

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 2, 2020

Computed Tomography Specialist's Factual Report

ERA19FA118

A. ACCIDENT

Location: Talking Rock, Georgia
Date: March 5, 2019
Time: 1130 eastern standard time
Airplane: MD Helicopters (Hughes) 369D, N89ZC

B. GROUP

Computed
Tomography
Specialist: Scott Warren
National Transportation Safety Board
Washington, D.C.

C. SUMMARY

On March 5, 2019, about 1130 eastern standard time, an MD Helicopters (Hughes) 369D, N89ZC, was substantially damaged when it impacted trees and terrain near Talking Rock, Georgia. The commercial pilot was fatally injured. The helicopter was operated by Rotor Blade LLC as a Title 14 *Code of Federal Regulations* Part 133 external load flight. Visual meteorological conditions prevailed, and no flight plan was filed for the local flight, which originated from a nearby field.

The internal configuration of the overrunning clutch was documented using radiographic images that were collected on June 13, 2019 in Chicago, Illinois. A total of 337 computed tomography (CT) slice images were examined, processed, and analyzed by the NTSB to evaluate the components.

Review of the images indicated that, when the scans were conducted, there were no indications of missing or broken components, blockages, or other abnormalities.

D. DETAILS OF THE INVESTIGATION

1.0 General

The overrunning clutch was subjected to x-ray radiograph and computed tomography (CT) scanning to document its internal condition. The scanning was conducted on June 13, 2019 by Varex, Inc under the direction of the NTSB using the Actis 1000 1 MV CT system.

For the CT scans, the component was loaded into the imaging unit and placed on a turntable. The component was then rotated in front of the x-ray source, and the x-rays were captured by a detector after they went through the part. The x-ray source produced a cone beam of x-rays, and the portion of the part imaged was adjusted slightly after each scan was completed until the entire assembly (or region of interest of the part) was scanned. The x-ray energy levels measured by the detector were recorded at several thousand different points during each rotation, and this information was converted into slice images using reconstruction algorithms.

The component was scanned using a total of 337 slices, and the total size of the data set was approximately 2.63 Gb. The complete scan protocol is given in table 1. The digital radiograph and CT axial slice images were provided by Varex to the NTSB where they were examined, processed, and analyzed to evaluate the components.

Table 1
Scan Protocol

Component	Overrunning clutch
Number of slices	337
Voxel Size - X Direction (mm)	0.22
Voxel Size - Y Direction (mm)	0.22
Voxel Size - Z Direction (mm)	0.25
Image Projections per Revolution	6500
Exposure time (ms)	10
Frames to Avg (frames per projection)	1
X-ray Source Voltage (kV)	1000
X-ray Source Current (mA)	4 PPV, 2.5 ms
Source Filter Thickness (mm)	3.3
Source Filter Material	Steel
Image Matrix Size	2048 x 2048

The data set of slice images was examined, processed, and analyzed by the NTSB using the VGStudioMax software package to convert the axial slice data into orthogonal slice images and a three-dimensional reconstructed image of the component. As part of the evaluation, some sections of the component were digitally removed or rendered transparent to allow closer observation of interior parts. In the images, the higher density areas were shown as brighter shades of gray and lower density areas were shown as darker shades of gray. The pointers shown in some of the images denote specific areas of interest within that image.

The images of the component were examined for any signs of missing or damaged parts, contamination, or any other anomalies. Specific results (including example images) are presented in subsequent sections of this report.

2.0 Computed Tomography Results

The computed tomography (CT) results for the components are shown in figures 1 through 10. Review of the images indicated that, when the scans were conducted, there were no indications of missing or broken components, blockages, or other abnormalities.

