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

July 16, 2014

Computed Tomography Specialist's Factual Report

WPR-13-FA-430

A. ACCIDENT

Operator:	CREX-MML LLC
Location:	Santa Monica Municipal Airport, Santa Monica, CA
Date:	September 29, 2013
Time:	1820 pacific daylight time
Airplane:	Cessna 525A Citation, N194SJ

B. GROUP

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

C. SUMMARY

On September 29, 2013, at 1820 Pacific daylight time, a Cessna 525A Citation, N194SJ, veered off the right side of runway 21 and collided with a hangar at the Santa Monica Municipal Airport, Santa Monica, California. The private pilot and three passengers were fatally injured, and the airplane was destroyed by a post-crash fire. The airplane was registered to CREX-MML LLC, and operated by the pilot as a 14 Code of Federal Regulations, Part 91 flight. Visual meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan. The flight originated at Hailey, Idaho, about 1614.

Witnesses reported observing the airplane make a normal approach and landing. The airplane traveled down the right side of the runway, eventually veered off the runway, impacted the 1,000-foot runway distance remaining sign, continued to travel in a right-hand turn, and impacted a hangar structural post with the right wing. The airplane came to rest inside the hangar and the damage to the hangar structure caused the roof to collapse onto the airplane. A post-accident fire quickly ensued.

On-scene examination of the wreckage and runway revealed that there was no airplane debris on the runway. The three landing gear tires were inflated and exhibited no unusual wear patterns. The Federal Aviation Administration (FAA) control tower local controller reported that the pilot did not express over the radio any problems prior to or during the landing.

Radiographic studies were done from April 29-30, 2014 in Chicago, Illinois to examine and document the internal configuration of the parking brake valve. The parking brake valve was documented using computed tomography (CT) scans using a total of 1,522 CT slices.

Review of the images showed that the valve cam (spool) was overdriven past the closed position roll pin stop. The roll pin that created the stop was noted to be fractured. The thermal relief valves appeared to be seated against their respective stops.

D. DETAILS OF THE INVESTIGATION

1.0 General

The parking brake valve was subjected to x-ray computed tomography (CT) scanning to document its internal conditions. The scanning was conducted from April 29-30, 2014. The scans were performed by Varian Medical Systems, Inc (formerly Bio-Imaging Research, Inc. (BIR)) under the direction of the NTSB using the Varian Actis 500/225 microfocus CT system.

For the CT scans, the parking brake valve was loaded into the imaging unit and placed on a turntable. It 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 was scanned. The x-ray energy levels captured 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 components were scanned using a total of 1,522 slices. The total size of the data set was 11.9 Gb. The complete scan protocol is given in table 1.

Table 1
Scan Protocol

Scan Type	Micro-focus
Number of slices	1522
Voxel Size - X Direction (mm)	0.097
Voxel Size - Y Direction (mm)	0.097
Voxel Size - Z Direction (mm)	0.099
Image Projections per Revolution	2160
Exposure time (ms)	285.58
Frames to Avg (frames per projection)	2
X-ray Source Voltage (kV)	222
X-ray Source Current (mA)	0.45
Source Filter Material	Brass
Source Filter Thickness (mm)	0.5
Image Matrix Size (pixels)	2048 x 2048

Each data set of slice images was evaluated using the VGStudioMax software package to create a three-dimensional reconstructed image of the component. As part of the evaluation, some sections of the component were digitally removed to allow closer observation of interior parts. In the images, the high density areas are shown as brighter shades of gray and lower density areas are shown as darker shades of gray. The pointers shown in some of the images denote specific areas of interest within that image. The label for each pointer contains a title for the pointer, the density value of the image at that point, and the coordinates for the pointer.

The images 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 parking brake valve are shown in figures 1 through 11. Review of the images showed that the valve cam (spool) was overdriven past the closed position roll pin stop. The roll pin that created the stop was noted to be fractured. The thermal relief valves appeared to be seated against their respective stops.

