# Measurement in civil engineering

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# Measurement of solidification

## Example 1

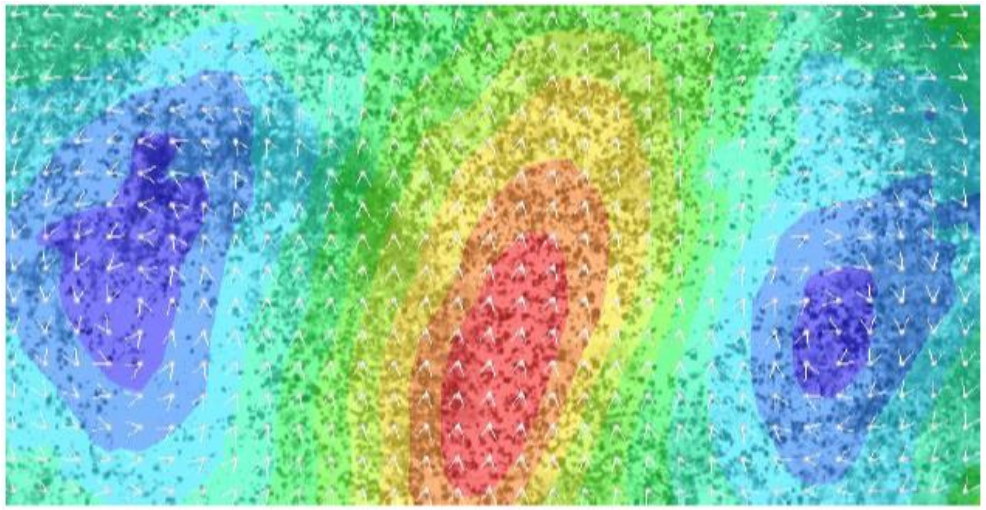
Mixed concret is not possible to measure from the beginning of the solidification. With standard measurement technic is possible to measure from certain moment, if the concrete is solid enoughf.

Therefor is measurement with cameras very suitable.

It is possible to display vectors, dimension absolut or relative and much more…

- System: ***2D***
- Product: ***Monet 2D***
- *Resolution:* ***2MPx***
- Software: ***Mercury RT***

**PDF application note**



**Pic 1:** various shrinkage on concrete during solidification

# Measurement of vibration

## Example 2

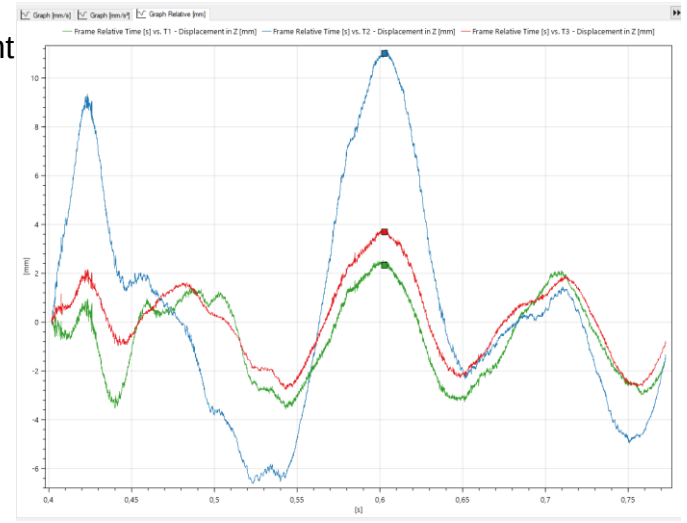
One of the universities used 2 high speed cameras (20 000 fps) for wall movement measurements after explosion behind the wall – postprocessing possible in case of non-repeatable test

