First results of the pixel hybrid bus

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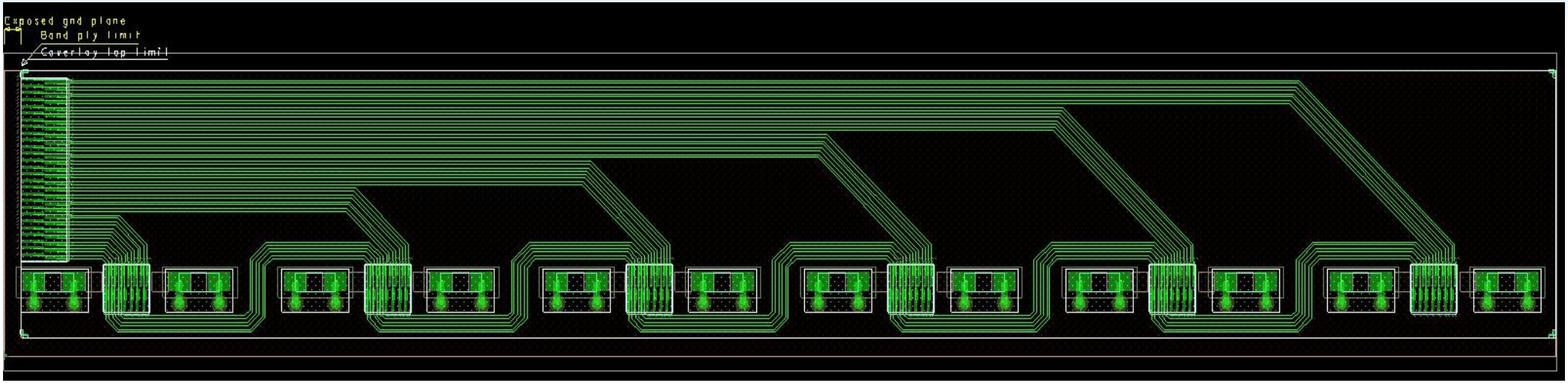
Hybrid bus



Hybrid bus structure for 6 readout chips

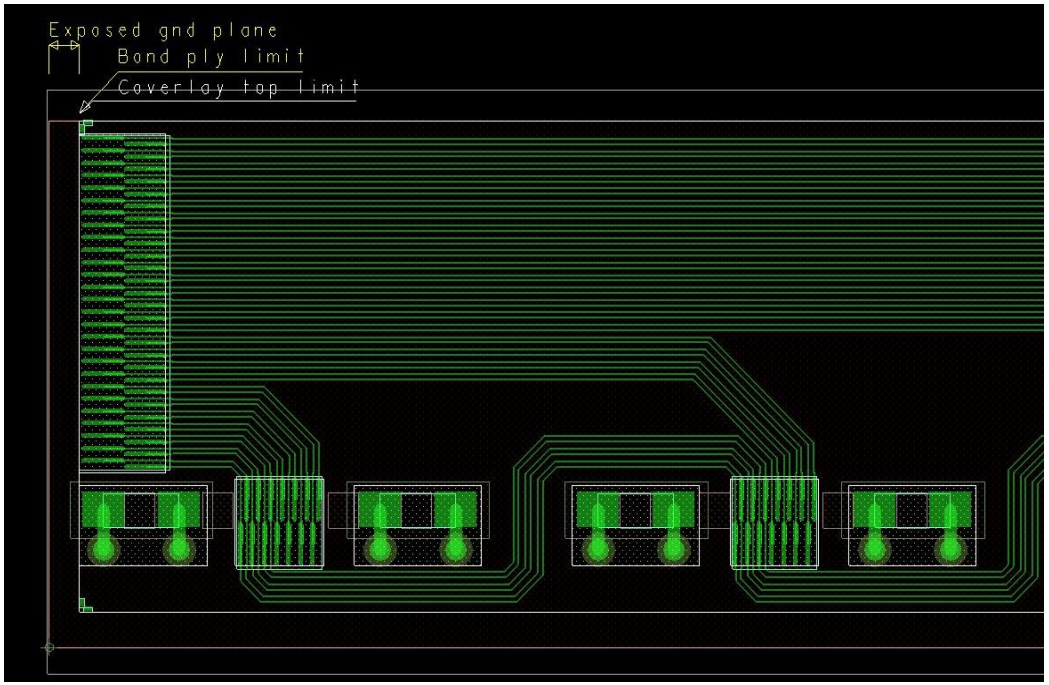
- size: 67.9mmx11.9mm
- for each chip:
  - 3 differential pairs in “daisy chain”
  - 4 “direct” differential pairs

