The Leading Edge

2024 Factor OSTRO VAM
Launch Book

Never.™
Status.
Quo.

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EXECUTIVE SUMMARY

We are cyclists ignited by a passion for our sport.
We are relentless engineers constantly raising the bar and redefining performance.
We are a proud and meticulous manufacturer and masters of carbon.

We are Never Status Quo.

The OSTRO VAM is the manifestation of our story: the pursuit of the bike that sets the standard. Attributes that are seemingly opposed – aerodynamics, lightness, stiffness, comfort – are brought together in cohesion. More than any other model, the OSTRO VAM represents everything that Factor Bikes stands for.

The second incarnation of the OSTRO VAM is driven by the same pursuit as its predecessor: harmony and excellence of both design and engineering. It's designed by riders, developed with science, manufactured in our own factory, and chosen by those who demand the best.

THE MODERN RACE BIKE

It's 2024. The fastest bikes are no longer the product of robotic optimization and a collection of individual, airfoil shaped tubes. Our take on the modern race bike is a carefully crafted system that precisely manages airflow over the entire length of the bike.

Although we have heavily focused on aerodynamic gains, we never lost sight of the need for precision handling in the sprints, comfort on the long, unforgiving roads, and pinpoint weight management to conquer the mountains. We wanted the soul of the OSTRO VAM completely preserved… only this time, faster.

FRONT-TO-BACK DEVELOPMENT

Our approach to the aerodynamic development was to learn how the bike's shape could steer the air favorably around the rider. The leading edge of the bike has the greatest impact on flow behavior for two reasons. One, because it meets the cleanest airflow. And two, because it can be made to manage the air for all elements of the bike that follow. Starting with this concept, we focused on the front of the bike and worked backwards.

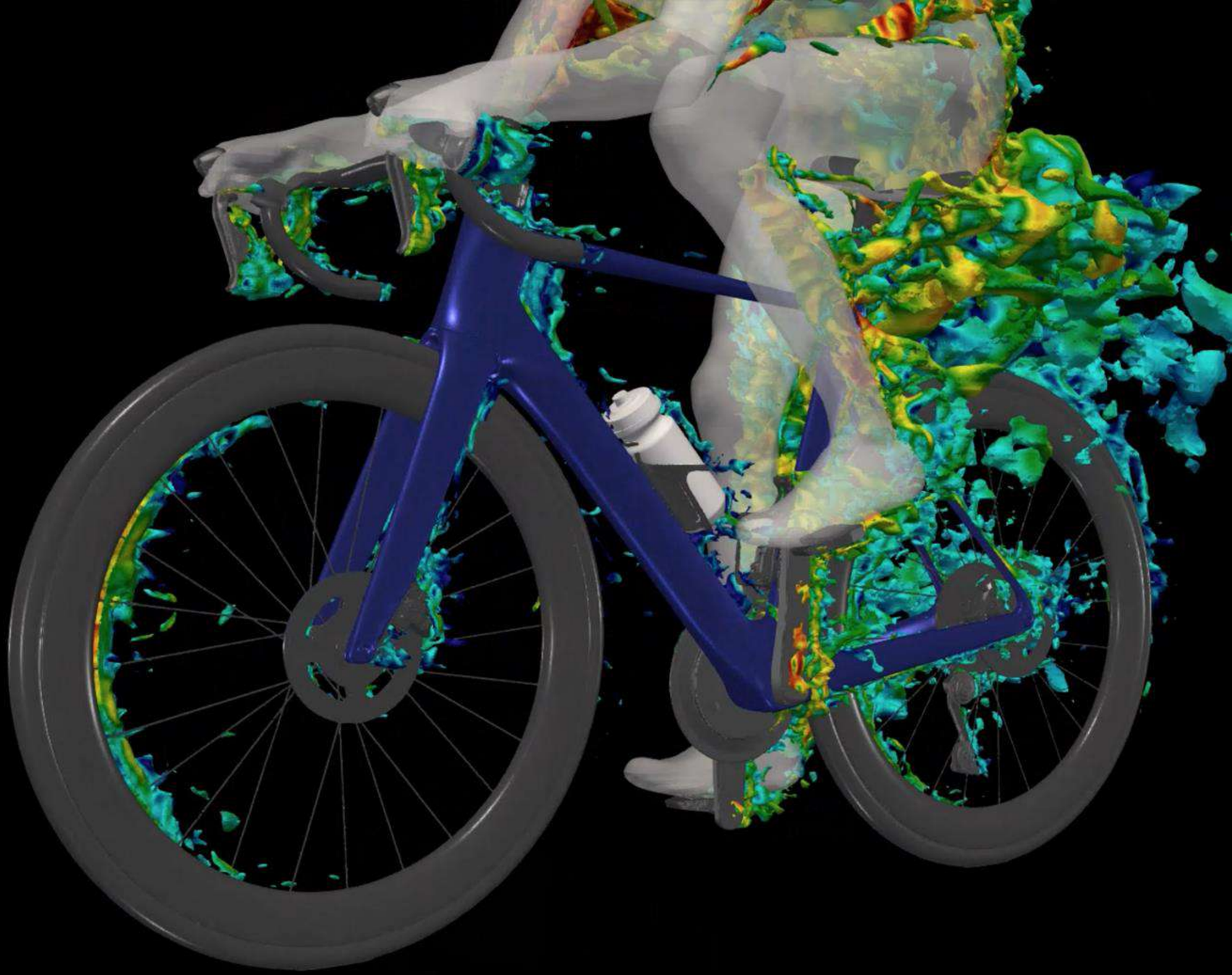
Improvements in aerodynamics at the front have a cascading effect on the elements at the rear – both positive and negative. The goal is to capture the positive gains and propagate them downstream. In some cases, changes made in the middle of the bike even influenced the drag generated upstream. For this reason, we continually reassessed the front as we worked our way rearward.

INCREMENTAL RAPID GAINS

Using advanced aerodynamic principles, the development team conceived a set of focused concepts, then employed a method of rapid iteration and dynamic simulation for each to determine the best combination of shapes. This led to 111 separate simulation runs to evaluate the effect of every change both upstream and downstream.

Design ideas were assessed in three ways: in isolation; as part of a complete bike; and dynamically with moving components and a pedalling rider.

3D visualizations were generated so that the airflow could be assessed not only in-plane but across the entire 3D space. This state-of-the-art flow analysis provided greatly enhanced understanding of the complex relationships between elements of the frame and allowed for a much deeper design optimization.



Design / Development

OPTIMIZING THE RIDE

Aero targets were established based on the zonal impact to ride characteristics. For example, in Zone 1 - the fork - we would only accept an aerodynamic gain if it could be achieved without compromising weight and stiffness. There was no scenario where one ride characteristic was improved at the expense of another.

Zonal Optimization Targets

	Aerodynamics	Weight	Stiffness
ZONE 1	▲▲	•	•
ZONE 2	▲▲▲	▼	•
ZONE 3	▲	▼	•
ZONE 4	▲▲▲	▼▼	•
ZONE 5	•	•	•

ZONE 1

▲▲	•	•

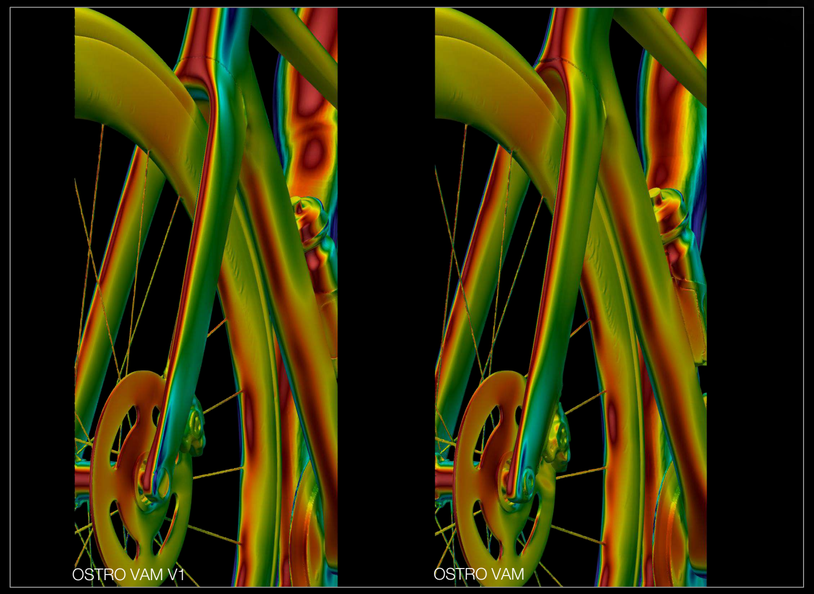
Aerodynamics / As a major part of the bike's leading edge, the fork has a large impact on the aerodynamics of the whole system. We looked to reduce drag by minimizing the frontal area and increasing the shape's efficiency. This included an exploration of flow management around the crown and down tube junctions to better work with larger tires. We also found gains from the synergies between surrounding components, such as the brake caliper mount and axles. This led to localized gains and more predictable flow into the zones downstream.

