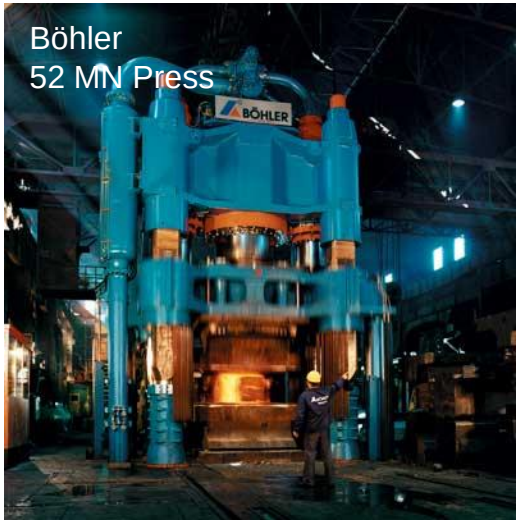
LaCam-Forge Installations

Buderus
80/100 MN Press


Buderus
55 MN Press



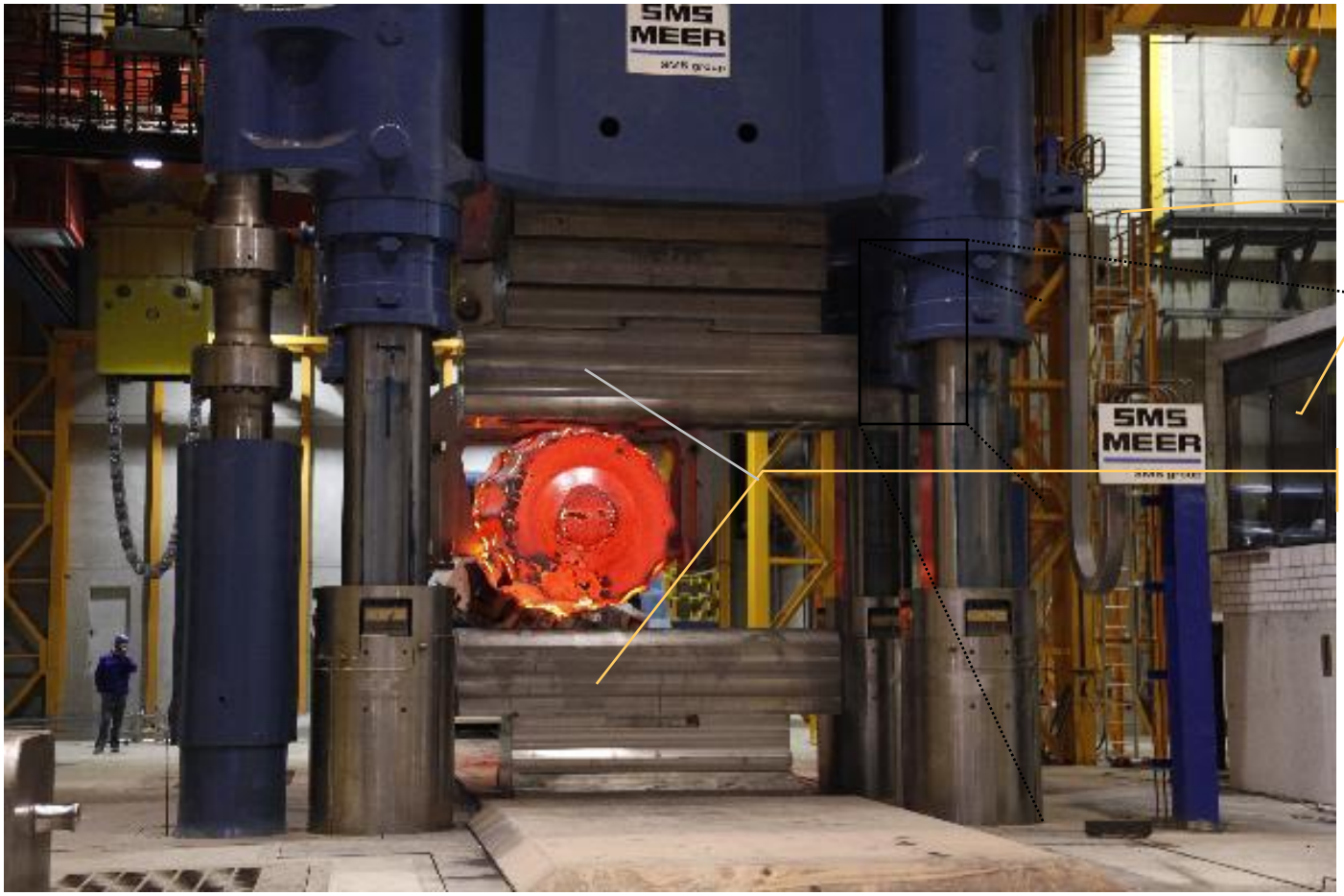
Böhler
52 MN Press


ThyssenKrupp VDM
45 MN Press

LaCam® -Forge – Technical Setup

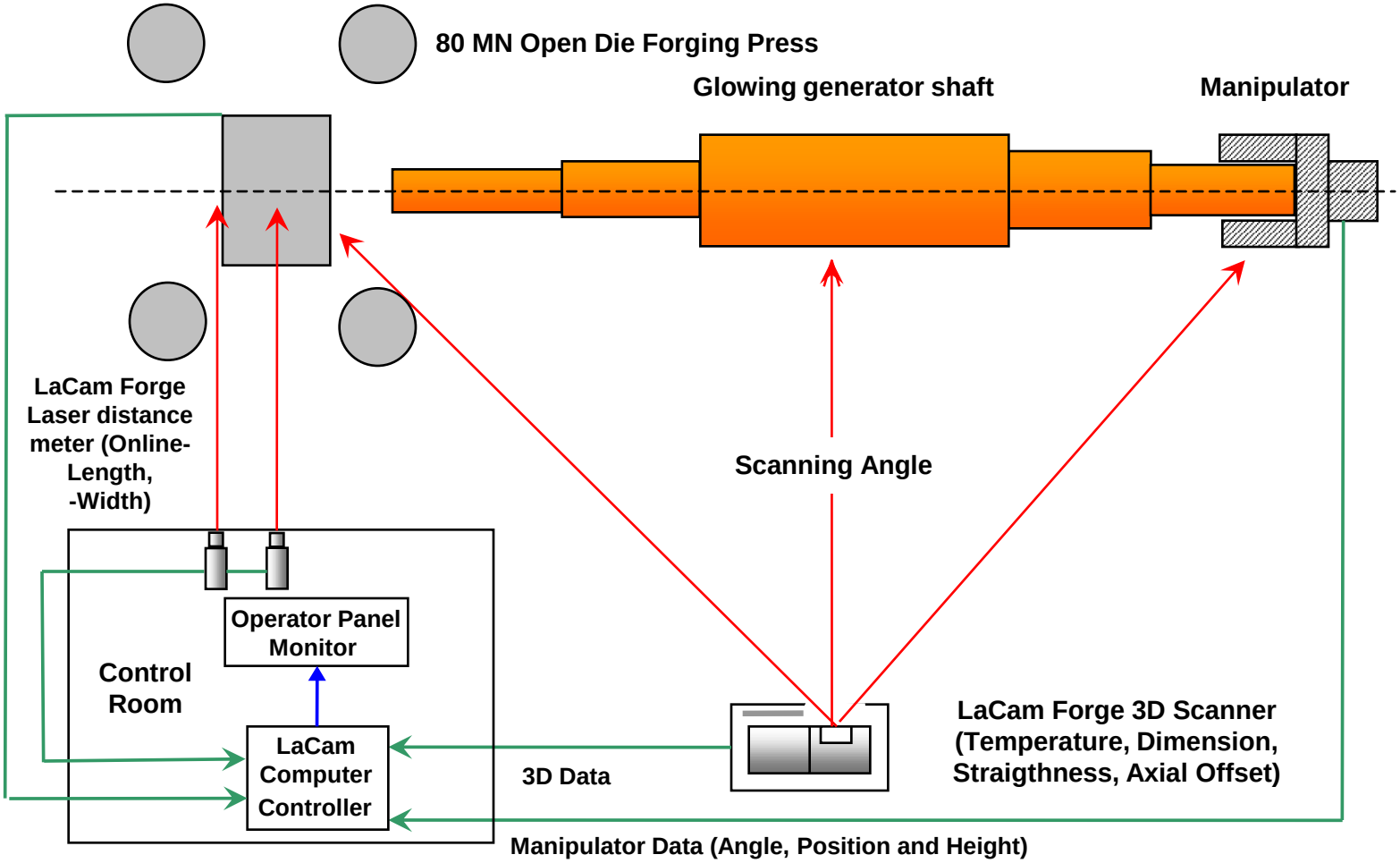
Buderus Stainless Steel, Wetzlar, Germany, 55 MN

LaCam® - Forge - Technical Setup



Buderus Stainless Steel, Wetzlar, Germany, 80/100 MN

Measurement Setup LaCam® Forge at Buderus 80/100 MN-Press



- **Distance to workpiece:** 9 meter
- **Max. workpiece length:** 15 meter
- **Data points per scan:** ca. 40.000
- **Time per scan:** < 10 seconds

Measurement Setup LaCam® Forge at Buderus 80/100 MN-Press

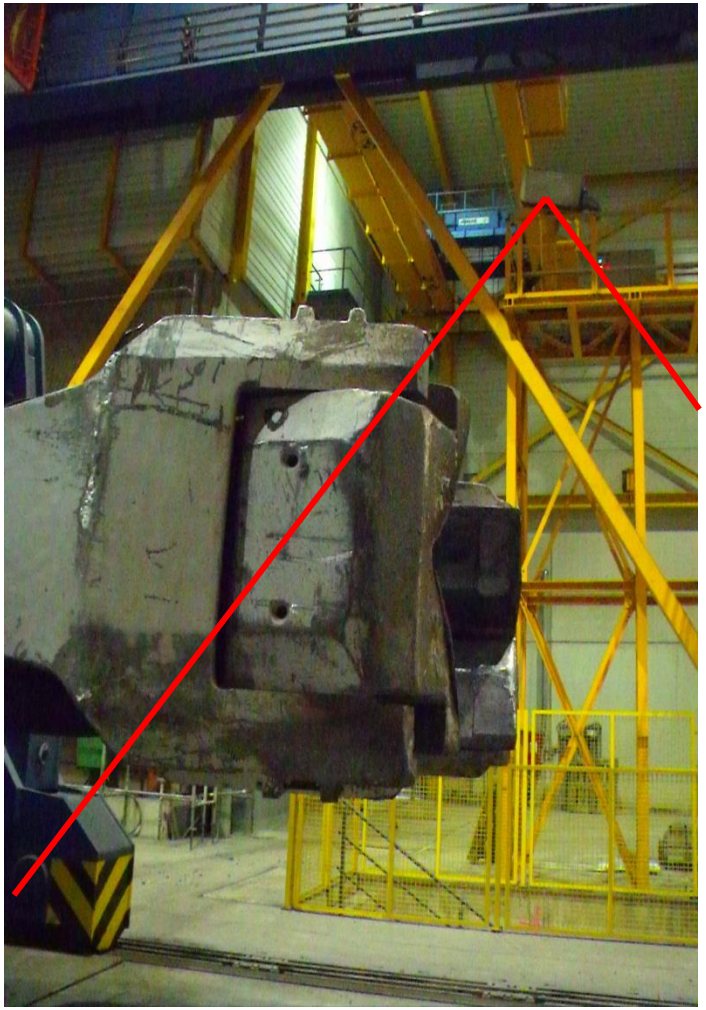
- Modules of LaCam®-Forge Measuring System at Buderus 80MN Press

  - 1. 3D-Scanner for measuring
    - Geometry / Straightness
    - Temperature Distribution

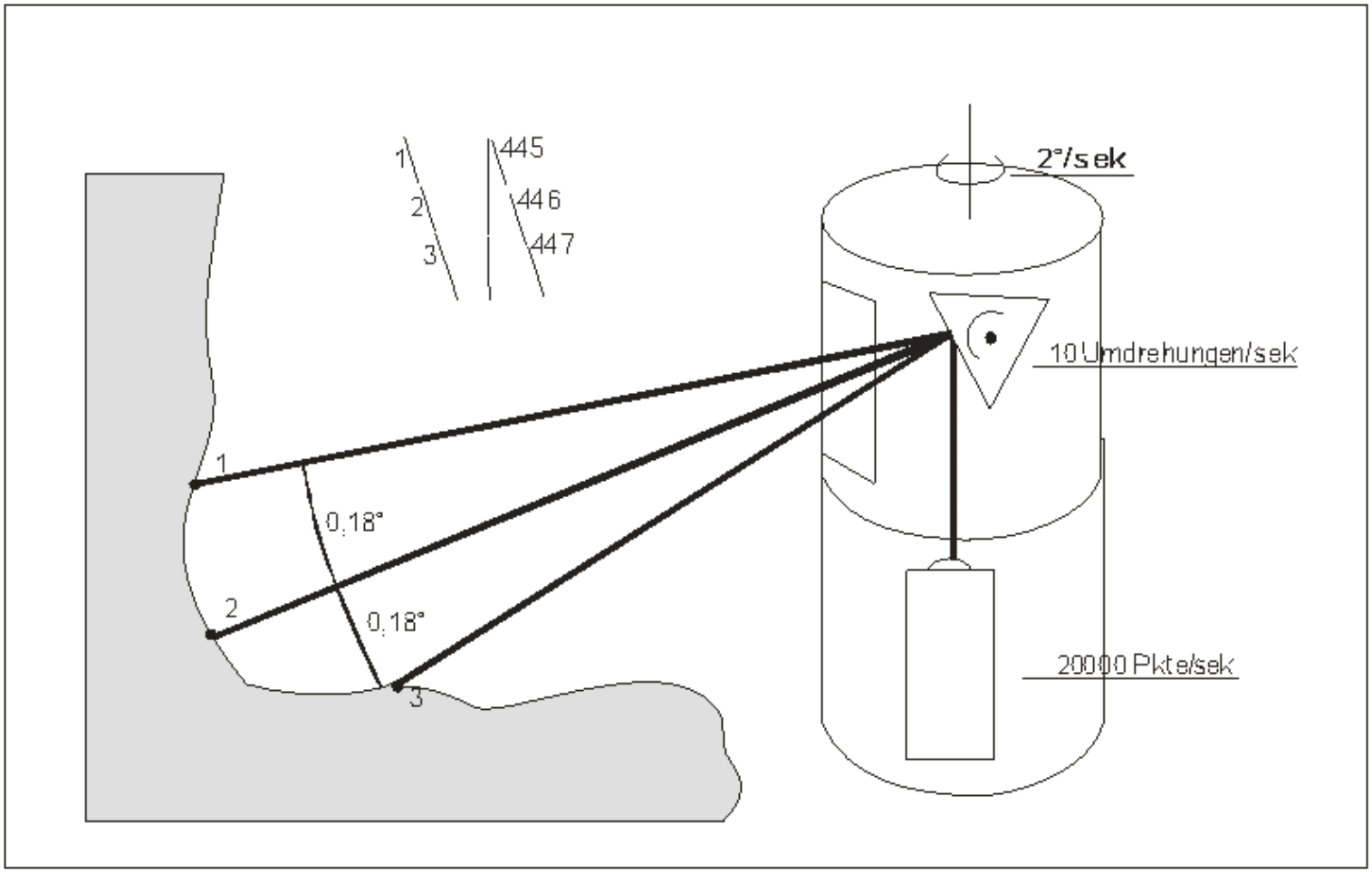
  - 2. Two vertically adjustable Laser Distance Meters for Online-Measurement of
    - Length
    - Width

  - 3. Control Cabinet : Industrial PC / Operator interface / Connection to Press and Manipulator Sensors / Connection to Steel Plant Data Base and File Server

