

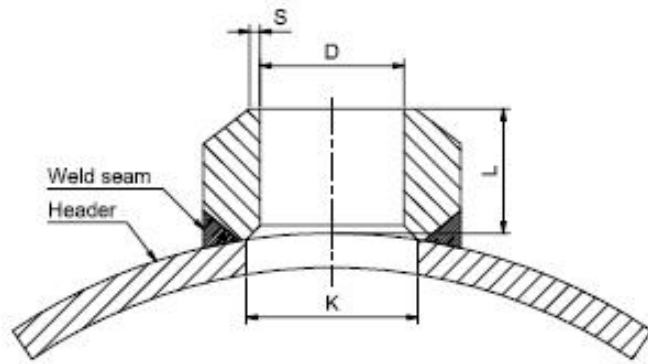


ULTRASONIC INSPECTION OF WELDOLETS, WELDOFLANGES AND SWEEPOLETS

SPC ECHOPLUS
Andrey Bazulin,
Deputy commercial director, PhD

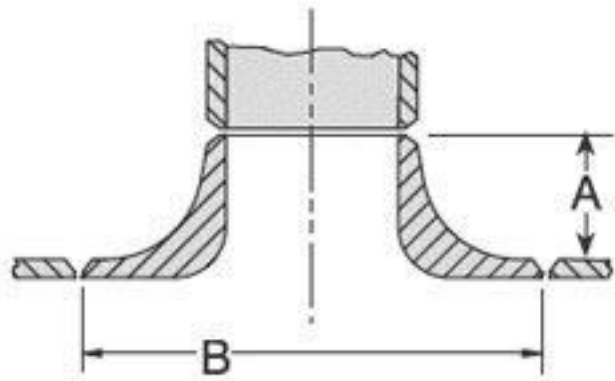
WELD DESIGN

WELD-O-LET, WELD-O-FLANGE

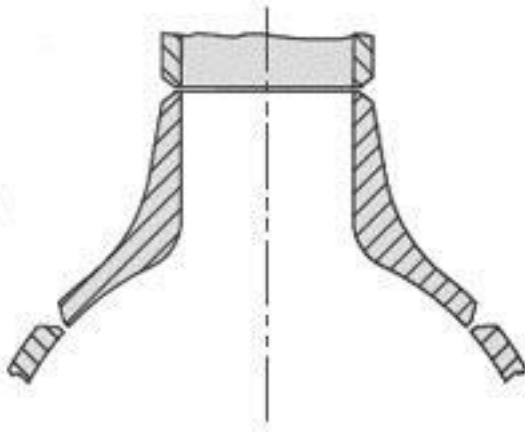


- Full penetration weld
- Surface of detail is not always flat
- Weld bevel is varying along the circumference

SWEEP-O-LET (INSERT WELDOLET)



SWEEPOLET



- Full penetration weld
- Surface of detail is not always flat
- Weld bevel is varying along the circumference

