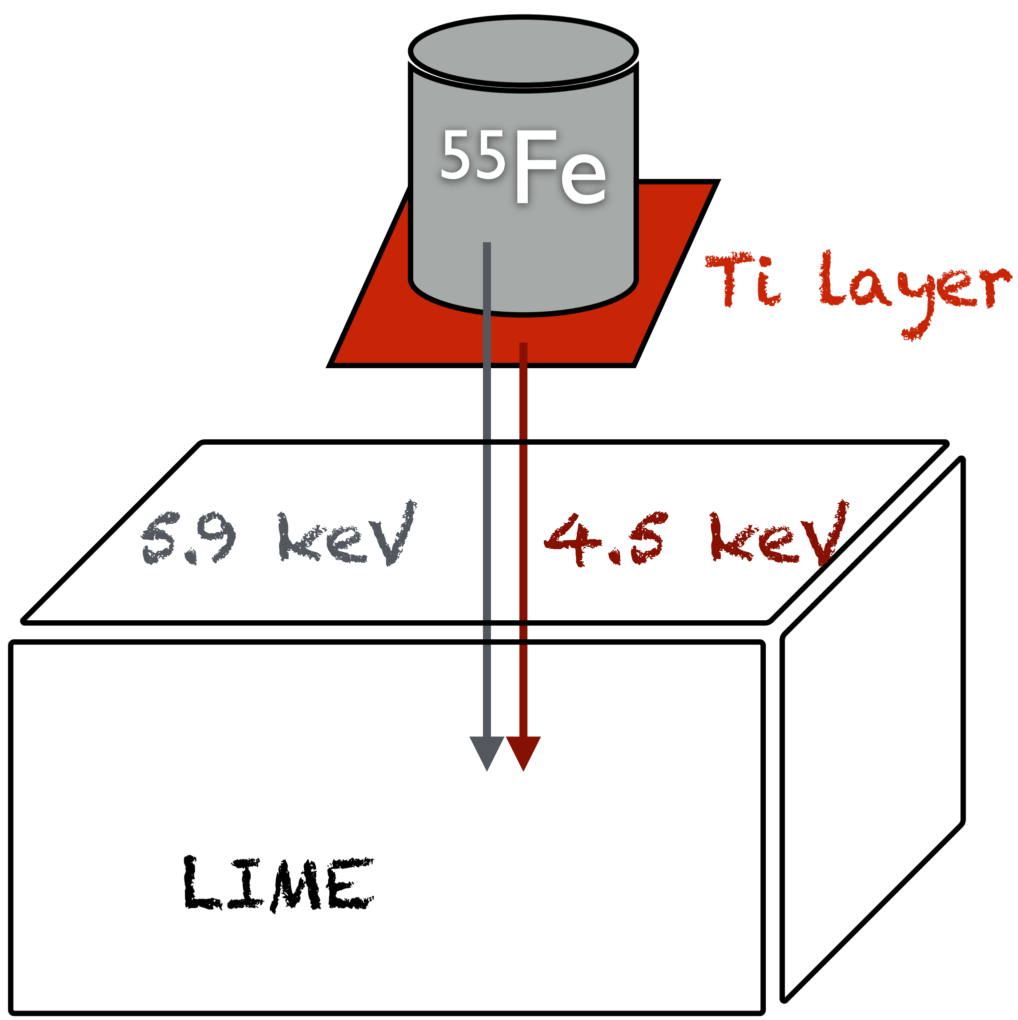


Very different probability of entering the 125

Davide, Roberto, Luigi took a lot of data with "45degree" reflection from material with the trolley built by Roberto

first look: test with Ti

Prior to that, we took some data with Ti (the one with the lowest absortion probabily from air and teflon window) in "penetration" mode:



