

Prototype Improvements

(Gabriela's IEEE TNS 2004 submitted paper)

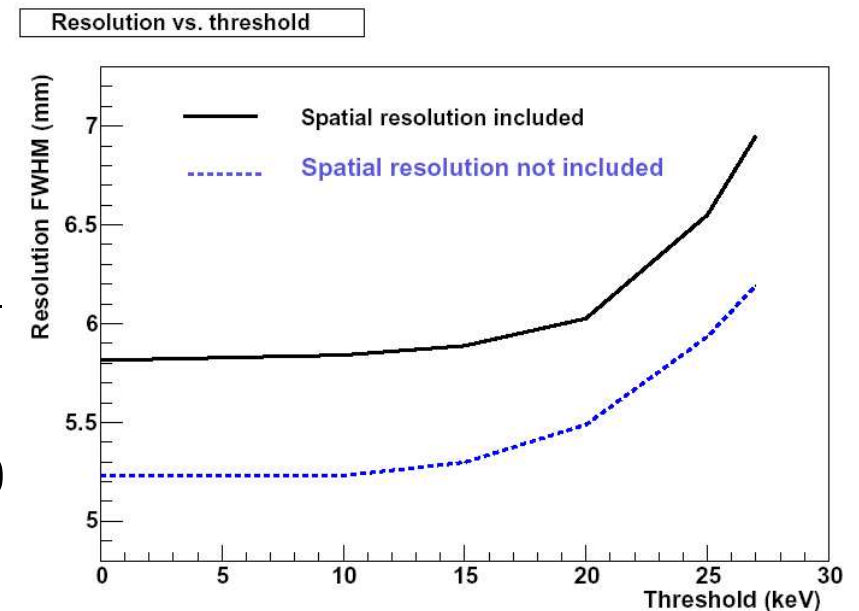
- lower the threshold
- shield the source
- increase silicon/scintillator spacing

In CERN, April 2004:

- hybrids optimized for energy resolution, not threshold.
- Threshold hysteresis observed: to stop oscillations, trigger must be set to much higher values and then decreased again

In Michigan, July 2004:

- Stable operation at 25-27 keV
- High threshold importantly influences image resolution
- in given setup, threshold below 10 keV desired.



In Ljubljana, November 2004:

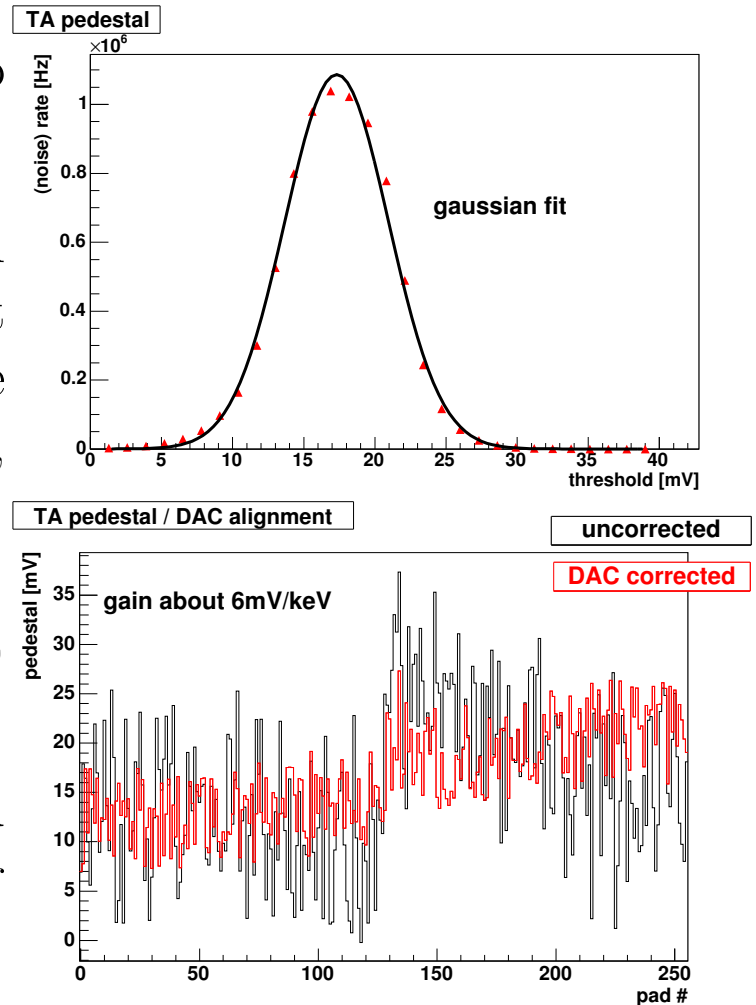
- added a $1\mu\text{F}$ capacitor on the trace, close to the 2nd chip (to account for asymmetric decoupling)
- increased mbias per chip (decreases shaping time of fast/slow shaper)
 - EXPECTED lower stable threshold in mV as smaller shaping times \rightarrow larger slope of the shaper output \rightarrow less switches in the discriminator \rightarrow NOT TRUE \rightarrow lower achievable threshold in mV remains fixed
 - BUT: higher gain (mV/ Am peak) observed if also vfp set to -800 mV \rightarrow effectively lower threshold in keV !!
 - no deterioration in energy resolution observed
- Alignment performed
- (MOST IMPORTANTLY) bonded grounds to VATAGP3's front end (unlisted ground pads).

