Fotónica de microondas en guerra electrónica y espacio

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Tecnologías ópticas y fotónicas para aplicaciones espaciales (Tres Cantos)

ELECTRONIC WARFARE (EW)

Electronic Warfare (EW) is any action involving the use of the electromagnetic spectrum (EM spectrum) or directed energy to control the spectrum, attack an enemy, or impede enemy assaults

We need to “listen” as much as possible electromagnetic spectrum (bandwidth) with high sensitivity and dynamic range.

ELECTRONIC WARFARE (EW)

Electronic Warfare

RIGEL
Radar band, detection and countermeasures

REGULUS
Communications band, detection and countermeasures

Radar and IFF

LANZA-N 3D Long Range Surveillance

ARIES LPI Radar

CIT-25D mode S and mode 5 IFF

SATCOM

TNX terminals in X, Ka and Ku bands

Optronics

SEOTS and ALPHARD observation systems

Technologies installed on over 100 ships of Navies all around the world

ELECTRONIC WARFARE (EW)

Key industrial partner in the most important European programs

- Eurofighter
- Airbus A400M

ELECTRONIC WARFARE (EW)

Benefits microwave Photonics:

- High bandwidth
- Low losses
- Low power consumptio
- Low weight

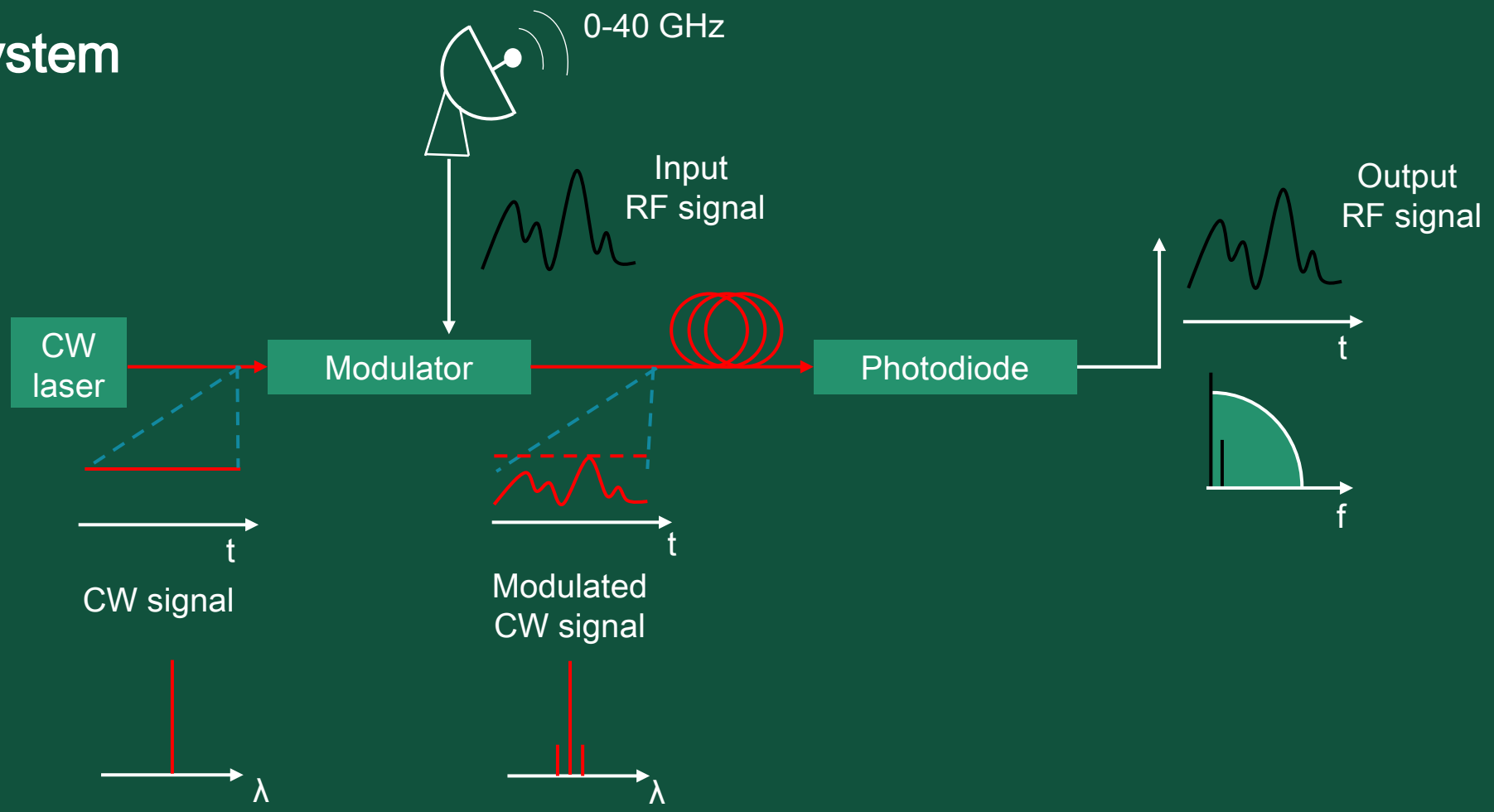
Particularly useful for:

- Photonic generation of microwave and mm-wave signals
- Photonic processing of microwave signals and mm-wave signals
- Optically controlled phased array antennas for beam forming
- Radio-over-fiber systems
- Optical Transceivers
- Photonic analog-to-digital conversion for ELINT systems.

Conventional RoF System

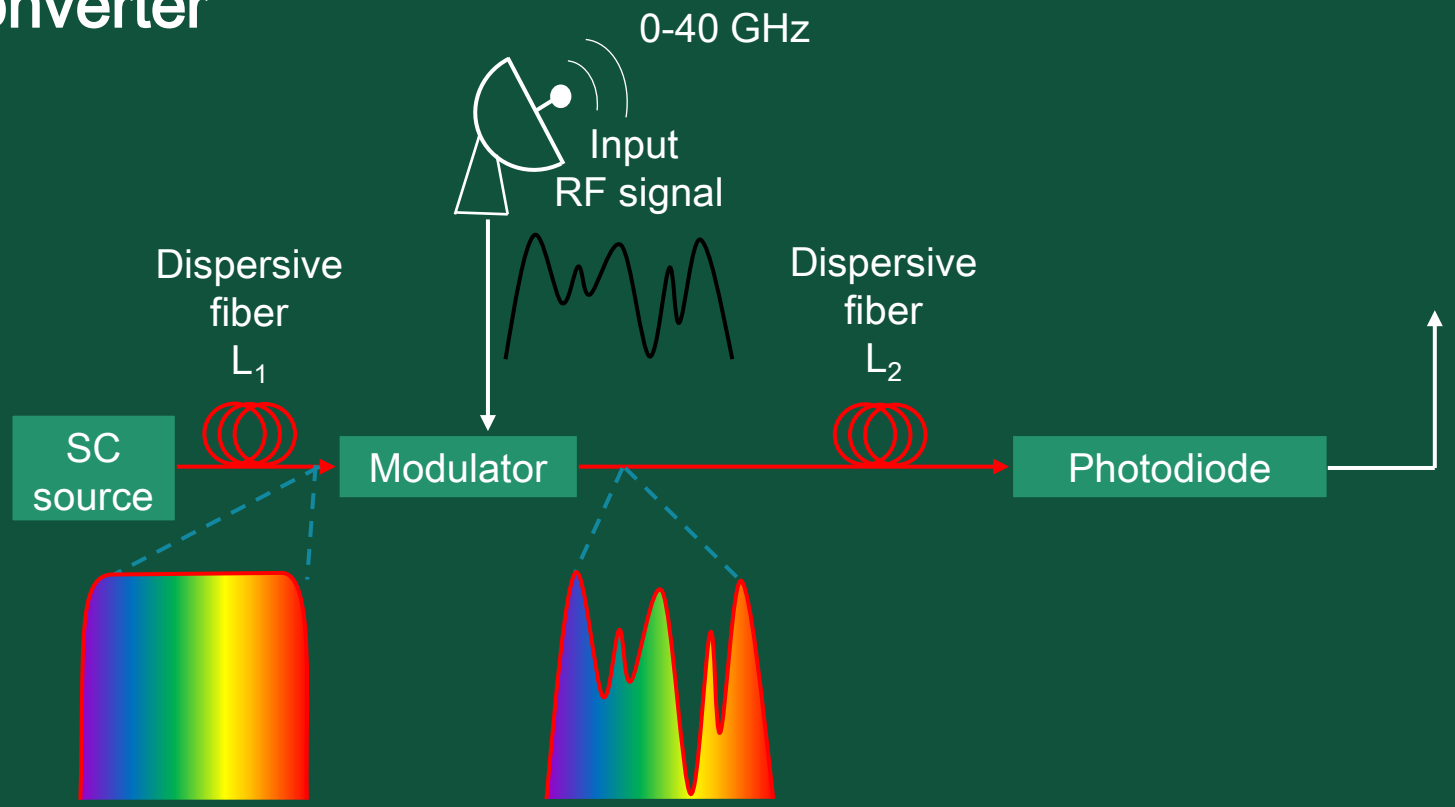
Bandwidth limited by:

