Status

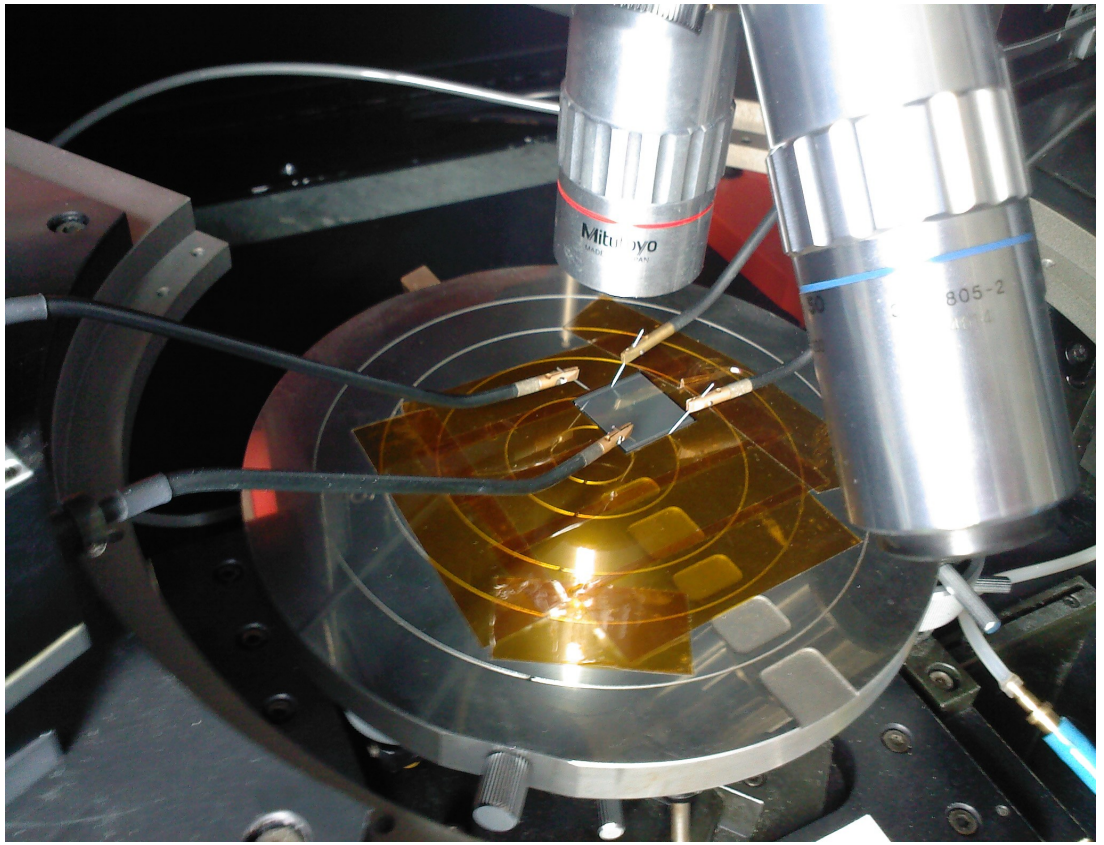
- **Sensors**
  - Design, Testing, Irradiation … **well under way**
- **Frontend** **3 Options**

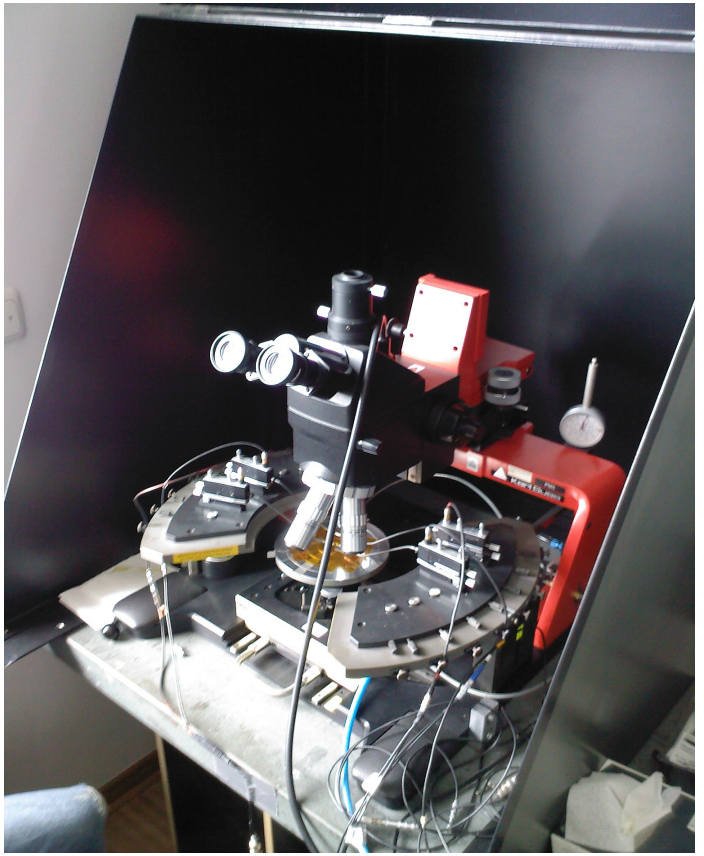
- **Module Data Concentrator ASIC** („Module Controller“) **Design Phase**

- **Hybridization:**
  - Cables, Flex PCB, Bonding, ... **Design Phase**
- **External Electronics/Supply**
  - Powering Concept, Cable Routing etc. **Planning**

Probe Station Setup

@PI Bonn





Manual Placement of Probe Needles

I-V and C-V-Curves of 2 different Sensors measured (2-and 4-Pin-Configurations)

Measurement Setup

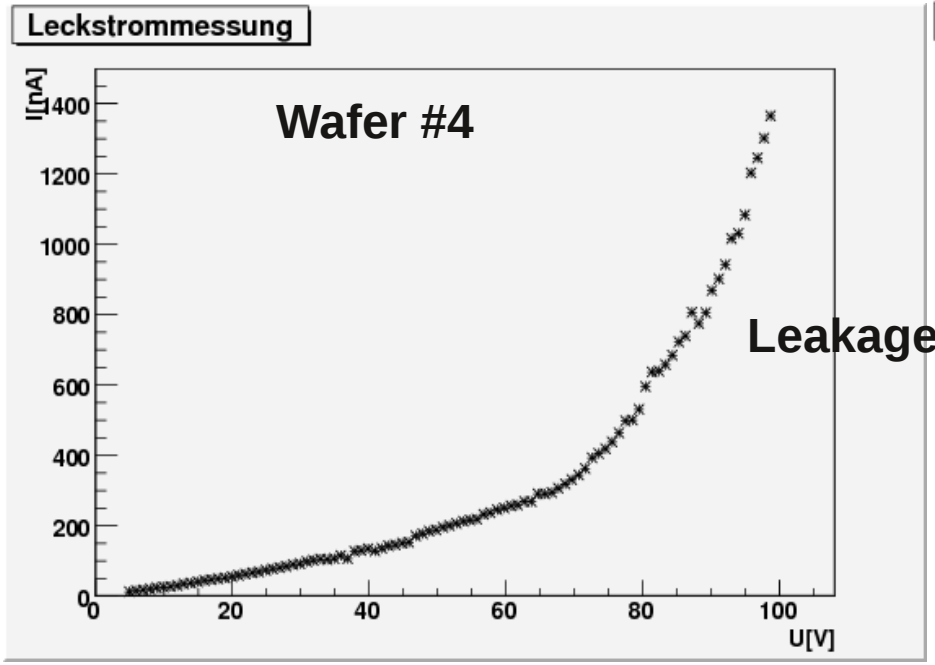
Resistors/Chokes to isolate DUT from Power Supply's low impedance

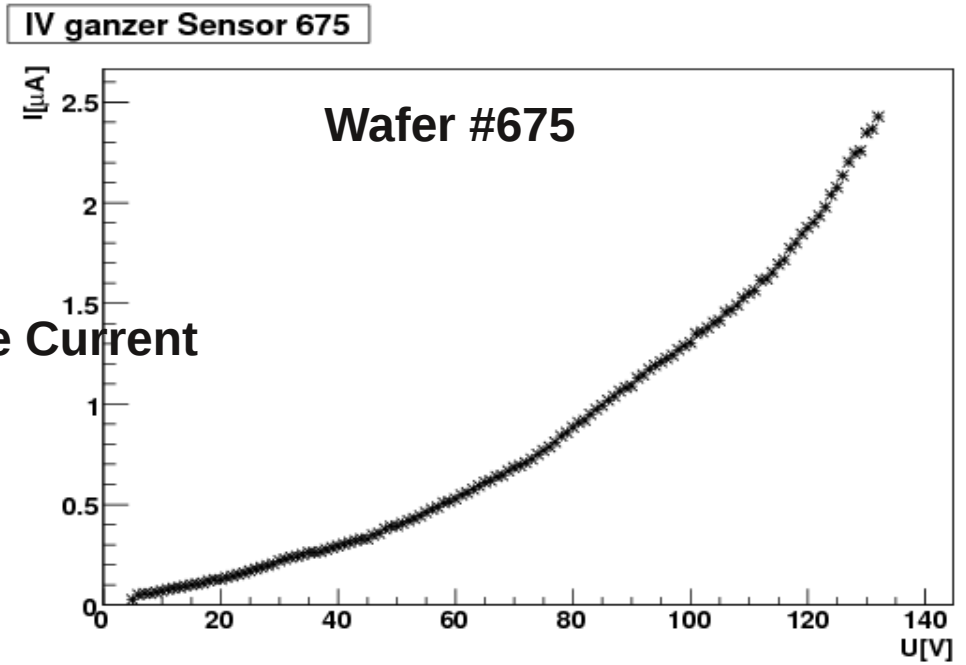
Bias Voltage (var.)

