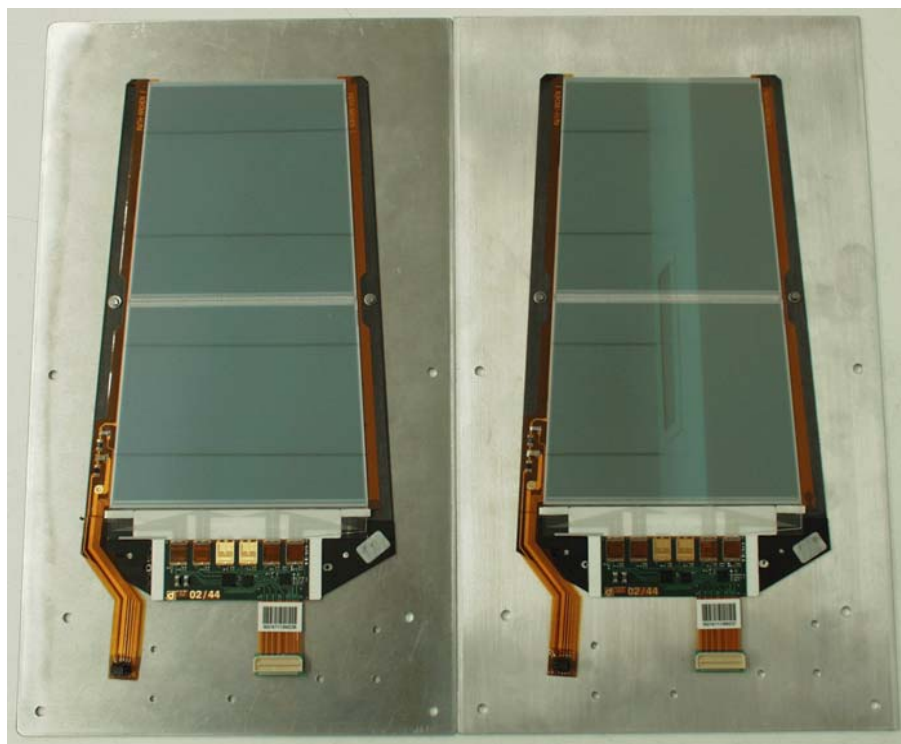


# Flex hybrid on TEC R6: *First test results*

Jan Olzem  
Aachen I

CMS tracker week, January 2003

# 2 TEC R6 modules

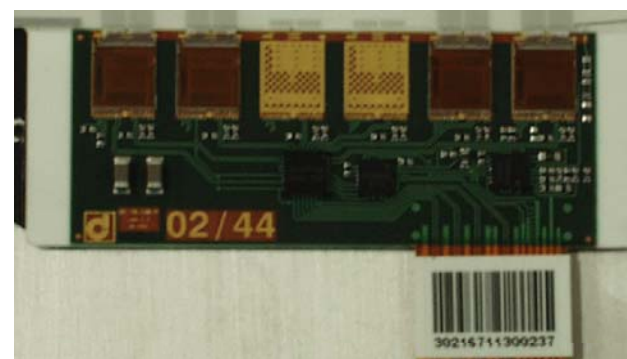


- flex hybrids laminated on ceramic (TOB-rigidifier)
- frames & sensors glued in Aachen
- sensors bonded in Aachen

hybrid numbers:

