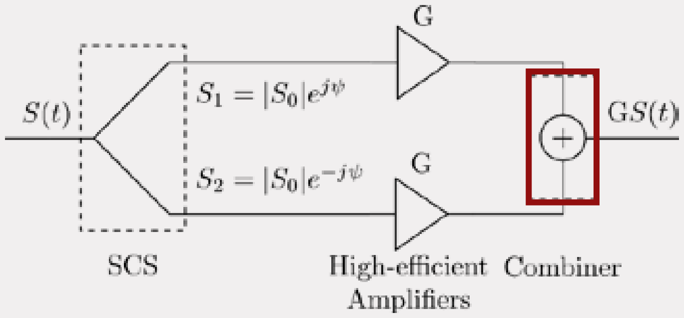
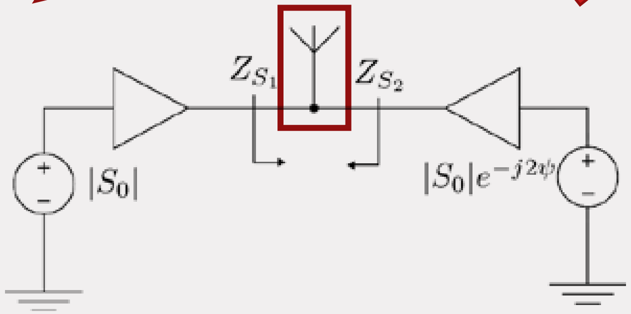
Poster pitches

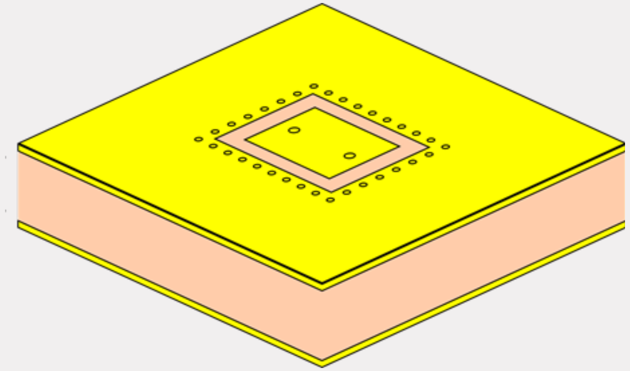
#	Name	Group	Poster Title
1	Meerten Versluis	EM	Outphased antenna combiner for mm-Wave phased arrays
2	Fahimeh Sepehripour	EM	Modeling of scattering by bodies of revolution (e.g. rotationally symmetric antennas)
3	Paola Escobari Vargas	EM	Characterization of the Dielectric Properties of Commercially Available Low-loss UV-curable Resins from 60 GHz to 90 GHz
4	Anudeep Karnam	ECO	Ultra Reliable & Low Latency Communication Networks in Aircrafts
5	Panagiotis Giannakopoulos	ECO	5G URLLC computing: variability and predictability
6	Elles Raaijmakers	IC	Integrated circuits designed by the public
7	Martijn de Kok	EM	Active Transmitarray for Ka-band Monopulse Tracking Radar with Commercial 5G Analog Beamforming Ics
8	Robbert Schulpen	EM	Millimeter-Wave Channel Sounding" – Exploring the Wireless Highway of Tomorrow
9	Piyush Kaul	IC	Spatial Power Combining and Impedance Matching Silicon IC-to-Waveguide Contactless Transition
10	Leroy Driessen	EM	Effects of antenna encapsulation in subdural neural implants
11	Vojkan Vidojkovic	IC	Next generation mm-wave sensing and communication systems
12	Bas van de Ven	IC	Mapping Error Reduction Methods for Polyphase Codes Generated by Quadrature Architectures
13	Carolina Sodre Campos Amaral	ECO	Hybrid mm-wave and optical wireless communication technology for high-capacity indoor systems
14	Remco Schalk	IC	Power-efficient 140GHz Transmitter Architectures for Next-Generation Automotive Radar
15	Vincent van Vliet	ECO	Free Space Optical Communications: Mitigation of Atmospheric Turbulent Effects
16	Eduardo Muller	ECO	Optical wireless technology - Non-Mechanical Beam Steering
	Mikolaj Wolny	ECO	"
17	Priscilla Allwin	ES	Run-time Bit-wise Data Gating for Dynamic Neural Networks in Wireless Receivers
18	Yiqin Hou	IC	Dual-band transceiver design at 77/140 GHz
19	Bram van Bolderik	ES	Low power hardware design for a dynamic AI-based 6G wireless Receiver
20	Corné van Puijenbroek	IC	Algorithmic Radar, a novel radar architecture
21	Nazanin Farid Mohajer	EM	A mm-Wave Hybrid Stirring Technique for Over-the-Air Testing in Reverberation Chambers
22	Erik Bertram	IC	Wideband Null Steering for Reliable Intra-Aircraft Communication

Outphased antenna combiner for mmWave phased arrays

Contact: Meerten Versluis, m.m.a.versluis@tue.nl







Non-isolated dual-feed patch antenna combiner at 28 GHz

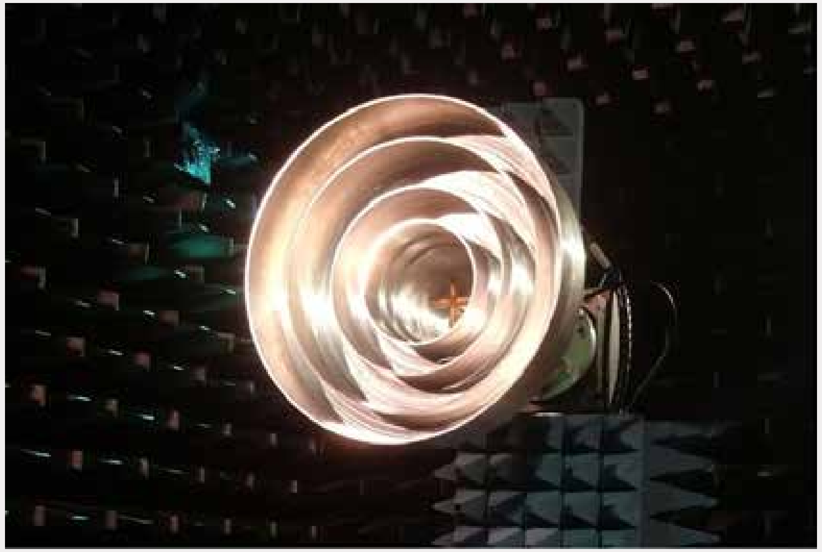
Electromagnetic modeling of axially symmetric antenna using electric field integral equation

Contact: <Fahimeh Sepehripour>, <f.sepehripour@tue.nl>

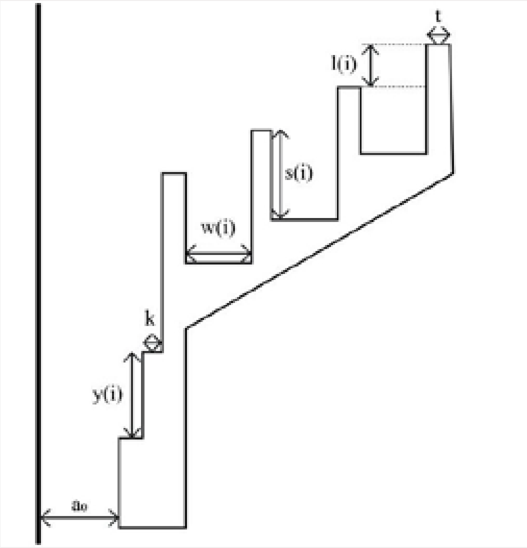
- Electromagnetic scattering analysis by corrugated horn antenna

- Computation of singular modal Green function (g_m):

