Poster-pitches

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2	Adedayo Omisakin	EM	Low-power Implanted Transceiver IC for a Visual Prosthesis
3	Carina Ribeiro Barbio Correa	ECO	Plastic Optical Fibres for LiFi system
4	Ngoc (Quan) Pham	ECO	Mobility Management in Indoor Optical Wireless Communication
5	Yu Zhao	ECO	Power allocation under imperfect channel hardening in cell-free mmWave massive MIMO
6	Asterios Souftas	ECO	Wireless On-board Aircraft Communications
7	Kaijie Ding	IC	Inter-satellite Links for Orbiting Low Frequency Antennas for Radio Astronomy (OLFAR) System
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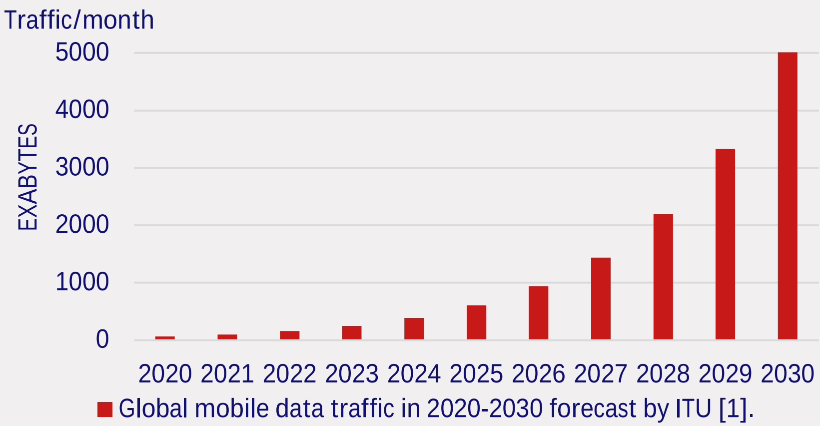
11	Robbert Schulpen	EM	Millimeter-wave channel sounding for 5G
12	Roel Budé	EM	Freepower: Free-space electromagnetic modulation with focal-plane arrays using non-linear power amplifiers
13	Tom van Nunen	EM	Electromagnetic Field Modeling for Biomedical Wireless Power Transfer in Multilayer Applications

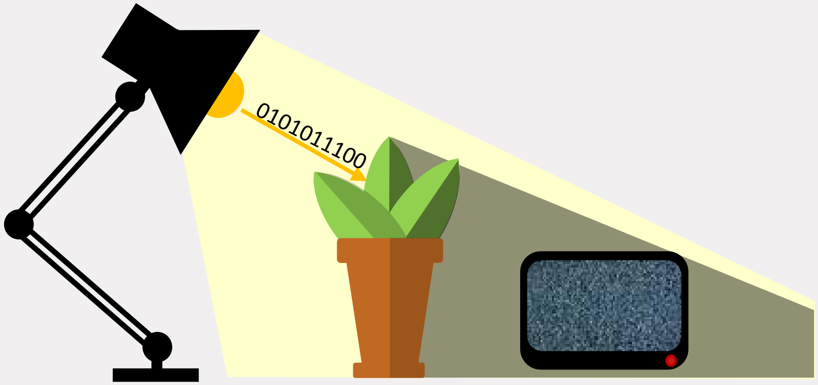
MIMO Optical Wireless Communication

Thiago Elias Bitencourt Cunha, t.e.bitencourt.cunha@tue.nl
Department of Electrical Engineering – Signal Processing Systems

ELIoT Enhancing Lighting for the Internet of Things

- *ELIoT is an Innovation Action project of H2020 with strong industrial and academic partners and aims to introduce Visible Light Communication (VLC) for the realization of dense reliable low-power high-bandwidth connectivity which should bring new features for Internet of Things (IoT) applications.*





- **Challenges:**
  - LiFi is very sensitive to interruption of the optical beam.
  - A single LiFi cell covers a few square meters.
  - Low-pass characteristics of the front-end device (LED+driver).
  - Limited bandwidth of the off-the-shelf LEDs.

[1] *IMT Traffic Estimates for the Years 2020 to 2030*, document ITU-R SG05, Jul. 2015.

MIMO Optical Wireless Communication

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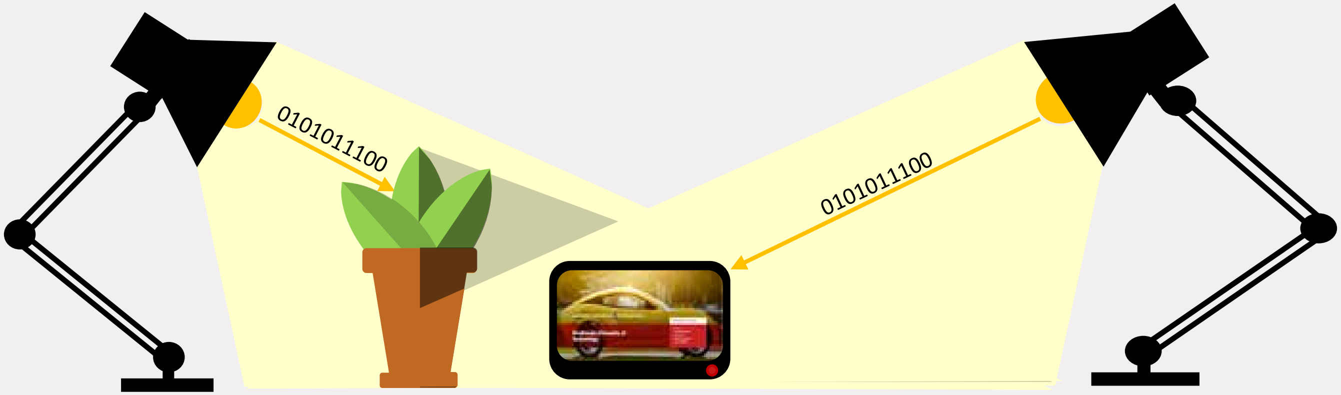


- **With MIMO:**
  - The system become robust to blockage.
  - Increase coverage area.
  - Soft handover.
  - Improve throughput and reliability.

Low-power Implanted Transceiver IC for a Visual Prosthesis

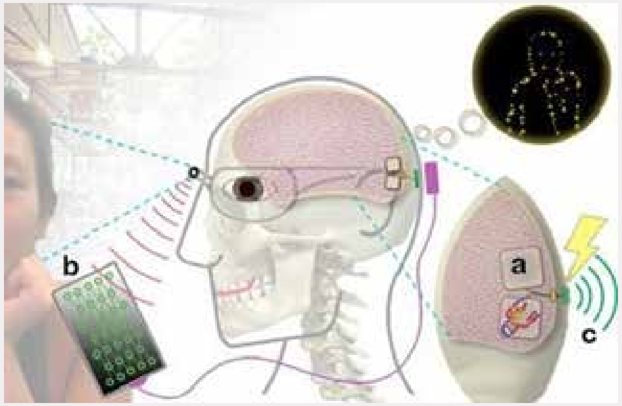
Contact: Adedayo Omisakin, a.e.omisakin@tue.nl

