

# Chassis

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Porsche Panamera Technology Workshop



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# Performance concept: Chassis

## Total vehicle concept



Systematic attention to driving dynamic requirements in total vehicle concept

Driver-oriented operating concept (seat position, steering wheel, pedals)

## Chassis mechanics



Precision suspensions

High-performance fixed-calliper brakes

High-performance tyres

Lightweight design

## Mechatronic chassis systems



Further boost to performance potential

Increased spread between driving dynamics and comfort

# Performance concept: Chassis

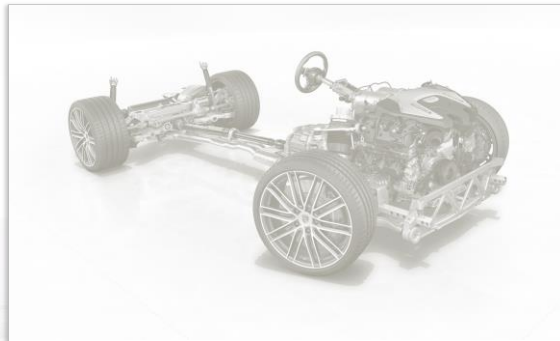
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# Total Vehicle Concept



Unladen weight under 2,000 kg despite much greater system complexity and added product substance



Defined aerodynamic balance



Boosted engine power



Mixed tyres tuned to axle load distribution



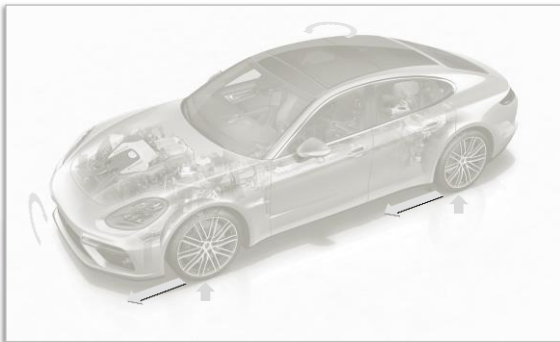
Longer wheelbase

# Total Vehicle Concept

Concept characteristic	Unit	Panamera Turbo (predecessor)	Panamera Turbo
Wheelbase	mm	2,920	<b>2,950</b>
Track width, front/rear	mm	1,646/1,637	<b>1,657/1,639</b>
Axle load distribution, front/rear	%	54.3/45.7	<b>54.4/45.6</b>
Centre of gravity height	mm	530	<b>532</b>
Engine power output	kW (hp)	382 (520)	<b>404 (550)</b>
Drive concept	-	All-wheel	<b>All-wheel</b>
Aerodynamic lift coeff. front/rear	-	0.13/-0.01	<b>0.13/-0.01</b>
Tyre width	mm	255/295	<b>275/315</b>

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## Chassis mechanics – front suspension

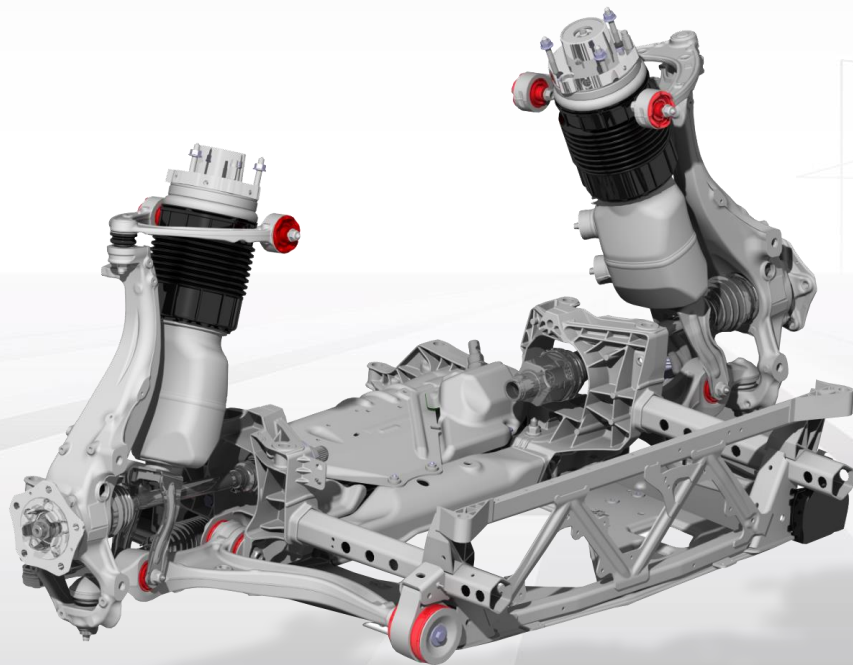
**Lightweight double-wishbone suspension** with steering at back and rigidly screwed subframe

