HIGHTEC
Custom made MicroCircuits

JOIN INNOVATION AND FLEXIBILITY.

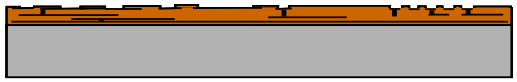
Flex Technology in the Industry

2nd ATLAS HV-MAPS Mini-Workshop
July 2, 2015

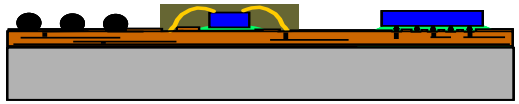
Presented by : Eyad Assaf – Hightec MC AG

HiCoFlex® Technology

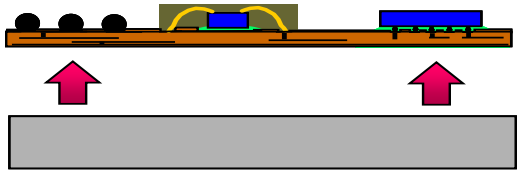
1- Fabrication of multilayer structure on rigid carrier substrate



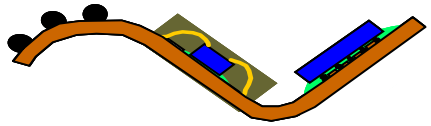
2- Assembling, Bonding Protection, Test

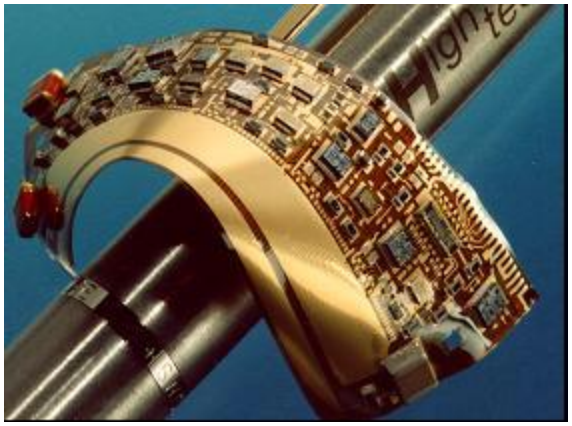


3- Separation of multilayer from rigid substrate

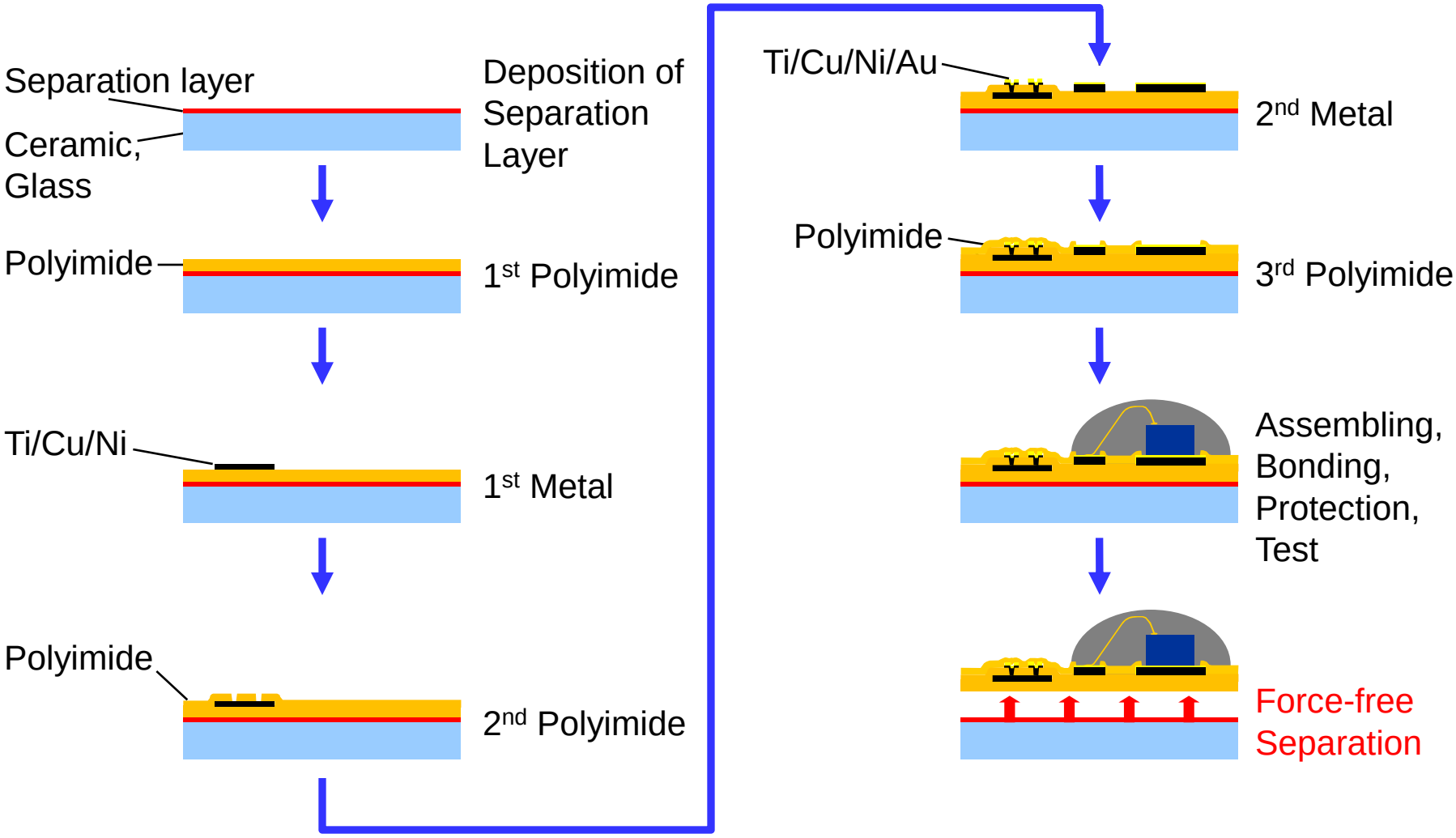


4- HiCoFlex Circuit





HiCoFlex® Process



HiCoFlex® Process

The HiCoFlex® Process: Carrier

Ceramics, glass or metal

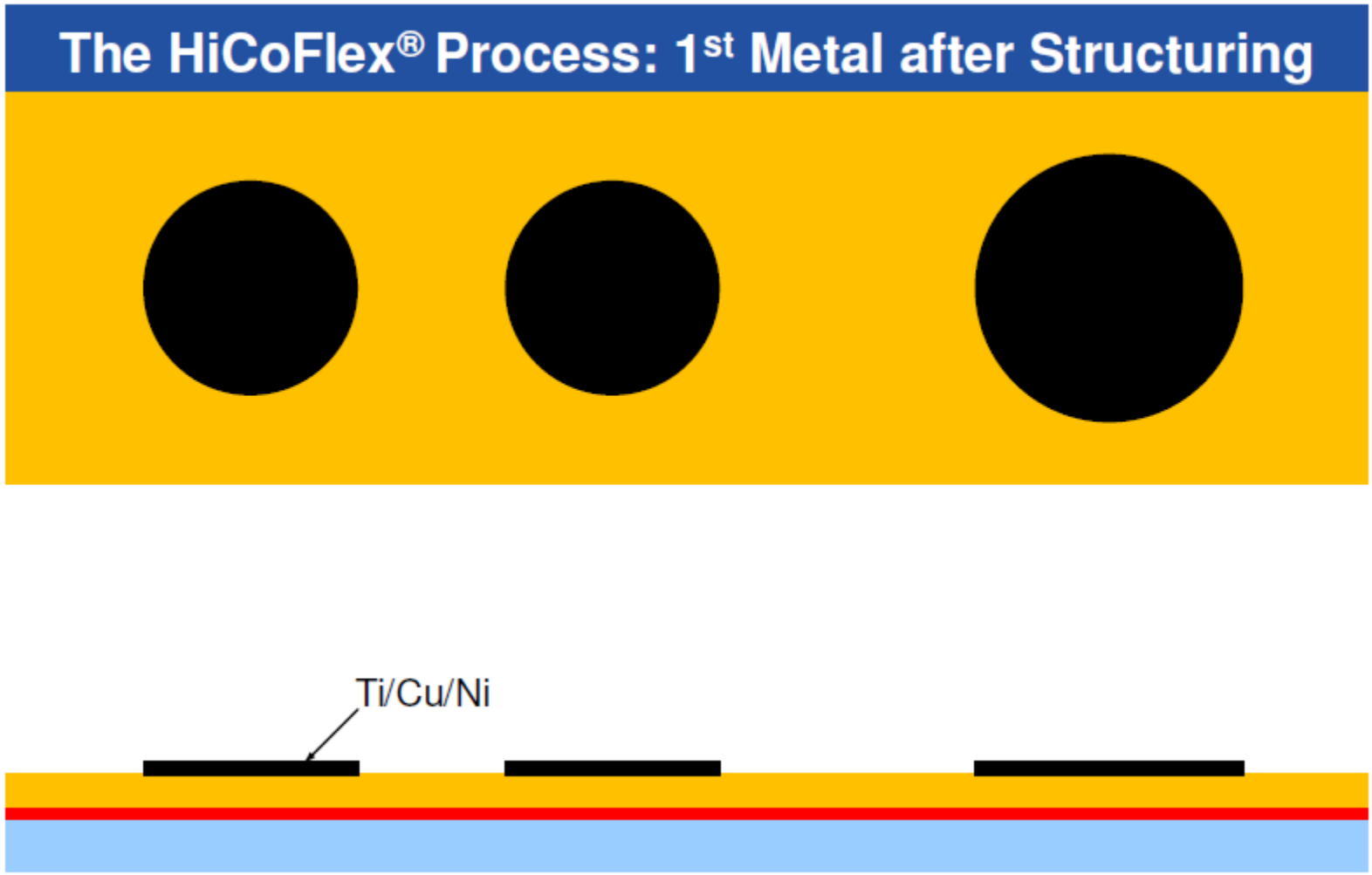
HiCoFlex® Process