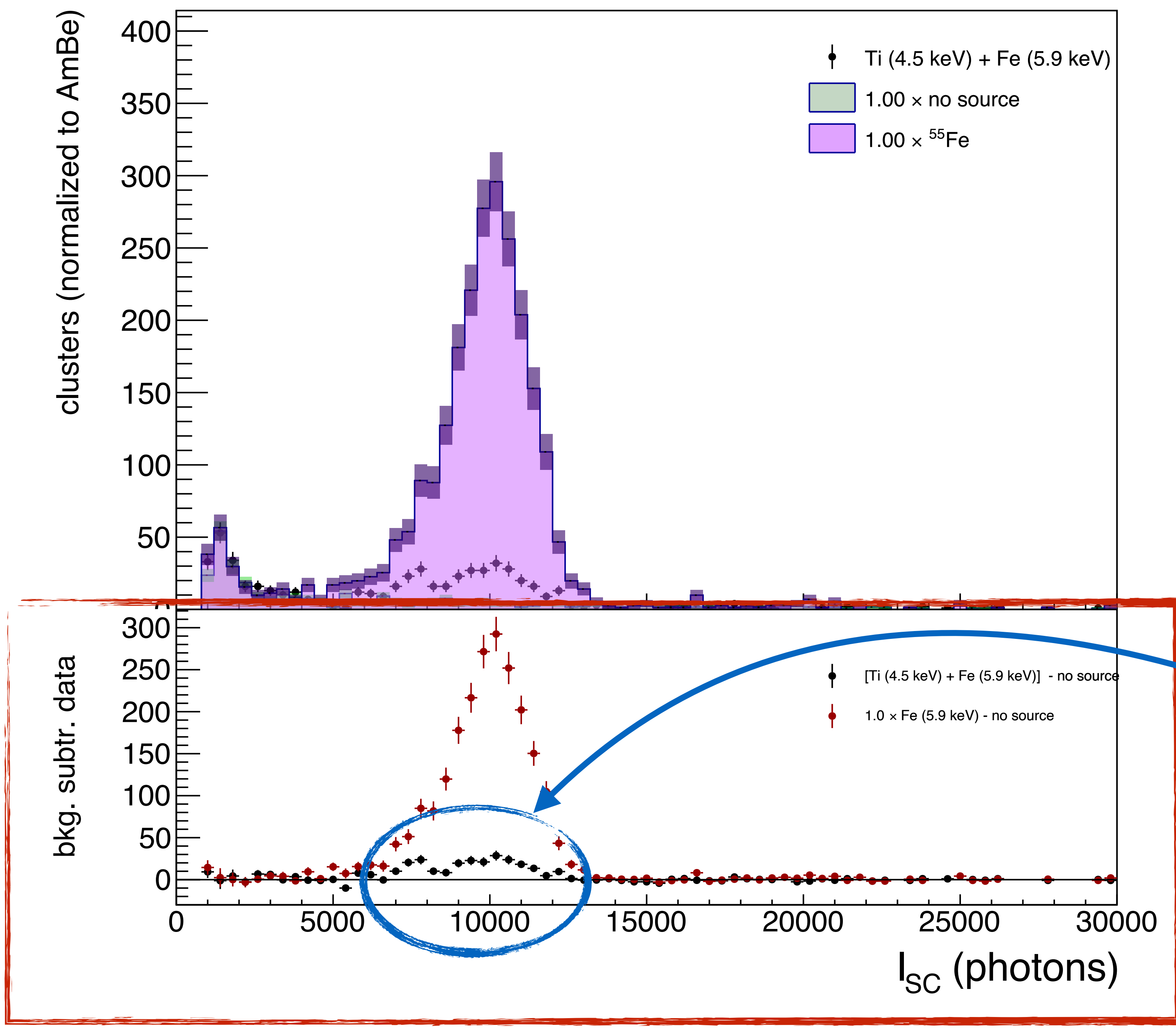
Expect to see inside LIME:

- the fraction of 5.9 keV X-rays not absorbed by Ti and teflon window
- a (smaller) fraction of 4.5 keV X-rays not absorbed by teflon window

