NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

June 4, 2018

Computed Tomography Specialist's Factual Report

ERA18MA099

A. ACCIDENT

Location:	the East River, near New York, New York
Date:	March 11, 2018
Time:	1908 eastern daylight time
Airplane:	American Eurocopter Corp (Airbus Helicopters) AS350B2, N350LH

B. GROUP

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

C. SUMMARY

On March 11, 2018, about 1908 eastern daylight time, an American Eurocopter Corp (Airbus Helicopters) AS350B2, N350LH, was substantially damaged when it impacted the East River and subsequently rolled inverted after the pilot reported a loss of engine power near New York, New York. The pilot egressed from the helicopter and sustained minor injuries. The five passengers did not egress and were fatally injured. The scheduled 30-minute, doors-off aerial photography flight was operated by Liberty Helicopters, Inc., on behalf of FlyNYON under the provisions of Title 14 *Code of Federal Regulations* (CFR) Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight, which originated from Helo Kearny Heliport (65NJ), Kearny, New Jersey about 1900.

The internal configuration of the right hand float discharge valve was documented using radiographic images that were collected from April 17-24, 2018 in Chicago, Illinois. A total of 8,657 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 blockages or broken components contained within any of the image data sets.

D. DETAILS OF THE INVESTIGATION

1.0 General

The right hand float discharge valve was subjected to x-ray radiograph and computed tomography (CT) scanning to document its internal condition. The scanning was conducted from April 17-24, 2018. The scans were performed by Varex, Inc under the direction of the NTSB using the Actis 500/225 microfocus 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 8,657 slices, and the total size of the combined data sets was approximately 67.5 Gb. The complete scan protocols are 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 Protocols

Component	Discharge valve - overall	Discharge valve – target CT - central components	Discharge valve – target CT - trigger mechanism
Number of slices	2108	4911	1638
Voxel Size - X Direction (mm)	0.073	0.022	0.022
Voxel Size - Y Direction (mm)	0.073	0.022	0.022
Voxel Size - Z Direction (mm)	0.075	0.022	0.022
Image Projections per Revolution	2160	1800	1800
Exposure time (ms)	285.58	285.58	285.58
Frames to Avg (frames per projection)	2	3	3
X-ray Source Voltage (kV)	222	222	222
X-ray Source Current (mA)	0.510	0.510	0.550
Source Filter Thickness (mm)	2	1	1
Source Filter Material	Copper	Brass	Brass
Image Matrix Size	2048 x 2048	2048 x 2048	2048 x 2048

The data sets of slice images were 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 components were digitally removed or rendered transparent to allow closer observation of interior parts. In the images, the high 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 components were examined for any signs of missing or damaged areas, contamination, or any other anomalies. Specific results (including example images) are presented in subsequent sections of this report.

2.0 Computed Tomography Results

A digital radiograph of the discharge valve is shown in figure 1. The computed tomography (CT) results for the components are shown in figures 2 through 29.

Review of the images indicated that, when the scans were conducted[1], there were no indications of blockages or broken components contained within any of the image data sets.

[1] Note that the valve safety pin was installed by the investigative team after the valve was recovered from the accident helicopter and prior to shipment to Varex for CT scanning.

