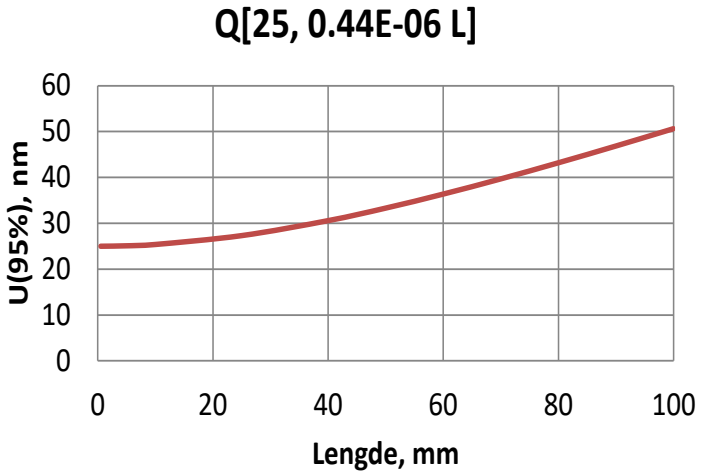
Justervesenets arbeid med CMC'er i BIPMs KCDB

Justervesenet

CMC i KCDB MRA database



Results for: Length > Dimensional metrology > Linear dimensions > End standards > G
"Norway"

4 results

In the CMC uncertainty statements, $Q[a,b] = [a^2 + b^2]^{1/2}$

Unless otherwise stated the expanded uncertainties given below correspond to $k = 2$ (at a 95 % level of confidence)

GROUP ID	SERVICE PROVIDER	INSTITUTE SERVICE CODE	COMMENTS	BRANCH	SERVICE	QUANTITY	INS ART STU
	Norway **JV**	JV-NL-LEN-020	Display comment	Dimensional metrology	Linear dimensions	End standards	Gau
	Norway **JV**	JV-NL-LEN-030	Display comment	Dimensional metrology	Linear dimensions	End standards	Gau
	Norway **JV**	JV-NL-LEN-021	Display comment	Dimensional metrology	Linear dimensions	End standards	Gau
	Norway **JV**	JV-NL-LEN-022	Display comment	Dimensional metrology	Linear dimensions	End standards	Gau

CMC i KCDB MRA database

Quantity	Instrument or Artifact	Method of Measurement	International standard	Parameters	Measurand	Uncertainty	Uncertainty Equation	Uncertainty Table	Comments	Approval date	NMI Service Identifier
End standards	Gauge block	Interferometry exact fractions		Central length L of gauge block : steel and tungsten	[0.5 , 100.0] mm	[25.0 , 50.0] nm (Absolute)	Q[25 nm, 0.44E-06 *L*] ()		Vertical orientation	2016-09-12	JV-NL-LEN-020
End standards	Gauge block	Interferometry exact fractions			[0.0 , 20.0] µm	20.0 nm (Absolute)			Vertical orientation	2017-10-10	JV-NL-LEN-021
End standards	Gauge block	Interferometry exact fractions		Temperature : 15 °C to 25 °C	K^{-1}	2.0E-7 K^{-1} (Absolute)			Vertical orientation	2017-10-10	JV-NL-LEN-022
End standards	Gauge block	Mechanical comparison			[0.5 , 100.0] mm	[0.07 , 0.2] µm (Absolute)	Q[0.07 µm, 1.8E-06 *L*] ()		Vertical orientation	2009-01-30	JV-NL-LEN-030

CMC i KCDB MRA database

Quantity	End standards	End standards	End standards	End standards
Instrument or Artifact	Gauge block	Gauge block	Gauge block	Gauge block
Method of Measurement	Interferometry exact fractions	Interferometry exact fractions	Interferometry exact fractions	Mechanical comparison
International standard	ISO 3650	ISO 3650	ISO 3650	ISO 3650
Parameters	Central length L of gauge block : steel and tungsten carbide	Length difference of gauge block pairs	Thermal expansivity Temperature : 15 °C to 25 °C	Central length of gauge block
Measurand	[0.5 , 100.0] mm	[0.0 , 20.0] µm	K^{-1}	[0.5 , 100.0] mm
Uncertainty	[25.0 , 50.0] nm (Absolute)	20.0 nm (Absolute)	2.0E-7 K^{-1} (Absolute)	[0.07 , 0.2] µm (Absolute)
Uncertainty Equation	Q[25 nm, 0.44E-06 *L*]			Q[0.07 µm, 1.8E-06 *L*]
Uncertainty Table				
Comments	Vertical orientation	Vertical orientation	Vertical orientation	Vertical orientation
Approval date	2016-09-12	2017-10-10	2017-10-10	2009-01-30
NMI Service Identifier	JV-NL-LEN-020	JV-NL-LEN-021	JV-NL-LEN-022	JV-NL-LEN-030

DimVIM:

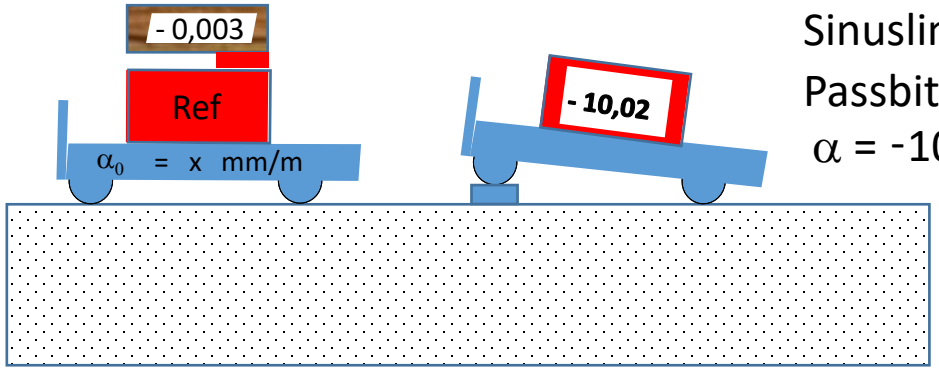
2.2.1	gauge block	central length; variation in length; thermal expansivity; length difference of gauge block pairs

https://www.bipm.org/en/committees/cc/ccl/dimvim

CMCs ‘FAIR’ (Findable, Accessible, Interoperable, Reusable)

Justervesenet

Ny CMC for kalibrering av vater



Sinuslinjal, L = 300 mm

Passbit, L = 3 mm

α = -10 mm/m

$$\alpha\left(\frac{mm}{m}\right) = \frac{PB}{\sqrt{L^2 - PB^2}} = \frac{PB/L}{\sqrt{1-(PB/L)^2}}$$

