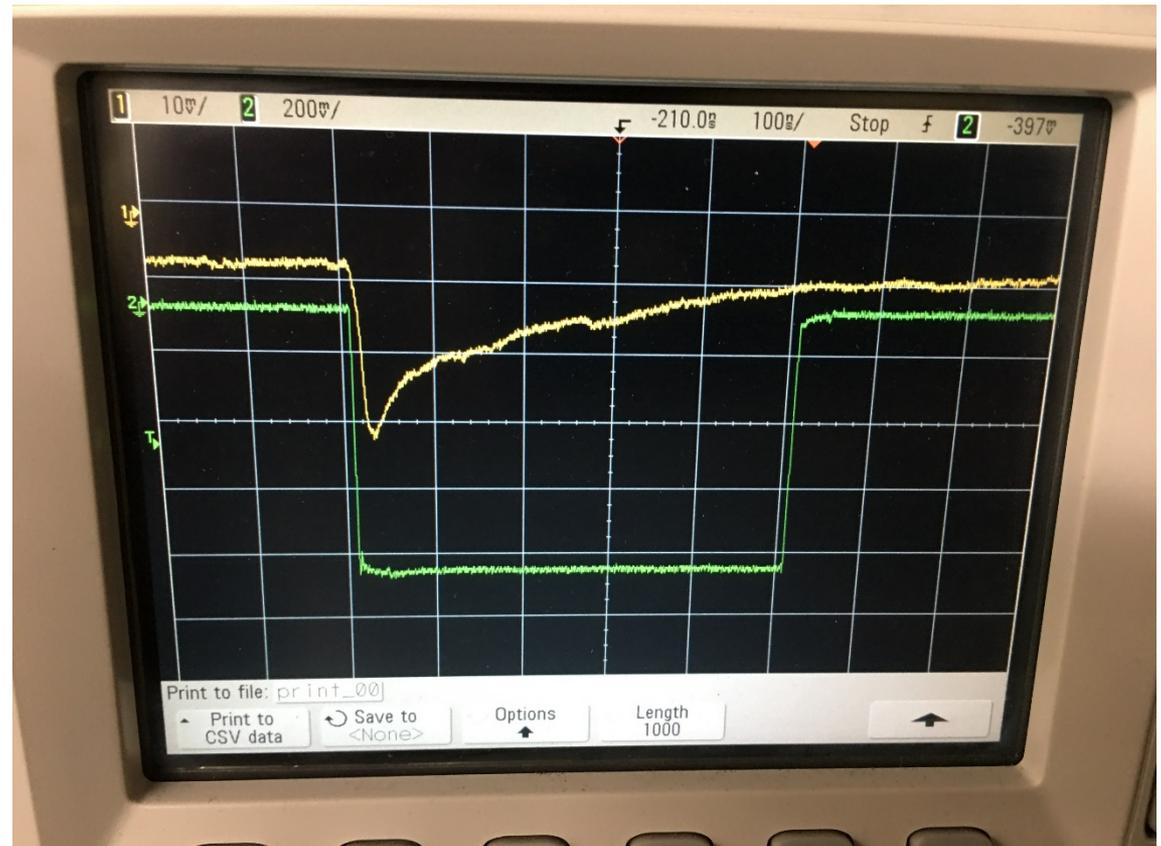
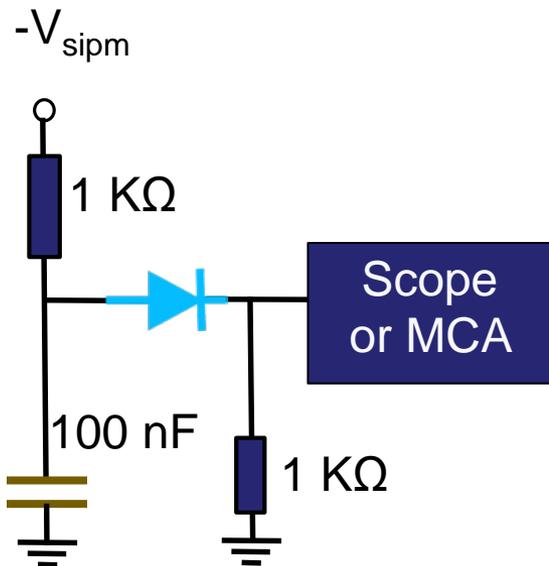


