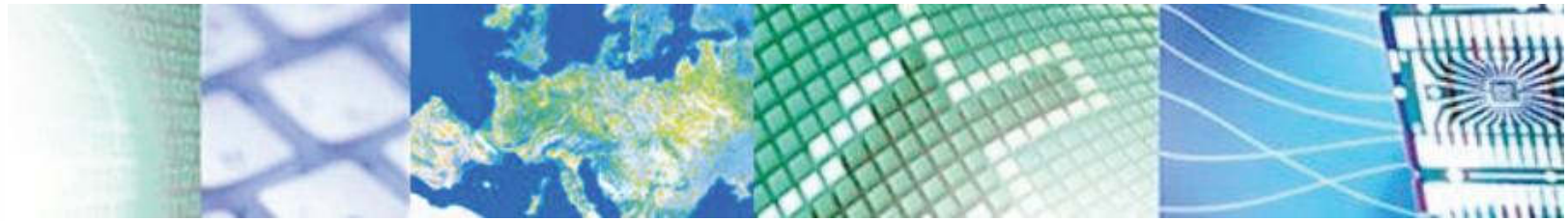


CHIST-ERA Projects Seminar
Cross Topics
Topic TMCS 2015

G. Ducournau, C. Del Rio Bocio, C. Gu

Paris, April 12th, 2018

Programme co-funded by the
EUROPEAN UNION

Introduction: Projects of the topic

- **TMCS: terahertz (THz) band for fast wireless communications**
- **Goal: demonstrate the use of 'terahertz' band for higher capacity (data-rate)**

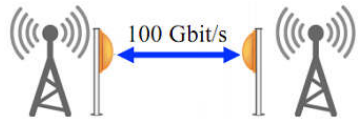
⇒ **Need developments at componants AND system level**

- **Why?**

- We all need to communicate, faster and faster

- If we take into account the user needs for bandwidth, actual systems can't handle this (radio ressources over crowded)

