

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 5, 2021

Computed Tomography Specialist's Factual Report

ERA19LA231

A. ACCIDENT

Location: Poughkeepsie, NY
Date: July 19, 2019
Time: 1440 eastern daylight time
Airplane: Piper PA46-310P, N811SK

B. GROUP

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

C. SUMMARY

On July 19, 2019, about 1440 eastern daylight time, a Piper PA46-310P, N811SK, was substantially damaged during a forced landing while on approach to Hudson Valley Regional Airport (POU), Poughkeepsie, New York. The private pilot and two passengers were seriously injured, and one passenger sustained minor injuries. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the flight that originated at Akron-Fulton International Airport (AKR), Akron, Ohio, about 1248. The airplane was owned and operated by the pilot under the provisions of Title 14 Code of Federal Regulations Part 91. The personal flight was originally destined for North Central State Airport (SFZ), Pawtucket, Rhode Island.

The internal configuration of the engine driven fuel pump seal was documented using radiographic images that were collected from October 2-15, 2020 in Chicago, Illinois. A total of 2,018 computed tomography (CT) slice images were examined, processed, and analyzed by the NTSB to evaluate the components.

Review of the images determined that when the scans were conducted:

1. There were no indications of cuts or other missing material on the seal surface.
2. The seal spring appeared to be intact.
3. The minimum seal opening diameter was measured to be 0.504 inches.
4. The maximum seal opening diameter was measured to be 0.509 inches.
5. There were indications of material buildup on the seal surface in multiple locations.

D. DETAILS OF THE INVESTIGATION

1.0 General

The internal configuration of the engine driven fuel pump seal was subjected to x-ray radiograph and computed tomography (CT) scanning to document its internal conditions. The engine driven pump was disassembled prior to the CT scanning during the engine examination, and only the housing and seal were subjected to the scanning work. For further information regarding the engine driven pump, refer to the Systems Group Chairman Factual Report. The scanning was conducted from October 2-15, 2020 by Varex, Inc under the direction of the NTSB using the Actis 500/225 micro focus 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 shaped 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 once using an overall scan and twice using a target CT scan. The overall scan imaged the entire part, and the target CT data sets used a smaller field of view to provide higher resolution images of the seal itself. The dimensional data from the first target CT scanning work did not match that of the overall scan, so the second target CT scan was conducted after extensive calibration work. The results of the second target CT scan were used as the basis for this report.

The component was scanned using a total of 2,018 slices, and the total size of the combined data sets was approximately 15.5 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 component.

Table 1
Scan Protocol

Component	Pump Seal – overall scan	Pump Seal – target CT scan	Pump Seal – target CT scan
Number of slices	679	661	661
Voxel ¹ Size - X Direction (mm)	0.014	0.011	0.011
Voxel Size - Y Direction (mm)	0.014	0.011	0.011
Voxel Size - Z Direction (mm)	0.014	0.011	0.011
Image Projections per Revolution	1800	1800	1800
Exposure time (ms)	285.61	285.61	285.61
Frames to Avg (frames per projection)	2	3	3
X-ray Source Voltage (kV)	222	222	222
X-ray Source Current (mA)	0.550	0.525	0.525
Source Filter Thickness (mm)	1	1	1
Source Filter Material	Brass	Brass	Brass
Image Matrix Size	2048 x 2048	2048 x 2048	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.

¹ A voxel is a three-dimensional picture element (pixel).

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 component are shown in figures 1 through 7. Review of the images determined that when the scans were conducted:

1. There were no indications of cuts or other missing material on the seal surface.
2. The seal spring appeared to be intact.
3. The minimum seal opening diameter was measured to be 0.504 inches.
4. The maximum seal opening diameter was measured to be 0.509 inches.
5. There were indications of material buildup on the seal surface in multiple locations.