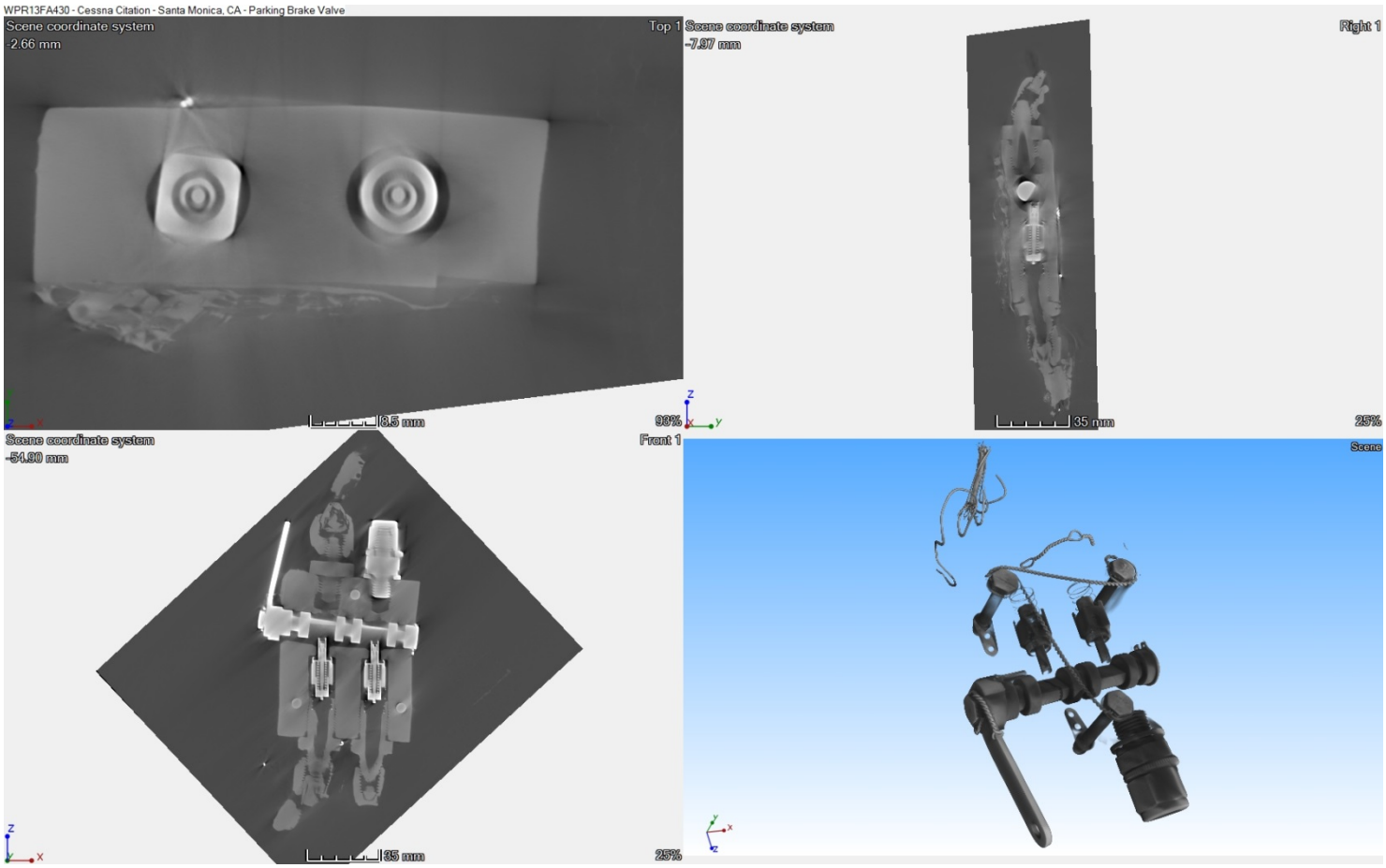

Figure 1
Parking brake valve – Overall cross section

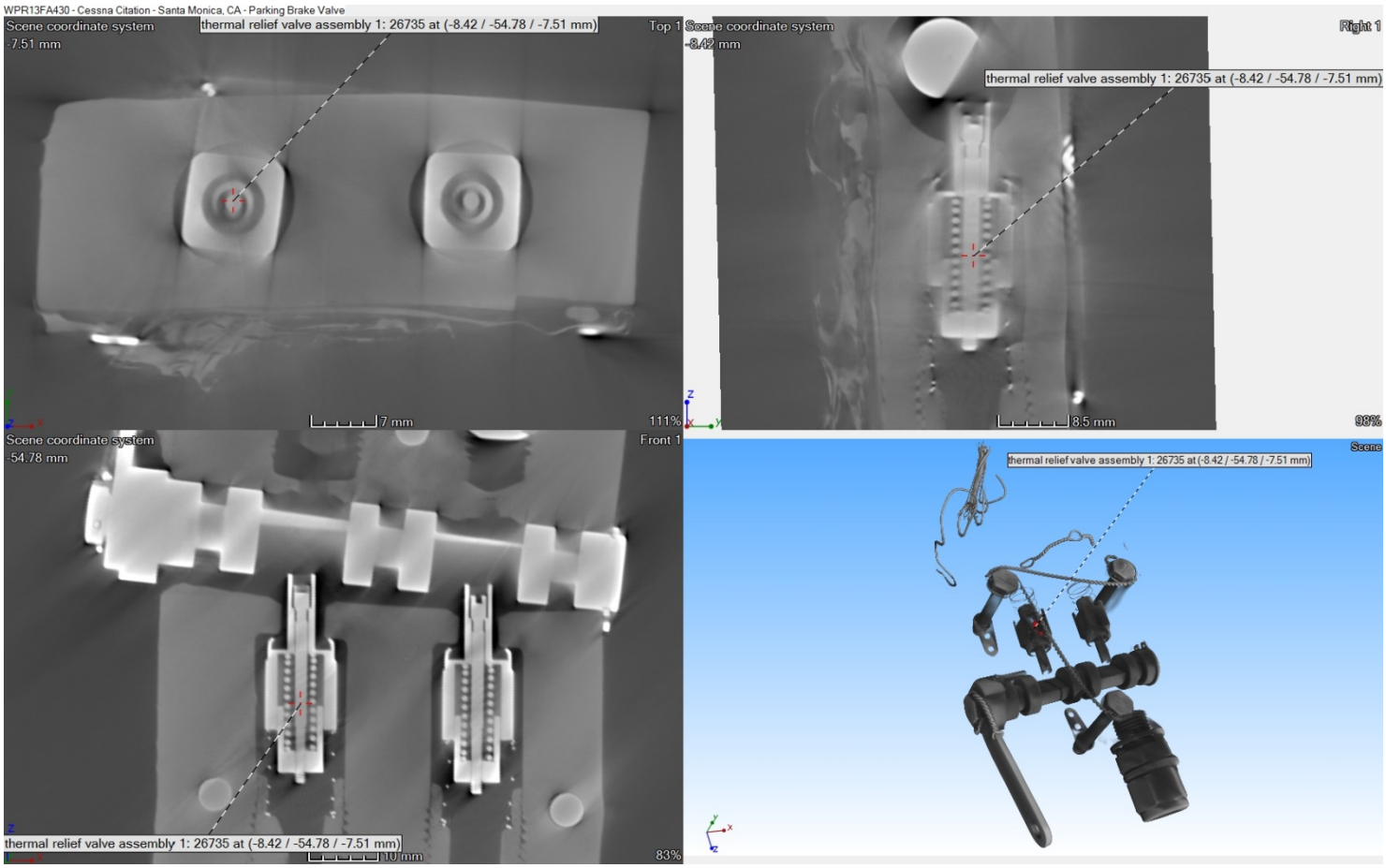

Figure 2
Parking brake valve – cross