



Composite NDT Requirements in Sports Cars

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Workshop on NDT Requirements for Automotive Composites

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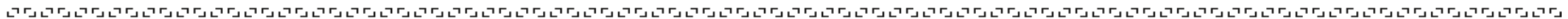
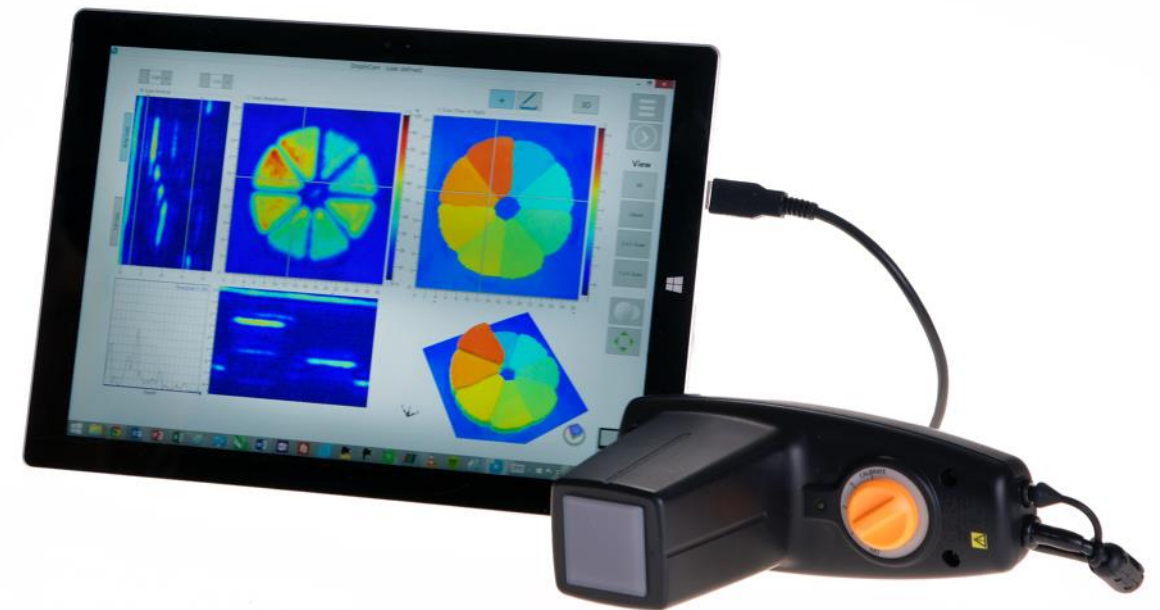
With material from
Felix Matthes, Audi AG

