

New Silicon Sensor Developments at Micron Semiconductor Ltd

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Susanne Walsh



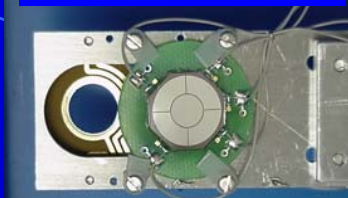
The Company



- UK manufacturer of silicon sensors for over 25 year.
- Based on the South Coast of England.
- 2 site facility with all in-house processing and testing:
 - 4 & 6-inch furnaces.
 - Varian 300 XP Implanter.
 - Poly-silicon deposition furnace.
 - Plasma etching facilities.
 - Silicon laser profiler.
 - Semi-automatic probing stations.

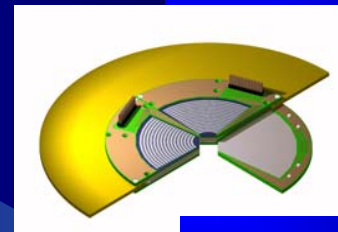


BEAM MONITORS



THIN SILICON DEVICES

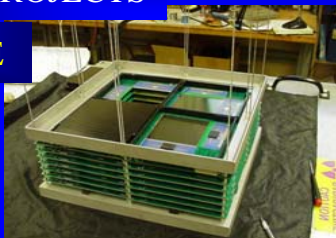
RADIOACTIVE BEAM PHYSICS



REX ISOLDE CERN

SPACE PROJECTS

TIGRE



SINGLE AND DOUBLE SIDED DC COUPLED DETECTORS

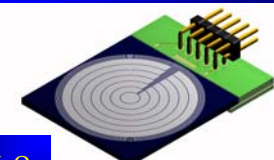
PIXELS + ANNULAR QUADRANTS + LARGE AREA DESIGNS + MICROSTRIP DEVICES

COSY



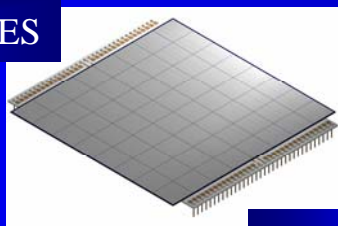
QUIRL DETECTORS

ANNULAR DEVICES



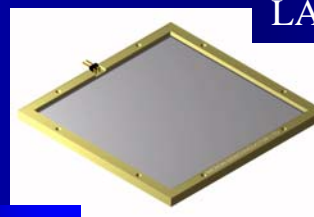
LL8

PIXEL DEVICES



MSPX080

LARGE AREA DESIGNS



MSX100

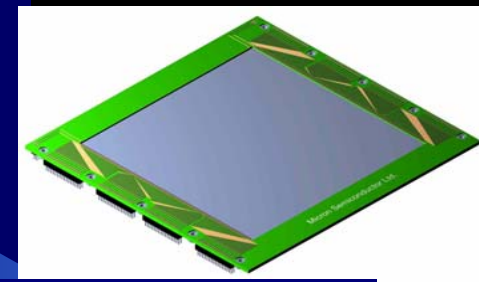




DOUBLE METAL PROCESSING



HV MULTI GUARD RING DESIGNS



DOUBLE SIDED AC MICROSTRIPS

