consorzio nazionale
interuniversitario
per le telecomunicazioni

INSTITUTE
OF COMMUNICATION,
INFORMATION
AND PERCEPTION
TECHNOLOGIES

Scuola Superiore
Sant'Anna

Microwave Photonics for radars

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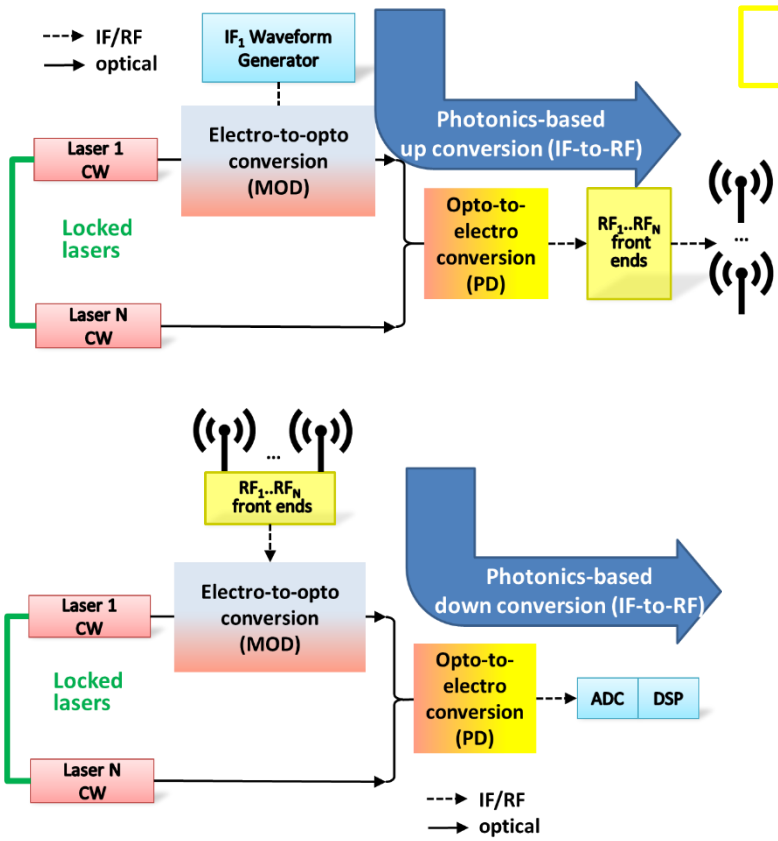
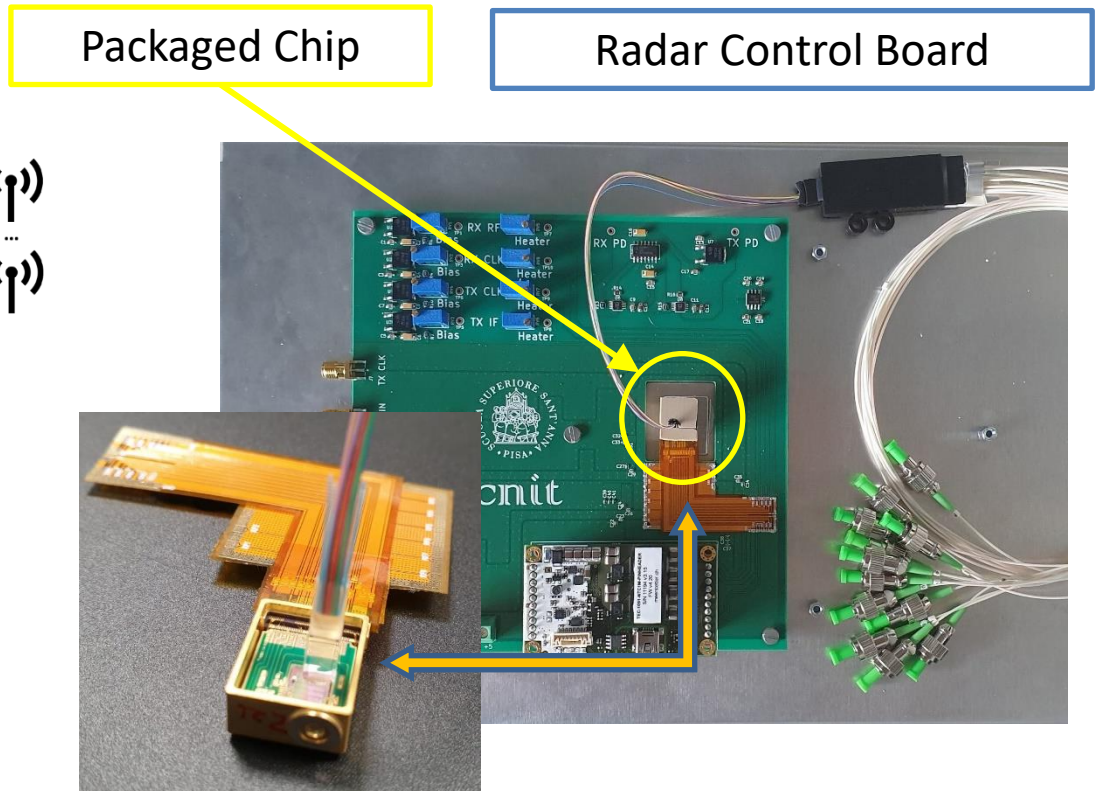
Photonics-based radar/comms transceiver on chip



