

Ultrasonic connected probe for in-service monitoring of pressurized hydrogen equipment



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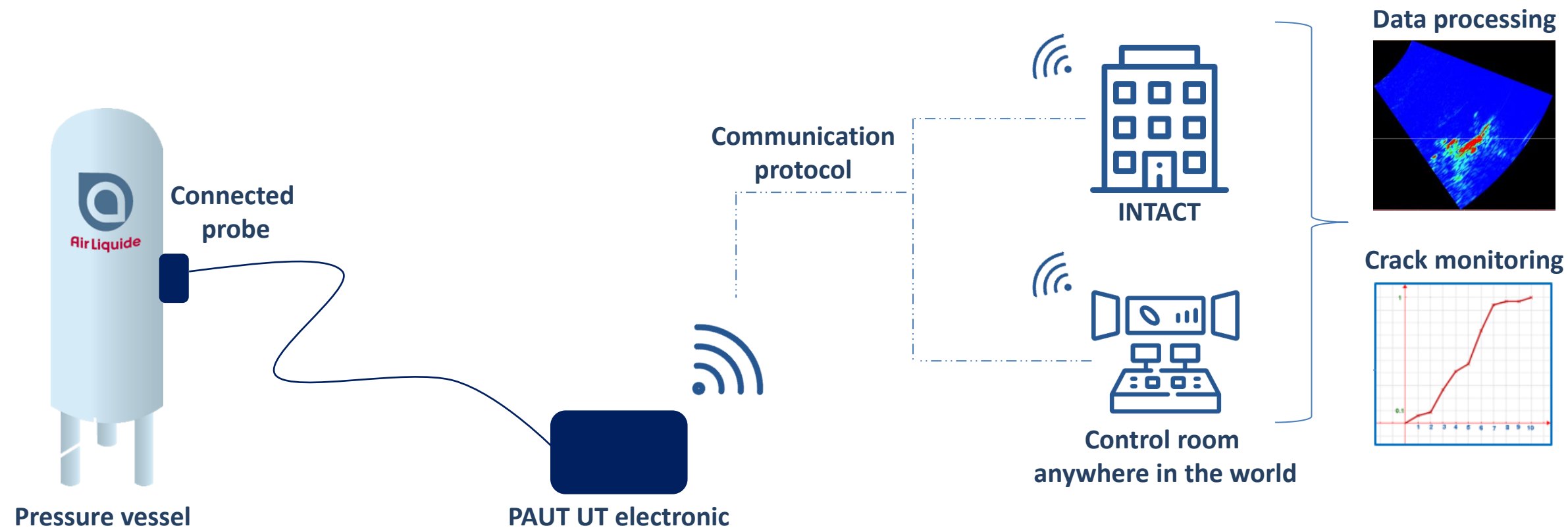
During pressure vessel maintenance inspection, evolutive defects that require monitoring may be detected.

Need: AIR LIQUIDE need to monitor the evolution of **fatigue cracks** in **Hydrogen** pressure vessels. Monitoring to be done while in service. Need to follow the crack evolution to operate safely and schedule component replacements or repairs if needed.

To monitor the evolution of the indications while in service, INTACT with AIR LIQUIDE developed the “**Connected ultrasonic probe**”