SINGLE AND DOUBLE SIDED AC COUPLED DETECTORS

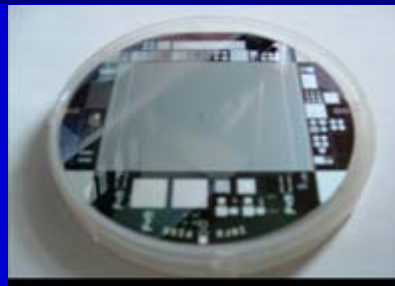
FOXFET BIASING + POLYSILICON RESISTORS + CAPACITANCE DIVISION

SINGLE & DOUBLE SIDED LAYERS + MULTI-GUARD RING DESIGNS FOR HIGH VOLTAGE OPERATION

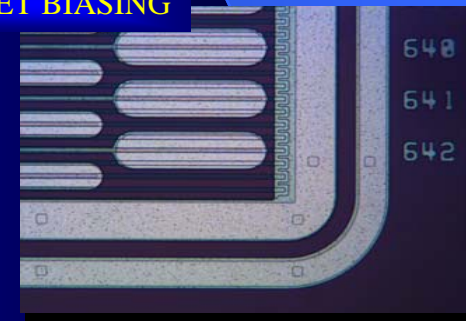


POLYSILICON RESISTORS

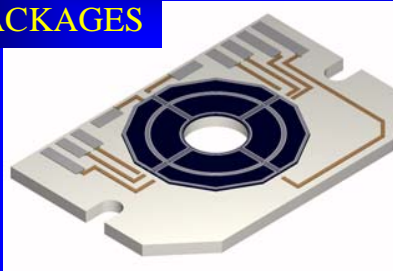
4 & 6-INCH WAFER PROCESSING



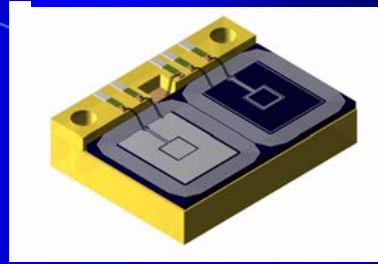
FOXFET BIASING



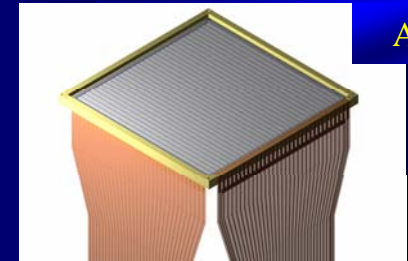
CERAMIC
PACKAGES



MULTI-LAYER PCB



MINIMUM DEAD
AREA

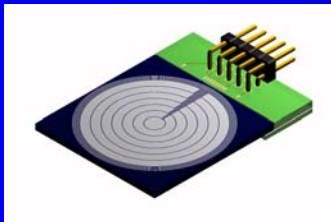


AREA

CUSTOM DESIGN PACKAGES

MULTI-LAYER PCBs + KAPTON READOUTS + MINIMUM DEAD AREA ASSEMBLIES

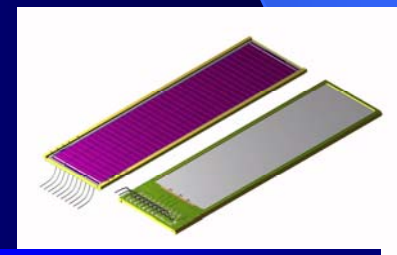
HIGH DENSITY LARGE AREA CERAMICS + TRANSMISSION & LEADING EDGE MOUNTINGS



LEADING EDGE MOUNTS



KAPTON READOUTS



TRANSMISSION
PACKAGES



TESTING

- ✦ FULL ELECTRICAL DC AND AC SEMI AUTOMATIC PROBING ✦
- ✦ ALPHA RESOLUTION MEASUREMENTS
- ✦ LIFETIME AND STABILITY TESTING
 - ✦ TEMPERATURE CYCLING
 - ✦ RANDOM VIBRATION TRIALS

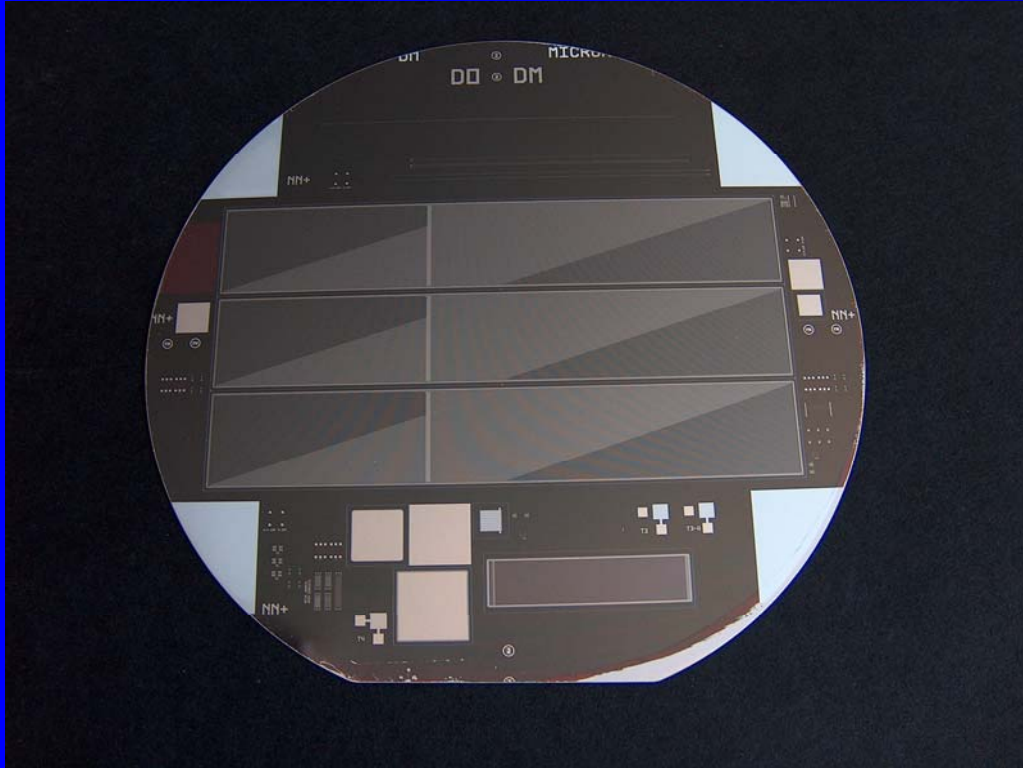
QUALITY ASSURANCE



- ✦ AQAP 1 DEFENCE STANDARD
- ✦ SPACE QUALIFIED FOR NASA AND NASUDA PROJECTS



DØ Double Sided Microstrip Detector.

