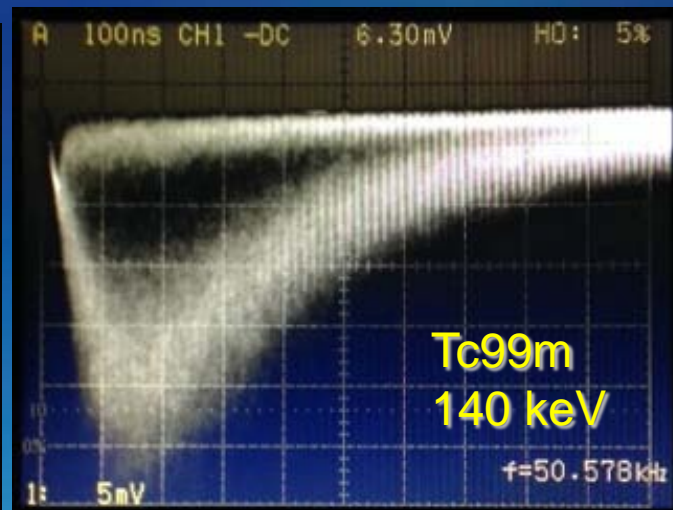
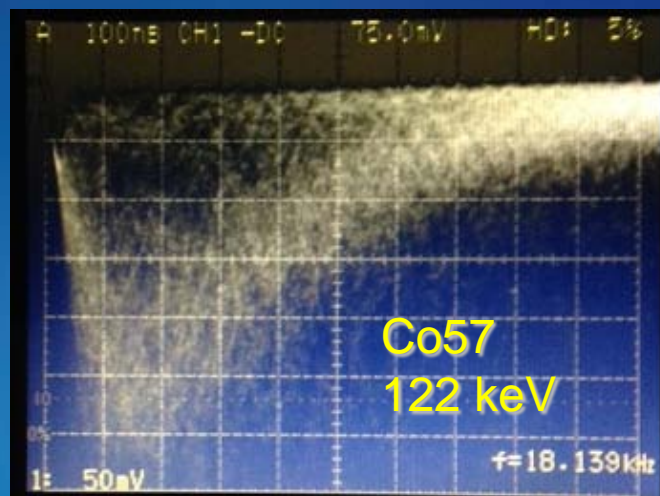
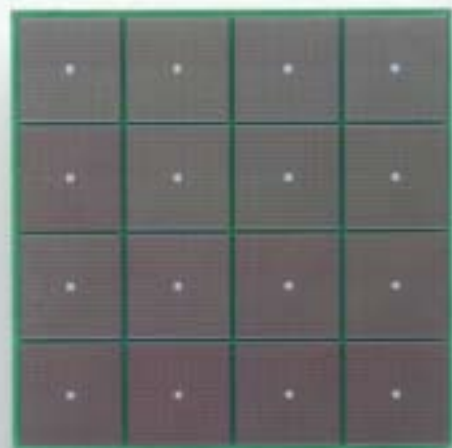




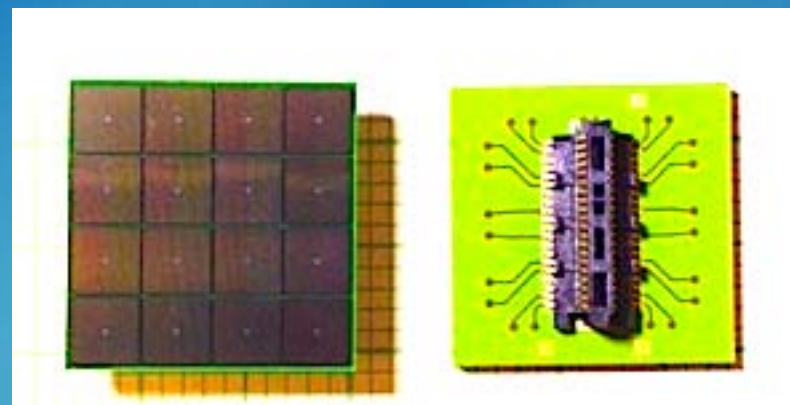
Pilot studies with MPPC array/NaI(Tl)

