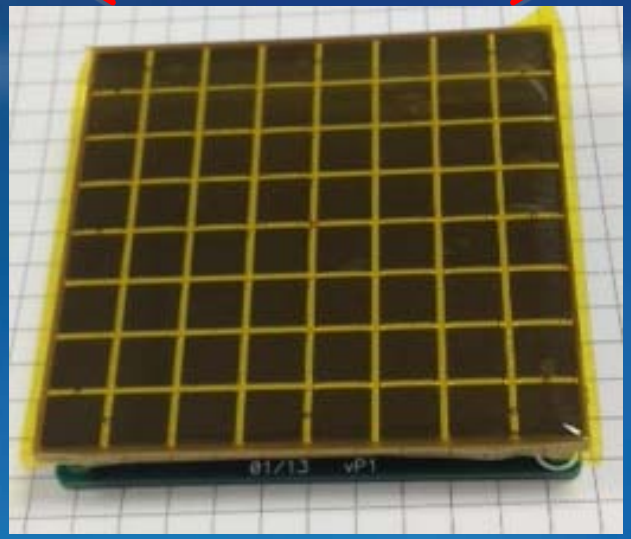
ArraySB-8

- Study of the single gamma operation using a 3mm NaI(Tl) array and a test 2mm array
- Effect of readout granularity: 8x8 row-and-column vs 4ch charge division
- Effect of temperature
- Effect of increased bias voltage

ArraySB-8

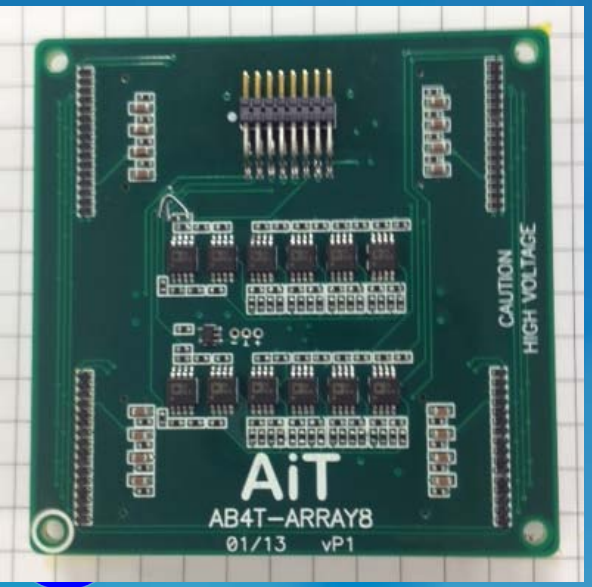
~57mm

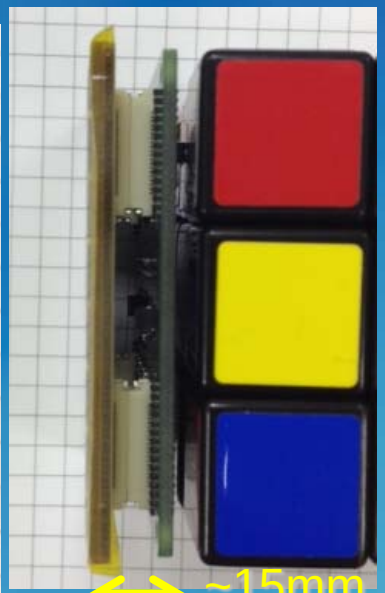


Parameter	Value
Number of pixels	8 x 8
Pixel active area	6 x 6 mm²
PCB size	56.6 x 56.6 mm²
Pixel pitch	7mm
No. of microcells per pixel	18980
Breakdown voltage (VBr)	24.5V ± 0.5V
Operating voltage (above VBr)	1V - 5V
Gain [a]	3x10⁶
Pixel dark current (Typical) [a]	12μA
Microcell recovery time [a]	130ns
Temperature dependence of VBr	<20mV/°C

