

Certificate of calibration

No. 113-3333

Object

1 plug gauge made of steel, ø 50 mm
Identification: SIP 43013

Order

Calibration of diameter and roundness deviation

Applicant

SIP, Société Genevoise d'Instruments de Physique
19, rue Pré - de - la - Fontaine
CH-1217 Meyrin 1 / Genève

Traceability

The reported measurement values are traceable to national standards and thus to internationally supported realizations of the SI-units.

Date of calibration

30 July and 21 August 2001

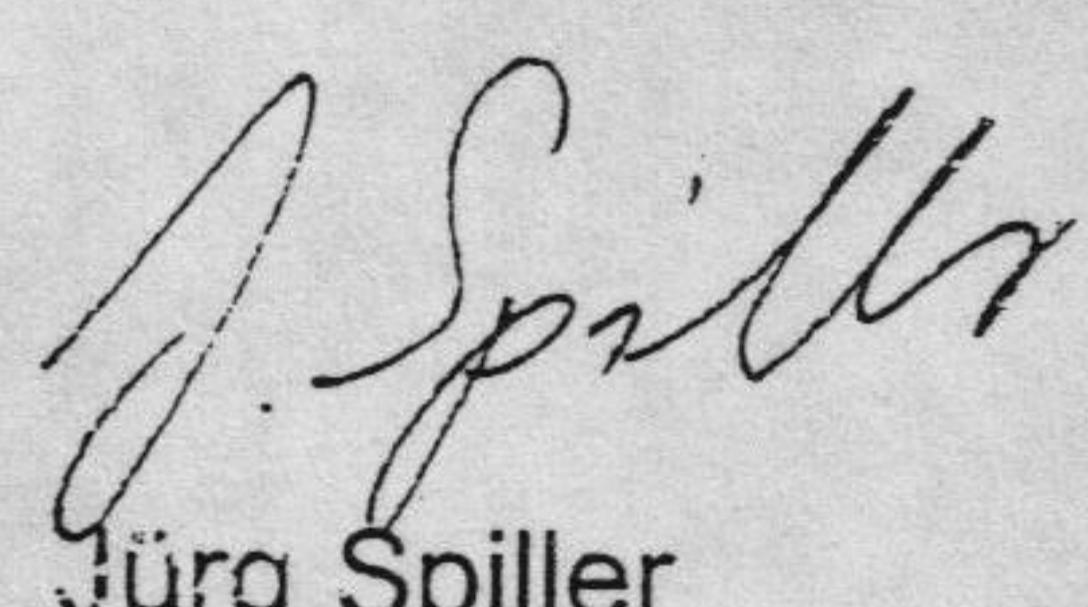
Marking

metas-calibration label

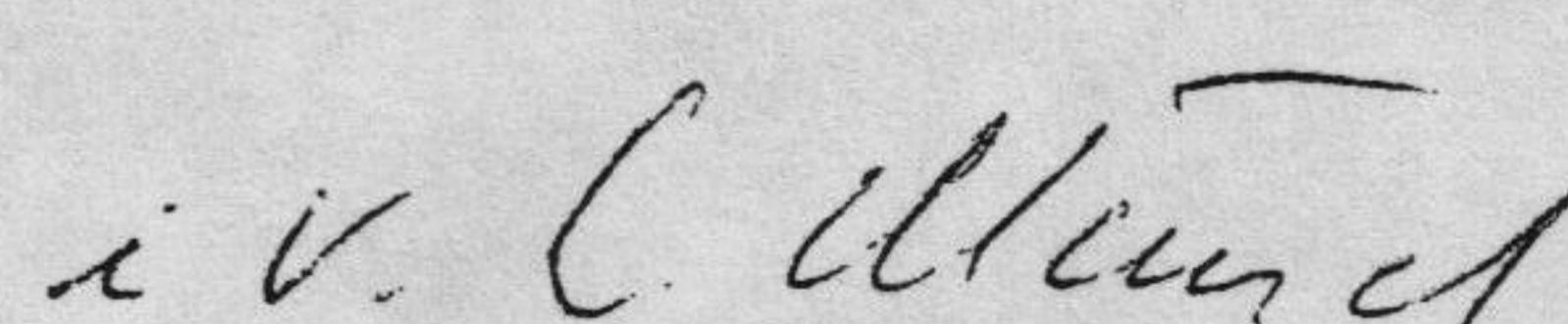
Wabern, 22 August 2001 Sp

For the measurements

Division of Mechanics, Radiation and Legal Metrology



Jürg Spiller



Dr. Bruno Vaucher, Deputy Director

Extent of calibration

The diameter and roundness deviation at three heights of the cylinder were measured.

Measurement procedure and conditions

The diameter of the plug gauge was calibrated on a length measurement machine using a laser interferometer and mechanical probing, according to the internal calibration procedure 11370K02.

Measurement probe: ruby sphere, \varnothing 4 mm

Measurement force: extrapolated to zero

Measurement direction: between the reference marks, parallel to the marking, perpendicular to the cylinder axis

The roundness measurement was carried out on a form measurement machine.

Measurement probe: ruby sphere, \varnothing 4 mm

Measurement force: < 0.05 N

Filter: 2-50 upr, 2RC, phase corrected

The roundness deviation was measured according to ISO 6318. It is defined as the peak to valley deviation from the least squares (LS) circle fitted to the measured profile.

The ambient temperature during the measurements was (20 ± 0.2) °C. The temperature of the ring gauge was 20.01 °C. The diameter results were corrected to the reference temperature of 20 °C assuming a linear coefficient of thermal expansion of $11.6 \cdot 10^{-6}$ K⁻¹.

Measurement results

Identification	Measurement position from front face of cylinder	Measured diameter	Roundness
SIP 43013	5.0 mm	49.988'94 mm	0.12 µm
	12.5 mm	49.988'99 mm	0.09 µm
	20.0 mm	49.988'99 mm	0.07 µm

