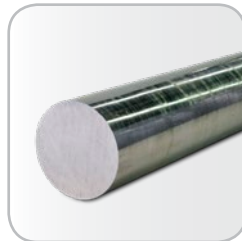
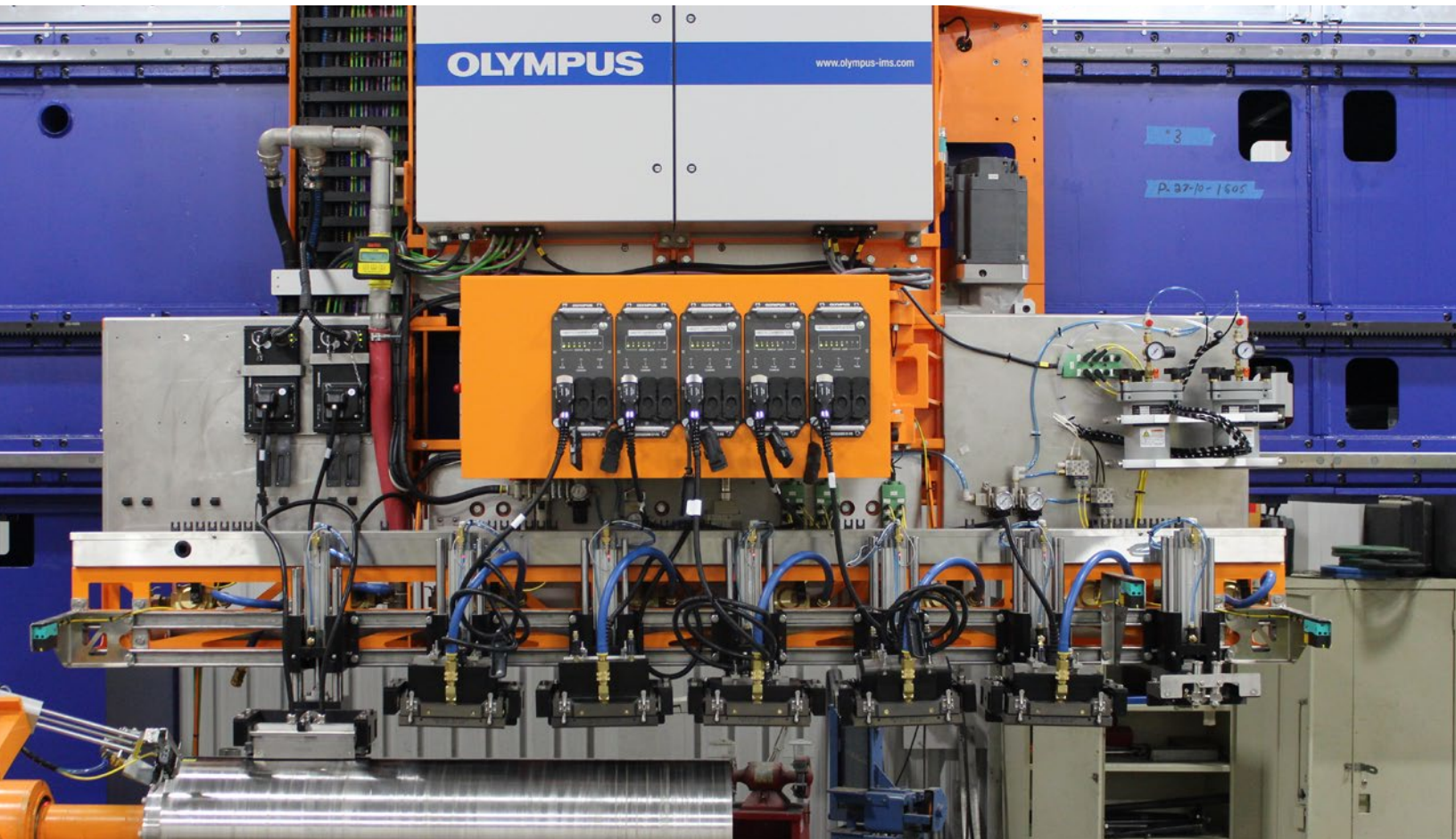


# Rotating Billet Inspection

## Phased Array Technology



- 100% volume and surface coverage
- Phased array and eddy current array testing system
- High throughput

# Introduction

Olympus' turnkey industrial solutions are adaptable to fit the needs of each customer. Our high-quality inspection solutions use ultrasonic phased array probes integrated into fully automated testing systems to meet even the most stringent requirements for volume and surface inspections. Our systems enable customers to meet strict quality control standards while maintaining productivity.

