

BS03-B
(Repolished, Recoated)

LIGO-T990136-01-D

BLANK

A. DCN: LIGO- T970202-00-D LIGO DETECTOR OPTICS
B. LIGO S/N: BS03 Incoming Inspection Check-off Sheet
Core Optics Blank Material

The purpose of this sheet is to verify material physical dimensions, perform visual inspection, and to facilitate material traceability of LIGO Detector optics. This sheet is to be included in the LIGO Quality Assurance traceability file. Complete a check-off sheet for each optic blank received and inspected.

C. LIGO Contract No.: PC 208421 D. Glass Mfg./Order No: Heraeus/5001652
E. Core optic Material: (BS) FM / ITM / ETM / RM F. Glass Mfg. Part No.: 50785
G. LIGO Drawing No.: D960793-B-D H. Manufacturer's Boule No.: MF, F 8913
I. Date Received at Caltech: 12-01-97

J Verify glass manufacturer's ^{inspection report} ~~Certification~~ against LIGO Component Specification No. E960094-A-D
Attach the applicable Component Specification Verification sheet.

K Attach a copy of the glass manufacturer's ^{inspection report} ~~Certification~~ to check-off sheet.

L Attach the glass manufacturer's birefringence map, ~~inclusion map~~, and data sheet per the above Component Specification. No inclusion map

M Visually inspect for shipping container for damage. If applicable, describe the damage on attached.

N Visually inspect the blanks for damage, for chips on surfaces and edges, or for other defects. If applicable, describe damage/defects on attached sheet.

O Verify core optic blank physical dimensions per applicable LIGO drawing.

Inspection of material diameter. Diameter 10.11 in 256.70 mm

Inspection of material thickness. Thickness 2.08 in 52.84 mm

P Verify that the Registration Mark is present (with arrow pointing to the first surface) as required by LIGO Component Specification. No registration marks present

Q Verify receipt of 25mm X 25mm cylinder Witness Sample(s) required by the LIGO Component Specification and visually inspect for damage. Describe damage on the attached sheet. shipped directly to Heraeus (France)

R Sign and date original packing slip (shipper) and distribute per paragraph 3.R.

Inspect By: [Signature] Date Inspected: 12-02-97

Reviewed and/or accepted by:

Cognizant Engineer: _____ Date: _____

LIGO QA Officer or Designee: _____ Date: _____

LIGO Component Specification Verification Sheet

Mirror Blanks, Beam Splitter

		Serial Number: <i>BS03</i>	Specification	Reported Value	✓
		Mirror Blanks, Beam Splitter	Requirements	Physical Dimensions	LIGO-D960793 - B
Diameter	256mm +1.0mm, -0mm			256.7 mm	✓
Thickness	52 mm +1.0mm, -0mm			52.84 mm	*✓
Chamfer	2.0mm Max 2pl				
Clear Aperture	Central 235mm				
Material	Fused Silica <i>Suprasil #7980 3115</i>			Certification	✓
Registration Mark	"Top" of Optic, 80mm Arrow Points to Side 1			Certification	No
Witness Sample	25mm dia. x 25mm cylindrical			<i>shipped direct</i>	✓
Witness Sample Map				Map Attached	✓
Defect Depth	< 0.5mm			Hand Sketch w/location & dim.	No
Homogeneity Within the Central 150mm	$\leq 5.0 \times 10^{-7}$ p - v $\lambda = 632.8\text{nm}$			Interferogram Homogeneity Map	✓
Homogeneity Within the Central 225mm	$\leq 2.5 \times 10^{-6}$ p - v $\lambda = 632.8\text{nm}$			Interferogram Homogeneity Map	✓
Homogeneity Data	ASCII Format			PC Compatible 3½ in. Disk	No
Birefringence Within the Central 150mm	≤ 1 nm/cm			Certification, Birefringence Map	✓
Birefringence Within the Central 225mm	≤ 5 nm/cm			Certification, Birefringence Map	✓
Bubble & Inclusion within the clear aperture. Max. Inclusion Diameter	Total $\leq 0.03\text{mm}^2$ Per 100cm^3 of Glass. $\leq 0.1\text{mm}$			Hand Sketch w/location & dim.	No
Absorption	2ppm/cm $\lambda = 1.06\text{nm}$			Certification	No
Striae within the Clear Aperture	Grade A per MIL-G-174			Inspection Report	✓

Blnk_BS.doc

OH : _____

Project LIGO

Customer : HERAEUS Amersil Inc. Duluth, Ga 30136-5821
Order No. : 45000023300dtd 30.09.96 as
HAI-Order No. : none
HQS-Order No. : 94908401
Item No. : 2
Quality : Fused silica Suprasil 311 S
HQS melt No. : MF.F 8913
Marking : 960095-IM 15-B503 BN 5059

