

BGO Array studies

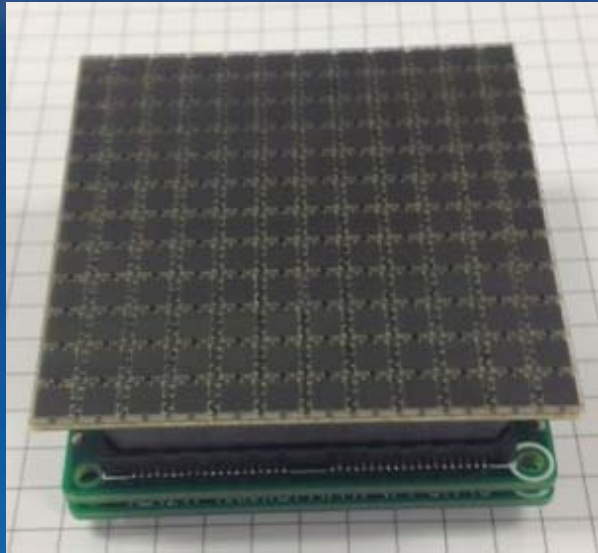
(last update 11/12/2013)

Goals:

- Separate 2mm BGO pixels @ 511 keV
- Achieve 15% FWHM @ 511 keV
- Consider cooling if necessary



