Single Crystal Diamonds

sensor id	x, um	y, um	z, um
1149	4960	4980	450
1367	5000	5000	410
0642612-17	4920	4930	500
064612-13	4950	4970	350
0642612-34	4940	4940	445
0642612-8	4930	4940	470
0642612-28	4900	4900	530
1366	5000	5000	410

8 single crystal diamond sensors from GSI.

Remains of some diamond detector research program.

Properties unknown

Metallisation standard Au-Pt-Ti, annealed

“TOP” of the sensor is side with the label on the frame

Positive voltage is when top connected to “+” of HV

Measurements

IV measurements

Standard procedure. Measurement in a dry nitrogen atmosphere.
30 seconds wait after changing the voltage, 10 measurments made after that with interval of 1 second and averaged.
Data saved in the CEC database.

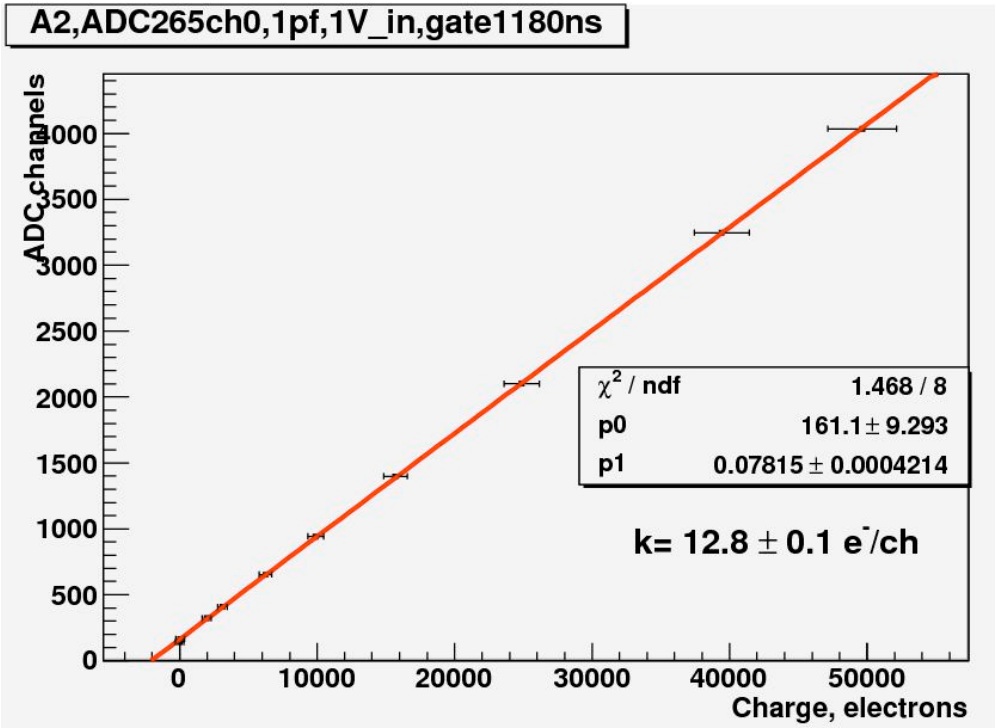
CCE measurements

Standard procedure too. Used our main CCE setup.
Used 2mm lead collimator between source and sensor
2mm G10 collimator between the sensor and trigger
- 4x5mm collimators in front of the source.

