Opto Working Group Meeting Summary
Tuesday 8 March 2011

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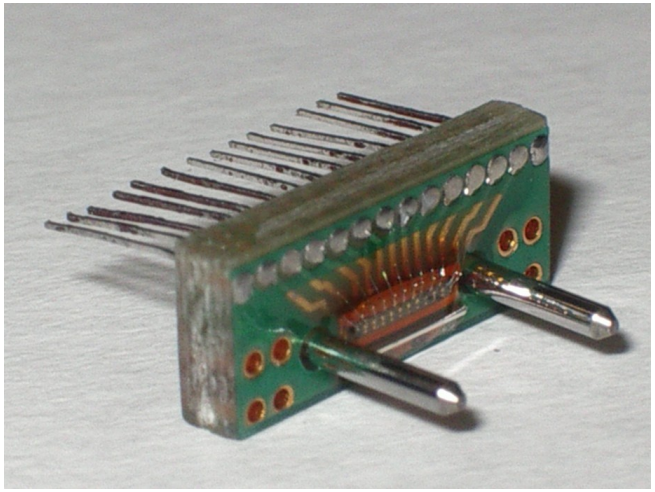
Workshop Outline

- Review the present opto systems situation
  - Experience with running systems from ATLAS, CMS, LHCb
- Inform about ongoing opto R&D projects
  - Environmental resistance tests
  - Opto ASIC designs and tests
  - Development projects for LHC upgrades (phase 0, I and II)
  - Only a short sketch here.
- Very interesting and open discussion about research status, issues and analysis.
- Community is growing.
  - Started with ATLAS/CMS, now includes LHCb and ALICE.

Current Status of running opto systems (1)

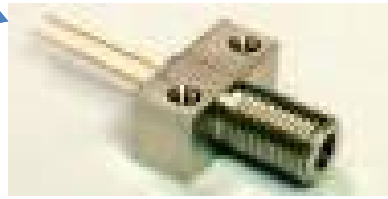
- ATLAS:
  - Link reliability influenced by severe off-detector VCSEL failures in Pixel and SCT (over 500 dead channels in 2010), and to a lesser extent LArg Calorimeter (46 failures so far)
  - SCT and Pixel exchanged off-detector lasers fully twice (2009 and then continuously over 2010)
  - Investigations focus on humidity, using damp heat tests (85°C/85% RH) for different configurations
    - Devices as used, with/without epoxy cover, stored in humid environment, …
    - Characterization studies relying on optical spectra, electroluminescence, EBIC, TEM measurements. Defects visible…
  - New opto plugins are needed
    - SCT/Pixel: Old style as spares, production on-going
    - SCT/Pixel: New style is under investigation with commercial vendor
    - LArg: Spares available. Strategies for more global replacement under discussion.

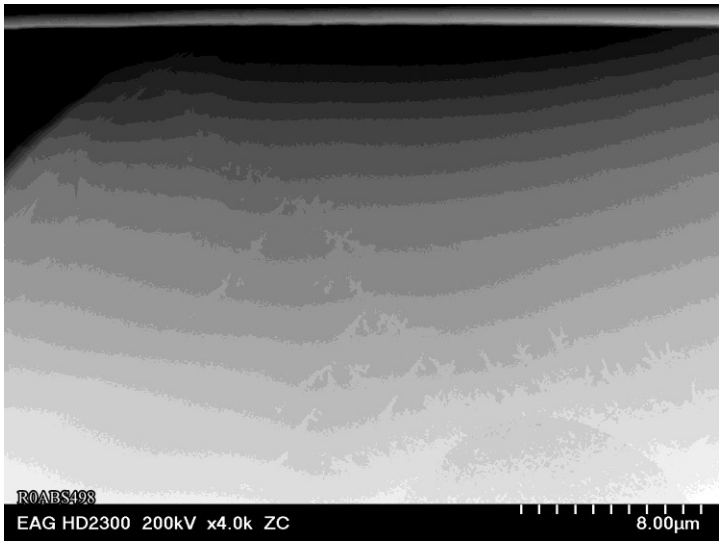
- Problem needs to be understood, not only fixed, in order to influence the QA programme of the next link generation



Current Status of running opto systems (2)