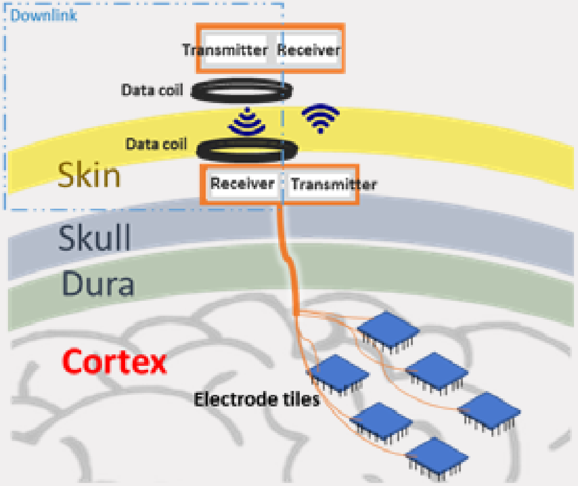
- IR-UWB Transmitter

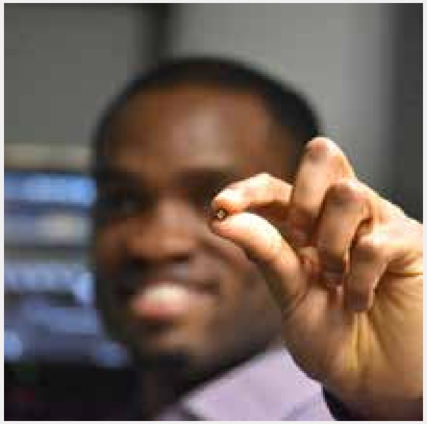
50Mbps, 3-9mW

- BPSK Receiver

1 Mbps, 0.4-0.8mW







Plastic Optical Fibres for LiFi system

Contact: Carina Barbio, c.ribeiro.barbio.correa@tue.nl

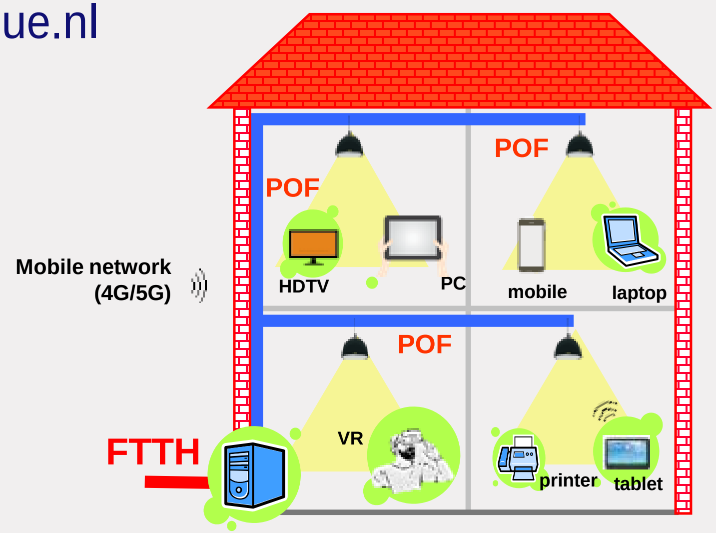
- *ELIoT - Enhance Lighting for the Internet of Things. ELIoT is an Innovation Action project of H2020 with strong industrial and academic partners and aims to introduce Visible Light Communication (VLC) for the realization of dense reliable low-power high-bandwidth connectivity which should bring new features for Internet of Things (IoT) applications.*

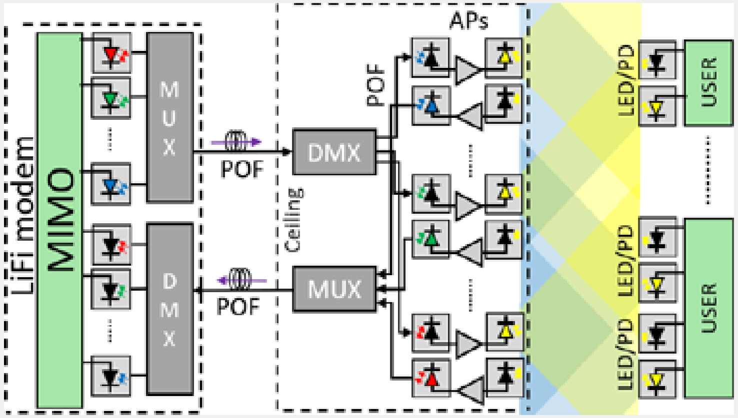
- *Future of IoT is defined by a large number of intelligent devices integrated.*
- *Demand on wireless link to integrate IoT services.*
- *Even higher demand for indoor scenarios.*
- *Li-Fi is one technology that can overcome this problem.*

Plastic Optical Fibres for LiFi system

Contact: Carina Barbio, c.ribeiro.barbio.correa@tue.nl

- Need for a broadband and electromagnetic interference (EMI)-free fronthaul to connect the LiFi access points to the access network.
- Options:
  - Silica fibre – SMF/MMF
  - Plastic optical fibre (POF)
    - DIY technology
    - Small bending radius
    - Low cost
    - Visible light





- Wavelength Division Multiplexing (WDM):
  - ☺ Minimum use of fibres
  - ☹ Need more colours LEDs
- Distributed Multiple-Input and Multiple-Output (D-MIMO)
  - Increase total throughput and reliability
  - Guarantee consistent link performance
  - Enable high user densities
  - Ensure smooth handover between LiFi access points

Mobility Management in Indoor Optical Wireless Communication

Contact: Quan Pham, *n.q.pham@tue.nl*

INTRODUCTION

- **Demand for wireless connectivity is booming**
- **Radio spectrum is getting congested**

→ Optical wireless communication → Real-time localization and efficient handover

- **Steerable narrow optical beams:**
  - Ultra-high capacity
  - High Security
  - Excellent energy-efficiency
  - EMI-free

BEAM-STEERED OWC SYSTEM

- **CCC**:
  - Adaptive network C&M
  - Tunable transceivers
- **OXC**:
  - Dynamic routing to the PRAs
- **PRA**:
  - Fully passive steering optics
  - Multiple beam steering
- **Vision-based Localization**:
  - Camera installed in addition to PRA
  - 4 IR-LED tag at the user terminals

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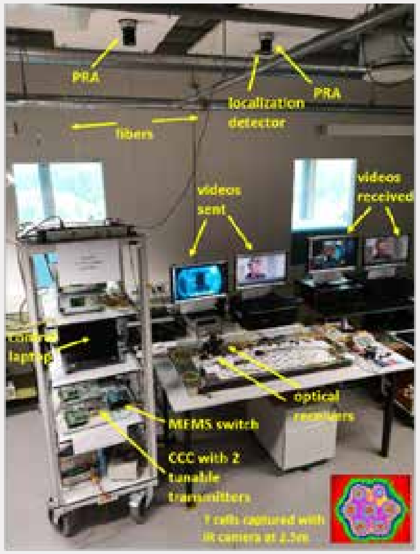
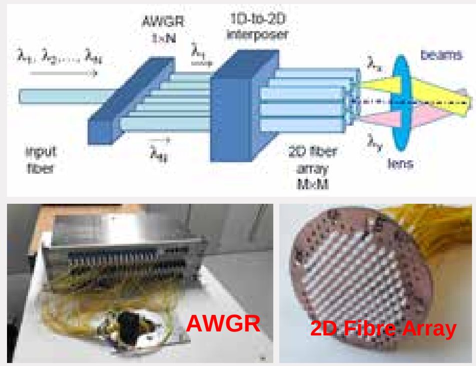
Mobility Management in Indoor Optical Wireless Communication