Studies with the ArrayB-30035-144P-PCB



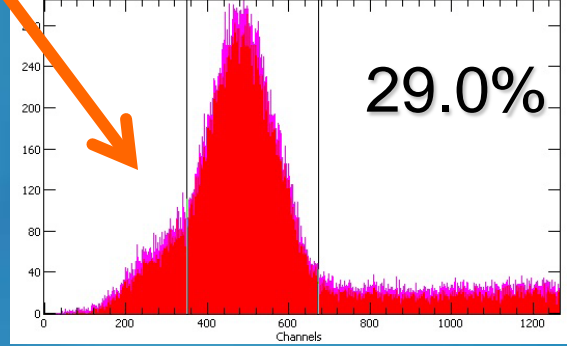
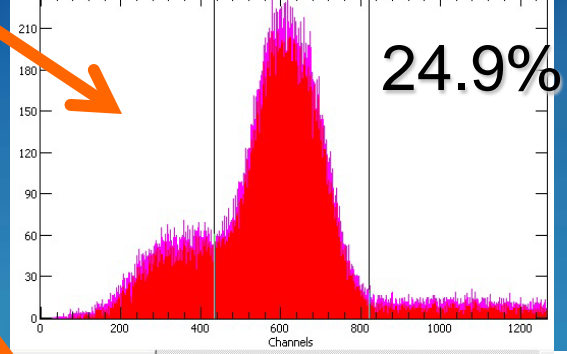
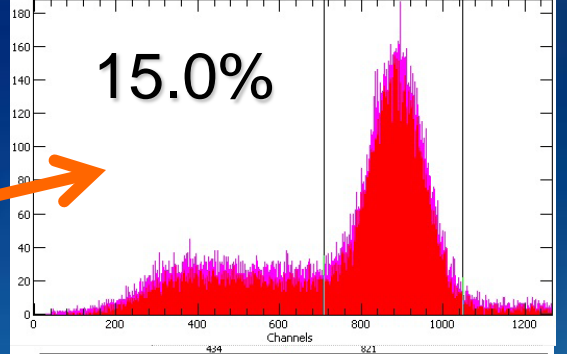
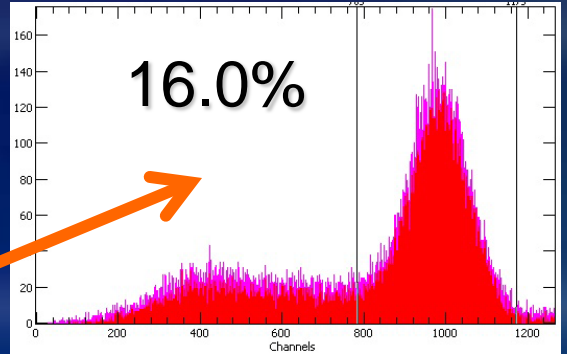
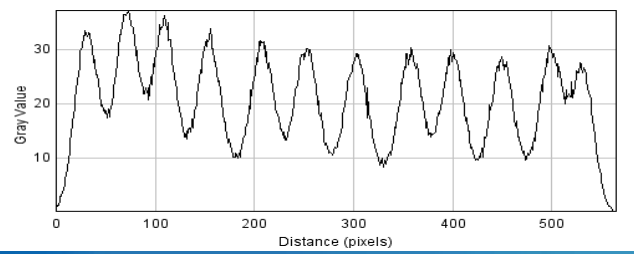
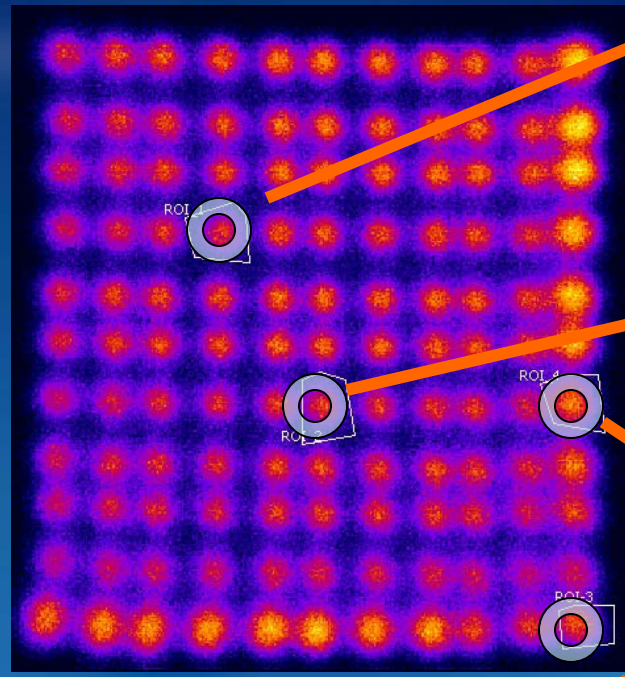
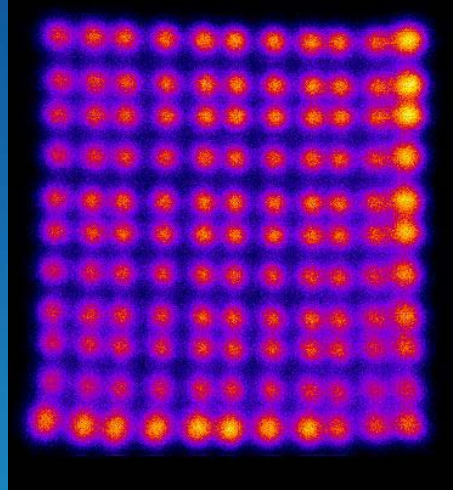
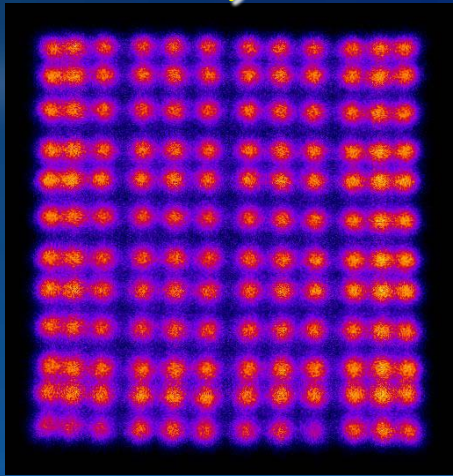
12ch columns

12ch rows

Hybrid readout board from AiT Instruments with the row-and-column cables at the bottom and the 4ch readout cable (top connector) used to provide bias voltage.

The B-type 144 (12x12) 3mm pixel array from SensL was tested with the 2x2x15mm BGO array. The BGO array was coupled to the SiPM array via 2.75mm acrylic window.

