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The new 911 Carrera Technology Workshop

Body and manufacturing





1

Warm-up

2

Development

3

**Body
highlights**

4

Production

5

Finish

Design

- Exterior even more muscular and contemporary
- Even wider body

Performance & efficiency

- Optimised three-litre six-cylinder flat engine with 450 hp
- New eight-speed Porsche dual-clutch transmission (PDK)

Lighting and assistance systems

- LED matrix headlights
- Night Vision Assist
- Porsche Wet Mode

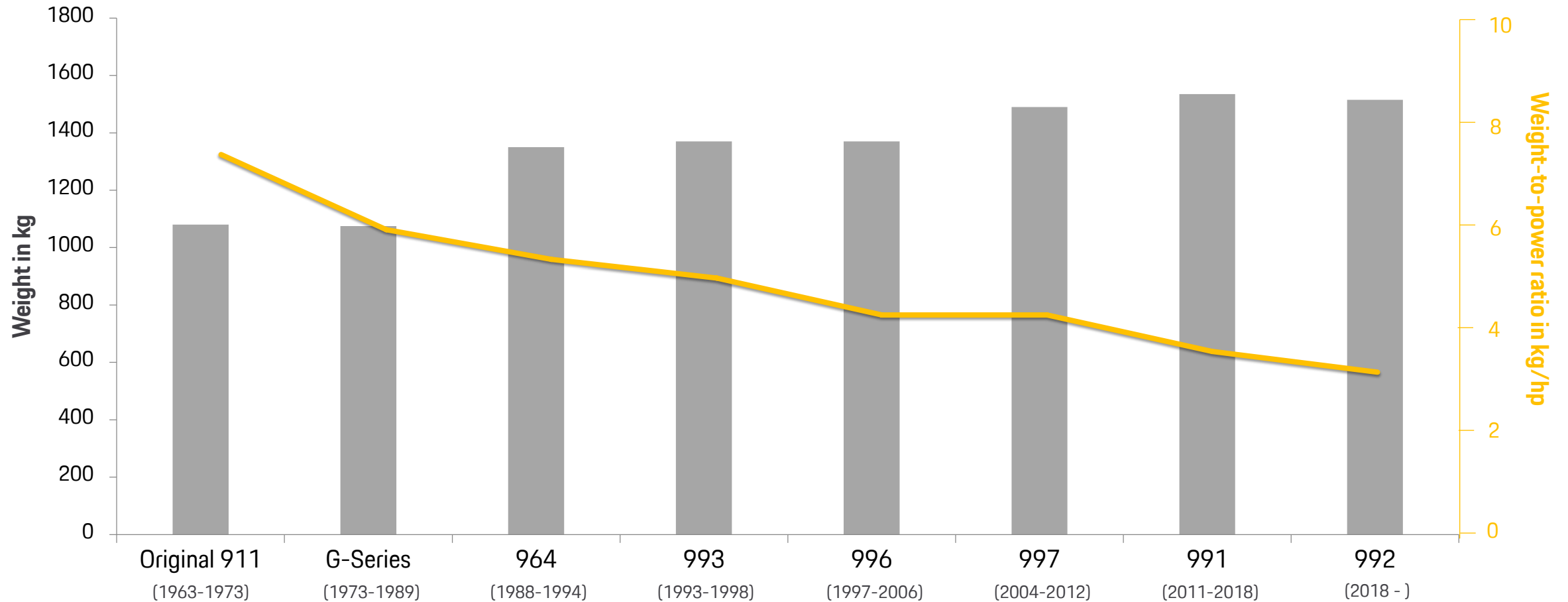
Individualisation

- Lightweight carbon roof
- Sport Design Package

Driving dynamics and driving comfort

- New Porsche Active Suspension Management
- New wheels and tyres with different dimensions (Front: 20-inch; rear: 21-inch)
- New engine mounts





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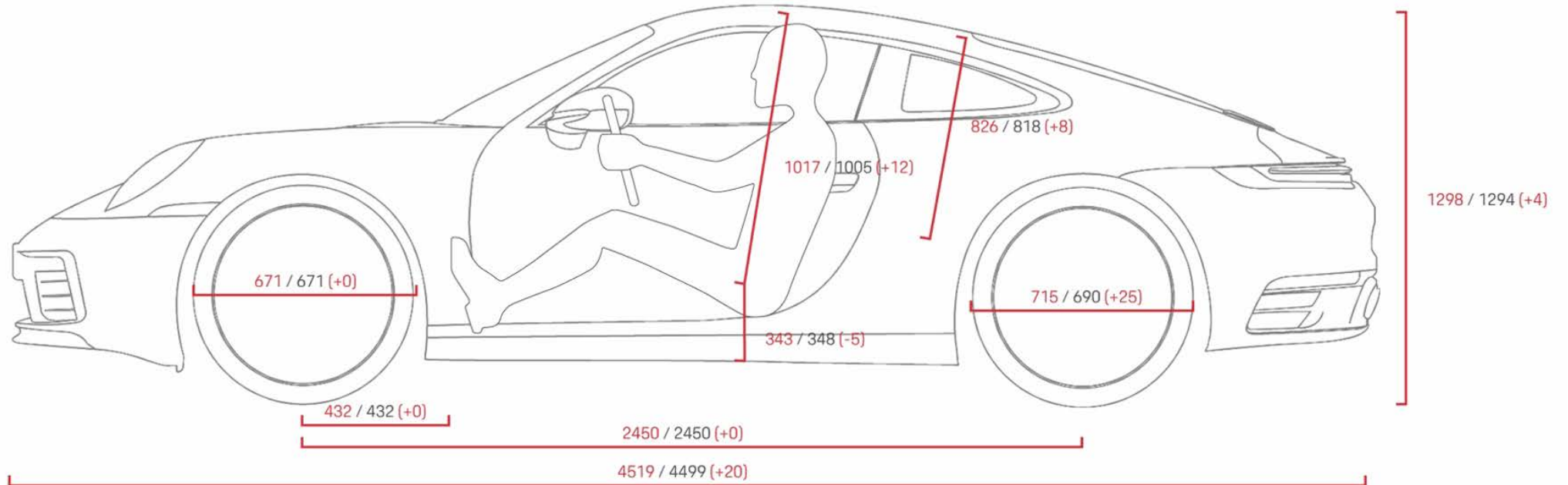
Finish

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The new 911 Carrera – The eighth generation of the 911



992



Process

- Derivatives development without prototypes
- New multi-story body manufacturing plant at brownfield site
- Methods development
- Up to nine body variants and two platforms on one production line

Product

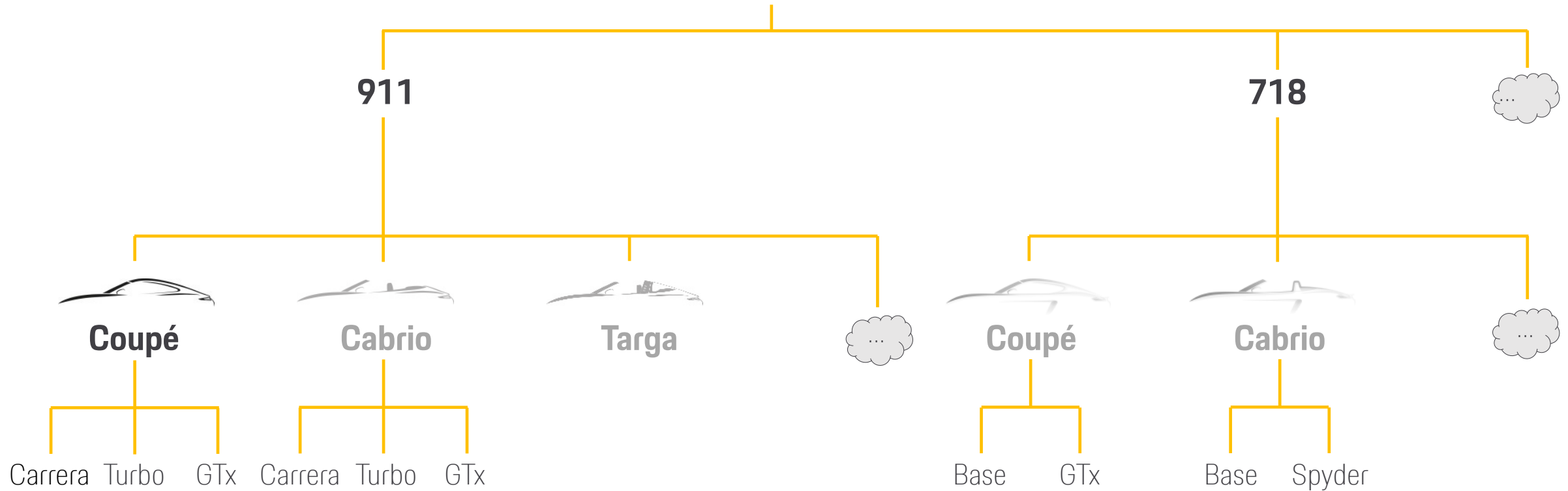
- Systematic lightweight design
- Multimaterial body
- Innovative joining technologies



