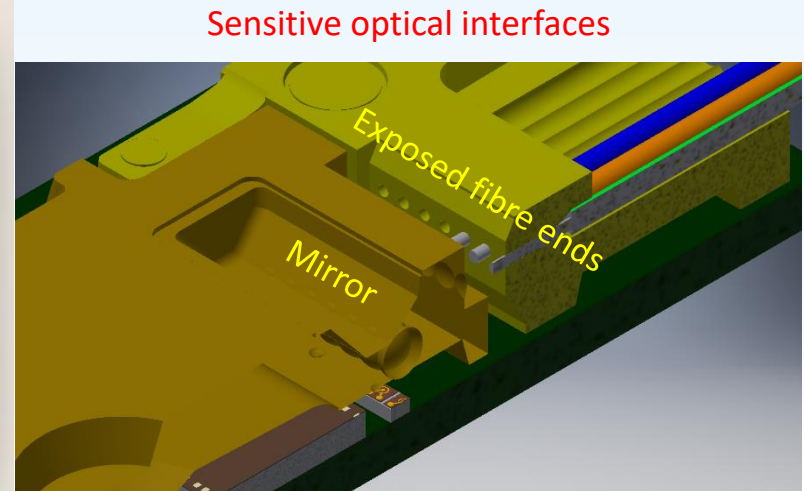
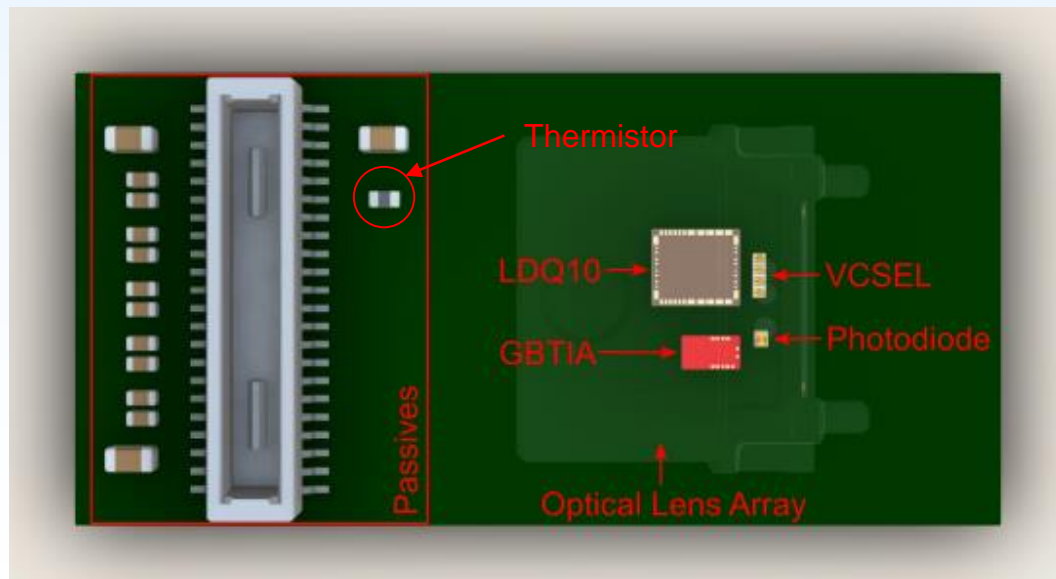


