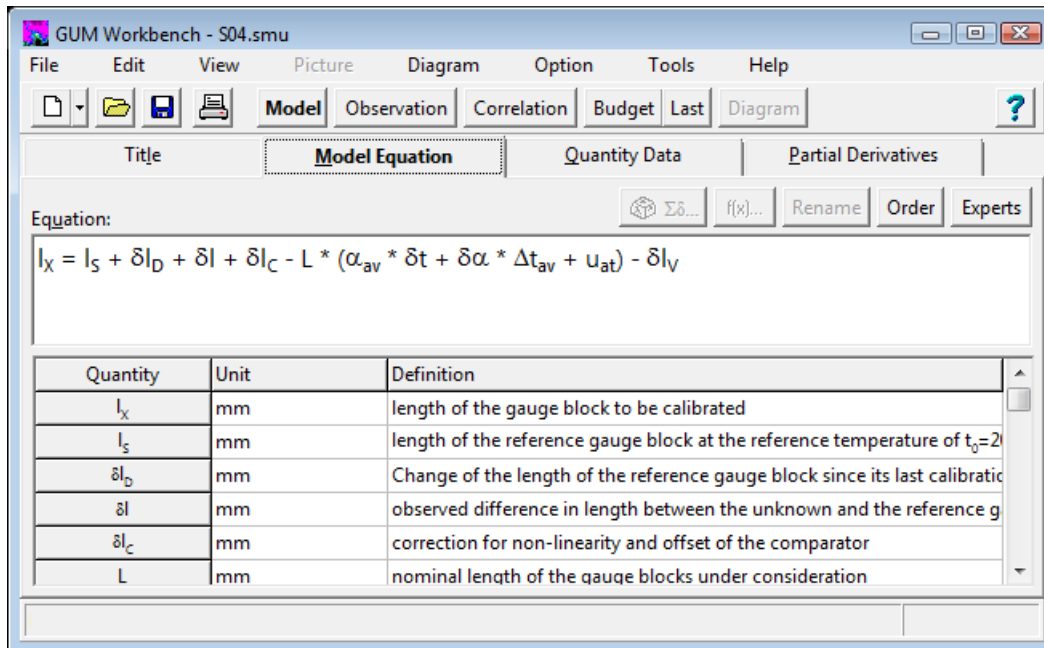


## GUM Workbench Version 1.4 Screen Views

### Model view - model equation



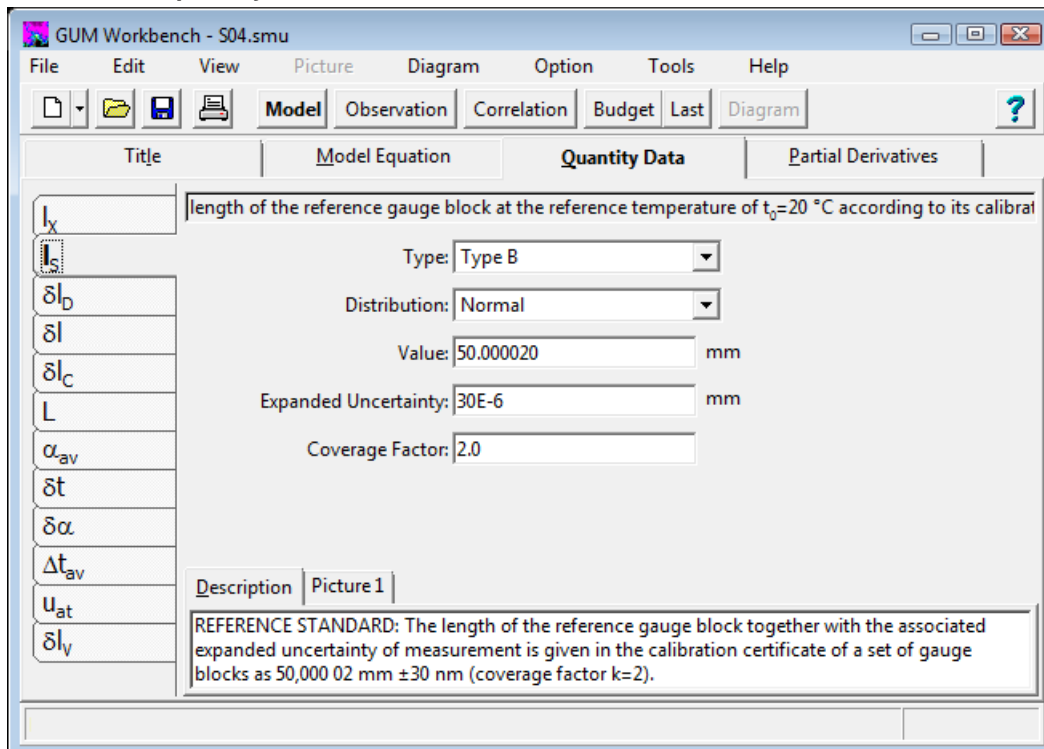
The screenshot shows the 'Model Equation' view in GUM Workbench. The equation is displayed as:

