



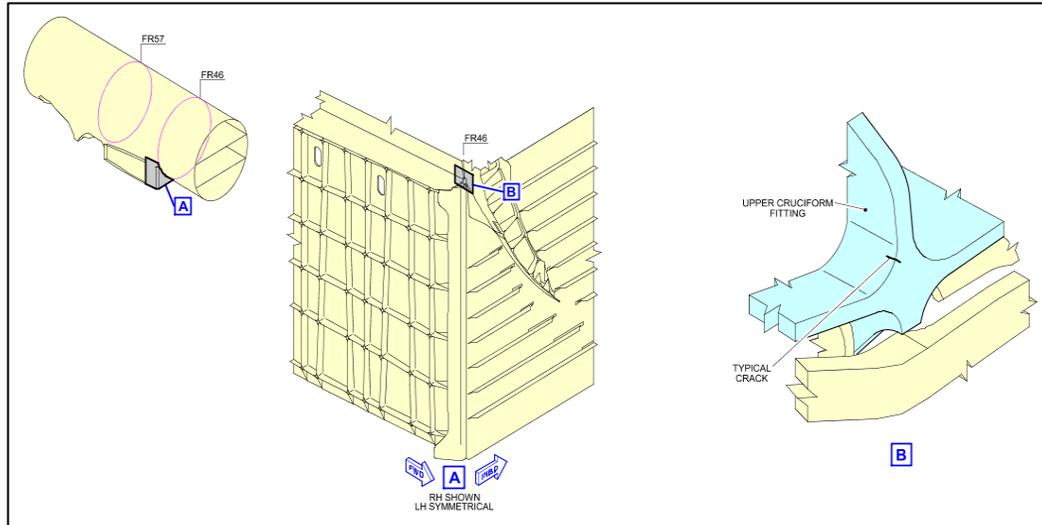
A SHM- Damage Monitoring Eddy Current solution results

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A-SHM project Leader - Expert NDT
Engineering Department

AIRBUS

A-SHM - Damage Monitoring - Context

The use case



**Damages Monitoring
replacing classical NDTs**

Keeping access for it !

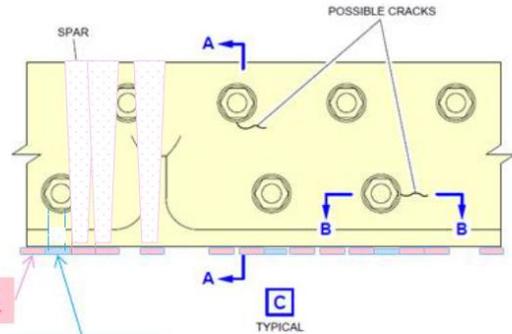
**Other drivers : Robustness – Business Case - Certification - Retrofit ability
Digitalization & Self Sustaining**

Questioned on demand & on ground - Durability for 15 to 20 years !

A-SHM DM Application- Metallic structure – Sensing solutions News

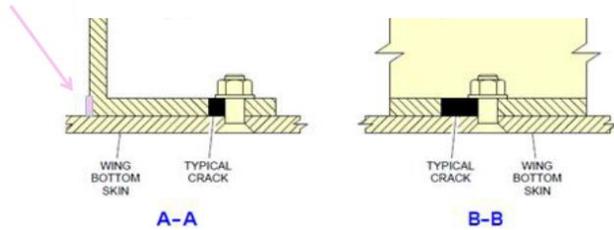
Status “Generation 1”

- **Ultrasonic (UT) sensors** for longitudinal waves :
Qualification program process is launched
- **Eddy current (ET) sensors** High Frequency:
Is under evaluation phase- Qualification will follow

