

## Effect of X-ray Computed Tomography Scan Noise on Observation of Internal Defects in

## a Blade Part Fabricated by Wire Arc Additive Manufacturing

Shinichiro EJIRI, PMP, Nikkiso Co., Ltd., Japan

[shinichiro.ejiri@nikkiso.co.jp](mailto:shinichiro.ejiri@nikkiso.co.jp)

### INTRODUCTION & AIM

How can we ensure the correct quality assurance of parts fabricated by additive manufacturing (AM)?

Large metal parts by AM

**Fabrication :**  
Wire Arc Additive Manufacturing (WAAM)

**Internal observation :**  
X-ray Computed Tomography (CT) Scan

**Purpose** Is it possible to mistake internal defects due to noise?  
Clarify the effect of artifacts, which are noise of X-ray CT scans, for proper evaluation of internal defects in parts by WAAM

### TEST MODEL

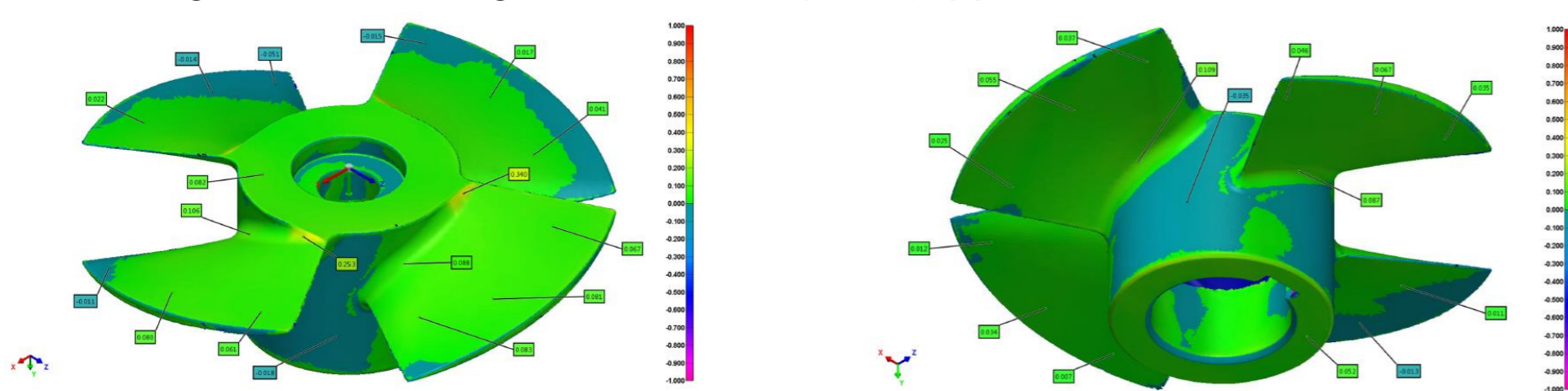
Test model is an axial-flow impeller called a fan type inducer fabricated by WAAM and machining. The near-net shape of a blade is additively manufactured by WAAM and finished by machining.

#### Specifications

Number of blades	4
Tip diameter	125.3 [mm]
Hub diameter	51 [mm]
Hub length	40 [mm]
Material	Stainless steel



[1] Ejiri, S., Fan Type Inducer for a Centrifugal Pump by Wire Arc Additive Manufacturing and Machining, *IJFMS*, 16-2 (2023), pp. 184-191.



The part was fabricated to the correct design dimensions.

### METHOD

Internal defects for the test impeller were observed using an industrial X-ray CT scanner, TOSCANER-24500AVFD by Toshiba IT & Control Systems.

