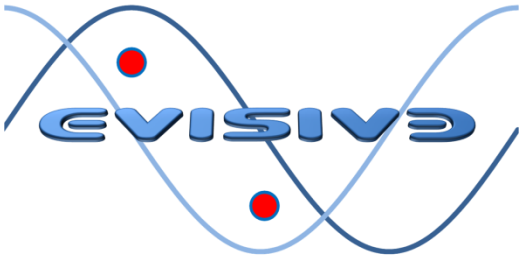
Fiber Reinforced Furan Pipe & Fittings Inspection and Imaging Using Evisive Scan™ Technology

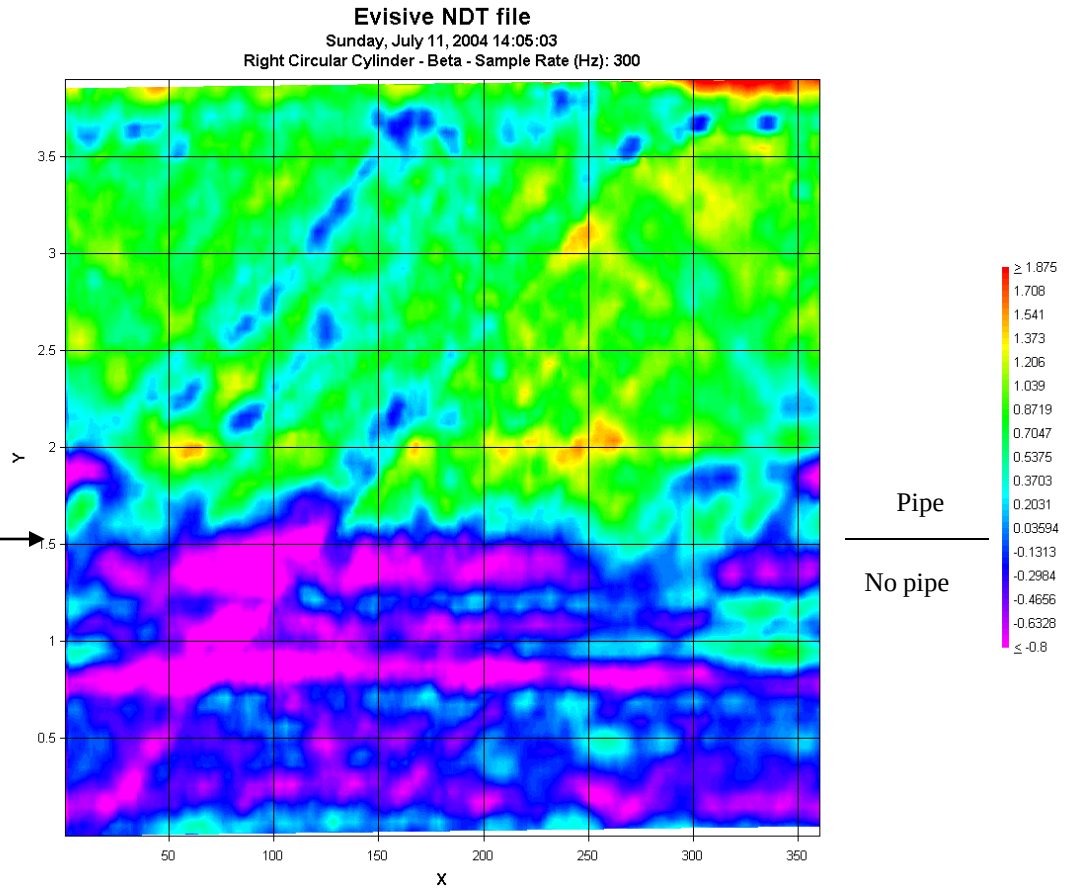


Fiber Reinforced Furan Pipe & Fittings – Prepared Coupons

- Lab inspections were performed on
  - Pipe coupling joint control standard (no defects)
  - Pipe coupling joint with insufficient adhesive
  - Pipe coupling joint with excessive adhesive
  - Pipe coupling joint with adhesive which has been allowed to over-cure prior to its use
  - Pipe section control standard (no defects)
  - Pipe section with defects sufficient to cause in-service failure

