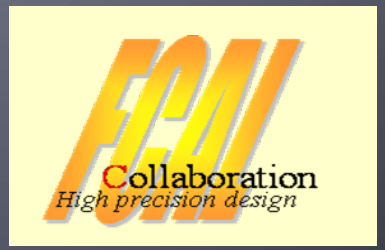
Comparison of CCD measurements for csCVD diamonds after irradiation

After TestBeam 2010 Rossendorf

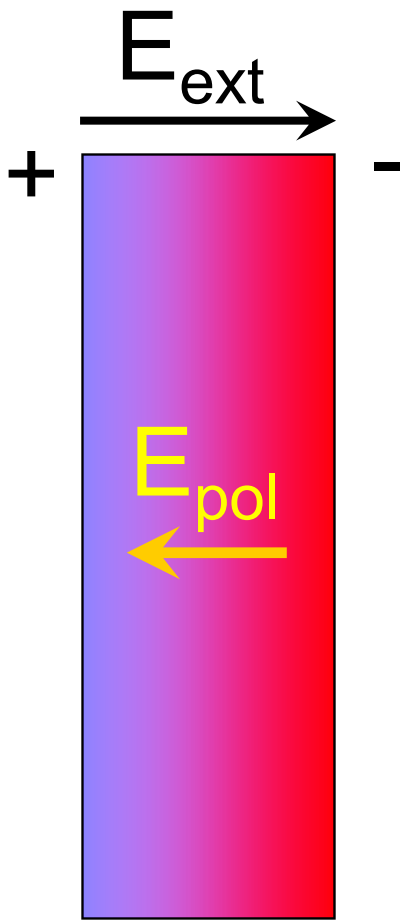
Olga Novgorodova, Sergey Schuwalow
DESY Zeuthen



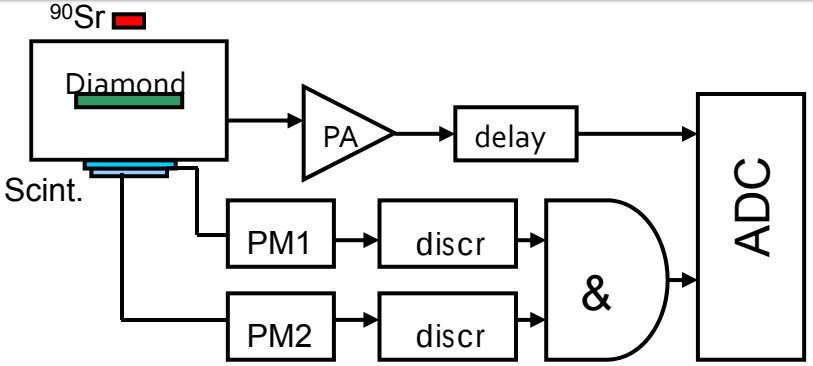
Two csCVD diamonds

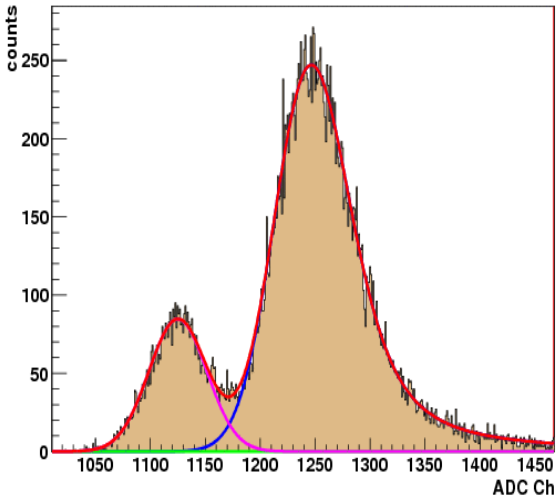
- Two csCVD diamond (6A100 and So14-10)
- 6A100 -> 100µm : So14-10 -> 320 µm
- Irradiated up to several MGy

- Polarization significantly decreases the detector charge collection efficiency in addition to pure trapping mechanism