section through thermal relief valve assembly 1

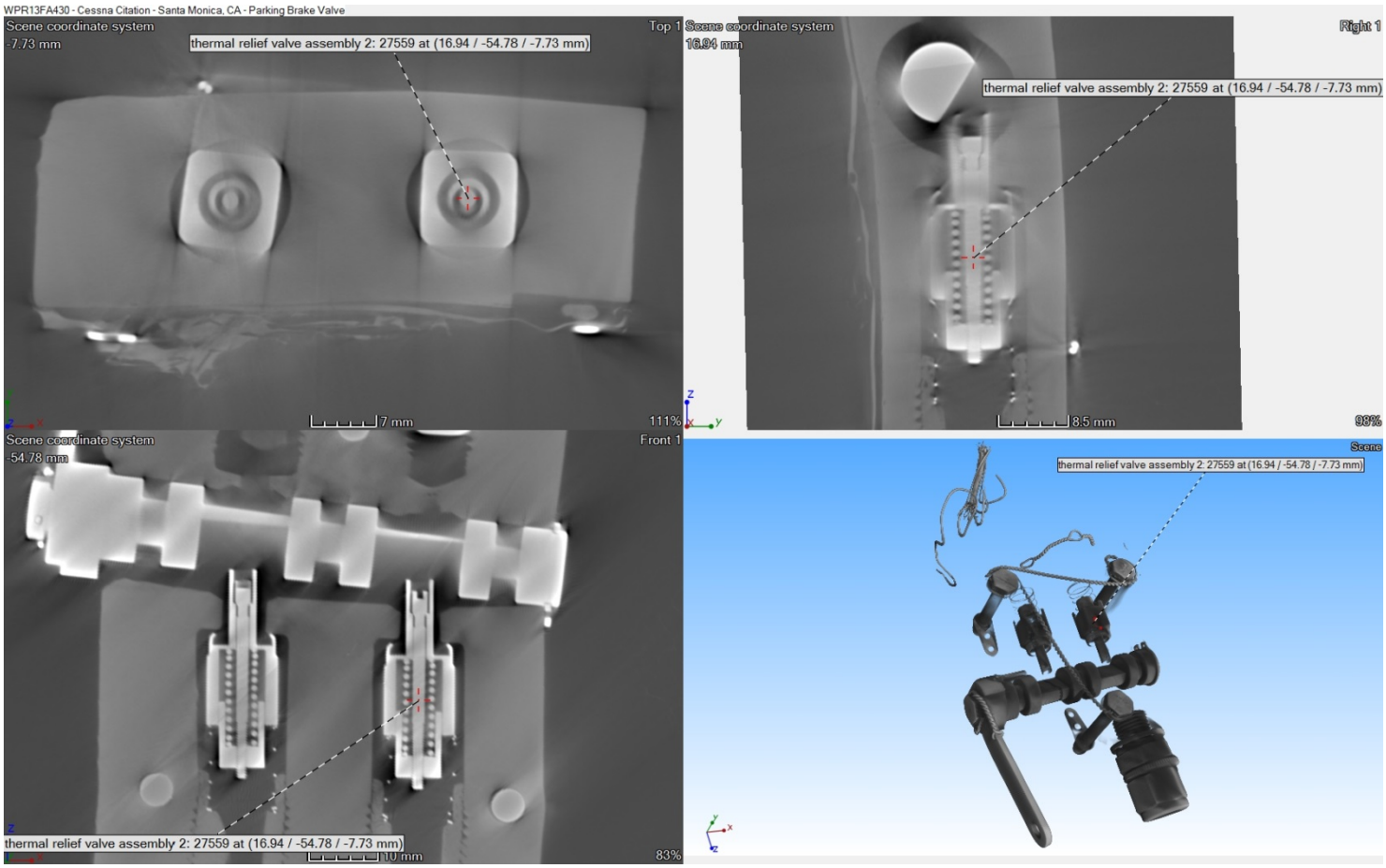

Figure 3
Parking brake valve – cross section through thermal relief valve assembly 2

