



**Recent advances in the use of photonic in space
communication applications:
Digital Payloads and QKD**

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Founded in 2005 as a technology start-up company with venture capital funds. Facility based in Valencia (Spain). World-class infrastructure.

DAS develops innovative products based on its proprietary photonic technology for high performance sectors such as **Defense**, **Avionics** and **Space**.

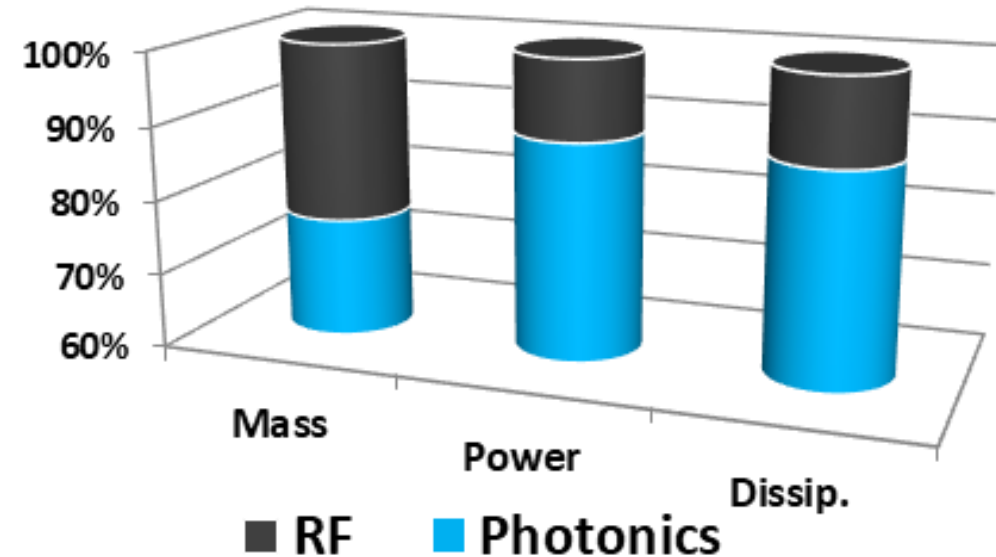
Photonic Payload Rationale

Concept:

- Spin-in terrestrial RF-over-Fiber techniques to the core of telecoms payloads
- Keep RF interfaces for users

Benefits:

- Reduce the required panel space for equipment mounting.
- Mass savings is in the hundreds of kilograms for VHTS satellite.
- Signal distribution with optical cables instead of RF equipment
 - ✓ Negligible distribution losses
 - ✓ Reduction in coaxial cables and waveguide
 - ✓ No EMI risk in optical pathways
 - ✓ Simplification in routing with reduced congestion
- Provides HTS flexibility without digital processing.
- Broadband, generic receivers for recurrence simplification.
- Use of high frequency bands (V/Q) for maximal capacity
- Potential seamless integration of optical feeders

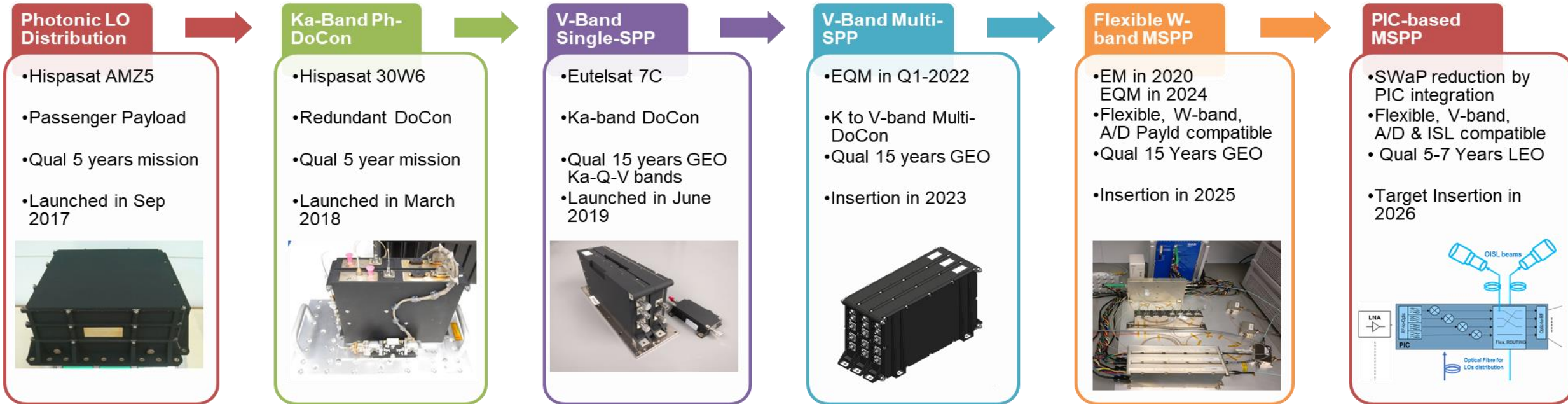


ICSO 2018 - Final Demonstration Results of OPTIMA, Photonic Payload for Telecommunication Satellites