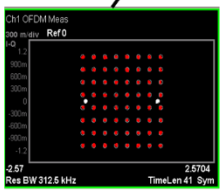


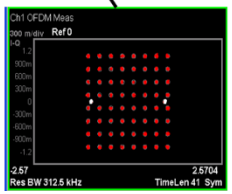
Radar/RF comms	
RF Carrier	4
Tunability	**S, C, X, Ku (from 2 GHz to 18 GHz)**
RF Signal Bandwidth	**<1.75GHz**
Sensitivity (w/o front end) at SNRmin=10dB	-52 dBm in S band; -38 dBm in X-band
SFDR	100 dB*Hz^2/3 in all bands
SNRmax:	68 in S band; 64 in X-band
Conversion loss (w/o front end)	56; 58; 61; 63 in S, C, X, Ku band
Isolation between TX and RX	> 80 dB

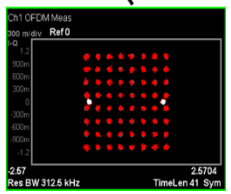
Photonics-based radar/comms transceiver on chip

RF communication

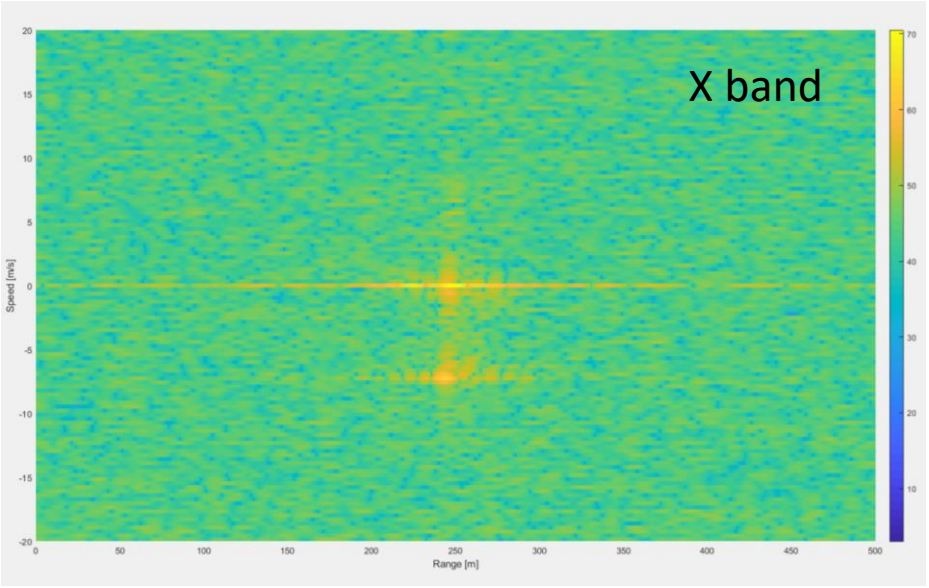
	B2b 100 MHz	B2b 2.9 GHz	Downconversion 2.9 GHz	Upconversion 2.9 GHz	Upconversion 9.1 GHz
EVM dB	-35.3	-39.2	-35.1	-33.2	-29.3
EVM %rms	1.71	1.09	1.75	2.18	3.41

