Νέες Τεχνολογίες Σάρωσης Σώματος για Ασφαλείς Διελεύσεις

5ο SECURITY PROJECT 2017
26 Μαΐου 2017 – Αθήνα, Divani Caravel

ROHDE&SCHWARZ

Where do we come from…

Manufacturers of mobile radios and other wireless devices

Operators of mobile radio and broadcasting networks

Electronics manufacturers

Electronics service providers

Aerospace and defense

Studios and broadcasting corporations

Government authorities and other public sector customers

Full Body Scanners - What is available today

Different techniques for people screening

Walk Through Metal Detector (WTMD)

- High throughput
- Alarm only for metal
- Shows no location of object
- Random alarm necessary (typ >30%)
- Low price

- No detection of explosives, ceramics, liquids, plastics…
- Always full pat-down

Eddy current technique

X-ray Backscatter

- Very low throughput
- Problems with Automatic Threat Detection
- Low price

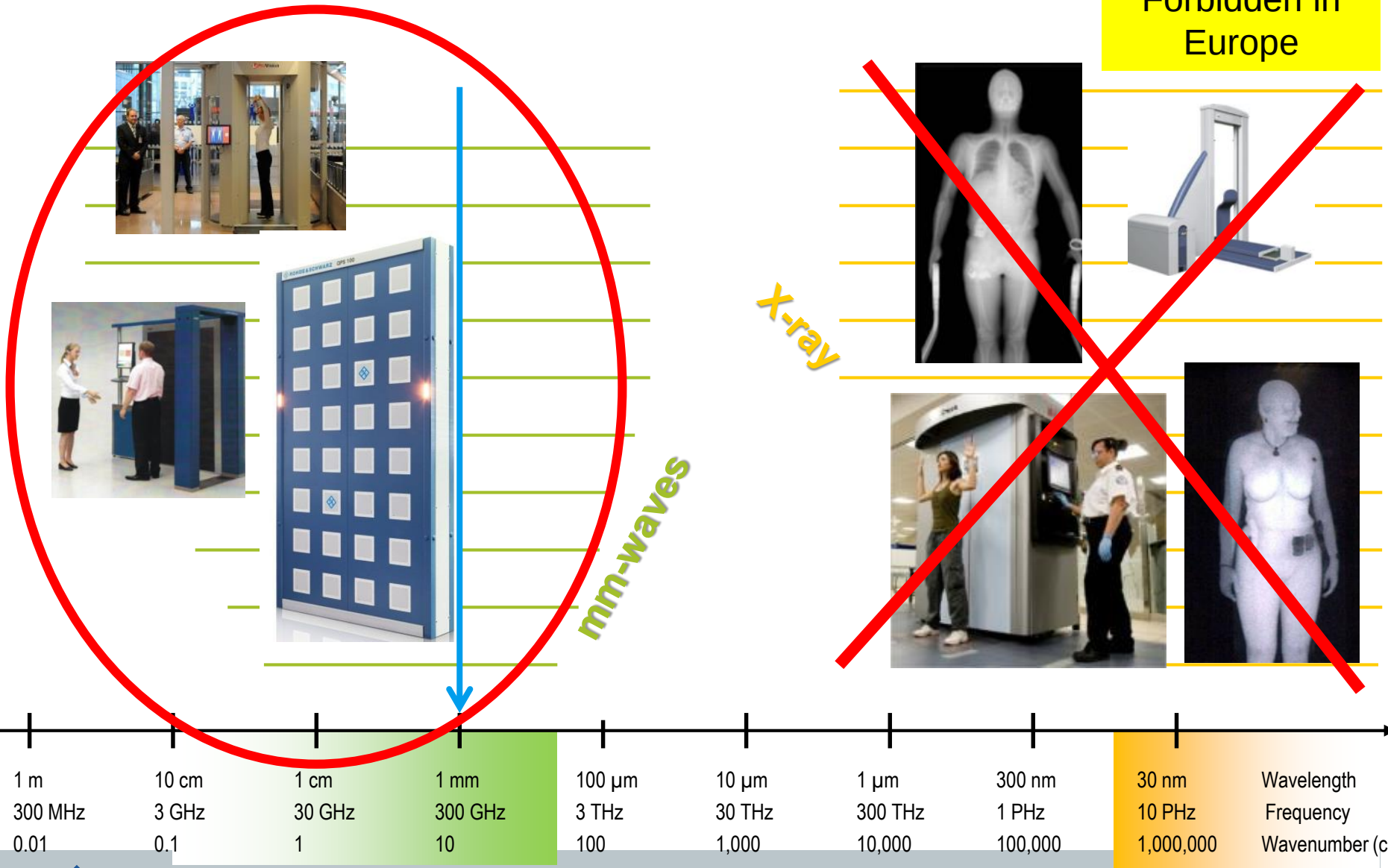
Forbidden in Europe

TSA has completely removed X-ray scanners from airports in the USA

An image of Susan Hallowell, Director of the Transportation Security Administration's research lab taken with backscatter x-ray system

Frequency range of Security Scanners

Forbidden in Europe



Active mm-wave Security Scanners

R&S QPS

Mechanical Scan	Electronic Scan	Electronic Scan
Monostatic Reflection	Monostatic	**Multistatic**
Rotating Antennas	Solid State	**No moving parts**
24 - 30 GHz	24 GHz (CW)	**70 - 80 GHz**
SW Focused	HW Focused	SW Focused
ECAC Std. 1&2	ECAC Std. 2	ECAC Std. 1&2

