Optical Link for Radar Digital Processor

Focused Research: M. Chang, A. Davidson, G. Emmel, R. Marsland*, M. Nesnidal, R. Williamson

Collaborators:

Prof. M. Rodwell (UCSB),

M. Dagerstrom, G. Fokken, D. Schwab (Mayo Foundation)

*rmarsland@newfocus.com

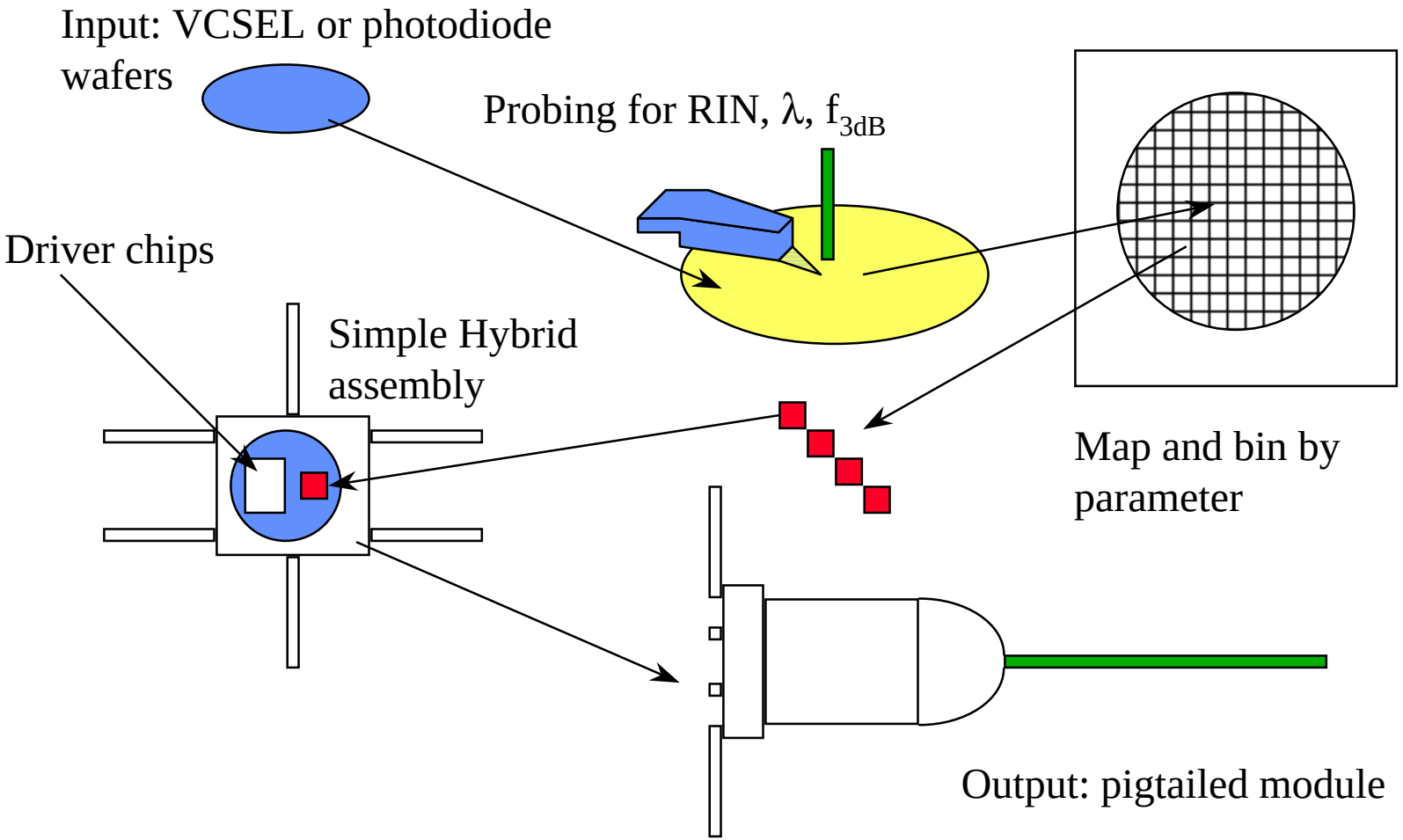
Optical MicroNetworks (OMNET)

- Develop dense (Gbps/10 mm sq.),
- low power (<50 mW/Gbps) optoelectronic transceivers and associated micro network (passive optical interconnect fabric polymer waveguide distribution circuits) which will
- cost effectively ($10/Gbps) replace copper cabling as interconnects to the 1 meter scale in future military platforms.