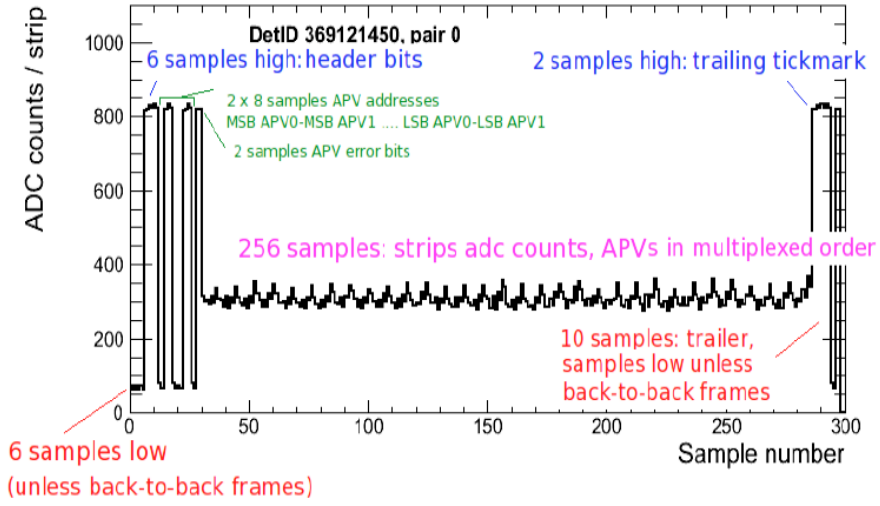
- LHCb
  - Observed failures for single channel laser (45)
  - Started same investigation (spectrum width measurements) as in ATLAS
  - Vendor is investigating, dislocations can be observed inside the diode bulk.





Current Status of running opto systems (3)

- CMS
  - Link systems functioning well.
  - No systematic issues reported
    neither by Tk or ECAL (edge emitting laser)
    nor by HCAL (VCSEL)
  - Analogue Link monitoring is an asset
    - Tools are maturing in synergy with other detector parameters
      - Temperature, leakage currents, HV
    - Still lots to understand
      - Methods and analysis
      - Sensitivity and errors

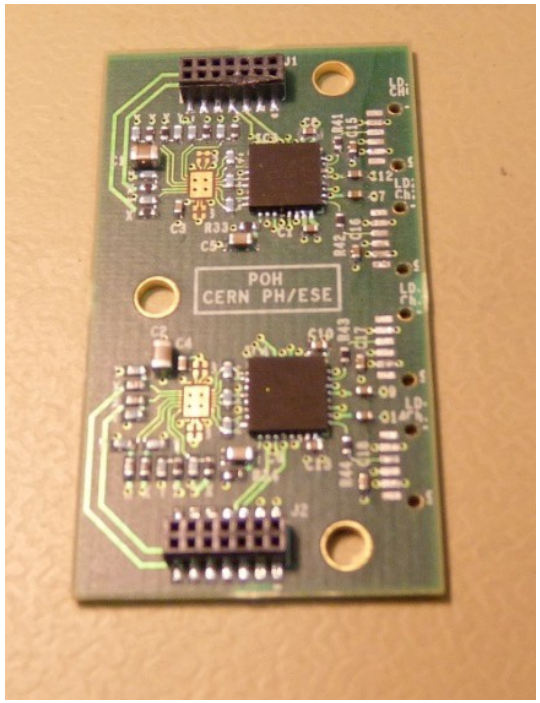


  - Physics seems to be more interesting than monitoring the system…

- Should remember to include long term monitoring capabilities in future systems

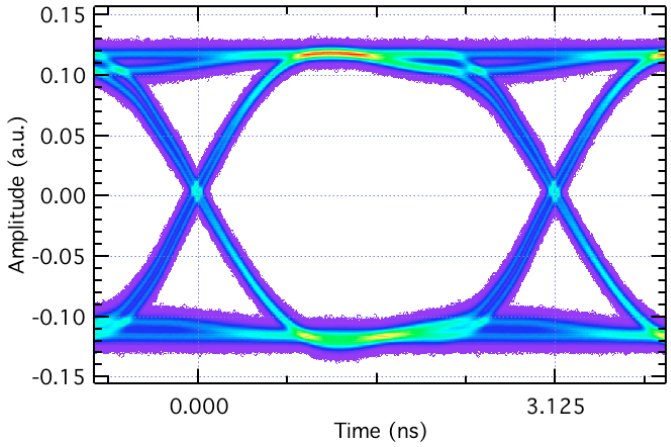
Opto R&D (1)

- CMS Pixel Optohybrid
- First spin-off from versatile link project
- Replace front- and backend components to with ones compatible with 320 Mb/s digital operation -> Versatile Link TOSA
- Prototype POH built, shows promising results
- Production to be managed by FNAL



