

AT A GLANCE

Problem:

Alignment is one of the most important aspects of knee implant lifespan and comfort. The success of implant hardware and surgical techniques relies on understanding these requirements.

Objective:

Characterize the dimensional error budget for next-generation implant and bone locating strategies.

Solution:

Prairiefire quantified the effects of the locating strategy options. We developed a novel cut geometry that allows 30% more variation with no reduction in implant alignment or performance.



Products pictured are representative and not necessarily the products for which the work was performed

SUMMARY

A major factor in the lifespan and comfort of a knee implant comes down to alignment. Rework is not an option, it must be correct the first time and every time.

Our customer knows knee implants, their alignment requirements, and the manufacturing process. They wanted to better understand how the alignment requirements would affect their next-generation implant hardware and surgical process, before ever entering the operating room.

Prairiefire analyzed knee implant alignment with a sensitivity model - quantitatively linking implant quality to component geometry, GD&T choices, fixture designs, manufacturing variation, and surgical techniques. We even built custom analysis code for the unique geometry and structural properties of cut bone surfaces. Our approach allowed us to optimize alignment throughout the range of motion rather than in a single, static pose.

We went on to develop a novel cut geometry that allows 30% more variation with no reduction in implant alignment or performance. The concept is being considered for FDA approval.

Our experience allowed us to consider design, manufacturing, and surgery all at the same time. We not only answered their alignment questions, we also improved their products in a way that is only possible by examining all these aspects simultaneously.

BENEFITS

- Allowed 30% more variation with no reduction in joint alignment or performance by developing a novel cut geometry.
- Quantitative comparison of multiple alignment strategies based on the implant's range of motion instead of a single, static position.
- Recommendations for preferred alignment strategies
- Customer able to use our results to develop their own analyses.
- Guidance on future designs from our best practices documentation.

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Prairiefire has 20 years of industry experience helping improve performance, quality, and fit-up through design and analysis of variation. We are 6 σ certified and have taught Sensitivity-Based Design, GD&T, and Dimensional Management to hundreds of engineers in 8 countries.