$$l_x = l_s + \delta l_D + \delta l + \delta l_C - L * (\alpha_{av} * \delta t + \delta \alpha * \Delta t_{av} + u_{at}) - \delta l_V$$

Below the equation is a table defining the quantities:

Quantity	Unit	Definition
$l_x$	mm	length of the gauge block to be calibrated
$l_s$	mm	length of the reference gauge block at the reference temperature of $t_0=20$
$\delta l_D$	mm	Change of the length of the reference gauge block since its last calibration
$\delta l$	mm	observed difference in length between the unknown and the reference gauge
$\delta l_C$	mm	correction for non-linearity and offset of the comparator
$L$	mm	nominal length of the gauge blocks under consideration

### Model view - quantity data



The screenshot shows the 'Quantity Data' view in GUM Workbench. The quantity  $l_x$  is selected, and its data is displayed:

- Quantity:  $l_x$  (length of the reference gauge block at the reference temperature of  $t_0=20$  °C according to its calibration certificate)
- Type: Type B
- Distribution: Normal
- Value: 50.000020 mm
- Expanded Uncertainty: 30E-6 mm
- Coverage Factor: 2.0

A description box is also visible:

REFERENCE STANDARD: The length of the reference gauge block together with the associated expanded uncertainty of measurement is given in the calibration certificate of a set of gauge blocks as 50,000 02 mm ±30 nm (coverage factor k=2).

### Model view - partial derivatives

GUM Workbench - S04.smu

File Edit View Picture Diagram Option Tools Help

Model Observation Correlation Budget Last Diagram

Title Model Equation Quantity Data **Partial Derivatives**

Partial Derivatives:

$$\frac{\partial l_x}{\partial L} = -(\alpha_{av} \cdot \delta t + \delta \alpha \cdot \Delta t_{av} + u_{at});$$

$$\frac{\partial l_x}{\partial \alpha_{av}} = -L \cdot \delta t;$$

$$\frac{\partial l_x}{\partial \delta t} = -L \cdot \alpha_{av};$$

$$\frac{\partial l_x}{\partial \delta \alpha} = -L \cdot \Delta t_{av};$$

$$\frac{\partial l_x}{\partial \Delta t_{av}} = -L \cdot \delta \alpha;$$

$$\frac{\partial l_x}{\partial u_{at}} = -L;$$

### Observation view

GUM Workbench - S04.smu

File Edit View Picture Diagram Option Tools Help

Model **Observation** Correlation Budget Last Diagram

SI

observed difference in length between the unknown and the reference gauge block

Observation:

No.	Observation
1	-100E-6
2	-90E-6
3	-85E-6
4	-95E-6
5	-100E-6

Method: Direct

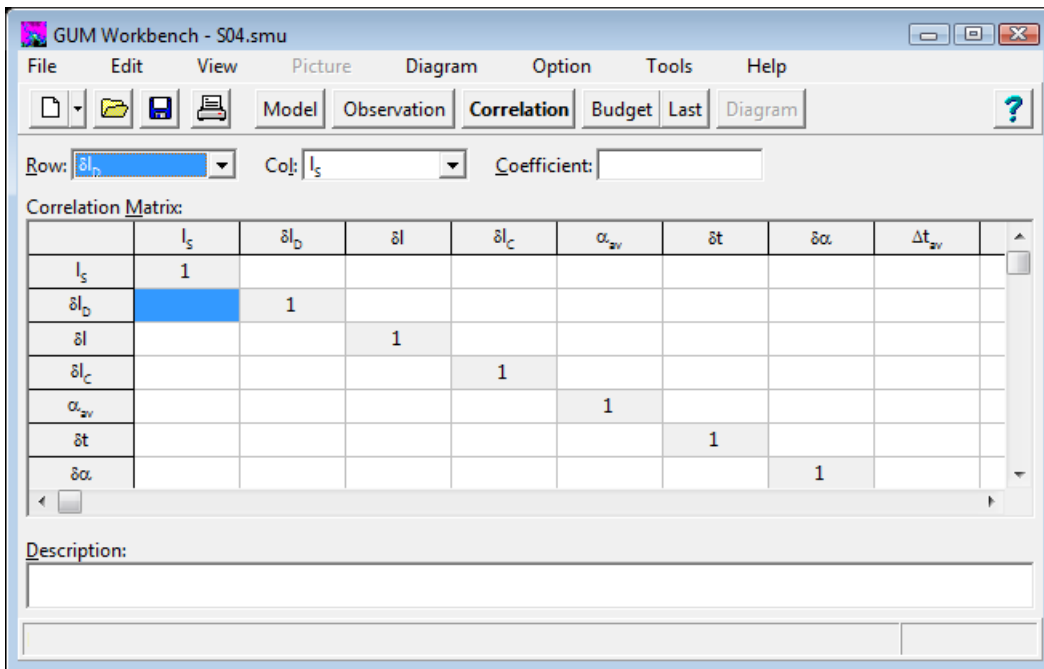
Unit: mm

Arithmetic Mean:  $-94.00 \cdot 10^{-6}$  mm

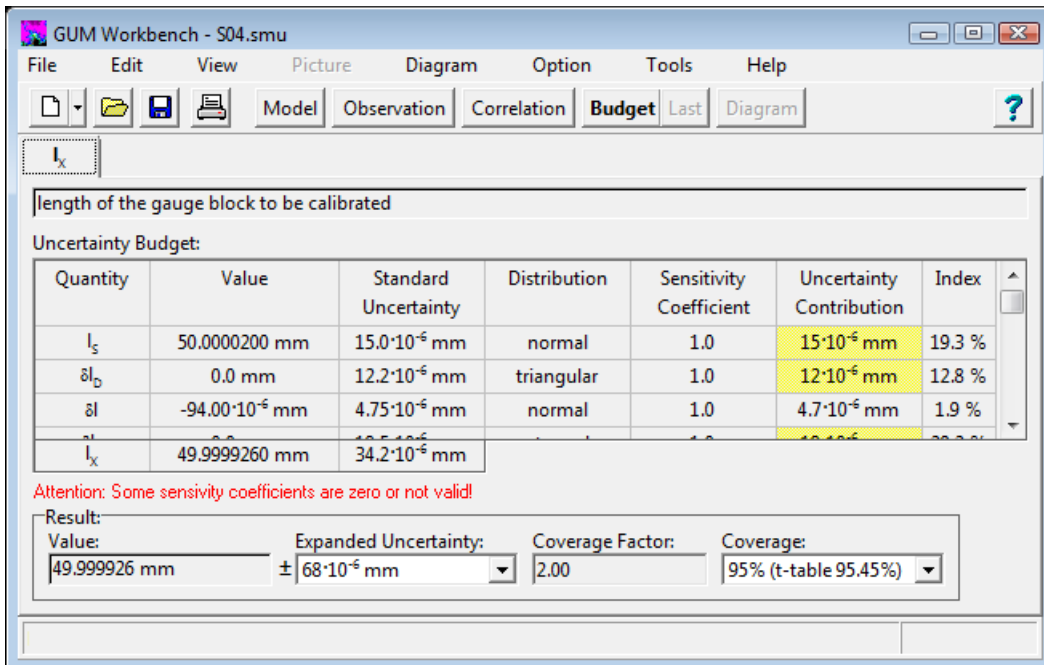
Experimental Standard Deviation:  $6.5 \cdot 10^{-6}$  mm

Standard Uncertainty:  $4.75 \cdot 10^{-6}$  mm

### Correlation view



### Budget view



### Result of a Monte Carlo simulation

