



ArcelorMittal

S-in motion

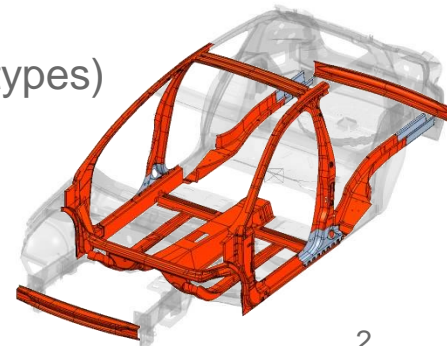


- Steel
- Saving weight
- Saving costs
- Sustainability
- Safety
- Service
- Strength
- Solutions



S-in motion

- **Objectives**
 - **Lightest vehicle with currently available AHSS grades** relative to a modern baseline C-class vehicle
 - Build a **catalogue of worldwide solutions** per sub module
 - Including worldwide crash and stiffness requirements & performance ratings
 - **At the lowest possible cost**
- **Use of worldwide available ArcelorMittal products**
 - ⇒ Solutions ready for implementation on new vehicle projects
 - ⇒ Including tubular products, stainless steels, long and forged products
- **Scope** Body In White, Hang on parts and Chassis
- **Worldwide ArcelorMittal R&D teams** involving:
 - **automotive suppliers** (engineering offices, diemakers, prototypes)
 - and industrial partners



Methodology



ArcelorMittal

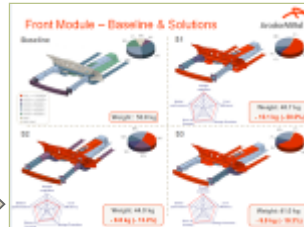
Baseline Meshing Baseline Set-up

Baseline

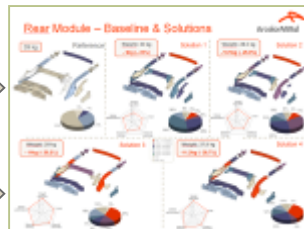


Innovative Design Proposal

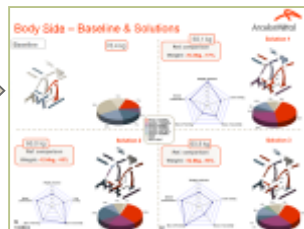
Sub-module approach



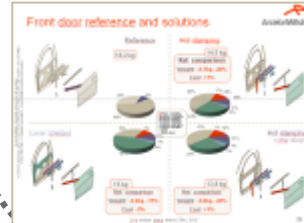
3 Solutions
Front Module
(-10.1 kg)