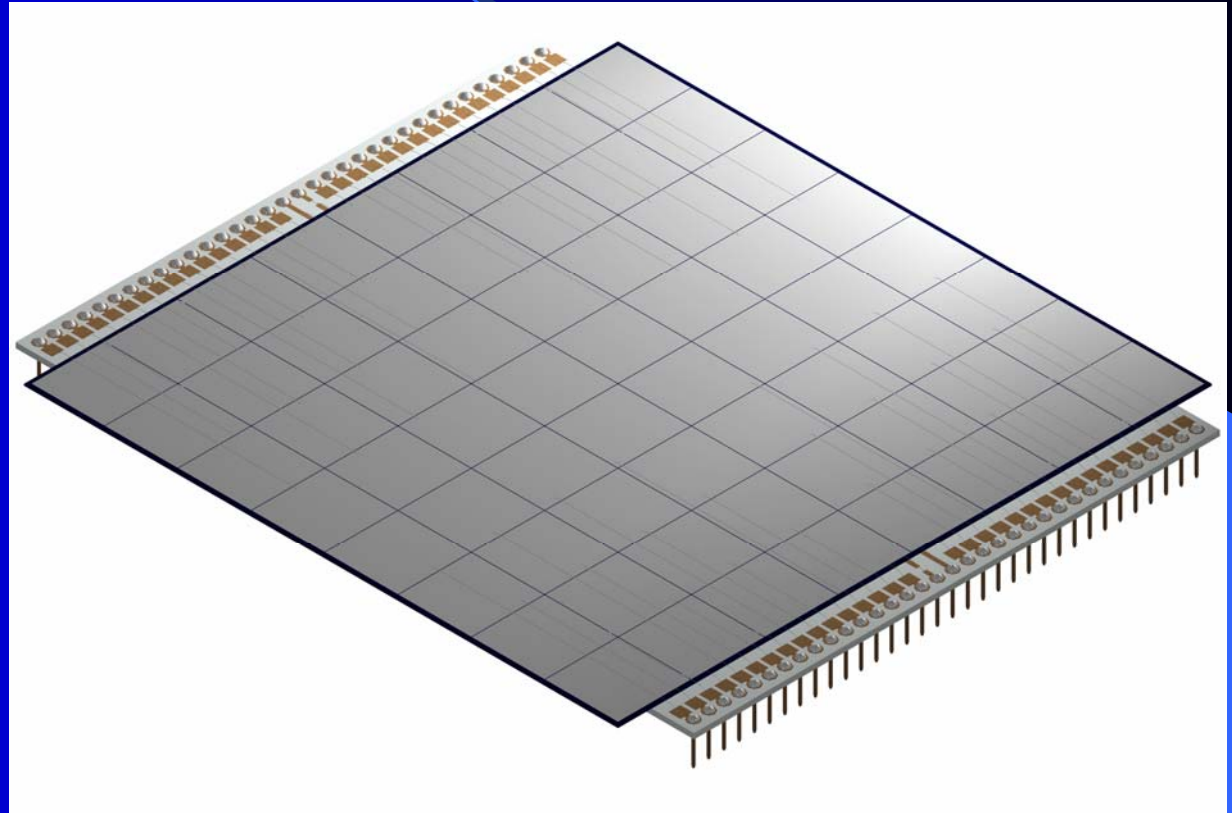


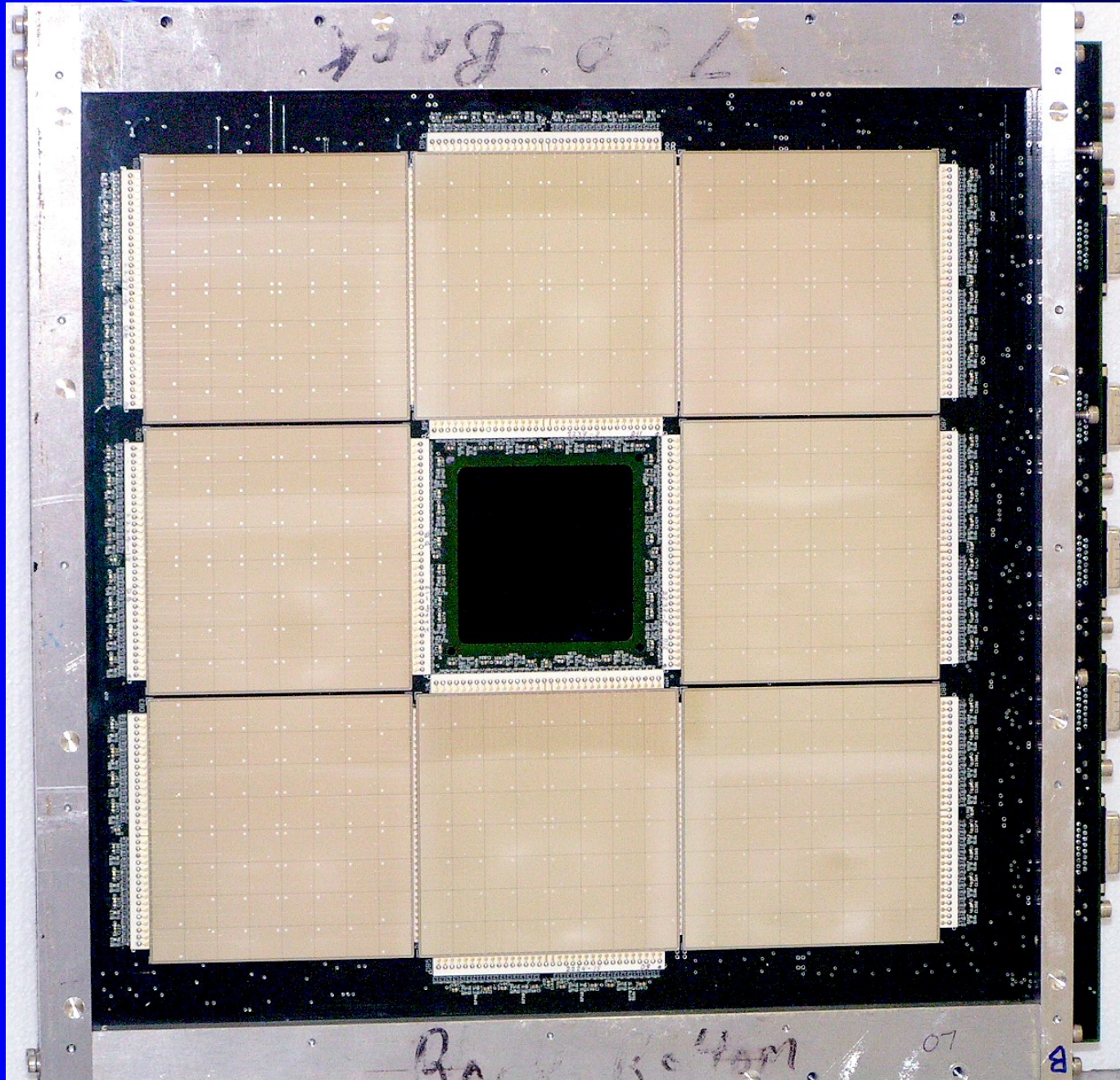
- Double sided AC-coupled, double metal detector.
- 6-inch, 300 um wafer.
- Junction side 384 strips, pitch 50 um.
- Ohmic side 768 strips , pitch 153.5 um.
- Poly-silicon resistor 2.5 M Ω .
- Capacitor Coupling 100 pF.
- Chip dimension ~ 120 x 21 mm².