MMB* platform

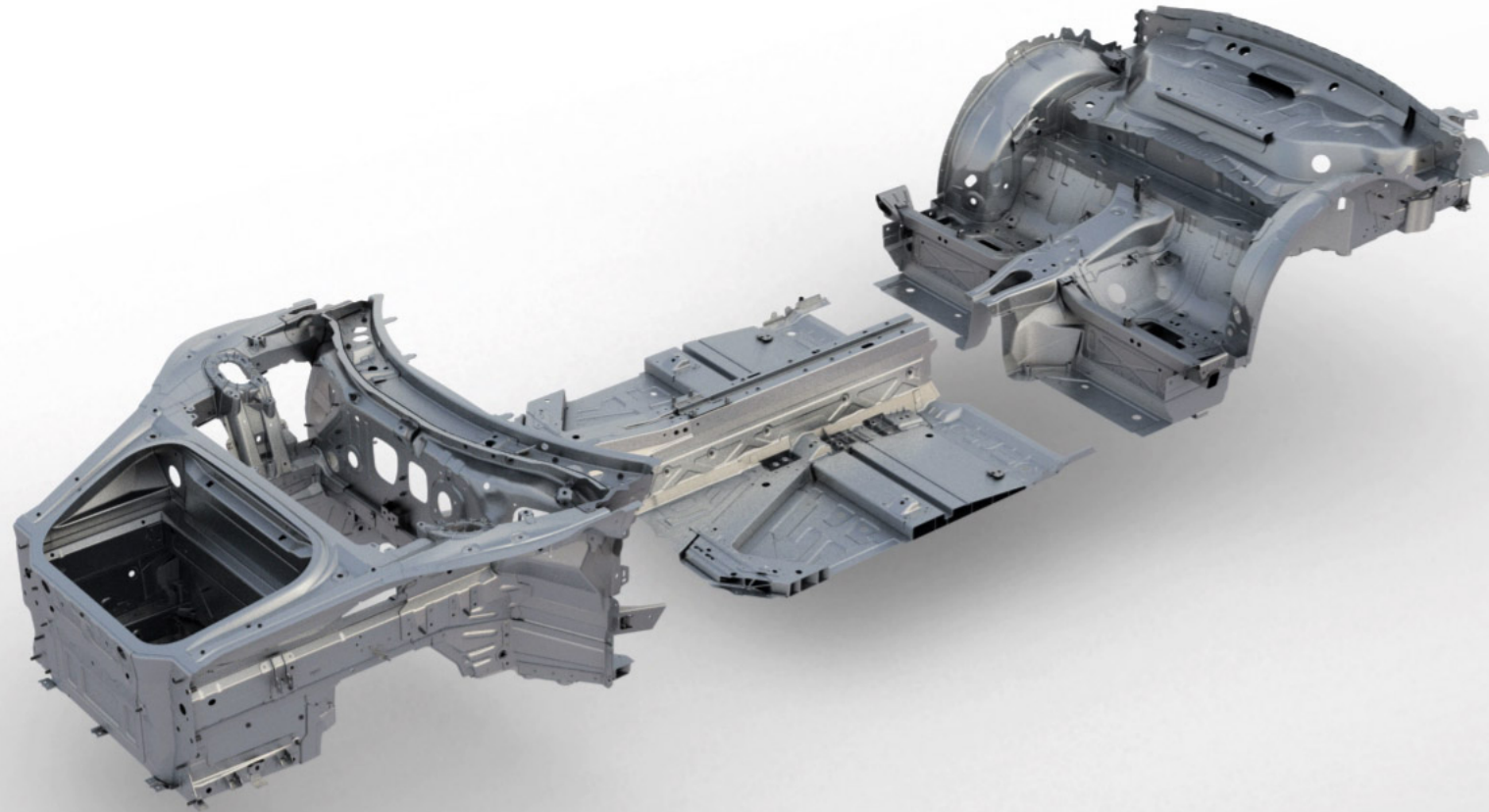
- Group modular platform
- Platform users
- Drive technologies

MMB platform



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Der neue 911 Carrera – Modulares Plattformkonzept



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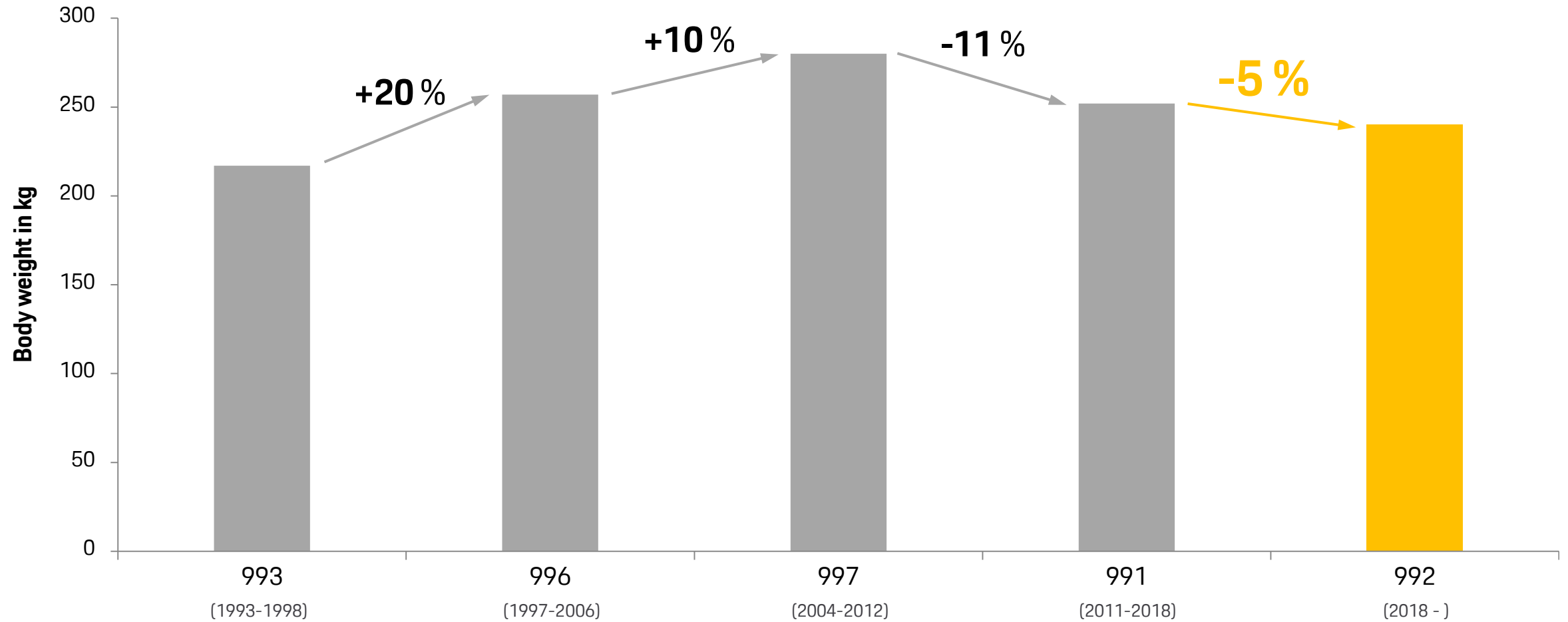
Body
highlights

