

# Motion Tracking of Windshield Wiper

Digital Image Correlation (DIC) may be used in a wide variety of ways. One of them is to **track motion**. Motion tracking using DIC enables engineers to track motion from position to displacement, velocity and acceleration. Mercury RT is equipped with cutting-edge algorithms using Point Tracking (making use of Markers) and Digital Image Correlation for high precision measurements.

Mercury RT combines Point Tracking with 3D DIC, allowing full-field motion analysis of even complex geometries under challenging real-world conditions. 3D Digital Image Correlation reconstructs 3D space – it can capture even complex shapes and capture displacement, velocity and acceleration in the reconstructed 3D space. The tracking is done by correlating markers or image subsets throughout the measurement.

## Objective

The aim of this study was to track the motion of a windshield wiper in a harsh environmental condition – the lighting was provided only by natural light during a cloudy but sunny weather – the lighting conditions changed over the course of the measurement.

## Description of the Case Study

The analyzed specimen was a **170 mm long windshield wiper component**, mounted on the rear window with complex 3D geometry. To capture out-of-plane motion, a **3D DIC setup** was required. Two synchronized **iDS UI-3180-CP-M-GL cameras** were used, running at a reduced resolution of **2000 × 972 px** and a **frame rate of 180 fps**, positioned at a **stereo angle of 25°** to accurately capture out-of-plane motion.





### ❖ Point Tracking

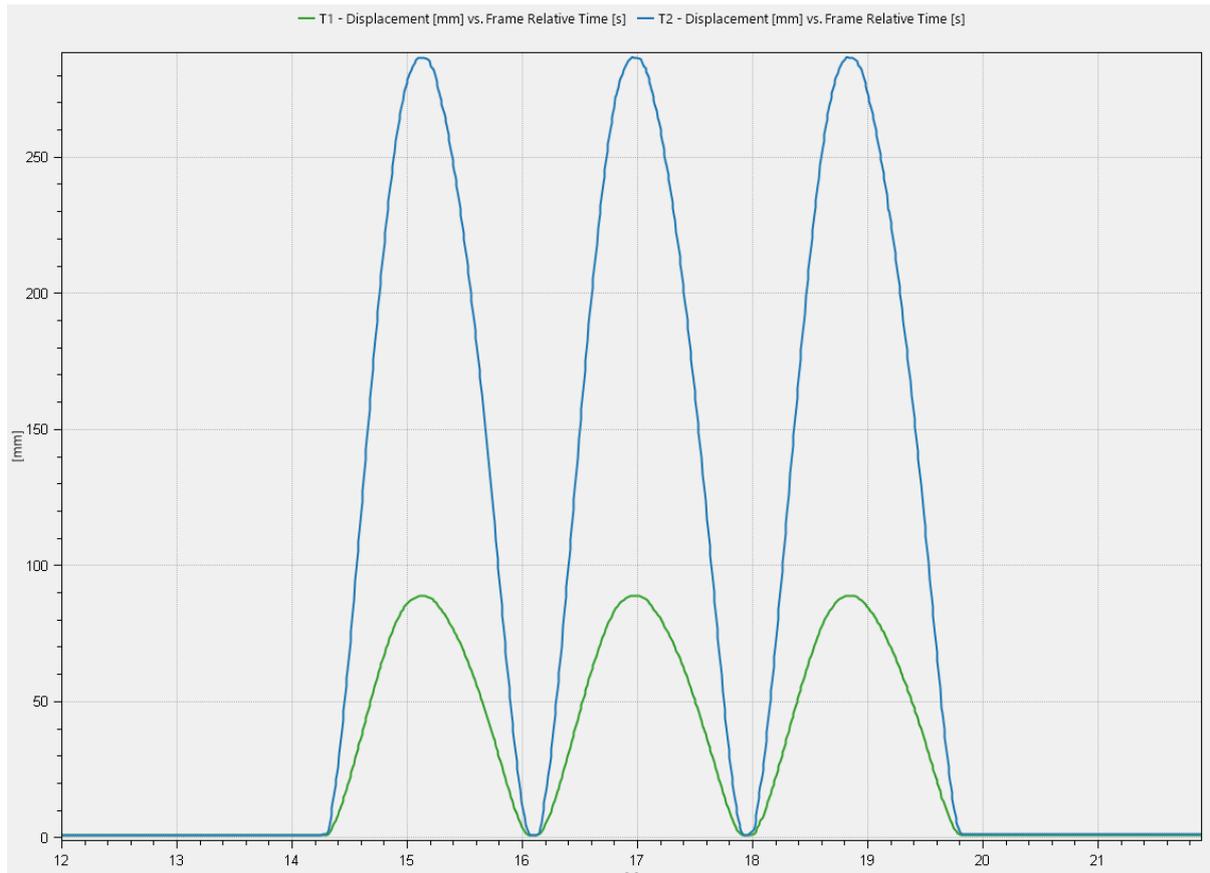
Two cross-mark stickers (T1 and T2) were tracked using two point probes, capturing displacement across all three axes (X, Y, Z).

