Near Field Communication
Research Lab
Hagenberg

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NFC Testing

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E-Smart 2008, Sophia Antipolis

www.nfc-research.at

mobilkom austria

OMNIKEY

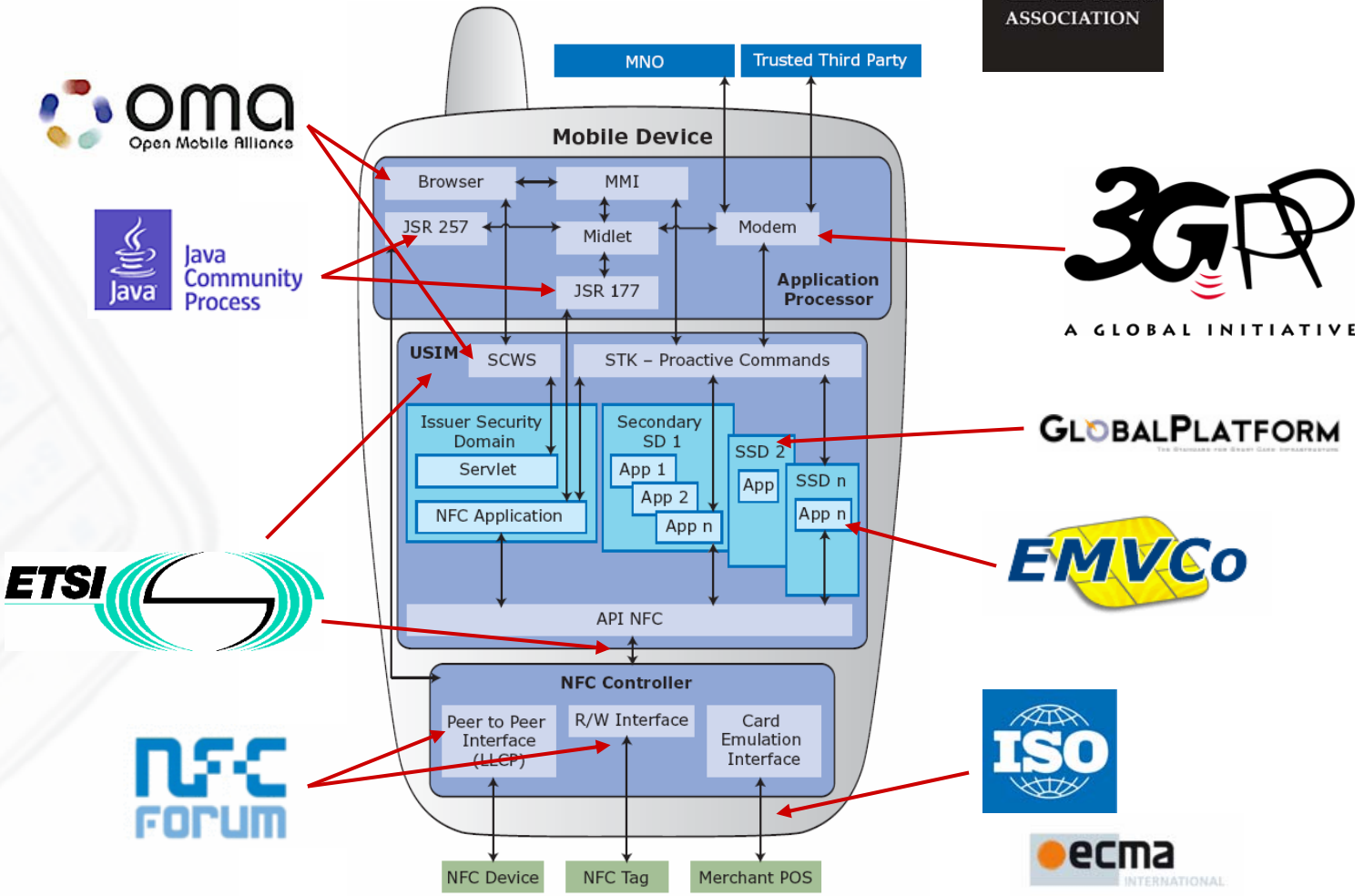
NXP founded by Philips

TU WIEN

NFC Research Lab Hagenberg

- Research Topics
  - Software: Contactless Applications and Infrastructure
  - Hardware: Testing & Interoperability
  - Security
  - Usability
- Founded by Industry Partners
  - Mobilkom Austria (Vodafone Partner)
  - NXP Semiconductors
  - Omnikey/Assa Abloy (HID Global)
- NFC Forum Member

NFC Device – what to test?



