

## A Laser-Beam Measures The *Very Early* Shrinkage and Expansion of Building Materials. Touchless and with 1 Mikron Resolution

With Schleibingers latest innovation the Schleibinger Shrinkage Cone *deltaEL* it is possible to measure the shrinkage or expansion of fluid building materials in the first minutes and hours after start of mixing. The expansion of the building material is registered touch-less and very exact by a laser beam. There is no mechanical coupling between the fluid and the sensor necessary.

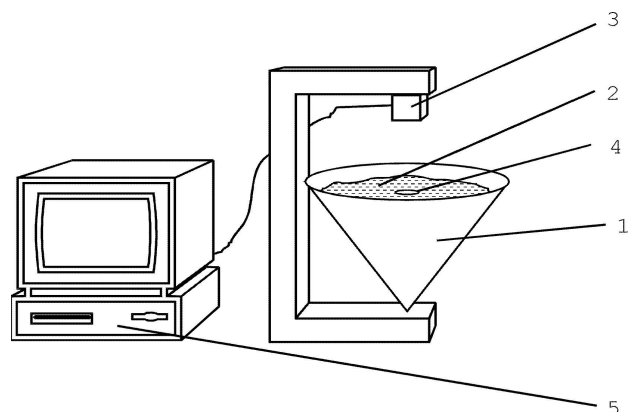
To ensure that the measured distance correlates with the relative length change of the material we use a cone formed specimen container. So the height changes always correlates with the volume change. The temperature of the double-wall specimen container may be controlled by an external circulator.

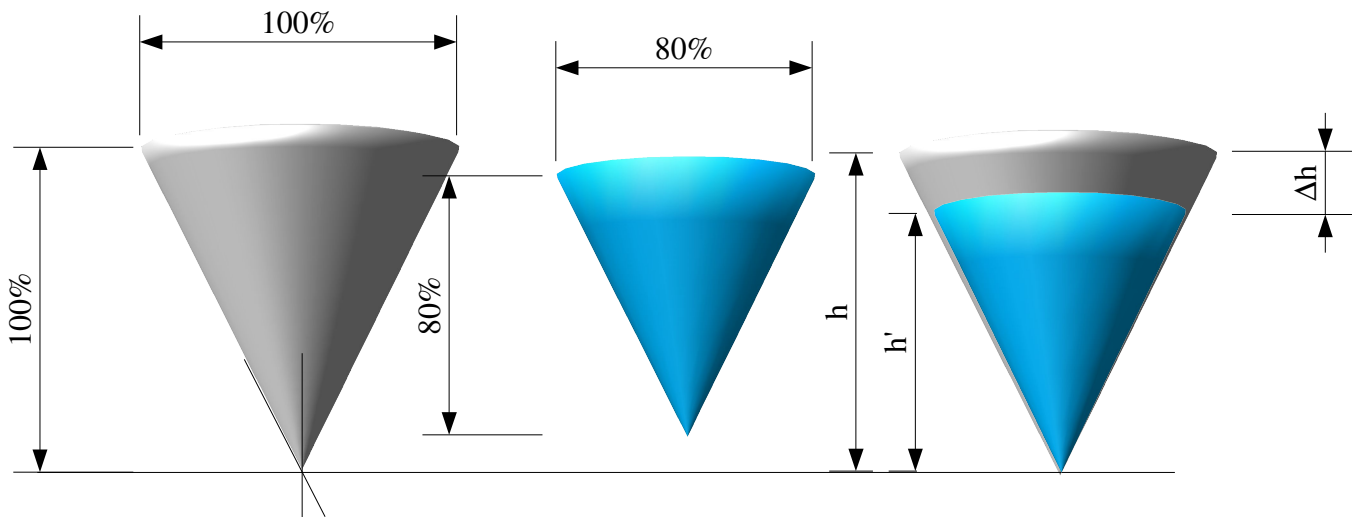
The length change is registered with a resolution of 1/10 mikron. A data-logger supplied with the system records the data as standard ASCII files. Optional a synchronous registration of temperature and humidity ore of a balance (Mettler-Toledo) is possible. Two temperature channels and a mixed temperature /humidity channel are available. The logger has a network interface (Ethernet). So you can easily integrate it into local intranet. With a standard web-browser software you can readout the data, and visualize it. For further data handling we recommend Microsoft Excel<sup>®</sup> ore any similar visualisation program. The data are visualized online graphical and numerical on the screen. No special PC software is necessary. You need only your browser-software like Mozilla or Internet-Explorer<sup>®</sup> .



