1st Look at FNAL at R11065 **at room temperature**.

Plots of pulses on oscilloscope at different voltages in response to LED (~ 60 photo-electrons) with histograms of pulse-area:

Calculation of gain from 1300 to 1600 Volts based on

N (p.e.) = [mean pulse height / rms(pulse height)]^2

Plot of gain vs voltage

Plots of linearity at 1300, 1400 & 1500 Volts up to 300 pC charge output.

Bottom lines: gain at 1500 Volts is ~4.5 x 10^6 (1 pe = 0.7 pc)

tube and base are linear up to 300 pC output

HAMAMATSU

TENTATIVE DATA SHEET
Mar. 2009

PHOTOMULTIPLIER TUBE

R11065

For Low Temperature Operation down to -186 deg. C
Special Bialkali Photocathode (Bialkali LT), Low Radioactivity
76 mm (3 Inch) Diameter, 12-stage, Head-on Type, Synthetic Silica

General

Parameter		Description / Value	Unit
Spectral response		160 to 650	nm
Wavelength of Maximum Response		420	nm
Window material		Synthetic silica	-
Photocathode	Material	Bialkali	-
	Minimum Effective Area	64	mm dia.
Dynode	Structure	Box & Linear-focused	-
	Number of Stages	12	-
Operating Ambient Temperature		-186 to +50	deg. C
Storage Temperature		-186 to +50	deg. C

Maximum Ratings (Absolute Maximum Values)

Parameter		Value	Unit
Supply voltage	Between Anode and Cathode	1750	V
	Between Anode and Last Dynode	300	V
Average Anode Output		0.1	mA
Pressure-resistance		TBA	atm

Characteristics at 25 deg. C

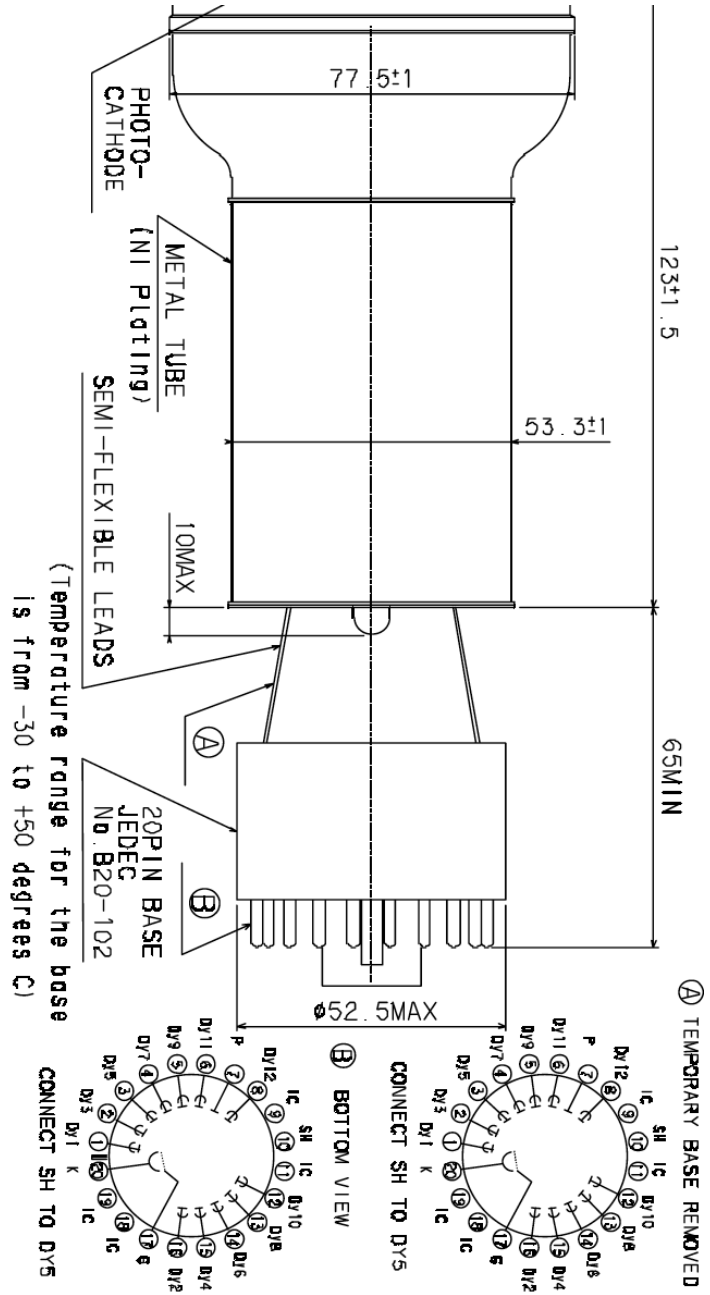
Parameter		Min.	Typ.	Max.	Unit
Cathode Sensitivity	Luminous (2856K)	-	120	-	uA/lm
	Quantum Efficiency at 175 nm	-	26	-	%
	Quantum Efficiency at 420 nm	-	25	-	%
Anode Sensitivity	Luminous (2856K)	-	500	-	A/lm
Gain		-	4.2×10^6	-	-
Anode Dark Current (after 30 min. storage in darkness)		-	10	100	nA
Time Response	Anode Pulse Rise Time	-	5	-	ns
	Electron Transit Time	-	41	-	ns
	Transit Time Spread (FWHM)	-	-	-	ns
Pulse Linearity at +/-2% deviation		-	13	-	mA

NOTE : Anode characteristics are measured with a voltage distribution ratio and supply voltage shown below :