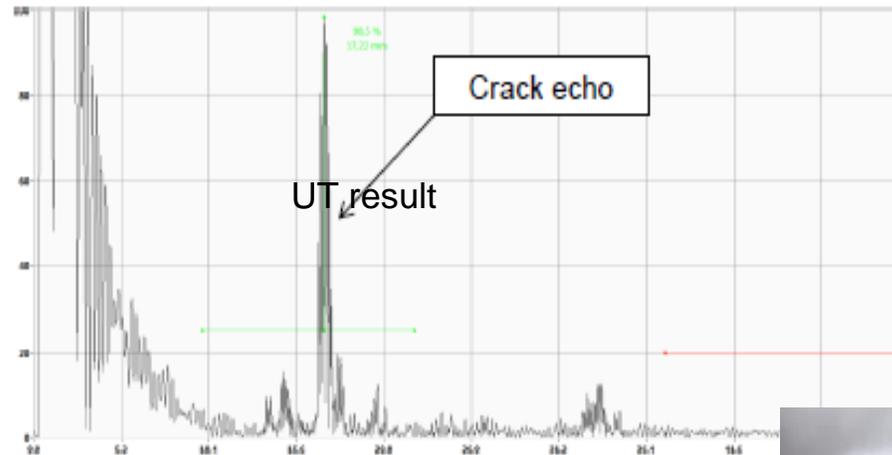


Ultrasonic sensors

Eddy Current sensors



Solution offers retrofit ability !



6 mm crack is detected

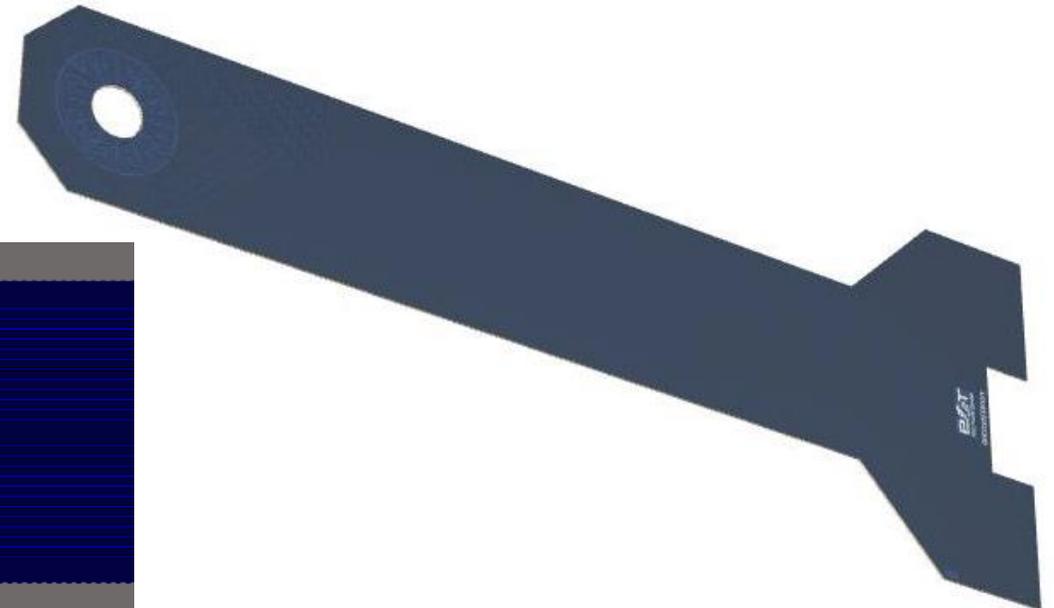
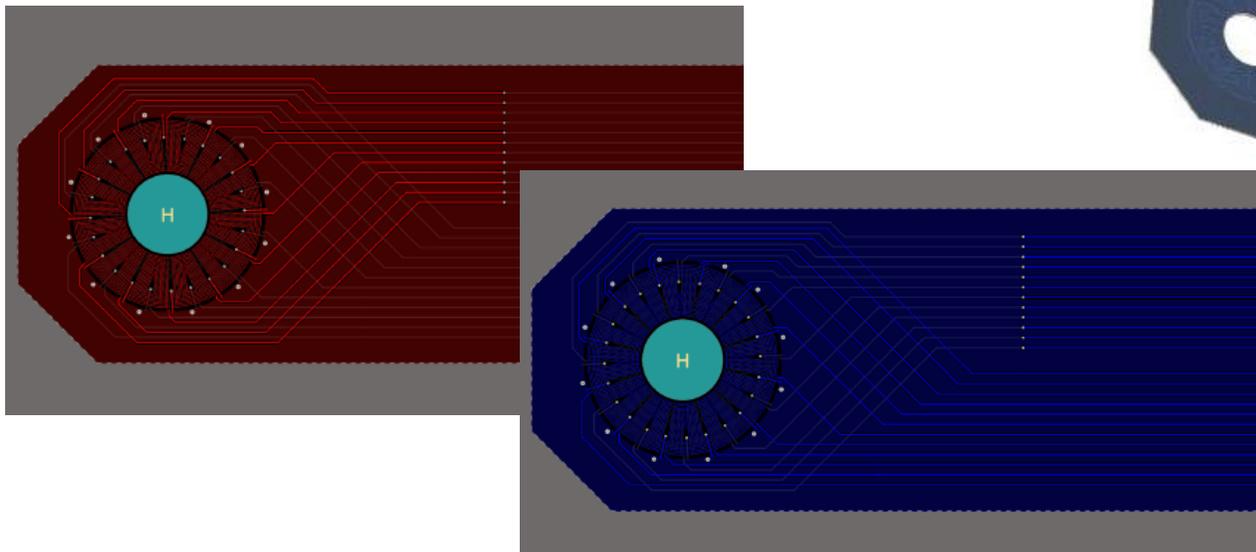