$$a_m g_{m-2} + b_m g_{m-1} + c_m g_m + d_m g_{m+1} + e_m g_{m+2} = 0$$



Generating curve



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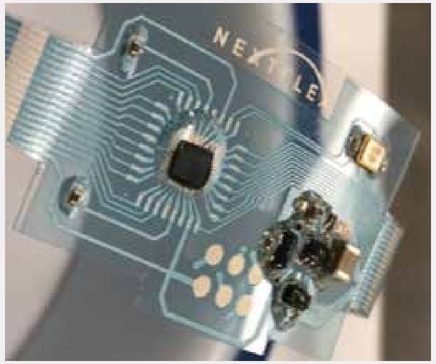
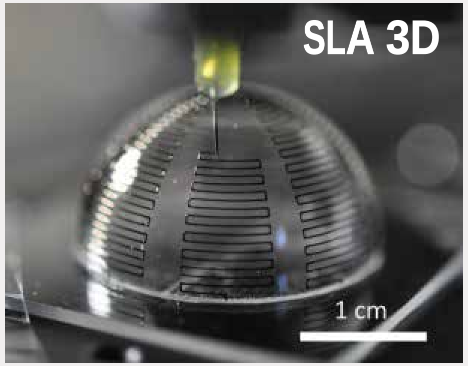
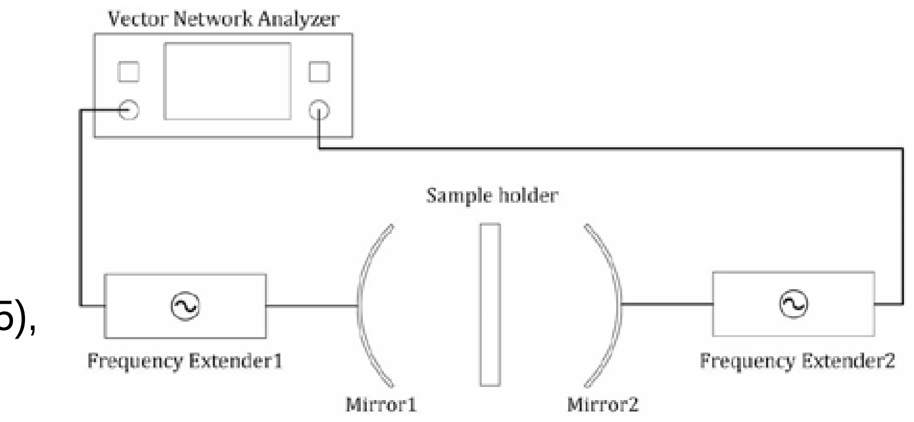
Characterization of the Dielectric Properties of Commercially Available Low-loss UV-curable Resins from 60 GHz to 90 GHz

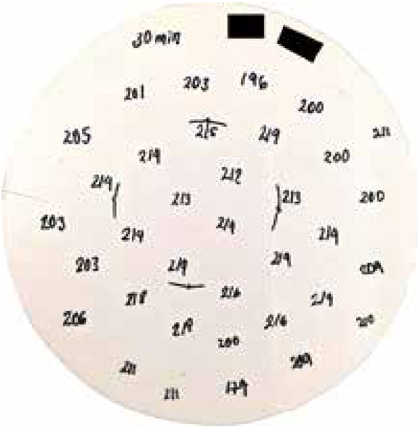
Contact: Paola Andrea Escobari Vargas. p.a.escobari.vargas@tue.nl





- Fabry-Pérot open cavity resonator
- Measurements of ε_r and $\tan\delta$ of dielectrics.
- Uncertainty: ε_r(±0.15), $\tan\delta$(±0.0005)





CITC
Chip Integration Technology Center

- Low-loss material at mm-waves
- Suitable for SLA 3D printing
- Commercially available
- Homogeneous material
- Stable in a wide bandwidth

Come to see the results in the posters section!

URLLC NETWORKS IN AIRCRAFTS

Contact: Karnam Anudeep, s.s.a.karnam@tue.nl

- Objective:
  - Developing wireless standards for diverse on-board applications while ensuring/improving reliability provided by current wired architecture

- Advantages of Going Wireless:
  - An A380 aircraft typically contains 470 km of wiring and total weight of wires is 5700 kg
  - About 30% of electrical wires can be substituted by going wireless!
  - Lower $C0_2$ emissions
  - Reliable monitoring of moving or rotating parts
  - Potential increase in reliability of safety critical applications

- Private 5G and Wi-Fi 7 integrated with time sensitive networking (TSN) is promising for the future of wireless avionics intra-communications (WAIC)

- Join hands in developing next generation aircraft!


Anudeep Karnam


Joshi Kishor


George Exarchakos


Sonia Heemstra


Ignas Niemegeers

Official Project Partners

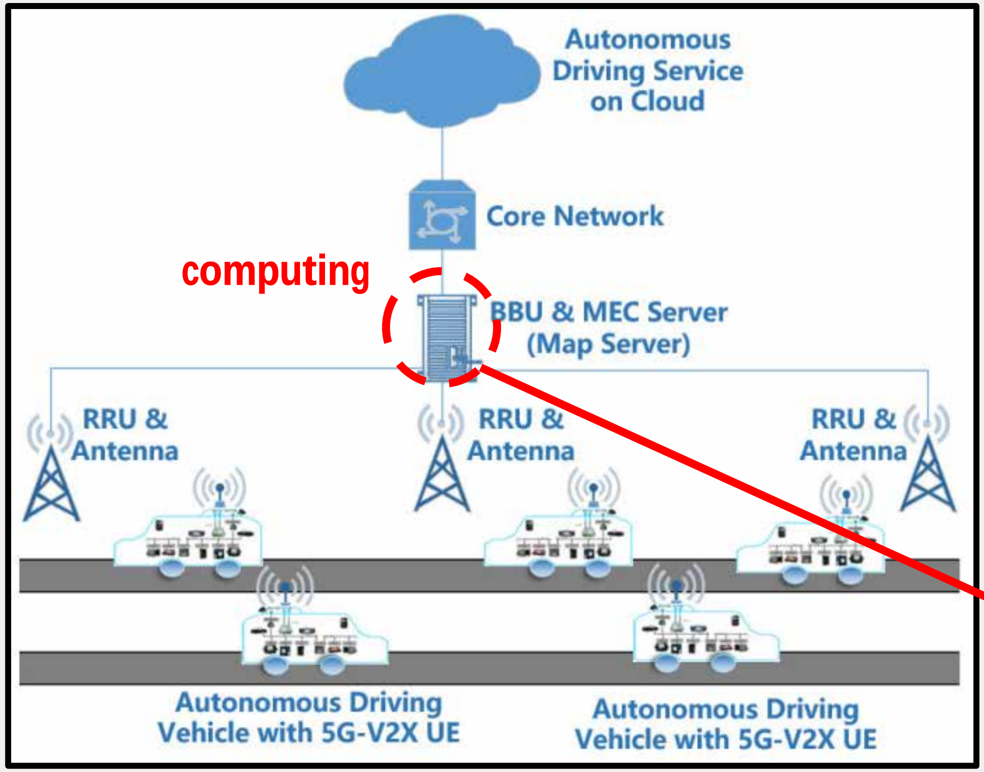
5G URLLC computing: variability and predictability

Contact: Panagiotis Giannakopoulos, p.giannakopoulos@tue.nl

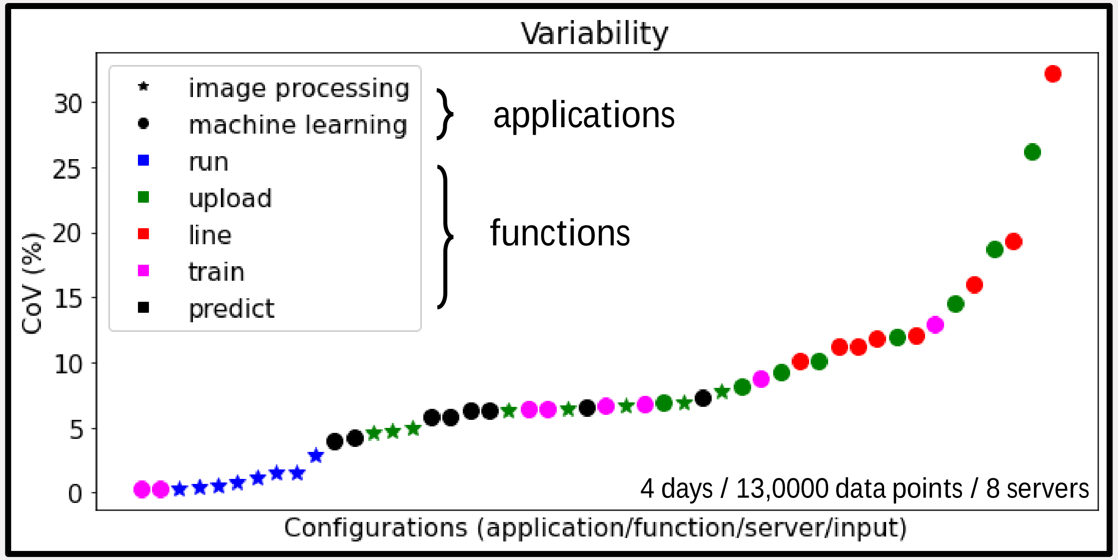
ADAPTOR

GOAL: Indicate the effect of computing variability at time-sensitive systems

5G & AUTONOMOUS DRIVING[1]



