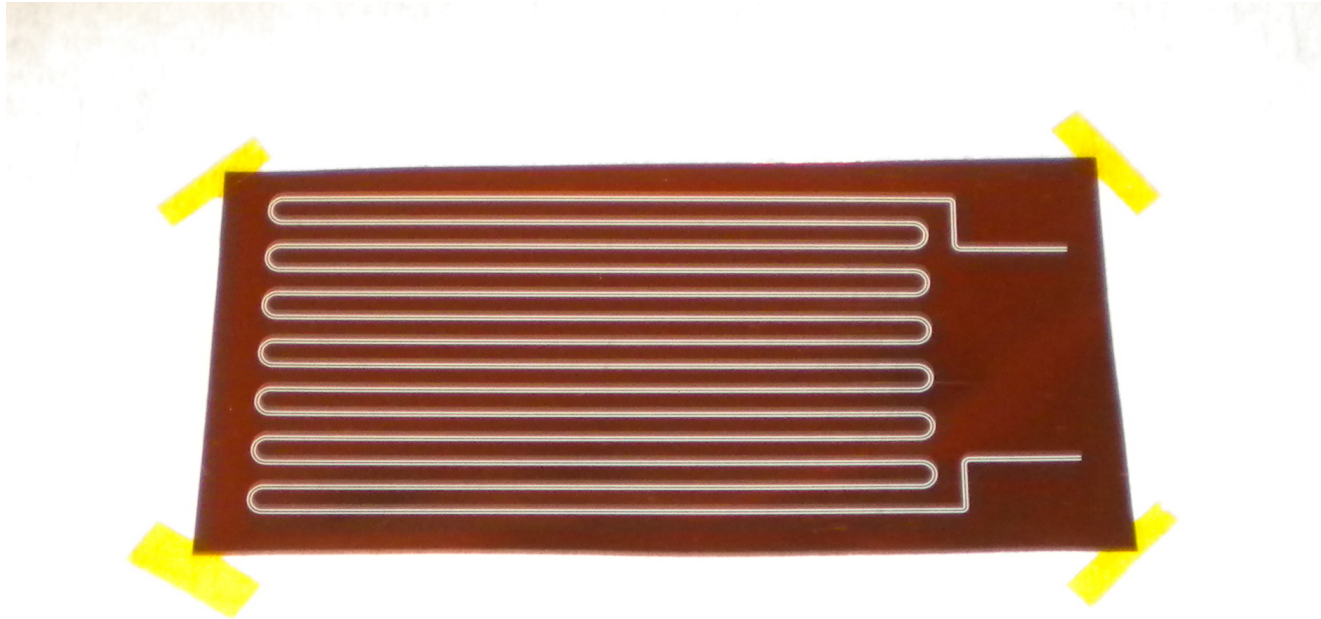# An update on the low mass cable.