!!matched!! isolation capacitors to protect LCR from overvoltage

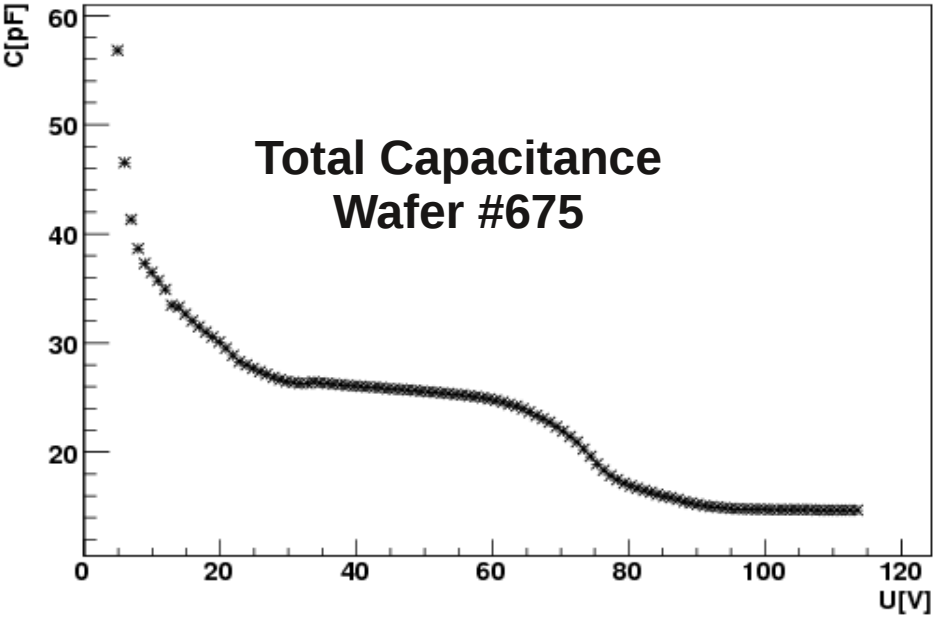
DUT

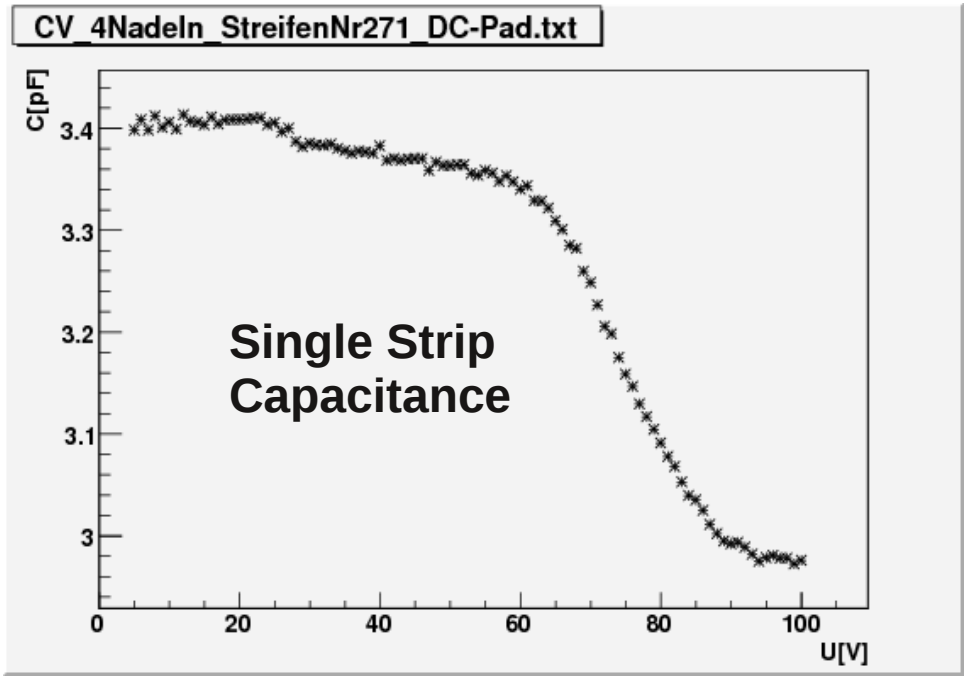
LCR Meter
(Sourcetronic ST2819)

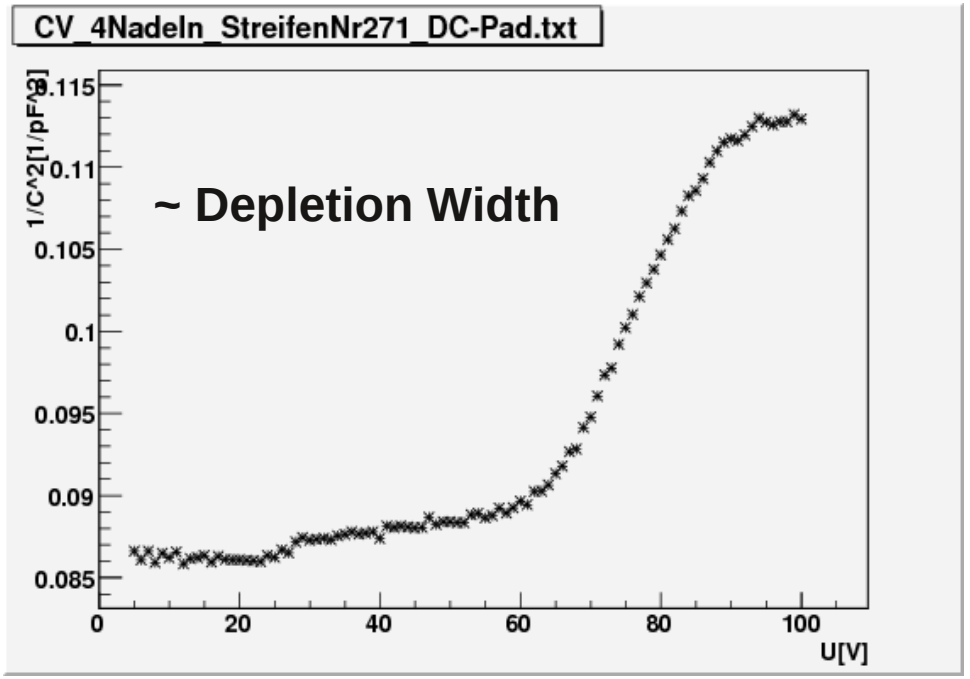


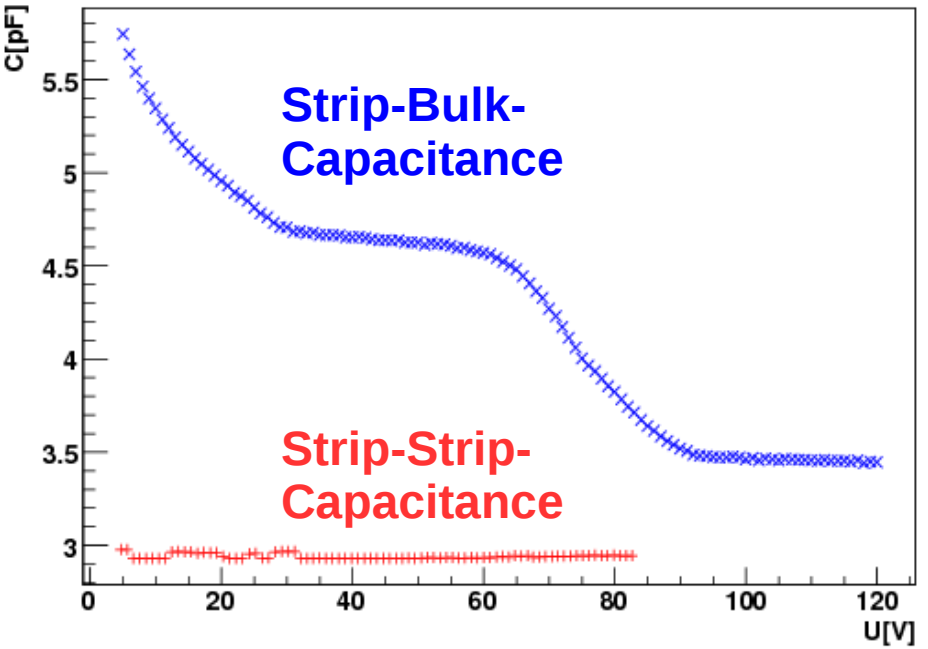


Leakage Current




CV_4NadeIn_StreifenNr271_DC-Pad.txt
C[pF]
3.4
3.3
3.2
3.1
3
0
20
40
60
80
100
U[V]
Single Strip
Capacitance


CV_4NadeIn_StreifenNr271_DC-Pad.txt
1/C^2[1/pF^2]
0.115
0.11
0.105
0.1
0.095
0.09
0.085
0
20
40
60
80
100
U[V]
~ Depletion Width


C[pF]
5.5
5
4.5
4
3.5
3
0
20
40
60
80
100
120
U[V]
Strip-Bulk-
Capacitance
Strip-Strip-
Capacitance

Requirements for Sensor Qualification

Tests with automatic Probestation (no Probecard necessary)

1) I/V-Curve of Sensor and C/V-Curves of each n-strip
2) Metal isolation (resistance and coupling capacitance) of each n-strip
3) Assign sensor to Quality Grades, e.g.:

- Grade A: nom. I_{Leak}, no Pinholes
- Grade B: higher I_{Leak} or max. 2 Pinholes
- Grade C: the rest

Cable Testing

- Evaluation of Aluminum Cables by Paolo/Tommaso
- Request to join in for evaluation of thin copper laminate

DuPont™ Pyralux® AP All-Polyimide Flexible Laminate

A Family of High-Performance Adhesiveless Laminates for Flexible Printed Circuit Applications

Product Description

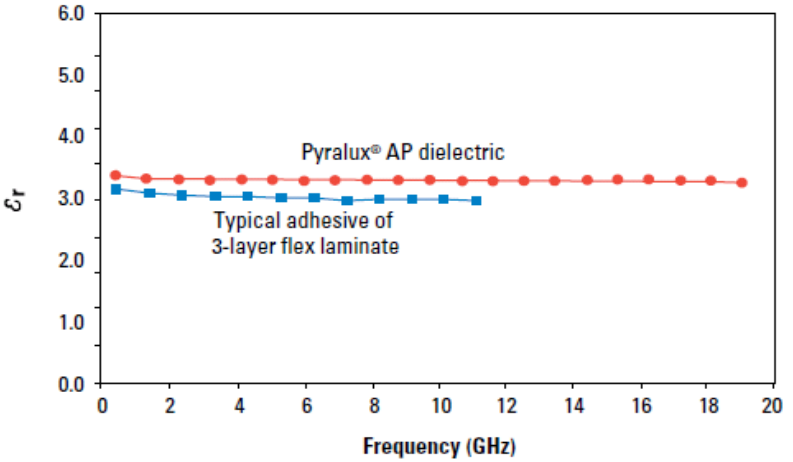
Pyralux® AP double-sided, copper-clad laminate is an all-polyimide composite of polyimide film bonded to copper foil. This material system is ideal for multilayer flex and rigid flex applications which require advanced material performance, temperature resistance, and high reliability.

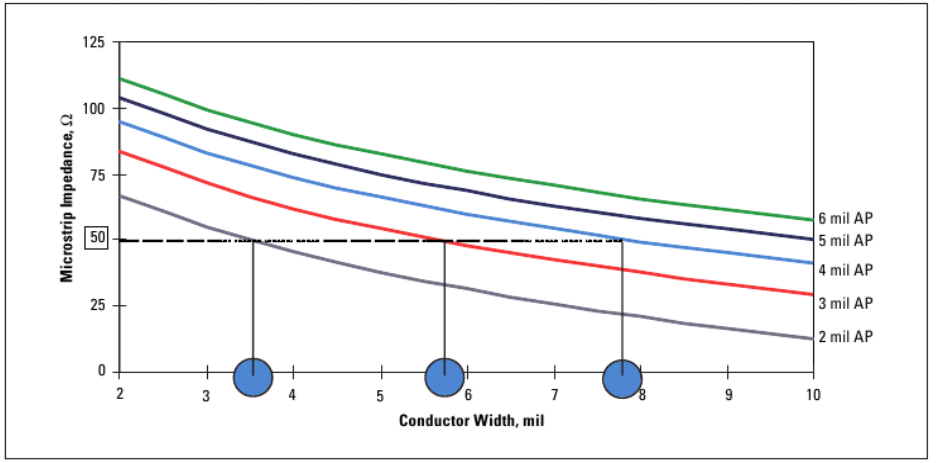
Offered in a full range of dielectric thicknesses, Pyralux® AP provides designers, fabricators, and assemblers a versatile option for a wide variety of flexible circuit constructions.