CERN VTRx+ Status Update

Csaba Soos
27 September, 2021

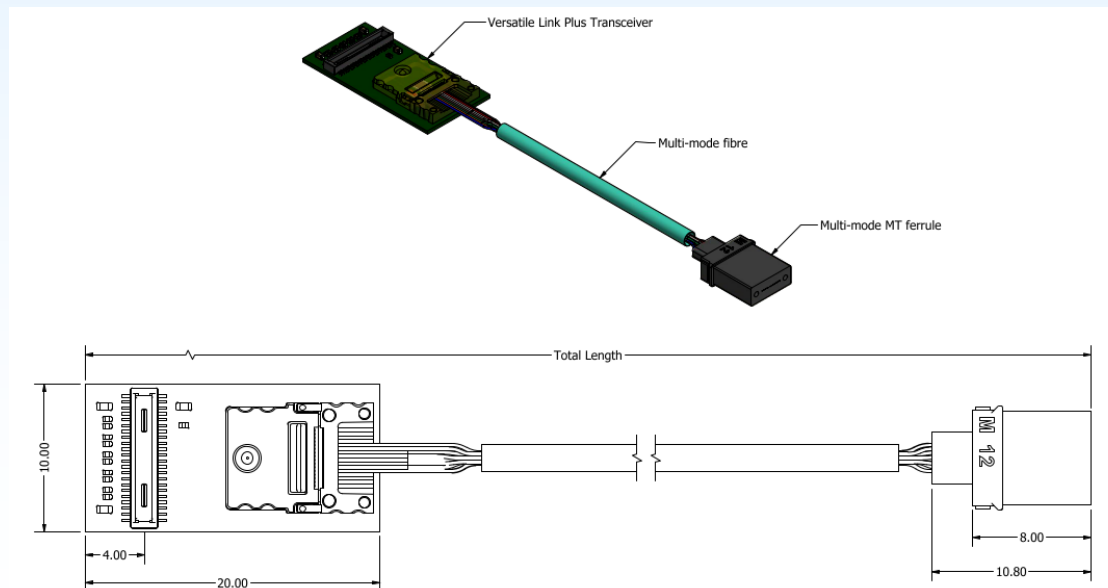
- VTRx+ Status
 - Design
 - Specifications
 - Pigtail length
- Plans
 - Assembly contract
 - Production schedule
- Qualification
 - Programme
 - Status

- After several iterations, the design has been finalized before the pre-production
