



Accelerated Lifetime Test of Opto-Boards

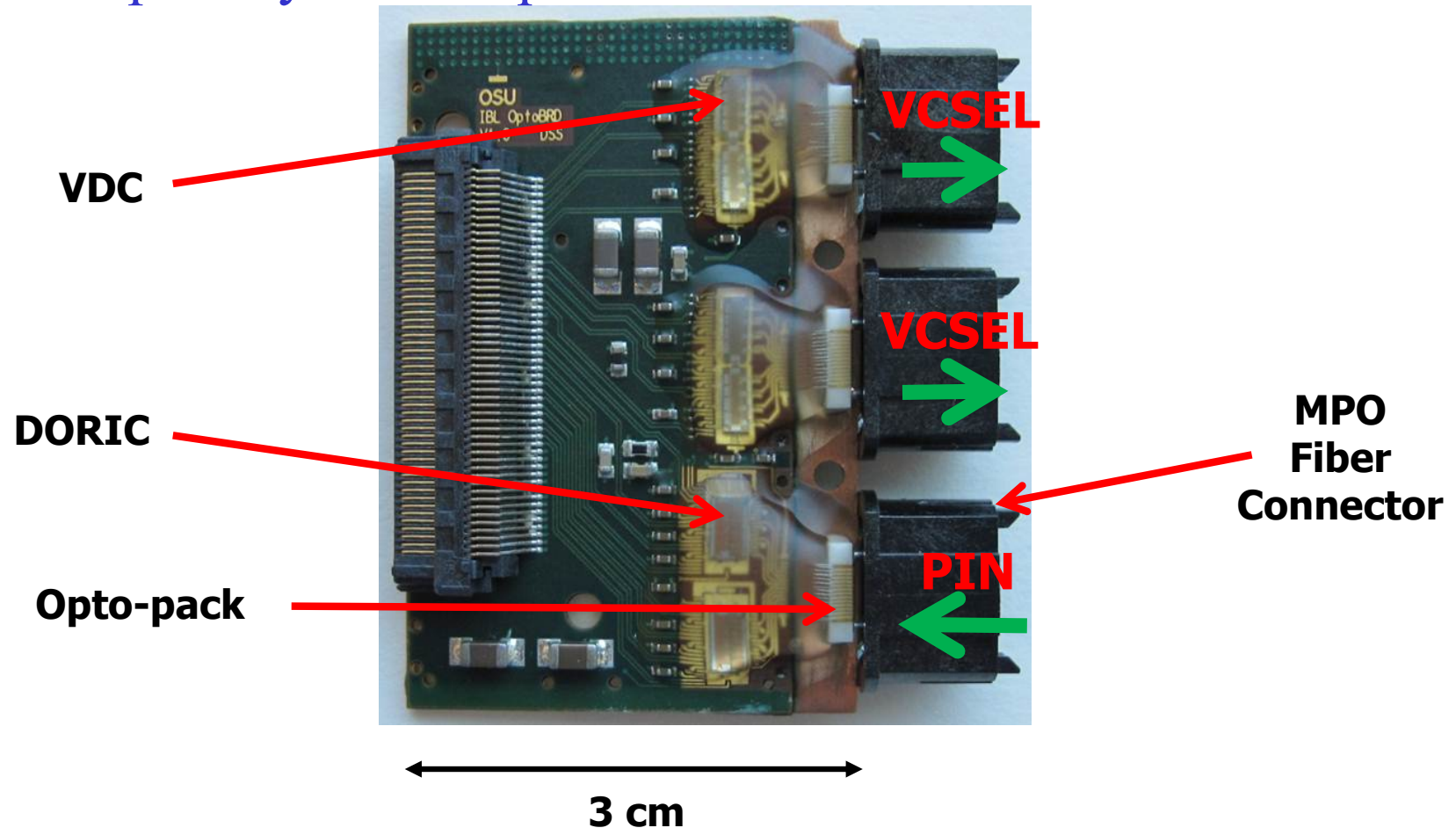
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Opto-Board

- Opto-boards transmit and receive data optically to/from pixel detector





Production Summary

- Opto-board production completed in spring 2022
- 408 boards produced
 - ◆ 1st class boards: 403
 - ◆ 2nd class boards: 5