Total of 27 differential pairs

- 100 Ohm differential impedance
- 100µm width for bonding Pad
- 60µm width for line
- 60µm spacing
- 15µm Al thickness
- 75µm Kapton dielectric
- 12 smd 0603 capacitor filters

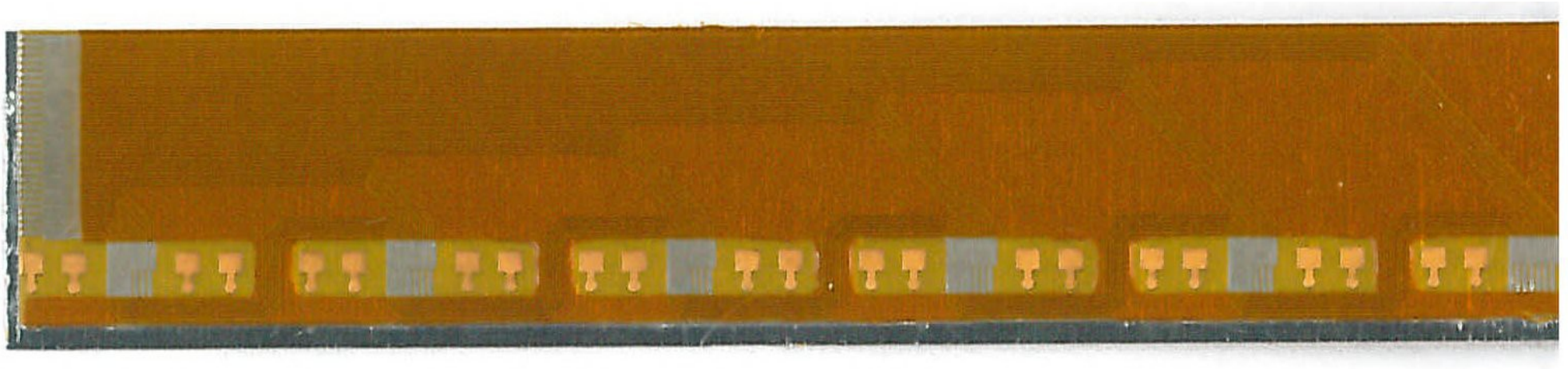
The hybrid bus under study is the longest one (6 chips).

