Measurement of dark rate using FADC

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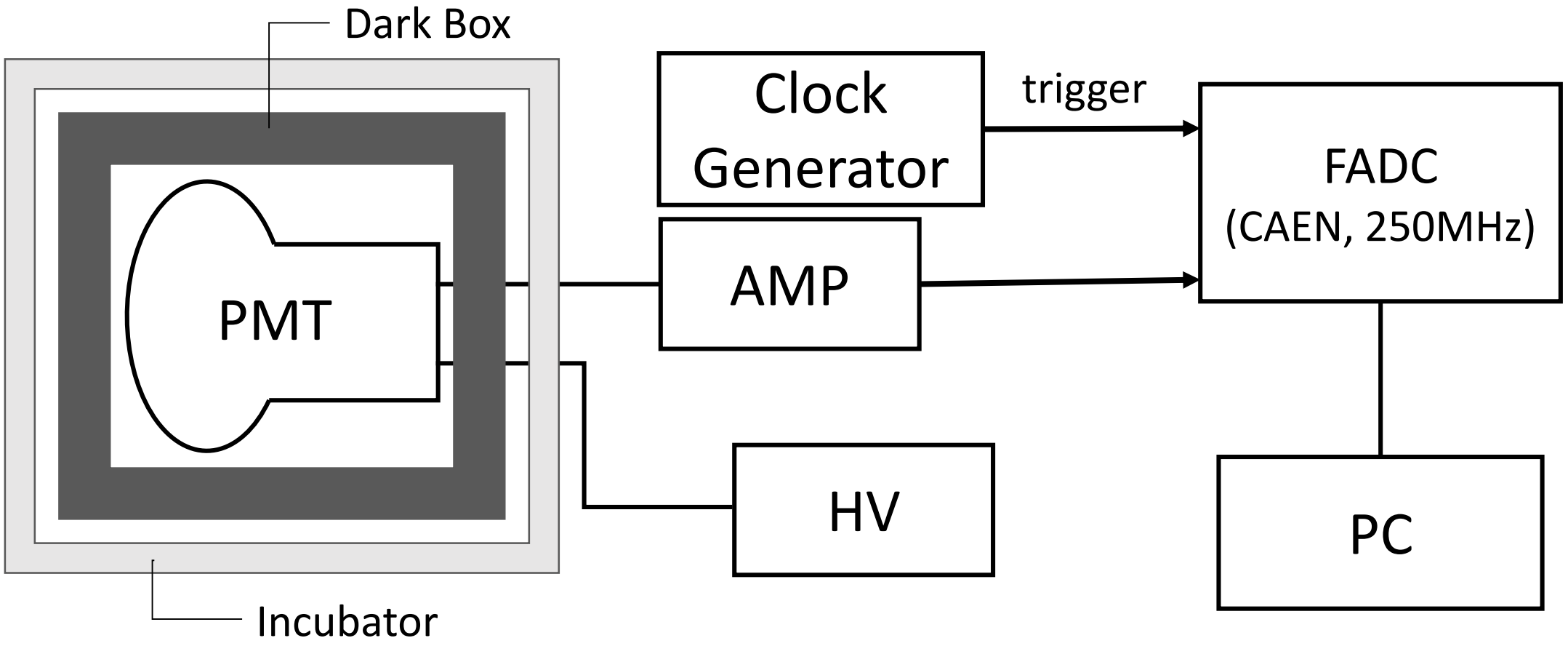
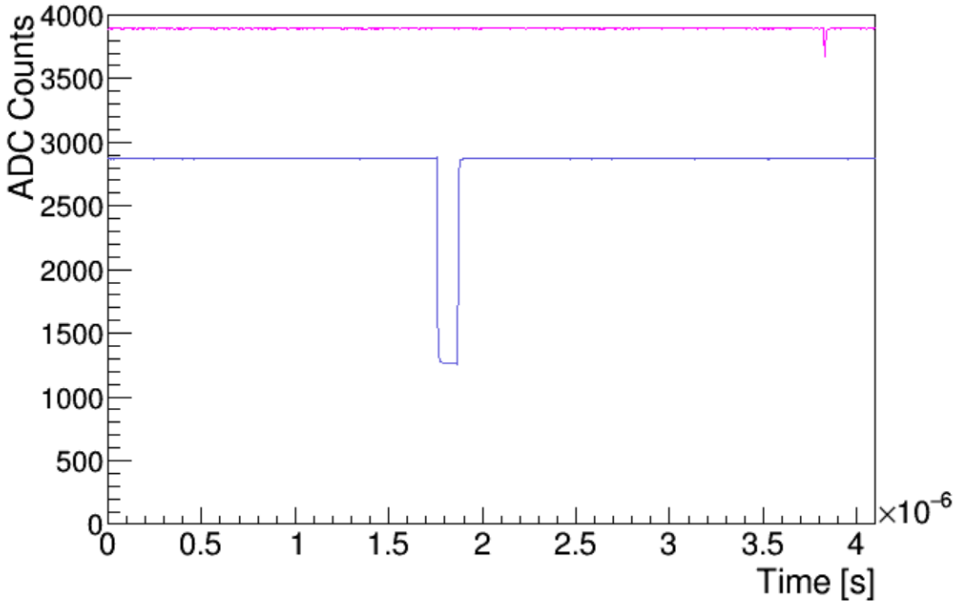
Introduction