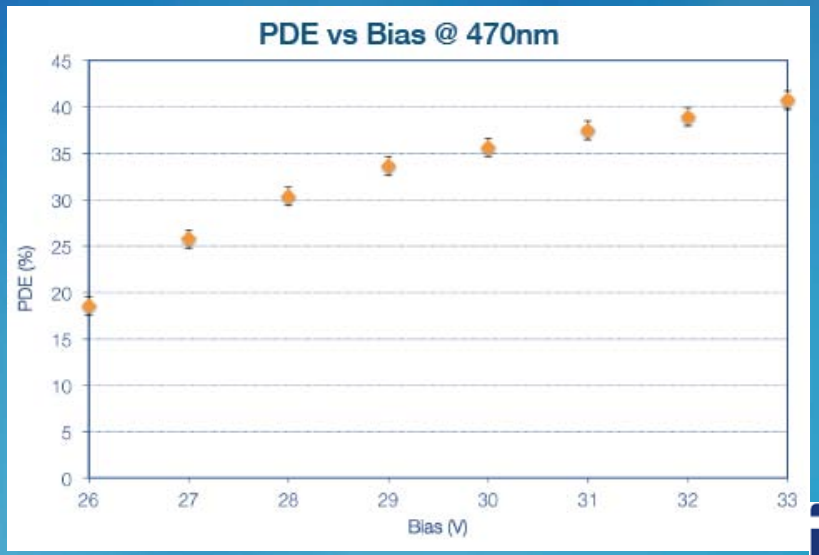
[a] *Measured at VBr+2.5V and 21°C*

[b] *Does NOT include the contributions from crosstalk and afterpulsing*

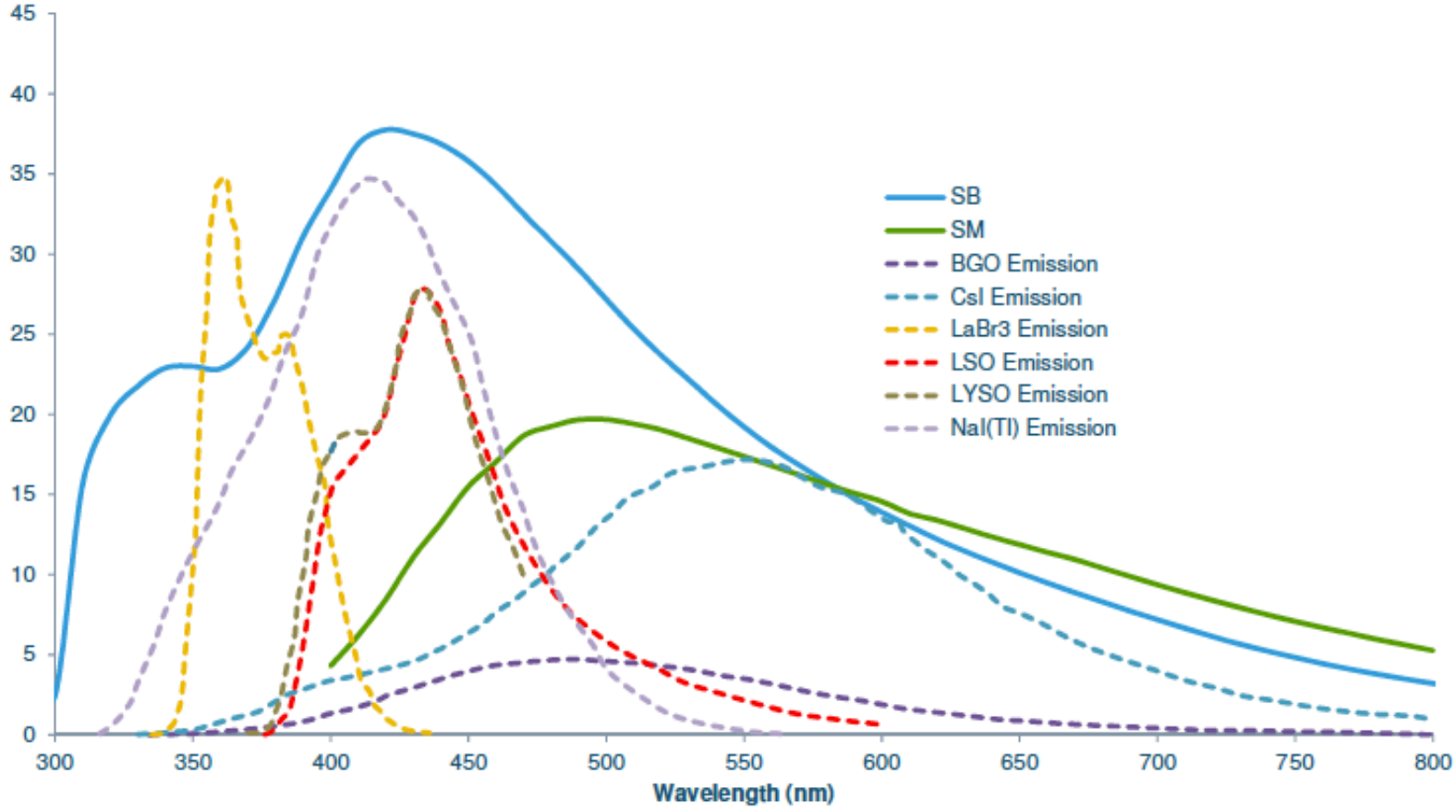




~15mm

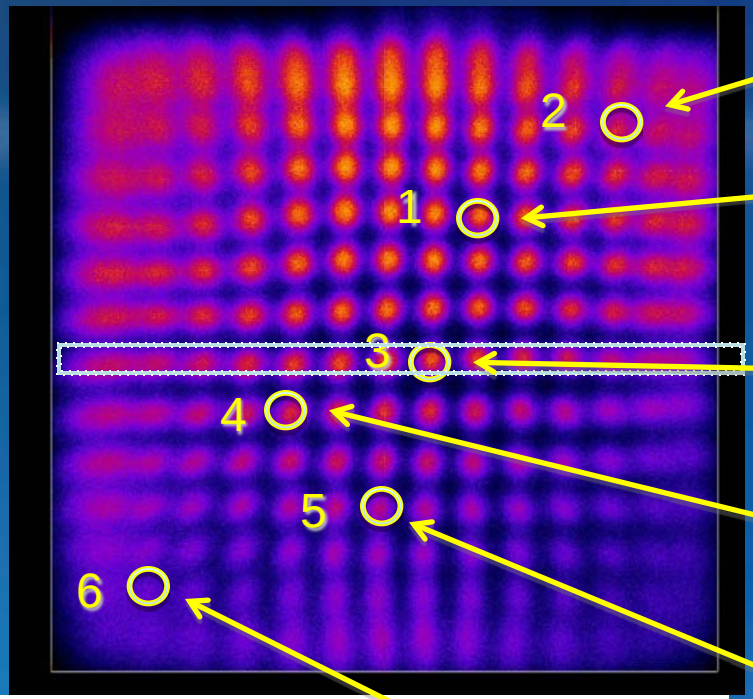


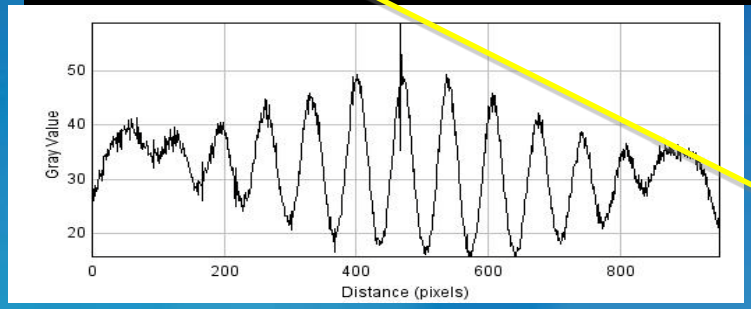
Common Scintillators & SensL SiPMs

