

ZDM work-shop: FLASH-COMP

FLASH-COMP: Flawless and sustainable production of composite parts through a human centred digital approach

GA nº. 101058458

23/11/2022 Aitor García de la Yedra

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General Data

- ⚡ Starting Date: 1st October 2022
- ⚡ Duration: 42 months (30th March 2026)
- ⚡ Project Budget: 6,69 M€
- ⚡ Funding: 5,61 M€
- ⚡ 14 partners:

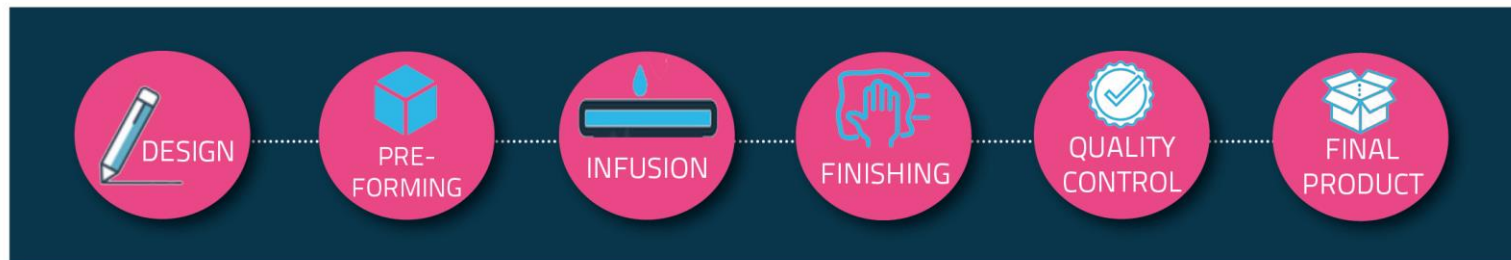


Context

- ⚡ Transition towards climate neutrality: need to reduce manufacturing waste
- ⚡ Composites play an important role In EU manufacturing: energy, naval, aerospace sectors...
- ⚡ Manufacturing of these parts largely based on manual operations (difficult to control)
- ⚡ Current processes: unsustainable and inefficient (excess of material, need of reparation...)
- ⚡ Considerable environmental impact (135.000 to 372.000 Tones/year in Liquid resin process)

