# Time Response of 50 $\mu$m sc-CVD

## (determination of the working bias)

## $\succ$ 3$^{rd}$ ADAMAS workshop $\prec$

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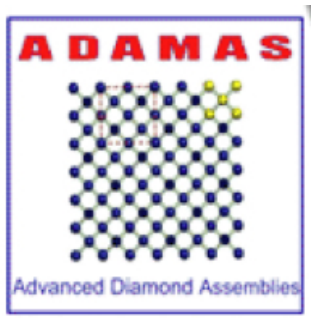
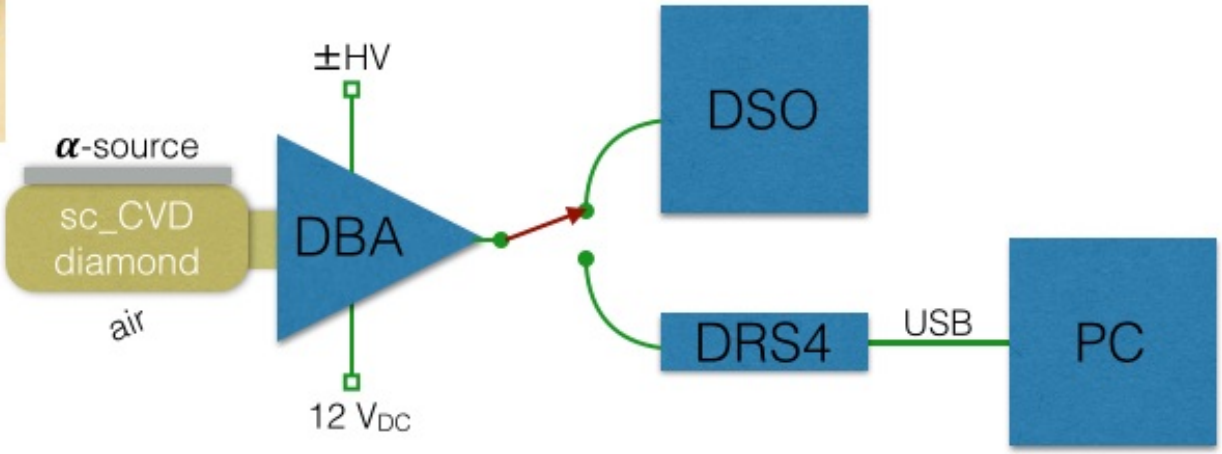


# Outline

1. Motivation
   - Study pulses with FWHM $\approx$ 1ns.
   - Look for alternative to bulky & expensive oscilloscope.
   - Graduate thesis of Juan Manuel Mora.
2. Time measurements with a 6 GHz oscilloscope
   - Rise time & FWHM.
   - Shape factor.
   - Working bias.
3. Digital Storage Oscilloscope vs DRS-4 chip
   - DRS-4 main characteristics.
   - Time measurements with DRS-4.
4. Conclusions