Generation- 1 Qualification program by end 2019

ASHM – DM- Eddy Current- High Frequency – Sensing concept

Fist Generation Prototype Sensor

- Two sensor layers, each having 12 coils, each coil having 8 windings
- Sensor layers are rotated for full coverage
- Each coil can be used as driver, receiver+ or receiver- coil

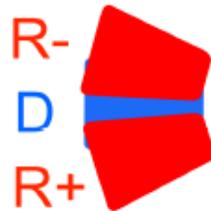
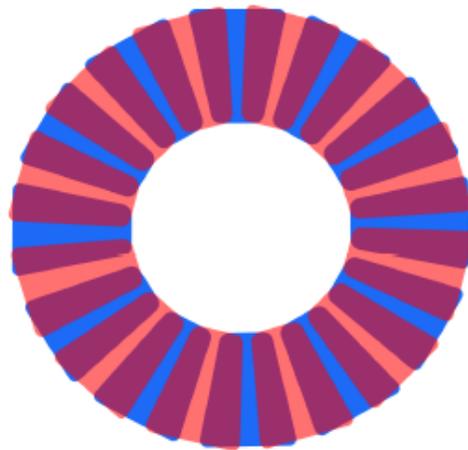


ASHM – DM- Eddy Current- High Frequency – Sensing concept

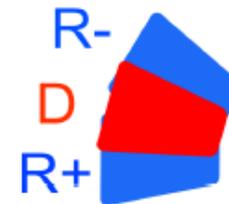
First Generation Prototype Sensor Multiplexing Sequence



- Sensor is used in differential mode
- For each multiplex channel:
 - 1 Coil is used as driver
 - The two neighbouring coils on the other layer are used as differential receivers
- Two types of „virtual differential sensors“

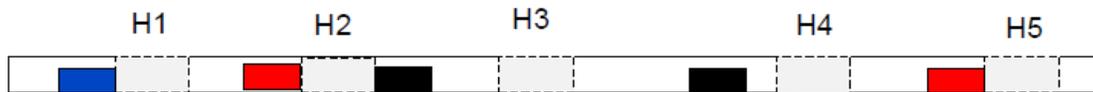
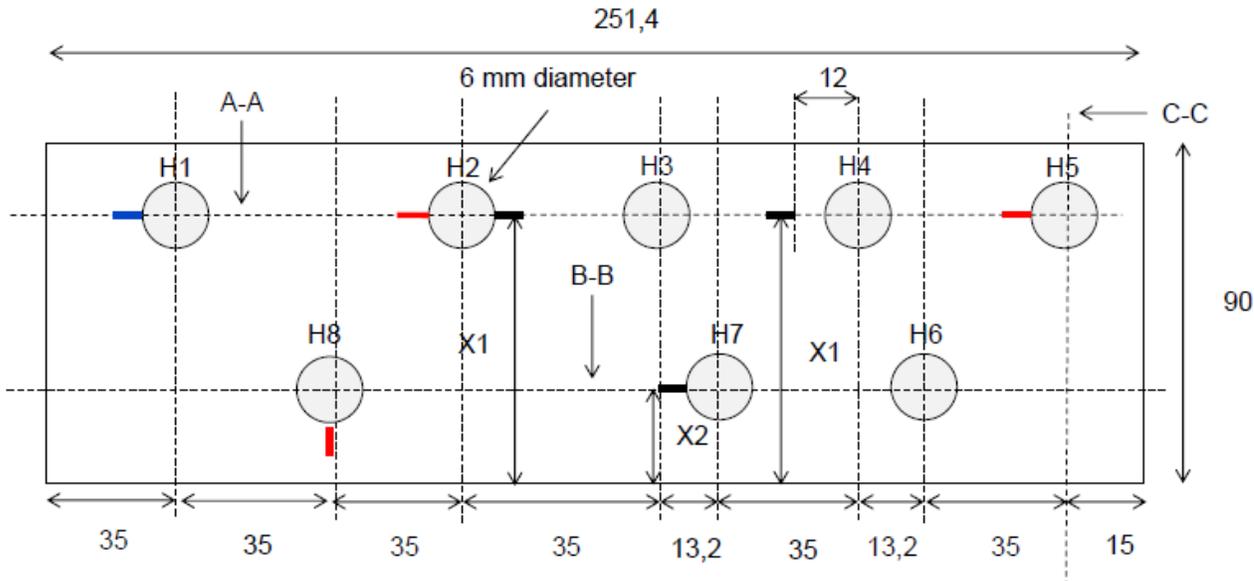


