

Lightweight Technologies Showcase

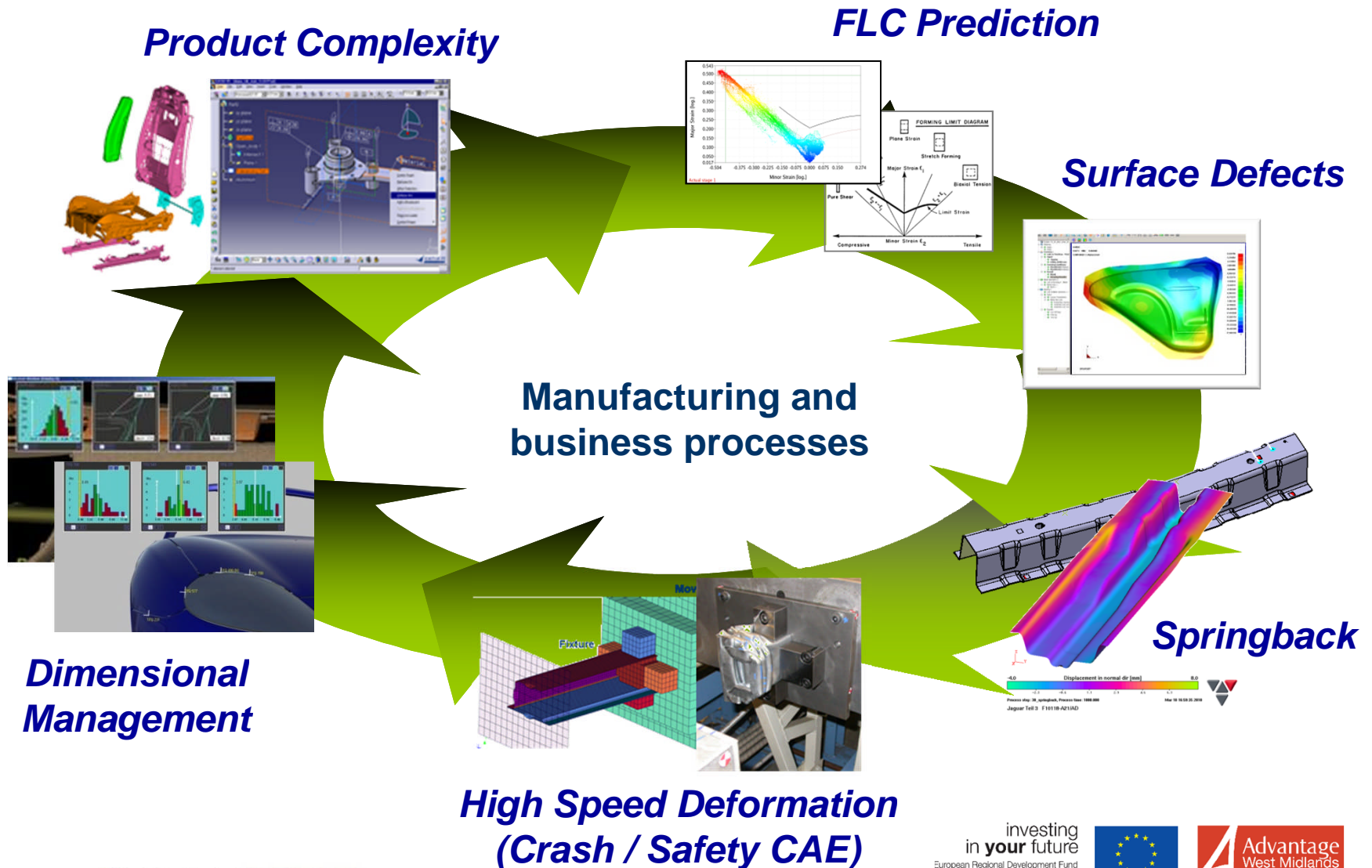


Simulation

D Williams, 20 July 2011



Research areas



Research partnerships



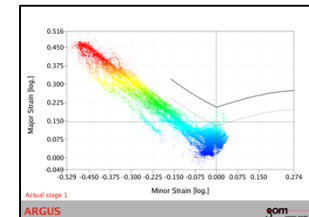
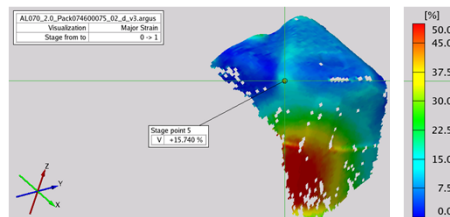
FLC Prediction	Lead	Interest	Interest	Interest	Lead	Interest
Surface Defects	Lead	Support	Support	Interest	Lead	Interest
Springback	Lead	Interest	Lead	Support	Interest	Interest
Dimensional Management	Lead	Lead	Interest	Interest	Interest	Interest
Product Complexity	Lead	Interest	Interest	Interest	Interest	Interest
High Speed Deformation	Lead	Interest	Support	Interest	Interest	Interest