4 Solutions
Rear Module
(-11.2 kg)



3 Solutions
Body Side
(-13.3 kg)



3 Solutions
Door Module
(-3.7 kg)

Weight Saving Optimization

Lightest vehicle

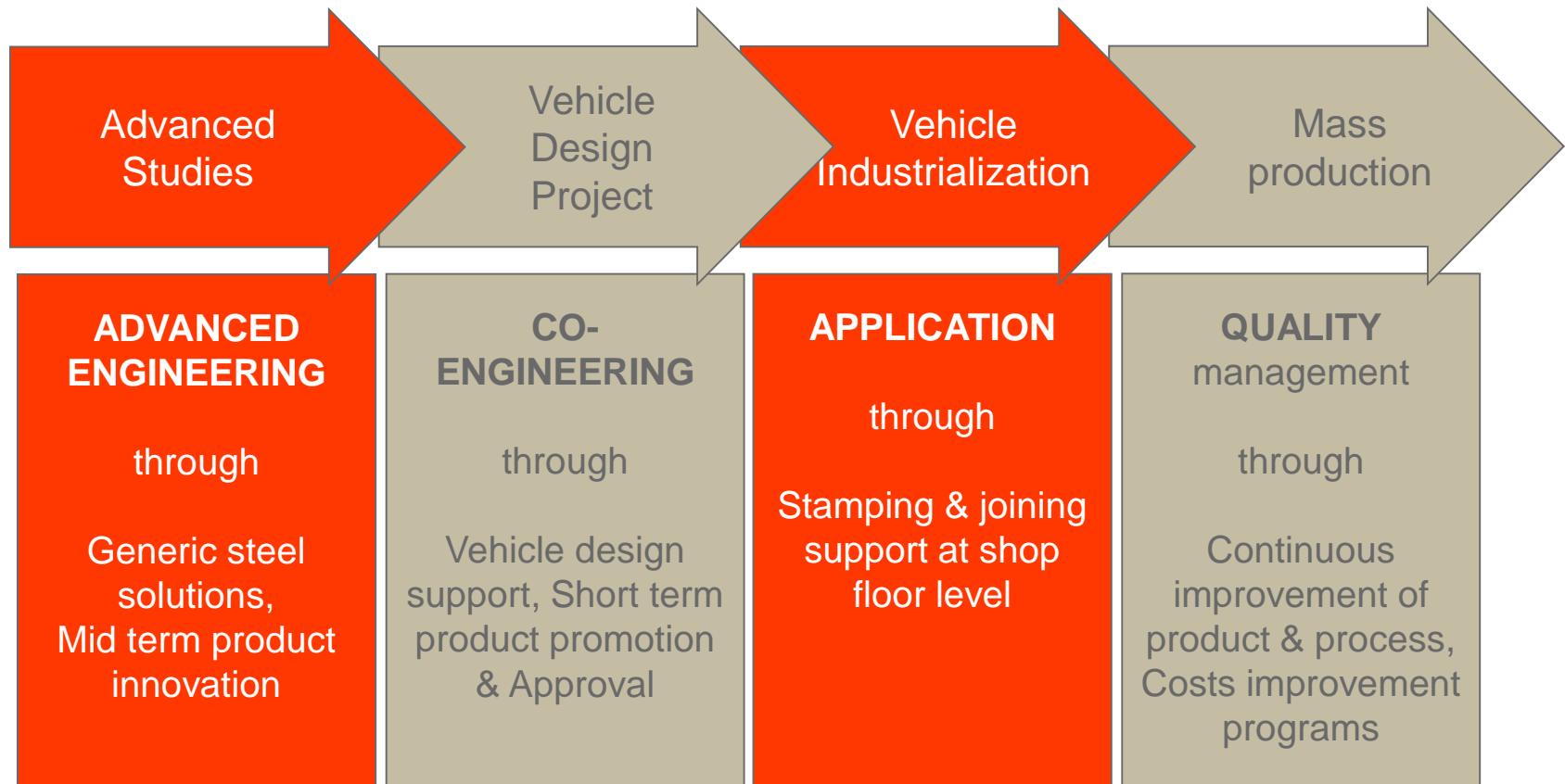


Constraints:

- 5* EuroNCAP
- Benchmark level NVH performance

Support to customers

from advanced engineering to mass production



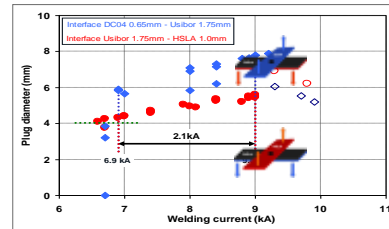


Assembly validation methodology

Weld stackups validation based on ArcelorMittal methodology

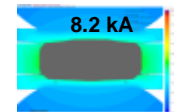
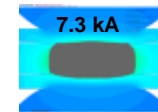
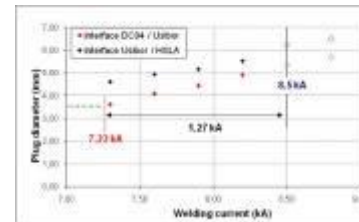
Experimental validation

