



Studies of pinhole and defect detection



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Overview of module behaviour
pedestals, noise & calibration
at 'standard' leakage currents

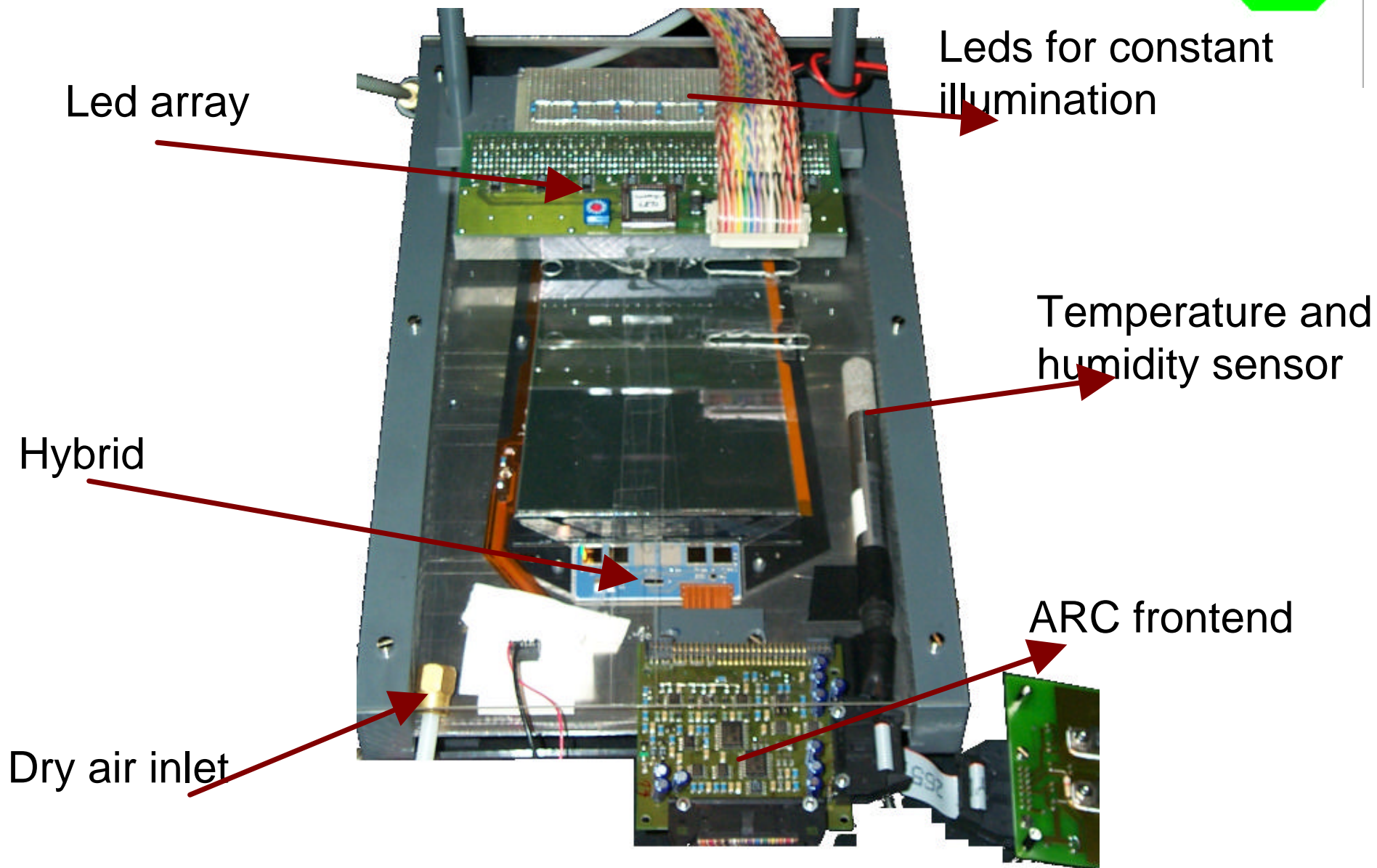
Effect of increasing leakage current on
pedestals and noise

IR Leds signals and their evidence about
defects and pinholes

Conclusions



Testsetup



Led array

Leds for constant illumination

Temperature and humidity sensor

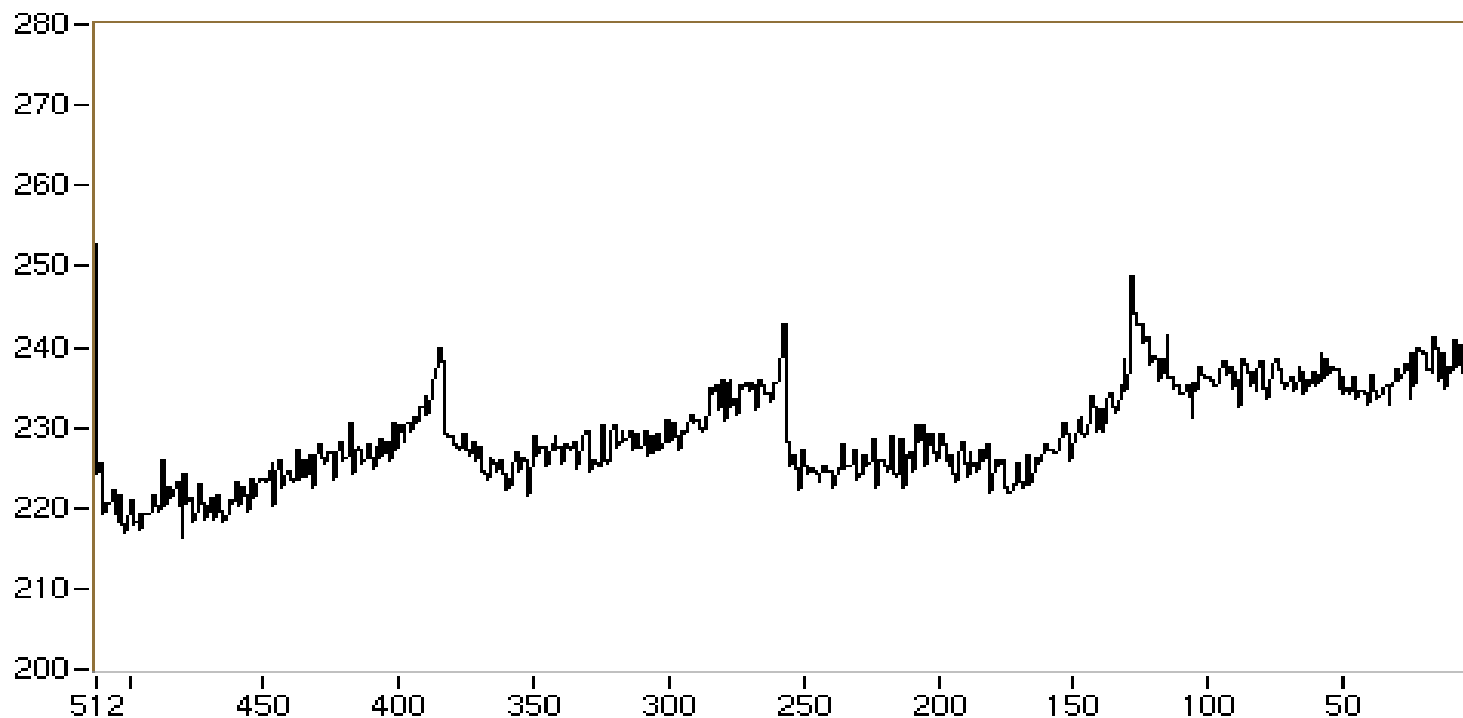
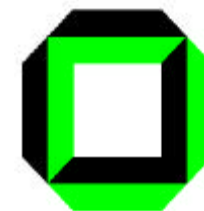
Hybrid

ARC frontend

Dry air inlet



Pedestals



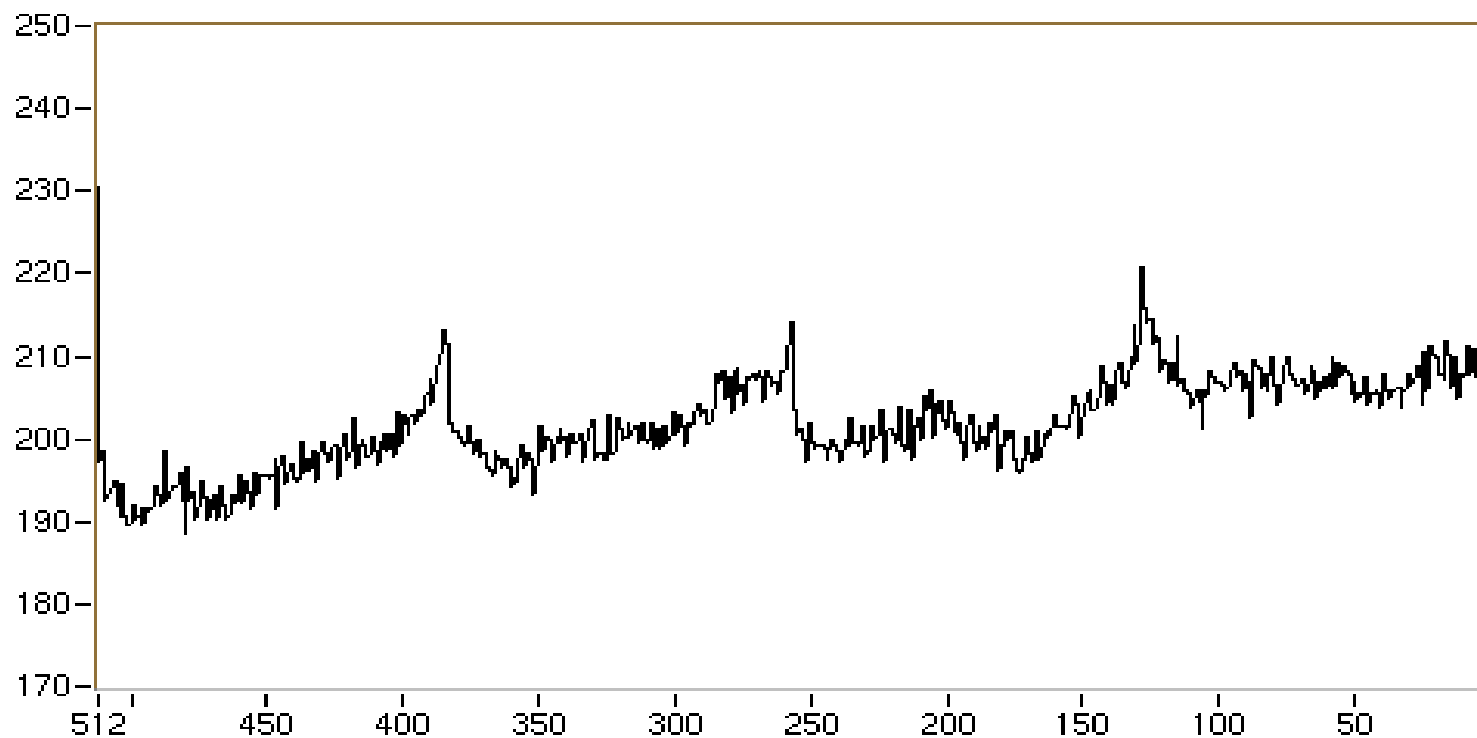
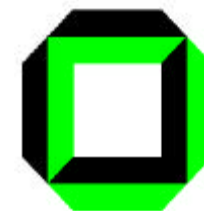
Peak mode

