LABORATORY EXERCISE 2
DIGITAL IMAGE CORRELATION [DIC]

Objectives:

· Measure the deformation of the object under forces by using digital image correlation

Basic information:

· Testing method: DIC
· Model made with Laminated veneer lumber (LVL) and laser cut + base in 3d printing
· Pattern: printed in vinyl stikers aplyed on top of the first three layers of the model
· Instra4D

Digital Image Correlation:

Digital Image Correlation (DIC) is a non-contact optical technique used in experimental mechanics to measure full-field displacements and strains on the surface of objects subjected to mechanical loading. It relies on analyzing images captured before and after deformation to track the movement of surface features.

The process begins by applying a random speckle pattern or a predefined grid of markers onto the surface of the specimen. These patterns serve as unique identifiers for tracking displacement and deformation. Then, high-resolution digital images of the specimen are captured using cameras before and after loading.

DIC software analyzes these images to determine the displacement and strain fields across the specimen's surface. The software correlates the pattern between the reference and deformed images, identifying corresponding points or markers to calculate the displacement of each point. By comparing the positions of these points before and after loading, DIC can quantify the full-field displacement and deformation.

DIC offers several advantages over traditional measurement techniques:

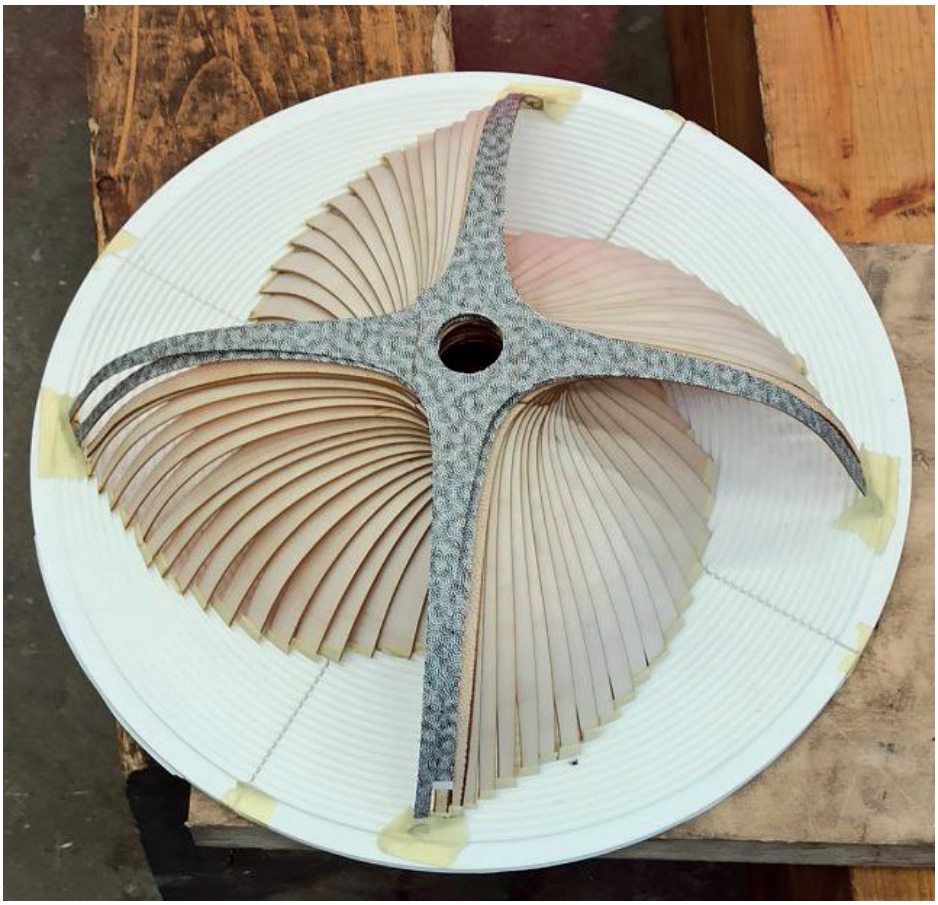
1. **Full-field measurement:** Unlike traditional point-wise methods such as strain gauges, DIC provides displacement and strain data across the entire surface of the specimen, offering a more comprehensive understanding of its behavior.
2. **Non-contact and non-invasive:** DIC does not require physical contact with the specimen, eliminating the risk of altering its mechanical properties or damaging its surface. This non-invasive nature makes DIC suitable for testing delicate or fragile materials.
3. **High spatial resolution:** DIC can achieve high spatial resolution, allowing it to capture fine details and small-scale deformations that may be missed by other techniques.
4. **High accuracy:** With proper calibration and image processing techniques, DIC can achieve high measurement accuracy, making it a valuable tool for research and quality control applications.

DIC finds applications in various fields, including material characterization, structural analysis, biomechanics, and product testing. It is particularly useful for studying complex deformation behaviors, such as material failure, fatigue, and fracture mechanics.

In summary, Digital Image Correlation (DIC) is a powerful optical technique for measuring full-field displacements and strains on the surface of objects subjected to mechanical loading, offering advantages such as non-contact measurement, high spatial resolution, and full-field data acquisition.