Experimental weldability range and cross tensile tests



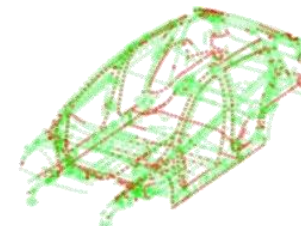
Numerical validation via Sorpas

Numerical weldability range



OEM acceptance criteria

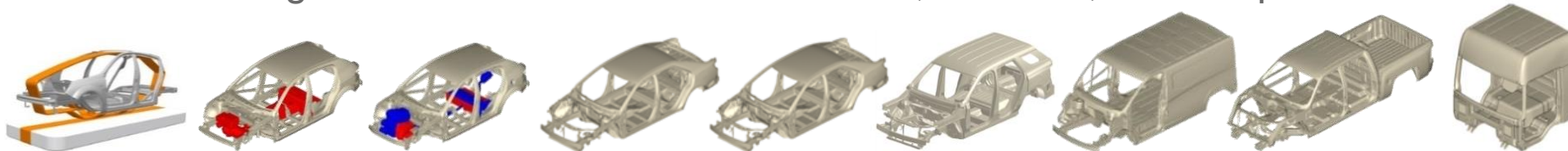
Exhaustive assessment



Element ID	Min. Stress (MPa)	Max. Stress (MPa)	Min. Strain (%)	Max. Strain (%)
1	120	180	0.001	0.002
2	150	220	0.001	0.003
3	180	250	0.001	0.004
4	200	280	0.001	0.005
5	220	300	0.001	0.006
6	250	320	0.001	0.007
7	280	350	0.001	0.008
8	300	380	0.001	0.009
9	320	400	0.001	0.010
10	350	420	0.001	0.011
11	380	450	0.001	0.012
12	400	480	0.001	0.013
13	420	500	0.001	0.014
14	450	520	0.001	0.015
15	480	550	0.001	0.016
16	500	580	0.001	0.017
17	520	600	0.001	0.018
18	550	620	0.001	0.019
19	580	650	0.001	0.020
20	600	680	0.001	0.021
21	620	700	0.001	0.022
22	650	720	0.001	0.023
23	680	750	0.001	0.024
24	700	780	0.001	0.025
25	720	800	0.001	0.026
26	750	820	0.001	0.027
27	780	850	0.001	0.028
28	800	880	0.001	0.029
29	820	900	0.001	0.030
30	850	920	0.001	0.031
31	880	950	0.001	0.032
32	900	980	0.001	0.033
33	920	1000	0.001	0.034
34	950	1020	0.001	0.035
35	980	1050	0.001	0.036
36	1000	1080	0.001	0.037
37	1020	1100	0.001	0.038
38	1050	1120	0.001	0.039
39	1080	1150	0.001	0.040
40	1100	1180	0.001	0.041
41	1120	1200	0.001	0.042
42	1150	1220	0.001	0.043
43	1180	1250	0.001	0.044
44	1200	1280	0.001	0.045
45	1220	1300	0.001	0.046
46	1250	1320	0.001	0.047
47	1280	1350	0.001	0.048
48	1300	1380	0.001	0.049
49	1320	1400	0.001	0.050
50	1350	1420	0.001	0.051
51	1380	1450	0.001	0.052
52	1400	1480	0.001	0.053
53	1420	1500	0.001	0.054
54	1450	1520	0.001	0.055
55	1480	1550	0.001	0.056
56	1500	1580	0.001	0.057
57	1520	1600	0.001	0.058
58	1550	1620	0.001	0.059
59	1580	1650	0.001	0.060
60	1600	1680	0.001	0.061
61	1620	1700	0.001	0.062
62	1650	1720	0.001	0.063
63	1680	1750	0.001	0.064
64	1700	1780	0.001	0.065
65	1720	1800	0.001	0.066
66	1750	1820	0.001	0.067
67	1780	1850	0.001	0.068
68	1800	1880	0.001	0.069
69	1820	1900	0.001	0.070
70	1850	1920	0.001	0.071
71	1880	1950	0.001	0.072
72	1900	1980	0.001	0.073
73	1920	2000	0.001	0.074
74	1950	2020	0.001	0.075
75	1980	2050	0.001	0.076
76	2000	2080	0.001	0.077
77	2020	2100	0.001	0.078
78	2050	2120	0.001	0.079
79	2080	2150	0.001	0.080
80	2100	2180	0.001	0.081
81	2120	2200	0.001	0.082
82	2150	2220	0.001	0.083
83	2180	2250	0.001	0.084
84	2200	2280	0.001	0.085
85	2220	2300	0.001	0.086
86	2250	2320	0.001	0.087
87	2280	2350	0.001	0.088
88	2300	2380	0.001	0.089
89	2320	2400	0.001	0.090
90	2350	2420	0.001	0.091
91	2380	2450	0.001	0.092
92	2400	2480	0.001	0.093
93	2420	2500	0.001	0.094
94	2450	2520	0.001	0.095
95	2480	2550	0.001	0.096
96	2500	2580	0.001	0.097
97	2520	2600	0.001	0.098
98	2550	2620	0.001	0.099
99	2580	2650	0.001	0.100
100	2600	2680	0.001	0.101
101	2620	2700	0.001	0.102
102	2650	2720	0.001	0.103
103	2680	2750	0.001	0.104
