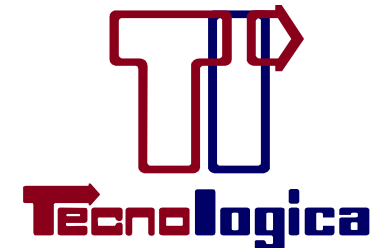


WORKSHOP

LASER DIODES IN SPACE

10-11 May 2006

Contraves | Space



Componentes
Electrónicos, S.A.

Evaluation and Qualification of Fibre Pigtailed Lasers for ESA's SMOS Mission

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Outline

SMOS/MOHA

- MOHA in SMOS
- COTS Fibre Optic Components in SMOS

Qualification Approach

- Strategy for SMOS/MOHA

Project qualification tests (main results)

- External visual: tack weld cracks
- Retention tests
- Proton radiation
- Dew point test
- Electro-optical measurements: comparison of measurements at the fibre optical end and at the photodiode.

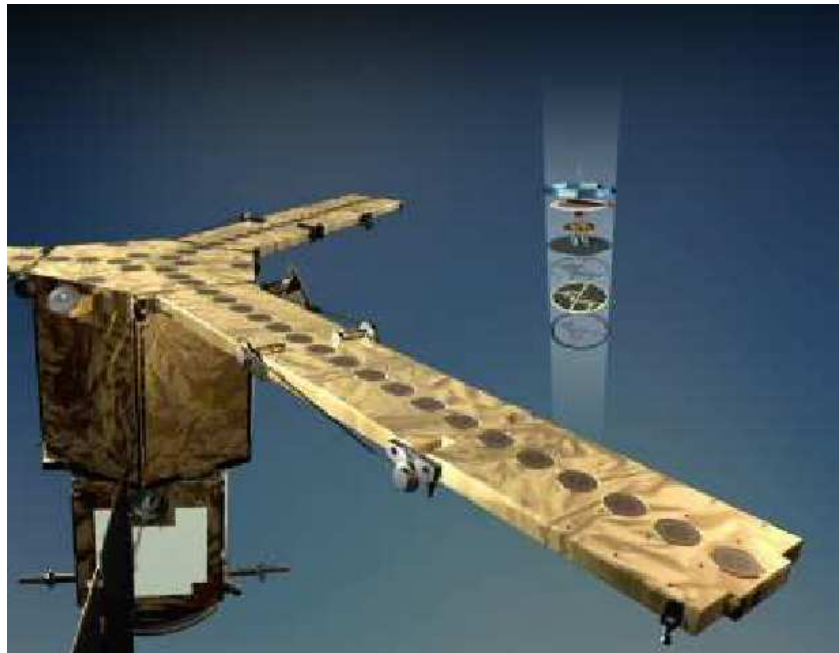
Lessons Learned and Issues

SMOS / MOHA

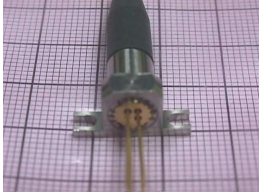
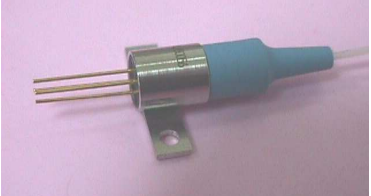
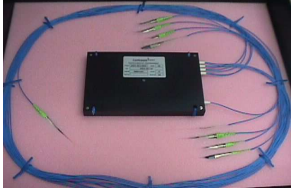
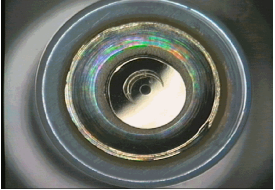
SMOS Mission (Soil Moisture and Ocean Salinity).

Payload Module: Microwave Imaging Radiometer with Aperture Synthesis (MIRAS).

MOHA (MIRAS Optical Harness): Connects antennas with the control and correlator unit via a custom optical bus.



