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EPIC Meeting on New Space at European Space Agency

Reliability considerations on photonics parts for new space applications

Juan Barbero
12 September 2019

- **Newspace**
- **Photonic Parts for space**
- **Tailoring for specific missions**
  - ***Custom packaging for space***
    - From commercial components
  - ***Mission Environment***
    - Temperature range
    - Radiation environment
    - Characterization under Vacuum

NewSpace Additional Challenges

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"NewSpace is an approach that focuses on **lowering the barriers to entry to space industry,** by providing **cheaper access to space...** One of the major characteristics of the NewSpace era is the fundamental **shift from** an industry which was heavily dependent on government **agencies to** a more agile and an **independent private sector** that relies on **innovation**, working with much **smaller budgets** than the early space industry”

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Additionally when photonics is involved, everything depends of point of view…

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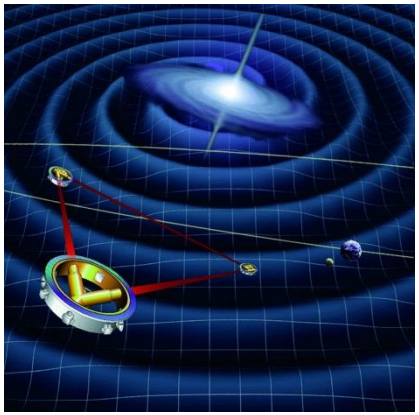
Constellations

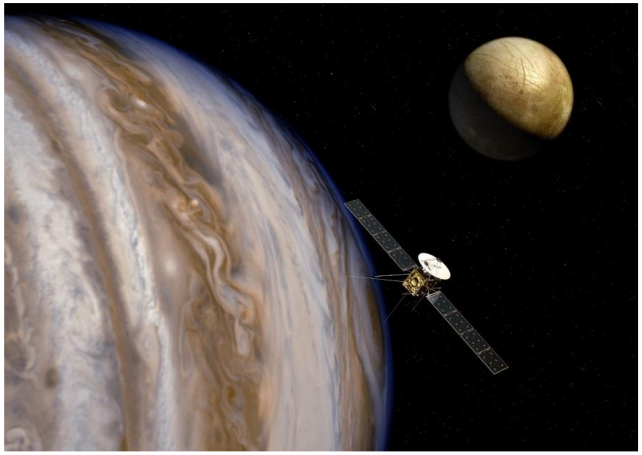
Extreme environments:

JUICE (JUpiter ICy moons Explorer)

EUCLID (Geometry of the dark Universe)

LISA (Gravitation waves)





ESA QUALIFIED PARTS LIST

Last edition: January 2017

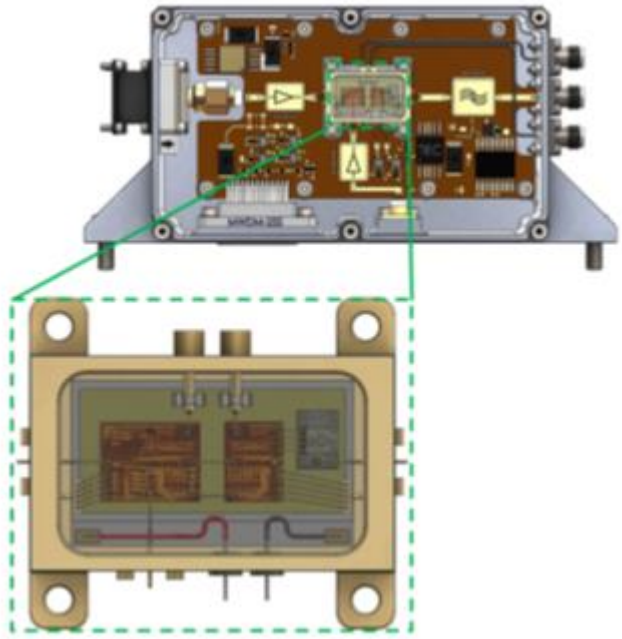
https://escies.org/download/webDocumentFile?id=64928