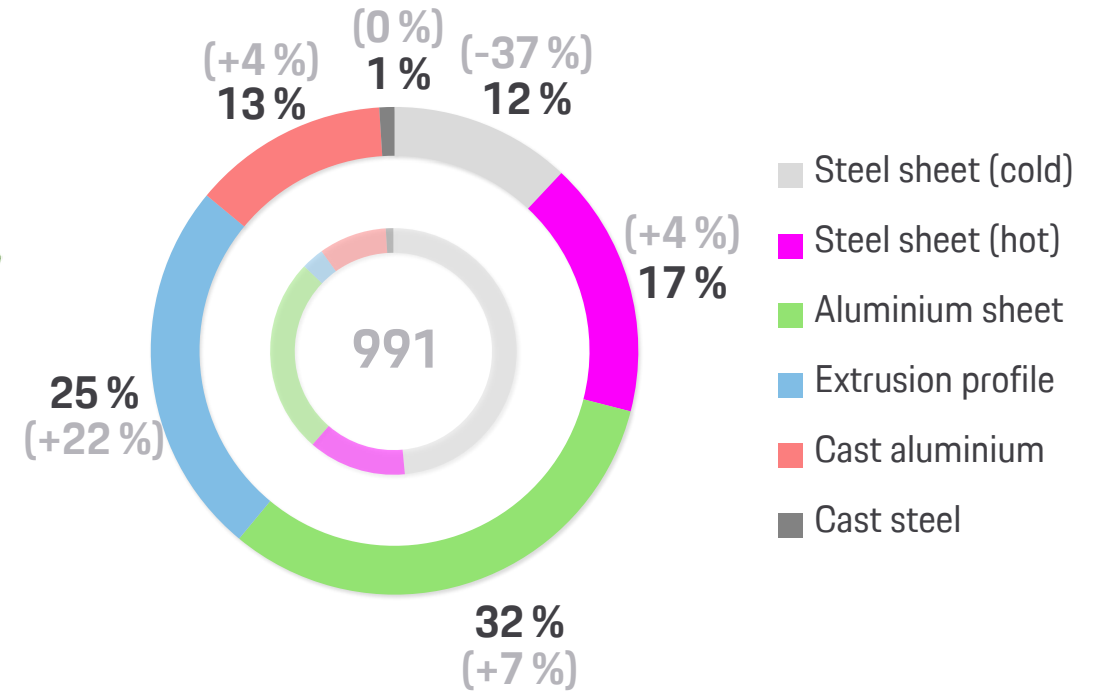
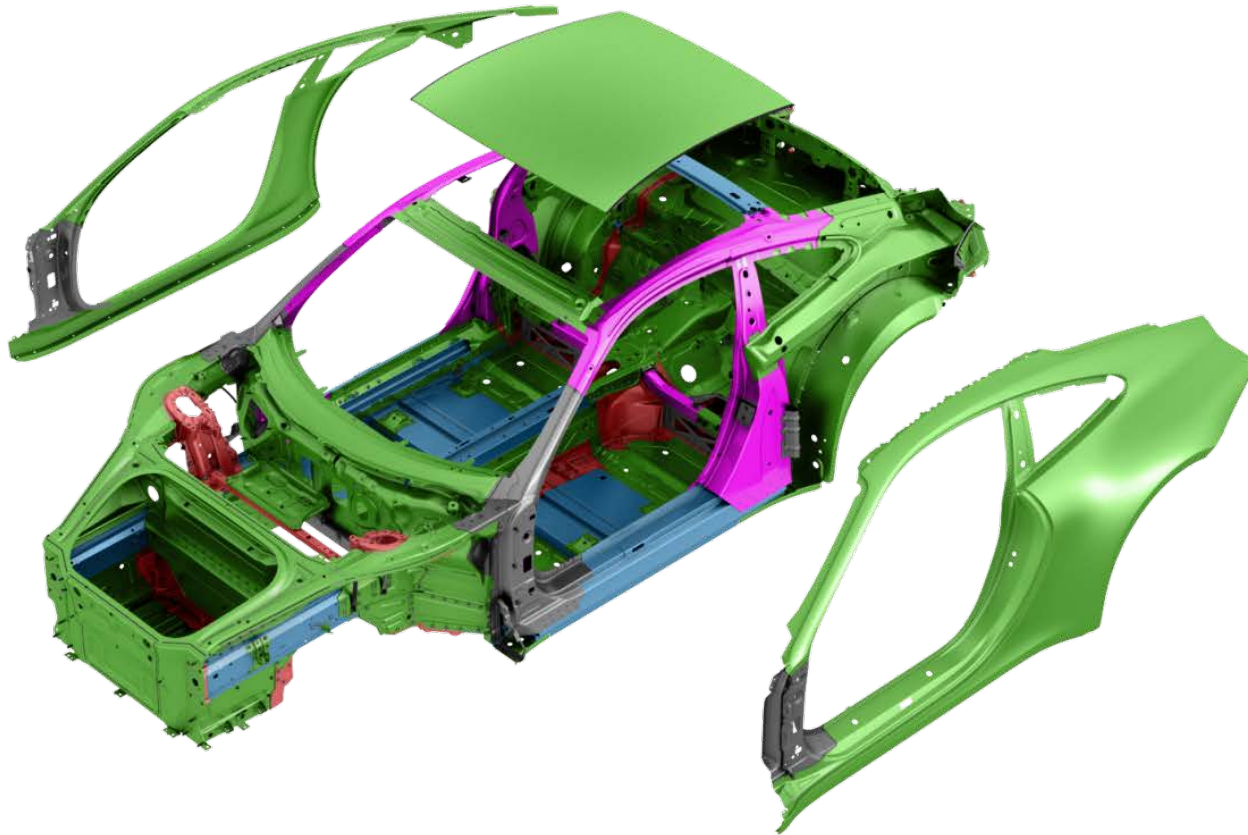
4

Production

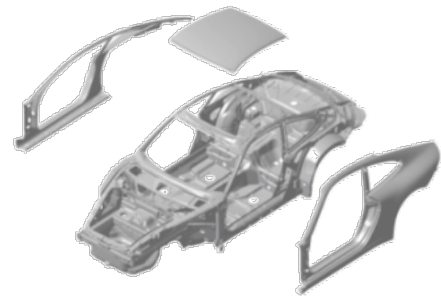
5

Finish





911 (Type 997)



- Sheet steel (cold)

Resistance spot welding



MAG welding



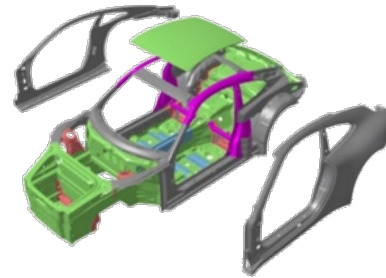
Adhesive bonding



Clinching



911 (Type 991)



- Steel sheet (cold)
- Steel sheet (hot)
- Aluminium sheet
- Extrusion profile
- Cast aluminium
- Cast steel

Resistance spot welding



MAG welding



Adhesive bonding



Clinching



Semi-tubular rivets



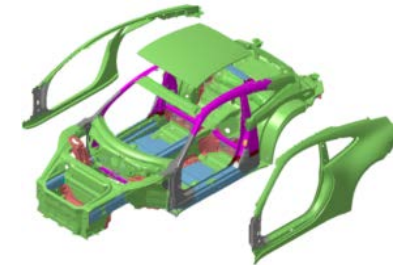
Flow-drilling screws



MIG welding



911 (Type 992)



- Steel sheet (cold)
- Steel sheet (hot)
- Aluminium sheet
- Extrusion profile
- Cast aluminium
- Cast steel

Resistance spot welding



MAG welding



Adhesive bonding



Clinching



Semi-tubular rivets



Flow-drilling screws



MIG welding



Solid punch rivets



Roller hemming



Friction welding



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The new 911 Carrera
Lightweight design of exterior side panel using aluminium.