Hybrid bus

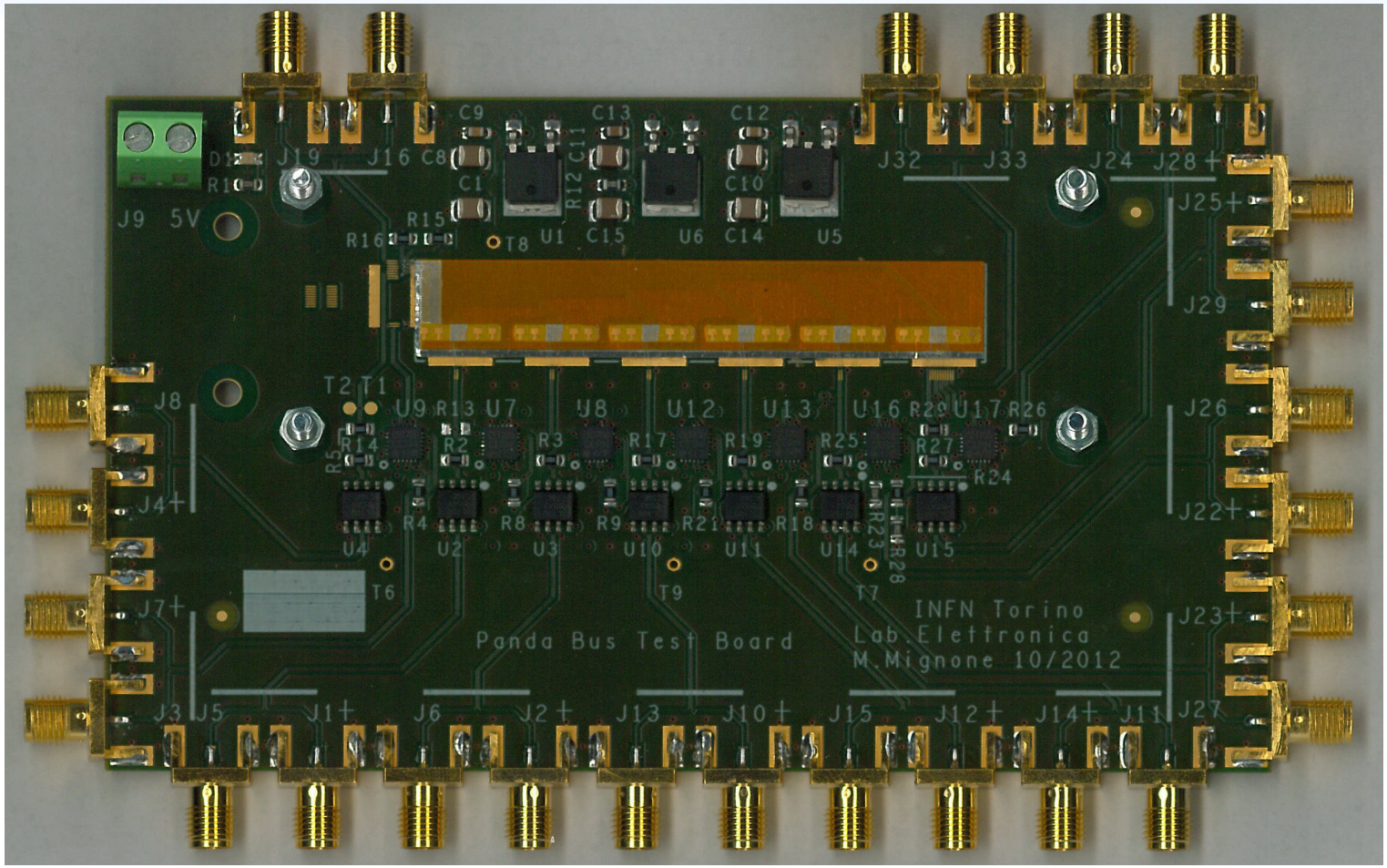


Zoom of the short side

Hybrid bus prototype

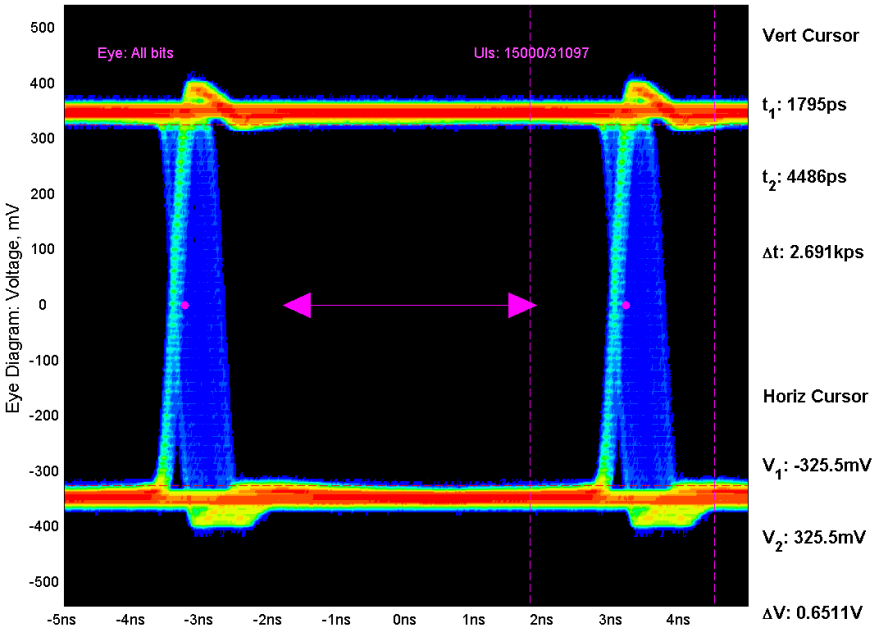


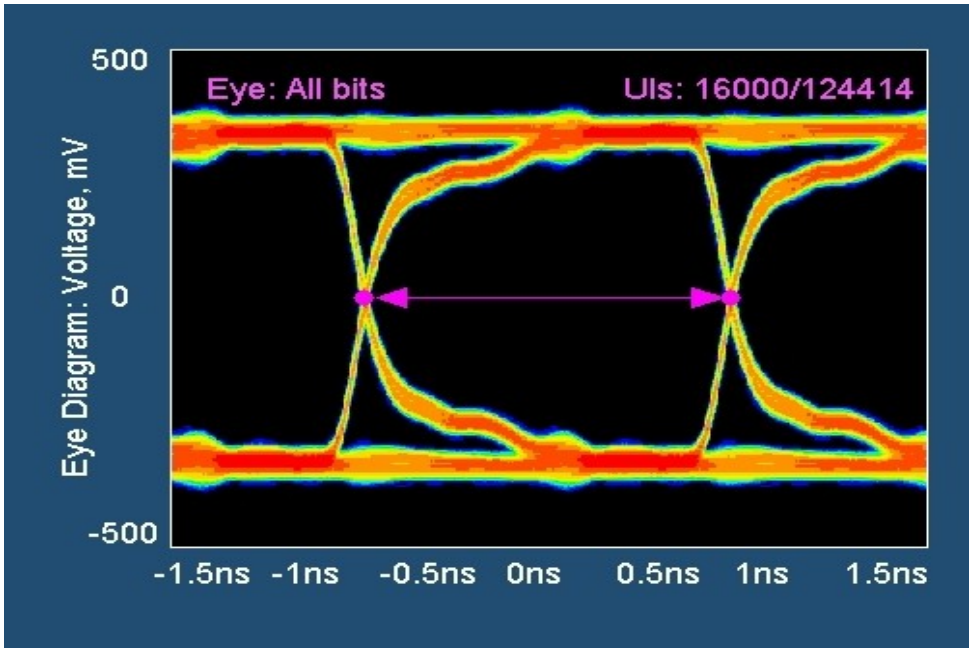
Test board



The test board contains LVDS/SLVS transceivers and buffers.