## Project-Based Turnkey Solutions:

- Dedicated project management
- Electronic instrumentation and probes
- Advanced software
- Mechanical equipment
- Water management system
- Commissioning
- Training and after-sales support

## Designed for:

- Round billets
- Carbon steel, stainless steel, aluminum, and titanium
- Black and bright bars
- Flat-bottom hole (FBH) detection
- High repeatability
- Ease of operation

## Key Features

### Volume and surface inspection

Single system using phased array and eddy current array technology

### High throughput

Save time compared to conventional approaches

### Automatic Calibration

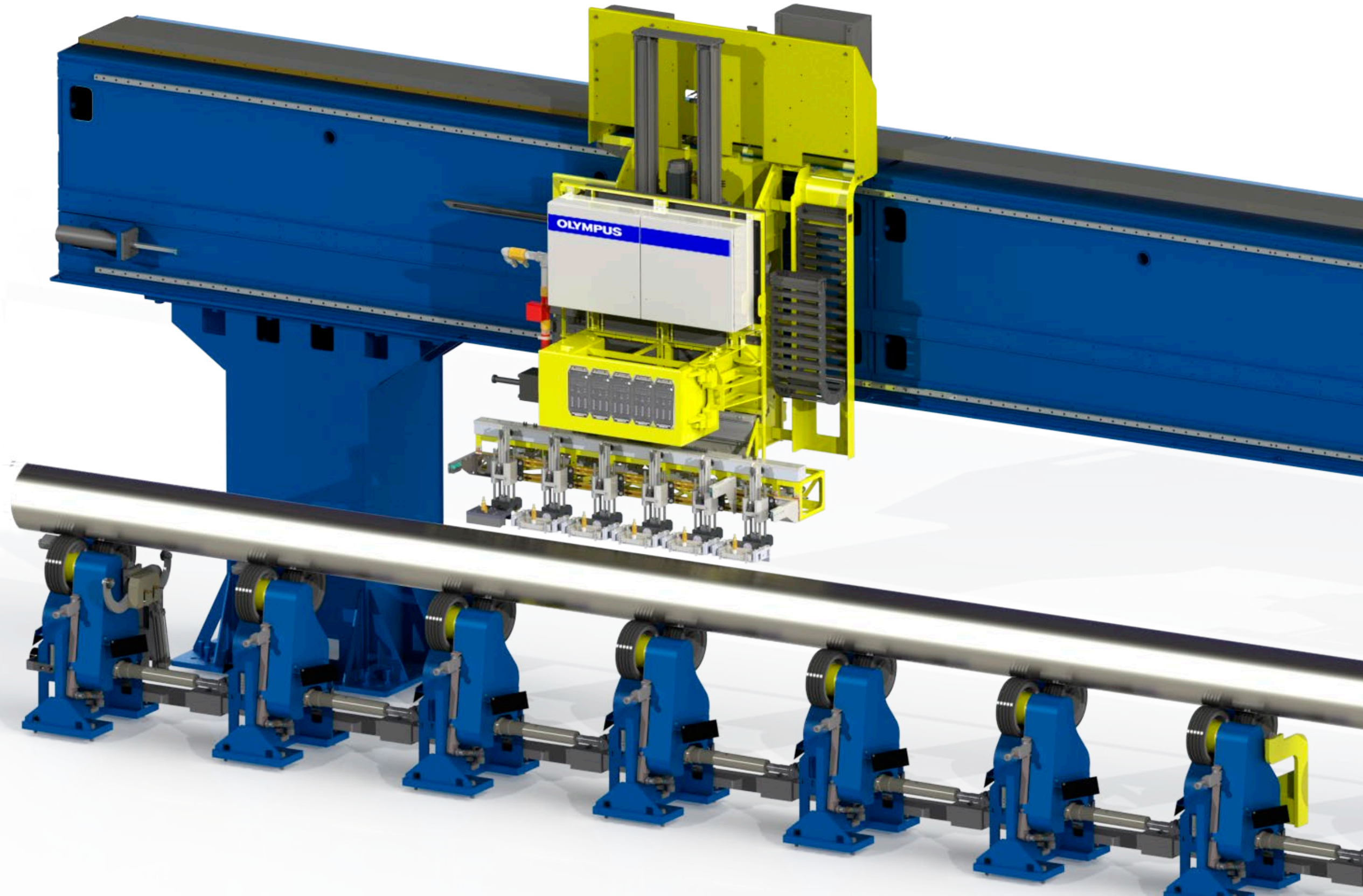
Minimize operator skill dependency

### Advanced algorithms

Get the most out of the system with 2D mapping

### Fast changeover

Limited downtime

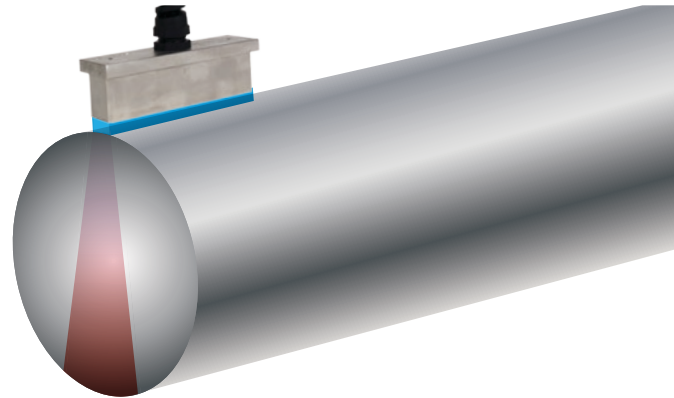


