



## COMPANY GROUP

**Automated Systems for  
Inner Diameter Control**

# Automated systems for Inner Diameter Control



Systems are intended for contactless measuring of inner diameter and profiles of gun barrels, cylindrical and taper pipes, progressive cavity stators, turbodrills and so on.

We offer systems on the base of

## TWO WORKING PRINCIPLES

- Multisensor measurement by stationary laser sensors
- Inner surface laser scanning by rotating sensors

## SYSTEMS PARAMETERS

- Measured ID – from 9 mm
- Up to several  $\mu\text{m}$  accuracy
- Up to 32000 measured points on the surface in 2 seconds
- Calculation of ovality and roundness
- Surface defects detection and measurement
- 3D model of inner surface design
- Measured ID (**beginning of 2017**) – from 5 mm

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# The basic elements of ID measurement systems

## THE SYSTEMS USUALLY CONTAIN:

- Laser measurement module with
  - stationary sensors
  - or
  - rotating sensors
- Translation module intended for transportation of measurement module inside the pipe:
  - self propelled or
  - any kind of pulling machine
- Software for PC
- Calibration rings

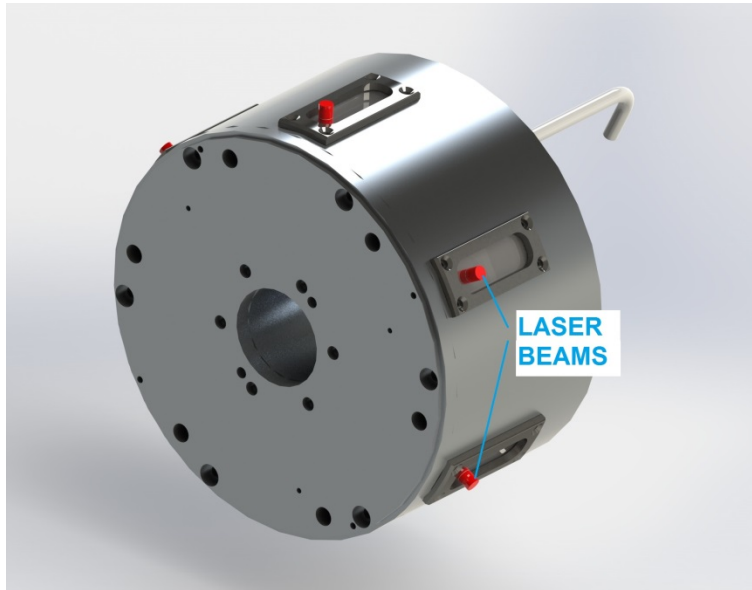
## THE SYSTEMS CAN CONTAIN:

- Centering frame to hold measurement module near pipe axis

## OPTIONS:

- Pipe straightness measurement module
- Video inspection module
- Wireless connection (Wi-Fi) module

# Multisensor measurement module. Structure and operational principle



## THE MEASUREMENT MODULE CONTAINS:

up to 6 laser triangulation sensors located circumferentially in one housing at known fixed angles.

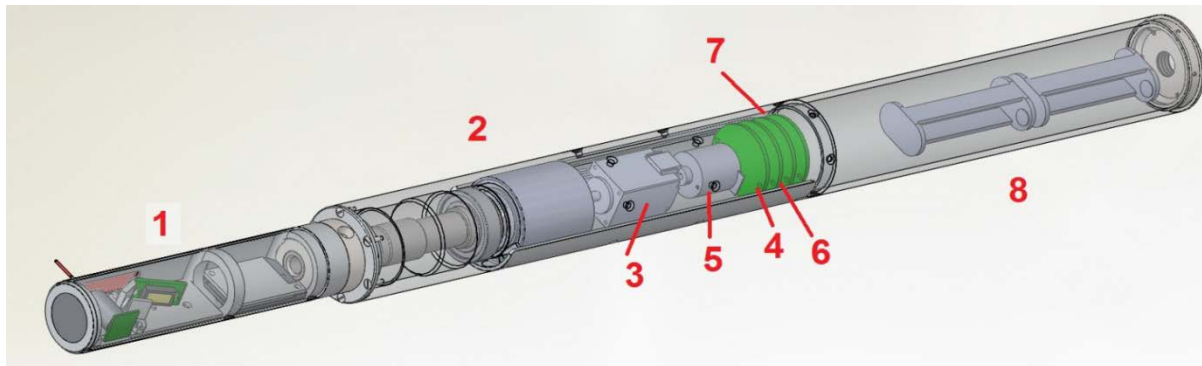
## THE SYSTEM OPERATES AS FOLLOWS

The measurement module is inserted into the pipe and moved by translation module to the definite position.

Calibrated laser sensors measure distances to the inner surface

Software calculates diameter of the pipe

# Rotating lasers measurement module. Structure



## THE MEASUREMENT MODULE CONTAINS:

laser triangulation sensor **1** (one or several with different measurement range and stand-off distance), mounted on rotating platform **2**, which contains motor **3** with electronic driver **4**, and rotary encoder **5** coupled to the motor **3**. The system also includes a tilt sensor **6**, intended for control of inclination of rotating platform during measurement.

**Options:** in-built Wi-Fi module **7** is used for communication between the system and PC; the system can be powered from internal batteries **8**.

**2D laser scanner** can be installed instead of points sensor

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# Rotating sensors measurement module. Operational principle

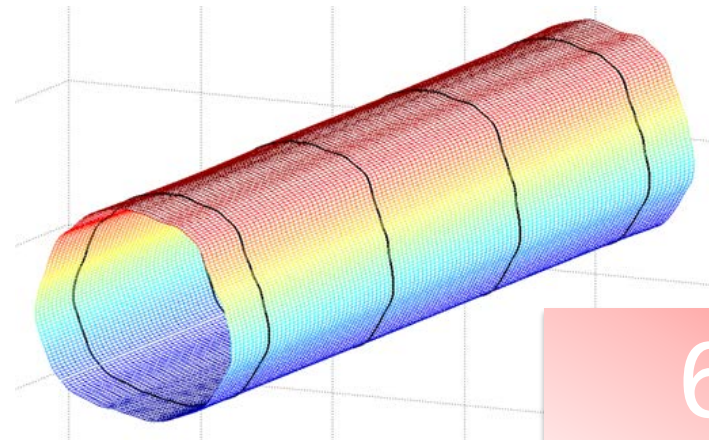
## THE SYSTEM OPERATES AS FOLLOWS:

The measurement module is inserted into the pipe and moved by pulling machine to the definite position.

Rotating laser sensor scans inner surface of the pipe and the module transmits polar coordinates of the surface (distance from rotation axis, measured by triangulation sensor and a corresponding angle, measured by encoder).

Software uses the set of transmitted coordinates to calculate:

- ID of measured pipe
- ovality and roundness to find
- surface defects to design
- full profile in definite section.
- 3D model of the pipe inner surface.