Type 1:
Driver Bottom
Receiver+ CCW Top
Receiver- CW Top

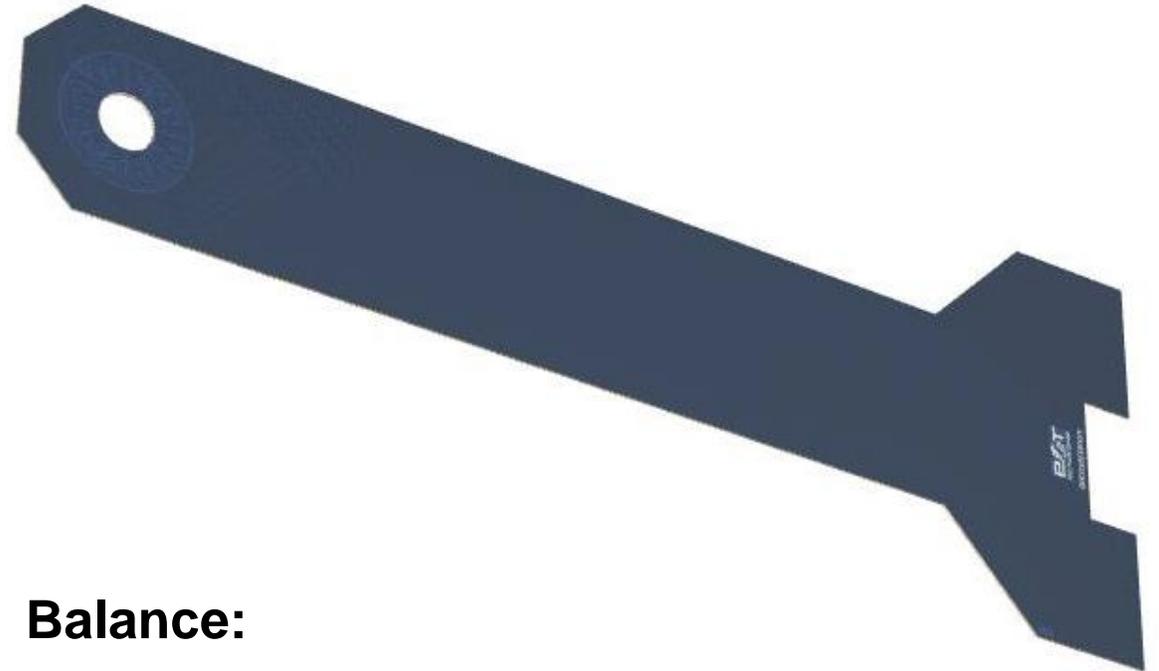


Type 2:
Driver Top
Receiver+ CCW Bottom
Receiver- CW Bottom

ASHM – DM- Eddy Current solution- High Frequency – Evaluation results



-  EDM notch 3 mm x 3 mm x 0,3 mm
-  EDM notch 1 mm x 3mm x 0,3 mm
-  EDM notches 2 mm x 2 mm x 0,3 mm