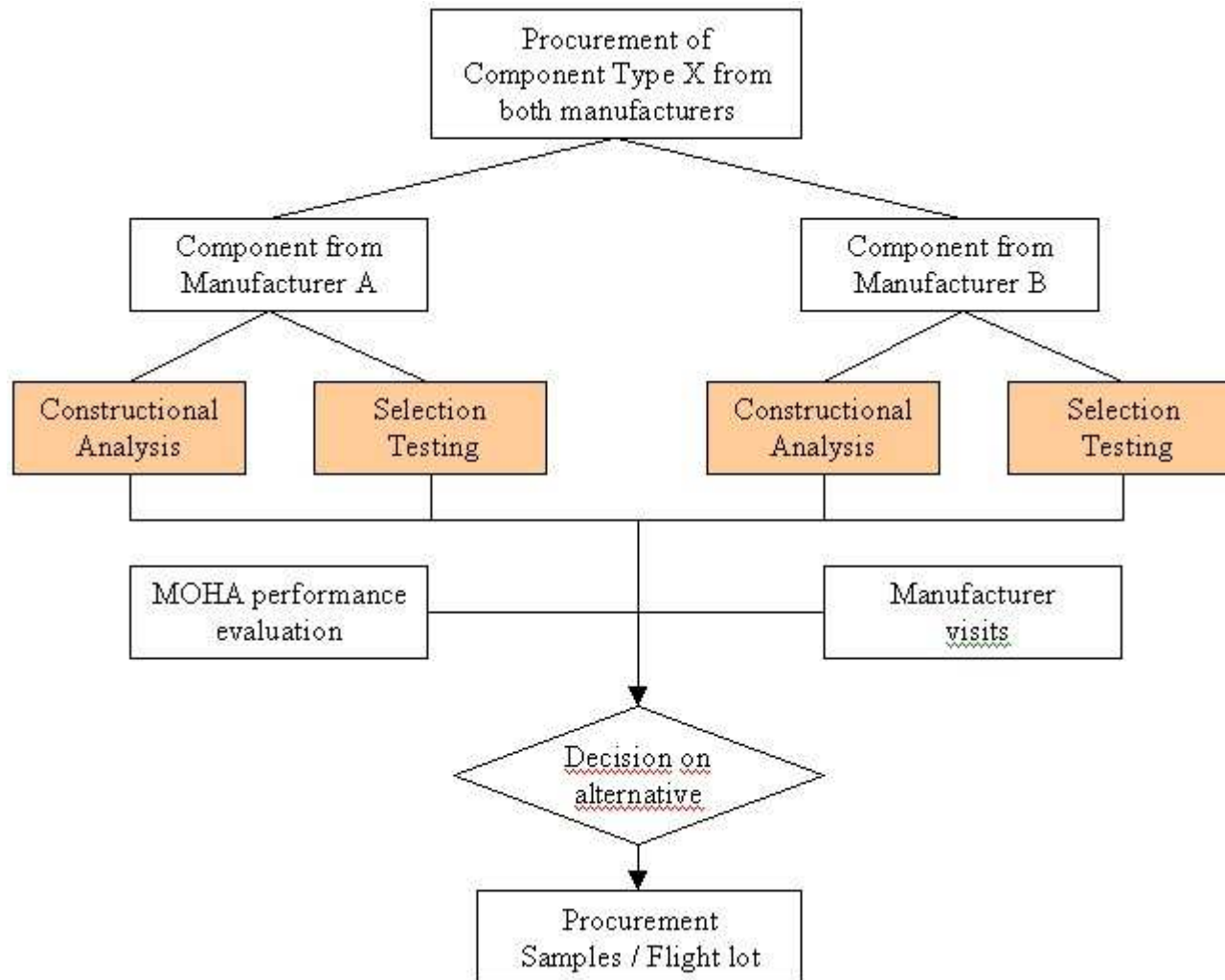
COTS fibre optic components in SMOS

<p>Fibre Optic Laser Transmitter</p>	 A small, cylindrical fibre optic laser transmitter with a black top and a metal base, mounted on a grid background.
<p>Fibre Optic Receiver</p>	 A fibre optic receiver with a blue plastic housing and a metal base, featuring three gold-colored pins on the side.
<p>Fibre Optic Coupler Assembly</p>	 A fibre optic coupler assembly consisting of a black rectangular component with several blue fibre optic cables connected to it.
<p>Fibre Optic Cable Pigtails</p>	 A close-up view of a fibre optic cable pigtail, showing the internal fibre optic core and the surrounding metal housing.