- Low CTE for rigid flex multilayers
- Excellent thermal resistance
- Thin Cu-clads with superior handling

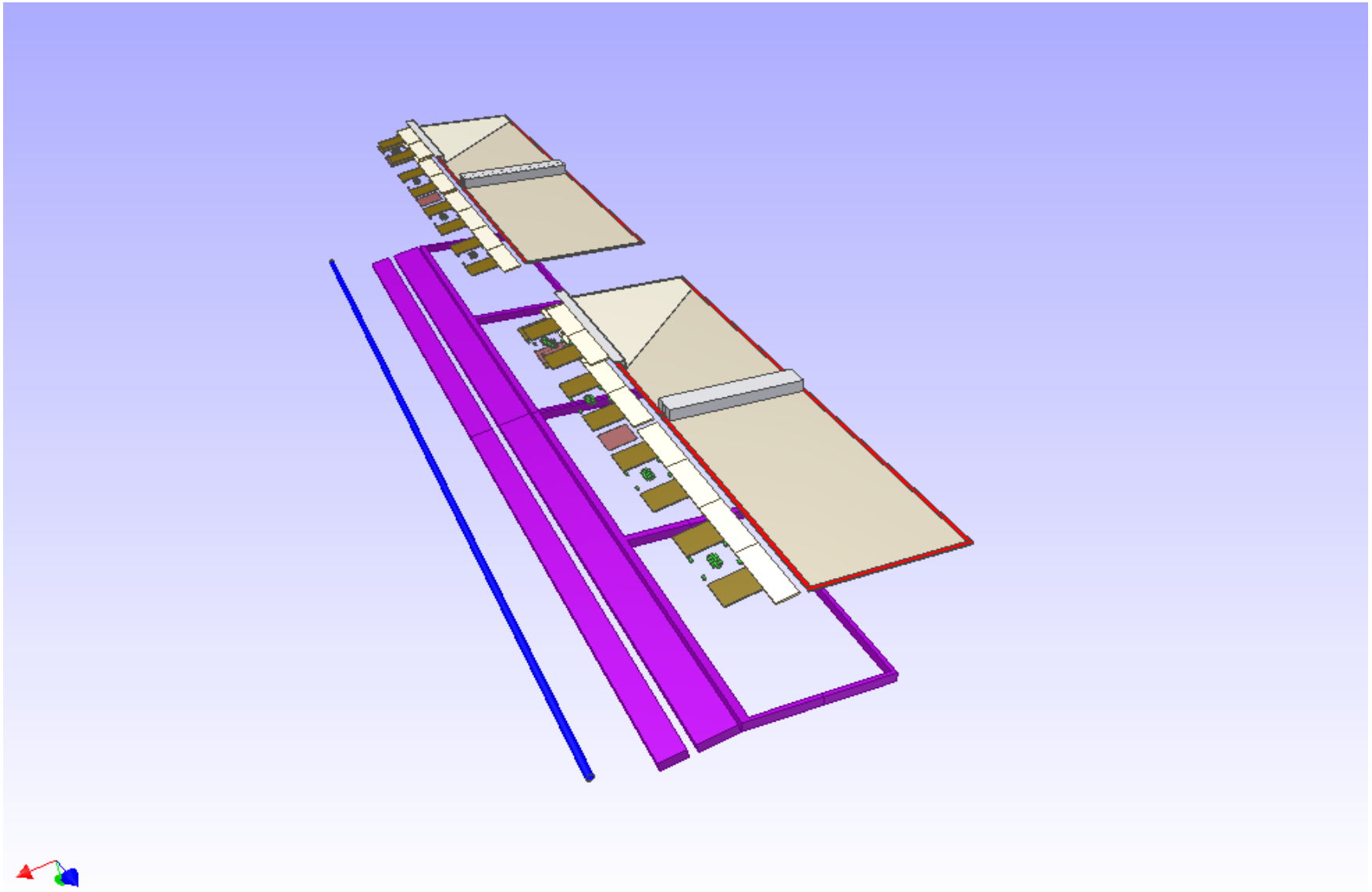
Table 1
Pyralux® AP Product Offerings*

Product Code	Dielectric Thickness, mil	Copper Thickness, µm (oz/ft²)
AP 7163E**	1.0	9 (.25)
AP 7164E**	1.0	12 (.33)
AP 8515R	1.0	18 (0.5)
AP 9111R	1.0	35 (1.0)
AP 9212R	1.0	70 (2.0)
AP 7156E**	2.0	9 (.25)
AP 7125E**	2.0	12 (.33)
AP 8525R	2.0	18 (0.5)
AP 9121R	2.0	35 (1.0)
AP 9222R	2.0	70 (2.0)
AP 8535R	3.0	18 (0.5)
AP 9131R	3.0	35 (1.0)
AP 9232R	3.0	70 (2.0)
AP 8545R	4.0	18 (0.5)
AP 9141R	4.0	35 (1.0)
AP 9242R	4.0	70 (2.0)
AP 8555R	5.0	18 (0.5)
AP 9151R	5.0	35 (1.0)
AP 9252R	5.0	70 (2.0)
AP 8565R	6.0	18 (0.5)
AP 9161R	6.0	35 (1.0)
AP 9262R	6.0	70 (2.0)

