

ArcelorMittal Multi Part Integration®

New concepts for body structure using Advanced High Strength Steels & Laser
Welded Blanks solutions



ArcelorMittal

AKT – Aachen 2023



ArcelorMittal

What is ArcelorMittal **Multi Part Integration™** ?

ArcelorMittal needed to provide an answer to new automotive market trends such as:

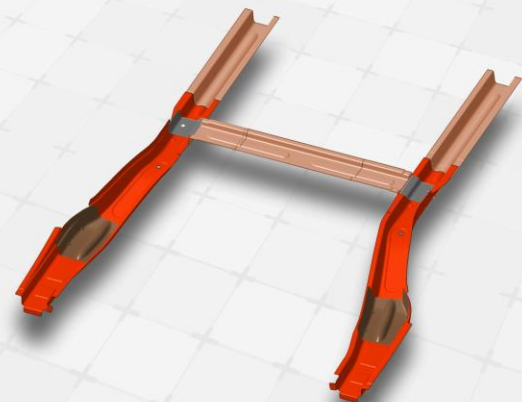
- Simplification
- Modularity
- Electrification
- Sustainability

ArcelorMittal **Multi Part Integration™** made of steel:

- Produces high-tech LWBs
- Uses latest PHS steel products to form complex designs
 - **Usibor® 2000 and Ductibor® 1000**
- Uses hot stamping or cold stamping of one single LWB
- Creates large parts which integrate many components

New **mindset** brings added value to OEMs – in addition to mass savings, cost efficiency and sustainability.

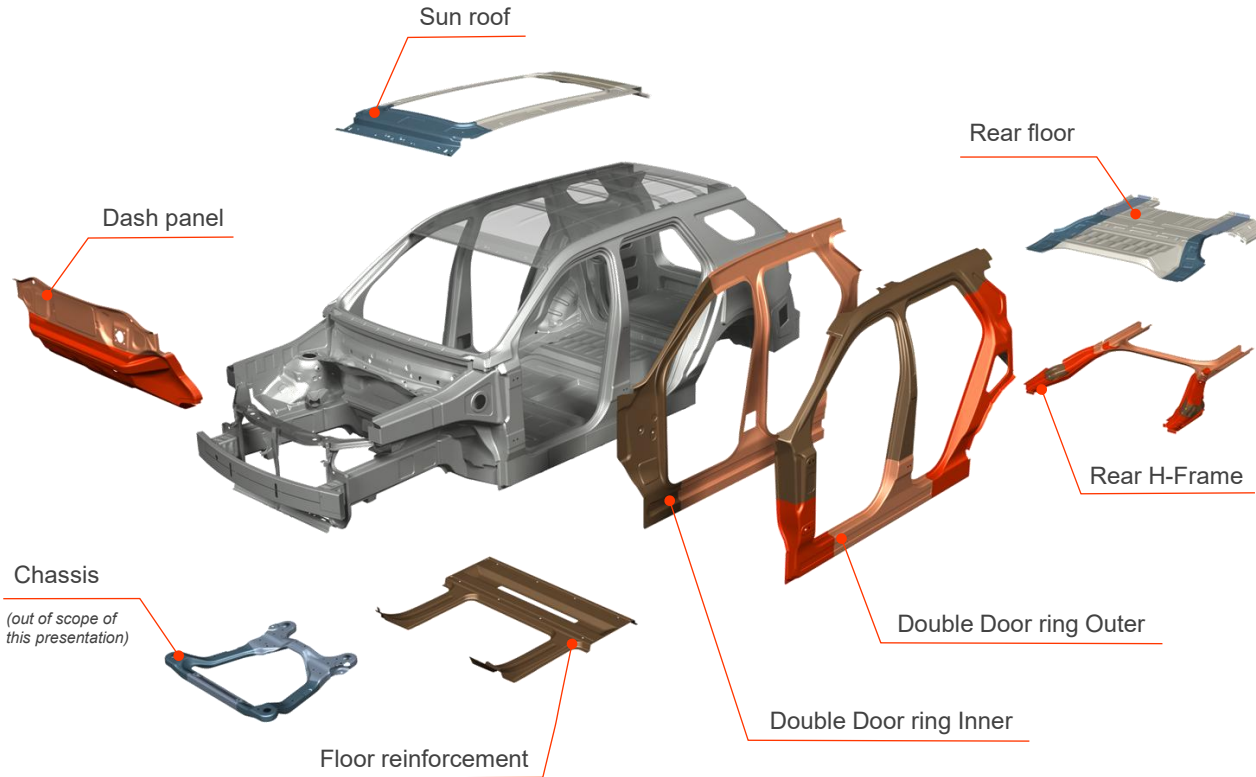
ArcelorMittal **Multi Part Integration™**
Sustainable steel solutions to simplify car manufacturing



ArcelorMittal **Multi Part Integration™** helps to reduce the number of parts.
Here from 11 parts to only 1 part.