Section 18 **Component Type: Optoelectronics**

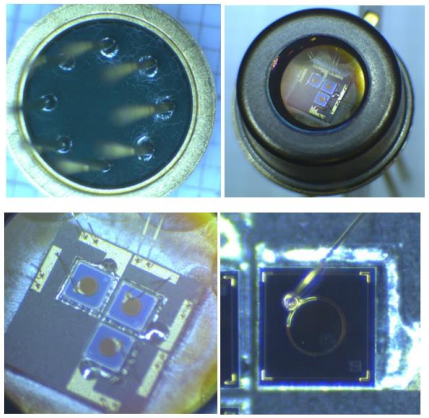
Sub-Section	Page No.	Cert.	Type Designation	Manufacturer
			Currently there are no qualified sources of Optoelectronics	

Packaging for New Space – ALTER Technology UK

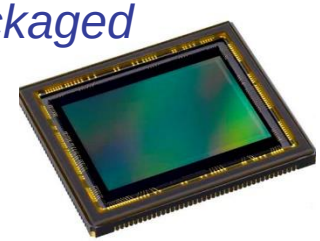
- *PICs packaged for space Optical Applications*
  - *RF inputs & outputs*
  - *Optical inputs & outputs*



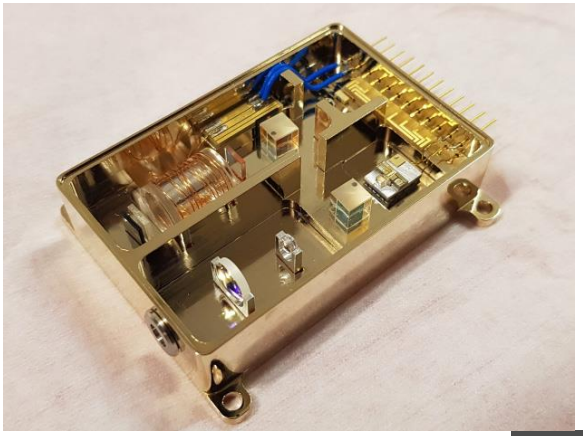
- *Single PackageTriple Photodiodes*



- *Commercial components space packaged*
  - *Image sensors*
  - *ASICs*

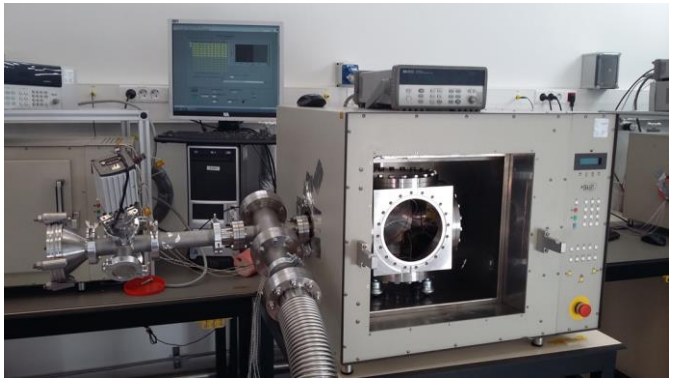


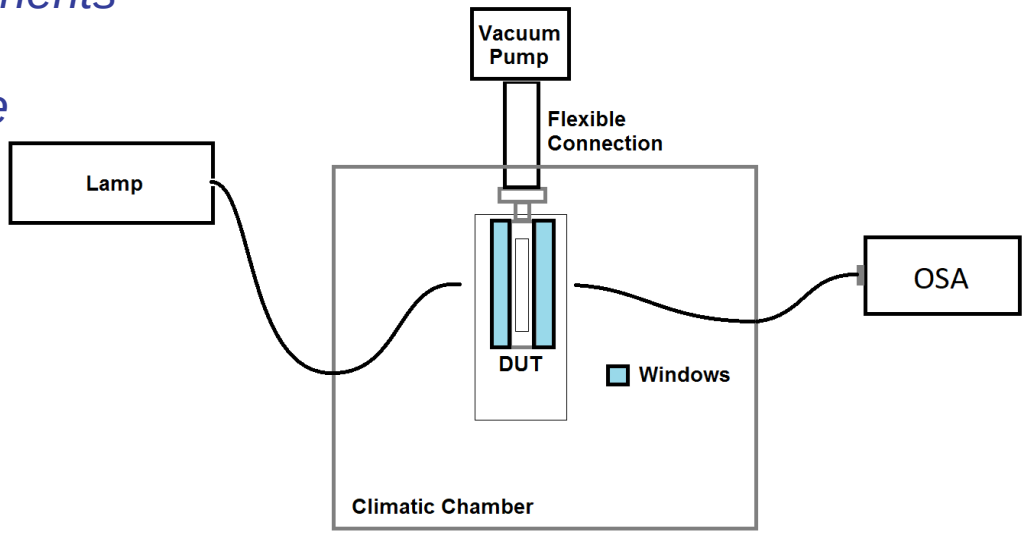
- *Frequency stabilized laser modules*
  - *Other complex optical packaging*



Testing for New Space – ALTER Technology Spain

- *Characterization of optical components*
  - *under vacuum*
  - *at PID controlled temperature*