S12642-0404PA-50: 3x3mm², 4x4ch, p50μm

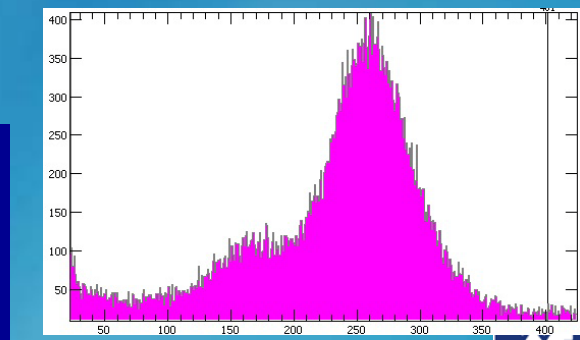
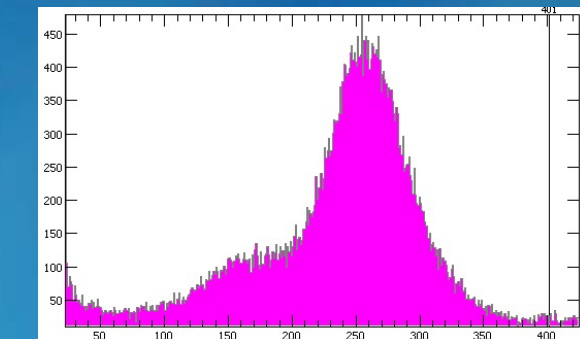
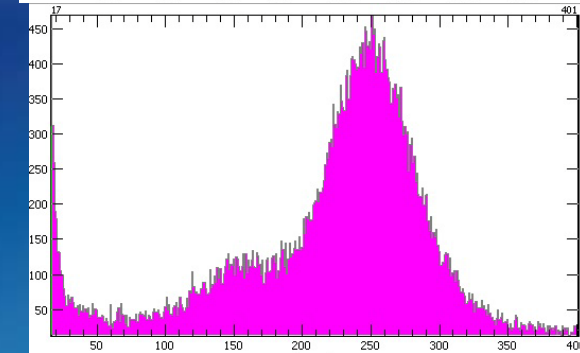
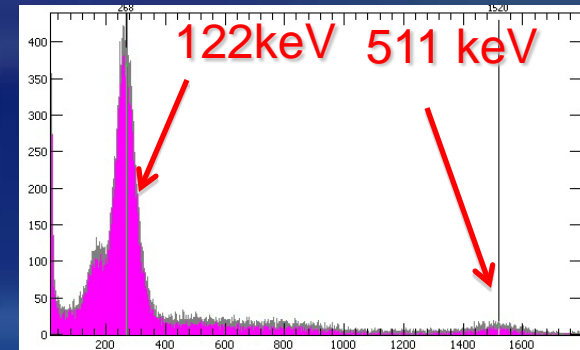
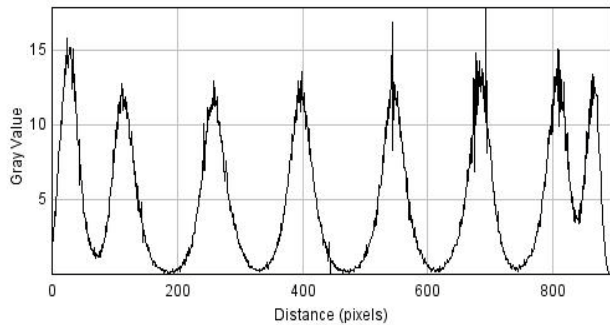
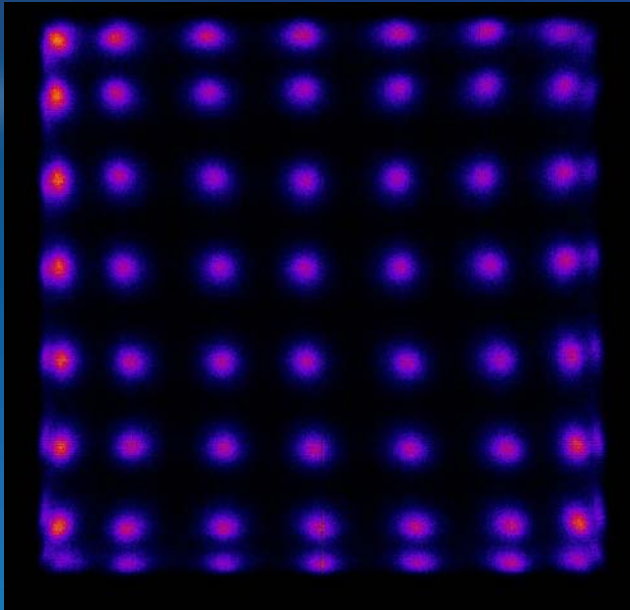