Alignment of thresholds

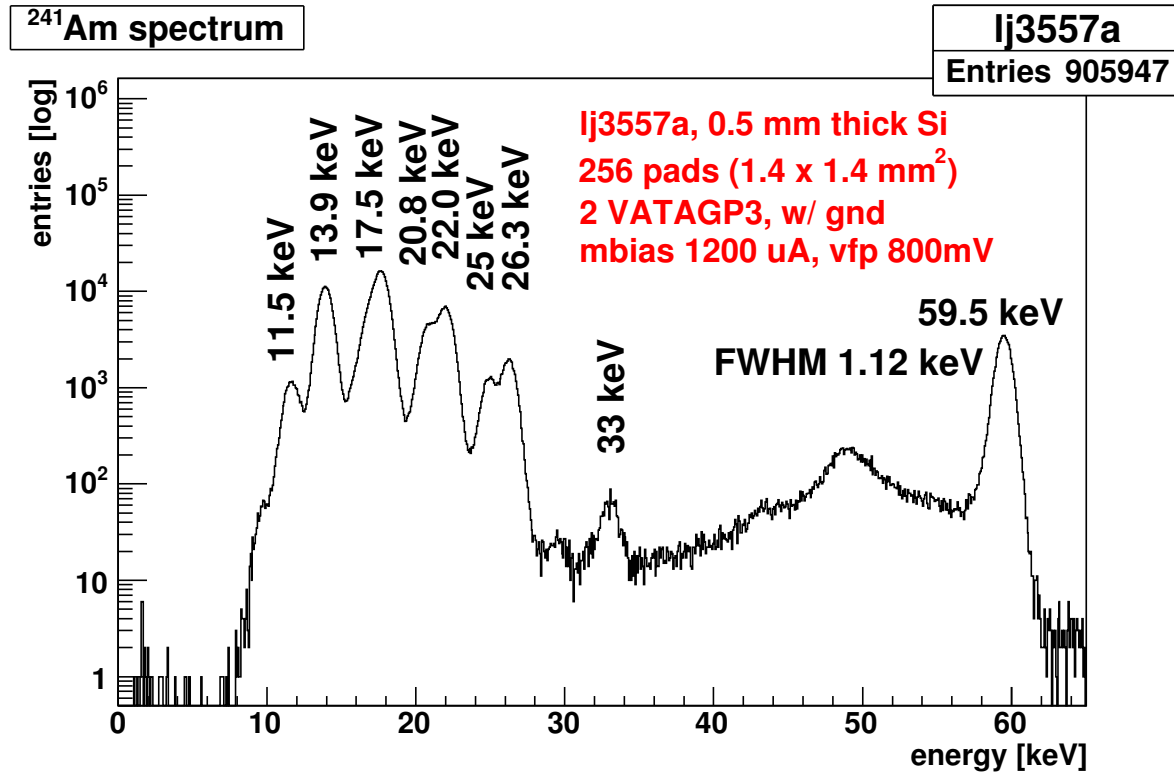
- Performed in the "normal" mode, no frequency generator or source used.
- Based on R , noise rate dependency on t , threshold with p , pedestal, σ , fast shaper noise and τ , its shaping time [Rice, The Bell Syst Tech J, vol. 23 (1944), p. 282-332 and vol. 24 (1945), p. 46-156]:

$$R = \frac{1}{4\tau\sqrt{3}} e^{-\frac{(t-p)^2}{2\sigma^2}} \quad (1)$$

- DAC mask minimizes pedestal spread while keeping sum of corrections 0 for each chip.

