# Investigation of Detector Properties of Diamond-on-Iridium Sensors

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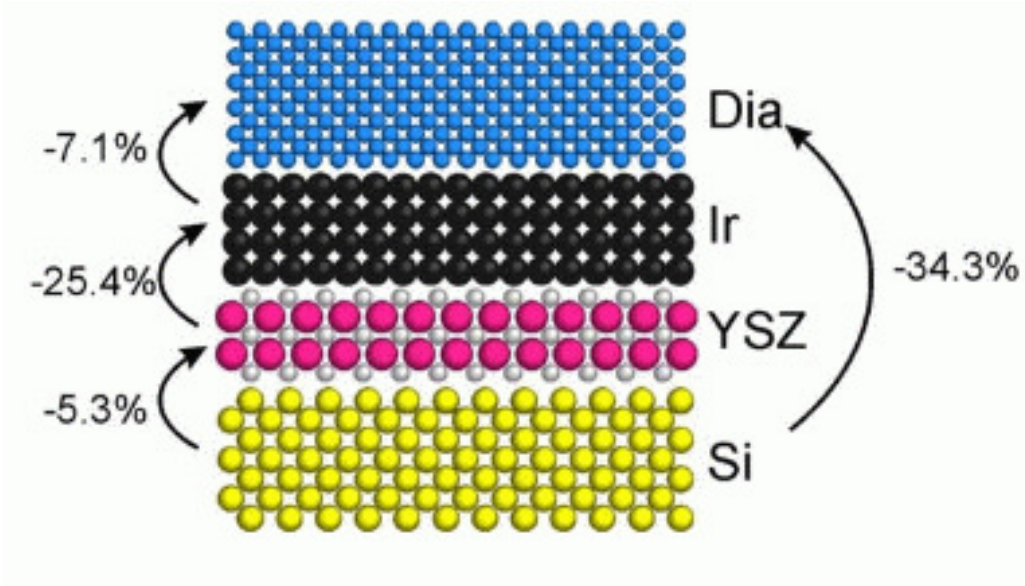
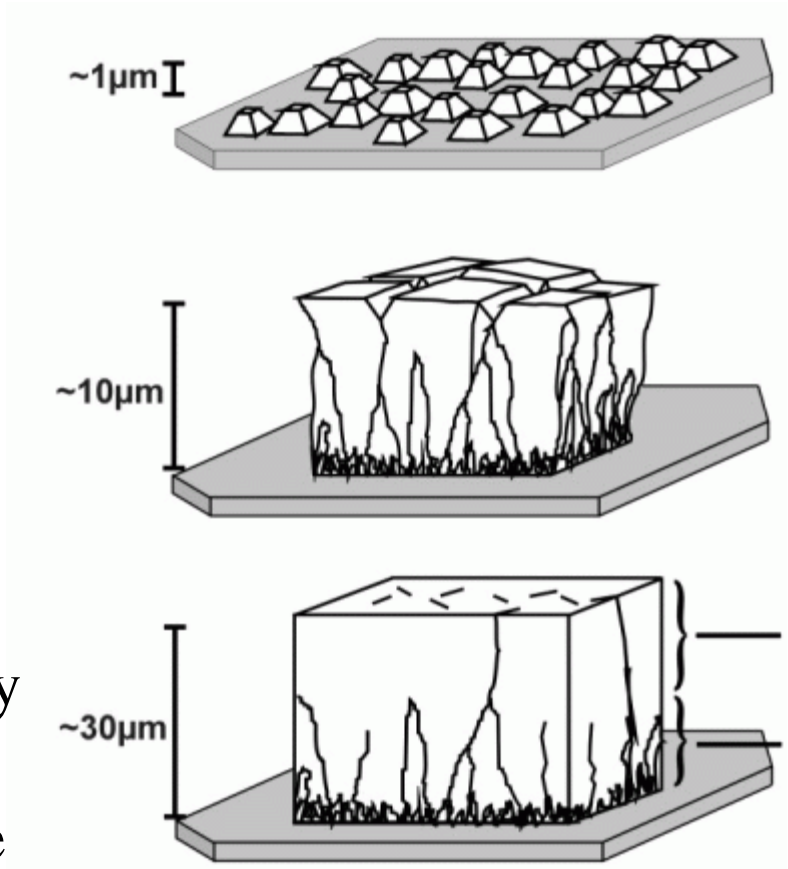
# Diamond on iridium