Study of the single-gamma operation using 1.5mm and 3mm NaI(Tl) arrays and AiT 4ch readout:

- Effect of temperature
- Effect of bias voltage
- Effect of integration gate width to ADC

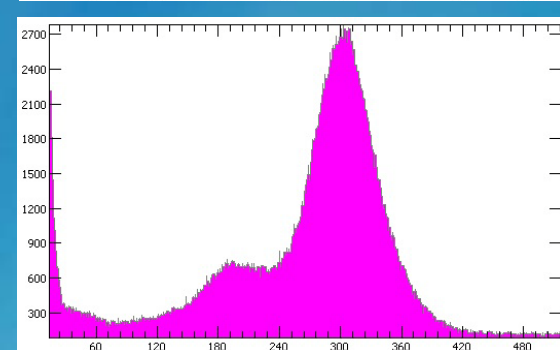
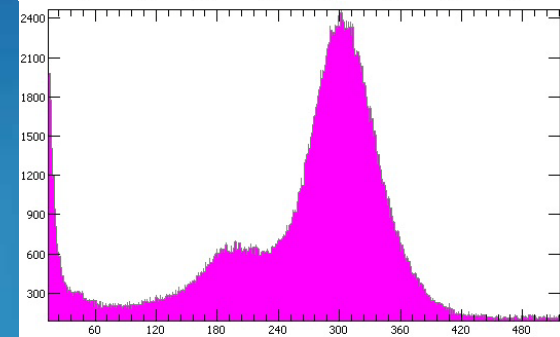
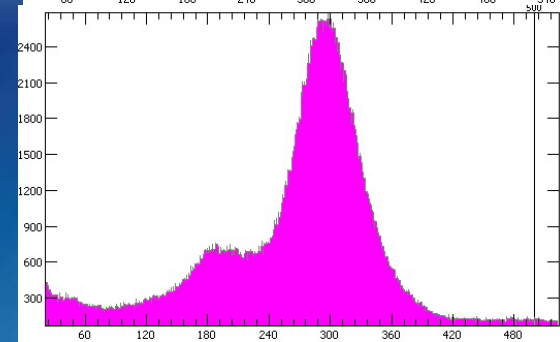
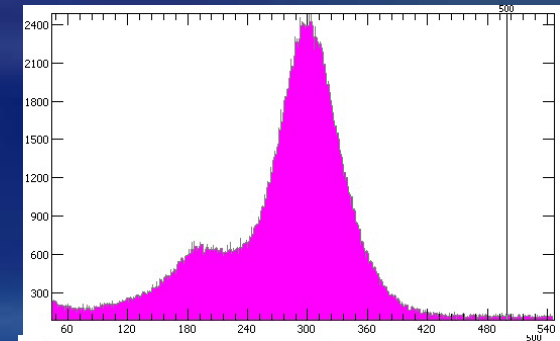
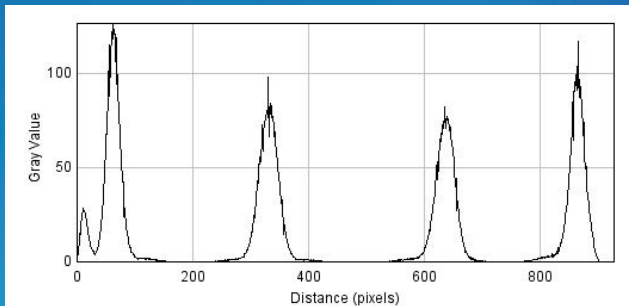
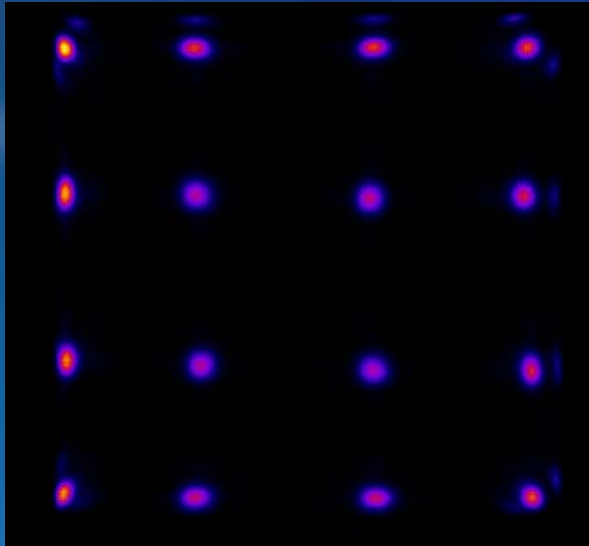


