

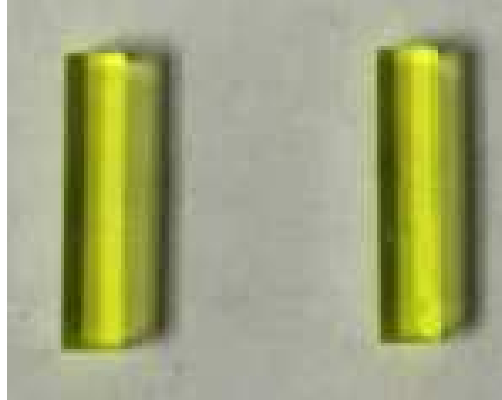
# Results of GAGG crystal timing measurement

**Conducted by LBL**

**Sponsor: Kinheng crystal material (shanghai) Co., Ltd.**

## 1. Experimental settings

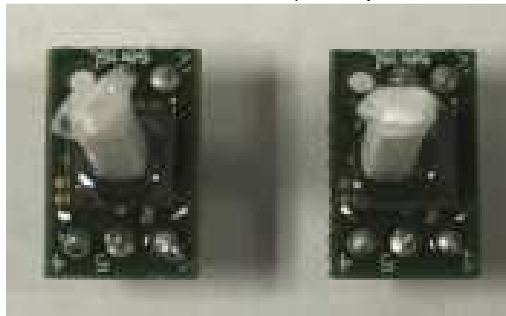
(a) Two samples (size: 2.12mm x 2.18 mm x 10.24 mm)



(b) Wrapped with Teflon tape



(c) Mounted on two SiPM 6mm J-series SiPMs (PDE plot shown below) with MeltMount

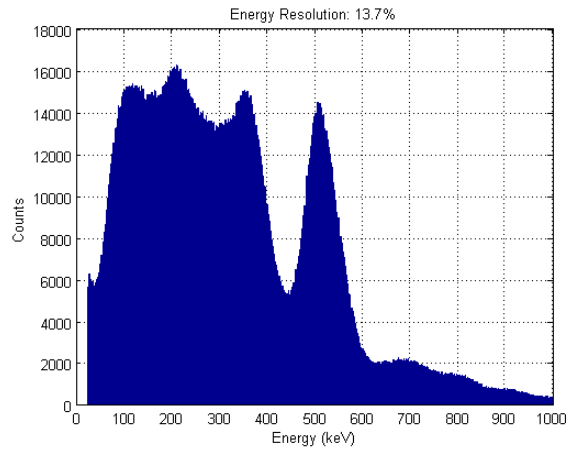


(d) Tested with Na22 point source



## 2. Experimental results

(a) Energy resolution: ER=13.7%



(b) Timing resolution: CRT $\approx$ 272ps (FWHM, energy window: [450keV 600keV])