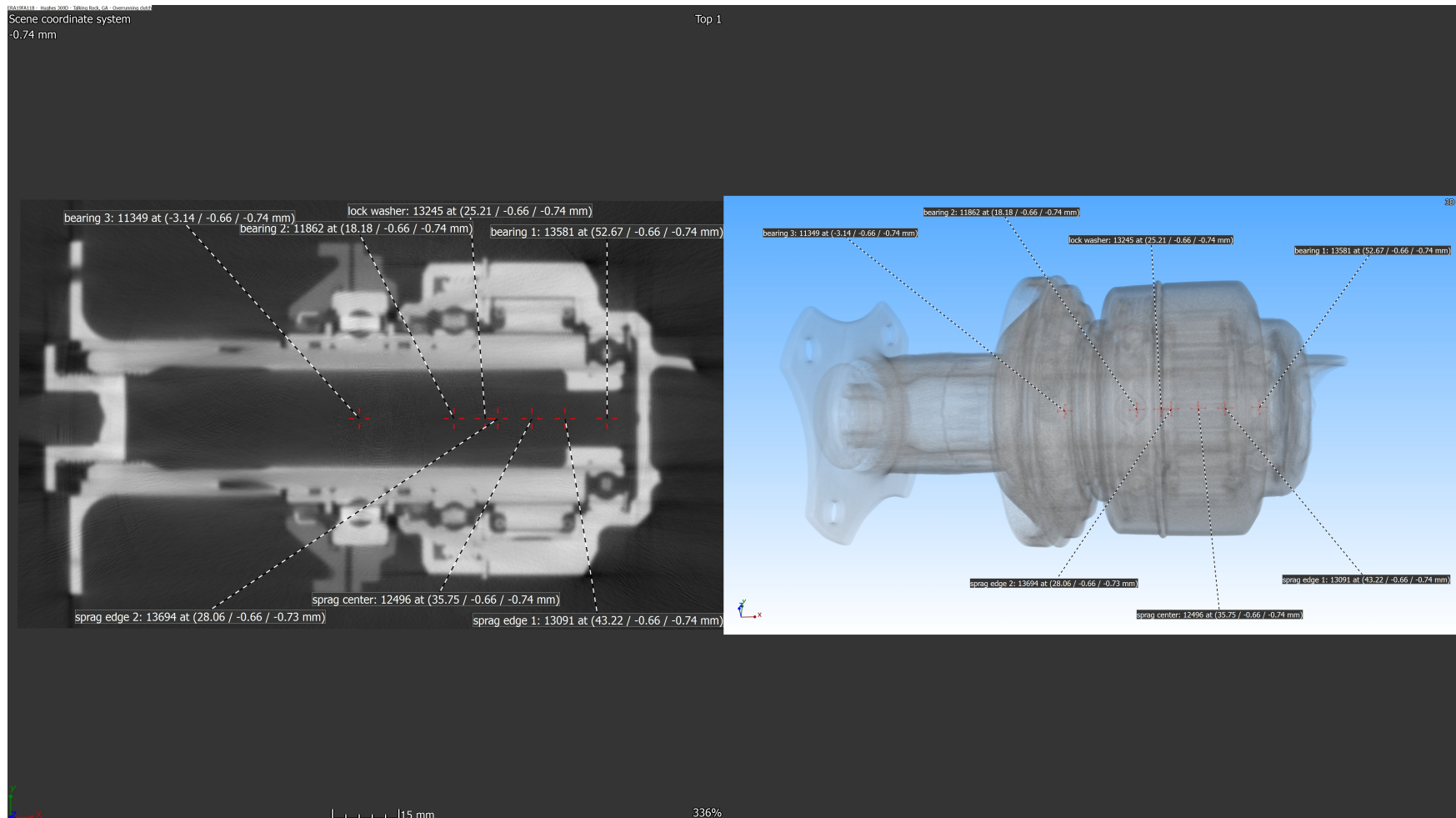


Figure 1
Overrunning clutch – overview

ERA19FA118 - Hughes 369D - Talking Rock, GA - Overrunning clutch

Scene coordinate system

