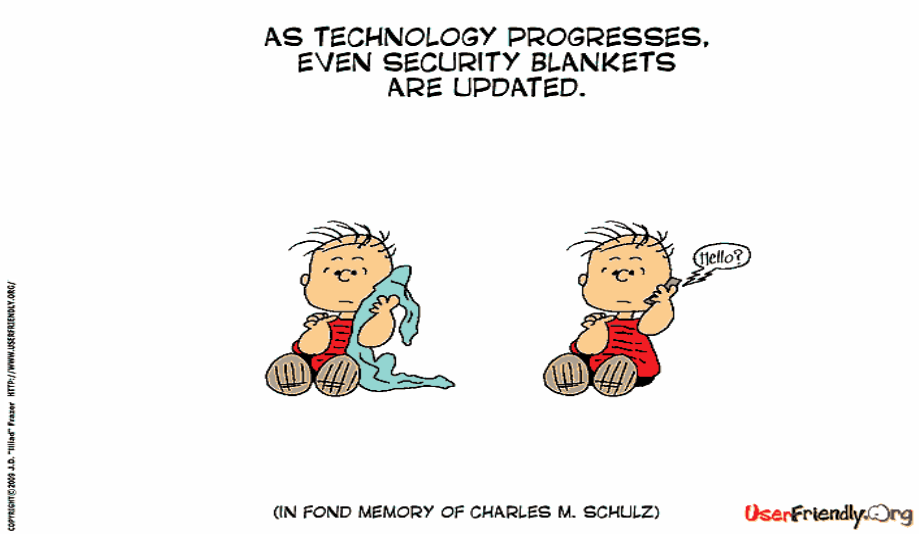
User Friendly NDE Phased Array



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iii. Technology to the Rescue: The past to the present.

iv. Analogue to Digital

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The Challenge

- A challenge for Ultrasound manufacturers, designers and development teams has been keeping Phased Array equipment easy to use. As technology advances, operators have access to more information, more views and more settings. Therefore it is the utmost importance to keep the user interface simple and easy to use.
- Phased Array (PA) ultrasonics is an advanced method of ultrasonic non destructive testing which can be used in any application environment where traditional ultrasonic flaw detectors can be used. It is a powerful NDT technology and one that is growing rapidly, nonetheless it can seem extremely complex to the untrained eye and to anyone not familiar with ultrasonics. So, how has this highly advance, complex form of NDT Testing become User Friendly?

User Friendly

- What makes a Phased Array system considered to be “User Friendly”?

First lets define User Friendly

User Friendly : “Something that is easy to use, *operate*, and understand”

Therefore a “User Friendly” phased array unit is one that the UT technician finds easy to use, operate and understand. A unit that is portable, intuitive, simple, adaptable and capable. Remember this is relative to the fact that the USER understands ultrasonics and phased array ultrasonics.

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Past	Present

Aloka's first linear array scanner, 1976

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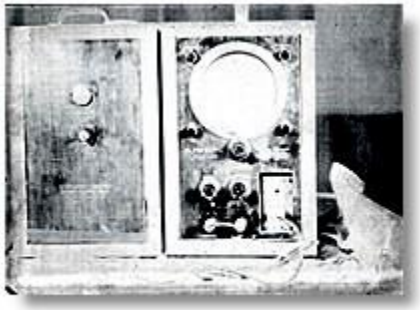
Technology to the Rescue

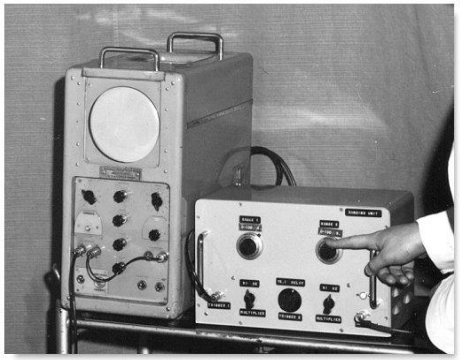
- Technology has come to the rescue in the form of portable phased array ultrasonics with user friendly interfaces, views and features.
- Phased array ultrasonic instrumentation has been around as early as the late 1950s and the beginning of the 1960s, but was restricted to the medical industry in the early days. In the later 1980s and early 1990s, the technology was embraced by a few manufacturers in the nondestructive testing (NDT) industry. Early versions were usually large and software was not exactly **user-friendly**.

Early Versions of UT & PA Scopes from the 40's, 50's & 60's



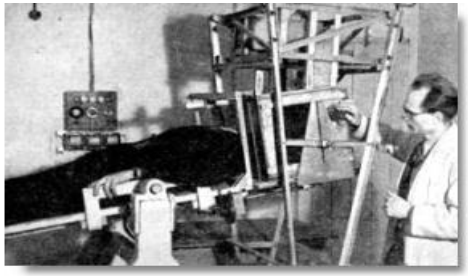
Ludwig's A-mode apparatus in his gallstone experiments

The early B-scan with the bistable oscilloscope **



Metal flaw detector in use **
(Kretztechnik, Austria)

B-mode scanner produced at Wuhan, China in the early 1960s

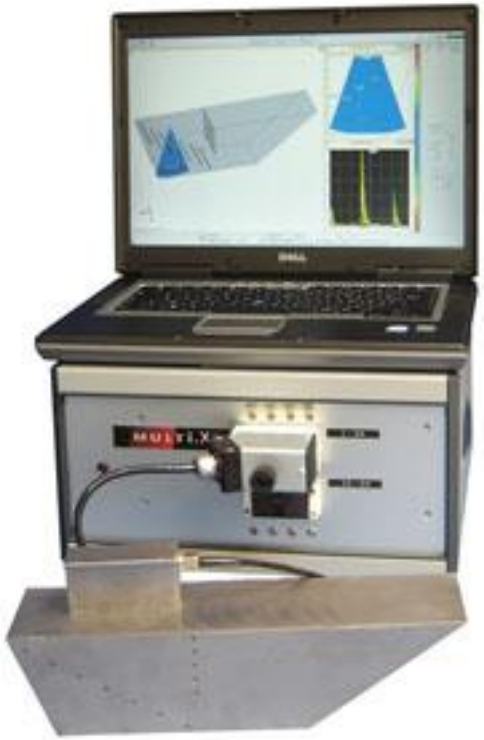


Dussik and his ultrasonic apparatus in 1946

Scopes from the 70's, 80's and 90's

Ultrasound and Phased Array Testing equipment has become portable and more technically advanced as each decade has passed.