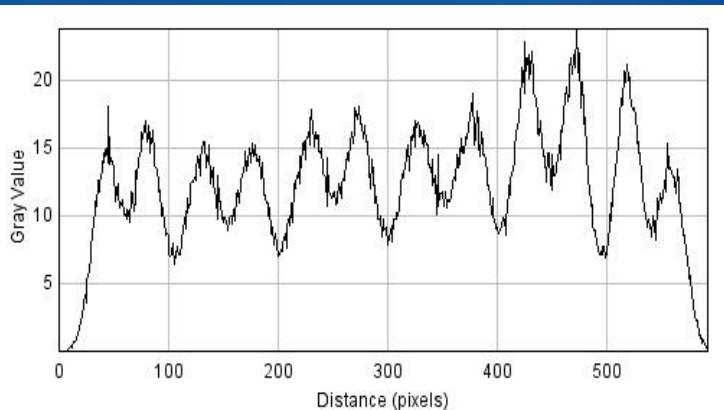
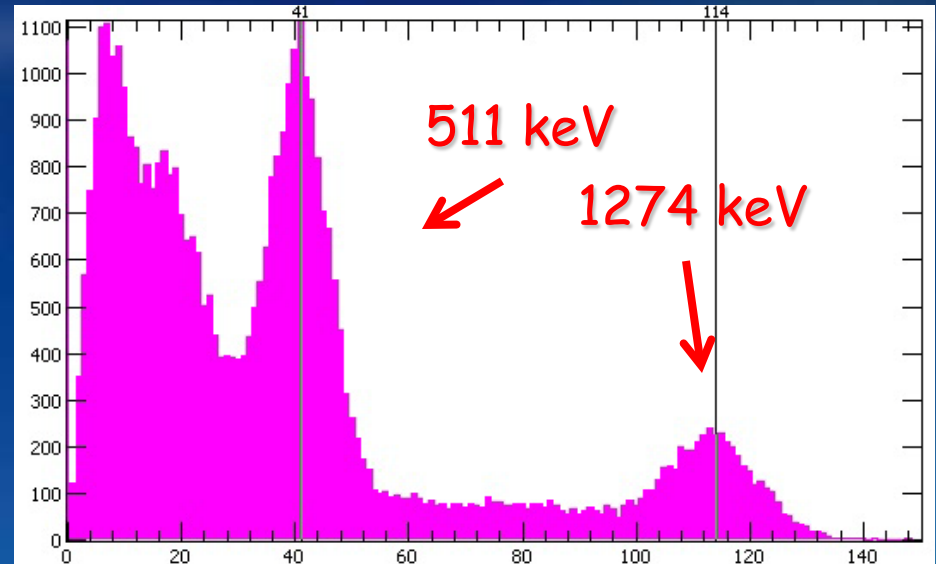
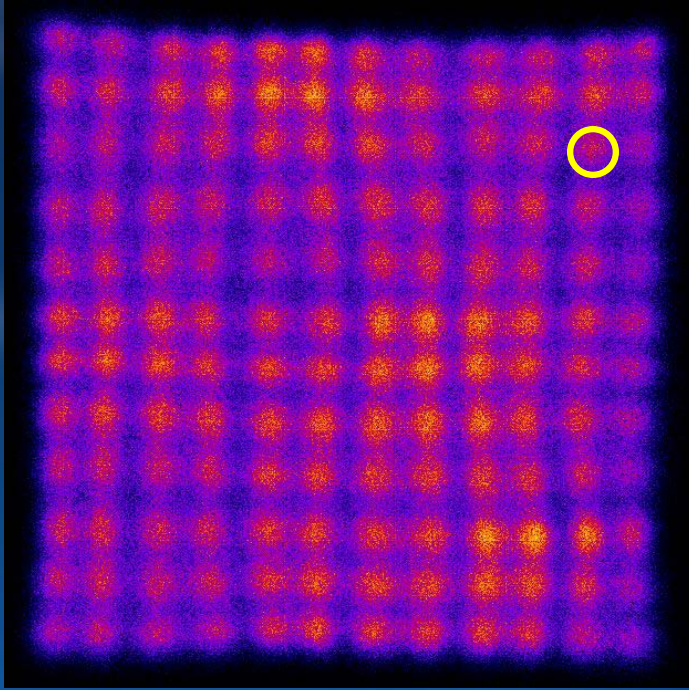
Reference: Studies with H8500 PSPMT (4ch readout)



Raw images at left for the central (top image) and corner (bottom image) locations of the 2x2x15mm BGO array. FWHM energy resolution @511 keV indicated next to the four spectra. Plot for one of the pixel rows in the center.