Taken with

- default apv25 settings
- depletion voltage of 150 V
- Leakage current 400 nA



Pedestals



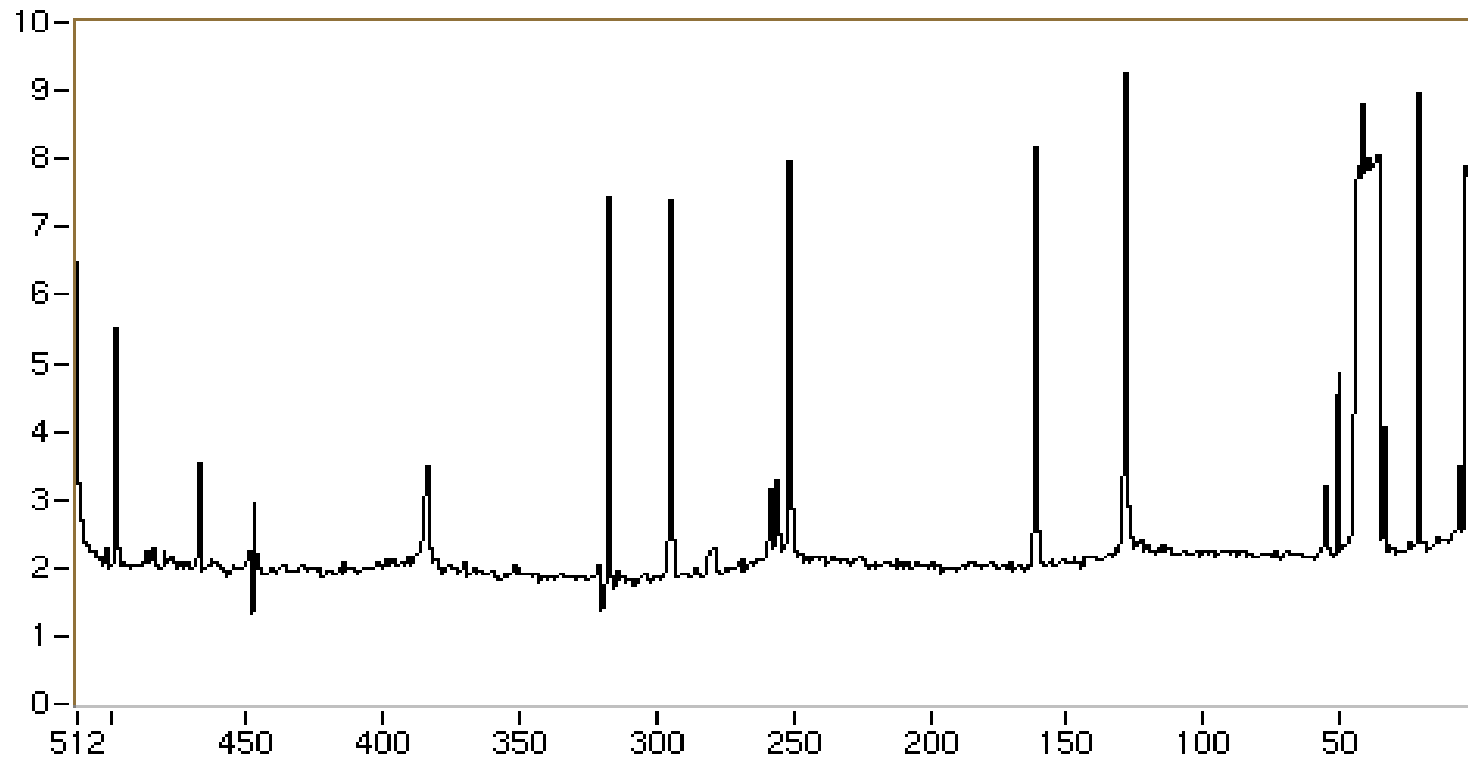
Deconvolution mode

Taken with

- default apv25 settings
- depletion voltage of 150 V
- Leakage current 3 μA



Noise



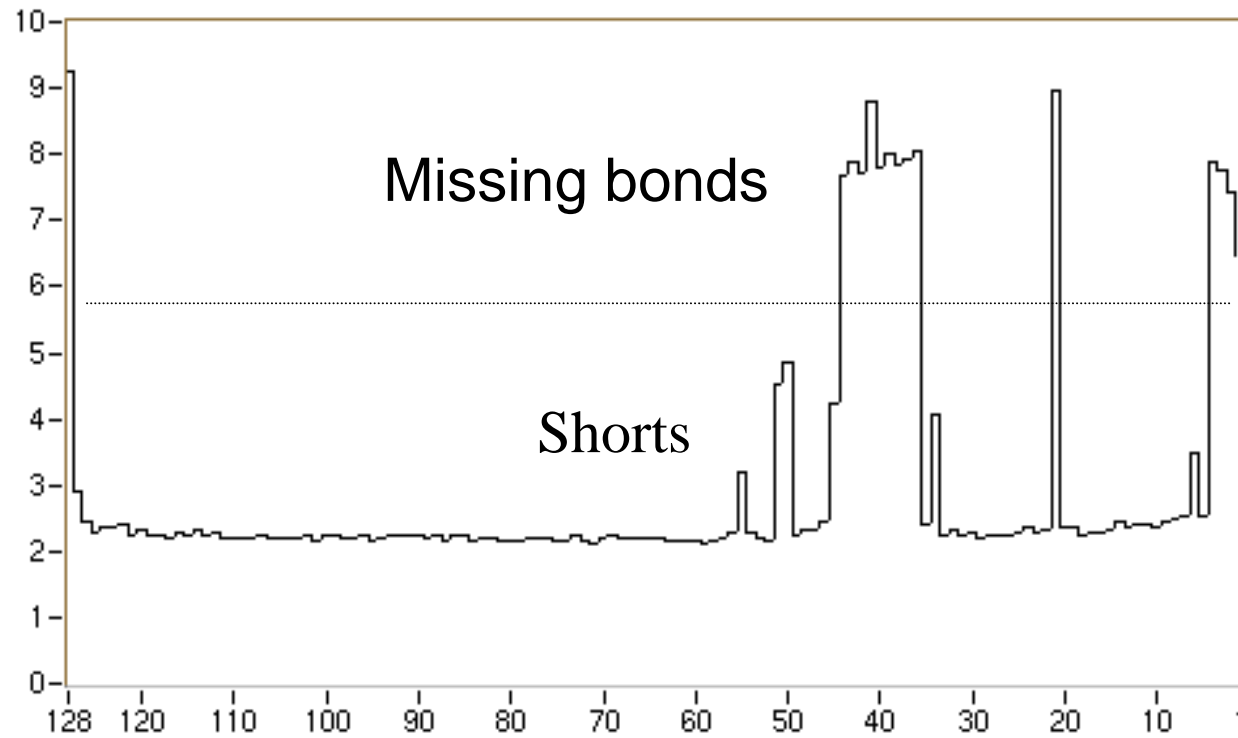
Peak mode

Taken with

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- I_{leak} 400 nA



Noise



Peak mode

Taken with

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- depletion voltage of 150 V
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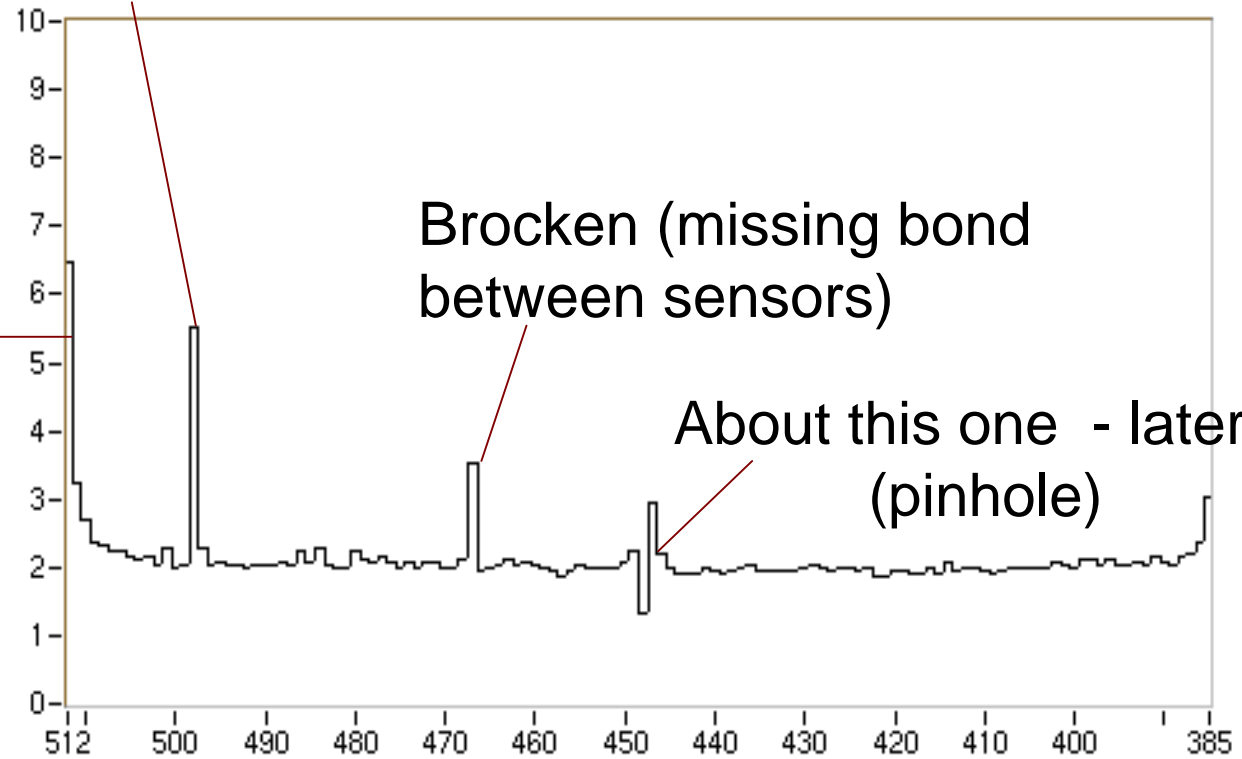