These first tests were done using the Agilent N5980A BERT (Bit Error Rate Tester) equipment.
All signals are analysed by the Tektronix DPO70604 oscilloscope

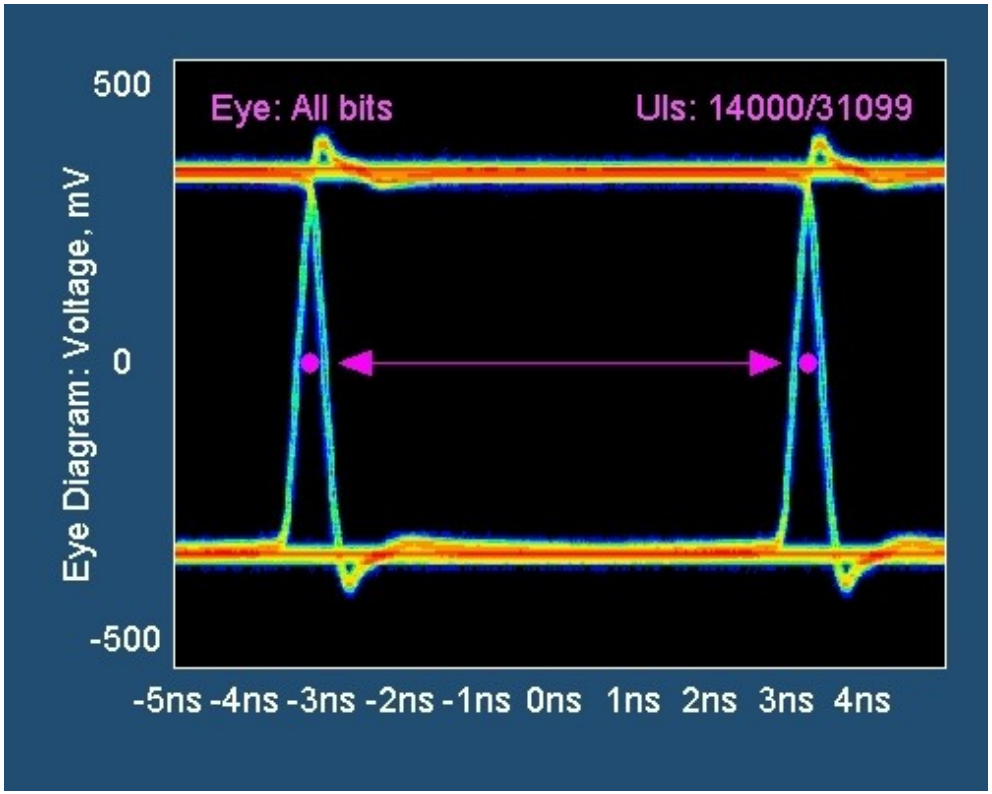
Signal integrity for the readout hybrid (1)