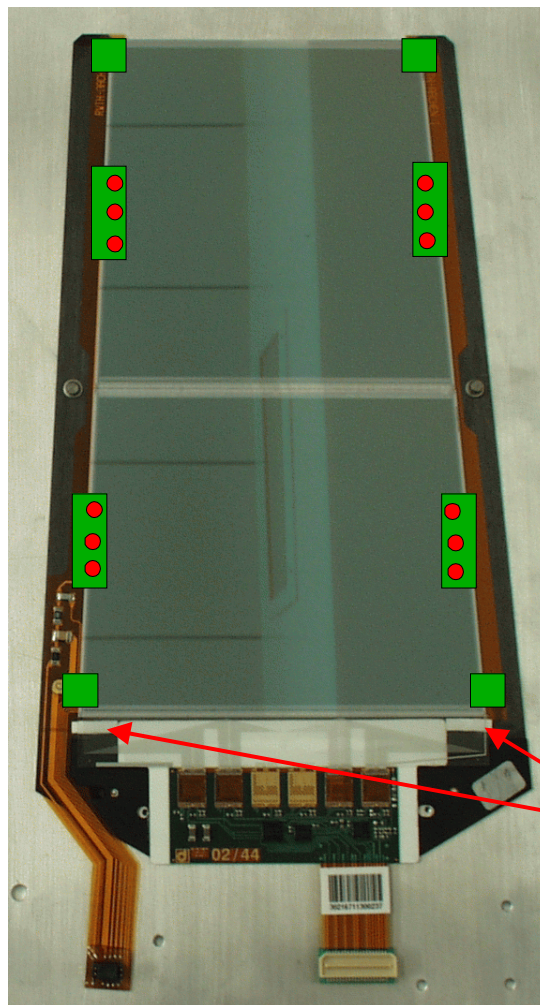
30216711300237

30216711300238



# Gluing scheme

Sensors glued to Kapton with NEE001 ●



Kapton glued to frame with Araldite ■

Additional spacers

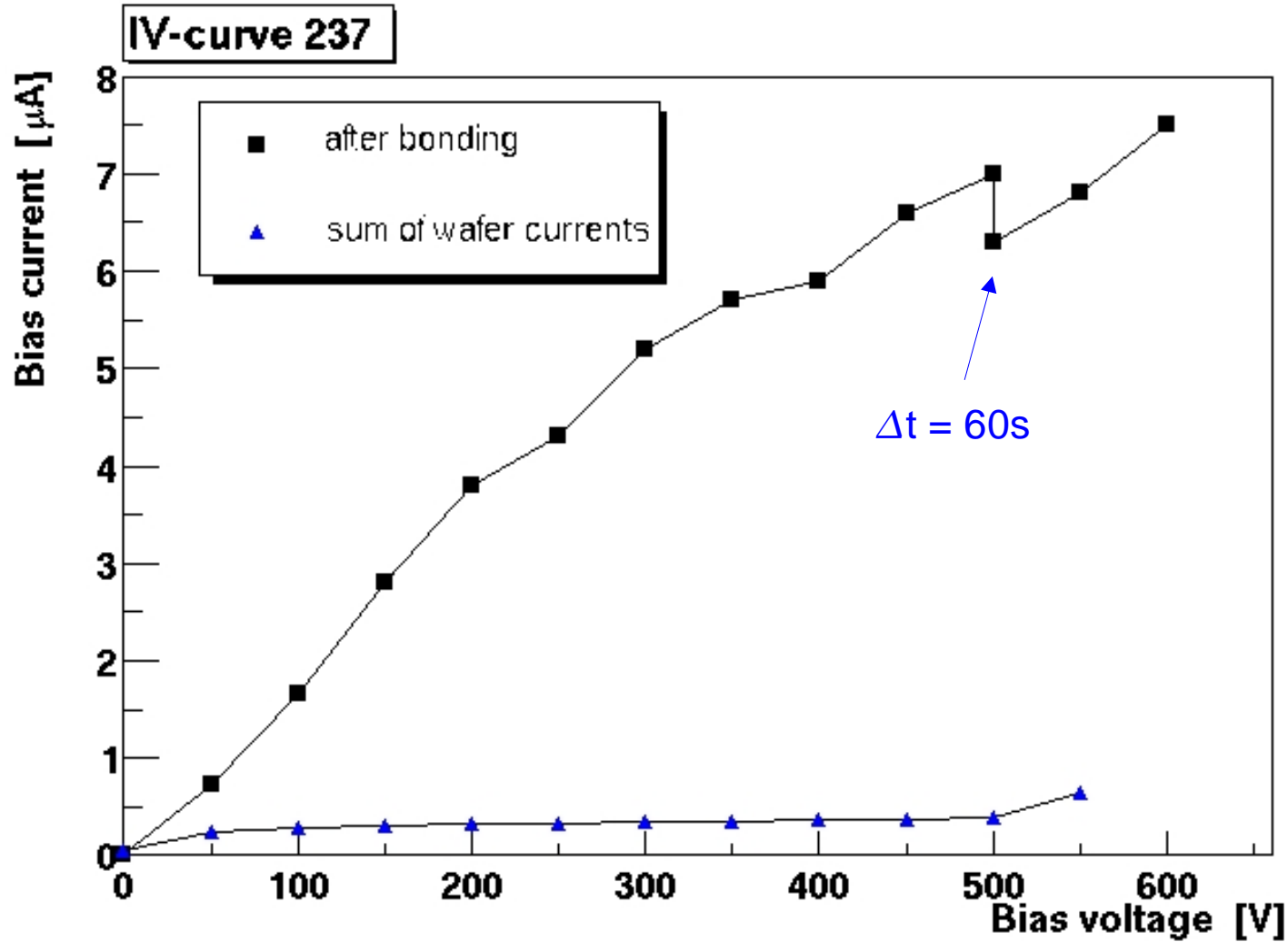


# First measurements



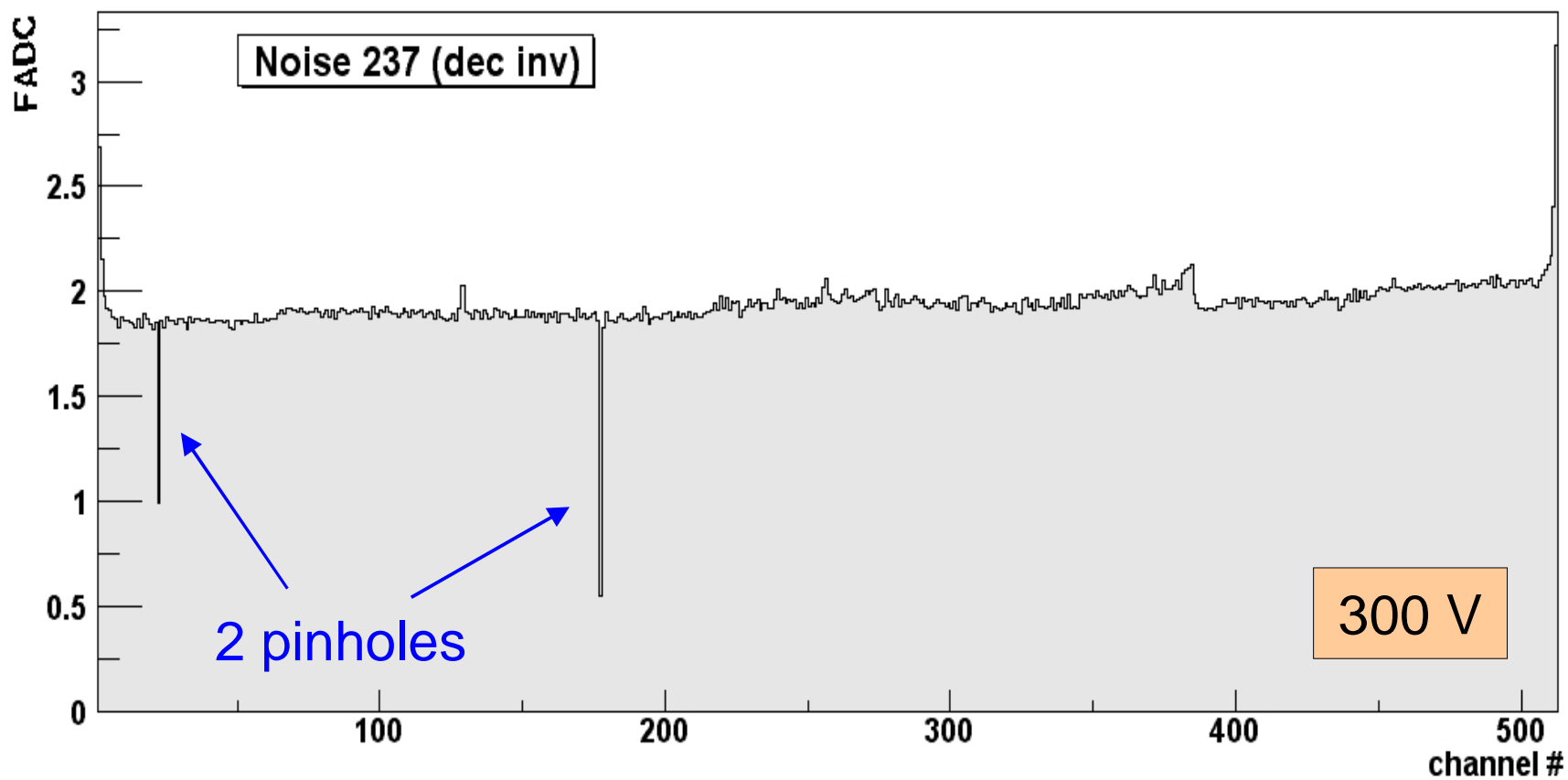
## Test of 1 module (...237)

1. After bonding tests (ARC):
  - IV-curve
  - noise
  - calibration pulse measurements
  - LED array test
  - pinhole test with continuous light
2. 14 temperature cycles (-20 ... +20 °C)
  - Wafer deformation monitoring
3. After bonding tests:
  - s.a.

