



Status of Preparation for Opto-Board Replacement

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Outline

- Introduction
- Status of opto-board production
- Status of opto-box improvement
- Summary

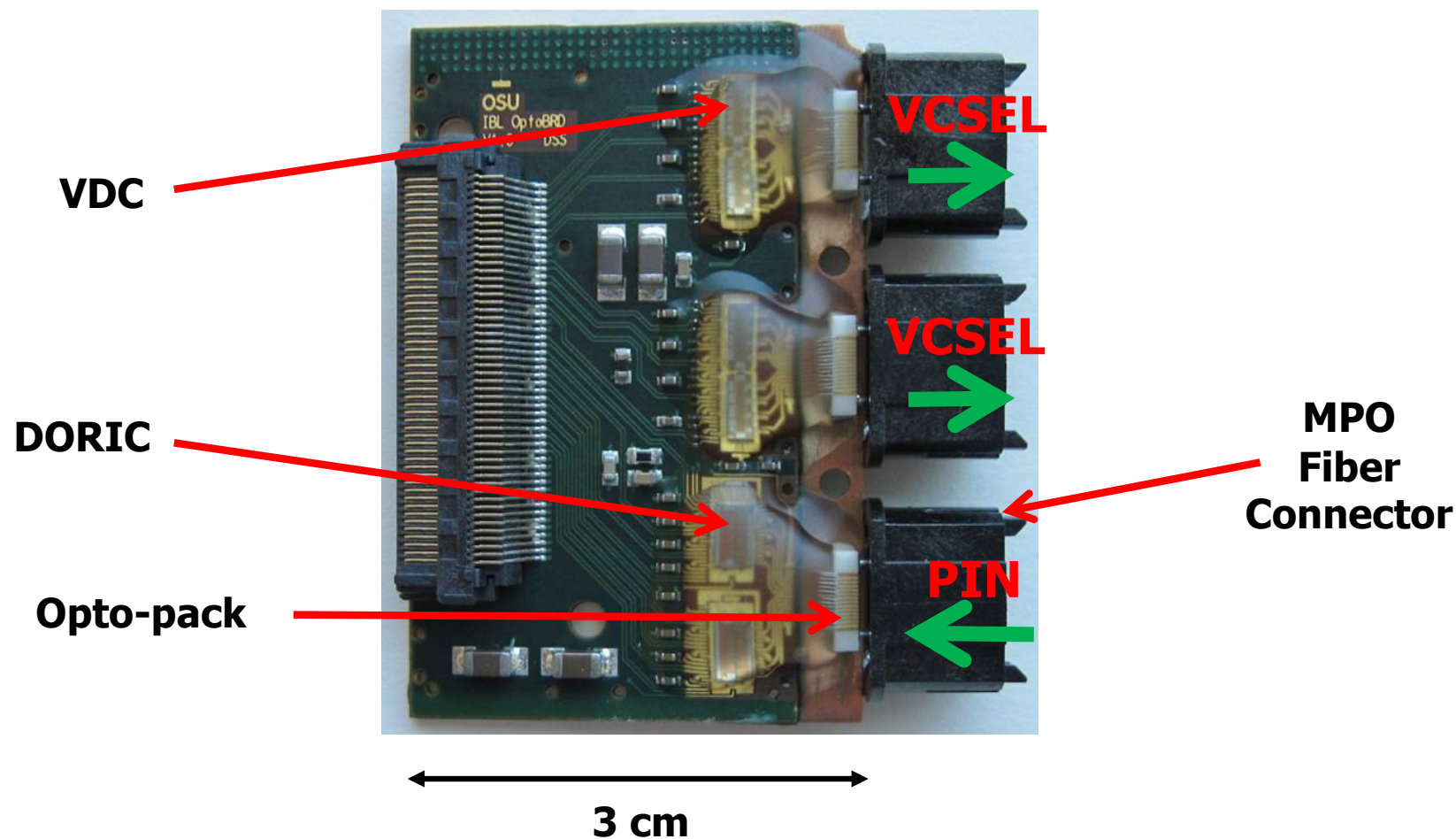


Introduction

- 63 out of 2620 VCSELs have failed (2.3%)
 - opto-box in dry environment
- no failure in 448 VCSELs of IBL
 - opto-box in N₂ environment/much higher radiation
 - probability of observing no failure is 2.5×10^{-5} (“4.0 σ ”)
- VCSELs survived over 2,000 hours in accelerated aging:
 - 85 C/85% relative humidity
 - industry standard is 1,000 hours
- premature dead not understood



