Update on graphene structures: Dirac point study

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Status a week ago

– We have seen the Dirac points in 5 different G-FETs belonging to two cells (cell 7 and cell 8).

– Dirac points position was always at high voltages $\sim$ 70-90 V seen when V_{back} and V_{top} were swept together maintaining an offset of 20 V between the two in order to grant depletion in Silicon.
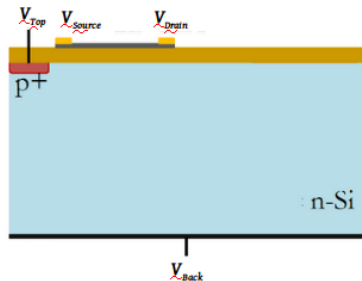
Study performed this week
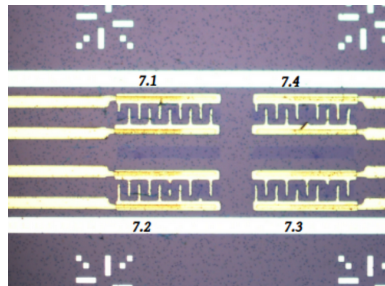
It was checked the Dirac point behavior:

– after a week;

– when increasing the offset between V_{back} and V_{top} up to 40 V when possible;

– when it is changed V_D-V_S in the range [-10 mV – 15 mV] ;

– when V_{back} is put at high values $\sim$ 130 - 150 V and then it is swept V_{top} up to 100V.

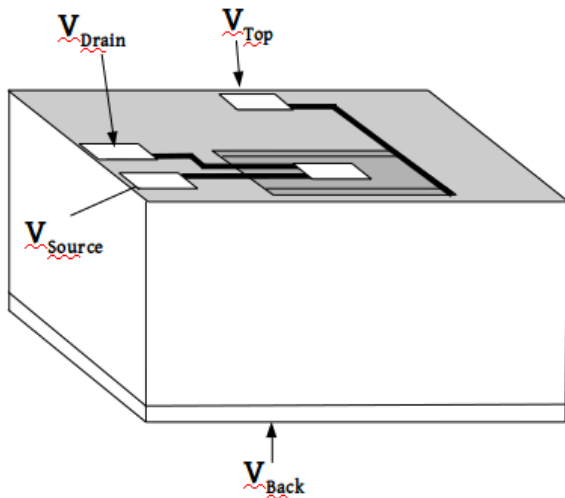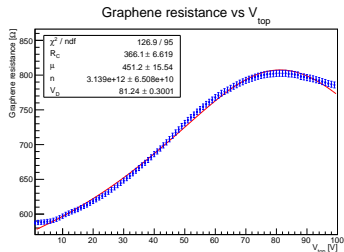# Sketch on how the measure is done

(a)

(b)
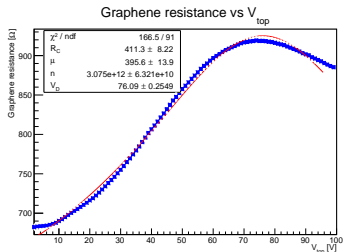
Sketch on how the measure is done

Dirac point position after a week

We observed a shift in the Dirac point position after a week on our structure of around 5 V. In figure the result for G-FET 7.1. Data obtained using Keithley 237 to provide a constant V_{back} of 130 V and sweeping, with Agilent 4156 C, V_{top} from 0 V to 100 V. V_D-$V_S = 5$ mV.
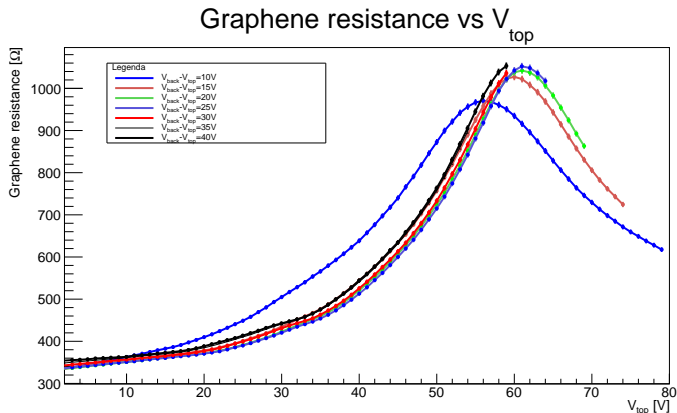

(c)

(d)

Dirac point increasing the offset between V_{back} and V_{top} up to 40 V
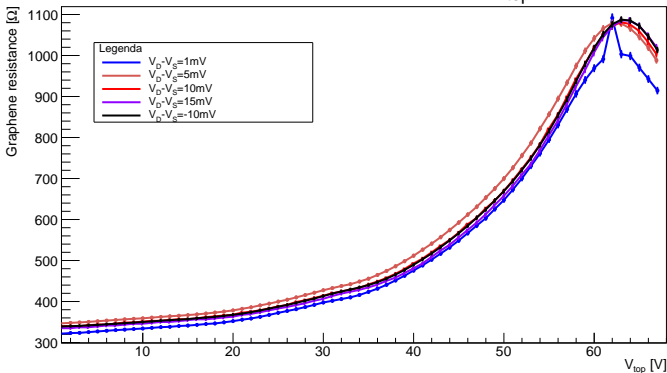
Data obtained using Agilent 4156 C to sweep synchronously V_{back} and V_{top}, while maintaining an offset of different voltages between the two contacts. V_D-V_S = 5 mV. The GFET is 8.4.

