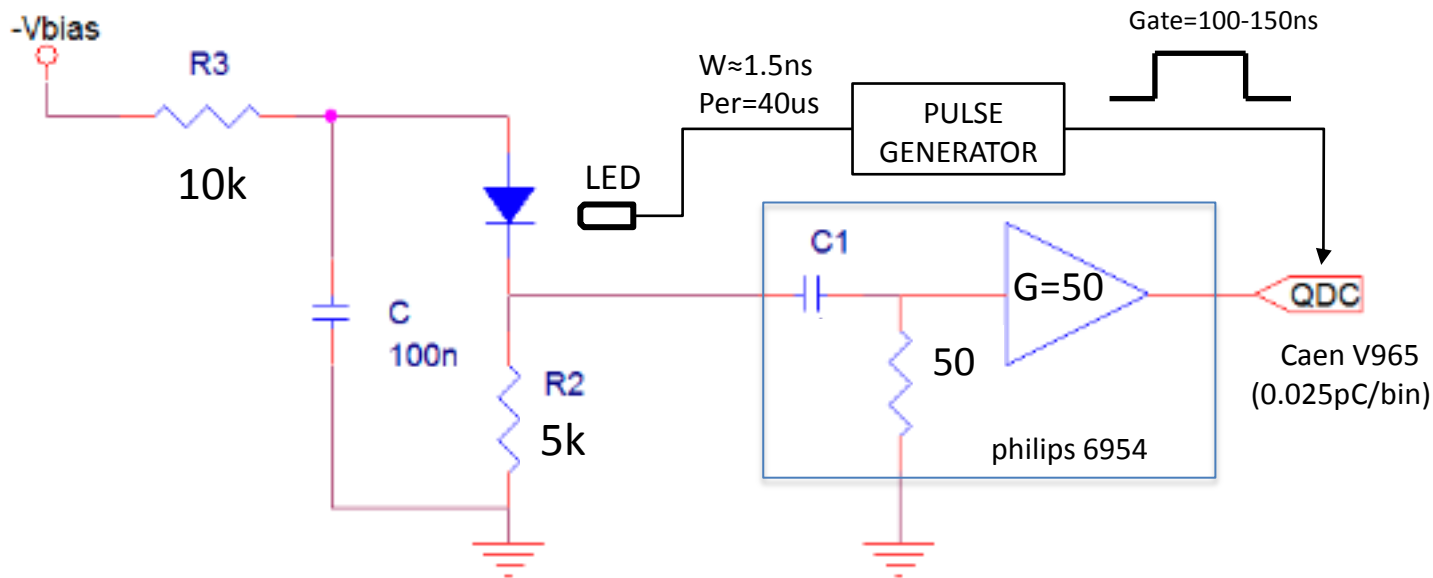


Electrical model of the S10362- 33-050C MPPC

A. Gil

Setup



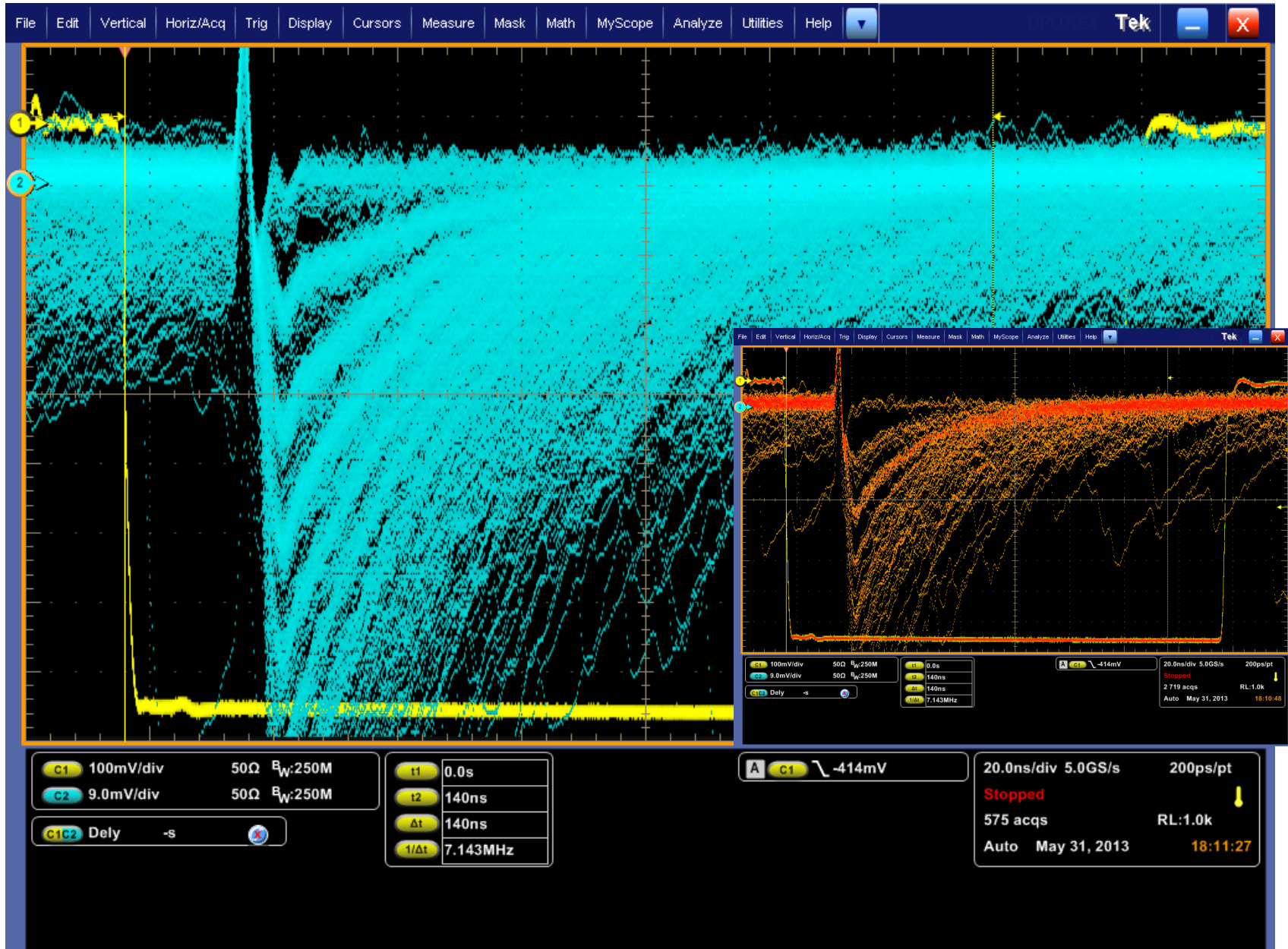
$$Q = \frac{\text{Value}_{QDC} \cdot \text{Bin}_{Res}}{G_{Amplif}}$$

| | DESY | KIP |
|----------------------|------------------------------|-----------------------------|
| Polarization circuit | 10K/5K | 1K/2.7K |
