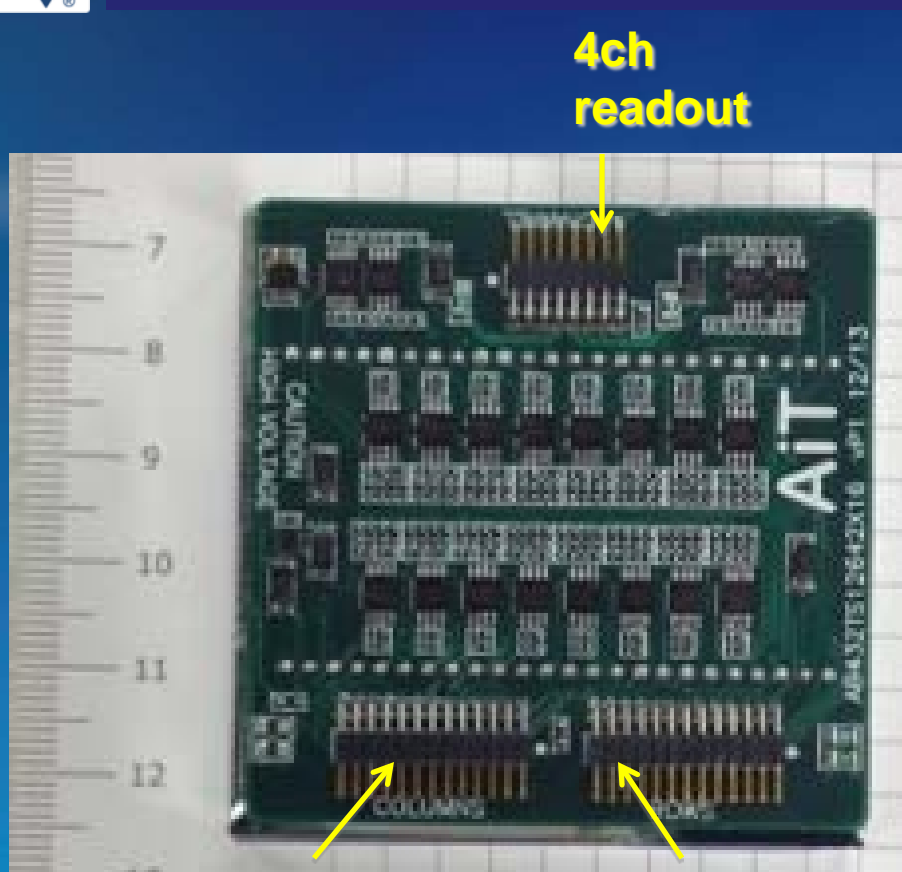




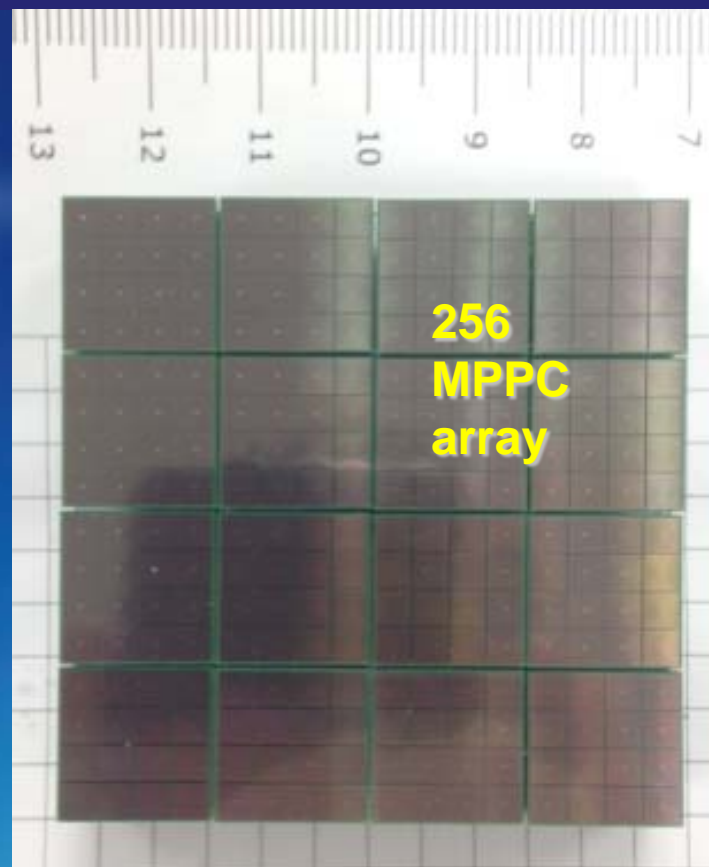
16x16 MPPC array pilot studies with NaI(Tl) arrays



4ch
readout

16ch columns 16ch rows

Hybrid readout board from AiT Instruments with the row-and-column outputs and a 4ch output.

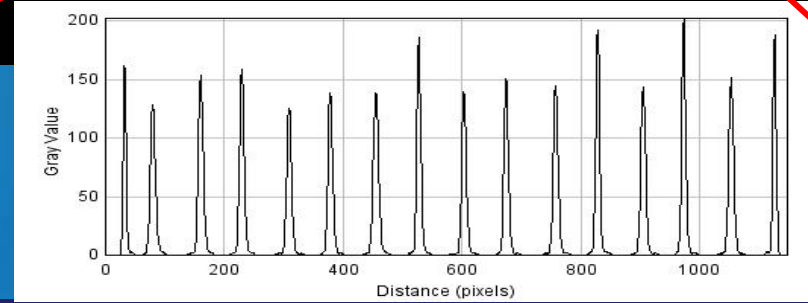
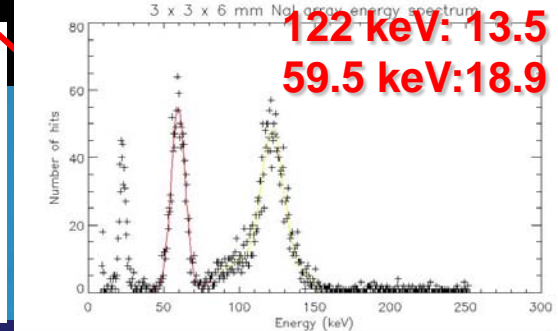
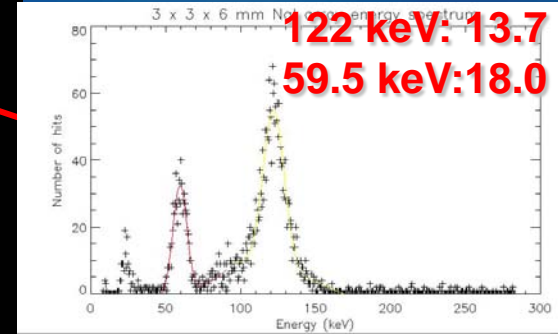
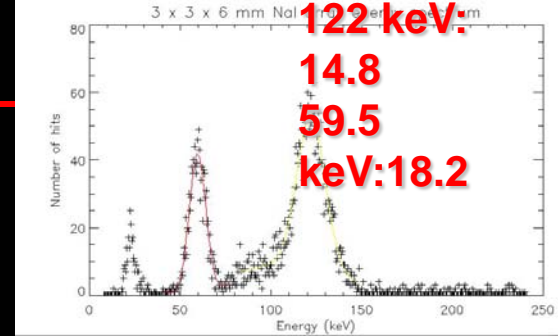
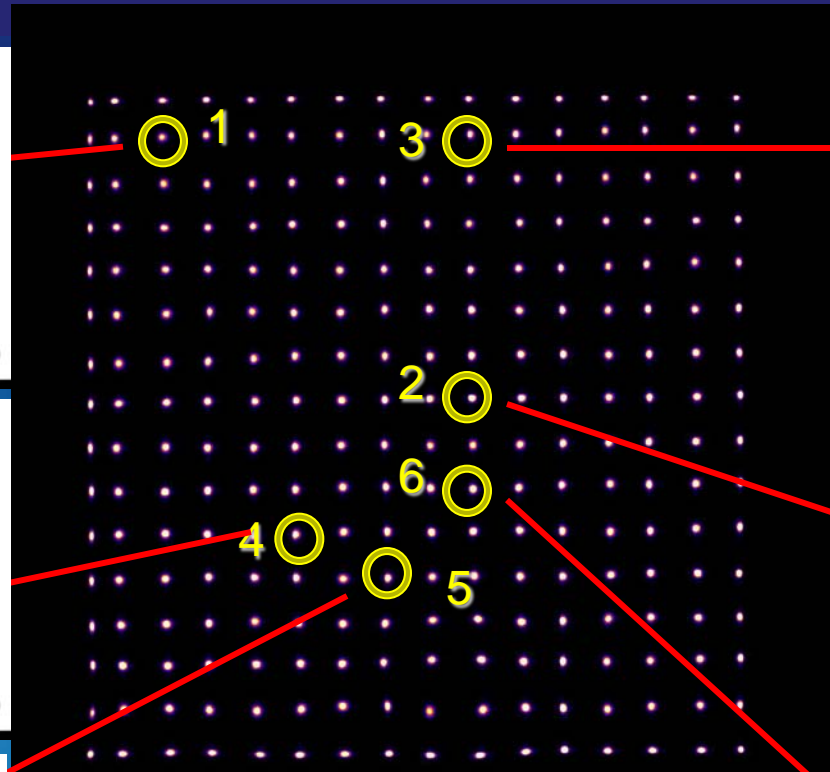
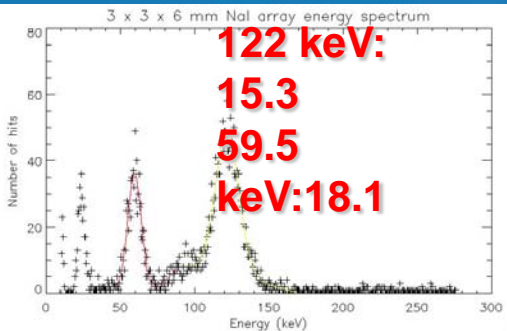
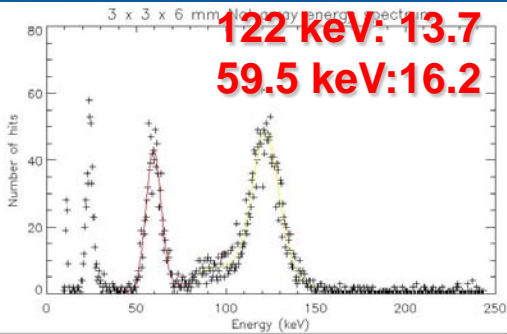
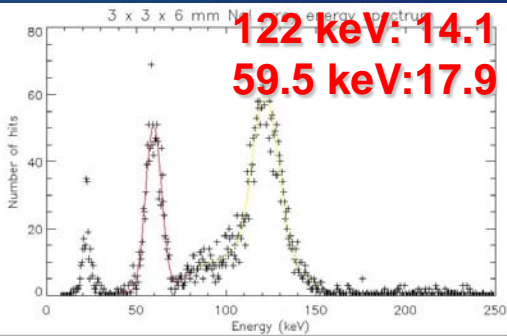