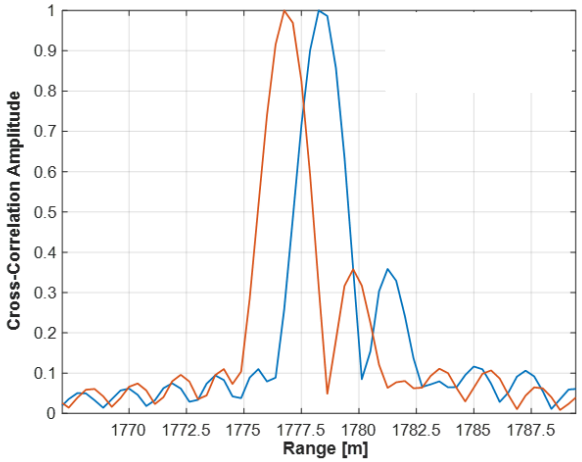






Radar detection





100MHz chirped signal (resolution of 1.5m)

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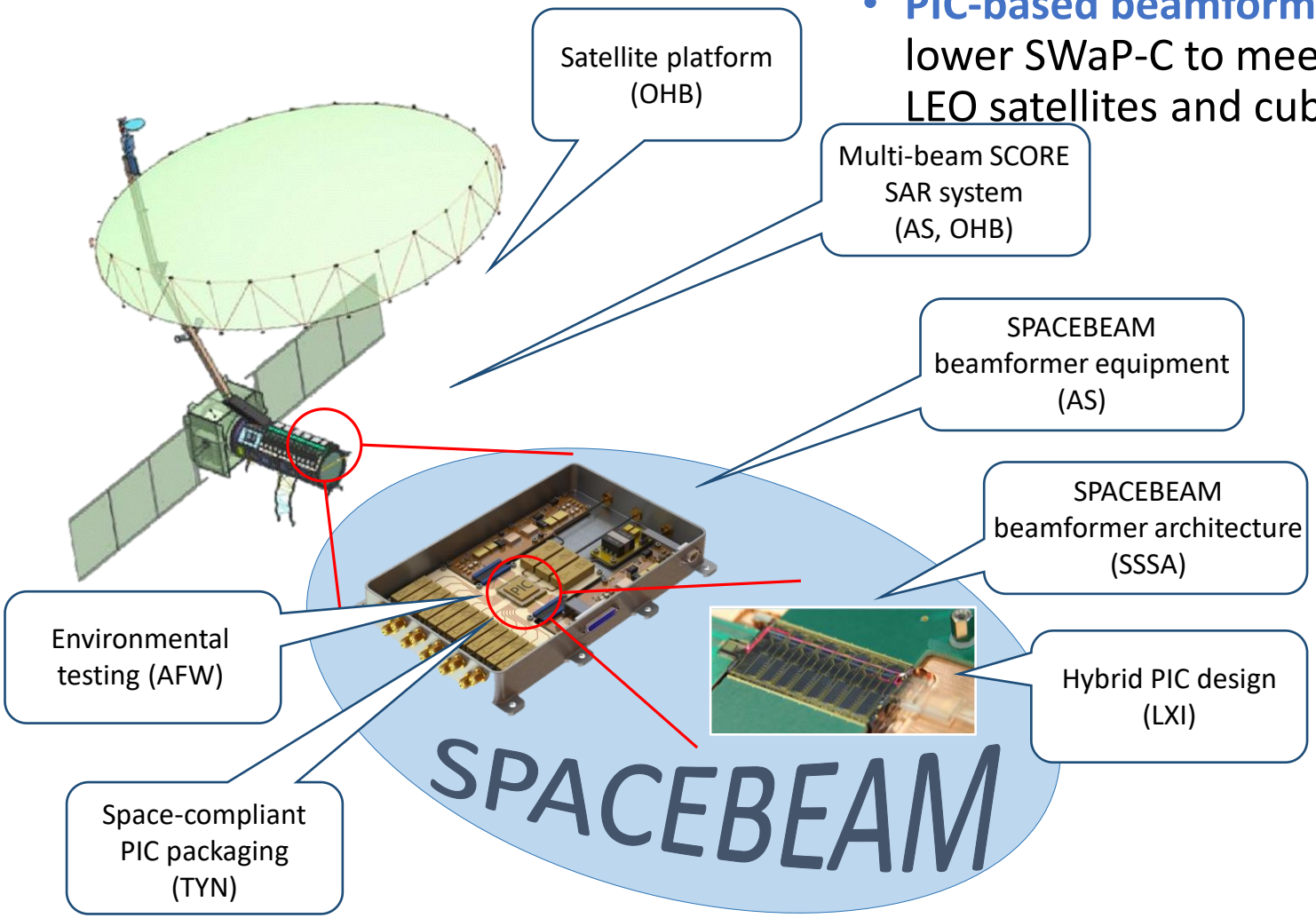
DELL'INFORMAZIONE
E DELLA
PERCEZIONE