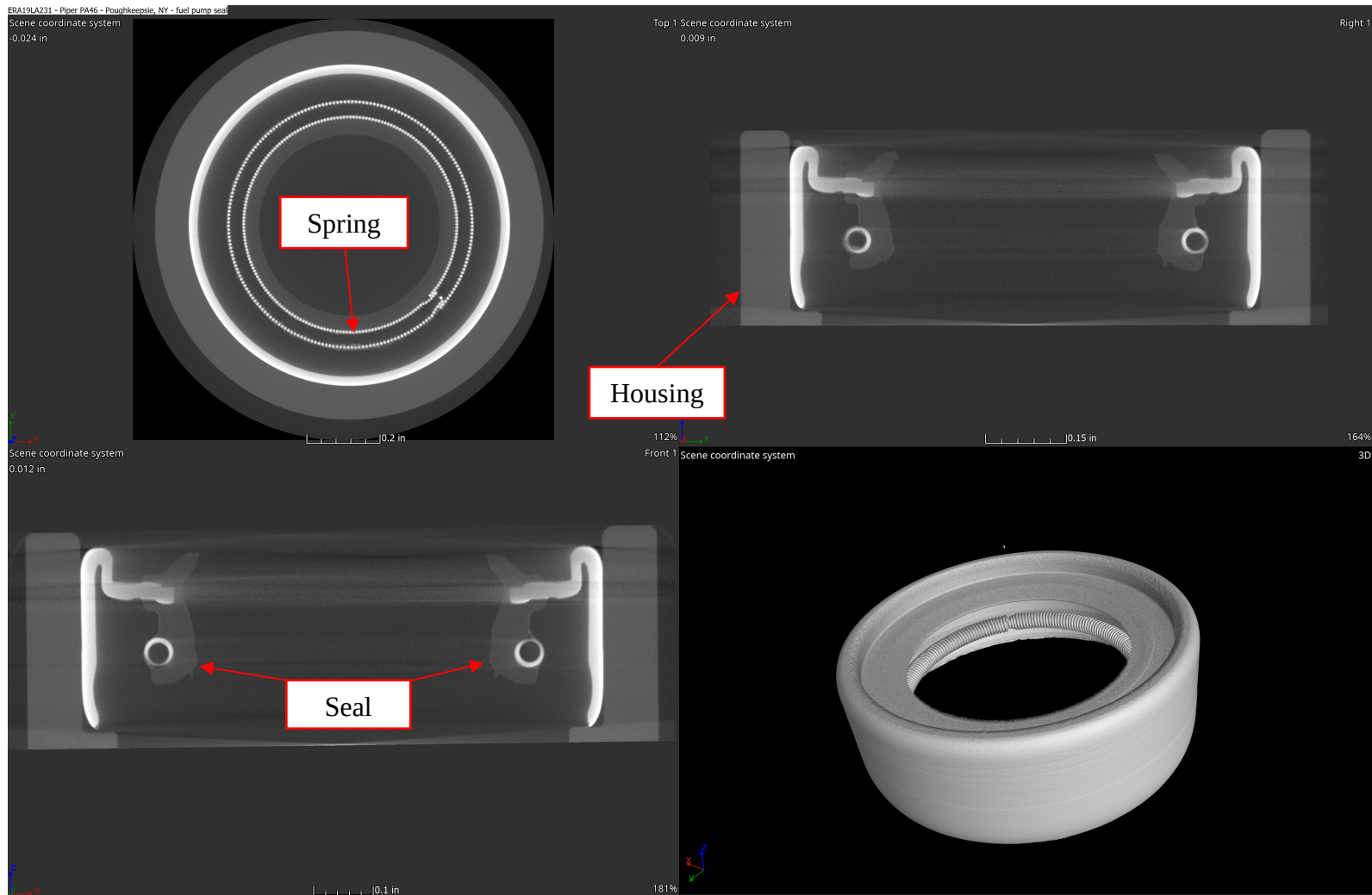


Figure 1
Engine driven fuel pump seal - overview

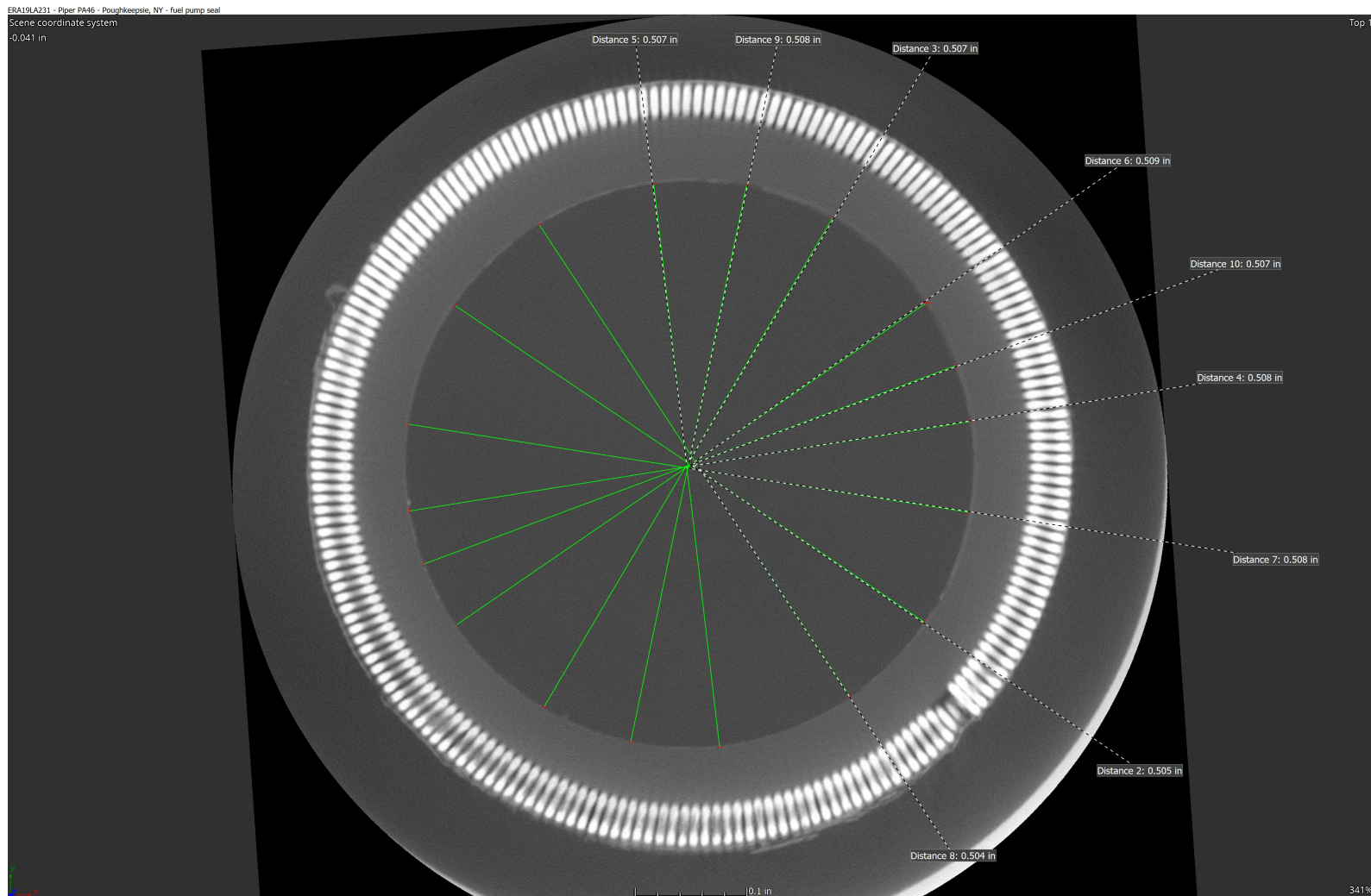


