VST Report to ADWG 08/23/12

Ben Jones

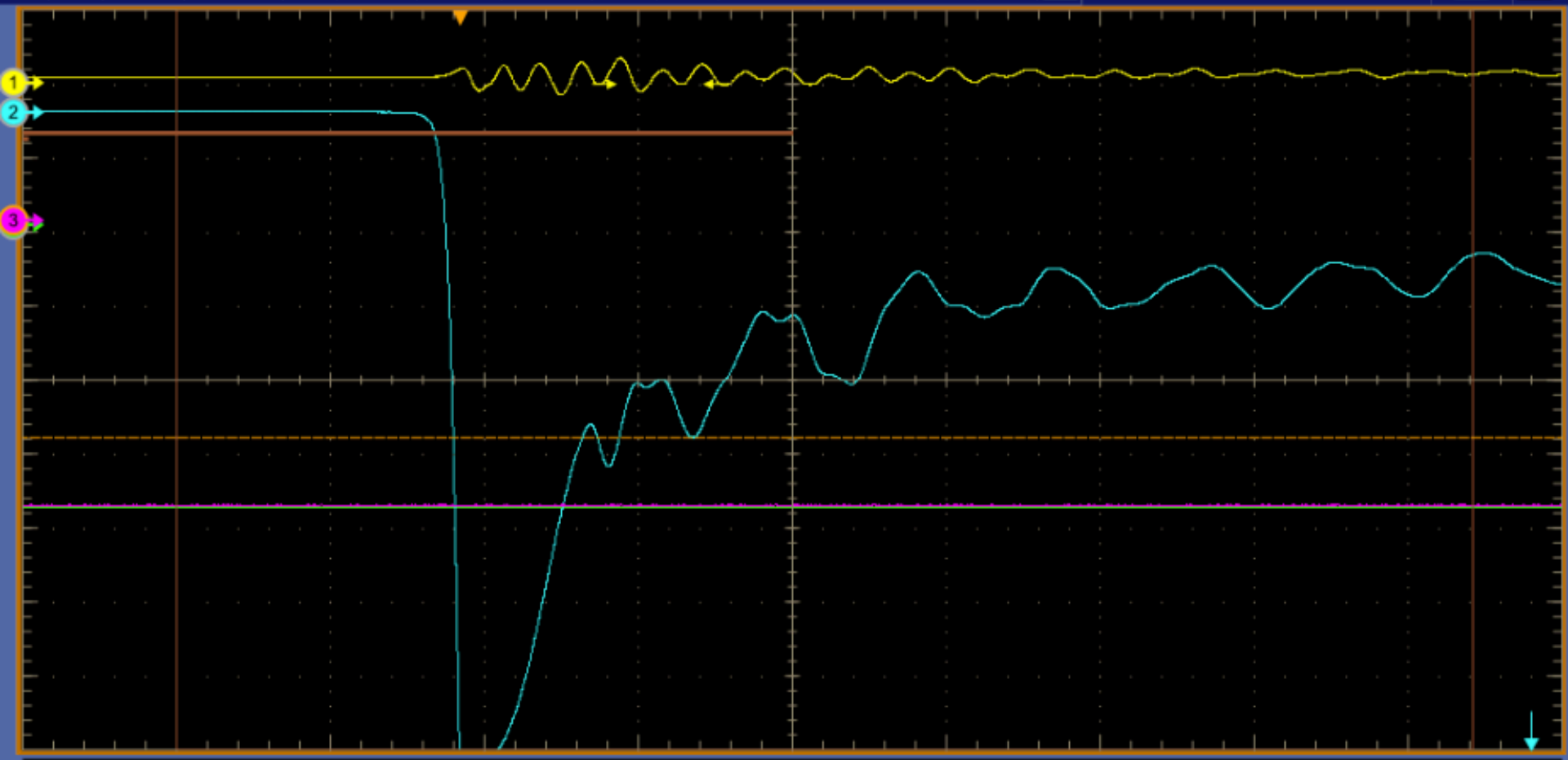
Activities since last ADWG

- 1. Ringing, noise and crosstalk
- 2. Single PE Calibration
- 3. Cosmic / noise rate measurements
- 4. Light leak hunting

Noise and Crosstalk

- 1. Standalone power supply tested, ringing still present
- 2. Notice crosstalk between channels 1 and 2, which seems to have its origin in the feed through.
  - Crosstalk signal displays ringing behavior – maybe related?
  - Test with PMT in a dark box?