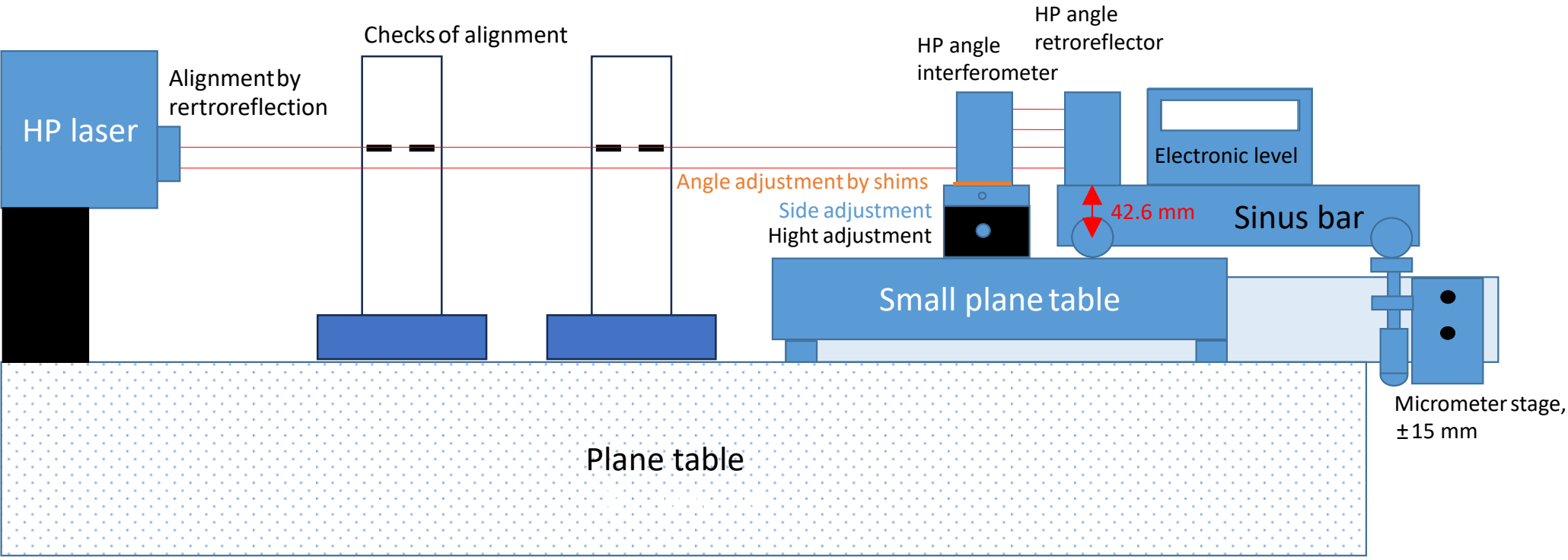
α= -10,000 5 mm/m

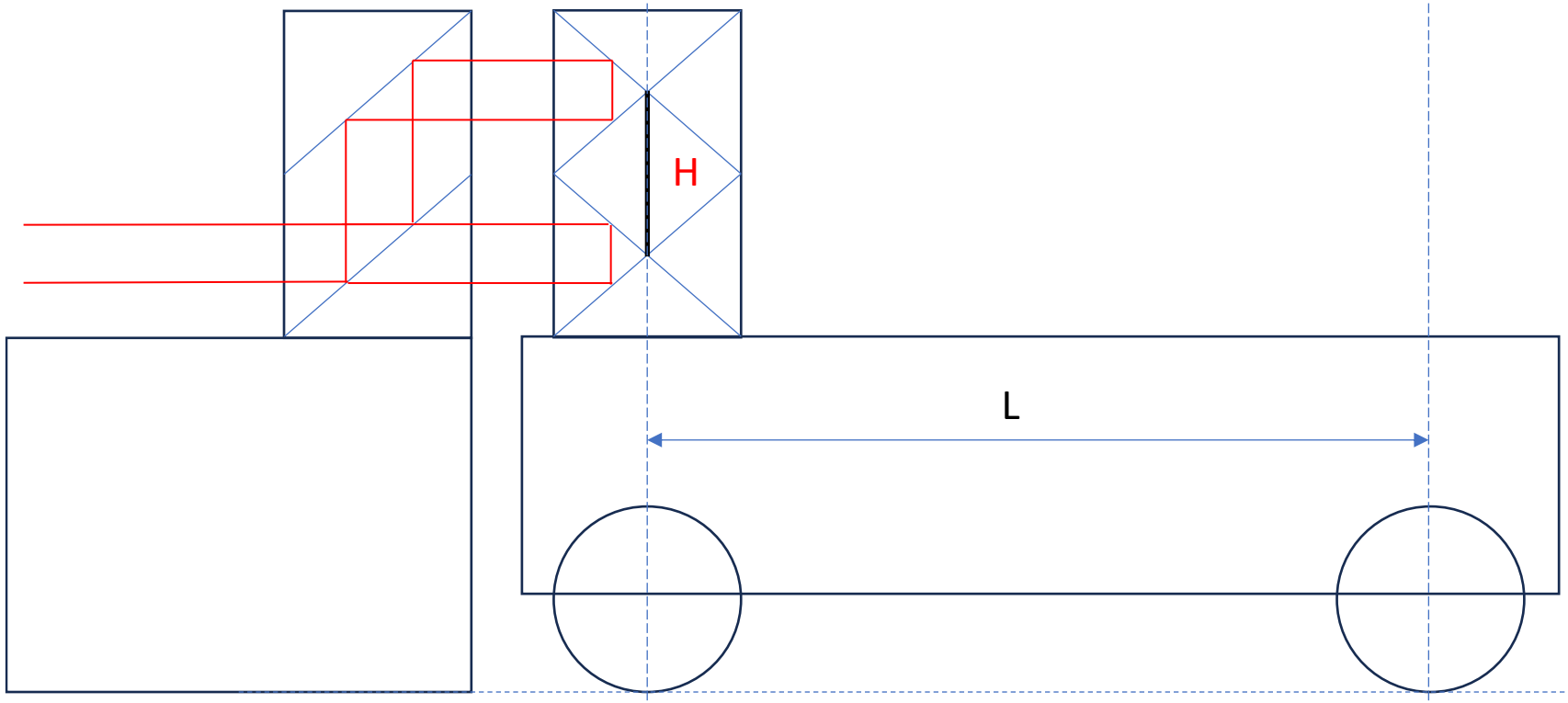
Innvendinger fra teknisk ekspert:

- Usikkerhetsbudsjettet ditt ser jo greit ut!
- Men hvordan kalibrerte du lengden til sinuslinjalen?