256
MPPC
array

256 element MPPC array was tested with several 1,5 and 3mm NaI(Tl) arrays from Saint Gobain, coupled directly without an additional window to the MPPC array. Visilox V-788 optical coupling compound was applied between the MPPC array and the NaI(Tl) arrays.



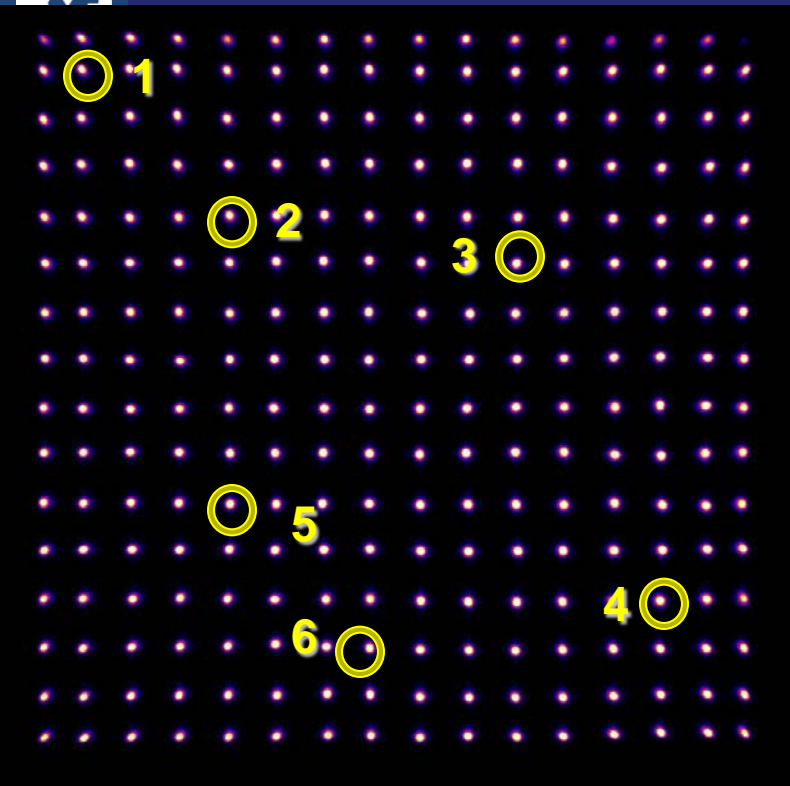
Pixellated 3x3x6mm NaI(Tl) scintillator array. R&C.



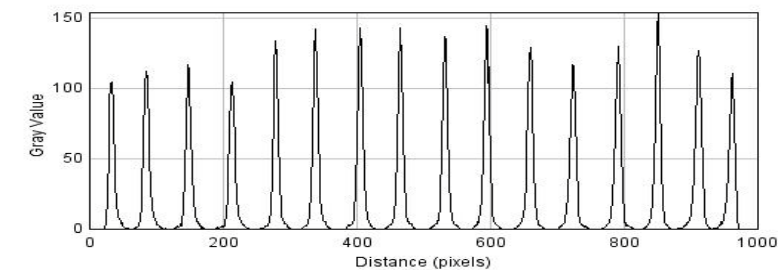
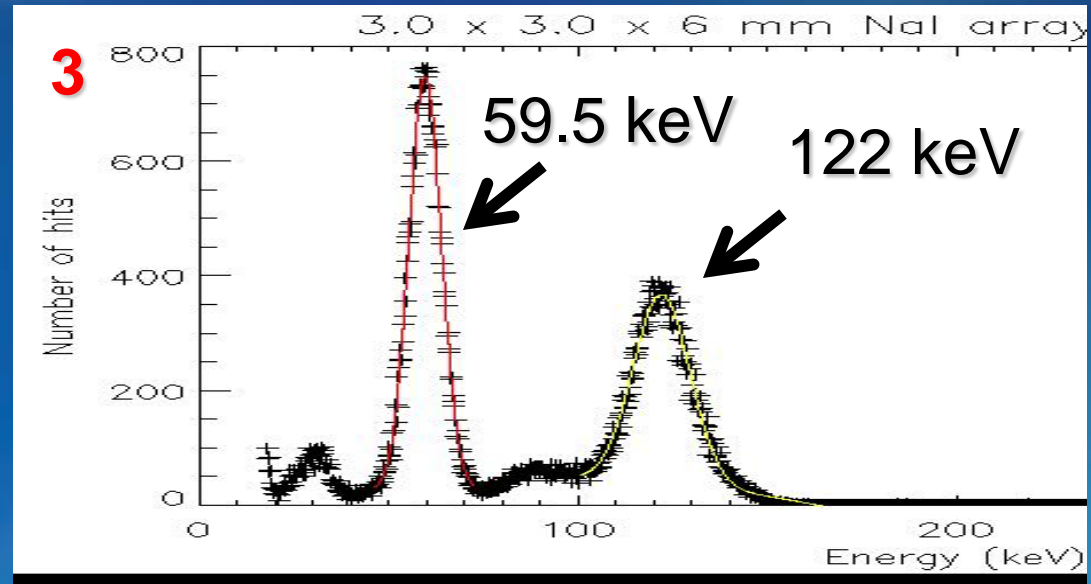
Temperature: 15.2 deg C, bias: 67.2 V. 520 ns ADC integration gate. Row and column readout. Truncation factor 0.065. Six selected NaI(Tl) pixels across the surface of the detector module. Shown six energy spectra obtained for a combination of Co-57 and Am-241 sources to calibrate zero energy channel. Values of FWHM in % are given for 59.5 keV and 122 keV photopeaks.



Pixellated 3x3x6mm NaI(Tl) scintillator array. 4ch.