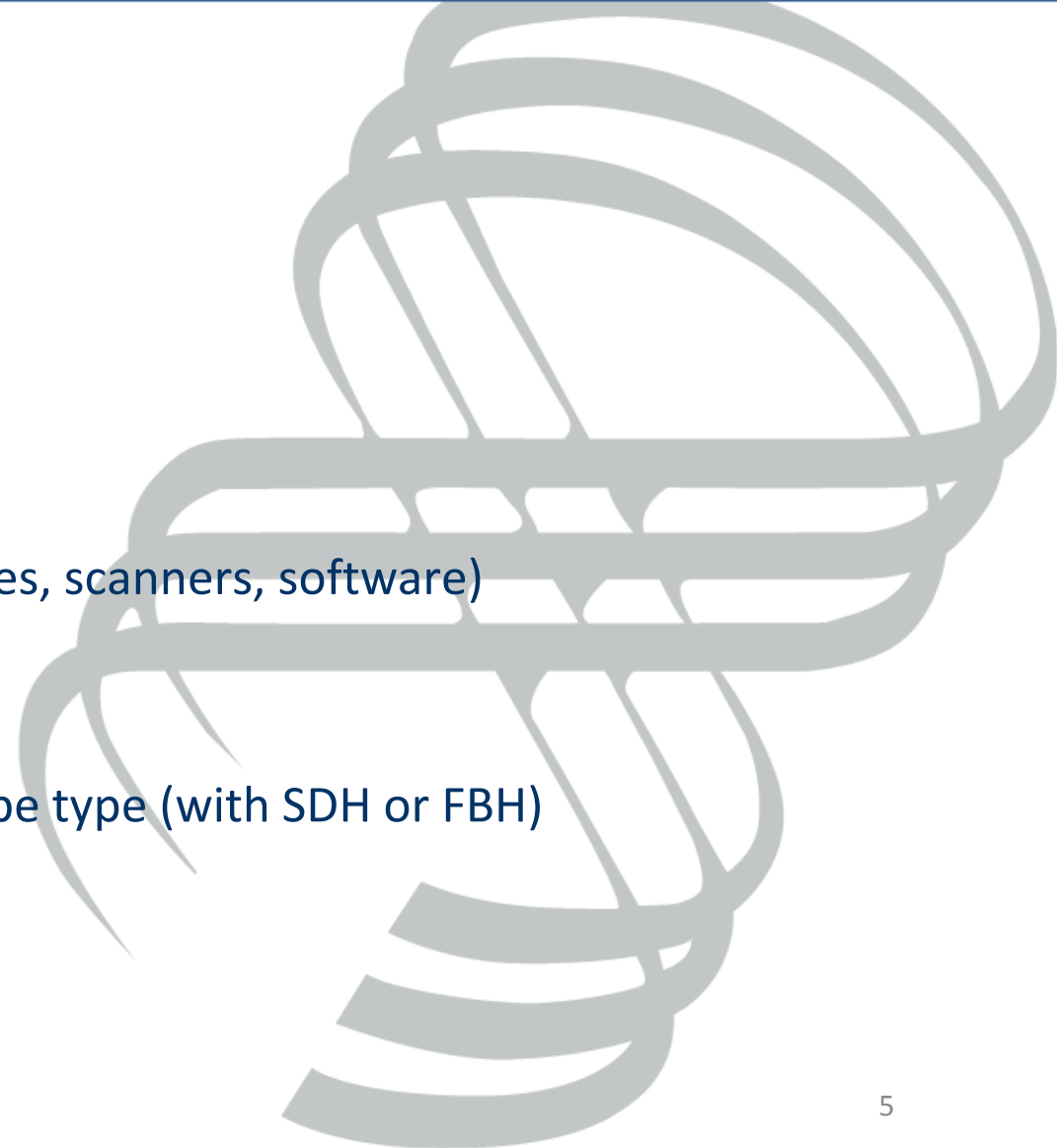


UT CONSTRAINTS

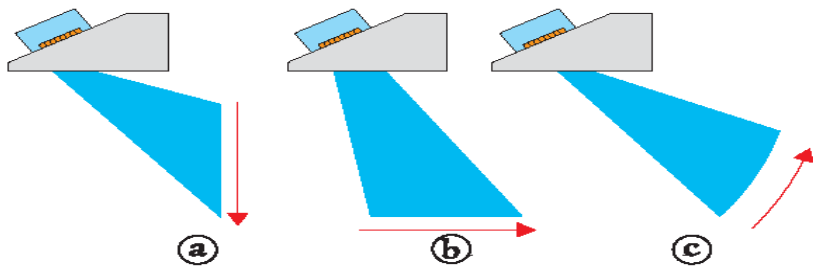
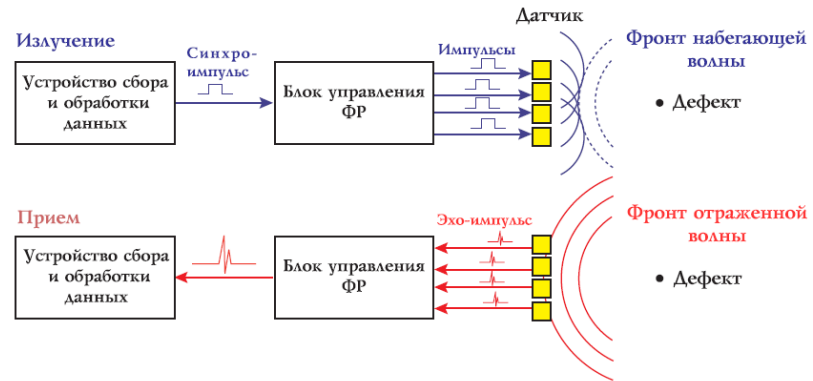
- Access from the side of the nozzle is limited or absent: the inspection technique from the side of the base pipe is not described in GOST R 55724 and ISO 17640
- Inspection from the base pipe side with a large pipe thickness is difficult (a large thickness and a decrease in signal amplitude when reflected from the inner surface)
- With a small pipe diameter, it is possible to use a probe with only a small shoe
- The changing geometry of the bevel greatly complicates the interpretation of the results
- Inspection of welded joints from austenitic materials introduces additional difficulties

PROPOSED TECHNIQUE

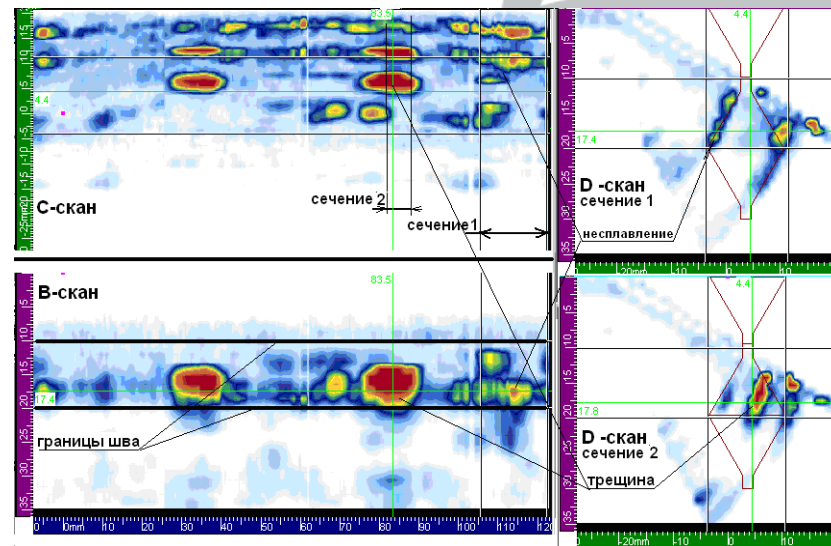
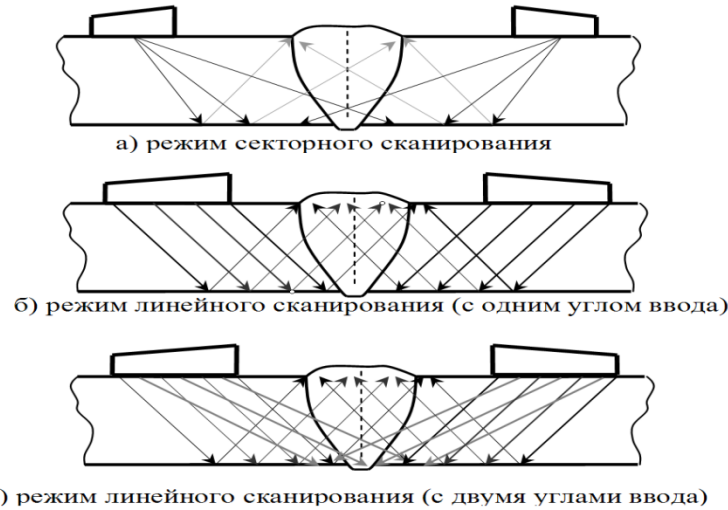
- Use of PA (TFM) ultrasonic imaging
 - 100% encoded record
 - Data visualization with use of 3D CAD model
- It is required to
 - Develop the inspection procedure describing
 - Requirements to equipment (flaw detector, probes, scanners, software)
 - Set up (sensitivity adjustment, scan plan)
 - Reference to the codes
 - Produce the reference blocks made from each pipe type (with SDH or FBH) and full scale blocks with hole for welded