ArcelorMittal **Multi Part Integration™**

Potential body-in-white applications for **BEV**

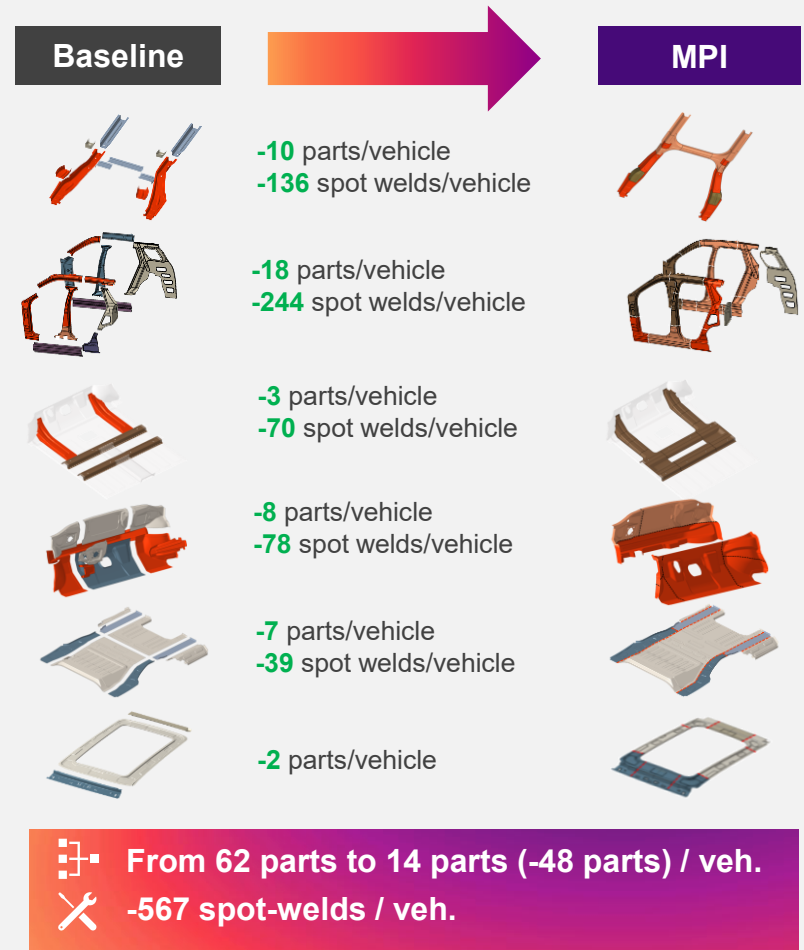


Why apply ArcelorMittal **Multi Part Integration™** solutions ?

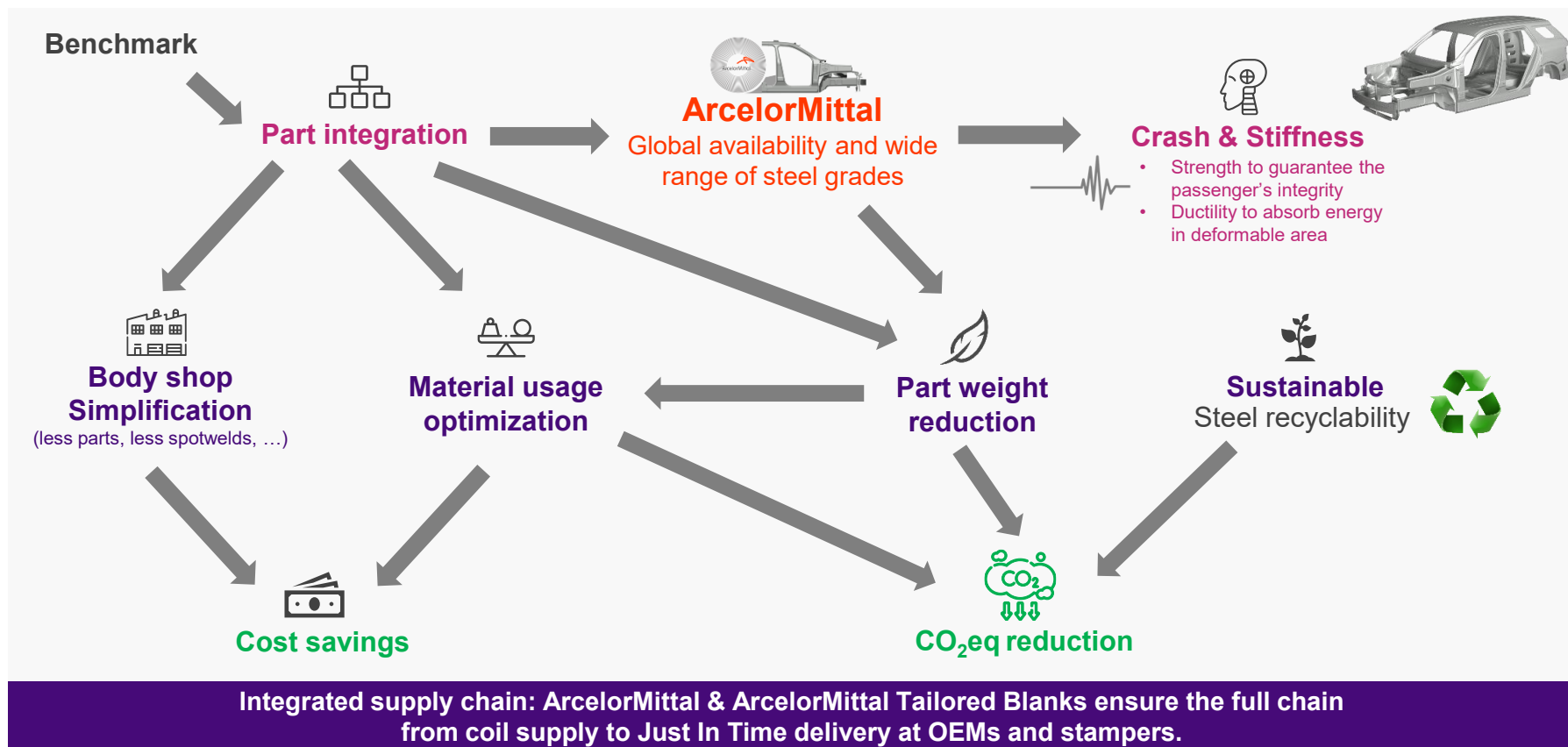
- Reducing the number of car body parts
- Less assembly spot welding
- Assembly lead time reduction
- Bodyshop area reduction
- Part weight reduction
- Engaged material savings
- CO₂eq savings
- Cost savings