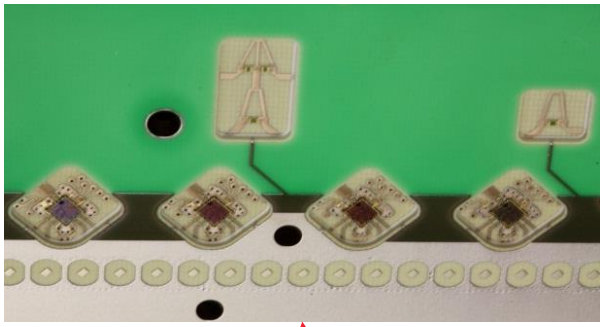
What is QPS

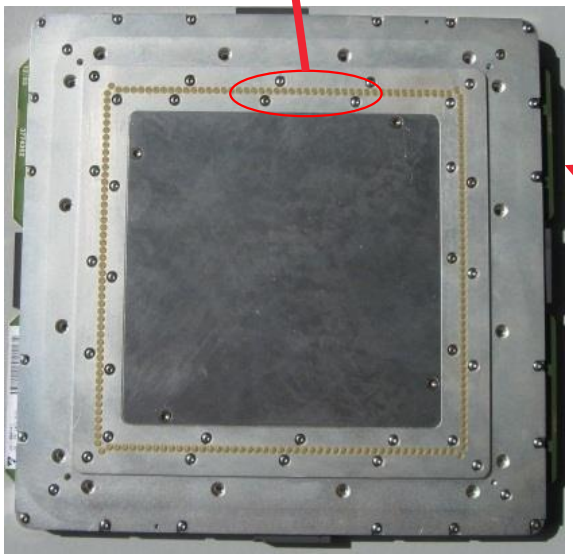
QPS200

QPS100

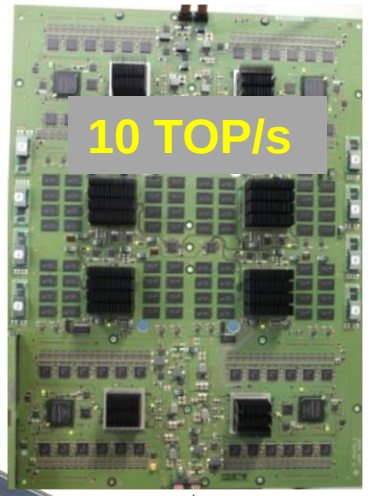
QPS look inside

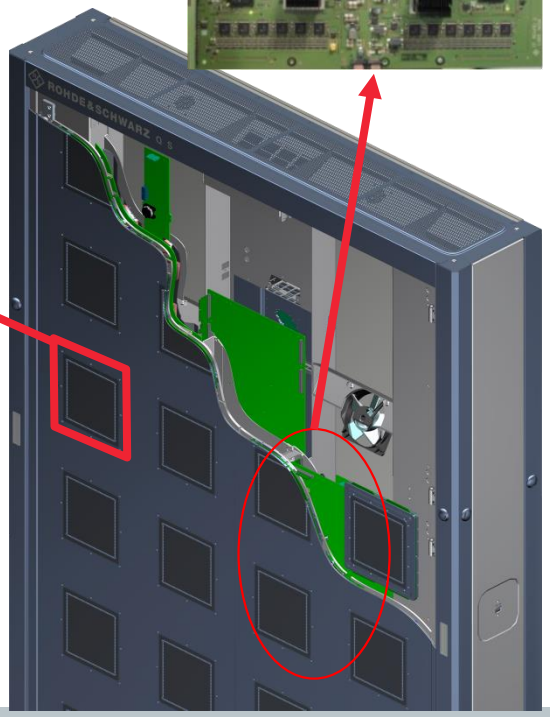
Chips & Antennas



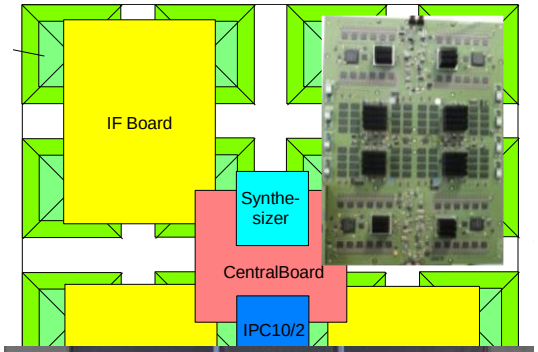


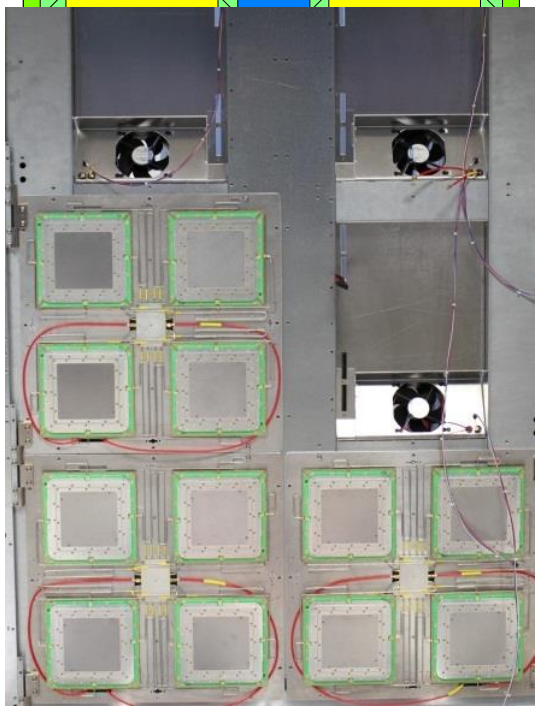
Data acquisition & Reconstruction unit





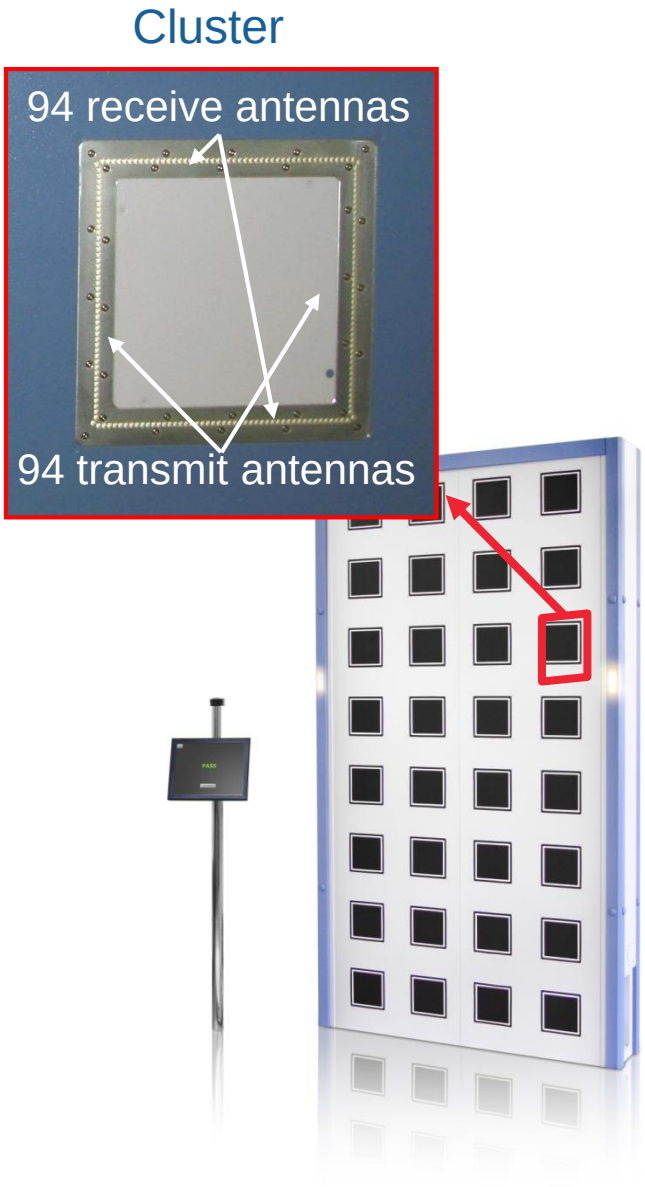
System integration





Technical Overview Panel

- Aperture 2 m x 1 m
- 3008 Tx & 3008 Rx elements in 32 Clusters per panel
- Data acquisition time (full scan)
  ≈ 32 ms (full scan per panel, QPS200)
- Frequency 70 to 80 GHz ($\lambda \approx 4$ mm)
- High image resolution < 2 mm
- Image dynamic range > 30 dB
- Processing time
  ≈ 6 sec (QPS200)
  ≈ 10 sec (QPS100, complete result)
- Peak Transmit Power ≈ 1 mW
- Rated current:
  QPS Panel: 8,6A



QPS: Health Aspects

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Prüfbericht
Test Report

Gegenstand: *Object:*	Emission Measurement of Full Body Scanner
Hersteller: *Manufacturer:*	Rohde & Schwarz
Typ: *Type:*	QPS 100
Gerätenummer: *Serial number:*	2
Auftraggeber: *Applicant:*	Rohde & Schwarz GmbH & Co. KG Mühldorfstraße 15 81671 München
Anzahl der Seiten: *Number of pages:*	14
Geschäftszeichen: *Reference No.:*	2.21 / 2263-12
Prüfzeichen: *Test mark:*	21994 PTB 12