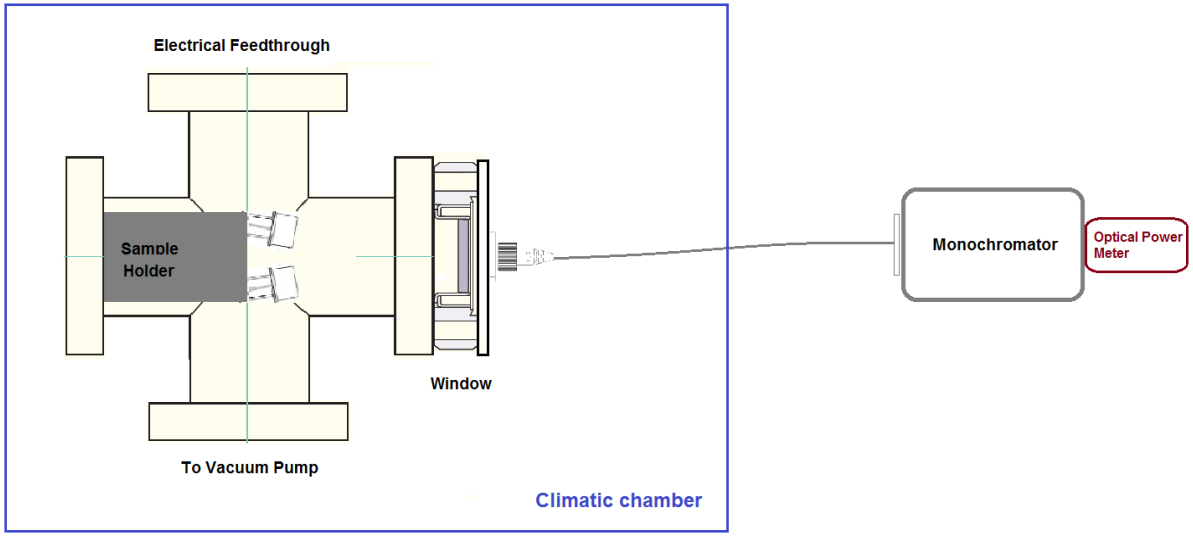
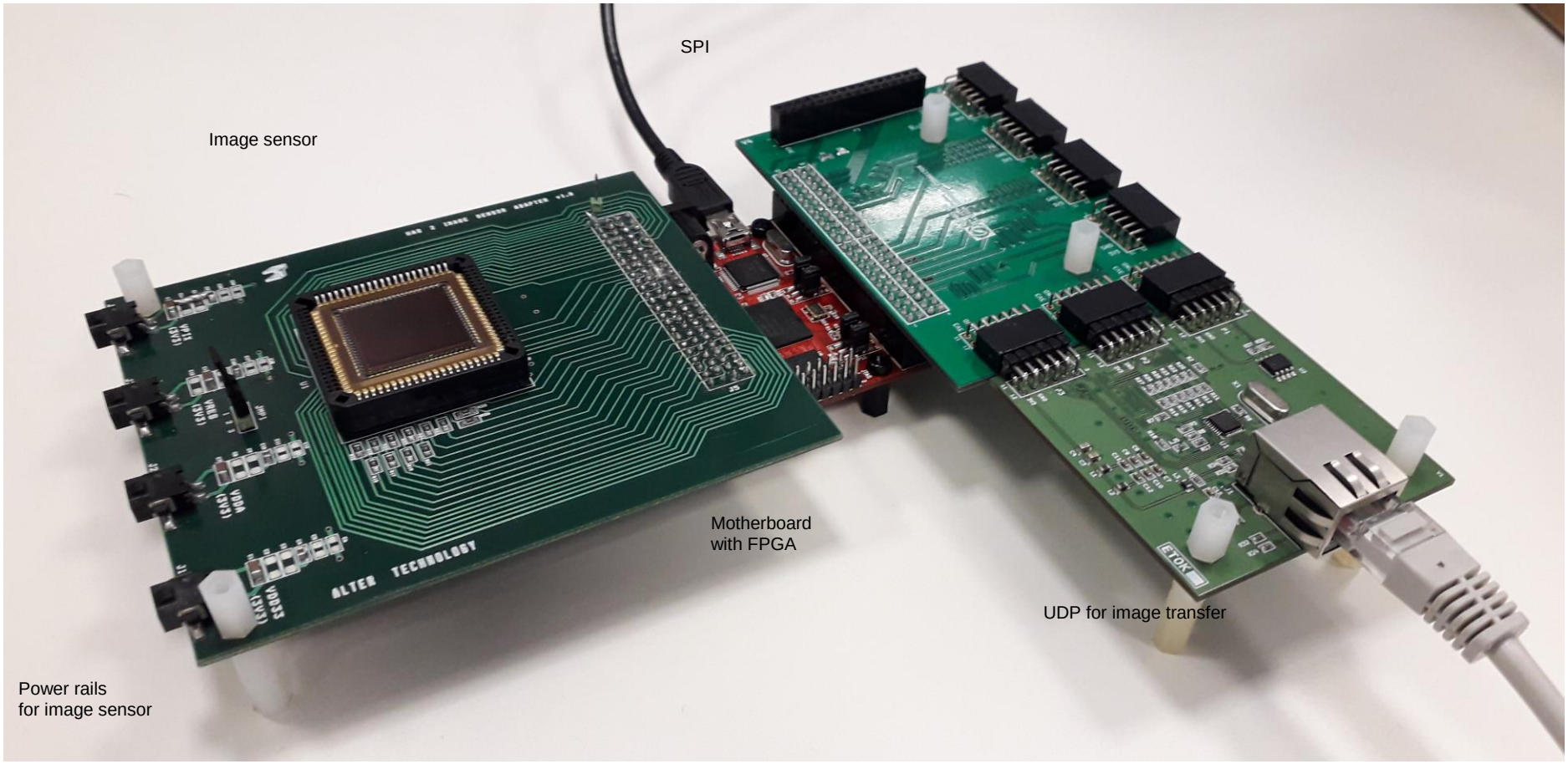


Image sensor Testing: board adapted by ALTER

- Flexible design to fit different image sensors CMOS or CCDs



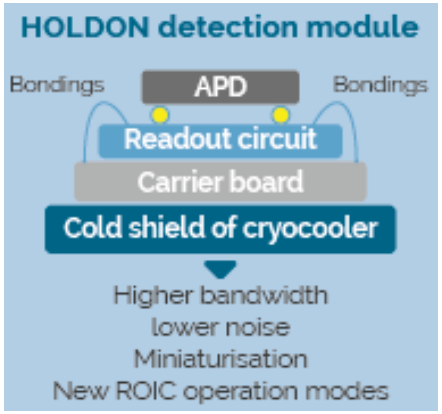
HgCdTe APD Optimization for Lidar Detection Of greeNhouse gases