Industrial validations were performed to assess the impact of MPI on OEM plant:

- Cycle time
- Workshop area reduction
- Assembly sequence
- Cost
- **Sustainability (CO₂ footprint assessment)**



ArcelorMittal **Multi Part Integration™** to help carmakers to reach their challenges



ArcelorMittal Multi Part Integration™

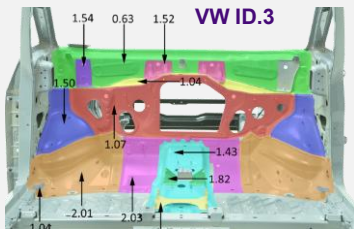
Baseline definition

Definition of the reference design representative of the current market used as baseline for the development of MPI solutions

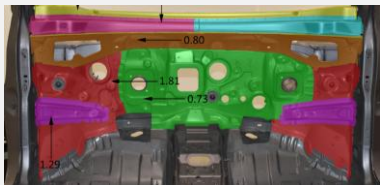
Benchmark A 2 M A C 1

Baseline for MPI solutions

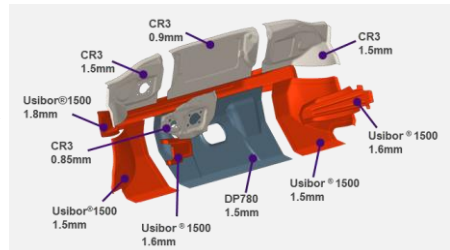
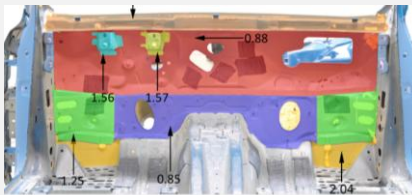
Dash panel



Mercedes EQA

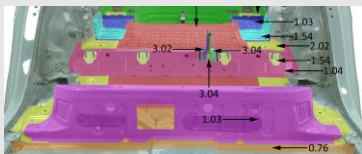


AUDI e-tron

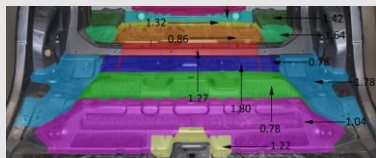


Rear floor

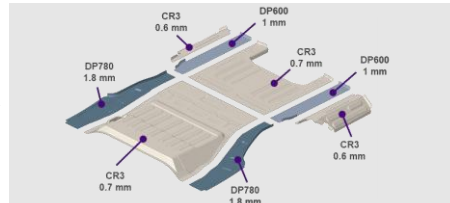
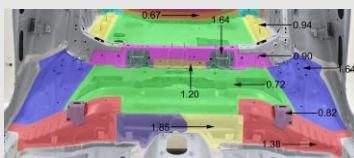
VW ID.3



Mercedes EQA

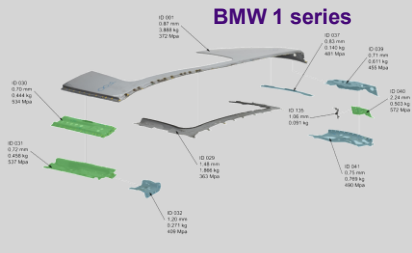


MAZDA MX-30

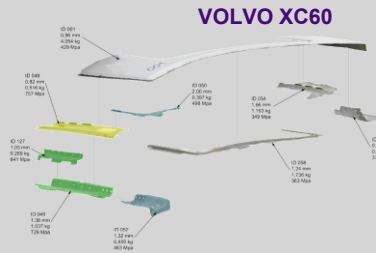


Sun roof

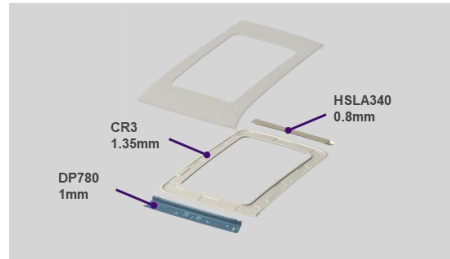
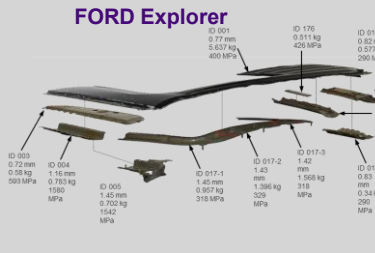
BMW 1 series