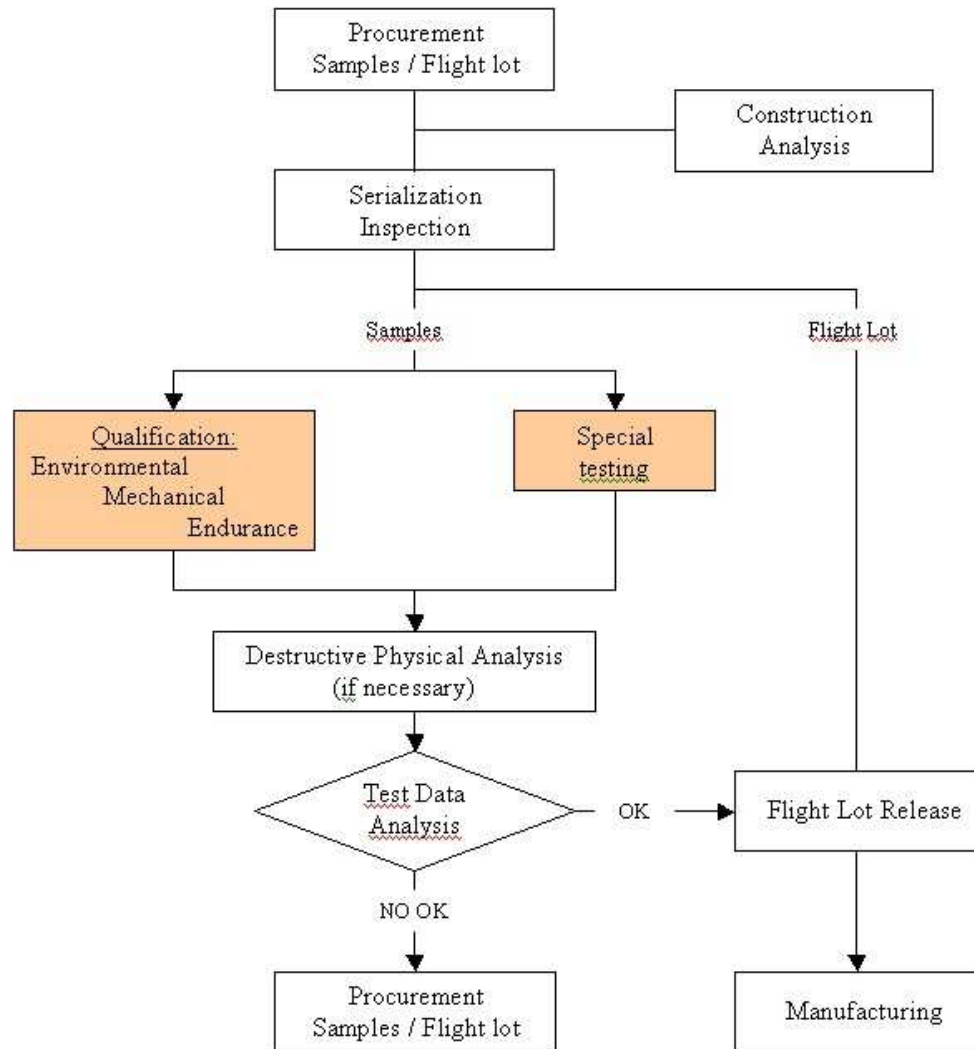
Qualification Approach

- Highest quality level for optical COTS is according to Telcordia standard or similar.
- Space qualified components not feasible (power budgets) or simply not existing.
- A full qualification exercise as per ESCC specification not feasible due to
 - Time and cost constraints
 - Industry is too fast moving
- STRATEGY FOR SMOS/MOHA
 - One time Lot Acceptance Testing for this particular mission
 - One flight lot is purchased and tested for its suitability to the particular space application
 - Evaluation phase with two possible COTS candidates for each component (subjected to most critical test, constructional analysis, manufacturer assessment).