- Pre-production confirmed that the design is ready for the series production
- The specifications can be consulted on EDMS
 - <https://edms.cern.ch/document/1719329/1>



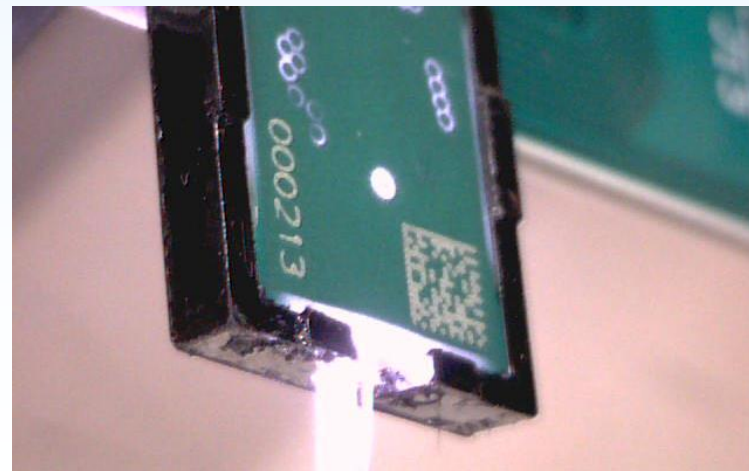
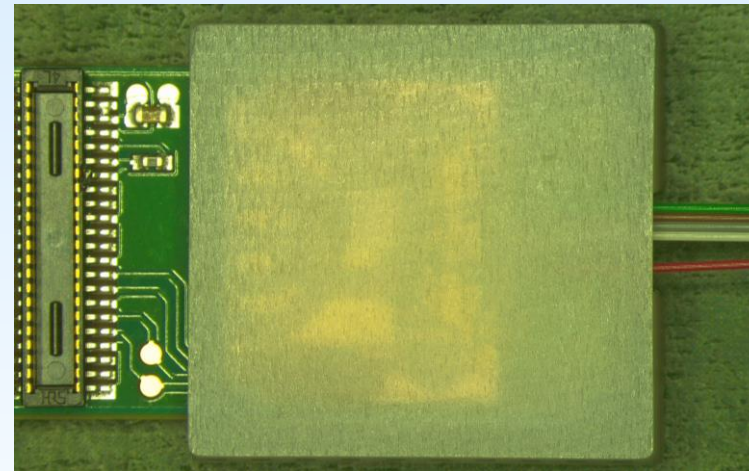
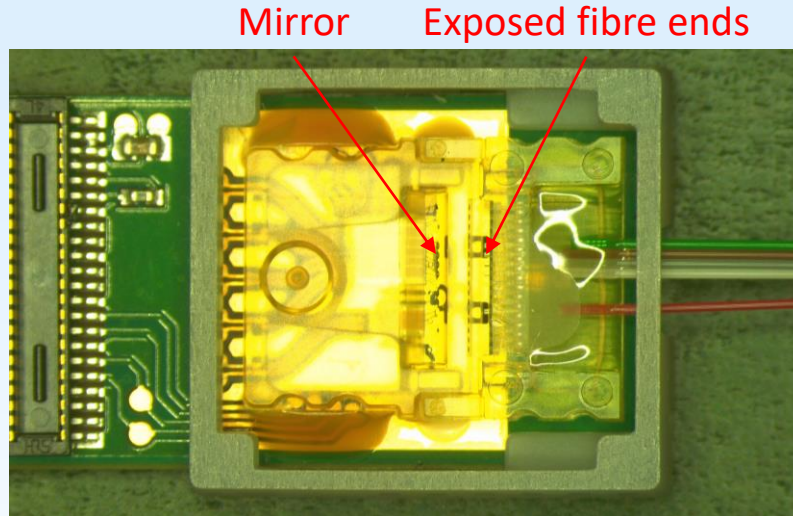
VTRx+ Pigtail

