



Test Results on Optical Link Components

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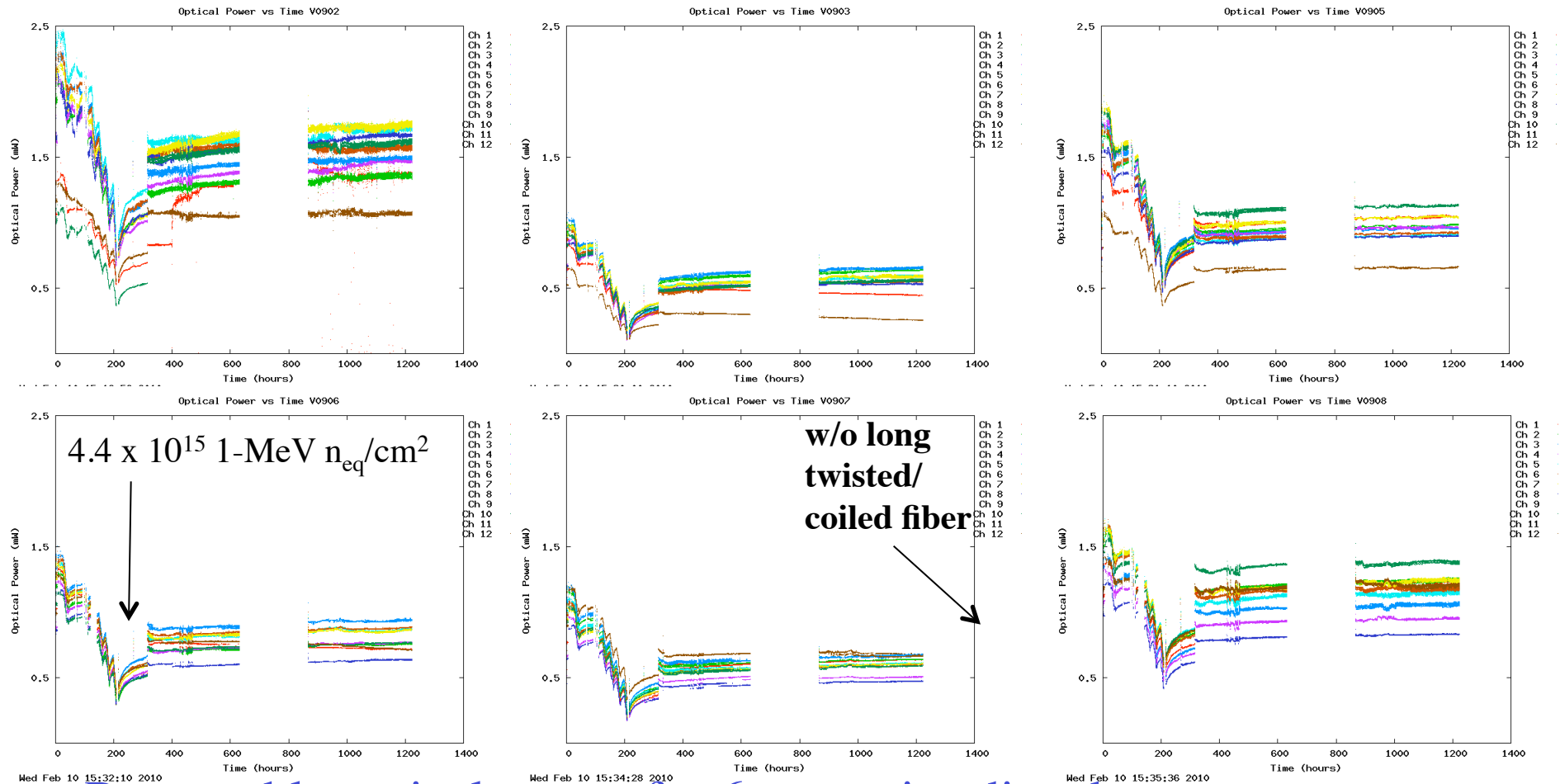


Outline

- Introduction
- Radiation hardness of VCSELs
- Radiation hardness of PINs
- Skinny wire test with opto-board
- Summary