Scan images of the FRP Coupons

- Pipe coupling joint control standard (no defects)



Note the crisp delineation of the end of the pipe in the fitting (purple/green)

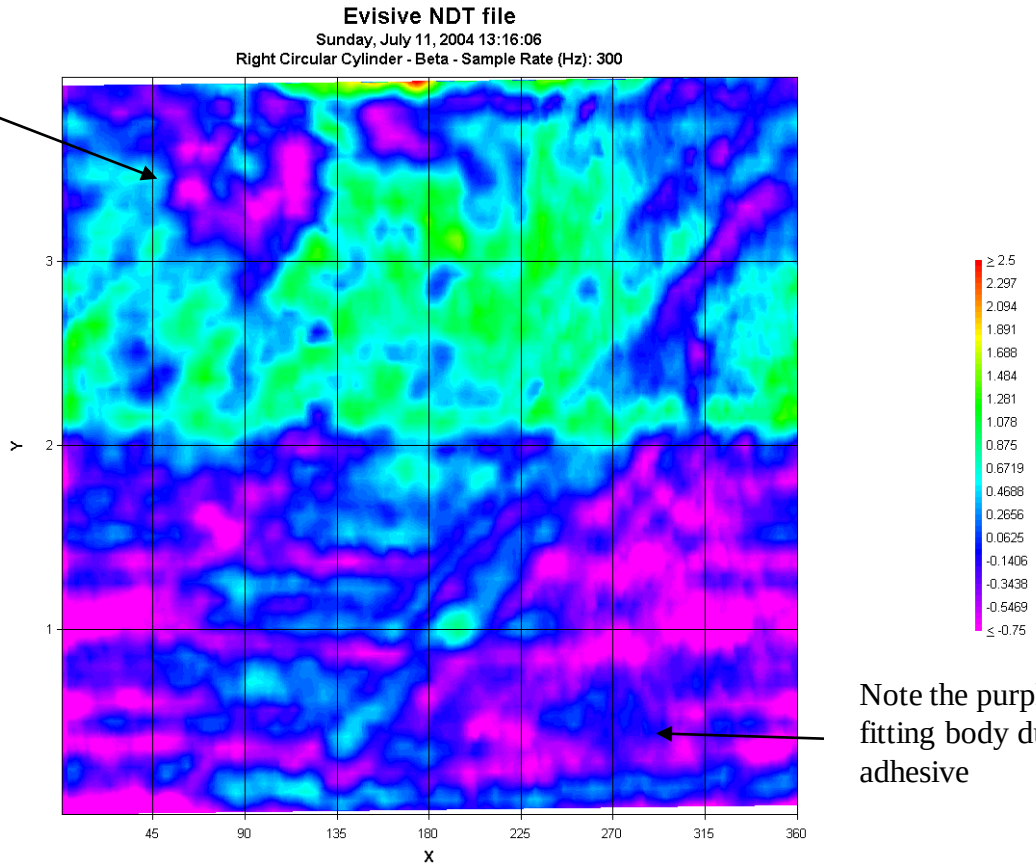
Pipe

No pipe

Scan images of the FRP Coupons

- Pipe coupling joint with insufficient adhesive

Note the purple areas in the fitting body due to lack of adhesive