The HiCoFlex® Process: Separation Layer

HiCoFlex® Process

The HiCoFlex® Process: 1st Polyimide Layer

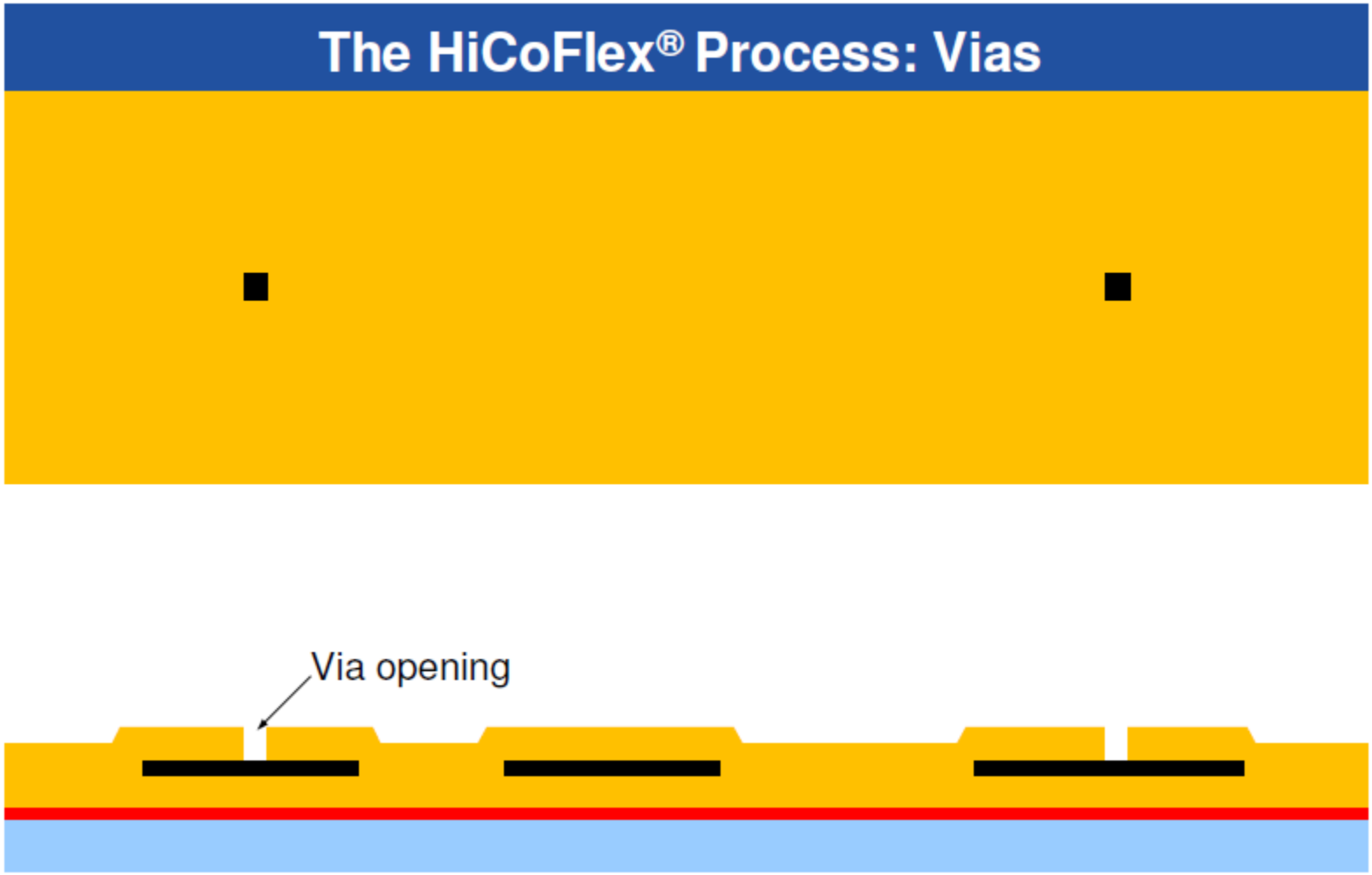
HiCoFlex® Process



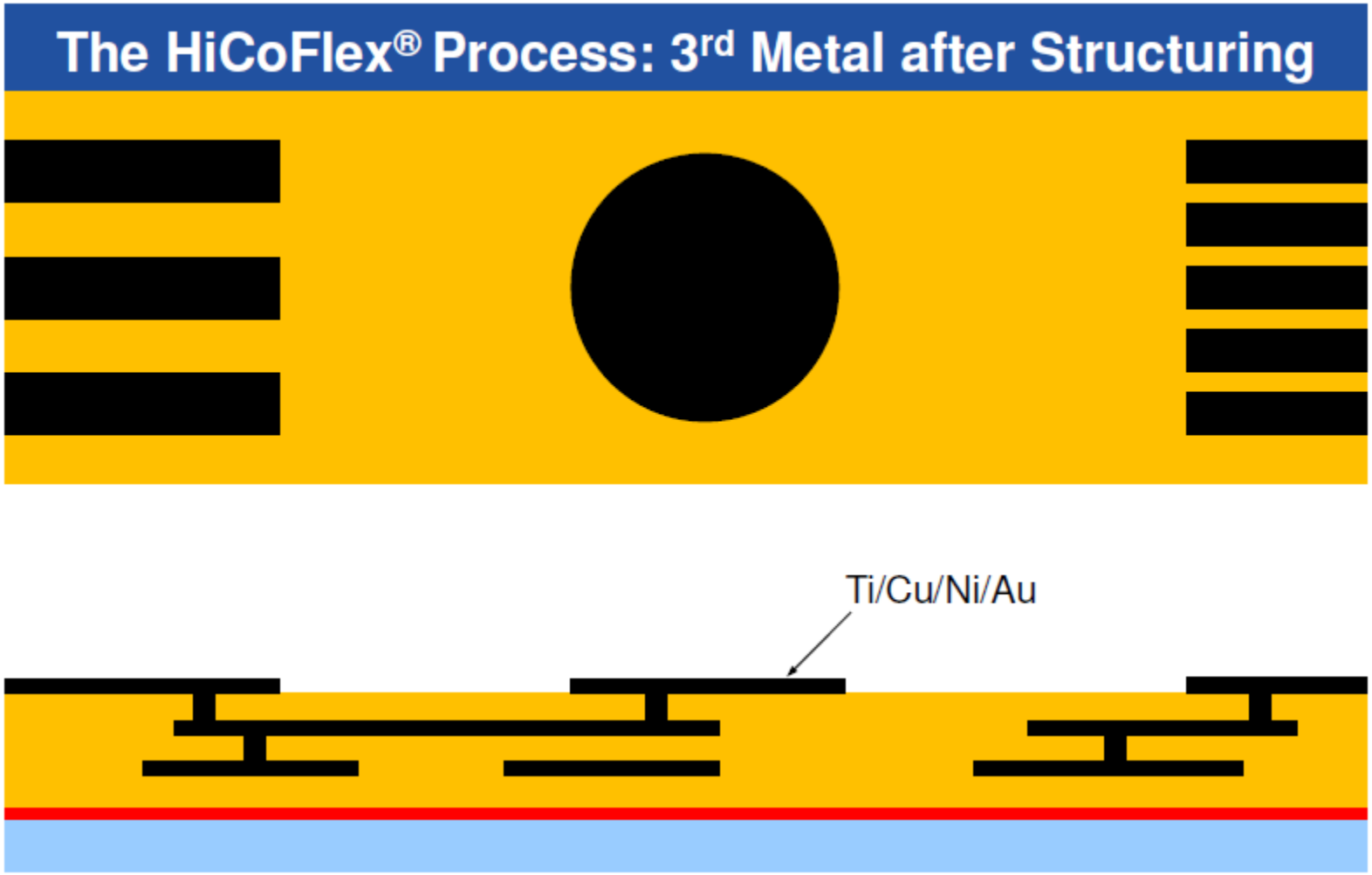
HiCoFlex® Process

The HiCoFlex® Process: 2nd Polyimide Layer

HiCoFlex® Process

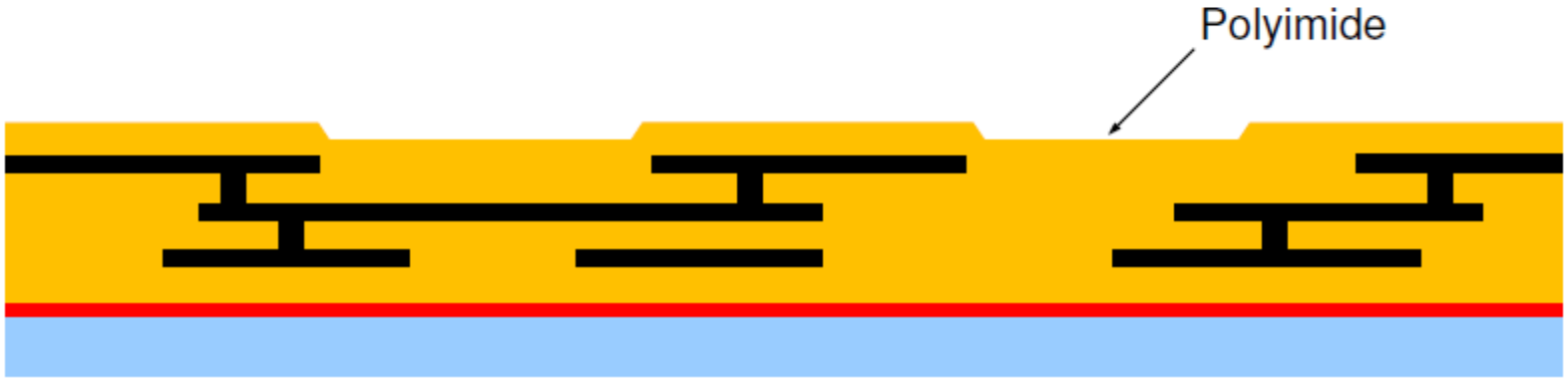


HiCoFlex® Process

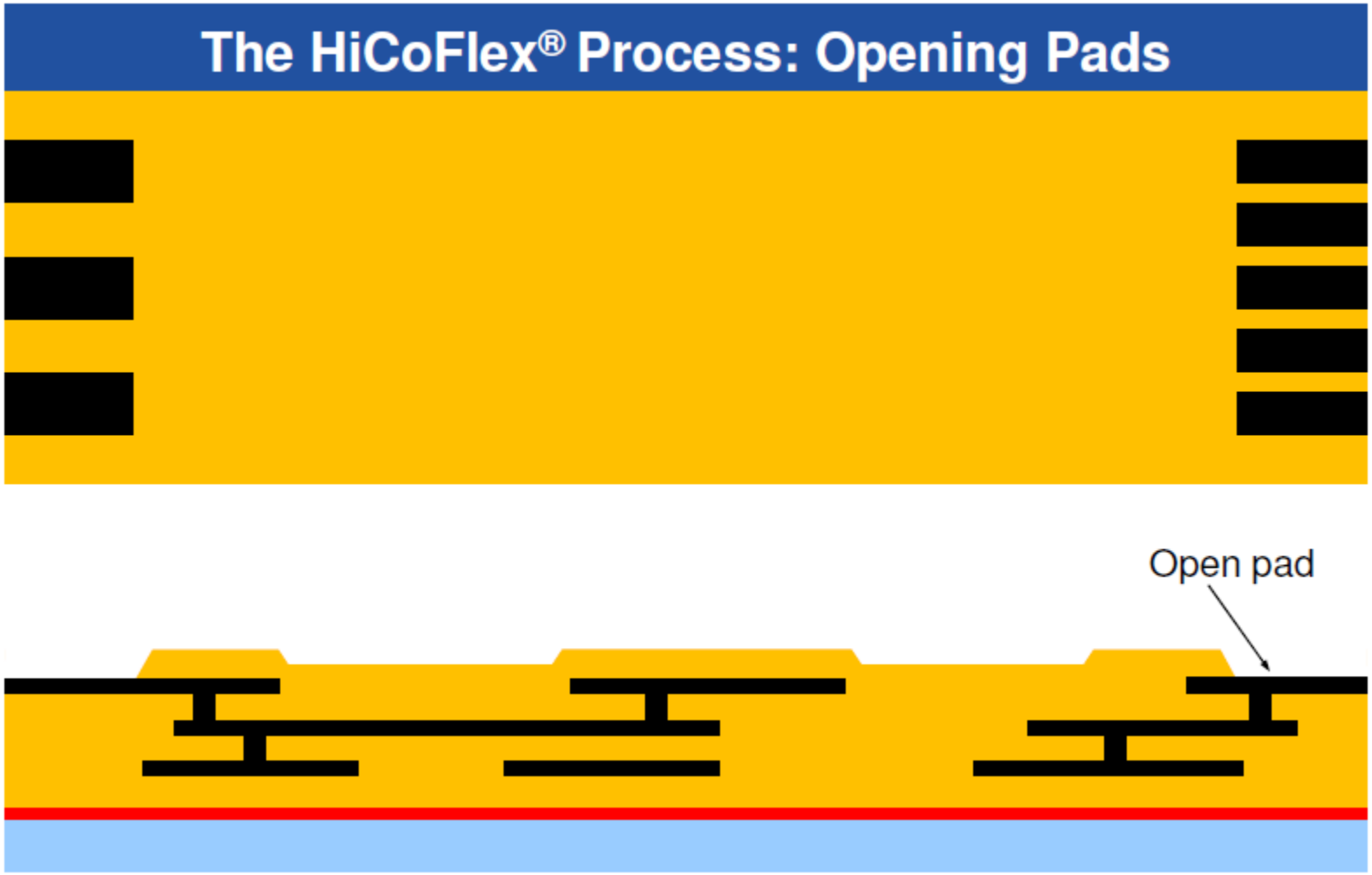


HiCoFlex® Process