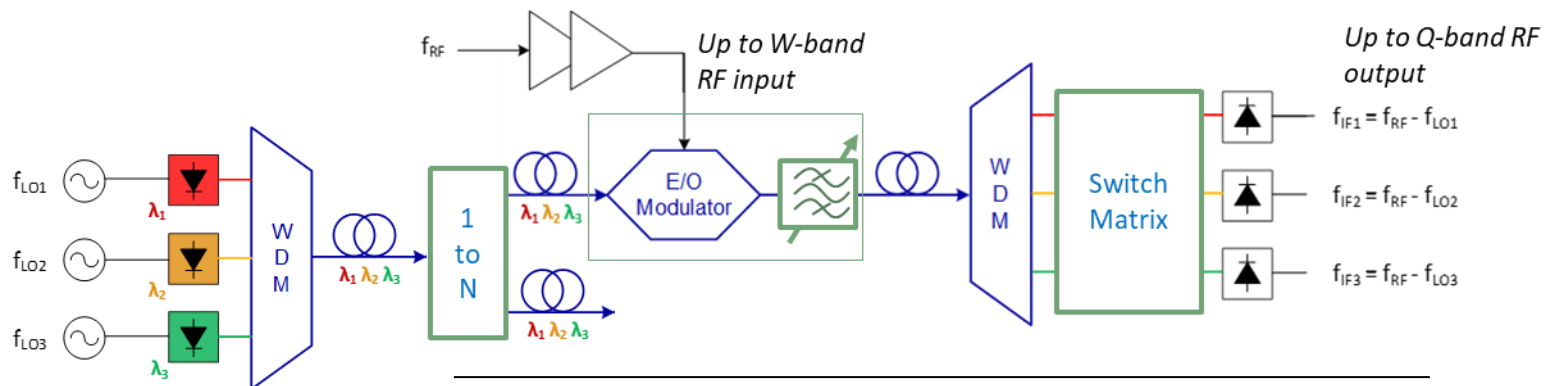
Photonic Heritage

Incremental roadmap

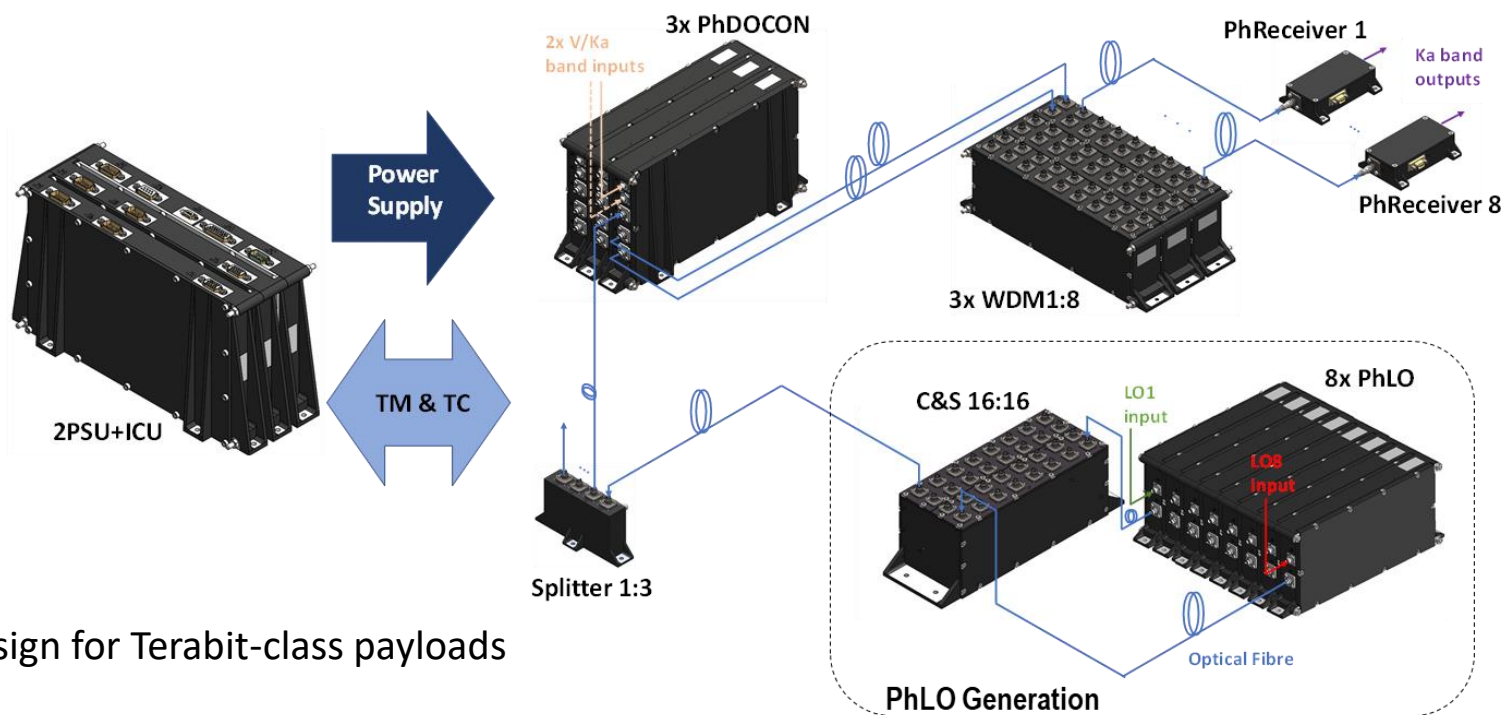
- Specific RF-Photonic Designs: PRODUCT ORIENTED
- Photonic Parts Qualification
- Photonic Heritage