Diameter : 256,7mm
CA Diameter : $\varnothing 200 \text{ mm} = 0,47 \times E^{-6}$
Thickness : 52,84 mm
Edge : 0,3 - 0,5 mm
Parallelism : 0,08 mm
Roughness : ground
 R_a : 1,08 μm
 R_z : 8,86 μm
Bubble class : 0 ; none bubbles
Birefringence : CA $\varnothing 200 \text{ mm} \leq 5 \text{ nm/cm}$;
Homogeneity : see Interferogram
Striae Grade : A
Granularity : none
Remark : Test Sample ($\varnothing 25 \times 25 \text{ mm}$) with the same marking

POL - Qualitätsprüfung Optik

Date : 06.10.1997

Inspector : Wink

Heraeus
QUARZGLAS

POL-QW

Order Nr.: 94908401 Pos.: 2

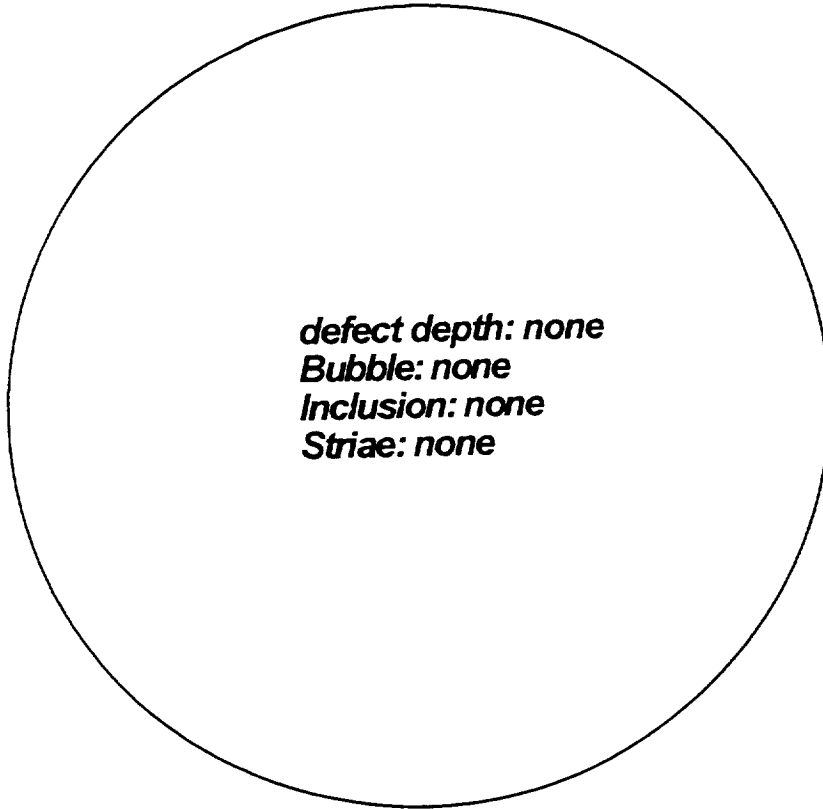
Ø 256,7 mm x 52,84 mm

Quality: Suprasil 311

Plate No.: 960095-1M 15/5059

Date: 6.10.97

Inspector: 