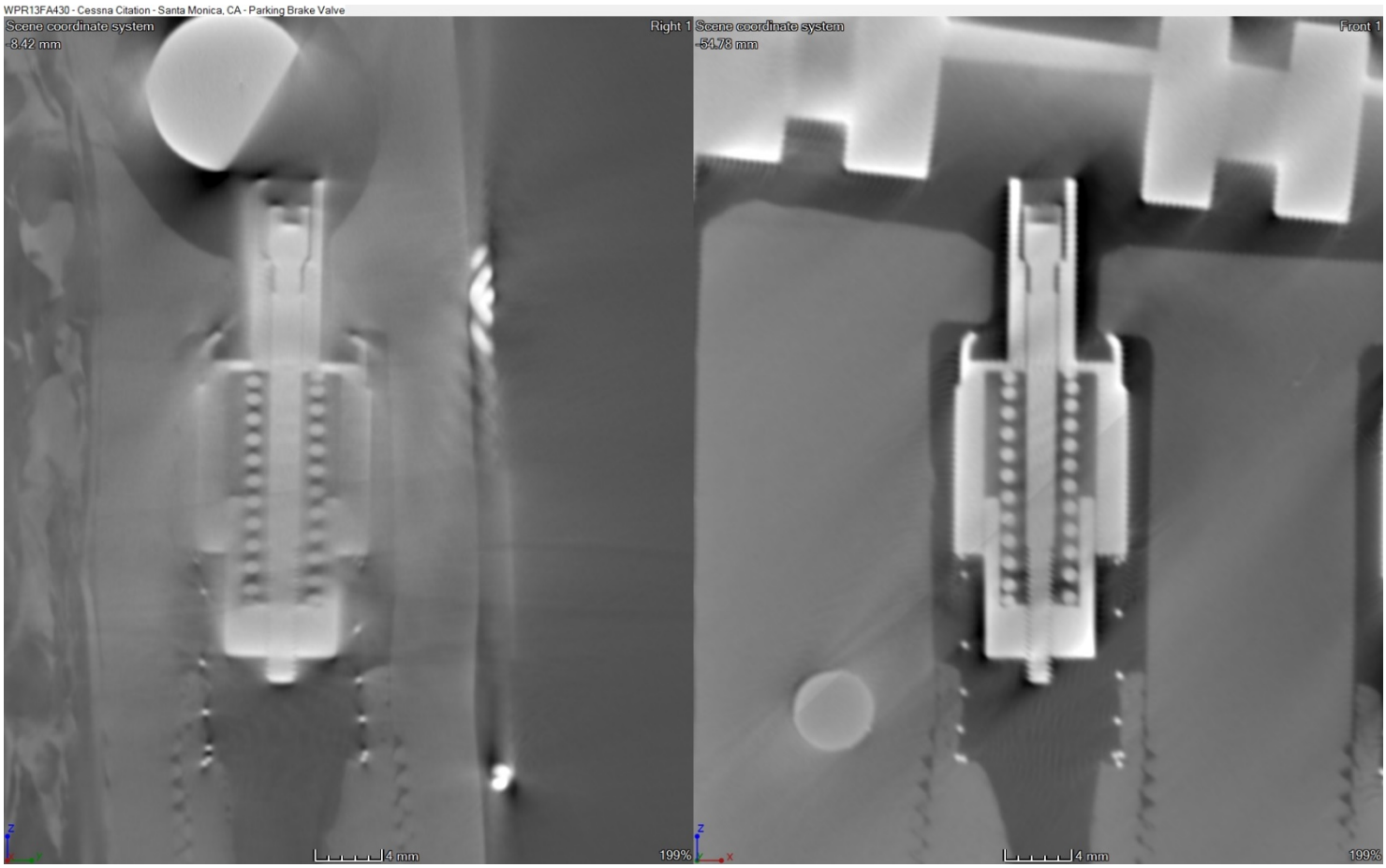

Figure 4
Parking brake valve – cross section through thermal relief valve assembly 1 – close up