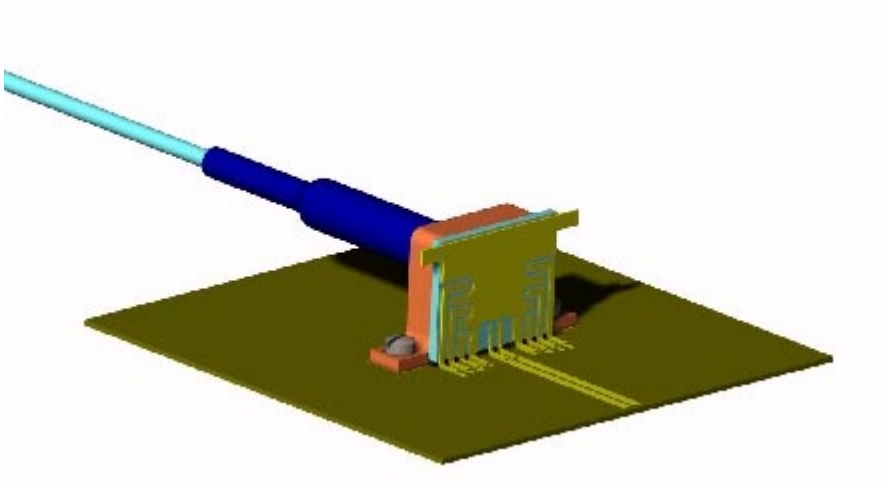
Optical link for Radar Digital Processor key program elements

- 10 Gbit/s 850-nm multi-mode VCSELs
- Low cost, high performance packaging approach
- Differential electrical interface
- High efficiency photodiode
- TIA insensitive to photodiode capacitance
- Integrated RX and TX interface chips in bipolar (SiGe or GaAs) technology
- Cost effective for 2 to 50-m links (ship mast, Harrier wiring harness)
- "flyable"

Approach


Input: VCSEL or photodiode wafers
Probing for RIN, λ, f_{3dB}
Driver chips
Simple Hybrid assembly
Map and bin by parameter
Output: pigtailed module