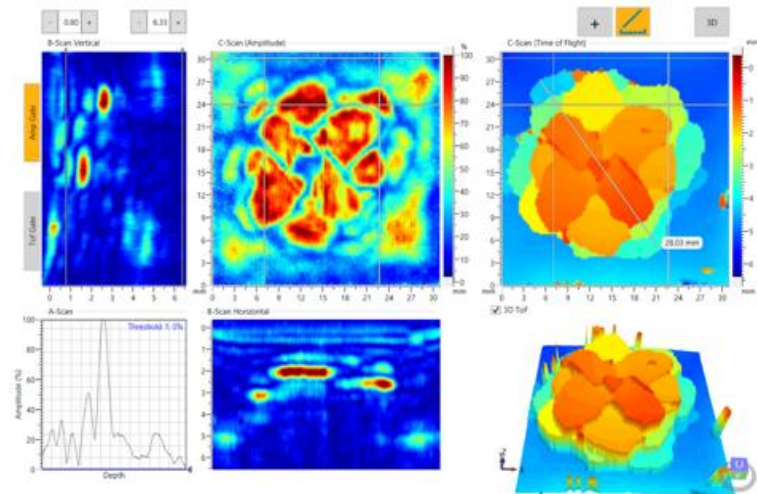




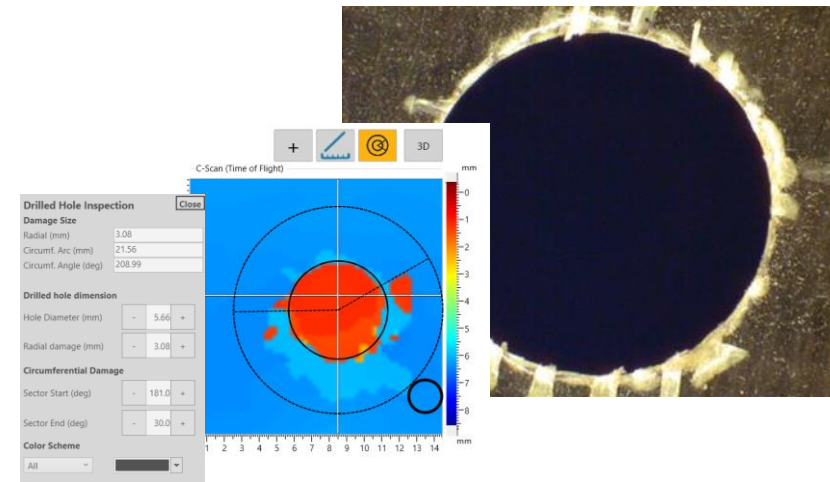
DolphiTech

- DolphiCam Ultrasound Camera
- 2D matrix transducer technology
- Ultrasound imaging for multimaterial structures
- Some customers
 - VW, Audi, Lamborghini
 - Boeing, Airbus, Cessna
 - Education & Research