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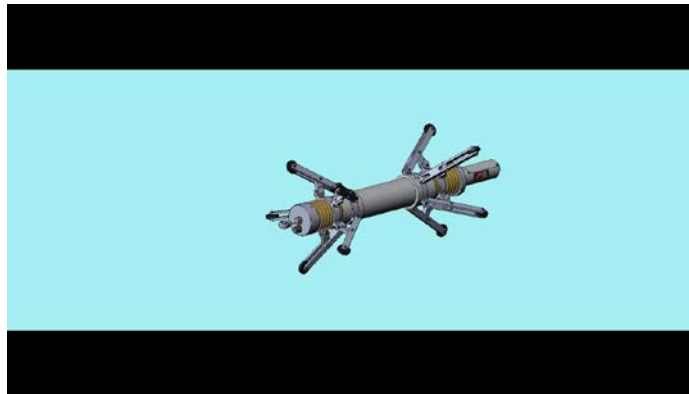
# Centering frames for measurement modules



Centering frame is intended to hold measurement module near pipe axis for different pipe diameters.

The frame can contain the set of wheels or rails symmetrically moving according the frame axis

Video demonstration:



<https://youtu.be/yfuouvYADtE>

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# ID measurement by stationary sensors systems APPLICATIONS





# Multisensor laser system for fiberglass pipes deformation measurement



- Six triangulation sensors inside
- Diameter range – 500...1250 mm
- Accuracy -  $\pm 2$  mm

# Multisensor laser system for smooth gun barrels control



- Six laser sensors inside
- Diameters: 125...132 mm
- Accuracy  $\pm 2 \mu\text{m}$
- Barrels straightness measurement accuracy  $\pm 5 \mu\text{m}$
- Self-propelled system for device translation

# VIDEO: Multisensor laser system for smooth gun barrels control



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[https://youtu.be/y4FR\\_ow6E3k](https://youtu.be/y4FR_ow6E3k)

# Multysensors module. Four laser sensors inside



- Diameter of the module – 70 mm
- Measured diameters: 95...195 mm (main range), 160...300 mm (extended range)
- Accuracy: 0,05 mm (main range) and 0,2 mm (extended range)

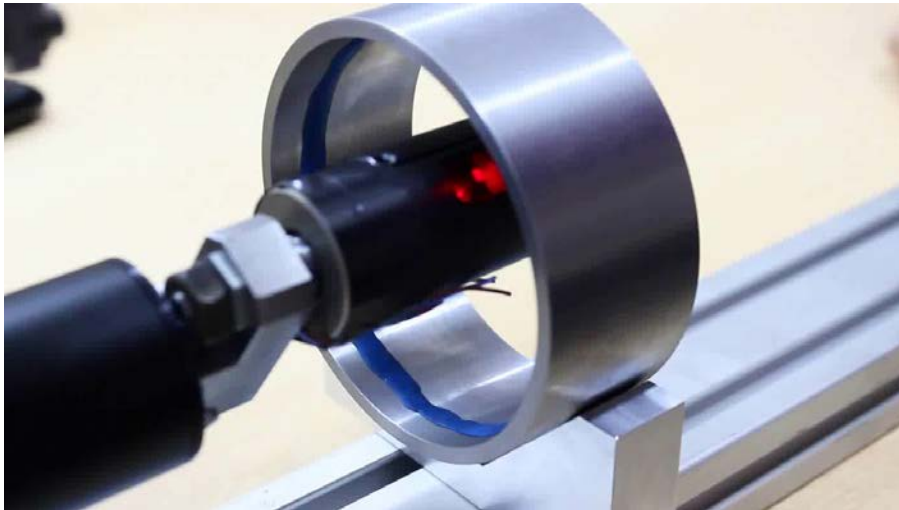
The gage is developed for inner surface inspection and ID measurement of nuclear Power station pipes

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# ID measurement by laser Scanning. APPLICATIONS



# Rotating lasers system. How it works

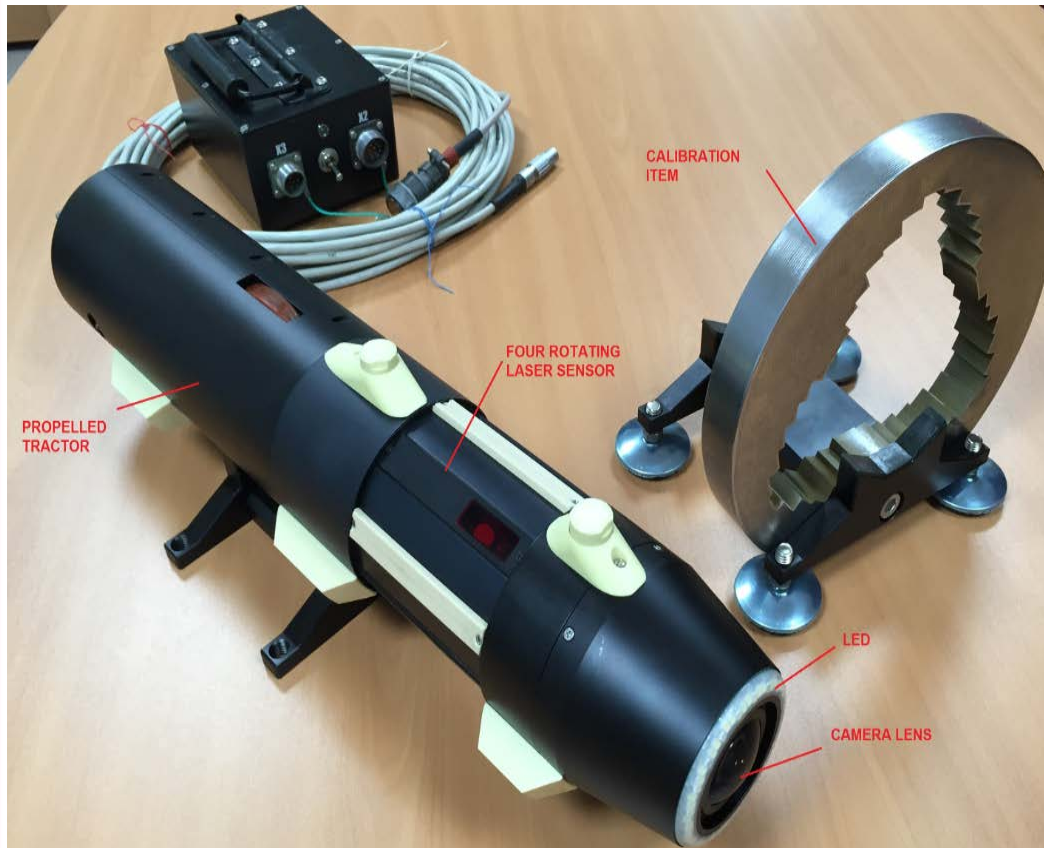


<https://youtu.be/c8q88ZQ5S5Y>



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# Rotating lasers system for rifled gun barrels control



