WHITE PAPER

INDEX

CICLI PINARELLO S.R.L. | Viale della Repubblica, 12 - 31020 Villorba (TV) - Italia
C.F. - R.I. - P.IVA IT 05994100963 | tel. +39 0422 42 08 77 | fax +39 0422 42 18 16 | **www.pinarello.com**

0. INTRODUCTION

Cicli Pinarello s.r.l is one of the most famous and winning bike manufacturers in the world. Founded in Treviso (Italy) in 1952 by Giovanni (Nani) Pinarello, it produces high end racing bikes. This name, Pinarello, recalls legendary victories of the greatest cyclists of all time: since 1975, the first victory in **Giro d'Italia** with **Fausto Bertoglio**, Pinarello has won all the most important races, including the **Olympics**, **World Championships** and the **Tour de France** to perform the best they possibly can.
All the bikes produced for the best riders in the world are also available for the amateurs, to allow everyone to perform the best possible. Collaboration with pro riders enables us to allow us to develop cutting edge technologies in order to win the races.... those technologies are then applied on the bikes that everyone can buy and use.

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1. PINARELLO DOGMA FS

a. MAIN CHARACTERISTICS OF THE BIKE

Carbon Torayca T1100 1K Dream Carbon with Nanoalloy Technology
Asymmetric Frame
Fork ONDA with ForkFlap™
Think2 System with E-Link™
ICR™ Internal Cable Routing
Drop in Bearing System 1" 1/4 - 1" 1/2
Italian thread BB
Seatclamp TripleForce
3XAir™ two positions available for the second bottle
Dogma Smart Adaptive System
FlatBack Profile
Max Tyre 700x28mm
4 sizes available: 530, 550, 560, 575

The frame has been designed to be a road racing bike with a focus on the comfort and on best performance on rough terrain.

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b. FRAME SPECIFIC DESIGN SOLUTIONS:

1. More relaxed head tube angle and longer chainstays to allow better control and handling on rough terrain.

2. The fork has been completely redesigned in order to guarantee the integration with the electronic front suspension. Fork rake has been slightly reduced to ensure the best force transmission to the suspension.

3. The Head Tube is wider to integrate the DSAS electronic front suspension. The length is shorter in order to guarantee 20mm of suspension travel. It has been also reinforced to support the stresses coming from with rough terrain and the upper bearing is moved up to 1' ¼.

4. Flex Stays technology: CSs are an important part for optimal performance of the whole frame. They support the power transfer, and their lateral and torsional deflections must be minimized to save energy; at the same time, they should have vertical compliance, to absorb the vibrations of the rear wheel and, in our case, let the suspension work. In normal frames, SSs link rigidly to the dropouts with the upper part of the seat tube (from now ST): this consequently limits the vertical deflection of the CSs, even if they are designed to flex. Instead, the Dogma FS's innovative frame positions the suspension in place of the monostay, so there is no rigid constrain between SSs and ST, and thus allows greater vertical deflections of the CSs. The CSs of Dogma FS are therefore designed to allow almost 10mm of vertical deflection, and, at and the same time, to guarantee enough torsional stiffness of the rear triangle. To reduce the flexural inertia in the vertical direction, we reduced the height of cross sections and. The left and right CSs has a dedicated asymmetric design to increase torsional stiffness and avoid loss of power transmission.

5. The downtube is becoming a crucial part of the bike:
a. It has a Flatback profile which guarantee the best balance between stiffness and aerodynamic performance
b. Concave trailing edge, derived from Bolide TT and Dogma F10, to enhance the aerodynamic integration of the bottlecage
c. We have evolved the E-link port: now it is a crucial point of the frame because it accommodates both Shimano Di2 groupset controller and the human-machine interface of the new eDSS2.0
6. The frame can accommodate 28mm tyres, a standard in the market for such kind of bikes.