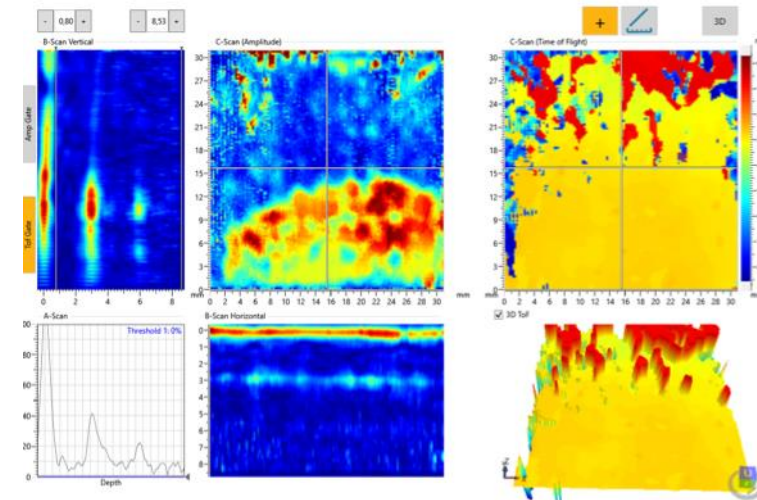




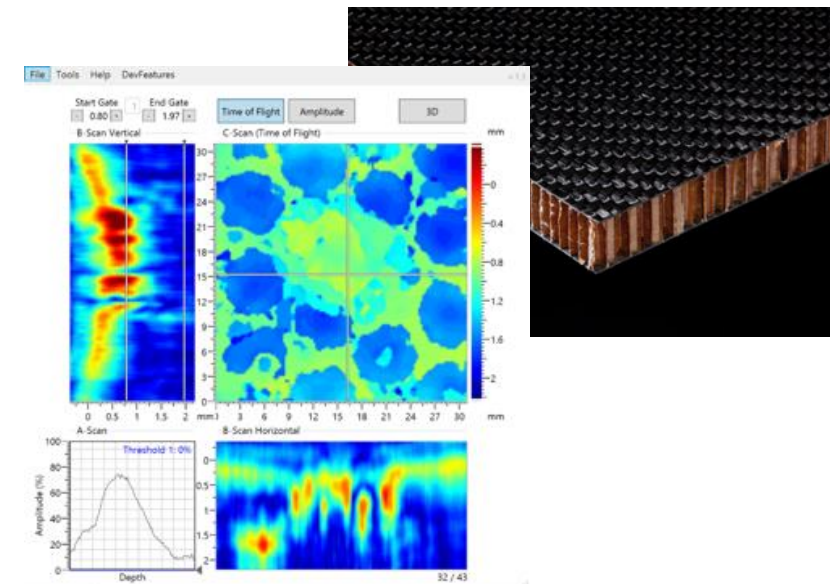
Impact damage



Drilled hole delamination



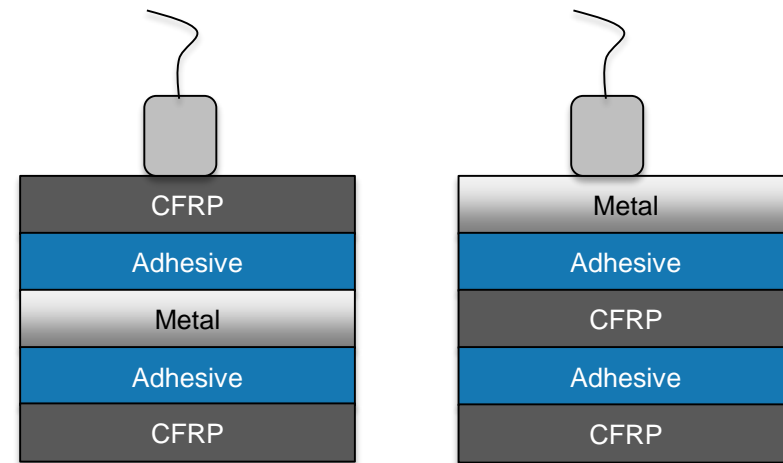
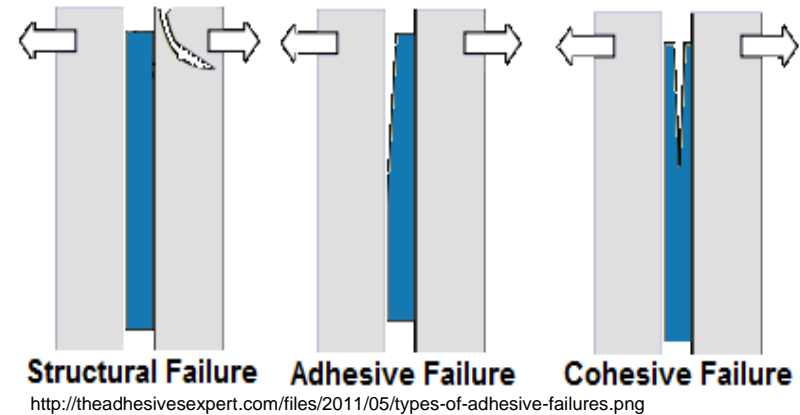
Bond line



Laminate to core disbond

Materials

- Types
 - CFRP
 - CFRP bonded to [CFRP, core or metal]
 - [C+G]FRP hybrid
 - GFRP
 - Thin metal adhesive joints
- Thickness
 - CFRP typically 2-4 mm
 - Full penetration with 3.8 MHz system
- Could be challenging:
 - High material porosity
 - Thick material
 - C+GFRP hybrids
 - Adhesive material properties, glass beads
 - Multi-layer sandwiches



Surface Contact

- 100% access impossible
 - Few flat, easy to access surfaces
 - But can get pretty close
- Large probe
 - Great image where access
 - Faster inspection
- Small probe
 - Improved access, more difficult to get overview
 - Slower inspection