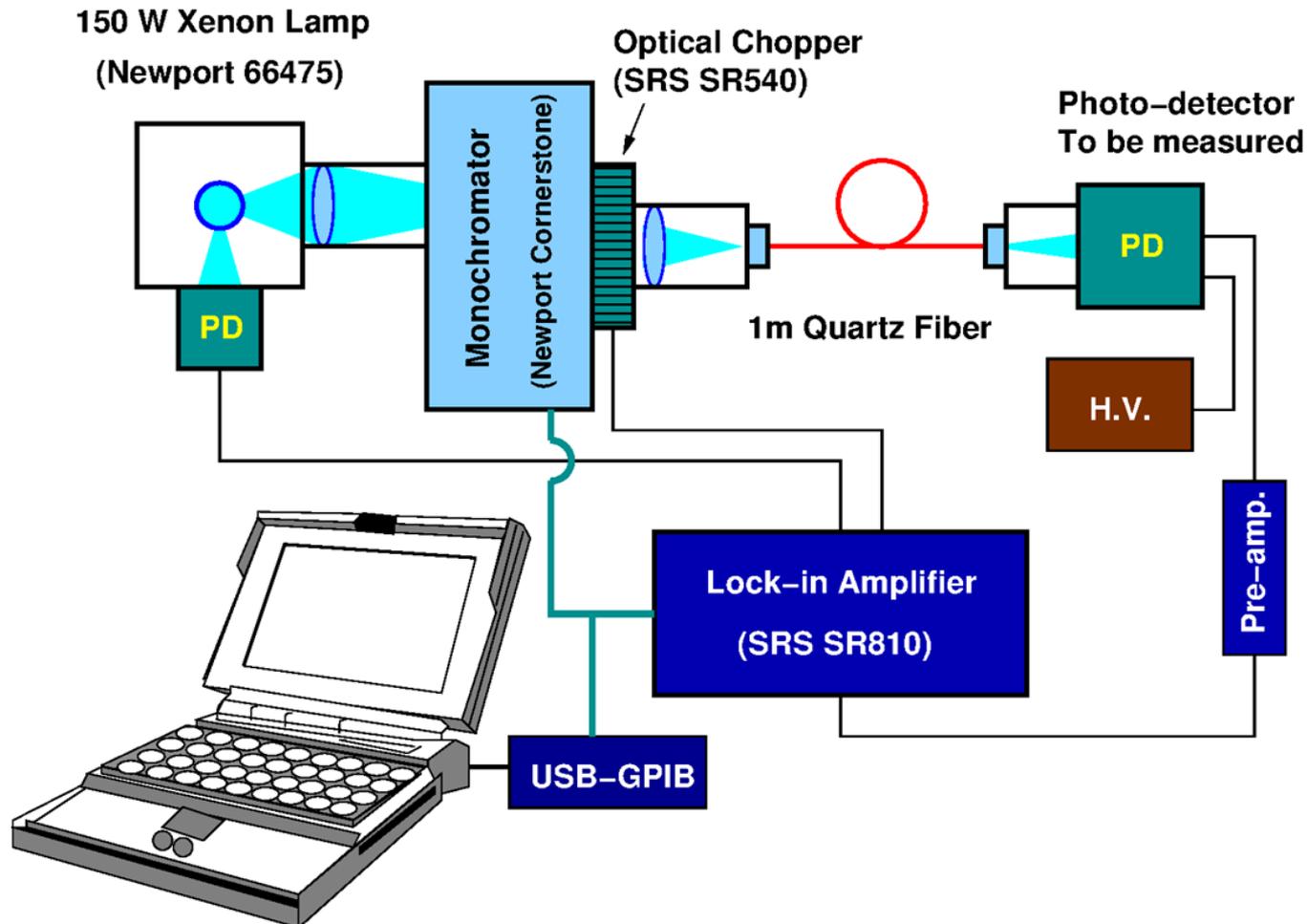
PDE Calibration with Pulsed LED at 465 nm

- PDE @ 465 nm was measured for four FBK SiPM packs by using LED light pulses of 10 ns wide. Input photon number was measured by using a calibrated PiN diode (Newport 71650), p.e. number from SiPM was calculated by fitting the photo-peak width.
- Result shows that SN499, 500 and 501 are similar, and SN496 is different.



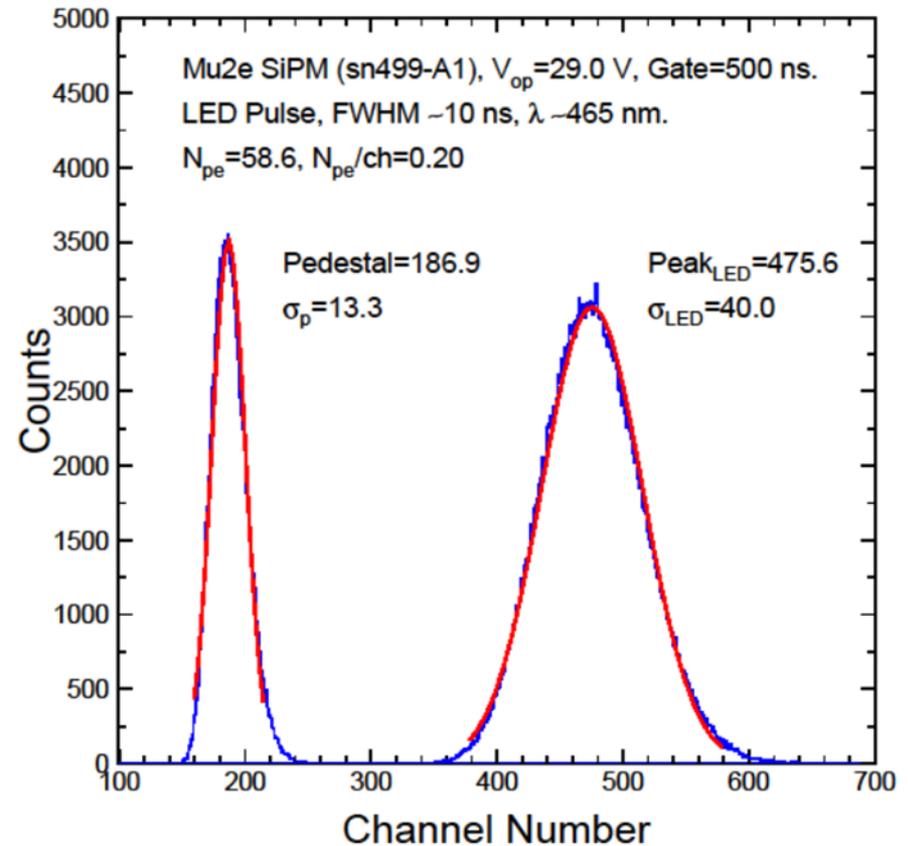
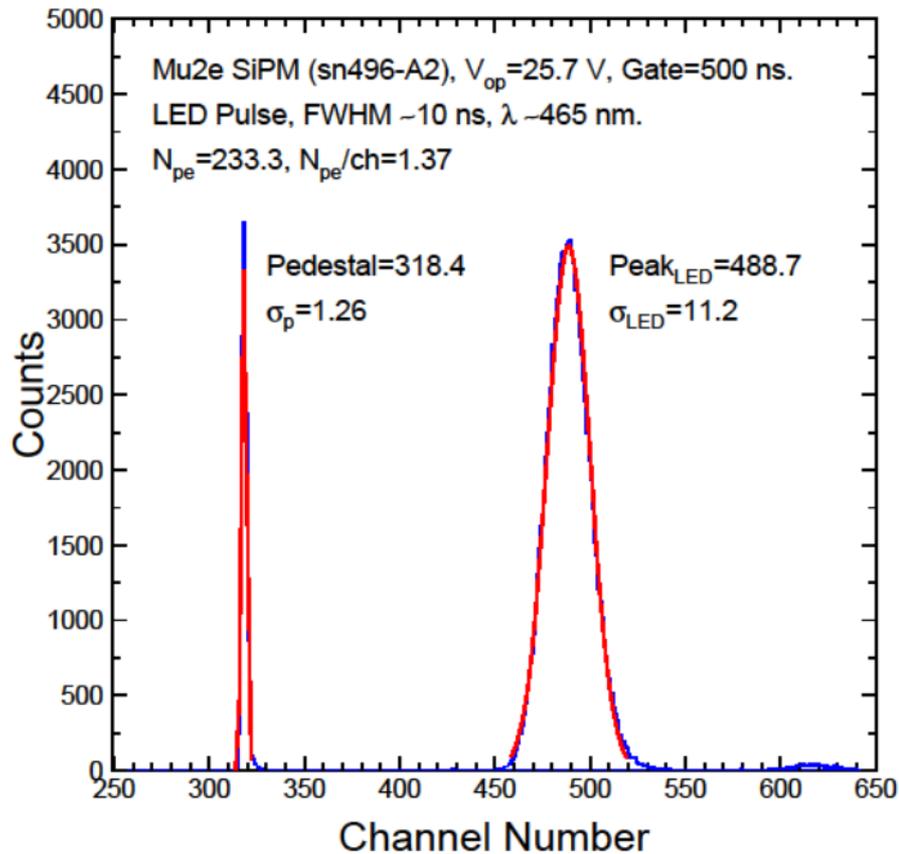
PDE as a Function of Wavelength