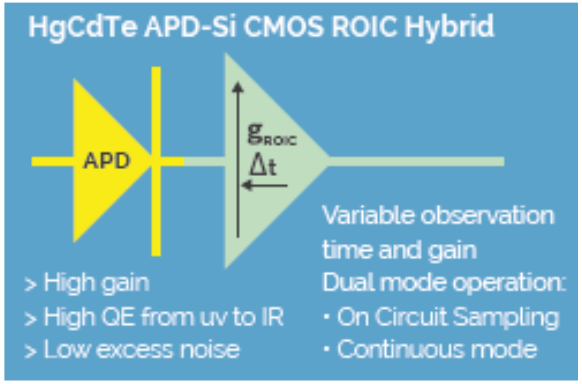
HOLDON

HOLDON Project

Three ambitious **objectives** are defined:

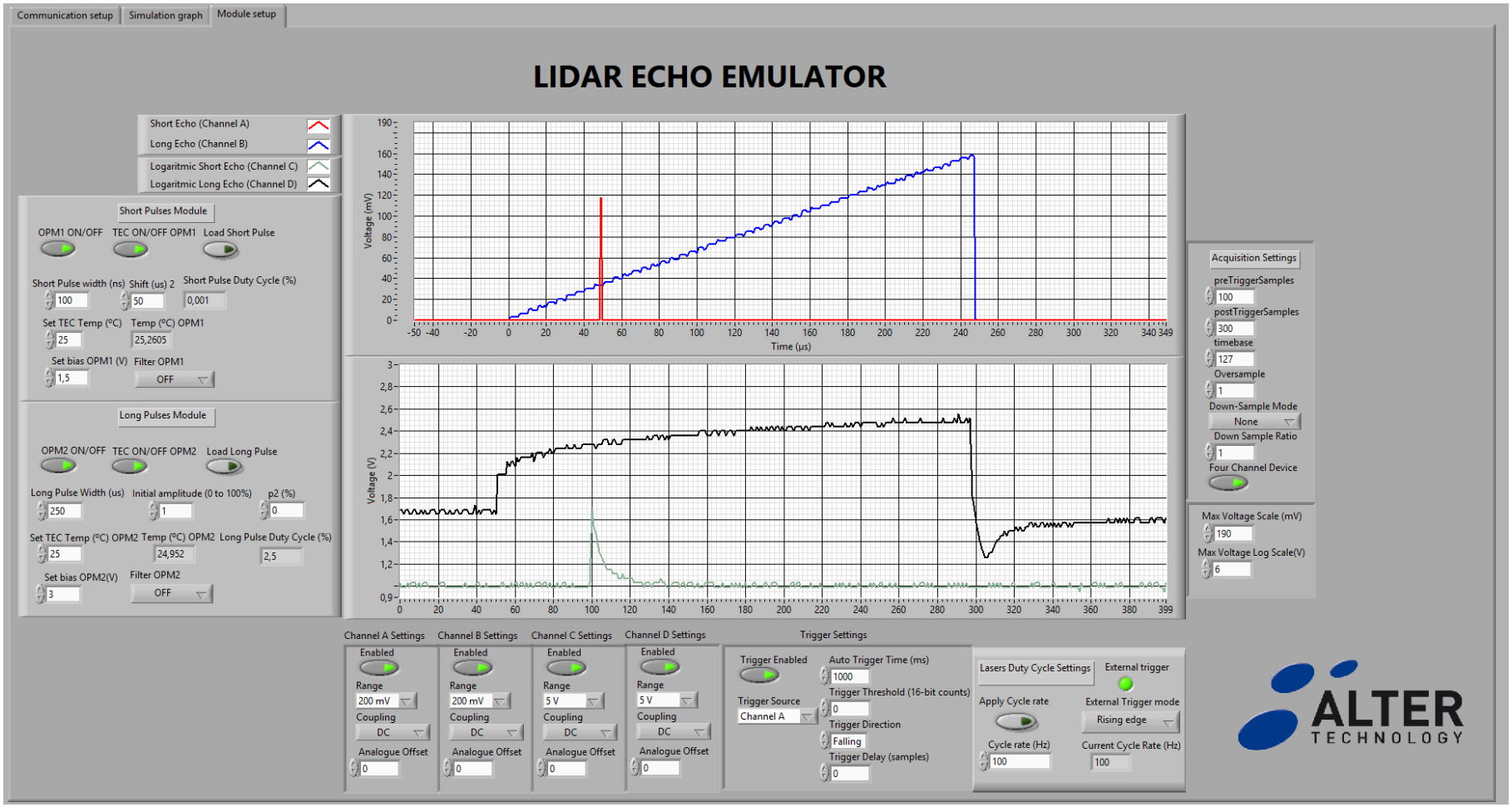
- Design and built a cutting-edge photon **noise limited** Lidar detection chain
- **Validate** adequation between detection chain **key performances** and future space mission requirements
- Demonstrate the **improvement** achieved with the cutting-edge detection chain for greenhouse gases detection