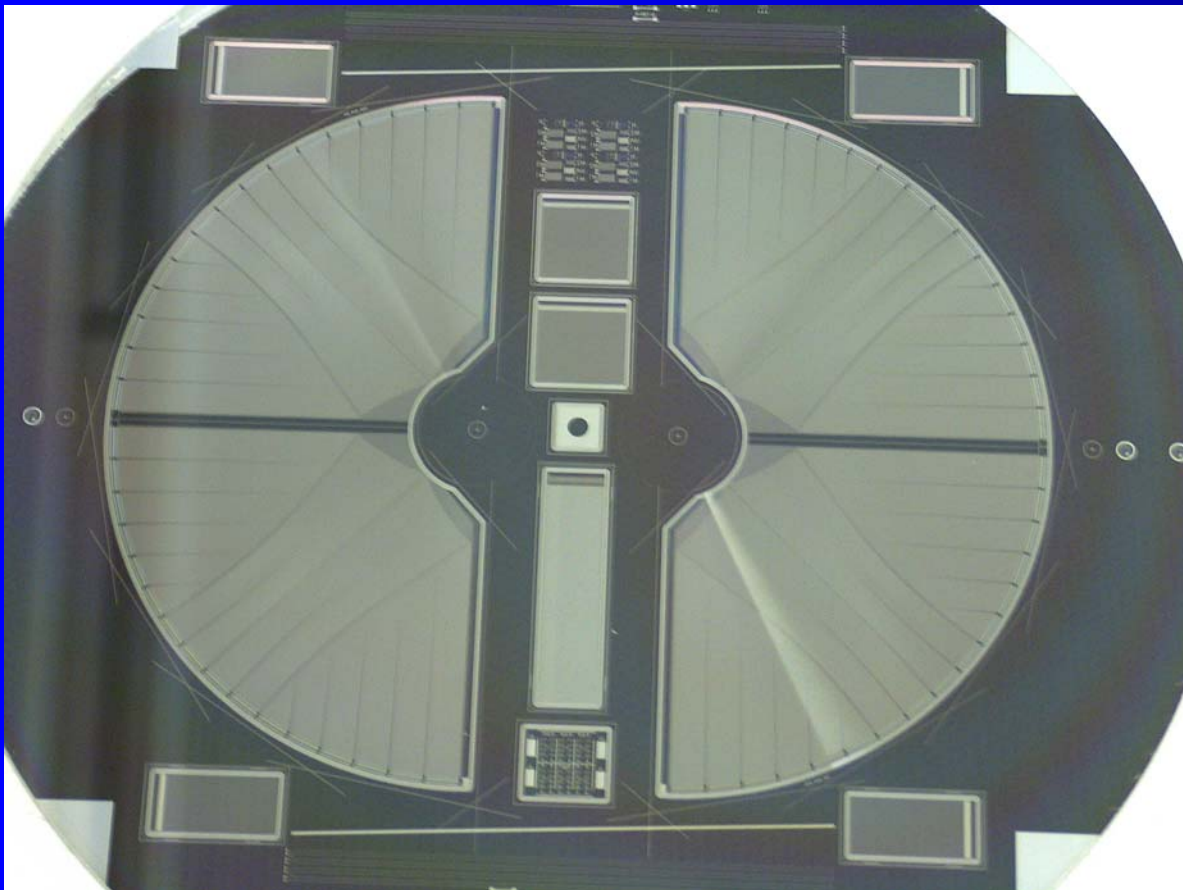
MSPX080 Double Metal Pad Detector.

- Single sided pad detector with double metal readout.
- 6-inch, 300 um wafer.
- Junction side 64 pads, pixels 12 x 12 mm².
- Chip dimension ~ 99 x 99 mm².
- Non transmission ceramic detector mount.
- Leakage currents 10 nA/pixel





LHC-b Detectors.

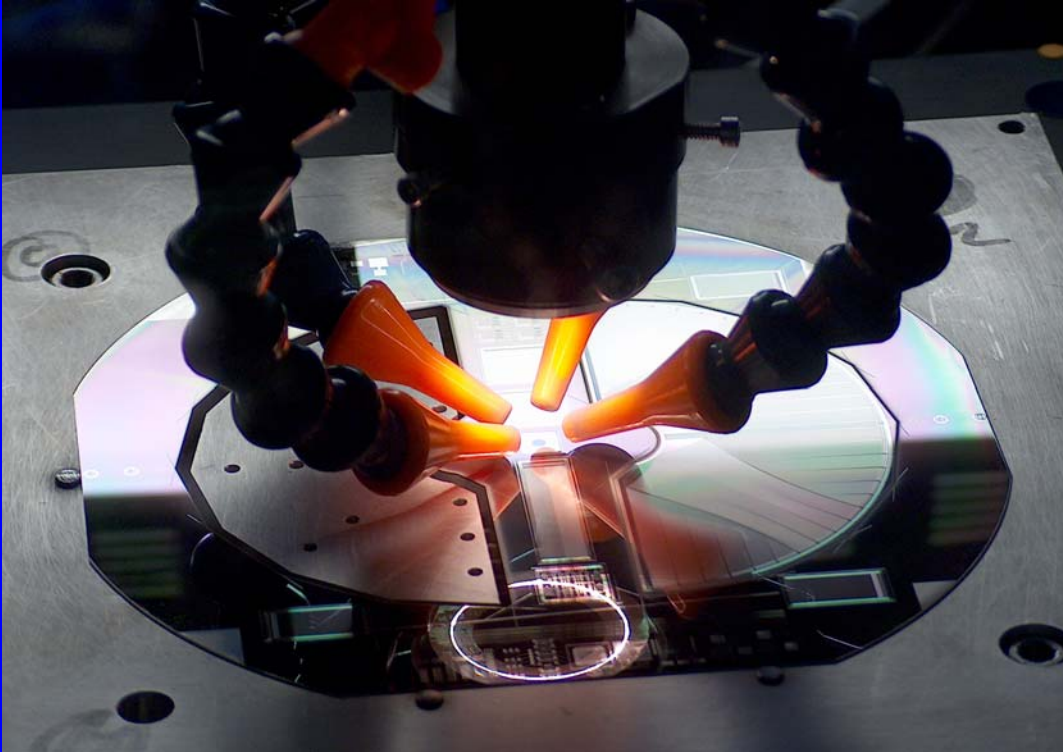


LHC-b R-300 um Silicon Wafer

- Oxygenated double sided AC-coupled radial microstrip detector with double metal readout tracking.
- n-on-n 6-inch, 200 and 300 um wafer.
- Ohmic side 2048 strips, pitch 13 – 92 um.
- Poly-silicon resistors 1M Ω .
- Coupling Capacitance 50 – 200 pF.
- Operating Voltage 350 V
- Total leakage current 5 uA
- Irradiated to 3 x 10¹⁵ protons/cm².