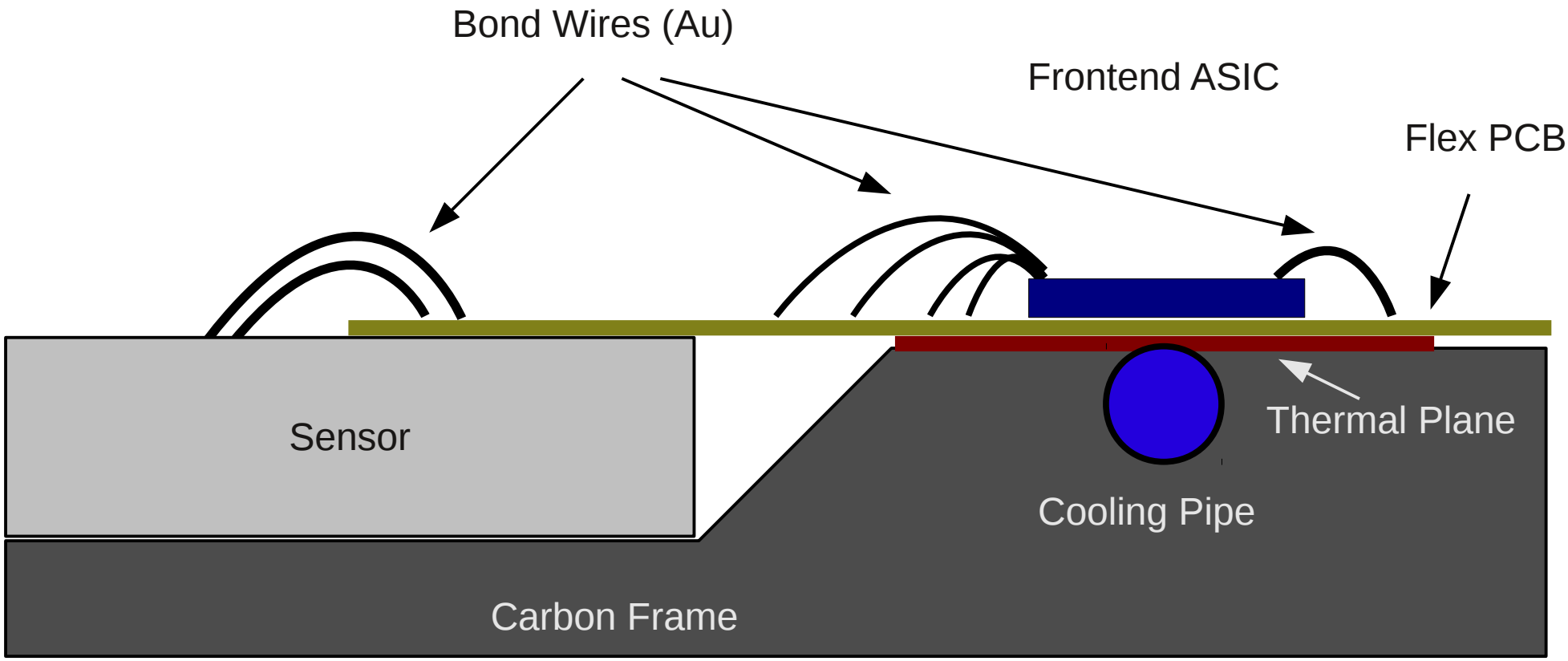


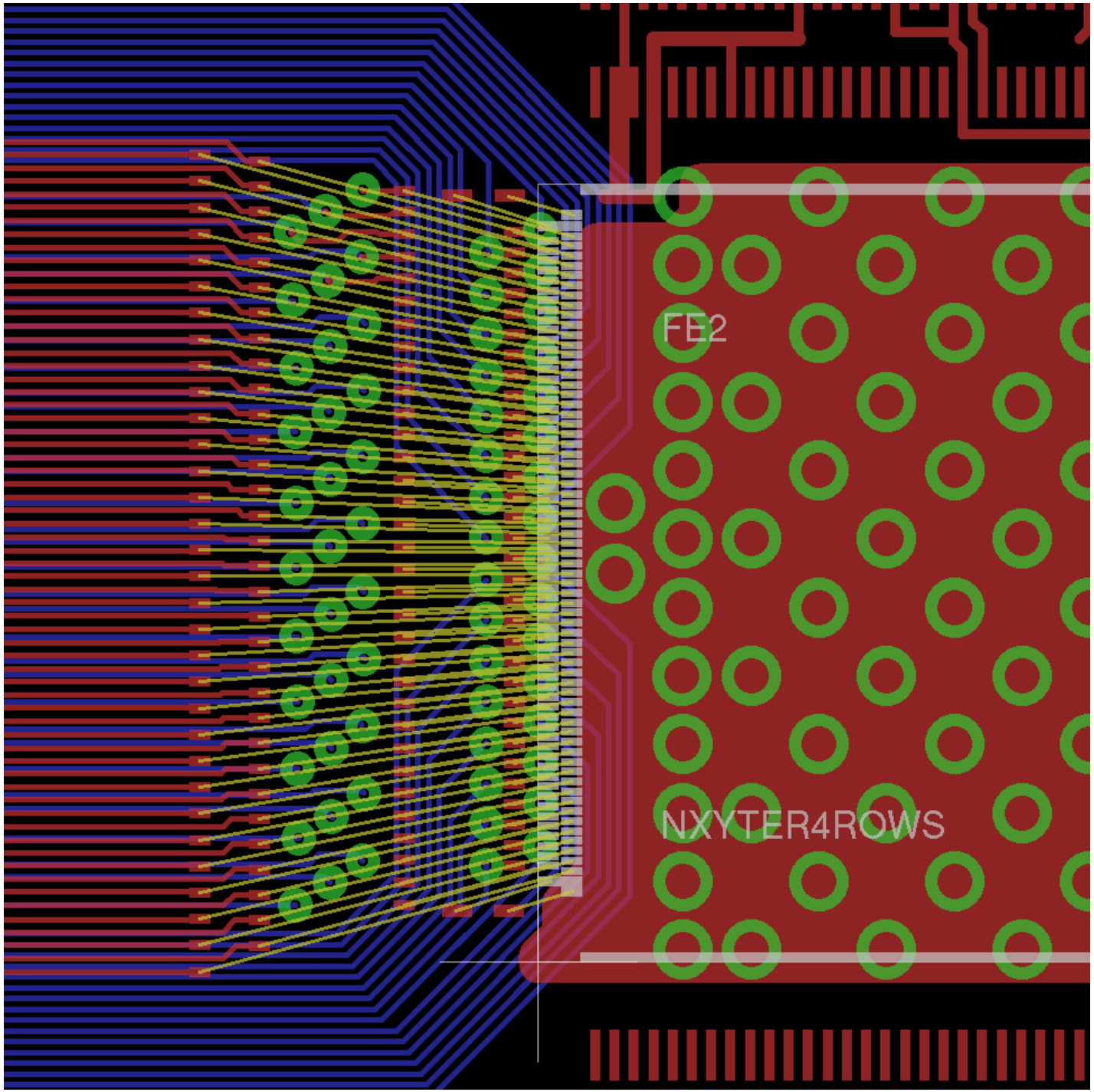


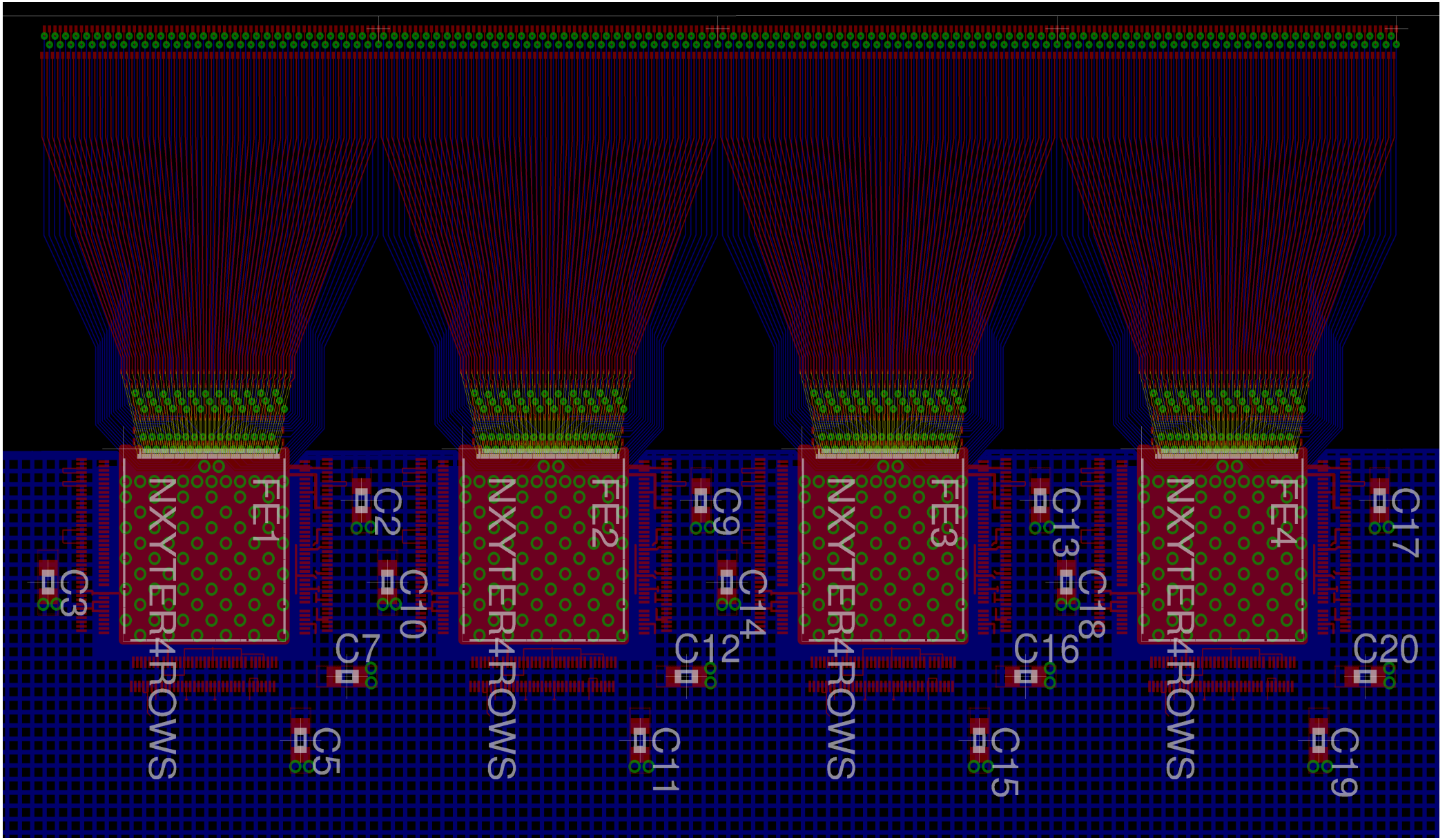
Module Assembly

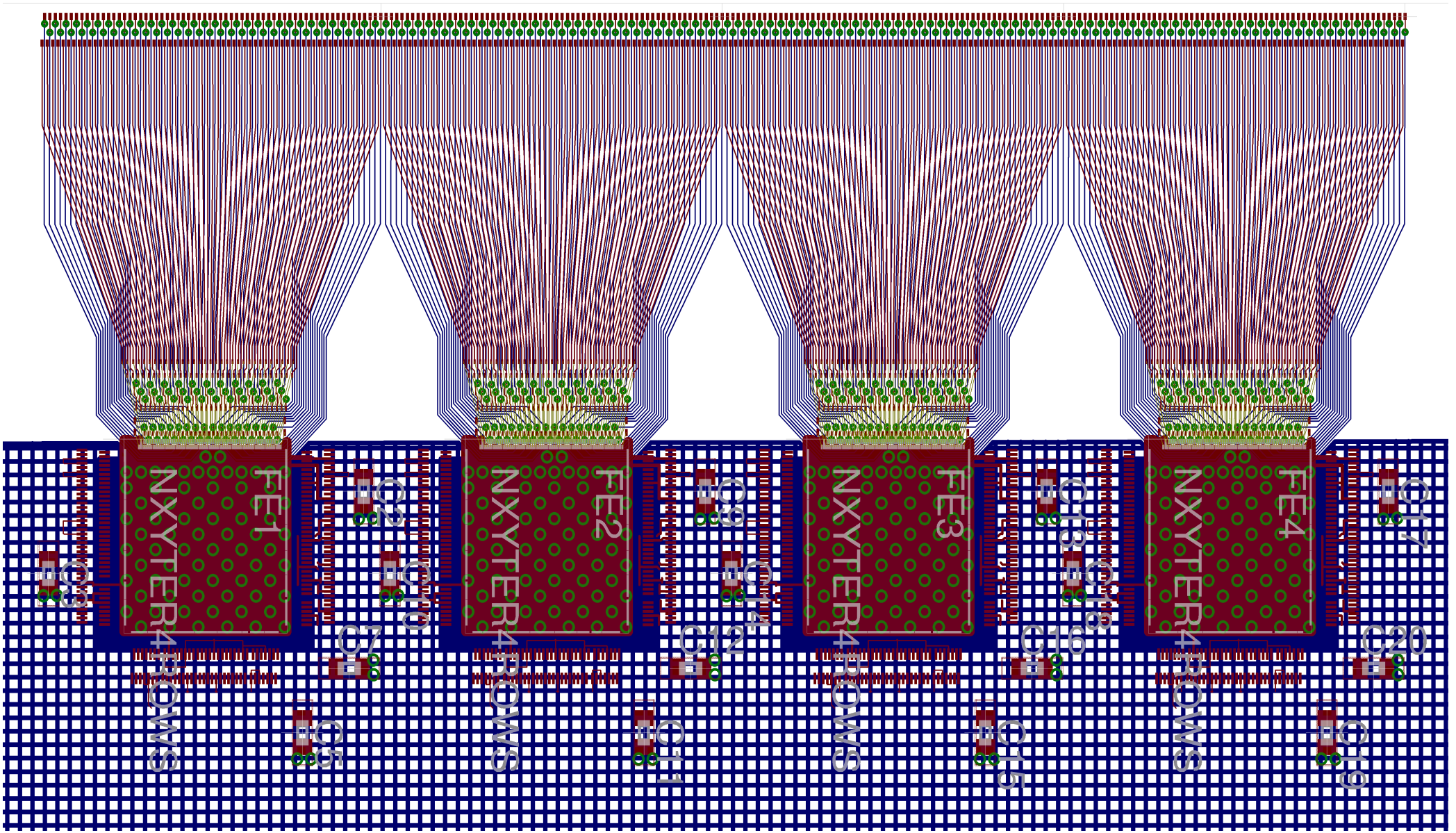


Module Assembly




FE2
NXYTER4ROWS


FE1
NXYTER4ROWS
FE2
NXYTER4ROWS
FE3
NXYTER4ROWS
FE4
NXYTER4ROWS
C1
C2
C3
C5
C7
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20


