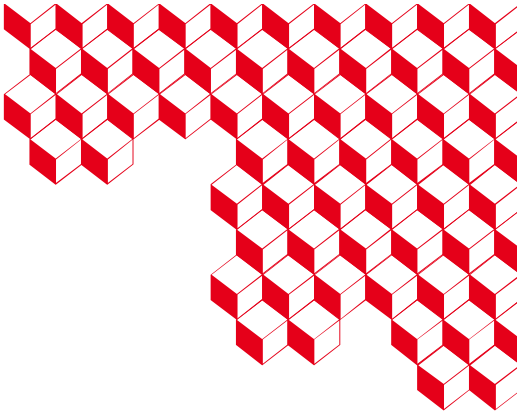


CEA Expression of Interest for SNS 2024 Calls

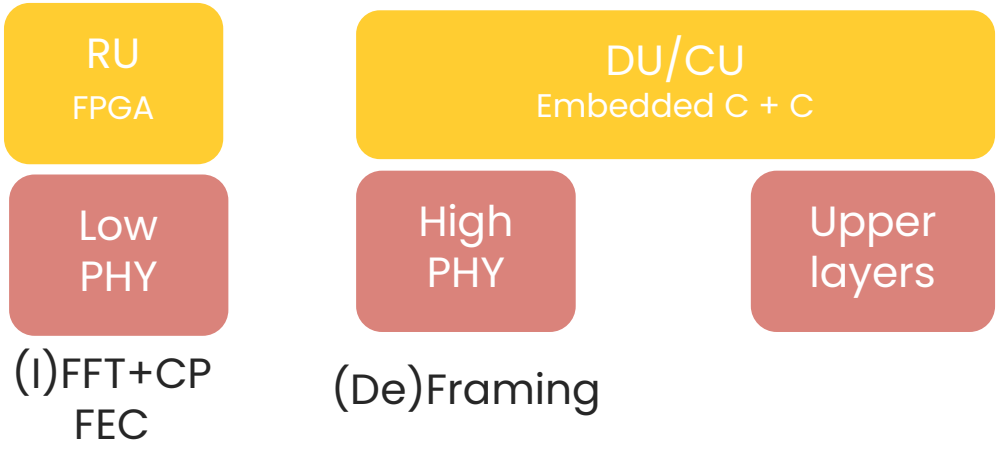
Sylvie MAYRARGUE CEA-LETI/DSYS

SNS Brokerage Event Jan 25-th 2024

5 ideas for proposals

1.1 5G-like Digital Broadband Modem

Implementation stack : Split 7.2



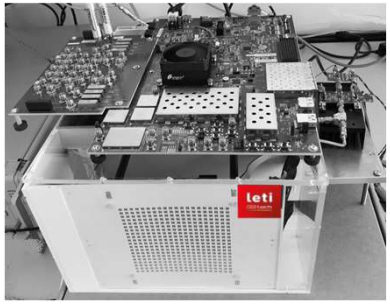
Features:

- 5G NR compliant
- Generates IF signal at 1.3GHz
- Up to 256-QAM with LDPC coding scheme
- Up to **400 MHz**, numerologies from 15 kHz to 60 kHz
- Up to 4 users **MU-MIMO**

Perspectives:

- Distributed MIMO with joint-transmission
- High-mobility, satcom
- Joint communication and sensing (JCAS)
- Exploration of split options, up to split 8

