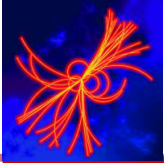




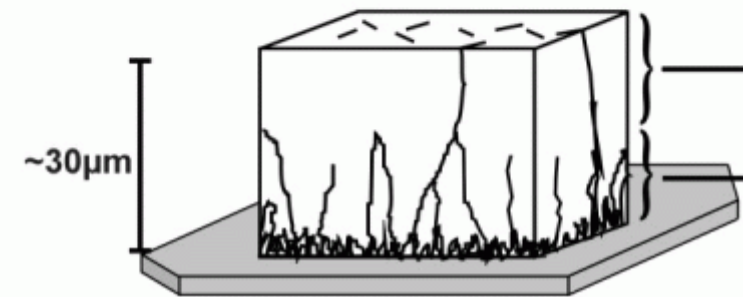
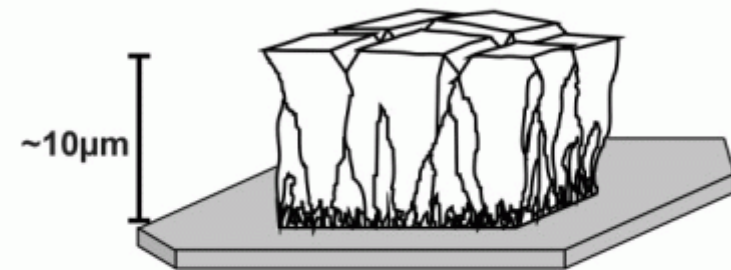
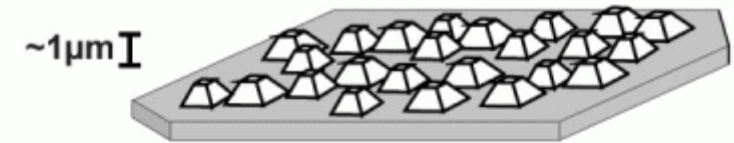
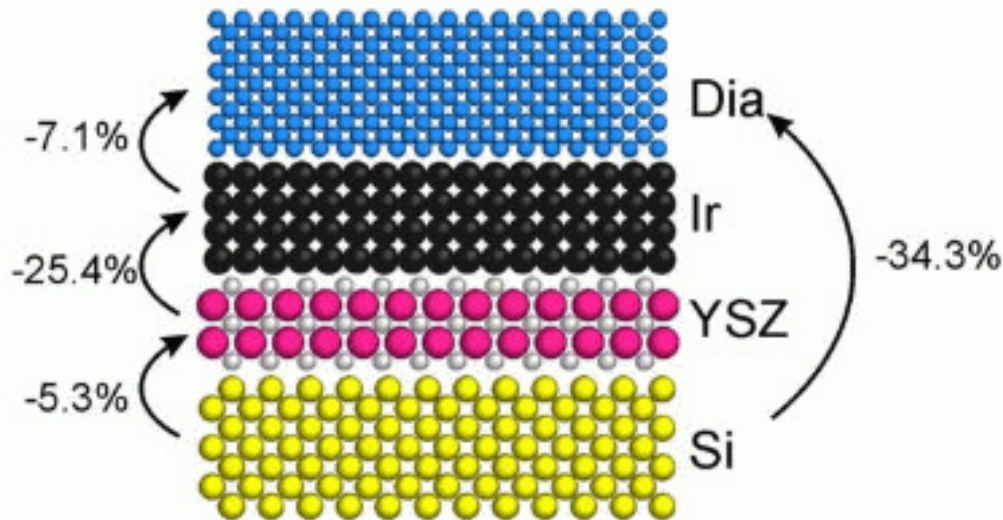
# **Investigation of Detector Properties of Diamond- on-Iridium Sensors**

K. Afanaciev

FCAL collaboration workshop, Krakow, 2013



## 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



## Diamond on iridium

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### Pros

- Could be produced (theoretically) in large wafer size  
Ir substrate up to 4 inches, diamond (reported) up to 1 inch
- Could be grown to a few 100 of um thick
- It is cheaper than single crystal diamond