FE1
NXYTER4ROWS
FE2
NXYTER4ROWS
FE3
NXYTER4ROWS
FE4
NXYTER4ROWS
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20

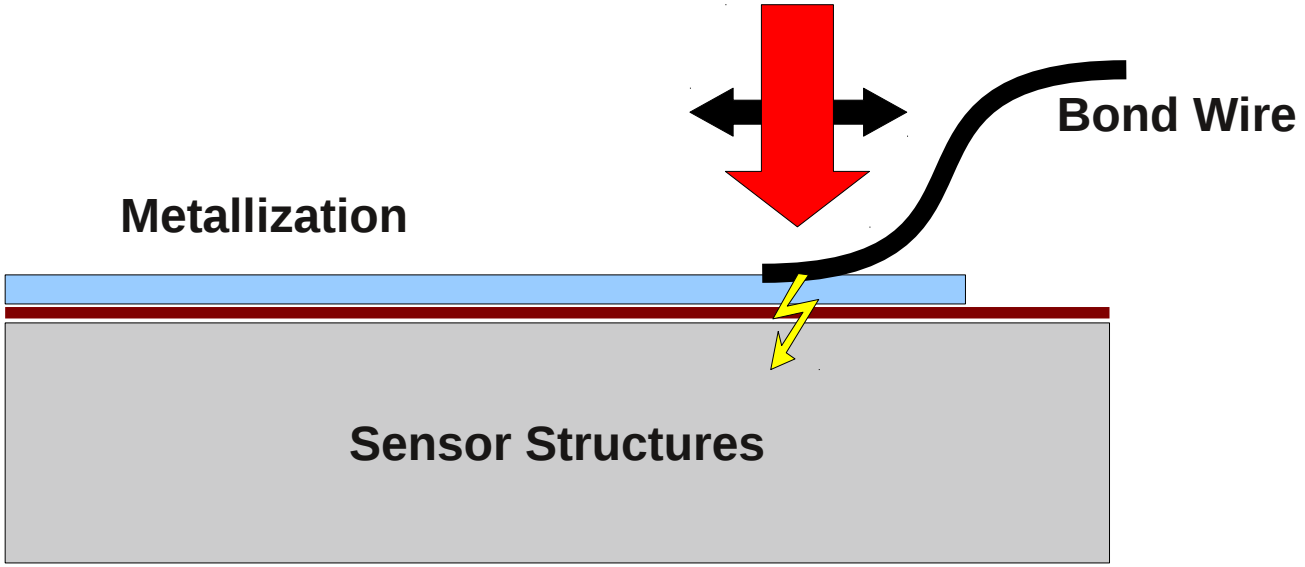
Pinholes

Ultrasonic bonding:

Wire gets rubbed upon bond pad

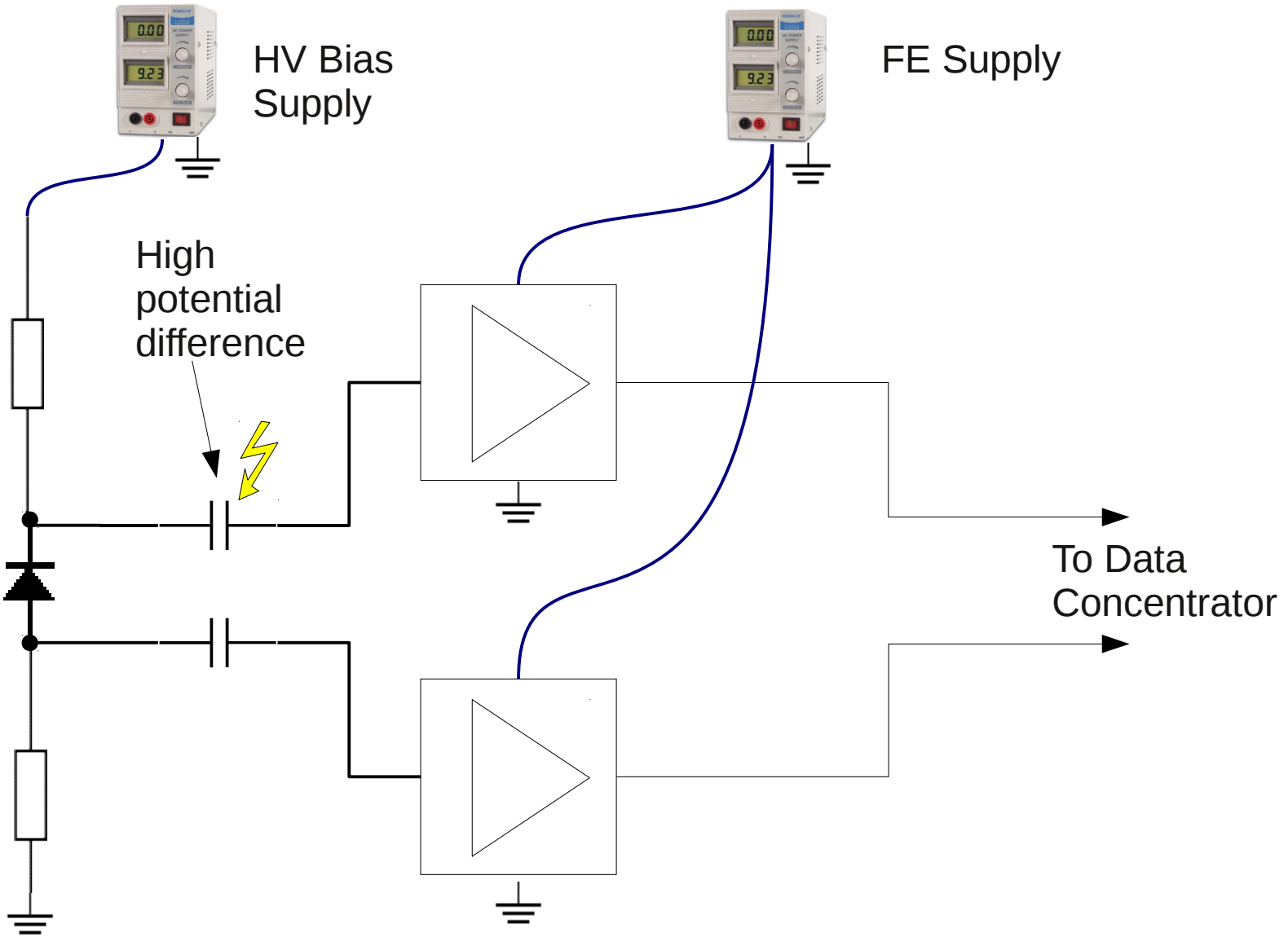
Mechanical force may damage insulation layer