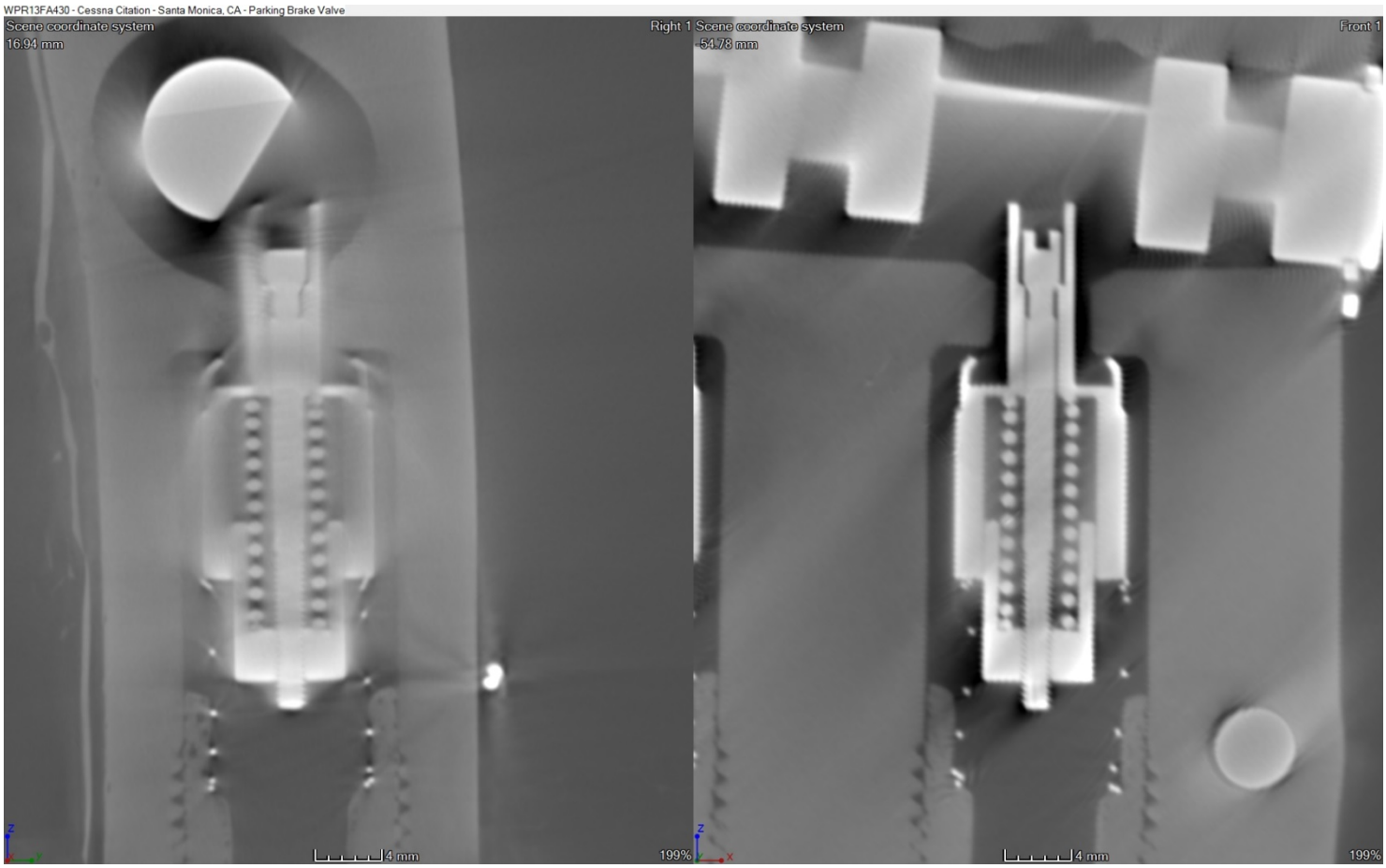

Figure 5
Parking brake valve – cross section through thermal relief valve assembly 2 – close up

