

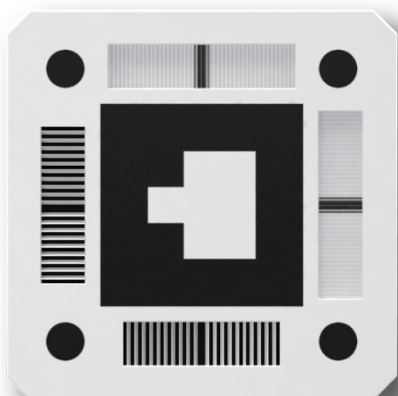
Photron

Revolutionary Fast and Simple Motion Analysis

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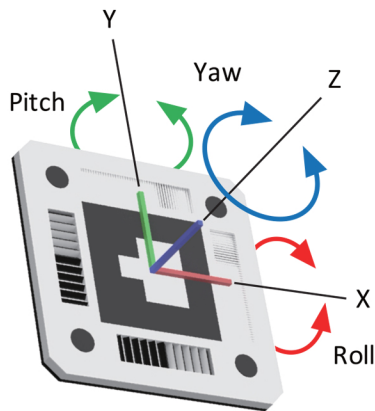


6D-MARKER



THREE-DIMENSIONAL IMAGE MEASUREMENT IN SIX DEGREES OF FREEDOM (POSITION AND ORIENTATION)
REQUIRING ONLY A SINGLE CAMERA AND MARKER





What is the 6D-Marker Analyst?

The 6D-Marker is a simple motion capture system that can track and measure 3D image data with six degrees of freedom (X, Y, Z, Roll, Pitch and Yaw) using only one camera and one 6D-Marker. Its compact structure allows users to measure various automotive tests, including engine vibration and vehicle impacts, which are difficult to analyze with a standard motion capture system.

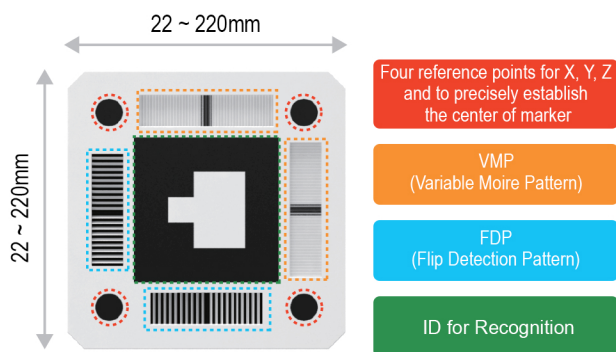
Features: Completely New Motion Capture System

A new concept in high precision AR (Augmented Reality) marker technology

With 6D-Marker's high precision printed reference points at the four corners, six degree of freedom (X, Y, Z, Roll, Pitch and Yaw) can be measured using only a single marker.

The VMP (variable moiré pattern) placed on the upper and right hand sides of the marker is a lenticular lens with a moiré pattern that changes according to the viewing angle. It can measure the markers orientation angle more accurately than conventional AR markers when the image was shot from the front.

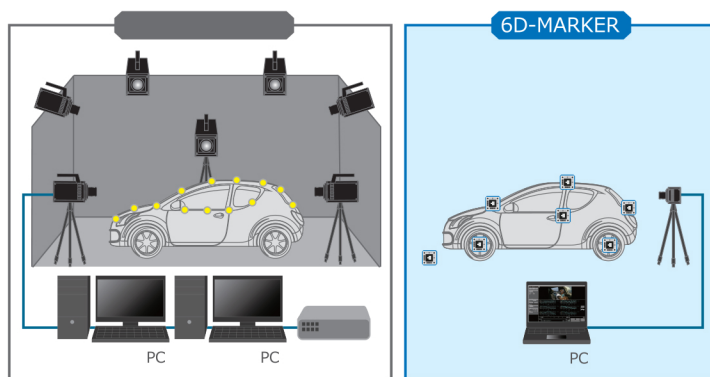
In addition, the FDP (flip detection pattern), located on the left hand and lower sides is the part where the black and white pattern is reversed according to the viewing angle, and indicates the markers physical orientation. The symbol at the center of the marker is used to identify each marker, with up to 32 (0 - 31) variations available.



Simple one camera solution

Typical motion capture and 3D image measurement systems require precisely calibrating two or more cameras within a large dedicated space, with the cameras being located at pre-determined positions.

With Photron's 6D-Marker Analyst", the only pre-test setup required is a simple calibration, and the equipment configuration is as simple as connecting one camera to your laptop PC and affixing one or more markers to the test subject.