Preparation:

Model preparation Pattern applied

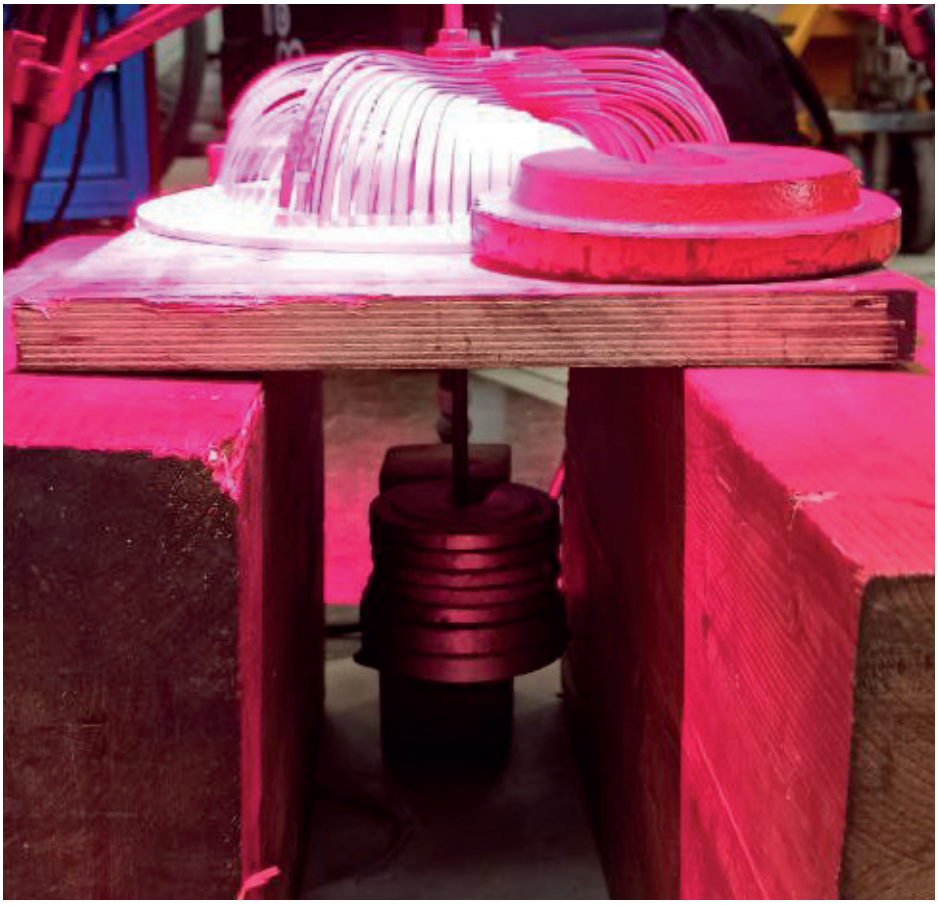


Camera adjustement + Camera calibration cameras aligned and use of standarized pattern to detect the position

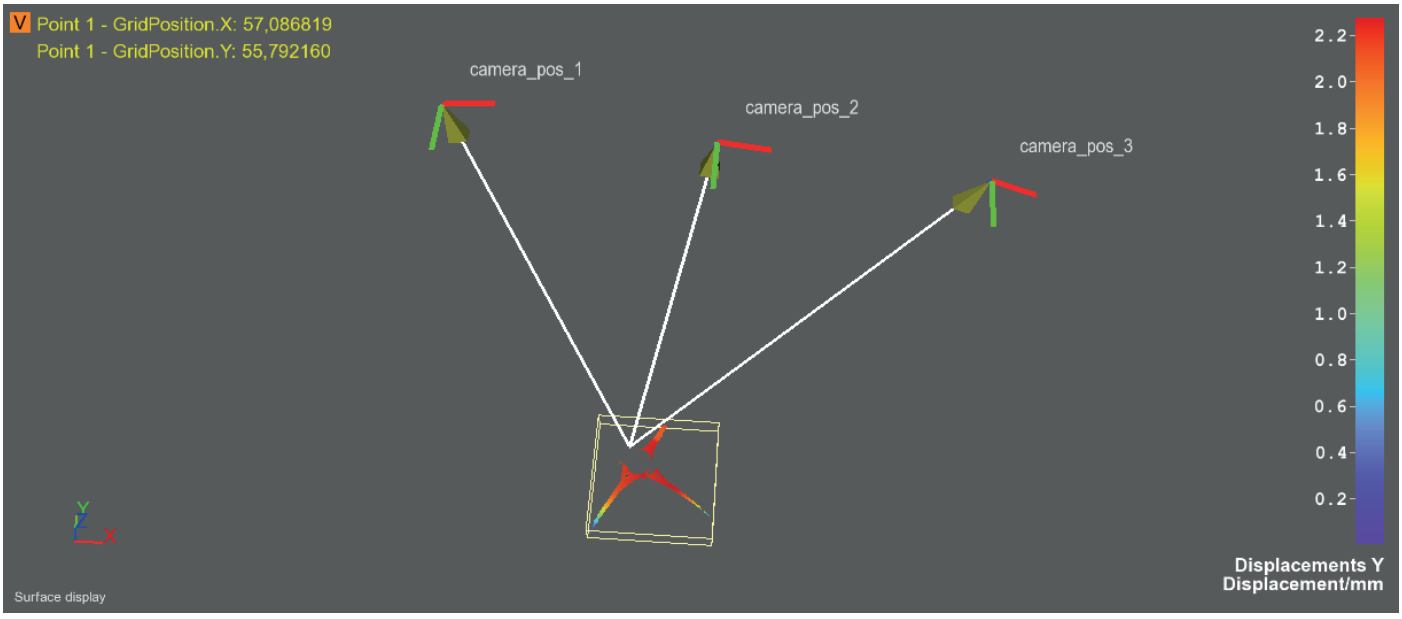
Model estabilization use of woods to create a surface that allows to add weights of 250gr each from the bottom