File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help Tek



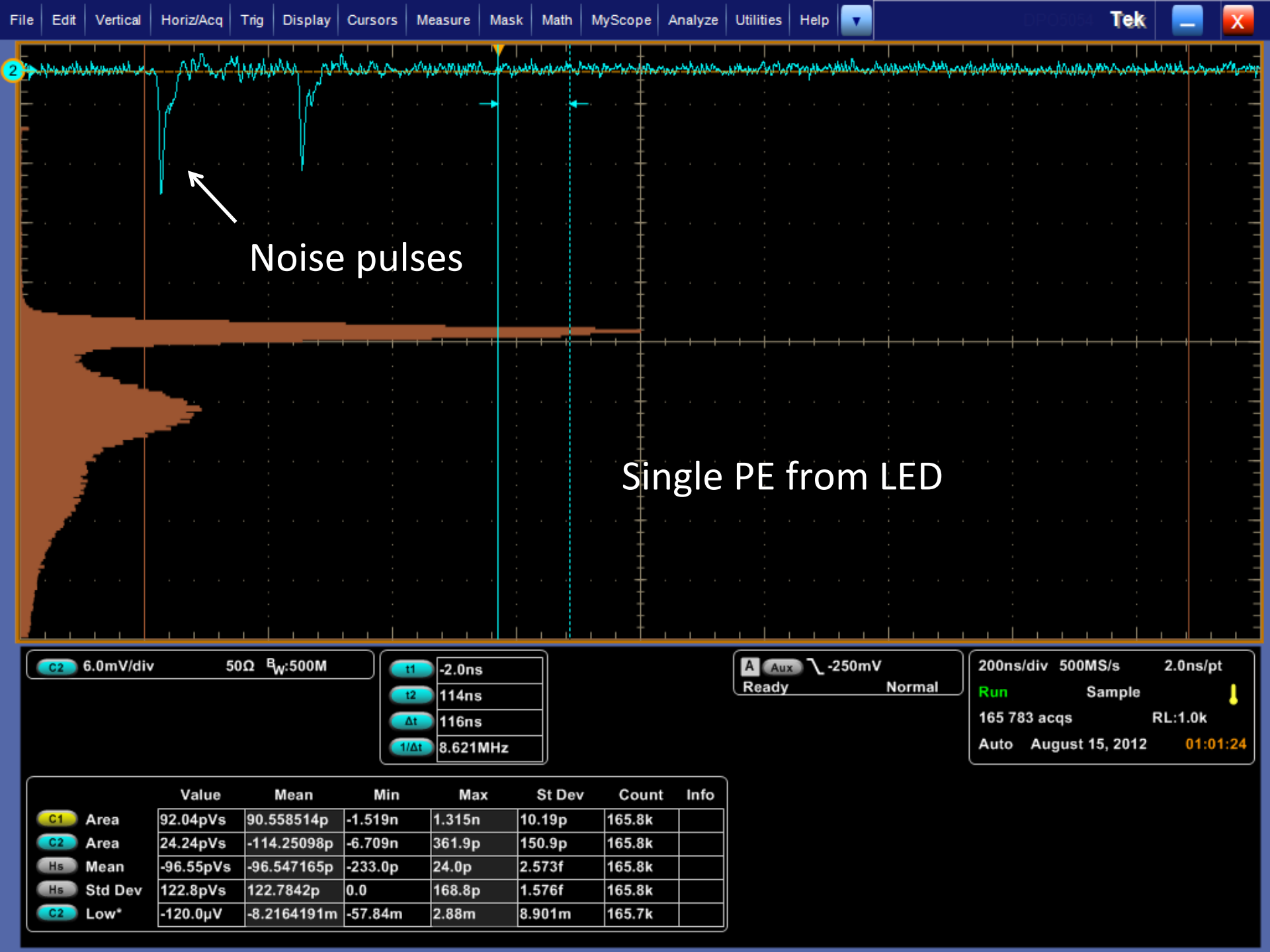
C1	60.0mV/div	50Ω	BW:500M
C2	60.0mV/div	50Ω	BW:500M
C3	200mV/div	50Ω	BW:500M
C4	200mV/div	50Ω	BW:500M

A C2 -589mV
None Normal

50.0ns/div 2.5GS/s 400ps/pt
Stopped
808 acqs RL:1.25k
Auto August 20, 2012 08:14:36

