POSTER

Full Wafer MSP Contact and the Challenges of Material Deflection

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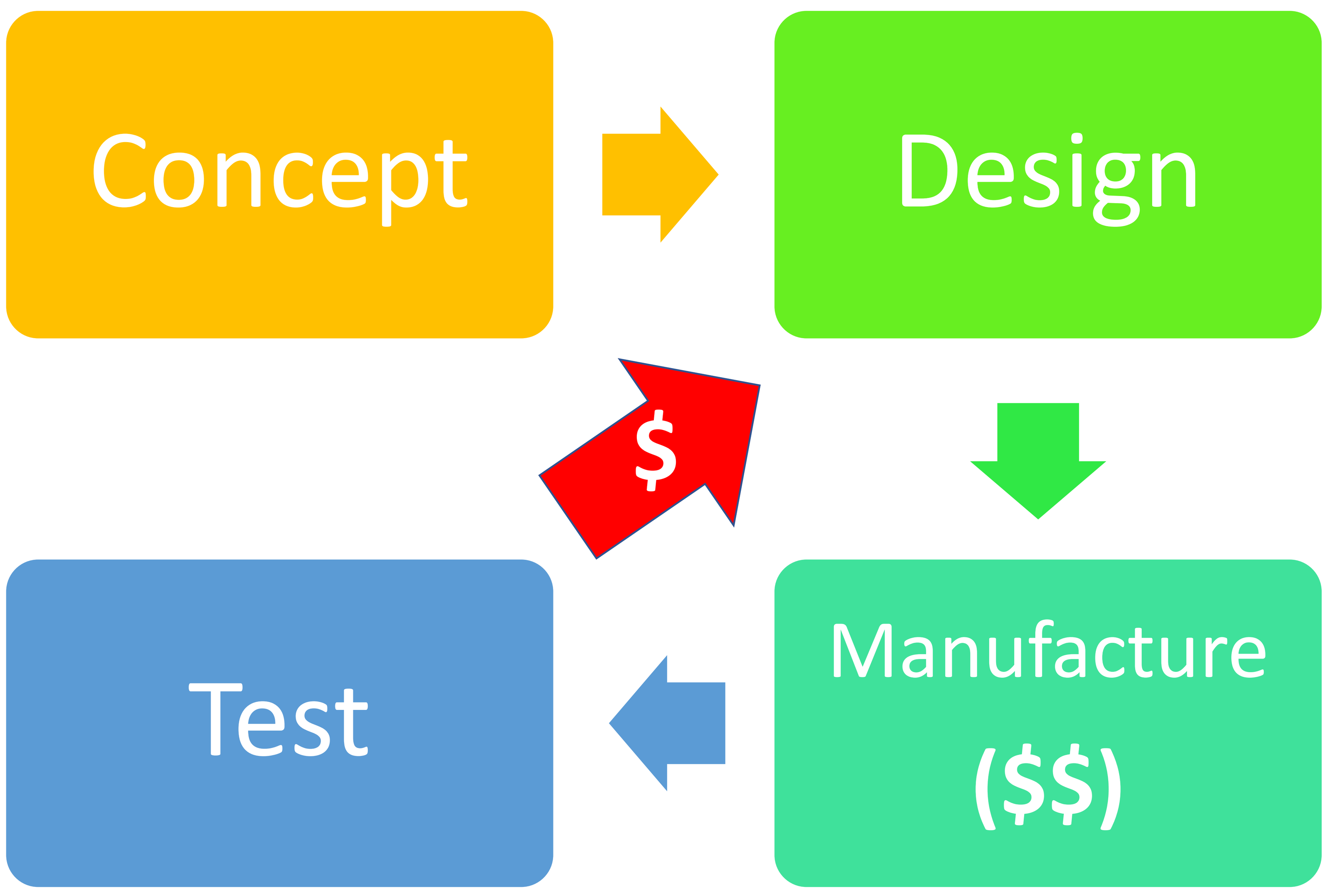
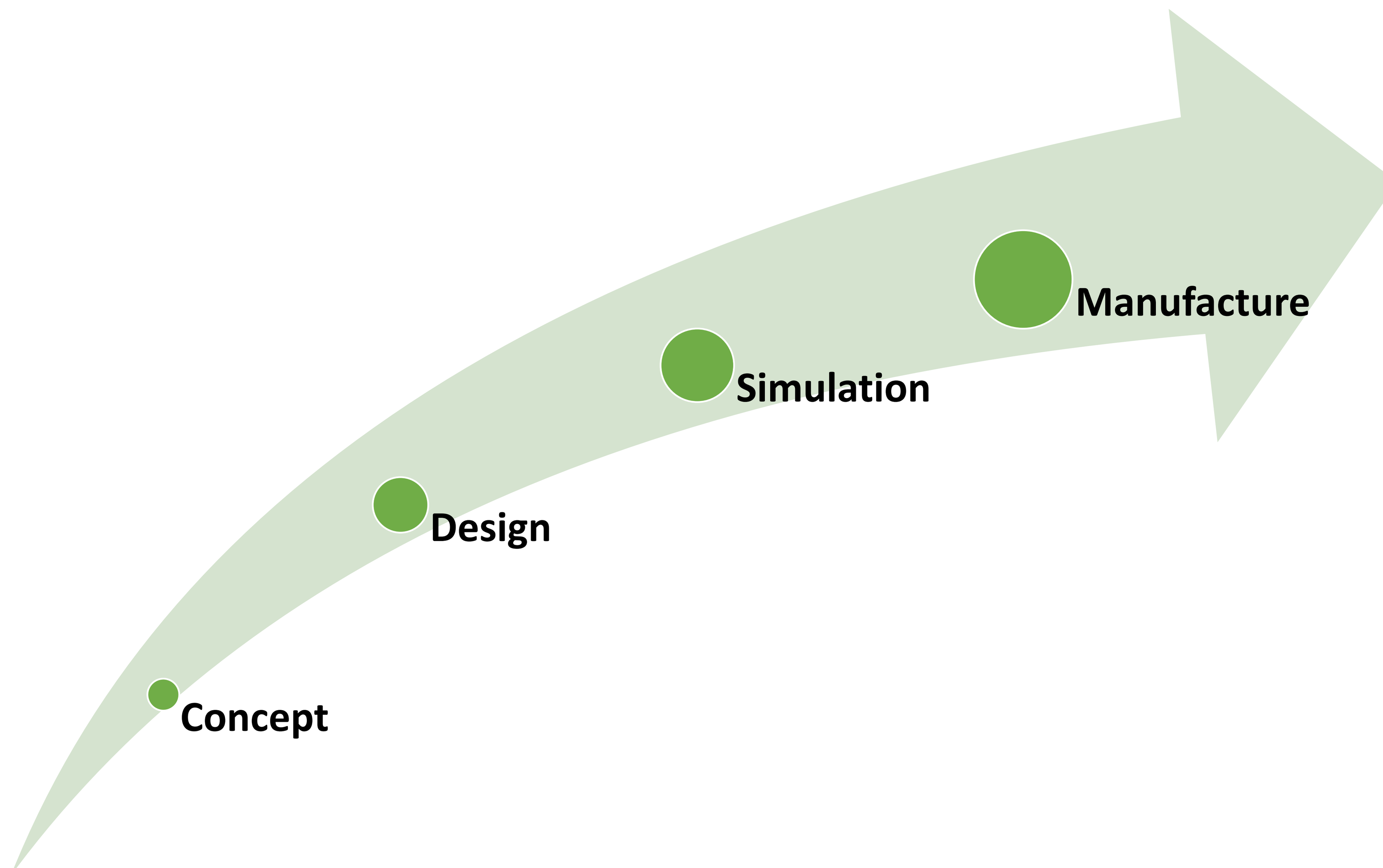
Introduction