Opto-Board





Plan

- produce 400 new opto-boards
 - 272 boards are needed
 - IBL boards will not be replaced
- sealing the opto-box to reduce humidity
 - opto-boxes were supposed to be flushed with dry air
 - valves were not open
 - ◆ no sure when valves were closed

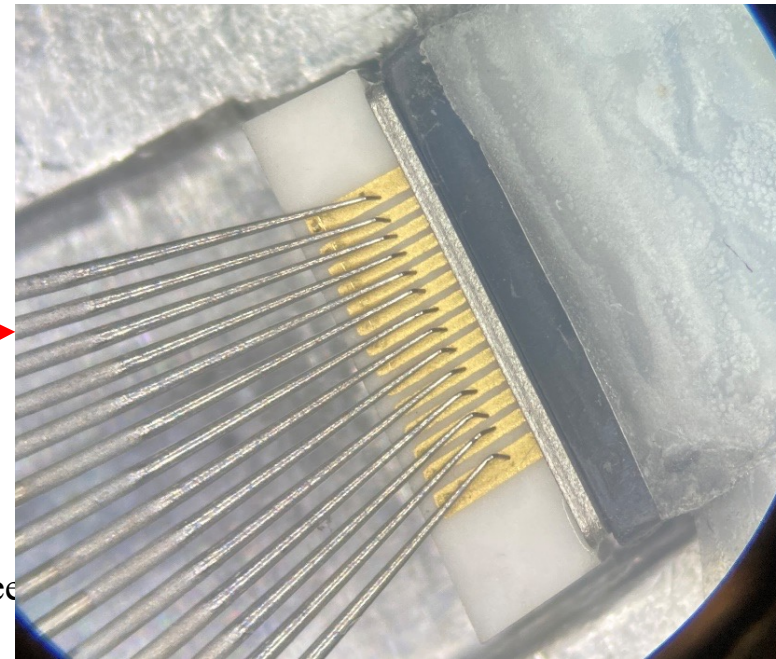
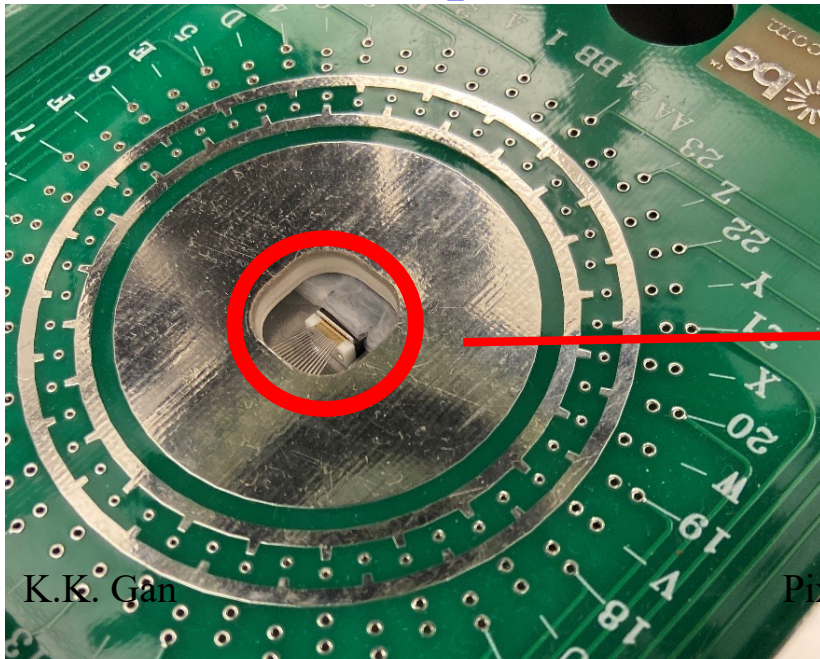


Opto-Board Replacement

- no change in opto-board design
 - fabricated by same expensive vendor: Cirexx
- use driver/receiver ASICs produced in ~2008
 - special thanks to G. Darbo for sending some ASICs
- VCSEL array:
 - Finisar arrays used in 2013/14 production no long available
 - ⇒ use arrays from II-VI
- PIN array:
 - ULM arrays used in 2013/14 production no long available
 - ⇒ use newer arrays