→ electrical contact between sensor strip and readout contact



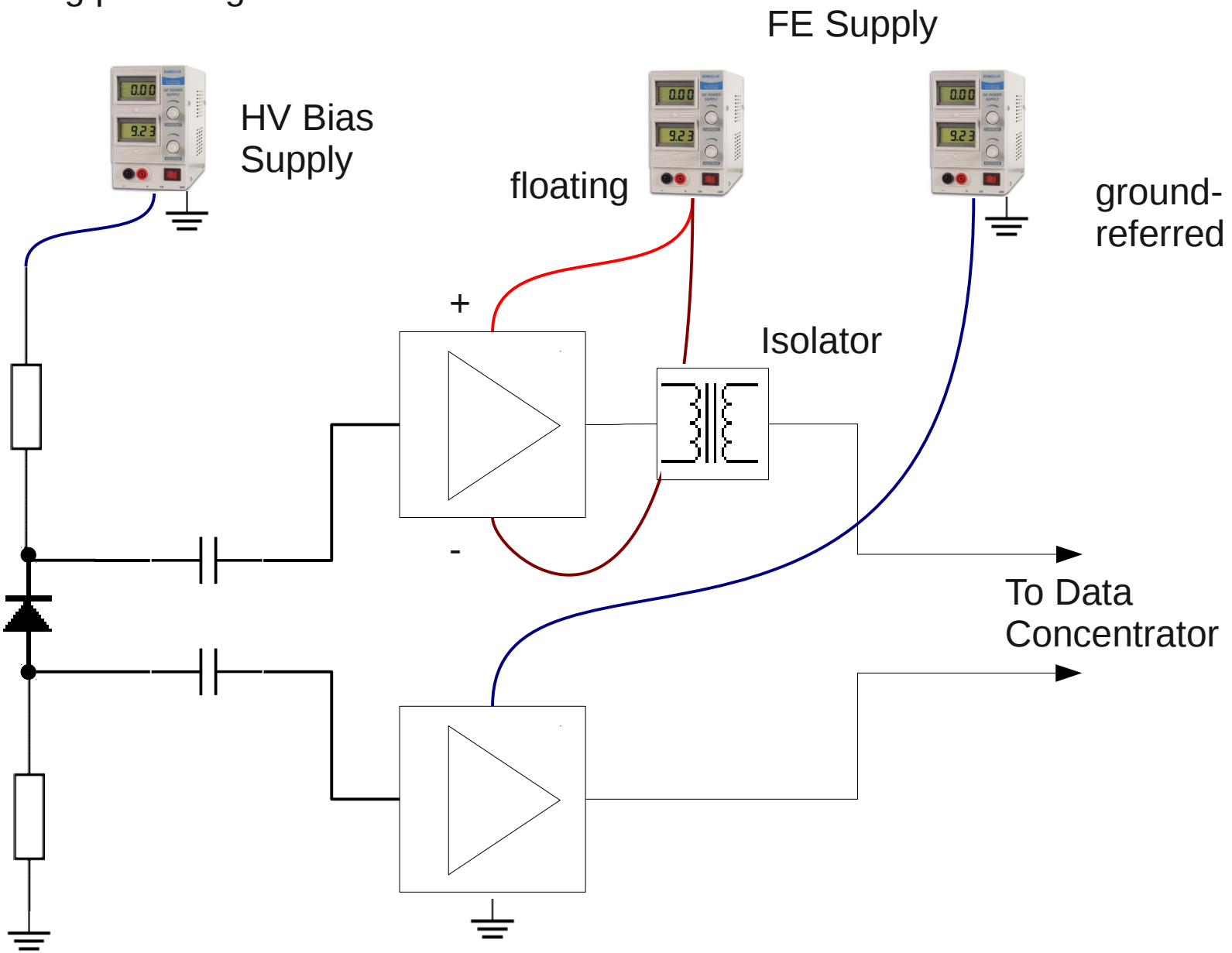
Conventional Powering Scheme

All grounds referring to same potential



Alternative Powering Scheme

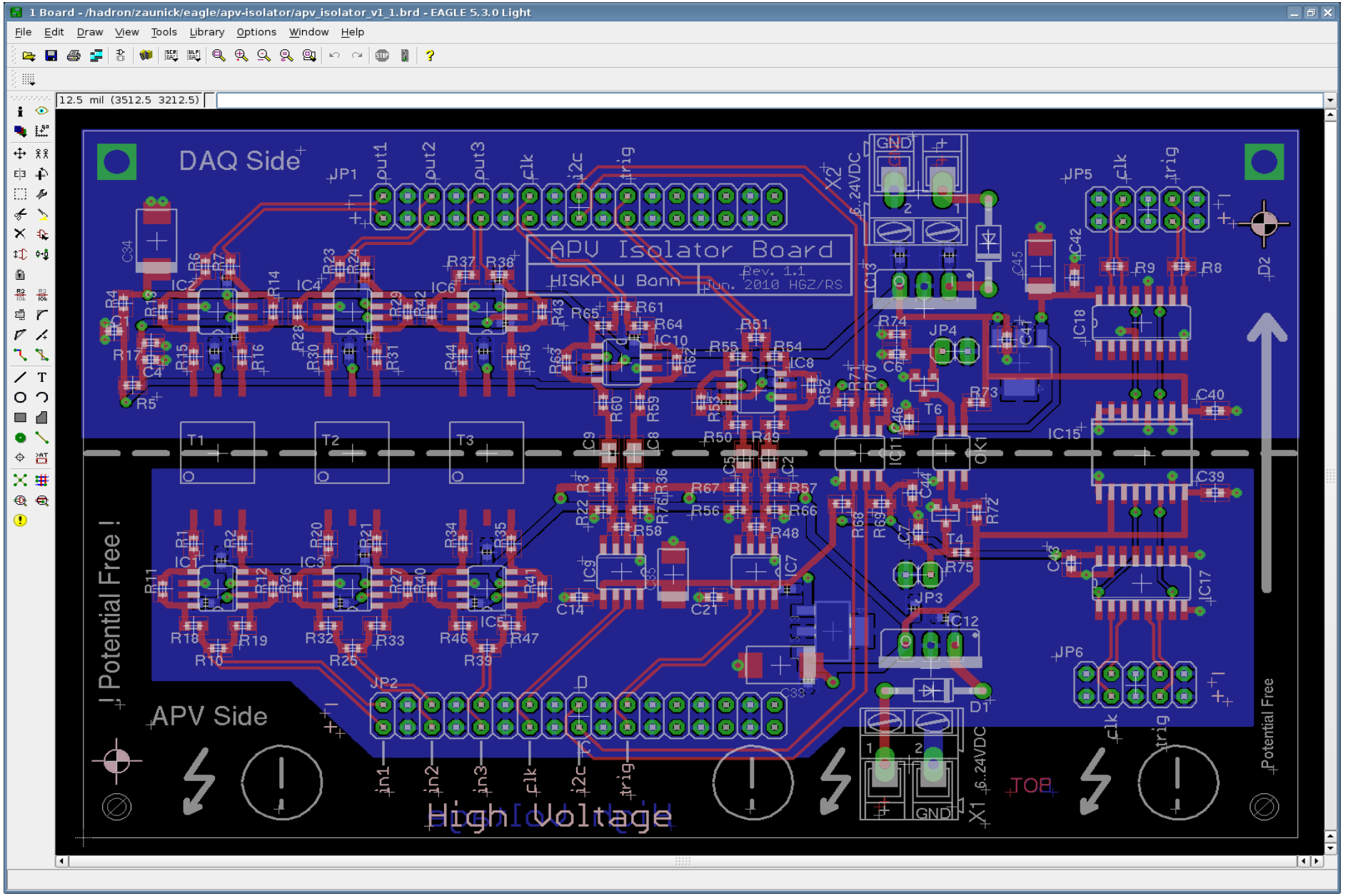
Floating powering of n-side electronics



Open Questions

- Which FE? → Current Consumption, Voltage not clear yet

Isolator Prototype PCB



Si8440/41/42/45

ISOpro Low-Power Quad-Channel Digital Isolator

Features

- High-speed operation
  - DC to 150 Mbps
- No start-up initialization required
- Wide Operating Supply Voltage: 2.70–5.5 V
- Wide Operating Supply Voltage: 2.70–5.5V
- Ultra low power (typical)
  5 V Operation:
  - < 1.6 mA per channel at 1 Mbps
  - < 6 mA per channel at 100 Mbps

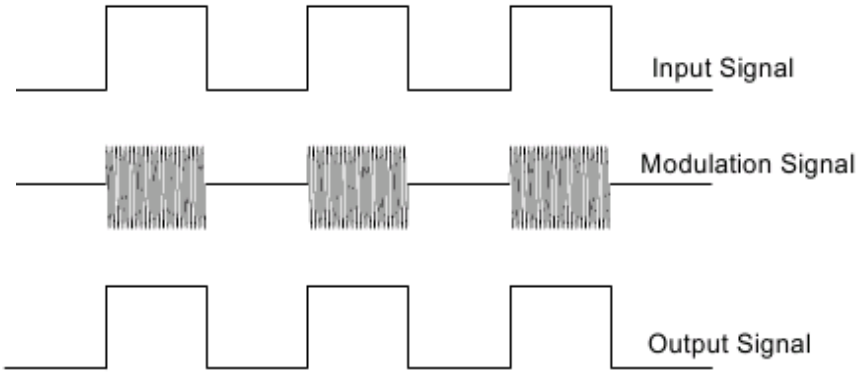
  2.70 V Operation:
  - < 1.4 mA per channel at 1 Mbps
  - < 4 mA per channel at 100 Mbps
- High electromagnetic immunity
- Up to 2500 V_{RMS} isolation
- 60-year life at rated working voltage
- Precise timing (typical)
  - <10 ns worst case
  - 1.5 ns pulse width distortion
  - 0.5 ns channel-channel skew
  - 2 ns propagation delay skew
  - 6 ns minimum pulse width
- Transient Immunity 25 kV/µs
- AEC-Q100 qualified
- Wide temperature range
  - –40 to 125 °C at 150 Mbps
- RoHS-compliant packages
  - SOIC-16 wide body
  - SOIC-16 narrow body

Applications

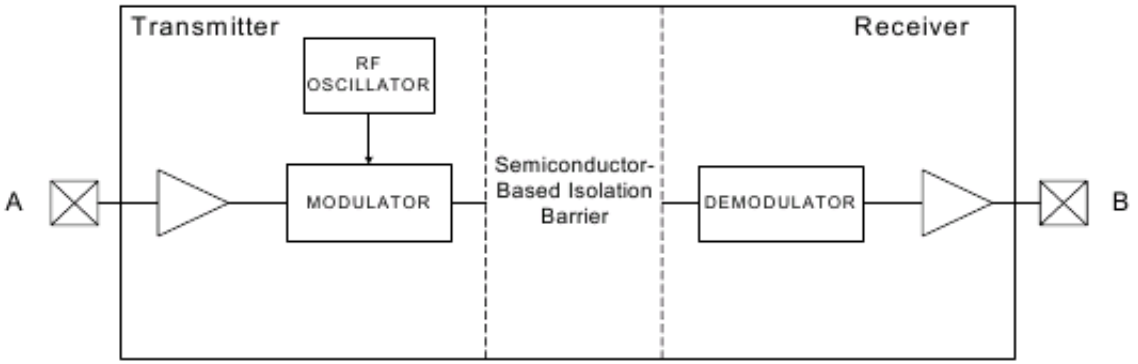
- Industrial automation systems
- Hybrid electric vehicles
- Isolated switch mode supplies
- Isolated ADC, DAC
- Motor control
- Power inverters
- Communications systems

Ordering Information:
See page 27.