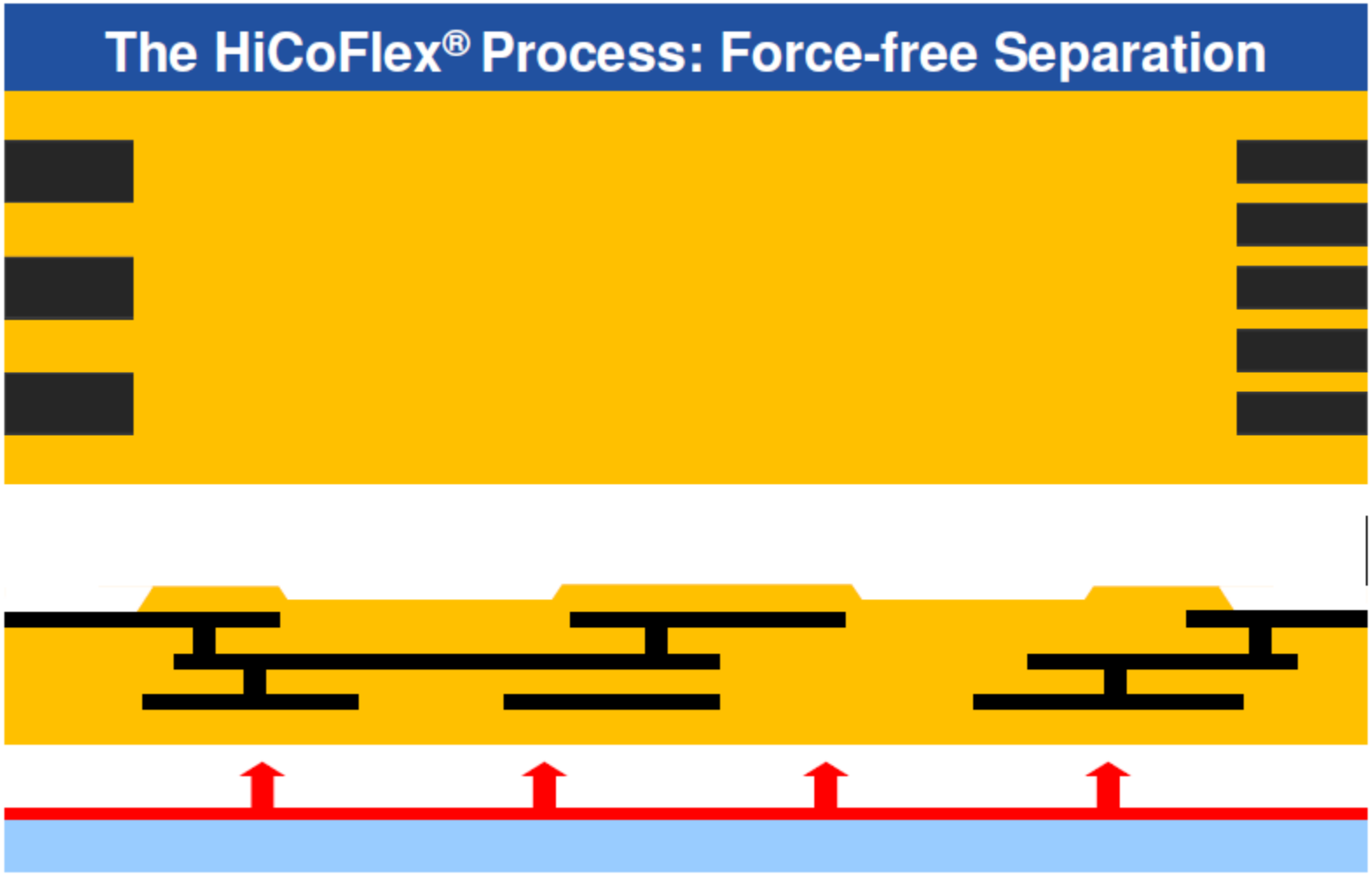
The HiCoFlex® Process: 4th Polyimide Layer



HiCoFlex® Process

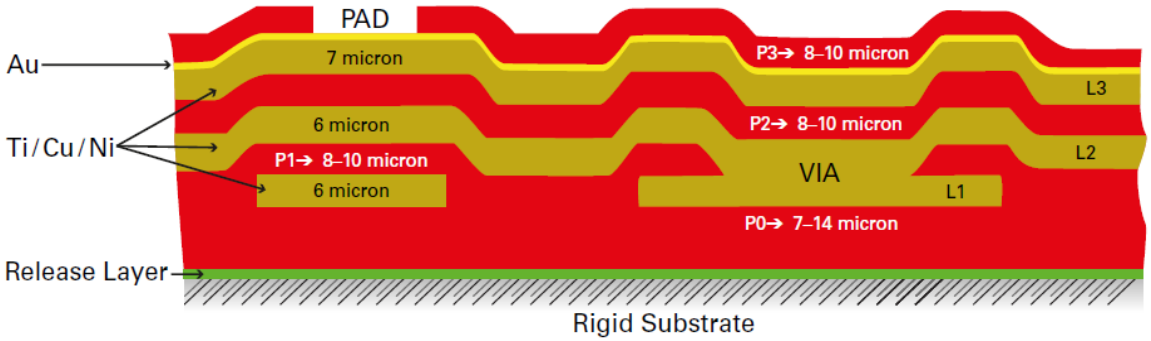


HiCoFlex® Process

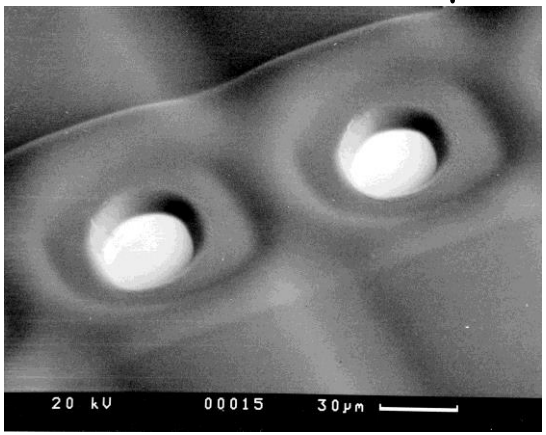


Via's Profil

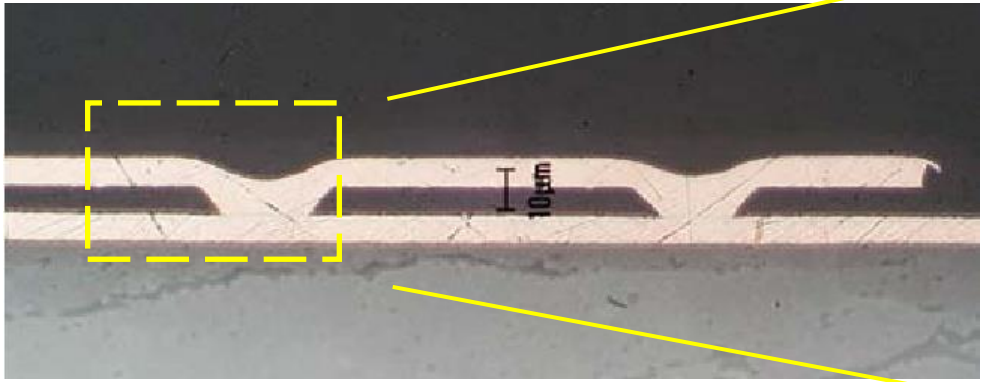
- Vias are formed by etching Polyimide prior to next level metallization
- 1–4 metal layers
- The release layer is used for lift-off