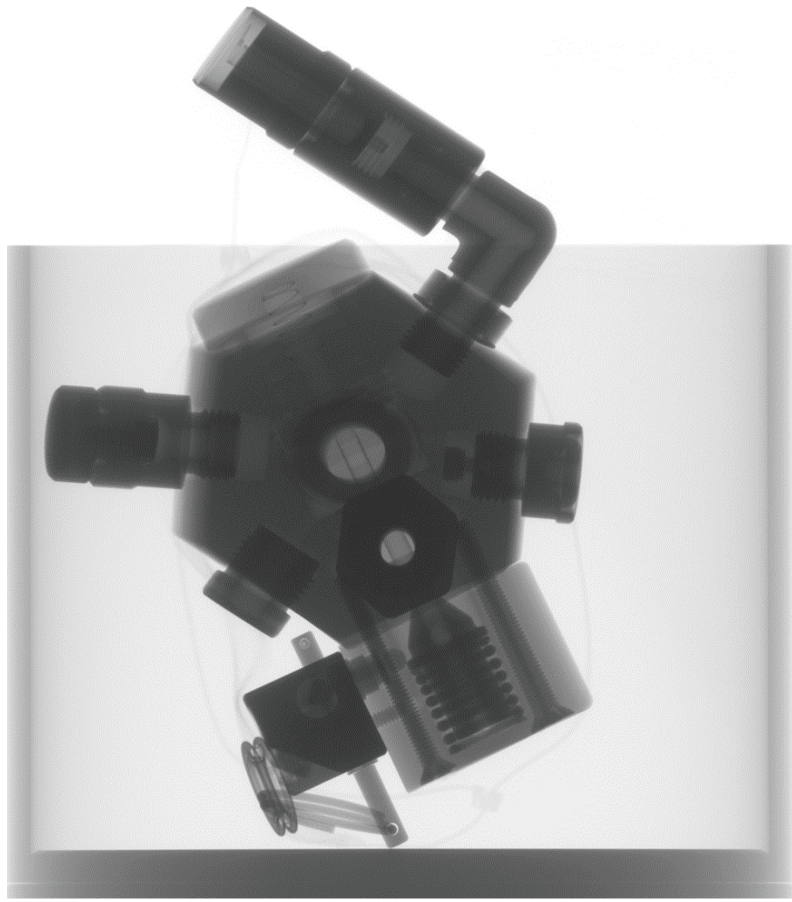

Figure 1
Digital radiograph of discharge valve

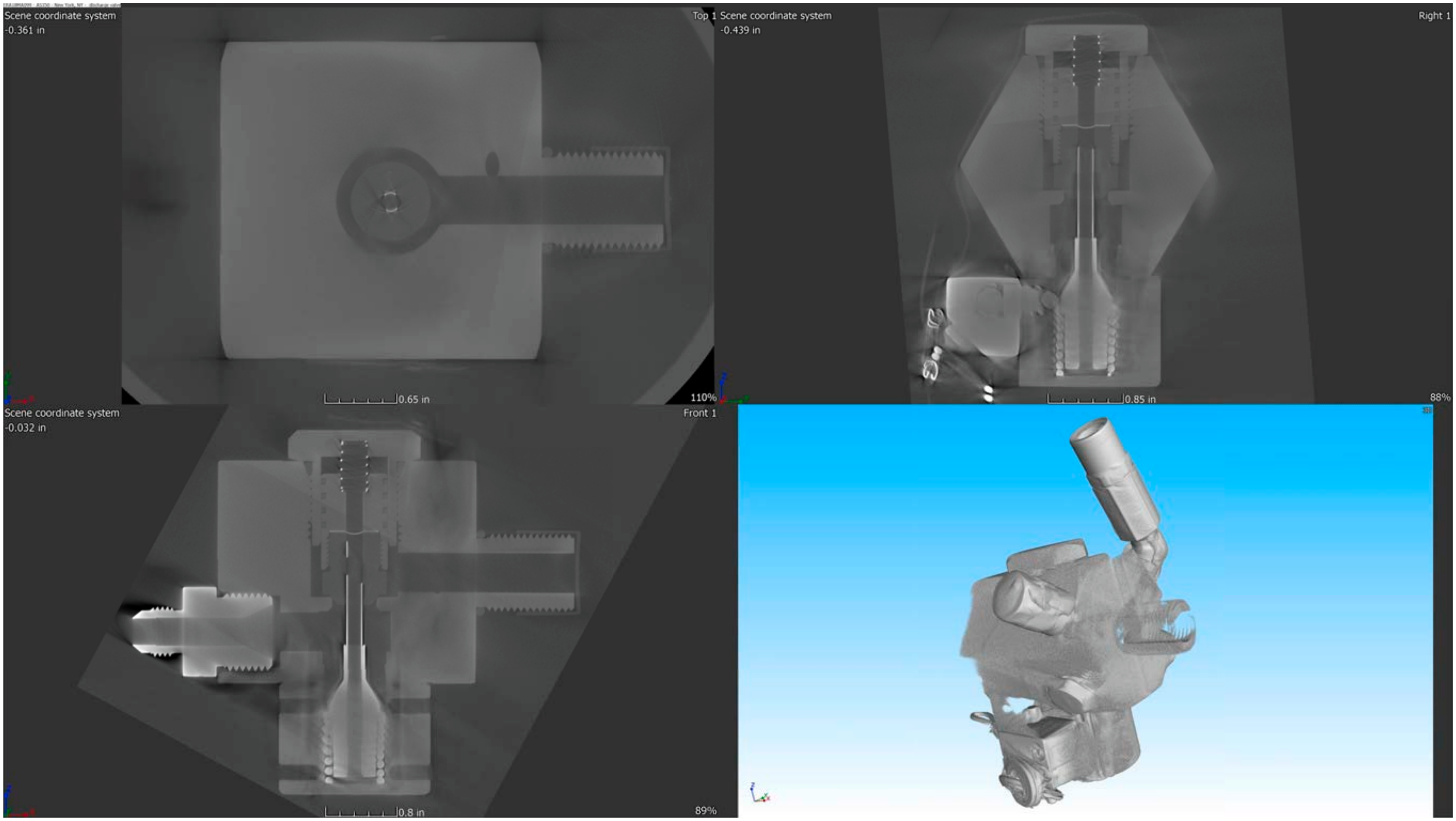

Figure 2
Discharge valve - overview

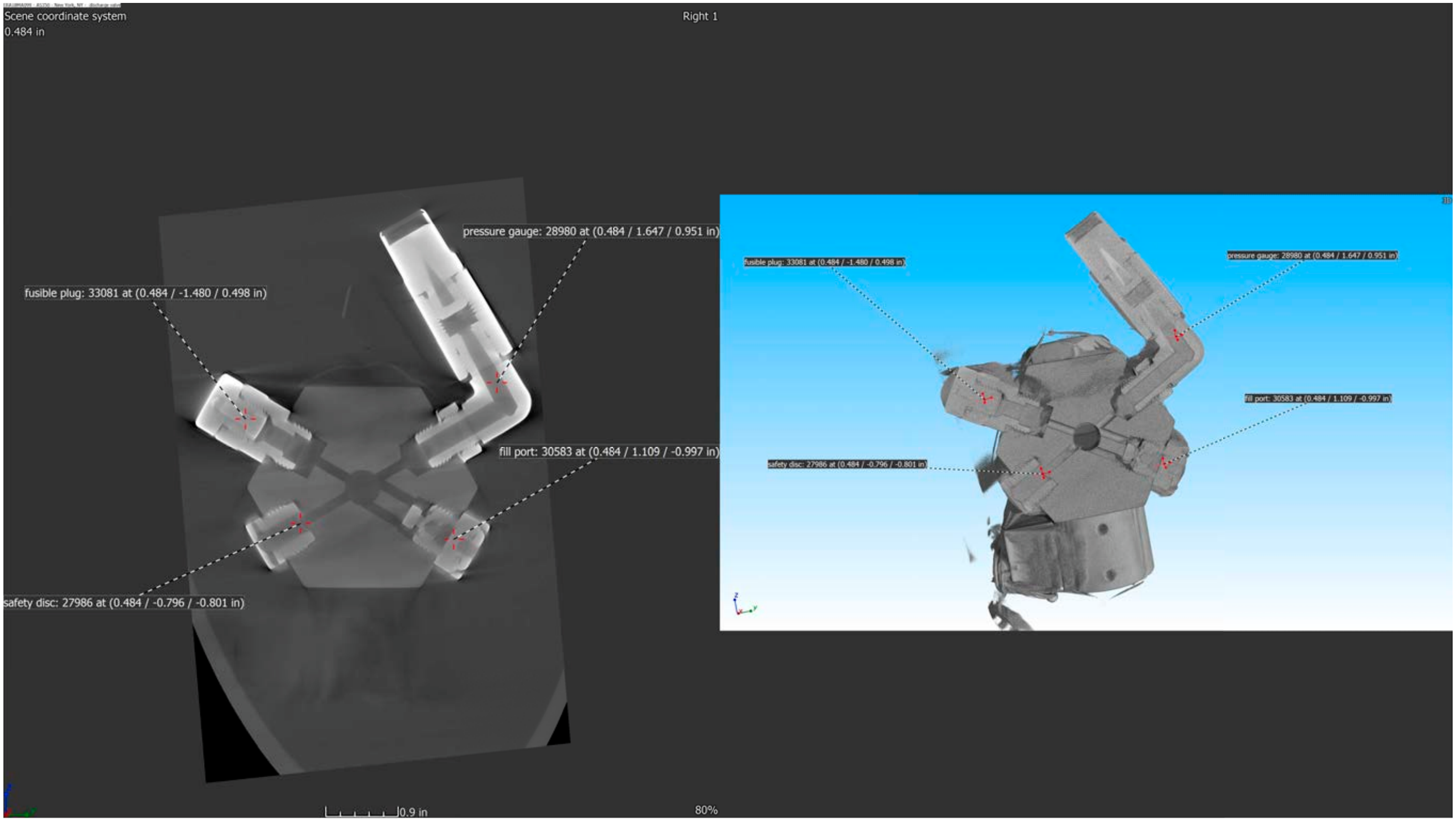

Figure 3
Discharge valve – port overview

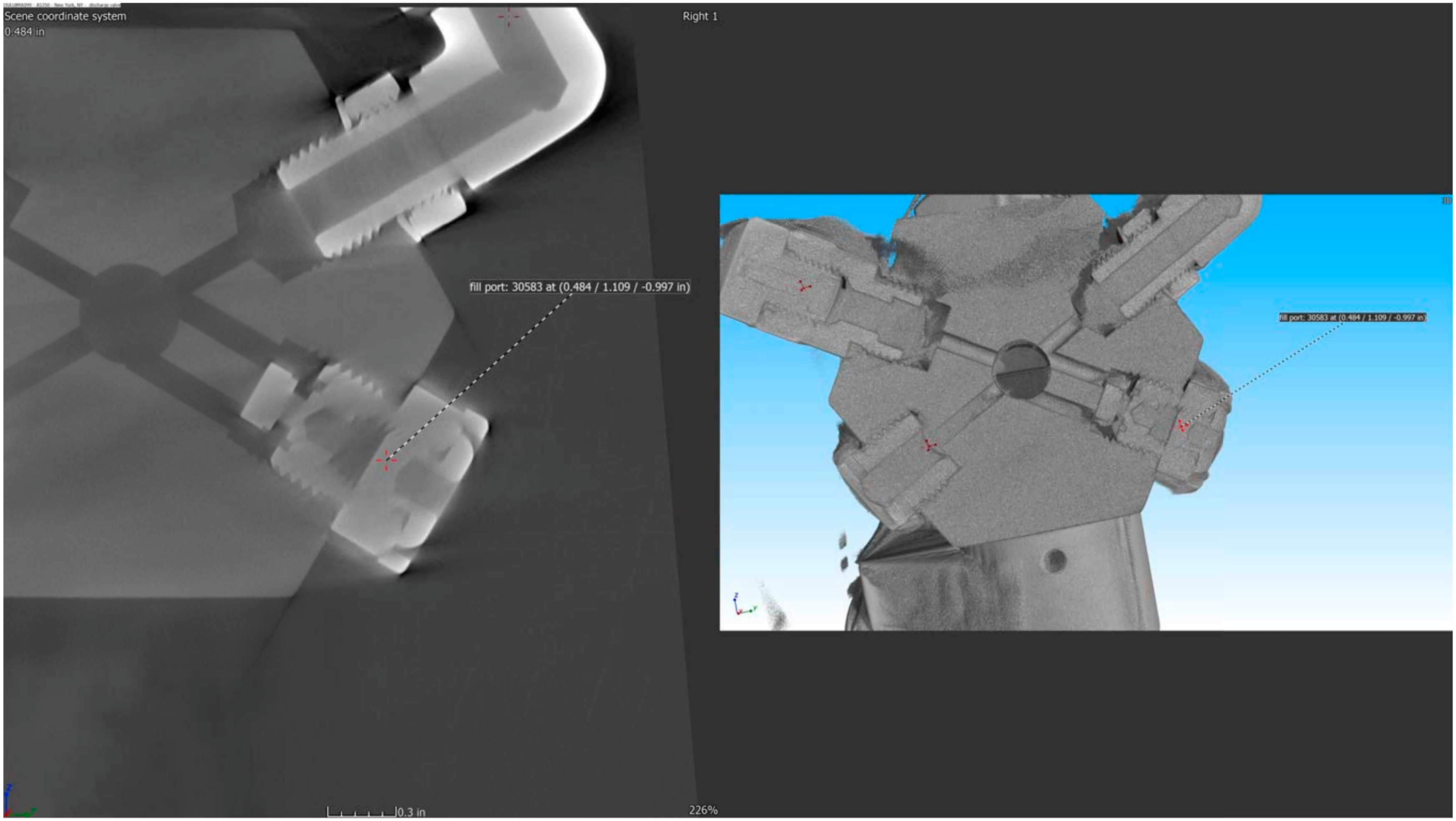

Figure 4
Discharge valve – fill port

Figure 5
Discharge valve – fusible plug

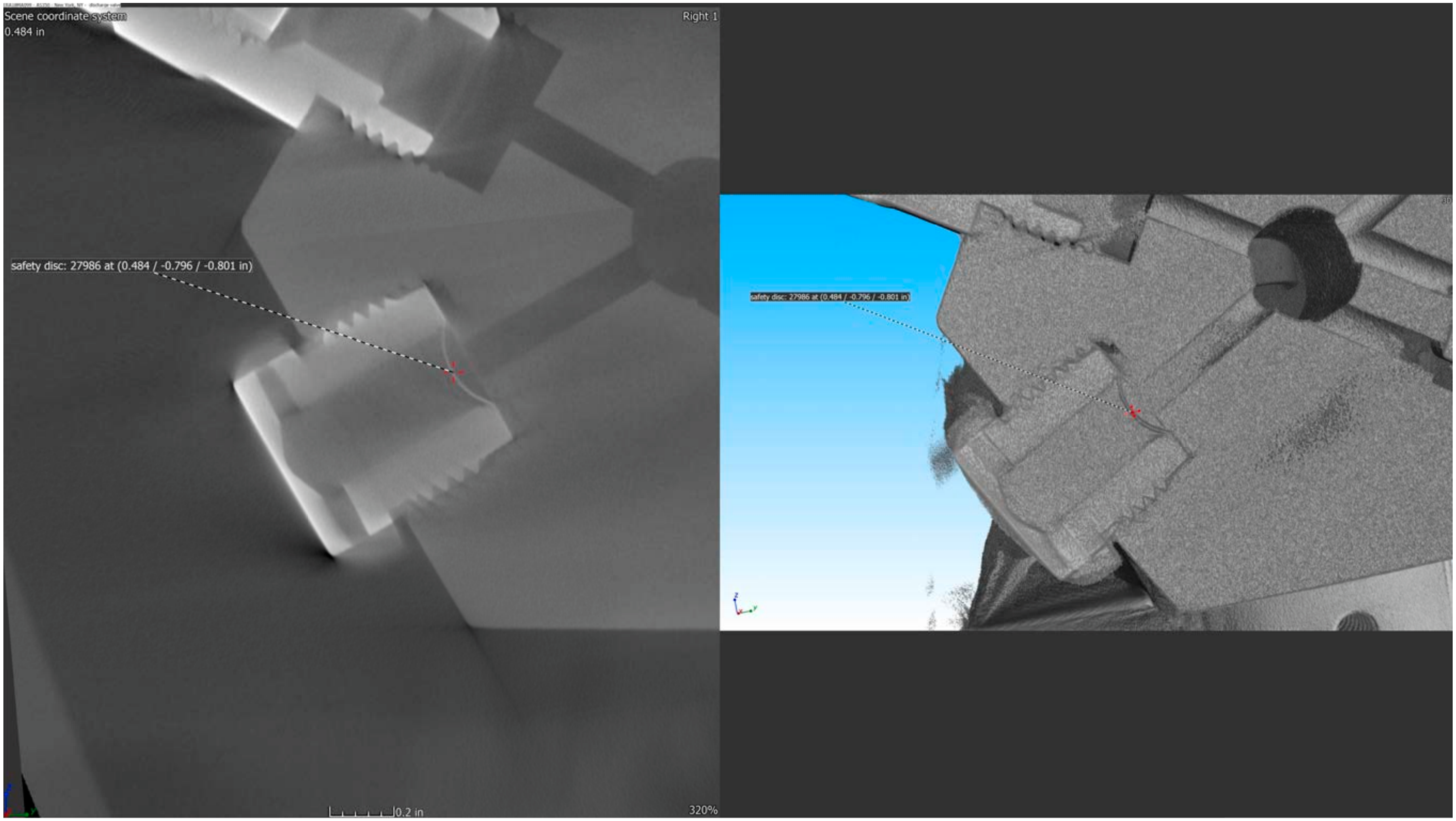

Figure 6
Discharge valve – safety disc