Weight / A reduced fork crown height coupled with the lower frontal area decreased the overall surface area of the fork, allowing us to place material in areas that would improve stiffness and ride feel while maintaining the same weight.

Stiffness / Ride feel and responsiveness are hallmarks of the OSTRO VAM. It was critical to maintain the point-and-shoot responsiveness of the front-end while also improving on the aerodynamics.

ZONE 1

Extending the leading edge of the head tube enabled us to move the leading edge of the fork forward. A smoother transition with the head tube allowed us to fine tune the frontal area and reduce not only the size but the downstream impact of the flow as it was tucked in closer to the bike. Very small surface details were added to the inside of the fork legs to promote better airflow next to the rotating wheel. The dropout and brake mount surfaces were meticulously modelled to manipulate the moving air from the axle. These details add up to create significant aerodynamic gains.



A decrease of stagnation pressure (blue) is seen across the fork crown and at the dropout around the axles, this indicates that the flow remains attached to the fork longer.

ZONE 2

▲▲	▼	•

Aerodynamics / The head tube was optimized around a smaller frontal area generated by a more dramatic hourglass shape. The variable profiling allows for much longer flow attachment and therefore reduced drag. Multiple head tube profiles and sizes were simulated before landing on a shape profile that yields exceptional results at both 0-degrees and higher yaw angles.

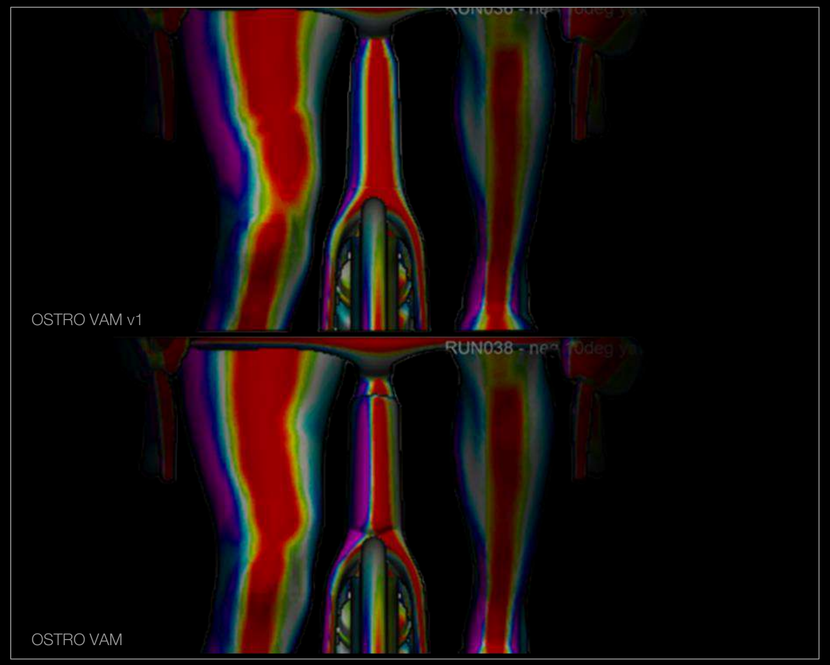
Weight / The reduction in frontal area had the knock-on effect of also reducing the amount of material in this section, resulting in some incremental weight savings. The smaller fork crown also meant a smaller frame cut-out, all the while maintaining a seamless transition between fork and frame.

Stiffness / As with the fork, this area achieved its goal of preserving the stiffness which is key to the OSTRO VAM's precise handling.

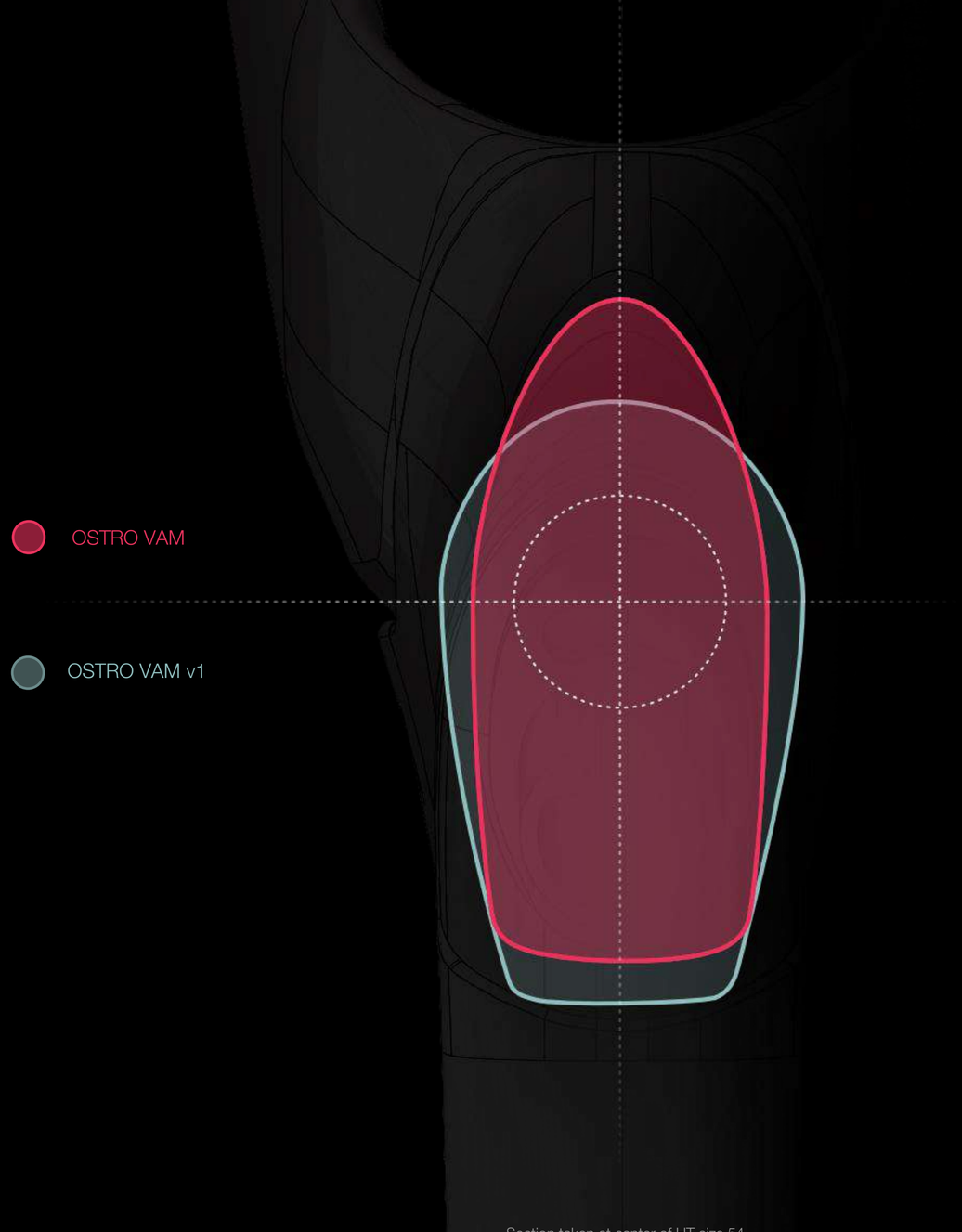
ZONE 2

The head tube profile was slimmed to reduce the impact of the frontal area on the bike's CdA and reprofiled to maintain flow attachment. The position of the leading edge of the profile was simulated at effective wind angles between 0 and 20 degrees (+/-) with a goal of steering the flow between the rider's legs and also onto the underside of the top tube, both for overall drag reduction.

The new and dramatic head tube profile meant that the trailing edge of the headtube could be brought forward while still seeing the increase in overall airfoil length needed to achieve the goal of enhanced airflow retention. This maximized the use of material, allowing for significant aero gains at no cost to weight or stiffness.



Decrease in stagnation pressure (red) and a smoother transition to lighter color indicates better flow management.