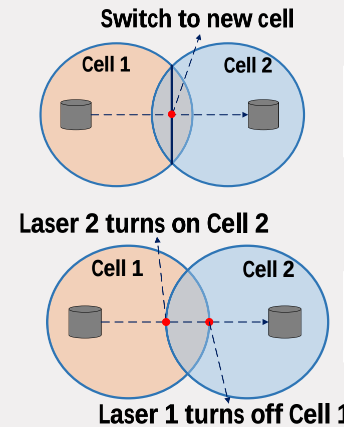
§ Experiment setup





AWGR-based PRA

Localization



Hard handover

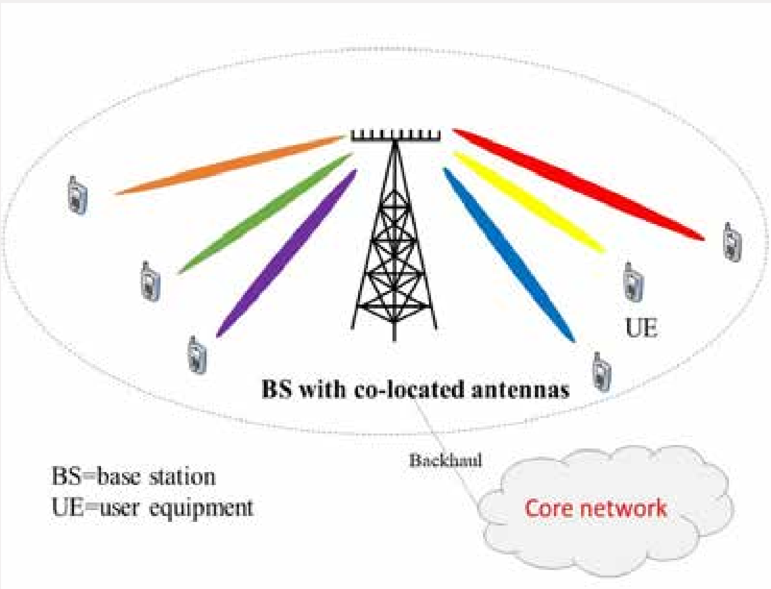
Soft handover

§ Results

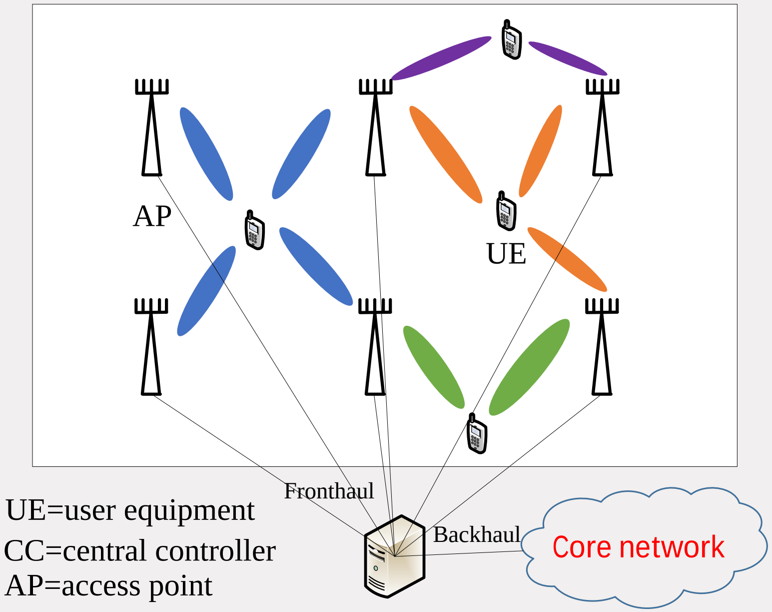
- >112 Gbps PAM-4 per beam up- and downlink for a reach 2.5 m have been demonstrated
- Real-time localization/tracking with an average pointing error < 2mm
- Handover mechanisms for a moving user:
  - o SOFT handover outperforms HARD handover but at the expense of more transmitters
  - o SOFT handover can realize seamless connectivity between access points and user.

Power allocation under imperfect channel hardening in cell-free mmWave massive MIMO

Contact: Yu Zhao, y.zhao3@tue.nl



Centralize massive MIMO



Cell-free massive MIMO

- Massive MIMO
- Channel hardening simplifies signal processing (power allocation only depends on large-scale fading).
- The channel hardens less in mmWave due to limited propagation paths.
- Investigate to what extend is affected by less frequent power allocation in cell-free mmWave massive MIMO.

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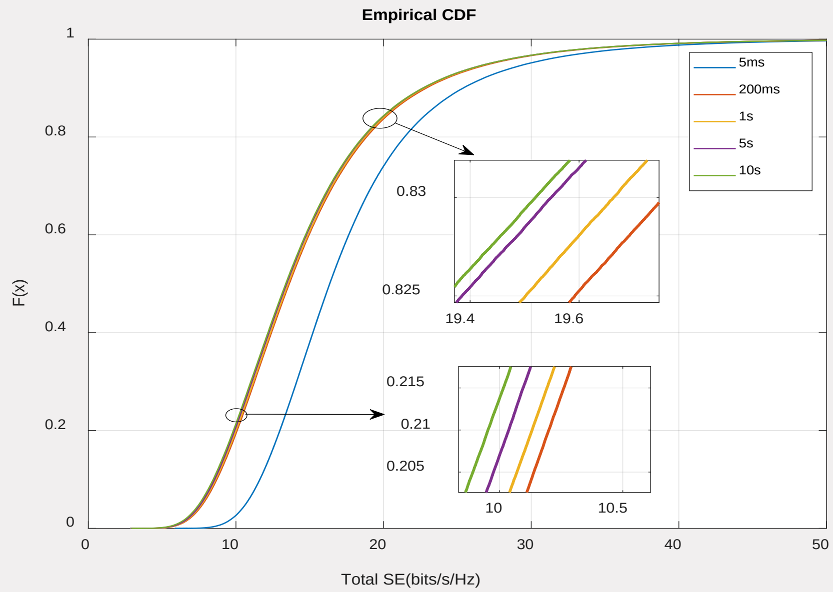
Power allocation under imperfect channel hardening in cell-free mmWave massive MIMO

Contact: Yu Zhao, y.zhao3@tue.nl

3GPP TR 38.901 indoor mixed office scenario

Parameter	Value
Coverage volume	120m×50m×3m
K, number of UEs	10
N, number of APs	12
Maximum downlink transmission power per AP	200 mW
Carrier frequency	28 GHz
Bandwidth	2.8 GHz
Noise power	-70 dBm
Distribution of UE velocity	U(0, 1) m/s



- Zero-forcing precoding
- Maximizing total spectral efficiency
- The extended Saleh-Valenzuela mmWave channel model

Conclusions:

1. The total spectral efficiency increases little when increase the power allocation update frequency. This phenomenon comes from more statistic characters obtained in time domain for a long period.
2. The power should be ideally adapted in each coherence time in cell-free mmWave massive MIMO.

Next step:

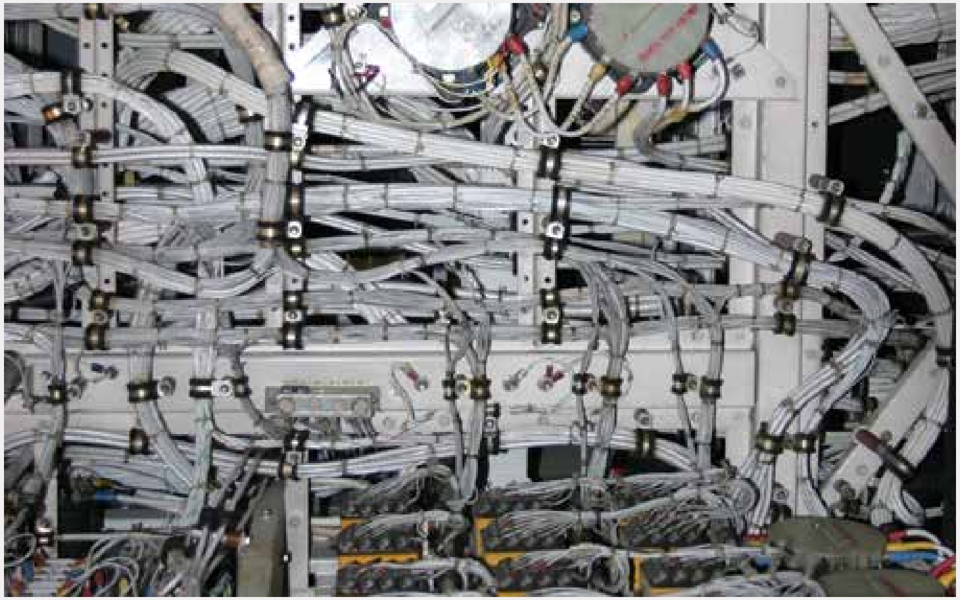
The ideal power allocation has very restricted time constraint thus a low-complexity method, e.g., deep learning or reinforcement learning can be used to adapt power in real-time (i.e., within each coherence time).