Opto-Pack Production

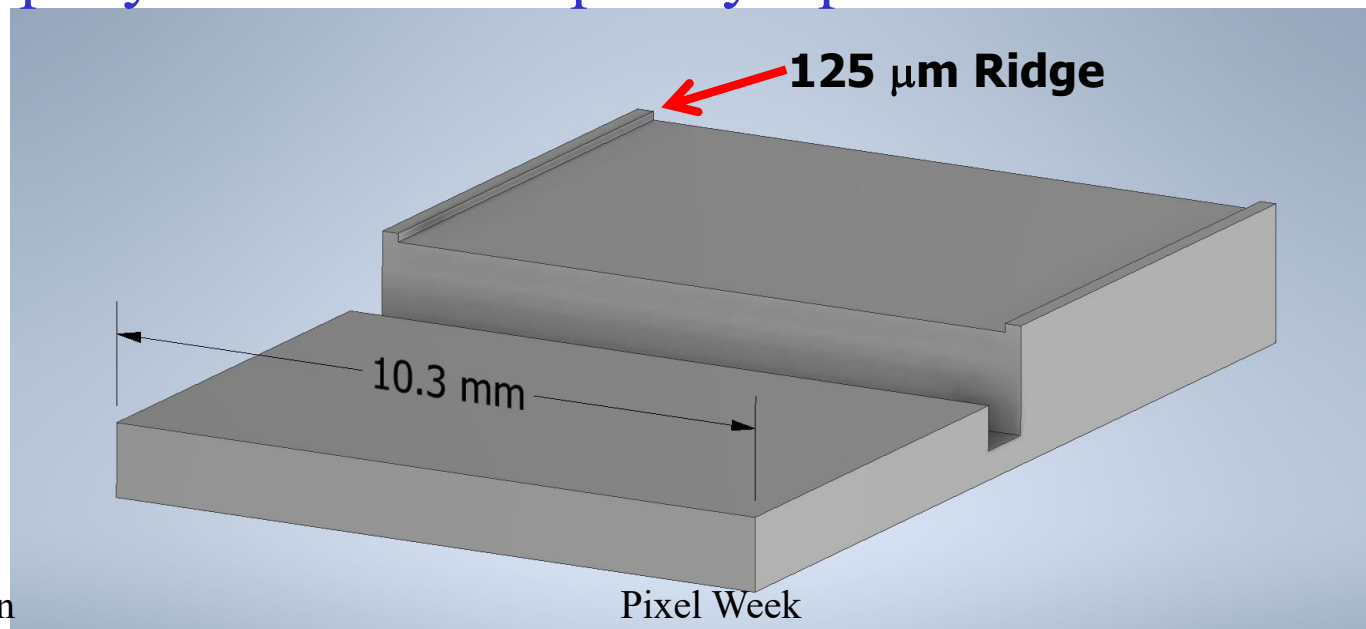
- each opto-board contains three opto-packs
 - each opto-pack contains a VCSEL or PIN array
- no change in the opto-pack design
- new VCSEL manufacturer recommended burn-in
 - burn-in system with 15 probe cards have been setup
 - QA procedure to compare changes in device characteristics has been implemented





Opto-Connector Improvement

- several opto-connectors detached from opto-boards during the 2013/14 installation of opto-boards
 - bond between smooth aluminum and copper surfaces is not strong
 - ⇒ both surfaces are now scored
 - aluminum connector modified to guarantee that epoxy cannot be completely squeezed out





COVID-19 Delay

- labs were shutdown for 2 months
 - one person (engineer) was allowed few hours/week
 - technician for VCSEL/PIN array alignment was none functional for three months due to emotional stress
 - replacement technician now fully trained
- labs now fully staffed (5 persons) after a slow reopening
 - produce 12 opto-boards/week as in original goal



CERN Reception Test

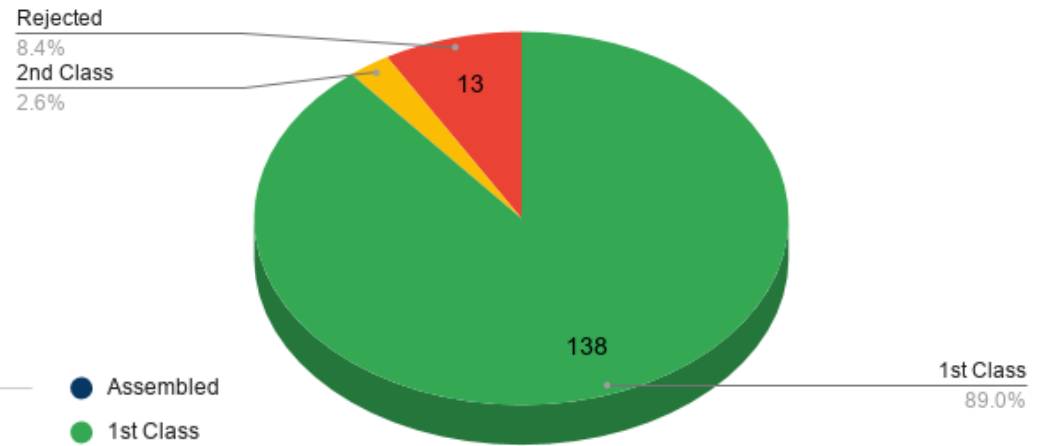
- CERN reception test system resuscitated in July at St. Genis
 - 50 opto-boards were delivered and all passed reception test
 - 3 opto-boards with detached opto-connectors returned to Ohio State and repaired
- reception test system is now setup at SR1