Section taken at center of HT size 54

ZONE 3

▲	▼	•

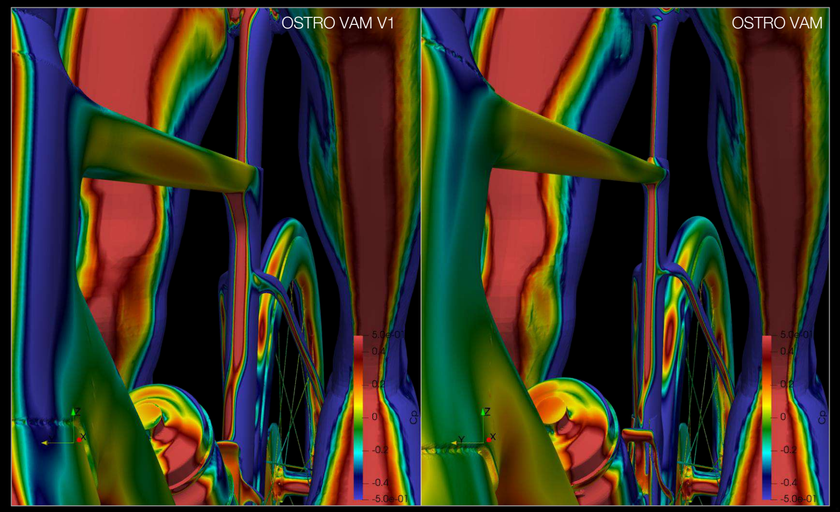
Aerodynamics / With Zone 3, the focus was capturing the smoother flow from the new head tube profile and maintaining it through to the rear of the bike. The top tube was simulated with the headtube to create an ideal scenario and mutual aerodynamic gains in both zones.

Weight / The naturally tapering top tube results in an organic reduction in the material required and a slight decrease in weight.

Stiffness / A focus on the improved surface transition for cleaner airflow also meant that the structure of the surface can dissipate loads over a greater distance, maintaining stiffness while reducing drag and weight

ZONE 3

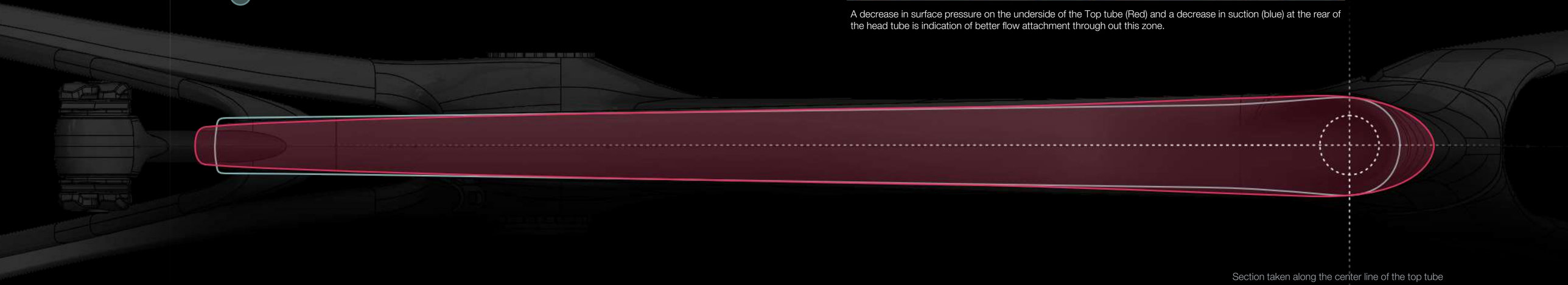
The transition from the head tube to the top tube was developed to promote flow attachment along the length of the bike. Any inflection points that would encourage the detachment of the flow were removed in favor of a long, tapering, single profile with minimal deviation of surface curvature. This was further facilitated with the downstream reduction in the seat tube size. This streamlining, coupled with the shape efficiency of the head tube, kept the airflow tight and between the rider's legs.



A decrease in surface pressure on the underside of the Top tube (Red) and a decrease in suction (blue) at the rear of the head tube is indication of better flow attachment through out this zone.

OSTRO VAM

OSTRO VAM v1



Section taken along the center line of the top tube

ZONE 4

▲▲	▼▼	•

Aerodynamics / This area was conceived and optimized under the new UCI regulations, which remove the 3:1 rule for components and reduce the minimum required tube thickness. A thinner seat post was developed, and the new seat tube shape followed. This also enabled the aggressive tapering seen on the top tube in the previous section. A significant overall drag reduction in this area was achieved.

Weight / The new shapes in this zone created a weight reduction. Additionally, the seat post clamp was changed from a wedge positioned in front of the post to a plate at the rear, reducing the amount of material needed and saving weight.

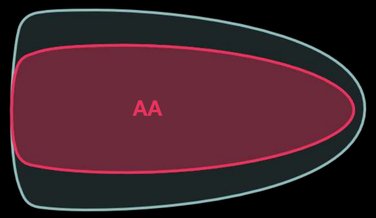
Stiffness / The objective in this zone was to maintain stiffness while greatly reducing the frontal area, and that was achieved. The lower section of the seat-tube, where it meets the bottom bracket, remains as wide as the OSTRO VAM v1. This area was a critical focus of lay-up development to counteract the reduction in bracing of the thinner upper seat-tube profile.

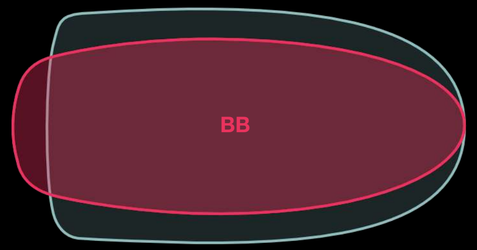
ZONE 4

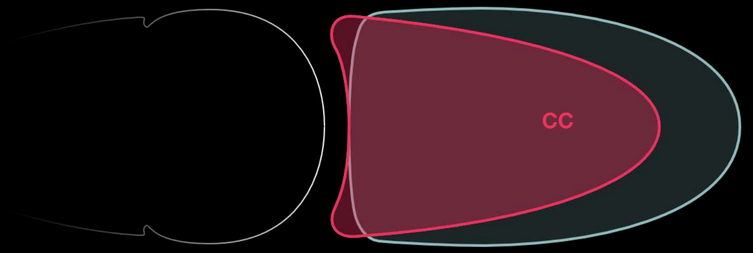
Maintain stiffness; increase aerodynamics; reduce mass

OSTRO VAM

OSTRO VAM v1





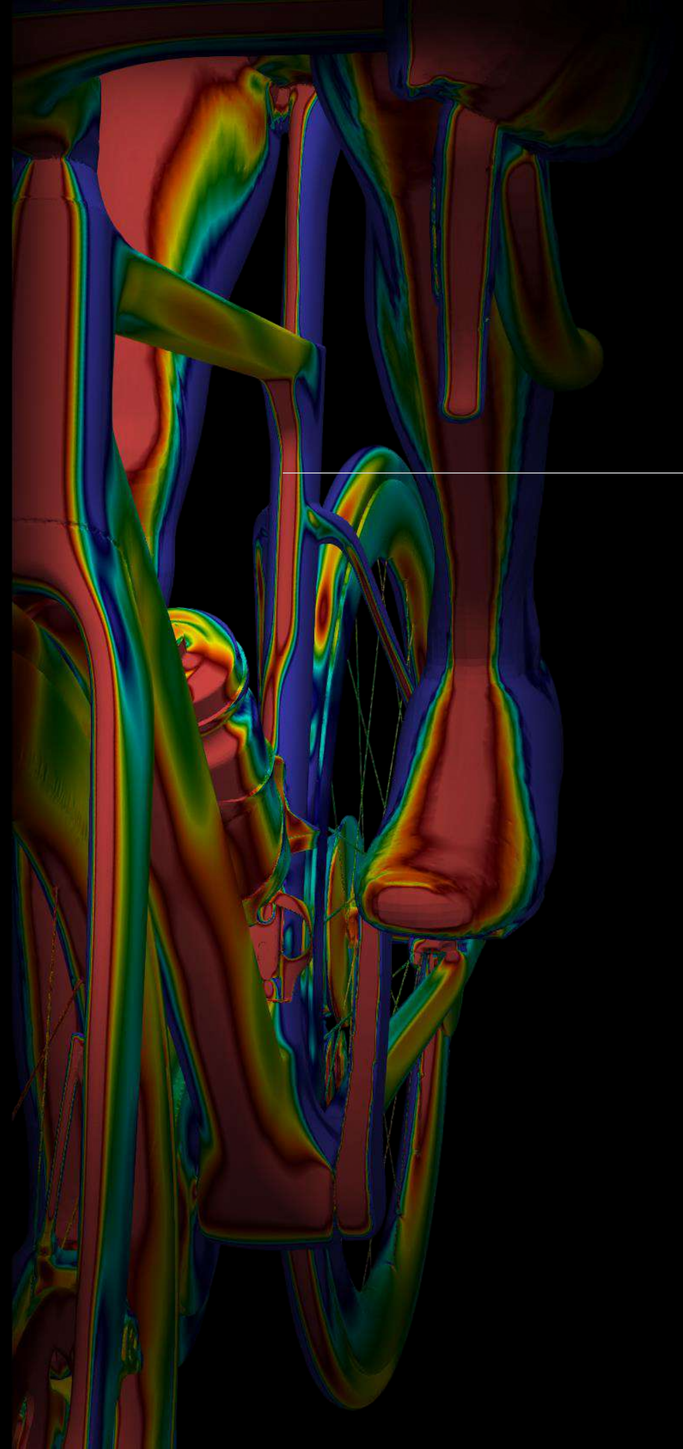


The seat post width was reduced by 36%, yielding a smaller frontal area in a zone that sees mostly turbulent flow because of the rider's legs. This reduction is possible because of the recent changes to the UCI regulations regarding minimum profile thickness.

