
MARQUISE
DIMOND
PROFILE DESIGN
78 TWENTY FOUR
DIMOND

LET THEM CHASE US.

In 2013, the original Dimond was first introduced to the world. We were pioneers in the re-introduction of UCI-illegal, triathlon specific bikes into the marketplace. The bike performed brilliantly in the wind tunnel and on the road, exceeding even our own high expectations.

But we couldn't stop there. We've spent the last three years learning, refining, testing and producing. We went back to the drawing board to examine our production process, the needs of our customers, and how to make a fast bike even faster.

With the introduction of the Marquise, we've taken our world class aerodynamics and improved them, while pushing the perfectly balanced ride the Dimond offers to the next level and providing enough integrated storage that a fast bike in the wind tunnel will be just as fast on race day.

The Marquise has two storage areas inside the frame, for all your nutritional and tool carrying needs. By adjusting geometry in the bottom bracket region and developing an entirely new layup process, we were able to improve stiffness where it counts, leading to increased stability and handling confidence and improved power transfer through the chainstays.

Throughout it all, we refused to compromise on the core competencies of the original Dimond. The bike is just as easy and intuitive to build, service, and travel with. And we were able to maintain the tight yet limber ride our athletes have come to know and love, leading to long stretches in the aero position, more aggressive fits, and top shelf run splits.

Our goal with the Marquise was to build the *fastest bike on race day.*

Throughout the development cycle, we made multiple trips to the wind tunnel to test design concepts produced with various rapid prototyping techniques, then finally to validate the production design. From the start of the project, we knew integrating storage into the frame would be crucial, and that we could use these additional design elements to improve aerodynamics.

After many months of design work, long days in the wind tunnel and long nights building parts, we were able to wring some more drag out of the frame while adding three storage areas. Data was collected from both the A2 Wind Tunnel and ARC tunnel in Indianapolis, IN.