Stabiliser interface at pivot bearing enables installation **of mono-tube dampers**

**Optimised suspension kinematics** for higher steering precision and good directional stability

Pivot bearing produced in **hollow, low-pressure casting process**

**Lightweight wheel suspension** with forged aluminium links



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## Chassis mechanics – rear suspension

Further developed, compact  
**four-link rear suspension**

**Optimised ride comfort**  
by use of hydro-bearings on  
subframe and transverse links

**Integration of rear axle steering**  
in front of the wheel centres

High **lightweight design** rating by use  
of hollow, low-pressure casting  
technology for the subframe  
and lower transverse links

**Lightweight wheel suspension**  
with forged aluminium links



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# Chassis mechanics – brakes with best-in-class performance

Panamera Turbo

**New six-piston aluminium monoblock fixed-calliper front brakes** 410 mm x 38 mm

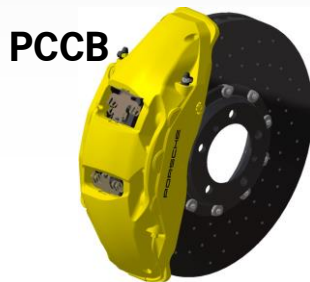
**New four-piston aluminium monoblock fixed-calliper rear brakes** 380 mm x 30 mm

New **ten-piston PCCB** brake system, optional

Improved **fading stability**

**Cu-free brake linings** (ECE market)

**Optimised pedal feel**



Brakes	Front axle	Delta previous model	Rear axle	Delta previous model
Panamera 4S Panamera 4S Diesel	ø 360 mm x 36 mm	0 mm / 0 mm	ø 330 mm x 28 mm	0 mm / 0 mm
Panamera Turbo	ø 410 mm x 38 mm	+20 mm / 0 mm	ø 380 mm x 30 mm	+30 mm / +2 mm
PCCB – Panamera 4S	ø 420 mm x 40 mm	+30 mm / +2 mm	ø 390 mm x 32 mm	+40 mm / +4 mm
PCCB – Panamera Turbo	ø 420 mm x 40 mm	+10 mm / +2 mm	ø 390 mm x 32 mm	+40 mm / +4 mm
<b>Actuation</b>	<b>New Panamera</b>		<b>Previous model</b>	
Brake servo	9/10" Tandem BKV		9/9" Tandem BKV	
Master brake cylinder	28.57 mm		26.99 mm	

# Extensive range of wheels

## 19-inch

Front axle: 9J x 19  
Rear axle: 10.5J x 19



**Panamera S wheel**

## 20-inch

Front axle: 9.5J x 20  
Rear axle: 11.5J x 20



**Panamera Turbo**



**Panamera Design**

## 21-inch

Front axle: 9.5J x 21  
Rear axle: 11.5J x 21



**Panamera Sport Design**



**911 Turbo Design**

## 21-Inch Exclusive

Front axle: 9.5J x 21  
Rear axle: 11.5J x 21



**Exclusive Design wheel**



**Exclusive Design wheel**  
High-gloss black

# Wide-ranging requirements for high-performance tyres

Use of a brand-defining **mixed tyre set**

**Steering precision** and **agility**

**High level of driving stability**  
and **driving pleasure**

Maximum **driving performance**

Best possible **ride comfort**

**Best-in-class braking distances**

**Low rolling resistance coefficients**



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## Wide-ranging requirements for high-performance tyres