http://www.silabs.com/Support%20Documents/TechnicalDocs/si844x.pdf

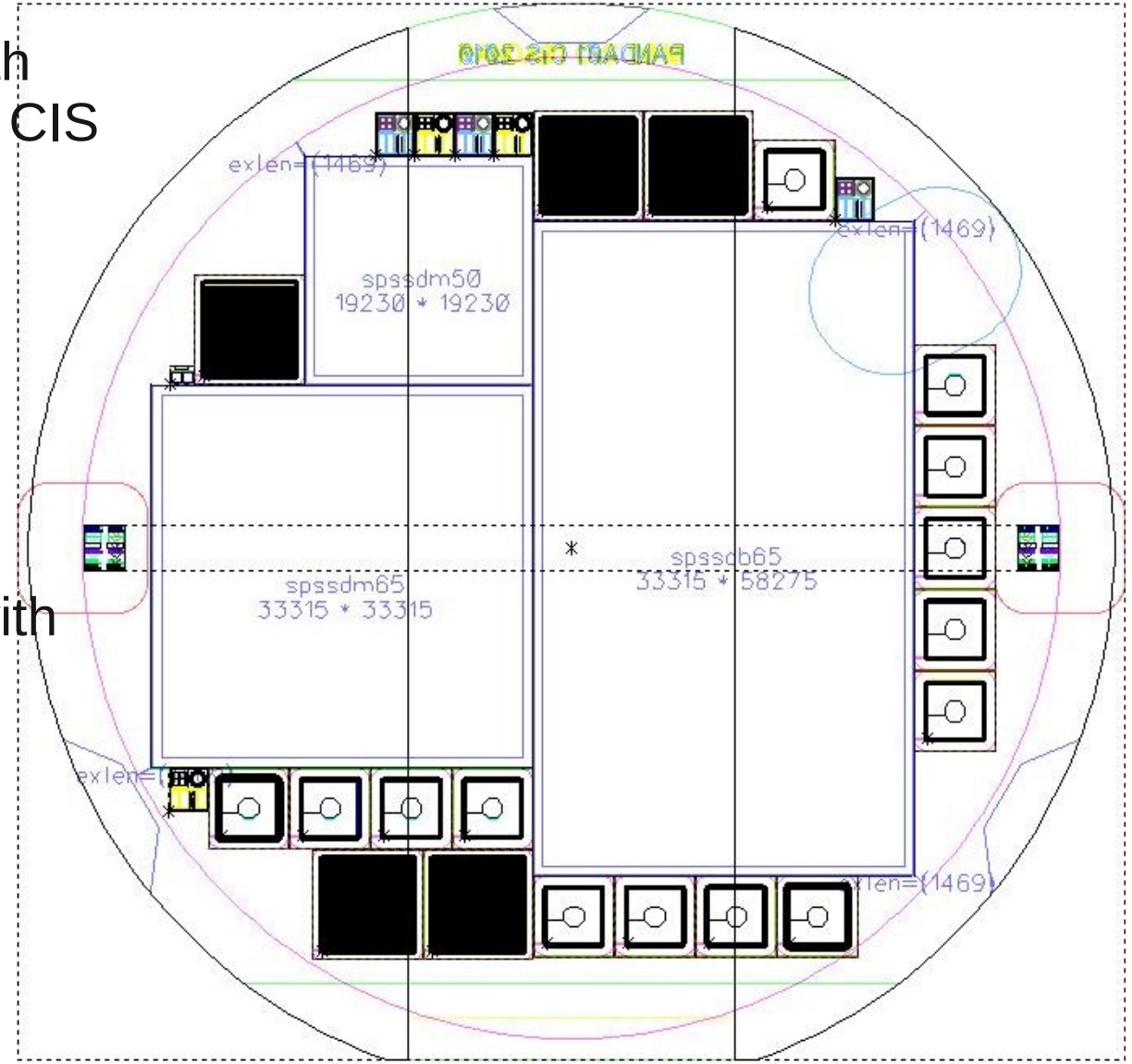


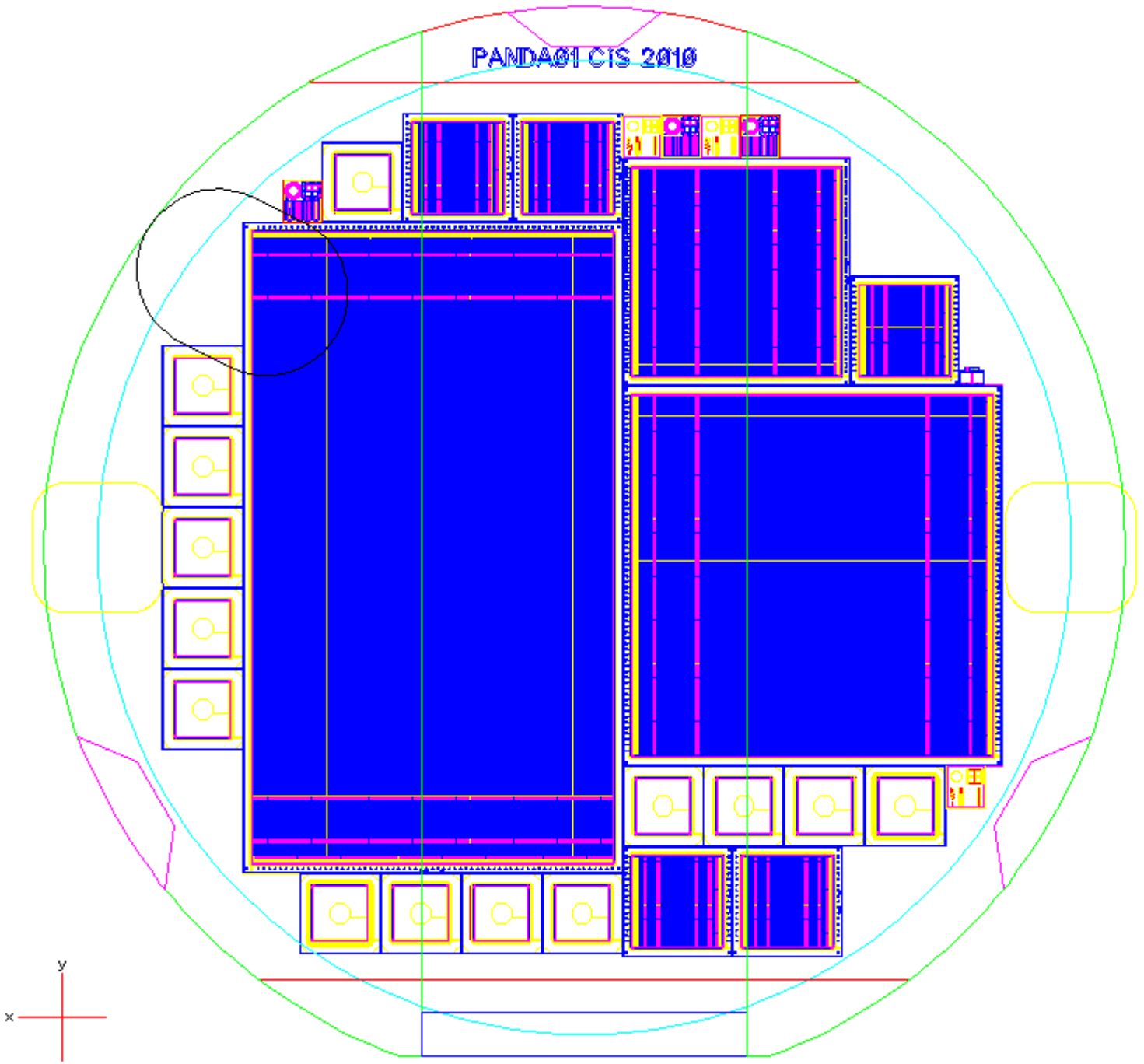
Modulation Scheme



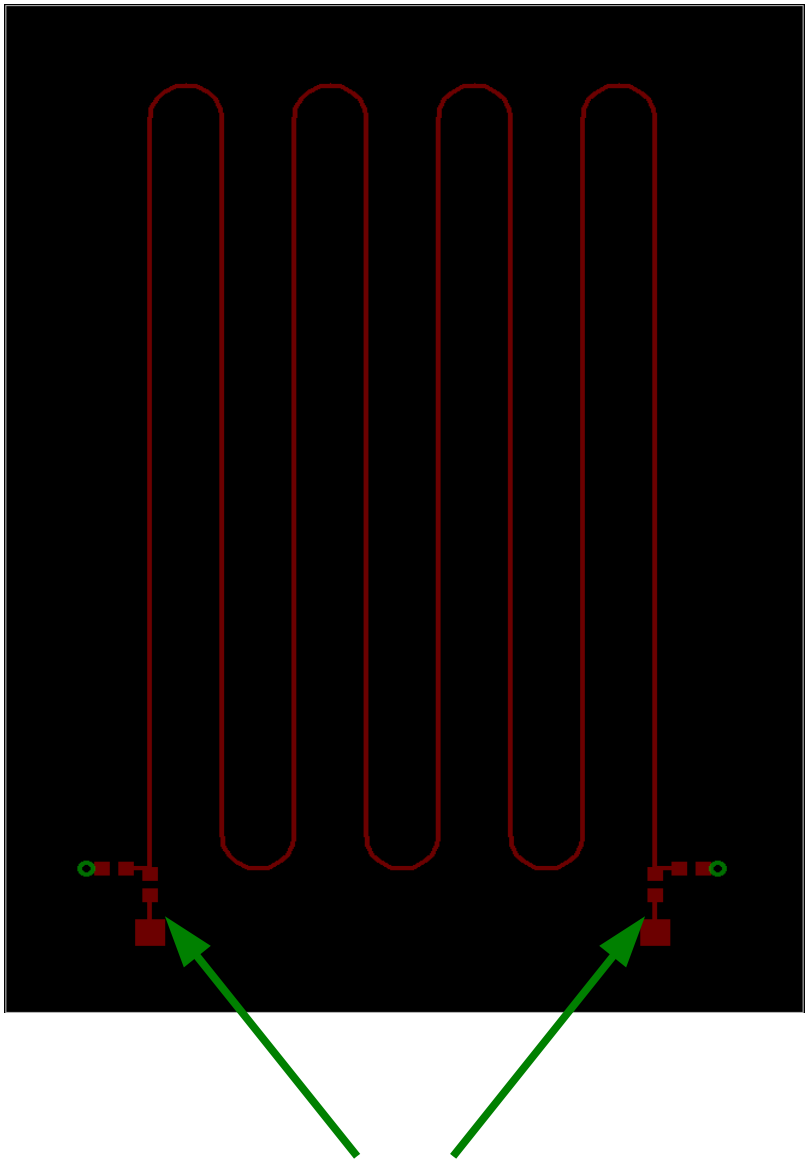
Full Scale Sensor Prototypes

- Production of 25 Wafers with different Sensor sizes @ CIS (Erfurt), delivery in June 2011
- Full (6x3cm) and half-size (3x3cm) PANDA sensor prototypes, 65µm pitch
- One reference sensor with 50µm pitch compatible with existing designs
- Several radiation dose monitoring diodes and bonding test structures