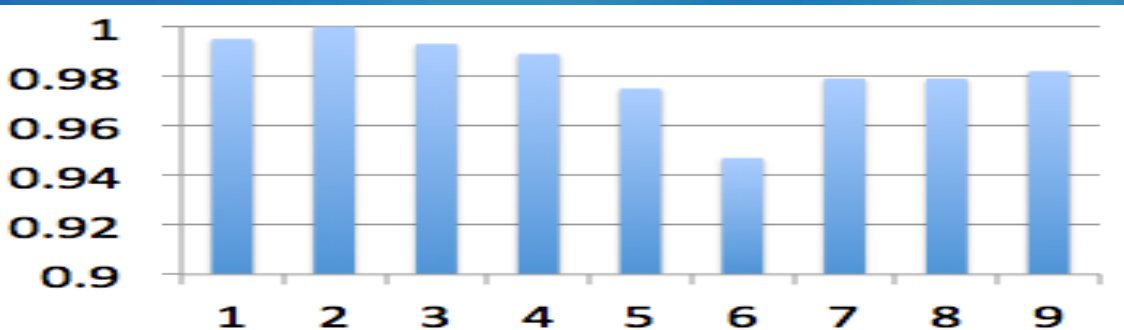
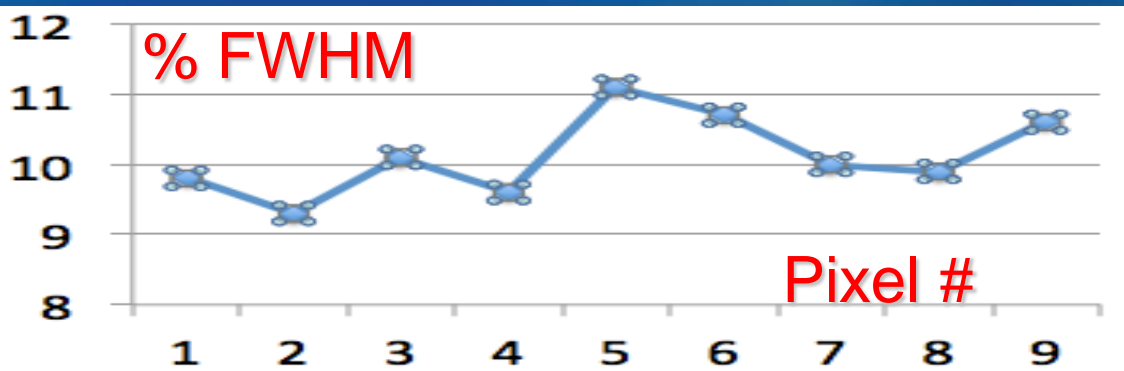
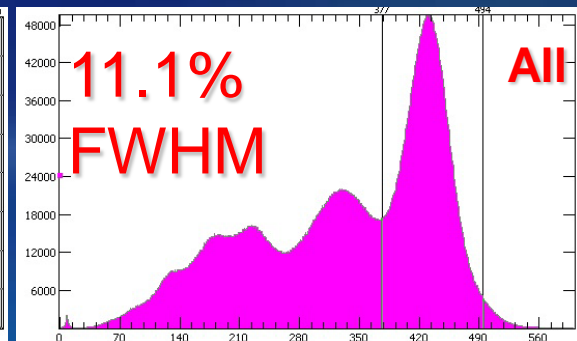
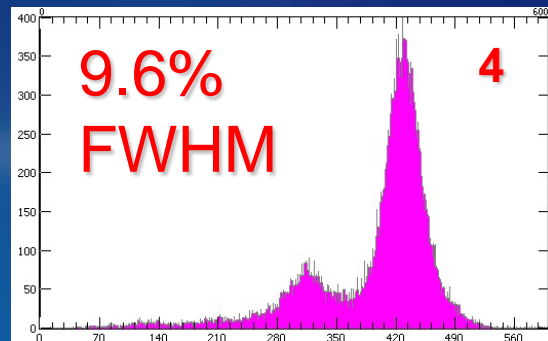
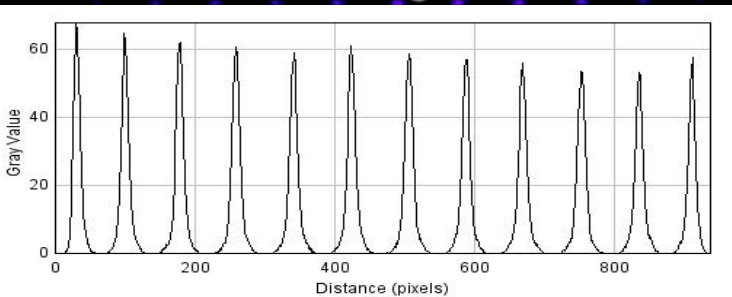
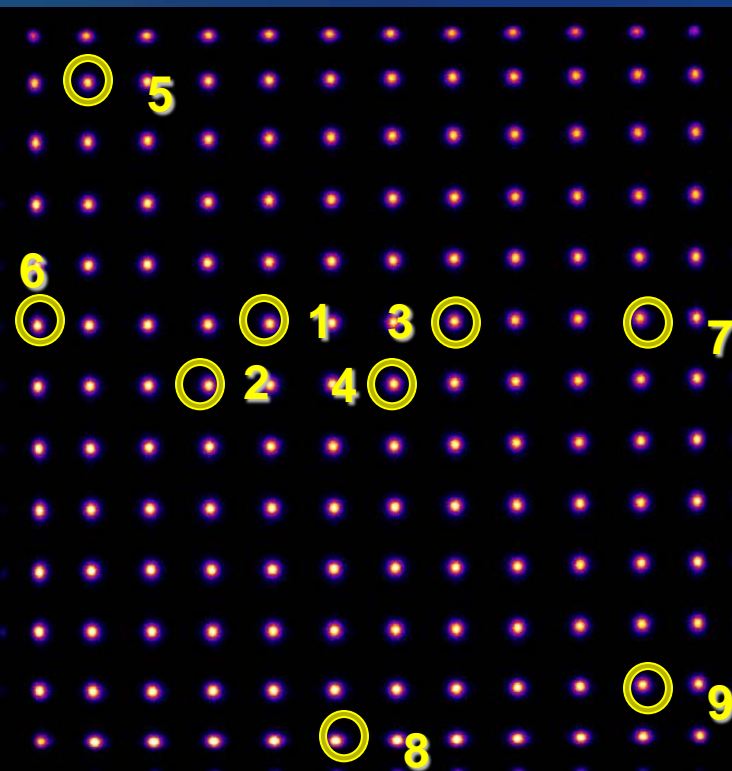
| | | | | | |
|------|------|------|------|------|------|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 13.4 | 14.3 | 14.5 | 14.6 | 14.1 | 14.6 |



Temperature: 14.7 deg C, bias: 67.2 V. 520 ns ADC integration gate. 4ch readout. Truncation factor 0.05. Six selected NaI(Tl) pixels across the surface of the detector module. Shown an example of energy spectrum obtained for a combination of Co-57 and Am-241 sources to calibrate zero energy channel. Table at top right gives values of FWHM in % for the 122 keV photopeaks.

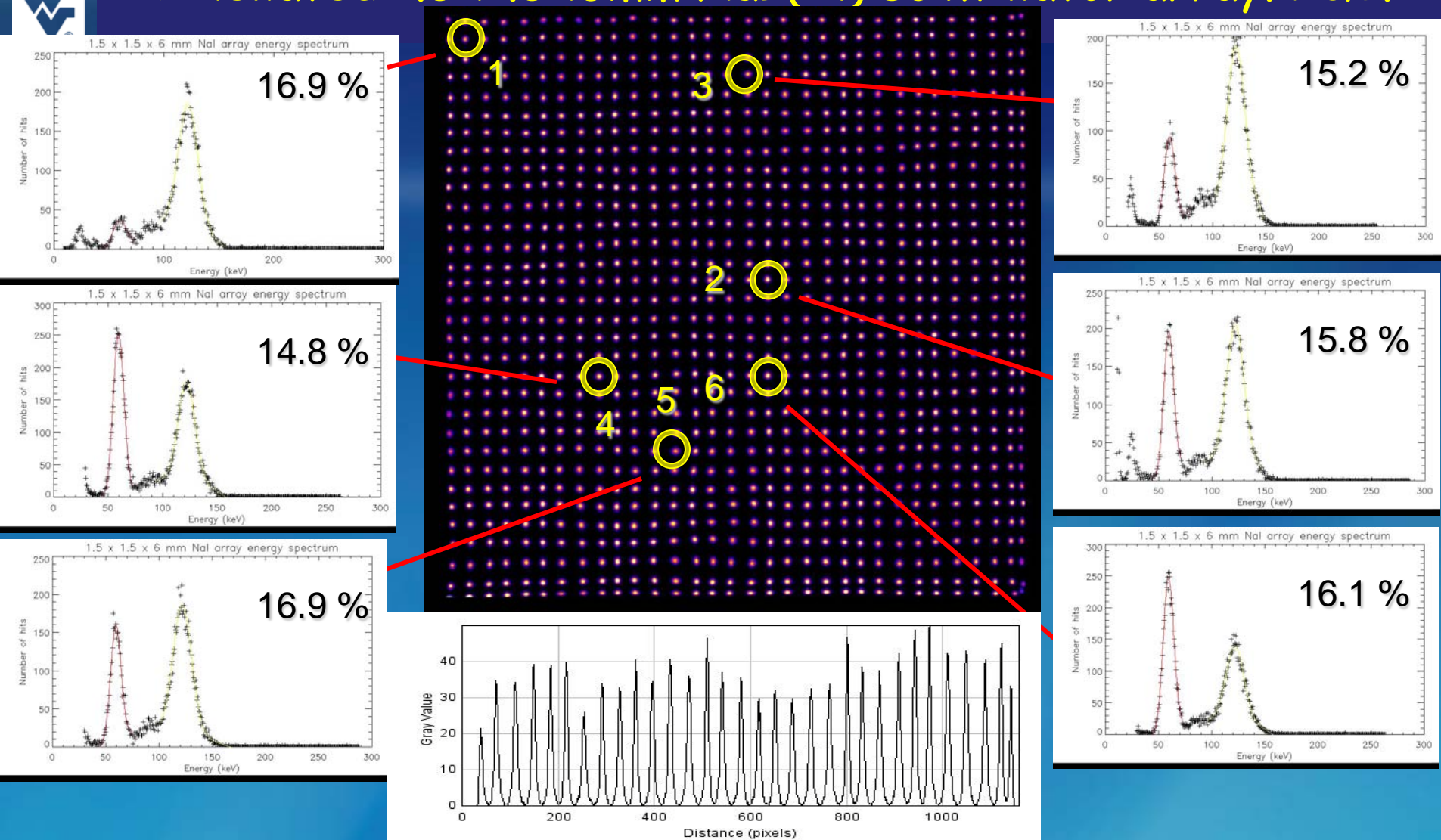
Pixellated 3x3x6mm NaI(Tl) scintillator array