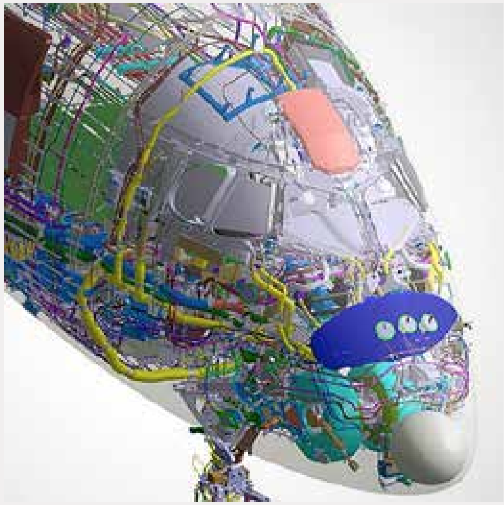
Wireless On-board Aircraft Communications

Contact: Asterios Souftas, a.souftas@tue.nl

Advantages

- Weight savings (Wiring weights 1-5 tons)
- New applications (hard to reach places)
- Improved reliability
- Space saving
- Re-configurability





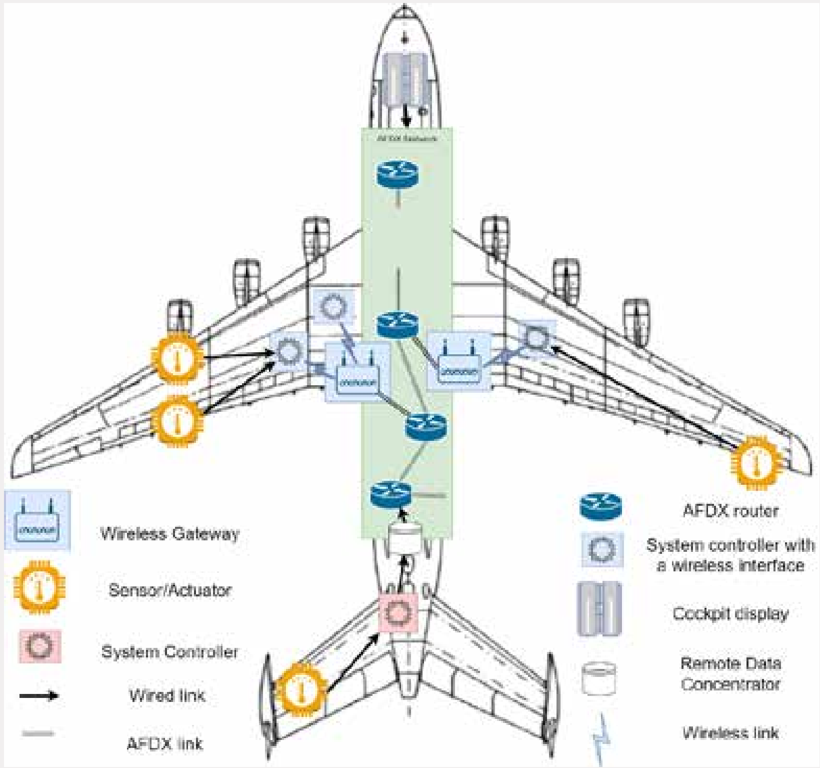
Sponsor: Fokker Elmo
Supervisors: Sonia Heemstra de Groot, Ignas Niemegeers, Kees Nuyten

Wireless On-board Aircraft Communications

Contact: Asterios Souftas, a.souftas@tue.nl

Challenges

- Ultra-high reliability
- Low latency
- Security
- Integration



Inter-satellite Links for Orbiting Low Frequency Antennas for Radio Astronomy (OLFAR) System

Contact: Kaijie Ding, K.Ding@tue.nl

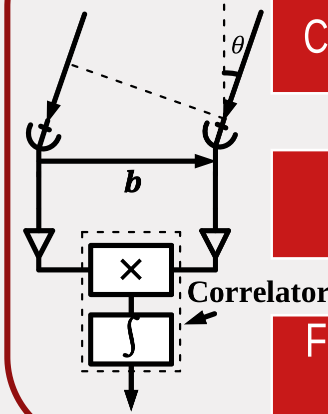
Background:

What? è A space-based ultra-low (0.1-30 MHz) frequency radio telescope

How? è Send 50 to 10000 Cubesats (10 cm scale) into space in order to form an interferometry, scattering in 100km

Why? è Earth ionosphere impact on low frequency radio signal

*Interferometry:



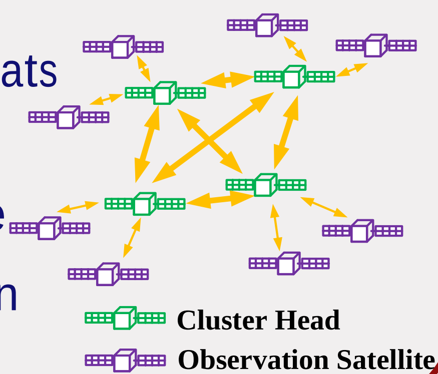
Correlations

Visibility Function

FFT it è Sky Picture

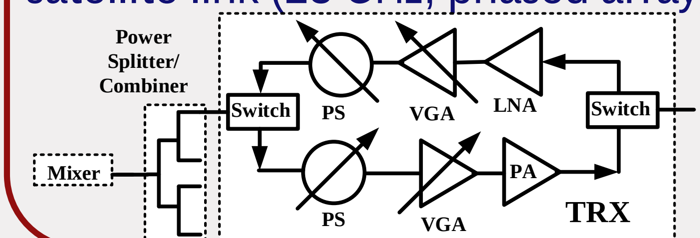
System Approach:

1. Correlations done in Cubesats and the result sent to earth
2. Dynamic clustering scheme
3. One patch antenna array on each surface of the satellite



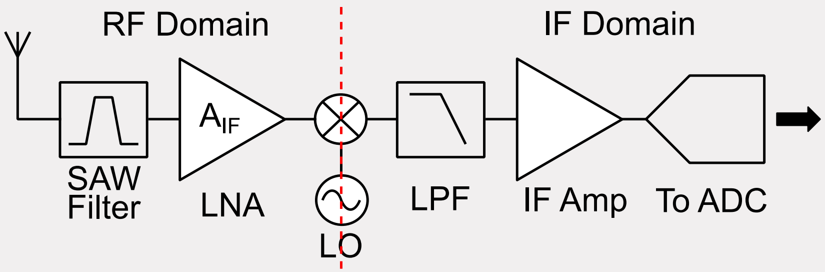
Current work:

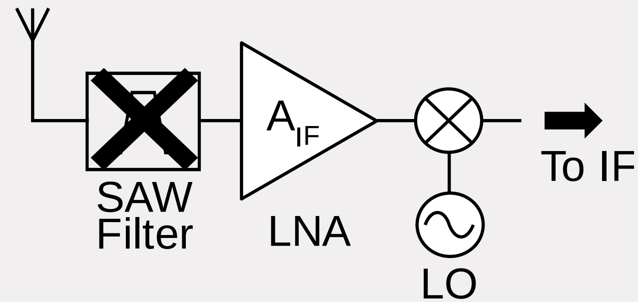
Designing transceiver for the Inter-satellite link (23 GHz; phased array)



Gain Boosted N-Path Receiver for low power application IoT applications

Debasish Mitra, d.mitra@tue.nl





RF Domain
- SAW filter à selectivity
- LNA à matching, RF gain
- Mixer à downconversion to IF

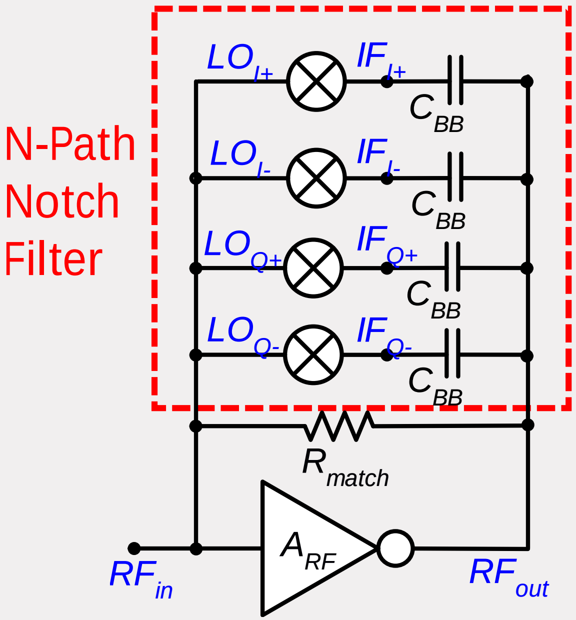
IF Domain
- IF Amplification
- Mixer à downconversion to IF
- Filtering, Channel Selection