See video example of the windshield wiper motion.

\\192.168.42.42\Projects\2025\Windshield\_points.mp4

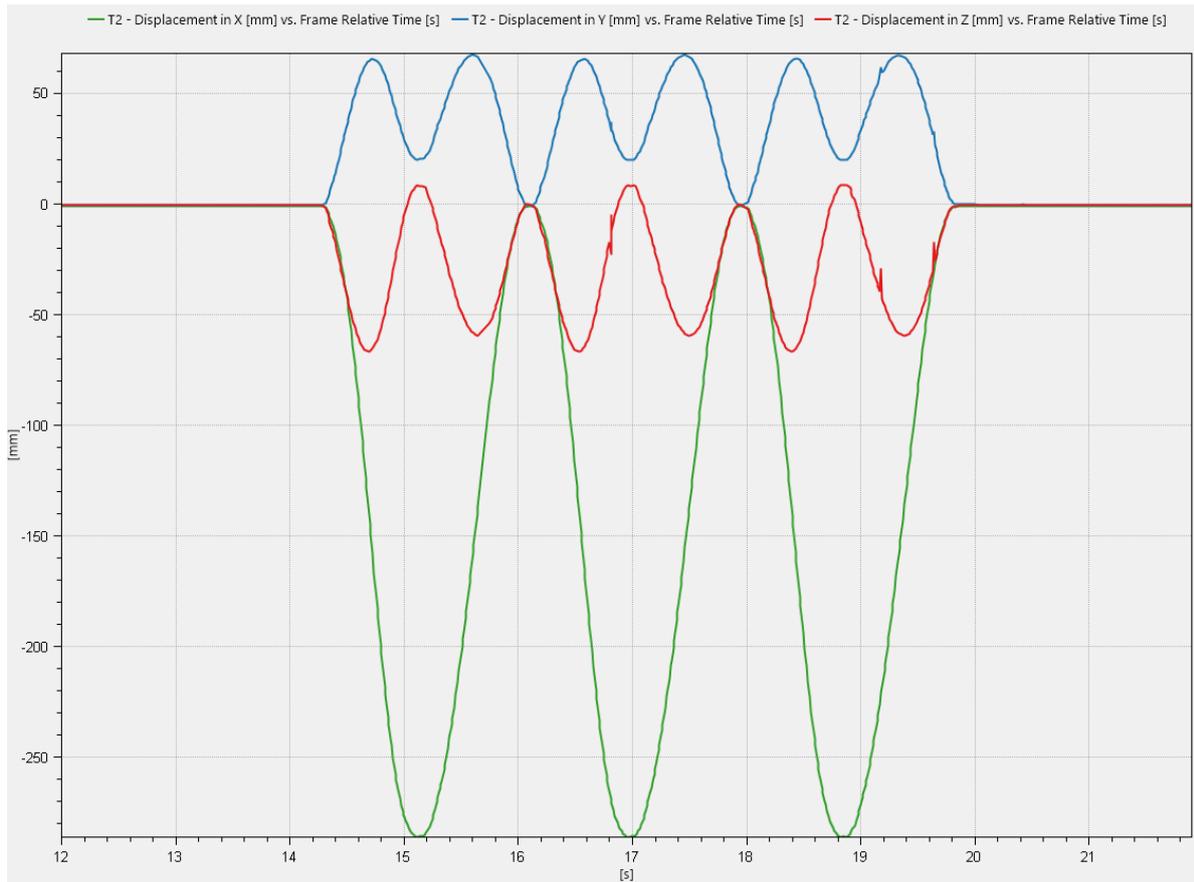
❖ **Overall Displacement:** The motion of the wiper was tracked across three full cycles.