In this presentation, I will discuss the engineering of an MSP (Micro Spring Pin) **200mm full wafer** contact for a burn in application. This will demonstrate, using simulations, what happens when comparing this environment to the real-world application.



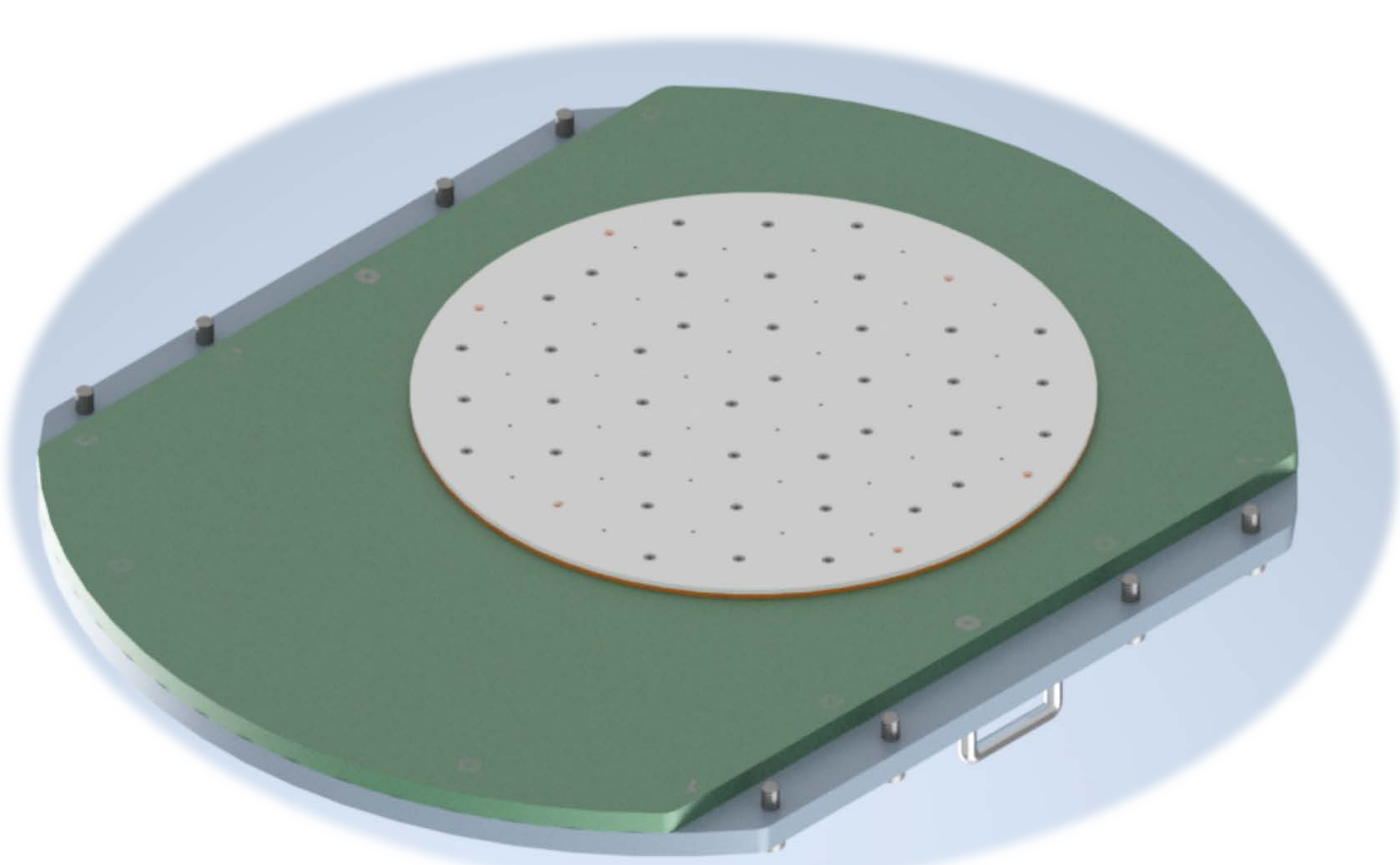


Using simulation to aid your design process can help you take your project flow from figure on the left to the figure on the right. Today I will presenting a recent project at PTSL to show how this process aided us in finding a worthwhile solution to a complex problem.

What is Simulation Software?

Finite element analysis software is widely used across all engineering fields as a way of **tuning** the design prior to manufacturing release. Using **mathematical formulae** associated with a model, the user can set parameters and test designs for specified temperatures, pressure, torsion, force, fluent flow, durability, deformation and many more. **PTSL** have been using this as part of their standard design process for many years, implementing it in everything from individual probe deformation to full probe card thermal expansion.