LHC-b Detector Profiling.



LHC-b R-300 um Silicon Wafer being Laser Cut.

- State of the art laser cut silicon
UV triple YAG 355 nm
15 ns pulsed laser.
- Programmable profiles of any geometry.
- Minimum feature & 20 μ m.
- Cutting thickness range 10 - 1000 μ m.
- Minimum plasma debris.
- Procurement of second percussion mode laser to be delivered in 3 months.



LHC-b Detector Profiling.



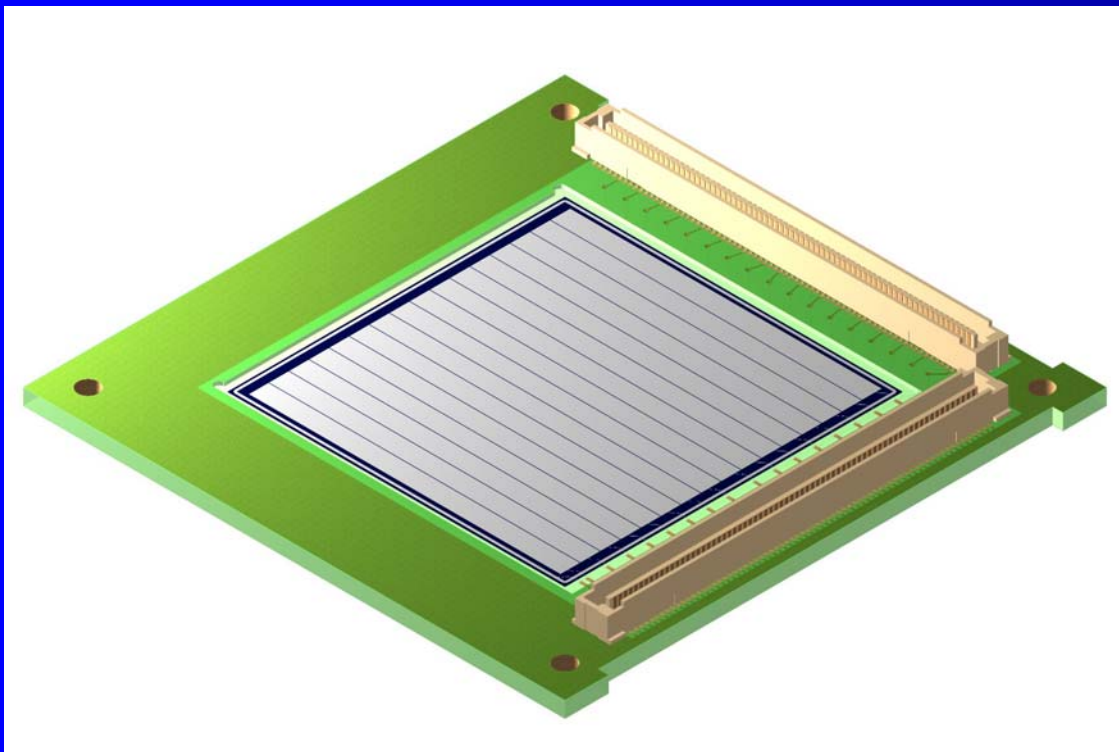
LHC-b R-300 um silicon chip.



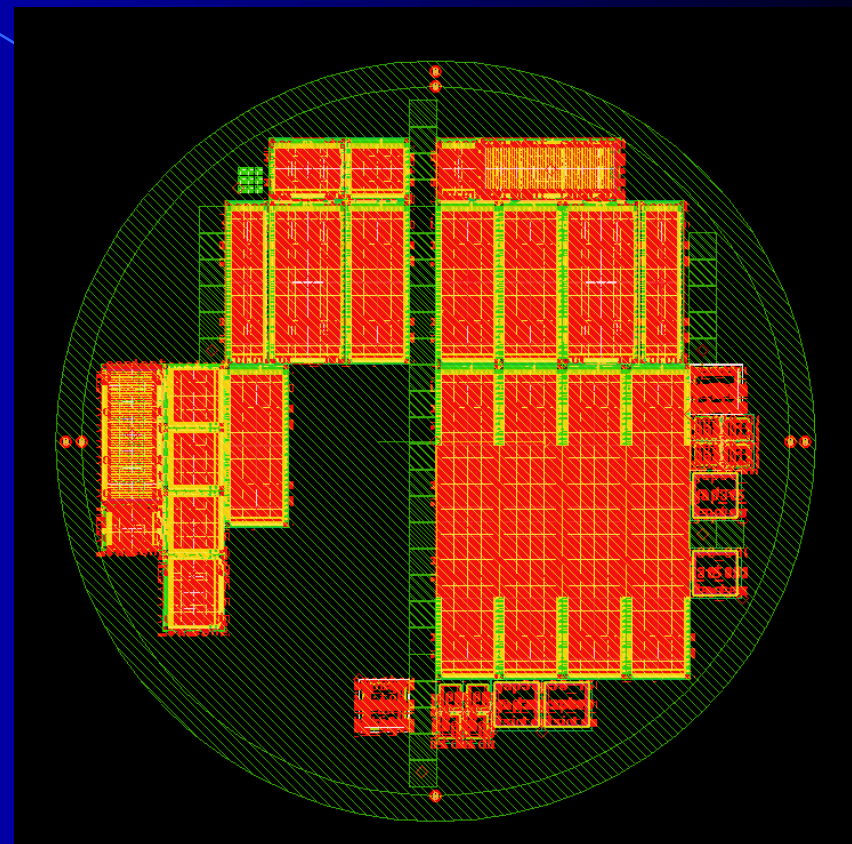
LHC-b Phi-300 um silicon chip.