- The VTRx+ transceivers will be distributed to users in pigtailed format
 - The pigtails will be attached by the manufacturer before the functional test
- Users can order the VTRx+ modules with the desired pigtail length



VTRx+ Clip (light leakage)

- Must pay attention to optical interfaces when designing any covers

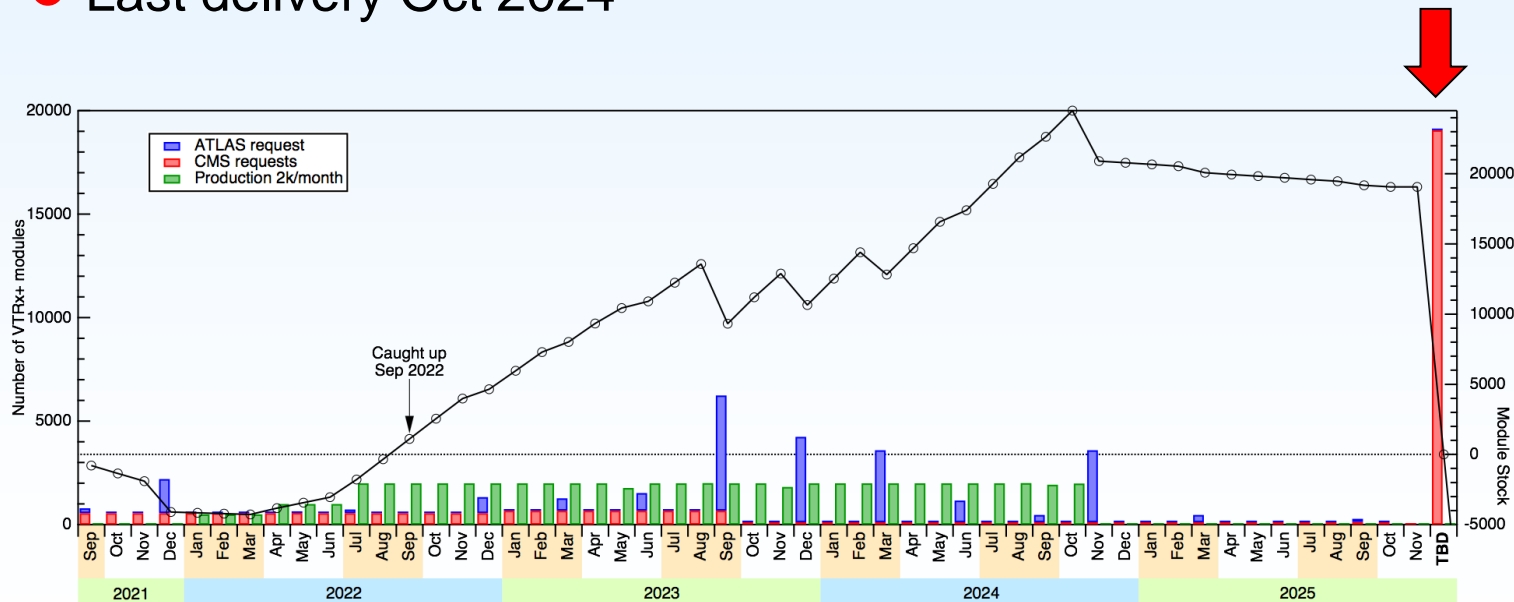


VTRx+ Production Schedule

● Baseline

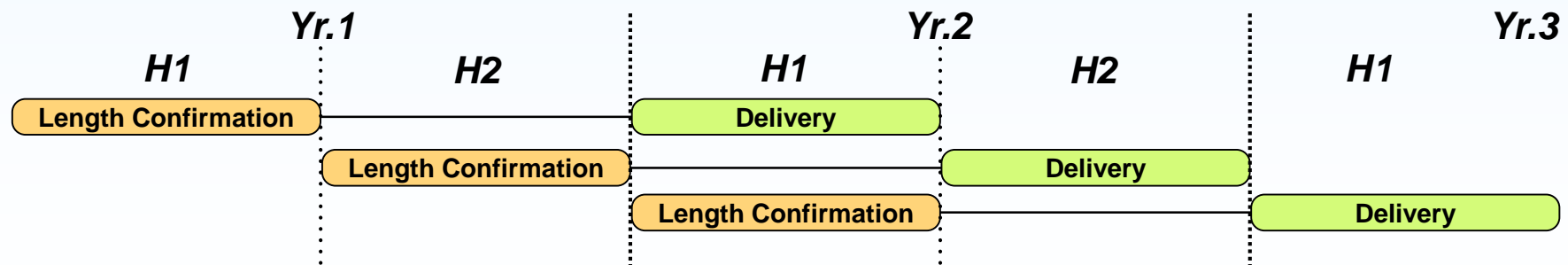
- Start first delivery end Jan 2022
- M1-3: 500 modules/mo
- M4-6: 1000 modules/mo
- M7-34: 2000 modules/mo
- Last delivery Oct 2024

Note: received some updates this morning;
need to update the production schedule



Pigtail Length

- A survey in 2019 and a pre-order survey in May 2021 used to collect user inputs concerning their pigtail requirements
- Production schedule according to *firm* user requests
- There will be a sliding window for updating the length distribution planned production
 - Orders in a given six-month period will be delivered 6-12 months after the end of the ordering period
 - Freeze H1 2022 at contract signature: Sept. 2021
 - Freeze H2 2022 at end Dec. 2021
 - Freeze H1 2023 at end Jun. 2021



Pigtail Length Distribution

		Pigtail Length [cm]																
		5.5	7.5	10	12	15	20	25	28.5	30	35	40	45	50	60.5	78.5	100	200
January	ATLAS ITk Pix&Strip, Muons, CMS OT			100	100	100				100		100						
February	ATLAS ITk Pix&Strip, Muons, CMS OT			100	100	100	100			100								
March	ATLAS ITk Pix&Strip, CMS OT				100	100		100	100	100								
April	Samples for all	100	100		100						100		100	100	100	100	100	100
May	ATLAS ITk Pix&Strip, Muons, CMS OT			100	300	200	100		100	100							100	
June	ATLAS ITk Pix&Strip, Muons, CMS OT			100	500	300	100											