PDE(λ) was measured by using a Xe lamp-based spectrometer from 200 to 600 nm, and was calibrated @ 465 nm.



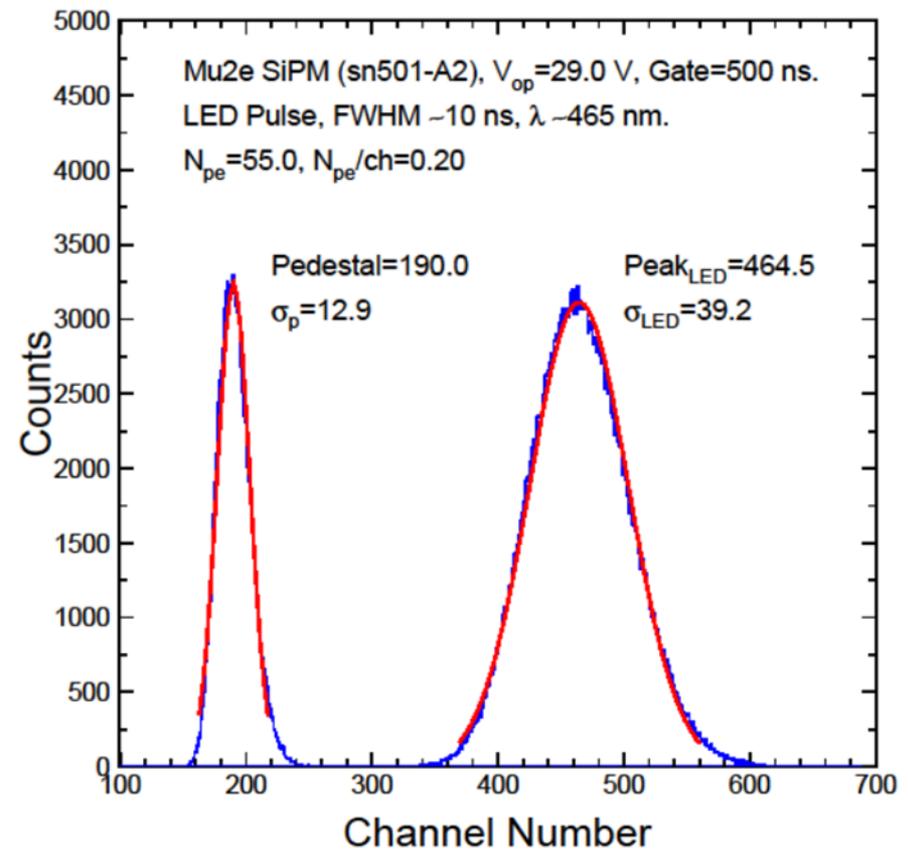
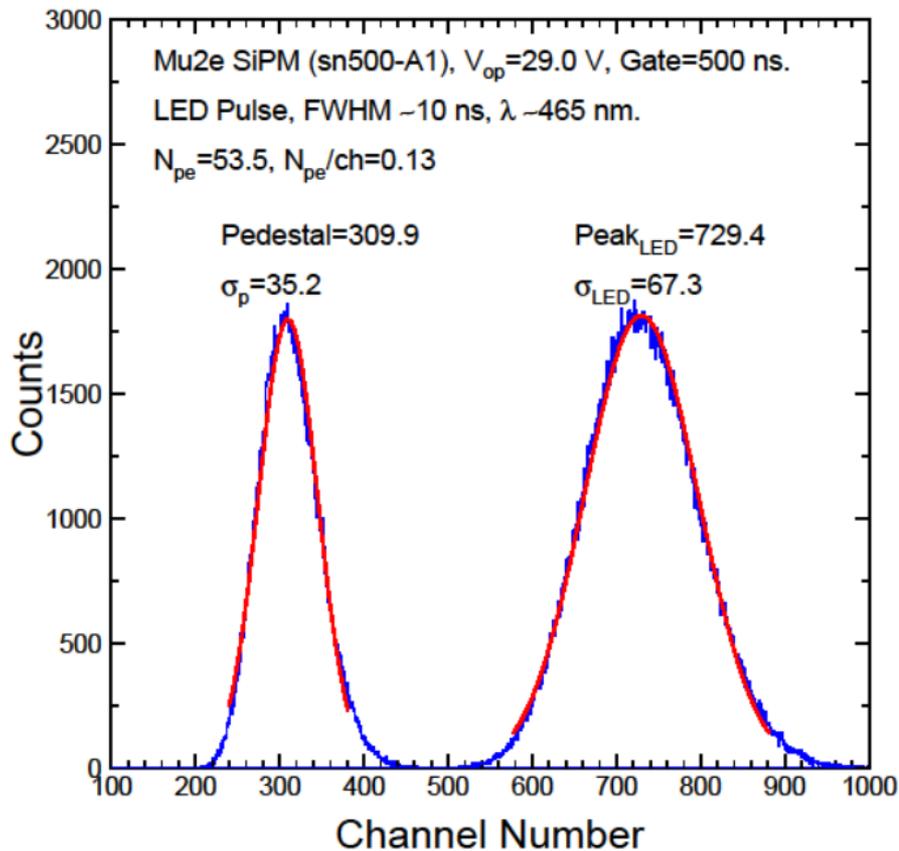
Calibration @ 465 nm: SN496 & SN499