D. Calvo, P. De Remigis, M. Mignone, R. Wheadon
*INFN Torino*

De Remigis

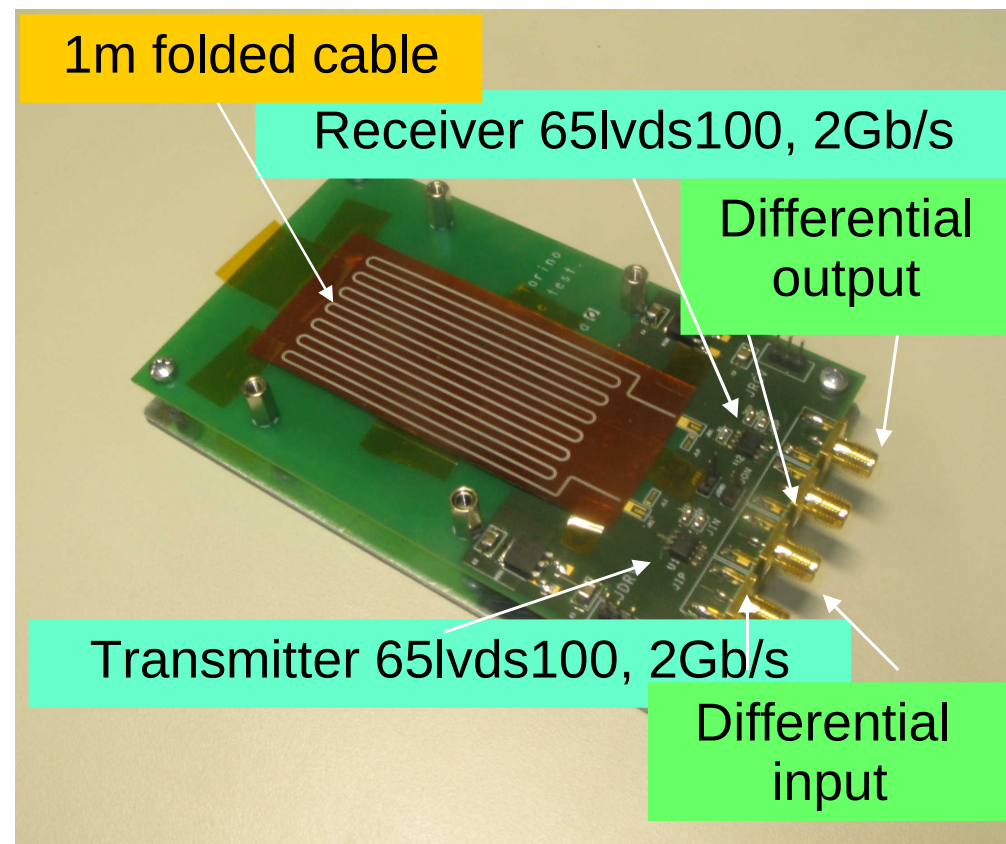# Cable prototype and testing board.

Two prototype made by:
- Techfab (Torino)

Technology with aluminum deposition on kapton, at present not completely reliable for bonding.
- CERN (Geneve)

Technology with laminated aluminum on kapton, reliable for bonding.



1m folded cable

Receiver 65lvds100, 2Gb/s

Differential output

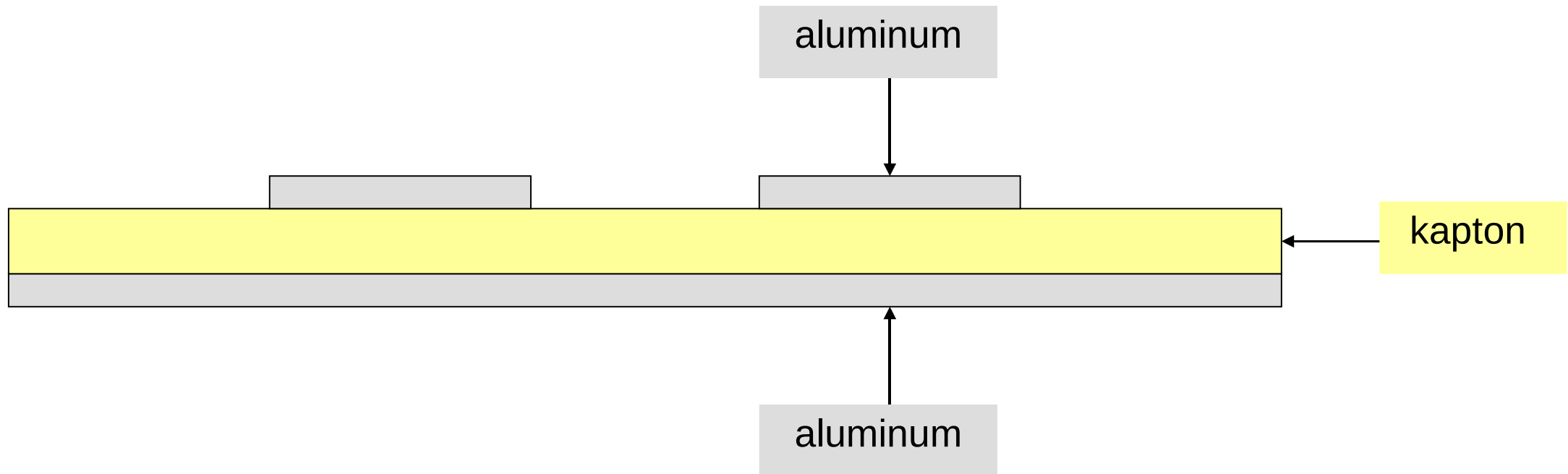Transmitter 65lvds100, 2Gb/s

Differential input

De Remigis

# Layout specification.

Both cable samples have a differential pair in a folded layout, for a total length of 1m.