VOLVO XC60

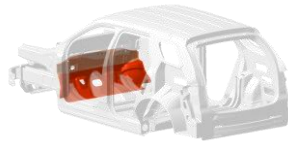


FORD Explorer

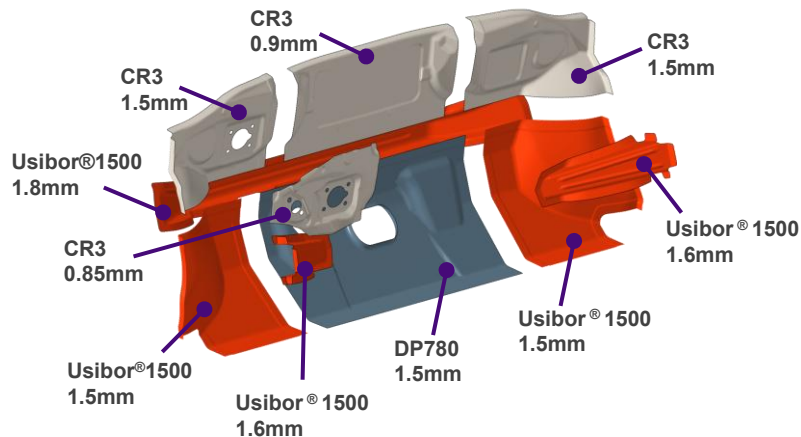


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Dash panel solution

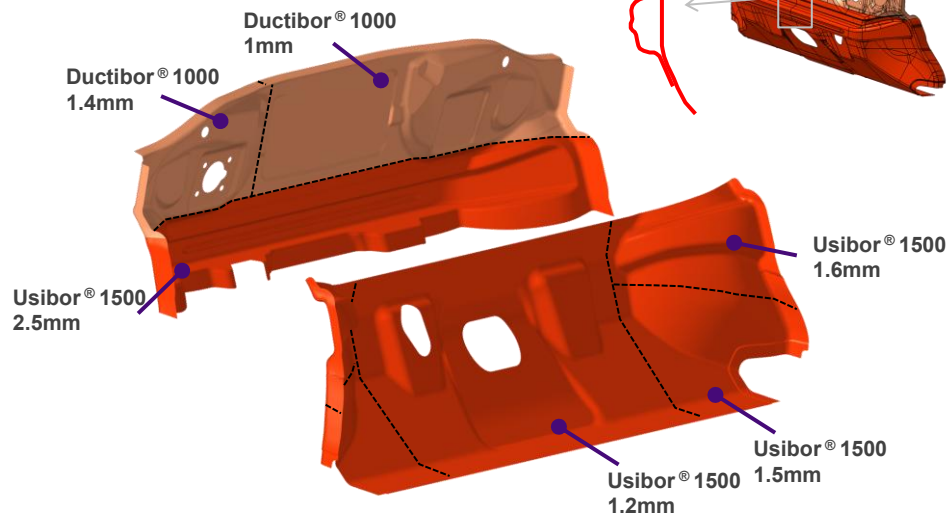


Baseline



10 parts
Module weight **18.70** kg
158 spotwelds

Dash panel solution
based on 2 overlapped LWB

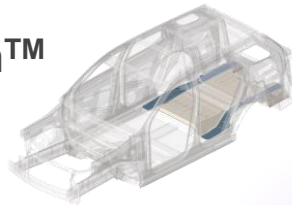


2 parts
Module weight **17.34** kg
80 spotwelds



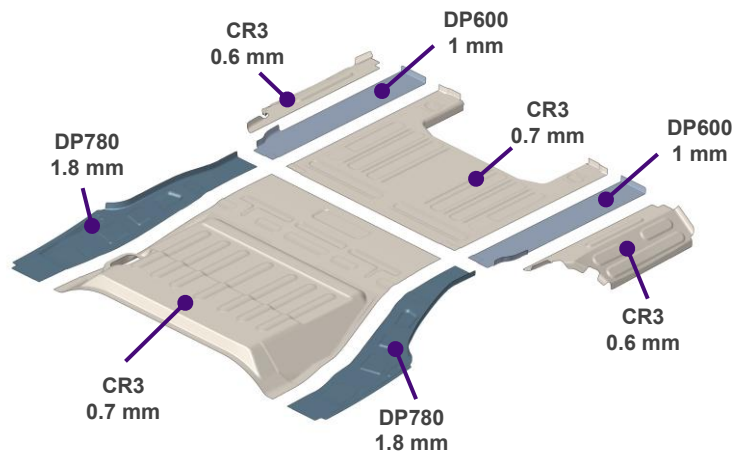
ArcelorMittal Multi Part Integration™

Rear floor solution

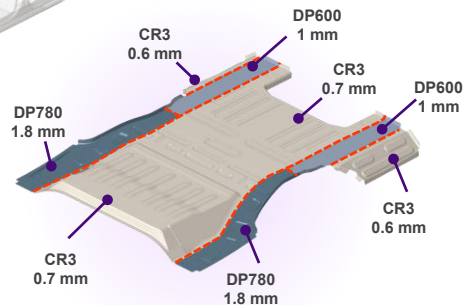


LWB Rear Floor solutions

Baseline multipart

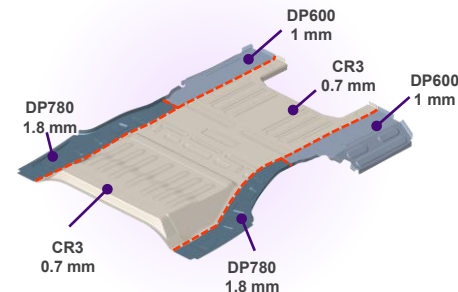


8 parts
Module weight **17.08 kg**



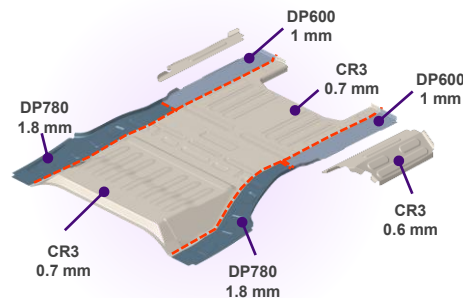
1 part
Module weight **16.43 kg**

*High integration (8 parts in 1 LWB)
Mass savings -0.65kg/veh*



1 part
Module weight **17.09 kg**

*High integration (8 parts in 1 LWB)
Iso mass*



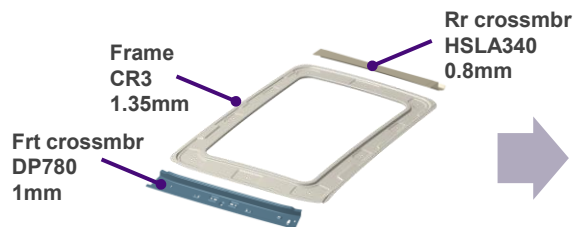
3 parts
Module weight **16.74 kg**

*Intermediate solution
Integration of 5 parts in 1 LWB
Mass savings -0.34kg/veh*

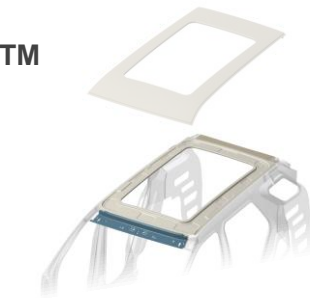
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Sun roof solution

Baseline

