Fraunhofer 5G Berlin

Fraunhofer's Perspective on 5G

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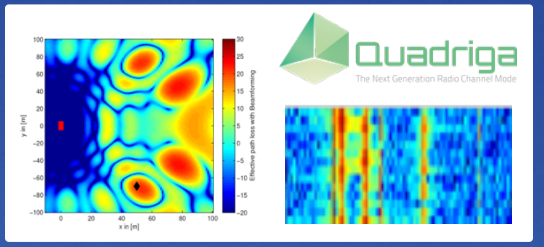
3GPP RAN Workshop on 5G, Sept. 17-18, 2015, Phoenix, USA

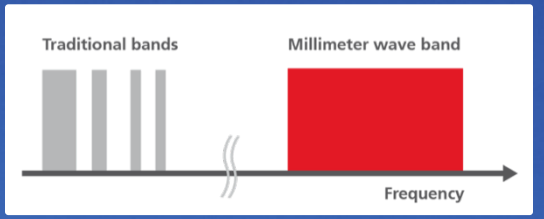
5G Research Contributions

Fraunhofer 5G Berlin

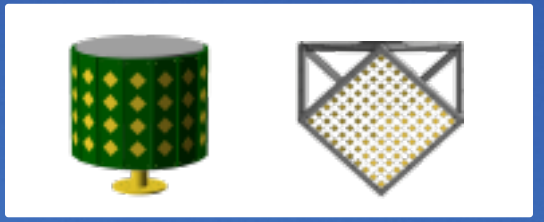
Radio Propagation: Channel Measurements & Modelling



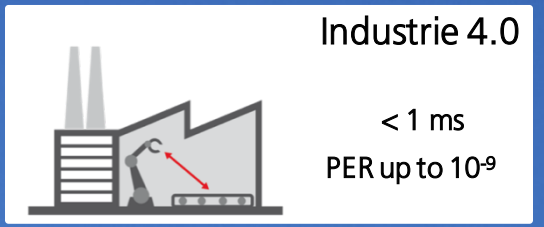
mmWave Communications: Sub-10 GHz, 28, 60, 70, 80 GHz



Massive MIMO: M-MIMO with up to 32, 64, 128, … Antennas



Industrial Wireless: Ultra Low Delay and Reliable Communications



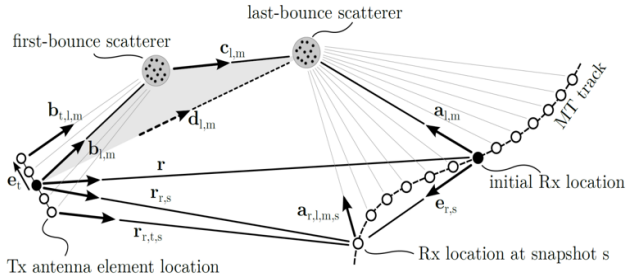
Radio Propagation

- Quasi-Deterministic Channel Model
- Virtual Field Trials
- 3D Propagation & Polarization
- Massive MIMO Modelling
- 0.5 – 6 GHz, Extensions above 6 GHz

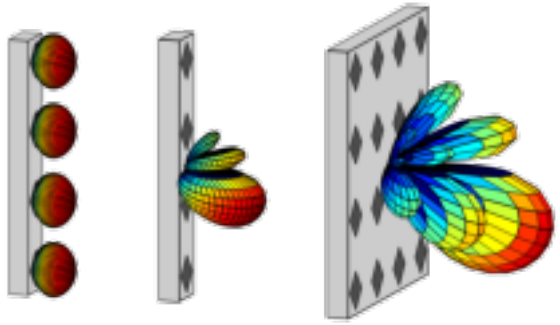
Quadriga
The Next Generation Radio Channel Model

