P-type One-sided Hexagonal Spiral Drift Detectors

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Why One-sided Hexagonal Spiral Drift

1) Low noise: low capacitance

low leakage current

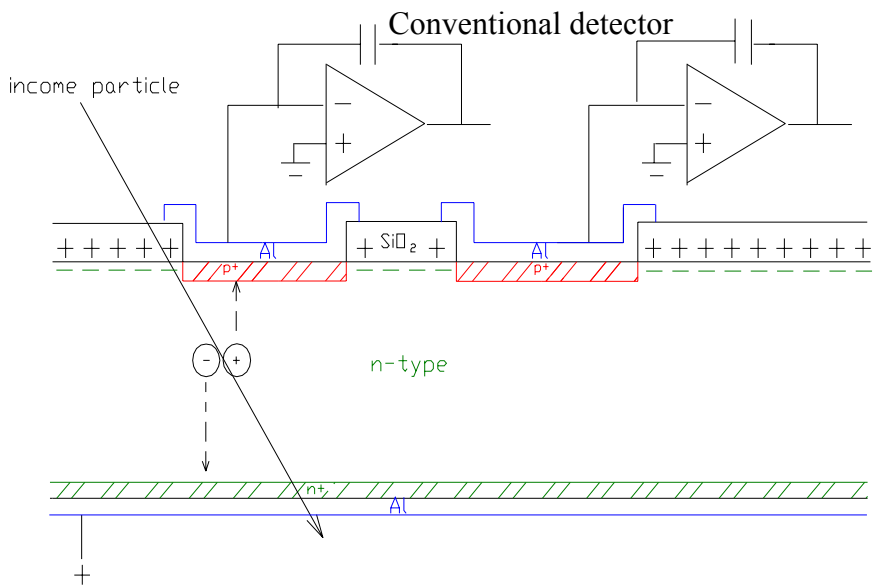
2) 100% coverage

3) Single-sided design

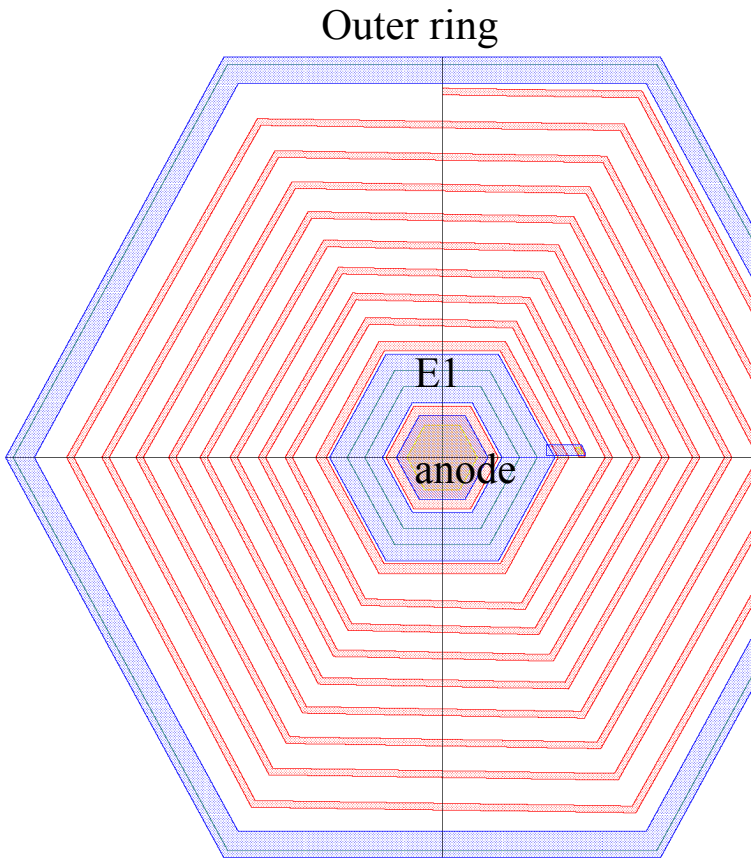
4) As low number of bond as possible: **2/pixel**

Why P-type Material

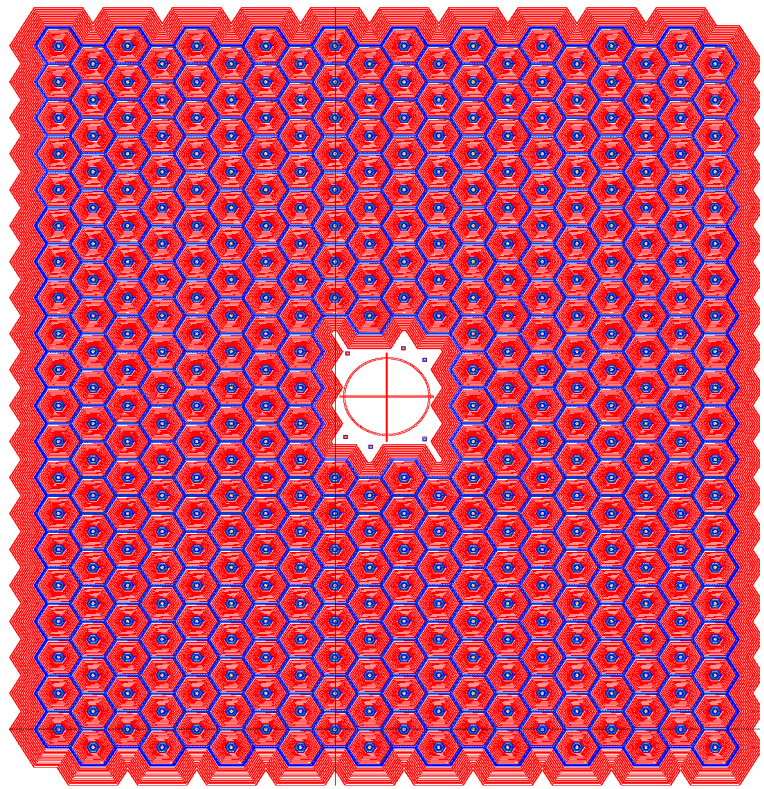
- Constraint of existing electronics
- Need positive polarity of signal