NFC Testing Working Group

- Testing Working Group @NFC Forum
  - Test Case for P2P, R/W Mode and Card Emulation
    - System Testing (SWP, HCI, Integration, NDEF, …)
    - Digital Testing Protocol (Contactless)
    - Secure Element NOT PART of NFC Testing
  - Plug-Fest Testing
    - 1. Plugfest Dez. 2007 (Athens)
    - 2. Plugfest Nov. 2008 (Monaco)
  - Physical Testing

NFC Compliance Working Group

- Specification of Test Equipment
  - Request for Information (handed out already)
  - Definition of the Requirements
  - MicroPros, Comprion, AT4Wireless …
- Specification of Test Houses
  - Request for Information
  - Definition of the Requirements
  - Virtual, ETSI, …
- Invitation for Presentation

NFC Testing - Overview

- Physical characteristics of electromagnetic field (EM field)
  - Amplitude
  - Power of generated EM field
- Interaction with other devices
  - Detect other devices (“Polling Loop”, “Mode Switch”)
  - Exchange data
  - Anti-collision
  - Communication at different data rates
- Requirements for Test System
  - Test system must be able to control device under test
  - Test system must be able to move device under test
  - Measurements (Amplitude, Power) must be taken

Test System: Challenges

- Mobile phones
  - Location of Antenna different
  - Vary in size and form
  - Most NFC phones still prototypes
  - J2ME Clients on phones using different APIs
  - Also different for eg. SD Cards/USB Readers
- Mobile phones use different methods to connect than readers
  - Bluetooth
  - TCP/IP (GPRS, WLAN)
- Test software (on Device) must be adopted for each new device.