- Modulator
- Photodiode
- ADC



Adapted from: Capmany, J. and Novak, D., Microwave photonics combines two worlds. Nature Photon.1,319–330(2007).

Photonic Time-Stretched Analog-to-Digital Converter



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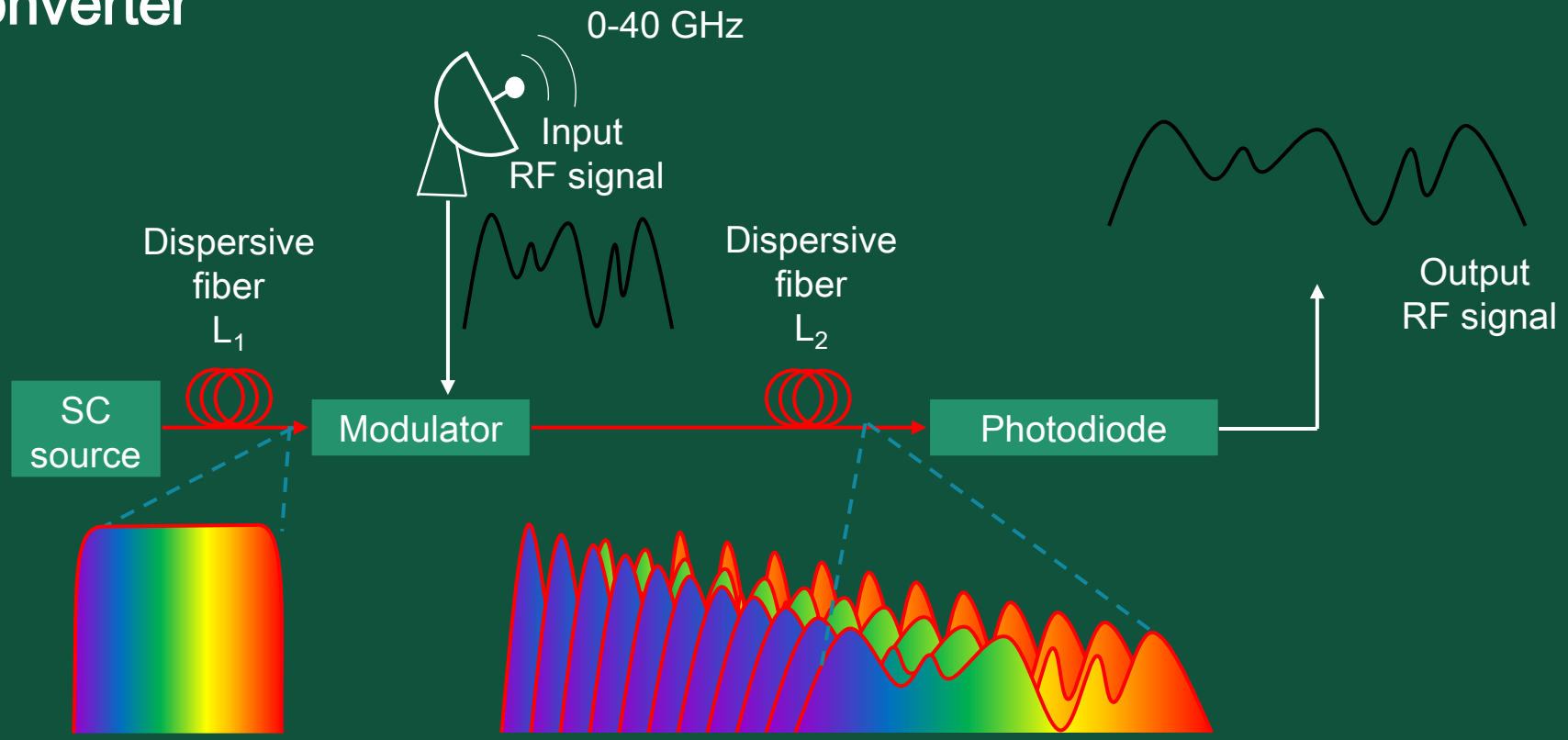
Photonic Time-Stretched Analog-to-Digital Converter