200mm Full Wafer MSP contact – Project Summary



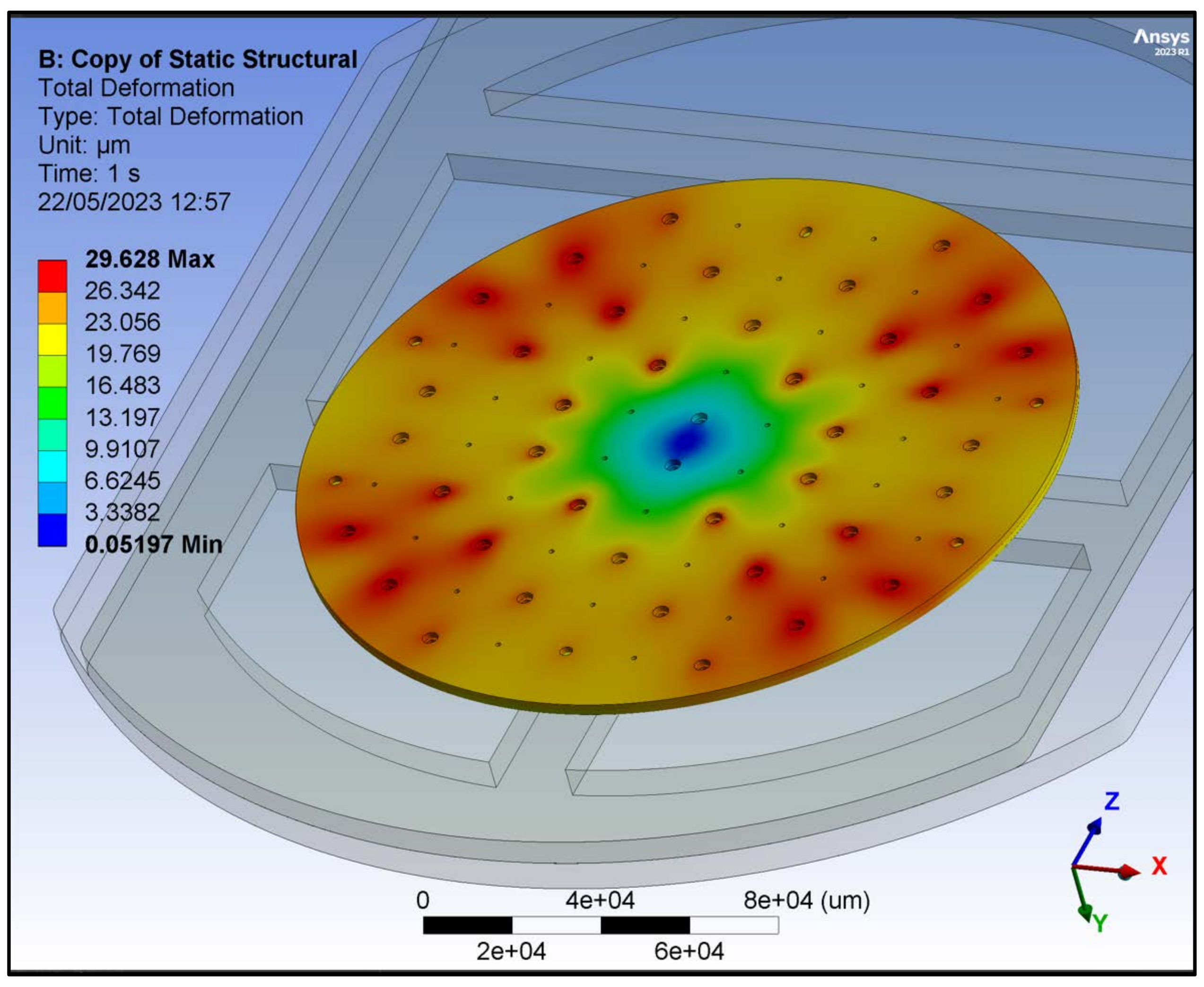
The aim of this project was to create a Probehead that could make full contact with a wafer in a single touchdown, 1118 probes over 86 sites.