COMPUTING VARIABILITY



variable processing time → variable latency → imminent accident

[1]Ma et al, IEEE Access'20

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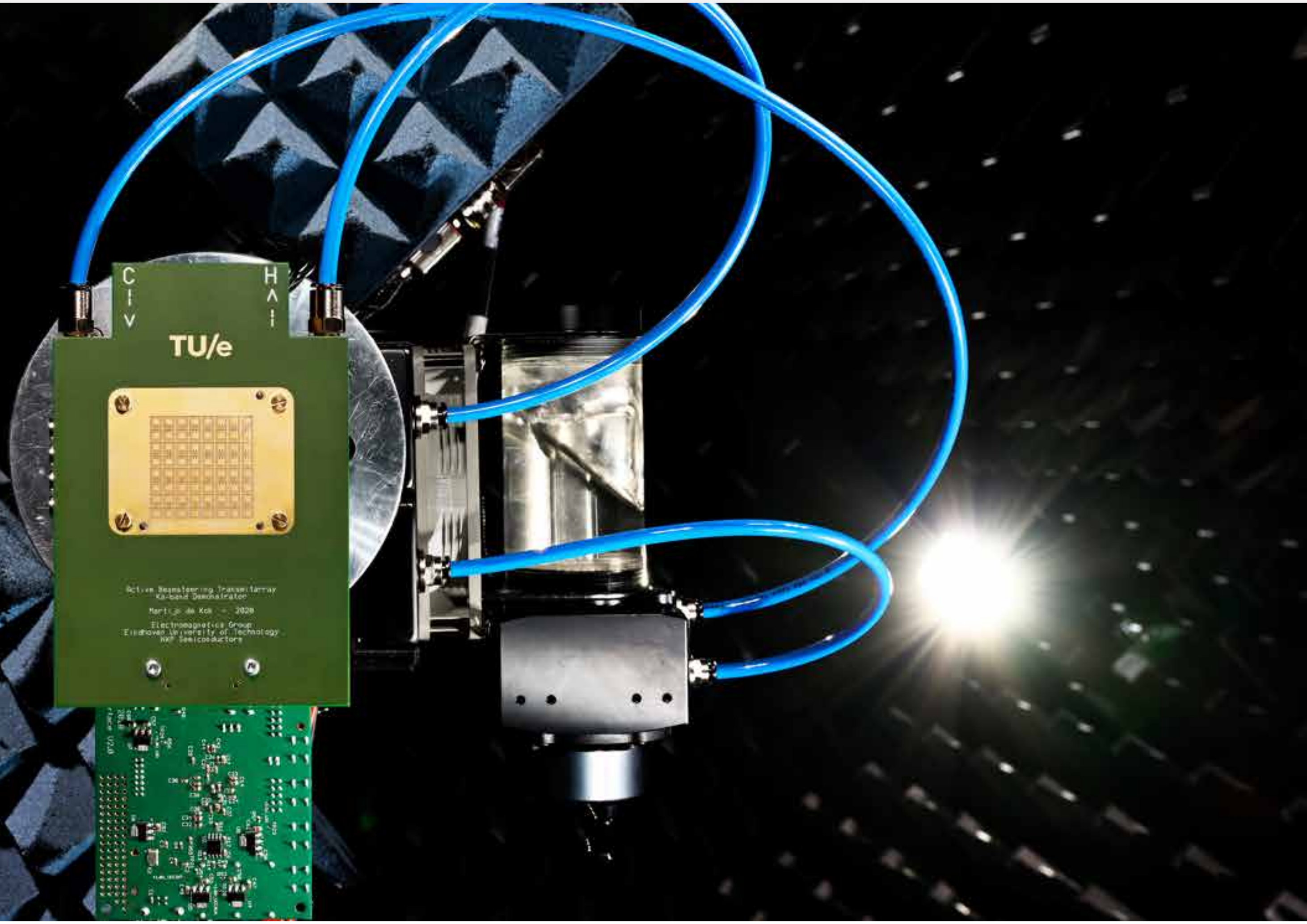
Integrated Circuits – designed by the public

Contact: Elles Raaijmakers, e.a.l.Raaijmakers@tue.nl

Active Transmitarray for Ka-band Monopulse Tracking Radar

Contact: Martijn de Kok, m.d.kok@tue.nl

- **Ka-band:**
  26.5-40 GHz
  5G
- **Low-cost SiGe-based electronics**
- **Large-scale, high power beamsteering array for naval missile defense**
- **Compact design with integrated liquid cooling**
- **64-element demonstrator designed and tested at TU/e**



NEXT PERCEPTION

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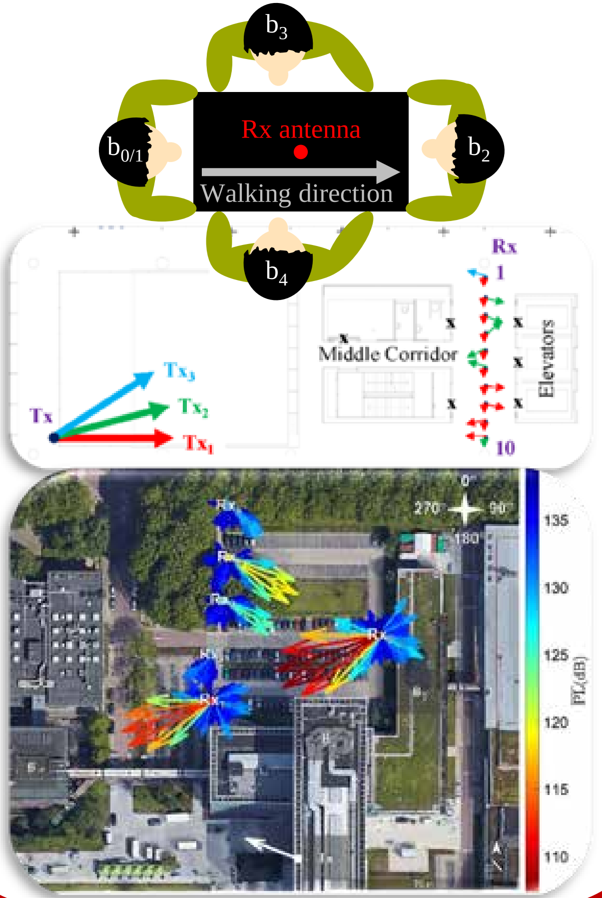
TU/e

Millimeter-Wave Channel Sounding

Contact: Robbert Schulpen, r.schulpen@tue.nl

Channel Sounder Development

Channel Measurements



Uncertainty Analysis Methodology

Measurements

↓

Model

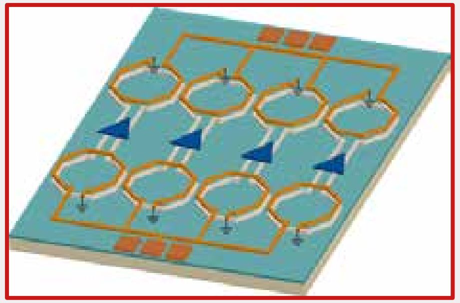
↓

Uncertainty

Spatial Power Combining and Impedance Matching Silicon IC-to-Waveguide Contactless Transition

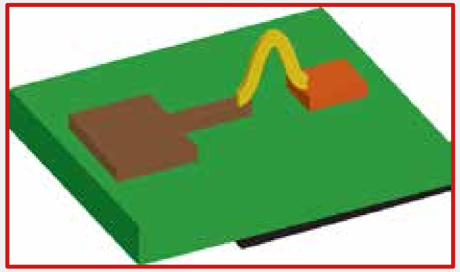
Contact: Piyush Kaul, p.kaul@tue.nl

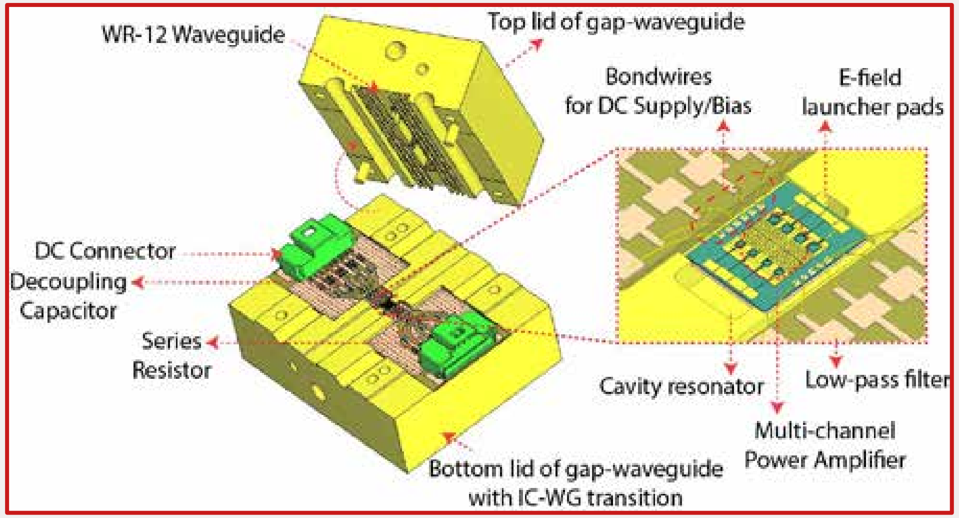
Conventional
IC-Waveguide/Antenna Integration

