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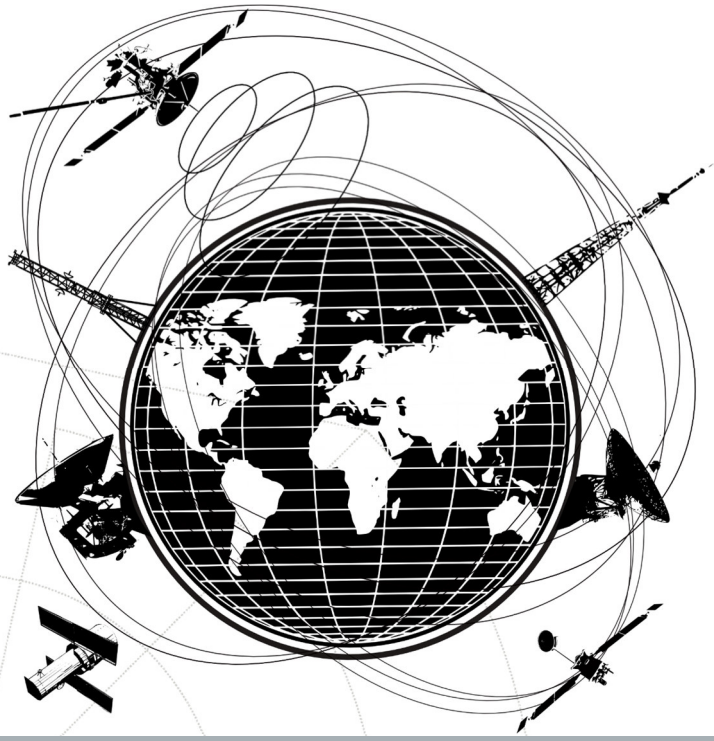
Phased array antennas are suitable for massive MIMO wireless communications, of which 5G and satellite communications are paradigmatic examples. These 2 patent families propose a photonic beamforming system that is able to process a large number of RF signals with a very broad bandwidth, something that cannot be done with digital processors. The proposed photonic beamformer is thus a key enabler for broadband massive MIMO wireless communications.



Tech offer | High capacity photonic beamforming for phased antennas

Digital beamforming for massive MIMO involves signal processing rates of Tb/s to Pb/s, which is extremely challenging. Today's most powerful digital beamformer chipset, Satixfy's PRIME, is limited to an instantaneous bandwidth of 1 GHz, meaning that it can output a 1GHz-wide signal from up to 32 antenna elements.
Here we propose two innovative techniques which have been widely investigated in the context of the FP7 project BEACON (www.space-beacon.eu), resulting in the first-ever real-time demonstration of a photonic processor handling 1Gb/s QPSK signals at 28 GHz, and a demonstration of two beams, totaling 2 Gb/s. Such demonstration was published in Nature Communications. As a result, the proposed system is currently the state-of-the-art technology in photonic beamforming.
The first patent family (PCT/PT2010/000061) targets photonic beamforming for a phased array antenna transmitter and features many important techniques, such as wavelength division multiplexing (WDM) and true-time delay (TTD) beamforming.
The second patent family (PCT/IB2016/052206) complements the first as it targets photonic beamforming for a phased array antenna receiver. It features new significant techniques, such as self-coherent (self-heterodyne) detection, hybrid optical/RF signal combining, WDM and TTD beamforming with a shared delay time.
This technology was awarded with the Altice Innovation Award in Academia, 2018 as well as the Fraunhofer Portugal Challenge 2019 for PhD.

APPLICATIONS

The proposed photonic beamformer is suitable for handling the heavy burden of processing RF signals of phased array antennas for:

- Very high throughput satellites (VHTSs)
- On-ground satellite communications
- 5G communications

BENEFITS

Processing of a large number of RF signals: large bandwidth, low latency, low power consumption and reduced size, due to RF signals being converted to light.

Based solely in COTS devices, and well-known technologies, such as WDM.