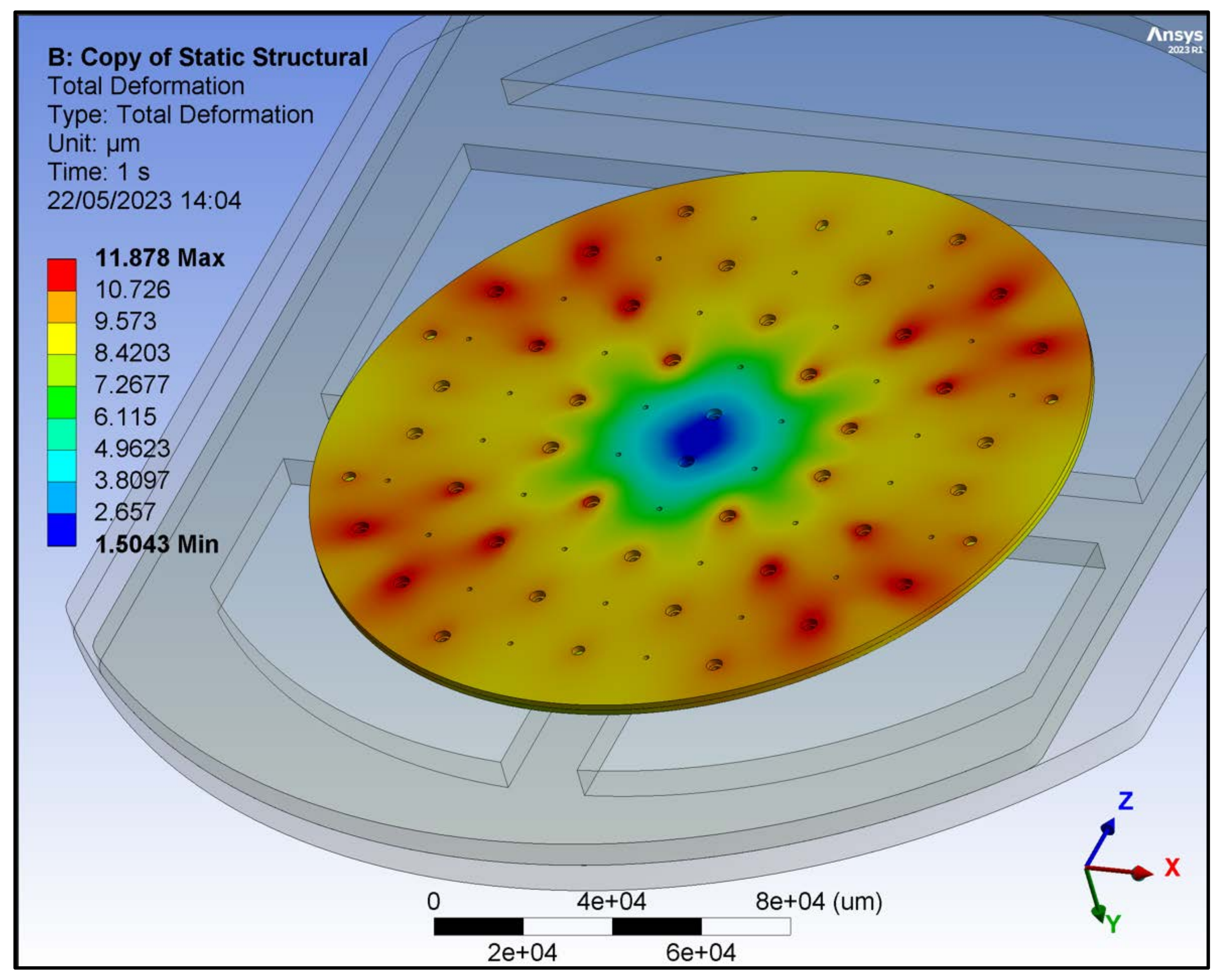
The XY positioning of the probes in this project was crucial to the success of the card. Therefore, understanding the effects of material selection, overall design and the build process was necessary to create a fit for purpose Probehead.

The process flow above shows the benefits of simulating a part before manufacture; however, simulations can only mitigate so much, as the ‘ideal’ environment they create is not always what happens in a real-life scenario. Today I’m going to go into depth on this recent project, showing how simulation was used to aid the development of an out-of-spec design.