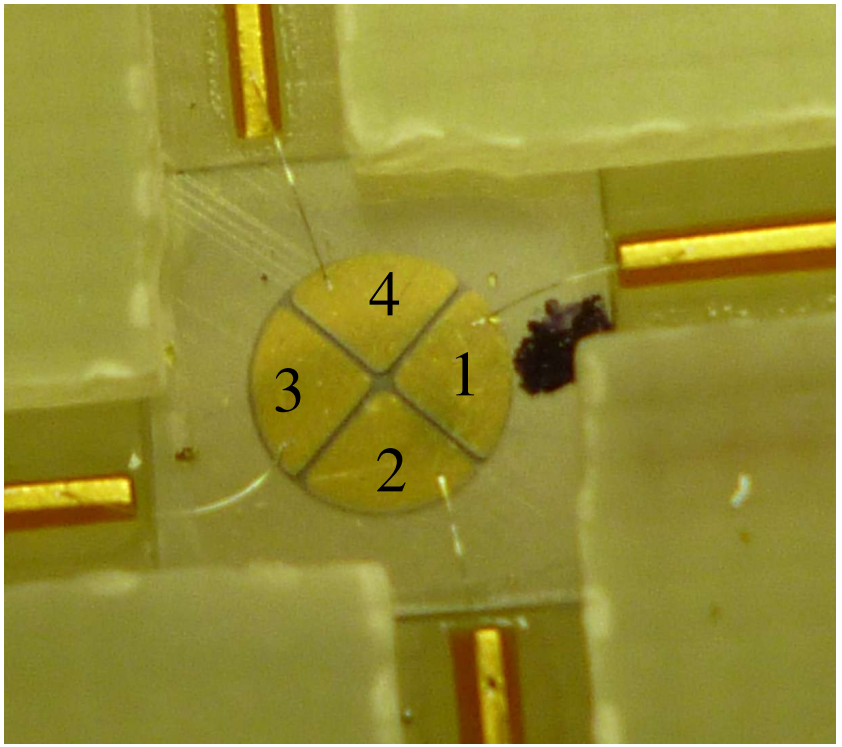

Iridium substrate provides high-density and highly ordered nucleation.
The crystallites are converging and the Boundaries are mostly gone after some 10th um growth => (should be) close to single crystal material

# Samples

Produced at Augsburg University
http://www.physik.uni-augsburg.de/
de/lehrstuehle/exp4/Arbeitsgruppen/diamant/

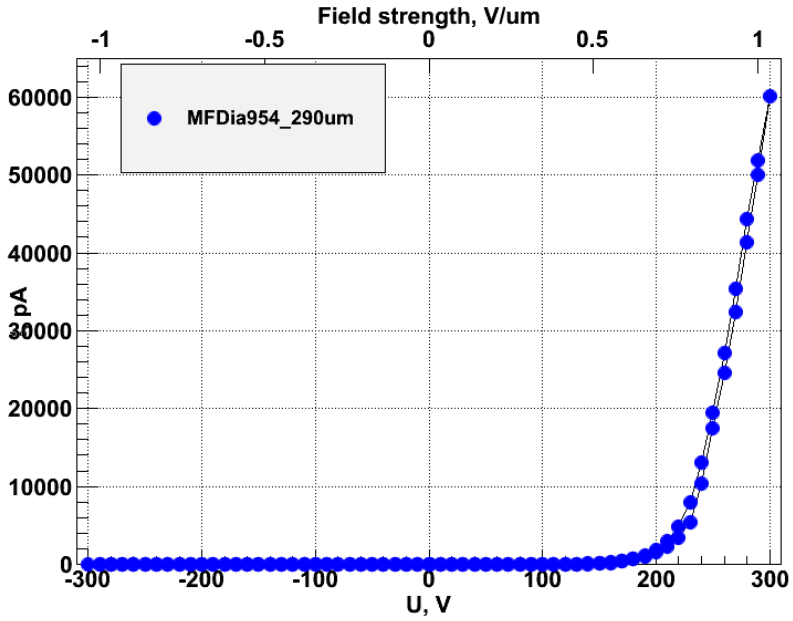
**MFDia954: 4.94x4.96mm x 290µm,**
**metallisation: 50nm Ti, 90nm Pt,**
**100nm Au (∅3mm)**

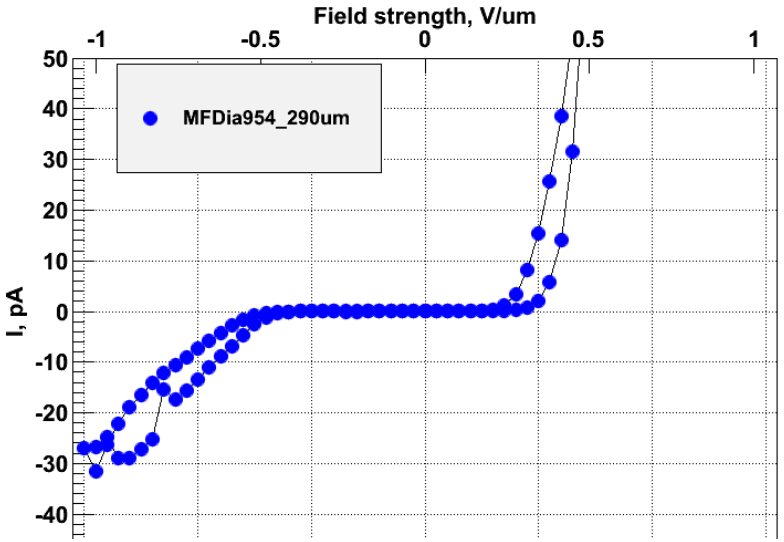
MFDia886-2: 3.49x3.5mm x 324µm,
metallisation: 100 nm Al
MFDia953: 4.9x4.95mm x 280µm,
metallisation: 100 nm Al