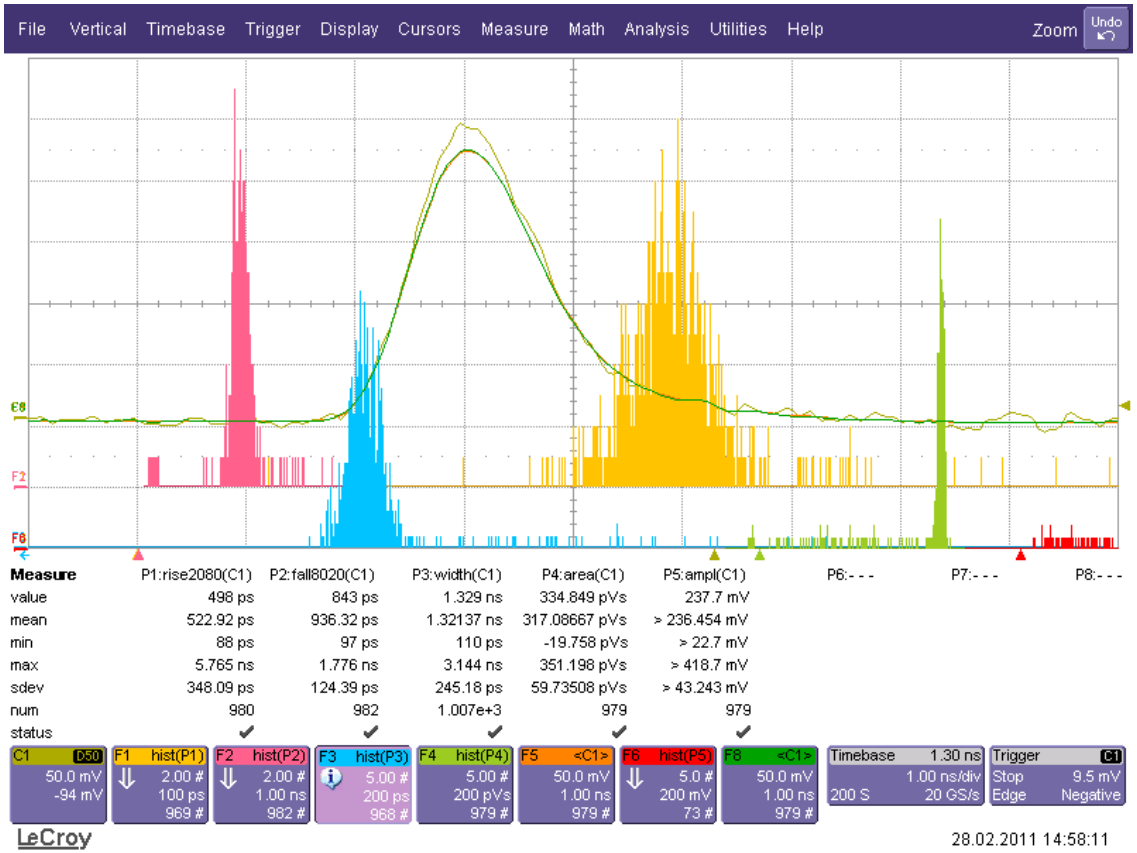
# Detectors & setup


## Detectors main characteristics

- From former company DDL.
- 3 samples sc-CVD 50 $\mu$m.
- Different housing.
- No vacuum conditions.
- Detector screwed on DBA.
- DAQ next slides.