Design, Process and Operation (design)

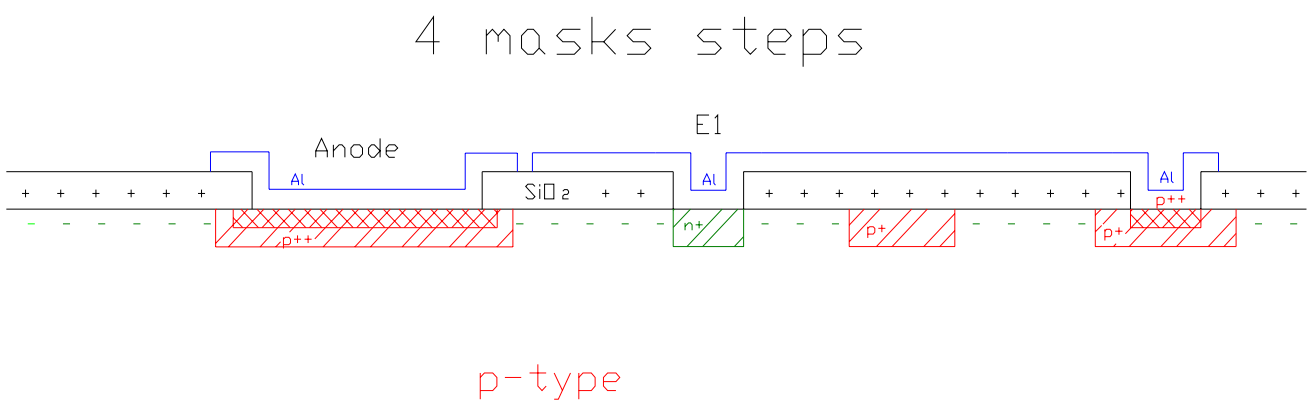


1 mm² in area



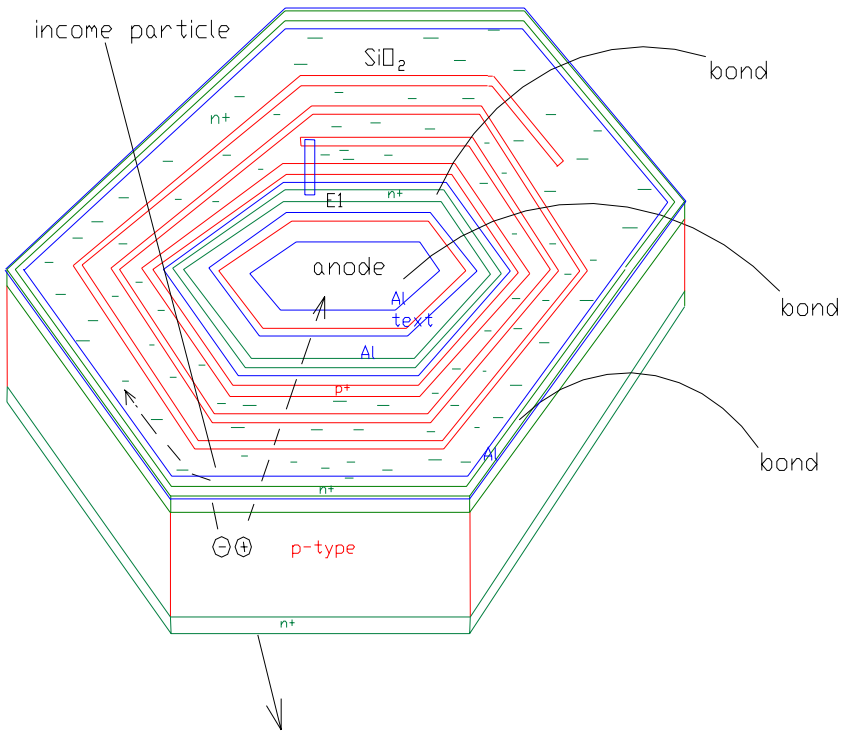
384 cells, 2x384+1 bonds

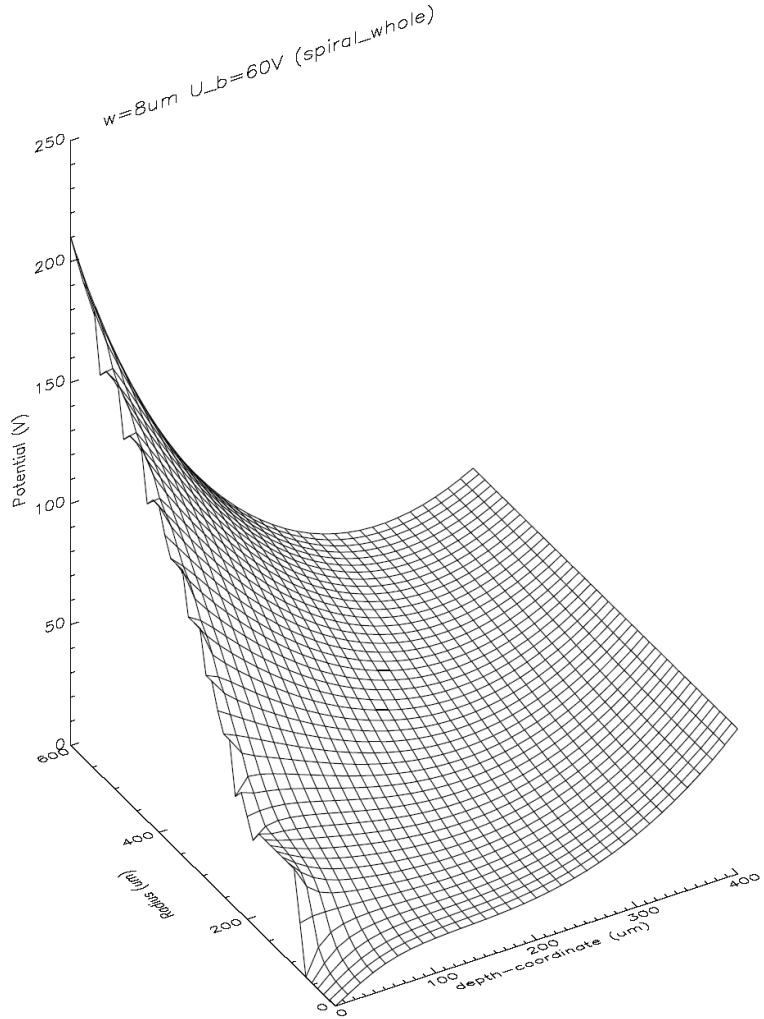
Design, Process and Operation (process)