**Advantages of optical measurement:**

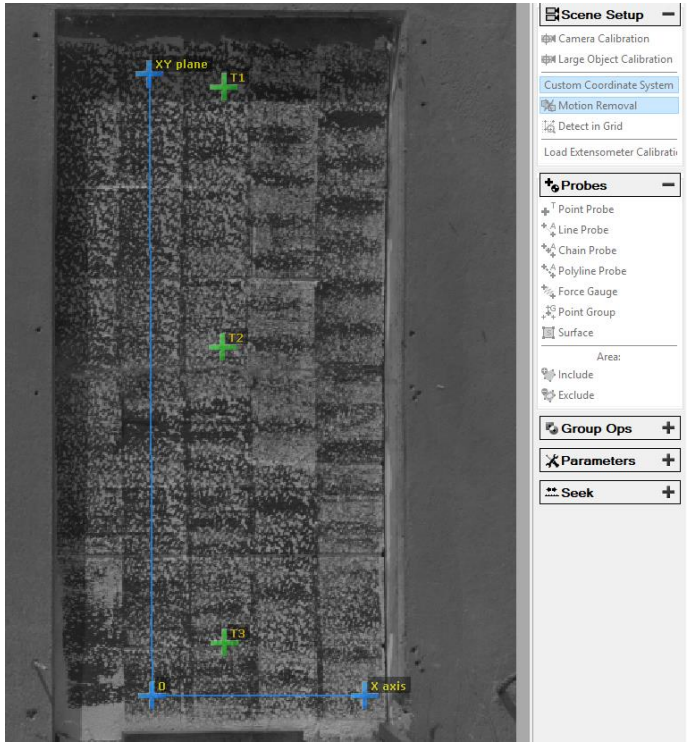
- no complicated installation – no sensors
- triggering by external signal like comming train…
- much more data than from standard measurement equipment
- possibility for post-processing
- measurement without danger

[Video with FF on the wall]

[Video with explosion]



**Pic 2:** Z-axis vibration on measured points




**Pic 3:** measured points

- System: ***2x high speed camera***
- Product: ***Monet 3D HS***
- *Resolution:* ***1MPx***
- Software: ***Mercury RT***

# Measurement of Poisson´s number

## Example 3

To investigate Poisson´s number it is necesary to carry out compression tests on concrete samples.

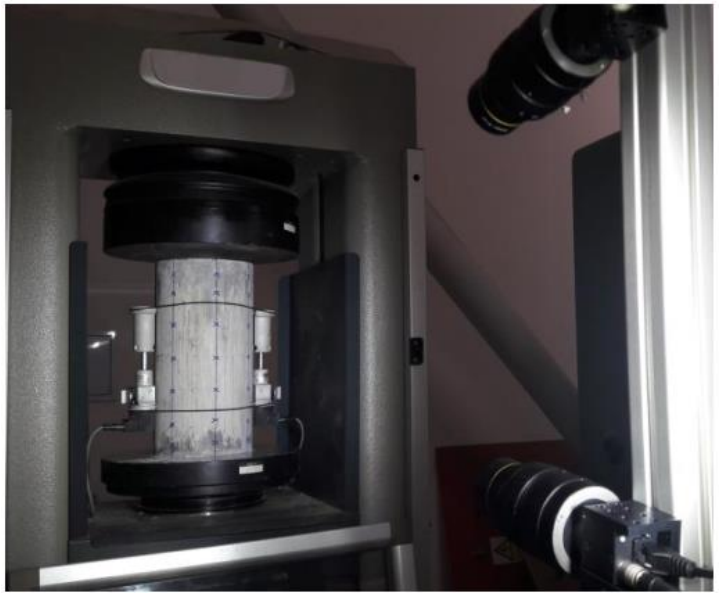
For the measurement are used 2 cameras for 3D measurement.

**Advantages of optical measurement:**

- no complicated installation – no sensors
- triggering by external signal like comming train…
- much more data than from standard measurement equipment
- possibility for post-processing
- measurement without danger

- System: ***3D***
- Product: ***Monet 3D***
- *Resolution:* ***2MPx***
- Software: ***Mercury RT***

