



Wind Tunnel Report



SUMMARY

The results in this report show that the Ventum One is the fastest of the bicycles tested. When tested in race trim (with 1.4 liters of hydration), the Ventum One demonstrated significantly better aerodynamic performance (24% less drag) than the closest competing bicycle tested, the Cervelo P5. The Ventum One, with its conformal water bottle, even outperformed the Cervelo P5 with water bottles and water bottle cages removed.



METHODOLOGY

Ventum conducted preliminary wind tunnel testing at the Faster wind tunnel in Scottsdale, Arizona and the A2 wind tunnel in Mooresville, NC in 2014 and 2015. Several prototype Ventum bicycles were tested, as well as production versions of the following competing bicycles: Cervelo P5, Scott Plasma, and Canyon Speedmax. The bicycles were comparatively tested using the same wheels, saddle, and fit. Tests for the competing bicycles were conducted both with and without frame-mounted water bottles and cages. The preliminary testing found that the fastest of the competing bicycles is the Cervelo P5.

Ventum conducted additional wind tunnel testing of the production Ventum One and the Cervelo P5 at the Faster wind tunnel in Scottsdale, Arizona in 2015 (the results of this testing are presented below).

The following configuration was standardized across the bicycles tested to ensure consistency and comparability:

- Gear position: big gear (large front chainring), smallest gear (rear), with the drive-side crank-arm forward and horizontal and taped in position.
- Wheels
 - Zipp 808 Firecrest wheels
 - Vittoria Corsa CX tires 100PSI
 - Vittoria Ultralite tubes
- Saddle – ISM Prologue
- Position
 - Saddle height
 - Saddle distance behind bottom bracket
 - Saddle angle
 - Distance from saddle to aerobar pad and extension/shifter
 - Distance from aerobar pad to front hub
 - Width of aerobar extensions and pads
 - Rise of aerobar extensions



The cycling industry does not have a standard protocol for wind tunnel testing; instead, every company has their own protocol. Ventum's protocol is as follows:

- Yaw: -20° to 20° Sweep in 5° step increments
- Speed: 30mph wind speed, 30mph wheel rotation speed.
- Sampling Interval:
 - 20-second average data collection interval,
 - 20-second settling period before data collection.
- Average of all sweeps for each bicycle

According to the aerodynamic technicians at Faster, *“testing was performed with Ventum in the most standardized way possible. Keeping wind and wheel speed at 30mph is the most consistent 'standard' in tunnel testing within the cycling industry. Ventum testing was performed at 30mph wind and wheel speed. The sweeps went from -20° to positive 20° in 5° increments. Multiple repeats were completed with each frame.”*



BICYCLES TESTED

Cervelo P5

- Dura Ace Di2 groupset, 25-11 cassette, 172.5 cranks
- 3T Aduro bars and stem
- ISM Prologue saddle
- Zipp 808 Firecrest
- Vittoria Corsa CX tires 100PSI
- Hydration configuration:
 - Configuration 1 'Naked': No hydration system present
 - Configuration 2 'Race Trim': 700ml bottle on down tube and 700ml bottle between aero bar extensions.

Ventum prototype (Gen. V, pre-production)

- Dura Ace Di2 groupset, 25-11 cassette, 172.5 cranks
- Ventum bars and stem
- ISM Prologue saddle
- Zipp 808 Firecrest
- Vittoria Corsa CX tires 100PSI
- Hydration configuration:
 - Ventum One 1.4 liter conformal water reservoir

Ventum One (production)