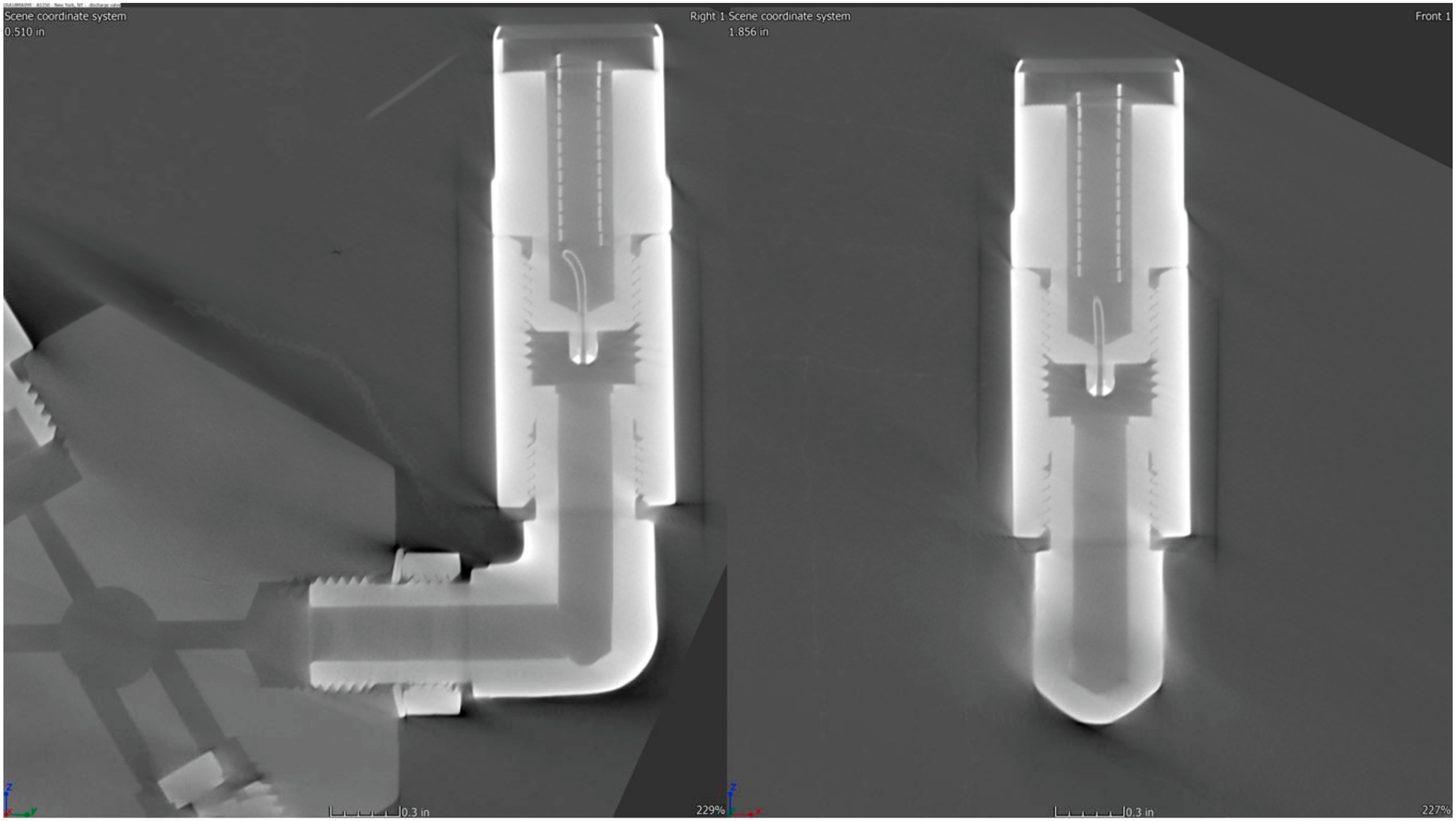

Figure 7
Discharge valve – pressure gauge

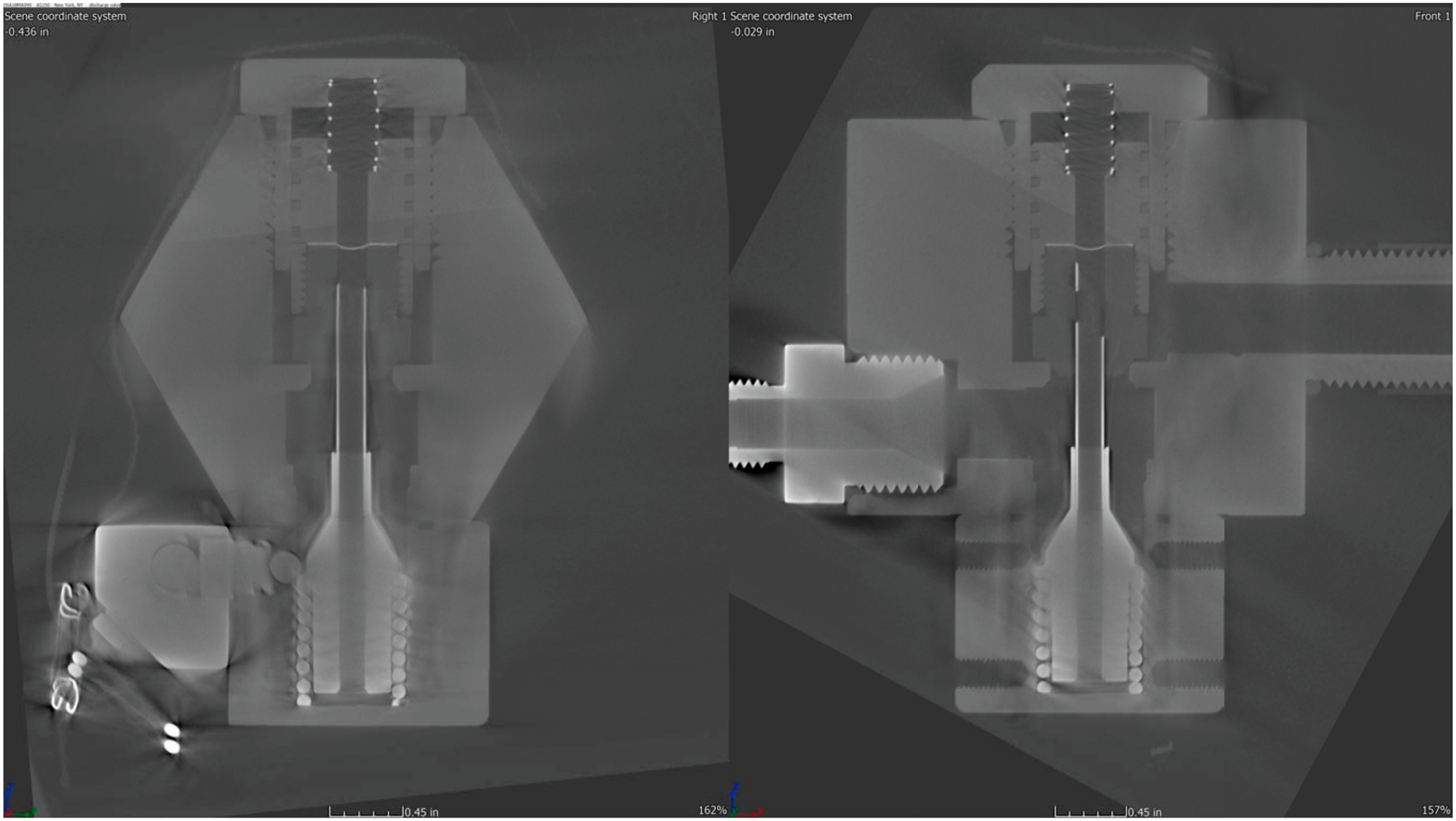

Figure 8
Discharge valve – bayonet and poppet assemblies

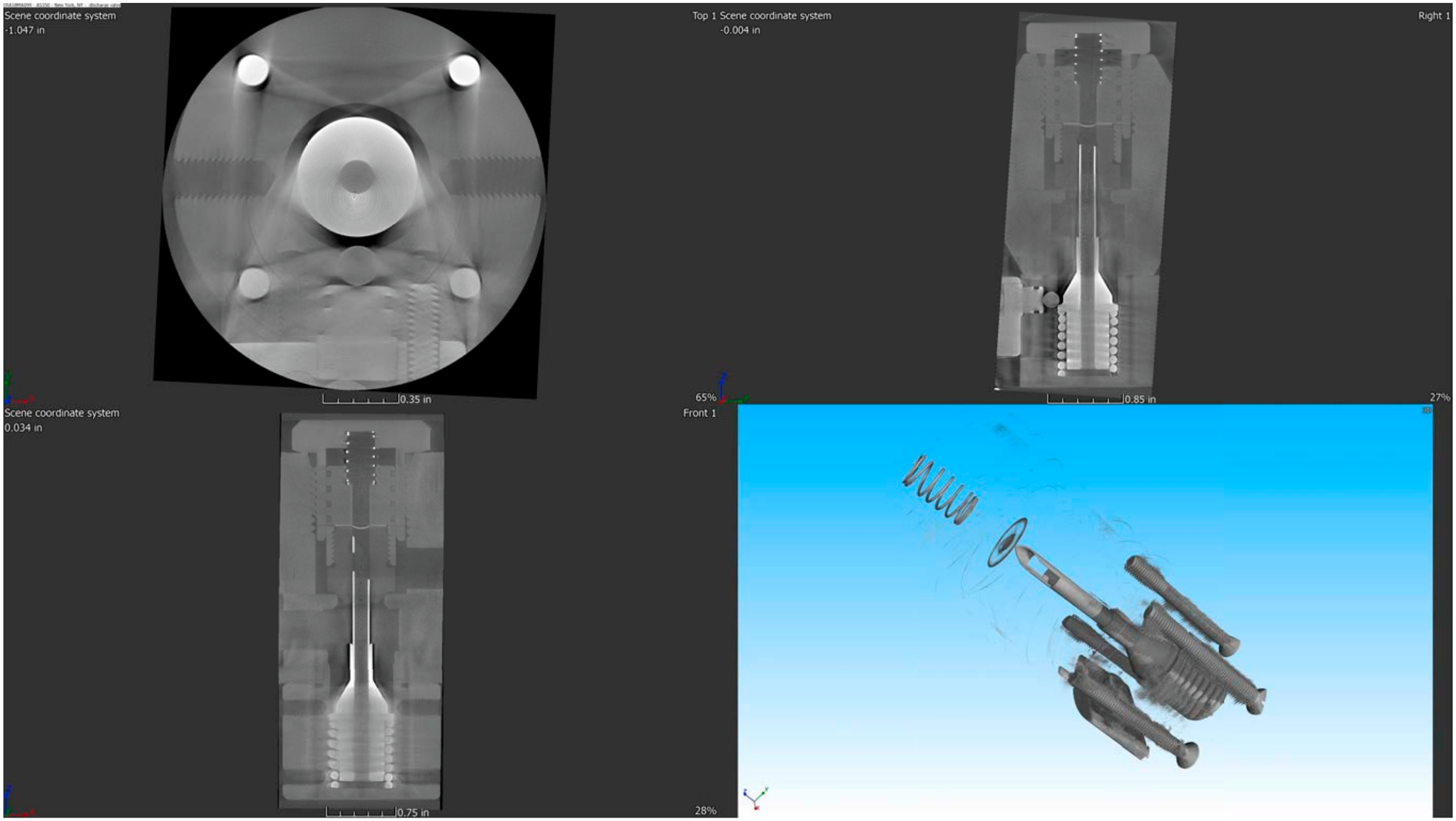

Figure 9
Discharge valve – target CT – bayonet and poppet assemblies

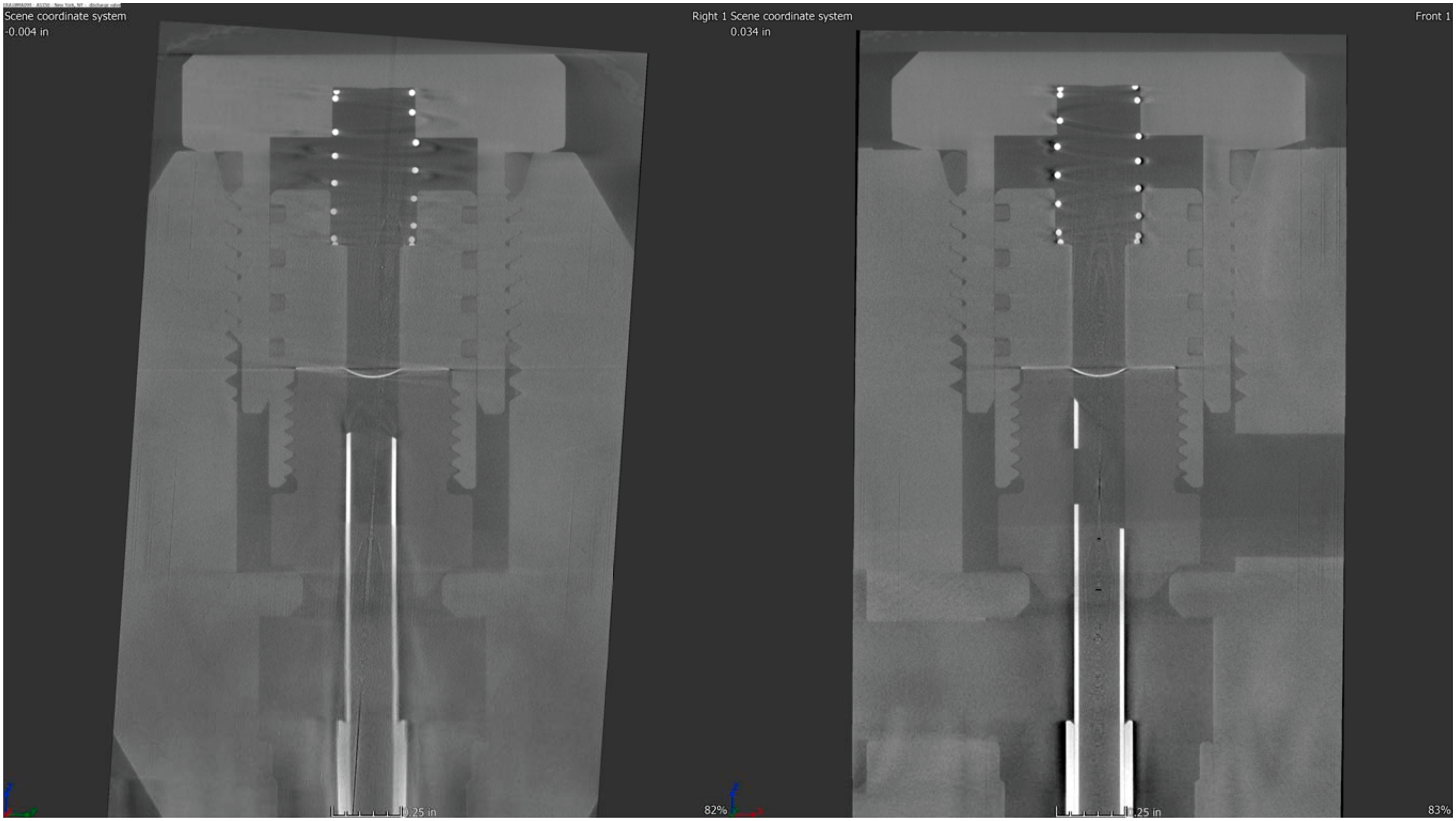

Figure 10
Discharge valve – target CT –poppet assembly

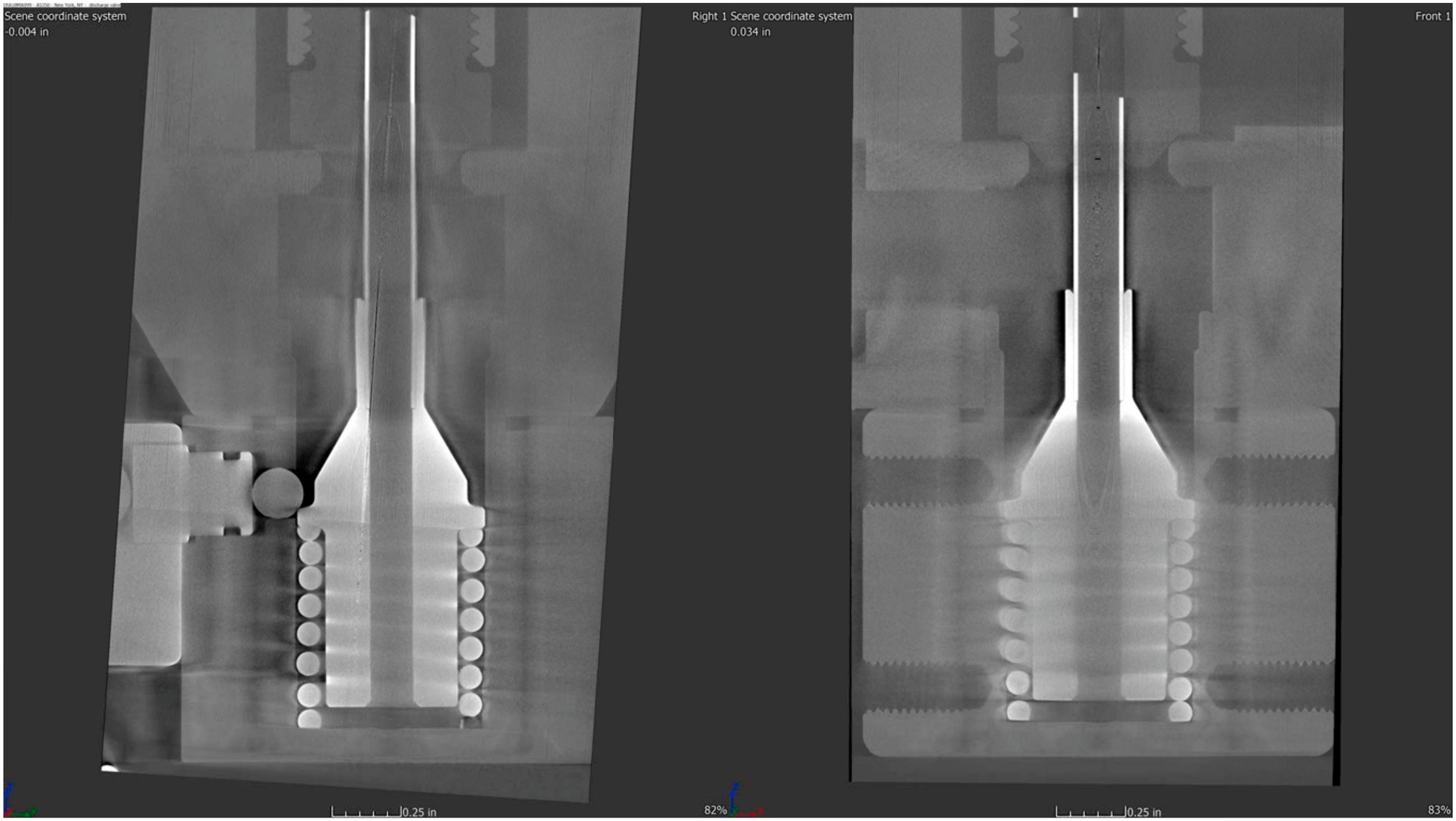