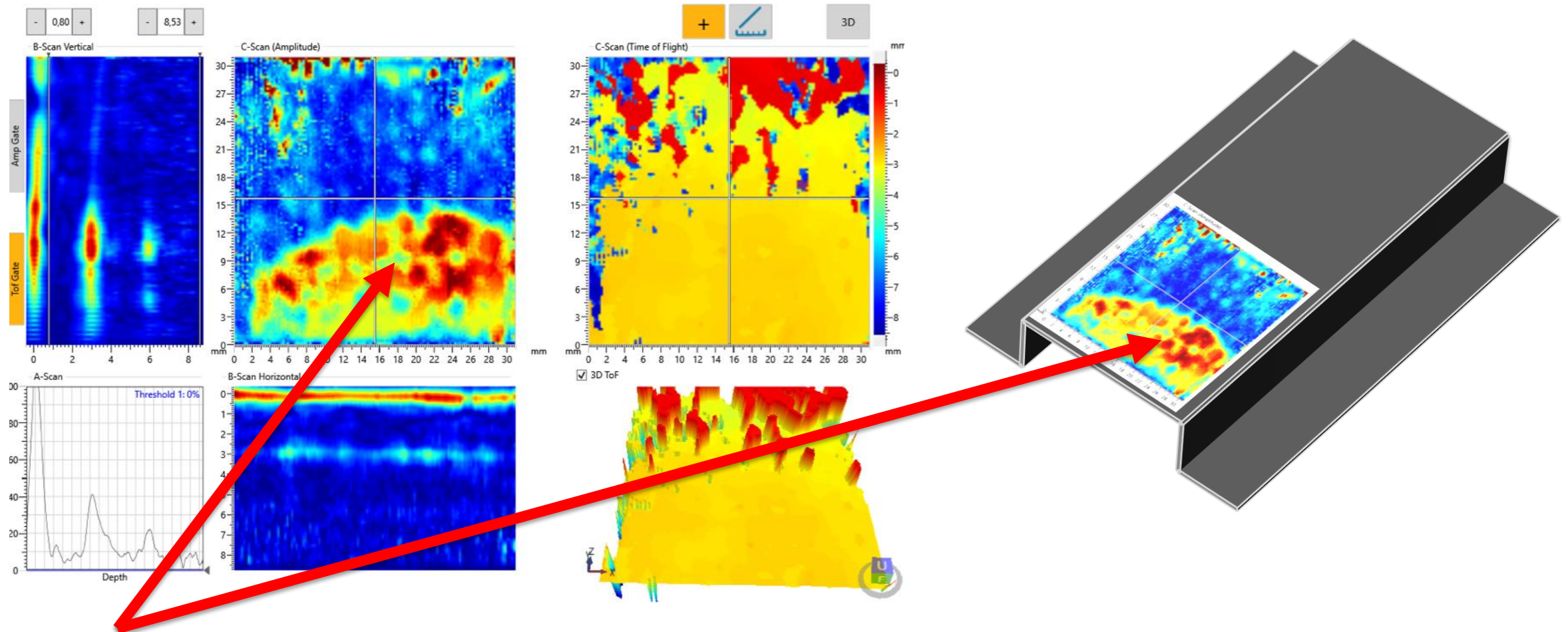
DolphiCam II

- Multimaterial
- Smaller footprint
- Performance
- Connectivity