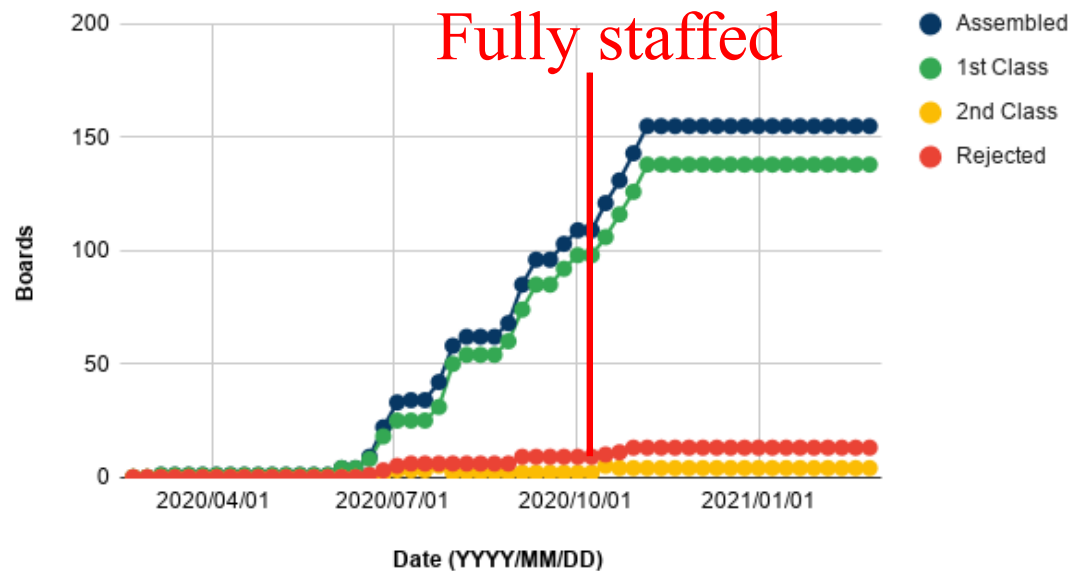


Opto-Board Production Summary

D-Tall



Opto-board Production



- goal: deliver 300 boards for installation in February



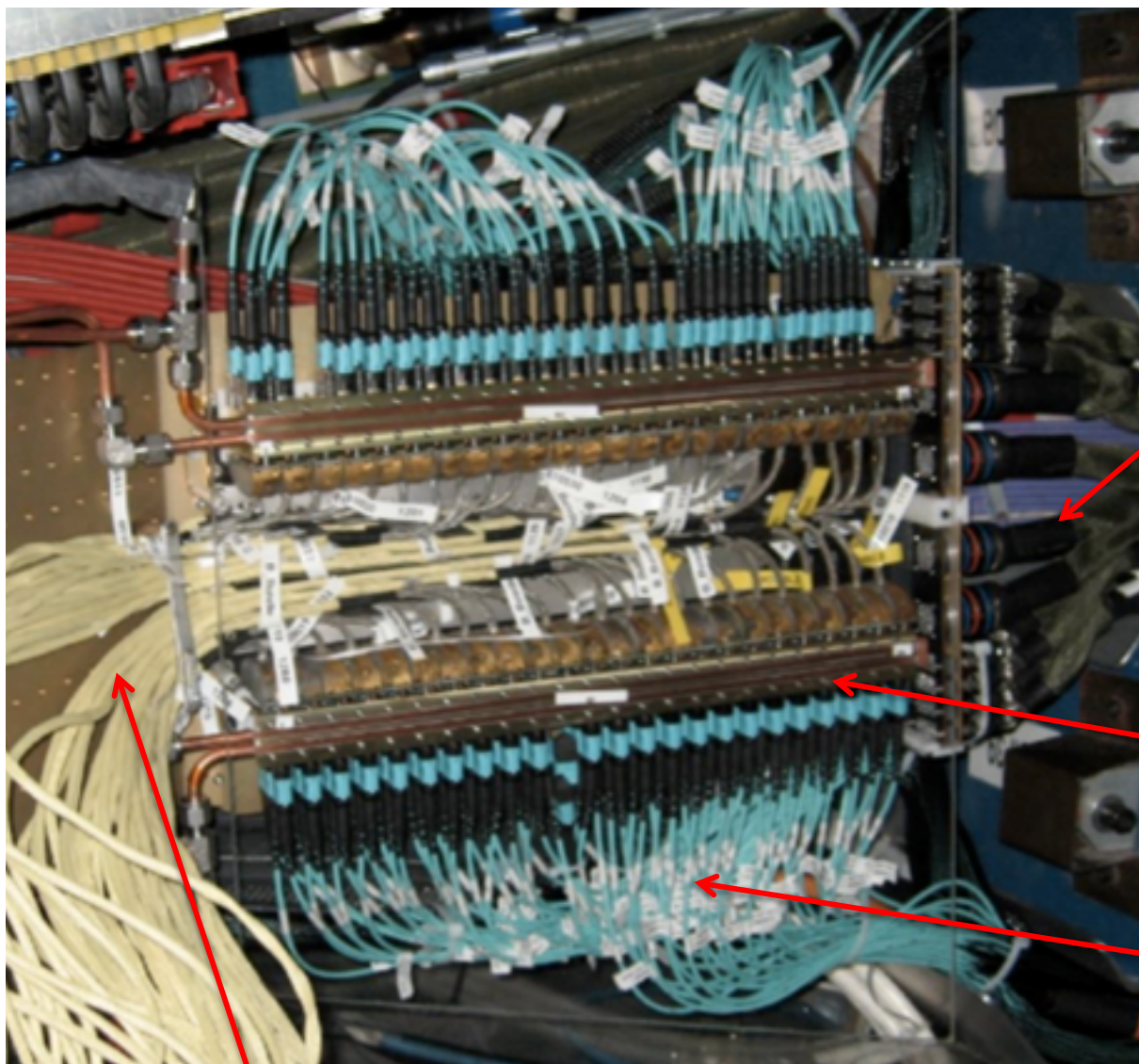
Opto-Board Production Summary

Fabricated	183
Pre-production	18
1 st class	147
2 nd class	4
Rejected	14

- production yield within budget