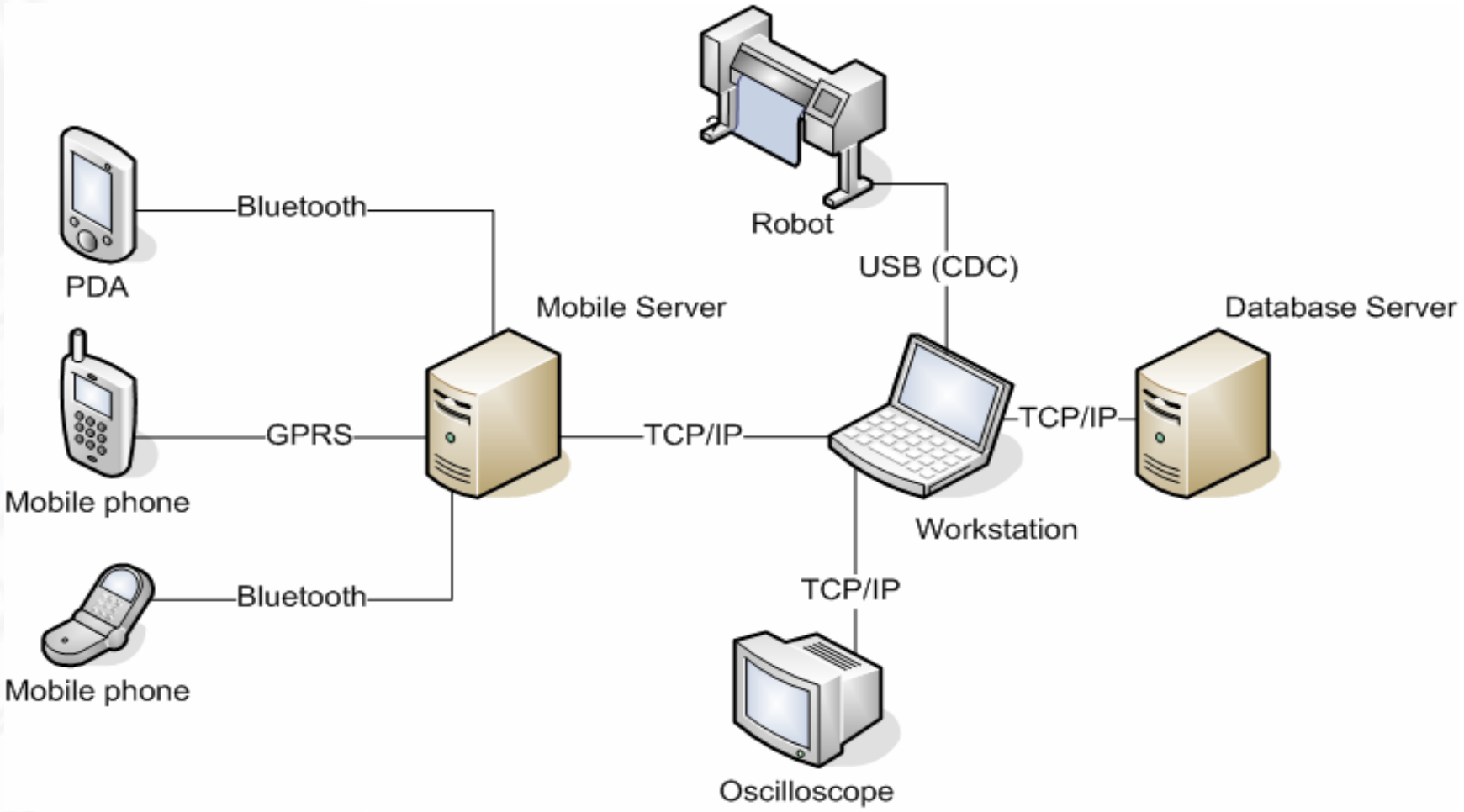
NFC Forum Test System: Requirements

- Control Device under test (DUT)
  - NFC Initiator (Active)
- Target
  - NFC Forum Tag Type 1/2/3/4 (Passiv)
  - NFC Peer-to-Peer device (Passiv and Active)
- Robot to move device under test
  - One direction only
  - Different windows and resolutions

NFC Forum Test System: Tests

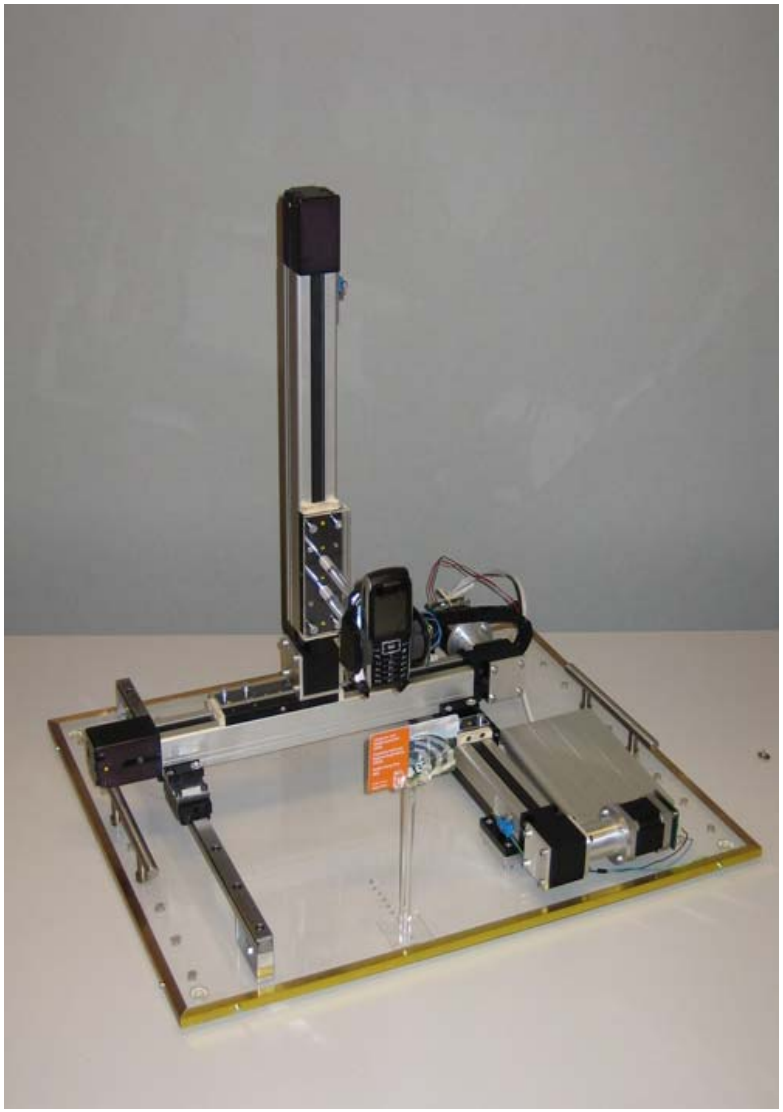
- Range tests
  - How far can a device detect other devices?
- Anti collision
  - Is a device able to detect a specific targets?
  - Is a device able to enumerate all available targets?
- Window tests
  - Is a device able to detect a target in a specific window?
  - Range varies between 0 mm (in touch) and 100 mm