Figure 2
Engine driven fuel pump seal – seal opening diameters

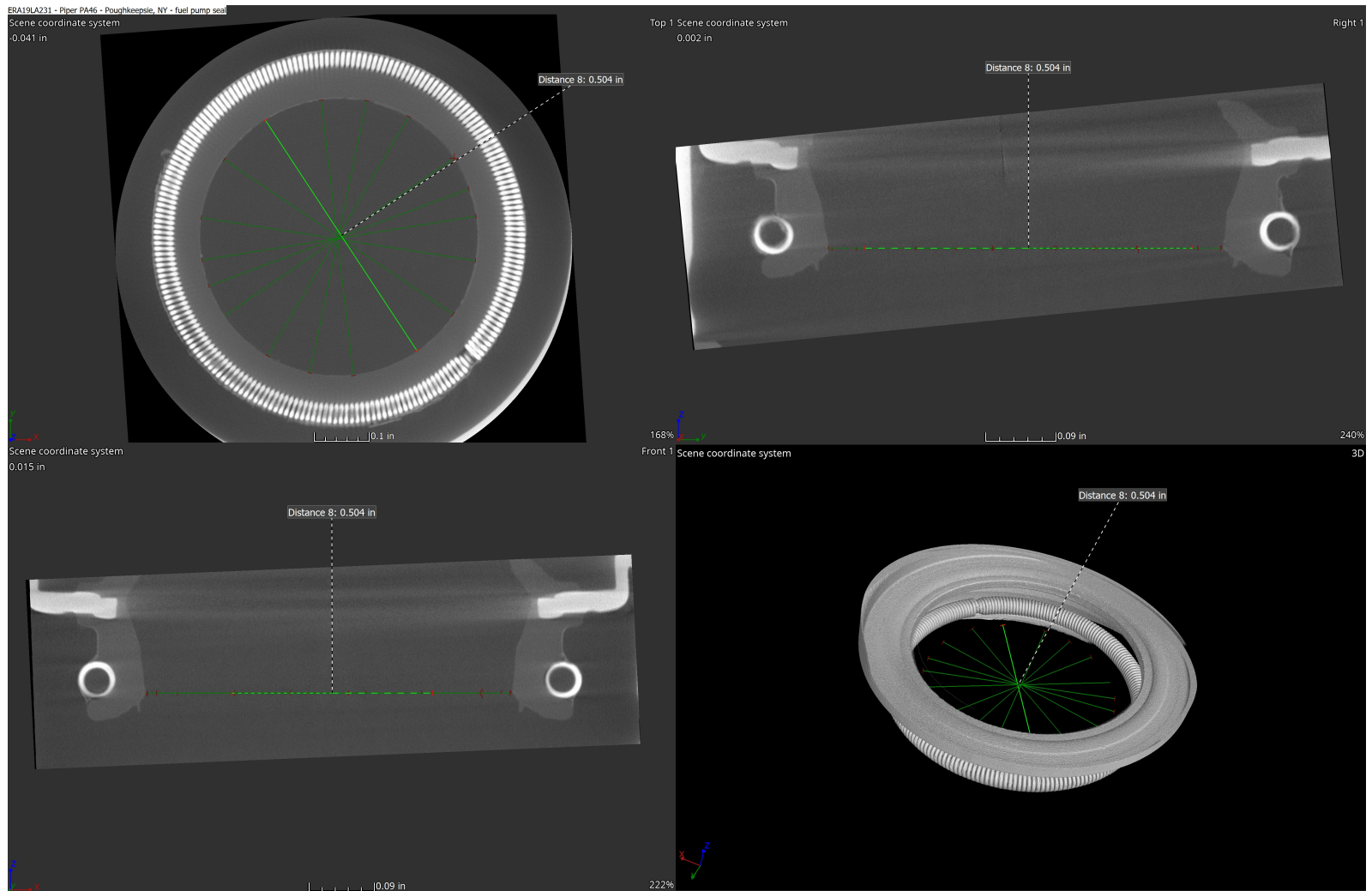


