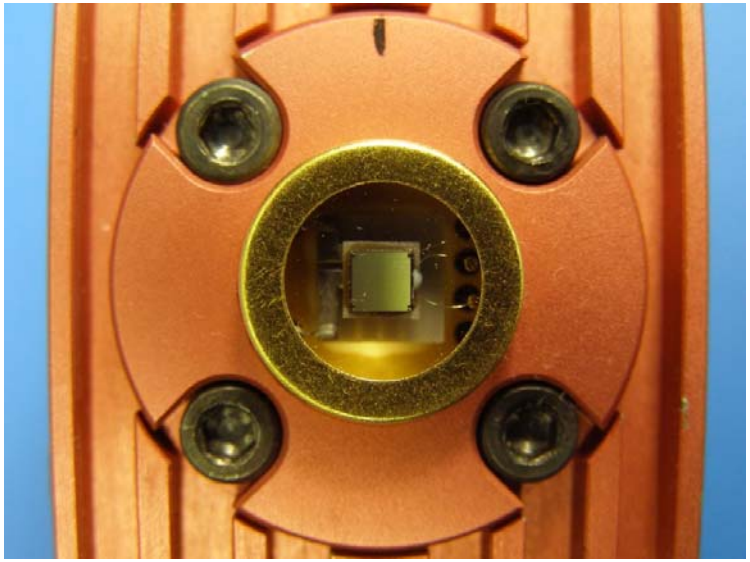
Silicon Photomultiplier Studies

Status Report – Gain of 1 mm^2 sample



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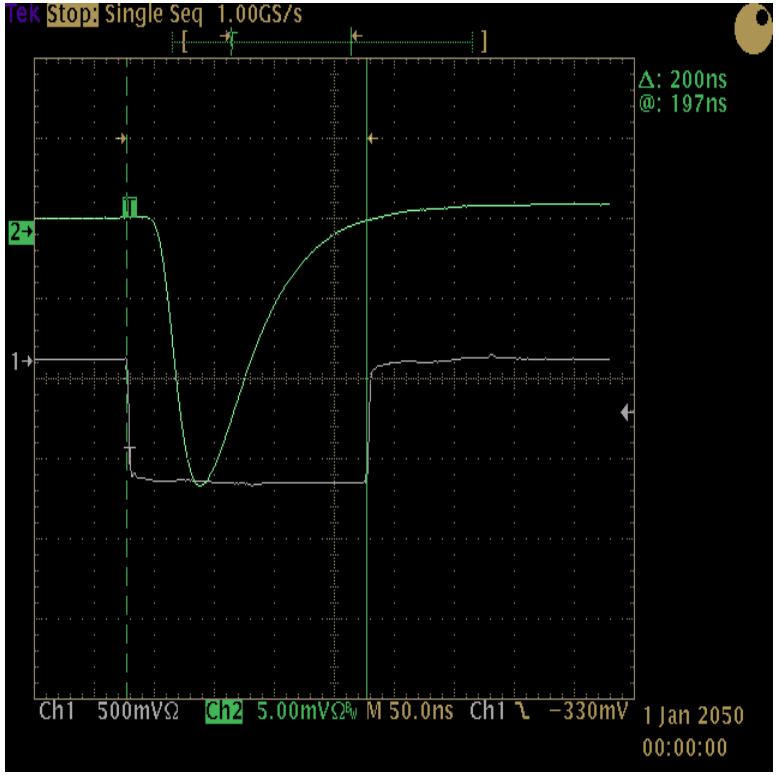
Test 1 mm² version *Current List from SensL*