| Led pulse width | 1.5ns | 8ns |
| Amplifier | Philips 6954 (standalone) | Philips 775 (NIM module) |
| QDC | Caen V965 (25fC/bin) | Lecroy 2249A (250fC/bin) |
| Led intensity | Variable | Fixed |

Setup

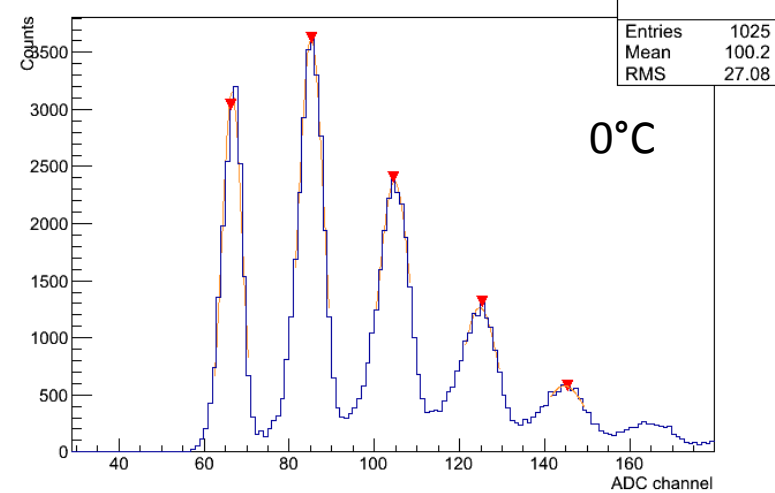
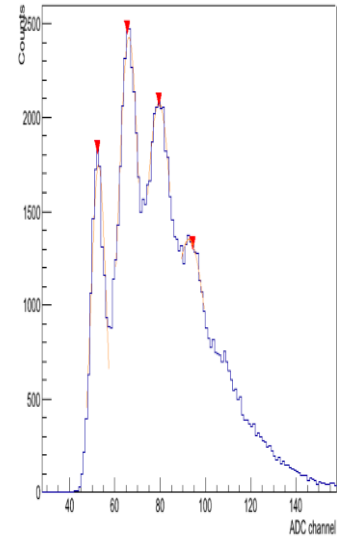
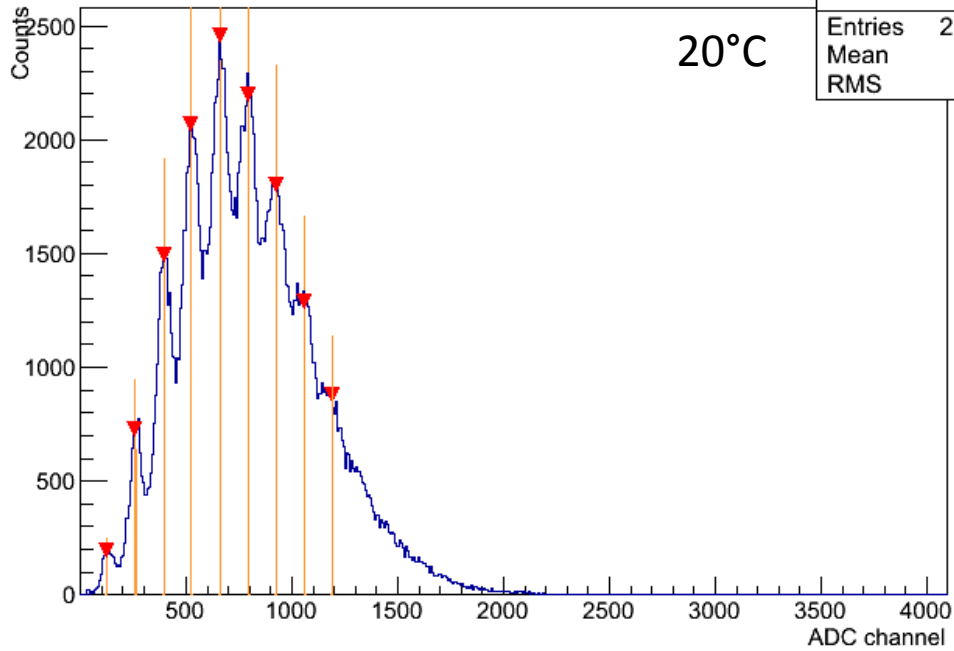