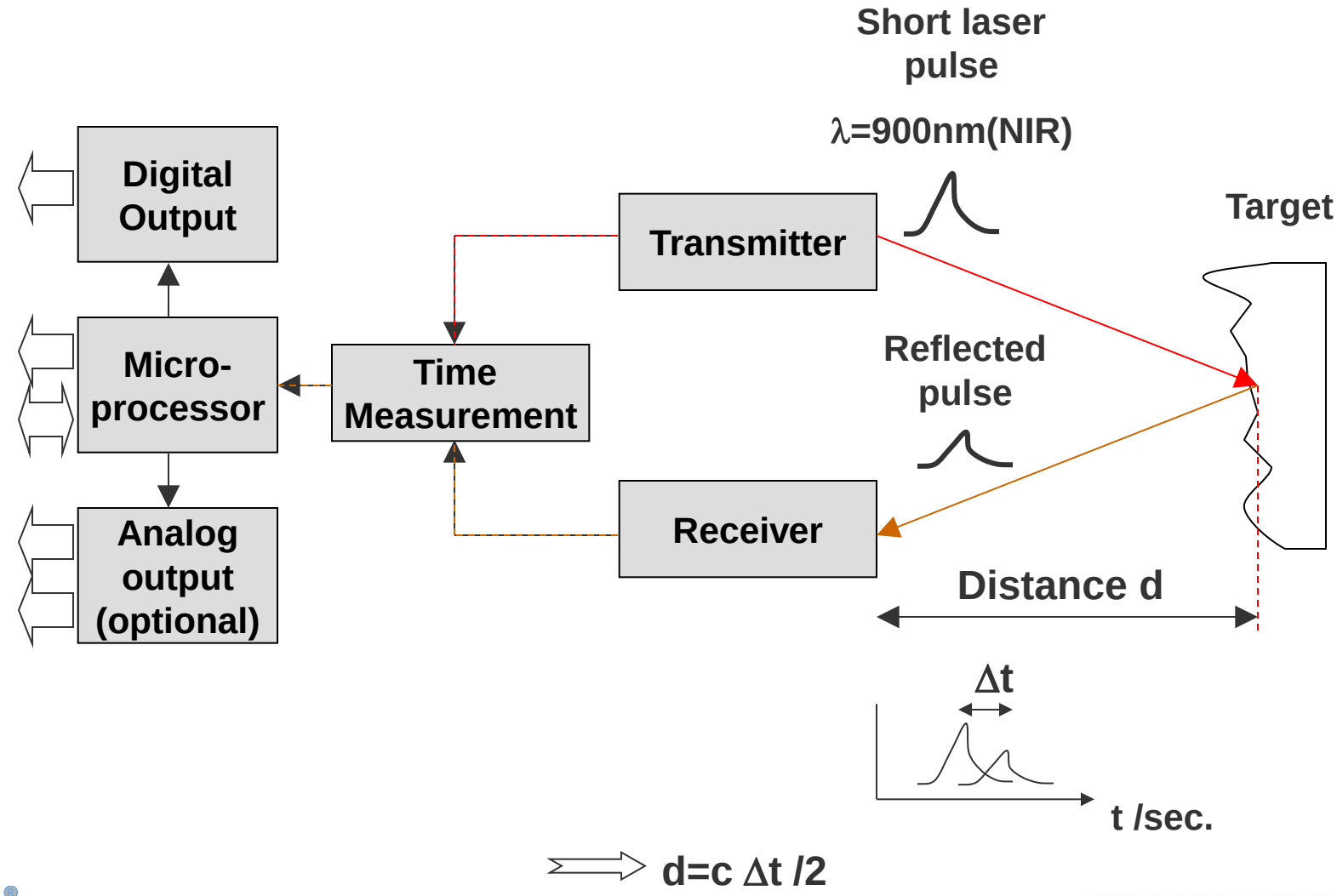
Installation of 3D-Laserscanners at 80/100MN-Press



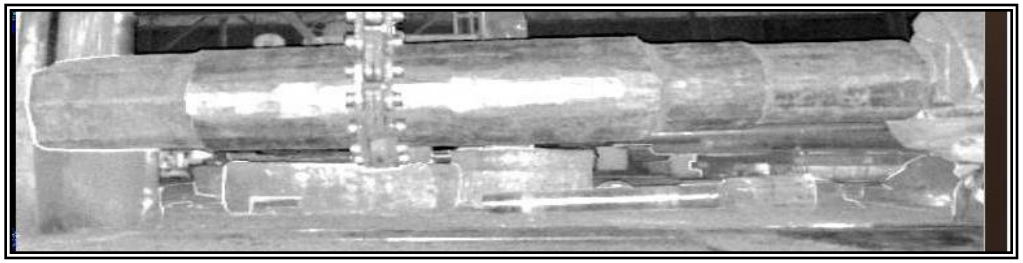
Technics: Principle

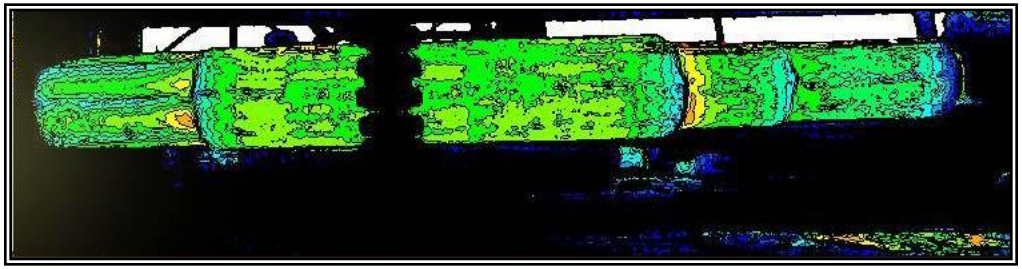


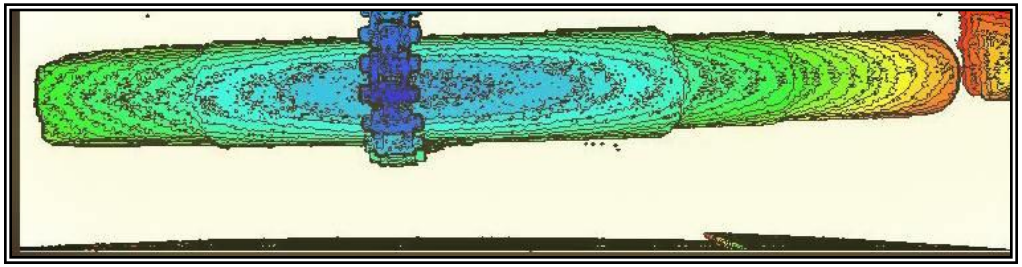
Measuring Principle



Scan Results







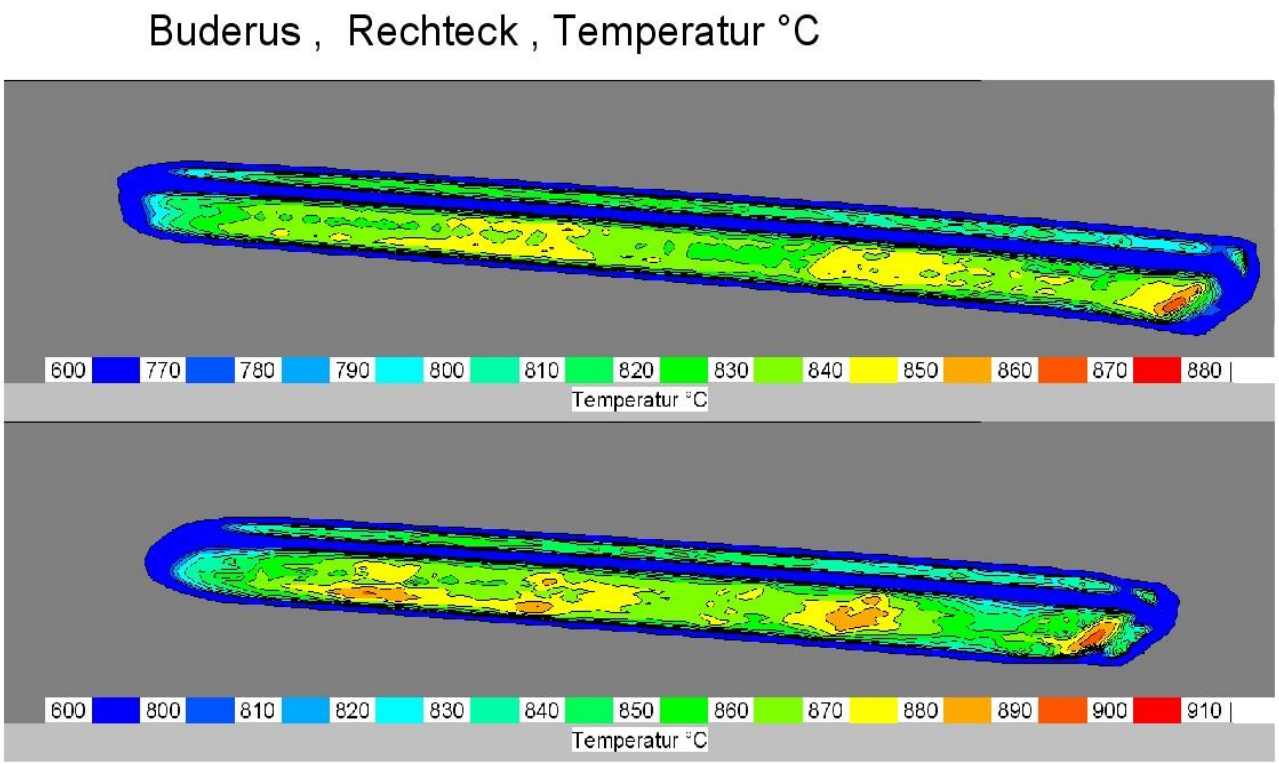
-**LaCam** 3D Scanner measures 3 values for every surface point:

Amplitude (top) **Temperature** (center) **Distance** (bottom)

3D-Surface Temperature

3D-Thermography

Surface – Temperature obtained during 3D-Scan



Schmiedewerk	Buderus Edelstahl
Geometrie Typ	Rechteck
	0
Auftrag Nr.	23140-0-2
Auftrag Dicke	--
Auftrag Breite	

Datum	05.06.2010
Zeit	01:10
Geo.Typ Nr.	1
Mess Nr.	66

LaCam®- Forge: Applications

1) Dimension Measurement

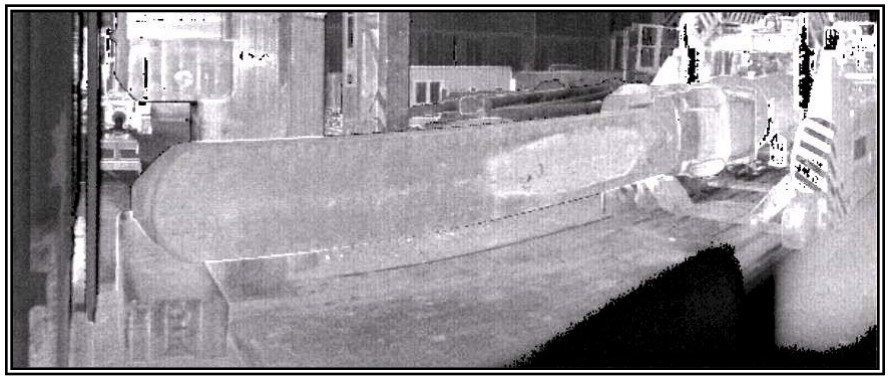
   A) Determination of Dimensions

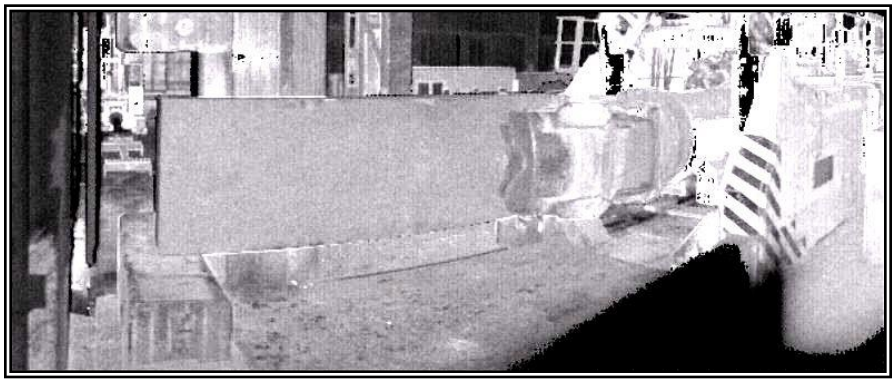
   B) Control of Work Piece Bending

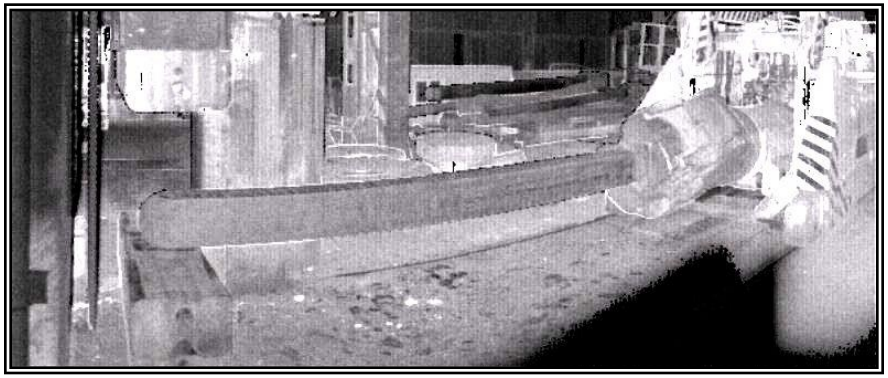
2) Bite shift Optimization (Online Measurement)

3) Documentation of process

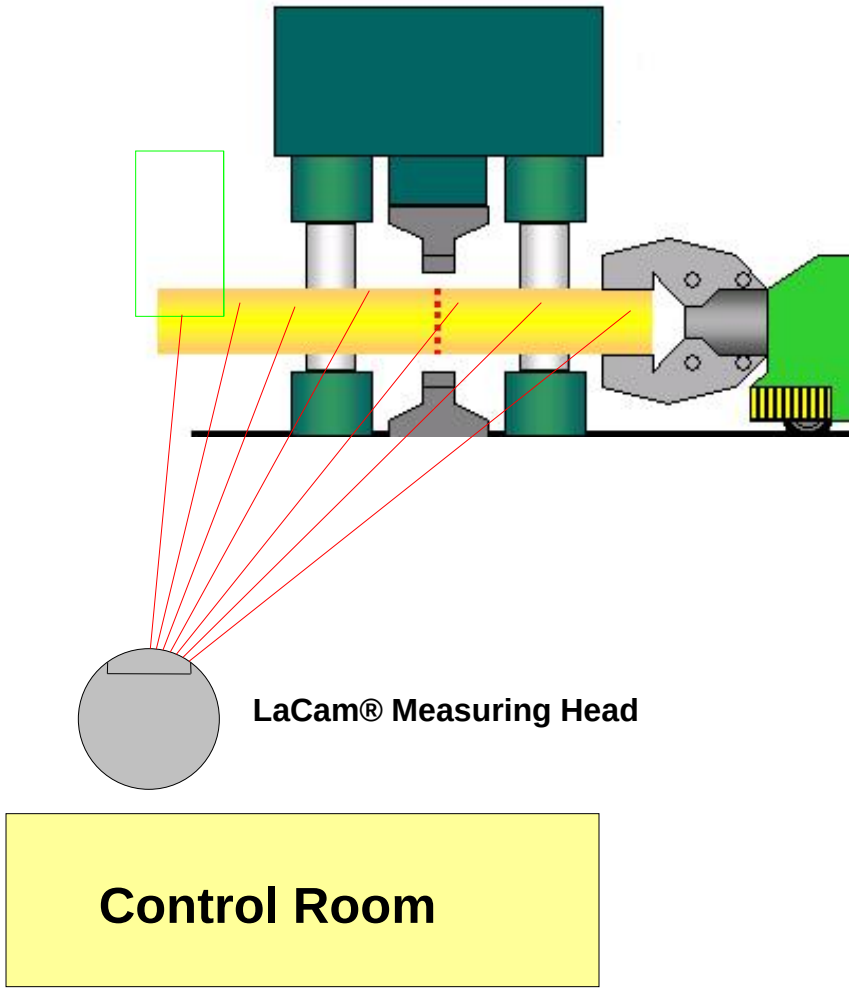
Straightness measurement for Flats, Squares, Rounds



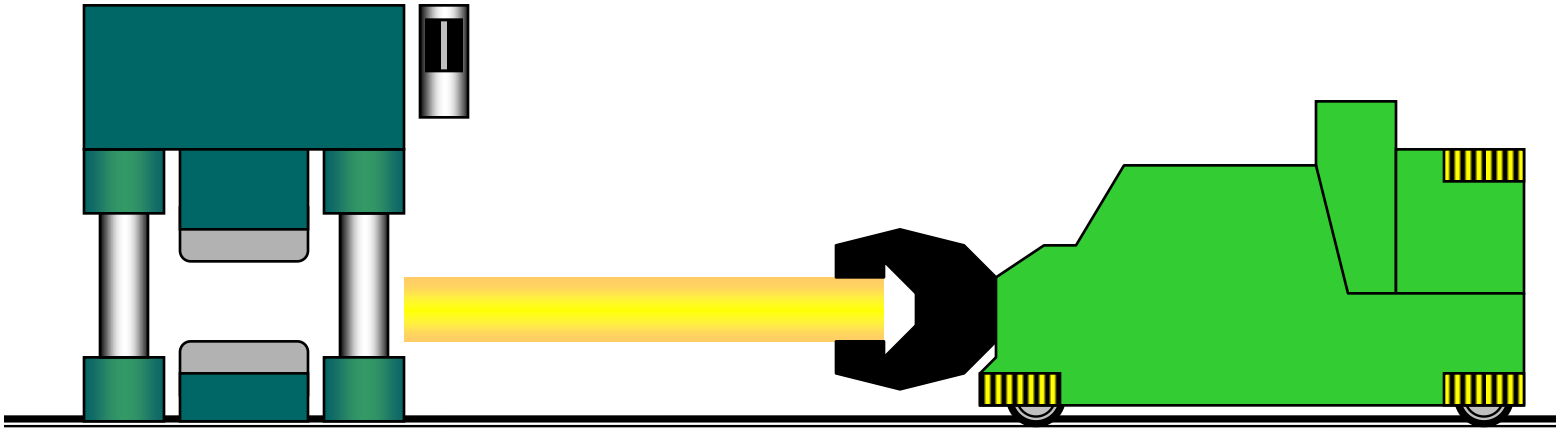




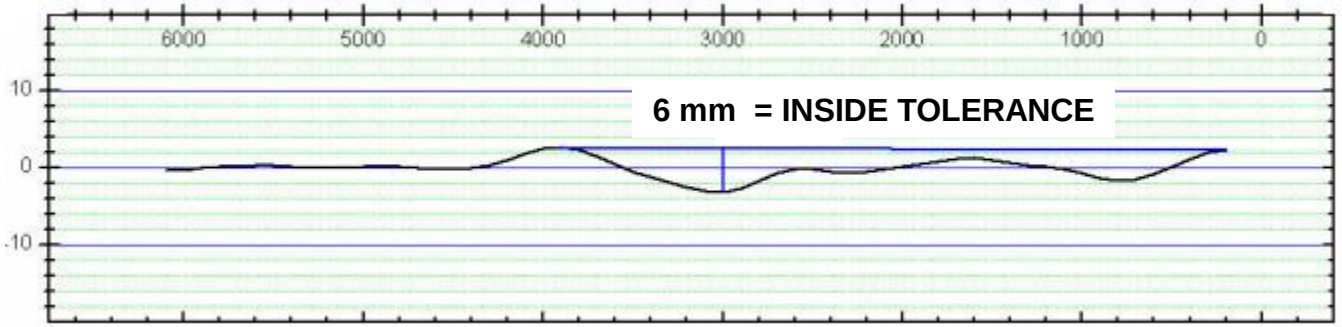
Straightness measurement for Flats, Squares, Rounds