Datum der Prüfung: *Date of test.:*	2012-06-12 to 2012-06-14
Im Auftrag: *By order:*	Braunschweig, 2012-07-20
	Siegel *Seal*
Dr. T. Schrader	
Bearbeiter: *Examiner:*	
Dr. T. Kleine-Ostmann	

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Prüfberichte ohne Unterschrift und Siegel haben keine Gültigkeit. Dieser Prüfbericht darf nur unverändert weiterverbreitet werden. Auszüge bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.
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- QPS averaged power density is by a factor of 40000 below the ICNIRP guidelines!

(ICNIRP = International Commission on Non-Ionizing Radiation Protection)

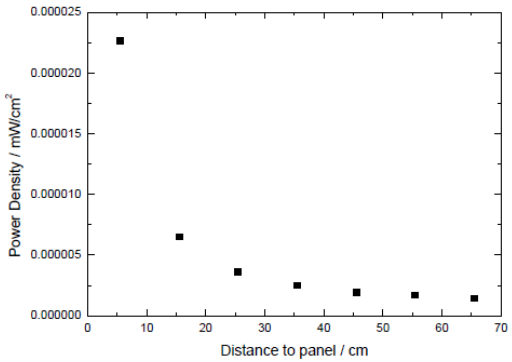


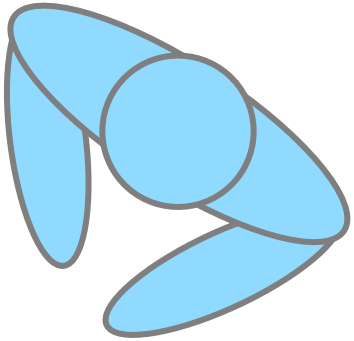
Fig. 11: Averaged power density according to ICNIRP as a function of distance to the panel in front of a distinct antenna (power density safety limit = 1.0 mW/cm²).

- The transmitted power of QPS is by a factor of 300 - 1000 below the power of mobile phones!

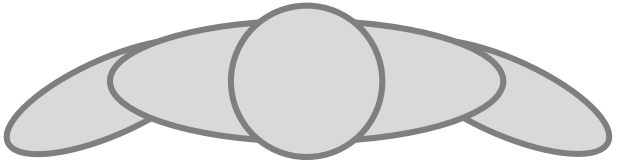
QPS Scan Process

Scanning step by step

Operator
(Screener)



Passenger
(Pax)

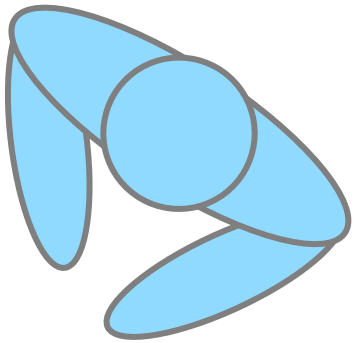


QPS Scan Process

Scanning step by step

Illuminating signal
coming from a single Tx antenna

Operator
(Screener)



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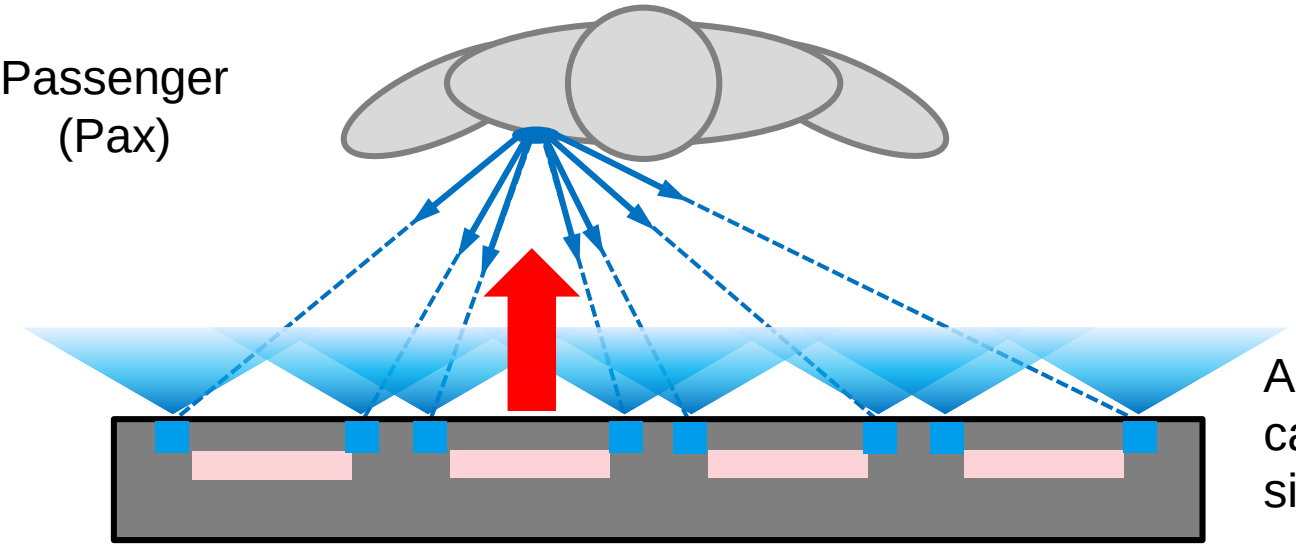