- SN496-A2 at 25.7 V, PDE = 233.3 p.e./20.8 k phs = 1.1%.
- SN499-A1 at 29 V, PDE = 58.6 p.e./20.8 k phs = 0.28%



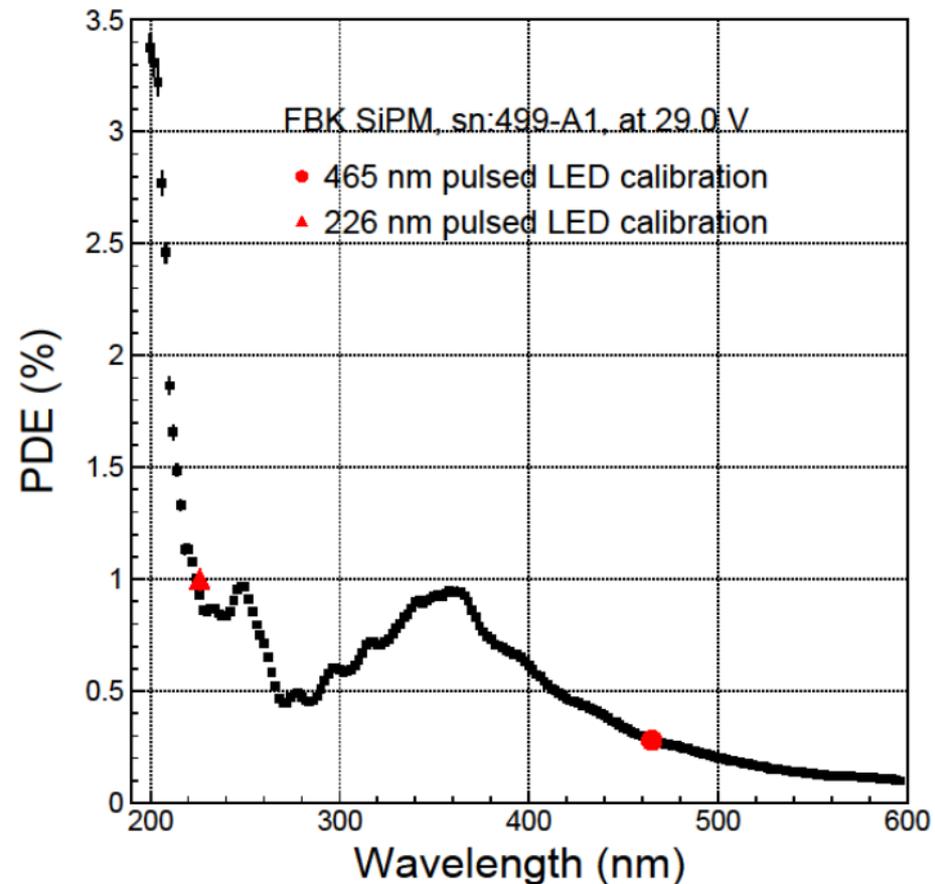
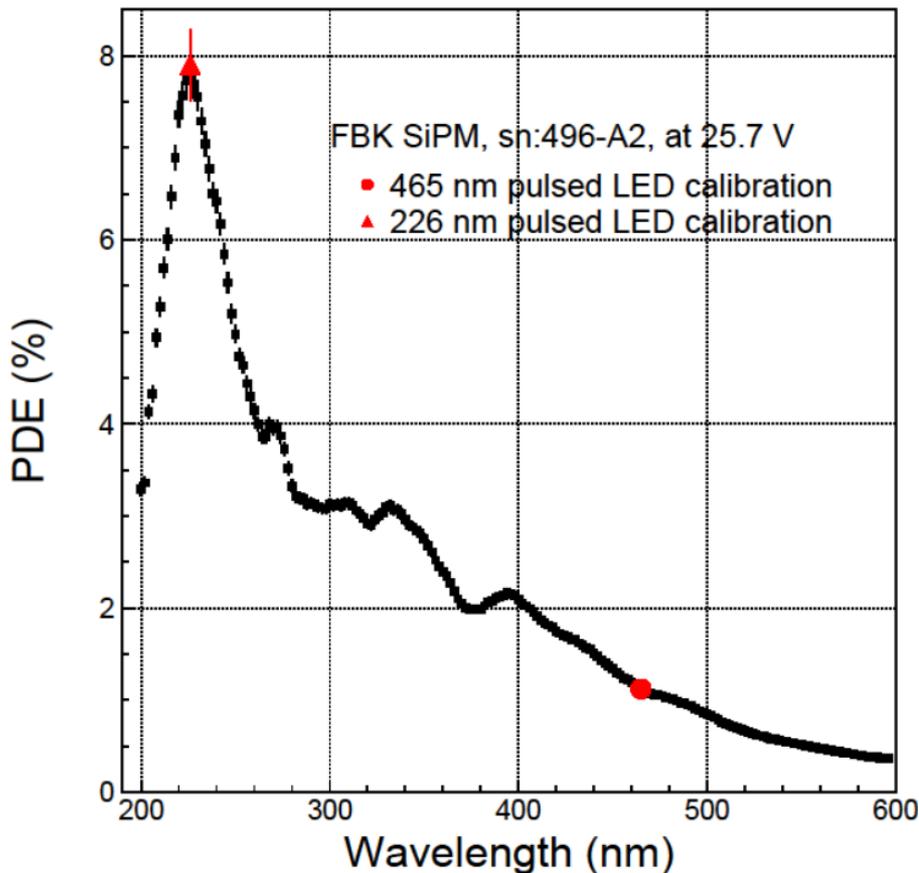
Calibration @ 465 nm: SN500 & SN501