Figure 3
Engine driven fuel pump seal – minimum seal opening diameter

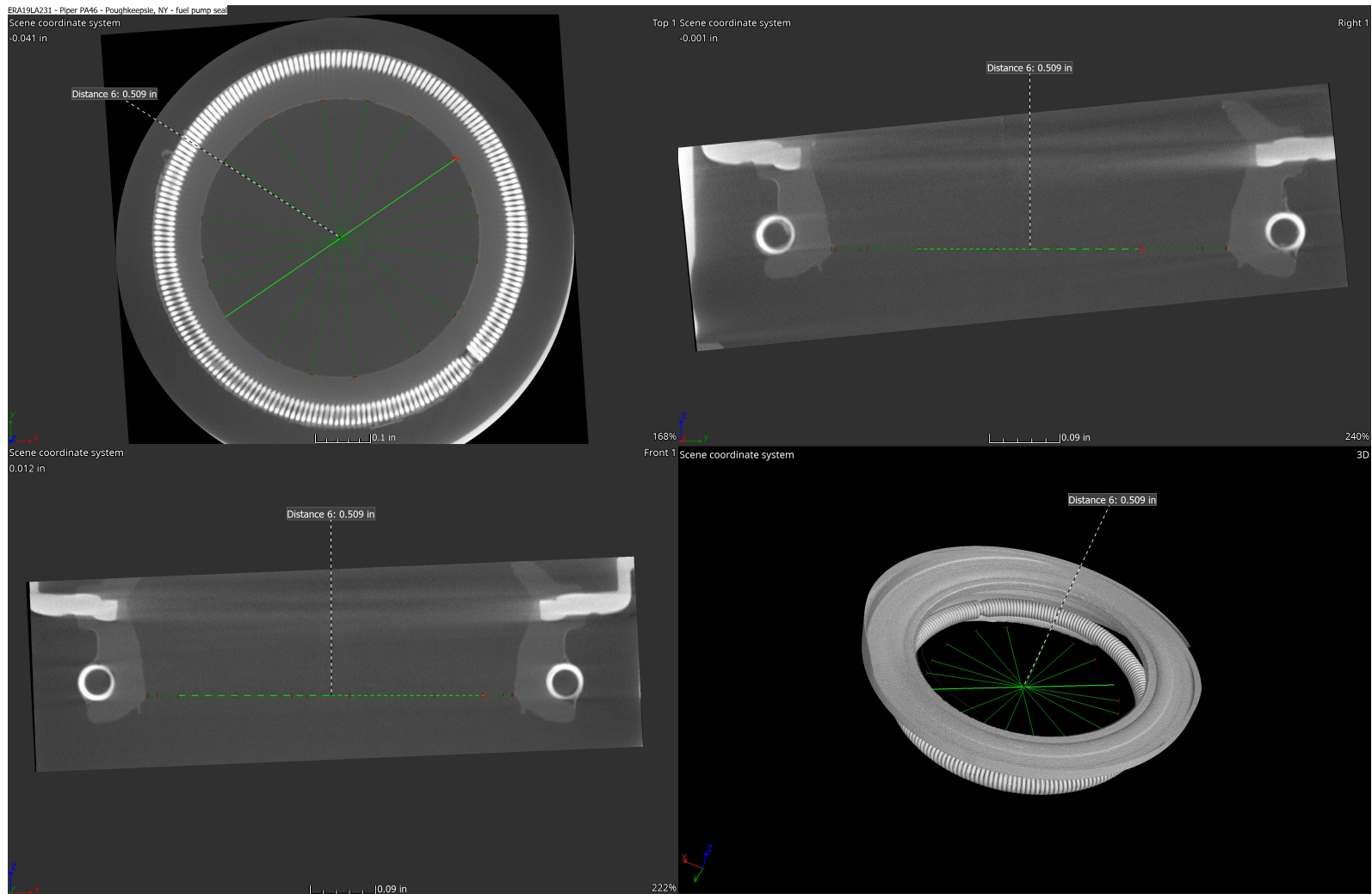


