

Cognitech® TriSuite⁶⁴ Feature List


Cognitech TriSuite⁶⁴ is the latest Major Release of Cognitech TriSuite, built with all new 64-bit architecture.

***Items marked with a hashtag (#) indicate unique forensic video capabilities that are proprietary ONLY to Cognitech, Inc. due to issued and pending US and International patents of Cognitech, Inc.**

***Items marked with marking  indicate the new or highly improved forensic video capabilities that are part of the release.**

***Cognitech® TriSuite⁶⁴ Items marked with an asterisk (*) are designated computational design capabilities that are the leading edge of forensic video technology and are not commonly available to other competitors in the field.**

General

1. Since 1988 Cognitech was the world's first forensic video company, with **30 years of experience** in providing US Patented software and hardware solutions for law enforcement and forensic professionals.
2. Cognitech is **constantly evolving** its primary software package, Cognitech® TriSuite, by providing end-users with new capabilities such as 3D Model to Video Fusion for Vehicles identification **(#)**, Automatic Video Face Blocker for Courts required reduction **(#)**, **VMap for geographical analysis and visualization of video recordings.**
3. Customers demand the best in forensic video products so Cognitech is constantly developing **new innovative technology** like Cognitech's patented **Biometric FaceFusion3D™ for facial shapes Adaptive Video** Super-resolution of Human Faces **(#)** 
4. Cognitech has by far the largest in the Forensic Video Field US Patent portfolio, with 23 US Patents Issued and many more pending. Most of our competitors use old off-the-shelf technology and have no US Patents at all.
5. All functions in Cognitech® TriSuite® have been **tested in both peer review scientific publications and the Court of Law**, nationally and internationally. The California Court of Appeals has accepted Cognitech's novel forensic video enhancement techniques into U.S. Courts in a historical **decision on forensic video**, the 1992-1996 Criminal Law and Procedure Citation, 96 Daily Journal DAR. 8023, which is the **first such decision in the US Courts.**
6. Cognitech® TriSuite® was developed for professional forensic expert use and meets the **repeatability** required for expert witness testimony.

7. The workflow in Cognitech® TriSuite® is completely **lossless**. Unlike traditional video capture solutions, the VideoActive® software provides real time lossless capture ensuring that you get the best evidence possible.
8. Cognitech TriSuite enables unprecedented **flexibility** in video processing by allowing the end-user to apply different filter parameters to any portion of any frame in a video.
9. Rapidly moving casework requires immediate evidence turnaround without compromising quality. Cognitech TriSuite algorithms utilize **parallel processing** with the latest **GPU CUDA technology (*) which** cuts even the most complex evidence processing time by tenfold or more.
10. Cognitech was the first to offer **hands-on training program in Forensic Video and continue innovating by being the first company to offer True Cloud Training with Cognitech software running on Cloud Servers World-Wide, hence no local installation is required by training students with Cognitech software being run through any browser.**
11. **Cognitech customer support** provide the end-user with the skills and support to handle any casework. With automated bugs detection and recording tools, the end-users can effectively communicate with Cognitech TechSupport team to quickly resolve any problems, be it user-errors or real bugs (rare incidents in comparison).
12. Cognitech has been **serving the forensic community since 1988** and prides itself on **excellent customer service**.


Supported File Formats and Accurate Video Playback

13. Most **image and video file formats** are supported including: COG, CFF, 3GP, 3G2, ASF, AVI, BMP, CAL, CMP, CUR, DCM, FLV, FPX, GIF, ICO, IMG, J2K, JPG, M2TS, MAC, MKV, MOV, MP4, MPEG, MSP, MTS, MTV, OGV, PCD, PCT, PCX, PGM, PNG, PSD, RAS, RM, SCT, SWF, TGA, TIFF, TS, VOB, WBMP, WEBM, WMF, WMV, WPG.
14. Streaming video is decoded and converted into a **frame accurate** format that can be processed and analyzed frame by frame.
15. Cognitech's patented lossless COG **(#)** encoding VIDEOZIPPER® provides at least **50% file size reduction** to raw video **without any loss of content or quality** and is 100% reversible.
16. **Cognitech® CogPlayer** provides proprietary lossless COG **(#)** and CFF playback on any computer with Windows Media Player, which enables court presentations on any computer.
17. **32-bit floating point (*)** image and video content is supported for more numerical accuracy. All filter computations are done in floating point, maintaining the highest level of quality throughout the signal chain.
18. Cognitech® Video Investigator® and VideoActive® provide **frame-accurate based video playback** allowing for easier and more accurate frame-by-frame analysis than traditional time based video playback software.