PDF application note



**Pic 4:** setup of the compression test and cameras

# Measurement of crack length grow

## Example 4

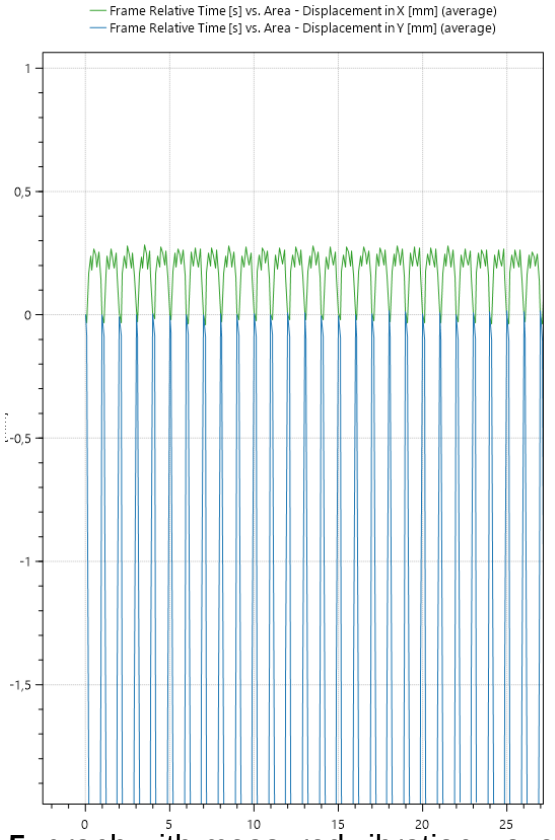
In some cases it is necessary to measure crack legth growth.

[Video with an example]

**There are 2 procedures:**

**1) Fatigue test:**
The testing conditions (loaded speed, amplitude, force) are given by the user.
It is possible with FullField module.

The measurered values are sent to the testing machine.




**Pic 5:** graph with measured vibration waveforms

- System: ***2D***
- Product: ***Monet 2D***
- *Resolution:* ***5MPx***
- Software: ***Mercury RT***

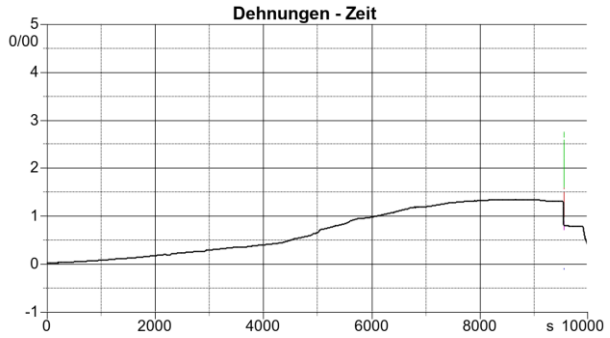
# Measurement of concrete sample under load

## Example 5

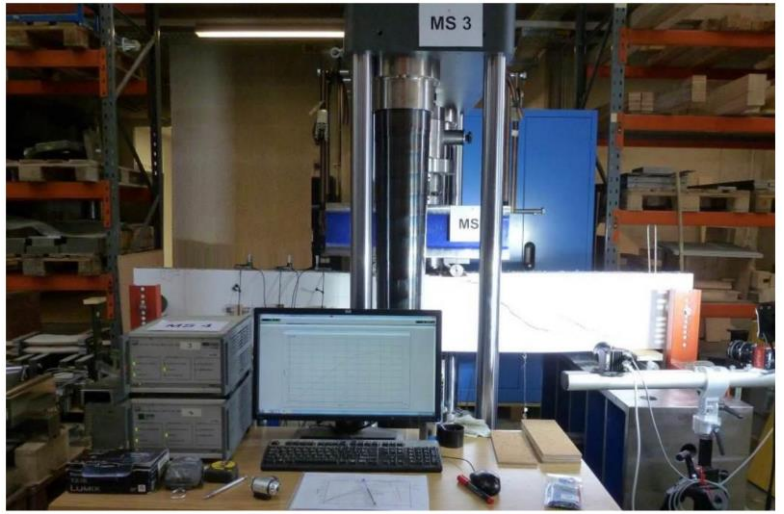
**2) 3-point bending test:**

It is important to know,
how big is the concrete at the defined force.

