Lesson Learned from ATLAS Pixel Optical Link

Outline

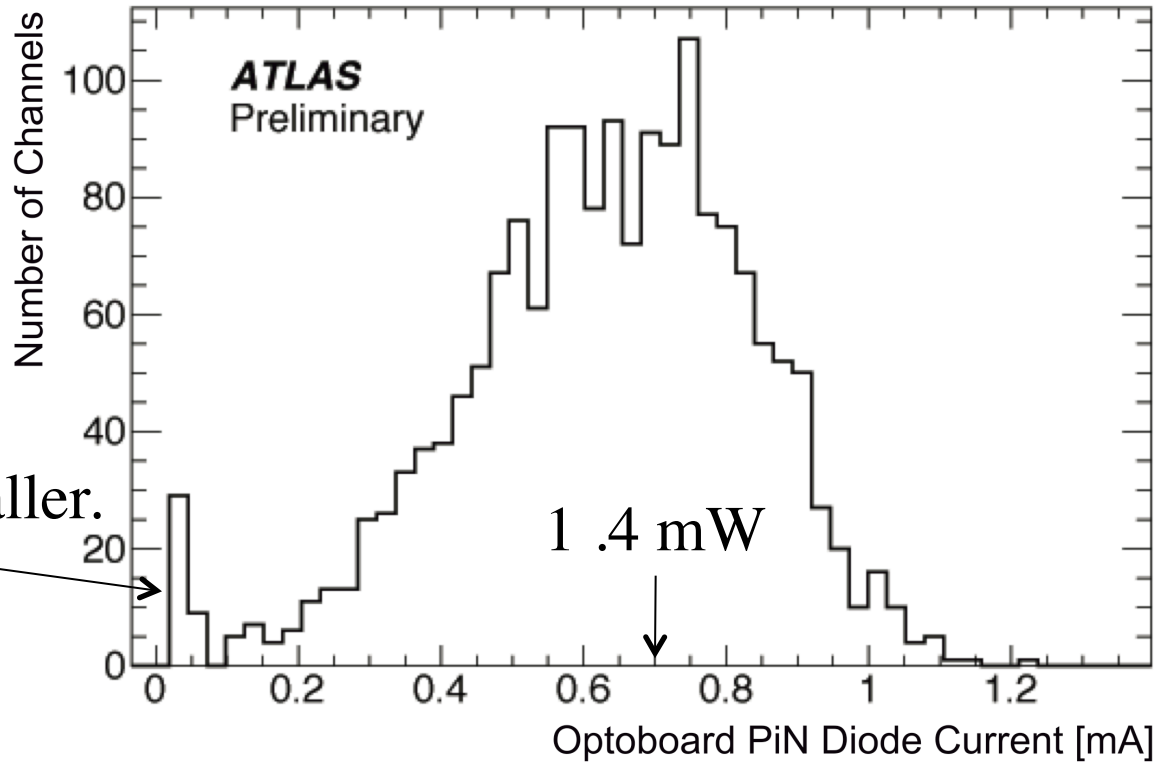
- Introduction
- VCSEL/PIN monitoring
- Analysis of opto-board/VCSEL/PIN failures
- Summary

Introduction

- Architecture of ATLAS pixel optical links is similar to strip detector
  - use VCSEL/PIN arrays for on-detector optical links
  - 1744 TTC links
  - 1788 datalinks
  - 272 opto-boards