Multiscan system from Organon Teknika, 1972



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- By the end of the 1990s and early 2000's, battery-powered phased array instruments for industrial use appeared. Reductions in the price of portable PA instruments have provided broader access to the technology. An increase in Phased Array manufacturers has also decreased PA instrument pricing and increased technical advancement. Analogue designs had required power and space to create the multi-channel configurations necessary for beam steering, but the transition into the digital world and the rapid development of inexpensive embedded microprocessors enabled more rapid development of the next generation phased array equipment.

- The availability of low power electronic components, better power-saving architectures, and industry-wide use of surface mount board design led to miniaturization of this advanced technology. This resulted in phased array tools which allowed electronic setup, data processing, display and analysis all within a portable device, and so the doors were opened to more widespread use across the industrial sector. This in turn drove the ability to specify standard phased array probes for common applications. Miniaturizing the PA unit allowed for advanced smaller components to be integrated in the units, making them more advanced.

The Switch from Analogue to Digital

Advancing from analogue technology to digital technology has made ultrasound equipment easier to operate and use. Digital technology has made functionality and imaging easier to understand.

Digital array-based technology simplifies most inspection by improving accessibility and reducing the number of scans required, at the same time providing intuitive real-time images. Hence, the overall transition of the ultrasonic NDT equipment market to digital array-based technology is a significant trend being observed.

The User Interface

The main feature that renders todays phased array systems easier to operate and understand, is the units user interface. An example of a user interface on todays PA units is one that controls displays, like a menu driven interface. The PA user is able to control the software applications or PA hardware devices. The user interface is so beneficial and reliable, it provides a “user friendly” experience allowing the user to interact in a natural and intuitive way.

The software programs on PA systems have graphical user interfaces or GUI’s. These programs have graphical controls which the operator can select using a mouse or keyboard. These types of interface allows users to interact with electronic devices through graphical icons & visual indicators. GUI’s include menu bars, tool bars, windows buttons, controls and icons.

There are command-driven interface where commands are entered. A menu-driven interface where a user can select command choices from various menus displayed on a screen.

Hardware devices with user interface usually consists of a software & hardware combination.

GUI User Interface

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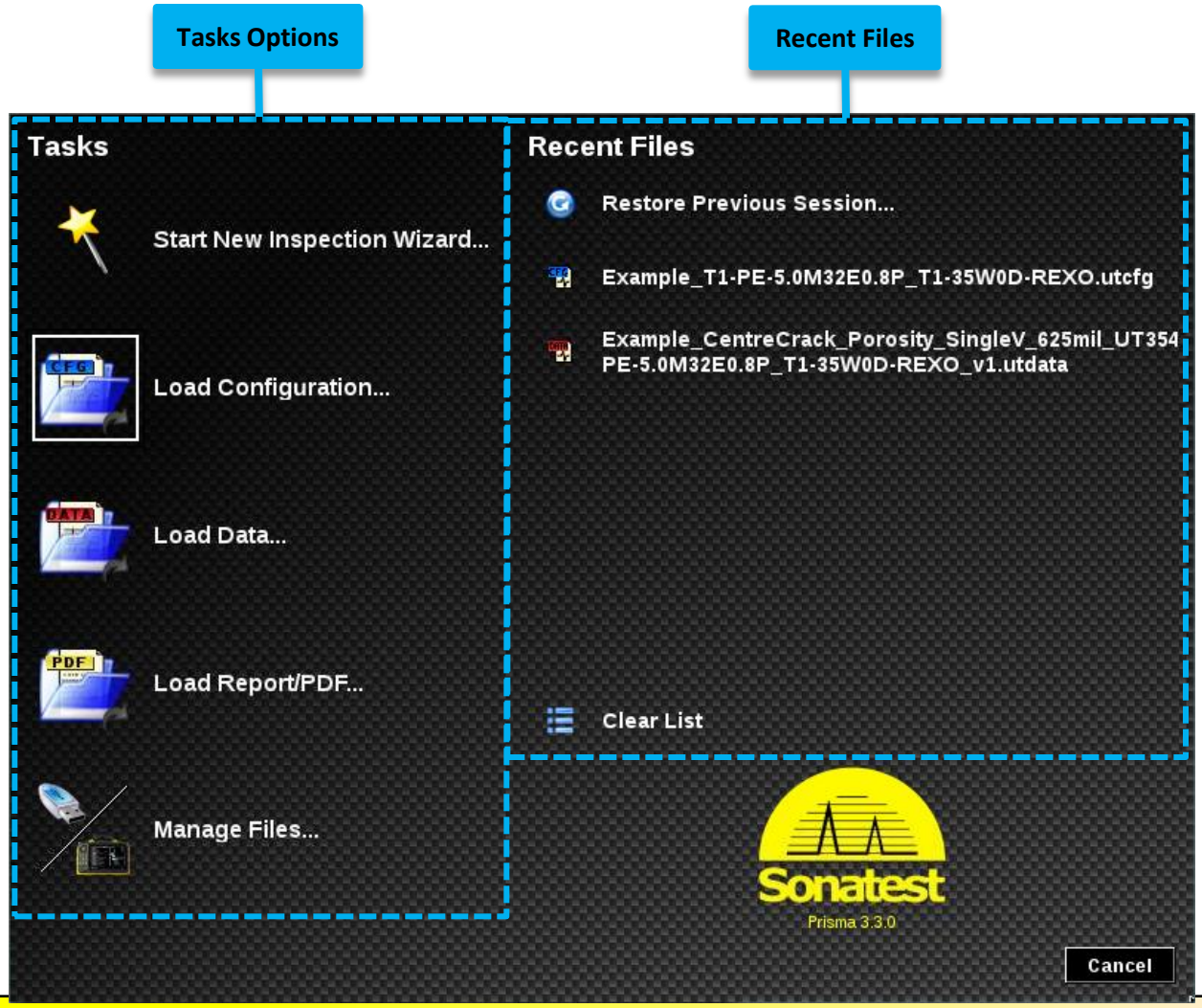
User Interface – Example of a Booting Menu