www.quadriga-channel-model.de

Multi-Bounce & Spherical Wave Modelling

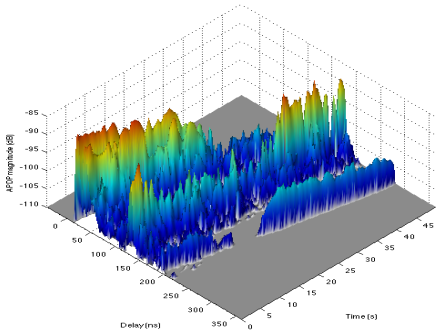


Antenna Models and Mutual Coupling

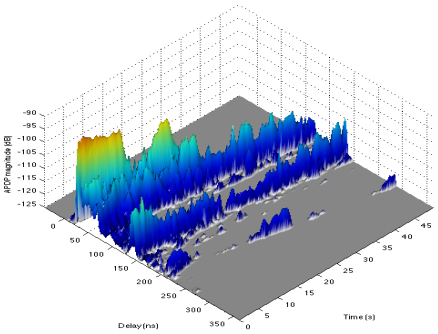


mmWave Spectrum

- Channel Measurements & Modelling
- Waveform Design & System Evaluation
- Antenna Design for Beamforming Antenna Arrays
- Xhaul – Backhaul, Fronthaul & Access

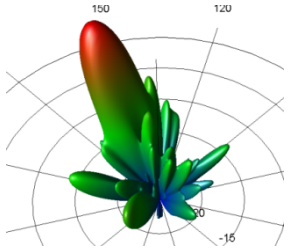


10 GHz

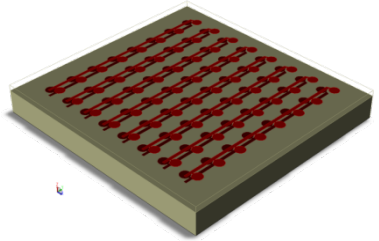


60 GHz

Simultaneous mmWave Measurement Campaigns



Beamforming with 8 Columns



Active Antenna Array,
8x8, 60 GHz

Massive MIMO

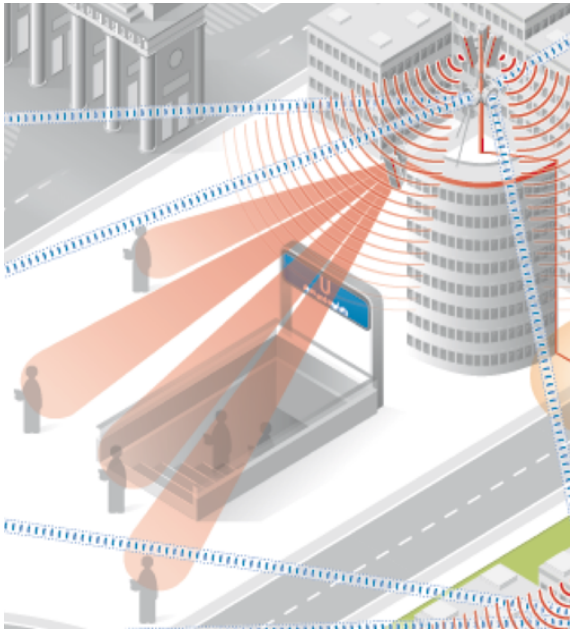
- Beamforming Concepts
  - Multi-user, multi-node coordination, localization
- Modelling & System Level Simulations
- SDR Prototyping –
  - 70 MHz – 6 GHz, 56 MHz bandwidth
  - 8TRx cascadable, 40 Gbps interfaces
- Measurements & Trials

8 TRx SDR

128 Antenna Cylinder

128 Antenna Cube

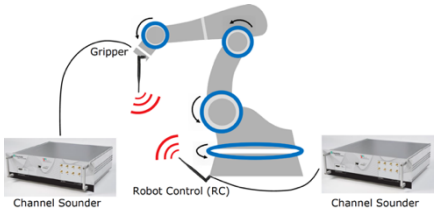
Massive MIMO Scenario



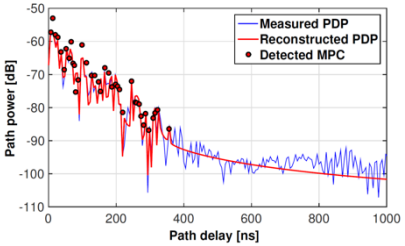
Industrial Wireless

- D2D, MTC
  - Use case: wireless factory automation
- PHY / MAC – Air Interface Design
  - Ultra low end-to-end delay < 1ms
  - High reliability: PER of up to 10^{-9}
  - Waveform design, resource management
- Channel measurements & parameterization