- SN500-A1 at 29 V, PDE = 53.5 p.e./20.8 k phs = 0.26%.
- SN501-A1 at 29 V, PDE = 55.0 p.e./20.8 k phs = 0.27%.



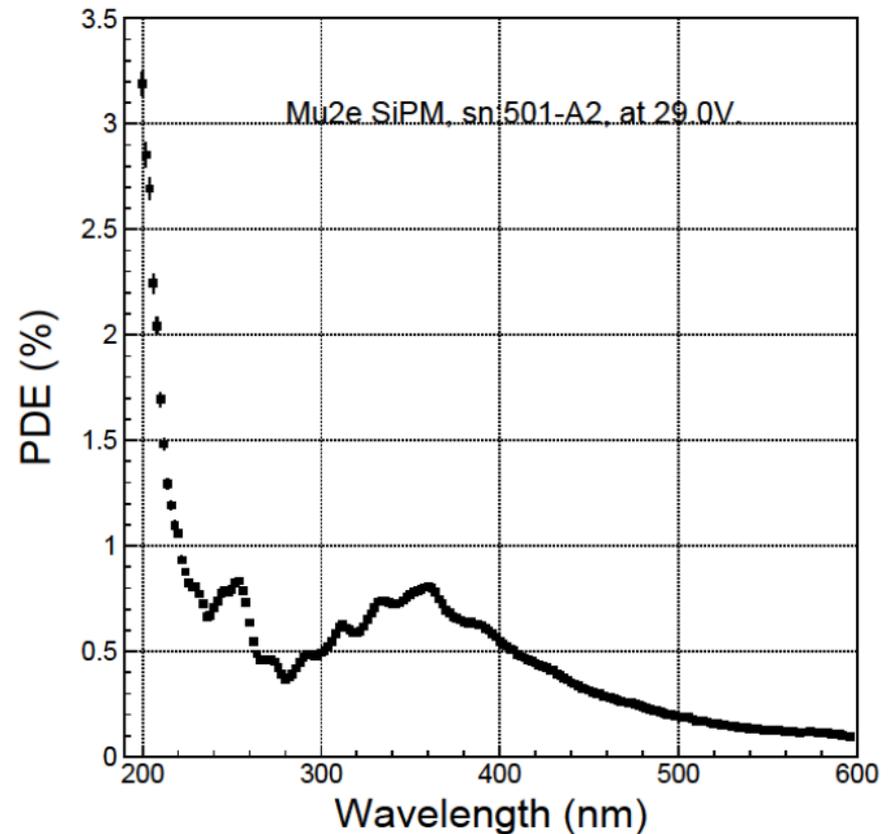
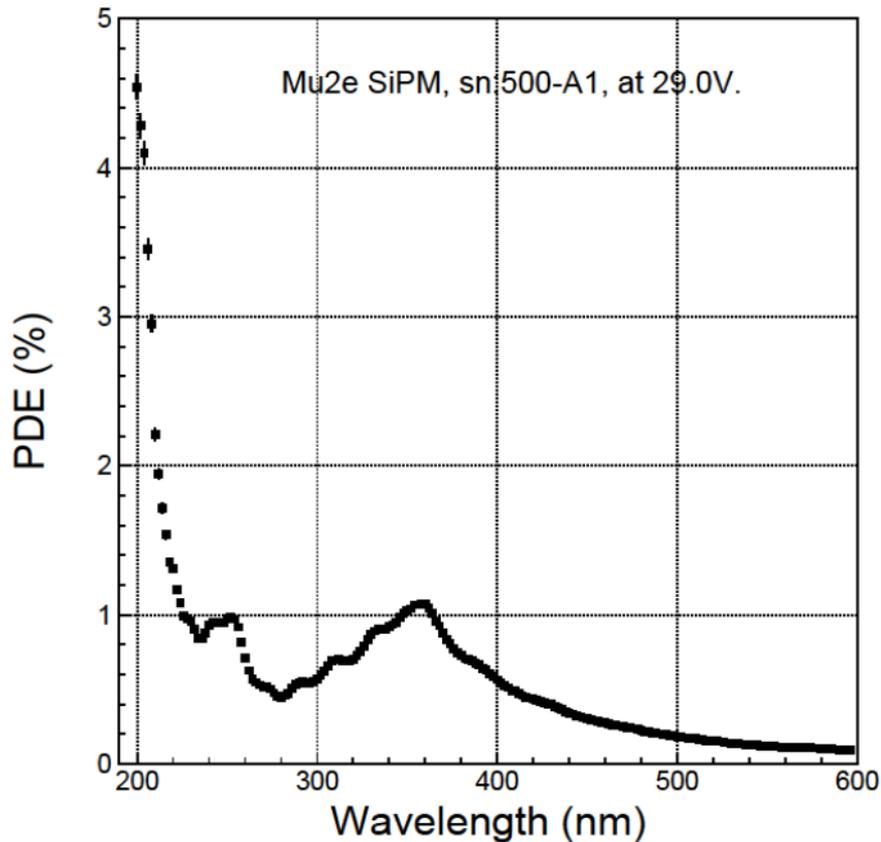
PDE(λ) (200-600 nm)