Reconfigurable Receiver??
- SAW Filter à frequency rigid

Target Specifications	
Frequency	100MHz – 2.5 GHz
Noise Figure	< 5 dB
IIP3 (OOB)	> 10dBm
Power	< 10mW

Gain Boosted N-Path Receiver for low power application IoT applications

Debasish Mitra, d.mitra@tue.nl

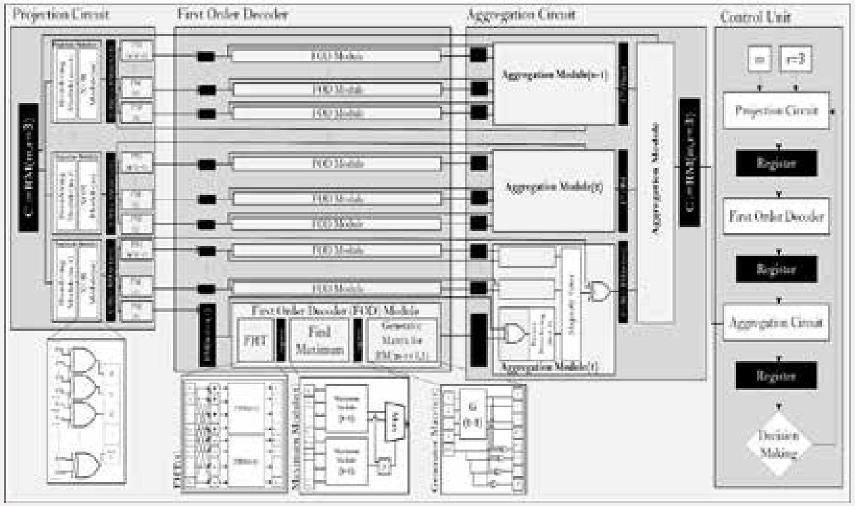


- Gain Boosted N-Path Receiver - Characteristics
  - 25% duty-cycle non-overlapping LO clock (N=4).
  - N-Path notch filter in feedback à bandpass filtering at RFin and RFout.
  - RF Amplification à conversion gain
  - Noise Sources à RF Noise sources (folding), IF Noise sources.

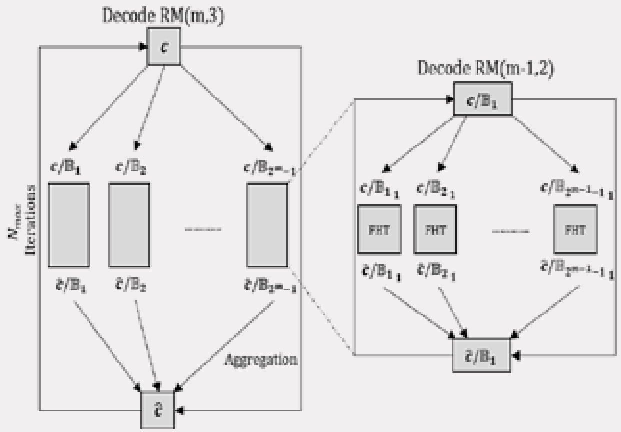
Hardware implementation of simplified RPA decoding of Reed-Muller codes

Marzieh Hashemipour Nazari < s.m.Hashemipour.Nazari@tue.nl>
Supervisors: Alexios Balatsoukas Stimming, Kees Goossens

- Ultra-Reliable Low-Latency Communication (URLLC) systems
- Short packets ➡ **error-correction is challenging!**
- Available Decoding methods for short codes
  - **Pro**: Good error-correcting performance
  - **Con**: Non-standard structure for the hardware implementation
  - **Example**: Recursive Projection Aggregation decoding of RM codes [1]



- **Our contributions:**
  1. We transform the recursive structure into a non-recursive structure with **minimal error-correction degradation**
  2. We explore the effect of commonly used approximation techniques
  3. We describe an **efficient hardware implementation**

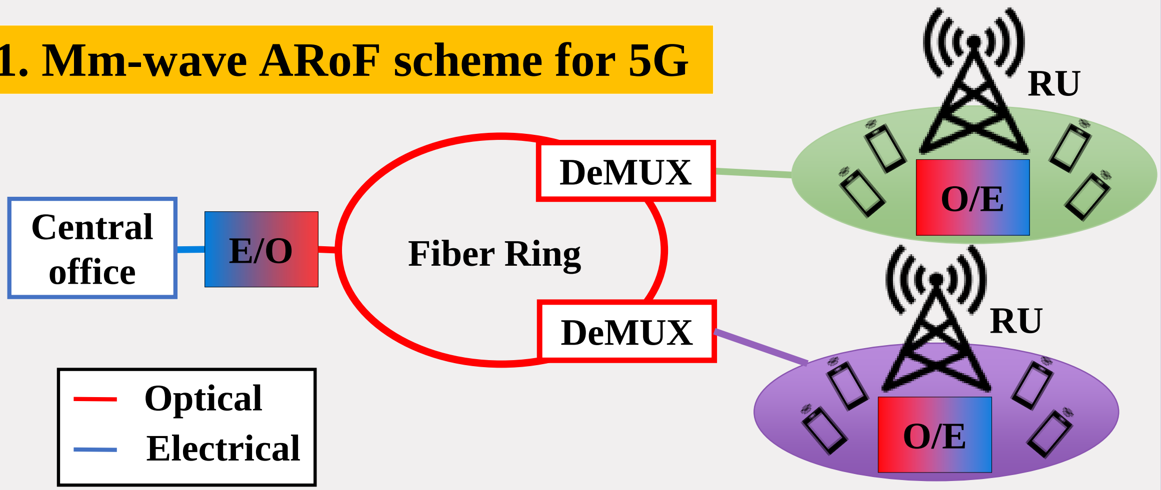


[1] Min Ye and Emmanuel Abbe, "Recursive projection-aggregation decoding of Reed-Muller codes," IEEE Transactions on Information Theory (2020).

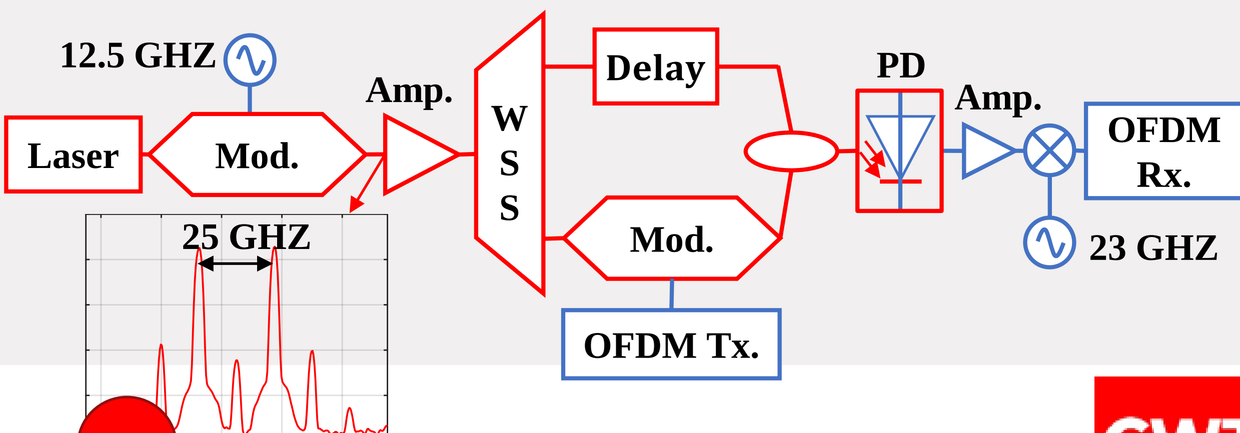
Analysis and Compensation of Phase Noise in mm-Wave Analog Radio-over-Fiber Systems for 5G