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2. DSAS – DOGMA SMART ADAPTIVE SYSTEM

a. THE REVOLUTIONARY SUSPENSION SYSTEM FOR ROAD BIKES

Pinarello and HiRide Suspension did it again!
One year after the lunch of the Dogma K10-S with the eDSS 2.0 (Electronic Dogma Suspension System) during the Paris Roubaix with Team Sky, a new weapon is ready to hit the cobbles.
Pinarello Dogma FS, equipped with DSAS, is the world's first electronic front and rear suspended road bike.

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b. DOGMA FS CONCEPT

The idea behind this revolutionary bike is to guarantee the unbeatable Pinarello handling and racing performance even on rough terrain. DSAS self-adapts the frame's stiffness by means of its electronic front and rear suspensions to maximize the bike's stability. DSAS is able to adapt the suspension behavior on each type of ground, automatically locking or unlocking it, ensuring maximum performance and stiffness on smooth tarmac and optimum comfort on bumpy and rough roads.
The system is composed as follow:

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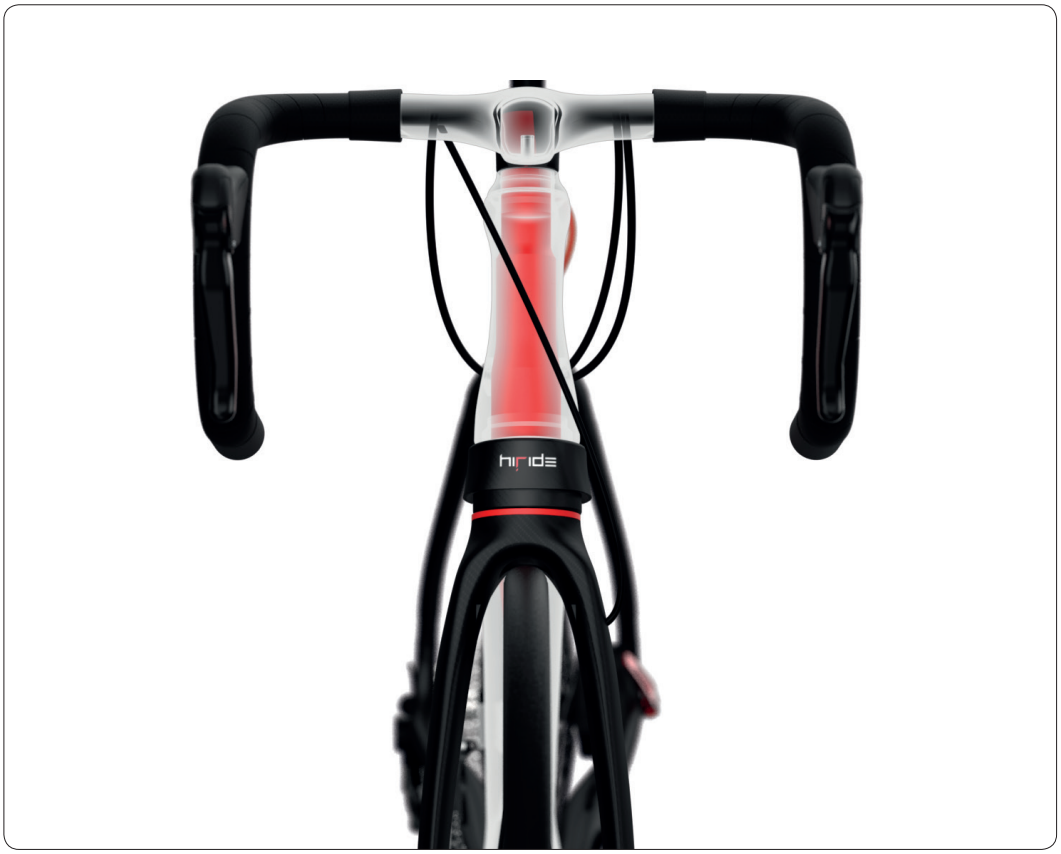
c. FRONT SUSPENSION

The front suspension has 20mm of travel. The core of the vibration absorption is a metal coil spring, the behaviour of which can be custom based on rider preferences. The damping is provided by an hydraulic system that also allows the suspension to electronically change its status from unlocked – fully able to move along its travel – to locked: completely firm for best stiffness and power transmission on flat asphalt. The Front suspension is fully integrated and hidden inside of the headtube.