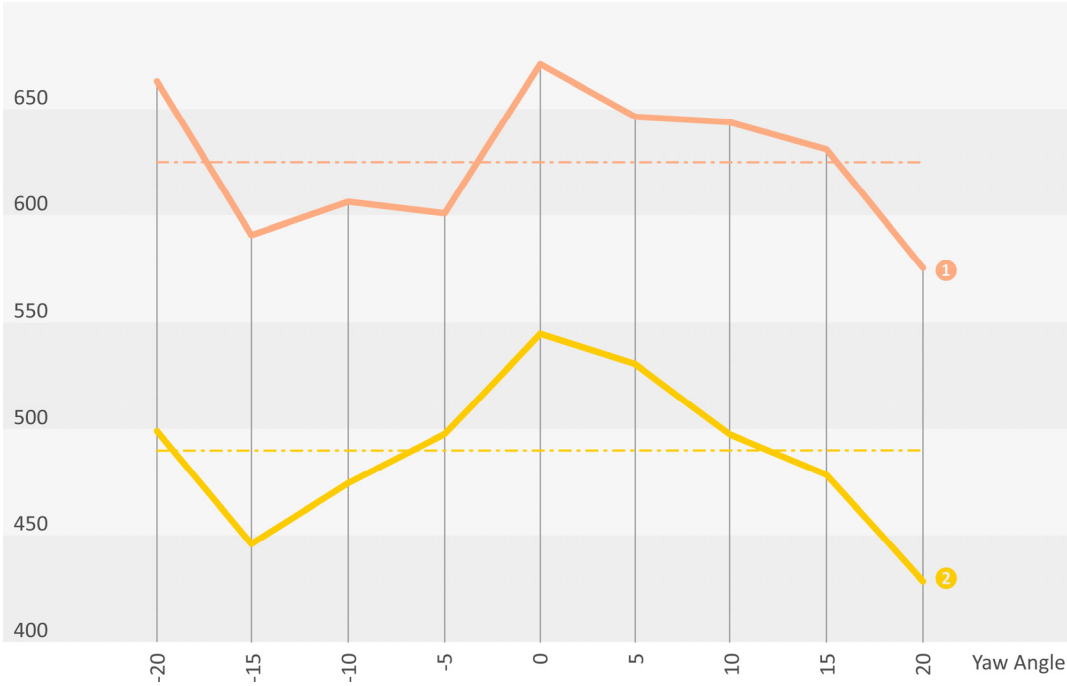
- Dura Ace Di2 groupset, 25-11 cassette, 172.5 cranks
- Ventum bars and stem
- ISM Prologue saddle
- Zipp 808 Firecrest
- Vittoria Corsa CX tires 100PSI
- Hydration configuration:
 - Ventum One 1.4 liter conformal water reservoir



DATA

Cervelo P5 in 'Race Trim' vs 'Naked' Cervelo P5

Average Long. Drag (grams)



① Cervelo P5 w/ 1.4l (2x 700ml bottles)

② Cervelo P5 w/ No Bottles or Cages

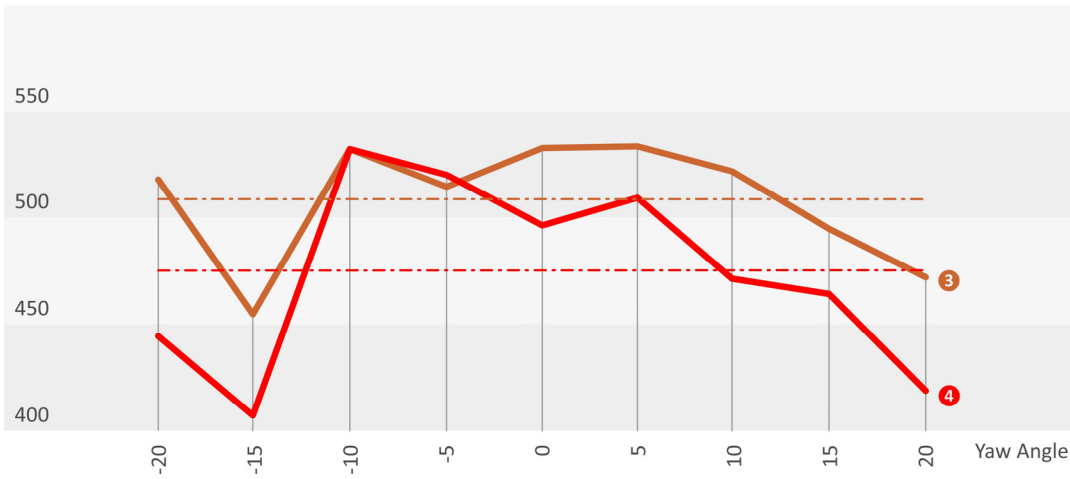
Bicycle / Hydration	Table Rotation (degrees)									
	Average Long. Drag (grams)									
	-20	-15	-10	-5	0	5	10	15	20	Average
①	662	591	607	601	672	647	644	631	576	625
②	499	447	476	499	545	531	497	480	429	489

Ventum's testing found that adding hydration to the Cervelo P5 had a significant adverse impact on aerodynamic performance.