Noise



Unknown

Missing bond at
pitchadatper



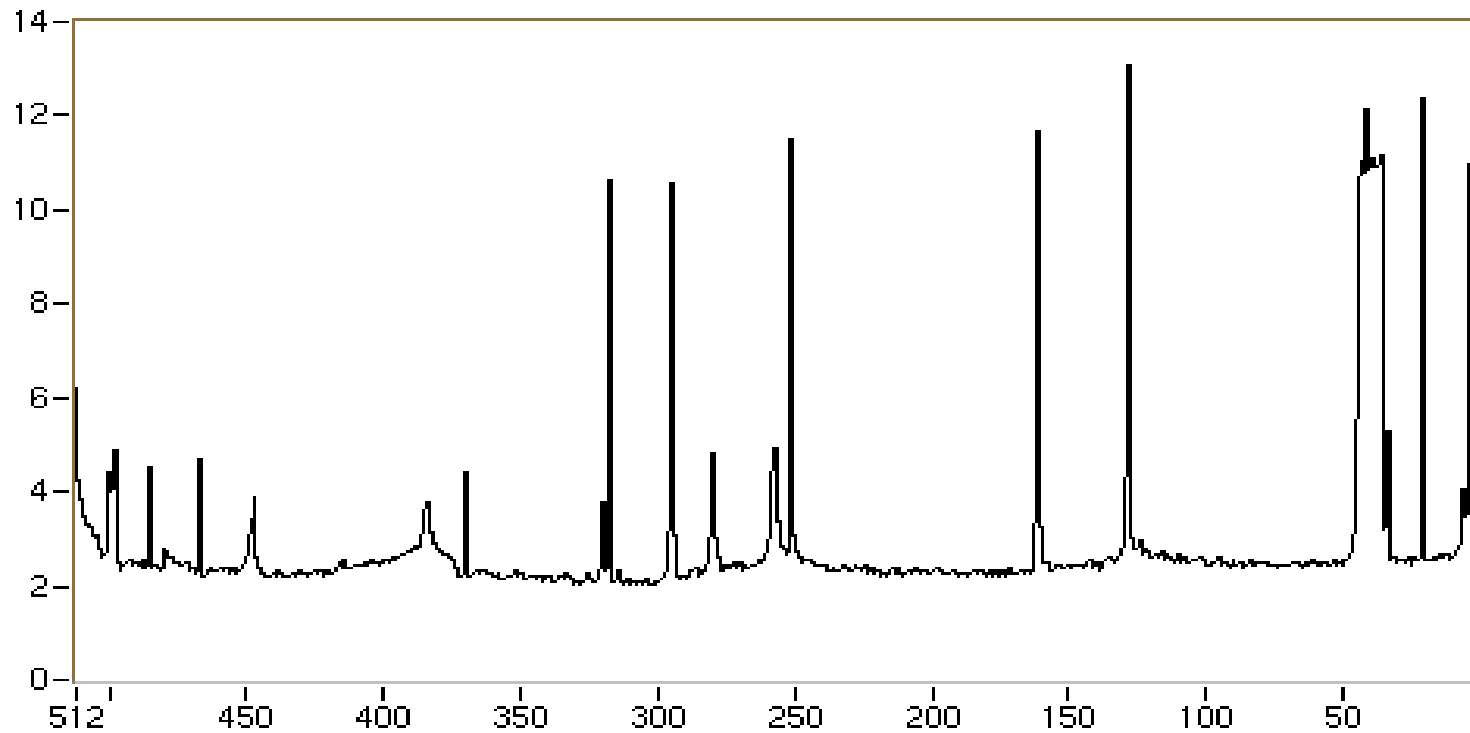
Peak mode

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Noise



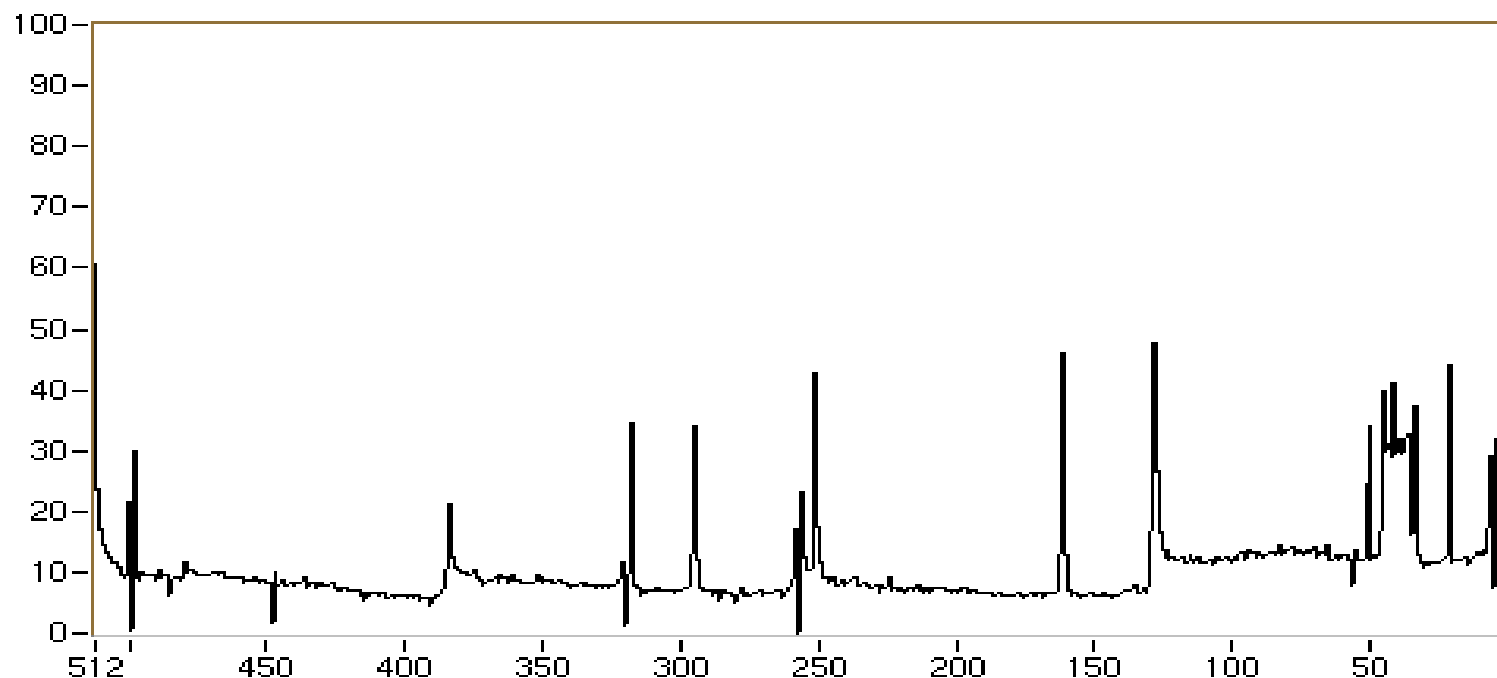
Deconvolution mode

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Noise without common mode correction