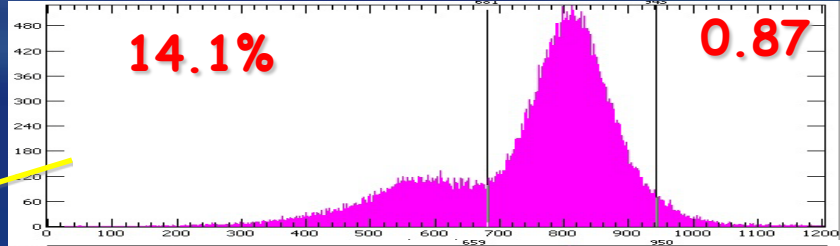


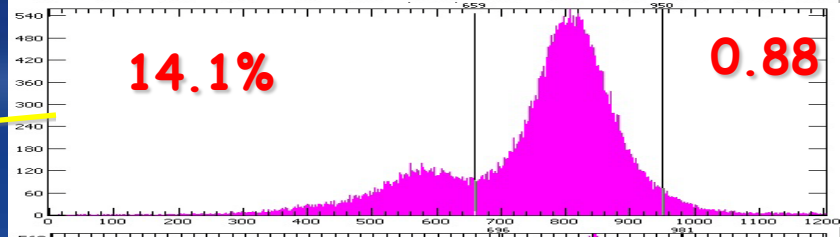
sensL
sense light

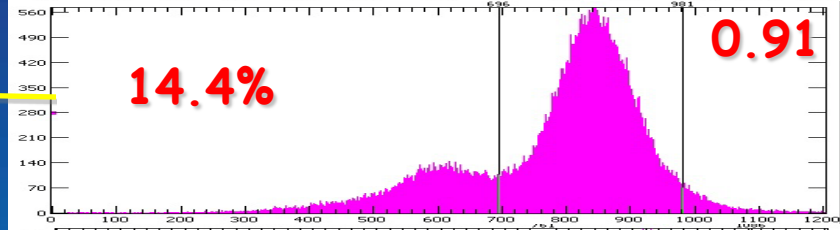
3mm NaI(Tl) array 4ch readout

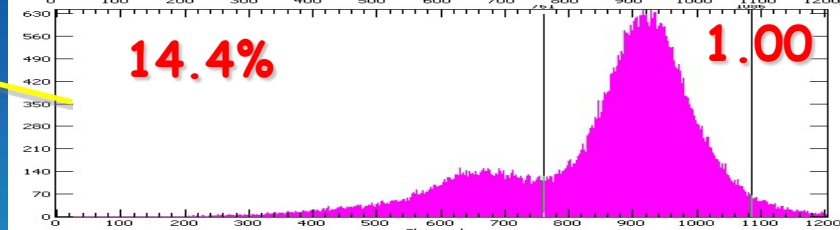


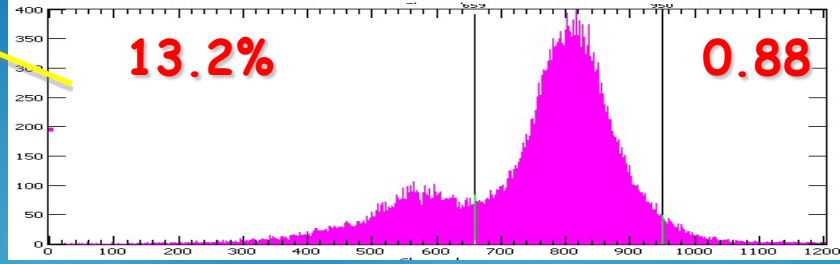


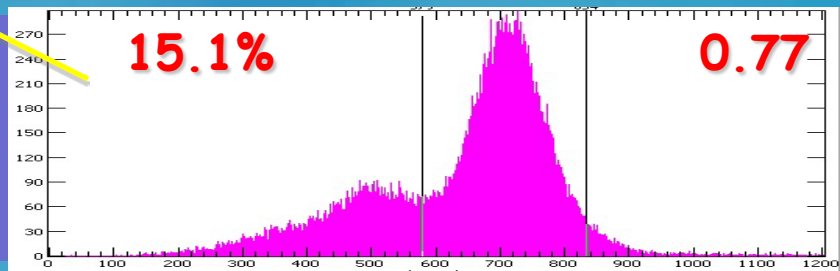






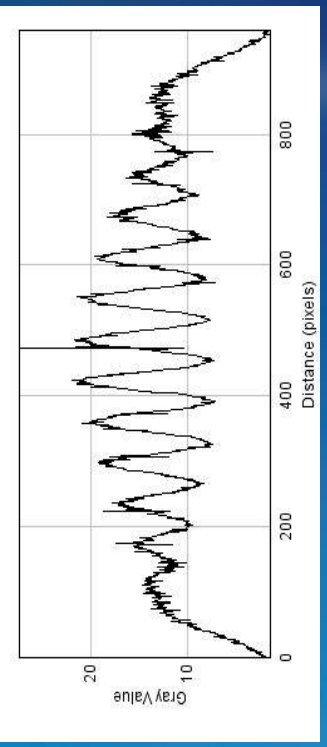