❖ **Axis-Specific Motion:** Displacements in individual axes were analyzed for both tracked points.





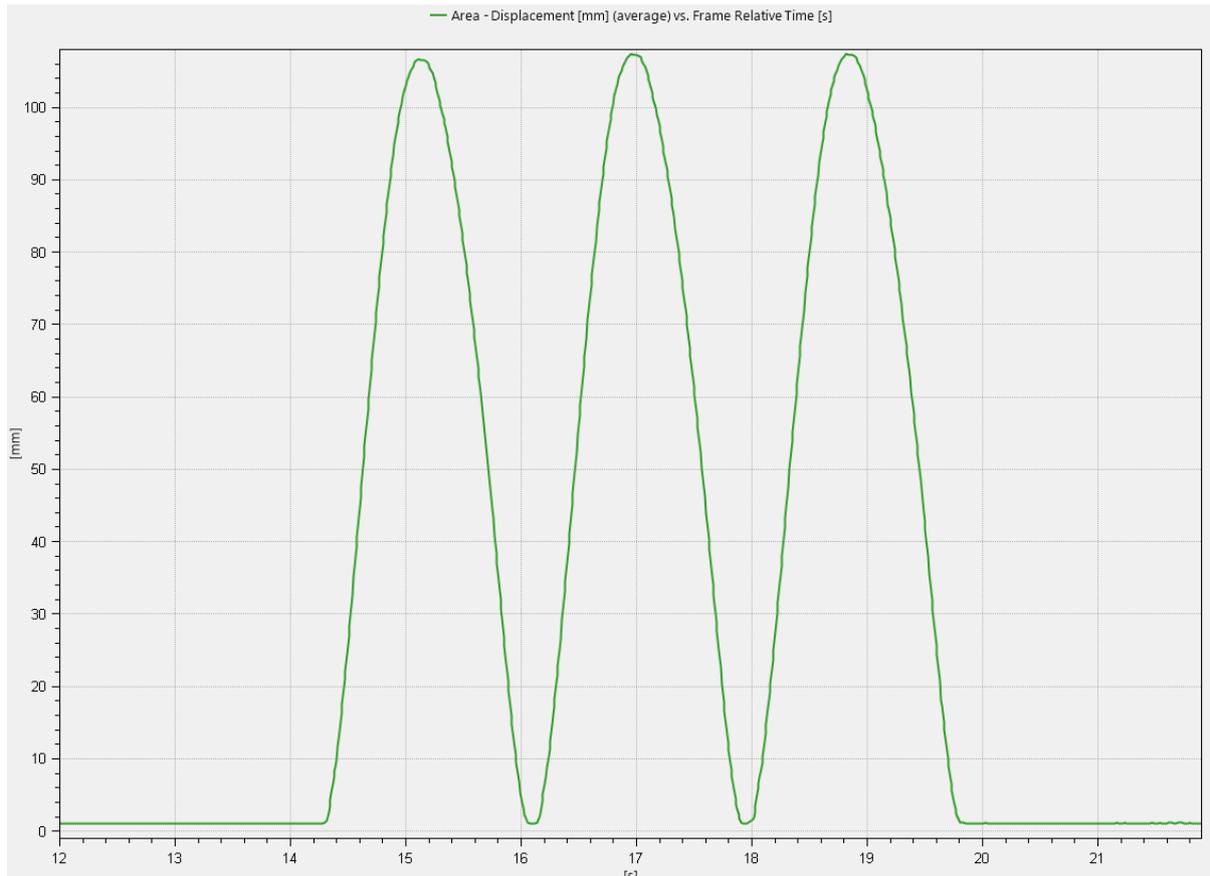
❖ **Full-Field Tracking:** Beyond points, full-field displacement maps were reconstructed, showing the complete deformation and trajectory of the wiper during motion.