-0.74 mm

Top 1

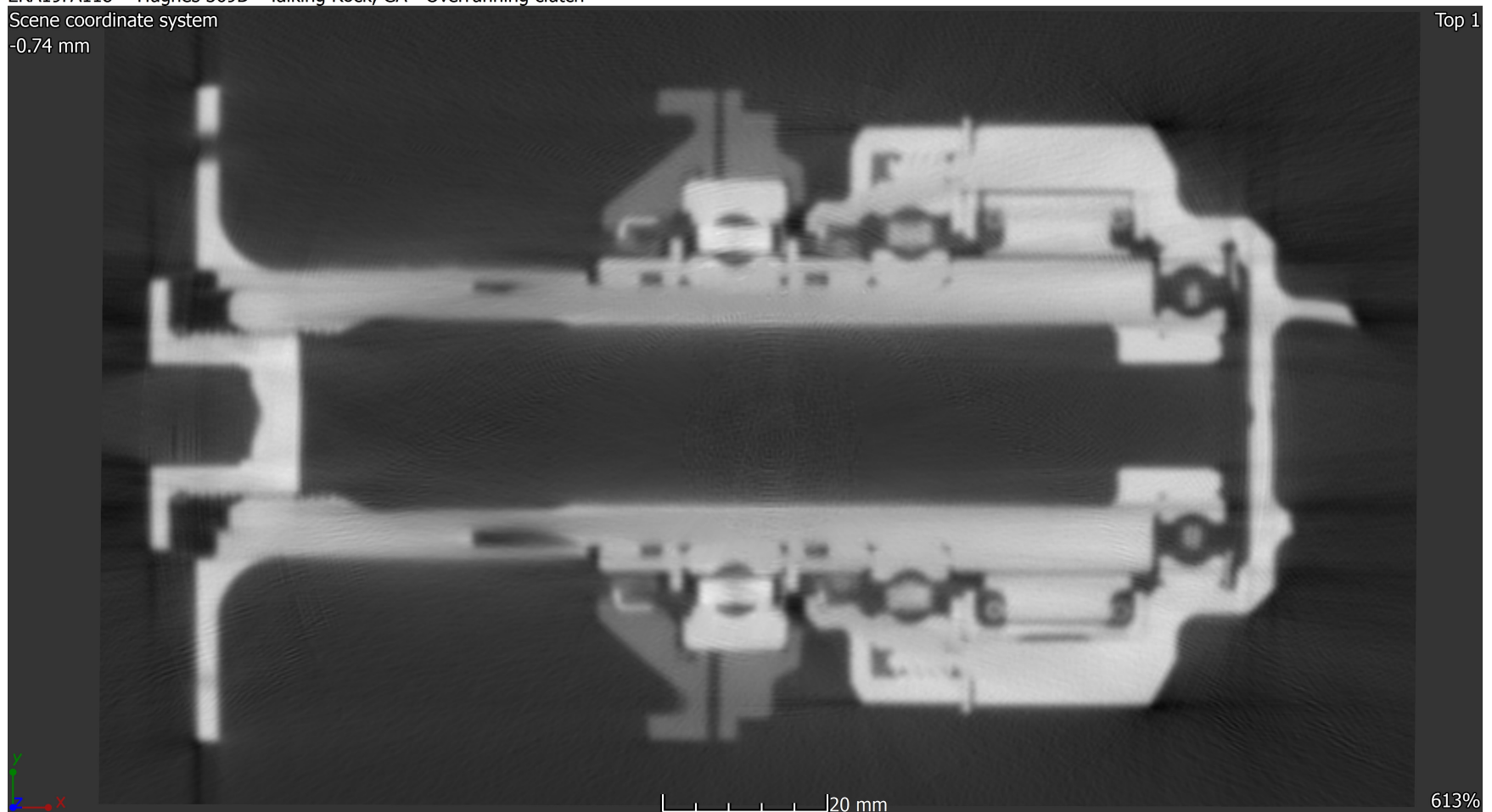


Figure 2
Overrunning clutch – cross sectional view

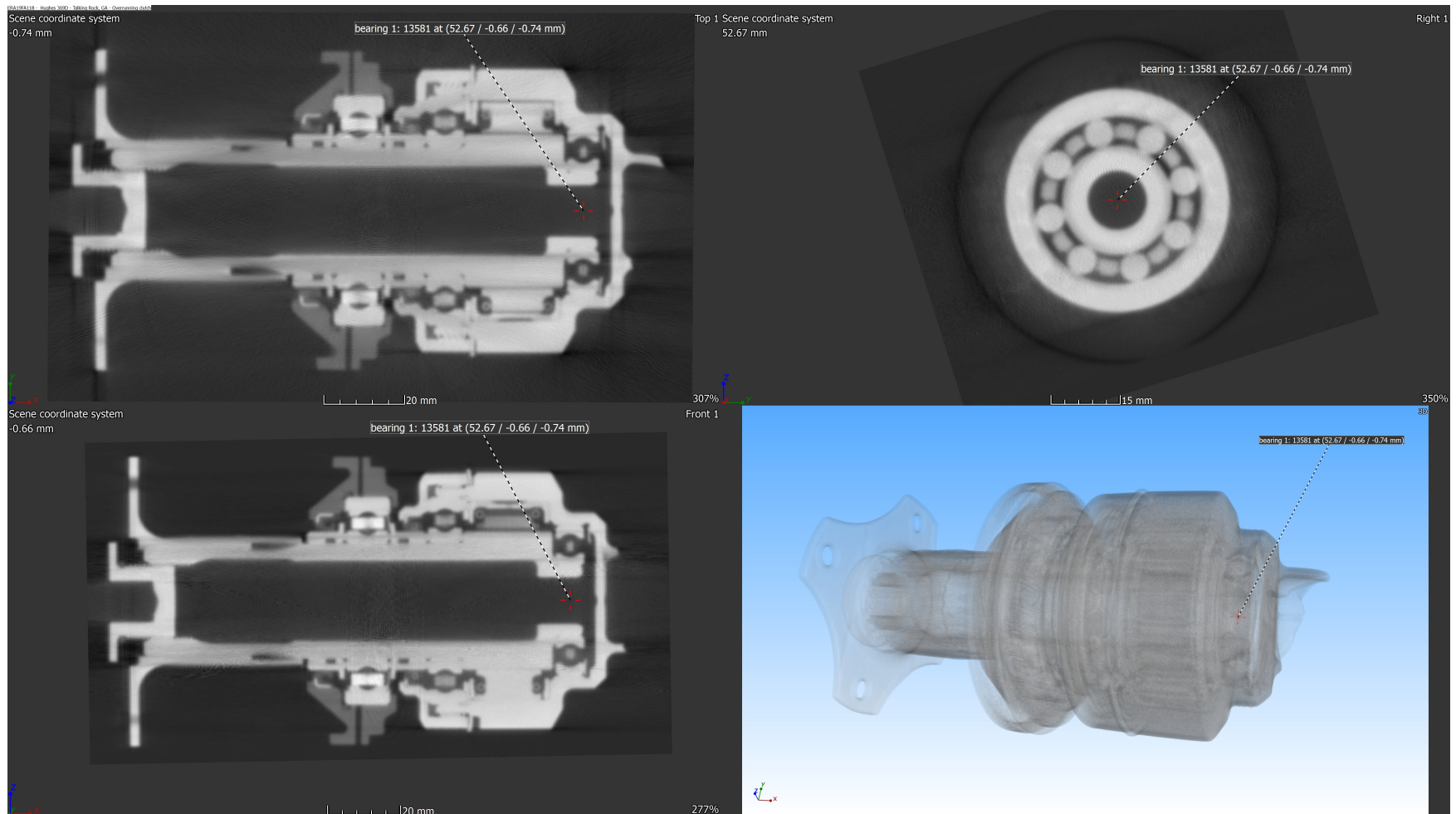


