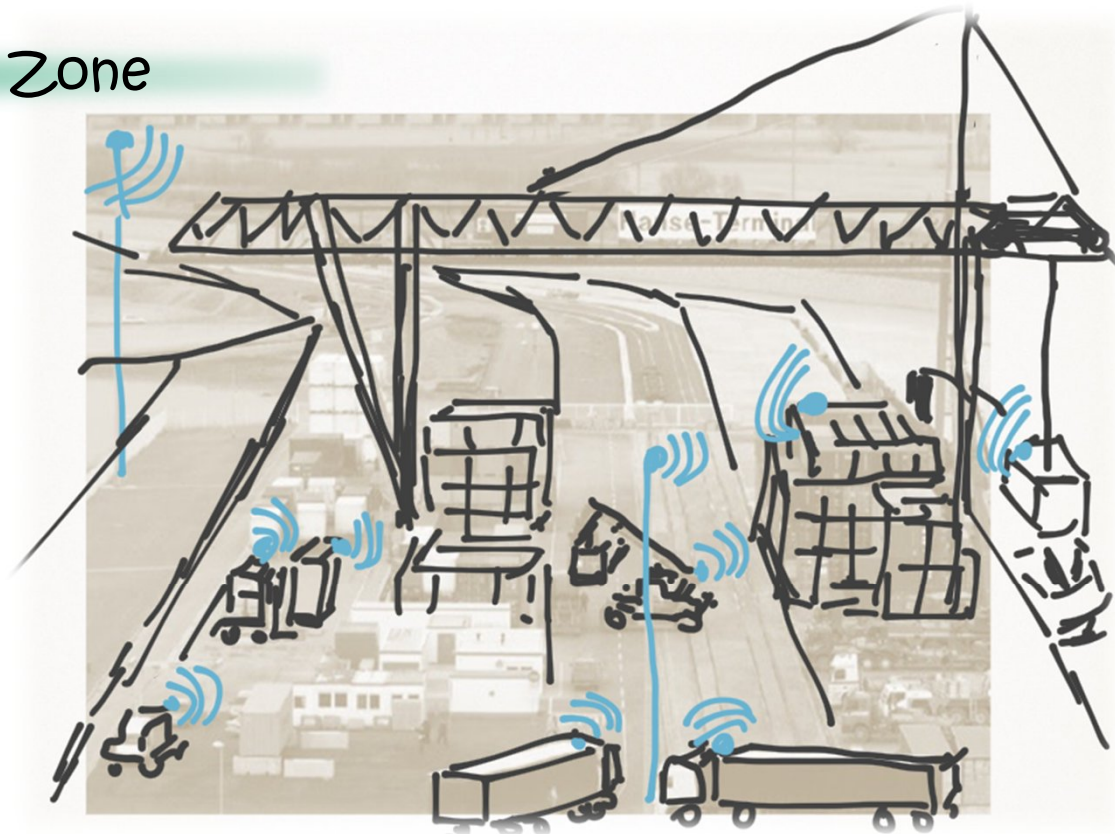


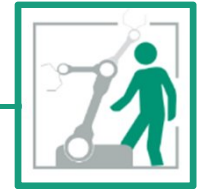
RFID IN LOGISTICS AND PRODUCTION: APPLICATIONS, RESEARCH AND VISIONS

Smart Logistics Zone



Prof. Klaus Richter
Fraunhofer Institute for Factory Operation and Automation IFF

1. Efficient RFID Applications



Supply Chain Reliability and Transparency

Metal RTI Tracking and Tracing for the Automotive Industry



Using RFID to inventory metal returnable transport items (RTIs)

- Highly accurate bulk reading of RFID attached to RTIs
- Performance testing of RFID transponders
- Special reading methods for intermodal containers moved by forklifts
- Electromagnetic reverberation chamber principle eliminates false positive readings



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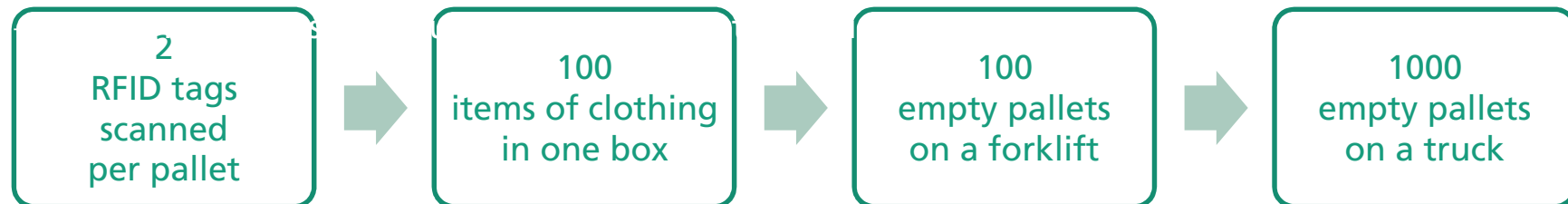
Supply Chain Reliability and Transparency