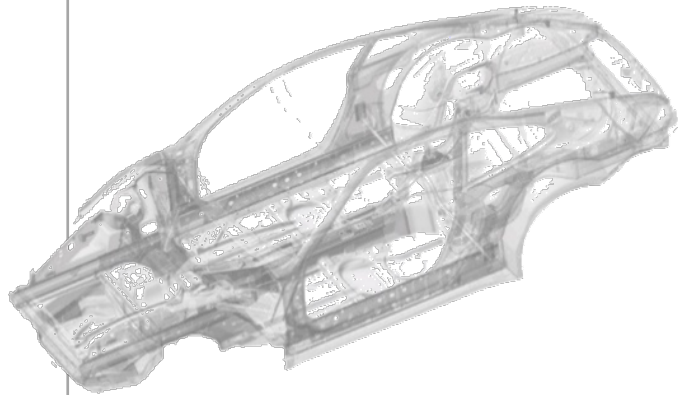
Weight reduction per vehicle

↓ **12 kg**

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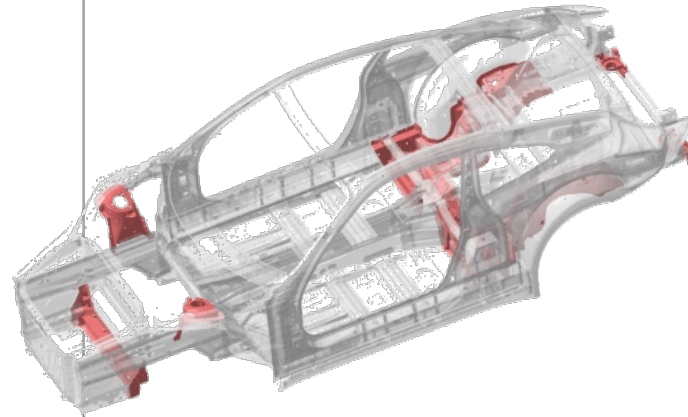
The new 911 Carrera – Approach to the use of casting materials over time

997



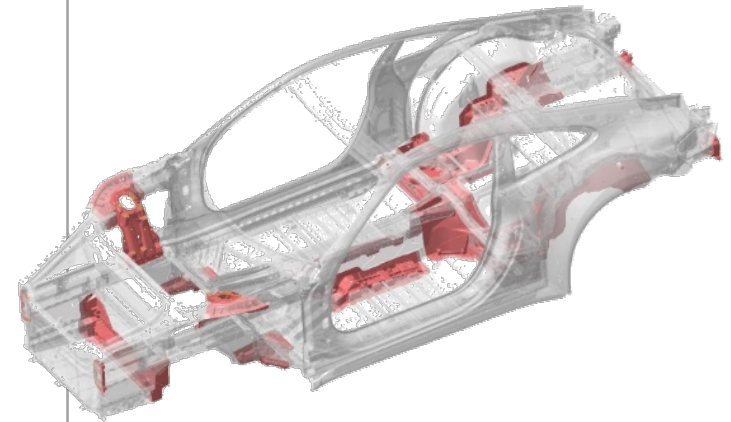
0%

991



9%

992



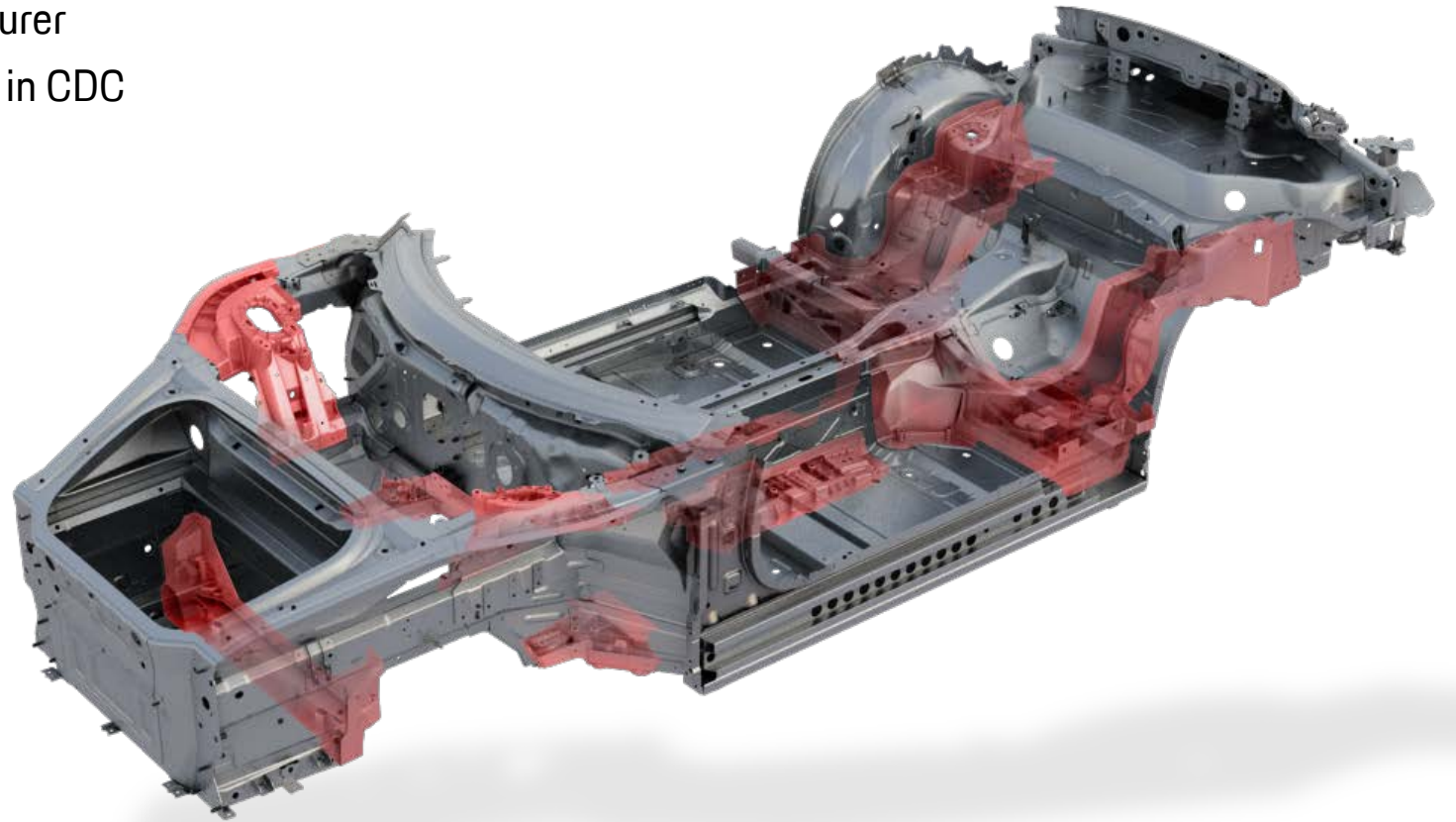
13%

Process optimisation

- Eliminates need for heat treatment at manufacturer
- Finished mechanical properties by input of heat in CDC process

Benefits

- Improved **CO₂ footprint** due to elimination of heat treatment at manufacturer
- Lower part costs
- Improved punch rivet process



Two load beams, one variant

- Lightweight coupé vehicles
- Heavy cabriolet/targa/turbo vehicles

Differentiated by wall thicknesses of the extrusion profiles with

- the same fastening points to the higher-level structure
- same joining technology to the higher-level structure

Goal

- Weight- and function-optimised structure for absorbing different levels of energy while conforming to mounting space limitations



Improvement of local dynamic transfer stiffnesses by

- optimised double-shear joints of the strut tower
- weight- and package-optimised braces concept

Goals

- Reduced rolling noise at front wheels
- Improved driving stability of front body