Amplified SiPM signal

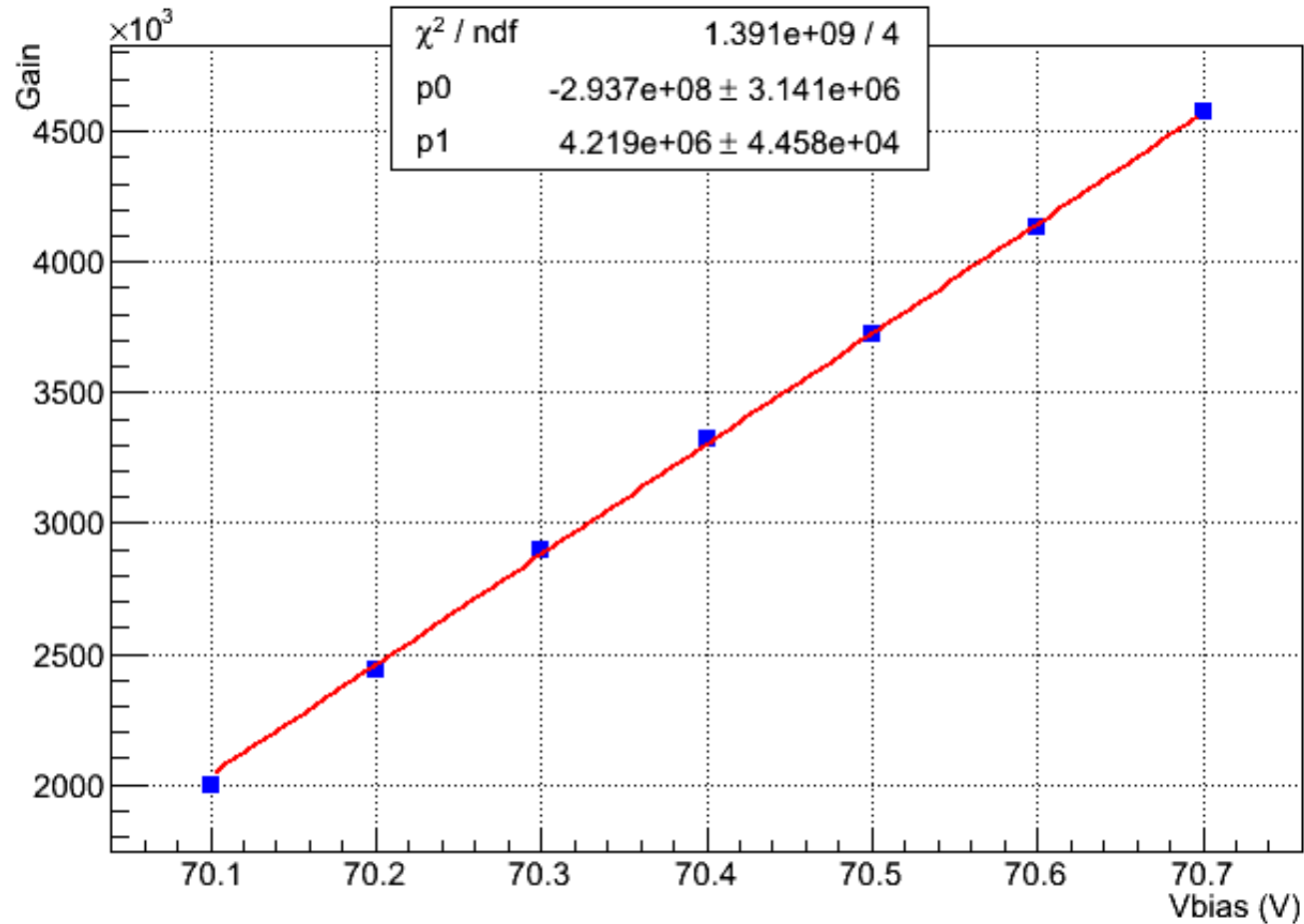


SPES

../data/spes-08J001603/spes-7.root



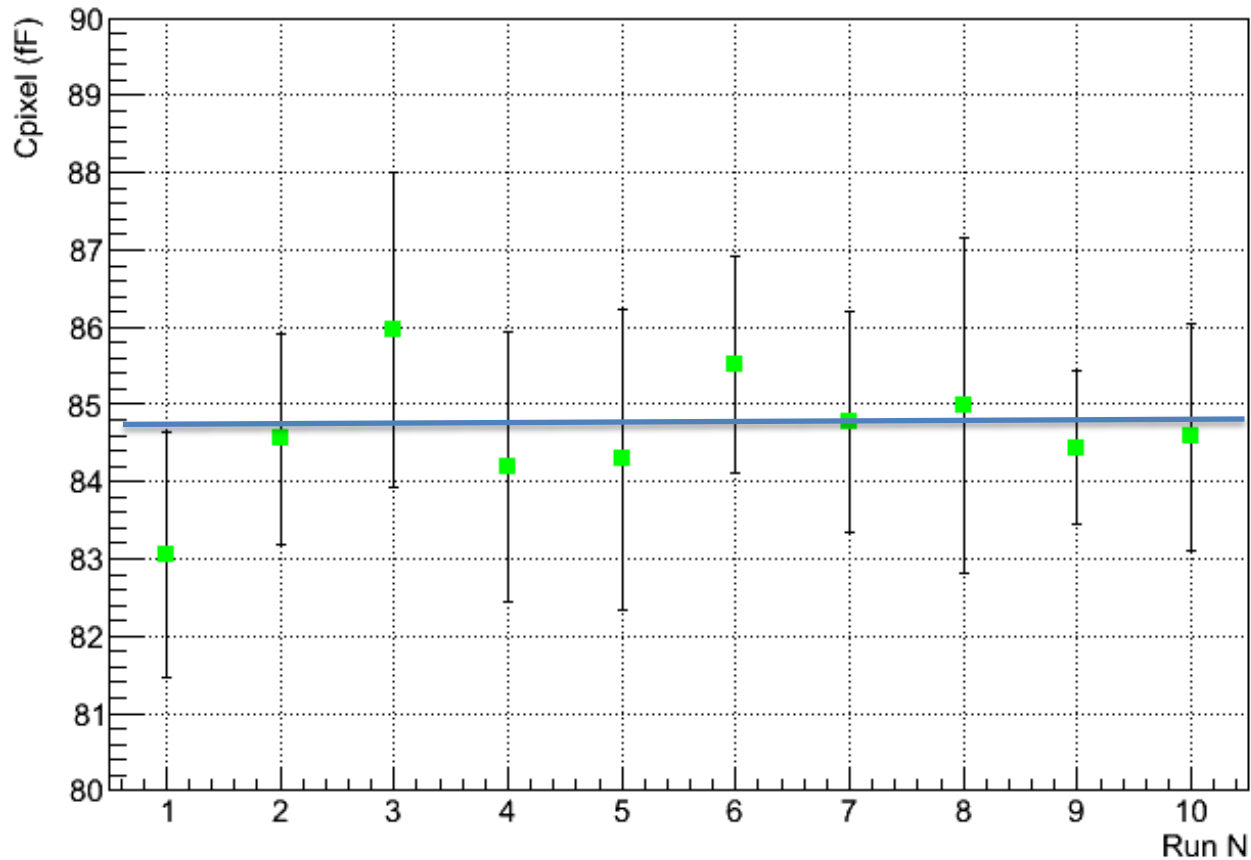
Peak fit



$C_{\text{pixel}} = C_d + C_q = 84.39\text{fF} \pm 0.89\text{fF}$ $V_{\text{br}} = -p_0/p_1 = 69.617\text{V}$ [Gate width=100ns]