Measurement uncertainty

diameter: $U = 0.10$ µm

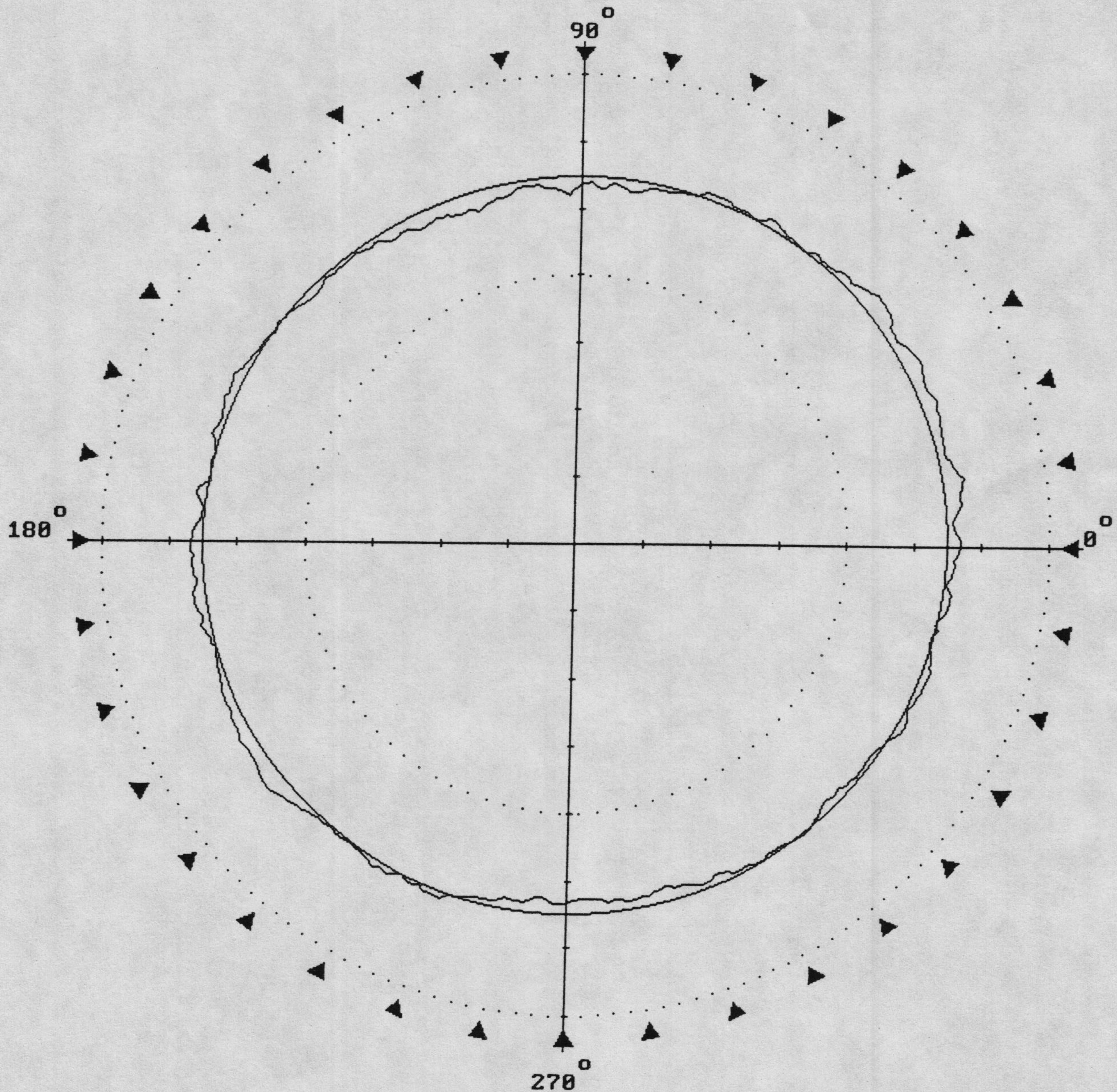
roundness: $U = 0.10$ µm

The reported uncertainty of measurement is stated as the combined standard uncertainty multiplied by a coverage factor $k = 2$. The measured value (y) and the associated expanded uncertainty (U) represent the interval $(y \pm U)$ which contains the value of the measured quantity with a probability of approximately 95%. The uncertainty was estimated following the guidelines of the ISO.

The measurement uncertainty contains contributions originating from the measurement standard, from the calibration method, from the environmental conditions and from the object being calibrated.