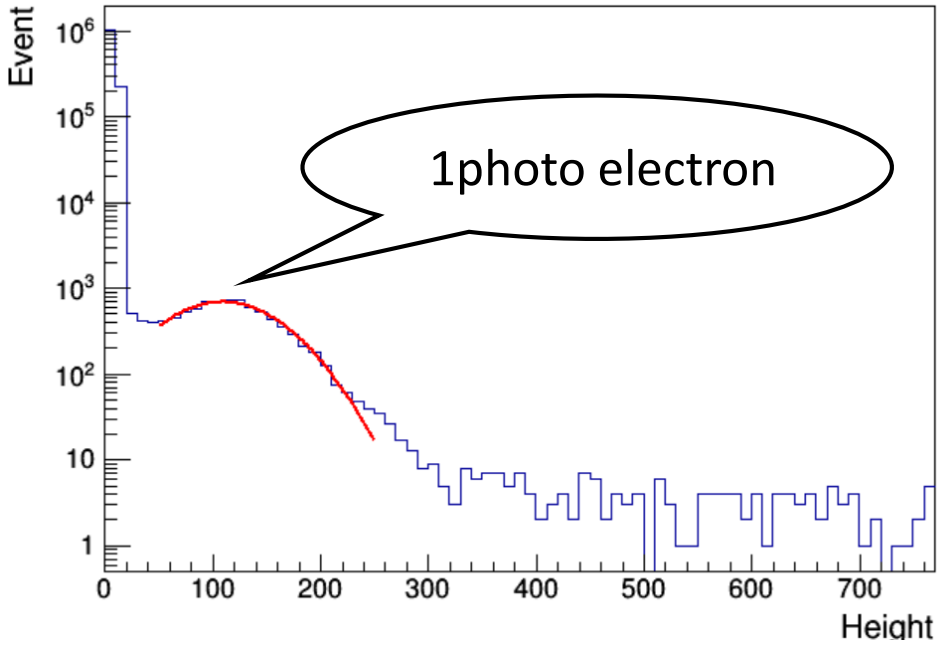
- We measured the dark rate of 3-inch PMT with a FADC.
- A FADC enable us to change the threshold easily.