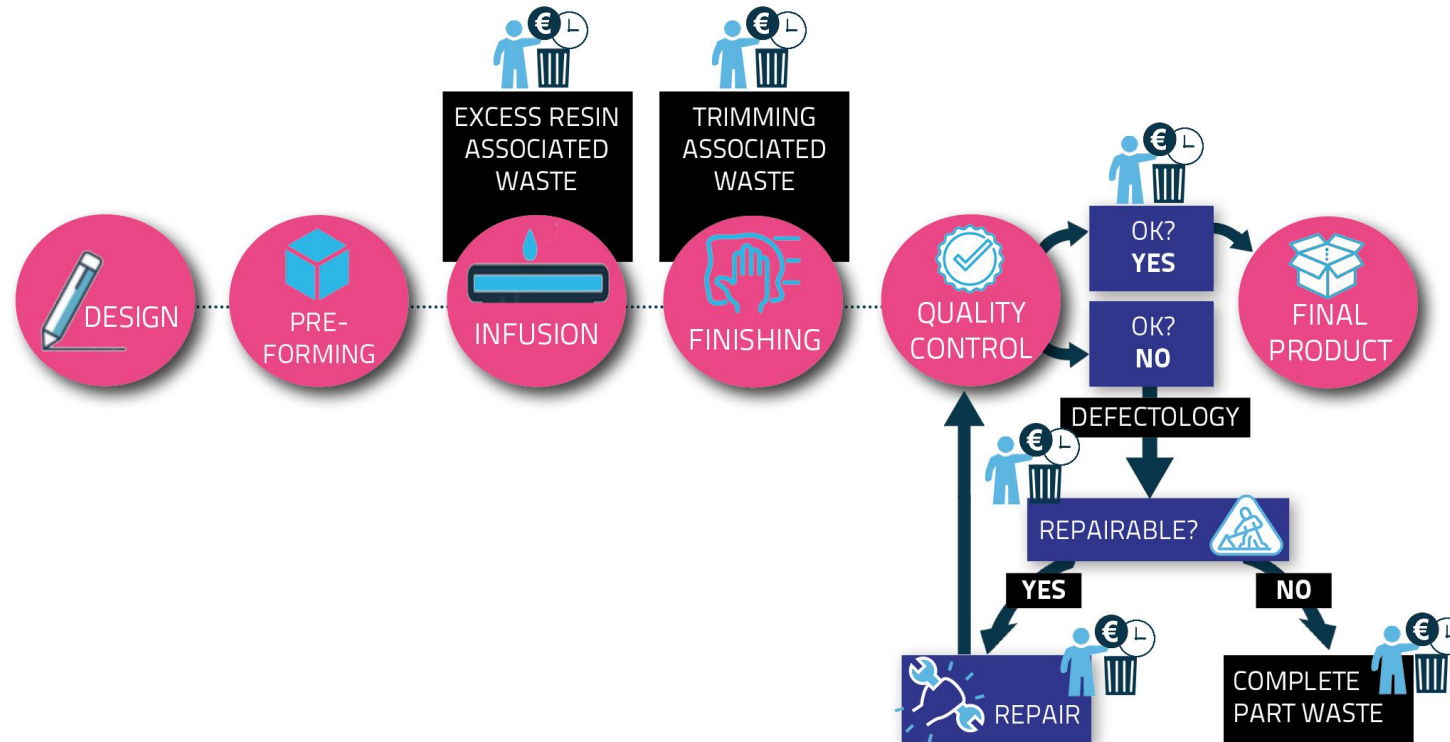
Goal of the Project

- ⚡ The main objective of FLASH-COMP is to **develop a fast and reliable (FLASH) human-oriented quality control solution capable of identifying in a timely-manner defectiveness during process and, consequently, to determine the in-situ corrective actions to be implemented.**
- ⚡ **Application field** will be **composites**, specifically Liquid Resin Infusion (LRI) processes, with the objective of reaching the **zero-defects paradigm** thus significantly **reducing the generation of polymer composites waste.**
- ⚡ **LRI Process Steps:**