Preamp A2, ADC V265 - Ch0

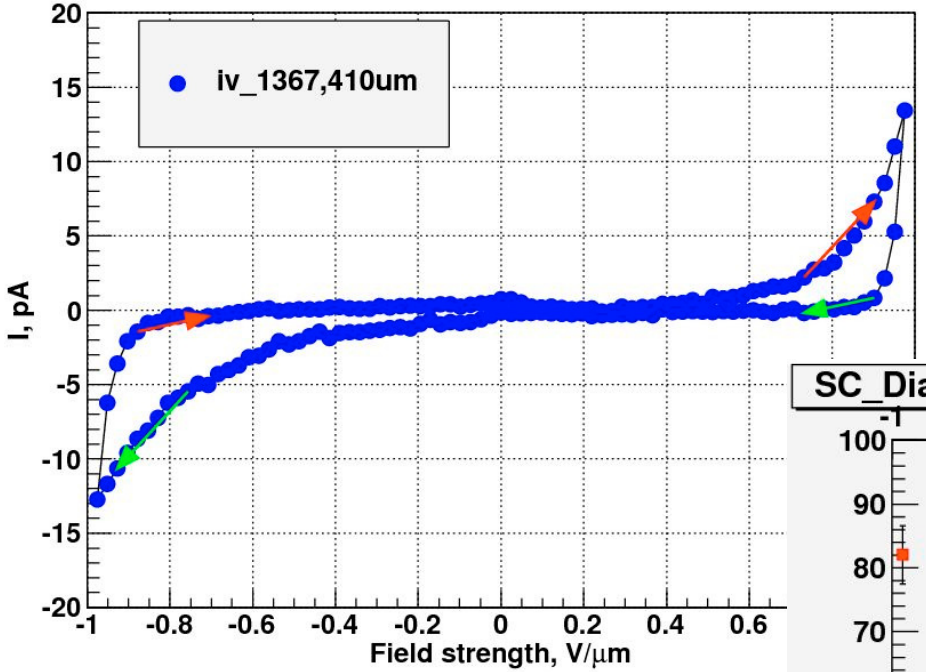
CCE setup changes

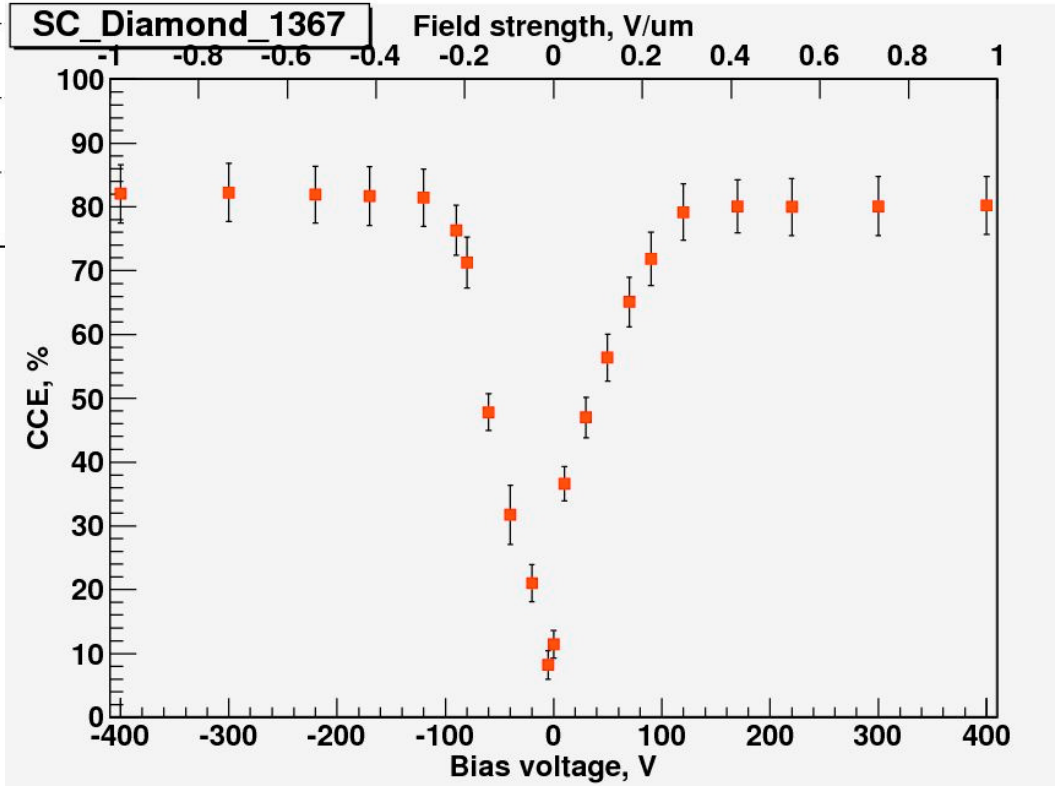
Gate changed to 1180ns.
Signal and calibration paths are adjusted to have the same signal delay in respect to gate. Now it is 120 ns in both cases.