Cognitech VideoActive⁶⁴®

Video Acquisition & Real-time Processing (VideoActive®)

Design

19. Cognitech VideoActive's **modular design** allows the end-user to choose a pre-defined configuration or user-defined signal processing chain.
20. VideoActive® modules can be easily combined to produce a **user-defined processing pipeline** from live sources or locally stored files, all in real-time.
21. Software code entirely re-written for **64-bit software architecture**  improving use of larger size files, such as 4K and 8K video to be opened, played, and saved. 64-bit architecture speeds up algorithms' execution.

Video Capture

22. **Analog acquisition** can be obtained from any RCA or S-Video source.
23. **Real-time lossless analog video acquisition** captures frame accurate video from analog sources without any loss of information.
24. Analog video can be acquired at the **frame level** for progressive video or **field level** for interlaced video.
25. **Digital acquisition** can be obtained from any DVI or HDMI source.
26. **Streaming Video Capture** allows a user to open multitude of streaming format files and pass the captured video to other modules for frame-accurate capturing, viewing and/or processing.
27. **Real-time lossless digital acquisition** captures frame accurate video from digital sources without any loss of information using VIDEOZIPPER®.
28. **Analog VGA video sources** can also be captured lossless unlike traditional scan converters.
29. VideoActive® supports both major analog formats, **NTSC and PAL** up to 10 bit per pixel per color, allowing 1024 levels per color as opposed to the standard 256 levels, i.e. 4 times more levels per color (*).
30. Video can be captured losslessly (VIDEOZIPPER®) from a local screen with **Screen Capture**.
31. Screen Capture can also be obtained from an external source using a DVI or VGA connection.
32. **Comprehensive proprietary DVR file format support** with screen capture provides a simple lossless capture without the limitation of **digital overlay** like traditional screen capture software.
33. **DV Capture** allows for camera DV output acquisition at the highest possible quality.
34. **Simultaneous Audio and Video Capture** preserves audio from video sources that contain audio.
35. Audio can be played in Video Dominant Mode (optimal audio sync for frame accurate video) or Audio Dominant Mode (optimal video sync for time accurate audio).

Processing Modules (Real-time Algorithms)

Demultiplexing





36. **Real-time demultiplexing (#)** converts multiple camera video source streams, such as multiplexed CCTV footage, into individual digital camera channels that can be stored in proprietary lossless compressed COG format (VIDEOZIPPER®), processed or viewed, individually or together.
37. **Automatic demultiplexing (#)** intelligently determines how to separate demultiplexed frames into individual camera channels with no human interaction for any number of channels.
38. **Manual demultiplexing** sorts demultiplexed video according to user-defined key frames allowing for more customized demultiplexing.
39. Demultiplexed video can be further sorted with Cognitech Video Investigator's **Video Scene Integrator** tool.

3D Model to Video Fusion (#)


In recent years the 3D industry produced more affordable 3D LIDAR scanning devices. The 3D scans of crime scenes have been used in SCSi for some years. We build on Cognitech's US Patented 3D Photogrammetry technology to extend the use of LIDAR derived 3D scans of crime scenes, vehicles and potentially individuals 3D scans to the tasks of measuring and identifying people and vehicles in videos of crime scenes, whose 3D scans are available. In addition, a kinematic analysis of vehicles and people, such as speed, acceleration, and even physical forces is possible.