620 pixels

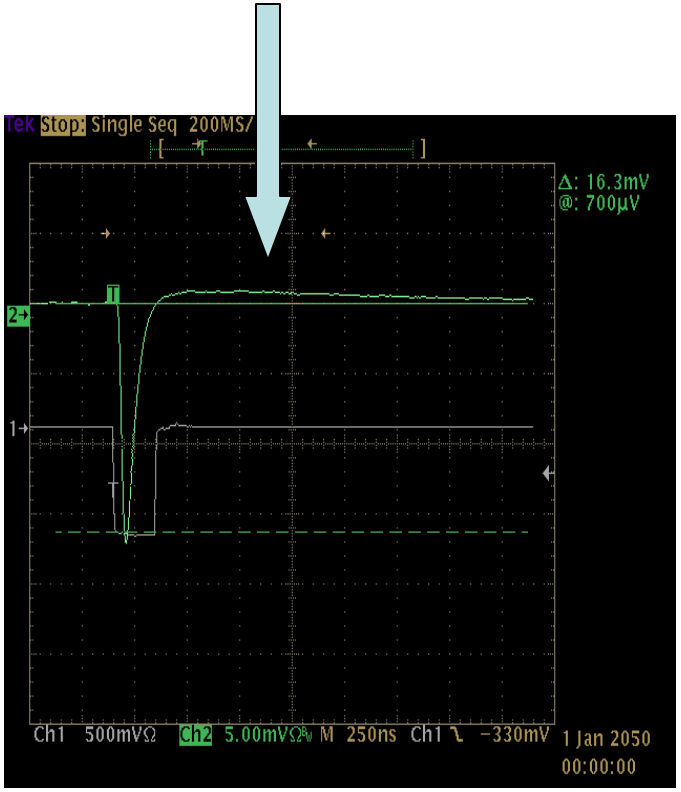
Serial #	# pixels	Microcell size	Fill Factor
0637-005	4496	20 μm	17.8 %
0641-006	4496	20 μm	17.8 %
0641-024	6744	20 μm	34.2 %
064-013	8640	20 μm	42.7 %
0641-036	2452	35 μm	30.5 %
0641-049	1930	50 μm	70.3 %