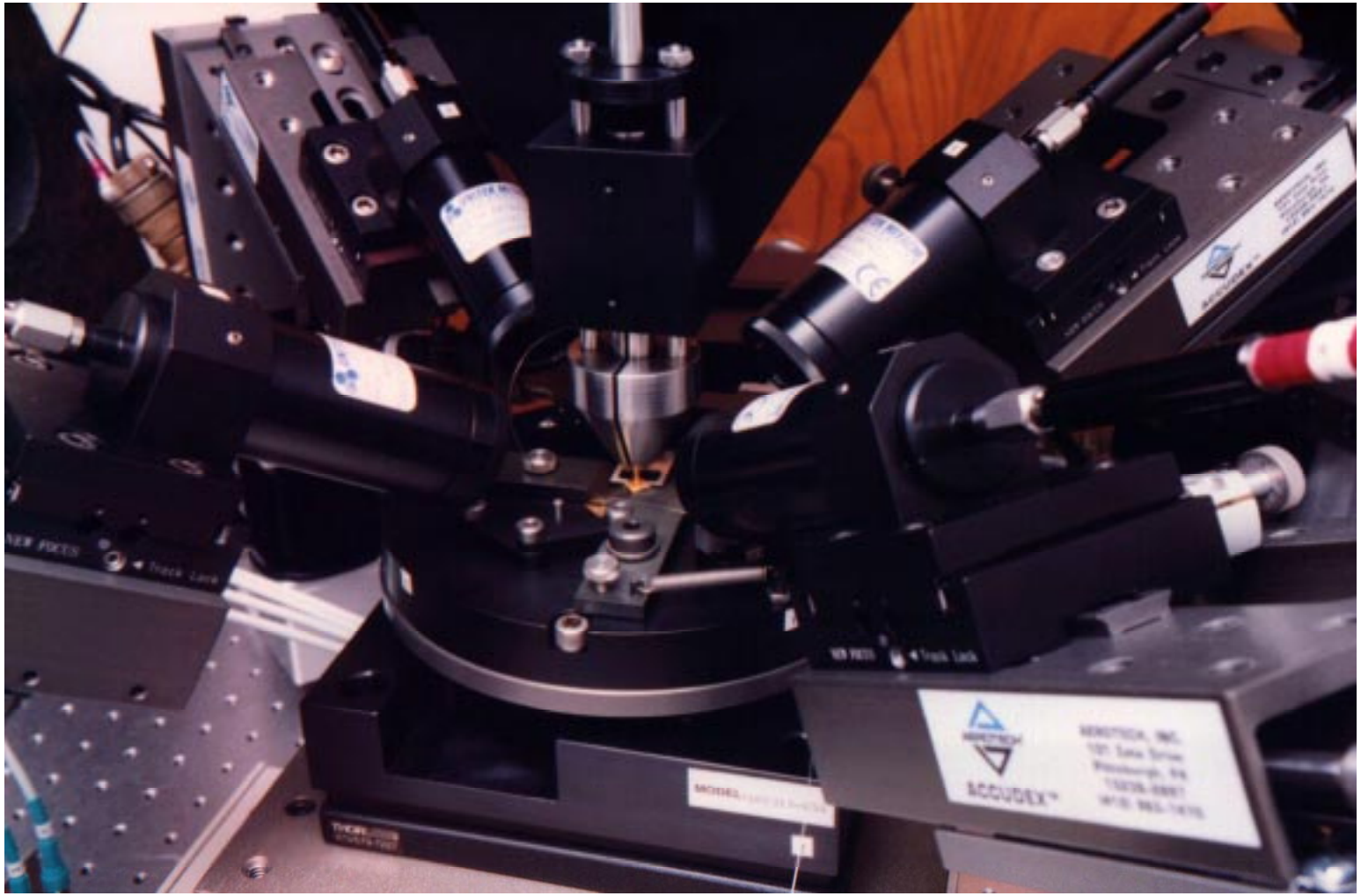
Differential Interface Package



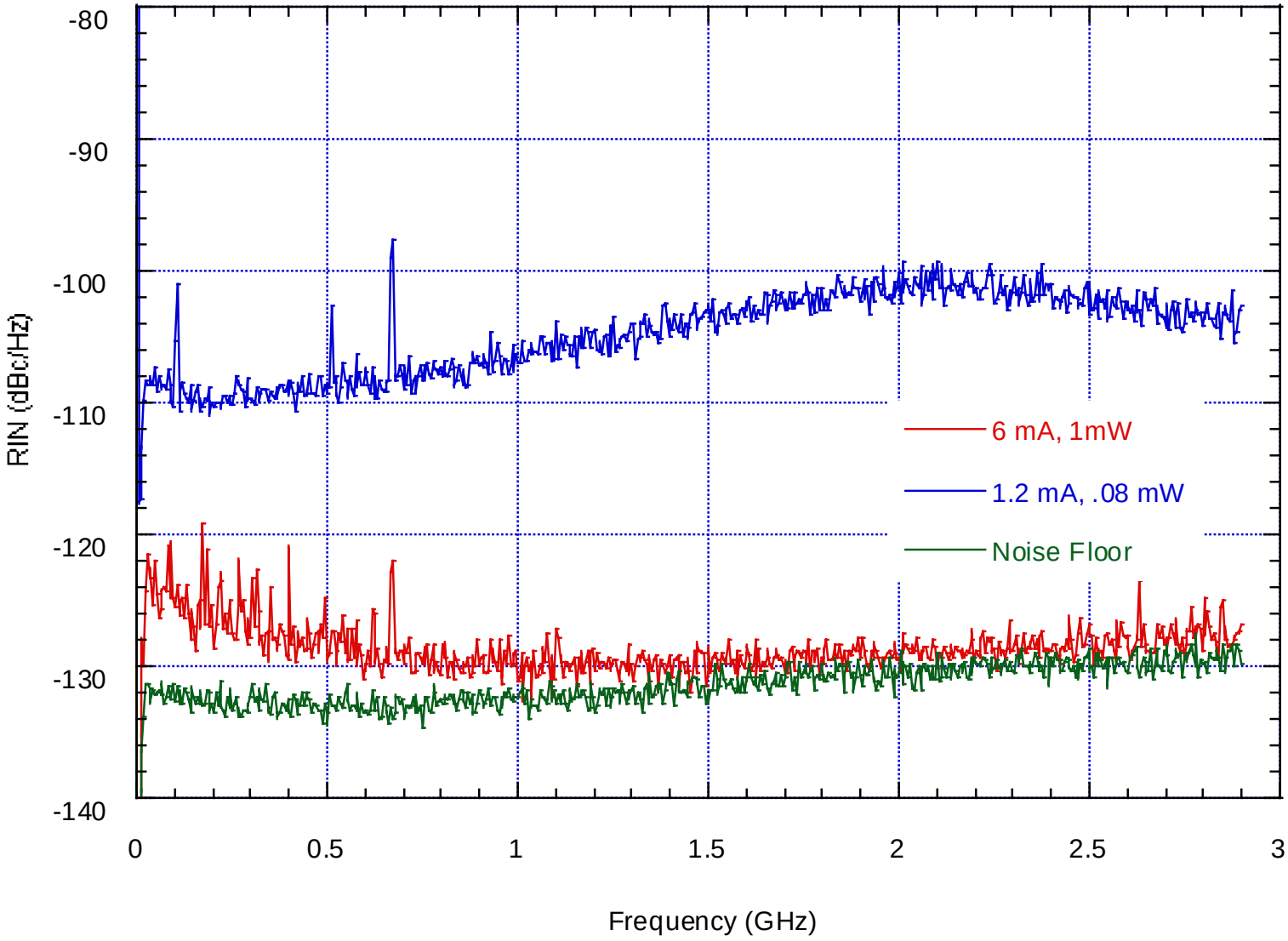
- Uses surface-mount microwave package
- Hermetically sealed
- Differential interface for both receiver and transmitter

- Can be mounted in both in-plane (shown) and out-of-plane configurations
- In-plane version: height only 0.25"