Metal RTI Tracking and Tracing for the Automotive Industry



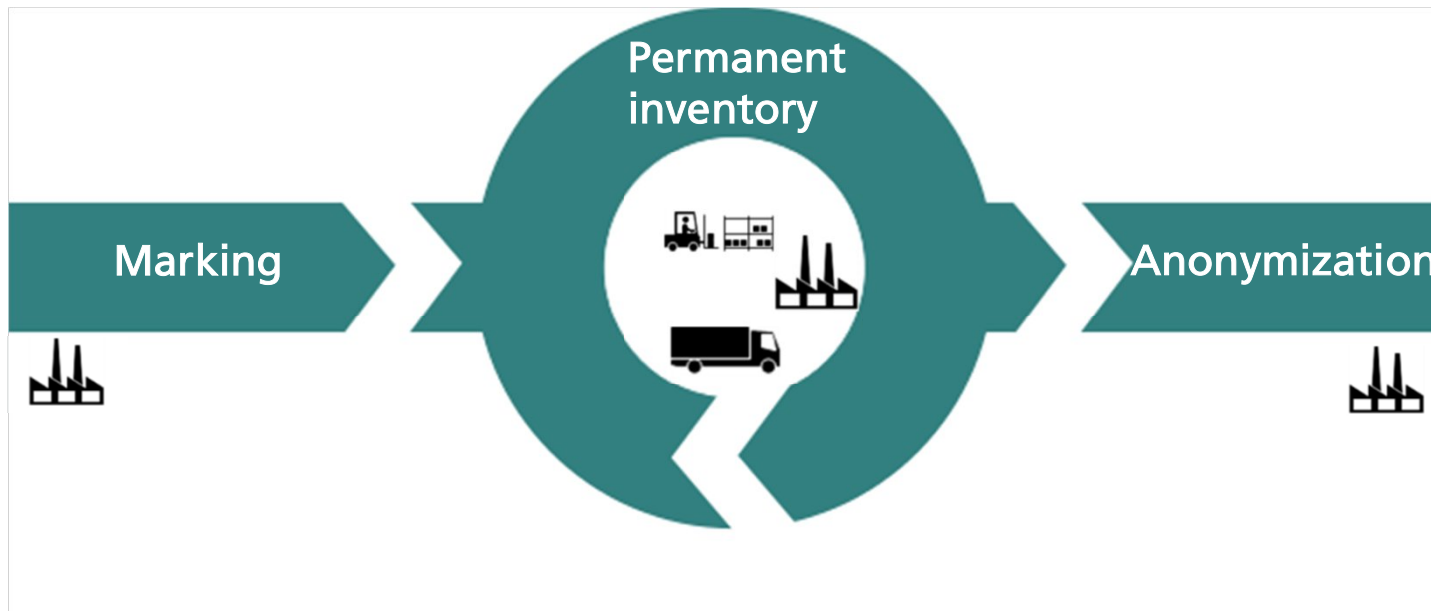
Using RFID to inventory pallets and items

- Performance testing of RFID transponders
- Scanning of RFID tag's regardless of location
- RFID gates scalable up to dimensions of truck using the electromagnetic reverberation chamber principle
- GS1 ready (who, what, where, when why)