		Value	Mean	Min	Max	St Dev	Count	Info
C1	Area	173.5pVs	173.48609p	173.5p	173.5p	0.0	1.0	
C2	Area	-6.832nVs	-6.8315957n	-6.832n	-6.832n	0.0	1.0	
Hs	Mean	179.7pVs	179.52362p	140.0p	179.7p	1.413p	148.0	
Hs	Std Dev	3.299pVs	3.8896327p	0.0	20.0p	1.338p	148.0	
C2	Low*	-264.0mV	-263.99998m	-264.0m	-264.0m	0.0	1.0	

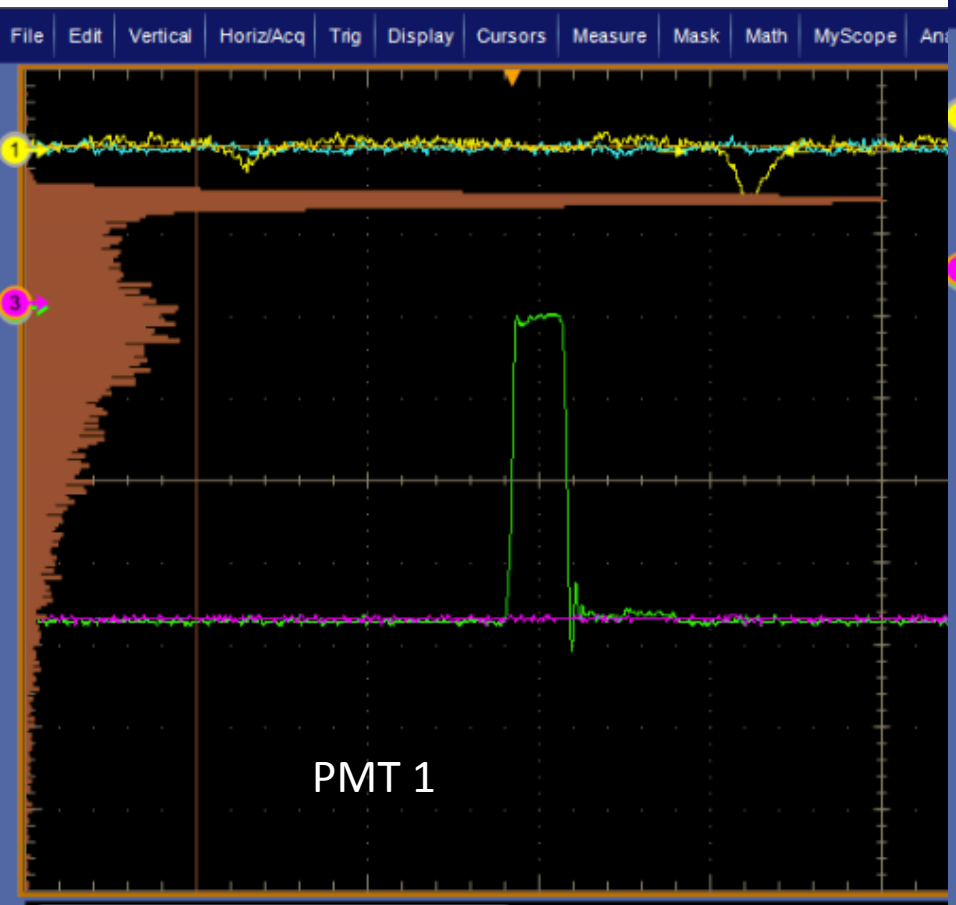
File Edit Vertical Horiz/Acq Trig Display Cursors Measure Mask Math MyScope Analyze Utilities Help
Tek
Dark box : no ringing
C1 40.0mV/div 50Ω BW:500M
C2 1.0V/div 50Ω BW:500M
C3 200mV/div 50Ω BW:500M
C4 500mV/div 50Ω BW:500M
t1 46.1ns
t2 85.1ns
Δt 39.0ns
1/Δt 25.641MHz
C3 -28.0mV
Ready Normal
50.0ns/div 2.5GS/s 400ps/pt
Run Average:10000
5 824 acqs RL:1.25k
Auto August 23, 2012 09:42:40
Value Mean Min Max St Dev Count Info
C1 Area 100.3pVs 100.32131p 100.3p 100.3p 0.0 1.0
C2 Area -4.538nVs -4.5377813n -4.538n -4.538n 0.0 1.0
C2 Low* -509.7mV -509.6875m -509.7m -509.7m 0.0 1.0