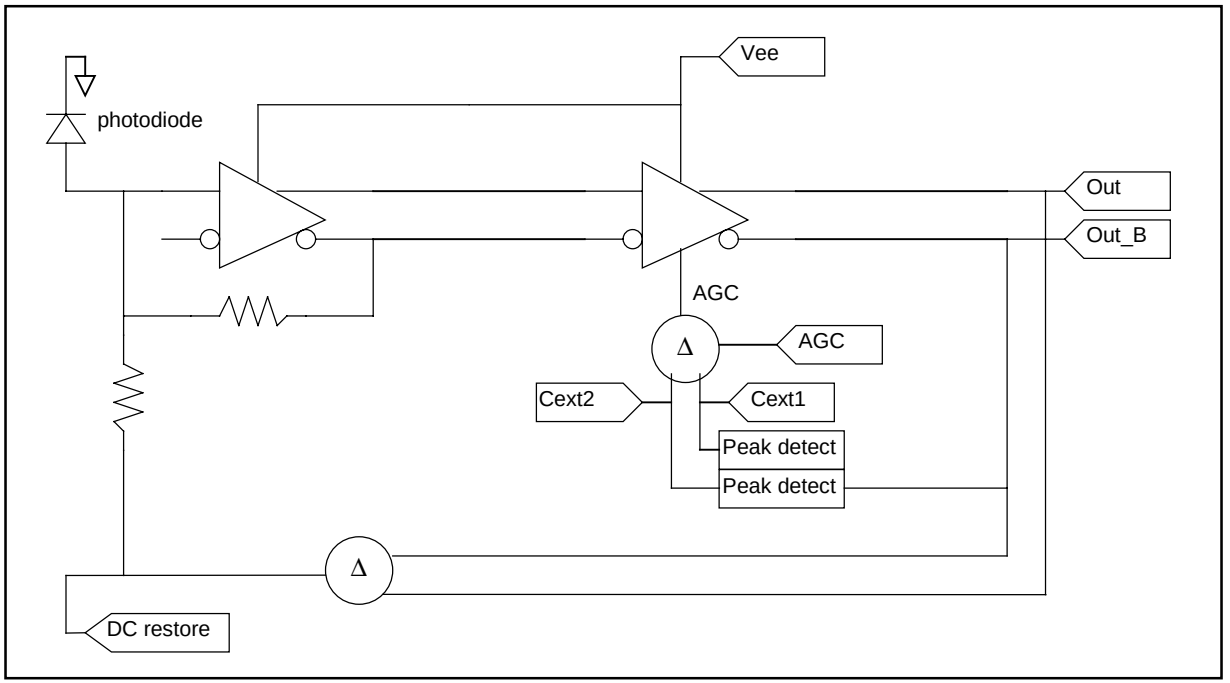
Laser Welder for surface-mount parts w/ four-fold symmetry and 10 Gbit/s package interface



