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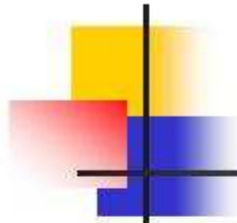
Non-Contact NDT of Composite Structures

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Overall Objective:

**The Development of a Technician Usable
Remote Scan NDT System
for the Detection and Characterization of Defects
in Large Area Composites in Field
or Factory Situations.**



Principle of the System

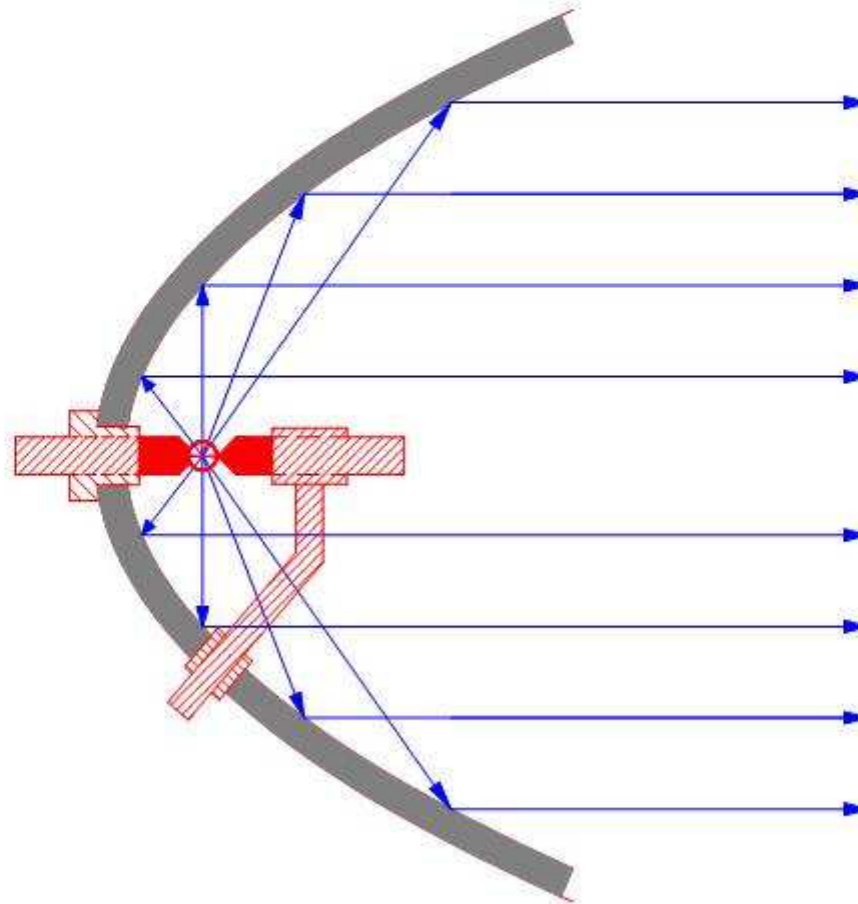
- **When a structure is correctly excited, the surface will move according to the underlying supporting structure.**
- **If the supporting structure is damaged, the local relaxation frequencies will differ from the surrounding area.**
- **Proof of this in the “Tap Test”: when a surface is excited by a tap a series of characteristic relaxation frequencies are produced - some of them audible.**
- **This system exploits these ideas with the application of modern technology.**



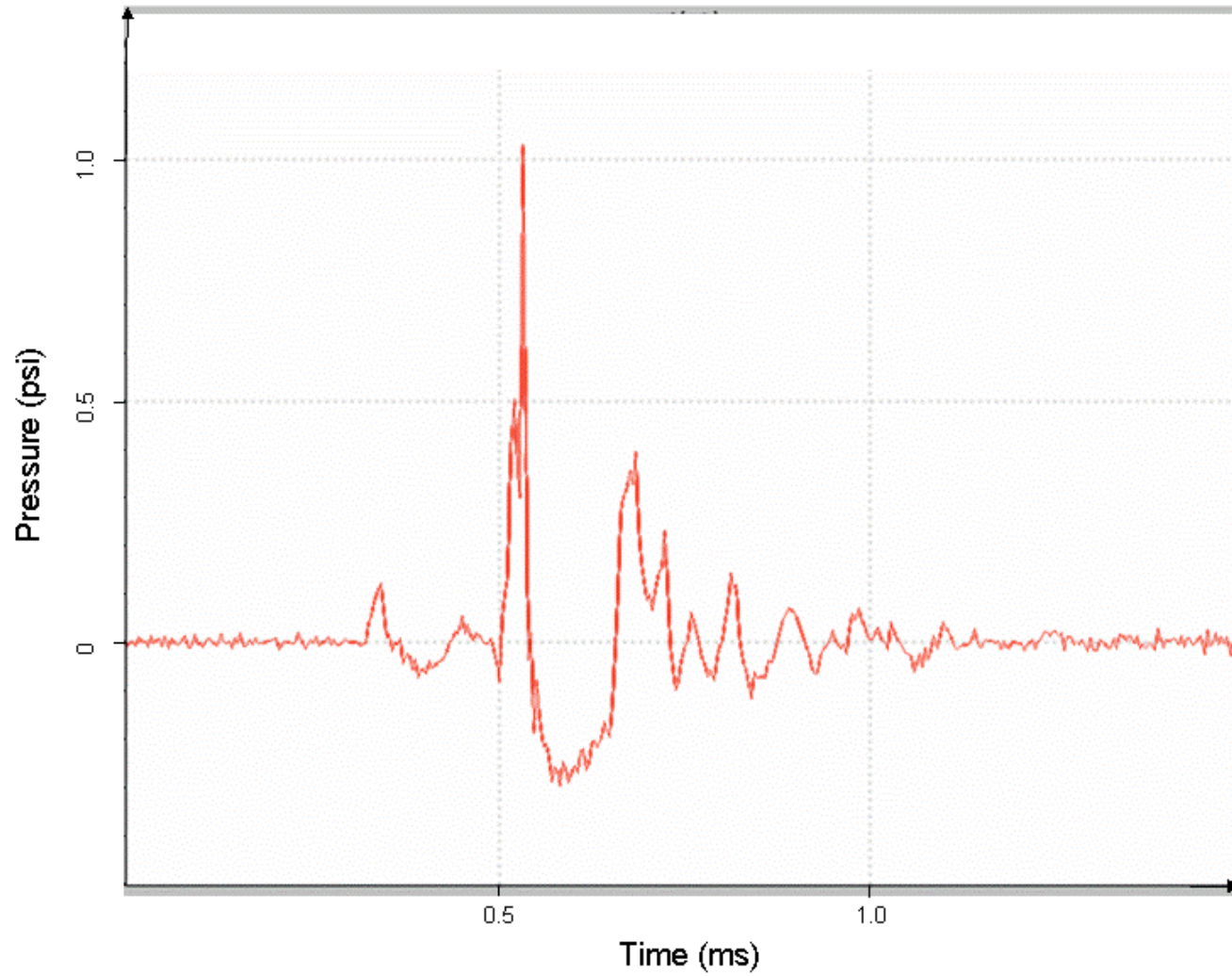
Pulsed Acoustic Exciter

- **It is analogous to non-contacting “Tap”**
- **The extremely short discharge time ensures a broadband excitation**
- **This prevents damping or blanketing of the ring-down of relaxation frequencies at each data acquisition point**

Acoustic Transducer employing a Parabolic Reflector Dish with non-restricted discharge