Measurement spread

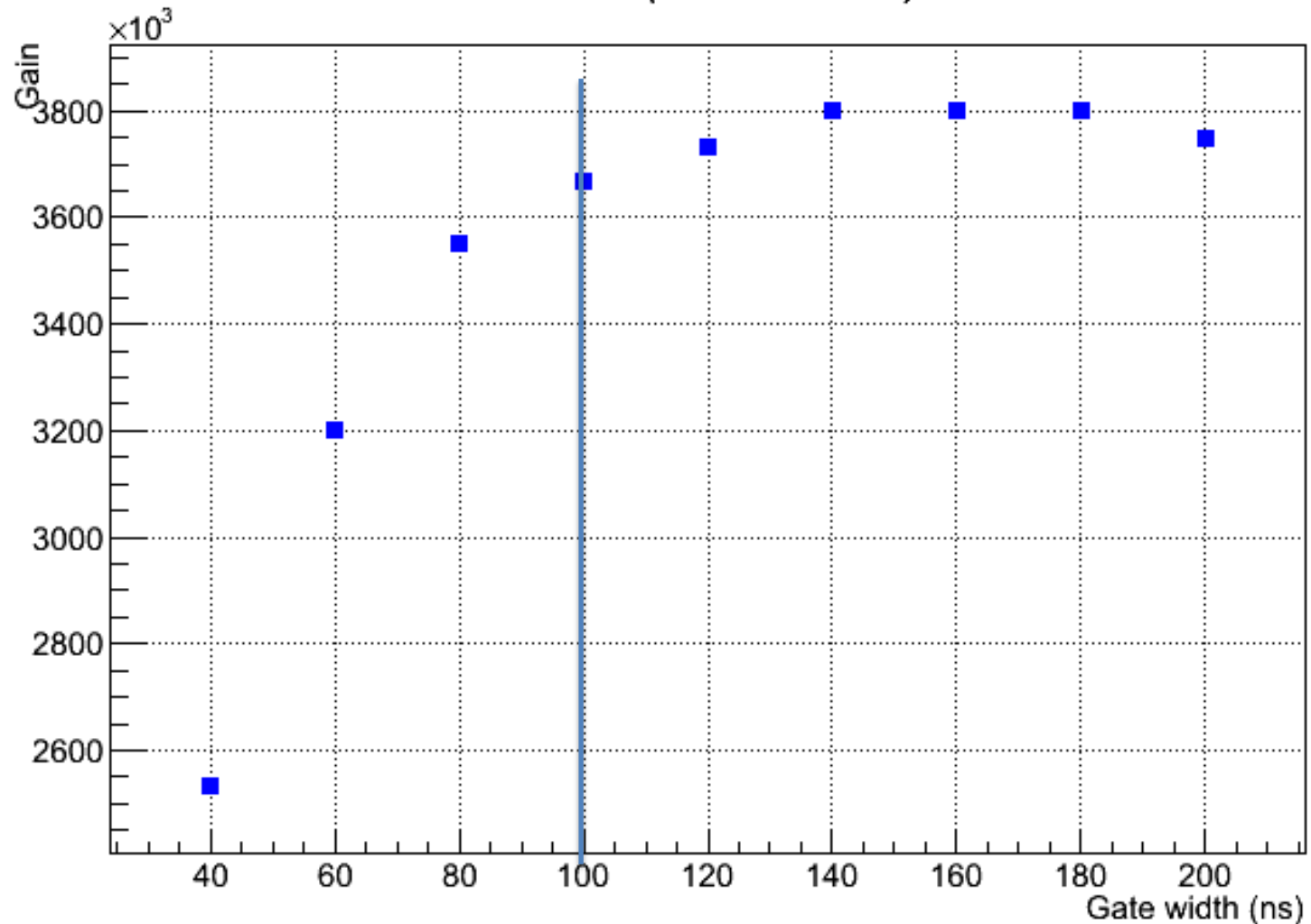
Gate width = 100ns

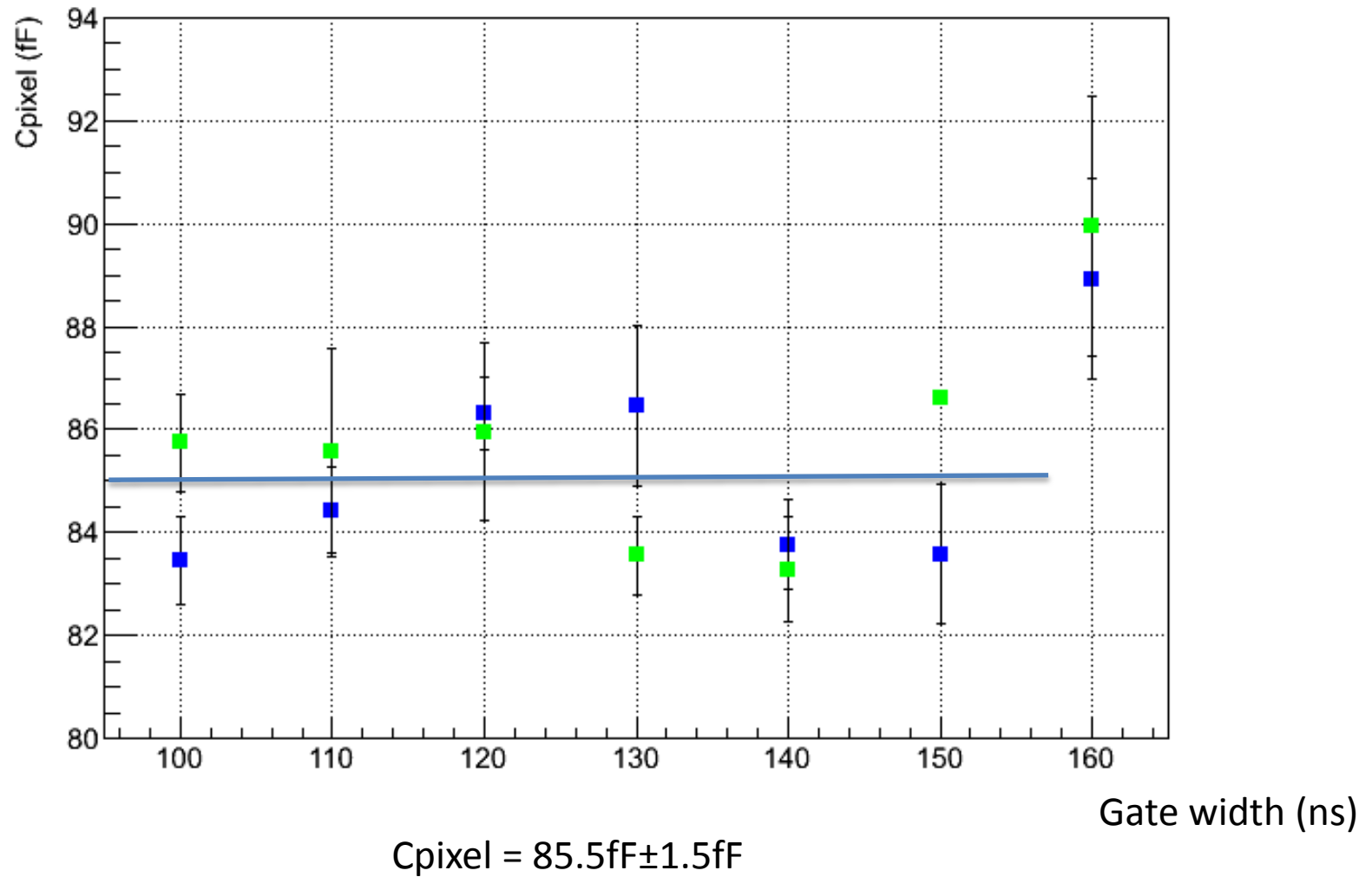


$$C_{\text{pixel}} = 84.6\text{fF} \pm 2\text{fF}$$

Gain vs. Gate width

70.4V (08J001603)