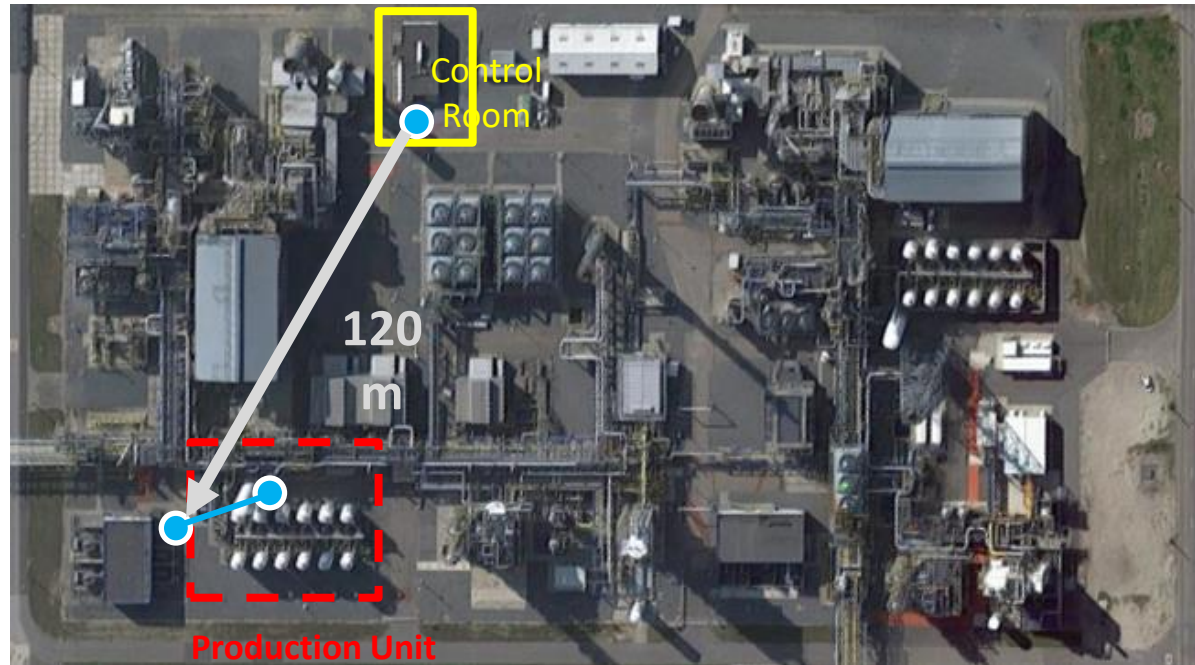
Connected ultrasonic probe



- ✓ A **multi-element ultrasonic transducer**, placed on the equipment in line with the defect.
- ✓ A **fixing system** ensuring the ultrasonic coupling.
- ✓ An **ultrasonic electronic board** that will manage the transmission and reception of UT waves.
- ✓ **Software** that controls the transducer via the card.

- ✓ Data transfers can be wired or **wireless**.
- ✓ Monitoring of indications can be done remotely, from **anywhere in the world** to INTACT offices.
- ✓ This concept could be broadened to any kind of defect to monitor: **High Temperature Hydrogen Attack (HTHA)**, **Hydrogen Enhanced Fatigue (HEF)**, **corrosion**, **blistering**, etc.