Simplified Control Keys

Click Wheel With Real Switches

Main *Control Keys*

9-key Keypad Numeric and Shortcuts

"VCR" modes: Play/Pause, Stop, Record

Files: Configs, Reports, Screen Caps

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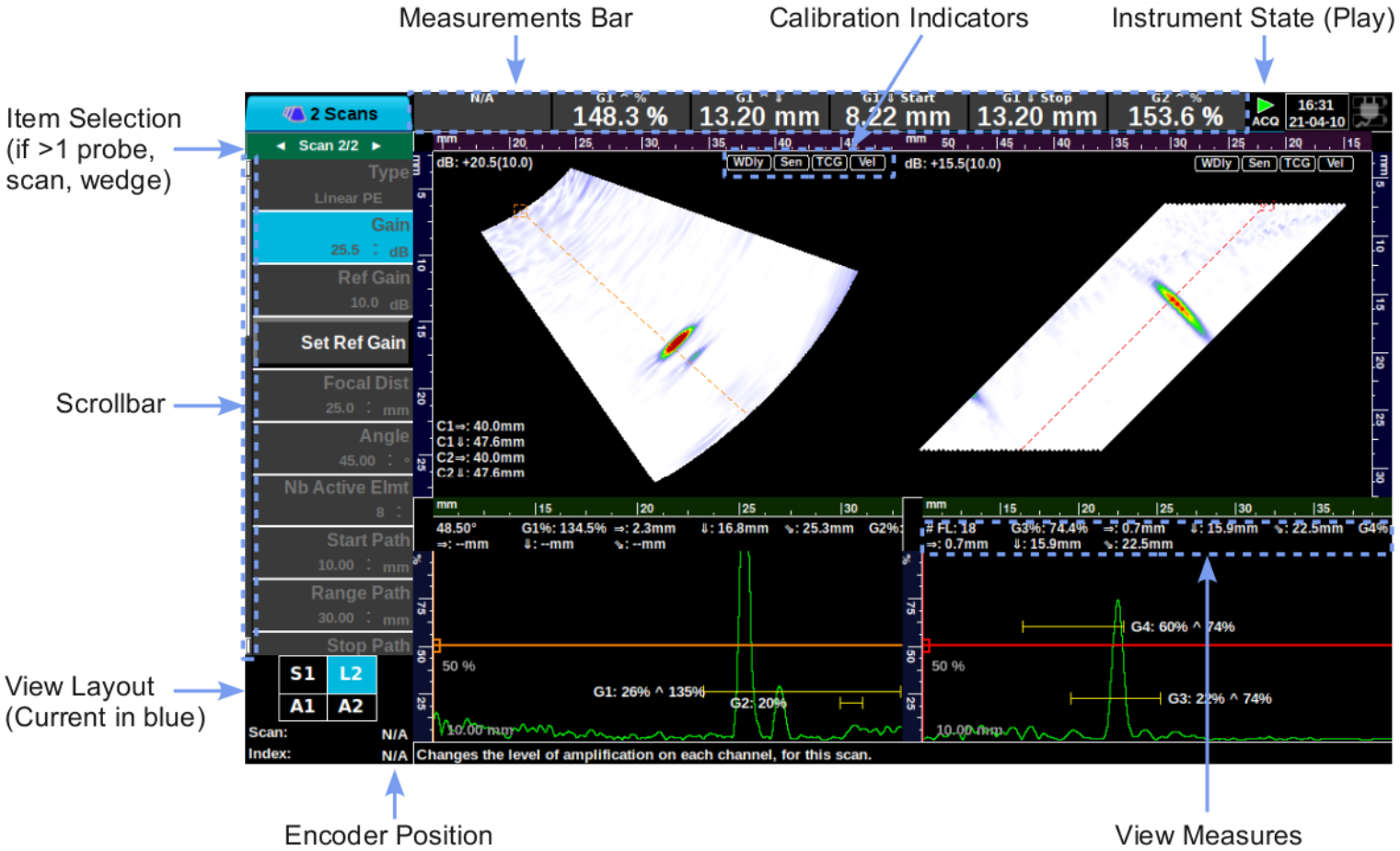
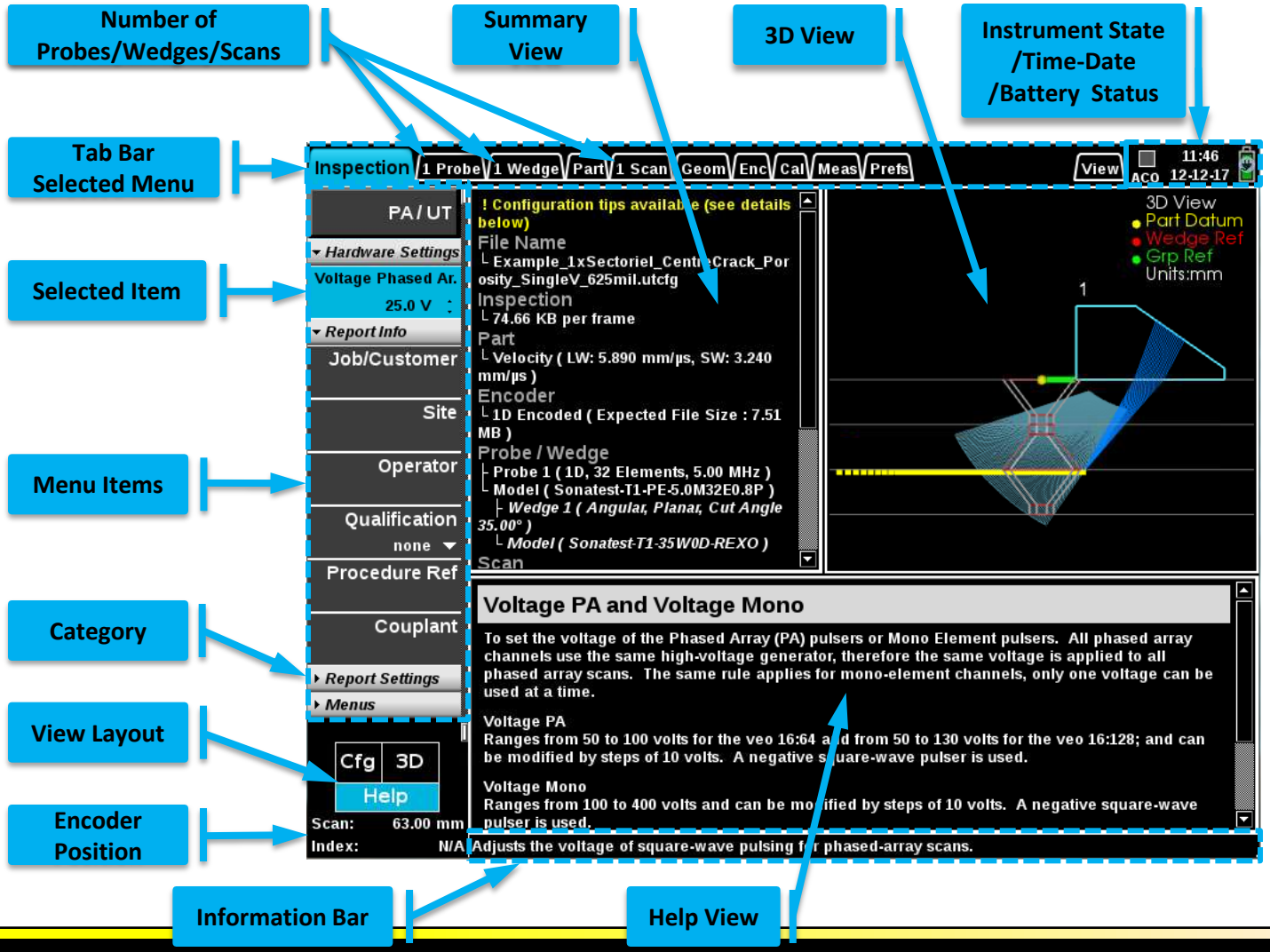
User Interface – Play Mode (acquisition)