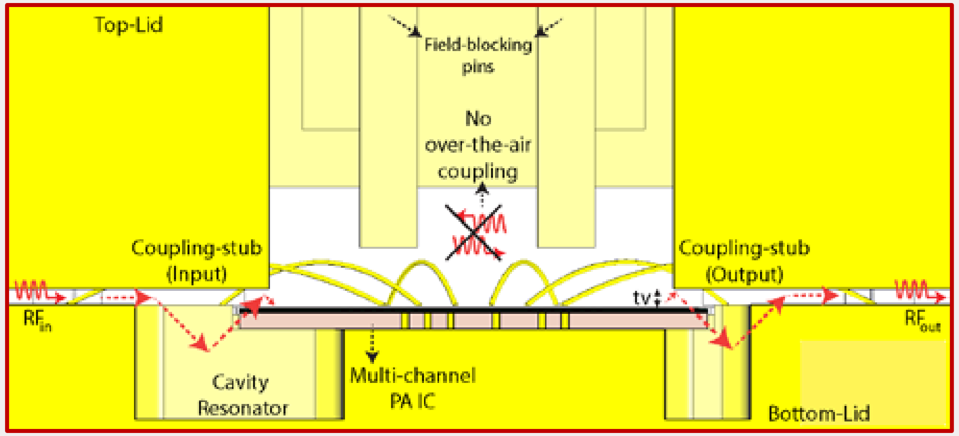


Additional packaging:
bond wires and flip-chip

50 Ω







- On-chip power combiner + Matching network + Packaging + Metal Antenna/Waveguide à Higher loss
- Conventional IC-Antenna/Waveguide integration à large occupied area + parasitics
- Co-design of IC-Antenna/Waveguide for optimal performance
  - On-chip antennas, Slot antennas
  - IC-Waveguide/Antenna transitions

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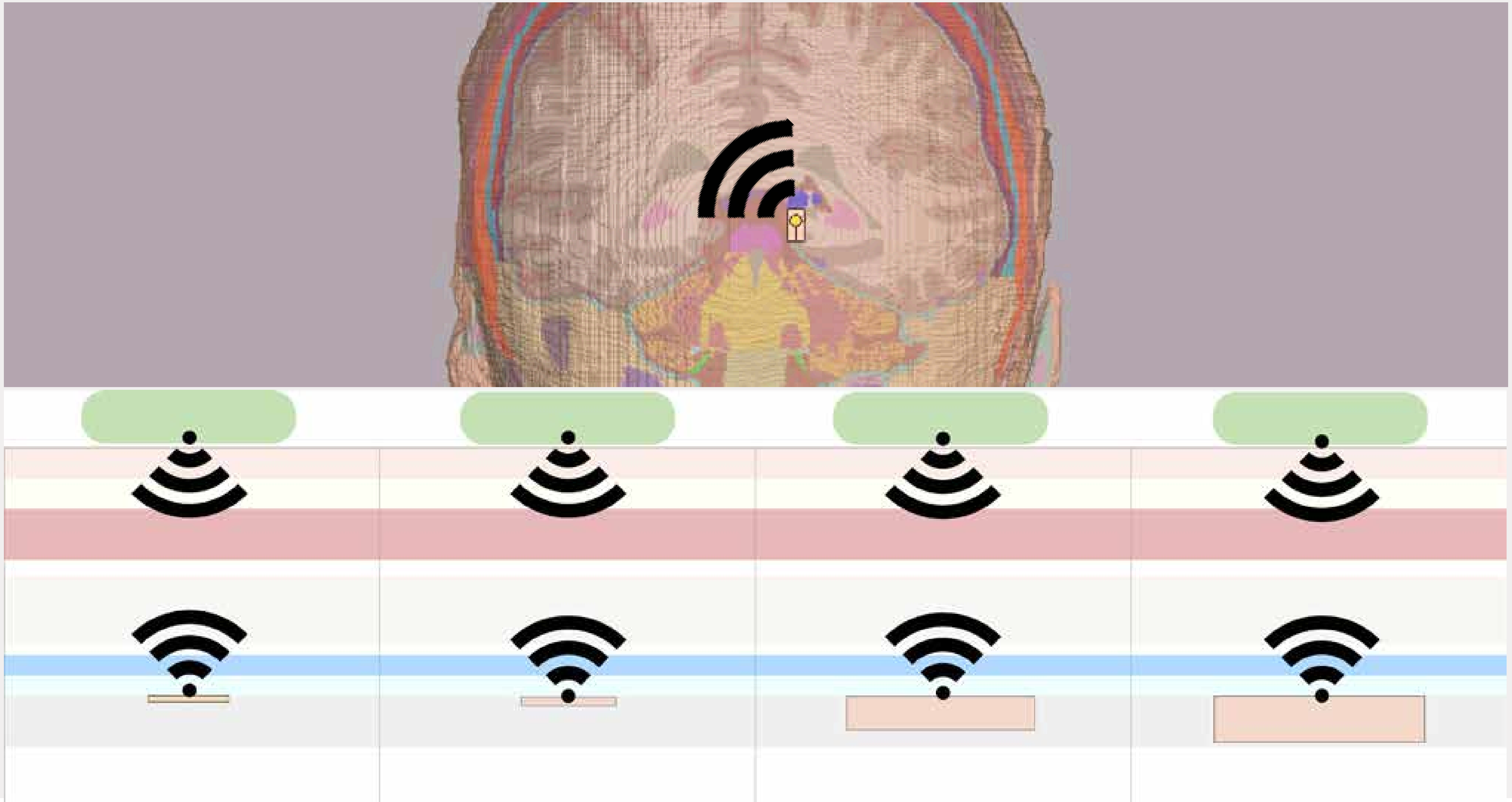
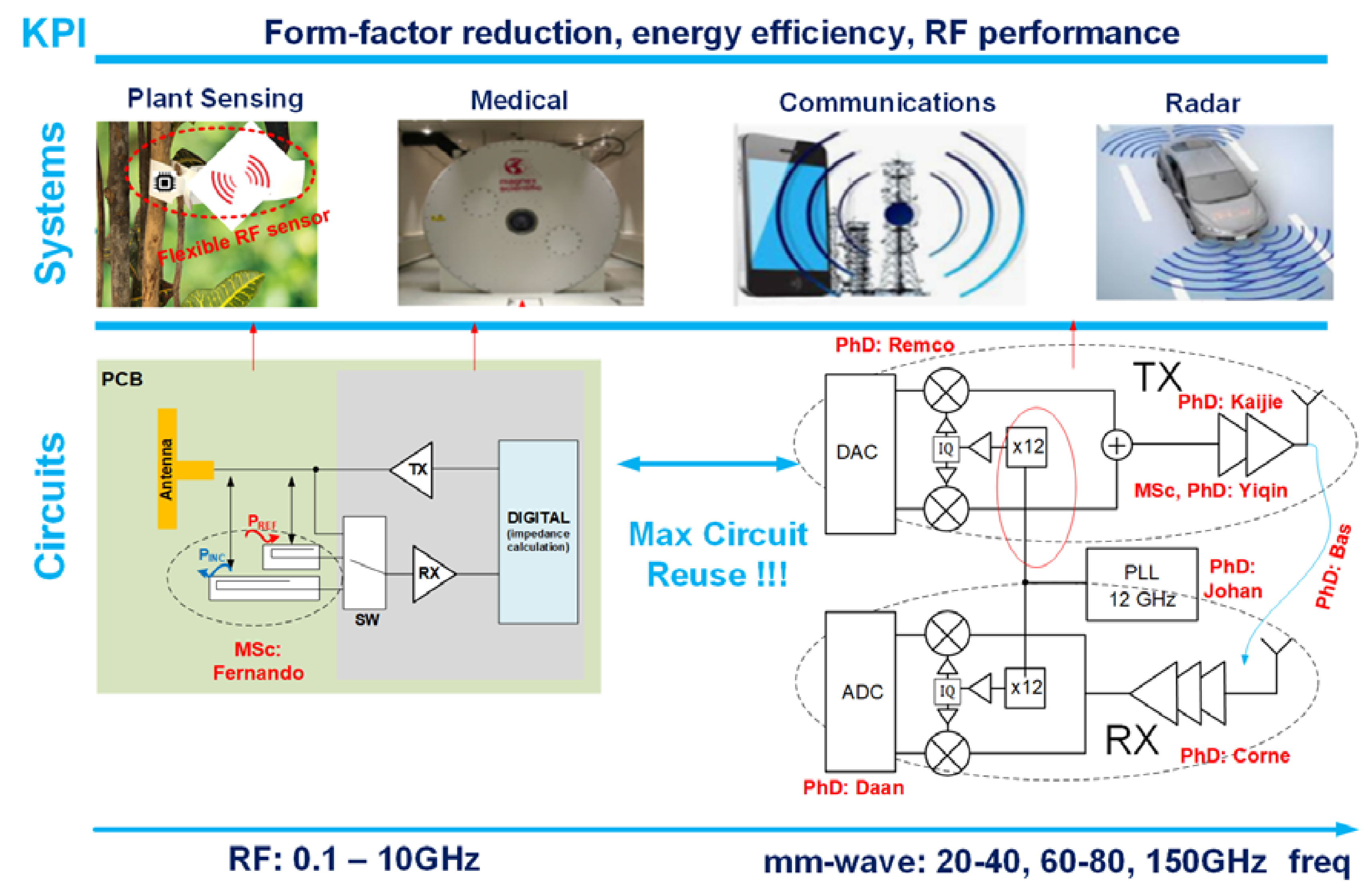
Effects of antenna encapsulation in subdural neural implants

Contact: Leroy Driessen, l.h.p.driessen@tue.nl



Next generation mm-wave communication and sensing ICs



Contact:

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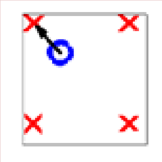
Mapping Error Reduction Methods for Polyphase Codes Generated by Quadrature Architectures

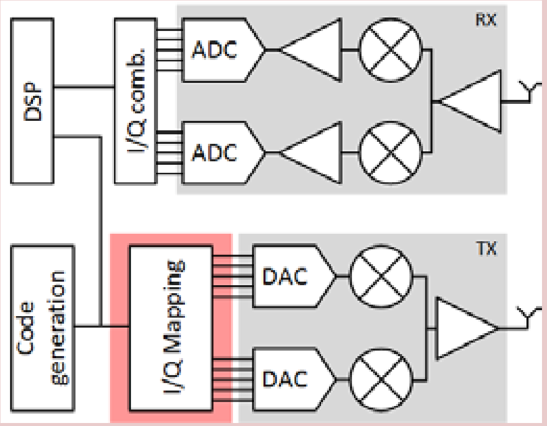
Bas van de Ven, Daan Rosenmuller, Erwin Janssen, Kostas Doris, Georgi Radulov, Marion Matters-Kammerer

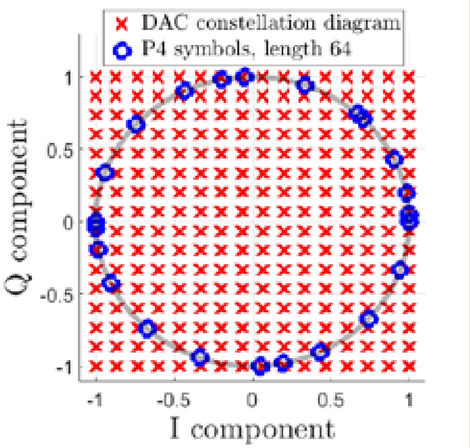
PMCW Radar code generation

I/Q mapping introduces

- Magnitude errors
- Phase errors

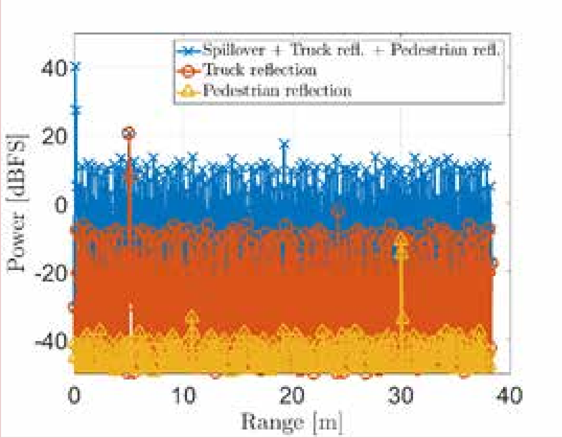






Impact on radar performance

1. Mapping errors introduce sidelobes
2. Reduced dynamic range
3. Weak reflections cannot be detected



Possible solutions

- Rotation of initial phase states
- Dithering before mapping

Hybrid mm-wave/optical wireless for indoor environment

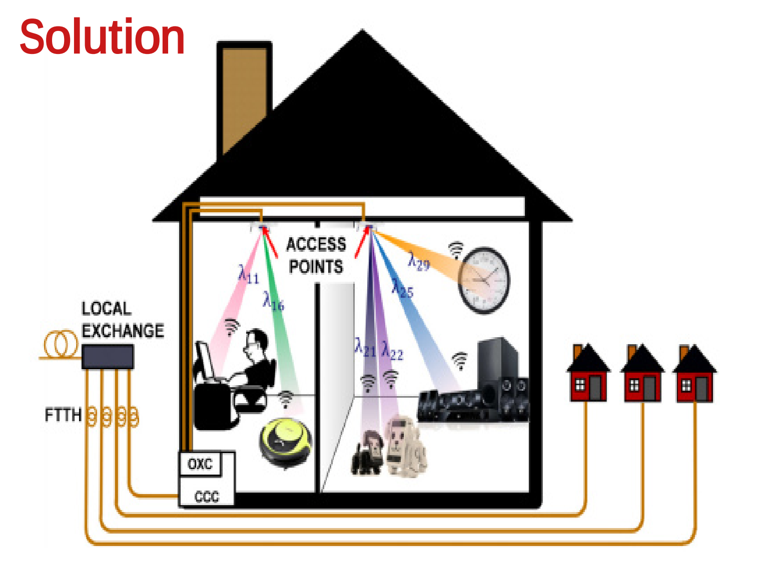
Carolina Maria S. C. Amaral, c.m.m.sodre.campos.amaral@tue.nl

- *SmartTwo+ is a collaboration project between TU/e, KPN and Eindhoven Engine that aims to integrate the strengths of two new technologies (optical wireless and mm-wave communication) to develop a high-capacity wireless system for an indoor environment.*

Motivation

- Increasing demand for wireless connection for IoT services
- Wireless network require higher bandwidth and data rate
- Pursue an alternative for the current overloaded Wi-Fi

Solution



- Indoor scenario can integrate mm-wave/OWC technologies
- Downstream link: infra-red optical wireless
- Upstream: mm-wave radio wireless

Power Efficient 140GHz Transmitter Architectures for Next-Gen Automotive Radar

Contact: Remco Schalk, r.schalk@tue.nl/remco.schalk@nxp.com

Next generation automotive radar requires

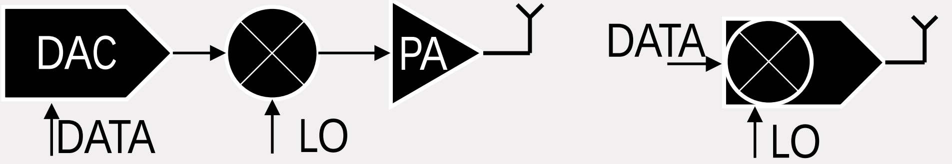
- **Increased** range, angular and velocity resolution
- **Increased** robustness
- **Increased** interference mitigation

140GHz automotive radar potential solution

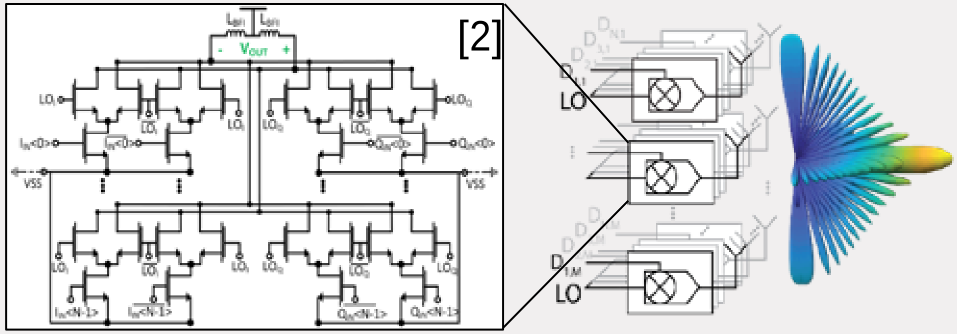
J **Increased** available BW

J **Reduced** antenna size

L **Reduced** efficiency



Explore potential of digital transmitters for 140GHz radar



[1] NXP Semiconductors, Automotive
[2] M. Neofytou, ISCAS 2021

Free Space Optical Communications: Mitigation of Atmospheric Turbulent Effects

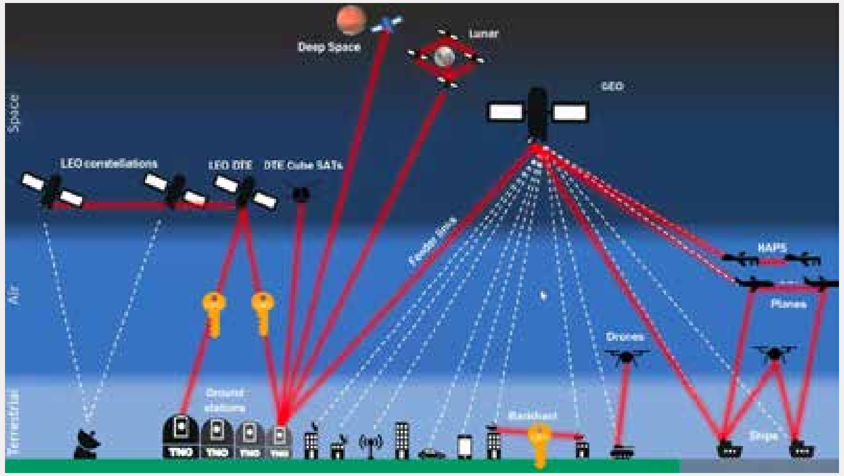
Contact: Vincent van Vliet, v.v.vliet@tue.nl

+ High bandwidth
+ No regulatory restriction
+ Narrow divergence angle
+ Small, light, low-power equipment
+ Quick and easy deployment

