



Results on Bandwidth Measurements

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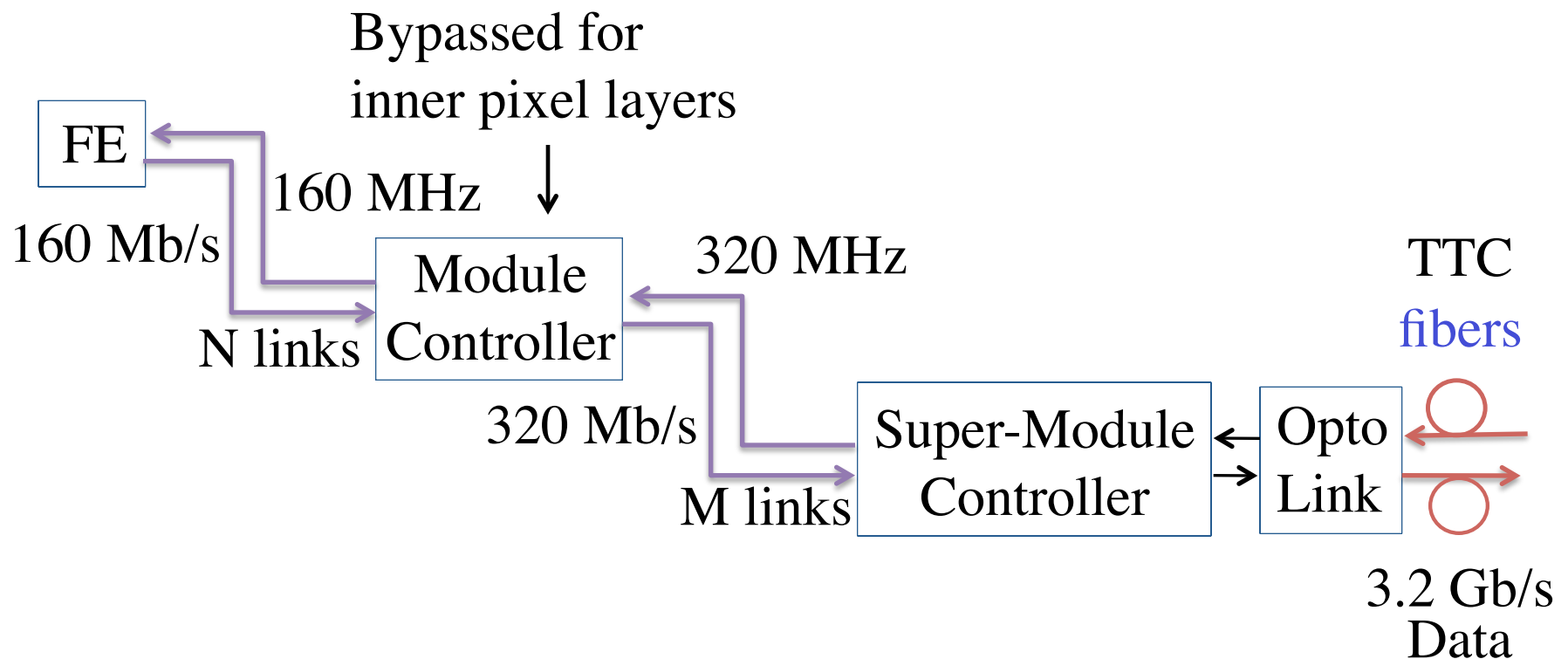
Outline

- Transmission on micro-cables
- Transmission on TRT micro-cables
- Transmission on micro-coax
- Summary