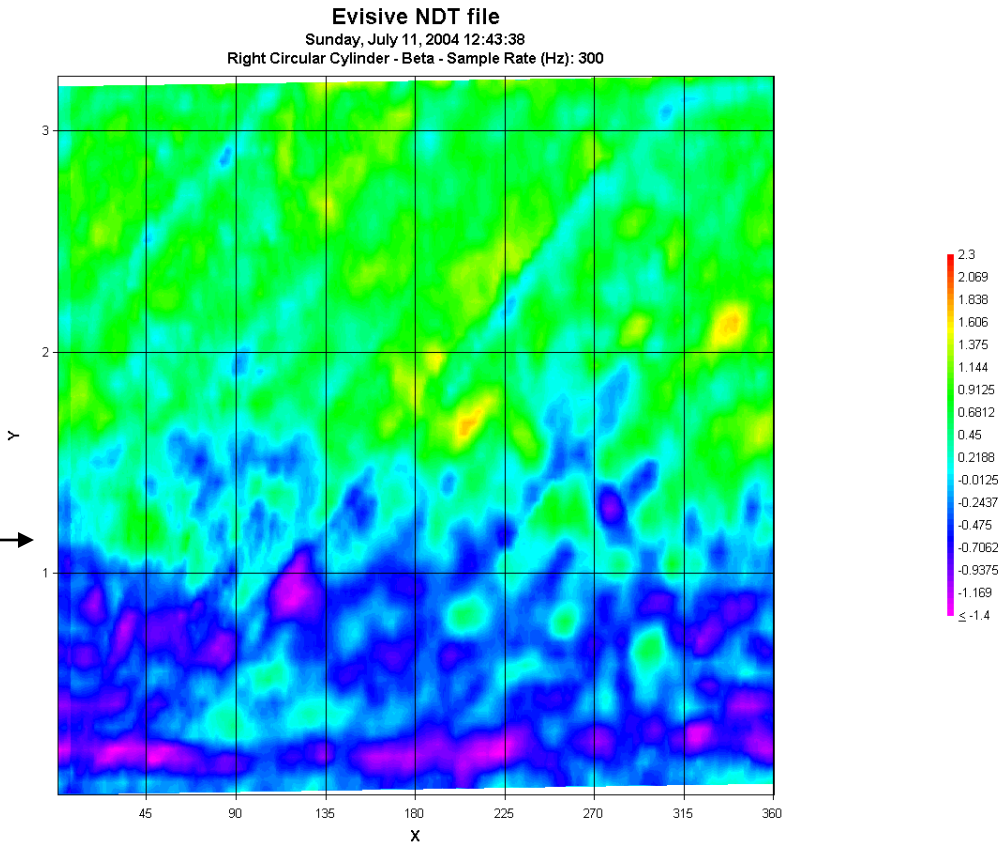


Note the purple areas in the fitting body due to lack of adhesive

Scan images of the FRP Coupons

- Pipe coupling joint with excessive adhesive

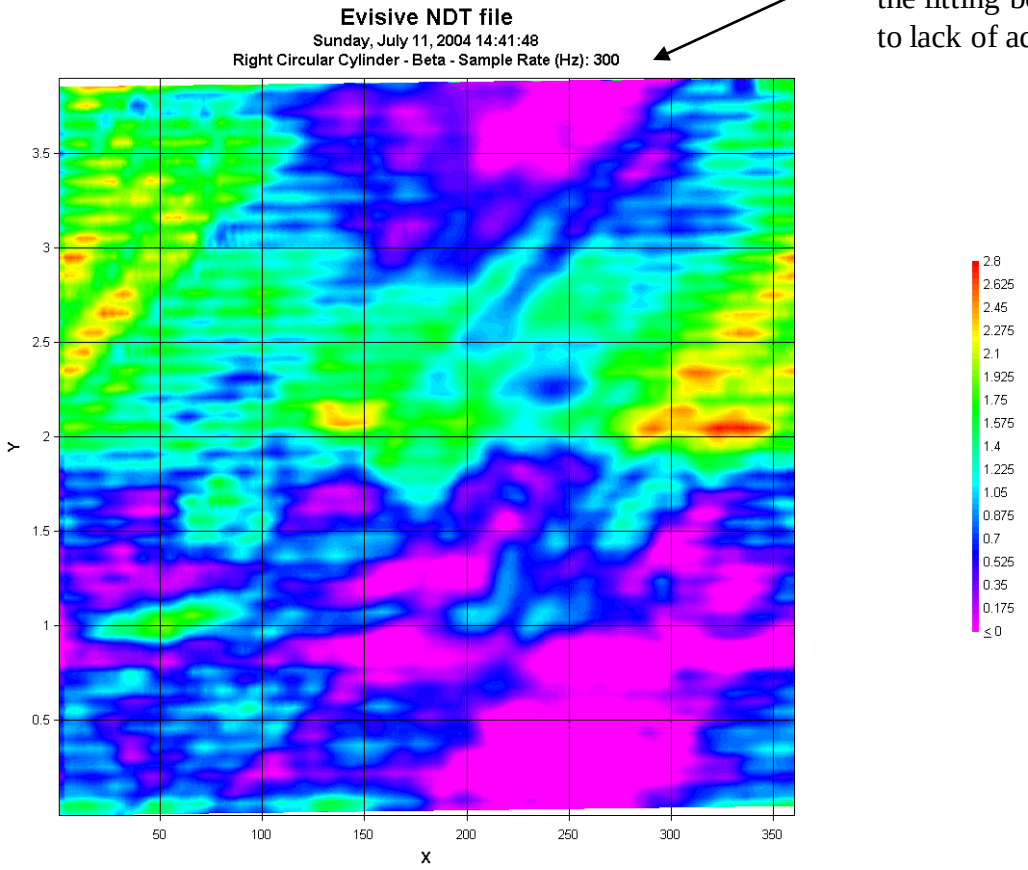
Note the “sloppy” delineation at the end of the pipe, due to excess adhesive in the fitting