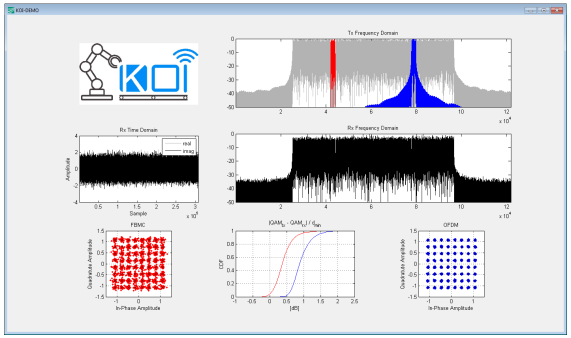
Measurement Setup:

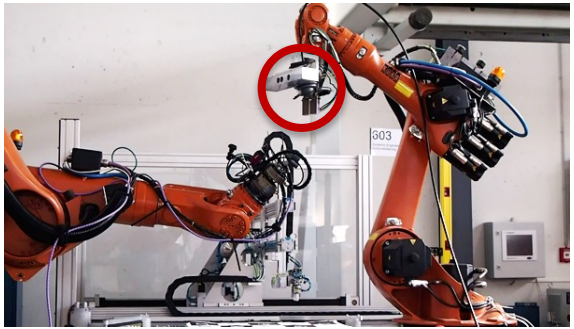


- Multipath Detection
- Power Delay Profile Statistics



www.koi-projekt.de

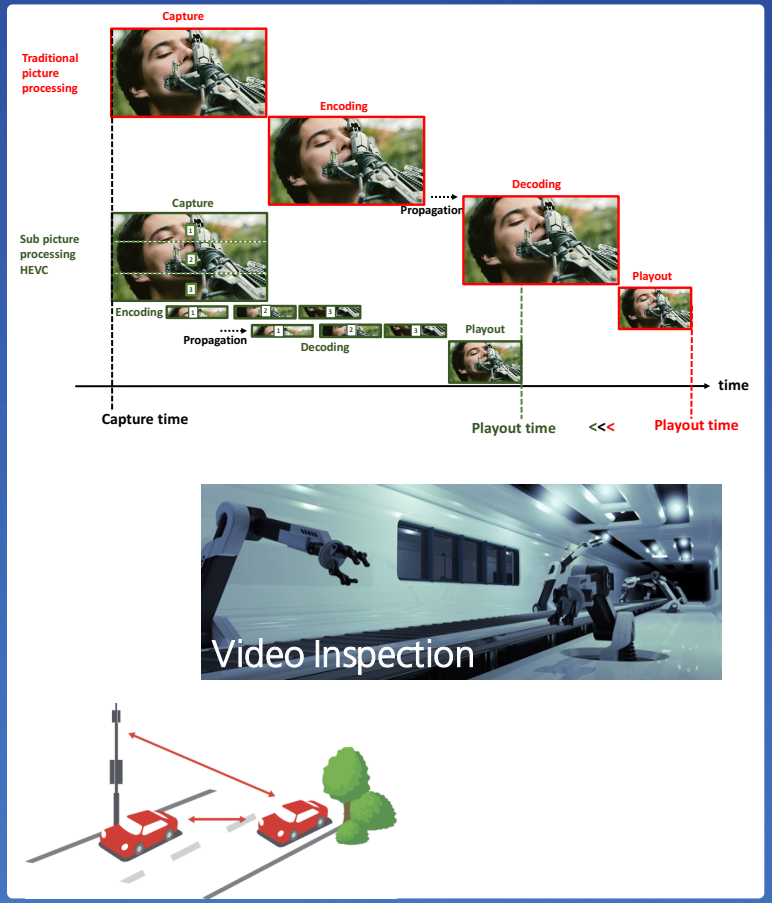




Robot-2-Robot Communications

Ultra Low Delay Video

- Applications
  - Industrial wireless
  - Collaborative autonomous cars
- End-to-End Delay < 1 ms
- Enabled by New Video Codec H.265
  - Sub-picture processing
- Cross-Layer Design to enable QoS with Dynamic Bit Stream Adaption to PHY