User Interface – Stop mode (configuration)



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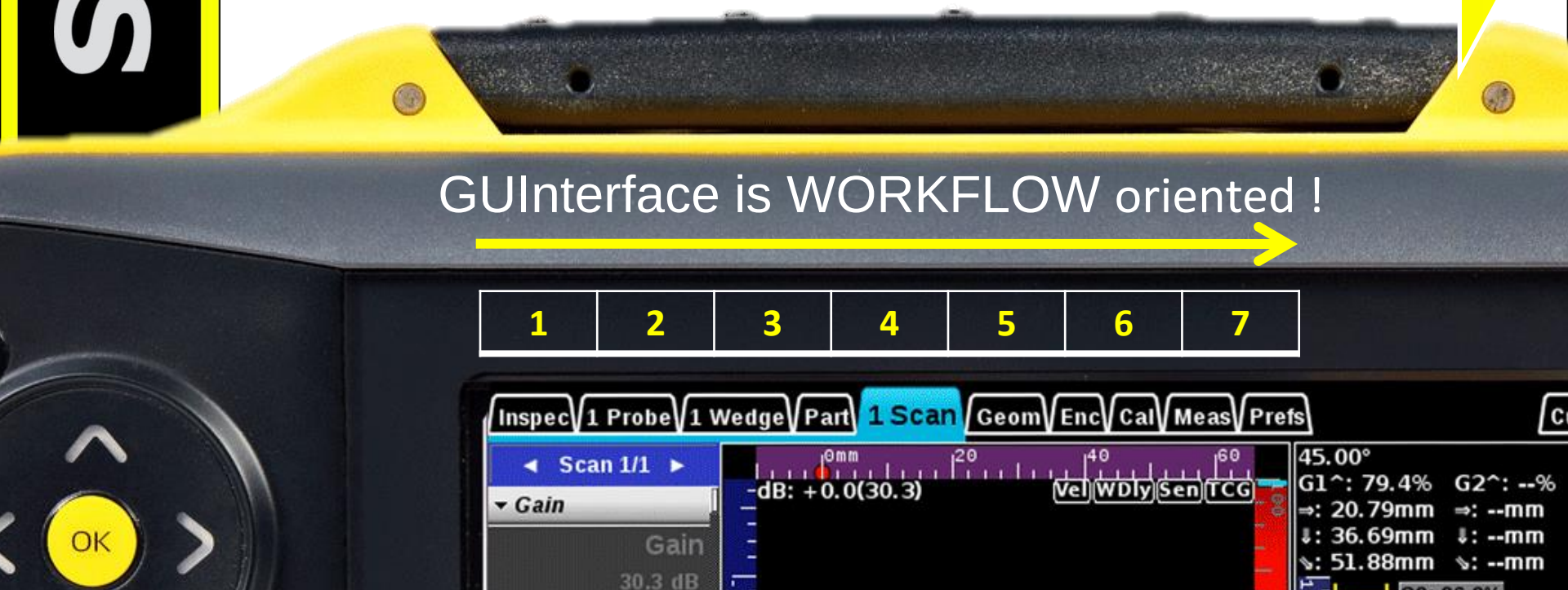
User Interface helps ease the creation of a New Phased Array Setup
Setup Workflow

The user interface has been designed to match the workflow described below. (From left to right as we usually read!)

1. Define inspection parameters	2. Choose probe and wedge	3. Define the part parameters	4. Define scan plan settings	5. Define geometry of probe & parts	6. Set up encoders settings	7. Calibrate + inspect!