### Cons

- Relatively new technology, not fully understood



## Samples

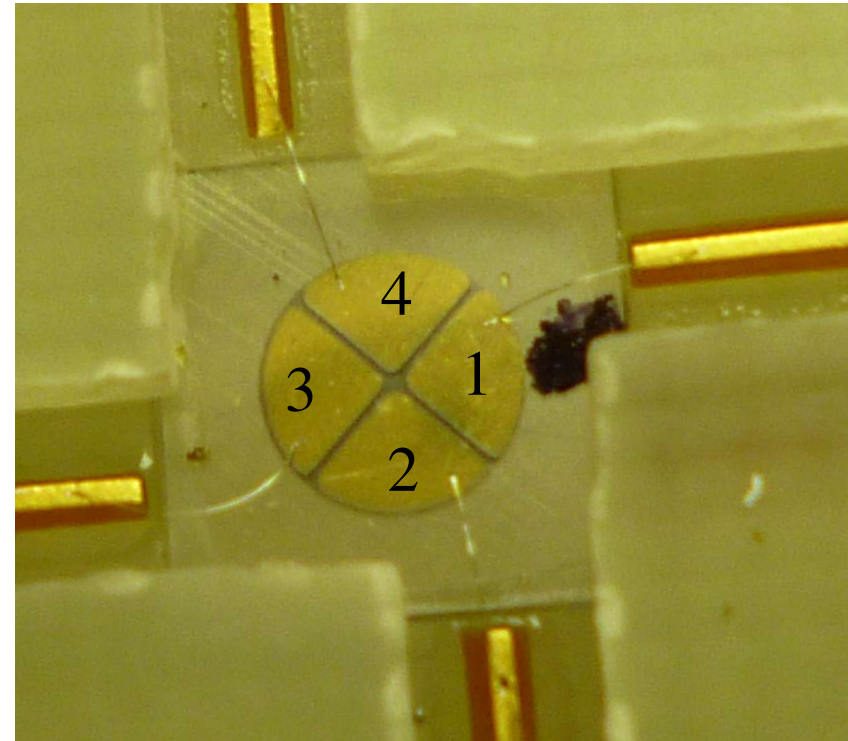
Produced at Augsburg University

[http://www.physik.uni-augsburg.de/  
de/lehrstuehle/exp4/Arbeitsgruppen/diamant/](http://www.physik.uni-augsburg.de/de/lehrstuehle/exp4/Arbeitsgruppen/diamant/)

MFDia954: 4.94x4.96mm x 290 $\mu$ m,  
metallisation: 50nm Ti, 90nm Pt,  
100nm Au ( $\varnothing$ 3mm)

MFDia886-2: 3.49x3.5mm x 324 $\mu$ m,  
metallisation: 100 nm Al

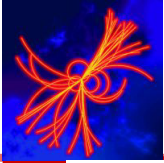
MFDia953: 4.9x4.95mm x 280 $\mu$ m,  
metallisation: 100 nm Al