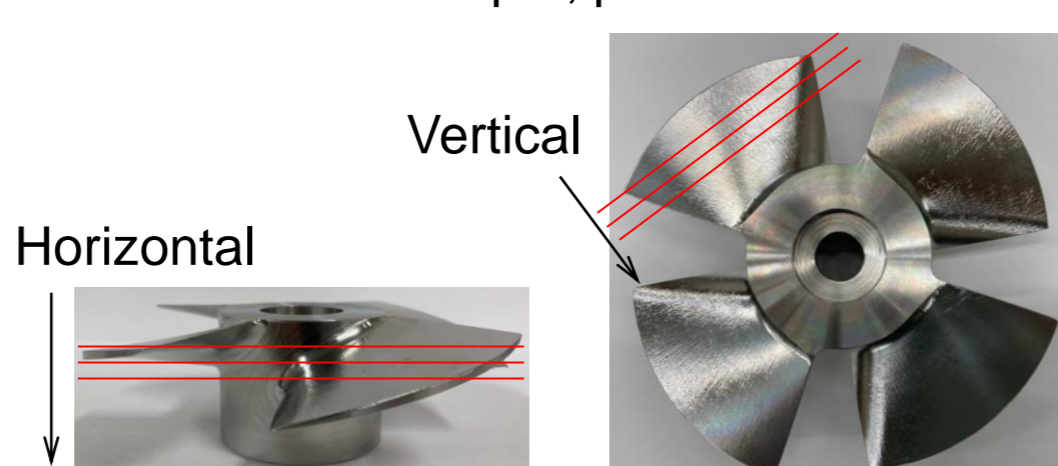
#### Conditions

Tube voltage	367 [kV]
Tube current	2.0 [mA]
Scan direction	Horizontal or Vertical

Change the placement orientation of the test model



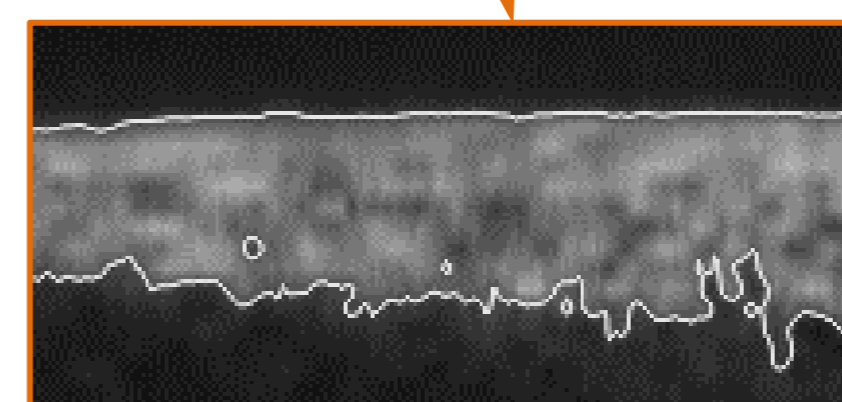
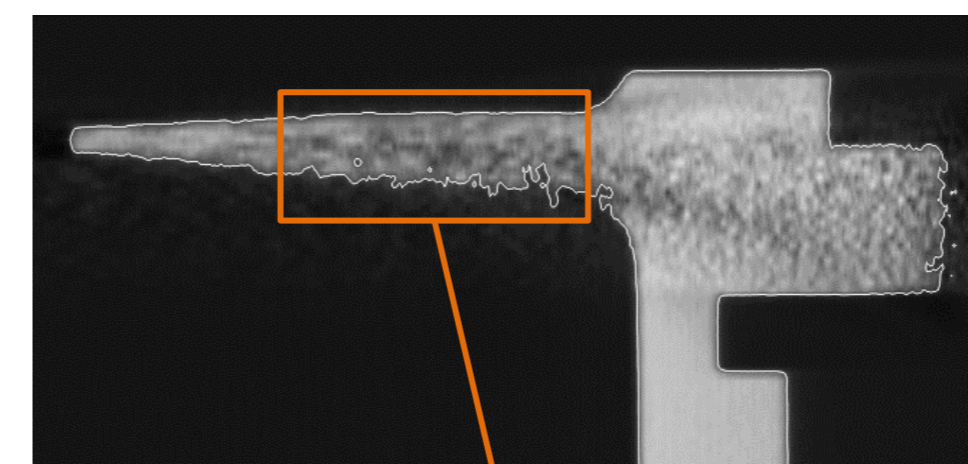
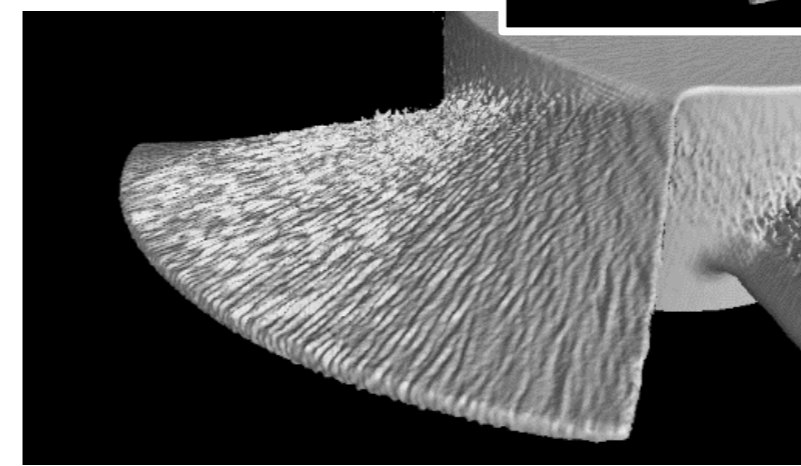
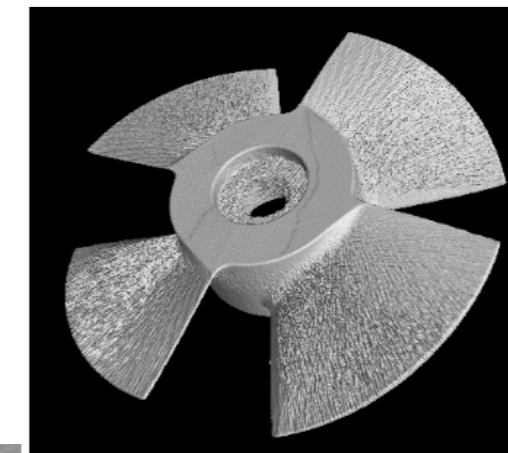
[2] <https://www.pref.fukushima.lg.jp/uploaded/attachment/469994.pdf>, p24