New pulse shape

-> Replace two capacitors

Still a slight overshoot

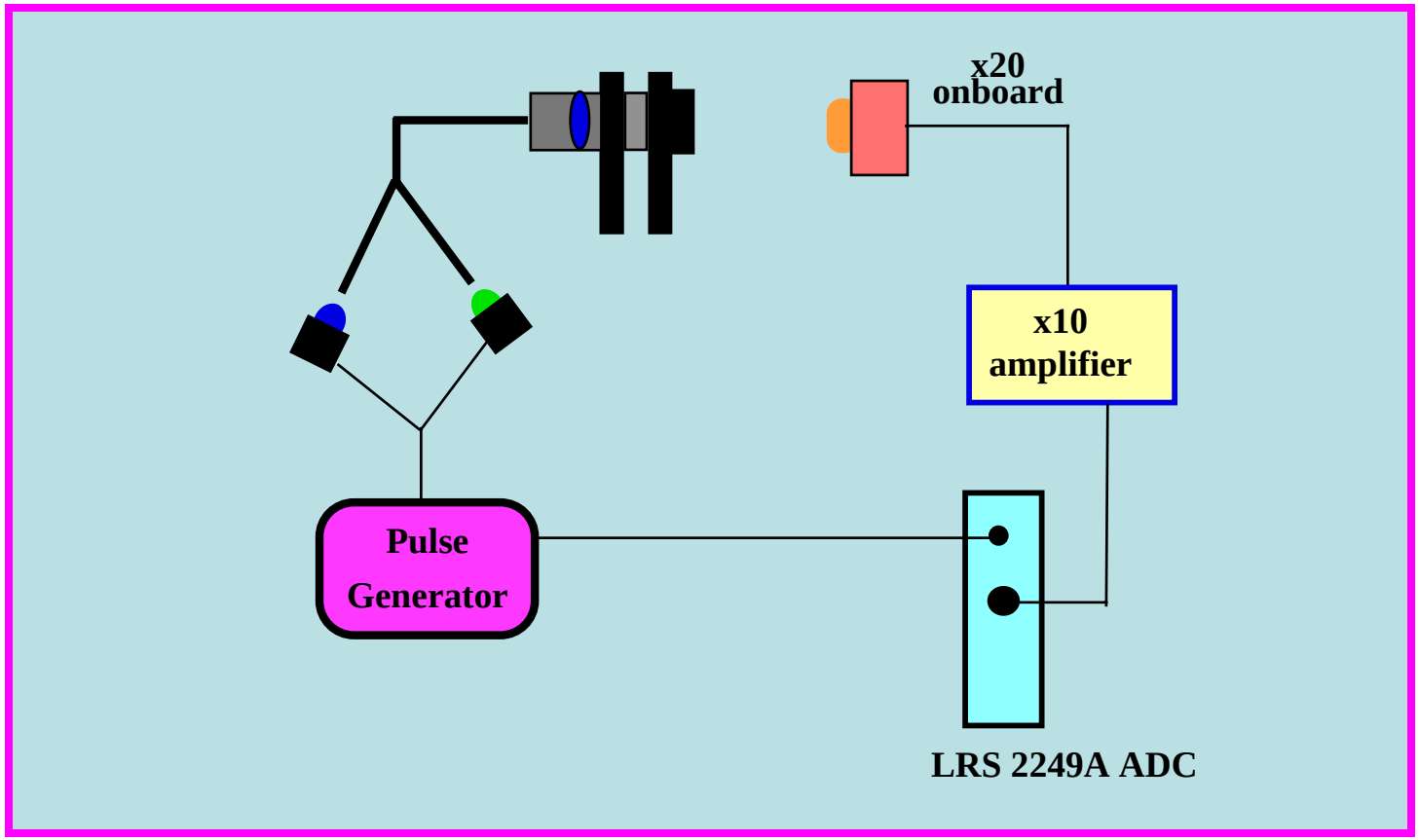


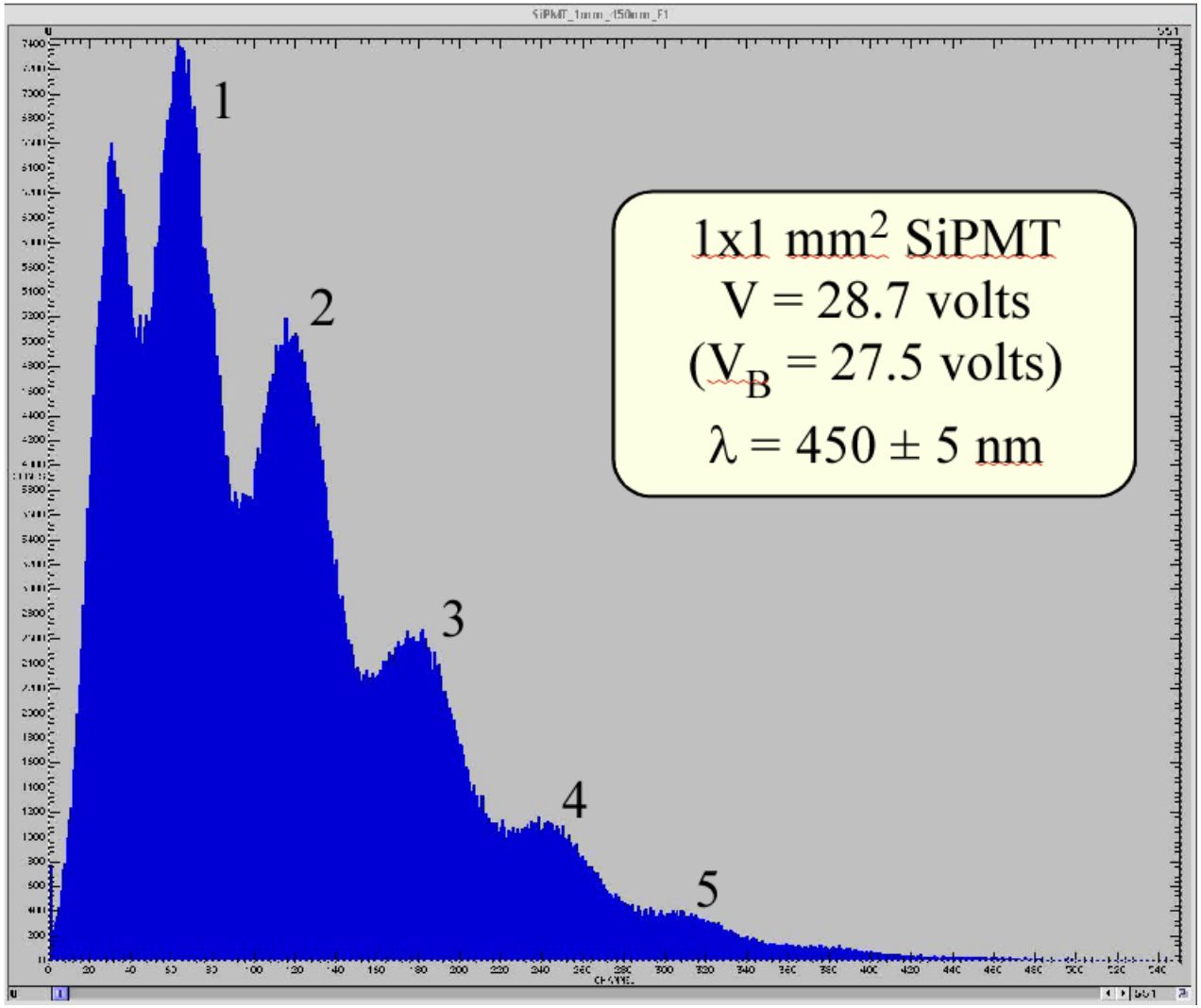
Filter system: [1] collimating lens

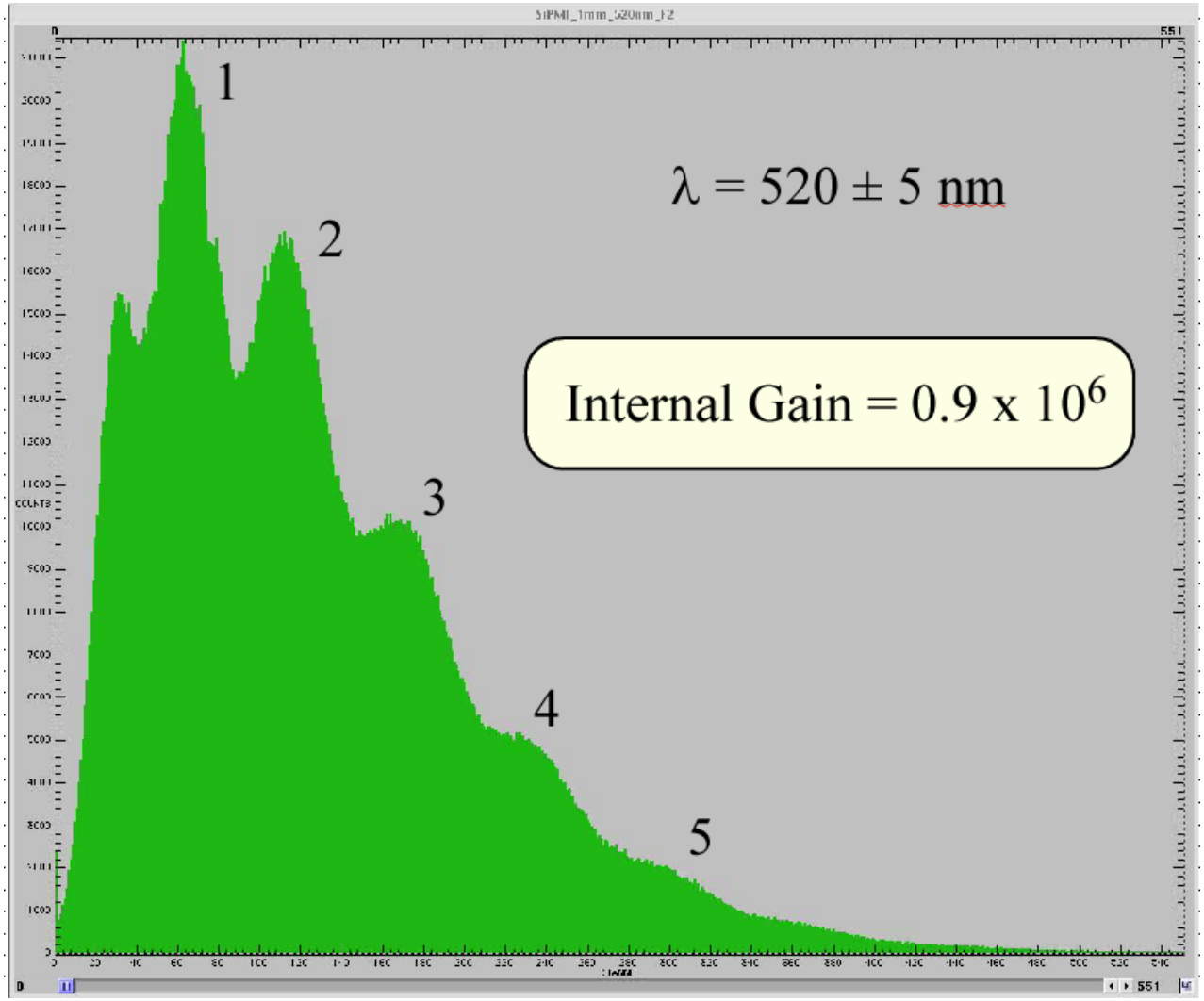
[2] narrow band (450 & 520 nm)