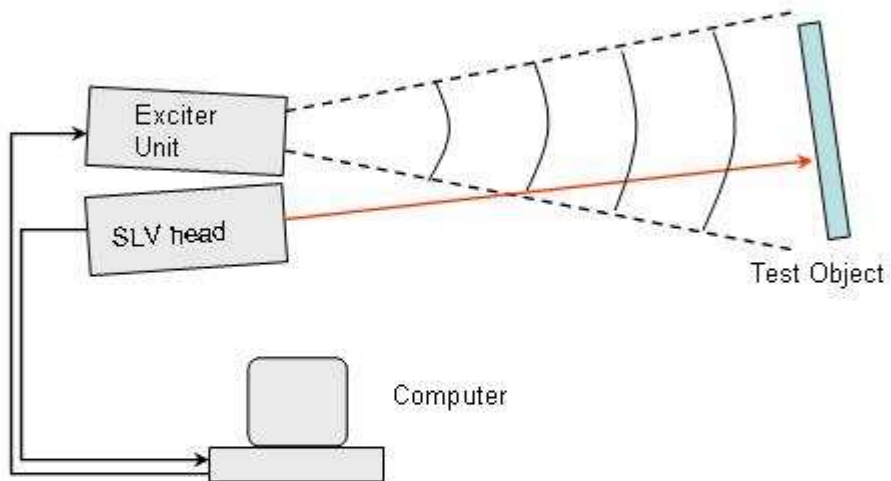


Blast recording of the excitation shockwave

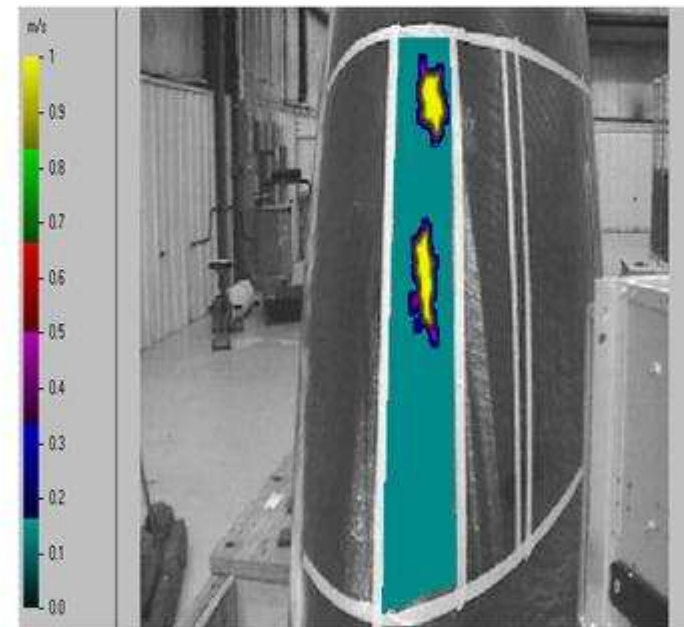


Operation of the NDT system

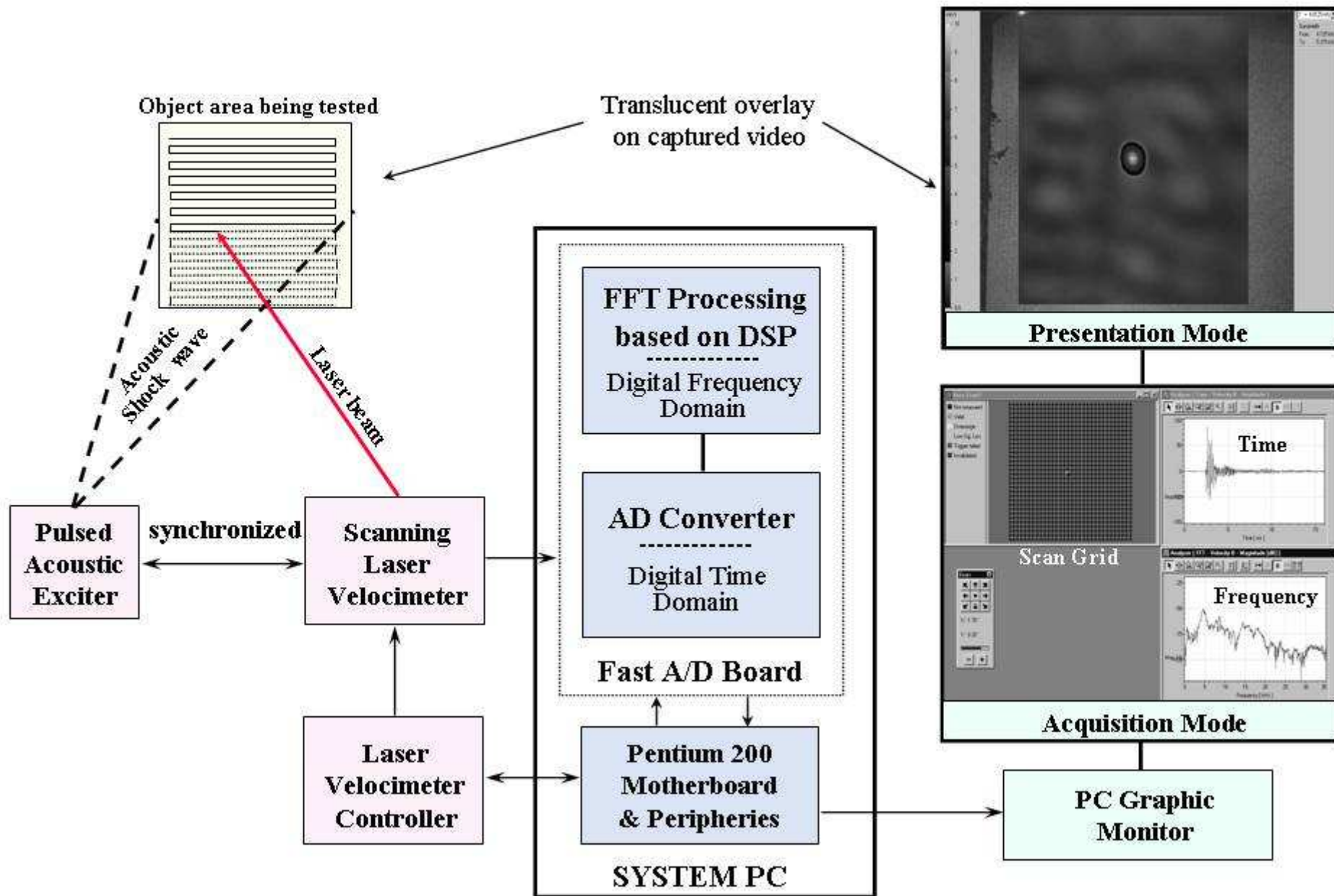
Instrument set-up



Test result

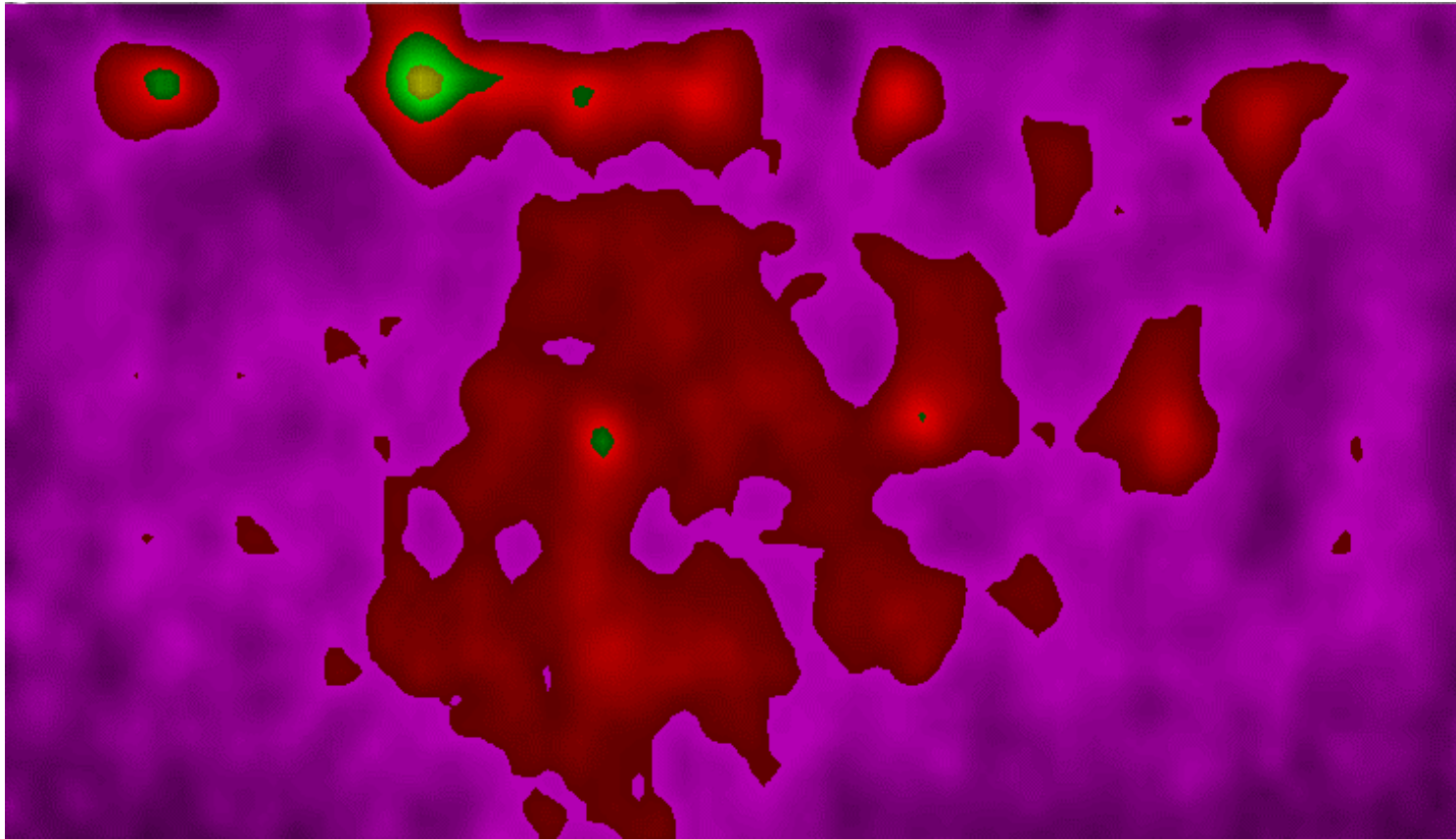


Schematic diagram NDT system