Studies of the 1.5mmx1.5mmx6mm NaI(Tl) array with Co-57



Conditions: Bias 66.6 V. Temperature: 11 deg C. Gate: 500ns. Na-22 source used for energy calibration. Energy spectra measured for four 1.5mm NaI(Tl) pixels. Average energy resolution @ 122 keV is ~16-17% FWHM.

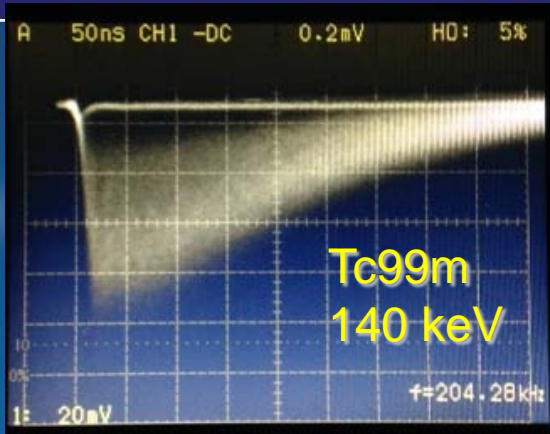
Studies of the 3.0mmx3.0mmx6mm NaI(Tl) array with Co-57



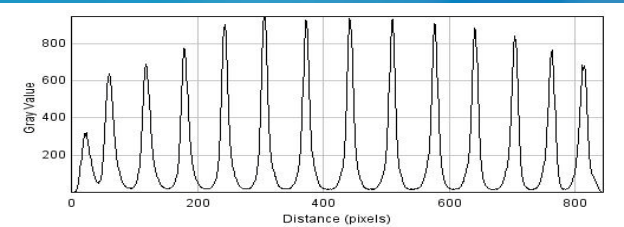