Main Concept

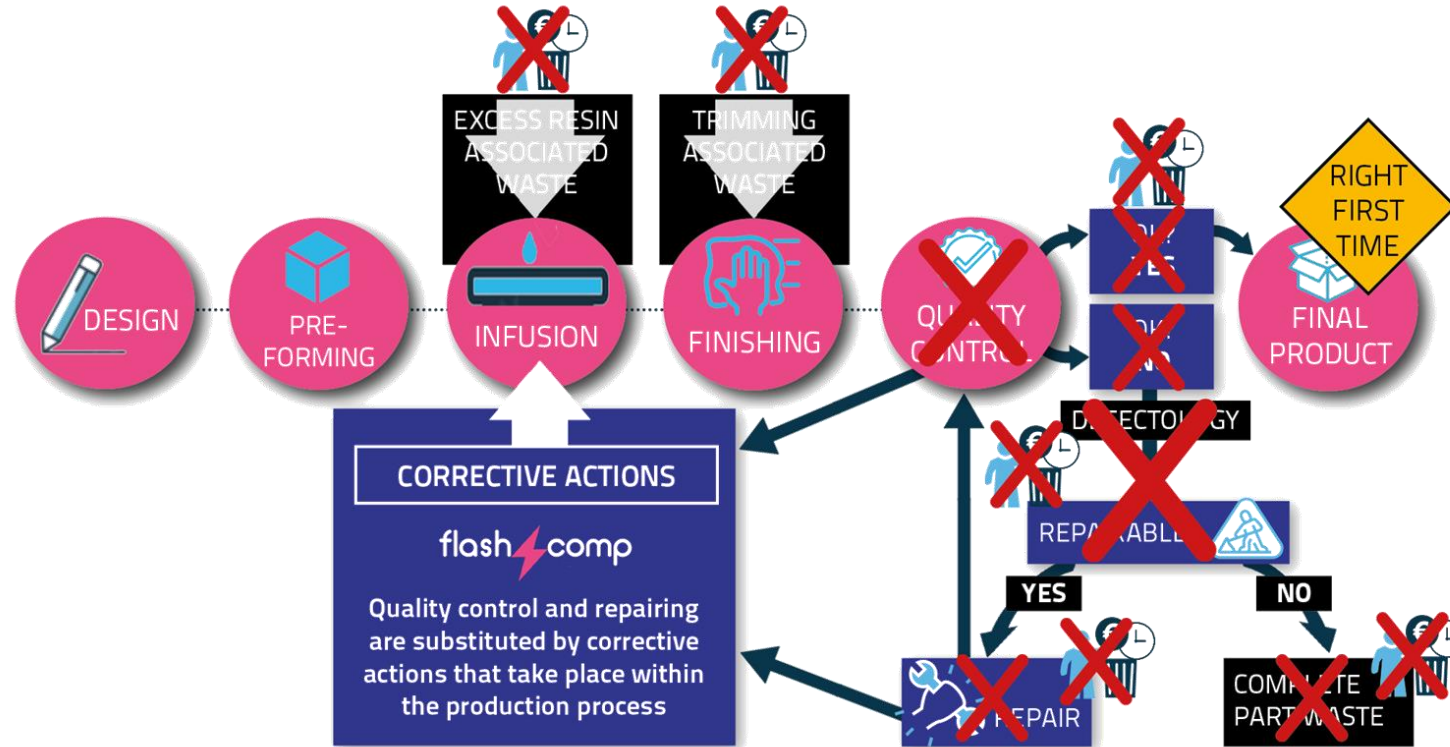
⚡ Current Approach:



- Defectiveness occurs (mainly) due to issues in the Pre-Forming and Infusion stages.
- Difficult to act over the Infusion process once it has started.
- Feasible defectiveness (voids, pores, ...) is avoided by introducing resin in excess:
 - waste within the Infusion and Finishing process
 - tedious and expensive quality control loop after the part is finished
- Possible to reduce costs from waste and the quality control loop by “simply” establishing corrective actions over the resin-infusion stage

Main Concept

FLASH-COMP Approach:

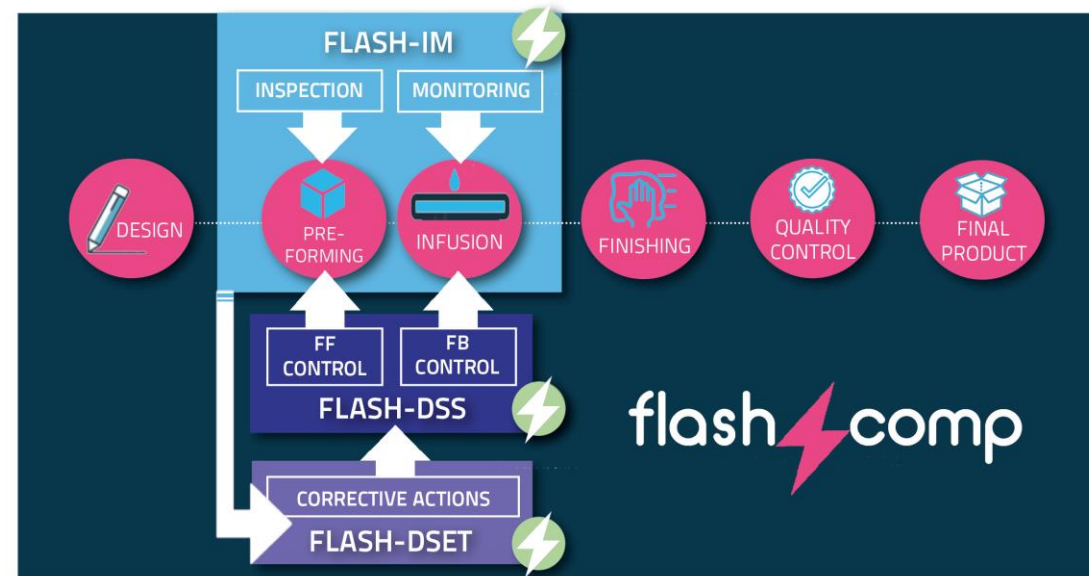


- Corrective actions within the Infusion stage will allow:
 - Manufacturing with no defects.
 - Reducing excess resin and trimming associated waste.
 - Eliminating the Quality Control stage.
 - Producing “right-first-time” products.