Scan images of the FRP Coupons

- Pipe coupling joint with adhesive which has been allowed to over-cure prior to its use

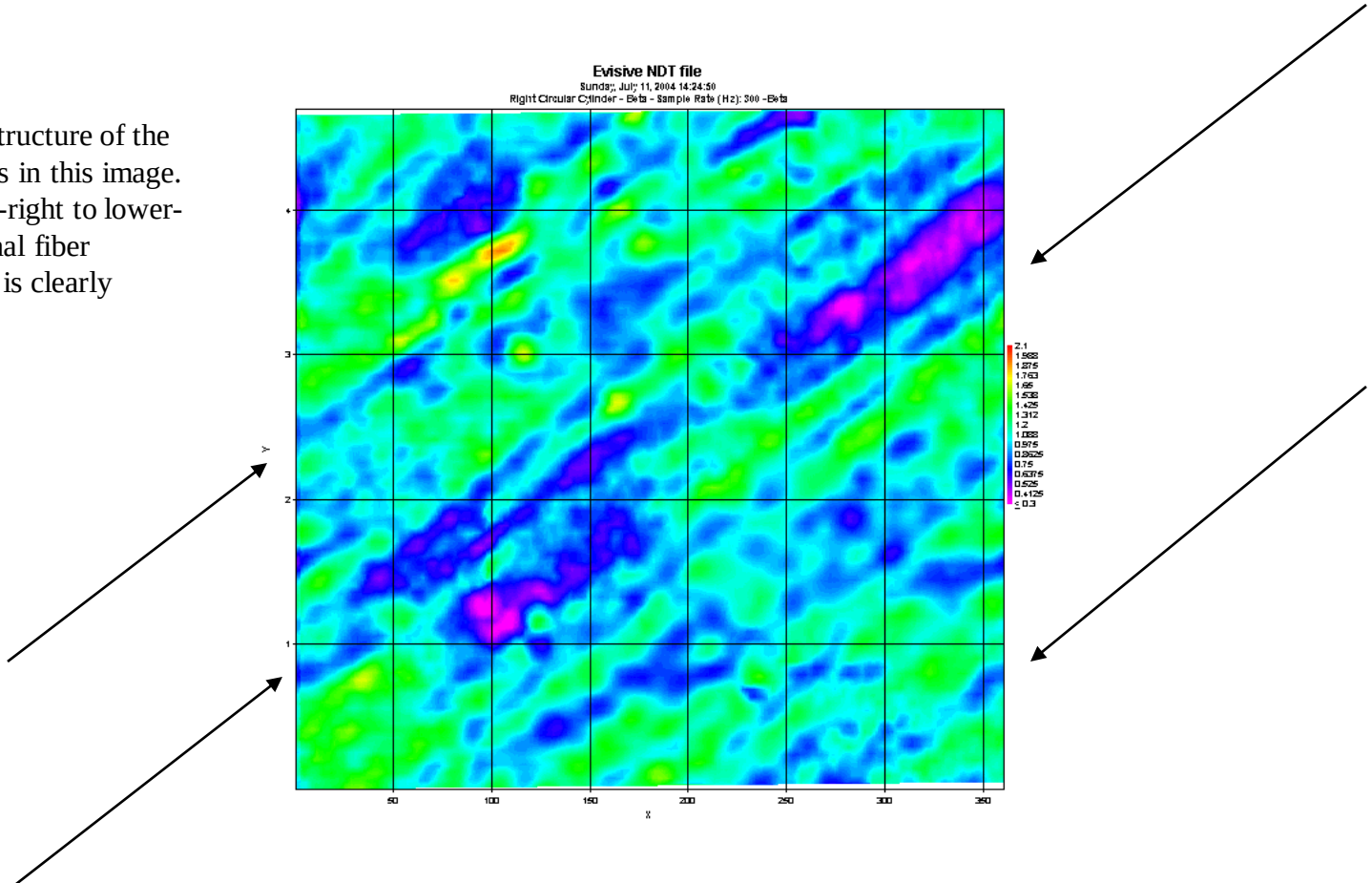
Note the purple areas in the fitting body, again, due to lack of adhesive