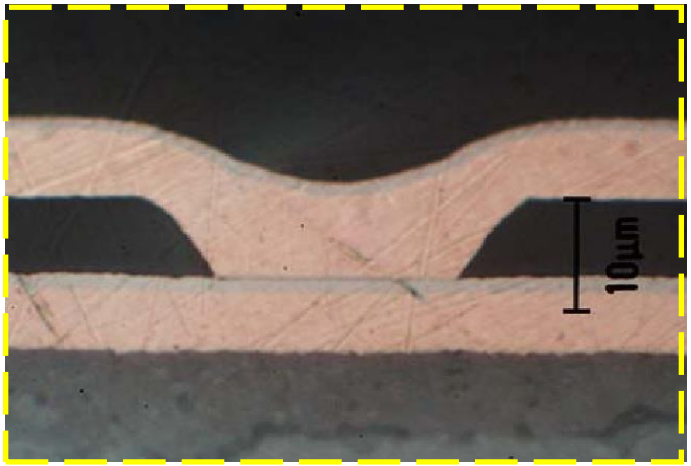


Laser cut vias
∅ 30 µm

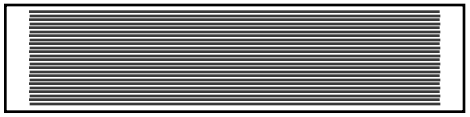


Electroplated vias



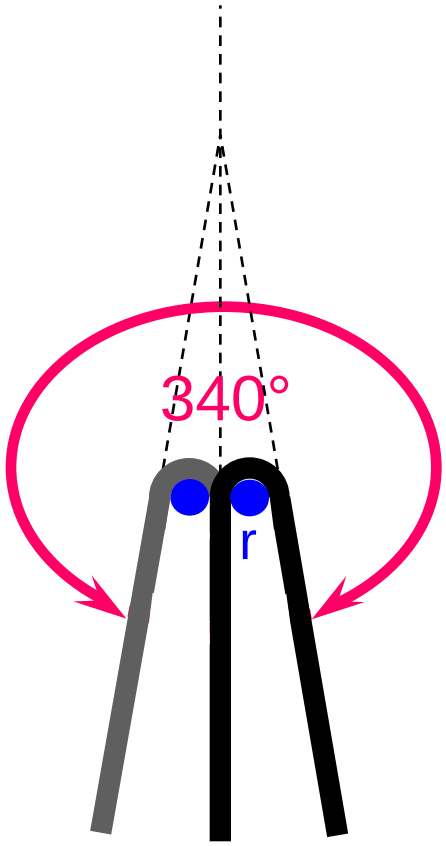


Flexibility



10 mm

77 wires,
130 μm pitch
25 μm total thickness

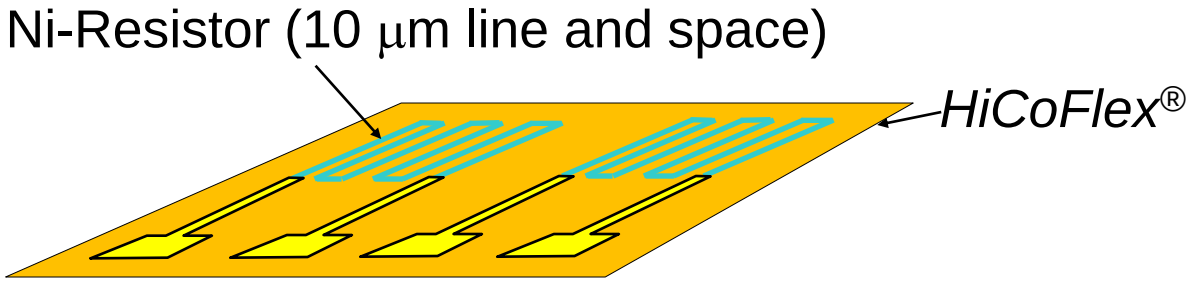


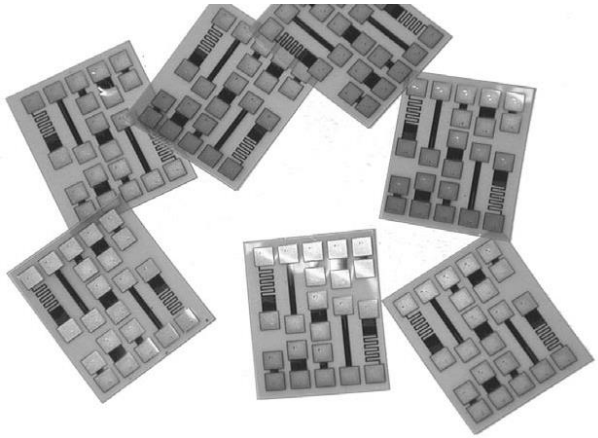
r = 1 mm

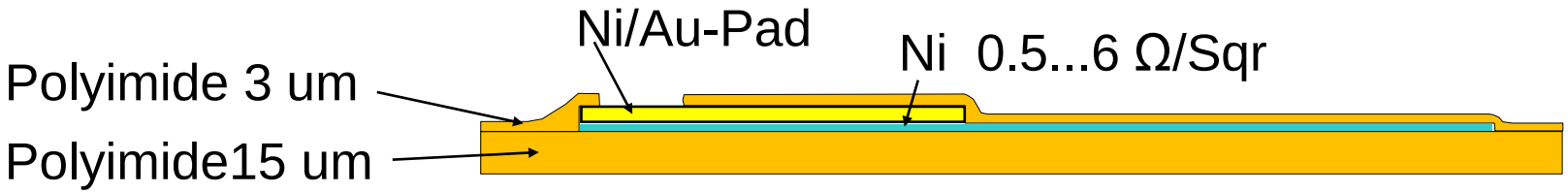
- no mechanical damage
- no change in electrical properties

number of cycles > 10^7

Integrated Ni-Resistors





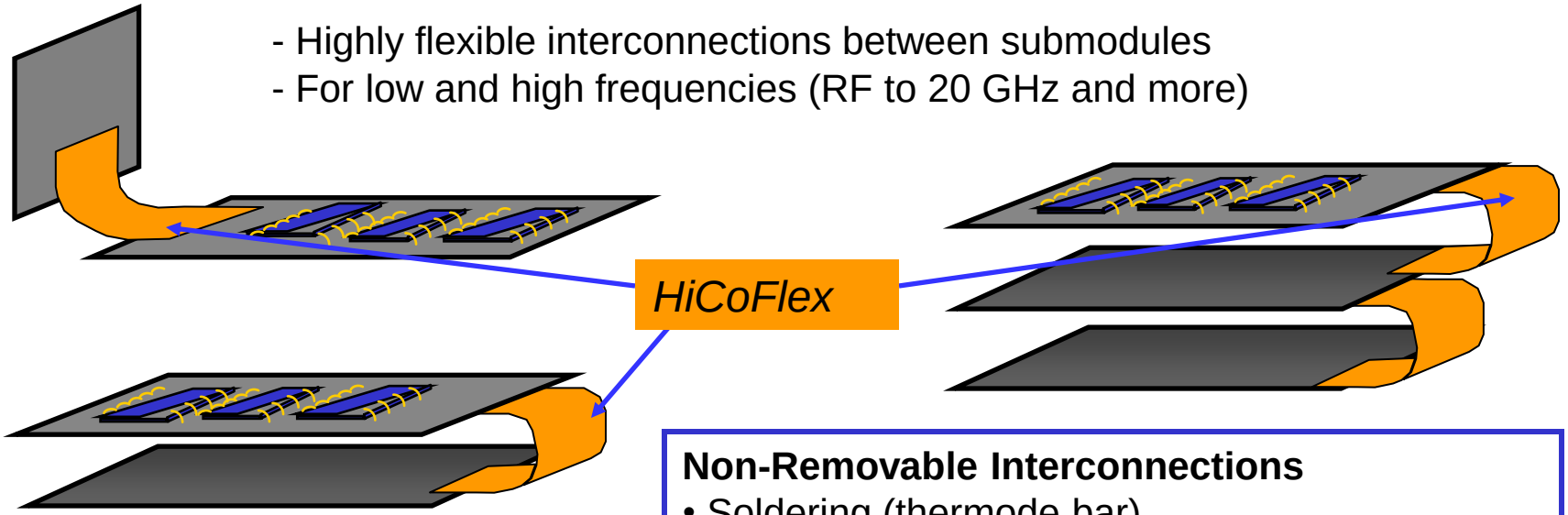


Low Thermal Mass → Fast Response

Protection by Polyimide → Excellent Chemical Stability

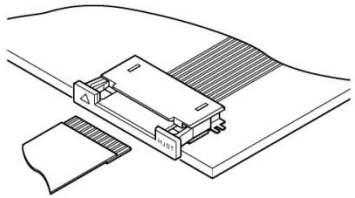
Cables and Interconnections

- Highly flexible interconnections between submodules
- For low and high frequencies (RF to 20 GHz and more)



Removable Interconnections

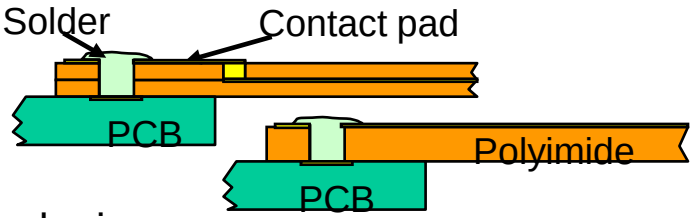
• Mini ZIF



• Cu pressure contacts

Non-Removable Interconnections

• Soldering (thermode bar)



• Conductive glueing

• Anisotropic conducting film (ACF) ~ Pitch 50 µm

• Glueing + Wire bonding

HiCoFlex Properties

Properties	Value	Unit
dielectric constant (23 °C)	3.1	
dissipation factor (23 °C)	0.002	
coefficient of thermal expansion	3	ppm/K
thermal conductivity	0.4	W/mK
volume resistivity	1 x 10E16	Ohm cm
breakdown voltage	> 250	V/mm
glass transition temperature	> 400	°C
decomposition temperature	620	°C
weight (3-layer circuit)	8	mg/cm2
water absorption (23 °C, 95% rel. humidity)	0.5	%
min. bending radius (3 layer circuit)	1	mm