40. **Load and Visualize LIDAR 3D Point-Cloud Data** of the Crime Scene and/or Vehicle(s) with Standard. XYZ or. WRL Formats. More formats are being integrated.
41. Proprietary point-cloud triangulation for **solid 3D model creation**
42. **3D Cropping Tool** to carve out relevant part of the Scene 3D Model
43. **Video to 3D Model Fusion Tools** enable Photogrammetrically Accurate
 - (i) 3D Virtual Reprojection of the frame accurate video onto the LIDAR derived solid 3D Model of the Crime Scene
 - (ii) Calibrate the Unknown camera through the LIDAR Data
 - (iii) 3D Virtual Reprojection of the solid 3D Model of a Vehicle or a Person into the frame accurate video for purposes of Matching and Identification

44. Scene, People, Vehicles Measure Tools:

- (i) **Point to Point Distance** 
- (ii) **Height from The Ground** 
- (iii) **Given Known object Height, locate its 3D position** 
- (iv) **Measure angle between visible or computed lines** 
- (v) **Other tools**

Multi-Channel Fusion (#)

- 40. Multi-Channel Fusion (#) **combines** two or more videos from different viewpoints together using perspective correction and fuses information from different cameras together.
- 41. Multi-Channel Fusion (#) can **accurately combine CCTV video with an overhead photomap (*)** (e.g. Google Maps, etc.) allowing for video playback with accurate geographic matching.
- 42. **Live video reverse projection photogrammetry (#)** makes onsite height measurement of evidence images easy with active playback of live video overlaid on the evidence image.
- 43. Enhanced video control while using Multi-Channel Fusion allowing frame accuracy control in playback. 

Camera Calibration & Real-time Lens Correction

- 44. The automatic **Camera Calibration (#)** module assists the end-user in calibrating a camera with constant user feedback for use in the Cognitech AutoMeasure software.
- 45. **Real-time Lens Correction (#)** removes geometric lens distortion in real-time for an undistorted video capture.



Other Processing Modules

- 46. **Digital VCR playback control** protocol allows the end-user to control supported VCRs through VideoActive®.
- 47. Video Conversion allows for **lossless conversion** of difficult to read files to a usable format.
- 48. Video Playback allows for detailed video investigation with **real-time frame accurate playback** or frame by frame analysis.







Cognitech Video Investigator⁶⁴®

Image/Video Processing and Analysis (Video Investigator®)

Basic Functions

49. Video Investigator's Active Interface GUI enables the user to execute the integrated plug-ins in a highly interactive mode with real-time results (*) which are seen in a video preview. This advanced video processing interface allows the user to find the most optimal set of video processing parameters in a highly interactive way.
50. Video Investigator's Active Interface (*) provides the user the capability to adaptively estimate the best set of processing parameters for any part of a video frame and vary these parameters if needed from frame to frame, or from a set of frames in a time-interval to another time-interval, yet processing the entire video in a single processing pipeline. This **frame-adaptive video processing (*)** feature accelerates the user's ability for time-space-adaptive processing of the entire video without first extracting each individual frame and individual parts of frames. An example of using the **frame-adaptive video processing is when deblurring the video in which different objects and subjects are blurred differently due to the time-varying motion blur and space-varying defocus blur.**
51. The Movie Controller provides **advanced video playback** with audio support allowing the end-user to adjust which frames of video to playback, how frames are played back, and even synchronize multiple videos.
52. **Smart Selection Window Tool**  provides end-user with a versatile set of tools to select single or multiple objects of interest quickly through the video frames. Seventeen different tools are available to deal with Selection operations. Save Selection is provided for a subsequent recall and use, to save the laborious selection process.
53. Objects and subjects Tracking is made possible by interpolating the Selection Position and Size between key-frames, thus tracking objects and people that may be moving towards or away from the camera. This specific function is useful for tracking an object with a consistent velocity in a movie.
54. **Glyph Tools with Free Form Curves and Regions Selection**  are Drawing Tools that create various Active geometrical tokens to be used as an input to plug-ins to guide their execution. Glyph tokens include Points, Lines, Open and Closed Polygons, Rectangles and Ovals. The newest addition are Free Form Curves and regions. Glyph tokens may be computed automatically, such as Tracking Rectangles, Line Detection etc., or they may be selected and drawn by the end-user. Glyphs are useful to compute Velocity, Select and Track objects and subjects, assist in 3D Analysis (see Cognitech AutoMeasure and Cognitech VideoActive 3D Model to Video Fusion. With the Free Form Curves and Region Glyphs, the end-user is


enabled to select exact geometrical shapes, such as face and objects outlines for subsequent processing, motion and 3D Analysis.

