MULTIX++™

PAUT equipment for high-speed NDT application

FULLY PARALLEL ARCHITECTURE

The MULTIX++™ full parallel architecture provides uncompromised performance. Ideal to optimize inspection speed, MULTIX++ systems are able to drive up to 256 channels in parallel, including beam forming and 2D array probes. Usable directly with its dedicated software or remotely third-party applications.

STANDARD PHASED-ARRAY

MultiX++ systems can perform electronic and/or linear scanning, Full Matrix Capture (FMC), pulse-echo, pitch-catch acquisitions with linear, matrix, TRL, personalized 2D probes and phased array probes with up to 256 elements.

FAST

Natively included in the MultiX++ systems, this inspection mode optimizes parallel firing of multiple apertures (on the same or distinct probes). Ideal for inspection requiring speed and resolution. Moreover, the fastest inspection mode is available: it fires a full aperture in 1 shot and recreates electronic scanning in reception. The time necessary for this process is the time of a single shot. Ideal for inspection of thick structures demanding speed.

SURFACE ADAPTIVE ULTRASOUND

Designed for complex composite structure inspection, the SAUL technique enables the inspection of components with varying geometries (flat, concave, convex surfaces), using a unique configuration. SAUL is a development tool for experienced users aiming to design inspection

SMART

Smart flexible probes, co-designed by CEA and IMASONIC, are phased-array probes (linear or matrix) with a conformable front-face and real-time profilometer. SMART is the M2M software plug-in that handles those probes. SMART provides real-time beam forming taking into account complex surfaces.

Eddyfi Technologies

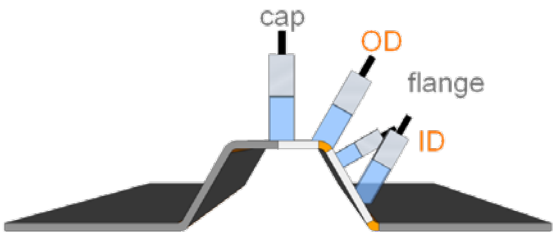
m2m

SURFACE ADAPTIVE ULTRASOUND

Many composite structures encountered in the aerospace industry have complex and variable geometries. Traditional ultrasound NDT requires either specific probes, specific coupling tools for each reference and/or high-resolution surface profilometer tools, making the whole process difficult to automate.

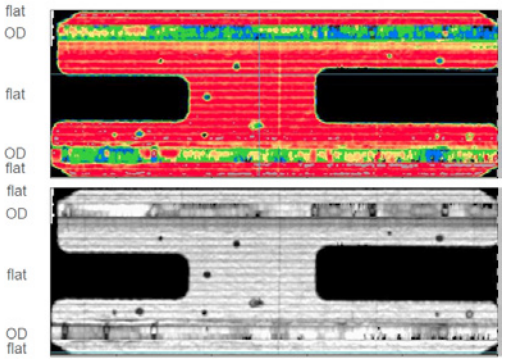
1 PROBE, 1 SOFTWARE, 1 FILE

SAUL is an iterative process that first learns the surface profile and then sends normal-incident waves into the component. The advantage of this technique, is that it can inspect with one probe, different geometries (stringer, radius,...) in a full automated immersion technique. Combined with the parallel architecture of the MultiX++ SAUL enables fast inspection of complex composite components.



REAL-TIME ADAPTIVE TECHNIQUE

SAUL is a real-time adaptive technique implemented for industry by M2M, that adds adaptability to any given phased-array probe.



800+ PART REFERENCES, QUALIFIED BY AIRBUS GOUP

Qualified by Airbus and already used by its subcontractors, SAUL enables the inspection of composite components with curved parts like stringers. Stelia Aerospace Composite, which provides many parts for the Airbus A350, inspects 800 different reference parts with this installation. Combined with robotic systems for part positioning and probe manipulation and software analysis the system can be fully automated to provide a report on the quality of the parts.