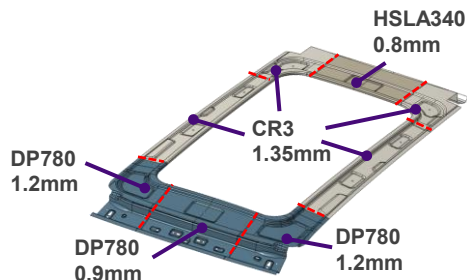


3 parts
Module weight **16.13 kg**



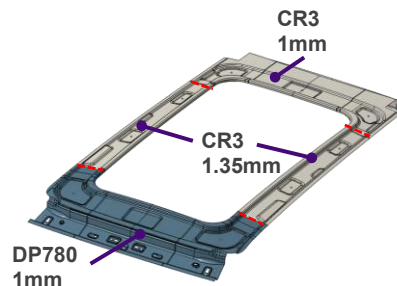
LWB Sun roof solutions

Part integration: 3 parts in 1 LWB
Material / Thickness distribution can be adapted to any specific technical requirements



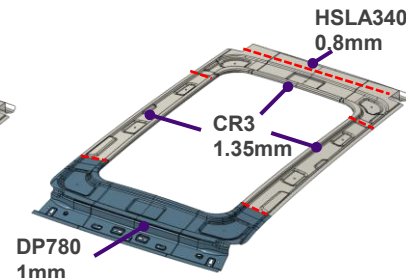
1 part
Module weight **15.63 kg**

LWB with 8 weld lines
Higher thickness in the corners
for stiffness requirements
Mass savings -0.50kg/veh



1 part
Module weight **14.95 kg**

LWB on frame with 4 lines
Reduced number of welds
Mass savings -1.18kg/veh



1 part
Module weight **15.45 kg**

LWB on frame with 5 lines
Strength/thickness distribution
close to baseline
Mass savings -0.68kg/veh

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Crash validations

Rear floor

FMVSS 301 Rear Impact

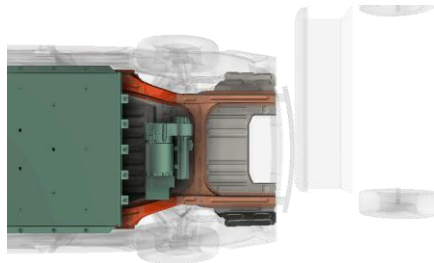
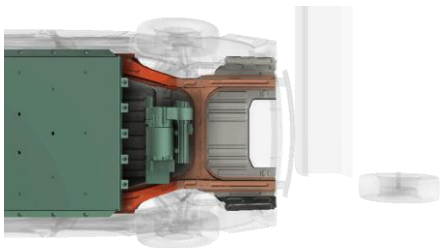
- 70% offset
- Deformable barrier
- Initial velocity = 80 km/h



Baseline



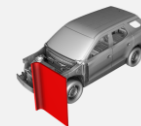
LWB Rear Floor



Dash panel

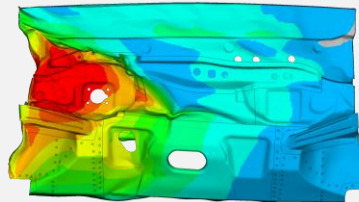
SORB

- 25% offset
- Rigid barrier
- Initial velocity = 64.4 km/h



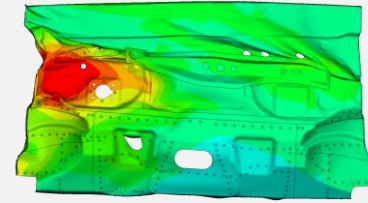
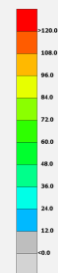
Baseline

