New Sensors for Detectors

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Barcelona

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STFC/DLS Instrumentation

Status Report

- XH : Germanium sensor on XSTRIP
- 2d Microstructuring of Ge at CMF
- Bump bonding and interconnect

- GaAs tests (GESEC and OI)
- Rad hard Si tests.
- CZT material programme (PS)

XH Germanium Sensor

- XSTRIP system fine to 15keV.
- Radiation damage issues.
- Efficiency issues.
- Scattering issues.

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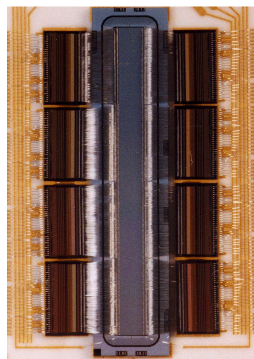
XSTRIP – A detector for Energy Dispersive EXAFS



Custom designed μstrip: Si 500μm thick, 1024 strips on 25μm pitch (CSNV)

8 x 128 channel XCHIP ASICs.

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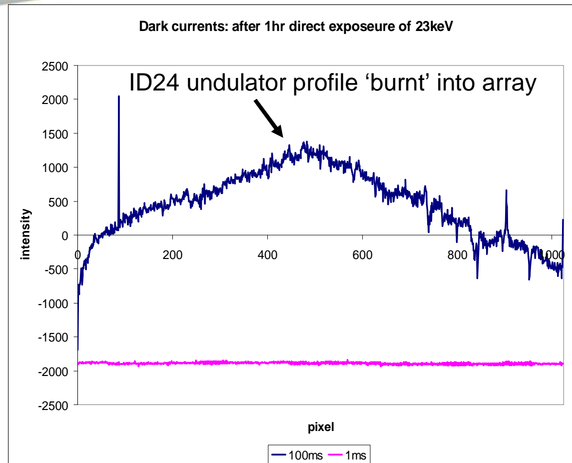

Surface oxide passivation charging at detector front surface causes localised breakdowns.

Limit to useful detector range to <15keV.

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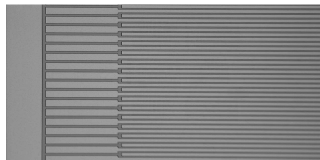
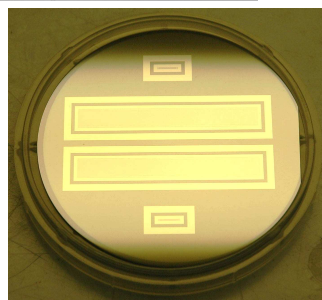
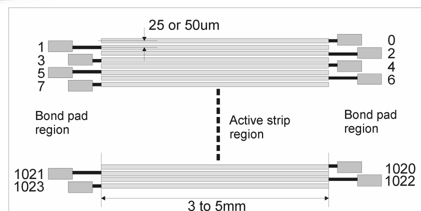
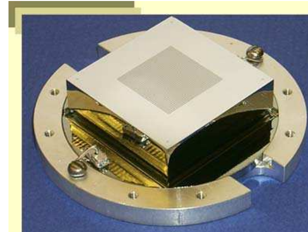
XH – Fine pitch Ge.
Test wafer.
LBNL Technology









RF sputtered a-Ge contact technology.
2d strip detectors demonstrated.
500um pitch pixels possible. NSS.

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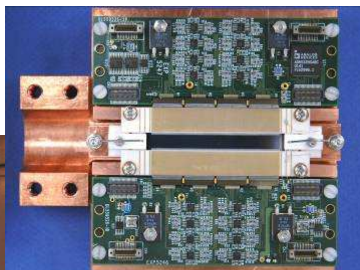
XH : Worlds first fine pitch Ge micro-strip for synchrotrons



Ge and ASIC/electronics thermally separated.
10us readout as per XSTRIP
Initial tests on Station 9.3 SRS
Radiation hard.
Good efficiency and spatial resolution.

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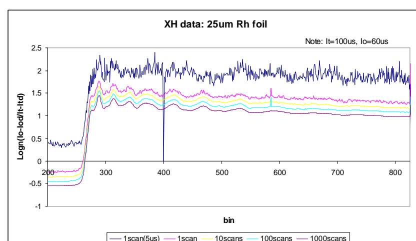
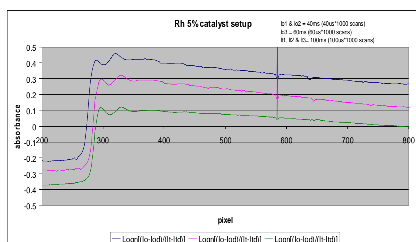
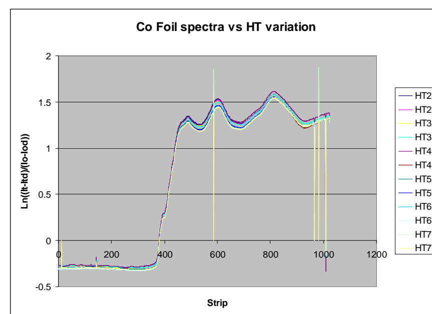


First XH data from ESRF and SRS (Preliminary!)