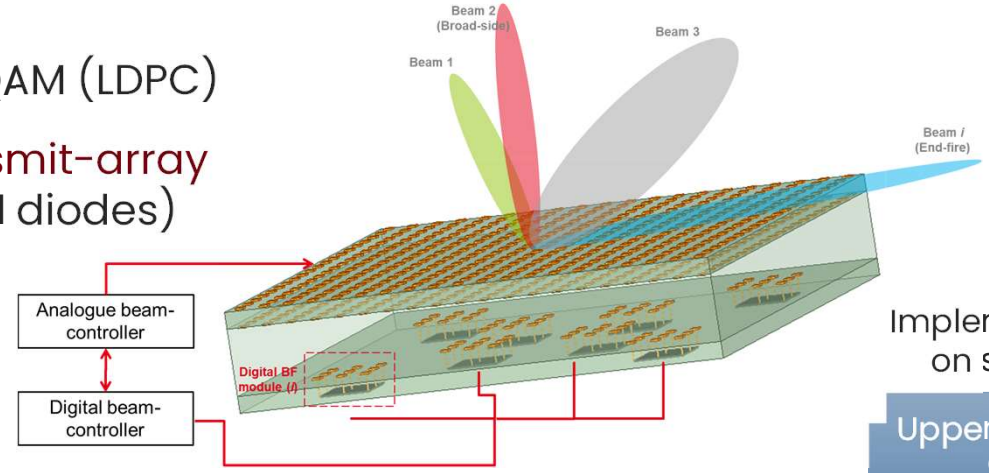
1.2 Digital Broadband included in a 26-GHz RF Platform



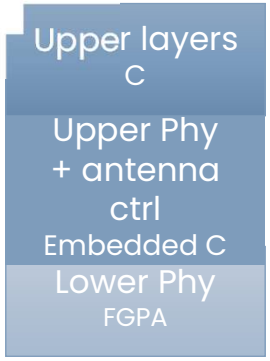
The platform is capable of transceiving in real-time 5G-NR-like transmissions at 26 GHz. It supports up to 4x4 MU-MIMO thanks to its quad-beam antenna array.

Assets :

- Design of broadband digital modem
  5GNR up to 400 MHz bandwidth and 256-QAM (LDPC)
- Design of multi-beam reconfigurable transmit-array
  electronically reconfigurable unit-cells (PIN diodes)
- Design of RF chain (based on COTS)
  Power amplifier, up/downconversion



Implementation stack

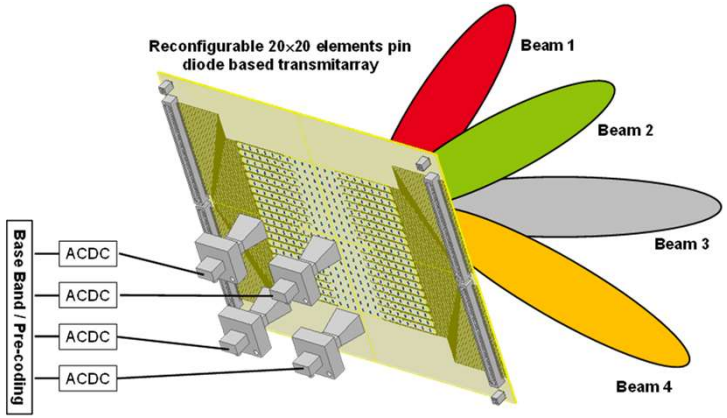


Advantages:

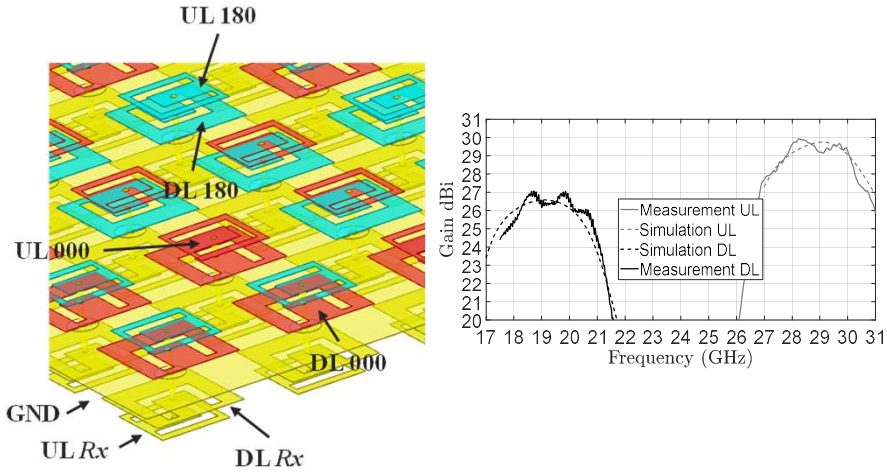
- Leti owns a licence to emit at 26 GHz on Grenoble site (ARCEP – 5G band n°258)
- Ready and easy to use : IP-compliant

2-Stacked EM surfaces for MIMO – What next?