CERN group

FNAL group



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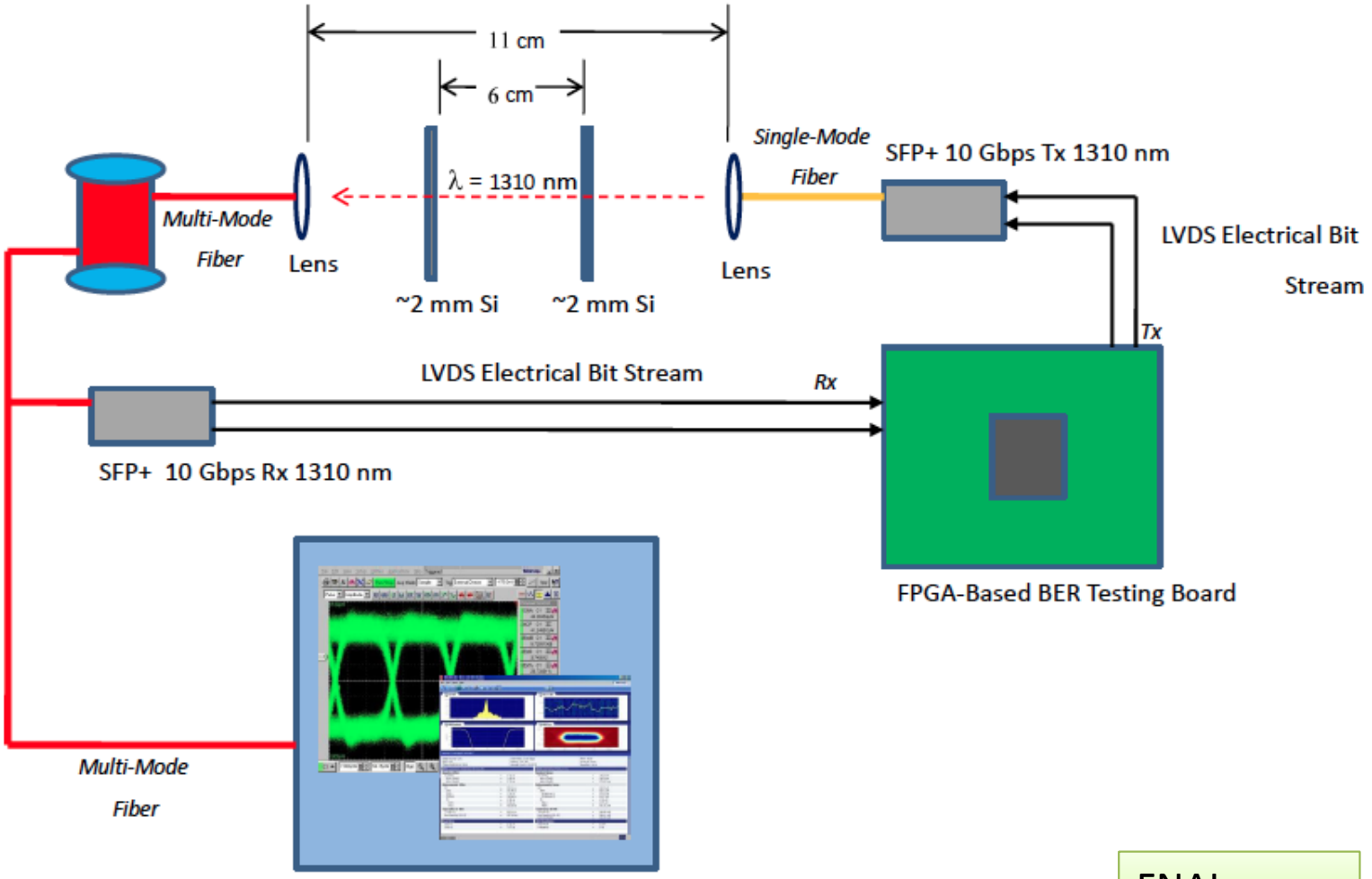
- TTC Passive Optical Network
- See talk by Sophie Baron

Opto R&D (2)