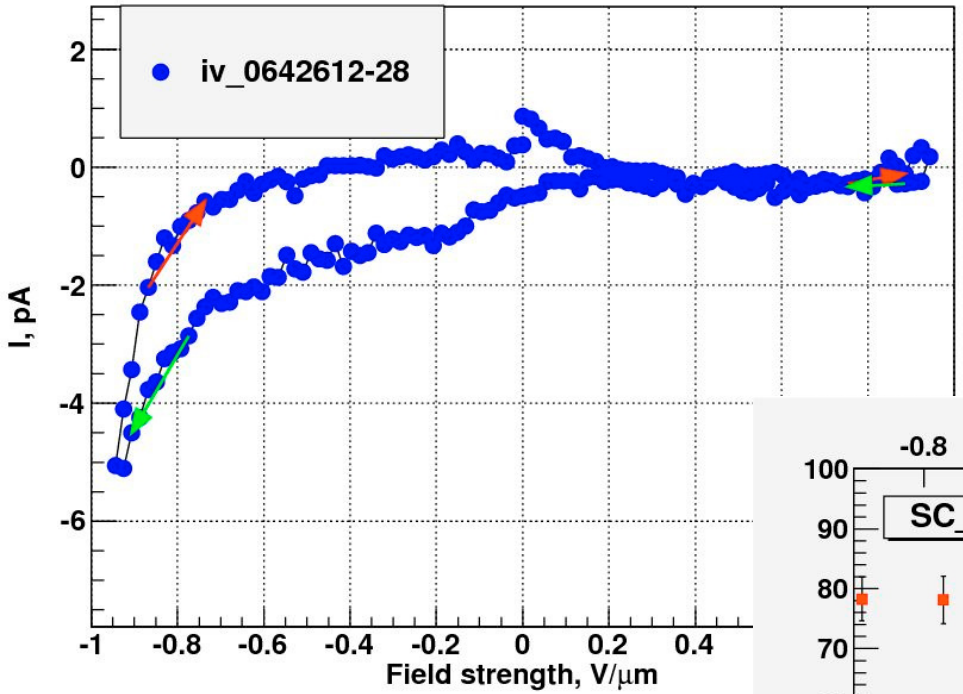
Need to check capacitor

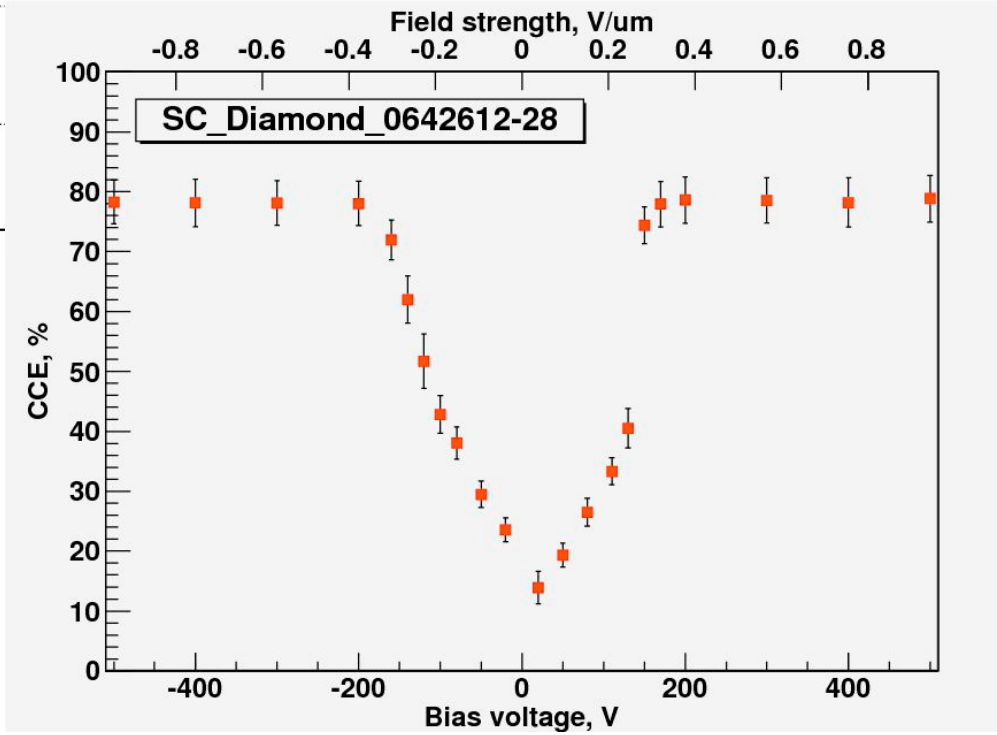
1367


iv_1367,410um
I, pA
Field strength, V/μm

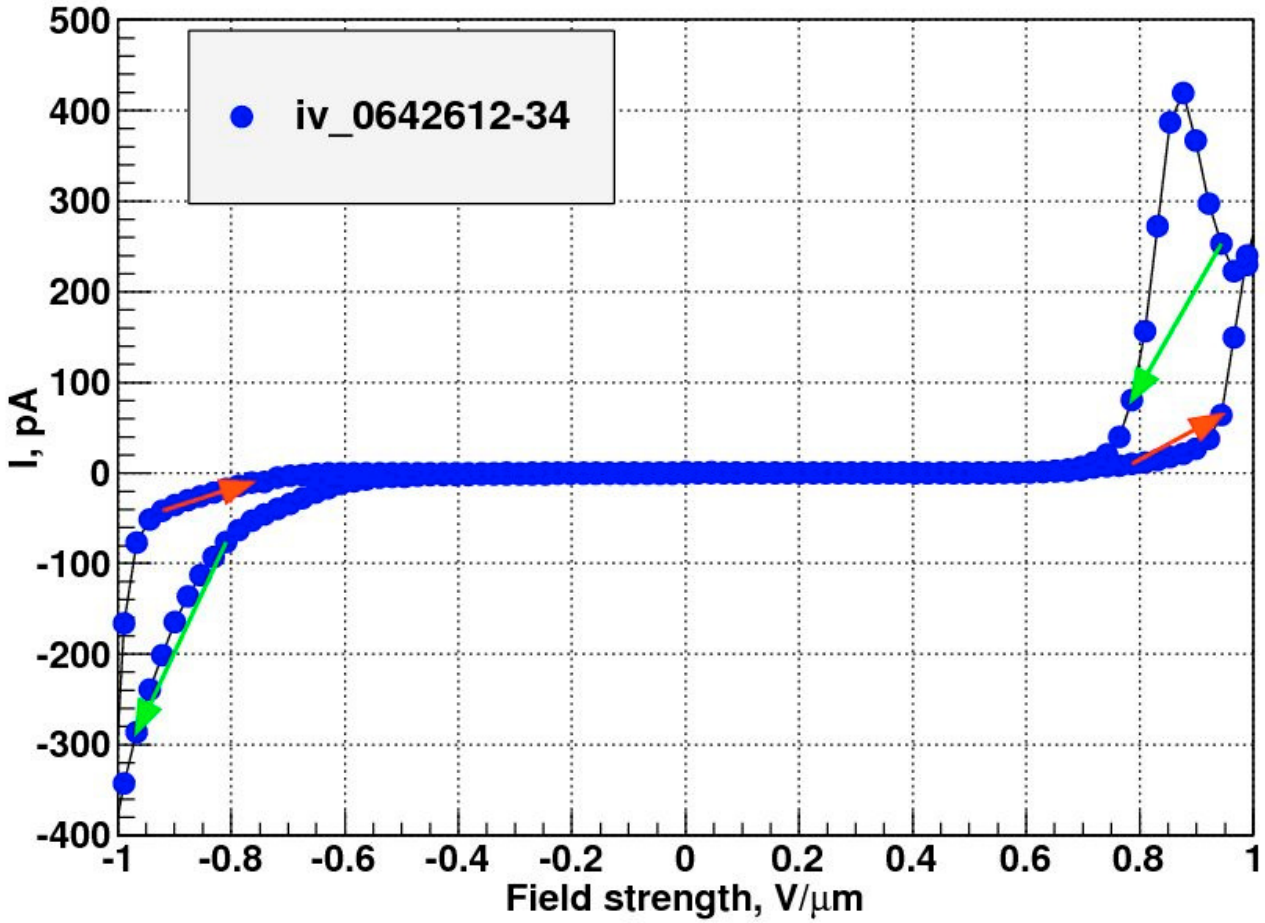

SC_Diamond_1367
Field strength, V/um
CCE, %
Bias voltage, V

0642612-28

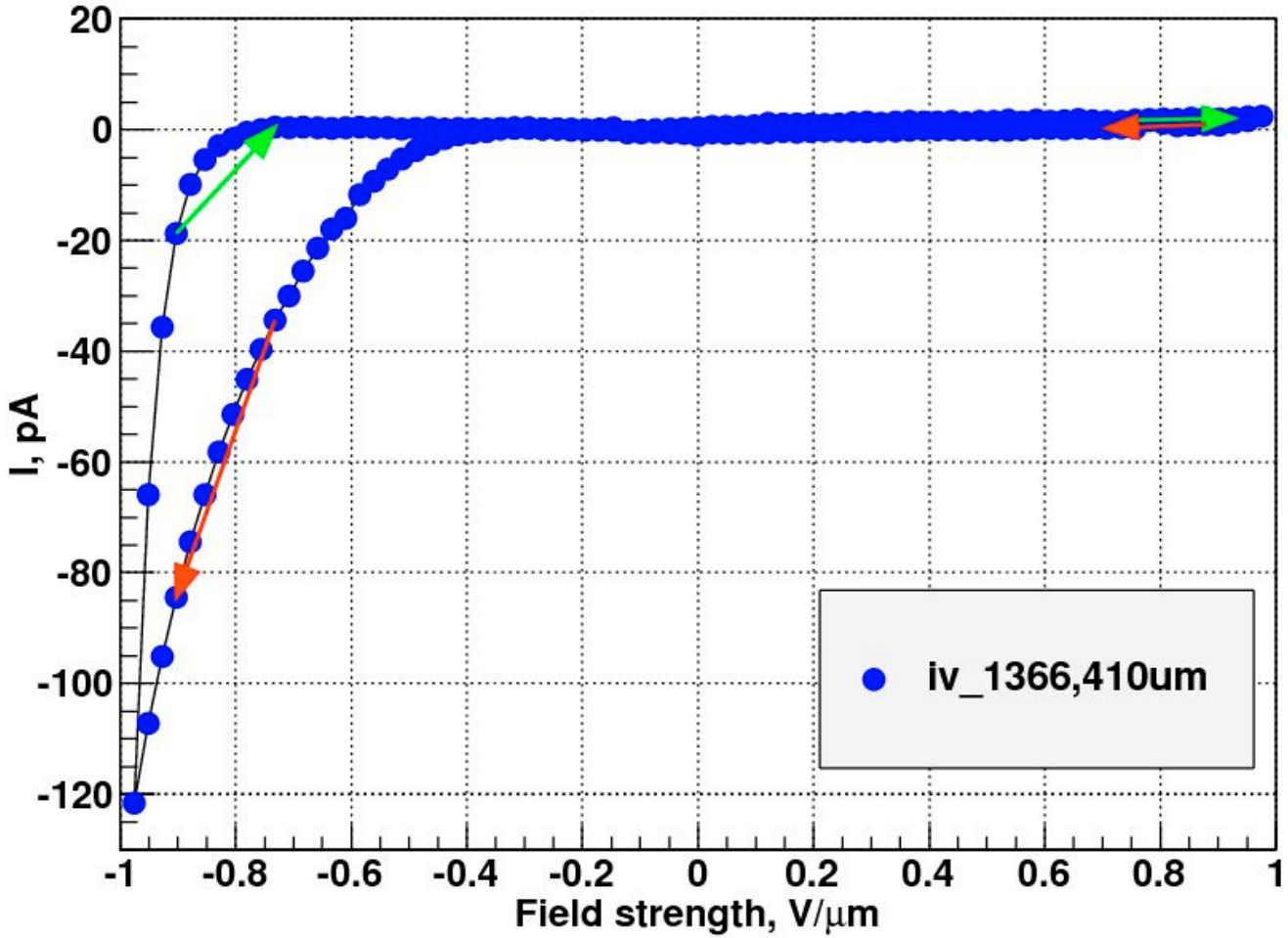

iv_0642612-28
I, pA
Field strength, V/μm
2
0
-2
-4
-6
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4


Field strength, V/um
SC_Diamond_0642612-28
CCE, %
Bias voltage, V
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
100
90
80
70
60
50
40
30
20
10
0
-400
-200
0
200
400