Initial Project Flow – Concept to Test

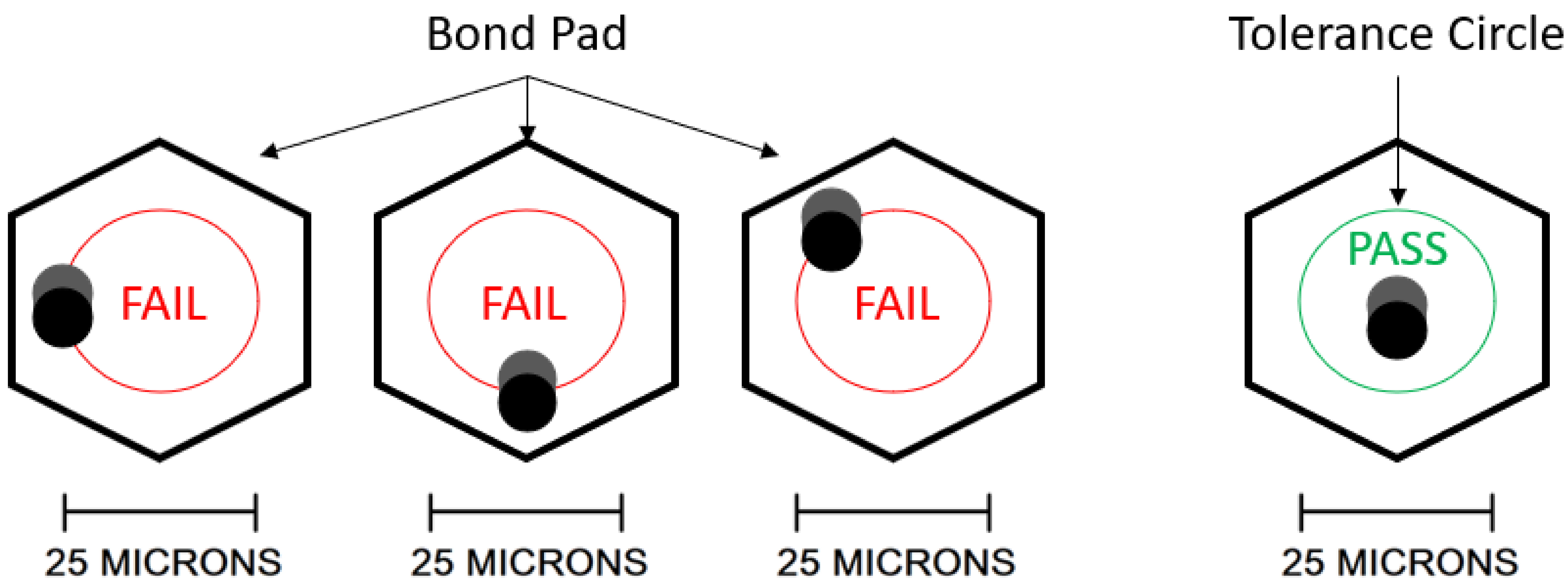
Below you can see a FEA simulation of the initial design showing the effect of the probe head attach screws on the top-level wafer. Simulations like this help us understand how the materials will behave under specific conditions. We can use this data so examine all aspects of the card for things such as deformation, stress, reaction forces and changes in temperature.



