



SINCROTRONE TRIESTE
Laboratorio metrologia e ottica raggi X molli
Experimental Division
S.S. 14 Km 163,5 in Area Science Park - 34012 Basovizza, TRIESTE, ITALY
TEL 0039-040-3758632/8038 FAX. 0039-040-3758565

Optics under test: Plane mirror PM1 670X110X60mm³

Beamline: X-MOSS

Manufacturer: ZEISS

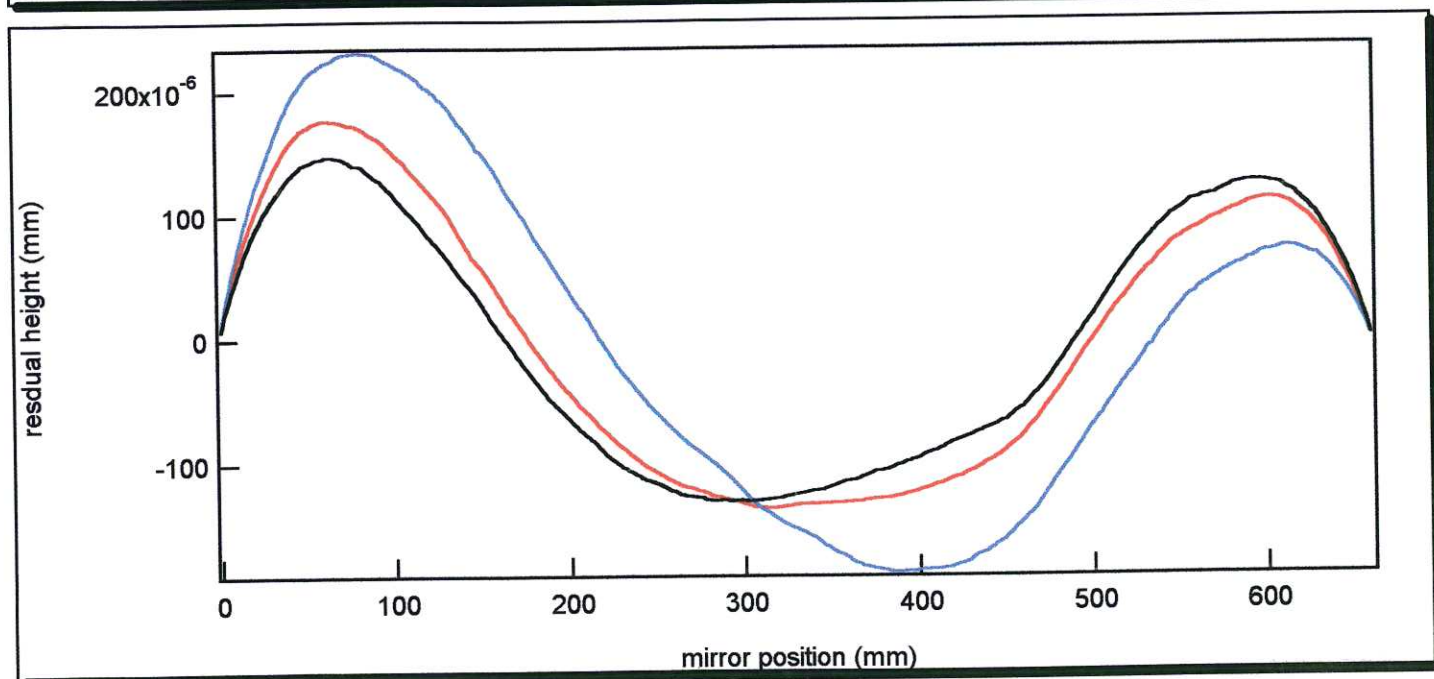
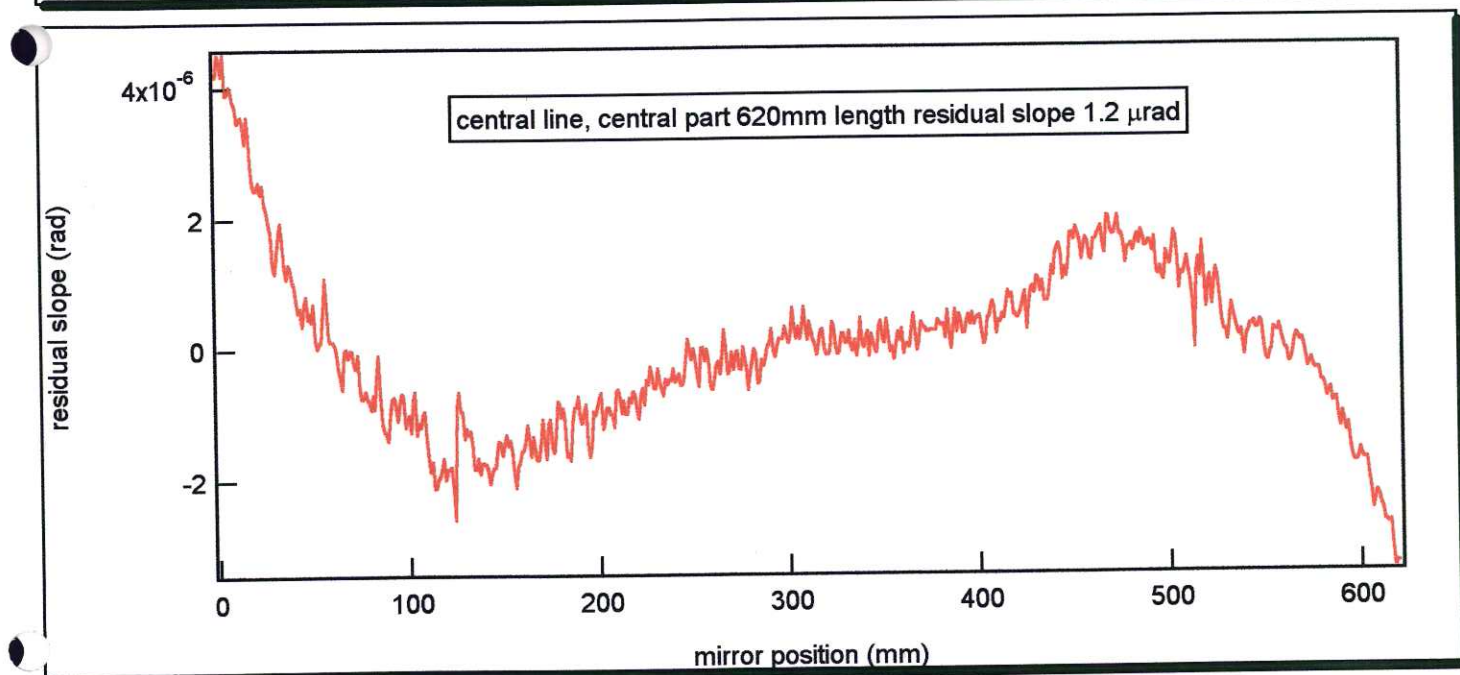
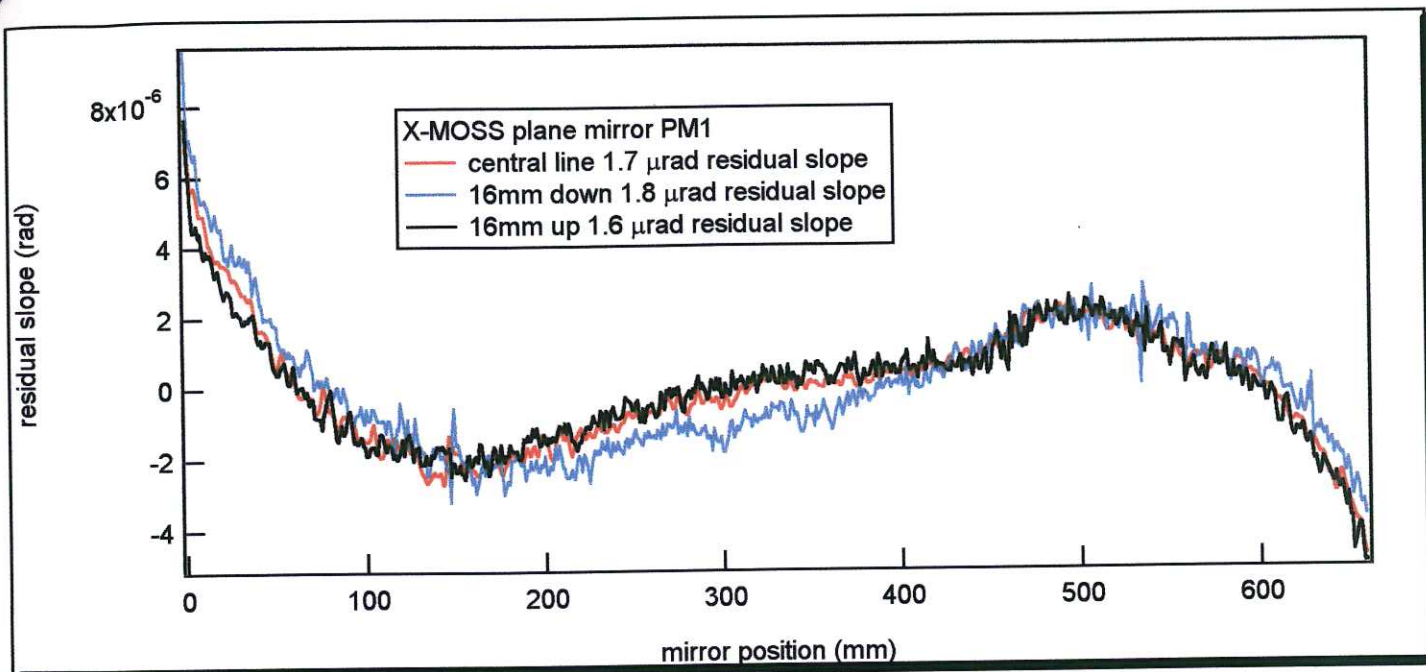
Test period: 14-16 December 1999