- Techfab

Aluminum thickness: ~7µm; kapton thickness: 50µm.
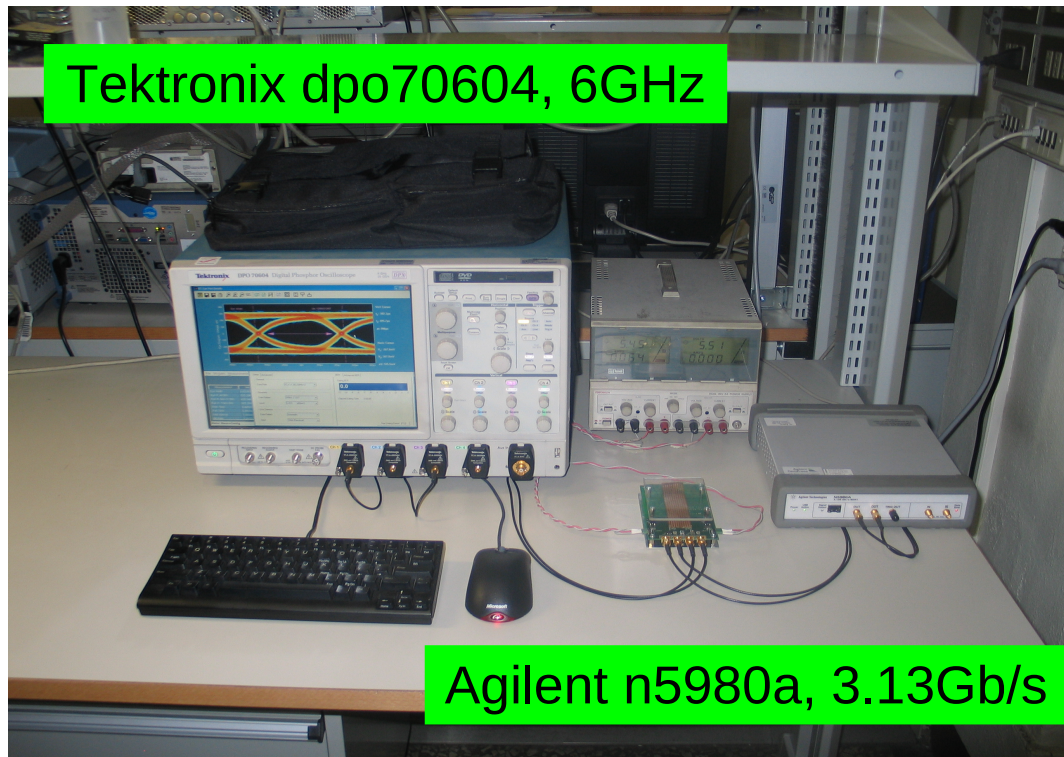
- CERN

Aluminum thickness: 15µm; kapton thickness: ~70µm.

# Test setup for cable prototype.

The test has been performed using some standard protocols, as listed in the table.



Tektronix dpo70604, 6GHz

Agilent n5980a, 3.13Gb/s

| Standard protocol | Data rate [Gb/s] |
|---|---|
| Optical Carrier 3x | 0.156 |
| Optical carrier 12x | 0.622 |
| Fiber Channel 1x | 1.060 |
| Giga Bit Ethernet | 1.250 |
| Fiber Channel 2x | 2.130 |

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# Results from prototypes (1).