See video below:

[\\192.168.42.42\Projects\2025\Windshield\\_area.mp4](\\192.168.42.42\Projects\2025\Windshield_area.mp4)

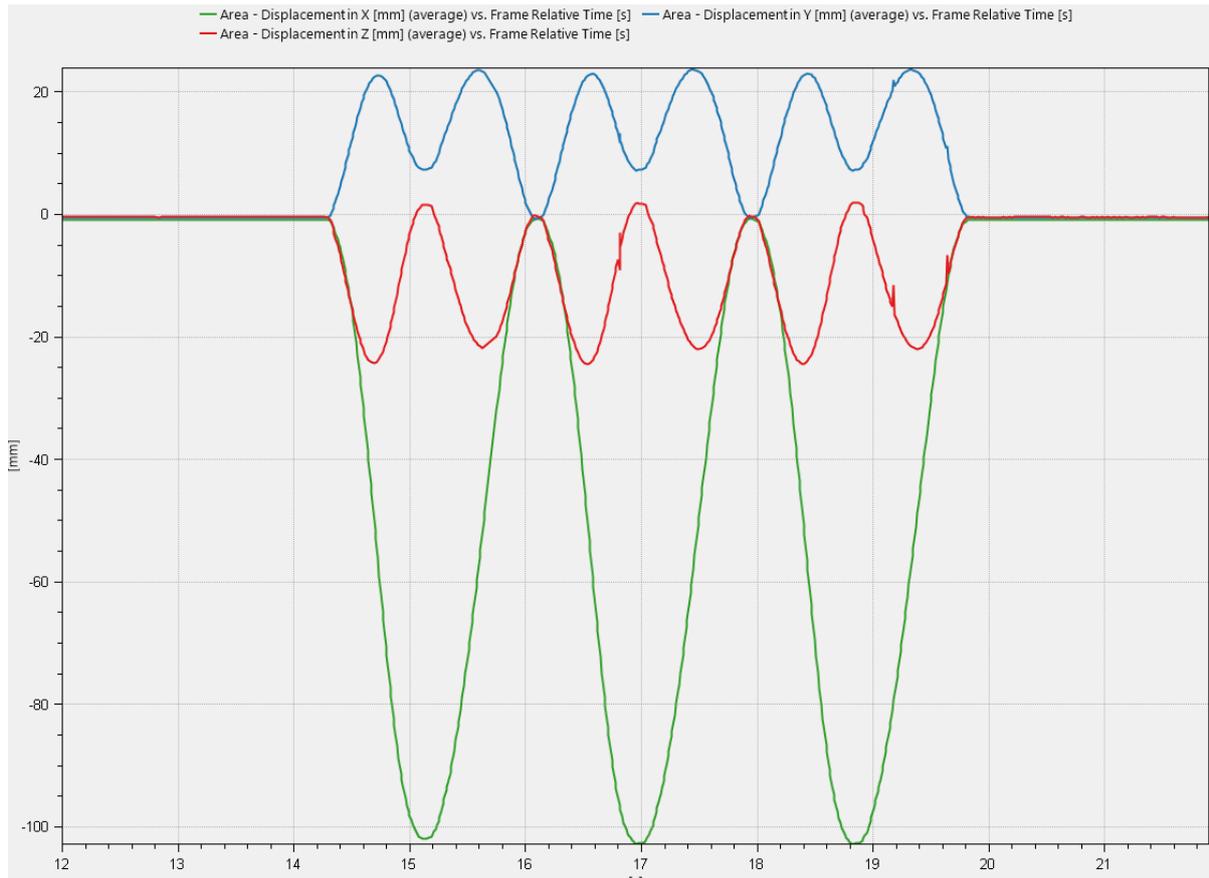
First, overall displacement was analysed:





Then, displacement in individual axes (x, y, z) was displayed:





## Advantages of Using 3D DIC in Motion Tracking

- ❖ **Full-field or point analysis** – from detailed distribution maps to precise point tracking.
- ❖ **Non-contact measurement** – no bonding, no interference with the specimen.
- ❖ **Real-time monitoring** – track motions live as they occur.
- ❖ **Post-processing capabilities** – reanalyze recorded footage for deeper insights.
- ❖ **High-speed motion capture** – integrate high-speed cameras for rapid or complex motions.

## Typical Applications of Motion Tracking

- ❖ Studying **relative movement** between mechanical parts.
- ❖ Analyzing the **trajectory** of moving components.
- ❖ Generating **full-field displacement** maps of structures or assemblies.