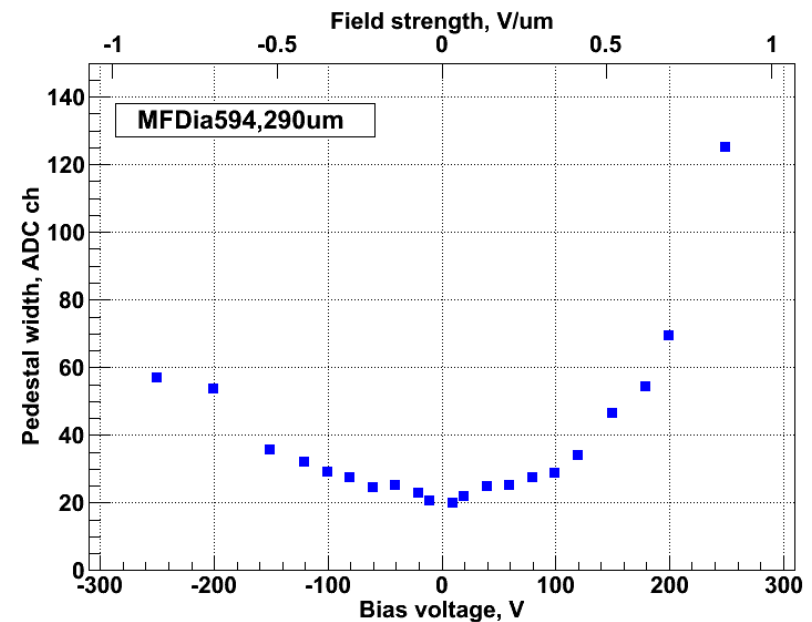
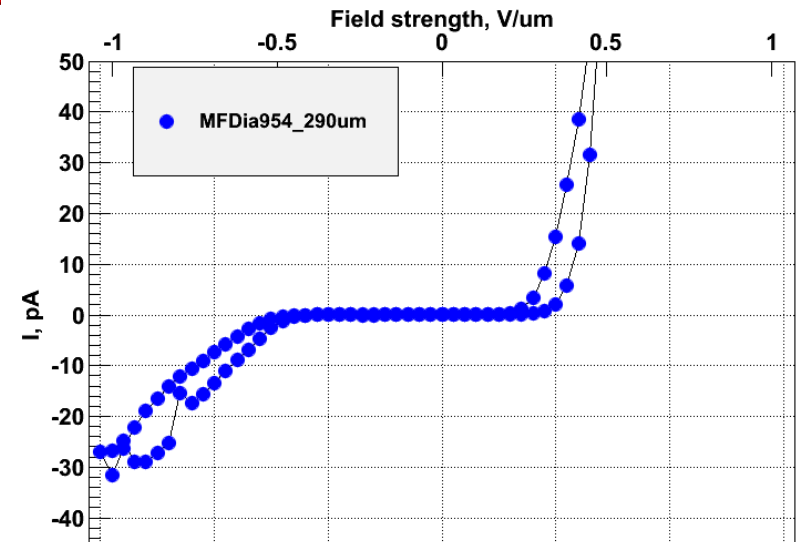
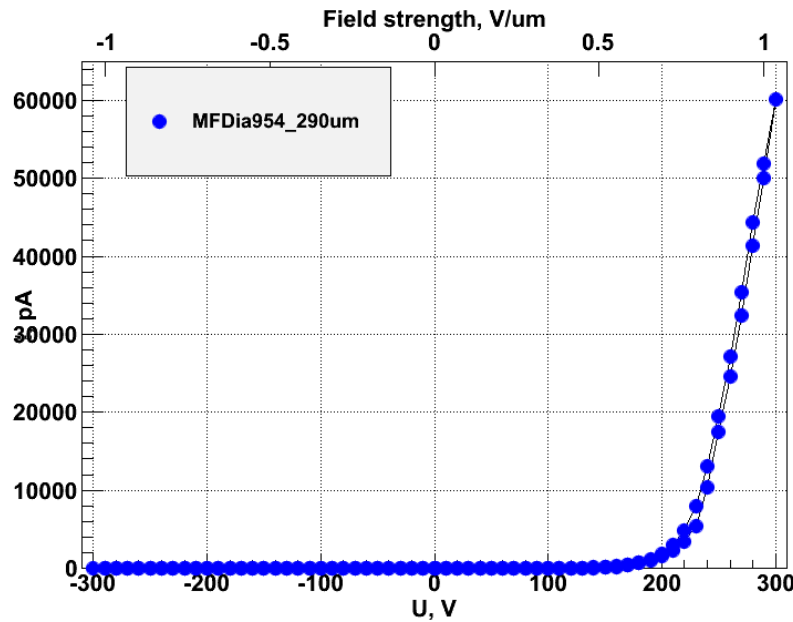
Bonding to Al metallisation problematic