All 3008 Rx antennas
capture the reflected
signal

QPS Scan Process

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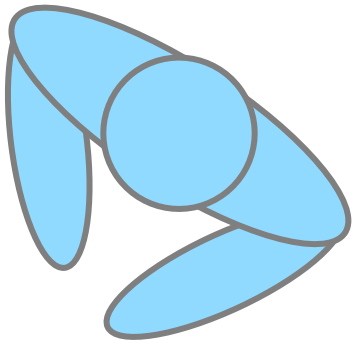

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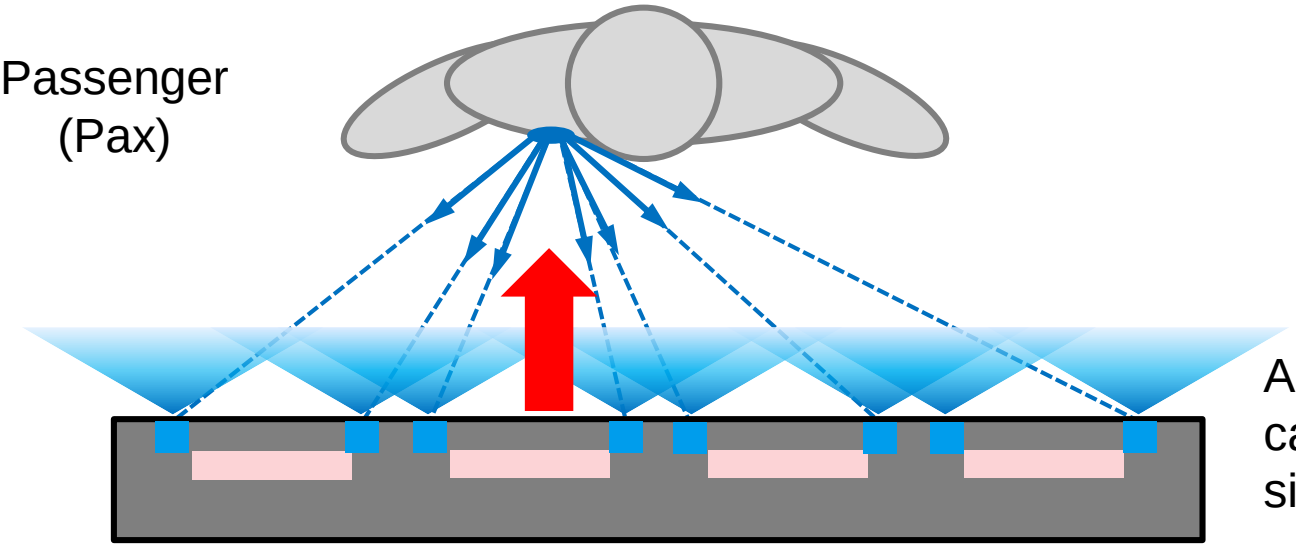

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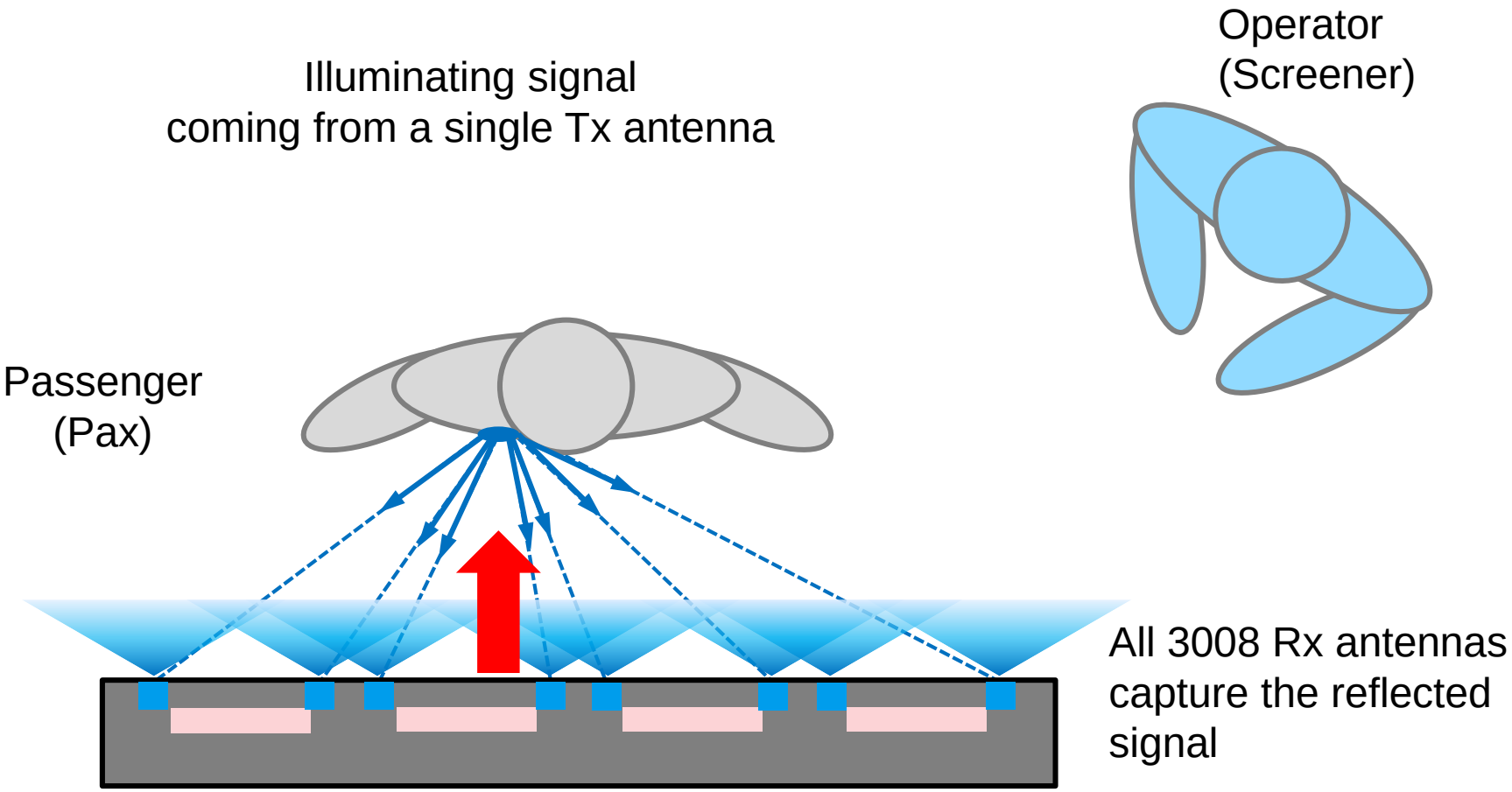

