PINARELLO BOLIDE TR+ WHITE PAPER 1.0

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INTRODUCTION

a. Pinarello

Historically, Cicli Pinarello has shown their ability to build the fastest bikes on the planet. Great successes such as the HR record, numerous TT stages won at the Giro, Tour and Vuelta, and the countless National TT Champions prove its ability as a winner.
Behind all of these victories there is one common name…: Bolide.
Since the Bolide first debuted in 2013 it is simply the best TT bike of its kind and the Bolide HR and Bolide TT have continued this tradition.
However, the Bolide is not just a fast bike over short distance TT stages or on an Olympic Track, it is also performing and winning the toughest test in triathlon: The Ironman World Championship in Kona (Hawaii). During the race in October of 2017, pro athlete Cameron Wurf on the Bolide was able to break the bike course record with an incredible 4h:12min:54sec over 180Km, more than 5 min faster than the previous record.
This incredible result pushes Cicli Pinarello to invest resources and research and development into a version of the Bolide specifically designed for triathlon races, so it's born the BOLIDE TR+.

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INTRODUCTION

b. Purposes of the project

To create Bolide TR+ Pinarellos Lab did not start from a blank slate, because of the great performances in the long distances shown by Bolide TT we already had the perfect starting point for this project. With that product development focused on optimizing the speed and geometric characteristics of the TT Bolide for endurance races such as triathlon.
To do this the cooperation of pro athletes like Cameron Wurf was essential and also considered the suggestions coming from amateur riders. The main target of the this project was to create a specific Triathlon bike that allowed the pro athletes to beat the competition and amateurs to have the best possible bike to enhance their performance during the race.
With that said, the main targets for this projects were:

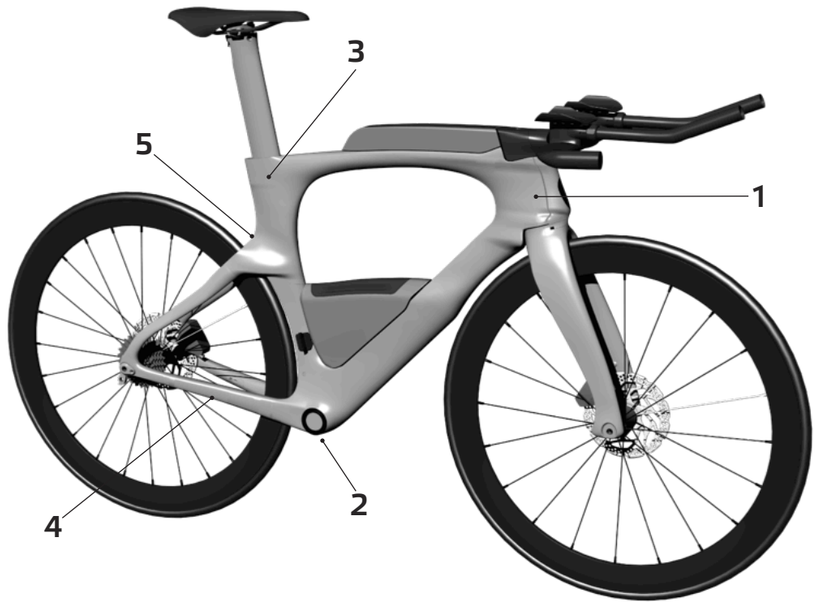
- Create a Triathlon bike without compromising the speed of the Bolide TT
- Keep the lightness as close as possible to the Bolide TT
- Reduce the complexity of the bike mounting/demounting operations
- Improve comfort, handling and stability
- Design specific storage that allows the rider to carry enough fuel without sacrificing aerodynamics

The request to have a bike easy to assemble pre-race and easy to disassemble post-race was feedback we received from both pro and amateur athletes. In fact, in such a physically and mentally wearing race like triathlon it is important not to waste nervous energy during bike preparation. This request was seriously taken into consideration and guided many engineering decisions.
Similarly we focused on improving the comfort and handling. Typically a TT is designed for TT stages (max 50Km) and generally flat. Triathlon and Ironman races can be much longer and are not necessarily flat, so it was an imperative update specific to the TR+.