Scan images of the FRP Coupons

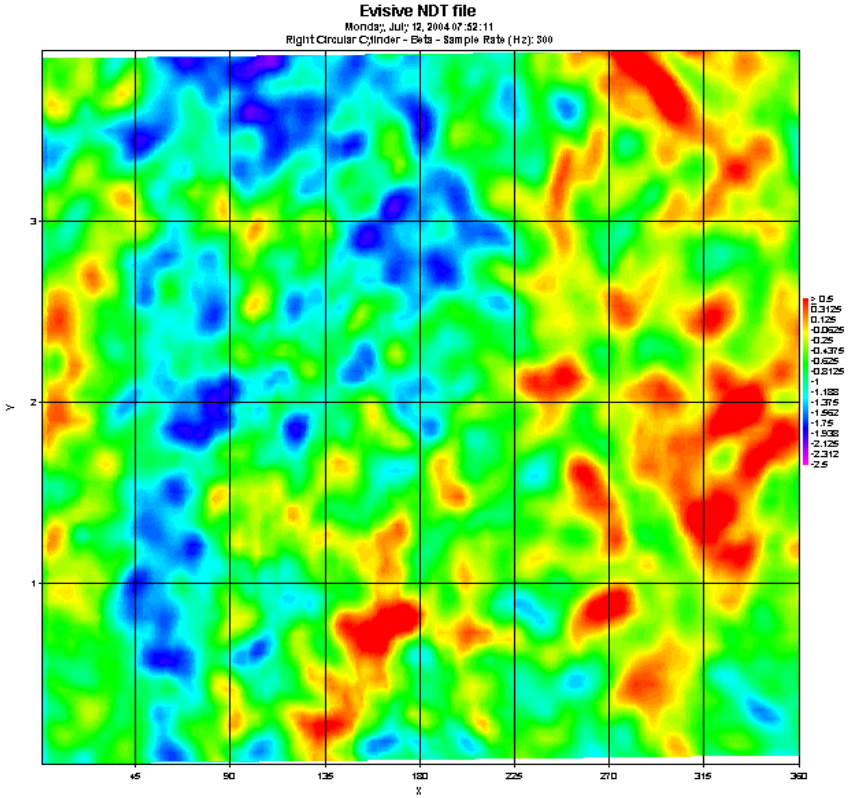
- Pipe section control standard (no defects)

Note the structure of the glass fibers in this image. The upper-right to lower-left diagonal fiber alignment is clearly visible.



Scan images of the FRP Coupons

- Pipe section with defects (loss of wall integrity)



Note that the fiber alignment, clearly visible in the image of new pipe is almost completely absent here. The random orientation of the remaining glass fibers in this sample dominate this image. The vast majority of the glass fibers here are anchored at one end only, and the ID of the specimen has a “furry” appearance, owing to the loss of resin component.

In-service Testing of Installed Piping Systems

- New components are imaged (control)
- Critical plant components are chosen which have experienced in-service degradation
- Known defects are imaged
- These images are compared to actual component condition (validation)
- Components for which the current condition is unknown are imaged, and the images evaluated

Scan of New Furan FRP Component

Note that this scan is nearly featureless. The only clear features are the diagonals due to the fibers in the composite.