Figure 11
Discharge valve – target CT – bayonet assembly

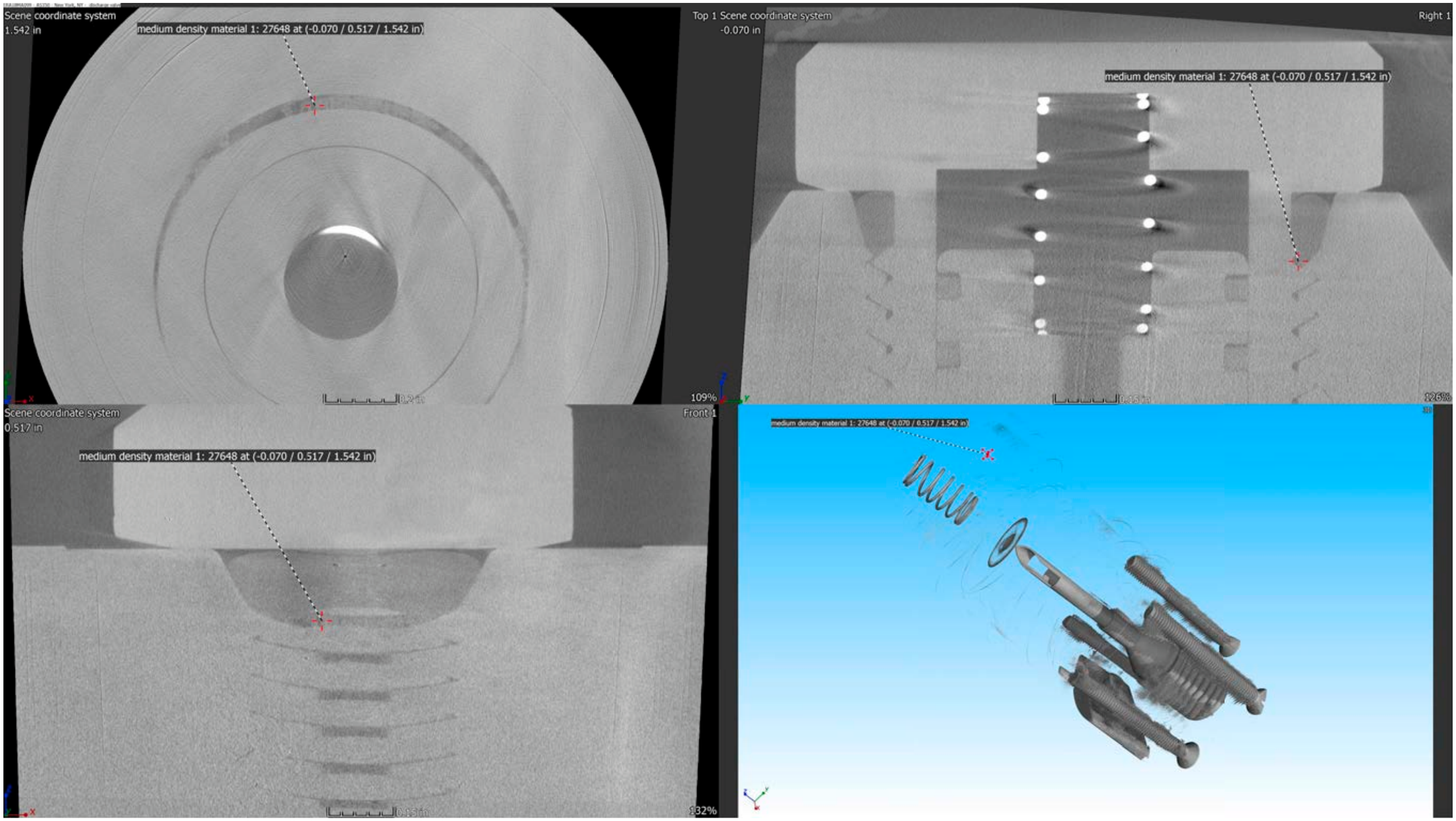

Figure 12
Discharge valve – target CT – medium density material 1

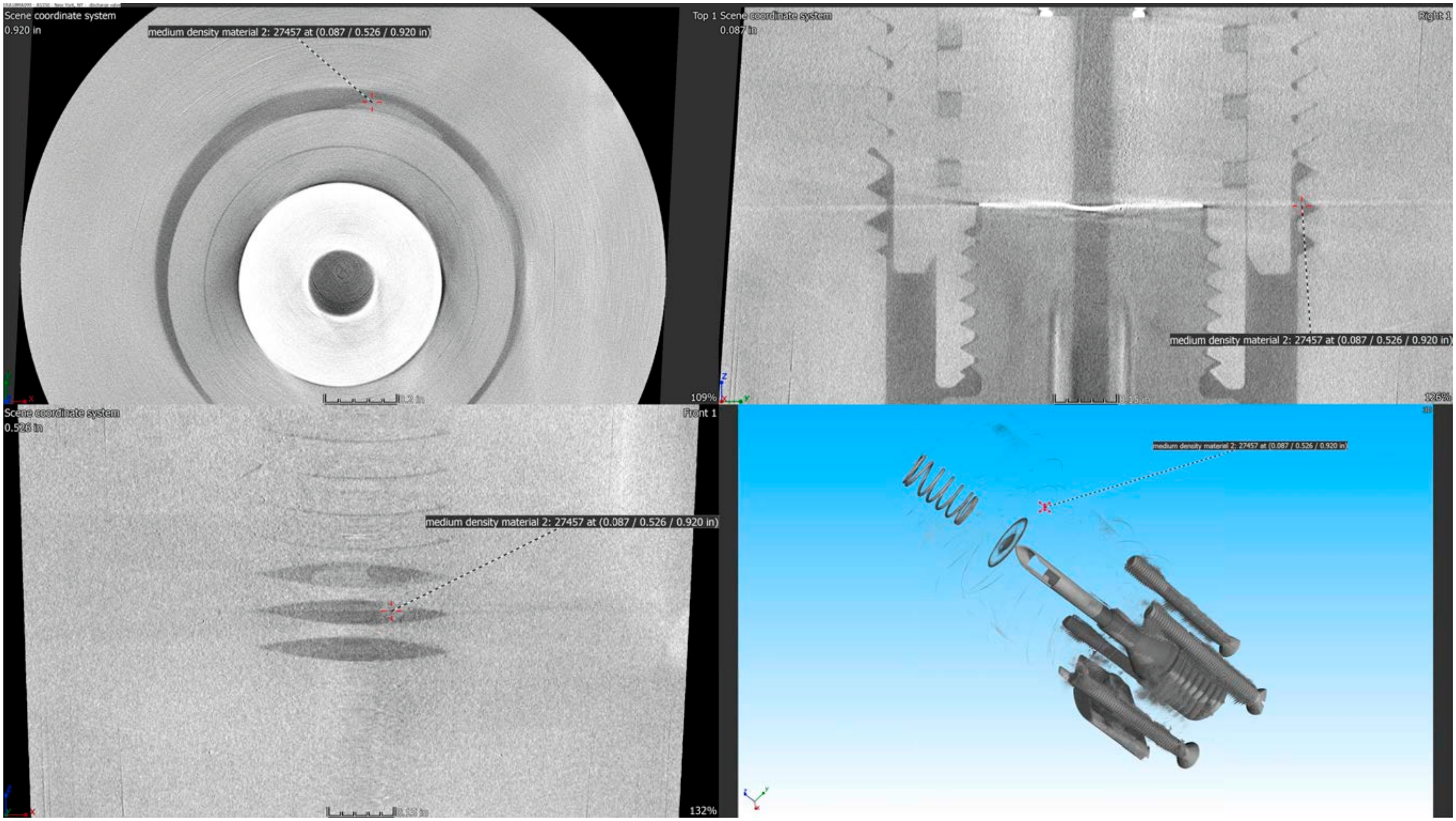

Figure 13
Discharge valve – target CT – medium density material 2

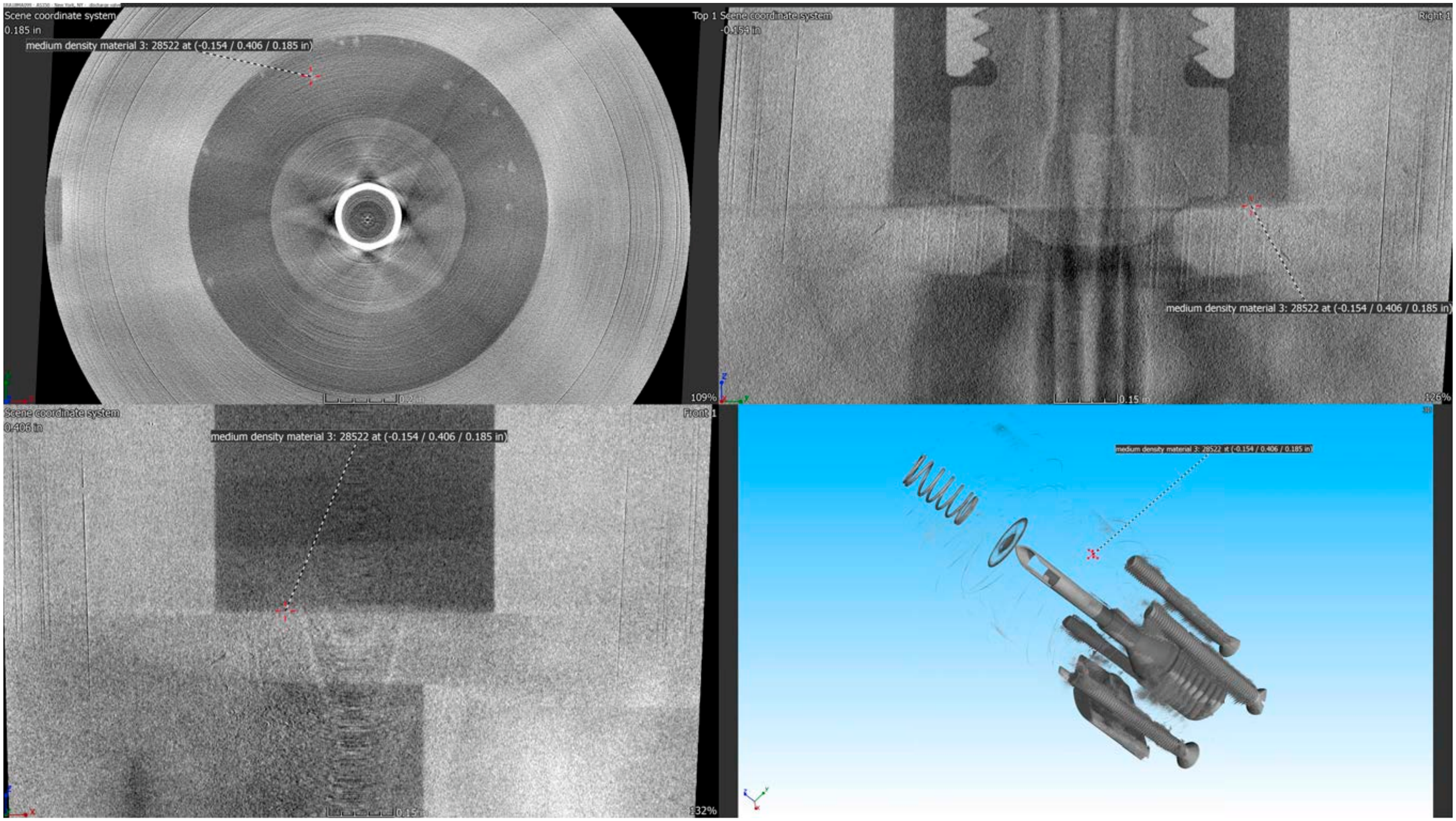

Figure 14
Discharge valve – target CT – medium density material 3

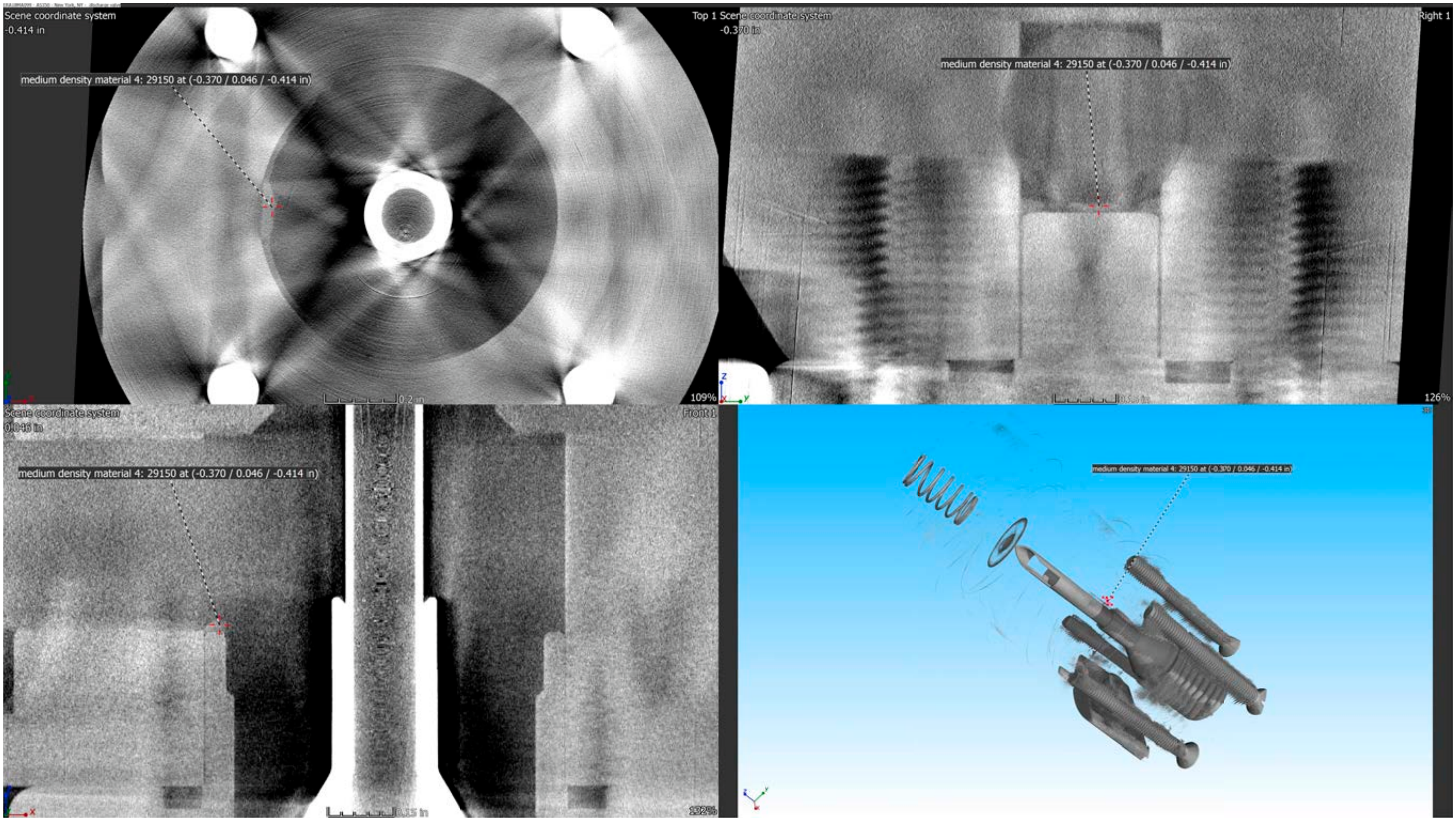

