

# Report on PID activity @ Padova

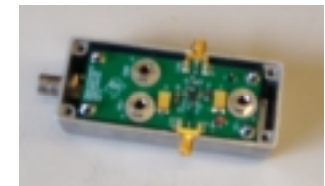
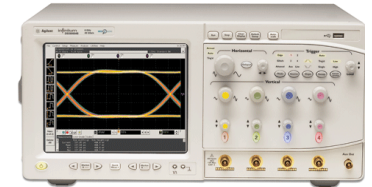
# Objectives

- **Primary interest:** front-end and read-out electronics of the TOF detectors.
- **Immediate goal:** to become familiar with fast light detectors (MCP-PM, Si-PM)

# Equipment & Setup

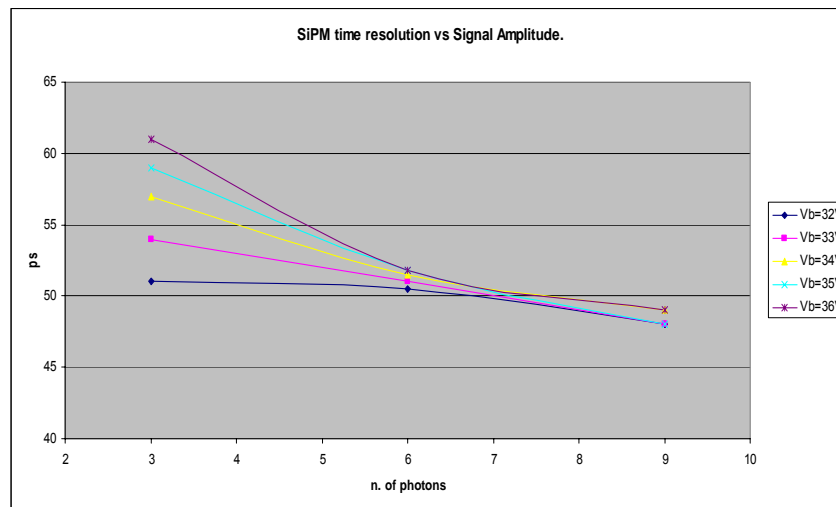
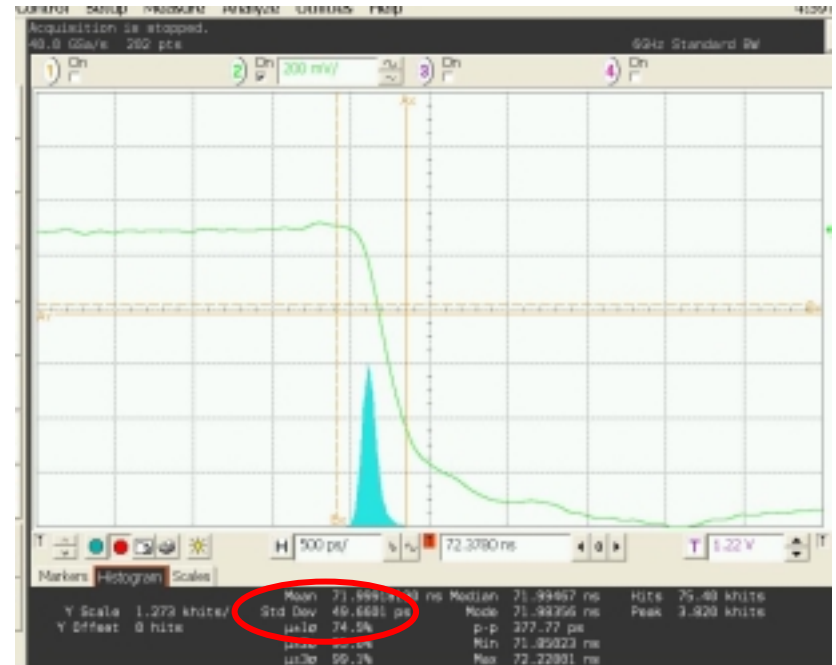


- Agilent DSO80604B scope (6 GHz - 40 GS/s).
- Picosecond Laser System (PiLas PILO40F: 400 nm, 40 ps)
- Kithley 6487 Picoammeter/Voltage Source
- Ortec 9327 Constant Fraction Discriminator
- Wideband amplifier THS4303 (1.5 GHz, x10 amp)
- Becker&Hickl SPC 130 TDC ( $\sigma=5$  ps)
- Burle MCP (not yet arrived)
- SiPM byIRST and Hamamatsu



