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Aging study of HRPPD #27

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Aging in normal HV

- Bias HV will be applied normally: Photocathode - entry of MCP#1: 200 V, MCP#1: 650 V; transfer: 200 V, MCP#2: 650 V, exiting of MCP#2 - anode: 200 V.
- For ten years, assume photon fluence: $10^{13}/cm^2$, hitting on the photocathode. (Gain not involved?)
- For an area on photocathode that covers one pore: $\frac{10^{13}}{cm^2} \cdot \pi \cdot (5\mu m)^2/0.7 = 1.1 \cdot 10^7$, number of photons, here 0.7 is open area ratio of MCP entry surface.
- If this area is hit by frequency 100 Hz (photoelectron in pore 100·QE Hz, QE is ~ 20-25% at 395 nm.) then, in 1 hour, we have 360000 photons.
- So time of illumination = $1.1 \cdot 10^7/(3.6 \cdot 10^5)$ = 30 hours.
- (In Jinky's slides, ten year fluence is $10^{14}/cm^2$, the frequency is 310 Hz.)

Is 100 Hz realistic/safe?

- We know that dead time of a pore is ~10 ms.
- Limitation comes from: 1, HV power supply current.
  - Current from HV power supply 1 mA, correspond to charge 10^-3 C in 1 s, correspond to number of electrons 0.625 x 10^{16}.
  - If gain is 1000 on each MCP, number of electron before amplification in MCP#2 should be 0.625 x 10^{13}. number of photo-electron before amplification in MCP#1 should be 0.625 x 10^{10}.
  - Number of pores covered by my light beam (2-mm diameter) is 3 x 10^4.

- 2, how many electrons can simultaneously enter one pore in MCP#2, still keep gain 1000?