Javier Pérez Santacruz, j.perez.santacruz@tue.nl

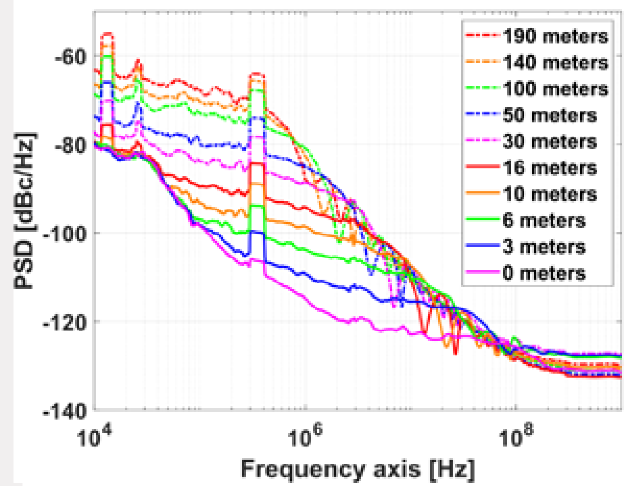
1. Mm-wave ARoF scheme for 5G

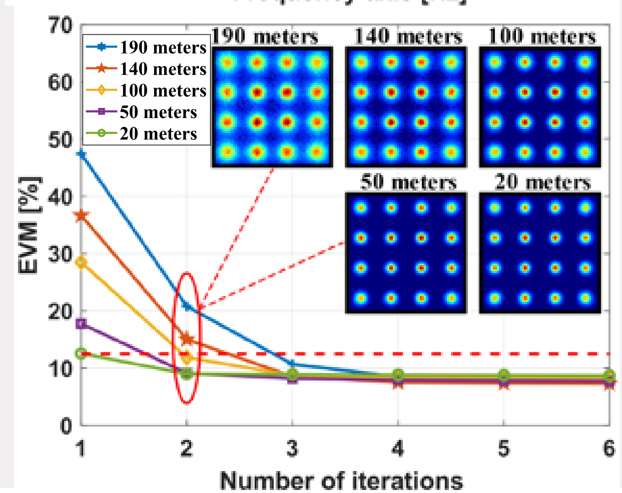


2. Experimental setup



3. Results

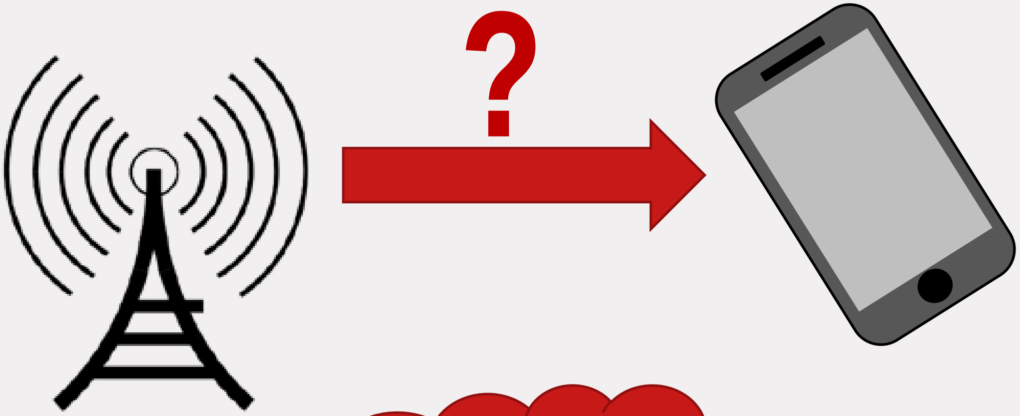


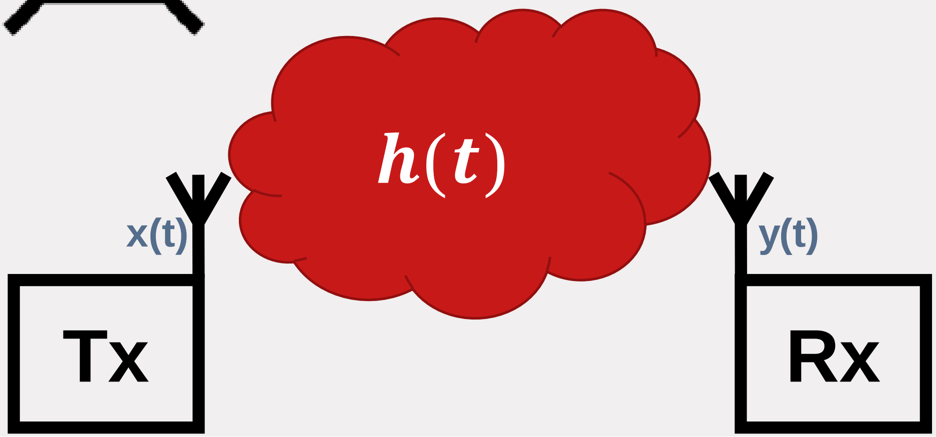


Millimeter-wave channel sounding for 5G

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

- What is channel sounding?
- How?