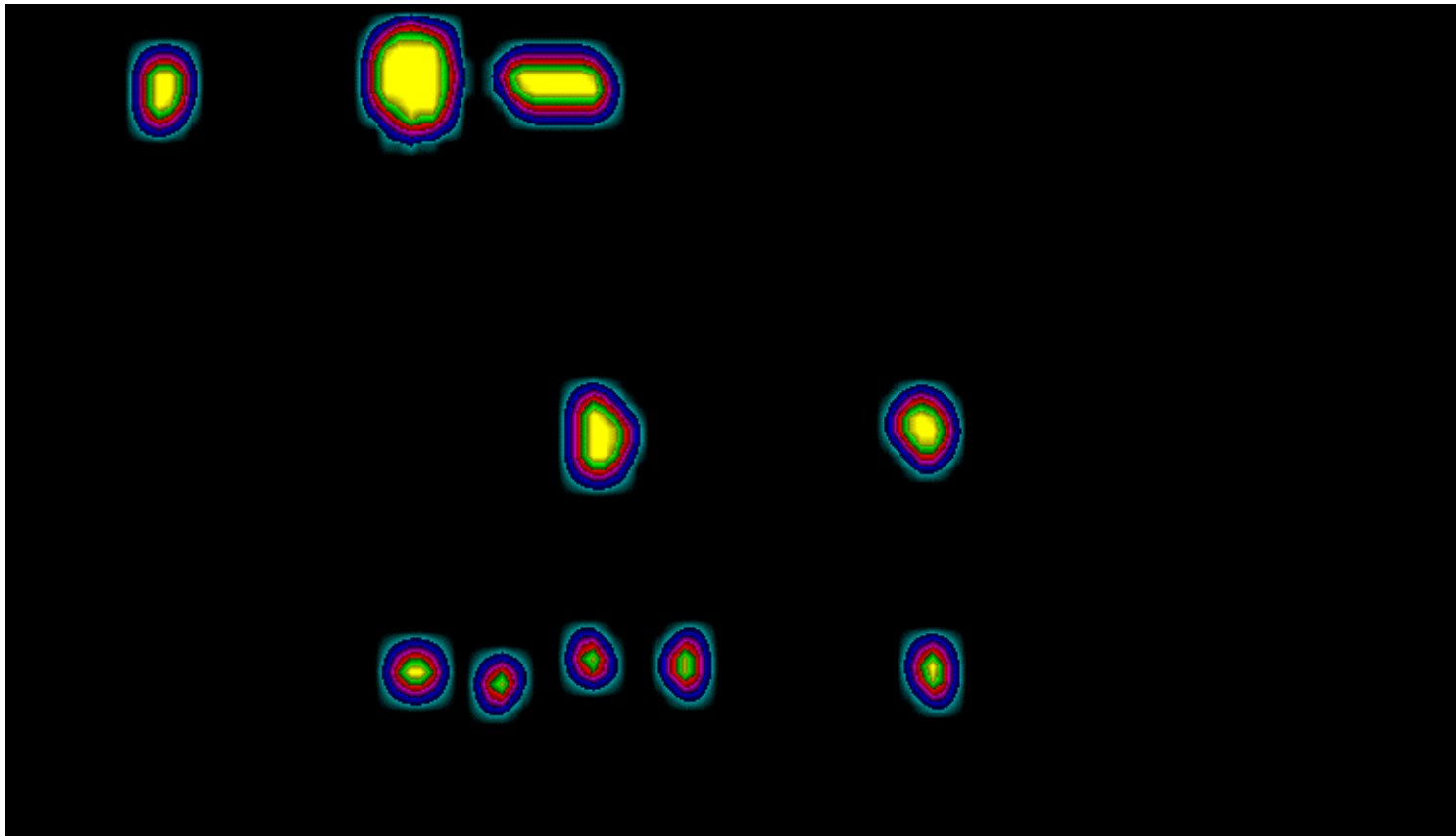
Topographical map from a scan of the test composite panel

- result produced by taking the average amplitudes of all recorded frequencies. The pre-programmed defects in the test panel are masked by noise from non-information carrying or the lower high velocity frequencies.