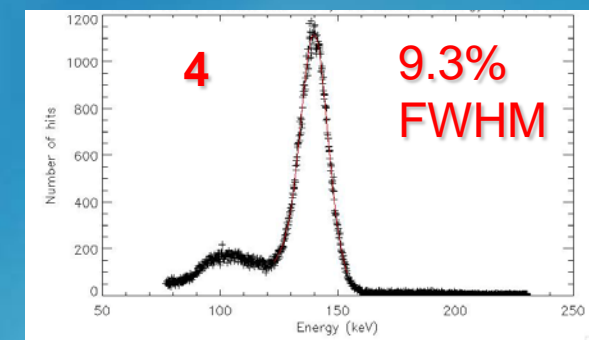
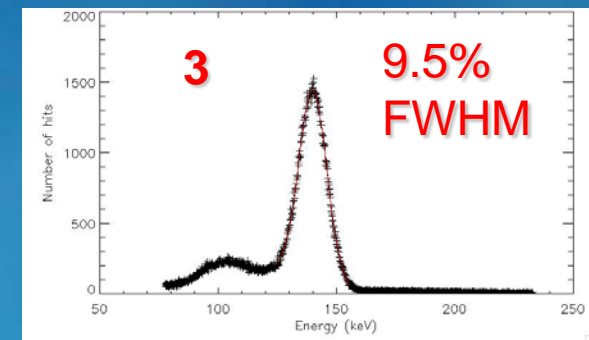
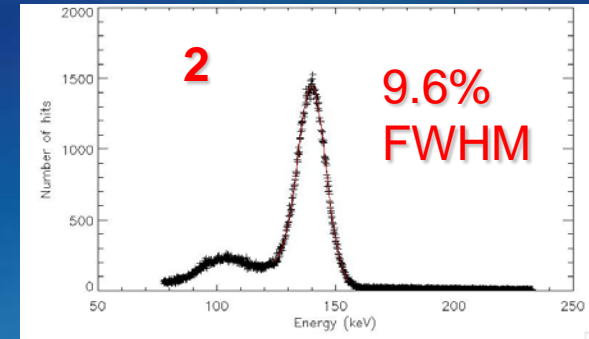
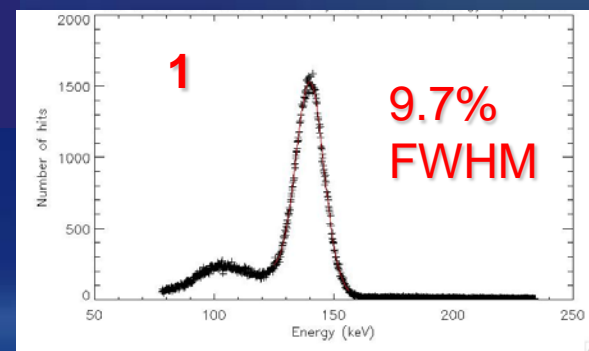
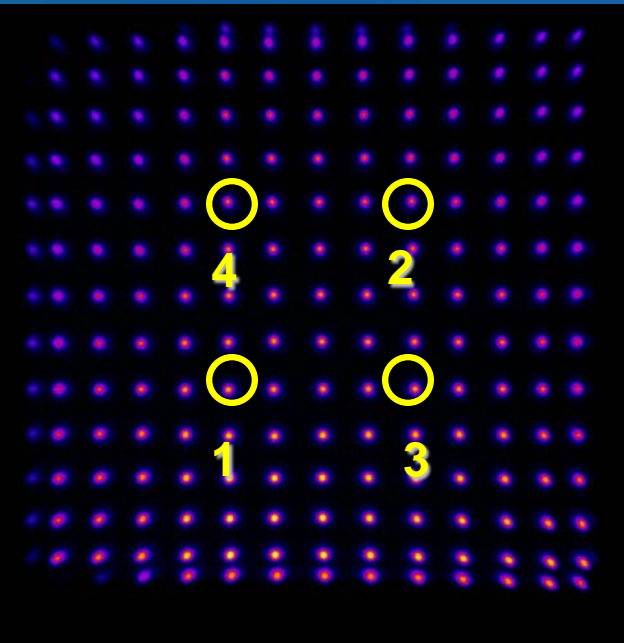
Conditions: Bias 66.6 V. Temperature: 11 deg C. Gate: 500ns. Energy spectra measured for four central 3mm NaI(Tl) pixels. Average energy resolution @ 122 keV is ~15% FWHM.