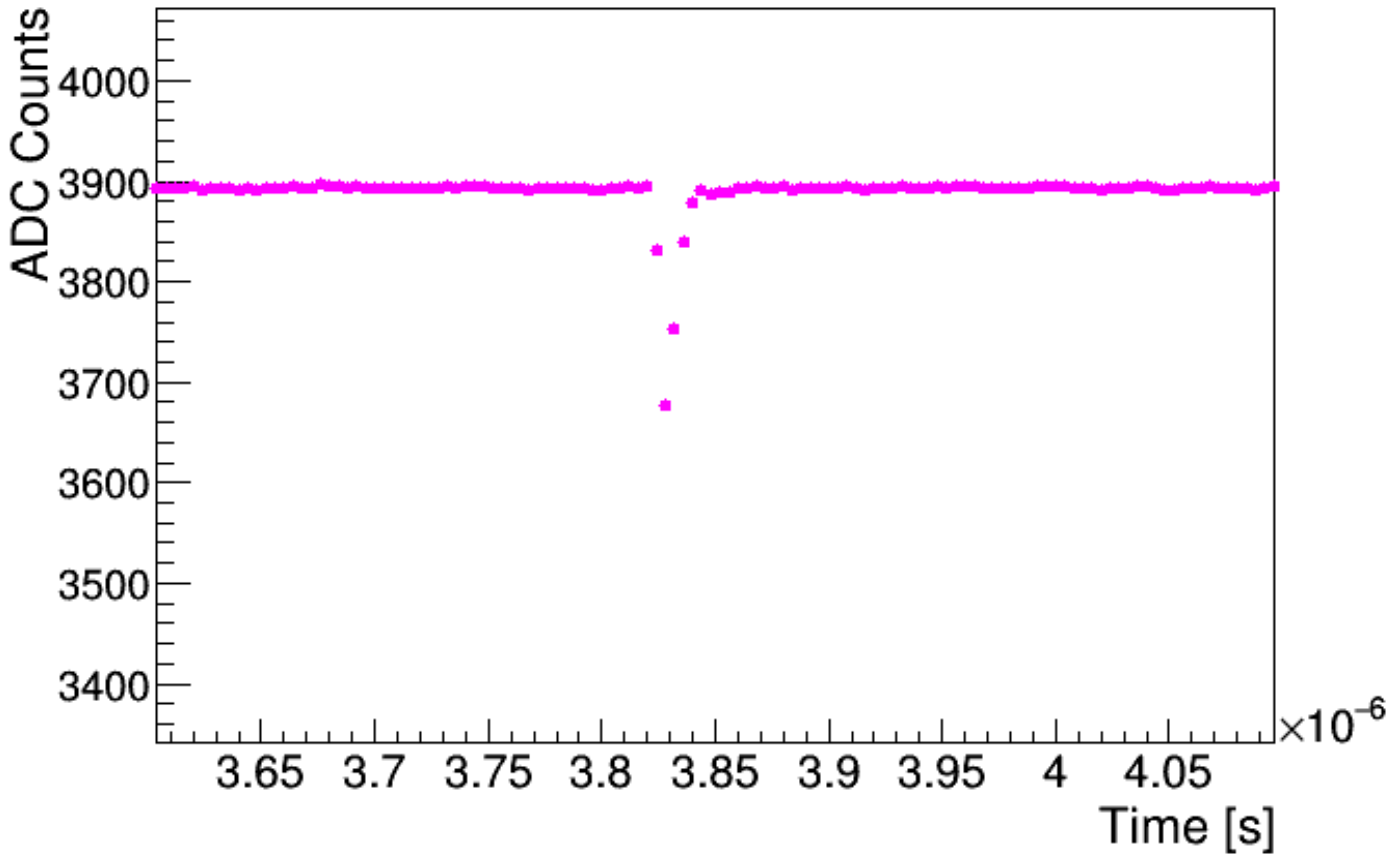
Dark rate measurement

- We measured the HV dependence of dark rate.
- We kept the temperature at 20°C with the incubator.
- We counted the dark noise synchronized with the clock generator.
  - Trigger is generated by clock signal.
  - Threshold for dark noise counting is applied at software level.
- We change the threshold from 0.3 to 1.0 photo-electron based on its gain.