Qualification Approach: Evaluation phase



Qualification Approach: Lot acceptance



Qualification Approach: Procurement Baselines

To reduce qualification effort

- Procure different parts with as many similarities as possible:
 - Same optical fibre.
 - Same pigtail cable.
 - Same fibre optic connector

Assess willingness of manufacturer to cooperate in the proceeding

- Willingness to disclose exact processing
- Willingness to manufacture according to custom requirements (use the supplied fibre, cable, connectors).
- Willingness to help in failure analysis

Qualification Approach: Testing

Evaluation phase

- Vibration, shock
- Thermal vacuum cycling
- Radiation (gamma & proton)
- Construction analysis & manufacturer assessment

Flight lot screening / qualification

- Extended burn-in
- Acceptance thermal cycling
- Measurement at high and low temperature

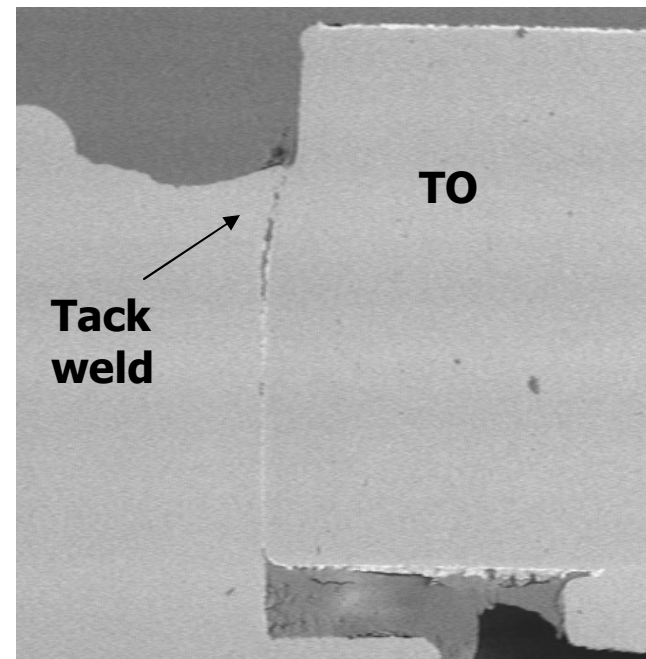
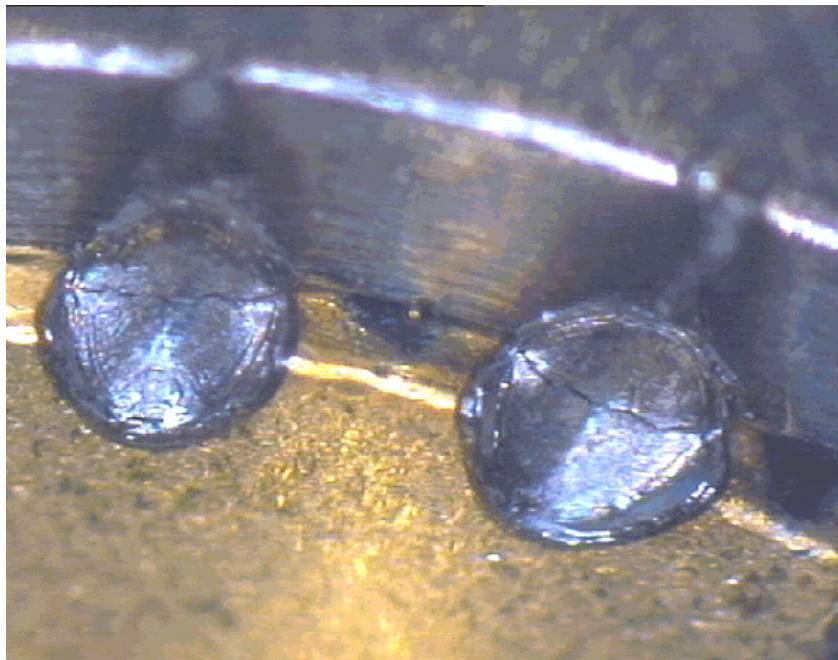
Flight lot acceptance testing

- Thermal cycling, vibration, shock and radiation
- Life test
- Bending, fibre pull, mating, DPA.