Figure 3
Overrunning clutch – bearing 1

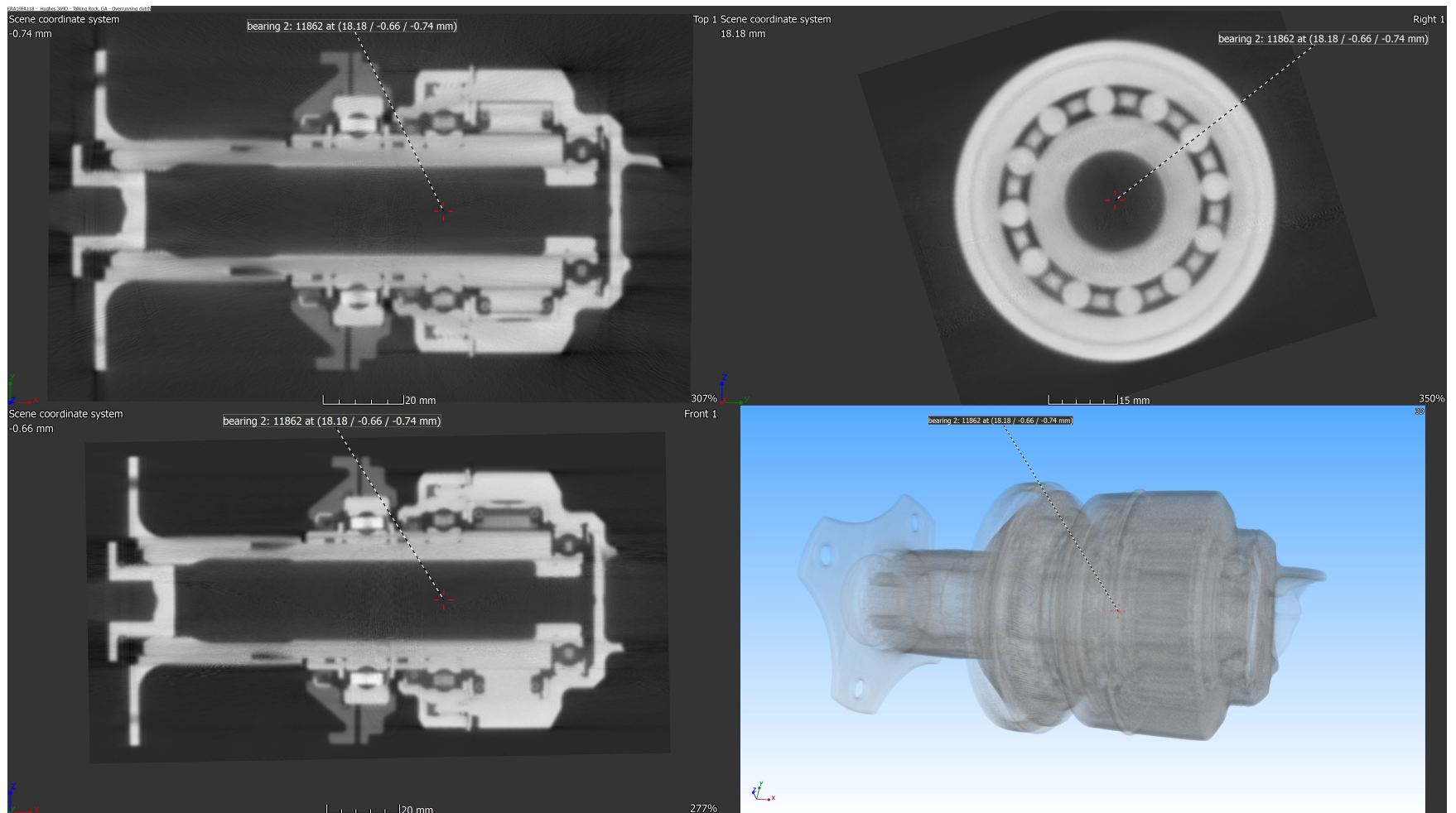


Figure 4
Overrunning clutch – bearing 2

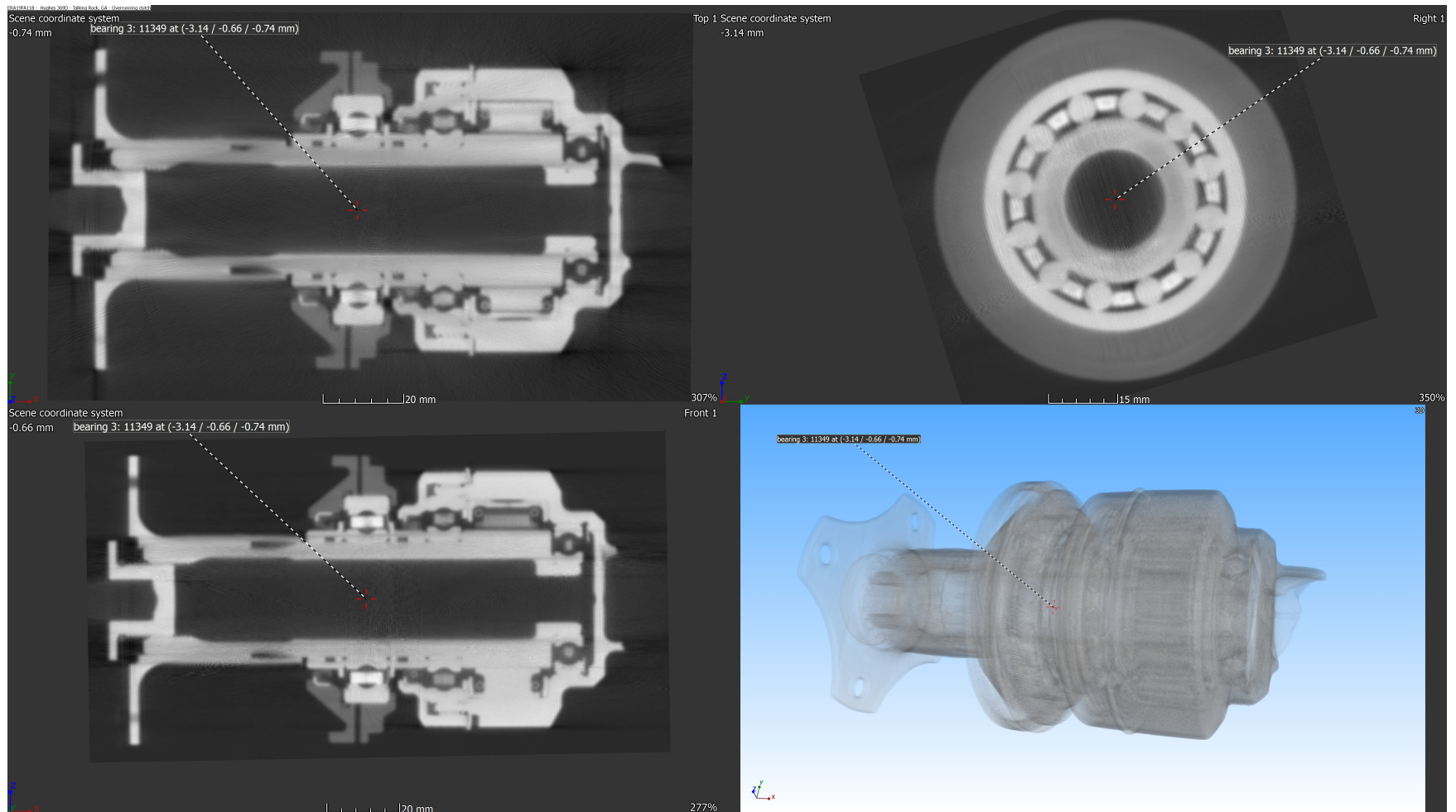