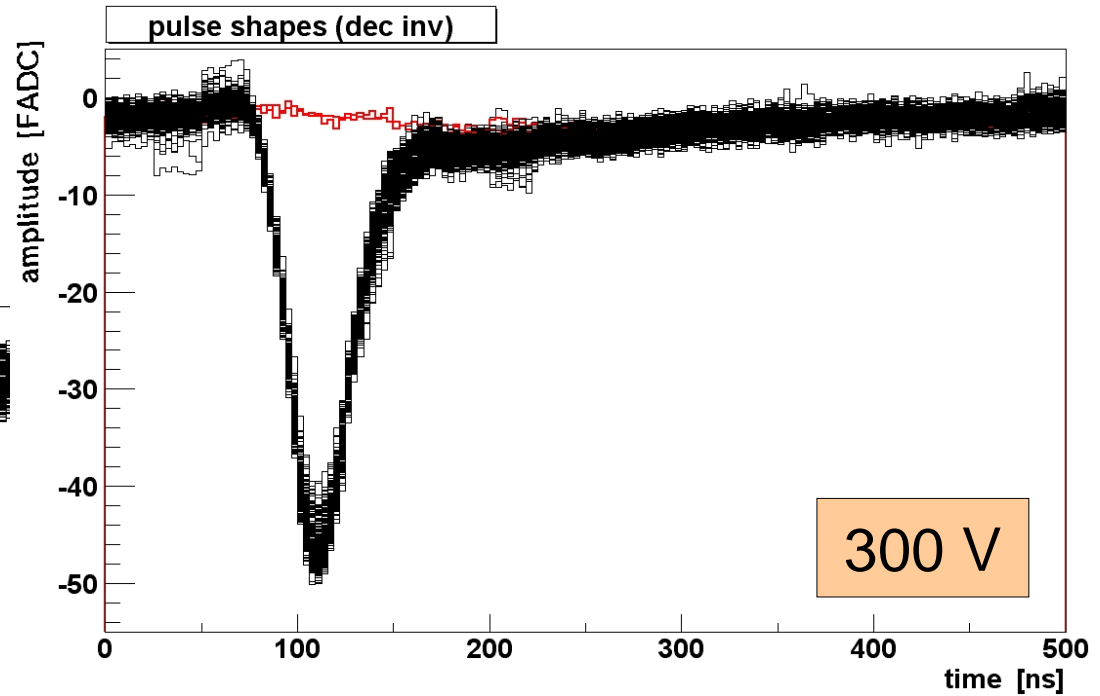
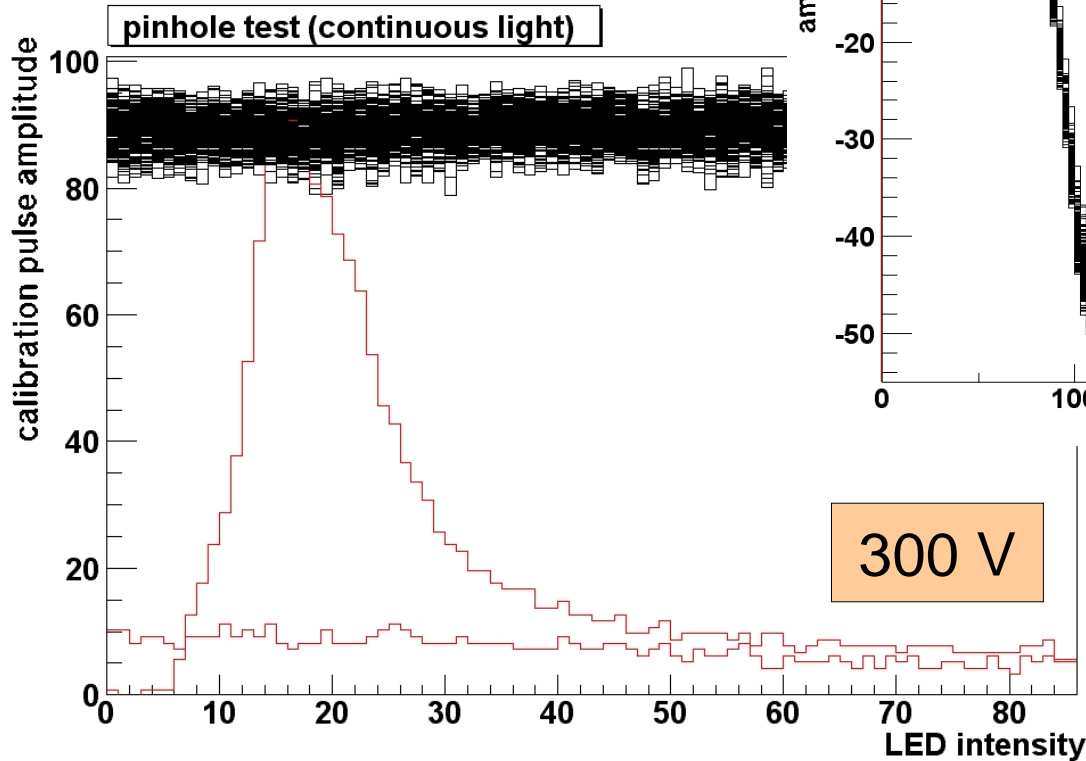


20°C, 40% RH

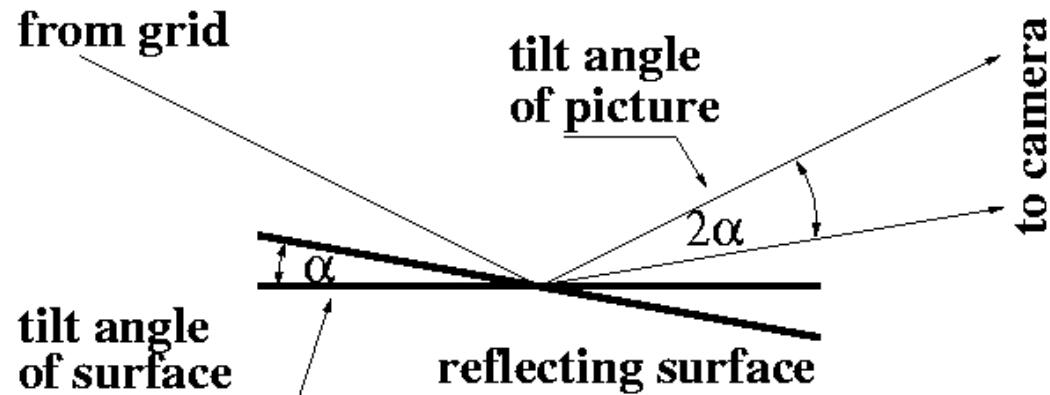
Module is electrically ok, no readout problems



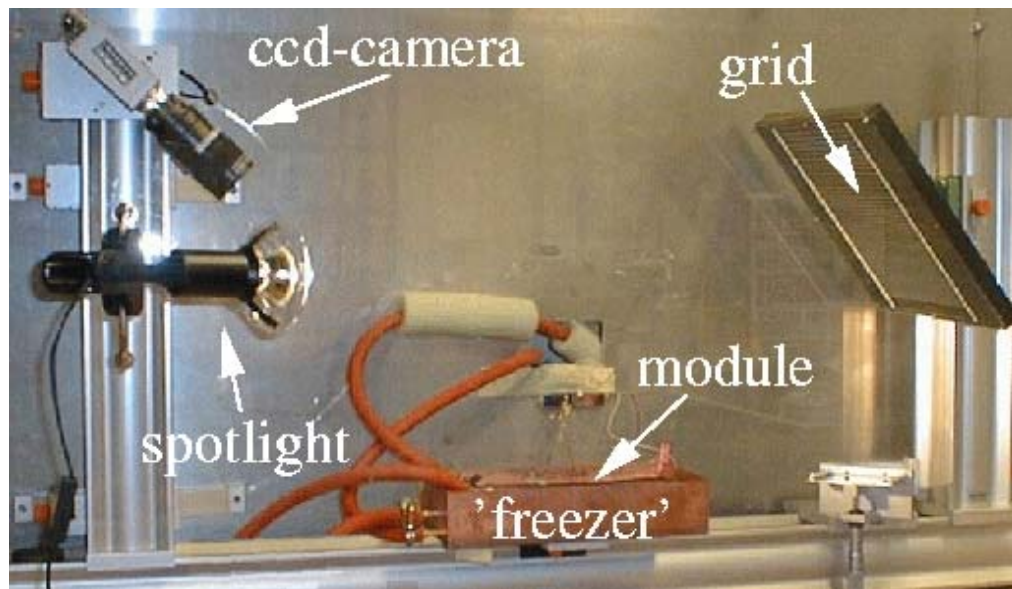
Pinholes not reported from wafer tests.

