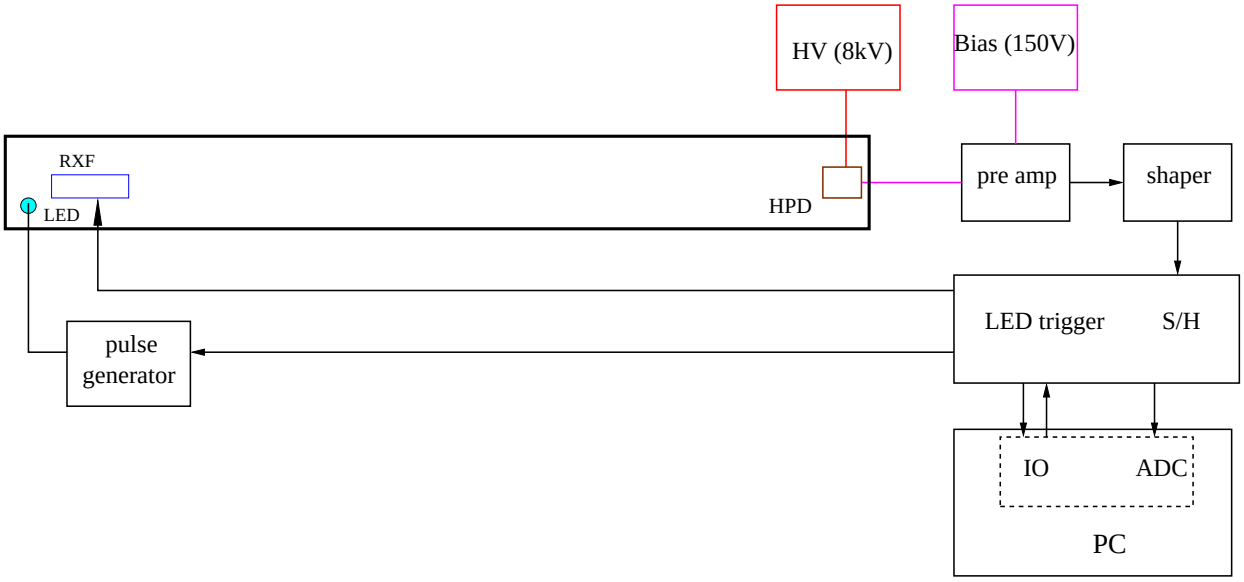
Roving Xenon Flasher calibration with Hybrid Photo Diode

HPD was calibrated at Rutgers.

HPD readout system for RXF calibration is now at Utah.

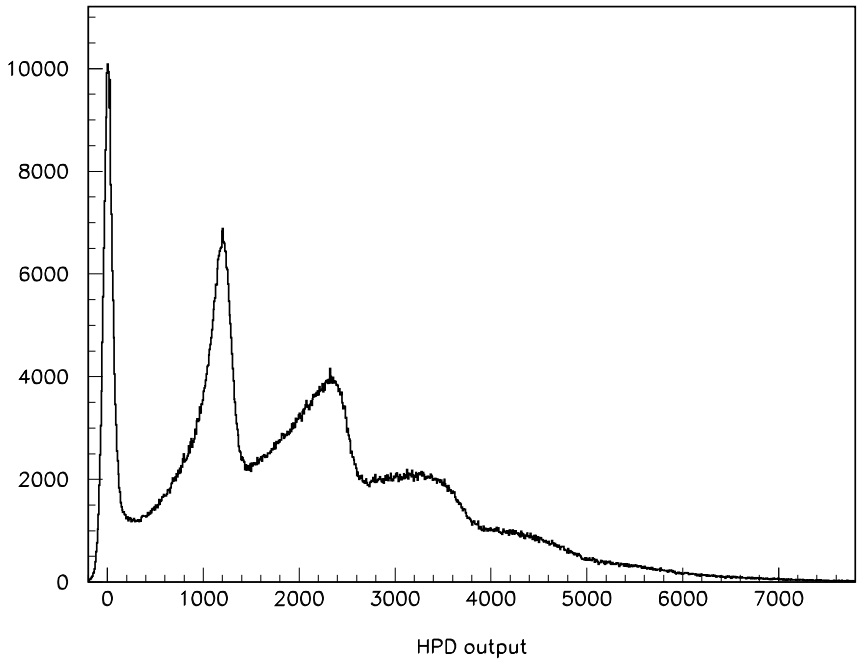
A preliminary RXF measurement was done last week

HPD Readout system:



PC controls the DAQ, monitor and store data.