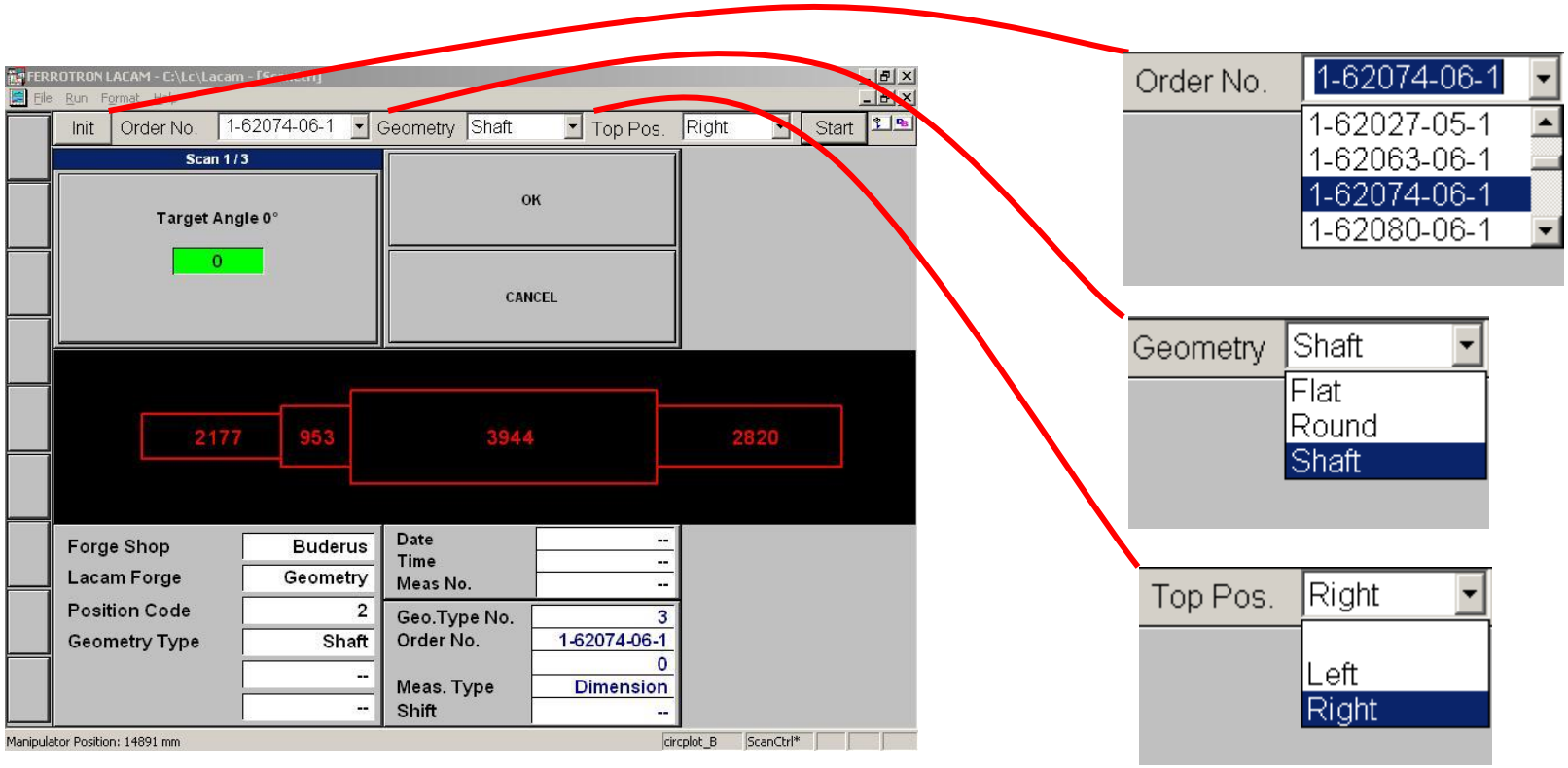
Straightness measurement for Flats, Squares, Rounds



Flatness within tolerance -> ready for next process step

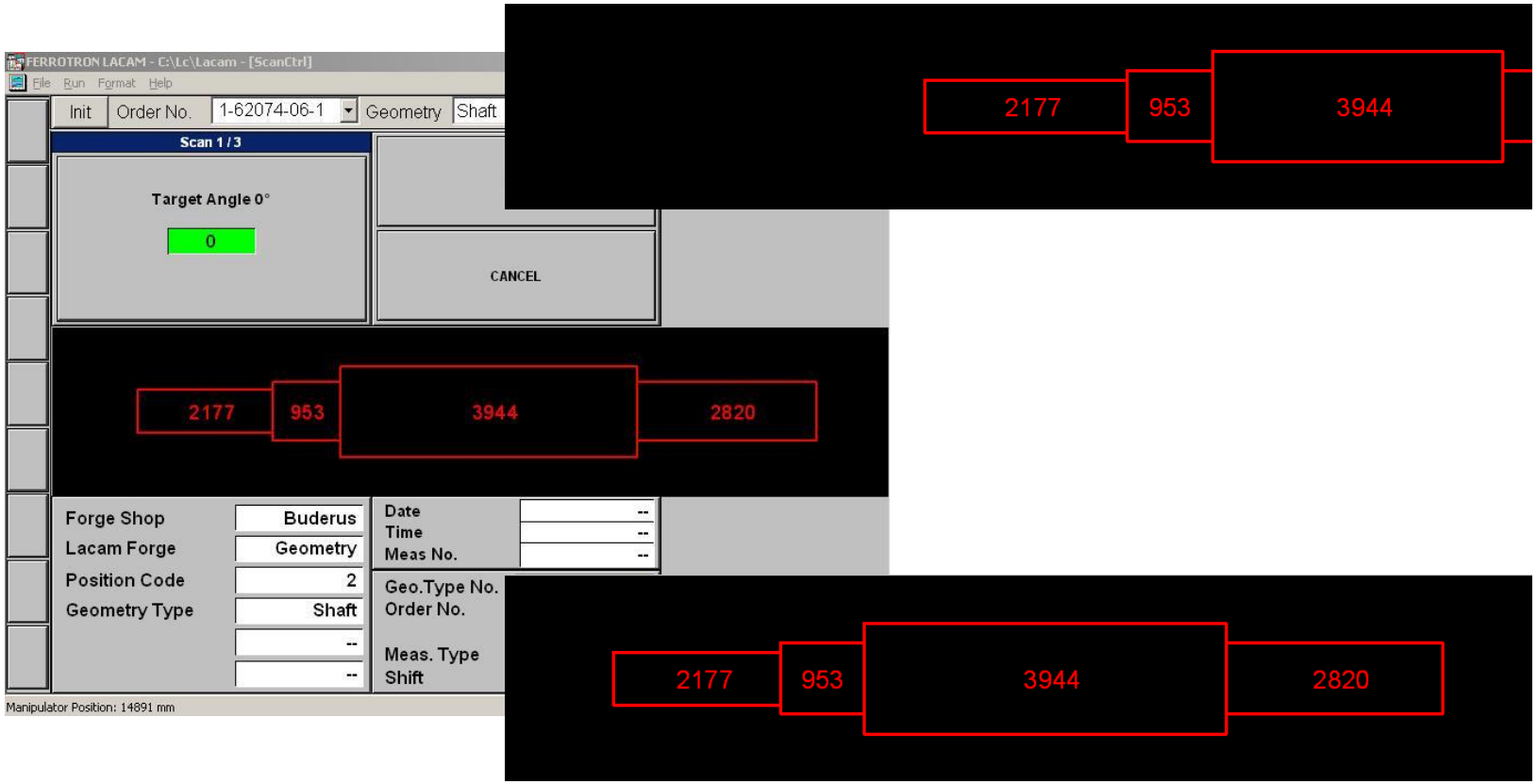


Measurement Procedure for Shafts



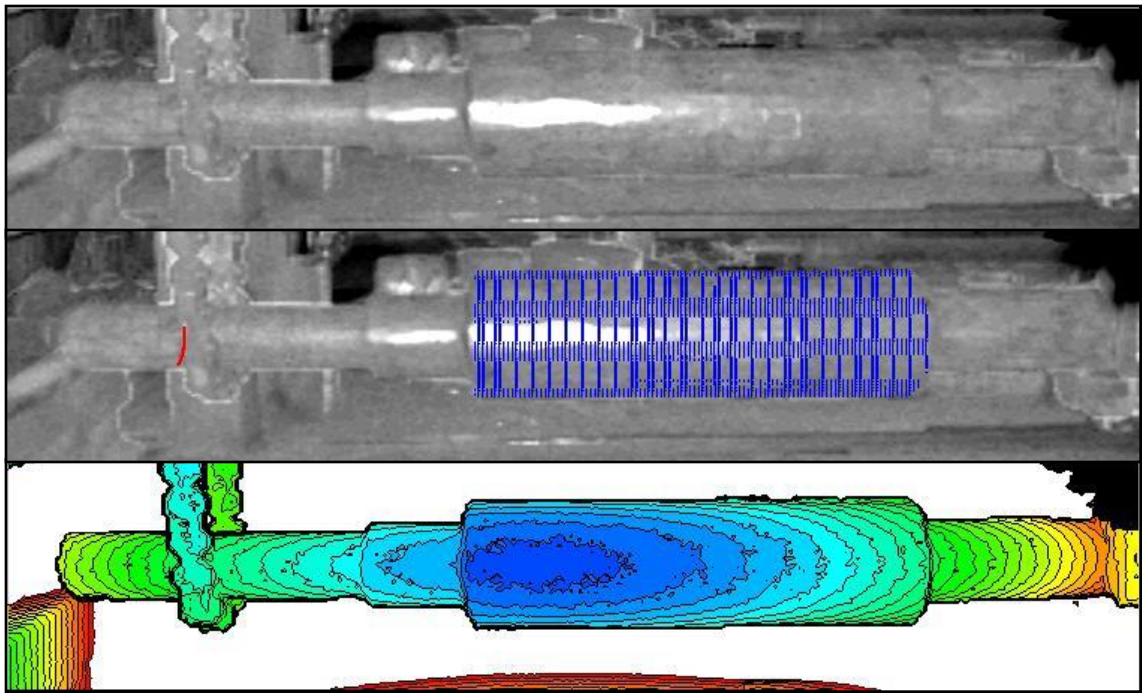
Operator selects before the first scan: **Order No.**, **Geometry** and **Ingot Top Position**

Measurement Procedure



Operator adjusts a suitable **manipulator position** before first scan by help of forging sketch and real time data: **Top: wrong** position, **Bottom: good** position