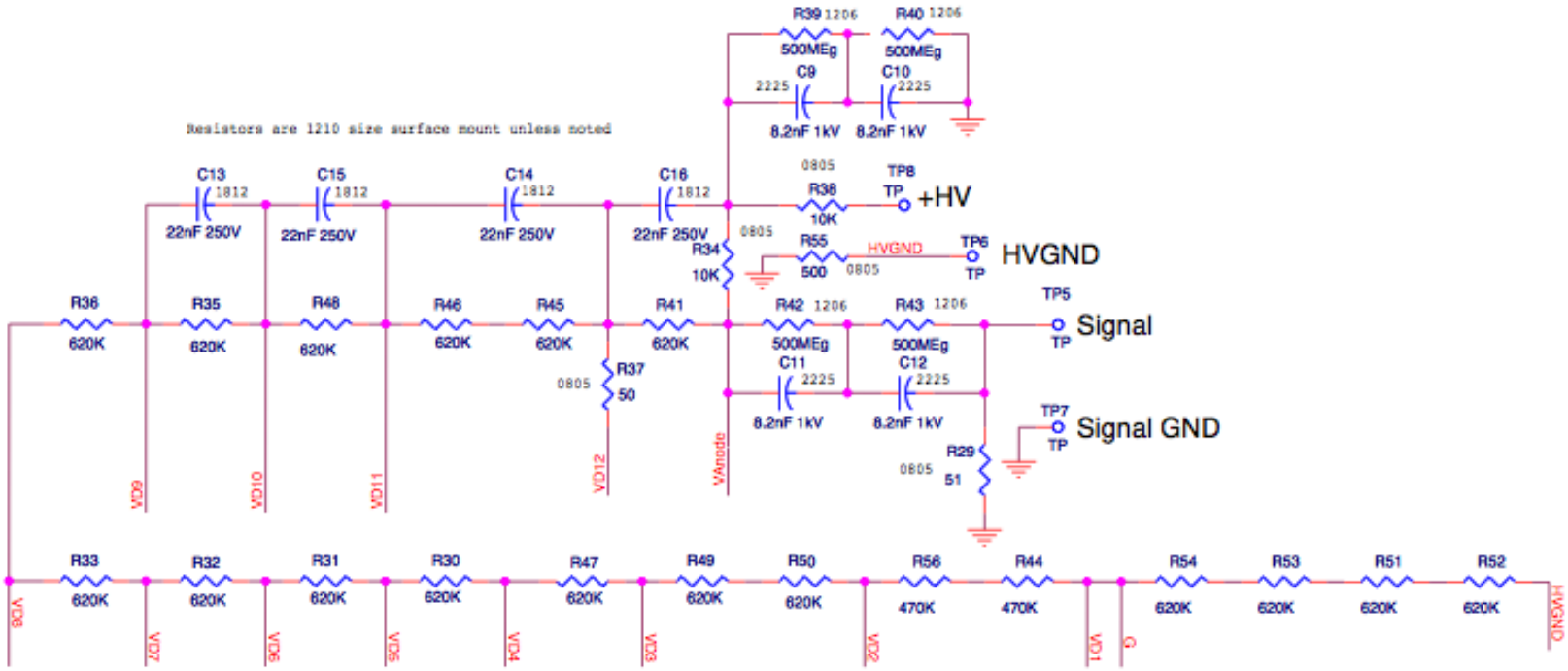
Voltage Distribution Ratio and Supply Voltage

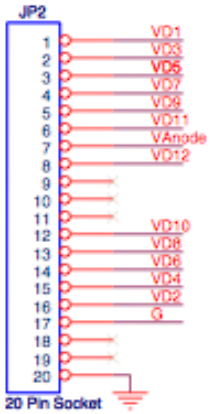
Electrodes	K	Dy1/G	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	Dy11	Dy12	P
Ratio	4	1.5	2	1	1	1	1	1	1	1	1	1	2	1