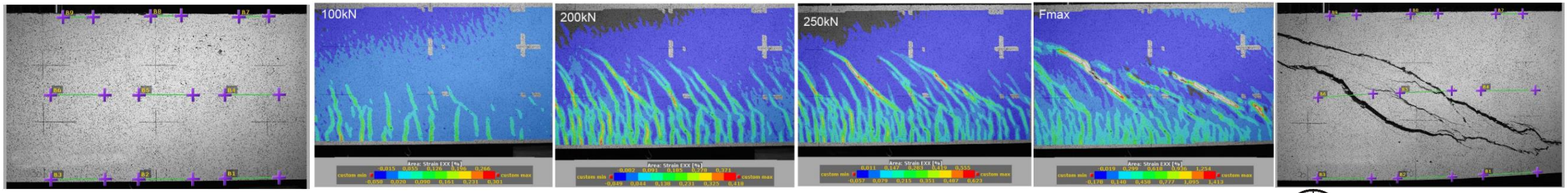
- System: ***3D***
- Product: ***Monet 3D***
- *Resolution:* ***12MPx***
- Software: ***Mercury RT***




**Pic 6:** graph strain/time




**Pic 7:** setup of the bending test and 3D systém (in front)




**Pic 8:** sample at the beginning, sample during the test with FullField (strain on the surface), sample after test

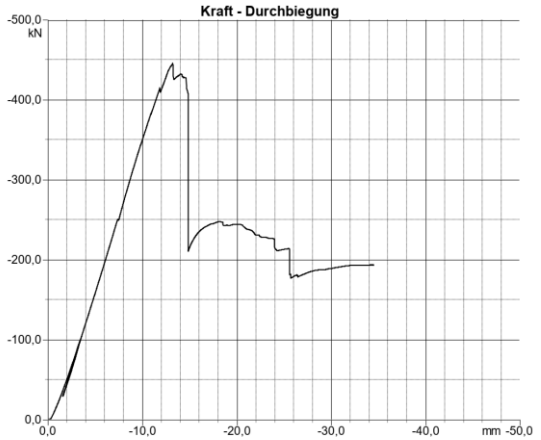
# Measurement of deflection

## Example 7

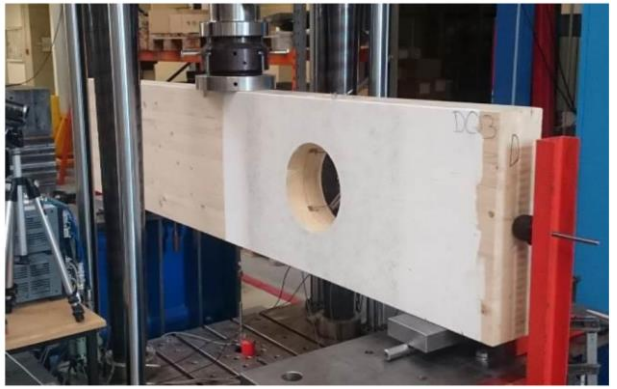
**Bending test on wooden beam**

Wood is contruction material.
It should be tested in tension – E-module or in bending test.
Both is with Monet 2D or 3D possible.

Standard measurement elements are not reliably,
therefor an optical system is very usefull.