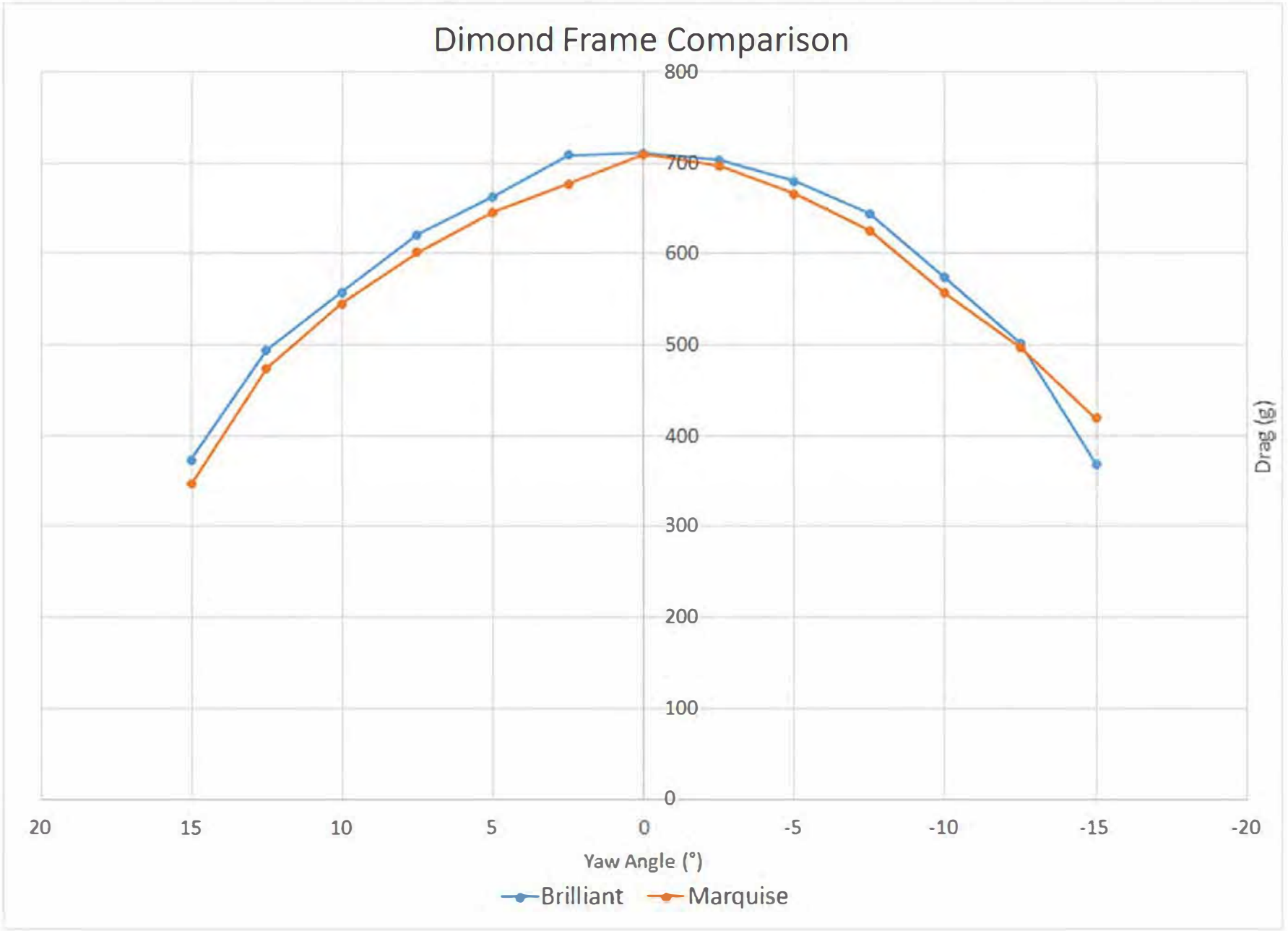


Figure 1: Drag comparison of Dimond Marquise and Dimond Brilliant without rider

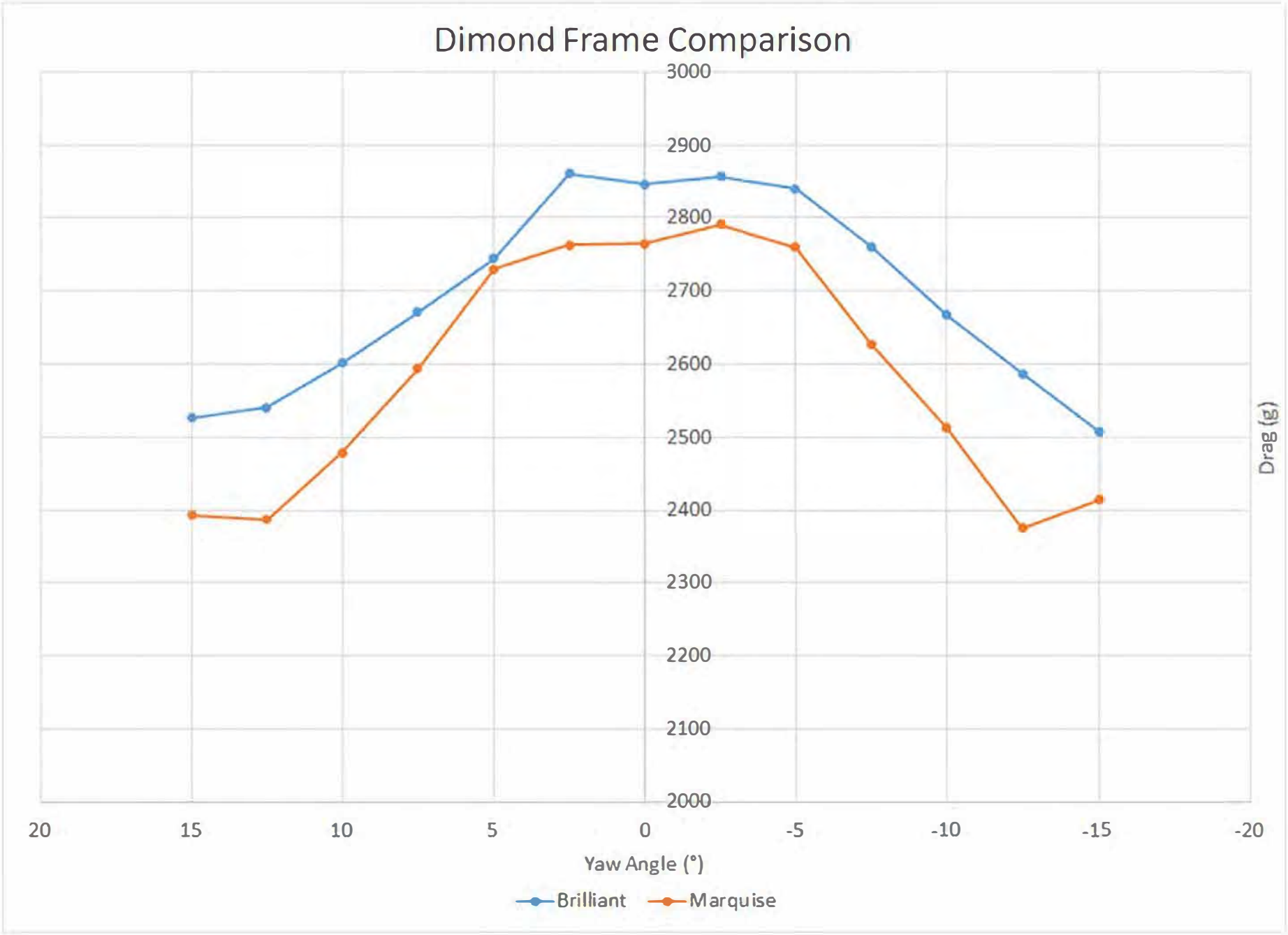