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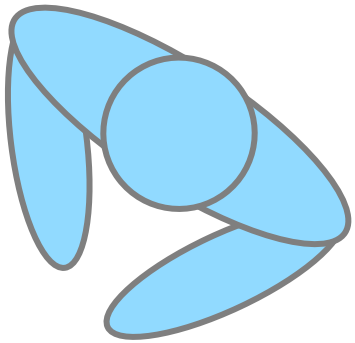

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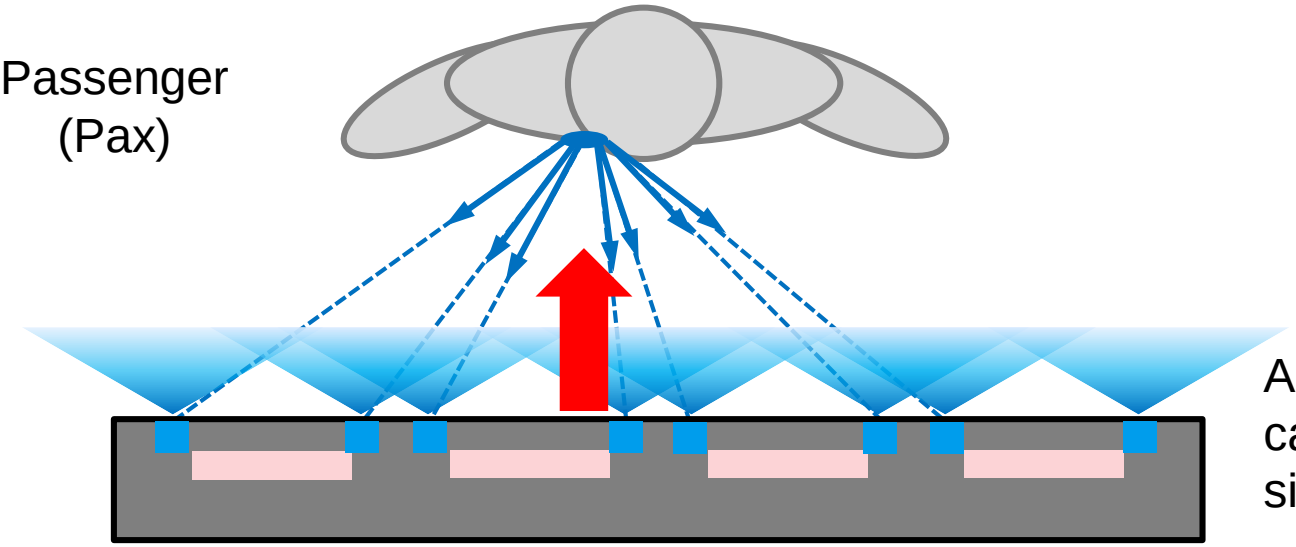