Comparative study with H9500 PSPMT. R&C.



Bias: -900 V. 520 ns ADC integration gate. Row and column (R&D) readout. Truncation factor 0.025. Nine selected NaI(Tl) pixels: FWHM values and relative amplitudes @122 keV are shown. Single pixel energy spectrum (from pixel 4), and from the whole module are also given.

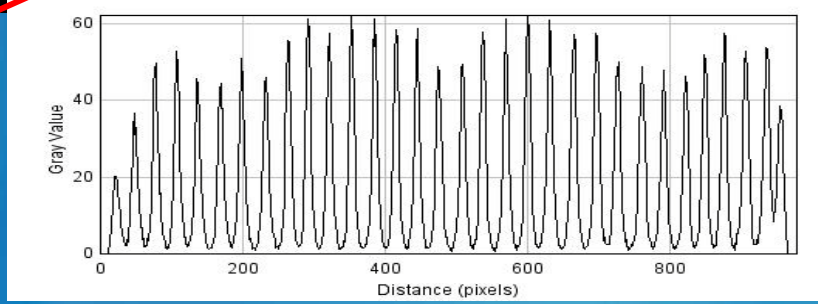
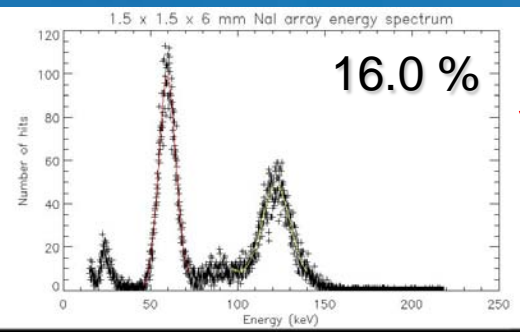
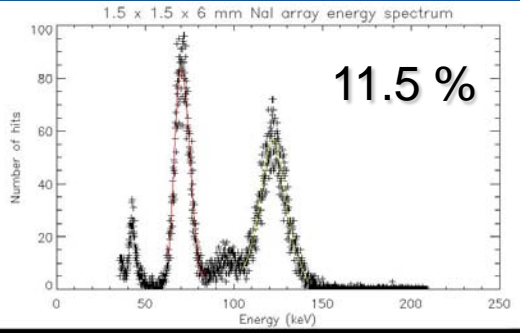
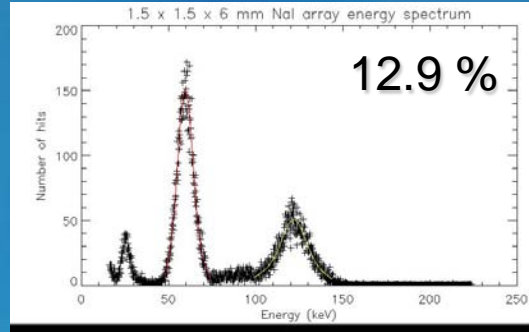
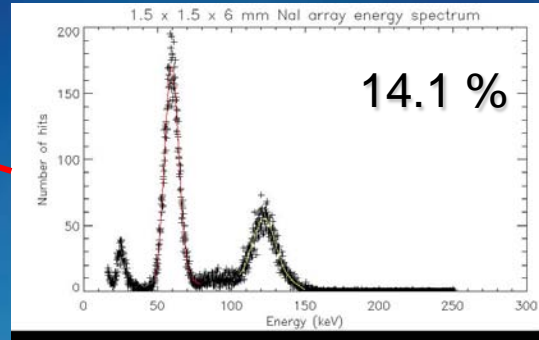
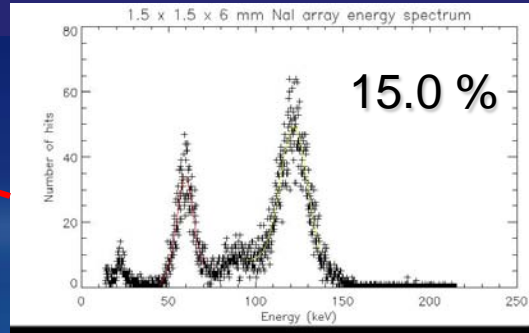
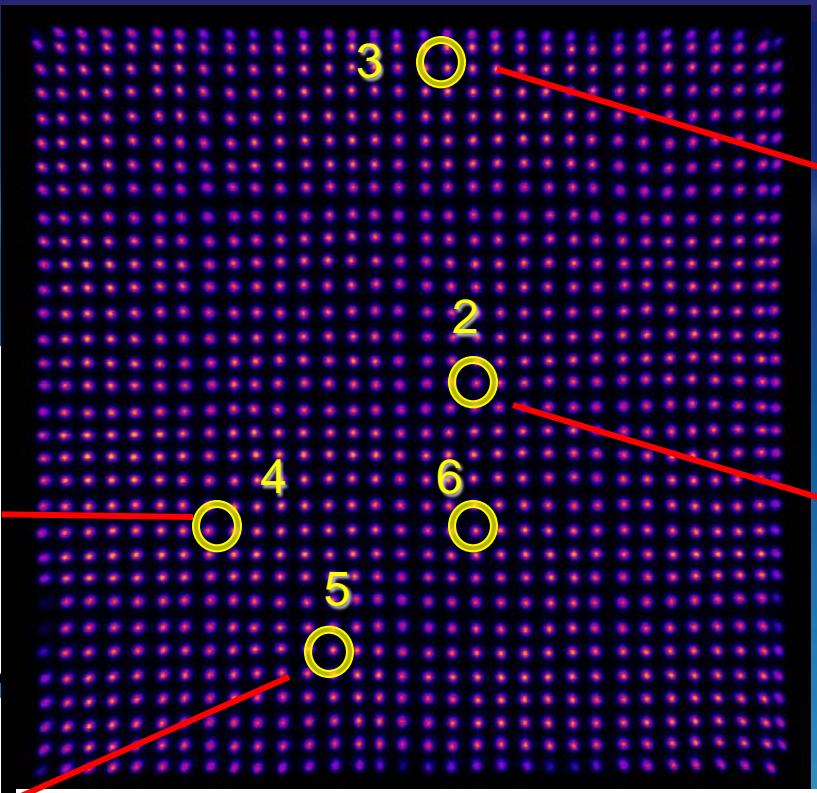
Pixelated 1.5x1.5x6mm NaI(Tl) scintillator array. R&C.



Temperature: 15.2 deg C, bias: 67.2 V. 520 ns ADC integration gate. Row and column readout. Truncation factor 0.065. Six selected LYSO pixels across the surface of the detector module. Shown six energy spectra obtained for a combination of Co-57 and Am-241 sources to calibrate zero energy channel. Values of FWHM in % are given for the 122 keV photopeaks.