defect depth: none
Bubble: none
Inclusion: none
Striae: none

Diameter	0,03mm	0,05mm	0,08mm	0,12mm	0,2mm	0,31mm	Sum
piece							
mm ²							

TBCS=

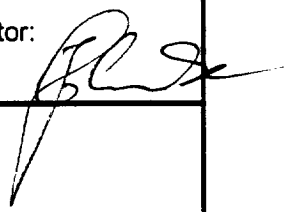
mm²
/100cm³

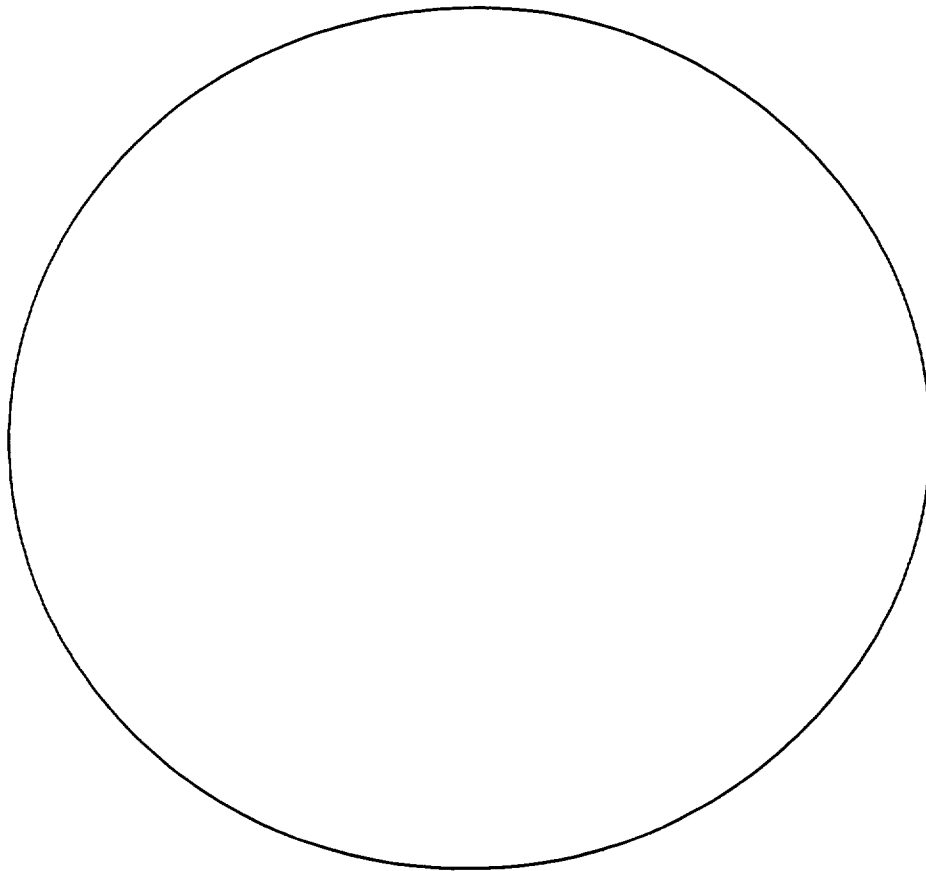
Heraeus
QUARZGLAS

POL - QW

Order No.: 94908401 Pos.: 2
Ø 256,7 mm x 52,84 mm
Plate No.: 960095-1M 15/5059
Residual strain- Report

Date: 6.10.97

Inspector: 