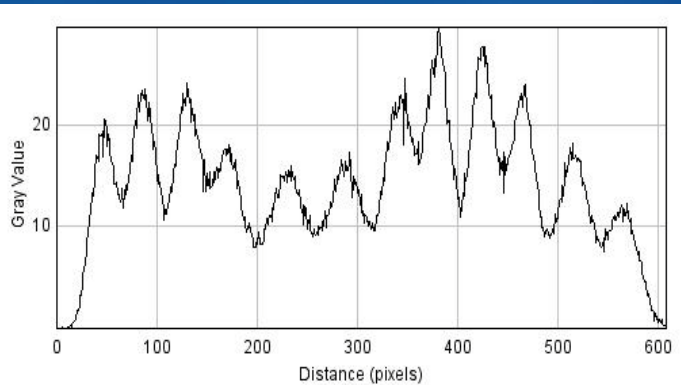
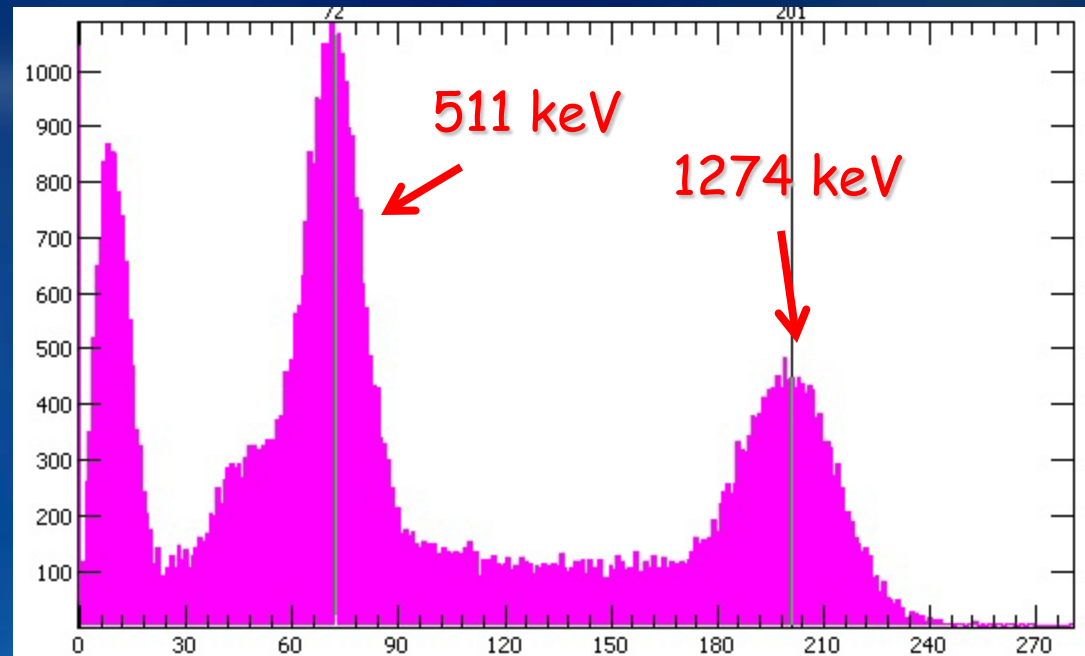
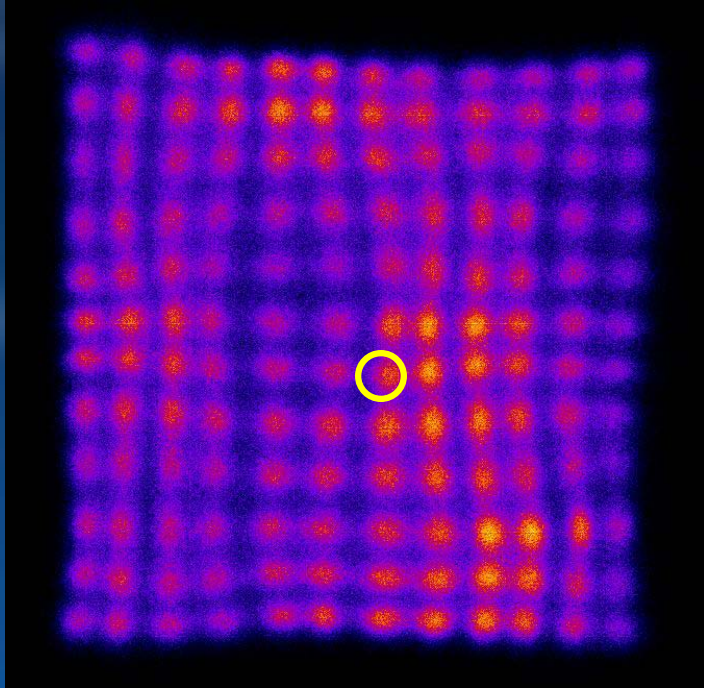