Beamforming for PAAs: the SPACEBEAM project

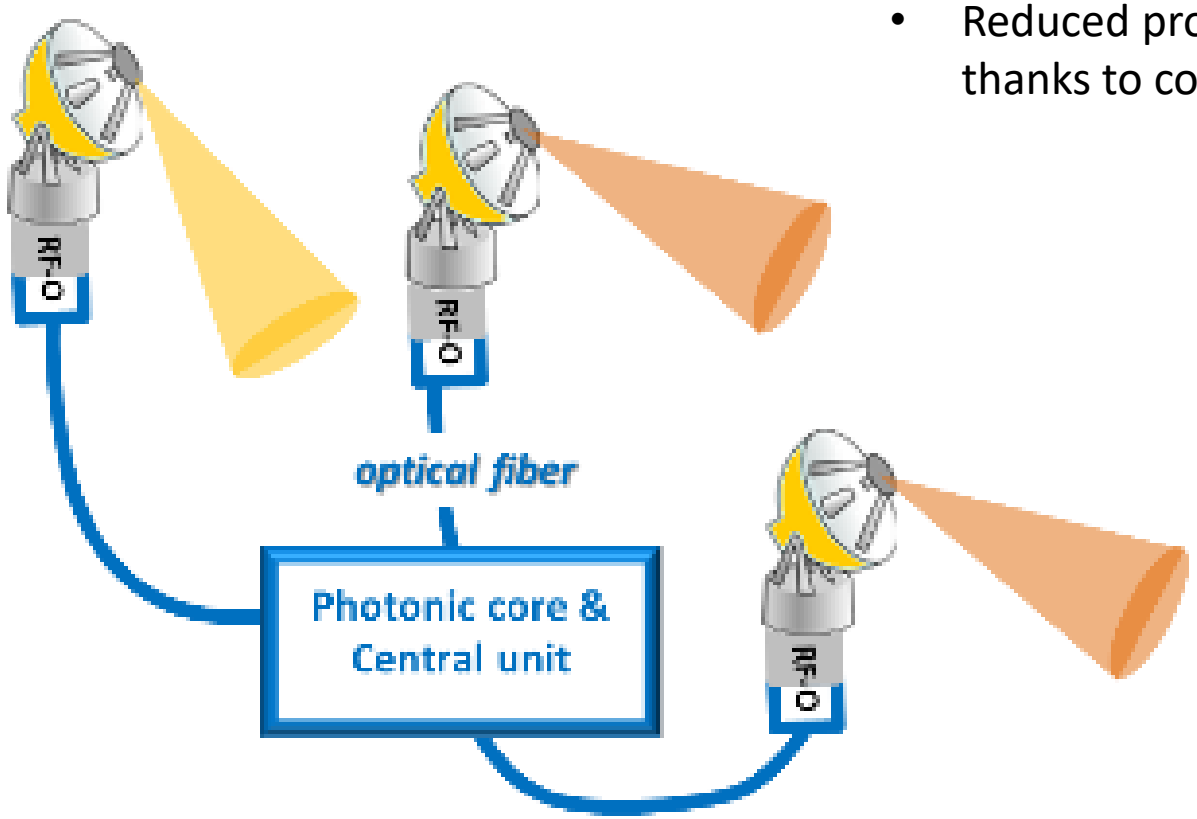
- SPACEBEAM will develop a **reconfigurable multi-beam Scan-on-Receive SAR** for Earth observation
- **PIC-based beamforming network** to lower SWaP-C to meet the specs for LEO satellites and cubesats