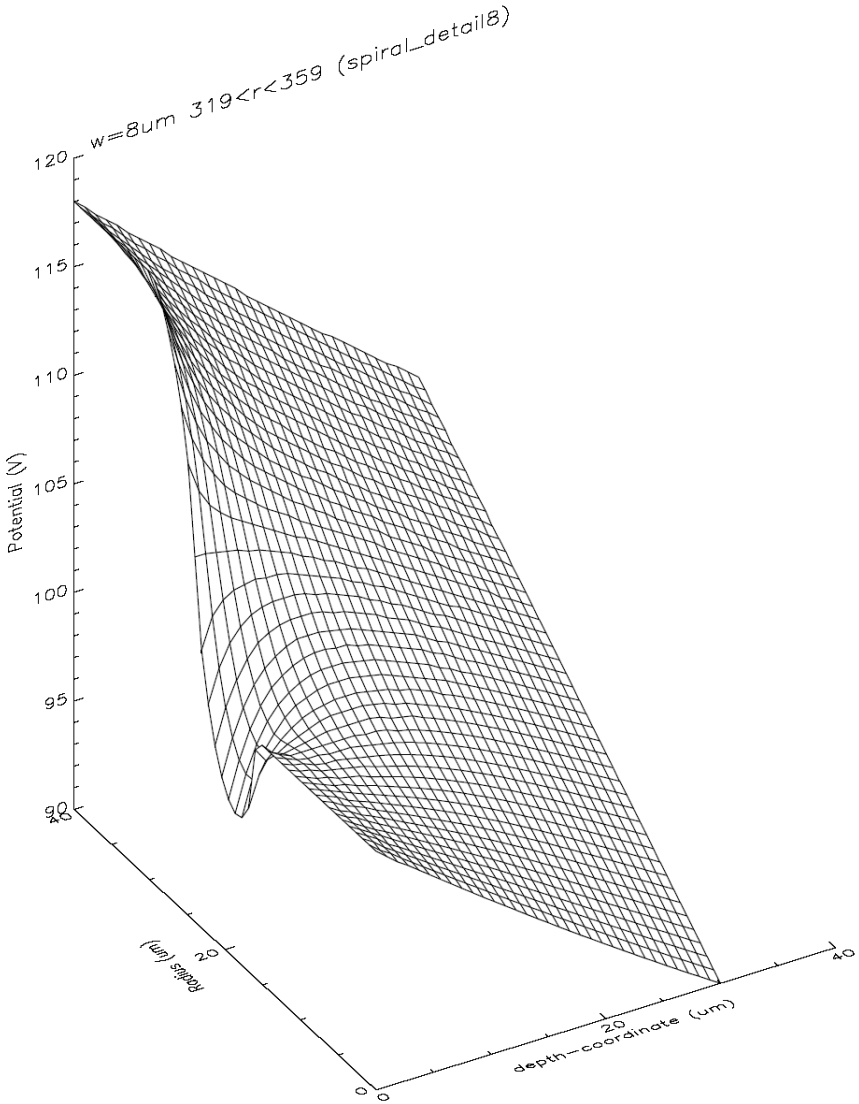
- Boron: 200keV, $8x10^{11}/cm^2$
- Phos.: 20keV, $4x10^{14}/cm^2$; 50keV, $4x10^{14}/cm^2$
- Boron: 20keV, $2x10^{14}/cm^2$; Phos.: 20keV, $4x10^{14}/cm^2$; 50keV, $4x10^{14}/cm^2$
- Al