Current Silicon Studies.



GANIL: Double sided DC-coupled strip detectors on 300 um 5-inch NTD material.



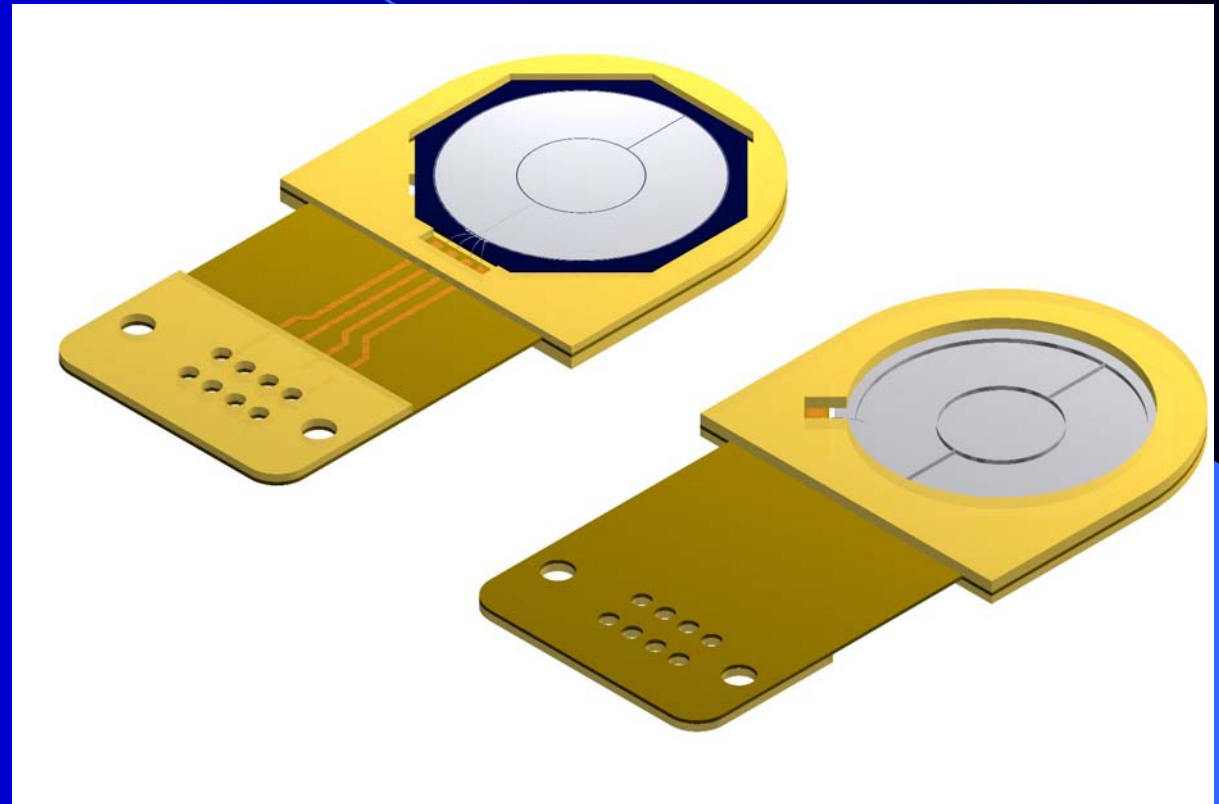
RD50: Study and comparison of CZ and MCZ 6-inch material.



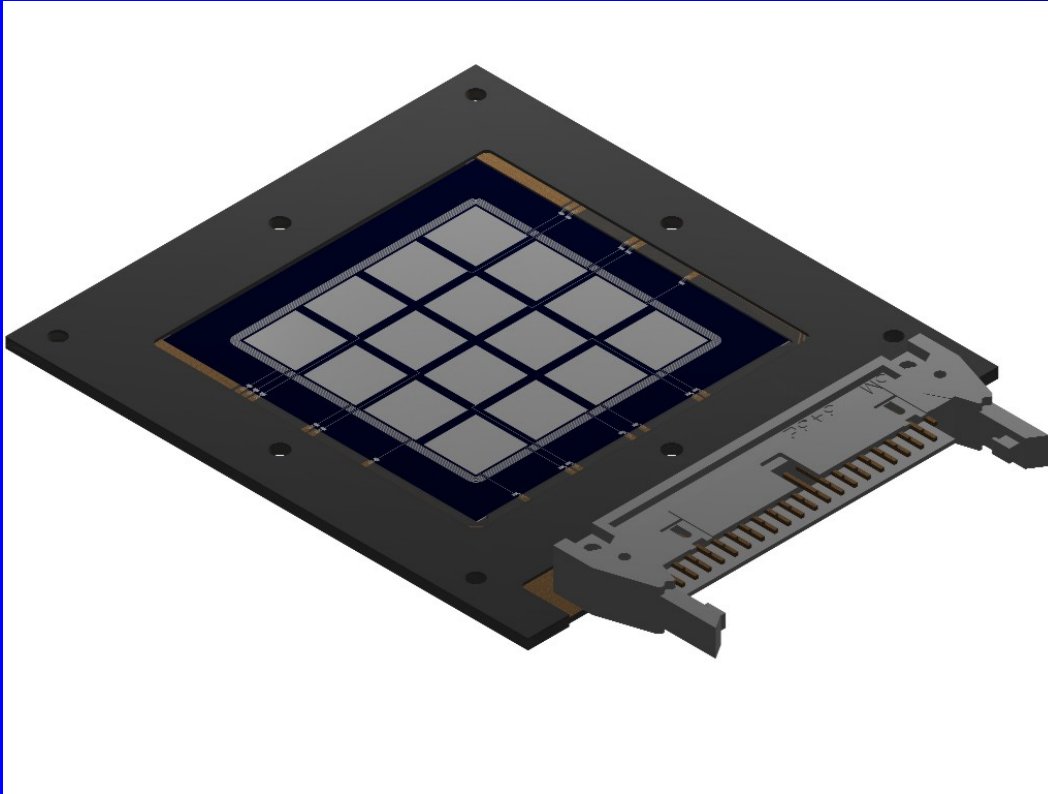
Thin Multi Element Silicon Detectors for Space.