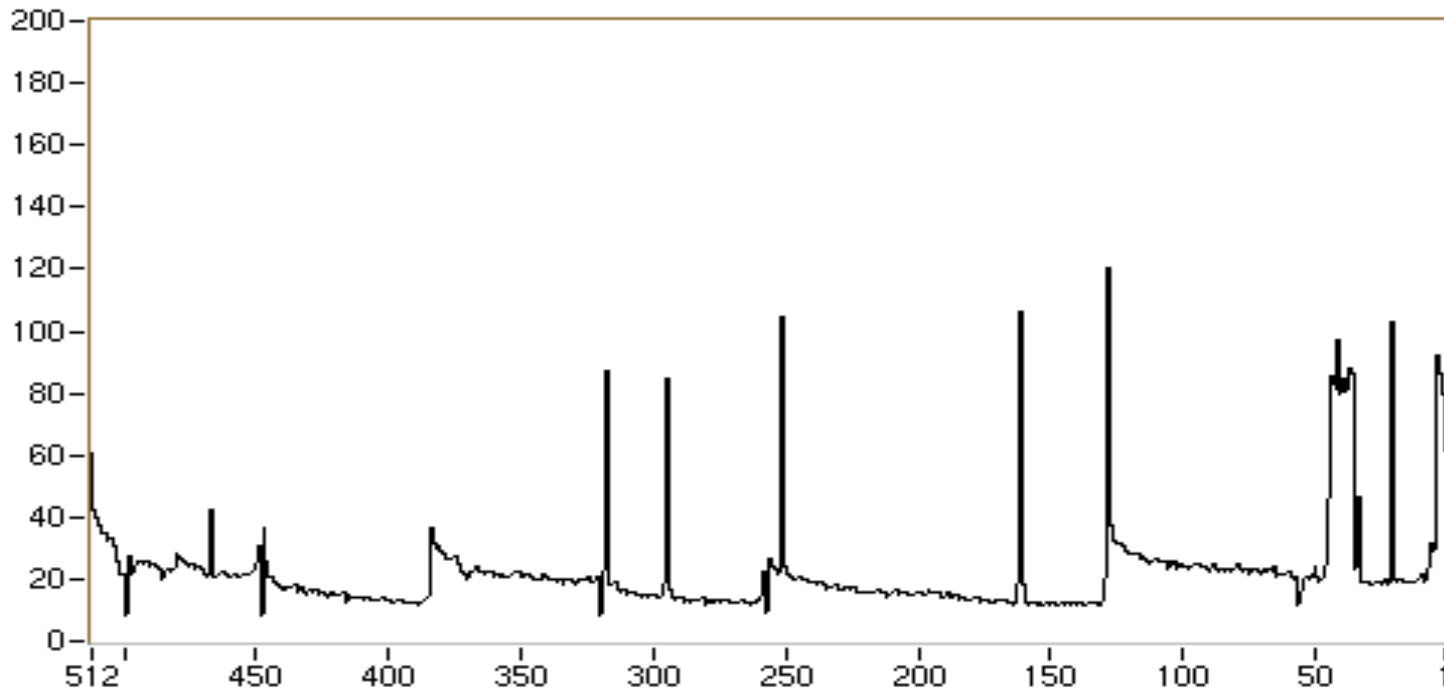
Peak mode

Taken with

- default apv25 settings
- depletion voltage of 150 V
- Leakage current 12 μA



Noise without common mode correction



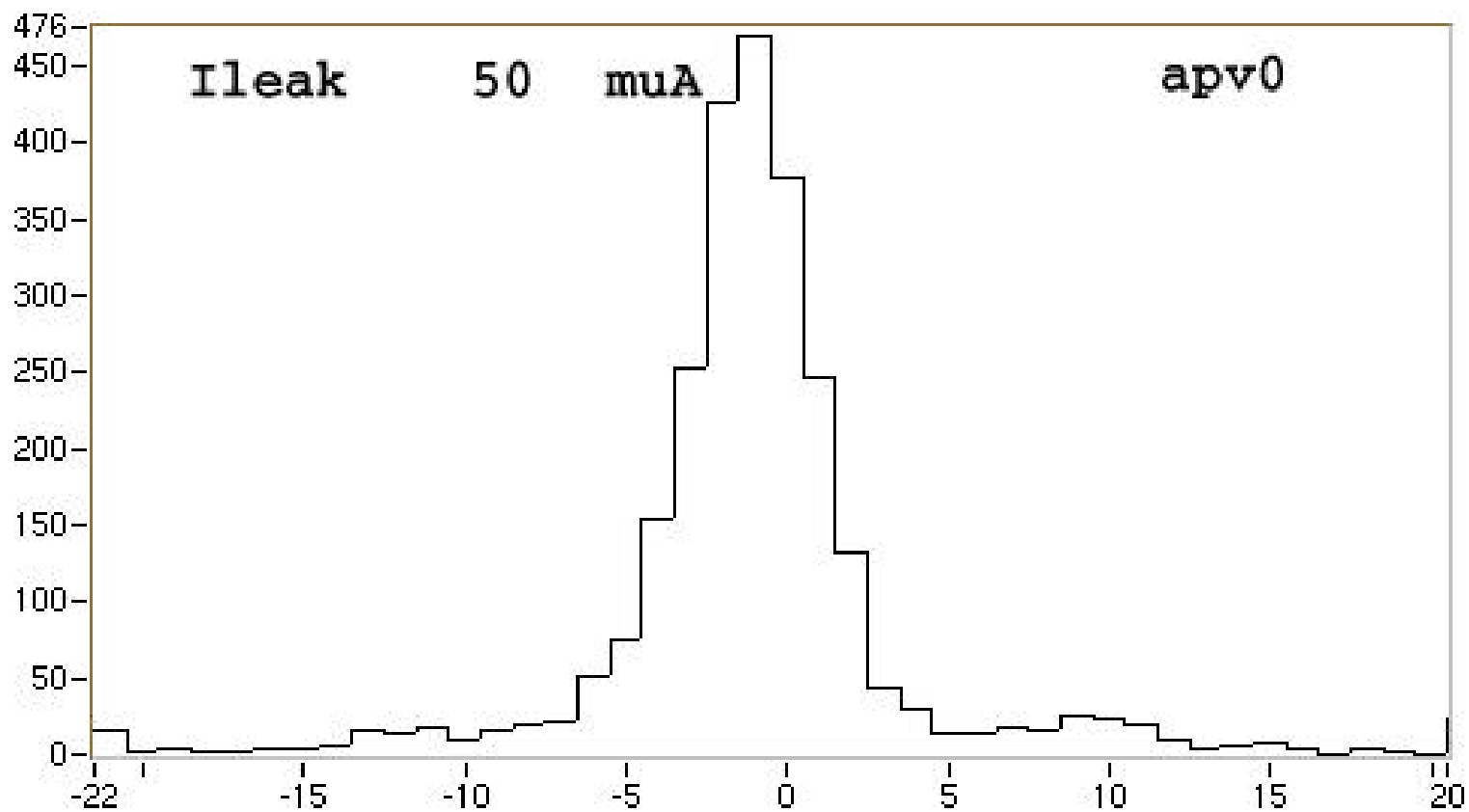
Deconvolution mode

Taken with

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- depletion voltage of 150 V
- Leakage current 12 μA



Common mode



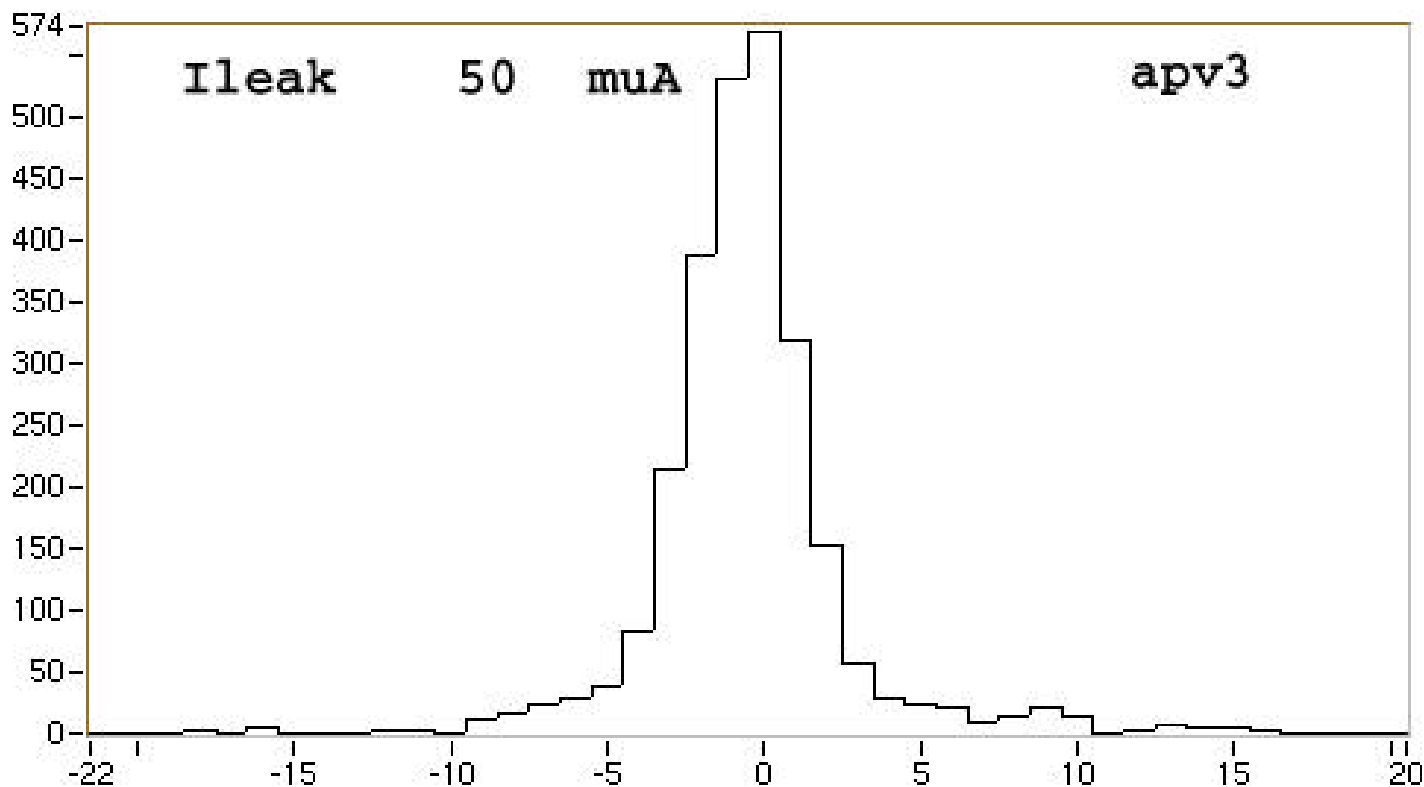
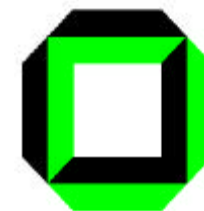
Peak mode

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- default `apv25` settings
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Common mode



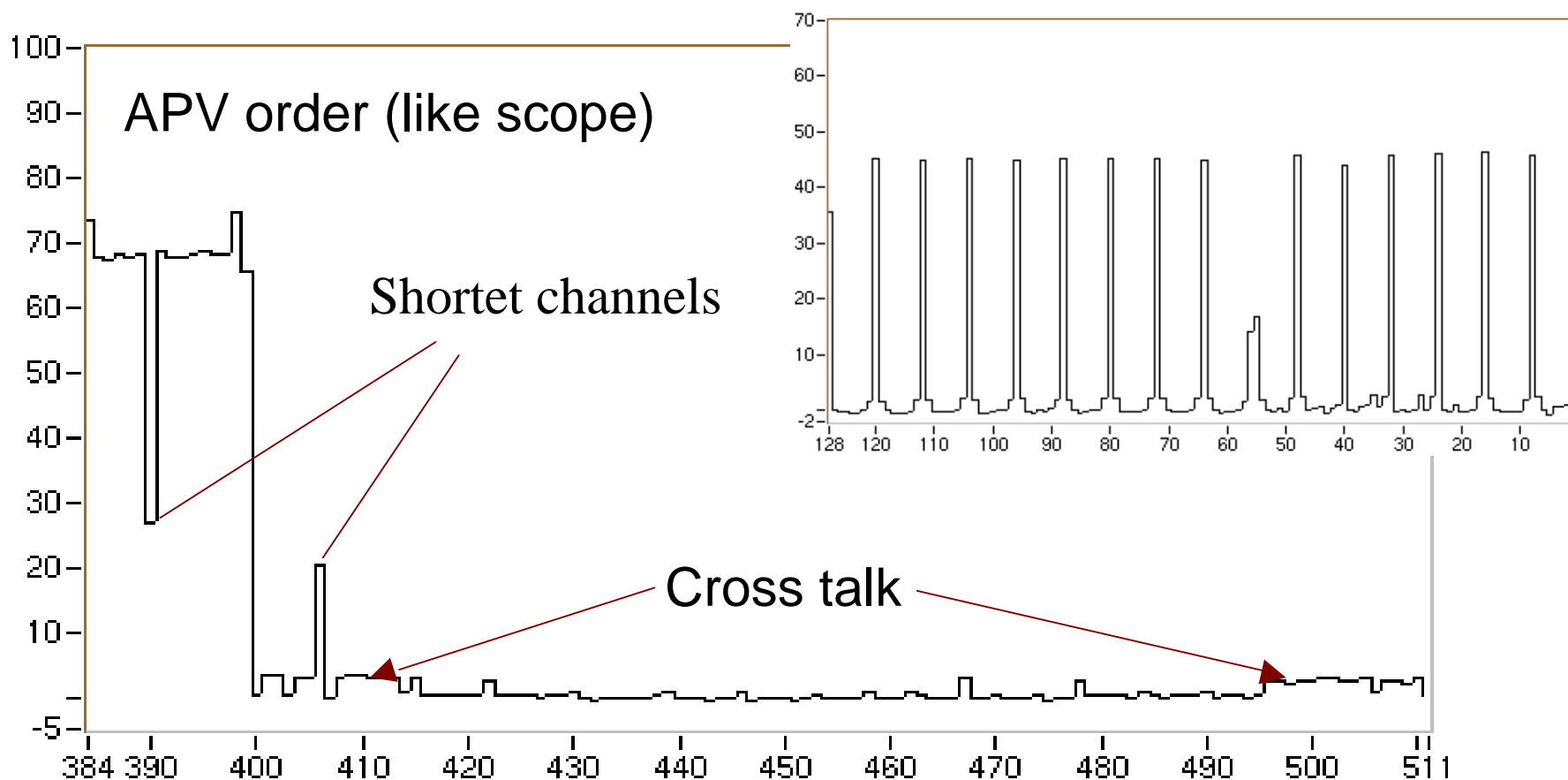
Deconvolution mode

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Calibration and leakage current