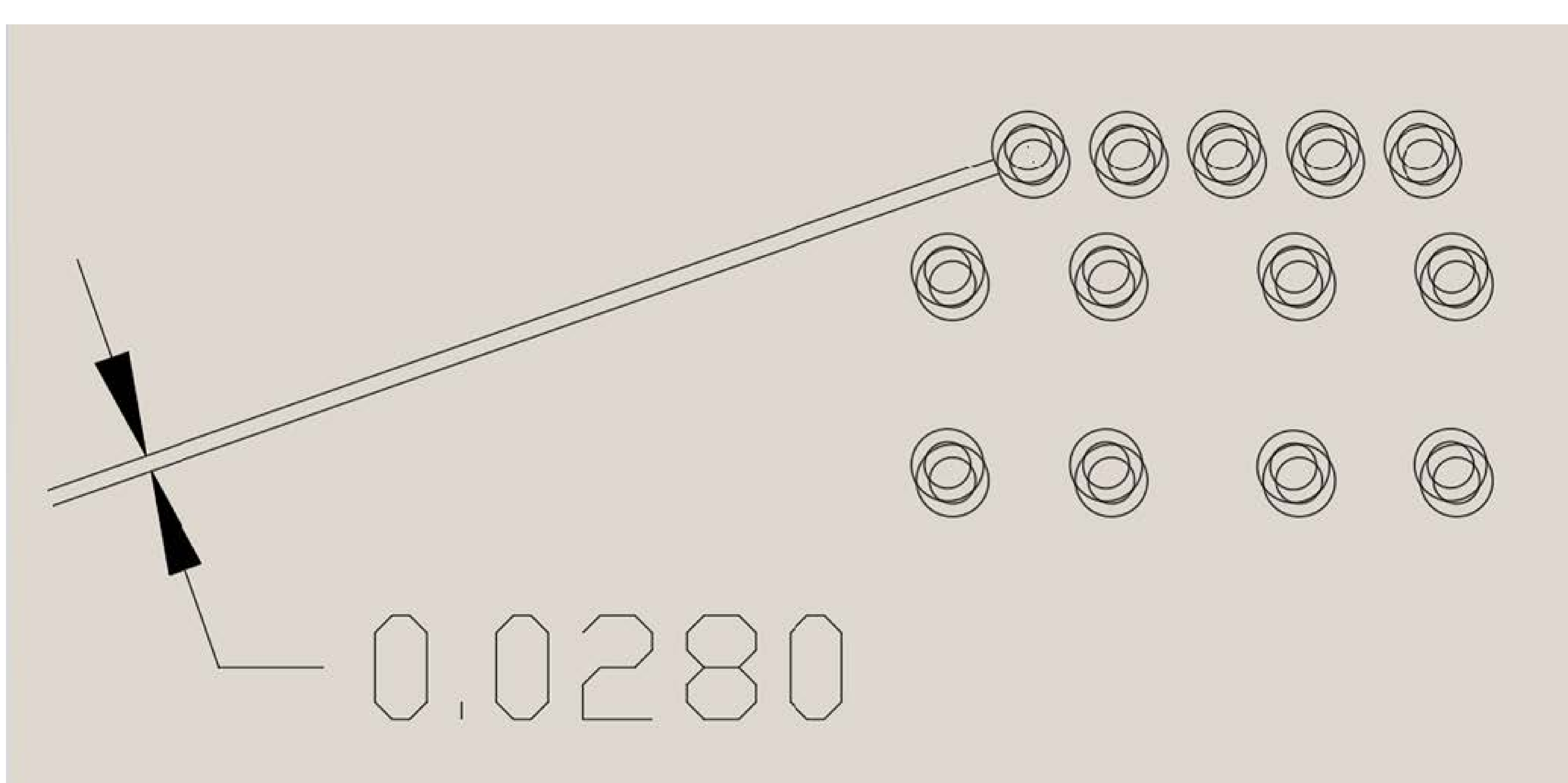


However, simulations cannot always prevent problems from occurring after the parts manufacture.

After assembly, a shift in the position of the outer pins was noticed during testing. As all 86 sites must be in contact with all relevant pads during the testing process, this resulted in probemarks being out of specification. Below we can see the resultant and ideal position of these probe marks during testing.



To verify this, we used an optical measurement tool to plot the final position of the pin tips against the specified XY coordinates. The figure below is an overlay of one of the outer sites – this shows the designed co-ordinate vs. tested position