Supply Voltage : 1500 V K : Cathode G : Grid Dy : Dynode P : Anode

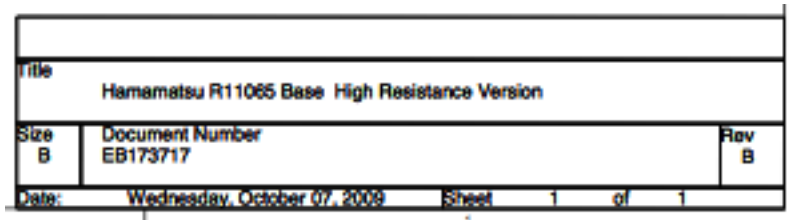


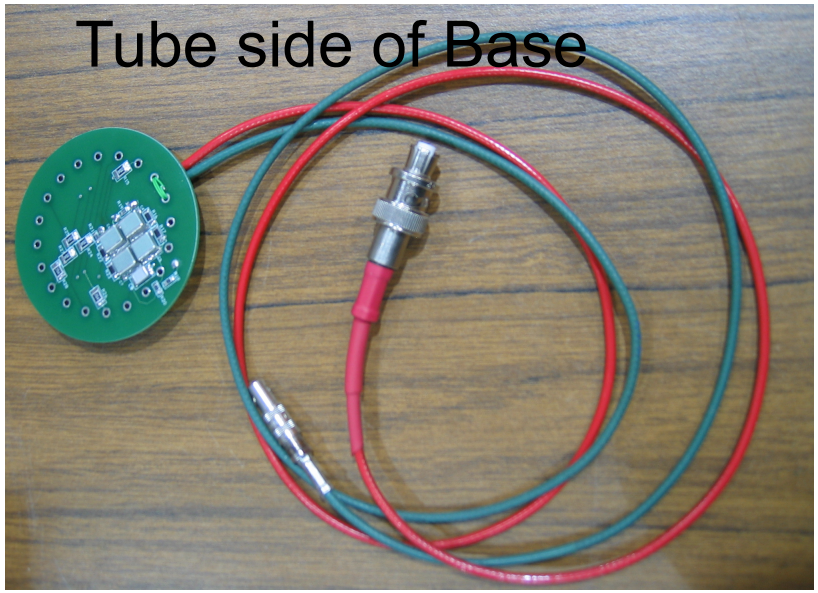
1 = 620 kOhm

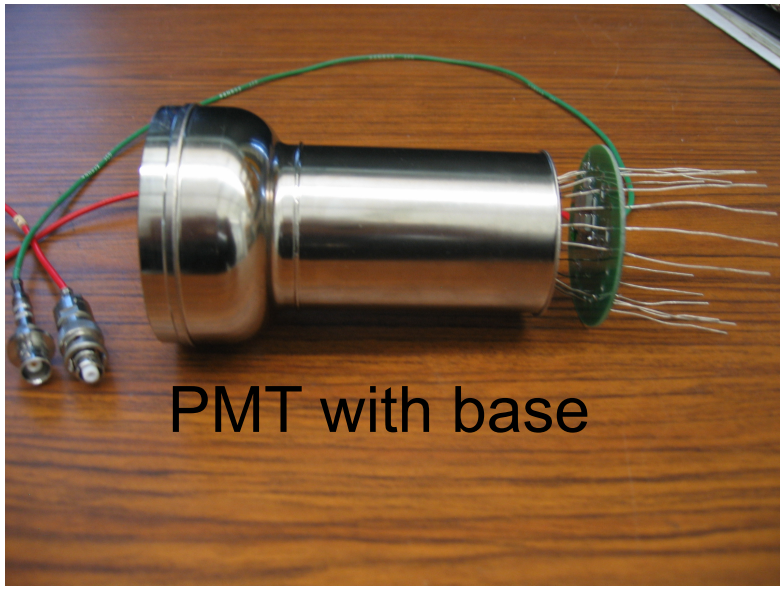


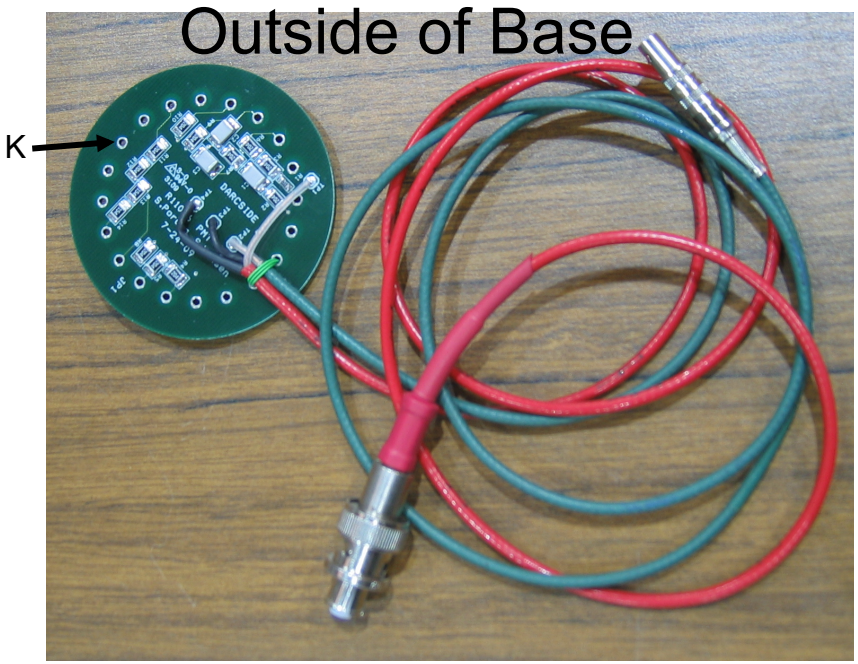


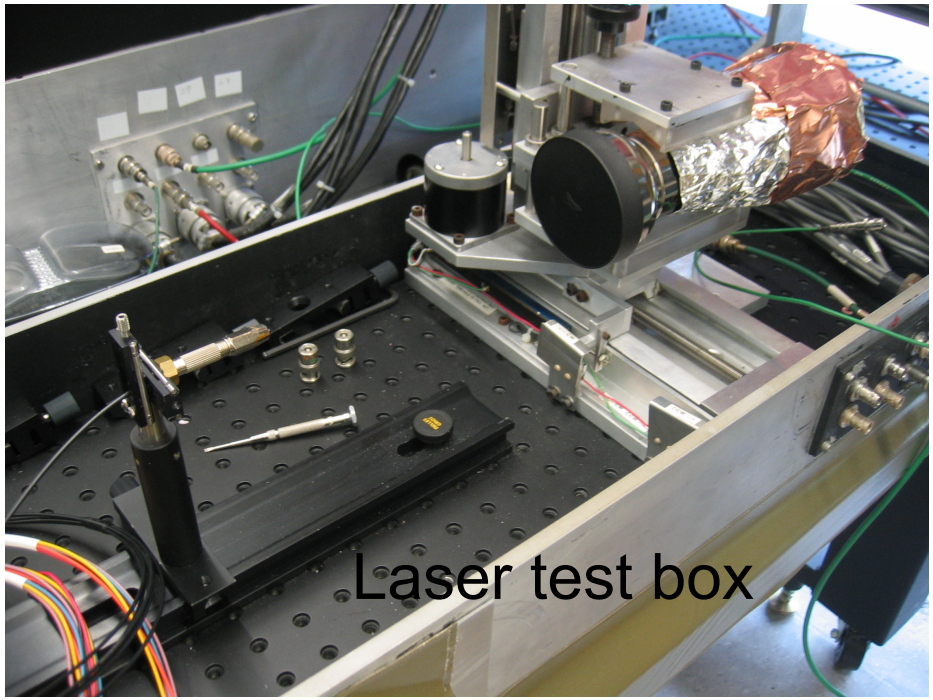
Total R ~ 11.5 Mohm

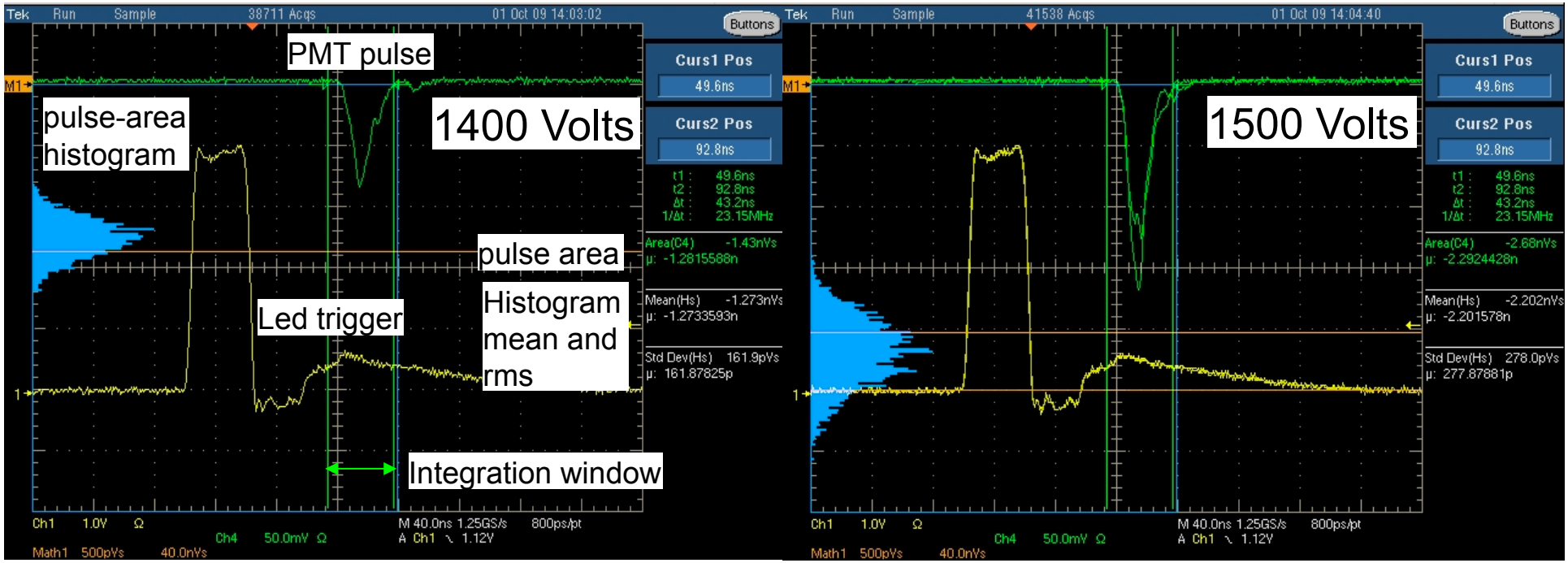