Balance:

- **For evaluation** - on H6
- **On aircraft** - Edge effect signal on selection of sensors used for comparison

Airbus patent

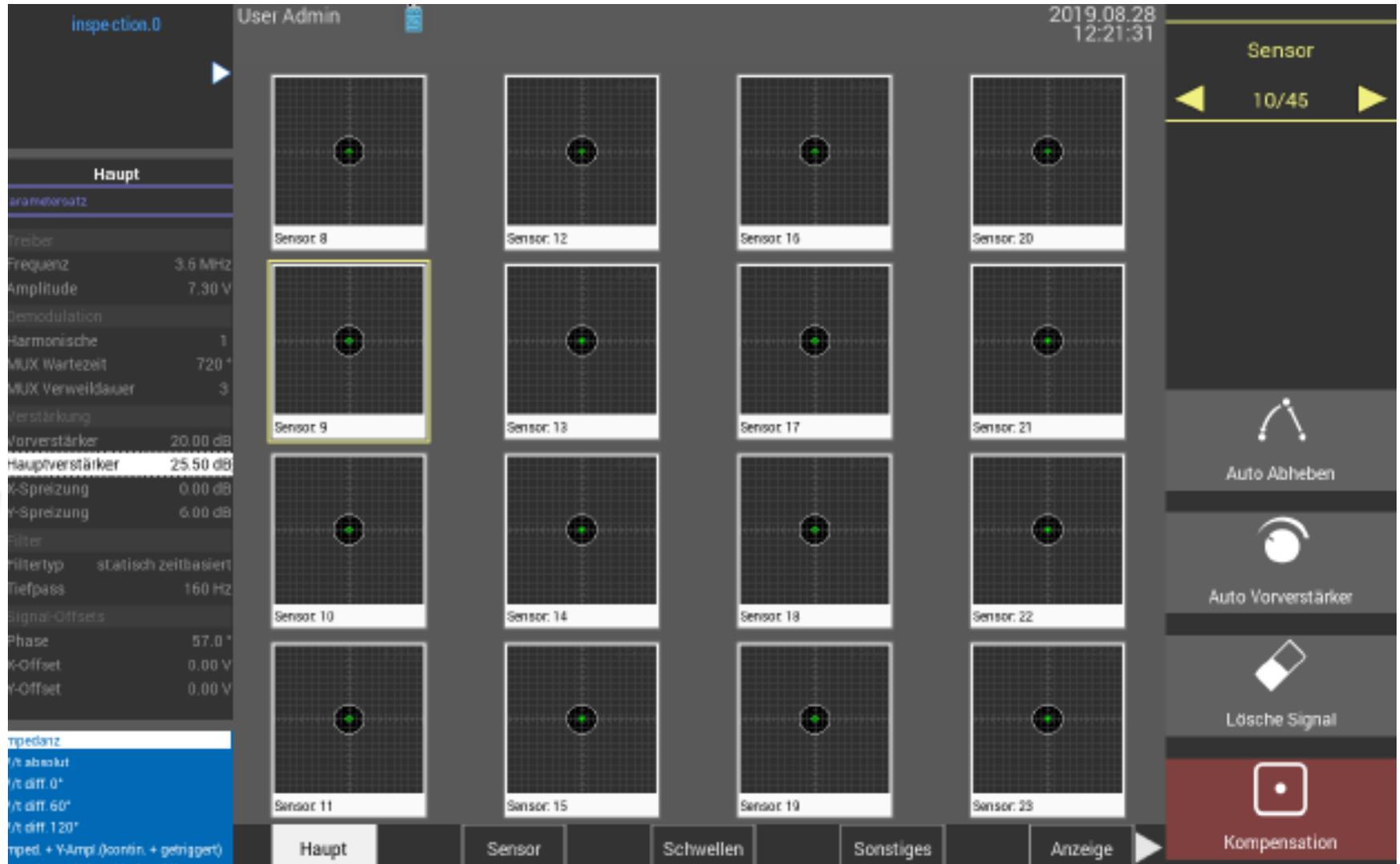
ASHM – DM- Eddy Current solution- High Frequency – Evaluation results

