European Commission

Horizon 2020
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AffordabLe LIghtweight Automobiles AlliaNCE

ALLIANCE Final Event

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Mass Manager Software Tool (WP1.3)

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Motivation & Objectives

- Management and reduction of complete vehicle mass is challenging (’000s of parts, modules, systems)
- Achieving a complete vehicle mass target requires optimization of many parts – the question is “which parts”, “how much mass”, “how can lightweight parts (and their technologies) be *scaled* from one vehicle to another?”
- Mass Manager is a complete vehicle Bill Of Materials data manager, encompassing statistical mass benchmarking tools, lightweight technology database and optimiser

Mass Manager Software Tool Overview

Benchmark

- Complete vehicle BoM analysis & alignment
- Competitor mass benchmarking
- Identify heaviest (target) components in vehicle
- Support “why heavy” process

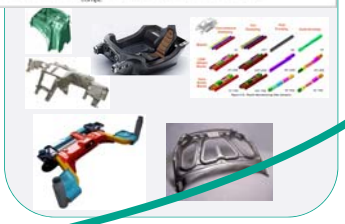
Alliance WP1.3 focus

Comparator

- Statistical analysis of benchmark BoM data
- Identify “should weigh” mass targets
- Scalability and transferability function

Builder

- Single vehicle mass reduction study
- Lightweight technology use-case database
- Vehicle level cost vs mass vs performance
- In-built optimiser



- Rapid, efficient complete vehicle mass analysis and diagnostics
- Evaluation and optimisation of lightweight technologies at complete vehicle level

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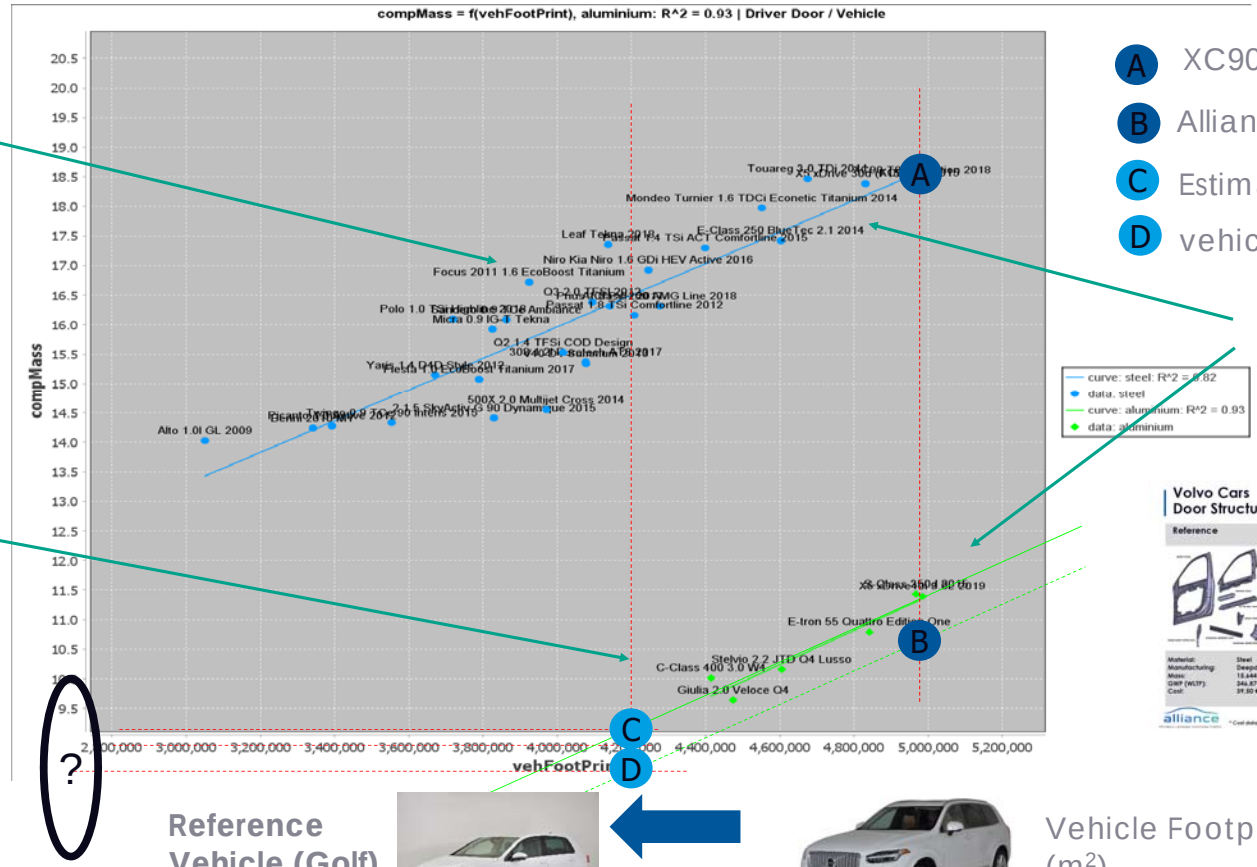
Mass Manager, example of *scalability* function