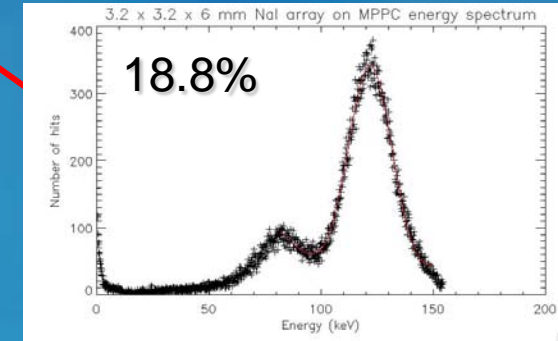
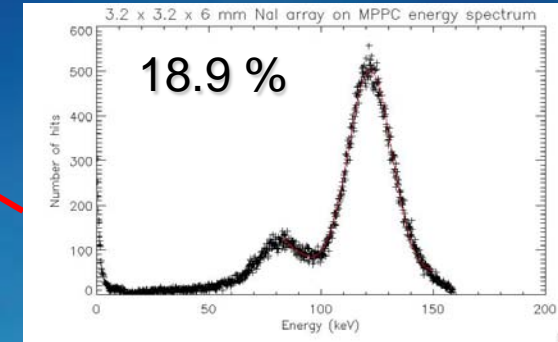
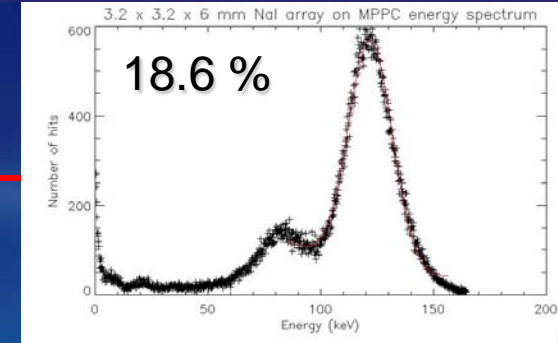
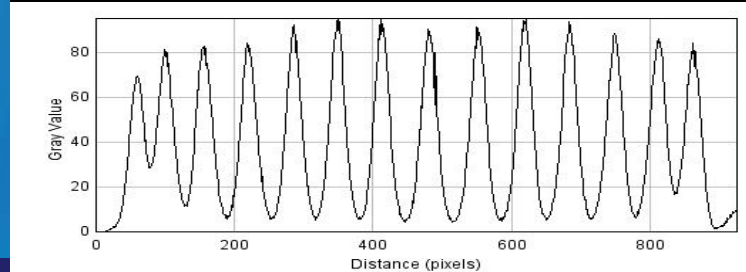
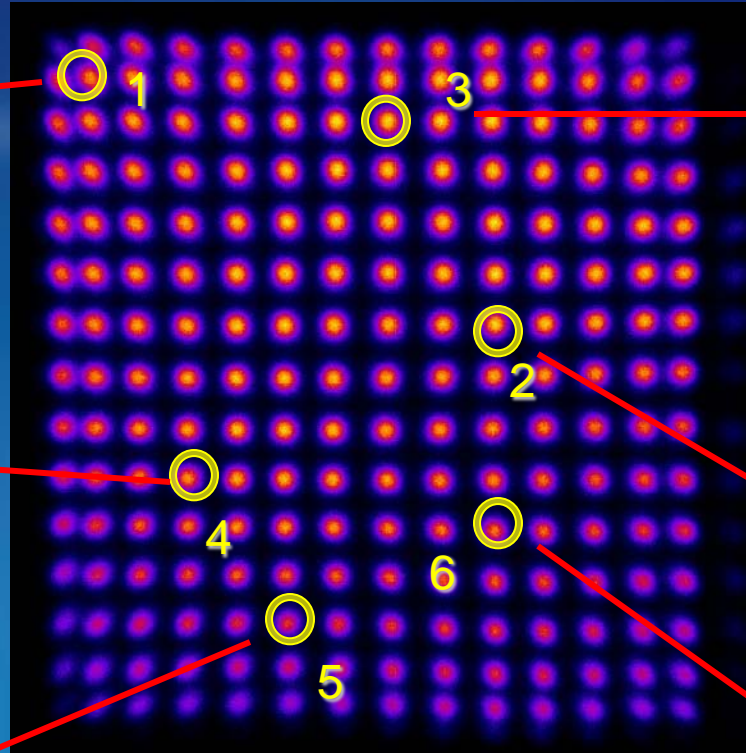
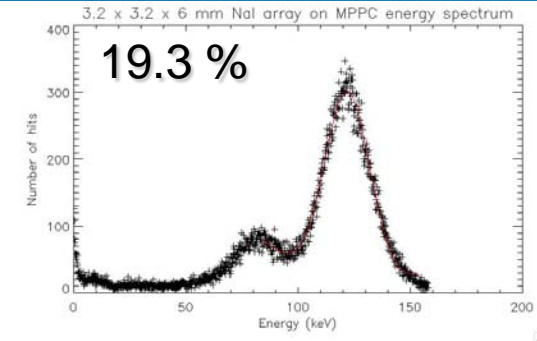
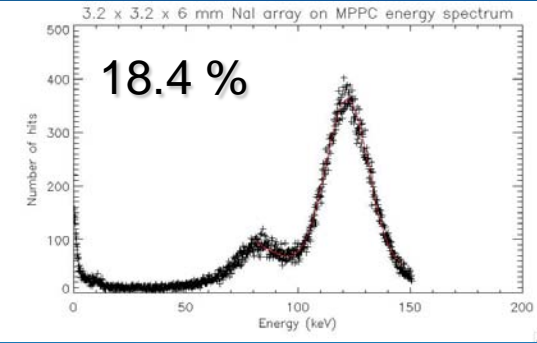
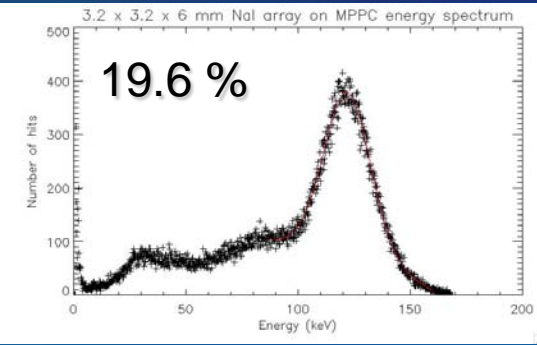
Pixellated 1.5x1.5x6mm NaI(Tl) scintillator array. 4ch.



Temperature: 15.2 deg C, bias: 67.2 V. 520 ns ADC integration gate. 4 channel readout. Truncation factor 0.065. Six selected NaI(Tl) pixels across the surface of the detector module. Shown five energy spectra obtained for a combination of Co-57 and Am-241 sources to calibrate zero energy channel. Values of FWHM in % are given for the 122 keV photopeaks.

Pixellated 3.2x3.2x6mm NaI(Tl) scintillator array. 4ch.