Measurement Evaluation

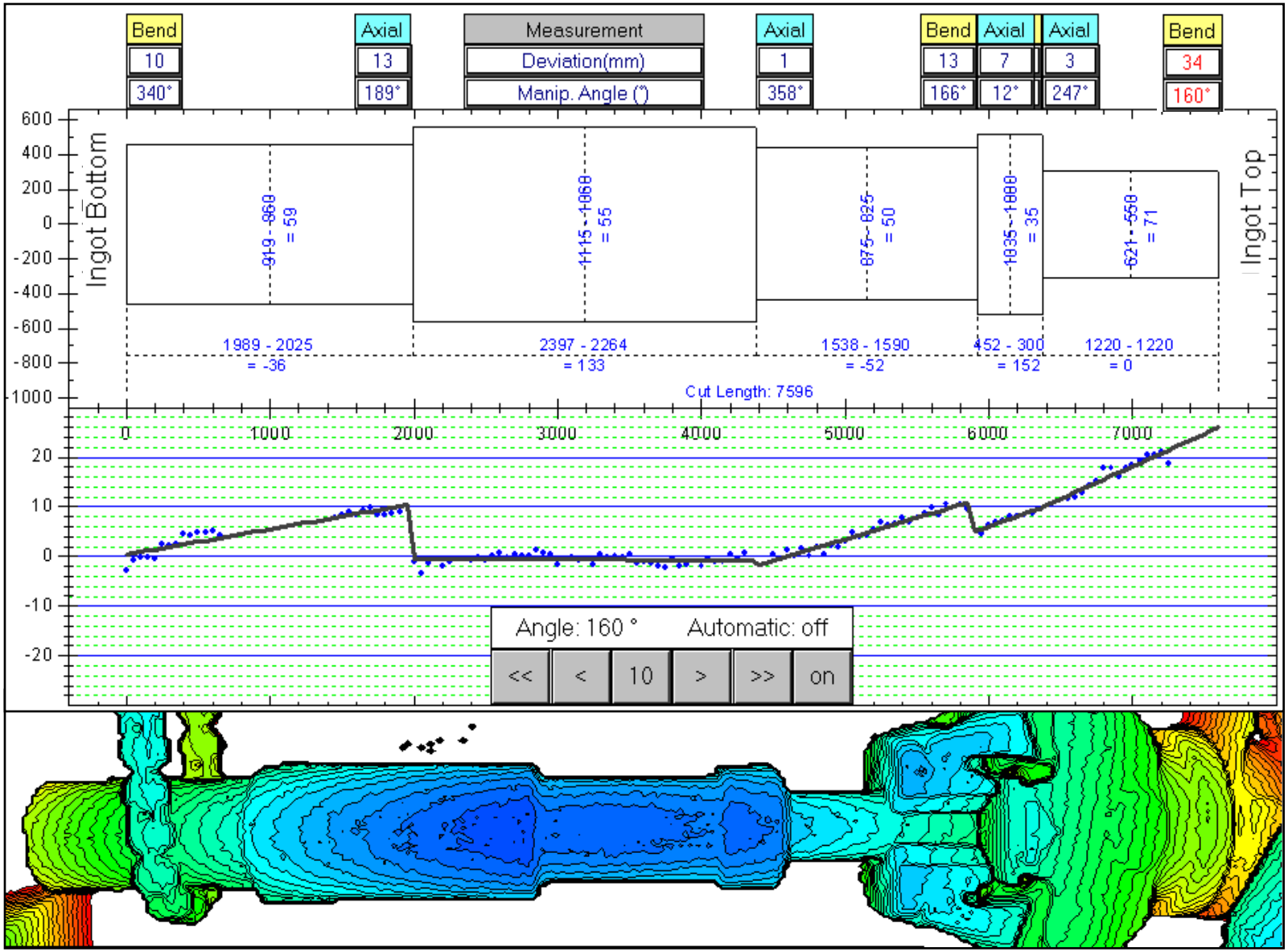


3D-Scan Data of a shaft displayed as **Amplitude frame** (top),

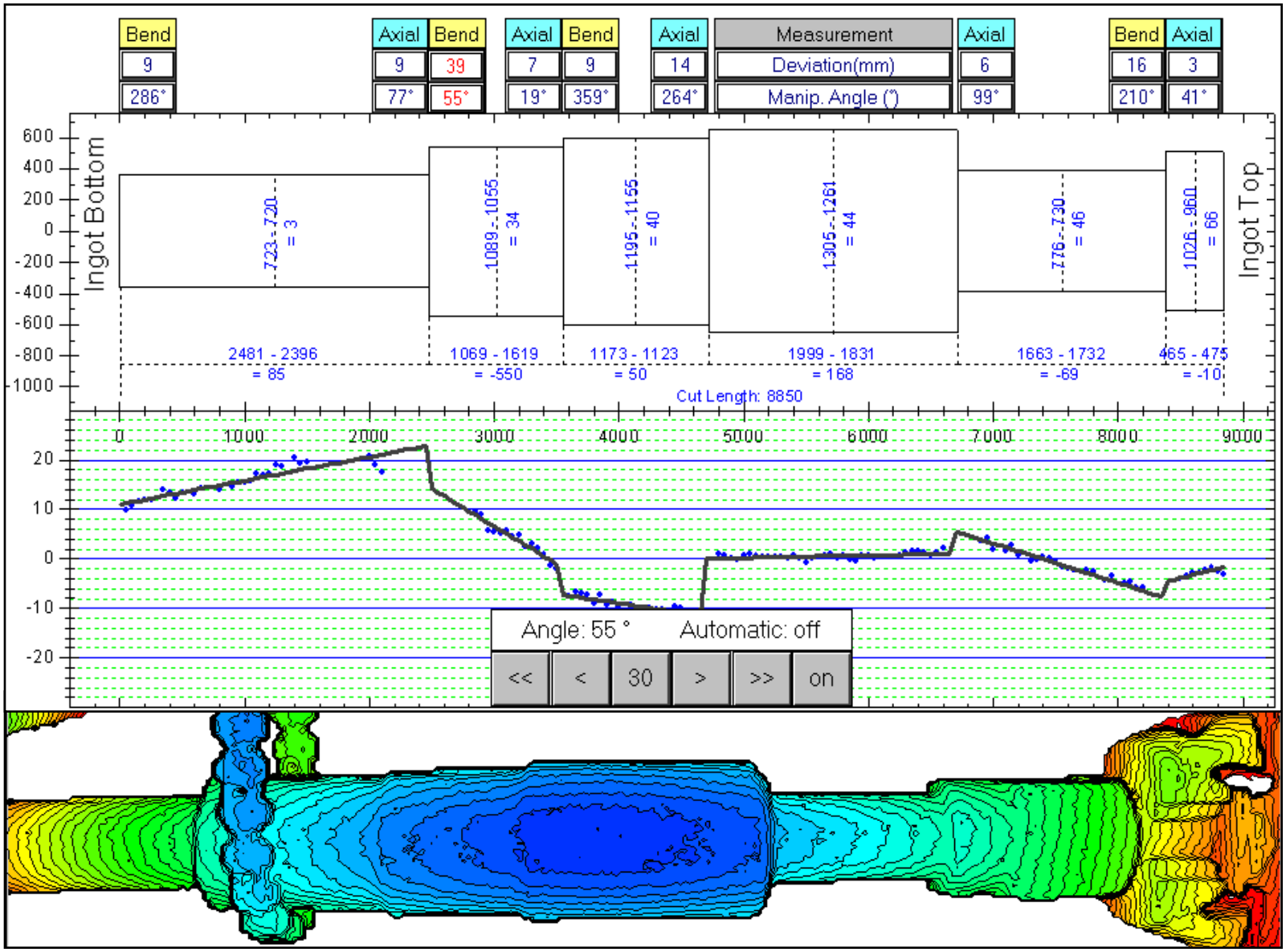
Ampitude frame with overlayed indication of **localizing result** (center),

Distance frame as colour coded plot due to measured distance (bottom)

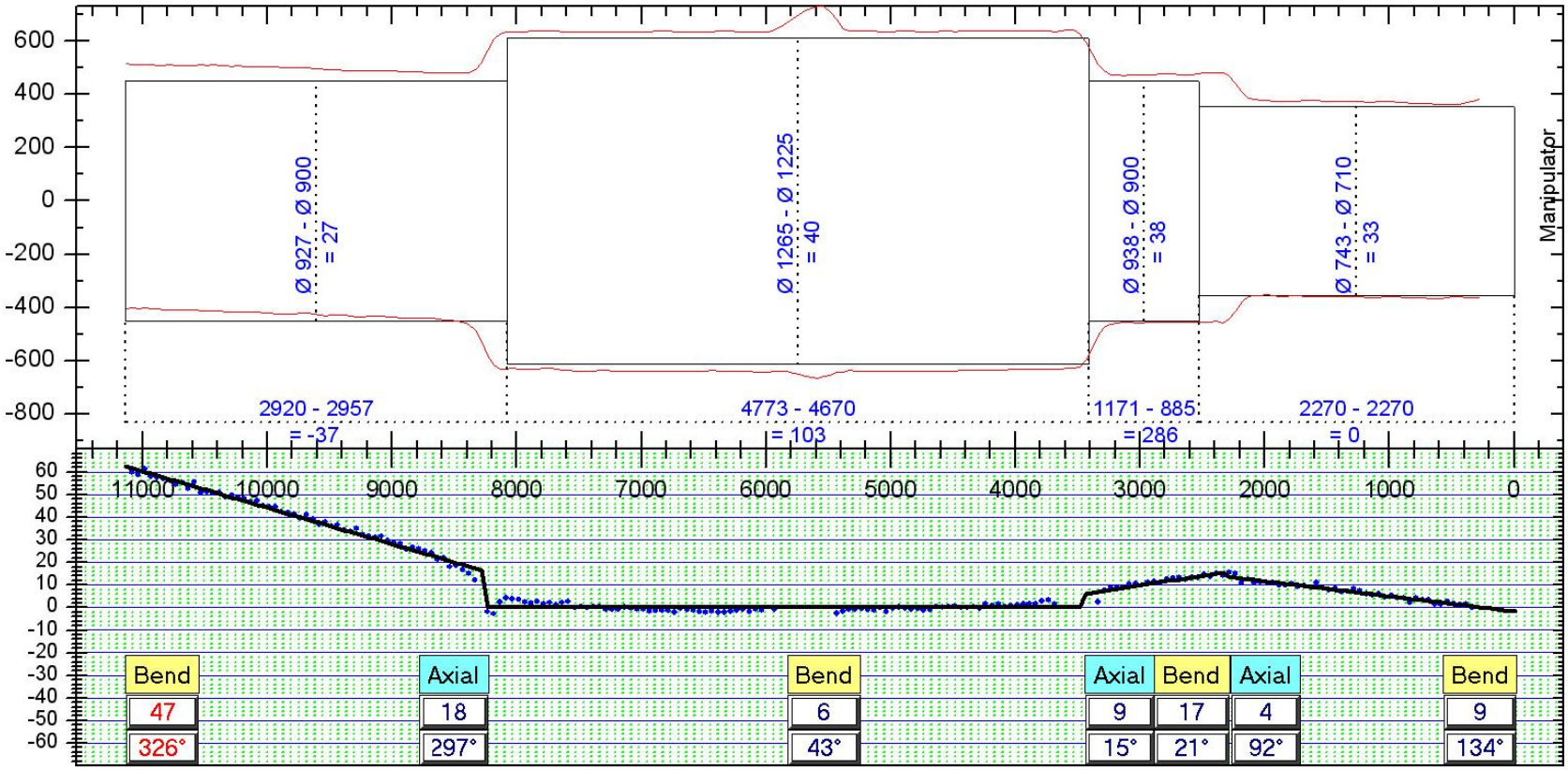
Measurement Results



Measurement Results



Dimension Measurement Report

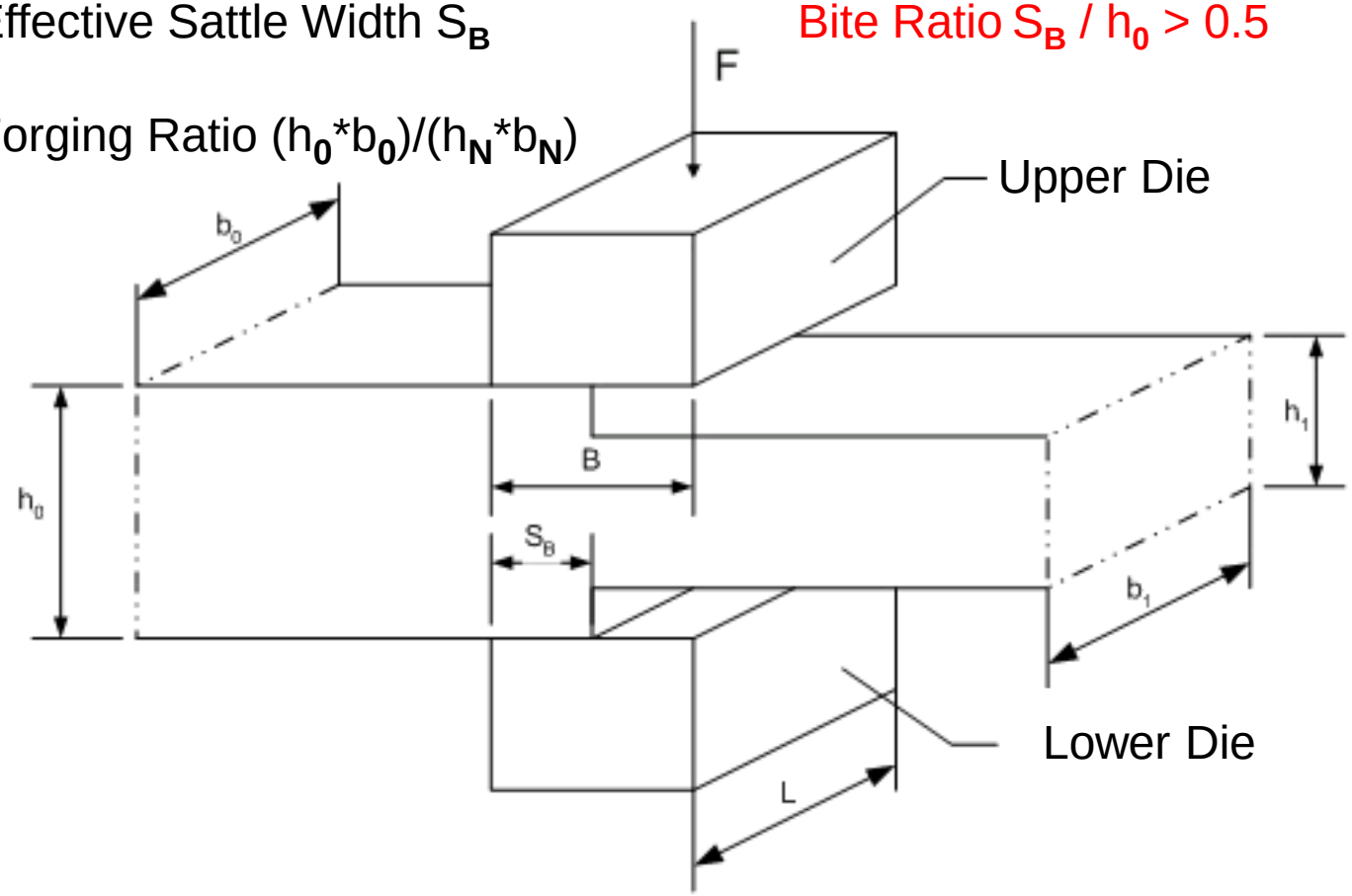


LaCam® Forge ONLINE Measurement

Description of Cogging Process

- Effective Sattle Width S_B
- Forging Ratio $(h_0*b_0)/(h_N*b_N)$

Bite Ratio $S_B / h_0 > 0.5$



2D-FEM Simulation of Bite Shift Operation

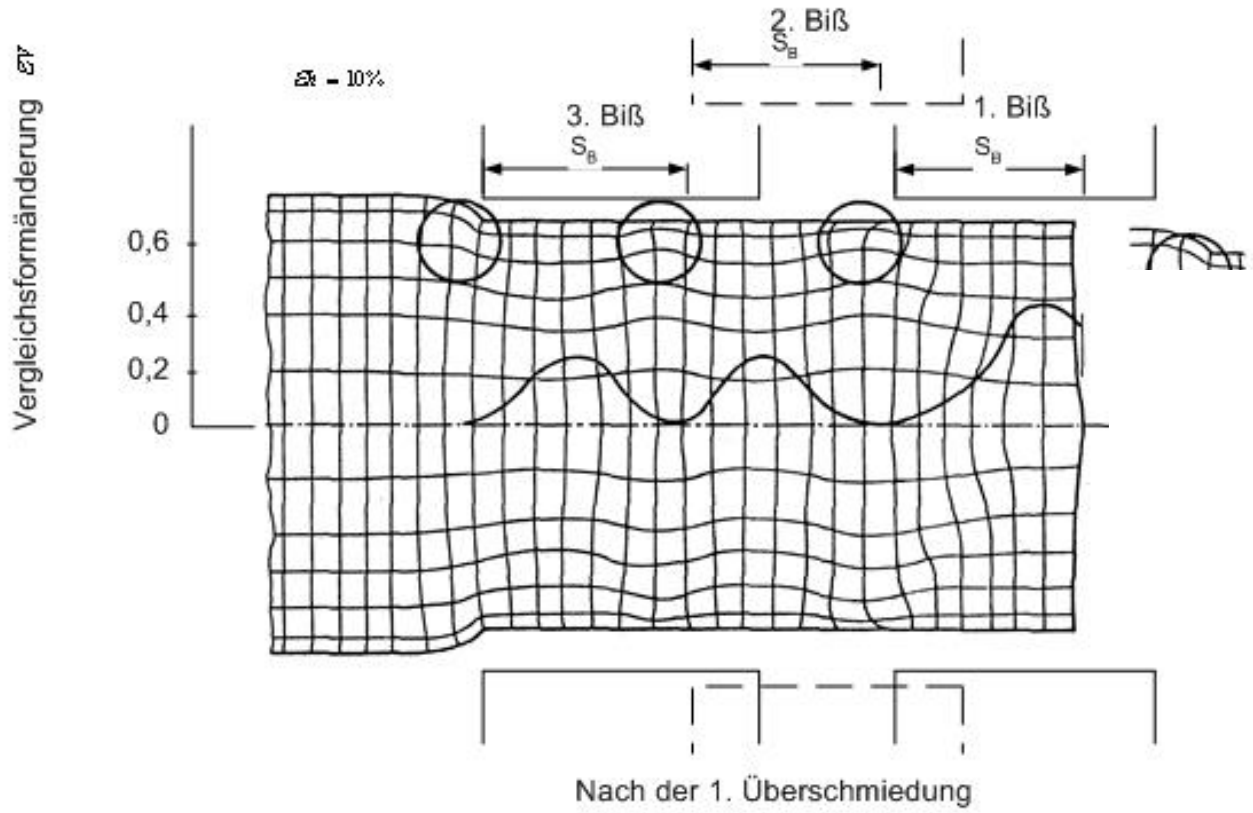
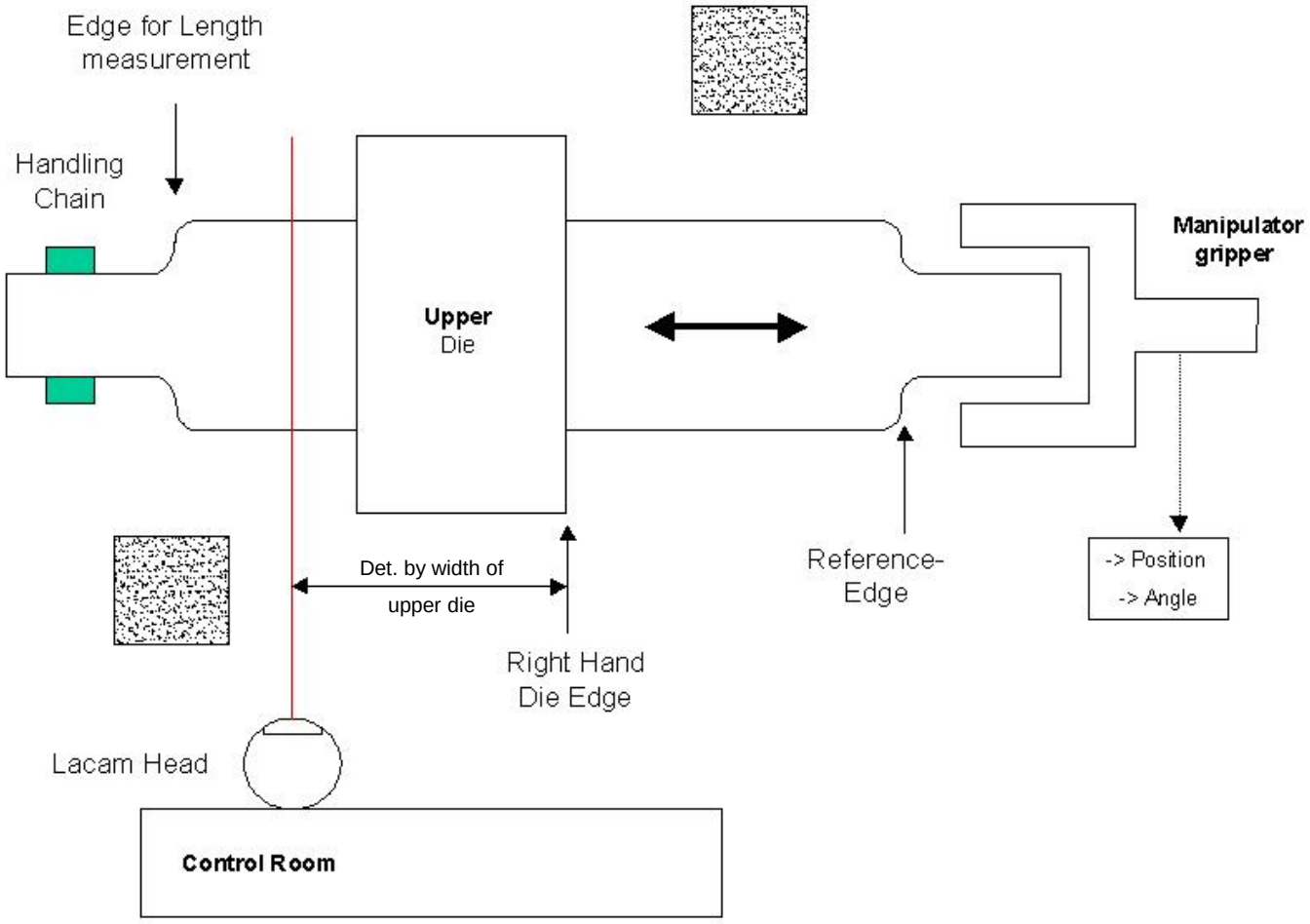