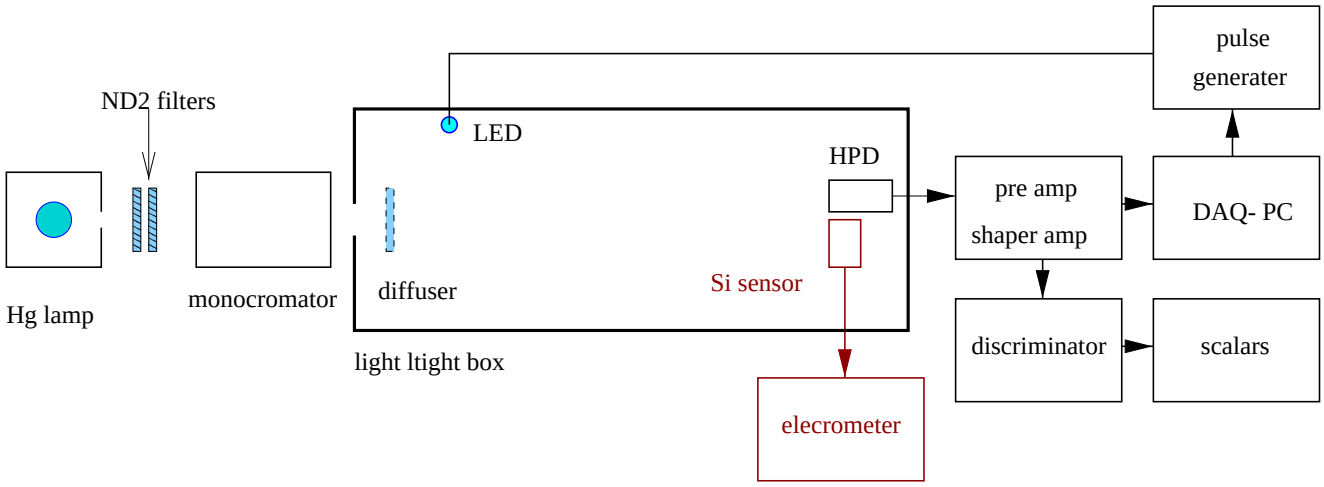
Detailed analysis done with PAW.



HPD Signal

HPD Efficiency Calibration:

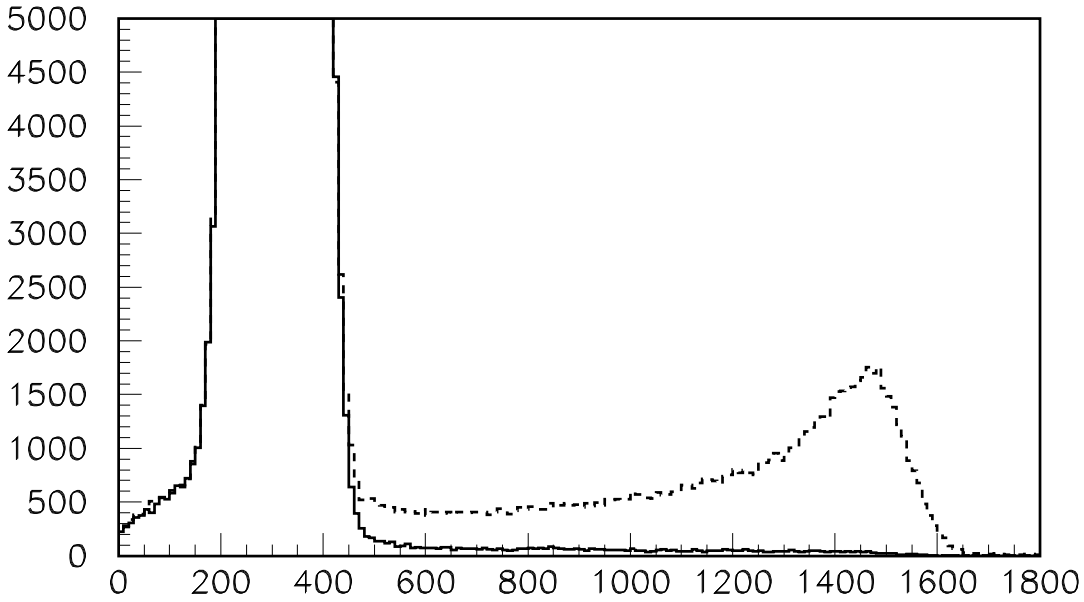
Experimental Setup:

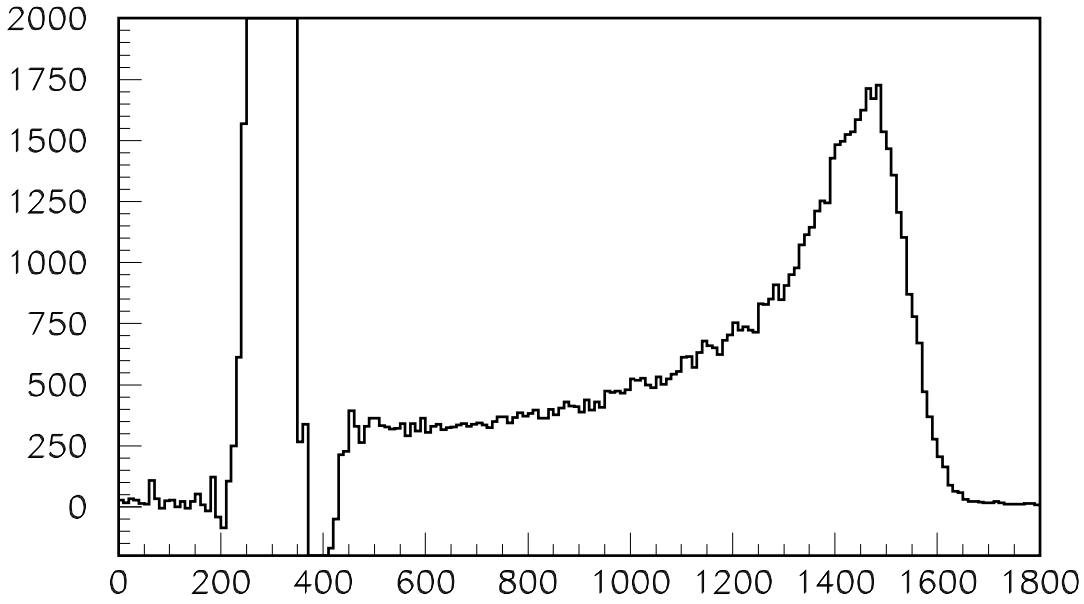


Si sensor can only measure continuous light levels.