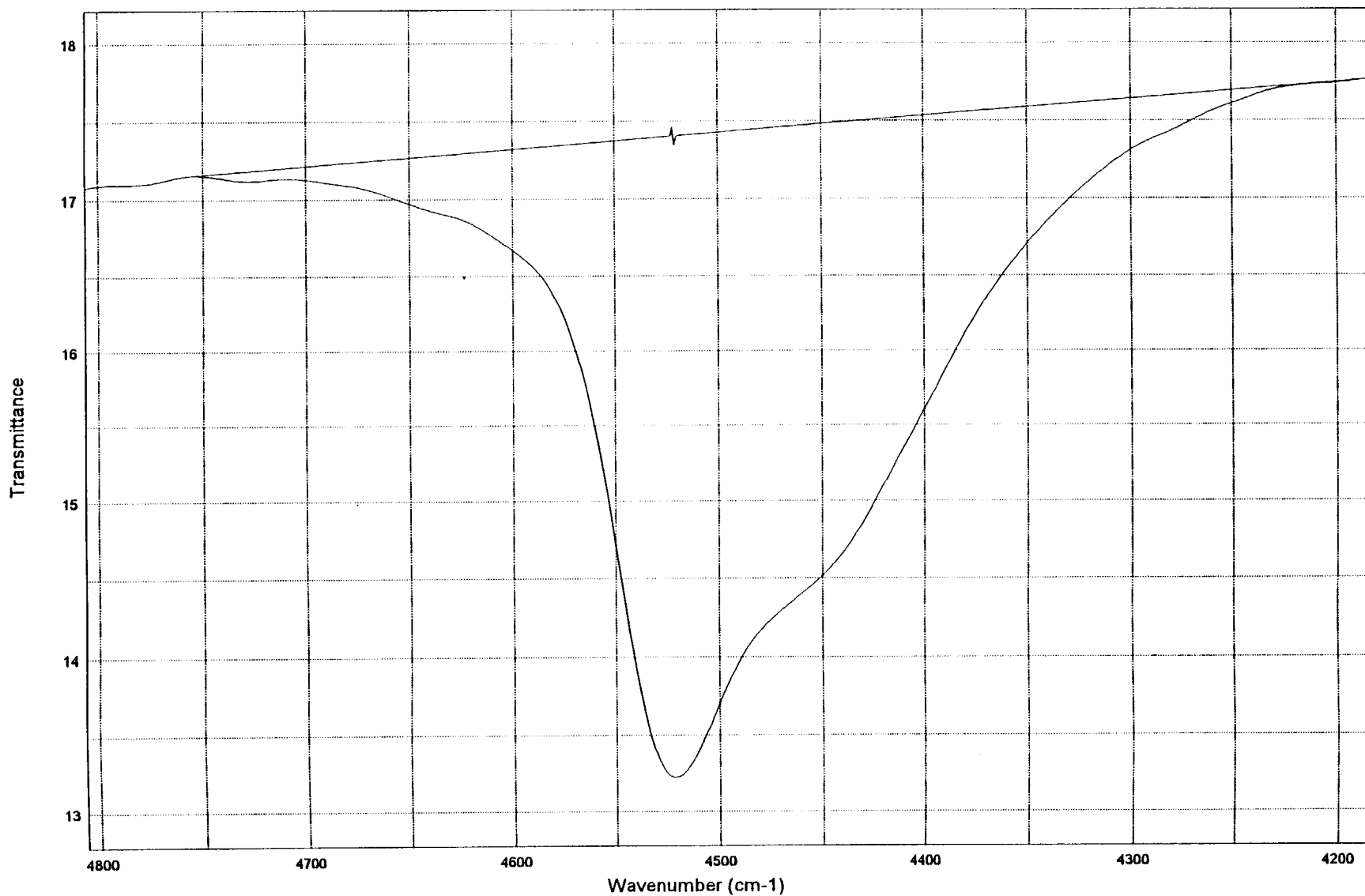


Edge	Center						Pos.
10							nm
2	<1						nm/cm

l0=17.4045 , l1=13.2243 at x=4521

OH-content: 201.9 ppm

MEASURE NO. : 5059
DATE : 05.09.1997 TIME : 12:35
MEASURE START : 10000 1/cm
MEASURE END : 2500 1/cm
OP-DISK-PATH LENGTH : Ko-203-PL: 2.60 cm / Order No.: 9930 3974 / Material: 5059-----OH-content: 201.9 ppm at x=4521



Heraeus
QUARZGLAS

POL-QW

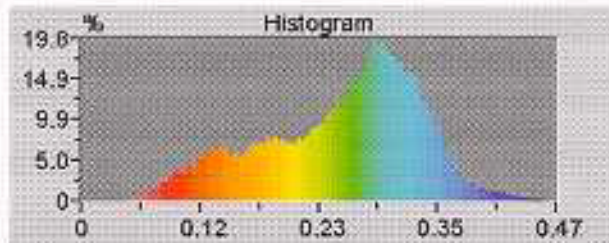
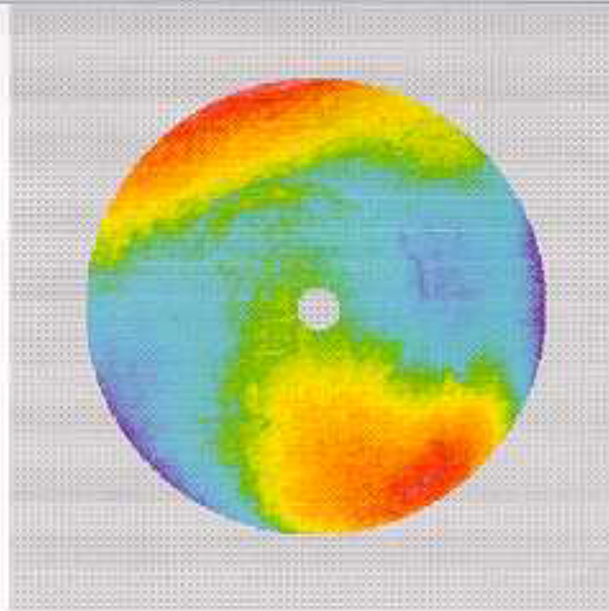
Data taken at 632.8 nm

Date: 04.09.97 Operator: Rf
ID: 505900 No.:

HQS-Order-No.: 98492874
Customer: HAI
Product: LIGO
Pos.-No.: 2
Order-No.:
Comment: 960094-im-xx

Thickness: 53.0 mm
sample diameter: 280.0 mm
CA diameter: 200.0 mm
examined diameter: 200.3 mm

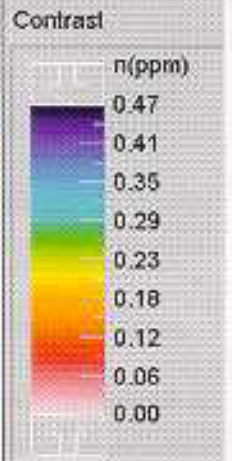
Center: (0.0mm,0.0mm)
Radius: 100.1mm
Points: 69729