Ventum One (Production) vs. Ventum (Prototype)

Average Long. Drag (grams)



3 Ventum Prototype (Gen. V) w/ 1.4l Integrated Bottle

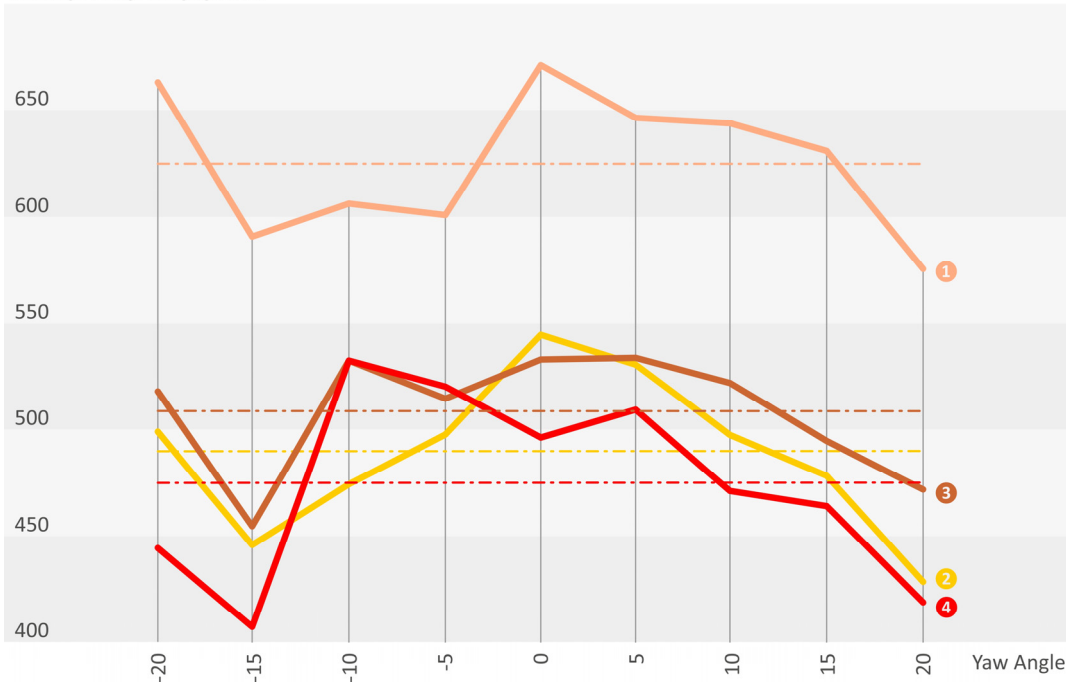
4 Ventum One w/ 1.4l Integrated Bottle

Bicycle / Hydration	Table Rotation (degrees)									
	Average Long. Drag (grams)									
	-20	-15	-10	-5	0	5	10	15	20	Average
3	519	455	533	515	533	534	522	495	472	508
4	446	407	532	520	497	509	472	465	419	474

The Ventum One is 7% faster than the Ventum Gen. V prototype due to enhancements to the frame and the introduction of the Ventum fork.

Ventum One (Production) vs. Ventum (Prototype) vs. Cervelo P5 in 'Race Trim' vs 'Naked' Cervelo P5

Average Long. Drag (grams)



- ① Cervelo P5 w/ 1.4l (2x 700ml bottles) | ② Cervelo P5 w/ No Bottles or Cages
- ③ Ventum Prototype (Gen. V) w/ 1.4l Integrated Bottle | ④ Ventum One w/ 1.4l Integrated Bottle

Bicycle / Hydration	Table Rotation (degrees)									Average
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