In turn, the seat tube was reduced by 20% in width and slightly elongated to house the seat post retention plate. The design is profiled to manage the airflow created by the top tube and head tube upstream.

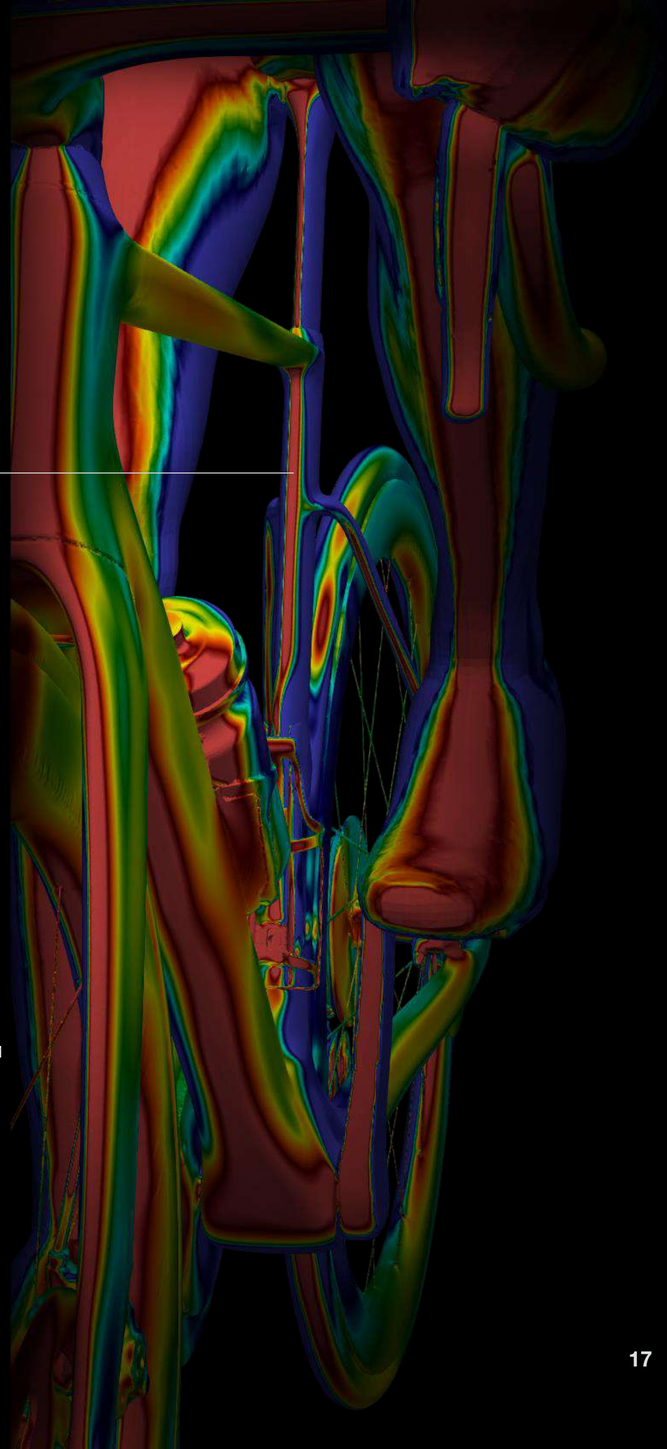
The lower section of the seat tube was shaped so that the tire and wheel complete the aerodynamic profile. This was achieved by shaping the rear of the tube to properly nest a 28mm tire and tuning the forward shape to be the leading edge of a continuous, integrated aerodynamic profile.

ZONE 4



OSTRO VAM v1

A large reduction in surface pressure (red) occurs on the leading edge of the seat tube, seat post and seat stay transitions



OSTRO VAM

ZONE 5

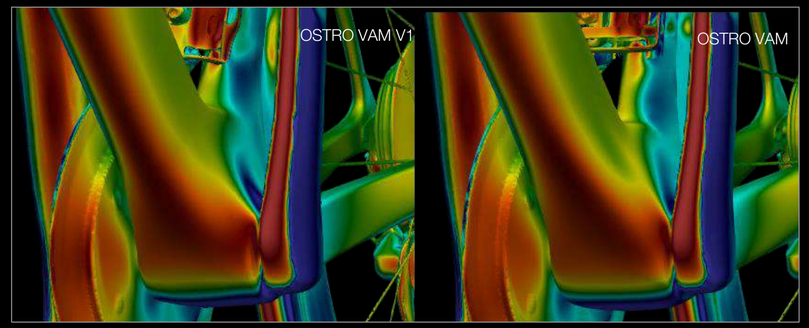
Aerodynamics / This zone received some subtle refinement in surface blending across the volume that bridges the seat tube and the down tube. Small gains in the CdA were seen through optimization of the shape.

Weight / **Stiffness** Our philosophy here was to avoid making changes for the sake of change. This was an area of zero compromise and maintaining stiffness was our priority. Great effort went into preserving the ride feel under acceleration.