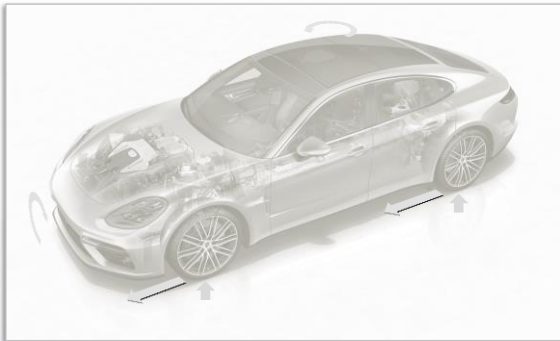
	Tyre dimensions	Wheel size
<b>19-inch</b>	Front 265/45	9.0 x 19
	Rear 295/40	10.5 x 19
<b>20-inch</b>	Front 275/40	9.5 x 20
	Rear 315/35	11.5 x 20 (winter: 10.5)
<b>21-inch</b>	Front 275/35	9.5 x 21
	Rear 315/30	11.5 x 21 (winter: 10.5)



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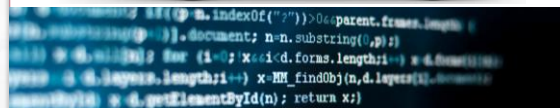
Precision suspensions

High-performance fixed-calliper brakes

High-performance tyres

Lightweight design

## Mechatronic chassis systems

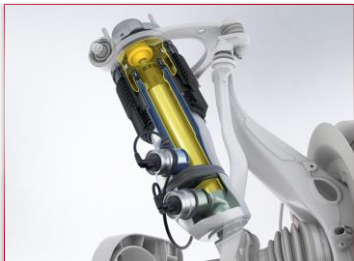


Further boost to performance potential

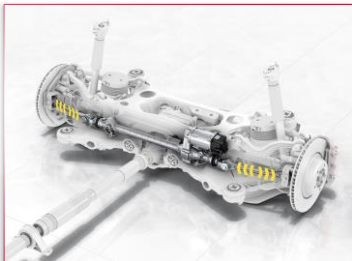
Increased spread between driving dynamics and comfort

# Chassis systems – overview

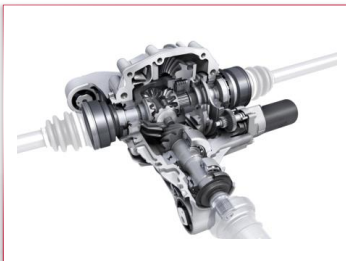
**Adaptive air suspension with PASM**



**Rear axle steering**



**Controlled torque vectoring**



**Electromechanical roll stabilisation**



**Hang-on all-wheel drive**



**Electromechanical steering**



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# Chassis systems – adaptive air suspension with PASM



**Three-chamber air spring**  
in conjunction with regulated  
mono-tube damper

**Spring rate switching** according to  
the driving situation and the selected  
driving mode

**Maximum spread** between **driving  
dynamics** and **ride comfort**

Reduces **rolling and pitching  
movements**

**Effects of** driving dynamic properties

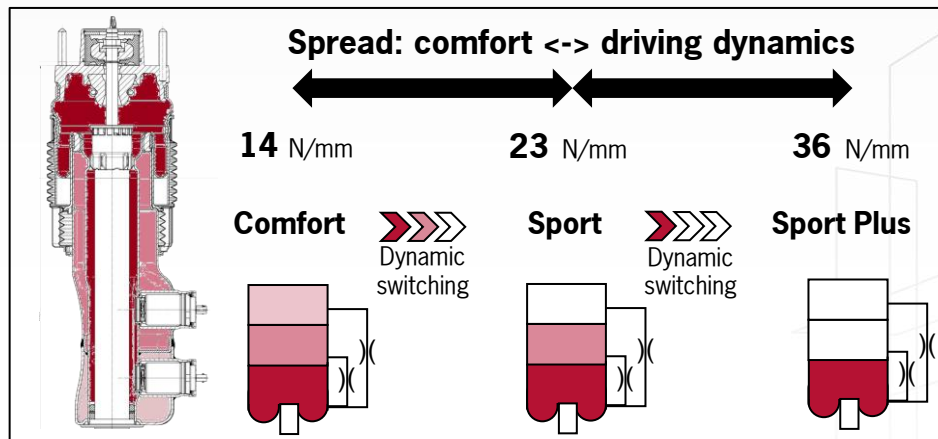
# Chassis systems – adaptive air suspension with PASM