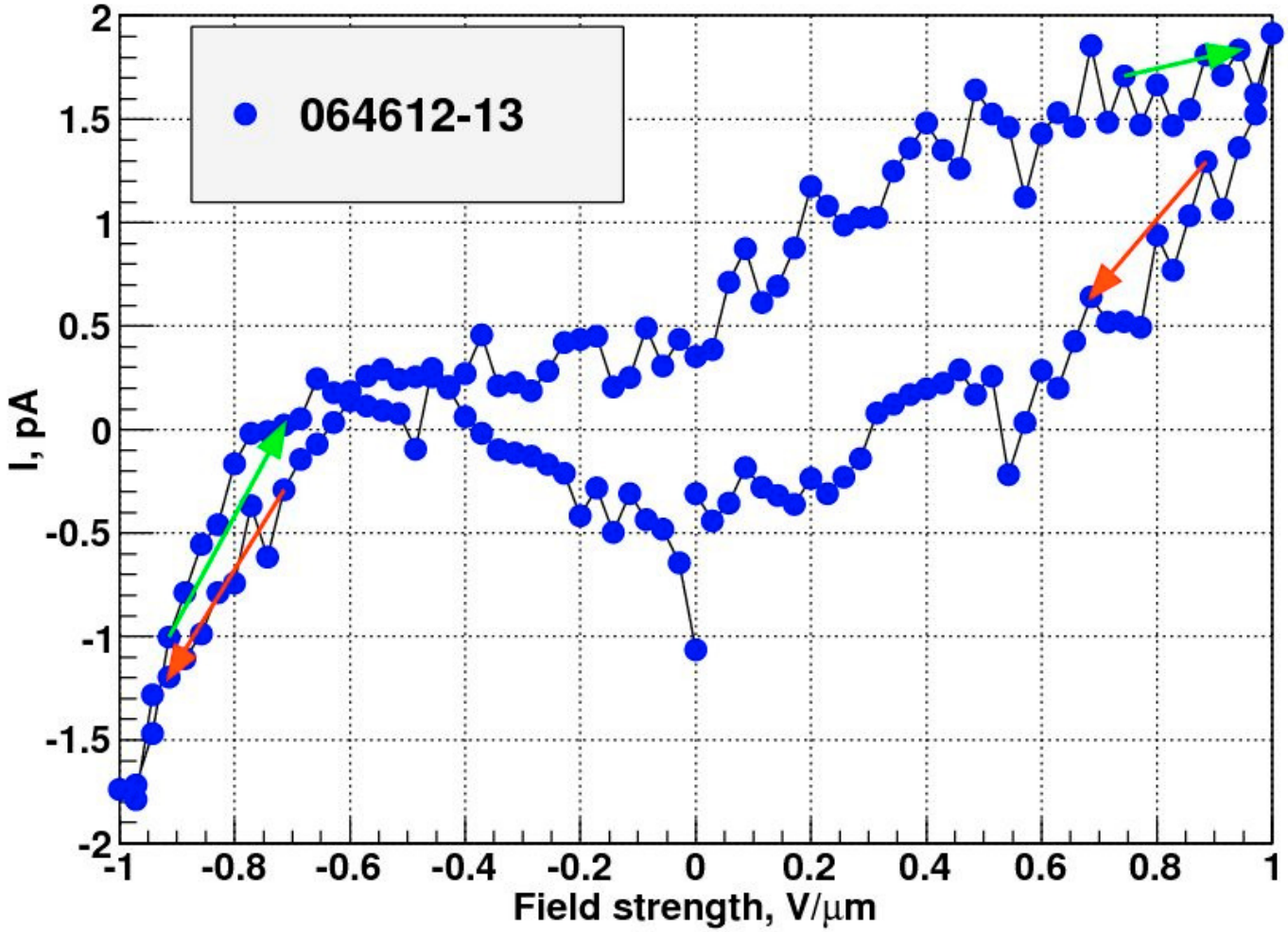
0642612-34


iv_0642612-34
I, pA
Field strength, V/μm
500
400
300
200
100
0
-100
-200
-300
-400
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

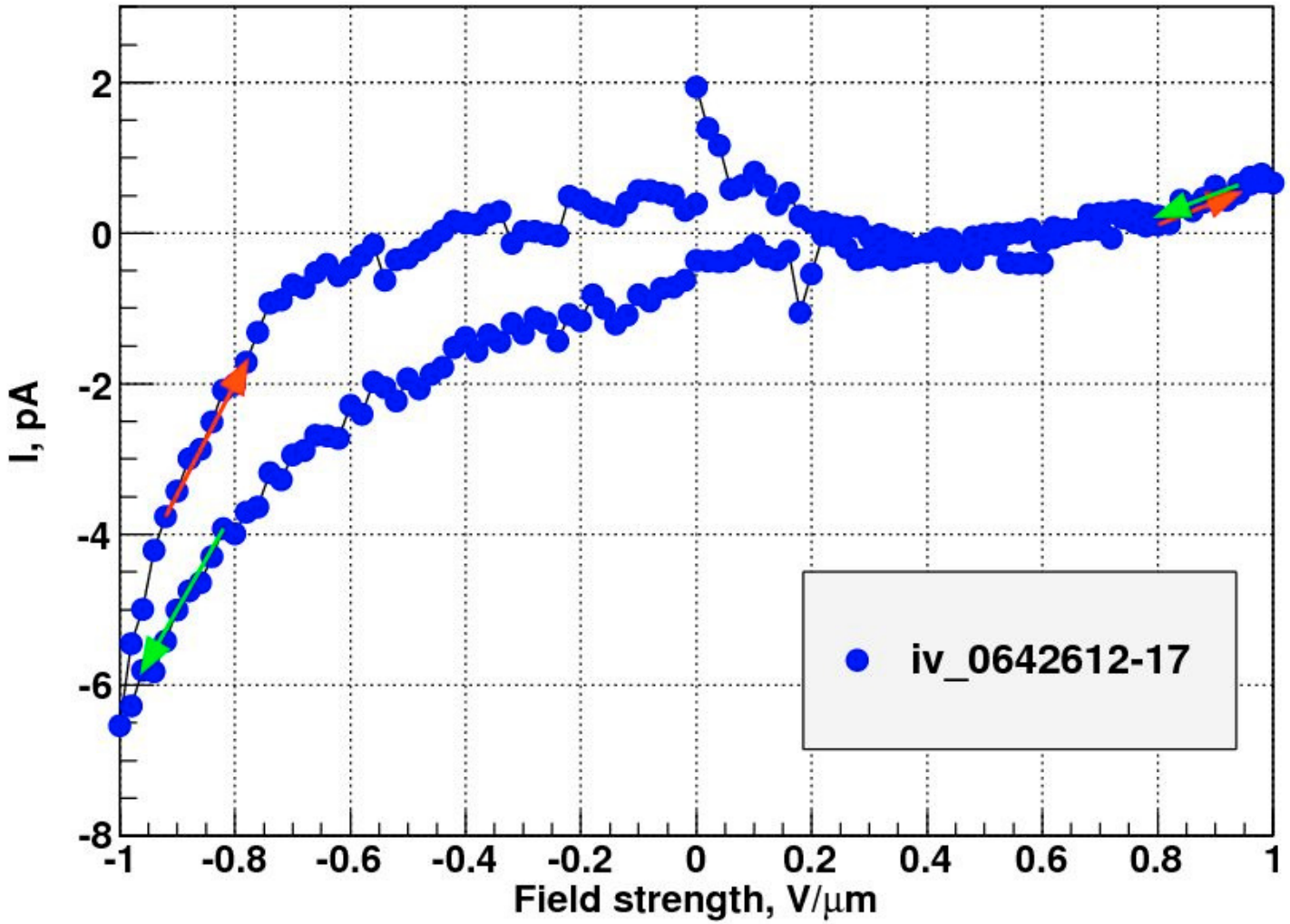
1366


20
0
-20
-40
-60
-80
-100
-120
I, pA
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Field strength, V/μm
iv_1366,410um