Figure CRT FWHM and FWTM vs. Bias voltage

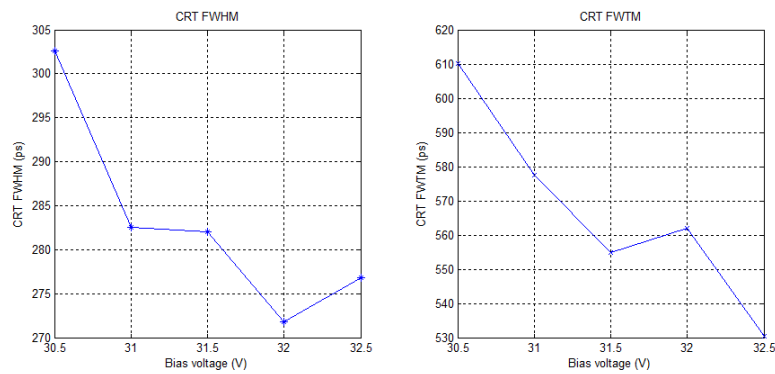
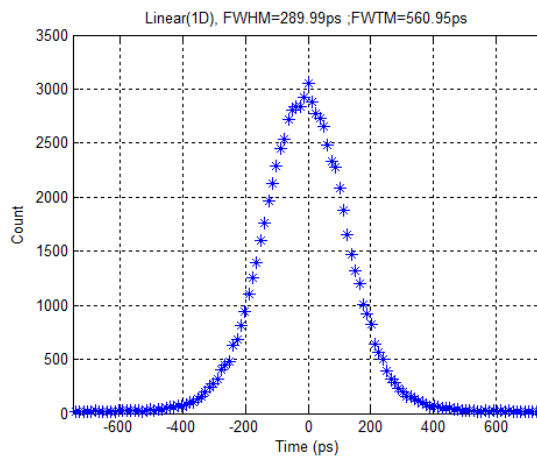
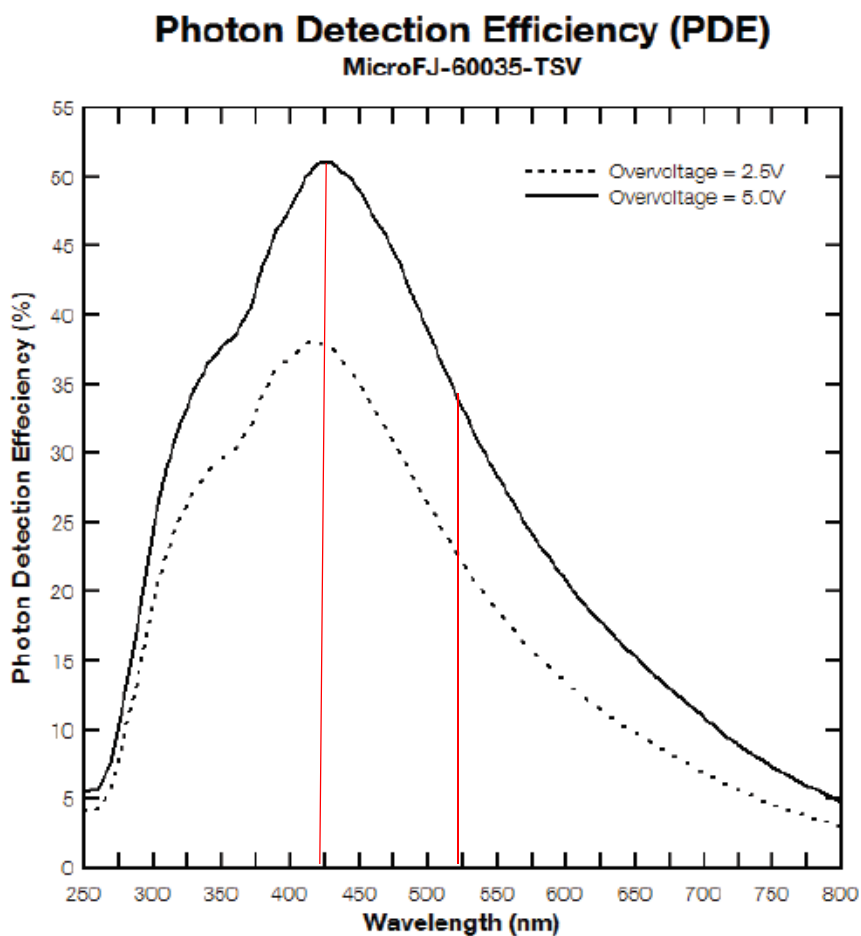


Figure. Typical timing spectrum



### 3. Notes

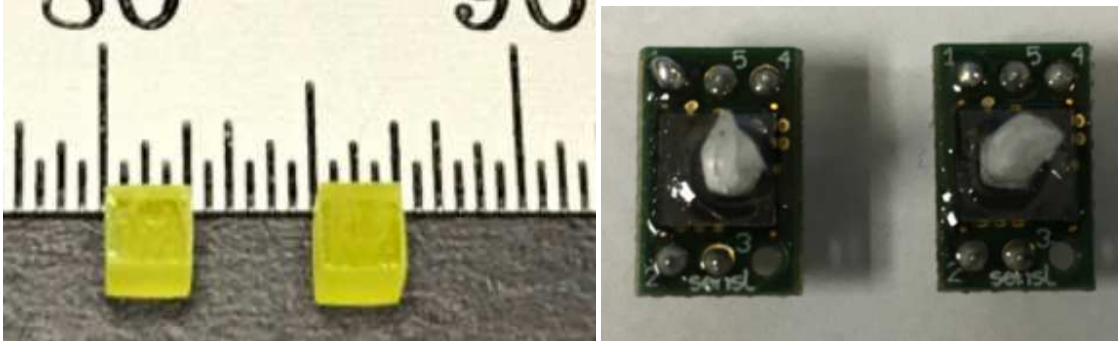
- (a) The sample provider doesn't allow us to cut the crystal into 2mm cubes. Thus, we had to measure the long (10mm) crystals instead. Our energy and timing measurements of 10mm crystals could be dramatically worse than those of 2mm crystal cubes.
- (b) Please note that the peak emission of GAGG is 520nm while the SiPM sensors are designed for crystals with 420nm peak emission (shown below). The PDE for 520nm is 30% lower compared with the PDE for 420nm. The CRT of GAGG could be improved from 272ps (FWHM) to 228ps (FWHM) if the PDE of the SiPM sensors for 520nm would matched with the PDE for 420nm.