# Rotating Billet Inspection

## Phased Array Full Body Inspection

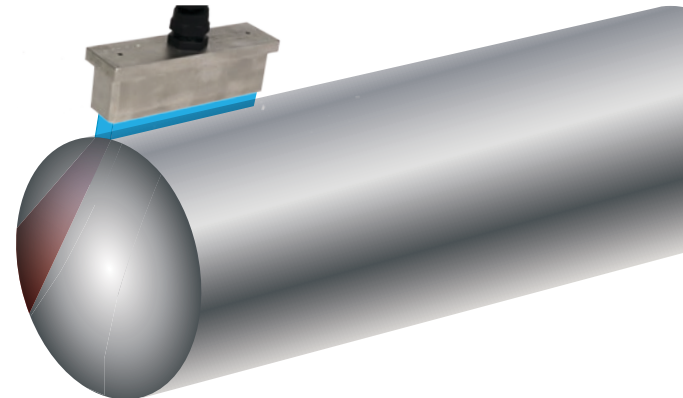
The inspection head is mounted on a carriage that travels on a gantry portal along the length of the inspected billet while the billet is being rotated. Air cylinders are used to move the wedges down at the beginning of the inspection sequence and up at the end of the cycle.

Probes are mounted in wedges that have many degrees of freedom and their own pneumatic suspension, ensuring optimal coupling despite variations in the straightness of the billet. Phased array probe wedges also have their own water couplant supply. The wedge design enables high repeatability of detection.



### Longitudinal Wave Wedge

The longitudinal wave (LW) inspection wedge is dedicated to inspecting internal defects using a phased array probe fixed on a 0° probe holder.