[3] neutral density + diffuser

Setup




1
2
3
4
5
1x1 mm^2 SiPMT
V = 28.7 volts
(V_B = 27.5 volts)
λ = 450 ± 5 nm


1
2
3
4
5
λ = 520 ± 5 nm
Internal Gain = 0.9 x 10^6

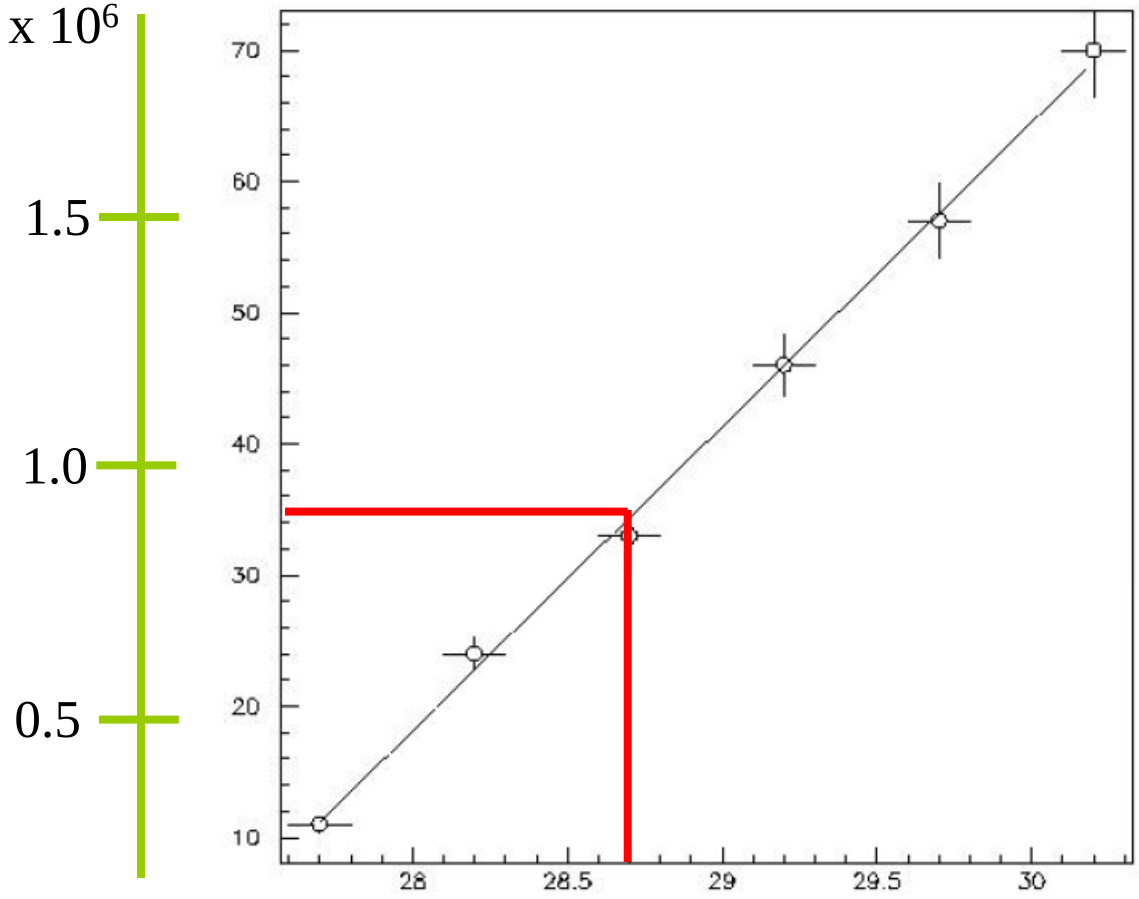


Figure 2. Pixel gain plot derived from SPS. The x-axis is SPM bias voltage in volts while the y-axis is ADC channels.