OBS: Det kan være en forskjell på mekanisk målt lengde og den *effektive lengden* til sinuslinjalen ved ulike vinkler!

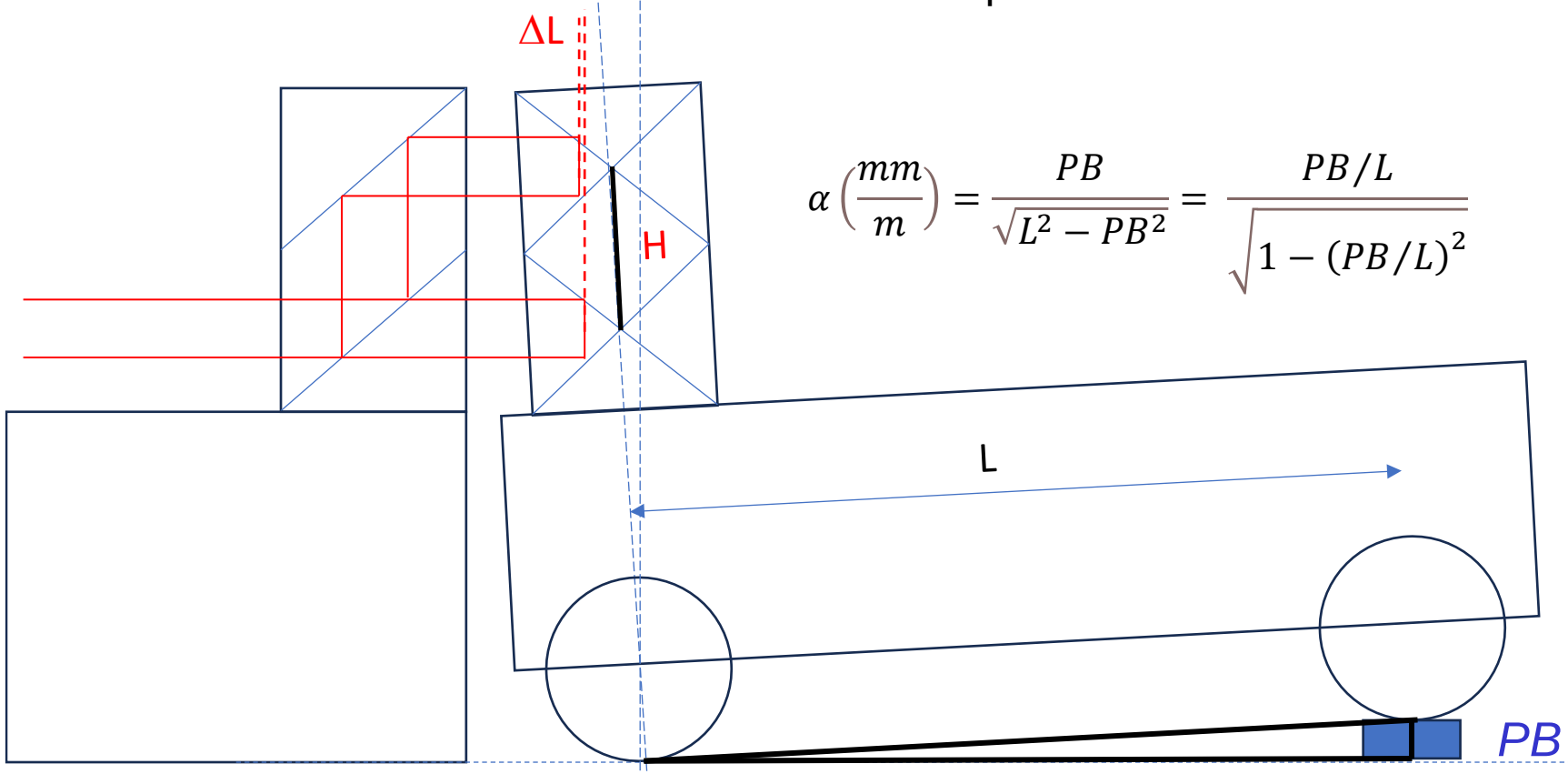
HP 5529A laser interferometer




H
L

$$\alpha\left(\frac{mm}{m}\right) = \frac{\Delta L}{\sqrt{H^2 - \Delta L^2}} = \frac{\Delta L/H}{\sqrt{1 - (\Delta L/H)^2}}$$

Størrelsen **H** må kalibreres!
Da er dette en primær målemetode for vinkel.



$$\alpha\left(\frac{mm}{m}\right) = \frac{PB}{\sqrt{L^2 - PB^2}} = \frac{PB/L}{\sqrt{1 - (PB/L)^2}}$$