AOC 10 Gb/s VCSEL



Med Feb 10 15:32:10 2010

Med Feb 10 15:34:28 2010

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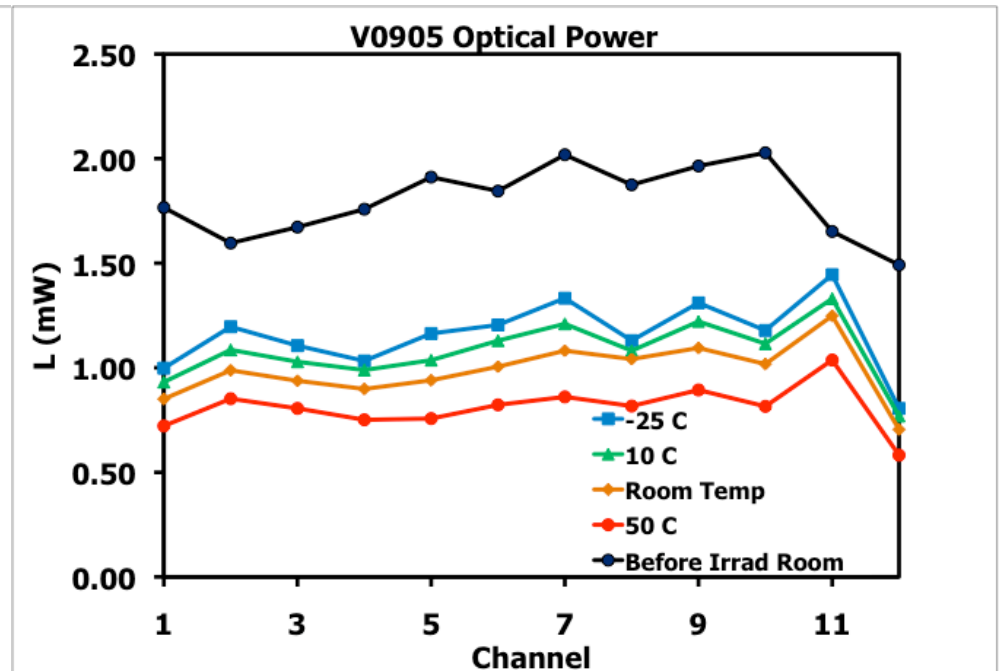
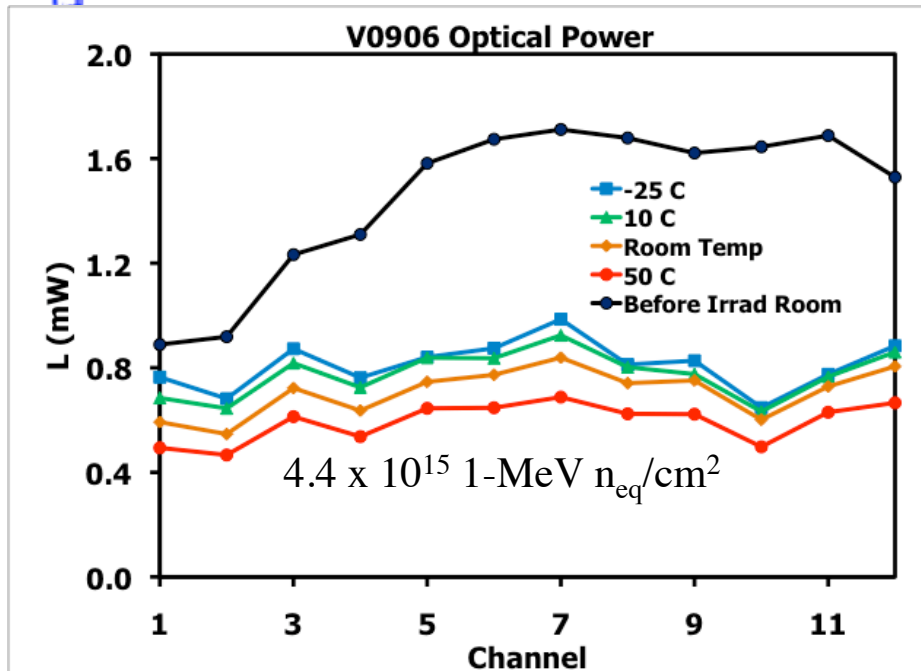
- Reasonable optical power for 6 arrays irradiated
- slow recovery of optical power during annealing
- ⇒ need to irradiate a sample of 20 arrays in 2010