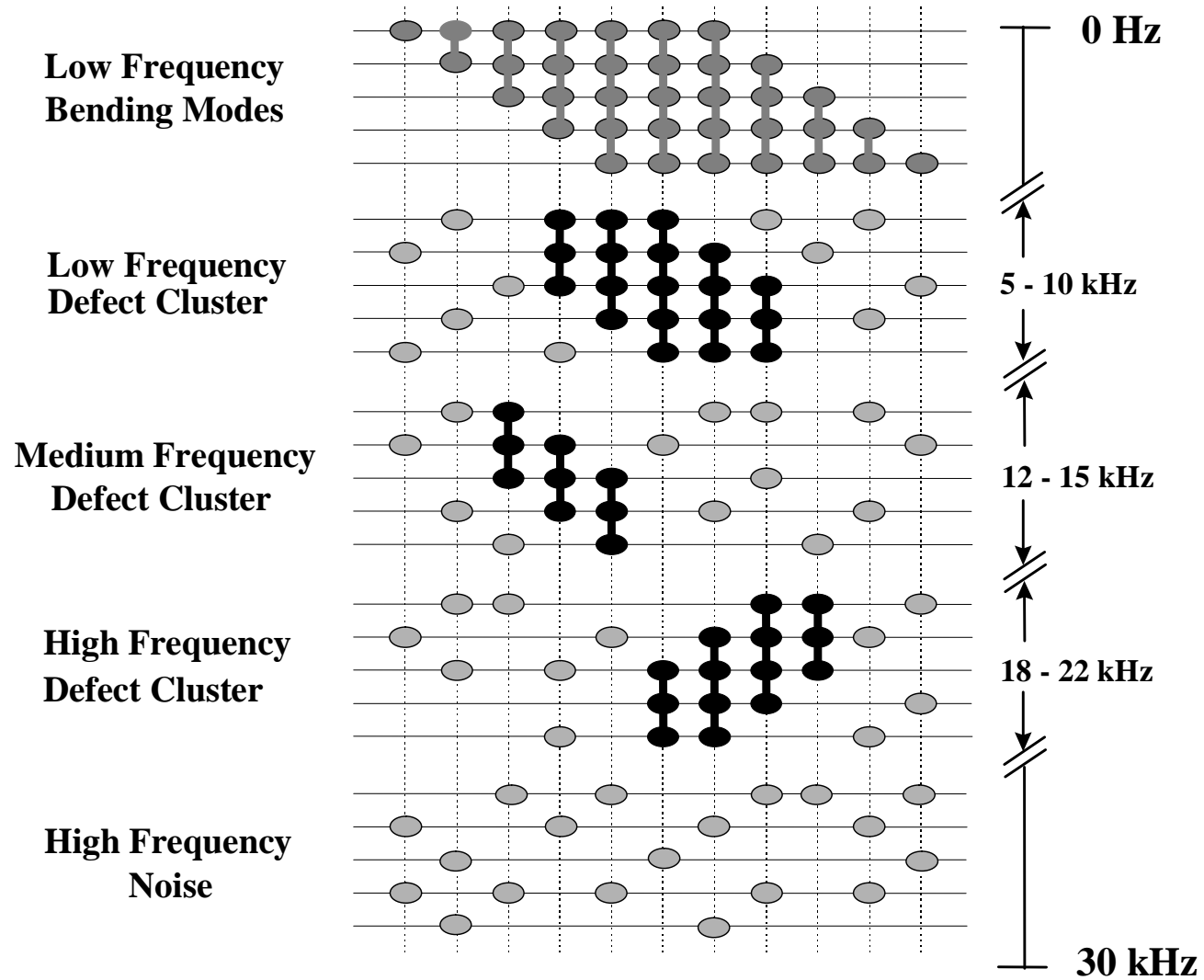


Result after analysis processing of the test-scan:

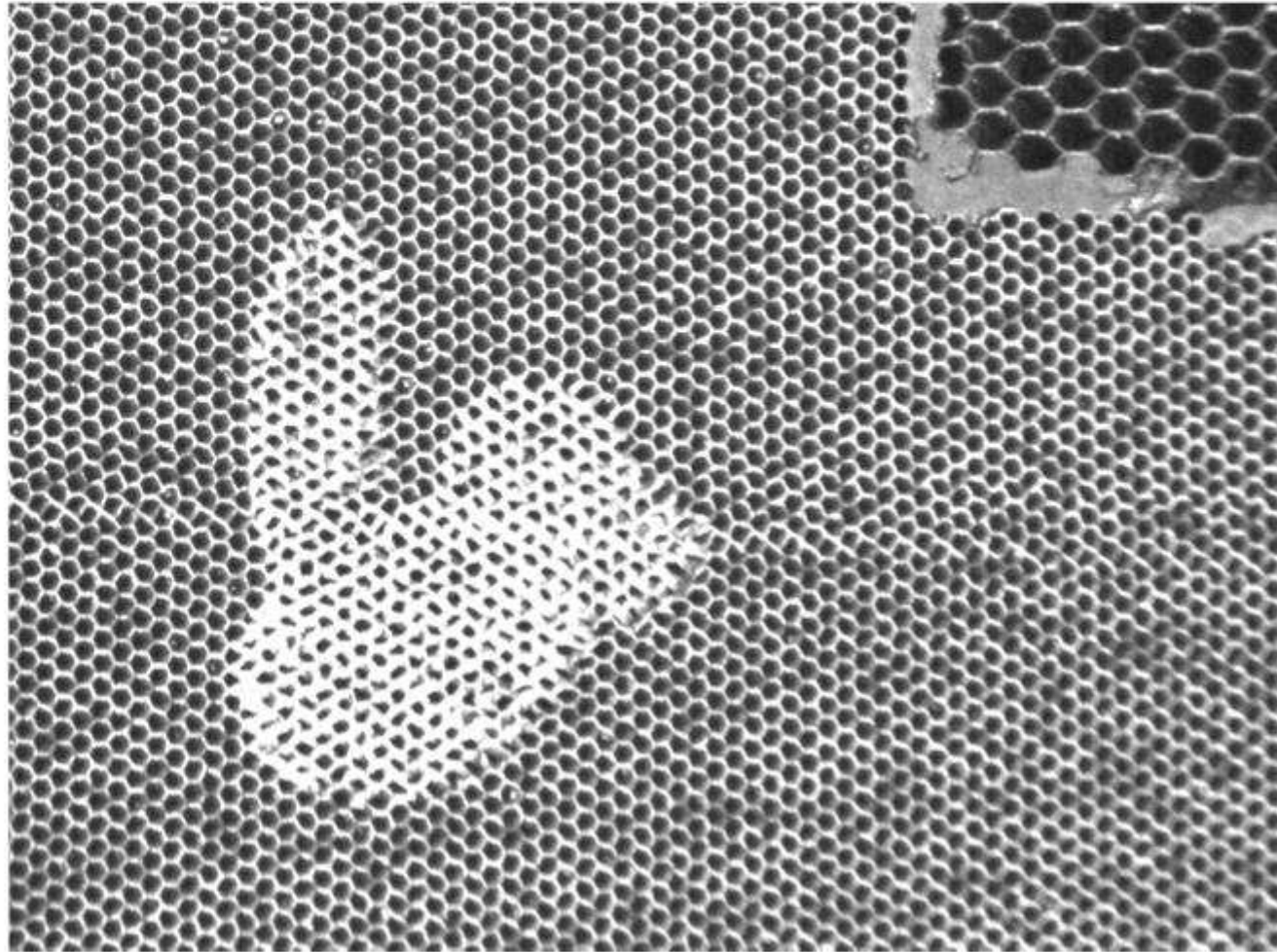
All ten pre-programmed defects are clearly revealed.