We were able to properly contact only MFDia886-2

And only with conductive glue



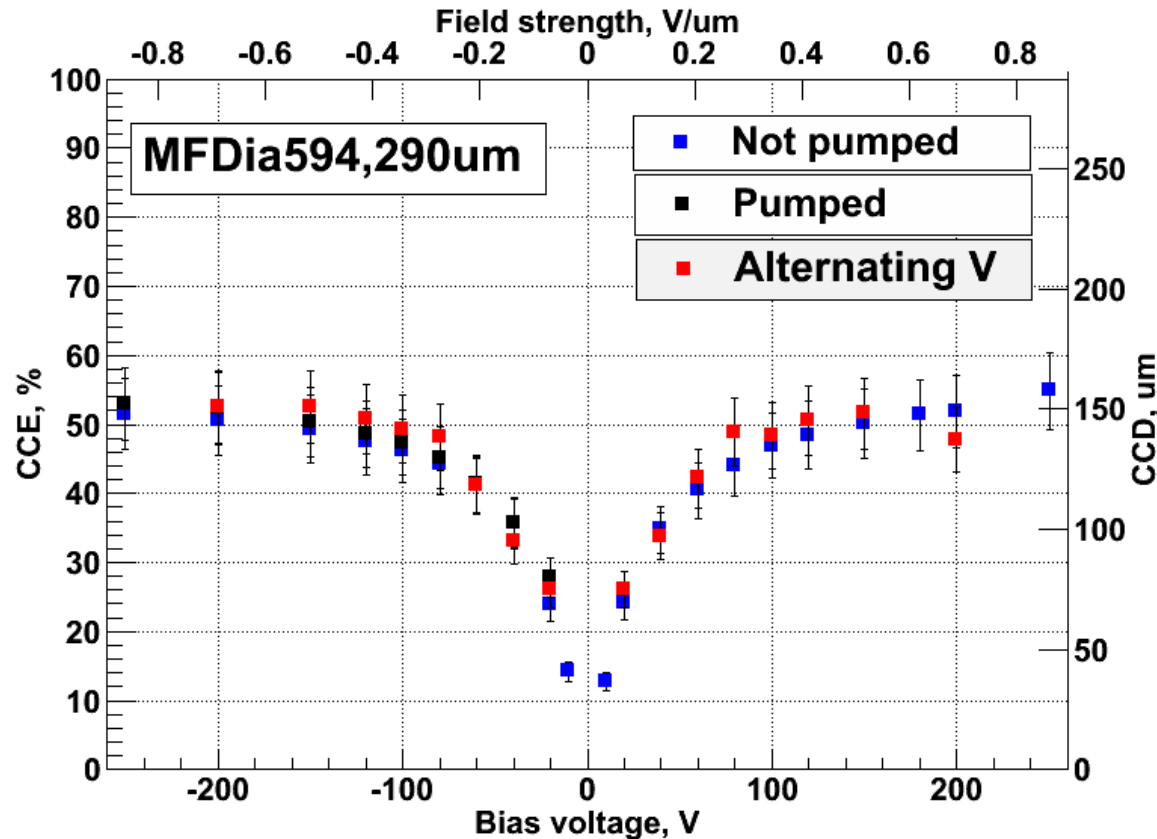
# MFDia 954, IV measurements



Current spike corresponds to increased noise, CCE measurements are difficult above 250V  
Should check influence of source



## MFDia 954, IV measurements



Depumped by UV for 30 min

Pumped by Sr source  
for ~ 12 hours

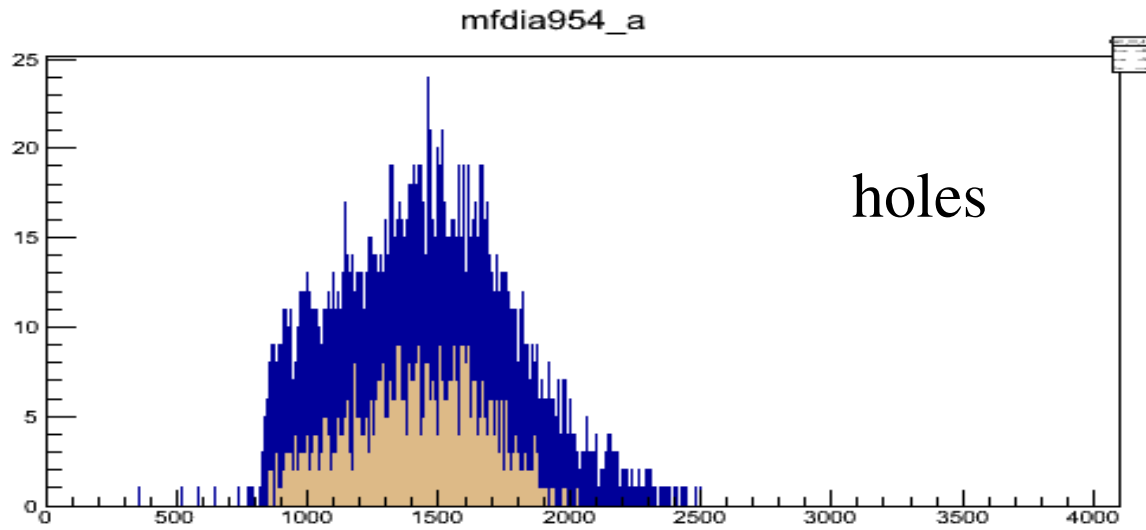
Alternating voltage :  
Square waves @ 0.1 Hz