Ge microstructuring at CMF / STFC

Steps

- *Structure material*
- *Model & fabricate true detectors*
- *Develop passivation.*
- *Develop interconnect*
- *Develop cooling and control*
- *Develop electronics*
- *Construct system*

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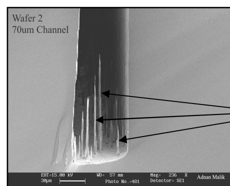
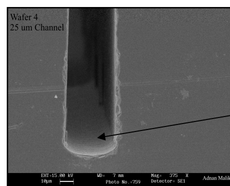
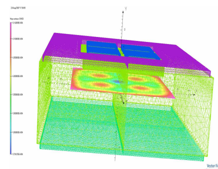
Microstructuring @ CMF : GED





- DRIE used for Ge structuring.
- Extensive modelling of pixel detectors ongoing.
- UK Commercial partners developing passivation technology.
- GeMOS transistors already in fabrication with QUB.
- Lithium implant being developed

- Goal to develop 2x2 HPGe pixel technology.



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Interconnect technology

- Developing key capability
- Gold stud bumping completed
- Adhesive bumping trialled
- Indium bumping underway

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Indium Bump Bonding

Indium Evaporator.
Wafer Size up to 200mm.

Goal : 172um initial
55um future.

Reflow Vacuum Hotplate
With Formic Acid Clean.
Wafer sizes up to 200mm.
On site, awaiting installation.

Suss-Microtec FC150
Installed & Tested

Suss-Microtec FC250
Awaiting installation

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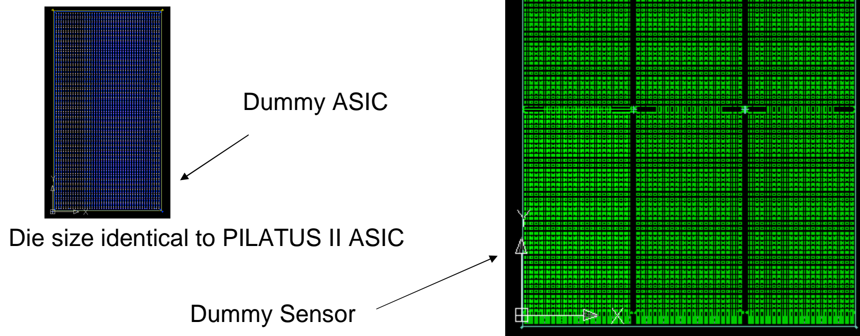
Daisy Chain Test Structure for Indium Bump Bonding Yield Tests



Wafer manufacture has been subcontracted to SemeFab.
CMF will evaporate indium through a lift off mask.
Reflow using Formic Acid reduction
Bump Bond using FC150

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JRA #19 Goals

Furthering Si damage tests and processing.
Supporting edgeless silicon processing (Glasgow)
Supporting Ge sensor processing.
Supporting CZT sensor processing.
Developing effective area cooling methods.
Designing cooled ASICS.
Scaling technologies.
Evaluating sensors on SR (DLS).

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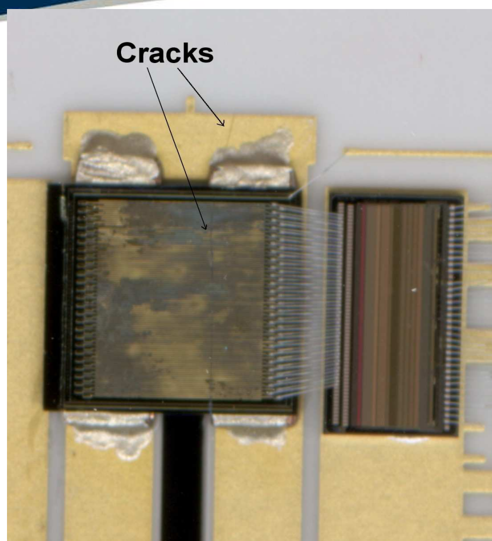

- 128 channels
- 25um pitch.
- 300um thickness !
- Initial bonding problems.

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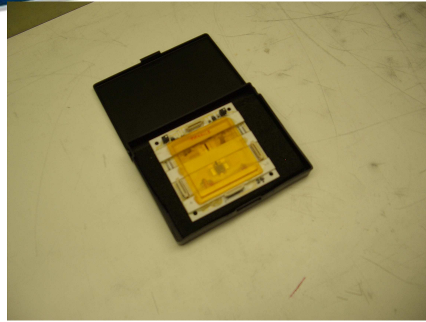

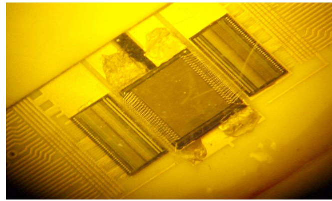

- Thickness issues.
- Initial tests inconclusive.
- Presently awaiting full tests.

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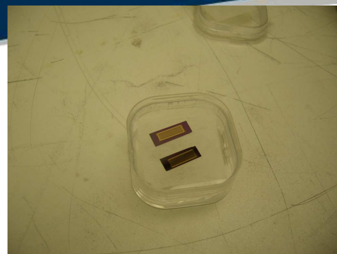
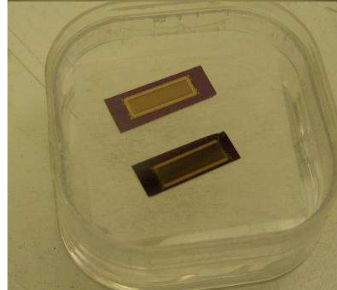
GESEC Detector





- Material from GESEC Paris (Bourgoin)
- Active thickness unknown at present
- Masks and strip detector fabrication at University of Sheffield EPSRC III/V fab' plant.
- Presently awaiting full test.