### Shear Wave Wedge

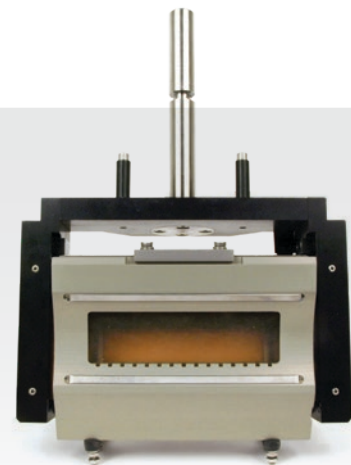
The shear wave (SW) inspection wedge detects defects close to the surface. The wedge is similar to the one used for longitudinal inspection, but a different probe holder is used to change the mechanical angle of the probes (incident angle) in order to generate a 45° refraction angle of the ultrasonic beam in the billet.

## Increased Productivity

Olympus inspection systems are developed to meet the productivity requirements of the metal manufacturing industry. Our high-speed inspection systems are designed to adhere to the highest international quality standards, without compromising productivity.

## Water Wedge Concept

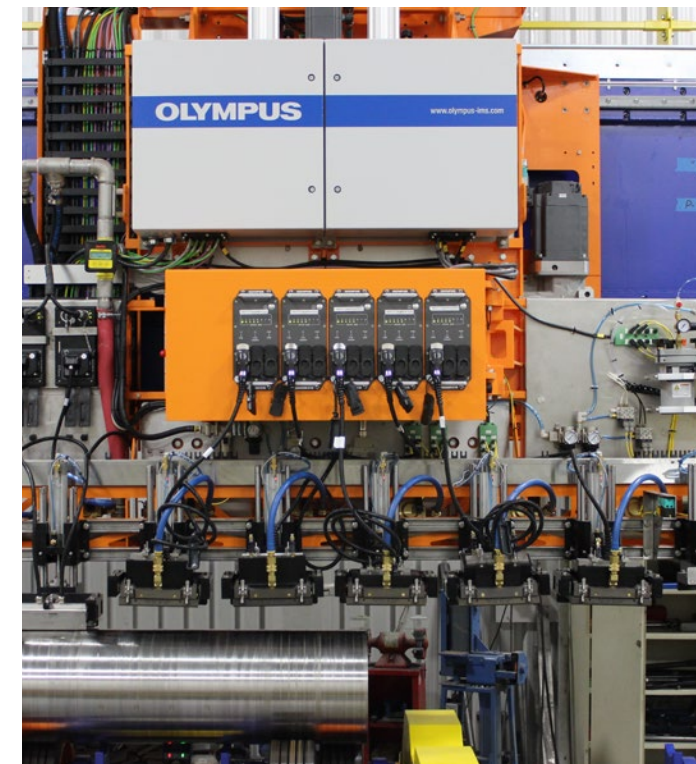
Olympus' unique water wedge has degrees of freedom so the wedge can follow pipe movement. The water wedge utilizes an Aqualene elastomer membrane that maintains a thin film of water for excellent coupling between the probe and inspected product. Keeping the water path undisturbed inside the water wedge yields high repeatability on a small reference defect. Wear plates are attached to the wedge and are available in different sizes to fit each product diameter. Pneumatic suspension enables the water wedge to follow the product movement.



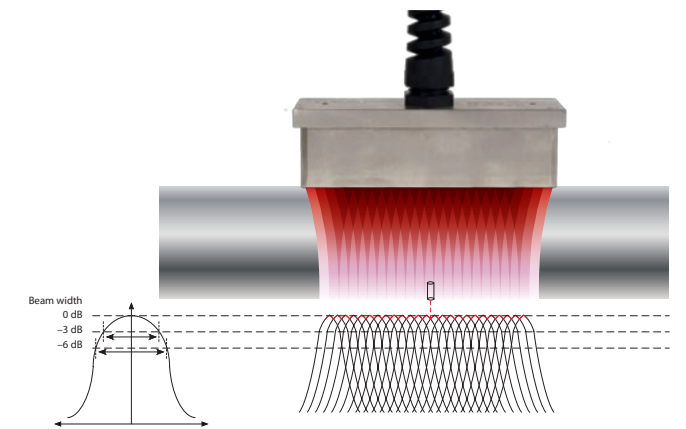
## Inspection-Head Configuration

The RBIS-PA-ECA inspection head has been designed to meet the highest industry standards. The acquisition electronics are embedded in the inspection head to shorten probe cable lengths and reduce electromagnetic noise.