Opto-Box



Power/monitoring
cables

Opto-boards

Fibers

K.K. Gan Data cables

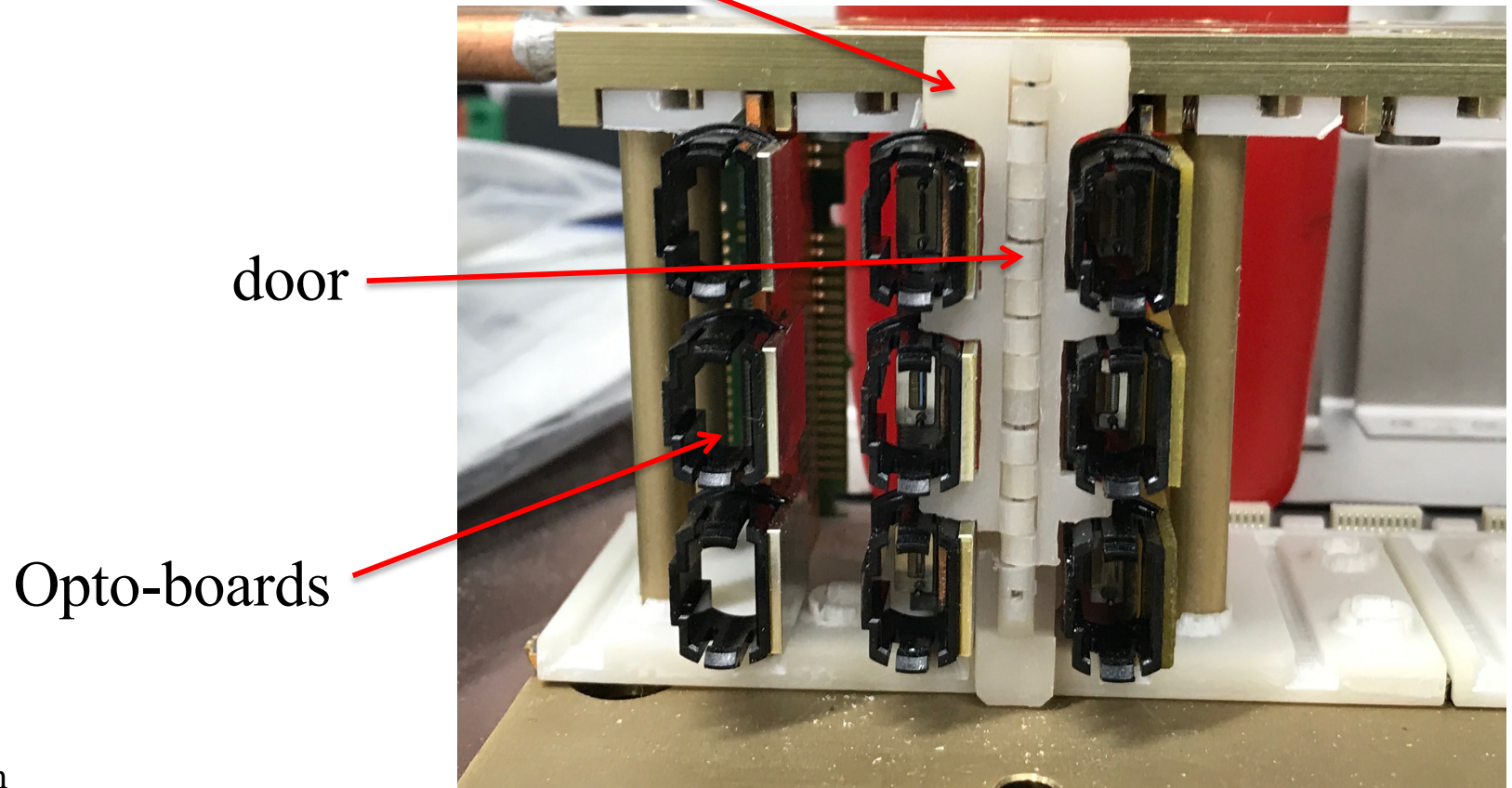
Pixel Week

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Opto-Box Sealing

- opto-boxes were supposed to be flushed with dry air
 - box is not air tight due to cables/fibers
 - ⇒ improve sealing