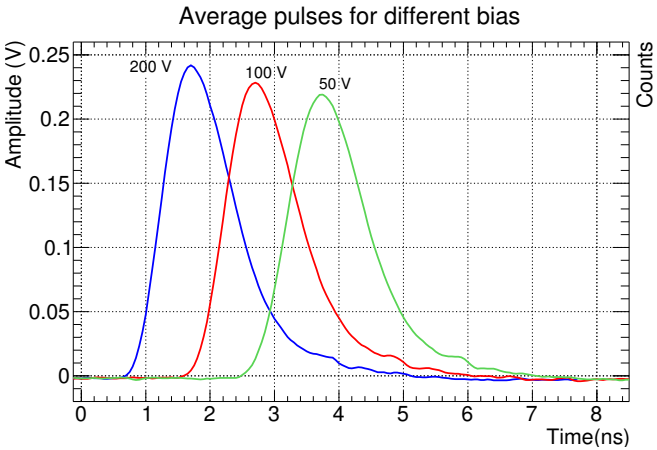
# Time measurement with a 6 GHz DSO

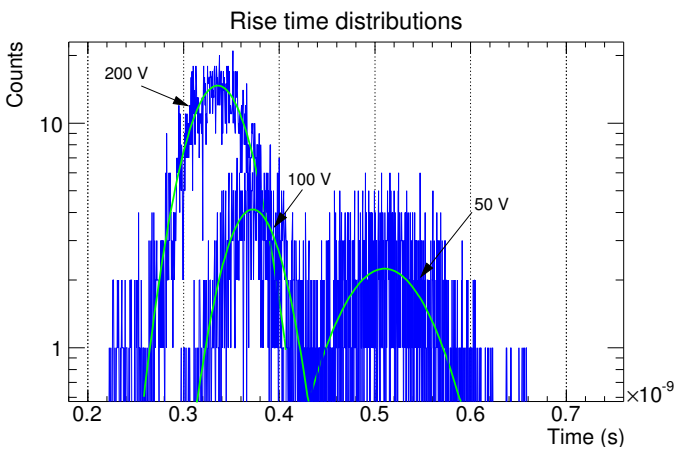


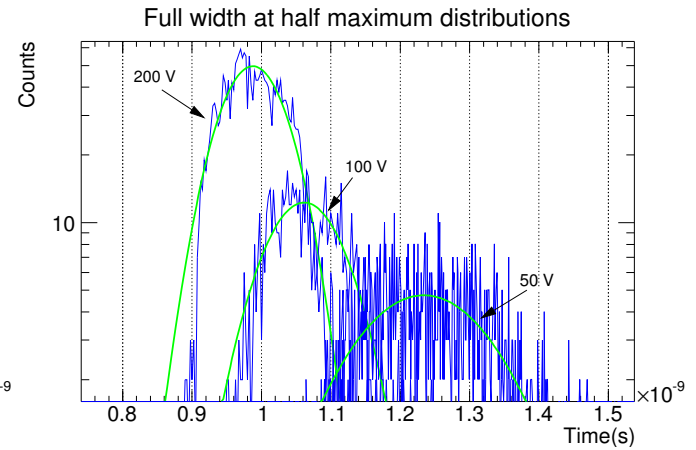

## LeCroy DSA 600 main characteristics

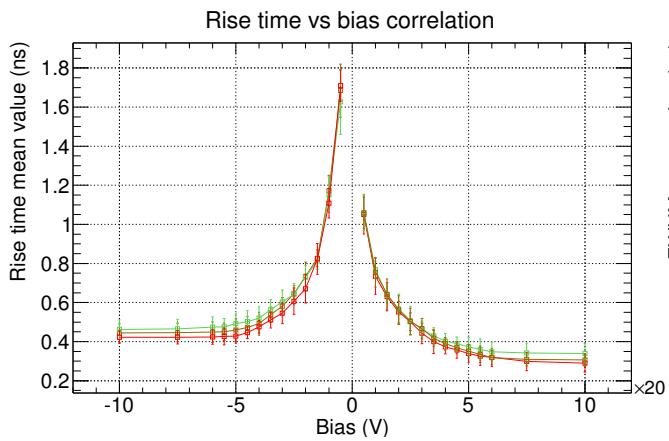
- BW 6 GHz ($-3$dB)
- Rise time 75 ps
- 8.5 to 11 bits
- up to 20 GS/S
- Statistics done
- cost $>$ 30 k€