- Remote NDT

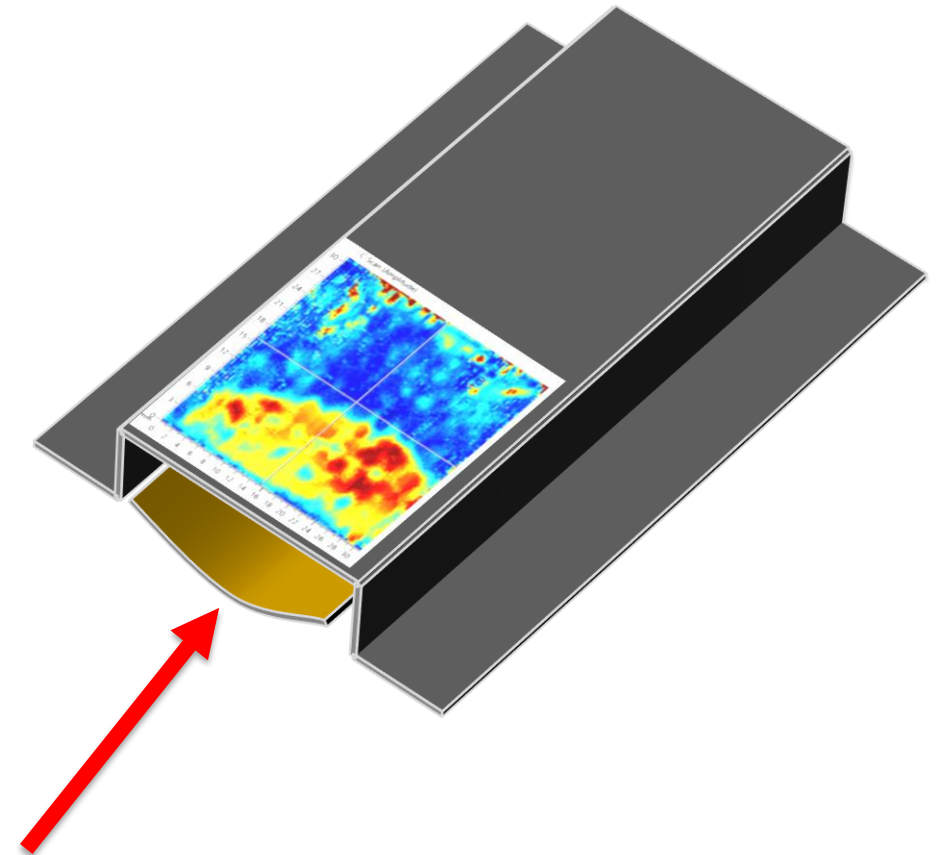
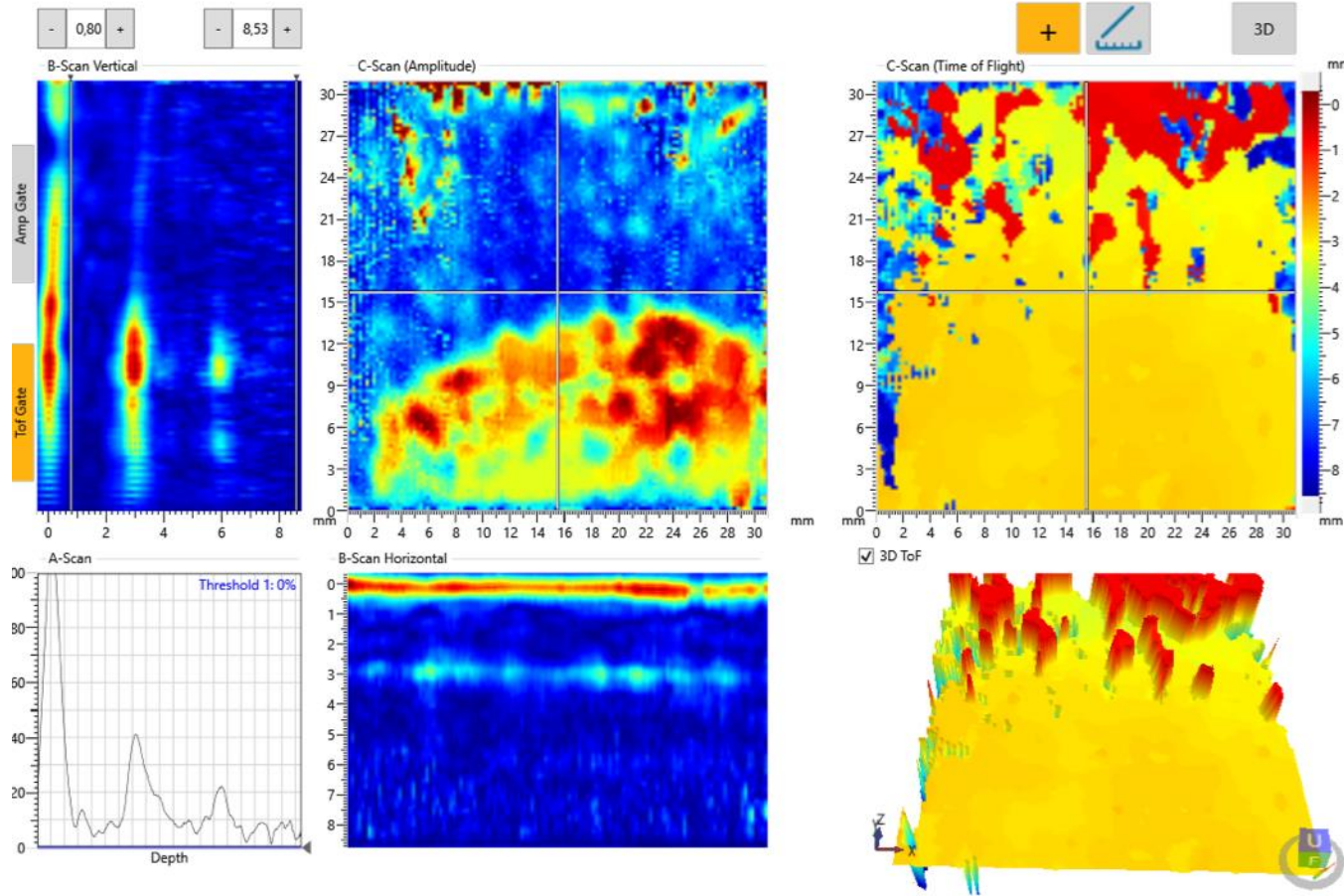
October 2017 !