On-wafer measurement of RIN in MODE VCSELs



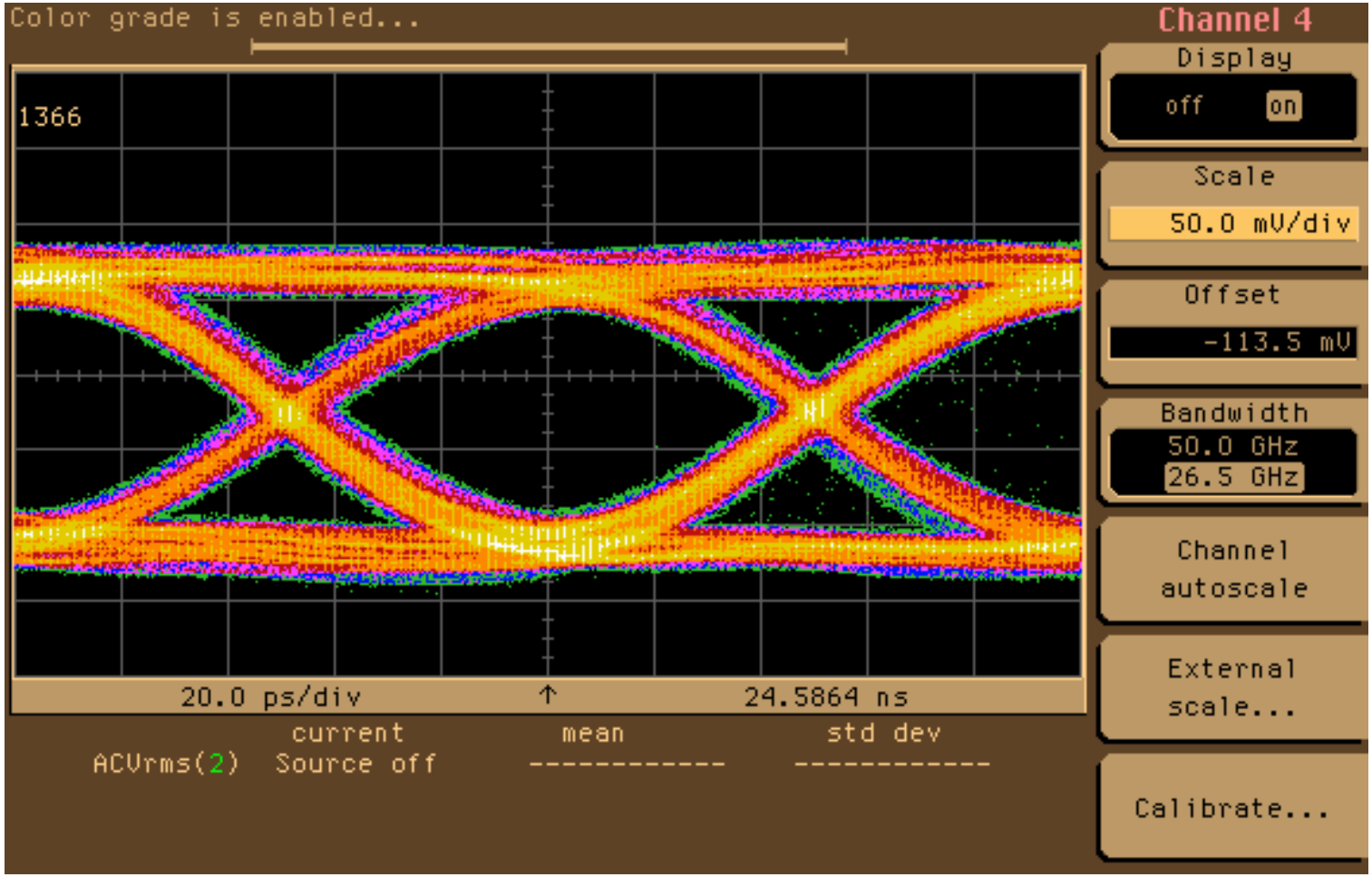
RX simplified schematic



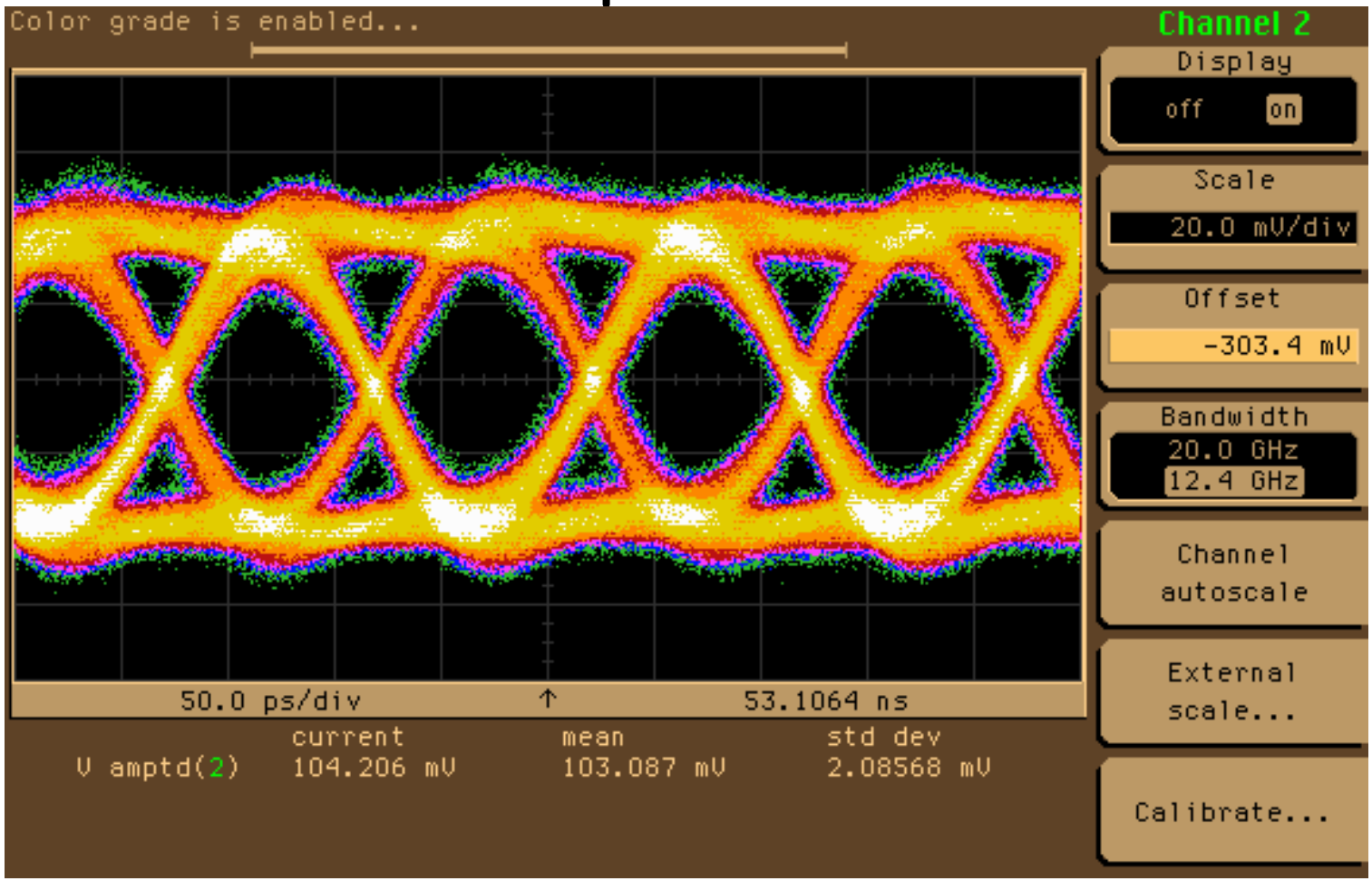
- Automatic Gain Control
- DC Restore
- DC coupled
- Differential