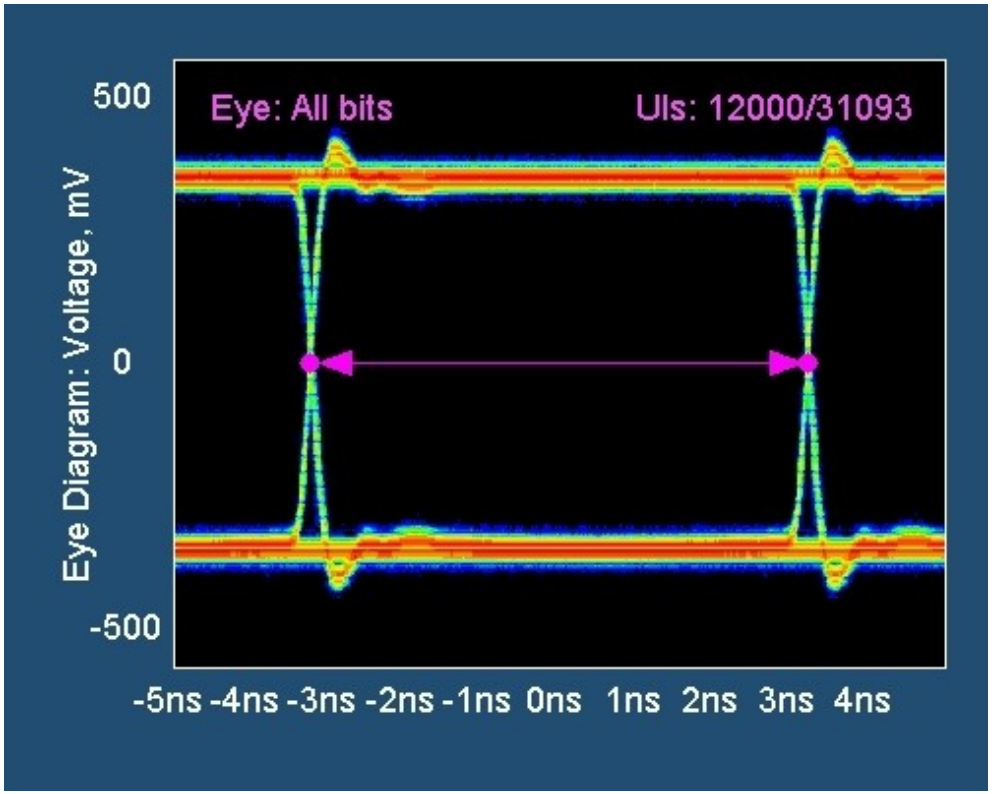




Analysis for the total jitter on the direct lines for Topix serial data output with the transceivers on the test board at 156 Mb/s (on the left), or without the transceivers on the test board at 622 Mb/s (on the right).