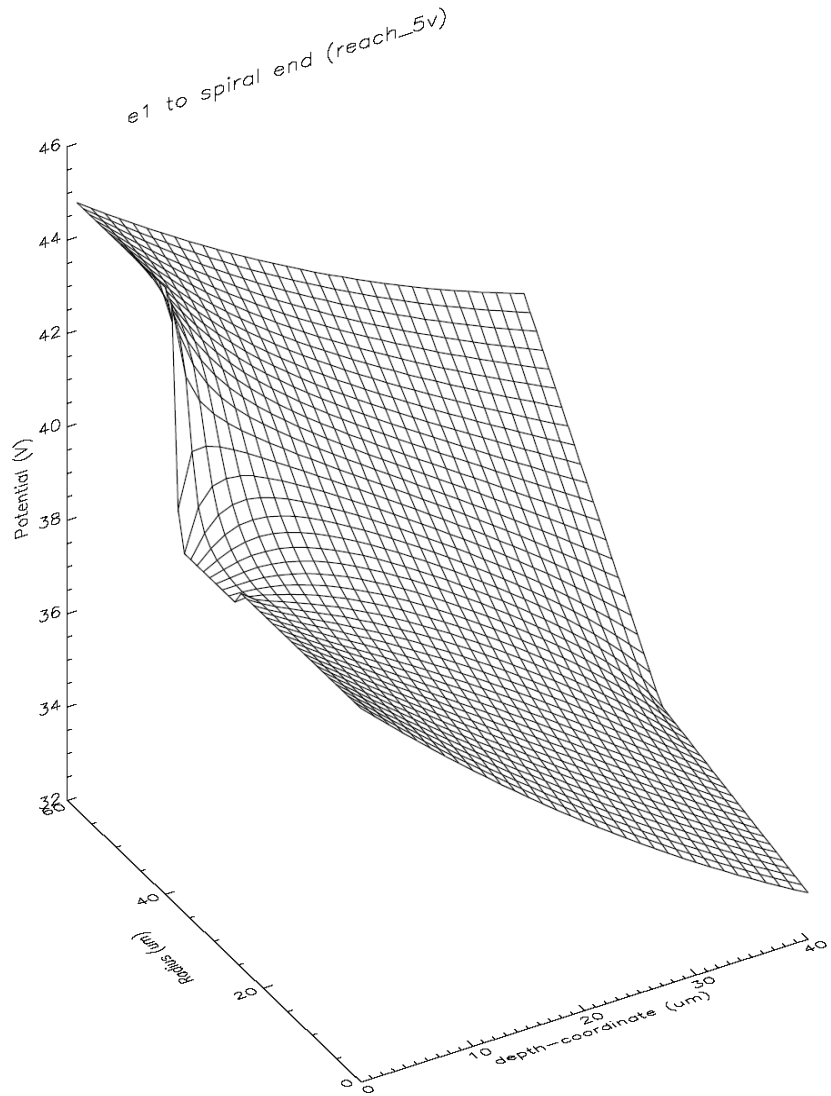
Design, Process and Operation (operation)