Figure 4
Engine driven fuel pump seal – maximum seal opening diameter

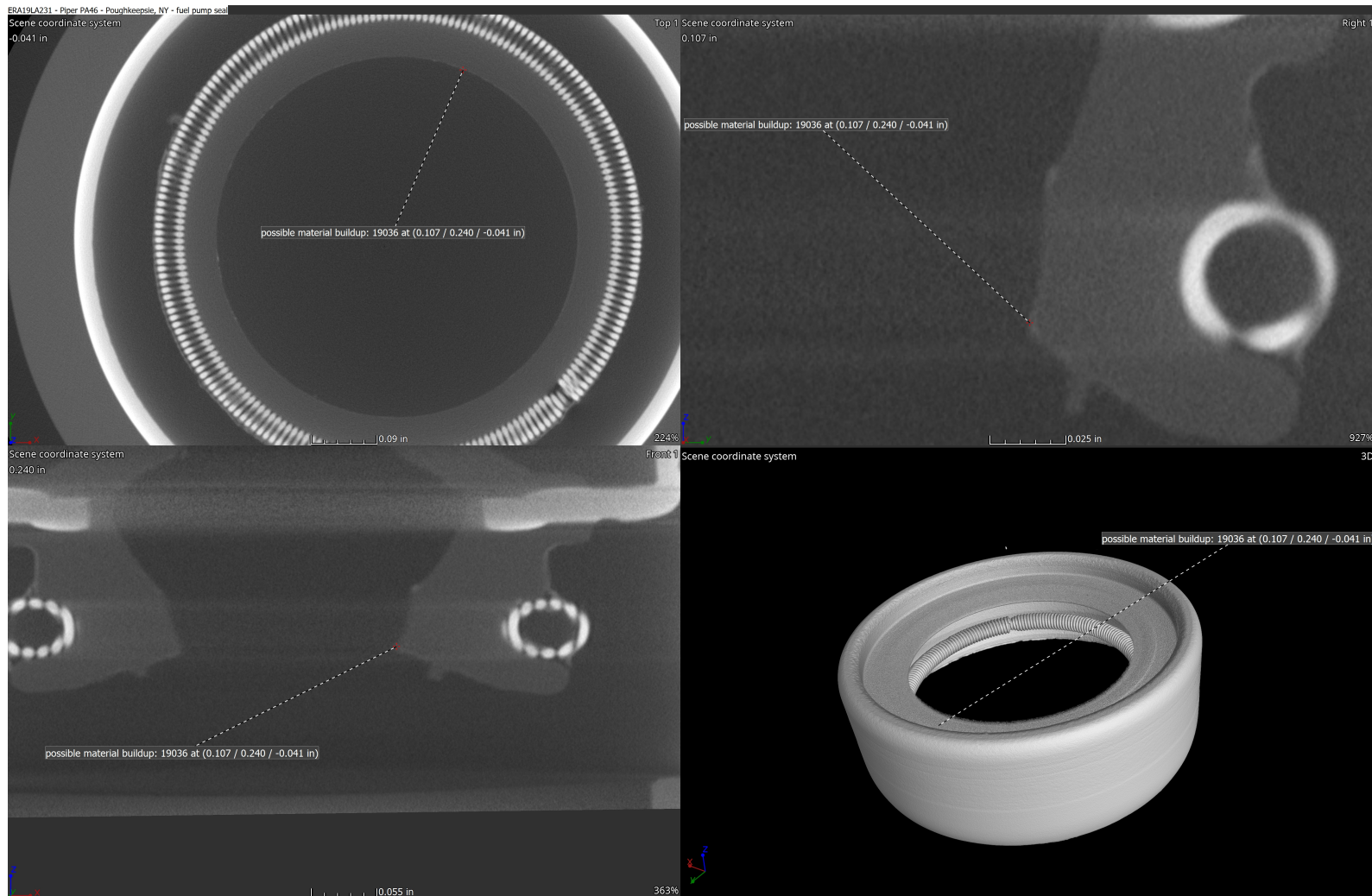