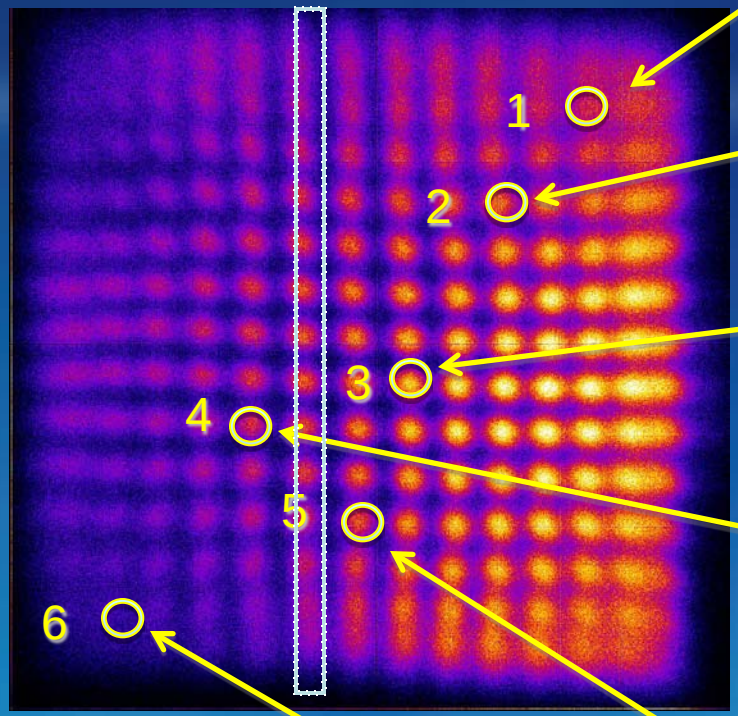


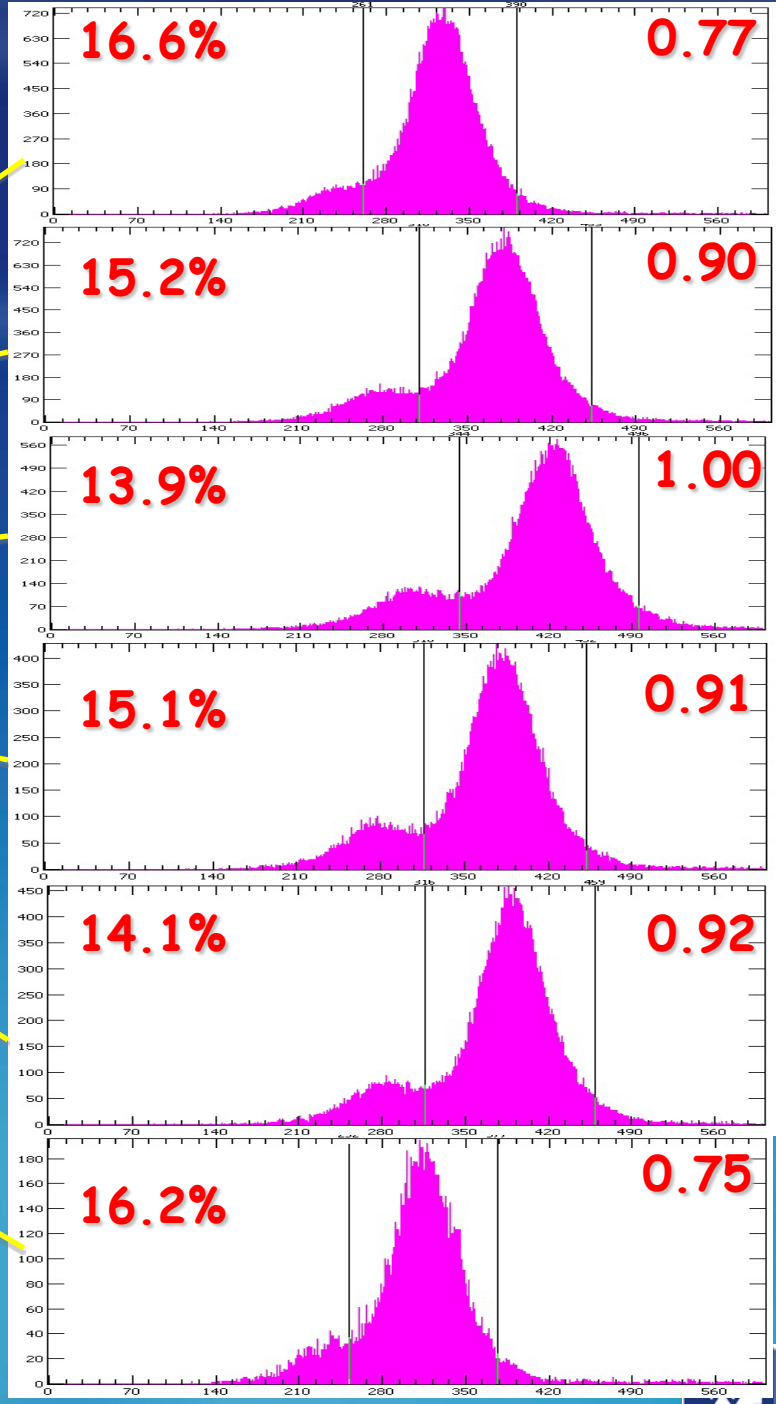


NaI(Tl) array of 3x3x6 mm pixels coupled to SiPM module through 6.5mm glass window. Bias ~ +30V. 21.5 C. 600ns signal integration gate. F factor 0.15. Co-57 energy spectra from six selected pixels, FWHM energy resolutions @122 keV and relative peak amplitudes.