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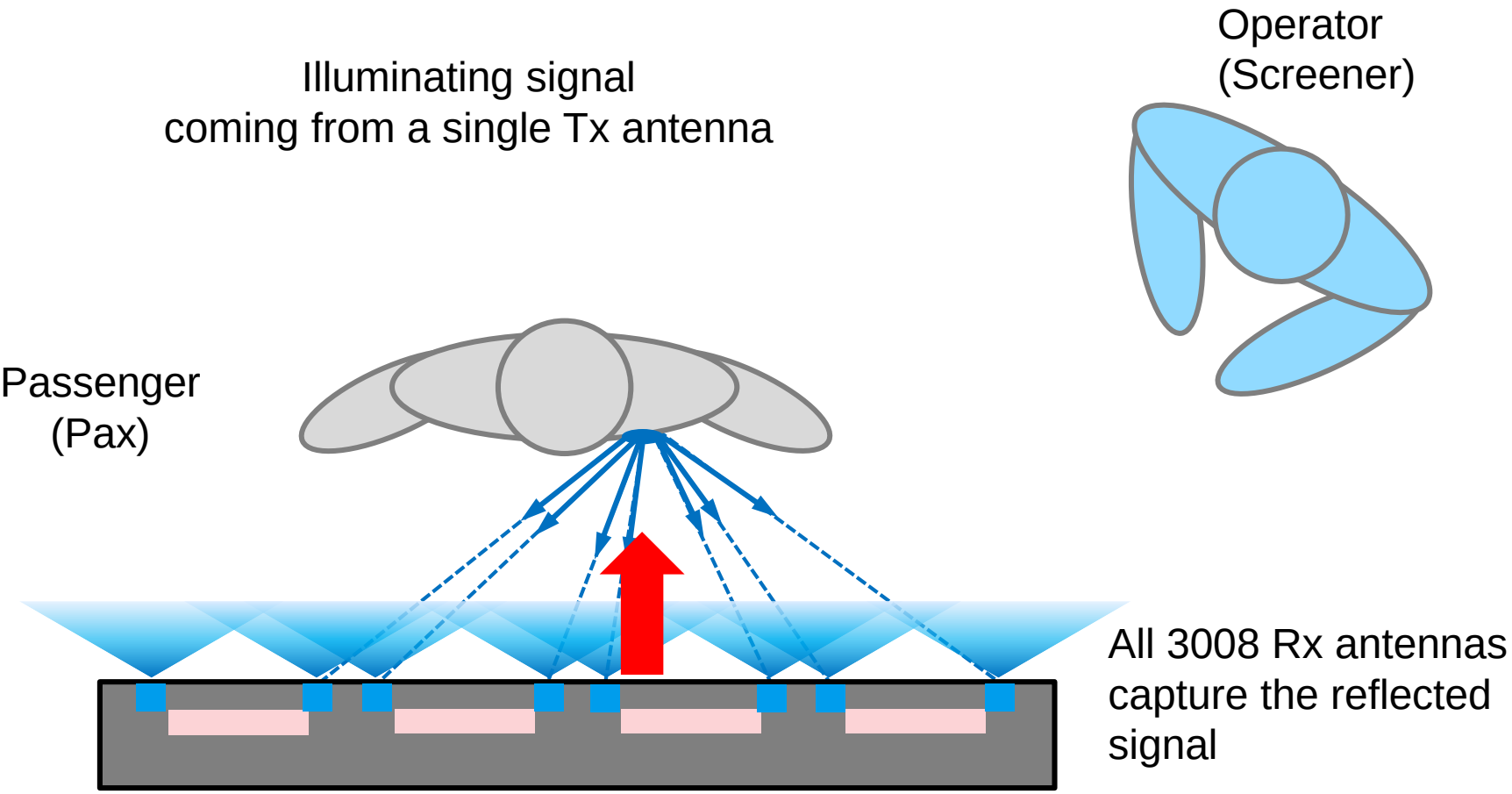
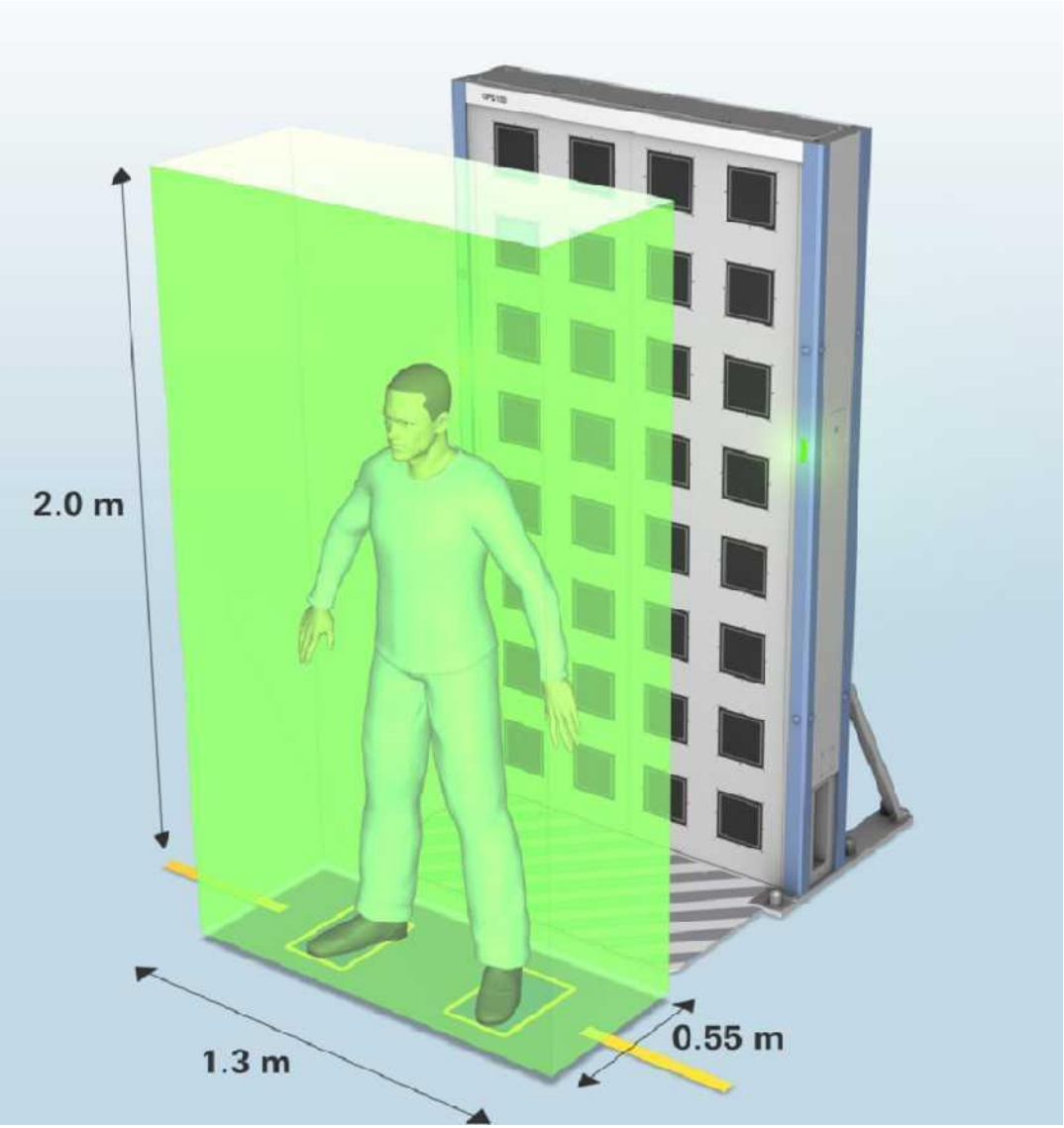
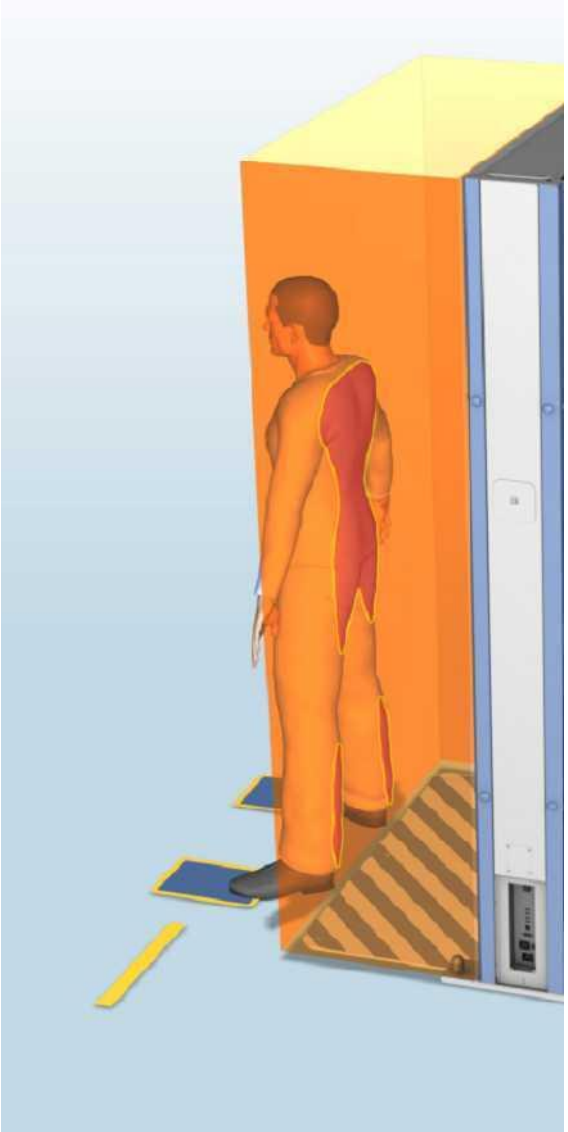
Scanning step by step