Studies with the ArrayB-30035-144P-PCB



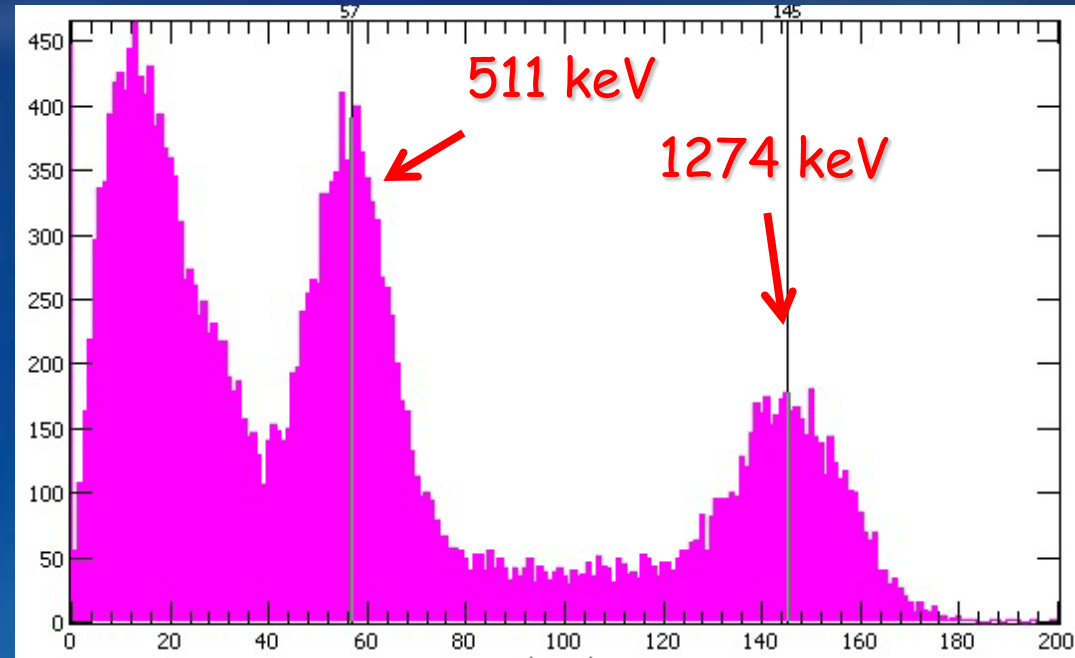
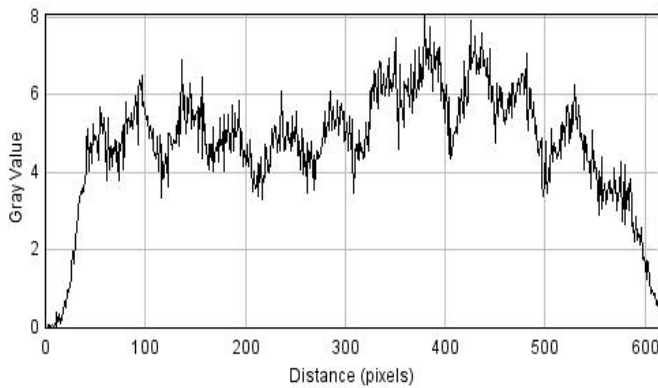
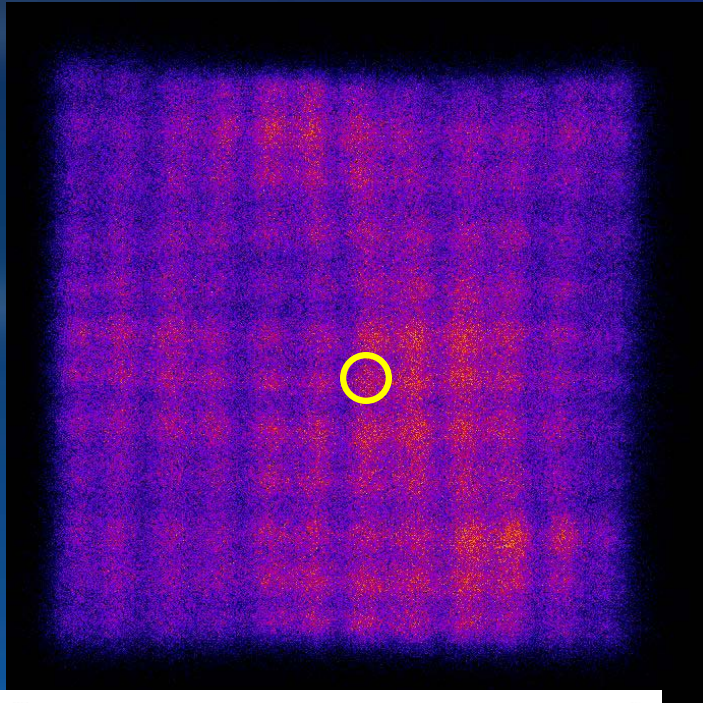
The B-type 144 (12x12) 3mm pixel array from SensL when tested with the 2x2x15mm BGO array. 10 deg. C. Bias voltage 31.7V. ADC signal integration time 400 ns. Raw image @ 511 keV with a profile of one of the rows. Truncation factor 0.1, Typical example of a single BGO pixel (as marked) energy spectrum. FWHM @ 511 keV ~ 20%. (The energy scale was corrected for the zero channel energy shift due to the diode circuitry used in the input stage of the row-and-column readout.)