Marking of Pallet for Returnable Transport Items

Reliable RFID Marking and Identification during Production



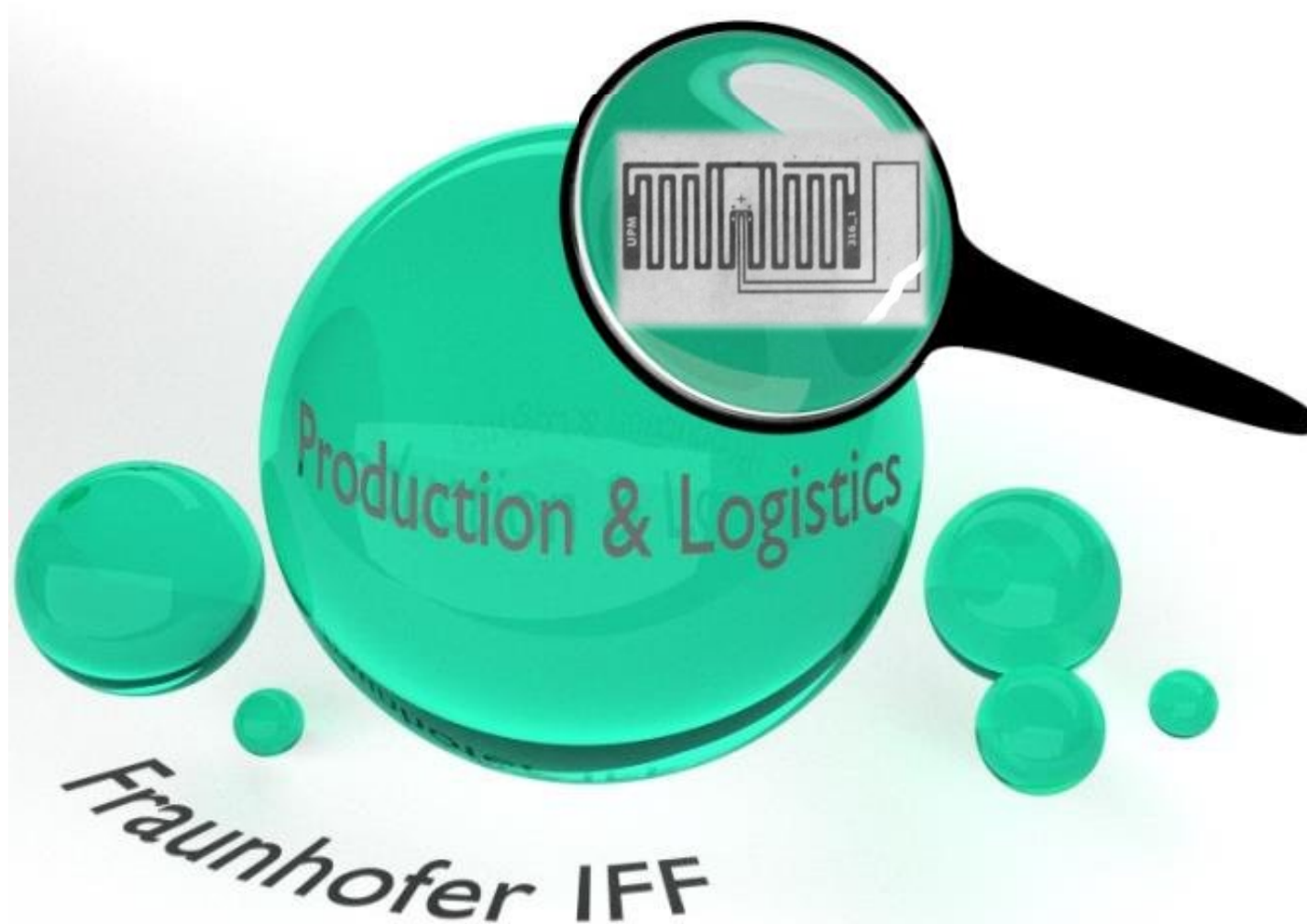
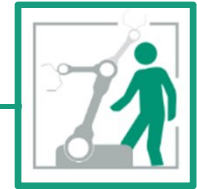
1. Attach 2 labels (detachable)
2. Check quality
3. Link object data
4. Guarantee authenticity

1. Take permanent inventory (who, what, where, when, why)
2. Process control
3. Documentation (tracking and tracing)

1. Detach 2 labels
2. Delete object and process links
3. End of identifiability

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2. Research and Test Scenarios



Vehicle Assembly Security and Transparency

Automotive Pre-Production Component and Part Tracking and Tracing

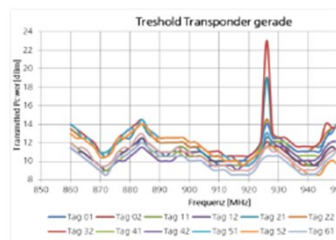


Using RFID to inventory vehicle parts

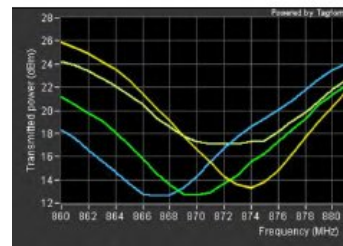


- High demands on readability and durability of RFID in vehicle compartments
- As many as 100 RFID transponders document a pre-production vehicle's status
- Incorporation of DIN /ISO and GS1/EPC know-how
- Integration of wearables for picking operations