- Four rotating laser sensors inside
- Diameters: 57, 81, 90, 105, 120 mm
- Accuracy +/- 2  $\mu\text{m}$
- Barrels straightness measurement option
- Video camera option
- Wi-Fi connection
- Self-propelled translation module

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# Rotating lasers system for rifled gun barrels control



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<https://youtu.be/0OwxHmT431E>





# Rotating lasers system for pipes diameter control



- Diameter range: 45...55 mm
- ID accuracy measurement :  $\pm 5$   $\mu\text{m}$

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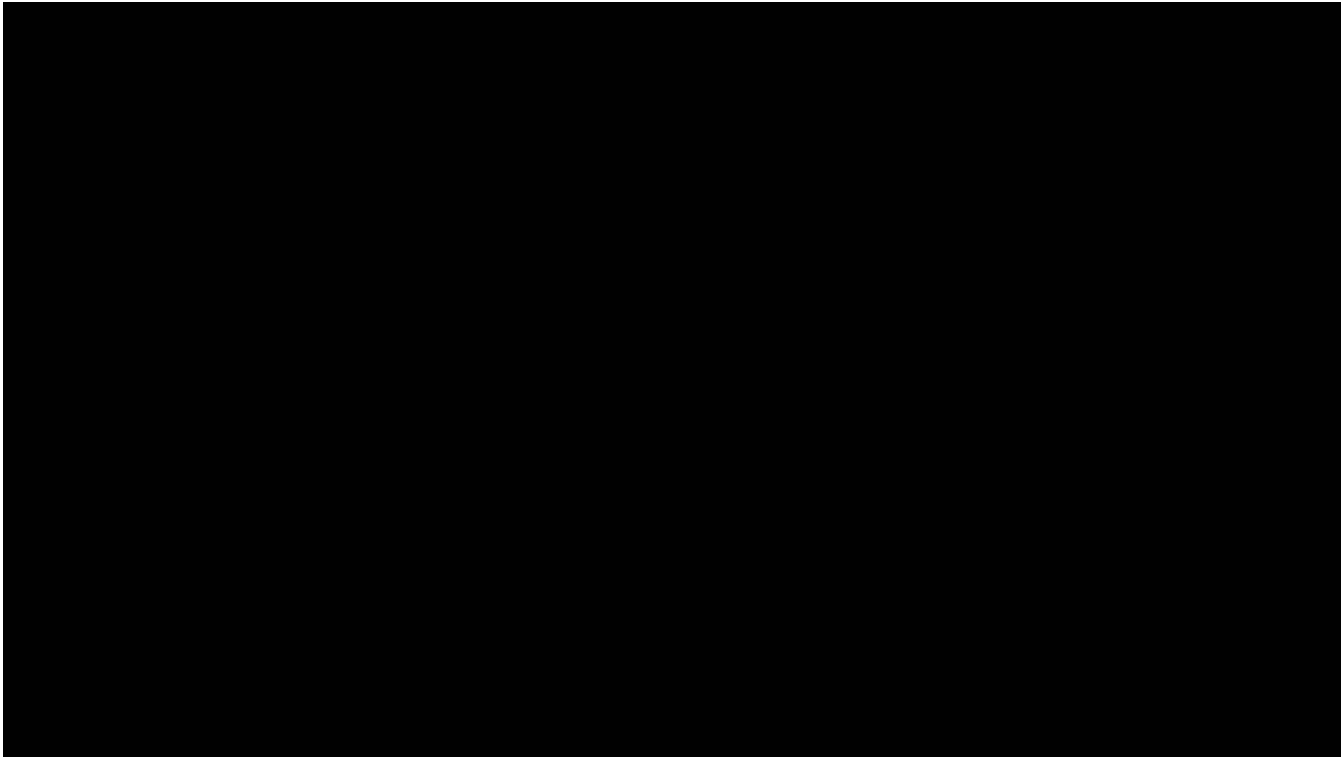
# Rotating lasers system for cylinders diameter control



- Nominal diameter: 185 mm
- ID accuracy measurement :  $\pm 5 \mu\text{m}$

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**VIDEO: Rotating lasers systems for  
cylinders diameter control.  
Measurement module is placed  
on linear translation stage**

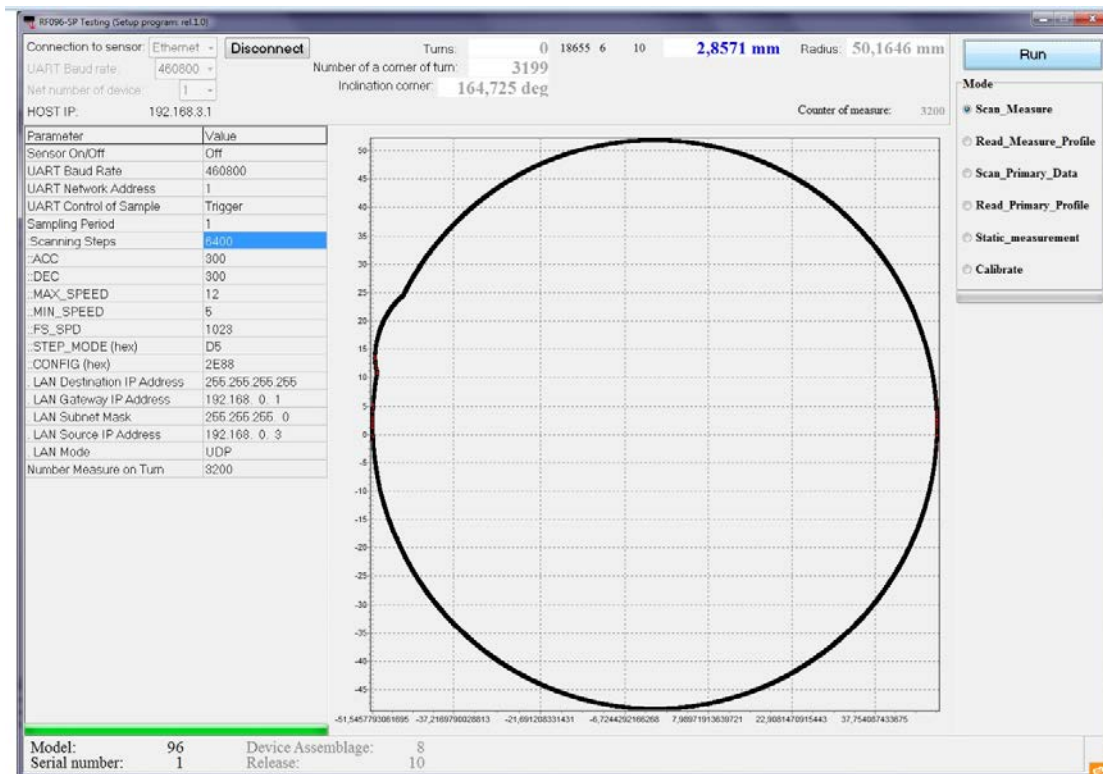


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<https://youtu.be/O6ykAsSAkFk>