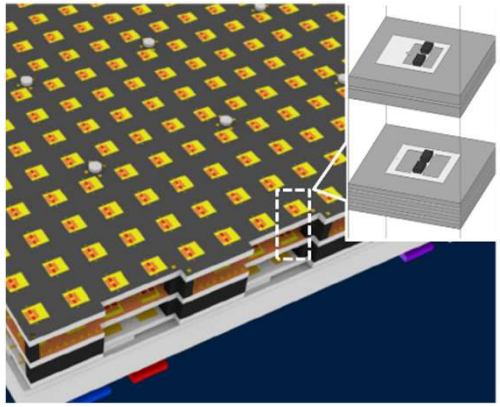
Current solution available at Leti



Current solution available at Leti of stacked EM surface for dual-band and dual-polarization

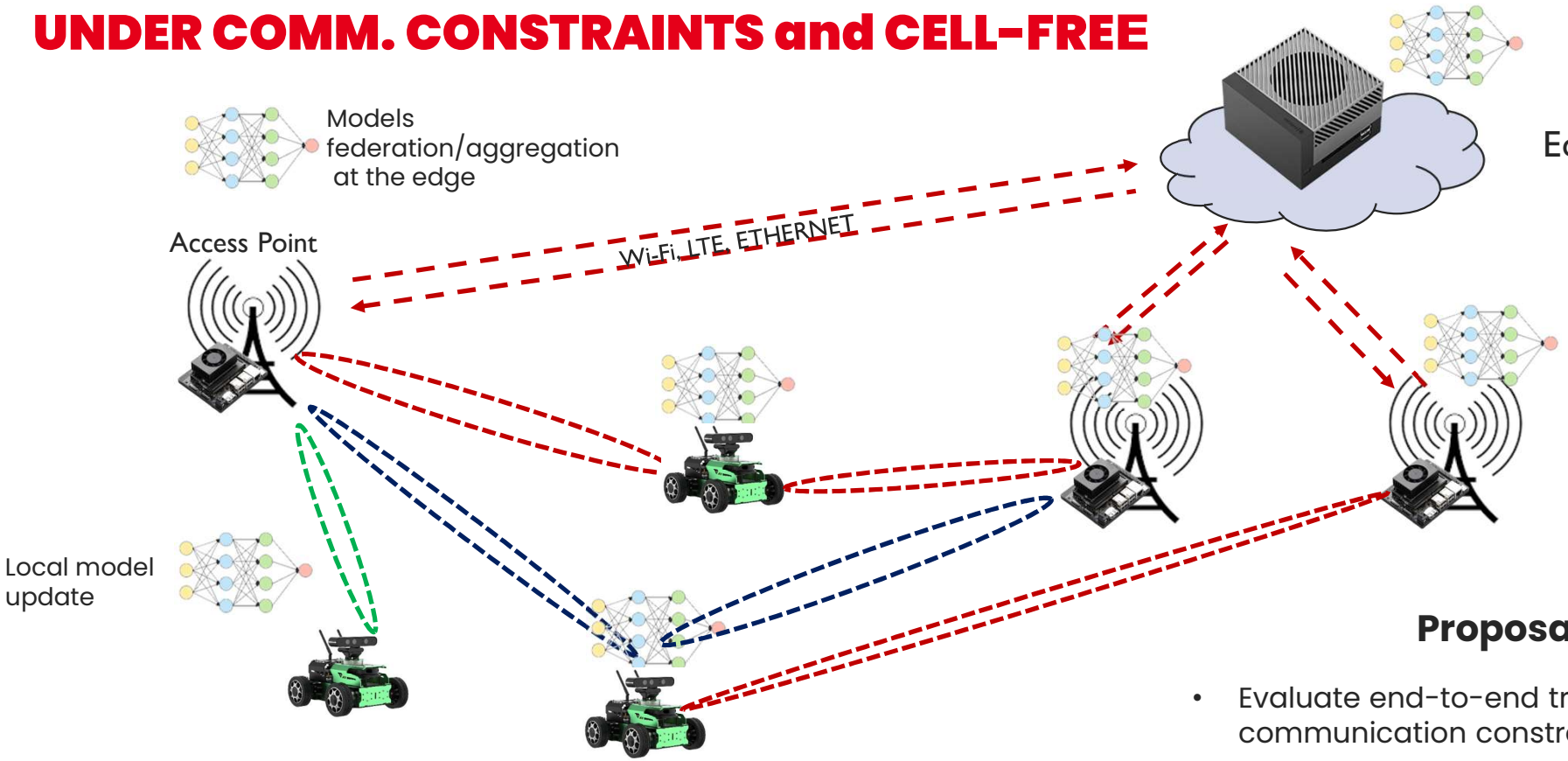


Current solution of stacked EM surface available at Leti for phase and polarization control



- How to improve MIMO capability at millimeter wave and sub-THz?
  - Multi-frequency, multi-polarization electronically reconfigurable metasurfaces with hybrid digital-analog control…
  - Time-modulating metasurfaces with interference mitigation …
  - Improve the phase resolution (> 2 bits) and integrate the amplitude control …
- How to improve the capacity at sub-THz? The road to Tbits communications
  - Use stacked or interleaved metasurfaces with N times LOS capacity and scanning capacity …
  - Near-field and far-field beam control …

3-PLATFORM for *OVER-THE-AIR* DISTRIBUTED LEARNING UNDER COMM. CONSTRAINTS and CELL-FREE



Proposal

- Evaluate end-to-end training accuracy vs communication constraints
- Federation protocols
  - who sends his model, when and under what (channel) conditions
- User clustering and local precoding for cell free networks