104	2700	2780	0.001	0.105
105	2720	2800	0.001	0.106
106	2750	2820	0.001	0.107
107	2780	2850	0.001	0.108
108	2800	2880	0.001	0.109
109	2820	2900	0.001	0.110
110	2850	2920	0.001	0.111
111	2880	2950	0.001	0.112
112	2900	2980	0.001	0.113
113	2920	3000	0.001	0.114
114	2950	3020	0.001	0.115
115	2980	3050	0.001	0.116
116	3000	3080	0.001	0.117
117	3020	3100	0.001	0.118
118	3050	3120	0.001	0.119
119	3080	3150	0.001	0.120
120	3100	3180	0.001	0.121
121	3120	3200	0.001	0.122
122	3150	3220	0.001	0.123
123	3180	3250	0.001	0.124
124	3200	3280	0.001	0.125
125	3220	3300	0.001	0.126
126	3250	3320	0.001	0.127
127	3280	3350	0.001	0.128
128	3300	3380	0.001	0.129
129	3320	3400	0.001	0.130
130	3350	3420	0.001	0.131
131	3380	3450	0.001	0.132
132	3400	3480	0.001	0.133
133	3420	3500	0.001	0.134
134	3450	3520	0.001	0.135
135	3480	3550	0.001	0.136
136	3500	3580	0.001	0.137
137	3520	3600	0.001	0.138
138	3550	3620	0.001	0.139
139	3580	3650	0.001	0.140
140	3600	3680	0.001	0.141
141	3620	3700	0.001	0.142
142	3650	3720	0.001	0.143
143	3680	3750	0.001	0.144
144	3700	3780	0.001	0.145
145	3720	3800	0.001	0.146
146	3750	3820	0.001	0.147
147	3780	3850	0.001	0.148
148	3800	3880	0.001	0.149
149	3820	3900	0.001	0.150
150	3850	3920	0.001	0.151
151	3880	3950	0.001	0.152
152	3900	3980	0.001	0.153
153	3920	4000	0.001	0.154
154	3950	4020	0.001	0.155
155	3980	4050	0.001	0.156
156	4000	4080	0.001	0.157
157	4020	4100	0.001	0.158
158	4050	4120	0.001	0.159
159	4080	4150	0.001	0.160
160	4100	4180	0.001	0.161
161	4120	4200	0.001	0.162
162	4150	4220	0.001	0.163
163	4180	4250	0.001	0.164
164	4200	4280	0.001	0.165
165	4220	4300	0.001	0.166
166	4250	4320	0.001	0.167
167	4280	4350	0.001	0.168
168	4300	4380	0.001	0.169
169	4320	4400	0.001	0.170
170	4350	4420	0.001	0.171
171	4380	4450	0.001	0.172
172	4400	4480	0.001	0.173
173	4420	4500	0.001	0.174
174	4450	4520	0.001	0.175
175	4480	4550	0.001	0.176
176	4500	4580	0.001	0.177
177	4520	4600	0.001	0.178
178	4550	4620	0.001	0.179
179	4580	4650	0.001	0.180
180	4600	4680	0.001	0.181
181	4620	4700	0.001	0.182
182	4650	4720	0.001	0.183
183	4680	4750	0.001	0.184
184	4700	4780	0.001	0.185
185	4720	4800	0.001	0.186
186	4750	4820	0.001	0.187
187	4780	4850	0.001	0.188
188	4800	4880	0.001	0.189
189	4820	4900	0.001	0.190
190	4850	4920	0.001	0.191
191	4880	4950	0.001	0.192
192	4900	4980	0.001	0.193
193	4920	5000	0.001	0.194
194	4950	5020	0.001	0.195
195	4980	5050	0.001	0.196
196	5000	5080	0.001	0.197
197	5020	5100	0.001	0.198
198	5050	5120	0.001	0.199
199	5080	5150	0.001	0.200
200	5100	5180	0.001	0.201
201	5120	5200	0.001	0.202
202	5150	5220	0.001	0.203
203	5180	5250	0.001	0.204
204	5200	5280	0.001	0.205
205	5220	5300	0.001	0.206
206	5250	5320	0.001	0.207
207	5280	5350	0.001	0.208
208	5300	5380	0.001	0.209
209	5320	5400	0.001	0.210
210	5350	5420	0.001	0.211
211	5380	5450	0.001	0.212
212	5400			