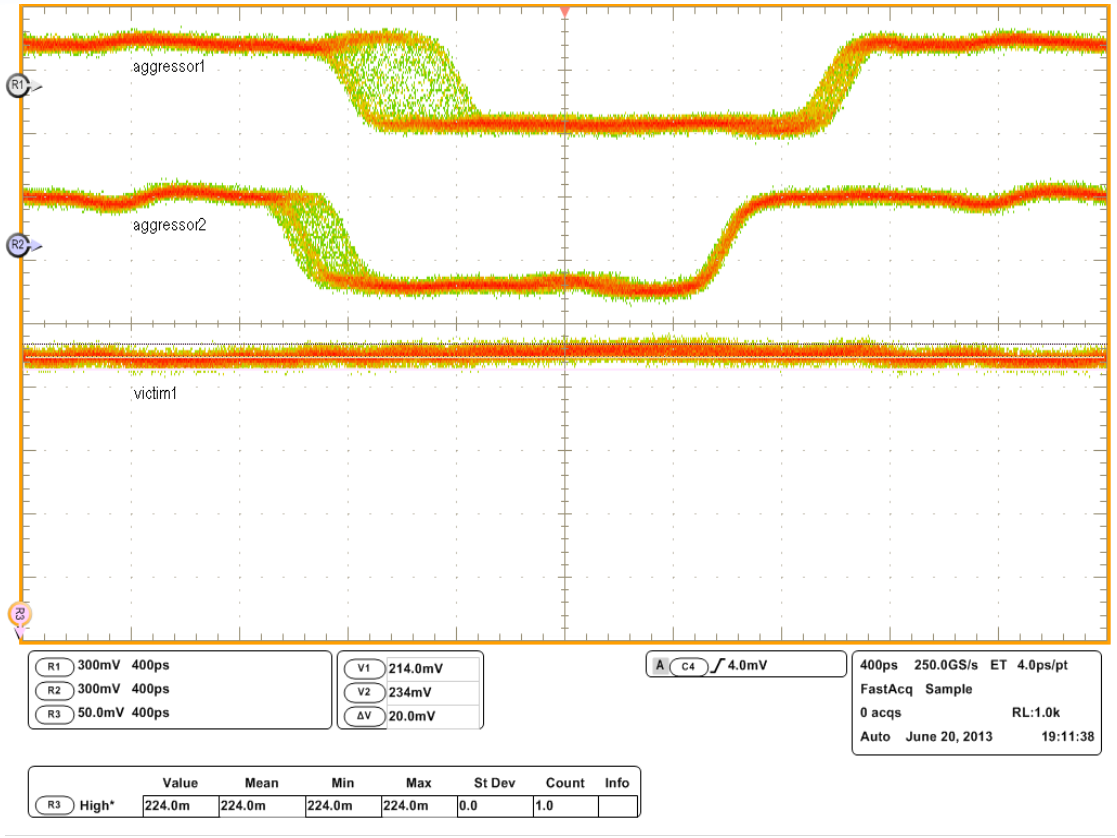
Signal integrity for the readout hybrid (2)





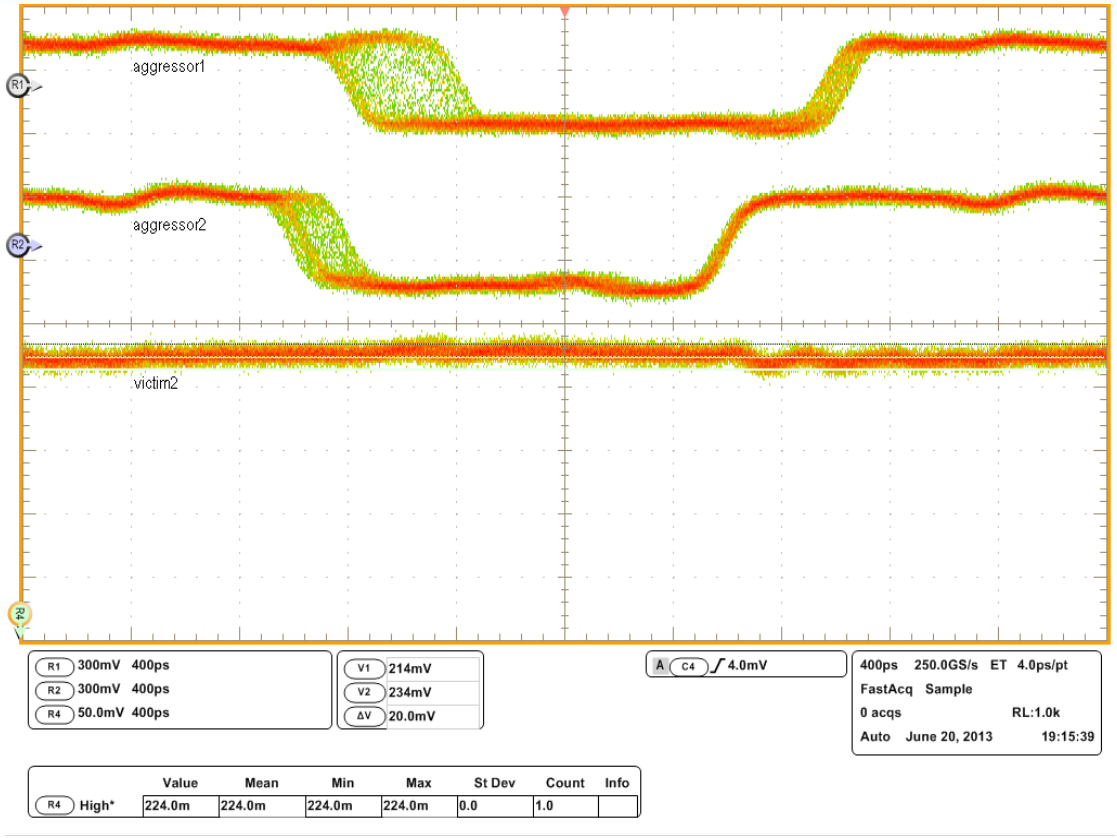
Analysis for the total jitter on the daisy chain lines connecting Topix clock and control signals at 156 Mb/s, for the short path to the first chip (on the left), and for the long path to the last chip (on the right).