Know your position – and structure!



Know your position – and structure!



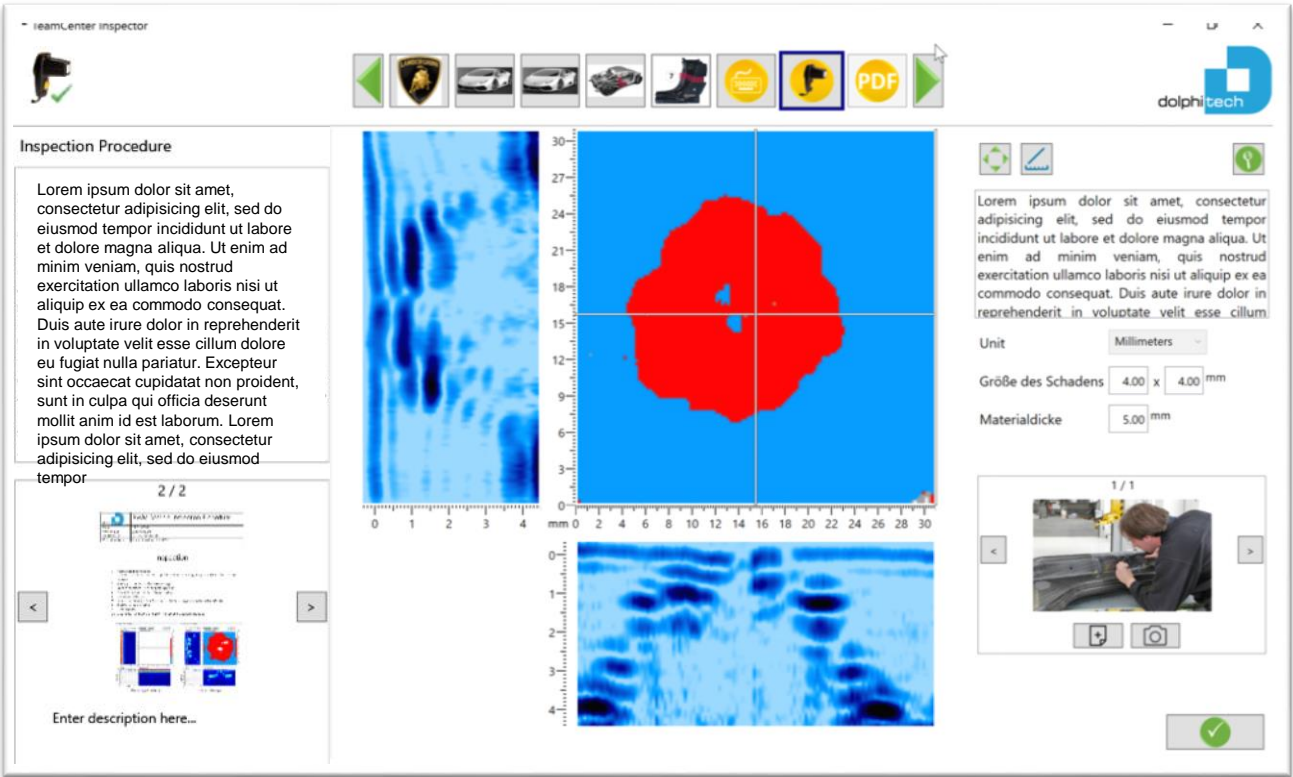


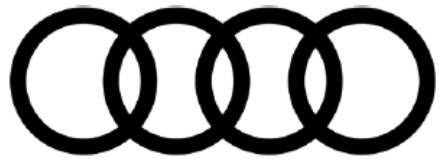
NDT for Repair Shops

Lamborghini Huracan



DolphiCam TeamCenter





NDI for composites in the automotive industry

Felix Matthes, Audi AG

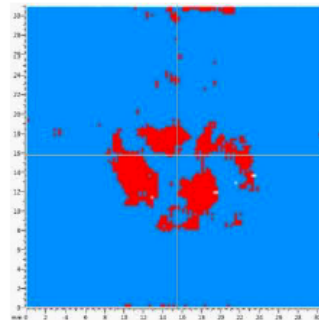
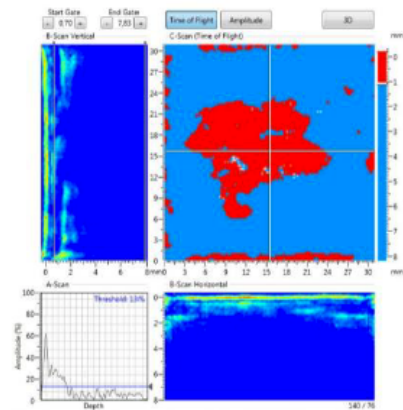
Neckarsulm