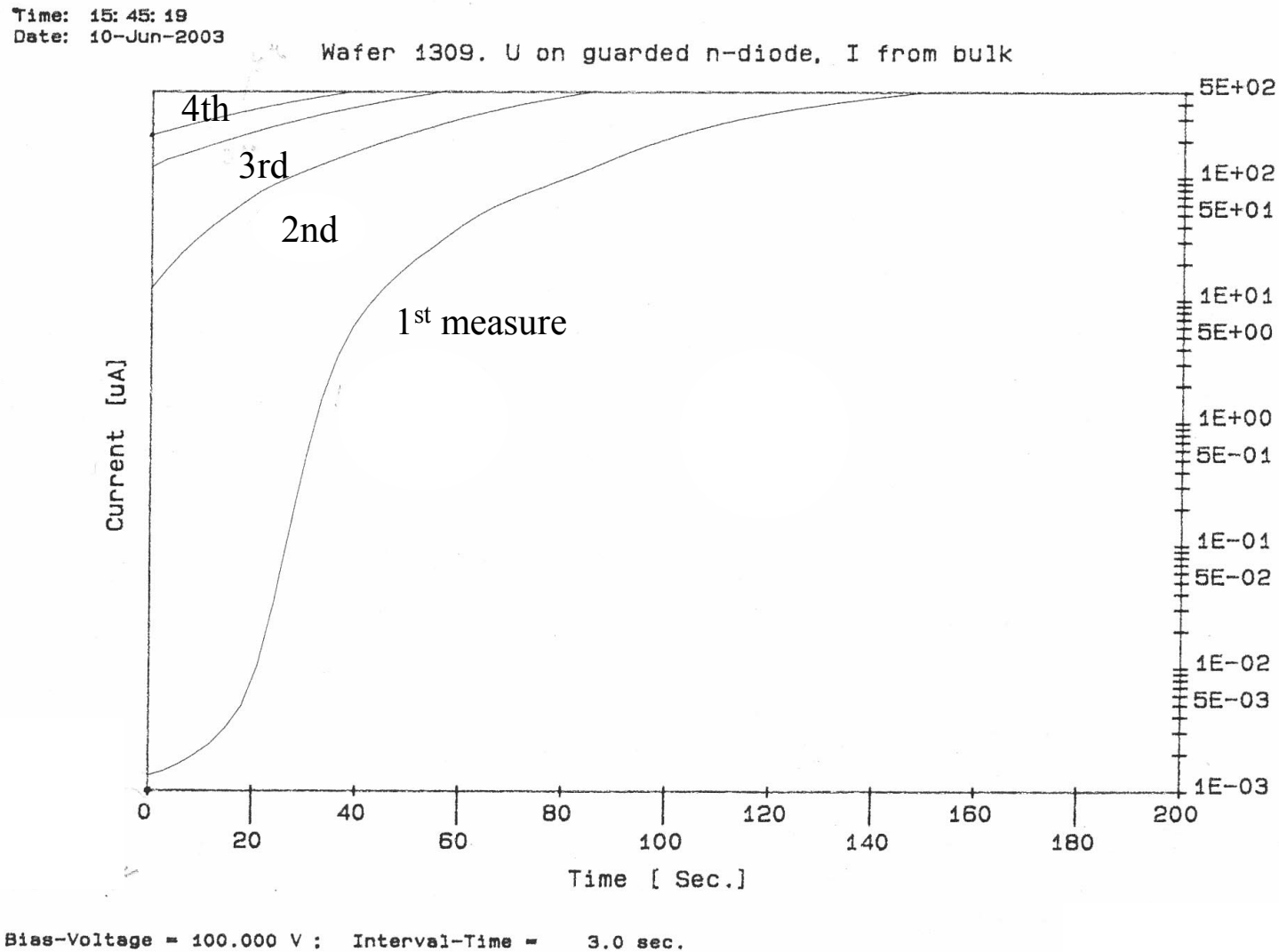


Design, Process and Operation (operation)