K.K. Gan

IBL General Meeting



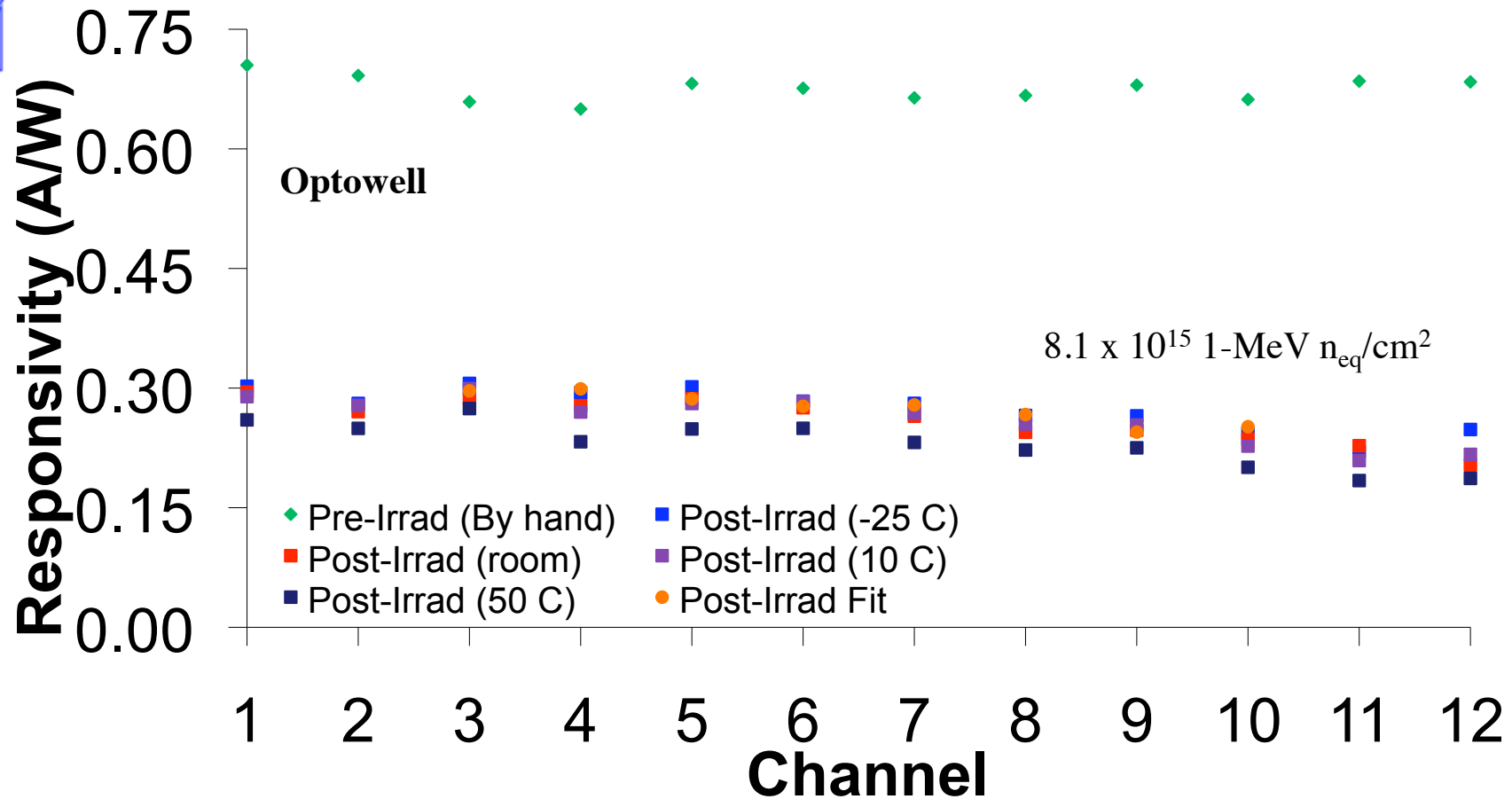
VCSEL Power vs Temperature



- Cooler VCSEL produces more optical power
- ⇒ Keep opto-board at ~ 10 C?