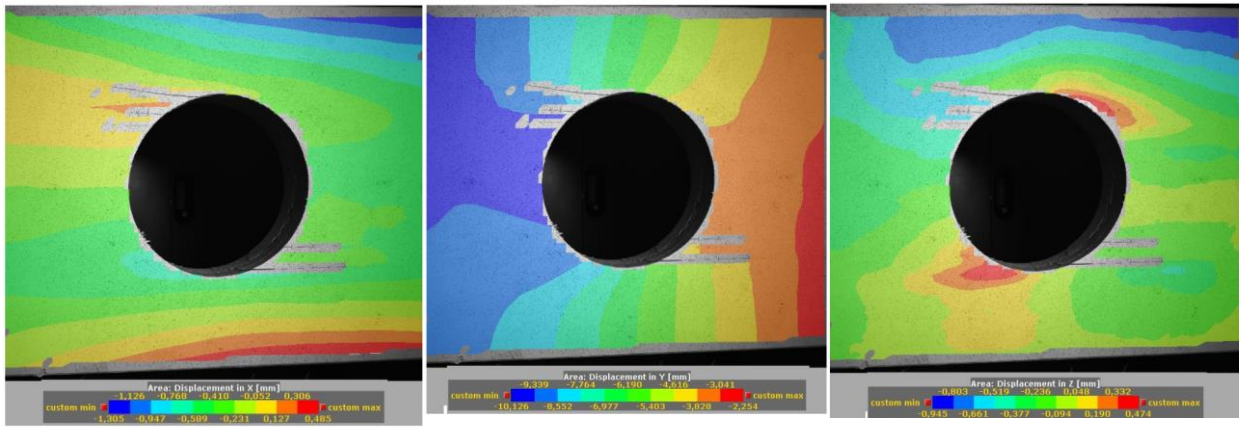



**Pic 9:** graph force/deflection



**Pic 10:** wooden beam in compression testing machine

- System: ***3D***
- Product: ***Monet 3D***
- *Resolution:* ***12MPx***
- Software: ***Mercury RT***



**Pic 11:** displacement of the material in X, Y and Z direction

# Measurement of big objects

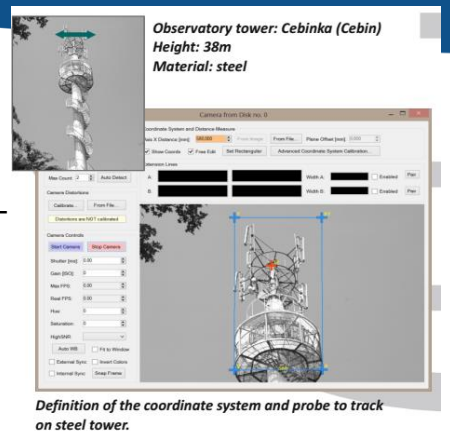
## Example 8

With the camera system MONET 3D it is possible to measure the deformation of large objects in operation. These can be bridge deflections, tower deflections, etc.

[Video with an example]

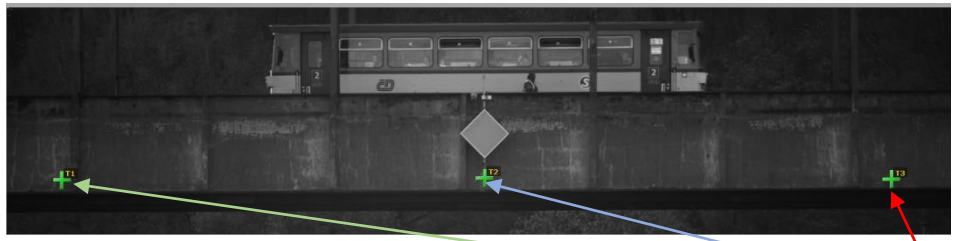
[PDF with application note]

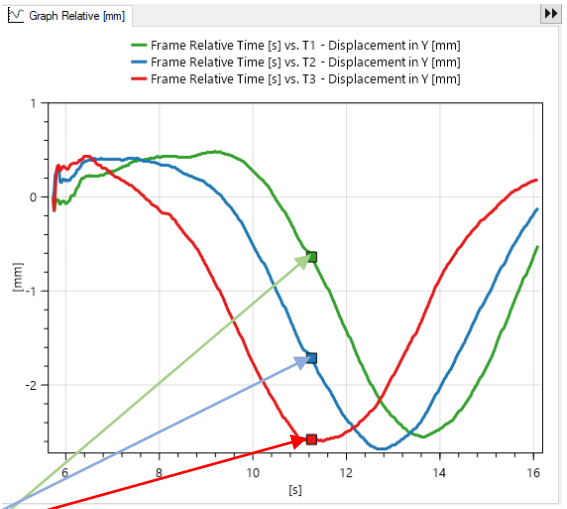
- System: ***2x 2D***
- Product: ***Monet 2D – with hardware for outdoor***
- *Resolution:* ***5MPx***
- Software: ***Mercury RT***