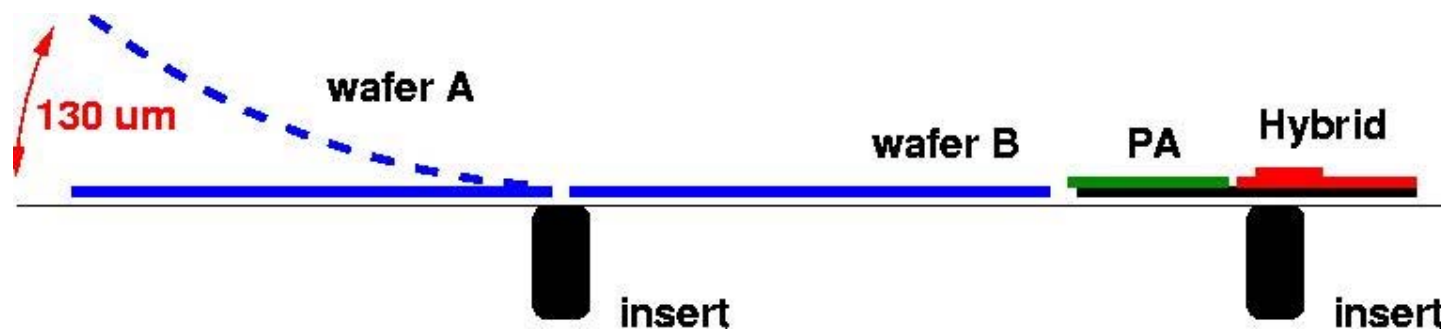
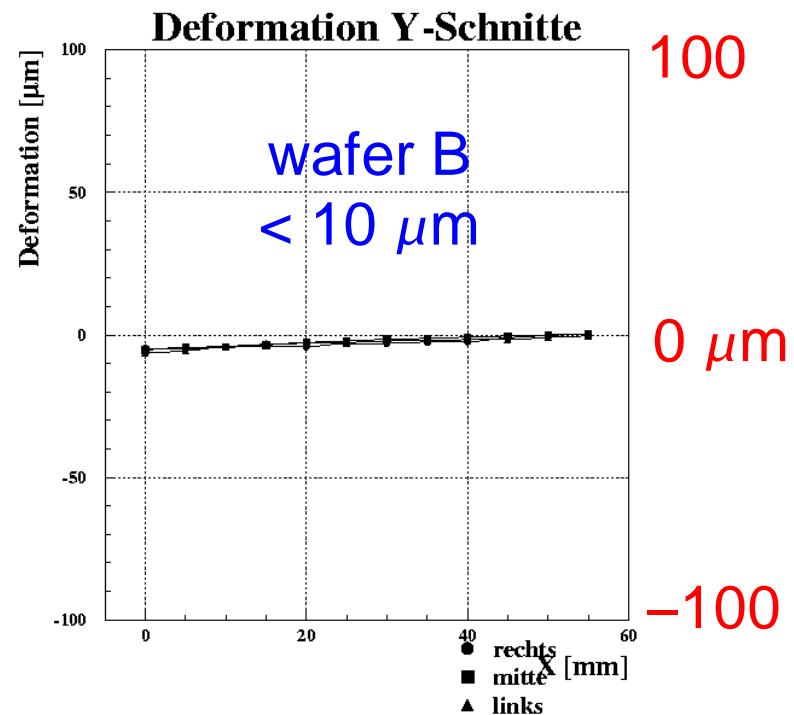
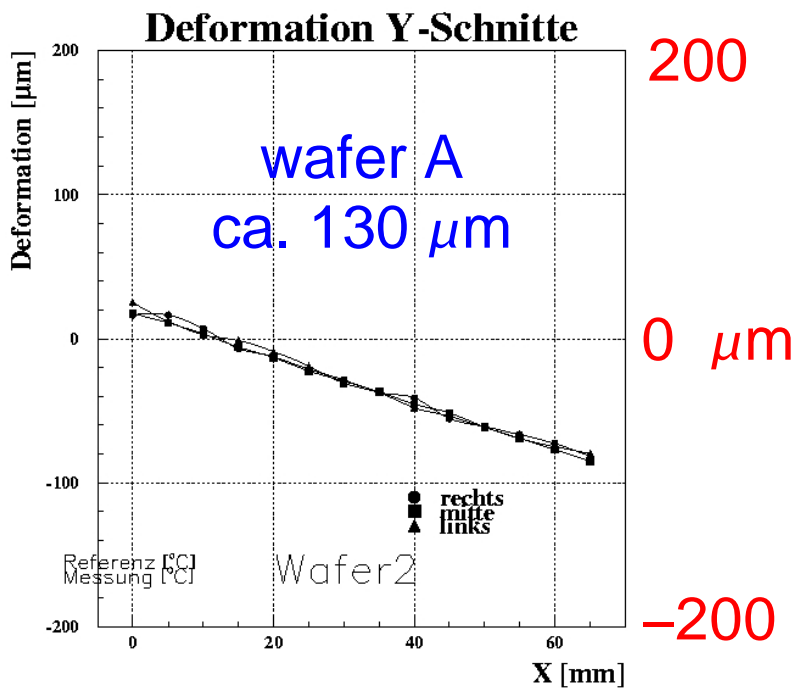


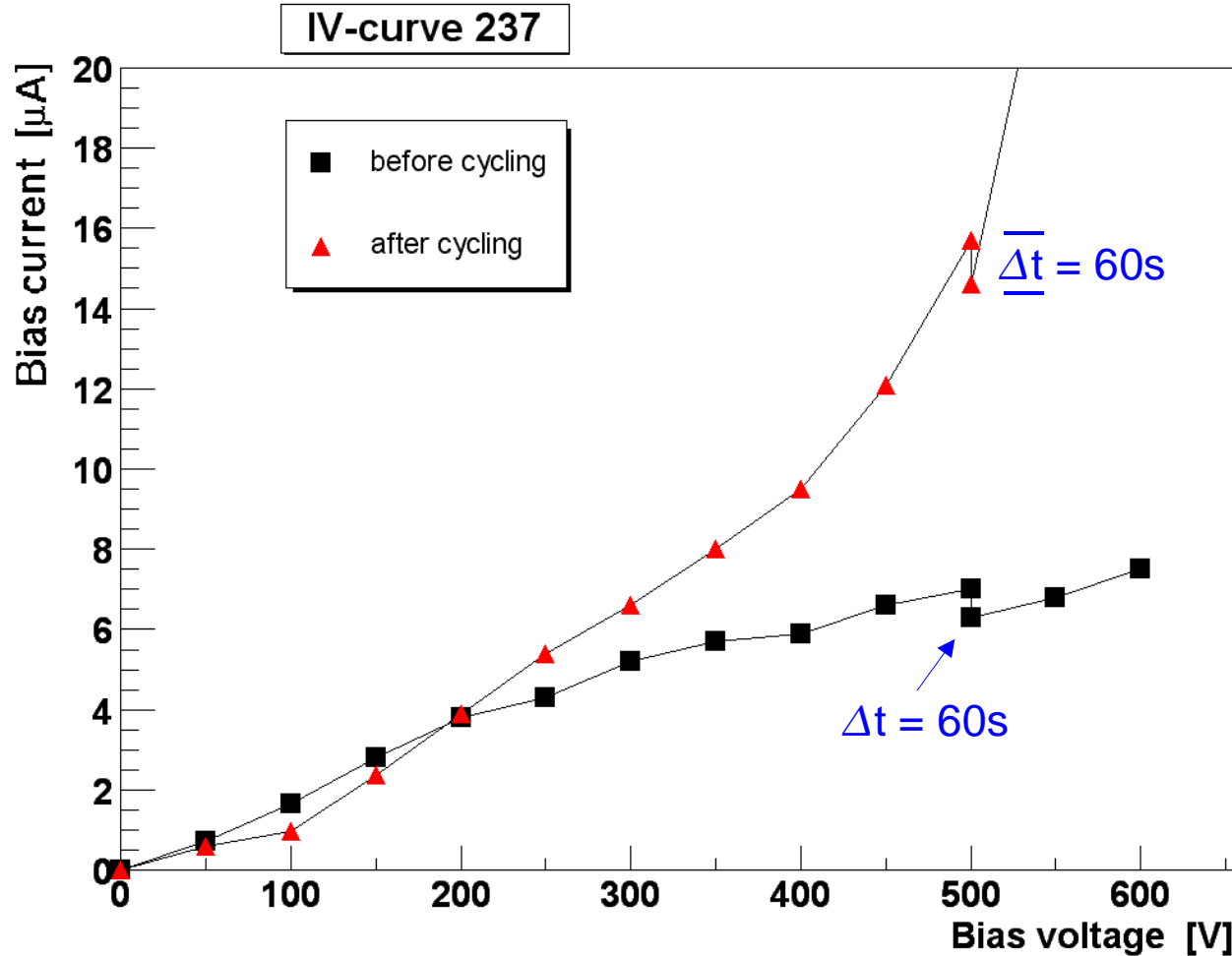
Origin of pinholes will be investigated.