HF-Hagenberg Test System: Overview



Robot

- 3 Axis
- 0.25 mm resolution each
- 20 cm range each
- Mobile phone holder
- 10 cm distance of DUT to metal
- Connected via USB
- Supports ISO14443 A, B & F
- Swiping Card Simulation (*Wachler*)



Software suite

- Task
  - Scripting of Task Cased (Python)
  - Control of DUT thru device abstraction Layer
  - Control Tests while running
  - Connection pooling of DUTs (e. g. P2P or emulated Felica)
  - Robot control
- Results
  - 3D Logs + viewer
  - Log Files creation
- Test configuration
- Easy integration of new test scripts

Software Suite – Device Abstraction Layer

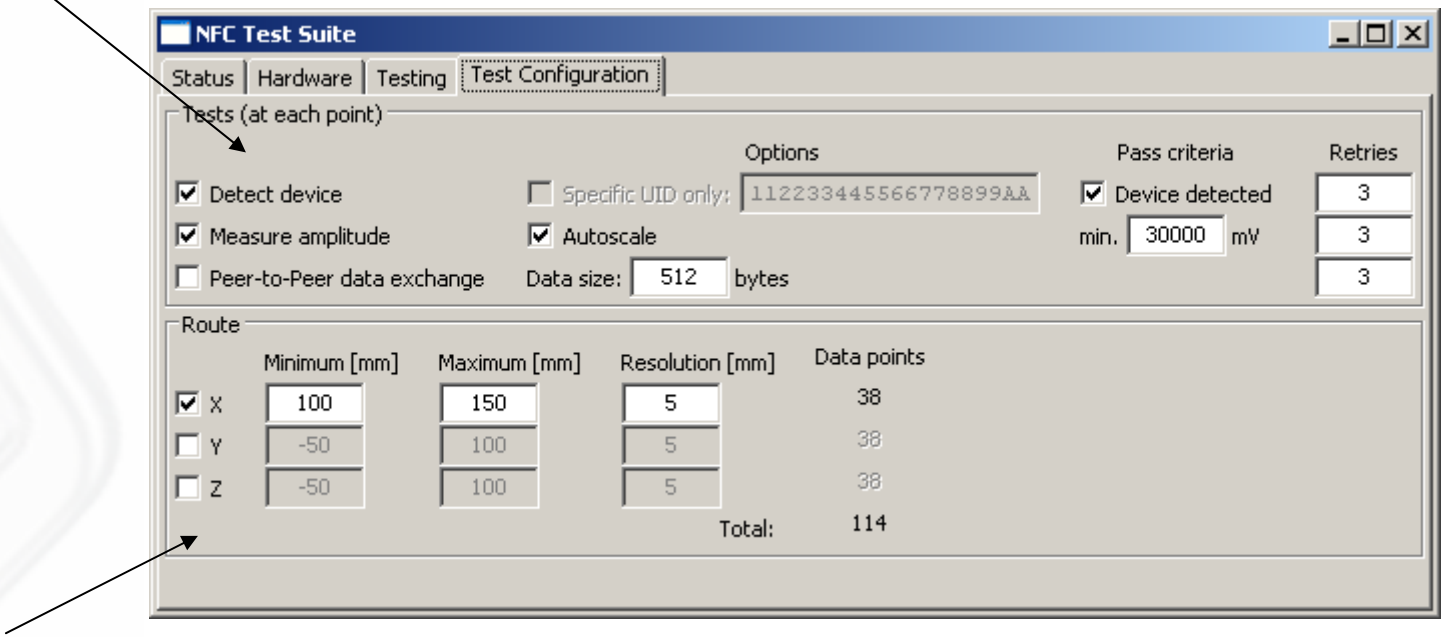
- Server for each connection method
- All servers are controlled via a single interface
  - Provide list of connected devices
  - 'Produce' devices which can be accesed in tests
- All devices share a common interface
  - Provides enumeration of capabilities
  - Defines how data is exchanged
- Test scripts access all devices the same way