**Total jitter vs data rate.**
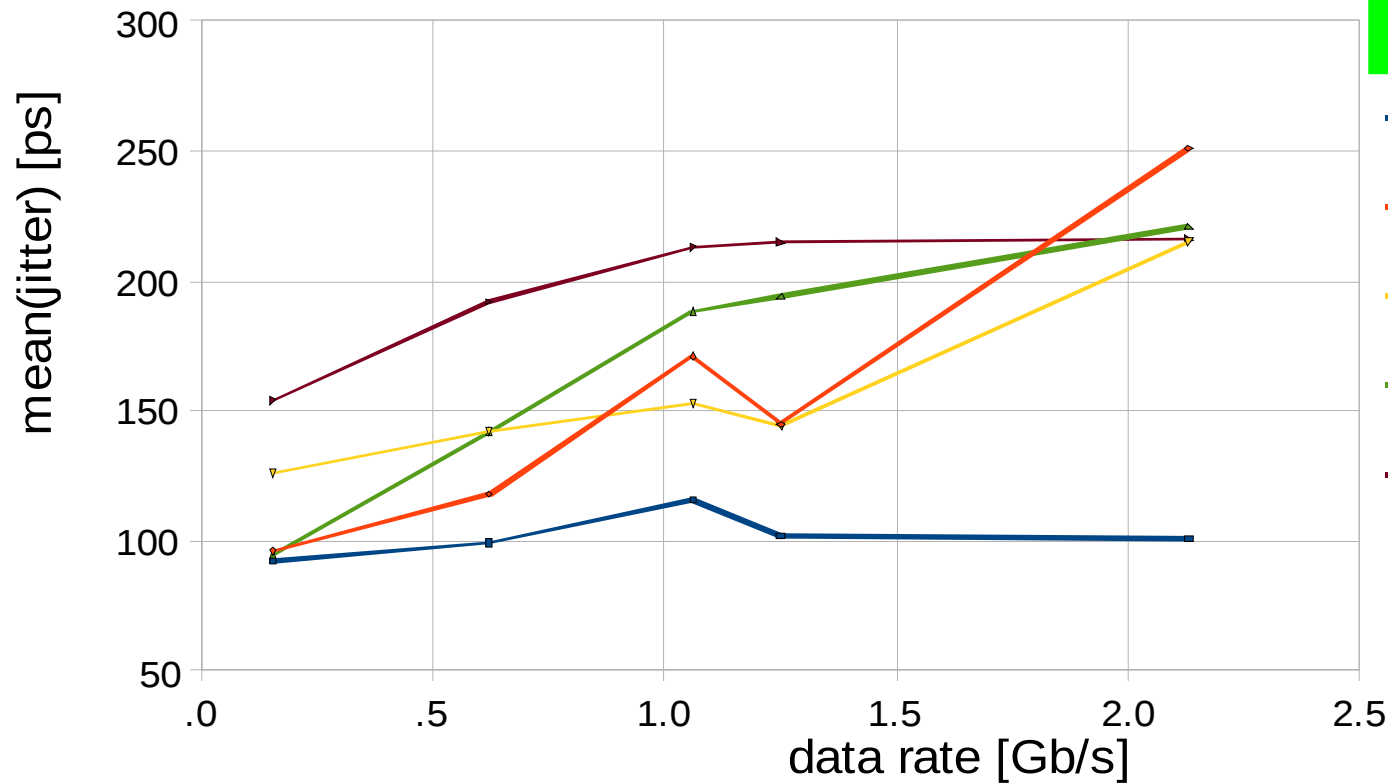


No errors in communication

- INFN, Cu, 0.570mm, no receiver
- Techfab, Al, 0.15mm, receiver
- Techfab, Al, 0.15mm, no receiver
- Cern, Al, 0.10mm, receiver
- Cern, Al, 0.15mm, no receiver