Weighted elements in this case the rod used to hold the weights

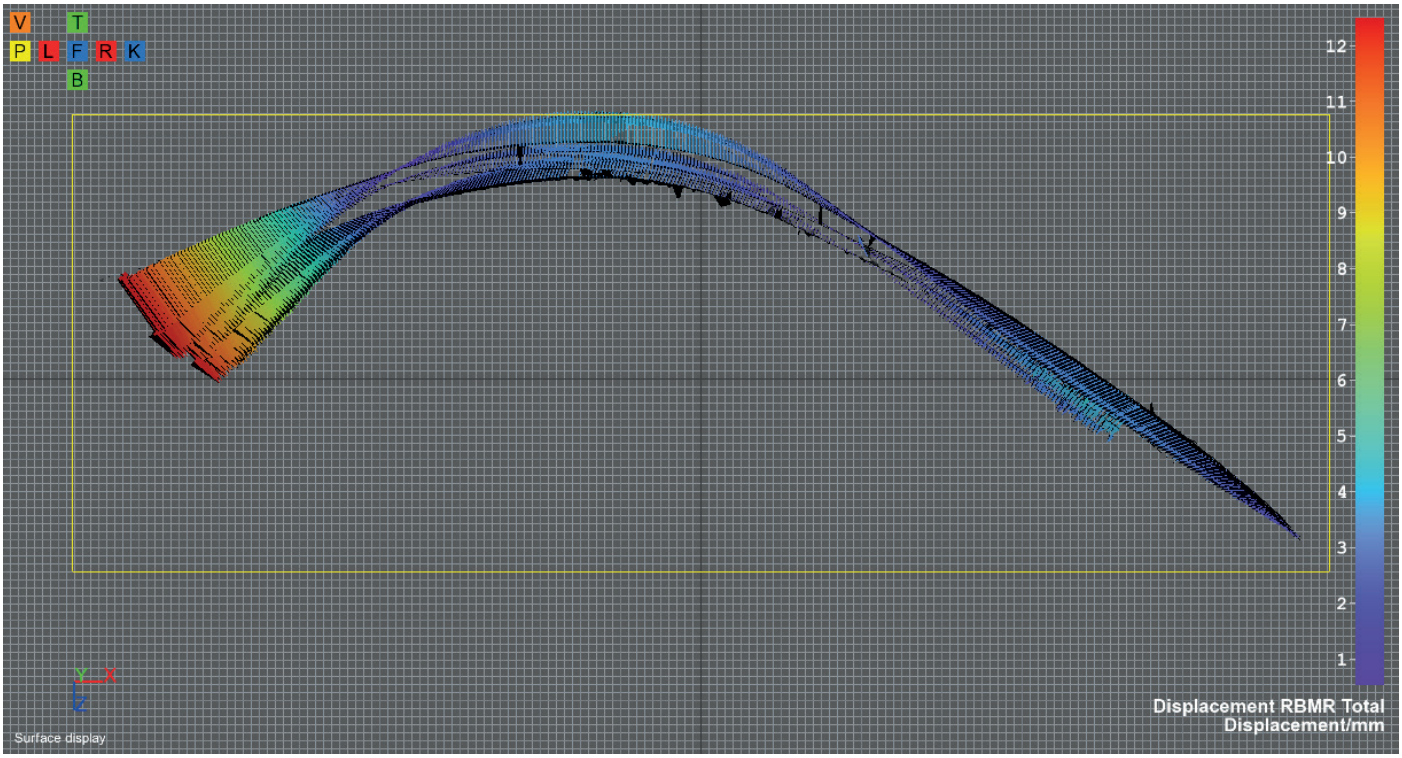
Test:
The tests made to the model are five following the same steps in each one of loads of 250gr each time (exept the free weight of 478gr of the handle).
The tests done are one for the overall model and four, each one for each leg of the model.
The maximum weight added is 5kgf.

