ITK-Pixel Optical Links

K.K. Gan, H. Kagan, R. Kass, D.S. Smith, B. Tar
The Ohio State University

P. Buchholz, S. Heidbrink, M. Vogt, M. Ziolkowski
Universität Siegen

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Outline

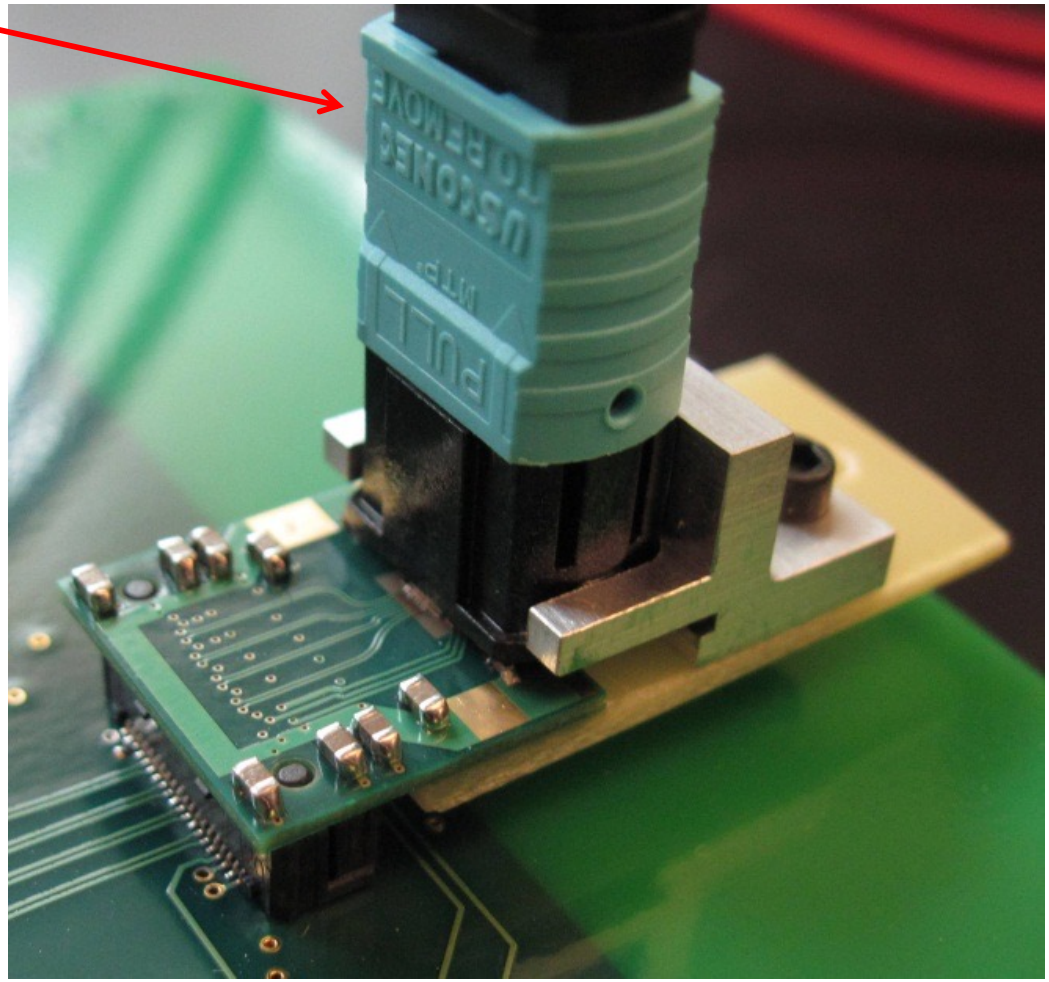
- Plan for Transmitter Opto-Board
- Plan for Receiver Opto-Board
- Summary

Transmitter Opto-Board

- current service estimate by Danilo:
  - 18,320 data links
- pixel detector is well served by 1st and 2nd generation opto-boards with 8- and 12-channel VCSEL arrays
  - if opto-board concept is implemented for ITK-Pixel with the use of 12-channel VCSEL array operating at 5 Gb/s
    - ⇨ 1,528 opto-boards are needed
      - 300 opto-boards in the current pixel detector
    - ⇨ quite a manageable opto-link system