Figure 15
Discharge valve – target CT – medium density material 4

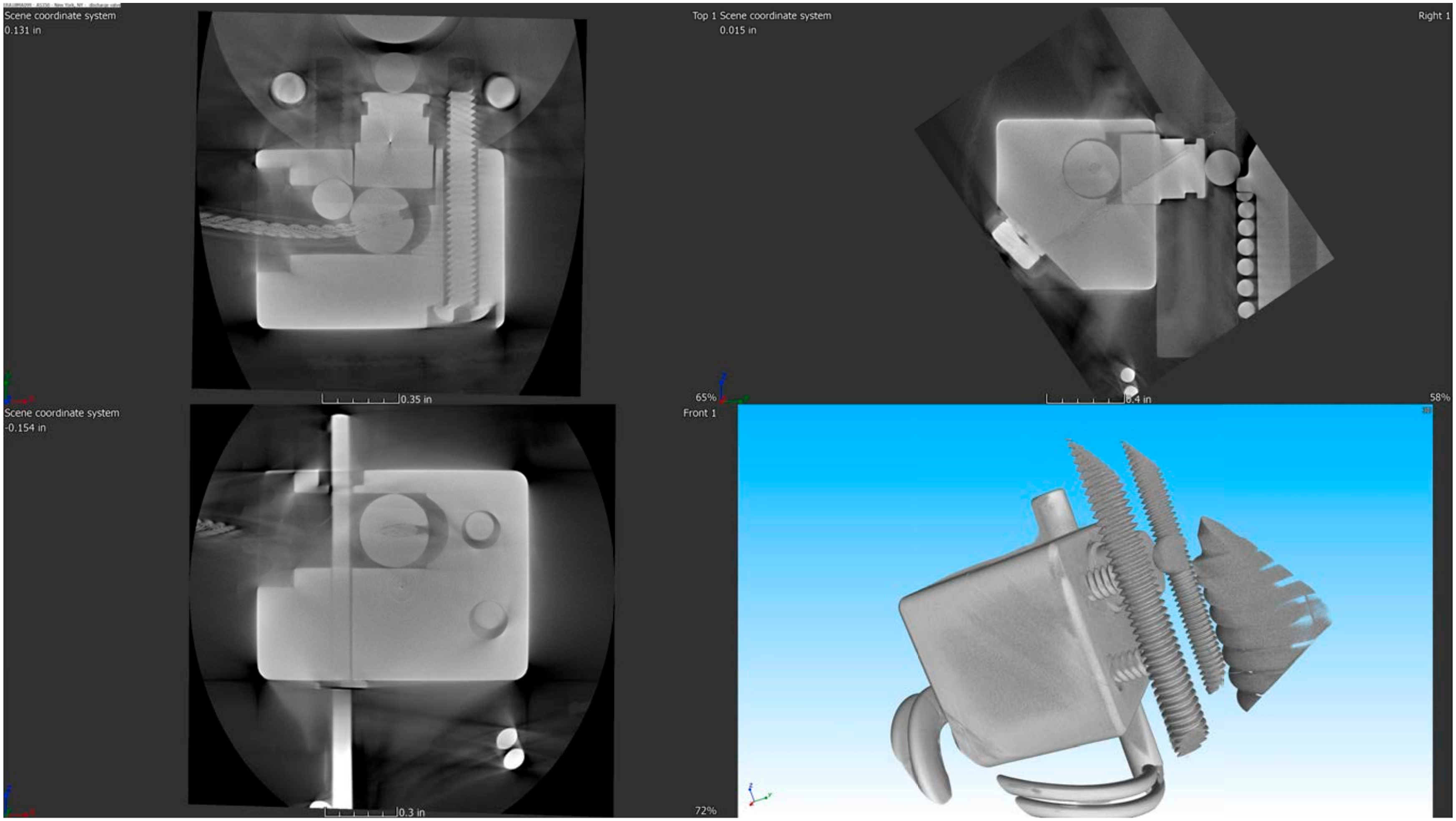

Figure 16
Discharge valve – target CT – pull cable housing overview

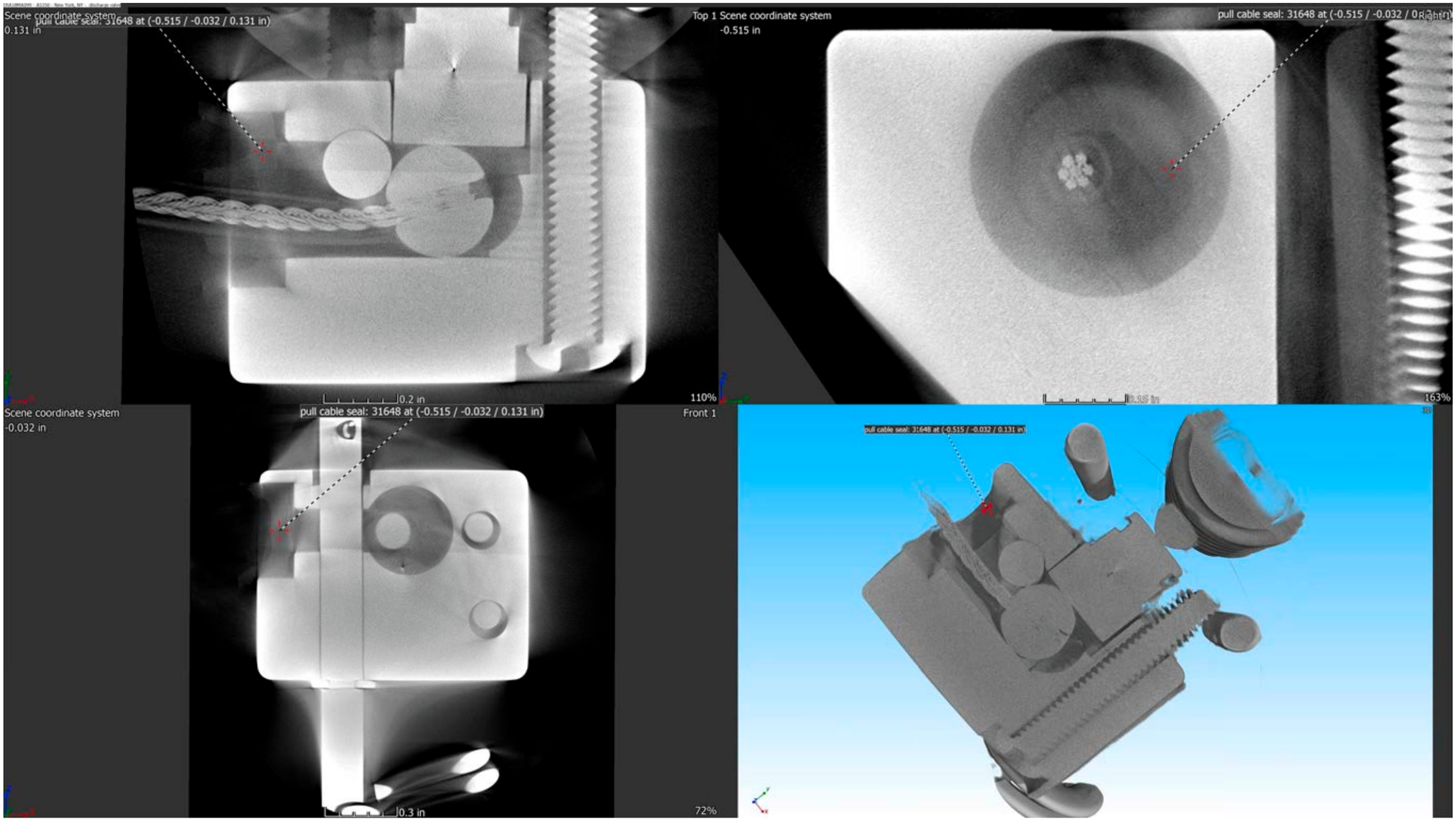

Figure 17
Discharge valve – target CT – pull cable seal

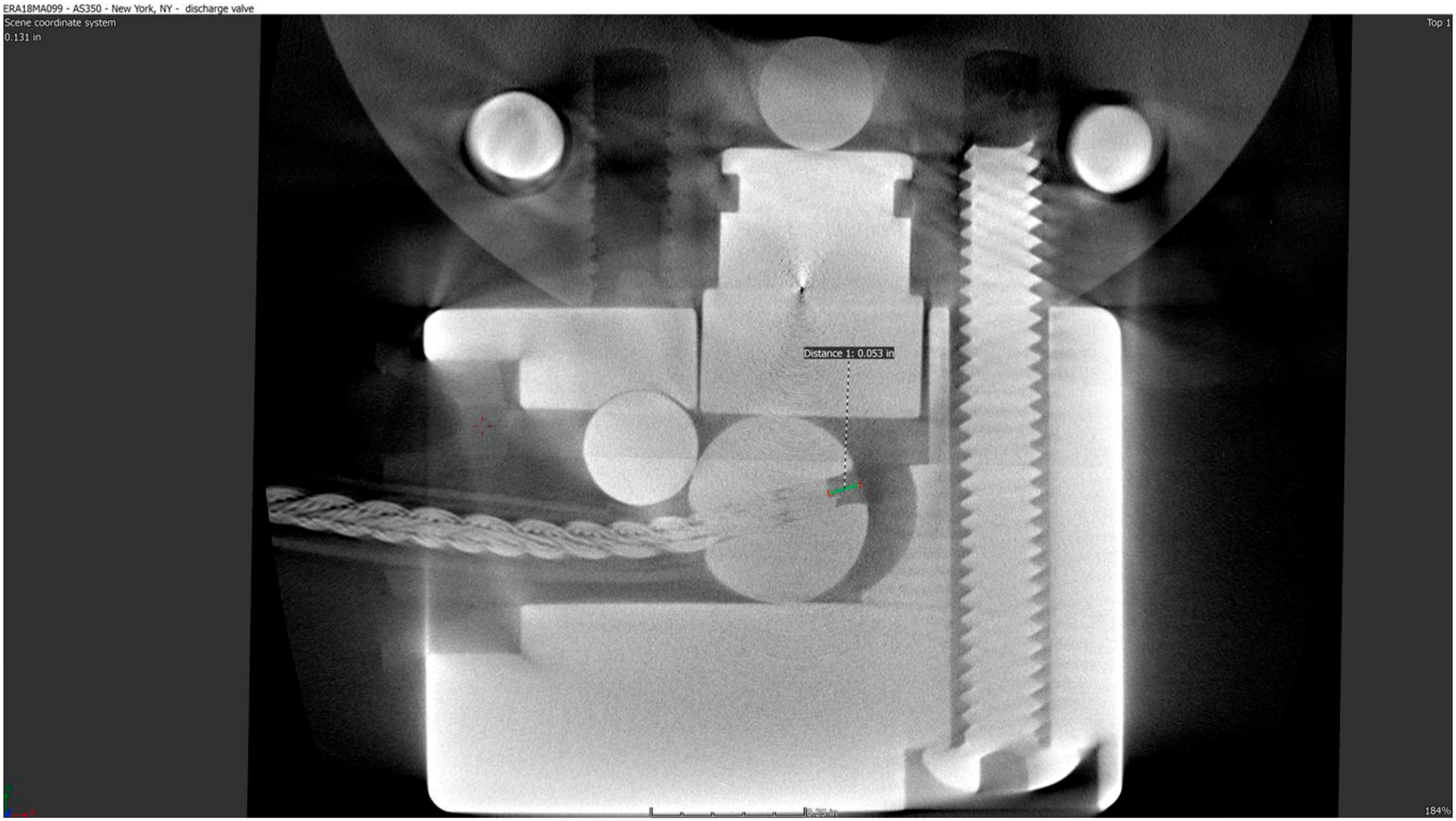

Figure 18
Discharge valve – target CT – pull cable end position

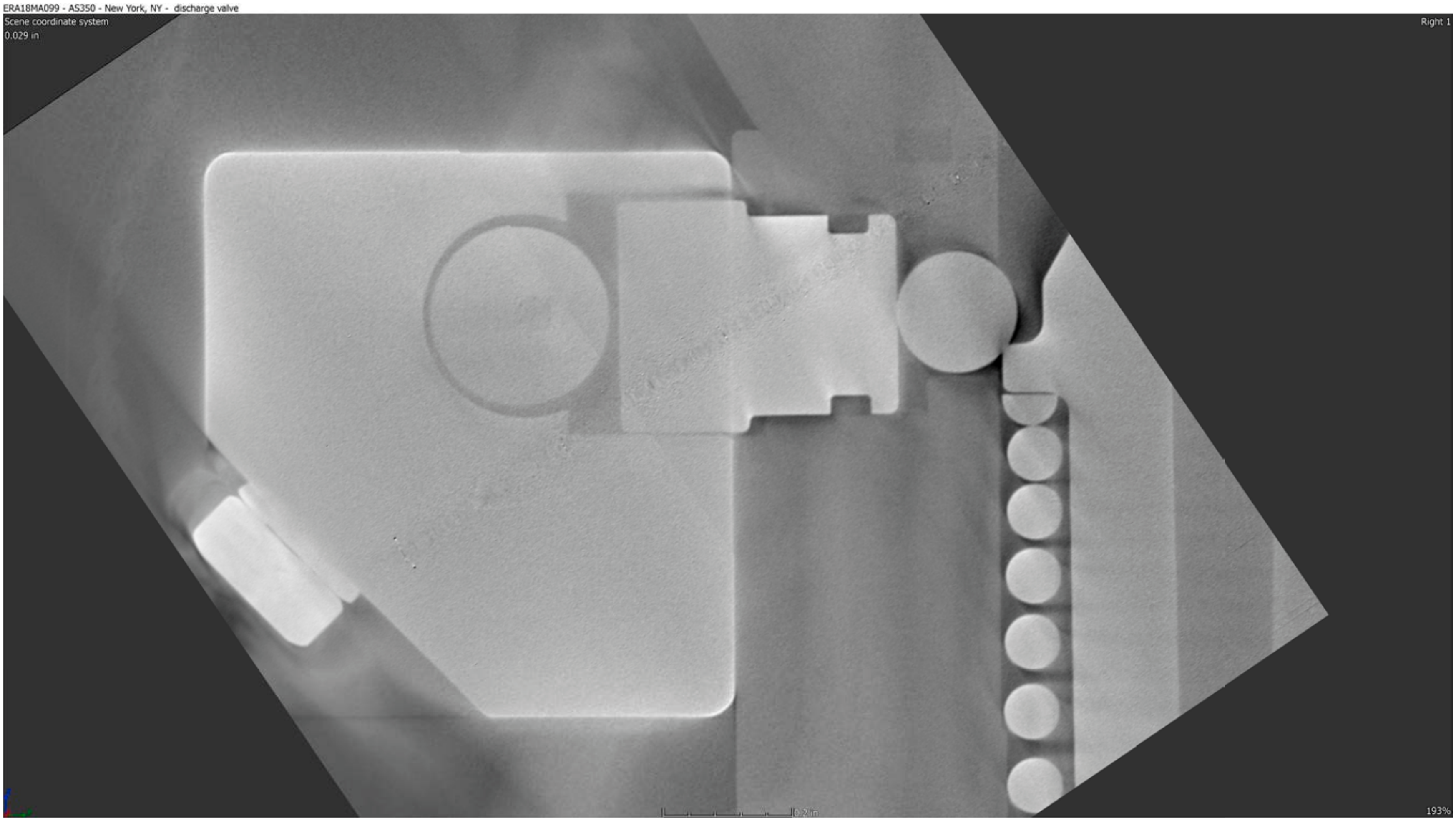

Figure 19