Phased array inspections



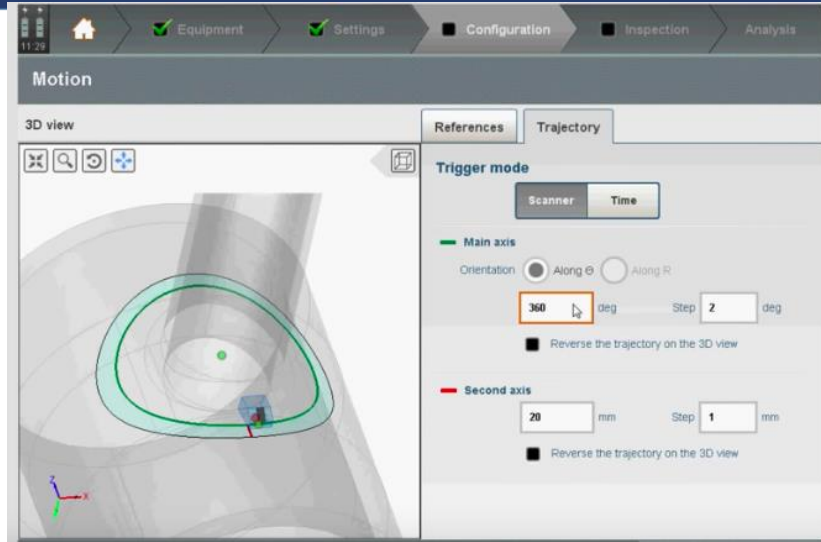
Focussing abilities



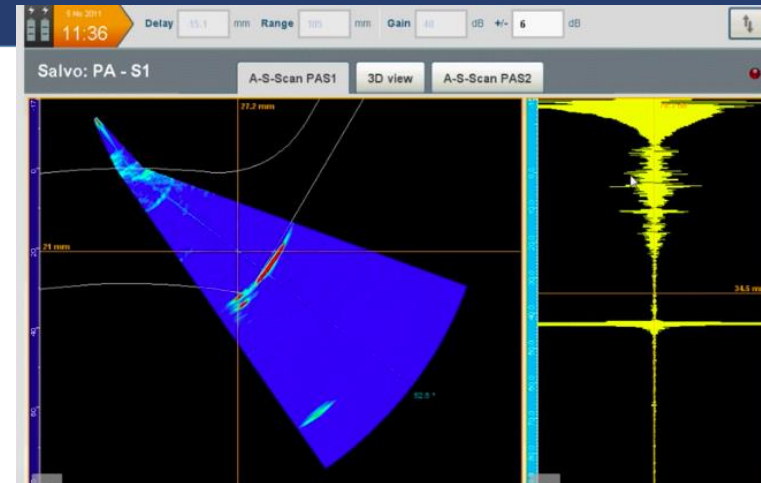
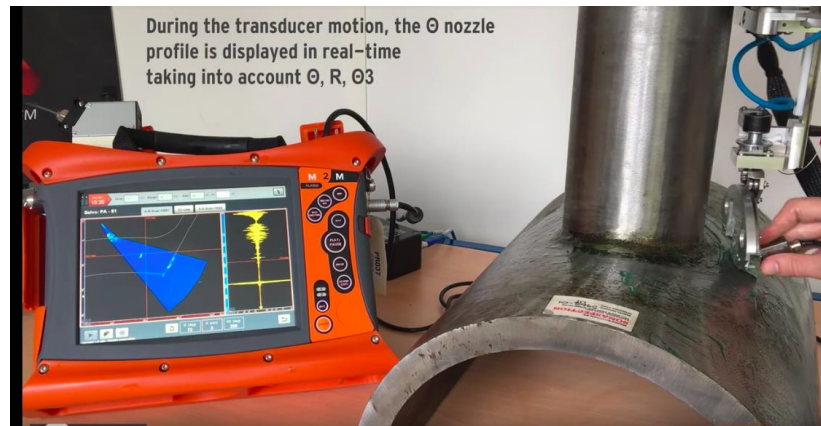
100% data record and visualization

Examples of lacks of fusions

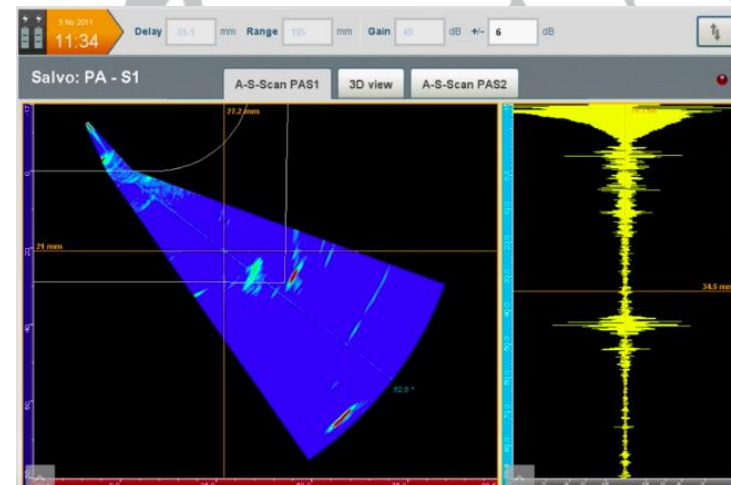
FLEXIBILITY of Phased arrays



3D model and scan plan



Adjustment of 3D model to the collected data



EXAMPLES

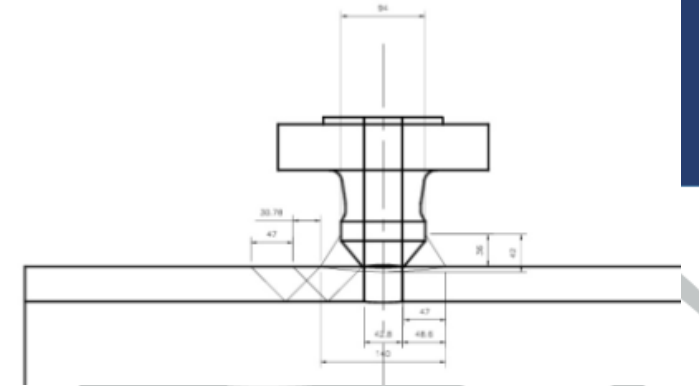
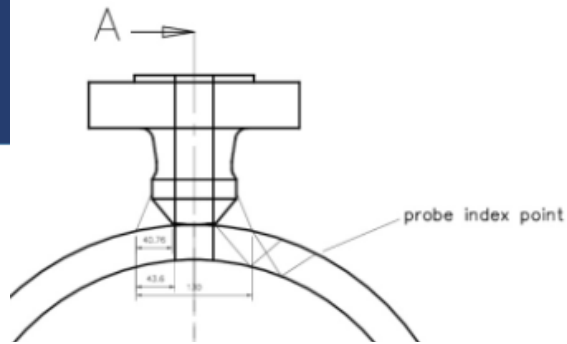
TurkStream 2017