Studies with the ArrayB-30035-144P-PCB



The B-type 144 (12x12) 3mm pixel array from SensL when tested with the 2x2x15mm BGO array. 10 deg. C. Bias voltage 30.3V. ADC signal integration time 1000 ns. Raw image @ 511 keV with a profile of one of the rows. Truncation factor 0.125, Typical example of a single BGO pixel (as marked) energy spectrum. FWHM @ 511 keV ~ 18%. (The energy scale was corrected for the zero channel energy shift due to the diode circuitry used in the input stage of the row-and-column readout.)

Studies with the ArrayB-30035-144P-PCB



The B-type 144 (12x12) 3mm pixel array from SensL when tested with the 2x2x15mm BGO array. 25 deg. C. Bias voltage 30.1V. ADC signal integration time 400 ns. Truncation factor 0.1, Raw image @ 511 keV with a profile of one of the rows. Typical example of a single BGO pixel (as marked) energy spectrum. FWHM @ 511 keV ~ 27%. (The energy scale was corrected for the zero channel energy shift due to the diode circuitry used in the input stage of the row-and-column readout.)

Summary of Pilot BGO Studies

- SensL arrays start performing well enough to consider for BGO, but S/N is still the limit
- Row and column readout with cooling down to 10 deg. C of the B array allows for separation of 2mm BGO pixels and 18-20 % FWHM @ 511 keV
- Further improvement in S/N is necessary to achieve 15% or better energy resolution and operation at room temperature
- Gain uniformity improvement would be also desired
- Latest generation of 16x16 arrays of MPPCs is expected to reach the set goals