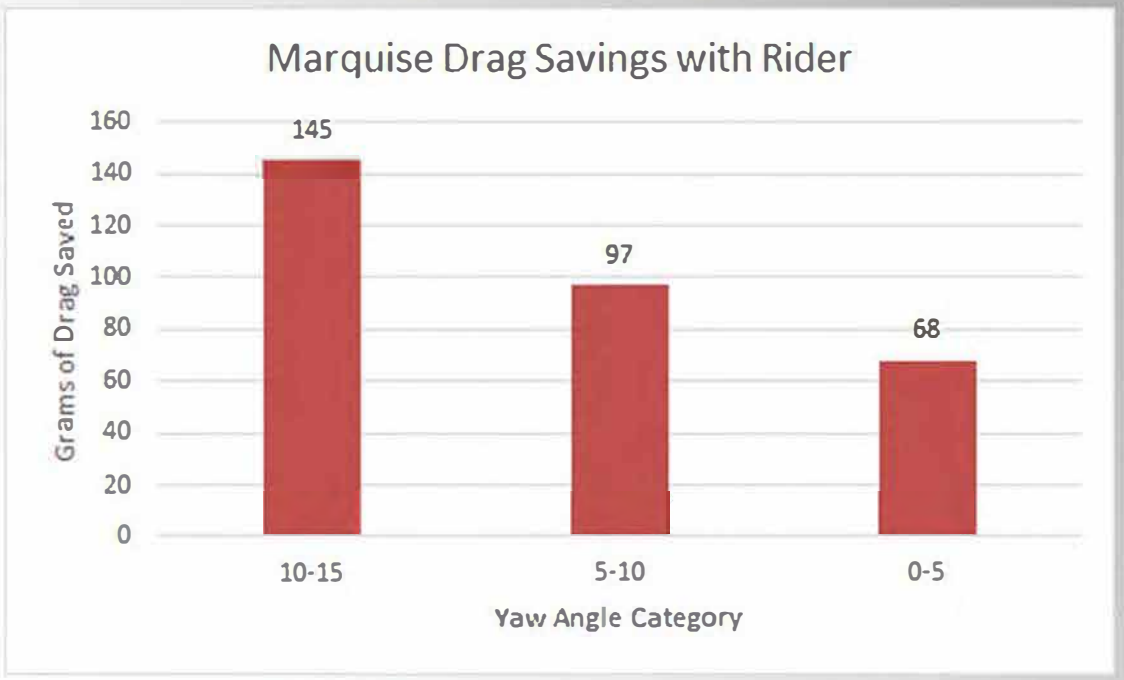


Figure 2: Comparison of Marquise and Brilliant with rider aboard



How did we make a fast bike even faster?