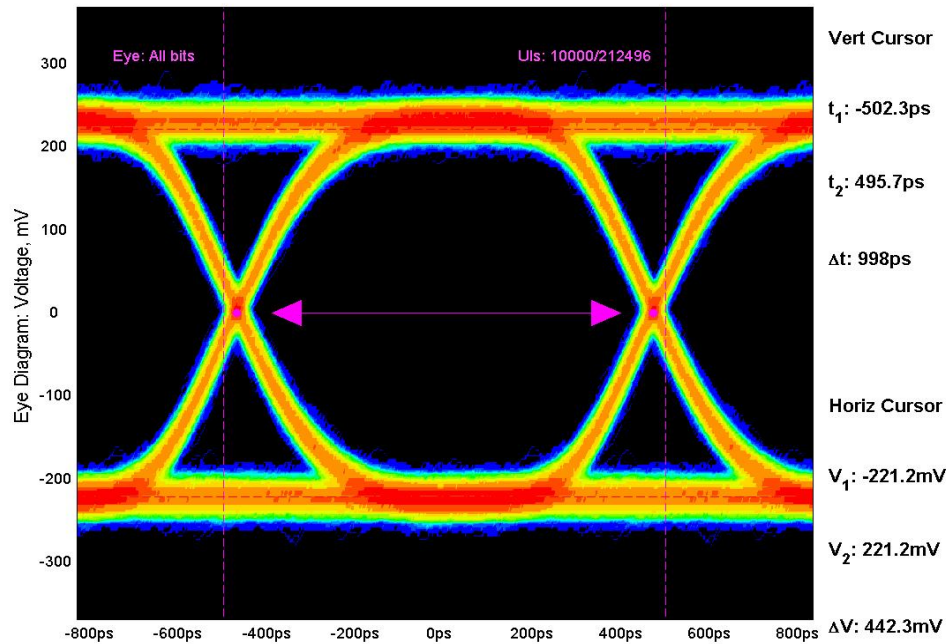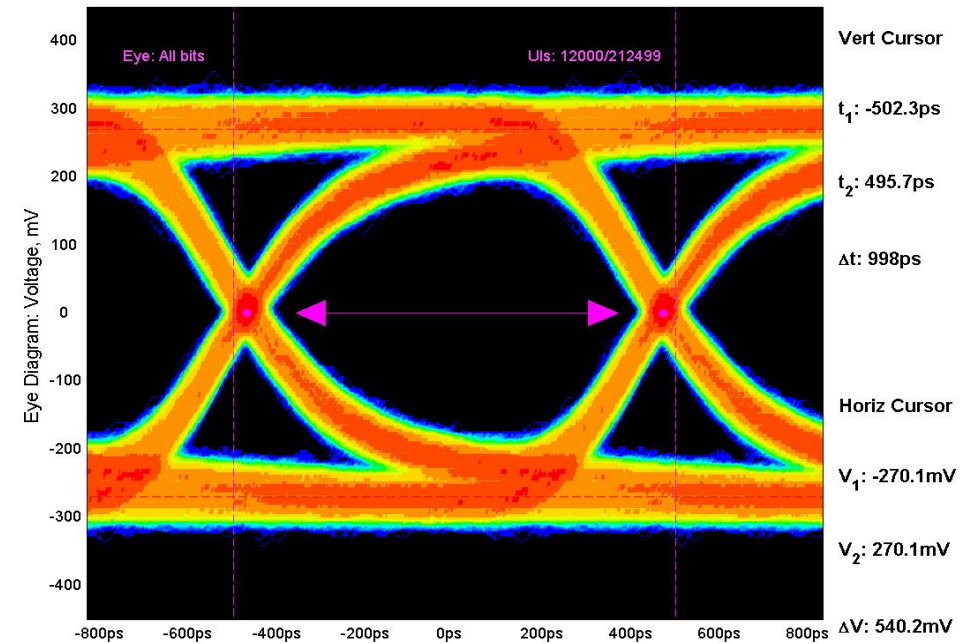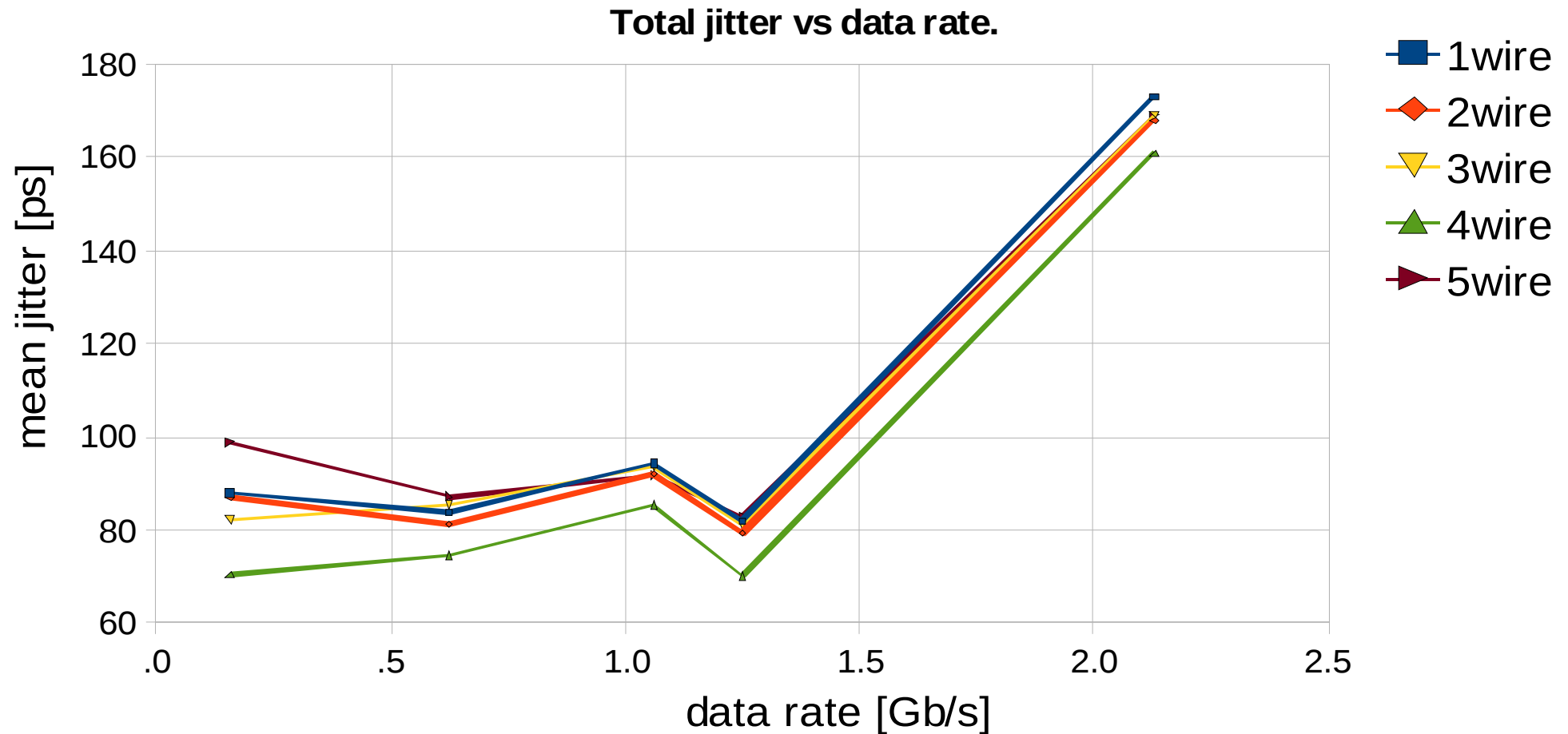The samples are measured with, and without, the receiver circuit.