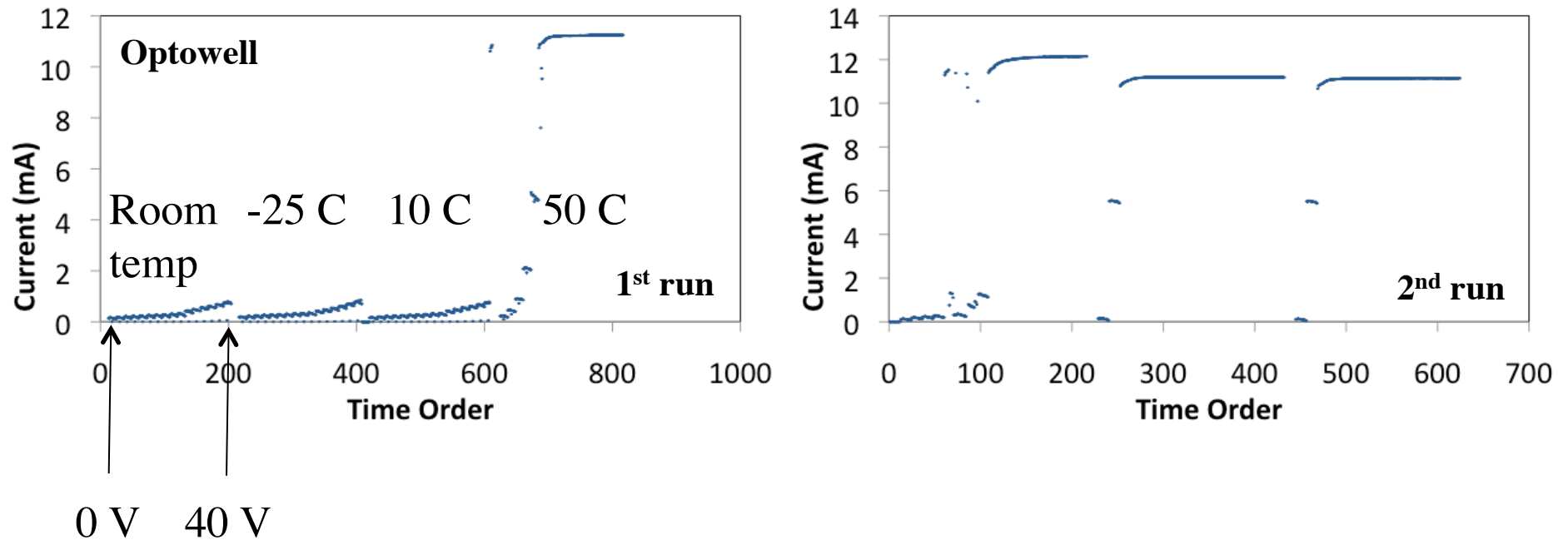
PIN Responsivity vs Temperature



- Responsivity is slightly higher at lower temperature
- VCSEL and PIN have similar temperature dependence
- ⇒ Keep opto-board at $\sim 10 \text{ C}$?



PIN Current vs Bias Voltage



- Sudden breakdown in PIN current during ramping of bias voltage
- Once broken, entire array has high leakage current even at low voltages

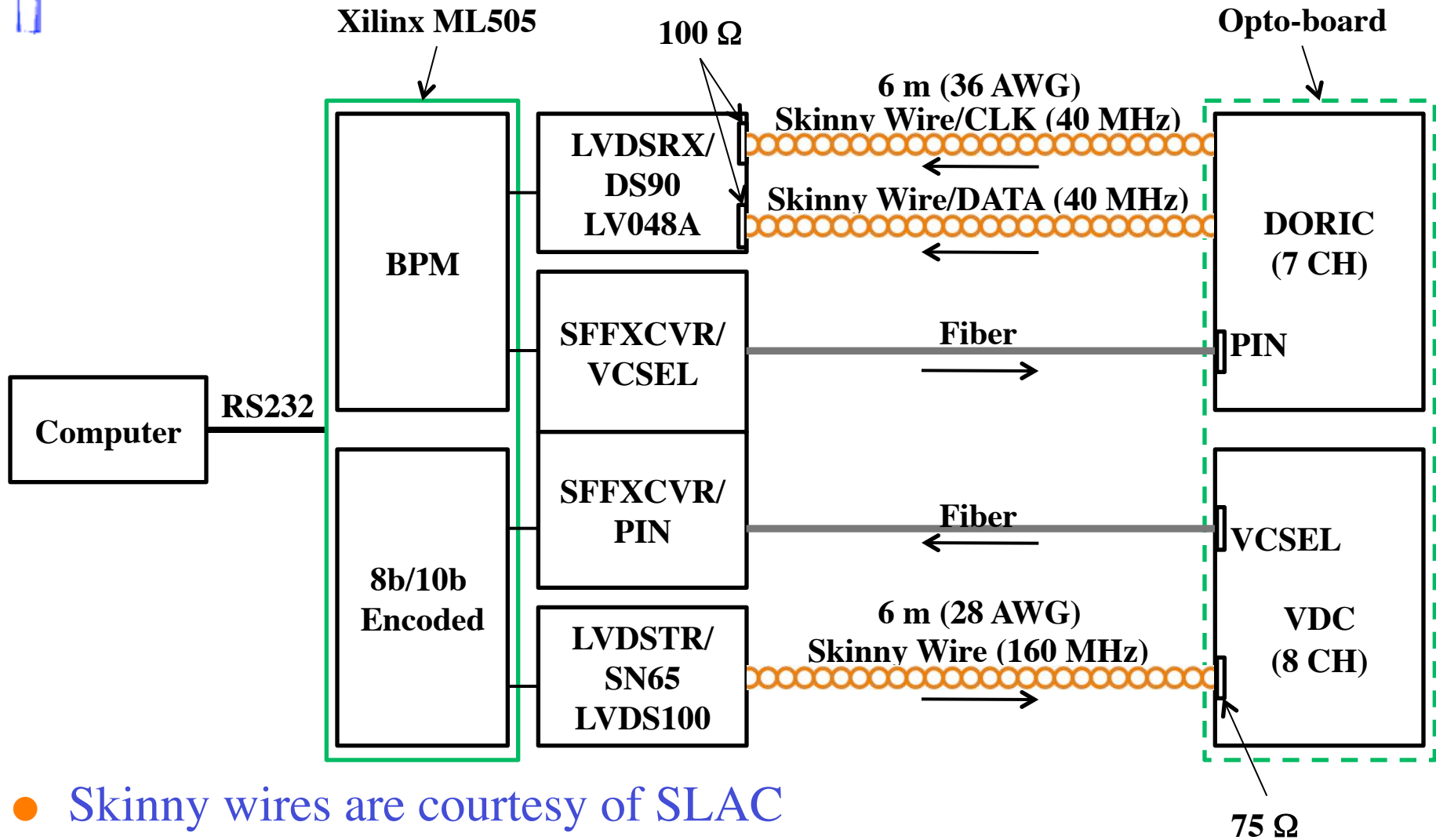


PIN Leakage Current Problem

- Three out of 20 irradiated Optowell PIN arrays are now inoperable due to high leakage current
- Cause of breakdown unknown:
 - ◆ devices are not actually capable of operation at 40V as claimed by vendor?
 - ◆ did radiation damage reduce the operation voltage?
- Recovery plan:
 - ◆ need to purchase/package a large sample of Optowell arrays (> 20) for bias current study followed by irradiation in summer 2010
 - communicate with vendor
 - ◆ need to purchase/package a large sample of arrays (> 20) from a second vendor (ULM) for irradiation in summer 2010
 - ◆ have made funding request to US ATLAS