Sub. Terms	Magn.	Angle
X Tilt	0.1243	-76.3872
Focus	-0.0268	
Astigm.	0.1509	-68.9243
Coma	0.0701	84.3668
SA3	0.0031	

Phase Data

Unit	n(ppm)
PV:	0.47
RMS:	0.076
Scale:	0.5



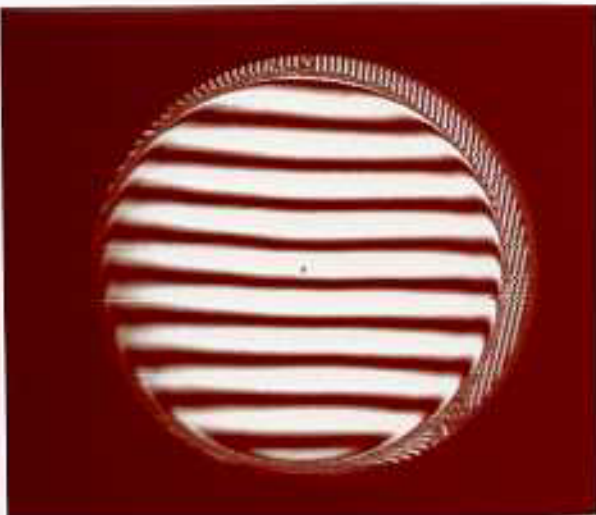
Reset

UpperL	0.468
LowerL	0.000

File: 505900.tif, 04.09.97, 17:39

XPS-12"

BSØ3



Heraeus AMERSIL

Heraeus Amersil Inc
3473 Satellite Blvd.
Duluth, GA 30096

Sales Order #: 5001652
Delivery #: 30039279

Delivery Note/ Packing List

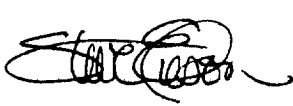
Terms: FOB Duluth
Customer PO #: pc208421

SOLD TO: Customer # 1658
CALIFORNIA INST OF TECH
ACCOUNTS PAYABLE 201-6
PASADENA, CA 91125
USA

SHIP TO: CUSTOMER # 5594
CALIFORNIA INST OF TECH
Attn: Gari Billingsley
391 SOUTH HOLLISTON
PASADENA, CA 91125
USA

Order Date: 09/24/1996
Account #:
Tracking #: 1Z3944240200060485
0476 0467 0458 0449 0430

Salesman: 00000020 MARC SCHNEIDER
Route: UPS002 UPS Blue 2 Day PPA
Total Weight: 252.000 LB
Shipping Cartons: 00006

LINE ITEM	MATERIAL NUMBER	DESCRIPTION	UOM	SHIP DATE	NOTICE	CURRENT SHIPMENT
000001	50785	DISC, SUP 311, G, 256 X 52 SUPRASIL 311 DISC, GROUND, 256MM DIA X 61MM THK. PER LIGO PROJECT DRAWING D980793-A-D REV A AND SPECIFICATION LIGO-E960094 REV A	EA	11/24/1997	<p>Open cartons and compare to bill of lading and packing list promptly. Claims for shortages or breakage must be made within 15 days after receipt of goods.</p> <p>Unpack with great care. Please do not discard the packing case nor any of the packing material until contents of case have been carefully checked and found correct and in good order.</p> <p>In case of damaged materials regardless of the external condition of the cartons, the consignee must institute the following procedure. Where shipments are made FOB Point of Shipment, it is the consignee's responsibility to file claim with the carrier and obtain an inspection report from the carrier for truck, air freight or parcel post shipments. For UPS shipments or FOB Destination shipments, all requests for inspection of damaged material should be made by the shipper and the consignee must notify Heraeus-Amersil Inc. promptly of such breakage to institute a claim. Damaged material, packing material, and packing case must be retained for carrier's inspection.</p> <p>Return no goods unless authorized. If material is not satisfactory, notify us and hold material subject to our order.</p>	6.000
		<p>Received complete 12-02-97 </p>				

jm

SUBSTRATE

A. DCN: LIGO-
B. LIGO S/N: BS03-B

LIGO DETECTOR OPTICS
Incoming Inspection Check-off Sheet
Core Optics Polished Substrate
(Repolish)

The purpose of this sheet is to verify material physical dimensions, perform visual and microscopic inspection, and to facilitate material traceability of LIGO Detector optics. This sheet is to be included in the LIGO Quality Assurance traceability file. Complete a check-off sheet for each optic blank received and inspected.