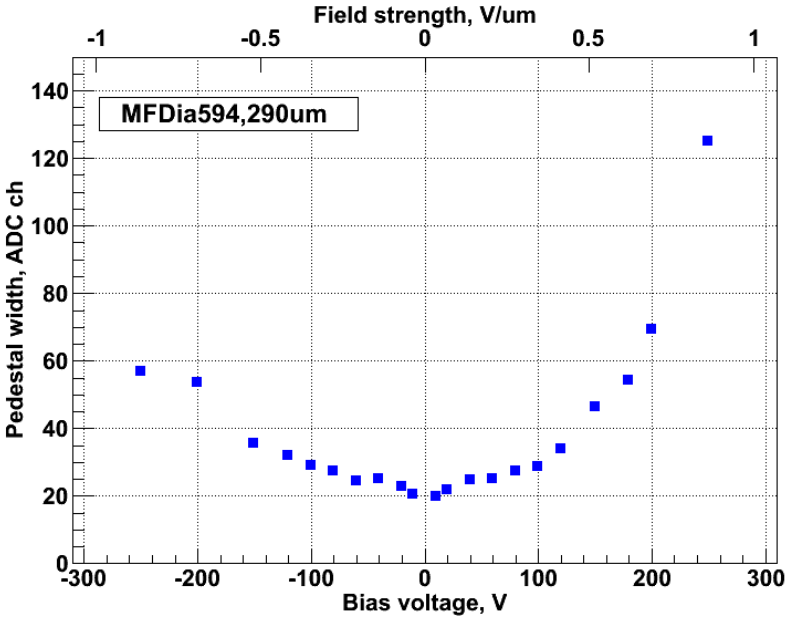



Bonding to Al metallisation problematic
We were able to properly contact only MFDia886-2
And only with conductive glue

# MFDia 954, IV measurements



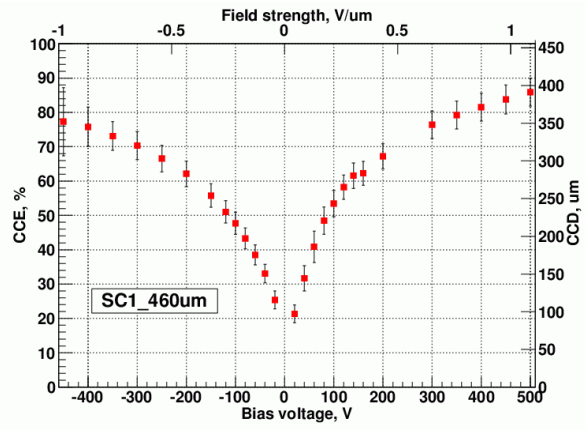



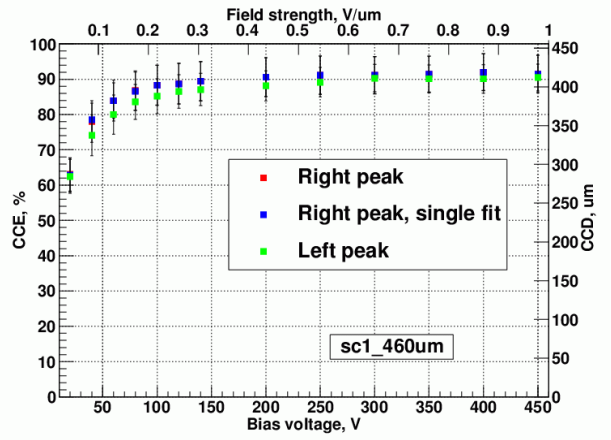



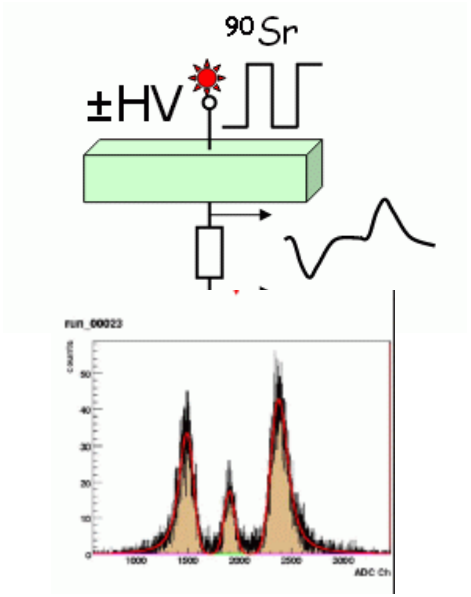

Current spike corresponds to increased noise, CCE measurements are difficult above 250V

# CCE Measurements

Standard CCE setup with Sr source.
Modes: Constant HV – constant high voltage applied
Alternating voltage – HV applied as a square wave
Frequency 1 – 0.1 Hz. This allows to suppress polarisation effects due to deep traps. (there is a significant difference for poly and damaged mono crystalls.)