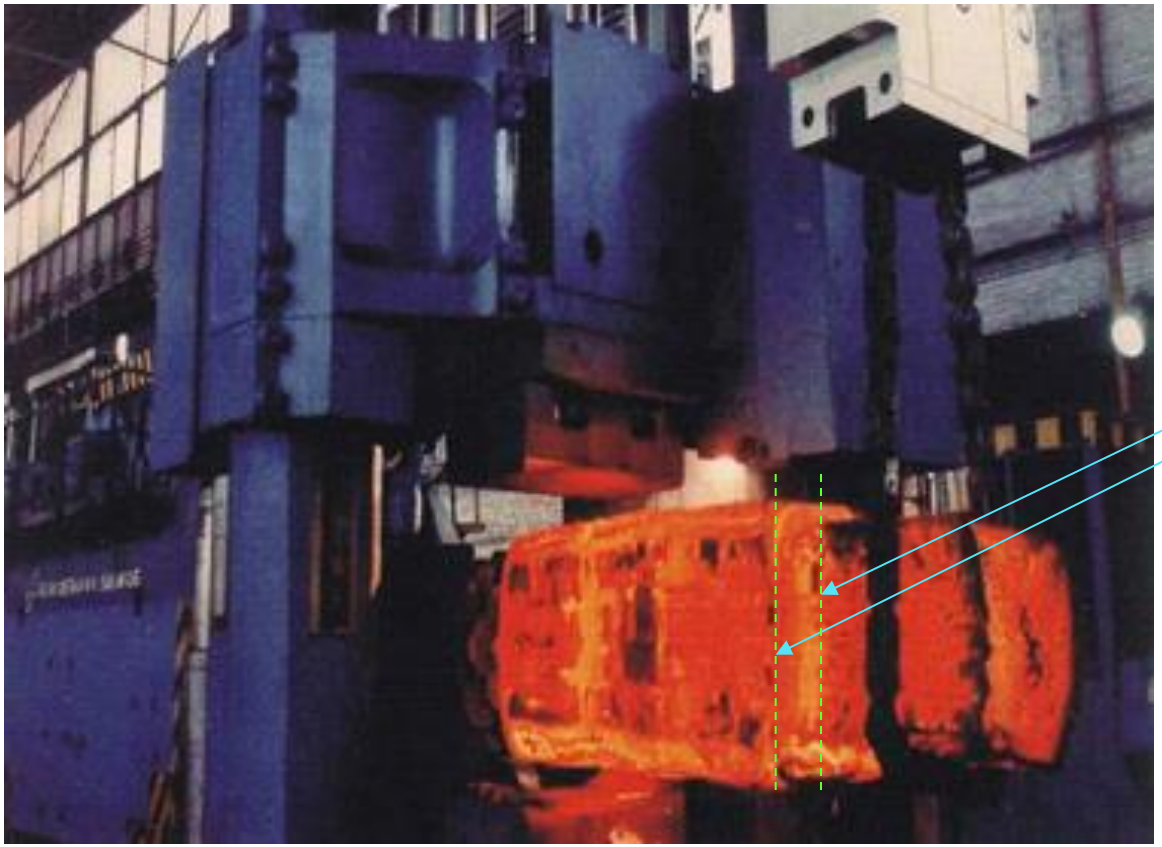
Bild 5.5: Simulation des ebenen Reckschmiedens mit Hilfe einer 2-dim FE-Rechnung nach /49/

RWTH Aachen, IBF: Prof. Kopp, Nieschwitz, Cho (1986), Siemer (1987)

Principle of LaCam® Forge Length Measurement

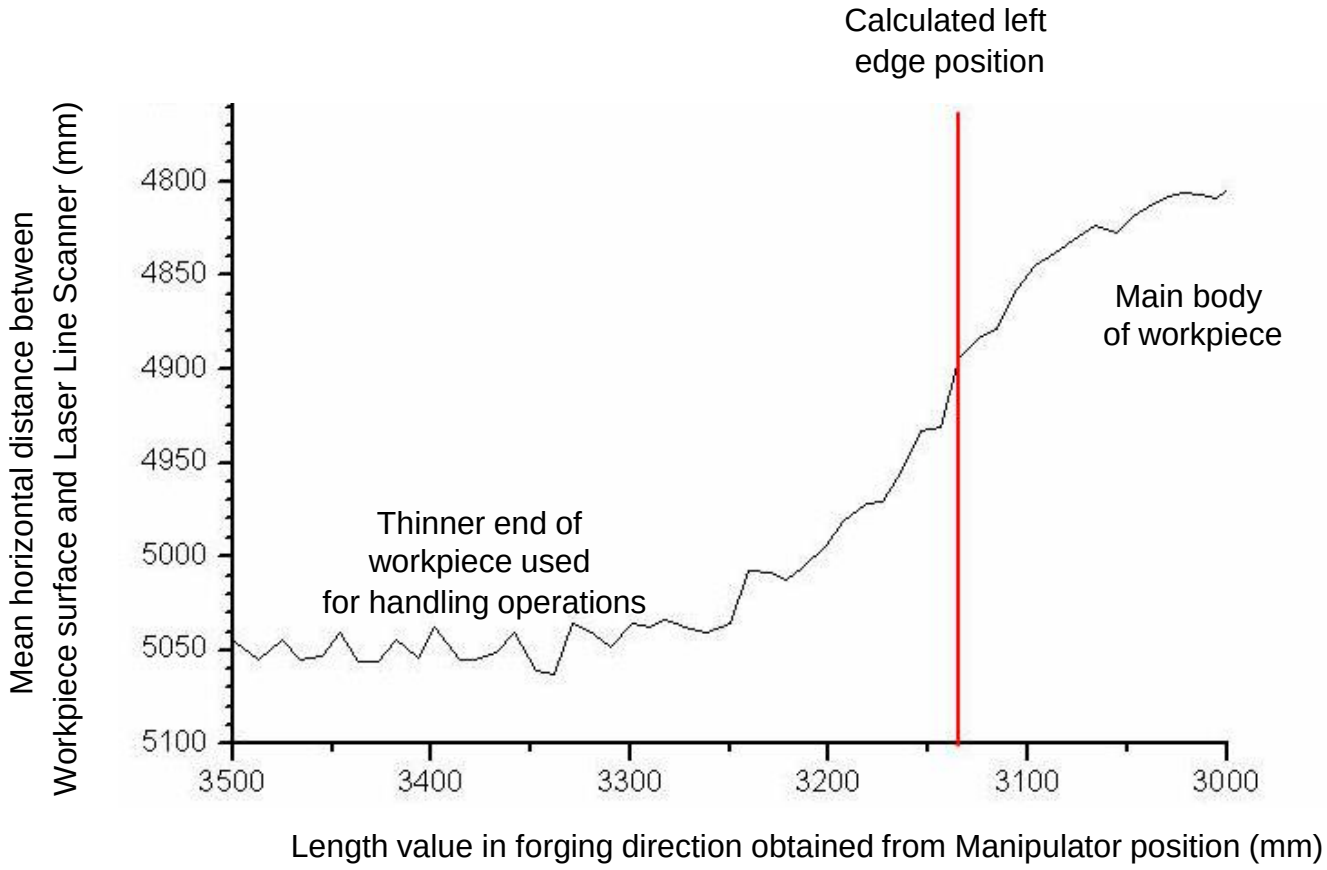


Profile Edge used for Length Determination

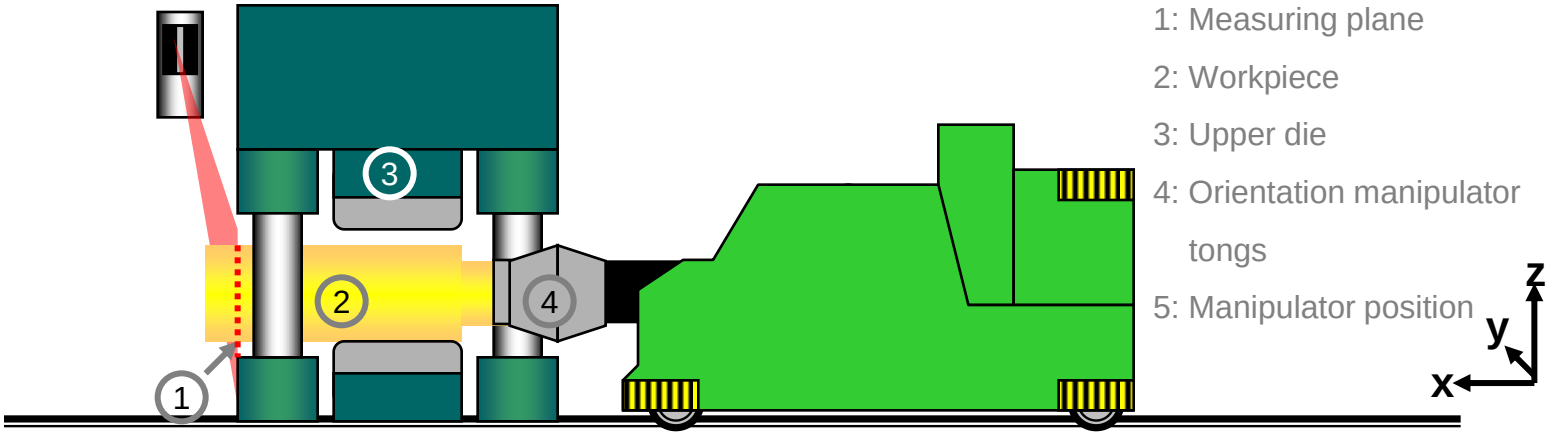


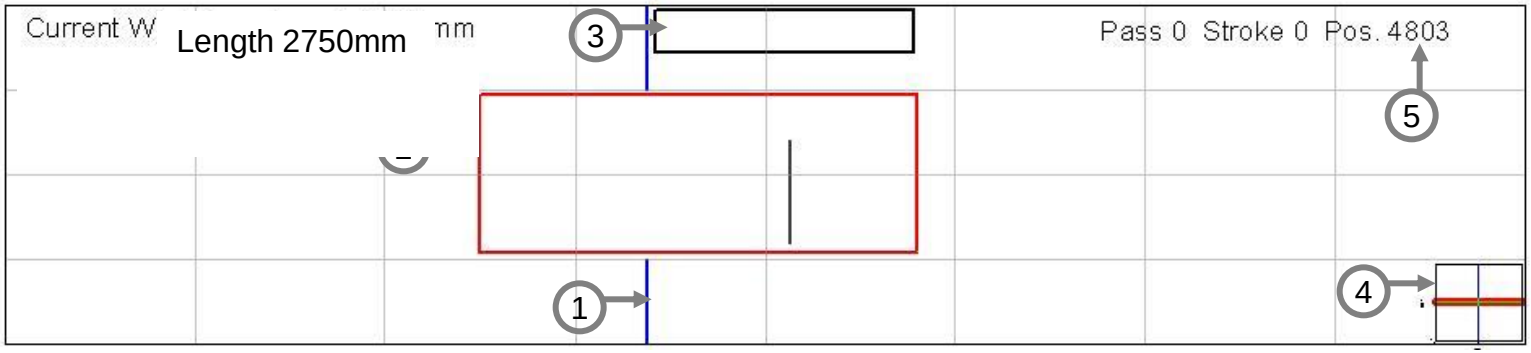
Profile Edge used for Length Determination

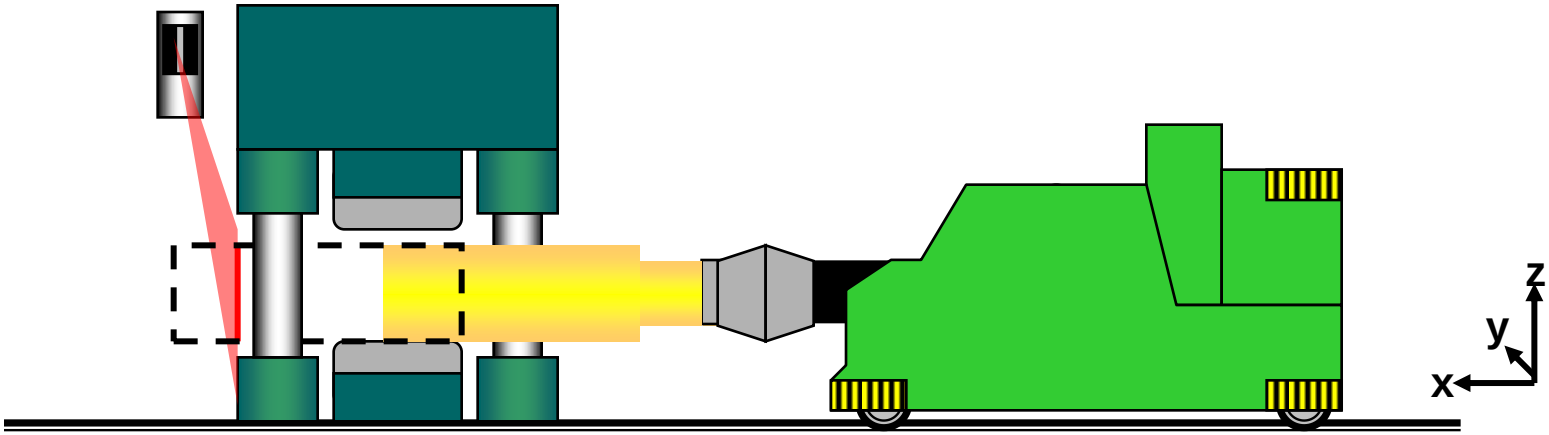
Laser Line Scanner: Measured Profile of workpiece´s end for determination of elongation