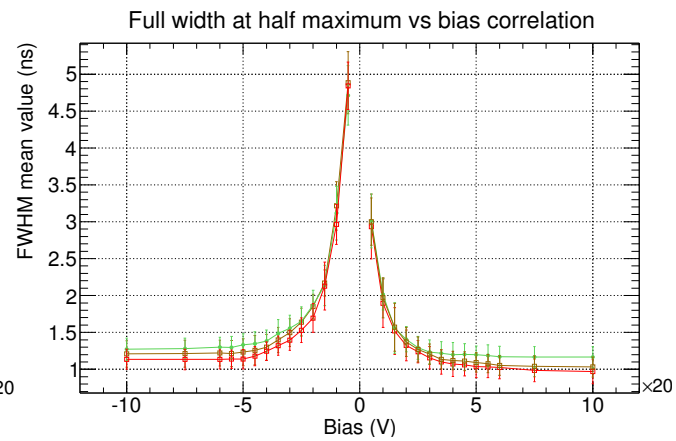
# Rise time & FWHM collected data

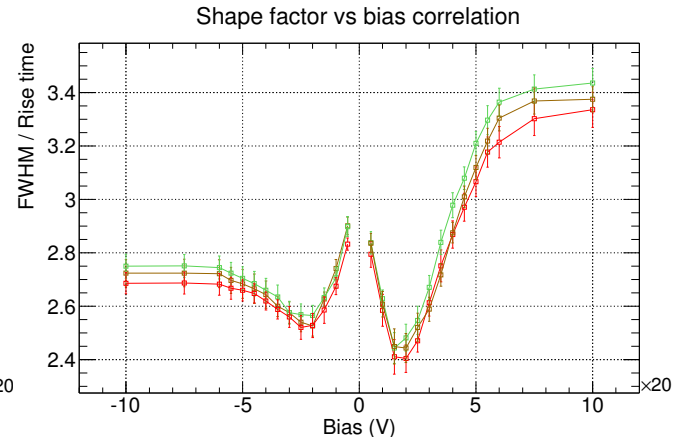


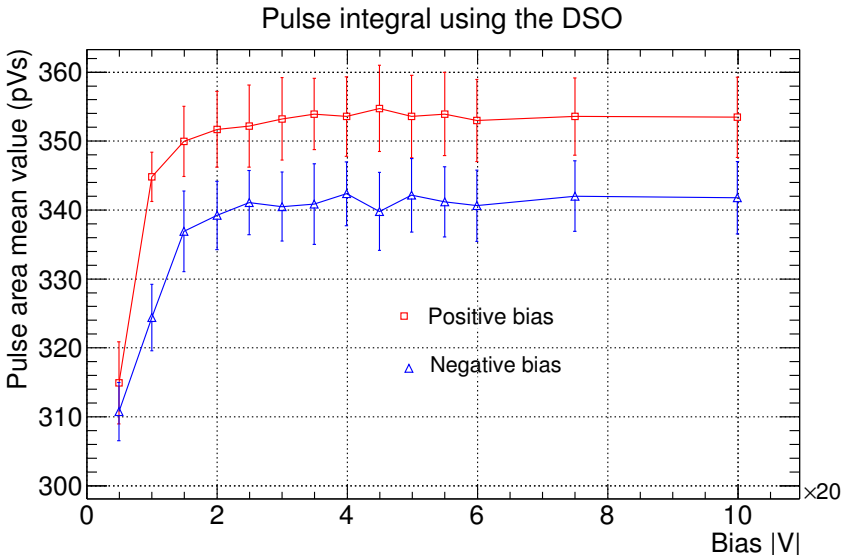



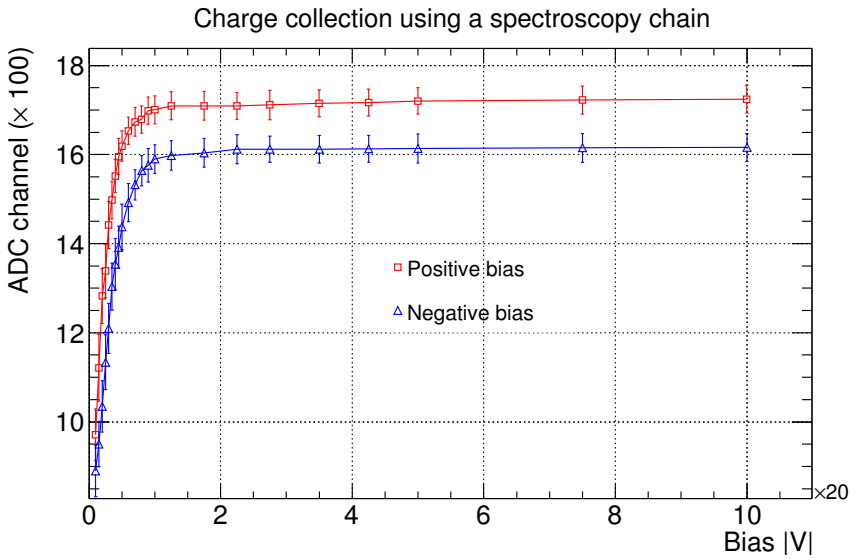




- Traces + statistics are stored.
- FWHM $\approx$ 1 ns
- Rise time$_{20-80\%}$ down to 300 ps
- Faster rising for positive bias
- Shape factor = FWHM/Rise$_{time}$
- Inflection point @ 40 V

# Integration of the pulses



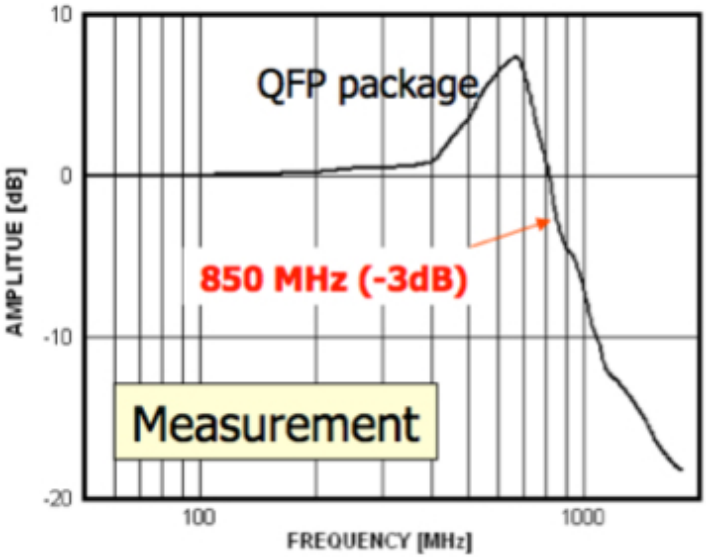




- Integration of each pulse (i.e. its area) at each bias.
- Sigmas relatively "big" due to fluctuations at the base.