http://www.holdon-h2020.eu/

LIDAR Echo Emulator Software



LIDAR Echo Emulator

Long Echo

OPM2 — OMP2 — OI3 — OI OPM2 — SN21 — SN2 (50:50) — SN22 — ATTN 11dB — SN31 — SN3 (99:1) — SN32 — PD-B (99%)

SN33 — LOGAMPL-D (1%)

SN2 — SN23 — ATTN MEC 70dB — VI2 — ATTN VAR — VO2

Short Echo

OPM1 — OMP1 — OI1 — OI OPM1 — OI2 — ATTN 16.6 dB — SN11 — SN1 (50:50) — SN13 — ATTN FIX 13 dB — VI1 — ATTN VAR — VO1

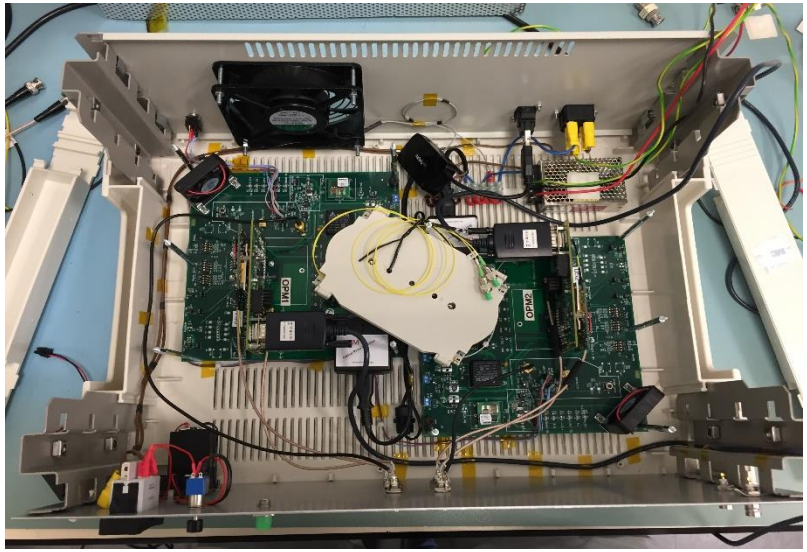
SN1 — SN12 — SN4 (99:1) — SN41 — SN43 — LOGAMPL-C (1%)

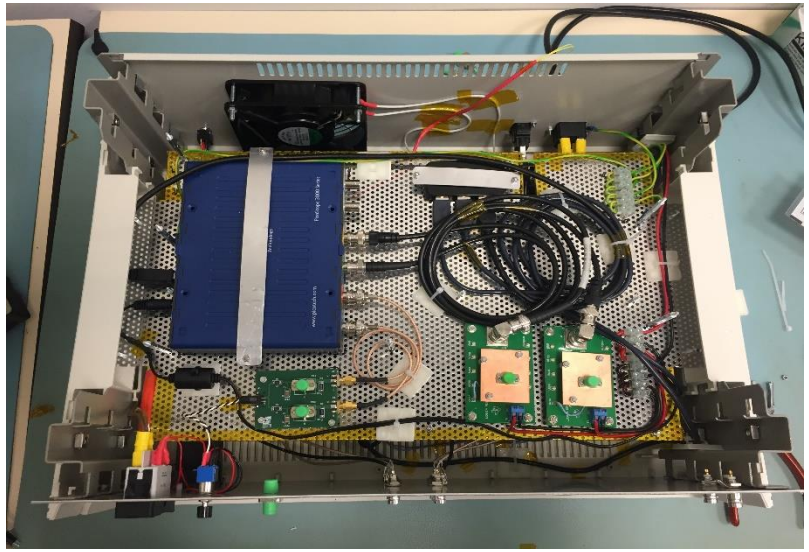
SN42 — PD-A (99%)