Steps and Visualisation of the Forging Process

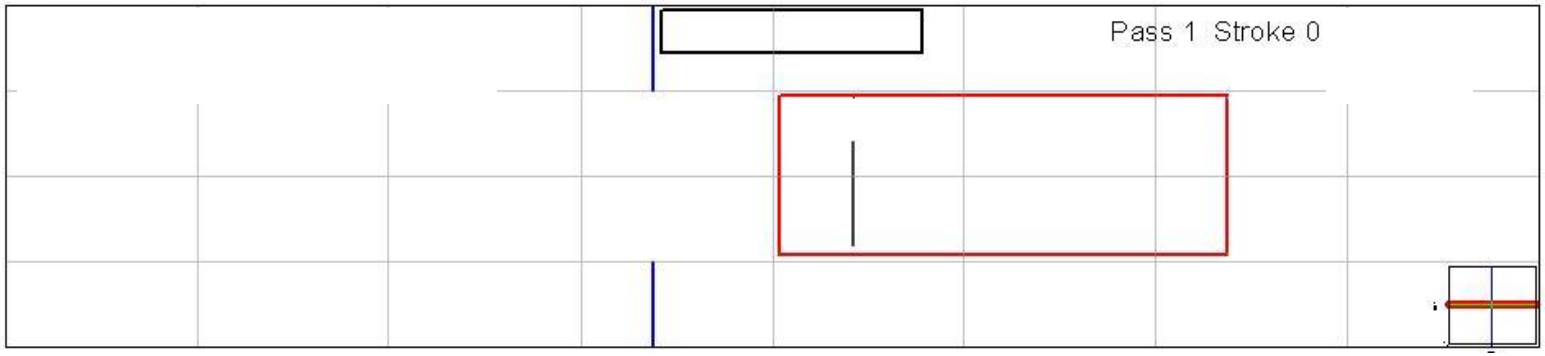


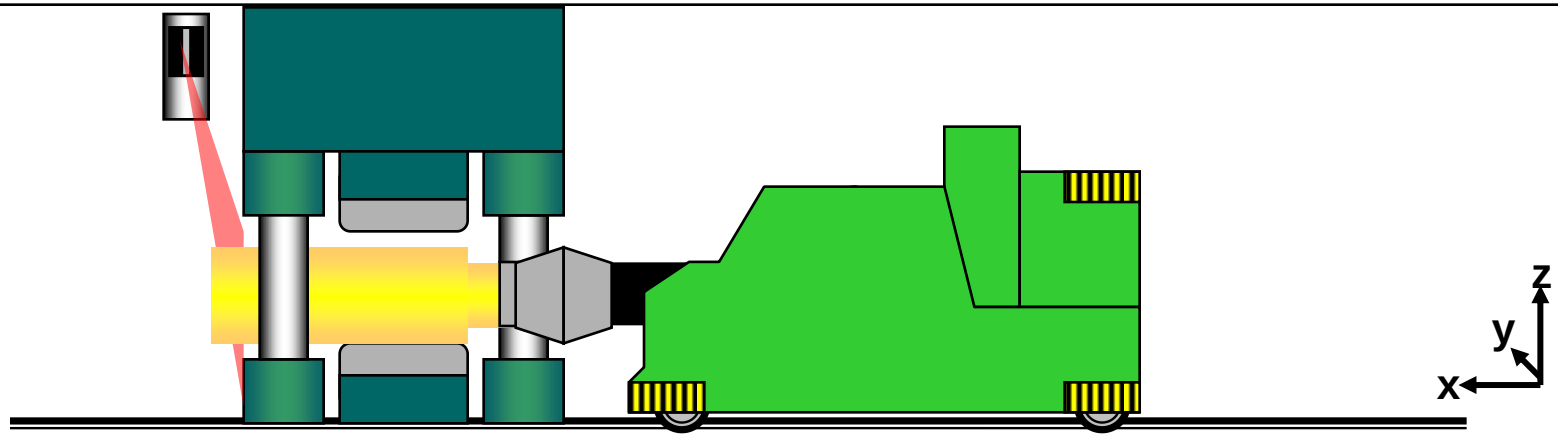




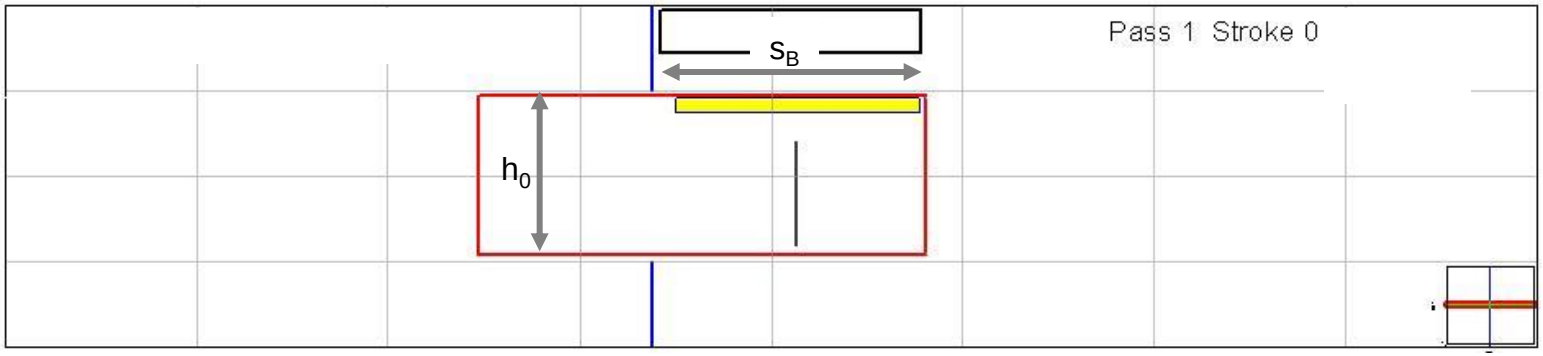
By moving the workpiece edge through the measuring plane

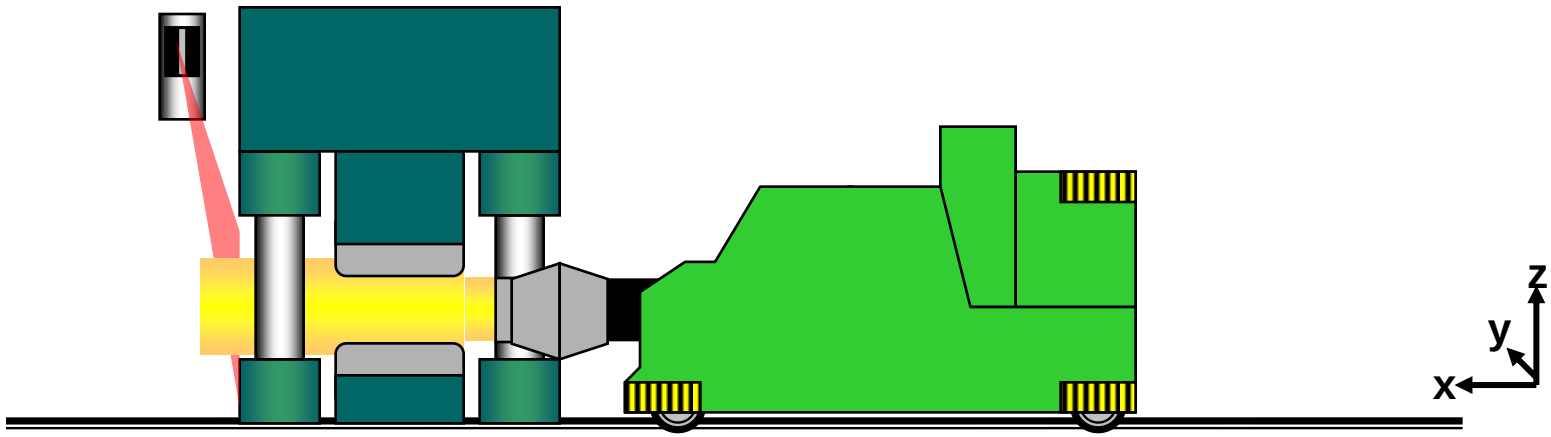
the initial length is determined



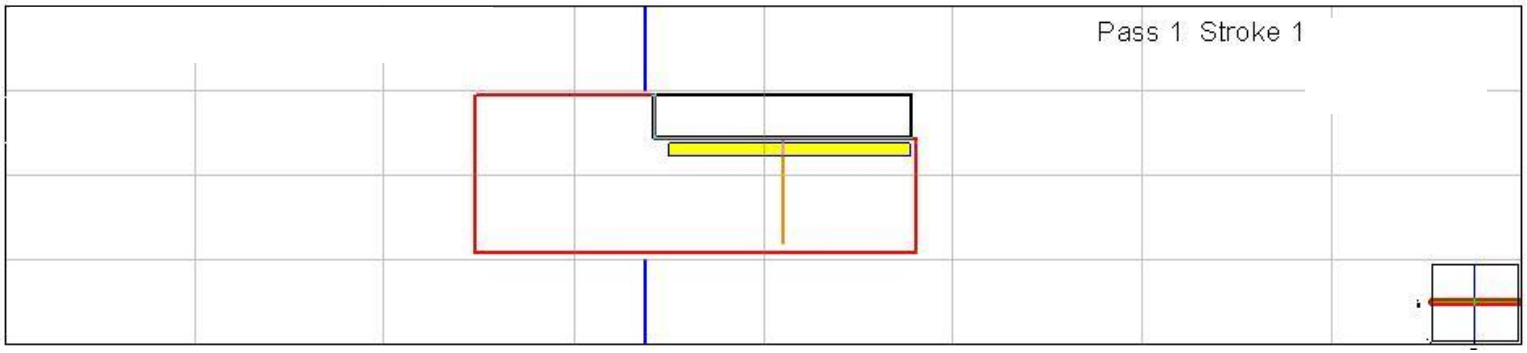


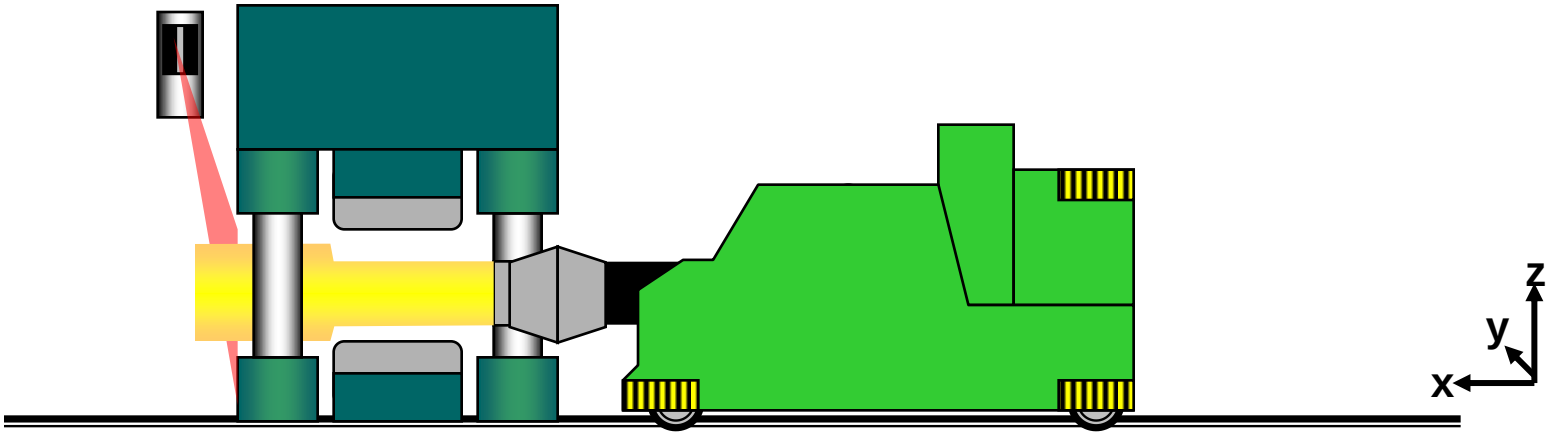
Continuous calculation of Effective Saddle Width (S_B) and Bite Ratio (S_B/h_0)





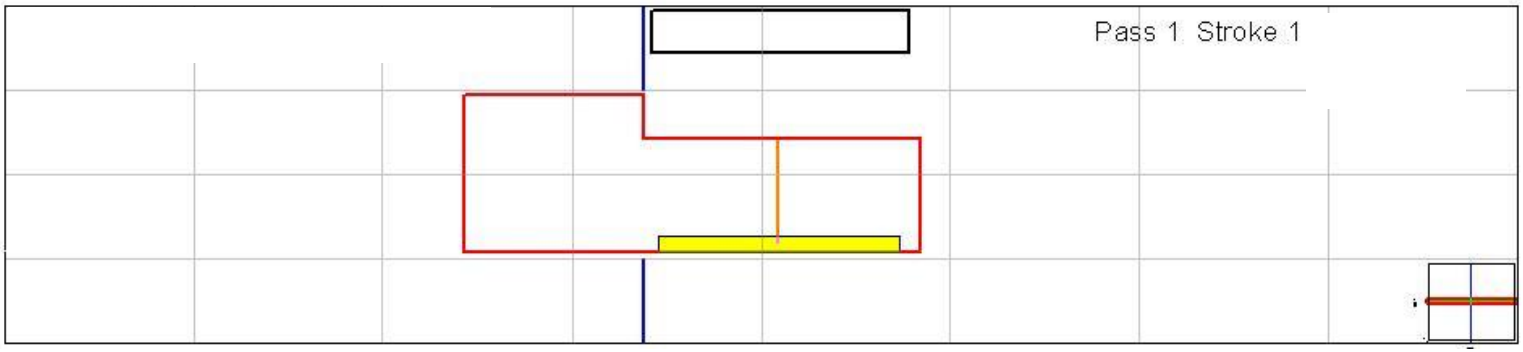
Stroke 1, Pass 1

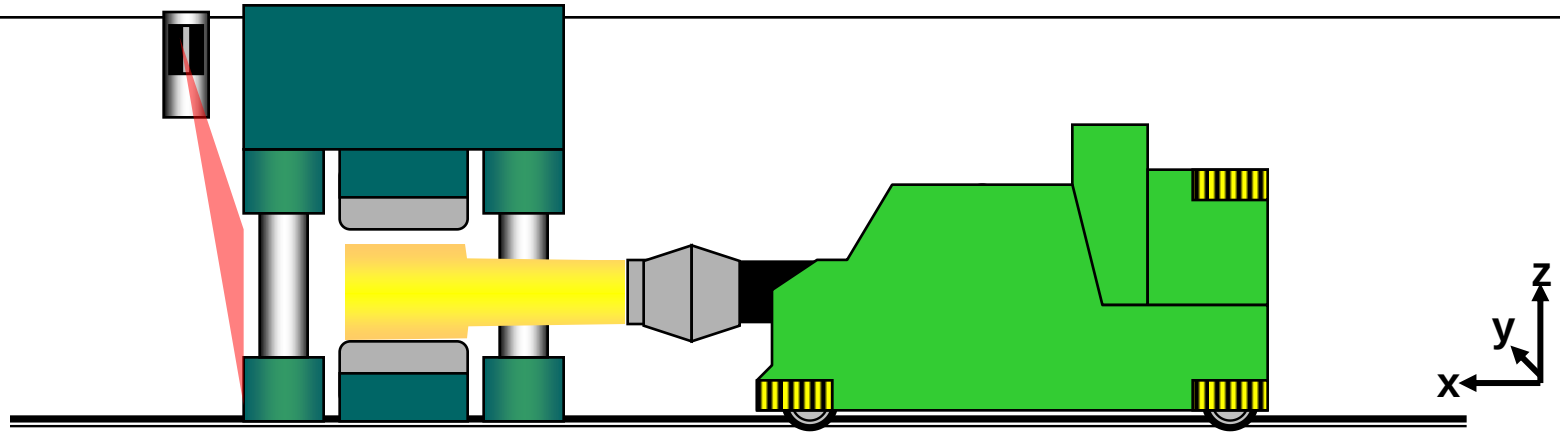




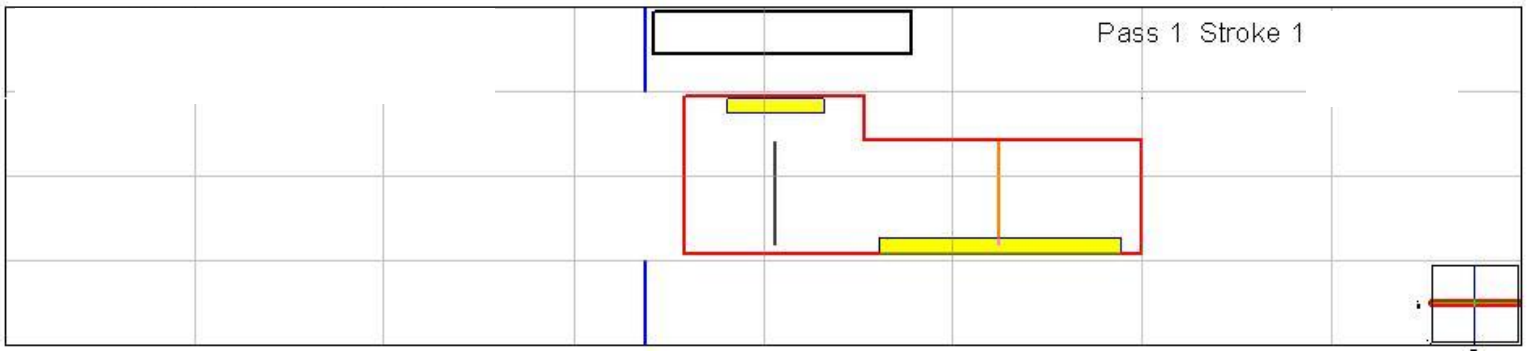
Cumulative representation of the carried out forging work