		Value	Mean	Min	Max	St Dev	Count	Info
C1	Area	92.04pVs	90.558514p	-1.519n	1.315n	10.19p	165.8k	
C2	Area	24.24pVs	-114.25098p	-6.709n	361.9p	150.9p	165.8k	
Hs	Mean	-96.55pVs	-96.547165p	-233.0p	24.0p	2.573f	165.8k	
Hs	Std Dev	122.8pVs	122.7842p	0.0	168.8p	1.576f	165.8k	
C2	Low*	-120.0µV	-8.2164191m	-57.84m	2.88m	8.901m	165.7k	

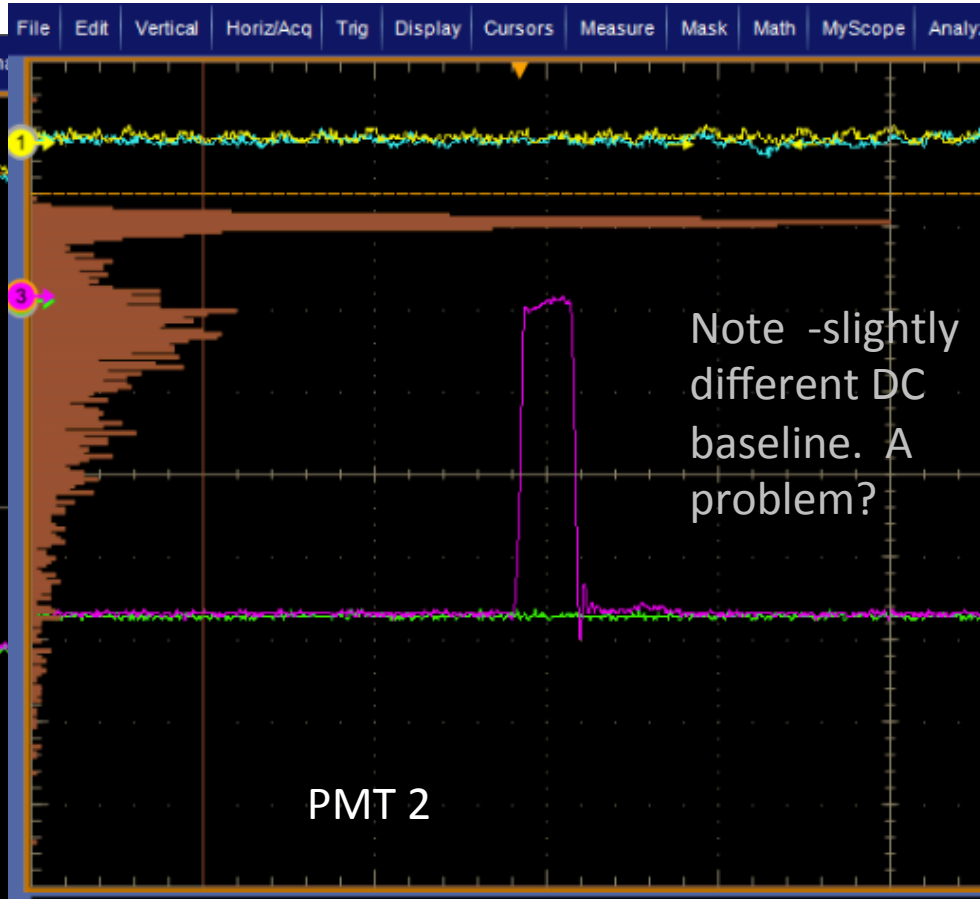
1PE Calibration

- Size of 1PE measured (in V) 2 ways:
  - Scope only : Poisson shape for large pulse
  - Scope only : Single PE peak position
- Then a known pulse of ~20PE prepared and sent to electronics.
- HV adjusted until this falls in the correct ADC channel
- As verification, #PE in the pulse independently confirmed using poisson stats from the recprded pulses
- Cannot send single PE to readout due to segfault issue



C1	10.0mV/div	50Ω	BW:500M
C2	10.0mV/div	50Ω	BW:500M
C3	200mV/div	50Ω	BW:500M
C4	200mV/div	50Ω	BW:500M

		Value	Mean	Min	Max	St Dev	Count
C1	Area	-50.16pVs	-36.402399p	-606.6p	202.0p	67.92p	9.037k
C2	Area	6.64pVs	-416.20044f	-18.4p	54.4p	3.116p	9.037k
Hs	Mean	-53.62pVs	-53.683552p	-59.07p	6.667p	41.47f	9.038k
Hs	Std Dev	78.0pVs	78.027871p	0.0	83.95p	18.62f	9.038k
C2	Low*	200.0µV	-323.69758µ	-3.4m	1.6m	294.4µ	9.037k