- Example for **scaling** lightweight, aluminium front door concept, developed on **XC90** and applied to VW Golf (reference vehicle)

Steel door benchmark dataset (from a2mac1)

aluminium door benchmark dataset (from a2mac1)



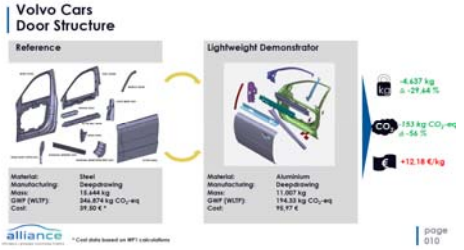
A XC90 steel door

B Alliance alum door (XC90)

C Estimated Reference

D vehicle door mass

Statistical regression relationship, door mass versus (vehicle footprint m²)



Estimated reference door mass with **scaled** technology from XC90 lightweight **= 8.5kg**

Reference Vehicle (Golf)

Source vehicle/part

Vehicle Footprint (m²)

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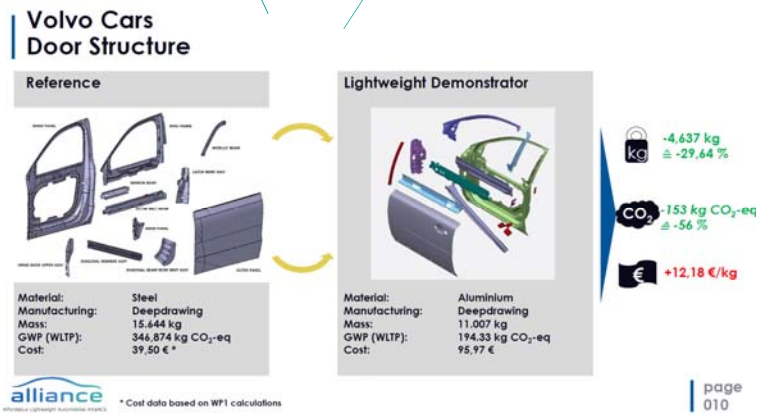
Mass Manager, example of *scalability* function

Volvo XC90

	Steel	Aluminium	Delta %
Mass (kg)	19.649	11.675	-40.5%
Cost (€)	39.50	95.97	+242%
GWP CO_2 kg	346.874	194.33	-44.0%

Alliance reference Vehicle

	Steel	Aluminium	Delta %
Mass (kg)	15.768	8.5	-32.8%
Cost (€)	47.91 (*1)	87.13	+182%
GWP CO_2 kg	283 (*2)	176.43	-37.7%



- **Mass Manager *scalability* function enabled the estimation of Reference vehicle performance (mass, cost, GWP) based on Volvo XC90 performance and a statistical dataset**

*1: Data source: “ALLIANCE_D_1-2.pdf”
*2: Data source: calculated by Unifi

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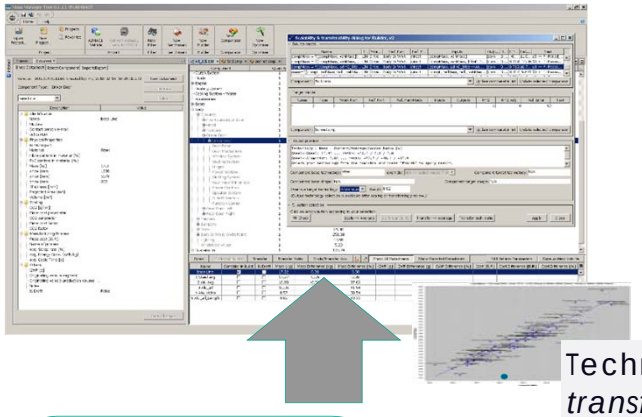
Mass Manager, Use Case Database in “Builder” Tool

Lightweight Vehicle Builder Tool



Weight reduction of existing vehicle or develop new/cleansheet vehicle

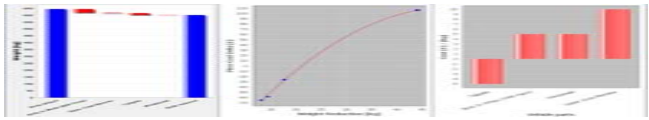
Technologies can be *scaled* or *transformed* from and to different vehicle/components using the regression functions identified in Comparator tool

Use Case Database
(lightweighting technologies)

Data stored in MM database for each technology:

- Weight saving (kg)
- Cost £
- GWP (g/CO_2)
- Performance risks (NVH, safety, repair…)
- Component requirements