Proof of concept



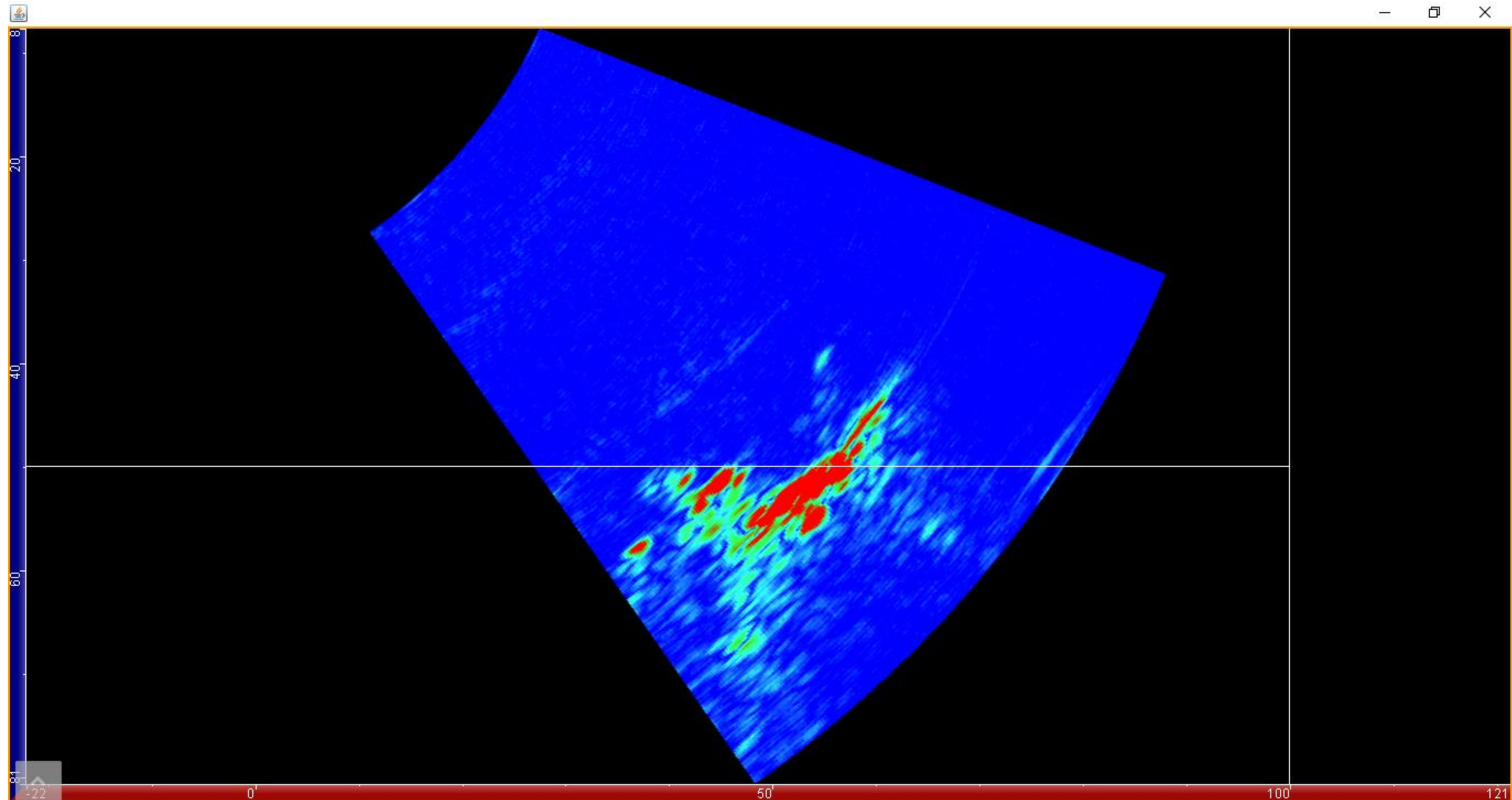
Equipment: Adsorber

Site: Air Liquide gas production site