Torsion

Bending

Dynamic stiffness
Body-in-white

> 53 Hz

> 76 Hz

Dynamic stiffness
Trimmed body

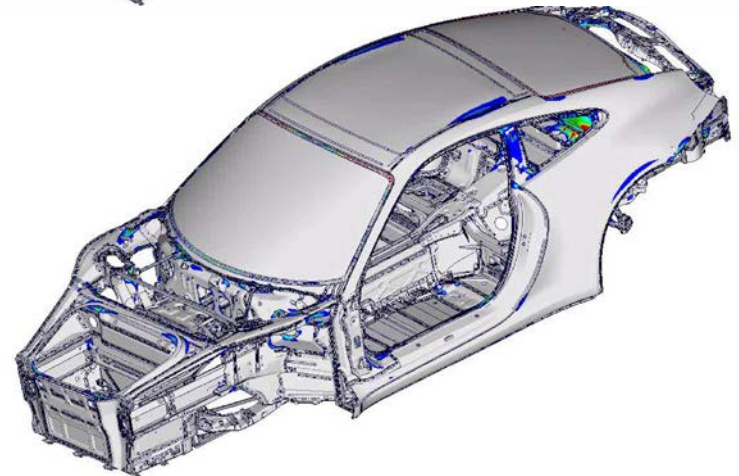
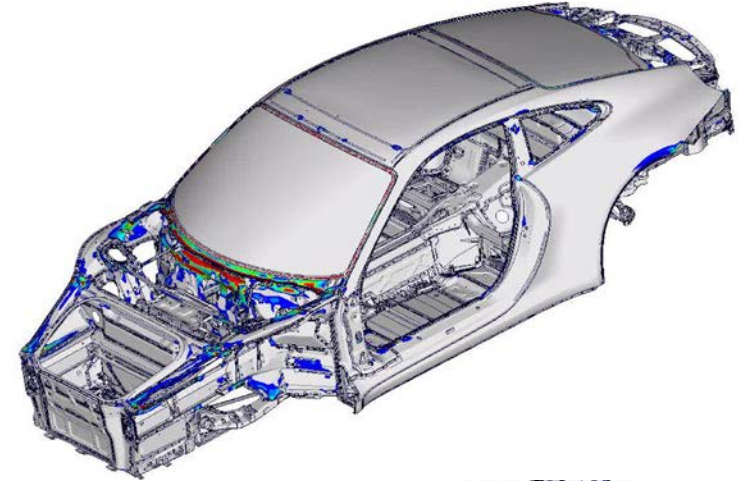
> 27 Hz

> 29 Hz

Static stiffness
Body-in-white

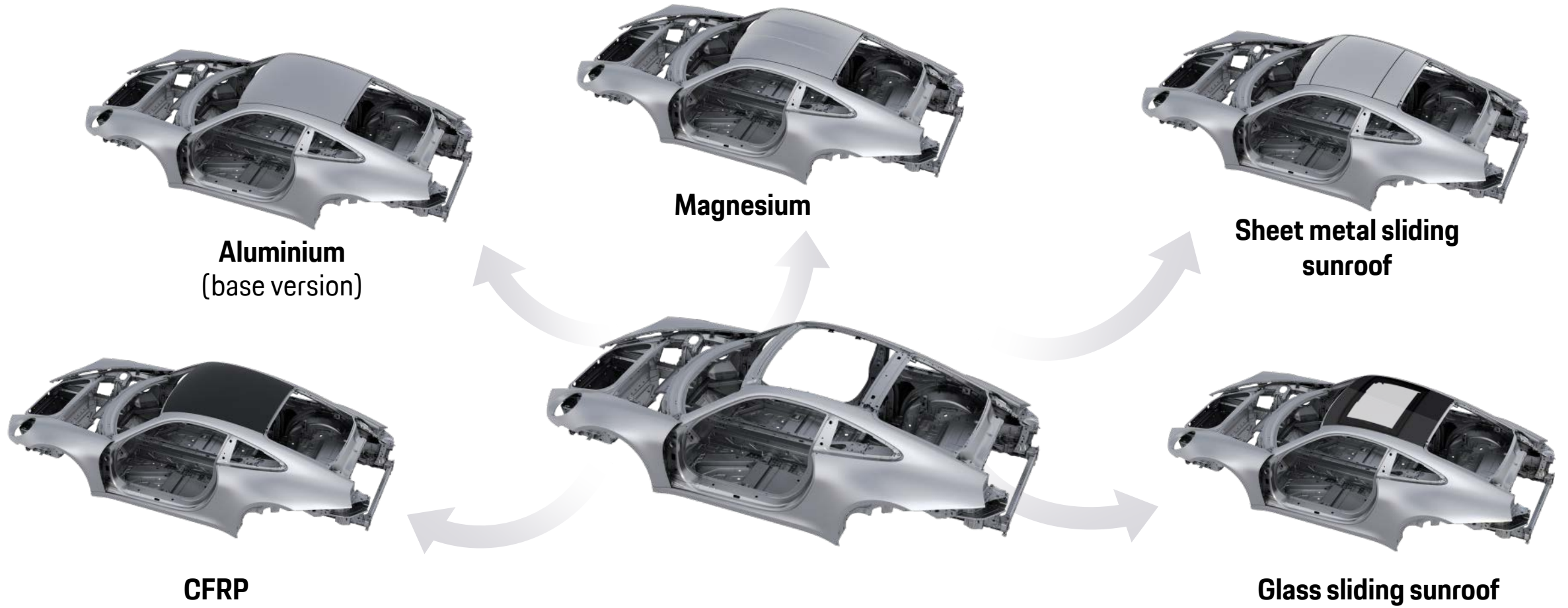
> 39,000 Nm/°

> 25,000 N/mm



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The new 911 Carrera – Modular roof concept



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highlights

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The new 911 Carrera – Pressed part competence at Porsche



Zuffenhausen, 1963



Schwarzenberg, 2018

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The new 911 Carrera – Universal process from design to part



Design

**Simultaneous
engineering**

**Tool
engineering**

**Tool
building**

**Quality
process**

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The new 911 Carrera – Requirements for an exterior side panel