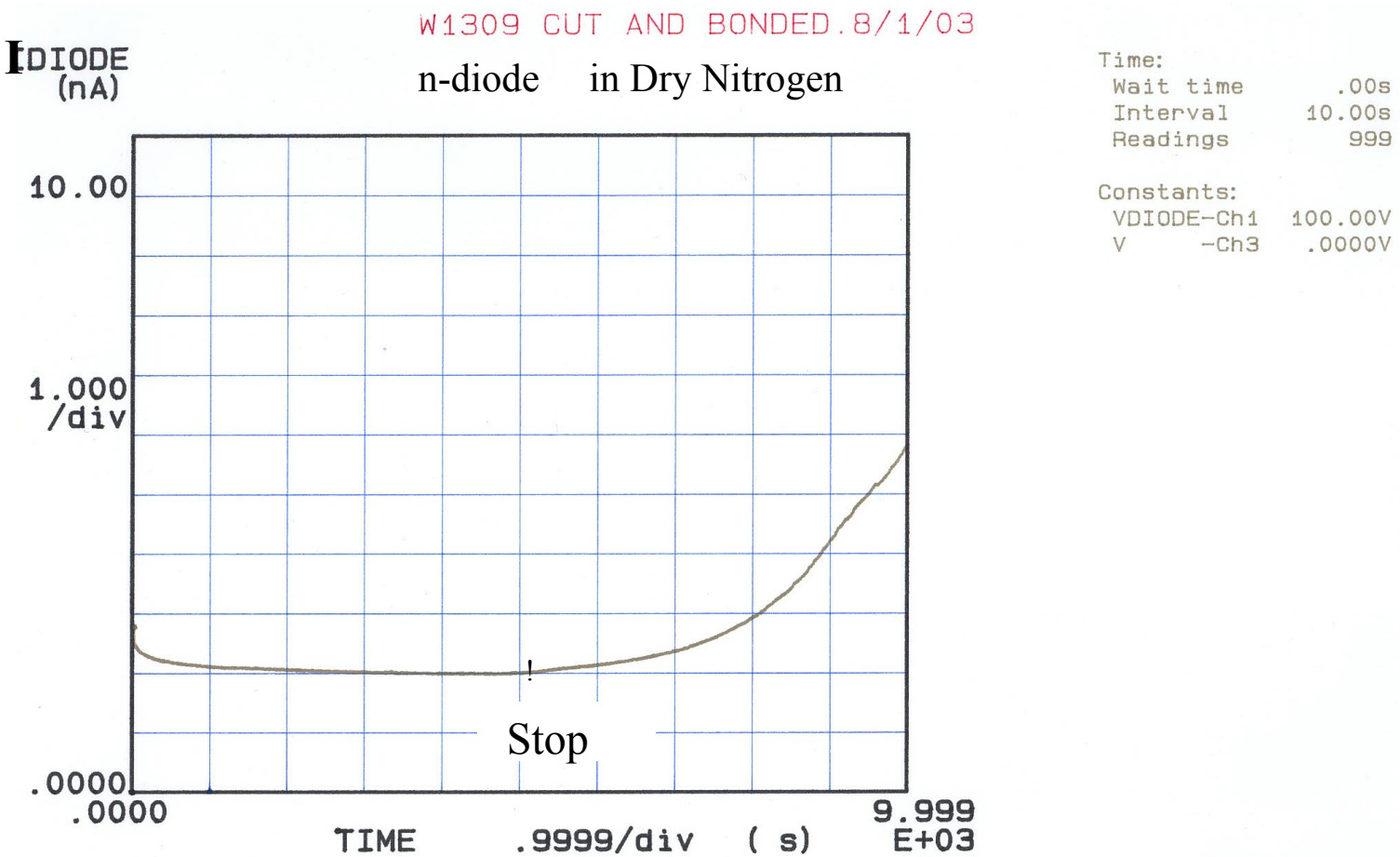




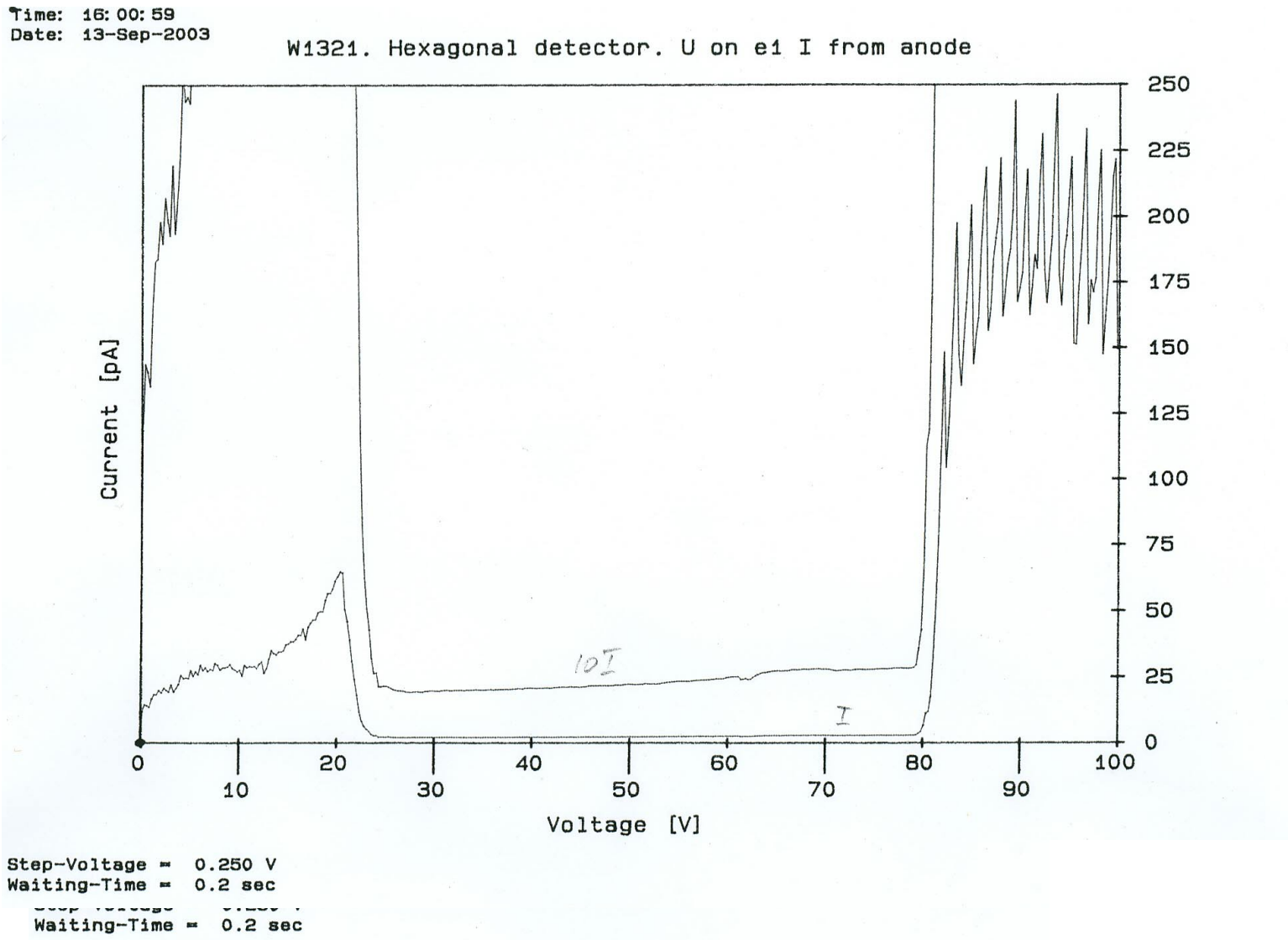
Test Results and Problems (instability)