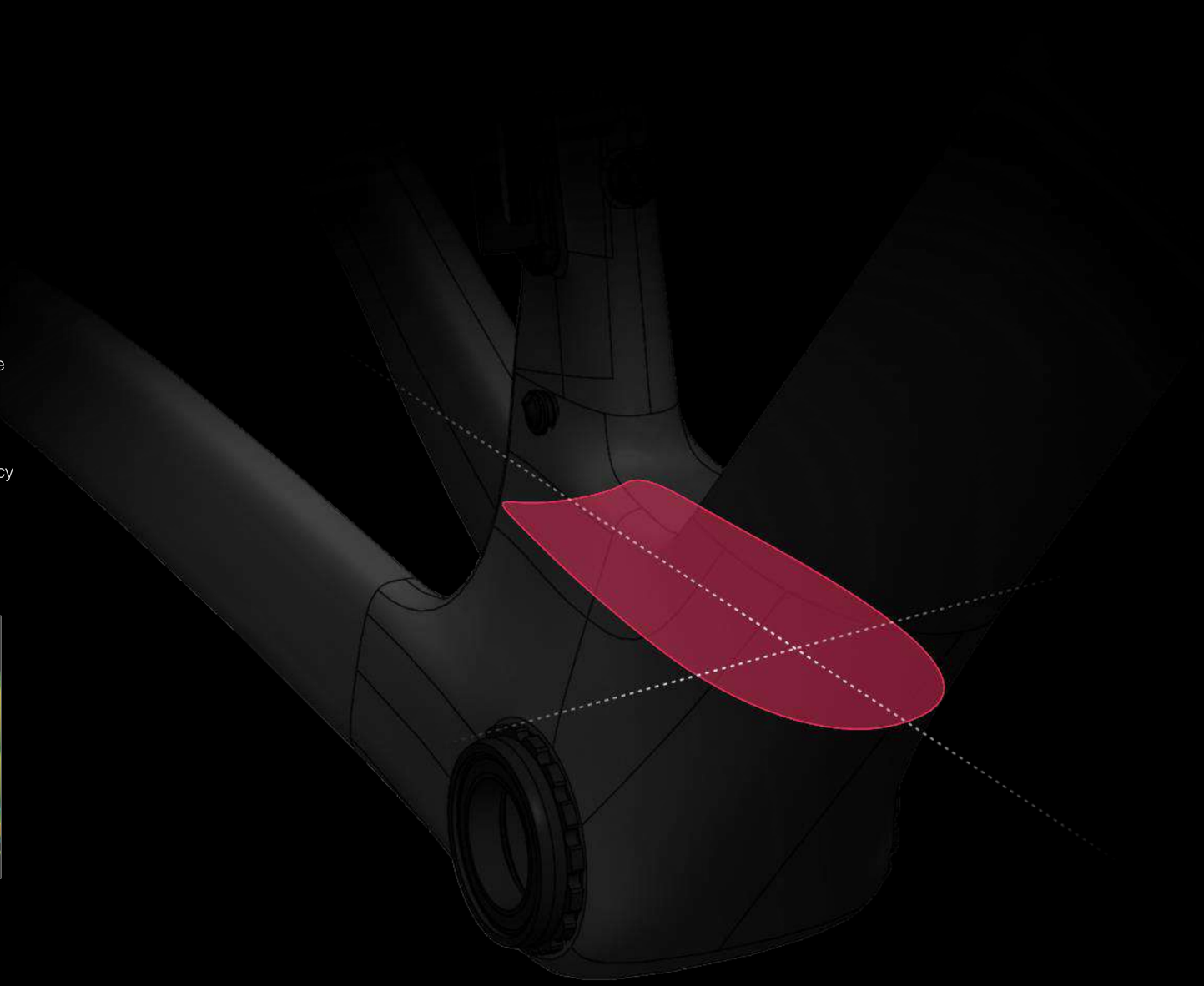
Zone 5

Width is critical for rigidity in this zone, but so are smooth surface transitions. Balancing shape efficiency and maintaining volume and rigidity are the keys to exceptional power transfer. Here, we had to manage the pedaling forces in one plane while promoting airflow retention in the other.

The area above the bottom bracket was fine-tuned to maintain the required stiffness while managing the flow and keeping it tight away from the rider's legs. Through surface optimization we were again able to slightly increase our aerodynamic efficiency in an area where that had not been expected.



Illustrates almost no noticeable changes in the BB area except a small change in the rate of the onset of suction caused by minor surface efficiency tweaks.



Black Inc

Black Inc 48/58 Wheels

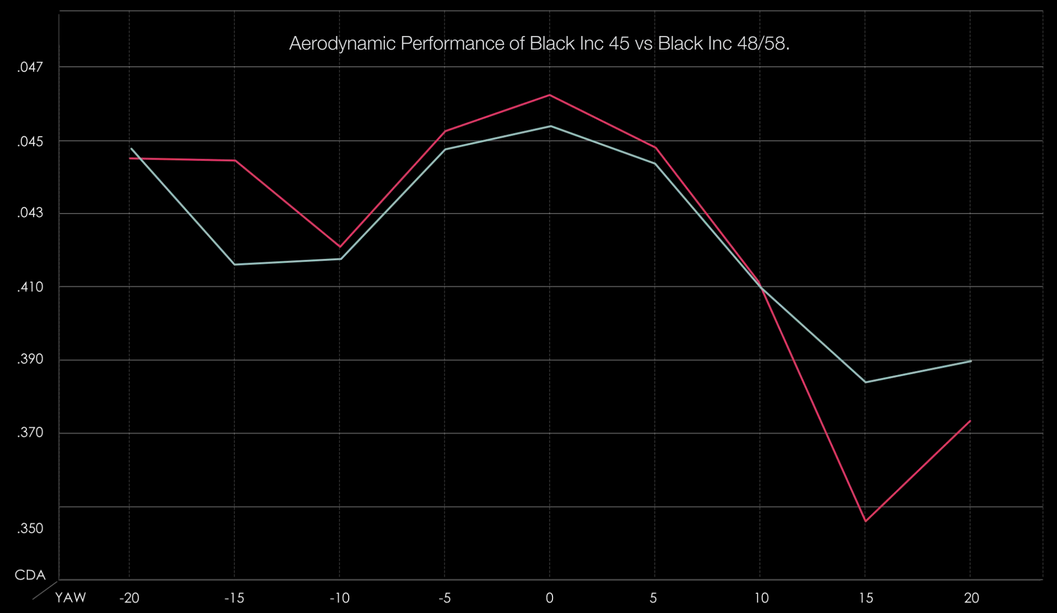
Developed alongside the OSTRO VAM, the new Black Inc 48/58 wheels have meticulously engineered, high-flange hubs, carbon spokes, an offset spoke bed for more balanced tension, and a rim profile that is optimized for 28mm tires.

At 1,270g per pair, they are the perfect complement to the OSTRO VAM – both attacking light and fast.

Black Inc 48/58 Wheels

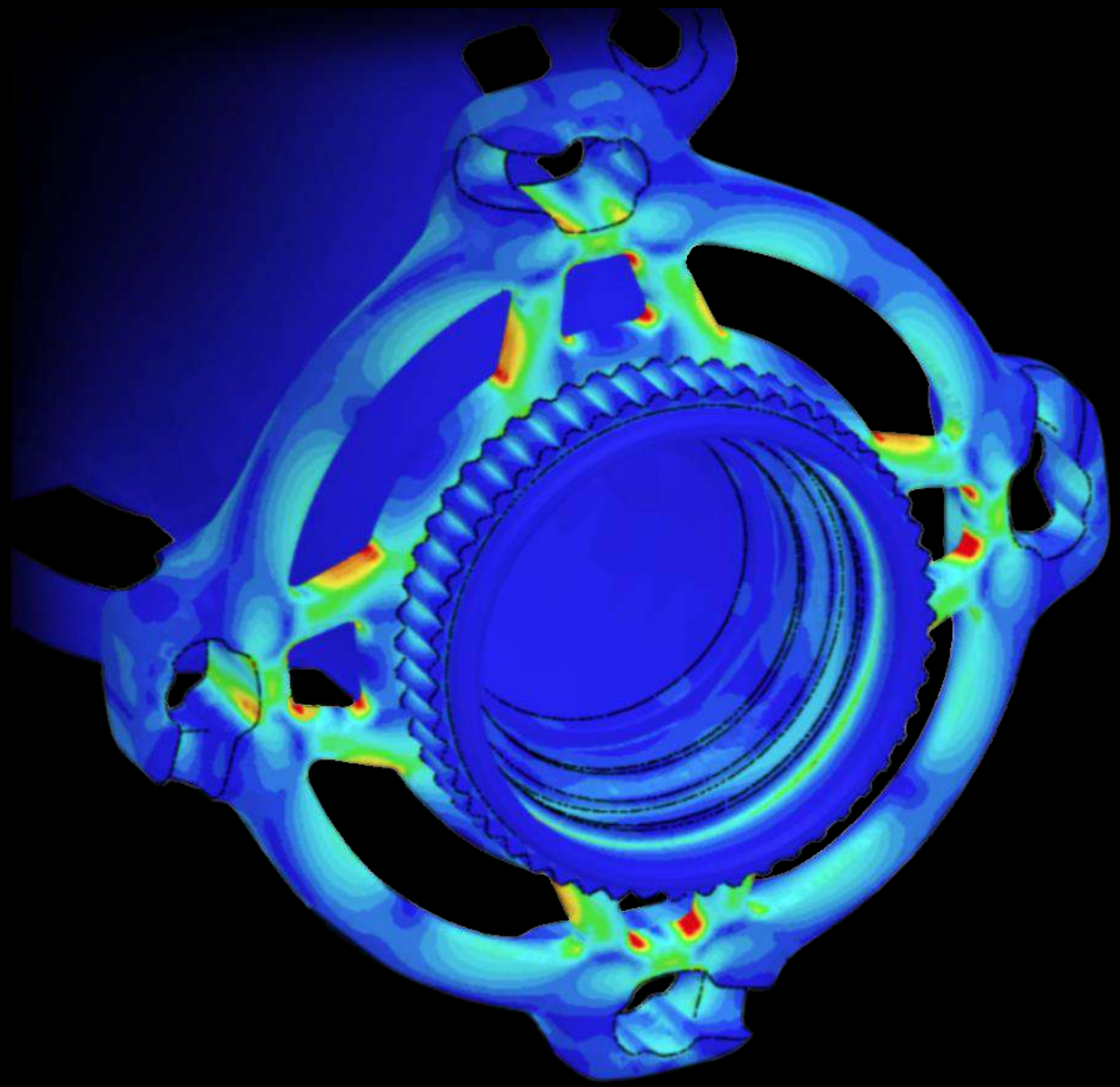
Aerodynamics We increased the leading-edge radius, creating a true airfoil shape that is optimized for 28mm tires. The increased radius creates a more gradual rate of curvature change, promoting flow attachment at larger yaw angles. In addition, the rounder profile and more-gradual change in curvature means that the aerodynamic stall onset is gentler, giving the rider a better feeling of control in gusts and strong crosswind situations.