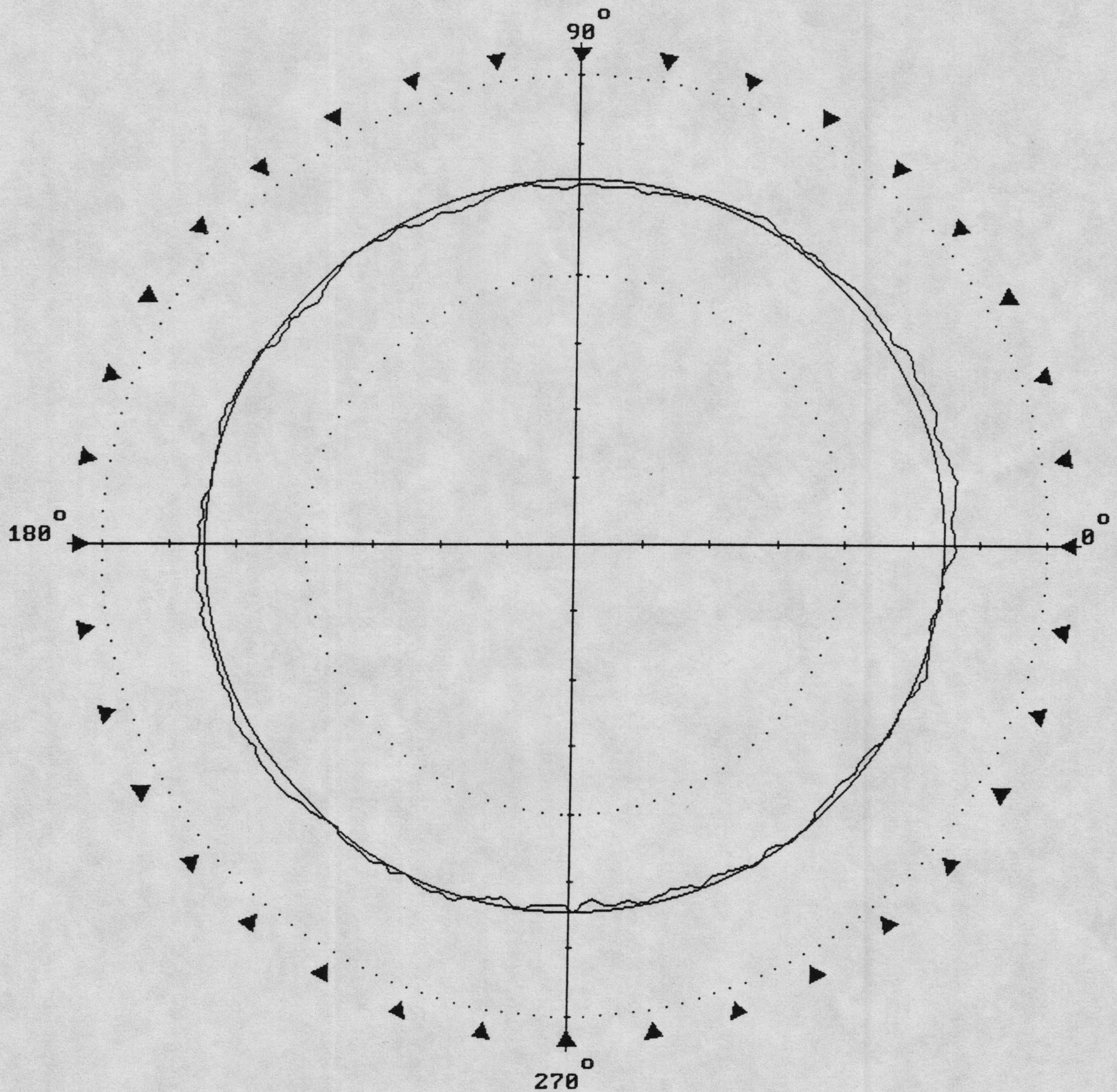
- Attachment: 4 form measurement protocols

LS ROUNDNESS RESULTS		Scale	0.20 um	Meas mode	External
Featurename	EAMD	Zht	101.8 mm	Meas. date	
Measurement no.	00	Radius	26.2830 mm	Meas. time	11:41:02
O	0.12 um	Datum	SPINDLE		
E	0.10 um	Filter type	2CR		
L	197.0 deg	Filter	1-50 upr		
A	0.25 um	Profile	100.0 %		



SIP	Pflug gauge, SIP, D = 50 mm
1217 Meyrin	Ident. No: 43013
	5mm from front face

LS ROUNDNESS RESULTS		Scale	0.20 um	Meas mode	External
Featurename	EAMD	Zht	94.3 mm	Meas. date	
Measurement no.	01	Radius	26.2831 mm	Meas. time	11:41:52
O	0.09 um	Datum	SPINDLE		
E	0.12 um	Filter type	2CR		
L	203.6 deg	Filter	1-50 upr		
A	0.26 um	Profile	100.0 %		



