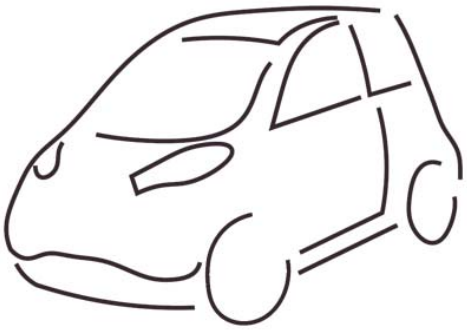
STEEL Solutions for Safe and Smart Structures of Electric Vehicles



Brochure 1

STEEL S4 EV: Preliminary results

Project description and objectives

STEEL S4 EV completes the research on a new trend in vehicles manufacturing approach based on high strength steels. Principal features of the project are urban electric vehicles design and its novel manufacturing environment.

STEEL S4 EV aims at putting HSS at the forefront of a new trend in electric vehicles

Vehicle chassis design is based on **advanced high strength tubular steels**, which are meant to comply with crash regulations and Euro NCAP demands. Research within **weld joint design** and welding methodologies are being carried out to maintain material properties in weld areas, ensuring robustness and long term durability.

The microfactory proposal depicts a cost-effective, energy efficient and low-investment manufacturing process, allowing a flexible response to the market demand of different vehicle architectures (passenger vehicles, pick-ups, delivery vans, taxis, etc.) with a single chassis. It will be achieved by a **modular and flexible** structural design based on a 3D skeleton frame of welded tubes bent with high accuracy using programmed laser cuts.

The aim is to satisfy the great majority of people needs without compromise on safety, automotive quality standards, ergonomics, smartness, aesthetics or costs.

Progress and first results

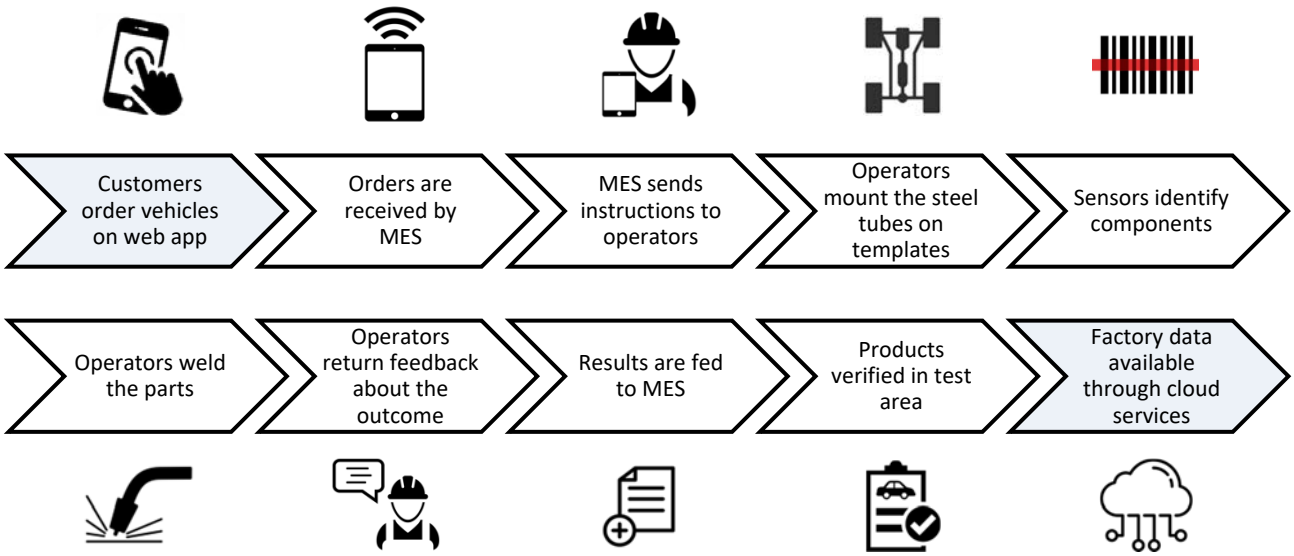
Definition of the overall factory architecture and assembly line

A Cyber Physical Factory Environment based on a decentralised cloud architecture which connects the physical systems to all the involved entities and produces high quality electric vehicles in low budget and flexible assembly lines.