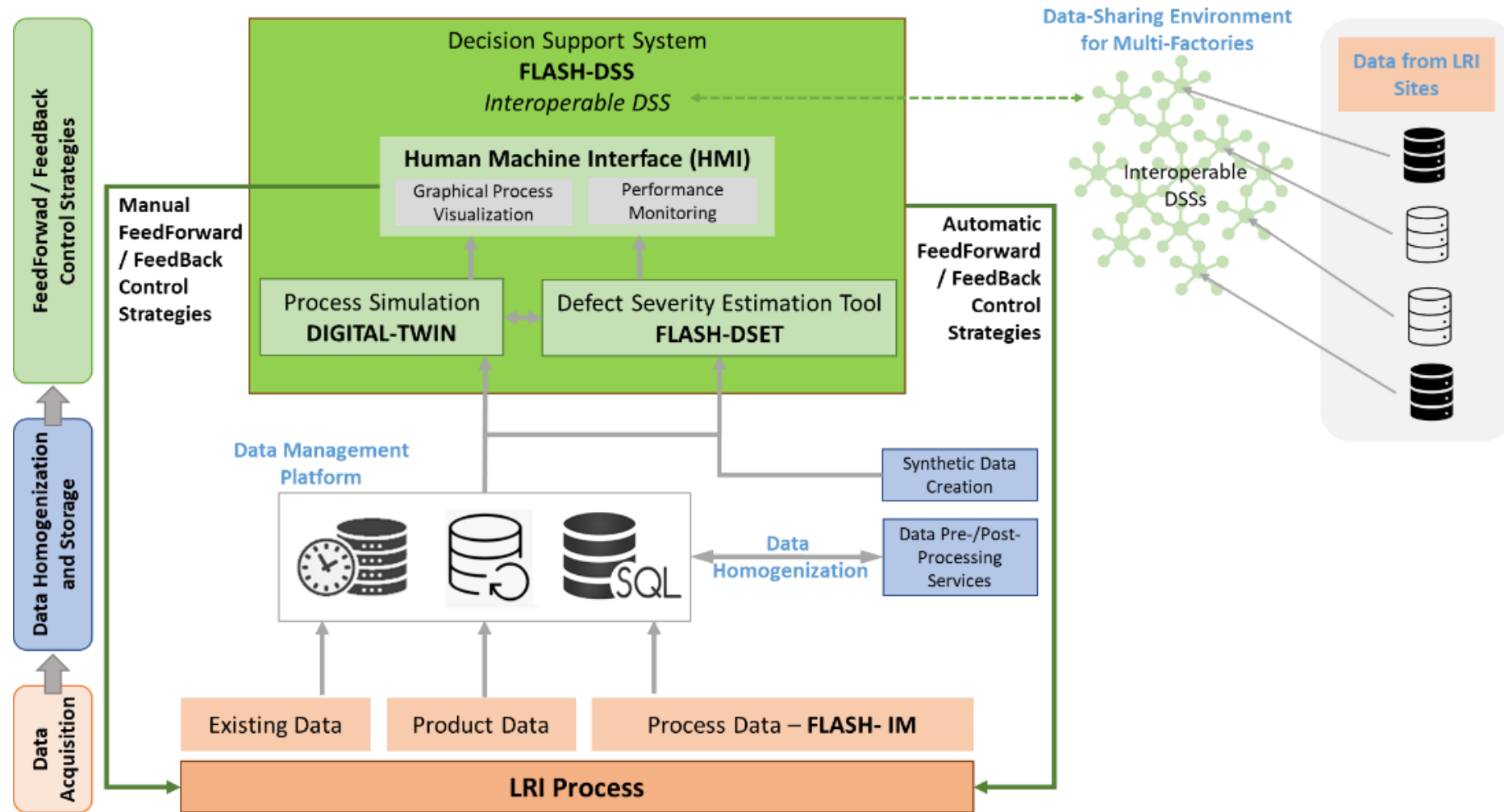
Goal of the Project

⚡ **FLASH-COMP will employ novel, fast and accurate Inspection and Monitoring techniques (FLASH-IM)** within the most critical manufacturing stages (Pre-Forming and Infusion), to retrieve key process parameters. This data will feed **an AI-based Defect Severity Estimation Tool (FLASH-DSET)**, capable of estimating the generation of defects and, in consequence, determining if and what kind of corrective actions should be adopted. Instructions will be linked to **real-time feedforward and feedback (FF/FB) control strategy Decision Support System (FLASH-DSS)** .

⚡ **The solution will increase its knowledge by sharing interoperable and sovereign data among different sites and factories.**



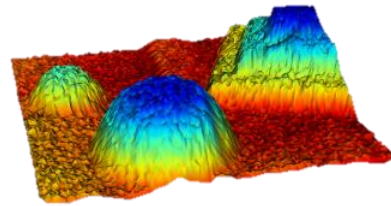
FLASH-COMP Solution



FLASH-COMP Solution: FLASH-IM (Inspection and Monitoring instruments):

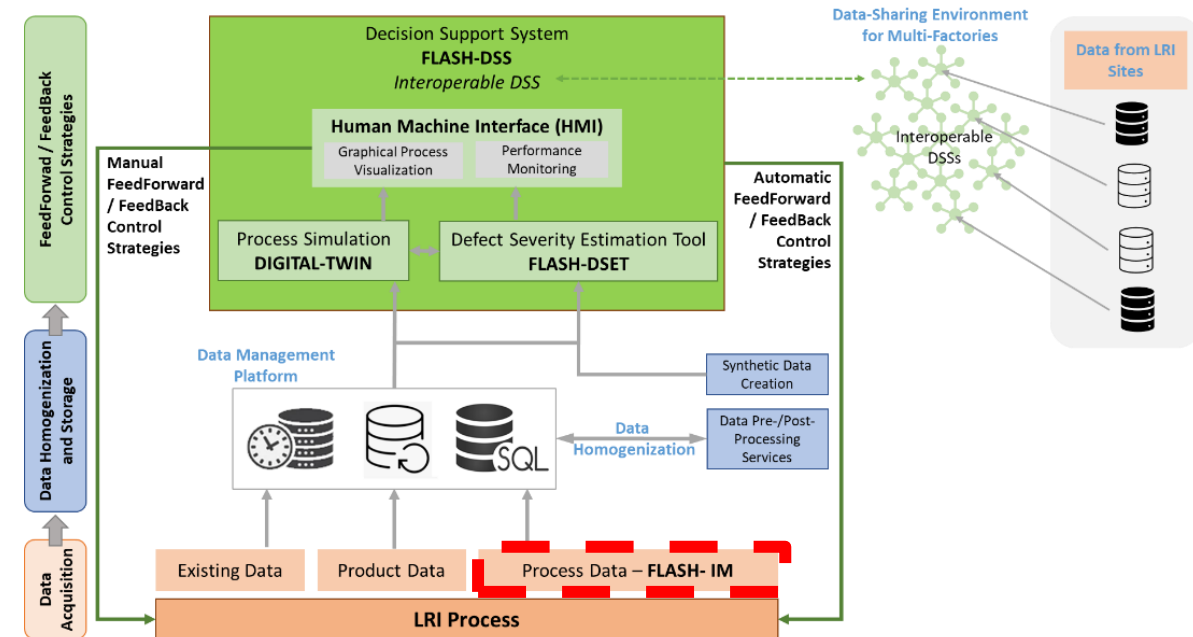
FLASH-IM –aim: collect relevant data from the Pre-Forming and Infusion stages