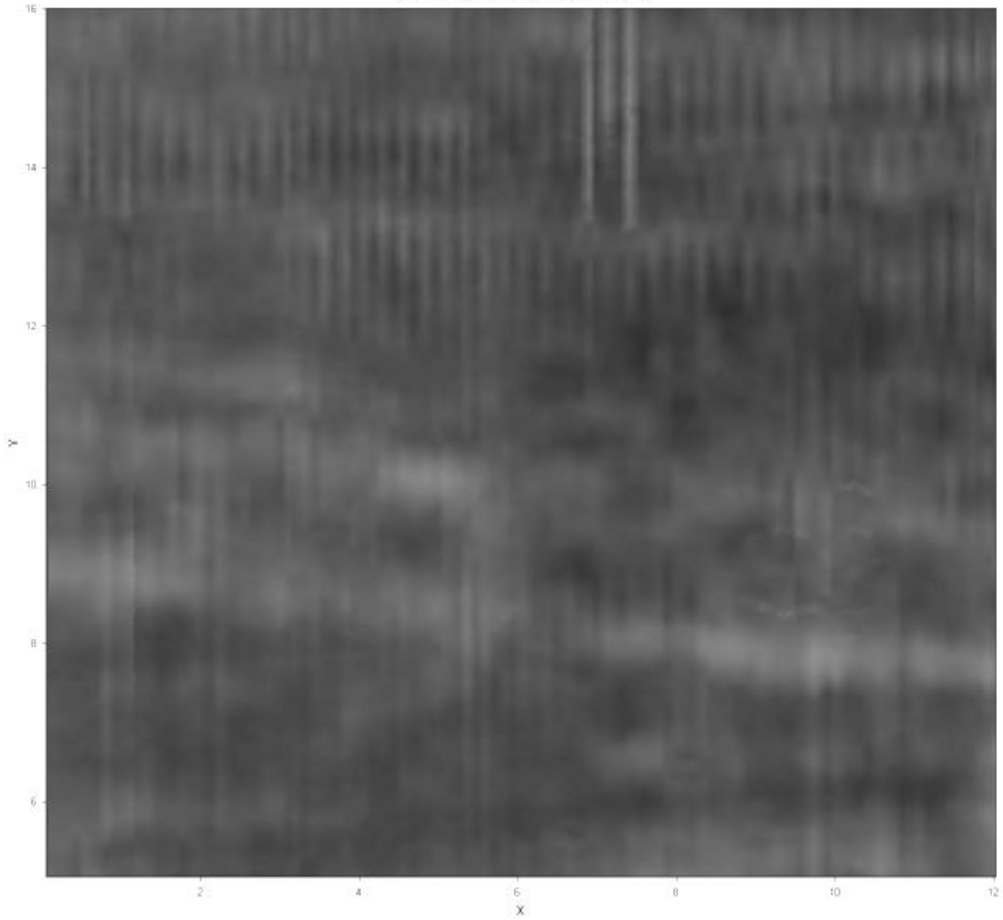
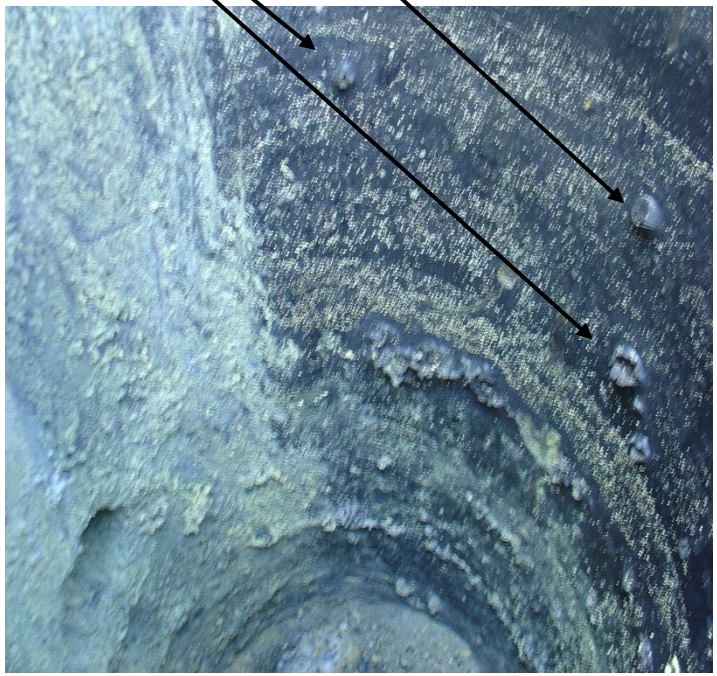