Discharge valve – target CT – piston, ball, and bayonet

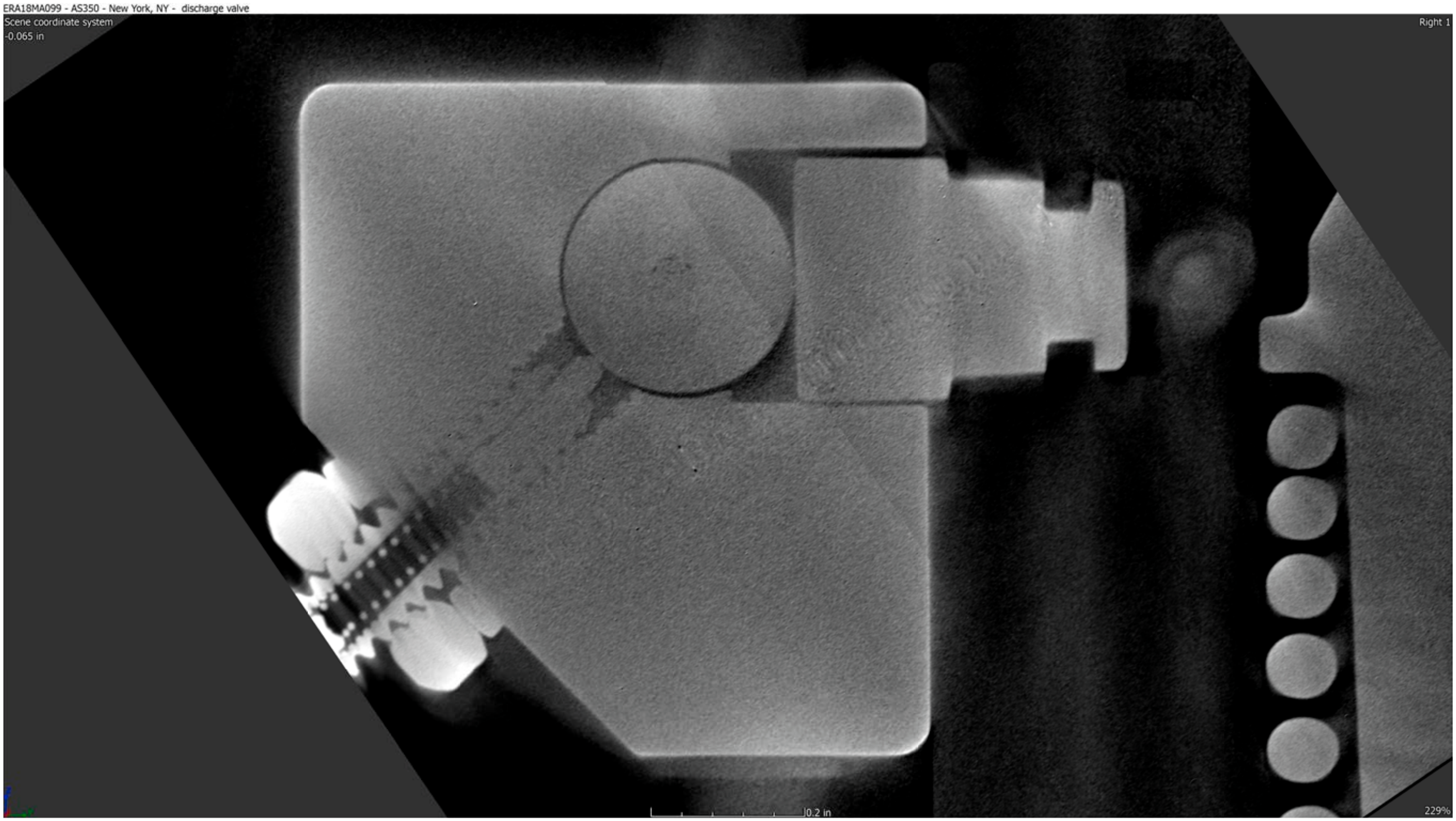

Figure 20
Discharge valve – target CT – housing set screw

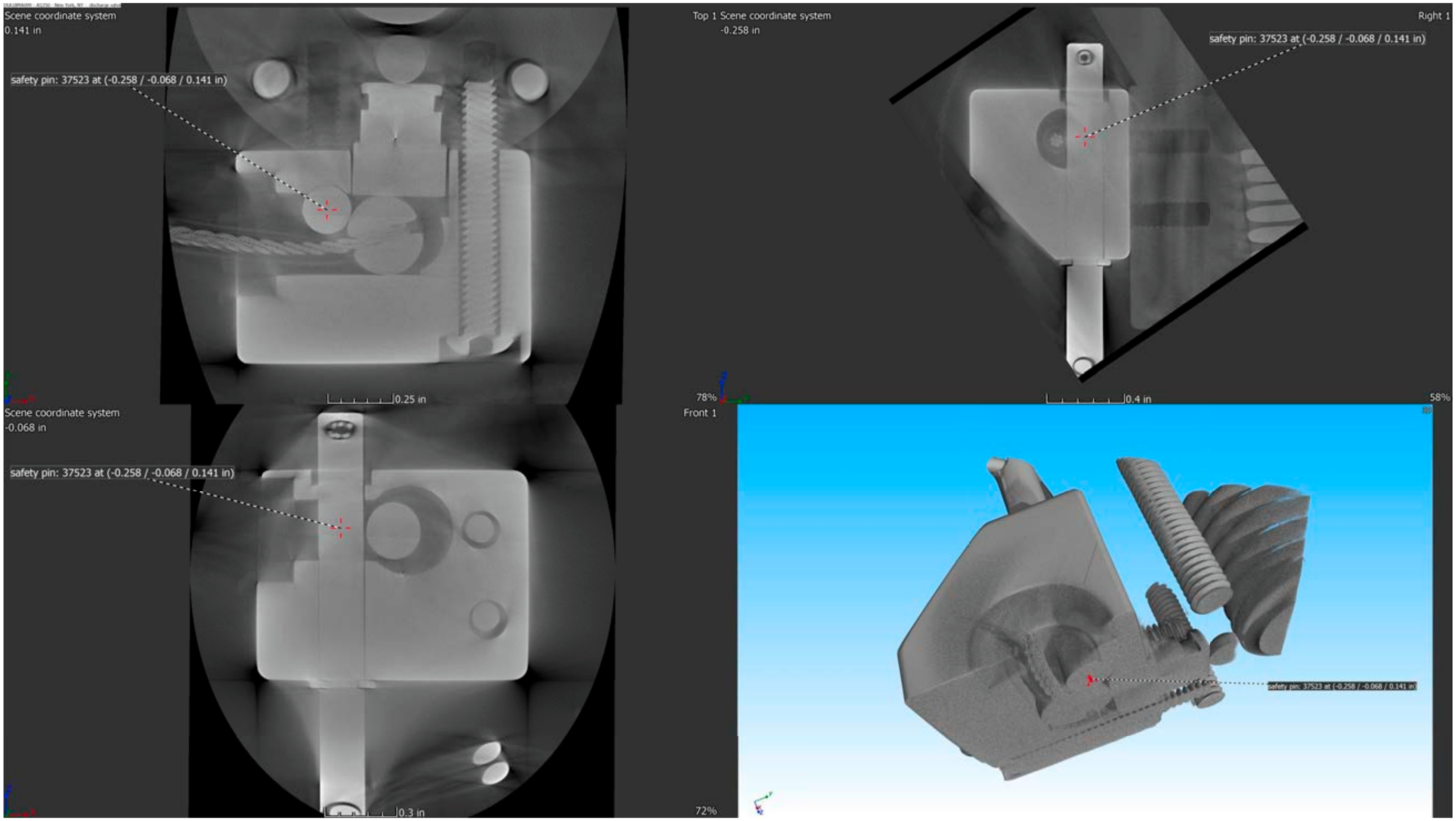

Figure 21
Discharge valve – target CT – safety pin[2]

[2] As stated in Note 1, the valve safety pin was installed by the investigative team after the valve was recovered from the accident helicopter and prior to shipment to Varex for CT scanning.