2017-03-20

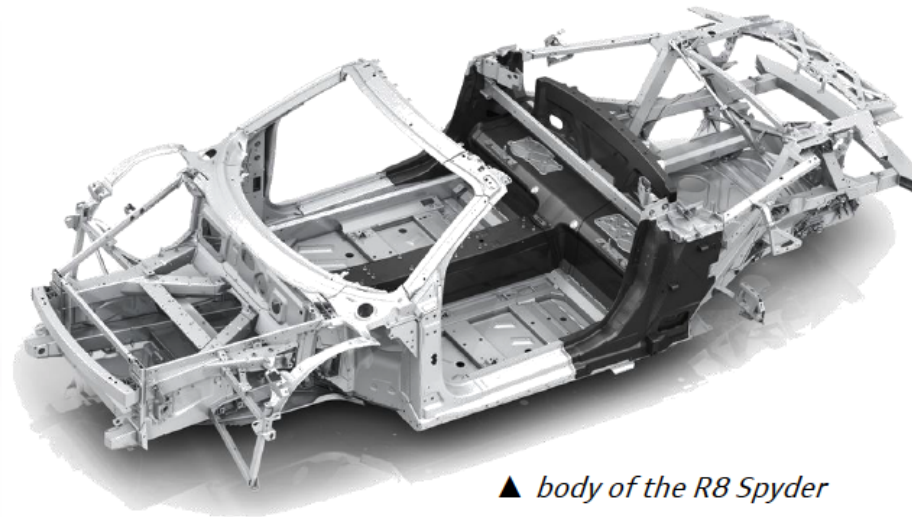
NDI for composites in the automotive industry - current applications and future problems

- › Ultrasound inspection on structural CFRP-Parts after an accident
- › suppliers final part inspection with Ultrasound or Thermography

▼ *local delamination after an impact-accident*



▲ *porosities of structural cfrp-parts*

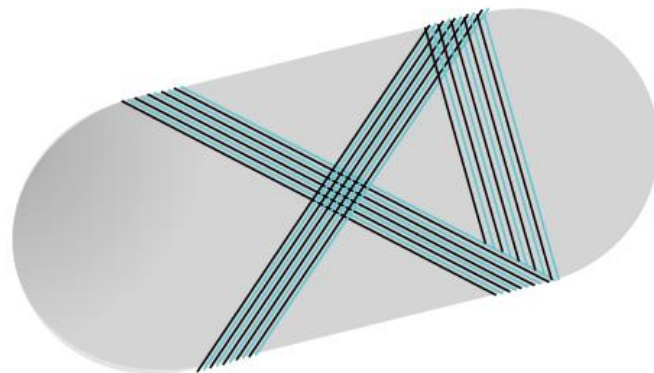
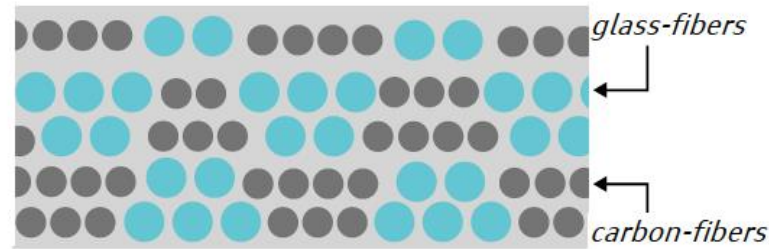
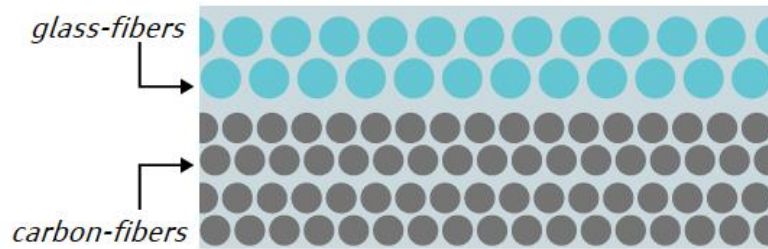