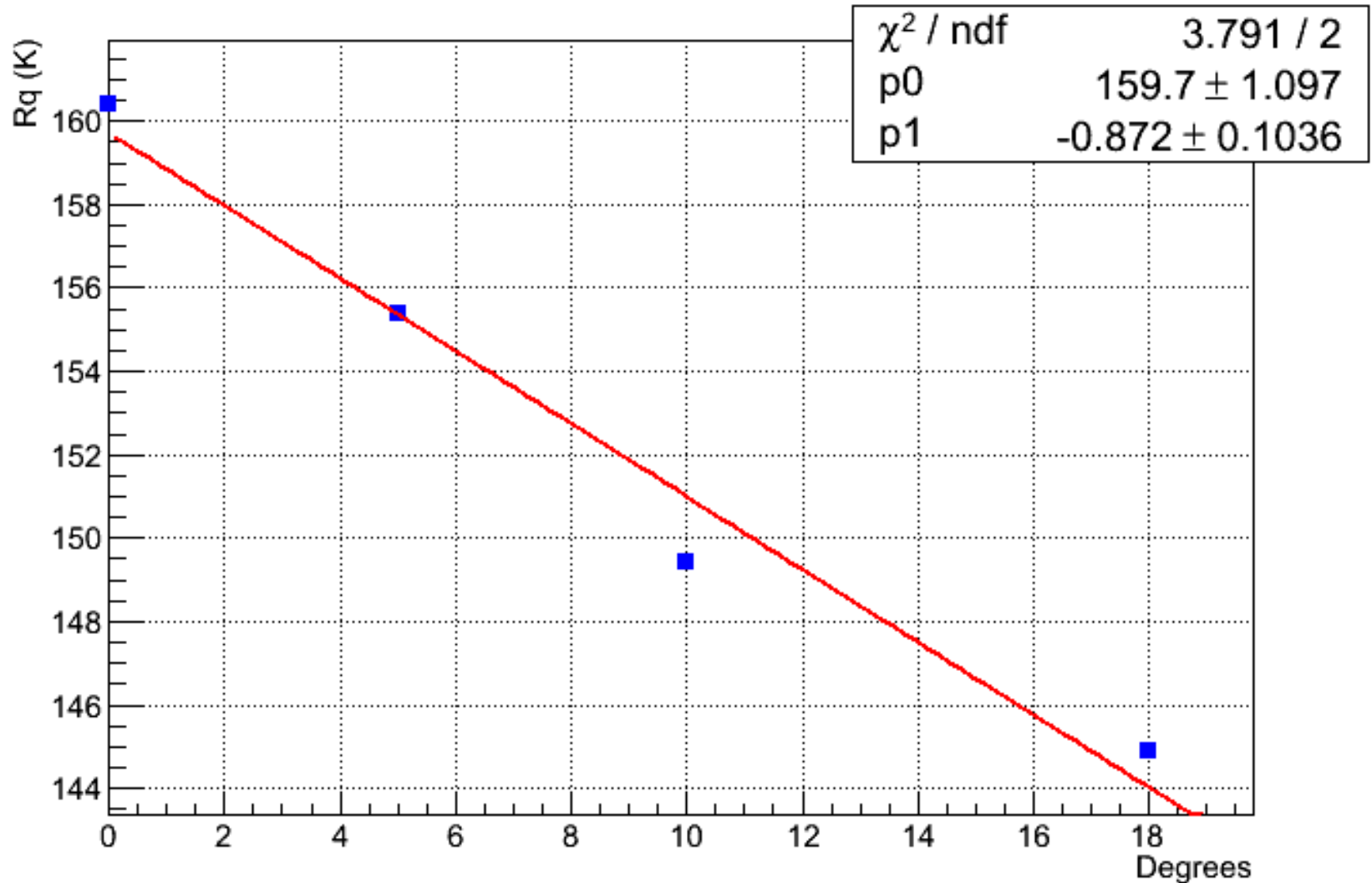




- Rising edge \ll falling edge
- Constant discharge, ie: $t=RC \rightarrow 63\%$ of the charge collected