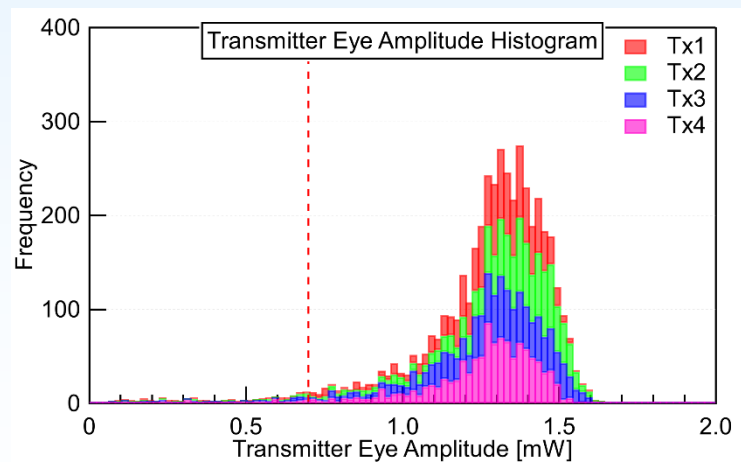
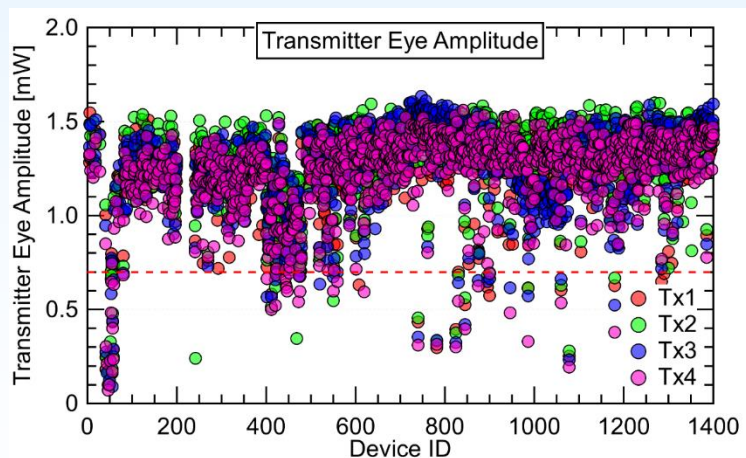
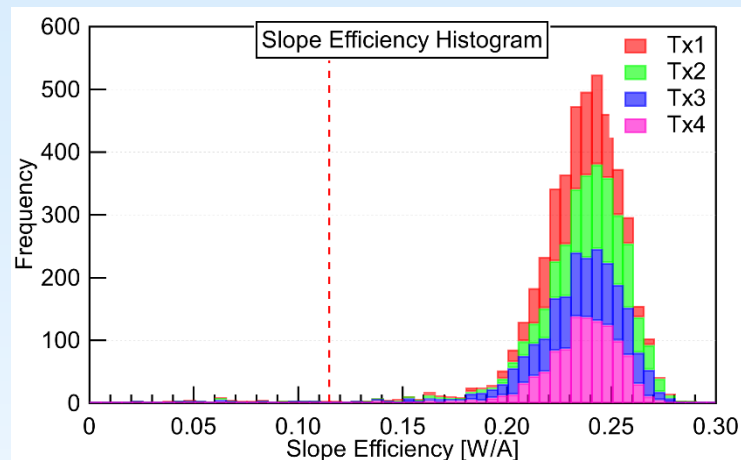
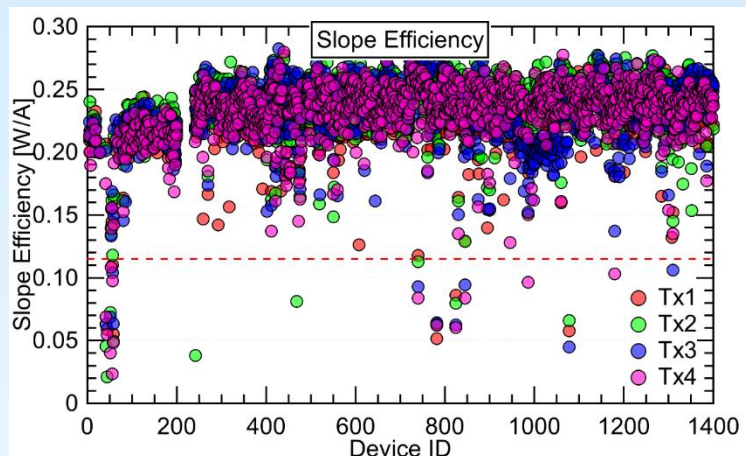
VTRx+ Qualification Programme

- The QA programme has been defined based on industry standards as well as considering CERN-specific requirements
 - See details here: <https://edms.cern.ch/document/2208920/1>
- Assembly process qualification (contractor)
 - Die shear test (ASICs, optical chips and lens block)
 - Wire bond pull and shear test
 - Temperature cycle and humidity tests
- Assembled module qualification
 - Functional tests (room temperature and over the operating T range)
 - Unbiased and biased test at high T
 - Biased damp heat test (85/85)
 - Irradiation tests (gamma/neutron)