STEREO PROJECT

- 30 Quadrant membrane detector assemblies have been supplied to the experiment.
- Silicon thickness $15 \pm 0.3 \text{ um}$.
- 3-inch wafer technology.
- Full space qualification.



Thin Pad Silicon Detectors for Space.



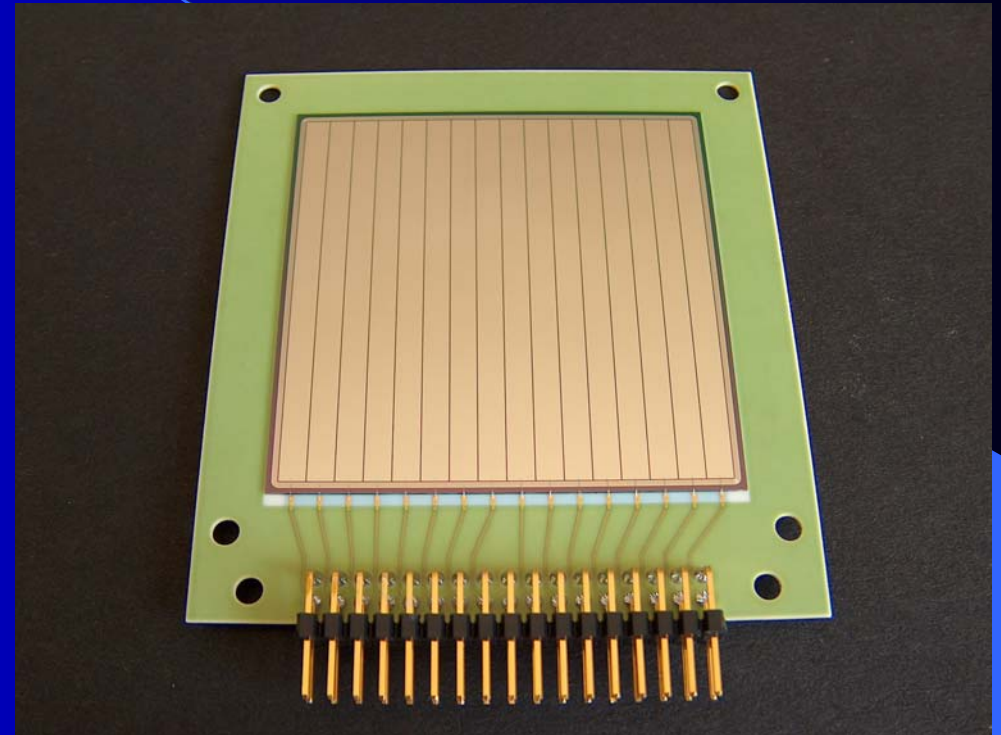
- 4 x 4 Pad Array, element 10 x 10 mm²
- Silicon thickness 15 ± 1.0 μm.
- 4-inch wafer technology.
- Chip Dimension 60 x 60 mm².



Thin DC-Coupled Silicon Detectors.



Large quantity order for Design W1 (DS) – 40 um



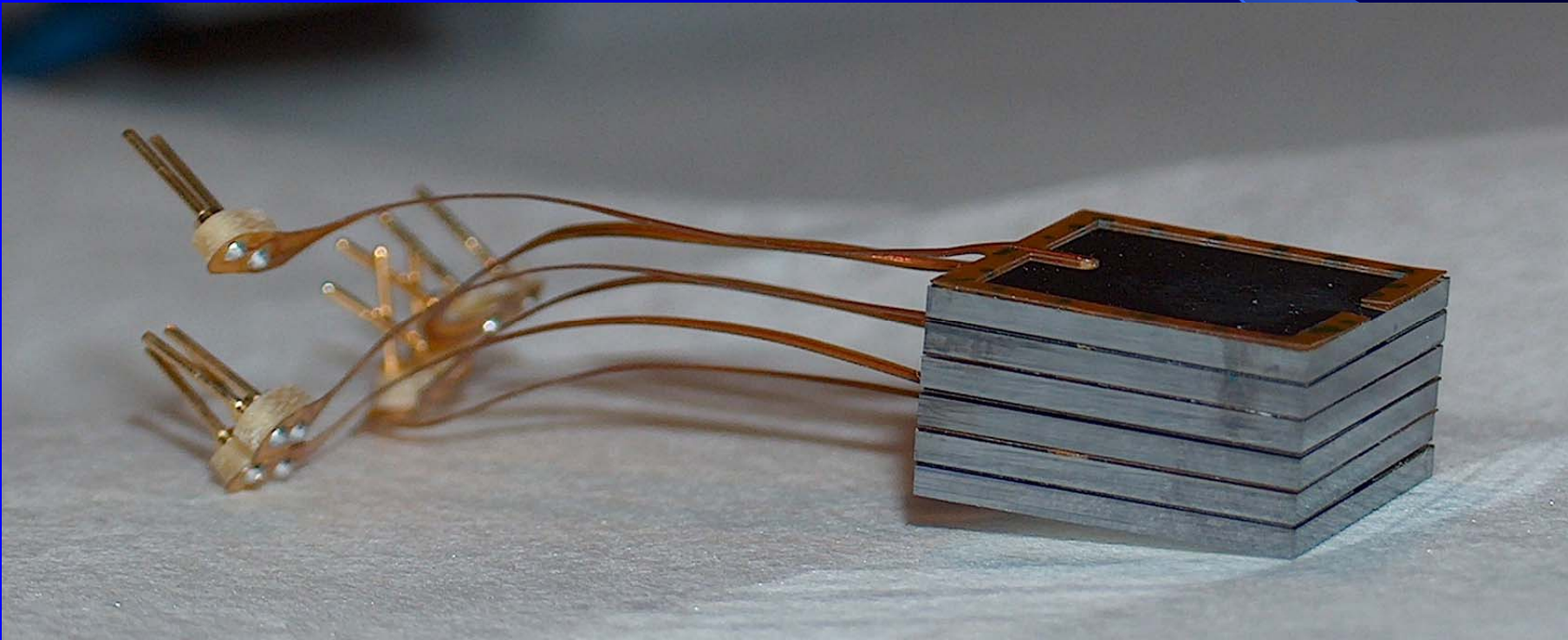
Design W1 (SS) – 20 um on a ceramic package