Modular and scalable

Compatible with hybrid beamforming: optical/digital

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TECHNOLOGY ID

PI-0104
PI-0105
PI-1001

INVENTORS

Researchers from:
– Instituto de Telecomunicações (Portugal)

INTELLECTUAL PROPERTY

Three patent families exclusively owned by Instituto de Telecomunicações:

- Two families (PCT/PT2010/000061 and PCT/IB2016/052206), both with granted and active patents in the major markets:
  - United States
  - China
  - Germany
  - France
  - United Kingdom
  - Italy
- One new patent family filed in December 2019

DEVELOPMENT STAGE

TRL 4
Technology built over one decade of R&D efforts, which started in 2010.
The technology continues to be developed currently targeting thousands of antenna elements and tens of output signals.

KEYWORDS

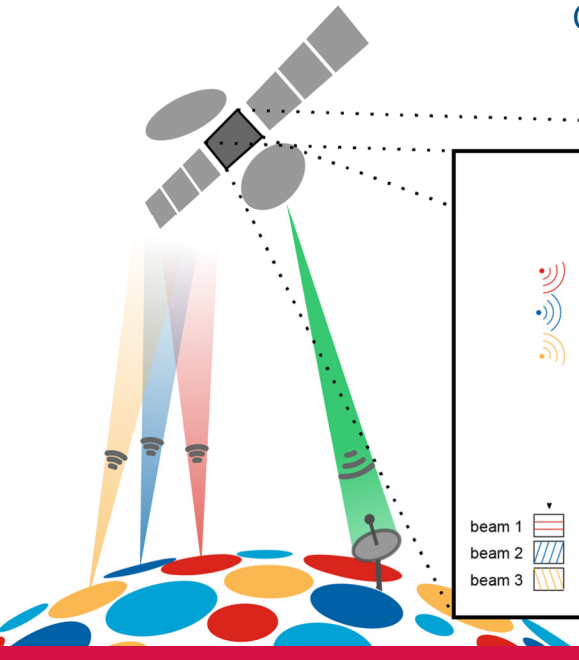
MASSIVE MIMO
PHASED ARRAY ANTENNA
BEAMFORMING
PHOTONIC BEAMFORMING
COMMERCIAL OFF THE SHELF (COTS) DEVICES

COMMERCIAL OFFERING

- Licensing agreement
- Testing new applications
- Joint further developments
- Services provision

TARGET MARKET

Instituto de Telecomunicações seeks industrial partners within the fields of satellite communications, satellite manufacturing, 5G communications, wireless, etc.



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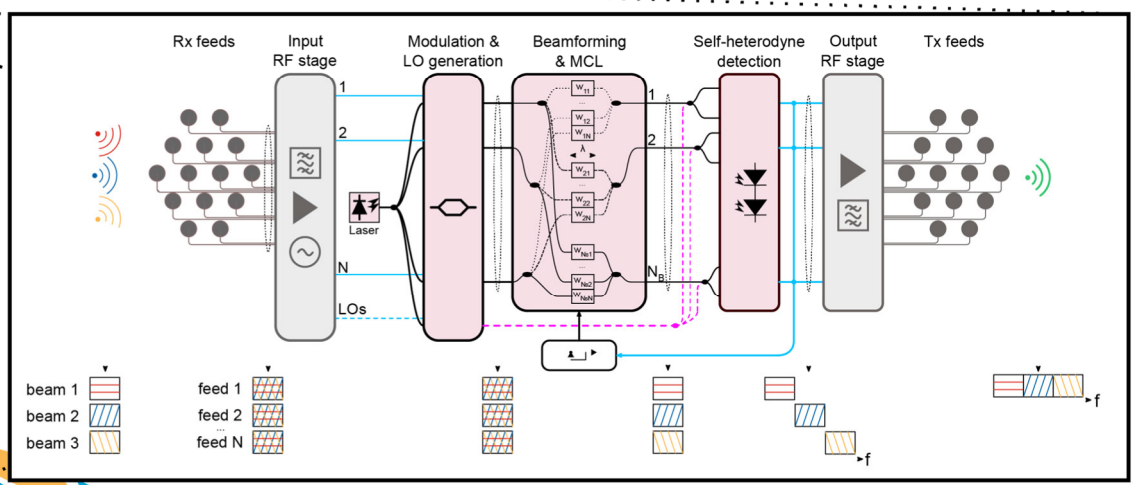

https://doi.org/10.1038/s41467-019-10077-4