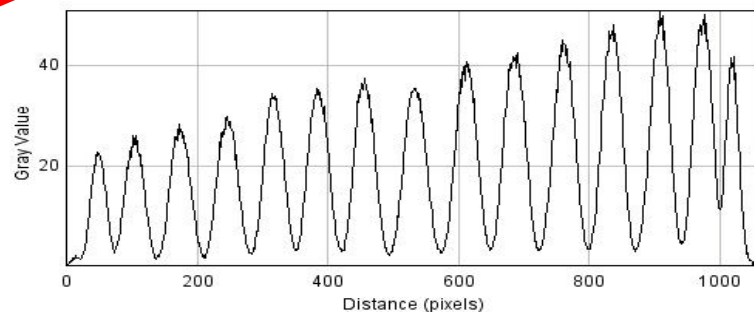
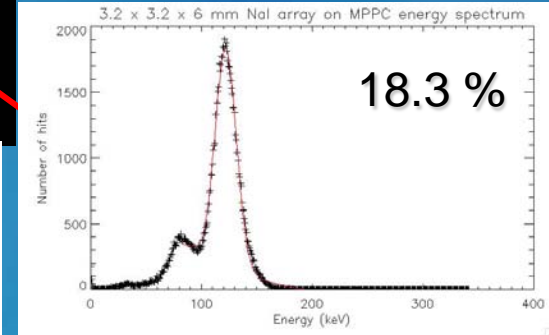
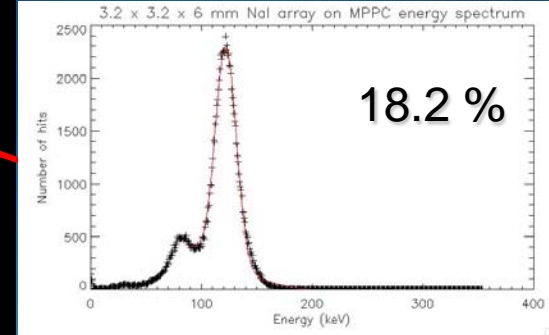
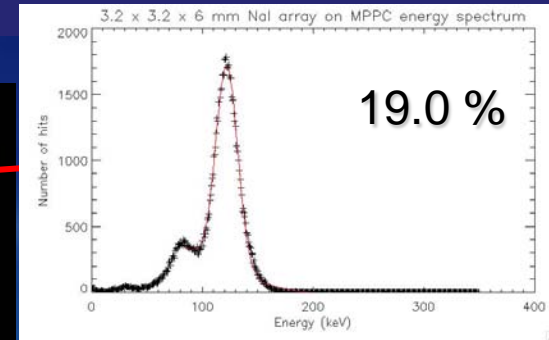
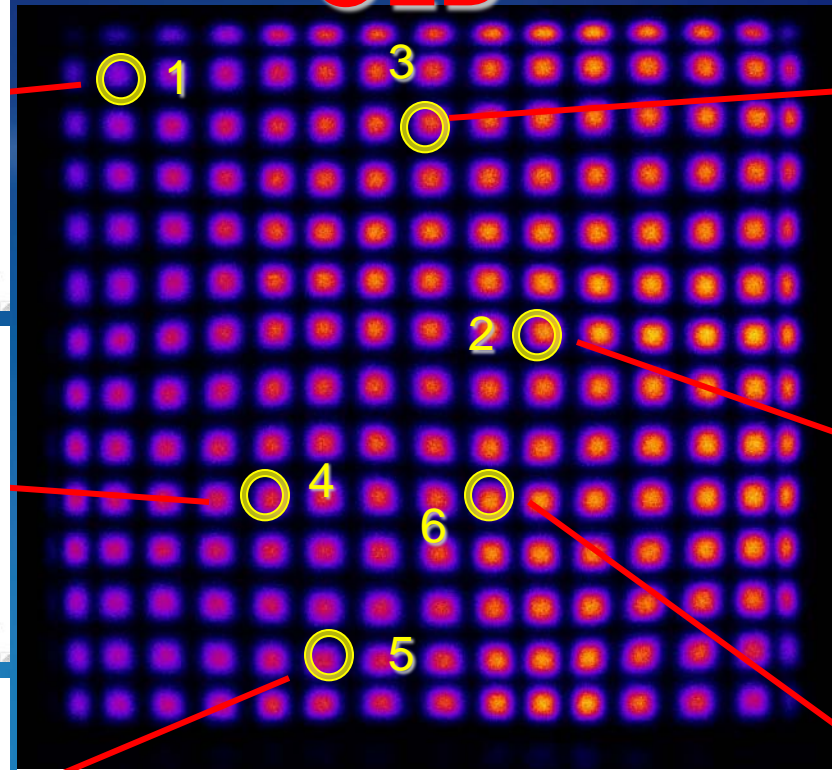
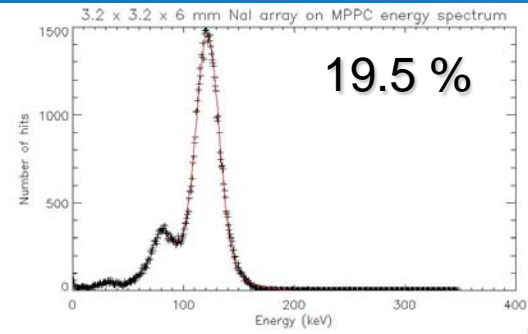
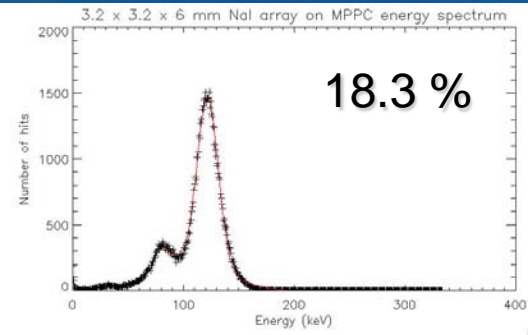
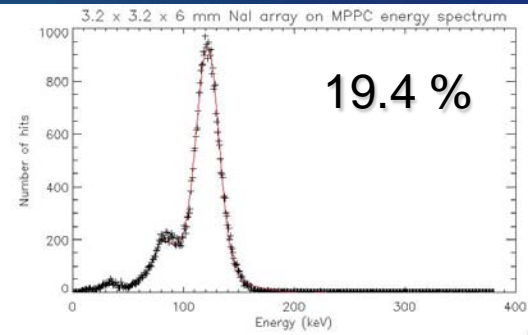
OLD



Temperature: 23.5 deg C, bias: 67.8 V. 520 ns ADC integration gate. 4 channel readout. Truncation factor 0.065. Six NaI(Tl) pixels across the surface of the detector module were selected to measure the FWHM energy resolution of their 122 keV photopeaks. The values were NOT corrected for the zero channel energy shift due to diode-based circuitry.

Pixellated 3.2x3.2x6mm NaI(Tl) scintillator array. R&C.

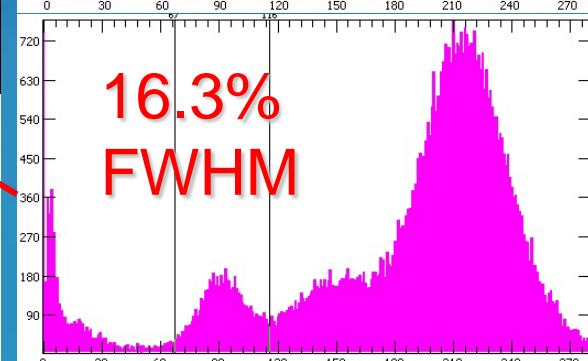
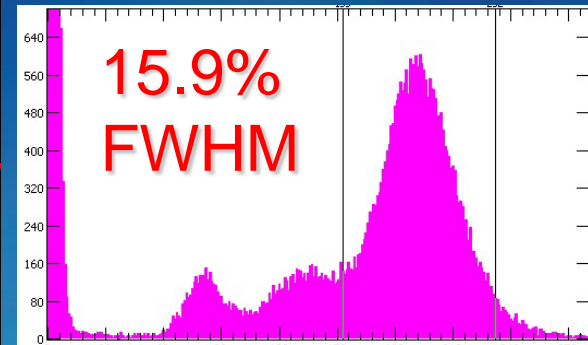
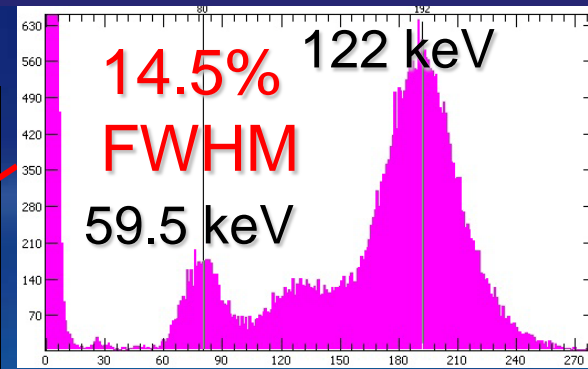
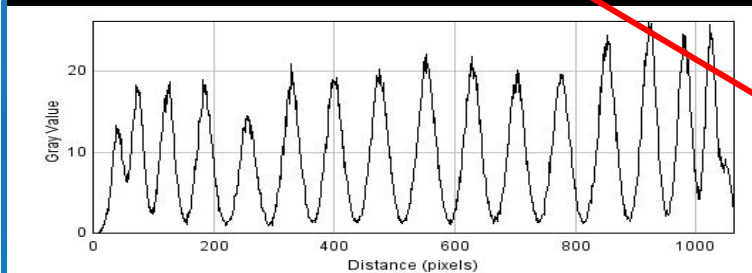
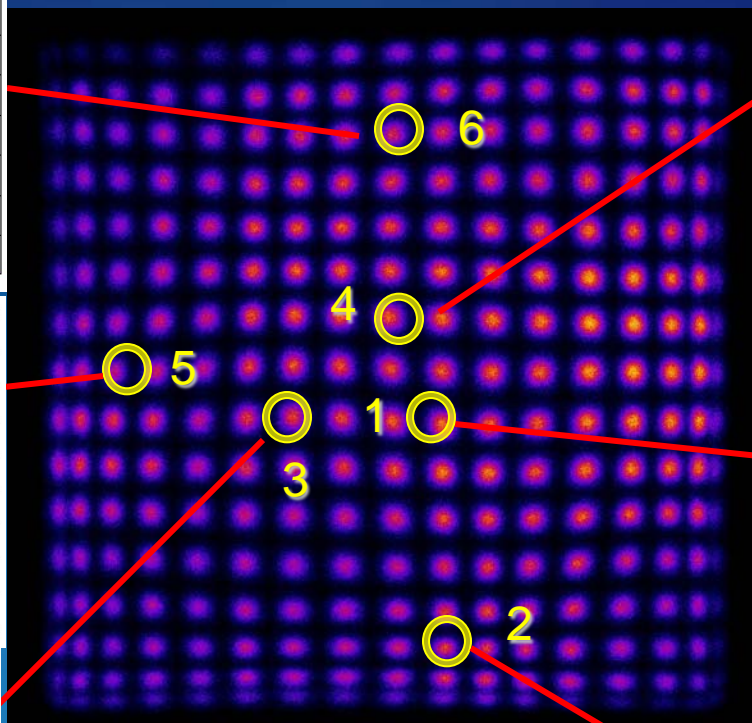
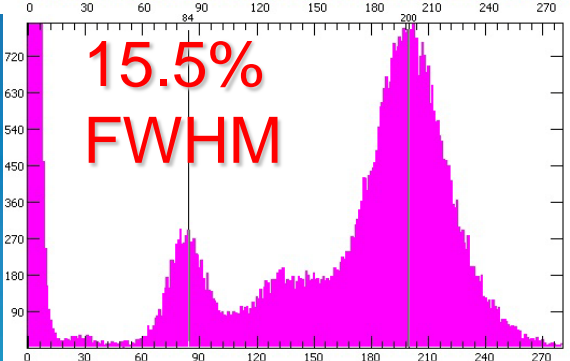
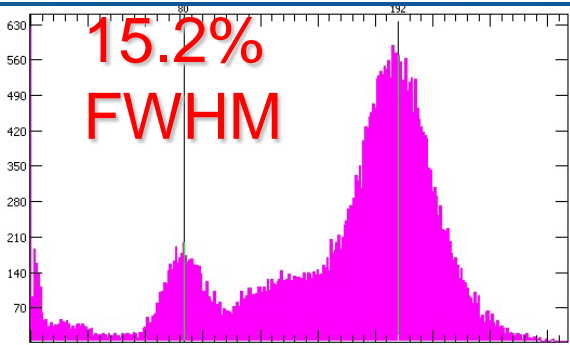
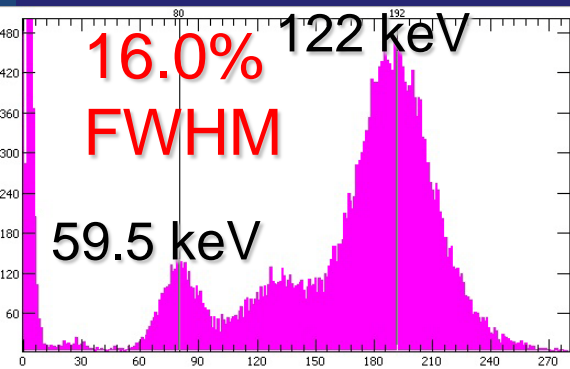
OLD