Photonic Communication Payload: Analog flexible



- Arrayed Frequency up/down conversion
- Designed for Terabit-class analog payloads
- Compatible with Digital Routers (operating in L/C band) as front-ends
- Mature solutions, scalable
- Broadband up to Q/V bands

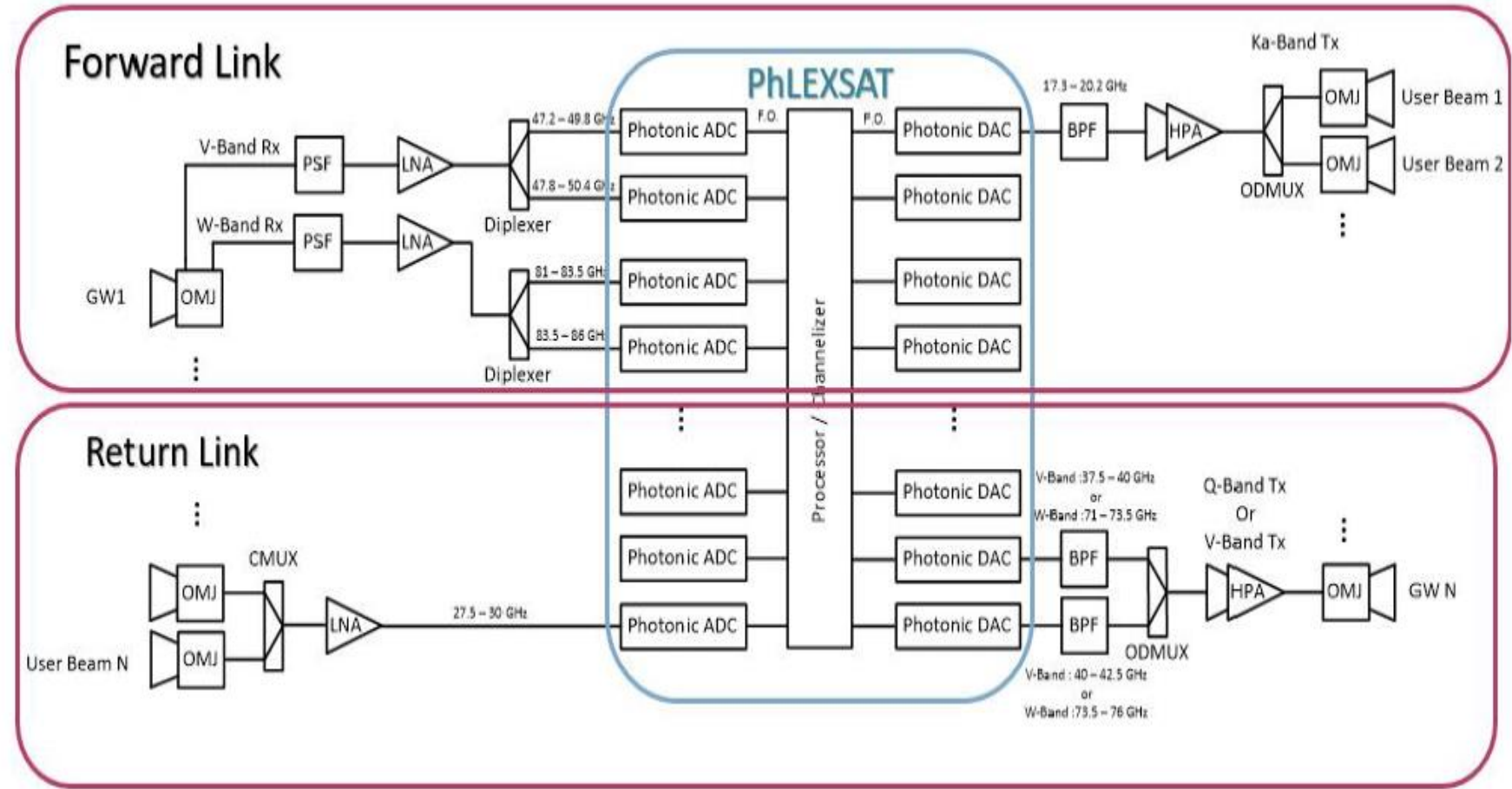
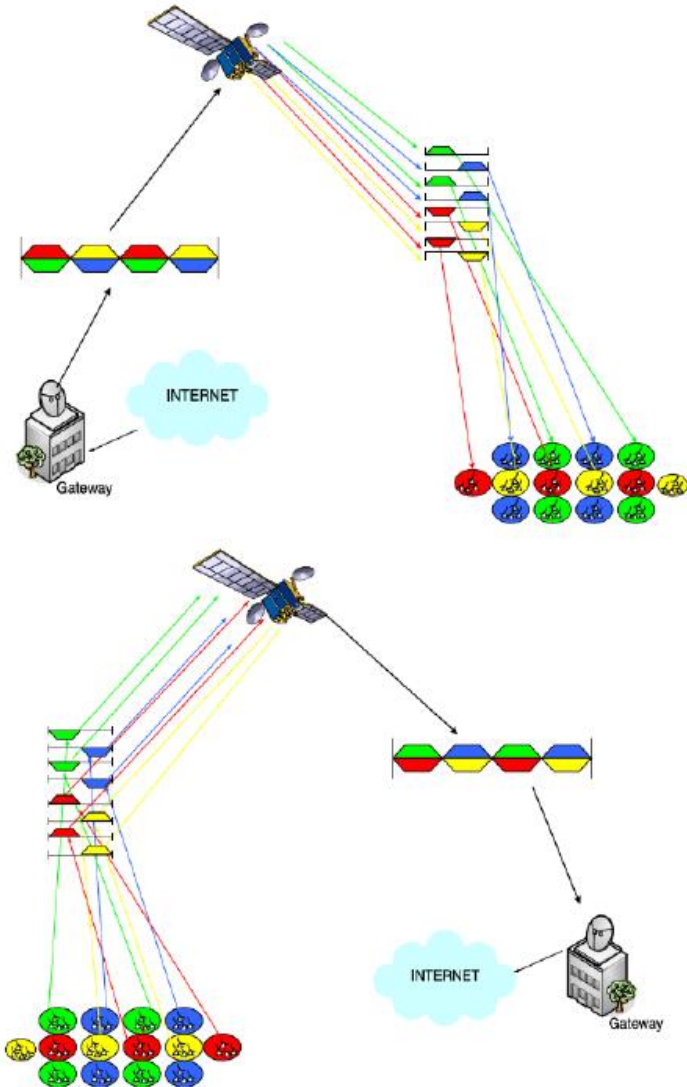


Design for Terabit-class payloads



- W-Band
- Fully digital P/L
- PICs for further SWaP optimization
- Hybrid integration

Photonic Data-Converters for Digital Payloads



PhLEXSAT Project

- Targeting Tbps-like digital payloads
- Photonic ADC up to 82GHz, 12Gsps, multichannel
- Photonic DAC up to 71GHz, 12Gsps, multichannel
- Dedicated IP cores
- **SWaP driver: use of PICS!!**