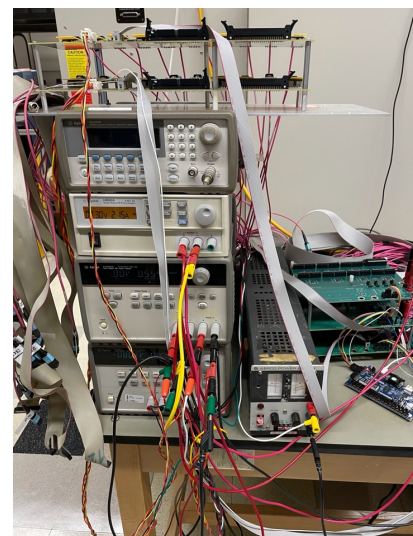
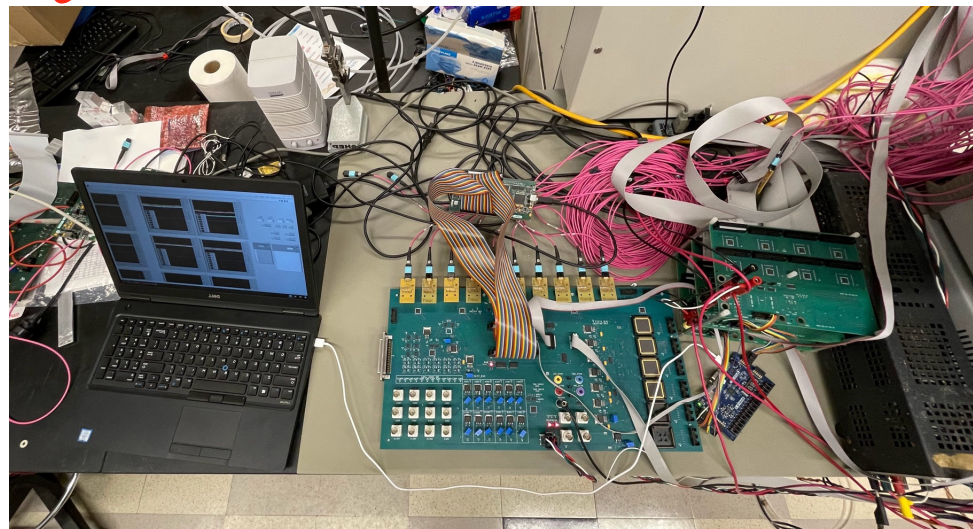


Accelerated Lifetime Test

- Industry standard: opto-boards should survive for 1,000 hours at 85°C/85% relative humidity
- test 7 opto-boards from production batch
 - ◆ use boards with broken DORIC/PIN
 - no monitor of DORIC
 - ◆ # channels: 7 x 2 arrays x 7 channels = 98 VCSELs
 - ◆ operate each VCSEL with 10 mA (pk-pk)
 - ◆ monitor VCSEL optical power