Pipes: 12-32", WT 22-40 mm
Weld-o-let: 0,5-4" , WT 5-28,5 mm

ISO 17640
ISO 13847

45° probe, beam plotting

Reference blocks made from base
pipeline with SDHs

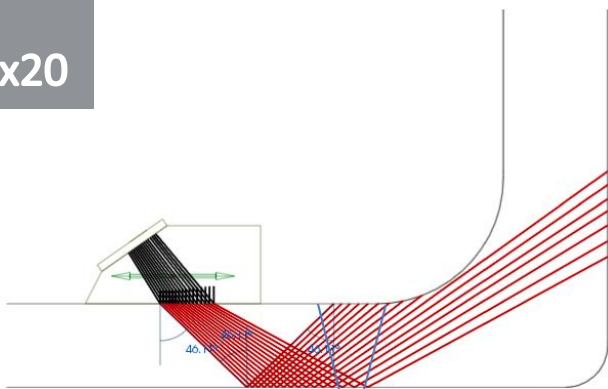


16" x 26.2 mm



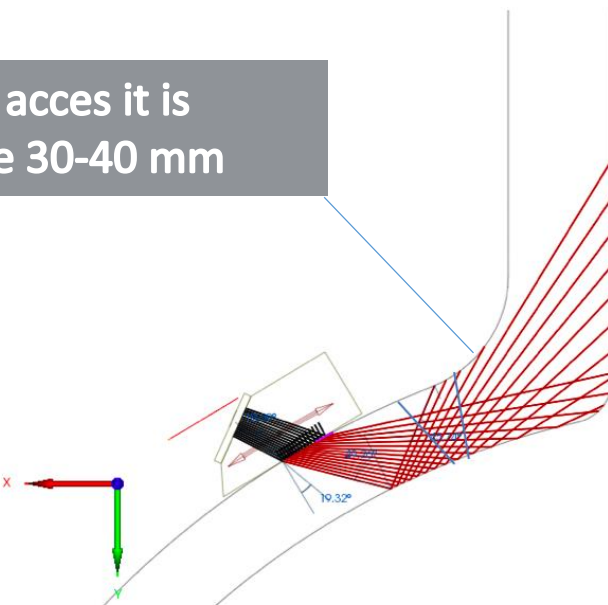
SWEEP-O-LET at 426 mm pipe

Pipe: 426x20
Sweep-o-let: 89x20

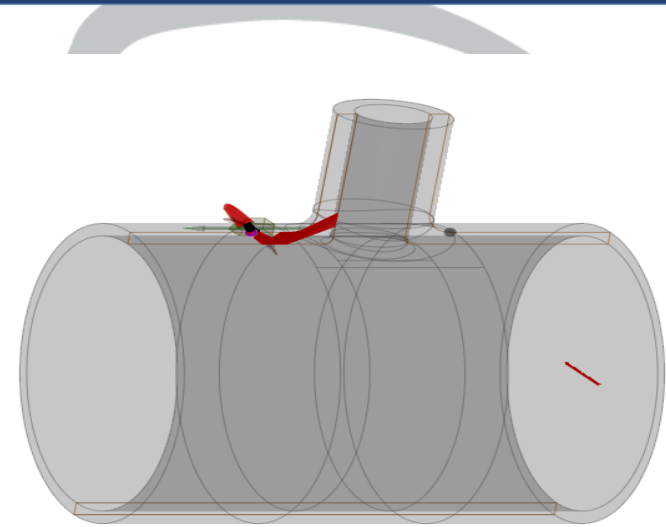


0 degree section

To have 2-sided acces it is required to have 30-40 mm



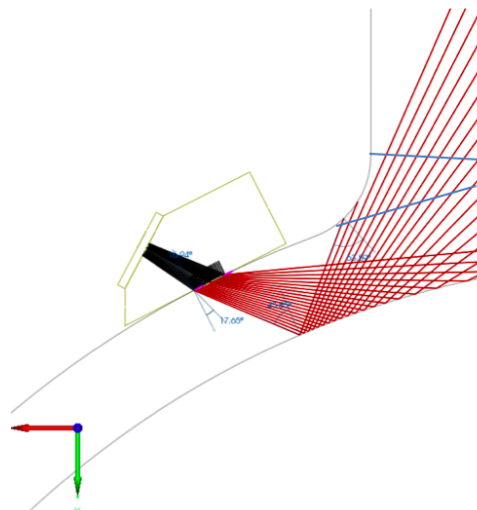
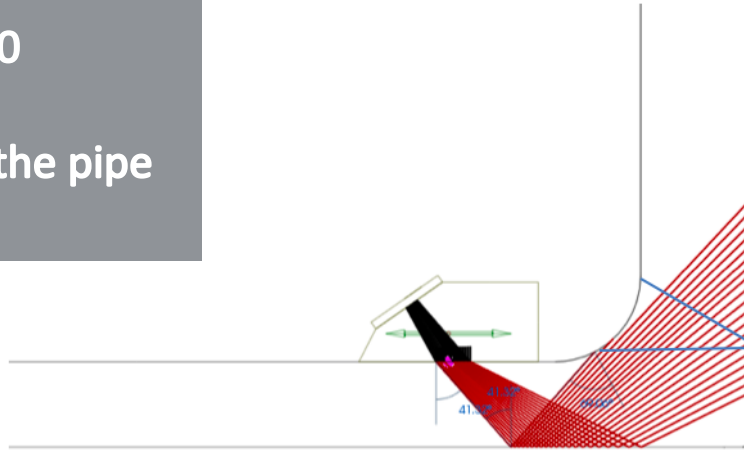
90 degrees section