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

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

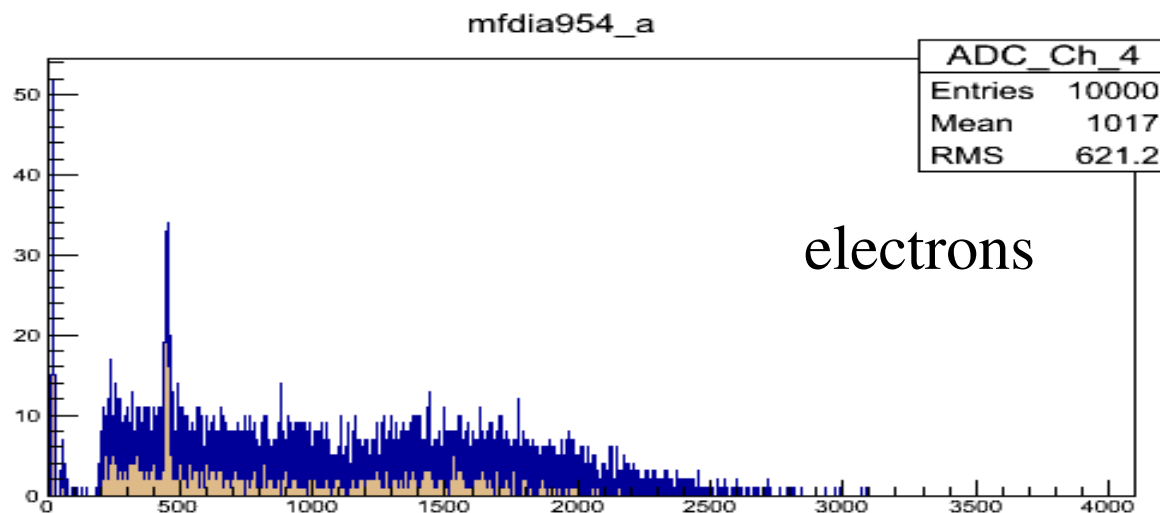


# Test with $\alpha$ -source



No significant difference in max signal size

Need to do it more carefully

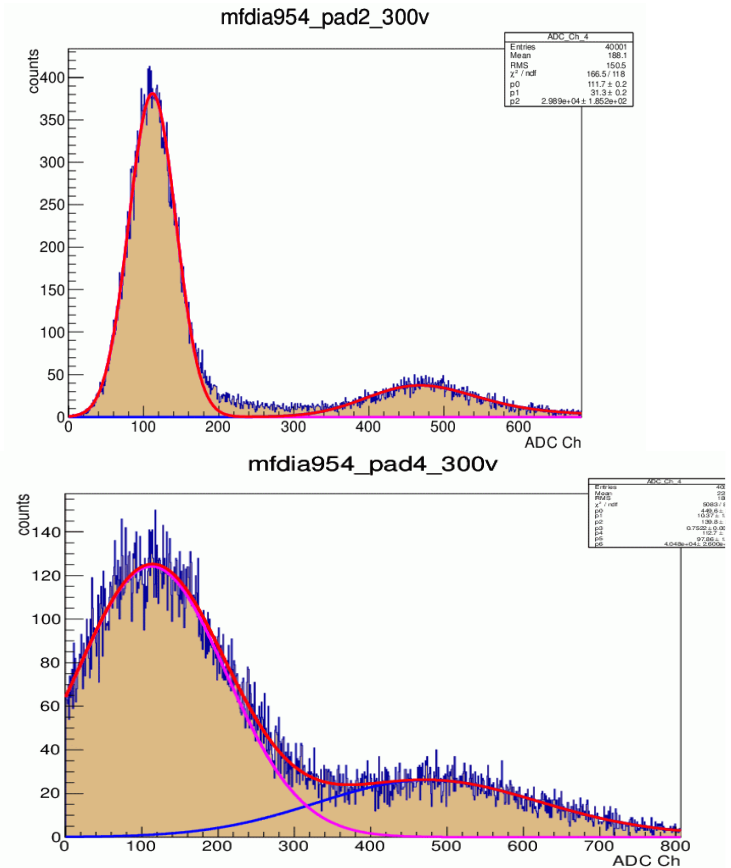
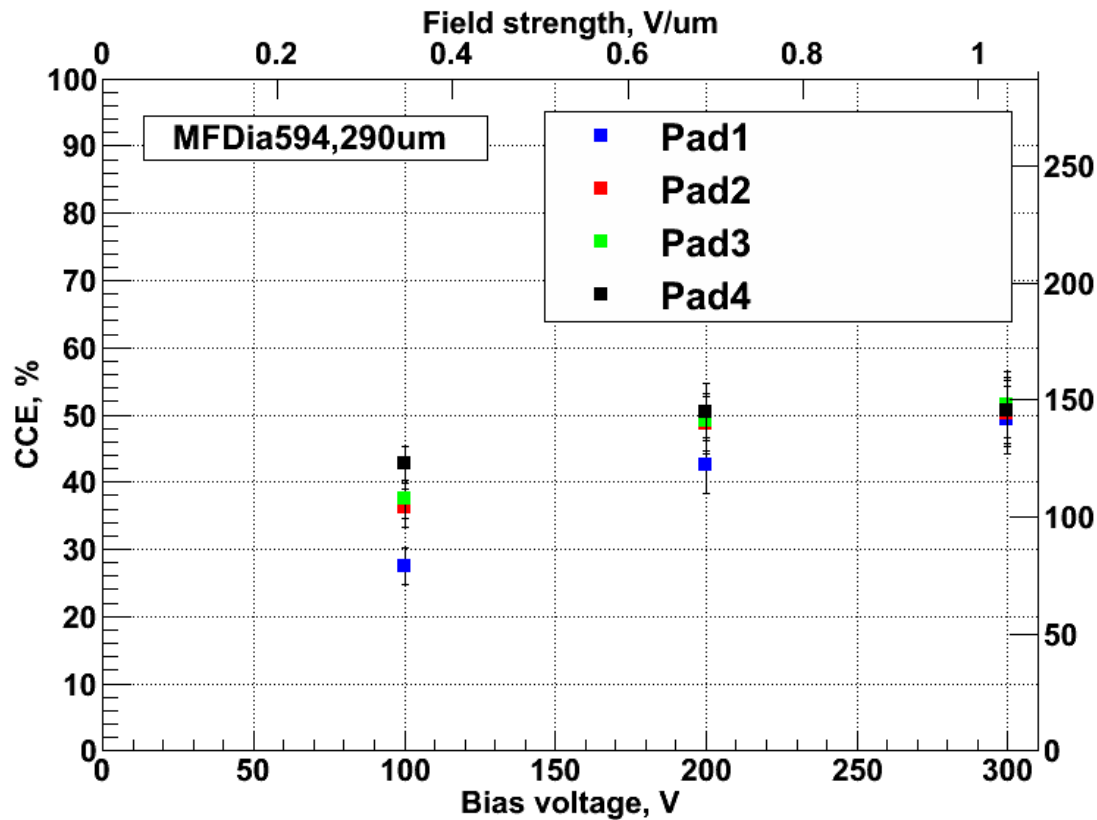