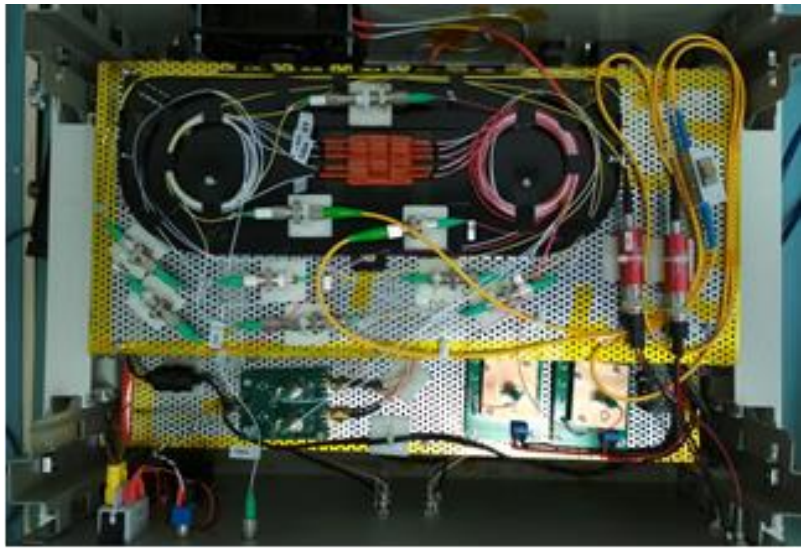
SN52 — SN5 (50:50) — SN51 — OUT

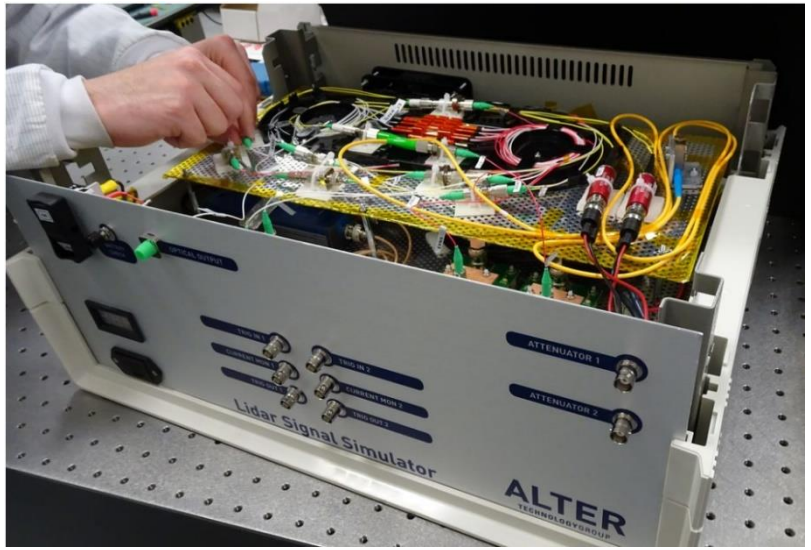
SN53

LIDAR Echo Emulator Basic Design









Summary

- **New Space Testing Challenges**
  - Custom Packaging
  - Mission adapted Optical Measurements
  - Custom developments

- **May lead to**
  - Cheaper
  - Faster
  - More flexible

The Optoelectronic and New Technologies Department is open to new challenges and developments in collaboration with our customers

Thank you

for your attention

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