By optomizing frame aerodynamics to interact with a rider, we were able to save an average of 100g of drag across the yaw sweep, a significant amount by any measure.

Major gains were seen by adding the storage compartment and at the same time, adjusting the airfoil shapes around the crank. The crank arms and rider's feet are moving at a relatively high speed in close proximity to the frame, and the front derailleur, which inevitably causes high turbulence in the flow. With the addition of the TOTES, we were able to provide a smoother transition to the flow over the rear wheel. Moving the front of the beam up towards the stem also offered aerodynamic advantages and made room for more storage in the beam. Reworking the chainstay shape helped push more air in the right directions as well.

Both frames were tested with the standard factory build, with the exception of the wheels. The same set of Zipp 808 FC front and Zipp Super9 were used for all tests. For both rider on and frame only testing, the bikes were set up in the same position as closely as possible, with fit parameters including saddle height and set back, pad stack, reach and width, and extension length. Finitely adjustable parameters were set within a 5 mm range, and infinitely adjustable parameters were set to +/- 1 mm. The rider was a live pedaling model, professional triathlete TJ Tollakson, and care was taken to ensure the position was as close as possible between runs. But as with any test with a human involved, there is potential for error. In order to mitigate this effect as much as possible, the rider was given feedback before the run to set the position, then was able to view his position at multiple points throughout the test to ensure the position was as similar as possible. Data from frame only results published above were collected at the A2 tunnel, and rider-on results were from the ARC tunnel.