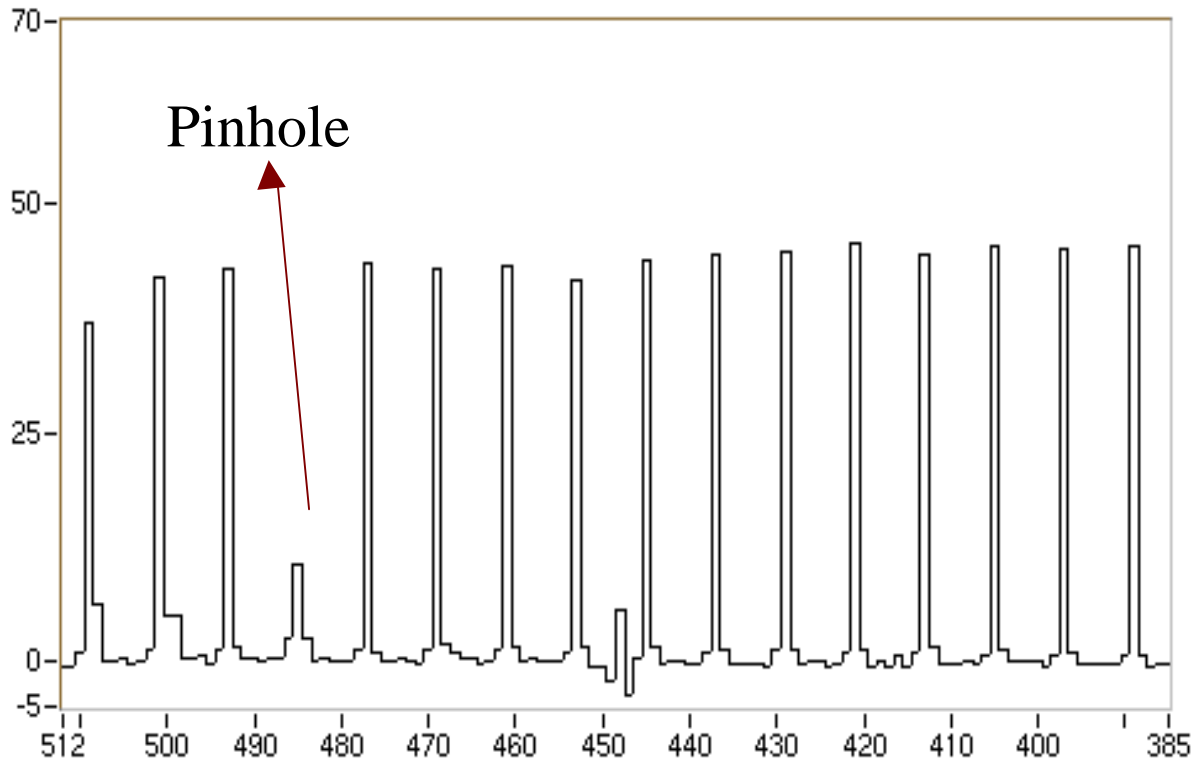
Taken with

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- depletion voltage of 150 V

Deconvolution mode



Calibration



Calibration unit 3
ical 60 (2 MIPS)

averaged signal

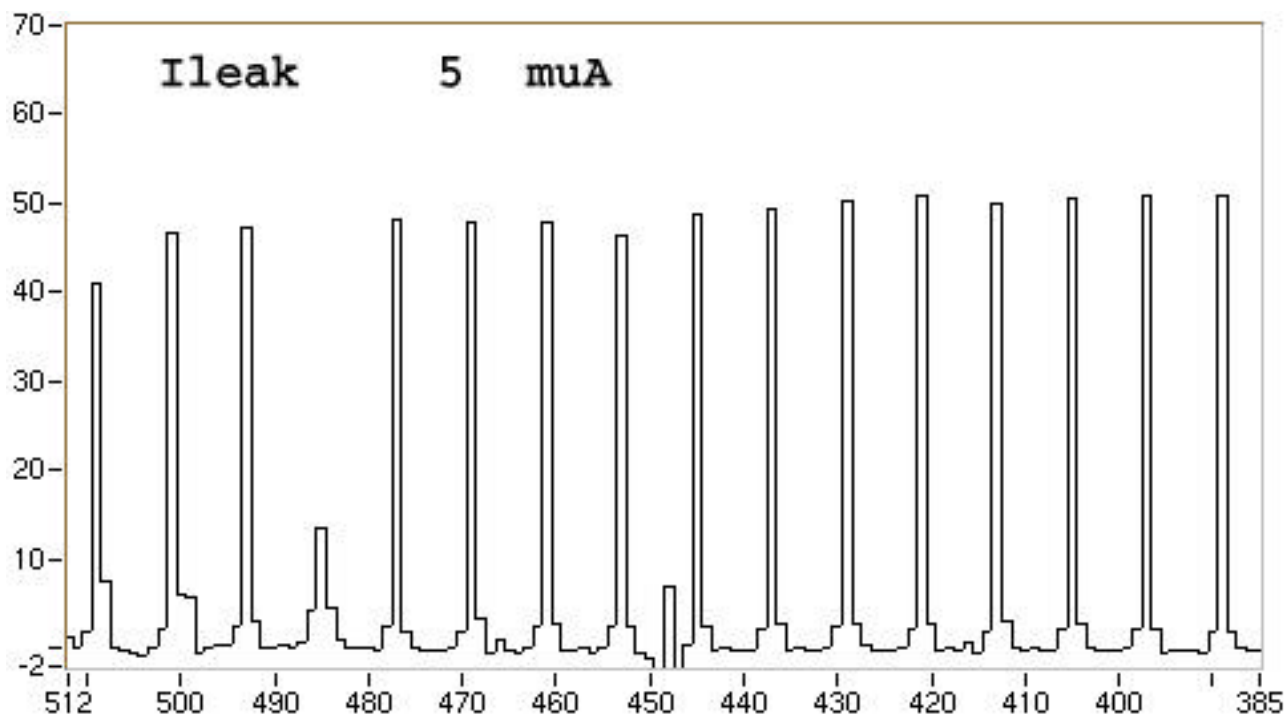
Deconvolution mode

Taken with

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Calibration, pinholes and increasing leakage current



Calibration unit 0
ical 60 (2 MIPS)

averaged signal

Deconvolution mode

Taken with

- default apv25 settings
- depletion voltage of 150 V



Intermediate result



We can detect with noise & calibration at standard leakage currents, as they are given by the silicon

- .. all kinds of missing bonds
- .. Breaks (act like missing bonds)
- .. Shorts

We probably will **not** detect all pinholes

(Will we take the risk ?)



Pedestals at different leakage currents



Peak mode

Taken with

- default apv25 settings
- depletion voltage of 150 V



Pedestals at different leakage currents



Detailed look on first apv

Peak mode

Taken with

- default apv25 settings
- depletion voltage of 150 V



Pedestals at different leakage currents



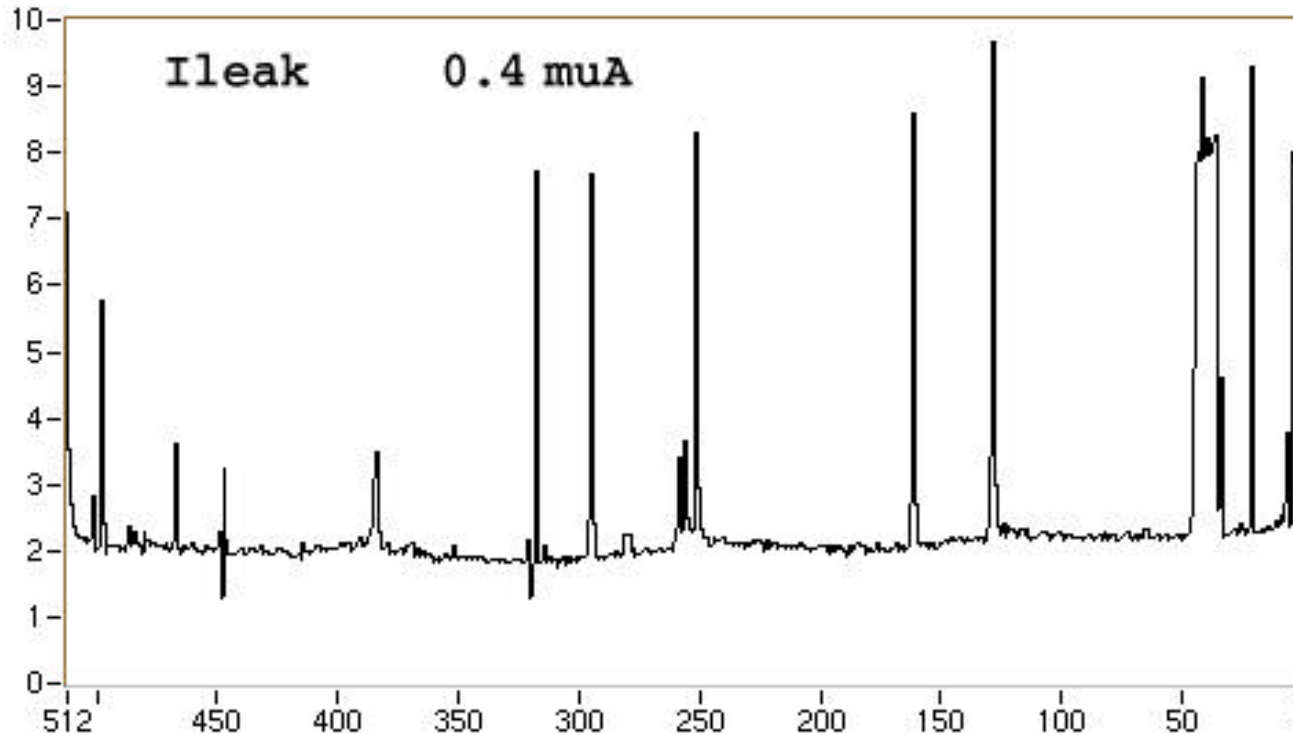
Deconvolution mode

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Noise & increasing leakage current