### How it works:

- Fill the fluid building material (2) into the cone formed specimen container (1)
- The container is set under the laser unit (3), which is mounted on a high performance boom stand.
- With a rack and pinion the distance is preset to about . 0  $\mu\text{m}$  .
- The automatic offset adjust is done by a mouse click on your PC (5).
- An autonomous data logger will register your data for several weeks on an integrated CF-card memory. The data-logger has a network interface. You can easily readout the data, with any browser software like Internet-Explorer ore Mozilla





### Why a cone works:

Under the prerequisite of an isotropic shrinkage (expansion) the radius  $r$  and the height  $h$  of a cone shrink (expand) the same percentage:  $h' = k \cdot h$  and  $r' = k \cdot r$  ( $k$  for example 80%)

$$\text{General: } V = \frac{1}{3} \pi r^2 h; V' = \frac{1}{3} \pi r'^2 h'$$

$$\text{Example: } k = 0,8; \alpha = 30^\circ; h = 10 \text{ cm}$$

$$h' = 0,8 h = 8 \text{ cm} \rightarrow \Delta h = 2 \text{ cm}$$

$$r = h \tan(\alpha) \rightarrow V = \frac{1}{3} (h \tan(\alpha))^2 \pi h$$

$$V = \frac{1}{3} (h \tan(\alpha))^2 \pi h = 349 \text{ cm}^3$$

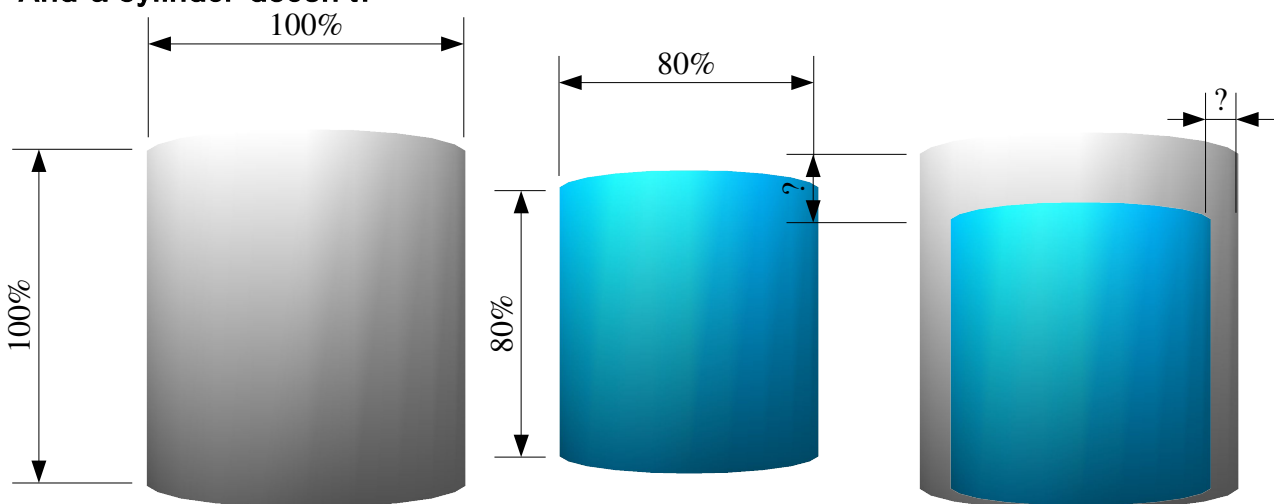
$$\alpha = \text{const} \rightarrow V = c h^3; V' = c h'^3$$

$$V' = \frac{1}{3} (h' \tan(\alpha))^2 \pi h' = 178,7 \text{ cm}^3$$

$$\frac{V'}{V} = \frac{h'^3}{h^3} \rightarrow \frac{h'}{h} = \sqrt[3]{\frac{V'}{V}}$$

$$\frac{h'}{h} = \frac{8}{10} = \sqrt[3]{\frac{V'}{V}} = \sqrt[3]{\frac{178,7}{349}} = 0,8$$

### And a cylinder doesn't:



## Technical Data

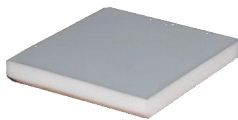
Range	5 mm
Basic distance	25 mm
Resolution	better 0.3 $\mu\text{m}$
Accurray	better $\pm 12 \mu\text{m}$ absolute
Spot diameter	0.8 mm
Laser	1 mW at 625 nm, class 1

Other measurement ranges also available. Recommended computer for readout the data logger: IBM-PC, one Ethernet port, Win 95, 98, NT, 2000, XP, Vista, Linux, FreeBSD, MacOS. Technical data maybe changed without notification, DBPa registered.