Laboratory conditions: Temperature: 22°C Humidity: <50 %

Parameter under test			
	Specification	Manufacturer measurement	Test result
Tangential radius	∞	124Km	$R > 100\text{Km}$
Sagittal radius	∞	124Km	-
Surface flatness peak-valley value	-	$\approx 150\text{nm}$	250nm
Tangential slope error	$< 0.2\text{arcsec}$	$< 0.2\text{arcsec}$	$\approx 0.3\text{arcsec}$
Sagittal slope error	$< 1\text{arcsec}$	0.23arcsec	-
RMS roughness	$< 0.5\text{nm}$	$0.28 < \sigma < 0.33$	$0.27 < \sigma < 0.38$
Groove density			
Groove density variation			

Additional Observations:

Trieste 17/12/99



Final Test Documentation

14-Oct-99

Components:

Plane mirror

Customer:

Dr. Stefano Nannarone
University of Modena
Department of Physics
Italy

Specification of the components

Mirror blanks geometry:

Material: Si
Dimensions: 670 x 110 x 60 mm³

Specification of the optical surface:

Plane mirror

Slope error: longitudinal ≤ 0.2 arcsec RMS
sagittal ≤ 1.0 arcsec RMS

Surface roughness: ≤ 0.5 nm RMS

Useful area: 660 x 100 mm²

Coating: 50 nm Pt

Type of measurements:

Type of measurement	Device	Resolution	Sampling area / surface
Surface scanning using an opto-mechanical probe head	Carl Zeiss precision coordinate measuring device M400	10 nm	$3 \text{ mm} < \lambda < 660 \text{ mm}$
Microinterferometry at 4 random positions	Micromap 512 (magnification 20x)	$< 0.1 \text{ nm}$	$1 \text{ } \mu\text{m} < \lambda < 408 \text{ } \mu\text{m}$

Results:

Figure 1 shows the result of the M400 measurement (figure range of $660 \times 100 \text{ mm}^2$). A radius of **124 km** had been determined. The achieved slope errors are given in the lower left corner. The values fulfill the specified level: longitudinal **0.20 arcsec RMS**, sagittal **0.23 arcsec RMS**.