Supports FASTCAM Nova, Mini, and MH6 series Cameras

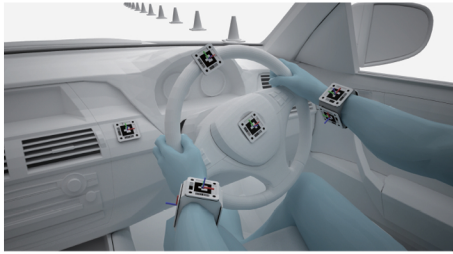
In addition to selected USB cameras, 6D-Marker Analysis software directly controls the latest generation FASTCAM high-speed cameras from Photron. With a high-speed camera, it is possible to measure high-speed behavior such as vehicle impacts and dummy interactions in automotive safety testing.

You can also import video data (AVI / WMV / MP4 format) captured with just about any camera type or brand, high-speed or otherwise, providing you have created the simple calibration file.

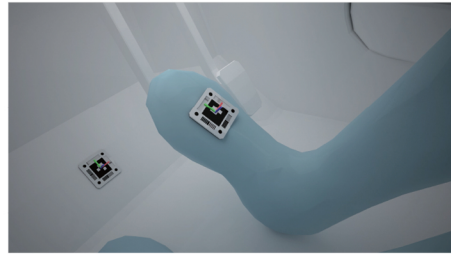


Application Examples

Expanding the world of motion capture and analysis



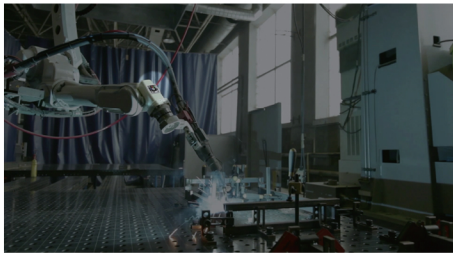
Steering movement



Biomechanics



Automotive safety test



Robotics



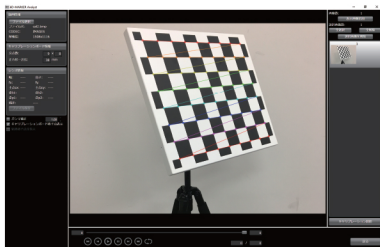
Aerospace and Defense



Kinesiology - understanding worker performance

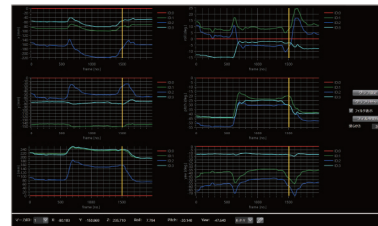
Main Function

Key considerations required for measurement



Calibration

The set up before measurement requires lens calibration only. As long as the lens focus and zoom are fixed, you do not need to recalibrate when you move the camera.



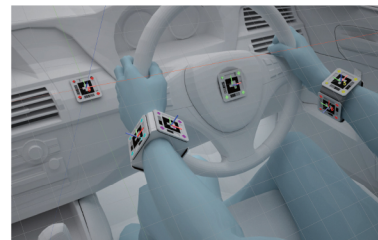
Graph Display

Each markers ID and 6 DOF elements can be displayed graphically. Smoothing filters and data interpolation are also available.



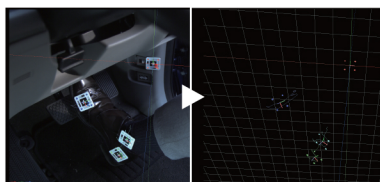
Automatic Tracking

Photron 6D-Marker Analysis automatically identifies and tracks the 6D-Markers visible in the image. IDs are automatically recognized and identified for easy measurement.



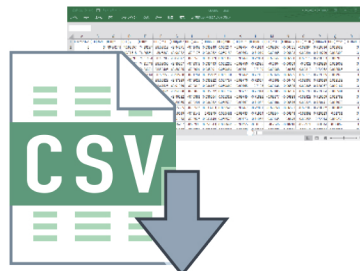
Coordination Setting

Coordinate origin can be selected from the camera's optical center, or the center of any marker visible. When the marker is defined as the origin, measurement is possible even if the camera shakes or vibrates as long as that marker is visible.