- PDE of SN496-A2 shows a UV band pass filter with peak ~ 225 nm.
- SN499-A1 shows a UV low pass edge at ~ 210 nm.
- A cross-check calibration @ 226 nm is shown as red triangles.



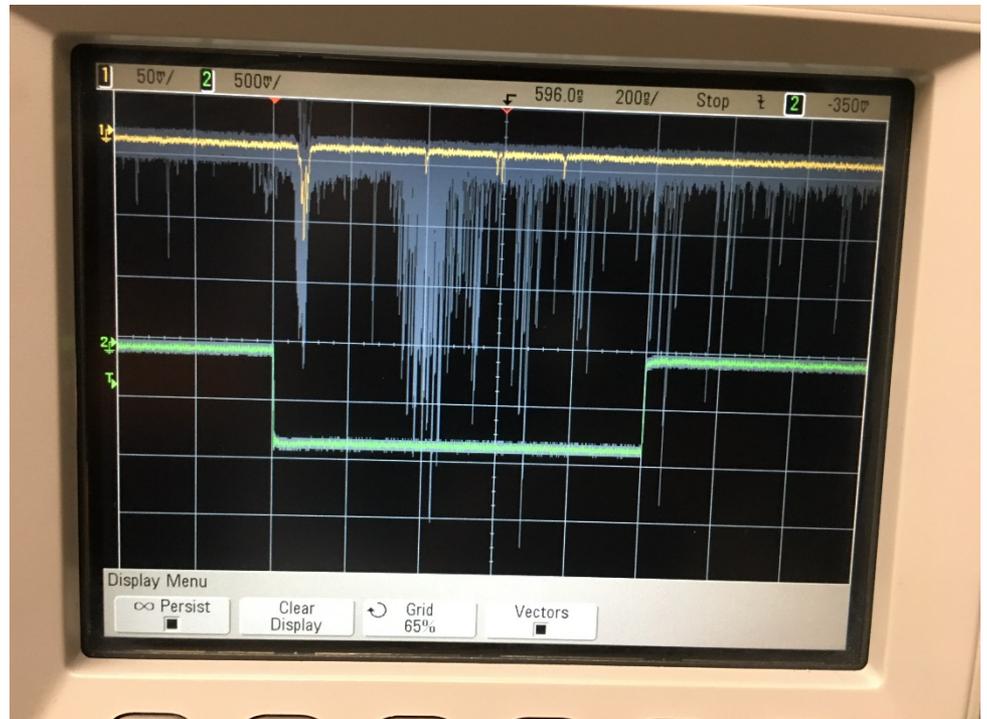
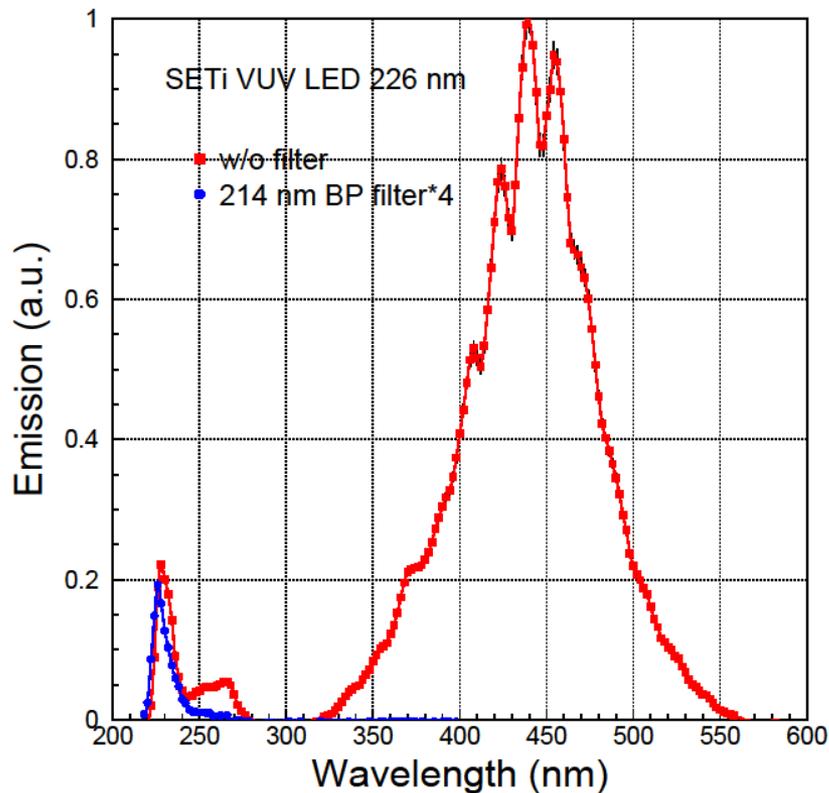
PDE(λ) (200-600 nm)