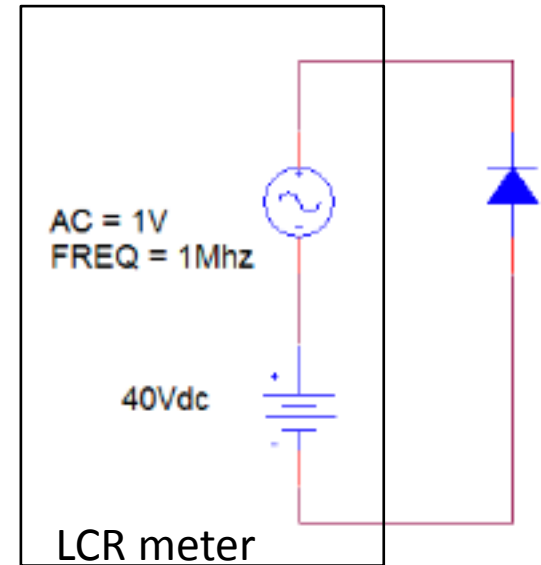
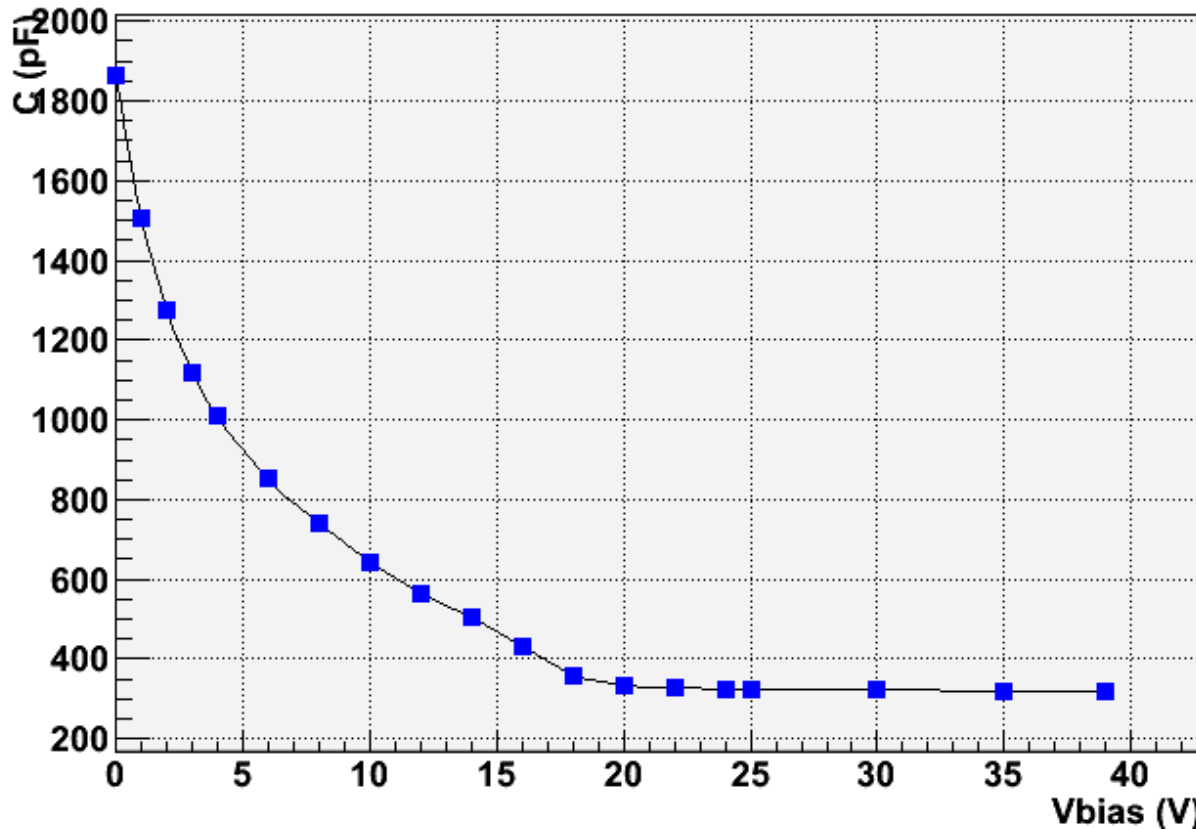
Quenching Resistor

Rq vs temp



1. RLC meter

Diode capacitance decreases with the reverse DC voltage

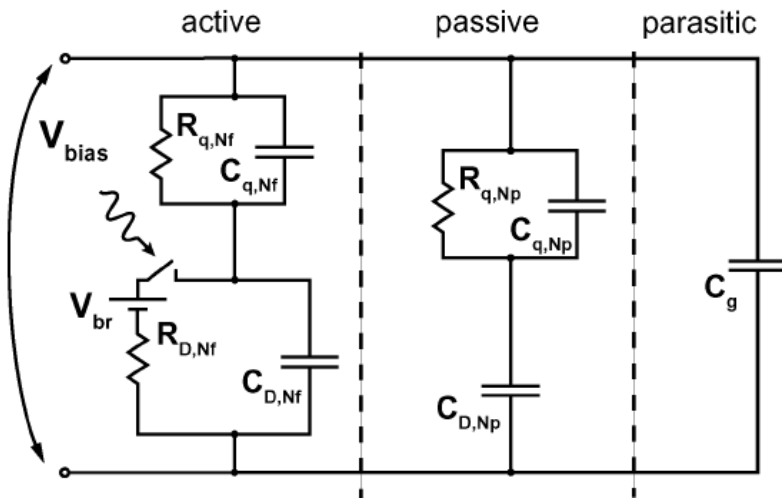


$C_m = 319.6\text{pF}$
 $G_m (=1/Z) @ 1\text{Mhz} = 132.28 \mu\text{S}$

Hamamatsu datasheet → Terminal capacitance=320pF

$$320\text{pF}/3600 = 88.9 \text{ fF}$$

Model parameters



Seifert et al. 2009

| Parameter | Published (Avella 2011) | Measured |
|------------------------|-------------------------|-----------------|
| R_q (K Ω) | 163.1 ± 0.4 | 145 ± 1.1 |
| G_{meas} (μS) | 139.9 ± 0.4 | 132.3 ± 2.1 |
| C_{meas} (pF) | 304.1 ± 0.6 | 319.6 ± 0.9 |
| C_q (fF) | 7 ± 8 | 4.6 |
| C_d (fF) | 78.0 ± 0.2 | 80.9 |
| C_g (pF) | 25.3 ± 0.9 | 28.8 |
| C_{pixel} (fF) | 85 ± 8 | 85.5 ± 1.5 |

MPPC S10362-33-050C 3mmx3mm 50um 3600 pixels