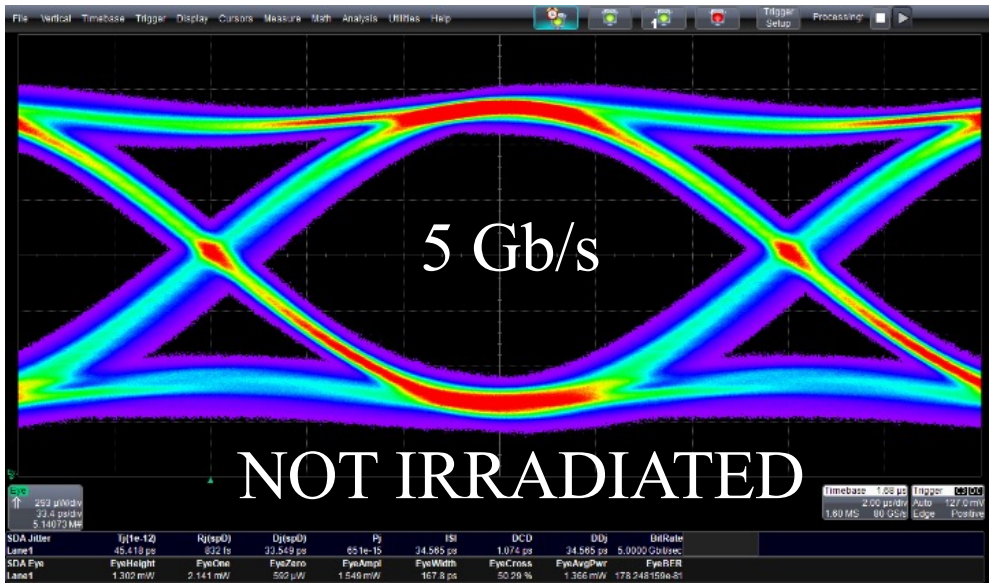
Status of Opto-Board R&D

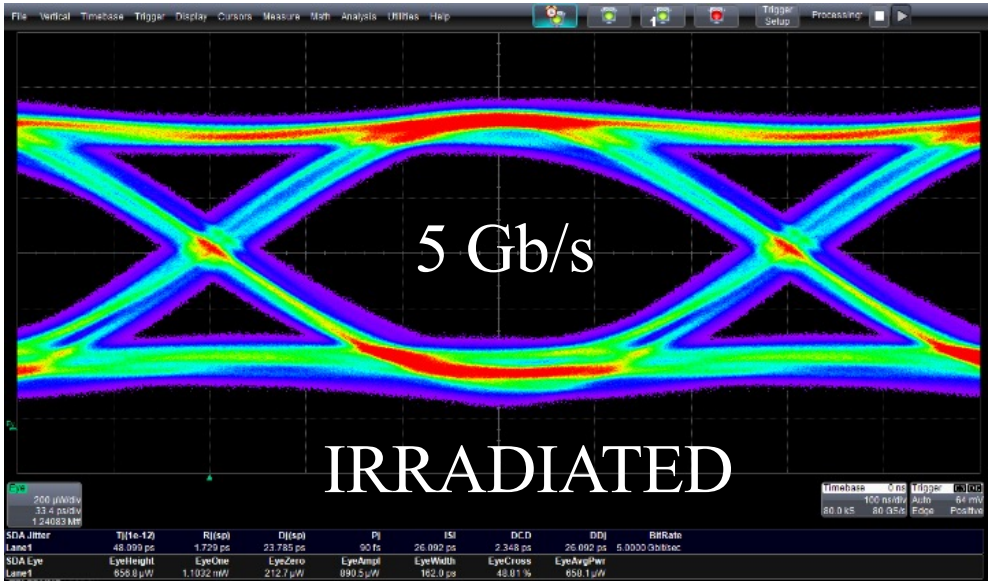
- ITK-Pixel opto-board has been prototyped
  - use MTP fiber connector as in current opto-board
  - use slightly simplified opto-pack
    - also used in RXs
  - compatible with opto crate (opto-box) concept



Post Irradiation Results

- All channels operational after irradiation
- Optical amplitude reduced from 2.07 mW to 1.19 mW
  - consistent with power loss seen during irradiation
- BER < 5×10^{-14} (run error free for more than 30 minutes)
- First demonstration of radiation hardness of an array driver/VCSEL combination at 10 Gb/s with a dose greater than 10 Mrads





Plan for Opto-Board R&D

- US ITK-Pixel upgrade program:
  - three prototype runs for ASIC developments including equalization circuit plus associated irradiation
  - two prototype opto-board runs
  - future opto-boards will be distributed for free