Tube side of Base


PMT with base


Outside of Base
K


Laser test box

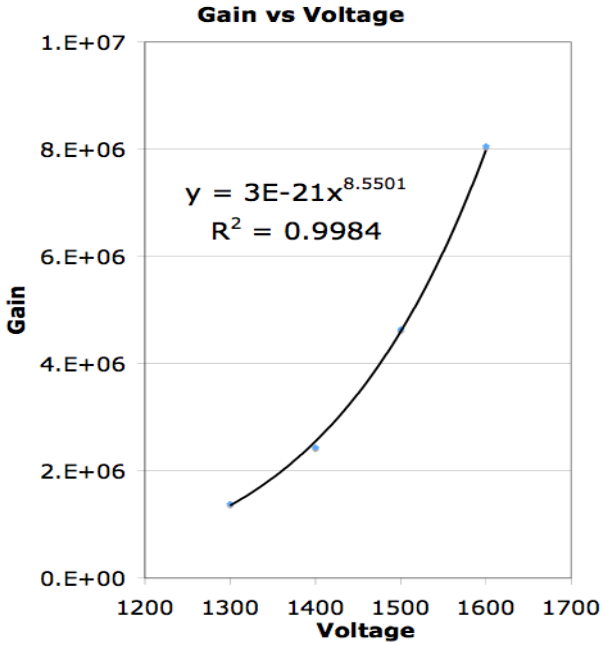


Response to blue LED on TDS 5054

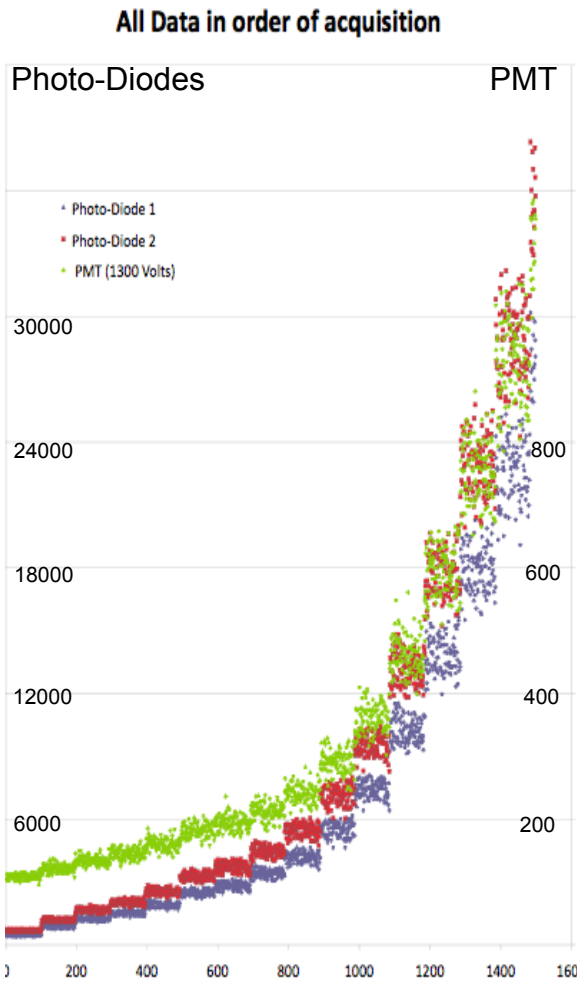
Volts	1200	1300	1400	1500	1600
Mean/ RMS(nVs)	0.347/ 0.05	0.73/ 0.09	1.28/ 0.16	2.22/ 0.29	3.66/ 0.49
~pe's	47	66	66	60	57
gain	0.94E6	1.4E6	2.4E6	4.6E6	8.1E6