55. **Image sequence compilation** converts a set of images into video for analysis or court room presentation.
56. The **Record function (*)**, when enabled, records every action the end-user makes and produces a script that can **replay the exact actions and settings the end-user used**. Unlike traditional report functions that only produce a PDF of parameter values, Video Investigator® Record scripts can be replayed at any time allowing the end-user to see exactly how the result was created.
57. The **Zoom filter** resizes images with confidence with several innovative zoom algorithms that retain the highest clarity and edge definition (#).
58. Several images or video can be combined together in layers to form a **video composition (*)** where every element can be relatively repositioned in the window and in time.
59. The **Command Window** provides an alternate entry point for executing commands for those who prefer to apply filters in the command line.
60. The **Highlight filter** focuses the viewer on a user defined area of interest.
61. If required by law, portions of images can be tracked and concealed or made unrecognizable to **cover sensitive information** with pixilation, blur or histogram adjustment.
62. The **VideoMap** Time and Trace Interactive Interface  is a new Geographical Information System approach to video analysis. Merging Geographical information with the arbitrary number of video recordings provides valuable analytical tools to investigate multiple video streams data for purposes of determining the time sequence of geographically distributed events. VideoMap tools enable the investigators to chart the Geographical Trace of the vehicles and individuals depicted on multiple videos.
63. Integrated **Problems Steps Recorder** for faster and more accurate technical support .
64. Integrated Screen shot, image snapshot and drawing tools .
65. New Automatic **Face Blocker filter**  will automatically blur faces and remove skin markings in images and videos as required by Courts. The end-user can select which individuals should or should not be Redacted. No tedious manual frame by frame blurring, all is done by an automatic detection algorithm.
66. **Hash Tool**  allows the viewing and saving of the **hash value** of an image or video for Authentication. Current Hash values: **MD5, SHA-1, and SHA-256**.
67. **EXIF Tool**  provides detailed Metadata data of a given image or video file for purposes of Authentication, codec analysis, Time Codes, GPS location id present. This data can be saved and re-opened at a later time.



Data Visualization

- 68. The **RGB Profile Plot** plots the line scans of RGB channels separately, allowing for independent 2D numerical visualization.
- 69. The **3D Profile Plot** displays a 3D plot of the entire image or video in time with a plot elevation corresponding to the image intensity allowing for 3D numerical visualization.
- 70. The **Elevation Plot** allows for the numerical visualization of images as 2D plots of linear image slices.
- 71. The **Matrix Tool** provides a detailed quantitative look at the pixel values in an image.
- 72. The **Video Scene Integrator** provides a method of manually sorting video frames to make event timeline (e.g. following a subject from camera to camera).
- 73. The **Component Information Window** provides a detailed description of all images and video in Video Investigator including image dimension, color space, data format, and other important metadata.

Denoise

- 74. A **large assortment of denoise filters (#)** provide both traditional and the most advanced methods for removing image noise without reducing clarity and features in evidence video (e.g. sensor noise and poor weather conditions).
- 75. **Deblocking (#)** reduces compression blocking and ringing artifacts related to harsh compression without reducing clarity and preserving fine features.
- 76. The **pattern removal filter (#)** is an advanced filter that removes pattern noise from images such as latent prints on textured surfaces.
- 77. The **Average Frames filter** generates an image by combining together multiple frames of the movie sequence, removing dynamic noise from stationary objects in the video.
- 78. The **FrameFusion® Denoise filter (#)** is a state of the art method of removing noise from an image or video with Cognitech's patented algorithm that preserves sharp edges and fine textures imbedded in noise.
- 79. The **Median filter** removes pixels that deviate from the median pixel value such as salt and pepper noise.
- 80. The **Remove Extrema filter** is an advanced filter that removes spurious shapes from an image that are due to noise distortions.
- 81. The **Total Variation (TV) Denoise filter (#)** is now a Classical method, discovered by Cognitech's Founder Dr. Lenny Rudin in his Doctoral Dissertating at CALTECH, for removing noise from an image using the Total Variation Minimization technique; retaining edges and minimizing visual artifacts associated with any image processing.
- 82. The fully automatic proprietary **Haze Removal filter (#)** removes haze and fog from images and videos as wells as enhances low-contrast chromatic images in ways that are different from the histogram editing. 