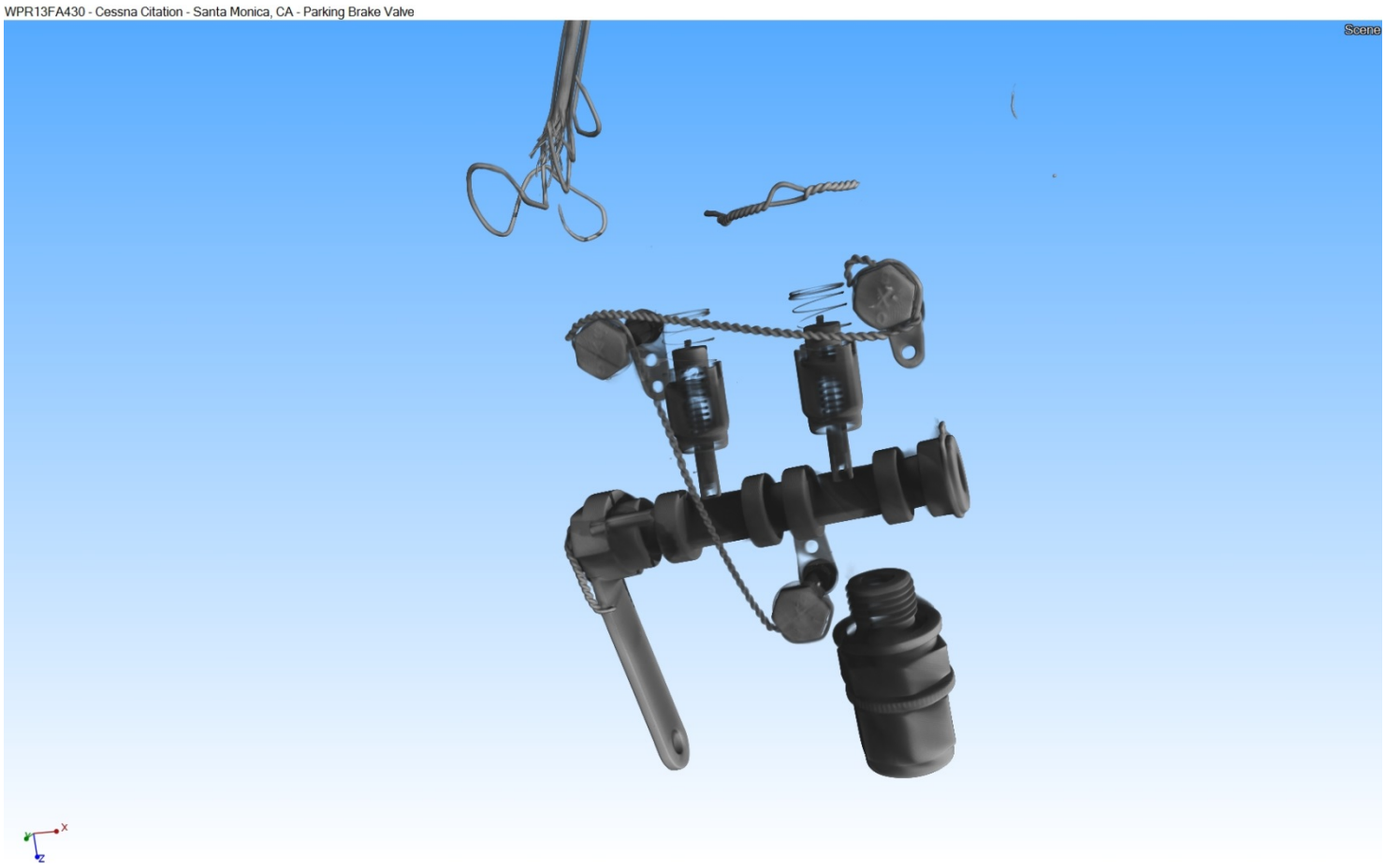

Figure 6
Parking brake valve – 3D view of thermal relief valves and cam

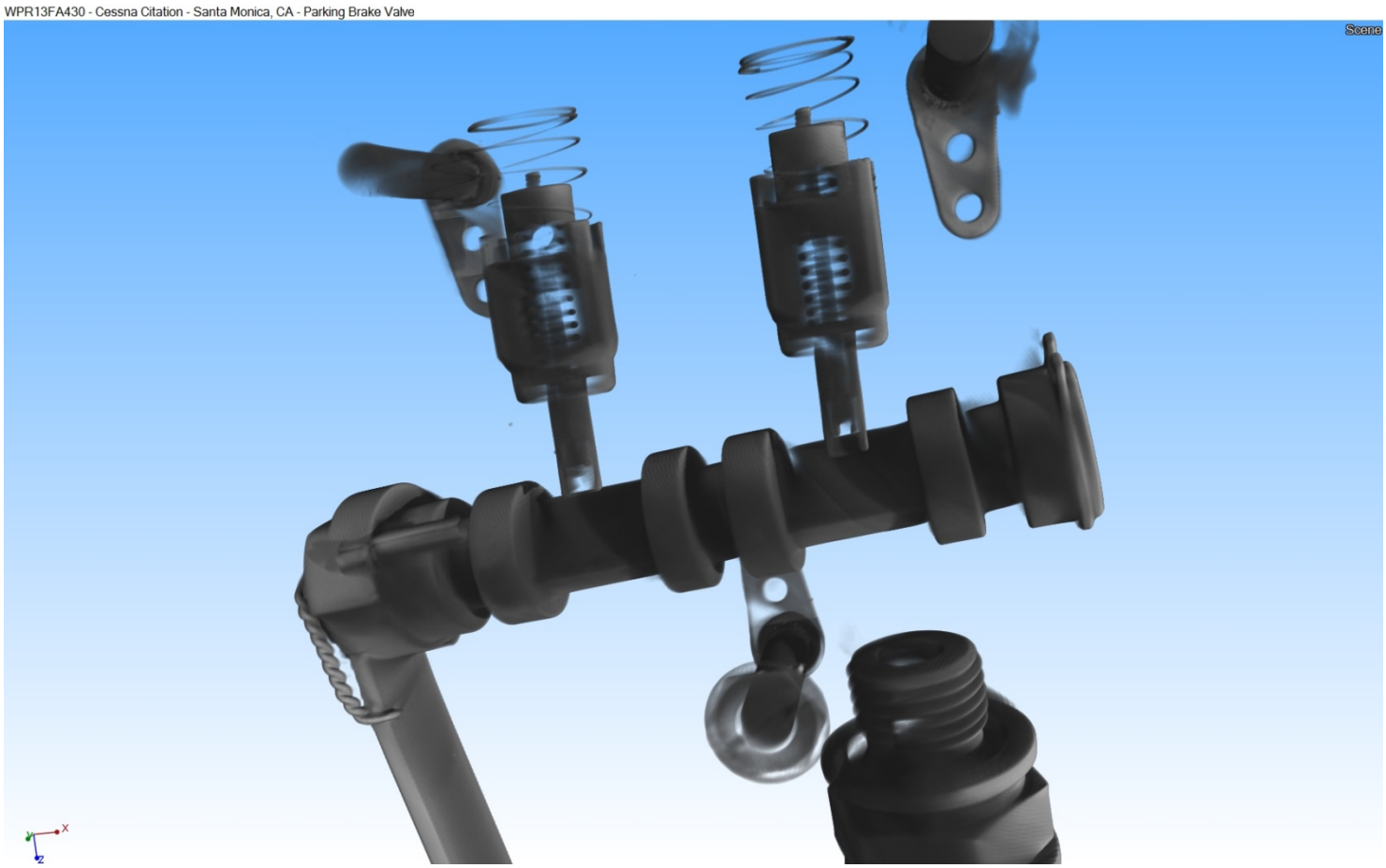

Figure 7
Parking brake valve – 3D view of thermal relief valves and cam – close up