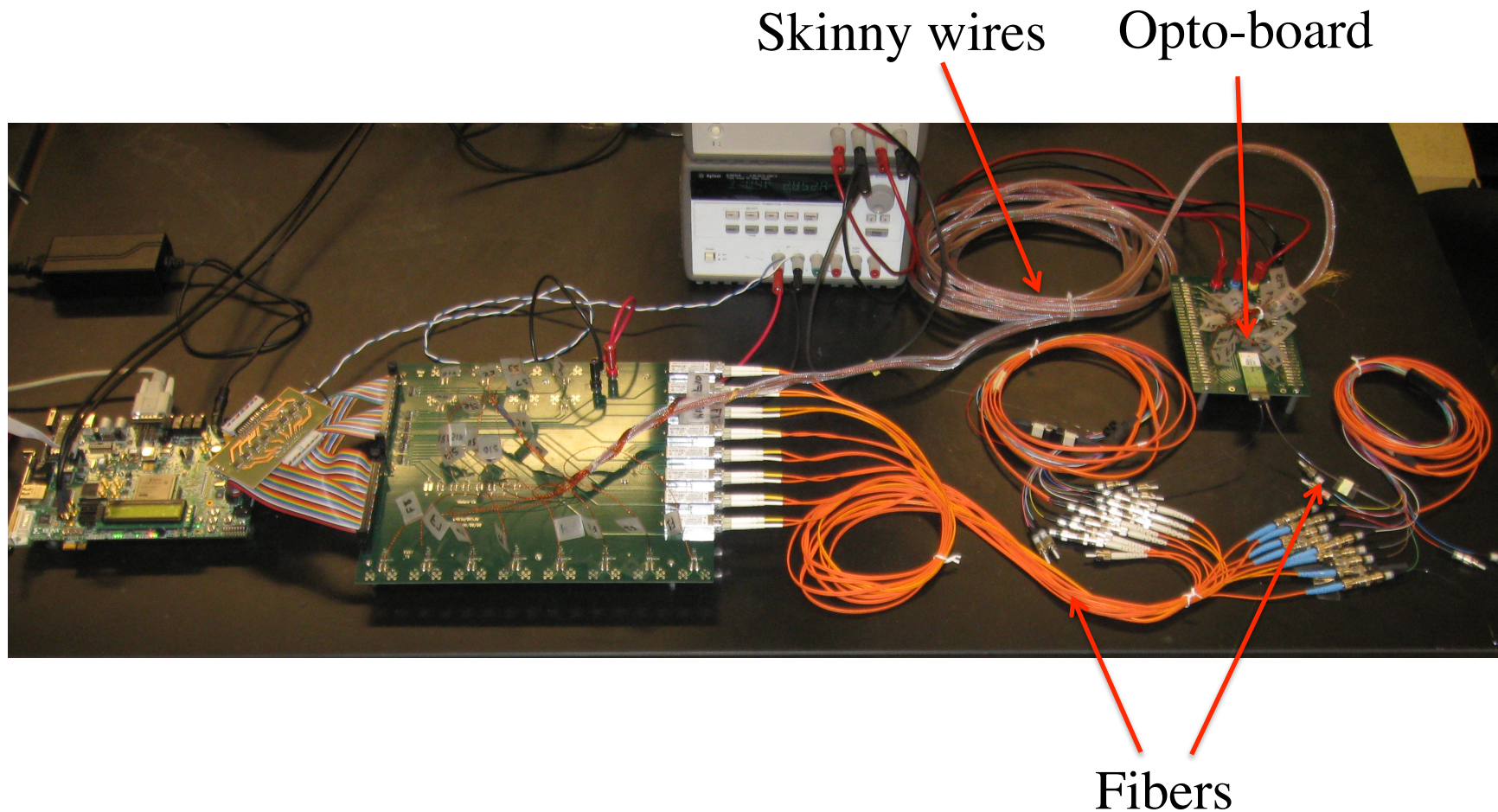
Skinny Wire Test Setup



- Skinny wires are courtesy of SLAC

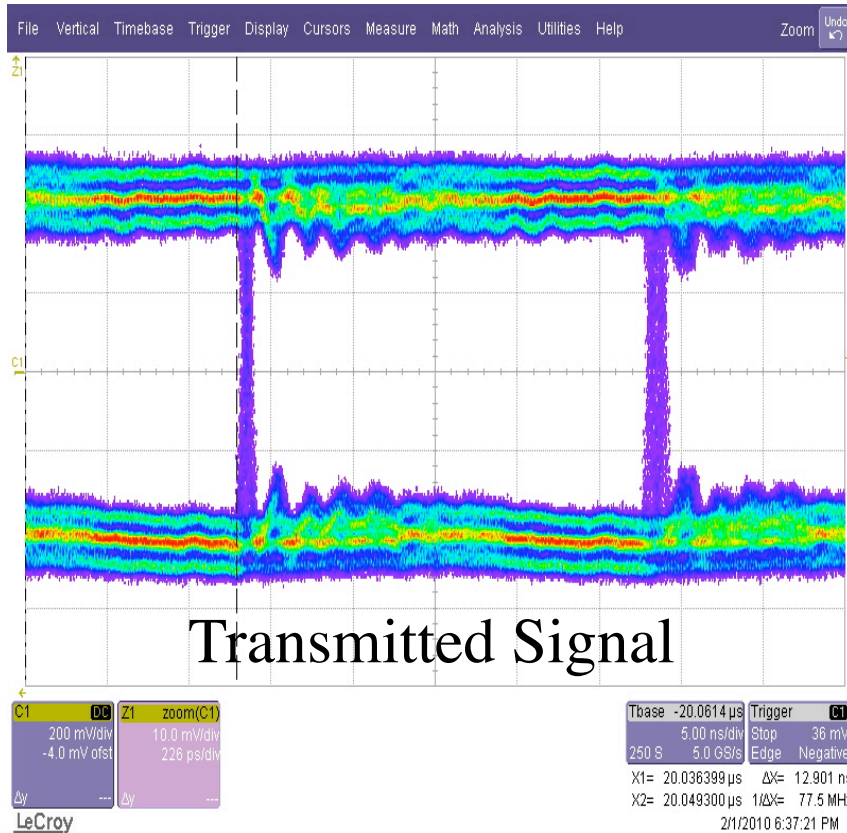


Skinny Wire Test Setup