3mm NaI(Tl) array 4ch readout

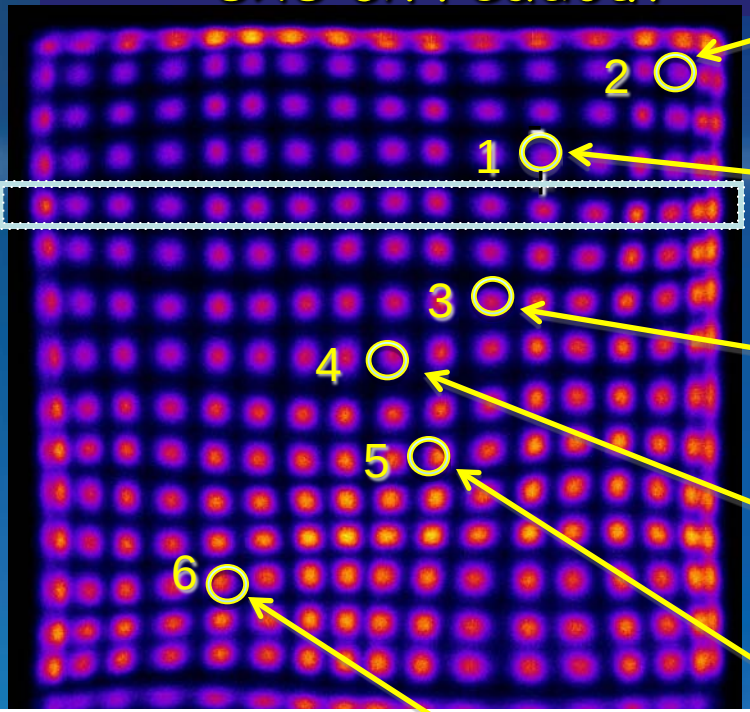


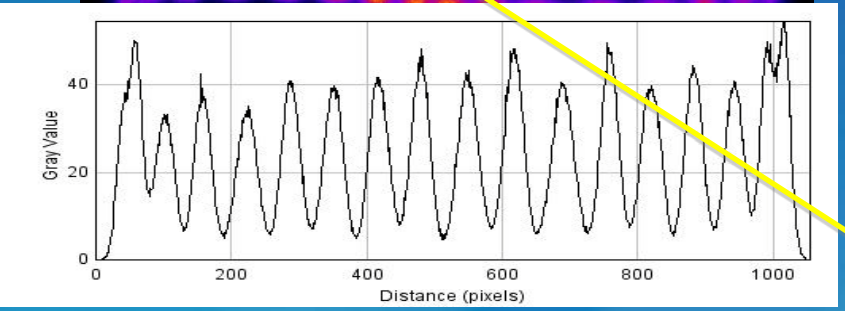


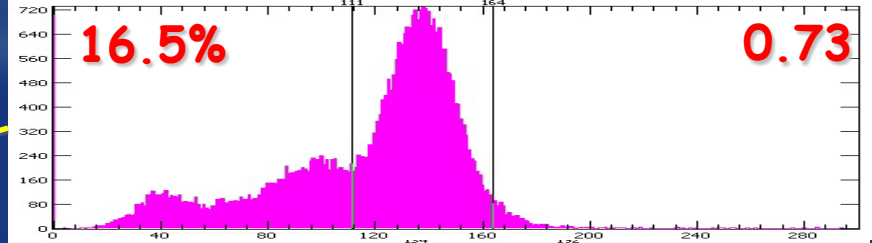


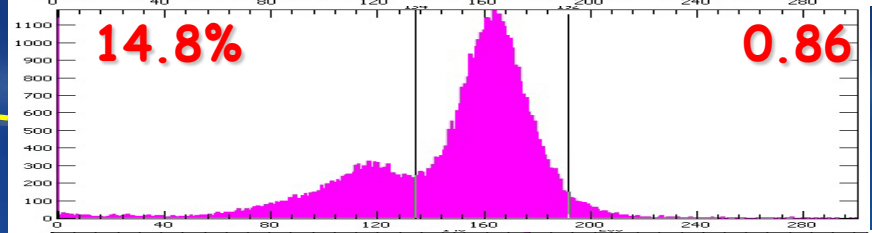
NaI(Tl) array of 3x3x6 mm pixels coupled to SiPM module through 6.5mm glass window. Bias ~ +28.8V. 21.5 C. 600ns signal integration gate. F factor 0.125. Co-57 energy spectra from six selected pixels, FWHM energy resolutions @122 keV and relative peak amplitudes.