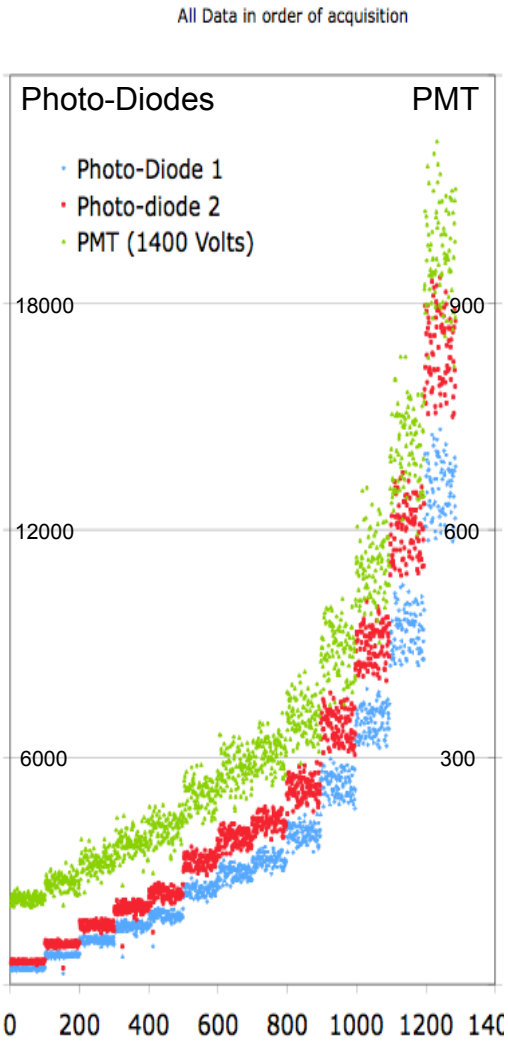
Pulse area = volts x seconds

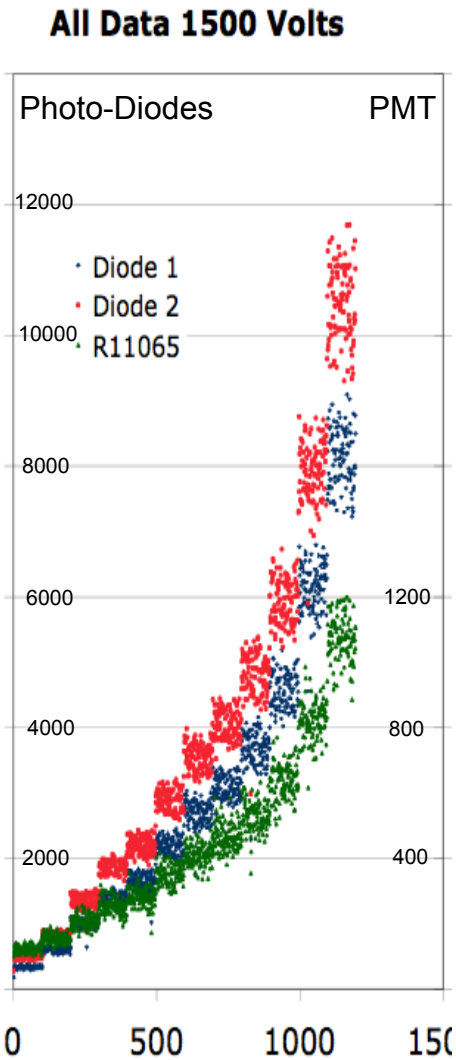
Charge (coulombs) = pulse-area/50 ohms



Linearity Study (Pulsed Laser /variable attenuator/monitored by 2 photodiodes)