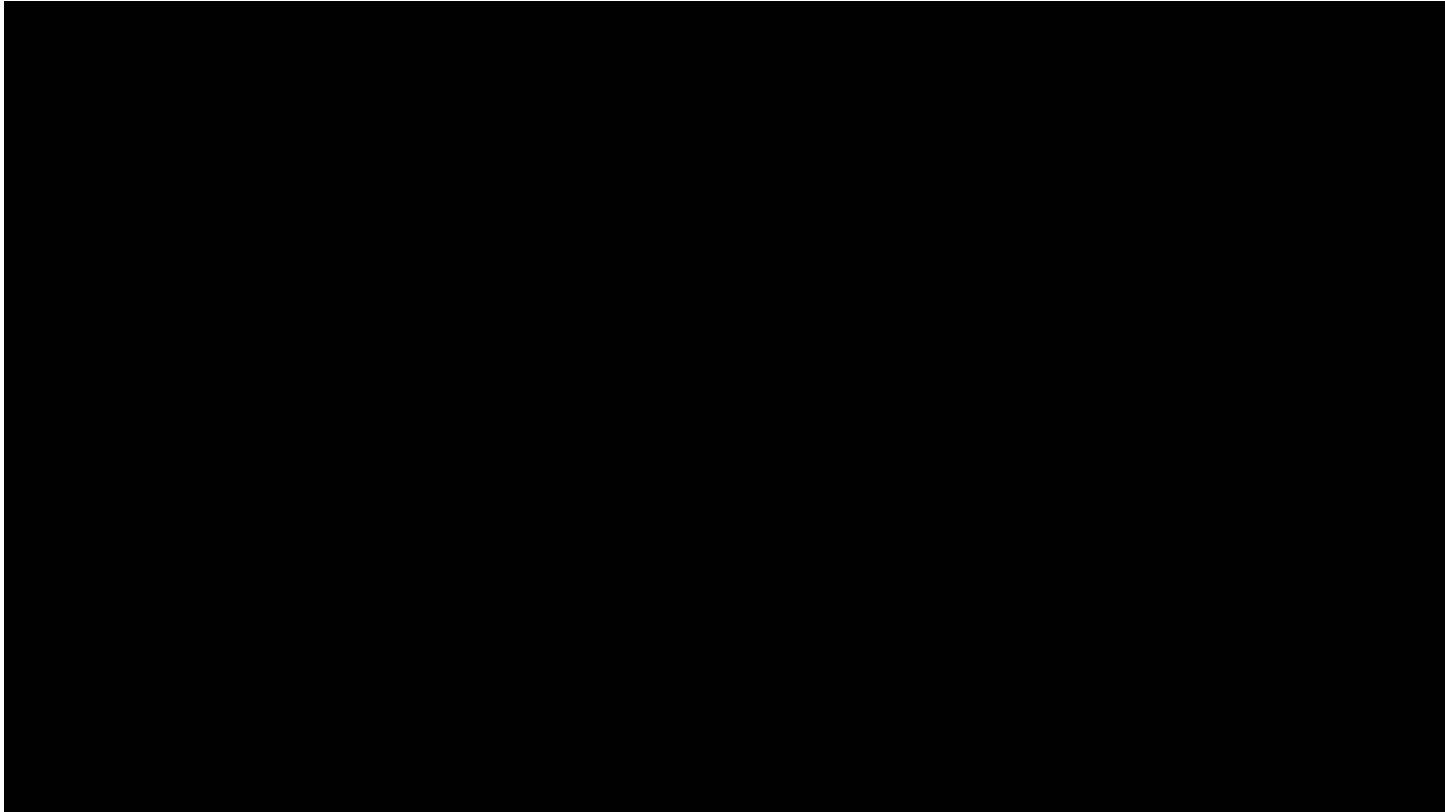
# Rotating lasers systems for cylinders diameter control

## Results: Diameter of the pipe with defect



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# Pipe ID Measurement Machine



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<https://youtu.be/QGFFOYDGWHI>

# Laser ID scanning module



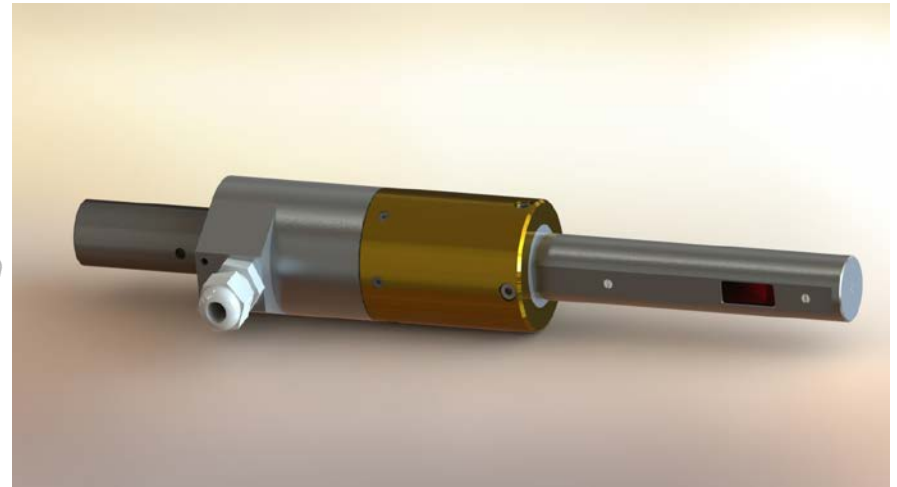
- Diameter of the sensor – 9 mm
- Measurement range – 5 mm (9...19 mm diameter)
- ID accuracy measurement  $\pm 5 \mu\text{m}$

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# Laser ID scanning module



# Laser ID scanning module for CNC machines



- Diameter of the sensor – 15 mm
- Measurement range – 20 mm
- ID accuracy measurement  $\pm 5 \mu\text{m}$

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# Laser ID scanning module for CNC machines



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<http://youtu.be/e1Bpb0oc9g8>