Total Jitter

De Remigis
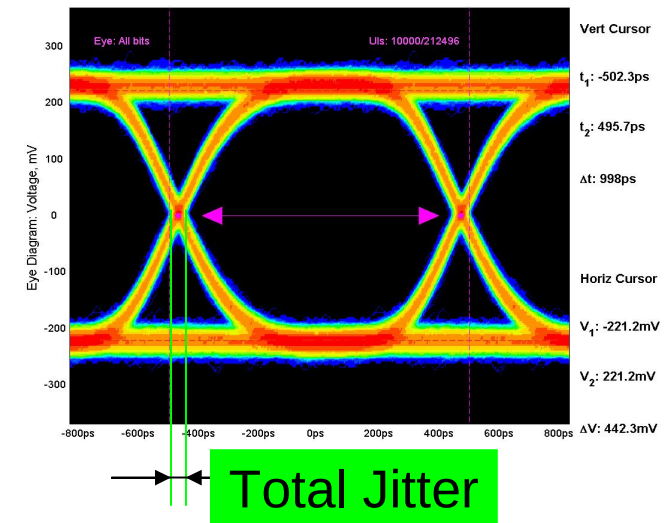
# Results from prototypes (2).

In the first case the swing is $s_t$=442mV, while in the last case it is $s_c$=540mV.