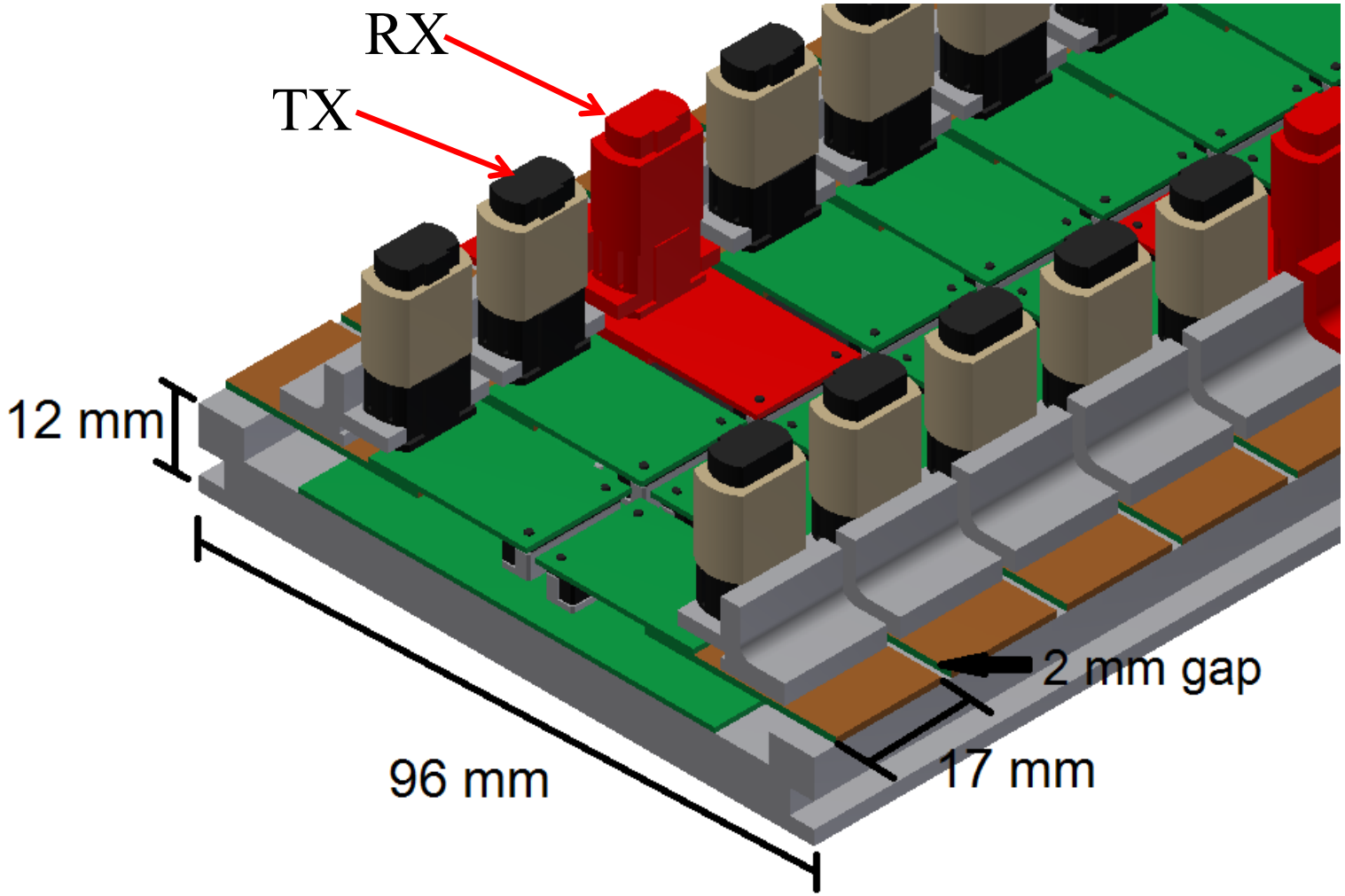
Plan for Receiver Opto-Board

- layout lpGBT/VL receiver (2.5 Gb/s) in 12-channel array
- use lpGBT to de-serialize signal from each channel into 8 x 160 Mb/s signals for transmission to modules
- current service estimate by Danilo:
  - 10,226 TTC links
    - ⇨ 1,280 lpGBTs with one e-link reserved for opto-board control
    - ⇨ 108 receiver opto-boards
      - one down-link opto-board for every 14 up-link opto-boards