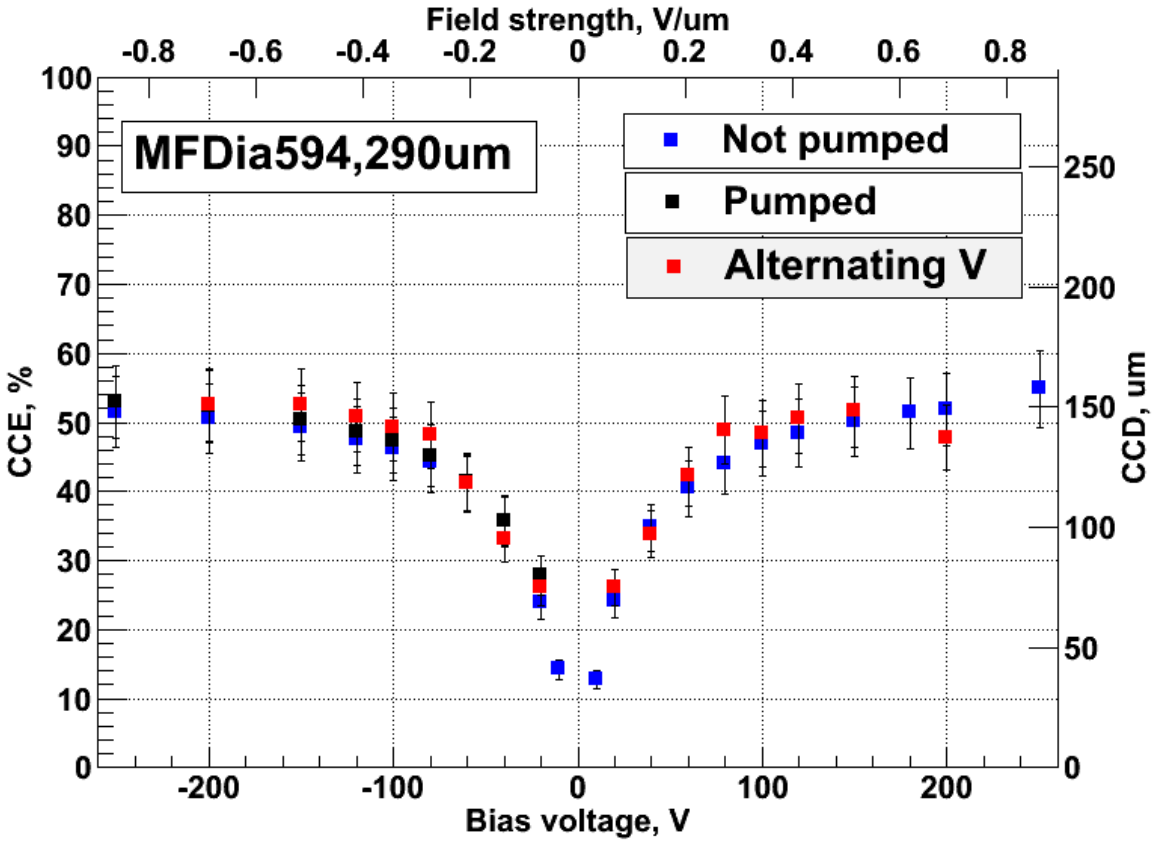



Presence of pumping effect was checked by irradiating the sample with Sr source for ~ 12 hours (~1-2Gy)

# MFDia 954, CCE measurements




Depumped by UV for 30 min

Pumped by Sr source
for ~ 12 hours

Alternating voltage :
Square waves @ 0.1 Hz

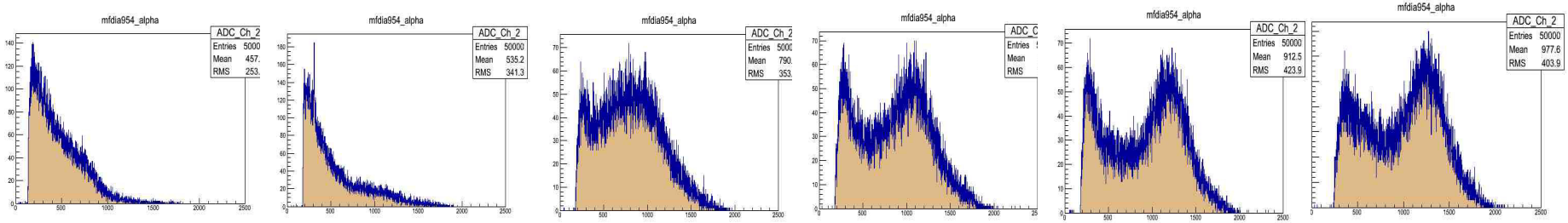
CCE ~ 50%, almost identical results for all measurement modes =>
No visible polarisation effects, low concentartaion of deep level traps?