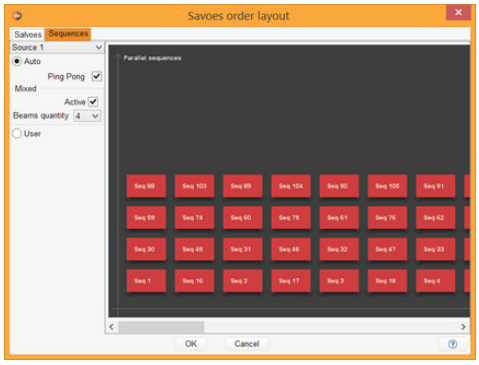
Industrial application ©Stelia Aerospace Composites

FAST MODE

One advantage using a MultiX++ full parallel system is the possibility to fire several apertures simultaneously on one or several probes improving greatly the productivity of an inspection. The fast mode is flash in transmission, then the electronic recontruction in reception is done for super fast mode and low-loss beam resolution.

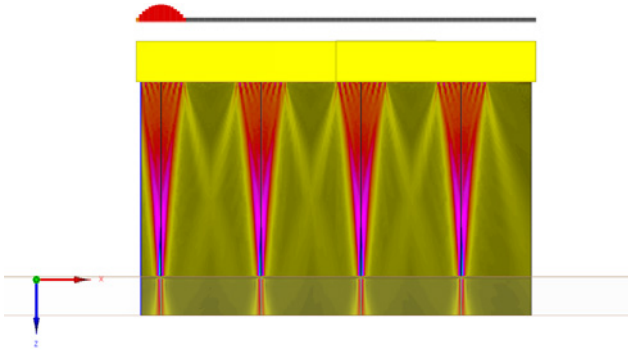
PARALLEL EQUIPMENT

For a 128-element system, up to 4 sub-apertures can be fired in parallel leading to gains in productivity of nearly x4 with no compromise on the resolution.



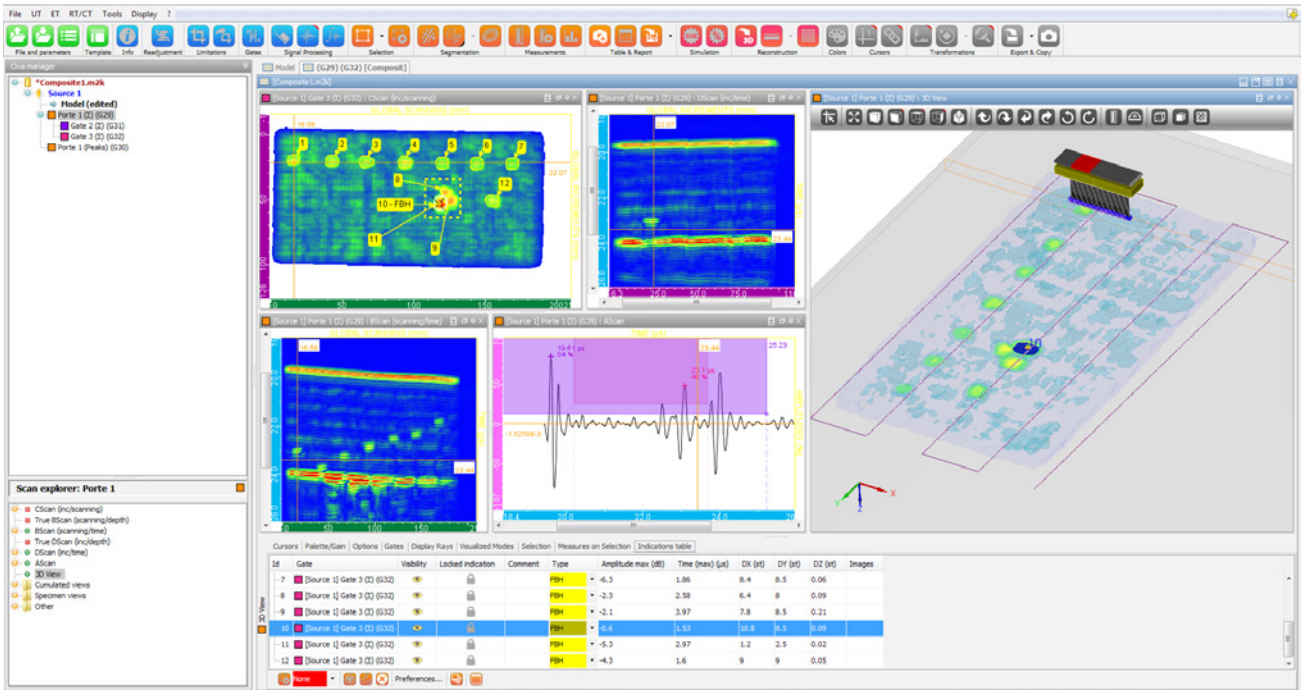
SEVERAL APERTURES FIRED SIMULTANEOUSLY

The following illustration shows the example of four sub-apertures fired simultaneously using the fast mode interface.