Deblur

83. A **large assortment of deblur filters** options provide tools for every type of blur problem including motion, defocus, optical, Gaussian averaging, and custom.
84. The **Adaptive Deblur filter (ADF)** with Interactive Blind Deconvolution , **(#), unlike any other traditional deblurring filters, ADF deblurs images and videos without any prior exact knowledge of the blurring process and blurring Point Spread Function (PSF Kernel).** ADF computationally estimates the blur from a blurred image and allows the end-user to remove complex non-linear blur in many cases when the standard filters like Motion, Gaussian, Outof-Focus filters fail. This class of filters are called Blind Deconvolution and are currently subject of the intense research by the scientific community. Cognitech has developed its proprietary (US Patents) Adaptive Blind Deconvolution technology which it is provided exclusively to the end-users of TriSuite 64 . ADF has two modes of operation: (i) Large Non-Linear Motion, Shaking, 'Overlay' Blur. This can solve for blurs generated by a sudden large camera motion (e.g. helmet mounted cam in a car accident, Police body cam in physical altercation) or blurs in a fixed camera with the subject/object undergoing curvilinear motion (rotation while moving). The new feature in TriSuite64  is end-users' ability to visually fit the Adaptive Blur Kernel not only to the 3D motion trajectory causing the blur, but also match the motion velocity for more exact deblurring.
85. (ii) **CSI Deblur: Known Crime Scene with Unknown Blur:** Cognitech's Proprietary uniquely SCI approach to the deblurring task. We designed a deblurring algorithm that can use the photos of the Crime Scene to determine the best blurring Kernel PSF and apply it to the surveillance video with objects and subjects no longer in the Crime Scene.
86. The **Motion Deblur filter (#)** automatically determines the motion direction and length from velocity estimation and removes the estimated motion blur.
87. The **Sharpen filter** is a simple enhancement solution for producing sharper, clearer images.
88. The **Wiener Deblur filter** applies any of the available deblur kernels using the Wiener method for fast and accurate blur removal.
89. The **Total Variation Deblur filter (#)** is a Classical method, discovered by Cognitech's Founder Dr. Lenny Rudin. It is the most peer-review quoted scientific paper on image deblurring with almost 15000 direct quotes. This filter applies any of the available deblur kernels using the Total Variation method in order to retain edges and minimize visual artifacts, such as ringing, which are commonly associated with traditional blur removal. The TV-based filters are mathematically proven to be the least artifact prone among all image restoration filters. Recently, the Total Variation algorithm was used to reconstruct the first ever image of a Black Hole in M87 Galaxy.

Histogram-Based Enhancement

90. **Automatic histogram equalization** provides three different methods of automatically enhancing images and video to obtain the best histogram levels locally or globally (e.g.

Morpho-Local Equalization (#) will equally enhance features in both under and over exposed regions of the image and in the presence of haze degradation).

91. The **Manual Histogram Editor** provides user-defined adjustments for better visualization of low dynamic range content such as night time video.
92. **Color correction** can enhance hue and saturation of video.

Reconstruction

93. The **FrameFusion® Reconstruction filter (#)** is a Cognitech patented **Super-Resolution** technique that not only removes noise from video but actually integrates adjacent frame information to form a higher resolution result and works with moving subjects unlike the traditional Video Averaging filter (e.g. license plate number clarification).
94. The **Stabilization Reconstruction filter** utilizes Cognitech's advanced velocity calculation algorithms to accurately track and stabilize an entire video or particular object (e.g. vehicle dash cam and handheld camera footage).
95. The **FaceFusion3D Reconstruction filter (#)** is the unique Cognitech US Patented technique that combines the principles of FrameFusion® with 3D facial models allowing for the Super-Resolution reconstruction of images and videos of human faces in **full 3D rotational motion**, which is not possible with the standard Super-resolution techniques used by others.
96. The **Mosaic Reconstruction filter** combines multiple frames into a single panoramic picture by accurately stitching common information between frames.
97. The **Reconstruction Wizard (*)** automates the video stabilization and mosaic reconstruction process for standard use cases.

Interlacing

98. **Interlacing** and **de-interlacing** functionality allows for lossless conversion between interlaced and progressive video.
99. The **Frame Align** operation aligns interlaced frames that are recorded at sequential points in time, doubling the resolution of the objects in the image.