Figure 5
Engine driven fuel pump seal – possible material buildup 1

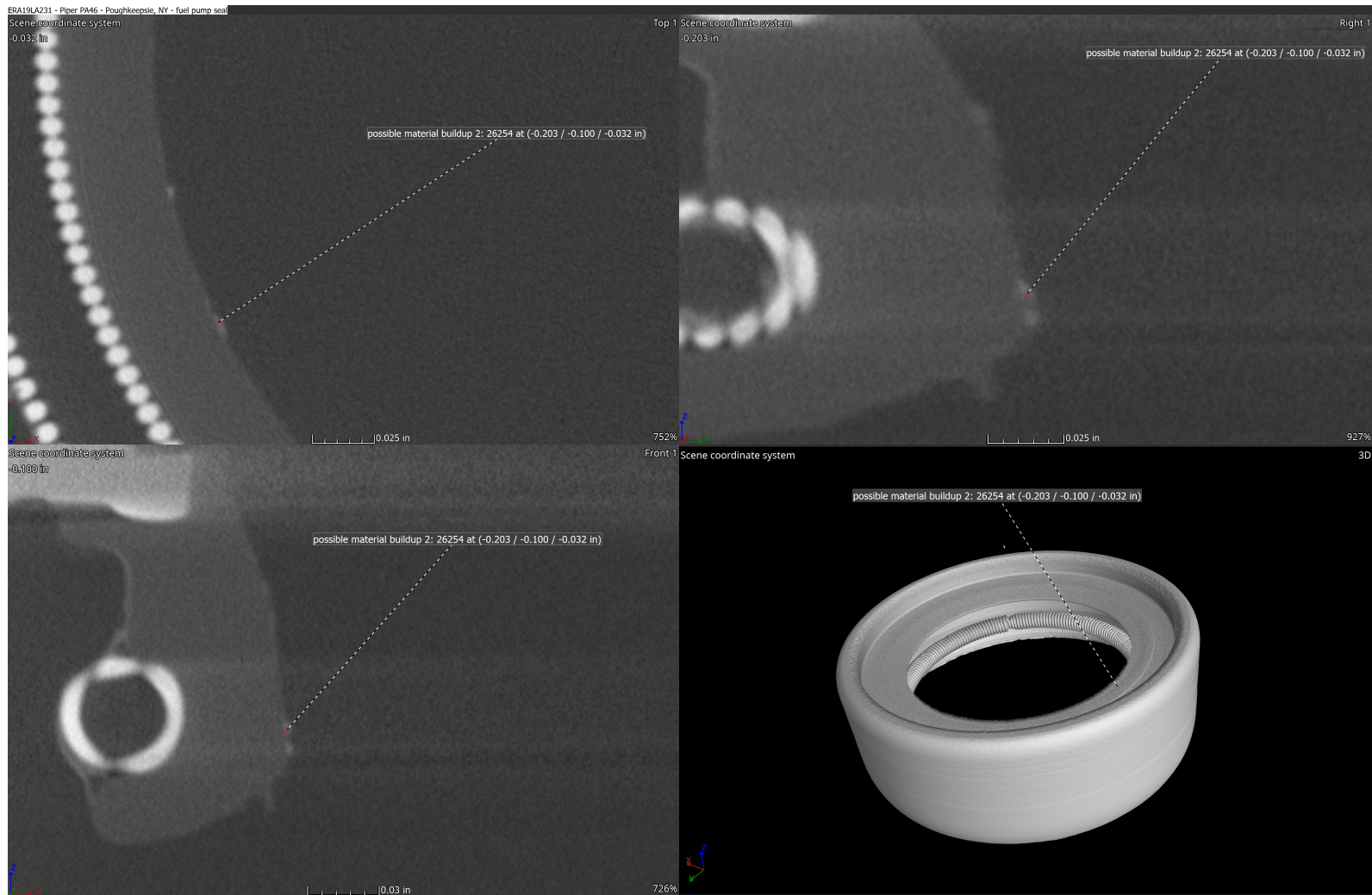


Figure 6