1. FEATURES AND SPECIFICATIONS

a. DEDICATED TRIATHLON GEOMETRY

The starting point for the Bolide TR+ project was to create a perfect Triathlon / Ironman geometry without distorting any characteristic of speed inherent in the Bolide TT. The specific geometry for Bolide TR was driven by the research for an optimal rider position that ensured comfort for long distances.
An in depth analysis of where the Pinarello Lab focused its attention:



1 - HEADT TUBE: increased by 35mm compared to the Bolide TT. This allows for improved ergonomics and to have a more relaxed position on the bike without sacrificing aerodynamics. Combined with the Aero TT bar and the ability to add 40mm spacers under the extension + 10mm spacers under the pads, every rider can find their best position or adapt the position specific to the race type.
Having a bigger head tube increases the rigidity of the bike frame and the overall stability of the head set.

2 - BOTTOM BRAKET: moved downward by 8mm compared to the Bolide TT. This improves comfort especially when in the saddle. The overall center mass of the bike is downward improving riding stability and aerodynamic efficiency.

3 - SEAT TUBE ANGLE: moved forward to 78º. Combined with the straight seatpost position this ensures the best thrust on the pedals.
An additional seatpost version will be available with -25mm offset. This allows every athlete to find the most congenial position for their ride.

4 - CHAINSTAY: As on the Bolide TT the length of the Chainstay remained 395mm, which is extremely short. This guarantees an excellent transfer of power to the wheel and agility in the bursts out of turns.

5 - TYRE CLEARANCE: Bolide TR+ is designed to allow up to a 700x28mm tire and a rim width of 30mm. This ensures the compatibility with modern Triathlon wheels specifically designed to optimize aerodynamics.

b. AERODYNAMICS

Once the frame geometry was defined, we next focused on the aerodynamic aspects. The clear target was to keep the aero performance of the Bolide TT but adapted to specific Triathlon needs. Countless hours were spent on the CFD simulator to optimize the Bolide TR+ shape.
Key points for fluid dynamic analysis:

- Bolide TT shape baseline. The Bolide TT aerodynamics were used as the starting point and as benchmark to design the Bolide TR+ frame shape.

- No UCI Limit. Bolide TR+ is following ITU (International Triathlon Union) rules for “draft-Illegal” competitions. So, the frames design is not limited by the UCI rules for TT bikes and specifically not limited by the aero-shape “3:1” ratio norm.

- Human dummy. The real aerodynamic performances of the frame must be tested with consideration for the rider of the bike. From previous studies we have seen that there can be considerable differences in the results if the analysis is carried out by studying the frame only vs. the frame and athlete. Therefore, a complete bicycle and a human dummy were been reconstructed in the CFD program before beginning any fluid dynamic analysis.

- Kona wind specifications. To define the wind parameters to be used in the CFD analysis, it was decided to consider the average wind values present at Kona (in terms of speed and angle of attack). The aerodynamic profile of the frame was then optimized for these conditions and then evaluated making sure of no contraindications in the case of wind parameters being different.

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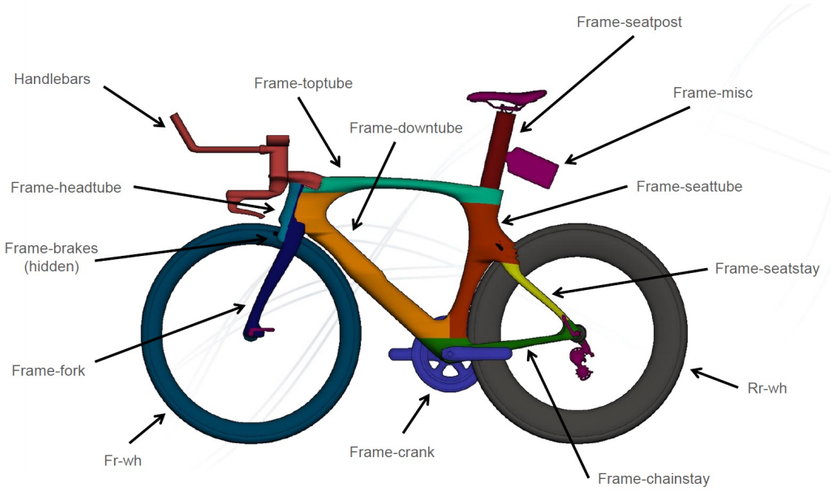
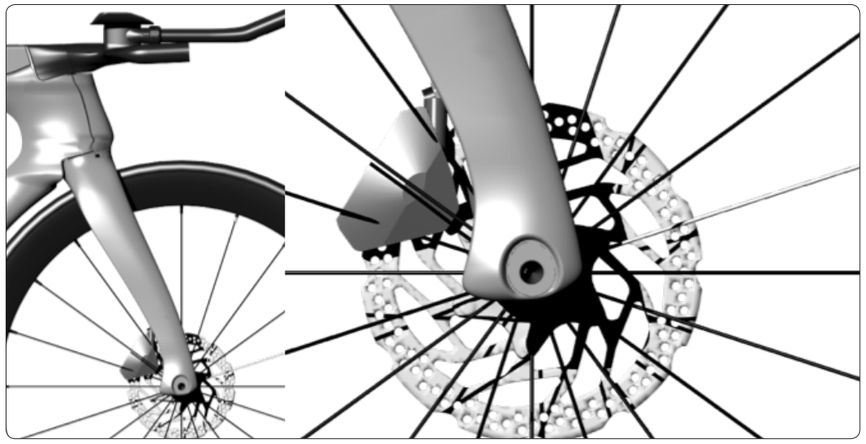
Once the initial parameters and the boundary conditions were defined, the aerodynamic study was carried out by breaking down the individual components of the Frame (as shown on the picture below) and evaluating their specific aerodynamic influence. Each element has therefore been optimized individually and then re-evaluated on the frame with an athlete present.