SN500-A1 and 501-A2 show consistent low pass edge as SN499-A1



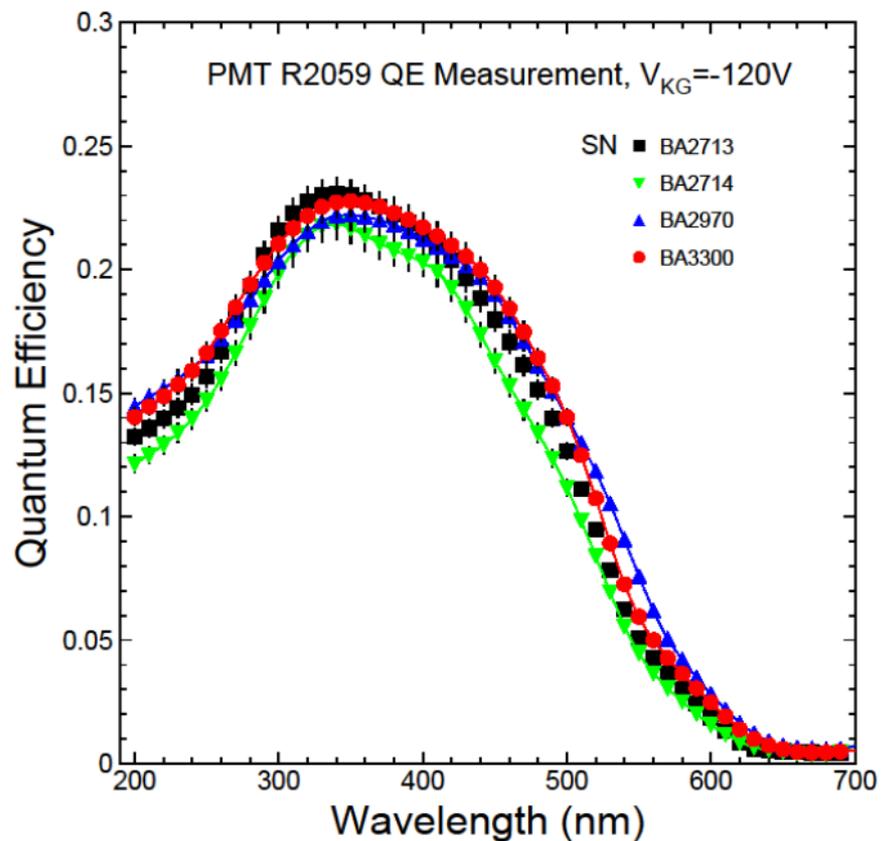
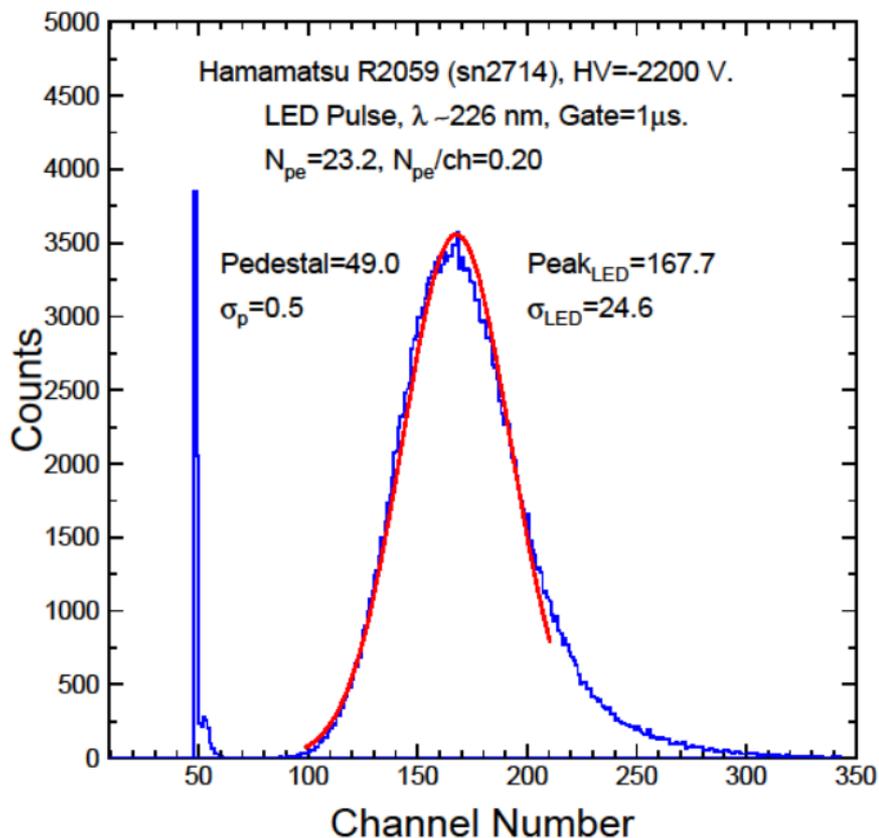
Photopeak Measurement @ 226 nm

- A SETi R&D VUV LED (UVTop226) was used for cross check calibration @ 226 nm.
- Additional emissions @ 270 and 450 nm are removed by a filter @ 214 nm.
- The LED provides a signal with a long tail up to a few hundreds μ s.
- 1 μ s gated was used to measure both the SiPM signal and the incident photon number by using an R2059 PMT with known QE.