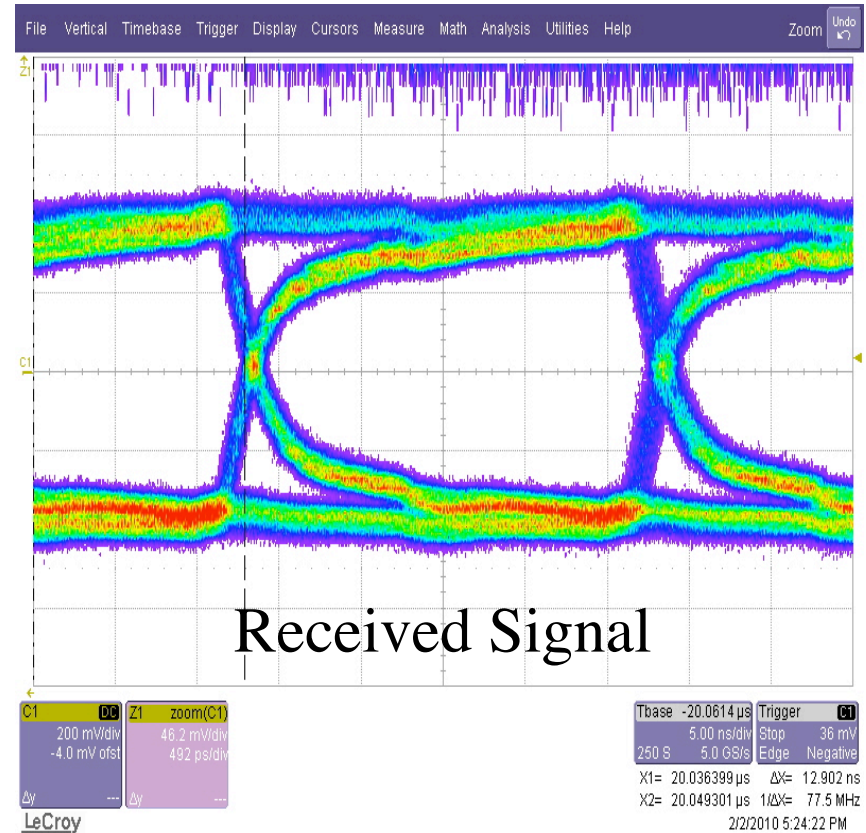




TTC Data (40 MHz) Eye Diagram



Transmitted Signal

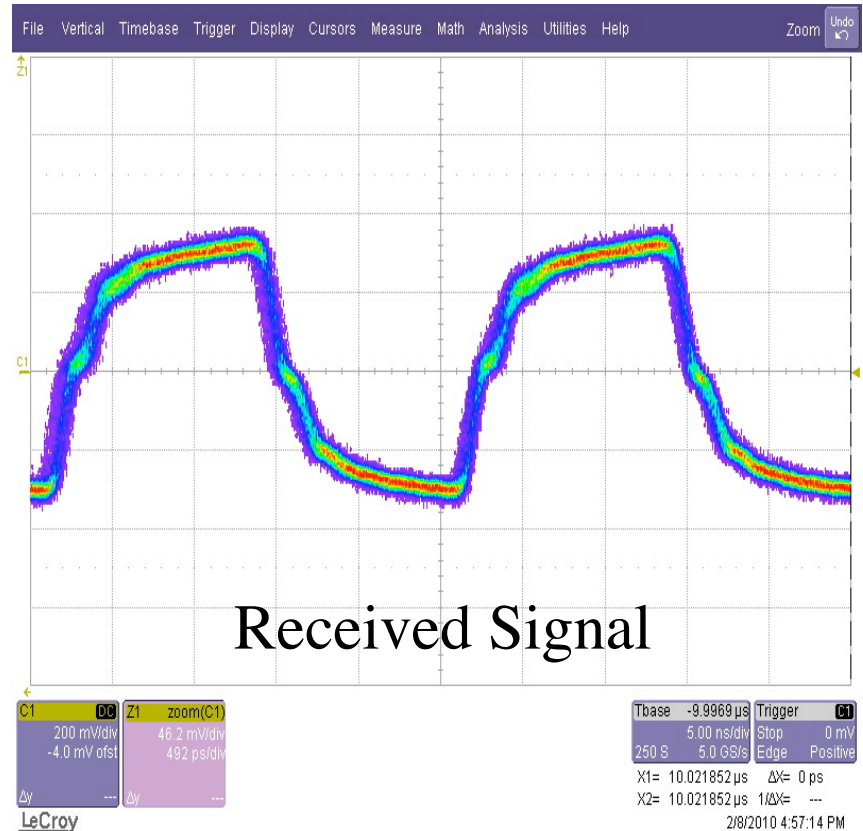