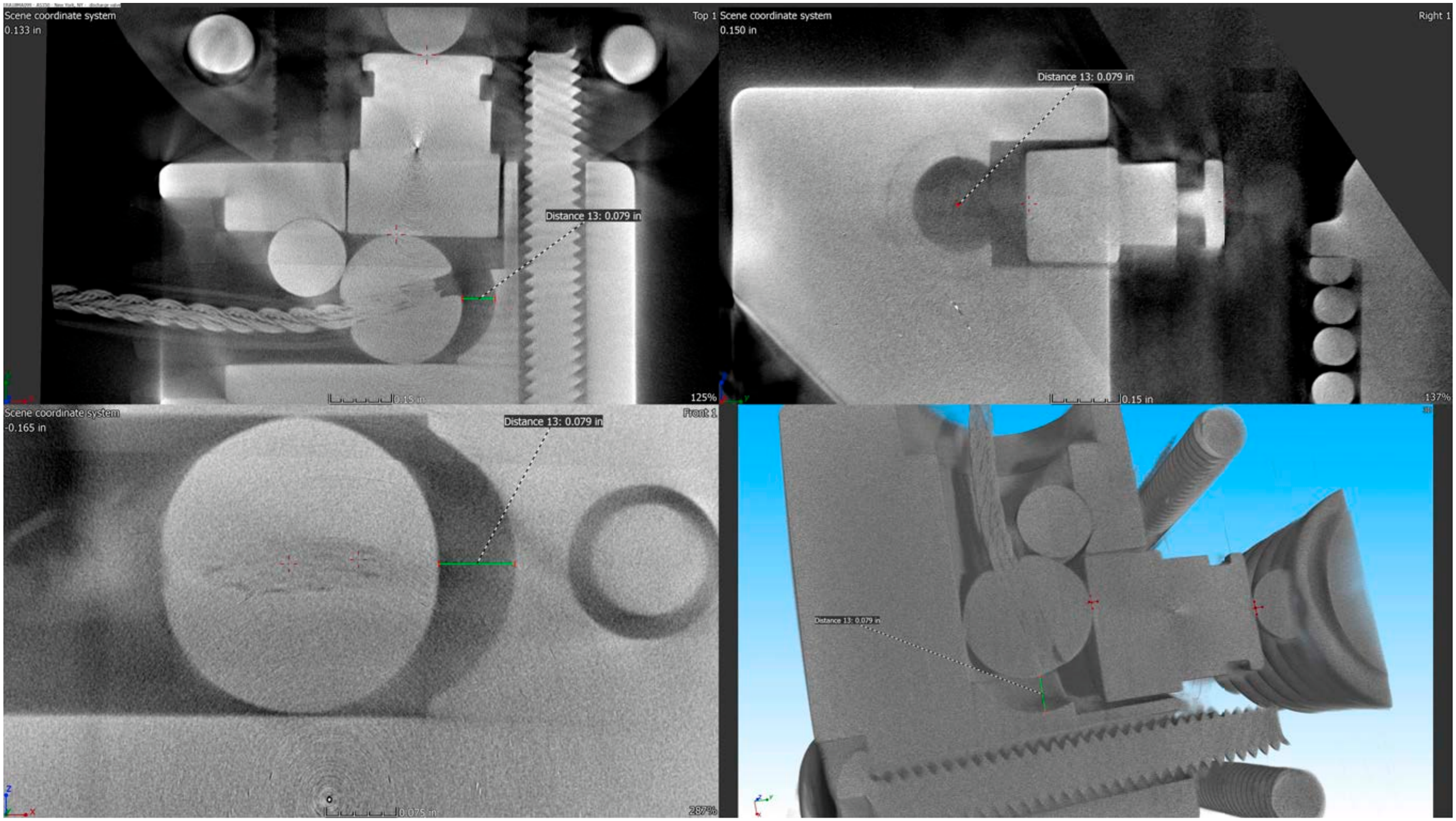

Figure 22
Discharge valve – target CT – pull cable to wall distance

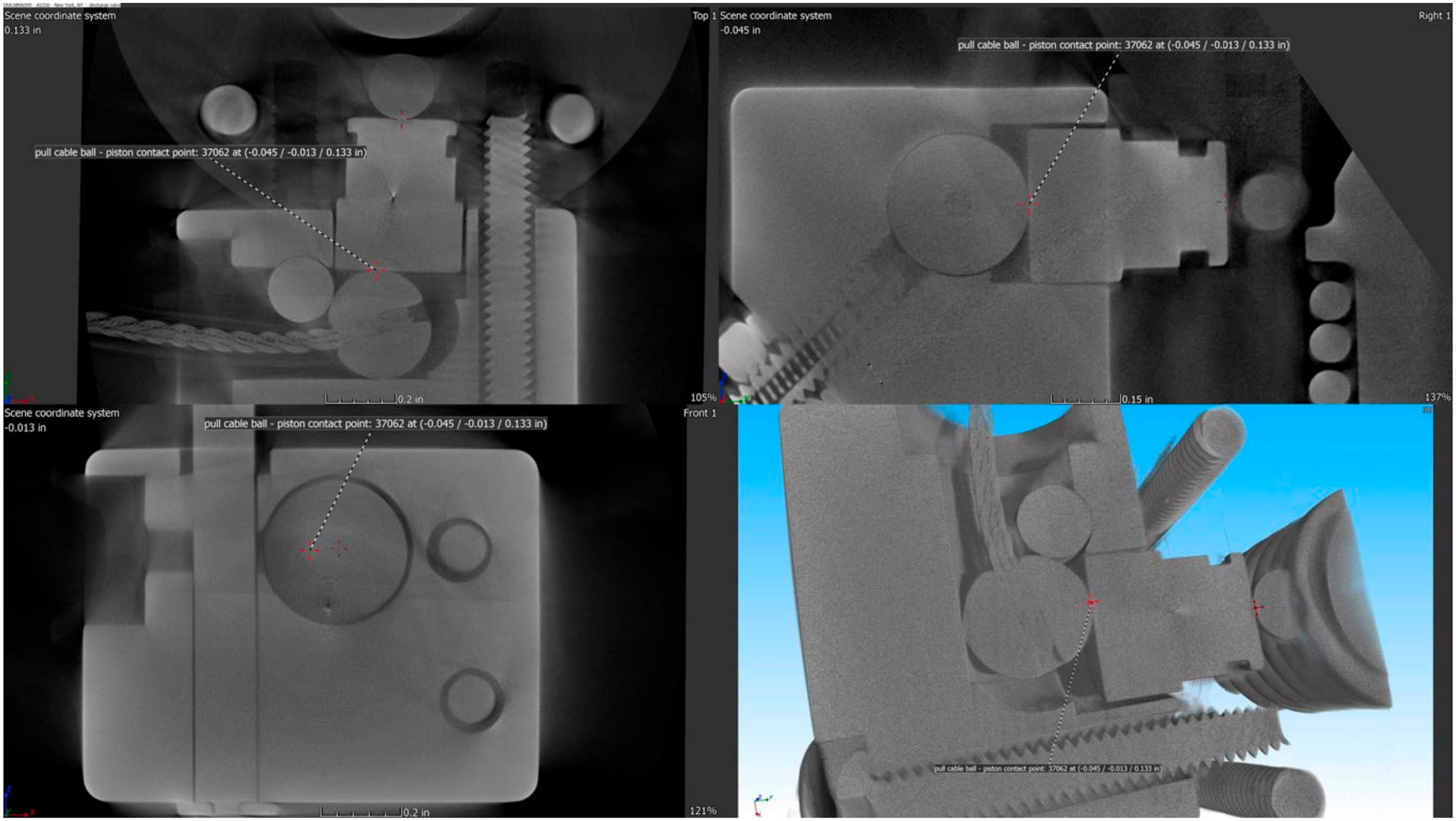

Figure 23
Discharge valve – target CT – piston contact point

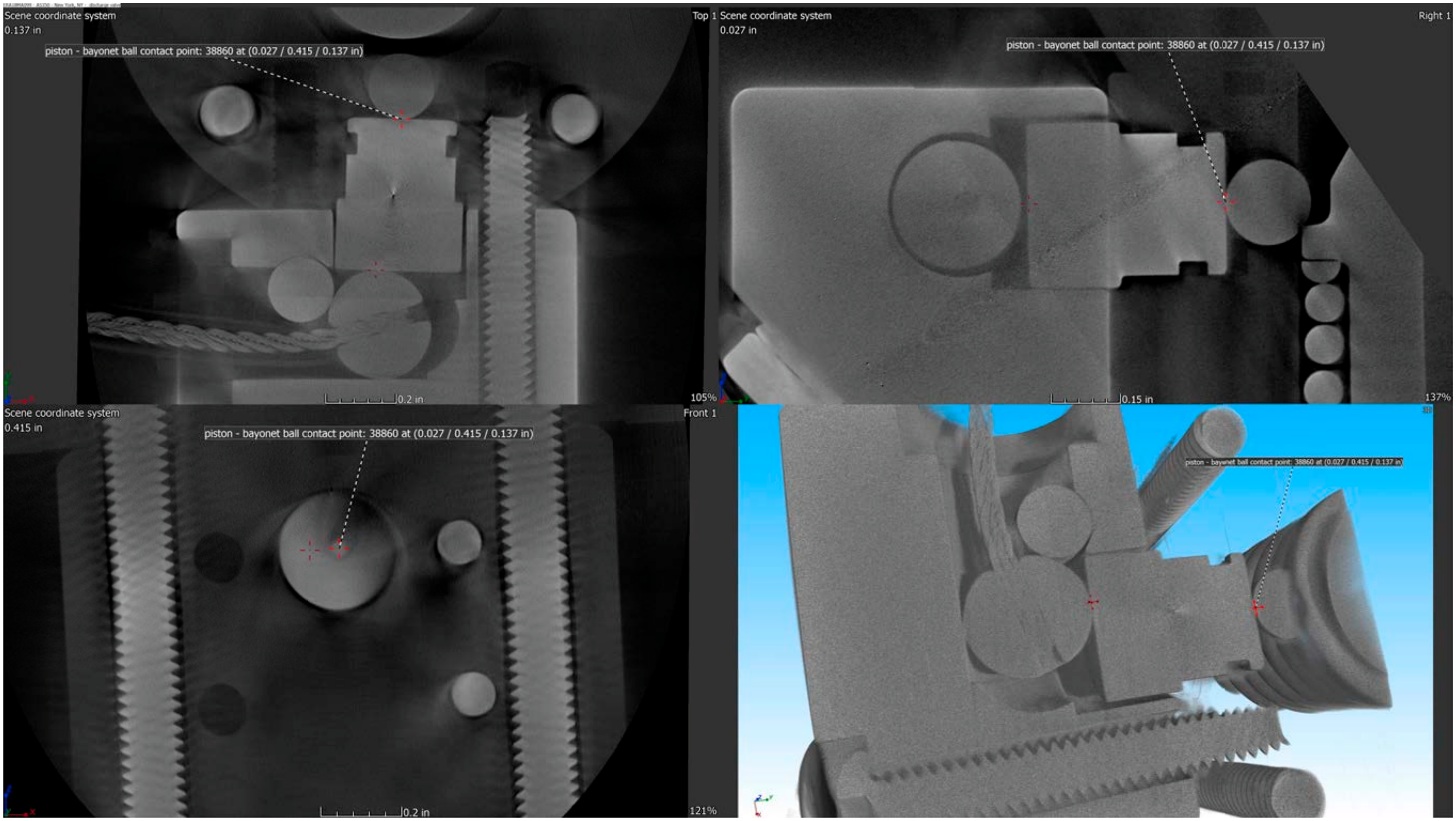

Figure 24
Discharge valve – target CT – bayonet ball contact point

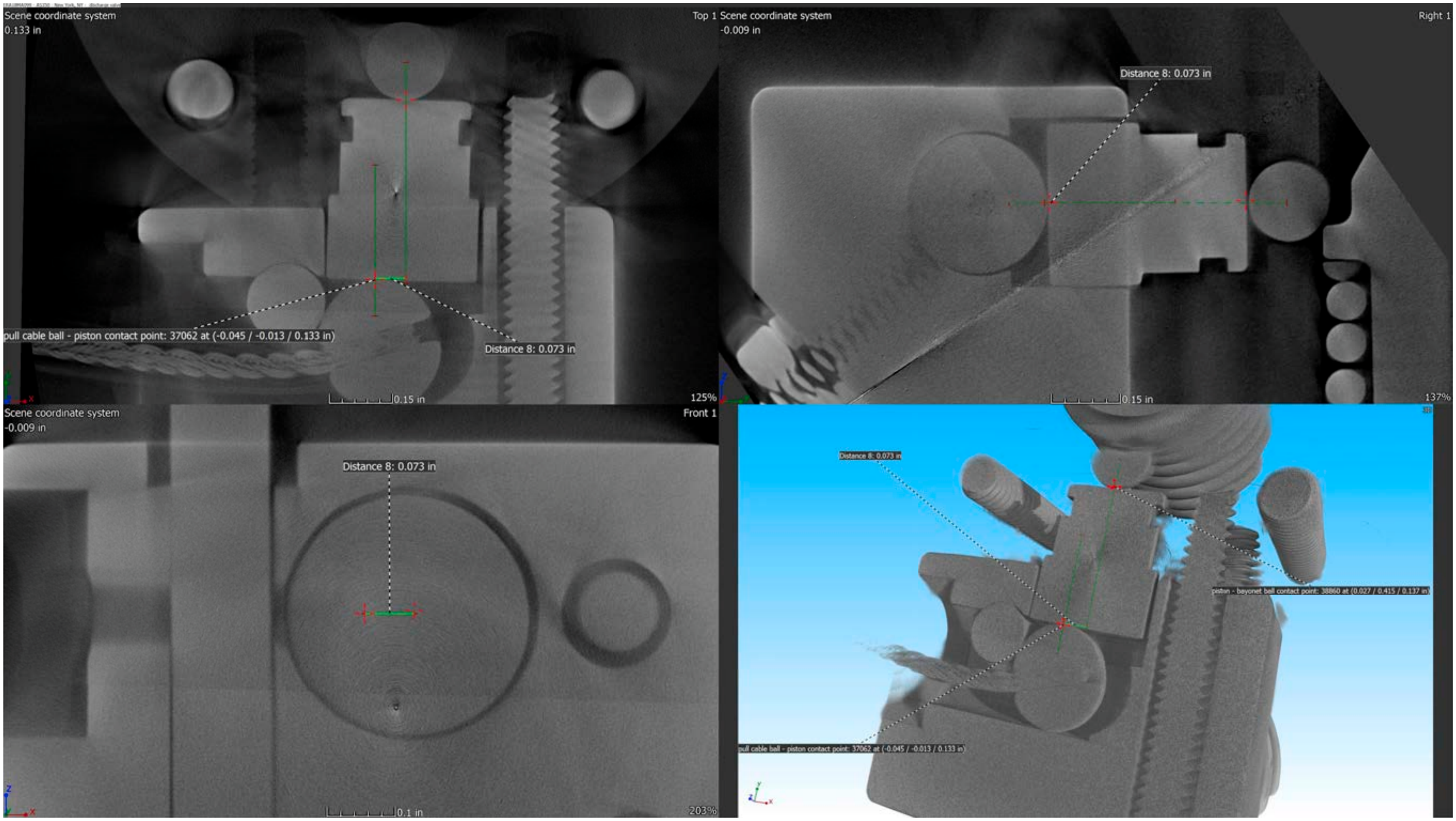

Figure 25
Discharge valve – target CT – pull cable ball and bayonet ball contact point offset - lateral