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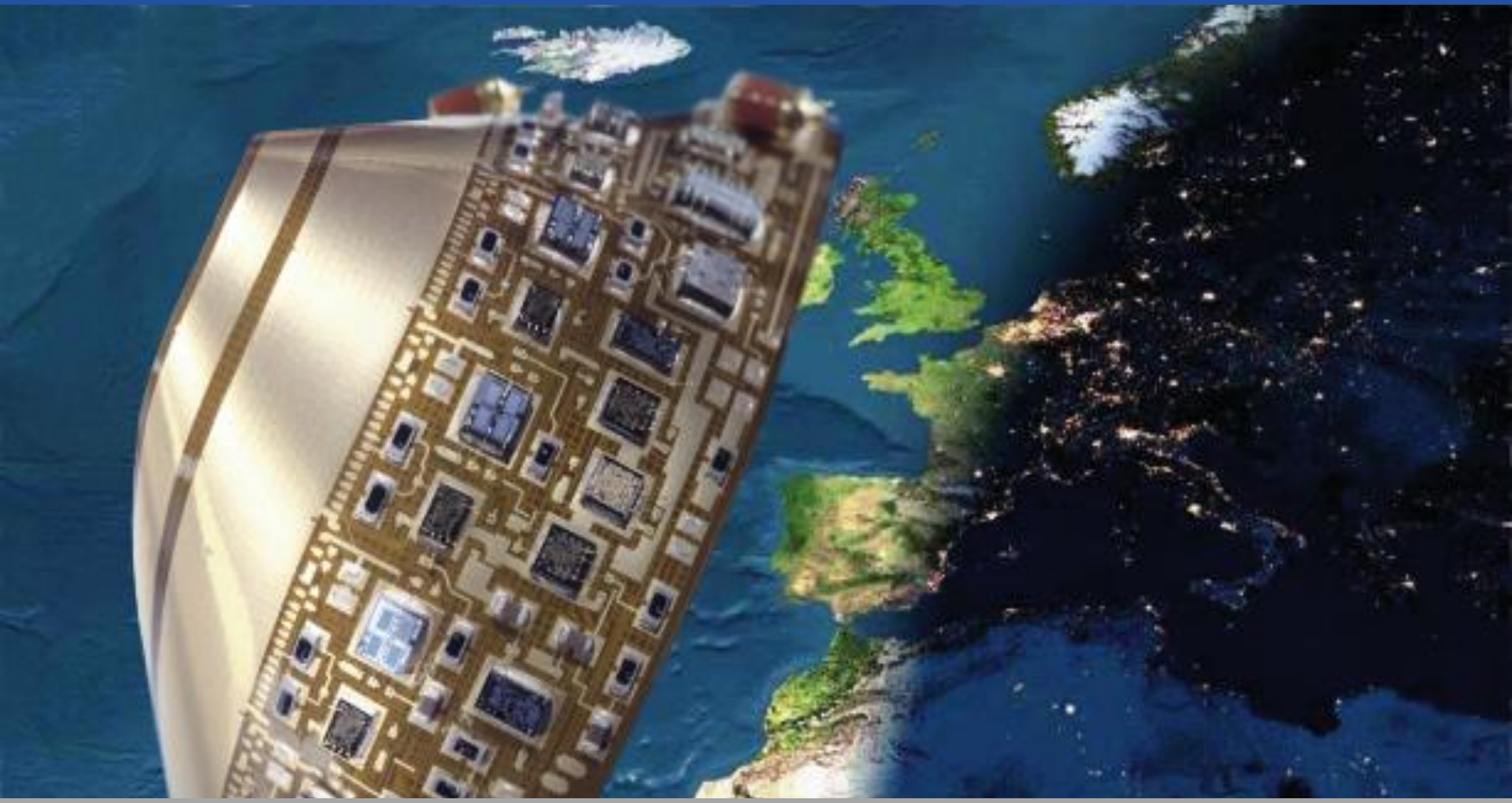
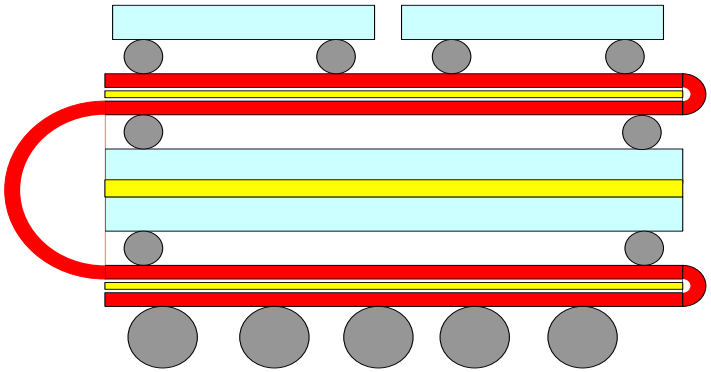
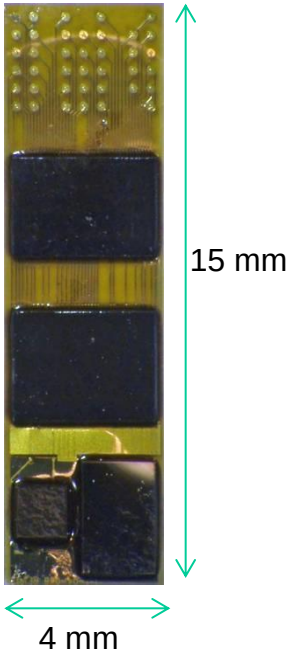
Flex Applications

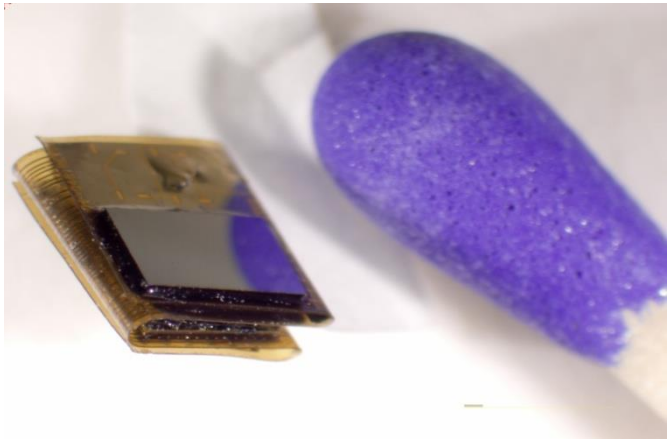


3D Flex Module

Thin dies, 50 µm (180 µm)
Small bumps, 10 µm (90 µm)
Sharp bending r < 200 µm
Adhesive: 60 µm
BGA bumps: 250 µm



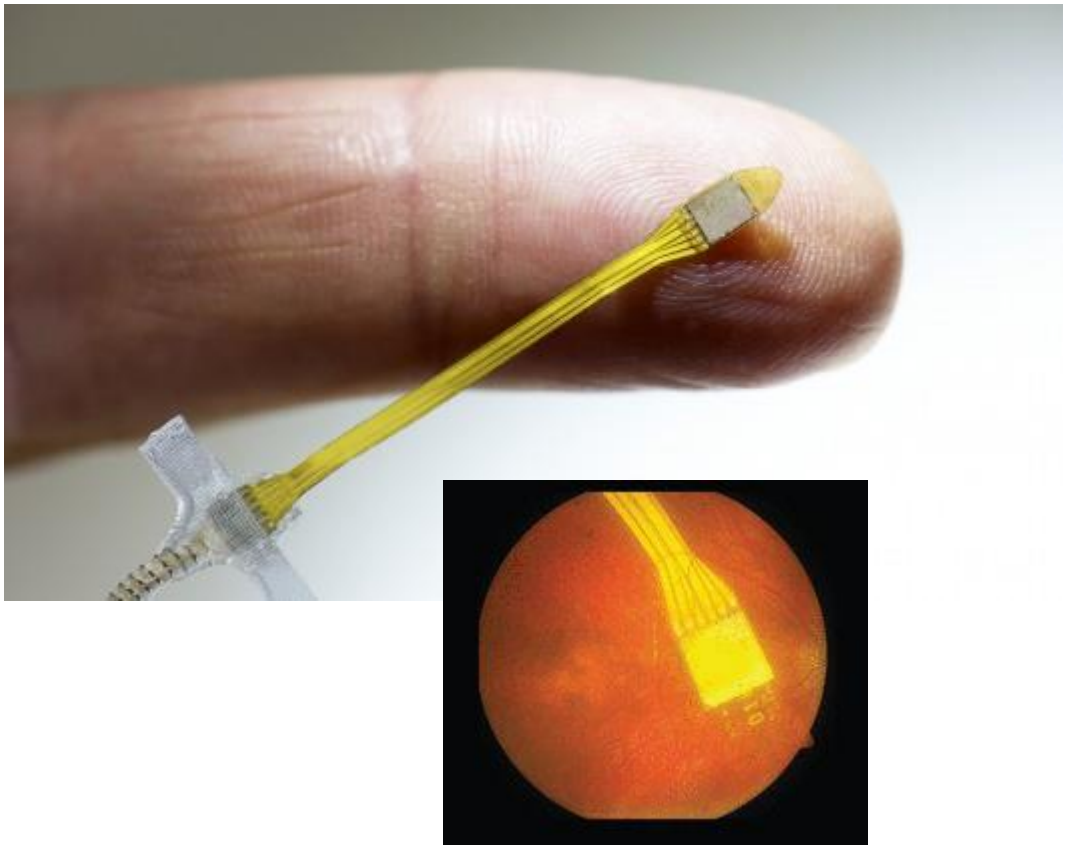




Wireless Endoscope

- Light flex substrate requested
- Multiple folded flex board
- Assembling of components with standard technology
- Function test on a rigid substrate => batch processing