of the pin tip. You can clearly see a 28µm shift between the designed XY coordinates and the measured coordinates.



After investigating the part, we found the mating of the ceramic material (Material A) with the stiffener was causing an uplift of the ceramic at the outer edges of the card. This is partially due to the manufacturing of the stiffener. While it was in spec, there was flatness variation which was not present in the "ideal" FEA model. This led to the material conforming to the profile of the stiffener.

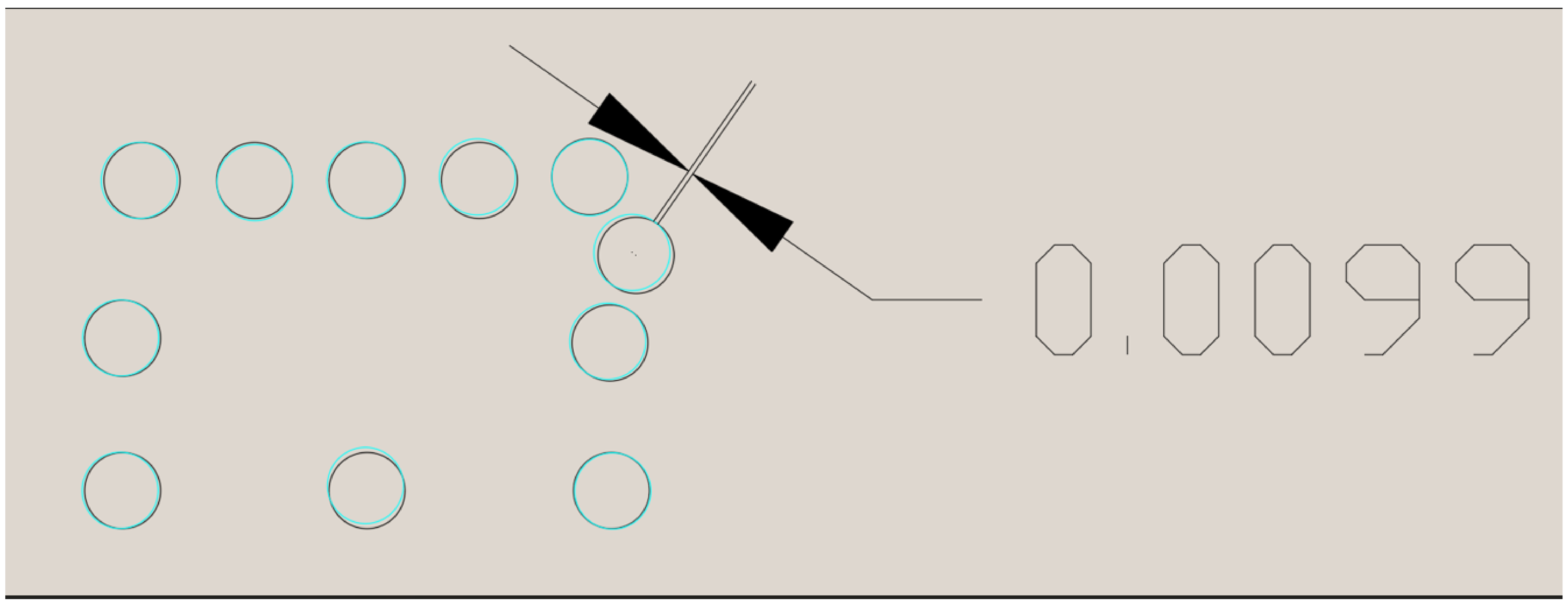
By further simulating the design with alternative materials, we were able to select a more appropriate material for this mechanical system.