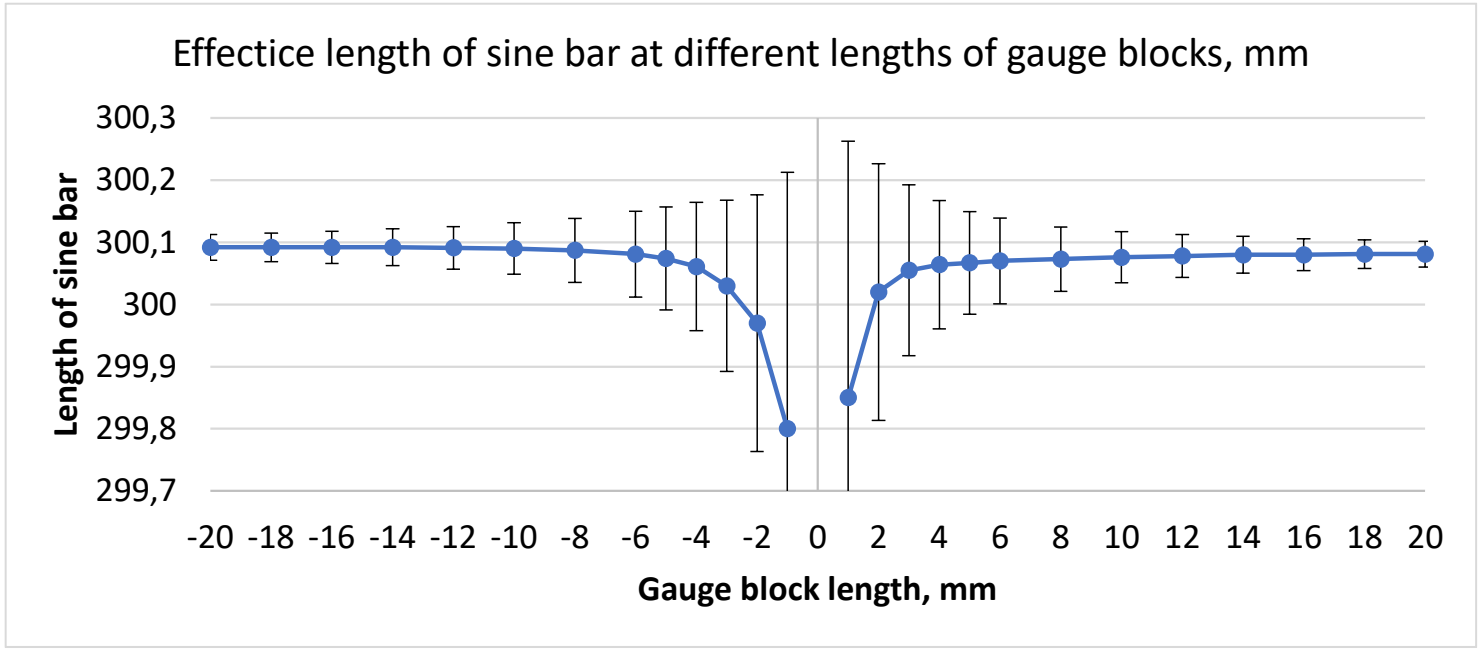
$$\alpha\,('') = 3600 \cdot \arcsin\left(\frac{\Delta L}{H}\right) \approx 3600 \cdot \frac{\Delta L}{H}$$

$$L = PB \cdot \sqrt{1 + \frac{1}{\alpha^2}}$$

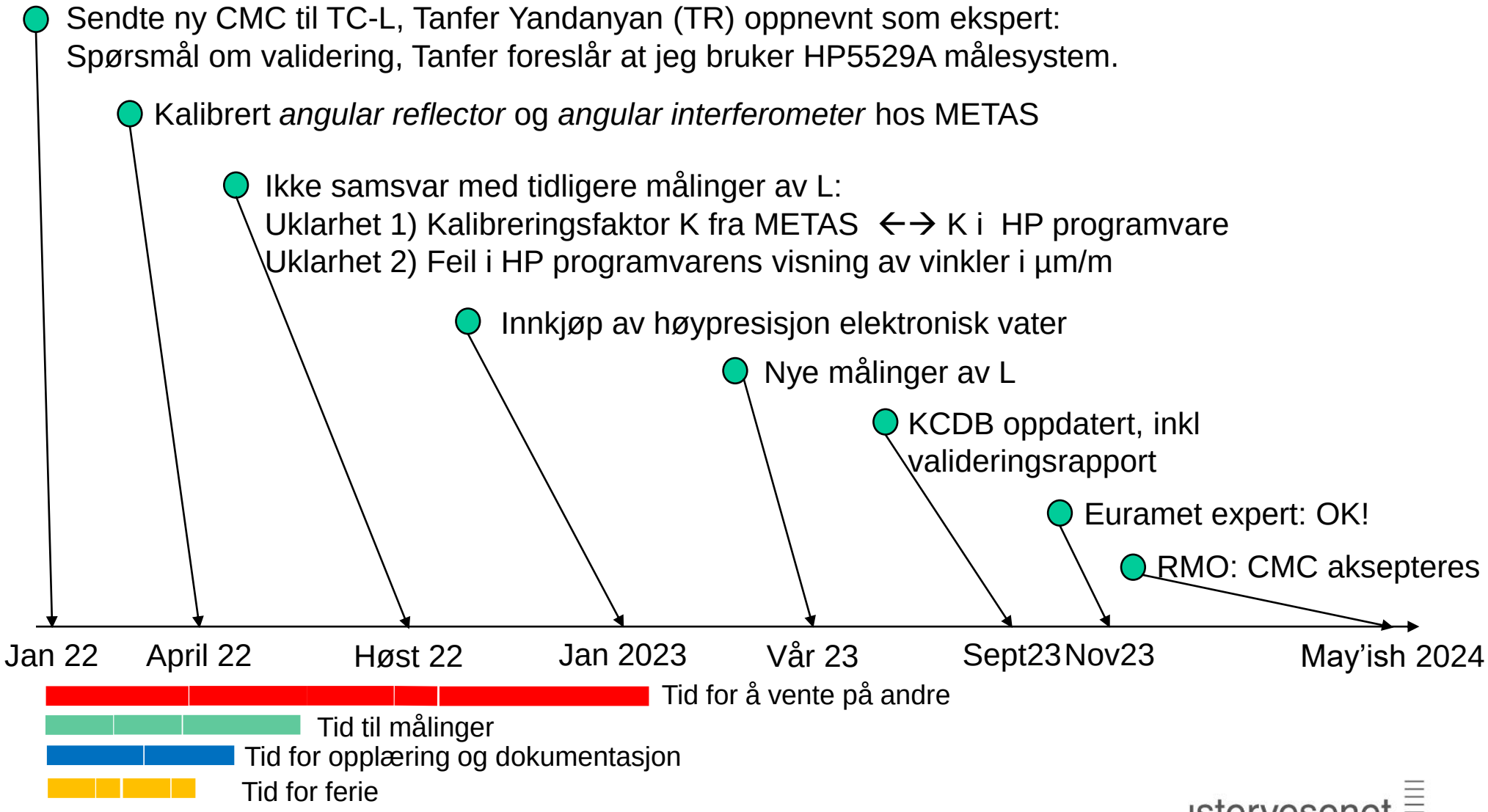
Lengde til sinuslinjal

Før validering: L = 300,056 mm ± 0,050 mm (1 sigma) mekanisk måling

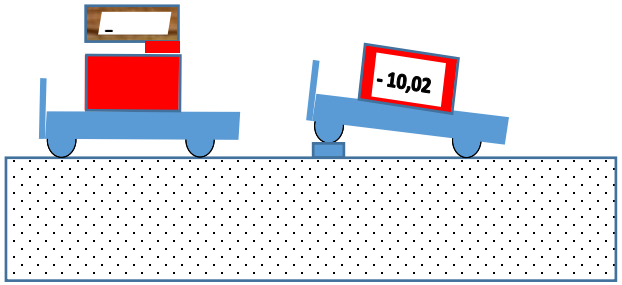
Etter validering: Ved 16 mm passbit: L = 300,086 mm ± 0,026 mm
Ved 12 mm passbit: L = 300,085 mm ± 0,034 mm
Ved 6 mm passbit: L = 300,076 mm ± 0,069 mm
Ved 3 mm passbit: L = 300,043 mm ± 0,138 mm