*Definition of the coordinate system and probe to track on steel tower.*

**Pic 12:** measurement of big objects – towers and bridges

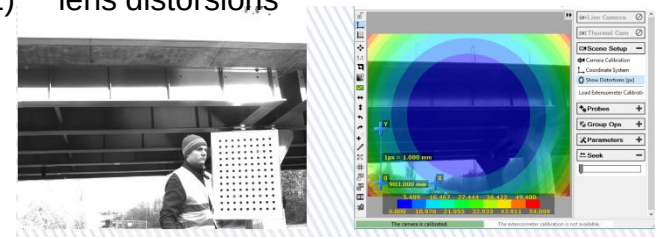


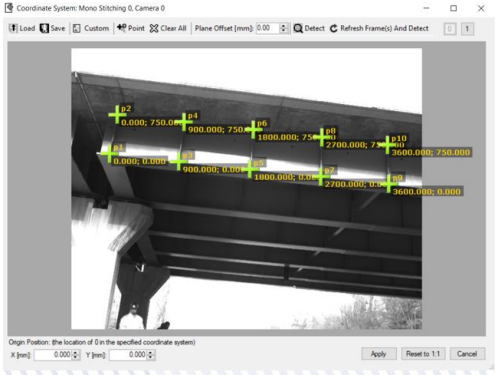

**Pic 13:** deflection of the bridge on three points

**2 callibration are needed**

1) lens distorsions



2) coordinate system
It is necessary to know dimensions to callibrate relationship **px=mm**



**Pics 14:** calibration using known dimensions of the bridge

MERCURY RT
REAL-TIME TRACKING SYSTEM

# Measurement on rebar

## Example 9

**Tensile testing on rebar**

Universities and producers have to test rebar after production
or as a part of research. It is necessary to cover full FOV, therefor are
connected up to 3 cameras to get FOV up to 1200 mm.

Class 1 or 0,5 according EN ISO 9513 is guaranted.

**CHAIN PROBE** – (specialised instrument in Mercury RT)
the measuring line placed over full FOV is divided into x segments
and to the testing software of the testing machine is sent this value,
where is highest deformation – to ensure, that the measured legth L0 is over the rupture...

- System: ***2D***
- Product: ***Monet 2D***
- *Resolution:* ***5MPx***
- Software: ***Mercury RT***

[Video with an example on flat specimen]

**Pic 15:** 2 cameras for long Field Of View

**Pic 16:** setup with 3 cameras for FOV 800 mm

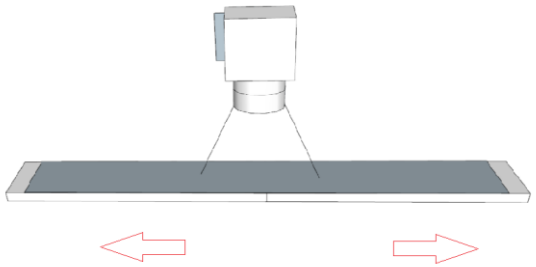
MERCURY RT
REAL-TIME TRACKING SYSTEM

# Measurement on rebar

## Example 10

**Test of thin asphalt layer on two samples with a gap.**

With the camera is measured strain on the surface.



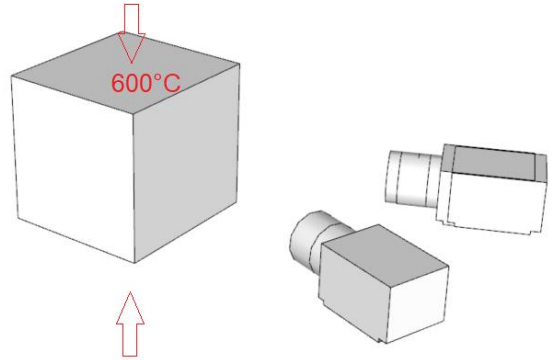
**Pic 17:** pricniple of the test

- System: ***2D***
- Product: ***Monet 2D***
- *Resolution:* ***5MPx***
- Software: ***Mercury RT***

## Example 11

**Compression test on cube of concrete under high temperature.**

High temperature (up to 600°C) is produced by induction heating.
It can be used temperature chambre.
Measurement is possible throu the glass.