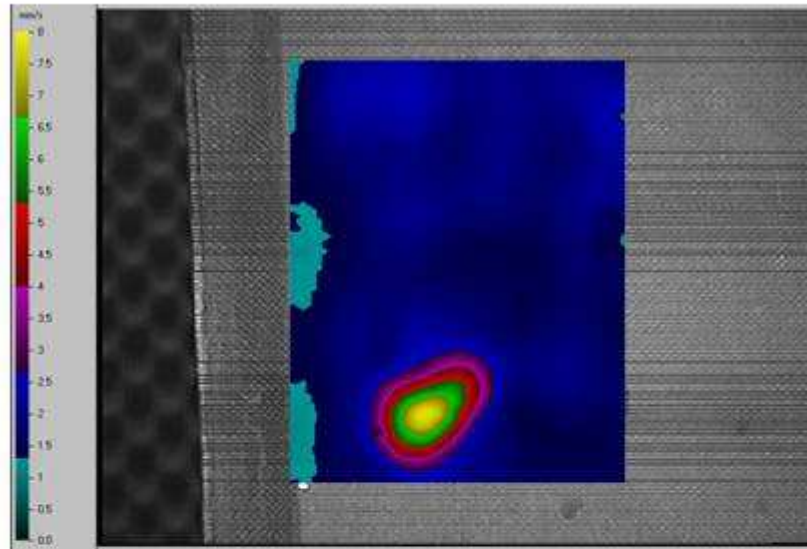
Identification of defect clusters from random noise signals



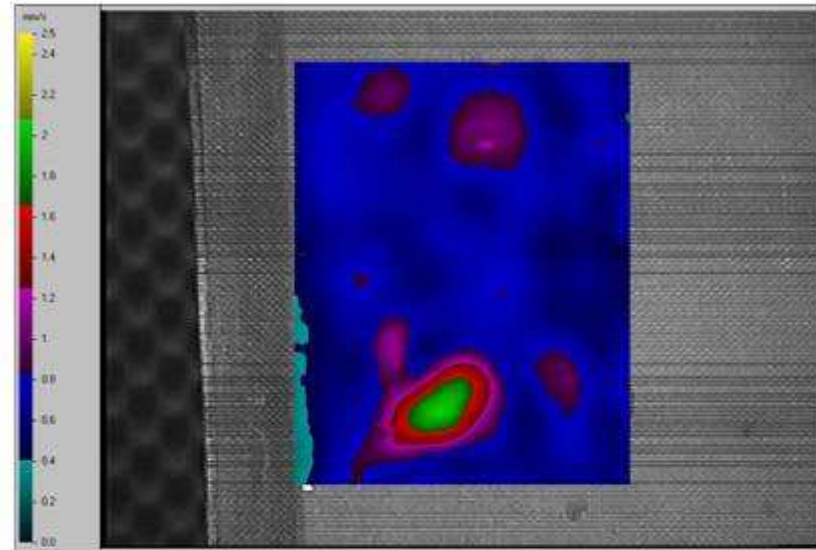
**Crushed core area which was photographed
before the top skins were laid up.**



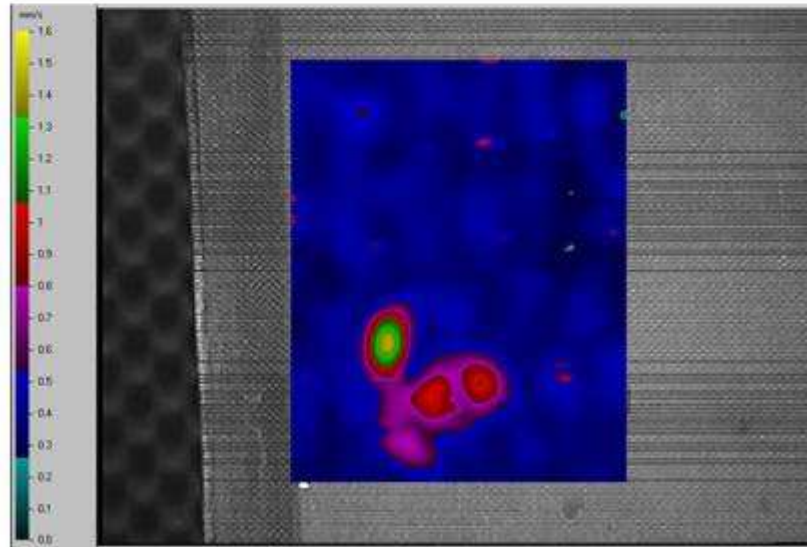
Defects unveiled at different frequency intervals