Temperature: 23.5 deg C, bias: 67.8 V. 520 ns ADC integration gate. Row and column readout. Truncation factor 0.065. Six NaI(Tl) pixels across the surface of the detector module were selected to measure the FWHM energy resolution of their 122 keV photopeaks.

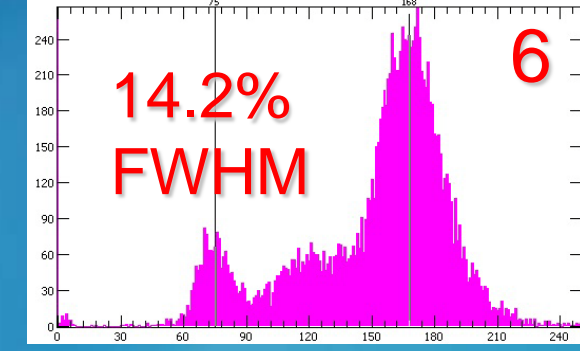
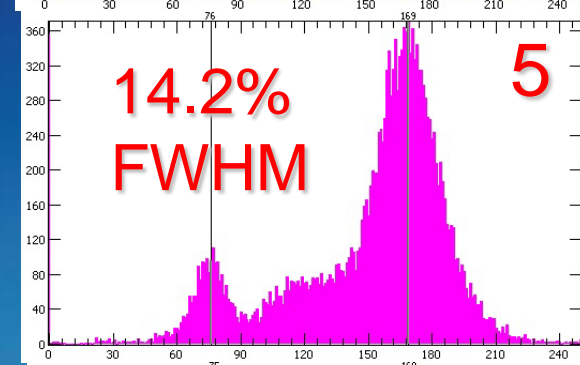
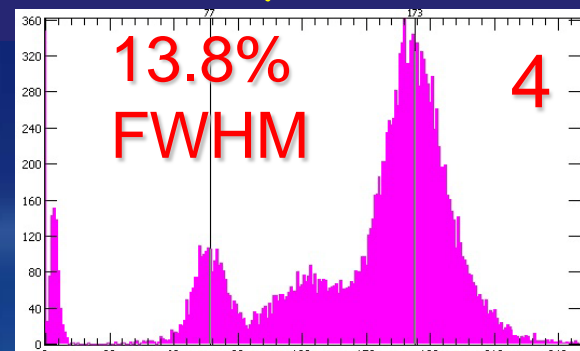
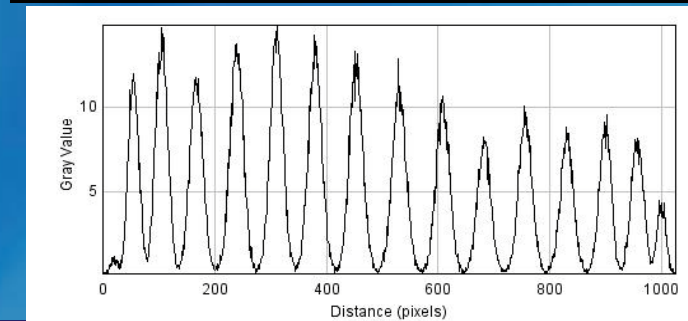
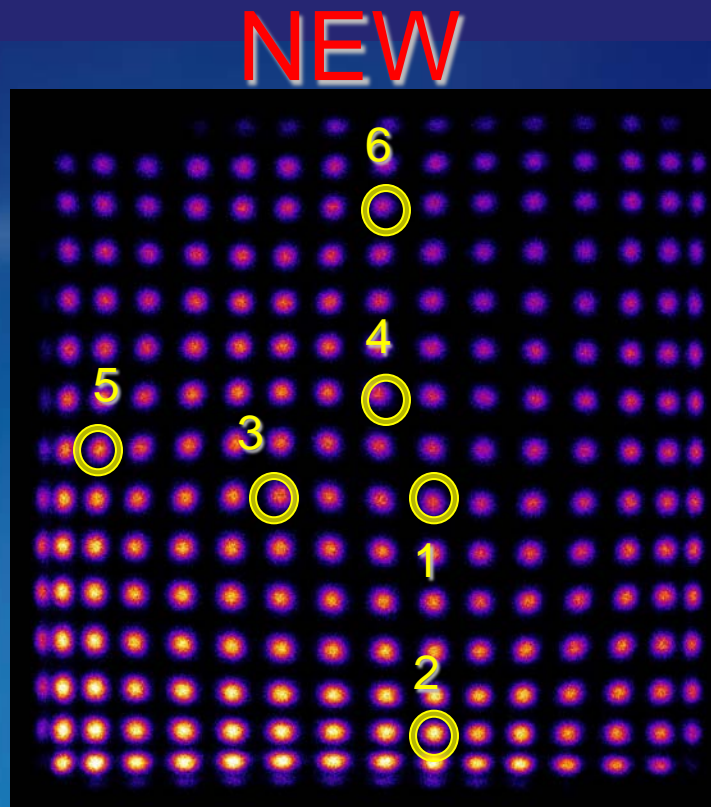
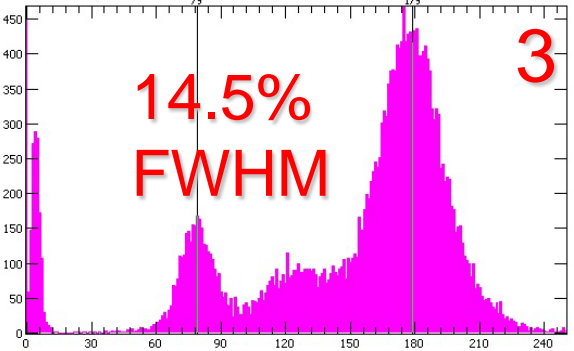
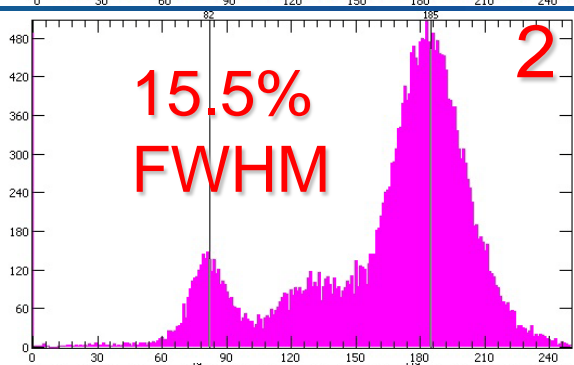
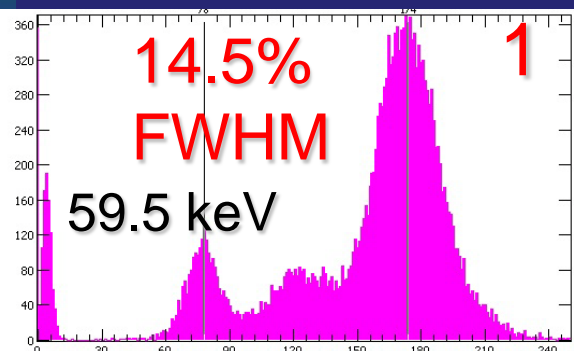
Pixellated 3.2x3.2x6mm NaI(Tl) scintillator array. R&C.