Visible polarisation during measurements

Need to do timed measurements



## MFDia 954, CCE by pads

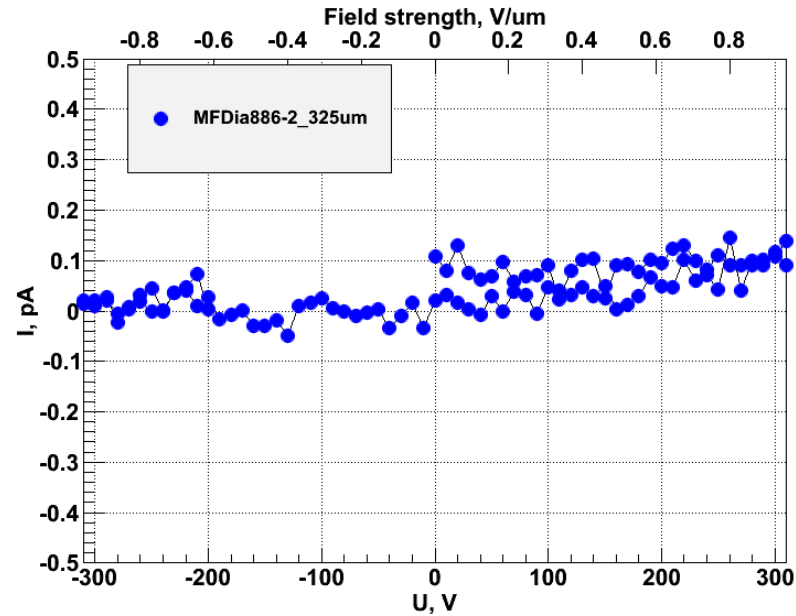


There is some difference in CCE between the pads  
But the saturated CCE value is ~ 50% for all pads  
High noise is only visible for pad 4