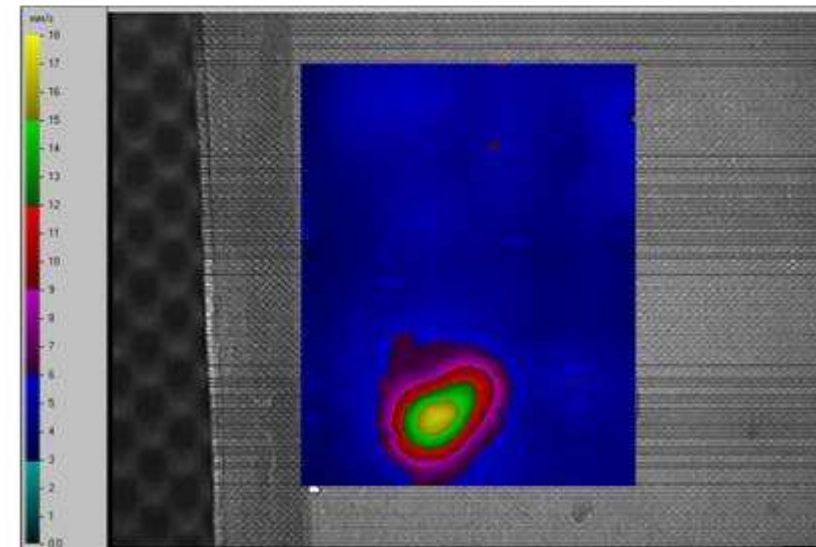
~2 kHz to 3 kHz



~5.5 kHz to 6.5 kHz

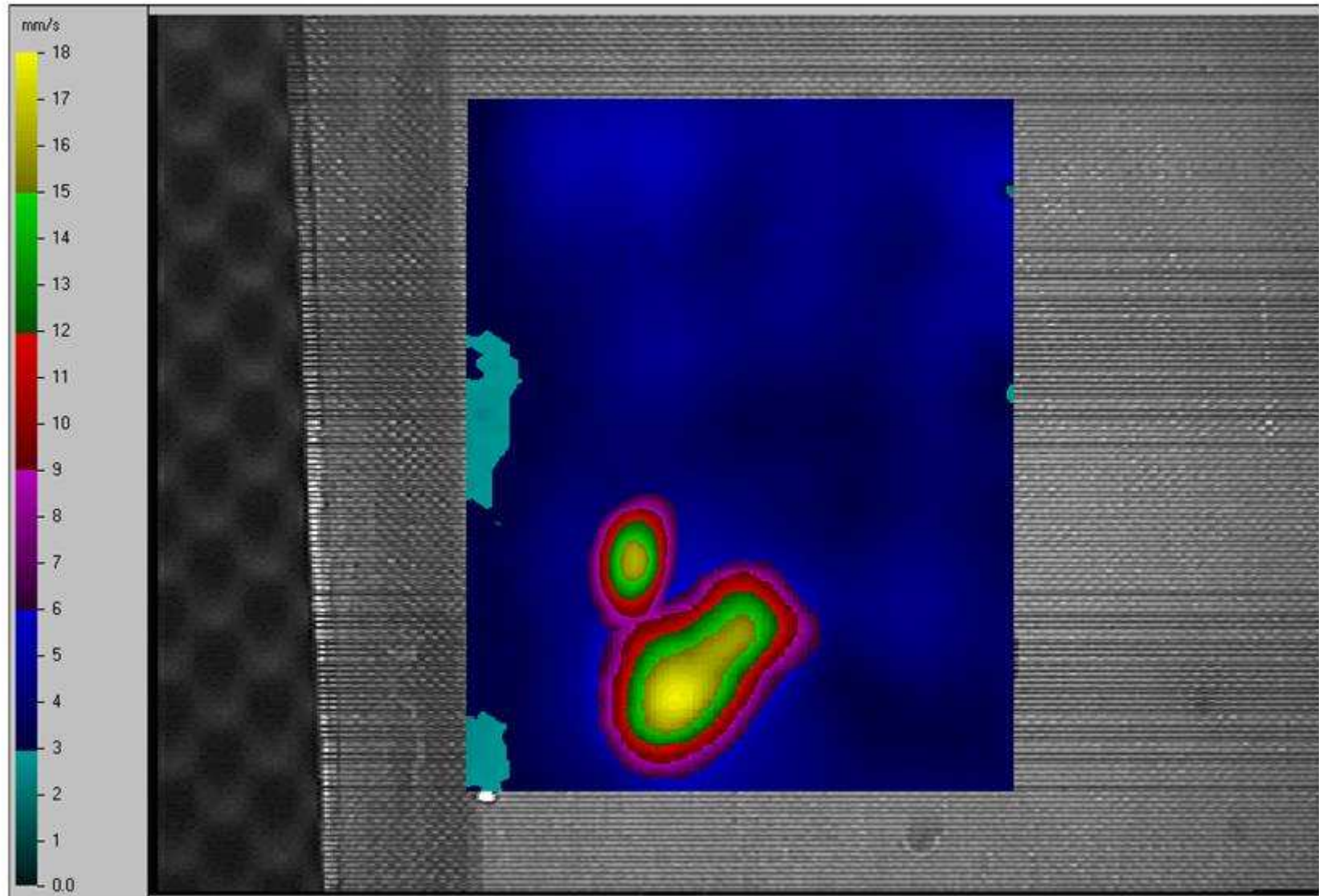


~8 kHz to 9 kHz

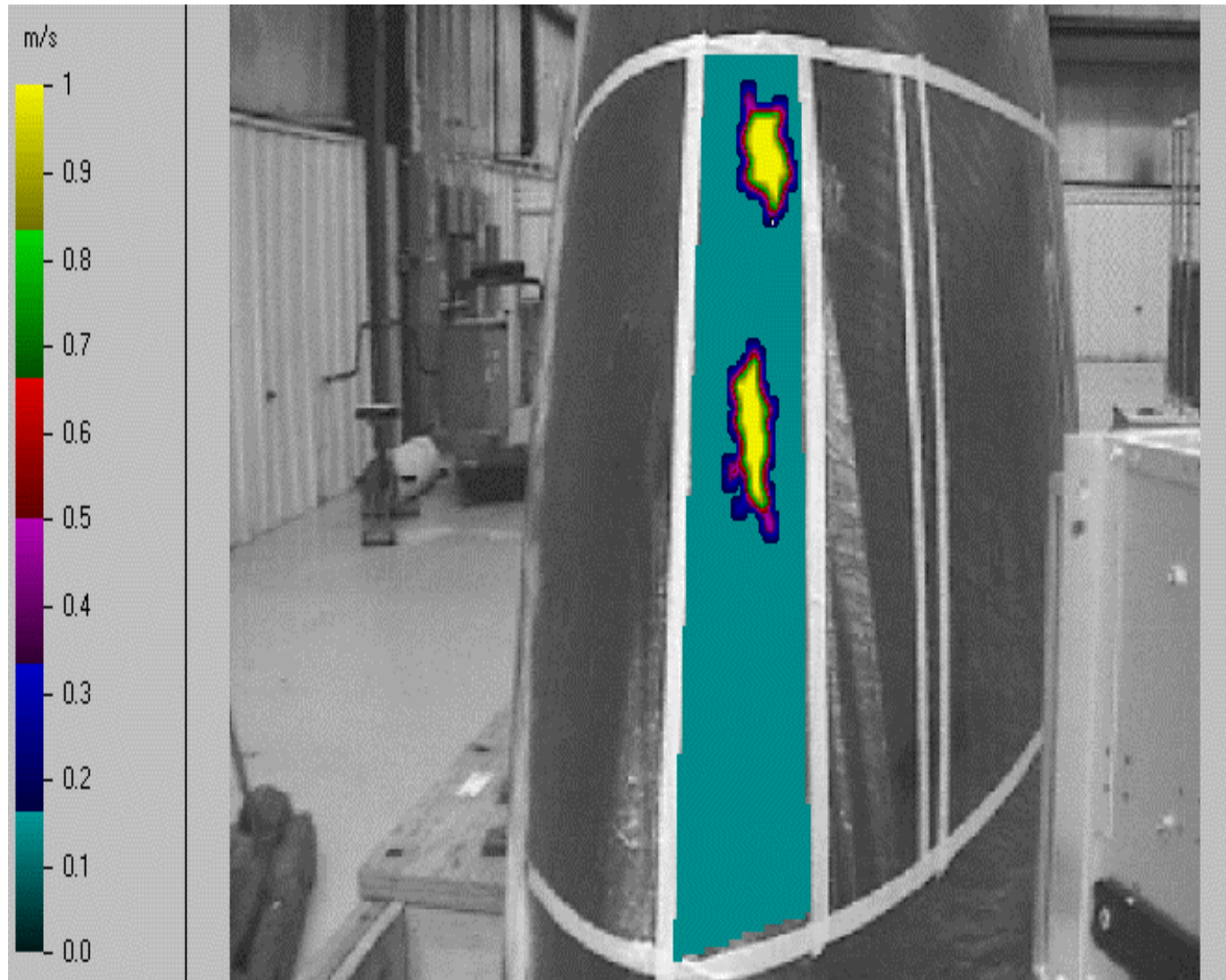


Entire Bandwidth (It does not reveal all defects)