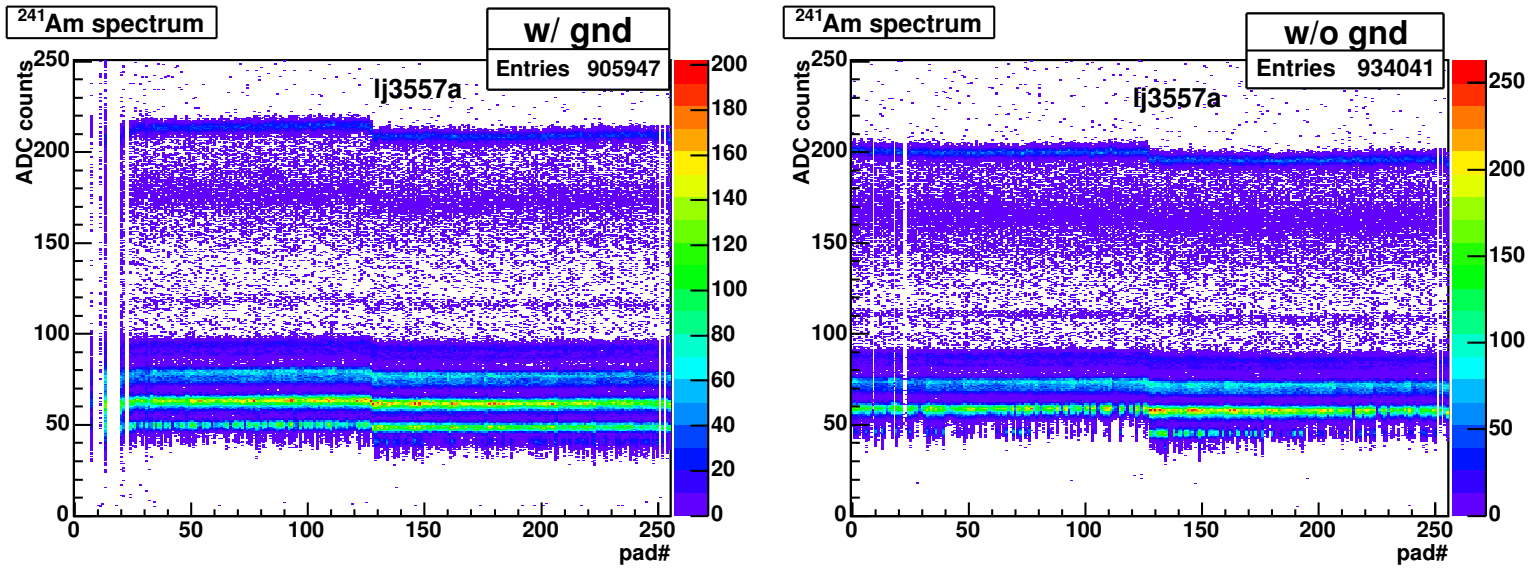


On lj3557a, 0.5 mm thick sensor



Stable triggering at 10-11 keV. All peaks accounted for.

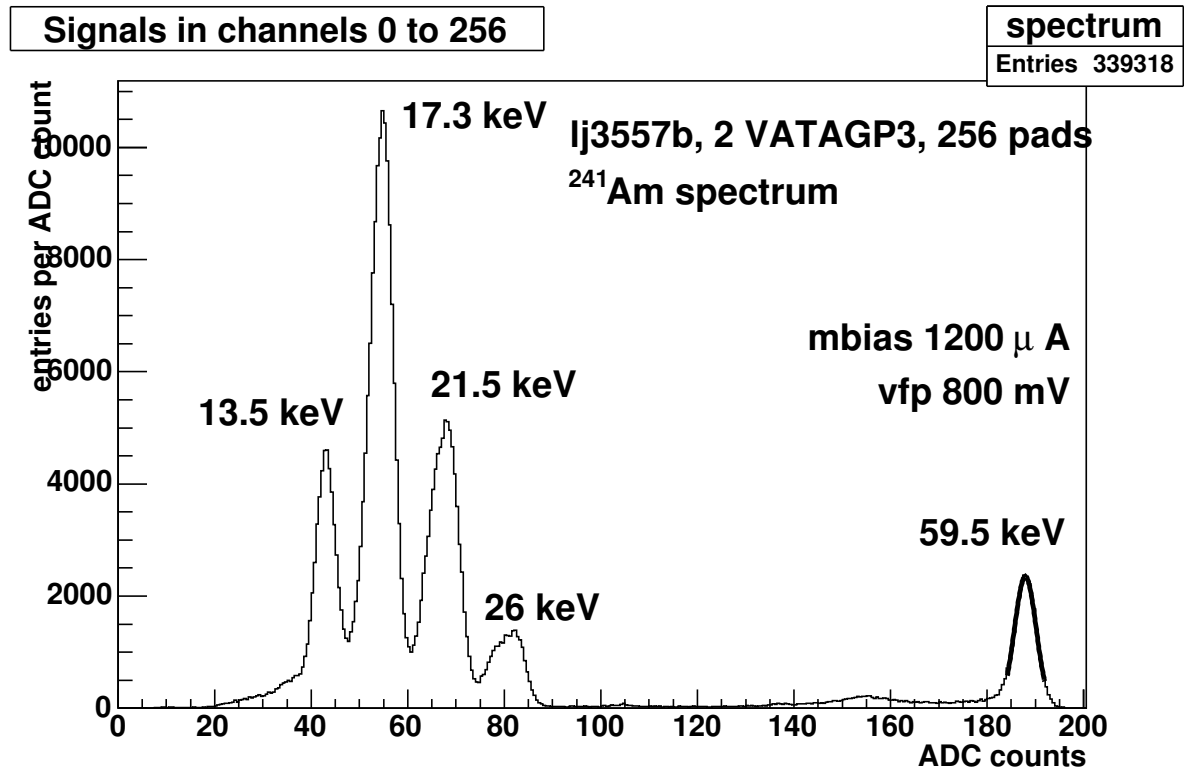
Looking closer -2D spectrum



grounding the pads \leftrightarrow no additional grounding

- possible lower threshold for about 3-4 keV
- observe **different mbias** for each chip (only sum of the two is set)!!!

Similar enhancement expected for 1 mm sensors



lj3557b (1 mm sensor) before grounding of the front ground pads. Energy resolution 1.7 keV.