Transform

100. The **Geometric Lens Correction filter (#)** corrects for geometric lens distortions automatically without any knowledge of the source camera.
101. The **Fourier filter** computes the 2D discrete Fourier transformation of images for frequency representation.
102. The **Geometric filter** provides an interactive interface for any perspective transformation of video frames.
103. The **Mirror Image filter** is an interactive tool to rotate an image or video 90, 180,-90 degrees and flip horizontally or vertically.
104. The **Automatic Rectification filter** rectifies an image to correct a perspective distortion due to camera angle, based on user-defined points.
105. The **Manual Rectification filter** provides an interactive 3D graphic interface for real-time perspective correction.

106. The **Wavelet filter** computes the 2D dyadic wavelet transform for spline wavelets of minimal support on a rectangular domain for advanced mathematical analysis.

Velocity

107. The **Correlation Matching filter** estimates the global motion between any set of paired frames (motion patterns) of a movie and produces accurate velocity vectors used to properly account for motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc.
108. The **Shape Matching filter (#)** estimates the dominant motion between consecutive frames of a movie and produces velocity vectors used to properly account for motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc. Shape matching will work when multiple object motions are present in the video (e.g. foreground and background motion).
109. The **Interactive Manual Matching filter (*)** manually matches motion between any set of paired frames (motion patterns) of a movie and produces velocity vectors used to properly account for motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc. Manual Matching will always work when automatic methods may not work due to the complexity of motion.

Segmentation

110. The **Segmentation filter (#)** provides an image analysis technique which automatically partitions an image into regions of similar intensity/color used for extracting tattoos.
111. The **Edge Detection filter** allows the end-user to extract edge features for extracting vehicle markings or license plates in a video.

Cognitech AutoMeasure⁶⁴® (#)



Photogrammetry (AutoMeasure®)

General

112. Cognitech® AutoMeasure® is a **general photogrammetric tool-set (*)** for measuring any subject or crime scene captured in at least one or several images/video frames.
113. The **automated visual workflow** interface in Cognitech® AutoMeasure® provides step-by-step instructions.
114. Steps are color coded according to completion and keep the end-user aware of current progress.
115. Since Cognitech® AutoMeasure® provides step-by-step instructions; **advanced knowledge of photogrammetry is not needed** in order to utilize the software.
116. **Contextual Feedback** provides constant instruction on the next step to be taken.
117. Evidence images with measurements can easily be exported in standard image formats.

118. **Advanced point placement** functionality provides a flexible method of placing, dragging & dropping and meta-tagging corresponding points of interest in order to simplify the process of multi-view stereo matching.

Automatic Camera Calibration (#)

119. Cognitech's patented automatic test pattern recognition method, **Automatic Camera Calibration**, detects a calibration pattern (designed by Cognitech) in test images.
120. Once a calibration pattern has been detected, Automatic Camera Calibration **accurately removes camera lens distortion** and **estimates internal camera parameters** (such as focal length and optical center deviation), which provides more accurate results than traditional camera test pattern methods.
121. Improved Algorithm for camera calibration provides more accurate measurement. 
122. Easier to use stand-alone program for camera calibration that displays calibration pattern on screen preventing "warping" or "stretching" of the calibration pattern. 

Single Frame Measure

123. Single Frame Measure provides the height of a subject in a single evidence image from several 3D crime scene measurements using the Single Frame Metrology Method, **even when the original camera source has been shifted or removed**. The traditional Reverse Projection technique cannot provide the same accuracy. More importantly, Reverse Projection technique is not possible if the original camera source has been shifted or removed.
124. With Single Frame Measure, **accurate camera position** is internally computed and used to determine projection geometry of the visible scene with respect to the camera.
125. Any image point XYZ coordinates can be determined by clicking a point on the evidence image, specifying any one of its coordinate components, such as X, and obtaining the two other coordinate components (Y and Z).

3D MultiView Measure (#)

3D MultiView Measure tools are described in the Measurement Tools Section.