Cross talk for the lines on the hybrid (1)



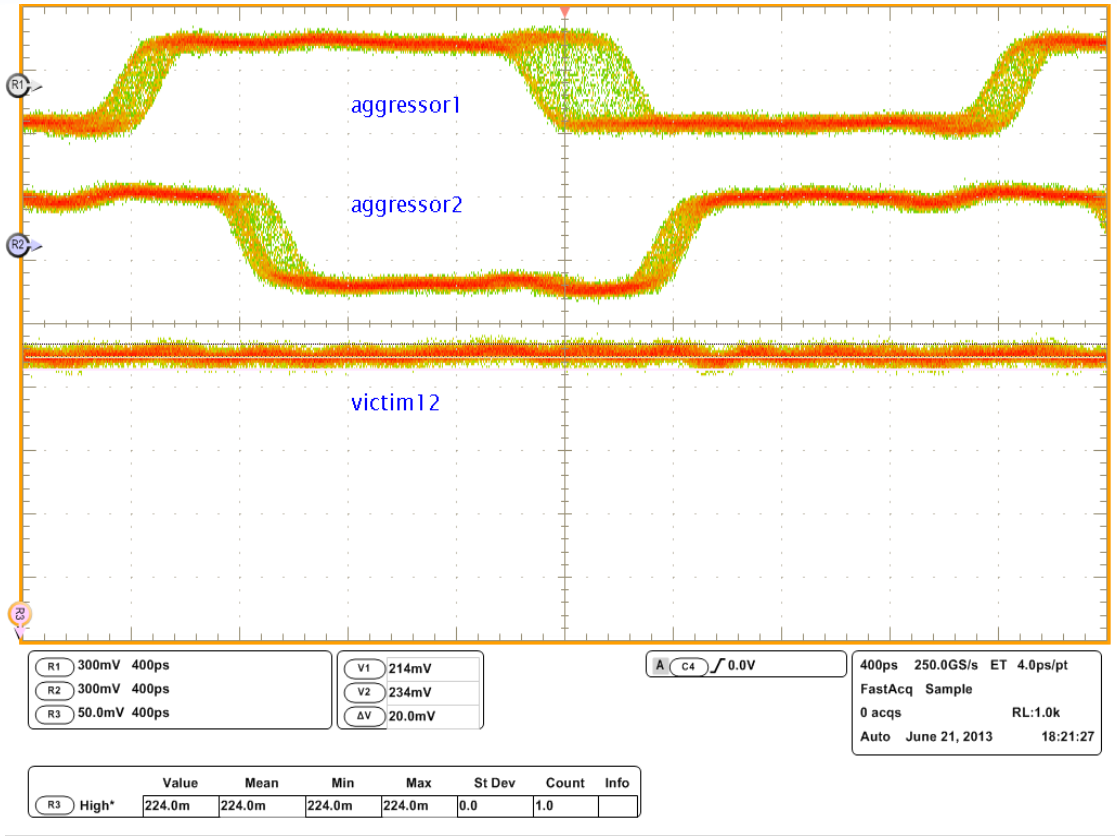
Analysis for the cross talk on the direct lines connected to the Topix serial output: in this case the victim line driven to a high state is simply subjected to the aggressor1.

Cross talk for the lines on the hybrid (2)



Analysis for the cross talk on the direct lines connected to the Topix serial output: in this case the victim line driven to a high state is simply subjected to the aggressor2.

Cross talk for the lines on the hybrid (3)



Analysis for the cross talk on the direct lines connected to the Topix serial output: in this case the victim line driven to a high state is subjected to both the aggressor1 and aggressor2.

Conclusions

The transceivers add their jitter (as already demonstrated with the aluminium cable tests).

The results are however acceptable (better without transceivers).

The detected errors during the data transmission are 1×10^{-12}

$$T = \frac{-\ln(1 - C_L)}{f \cdot Ber}$$

The cross talk (<10%) is acceptable.

Additional measurements

- @ higher data transmission (320 Mb/s)
- by connecting long cable to the hybrid bus