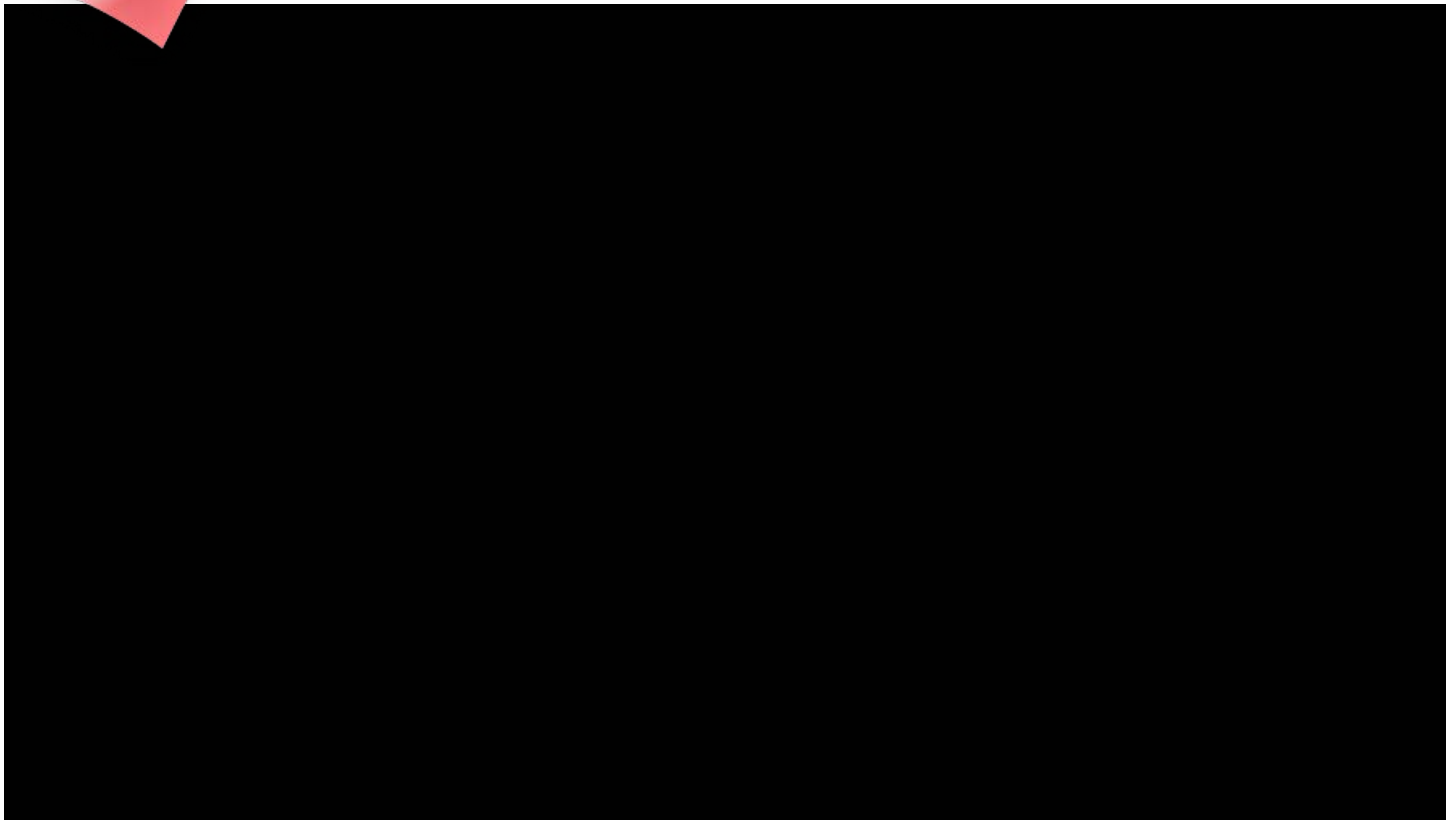


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**NEW**

**2017**

## AUTOMATED SYSTEM FOR LAMINATED TUBES GEOMETRY MEASUREMENT



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<https://youtu.be/Mw-T0Bww0E>