Magnification factor (stretch factor):

$$M = 1 + \frac{L_2}{L_1}$$



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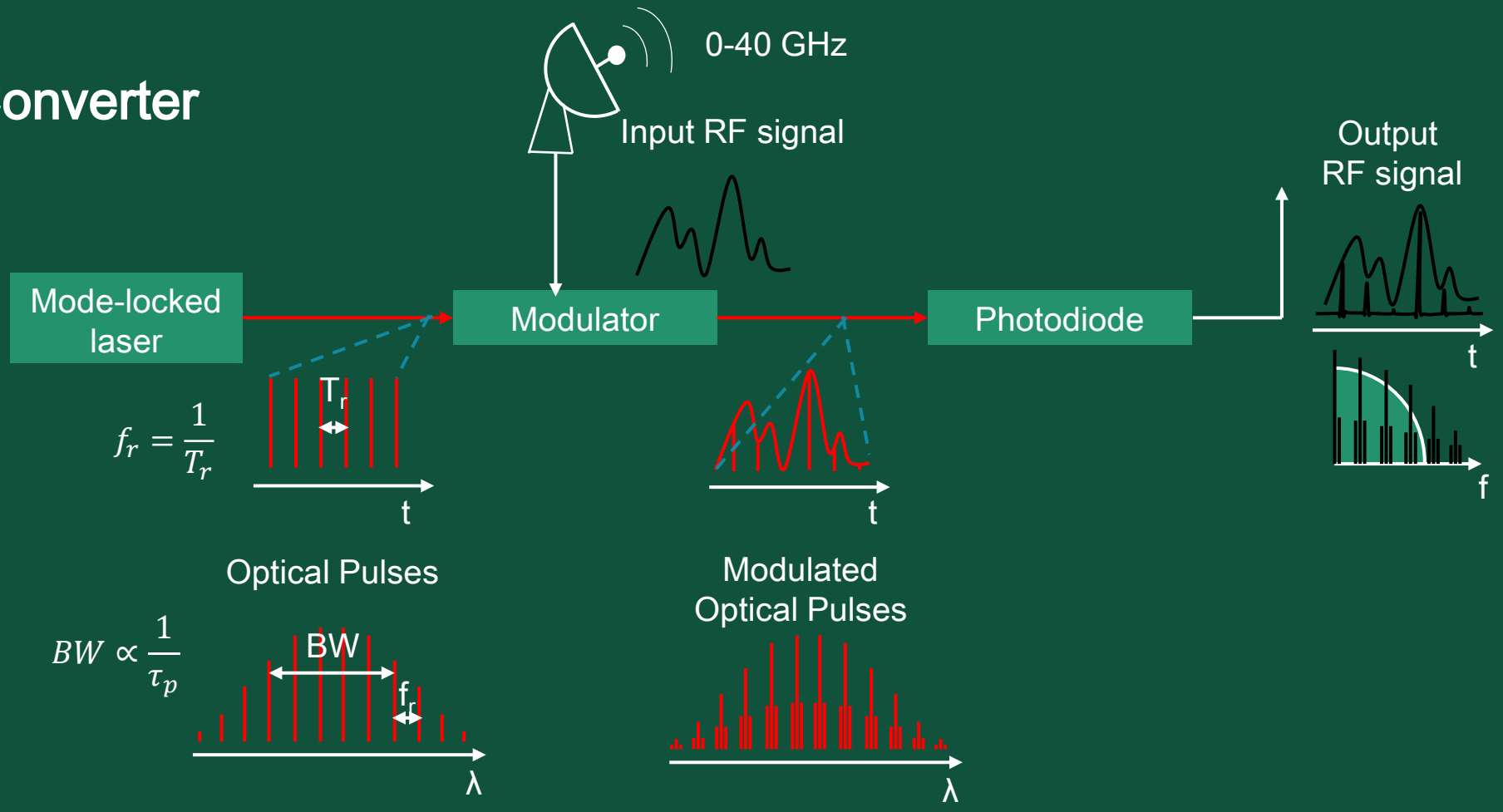
Photonic Sampled Analog-to-Digital Converter