## Order Info

### Shrinkage Cone

Cone formed specimen container, boom stand, Laser range finder, data acquisition electronic, data logger reflector, separation foil, software, user manual  
S0050 Shrinkage Cone



### Reflector

made of PP coated with a dull aluminium foil, 20 x 20 x 3 mm  
S0051



### Seperation Foil

cone formed foil, avoids wall friction, may be used several times  
S0053

### Option Tempere Channel

add. temperature measurementincl. RTD PT1000.  
Accurray better then  $\pm 0,5\text{K}$   
S0013

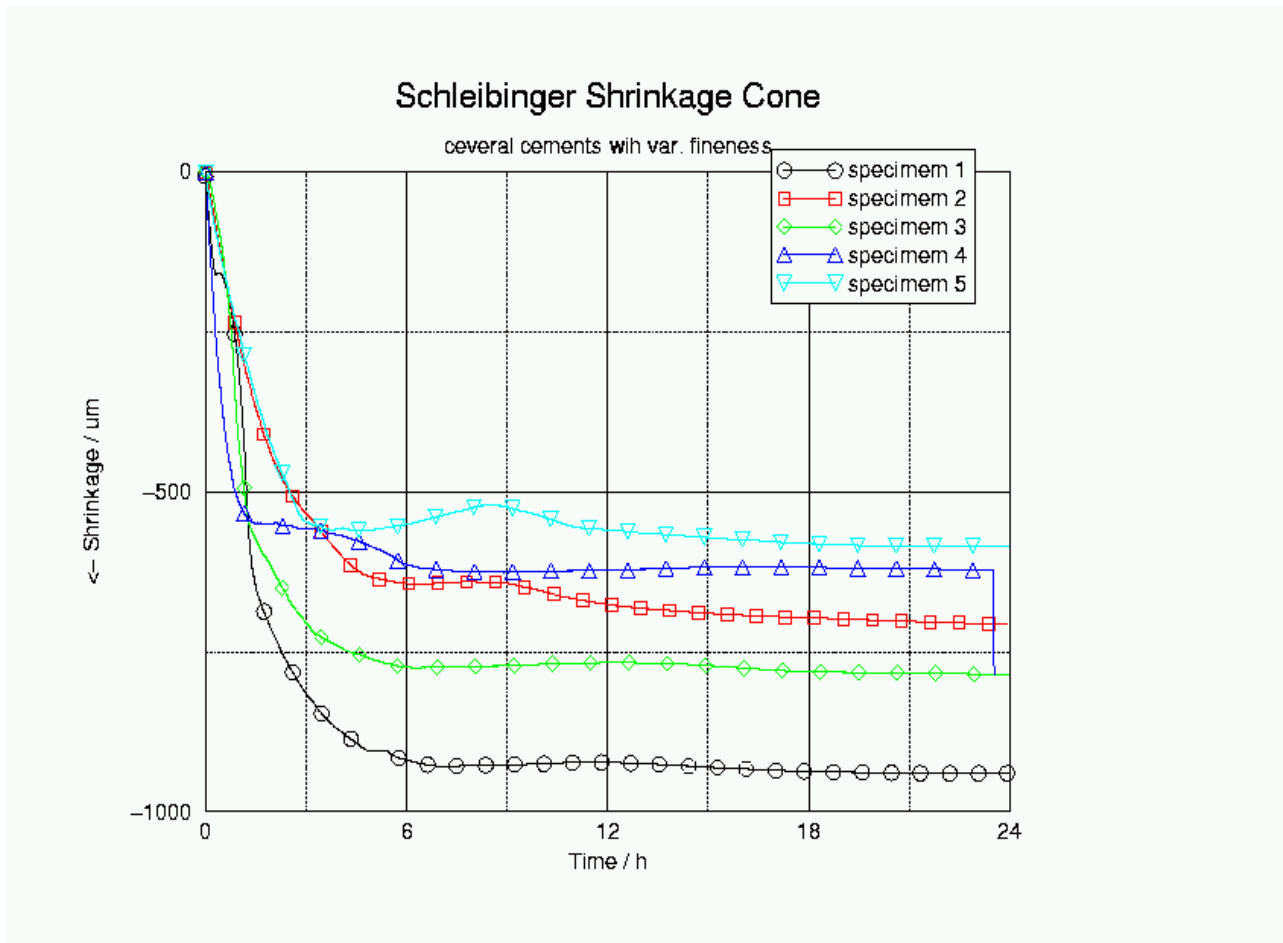
### Option Temperature / Humidity Sensor

For measuring temperature and rel. humidity. Stainless steel case  
Accurray Temperature  $\pm 0.3 \text{ K}$  @  $i 25^\circ\text{C}$ , Humidity  $\pm 1.8\%$  @  $25^\circ\text{C}$   
S0016

## Balance Interface

Serial Interface for a balance of Mettler-Toledo, according to the software standard MT SICS 0 version 2.2x or higher  
S0030

## Application



Cements with several finess.