WELD-O-LET at 426 mm pipe

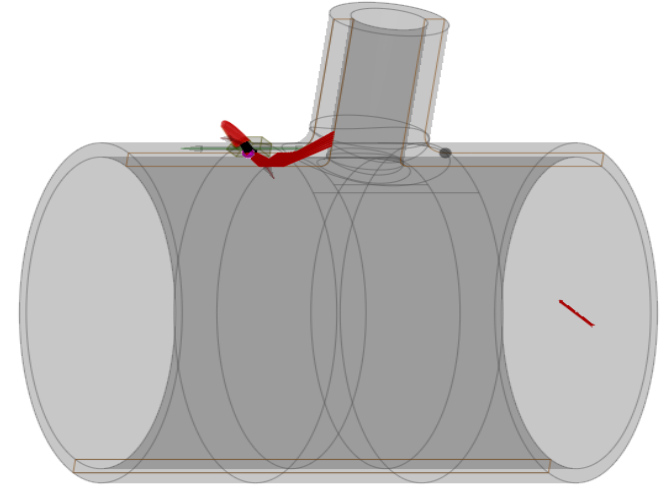
Pipe: 426x20
Weld-o-let: 89x20

Inspection from the pipe side



0 degree section

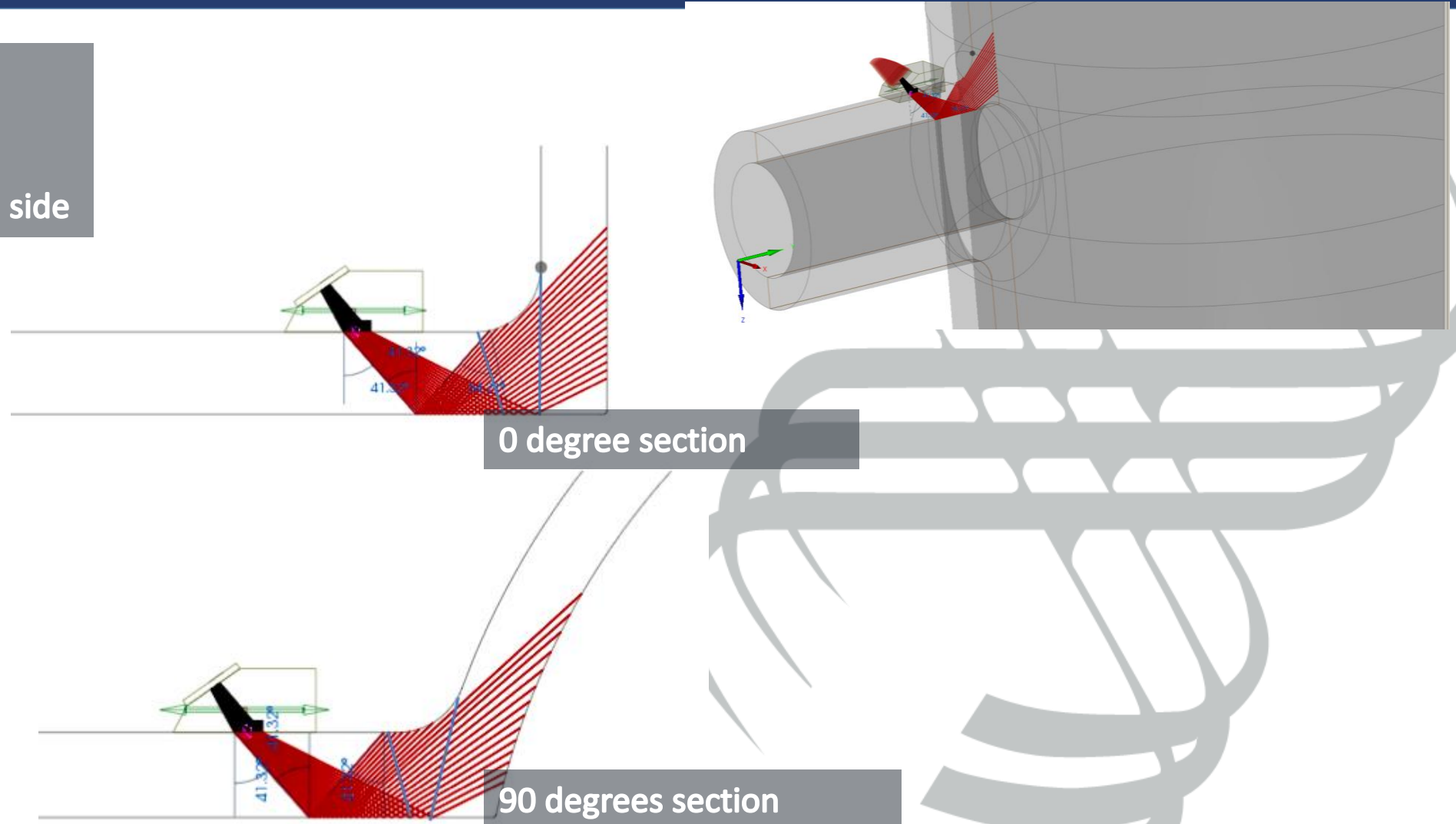
90 degrees section



WELD-O-LET at 426 mm pipe

Pipe: 426x20
Weld-o-let: 89x20

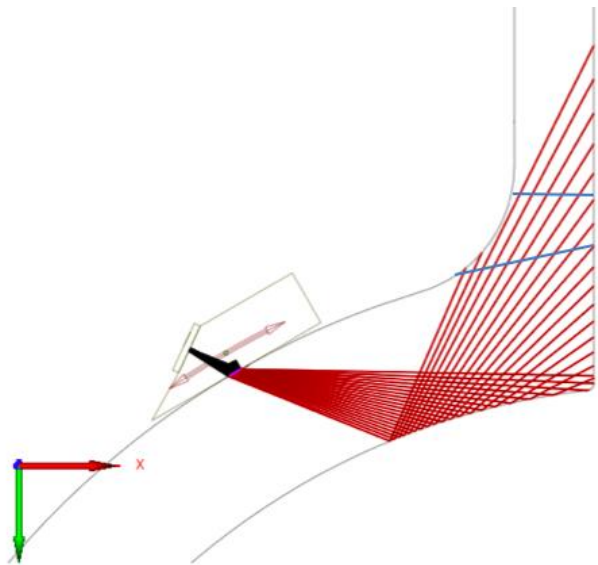
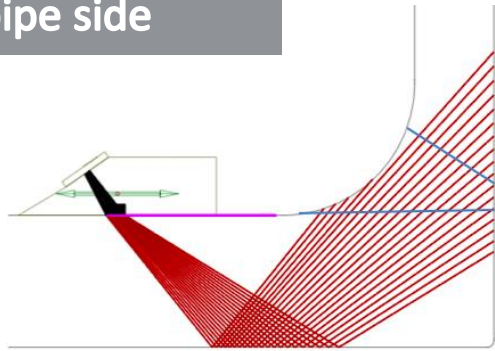
Inspection from the nozzle side