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C4	200mV/div	50Ω	BW:500M

		Value	Mean	Min	Max	St Dev	Count
C1	Area	22.16pVs	21.058714p	-8.64p	32.96p	3.107p	2.441k
C2	Area	-74.56pVs	-50.961281p	-450.3p	144.1p	64.81p	2.441k
Hs	Mean	-61.73pVs	-61.815037p	-174.0p	-4.0p	141.4f	2.444k
Hs	Std Dev	67.15pVs	67.238438p	0.0	97.79p	84.23f	2.444k
C2	Low*	-7.2mV	-4.9159412m	-32.4m	4.6m	5.697m	2.441k

Single PE Sizes (after tuning)

- PMT1:
  - 1PE Method : 1PE = 76 pVs N = 21.4
  - Poisson Method: 1PE = 64 pVs N = 18.2
- PMT2:
  - 1PE Method: 1PE = 67 pVs N = 20.1
  - Poisson Method: 1PE = 64 pVs N = 21.0
- Gains:
  - PMT1 = 5.9E-6 PMT2 = 5.5E-6

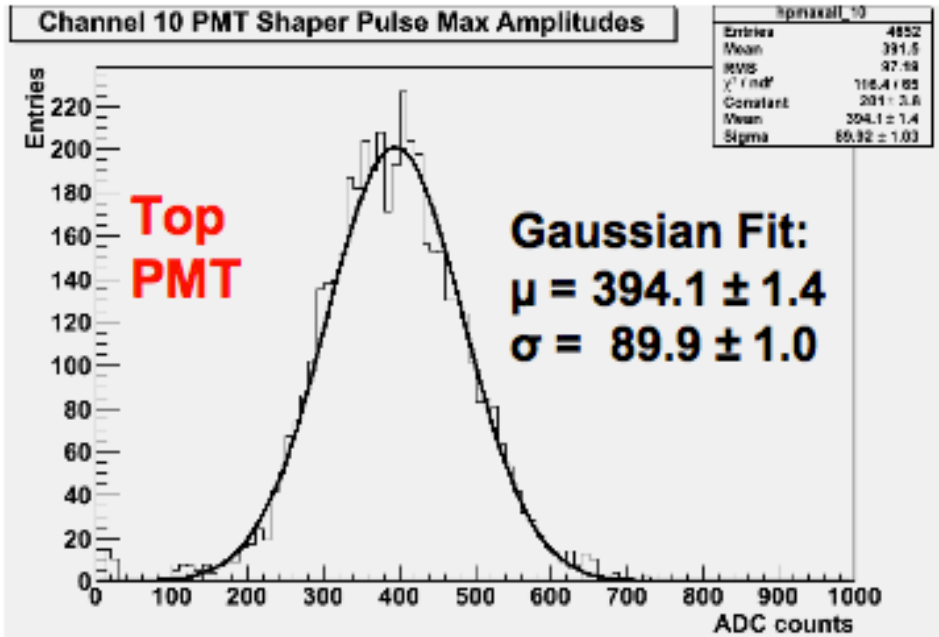
HV Required:

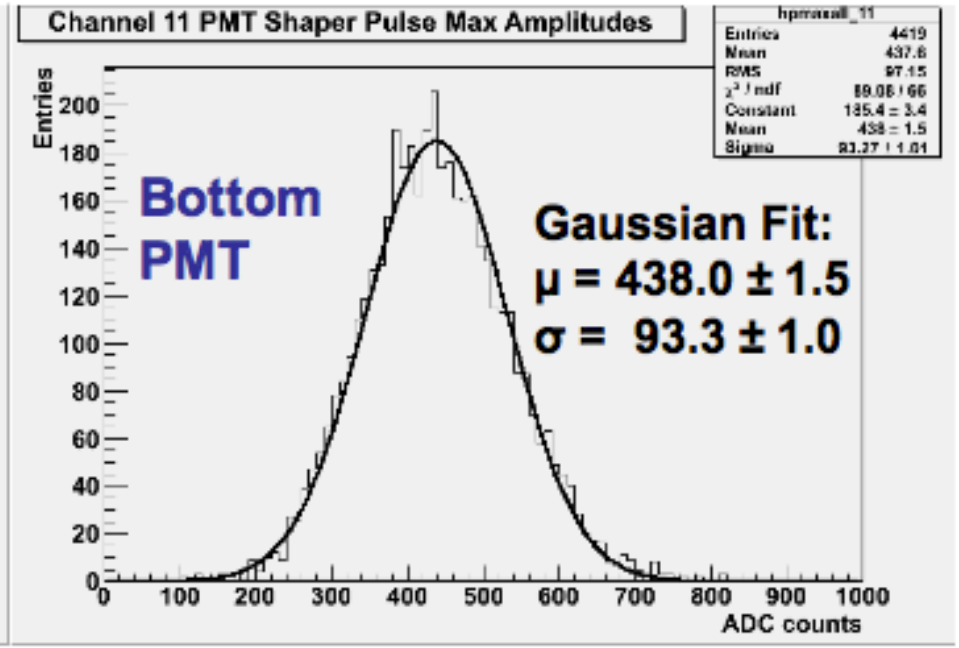
- PMT1: 1080V
- PMT2: 1125V

Bo ADC/PE Calibration

For each LED trigger:

- Apply tight timing cut with respect to expected PMT pulse arrival time
- Histogram the max ADC value for the PMT corresponding to LED that fired