Factory architecture is based on the following specifications:

- MES (Manufacturing Execution System) – processes orders, monitors and visualize KPIs
- Scheduler – plans services to optimize the production
- Working islands – feature part identification sensors, feedback lights and HMI
- Testing area – tests are performed on sub and complete systems, results are fed to MES

The workflow defined for the microfactory demonstrator is described in the following figure:

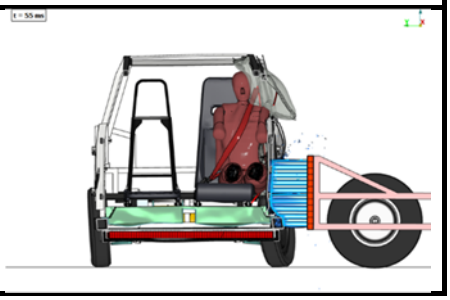


With that kind of manufacture all subcomponents and all assembly processes have to be marked and recorded to allow tracking. A vehicle has to be associated to a specific moment of manufacturing of all its components and subcomponents.

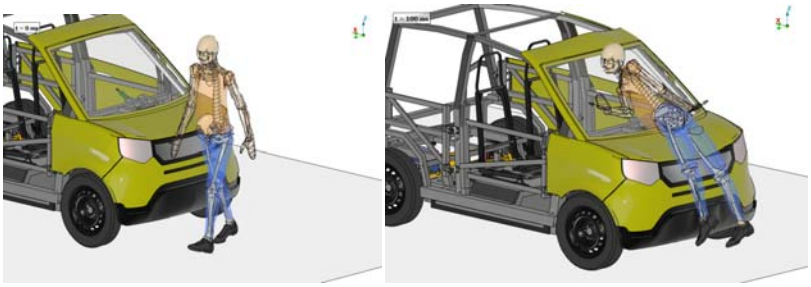
Safety vehicles design

Vehicle design is being optimized to accomplish safety regulations to protect vehicle occupants and vulnerable road users. Also structure durability will be analysed through simulations and testing to ensure vehicle fatigue behaviour.

Safety on vehicle occupants. With the aim of accomplishing Euro NCAP and UNECE safety requirements virtual model simulations are being performed to assess structure design.

Frontal crash EURO NCAP FOR SAFER CARS M1 vehicles	Crash of vehicle at 50 km/h against full width rigid wall. Different geometry configurations are analysed of the front side members to minimize intrusions in the vehicle and accelerations on vehicle occupants.	
Lateral crash UNECE regulations	Side impact of vehicle at 50 km/h with a movable deformable barrier. Specific restraint systens are been developed to maximize the occupants' protection for both frontal and lateral crash.	

Vulnerable users' protection. Pedestrian simulations with human models analysing different impact velocities are being carried out. The aim is to optimize vehicle design to reduce damage on pedestrian. Vehicle performance has demonstrated to be safe at speeds underneath 40 km/h.



Crash tests and **structure fatigue tests** will be performed in the second half of the project.

Conclusions

- The proposed experimental assembly line is conceived for **50 vehicles a day over two shifts** in an automated assembly line of only 7 cells and two testing areas

- The manufacturing of different vehicle architectures within the same day should only minimally influence the potential daily throughput

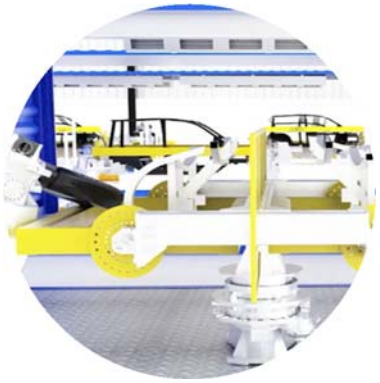
- The vehicle totally fulfils lateral crash requirements

- Front side members are being redesigning to ensure the safest behaviour of the vehicle in frontal crashes

Next steps

- Validate vehicle performance through fatigue simulations
- Manufacture of prototypes
- Crash test of prototypes
- Project results validation





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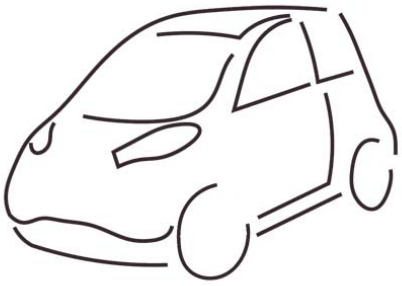

STEEL S4 EV

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The Project has received funding from the Research Fund for Coal and Steel (RFCS) under grant agreement nº 800726. The RFCS provides funding for high quality Research, Pilot and Demonstration projects which support the competitiveness and sustainability of the European industries.

Research Fund for Coal & Steel

European Commission