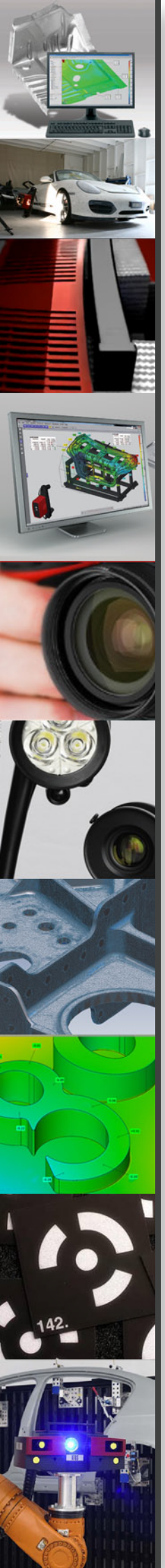


SCAN-XPRESS

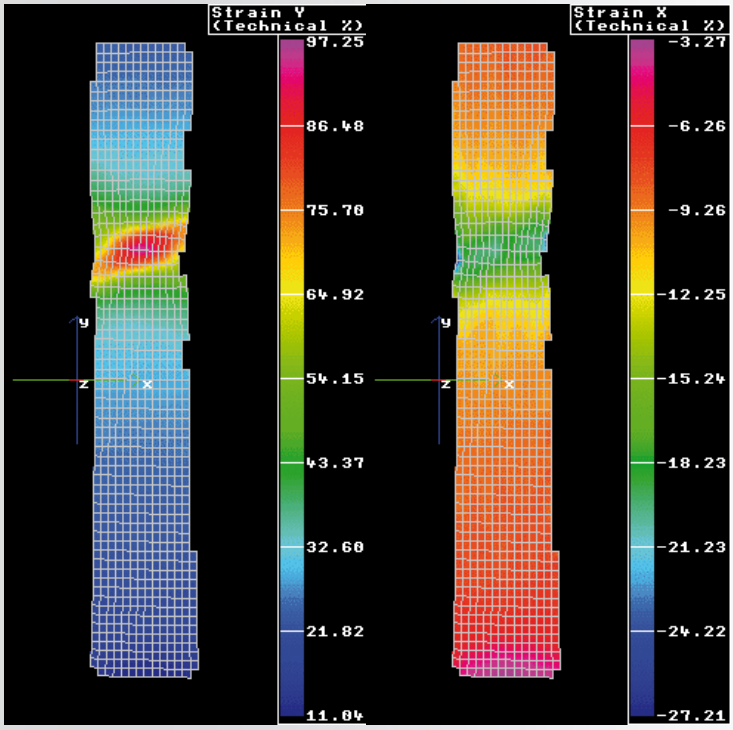
EXCELLENCE IN 3D MEASUREMENT

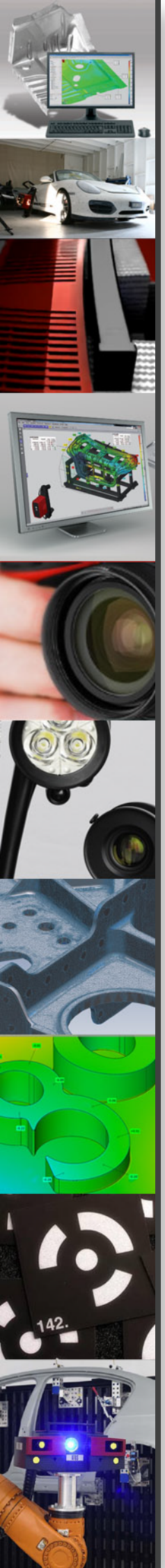
Application Example: Material Testing

Material Properties: ARAMIS and the detection of flow behaviour for sheet metal material in high speed tensile test

Measuring Systems: ARAMIS
Keywords: Flow curve, high speed camera

Information about the flow behaviour of material is important for crash- and forming simulations. The flow behaviour can be described by the true stress strain curve.





SCAN-XPRESS

EXCELLENCE IN 3D MEASUREMENT

Material Testing / Material Properties

ARAMIS and the detection of flow behaviour for sheet metal material in high speed tensile test

Information about the flow behaviour of material is important for crash- and forming simulations. The flow behaviour can be described by the true stress strain curve.
Mechanical sensors are not suited for determination of the flow behaviour above uniform extension because they provide only an integral value. Further are mechanical sensors not suitable for high speed tensile tests because of the occurring accelerations.

The high data point density qualifies the ARAMIS system to determine the true stress strain behaviour in the case of necking with more than a hundred data points. In addition it is possible to receive the plain strain tensor (e.g. longitudinal, transversal) and the thickness reduction for each measurement point. Because ARAMIS uses a non-contact measuring method high speed tensile tests are possible by using high speed cameras.

Fig. 1 shows the set up of an ARAMIS 3D-system installed on a ZWICK testing machine and a flat specimen.

Fig. 2 shows a sequence of pictures during a measurement. The detected distribution of longitudinal and transversal strain and thickness reduction can be seen in the fig. 3, 4 and 5 for a measurement with low haul-off speed.

