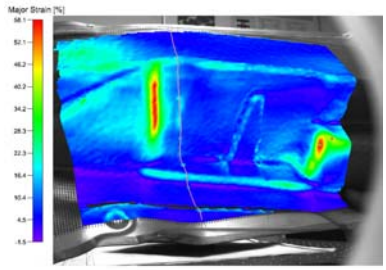
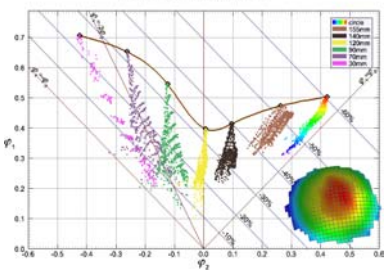
AutoGrid® *in-process*

Highest flexibility for component analysis and in-process materials testing



Forming Limit Diagram



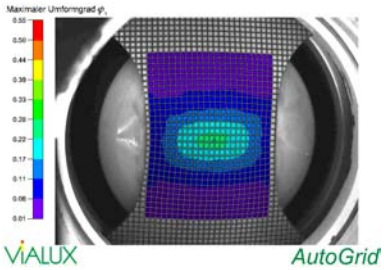
The AutoGrid® product family enables for strain analysis on samples and components in sheet metal industry. The AutoGrid® *in-process* has been designed to meet our customers needs for highest flexibility in the optical setup, measurement volume and local resolution. The direct, fast, and accurate measurement is based upon the automatic evaluation of grid patterns that consist of mostly electrochemically-marked orthogonal lines spaced 1-5 mm. The system is able to determine a field of strain values in the range of 0.5 % to more than 100 % without any unambiguity. The AutoGrid® systems proved well suited for a variety of applications in deep drawing and hydroforming as well as for different materials including aluminium alloys, stainless steel and fibre reinforced composites.

The AutoGrid® *in-process* is fitted with an in-process facility, i.e. an extension that allows the recording of deformations and strains during a forming process. This type of operation facilitates the measurement of forming limit curves (FLC) if the pre-calibrated measuring head is mounted on a sheet metal testing machine (Erichsen or others). All four cameras observing the specimen from different perspective views are exactly synchronized and the image sequences are recorded with a rate of up to 15 x 4 frames per second. Electronic shuttering is combined with the progressive scanning mode of the cameras with variable exposure time to avoid any blur or disturbance due to the object motion. Employing latest digital camera technology AutoGrid® *in-process* with 1,4 Megapixel Cameras provides 5.79 million pixels per recording. In case of the standard testing velocity of 1-2 mm/s, a punch depth resolution of less than 0.1 mm can be achieved. In many practical cases some lower frame rates can be chosen. The length of the sequence recorded fulfils all practical requirements by appropriate memory configuration of the PC used.

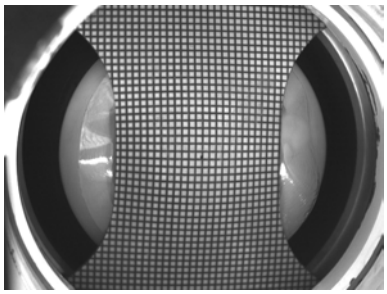
In addition, the AutoGrid® software supports the acquisition of additional data from the testing machine. For example, punch stroke and drawing force can be predefined as starting point of the recording.

After the test, the whole sequence of image ensembles is stored in memory and may be inspected immediately or saved to disk for further analyses if desired. The sequence can be displayed step by step, zoomed and also connected to drawing force/punch stroke data in order to identify the moment and the location where the critical necking occurred first.

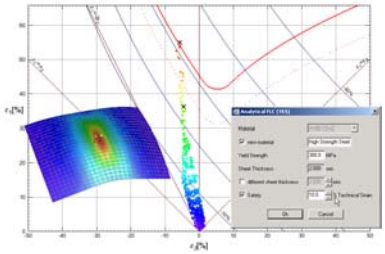
The results of a specimen for the forming limit diagram are available about 5 min after the test run. A variety of stress conditions is required for a complete forming limit curve. They are generated by differently shaped specimens and, using AutoGrid® *in-process*, all the results can be conveniently combined in one diagram to define the points of a FLC automatically or interactively. Polygon or spline functions can be used for interpolation. Data export is given by ASCII format.



ViALUX provides a fast and accurate tool for the determination of forming limit curves (FLCs) of sheet metal materials. Directly connected to the testing machine, the system gives precise access to the maximum strain value just *before* necking and subsequent cracking occurs. Comfortable software allows to create FLCs from a set of specimens very effectively. Furthermore, the customer has the option to create free editable FLD reports for documentation. Of course, AutoGrid® *in-process* can also be used e.g. for bulge or tensile tests.



The unsurpassed performance allows for materials testing and component analysis with one system, which makes AutoGrid® *in-process* the ideal solution for quality assurance purposes in sheet metal industry.



Specifications

Measuring head	4 progressive scanning CCD cameras 1292 (H) x 964 (V) active pixel with high quality measuring lenses; PC connection and power supply via a single 4 m cable using the firewire interface, size: flexible, e.g. 205*205*200 or 500*450*150 mm³ convenient transport box
Computer	brand mark first class PC with worldwide service
Environment	temperature: operating 10 ... 35° C, non-operating: -40 ... +70° C humidity: 20%...93% non-condensing
Software	Microsoft Windows XP Professional full compatibility with Microsoft Office applications and other standard software
Measuring volume	up to 600∗450∗220 mm³ per image set (other volumes on demand)
Field of data	up to 12.000 measured points per single measurement; combined measurements without size limitation
Calibration	fixed optical setup maintaining long term calibration; automated, robust self-calibration procedure (3 min) using certified calibration gauge
Measuring time	3-5 min for a complete analysis of one image set
Results	3D shape: coordinates x,y,z [mm] at grid line crossing points; engineering strain ε [%], true strain φ, v.Mises equivalent strain, thinning [%], thickness [mm], safety strain, max. failure
Grid size/ recommended FOV	mm: 1.0 | 2.0 | 2.5 | 5.0 mm³: 140x100x50 | 280x200x100 | 350x250x125 | 600x450x220
Strain accuracy (rms)	for grid size 2.0 mm Δε = 0.2%
Graphs	3D surface display using original object grid for direct result mapping to object colour encoded presentation of strain and thickness as texture on the 3D object 2D data profiles along user defined curves forming limit diagram (FLD) with in-processus FLC's and auxiliary lines interactive tool for the creation of FLC's from strain data sets automatic MS-Word FLD reports based on free editable templates
Export	graphs: printer, clipboard, *.bmp, *.tif, *.png, *.jpg, *.vrml, *.ps, *.eps data: ASCII, MS-Excel, AutoForm, Pam-Stamp, *.stl, AutoCAD, LS-Dyna

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