## Technology of three-chamber air spring

- Comfort advantage due to higher volume air spring
- Performance benefits due to three-stage, adaptive switching

## Implementation

- Each driving mode is assigned its own spring rate
- The system switches to the optimal spring rate based on the driving situation (braking, accelerating, lateral acceleration, sudden changes in steering angle input)



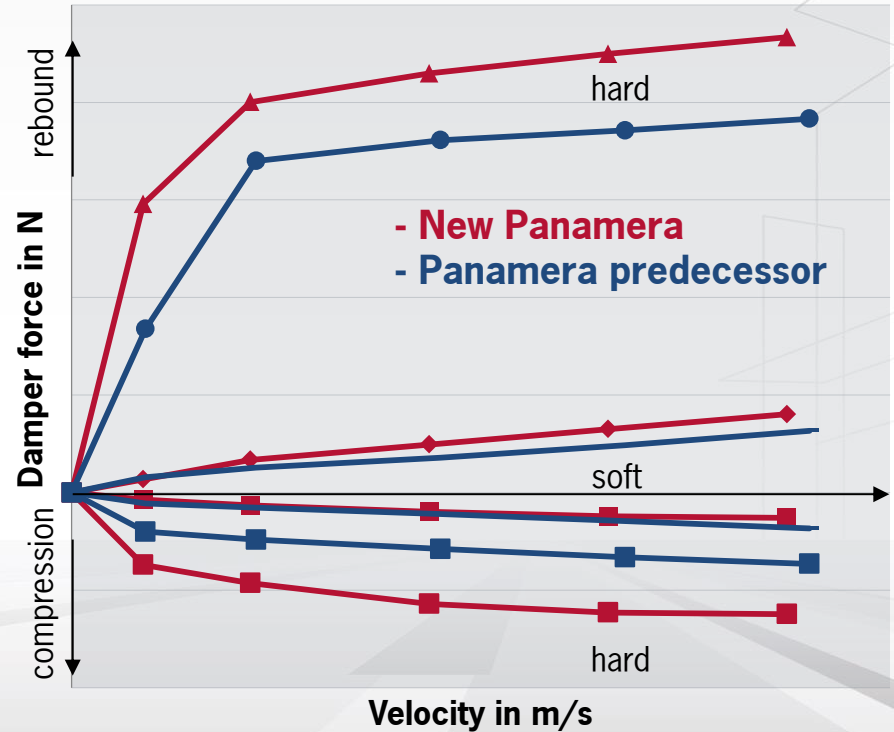
# Chassis systems – adaptive air suspension with PASM