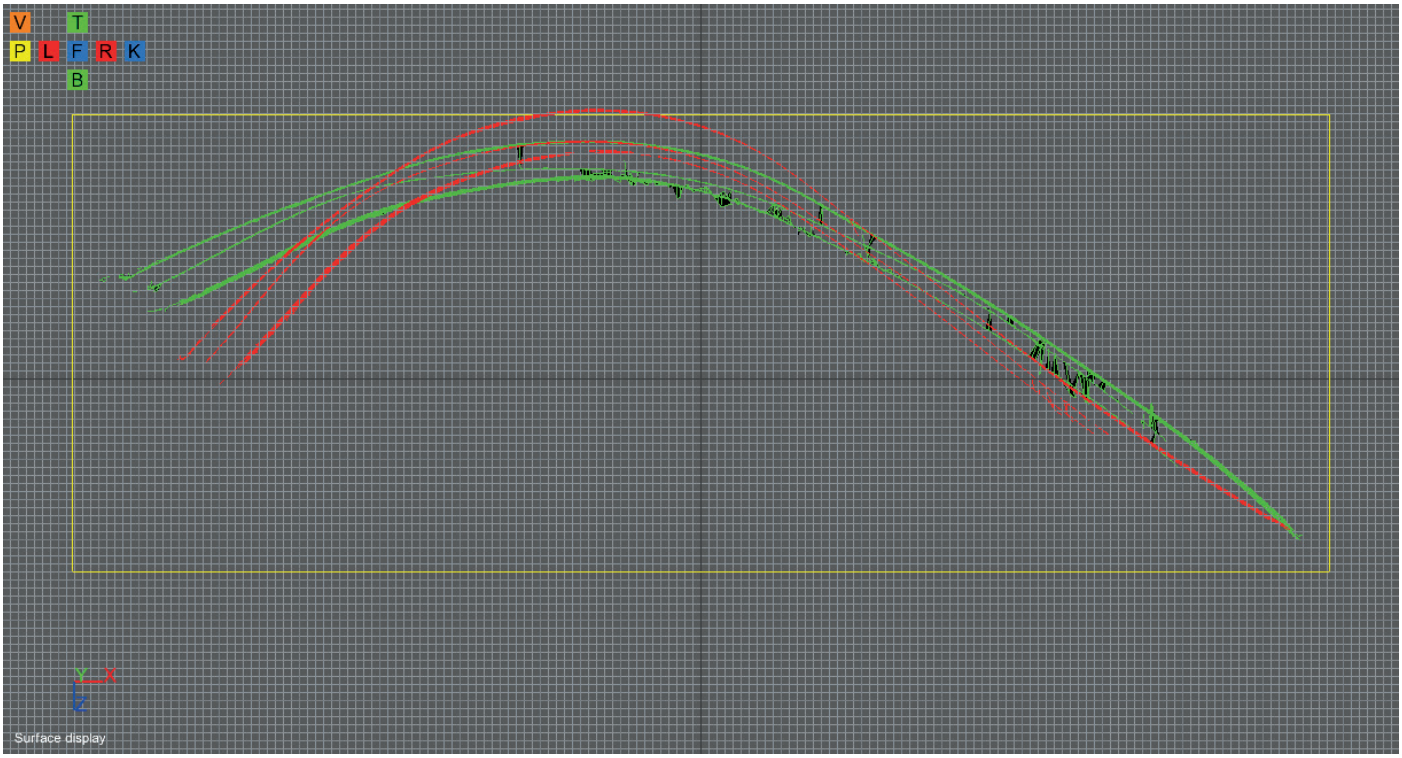


Set up:
Three cameras with a focus on the center of the studied element.