Porsche DNA

Strategic goals

Business requirements

Aluminium

Dynamics

Impression

Legal requirements



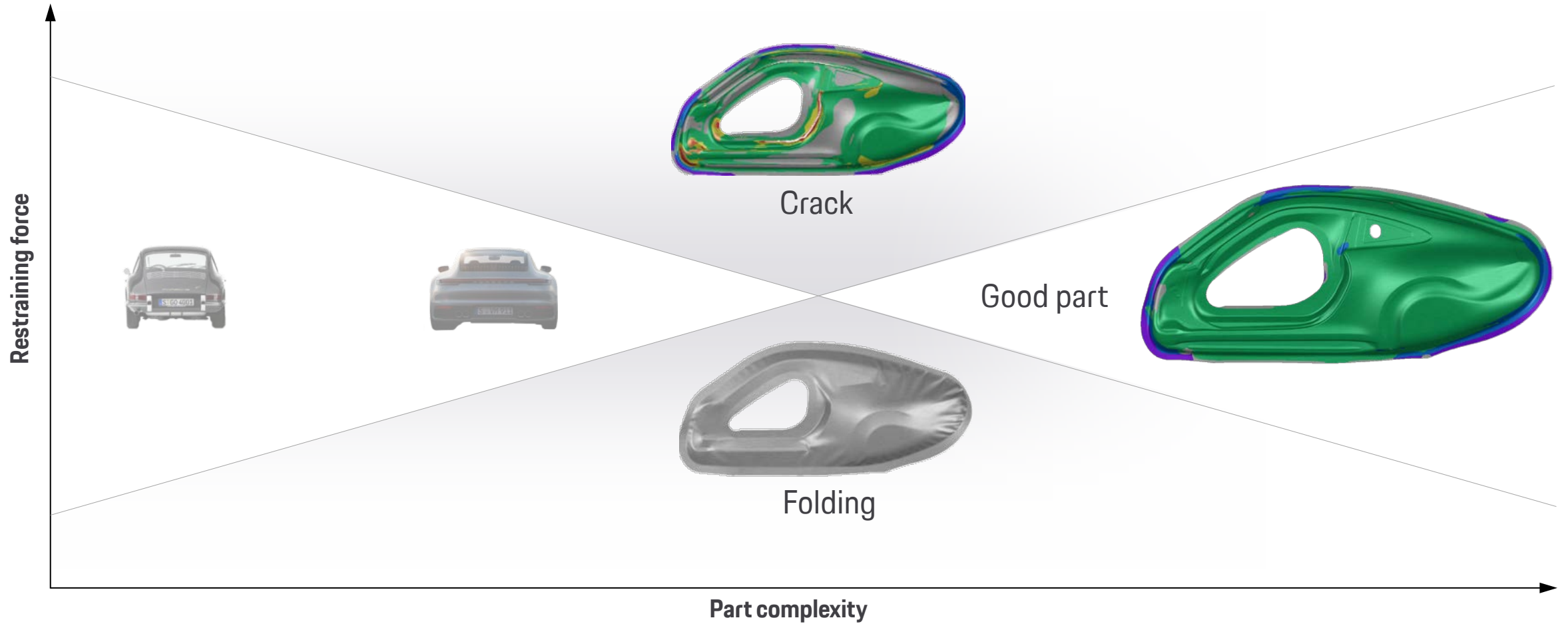
Highly precise fit and repeatability

**Higher
Design requirement**

Increasing tool complexity

**Lightweight
design**

Shorter manufacturing times and reaction times



Example of exterior side part

- Forming force **> 1200 tonnes**
- Weight of drawing tool **> 45 tonnes**
- Blank holder travel **> 325 mm**
- Forming precision **±0.02 mm**
- Drawing depths **up to 300 mm**

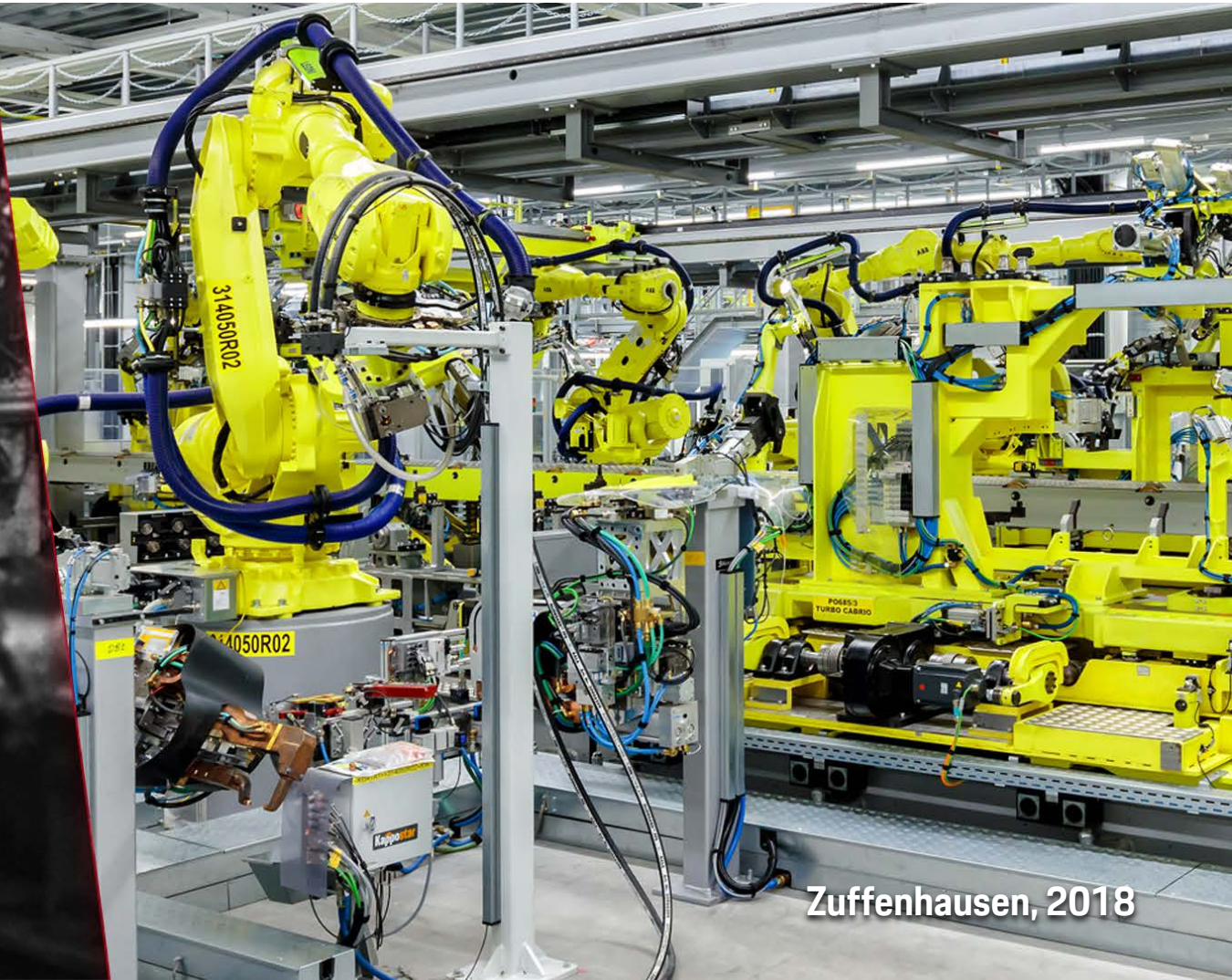


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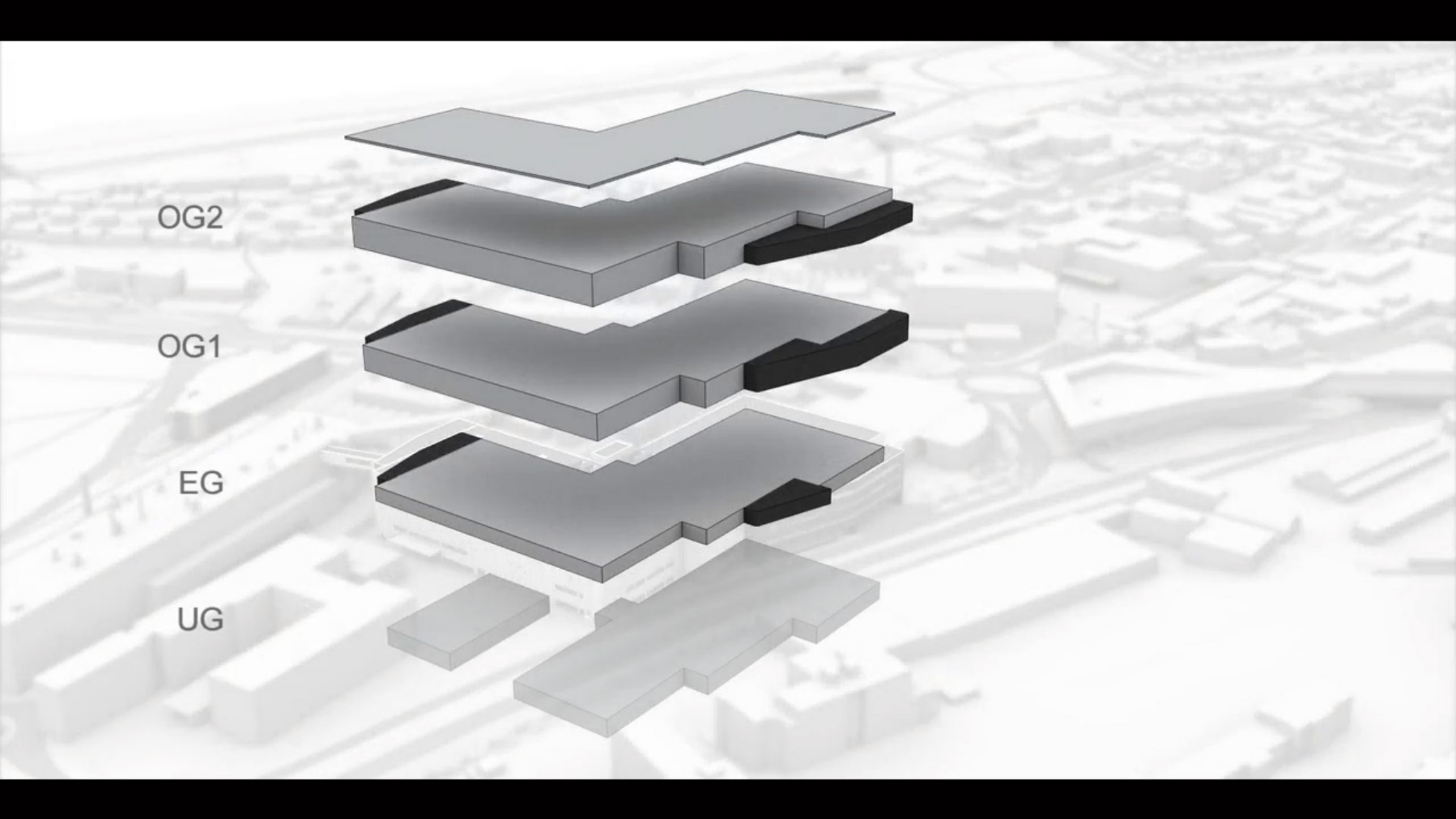
The new 911 Carrera – Body manufacturing in Zuffenhausen