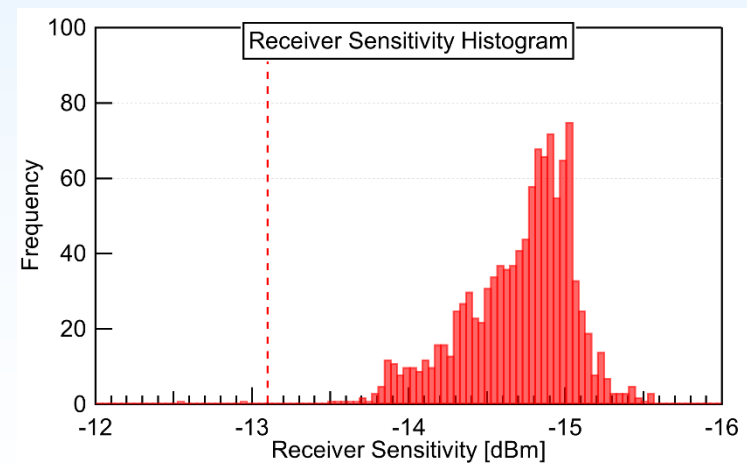
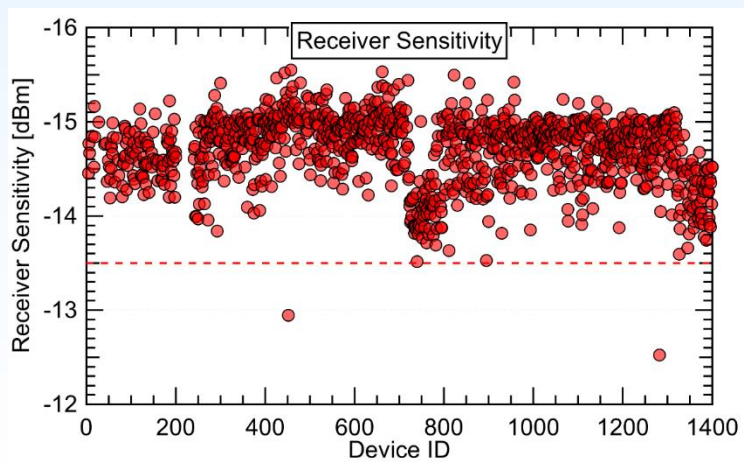
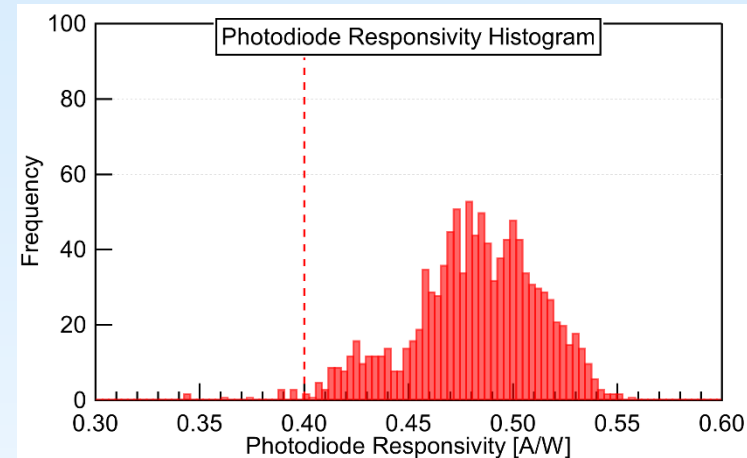
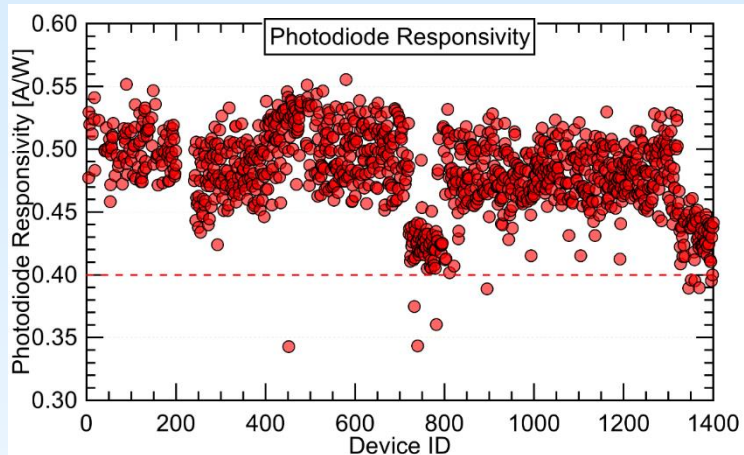
VTRx+ Pre-production

