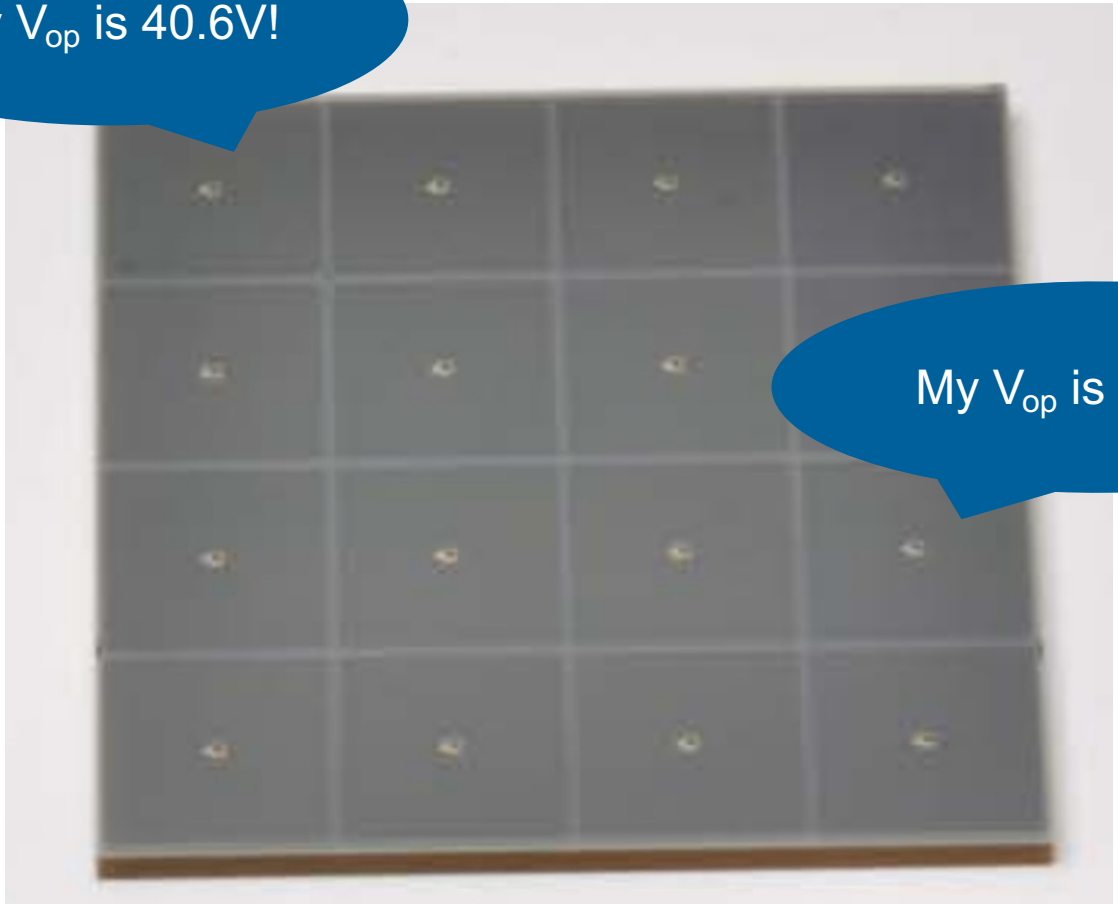
V_{OP} VARIATION

- **Electrical and optical characteristics (Typ. Ta=25 °C, Vover=2.7 V, unless otherwise noted)**

Parameter		Symbol	S14160/S14161 -3050HS-04, -08	S14160/S14161 -4050HS-06	S14160/S14161 -6050HS-04	unit
Spectral response range		λ	270 to 900			nm
Peak sensitivity wavelength		λp	450			nm
Photon detection efficiency at λp*3		PDE	50			%
Breakdown voltage		V_{BR}	38			V
Recommended operating voltage*4		V_{OP}	V_{BR} + 2.7			V
Vop variation between channels in one product*5	Typ.	-	0.1			V
	Max.		0.2			
Dar		I_D	0.6	1.1	2.5	μA
			1.8	3.3	7.5	
			7			%
		Ct	500	900	2000	pF
Gain		M	2.5×10^6			-
Temperature coefficient of recommended reverse voltage		ΔTVop	34			mV/°C

Is this okay?