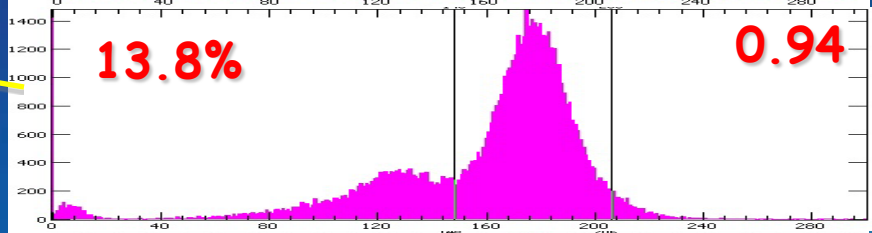
3mm NaI(Tl) array 8x8 ch readout

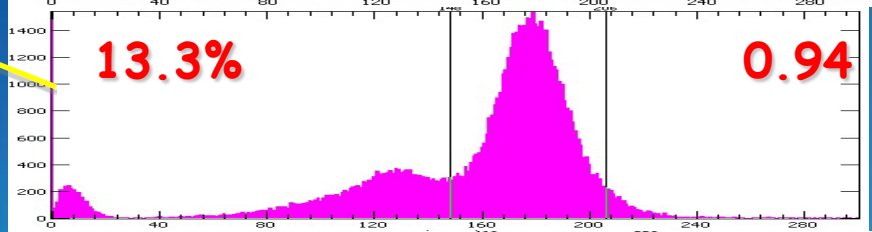


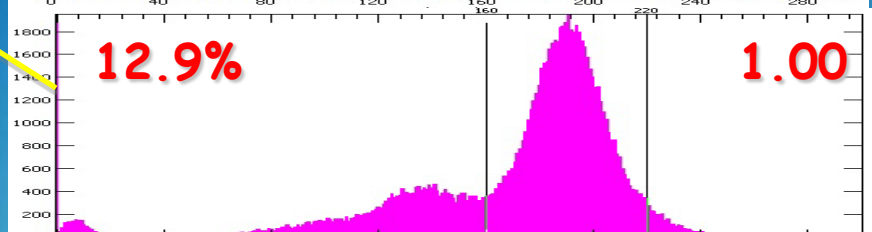


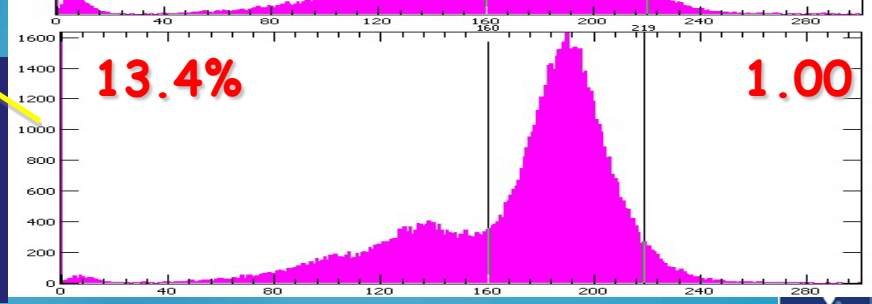






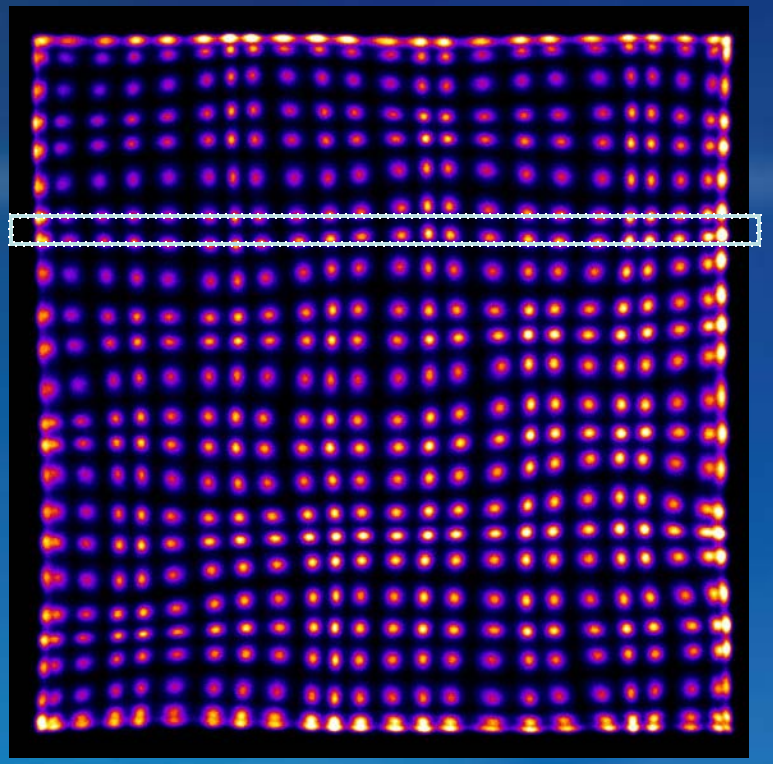


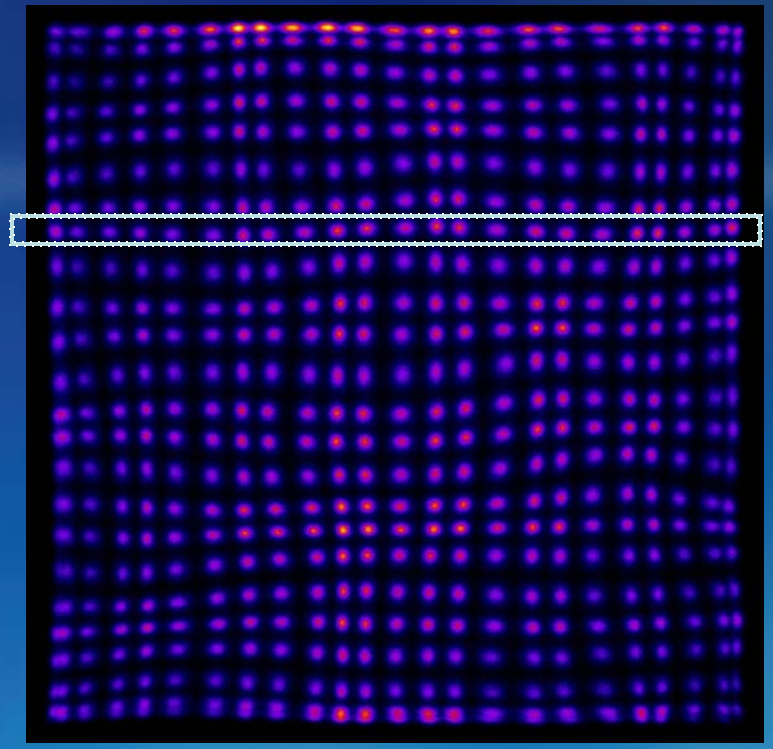


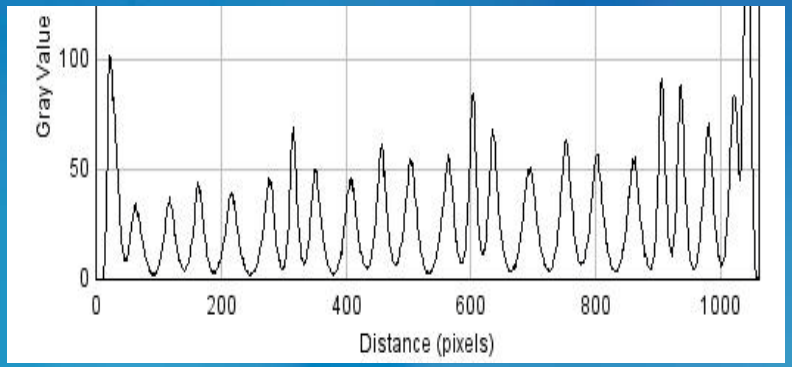