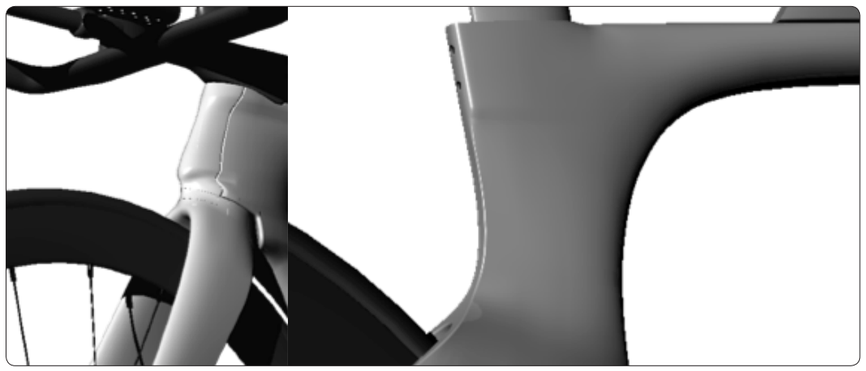


The results of the CFD analysis have led to the review of every single surface of the frame of the Bolide TR+ compared to the Bolide TT, however the most visible changes were:

1 - FORK. Being free of the UCI standards, the fork profile could be considerably lengthened to improve the aerodynamic flow. In addition, the fork flap design has been revised with the dual objective of integrating the trough axle drop out and reducing the aerodynamic drag.



2 - FRONT COVER. The cable routing is completely integrated into the frame. The front cover, hides the routing of the front brake hose and is integrated with the fork. This guarantees aerodynamic improvements both with the surface between the cover and the fork being continuous, and the hosing is concealed from air flow.



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1. FEATURES AND SPECIFICATIONS

3 - REAR MONOSTAY. The advantage of mounting disc brakes allowed us to revise and optimized the monostay. In fact we completely removed the rim brake integration cover. So the monostay has been redesigned in such a way as to minimize its front surface and ensure an optimal air flow through to the rear wheel.

All the other aerodynamic improvements introduced with the Bolide TT were transferred over to the Bolide TR+, including:

1) Concave downtube
2) Slooping Top Tube
3) Seatpost clamp Twin Force

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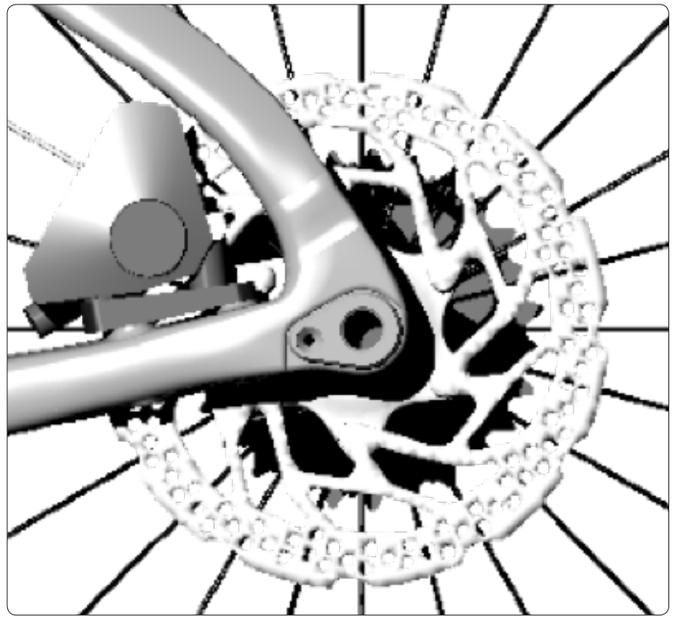
c. DISC BRAKE

Disc brakes simply provide better braking performance and are more consistent in all weather conditions even during long descents. Since the 1st of January 2018 the ITU has released the ability to use disc brake systems on the bike, so it was an obvious decision for the Pinarello Lab to equip Bolide TR+ with this system.
The main features of the Disk Brake system assembled on the Bolide TR+ are:
1) 160mm DISK ROTOR: assure the best braking performances
2) TROUGH AXLE: 12x100mm at the front and 12x142mm at the rear. This assures the best responsiveness and stability while braking. Compared to the Bolide TT, the trough axle at the rear provides benefit while mounting/demounting the bike.
3) FLAT MOUNT BRAKE: ensures a constructively simpler and lighter frame. Furthermore, the brake caliper is more compact and light.
4) INTEGRATED CABLE ROUTING: all brake hosing is completely integrated into the frame, this assures the best aerodynamics and also less complexity for mounting/demounting the bike for long travel.



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1. FEATURES AND SPECIFICATIONS

d. MATERIAL CHOICE

In order to satisfy all customer categories, Bolide TR will be available in two different models.
The high end version Bolide TR+ is constructed with Torayca T1100 G UD finish. The mid-tier version Bolide TR will use T700 UD finish. Both materials are of the highest tensile strength. Torayca T1100 G will be a lighter frame in comparison to the T700.

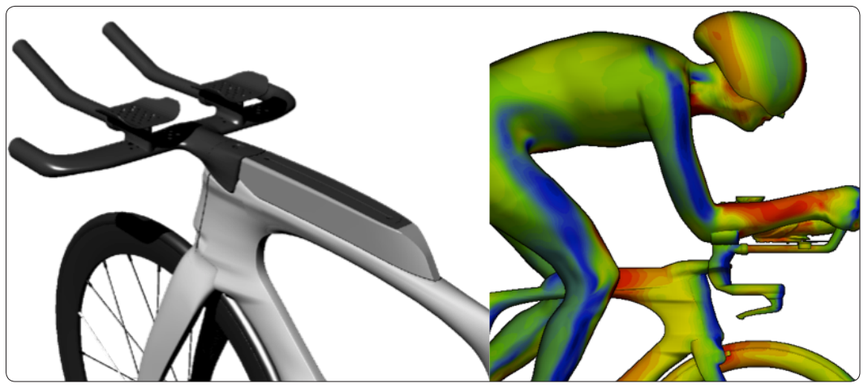
Pinarello has always been known for its asymmetry concept. With down tube moved to the right, we were able to increase the stiffness which recovers the stiffness lost with the usage of less material.
Thanks to the use of the highest grade carbon fiber available we were able to get a lighter frame while maintaining strength.

T1100 G fibers have been used in the higher stressed areas, in order to take advantage of its incomparable strength.

e. FUEL STORAGE

One of the main objectives of this project was to provide the Bolide TR+ with triathlon specific fuel storage options that had function satisfying the needs of athletes during long races without adversely affecting the aerodynamics of the bike.
The decision for the type and position of the fuel storage was again a direct result following the feedback of the athletes. Everything was validated using several CFD simulation sessions. For example from the beginning we excluded having an integrated water tank below the handlebar, this was due to the CFD showing us that a big lateral surface has a negative influence on aerodynamics and ride quality during crosswinds.
The fuel storage options for Bolide TR+ are:

1 - TOP TUBE BOX: designed to carry gels and energy bars. It has a rubber membrane on the top were the food can be easily taken in and out. It is fixed on the toptube with two screws, so it can be easily removed. It is completely integrated with the handlebar cover and the shape is designed to reduce the aerodynamic drag.



