Summary of Inner Tracker Silicon Meeting

in Zürich, July 04, 2000

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1 Prototypes from DETECTOR/Kiev

- Specs okay as listed in FAX offer, with exception of strip length, again given as 60.0 mm instead 66.7 mm. Assume is typo, as they agreed on 66.7 mm in earlier e-mail. Want to insist on 66.7 mm (20 cm ladder from 3 detectors). Valery going to check with them.
- Price is 7.000 USD (11.500 CHF) for 20 detectors, including mask production but excluding wafers.
- Wafers to be provided by us. Need 25 wafers to produce 10 detectors (2 detectors per wafer, i.e. yield is 20%).
- Detectors can be delivered by end September if wafers received in Kiev by August 20.
- SINTEF can provide 4" wafers, 300 μm thick, n-type, oxygenated, 2.5-4 kOhm, <100>; 1 kOhm not available now (see section 3 for comment on resistivity). Price is 44.000 NOK (8.400 CHF) for 50 wafers. Delivery time 3 weeks. Order to reach them before July 10, otherwise after August 4.
- CIS could provide 4" wafers, 300 μm thick, <100> n-type, low-resistivity, 25 pieces. No price quoted, decided not to follow up on this option.
- Agreed to order 50 wafers from SINTEF and 20 detectors from DETECTOR. Finalize decision this week, order of wafers should go out before July 10. Total cost $\approx$20.000 CHF, going to be covered by Lausanne.

2 Prototypes from Hamamatsu

- Received offer for CMS multi-geometry prototype detectors; 60, 80, 120, 240 μm pitch. 6" wafers, 320 μm thick, n-type, 1 kOhm <100> or 1 kOhm <111> or 4-8 kOhm <111>.
- Price quoted is 25.000 CHF for 5 detectors or 40.000 CHF for 10 detectors (excl VAT), including wafers. Seems expensive considering that no masks have to be produced.
- Decided to a) try to re-negotiate price for this offer and b) ask new offer including mask production according to our specifications. Philip will take care. If not possible to get improved offer, order 5 CMS-type detectors, Zuerich going to cover cost.

[*] Summary by O. Steinkamp

3 More on Detectors

- Philip asked SINTEF offer for detector production. Quote price of 220.000-270.000 NOK (42.100-51.300 CHF) for 15, or 270.000-330.000 NOK (51.300-62.600 CHF) for 25 fully tested wafers; exact price depends on details of detector specifications. Masks can be provided by us, or produced by them for for 165.000 NOK (31.300 CHF). Decided to send our specifications and ask for detailed offer, Philip going to take care.
- Current specs on bulk resistivity ($\approx$ 1 kOhm) may not be optimal. Expected 1-MeV neutron flux is 5×10^{12}/ year in maximum (from Vadim Talanov's study, LHCb note 2000-013; no safety factor included but remember maximum very localized). Comparison to CMS measurements show that type inversion will occur after 20 years for low-resistivity 1-3 kOhm, after 5 years for high-resistivity 4-8 kOhm material. Disadvantage of low-resistivity material is higher initial depletion voltage, 200 V vs 50 V for 300 μm thick diodes (from CMS Addendum to TDR, LHCC 2000-016, especially fig 11). First prototypes from DETECTOR in any case "intermediate" 2.5-4 kOhm because of availability of wafers at SINTEF. Decided to modify prototype specs to $\approx$4 kOhm, but test low-resistivity later.
- Have to think about extra markers on detectors, e.g. alignment pads, type and serial number. Valery going to cross-check with DETECTOR.

4 News on BEETLE

- Bug on chip found and fixed. Chips expected in Heidelberg around July 24.
- Test-PCB expected end July, motherboard produced locally on short notice.
- Hybrid still to be designed (Chr.Bauer). Ueli expressed doubts that hybrid is apropriate solution for IT application, PCB probably preferable because more flexible and expect enough space for PCB available. To be discussed with Heidelberg ASIC lab (who?).
- First irradiation tests (21 MeV proton beam at HD) from beginning September.

5 Prototype assembly

- Need mechanical support for prototypes and front-end electronics. Fixation of detectors must be done with care to avoid mechanical stress, resulting in increased leakage currents. Valery recommended to study publications by HERA-B VDS (I.Abt et al).
- First tests expected to be done with single detector connected to BEETLE, i.e. will need two versions of support, for single detector and for ladder. Lausanne takes responsibility.
- Will need pitch adaptor to fit detector to BEETLE. May be possible to use existing 3-GEM/Helix adaptor. Zuerich takes responsibility.

6 Ladder assembly

- Short discussion on assembly of ladders from AC coupled detectors. Valery suggested that different detector layouts may be needed for first and for subsequent detectors; we convinced him that not (see Fig. 1).

- Some study needed to minimize dead space in between detectors on ladder. May have influence on design of support structure (staggered detectors) and position of bond pads. Olaf going to investigate.

7 Station assembly

- Olaf presented proposal how to accomodate arbritrary beamhole size with "standard" detector modules, allowing extra overlap in x between half stations and shifted detectors in y above/below beam pipe (see Fig. 2).

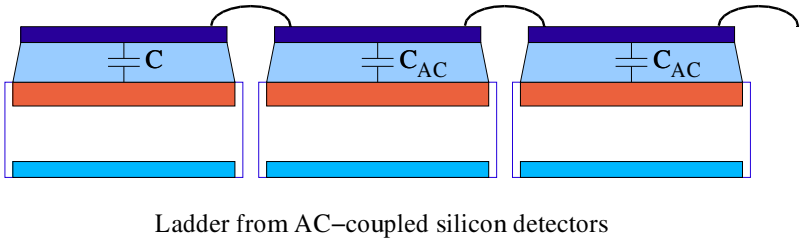

Figure 1: Ladder assembled from AC-coupled detectors; metal strips are bonded together and to readout electronics, coupling capacitance between implant and metal strip is indicated.

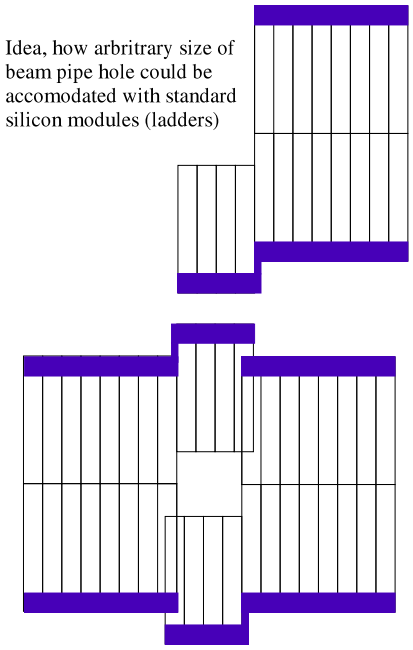

Figure 2: Possible layout of overlapping silicon half stations, to accomodate arbritrary beamhole size with standard detectors.