Photonics-based coherent MIMO radar system

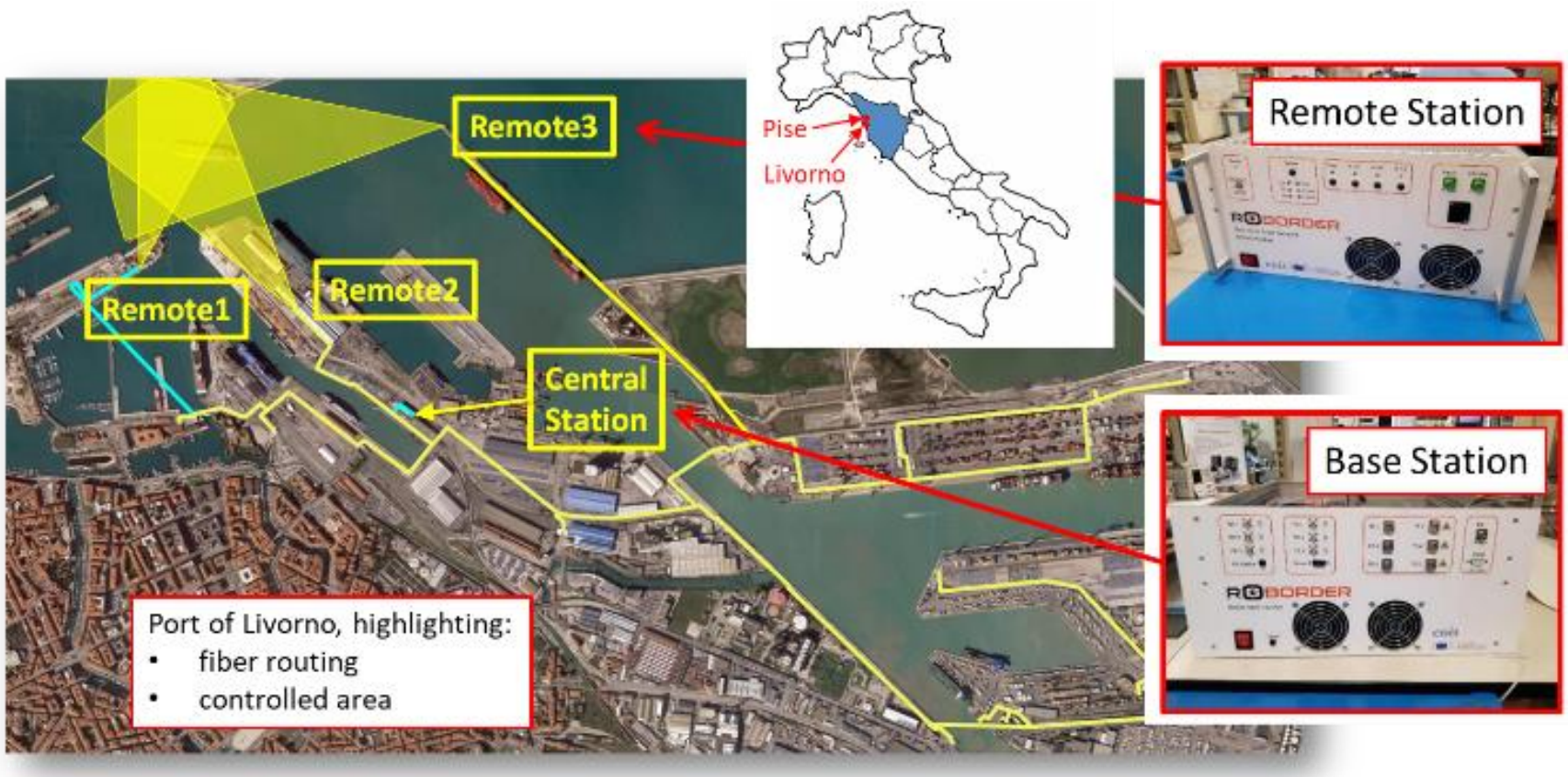
A central unit can manage multiple distributed radars