The modular design makes it easy for upgrades or added options and maintenance. A single head can hold up to 8 wedges, 5 QuickScan™ LT and 1 Quicksan ECA acquisition units while accommodating standard options such as on-board paint marking and a pre-wet device.



## Phased Array Probe Concept



Phased array technology uses sophisticated multielement array transducers and powerful instrumentation to steer and focus ultrasonic beams without mechanical movement or lenses. Groups of elements generate ultrasonic beams, replicating the effectiveness of several conventional ultrasonic (UT) probes.

It provides a tight overlap between groups of elements (virtual probes) that are electronically adjustable depending on the size of the defects, resulting in a very high energy density in the billet and repeatable performance.

## Automatic Calibration

To achieve thorough inspections, each phased array probe must be calibrated to receive the same response no matter which probe detects the defect. To calibrate the probe, the apertures of each probe are passed over a known defect, and the probe's gain level is adjusted automatically. The automated calibration sequence enables users to easily perform and validate a precise calibration of each focal law, saving time without relying on the operator's skills.

The calibration check sequence is performed under the normal production conditions of the inspection process. Each reference defect is validated to help ensure that they will be detected above the alarm level. The results are displayed in easy-to-interpret views.

Channel	Type	Amplitude	Gain
11Pa1	C	72%	72%
11Pa2	C	69%	69%
11Pa3	C	62%	62%
11Pa4	C	60%	60%
11Pa5	C	79%	79%
11Pa6	C	81%	81%
11Pa7	C	75%	75%
11Pa8	C	72%	72%
11Pa9	C	74%	74%
11Pa10	C	74%	74%
11Pa11	C	75%	75%
11Pa12	C	78%	78%
11Pa13	C	81%	81%
11Pa14	C	83%	83%
11Pa15	C	83%	83%
11Pa16	C	84%	84%
11Pa17	C	82%	82%



## Surface Defect Inspection

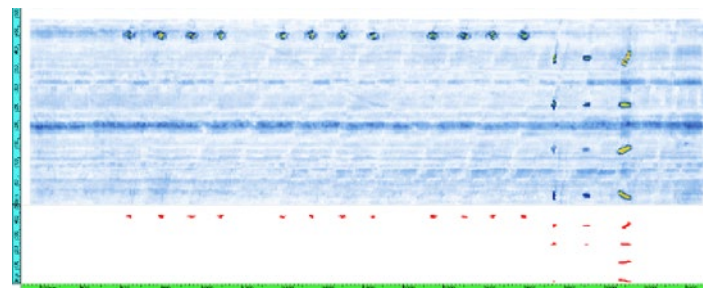
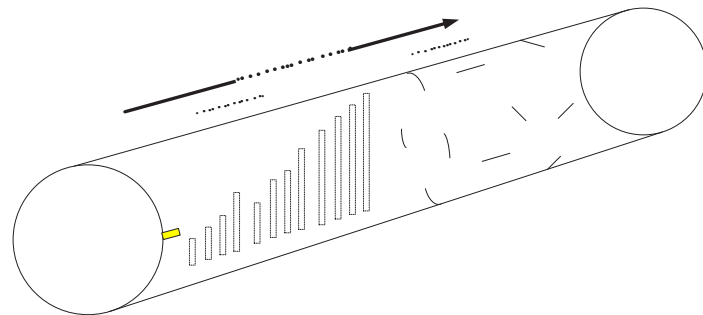
The solution offered by Olympus for detecting surface-breaking defects on large-diameter billets is based on eddy current array technology.

The ECA inspection is performed by using the same inspection head mechanical concept as with phased array technology. The only difference is that the water wedge is replaced by a special ECA probe holder, enabling in-contact inspection with constant optimized lift-off for any billet diameter.