126. 3D MultiView Measure provides the same, or higher, accuracy as the Single Frame Measure since it **only requires a single scale measurement** instead of manual measurements of the XYZ positions of all reference points. 3D MultiView Measure provides more accurate measurement results when using multiple images.
127. 3D MultiView Measure provides height, area, and distance measurements of objects from a single scale measurement, **whether or not the original camera source is available**.
128. 3D MultiView Measure **does not require that any linear structures** be visible in the evidence image (i.e. no vanishing points are required).
129. Additional photos required for MultiView Measure can be taken at any time as long as there are enough similar features present from the evidence image. This process increases measurement accuracy and allows measurements to cover larger crime scenes.

130. MultiView Measure is designed to be used not just for measuring the height of an individual in the evidence image, but also to **measure any geometric attributes of the crime or accident scene (*)** captured in multiple images.

Panorama Builder (#)

131. Panorama Builder accurately produces up to a full 360° **stitched panorama** from fisheye images **(*) (#)**.
132. The stitched panoramas are unwrapped and rectified for normal **rotational viewing**.
133. Panorama images produced in Panorama Builder can be used in 3D RAMA® Panorama Measure **(#)** as well as providing accurate 360° crime scene photography.

3D RAMA® Panorama Measure: Measuring in the Entire 360° Visual Sphere of View (#)

3D RAMA® Panorama Measure tools are described in the Measurement Tools Section.

134. 3D RAMA® Panorama Measure utilizes a different advanced photogrammetric method than the MultiView Measure, allowing for much more flexible measurements of people, objects, accidents and crime scenes.
135. With 3D RAMA® Panorama Measure, the evidence image can be matched to multiple test images without the careful positioning of the test image camera in order to capture as many points in common as possible. This significantly simplifies crime scene data collection and eliminates point omission errors.
136. 3D RAMA® Panorama Measure provides the ability to measure all the same geometrical quantities as in 3D MultiView Measure, e.g. height, area, and various distance measurements. However, measurement points do not need to belong to the same captured image, thus allowing the distances between the points, that are separated by occlusions (e.g. walls, trees) and large distances, to be measured.
137. The 3D RAMA® Panorama Measure method provides the most efficient method of capturing scene images and producing accurate measurements.
138. **Ricoh's Theta 360° full panoramic camera data** is seamlessly integrated for viewing an entire real-world 360° sphere of view.
139. **By taking two or more panoramic images with Ricoh's Theta 360° camera and using 3D RAMA® Panorama Measure**, the user can perform all geometric measurements that the 3D MultiView Measure provides with the added convenience of **operating and measuring in the entire 360° visual sphere of view (#)**.

3D Tour: 360° Stitching Extended Crime Scenes

NEW

140. Setup tours that allow the user to “walk through” a 360° stitched crime scene. The walk through automatically determines the closest camera view by clicking anywhere on the floor.

NEW

141. **Photogrammetrically Measure** distances, angles and objects within the scene Tour.

Distances may be measured between points even if visible only on different cameras.

142. Combine 360° camera images into a single tour that can be displayed via web browser.

143. Measure from within your standard web browsers (Chrome, Firefox, Edge) no software

required.

144. Labeling object within the scene.

145. Saving Measurements as an independent overlay dynamically visible while moving through

the scene.

Measurement Tools (*)

146. Cognitech® AutoMeasure® provides **automatic error feedback (#)**, which helps the end-user to determine and correct inaccurate point placements and increase measurement accuracy.

147. The Base Triangle allows the end-user to define a 3D plane by clicking any three points in the image. This 3D plane can be used to compute the XYZ coordinates of any point that lies on the plane by just clicking on that point.

148. The **Virtual Ruler Height Measurement Tool (*)** provides a real-world perpendicular **digital ruler tool** to measure the height of any object or individual whose base can be seen.

149. When points and planes are defined by clicking the image, real-world distances can be measured with the **Distance Measure Tools (*)** from point to point, plane to point, or plane to plane. This capability of measuring distances and therefore angles (through simple trigonometry) is useful in **crime scene ballistics investigations**.

150. By simply clicking the sequence of points in the image and delineating the area, any real-world region can be measured with the **Area Measure Tool (*)**. This is often useful in **blood spatter analysis**.

151. A **digital magnifying glass** is provided in the Cognitech AutoMeasure® software allowing for detailed point placement.

152. The **World Coordinate Tool** allows the end-user to manually set a known coordinate system, which allows the end-user to incrementally unify coordinates of all measured points in all images under a single 3D coordinate system.

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