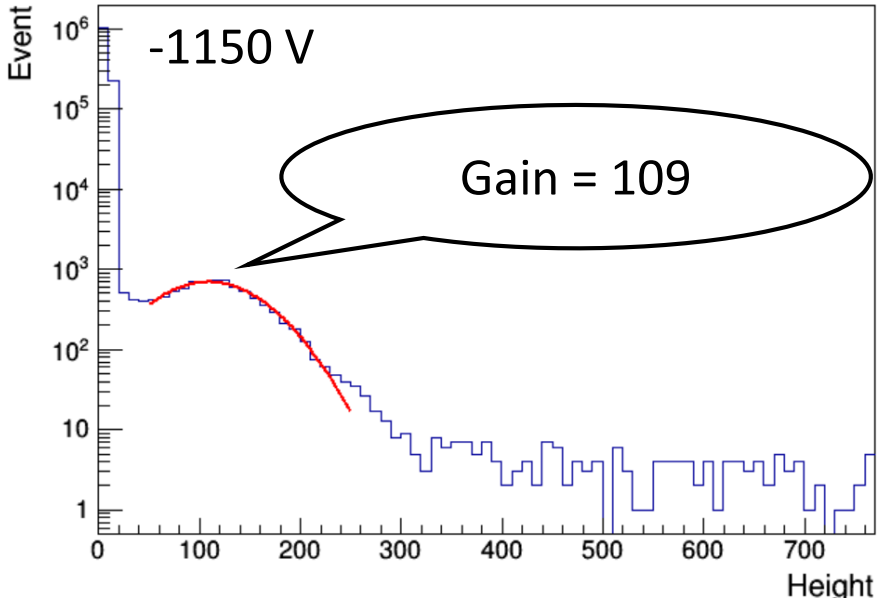


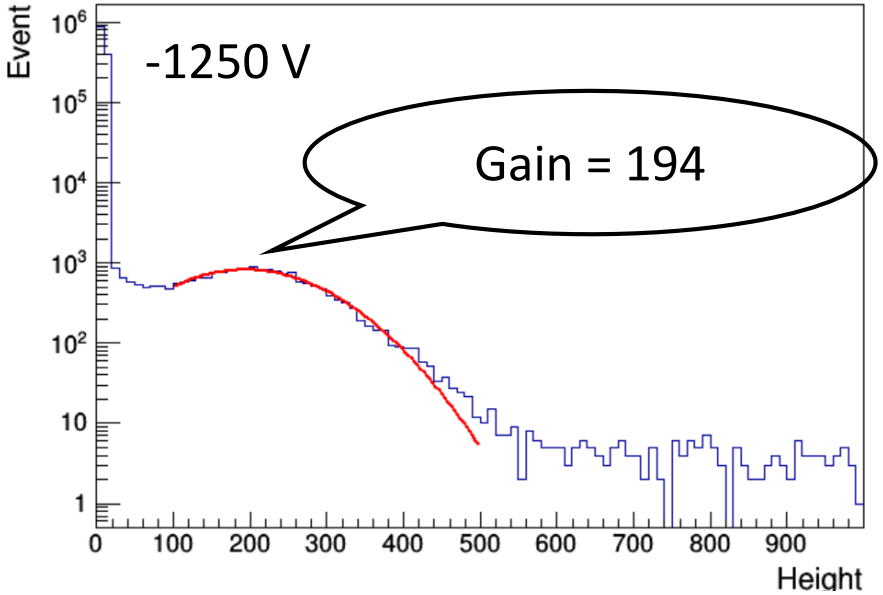


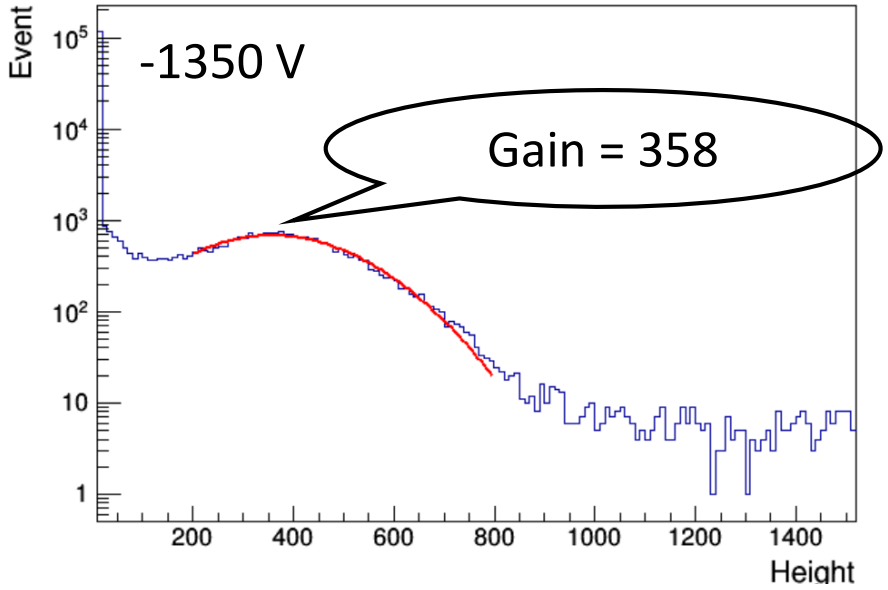
Wave form


ADC Counts
4000
3900
3800
3700
3600
3500
3400
3.65
3.7
3.75
3.8
3.85
3.9
3.95
4
4.05
×10⁻⁶
Time [s]