As “Sorting” signal processing:

Here:

Balancing on H6

All impedance plane signals are in an acceptable range



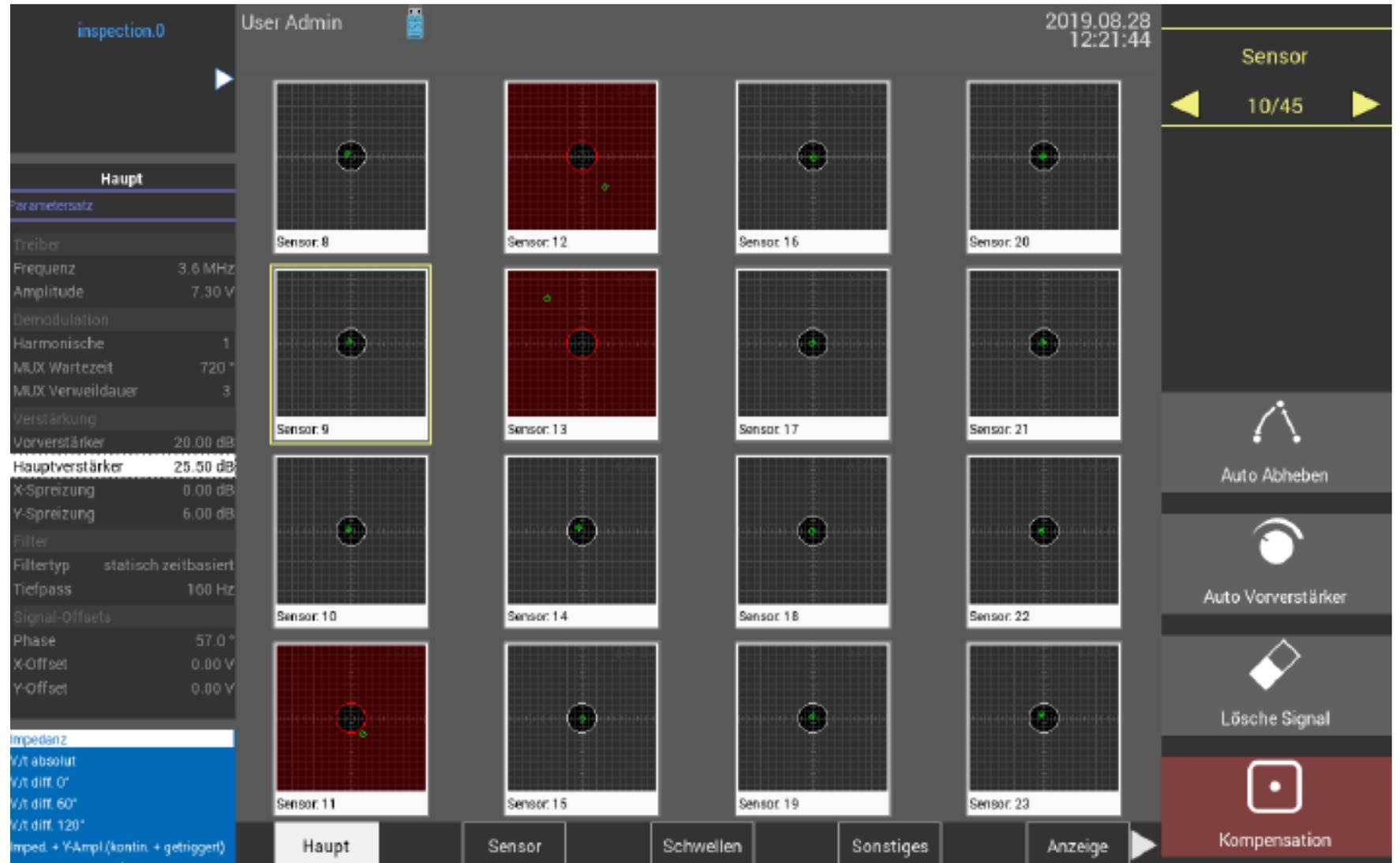
ASHM – DM- Eddy Current solution- High Frequency – Evaluation results

