Discussion with Colin Wilburn, Susanne Walsh and Neil Greenwood on the Common RD50 6" p-type Project

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Colin Wilburn direct@micronsemiconductor.co.uk
Susanne Walsh design@micronsemiconductor.co.uk
Neil Greenwood production@micronsemiconductor.co.uk
Hartmut Sadrozinski hartmut@scipp.ucsc.edu
Zheng Li zhengl@bnl.gov (for part of the discussion)

1) Micron is in receipt of a memo "RD50_Project_10_23" which explains the general frame work of the planned p-type common project of RD50 (Colin suggested a few changes, for example to replace the incorrect word oxidation by oxygenation). The new version is attached.

2) Colin explained that Micron is very busy with LHCb. Micron has produced p-type prototype detectors of the LHCb design, and will do another run. In addition, Giahnluigi's 4" run supported by RD50 is now in production, and if we are lucky, the results of that run can be applied to the design of the detectors on the 6" wafers.

3) Micron prefers that all technical questions are vetted through Gianluigi, who signed the NDA.

4) Micron prefers to do all the cutting in house, and a 50μm should be left between different detectors

5) Micron quotes a price of $50k for a run of 25 working detectors. Micron will supply the wafers.
   Micron has sufficient p-type and n-type FZ detectors in 6" in stock (n-type 3kΩ in 300μm, 8kΩ in 200μm) , p-type (10 - 30kΩ in 200 μm).
   They suggest that BNL supplies of the order 25 p-type MCz to them. They are thicker (500 μm?) and if they will be used will be lapped down and re-polished. In that case the RD50 management is requested to make arrangements to consider this in-kind contribution in future BNL's yearly contribution.
   RD50 still has to find n-type MCz in 300 μm thickness (not included in price).

6) If we can submit masks and wafers by January, a June 2006 delivery is being quoted. Processing alone is quoted as taking 3 month, interference from LHCb is being mentioned.

7) Micron proposes that all funds are channeled through Liverpool. WE have to find out if that can be done without paying overhead. Otherwise a CERN centered procurement is being envisioned.

8) Much details on detector layouts:
    a. All detectors (specially the test structures and pads) need to be numbered.
    b. Zheng Li and Micron will supply test structures located in the center strip to add to the pads, which will be used to check the doping density.
    c. We confirm that the backside will be a simple sheet, no openings for laser light injection etc.
    d. Guard ring design will hopefully incorporate “lessons learned” from the above mentioned LHCb and RD50 fabrication runs at Micron. TBD by Gianluigi and Susanne.
    e. Oxygenation process will be determined by Gianluigi and Susanne.
    f. Passivation will be oxyde+nitrite, as the coupling caps.
    g. Al will be 1μm thick.
    h. Biasing resistors (1+-0.5)MΩ, but with good uniformity.
    i. Specs on capacitor leakage: <1nA at 100V.
    leakage current and breakdown specs are still being discussed.

Common RD50 6" Project
Fabrication of silicon strip detectors in various geometries and substrates

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Gianluigi Casse (Liverpool U.) gcasse@hep.ph.liv.ac.uk
Hartmut Sadrozinski (UC Santa Cruz) hartmut@scipp.ucsc.edu

1) Motivation:
   j. P-type isolation study
   k. Geometry dependence
   l. Charge collection studies
   m. Noise studies
   n. System studies: cooling, high bias voltage operation,
   o. Different materials (MCz, FZ, DOFZ)
   p. Thickness
   h. Stability Test (21 days @10^{-6} atm and RT))
2) Mask Set: 7 masks (8 if moderated spray needs extra one)
   Multi-chip design arranged by Rd50 (Gianluigi Casse), see attached map

3) Target # of working wafers: 25 (17 p-type, 8 n-type)

4) Wafer (from different suppliers) furnished by RD50
   6"
   p-type > 4 kOhm Orientation: <100>, thickness 300um
   n-type ~ 1 kOhm, thickness 200um, 300um

5) Processing:
   Oxygenation (for part of the wafers): 24h @ 1050 ^{o}C, 12h @ 110 ^{o}C (Zheng uses 7 days at 1200 ^{o}C) (TBD)
   Single-sided processing only (even for n-on-n)
   Single-metal
   Polysilicon resistor biasing (~ 1Mohm)
   Mostly AC coupling with integrated coupling cap
   Isolation with "combined" P-stray [p-spray & p-stops]