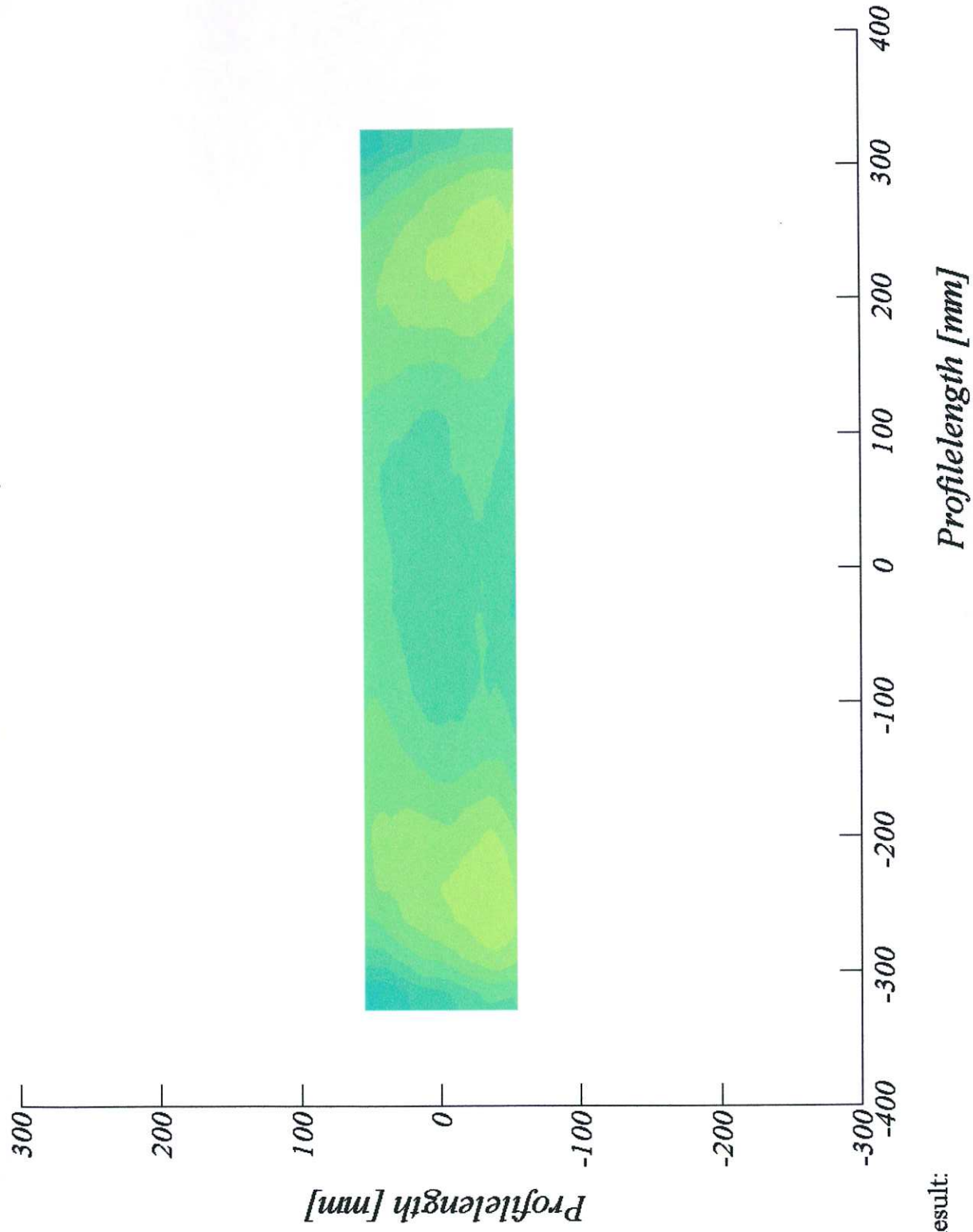
Surface roughness measurements were taken at 4 random positions on the mirror. Figures 2 to 5 show the results. The surface roughness is indicated in the lower left corner of the pictures. The measured values range between **0.28 nm RMS** and **0.33 nm RMS** roughness for surface spatial wavelength between $1 \text{ } \mu\text{m}$ and $408 \text{ } \mu\text{m}$ (magnification 20x). All values meet the specified surface roughness.

Carl Zeiss
Manufacturing division
Optics technology



Dr. Andreas Seifert

Uni Modena 98180 M2 , R = 124 km



Result:

RMS-Slope error (tang.): 0.20 arc sec

RMS-Slope error (sag.): 0.23 arc sec

Micromap 512
PM2-A.D10

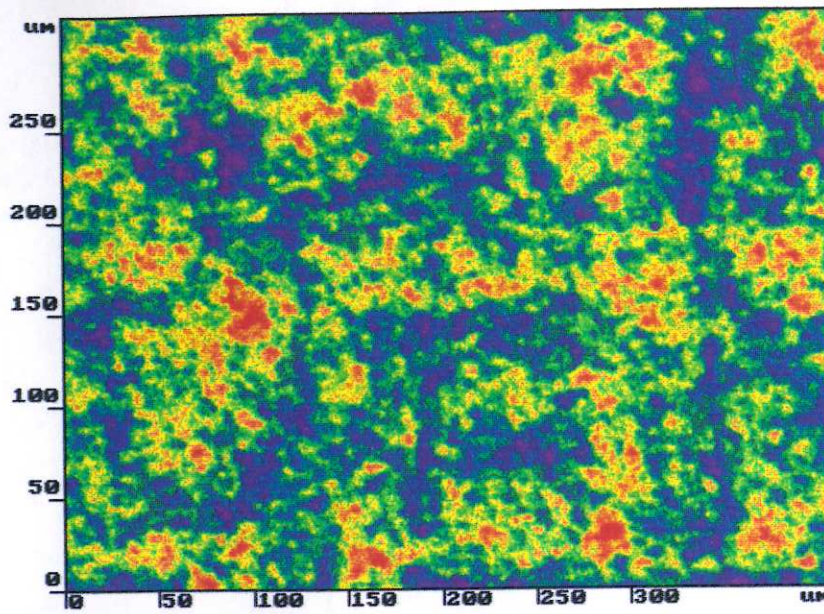
640x478 1x1

SURFACE CONTOUR DISPLAY

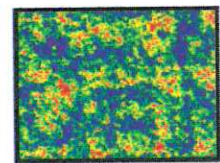
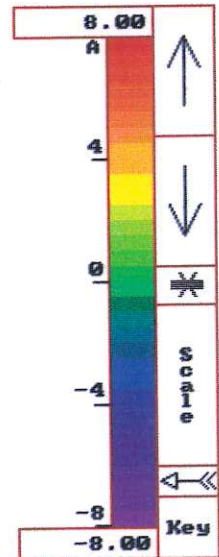
20X

6321A

Research 1.39
10/12/99 11:43



RMS: 2.84 A Term: QUARTIC
Ra: 2.26 A
P-U: 35.29 A
408 um x 314 um



Zoom: 1.0

Micromap 512
PM2-B.D10

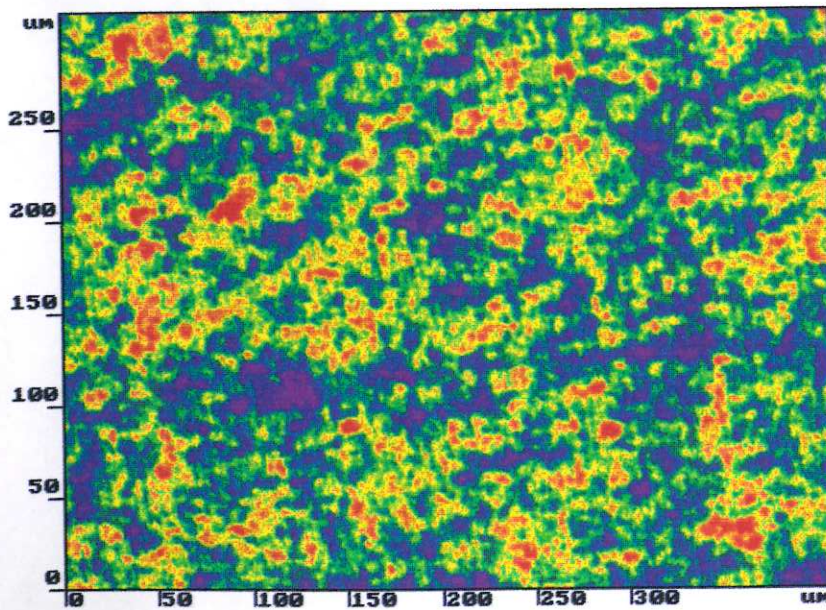
640x478 1x1

SURFACE CONTOUR DISPLAY

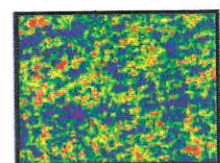
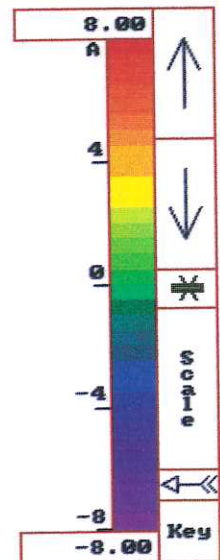
20X