H1 :
3x1x0,3 mm
in 5 mm thick

 EDM notch 1 mm x 3mm x 0,3 mm



11 /12 and 13
sensor signals
are not in
acceptable range



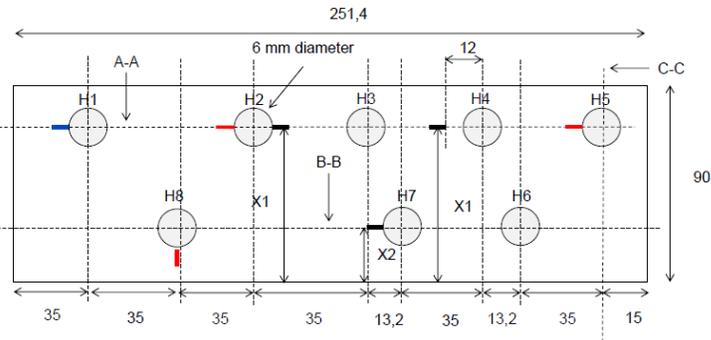
ASHM – DM- Eddy Current solution- High Frequency – Evaluation results

**H1-H2-H3 :
in 5 mm thick**



ScanAlyzer Software

Results from RTP # 6 with 2,5 MHz



- EDM notch 3 mm x 3 mm x 0,3 mm
- EDM notch 1 mm x 3mm x 0,3 mm
- EDM notches 2 mm x 2 mm x 0,3 mm