Figure 8
Parking brake valve – 3D view of roll pin

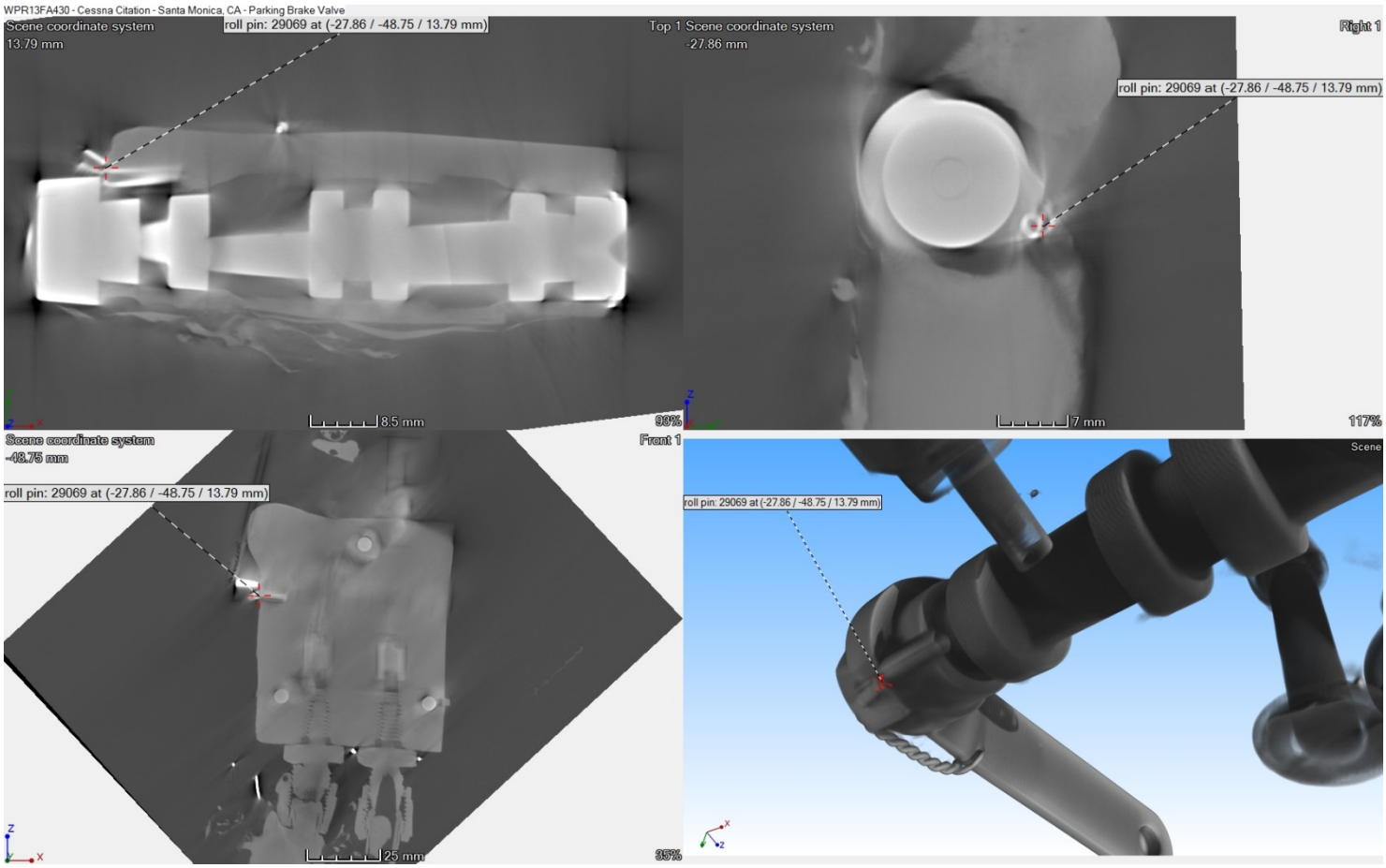

Figure 9
Parking brake valve – multiple views of roll pin

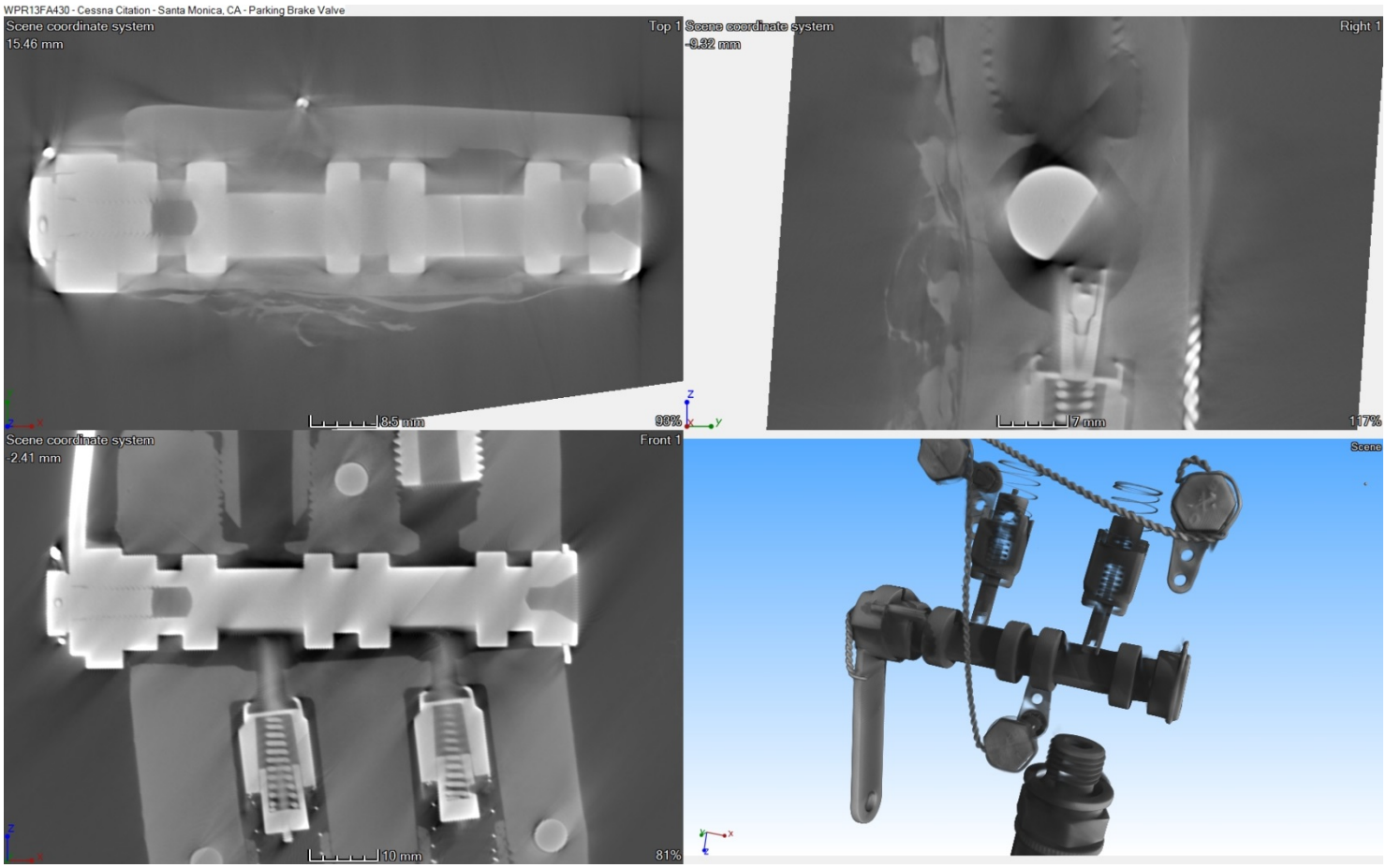

Figure 10