How a test works

- Take measurements in a cube of given dimensions
- Steps to take:
  - Connect robot and oscilloscope
  - Connect device under test
  - Place device under test in robot
  - Place target and oscilloscope antenna
  - Configure test in software suite
  - Select DUT, test configuration and target in software suite
  - Run test
  - Admire 3D log view

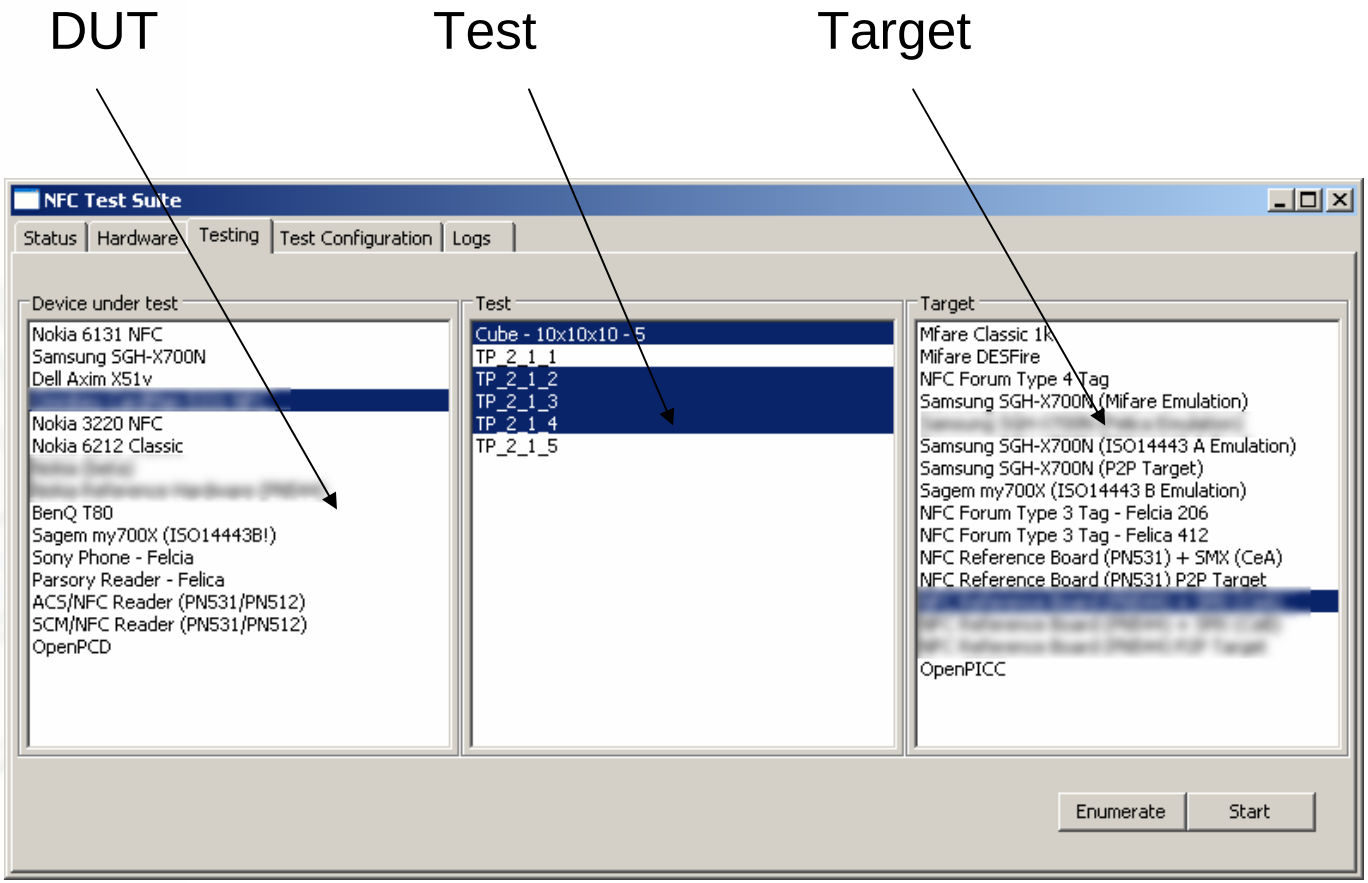
Screenshots: Test configuration

- Available tests that will be executed at each point



- Area where tests take place

Screenshots: Test selection



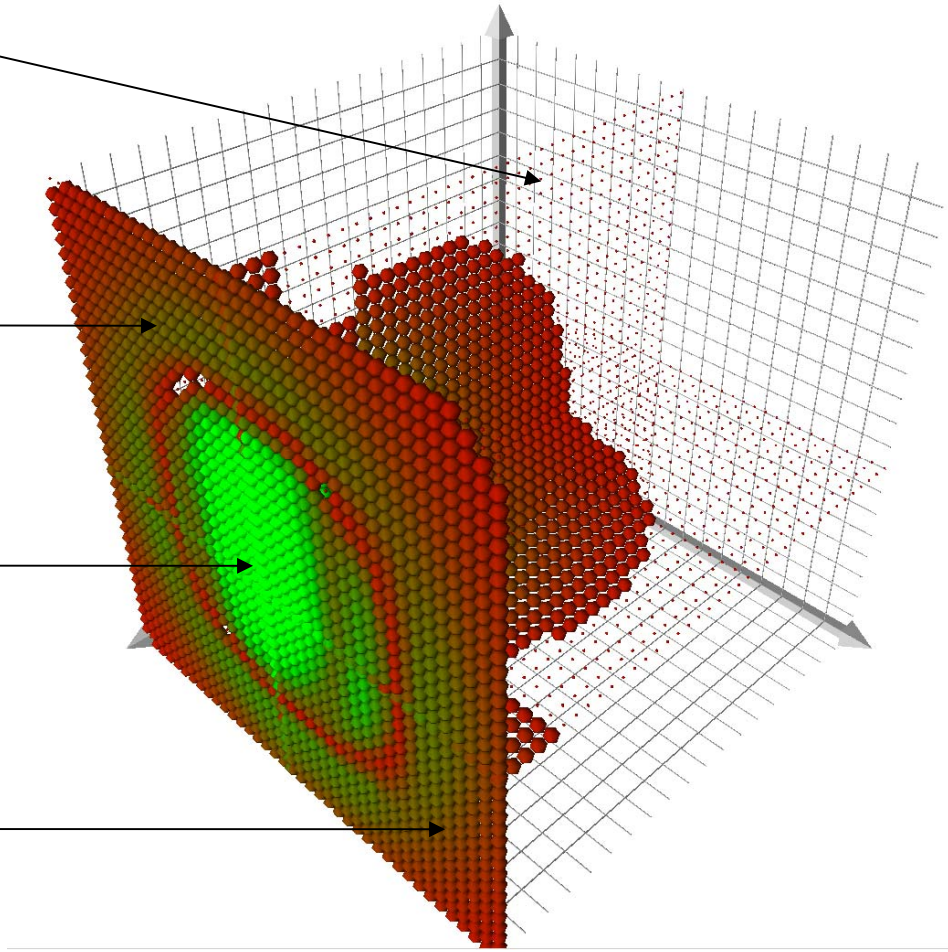
Screenshots: 3D log view

No amplitude measured

Front plain (Y and Z axis)

High amplitude

Low amplitude



Further „NFC“ Testing

- Digital Protocols
  - Contactless Interface
  - SWP Interface
  - Combined Testing
- Performance
- Applications
  - JSR, SCWS
- Systems

Conclusion

- RF/NDEF Testing: basic functionally of an NFC Device
- Testing of whole system complex
  - JSR Testing (Java APIs)
  - SWP Testing
  - UICC Testing
  - Application/Unit Tests
  - Not only functionally tests, but also performance tests

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congress.nfc-research.at

Happy to answer any questions

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http://www.nfc-research.at

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