Engine driven fuel pump seal – possible material buildup 2

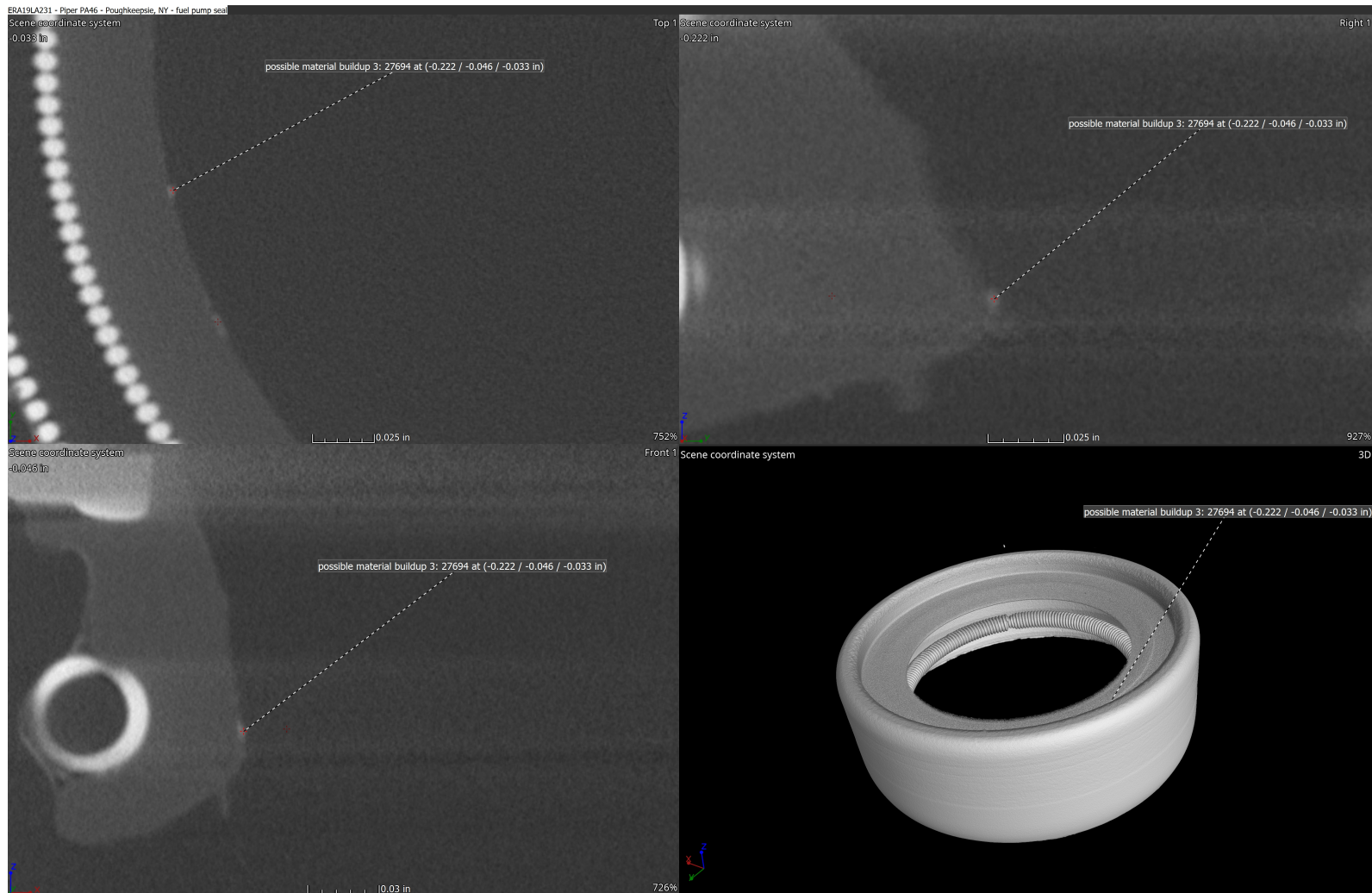


Figure 7
Engine driven fuel pump seal – possible material buildup 3

Scott Warren
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