Max intrusion = 146mm @90ms



LWB Dash panel

Max intrusion = 153 mm @85ms



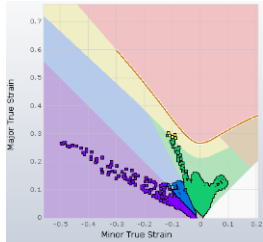
ArcelorMittal Multi Part Integration™

Dash panel forming analysis

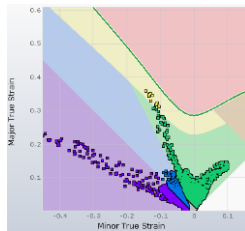


Forming limit diagram

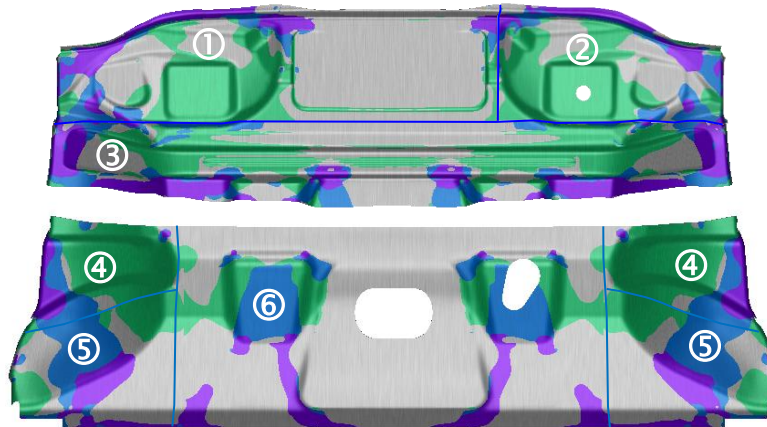
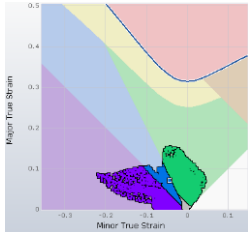
① Ductibor® 1000 1mm



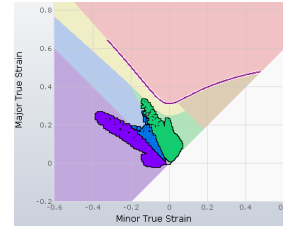
② Ductibor® 1000 1.4mm



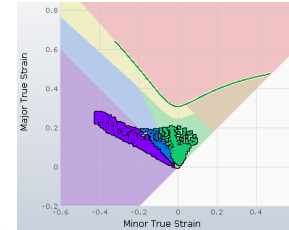
③ Usibor® 1500 2.5mm



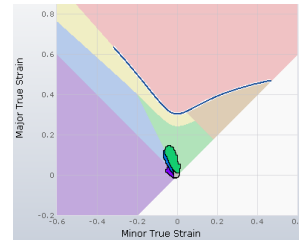
④ Usibor® 1500 1.5mm



⑤ Usibor® 1500 1.5mm



⑥ Usibor® 1500 1.2mm

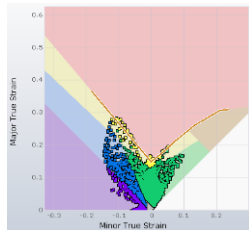


Feasibility of the LWB Dash Panel lower validated through numerical simulation

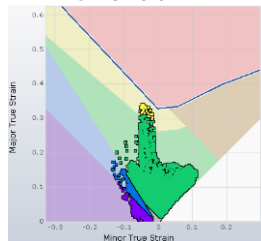
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Rear floor forming analysis

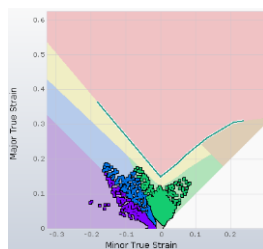
② DP780 1.8mm



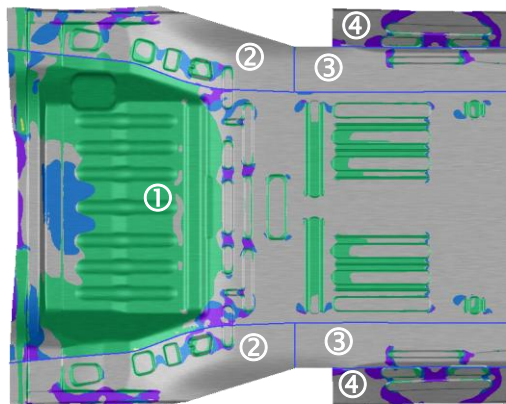
① CR3 0.7mm



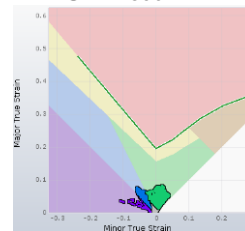
② DP780 1.8mm



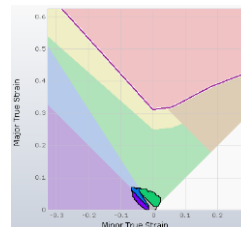
Forming limit diagram



③ DP590 1mm

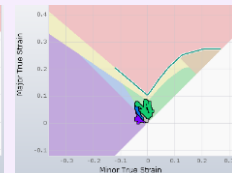
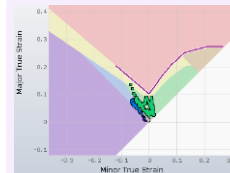


④ CR3 0.6mm

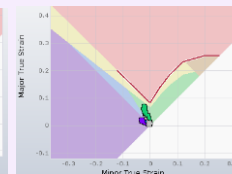
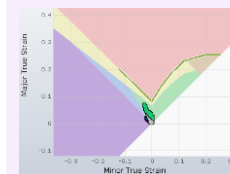


Interaction zones

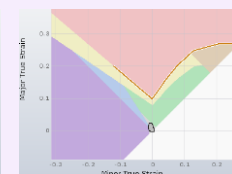
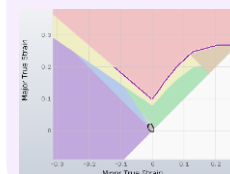
CR3 0.7mm / DP780 1.8mm