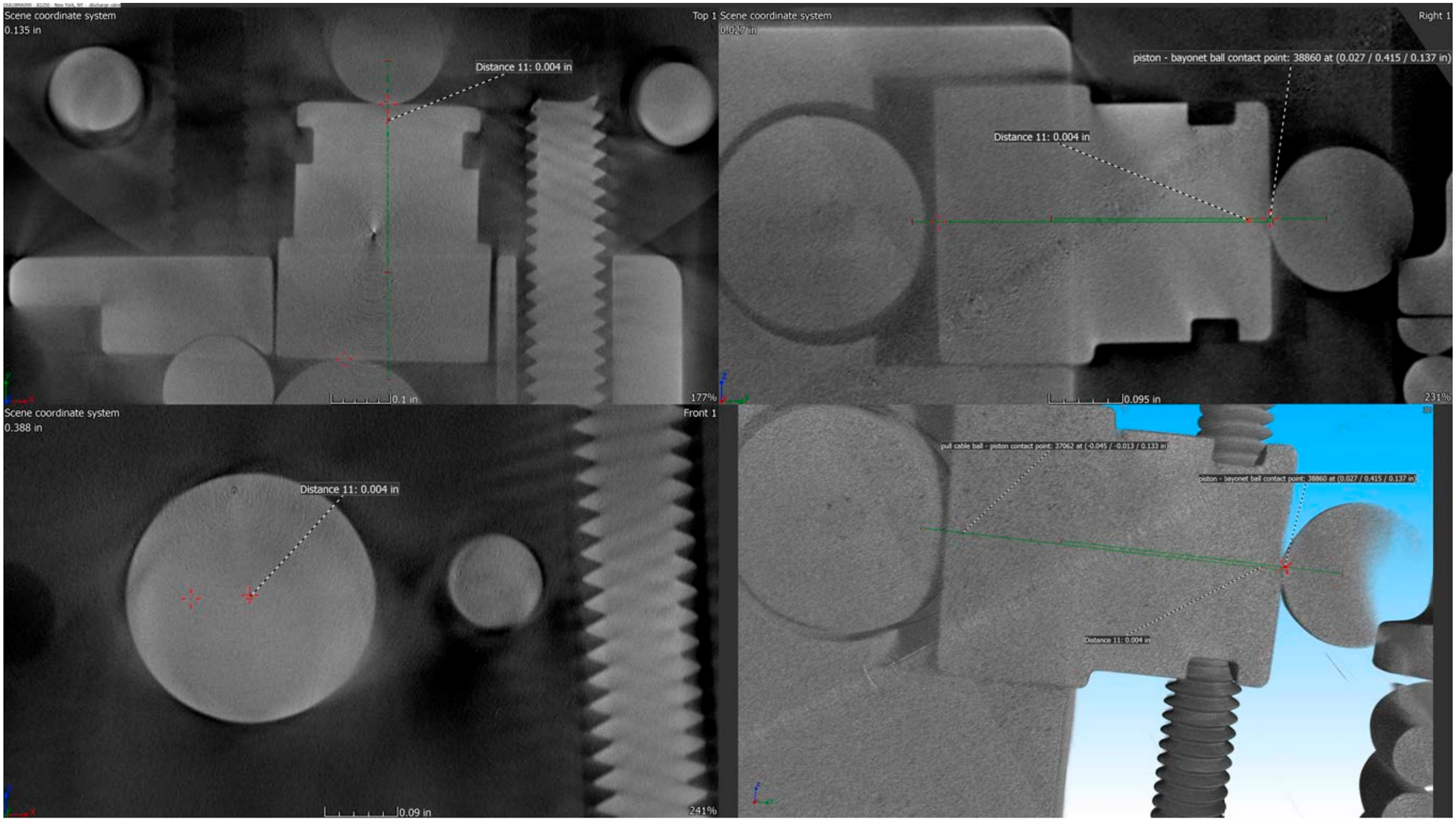

Figure 26
Discharge valve – target CT – pull cable ball and bayonet ball contact point offset - vertical

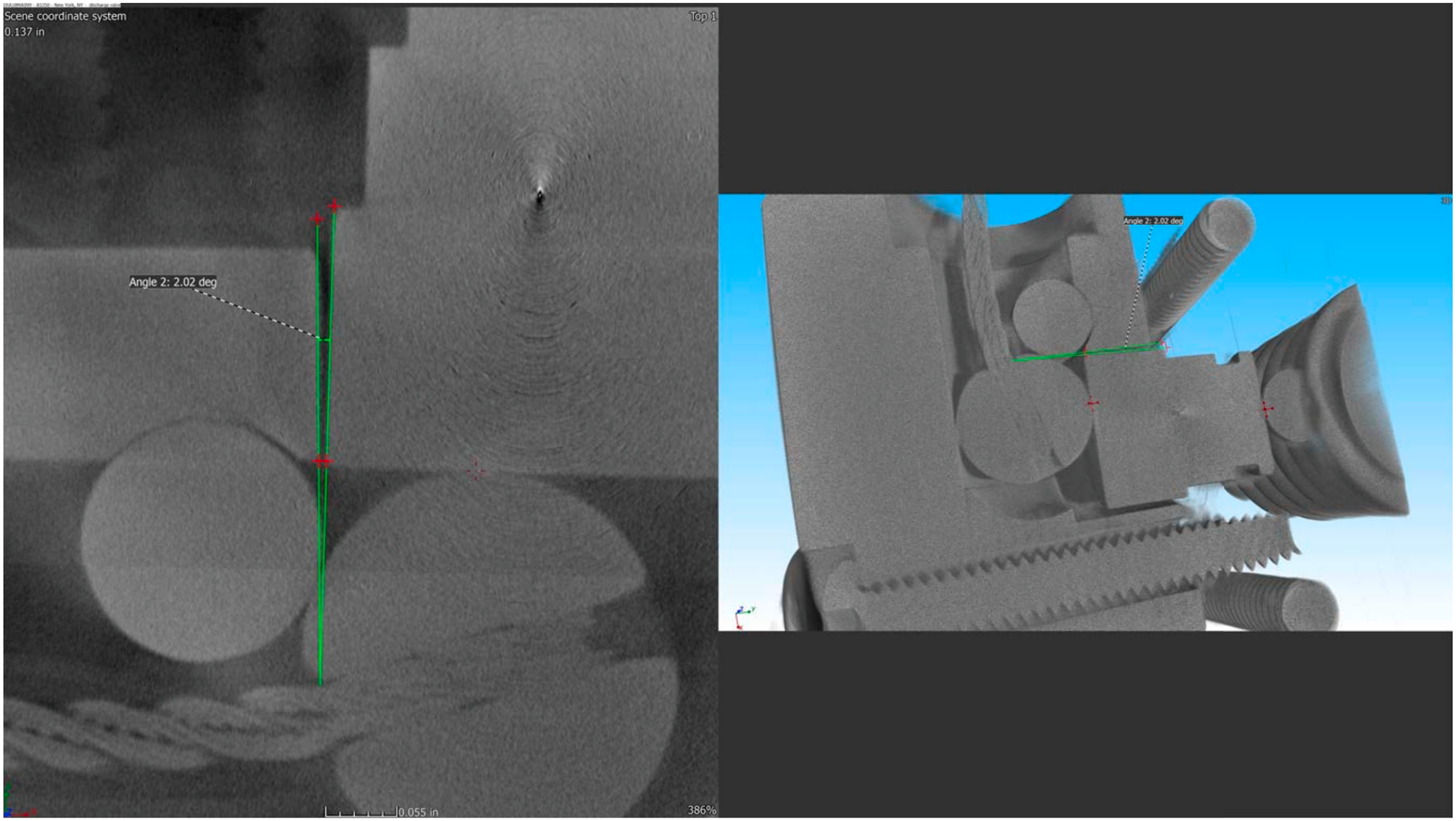

Figure 27
Discharge valve – target CT – piston angle relative to the wall

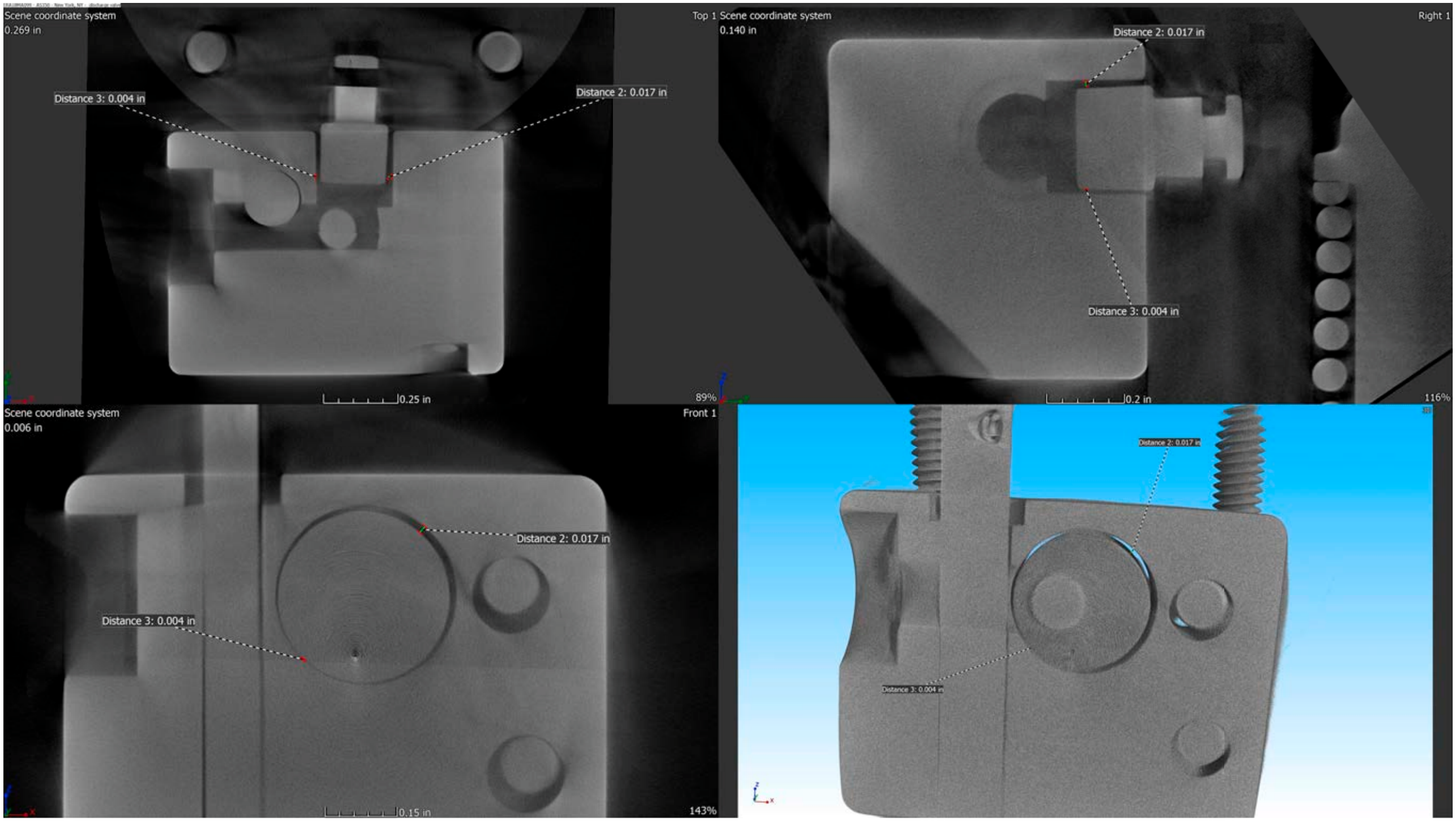

Figure 28
Discharge valve – target CT – piston to wall gap – housing end

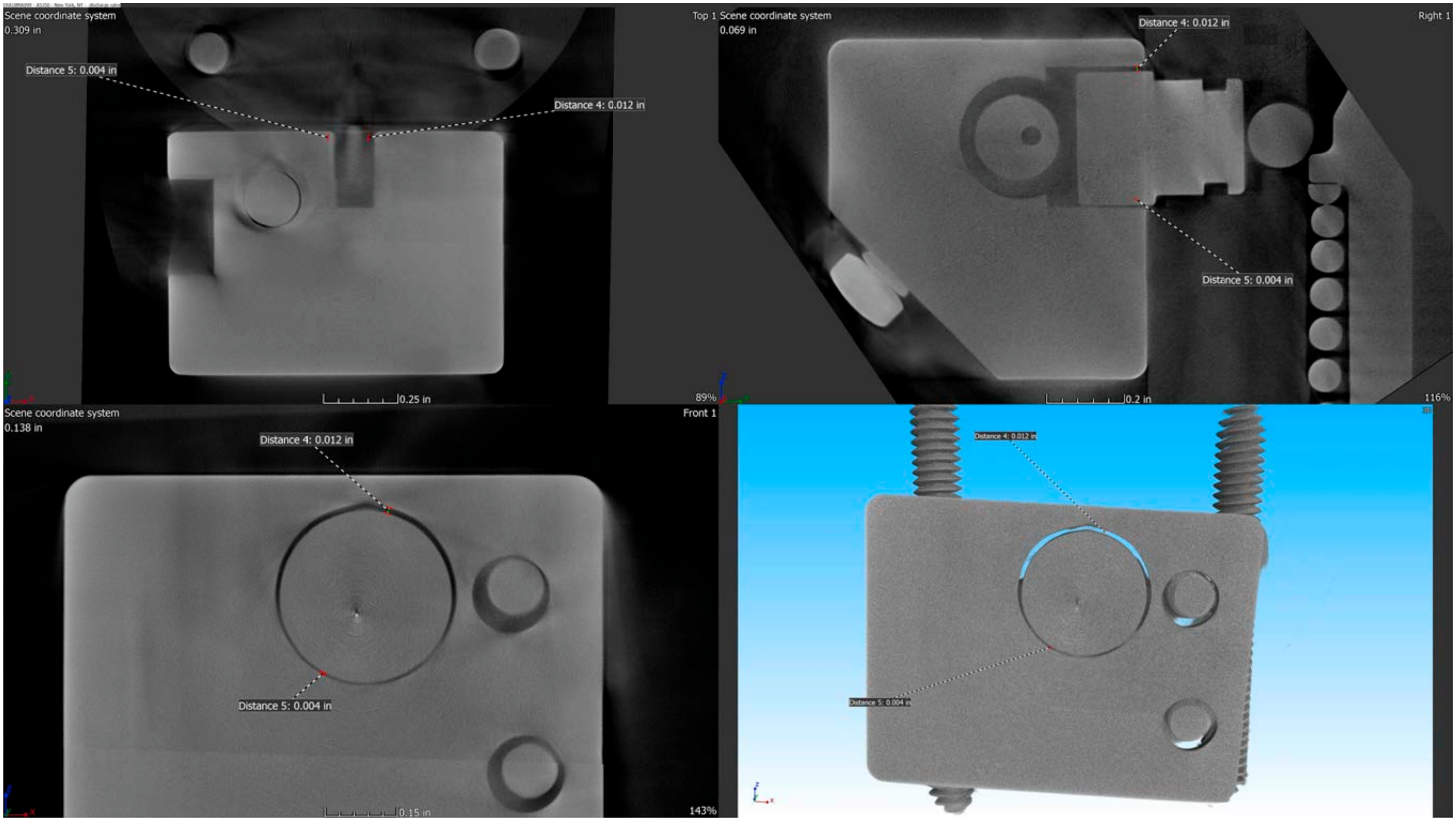

Figure 29
Discharge valve – target CT – piston to wall gap – bayonet end

Scott Warren
Lead Aerospace Engineer
(Computed Tomography Specialist)