Bandwidth limited by:

- Pulse Duration



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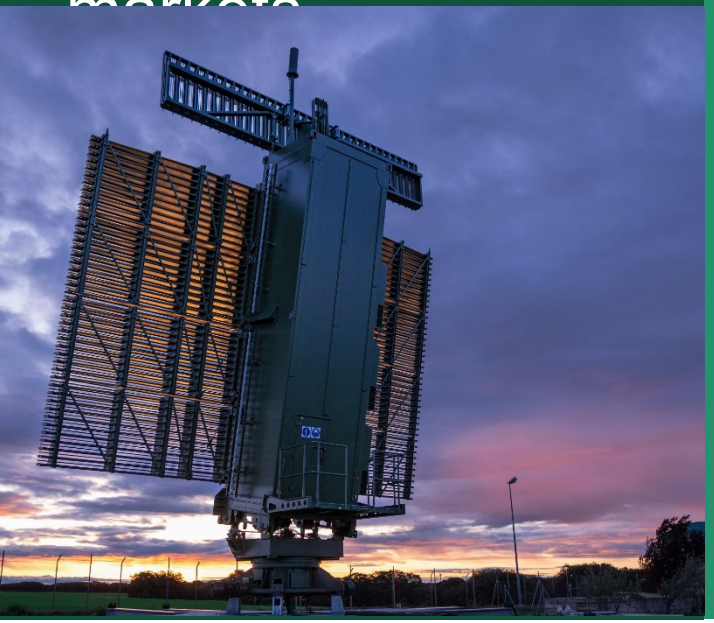
APPLICABILITY OF PHOTONICS IN INDRA

Energy (Oil & Gas)	Security	Electronic Warfare	Among Others…
▪ Chemical Sensing (gas and liquid) ▪ Leak detection in pipelines	▪ Civil Infrastructure protection ▪ Distributed sensing technology in avionics and space via miniaturization of the optical interrogator	▪ Reduction of size and weight ▪ Reduction of power consumption ▪ Controllable phase matching	

CONCLUSIONS

INDRA has found several applications of photonic technology in its markets



Different photonic devices are required such as:

- High power lasers
- Pulsed lasers
- High power photodiodes
- High sensitivity infrared image sensors
- High bandwidth intensity modulators
- High dispersive devices

INDRA is interested in the applicability of PIC in a near future.

INDRA is looking for partners to work together in this new field!

Diseño y Desarrollo

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