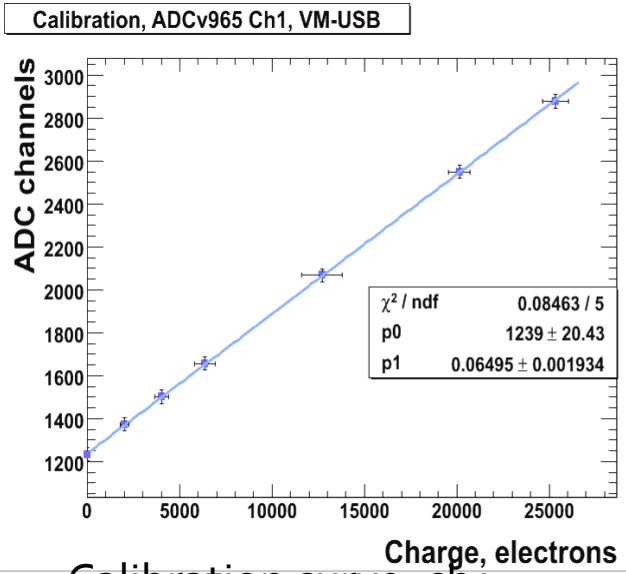


MIP Response of scCVD Diamond



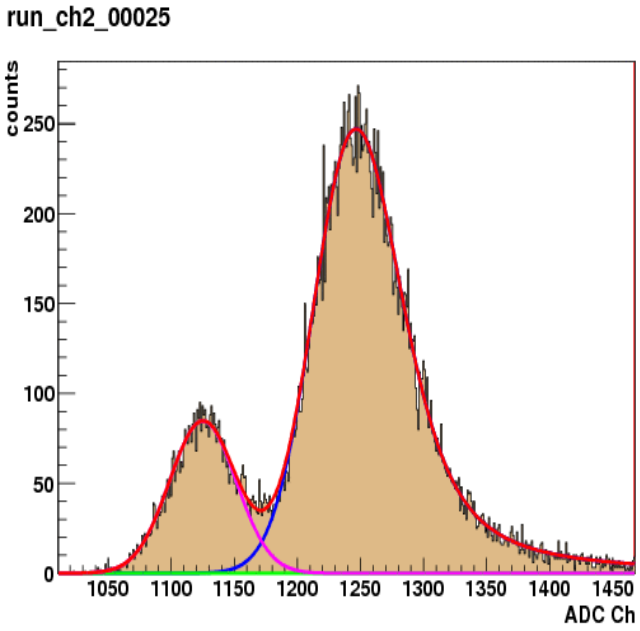


ADC spectrum



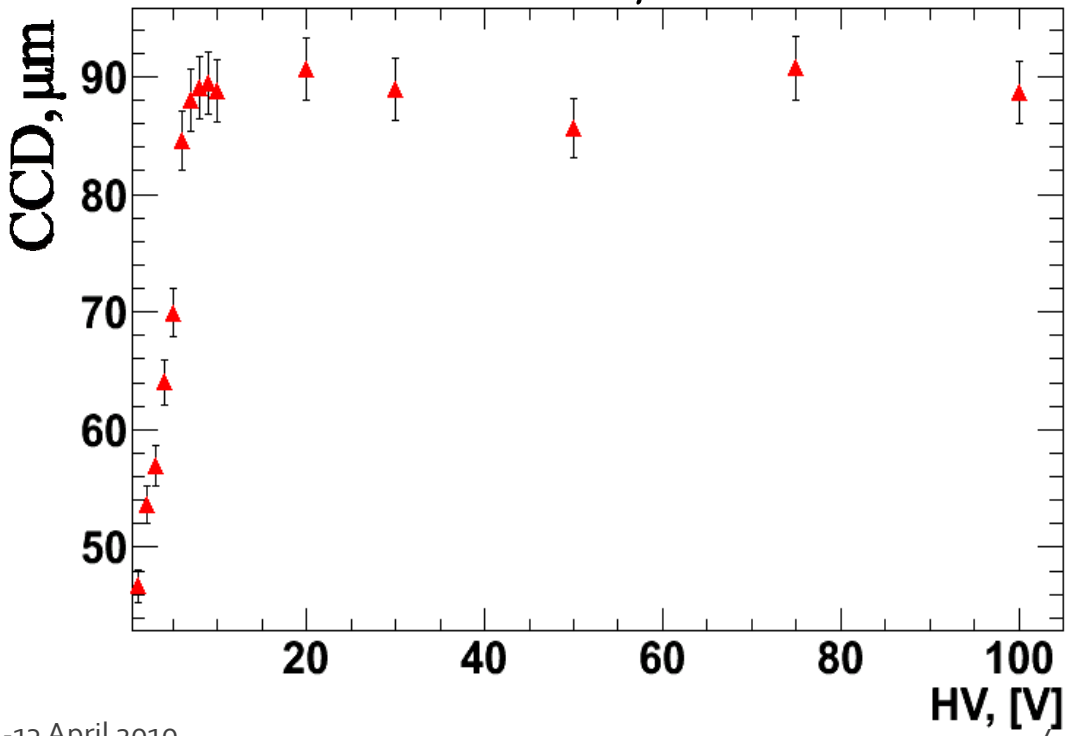
Calibration curve, ch1

Sensor under ^{90}Sr Source: CCD vs HV



$$CCE = \frac{Q_{collected}}{Q_{induced}}; \quad CCD = CCE * d_{diam}$$

$$CCD = \frac{(GL_{andau} - P_{edestal}) * K_{calibration}}{36e/\mu m}$$