Figure 5
Overrunning clutch – bearing 3

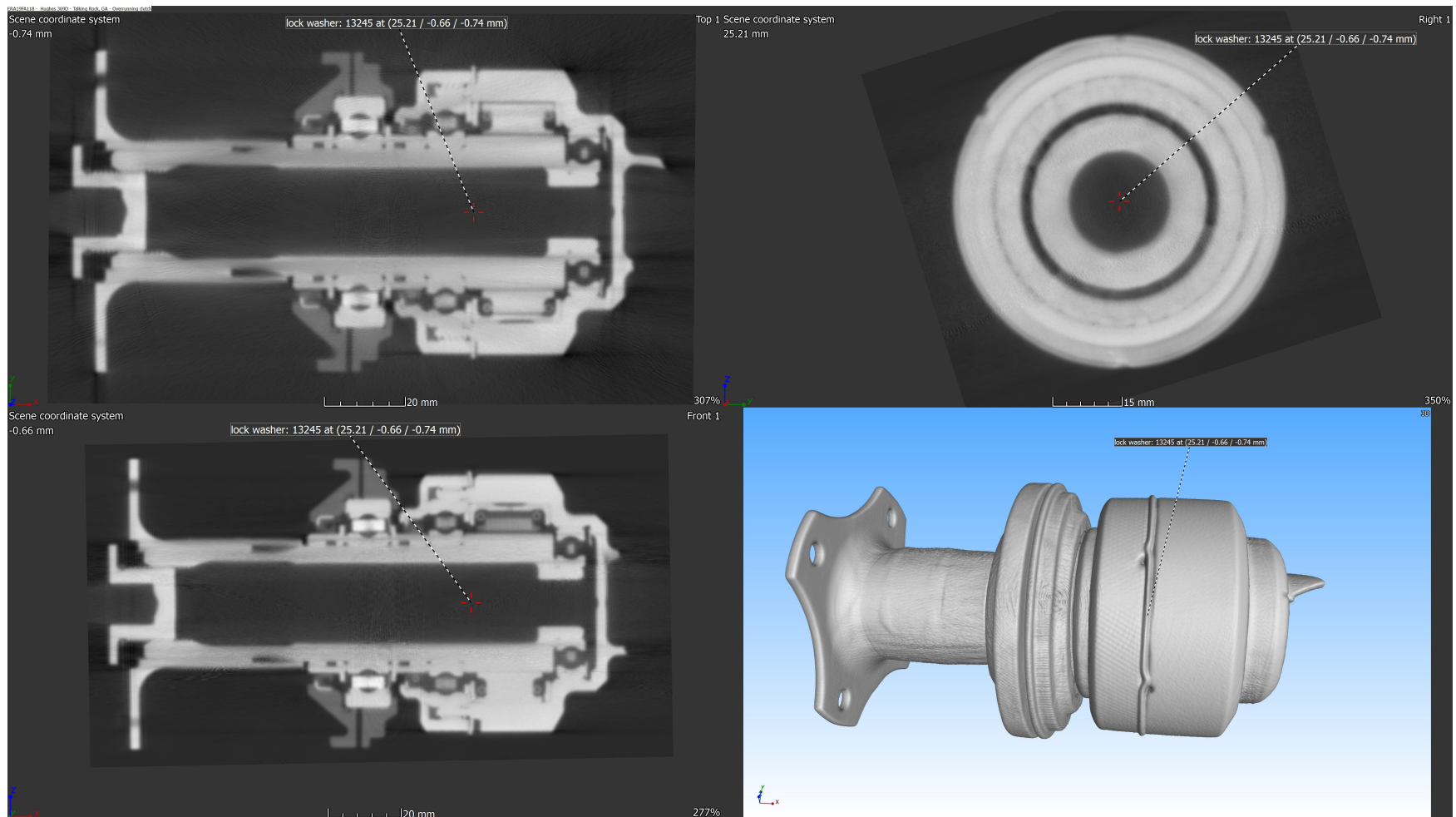


Figure 6
Overrunning clutch – lock washer

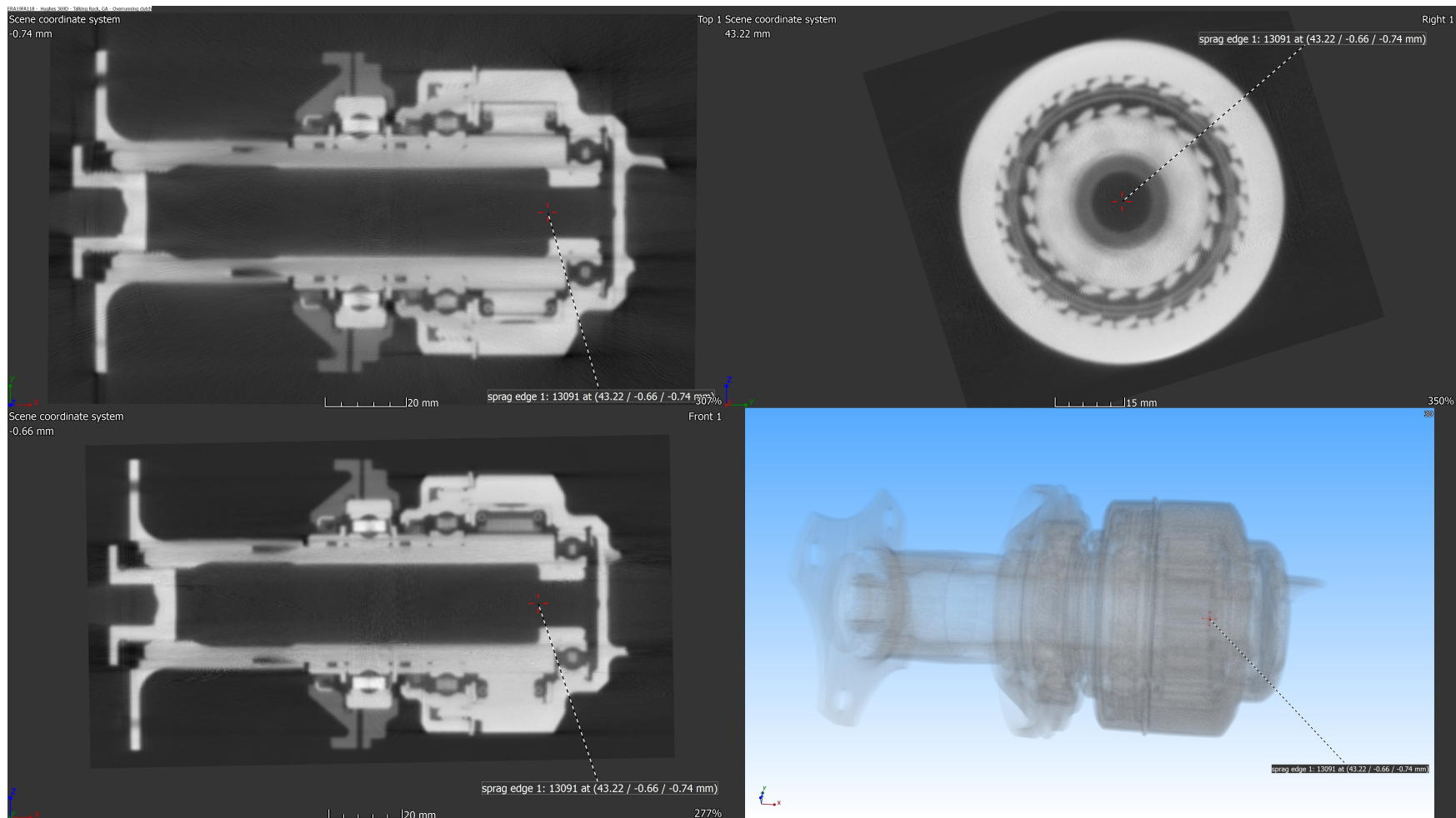