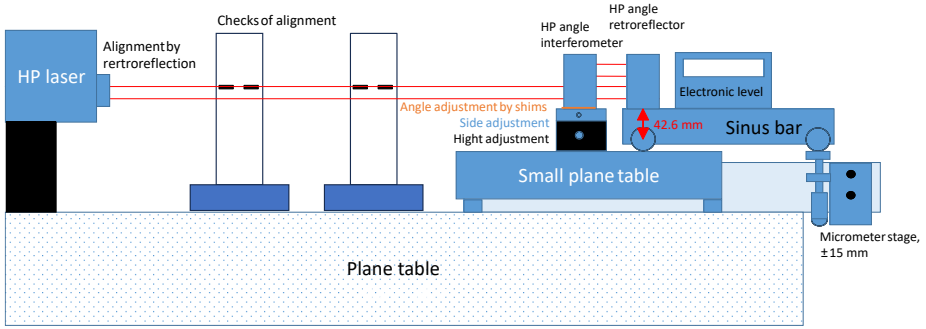


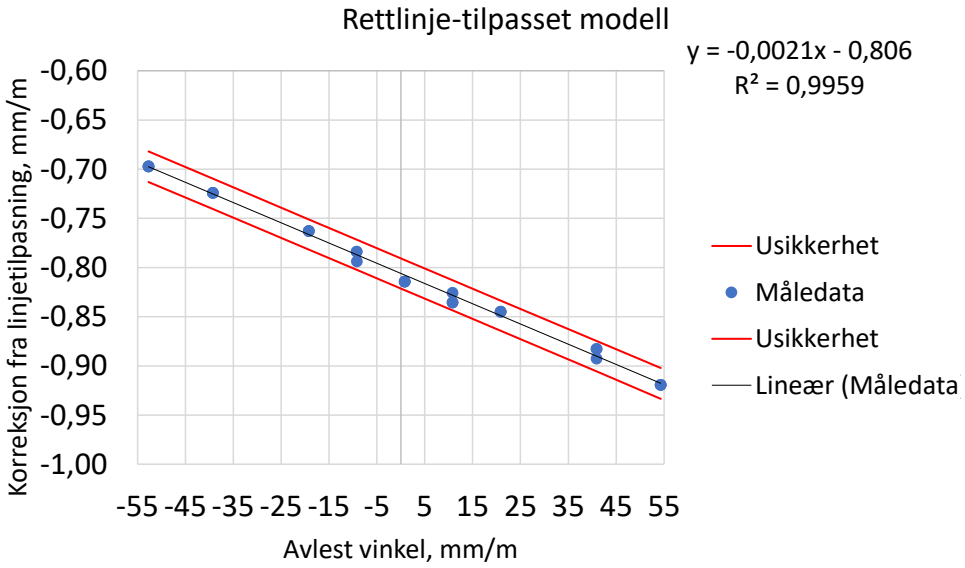
Ny CMC for kalibrering av vater, tidslinje