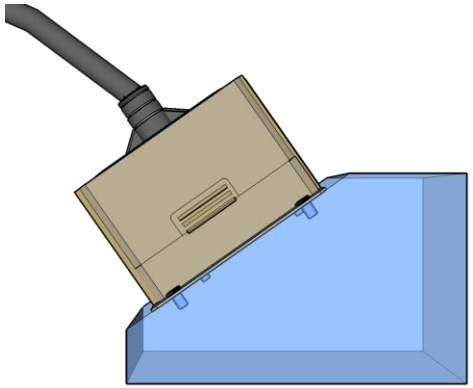


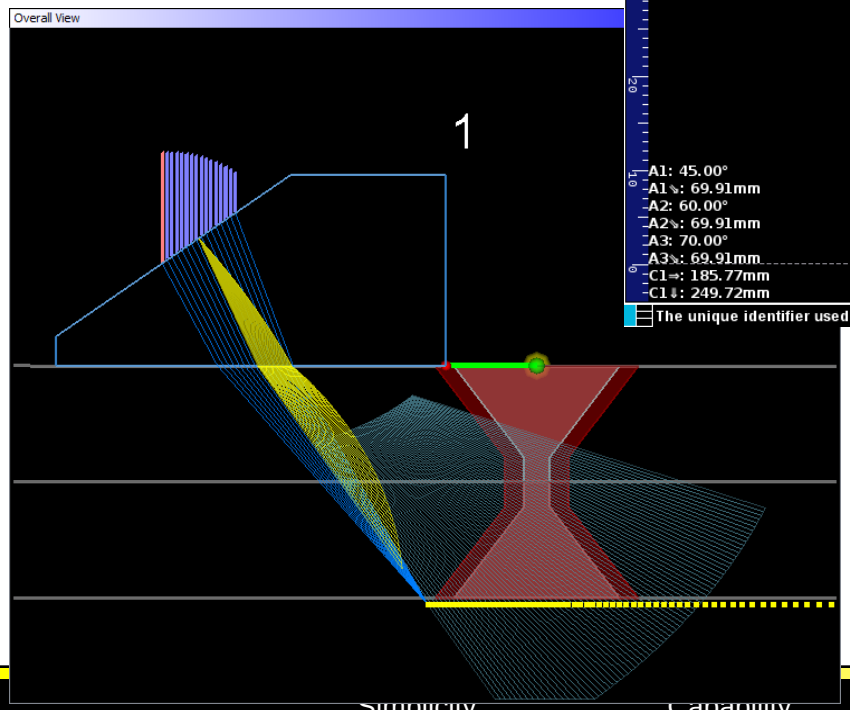
Easy to understand: assisting the operator

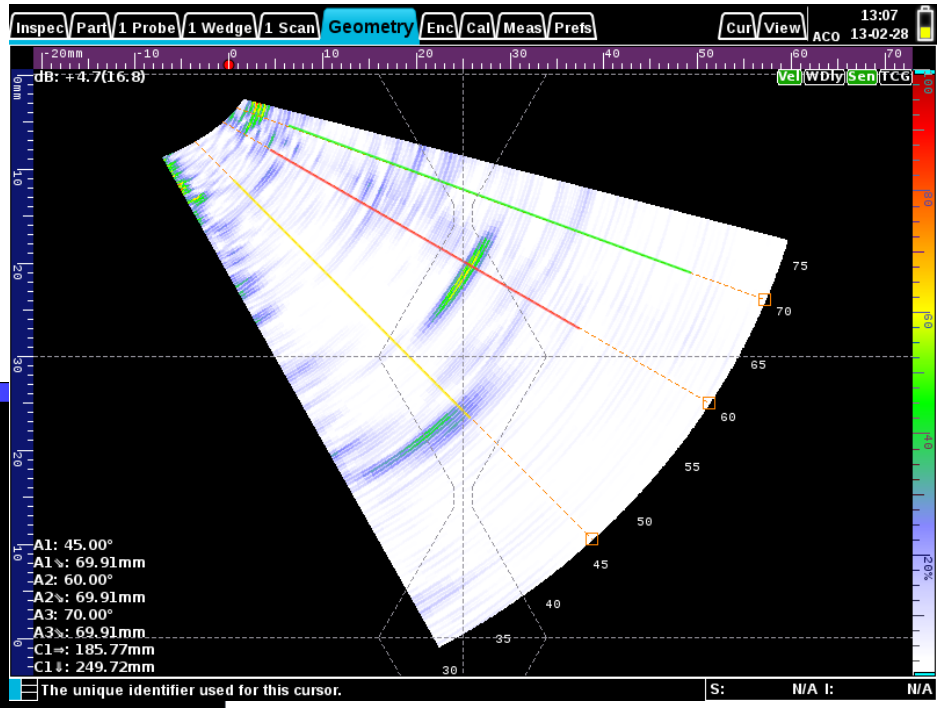
- **Full User Manual is on-board**

- **French and German languages**

Easy to Understand Phased Array Ultrasonic Testing







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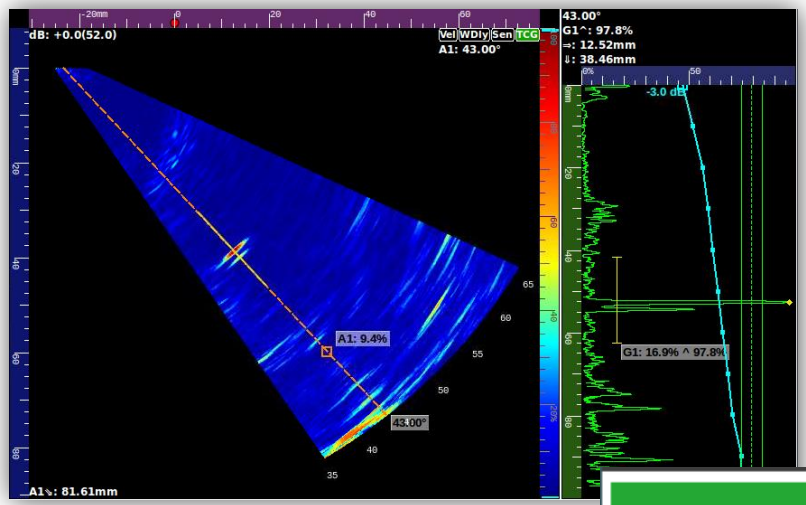
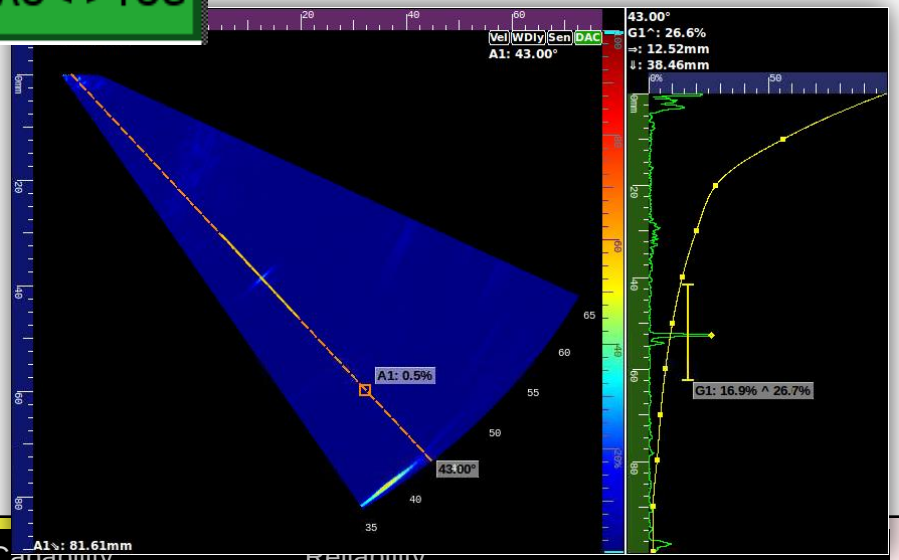
Creating a New Phased Array Setup