- Insensitive to PD capacitance < 0.5pF
- Minimum external components
- Portable to other bipolar technologies
- 200 mA, 5.2V operation w/ GaAs HBT

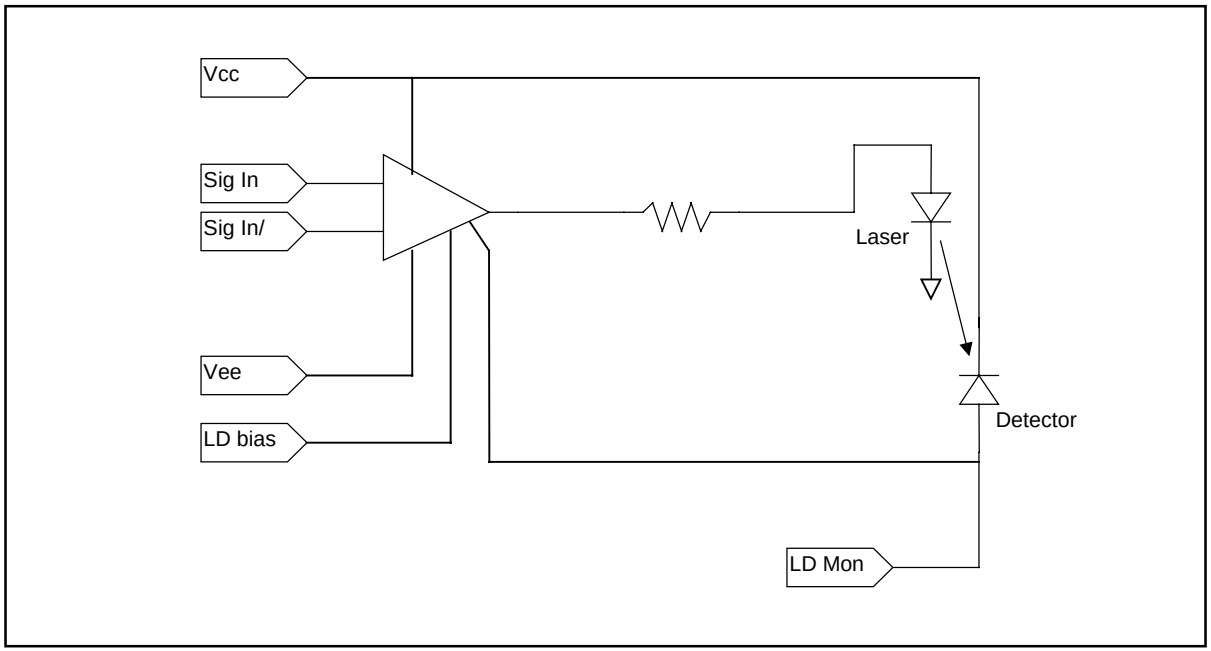
Output of Giga Mux-Demux evaluation board fed by Vitesse 622 Mbit/s PRBS generator