- Sharing the hardware
- Centralized processing
- Reduced processing complexity thanks to coherence



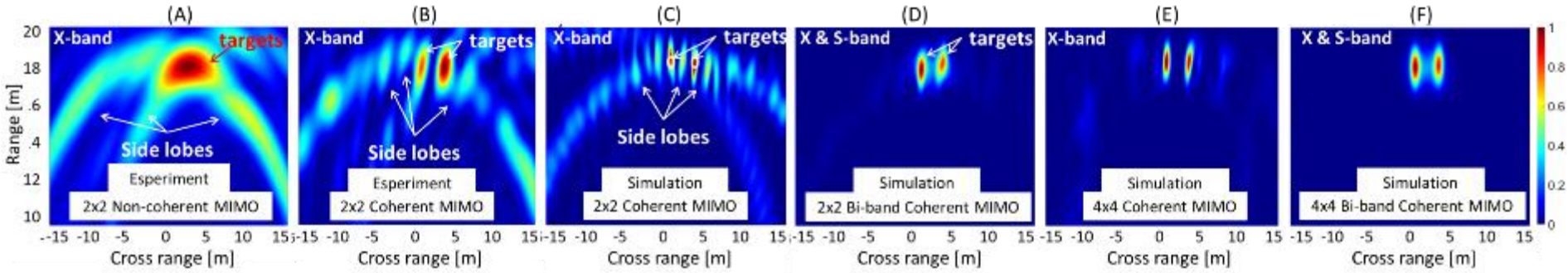
Photonics-based coherent MIMO radar system

- Three dual-band remote radars
- BW: 100MHz @2.9GHz + 100MHz @9.7GHz

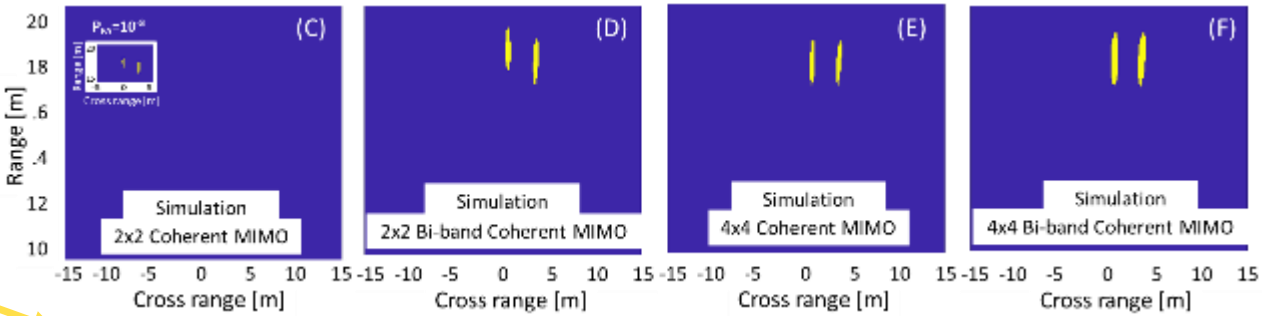


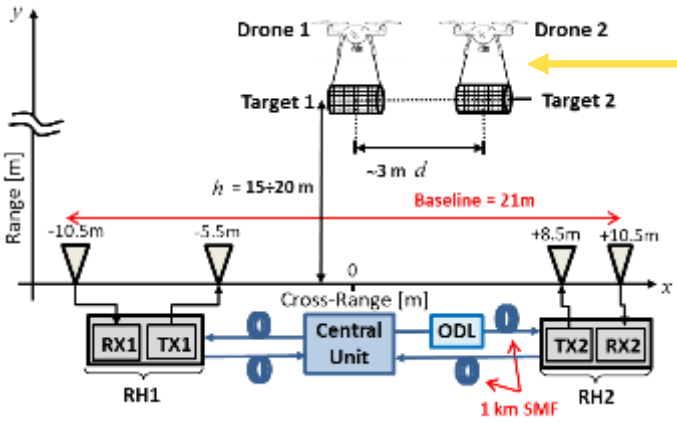
Photonics-based coherent MIMO radar system