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d. REAR SUSPENSION

The rear suspension has 11mm of travel. The core of the vibration absorption is an elastomer, the behaviour of which can be custom based on rider preferences. The rear suspension implements an electro-hydraulic system which is able to switch the rear suspension status from unlocked – fully able to move along its travel – to locked: completely firm for best stiffness and power transmission on flat asphalt.

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e. SMART BATTERY PACK

The system's central unit is assembled inside the seat tube. It is composed of a LiPo battery pack and a circuit board that control the system's status. It is equipped with a CPU that run the suspension control algorithms. It is able to collect data from gyroscopes and accelerometers to distinguish the road condition and change the status of the suspension itself.

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f. RIDER INTERFACE

Manual control and system check can on be performed by the rider interface assembled on the E-Link, placed on the down tube.
This component allows the rider to switch the system on and off, control the system status through the led, switch between manual mode and automatic mode, change action threshold or change between lock and unlock in manual mode.

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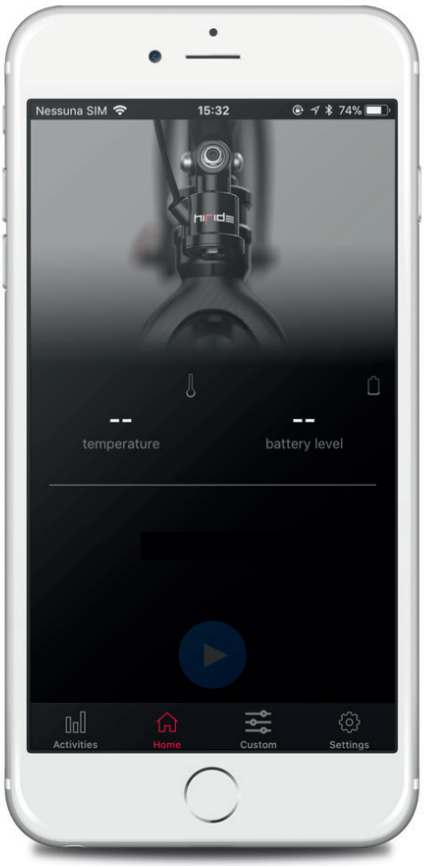
The HMI has also Bluetooth Low Energy and ANT+ communication capability. This enables us to control the system using a smartphone app for data analytics, settings and fine tuning or with an app for Garmin cycle computers, which allow a fast and easy interaction with the system (system status check and status change)



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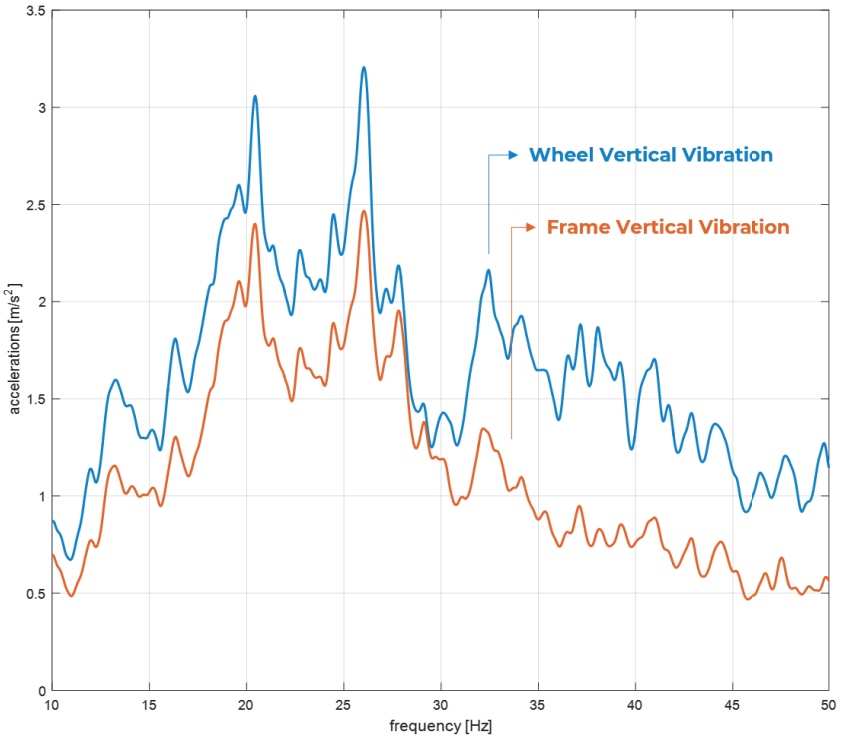
3. DOGMA FS IN NUMBERS