Stable tags for missing bonds

Slight global noise increase with leakage current

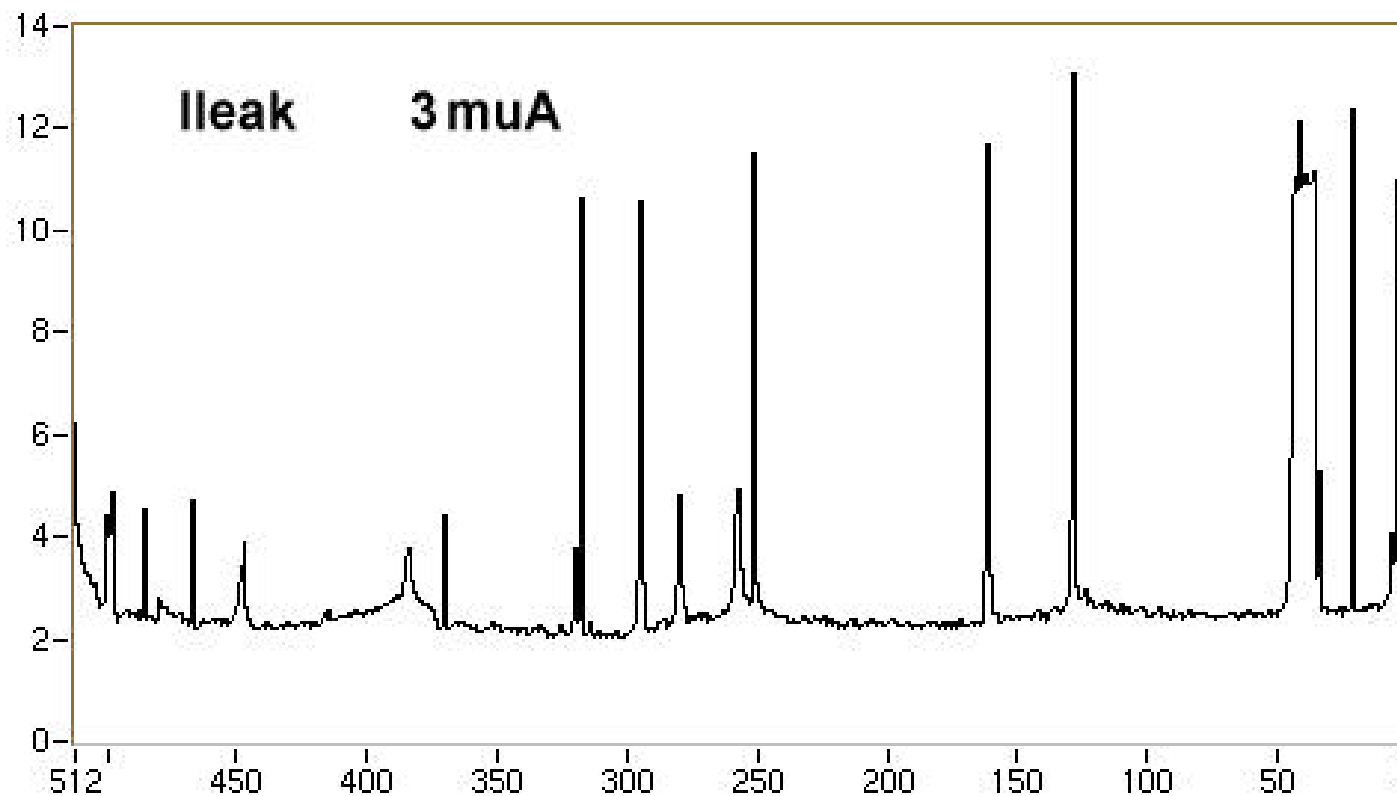
Peak mode

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Noise with running leakage current



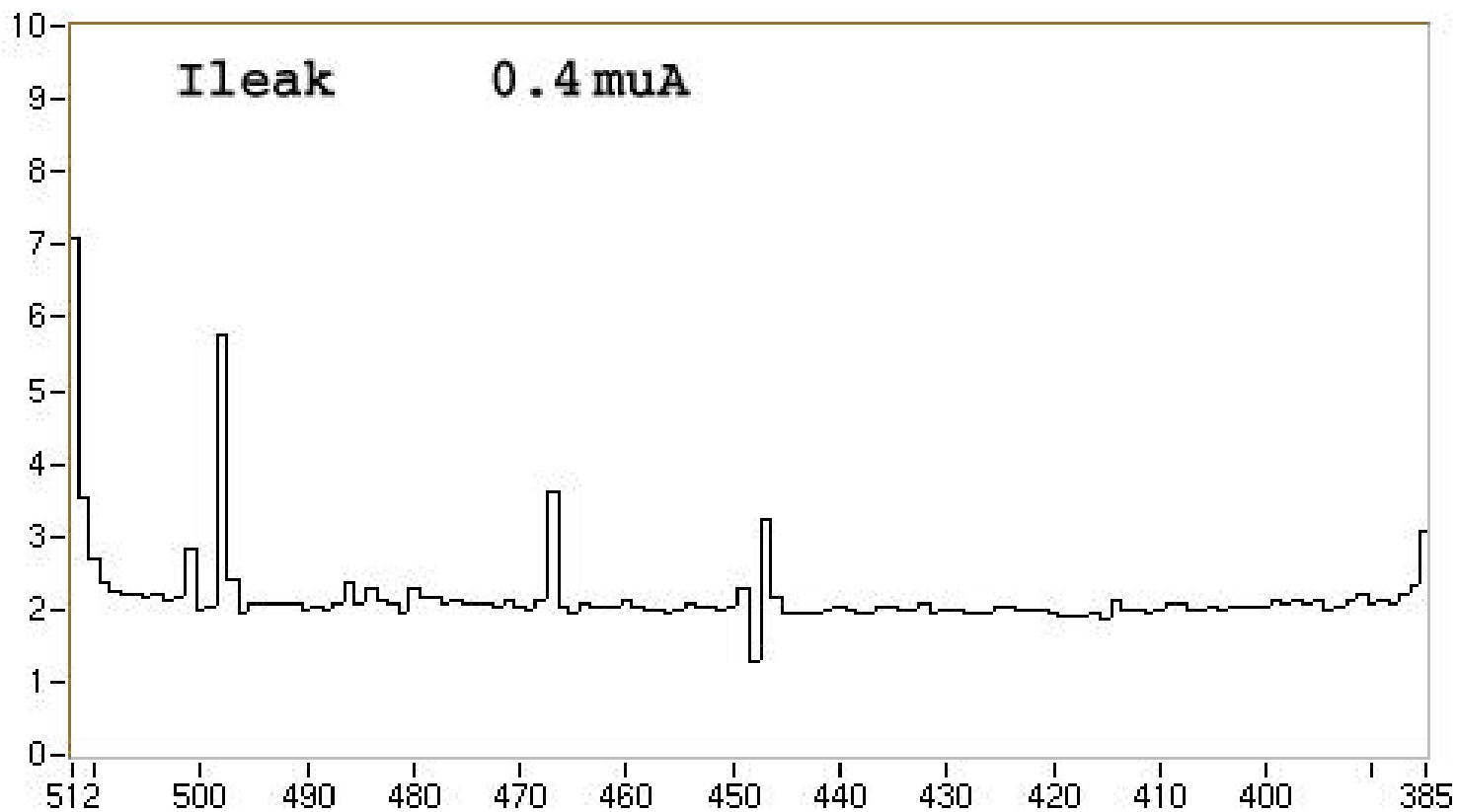
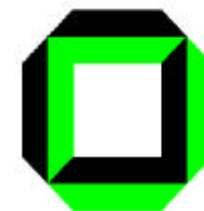
Deconvolution mode

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Noise with running leakage current



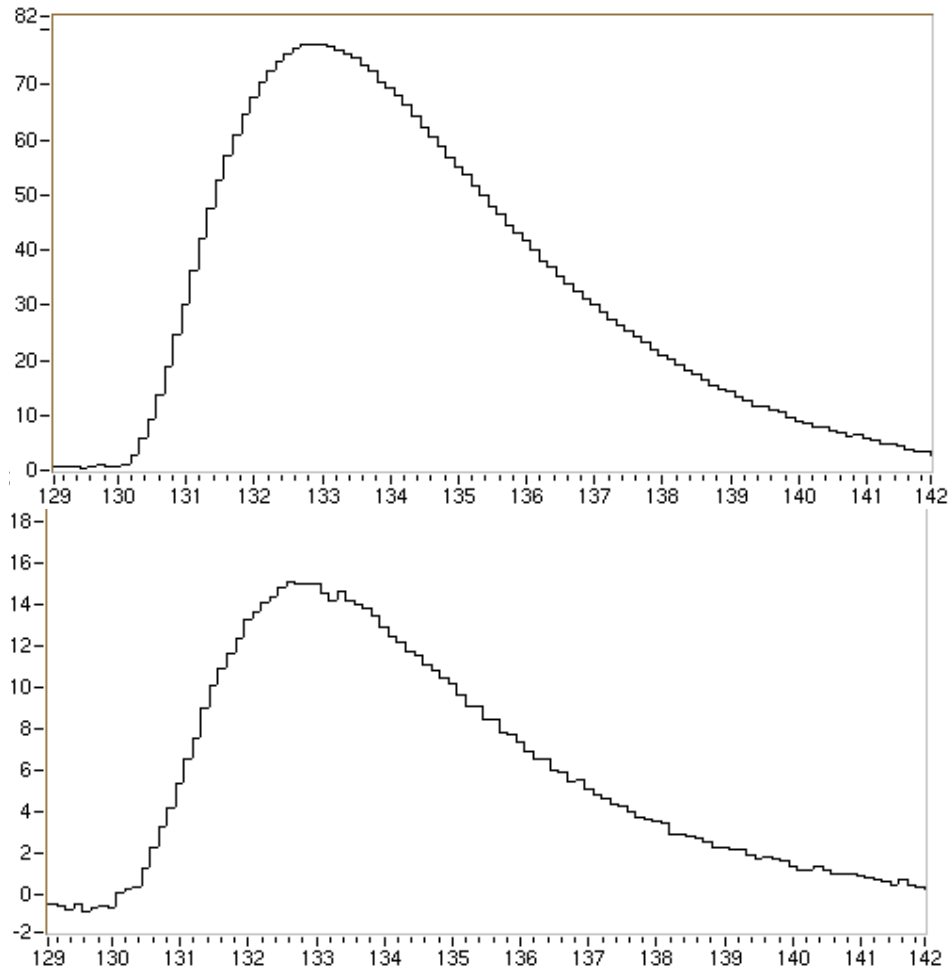
Peak mode

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- Ileak 400 nA



Calibration



Peak mode

We have already seen:

- „ It will tag faults at higher leakage currents

Pulse shape looks independent of faults, only variations in height

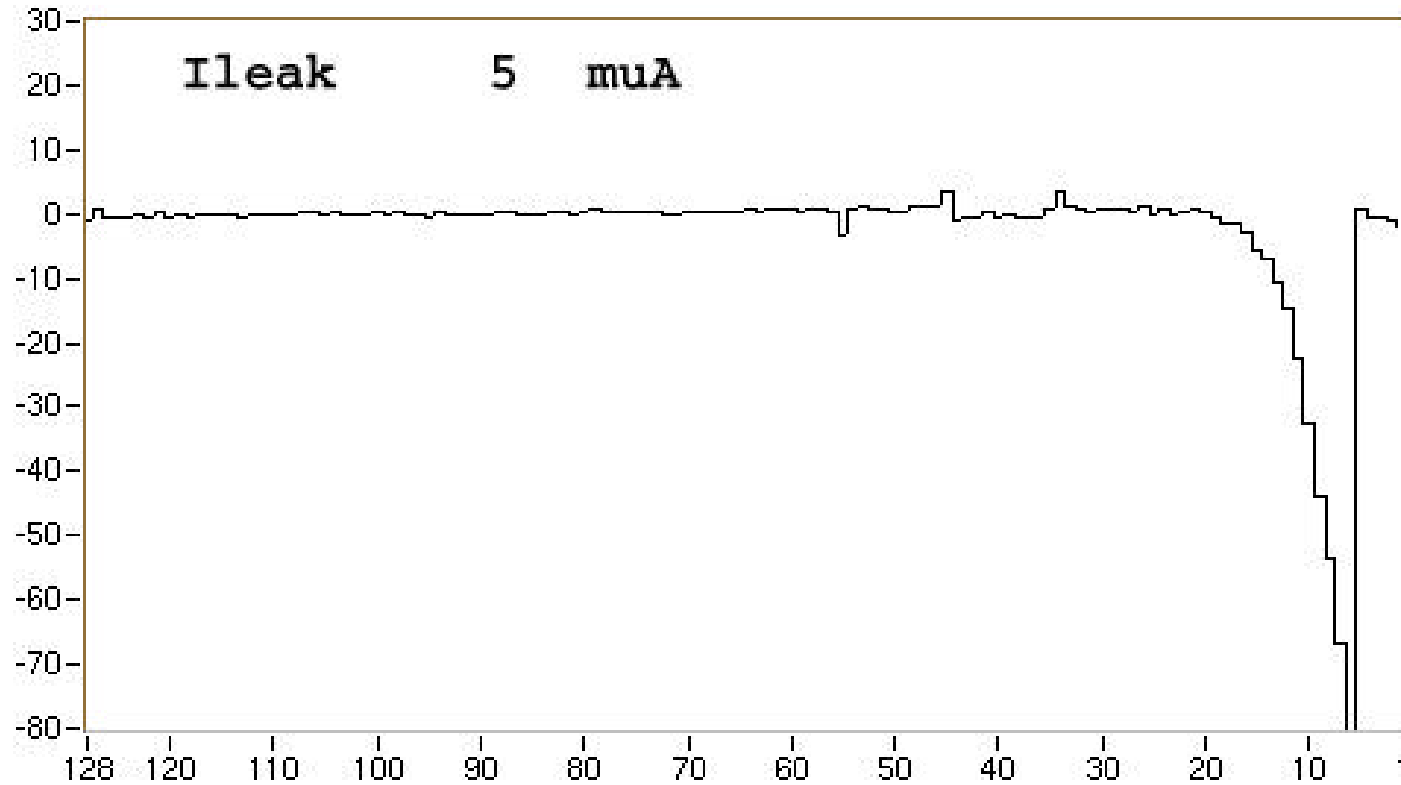
But time consuming test

Taken with

- „ default apv25 settings
- „ depletion voltage of 150 V
- „ Leakage current 400 nA



IR Leds and faults



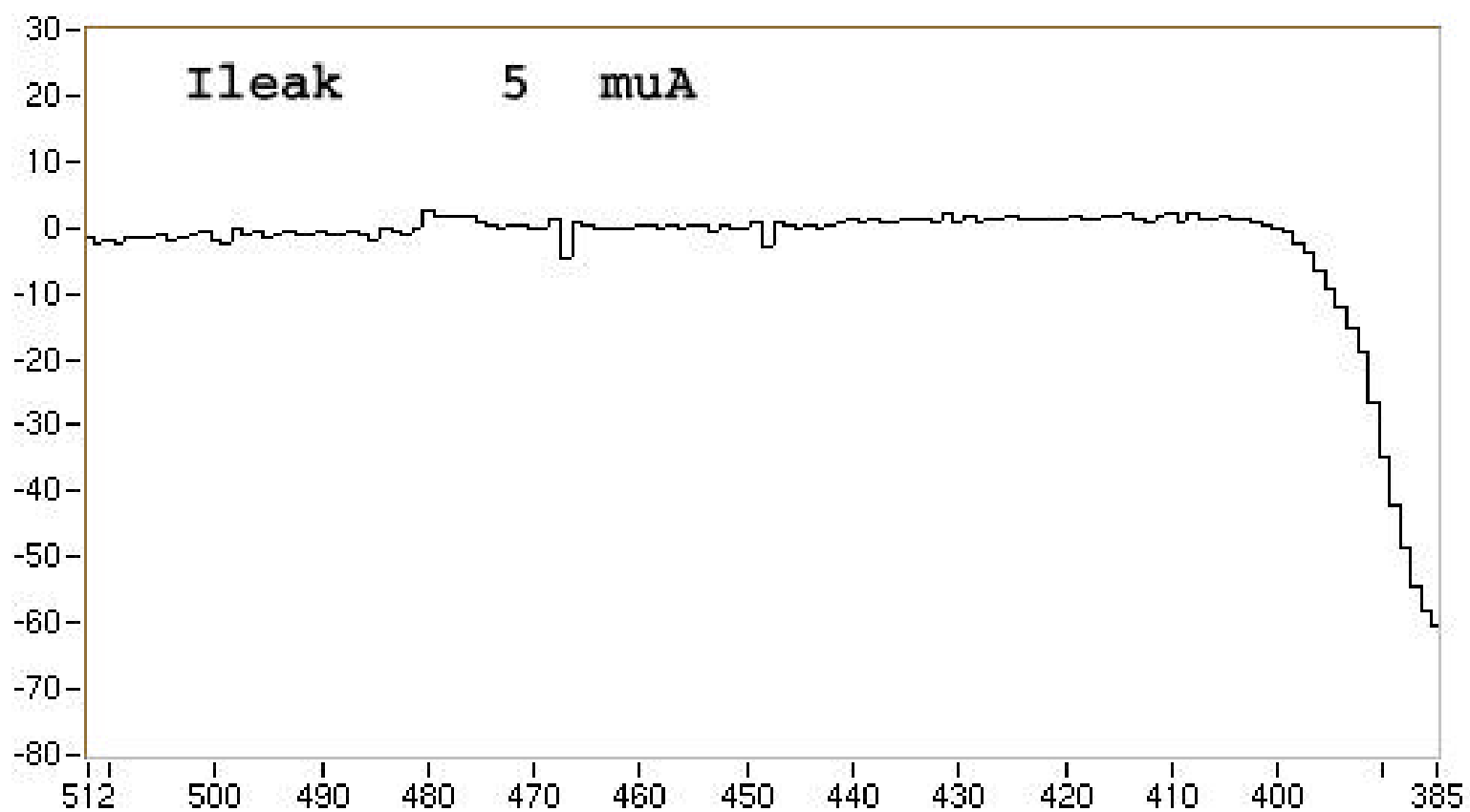
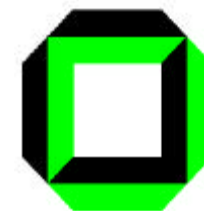
Peak mode