- Grid of dots is reflected by surface, observed by CCD
- Deformation of surface translates into motion of dots on CCD
- Full 3D surface reconstruction





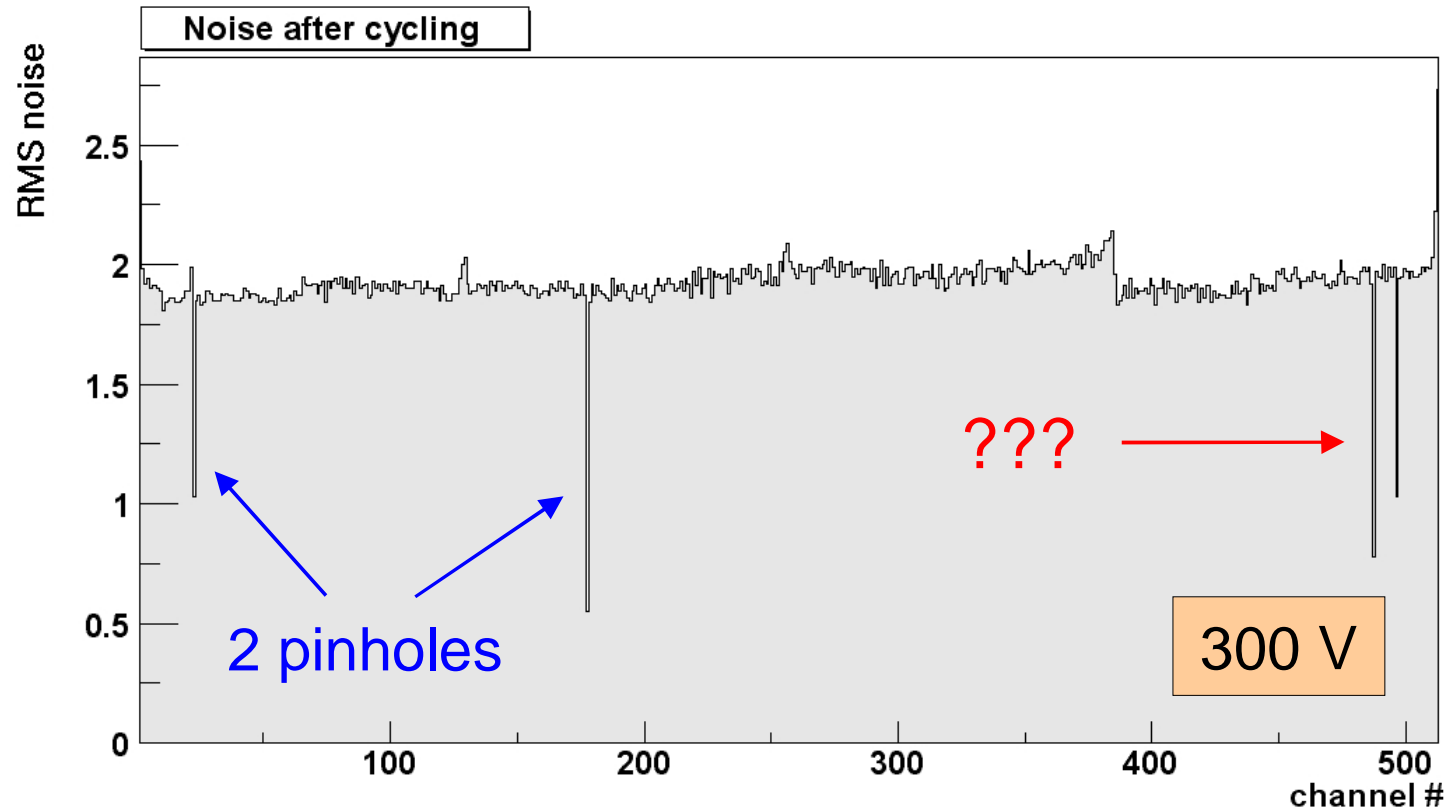


■ Immediately after bonding  
20°C, 40% RH

▲ After cycling and drying (12h)  
20°C, < 30% RH

Test passed, but unusual high current.