**Pic 18:** pricniple of the test

- System: ***3D***
- Product: ***Monet 3D***
- *Resolution:* ***4MPx***
- Software: ***Mercury RT***

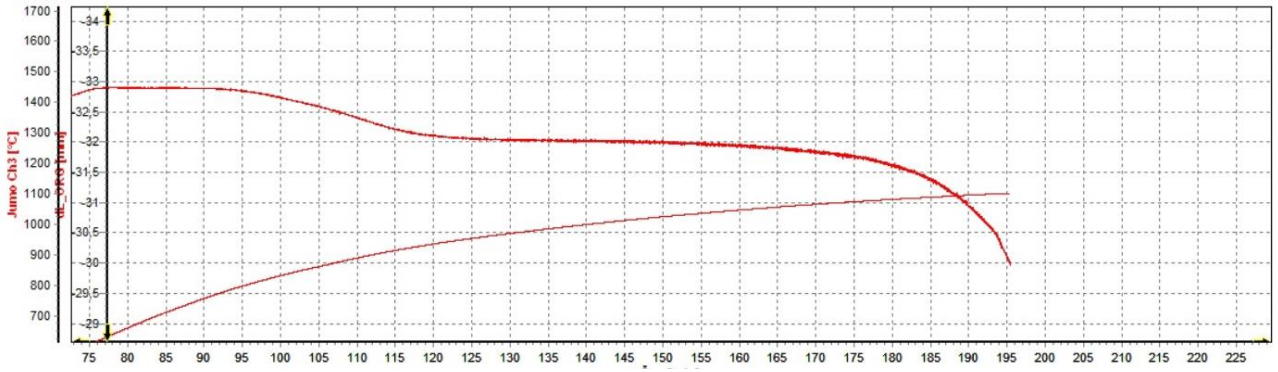
# Measurement in HT chamber

## Example 12

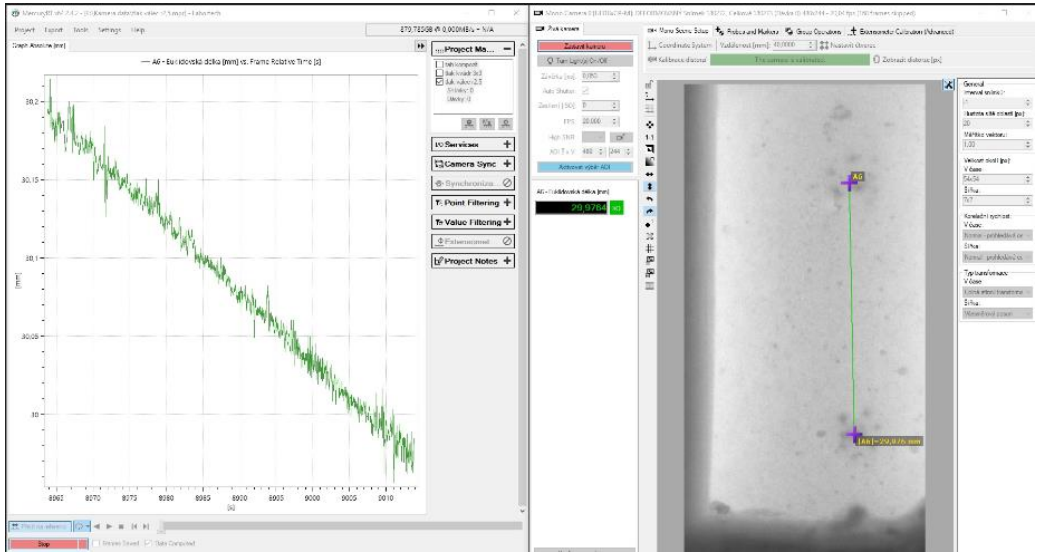
**Compression testing on refrectory materials**

New silicon-based materials are tested with different fillings – this material are tested in compression up to 1100°C.

- System: ***2D***
- Product: ***MEVIX with accessories for HT***
- *Resolution:* ***5MPx***
- Software: ***Mercury RT***




**Pic 17:** curve Deformation-time and temperature-time



**Pic 18:** silicon-based material in high temeprature chamber