- Pre-forming Inspection:
 - Linear Scan Cameras
 - Spectral Imaging,
 - 3D Laser Line Profilers



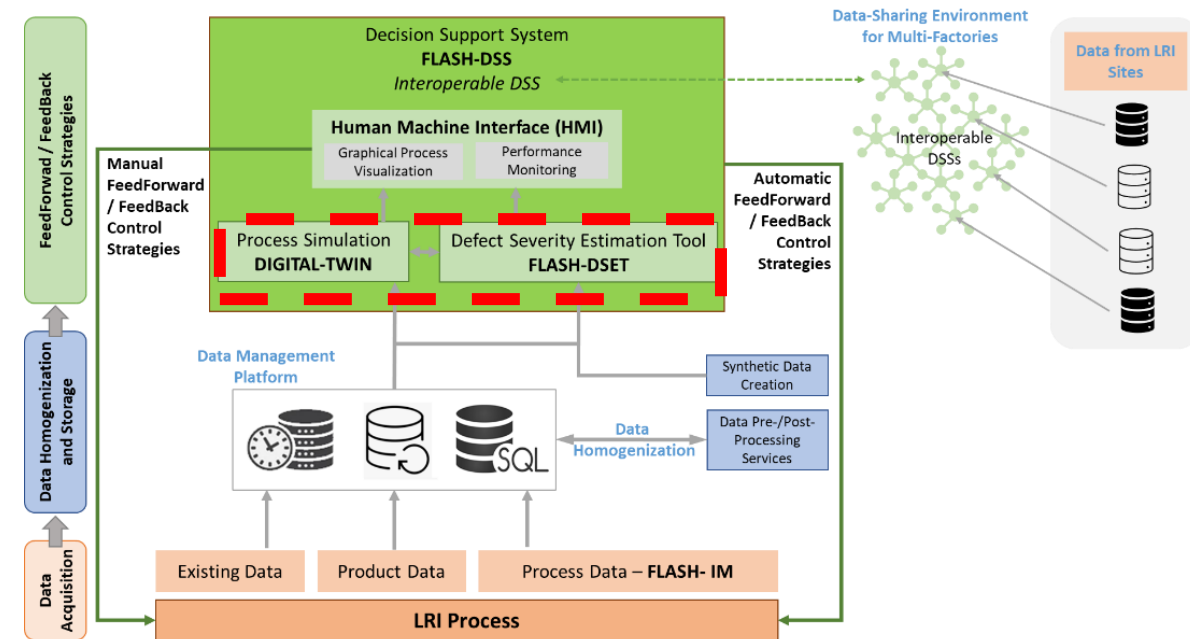
- Infusion Process Monitoring:

- FLASH-LiDAR: 3D resin flow monitoring
- Embedded Sensors: temperature, pressure....
 - Fibre Optic Sensors (FOS)
 - PyzoFlex®



FLASH-COMP Solution: FLASH-DSET (Defect Severity Estimation Tool):