> ArcelorMittal generic steel solutions include BIW, closures, chassis parts and seats



S-in motion® ICE C-Segment	S-in motion® Electric C-Segment	S-in motion® Plug-in Hybrid C-Segment	S-in motion® D-Segment <i>EU market</i>	S-in motion® Mid-size Sedan <i>NA market</i>	S-in motion® Mid-size SUV	S-in motion® Light Commercial	S-in motion® Pick-up Trucks	S-in motion® Truck Cabs
-70kg (-18%) vs current ICE baseline	-60kg (-15%) vs current ICE baseline	-50 kg (-16%) vs current PHEV baseline	-98 kg (-25%) vs BIW and closures current baseline	-86 kg (-23%) vs current Mid-size sedan baseline	-102 kg (-20%) vs current SUV baseline	-45kg (-20%) About 140 parts upgraded	-174 kg (-23%) vs current Pick-up baseline	-54 kg (-17%) vs current cab baseline

Steel grades breakdown - BIW & Crash management system

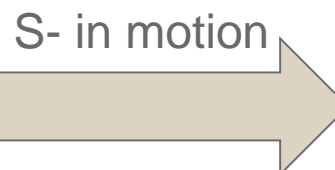
✓ Baseline

36% AHSS

Processes

- Hot stamping 4 parts
- Stamping of LWB 8 parts
- Roll forming 1 part

300 kg



✓ Solution

54% AHSS

Processes

- Hot stamping 29 parts
- Stamping of LWB 16 parts
- Roll forming 2 parts

259 kg



Worldwide Modules Catalogue

Comparison of all solutions per module and sub-module in terms of:

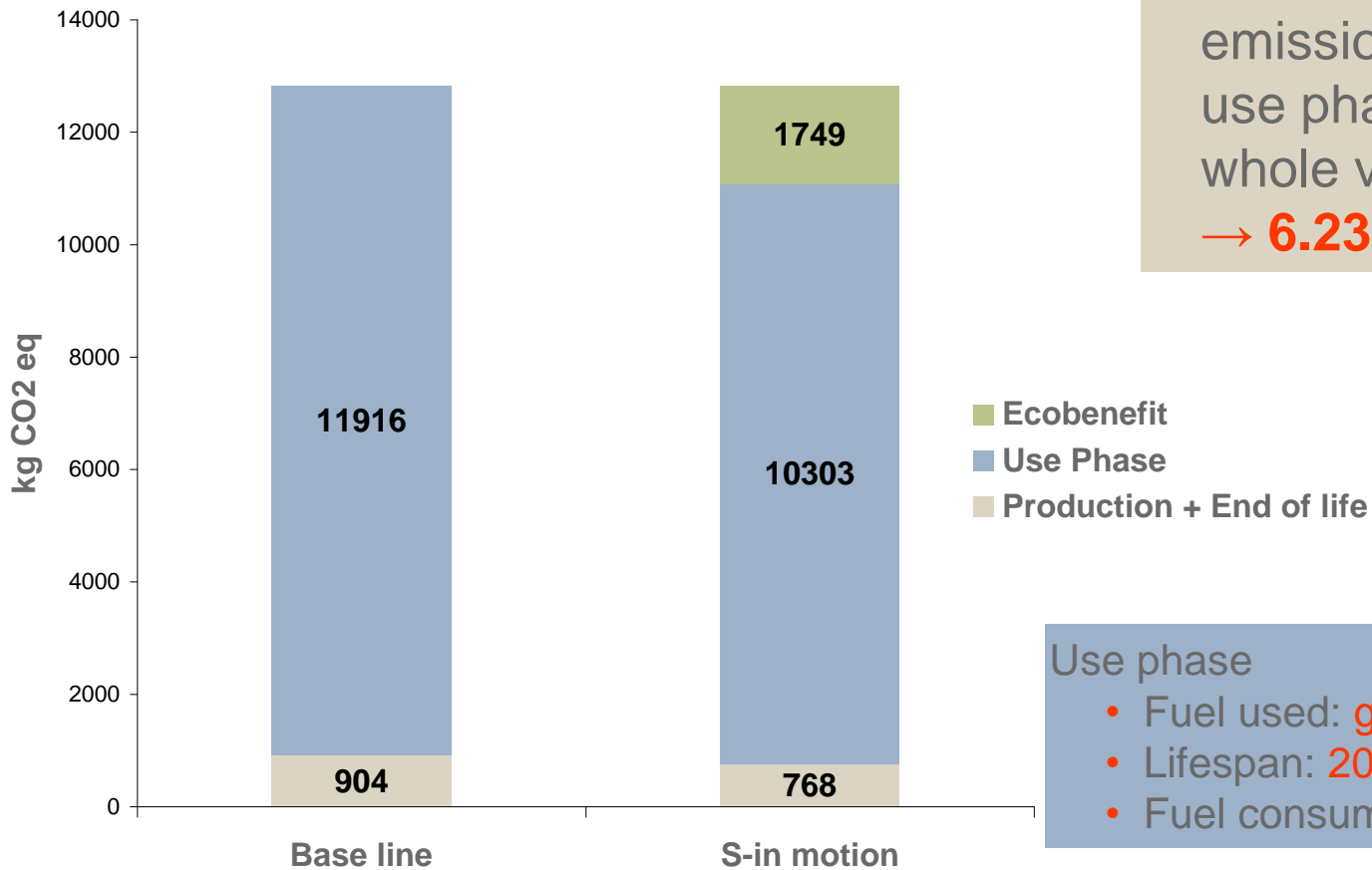
- performances
- weight reduction
- freedom design
- cost efficiency
- assembly compatibility





Life Cycle Analysis Results

Global warming potential of Body in white and Hang on parts



Reduction in GHG emissions during the use phase of the whole vehicle

→ **6.23 g CO₂ / km**

Use phase

- Fuel used: **gasoline**
- Lifespan: **200 000 km**
- Fuel consumption: **6.6 l/100 km**

Lightest BIW: Cost Summary

Weight saving is achieved at neutral cost !