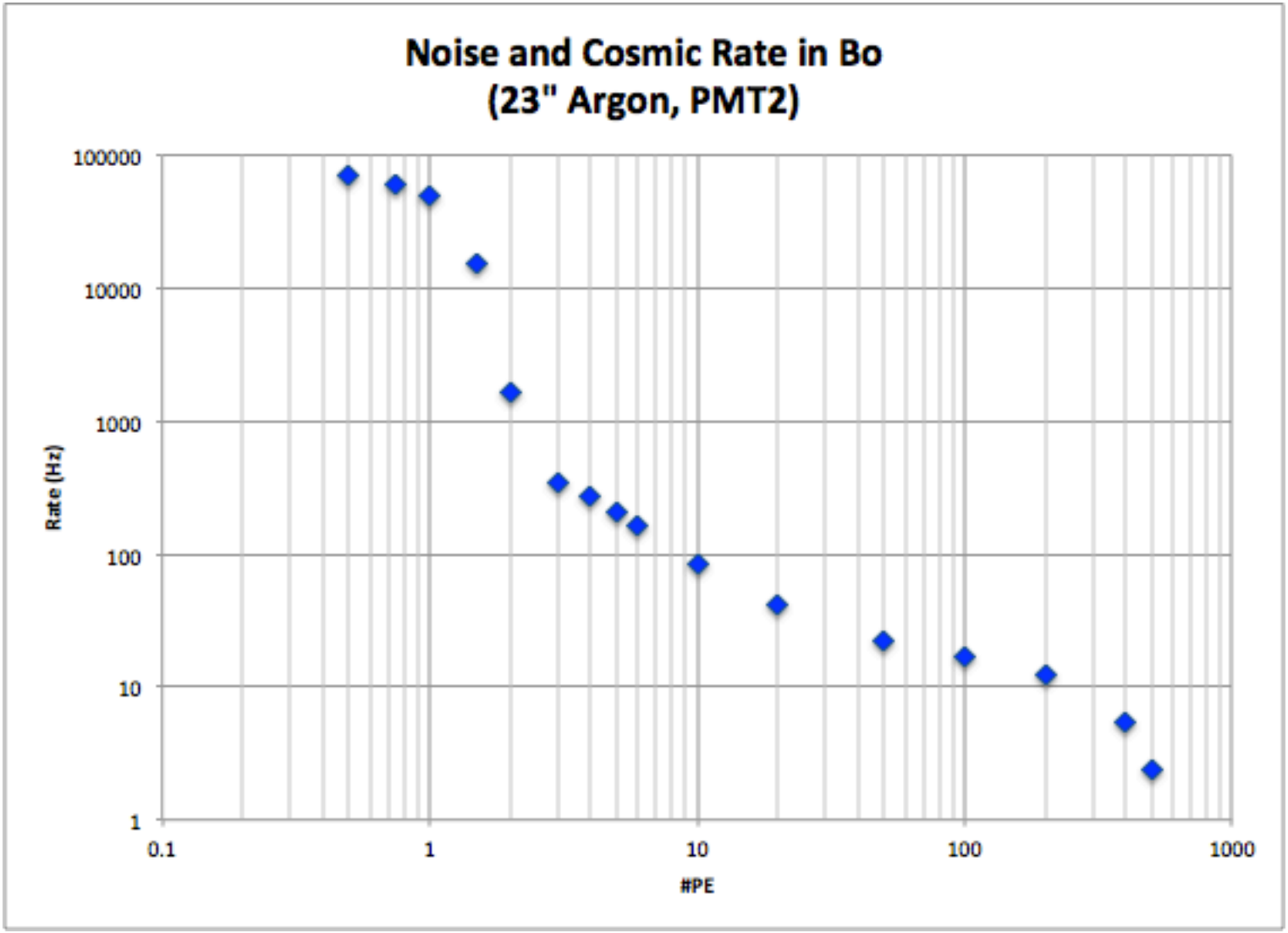


Assuming naïve Poisson statistics: $\mu = kgeN_{pe}$ and $\sigma = kge\sqrt{N_{pe}}$,
where k = charge/ADC conversion, g = gain, and e = electron charge