5G Berlin

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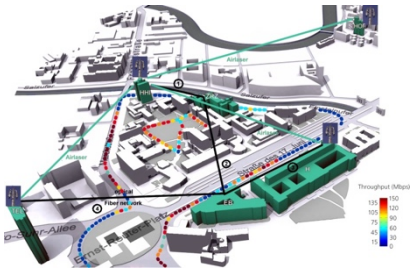


open5Gaccess
Berlin / Germany

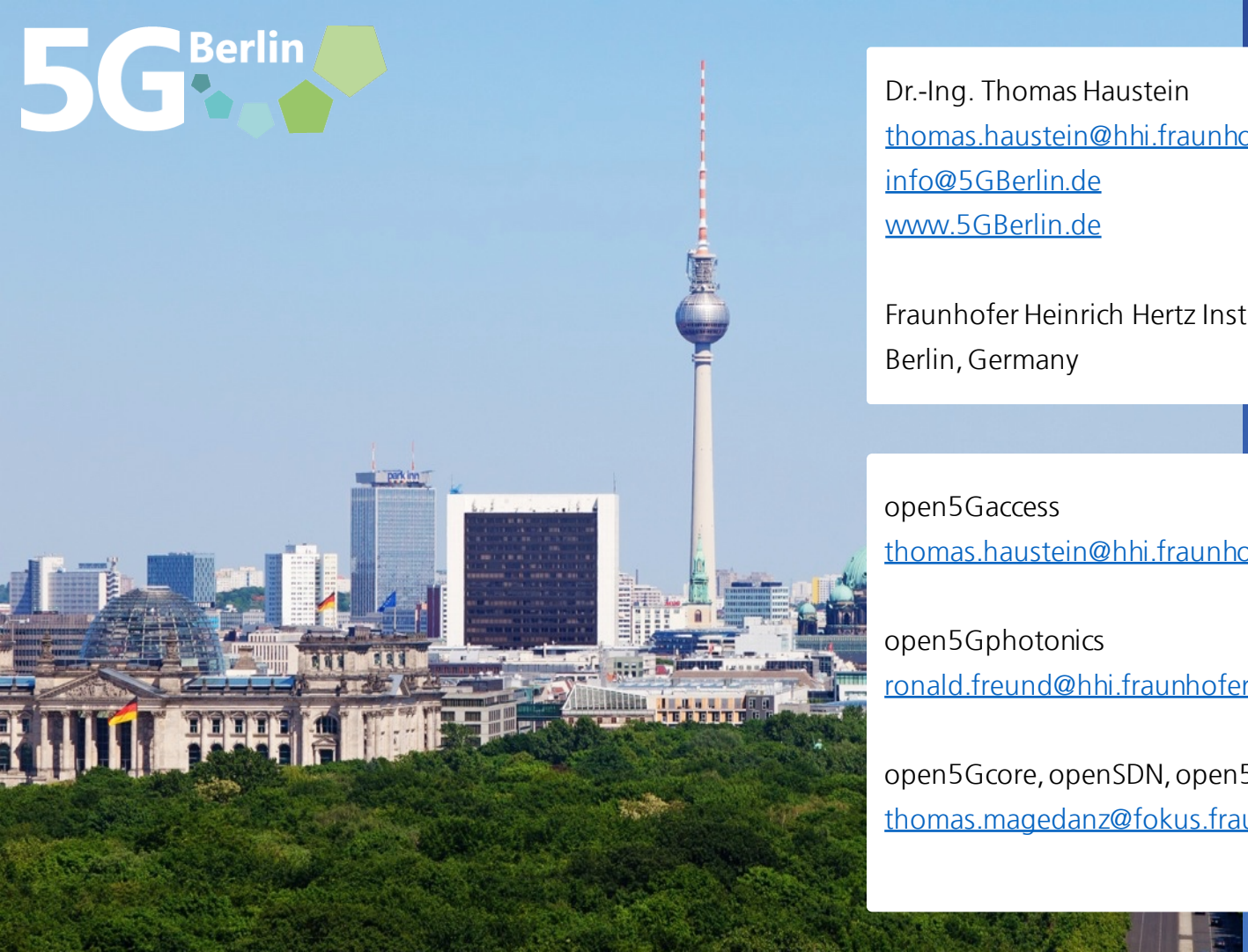
5G –Access, -Core & Xhaul Technology to be tested in one Place

5G Berlin contributes in the global research arena being a place to have 5G related researchers join their effort, interact across disciplinary borders and test latest technologies, system components and applications in a real world setup.

www.5GBerlin.de
info@5Gberlin.de

OUR TESTBEDS

open5Gaccess open5Gphotonics open5Gcore Open SDN Core



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