On-Detector PIN Current

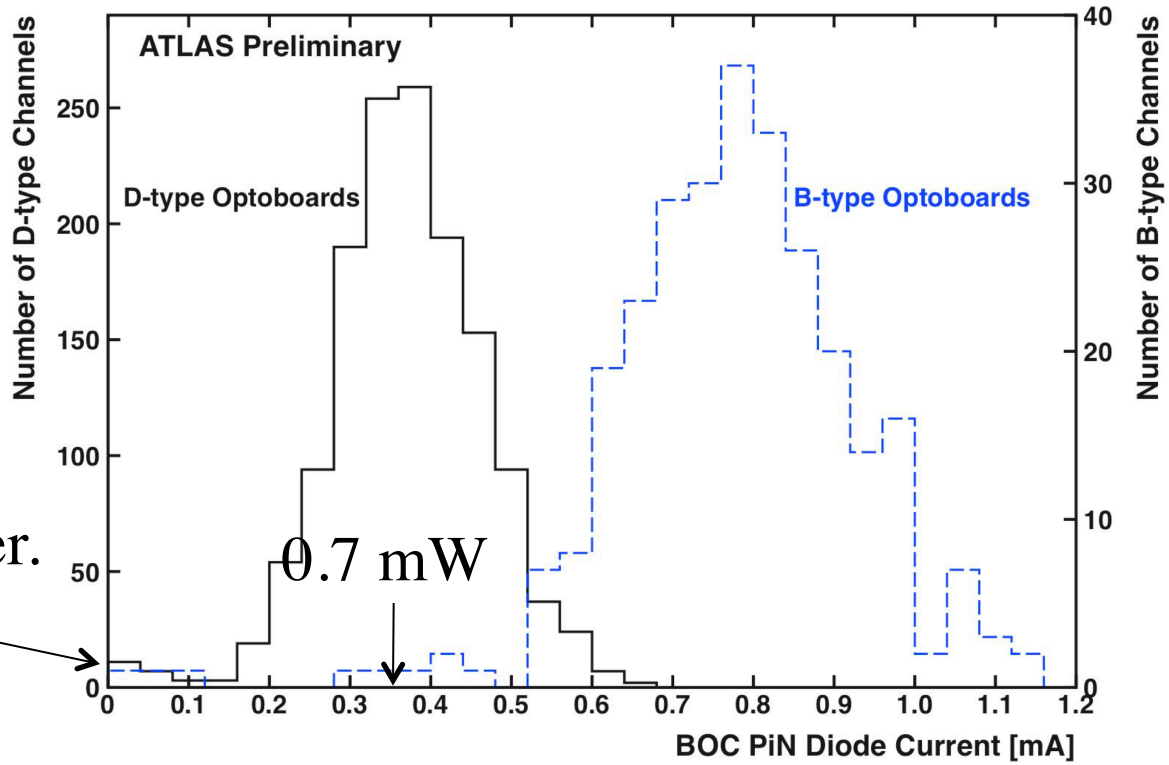
- Monitoring of PIN current on opto-boards (on-detector) will tell us about the failures or radiation induced degradation



Actual failures much smaller.
See analysis later.

Off-Detector PIN Current

- Monitoring of PIN current on RXs (off-detector) will tell us about the failures or radiation induced degradation



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Summary of Failures

- ~44 out of 1744 pixel modules are dead
  - HV, shorts/dead/noisy on FE's, opto failures…
  - opto failures account for ~1/3 of the problems

Opto-board Failure

- One opto-board (out of 272 boards) is inoperable
  - six pixel modules are inoperable
  - failure cannot be on opto-board itself due to multiple connections between opto-board and VCSEL driver chips (VDC)
  - a connection failure between opto-board and patch panel (PP2)
  - need redundant and more robust connection between opto-board and PP2
    - new VDC on IBL:
      - power on reset circuit to set default VCSEL current to 10 mA

PIN Problem

- 9 pixel modules receive no clock or cannot be configured
  - 2 opto-board channels have no PIN current
    - ⇨ cold solder between PIN and opto-board
    - ⇨ replace the challenging micro soldering by wire bonding with new opto-pack design in IBL
  - the other 7 failures are probably due to a connection failure between opto-board and FE module control chip (MCC)
    - type0 cables are fragile

VCSEL Problem

- 5 pixel modules send no light to off-detector
  - cold solder between VCSEL and opto-board or ESD dead
    - ⇨ replace the challenging micro soldering by wire bonding with new opto-pack design in IBL
  - one of the dual data links for the innermost layer (B-layer) has the same problem
    - ⇨ must send all data out in one link

Summary

- Opto failures probably account for ~1/3 of the total failures
- Need redundant/more robust connection for VCSEL current control
  - propose to implement power on reset circuit to set default VCSEL current to 10 mA for IBL
- Opto-pack redesigned to use wire bonding instead of micro soldering for IBL
- Propose to implement redundancy for IBL