Talk @ CARAT suggests different carrier collection eff., check with alpha

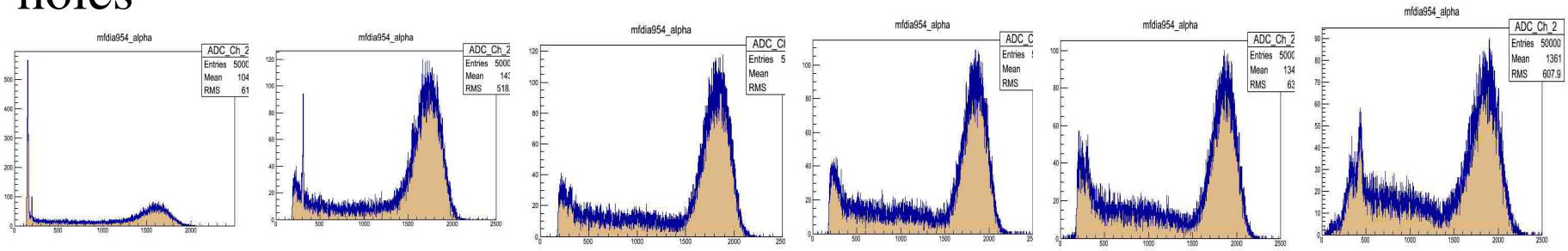
# Test with α-source

Am-241 alpha source was used. Small pinhole collimator.
Selftriggered, threshold to suppress noise
Alt HV to suppress possible polarisation effects

electrons



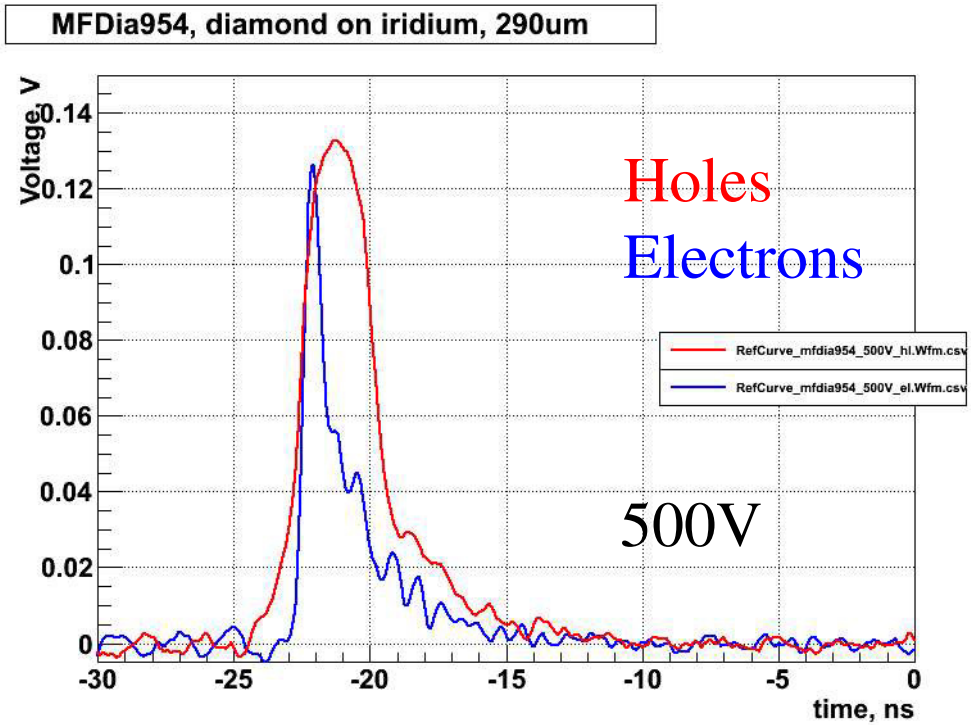

holes




50V 100V 200V 300V 400V 500V

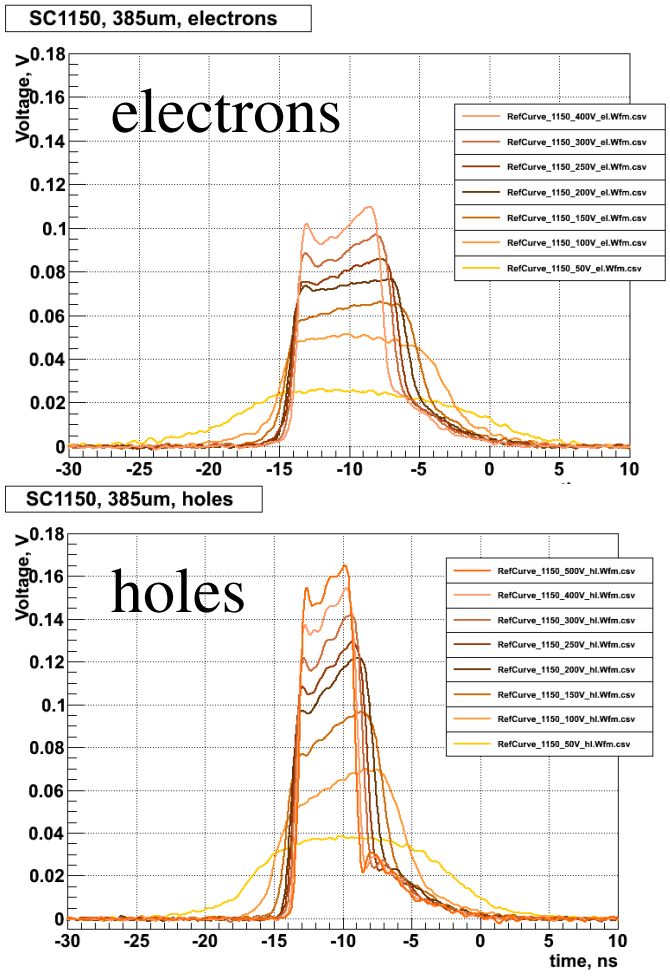
# TCT

Transient current technique.