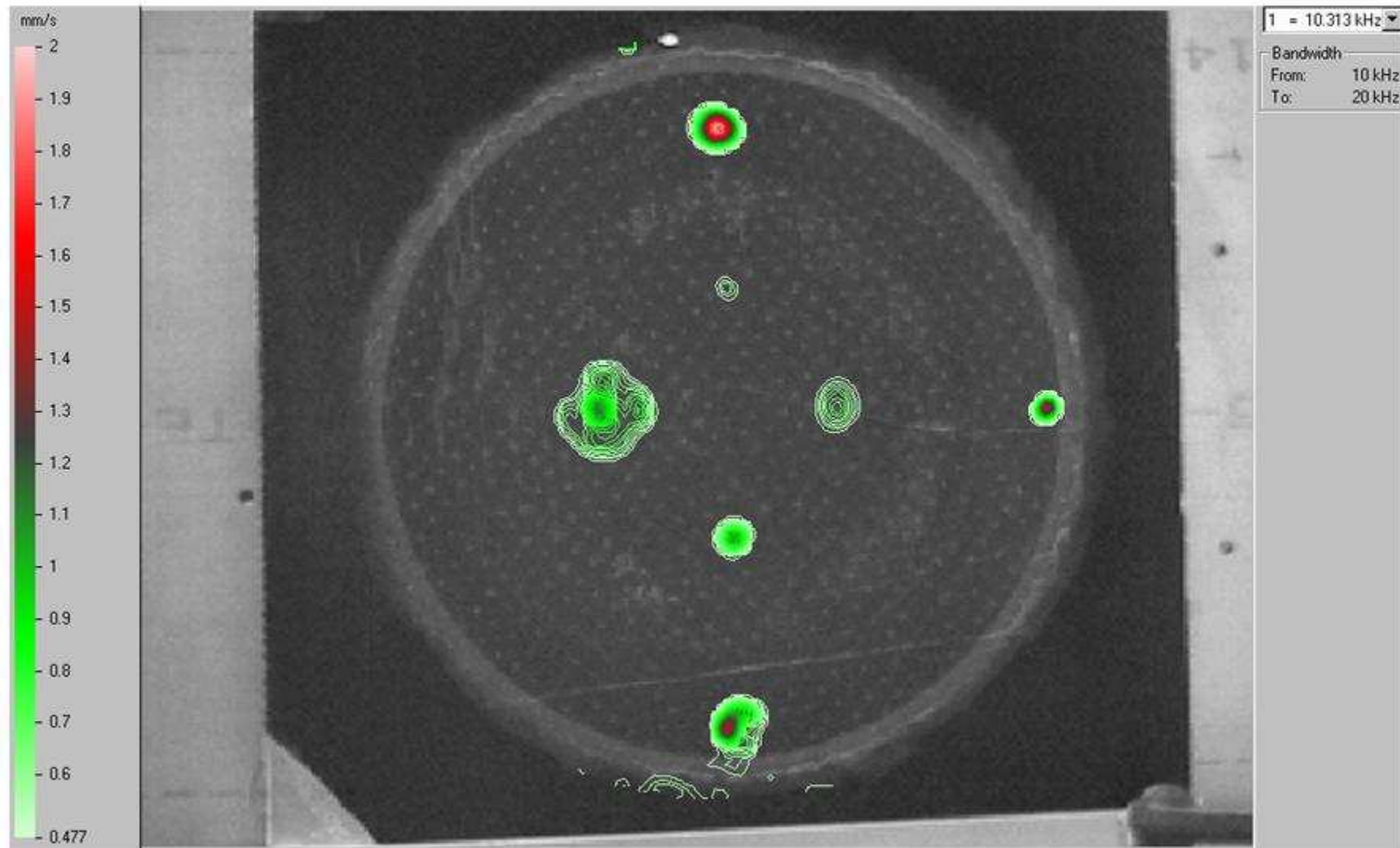
**Optimized final presentation with “Selective RMS”.
This significantly improves shape delineation.**



