Array-Based Opto-Link R&D Activity and Plan

A. Adair, W. Fernando, K.K. Gan, H.P. Kagan, R.D. Kass,
H. Merritt, J. Moore, A. Nagarkar, S. Smith, M. Strang
The Ohio State University

P. Buchholz, A. Wiese, M. Ziolkowski
Universität Siegen

T. Flick, P. Maettig
Universität Wuppertal

A. Pellegrino, T. Sluijk
NIKHEF (LHCb)

September 22, 2010

Motivation

- ATLAS Pixel detector:
  - signal from FE transmitted on ~1 m skinny wires to patch panels
    - signal transmitted off patch panels using VCSEL arrays
    - similarly using PIN arrays for transmission in other direction
    - a compact solution
- ATLAS Insertable B Layer (~2015-16):
  - will be an array-based system
  - economical redundancy system
- ATLAS SLHC Pixel detector:
  - signal from FE will be transmitted on ~5 m skinny wires
  - develop array-based solution to take advantage of experience

Current Activity

- ATLAS Insertable B Layer:
  - optical links will use VCSEL/PIN array as in current pixel detector
  - design an updated version of current driver and receiver with redundancy and individual VCSEL current control
    - experience gained from the development/testing of such new chips would help the development of on-detector array-based opto-links for SLHC
      - ⇨ submission of 1st prototype chip (130 nm) in 2/2010
    - a collaborative research between Siegen and Ohio State

Summary of IBL Prototype Chips

- prototyped 4-channel driver/receiver:
  - ✔ redundancy to bypass broken PIN or VCSEL channel
  - ✔ individual VCSEL current control
  - ✔ power-on reset to set VCSEL current to several mA on power up
  - ✔ VCSEL driver can operate up to ~ 5 Gb/s with BER < 5×10^{-13}
  - ✔ small decrease in VCSEL driver output current
  - ✔ PIN receiver/decoder properly decodes signal with low threshold
  - ✔ very low SEU rate in latches/DAC
  - ◆ next submission of 12-channel chip: 2/2011

SLHC Array ASIC R&D Plan

- VCSEL driver/PIN receiver developed by GBT/VL need to be laid out as an array
  - will work closely with GBT/VL groups
  - special thanks to P. Moreira for thoughtful advice
  - first submission: 2011/2012?
    - 4-channel prototype only
- Continue evaluation of radiation-hardness of new high-speed PIN/VCSEL arrays