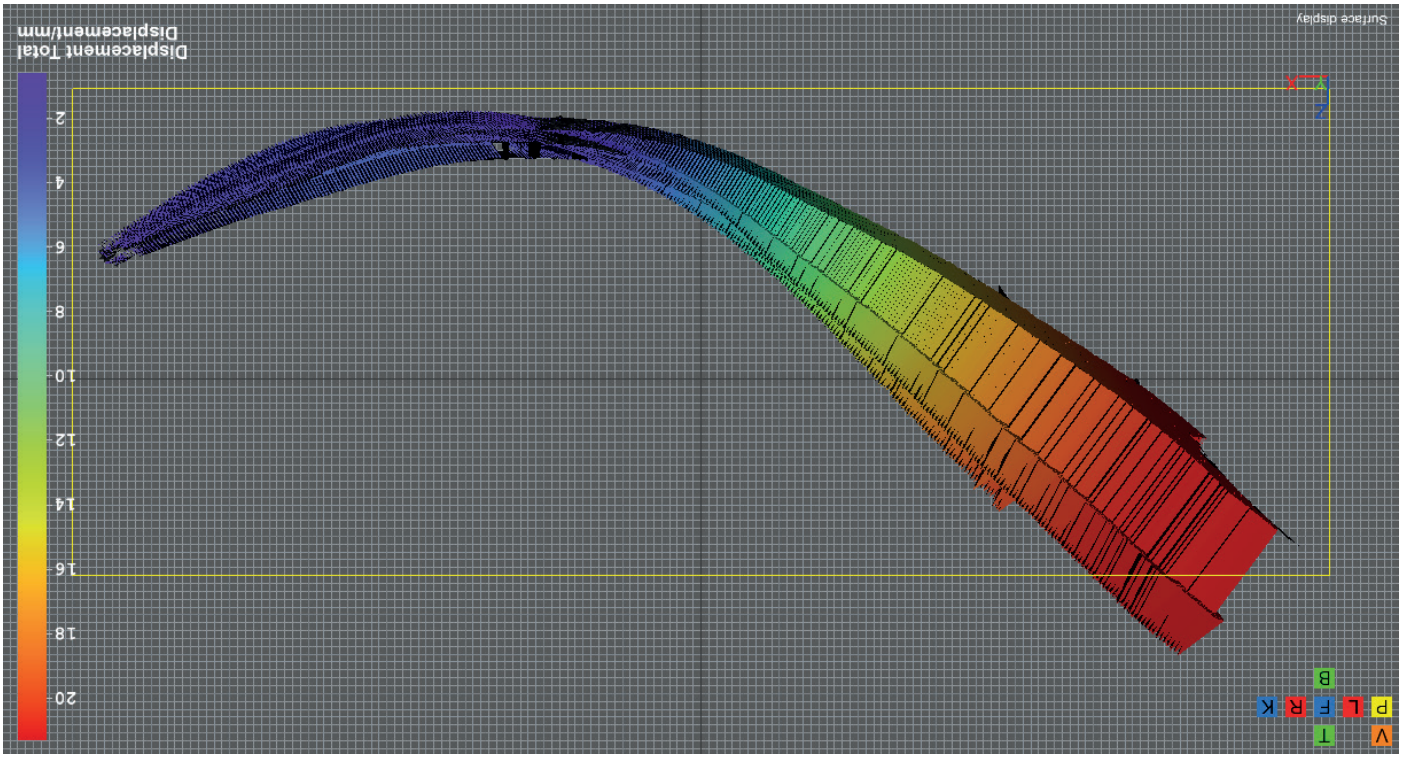


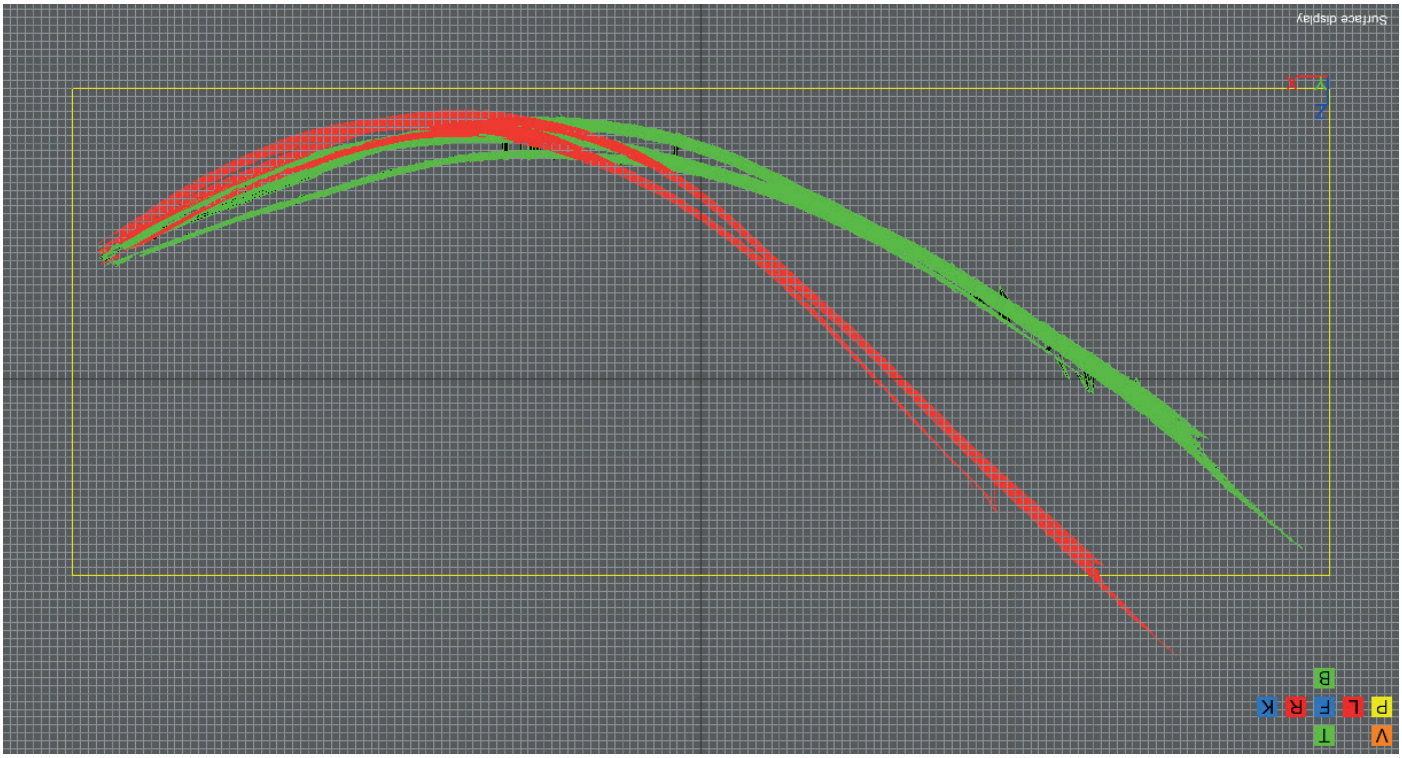
Results