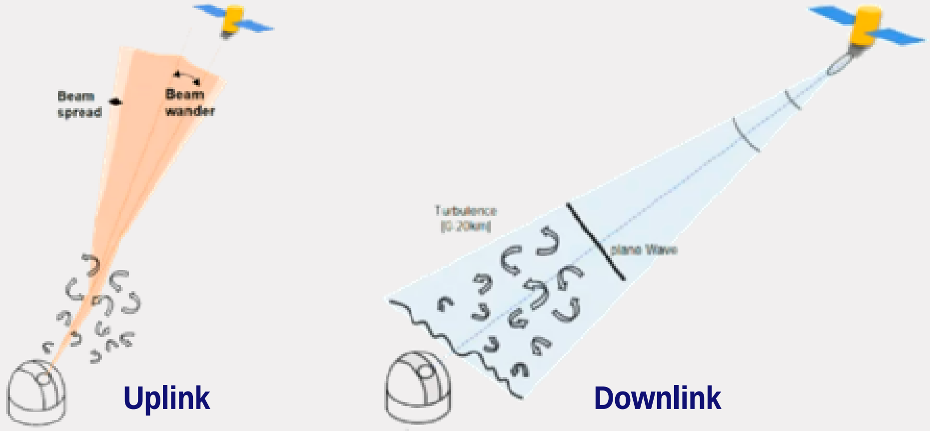
- Obstruction
- Absorption
- Scattering
- Pointing and tracking
- <u>Atmospheric turbulence</u>

à *Atmospheric turbulent effects reduce link performance*

Objective: Improvement of channel availability through the development of (DSP-based) **diversity techniques** (spatial, temporal, spectral)



W. Crowcombe (TNO), *NVR Faster than Light Webinar*, 2021



G. Artaud, *Space optical links, a review of next challenges*, ECOC 2021

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Non-Mechanical Beam Steering

Contact: Eduardo Muller, e.muller@tue.nl

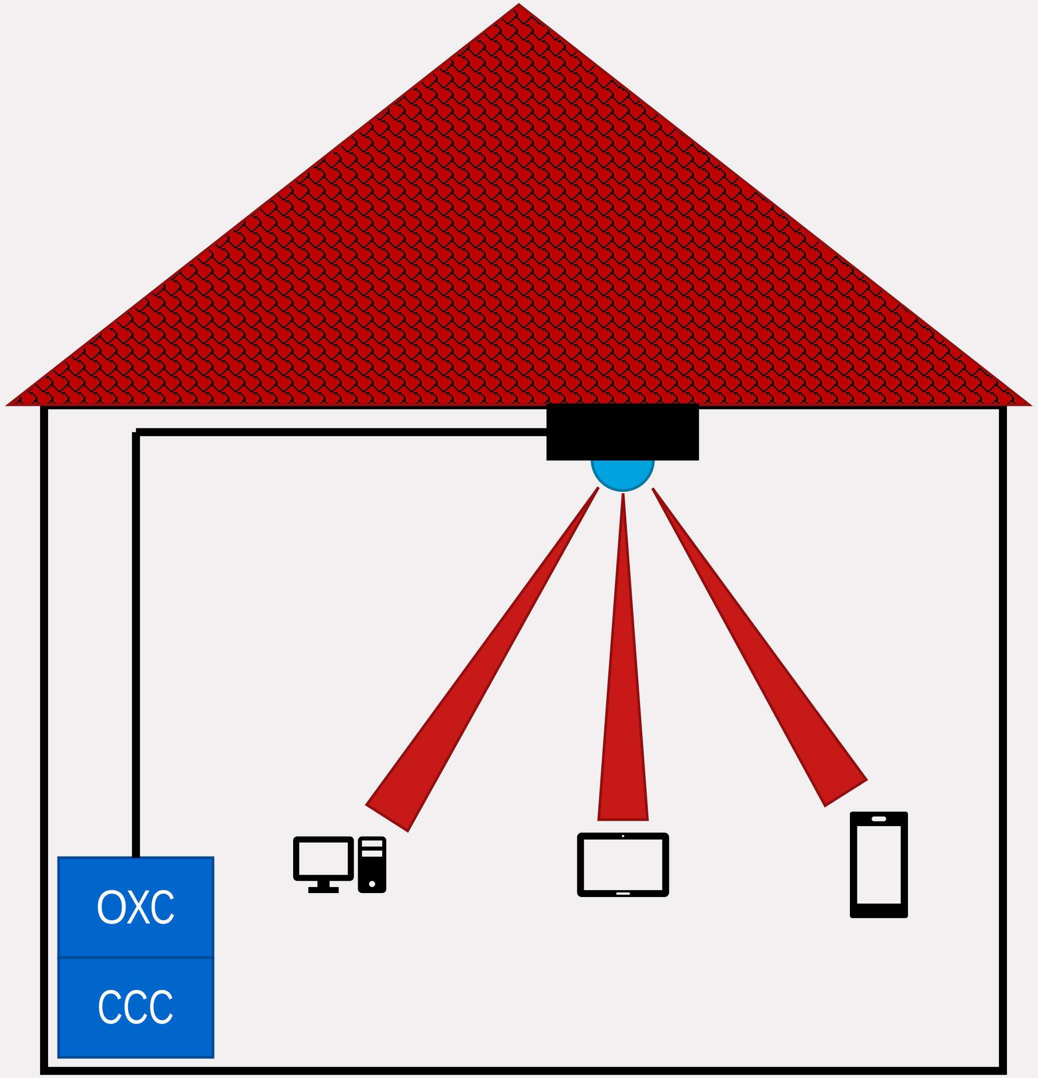
Beam steering is used by the transmitter to shape and move optical beams in free space in order to build high-bandwidth connections to many users

Motivations:

- Security
- Fast and Reliable
- High Bandwidth
- Unrestricted Frequencies

Objectives:

- Fast beam steering in order to address users with high mobility
- Simultaneous multi-users (multi-beam)
- 2D Steering
- Wide field of view