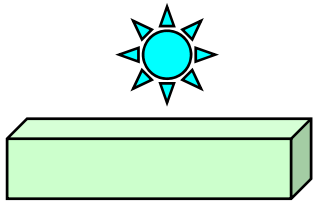


Before Test Beam in Rossendorf CCD for the 6A100 csCVD diamond was measured as a function of HV

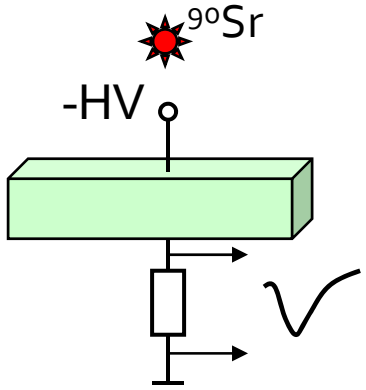
Maximum CCD is around 90µm

Damaged Sensor under ^{90}Sr Source: CCD vs time

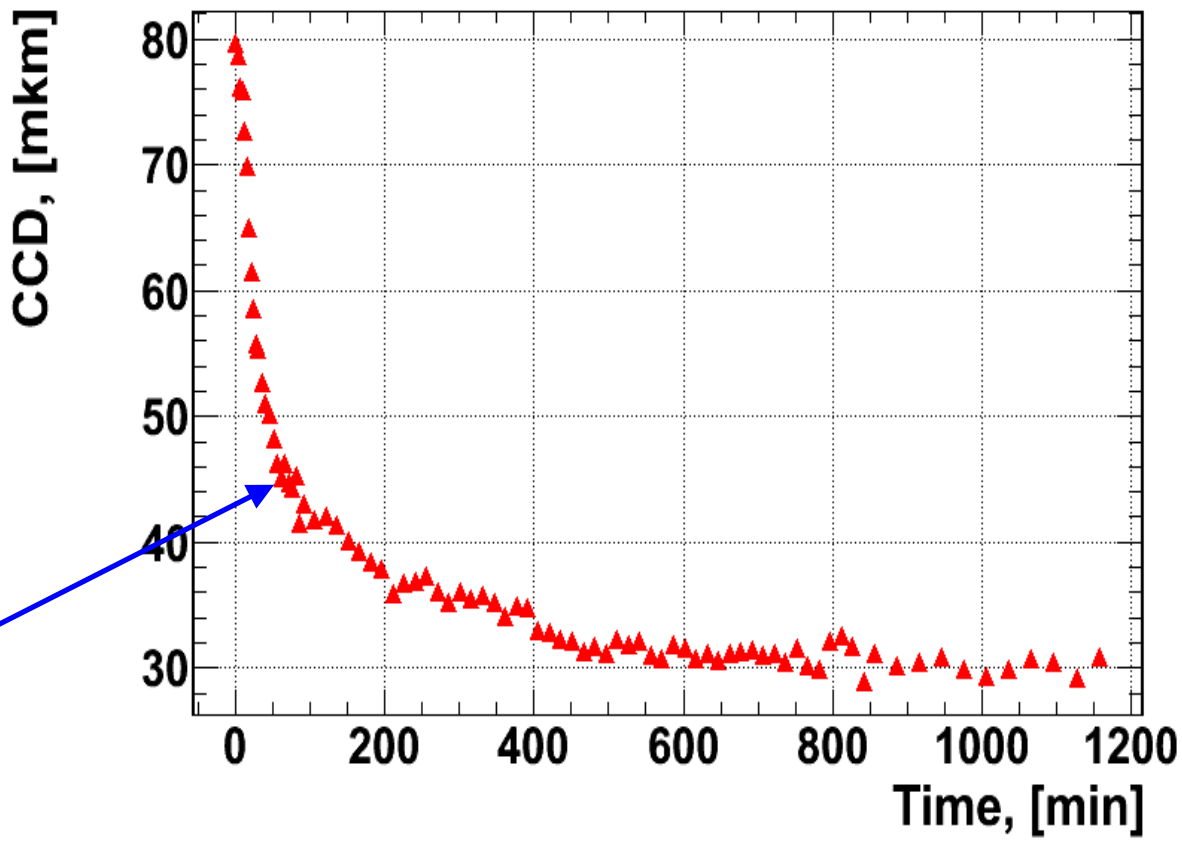
Illuminate by UV-light to free all traps