### RESULTS & DISCUSSION

#### Horizontal

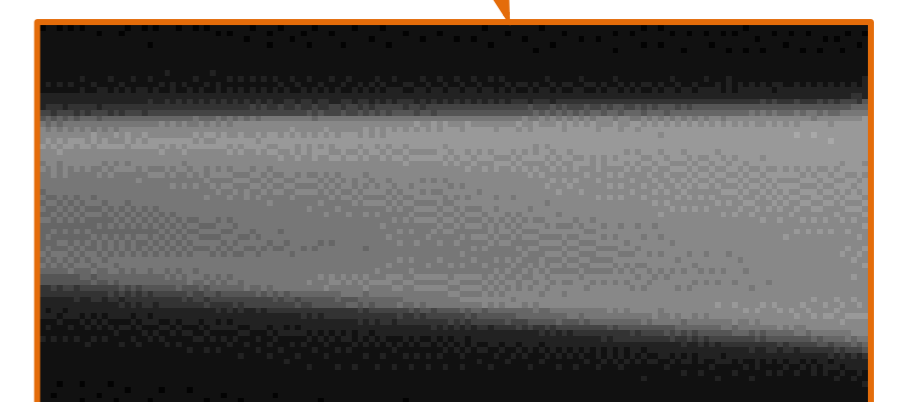
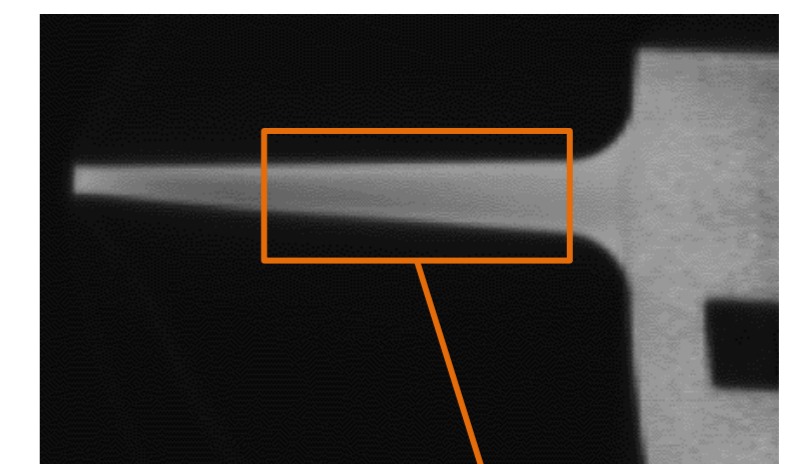
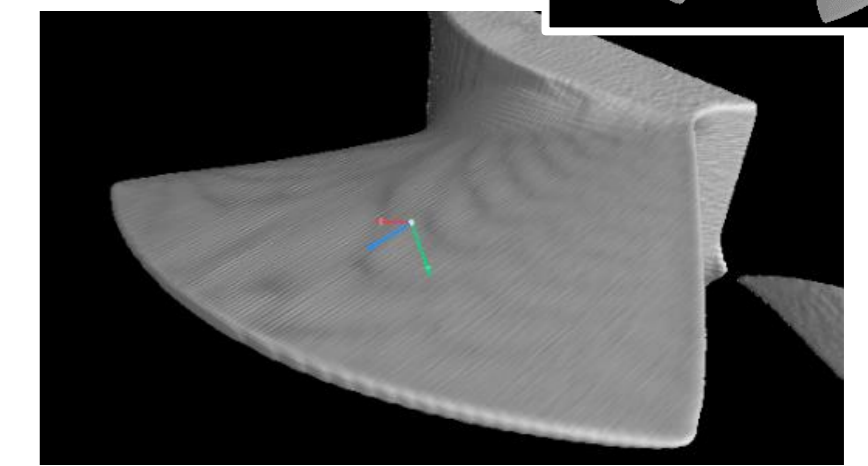
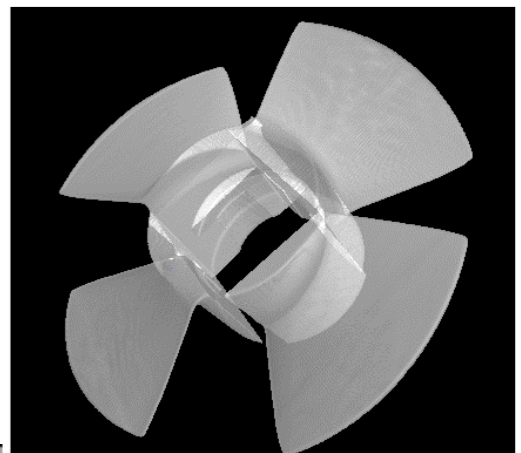
Scan at once, **w/ Noise**