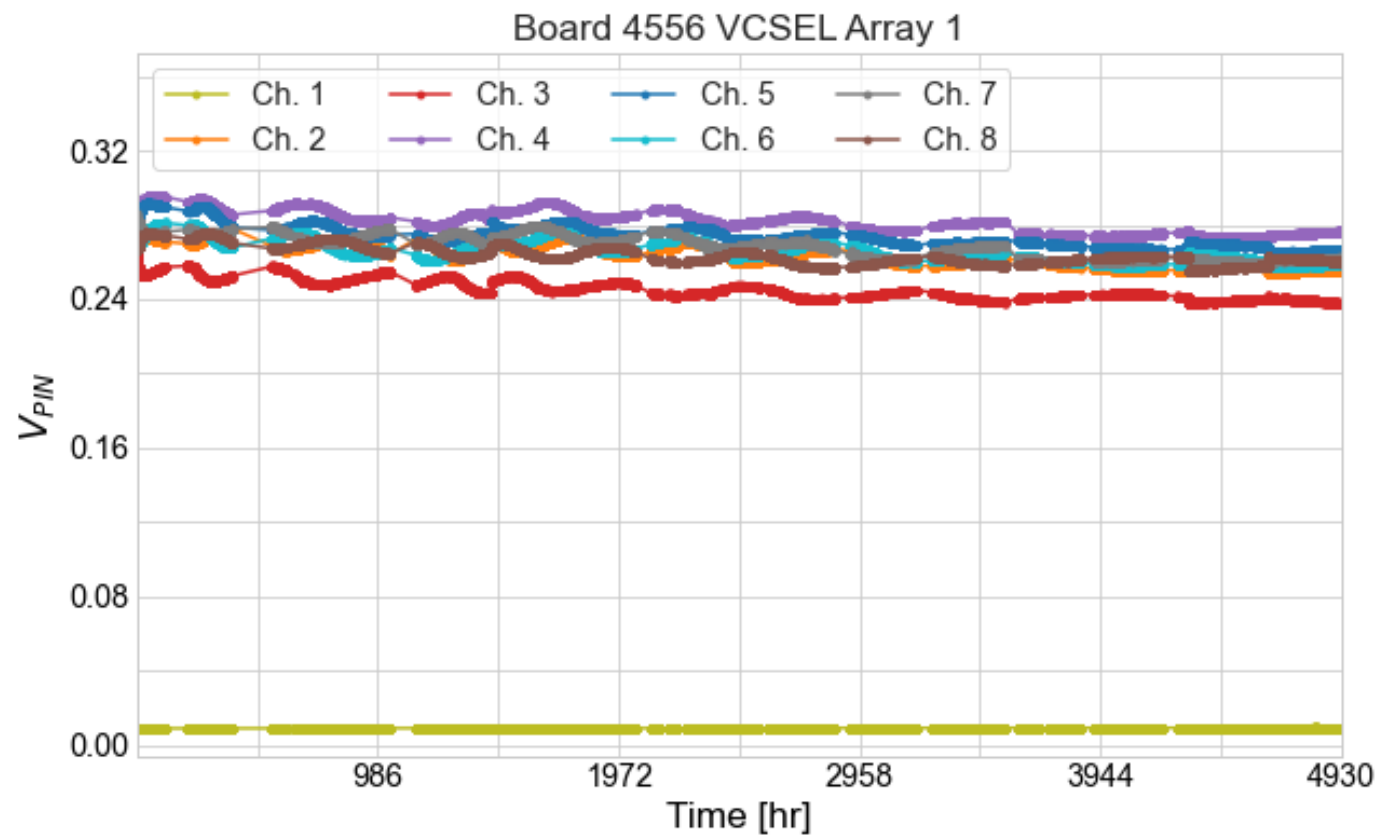
Test System



Environmental chamber



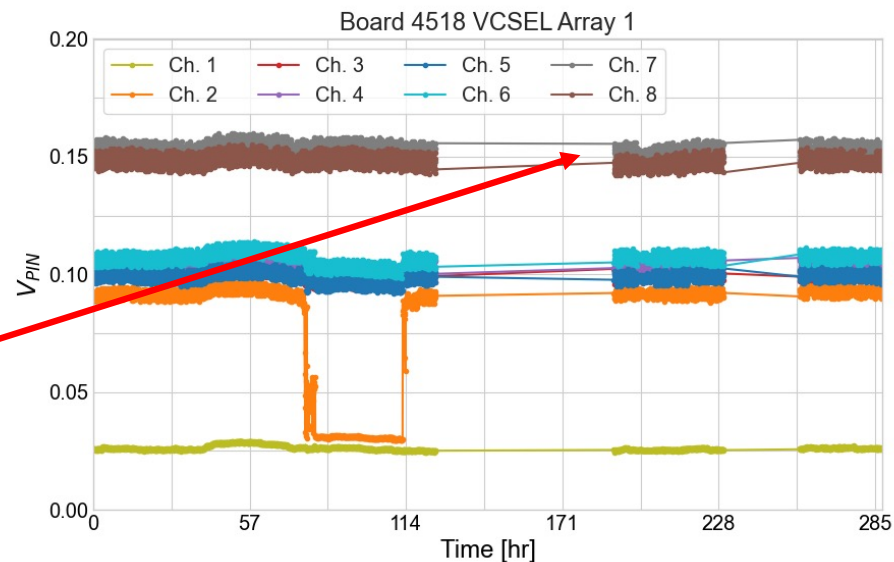
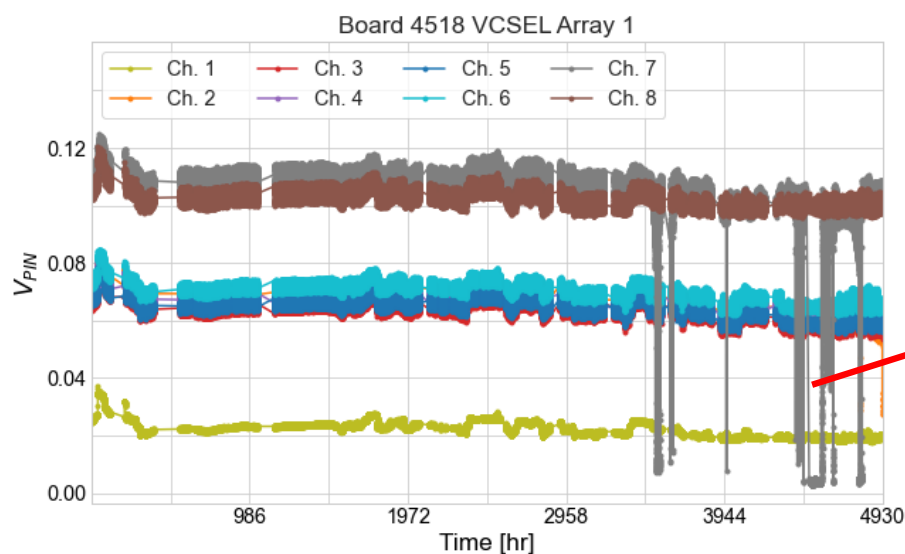
Result