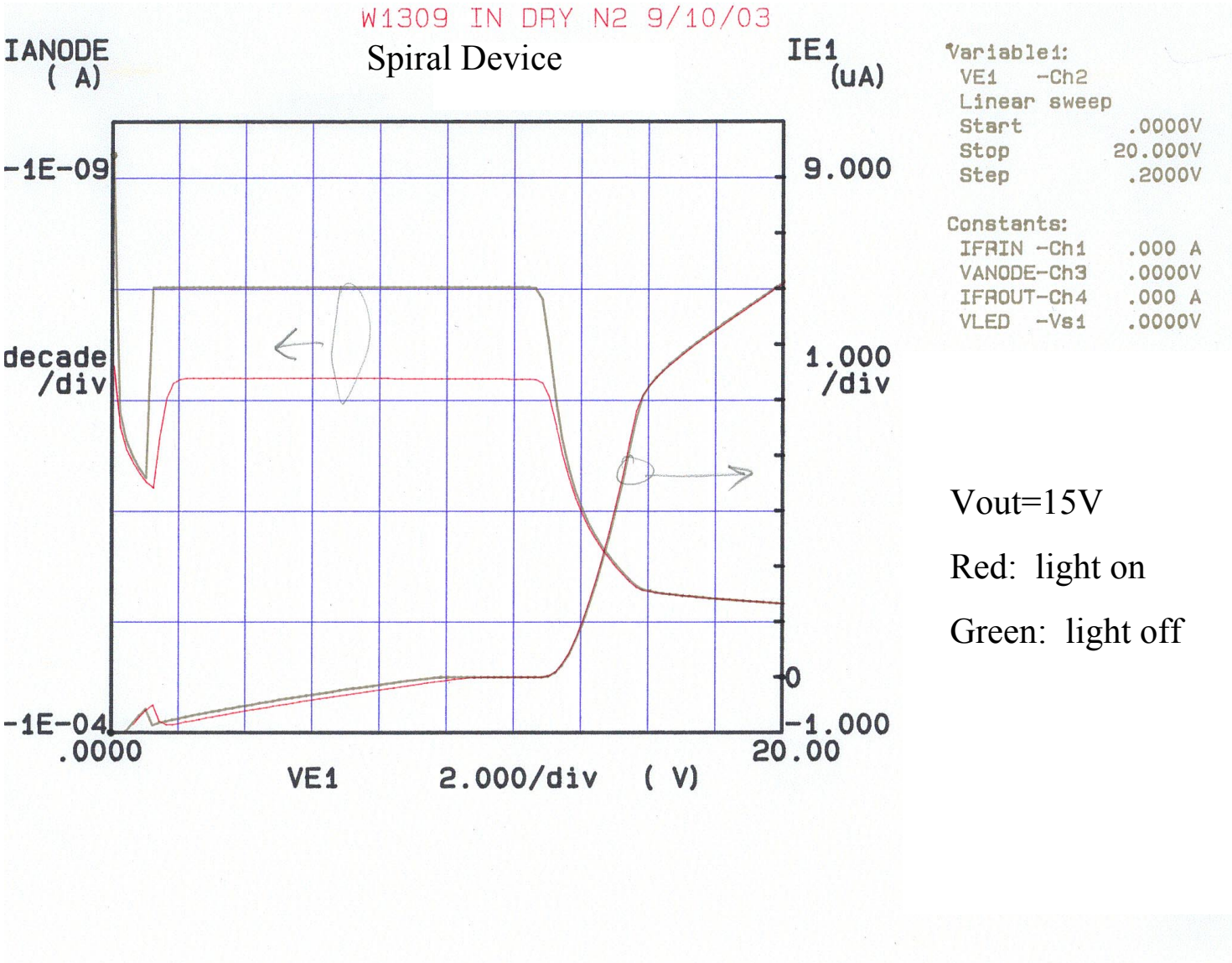
Test Results and Problems (stable)



Test Results and Problems (anode current)