- Total vehicle weight saving potential and breakdown



- Potential impact on cost and vehicle performance
- Updated Vehicle BoM

Key Benefits

- Complete vehicle weight management at all vehicle development phases
- Rapidly apply and assess lightweight technologies and effects at complete vehicle level
- Central knowledge / database

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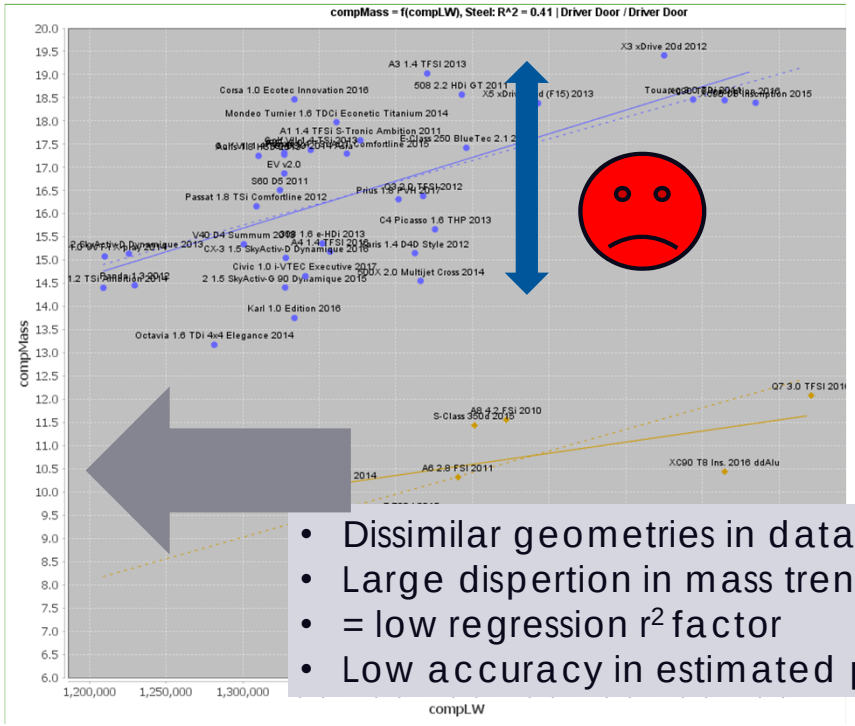
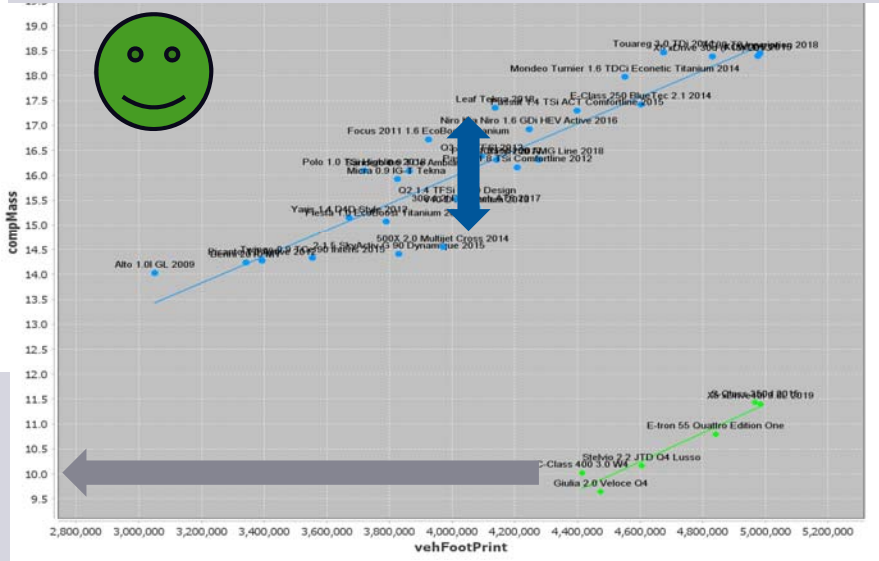
Lessons learnt – scalability results are only as good as the quality of the statistical dataset



- Dissimilar geometries in dataset
- Large dispertion in mass trends
- = low regression r^2 factor
- Low accuracy in estimated part mass

- Comparable geometries in dataset
- Low dispertion/variation
- High regression r^2 factor ~1.0
- High accuracy in estimated part mass



- Throughout the project we have “learned” which dimension parameters are best/appropriate to use for different components

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Lessons learnt – scalability results are only as good as the quality of the statistical dataset

- a2mac1 provides a good data sample but not for every vehicle segment (trucks, low number of Evs)
- a2mac1 provides mass and dimension at module level (e.g. no breakdown for BIW, therefore difficult to assess Toyota spare wheel module in Mass Manager)
- Requirement to calculate cost and GWP data for statistical benchmark vehicles (time consuming but idea is to create a robust database)
- Difficult to get *Transferability* methodology to give robust results (only when considering parts with similar performance requirements)

Thank you !

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