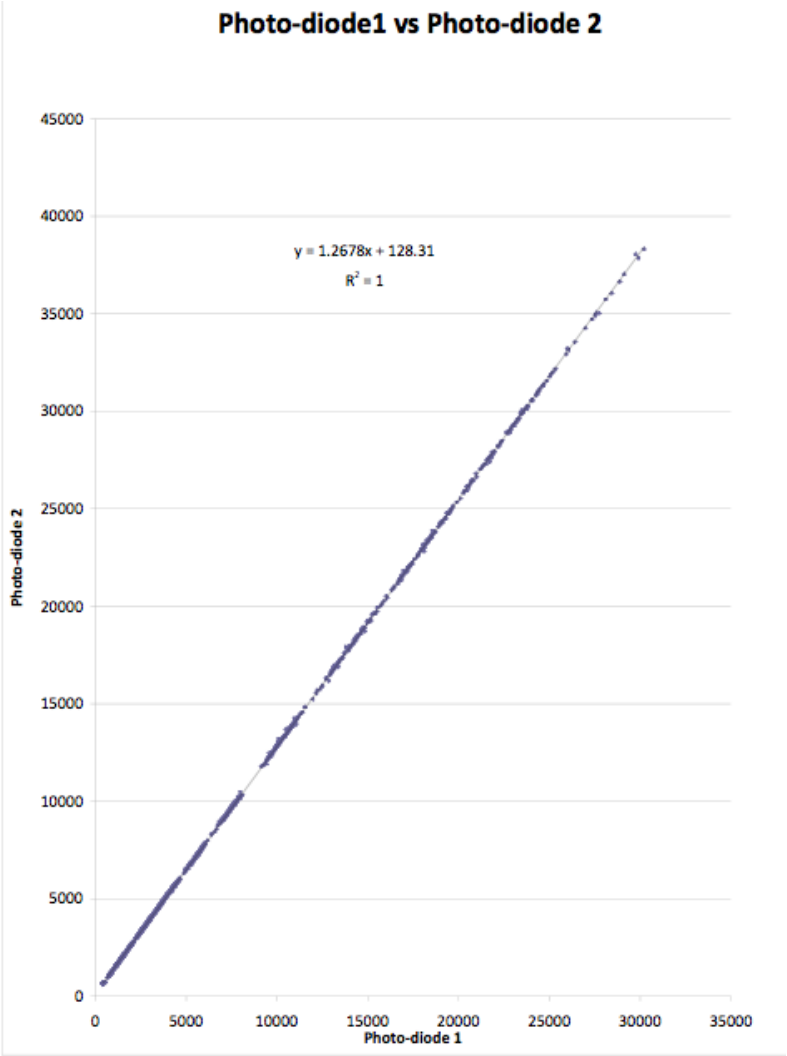


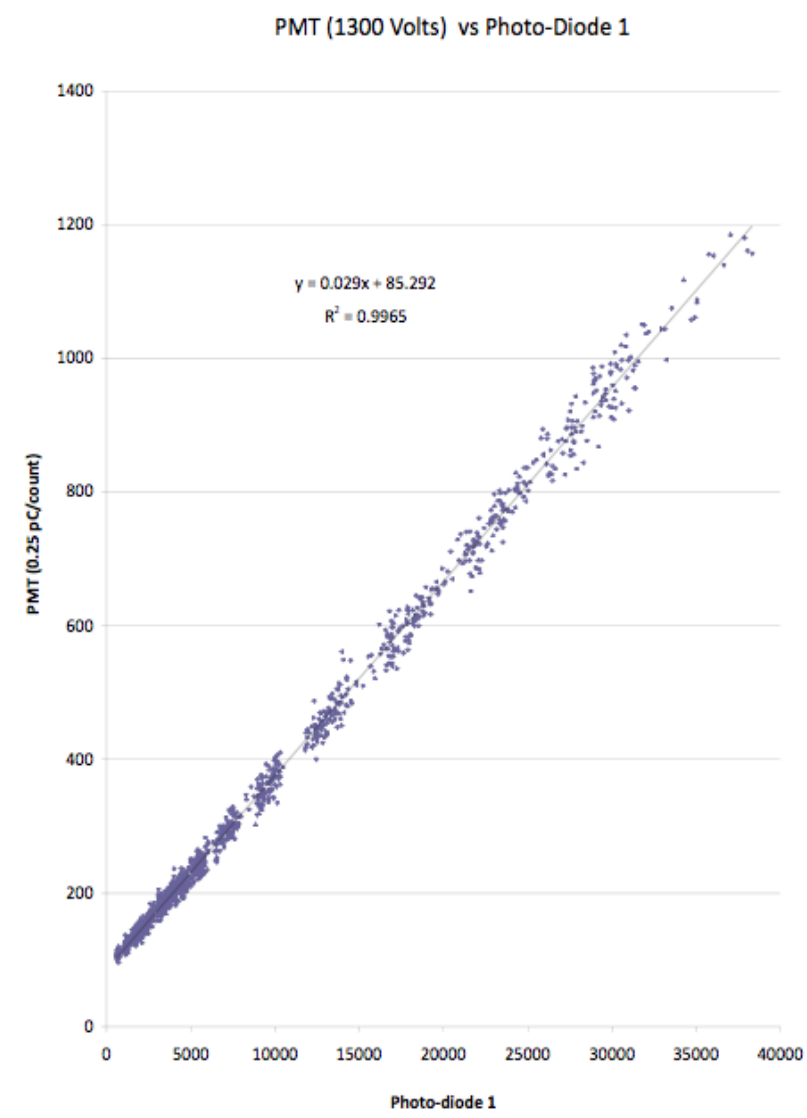




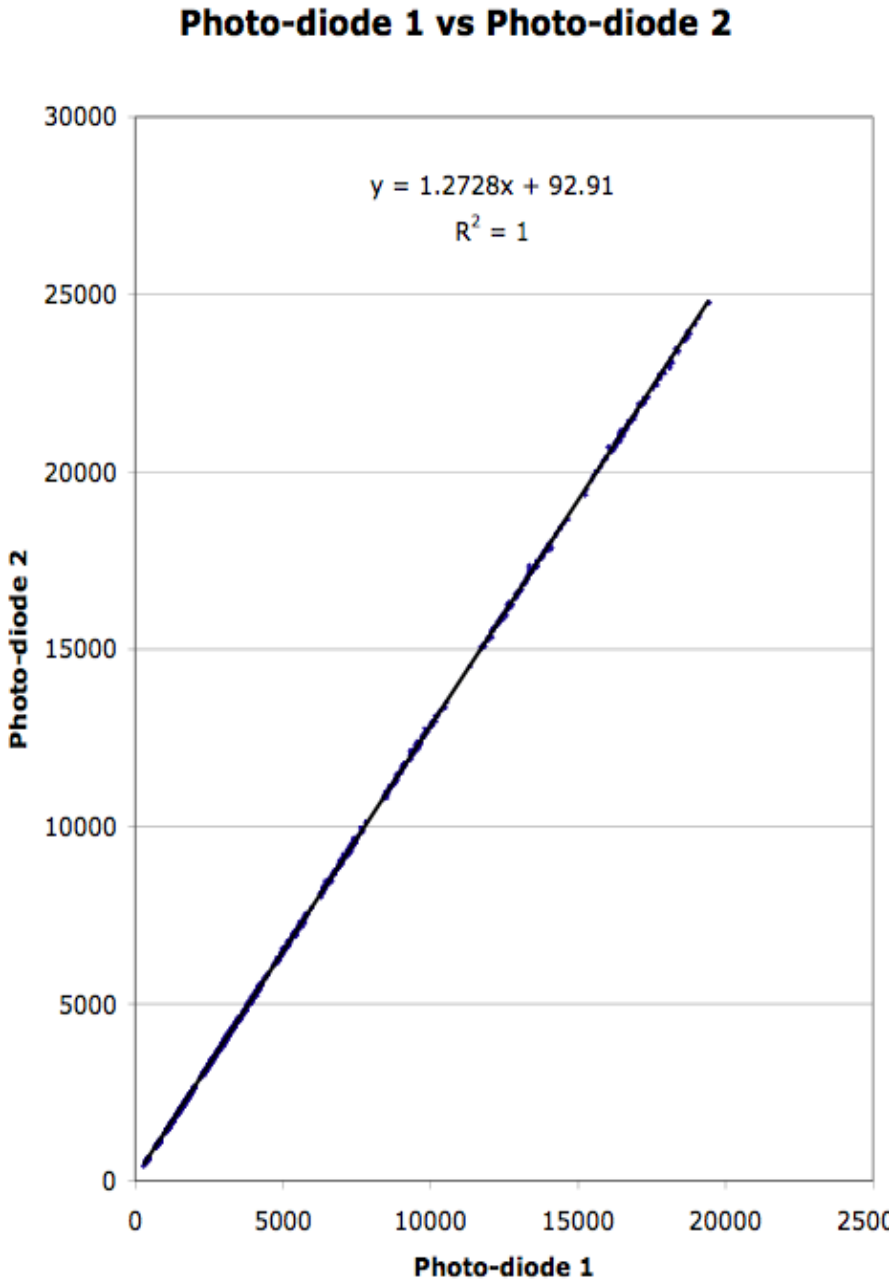
set light-attenuator at several positions