RFID
threshold test



RFID
climate test



Wearables in
assembly areas



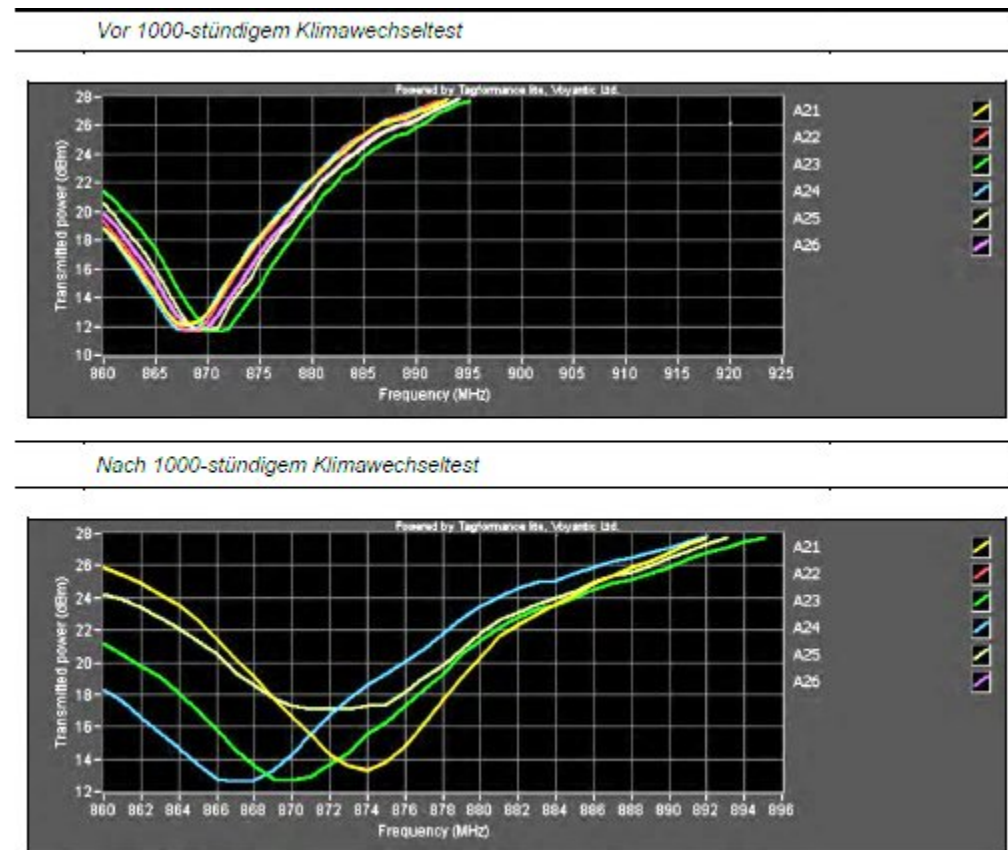
Status
documentation



Transponder Selection and Testing at the Pre-Production Center

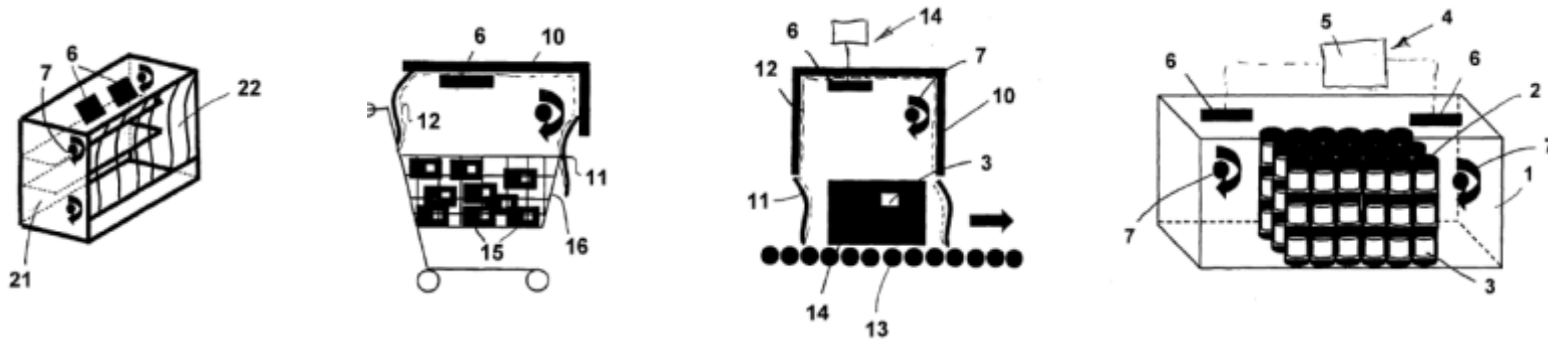
Transparent Automotive Prototype

1. Define the size and structure of the data domains
(especially status documentation: data-on-tag, data-on-network)
2. Select the transponder and method of attachment (on-metal RFID tag, smart label, etc.)
3. Analyze the process conditions for the use of RFID including reader points
4. Analyze the ambient conditions for the use of RFID
 - a) ESD and EMS audit
 - b) Adhesion test
 - c) Status documentation