WELD-O-LET at 219 mm pipe

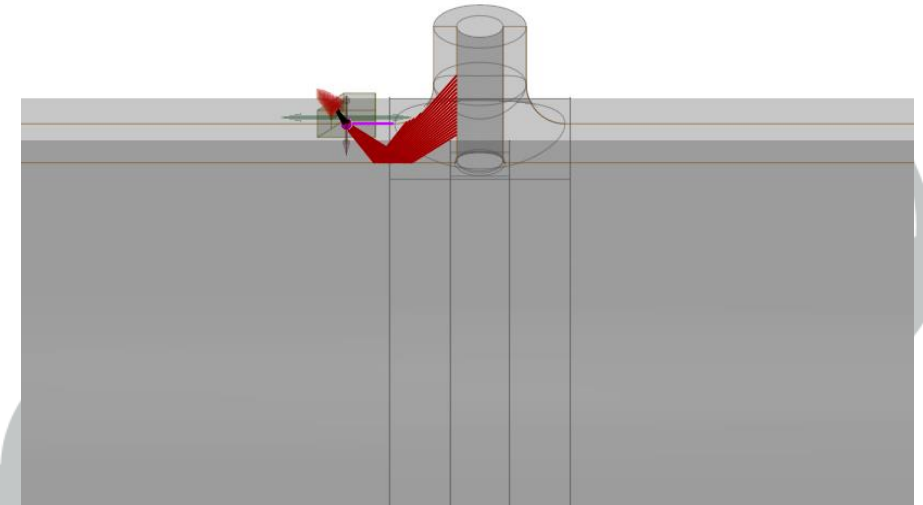
Pipe: 219x15
Weld-o-let: 48x12

Inspection from the pipe side



0 degree section

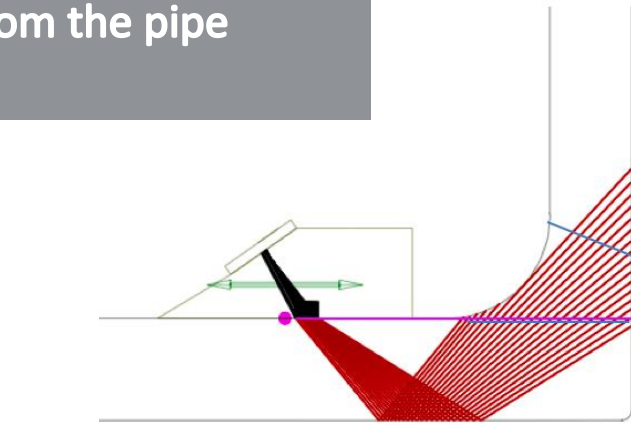
90 degrees section



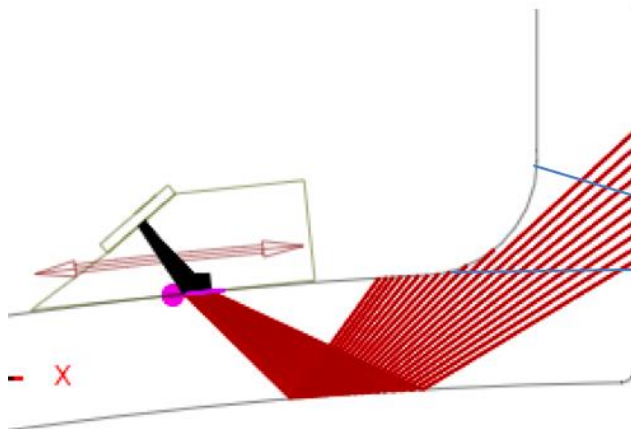
WELD-O-LET at pipe 826 mm

Pipe: 826x10
Weld-o-let: 28x6

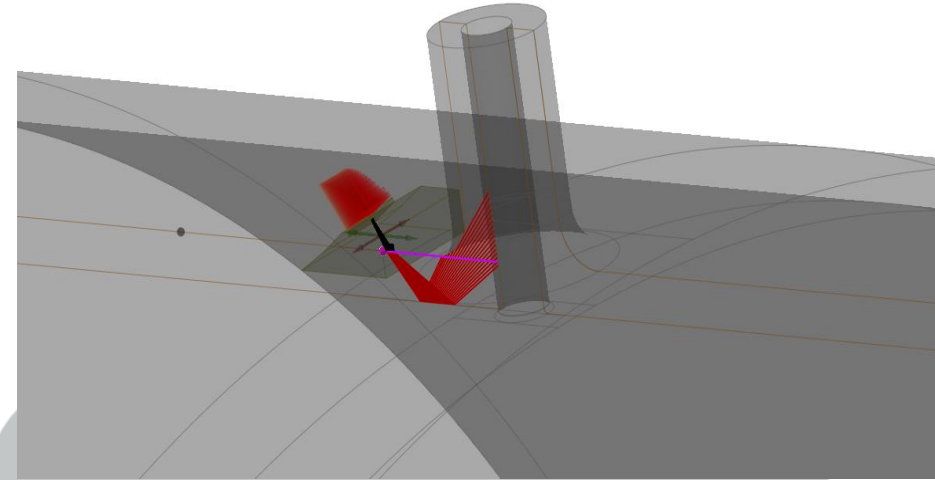
Inspection from the pipe
external side



0 degree section

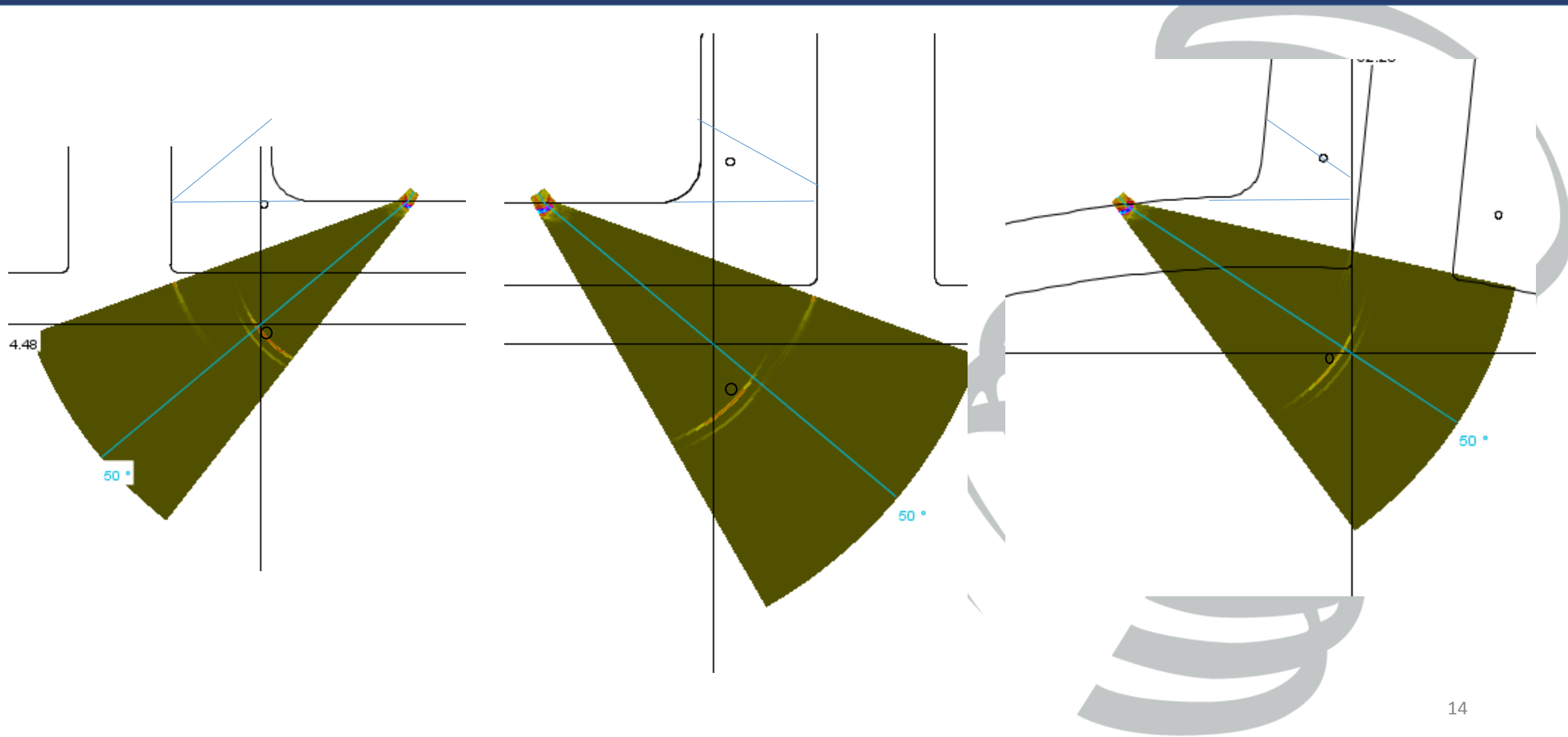