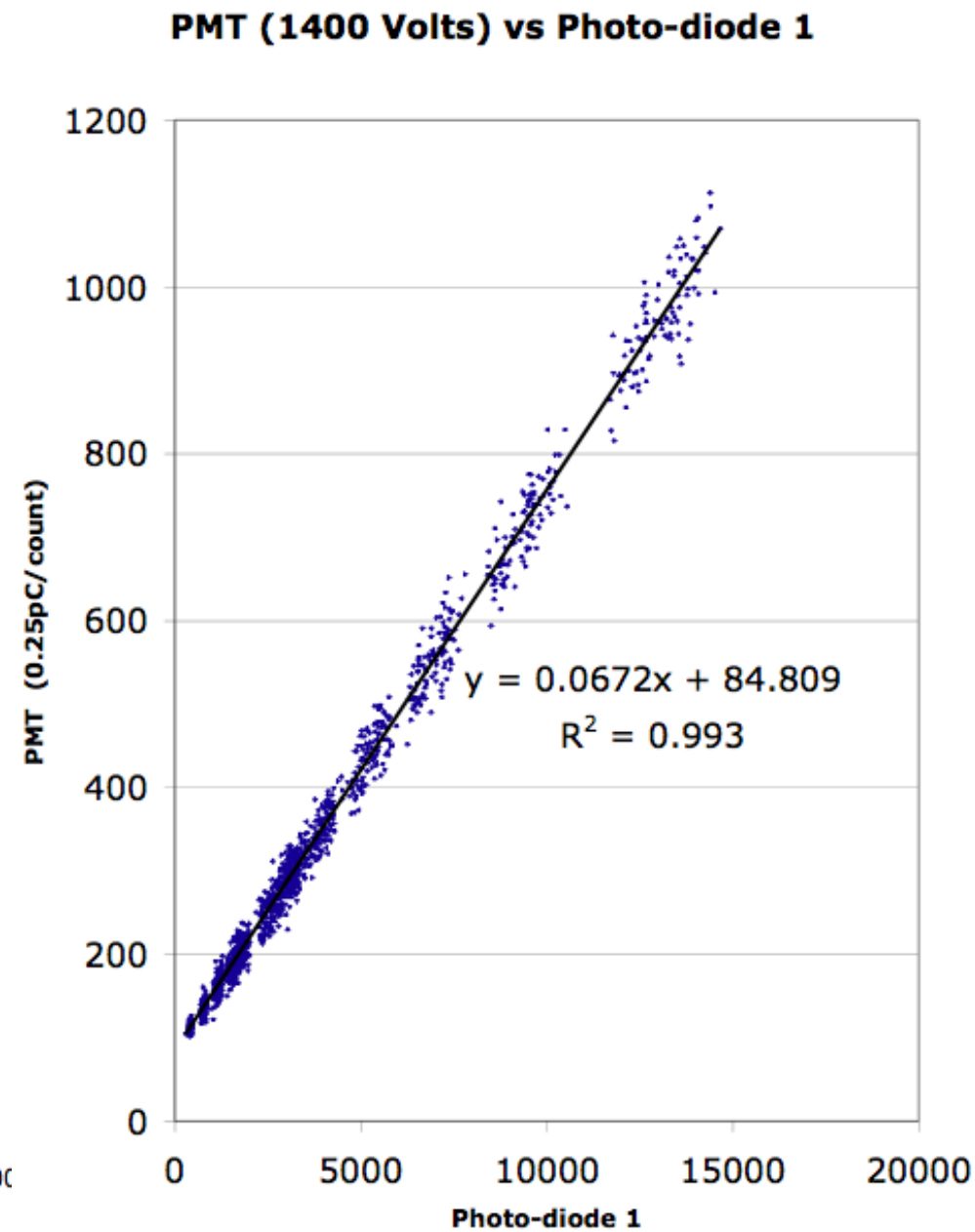
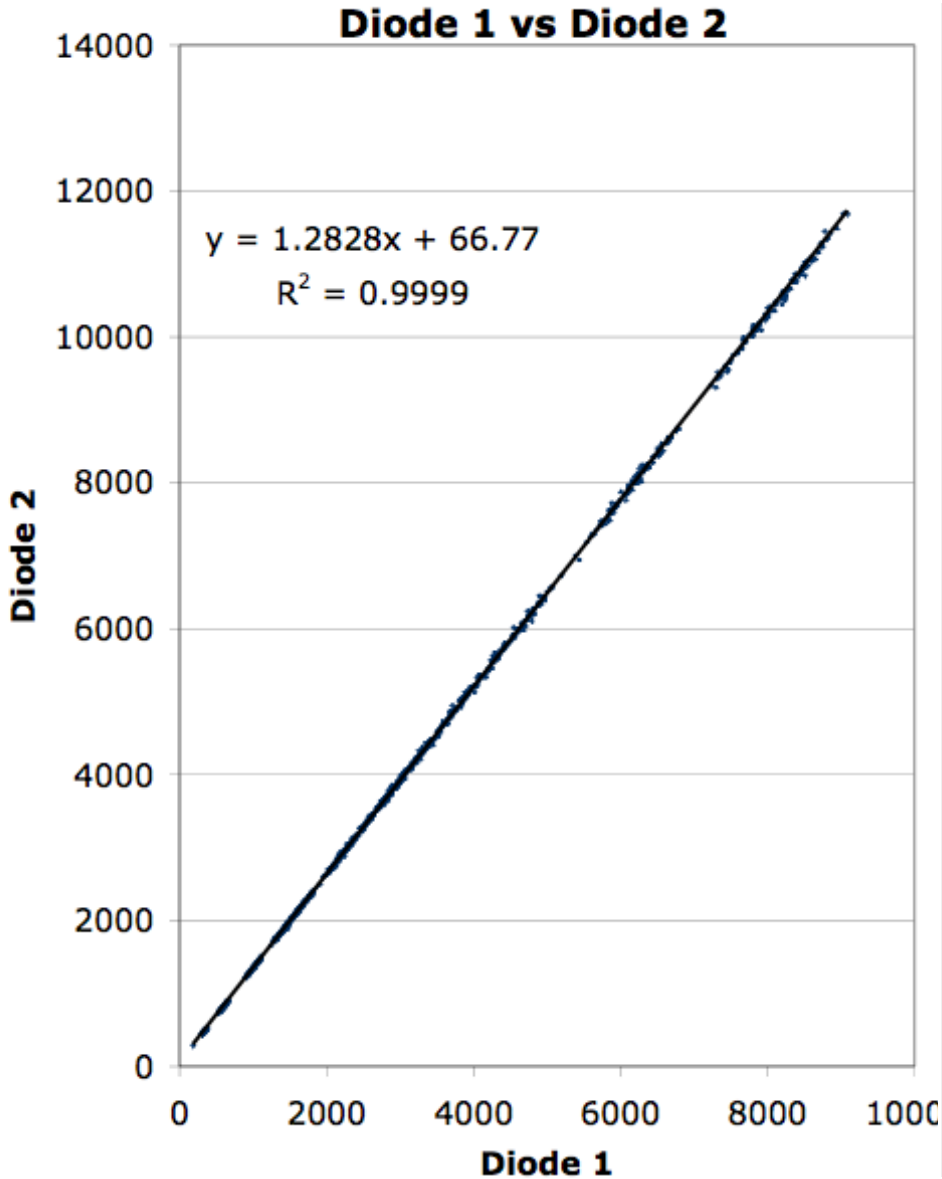