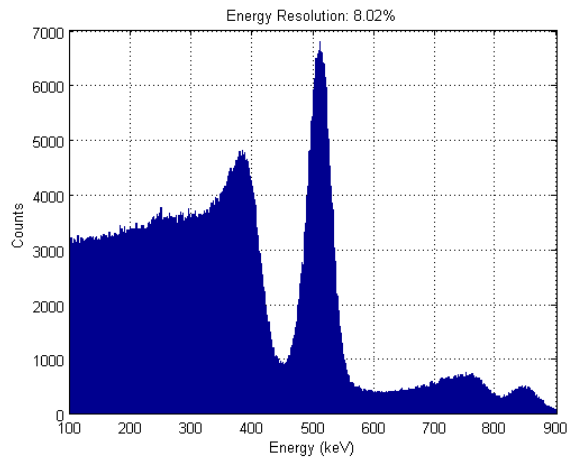
- (c) Please refer to: "First Performance Results of Ce:GAGG Scintillation Crystals With Silicon Photomultipliers"

4. **New results with 2 mm cubes** (Two samples, size: 2.12mm x 2.18 mm x 2 mm)

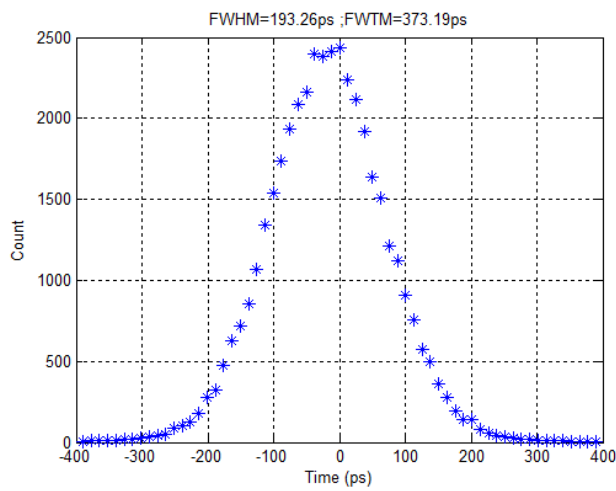
(a) size: 2.12mm x 2.18 mm x 2 mm



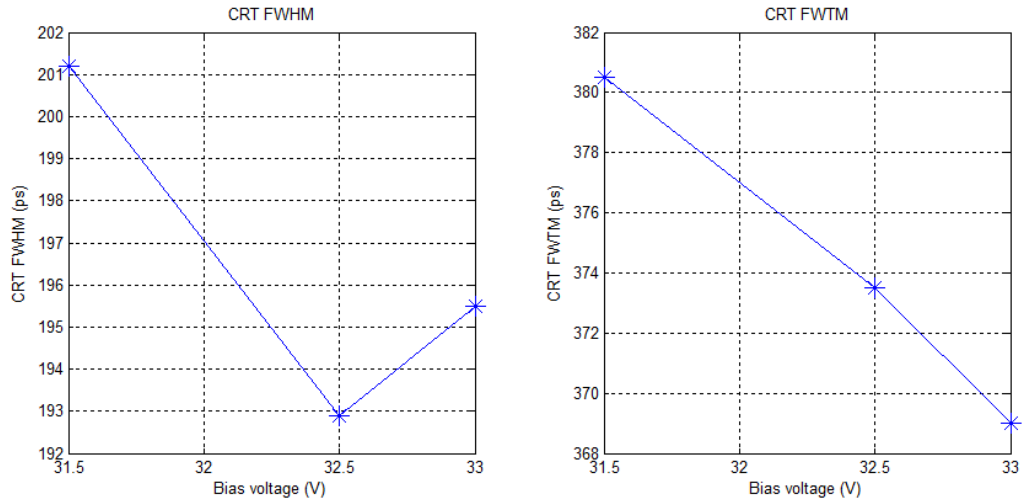
(b) Energy resolution: ER=8.02%



(c) Timing resolution: CRT=193ps (FWHM, energy window: [440keV 550keV])



(d) Timing resolution Vs. bias voltage: (energy window: [440keV 550keV])



(a) Please note that the peak emission of GAGG is 520nm while the SiPM sensors are designed for crystals with 420nm peak emission. The PDE for 520nm is 30% lower compared with the PDE for 420nm. **The CRT of GAGG could be improved from 193ps (FWHM) to 161.5ps (FWHM) if the PDE of the SiPM sensors for 520nm would matched with the PDE for 420nm.**