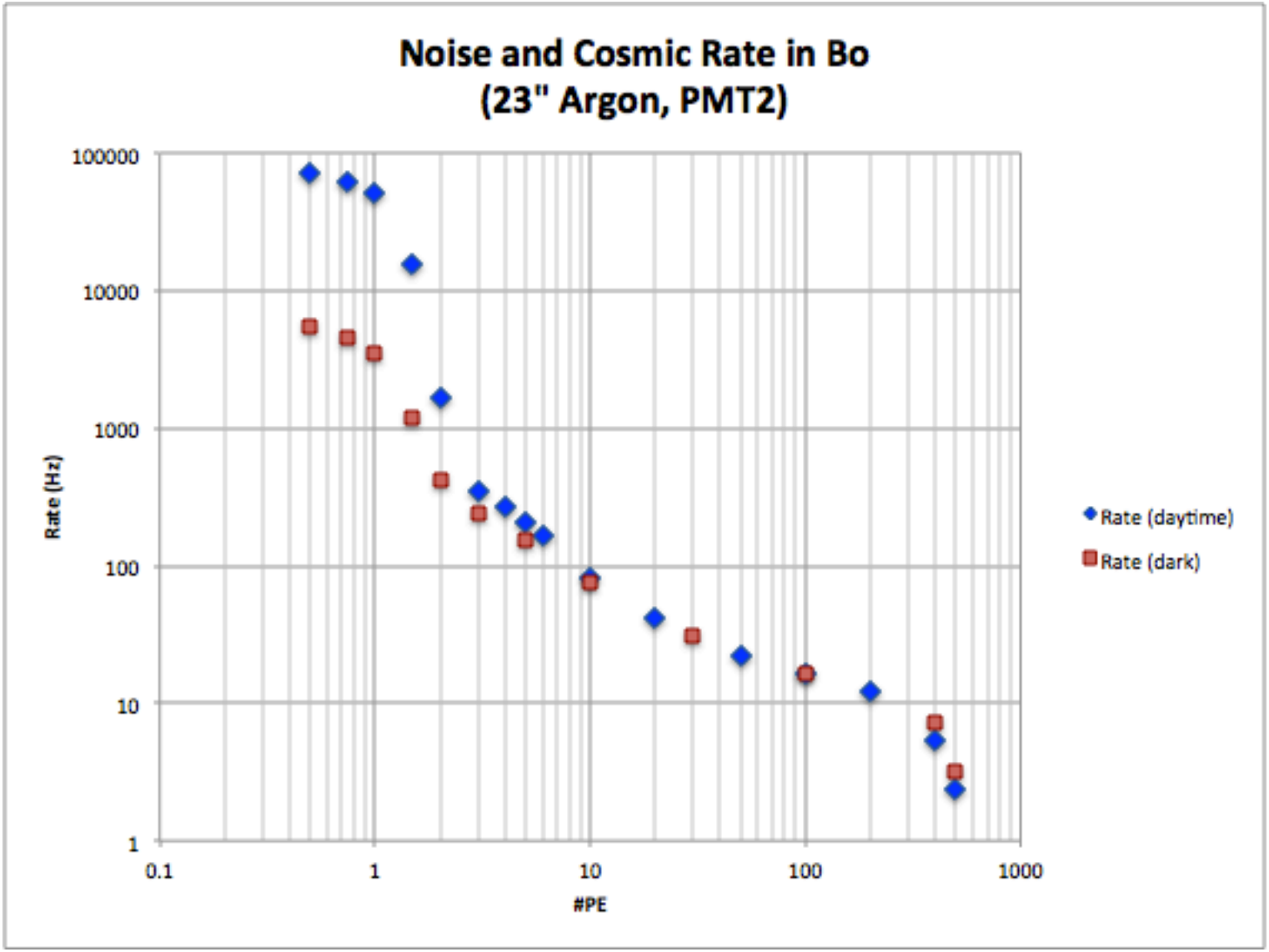
N_{pe} = 19.2 ± 0.3
ADC/PE = 20.5 ± 0.3

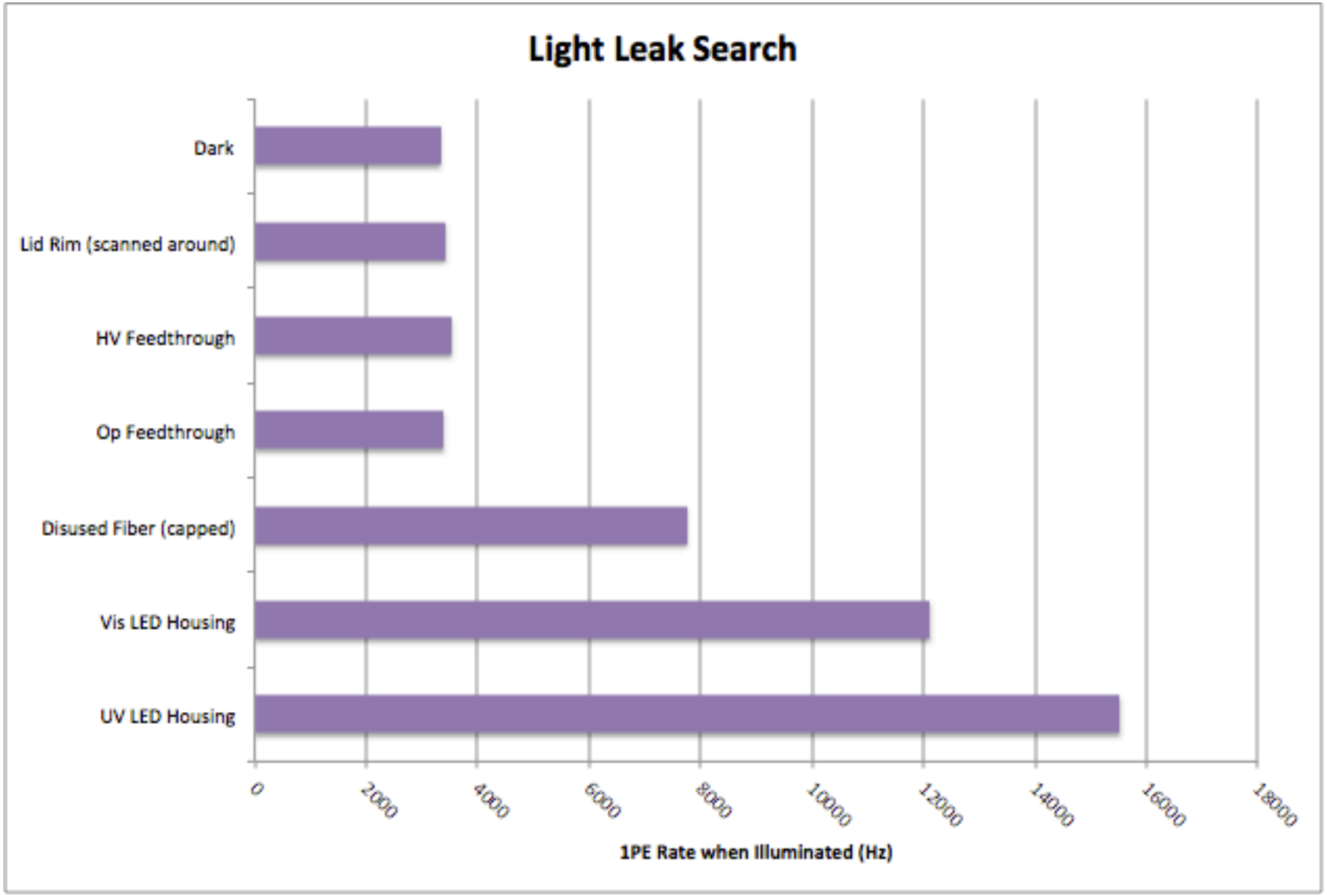
N_{pe} = 22.1 ± 0.4
ADC/PE = 19.9 ± 0.3

Cosmic and Noise Rates



Light Leak in 1PE Region




Light Leak Search
Dark
Lid Rim (scanned around)
HV Feedthrough
Op Feedthrough
Disused Fiber (capped)
Vis LED Housing
UV LED Housing
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
1PE Rate when Illuminated (Hz)