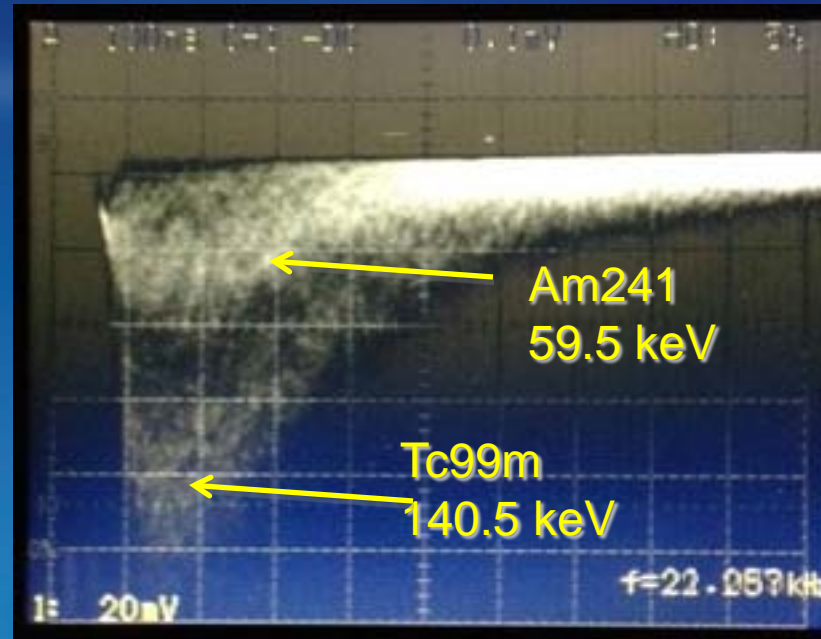
Comparative studies with the H8500 PSPMT



Comparative measurements. The same 3mm NaI(Tl) array was coupled to a H8500 PSPMT. Scope pulses, raw image and projection of one of the pixel rows are shown. Also four examples of energy spectra from individual 3x3x6mm NaI(Tl) pixels from the central region, with Gaussian fits. Energy resolutions are: 9.7, 9.6, 9.5 and 9.3 % FWHM for pixels 1, 2, 3 and 4, respectively.



Studies with the Tc99m and Am241 sources

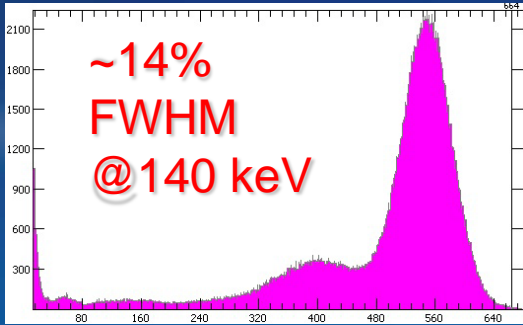


To provide energy calibration, a low intensity Am-241 source was used, in addition to the Tc99m source. The output from the combined MPPC sum signal of the 4ch AiT charge division circuitry is shown here on the scope screen.