PIGTAILED LASER DIODES: Testing

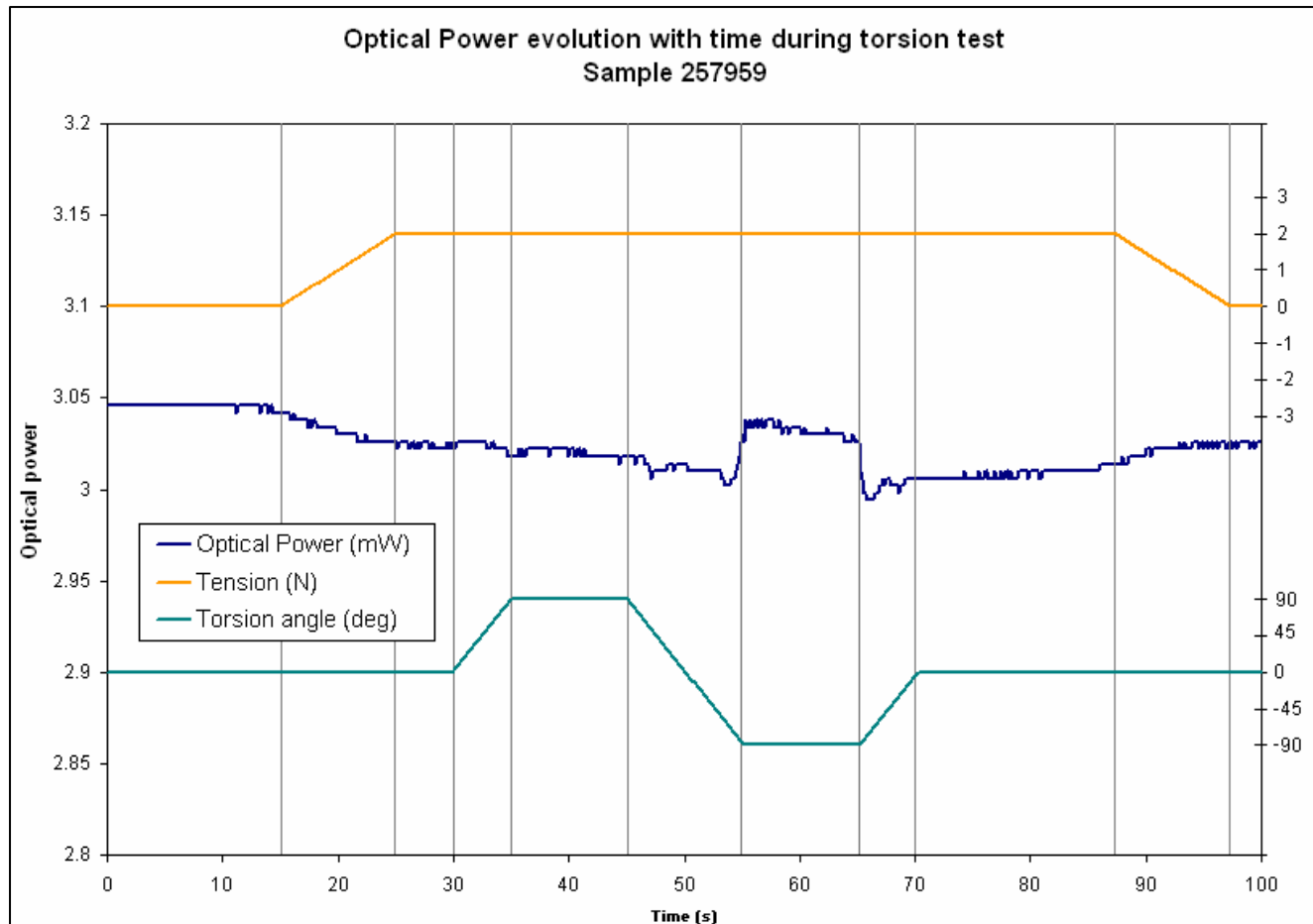
External visual inspection: cracks in tack welds

- Defect detected in constructions analysis and known by the manufacturer.
- Reliability tests and cross-sections