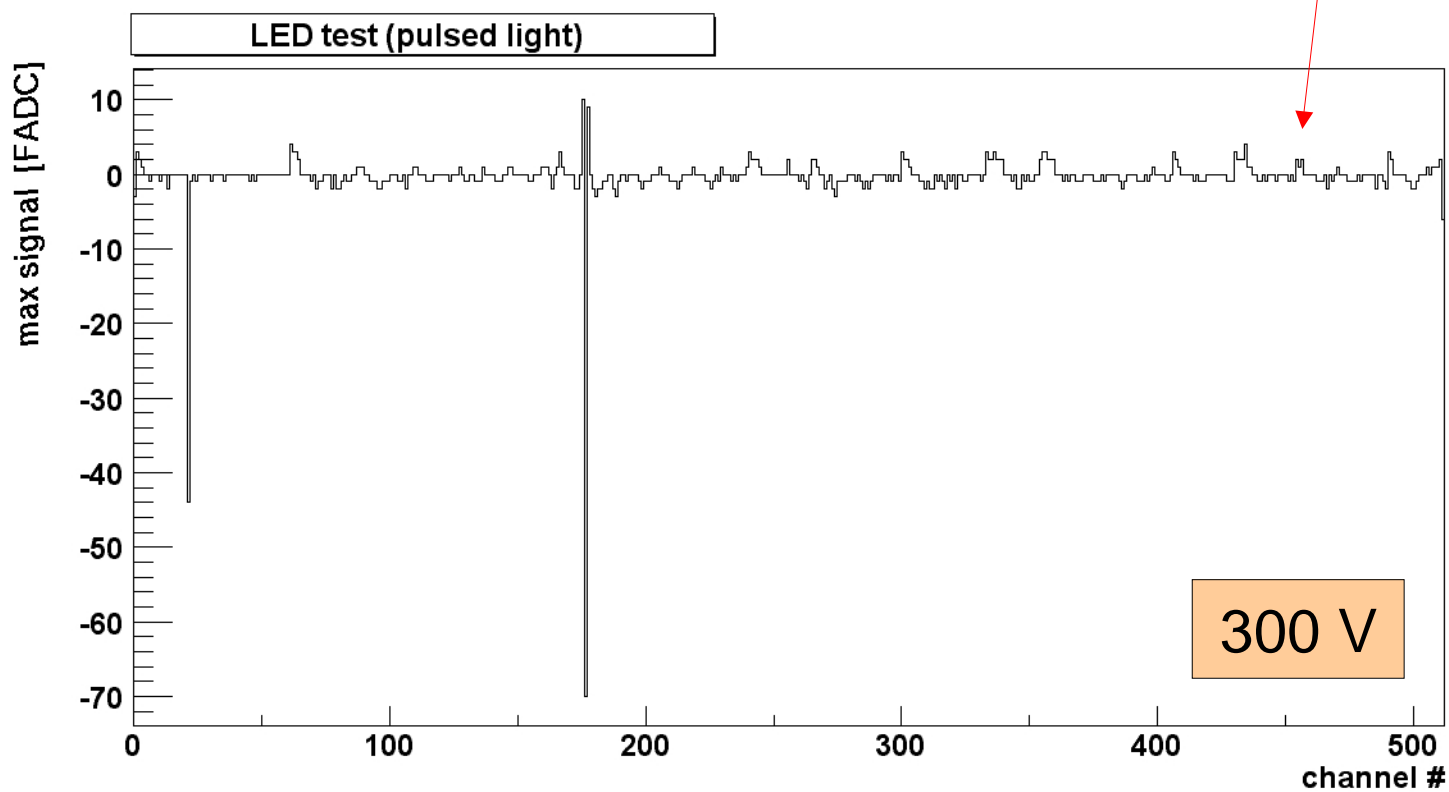
Further investigation will be done.



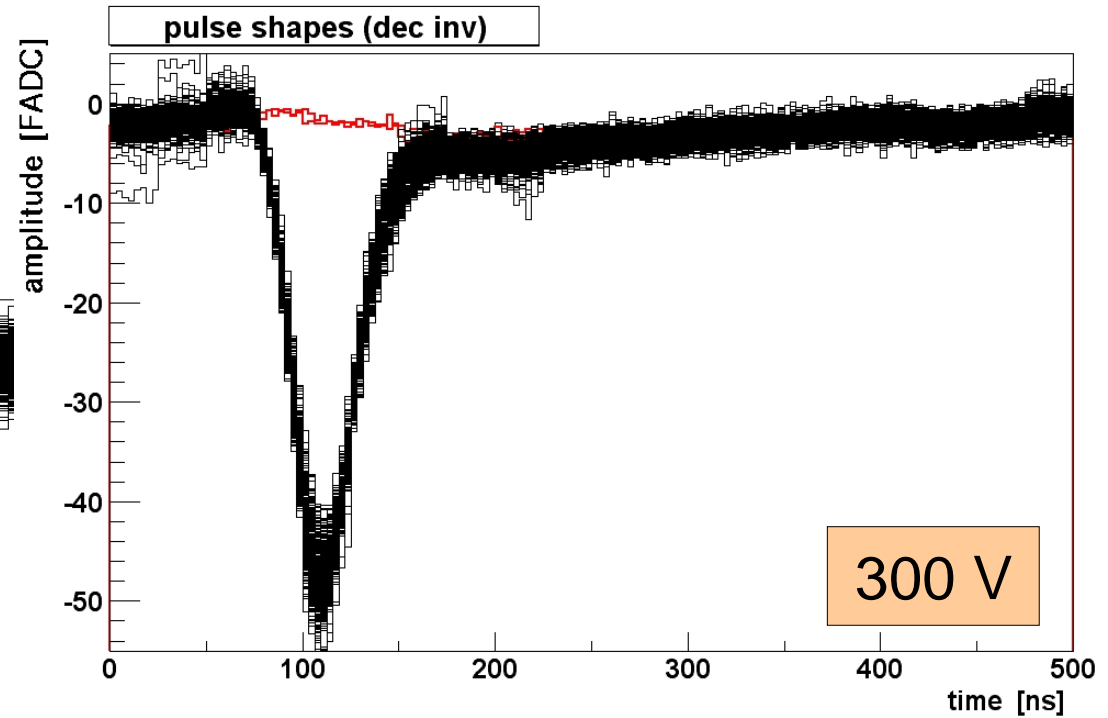
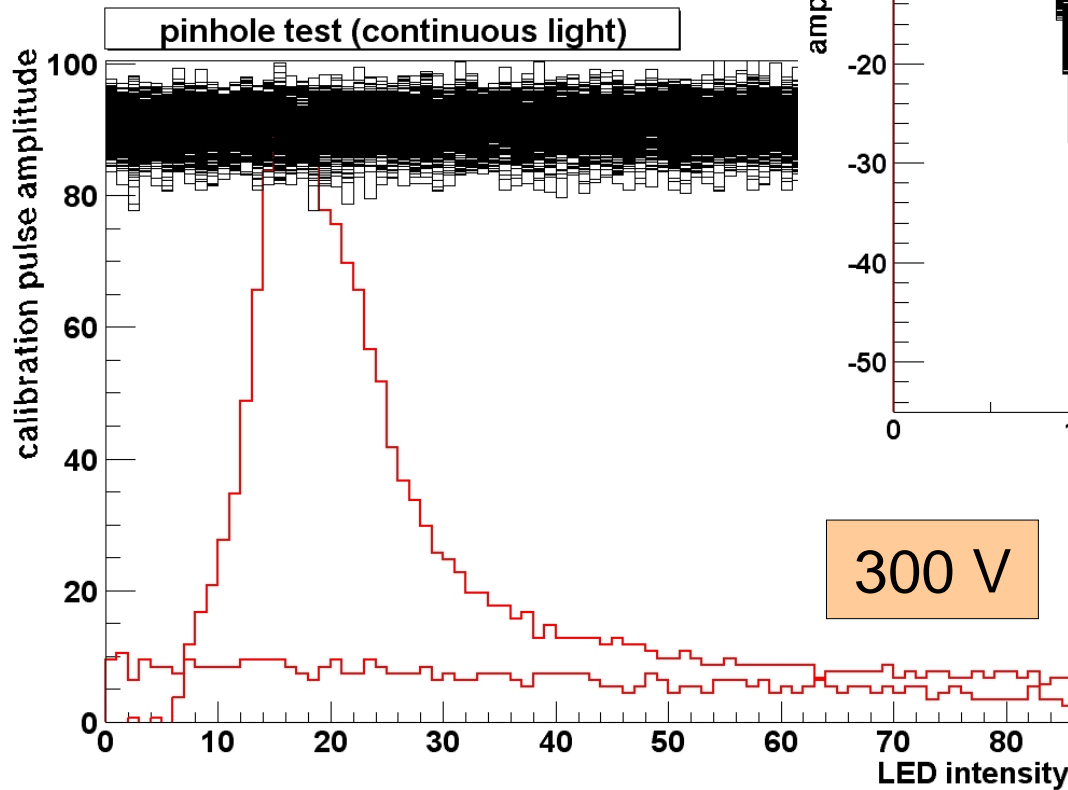
Effect does not show up in pinhole test / LED test  
Bad bonds?