INDUSTRIAL APPLICATION FOR HIGH SPEED COMPOSITE INSPECTION

A carbon epoxy plate was inspected with a MultiX++ system using the new Multi2000 V8 version. Thanks to the parallel architecture of the MultiX++, two sub-apertures were fired in parallel with a 64-element probe. A substantial improvement (x2) of the inspection speed, up to 400mm/s, has been obtained with a pixel resolution of 0.5x0.5mm, including full A-Scan storage. Multi2000 V8 is linked directly to CIVA Analysis for powerful post-processing, analysis and 3D visualization of defects.



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SPECIFICATIONS

GENERAL	
32, 64, 128: L x W x H: 236 mm x 376 mm x 266 mm	256: L x W x H: 342 mm x 376 mm x 266 mm
Weight: ~9.5 kg	Weight: ~13 kg

ACQUISITION	
Hardware acquisition gates, software gates, synchronization of gates	Choice of data (e.g., RF, peaks, elementary A-Scan), real-time imaging, user-specified configuration
Acquisition trigger on event (threshold, echo, etc.), acquisition on user-specified trigger (e.g., time, coder)	Public file format for parameters (XML) and data (binary), max. data flow 30 MB/s

PHASED-ARRAY	
Customized focusing, electronic scanning, sectorial scanning, full matrix capture (FMC)	2GB hardware RAM (enabling fast multiplexing)
Pulse-echo and transmit-receive modes, DDF with dynamic aperture	Corrected images (e.g., sectorial B-Scan, C-Scan)

PULSERS	
Adjustable voltage: 30 to 200V with 1V step	Rise time < 10 ns (200V, 50 Ω)
Negative rectangular pulse	Max. PRF: 30 KHz
Adjustable width: 20 ns to 1280 ns, step of 2.5 ns	

RECEIVERS	
Bandwidth: 0.8 to 20MHz	Max. input signal amplitude: 0.8 Vpp
Adjustable gain on each channel from 0 to 80 dB	Adjustable analog DAC on 80 dB (max. 40 dB/µs) synchronized on events
Cross-talk between two channels > 50 dB	

DIGITIZER	
Digitizing and real-time summation on 32-channel boards	Range: 16 bits
Max. sampling frequency: 100 MHz (adjustable from 100 MHz to 6.6 MHz)	FIR filters
Global delay: 0 up to 1.6 ms, step of 10 ns	Input impedance: 50 Ω
Delay-laws at transmission/reception: 0 to 20 µs, step of 2.5 ns	Digitizing depth: up to 50,000 samples (16,000 samples max. per elementary channel)

HARDWARE / FIRMWARE CONFIGURATION	
Parallel summations for fast data acquisition / beam forming	FPGA on CPU-board
Parallel architecture: 32-, 64-, 128-, and 256-channel systems are available	Windows-based PC, USB2 link between Hardware and PC (desktop or laptop)

SOFTWARE	
CIVA subset into Multi2000 software, complete description of the inspection configuration	Focal-laws and associated ultrasonic field computation
Compatibility with CIVA, NDT kit / ULTIS	Windows-based PC, USB2 link between Hardware and PC (desktop or laptop)

I/O		
32: 1 Hypertronix connector	64,128: 2 Hypertronix connectors	256: 4 Hypertronix
8 encoders input, 31 analog input + 1 synchro output		8 analog outputs, 2 open collector, 1 I/O synchro,1 USB2
2 switch, 4 TTL inputs, 4 TTL outputs		16 analog inputs, 4 LEMO connectors (type 00) (up to 8 optional)

Eddyfi Technologies

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