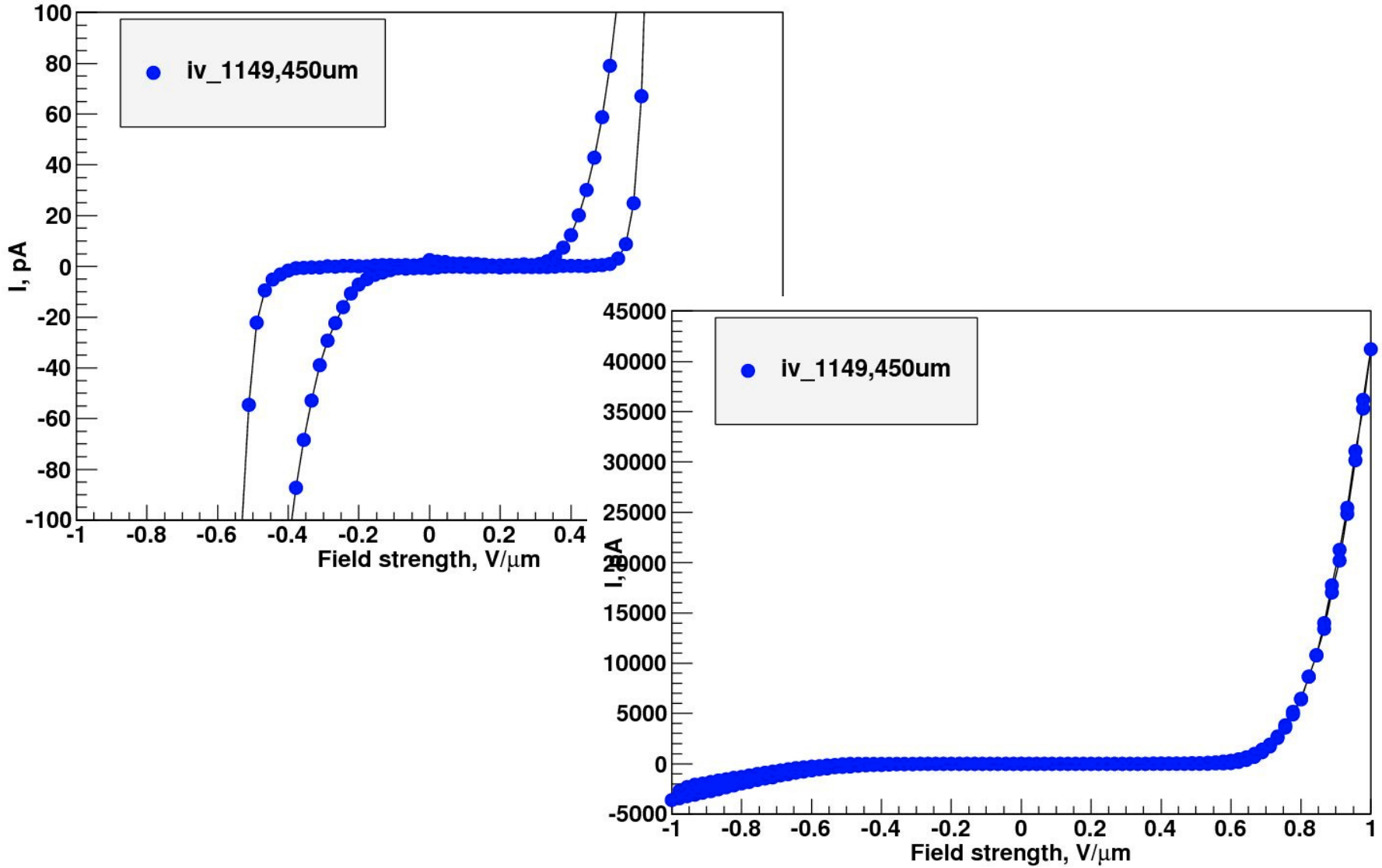
064612-13


064612-13
I, pA
Field strength, V/μm
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