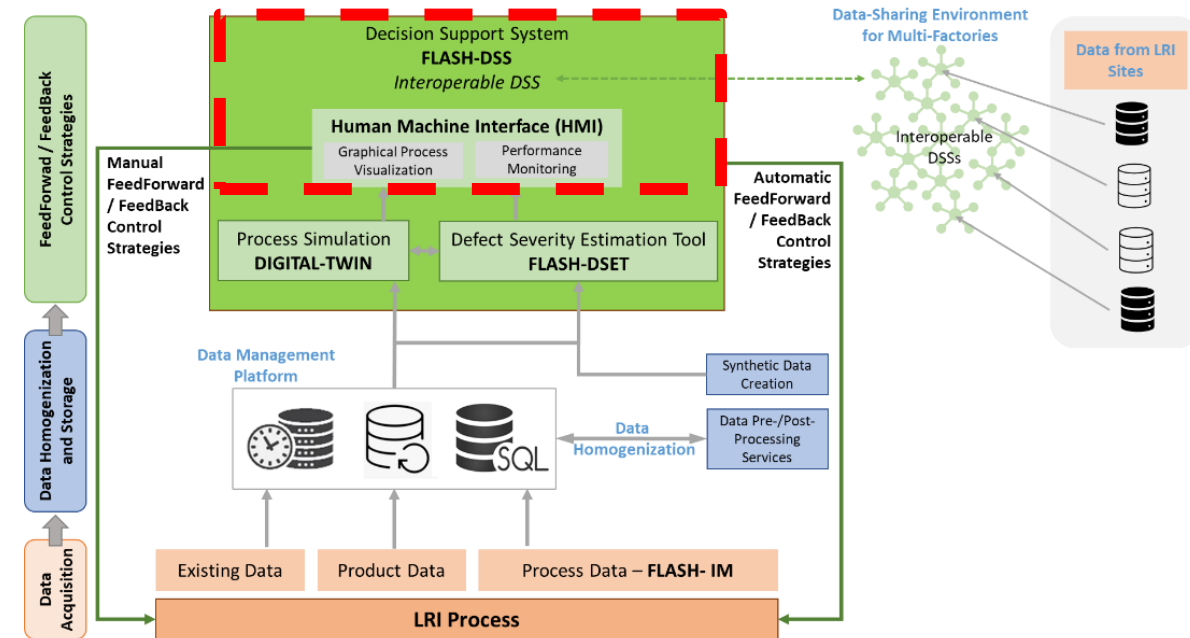
- **FLASH-DSET** –aim: infusion process simulation. Predict the generation and propagation of defectology and to evaluate its severity (Digital-Hybrid Twin).
- Hybrid approach:
 - Physic based simulation (near real time simulations):
 - Infusion process simulation
 - Model Order Reduction (MOR)
 - Artificial Intelligence based simulation (real time-process data):
 - Data-Driven
 - Based on data retrieved by FLASH-IM



Comparison of process estimation and process reality

FLASH-COMP Solution: FLASH-DSS (Corrective Actions Decision Support System)

- **FLASH-DSS** –aim:determine actions to be adopted to optimize production process in the form of:
 - Automatic orders:
 - Acting upon different actuators
 - Resin inlet/outlet pressure modifications and local heating (FeedBack)
 - Assist operators with the required operations (HMI):
 - Inlet rearrangement prior infusion process (FeedForward)



NAVAL SECTOR: AZIMUT

- ⚡ Yacht manufacturing, composite: 14-50 m in length
- ⚡ Annual Production: 250 yachts, 1400 big components
- ⚡ Expected savings: 30 % resin waste, 20 % repairing materials and 808 MWh energy consumption

AERONAUTICAL SECTOR: IAI

- ⚡ Aircraft structures manufacturing: wing skin
- ⚡ Annual Production: 72 wings per year
- ⚡ Expected savings: 30 % reduction resin waste, 100 % reduction in discarded spars and wingboxes