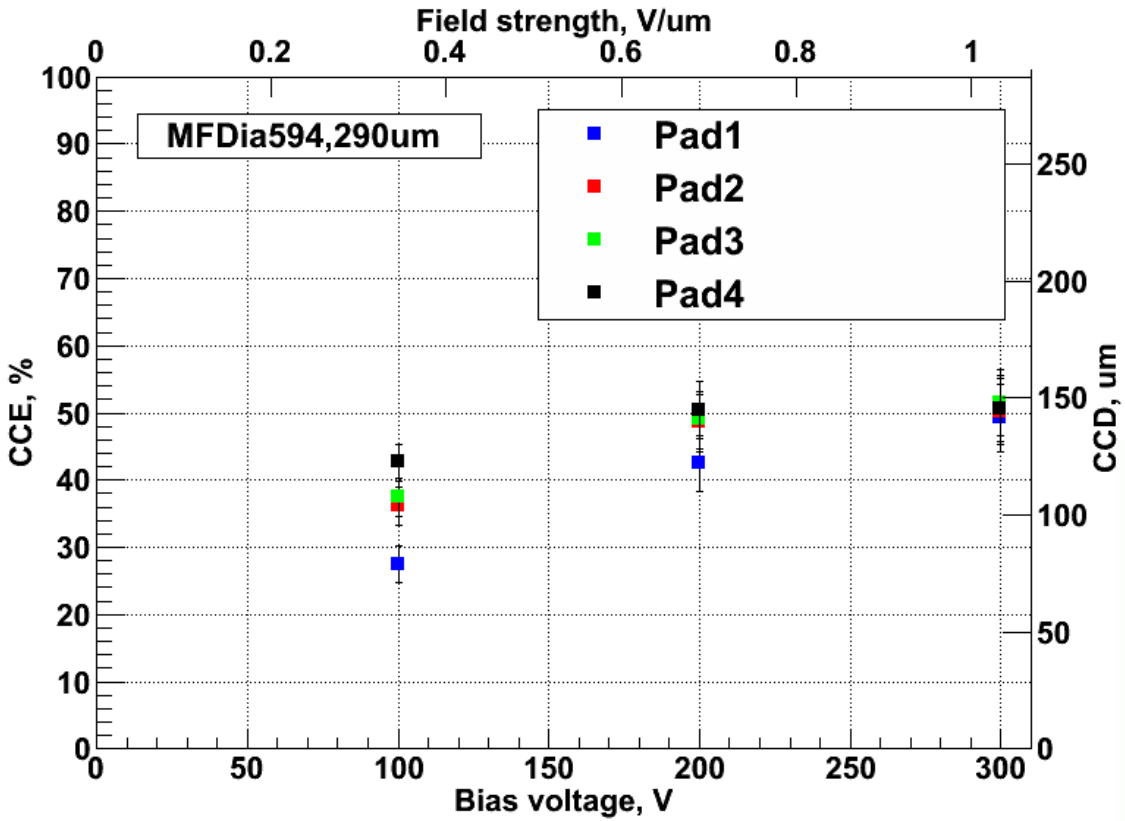


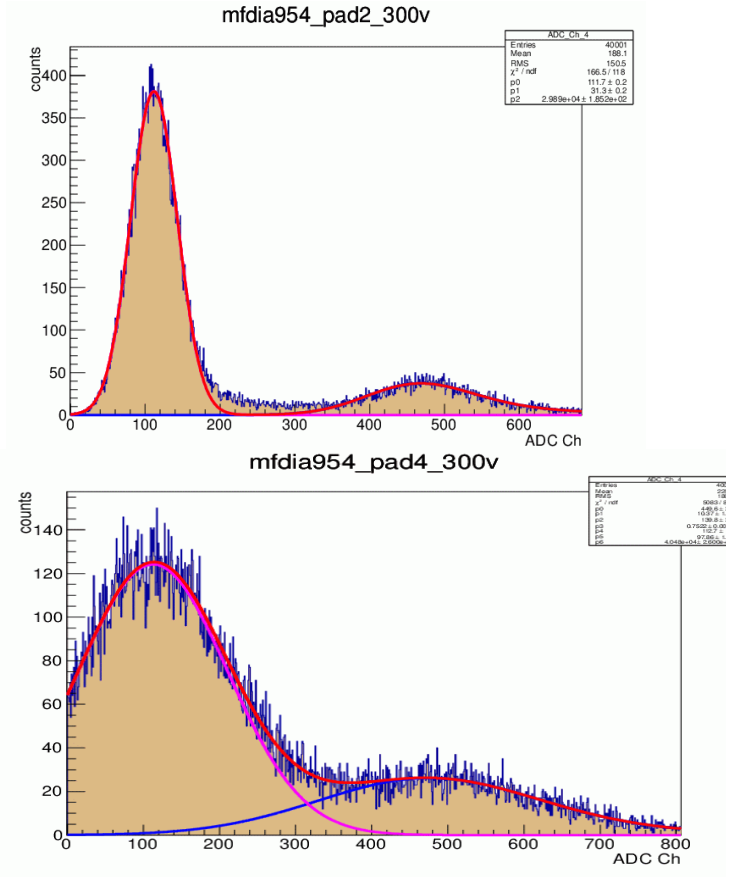

Better transport by holes
Shape is not clear

SCVD



# MFDia 954, CCE by pads



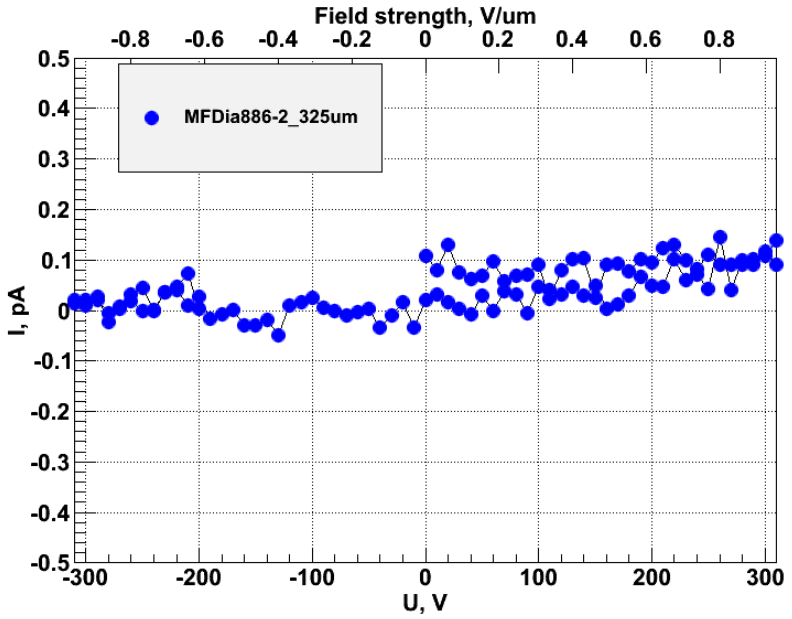




There is some difference in CCE between the pads

But the saturated CCE value is ~ 50% for all pads

High noise is only visible for pad 4