6321A

Research 1.39
10/12/99 11:46



RMS: 3.00 A Term: QUARTIC
Ra: 2.39 A
P-U: 26.68 A
408 um x 314 um



Zoom: 1.0

Micromap 512

PM2-C.D10

640x478

1x1

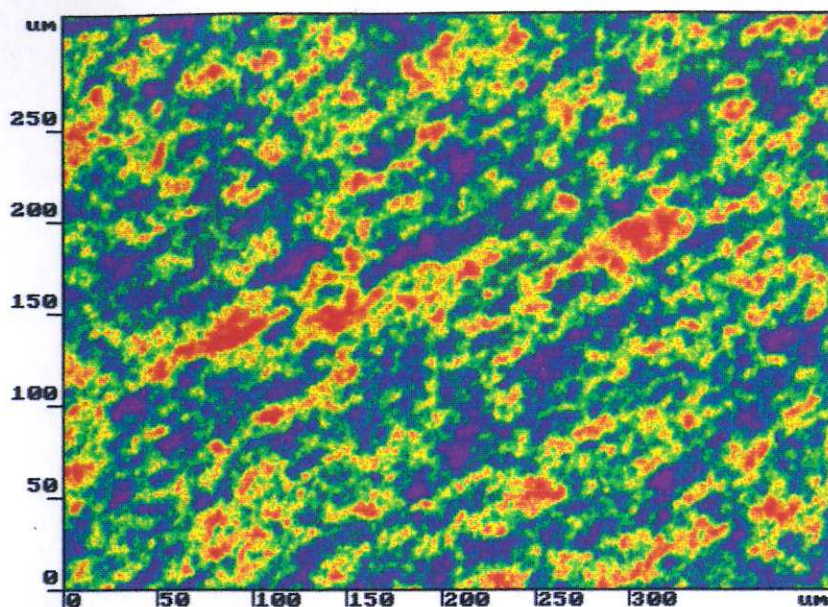
SURFACE CONTOUR DISPLAY

20X

6321A

Research 1.39

10/12/99 11:48



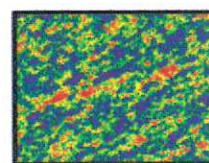
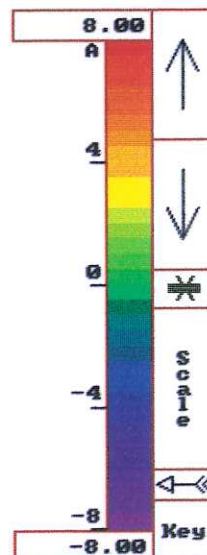
RMS: 3.12 A

Term: QUARTIC

Ra: 2.48 A

P-V: 29.56 A

408 um x 314 um



Zoom: 1.0

Micromap 512

PM2-D.D10

640x478

1x1

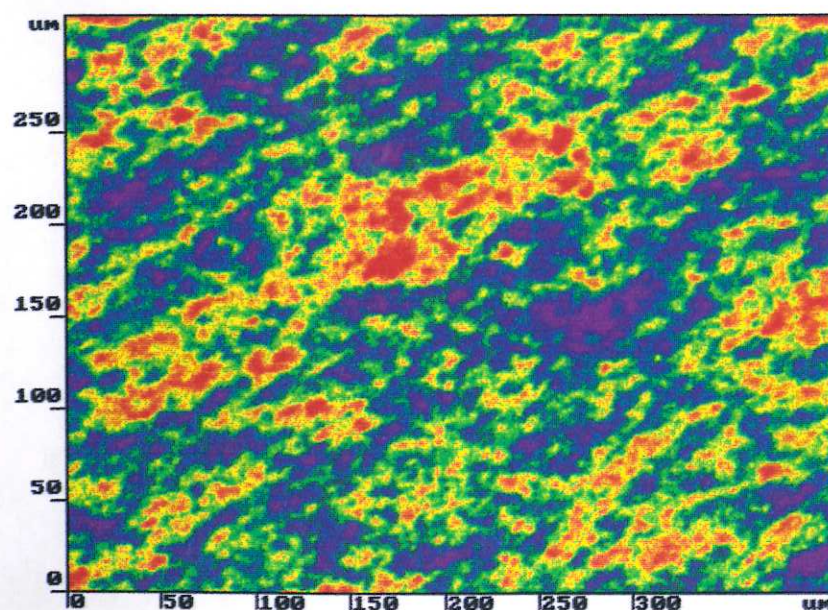
SURFACE CONTOUR DISPLAY

20X

6321A

Research 1.39

10/12/99 11:57



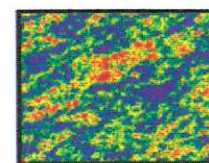
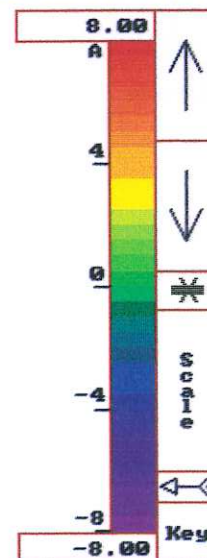
RMS: 3.31 A

Term: QUARTIC

Ra: 2.66 A

P-V: 27.75 A

408 um x 314 um



Zoom: 1.0