## PASM technology

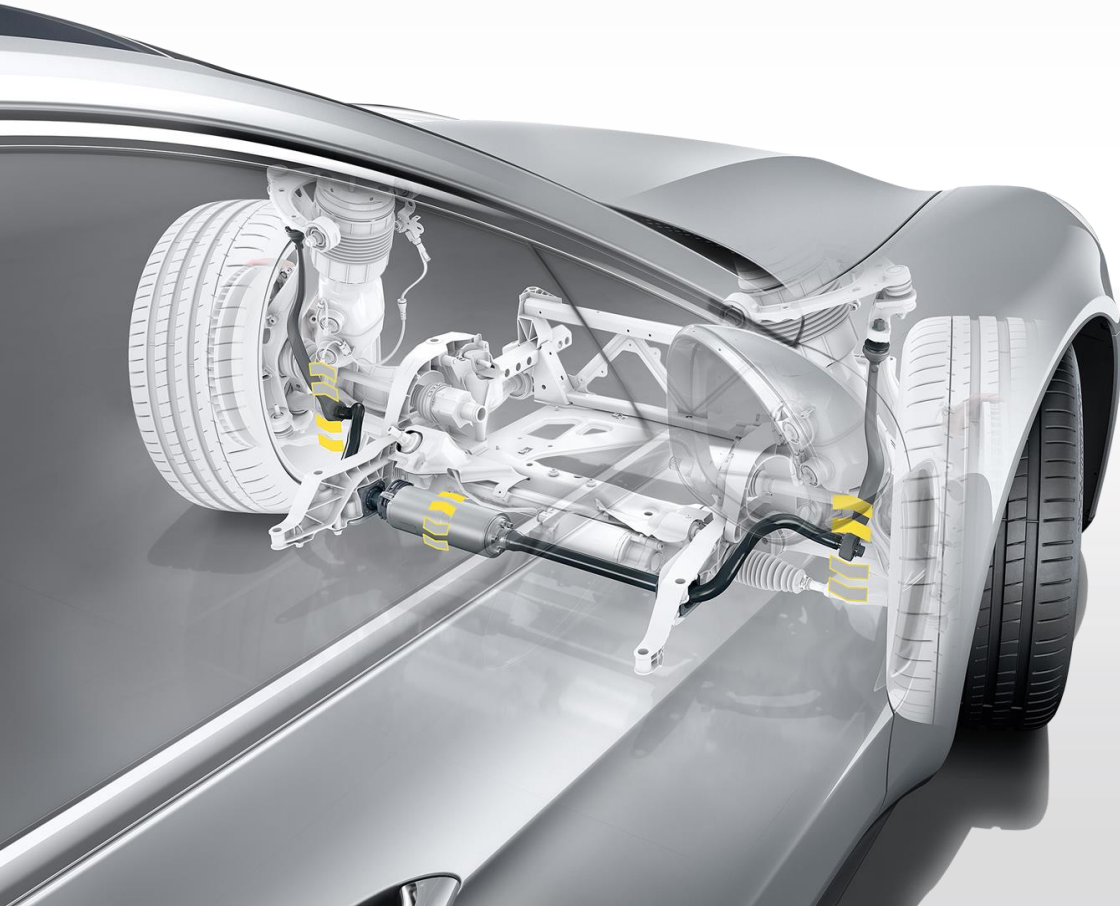
- Controlled mono-tube damper, high-performance and lightweight
- Comfort advantage due to very low, minimal damping forces
- Significantly larger spread of damper characteristics (hydraulic) for optimal interface to car body and wheel control
- Performance advantages due to high maximum forces

## Implementation

- Extended sensor system for more precise control
- Controller developed in-house at Porsche
- Integrated reaction to spring rate switching for optimal degree of damping



# Chassis systems – Porsche Dynamic Chassis Control Sport



Conceptually, **electromechanical system** lends itself to use in PHEV and BEV vehicles

**Precise control** of roll movements

**Active compensation** for rolling moments

**Roll torque is distributed variably according to driving situation** and therefore affects self-steering behaviour

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# Chassis systems – electromechanical steering