Retina Implant

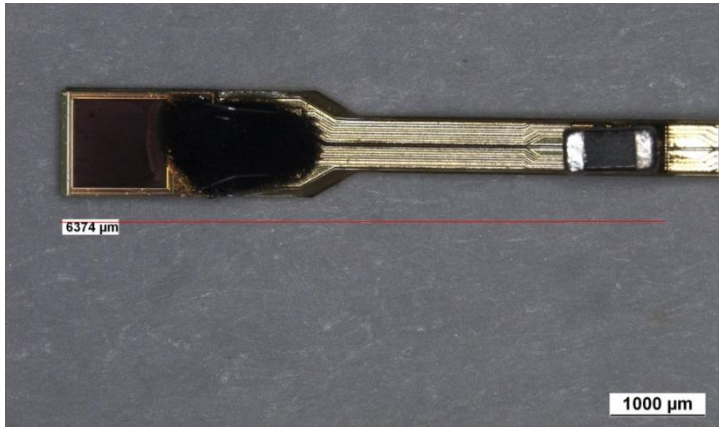


Article in Focus 6/2012

Long micro cables for Endoscopes

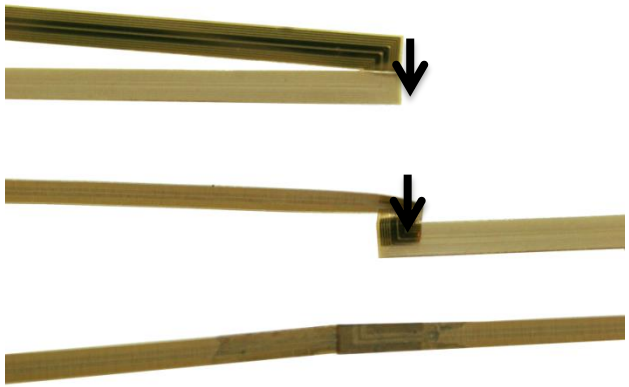
Medical application for catheder and endoscope connection

- Length typ. ≥ 1m
- Width ≤ 100 – 200 µm
- Number of lines: from 2 (e.g. twisted) to 128
- Number of metal layers: 1 to 4
- Flip-Chip assembling or glue and wire bond



CCD camera cable with 8 conductors

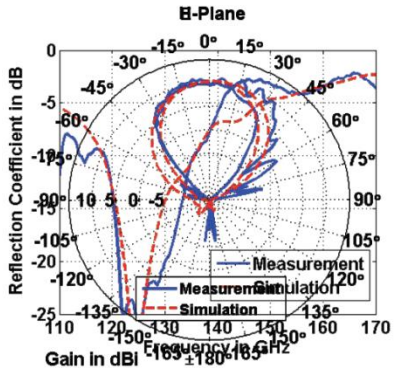
Long flex cable with laser cut.
Length over 15meters

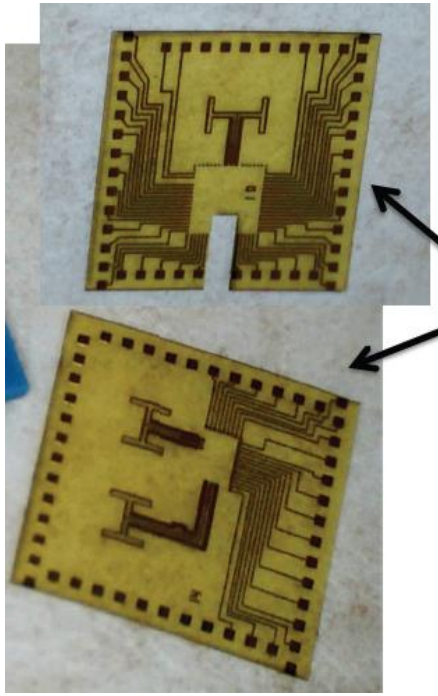


Long flex cable with meander laser cut.
Straight cable length over 1meter

High Frequency – 122GHz

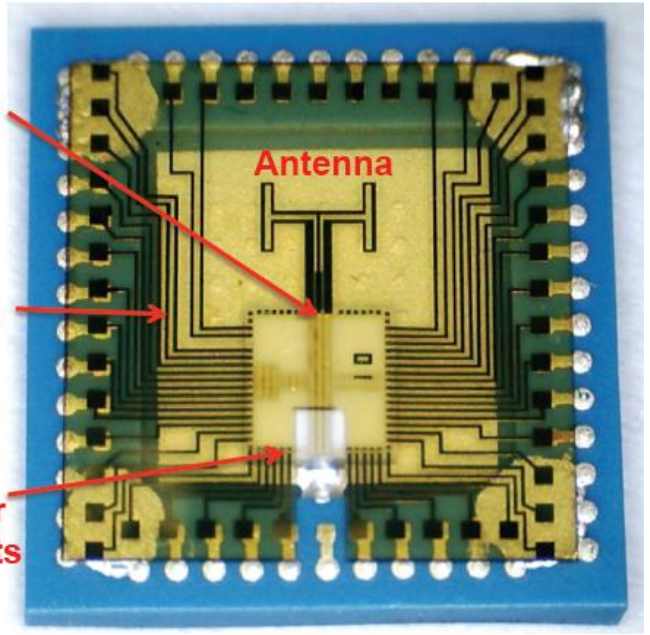
www.success-project.eu





Antennas on HiCoFlex
(14 µm Polyimide)

→ Double Dipole Antenna
→ Uses package base as reflector



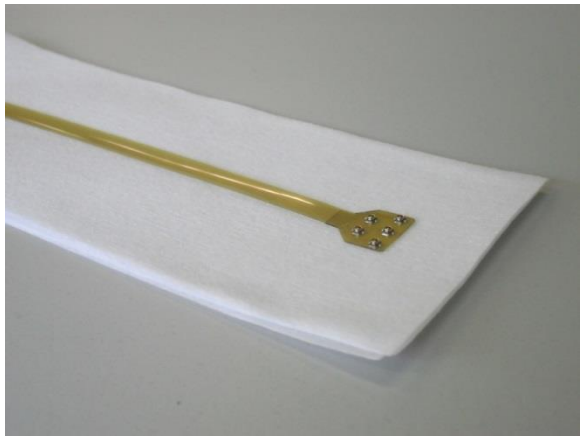
- Performance including the flip chip interconnect:
- 17 GHz Bandwidth
- 11 dBi Gain
- No sidelobes
- Not affected by interconnect lines