- this is driving the 5G implementation and beyond 5G research



- **How? THz communications scenarios studied in TMCS:**

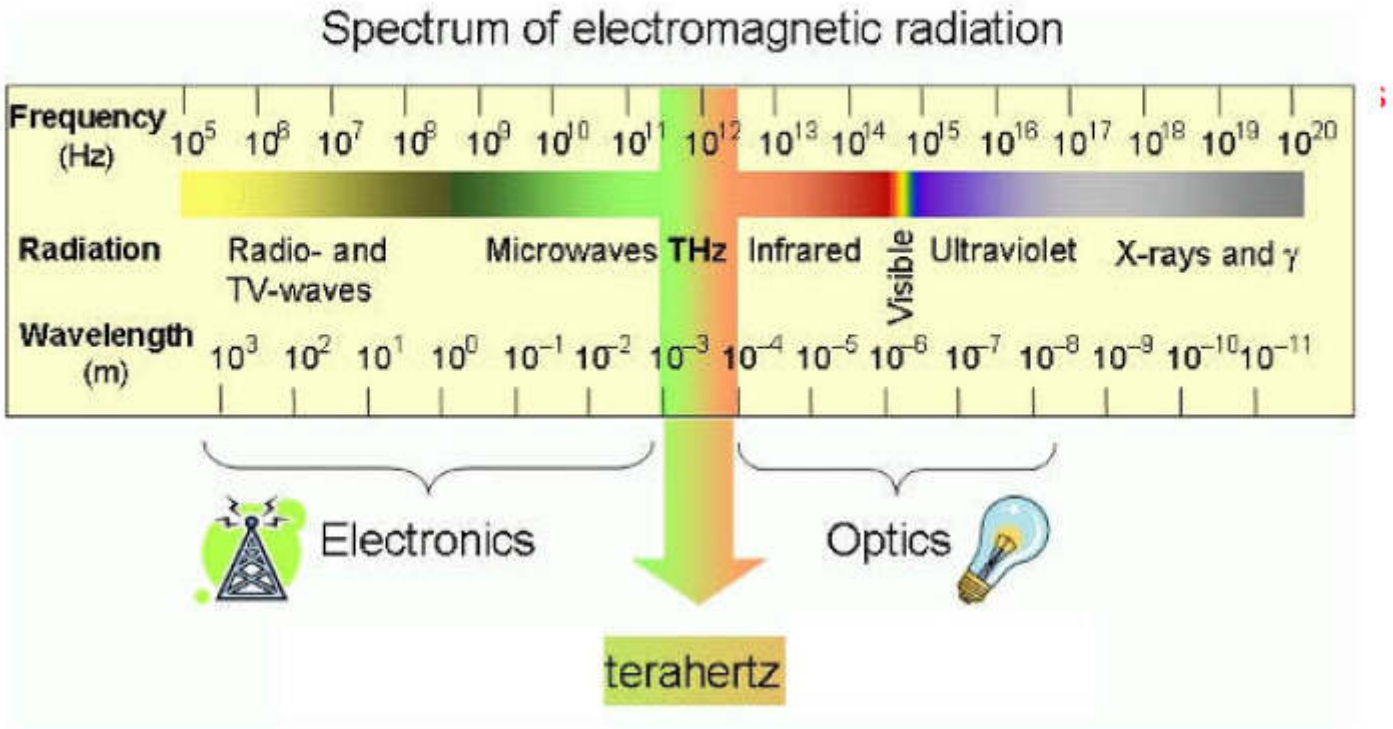
TERALINKS
WISDOM

- Long range, Fixed link (point to point), advanced technology (feed by fiber networks)
- Short range: adjustable link (mobile user), cheaper technology, steerable antenna)

Introduction of the domain

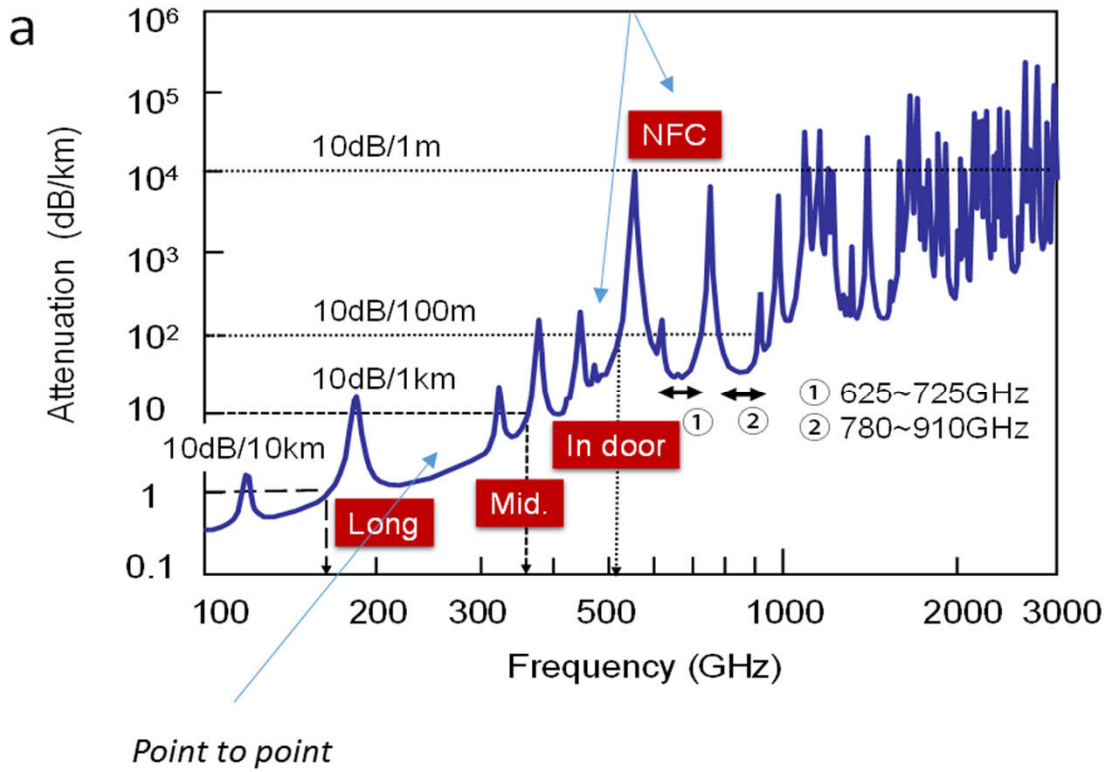
❖ What is THz?

- ✓ There remains a lack of sources at the THz frequency range.
- ✓ Two possibilities:



Introduction of the domain

❖ Where we should do THz links?