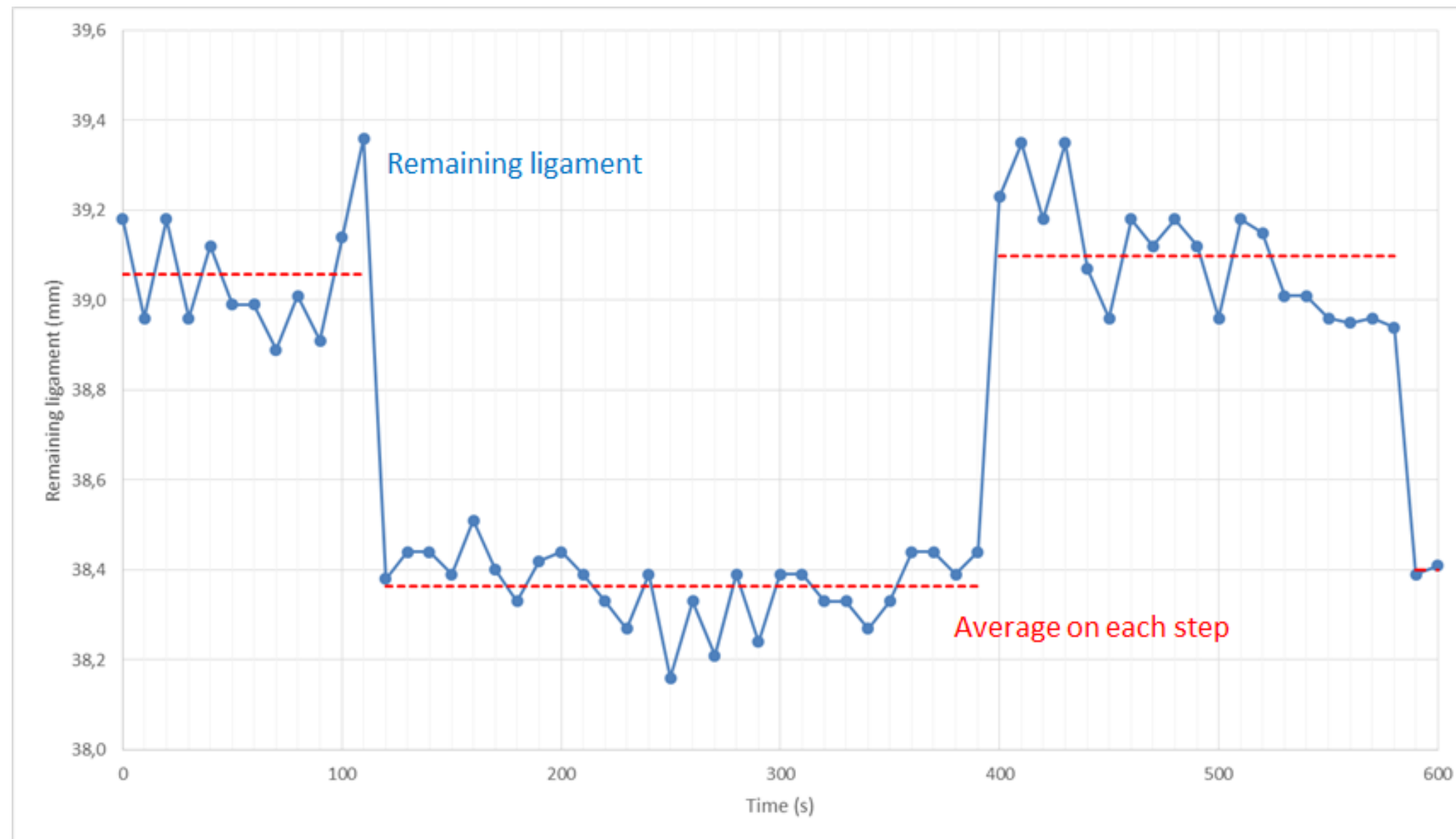
Type of damage: Fatigue cracking enhanced with H2