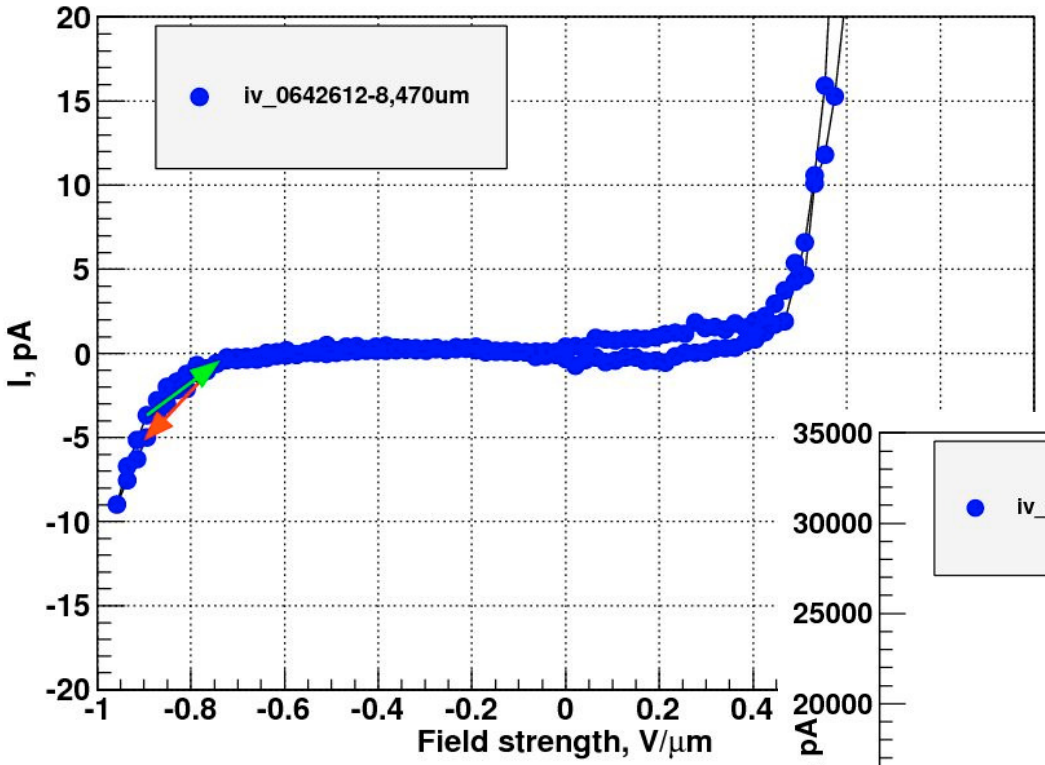
0642612-17

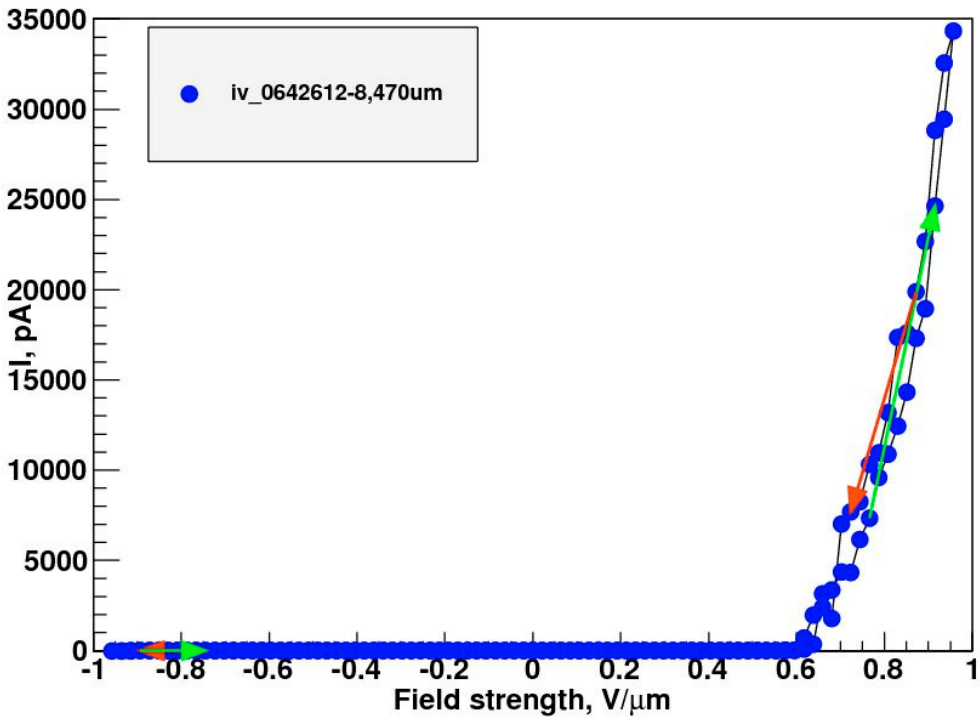

I, pA
2
0
-2
-4
-6
-8
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
Field strength, V/μm
iv_0642612-17

1149


iv_1149,450um
I, pA
Field strength, V/μm
100
80
60
40
20
0
-20
-40
-60
-80
-100
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
iv_1149,450um
I, pA
Field strength, V/μm
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

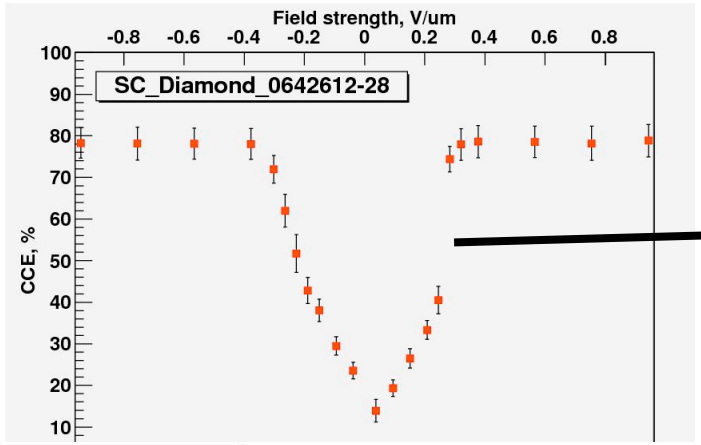
0642612-8


iv_0642612-8,470um
I, pA
Field strength, V/μm
20
15
10
5
0
-5
-10
-15
-20
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4

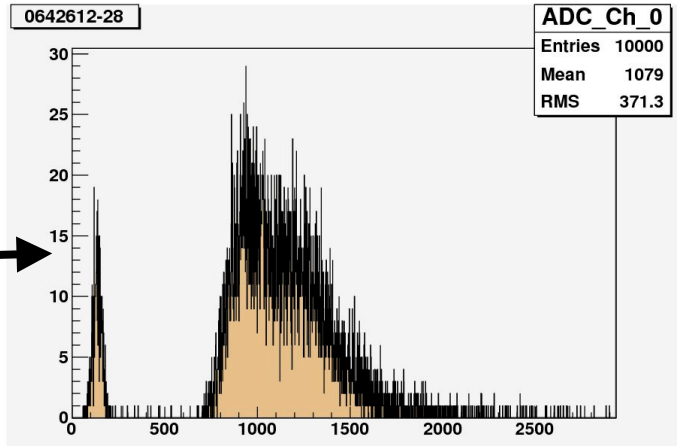

iv_0642612-8,470um
I, pA
Field strength, V/μm
35000
30000
25000
20000
15000
10000
5000
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

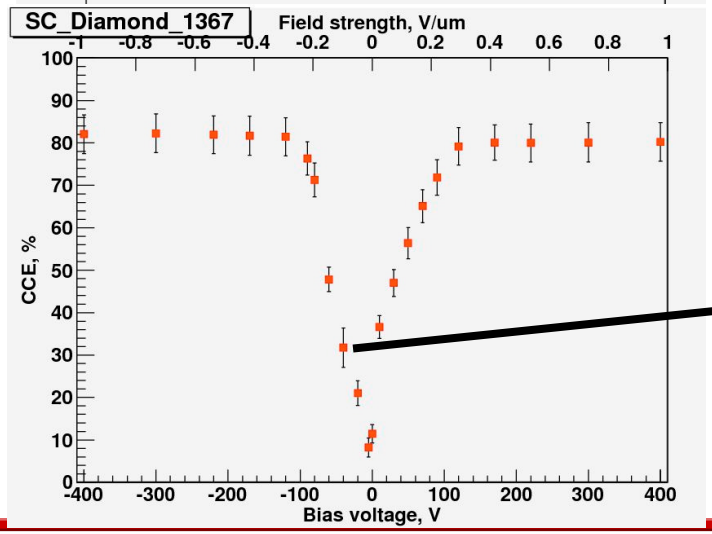
Doublepeaks

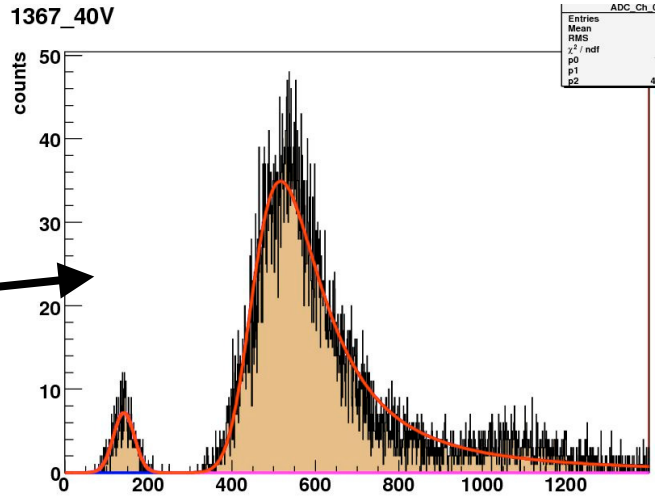
At the point of fast rise of CCE with HV some of the sensors show curious double peaks. The double peaks are gone near saturation.