- Freespace Transmission



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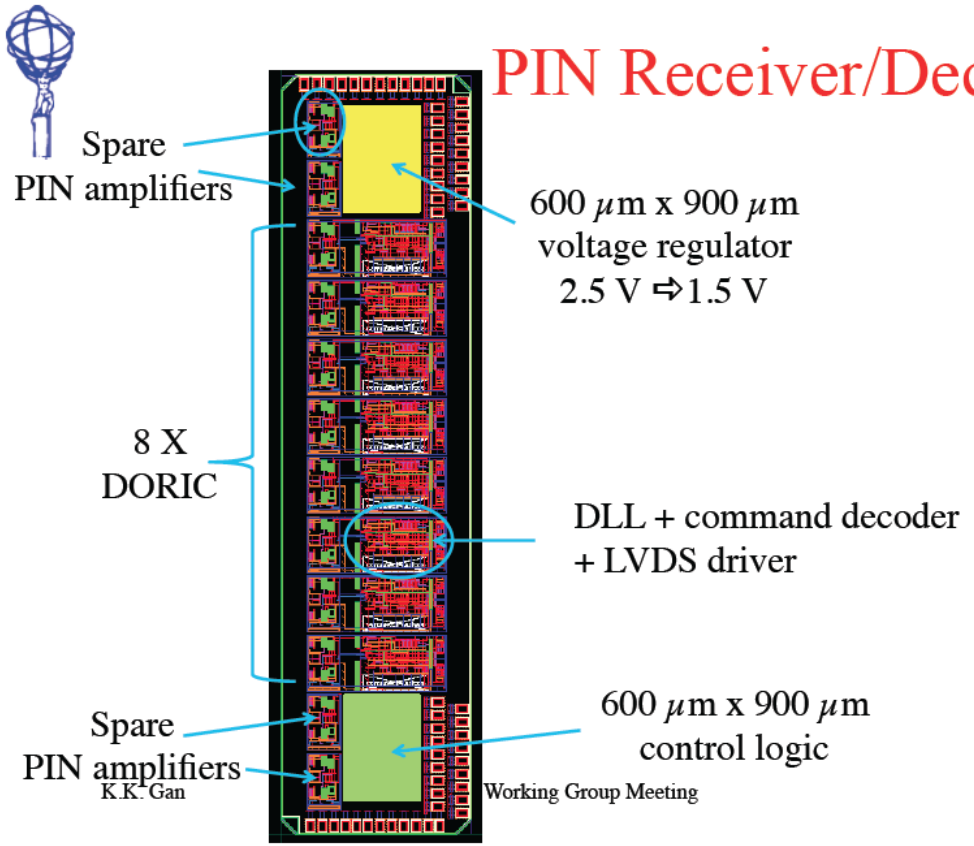
Opto R&D (3)

- Multichannel PIN Receiver and Laser driver



- ATLAS Pixel receiver chip updated into 130nm process.
- Redundancy scheme added:
  - Possible switching to spare channel inside the chip (induced by command from off-detector side)

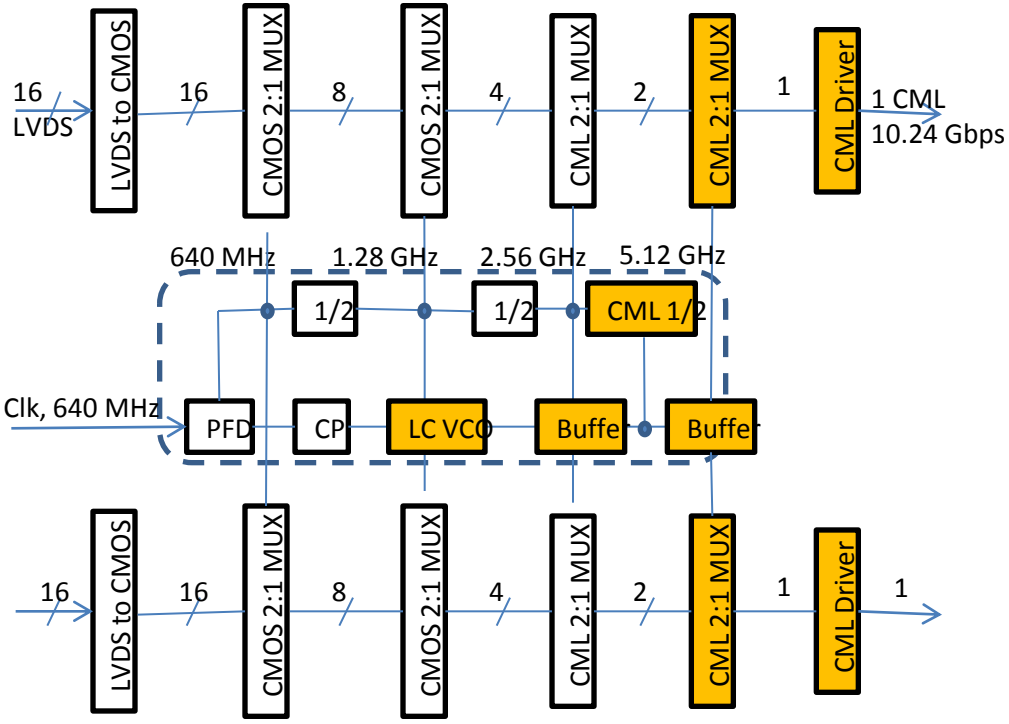
- Driver chip also under investigation for multichannel version including redundancy scheme for pixel detector readout (nSQP or phase I upgrade)

Ohio group

Opto R&D (4)

Link on Chip (multichannel approach)

- LOCs1: 5 Gb/s 16:1 serializer in 250nm SOS
  - a 2 channel version is under development (LOCs2)
- Speed aim is 10 Gbps
- Currently the high speed parts are under design
- Silicon on saphire process is intrinsically a high speed process.
- Process improvements announced for this year (Peregrine/IBM)



SMU group