- CERN ordered 1200 VTRx+ modules assembled with four different pigtail lengths: 100, 40, 30, and 15 cm
- Industrialisation using final transceiver components
 - Allowed to carry out the assembly process qualification
- Complete production testing including VCSEL burn-in
 - Required to estimate the final price
- Build stock for users ready to adopt the VTRx+
 - 580 15 cm, 88 30 cm, 94 40 cm, 100 cm for QA
- Production-grade transceivers for the QA programme
- Long process that required more effort than expected
 - Purchase order in January 2020
 - Last delivery in May 2021

Transmitter Performance

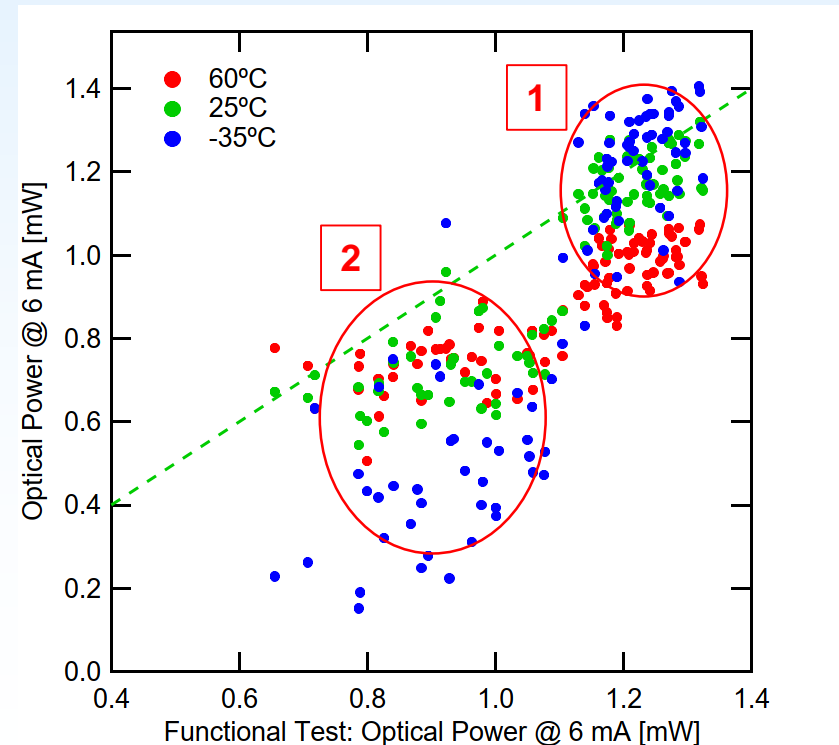


Receiver Performance



Temperature Range (-35°C – 60°C)

- Good correlation for parts where RT data shows good alignment/coupling (1)
- Performance drops more (mostly in cold) for poorly aligned/coupled parts (2)
- Being investigated
 - Discussions with lens/pigtail mfr.
 - Tighter acceptance limits ?



VTRx+ Qualification Status

Qualification Procedure	Completed	Carried out by	Comment
Assembly Process	✓	CM	
Functional RT	✓	CERN	
Functional full temperature range		CERN	In progress, 80% complete
Unbiased High Temp	✓ / -	CM / CERN	by end 2021
Biased High Temp		Oxford	In progress, 5% complete
Biased Damp Heat (85/85)		CERN	In progress, 5% complete
Gamma irradiation	✓	CERN	
Neutron irradiation	✓	CERN	