NEW



Temperature: 12.0 deg C, bias: 67.2 V. 520 ns ADC integration gate. Row and column readout. Truncation factor 0.025. Six NaI(Tl) pixels across the surface of the MPPC detector module were selected to measure the FWHM energy resolution of the 122 keV photopeaks. The 59.5 keV photopeaks from low intensity Am241 was used to provide energy scale calibration.

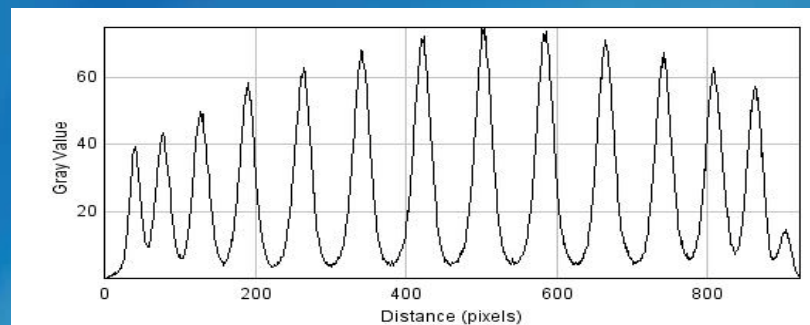
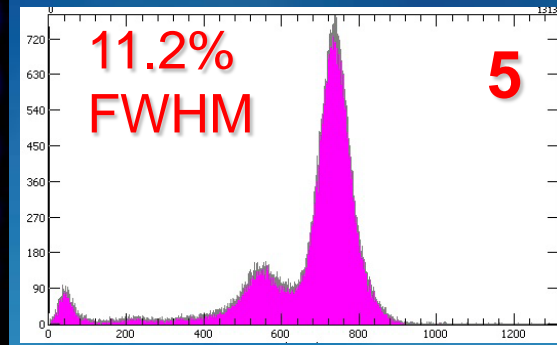
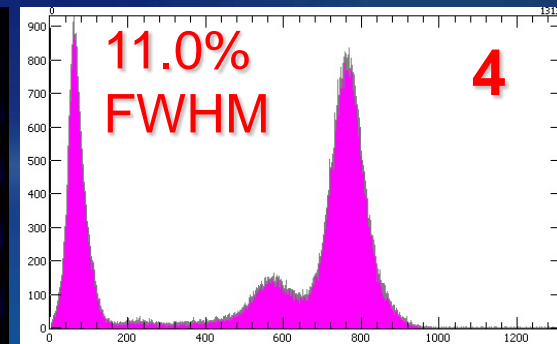
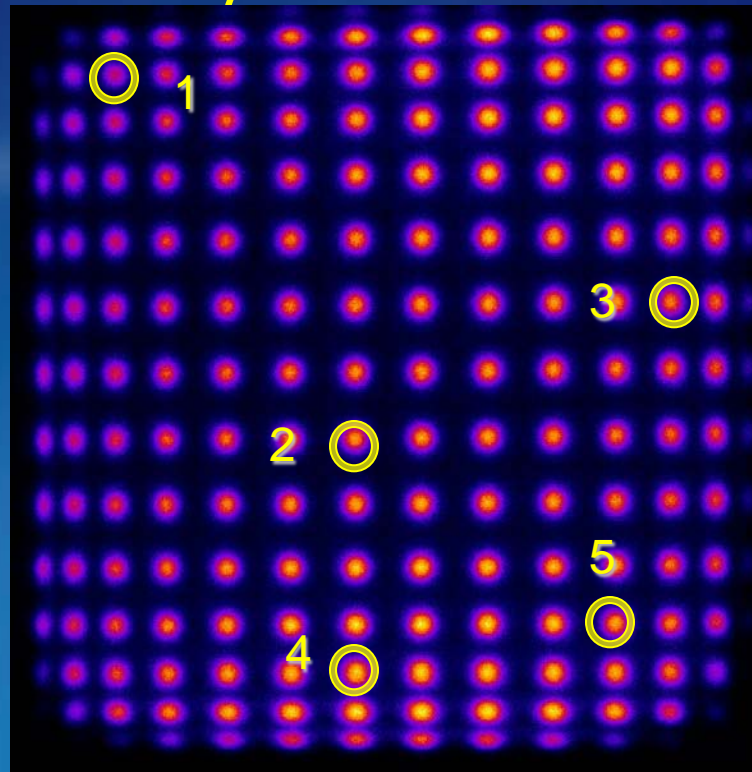
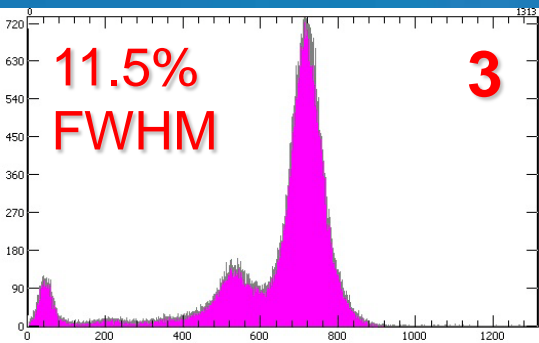
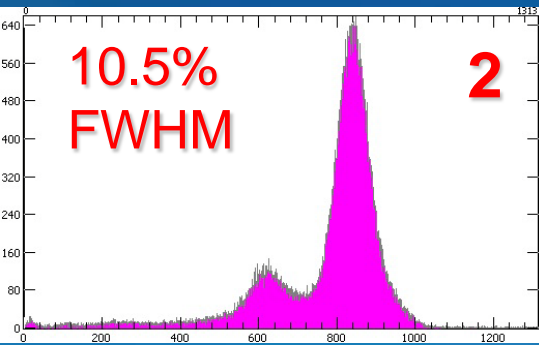
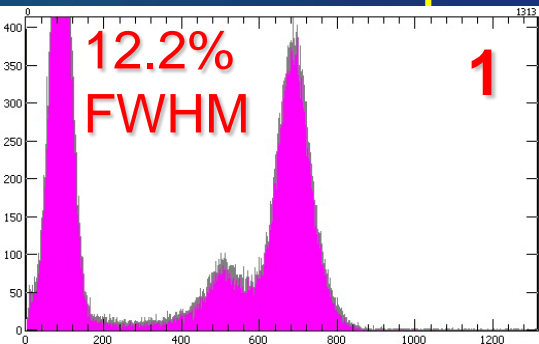
Pixellated 3.2x3.2x6mm NaI(Tl) scintillator array. R&C.



Temperature: 21.0 deg C, bias: 67.8 V. 520 ns ADC integration gate. Row and column readout. Truncation factor 0.025. Six NaI(Tl) pixels across the surface of the MPPC detector module were selected to measure the FWHM energy resolution of the 122 keV photopeaks. The 59.5 keV photopeaks from low intensity Am241 was used to provide energy scale calibration.

Pixellated 3.2x3.2x6mm NaI(Tl) scintillator array

Comparative study with H9500 PSPMT. R&C.



Bias: -1000 V. 520 ns ADC integration gate. Row and column (R&C) readout. Truncation factor 0.075. Energy spectra and FWHM energy resolution values @ 122 keV for five selected Na(Tl) pixels are shown.



Summary for the NaI(Tl) study

- Both row-and-column and 4ch readouts can separate 1.5mm and 3mm NaI(Tl) pixels
- Energy resolution is similar for the 4ch and 16x16ch (row-and-column) readout
- Average energy resolution is reaching less than 14.5% FWHM @ 122 keV for a test 3mm sample at ~15 deg C.
- Scintillator (3.2mmx3.2mmx6mm) placed behind the 6.6mm thick window and at room temperature (21 deg.C) has average resolution of about 14.5% FWHM @ 122 keV.
- Array at 12 deg C operates at similar resolution
- In a comparative test with NaI(Tl) array with H9500 PSPMT, average energy resolution is below 11.5% FWHM @ 122 keV.

