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TRENDS IN INDUSTRIAL COMPUTED TOMOGRAPHY

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ABSTRACT

The future of industrial computed tomography (CT) in the United States is mainly driven by the automotive and aerospace industry. Other uses include bio research and the oil industry.

The aerospace industry mainly uses the technology to perform nondestructive testing on welding seams, castings and failure analysis. The growth in additive manufacturing (AM) will open a whole new market for CT for both dimensional inspection and flaw detection. All indications show that there will be parts directly printed or cores for investment casting will be printed in much greater quantities than today.

All electrical vehicles will be taking over pretty soon if we believe some of the market predictions. India and The Netherlands already committed to ban all internal combustion engine cars by 2030/2035. That will change the automotive landscape without a doubt. The use of light AL or Mg alloys is predicted to go up from less than 10% per vehicle today to about 30% in 2035. This change will have an impact on how vehicles are manufactured. More safety critical parts will be made of light alloys. That will increase the demand for nondestructive evaluation.

We've all seen major changes in our everyday lives when it comes to cell phones. The evolution took us from large and heavy to small and then back to big again when we started to use our phone as internet devices. In the past few years these device became much more user friendly and more powerful. The same is possibly happening when it comes to industrial CT systems. With the latest touch screen technologies, commonly known gestures (like swipe the screen) and camera technology the user interaction will be much more intuitive. The presentation will show some of the latest technologies applied to an industrial product and how it changes the operation of the system. Technical explanations will be provided to understand how modern systems provide easy to use user interfaces. Also covered in this presentation are various new scan techniques that provide large scan envelopes and great image quality

Keywords: industrial x-ray computed tomography, trends

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1. INTRODUCTION

In order to guarantee collision free operation for any object being scanned in a general purpose CT system, the system has to know the geometry of the object that is currently in the system. The way modern CT system can do this through latest camera technology and 3D reconstruction of the outer geometry of the specimen.

The second part discusses various scan techniques that are available to today to maximize the part size envelope and data quality.

2. METHODS

2.1 Collision Protection

IntelliGuard is a method being used to create 3D information about the object in the scanner:

FIGURE 1: Inside CT system, left: white screen, middle: object stage, right: x-ray tube

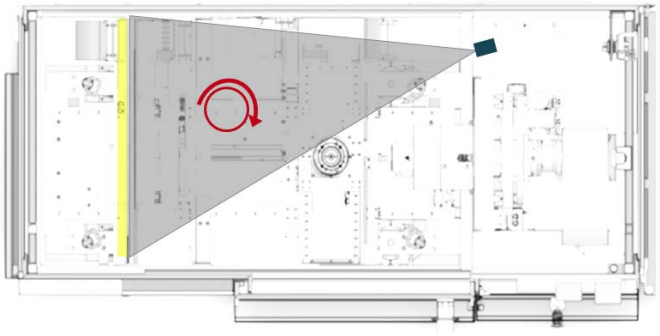

FIGURE 2: Camera and object stage for IntelliGuard

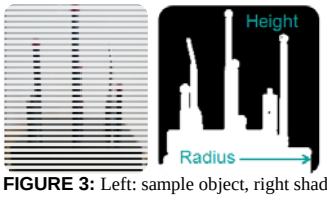

FIGURE 3: Left: sample object, right shadow on the screen seen by camera

With the information of the shadow image a visual camera can create a 3D envelope of the object. The object has to be rotated 360 degrees to cover all relevant angles for reconstruction.

FIGURE 4: 3D model after IntelliGuard

After a few seconds the system has accurate information to place the object as close as possible to the tube for maximum possible geometrical magnification. The user doesn't need to worry about damaging the part or the system. No camera or window is required.

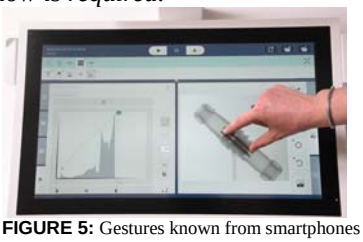

FIGURE 5: Gestures known from smartphones are possible

2.2 Scan methods

Helical CT Scan:

The helical CT scan trajectory acquires projections while the parts relative vertical position is changed.

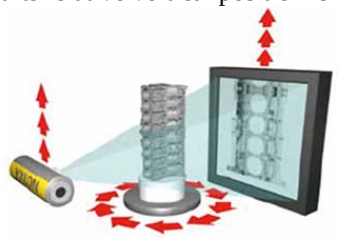

FIGURE 6: Helical CT scan trajectory

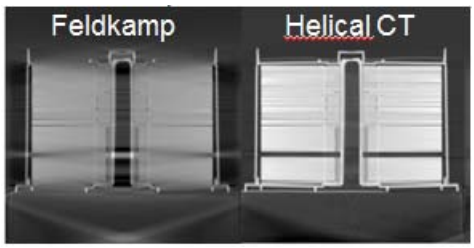

FIGURE 7: Standard Feldkamp reconstruction vs. helical CT

Dual Helical CT Scan:

Dual helical scan allows using the helical trajectory to scan even larger parts or scan part at a higher resolution.

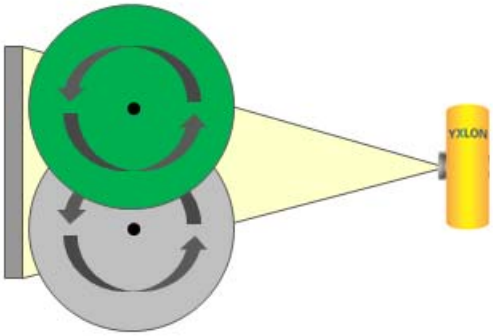

FIGURE 8: Dual Helical CT scan

FlexCenter:

If the area of interest is not in the physical center of rotation the, FlexCenter allows to rotate the object off-center.

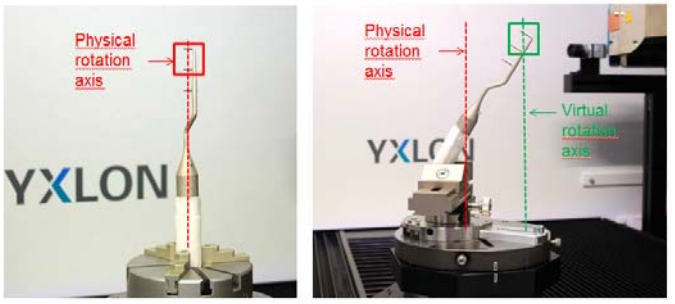

FIGURE 9: FlexCenter CT Scan

3. RESULTS AND DISCUSSION

Usability has been a focus for latest product developments in the industry. Increased computer power and new algorithms enabled the industry to create new features that increases the productivity and image quality.

4. CONCLUSION

Looking at recent new released technology shows that industrial CT has grown into an easy to use technology and will continue to do so. Also image quality and resolution is reaching levels that have never seen before.