Ultimately, the result is a set of wheels optimized for real-world wind conditions rather than a 0-degree simulation.



Black Inc 45 pair

Black Inc 48/58 pair



Black Inc 48/58 Wheels

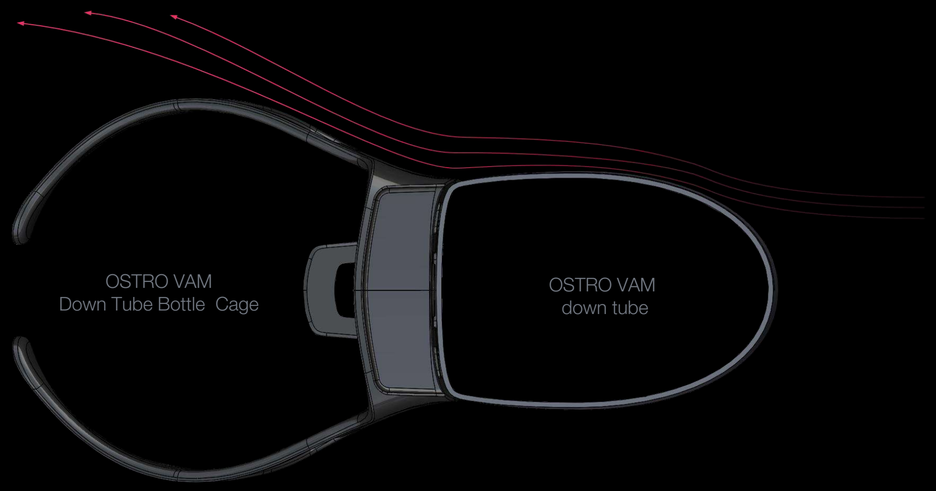
A high flange hub increases the bracing angle of the spokes. This improves both the ride feel and the lateral stiffness of the wheel. The flange shape was extensively developed to handle the required loads while also dramatically reducing the overall weight of the wheelset.

The result is a unique wheel, optimized for 28mm tires. It's strong, light, and aerodynamic, and feels confident in windy conditions.

Black Inc OSTRO VAM Down Tube Bottle Cage

This down tube-specific bottle cage is designed to subtly bridge the gap that is created between the OSTRO VAM's down tube and the bottle. It promotes longer flow attachment and reduces localized drag that would otherwise be created by the gap.

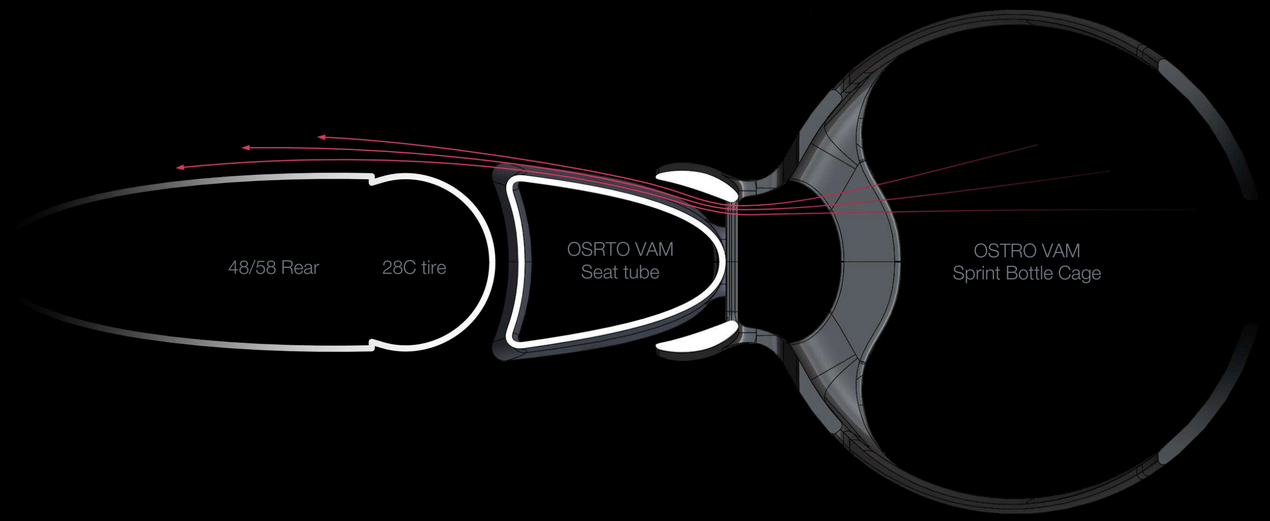
The water bottle cage is dedicated and optimized to the new OSTRO VAM. The drag reduction is small but measurable, both with and without a bottle present.



Black Inc OSTRO VAM Sprint Bottle Cage

The OSTRO VAM Sprint Bottle Cage applies a different aerodynamic approach by acting as a high-speed flow management device.

This OSTRO VAM-specific bottle cage is designed to be most aerodynamically functional when a racer discards their bottles before the final sprint. Without a bottle in place, the shape of the cage acts like the leading-edge slats found on light aircraft. The foil profiles and precise spacing with the seat tube act to funnel air very tightly across the seat tube and transition it to the rear wheel.



Results

BY THE NUMBERS

7

Watts of power conserved vs the OSTRO VAM v1

267.8

Grams saved vs the OSTRO VAM v1 (premium package with wheels)

2:21

+ Additional time advantage (min and sec) Michael Woods would have had aboard the OSTRO VAM on his Stage 9 victory at the 2023 Tour de France.

<6.8

Weight in Kg That is effortlessly achievable when building up your OSTRO VAM.

SIMULATION RESULTS

Coefficient of Aerodynamic drag (CdA) is the value that we use to measure efficiency through the air. CdA is independent of airflow velocity. Whereas drag force (Newtons) and drag power (Watts) are highly dependent on flow velocities, CdA is stable and defines the drag seen by every cyclist. In the equation, Cd represents coefficient of drag, while the A is the projected frontal surface area.

Like developing front-to-back, the increased value of drag is accumulated as the air flows over the bike. The cumulative impact of the drag on the CdA can be seen in the first graph and the individual impact of each of the zones can be seen in the graph below.

Ultimately, the reduction in CdA was measured at .0055 when averaged over simulations done at all yaw angles. This equates to around 0.3kph on flat terrain, or a gain of 0.6 sec/km over the OSTRO VAM v1. Translating the results to power, this is a saving of 7 watts at 48kph.