Analysis of a photonics-based coherent MIMO radar system

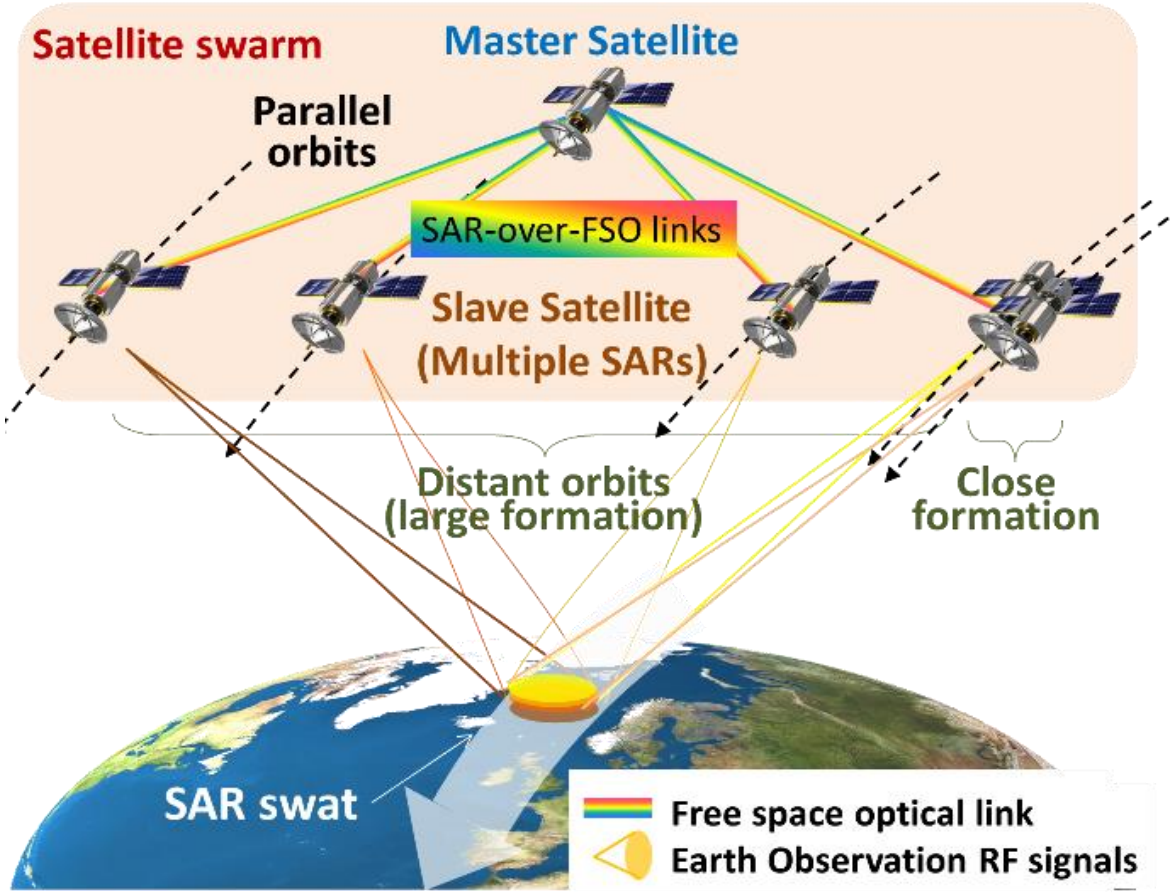


Detection maps





Photonics-based coherent MIMO SAR



MINISTERO DELL' ISTRUZIONE, DELL'UNIVERSITÀ E DELLA RICERCA

Microwave Photonics for Radars

- What we do:
  - Using Microwave Photonics for bringing new potentials into the filed of Radar and its applications

- What we offer:
  - Experience with the design and implementation of MWP solutions for radars, at several levels: photonic system, radar system, technology, integration

- What we look for:
  - Photonic Technologies for better RF performance
  - Collaborations on new applications in the radar field