# Olympus

## Get Up to Speed with Railway Safety

## – Advanced Phased Array Technology Enables Wheelset Inspection

**DTEC GmbH** is a supplier of NDT (non-destructive testing) equipment specialising in innovative, turnkey flaw detection solutions for railway wheelsets and train condition monitoring.

To enhance inspection services for railway safety, DTEC GmbH has combined Olympus' **advanced phased array ultrasonic testing** (PAUT) with machine vision to create intelligent automated wheel inspection systems (WIS). DTEC GmbH's automated inspection system solutions can perform:

- Wayside wheel inspection
- In-service wheel and axle inspection when wheelsets are on a train
- Routine wheel and axle maintenance phases on dismounted wheelsets

The WIS uses **Olympus' FOCUS PX** PAUT instrumentation to detect manufacturing flaws, defects, and fatigue cracks in high-speed train, locomotive, and rolling stock wheels and axles.

*DTEC GmbH's Underfloor Wheelset Ultrasonic Testing System (UW-UT)*

*"The Olympus FOCUS PX makes our star product, the Underfloor Wheelset Ultrasonic Testing System (UW-UT, or UFPE in German), an excellent solution for modern railway maintenance depots. It enables the inspection of wheels for fatigue cracks without needing to remove the wheelset from the vehicle,"* says Dr Eric Peng, Chief Engineer at DTEC GmbH.

### Overcoming the Challenges of Wheelset Inspection

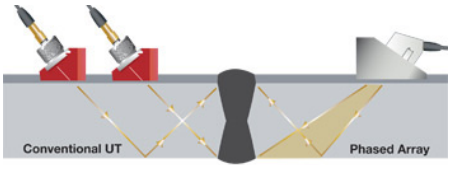
The wheelset components of trains are susceptible to rolling-contact

fatigue (RCF) due to consistent high loads and speeds. RCF can induce spalling (flaking) and shelling, causing the wheel rim to lose chunks of material leading to serious safety issues such as the potential for derailment.

Railway operators can use conventional ultrasonic testing (UT) to detect rail-wheel contact and cycling stress, limiting the 360-degree-circumferential flaw detection of wheels. Inconveniently, UT requires that wheelsets be removed from the vehicle to perform a proper inspection, which is inefficient.

DTEC GmbH needed an efficient, accurate, and reliable solution that would enable them to keep the wheels on the vehicle during the inspection process.

PAUT allows operators to do just that. In comparison to UT, PAUT offers the ability to steer, focus, and scan beams allowing the inspector to scan difficult-to-reach components, such as wheels in the undercarriage.




*Phased array testing compared to conventional UT: The ability to test welds with multiple angles and depths from a single probe can increase the probability of detecting an anomaly*

Though phased array probe technology may be more expensive, the greater flexibility and increased inspection efficiency that PAUT systems provide offset the cost.

Using Olympus' PAUT technology reduces the number of probes that DTEC GmbH's UW-UT system uses by half compared to conventional UT transducers. The compact probe carrying device also means it is compatible with many different wheel types.

## FOCUS PX and FocusPC Software Deliver an Automated Solution for Wheelset Inspection

The FOCUS PX data acquisition unit is a conventional UT and phased array instrument that can automate inspections. With its sturdy casing, the unit requires no air intake, is scalable, easy to integrate, quick to program, and has been thoroughly tested in harsh production environments.

FOCUS PX software, FocusPC, offers powerful inspection features, advanced analysis tools, and fully customisable displays. Driving up to four FOCUS PX acquisition units in parallel, FocusPC software can combine data in a user-defined display. FocusPC can inspect without interrupting the inspection sequence thanks to the ample data file storage, flexible compression and digitising rates, and conditional A-scan saving.

## Integrated Solutions: A System for Undercarriage Wheelset Ultrasonic Testing

DTEC GmbH's UW-UT (or UFPE) with an integrated Olympus FOCUS PX acquisition unit is a fully automatic ultrasonic wheel inspection system used during light maintenance. On the maintenance track, the UW-UT system automatically lifts and rotates each wheelset. At the same time, PA probes are placed on both wheels by twin robots – acquiring ultrasonic data and transferring it to the WIS software program before generating a report. The process from acquisition to review takes a total of two minutes.

**Key features of DTEC GmbH's UW-UT system:**

- Automatic positioning and inspection
- UT data acquisition: ≤1 min/ wheelset
- A/B-scan, bar chart, data analysis for wheel side view
- Flaw detection ability:
- Equivalent defect in wheel rim: ≥ 2 mm FBH
- Equivalent crack on wheel rim: 10 mm×3 mm
- Equivalent crack on wheel disk: 15 mm×3 mm
- Equivalent defect in wheel disk: ≥ 3 mm SDH

## The Route to Results with PAUT Inspection and Data Management

Around 50 A-scans are simultaneously triggered for every 1mm rotation of the wheel tread in the UW-UT system, meaning inspection of a 920mm diameter wheelset generates around 30,000 A-scans. A data set of such magnitude requires a powerful instrument like the Olympus FOCUS PX unit to execute the data

*UW-UT system on a calibration reference wheelset (left) and an on-vehicle wheelset inspection (right)*

acquisition and transfer in real-time.

With such a large volume of data collected, DTEC GmbH set up specialised data management for its operators with automatic alerts, the option to apply manual confirmation, the ability to visualise defect details such as depth, location, and severity, and instant re-calculation each time a defect is manipulated.

The combination of Olympus' fully automated PAUT technology and robust data management in the DTEC GmbH UW-UT system has streamlined the inspection process. 130 UW-UT systems have been installed since 2009, successfully detecting wheel cracks that can be removed with a lathe and safely put back into service.

## Smart Solutions for Safety

In addition, DTEC GmbH has developed the Dismounted Wheelset Ultrasonic Testing (DW-UT) system that also uses the Olympus FOCUS PX. This enables operators to easily assess wheel fatigue cracks in dismounted wheelsets which along with the WIS delivers a comprehensive wheelset inspection solution.

The innovative Olympus technology and instrumentation integrated into DTEC GmbH's wheelset inspection solutions enables them to successfully produce intelligent automated solutions to keep railways safer and smarter.

OLYMPUS®

**Contact Us:**

OLYMPUS EUROPA SE & CO. KG
Wendenstraße 20
20097 Hamburg
Germany

**www.olympus-ims.com/contact-us**

OLYMPUS


# Phased Array Instrumentation

## For easy integration

Olympus offers a complete advanced phased array integration solution that meets the requirements of your most demanding customers. The solution includes the FOCUS PX, a powerful and scalable acquisition unit; FocusPC, a powerful data acquisition and analysis software program; and two software development kits (SDK), FocusControl and FocusData, to customize your software interface based on your application, and control FocusPC for a fully automated inspection solution.

**Instrument**

FOCUS PX

**Software**

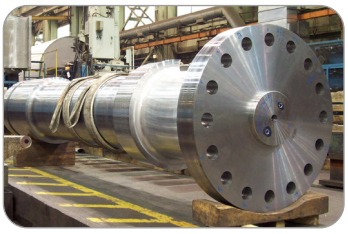
FocusPC, FocusControl, and FocusData

### Aerospace and Defense

- Composite parts
- Honeycomb-reinforced composite parts
- Friction stir welds (FSW)

### Transportation

- Train wheel
- Train axle



### Metal Manufacturing and Fabrication

- Heavy forging
- Plate
- Tube
- Bar

### Oil and Gas

- Welds (including austenitic)
- Corrosion mapping