Inspection of AWAC aircraft radome section

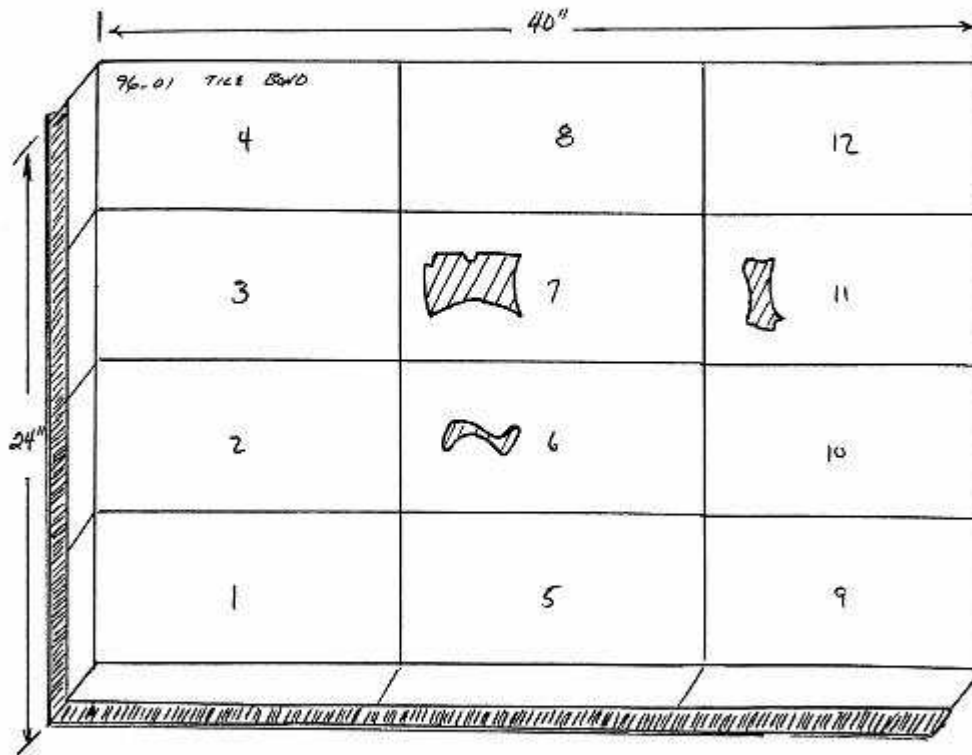


Parametric Repair Panel

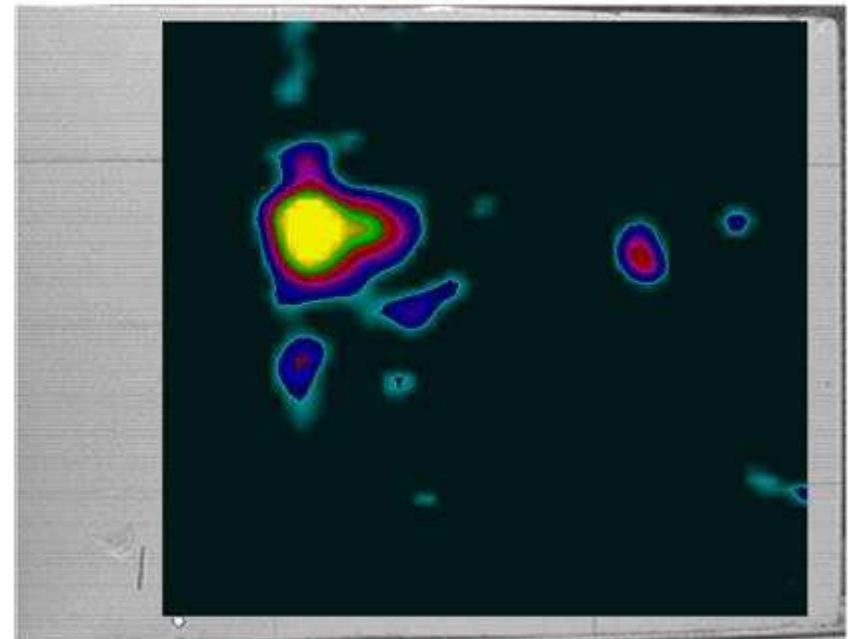


Isoline presentation with image of panel

Local area scan from an array of 12 tiles containing preprogrammed debonds

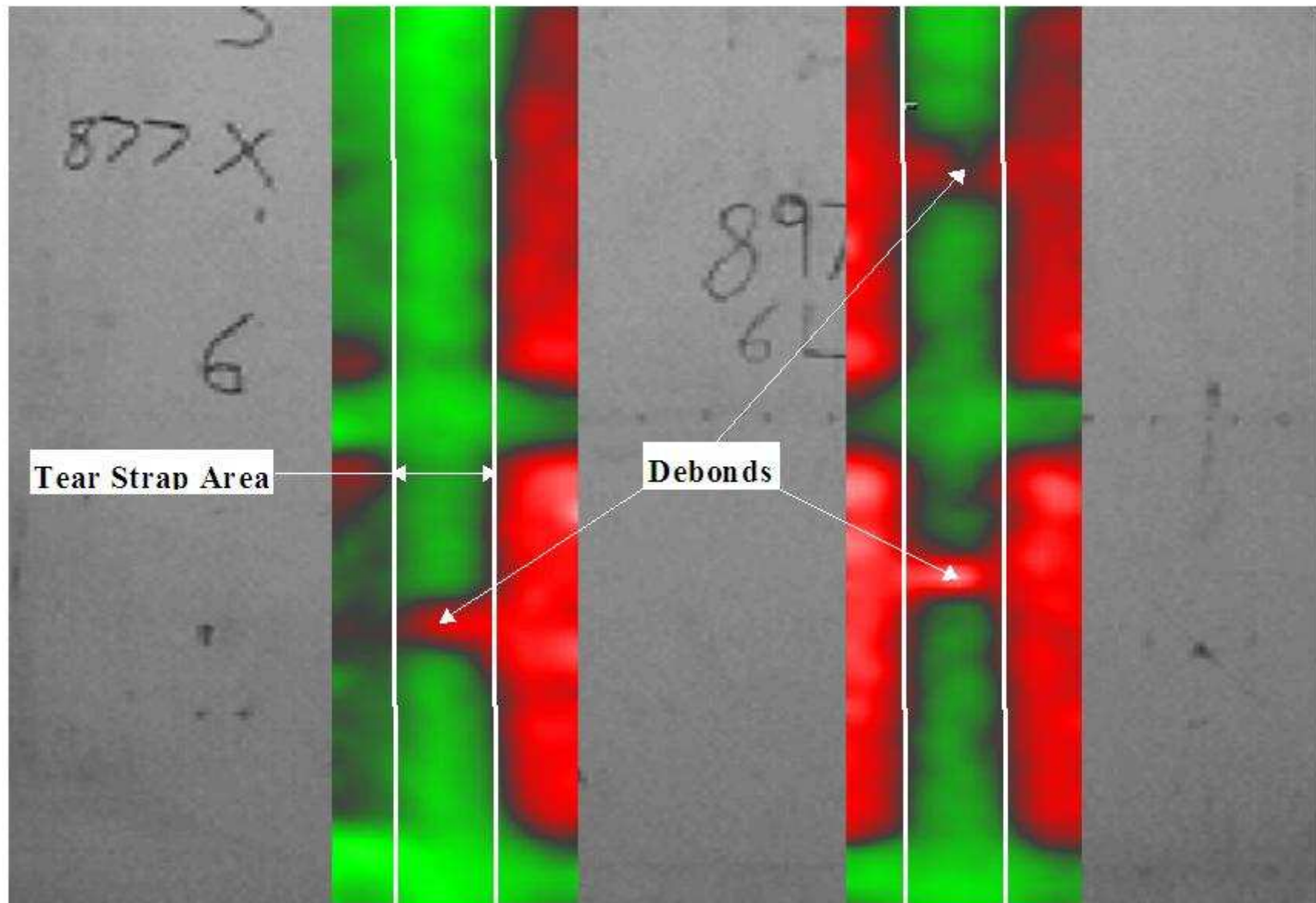


Plan of preprogrammed debonds

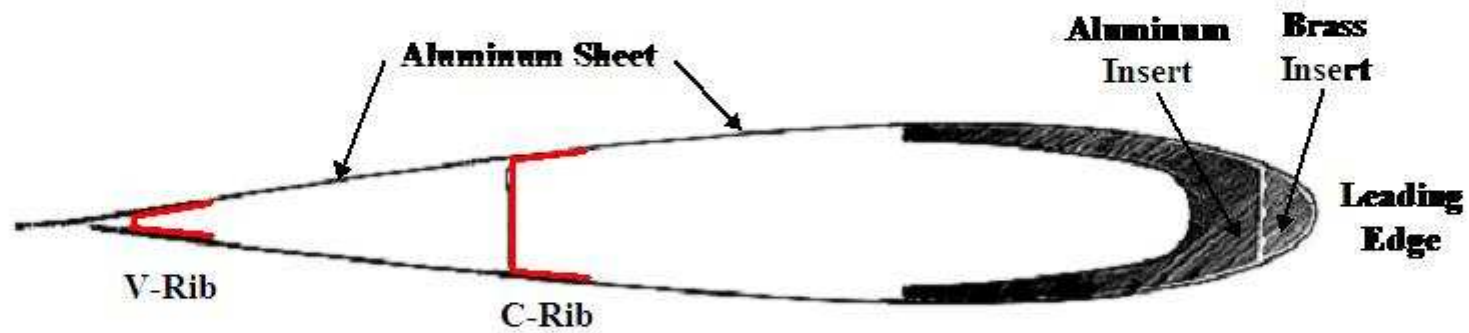


Result of the scan

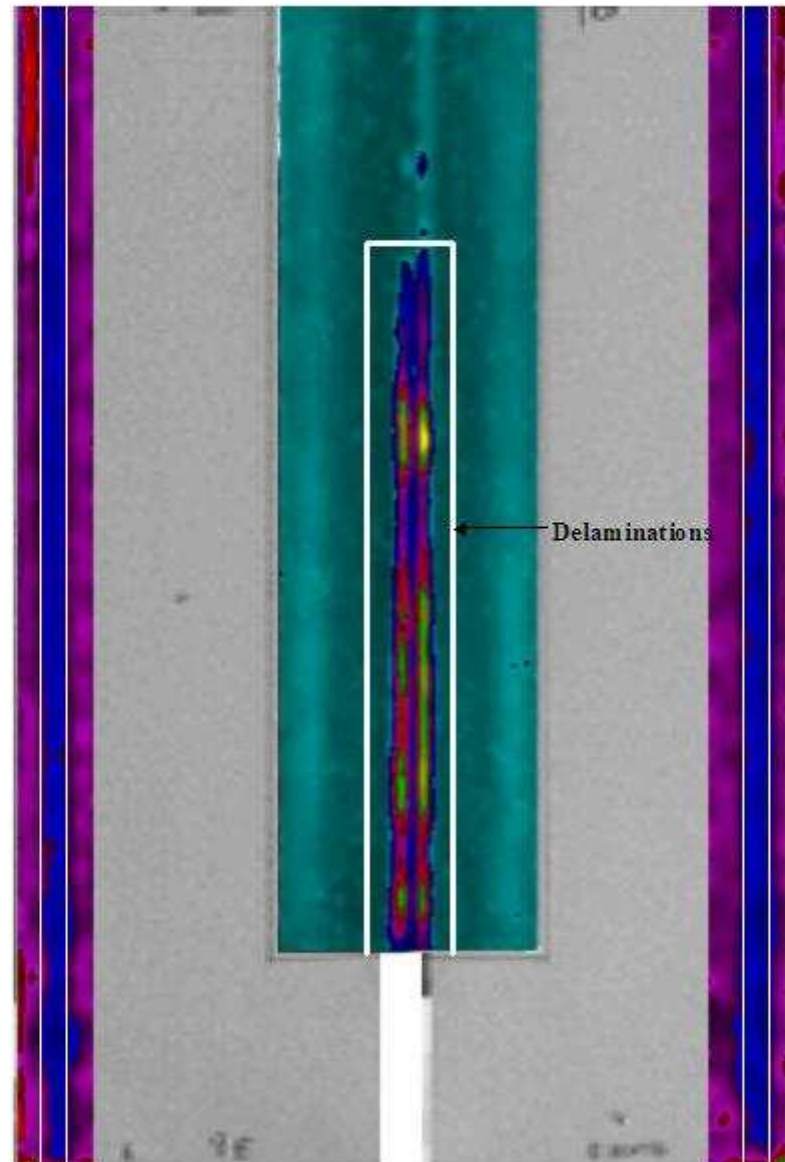
Tear strap debonds in aircraft fuselage



Cross-sectional view of the helicopter blade



Delaminations along the leading edge of a helicopter blade



Future Work

- **Further enhancement of the defect detection software**
- **Characterisation of the defects – obtain depth information**
- **Substantially increase scan speed by using multi-point vibrometer**
- **Improve excitation source**