C. LIGO Contract/Purchase No.: PC167159 D. Substrate Polisher: CSIRO
E. Core optic Material: BS / FM / 2ITM / 4ITM / ETM / RM F. Date Received: _____

G Verify glass polisher's Certification with LIGO Component Specification No. E960100-B-D
Attach the completed LIGO Component Specification Verification Sheet.

H Attach a copy of the glass polisher's Certification Document and data sheet to check-off sheet.

I Verify receipt of an IBM PC compatible disc in ASCII format of all Surface Data per the applicable LIGO Component Specification sheet

J Attach the surface maps supplied by vendor per above Component Specifications to the check off sheet.

K Visually inspect for shipping container damage. If applicable, describe damage on attached sheet and notify the Cognizant Engineer

L Visually inspect the polished substrate for shipping damage, for chips on surfaces and edges, or for other defects. If applicable, describe damage/defects on attached sheet and notify Cognizant Engineer.

M Verify polished substrate's physical dimensions per applicable LIGO drawing.

No changes from previous polish

- Inspection of material diameter. Diameter _____ in _____ mm
- Inspection of material thickness Thickness _____ in _____ mm
- Wedge Angle _____

N Verify that the Serial Number is present in the proper format as required by LIGO Component Specification.

O Verify that the Registration Mark (line with arrow pointing toward surface #1) is present as required by LIGO Component Specification.

P Inspect the sides and bevels with the naked eye in normal room light and against a black background to verify that there is no gray, scuffs or scratches per the applicable LIGO Component Specification.

Q Use a dark field microscope at 5X magnification to inspect the polished optic for scratches and defects over the central 80 mm diameter per the applicable LIGO Component Specification.

LIGO-INS-000001-000001

R Sign and date original packing slip (shipper) and distribute per paragraph 3.R.

Inspection By: Steven Gibson Date Inspected: _____

Reviewed and/or accepted by:

Cognizant Engineer: _____ Date: _____

LIGO QA Officer or Designee: _____ Date: _____

FM300

Figure 1

**LIGO DETECTOR OPTICS
Incoming Inspection Check-off Sheet**

Core Optics Polished Substrate

COMMENTS/DISCREPANCIES: (Disposition damage/discrepancies per LIGO Quality Assurance Plan (LIGO M960076-00-P) paragraphs 5.12 and 5.12.1.) _____

SKETCHES:

DISPOSITIONS: _____

Substrate, Beam Splitter	Serial Number: BSØ3-B		Specification	Reported Value	✓
	Surface 1	Surface Figure Over Central 200mm dia.	Flat		
		Radius of Curvature	> 200 km convex > 720 km concave	1450 Km (3.2 nm)	✓
		Astigmatism	< 16nm p-v	-5.7 nm	✓
	Surface 2	Surface Figure Over Central 200mm dia.	Nominally Flat		
		Radius of Curvature of the Wavefront	> 140 km convex > 500 km concave	-907 Km (-5.8 nm)	✓
		Astigmatism	< 23nm p-v	-7.1 nm	✓
	Surface Errors	Low Spatial Frequency Band Central 80mm	$\leq 4.3 \text{ cm}^{-1}$ $\sigma_{\text{rms}} < 1.6\text{nm}$	1.2 nm	✓
		Low Spatial Frequency Band Central 200mm	$\leq 4.3 \text{ cm}^{-1}$ $\sigma_{\text{rms}} < 3.2\text{nm}$	1.3 nm	✓
		High Spatial Frequency Band Central 80 & 200 mm	$\leq 4.3 - 7,500 \text{ cm}^{-1}$ $\sigma_{\text{rms}} < 0.4\text{nm}$	0.17 0.18nm	✓

Scratches, Point Defects & Polish	Specification		Certification	✓
	Scratches	The Total Area of scratches within the central 80mm diameter shall not exceed 75×10^3 square micrometers (width x length).	Hand Sketch w/dimensions	
		The total area of scratches outside the central 80 mm diameter shall not exceed 750×10^3 square micrometers.	Hand Sketch w/dimensions	
	Point Defects	There shall be no more than 30 point defects within the central 80mm diameter. 10,000	Hand Sketch w/dimensions	✓
		There shall be no more than 100 point defects on the entire surface. Point defects of radius greater than 25 micrometers are treated like scratches for the purpose of this specification. Point defects of radius less than 2.5 micrometers are disregarded. 15,000	Hand Sketch w/dimensions	✓
	Side/Bevel Polish	Sides and bevels shall be polished from a three micrometer grit finish. These surfaces shall appear transparent with no gray, scuffs or scratches visible to the naked eye when viewed in normal room light against a black background.	Inspection Report	✓