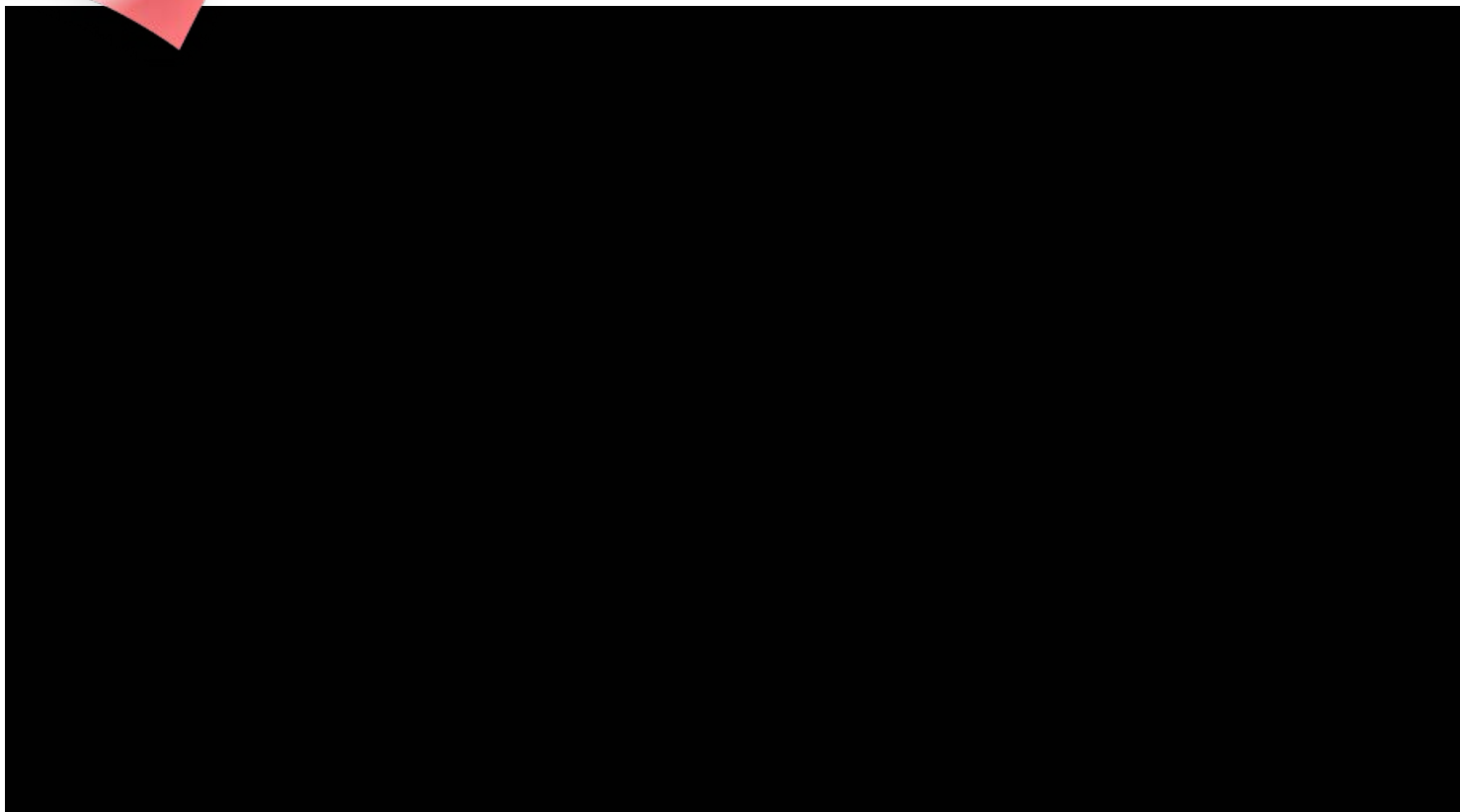


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**NEW**

**2017**

## LEAF SPRINGS HOLES ID MEASUREMENT MACHINE



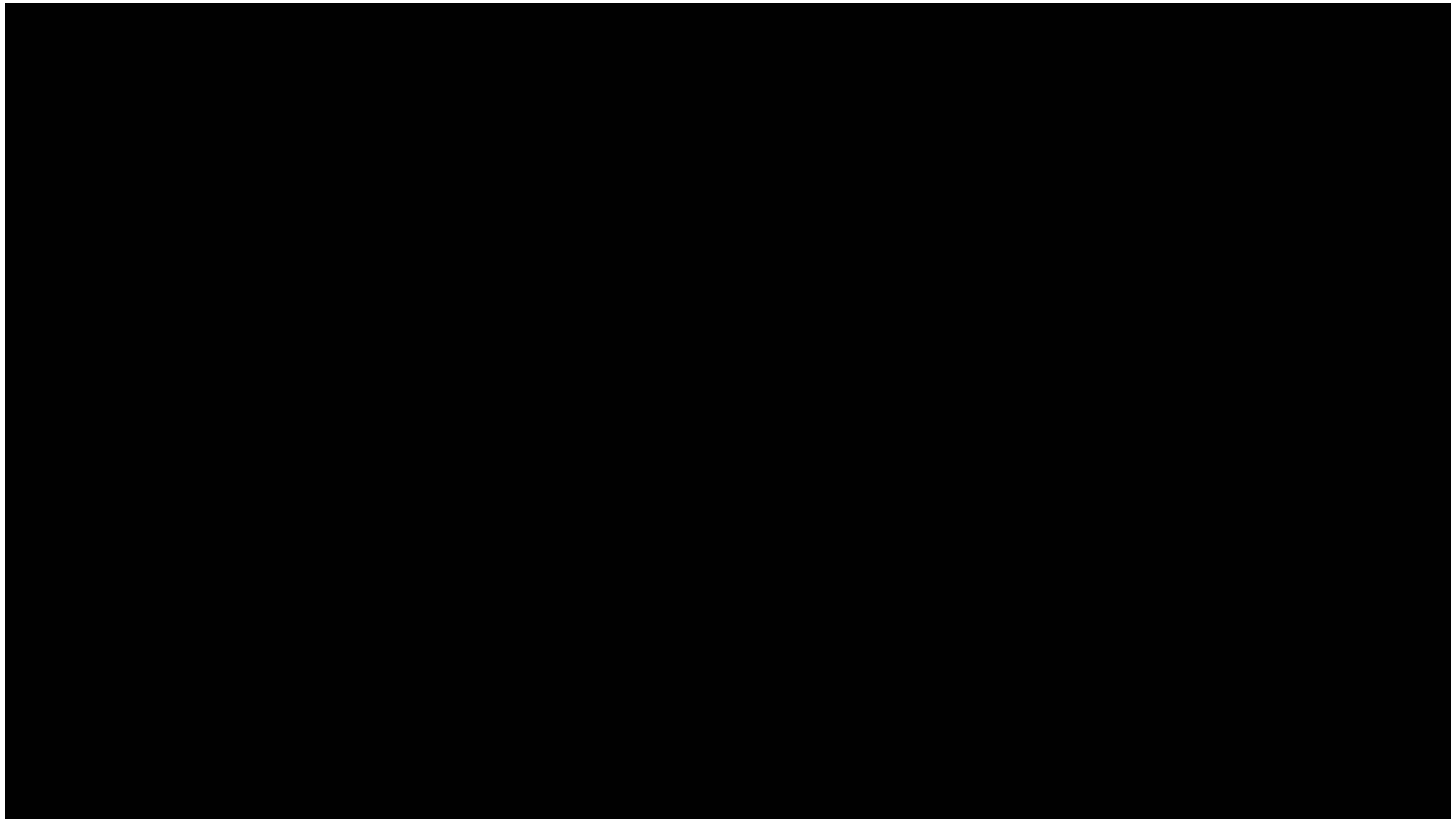
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[https://youtu.be/DoKnp4\\_YJU](https://youtu.be/DoKnp4_YJU)



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# Laser Inspection System. RF096-Insp