OSTRO VAM

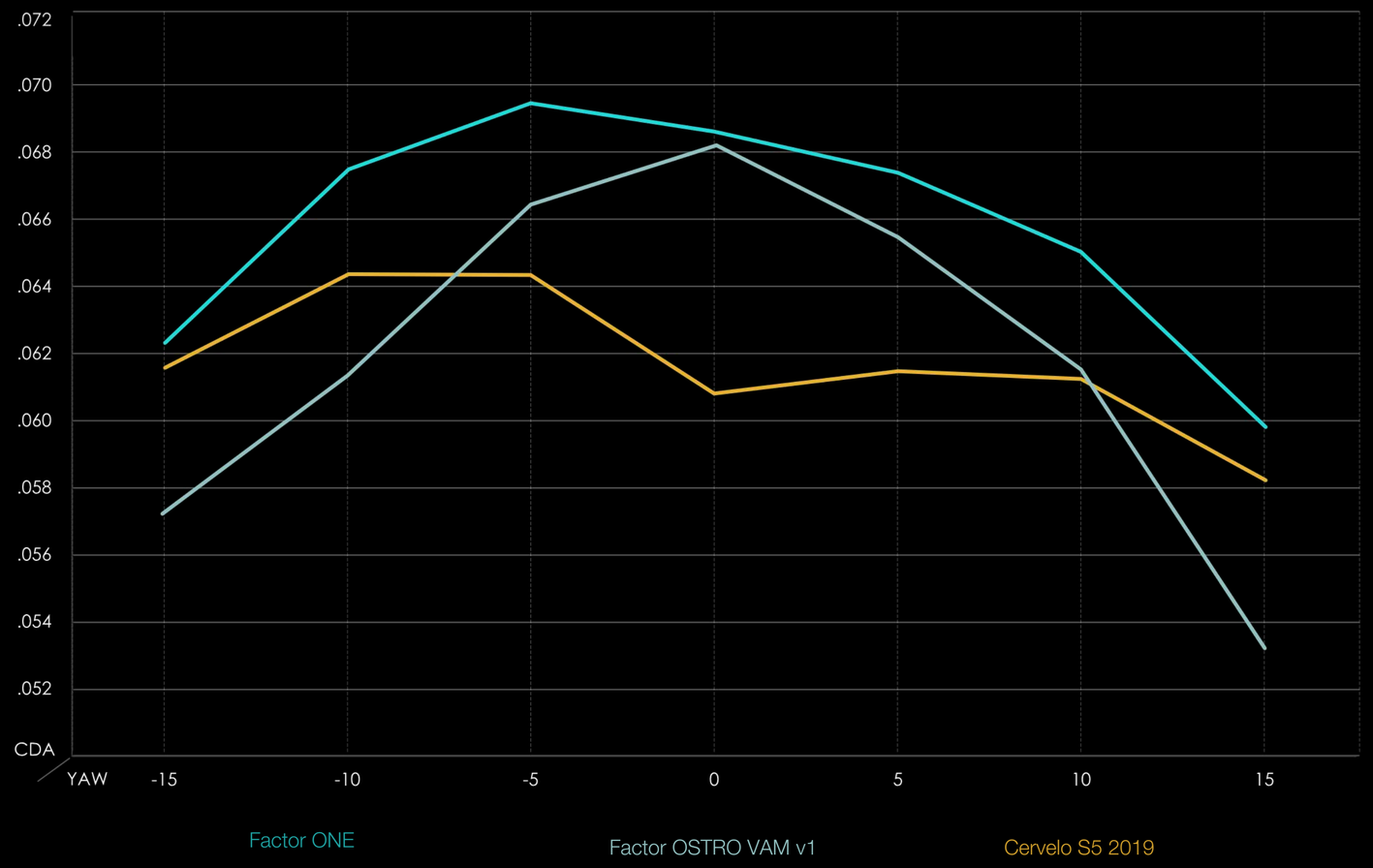
OSTRO VAM v1

GENERATIONS OF FAST

Let's go back. The definition of ‘aero’ during the inception of the OSTRO VAM v1 was straight-line aero efficiency and compromised weight was accepted. The goal of our first incarnation of the OSTRO VAM v1 was to match the benchmark aero bike of the time while attempting to be significantly lighter.

At this time, our then flagship aero bike, the Factor ONE, was a valuable benchmark as it was grouped amongst the fastest bikes of its time.

The OSTRO VAM v1 was a significant improvement over the Factor ONE and a worthy competitor to the Cervelo S5. While the S5 was extremely quick at 0-degrees, the OSTRO VAM v1 was superior at larger yaw angles. The OSTRO VAM v1 was only marginally behind the 2019 S5 on average across a full sweep of angles, with a net performance gain of 6% over the ONE. What’s more, it only trailed the S5 by 0.5% while being over a kilogram lighter as a frame, fork, and barstem system.



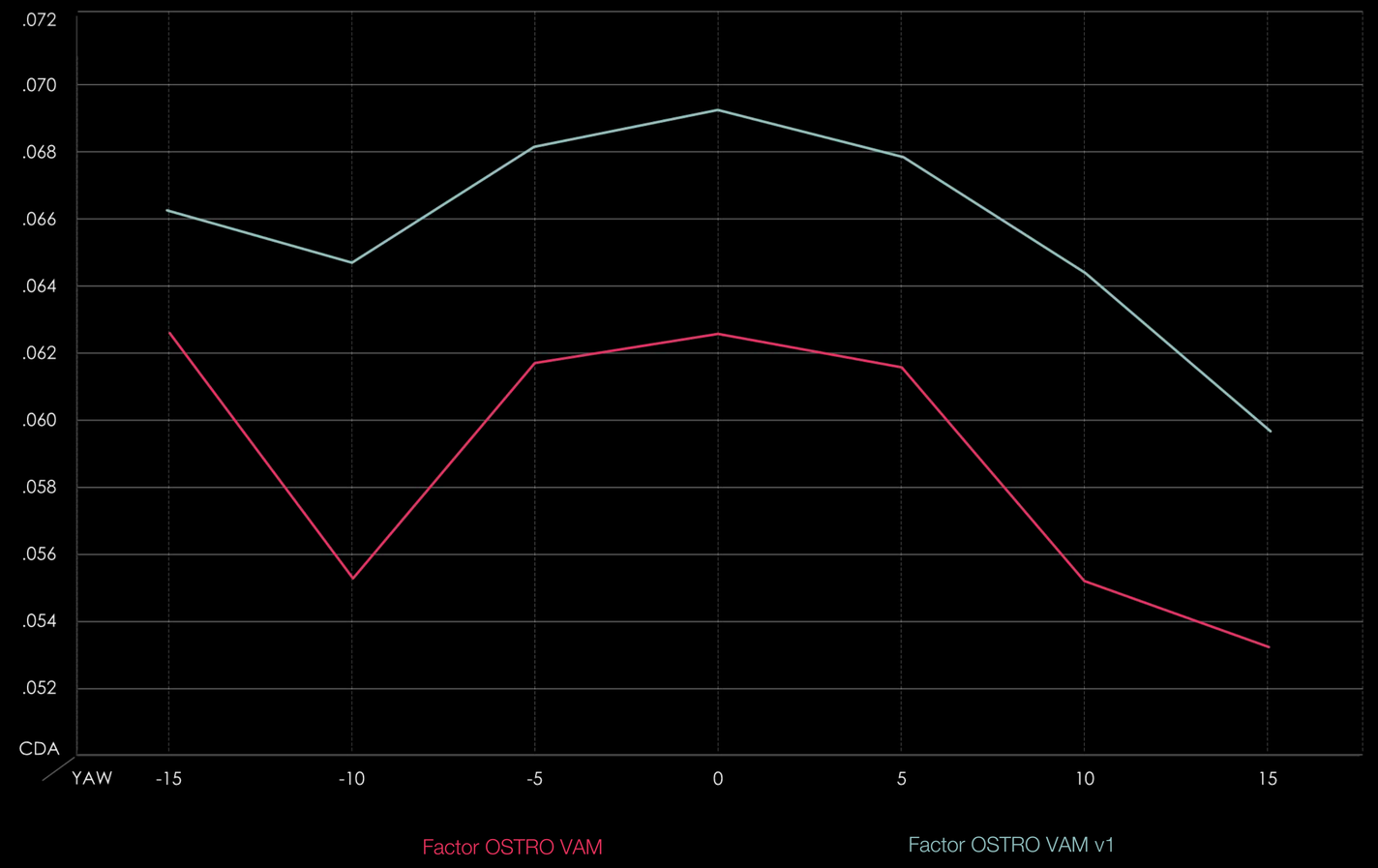
Baseline setup was Black Inc 60 wheels / GP5000TL 25mm tires /11s Di2 was all parts normalized where not integrated with the corresponding frameset.

THE NEXT GENERATION

The OSTRO VAM represents another generational leap in our approach to creating aerodynamic superiority.

In the wind tunnel, we have achieved a net gain of 10% on aerodynamic efficiency, with all variables controlled and normalized.

This is, on average, a 70-gram reduction in drag versus the OSTRO VAM v1, which equates to 7W at 48kph. Crucially, this figure corresponds exactly with our simulation data. In addition, the aerodynamic benefit increases as yaw angles become closer to real world expectations (5-10 degrees).