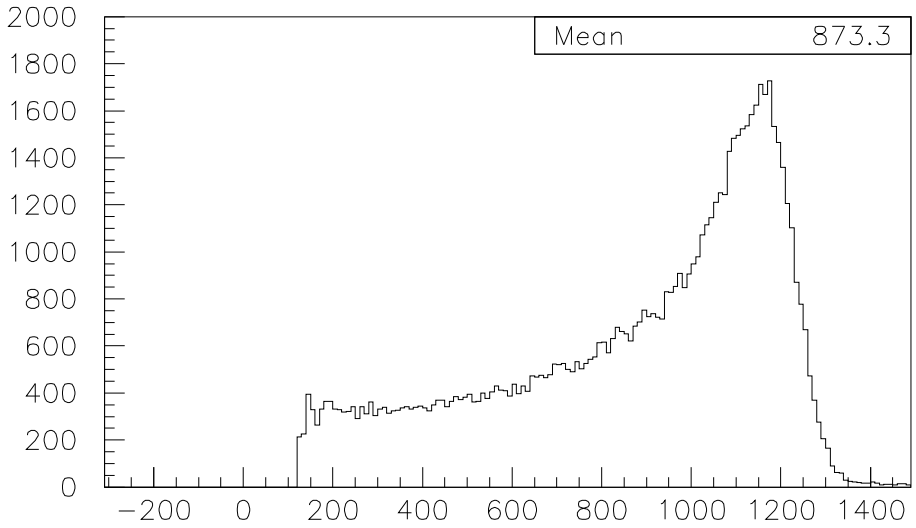
Si sensor and HPD dynamic ranges do not overlap.

- Measured the light level with NIST calibrated Si sensor
- Used calibrated ND filters to lower the light level and count single photons with the HPD.


5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
200
400
600
800
1000
1200
1400
1600
1800


2000
1750
1500
1250
1000
750
500
250
0
0
200
400
600
800
1000
1200
1400
1600
1800

Results:



Si sensor calibration 0.1325 A/W at 355 nm.

Si sensor area 100 mm^{-2}

measured sensor current = 0.192 nA

HPD maximum count rate 160 KHz.

discriminator level 80 mV.(all/counted =1.054 ± 3.5%)

single photon count rate 16.22KHz - averaged over 6 min.

(with light 18.45 KHz- no light 2.23 KHz)

ND filter attenuation 1.36×10^4 (± 1.5%)

HPD window diameter 9 mm

HPD efficiency at 355 nm 13.9% ± 5% ± 10%

Simulation:

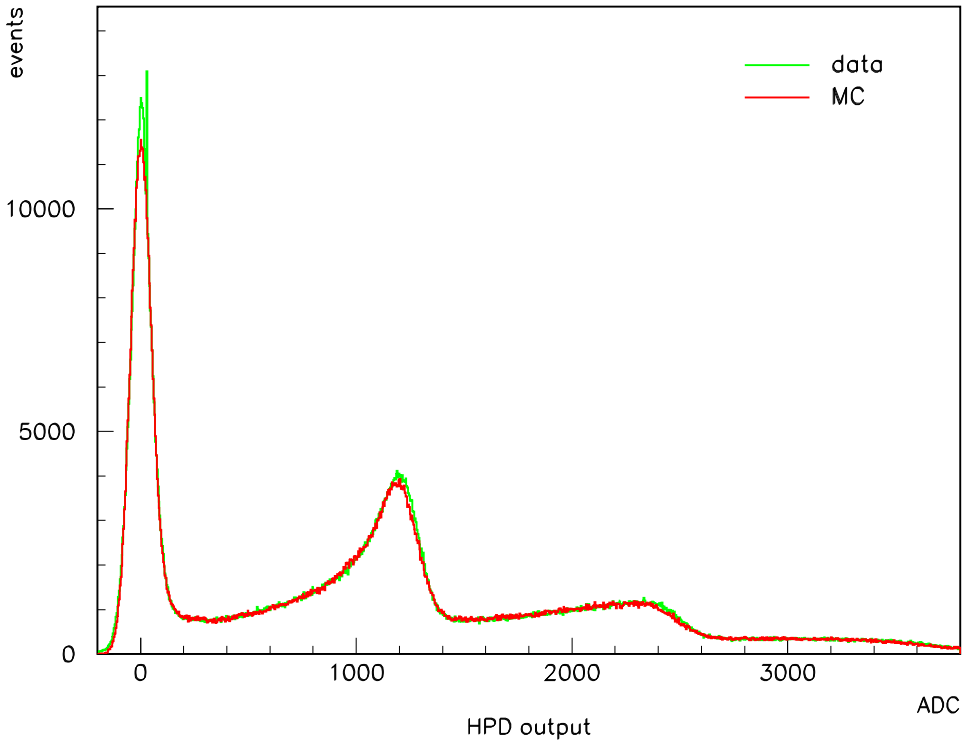
Use:

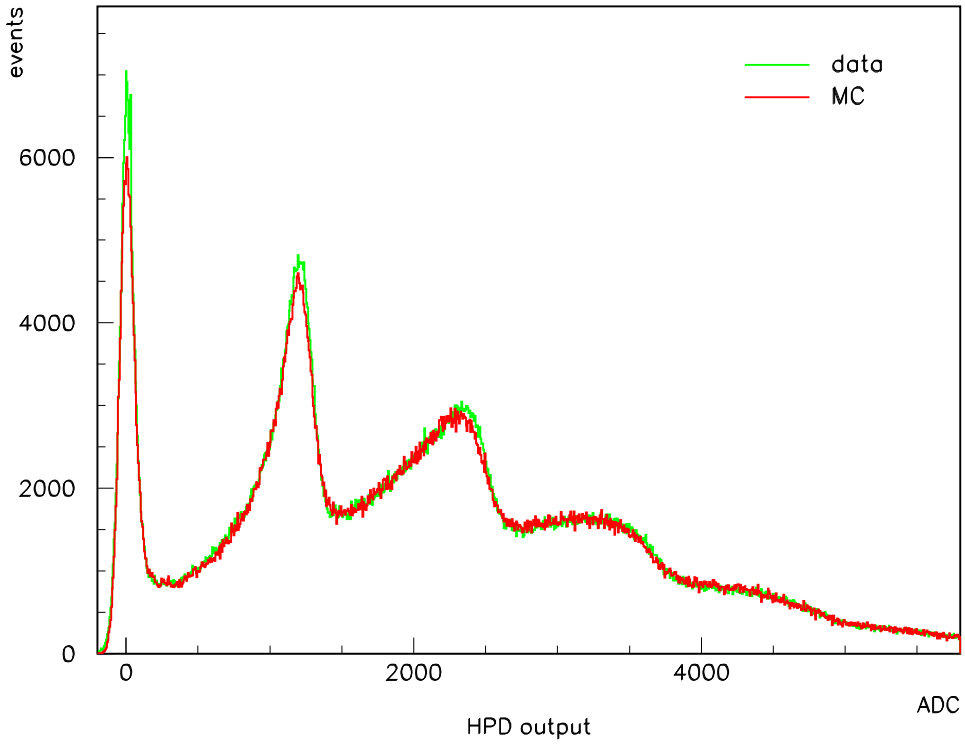
- Deconvoluted single photon distribution
- Poisson distribution for the number of photons
- Gaussian noise for electronic noise

To simulate HPD signal for different light levels

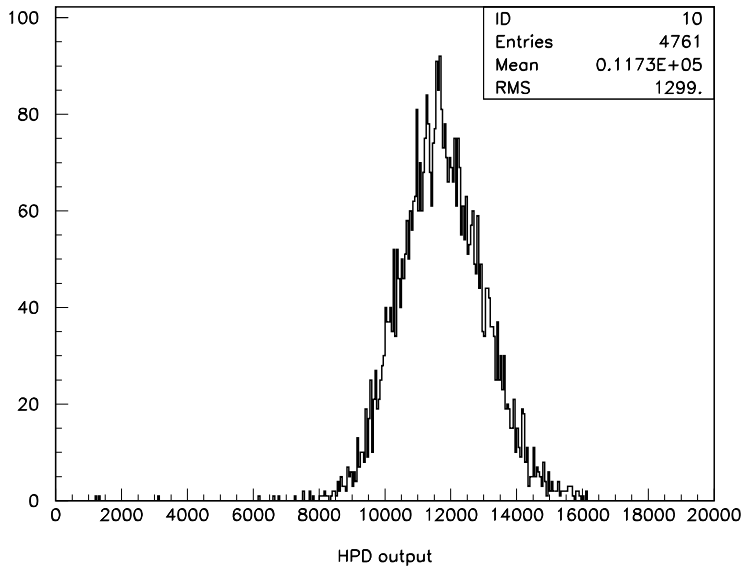
- select a mean number of photons
- Generate an integer N according to the Poisson distribution.
- Generate N numbers according to single photon distribution
- Generate a number according to noise Gaussian distribution
- add above values.