4–Passive radars opportunistic environment sensing

- **Objective**

  Detect and localise moving objects (eg. UAV) in urban context thanks to cellular networks already deployed: 4G and 5G waveforms sub 6 GHz (TDD or/and FDD)

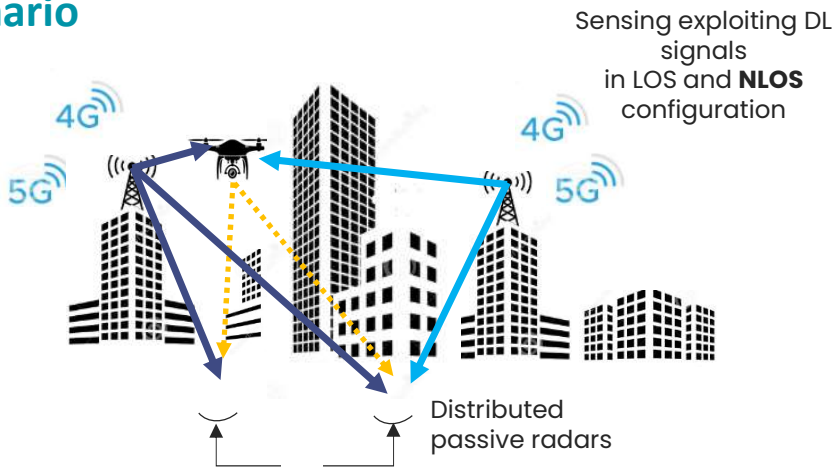
- **Recent results**

  We have shown that it is possible to detect and localise UAV in LOS scenarios with low inter cellular interferences (*experimental results on real LTE signals*)

- **Proposals**

  - Exploit N passive radars distributed over the coverage area, able to individually process multi-band information (eg. LTE at 2.6 GHz but also the low bands at 700 MHz or the TDD 5G band at 3.5 GHz).
  - Extending this low-cost solution to various use cases : sensing, security, counting, etc...

Scenario



THANK YOU!

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2. Back-up slides

Application: Coverage extension based on Multi-RAT + Integrated and Access Backhaul

IAB : supports dual access and backhaul transmissions

Multi-Rat : supports dual FR1/FR2 5G-NR transmissions

- FR2 is used as very high capacity link (UL and DL) when possible (short distance, no obstacle, ..).
- FR1 is used as control link and side-link for FR2