140 V

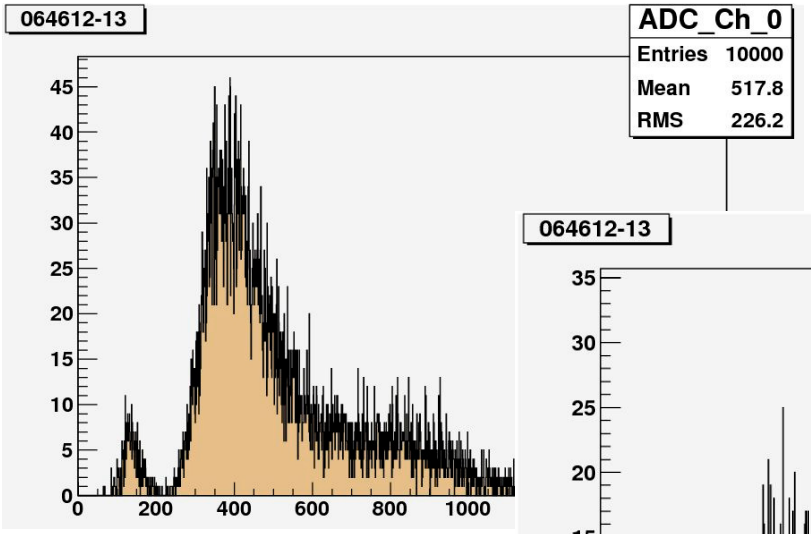




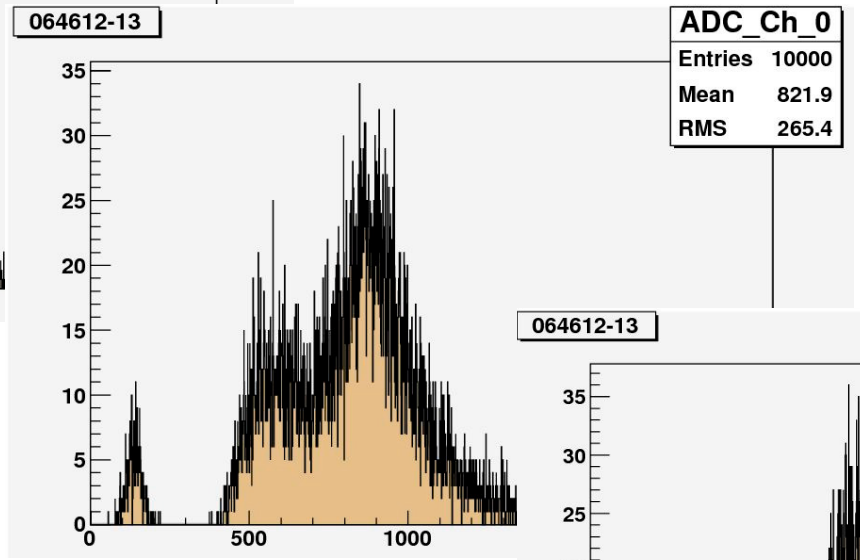


Doublepeaks

This effect was most pronounced for sensor 064612-13

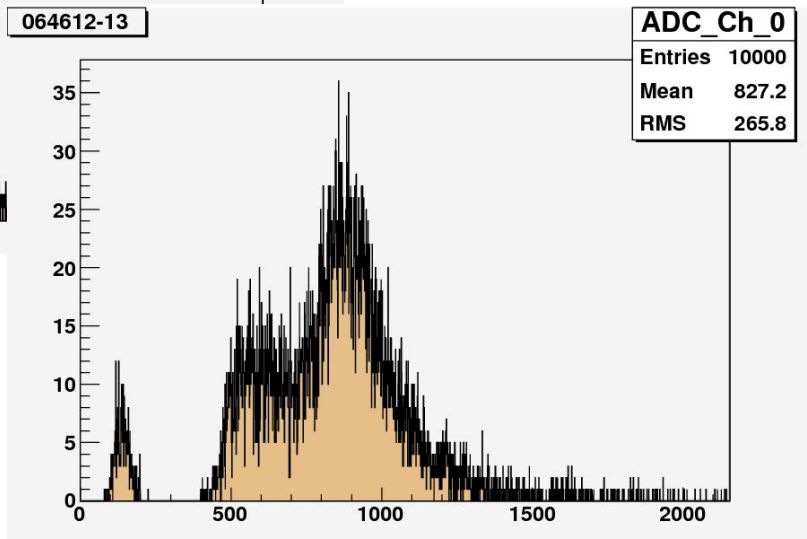


10V



30V

40V



Things to discuss

Pedestal values used for CCE calculation - fixed or from fit?
Pedestal is shifted a bit due to positive signal overshoots,
but so is the signal.
Anyways, it is in the order of 5 ADC channels for ~1000 channel signal.

MPV of deposited energy in our setup depends on the detector thickness and also a bit different from that of a MIP.
This was demonstrated by Sergey Schuwalow for GaAs detectors
GEANT simulation shows 160 for 500 um thick GaAs and 150 for 200 um.
We have always used value of 36 e-h pairs per micron for diamond.
Do we have some other value? Good idea to make a simulation.