Gain

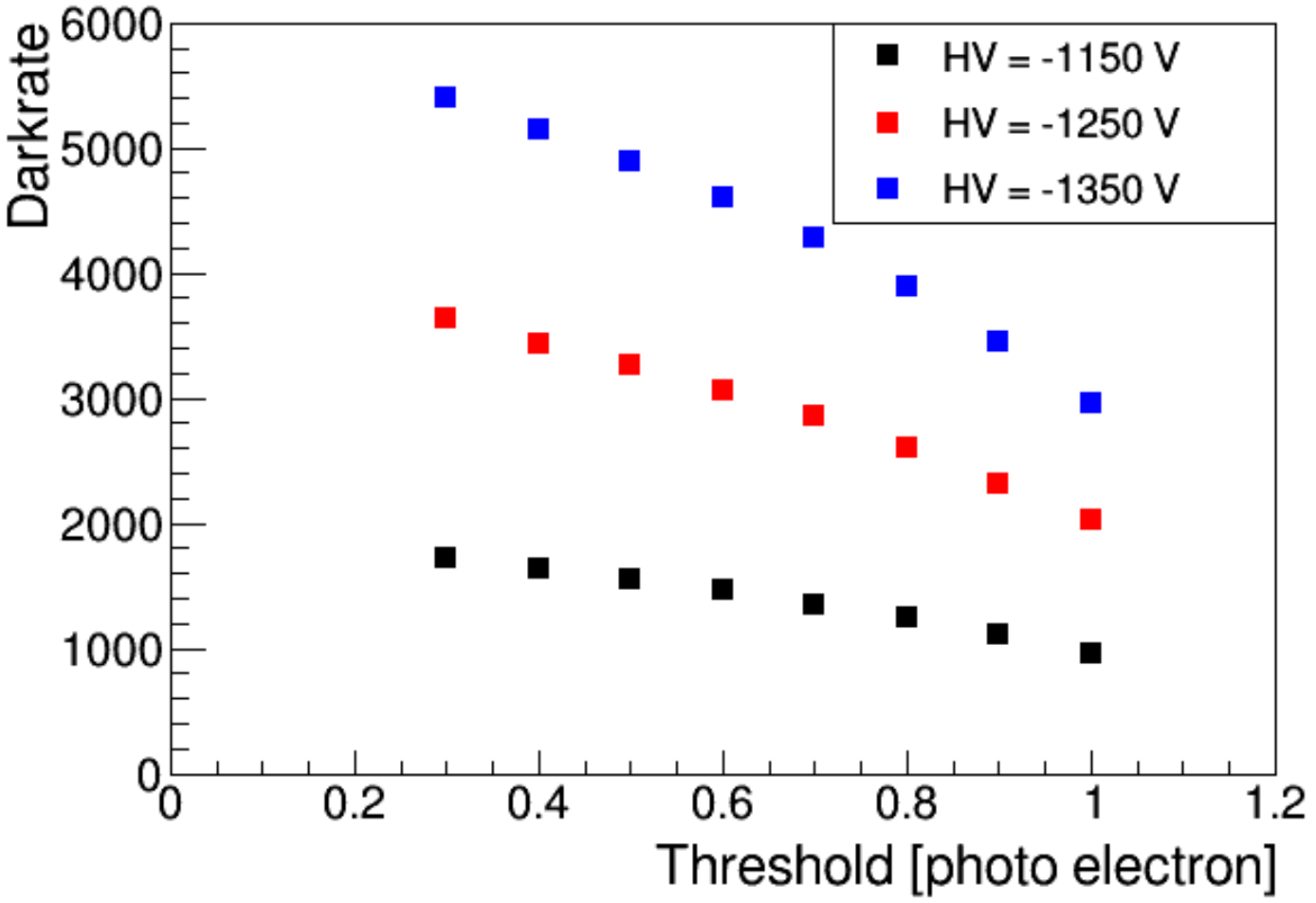

-1150 V
Gain = 109
Event
Height


-1250 V
Gain = 194
Event
Height


-1350 V
Gain = 358
Event
Height

Result of dark rate measurement

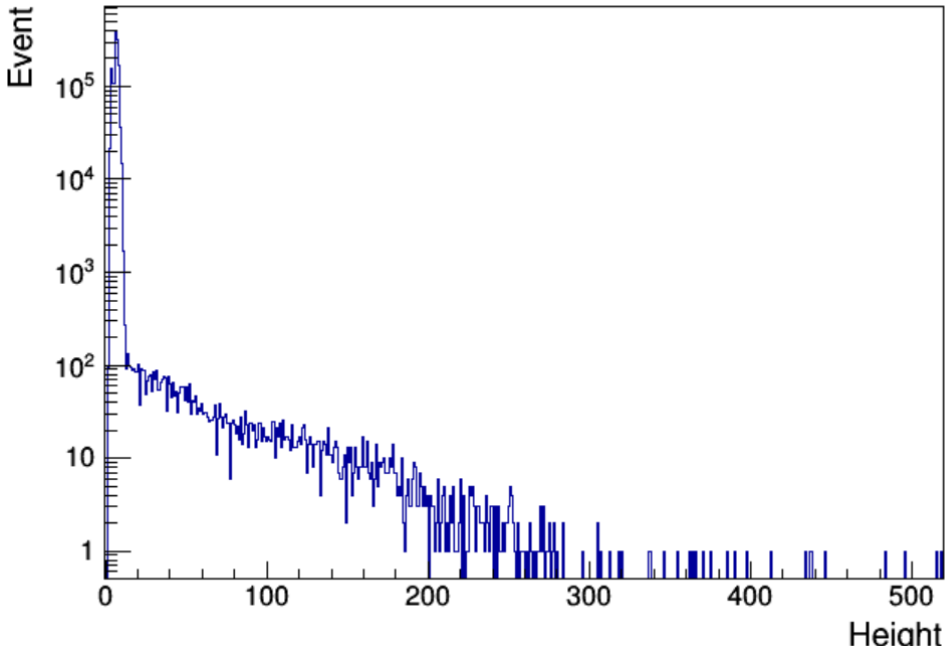
- I took the data with -1150 V, -1250 V, -1350 V.
- The right-hand figure shows dark rate in each threshold and HV.
- The dark rate was higher at higher HV.
- This result is similar to the result from Inomoto-san.
  - The rate is too high probably due to malfunction of this PMT.