Cryogenic cables for Space

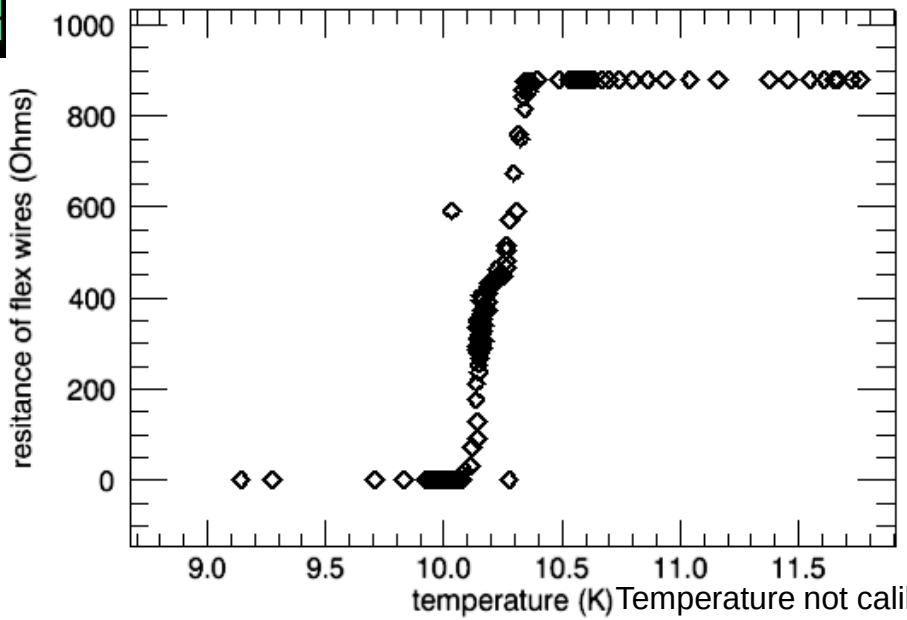
Cryo harness

250 nm Nb

T_c ~ 8-9K



Measurement done by SRON

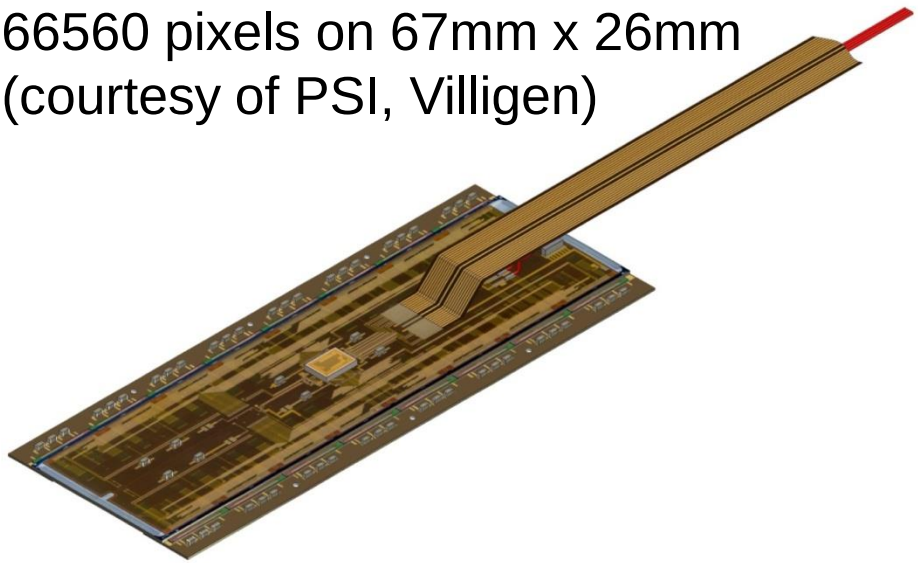


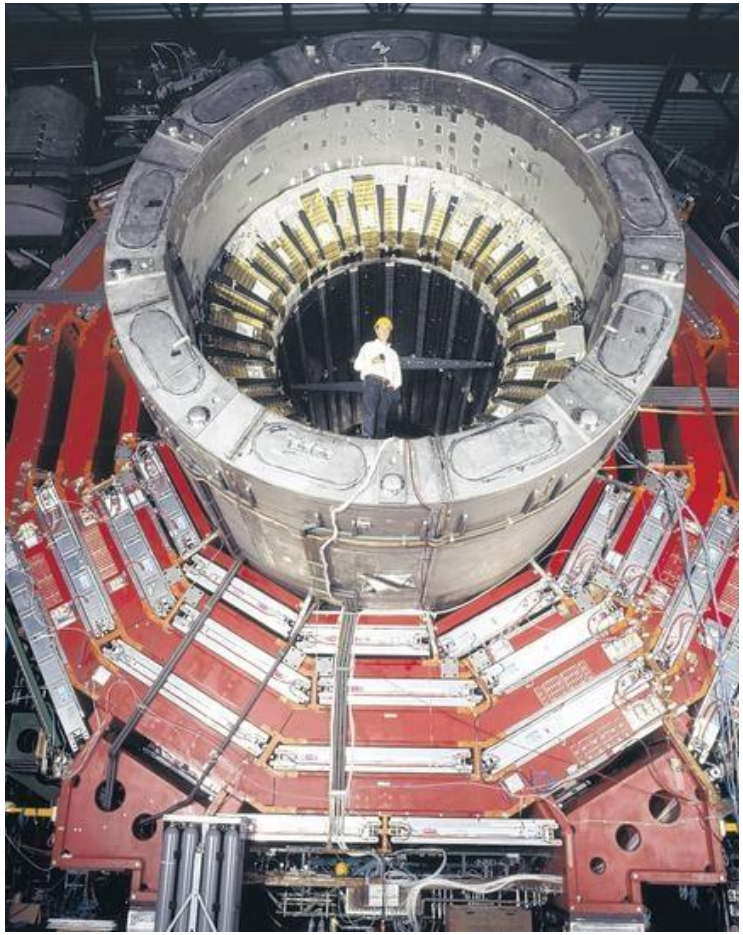
Temperature not calibrated

High Density Interconnects

3-layer HDI flex
CMS experiment in the Large Hadron Collider (LHC) at CERN

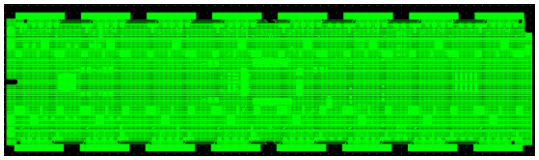
Assembled barrel modul for
66560 pixels on 67mm x 26mm
(courtesy of PSI, Villigen)



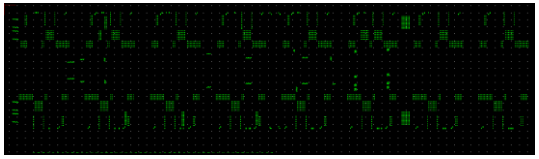


Detector Module Design

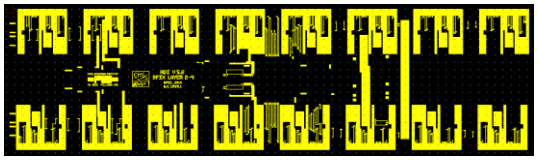
L1



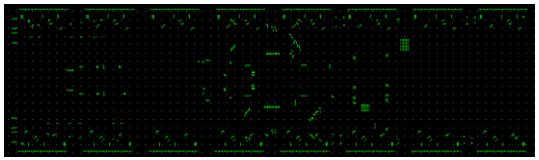
Via12



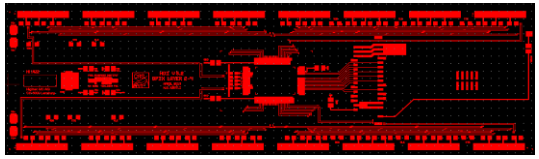
L2



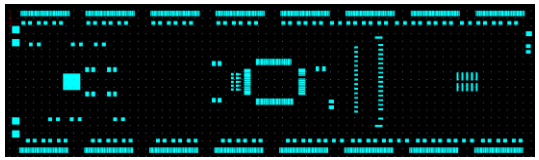
Via32



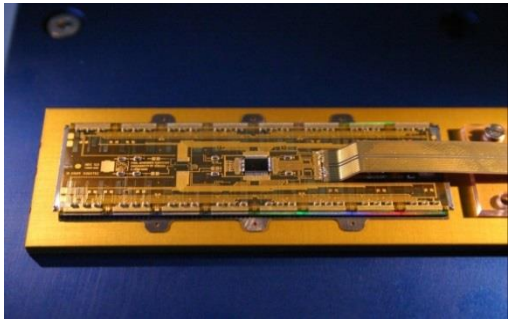
L3



P3



Solder Mask



3 Layers circuit, dim. 67mm x 26mm
56 Resistors (0402)
2 Capasitors (0402)
Line/Space=25um/25um
14 Circuits/Substrate 6 inch
Connector FPC Molex 0.3mm pitch
2 versions
100% Electrical test

HiCoFlex® Technology Benefits

1. High density, 15 µm Line/Space
2. Very good flexibility and reliability
3. High mechanical robustness
4. Very thin, down to 10 µm for single layer and up to 70 µm for 4 layers
5. Thermal stability from -273°C to 380°C
6. Reliable under high radiation dose
7. Long cables > 1 m
8. Backside metallization
9. Integrated Resistors
10. Embedded Si chips
11. MOEMS intgrated on flex
12. 24”x24” production panel
13. Foldable with r < 200 µm
14. Chemical resistant
15. Bio compatible
16. No adhesive material
17. Non outgasing

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