The scan failed with artifacts effects appearing not only on the surface profile but also on the interior.

#### Vertical

Scan in quadrants, **w/o Noise**

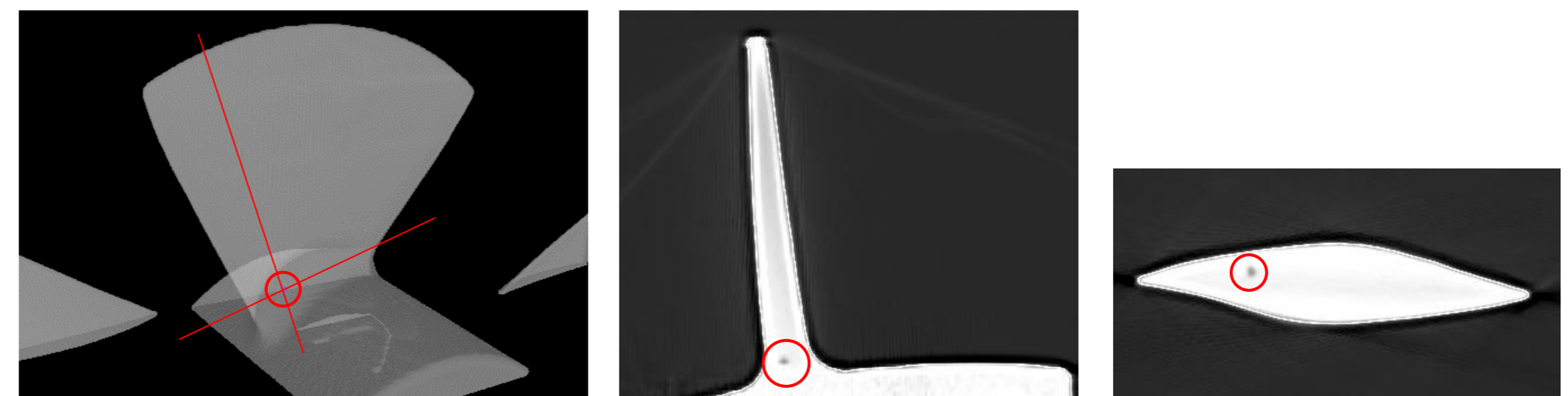


The scan succeeded with the interior being observable.

Errors due to artifacts can affect even the inside of the blade, which can cause misidentification of internal defects if X-ray CT scans are not performed under appropriate conditions where artifacts is eliminated.

#### Internal defects observation by vertical direction scan

Internal defects in the blades were detected by using appropriate conditions.



### CONCLUSION

X-ray CT scans were conducted on the blades fabricated by WAAM to consider the effect of artifacts. It was shown that the artifacts affects the imaging results which may lead to misidentification of internal defects.

### ACKNOWLEDGMENTS

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