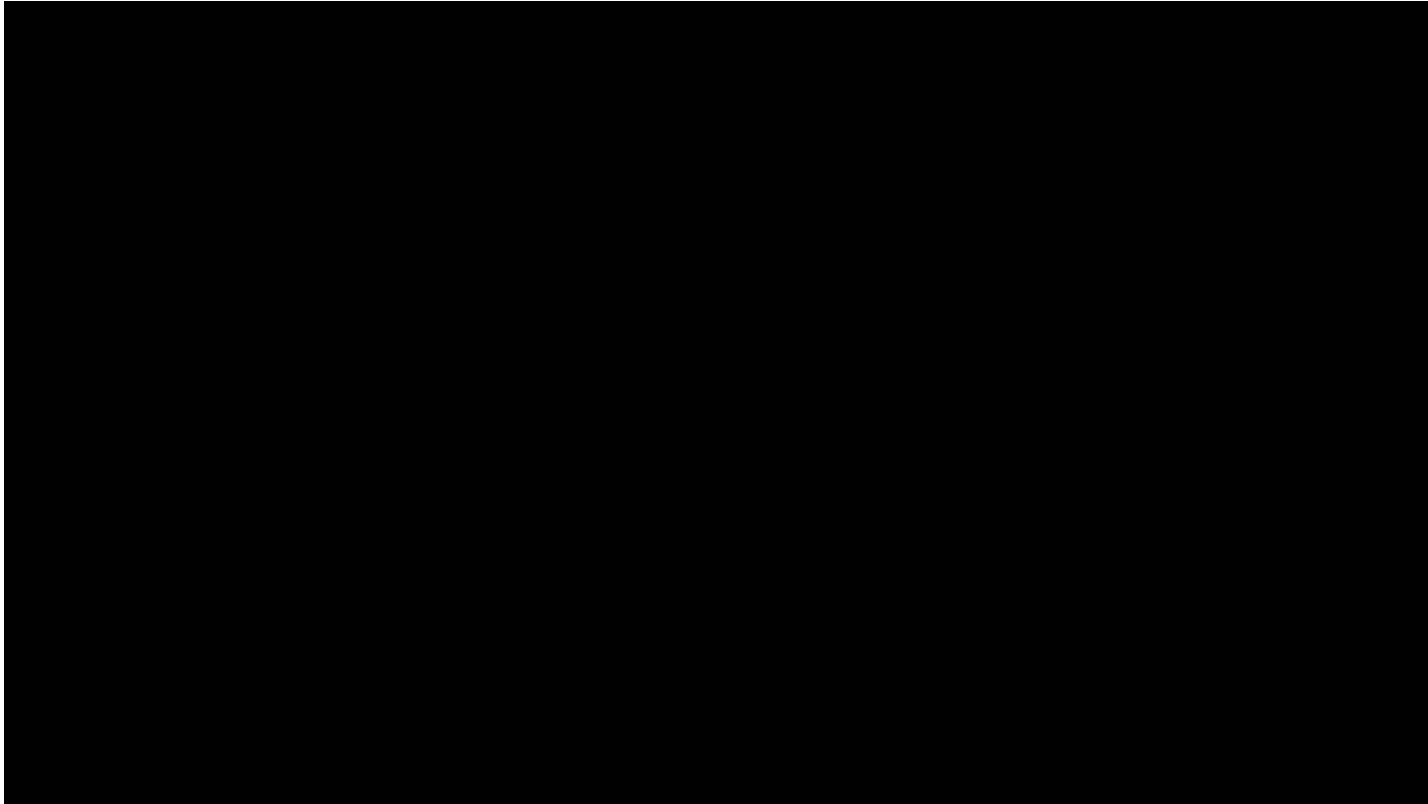
28

<https://youtu.be/ooVtGOnnQ5o>



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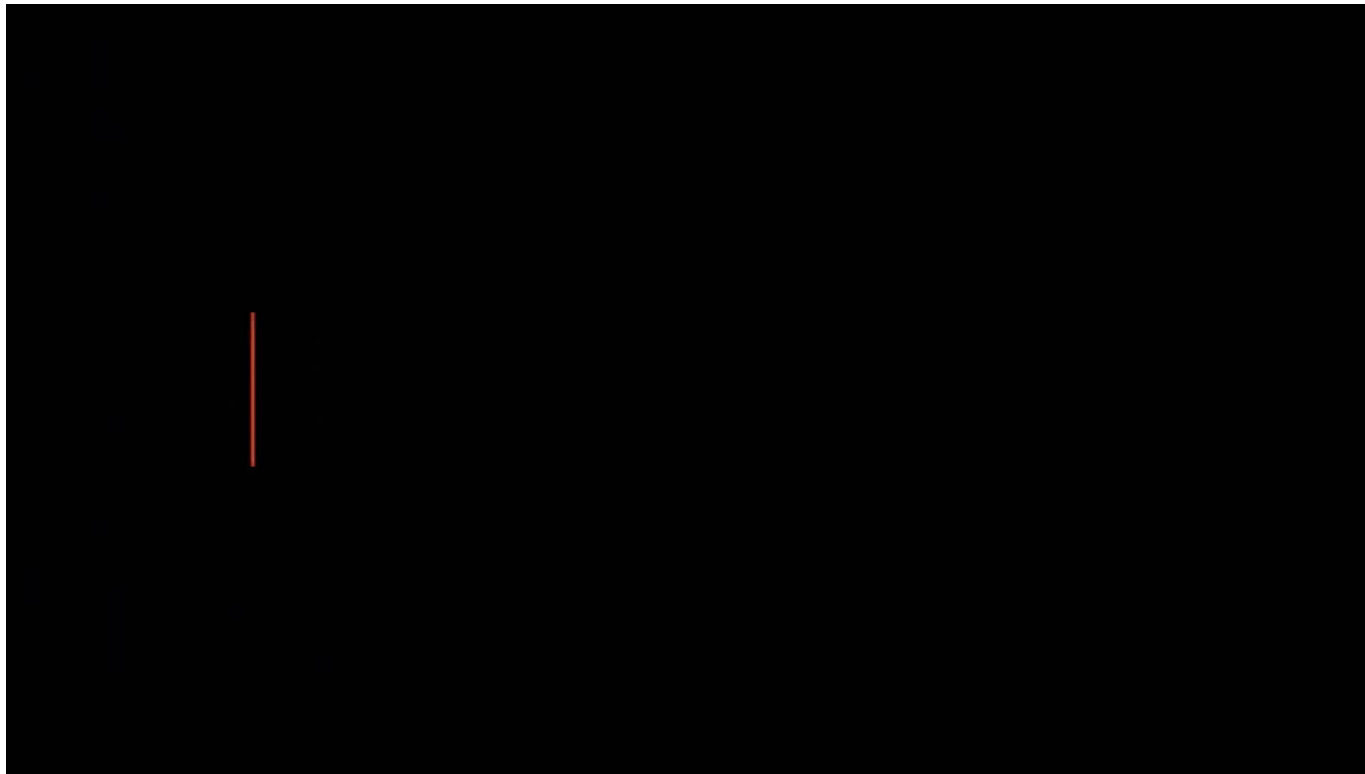
# The system for measurement of ID and OD high temperature pipes



<http://youtu.be/tkf9jYPbr5M>

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# Laser measurement (by rotating triangulation sensors) of ID and OD of large diameter pipes



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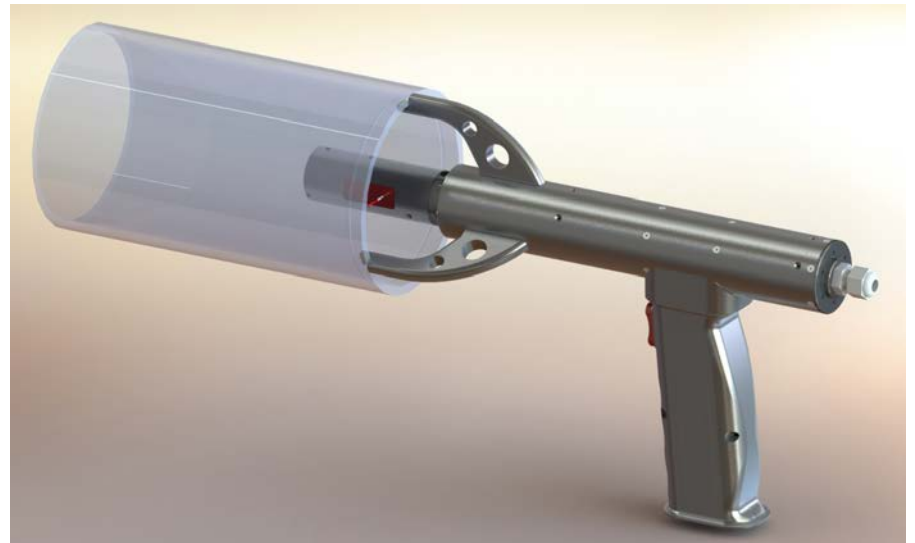
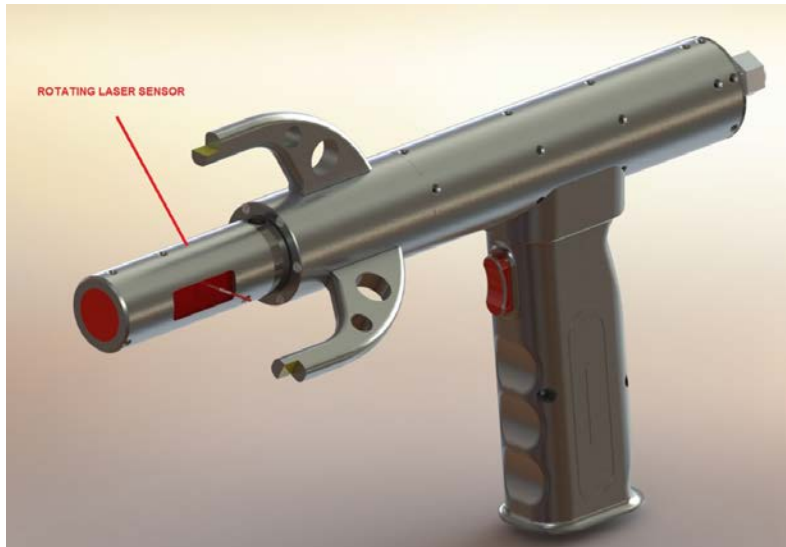
[https://youtu.be/I8P\\_C24kTY0](https://youtu.be/I8P_C24kTY0)