Atmosphere is suitable for THz coms around 200-300 GHz

Frequencies not (yet) allocated beyond 275 GHz

TERALINKS in a nutshell

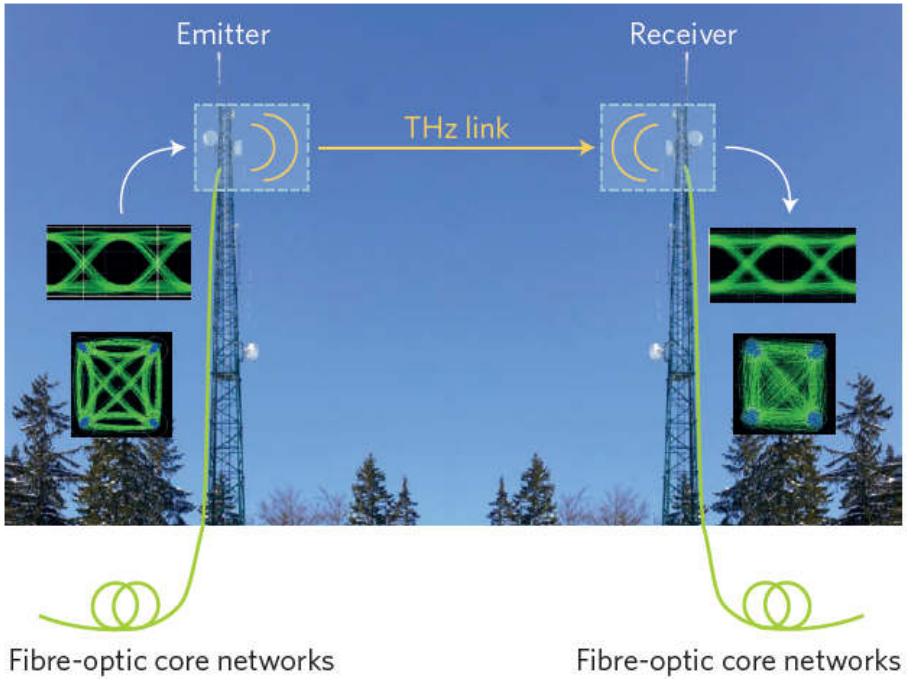
❖ TERALINKS: main goals

- ✓ Achieve the first outdoor THz link, with 40 Gbps data-rate real-time
- ✓ Combine photonics, tube amplifier and smart antennas

❖ Distinctive features

- ✓ Push and interconnect different technologies towards a real functionnal system for back-haul links

Example:
1 km targeted system with 40 Gbps



Partners:
Univ Lille [FR], Lancaster Univ [UK], Queen Mary College [UK], Univ. Nice [FR], Univ public of Navarra [SP]

WISDOM in a nutshell

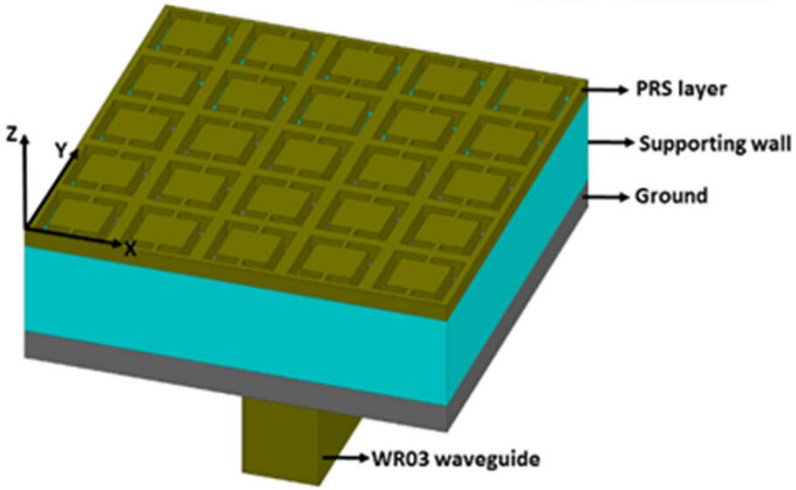
❖ WISDOM: main goals

- ✓ Use 3D techniques for fast fabrication THz passive/active antennas
- ✓ Combine 3D and CMOS devices toward power combining/antenna arrays

❖ Distinctive features

- ✓ Demonstration of beam-steerable links for device to device communications

Examples:
A novel high-gain resonant cavity antenna operating at 300 GHz
New unit cell design of the partially reflecting surface layer



Partners:
UniKent [UK], KU Leuven [BE], TU Graz [AT], Univ Warwick [UK]