Based on
Photonic Sampling



H2020 GA 101004253

PhLEXSAT

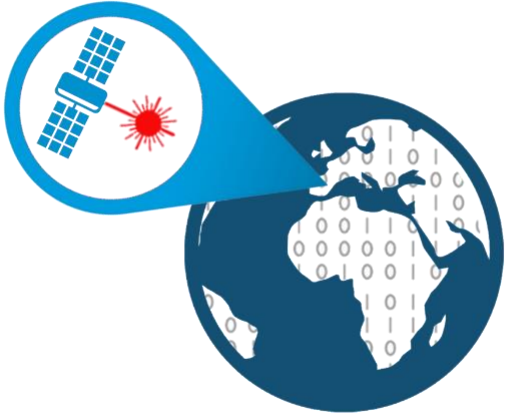
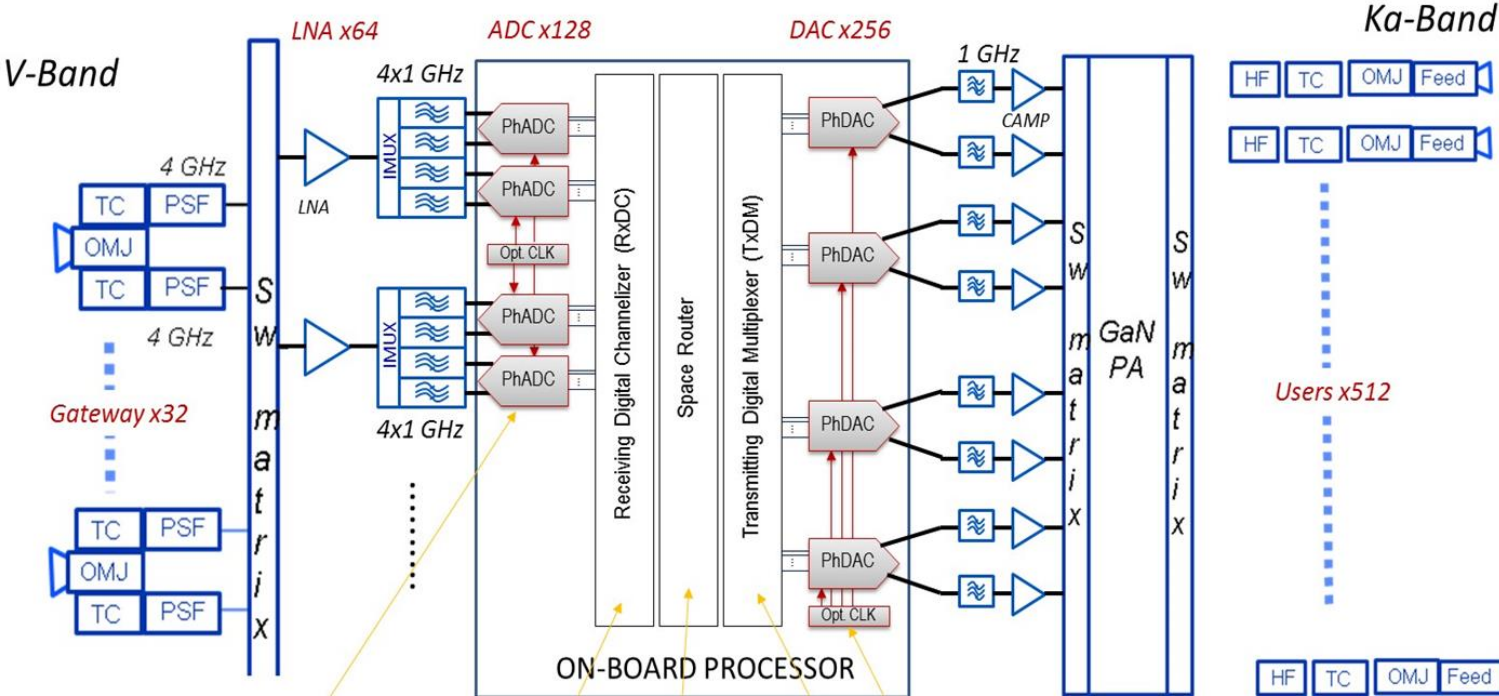
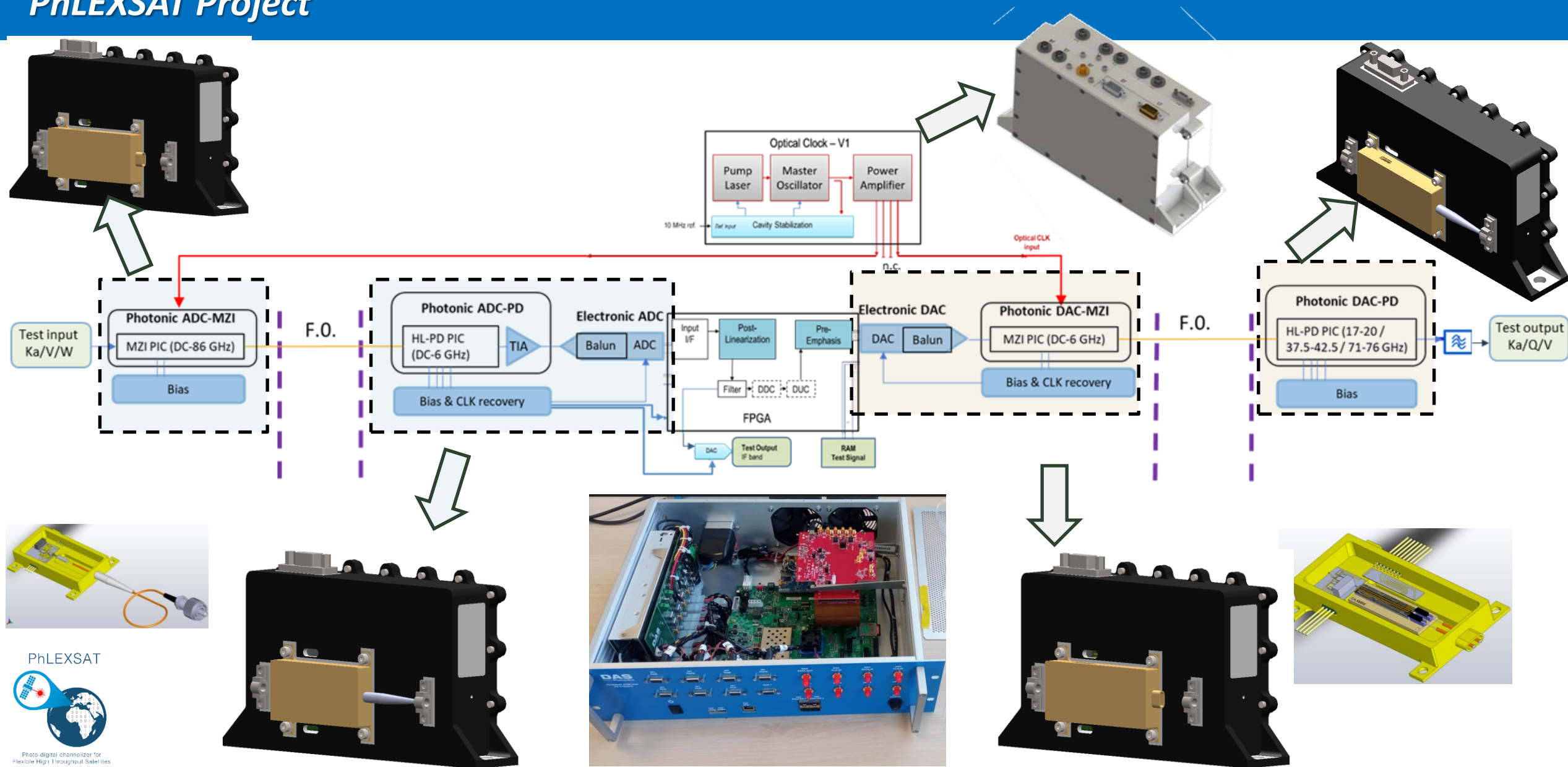