# SiPM-IRST time resolution

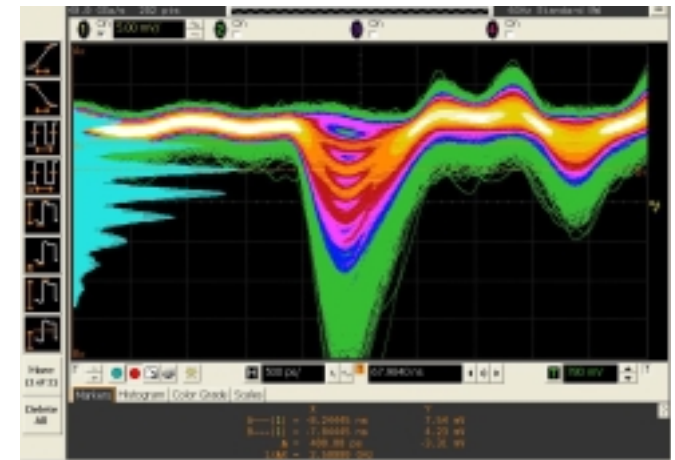
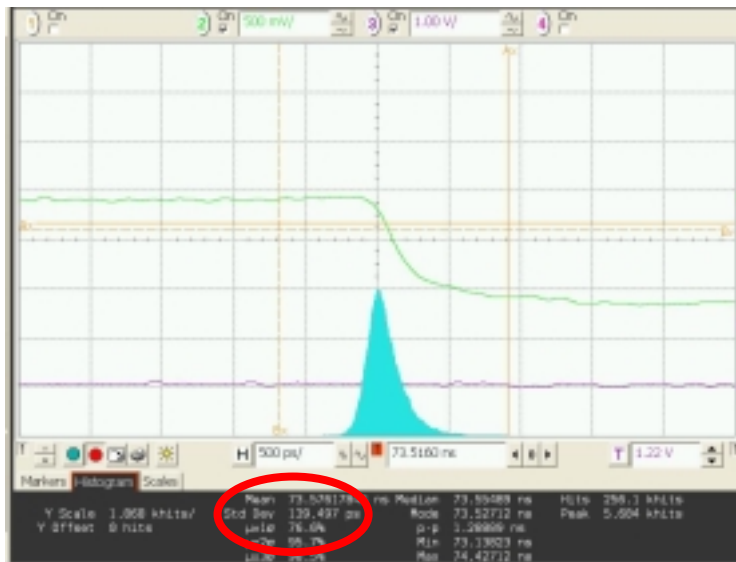
- Jitter of the CFD output w.r.t. PiLas trigger (measured with the "histogram function" of the scope).



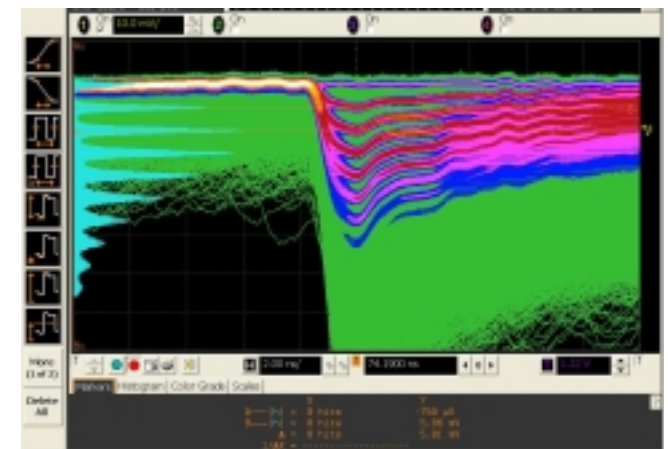
- Strong dependence on Vbias at low amplitude.
- Almost constant at low Vb or high enough signal ( $\geq 6$  photons)

# SiPM-Hamamatsu time resolution

Hamamatsu device, in spite of higher gain ( $\sim 1\text{mV}/\gamma$  over  $50\Omega$ , against  $\sim 0.5\text{mV}/\gamma$  of the SiPM by IRST) exhibits a worse time resolution;  $\sim 140\text{ ps}$



IRST ( $\uparrow$ ) vs Hamamatsu ( $\downarrow$ )  
SiPM spectra



# Consideration on SiPM-IRST time resolution

Intrinsic SiPM time resolution is a little better than 50 ps:

$$\sigma_{mis} = \sqrt{\sigma_{SiPM}^2 + \sigma_{CFD}^2 + \sigma_{Pilas}^2 + \sigma_{scope}^2}$$

$$\sigma_{CFD} \approx 20 ps \quad \sigma_{Pilas} \approx 3 ps \quad \sigma_{scope} \approx 5 ps$$

$$\Rightarrow \sigma_{SiPM} \approx 45 ps$$

**This is a very good result**, at the top of the resolution achieved with these kind of device reported in literature

# Consideration on SiPM-IRST time resolution. Conclusions

## Can this good result be improved?

Not impossible; the result was obtained with just one prototype, with a setup very likely not in the best shape:

- No or poor noise filtering techniques was applied;
- There are some discrepancies between our results and the ones reported by IRST, mainly due to different acquisition modes: charge integration ADC vs peak sensing ADC. This needs further investigations.

## Can it be useful for the PID-TOF detector?

Here a time resolution of  $\sim 20$  ps or better is required; this seems a very ambitious goal for SiPM devices, but similar results was already obtained (with high enough signals).

Answer postponed after measurements on Burle MCP and fine tuning of SiPM measurements. Works on progress.