The Olympus ECA probes have been designed to optimize the lift-off capacities and a ceramic hard face was added to protect the sensors and make the probe resistant to damage.

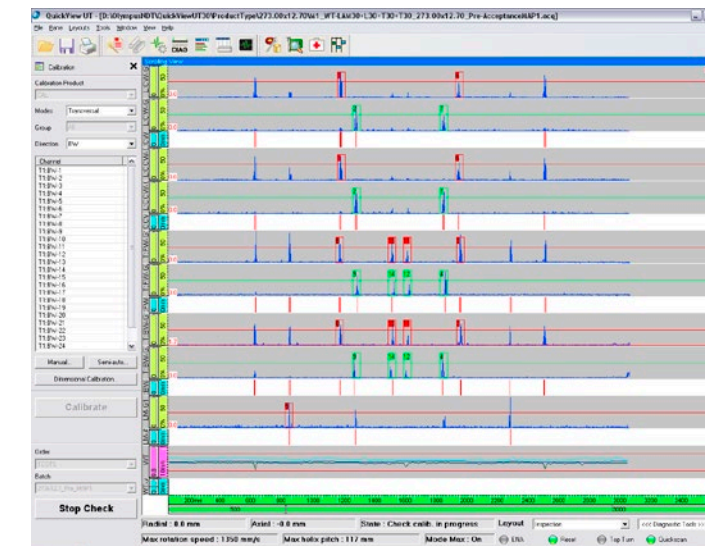
## Mapping

Using a reference signal at each revolution, the system provides the X and Y defect position as well as measuring the size of the defect's surface and its orientation. Data mapping enables the system to perform the 2D marking used by prove-up or automatic grinding applications.



## Phased Array Acquisition Unit

The QuickScan™ PA 32:256 module is a phased array acquisition unit developed by Olympus for industrial inspection systems. The acquisition unit meets IP55 standards and was specifically designed for easy integration into industrial environments. The unit is managed by QuickView™ advanced software designed for ultrasonic inspection.



## Advanced Software

Olympus' advanced QuickView software makes it easy to set up the system, acquire data, and manage data.

QuickView software includes a user-friendly wizard, making it simple to create various inspection setups for each part size. The inspection configuration and calibration parameters for each billet diameter are saved and can be retrieved by the operator within a few seconds. The final inspection results are merged and displayed to clearly differentiate between accepted and rejected billets.

The QuickView software helps simplify the inspection process with features including:

- Software available in multiple languages.
- Software can restrict access to certain users to help minimize operator errors.
- Calibration and inspection information is stored for future reference and traceability. Acquisition files are generated for every inspected billet, and these data can be stored locally or remotely.
- Communication protocol is available for a programmable logic controller (PLC); users can integrate the system into their own inspection application, facilitating an automatic operating mode that requires minimal human intervention.
- Access to parameters and results enable custom reports and advanced process control tools.

# Inspection System Specifications

## STANDARD PRODUCT RANGE

Diameter	≥ 80 mm (3 in.)
Length	3 m to 15 m (10 ft. to 50 ft.)

## INSPECTION COVERAGE

Volume and Surface	100%
Resolution	Configurable

## DATA PRESENTATION

Real-Time Inspection Results	C-scan, strip charts, and alarms
Parameter Setup	A-scan, B-scan
Inspection Layout	20 different user-configurable layouts

## INSPECTION MODES

Typical Inspection PA Modes	Longitudinal waves, shear waves: 1st half, 2nd half, multizone
PA Firing Mode	Pulse-echo
Surface	360°

## DETECTION CAPABILITIES FOR TYPICAL REFERENCE DEFECTS

Typical Defects	FBH ≥ 0.7 mm SDH ≥ 0.5 x 10.0 mm Notches ≥ 0.2 depth, length ≥ 10 mm
Signal-to-Noise Ratio (SNR)	≥ 9 dB
Untested Length	30 mm

## REPORTING AND DATA STORAGE

Report Types	Inspection, calibration, and calibration-check user configurable reports
Storage	Real-time database inspection data storage

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