Read Out Architect

- G. Darbo, P. Farthouat, A. Grillo, ATL-P-EN-0001



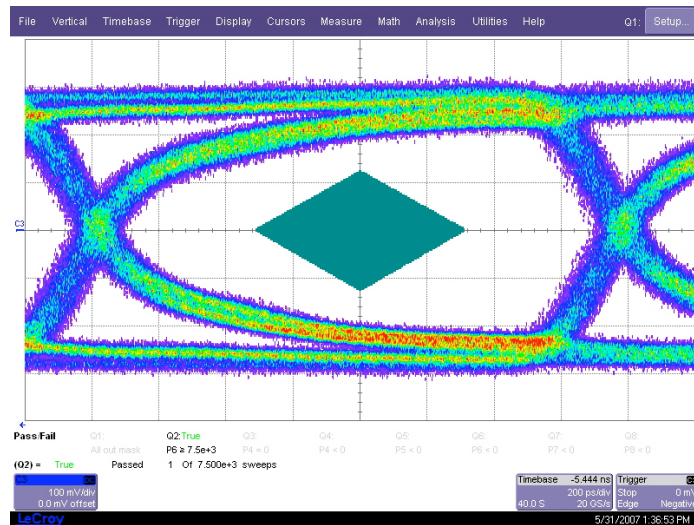


Eye Diagrams

100 μm current pixel cable

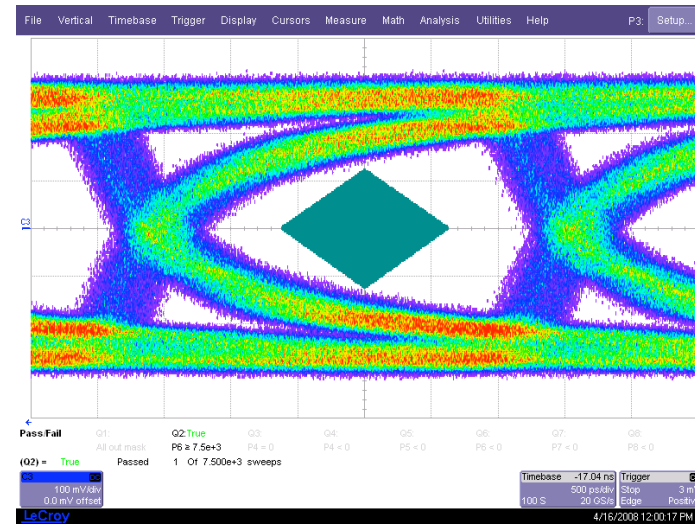
640 Mb/s

1.4 m



320 Mb/s

3 m



- Signals from modules can be sent to current PP0 location (1.4 m)
- Signals from modules (320 Mb/s) can be transmitted up to ~ 3 m