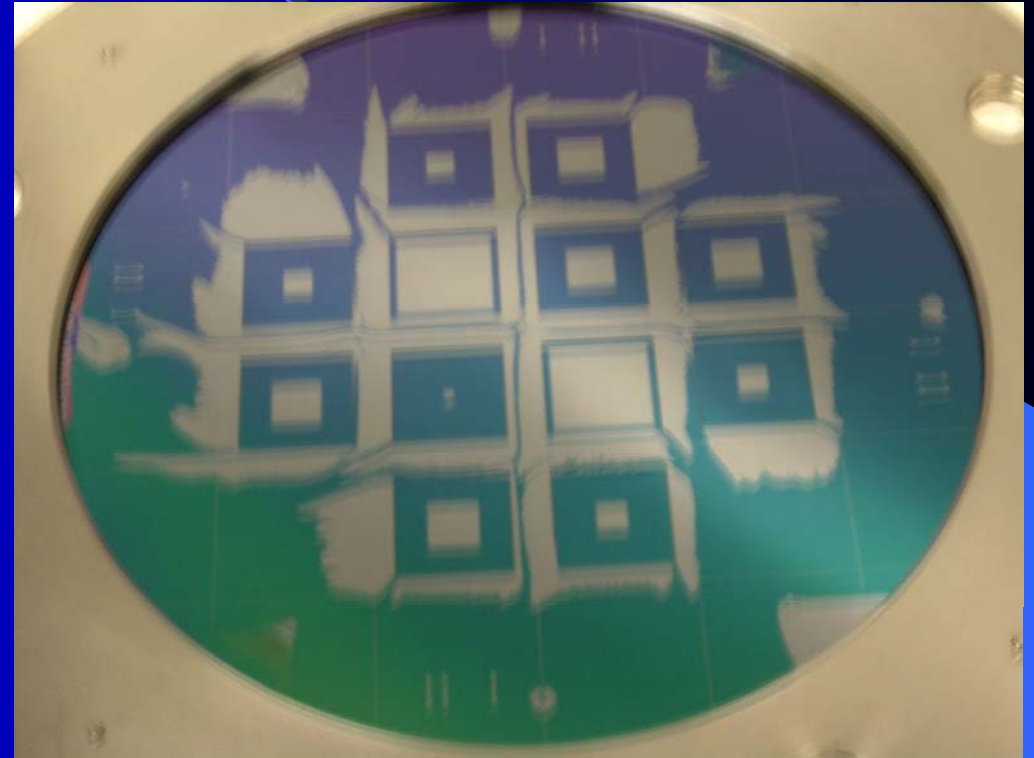
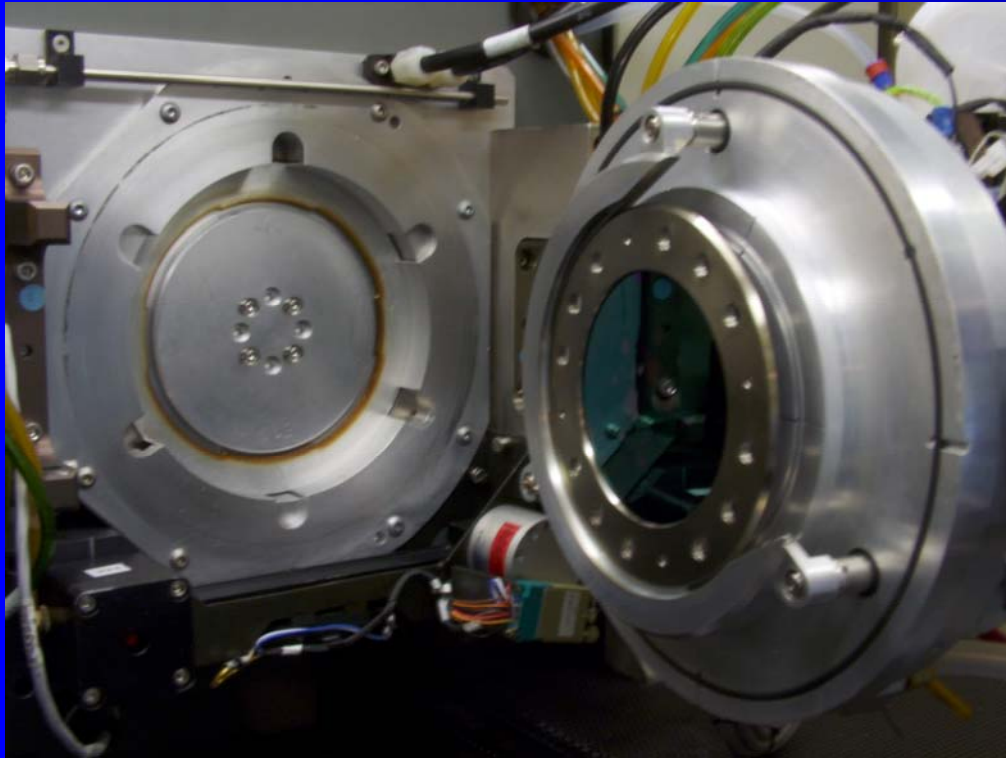
Current Silicon Detectors.

Silicon Stack

- 1 mm Si, single active area 10 x 10 mm².
- Readout via ~100 um thick kapton spacers.
- Future to stack 10 planes to achieve 10 x 10 x 10 mm³ active volume for space flight qualification.



Current Silicon Detectors.



Thick/Thin silicon Double sided PSD at Implant stage