The Ease of Converting the TCG to DAC to TCG



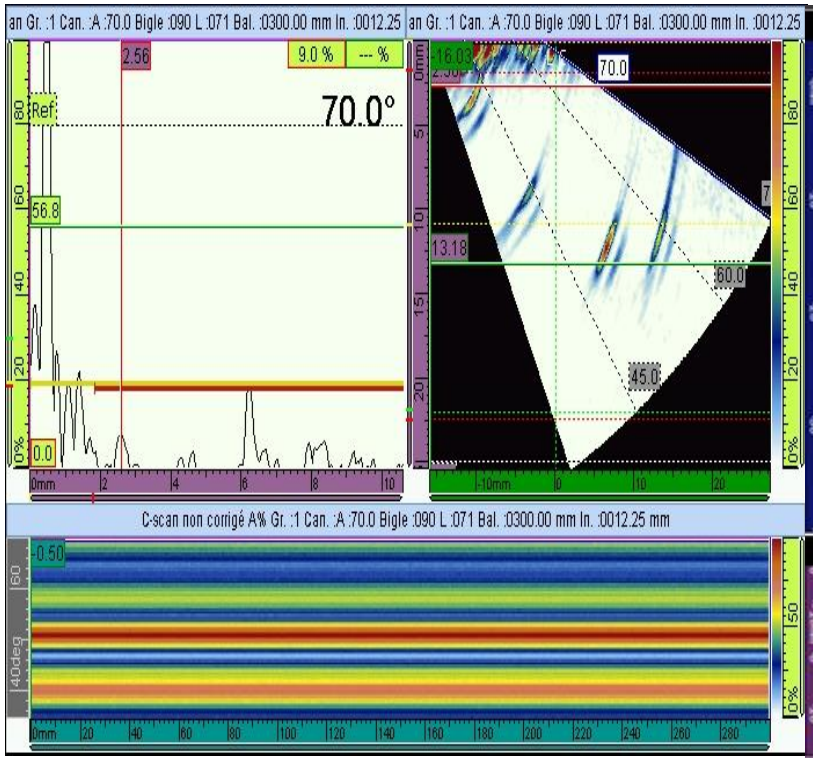
TCG to DAC

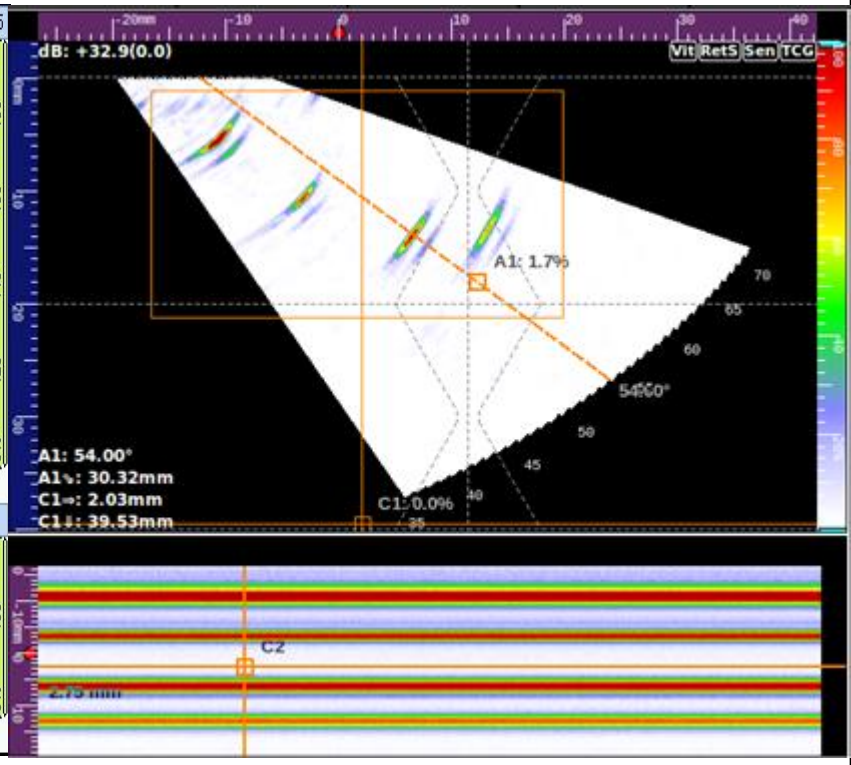
DAC <-> TCG



DAC to TCG

User Friendly Views that make it easier to understand what you are seeing Top views and C-Scans