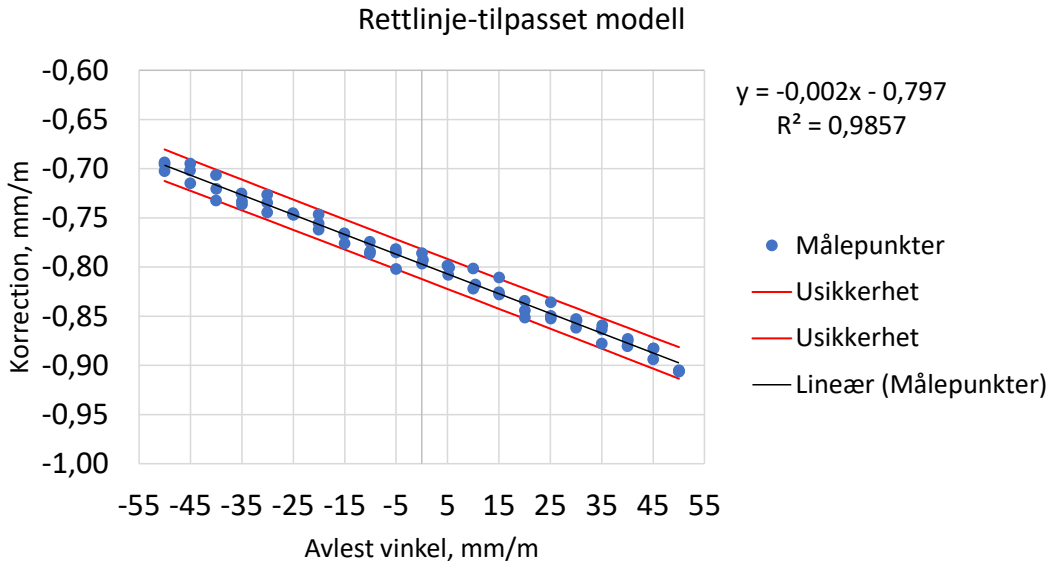


Vater nr 1: Oppløsning 0,01 mm/m

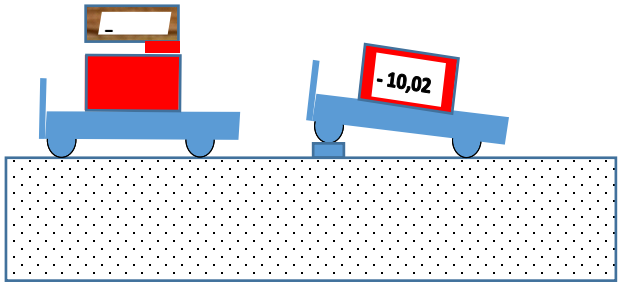


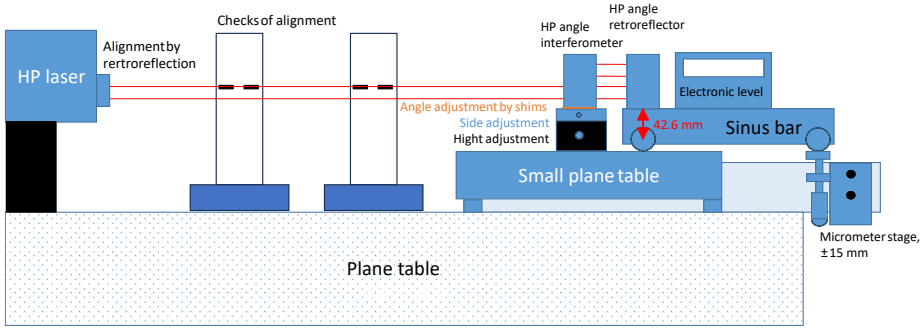


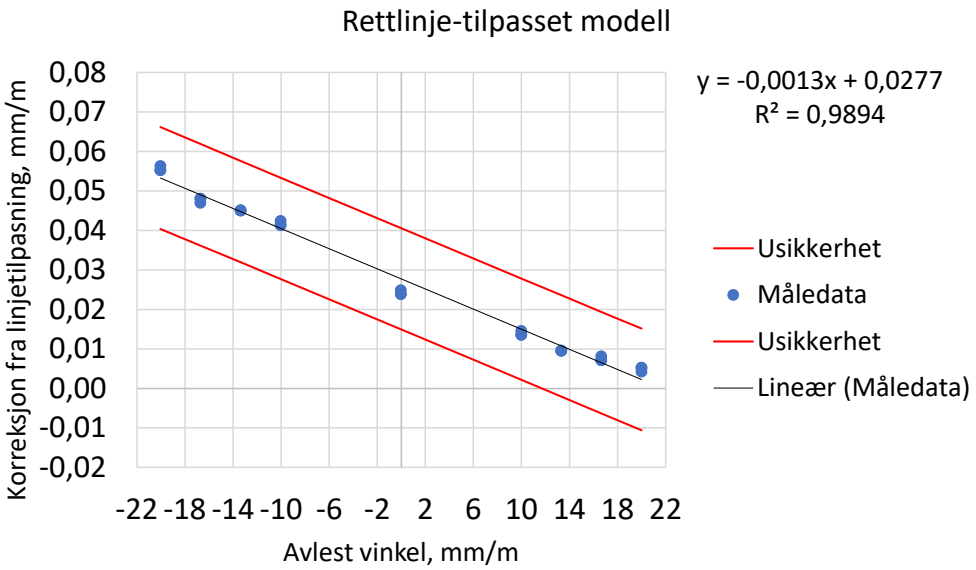


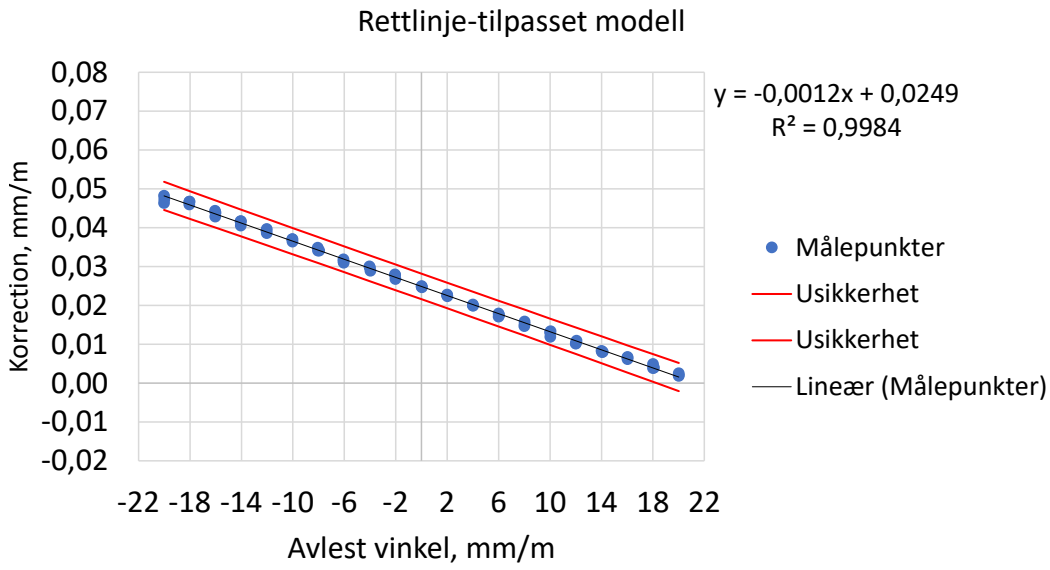


Vater nr 2: Oppløsning 0,001 mm/m

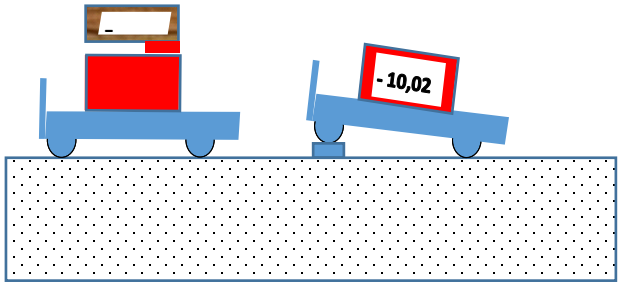


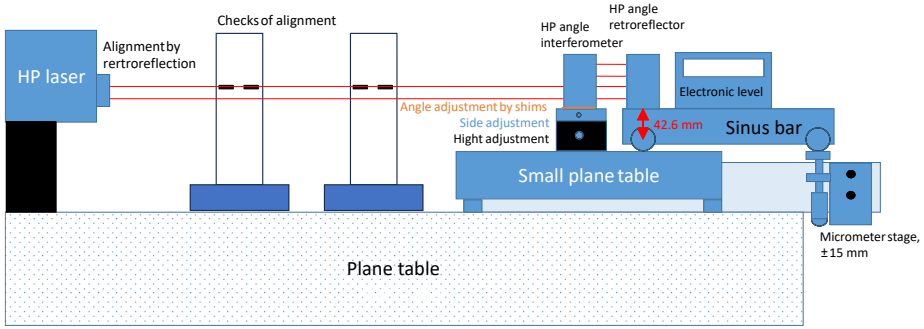


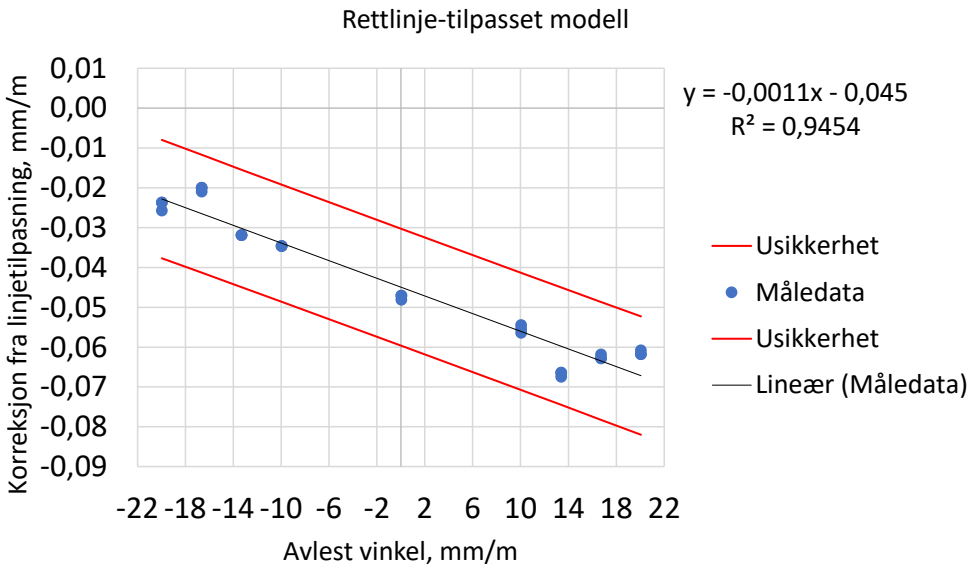


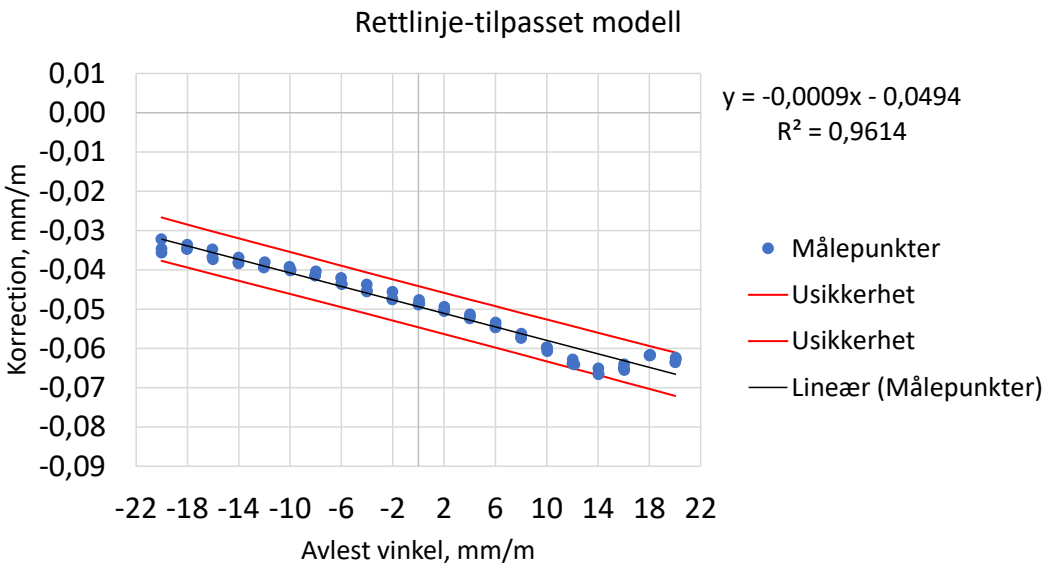


Vater nr 3: Oppløsning 0,001 mm/m

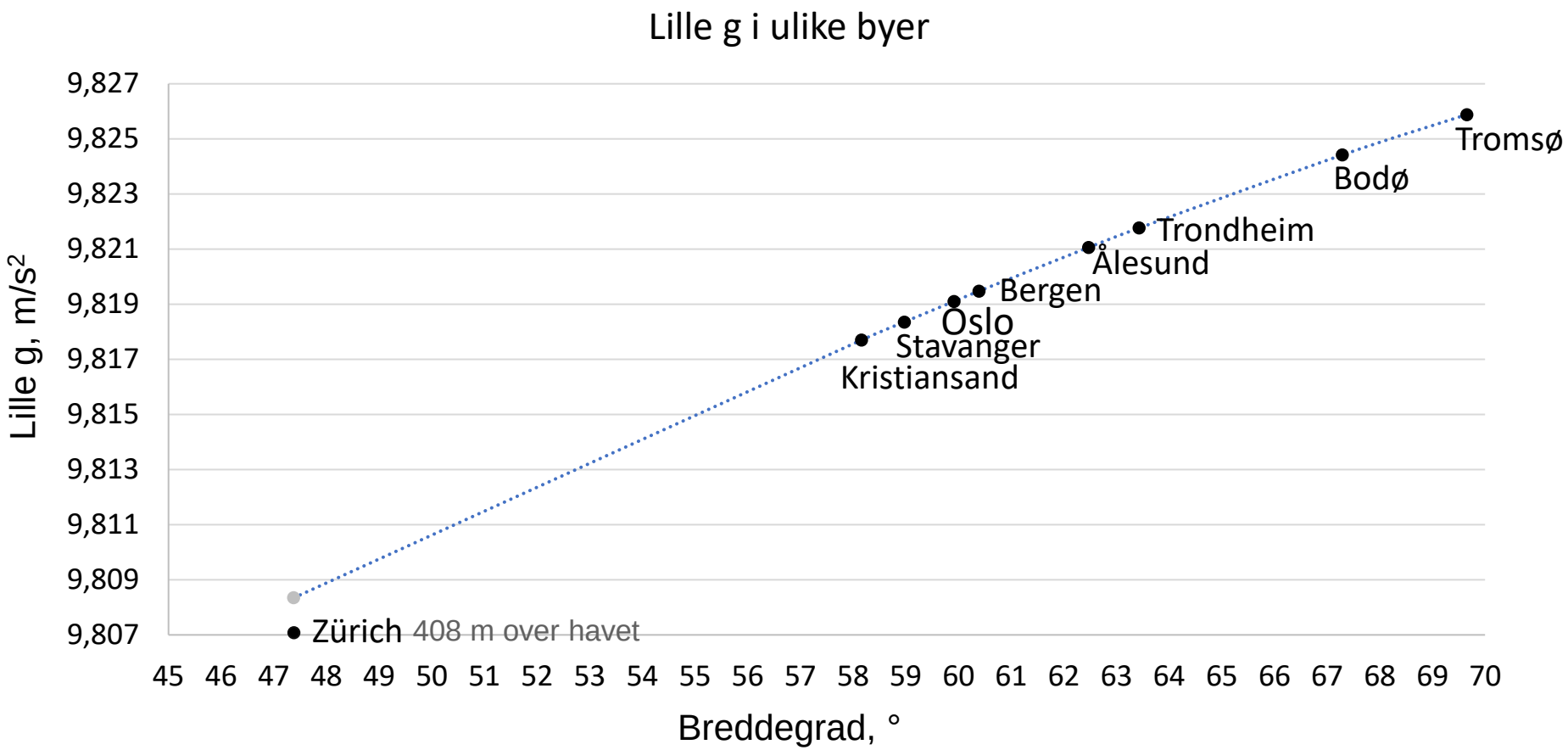








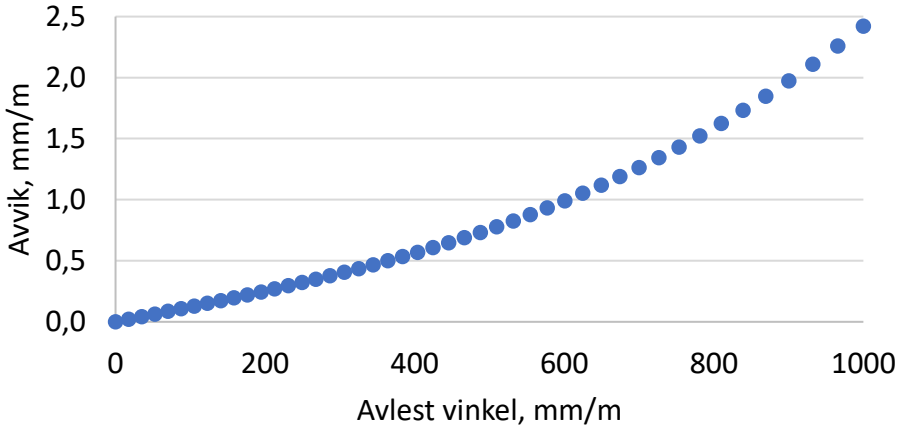