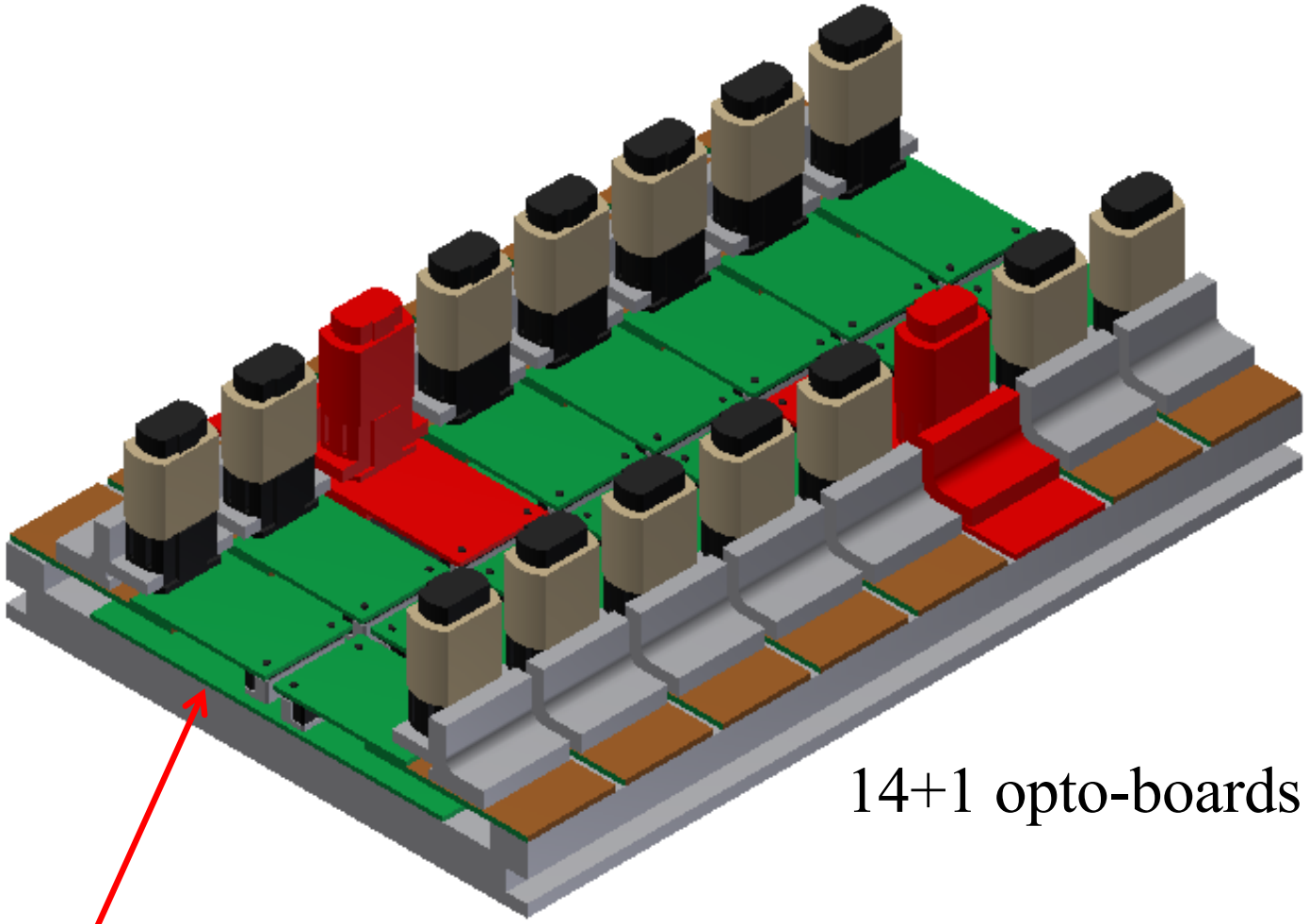
Plan for Receiver Opto-Board R&D

- US ITK-Pixel upgrade program:
  - two prototype runs for ASIC developments including irradiation
  - future opto-boards will be distributed for free

Opto-Box



Opto-Box



14+1 opto-boards per side

14 lpGBT per side on back-plane

Summary

- ITK-Pixel opto-links based on the opto-boards take advantage of the experience in building two generations of opto-boards using VCSEL and PIN arrays
- opto-board solution with MPO connector is compact and user friendly