i.e. a double peak

Data after selection

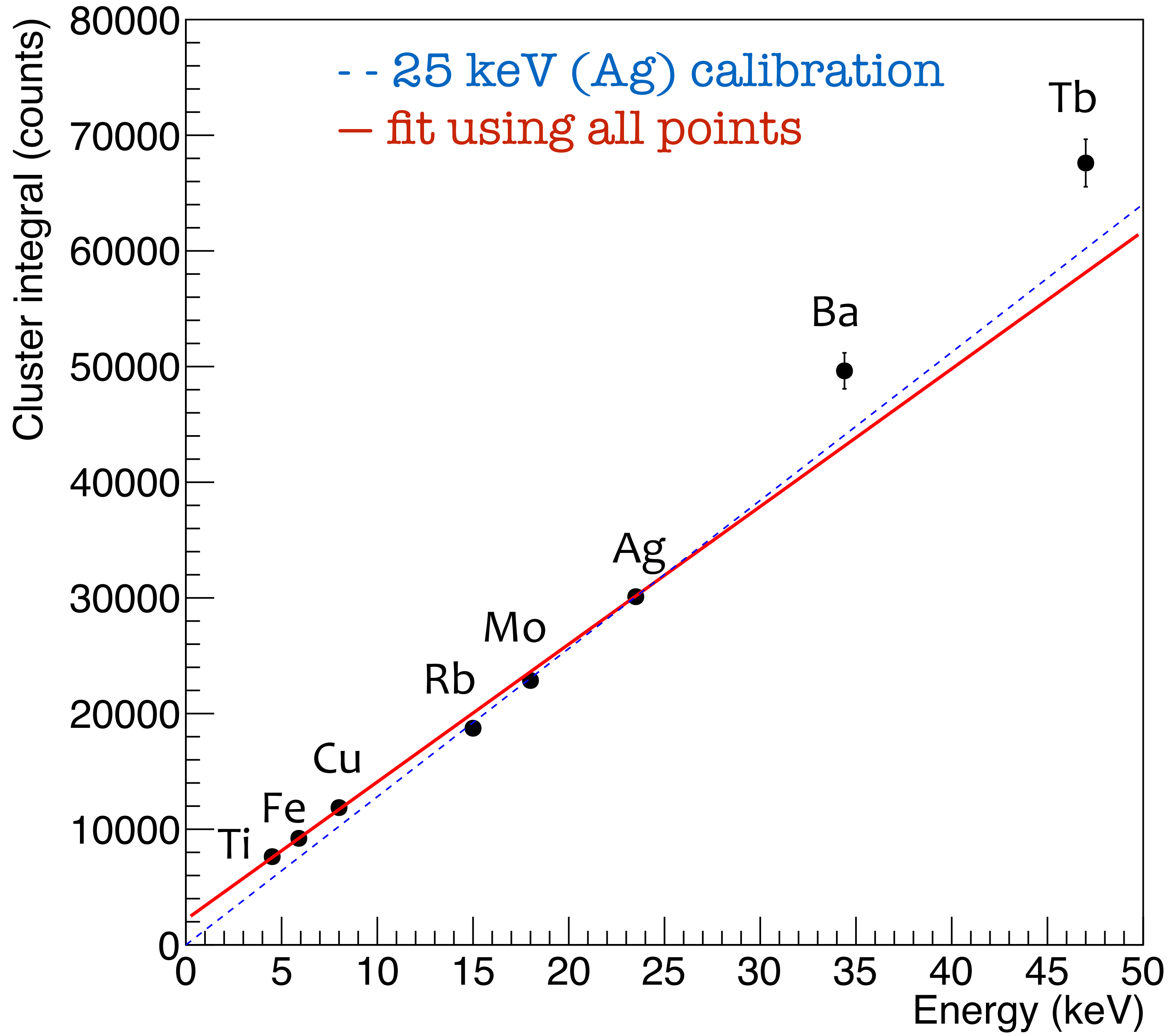
As usual compare data with Fe-only, Fe+Ti, bkg-only. Subtract bkg-only normalized to exposure time.



roughly what we expect, where we expect

One more energy point

Remember: last two points have a large syst error from bkg subtraction not considered here



Conclusions

Analyzed a first run taken with Ti, which seems to have reasonable production efficiency and survive the Teflon window => can be used as calibration at 4.5 keV

More data taken with "reflection" mode (eliminates original 5.9 keV line) with Ti, Ca, Cl, to be analyzed.

From rough calculation, the rate of Ca[3.7 keV] (production efficiency x absorption) could be barely visible => taken ~20k events

Cl should be impossible to see => 3.7 keV could be the lowest energy point visible with teflon window