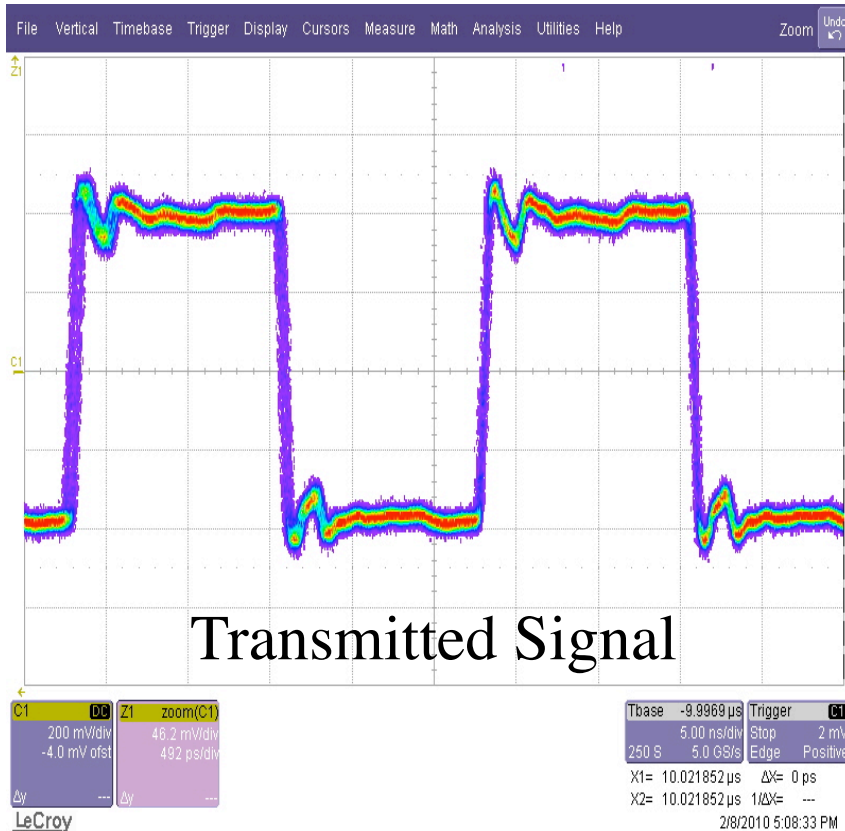


Received Signal

- All channels (7 TTC, 7 clock, 8 data) active
 - ◆ other TTC channels look similar
 - ◆ $BER = 0/2.1 \times 10^{13}$