LIGO Component Specification Verification Sheet Beam Splitter

LIGO Certification Report

This Certification Package relates to the following substrate: **Beamsplitter (Re-worked)**

Serial number: BS03-B

The Package consists of the following documents:

1. Printed documents

HABA - LIGO - C - PD:	Certification of Physical Dimensions and Registration Mark location, orientation and dimensions	* *
HABA - LIGO - C - SB:	Certification of Side and Bevel Polish	* *
HABA - LIGO - C - SP:	Certification of Scratches and Point Defects	
HABA - LIGO - C - SN:	Certification of Serial Number location, dimensions	* *
HABA - LIGO - C - SF:	Certification of Surface Figure for Sides 1 and 2 and transmitted wave front	
HABA - LIGO - C - SL:	Certification of Surface Errors - Low Frequency, for Sides 1 and 2	
HABA - LIGO - C - SH:	Certification of Surface Errors - High Frequency, for Sides 1 and 2	
Attachment 1	Hard copy print out of LADI data for Side 1 with piston, tilt removed and also for piston, tilt, power, astigmatism removed	
Attachment 2A	Hard copy print out of LADI data for Side 2 with piston, tilt, removed and also for piston, tilt, power, astigmatism removed	
Attachment 2B	Hard copy print out of LADI data for transmitted wave front in measurement configuration where beam enters through side 2, reflects from side 1 and exits through side 2, with piston, tilt removed and also for piston, tilt, power, astigmatism removed	
Attachment 3	Hard copy printouts of TOPO 2D data obtained with 2.5X and 40X heads at three central positions (side 1)	
Attachment 4	Hard copy printouts of TOPO 2D data obtained with 2.5X and 40X heads at three central positions (side 2)	

** no change from previous certification - not included here.*

LIGO Certification Report

2. Electronic data

Surface maps for sides 1 and 2 are available at the CSIRO ftp site under the following file names:

LADI data:	BS3B1R.zip	(Side 1)	BS3B2R.zip (Side 2) BS3B2AR.zip (wave front)
TOPO data: (2.5X)	T2BS31AR.asc	(Side 1)	T2BS32AR.asc(Side 2)
	T2BS31BR.asc		T2BS32BR.asc
	T2BS31CR.asc		T2BS32CR.asc
(40X)	T4BS31AR.asc		T4BS32AR.asc
	T4BS31BR.asc		T4BS32BR.asc
	T4BS31CR.asc		T4BS32CR.asc

1	Substrate Type:	Beamsplitter
2	Serial Number:	BS03-B
3	Physical quantity certified:	Scratches and Point Defects
4	LIGO specification reference:	E960100-B-D
5	CSIRO measurement/inspection procedure reference:	HABA-LIGO-M-SP-A
6	Variations to the measurement/inspection procedure: (indicate Yes/No and attach separate sheet if Yes)	No.
7	CSIRO Log Book Reference	LN00062
8	Team member responsible for measurement/inspection:	E Pavlovic
9	Measurement/inspection results reviewed by:	C Walsh

10. Results

	Numbers of point defects		Total Area of scratches (square micrometres)	
	Inside central 80 mm	Entire surface (235 mm)	Inside central 80 mm	Outside central 80 mm (235 mm)
Surface 1	nil	nil	<10,000	<15,000
Surface 2	nil	nil	<10,000	<20,000

11. Certification

The measurements and inspection data presented in this report were obtained using the procedures outlined in the relevant CSIRO procedures document (sec. 5). These results have been reviewed against the LIGO specifications (sec. 4). Taking into account the variations (if any) from these measurement procedures noted in sec.6, CSIRO certifies the substrate to comply with the LIGO specification for this physical quantity.

Project Manager:



Chris Walsh

Date:

22 Dec 98

~~TRUCK~~

2002

2503
SIDE 1

2003

2000

4000

2002

100

2003

Thin

0001

0001

~~0001~~

0002

0003

0004

0005

B503

SIDE 2

1	Substrate Type:	Beamsplitter
2	Serial Number:	BS03-B
3	Physical quantity certified:	Surface Figure
4	LIGO specification reference:	E960100-B-D
5	CSIRO measurement/inspection procedure reference:	HABA-LIGO-M-SF-A
6	Variations to the measurement/inspection procedure: (indicate Yes/No and attach separate sheet if Yes)	The measurement of wave front as per E960100-B-D has been replaced by a specification on the wave front transmitted through the substrate, and is calculated as a sum of the measurement on side 1 and the wave front measured as per E960100-B-D (refer CSIRO/Caltech fax correspondence)
7	CSIRO Log Book Reference	LLN/0137-02 p 62
8	Team member responsible for measurement/inspection:	E Pavlovic
9	Measurement/inspection results reviewed by:	B Oreb