LED test:  
New algorithm gives flat baseline

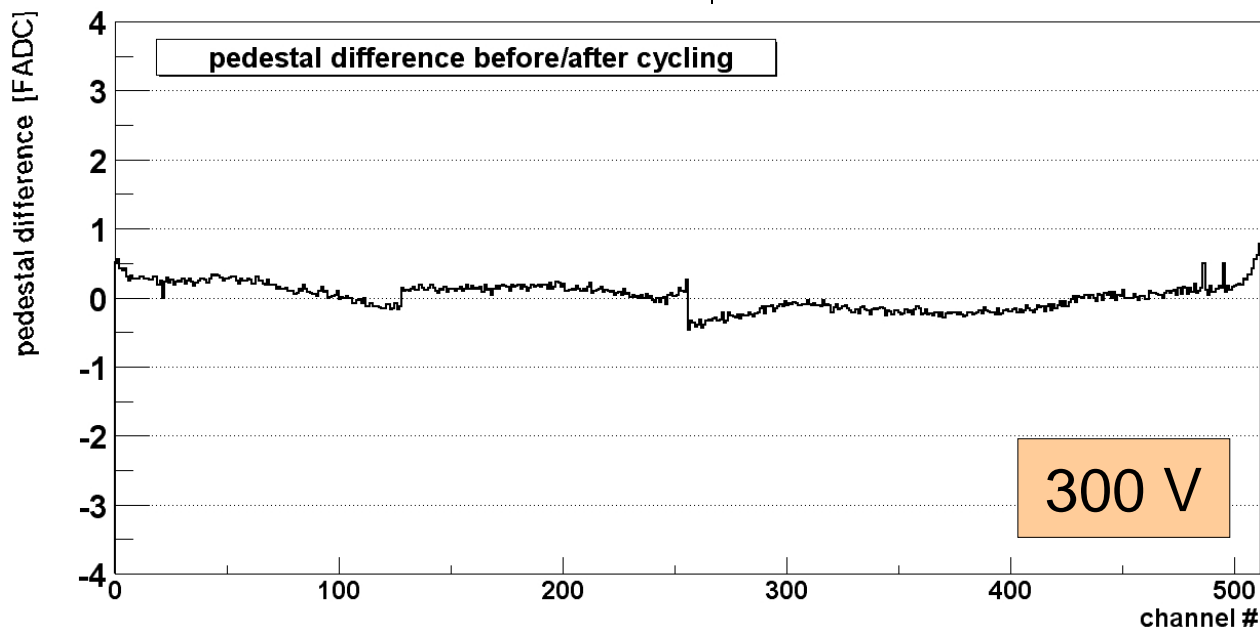
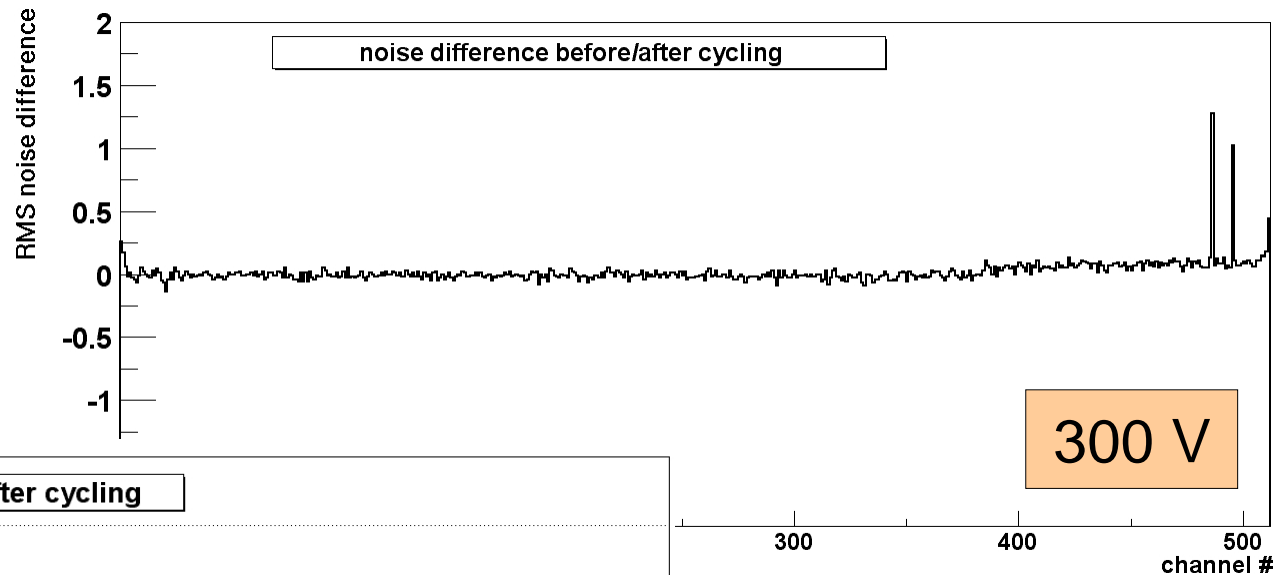
No indication  
for open bond



No additional pinholes



Noise difference:  
before –after  
cycling



Pedestal difference:  
before –after  
cycling



## Further investigations



1. Reason for high leakage current and current difference before and after cycling?  
Which wafer is affected?
2. Origin of pinholes?  
Systematic study of bond parameters with respect to pinholes planned.
3. Anomalies in noise after cycling?

Further tests:

Long term cooling, laser, cosmics, ...