Figure 7
Overrunning clutch – sprag edge 1

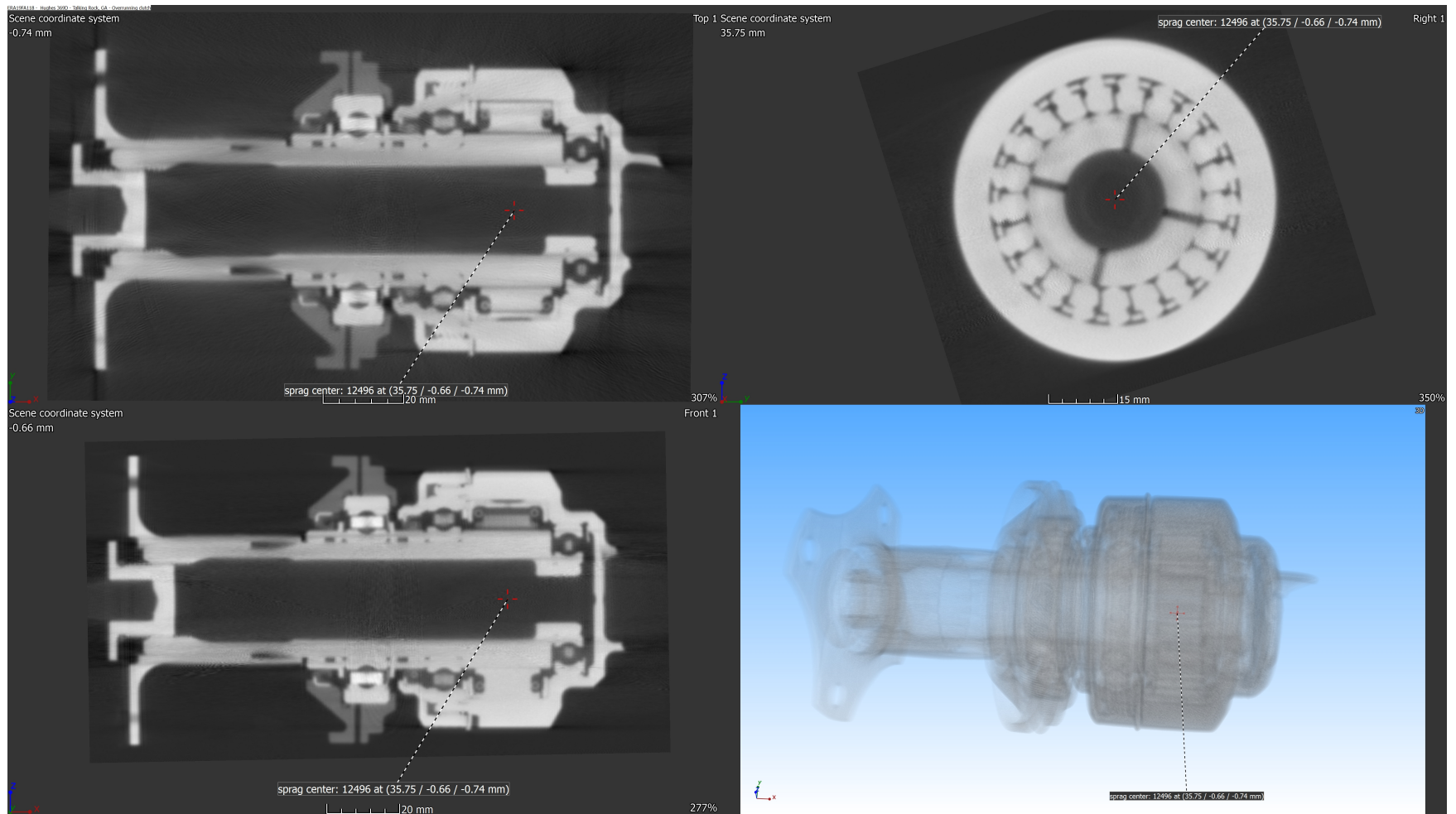


Figure 8
Overrunning clutch – sprag center

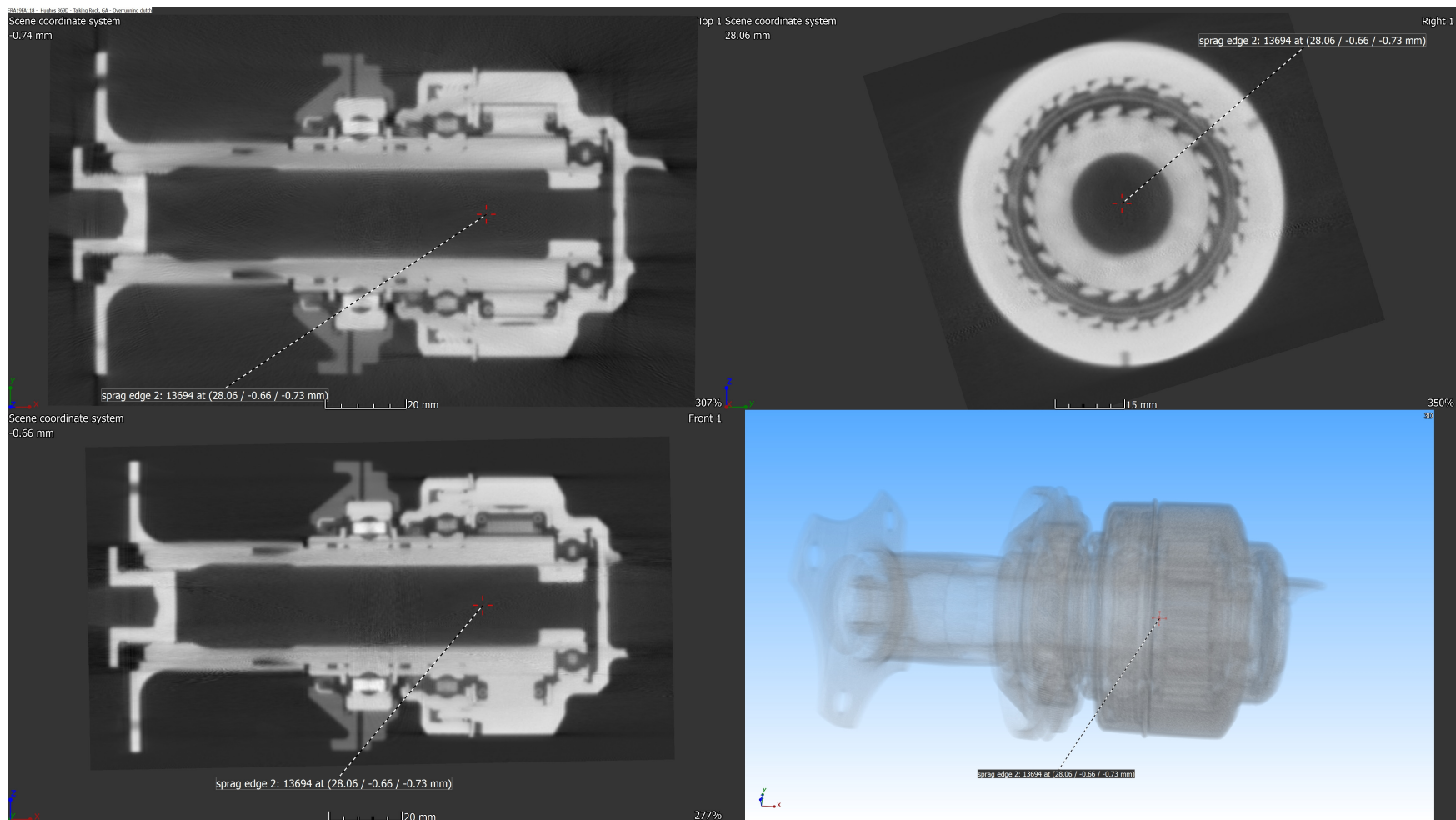