Scan Volume and “forbidden zone"





What QPS detects

Security threats and objects of interest of **various nature and shape**:

- metallic and non-metallic
- plastics
- ceramics
- explosives
- liquids and gels
- powder
- monetary bunch
- others

3D printed weapon

3D printed gun

body-shaped explosives

Detection is based on material parameters, not on comparison of images or shapes!

Machine learning

- Collection of large training and testing dataset
- Labelling of threat and non-threat objects in datasets
- Supervised an unsupervised classification algorithms
  - Generalized and specialized classifiers
  - Combination of predictive model responses
- Probabilistic and pixel-accurate prediction
  - Probability of pixel belonging to image region, containing concealed object(s)
- Continuous testing with disjoint testing datasets

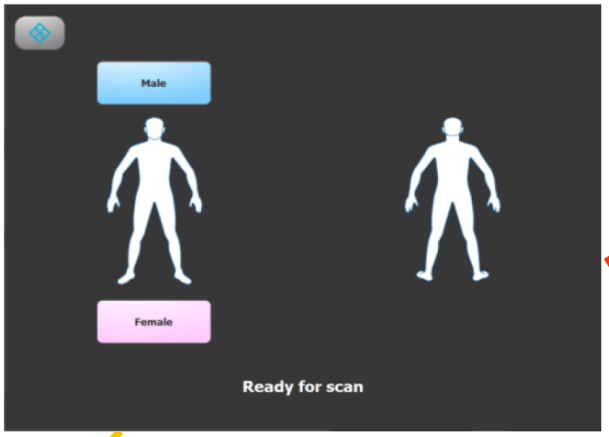
QPS Concept of Operation

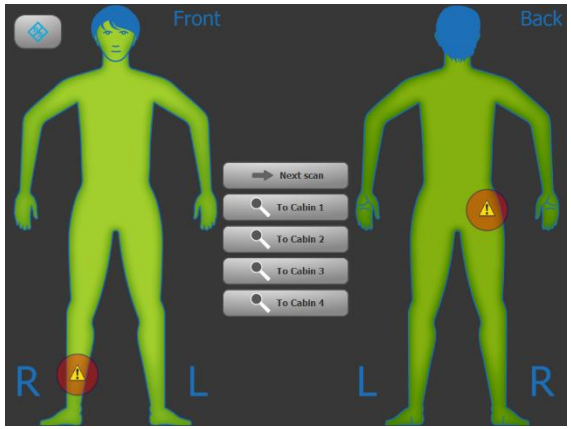
Comfortable, non criminal position

Posture is automatically checked by SW in order to improve detection

- **No discrimination**
- **Reduces false alarms due to arm position**
- **Easy for elder people and kids**
- **Acceptable for all religions**
- **ECAC Std. 1&2 approved**