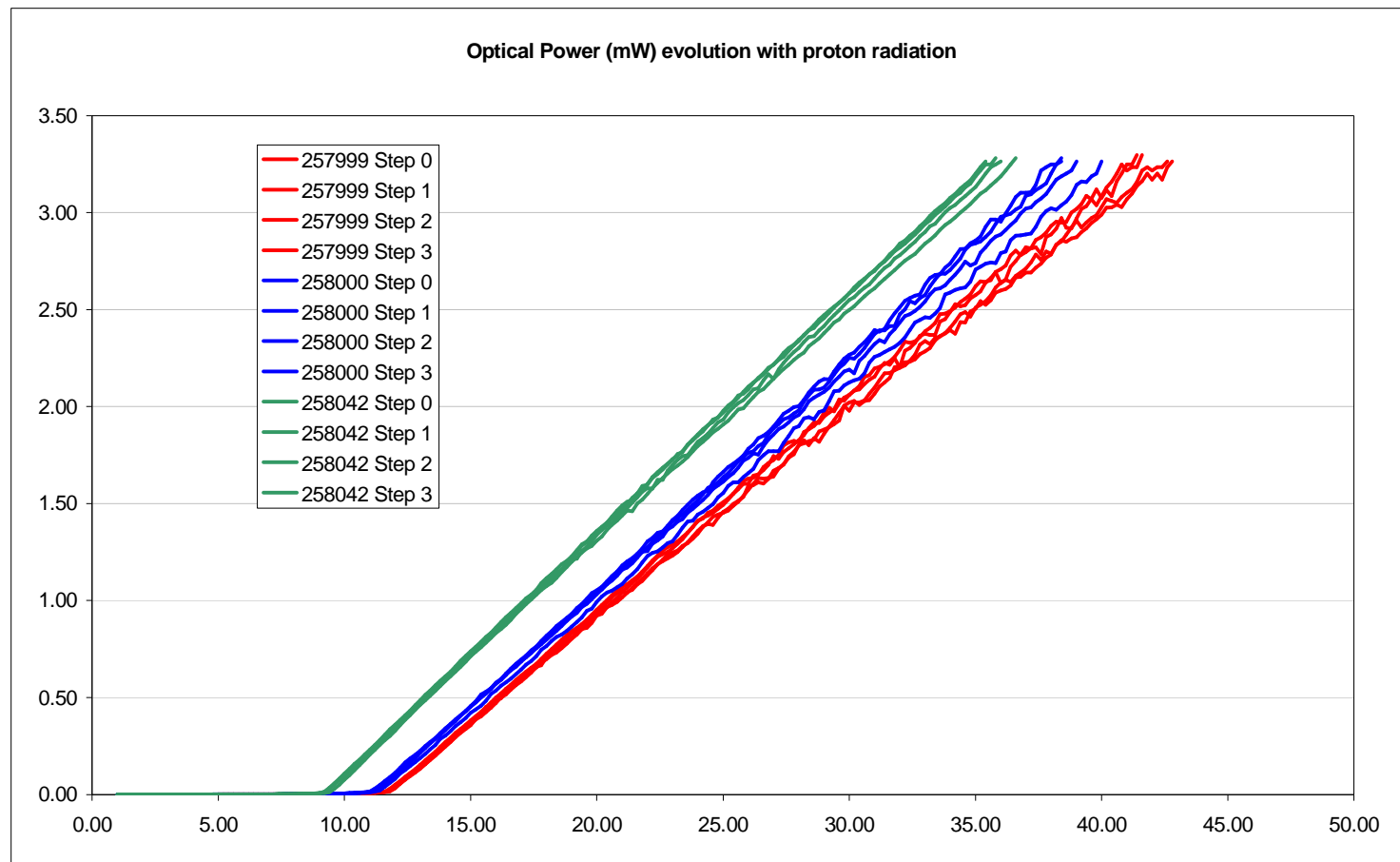
PIGTAILED LASER DIODES: Testing

Retention tests



PIGTAILED LASER DIODES: Testing

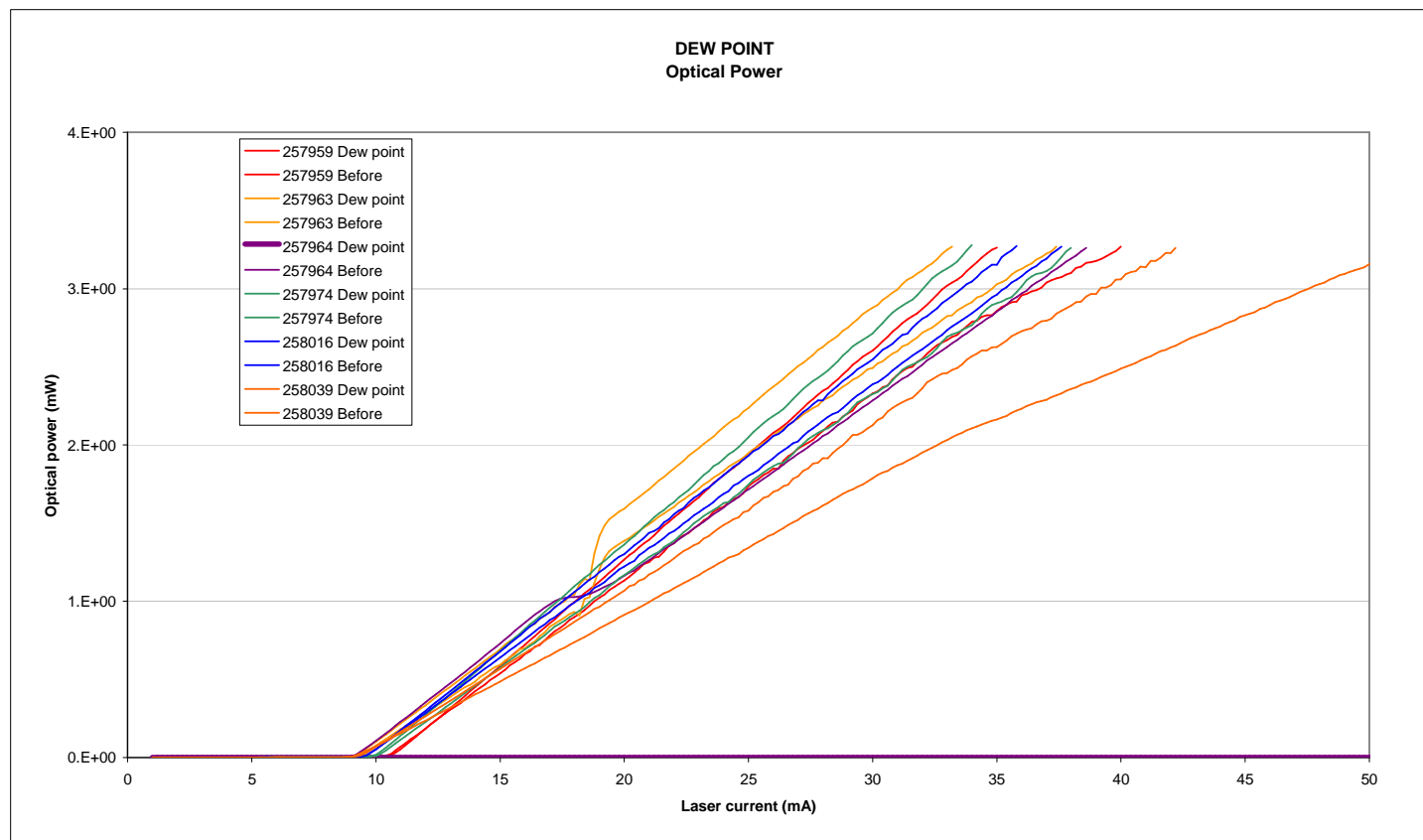
Proton radiation



PIGTAILED LASER DIODES: Testing

Dew point test

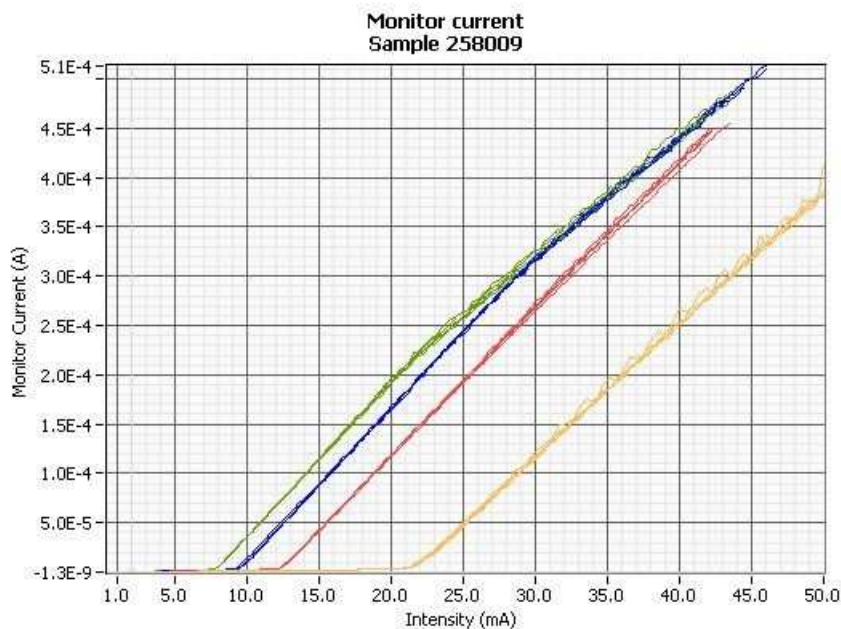
- Failures. Failure analysis not allowed to clarify the origin.



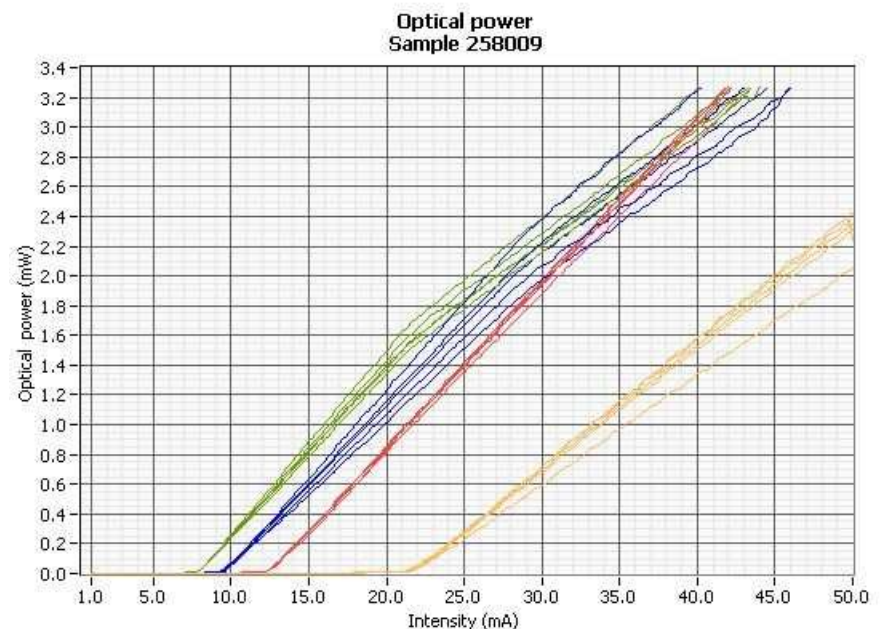
PIGTAILED LASER DIODES: Testing

Life test: Electro-optical measurements: comparison of measurements at the fibre optical end and at the photodiode.

— Measurements at -20°C , 0°C , 25°C , 70°C .



Photodiode



Fibre optical

Lessons learned; conclusions

Evaluation and Qualification approach:

- Most manufacturers are not willing to customise their process for a small volume order.
- Smaller manufacturers show greater interest and higher flexibility to customise their manufacturing and/or disclose the exact processing.
- A cost effective project qualification approach has been presented.

Qualification tests

- Optical measurements through fibres are less repetitive than electrical measurements. Optical connectors repetitiveness is lower than for electrical connectors.

End of the presentation