Results - Material A vs Material B XY Position

After the implementation of the new material, we were able to successfully re-test the design using optical measurement to gather the coordinates of the probe tips and validate the true position.

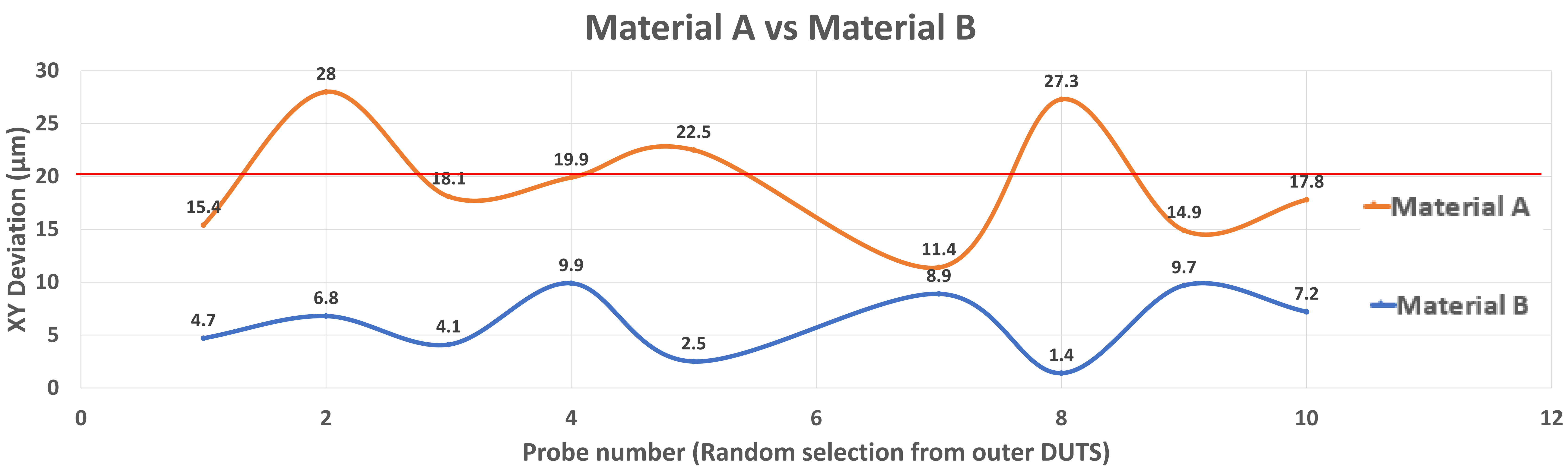
Below you can see the XY positioning of the probe tips after the implementation of material B. The increased material stiffness constrained the pins and held the XY coordinates within the specified tolerance window.

This is attributed to the revised material holding its form and not conforming to the stiffener flatness variations.



This shows the site with the highest deviation from the specified coordinates, at 9.9 microns movement.

Below you can see a graph highlighting the variation of the tested probe tip coordinates in comparison to the designed coordinates over material A and material B:



Here we can see a marked decrease in deviation between material A and material B. Any points above the red line are out of specification. Each deviation is measured in a direct line from the center of the designed XY to the center of the measured XY coordinates.

Conclusion

Simulation is an invaluable tool for your design process. Understanding how to properly utilize simulation can help save money in the manufacturing stage of your design process. Simulation will never completely eradicate manufacturing challenges; however, it is an invaluable tool when planning for project success. Using simulation, we were able to understand the problems that arose during the testing stage and quickly identify a solution then effectively implement the change in our solution.

Questions ?

If you have any questions, please contact

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