CR3 0.6mm / DP590 1.0mm



CR3 0.7mm / DP590 1.0mm

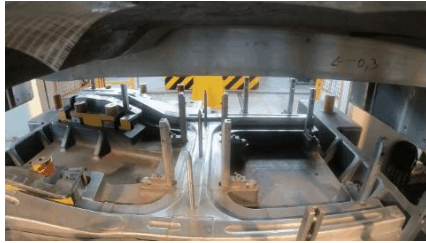


ArcelorMittal **Multi Part Integration**™

From design engineering to Prototyping and Implementation

Rear H-Frame

- Prototype parts performed by ArcelorMittal R&D



- First industrial project with Chinese OEM

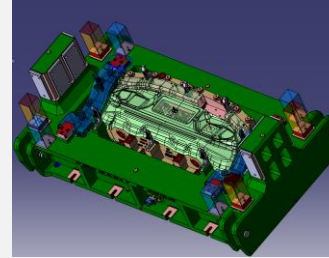


Project with Voyah (China)

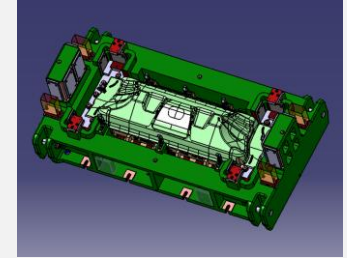
https://www.youtube.com/watch?v=pr0QIHJ_4RY

Dash panel

- Prototype parts available by the end of this year



Dash panel upper tool design



Dash panel lower tool design

ArcelorMittal Multi Part Integration™

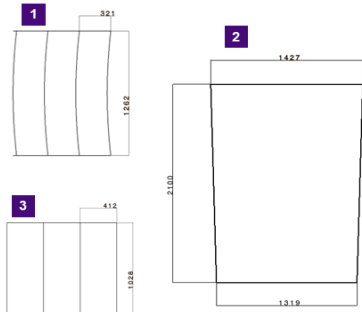
Scrap and gross weight reduction

- Better nesting with LWB
- No overlap flanges required for LWB

Baseline



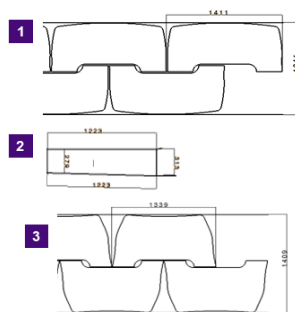
Material utilization rate: **43%**



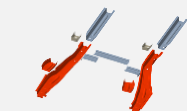
LWB Sun roof



Material utilization rate: **68%**



Reference



-1.4kg / **-4.3kg**
-10% / **-21%**



-4.8kg / **-12.7kg** (Inner)
-11% / **-18%**



-5kg / **-9.3kg** (Outer)
-11% / **-15%**



-0.6kg / **-1.8kg**
-5% / **-10%**



-1.4kg / **-3kg**
-7% / **-11%**

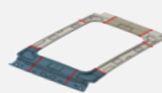
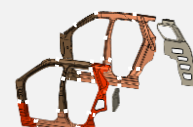


-0.65kg / **-0.8kg**
-4% / **-3%**



-0.5kg / **-13.6kg**
-1% / **-36%**

MPI



Weight saving / **Gross weight reduction**



Material savings -18% (-45.5kg) / veh.

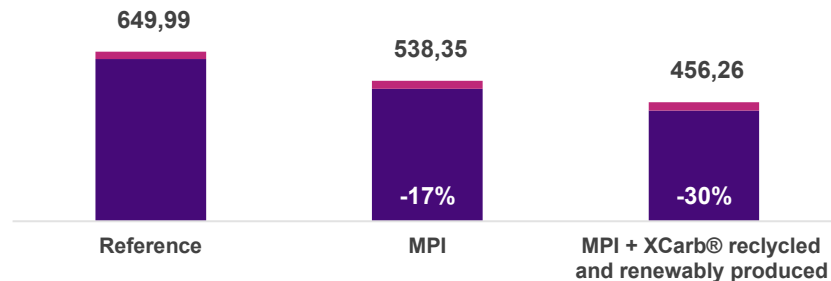
XCarb® products combined with ArcelorMittal Multi Part Integration™ to go further in terms of sustainability

Usibor® 1500 AS coated represents only **20%** of MPI gross weight



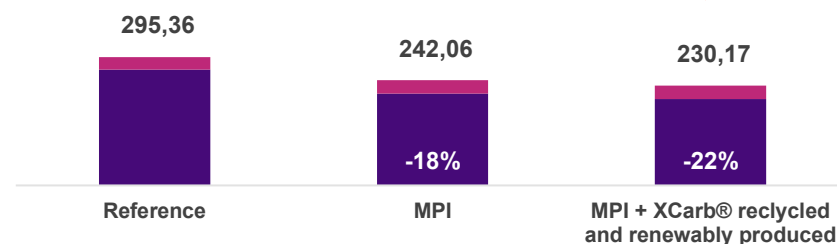
■ Steel making
■ Manufacturing

Without recycling credit (kg CO₂eq)



■ Steel making
■ Manufacturing

With recycling credit (kg CO₂eq)



Driving phase not included

Targets & ambition



ArcelorMittal
net zero 2050

2030

Group - 25%
EU+NA - 35%



Decarbonisation
projects in EU
started

XCarb®
Green steel certificate

- 2020: Launch of XCarb® green steel certificates
 - For steel made in blast furnace route
 - CO₂ savings from reducing fossil coal via specific & audited decarbonisation investments
 - Available in all products and grades

XCarb®
Recycled and renewably produced

- 2022: Launch of XCarb® recycled and renewably produced
 - Low CO₂ footprint steel made in electric arc furnace
 - Using renewable electricity
 - High recycled content
 - Available products:
 - HRP&O: FB & HSLA
 - Usibor®1500
 - More to come