SIP

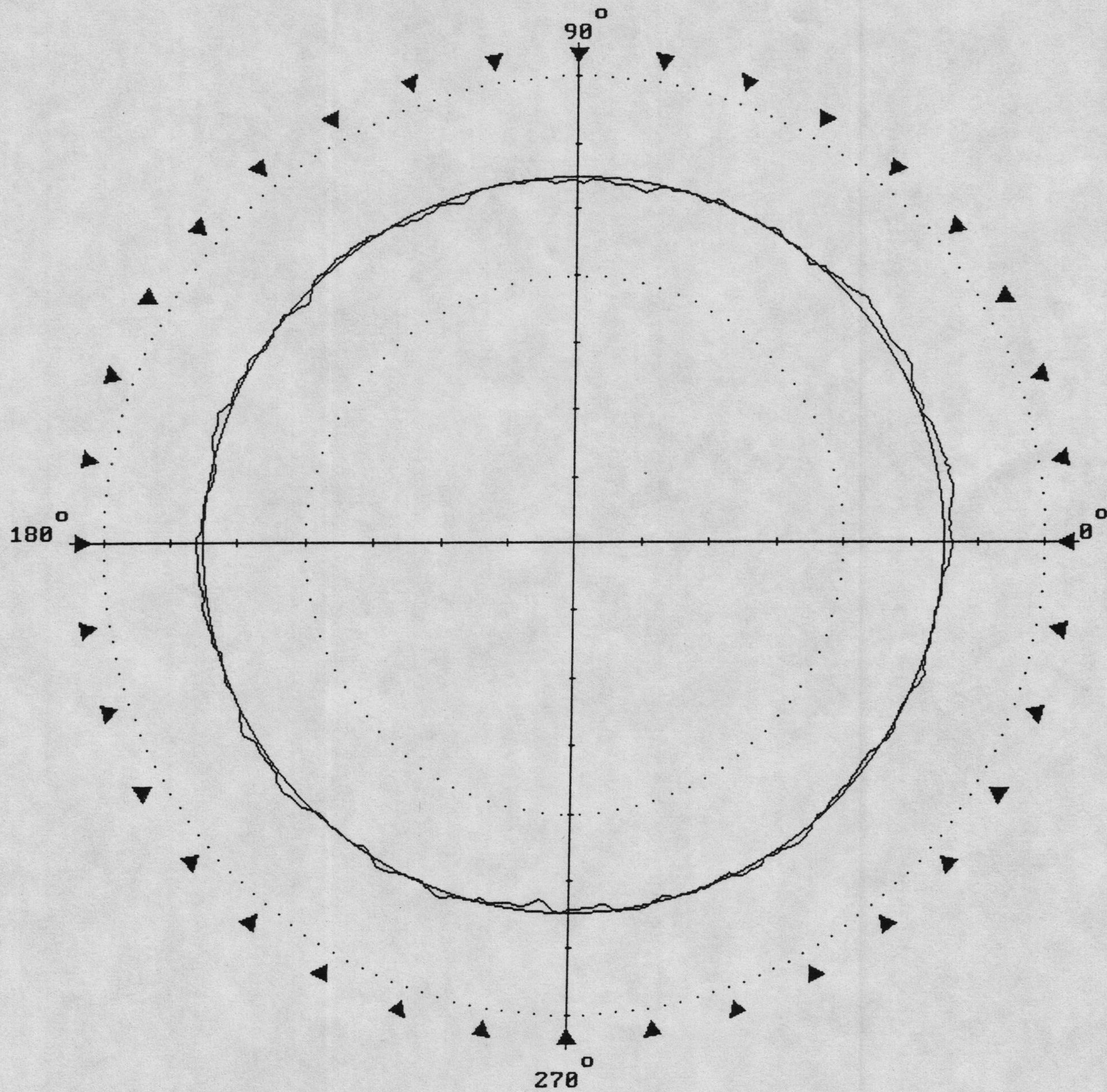
1217 Meyrin

Pflug gauge , SIP , D = 50 mm

Ident. No:43013

12.5mm from front face

LS ROUNDNESS RESULTS		Scale	0.20 um	Meas mode	External
Featurename	EAMD	Zht	86.8 mm	Meas. date	
Measurement no.	02	Radius	26.2831 mm	Meas. time	11:42:41
O	0.07 um	Datum	SPINDLE		
E	0.13 um	Filter type	2CR		
L	202.5 deg	Filter	1-50 upr		
A	0.29 um	Profile	100.0 %		