Figure 9
Overrunning clutch – sprag edge 2

ERA19FA118 - Hughes 369D - Talking Rock, GA - Overrunning clutch
Scene coordinate system
0.00 mm

Top 1

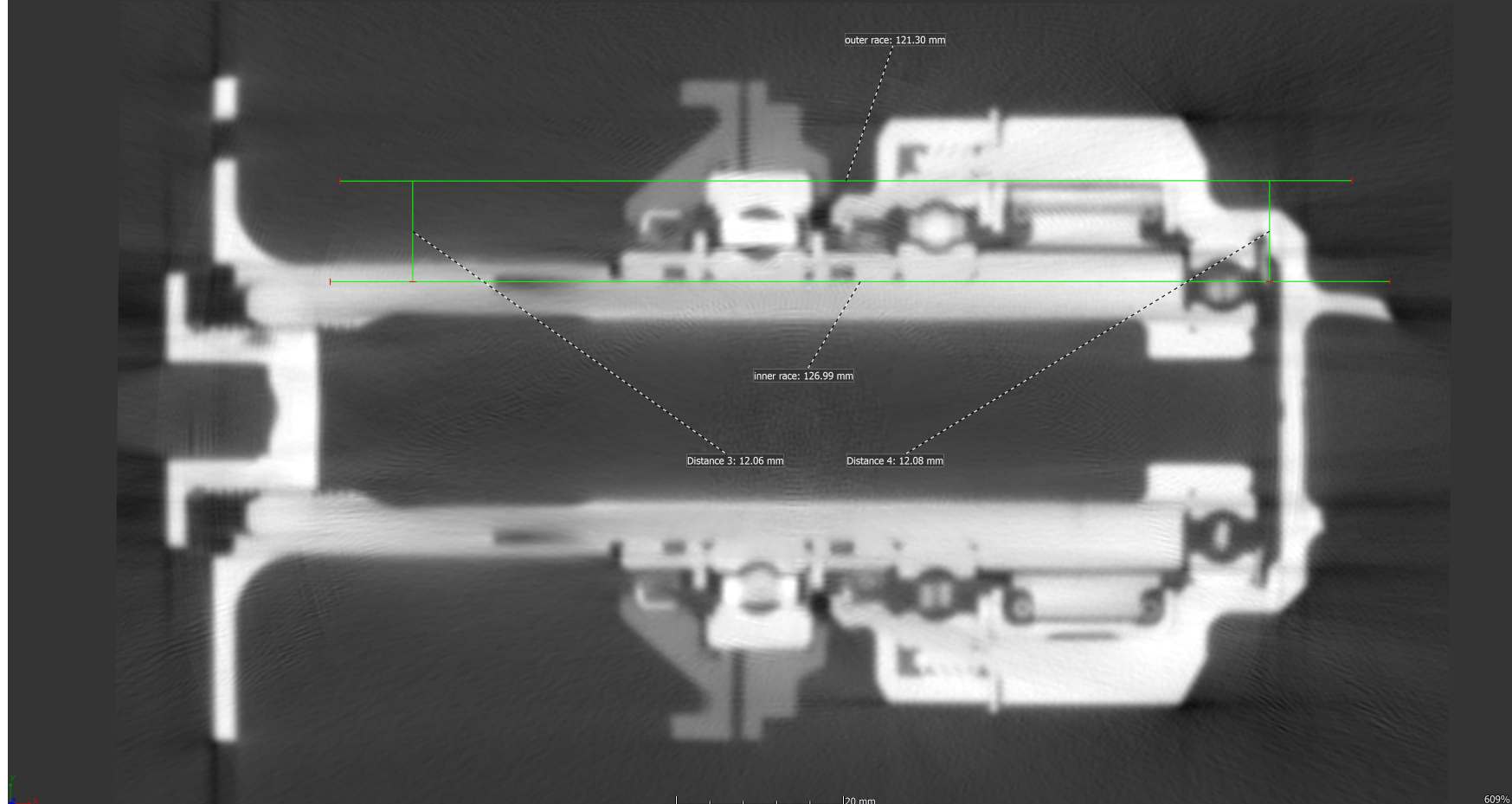


Figure 10
Overrunning clutch – inner and outer race alignment

Scott Warren
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