## MFDia 886-2

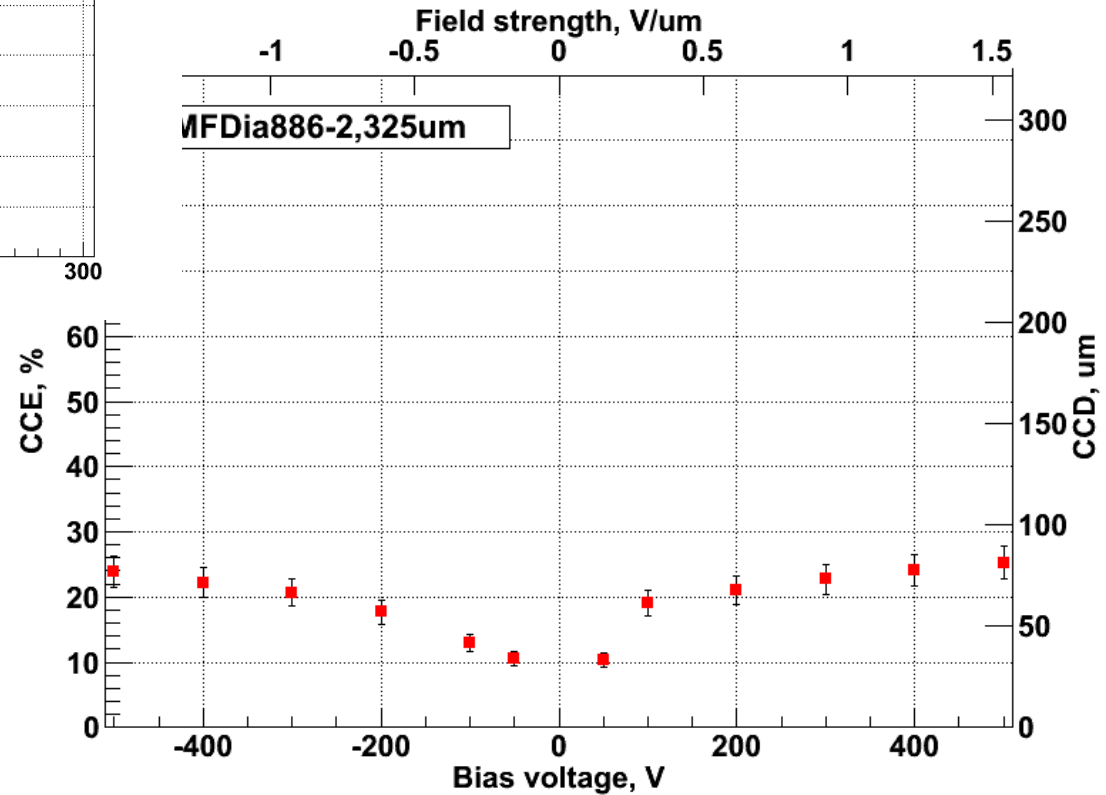


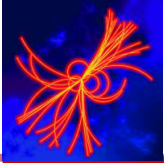
CCE ~ 25%

Saturates around 200V

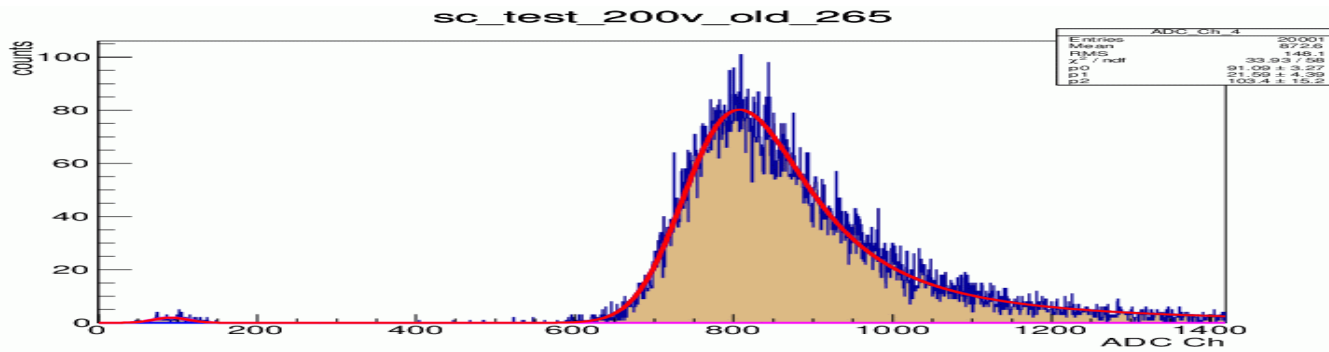
Slightly asymmetric

No noise visible upto  
500V

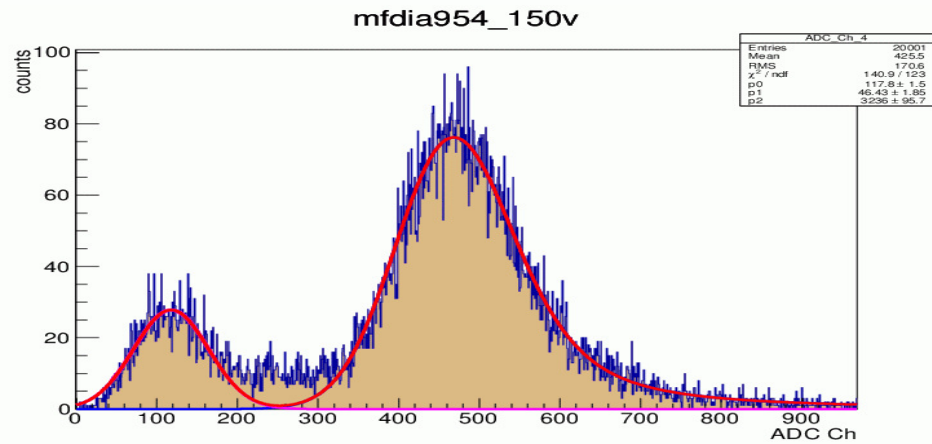




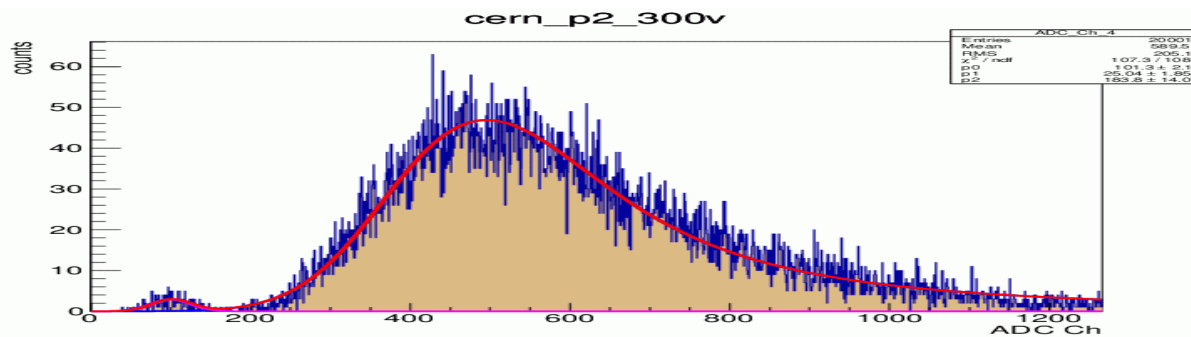
# Signal comparison



Single crystal  
CCE ~ 100%



MFDia 954  
CCE ~ 50%



E6 poly  
CCE ~ 40%



## Conclusions

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- Looks promising for a relatively new technology
- CCE is on the level of best E6 poly.
- Theoretically possible to get large size (homogeneity?)
- Would be interesting to compare results for 886 with different metallisation
- Getting more samples and more statistics would be great

**Thank you**