SIP	Pflug gauge , SIP , D = 50 mm
1217 Meyrin	Ident. Nr.: 43013
	20.0mm from front face

RTI TR300 V04.00 SO

102.00

100.00

98.00

96.00

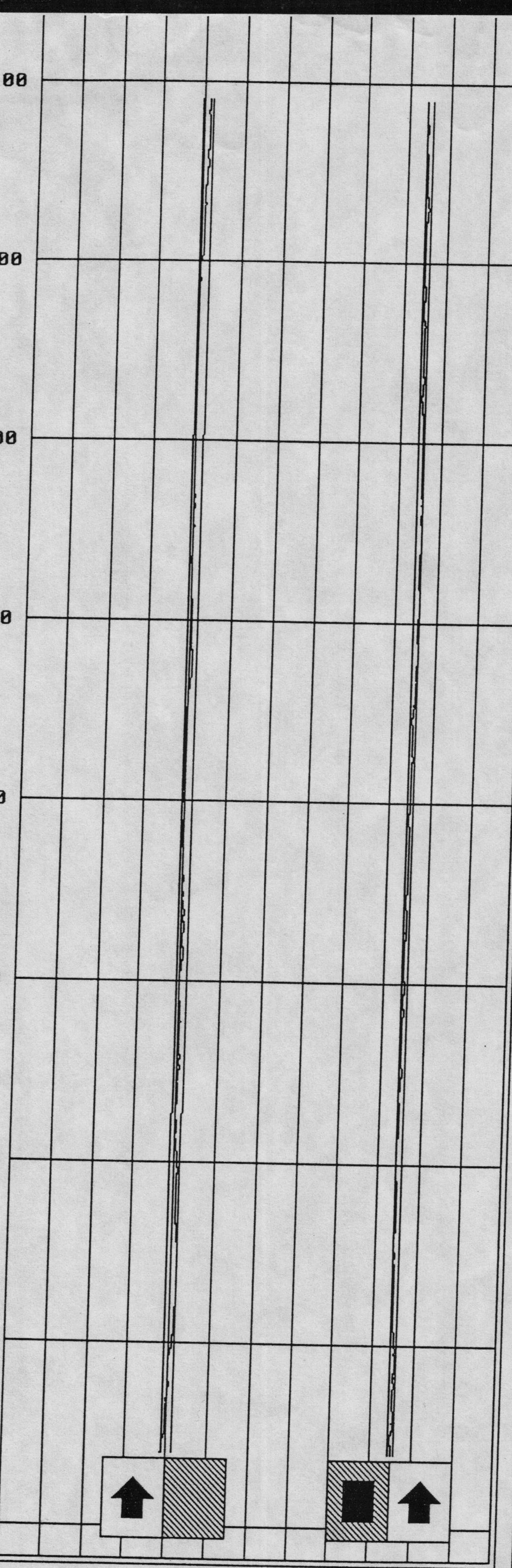
94.00

92.00

90.00

88.00

86.00



metas, Bern-Wabern

MZ VERT PARALLELISM

Featurename EAMD
Measurement no. 04
Par. 0.05 um
P-V 0.05 um
Par Angle 0.2 sec
Trav. Lth. 15.0 mm
Trav. Start 86.8 mm
Trav. End 101.8 mm
Spindle ang. 359.9 deg
Datum EAMD 03
Filter 0.80 mm
Profile 100.0 %
Meas. Mode Vert. Up
Meas. date
Meas. time 11:44:35

SIP

Pflug gauge , SIP , D = 50 mm

1217 Meyrin

Ident. No:43013