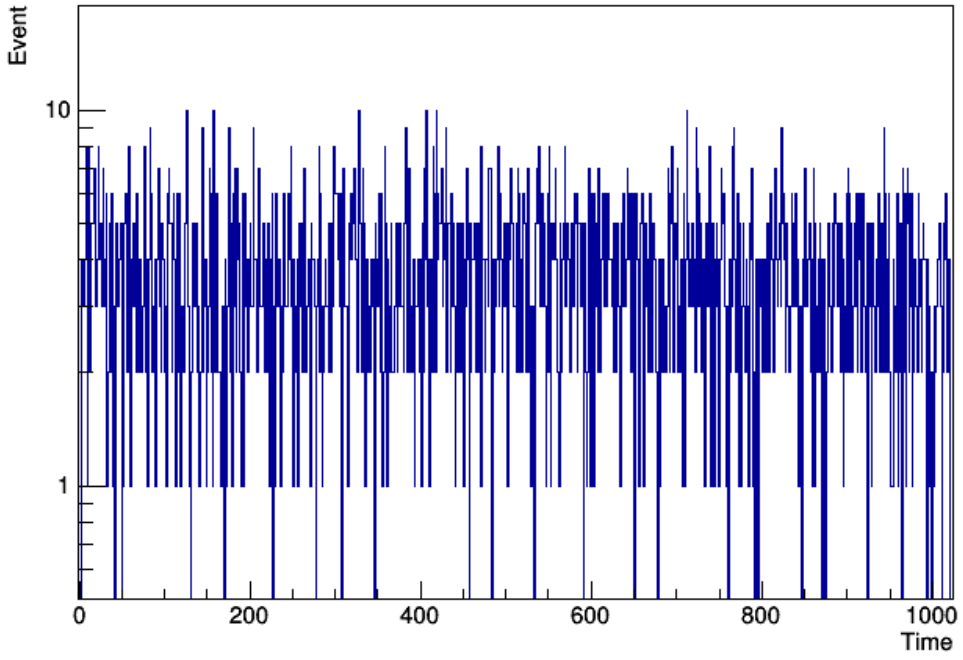
Measurement of another PMT

- We measured another PMT through the same process with -1250 V.
- In this measurement, we could not see its gain clearly.
- Dark noises appeared randomly resulting in flat hit time distribution.
- I assumed that the gain is about 100 ADC counts.