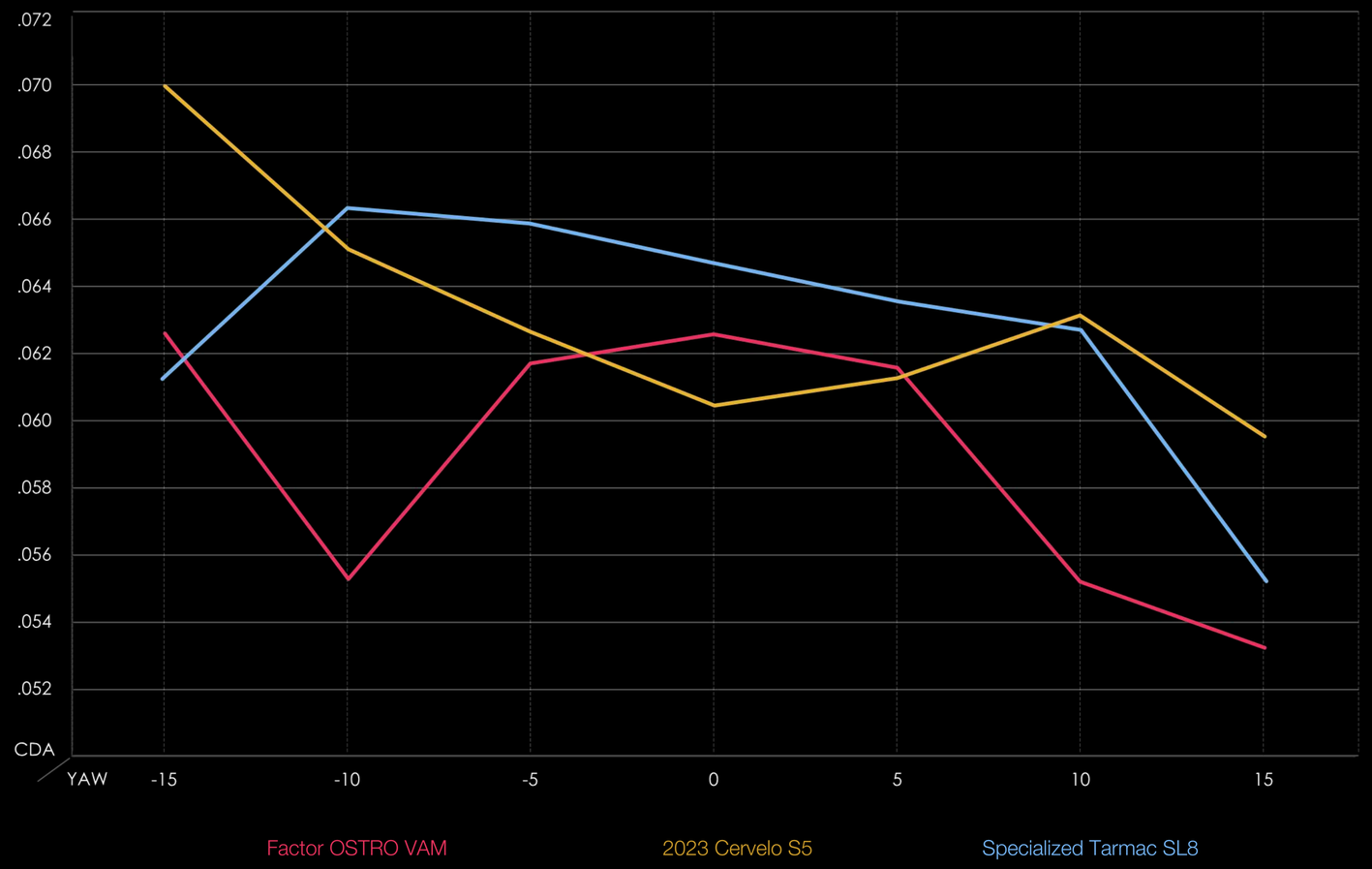
Baseline setup was with Black Inc 48/58 wheels/ GP5000TL tubeless 28mm tires /12s Shimano Di2 and .a black inc aero barstem 110mm x 42cm

WIND TUNNEL VALIDATION

As-sold versions of the competition were used with normalized drivetrain options across all models. Tests were conducted using the stock wheels and peripheral components, including tires from the corresponding companies.

While the S5 excels in 0-degree scenarios, the OSTRO VAM is significantly faster once yaw angles approach 5 degrees and the margin increases dramatically up to 10 degrees.

Averaged results across all yaw angles show the OSTRO VAM to now be the benchmark aerodynamic, lightweight race bike. While the OSTRO VAM bests the S5 by 6% across the averaged yaw sweep, the SL8 almost matches the S5 due to deeper wheels, narrower tires, and a deeper bar. The OSTRO VAM bests the SL8 as sold across the yaw sweep by 6.8%.

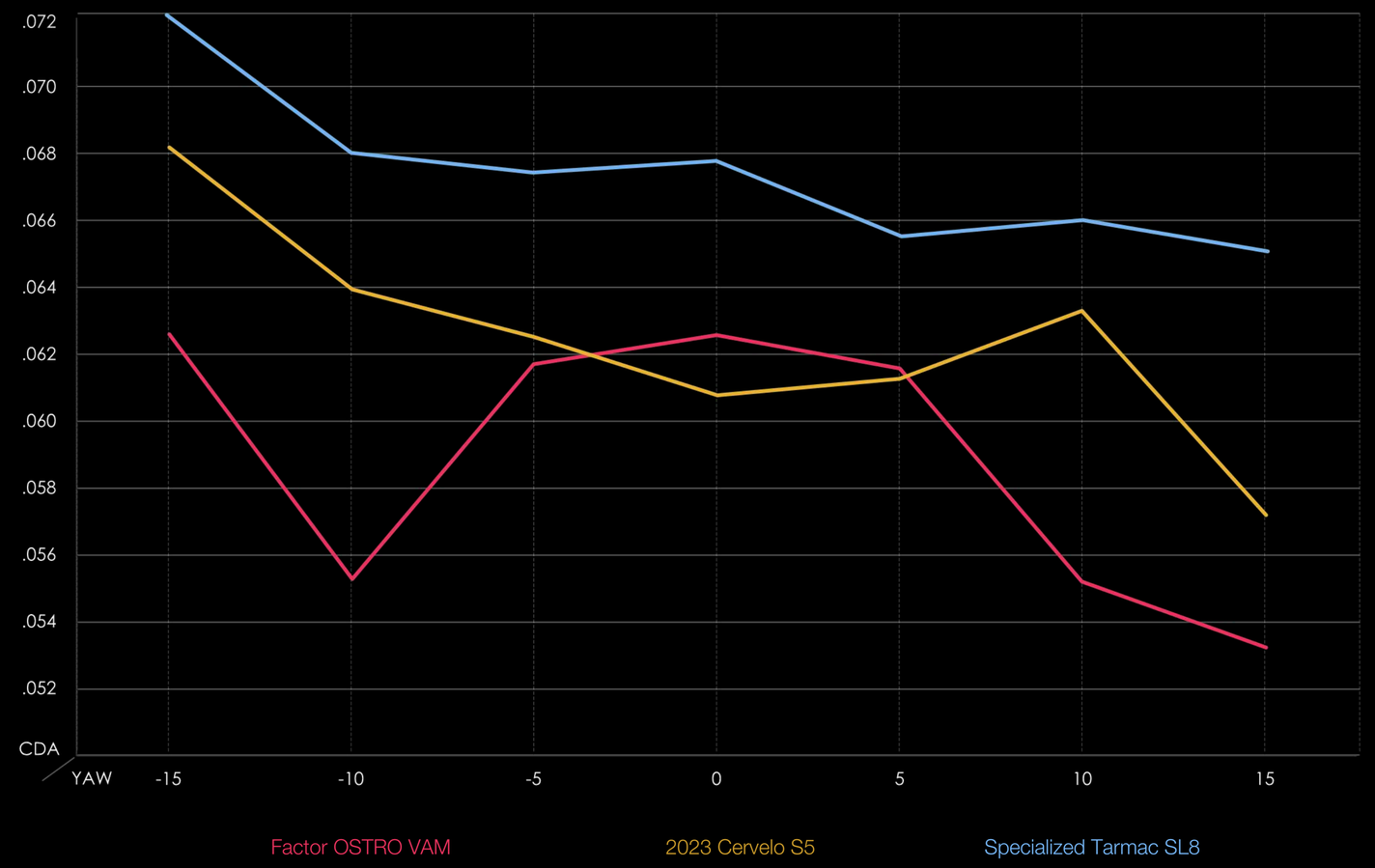


Stoclk size 54 cm complete bikes were used with as-sold options for components and wheels. Shimano Di2 models were used to compare.

NORMALIZED VALIDATION

We compared the competition with normalized components to isolate the impact of the frame and wheels. In this scenario all bikes were outfitted with the same tires and Black Inc 48/58 wheels. We swapped the SL8 to the Black Inc Aero Barstem, though this was not possible on the S5 owing to its design.

When normalized, much of the performance variations are removed and the individual aerodynamic performance becomes more evident.



WEIGHT TABLE

The new OSTRO VAM Premium Package is 7% lighter than the previous generation. With the new Black Inc 48/58 wheels, you save an incredible 267.8 gr. versus the OSTRO VAM v1 with Black Inc 45 wheels.

	Factor OSTRO VAM	Factor OSTRO VAM v1	△
*Frame	820	865.2	-45.2
*Fork	463	454	+ 9
Seat Post with hardware	168.6	182	-13.4
Small parts	268.4	267.6	+ 0.8
Black Inc Aero Barstem (110x42)	376	376	-
PREMIUM PACKAGE	**2096**	**2144.8**	**-48.8**
Black Inc 48/58	1270	-	-219
Black Inc 45	-	1489	
PREMIUM PACKAGE with WHEELS	**3366**	**3633.8**	**-267.8**

*size 54 painted frame and fork 'chrome/black' used for evaluation. Individual results can vary depending on paint selection and size. All weights measured in grams unless otherwise noted.

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