OXC: Optical Cross Connect; CCC: Central Communication Controller

Run-time Bit-wise Data Gating for Dynamic Neural Networks in Wireless Receivers

Contact: Priscilla Sharon Allwin, p.s.allwin@tue.nl

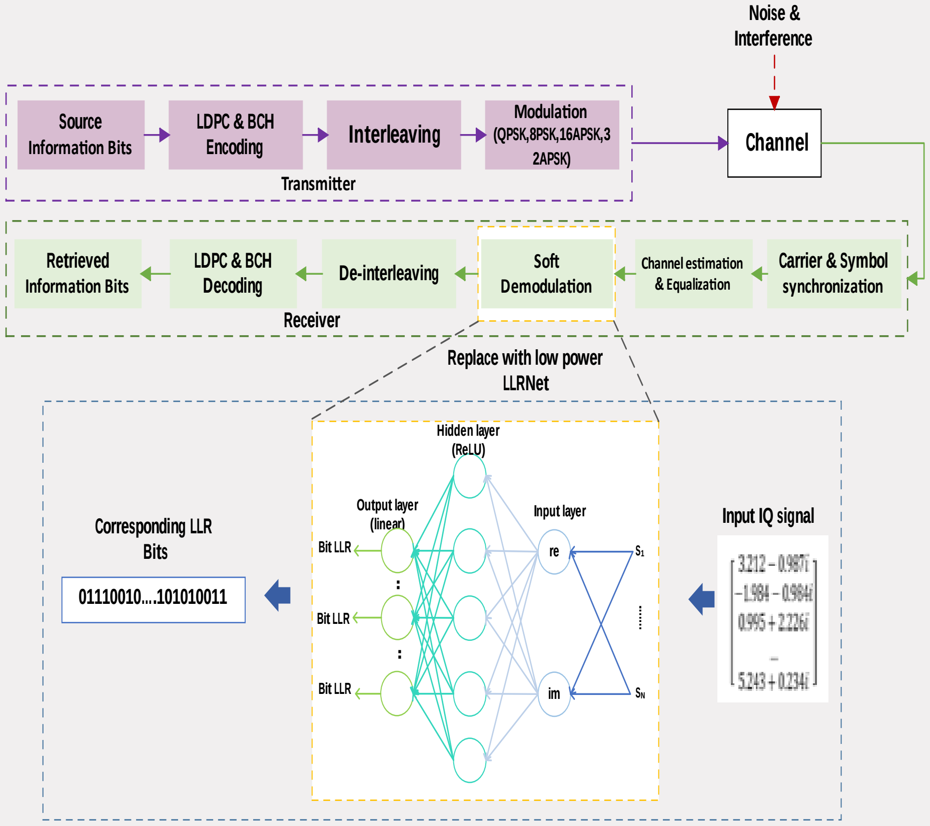


Fig 1. Physical layer of wireless communication

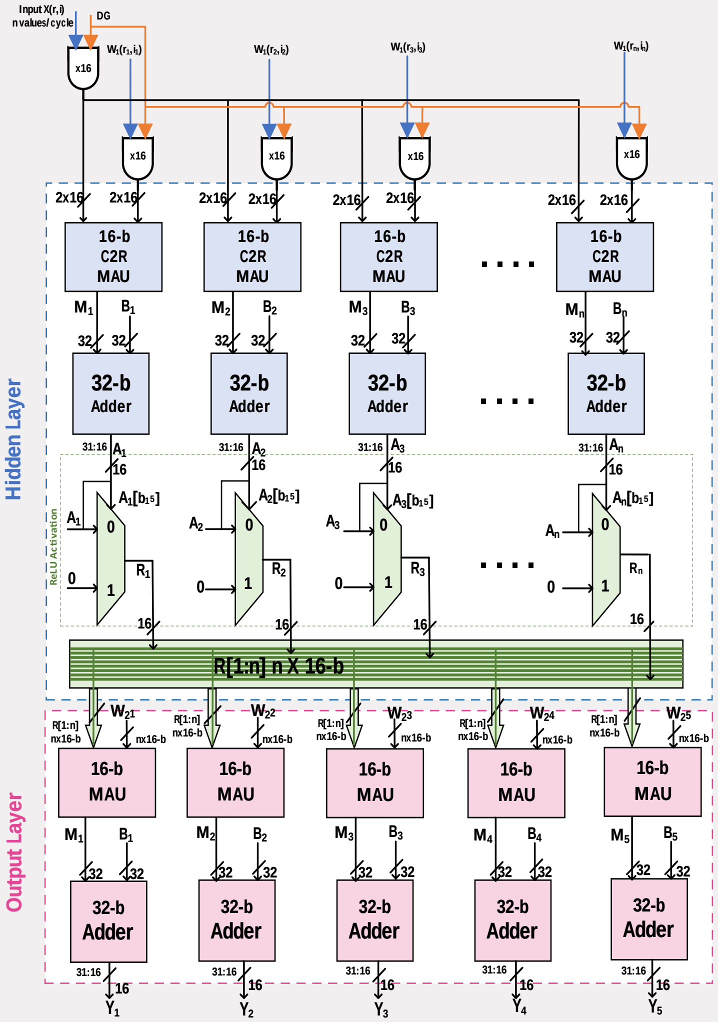


Fig 2. LLRNet with bit-wise data gating hardware

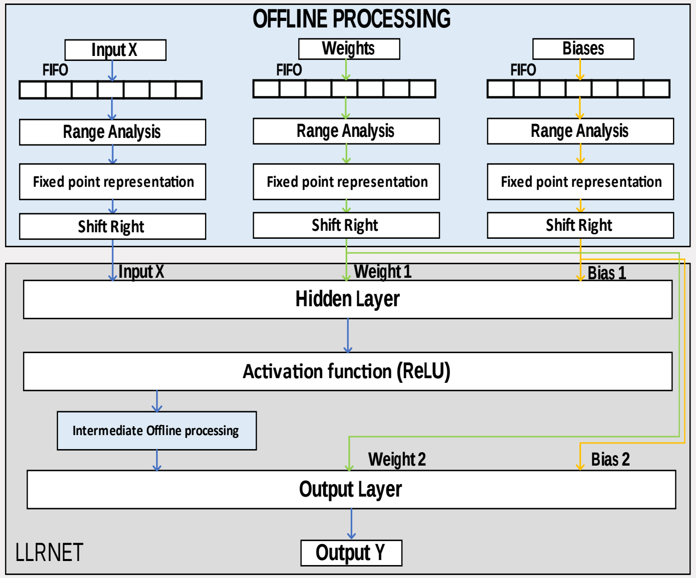


Fig 3. Offline range analysis and bit-shift algorithm

Results:

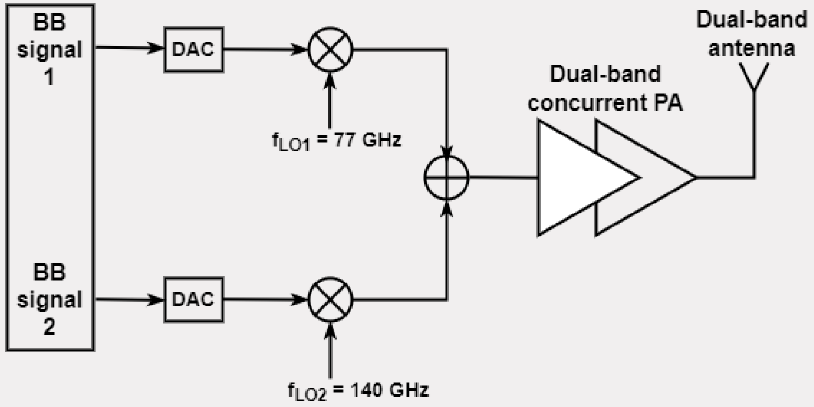
- 8% reduction in switching power
- 5% reduction in total power consumption
- 2% minimal area overhead

Dual-band transceiver design at 77/140 GHz

Contact: Yiqin Hou, y.hou1@tue.nl

- Simultaneous functioning of radar and wireless communication
  - 77GHz for communication
  - 140GHz for radar
  - Reduced number of sensors

- Dual-band concurrent PA and matching networks
  - Coupled resonators
  - On-chip power combining

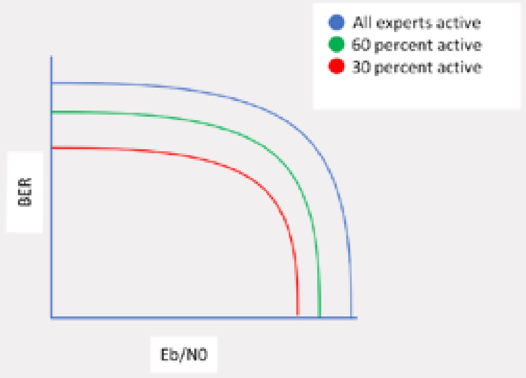


Low power hardware design for a dynamic AI-based 6G wireless Receiver

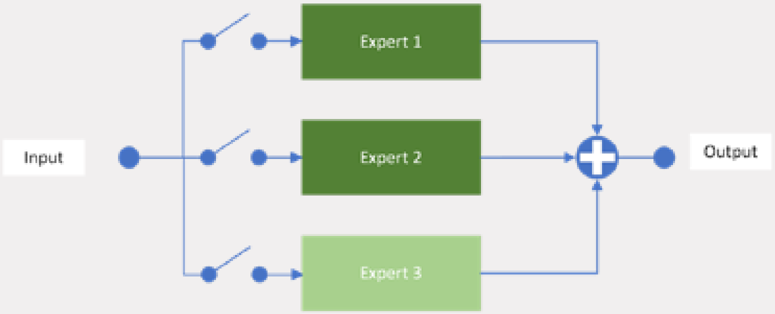
Contact: Bram van Bolderik, b.v.bolderik@tue.nl

- Dynamic AI-based physical layer processing that outperforms classical receivers are promising for 6G wireless communication systems
- However, dynamic AI-based receivers are computationally complex and requires huge amount of memory
- Therefore, the need for efficient hardware for neural communication architectures is growing
- We propose a Mixture-of-experts based approach to dynamically adapt the hardware according to varying channel conditions.

Variable energy consumption based on signal strength



Mixture of experts

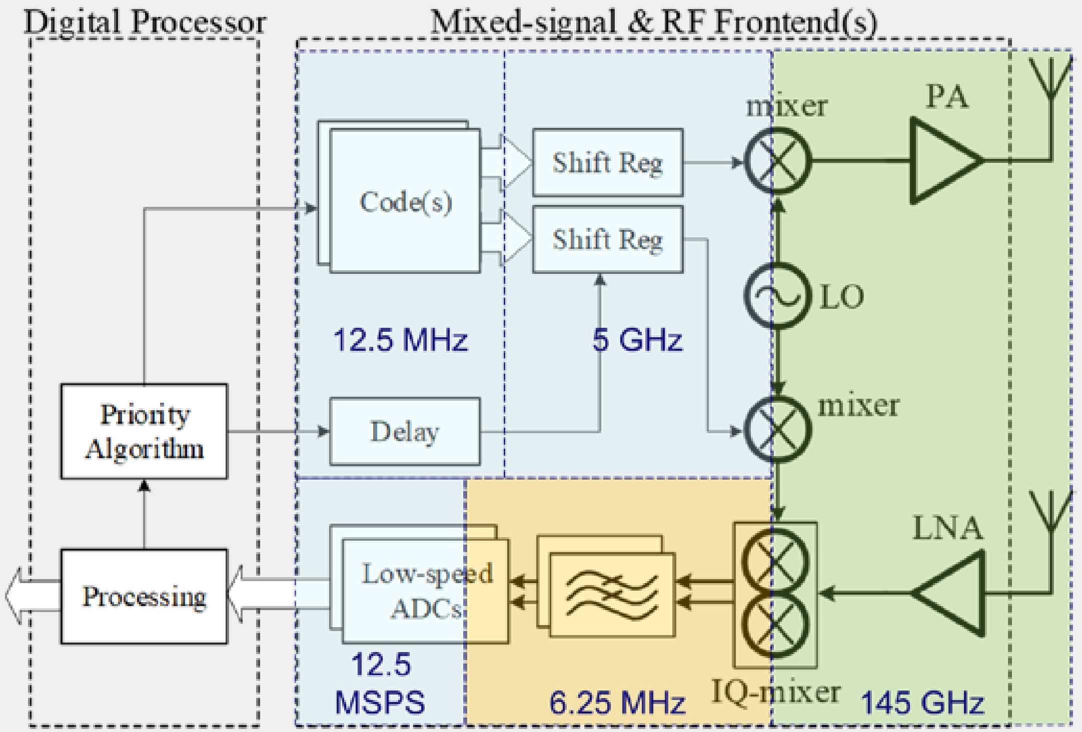


Algorithmic radar, a novel radar architecture

Contact: Corné van Puijenbroek, c.a.h.m.v.puijenbroek@tue.nl

Research target: **145 GHz 5 Gbps BPSK PMCW radar for SISO and 4x8 MIMO, 400 bit APAS code**