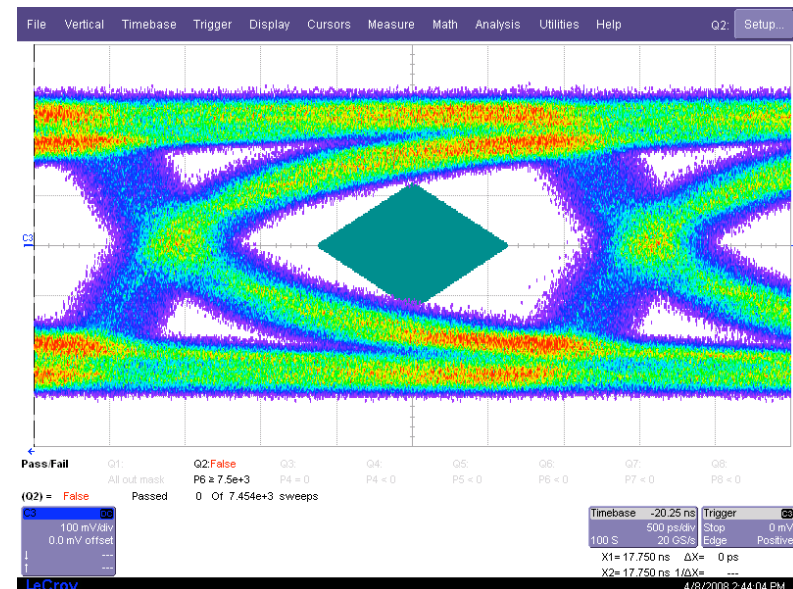
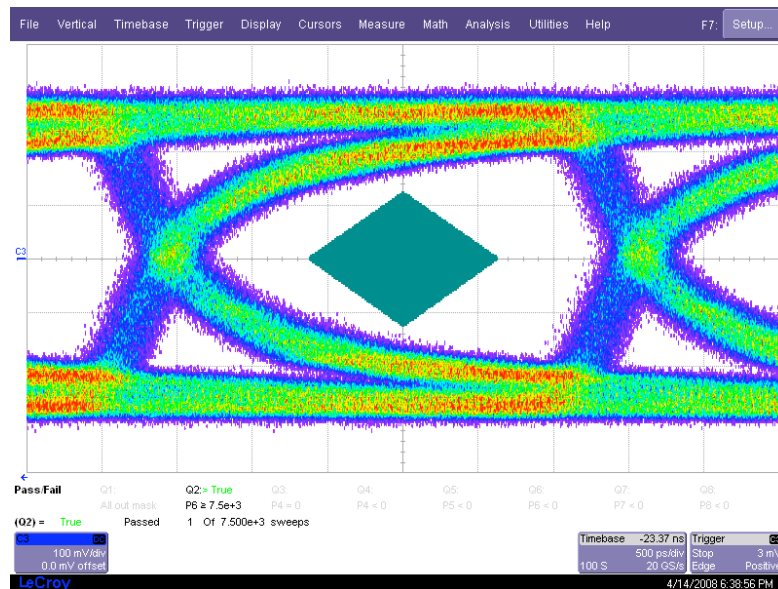


Eye Diagrams

1 mm TRT shield twisted pair (320 Mb/s, 100 Ω)

4 m

5 m



- Signals from modules (320 Mb/s) can be transmitted up to 4 m



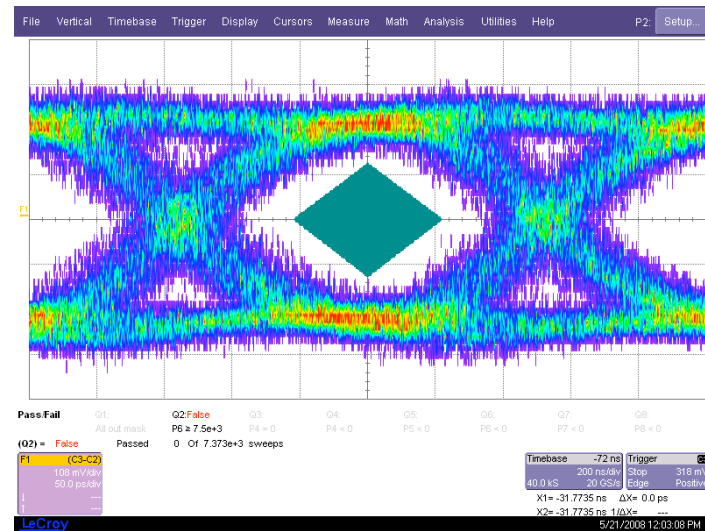
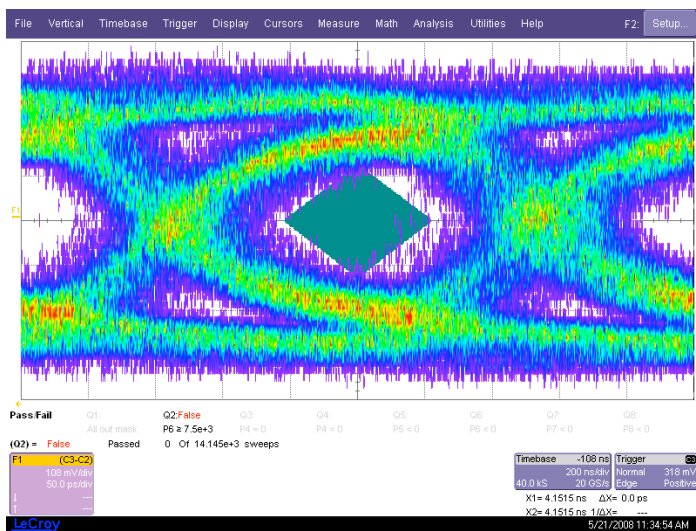
Test with Micro Coax