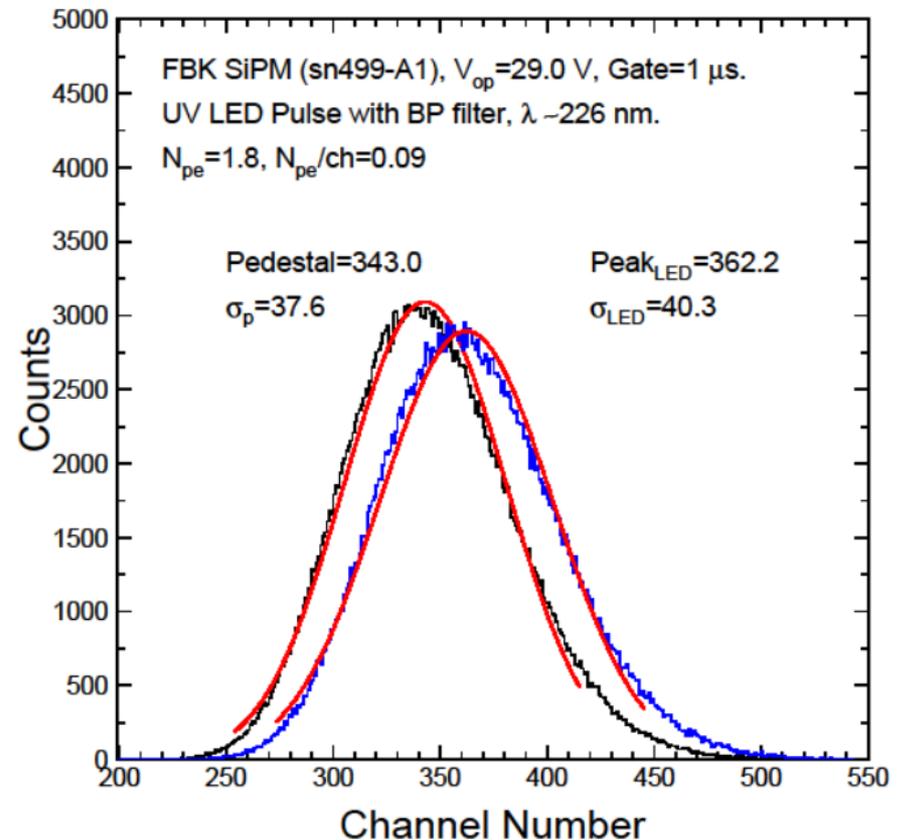
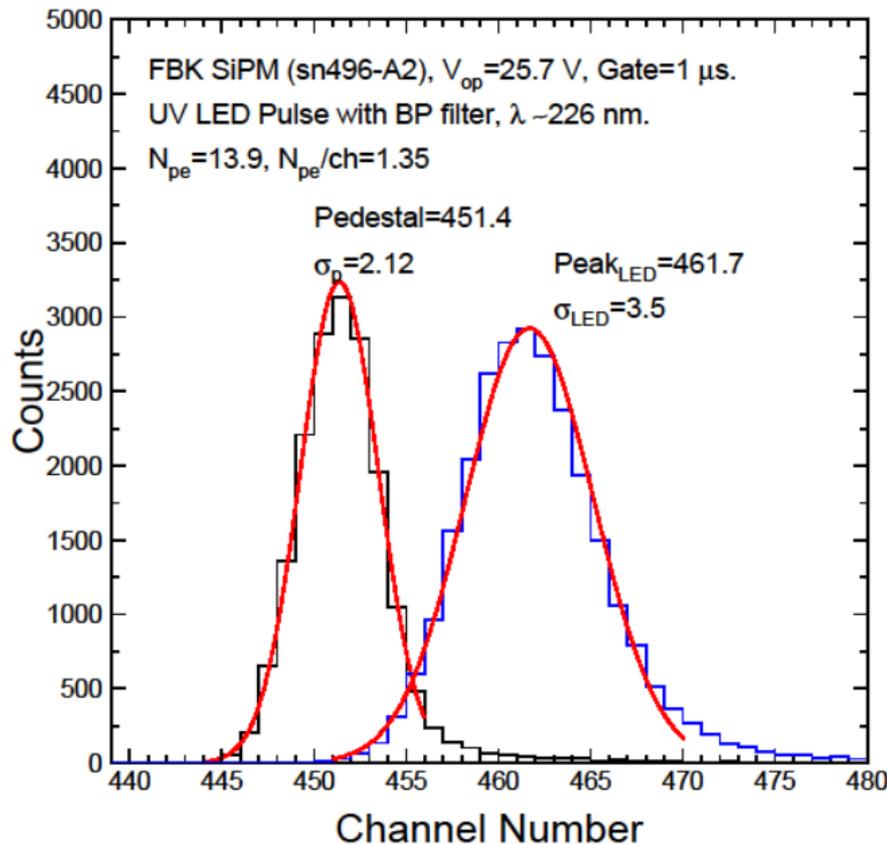
Photon Number at 226 nm.

The incident photon number is $177 = 23.2/13.1\%$ @ 226 nm



Calibration @ 226 nm: SN496 & SN499

- SN496-A2 at 25.7 V: PDE @ 226 nm = 13.9 p.e./177 phs = 7.9%
- SN499-A1 at 29 V, PDE @ 226 = 1.8 p.e./177 phs = 1.0%



Summary of 4 FBK SiPMs for BaF₂

SN	V _{br} (V)	V _{op} (V)	PDE at 465 nm (%)	PDE at 226 nm (%)
496A-2	26.2?	25.7	1.12	7.9
499A-1	26.1	29.0	0.28	1.0
500A-1	26.1	29.0	0.26	
501A-2	26.1	29.0	0.27	