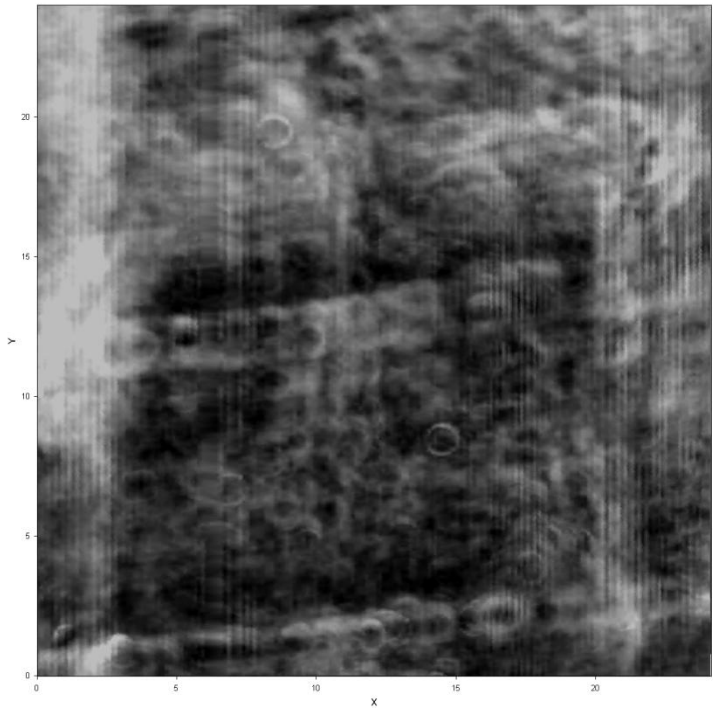
Photo and Scan of Known Degraded Component

Note the round blisters in various stages of formation throughout the specimen

(Validation Scan)

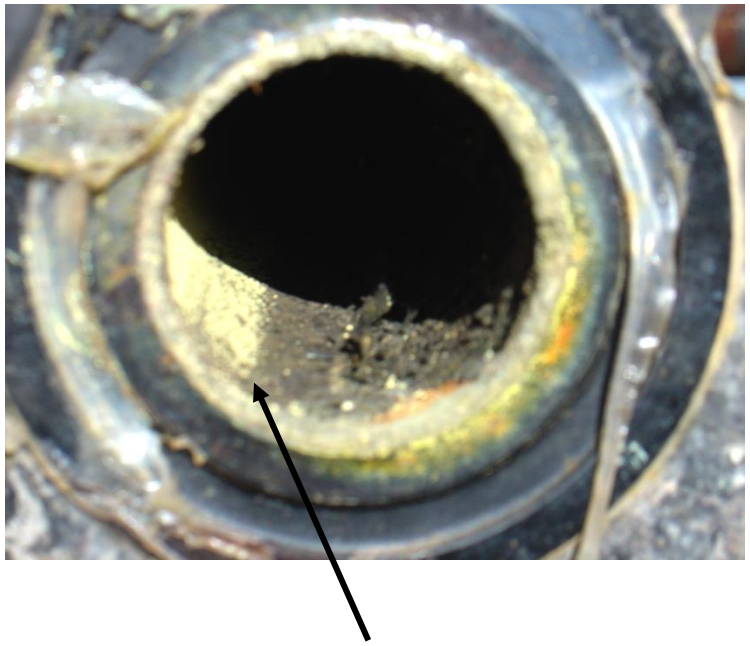
Note the ID blisters, clearly imaged from the OD