▲ *body of the R8 Spyder*

- › some other more like X-Ray or Computertomography

NDI for composites in the automotive industry - current applications and future problems

- Ultrasound inspection on structural FRP-Parts with an multi-fibre-mix like glass/carbon
 - e.g. Type 4 CNG-Tanks after ECE R 110
 - different Types of Composites and thicknesses up to 25mm
 - pole winding surface of the composite



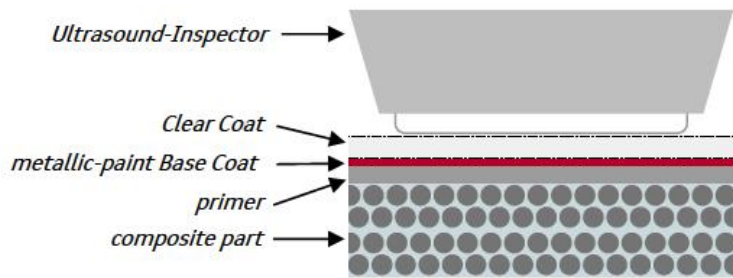
▲ *single CNG-Tank*



▲ *CNG-unit of Audi A4*

NDI for composites in the automotive industry - current applications and future problems

› Inspection of painted FRP-Parts, especially with metallic-paint

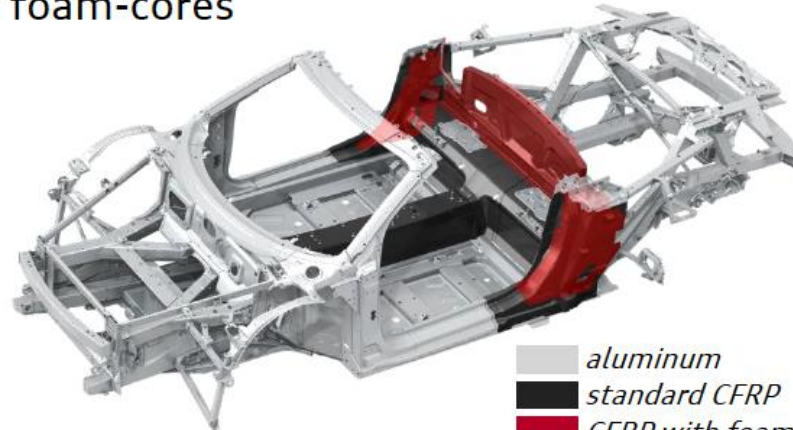
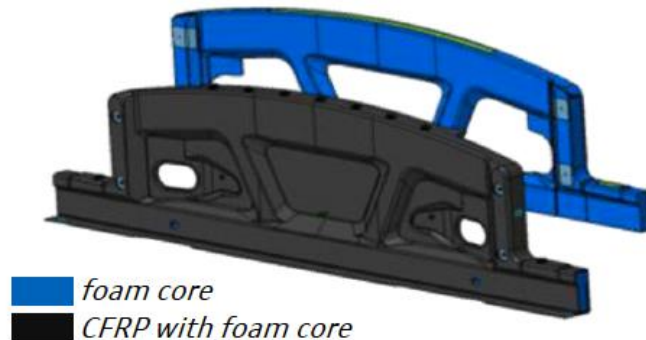


*possible composite parts
with metallic-paint ▼*



- › current situation: metallic-paint Base Coat is blocking the Ultrasound-Signal
- › inspection of the composite with Ultrasound is not possible

› Inspection of complex CFRP-Parts with foam-cores







aluminum
standard CFRP
CFRP with foam core



Summary

- Design for Inspectability
- Include NDT supplier early!
- Determine Critical Areas
- Determine Critical Defect Size (CDS)
- Improve Probability of Detection
 - Test samples with artificial defects
 - Know your structure
 - Training
 - Deployment
 - Make it simple!

	Below CDS	Above CDS
Inspector calls “Defect”	 £ out window	 Repair or replace
Inspector calls “No defect”	 Go!	 Danger!



Questions?