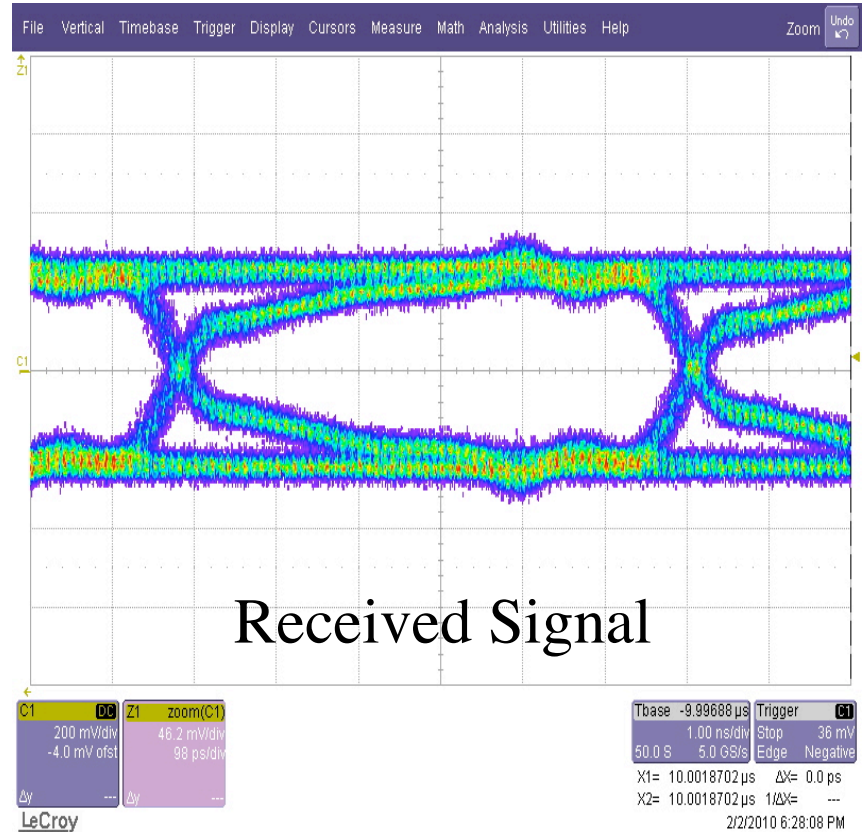
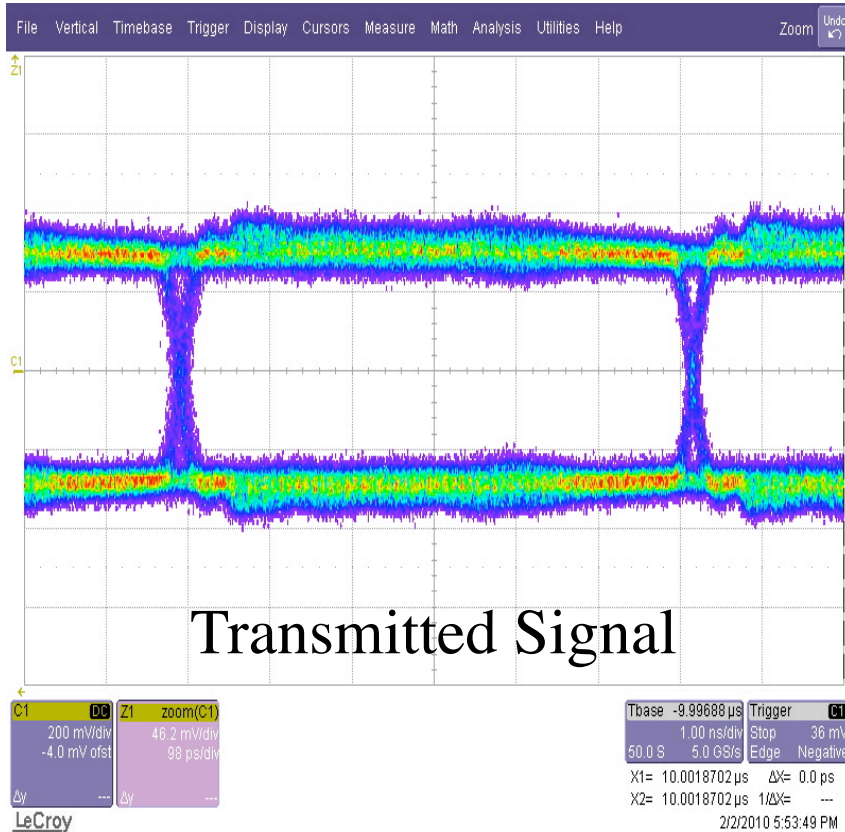
Clock (40 MHz) Eye Diagram



- All channels (7 TTC, 7 clock, 8 data) active
- ◆ other clock channels look similar



Data (160 MHz) Eye Diagram



- All channels (7 TTC, 7 clock, 8 data) active
 - ◆ other data channels look similar
 - ◆ $BER = 0/8.2 \times 10^{13}$



Summary

- VCSEL and PIN have similar temperature dependence
 - ◆ good to operate the devices at room temperature or lower
- 3 out of 20 Optowell PIN arrays broken
 - ◆ need further investigation and second vendor
- Skinny wires tested with opto-board and commercial LVDS receiver and transmitter
 - ◆ transmitted signals look quite reasonable