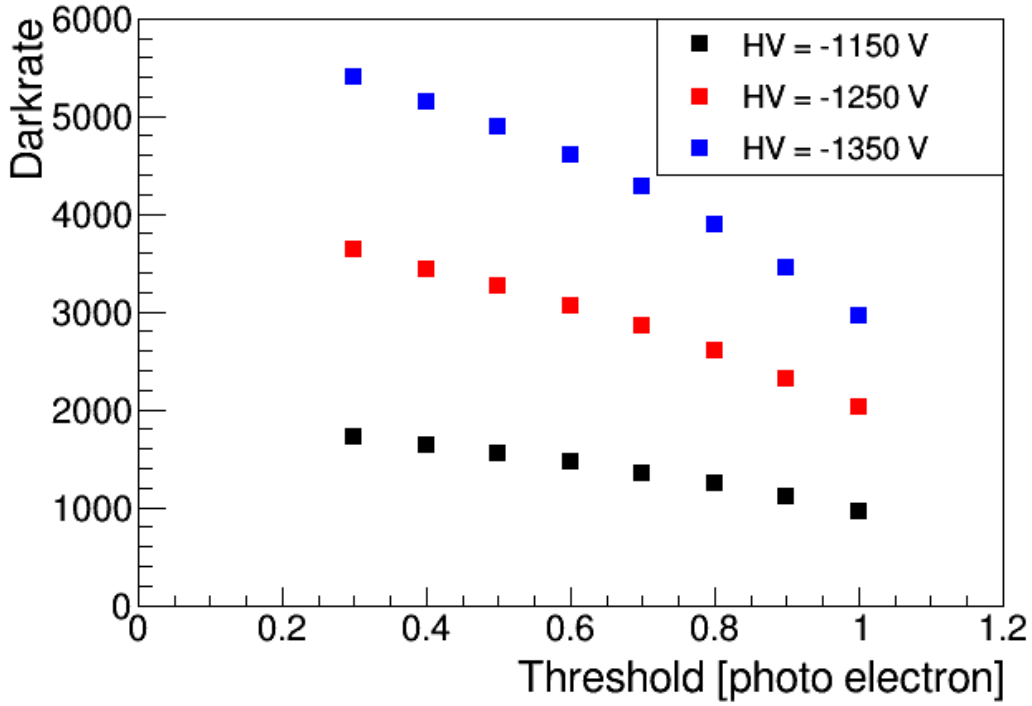
Pulse height

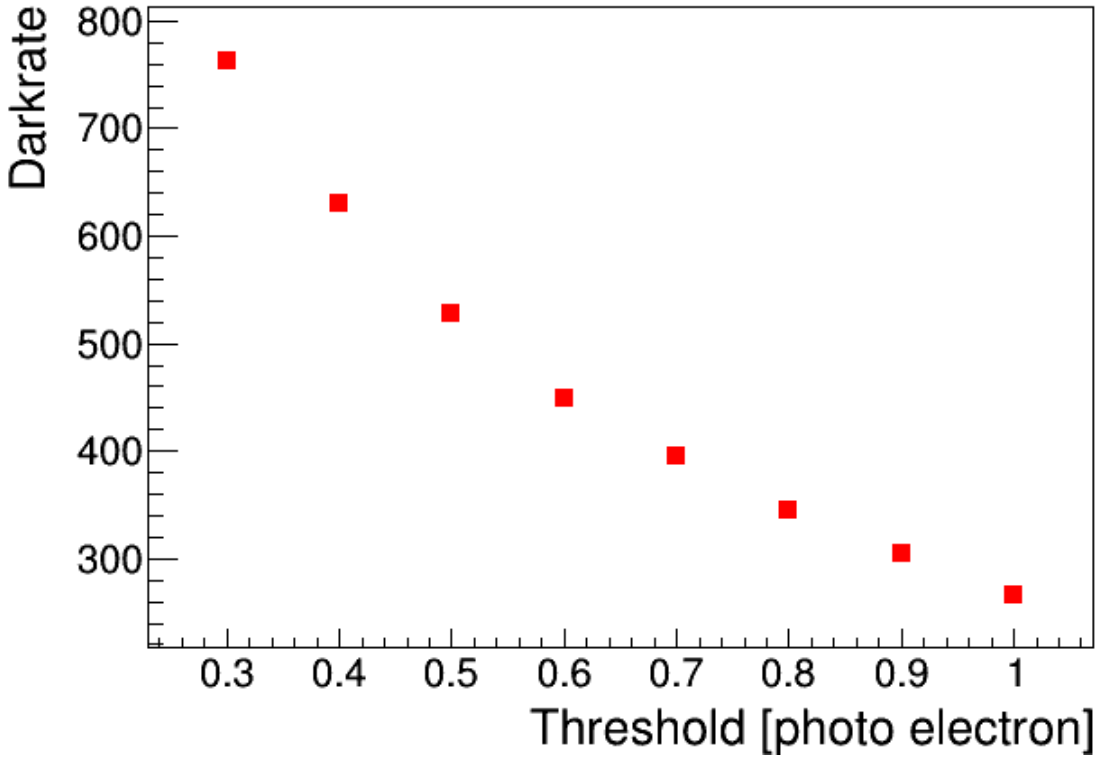


Hit time



Comparison of dark rates





- The rate of another PMT was order of a few hundred Hz.

Summary

- We measured dark rate using FADC.
- The dark rates were measured for two PMTs.
  - We found the rate was too high for one PMT.
  - The rate was reasonable for another one (a few hundreds Hz).
  - These measurements were similar to the results from Inomoto-san.