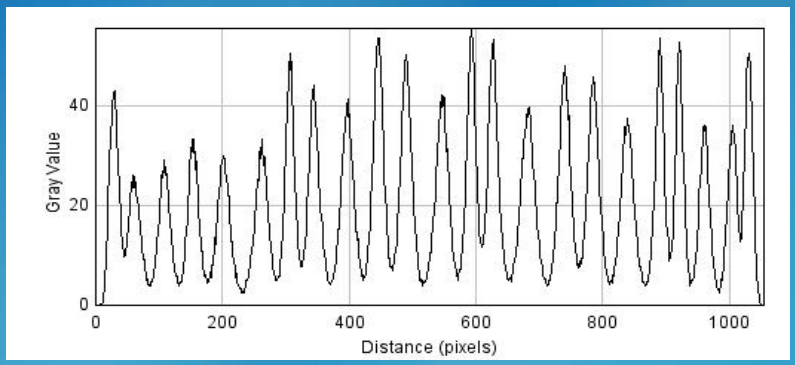
NaI(Tl) array of 3x3x6 mm pixels coupled to SiPM module through 6.5mm glass window. Bias ~ +28.8V. 21.5 C. 600 ns signal integration gate. F factor 0.075. Co-57 energy spectra from six selected pixels, FWHM energy resolutions @122 keV and relative peak amplitudes.