**Direct steering response**

**Ideal steering precision**  
and typical Porsche steering feedback

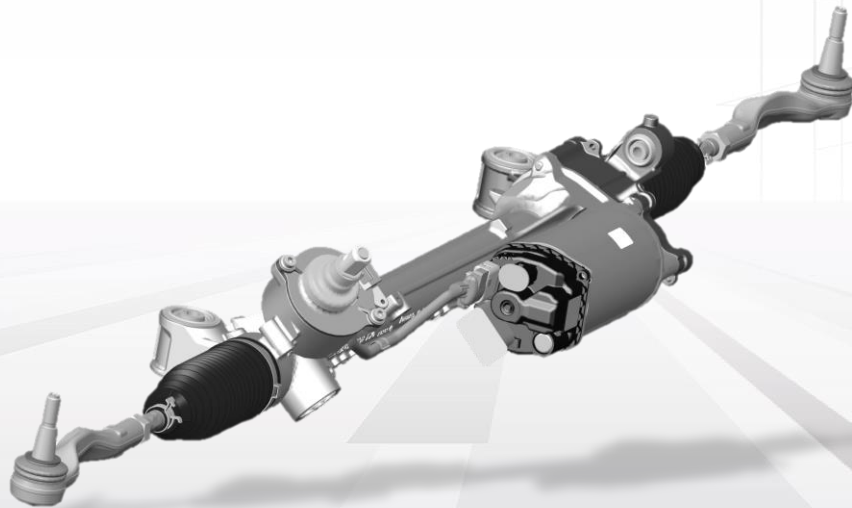
Enhanced **steering comfort**

**Active steering wheel return**

**Steering pulse during** split- $\mu$  braking  
(DSR)

**Lane keep assist (LKS)**

**Reduced fuel consumption**  
(approx. 0.1 l/100 km)



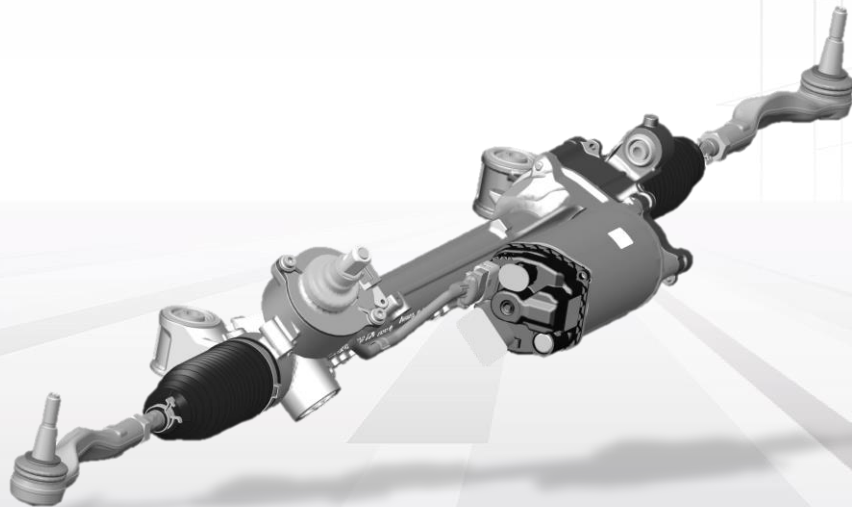
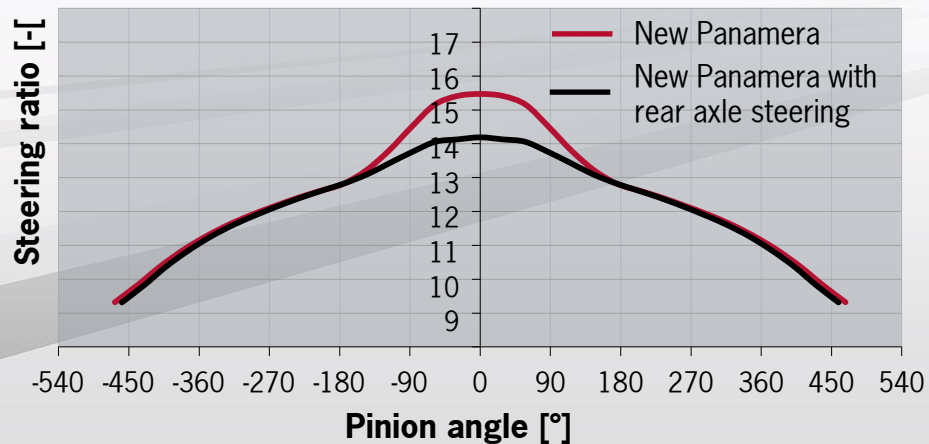
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# Chassis systems – electromechanical steering

Feedback optimised **hand torque control**

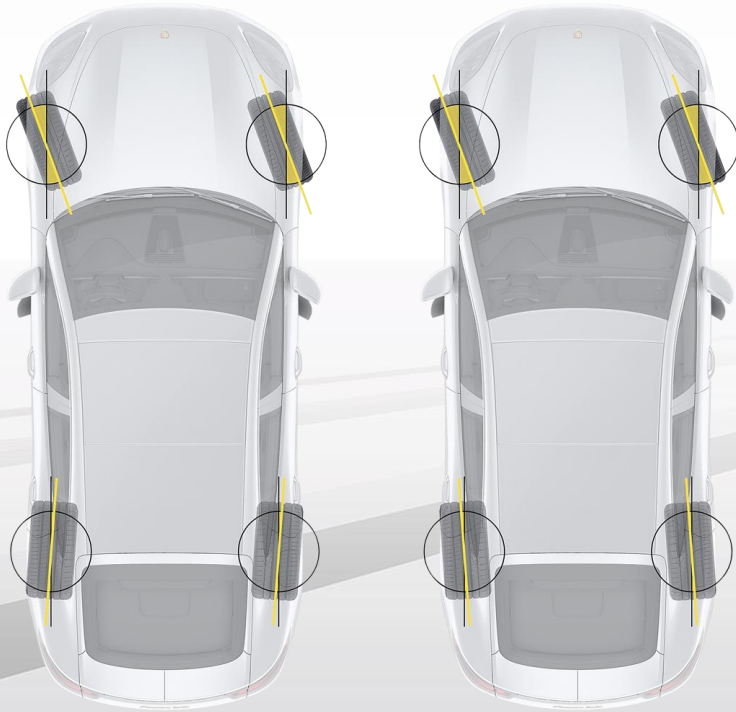
**Performance-oriented** system layout  
with 8 Nm boosting motor