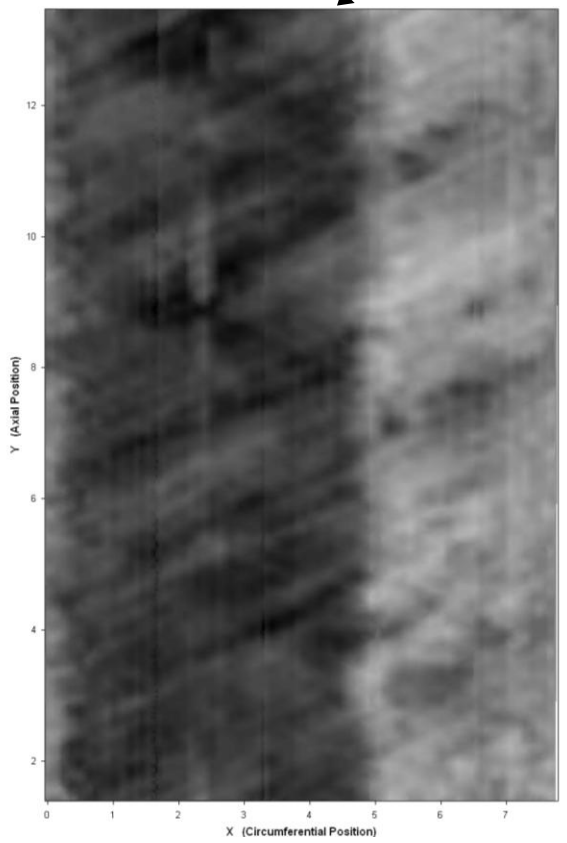
Note the areas where the blisters overlap, creating large degraded regions on the ID on both the photo and scan image

Photo and Scan of Known Degraded Component

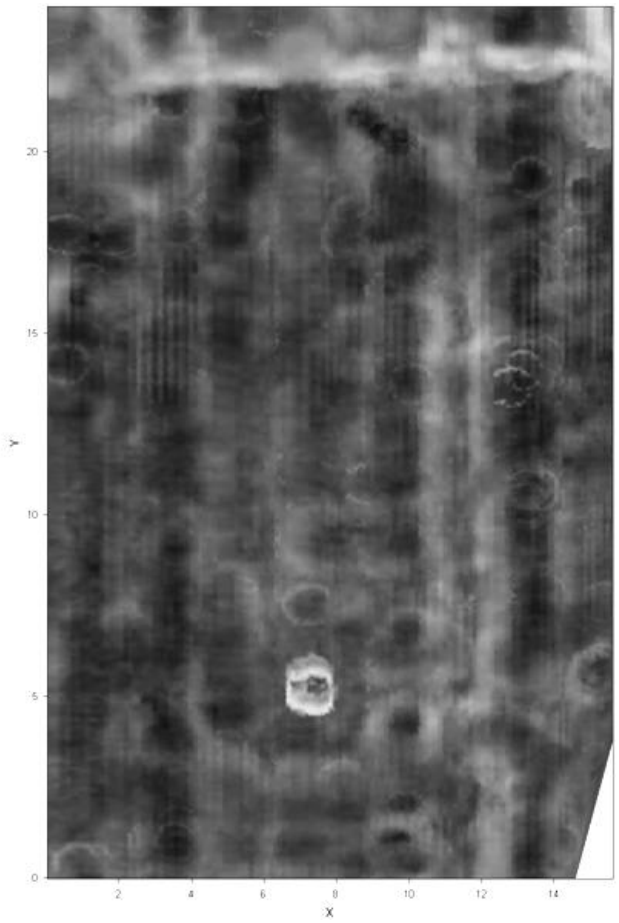


Note the axial line on the pipe ID, indicating that it is degraded over approximately half of its circumference. The resin system has become degraded, exposing the naked fibers.

Note the axial line in the scan, to the right of which, the resin system has become degraded



Scan of Component, for Which the Condition Is Unknown



Note the numerous circular indications, very similar to the blister indications in the validation scan

Defense and Aerospace Applications

Advanced materials require advanced NDE methods.

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