2mm NaI(Tl) array 8x8 ch readout





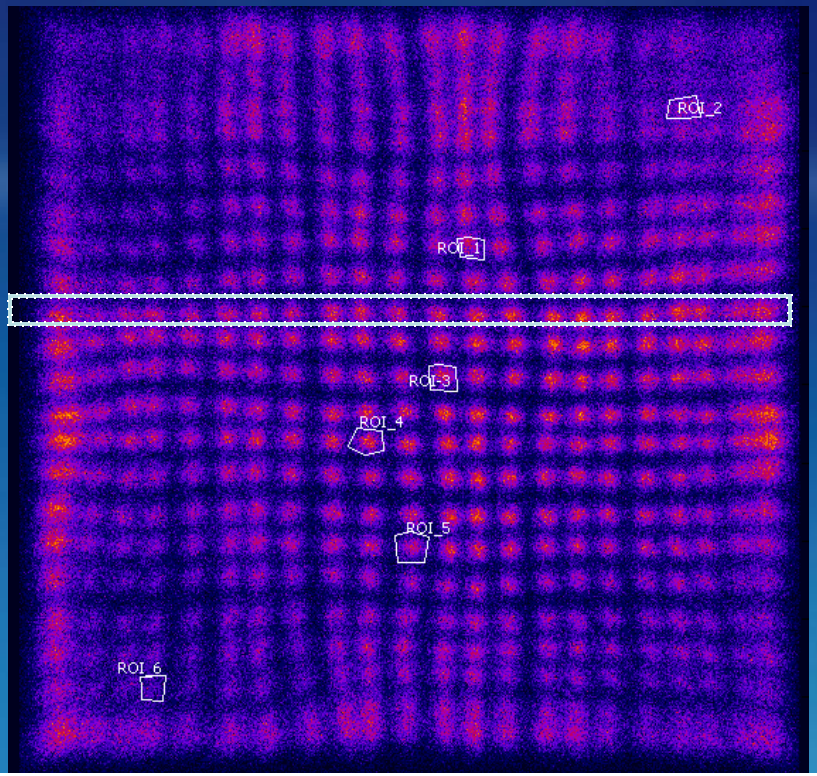


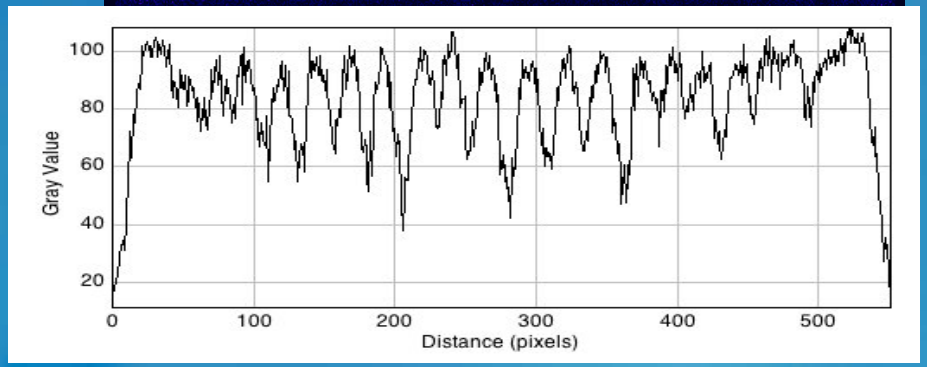


6.7 deg. C

20.5 deg. C

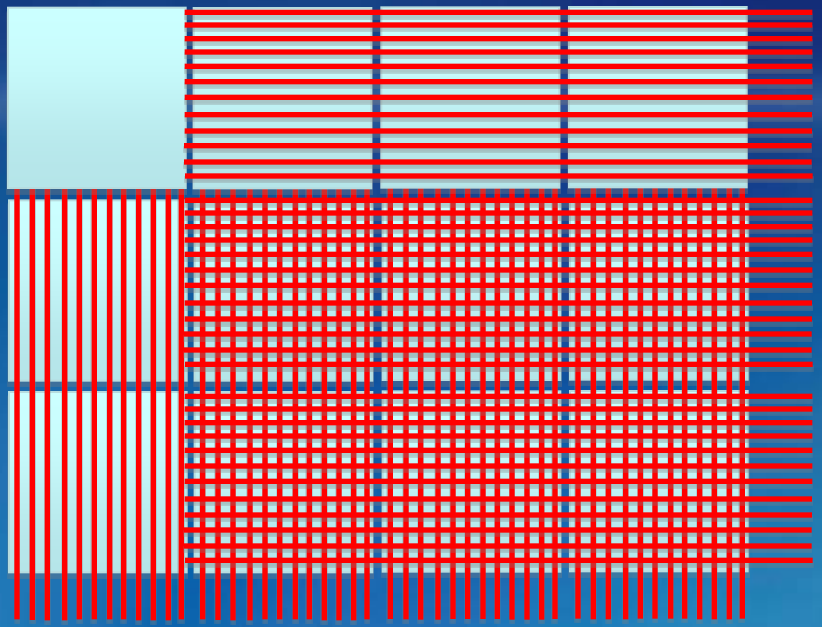
2mm NaI(Tl) array 4 ch readout





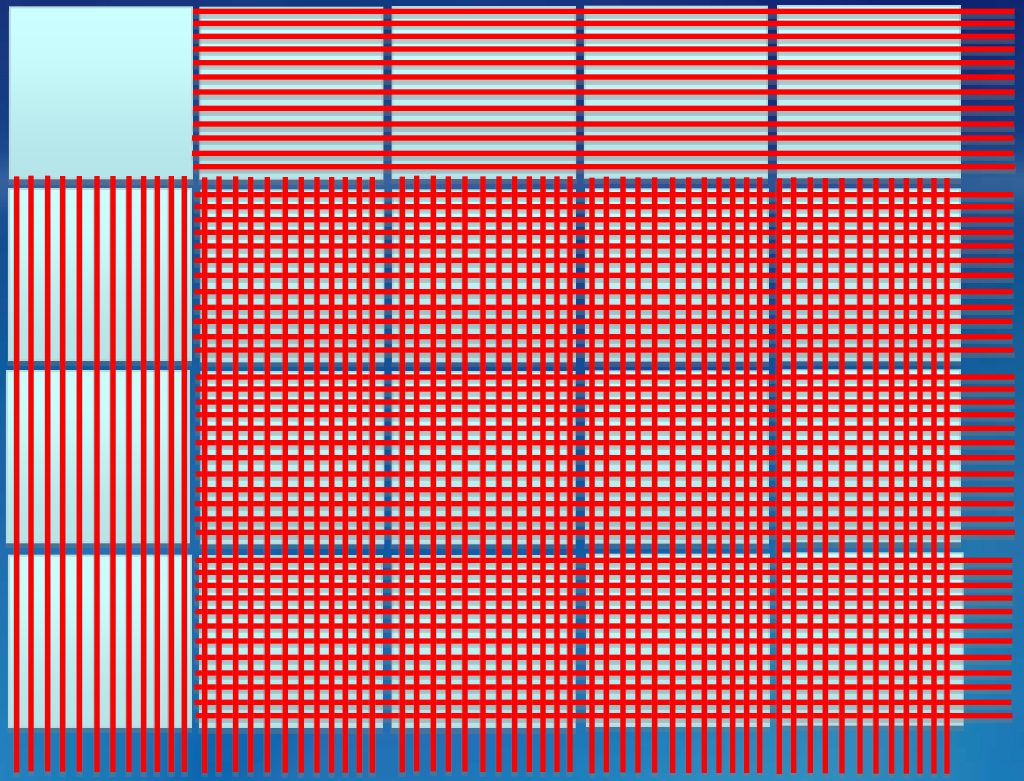
6.7 deg. C

Multiplexed Row-and-Column (MR&C)



In this schematic example of the 3x4 array of SiPM modules forming ~ 20x15cm detector panel, the corresponding row and column outputs from individual modules are connected together (multiplexed - passively or actively) to form common row and column readout lines for the whole detector panel. For the 144 SiPM modules the initial number of 288 R&C readout channels is reduced to 36 rows and 48 columns = 84 MR&C channels. For Array 8 the channel number will be 56 for the same size panel.

Multiplexed Row-and-Column (MR&C)



In this schematic example of the 4x5 array of SiPM modules forming ~ 25x20cm detector panel, in the 144 SiPM modules the initial number of 480 R&C readout channels is reduced to 48 rows and 60 columns =108 MR&C channels. For Array 8 the MR&C channel number will be 36+40 = 72 for ~ the same size panel.

Summary

- Proper separation of pixels in the image is only possible with row-and-column readout
- Energy resolution improves with voltage and is <15% FWHM @122 keV also with 4ch readout and at room temperature
- Cooling has only limited effect on improving performance