Fig. 1: ARAMIS set up

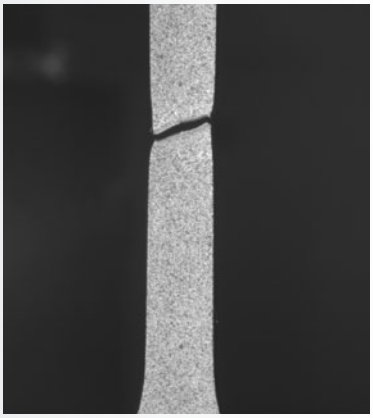
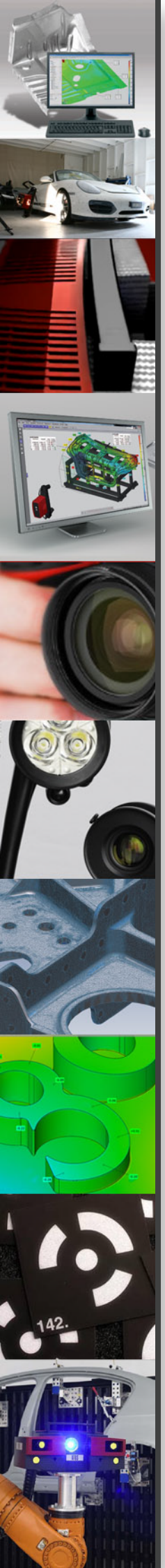


Fig. 2: Specimen during a measurement

High-speed cameras allow measurements with more than thousand pictures taken per second. Longitudinal strain as measured during a high-speed tensile test (haul-off speed 23 m/s) is shown in fig. 6.



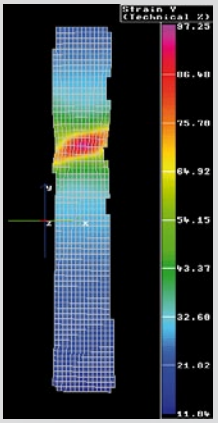


Fig. 3: Longditudinal strain

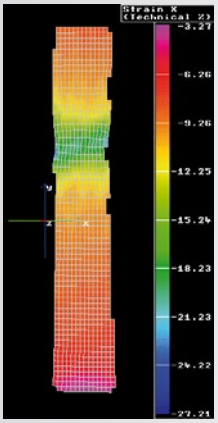


Fig. 4: Transversal strain

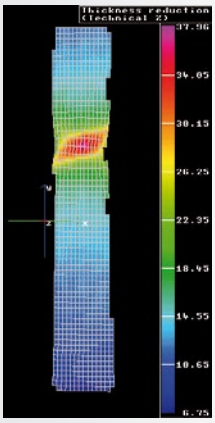


Fig. 5: Thickness reduction

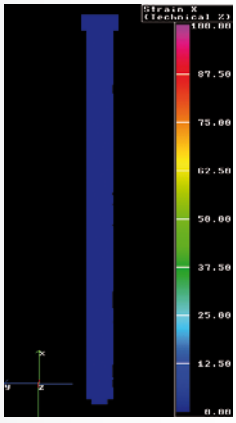


Fig. 6: Animated longditudinal strain

The longitudinal and transversal strain along a longitudinal section for different stress can be seen in fig. 7. Up to a longitudinal strain of 20% a uniform extension can be determined. For higher values necking forms out and reaches values up to 80% until fracture.

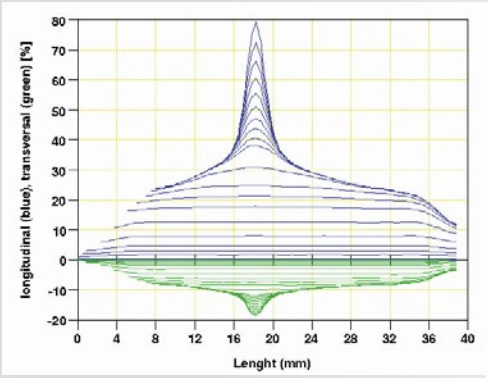


Fig. 7: Longditudinal and transversal strain

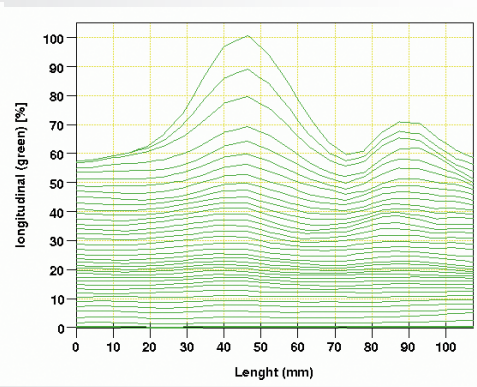


Fig. 8: Graph of longditudinal strain

In this experiment the pictures are taken with a rate of 18´000 per second. Fig. 8 displays the longitudinal strain along a section. Only every second load state is shown. The maximal strain reaches a value of 100%. In this experiment the cameras accomplish a strain resolution of approx. 0.8% in the sector of uniform extension. The strain accuracy is 0.1%.

By courtesy of DaimlerChrysler and the LWF Universität Paderborn.