XCarb®
Brand to be developed

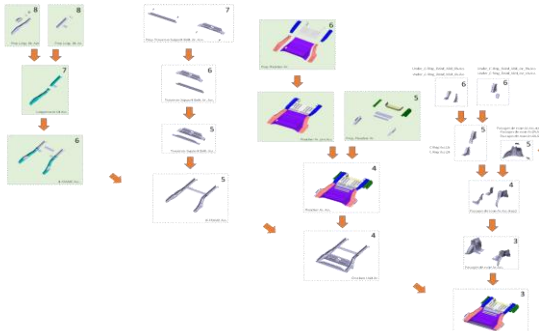
- From 2025: New XCarb® products to be launched
 - Physical decarbonised steel
 - Based on direct reduced iron (DRI) technology
 - Available in all products and grades

More low-carbon emissions XCarb® solutions will be launched as new decarbonisation technologies are deployed

ArcelorMittal Multi Part Integration™

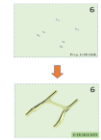
Insight of economical impacts on assembly bodyshop

Conventional rear unit

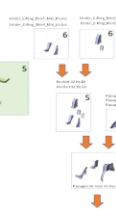
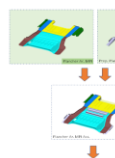


Rear unit with 2 MPis

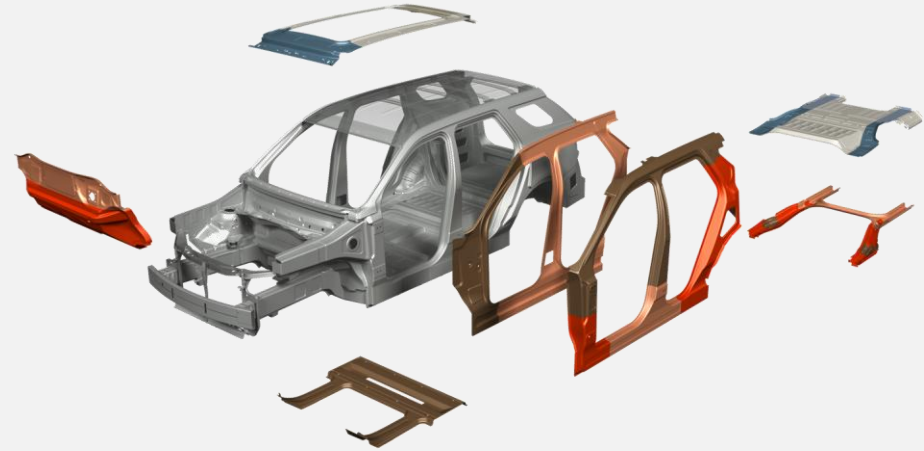
LWB H-Frame



LWB Rear floor



Operators : -18%
Bodyshop area: -11%
Robots : -20%
CAPEX: -18%
HPV: -17%



- Number of operators reduced by 15% to 30%*
 - Bodyshop area reduced by 0% to 15%*
 - Number of robots reduced by 5% to 10%*
 - CAPEX reduced by 5% to 10%*
 - HPV (Hour of labor per vehicle) reduced by 15% to 30%*
- *depending on assembly bodyshop layout and automation level*

ArcelorMittal Multi Part Integration™

Main takeaways



MPI solutions based on Tailored blanks **integrate a large number of parts** and **simplify car manufacturing**



Solution with **complex geometries** that can be achieved thanks to hot stamping of **Usibor®** and **Ductibor®** products and **validated through forming simulations**



Solution meets **all relevant safety requirements** for worldwide market (North American and European crash load cases)



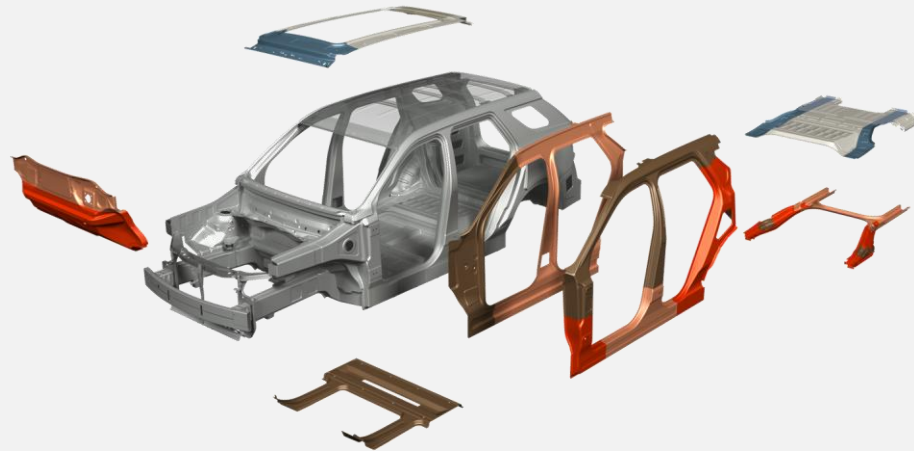
Optimized solution in terms of **mass** and **material utilization rate**



Lower investment and factory footprint compared to a conventional design



Sustainable solution thanks to part integration and high material savings



-  **From 62 parts to 14 parts (-48 parts) per vehicle**
-  **-567 spot-welds per vehicle**
-  **-26 stamping tools**
-  **Gross weight savings: -45.5kg (-18%) per vehicle**
-  **Up to 18% of CO₂eq reduction** *(without use phase & XCarb®)*

Multi Part Integration

Discover the power of less with MPI

In a rapidly evolving automotive industry, flexibility wins. Multi Part Integration maximises automotive manufacturers' ability to adapt through the power of less: less parts, less time less process, less floor space, less material, less CO₂ and less assembly cost.

Harness the strength of steel and the power of less.

For more, head to
mpi.arcelormittal.com