Compare/fit data with the simulated distribution.

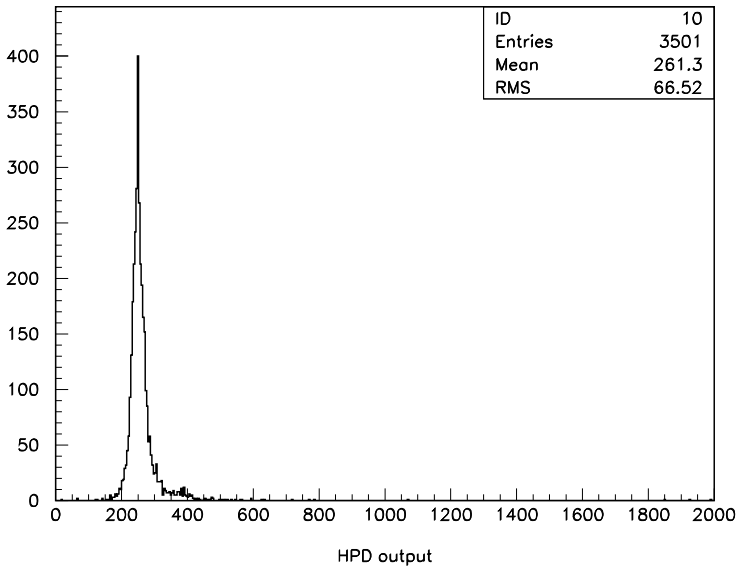

events
10000
5000
0
0
1000
2000
3000
ADC
HPD output
data
MC


events
6000
4000
2000
0
0
2000
4000
ADC
HPD output
data
MC

RXF measurement:

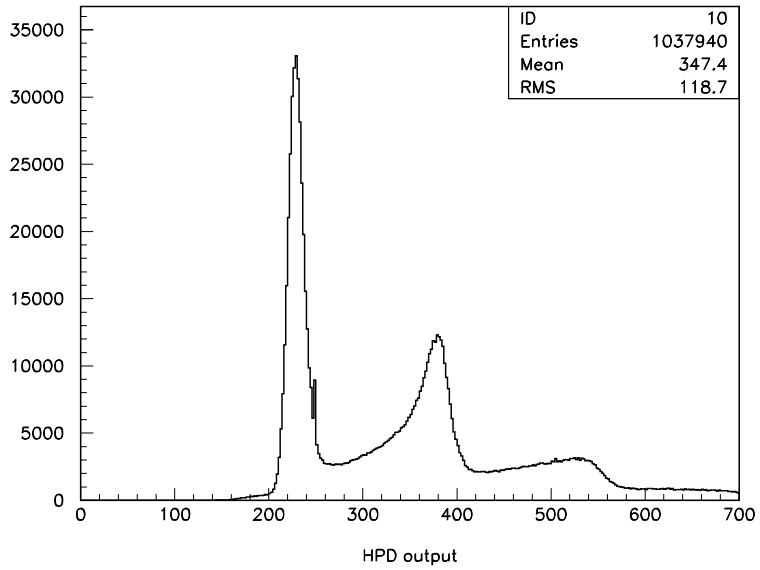


RXF flashing (4Hz).



RXF working but light output covered.

Results:



Signal with LED

RXF signal = 11730-281= 11449 counts

Single photon peak =379-228=151 ADC

Single photon mean = 151×0.73=110.23 ADC

number of RXF photons detected by HPD 103.9

after efficiency correction = (0.139) 747

number of photons/mm^{2}at 96 inches = 11.7 ± 5% ± 10%