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IR Leds and faults



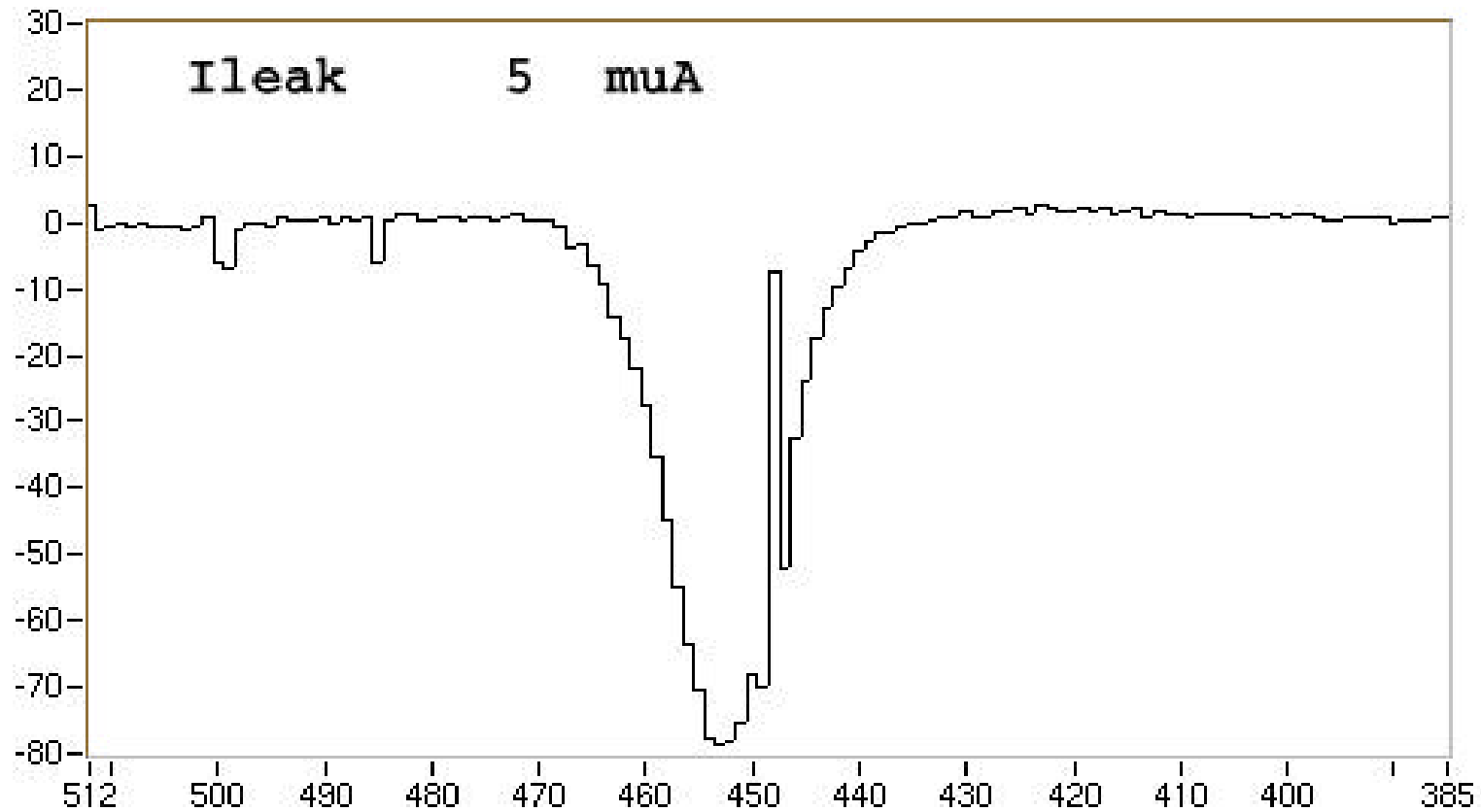
Peak mode

Taken with

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IR Leds signals stability



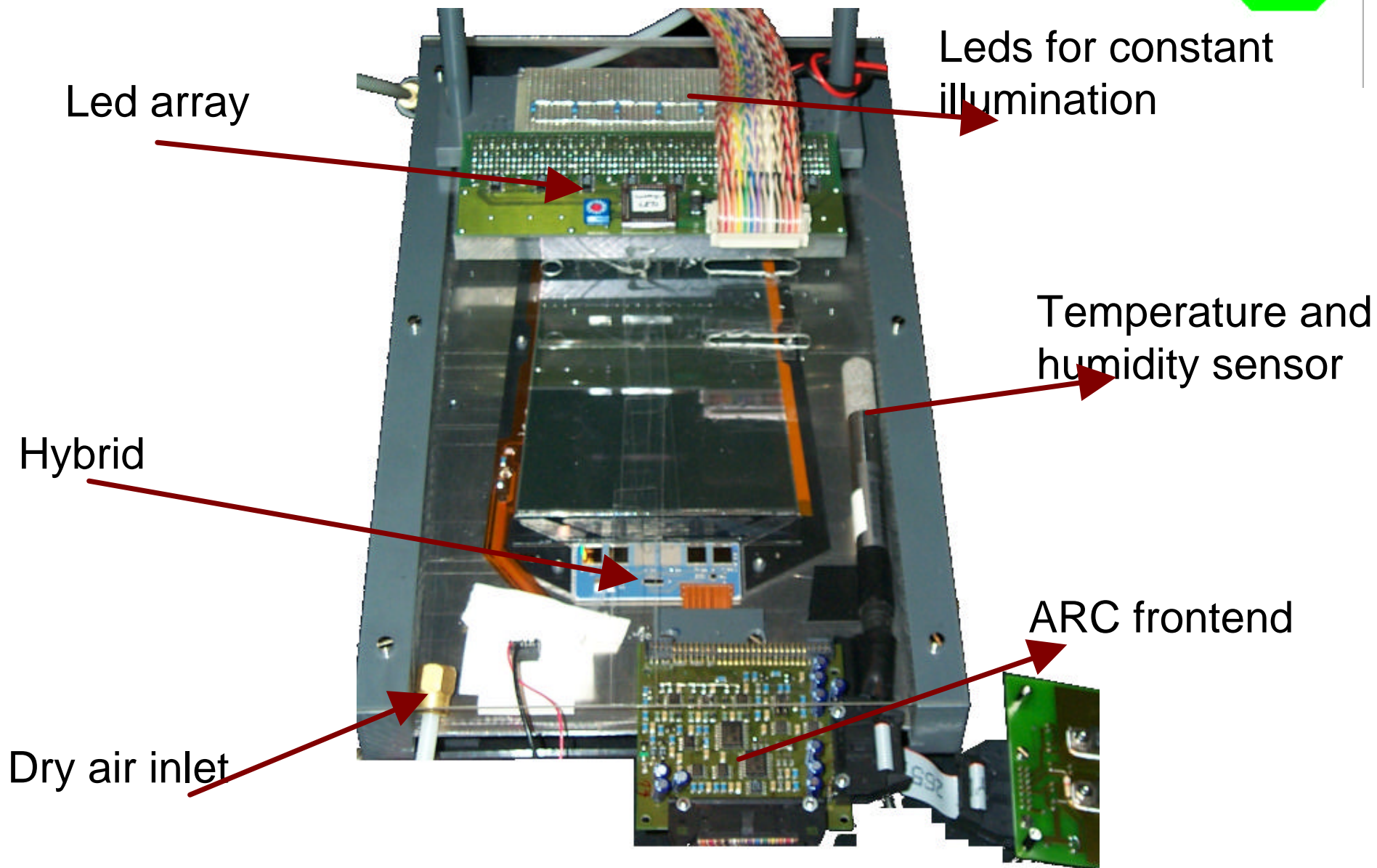
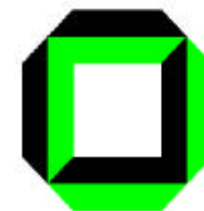
Peak mode

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Testsetup



Led array

Leds for constant illumination

Temperature and humidity sensor

Hybrid

ARC frontend

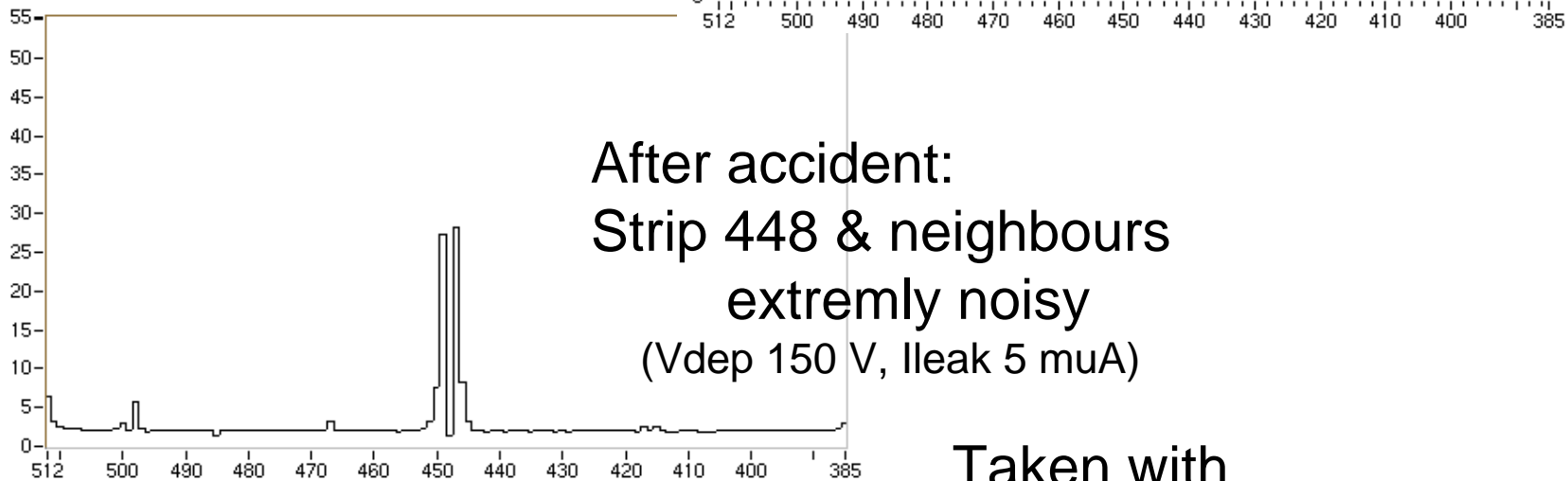
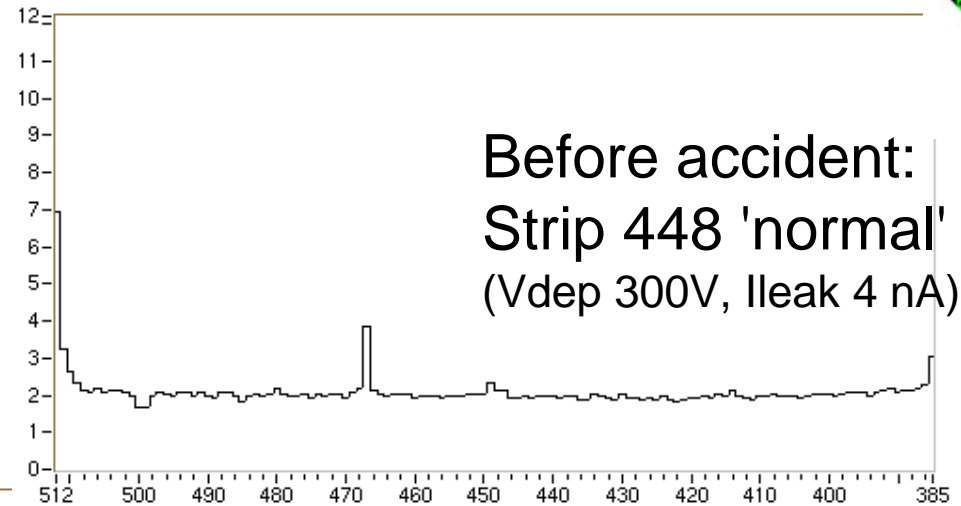
Dry air inlet



Light and depleted silicon



Strip 448 bond pinhole



Taken with
" default apv25 settings

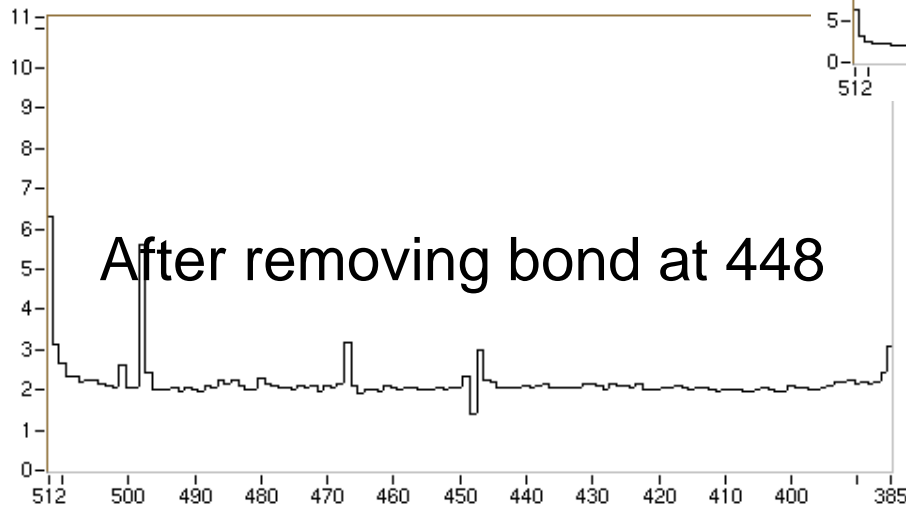
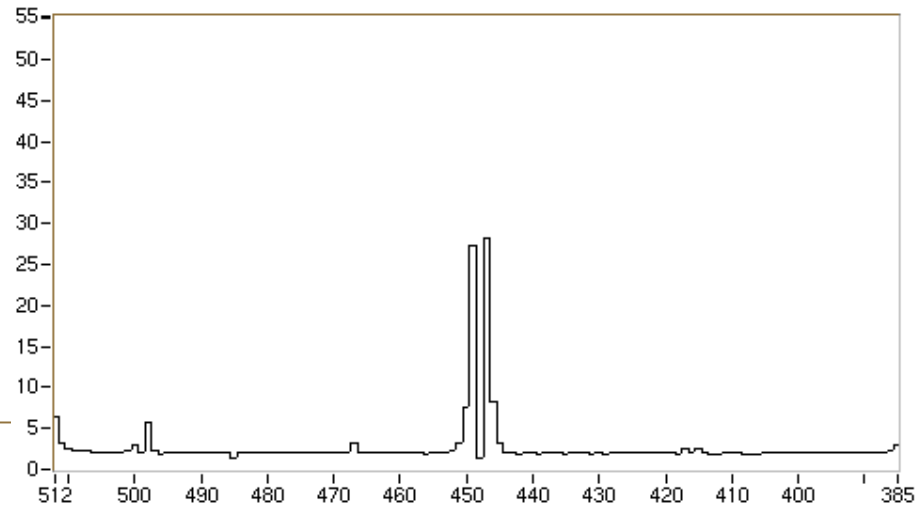
Peak mode



Light and depleted silicon



Looks like a real pinhole now, but what happened ?



Peak mode

Taken with

- default apv25 settings
- Leakage current 4 μA



Conclusion



Module is still stable even with four pinhole/chip at 1.9 mA, but common mode is affected by pinhole

Increasing leakage current combined with noise and calibration studies gives clear tags for different defect types
-> **Operator command: remove / rebond possible**

Continuous illumination with IR Leds enables us to control leakage current at final working conditions (reverse bias)

Led array give physical signal to ensure functionality of all channels and gives redundand tags for all defect types

Noise increase with leakage current as expected
Deconvolution is less effected than peak mode