RX output when driven by 10mV p-p 10 Gbit pattern



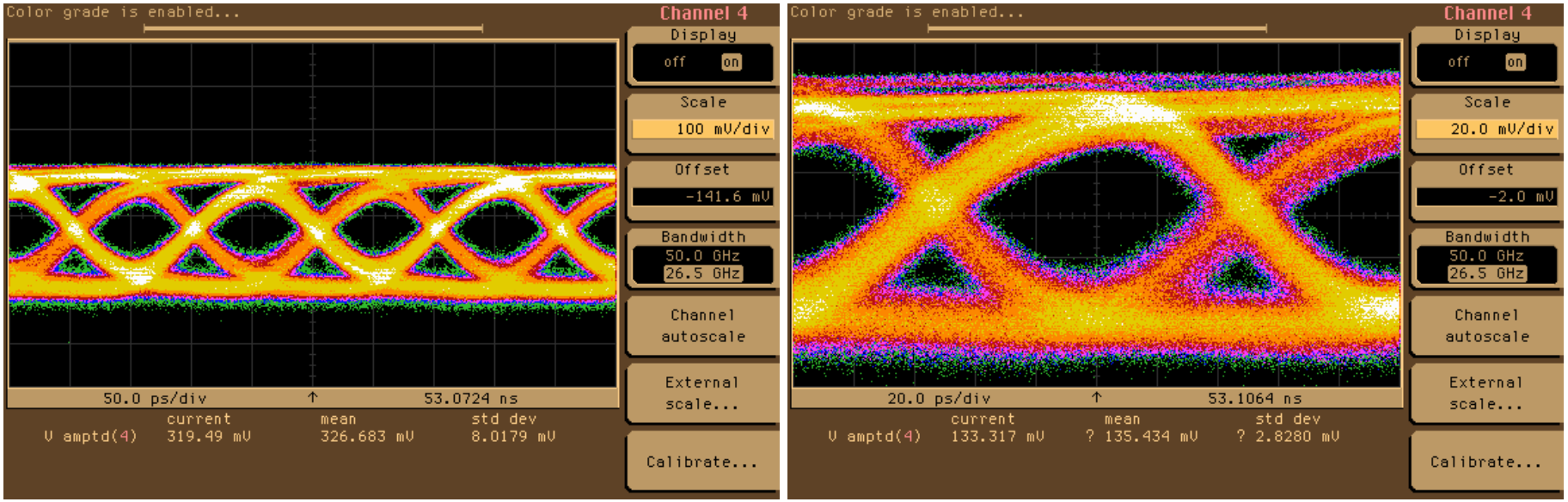
TX simplified schematics



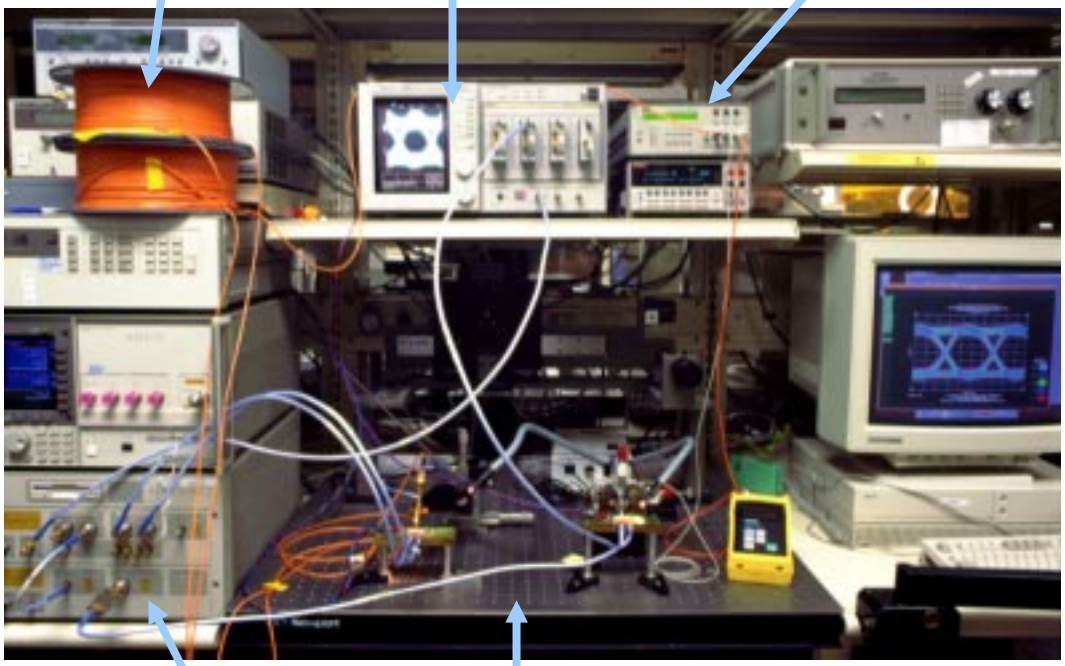
- Differential CML input
- DC coupled
- Plus and minus supply

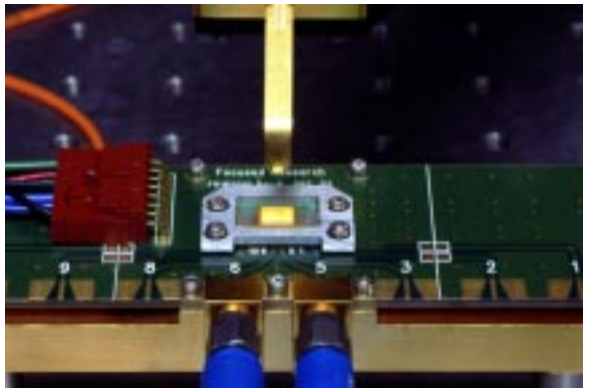
- 40 mA supply current
- Present design runs at 5.2V