Video Overlay Display

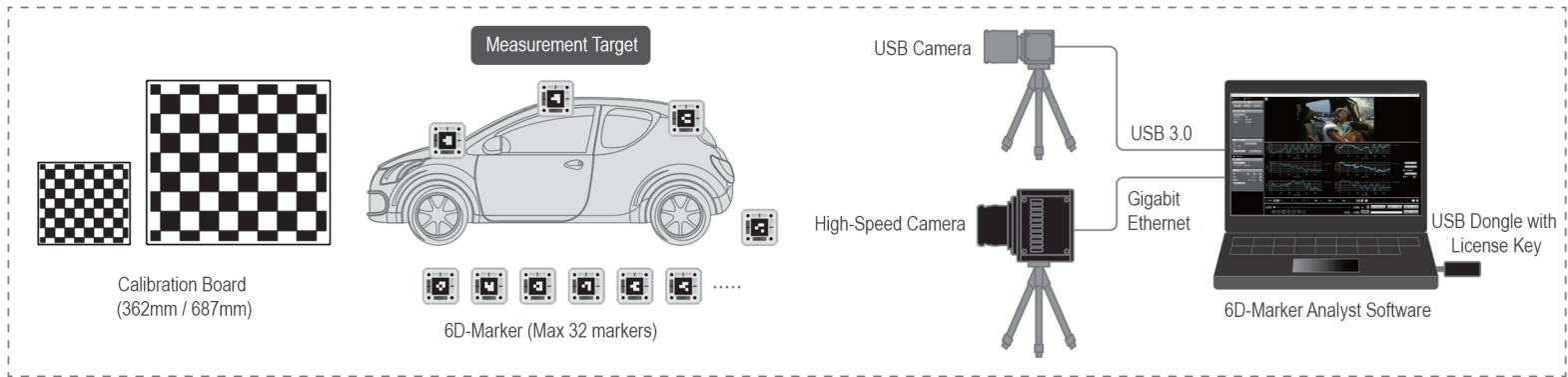
Unlike typical motion capture, you can display measurement points, trajectories, coordinate axes, IDs, etc. superimposed atop the recorded images. Or you can rotate, zoom, etc. the markers with the images hidden so as to better understand the objects motion.



Data Output

Measurement results can be output in CSV format. The "Position" (X, Y, Z) and "Orientation" (Roll, Pitch, Yaw: Rotation matrix)" of each marker can be output for each "image frame number".

System Configuration



Camera Measurement Range Examples

Camera		2.3MP Camera (Monochrome)	
Resolution		1920 x 1200 pixel	
Recommended focal length lens		12 mm · F4	25 mm · F4
Focus plane field size *1		About 2000 x 1250 mm	
Shooting distance		About 2100 mm	About 4400 mm
Measurement Accuracy *2 *3 *4	X, Y (???)	1.18 mm	2.04 mm
	Z	3.57 mm	3.57 mm
	Roll, Pitch, Yaw	0.27°	0.50°

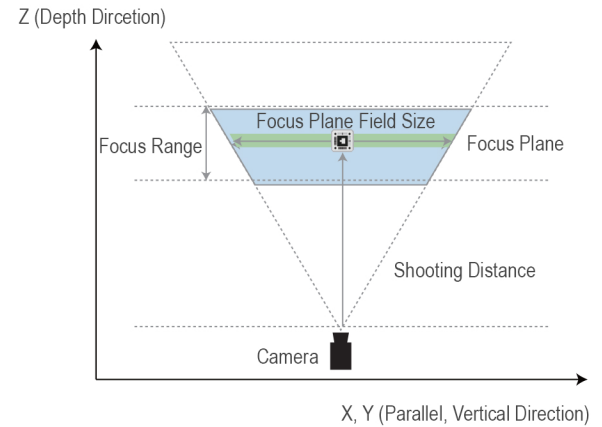
Measurement Accuracy *2, *3, *4

*1 Field size with a resolution of approximately 1mm per pixel

*2 Accuracy based on 44mm marker

*3 95% of measurement data shows accuracy within the standard value

*4 The measurement accuracy is an actual value in our environment, not a guaranteed performance value.



Specifications

6D-MARKER Analyst and/or Software Development Kit (SDK)

Supported OS	Windows 8.1/10/11 (64-bit only)
Directly Supported camera	Photron: FASTCAM cameras (Nova, Mini, and MH6) Toshiba: BU-238M/MCF USB3.0 camera Basler: ACA4112-8GM/C (GigE), ACA4112-30UM/UC (UVC/DirectShow) cameras
Max number of markers when using simultaneously	From 1 to 32 markers in a single session (Must be captured at a resolution of 40 pixels or more between marker reference points)
Measurement output data	Six degrees of freedom (X, Y, Z, Roll, Pitch, Yaw)
Measurement data output format	CSV
Video data input format	AVI, WMV, MP4, BMP, PNG, TIFF

Required Configuration

- 6D-MARKER Analyst Software
- 6D-Marker (22mm, 44mm, 88mm, or 220mm)
- Calibration board (362mm or 687mm)
- Camera (refer to support cameras)
- Lens for the camera

Optional Accessories

- 6D-Marker network license option
- Calibration board tripod (pan head with gear)
- Camera tripod (with mounting bracket)
- USB3.0 camera cable (2m~)

Development Kit

- 6D-Marker SDK software

6D-MARKER Sizes

Marker Size	Marker Dimensions	Marker Weight
22 mm	22.0(W) x 22.0(H) x 2.35(D) mm	1.3g
44 mm	44.0(W) x 44.0(H) x 2.35(D) mm	5.0g
88 mm	88.0(W) x 88.0(H) x 4.70(D) mm	39.0g
220 mm	222.0(W) x 220.0(H) x 10.80(D) mm	536.0g

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