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 $\approx 1$ns.
   - 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 µm.
- 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 (−3dB)
- Rise time 75 ps
- 8.5 to 11 bits
- up to 20 GS/S
- Statistics done
- cost > 30 k€
Traces + statistics are stored.
FWHM \approx 1 \text{ 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 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€
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 !!!