Preliminary TX testing 200-mV differential TX drive, 6 mA p-p VCSEL modulation

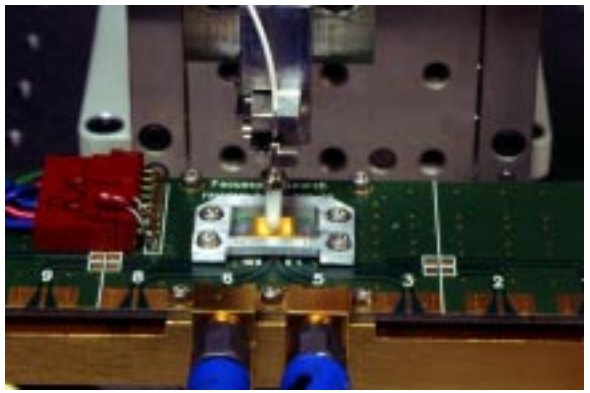


Testing at Mayo Foundation



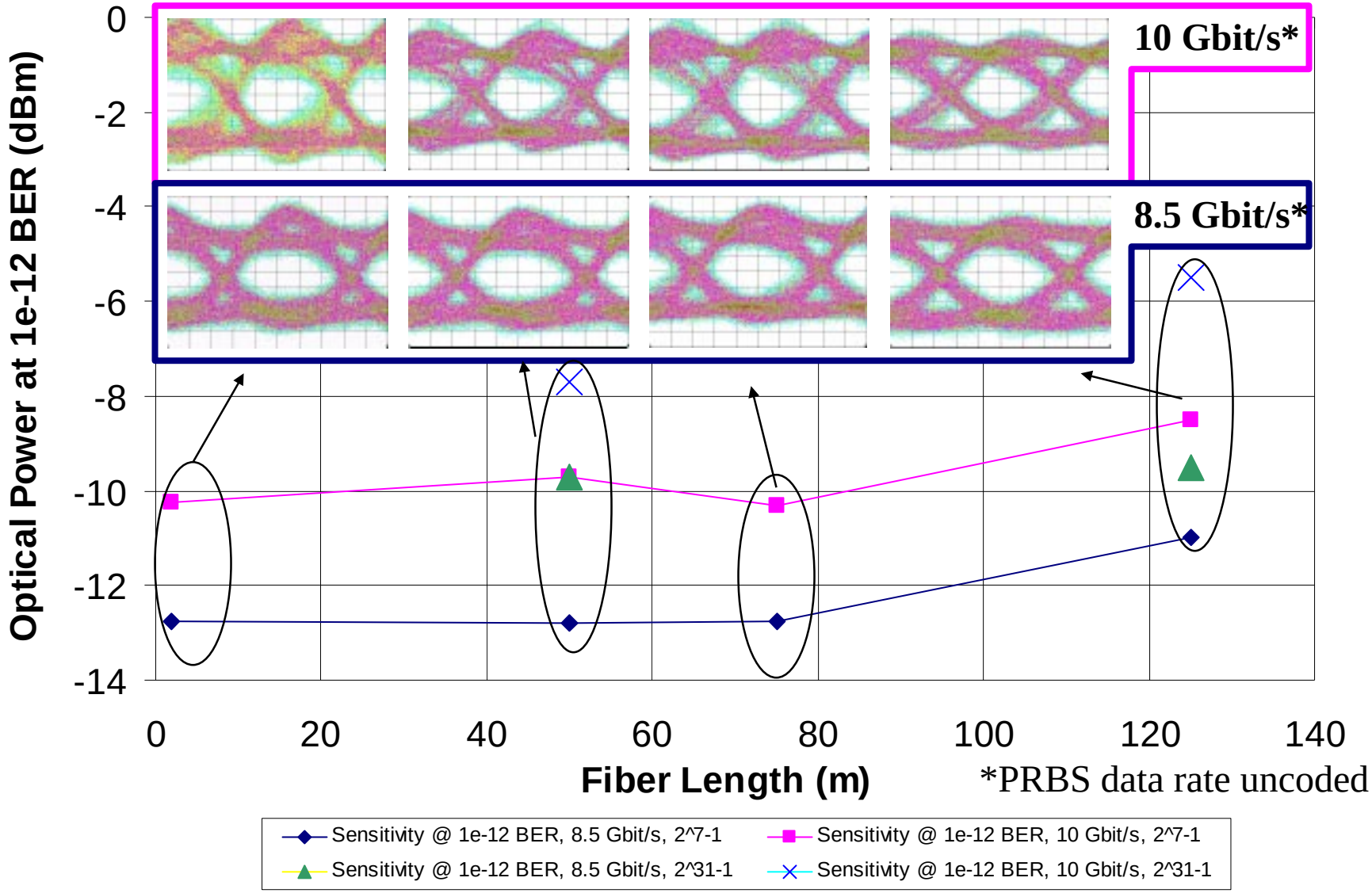


Packaged 10um VCSEL/TX on test fixture



Packaged PD/TIA-AGC on test fixture

Transceiver Testing w/ 50-125 μm fiber



Suggestions

- Don't assume that the short links (eg. Server connections) are copper
- Consider new markets such as Tbit switch wiring as well as existing LAN applications
- Relax extinction ratio spec (6 dB) to facilitate inexpensive serial TX
- Fiber pigtail approach for smaller package, reduced emi