While on smooth tarmac the DOGMA FS behaves like a rigid bike, on cobbles or off-road, things change significantly. DSAS unlocks the suspension, enabling it to absorb vibration from the ground.
The graph below the shows the difference in vertical acceleration between the wheel and the frame. DSAS system is able to absorb on average **42%** of the vibration coming from the ground that directly means an **increase in comfort and bike stability.**
At higher speed DSAS is able to reach a peak of 60% of absorption.

DSAS Vibration absorption



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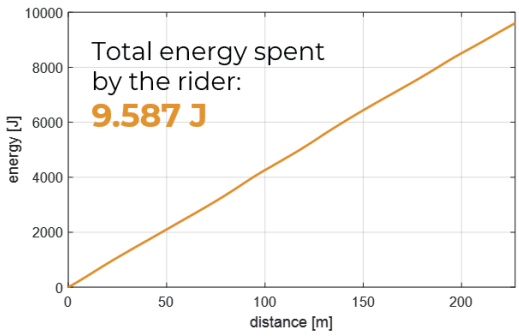
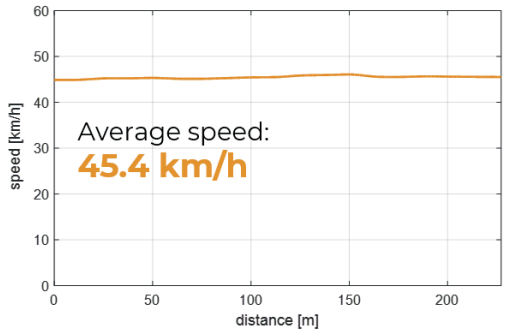
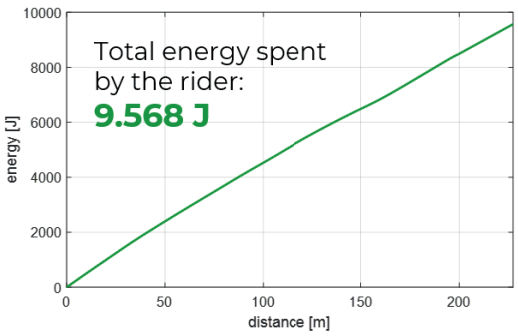
Performance-wise, DSAS is able to improve the bike's speed on rough terrain! This is because of the **increased traction** (rear suspension) **and stability** (front suspension) that overall means a more **efficient bike.** Measurements taken from a comparison between a rigid bike and the DOGMA FS on the Carrefour de l'Arbre cobbles show a gain of the **9.67%** in speed compared to a rigid bike while the rider used the same energy.
This means that the rider with Dogma FS was able to gain 15 seconds in 2Km of cobbles in comparison to a traditional rigid road bike.

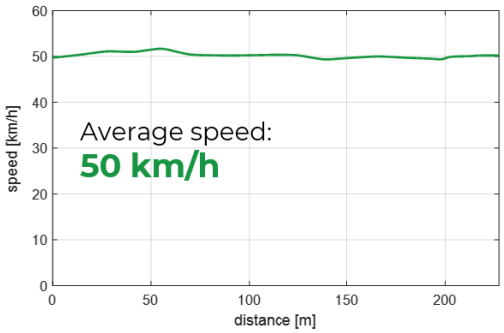
Rigid Bike





DOGMA FS





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infobike@pinarello.com
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