- Qualitatively comparable to CCE obtained with MCA.
- Positive bias (hole drift) gets higher CCE.

# DSO vs DRS-4 chip

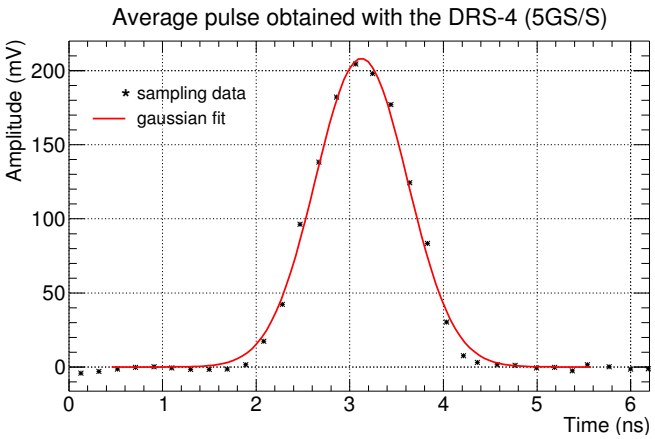


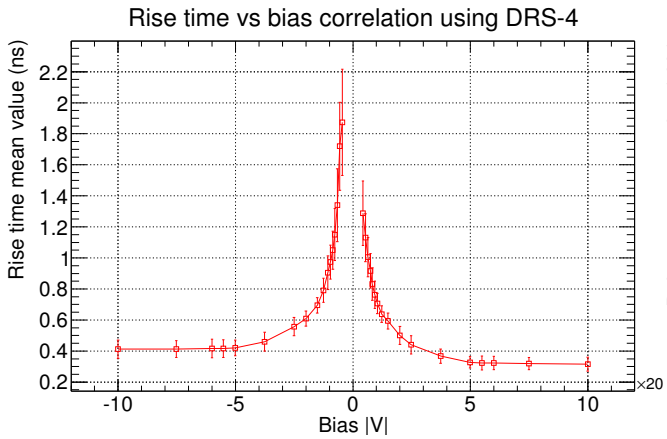


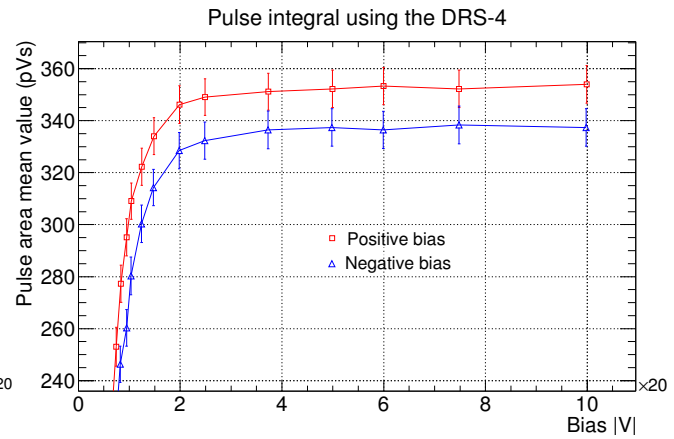

## DRS-4 main characteristics

- 12 bits
- up to 5 GHz sampling speed
- variable bin size
- BW 850 MHz  50 Ω ($-3$ dB)
- rise time $>$ 400 ps
- 4 chns per board
- internal FPGA
- several board connection
- USB bias & control
- designed at Paul Scherrer Institute
- cost $<$ 1000€

# DRS-4 measurements




- Pulses need to be fitted to get comparable time measurements.
- Gaussian fit give us all the parameters we need: rise time, FWHM and area.

- Rise time & FWHM bias correlations in good agreement with the 6 GHz oscilloscope.
- Positive bias (hole drift) gets higher CCE.

# Conclusions

1. 50 $\mu$m sc-CVD diamond detectors produce pulses with rise time (20-80%) $\approx$ 300 ps and FWHM $\approx$ 1 ns.

2. Relation between the FWHM and rise time ("shape factor") helps to determine the appropriate working bias for detectors.

3. Low-cost DAQ with bandwidth around 1 GHz can be employed to evaluate thin ($\geq$ 50 $\mu$m) diamond samples, not only regarding its temporal response but also charge collection to a qualitative level.

THANK YOU FOR YOUR ATTENTION !!!