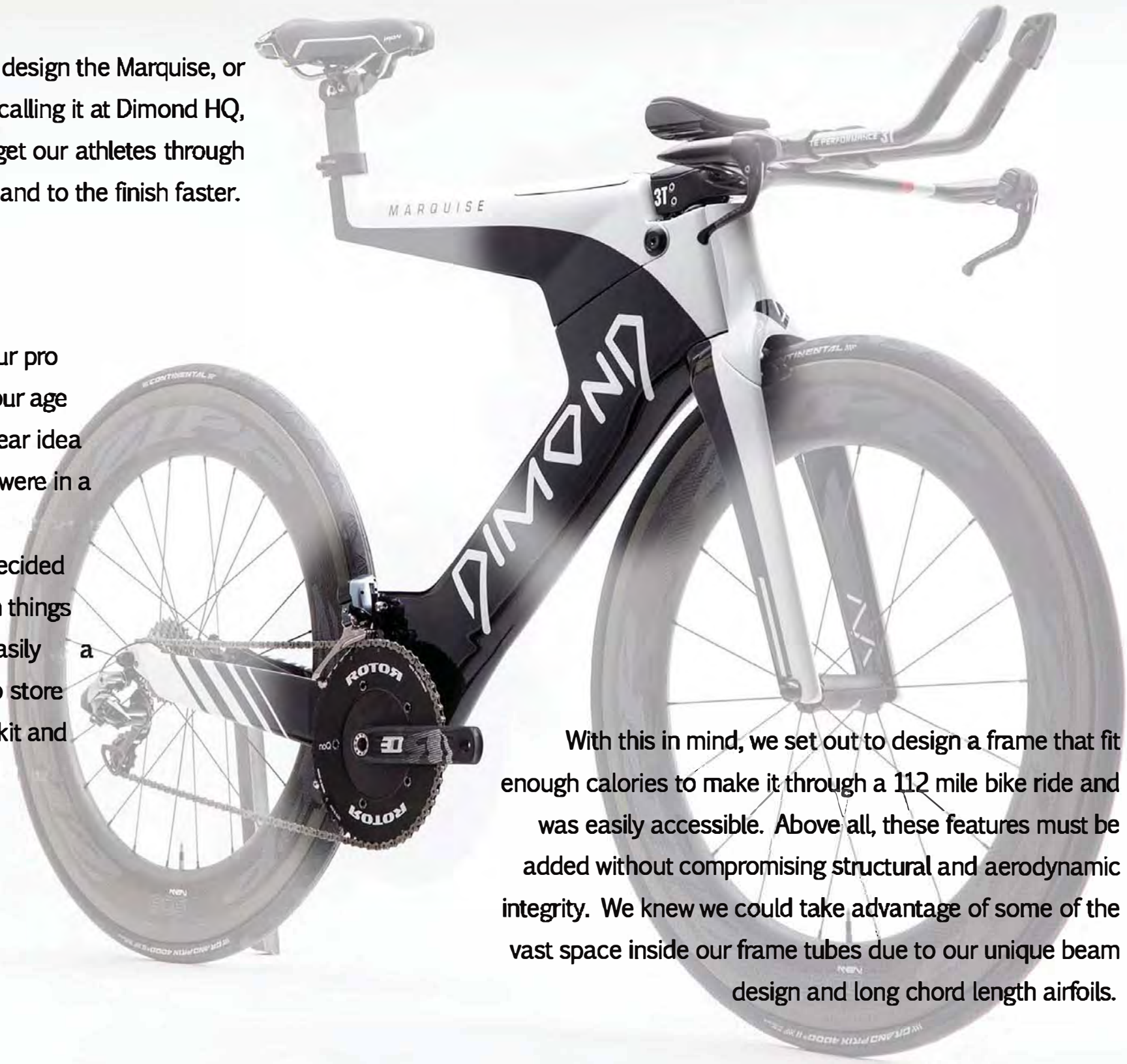
Overlay of rider position

Brilliant testing

Marquise testing

When we set out to design the Marquise, or Q as we've taken to calling it at Dimond HQ, our end goal was to get our athletes through the bike course and to the finish faster.

We sat down with our pro athletes as well as our age groupers to get a clear idea of what their needs were in a race. After much consideration, we decided there were two main things triathlete needed: easily accessible places to store nutrition, and a flat kit and tool storage area.



With this in mind, we set out to design a frame that fit enough calories to make it through a 112 mile bike ride and was easily accessible. Above all, these features must be added without compromising structural and aerodynamic integrity. We knew we could take advantage of some of the vast space inside our frame tubes due to our unique beam design and long chord length airfoils.

LUNCHBOX

The Dimond Marquise utilizes three independent and brand new storage systems. The beam offers a lid into a massive world of storage potential, called the Lunchbox. Inside is an easily accessible and cavernous 700mL of dry storage that can easily fit 1500 calories. In comparison, today's most popular bento boxes store somewhere between 200 and 400 mL. The pop up magnetic latch on the Lunchbox allows complete access into the inside of the box. This eliminates endlessly jamming your hand into a tiny, dark space and searching for that gel you've been dreaming about.

TOOLS OR TECHNICAL EQUIPMENT STORAGE (TOTES)

This storage area is molded directly into the frame in the lower portion of the bike just above the crank. It is designed to hold a flat kit and multi tool, as well as anything else you might need while stopped on the side of the road. Instead of cramming every last emergency tool possible into your kit, free yourself up and place these items into the TOTES. This system allows for riders to be prepared and safe without compromise. With the TOTES system, you can have everything you need to get back on the road quickly.