Omniscan: 3 Indications in C-Scan

VEO: 4 Indications in top view

Onboard 3D ray tracing toolset

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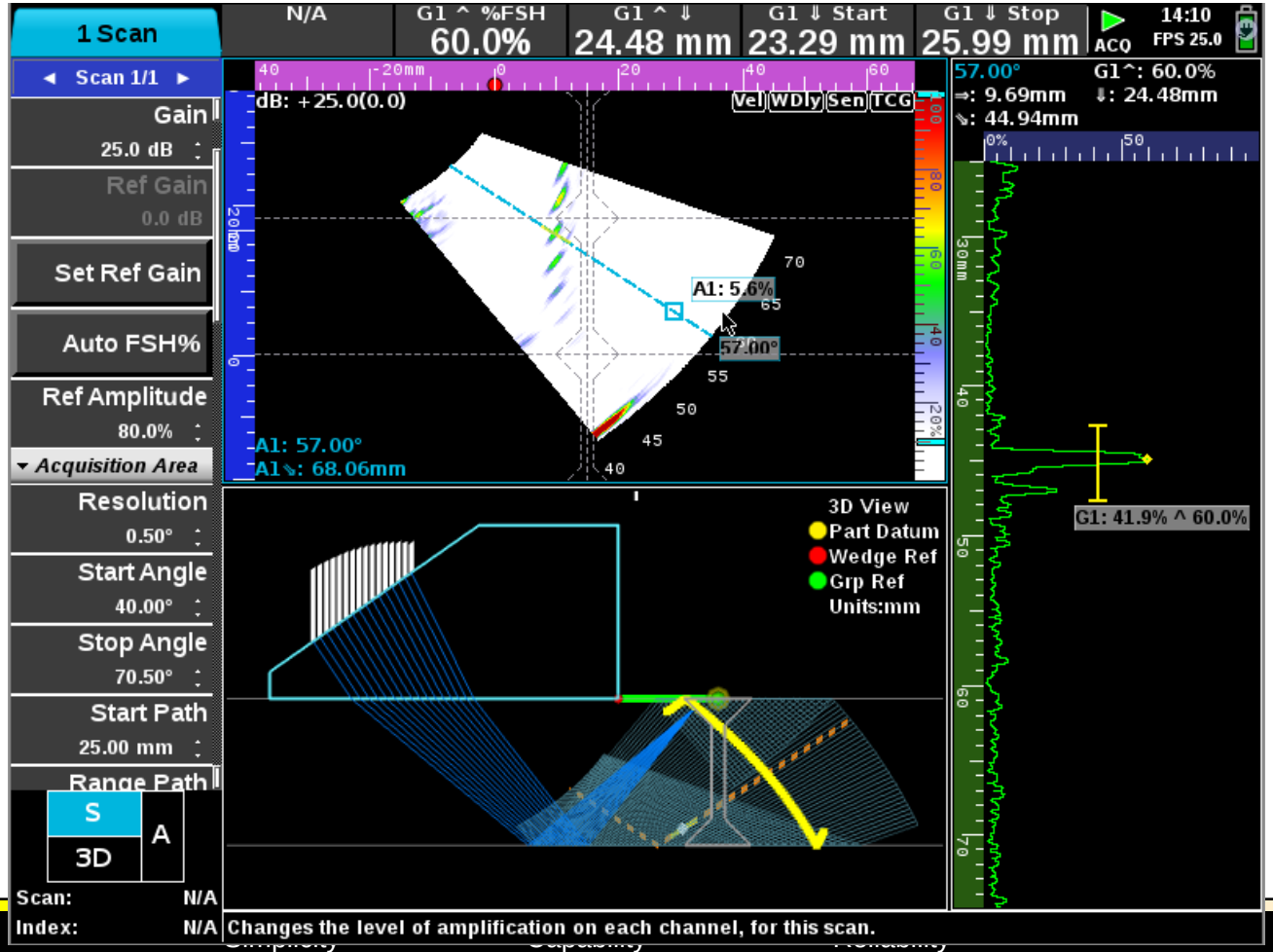
Ease of Creating a New Phased Array Setup

Choosing a layout with live 3D view

Some layout have a live defect rendering in 3D view during the inspection.



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Useful tool to create New Phased Array Setup with the live 3D view

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prisma veo

VALIDATE

ENCODING AREA PLAN

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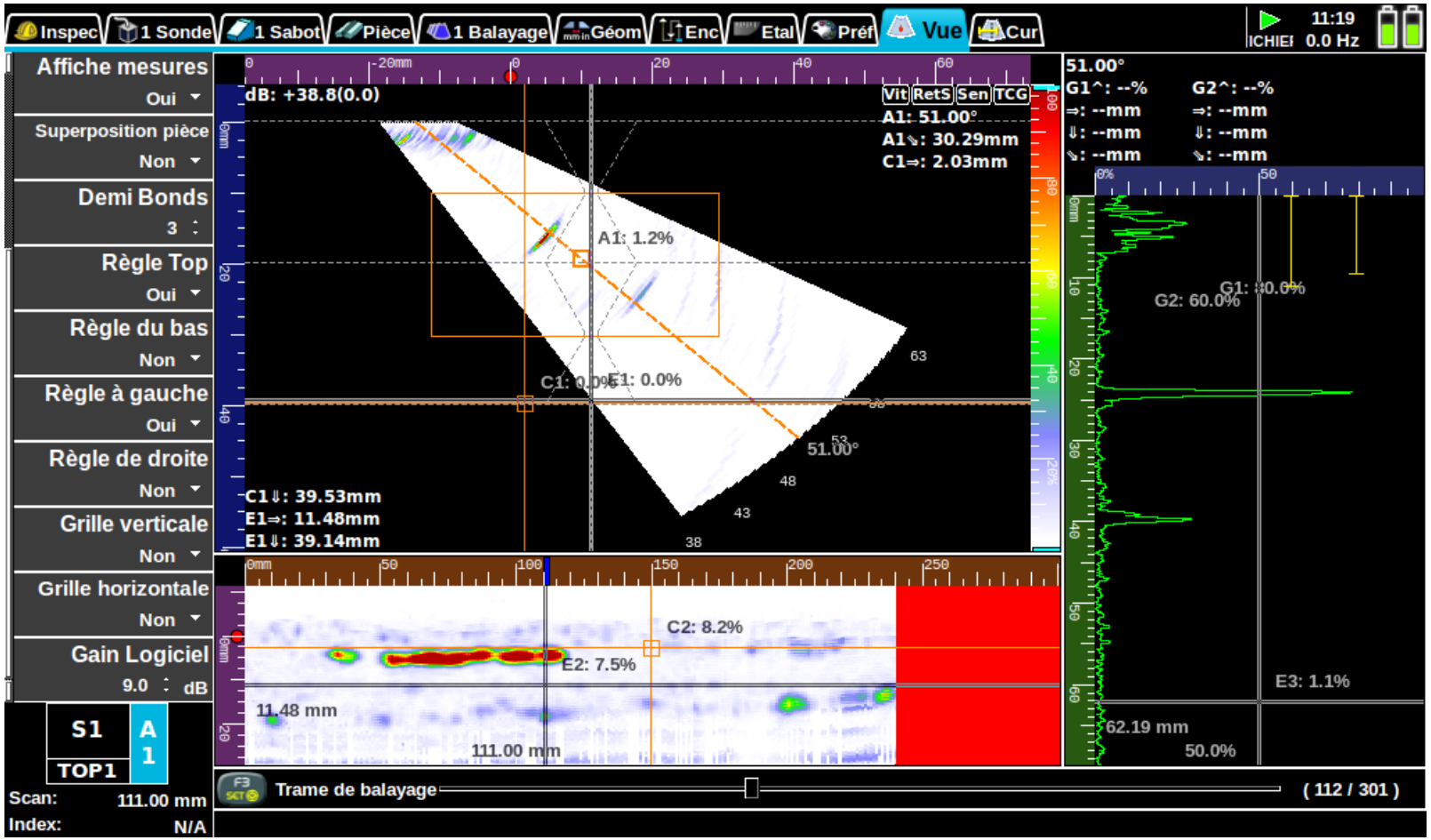
Top views and C-Scans