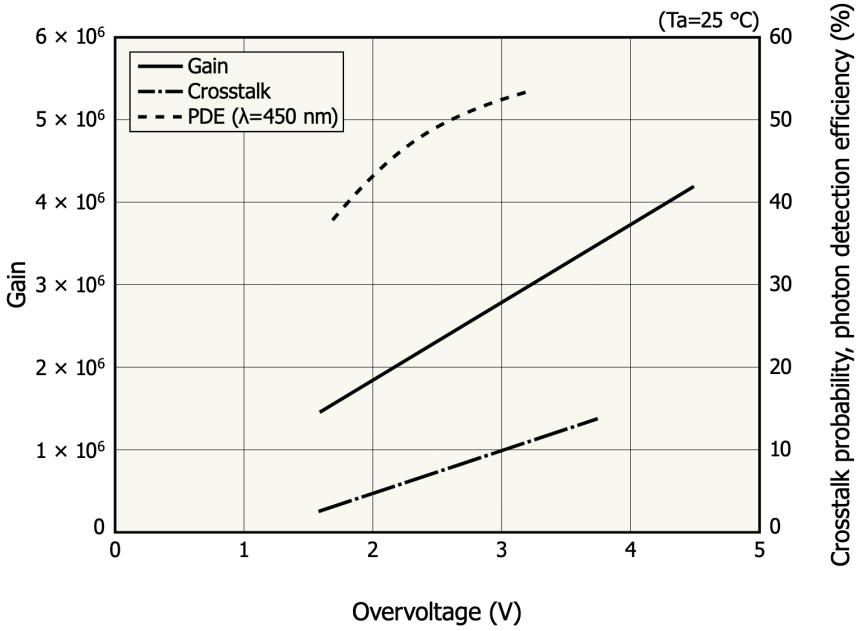
My V_{op} is 40.6V!