90 degrees section

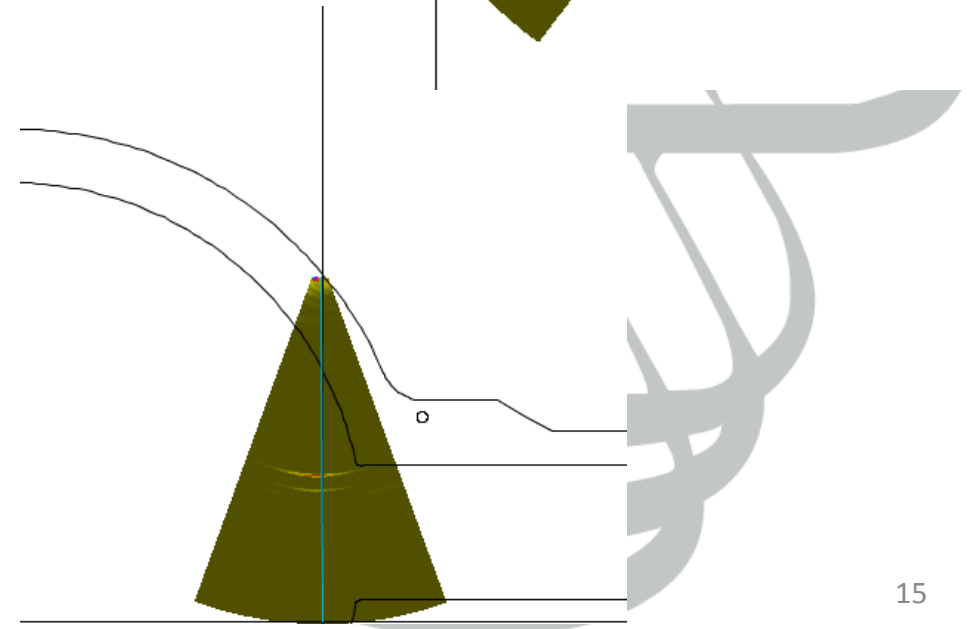
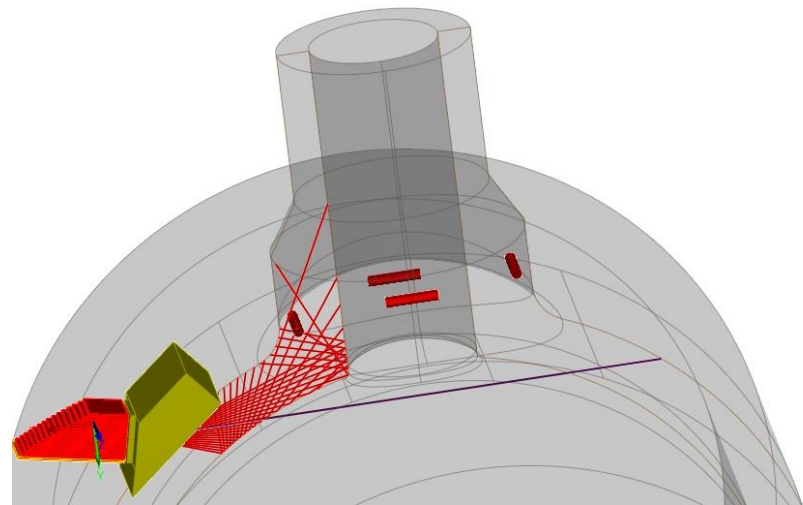
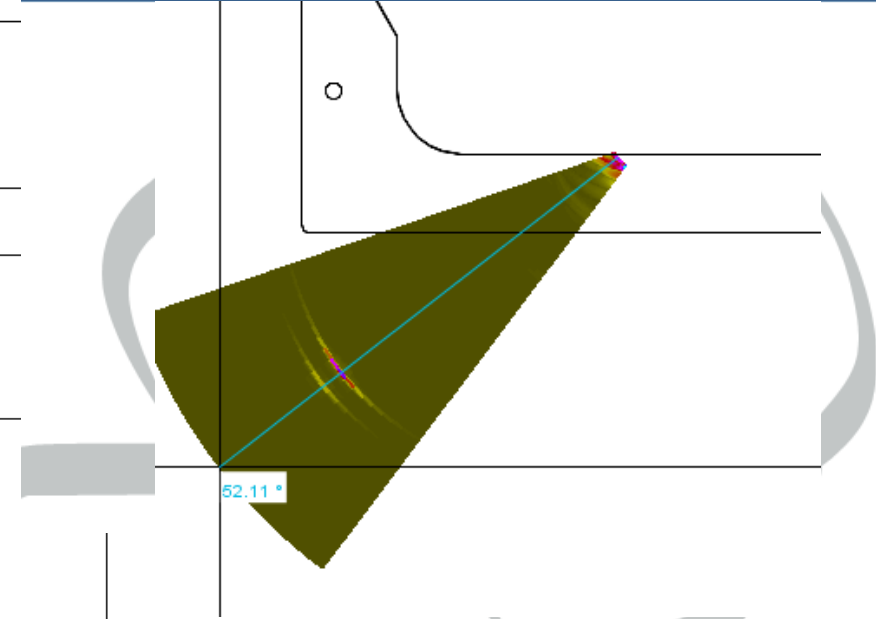
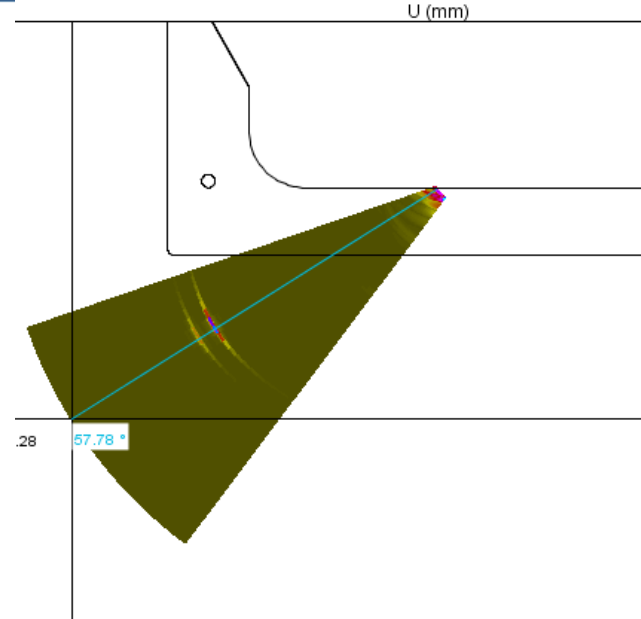
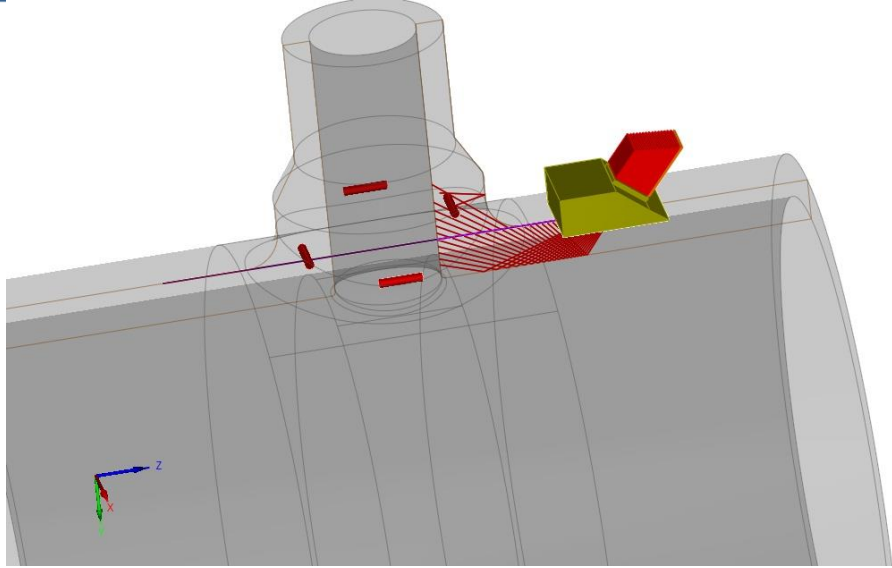


It is possible to make inspection from the
inner side of pipe for some cases

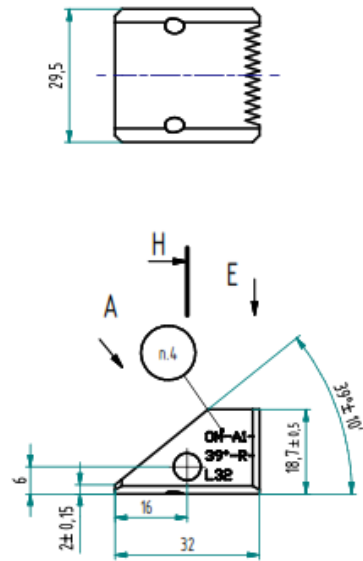
WELD-O-LET на трубе диаметром 826 мм



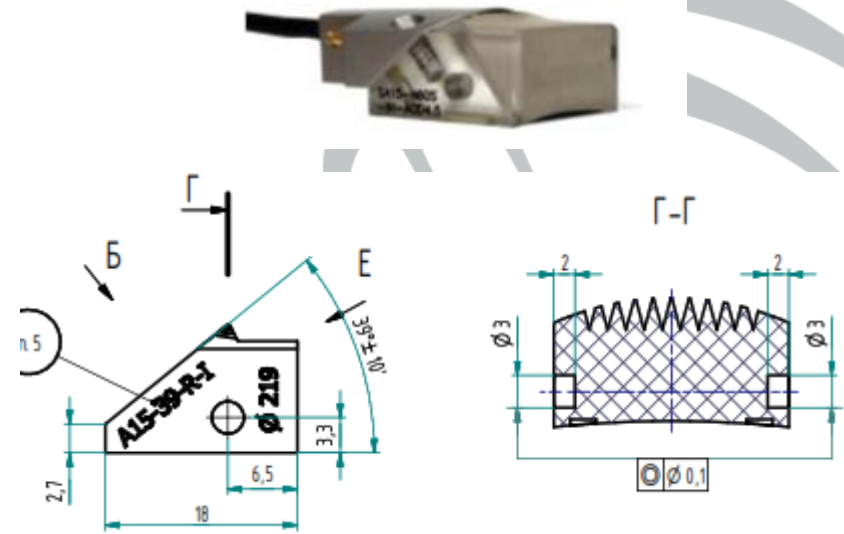
WELD-O-LET 1" на трубе диаметром 6" (150 мм)