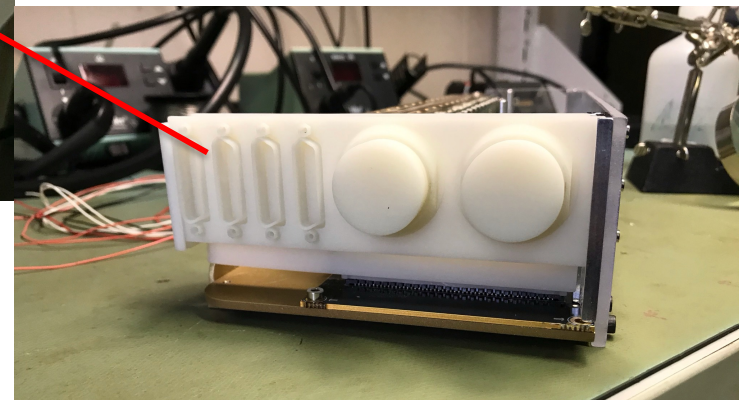
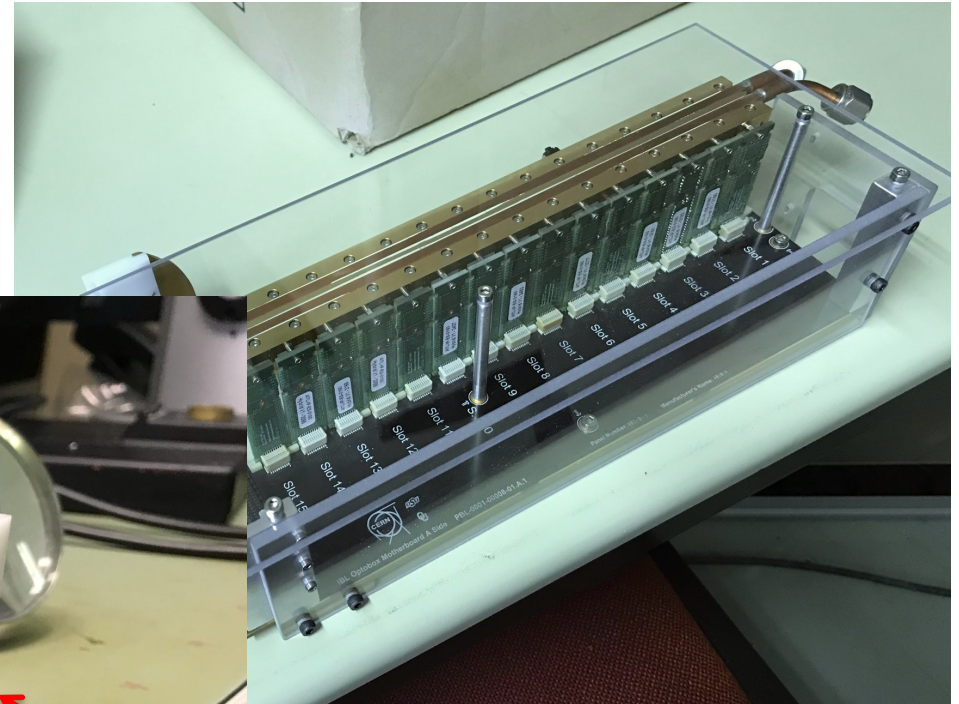
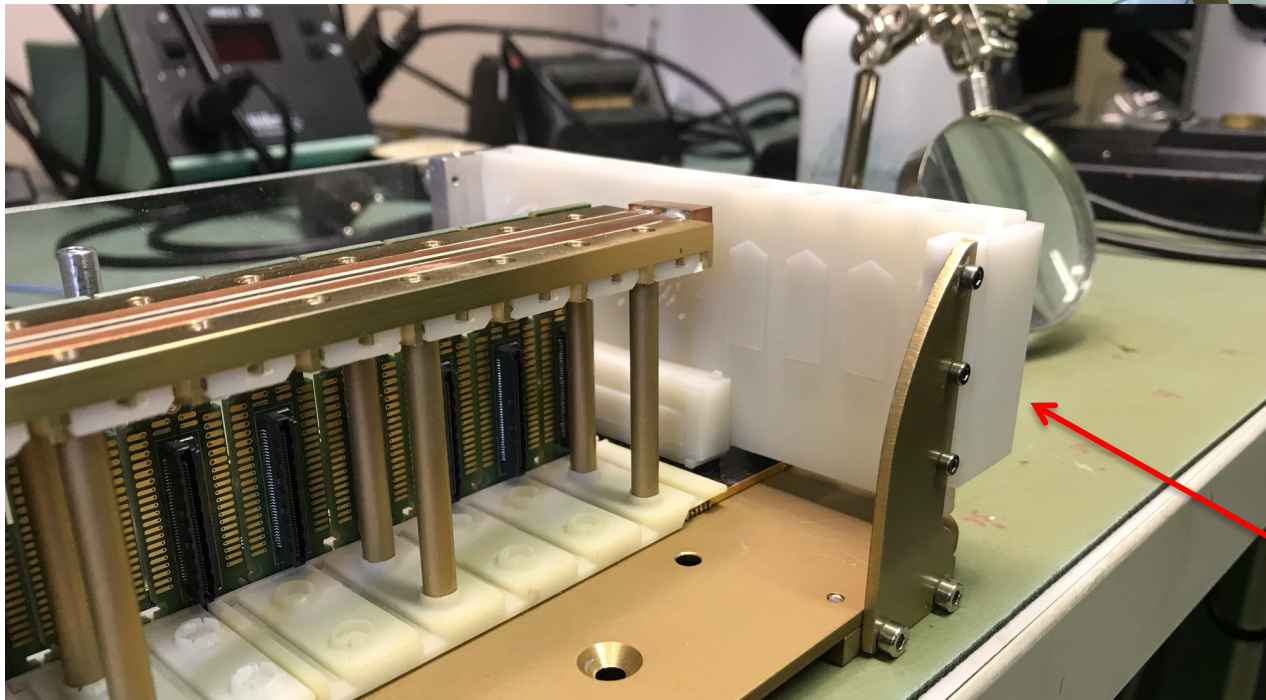


Prototype Status

- parts have been received and test fit
 - 3D printed box end board is working well
 - 2nd round of 3D printed doors don't fit that well
 - ◆ probably due to a change in the orientation of the print
 - ◆ acceptable tolerances have been specified
 - ⇒ should fix the issue.
 - 3rd round is scheduled to be finished on November 10th
- climate chamber has been serviced and is being characterized
- once the new parts are fitted
 - ⇒ characterize the sealing performance of the opto-box in terms of humidity vs. flow rate of dry air