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# ID measurement: Projects

## Hand-held ID measurement gauge



- From 2017

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# Hand-held ID Measurement Gauge Model RF096-200/600-HH (prototype tests)



## Basic specification:

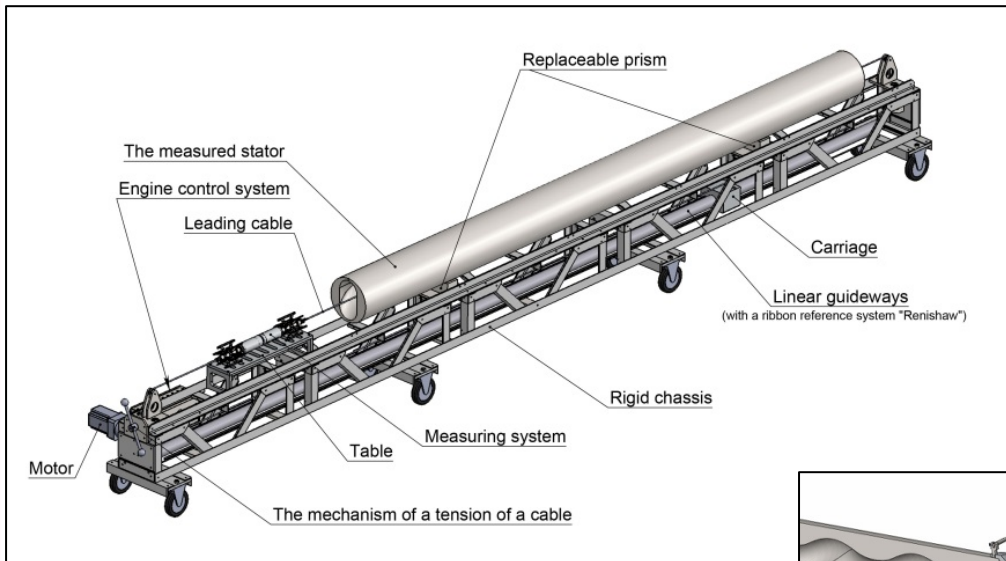
Measured ID range, mm	200...600
Accuracy, mm	±0.1
Depth of measurement, mm	on request
Measurement time, s	2
Sensors laser power, mW	1
Laser Class	2

<https://youtu.be/1BKwPpssy7U>

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# Laser Systems for Inner Surface Scanning



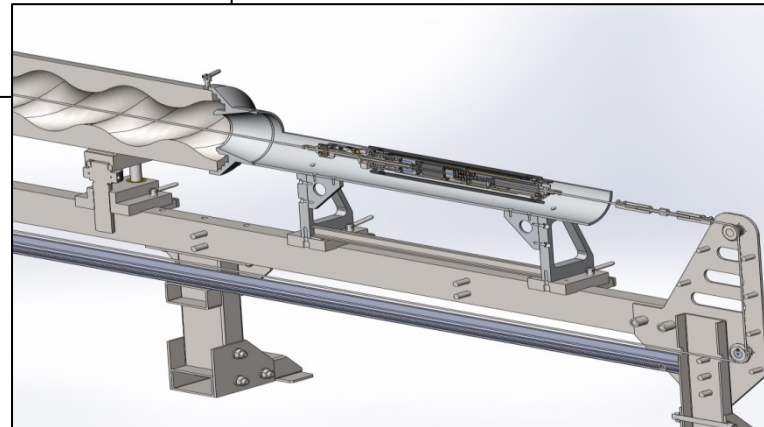
**Designed use:** Progressive cavity stators, tubes and pipes, gun barrel bore (rifled and smooth)

**ID range:** 10...300 mm

**Accuracy:** from  $\pm 2\mu\text{m}$

**Angle resolution:** 4 arcminutes

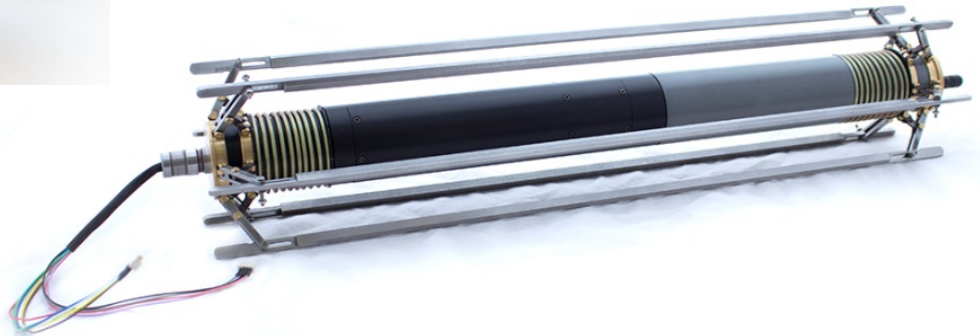
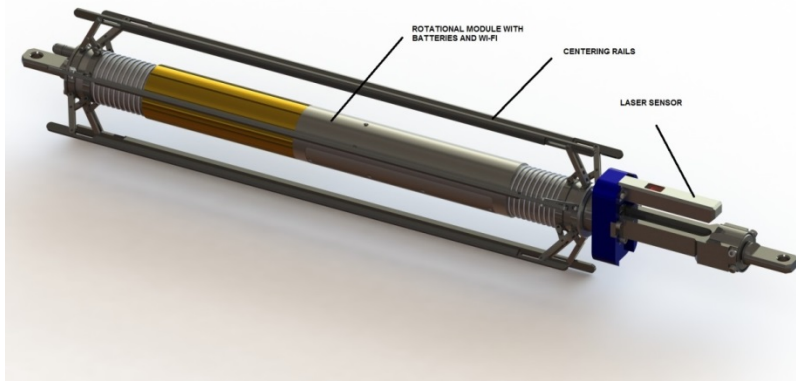
**Linear resolution:** 20  $\mu\text{m}$



- From 2017

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# Laser Scanning Modules



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**THANK YOU  
FOR YOUR ATTENTION!**

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