Wafer	bulk	#	Thickness [um]	SSD
MCz	p	7	300	n-on-p
DOFZ	p	5	300	n-on-p
FZ	p	5	300	n-on-p
MCz	n	3	300	p-on-n +n-on-n (no backside
Fz	n	2	300	p-on-n +n-on-n (no backside
MCz	n	3	200	p-on-n +n-on-n (no backside

6) Irradiation Plan

Irradiations at CERN Spring/Summer 2006
Target Fluence: Few * 10^15

7) Details of strip detectors
   Length: mainly 3 cm length
   Width: 128 strips matches ASIC and allows CCE measurements.
   Pitch: 80 micron (also 50um and 100mu)
   Width/pitch ~ 0.25
   Modified P-stray [p-spray & p-stops]
   3 um overhang on both sides

8) Layout on Wafer
   See picture

List of SSD and Pads

Inst.	Device	# of dev.	Footprint	Pitch	# of strips	Length	Metal	Bias	Coupling	Isolation	w/p	p-implant
UCSC	Short strips	1	6.2 x 0.80	50	128	2 x 3	Single	poly 1M	AC	Mod p	0.3	15
UCSC	Short strips	1	6.2 x 1.2	80	128	2 x 3	Single	poly 1M	AC	Mod p	0.3	30
UCSC	Short strips	1	6.2 x 1.5	100	128	2 x 3	Single	poly 1M	AC	Mod p	0.3	40
UCSC	Medium strips	1	6.2 x 1.2	80	128	6	Single	poly 1M	AC	Mod p	0.3	25
BNL	2-D	1	3.2 x 3	50	256	6	Single		DC	p-spray	0.6	
Ioffe	very short strips	3	1.2 x 1.2	100	64	~1		poly 1M	AC and DC	Mod p		
PSI etc	Pixel 1	2	1.04 x 0.98							Mod p		
PSI etc	Pixel 2	2	1.02 x 0.99							Mod p		
PSI etc	Pixel 3	2	0.62 x 0.54							Mod p		
Liverpool	Test structures	3	1 x 0.8	50	128	1	Single	poly 1M	AC	All?		
Liverpool	Test structures	4	1 x 1.2	80	128	1	Single	poly 1M	AC	All?		
Liverpool	Test structures	3	1 x 1.5	100	128	1	Single	poly 1M	AC	All?		
Syracuse	Pixel1x4	1	0.85x3.93	50	22x128x4		Single		dc	mod p		28um (n+ implant)
Syracuse	Pixel 1x1	3	0.85X1.14	50	22x128		Single		dc	Mod p		28um(n+ implant)
4"	Short strips	1	3.1 x 0.8	50	128	3	single	poly 1M	AC	Mod p	0.25	15
4"	Short strips	1	3.1 x 0.8	50	128	3	single	poly 1M	AC	Mod p	0.25	20
4"	Short strips	1	3.1 x 0.8	50	128	3	single	poly 1M	AC	Mod p	0.3	15
4"	Short strips	1	3.1 x 0.8	50	128	3	single	poly 1M	AC	Mod p	0.2	20
4"	Short strips	1	3.1 x 1.2	80	128	3	single	poly 1M	AC	Mod p	0.25	40
4"	Short strips	1	3.1 x 1.2	80	128	3	single	poly 1M	AC	Mod p	0.3	10
4"	Short strips	1	3.1 x 1.2	80	128	3	single	poly 1M	AC	Mod p	0.3	35
4"	Short strips	1	3.1 x 1.5	100	128	3	single	poly 1M	AC	Mod p	0.3	30
4"	Short strips	1	3.1 x 1.5	100	128	3	single	poly 1M	AC	Mod p	0.3	50

Proposed 6" Wafer Mask Layout

5 mm x 5 mm pads

Strips 3 cm long, 128 strips wide, common to 4" and 6"

2D strip detectors 3 cm x 3 cm

6 cm (2 x 3cm) strip detectors

Ioffe 1cm x1cm

6 cm strip detectors

PSI Pixel detectors

Liverpool 1 cm tests

major cut line

Syracuse pixel 4 x1, 1x1