PROBES AND WEDGES



A10 TYPE



Cobra A15 TYPE

ACOUSTIC COUPLING

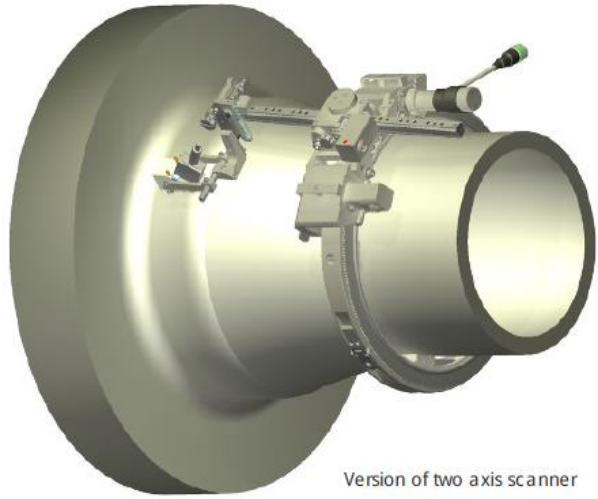
Use solid oil for

Add special channel for acoustical coupling monitoring



6" (159 mm) pipe

SCANNERS

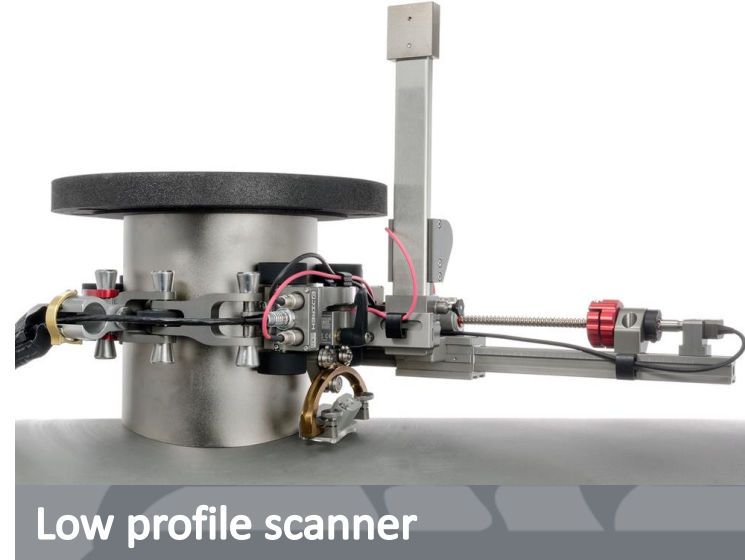


Version of two axis scanner

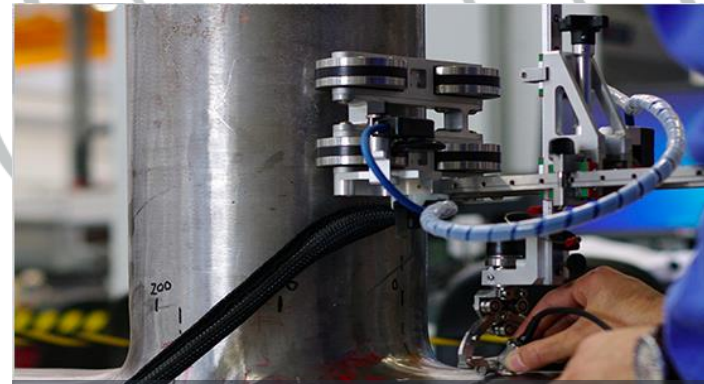
Motorized scanner installed on nozzle



Mini encoder



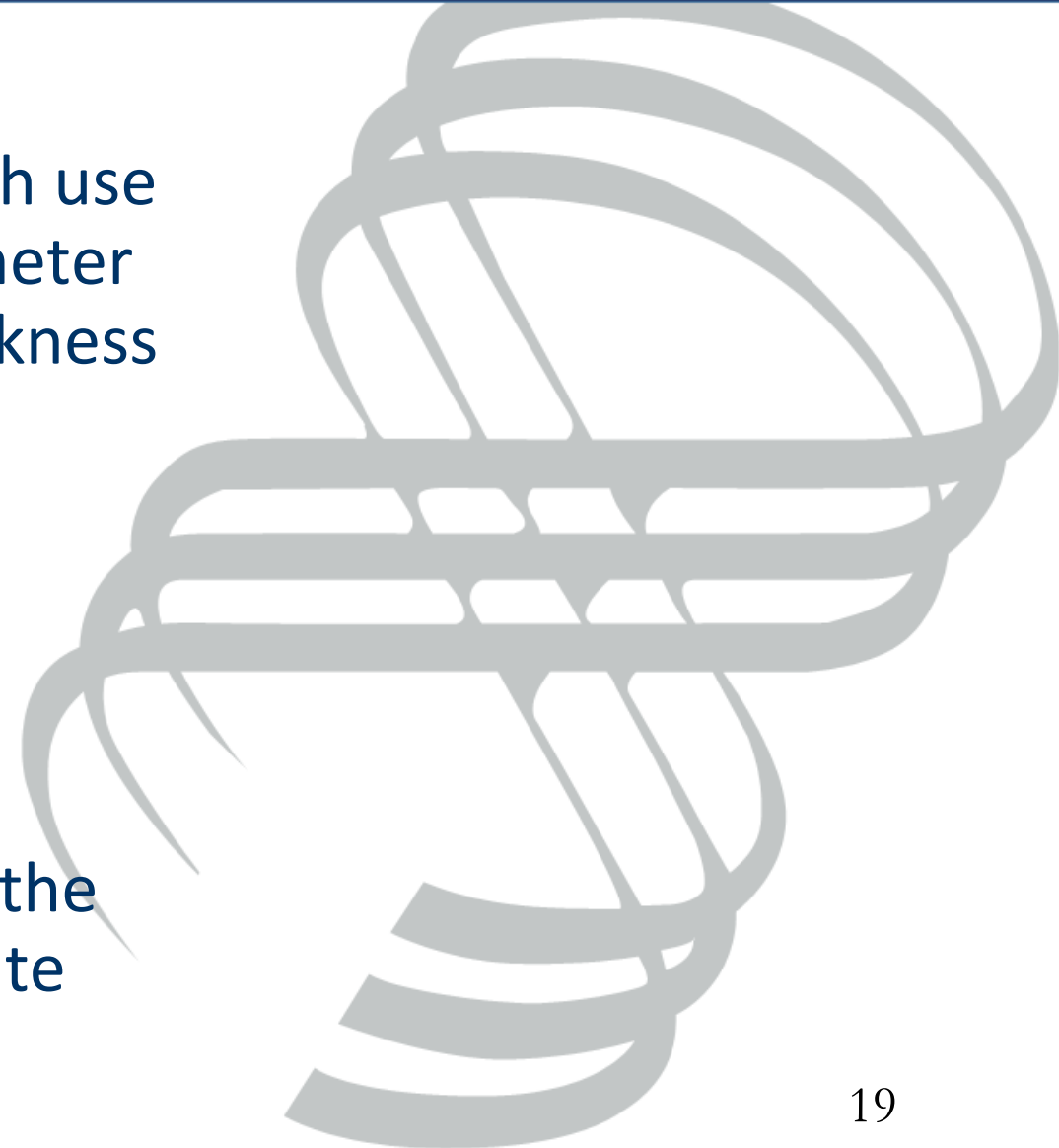
Low profile scanner



3 axis manual scanner

SUMMARY

- It is possible to provide UT inspection of weldolets, weldoflanges and sweepolets with use of phased array (TFM) imaging for pipe diameter 6"+ (150+ mm), WT 10+ mm and nozzle thickness 10+ mm
- Reliability of inspection is provided with
 - Visualization of object cross sections and proper chose of the scan plan
 - Permanent record of the UT data
 - Building the 3D model and adjustment of the UT data to the model, this assist to evaluate indications



NEXT ACTIONS

- To produce the reference and validation blocks (MSU-90)
- To make tests (ECHOPLUS)
- To make a decision about the technique for branch welds inspection



Thank you for your attention



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