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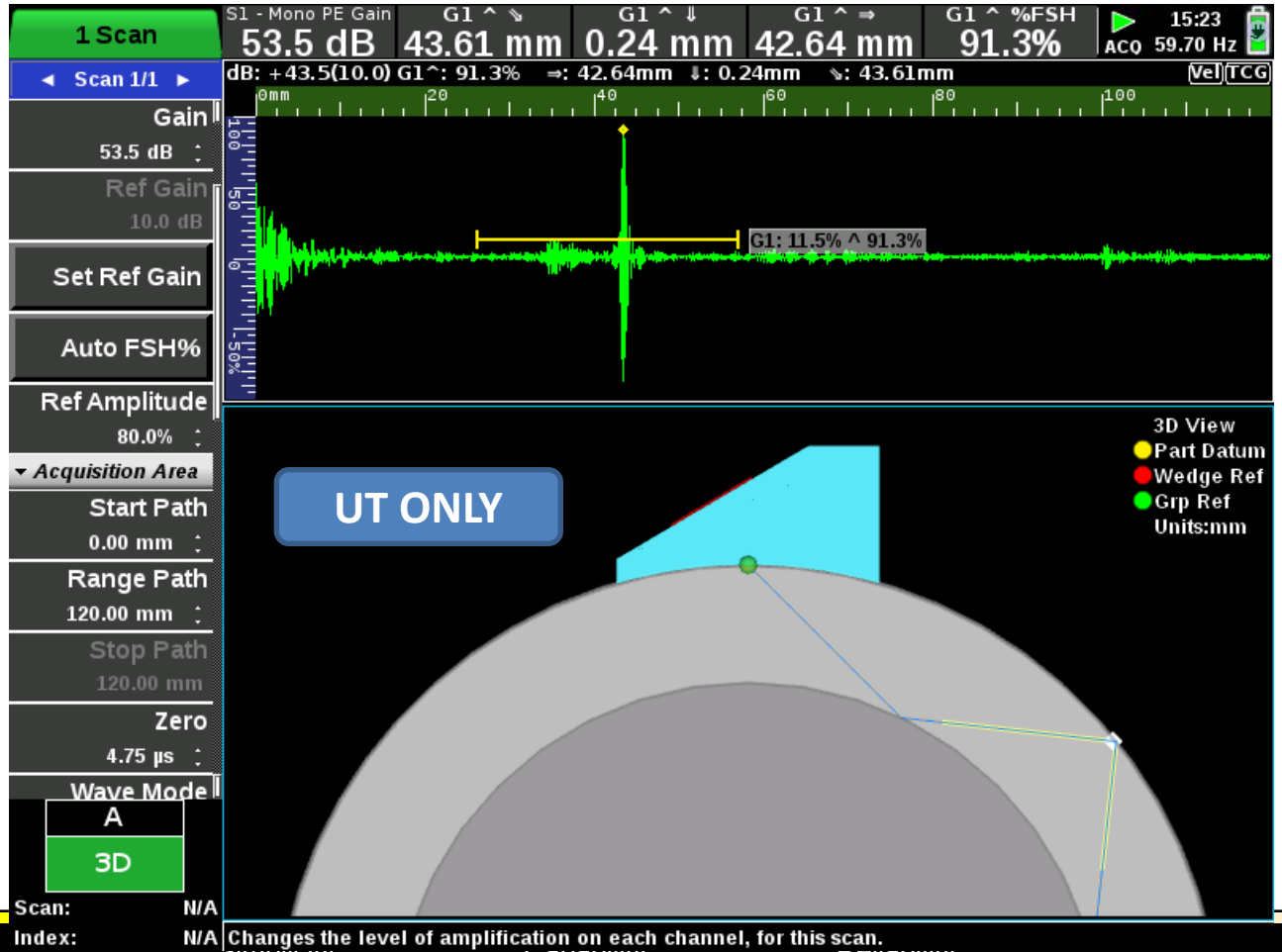
UT conventional Setup on a PA Unit Inspection on curved parts with 3D view

Inspection of curved parts with a live 3D view to help you to simulate your setup, that can also calculate depth of flaws.



High tech connectivity
Access to new communication tools!

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Other Features

Other features that make PA easy to operate

- Bluetooth
- Scroll Wheel
- Touchscreens
- Internet/Wifi Connections: Ethernet, wireless
- Remote Access. Controls controlled by Androids
- 3D Scanning
- Post Analysis Software.

Conclusion

- Ultrasonic Conventional and Phased Array Units have come a long way since they were first developed and implemented outside the medical field. They have become smaller, more portable and definitely user friendly. The possibilities of 3-D Scanning in a live view is an exciting feature in the development of Phased Array technologies. It will be interesting to see what the future has in store for the progressive development of new Phased Array units.