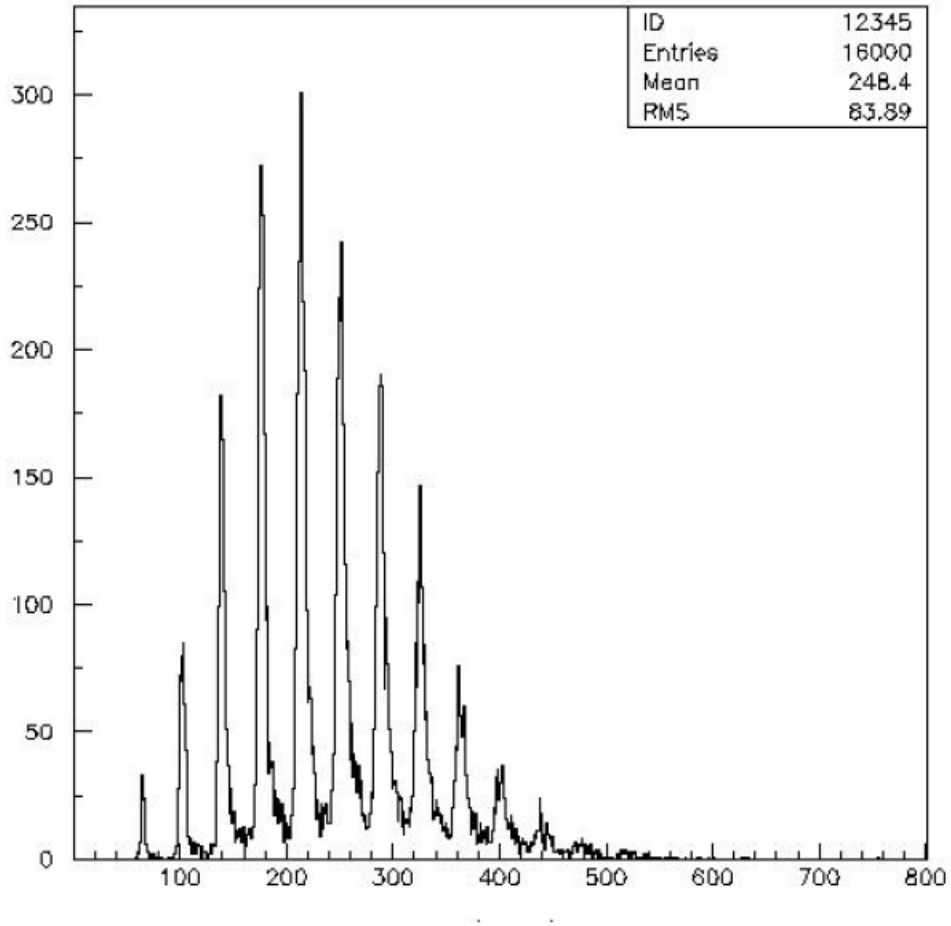


Figure 1. SPS from 1x1mm^2 SensL SPM with C20 design (620 pixels) recorded at 28.7V. The C20 design consists of circular 20μm pixels with a 17% fill factor.

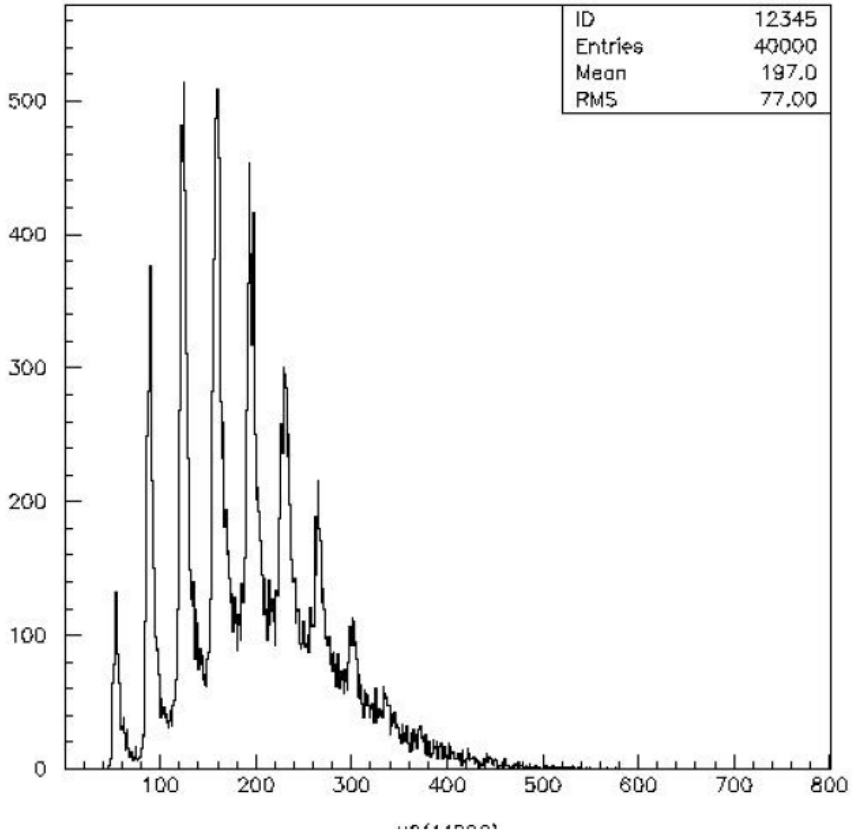


Figure 3. SPS from SensL 1x1mm^2 SPM with A20L design (920 pixels) recorded at 28.7V. The A20L design consists of 20μm square pixels with a fill factor of 34%. By using square pixels and packing the pixels closer together the fill factor is increased. However, this results in more active silicon and hence increased dark rate. This is evident in the SPS from the fact that the SPS peaks are super-imposed a boarder peak. This is indicative of a higher dark rate.