High Performance Bulk Reading

RFID Electromagnetic Reverberation Chamber



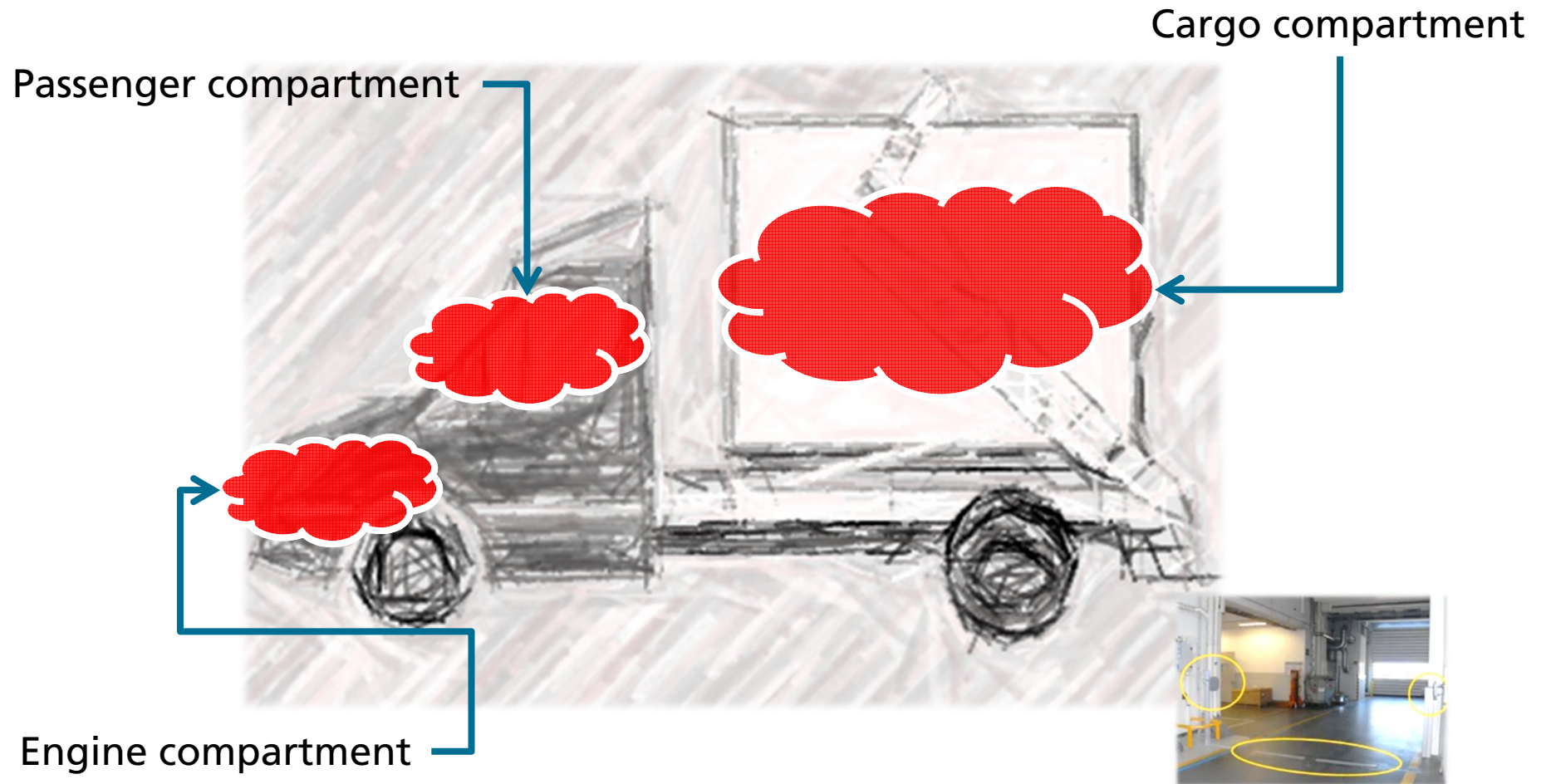
Uniform energy density and energy flow, random wave phases
Rigid or flexible metallic shielding material



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Good Environments for Electromagnetic Reverberation Chambers

Onboard Metallic Shielded Zones



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ESecLog R&D Project: Enhanced Air Cargo Security

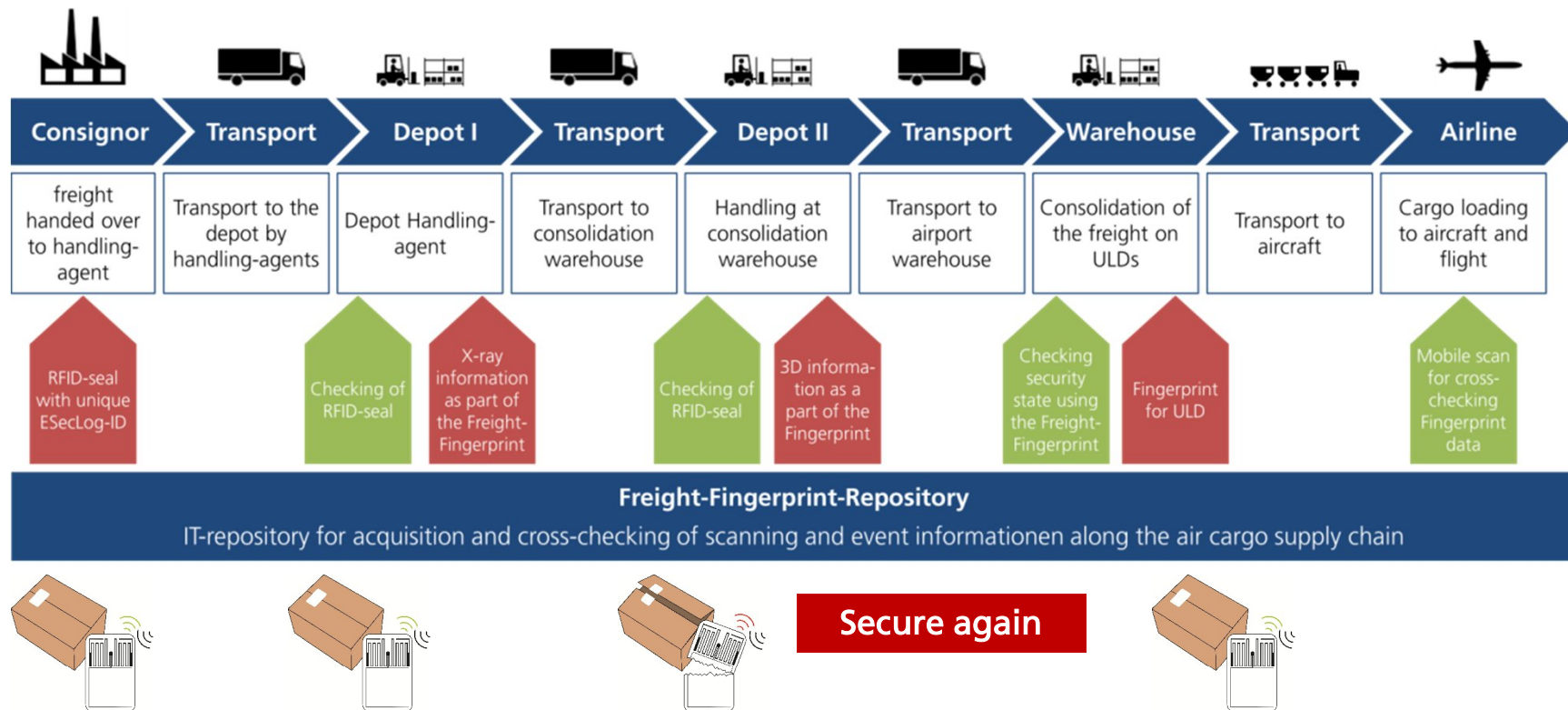
Cross-Checks Eliminate Repeated Inspections