- Lead
- Support
- Interest



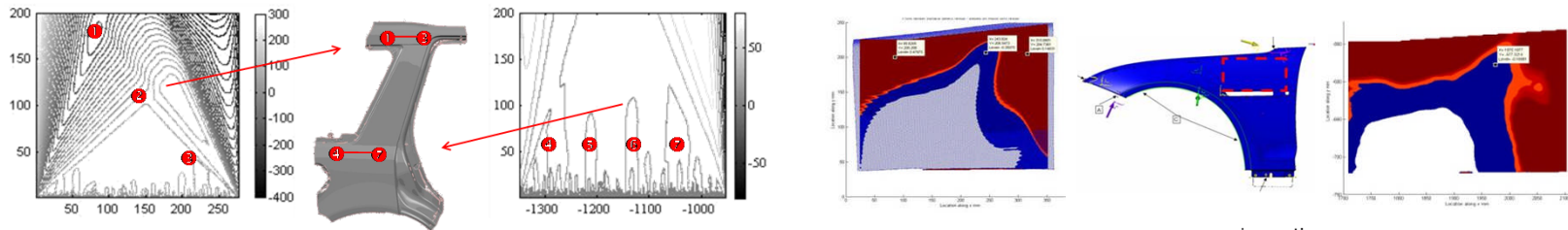
FLC Prediction

- **Business need**
 - Introduction of new materials requires an extensive knowledge of their behaviour
 - *Forming Limit Curves* (FLCs) describe material failure, for a particular gauge, under different major and minor strain conditions
 - The FLC is used to predict the formability of the material in question
 - An accurate FLC is an essential element in the toolbox of *feasibility simulations* and *part / tool buy-off*
- **Benefits**
 - Greater confidence in the assessment of advanced materials
 - Opportunities for greater styling freedom and operational efficiency
 - Reduced time to assess feasibility of new materials
- **Applications**
 - Skin panels and structural components that form Major Stamping Operations



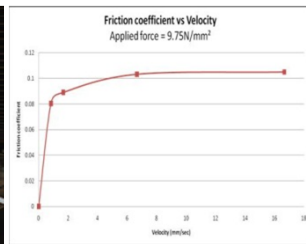
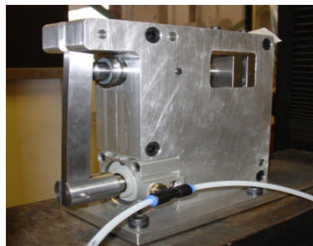
Surface defect prediction

- **Business need**
 - Prediction of cosmetic defects in stamped sheet metal parts is typically based on experience
 - Goal: Accurate prediction of the *occurrence* and *perceived severity* of a defect based on objective criteria to extend existing feasibility processes
 - Improved *understanding* of the causes of these conditions and *steps* that have to be taken to resolve them
- **Benefits**
 - Early identification of potential problems and early implementation of solutions
 - Increased confidence in decision-making during part feasibility & prioritisation of areas requiring re-work
 - Reduced cost and time associated with re-work
- **Applications**
 - All cosmetic stamped panels with potential to apply to non-stamped parts / trim items

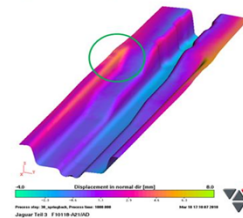


Springback prediction

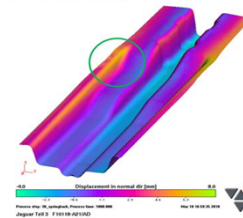
- **Business need**
 - New high strength steel & aluminium alloys are subject to much higher levels of springback than conventional deep drawing steels
 - Increases tooling buy-off whilst acceptable dimensional integrity of components is achieved
 - Work has established a validated FE method to accurately predict springback
- **Benefits**
 - Reduce time / cost to physically prove-out press tools through optimised component design and process planning
 - Reduced material requirement
 - Facilitate tailored, and potentially tighter tolerances, on pressed parts leading to better dimensional accuracy of assemblies
- **Applications**
 - Skin panels & structural parts that form Major Stamping Operations (MSO) content



Isotropic Hardening

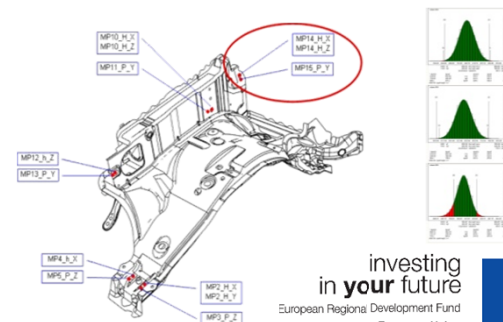
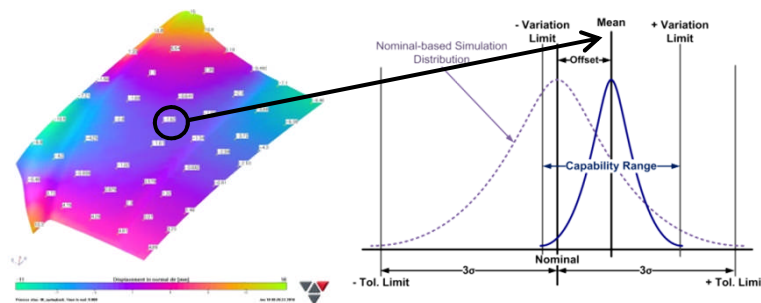