**Optimised system weight** (16.0 kg)  
at maximum boost force of 15.6 kN



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# Chassis systems – electromechanical rear axle steering



## At low driving speeds

Reduces the steering angle required  
→ **Makes steering more manageable**

Virtual shortening of wheelbase  
→ **Increased manoeuvrability**

## At higher driving speeds

Improved damping of yaw movements  
→ **Increased vehicle stability**

Faster build-up of lateral acceleration for more spontaneous vehicle response  
→ **Enhanced agility**

Virtual elongation of wheelbase  
→ **Improved stability at high driving speeds**

# 4D Chassis Control – electronic chassis platform

**NEW**

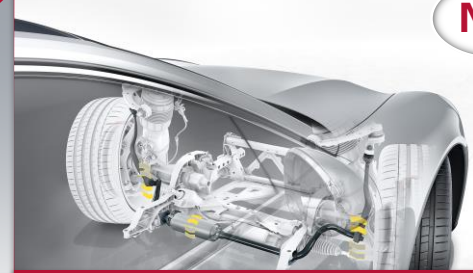


**Three-chamber air suspension  
(+ 60 % air volume)**

**NEW**

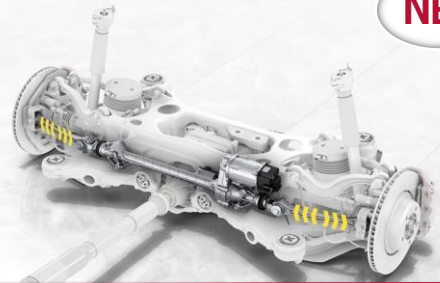
**Porsche  
4D Chassis  
Control**

**NEW**



**Porsche Dynamic Chassis  
Control Sport (PDCC Sport)**

**NEW**



**Rear axle steering**

**Porsche Active Suspension  
Management (PASM)**

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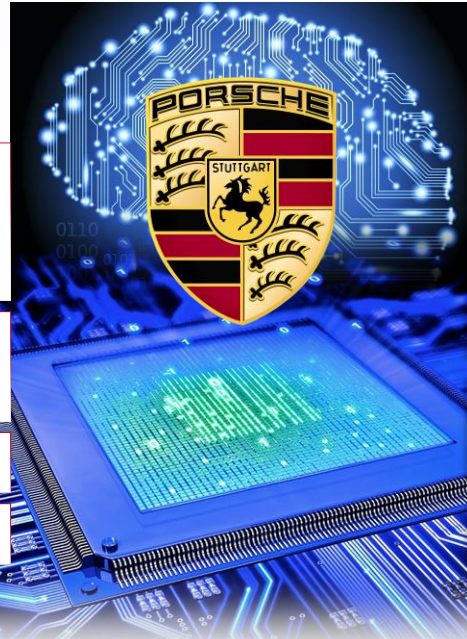
# 4D Chassis Control – electronic chassis platform

Internal know-how  
to assure typical Porsche  
handling characteristics

Maximum utilisation of  
system performance

Intelligent networking of systems

Differentiation from competition



Adaptive air suspension

Adaptive damper control

Roll stabilisation

Controlled all-wheel drive  
and torque vectoring

Vehicle state observer

**Ideal conditions for advancing along the path towards the intelligent chassis**

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# Chassis of the new Panamera – overview