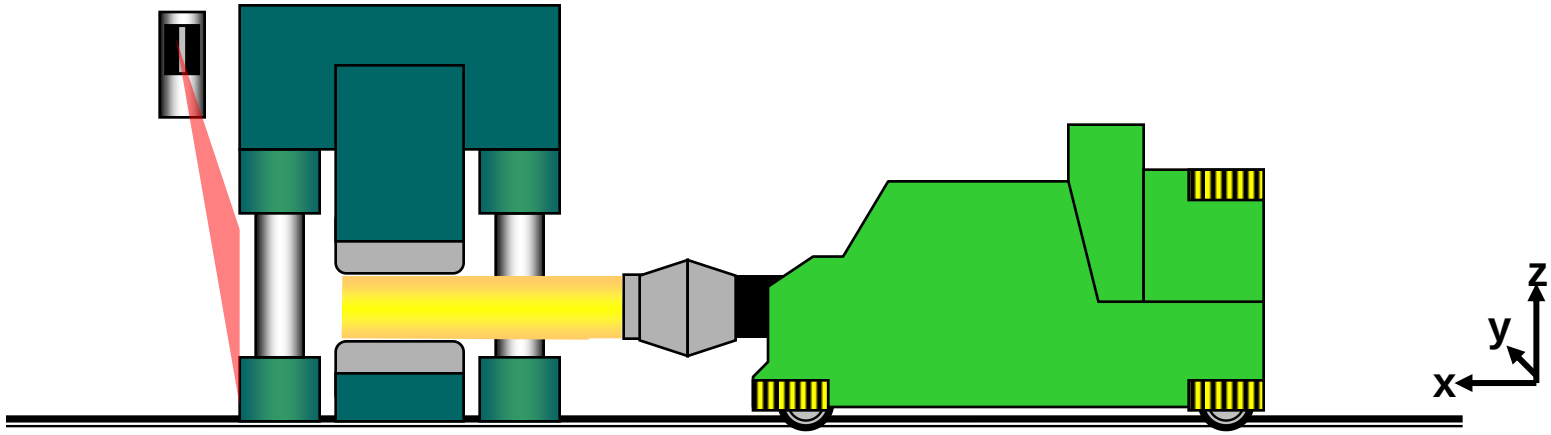
along the workpiece´s center line



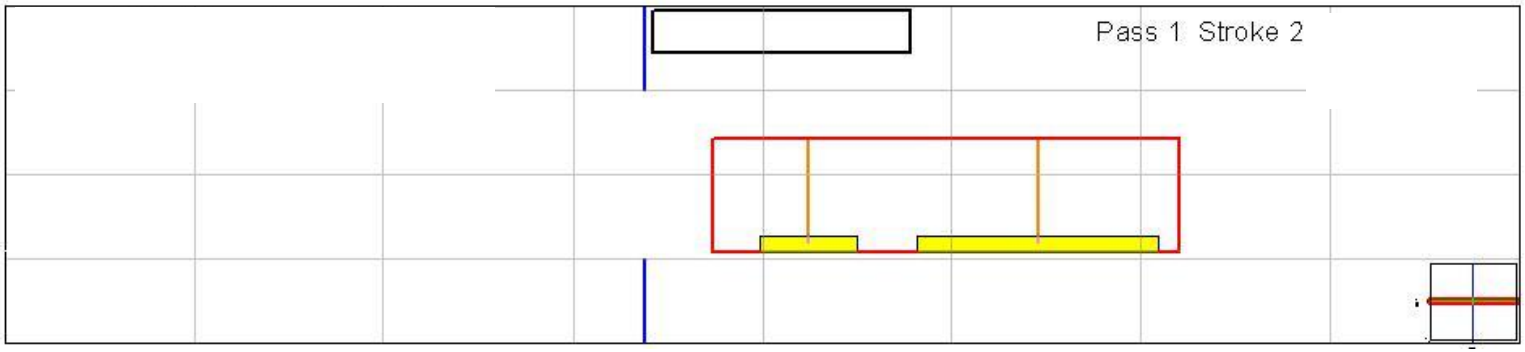


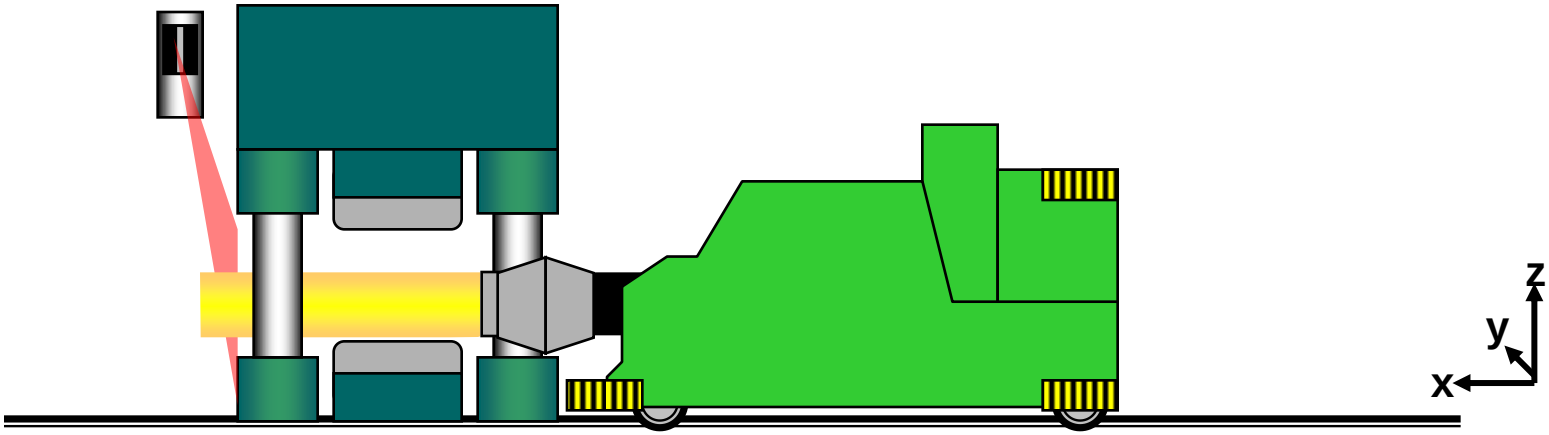
Calculation of Consolidation Zone for Stroke 2



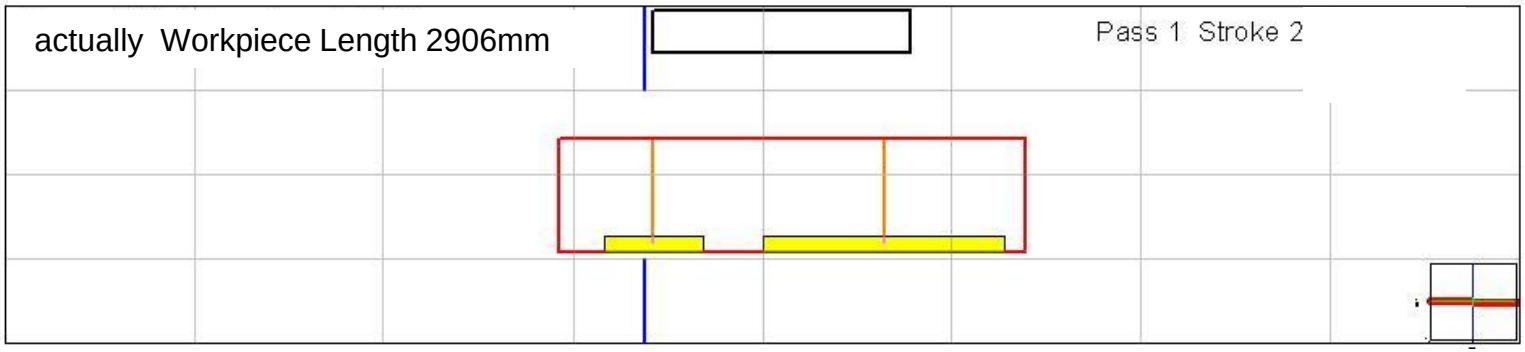


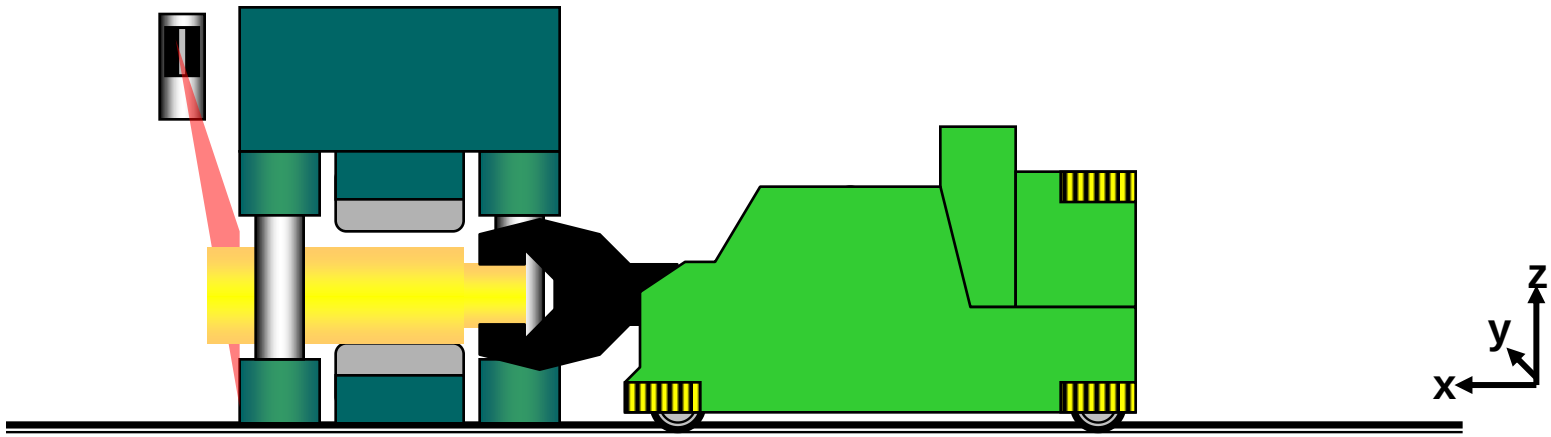
Cumulative representation of the carried out forging work after stroke 2, pass 1



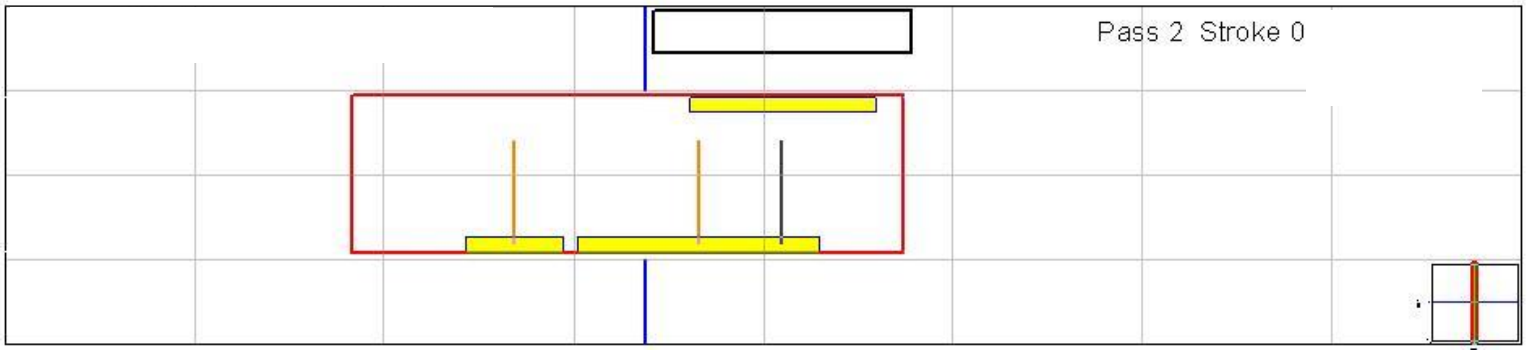


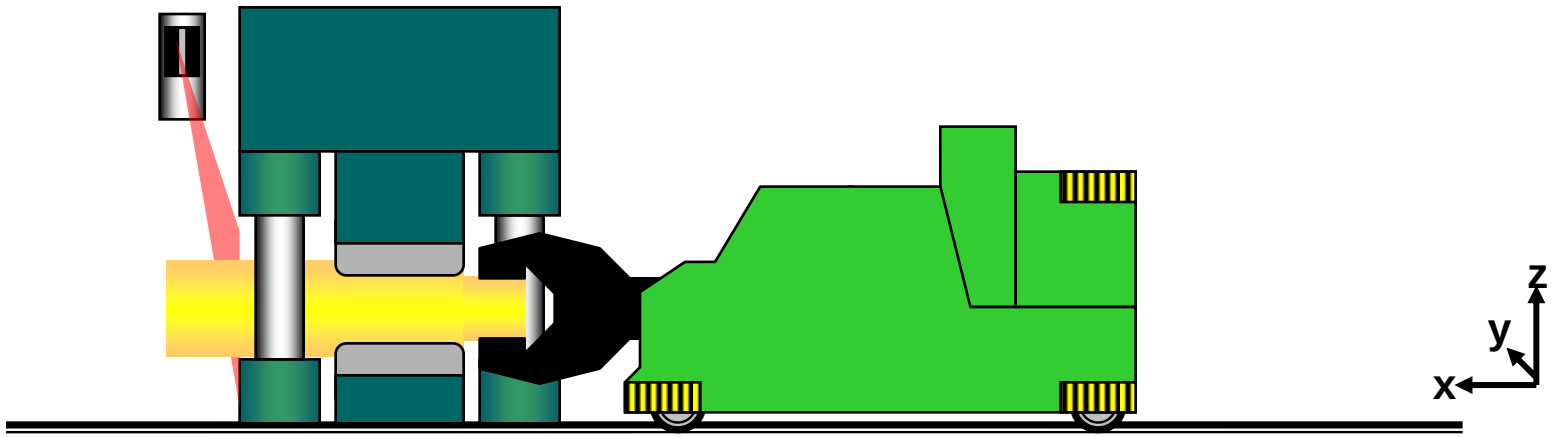
Determination of current workpiece length after pass 1



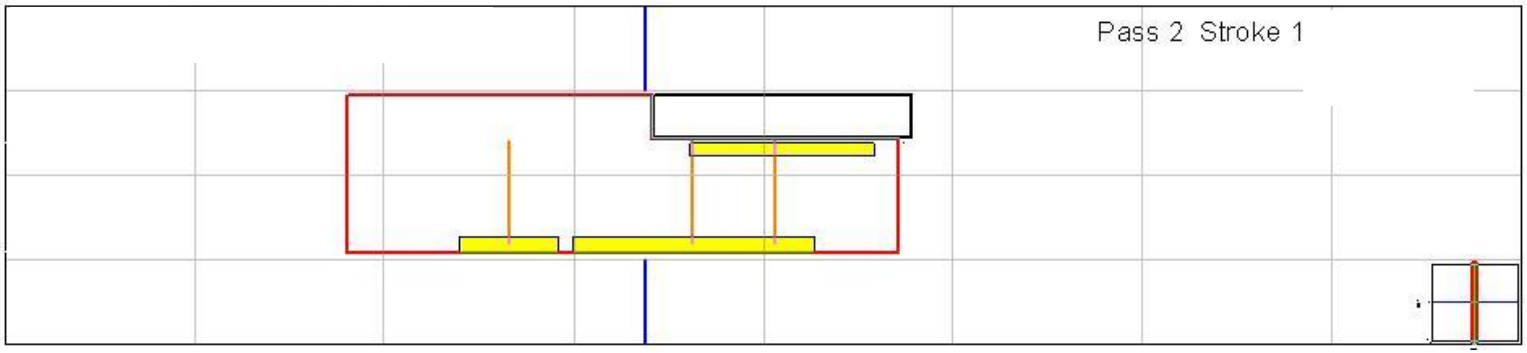


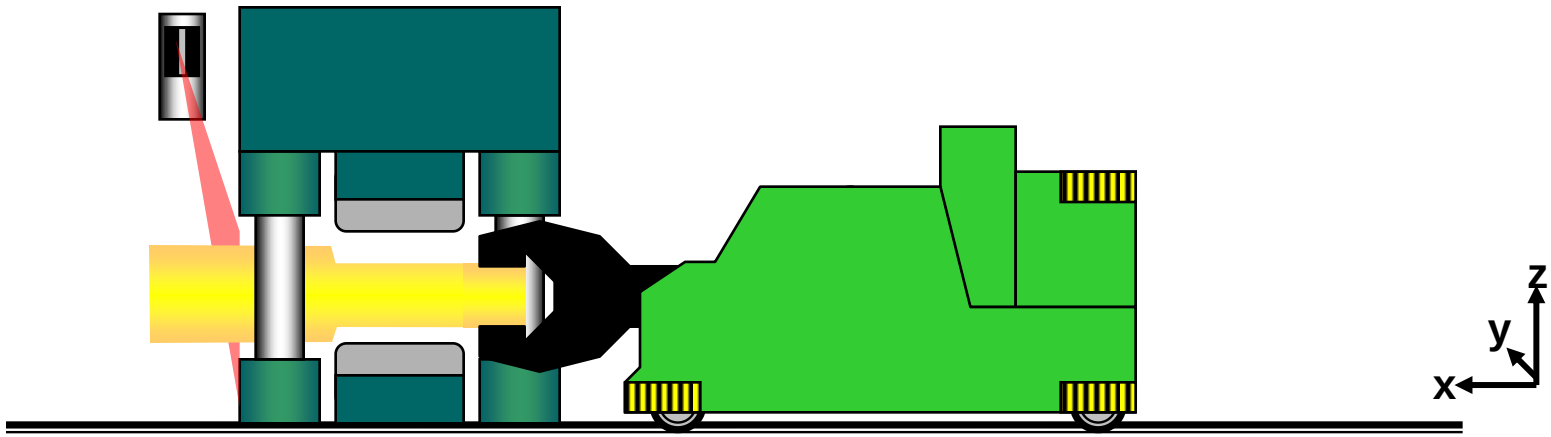
Rotation of workpiece of 90°, ready for stroke 1, pass 2



