

Status Wuppertal

Opto-Electronic Readout Systems for SLHC

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Tiny Outline

- Current ATLAS Pixel system
- Data rates
- Possibilities in Wuppertal



ATLAS Pixel System

- 1744 Modules of 46080 sensor cells
- Per 6/7 Modules one 'opto-board'
- Electr. connection module <-> opto-board via self-bundled 'type0' cables
 - Aluminium wires for LV-supplies and
 - Twisted pair Al wires for data
(150 μ m, 70Ohm, Polyfil (Zug, CH))
- A Kapton circuit serves as patch panel, connecting type0 cables and optoboard
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opto-board

- BeO carrier (OSU) with
 - receiving and transmitting asics (OSU & Siegen)
 - Truelight VCSEL- & PiN-arrays
 - ◆ VCSELs are oxide-confined
- Irradiated to 10^{15} n_{1MeV equiv}



Fibres

- Ctrl: 50 μ m GRIN -> 50 μ m SIMM
- Data: 50 μ m SIMM -> 62.5 GRIN
- Complete cables ordered at Ericsson & Diamond (Losone, CH)
- One Ctrl fibre and one or two Data fibres per module



Off Detector

- Wuppertal adapted the SCT design to pixel needs
 - Reduced number of channels
 - Higher data-rates
- Reuse of the opto-interfacing asics and same Truelight Vcsel- & PiN-arrays (8way instead of 12way)



Data rates

- Pixel is NOT part of Level1 Trigger
 - Rough calculation **per Module** (of 1744):

Raw data:

$$50000 \text{ cells} \times 40\text{MHz} \times 0.1\% \text{ Occu.} \times 25\text{Bit/Hit} \\ = 5 \cdot 10^{10} \text{ Bit/s}$$

Trigger LVL1 reduction:

$$50000 \text{ cells} \times 100\text{kHz} \times 0.1\% \text{ Occu.} \times 25\text{Bit/Hit} \\ = 1.25 \cdot 10^6 \text{ Bit/s}$$

And we would like to reduce the pixel size
(= = increase numbers of pixels per module)



Data Format

- Ctrl. is encoded as BPM, combining 40MHz clock and ctrl stream
 - Decoded on opto-board
- Data is NRZ with 40MHz, 80MHz or 2x80MHz
 - No encoding



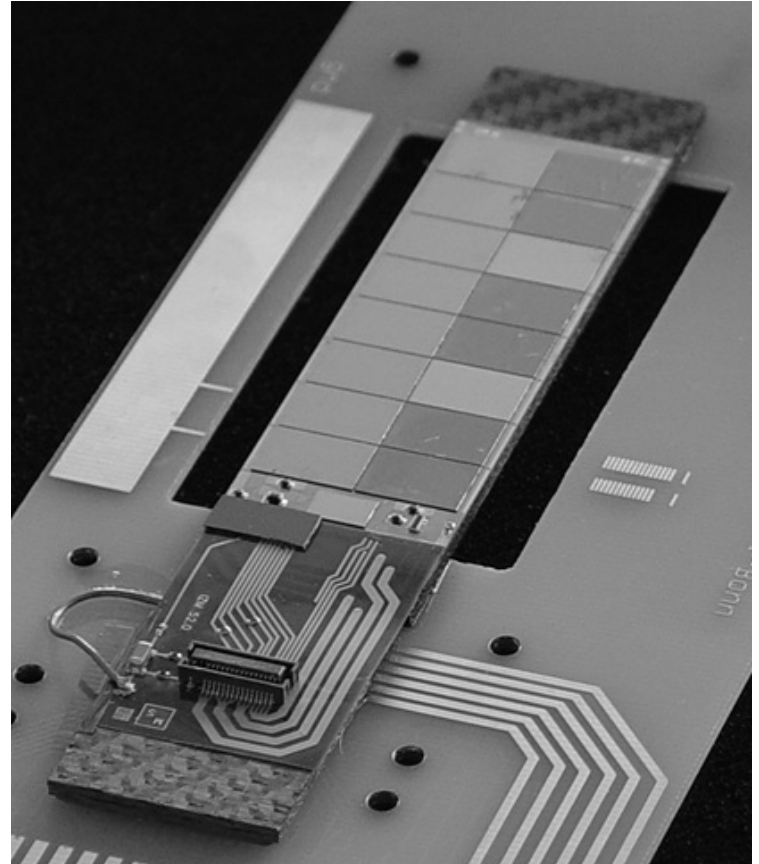
Ideas in Pixel Community

- Replace B-Layer ~2012
- This might serve as a nice 'test-bed' for an intermediate step for opto-link, too.
- Focuses more on detector module, for now. But these changes might need higher data rates.



Ideas in Wtal

- How can Pixel contribute to the trigger?
 - On-detector ideas
 - Data-link
- Off-detector electronics
- Packaging
 - Depending on the electrical frequencies needed, there will be a need of a very high quality substrate
 - > MCM-D
 - Silicon carrier for high definition micro-strip lines



**Full featured MCM-D pixel detector module
(16 Front-End ICs and Ctrl chip on sensor-tile,
Which is acting as substrate for intra-connections**