- Board with 7 channels survived to 5,000 hours



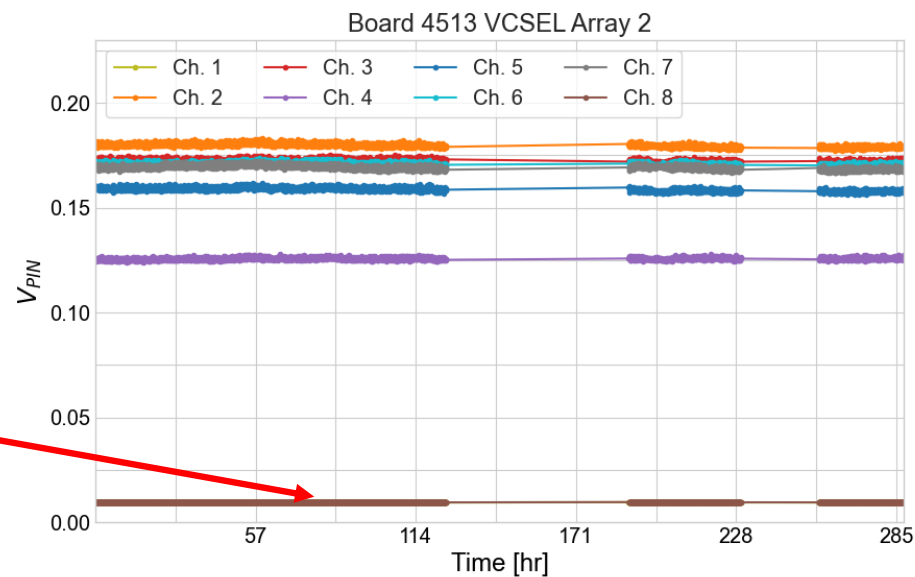
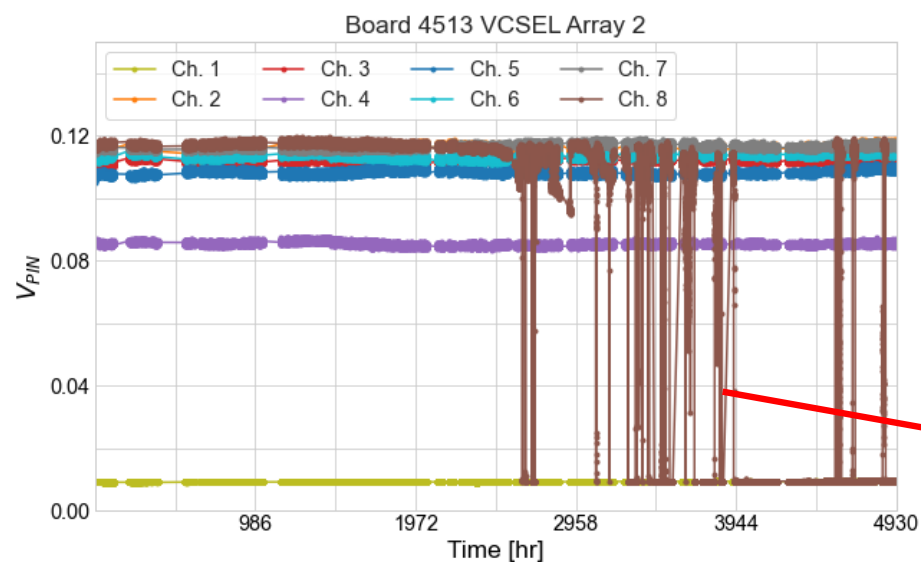
Result



- One channel had fluctuating optical power after ~3,500 hours
- Channel is alive after moving to a different slot