Zuffenhausen, 1963



Zuffenhausen, 2018

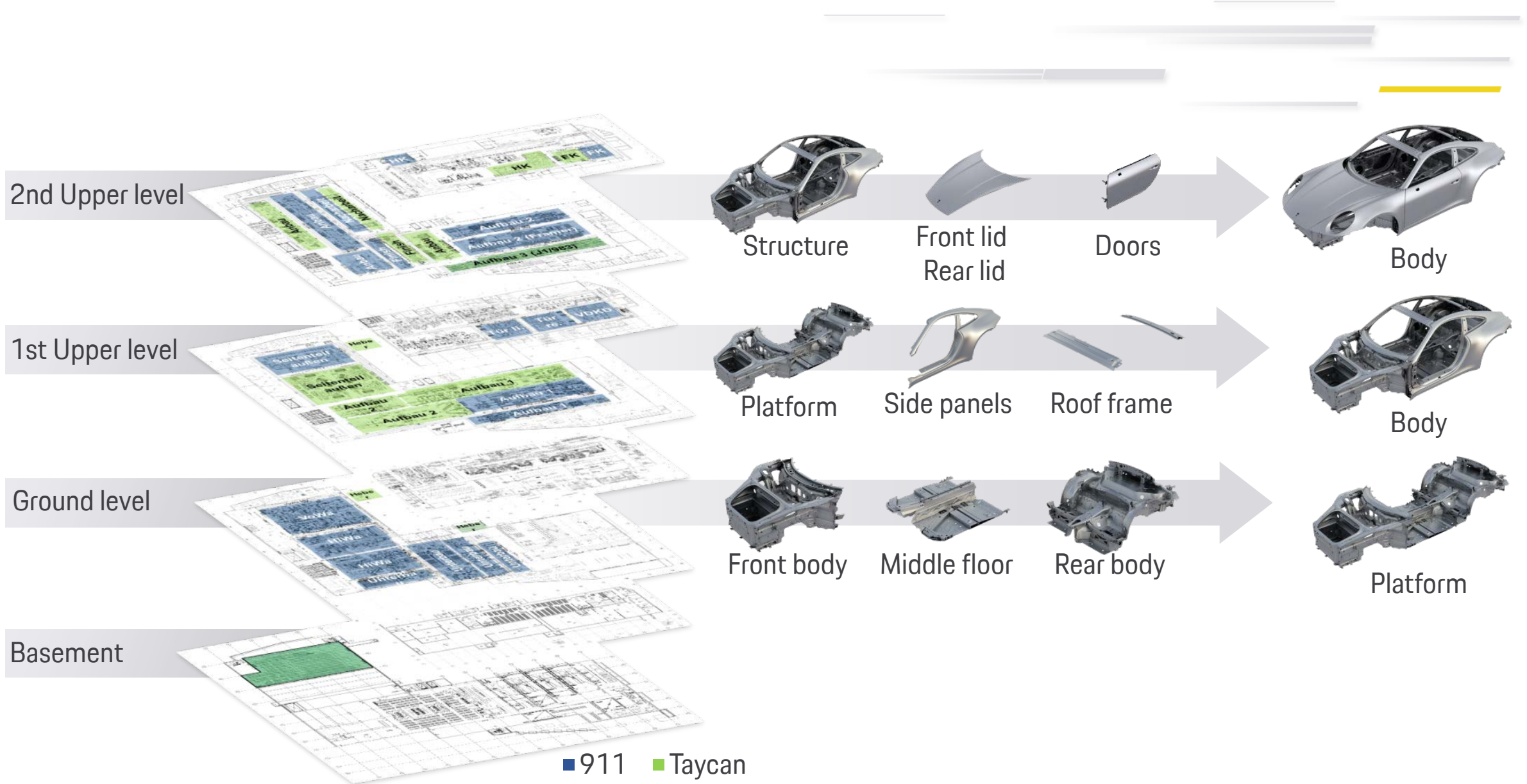


OG2

OG1

EG

UG



Flexibility

- Shared body manufacturing for 911, 718 and Taycan
- Up to nine side body variants

Innovation

- Energy and control technology
- Human-robot collaboration
- Digital planning tools

Automation

- 280 robots
- 404 m travel axis
- approx. 1,000 system components

Conveyor technology

- 2,200 m skid conveyor technology
- 1,500 m overhead conveyor technology
- 1,800 m chain conveyor technology



Flexibility



- Shared production line for 911 and 718
- Up to nine plus two side panel variants

Innovation



- Implementation of highly flexible framer concept in compact construction
- Automated part feed in “wild mix”

Automation



- Clamping frame transport by framer portal
- Camera-guided roll hemming
- Variant changeover: no cycle time loss

Production area



- Structures 1 and 2



Flexibility

- Shared manufacturing island for exterior side panel of 911 and 718
- Flexibility for seven plus two side panel variants