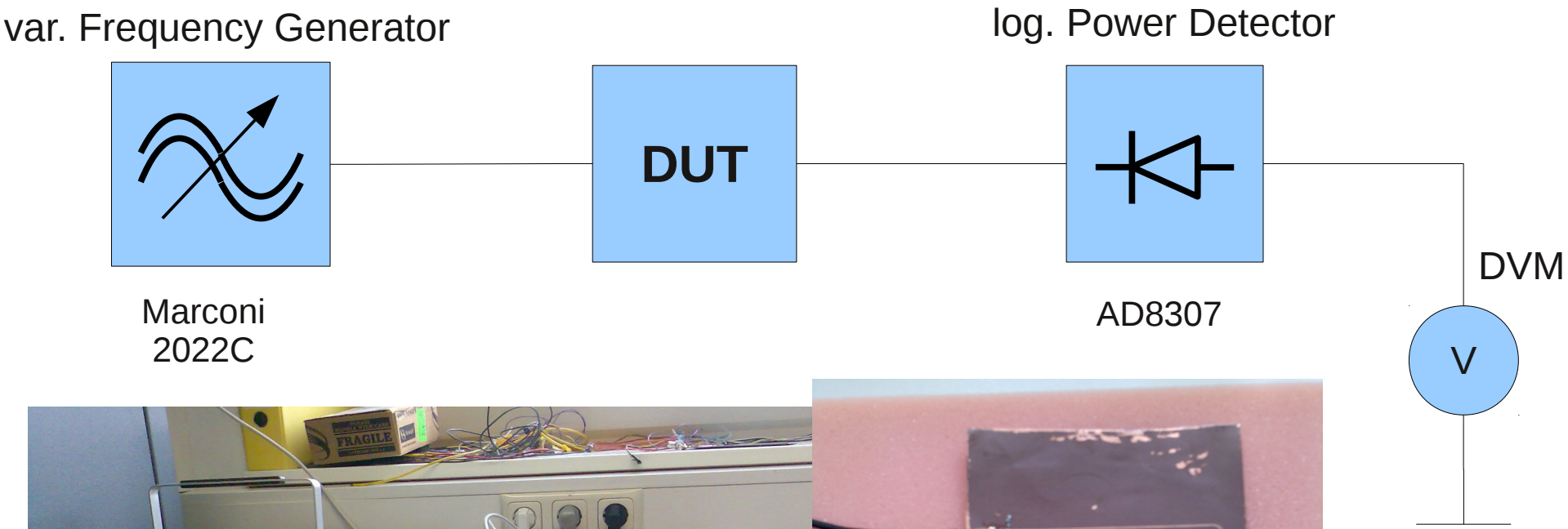

PANDA01 CIS 2010
y
x

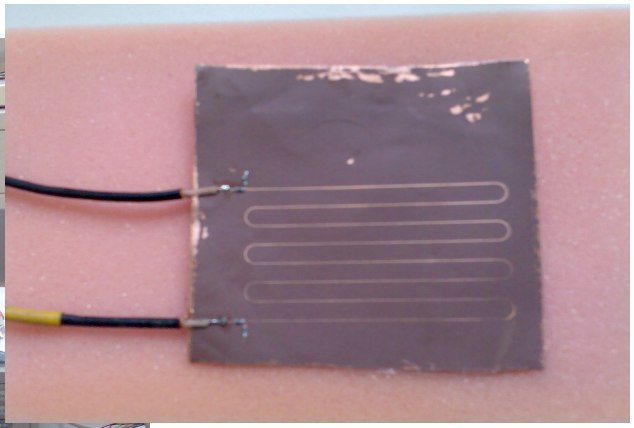
25 Ohm Microstripline Test Structure



Impedance Transformers

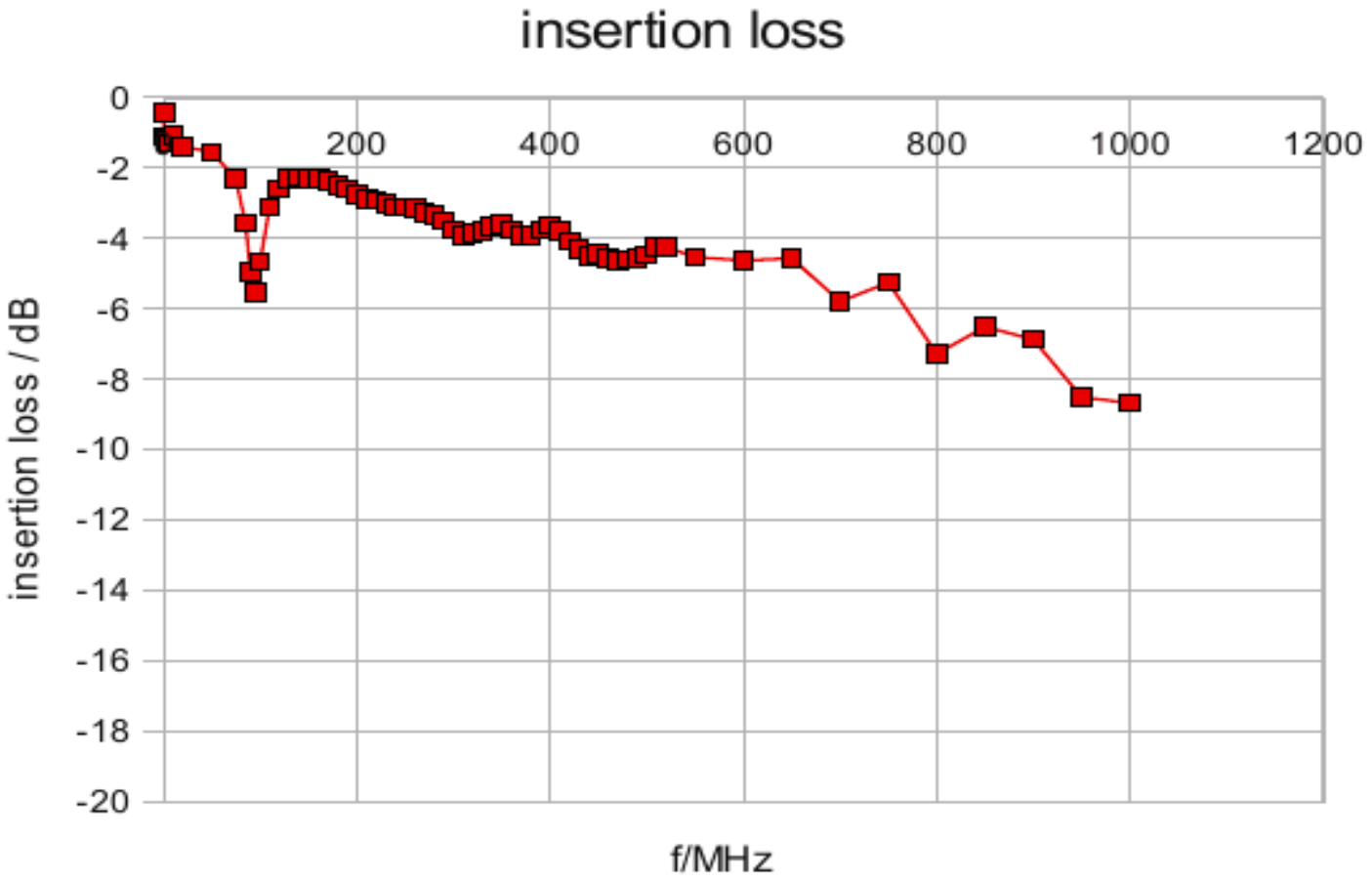
Etched on AP9121 2mil thick foil
Transmission µStripline, length 518mm



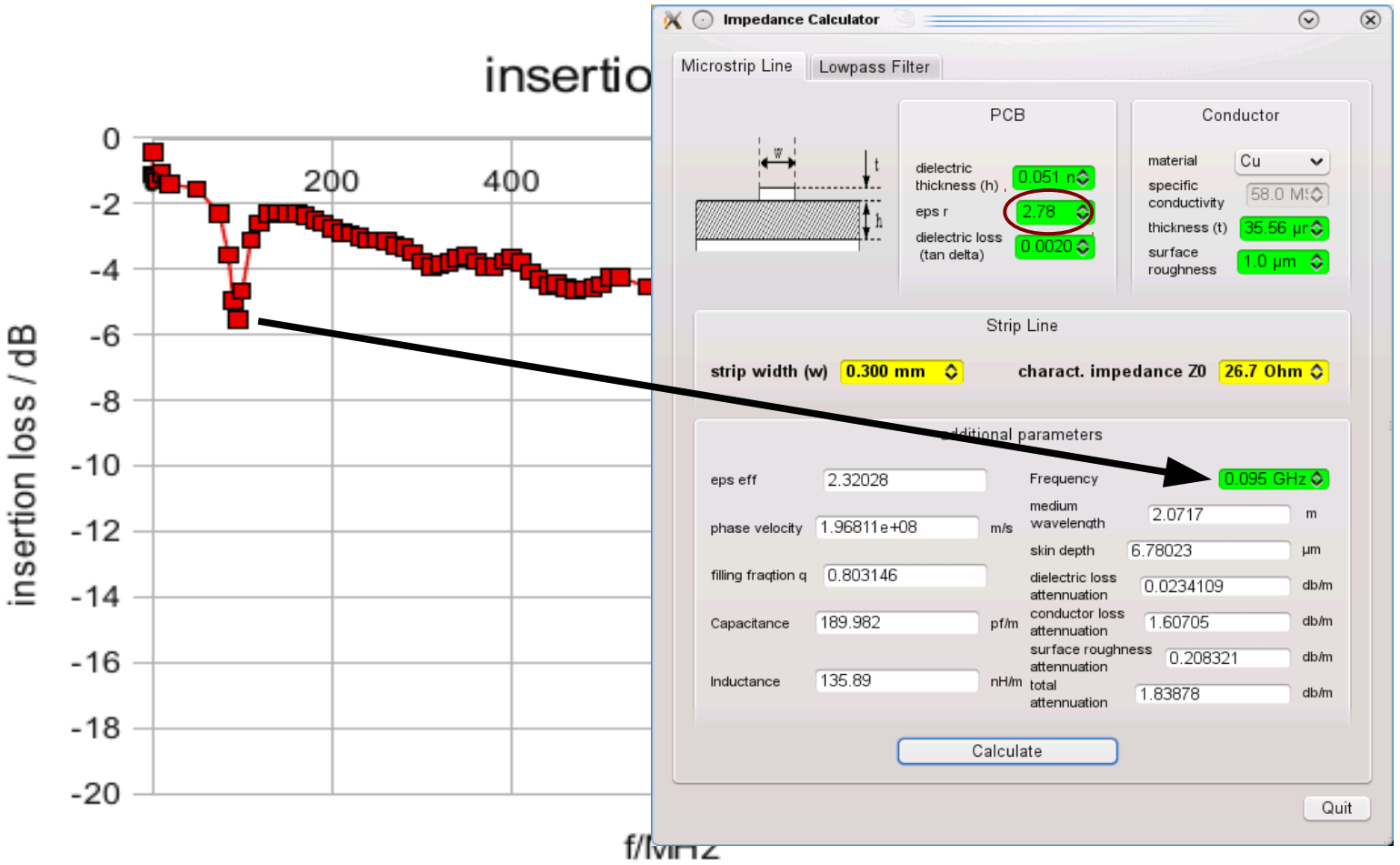


Setup for Measurement of Frequency Behaviour

Determination of Insertion Loss, Return Loss



- Impedance matching not perfect due to inacurrate etching process
→ resonance visible
- Dip corresponds to lambda/4-wavelength along the stripline
- flatness within 3dB up to >400MHz



- Impedance matching not perfect due to inacurrate etching process
→ resonance visible
- Dip corresponds to lambda/4-wavelength along the stripline
- flatness within 3dB up to >400MHz

Irradiation

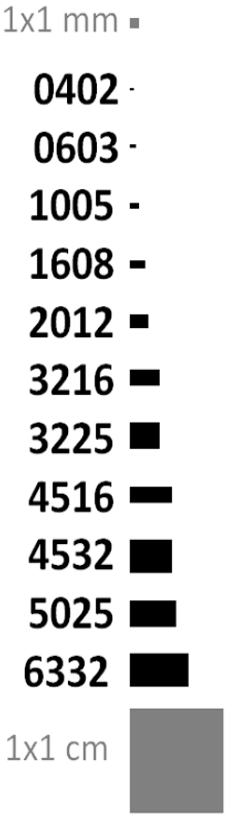
Irradiation of ceramic capacitors, sizes 0603, 0402 and 0201

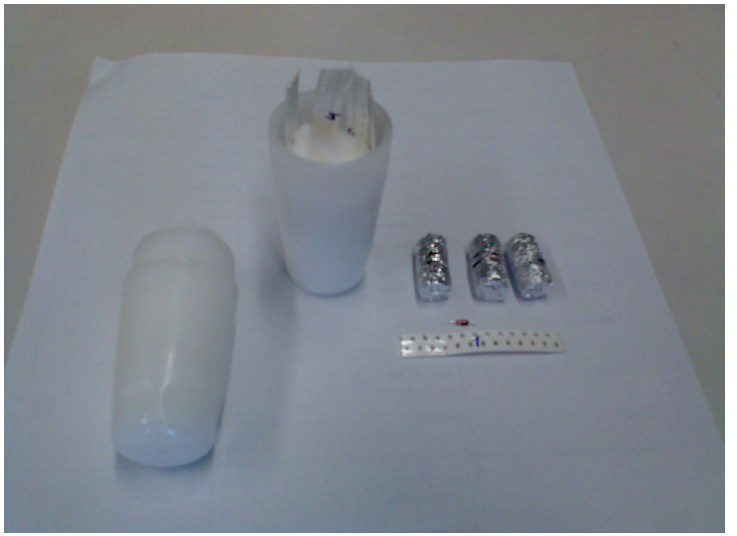
Study degrading of parameters (C,Q,Rs,Rp,I_{Leak},$V_{breakthrough}$) with applied fluence

Flux: ~10^{12} n * s^{-1} * cm^{-2}

TU Delft

http://www.nkrv.nl/centra/delft/





Identified Elements and Estimated EOB Activities

CAP0201 (X7R, Tayo Yuden) : Ba, Au, Co, Sb
CAP0603 (X7R, Kemet) : Ag, Na, Cr, Ba, Sb
(in Order of Activity)

Sample size: 10Pcs

Nucleus	$T_{1/2}$ [d]	$\sigma_{n,th}$ [barn]	Activity (t=10d)	Activity @EOB
130Ba	11.5	8.6	2.8	5
50Cr	27.7	15.9	0.1	0.13
197Au	2.70	98.7	0.4	5
57Co	70.9	?	0.46	0.5
121Sb	2.72	5.8	0.45	5.6
23Na	15h	0.5		
109Ag	249.8	91.1		

Avoid taking Components with significant amount of high $\sigma_{n,th}$ material