Photo-digital channelizer for Flexible High Throughput Satellites



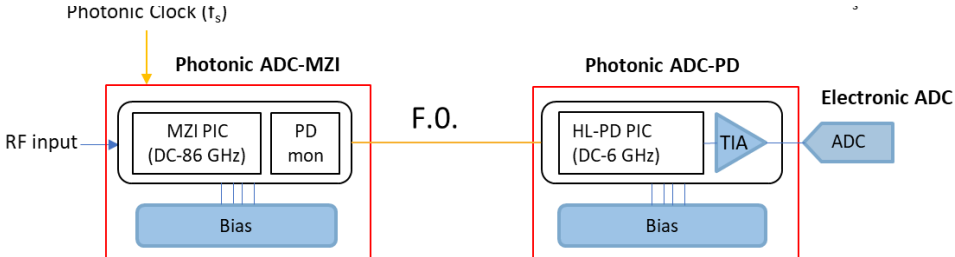
PhLEXSAT Project



EPIC Meeting on Photonics for Space: Opening New Horizons
 21-22 September, 2023 -- Exail HQ - Paris

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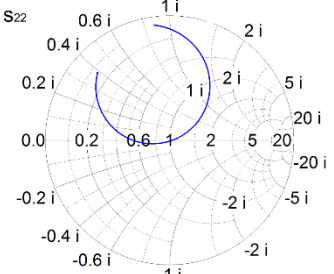