Kinematic Hardening



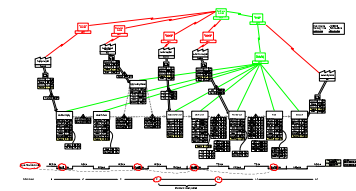
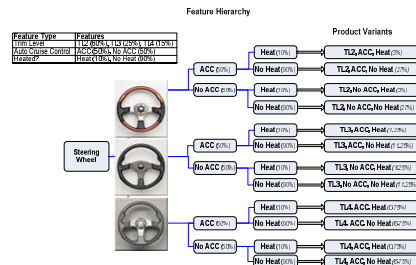
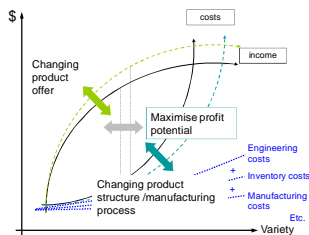
Dimensional Management

- **Business need**
 - Conventional Dimensional Variation Analyses (DVA) assume parts are manufactured to nominal dimensions with variation normally distributed
 - How can a more accurate representation of part & assembly geometry can be achieved?
 - Stampings simulation provides more realistic geometry, reflecting tooling changes required to produce a feasible part, allowing improved prediction of where assembly conditions are likely
- **Benefits**
 - Improve accuracy of prediction for assemblies using stamped sheet metal parts
 - Contribute to improvement of perceived quality
 - Reduce unplanned work and cost associated with rectification of cosmetic or functional issues attributed to dimensional variation
- **Applications**
 - Parts & assemblies where stampings simulation data is available



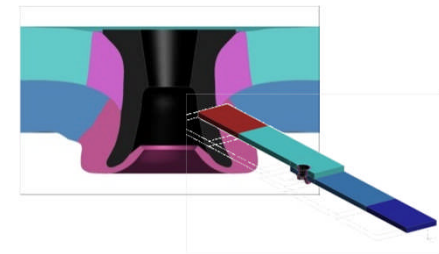
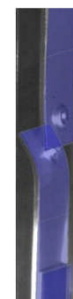
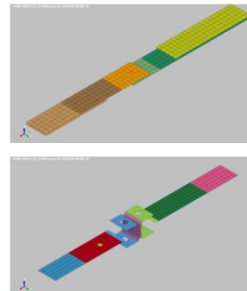
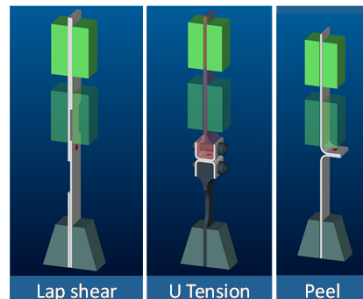
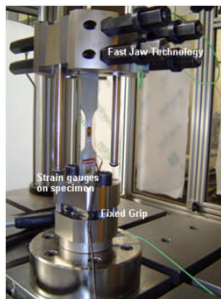
Product complexity

- **Business need**
 - Complexity and variety management is concerned with 3 interlinked issues:
 1. Ensuring that a business has the correct breadth of product mix, providing appropriate revenue and profit streams
 2. Ensuring that the design of product families is in line with these product mix requirements in the most cost effective way
 3. Ensuring that the manufacturing and supply chain processes are capable of managing the ensuing complexity
- **Benefits**
 - Improved range of features available for customers
 - Simpler product designs, appropriate for levels of customer choice
 - Supply chain effectiveness improvements leading to Improved PROFITABILITY
- **Applications**
 - Any product or commodity that has:
 1. High levels of variety, in particular where feature content can be specified by the customer
 2. Low levels of customer off-take
 3. High levels of inventory and/or sequencing costs
 4. High variances of manufacturing content



High Speed Deformation

- **Business need**
 - Improved prediction of the performance of joints in automotive body-in-white (BIW) structures gives greater confidence in the design before physical parts & assemblies are produced
 - Goal: to improve the fidelity of CAE models of Resistance Spot Weld & Self Pierce Rivet joints in typical substrates and for common joint configurations / material stacks
- **Benefits**
 - Greater confidence allows efficiencies in application of virtual testing to product development
 - Greater confidence at design freeze supports reduced time, cost & risk in the NPI process
 - Improved understanding of joint failure allows efficient use of joints and potentially weight savings within the BIW
- **Applications**
 - Resistance Spot welds - steel body structures
 - Self Pierce Rivets – aluminium / mixed material body structures



Final thoughts...

- Collaboration is *the* key success factor
- Partners in PVLT share
 - Common goals / objectives
 - Flexibility of approach
 - Positive attitude
 - Willingness to support each other
- Stronger relationships as a result of the work
- Successful technical delivery
- Research meeting business needs

Lightweight Technologies Showcase



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