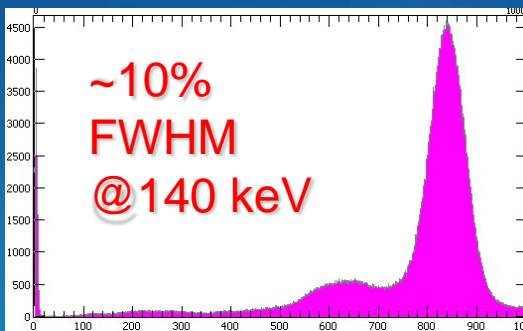


Studies with the 3mm Na(Tl) array

MPPCs

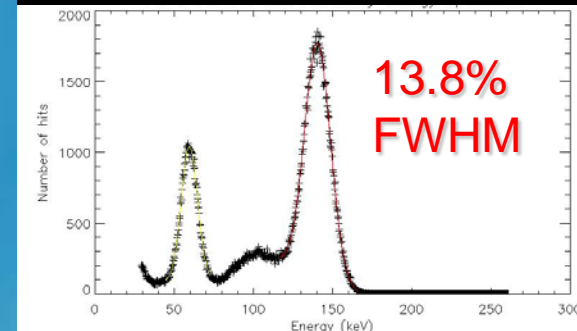
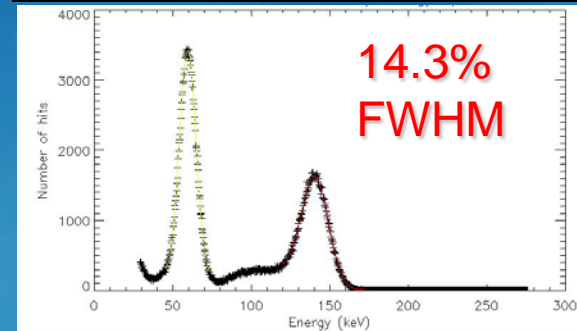
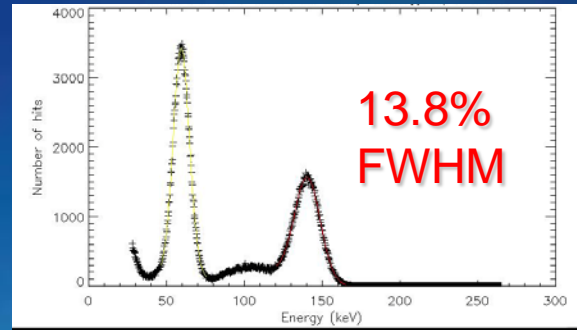
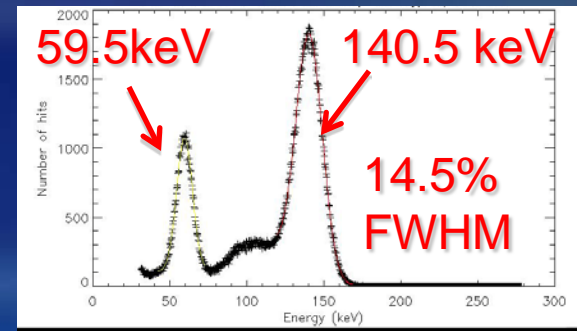


H8500



Energy fit results are:

Tc-99m and Am-241 (linear calibration of the energy scale) :
 14.5, 13.8, 14.3 and 13.8 % FWHM at 140.5 keV
 20.5, 20.3, 20.8 and 20.7 % FWHM at 59.5 keV



Results with the 5x5 cm NaI(Tl) array (from Saint Gobain) of 3x3x6 mm pixels coupled to the SiPM module through ~2mm glass window. Bias 67.5V. 16.5 deg C. 500ns signal integration gate. F factor 0.175. Examples of combined Am-241 and Tc99m energy spectra from four 3x3x6mm NaI(Tl) pixels. FWHM energy resolution @140.5 keV is under 15.0%. For comparison a single pixel spectrum is shown for H8500 PSpMT using the same NaI(Tl) array.





Summary for the pilot study

- Achieved full separation of pixels in the raw images for 1.5mm and 3.0mm pitch NaI(Tl) arrays with 4ch AiT Instruments readout
- Achieved energy resolution is better than for any other SiPM array, and is less than 15% FWHM @140 keV at a temperature of 16.5 deg C
- For comparison energy resolution for the same arrays placed on an H8500 PSPMT is about 4% better (~10% FWHM @140 keV)
- The best energy resolution is obtained at lower bias voltages, and is limited by the induced electronic noise (measured but not documented in this short summary)
- Energy resolution is better at lower temperatures (measured but not documented in this short summary)