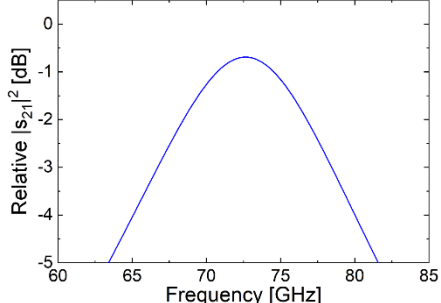
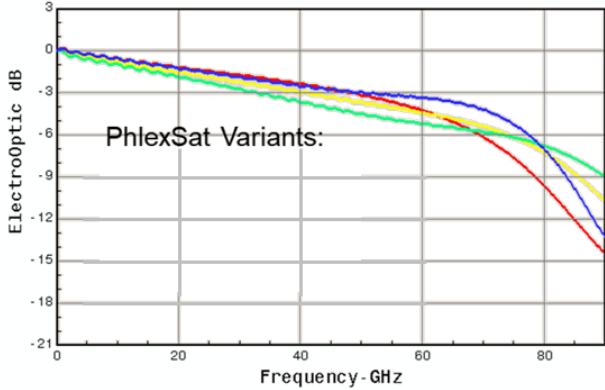
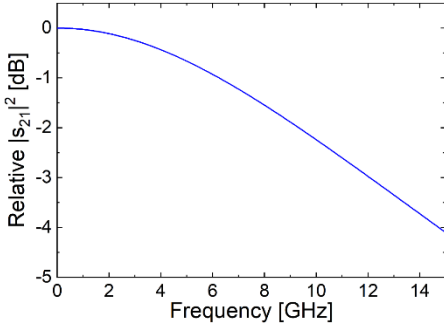
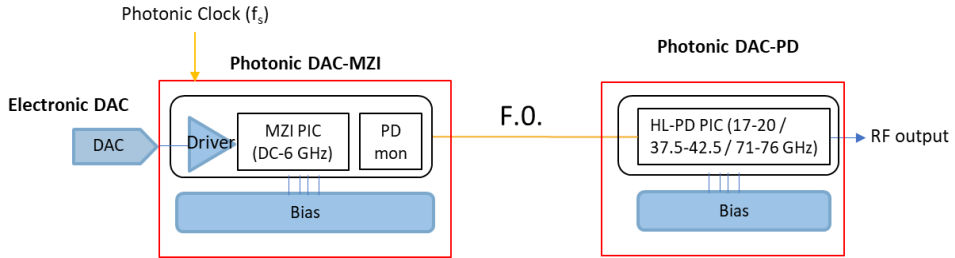
Photonic ADC



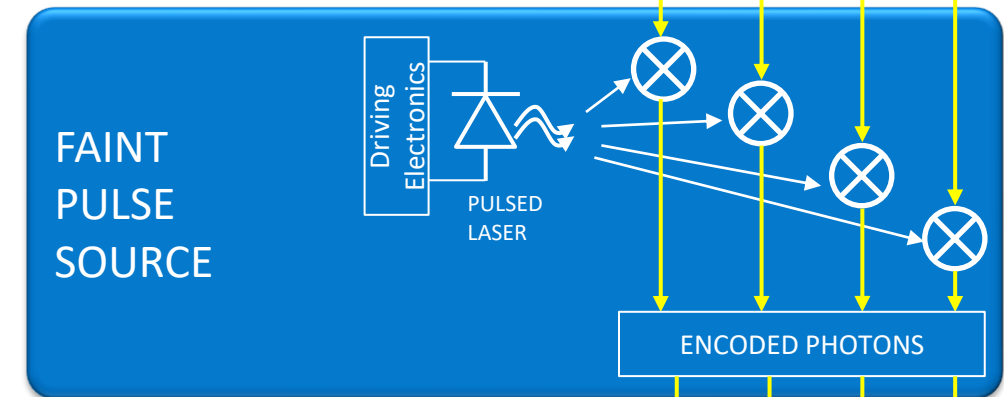
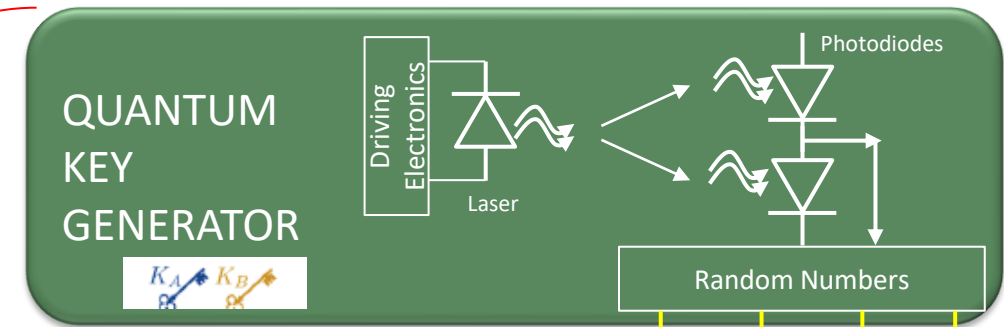
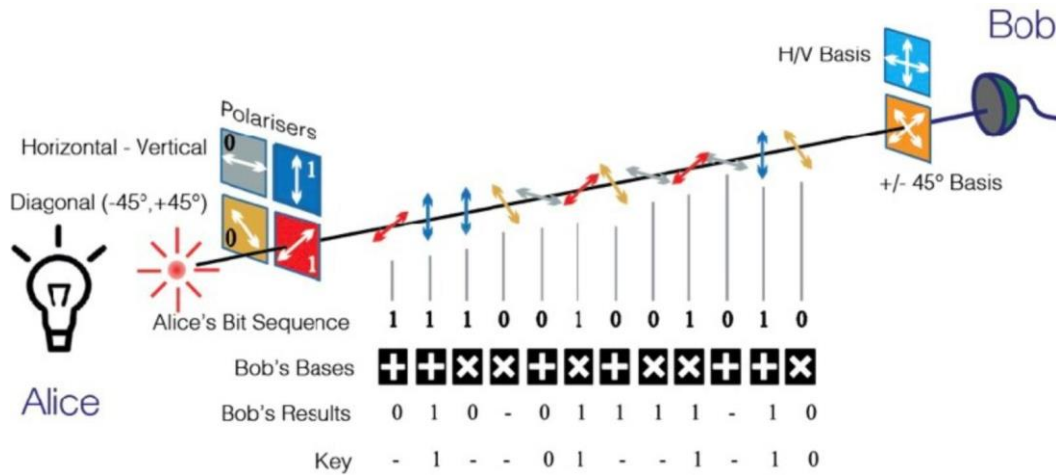
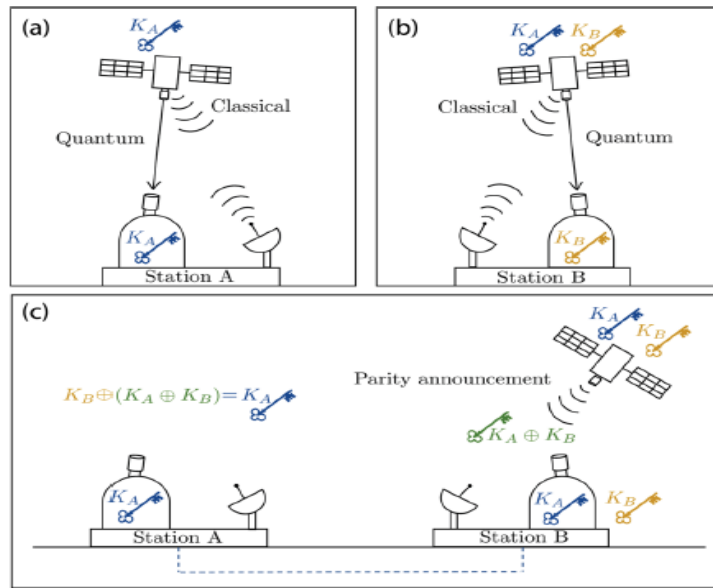
Specific PIC designs:

- MZI (DC-86 GHz)
- High-Linear Photodiode (DC-6GHz)
- MZI PIC (DC-6 GHz)
- HL-PD (17-20 GHz)
- HL-PD (37.5-42.5)
- HL-PD (71-76 GHz)

Photonic DAC



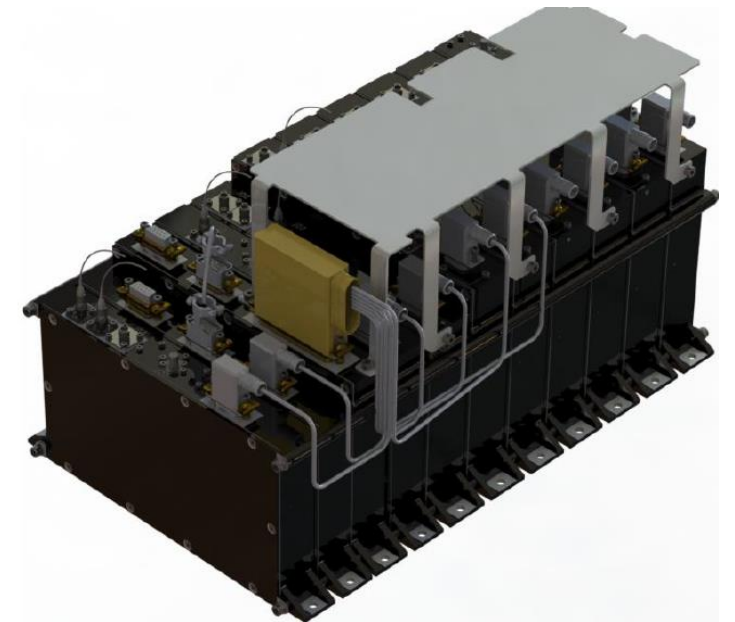
Fundamentals of Satellite QKD



Quantum Channel



QKDSAT
SPACE QUANTUM &
STRONGER ENCRYPTION



QKDSat Photonic Payload



Thanks!

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