# MFDia 886-2

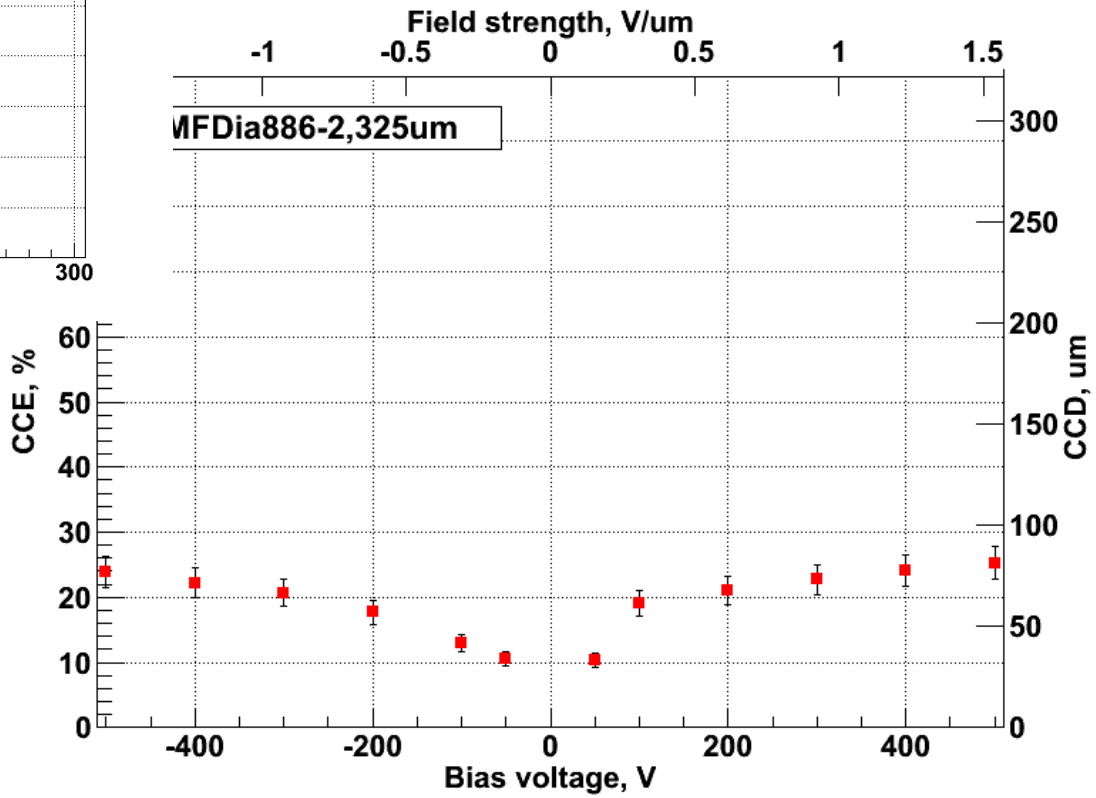



CCE ~ 25%

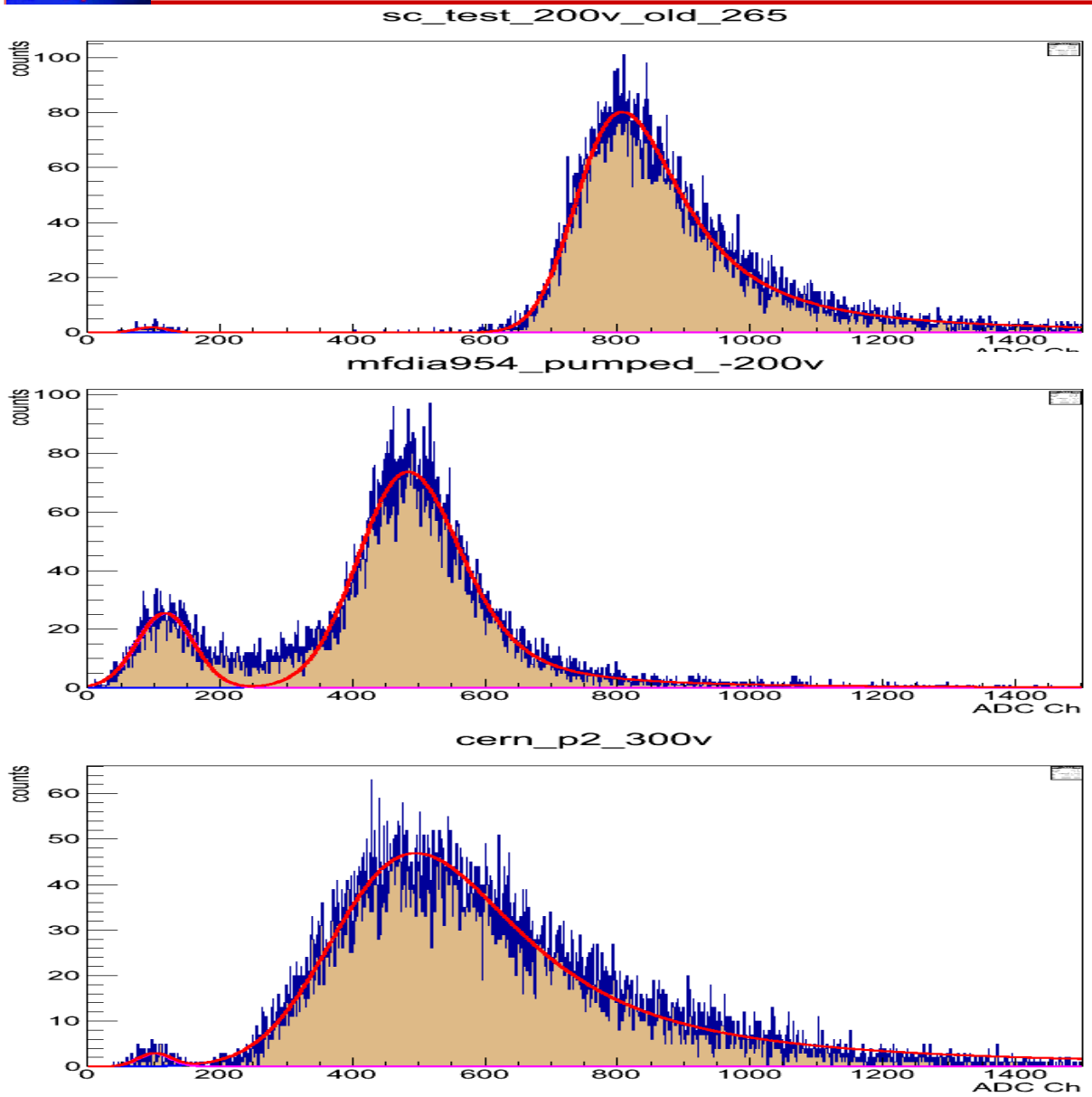
Saturates around 200V

Slightly asymmetric

No noise visible upto 500V



# Signal comparison




~ same field strength

Single crystal
CCE ~ 100%

MFDia 954
CCE ~ 50%

E6 poly
CCE ~ 40%

# Conclusions

- CCE is on the level of best E6 poly.
- Better homogeneity than poly.

- Holes are better for charge transport
- No significant pumping and polarisation effects (should mean something in terms of trapping levels)

- Getting more samples and more statistics would be great
- Is it possible to produce larger samples – 10x10mm? more?

**Thank you**