$$g_\phi = 9.780318\left(1 + 0.0053024\sin^2\phi - 0.0000058\sin^2 2\phi\right) - 3.086\times 10^{-6}h$$

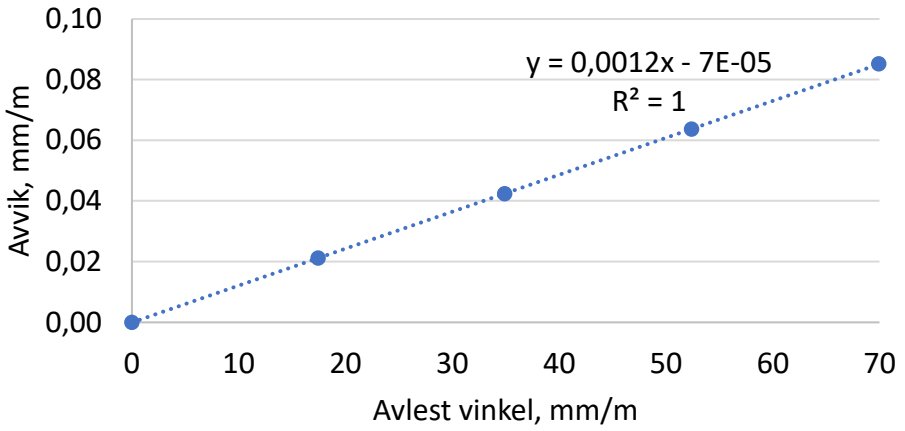


Korreksjon for lokal g

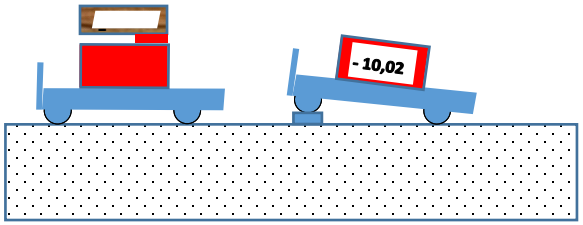
$$\alpha_{corr} = \arcsin\left(\frac{g_{Cal}}{g_{Meas}} \cdot \sin(\alpha_{Displayed})\right)$$

Kalibrert og innregulert i Zürich, måler i Oslo





To nye prosedyrer i kvalitetssystemet

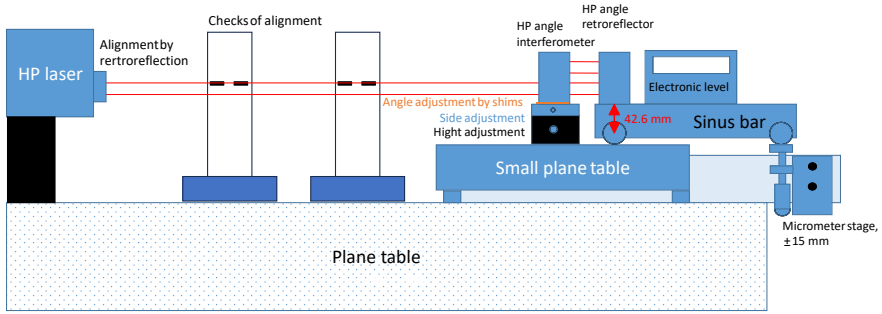


JV-NL-LEN-112 Kalibrering av vater ved sinuslinjal

JV-NL-LEN-112.01 Måleprotokoll og usikkerhetsbudsjett
JV-NL-LEN-112.09 Opplæringsskjema

CMC claims:

Clinometers, resolution ≥ 10 µm/m,
Straight line fit to all measurement points on the scale, range ±53 mm/m,
U(95%) = 0.020 mm/m (4.1''), k = 2 for a normal distribution.



JV-NL-LEN-017 Kalibrering av elektronisk vater ved laserinterferometri
JV-NL-LEN-017.01 Måleprotokoll og usikkerhetsbudsjett
JV-NL-LEN-017.09 Opplæringsskjema

CMC claims:

Electronic levels, resolution ≤ 1 µm/m,
Straight line fit to all measurement points on the scale, range ±20 mm/m,
U(95%) = 5 µm/m (1''), k = 2 for a normal distribution.

However, poor repeatability and a poor fit of a straight line to the calibration points will increase measurement uncertainty.