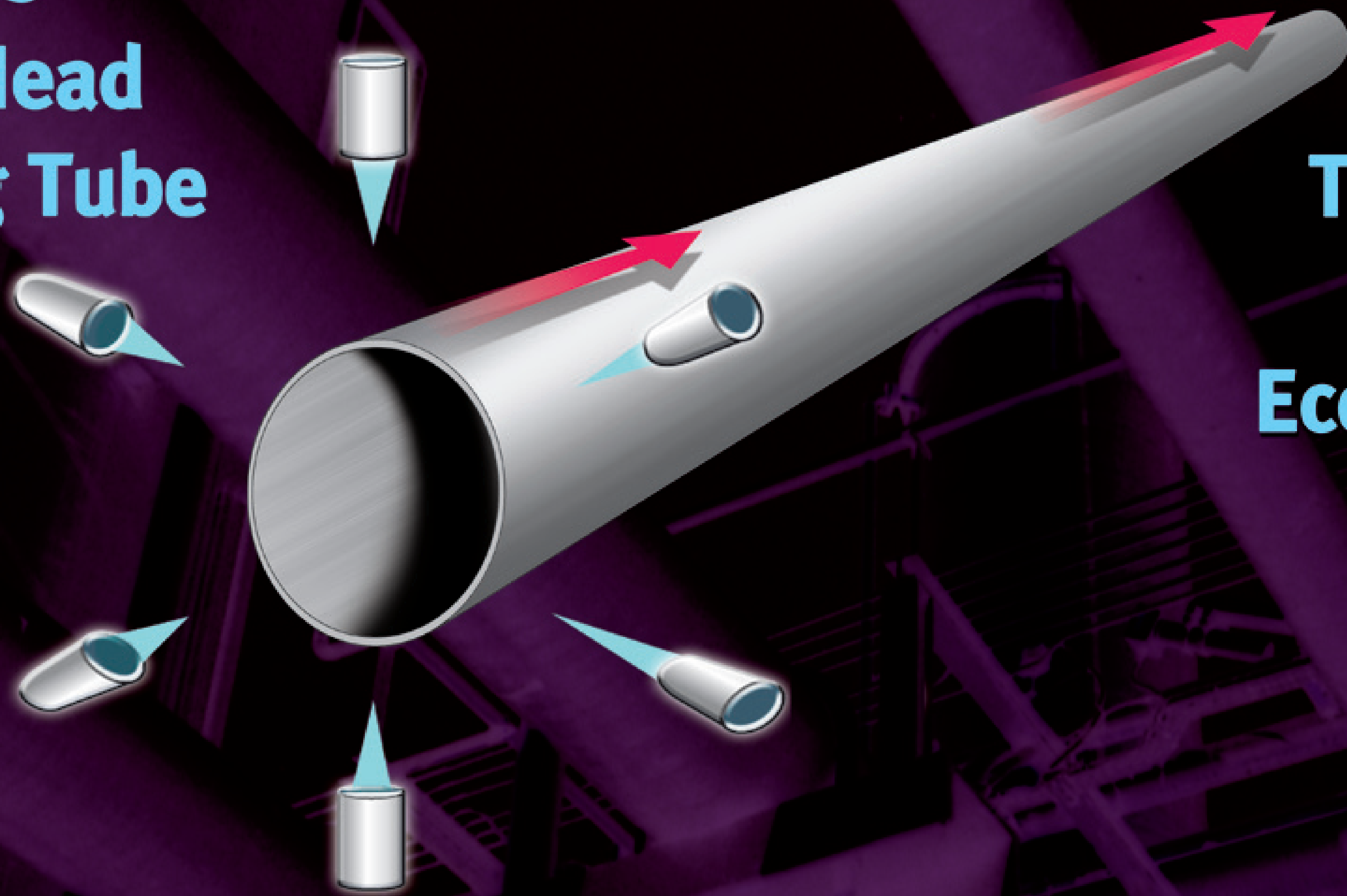


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PATENTED

VERY FAST ULTRASONIC TUBE MEASURING SYSTEM

Fixed Probes
No Rotary Head
No Rotating Tube



OD
ID
Thickness
Ovality
Eccentricity

- 400 points restitution per cross-section
- 1000 cross-section per second
- Equivalent to 60 000 RPM
- High Resolution, up to 1µm
- High Accuracy, up to ± 2µm
- Easy integration in line
- Easy to use in setup
- Very economical
- Reduced Maintenance
- Decrease production Cost

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PATENT
FR 04 05694 26 MAY 2004
TCP N° FR 0501257 10 MAY 2005
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Goal

- To achieve a complete tube thickness and diameter measurement without any rotation of tubes or probes.
- To supply the same results as those obtained with either a Rotary Head or a Rotating Tube system.

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Principle

Apply to the tube measurements, the same principle as used for sampling electric signals (Nyquist-Shannon theorem), which says :

- If the highest frequency contained in a signal is $\pi \times F$, so it is enough to sample it with a sampling frequency of $\pi \times F$.
- That means, according to this condition, we can have $\pi \times 2F$ static probes around the tube to correctly sample its thickness and diameter, and then, calculate the missing points by interpolation.

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Sorry, just a little bit of Mathematics

General theoretical formula for thickness curve is :

$$\text{Thickness}(t) = A1 \cdot \sin(\omega t) + A2 \cdot \sin(\omega t + \phi) + A3 \cdot \sin(\omega t + \phi + \phi)$$

As a matter of fact, manufacturing methods of tubes generate other interferences on thickness variation, adding a number of cycles per section higher than 2 due, for example, to the manufacturing tools.

In that case, the formula becomes :

$$\text{Thickness}(t) = A1 \cdot \sin(\omega t) + A2 \cdot \sin(\omega t + \phi) + A3 \cdot \sin(\omega t + \phi + \phi) + \dots + An \cdot \sin(\omega t + \phi + \phi)$$

where : n is the number of cycles per section for the fastest sine-wave
 ϕ is the phase of this sine-wave
 ϕ is the phase of this sine-wave

According to the Nyquist-Shannon Theorem, it is enough to have 2n samples to calculate the curve.
So, we just need 2n probes to calculate the right thickness curve like the one obtained by a rotating head. Obviously, it is the same to calculate the right diameter curve.

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Thickness

Outside Diameter

Eccentricity + Internal and External Quality

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E-rolta APPLICATIONS

- COLD DRAWN TUBES
- HOT LAMINATED TUBES
- PRECISION TUBES
- NUCLEAR TUBES
- Complementary solution to Flaw Rotary Heads
- Complementary solution to Phased Array Flaw Detectors
- Easy Adaptation to EC testing linear benches

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In-Line System

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In-Line Testing OD/WT/ID/Ecc/Ovality

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TubeN.. Data Analysis



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