- Conventional architecture: 2x5 GSPS 10 bits ADC : SISO: 100 Gbps, MIMO: 800 Gbps
- Steps towards new architecture:
  - Change from digital to analog correlator:
    - Down-convert with modulated, delayed signal
    - reduces sample-rate by factor 400
    - Limitation: correlate one code with one delay at a time
    - Use priority algorithm to determine code and delay
  - Most is noise anyway: Compressed Sensing
  - Radars get faster, physics not: Finite Rate of Innovation
- No compromises on accuracy or measurement speed
- Superior flexibility: change codes, code lengths on the fly
- Results for algorithmic architecture: 2x12.5 MSPS 10 bits ADC : SISO: 0.25 Gbps, MIMO: 2 Gbps



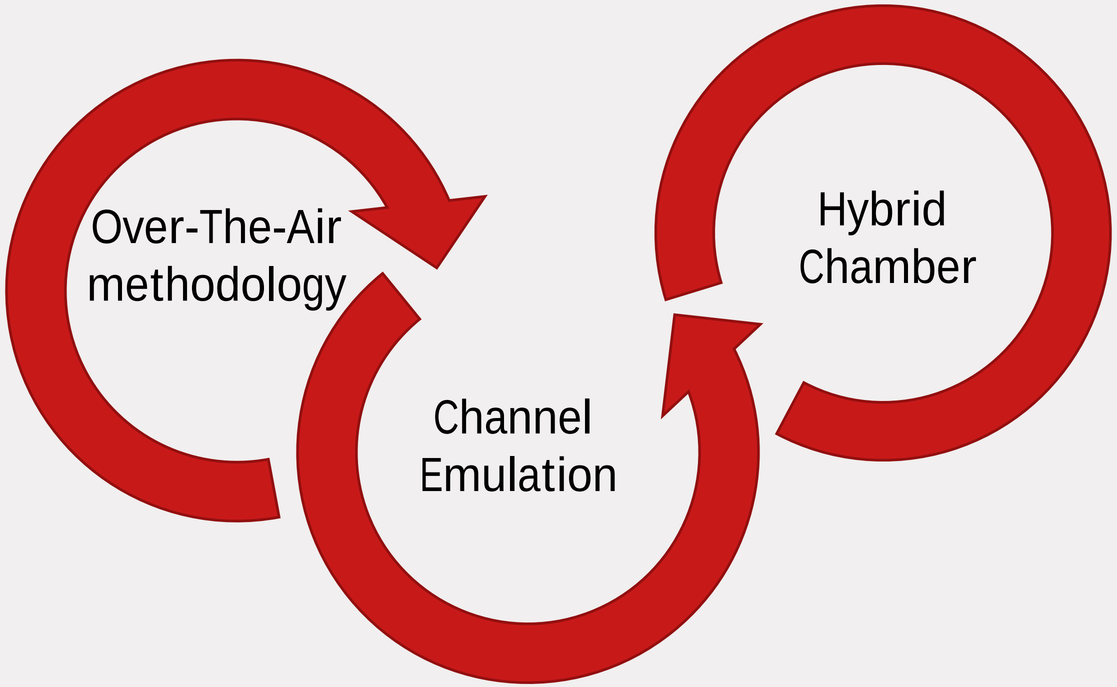
A mm-Wave Hybrid Stirring Technique for Over-the-Air Testing in Reverberation Chambers

Contact: Nazanin Farid, s.farid.mohajer@tue.nl

Beyond 5G

- mm-Waves with larger bandwidth
- High integration
- m-MIMO and beamforming
- Propagation challenges

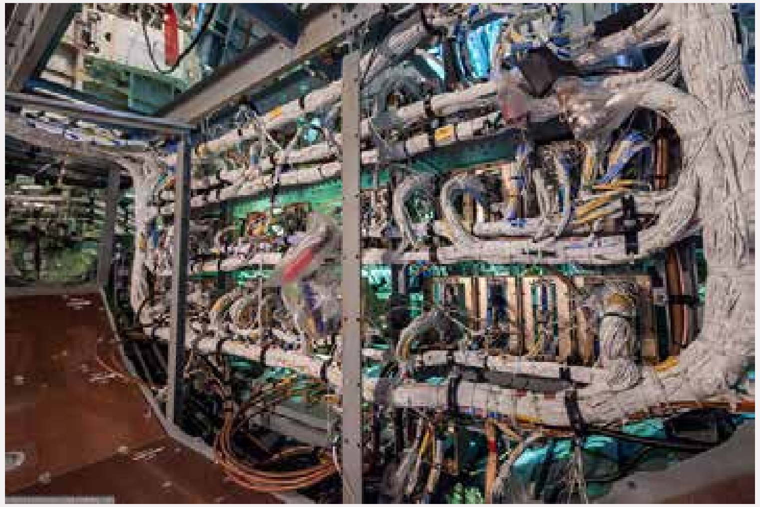
How to characterize mm-Wave devices?



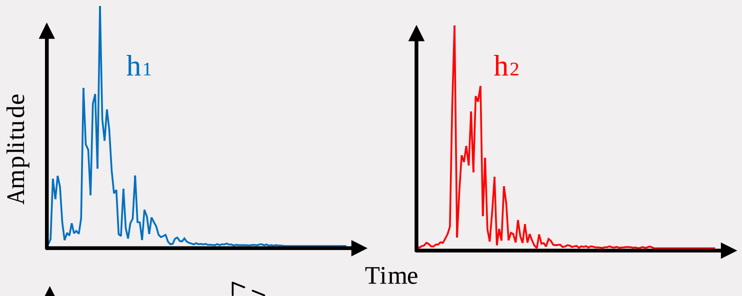
Wideband Null Steering for Reliable Intra-Aircraft Communication

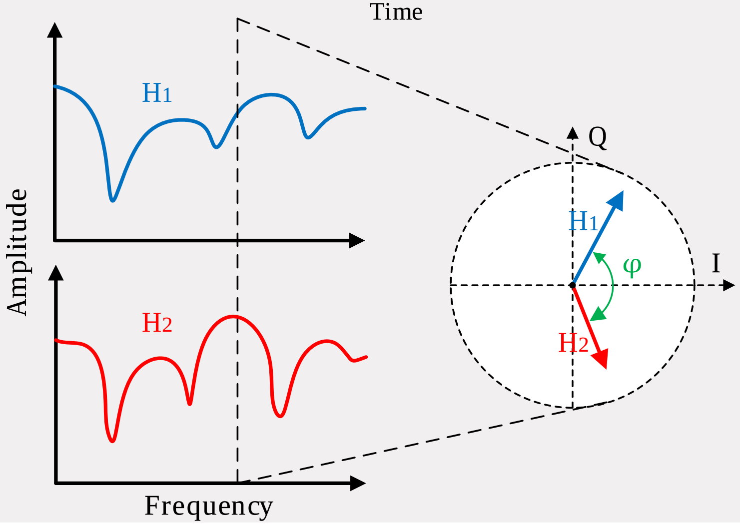
Contact: Erik Bertram, e.s.bertram@tue.nl

- Aircraft have very bulky wiring systems
- ADENEAS hopes to reduce this wire bulk
- Provide Reliable Wireless solutions as replacement

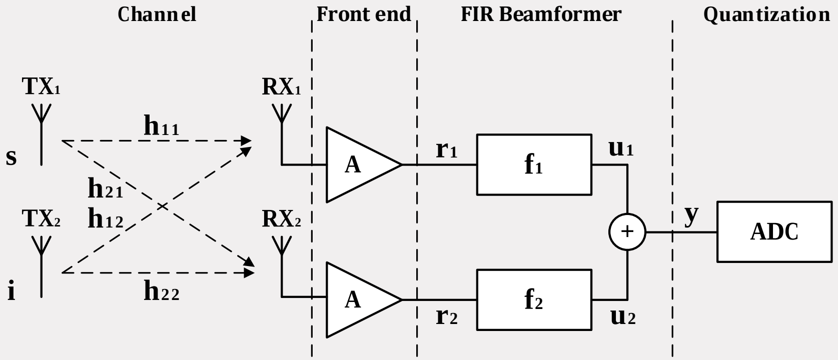


- Rich scattering environment inside the aircraft
- Conventional Null Steering becomes ineffective





- Create a beamformer that can separate signals in rich scattering
- Use FIR filters to compensate the channel
- Reduce ADC bit resolution



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