**Adaptive air suspension  
with Porsche Active  
Suspension Management**

**Optimised  
concept parameters**

**Porsche 4D Chassis Control**

**Newly developed suspensions**

**Rear axle steering**

**New generation  
of tyres, new wheels**

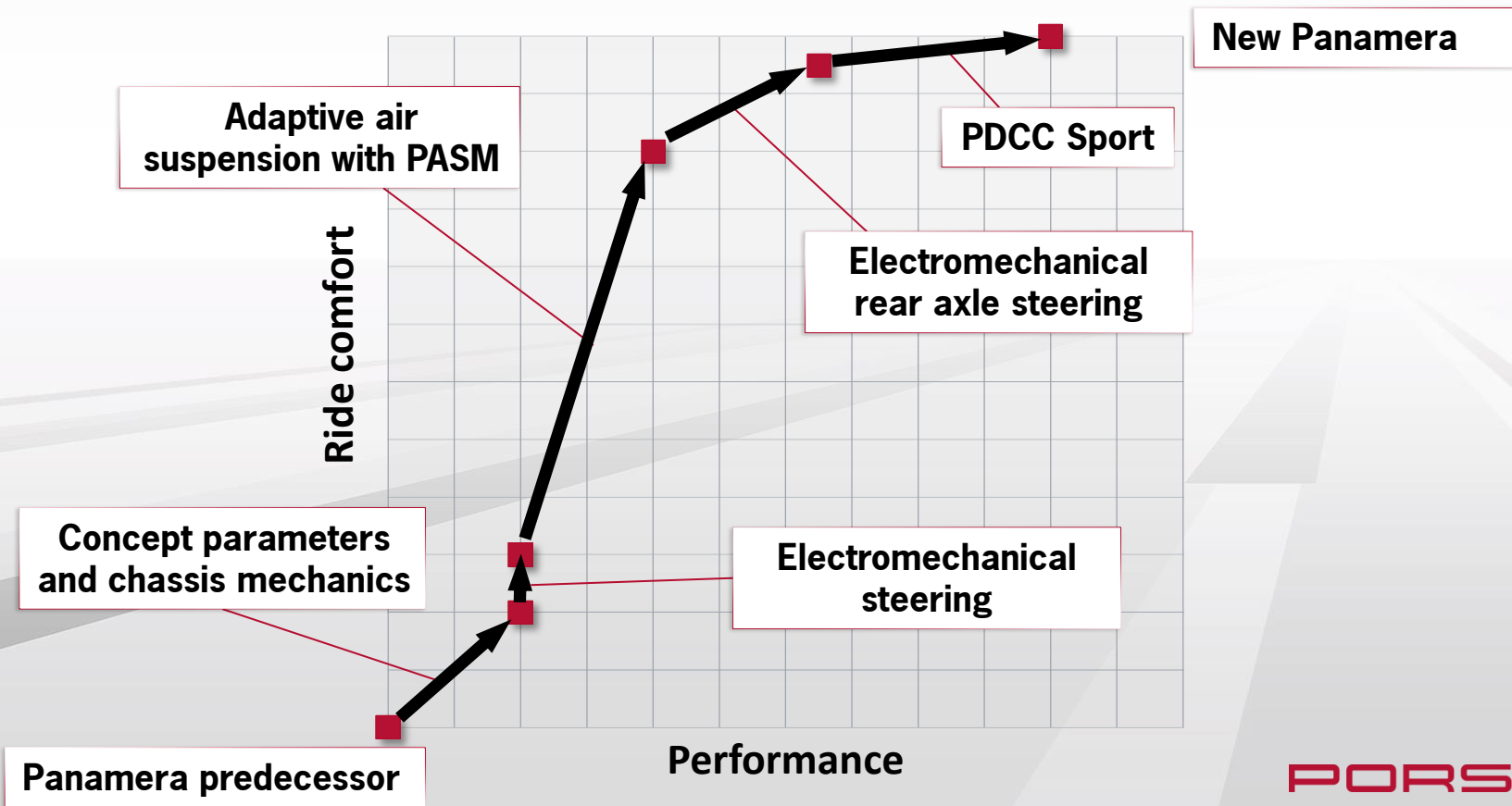
**Porsche Dynamic Chassis  
Control Sport with  
Porsche Torque Vectoring Plus**

**Optimised brakes**



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# The new Panamera chassis – maximum spread between performance and ride comfort





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