Graphene resistance vs V_{top}
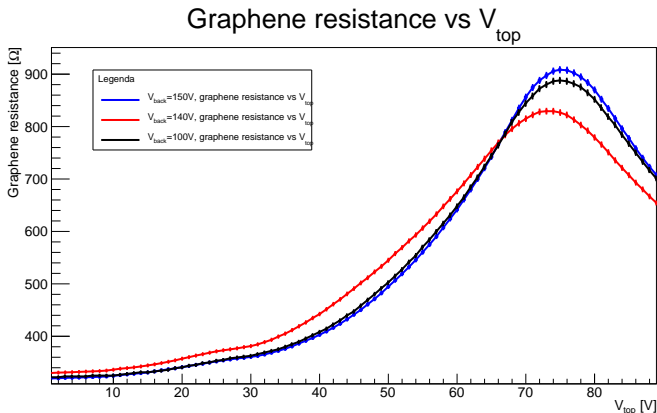
Dirac point changing V_D

Data obtained using Agilent 4156 C to sweep synchronously V_{back} and V_{top}, while maintaining an offset of 30 V between the two contacts. V_D-V_S = [-10 mV - 15 mV]. The GFET is 8.4.

Dirac point maintaining V_{back} t high voltages while sweeping V_{top}

Data obtained using Ke237 to provide an high constant value at V_{back} of 130 − 150 V, while Agilent 4156 C is used to sweep V_{top} from 0 to 100 V. V_D-V_S = 5 mV.

Graphene resistance vs V_{top}

Conclusions

– Dirac point seem pretty stable when depletion is imposed in Silicon and over-deplete does not seem to shift at lower voltages the Dirac point position;

– respect to a time scale of 1 week Dirac point position shows a shift in the deposition of 5-10 % ;

– No dependence seems to be present in the Dirac point position due to different values of V_D-V_S ;

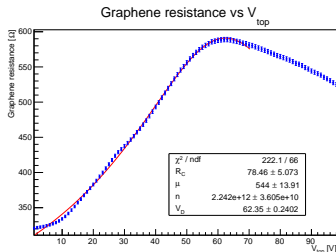– next week will receive a new chip with GFETs from NEST.
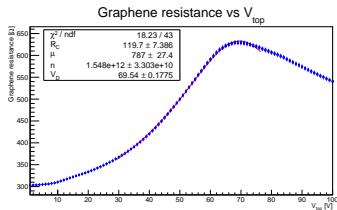
Back - up slides

Dirac point position after a week G-FET 7.3

Data obtained using Keithley 237 to provide a constant V_{back} of 130 V and sweeping, with Agilent 4156 C, V_{top} from 0 V to 100 V. V_D-V_S = 5 mV.
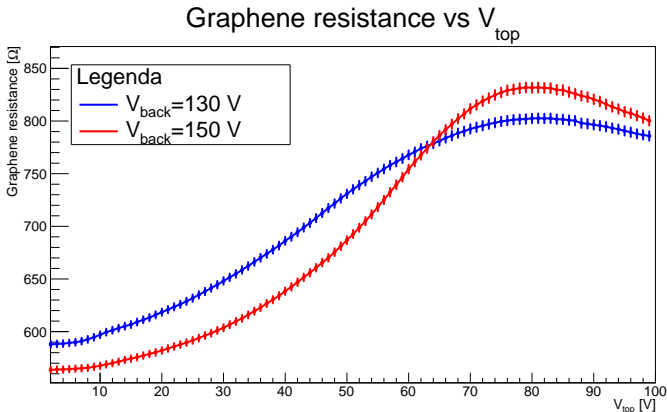

(e)

(f)

Dirac point maintaining V_{back} t high voltages while sweeping V_{top}

Data obtained using Ke237 to provide an high constant value at V_{back} of 130 − 150 V, while Agilent 4156 C is used to sweep V_{top} from 0 to 100 V. V_D-V_S = 5 mV. GFET 7.1.

Dirac point maintaining V_{back} t high voltages while sweeping V_{top}

Data obtained using Ke237 to provide an high constant value at V_{back} of 130 – 150 V, while Agilent 4156 C is used to sweep V_{top} from 0 to 100 V. V_D-V_S = 5 mV. GFET 7.3.