- Use 4 m of Belden 1674A micro coax with 1.2 mm OD
 - ◆ transmit LVDS signals at 3.7 Gb/s on two coax
- Use Altera Stratix II GX to study pre-emphasis settings
 - ◆ use 8B/10B encoding



Eye Diagrams

Pre-emphasis



- pre-emphasis opens up the eye diagram



Fiber

SLHC SCT fibers

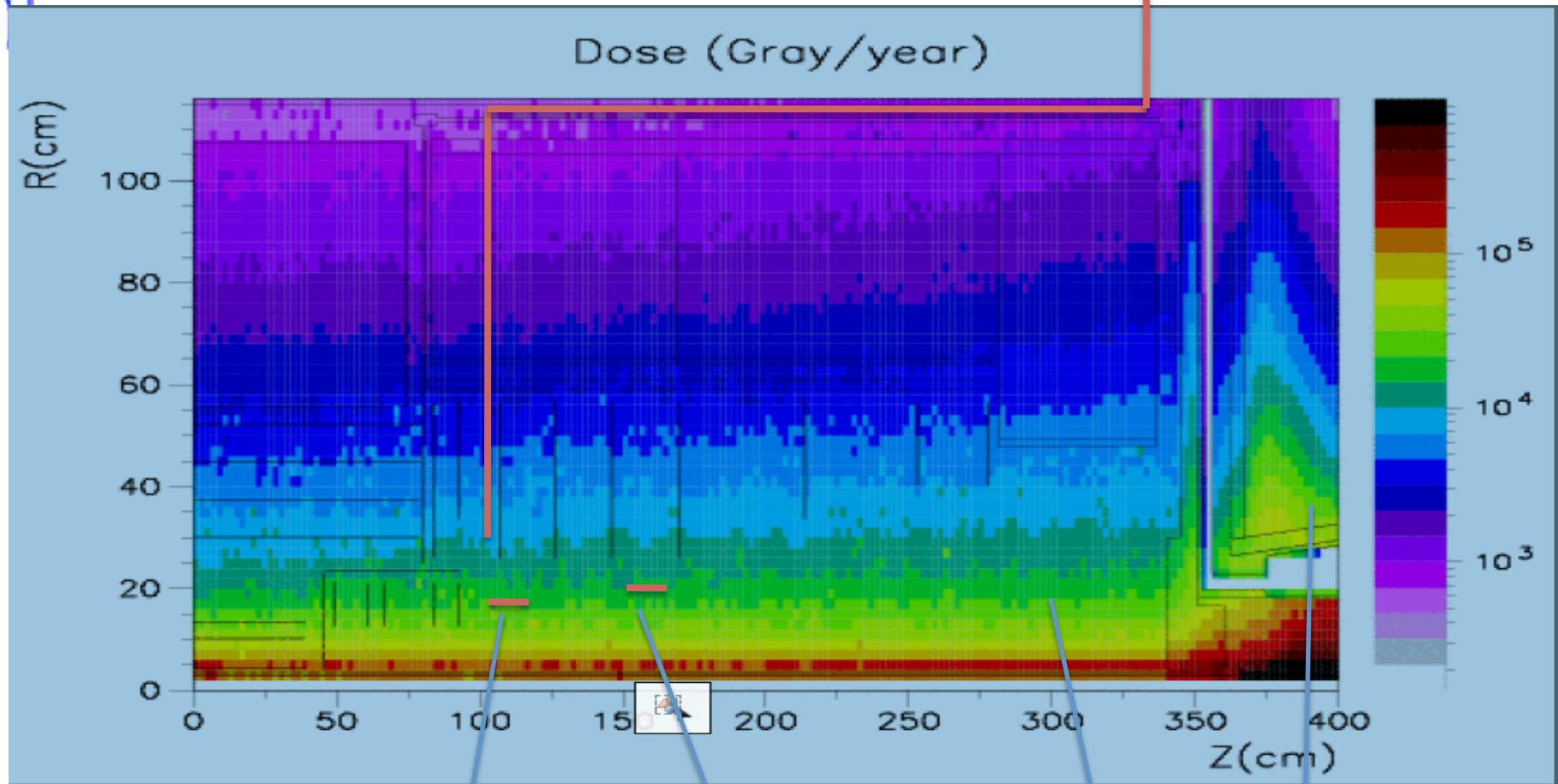


Figure 5.6 Annual doses (Gy/Year) assuming 10^7 s at high luminosity.

OSP bottom/ISP top

OSP top

320 Mb/s on TRT cable

3.7 Gb/s on coax cables

K.K. Gan

US ATLAS Pixel Upgrade Meeting

● SCT plans to use GRIN fiber @ SLHC

320 Mb/s on skinny cable

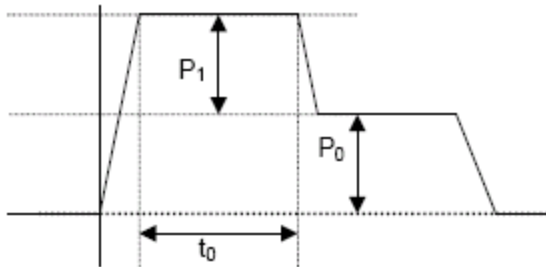


Opto-Link Locations

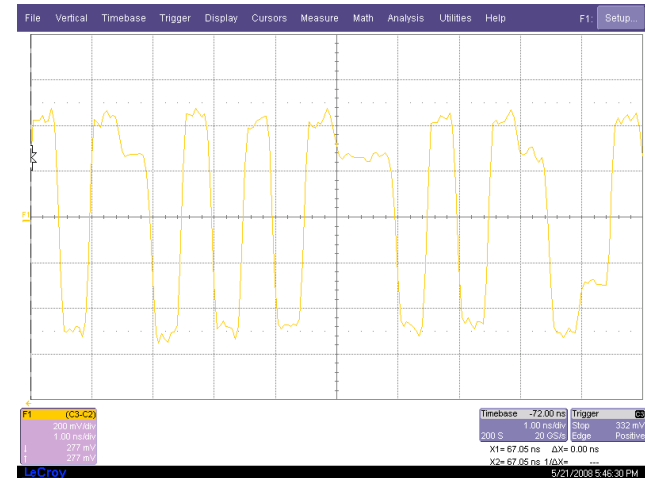
- Use skinny cables to transmit 320 Mb/s signal to ~ 3 m
 - ◆ no further R&D needed
 - ◆ minimum material (8 x 2 x 150 μm cables)
- Use TRT micro cables to transmit 320 Mb/s to 4 m
 - ◆ no further R&D needed
 - ◆ significantly more material (8 x 2 x 127 μm cables + insulation)
- Use micro coax to transmit 3.7 Gb/s to 4 m
 - ◆ significant R&D needed
 - ◆ significantly more material (2 x 1 mm cables)



R&D Needs for Coax Transmission



- Need to choose a coax cable first
 - ◆ qualify radiation-hardness
 - ◆ tune t_0 , P_0 , and P_1 of pre-emphasis
 - ◆ implement pre-emphasis in driver ASIC
 - ◆ qualify radiation-hardness
- require at least 2 years of R&D
 - ◆ require at least 2 ASIC iterations





Summary

- Can bring 320 Mb/s signals to ~ 3 m on skinny wires
- Can bring 320 Mb/s signals to 4 m on TRT twisted pairs
- Can bring 3.7 Gb/s signals to 4 m on coax with significant R&D