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ESecLog R&D Project: Enhanced Air Cargo Security

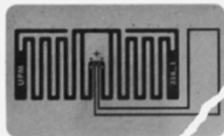
Cargo Fingerprints for Air Cargo Security

Development of a cargo fingerprint with new inspection features

- Development of an IT repository for recording and cross-checking of cargo
- Provision of fingerprint data at different nodes of the air cargo supply chain
- Integration of new inspection features in existing air cargo supply chains

RFID-seal and freight tracking

- passive UHF-RFID-seal for protection and identification on item-level

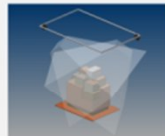


RFID-label with manipulation-bit

- passive UHF-RFID seal for protection of ULDs
- mobile and stationary solutions for bulk reading and single inspection

X-ray marker and 3D scan

- Low-cost-3D scans of freight contour as a part of the Freight-Fingerprint



3D imaging of freight contours

- X-ray markers as a part of the freight fingerprint
- stationary acquisition of information and mobile inspections

IT repository and process mgmt

- Freight-Fingerprint repository for acquisition and cross-checking of scanning data



mobile devices for cross-checking Fingerprints

- mobile applications to support air-freight-operators
- link of IT repository to order systems and e-freight

R&D Project ESecLog: Enhanced Air Cargo Security

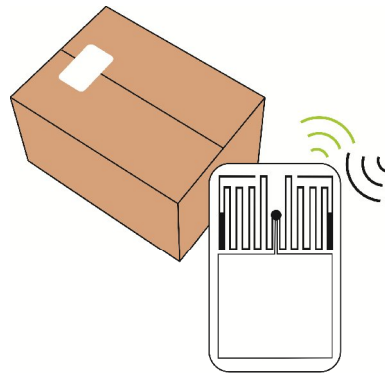
Tag Tamper Alarm

Electronic article surveillance EAS is an integral part of a security system.

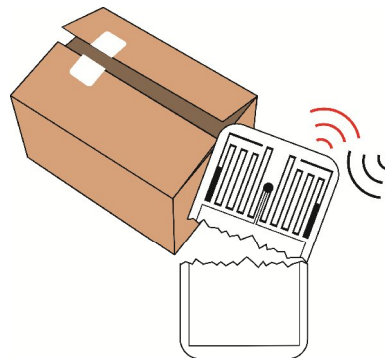
Chip activates an alarm if the label is tampered with.

Evidence if label is ripped, torn, cut or removed.