Display of Results





“Pass”:
The passenger gets clearance

“No Pass”:
A suspicious object has been detected

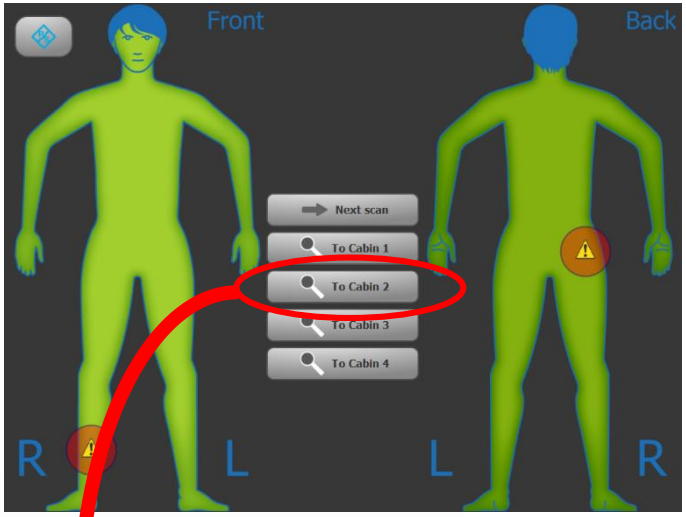
→ <u>selective</u> manual screening

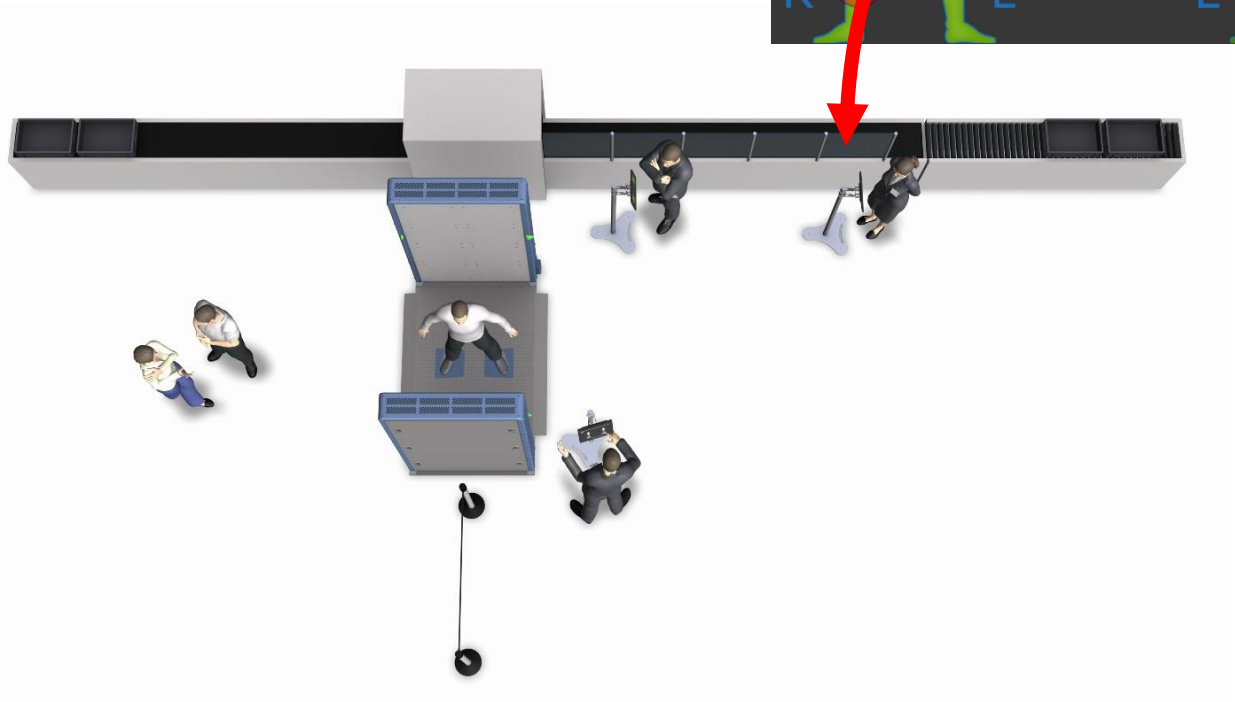
“Inadequate Scan”:
Detection is not possible

→ repetition of scanning or manual screening

Manual Screening in Cabins

- Passenger can be sent to cabin for manual screening
- Scan results will be sent to display in respective cabin
- Up to 4 cabins can be supported
- Different operating modes available (gender specific, peak mode)





Advantages of the QPS

Structure

Flat Panel architecture:	Passenger does not have to enter a cab Excellent oversight on entire security lan Offers easy bypass for wheelchair users No obstacle in case of panic No rotating elements Silent operation QPS100 easily to be upgraded to QPS200, no lost investment in case of higher throughput requirements
Mechanical dimensions:	Very small footprint Fits into existing lanes Low area load allows installation on double floors
Flexible installation:	Mobile platform, movable mounting plate and floor-/wall installation available Wall integration possible Installation requires no special tools or cranes

Advantages of the QPS

Operational Concept

Relaxed Scan Positon:	No raising of the arms necessary Two fixed positions for QPS100 Only one position for QPS200 Peak mode offers highest throughput
For the operator:	Security staff stands directly close by, full assistance through entire process Extremely low exposure of 1mW during the scan process of 16ms (QPS100) / 32ms (QPS200) Silent operation
For Security staff:	Provides best view on passenger traffic

Advantages of the QPS

Detection

Unique multistatic approach:	One transmitter at a time is transmitting, all receivers are listening
Highest bandwidth:	Unique resolution of 2mm x 2mm x 6mm
Short scanning time:	16ms (32ms) avoids blurring due to moving or breathing of the passenger
Unique mirroring concept:	Unrivalled illumination of leg below knees

➡ Enhanced detection capability
Low false alarm rate

➡ Less pat-down required
Higher throughput

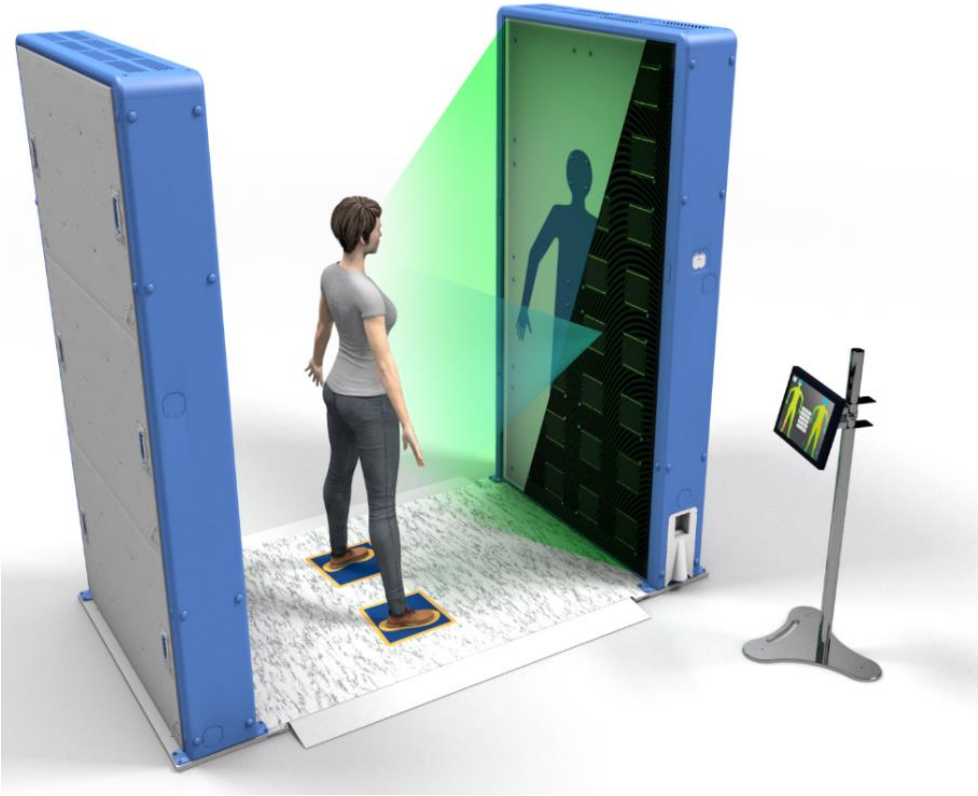
Advantages of the QPS

Reliability and Service

No moving parts:	Reduced service efforts and costs
Calibration:	No preventive calibration required
Modular architecture:	Maintenance and service can be performed easily

Highest System availability
Limited downtime
No interruption of scanning process
in high traffic times

Thanks for your attention!



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