Test 1
Leg 1



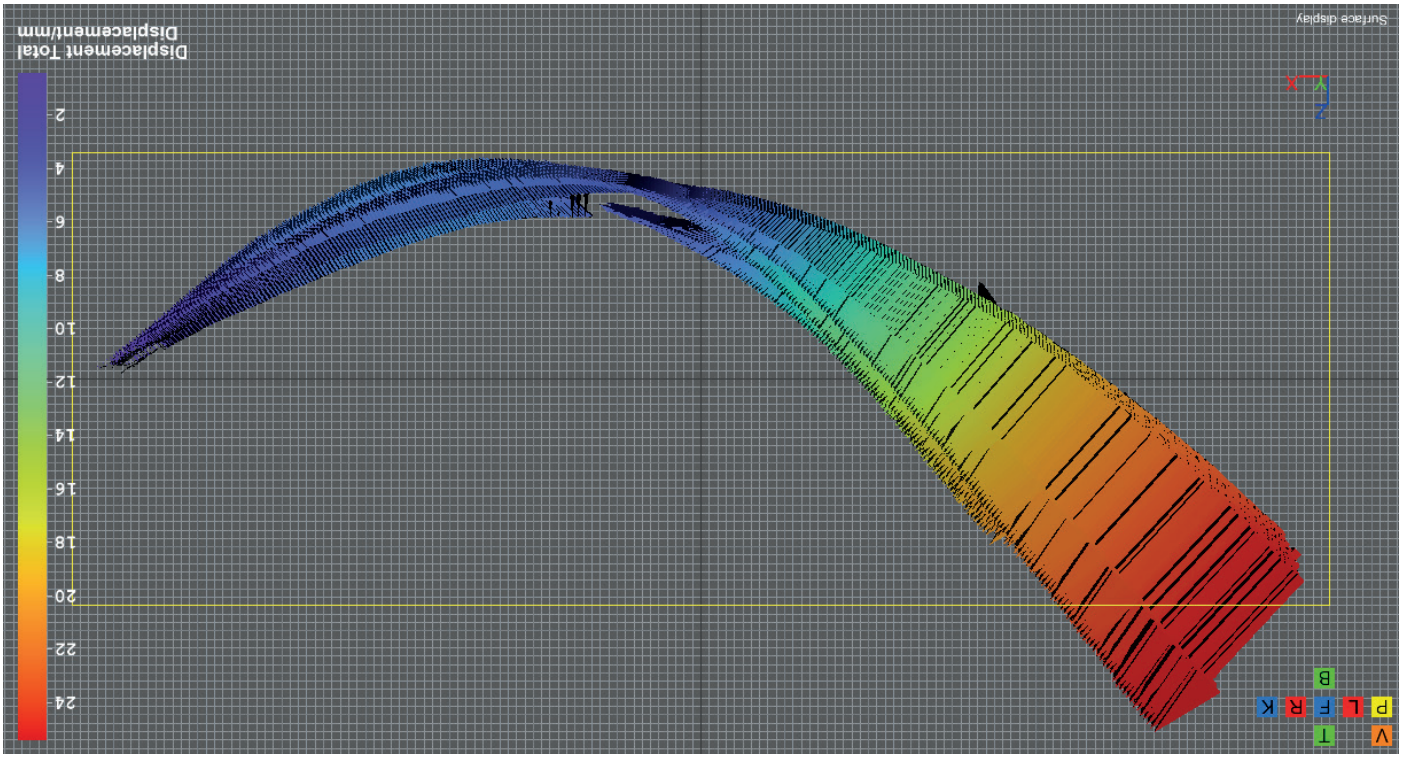


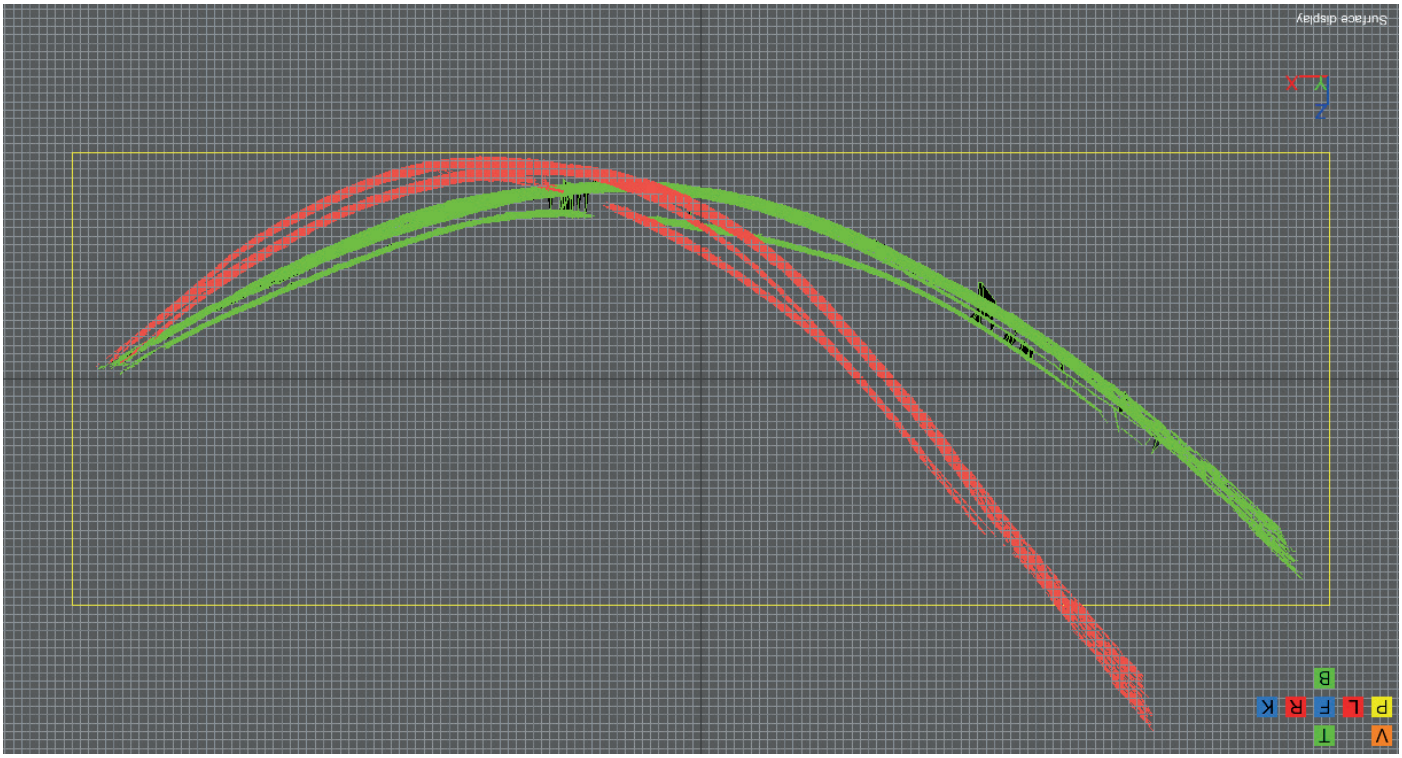