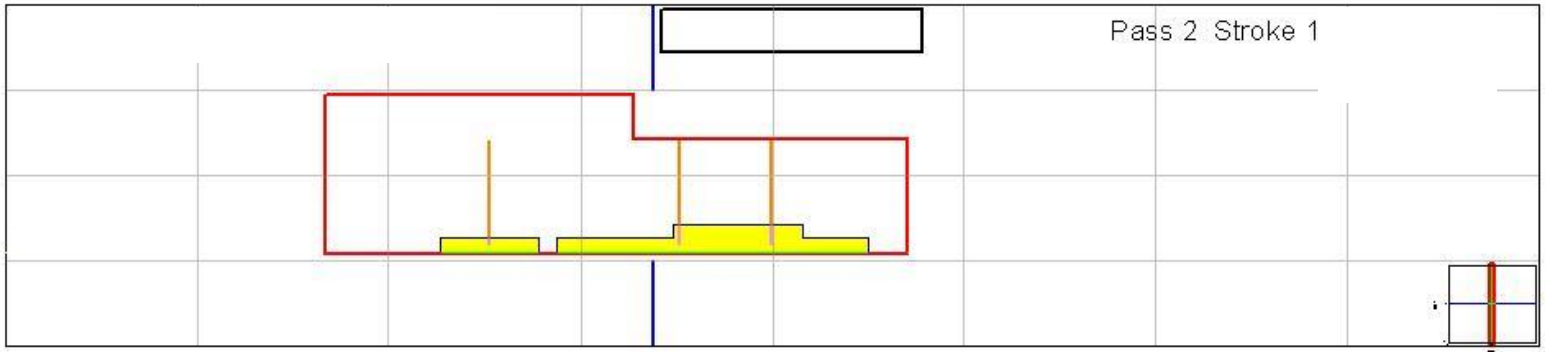


Stroke 1, Pass 2

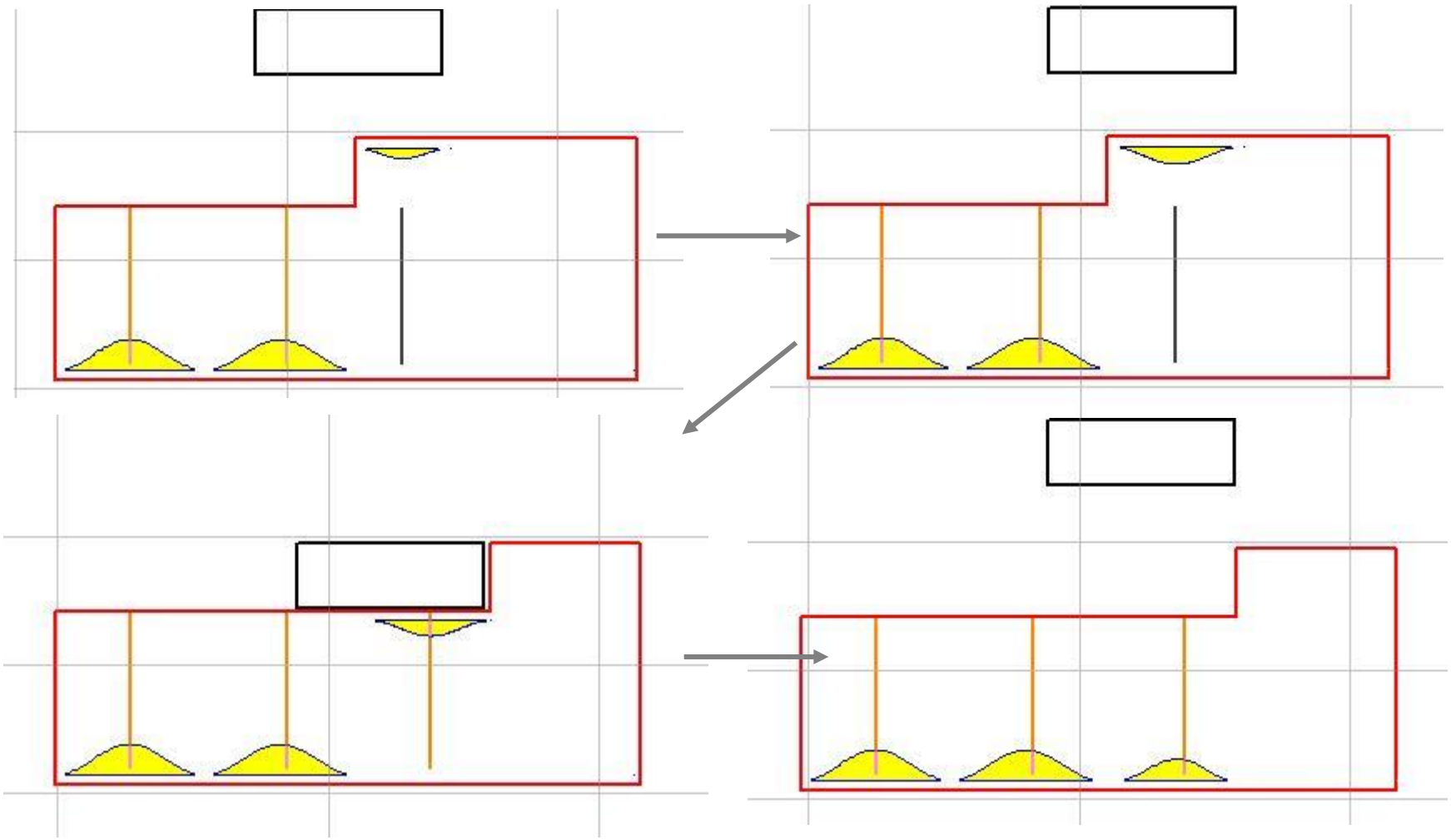




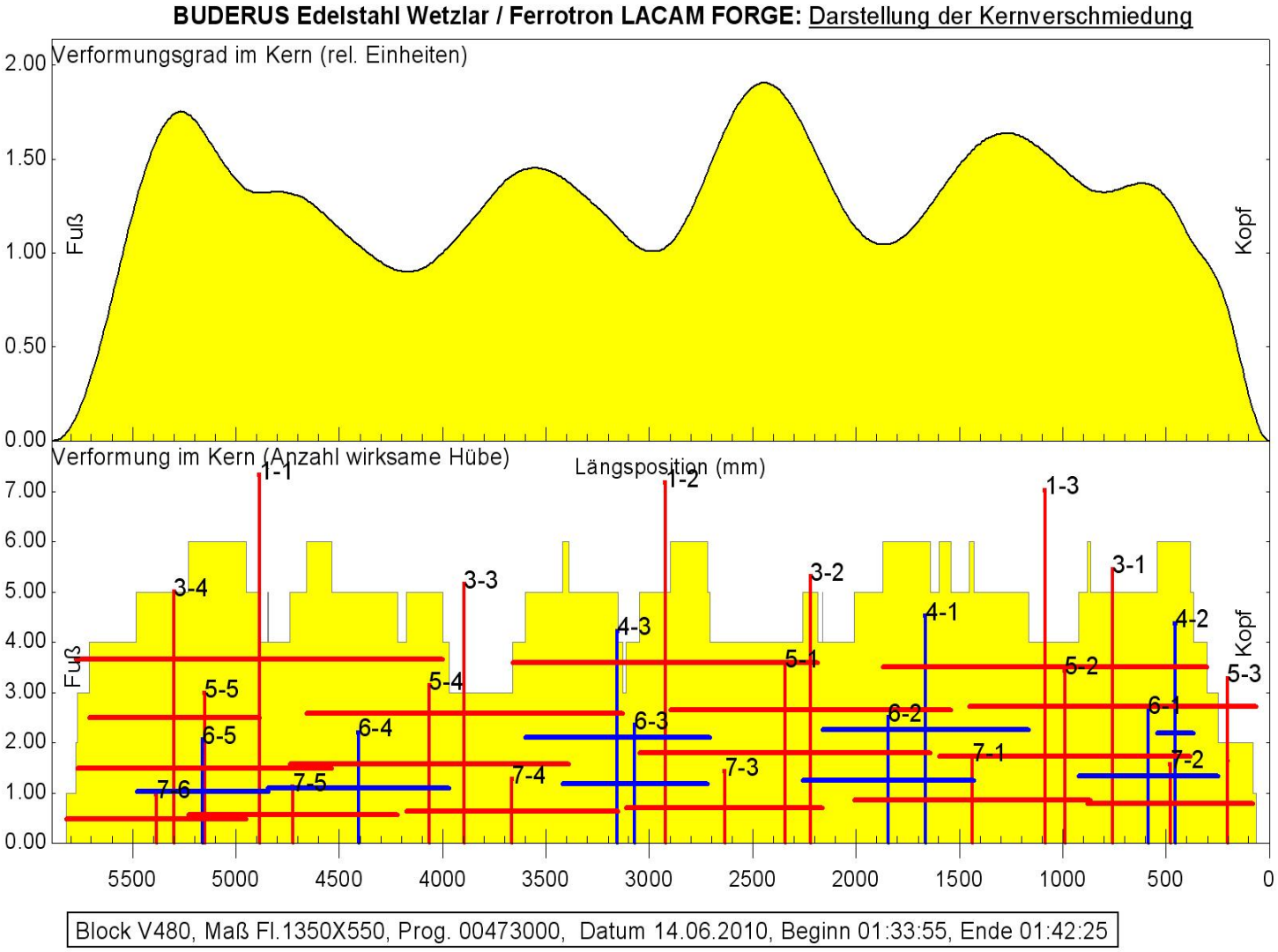
Cumulative representation of the carried out forging work after stroke 1, pass 2



Sinus-model for center line consolidation

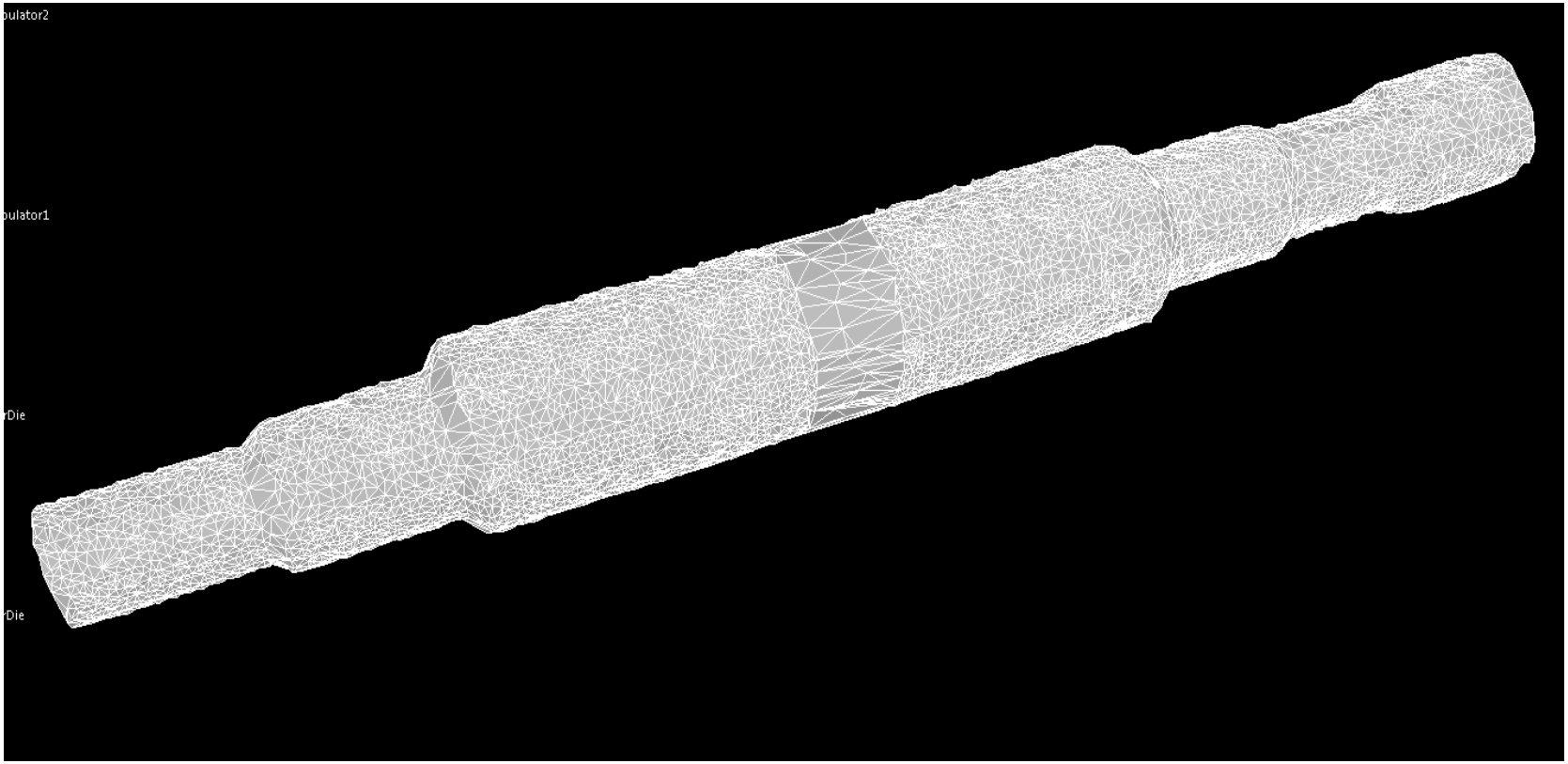


LACAM® FORGE Online –Measurement Report

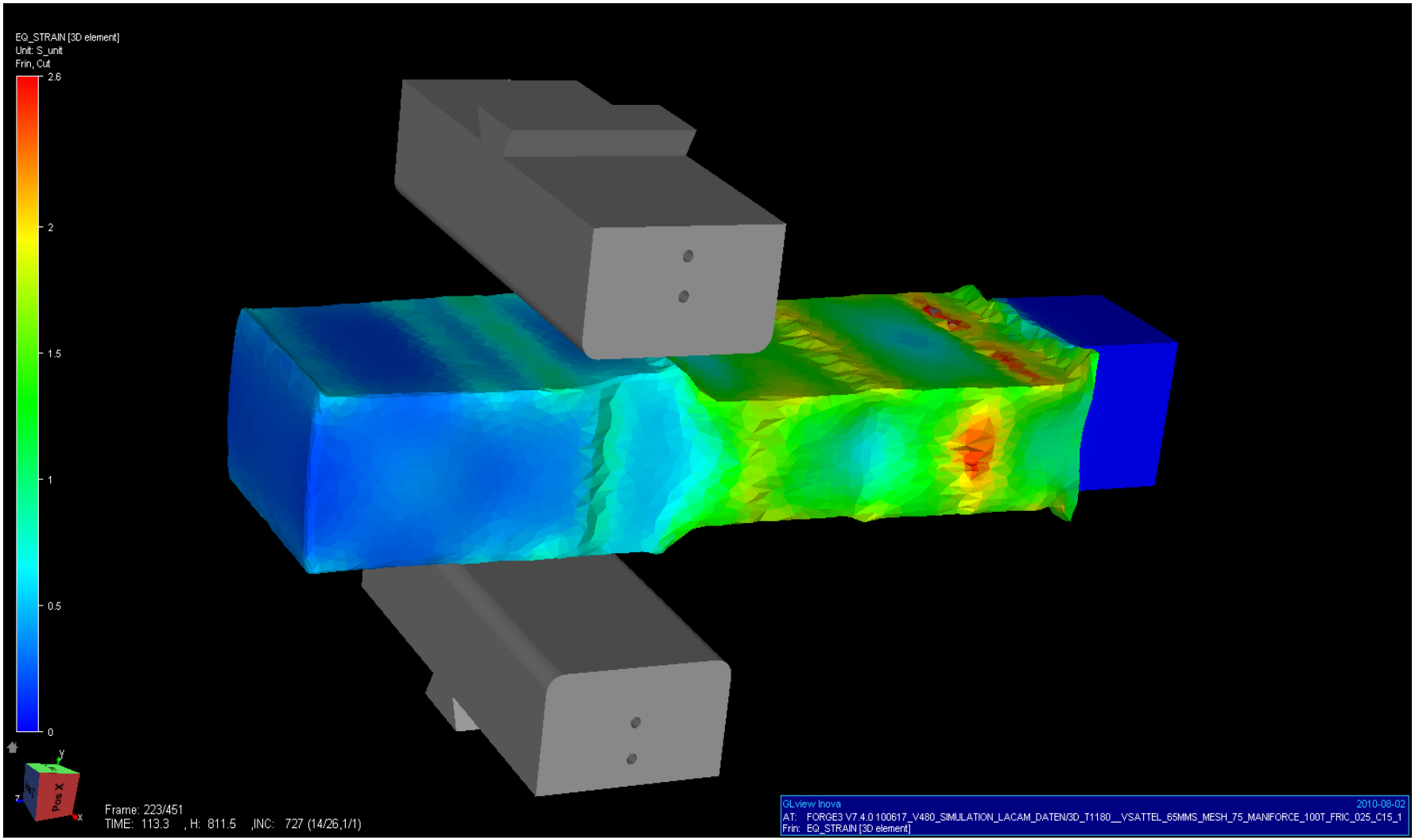


LaCam Forge supplies data for FEM-Model:

- Press kinematics, Manipulator kinematics, Pressure / Force per stroke
- Temperature measurements, Geometry (Length, Width, 3D-Scans)



FEM Simulation by FORGE 2009 (TransValor) on Base of LaCam® Forge Data



Summary LaCam® Forge ONLINE

-Lacam Forge enables forging operation with controlled Bite Shift

-> Homogenisation of the Center Line Consolidation along the forge piece

-> Possibility of decreasing the Forging Ratio

-> Full documentation of the forging process for quality control

-> Automatic creation of input data for FEM Simulation