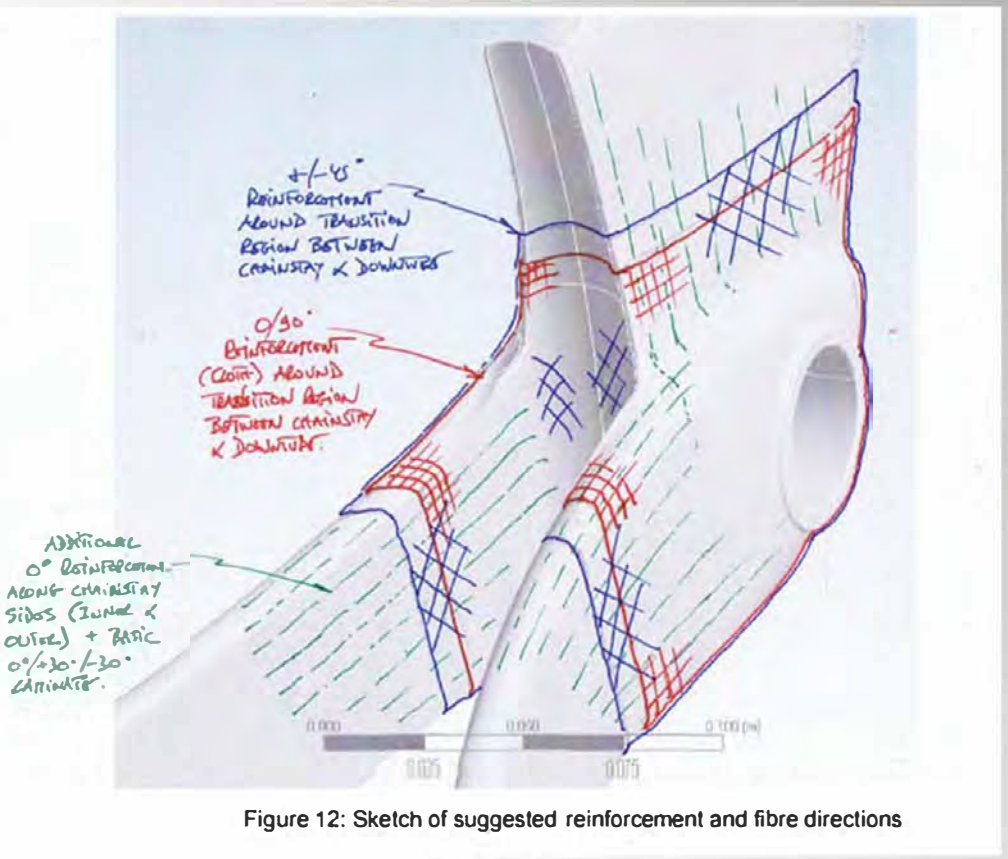


Figure 12: Sketch of suggested reinforcement and fibre directions

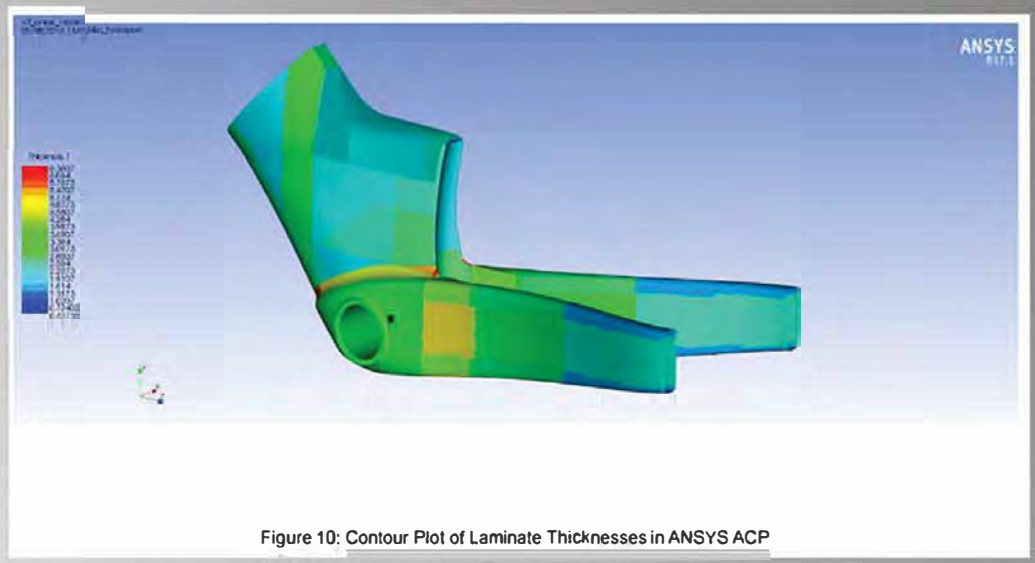


Figure 10: Contour Plot of Laminate Thicknesses in ANSYS ACP

While building first generation of Dimonds, we were in relatively uncharted territory. Building a carbon fiber beam bike hadn't been done in almost two decades. When building the Marquise, we were the world's leading experts in beam bike technology. We knew how they behaved in the lab and in the real world. We knew the areas that caused problems, and we knew exactly what the load paths looked like. We were also able to consult with STRUCTeam, a UK based composites consultant, to do extensive FEA analysis on our layup and work to not only qualify its strength, but optimize it as well. After several layup iterations, we were able to make an even stronger bike with an integrated storage compartment.