Innovation

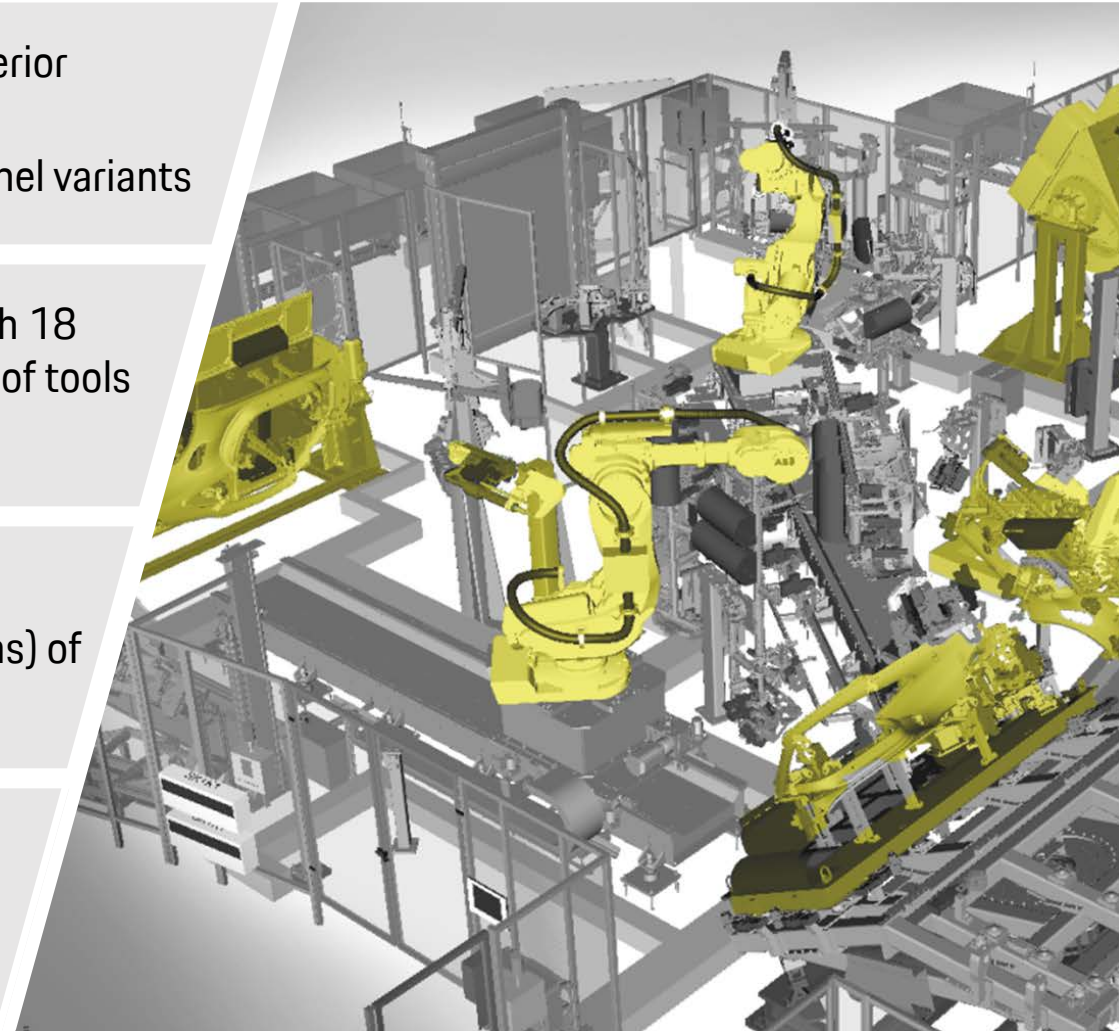
- Use of storage and retrieval machine with 18 spaces (cycle time neutral) for provision of tools
- Automated part feed in “wild mix”


Automation

- Fully automated changeover of tools
- Automated process monitoring (with cameras) of derivative-specific parts


Production area

- Exterior side panel



- Flexibility** 
- Use of innovative technologies in production applications
 - Ergonomic work processes
 - Working without safety fence

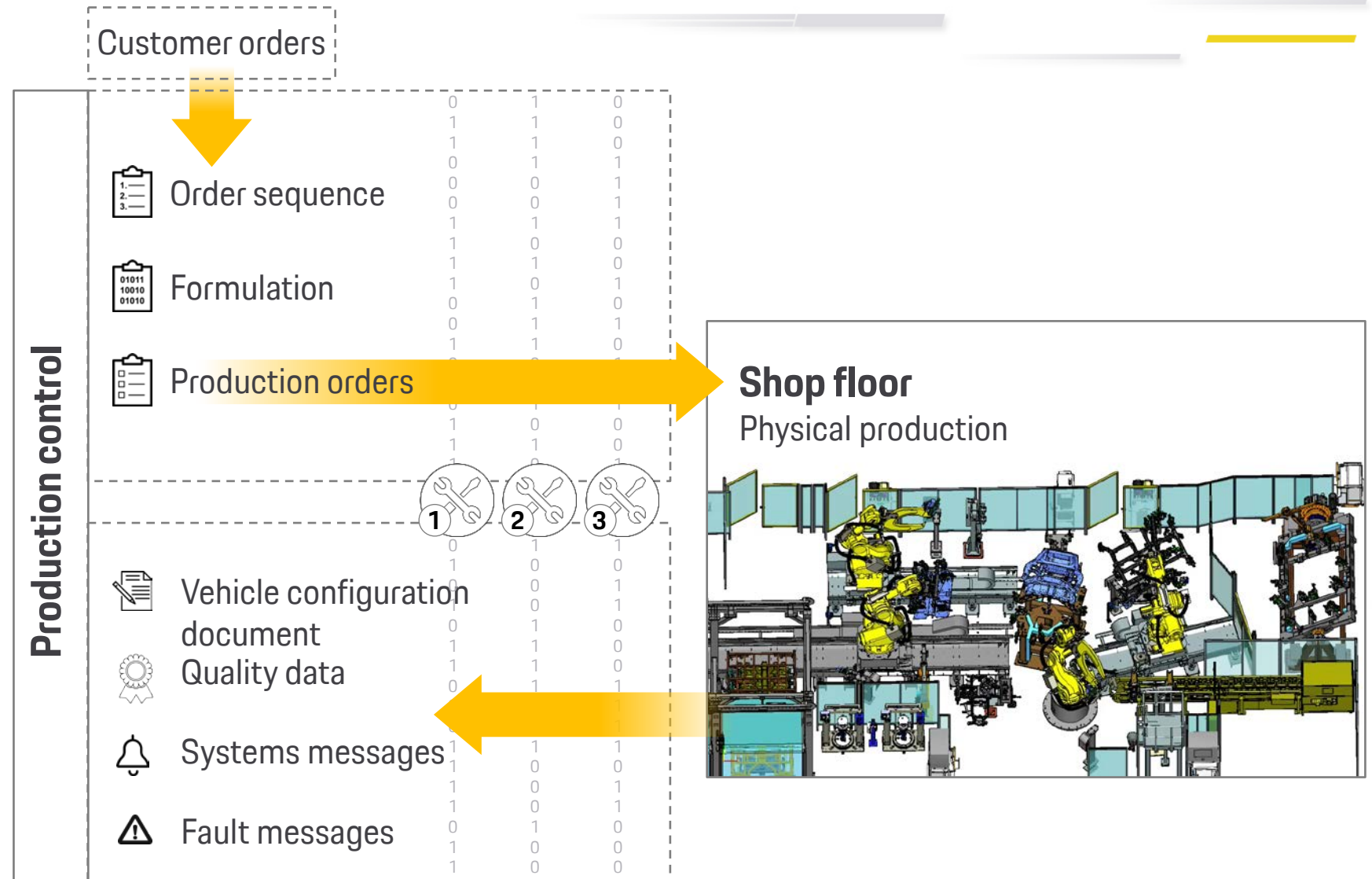
- Innovation** 
- Human-robot collaboration
 - “Grab in the box”
 - Flexible component feed

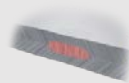
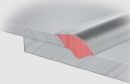
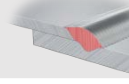





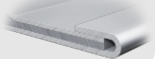

- Automation** 
- Heavy-duty robot with capacitive skin
 - Driverless transport system (FTS) for flexible changeover of load carriers

- Production area** 
- Rear body




- All data is saved from the first production step
- Quality data, measurements and information on joints are available throughout the process chain.
- This database assures that high Porsche quality requirements are fulfilled at all times




Resistance spot welding		813 units
MAG welding		3.5 m
MIG welding		17 m
Clinching		527 units
Semi-tubular rivets		1,944 units
Flow-drilling screws		596 units
Adhesive bonding		188 m
Solid punch rivets		6 units
Roller hemming		4.8 m
Friction welding		116 units




Flexibility 

- Qualification of “new” method for joining high-strength steels and aluminium directly

Innovation 

- Reduced number of individual parts by eliminating adapter parts/bridge parts
- No annoying contour due to joining element (use in functional areas like window mounts)


Product 

- Reduced number of parts
- Eliminates seam sealing in wet area


Application 

- Window mount flange
- Roof frame
- Rear window




Flexibility 

- Qualification of method for joining aluminium side panel with hot-formed interior panel

Innovation 

- Hemming of side panel to structure in three stages
- No other joining technologies needed for joint

Product 

- No annoying contour due to joining elements (seal assembly)
- High flexibility of roll hemming head in derivative integration

Application 

- Door sill



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The new 911 Carrera – Finish

Exterior design even more
muscular and
contemporary

Heightened body stiffness

First use of MMB platform

Lightweight design with
multimaterial body
structure

Advanced development of
joining technologies

Flexible and innovative
body manufacturing