Test Results and Problems

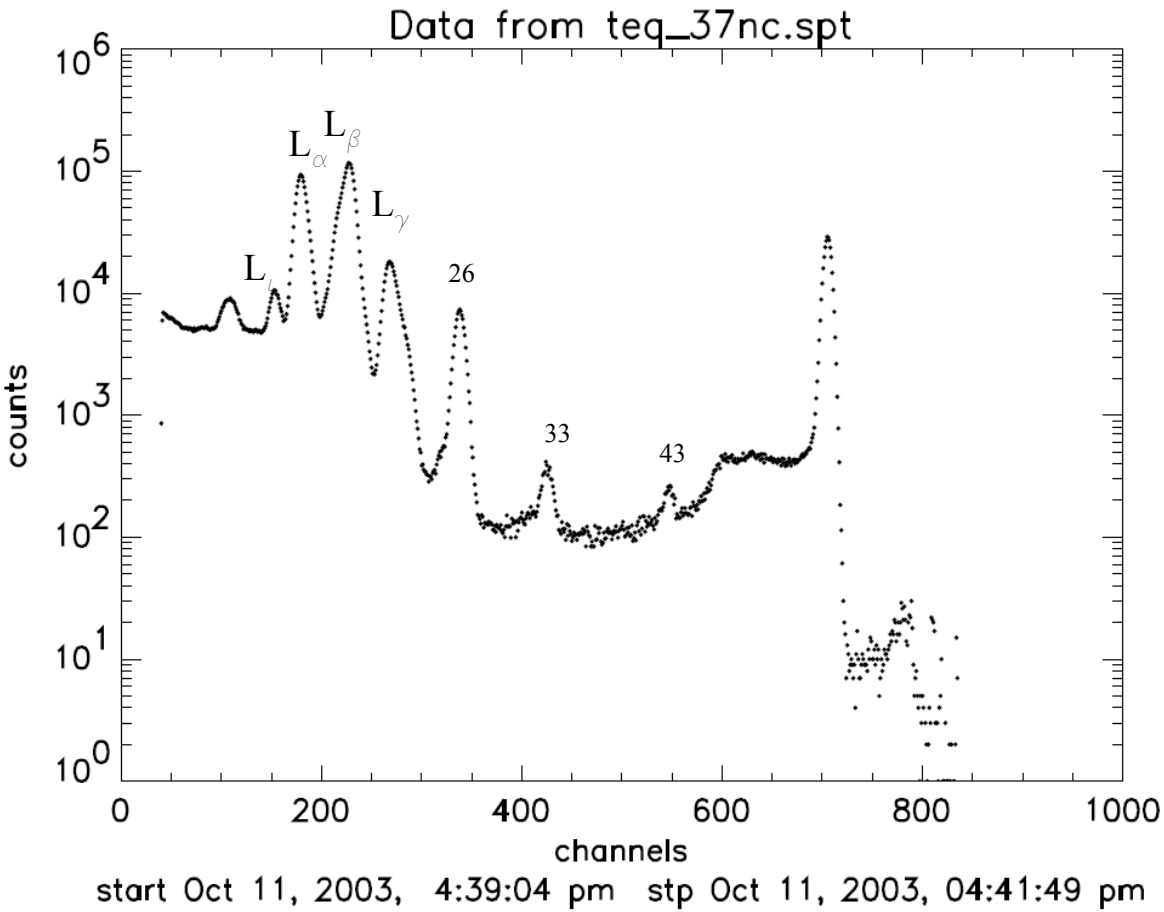


Vout=15V

Red: light on

Green: light off

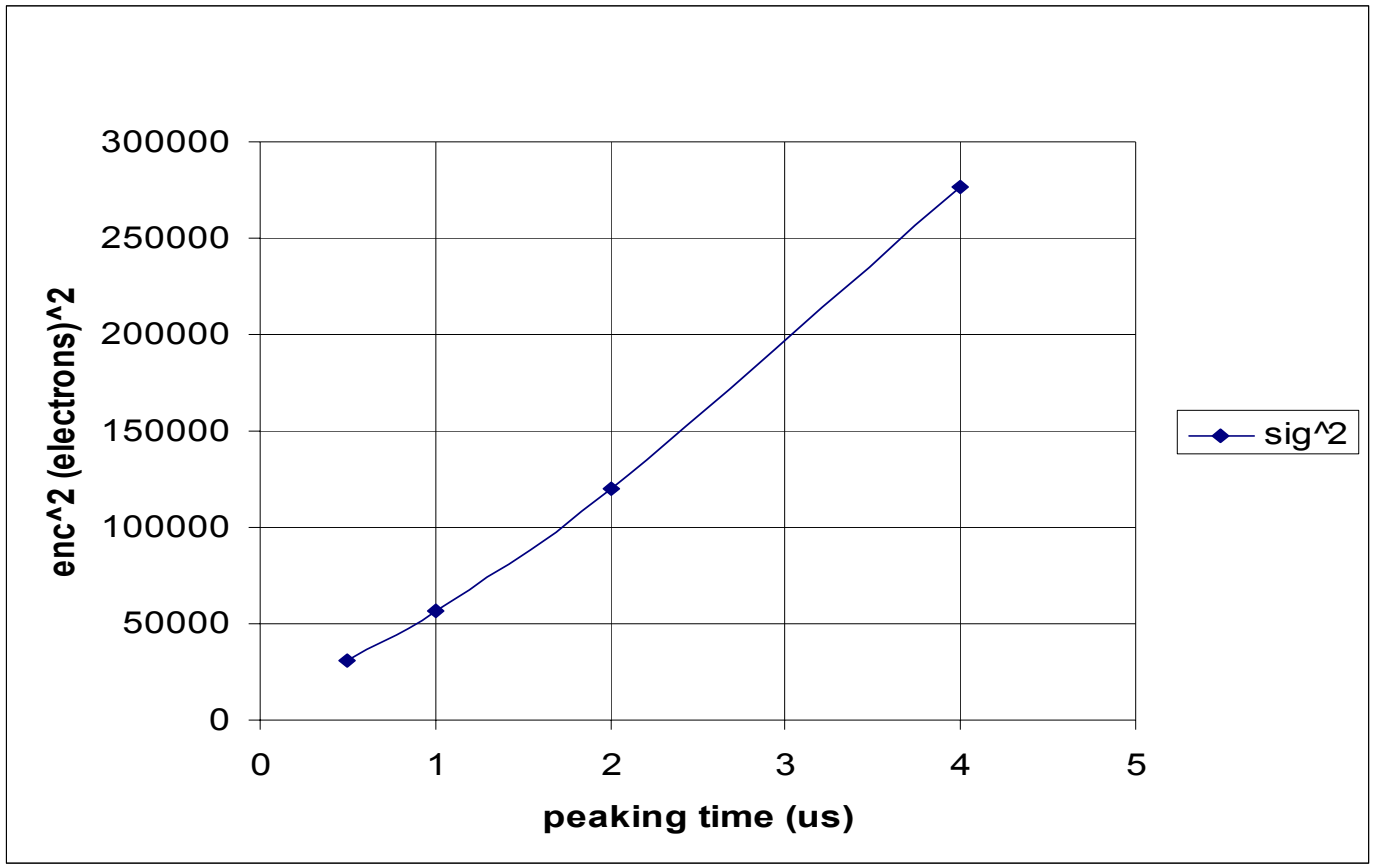
Test Results and Problems (Spectrum)



Outer ring: 150V. Back: 73V E1: 40V

Test Results and Problems (Noise)

room temperature



Conclusions

- P-type one-sided hexagonal spiral drift detectors have been produced and they work.
- Currently dry nitrogen is used for stable operation of the detector. Technological solution including additional insulating layer is being investigated.
- Resolution is limited by the high leakage current. Need to understand and reduce the leakage current.

Two groups of detectors have been produced