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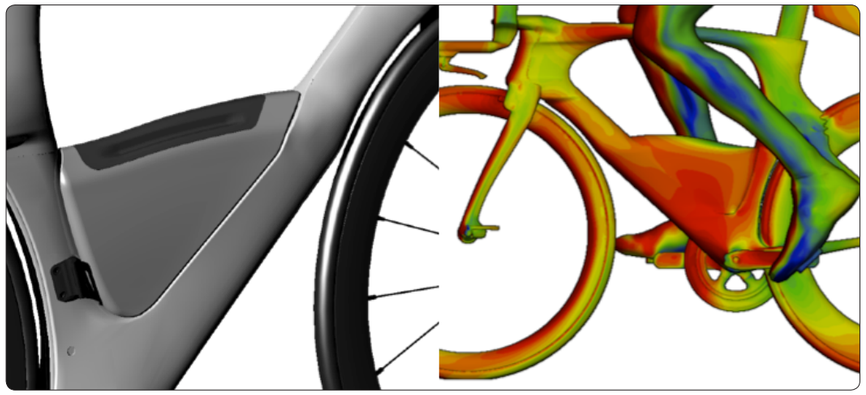
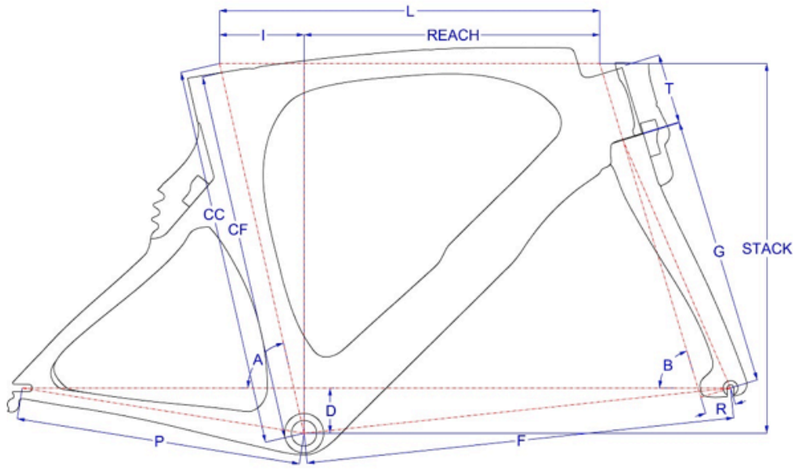
1. FEATURES AND SPECIFICATIONS

2 - DOWN TUBE BOX: designed to carry food or tools (inner tube, multitool, tire lever, etc.) It is fixed to the downtube with two screws. Can be easily removed and can be replaced with a bottle cage. Integration with the downtube helps improve the air flow around the frame.



2. SIZES AND GEOMETRIES



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485	500	101	78	72	576	395	106	70	43	373	386	515
520	520	108	78	73	595	395	120	70	43	373	405	530
550	540	114	78	73	618	395	134	70	43	373	424	543

3. PINARELLO BOLIDE TR+ FEATURES

BOLIDE TR+

- Carbon Torayca T1100 G UD with NANOALLOY Technology
- Asymmetric frame
- Drop In bearing system with tapered headset (1” 1/8 up; 1” ½ down)
- Internal cable routing
- Italian thread BB
- Flatback Profiles
- Fork Flap
- Aero Seatpost with Aero Rear Clamp
- RAD System Disk Brake
- Front Thru-Axle 100 x 12 Shimano
- Rear Thru-Axle 142 x 12 Shimano
- Disk Flat Mount max 160mm
- Max Tire 700 x 28

BOLIDE TR

- Carbon Torayca T700 UD
- Asymmetric frame
- Drop In bearing system with tapered headset (1” 1/8 up; 1” ½ down)
- Internal cable routing
- Italian thread BB
- Flatback Profiles
- Fork Flap
- Aero Seatpost with Aero Rear Clamp
- RAD System Disk Brake
- Front Thru-Axle 100 x 12 Shimano
- Rear Thru-Axle 142 x 12 Shimano
- Disk Flat Mount max 160mm
- Max Tire 700 x 28

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