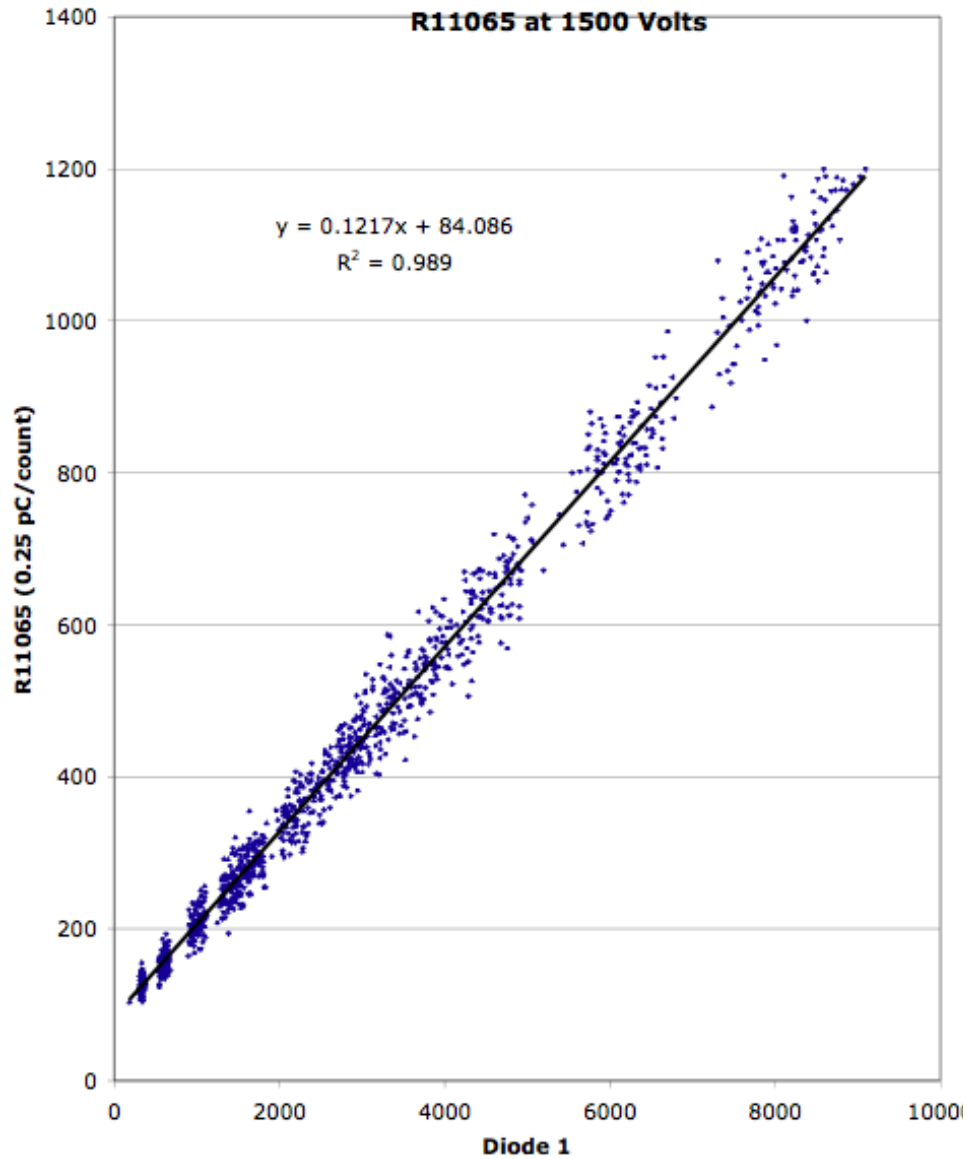
1300 Volt Data





1400 Volt Data





1500 Volt Data