Tests of the second module



# BACKUP

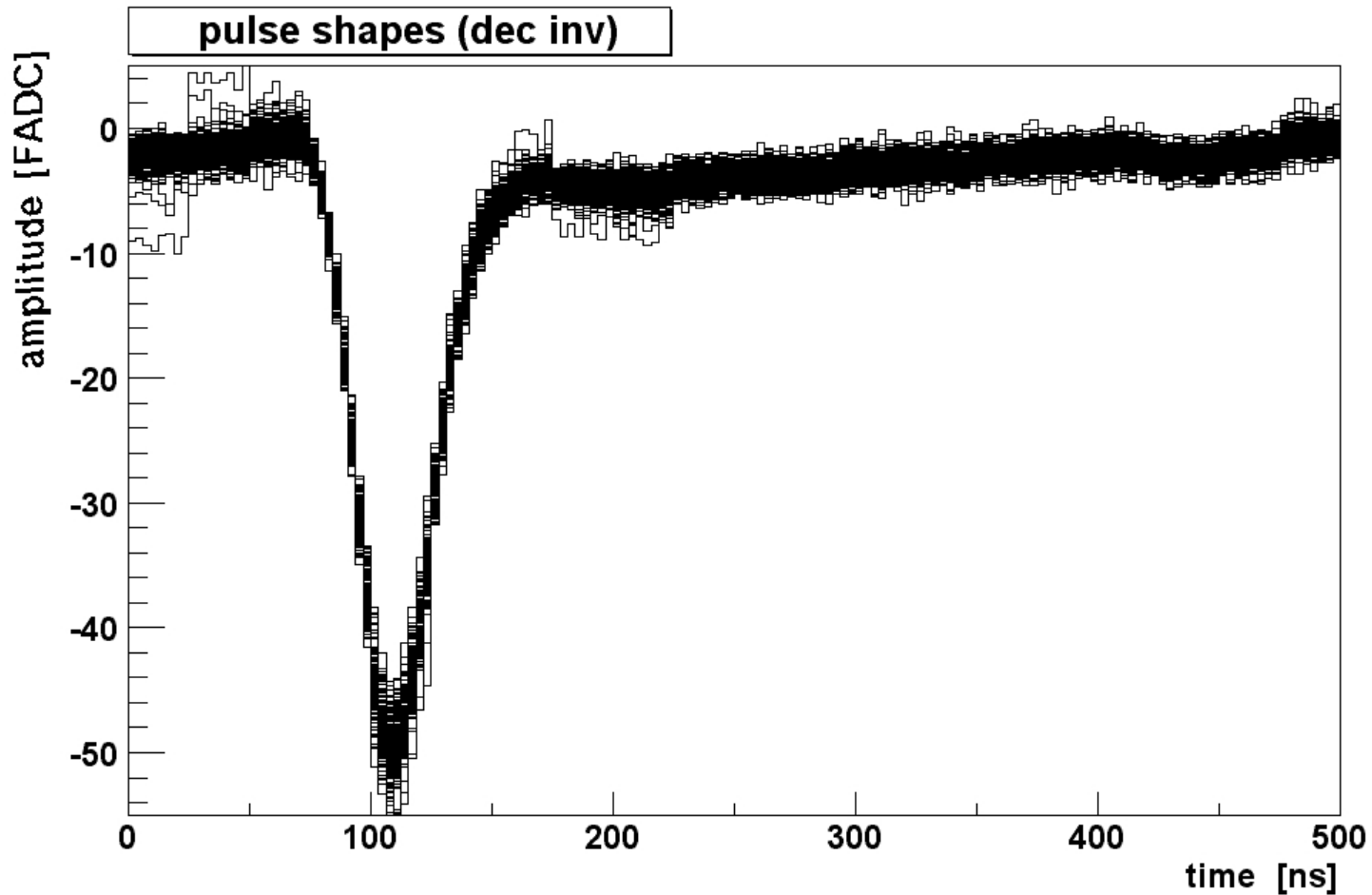


# Thermal properties of materials



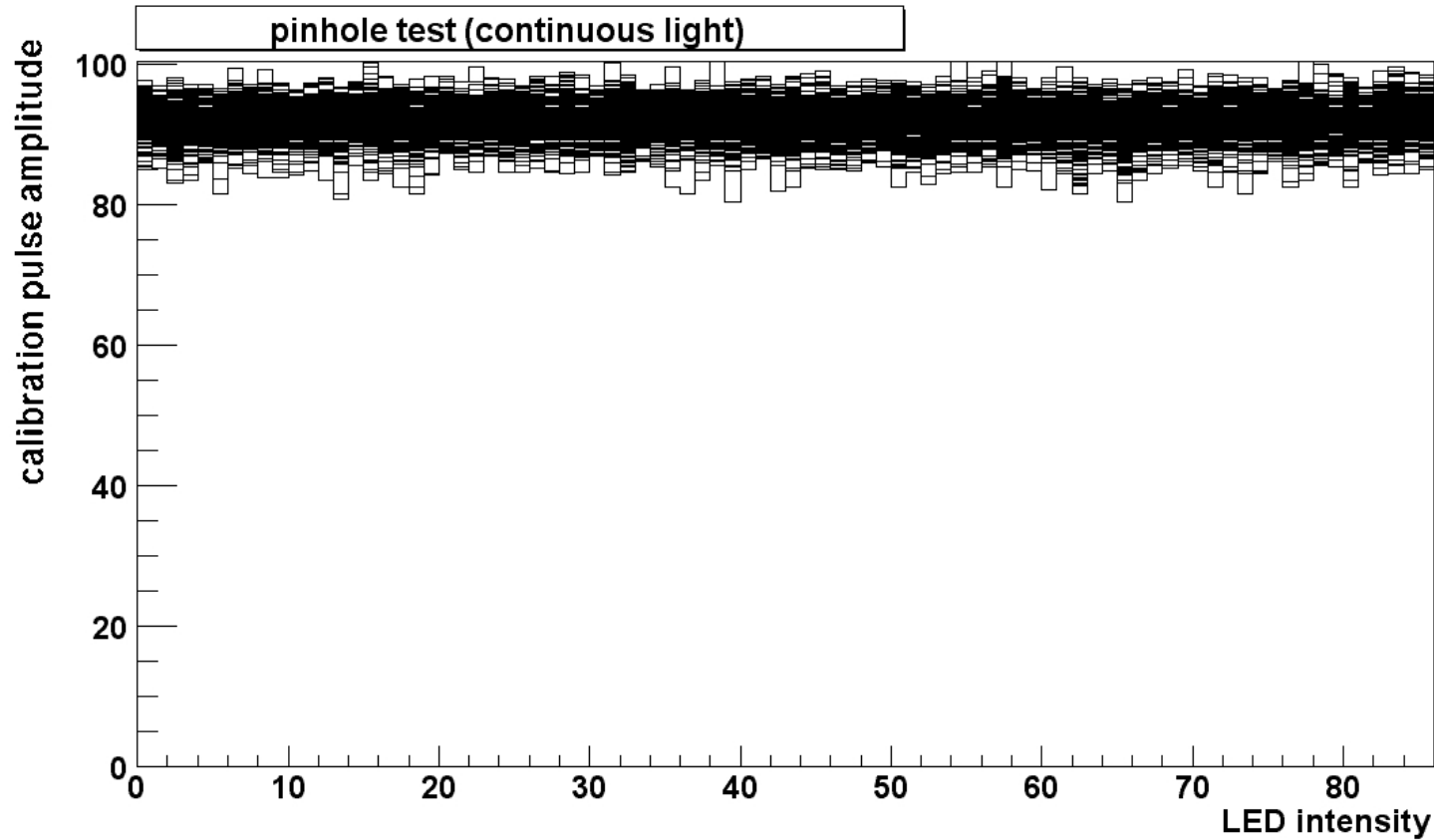
material	thermal conductivity	expansion coefficient
silicon	84 $W/mK$	$\sim 4.7 \text{ ppm}/K$
$Al_2O_3$	25 $W/mK$	• $\sim 6.5 \text{ ppm}/K$
FE779	65 $W/mK$	• $\sim 7.4 \text{ ppm}/K$
carbon fibre	300 $W/mK$	• $\sim 0.5 \text{ ppm}/K$

Type	Elasticity $N/mm^2$	Nu	CTE $1/K$	K $W/mm/K$	Density $to/mm^3$
Aluminium	71018	0,33	2,30E-05	0,154	2,82E-09
Carbon	15000	0,33	7,40E-06	0,065	1,95E-09
Epoxy	4276	0,34	4,09E-05	1,90E-04	1,27E-09
Copper	115000	0,31	1,70E-05	0,385	8,90E-09
Glass/Epoxy	30000	0,17	• 1,00E-05	9,70E-04	2,20E-09



APV 0x48  
&  
APV 0x4A

# Pinhole test after cycling



APV 0x48  
&  
APV 0x4A