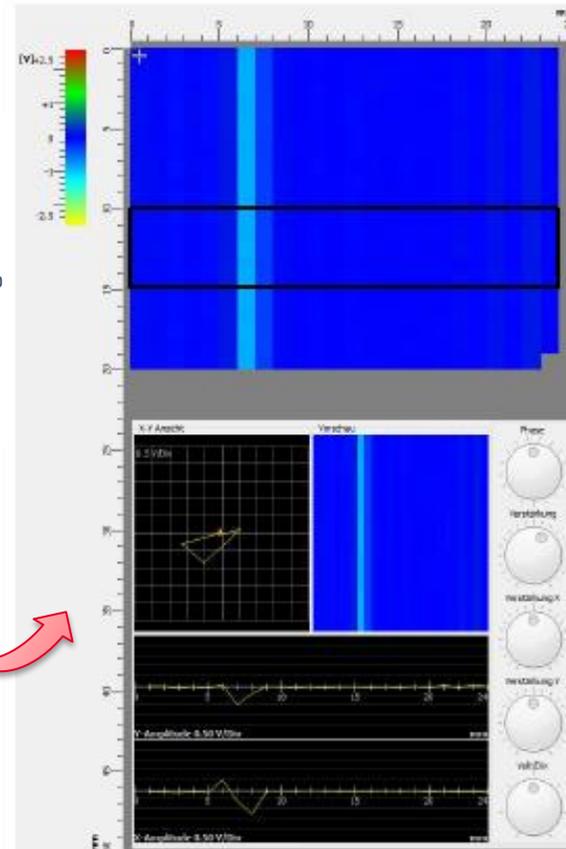


Fig. 27: H1_2,5MHz_6dB_amplification_24 probes

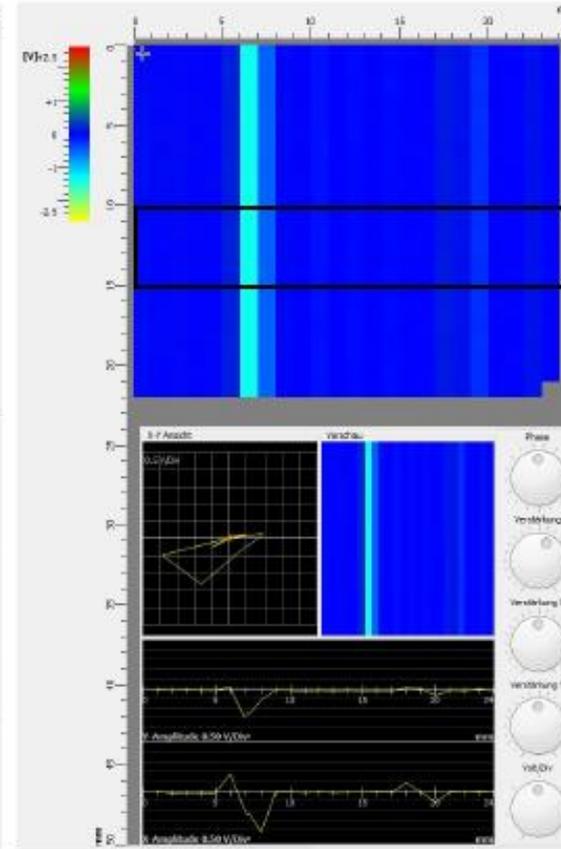


Fig. 28: H2_2,5MHz_6dB_amplification_24 probes

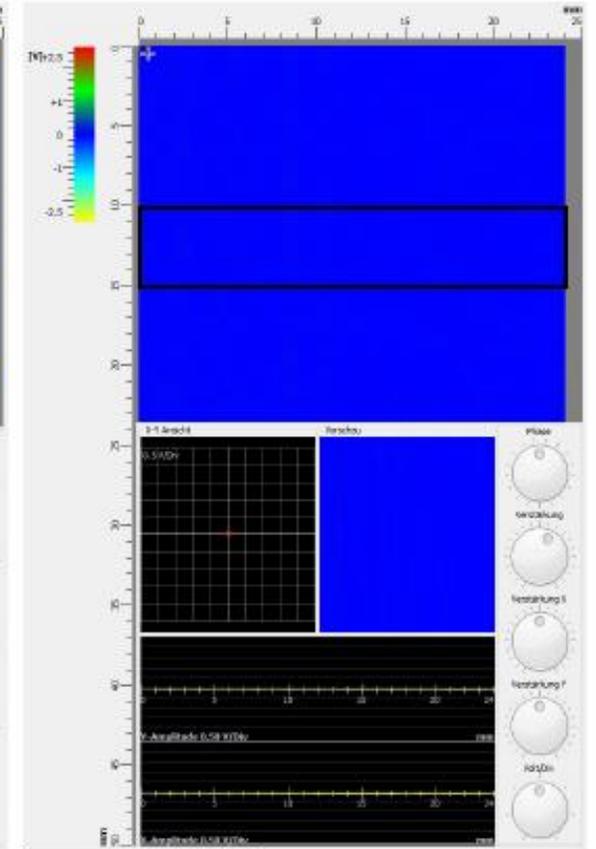
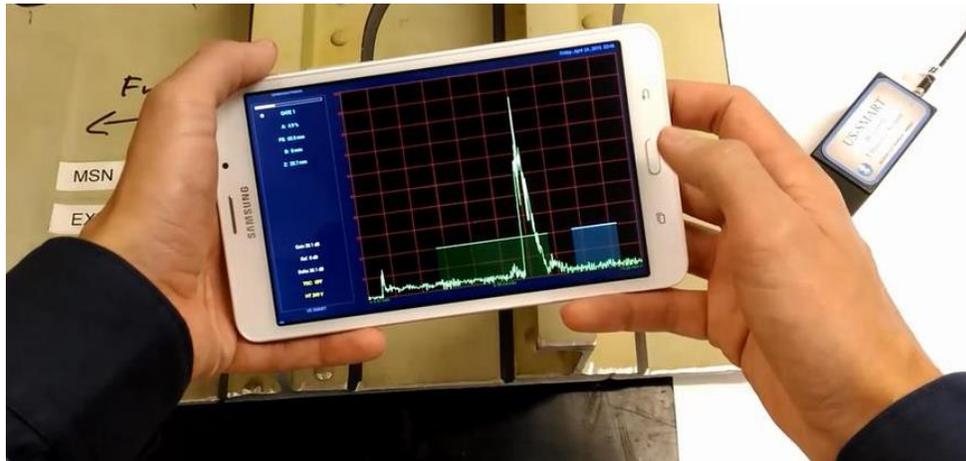


Fig. 29: H3_2,5MHz_6dB_amplification_24 probes

ASHM- DM

Ultrasonic and Eddy Current signals will be transferred by wireless to a Smart phone

Smart Phone tool from Lecoeur :



Signal signatures will be accessible by Inspectors on ground

To day

- Signal signatures will be captured by NDT Inspectors on ground

Next step

- Signal signatures will be automatically interpreted
- All details accessible for doubtful analysis inspection traceability and predictive maintenance

THANK YOU