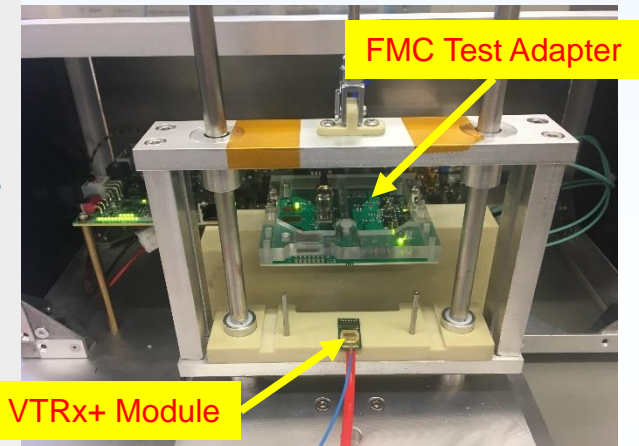
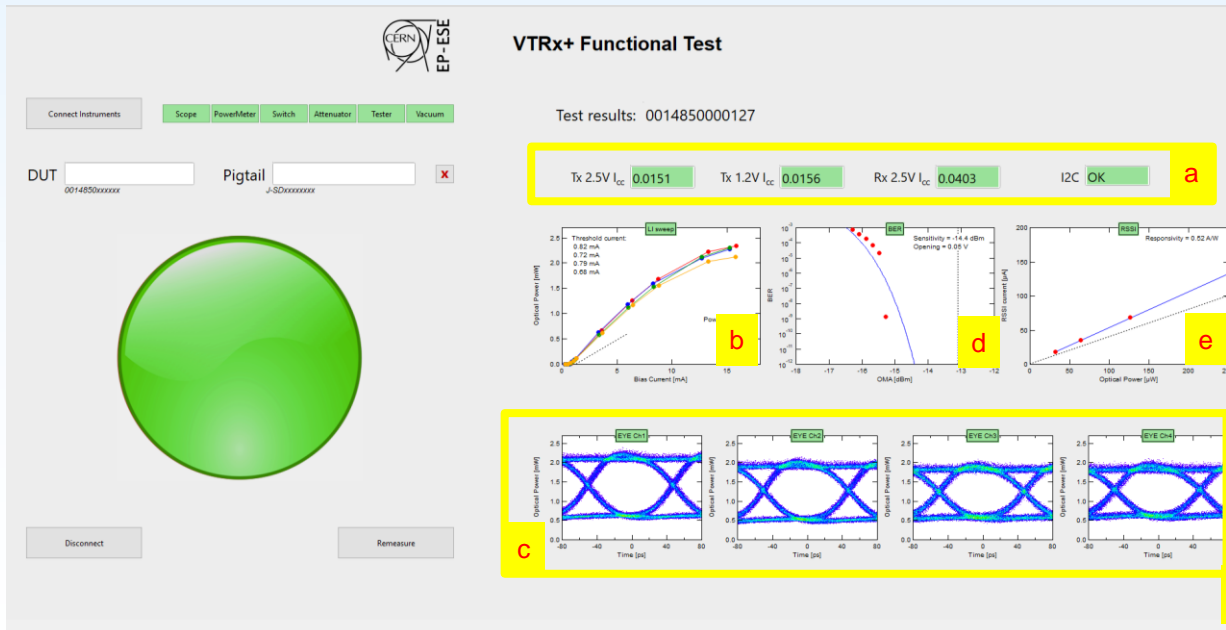
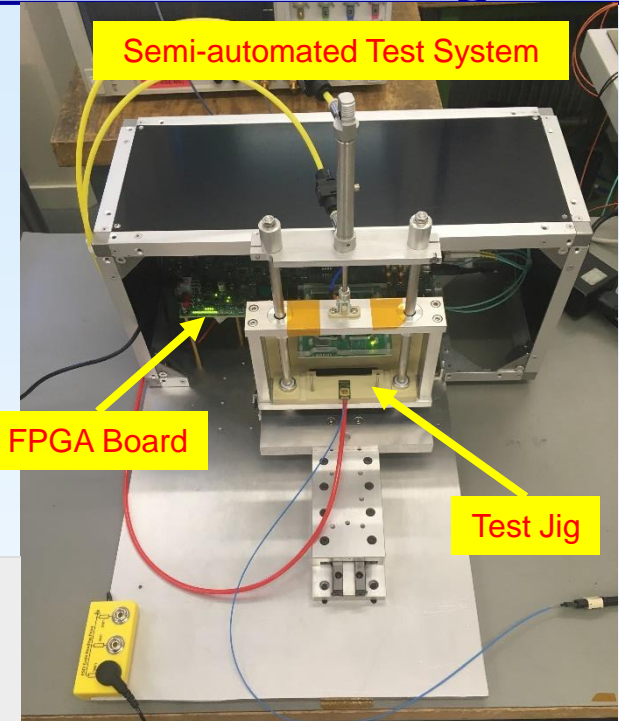
- Qualification is being carried out against specifications
- Cannot explicitly cover all possible use-cases
- Therefore, recommend all users carry out in-system qualification

Back-up Slides

Production and Lot Acceptance Test System

Test procedures

	Static	Dynamic
Transmitter	Supply Current (a), VCSEL L-I (b)	Tx Eye Diagram (c)
Receiver	Supply Current (a), Photodiode responsivity (e)	Rx Sensitivity (d)



Transmitter Coupling