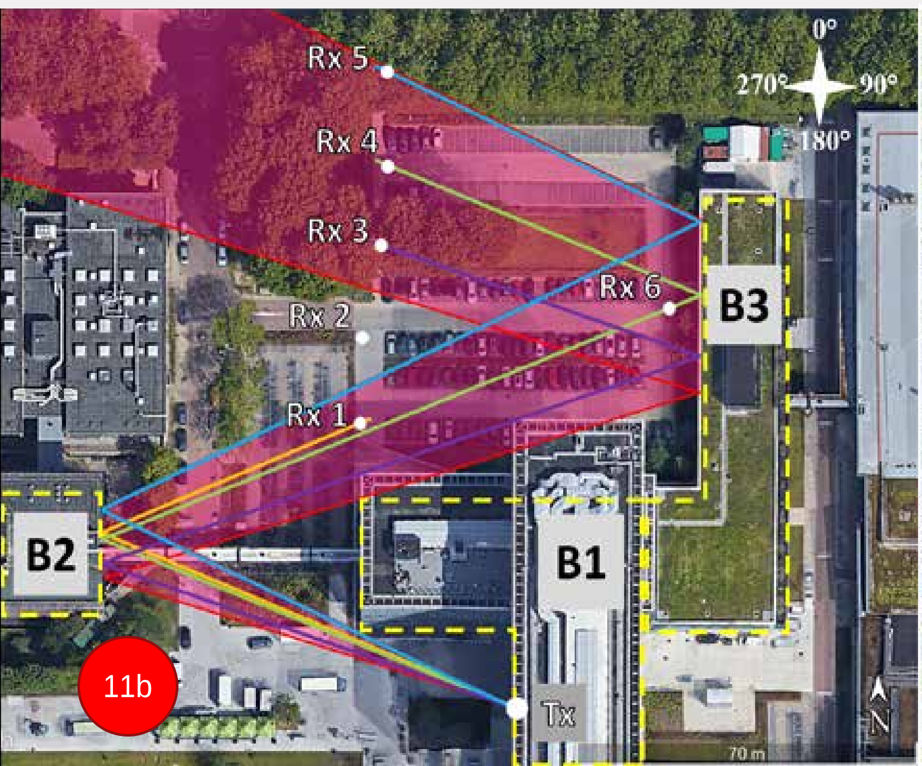
Millimeter-wave channel sounding for 5G

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

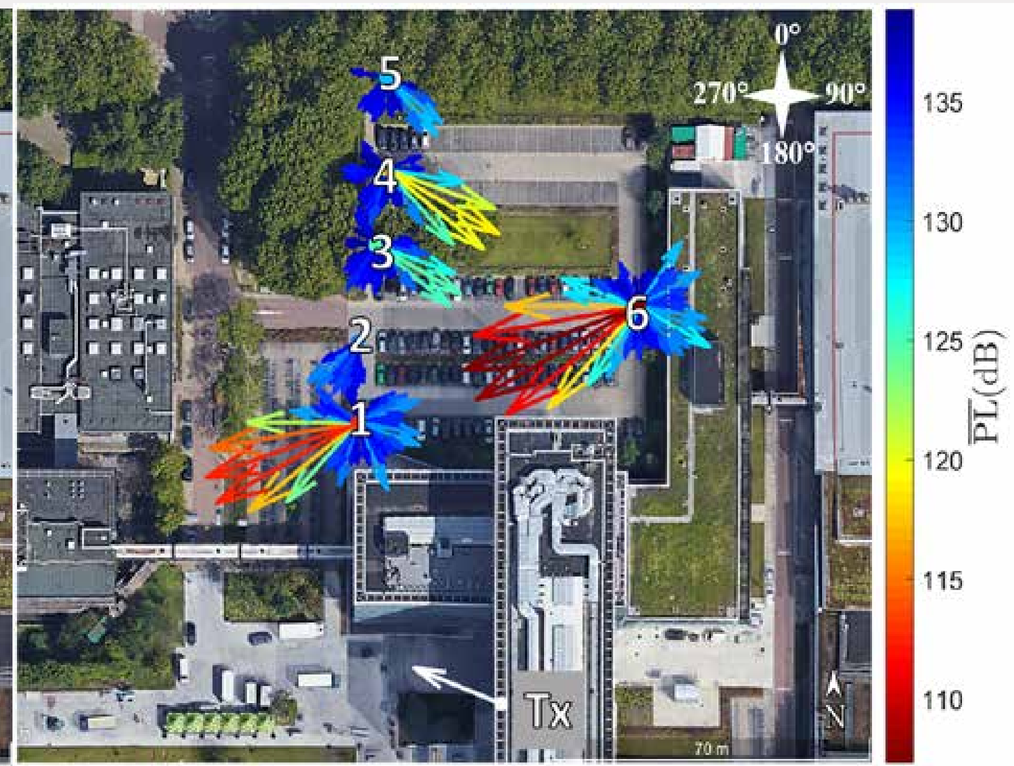
Measurement campaign at 24 GHz:

- Flat metal/metallized surfaces
- Specular reflections dominant

Theory

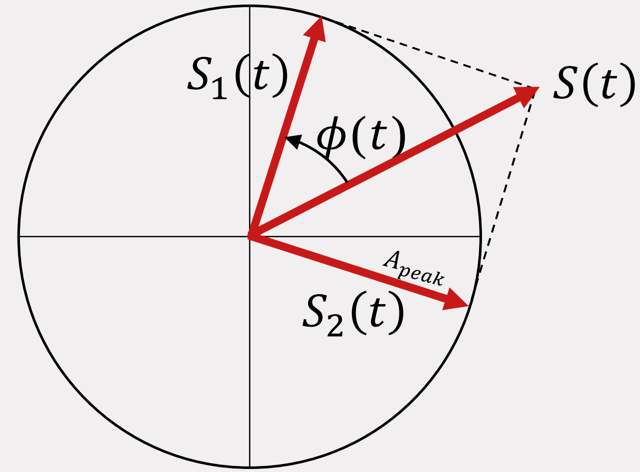


Measurement results

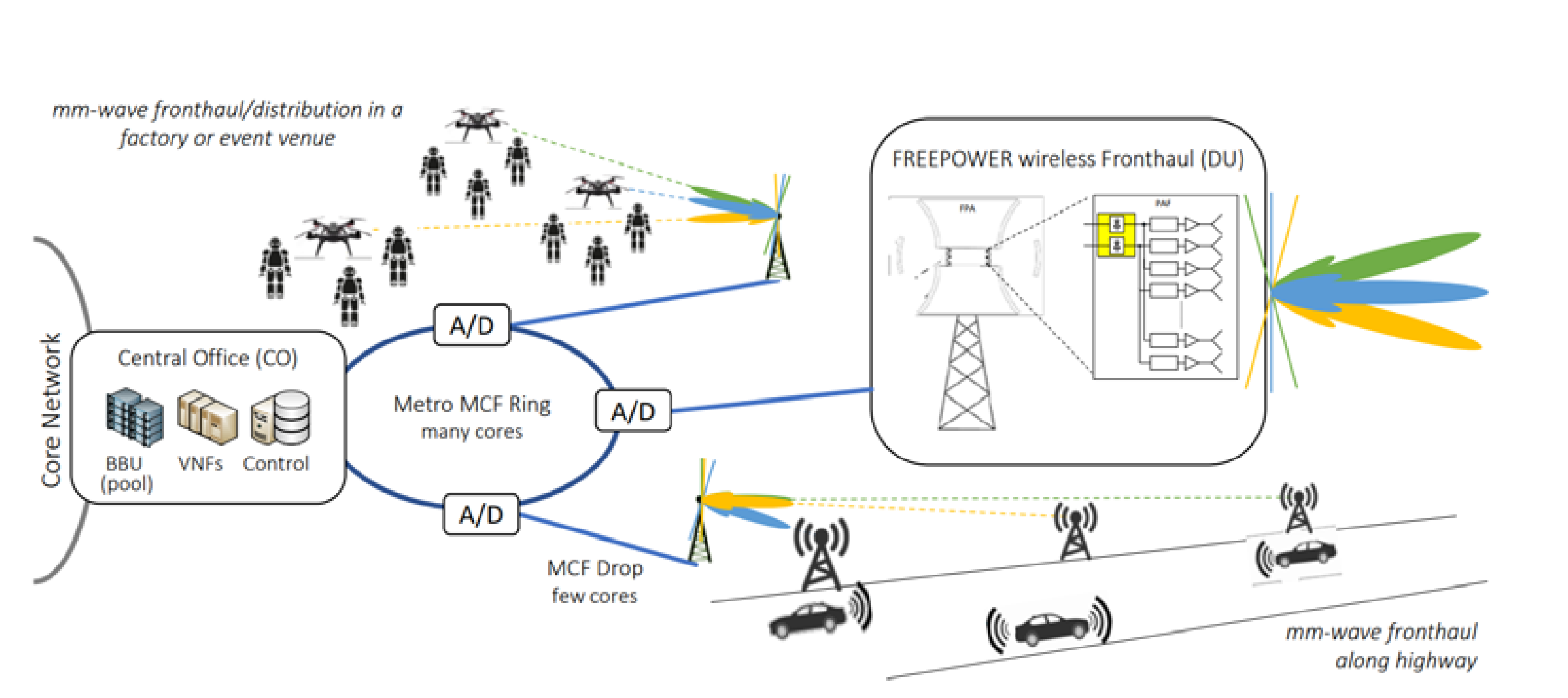


FREEPOWER

Roel Budé, Gleb Nazarikov, Meerten Versluis
r.x.f.bude@tue.nl

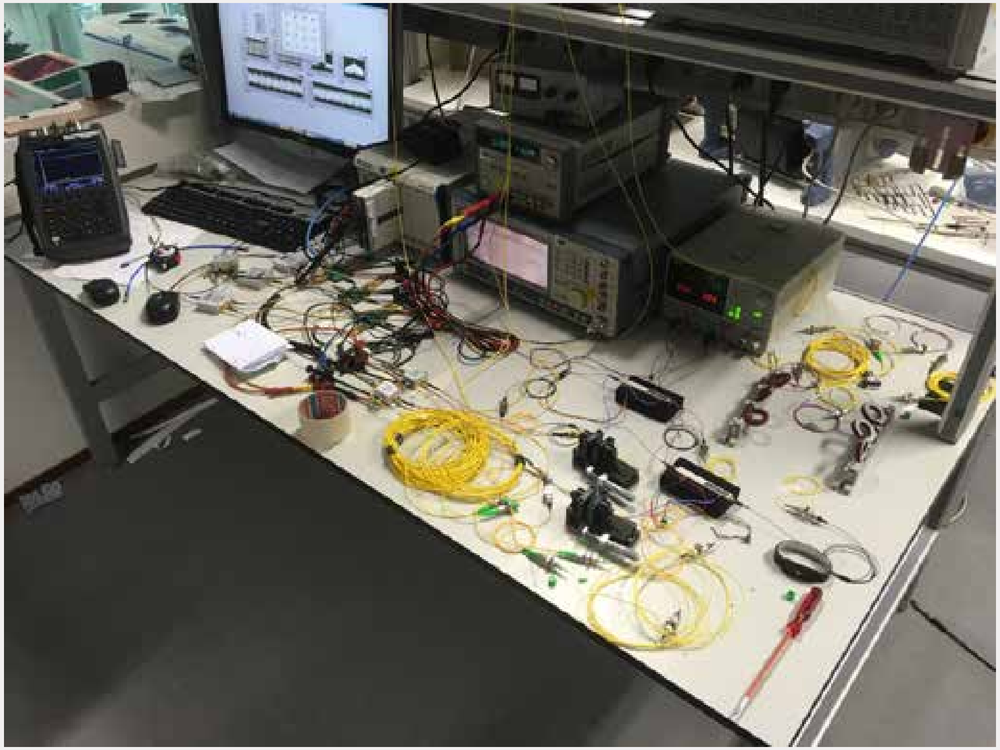


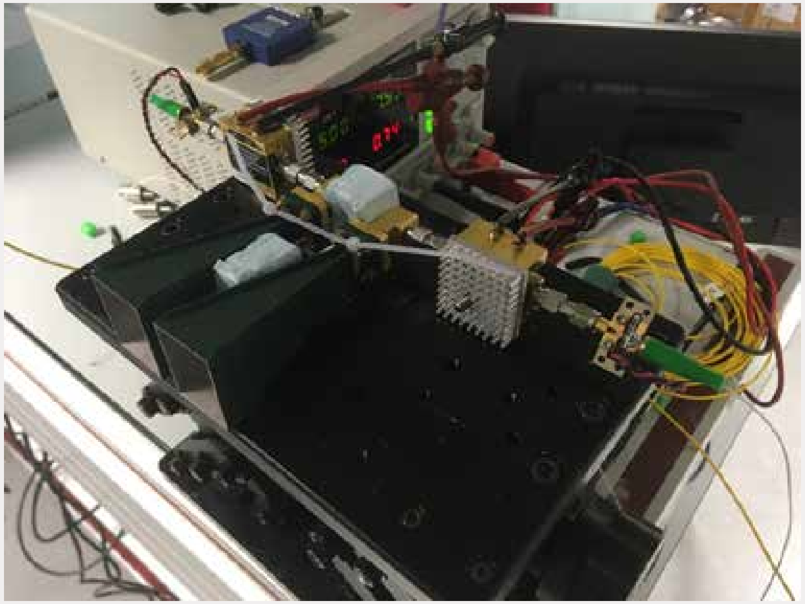
Free-space electromagnetic modulation with focal-plane arrays using non-linear power amplifiers

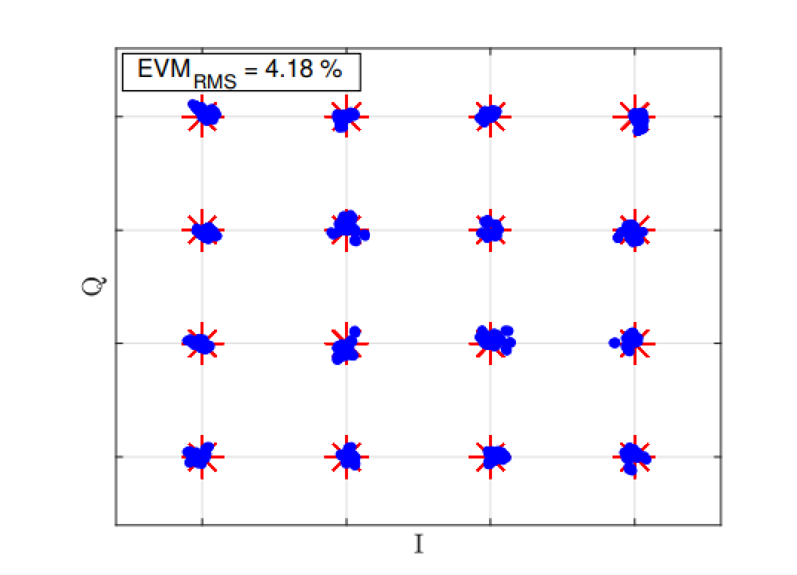


FREEPOWER

Roel Budé, Gleb Nazarikov, Meerten Versluis r.x.f.bude@tue.nl



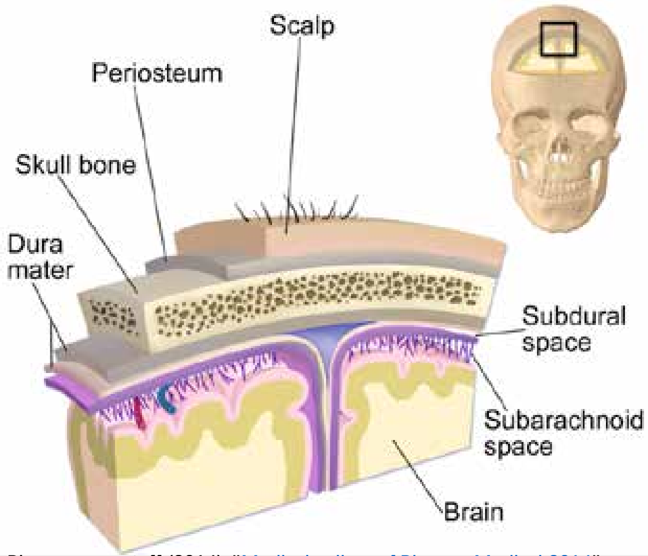




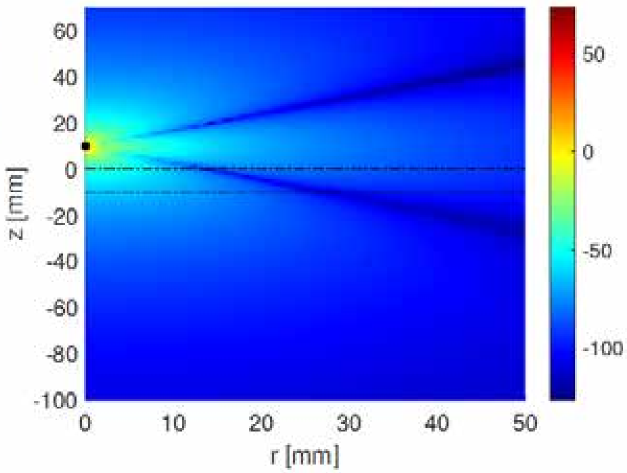
Millimeter-Wave Outphasing using Analog-Radio over Fiber for 5G Physical Layer Infrastructure

Electromagnetic Field Modeling for Biomedical Wireless Power Transfer in Multilayer Applications

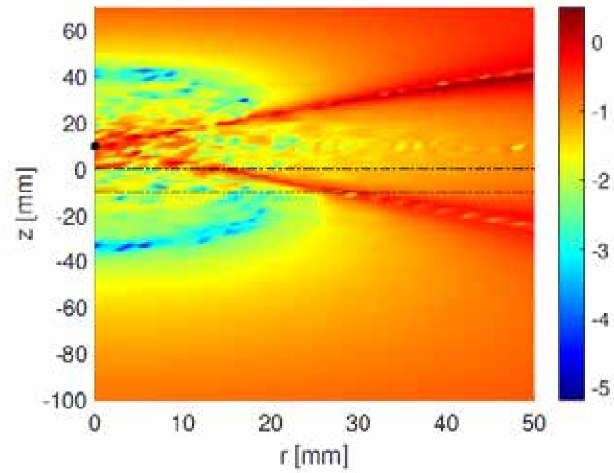
Contact: Tom van Nunen, t.p.g.v.nunen@tue.nl



Blausen.com staff (2014). "Medical gallery of Blausen Medical 2014". *WikiJournal of Medicine* **1** (2). DOI:10.15347/wjm/2014.010. ISSN 2002-4436.



(a) $|H_z|$ [dBA/m], analytical model.



(b) Relative difference, log scale.

(commercial) EM field solver	Analytical model
Powerful computer	Standard computer
Takes hours	Takes minutes
Expensive license	Free license