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# Results from prototypes (3).

**Total jitter vs data rate.**
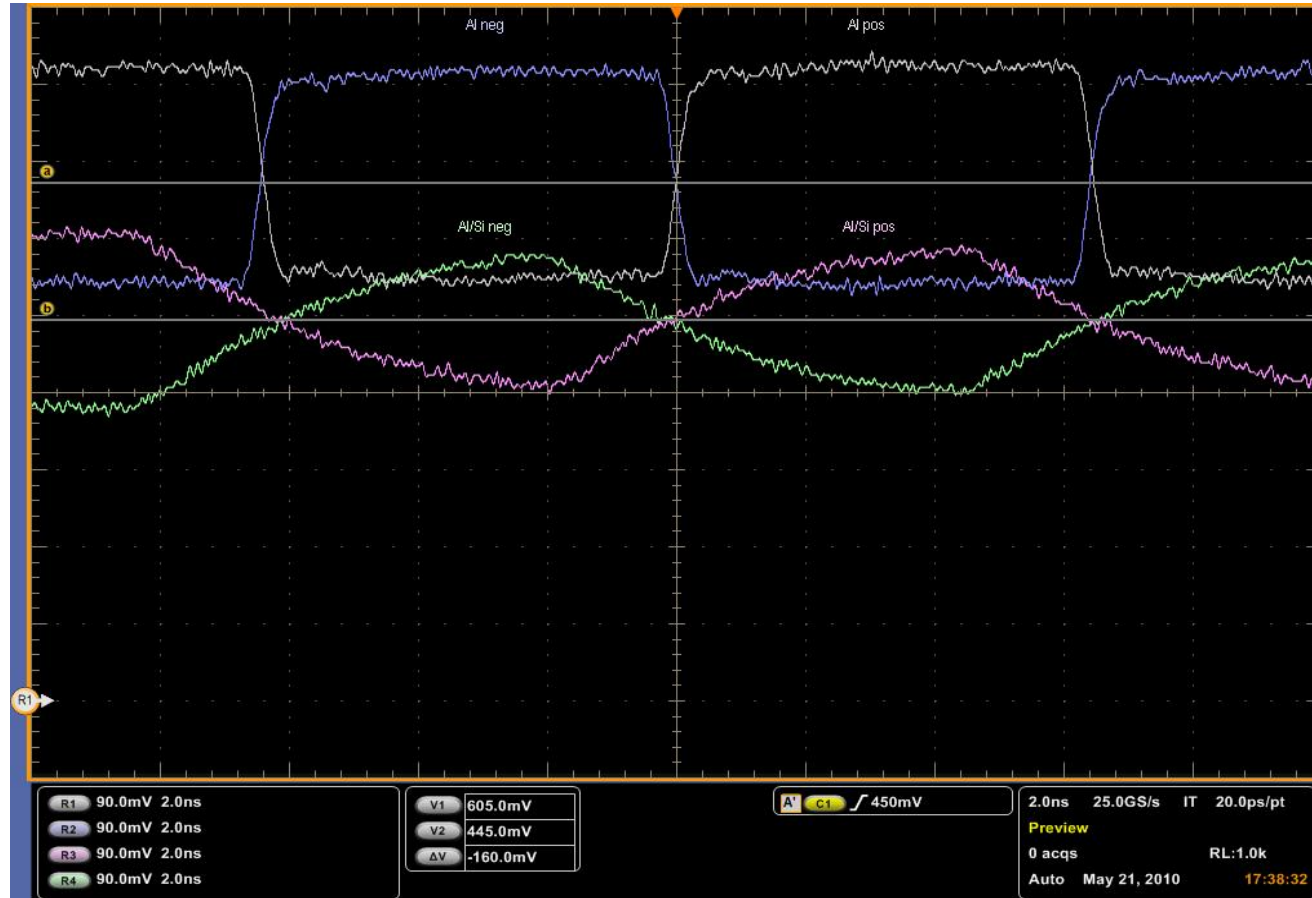


Mean total jitter, relative to a board connected in loopback mode, to study the influence of the wirebond number on the transmission quality of the data link.

All measurements was performed with the receiver circuit.