No tampering:
Closed loop



Tampering:
Disrupted loop



X-ray cargo system
with integrated RFID reader using the
principle of the electromagnetic
reverberation chamber
1056 RFID tags read with 31 dBm (1.25
W)

ESecLog R&D Project: Enhanced Air Cargo Security

Scintillators Detect X-Ray Inspection

Detection of daylight and X-rays

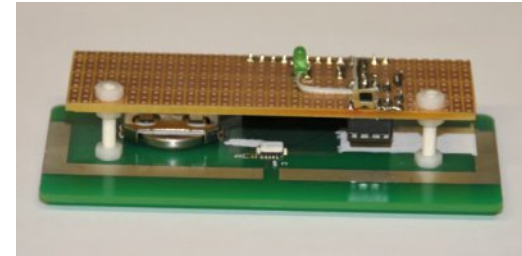
Use of scintillator materials to detect x-rays

A scintillator is a material that fluoresce in the presence of ionizing radiation

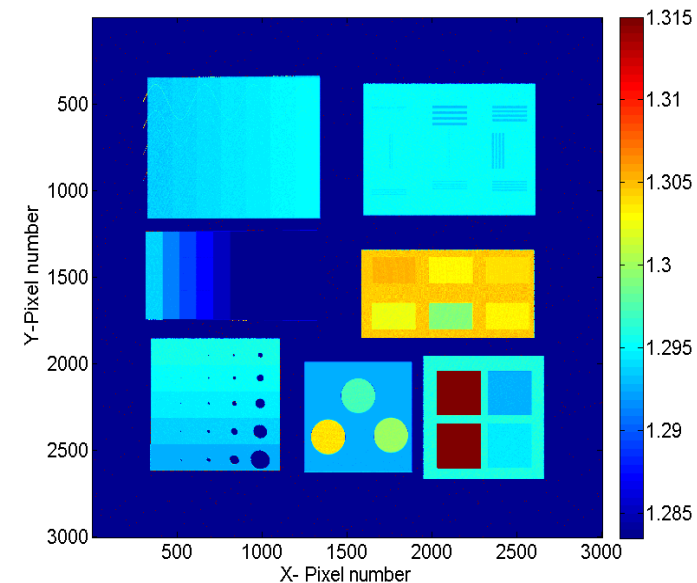
Combined with a photosensor

One bit set in a passive RFID tag

R&D partner: BAM Federal Institute for Materials Research and Testing, Berlin

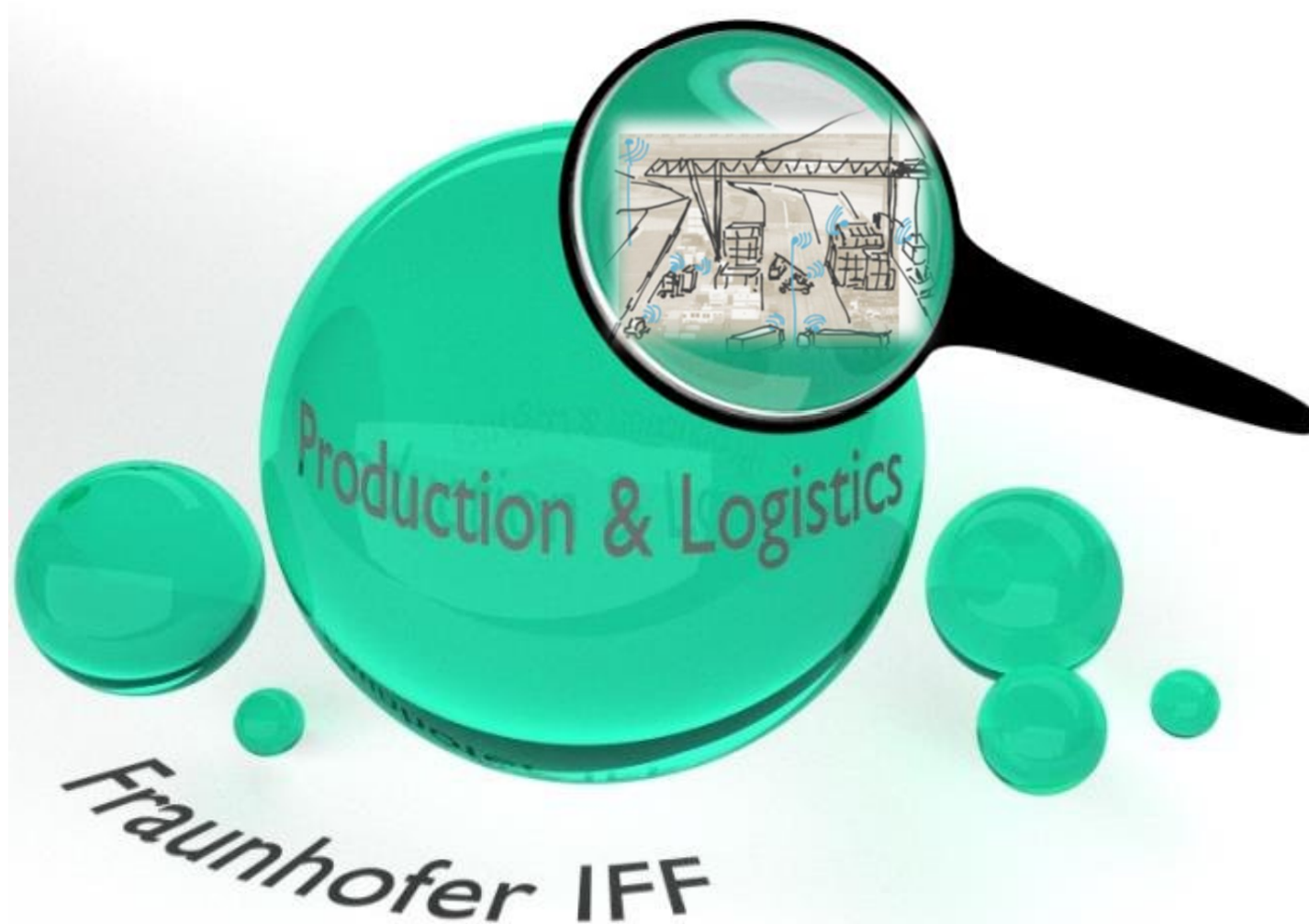


RFID evaluation board



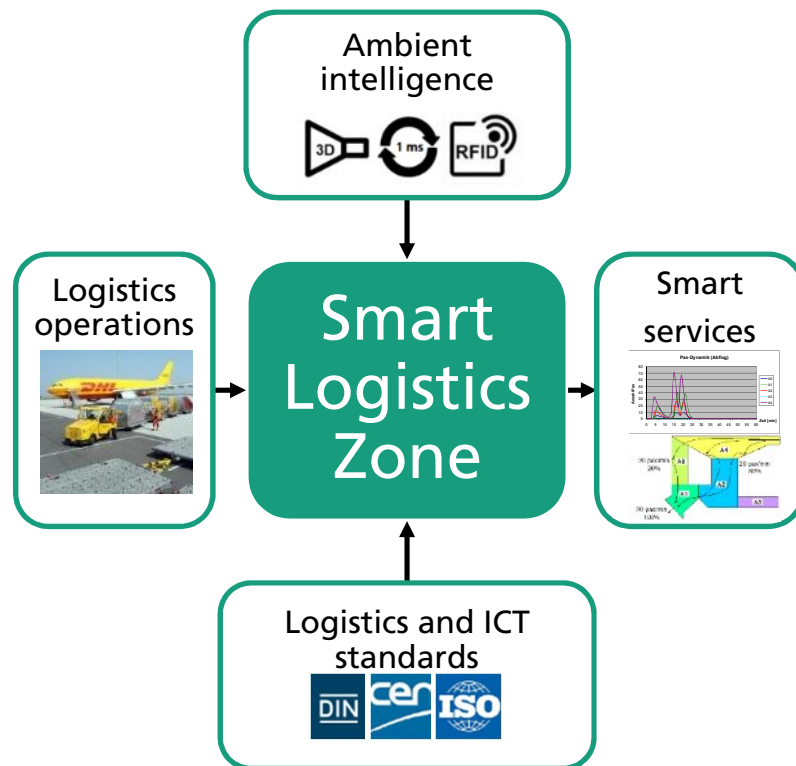
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3. Our Vision of Smart Logistics Zones



Smart Standardized Logistics Zones

Action and Perception Space for Collaboration between People and Objects



Smart Logistics Zone

Sphere of action of mobile objects in logistics infrastructures equipped with ICT which constitute ambient intelligence.