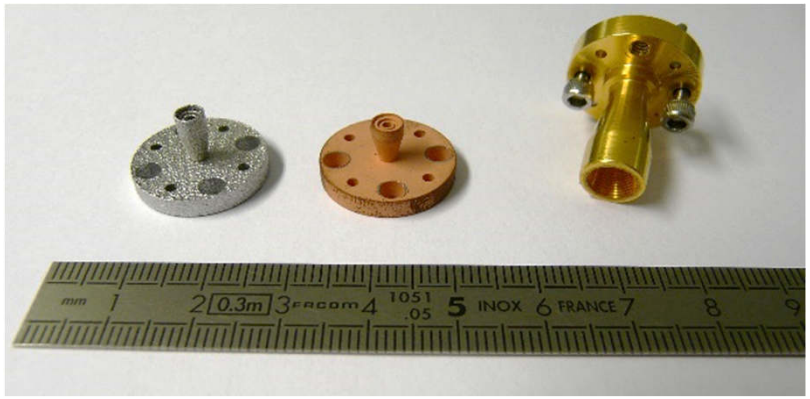
Major achievements and output

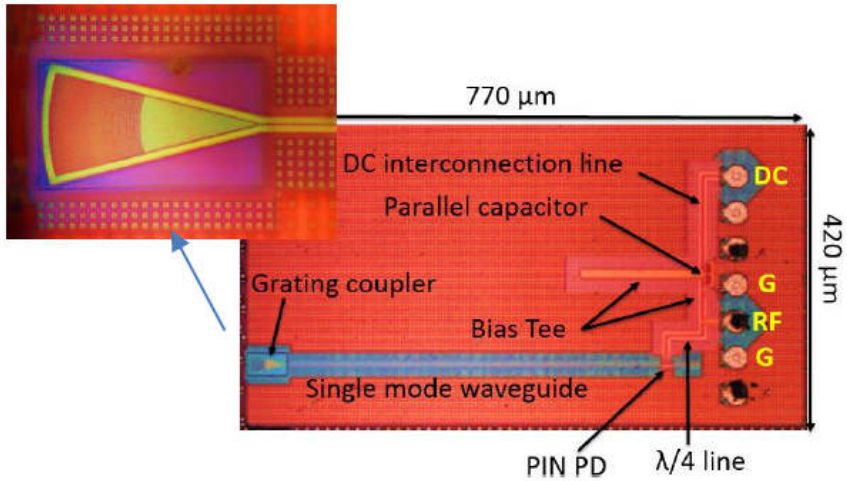
❖ TERALINKS

System Devices

- ✓ THz sources achieved
- ✓ Tube amplifier designed for 240 GHz
- ✓ 3 types of antenna fabricated & characterized
- ✓ 10 Gbps system in the lab demonstrated with silicon photodiodes
- ✓ 100 Gbps system in the lab demonstrated with III-V photodiodes

Website for project dissemination (5 journal papers + 10 conferences (2 invited))



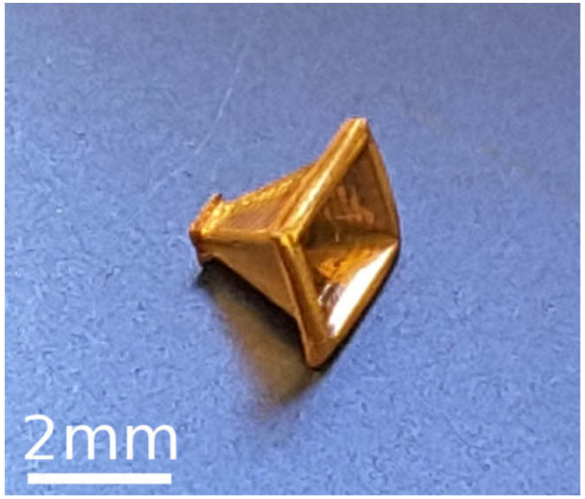


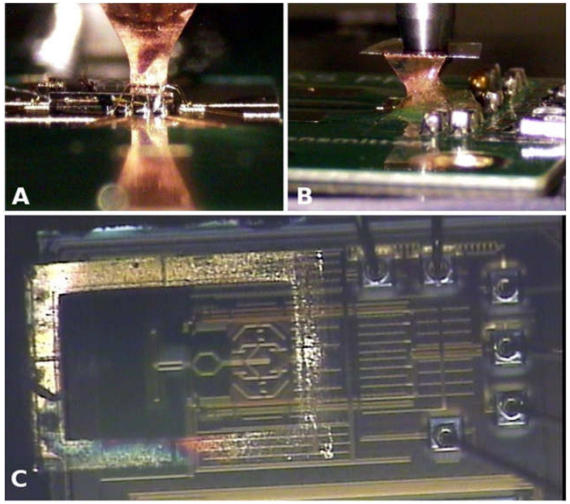
Major achievements and output

❖ WISDOM

- ✓ 3 types of antennas fabricated and measured up to 300 GHz
- ✓ CMOS transceiver integrated with horn
- ✓ Novel design on metamaterial based lens