# Results from prototypes (4).



Concerning the Techfab cables, due to some problems on connection, a new cable was made with an Al/Si alloy, but it presents a very large linear resistance that reduces the voltage swing and the common mode. The eye diagram becomes closed generating errors, starting from 622Mb/s.
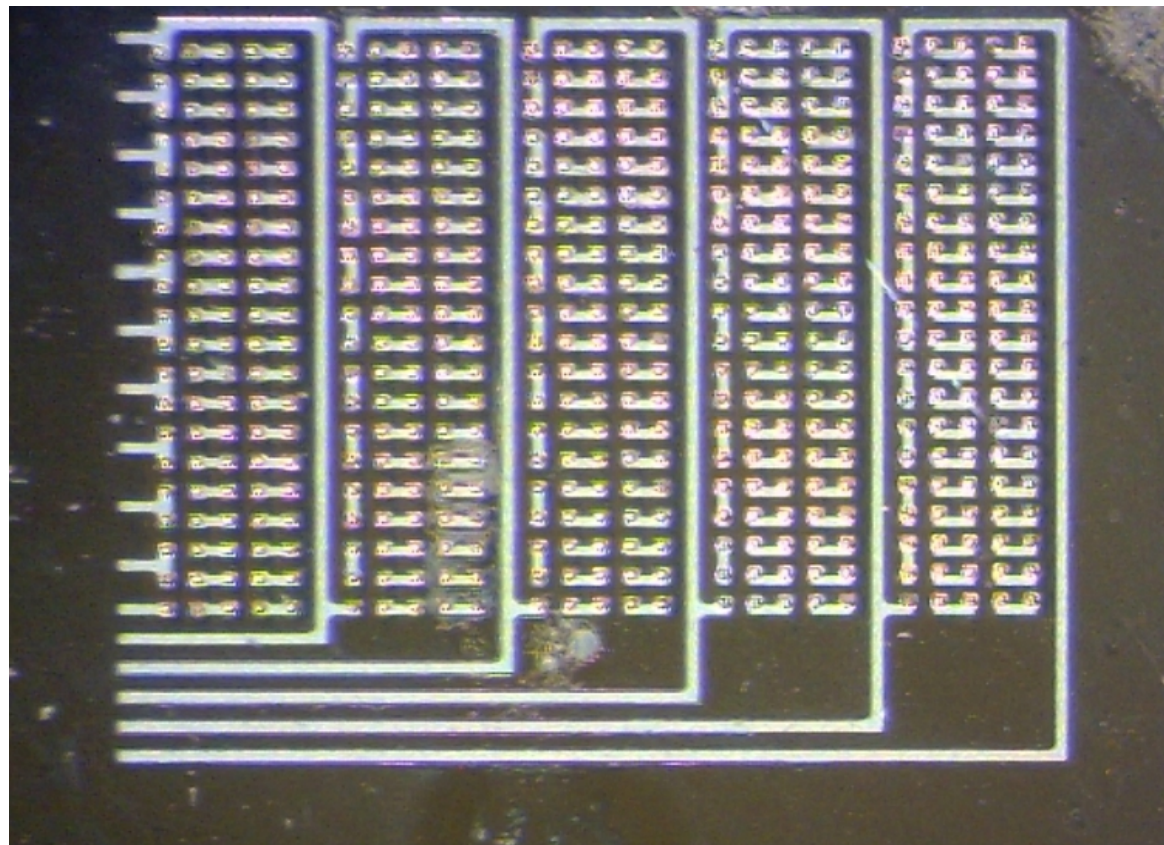
# Bus prototype.

SMD capacitors soldering:
partial success with a low yield, due to the disconnection of many aluminum pads and components.

Copper via:
the large measured value r=200Ω looks related to a rough mask alignment, and has to be repeated.

# Short summary.

- Both providers, Techfab and Cern, can produce cables that are working up to 2Gb/s.

- Techfab samples show some difficulties for the bonding process, and present a large linear resistance.

- The first bus prototype, for connection of the readout chip, needs improvements on the mask alignment and soldering capability for the SMD components.

- Next steps will be the production of cables with a linear layout, and some test without transceiver to verify the intrinsic feature of the differential pair.