Standardization in logistics and ICT establishes robust, secure and efficient logistics operations.

Smart logistics zones necessitate new requirements for ICT services:

- Specified mobile data sovereignty (e.g. electronic cargo fingerprint),
- Fast mobile communication (e.g. use of 5G technologies)
- Privacy protected wireless and video analytics (e.g. in interconnected sensor systems).

The Tactile Internet for Smart Logistics Zones

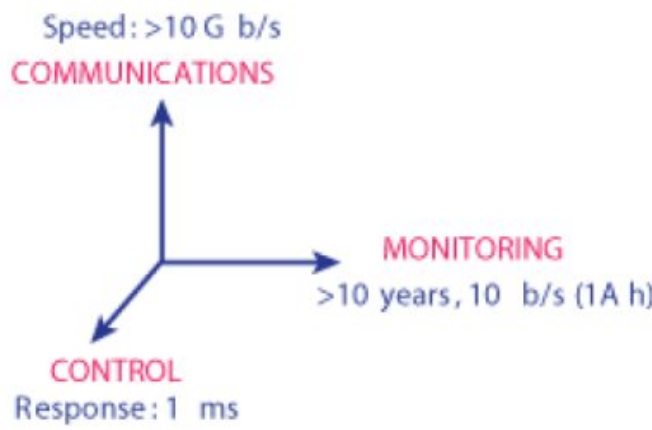
New Human-Machine Interfaces

Tactile Internet

- Extension of the “Internet of Things” and “Mobile Internet”
- Definition of real-time applications with mobile objects
- Wireless control for human-centric workstations



R&D project
Fast actuators sensors and transceivers - 1 ms latency
Sub-project: Fast-realtime FKZ: 03ZZ0504D



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Yard Logistics Security, Reliability and Transparency

Real-Time Identification, Localization and Communication

Situation Analysis: Virtual Top View with several Cameras



Incoming goods:
Truck with 78 metal RTIs

Outgoing goods:
Truck with 990 empty pallets

Cloud

Collision detection
between vessel and
crane





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