- ✓ Website for project dissemination (2 journal papers + 4 conferences (2 invited))





Upcoming challenges and needs

❖ THz state of the art

Challenges:

- Real capability of the system

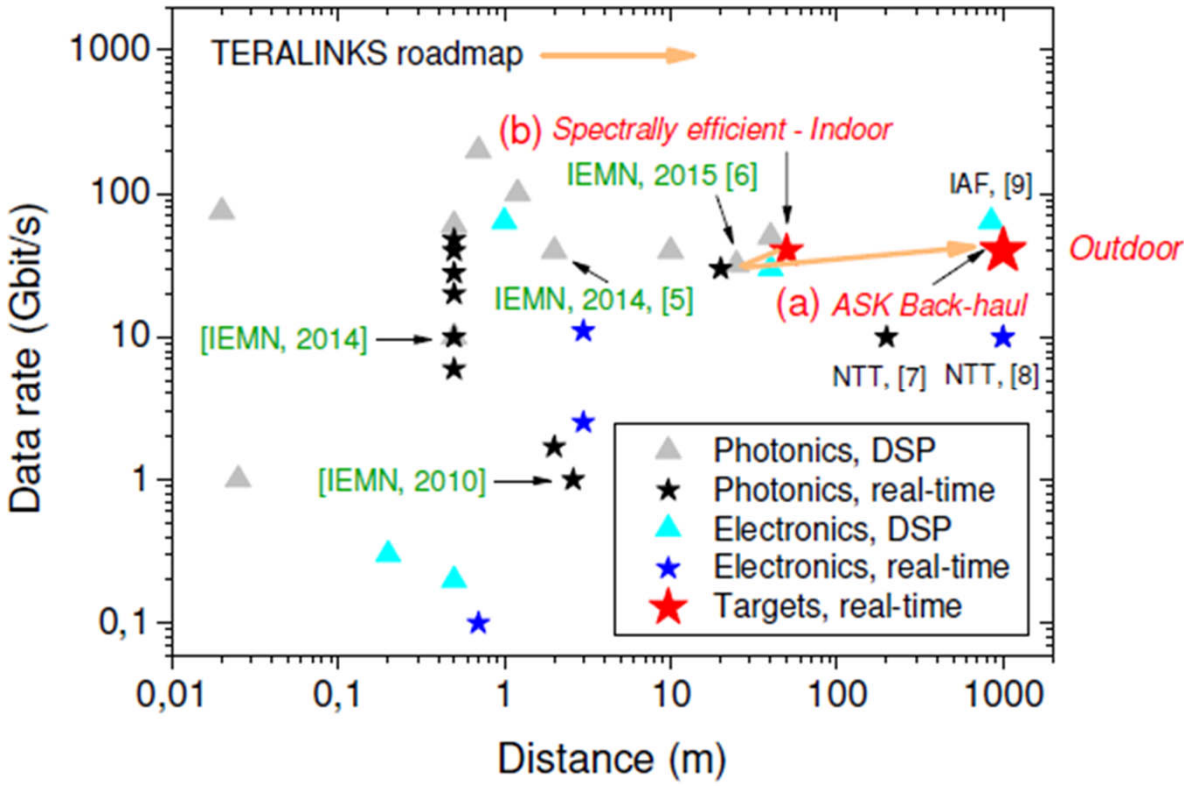
- Cost reduction (exemples):

- *3D printed techniques*
- *use of 28 nm CMOS*
- *use of industrial silicon photonics*

- III-V technologies

- Integration of the system

- Energy efficiency of the links



Roadmap:

TERALINKS: towards km-range links

WISDOM: towards indoor beam-steerable links

Challenges focus

	Real-time capacity	Integration	Energy efficiency	3D tech.	CMOS tech.	Silicon-photonics based tech.	III-V tech.
TERALINKS	X	X	X	X		X	X
WISDOM		X	X	X	X		

Role of the CHIST-ERA support

- **Helps to establish transnational/interdiscipinary relationships towards THz applications**

- **Fully in line with european strategy towards THz datacom beyond H2020 programs**
  - ✓ Chistera will enable new EU proposals
  - ✓ Chistera helps Europe to contribute in this field (strategic due to recent new IEEE standard 802.15.3d

  - ✓ New topic suggestions:
    - **beyond 5G research / sustain the user connectivity**
    - **Next generation internet application**

Questions

Questions ?