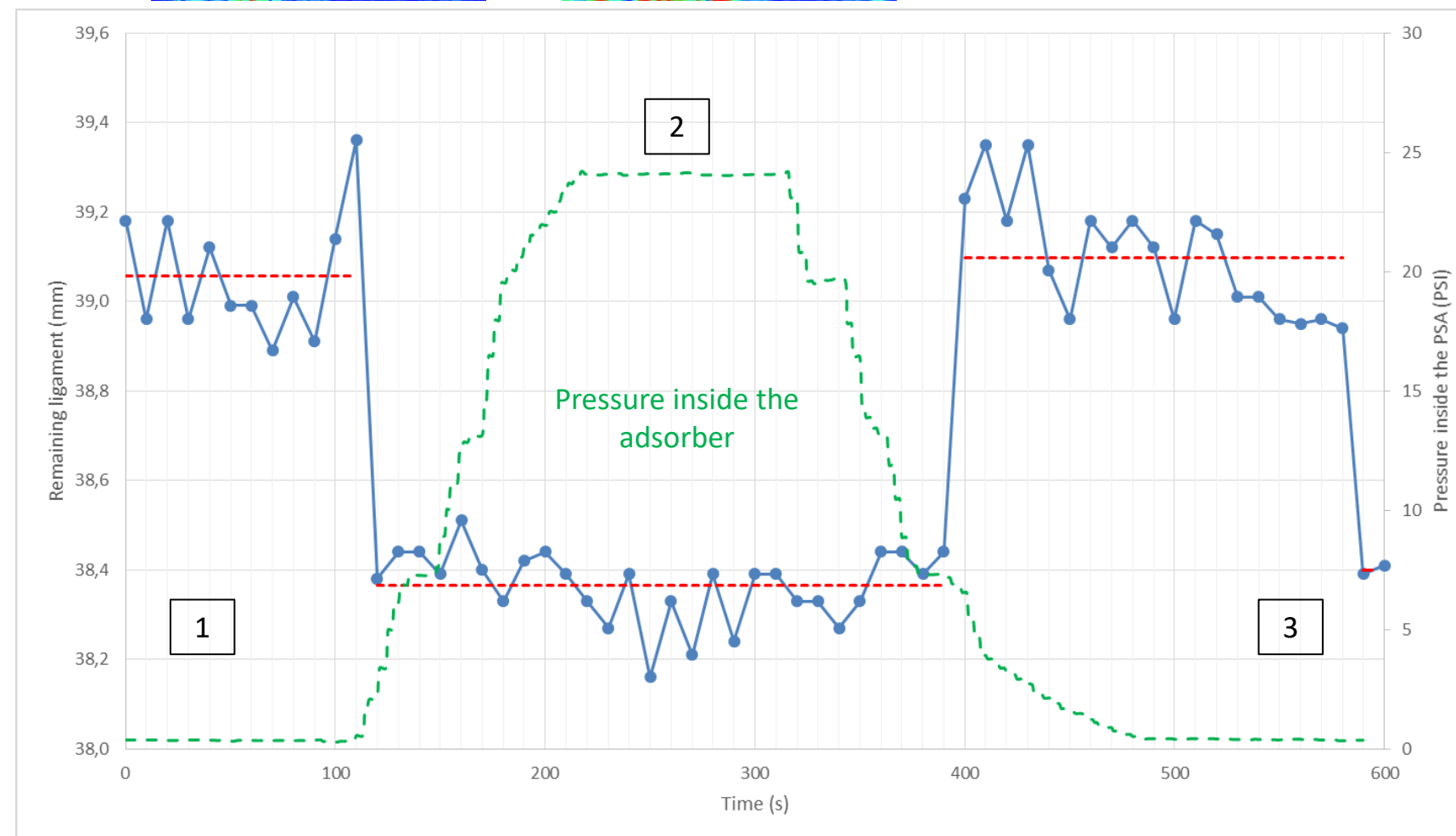
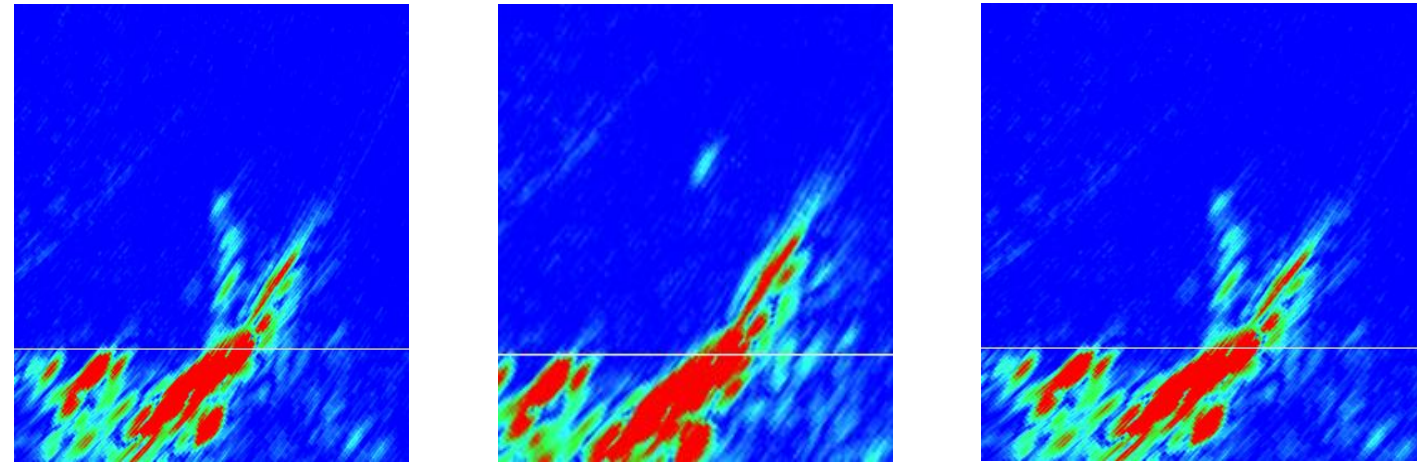
Crack over full cycle