Parking brake valve – multiple views of cam at thermal relief valve assembly 1

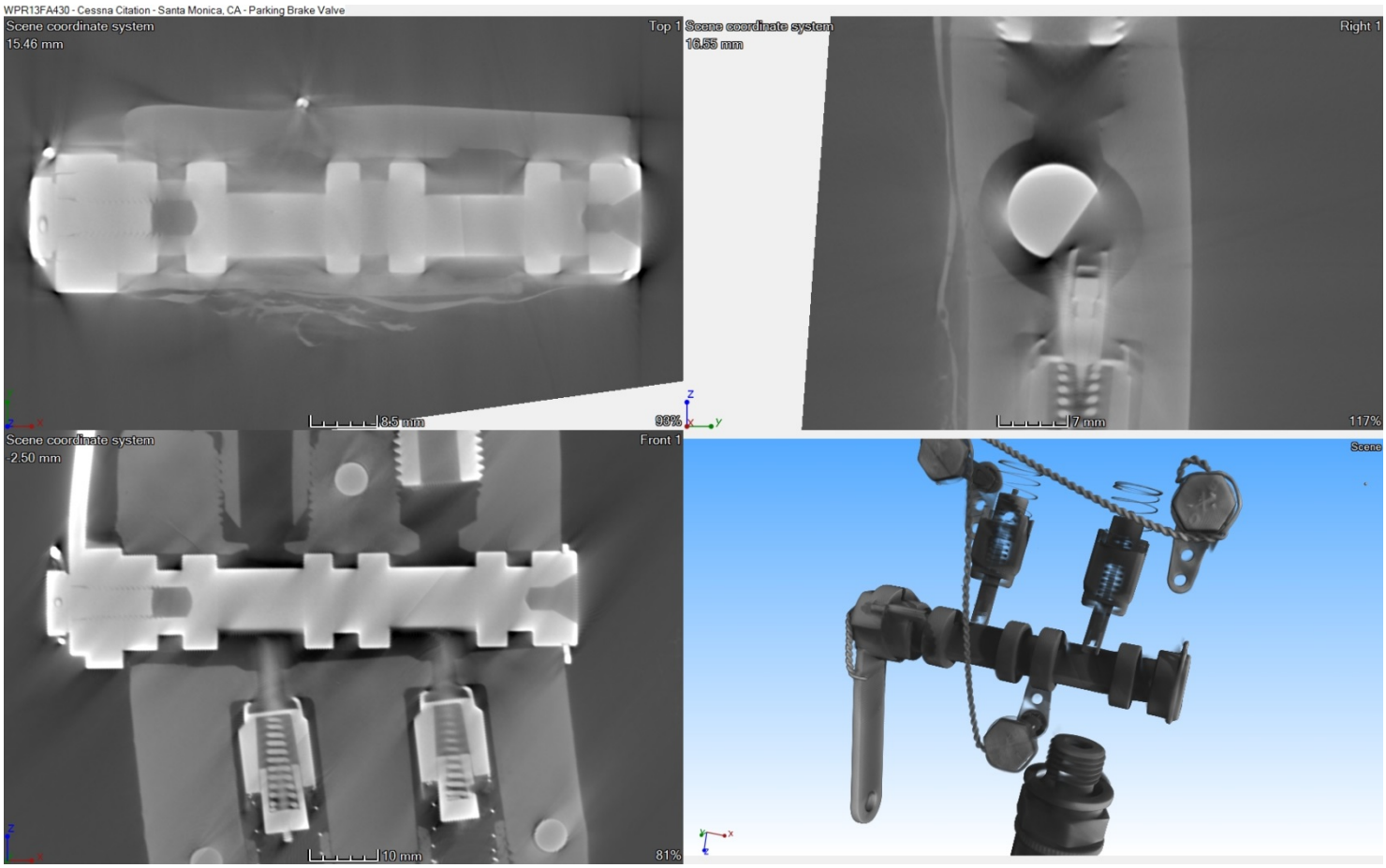

Figure 11
Parking brake valve – multiple views of cam at thermal relief valve assembly 2

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