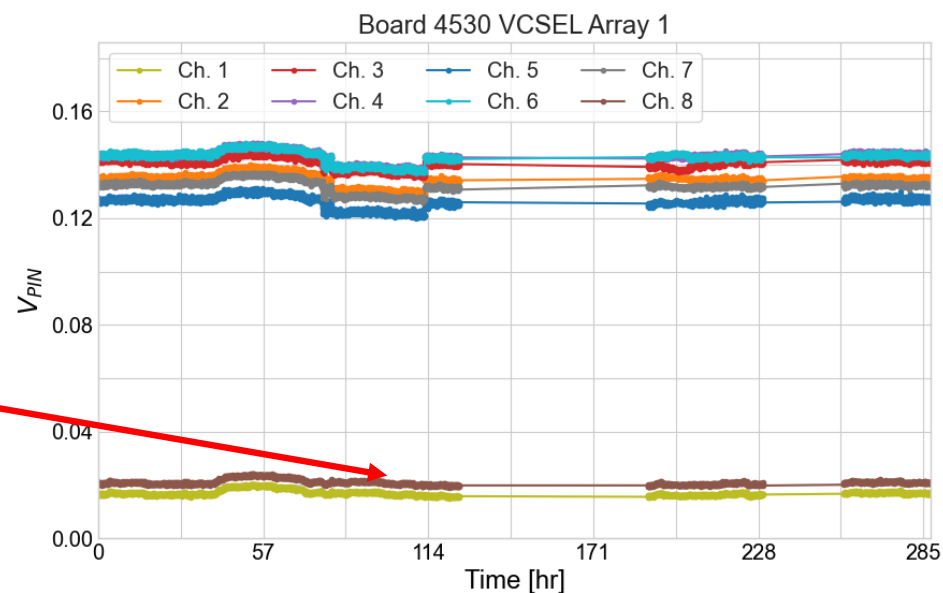
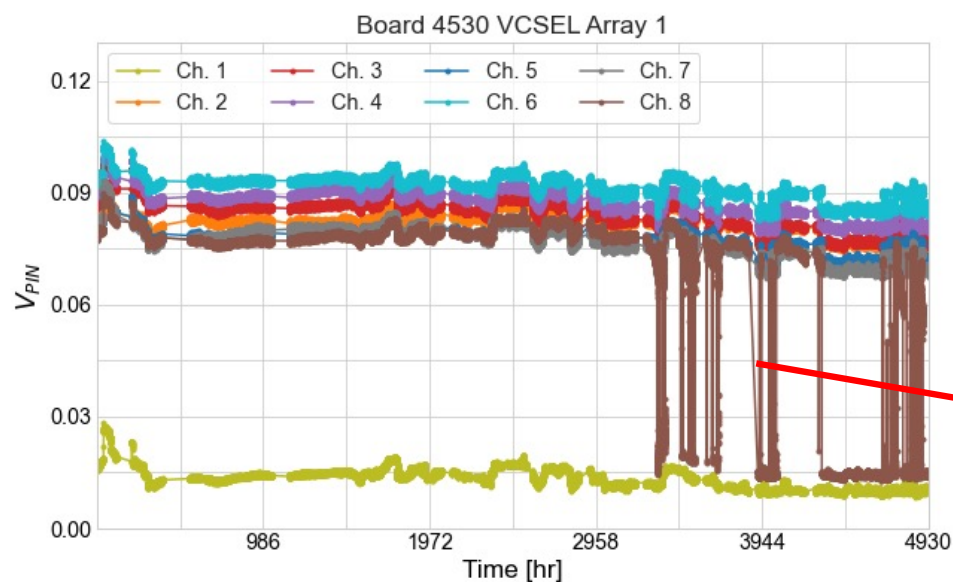
Result



- One channel had fluctuate optical power after $\sim 2,500$ hours
- Channel remains dead after moving to a different slot



Result



- One channel had fluctuating optical power after ~3,500 hours
- Channel remains dead after moving to a different slot



Summary

- production opto-boards passed accelerated lifetime test up to 2,500 hours
 - ◆ one board failed at ~2,500 hours and the other at ~3,500 hours
 - ◆ industrial minimum standard: 1,000 hours
- No replacement opto-boards installed in Pixel have failed so far
- Previous generation opto-boards also passed accelerated lifetime test but failed after 2 years...
- Next: put another batch under test at 50 C/50% relative humidity
 - ◆ boards should survive for years in the test...