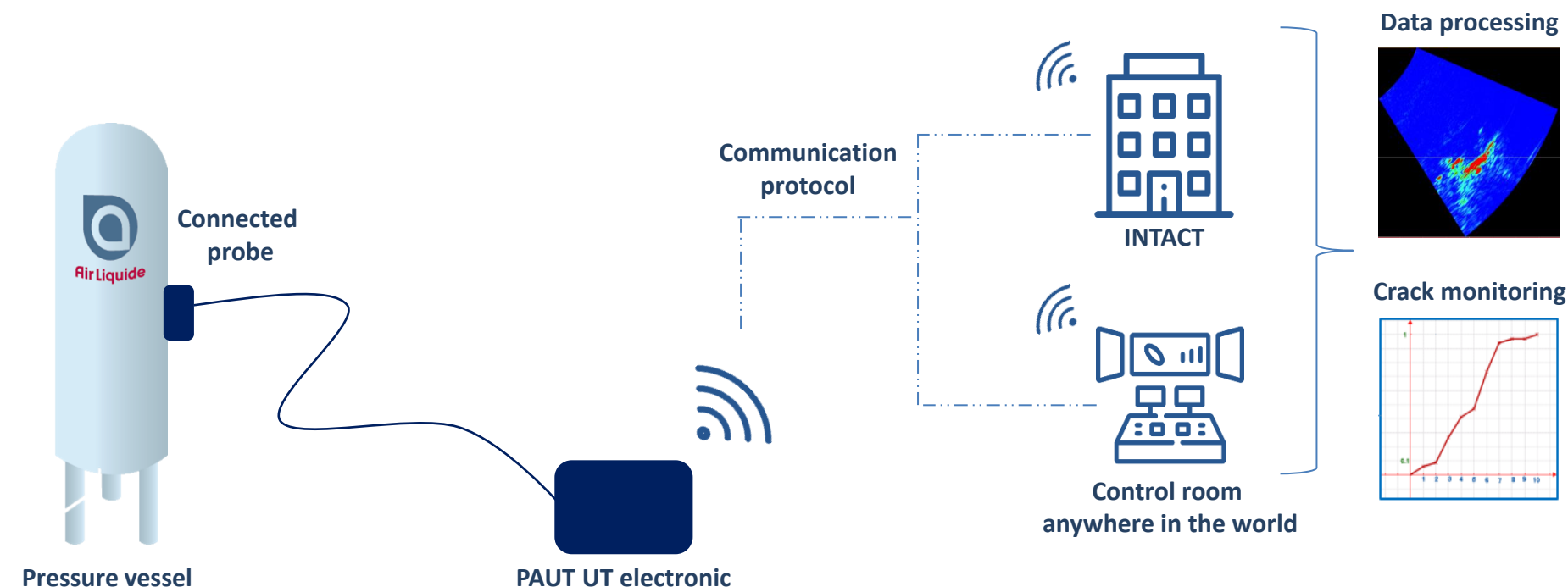
Crack height variation over a full cycle



Crack height variation over a full cycle



- ✓ The connected probe solution for PAUT monitoring of fatigue cracks has been tested with success.
- ✓ Depending on the pressure cycle stage (high or low pressure) the crack is visible or not. As well for the sizing of the crack the measurement may vary depending on the pressure of the equipment.
- ✓ The connected probe solution is used to monitor cracks at early stage of detection and can be also used for other damage mechanisms such as High Temperature Hydrogen Attack (HTHA), Hydrogen Induced Cracking (HIC), corrosion, blistering, etc.
- ✓ The industrial version of the connected probe is ongoing.



Questions?



For more information, contact us at natalia.marcial@intactintegrity.com

Thank you!

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