Results
Test 2
Leg 2



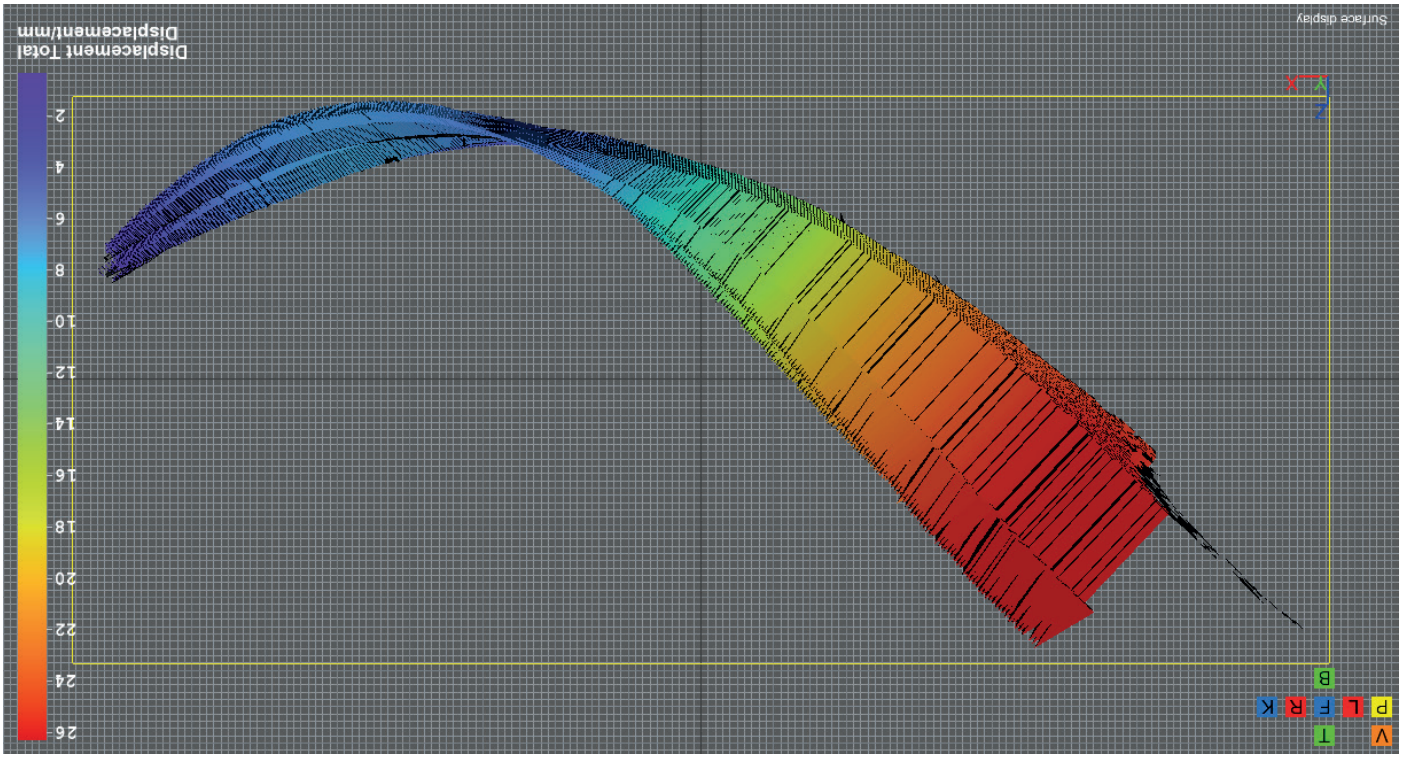


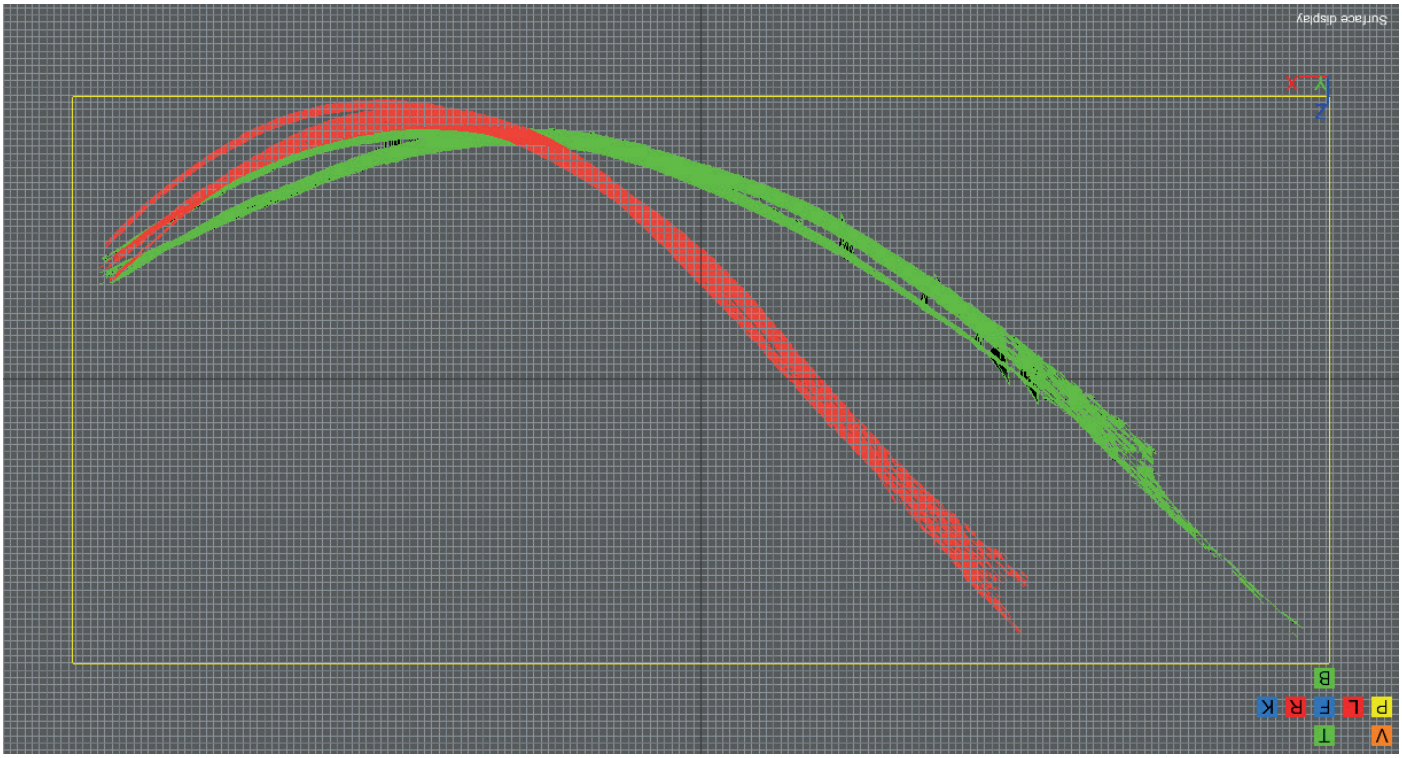
Results
Test 3
Leg 3





Results
Test 4
Leg 4





Results
Test 5
Overall model