My V_{op} is 41V! 😱

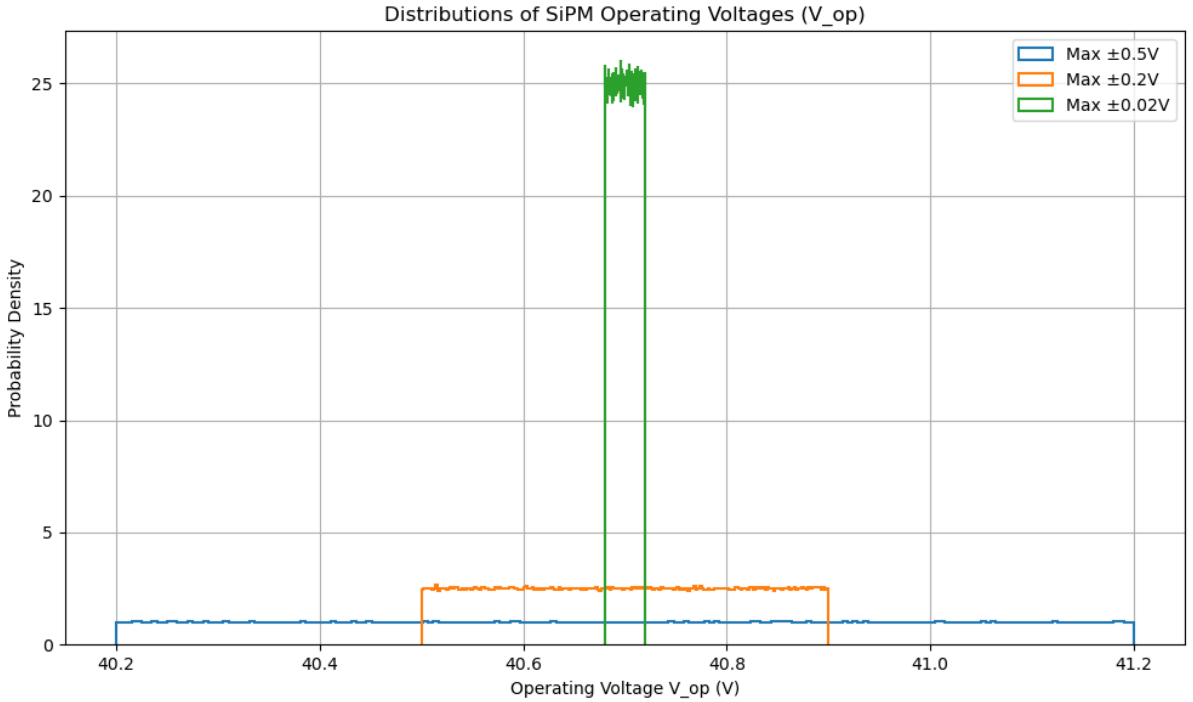
SIMPLE MC

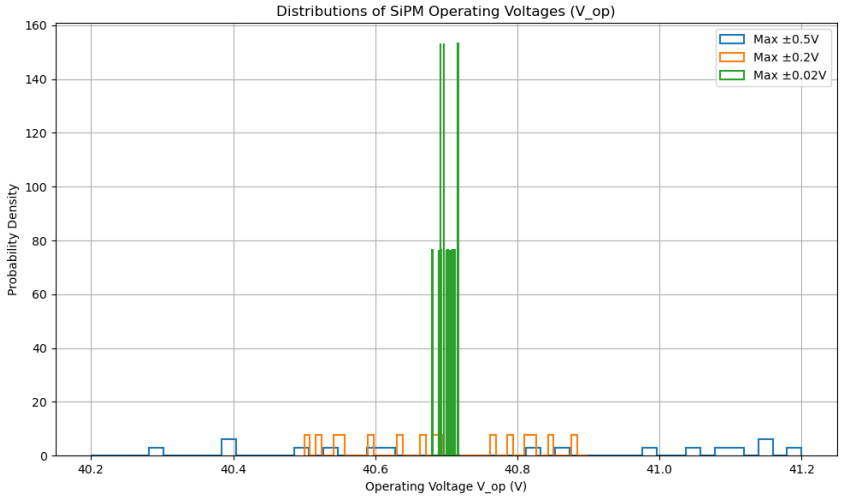
- Study the amount of charge produced by the SiPM including variations in operating voltage of up to 0.2V
- Assume gain is linear, 0.2V ~ 1.8E5 electrons, something like 10% gain variation
  - But, this is the max variation, and typically won't be that bad



- Want to MC various V_{op} distributions
- In lieu of any information on shapes of distributions, assume a flat distribution around the nominal value (worst case?)

(Ignore y-axis, arbitrary)

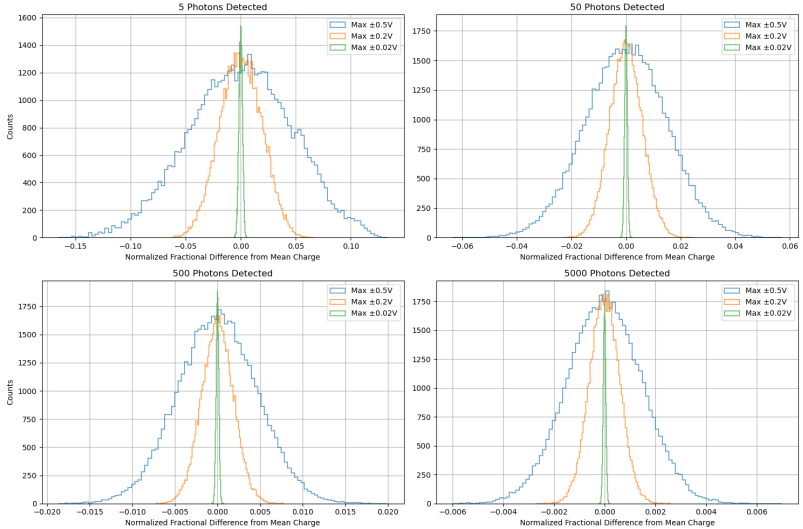


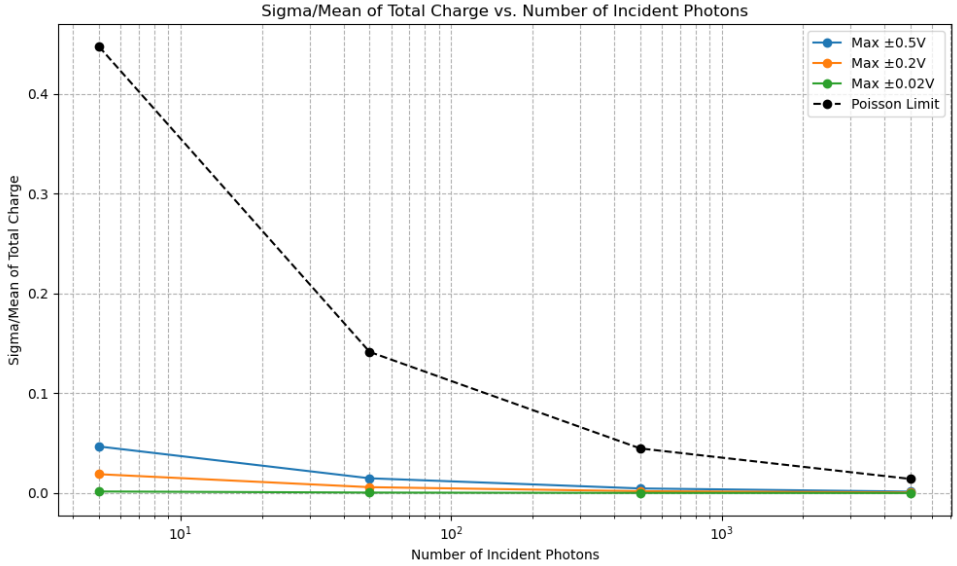


Top Left: 16 random SiPM V_{op} values

Bottom Left: Distribution of measured charges at front-end electronics for different N_{pe}

Bottom right: Sigma/mean of measured charged at FEE





UPSHOT

Variation of V_{op} produces a resolution effect which is less than poisson statistics over the whole dynamic range we're interested in

This V_{op} variation has the same effect as a ~3°C ΔT

Therefore, from the point of view of signal we can also tolerate heat differences of that scale across the face of the SiPM