Apply HV and source



6A100 100μm diamond after irradiation, ^{90}Sr-test

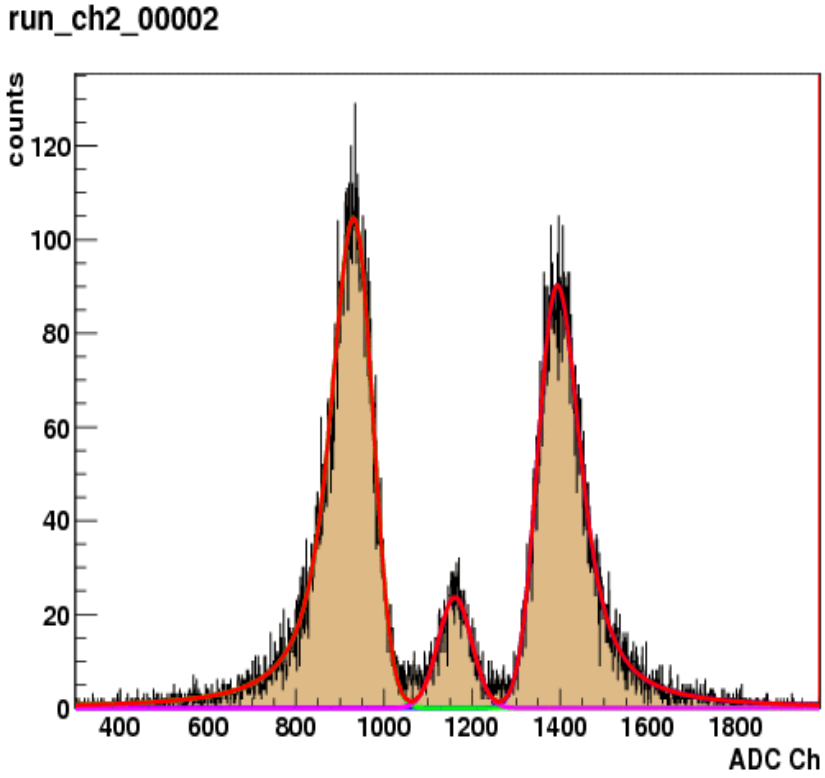


Method of routinely switching bias HV polarity

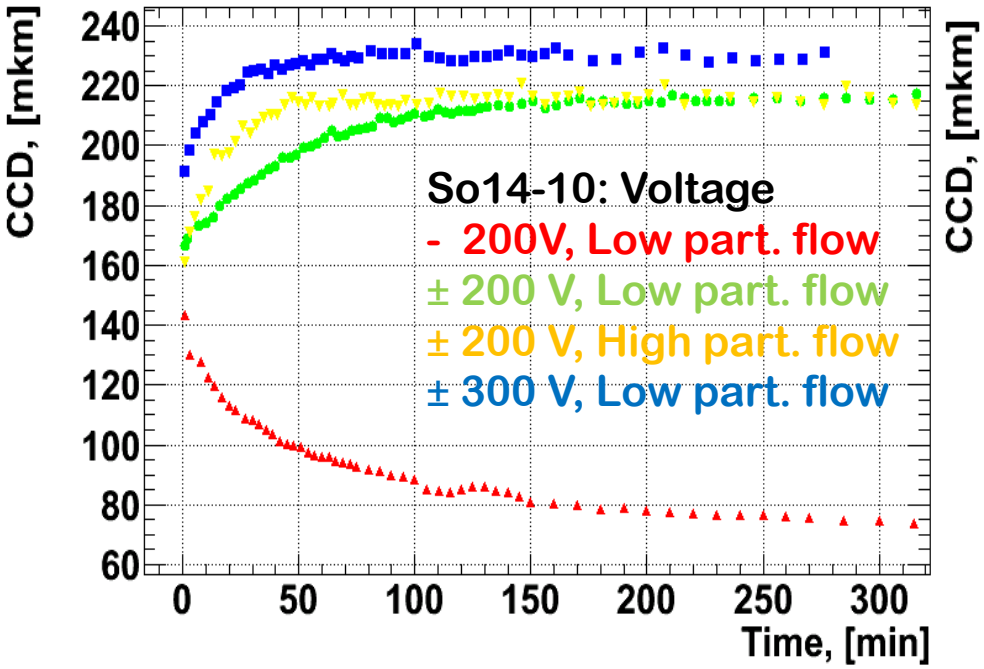
Switch HV ±60, ±120V for 100μm csCVD diamond 6A100
And ±200, ±300V for 320μm csCVD diamond So14-10

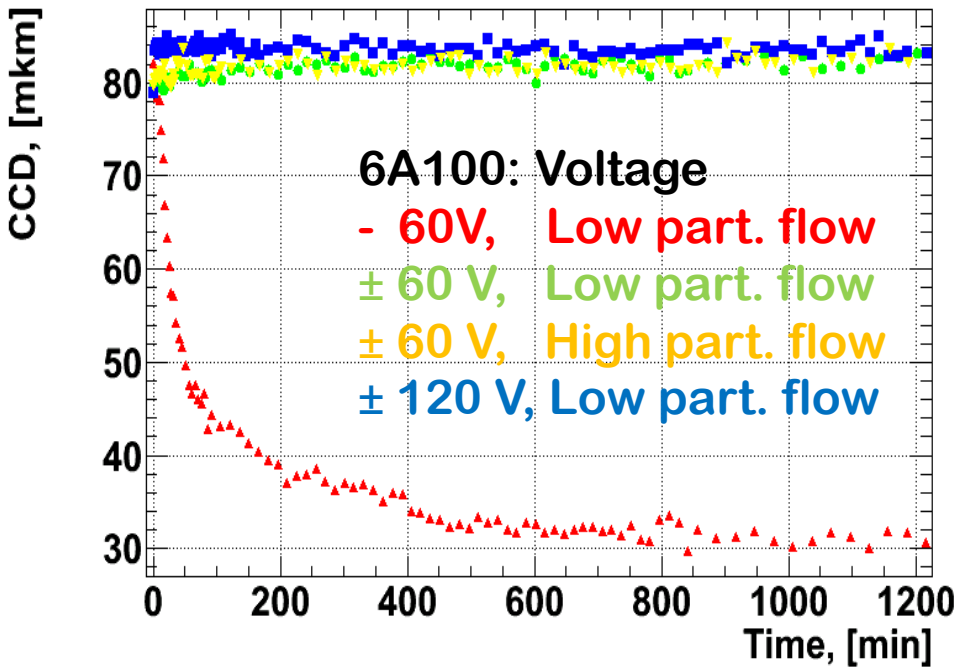
To suppress bulk polarization of long-living traps

Switching frequency
0.1Hz



CCD vs Time and conclusions





For S014-10 (320μm) switching HV polarity algorithm helps to increase CCD vs Time. And with increasing HV increase CCD.
For 6A100 (100μm) – CCD stay in saturation value around 90μm

- **Thank You!**