Partially Assembled First Prototype

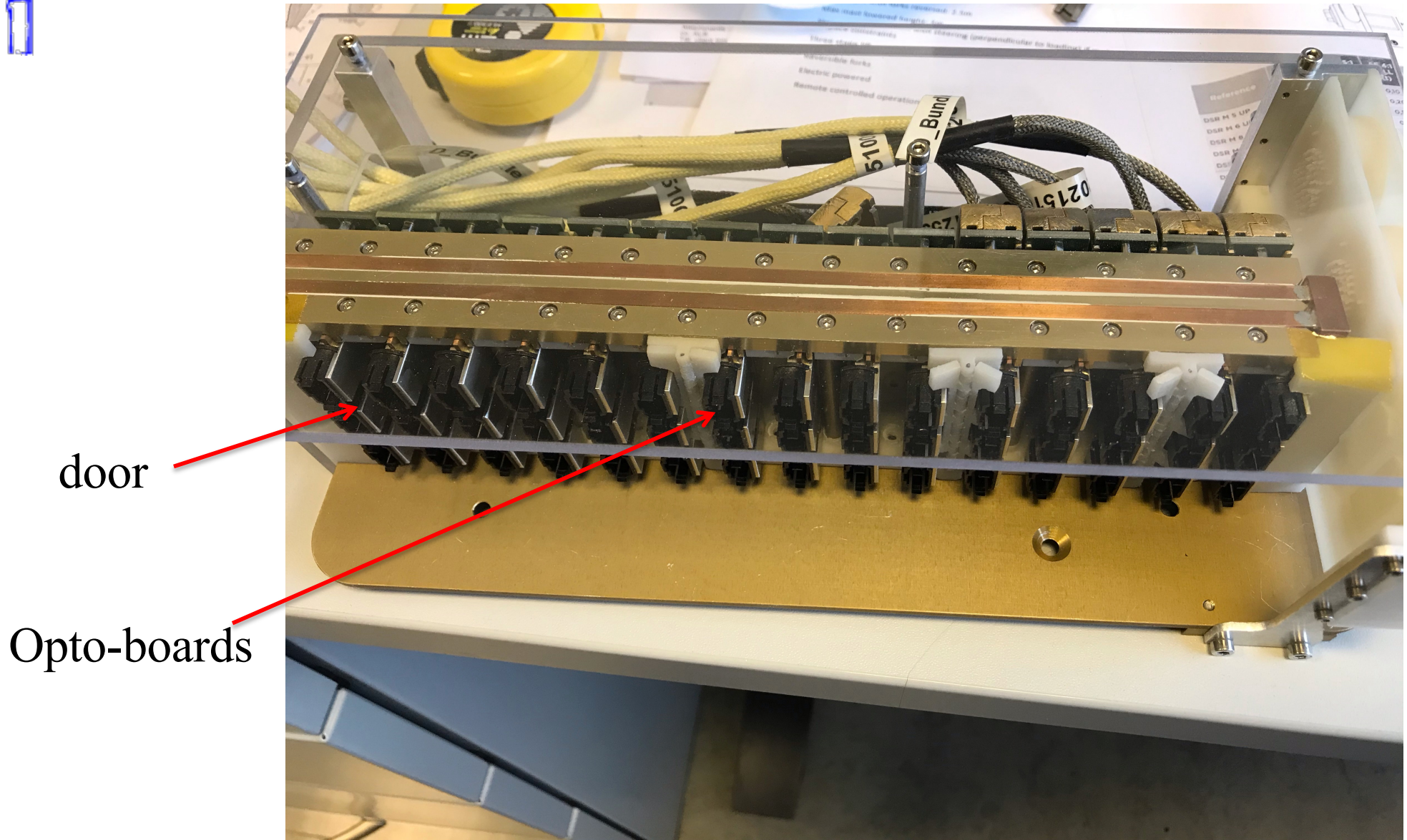


K.K. Gan

Pixel Week



Partially Assembled First Prototype





Opto-Box Schedule

- ✓ design finished – July 3
- ✓ send parts for prototyping – July 5
- ✓ test fit of IBL opto-box mid August – delayed
- ✗ ship to Oklahoma at end of October
- test chamber end of November
- second round of prototyping if necessary



Summary

- steady opto-board production has been achieved
 - steady production critical to produce enough boards for February installation
- improved sealing of opto-box being prototyped
 - schedule is tight but quite doable



Discussion

- opto-board replacement scheduled for February
 - 50 channels with failures (~half are opto-boards related)
 - 50 channels likely will fail due to shifted spectra
- 272 opto-boards needed for full replacement
 - should all boards be replaced if there are enough boards?
 - would new boards be better?