10. Results

	Radius of Curvature in km (Parabolic sag in nm)	Astigmatism (nm)	Electronic data file reference
Surface 1	1450 km (3.2 nm)	-5.7	BS3B1R.zip
Surface 2	-907 km (-5.8 nm)	-7.1	BS3B2R. zip
Wave front*	>1800 km (-2.8 nm)		BS3B2AR.zip

* Measured as per the test procedure in E960100-B-D. Figure quoted and phase map are for the equivalent of a single pass.

Transmitted wave front (single pass): The parabolic sag equivalent to that of a wave front transmitted through the beam splitter can be found by adding the sag measured for surface 1 to that measured for the single pass-equivalent of a wave front double passing the material after reflection from side 1 (shown in the table above).

The combined sag is **0.4 nm**, which lies within the tolerance band agreed with Caltech of $14 \text{ nm} > \text{Sag} > -50 \text{ nm}$.

Hardcopies of the phase maps are attached to this certification as part of Attachment 1 for Side 1, Attachment 2A for Side 2 and Attachment 2B for the wave front measured as per E960100-B-D. The phase of the wave front shown in Attachment 2B is equivalent to a single pass measurement. Phase map data is stored in electronic format at the CSIRO ftp site under the filenames shown in the third column.

11. Certification

The measurements and inspection data presented in this report were obtained using the procedures outlined in the relevant CSIRO procedures document (sec. 5), modified during subsequent discussions and fax correspondence. These results have been reviewed against the LIGO specifications (sec. 4). Taking into account the variations (if any) from these measurement procedures noted in sec.6, CSIRO certifies the substrate to comply with the LIGO specification for this physical quantity.

Project Manager:

Chris Walsh
22 Dec 98

Chris Walsh

Date:

LADI CERTIFICATION DATA

Title: BS_31R

Date: 12/11/98

Diameter: 200 mm

Astig: 5.7 nm

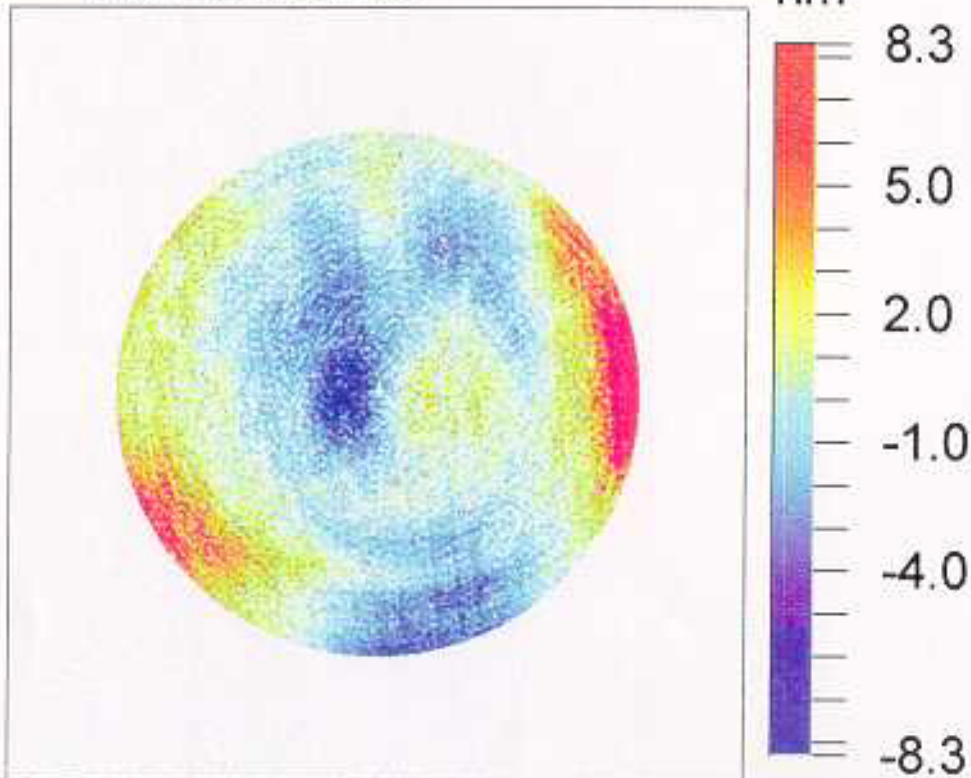
Power: 3.2 nm



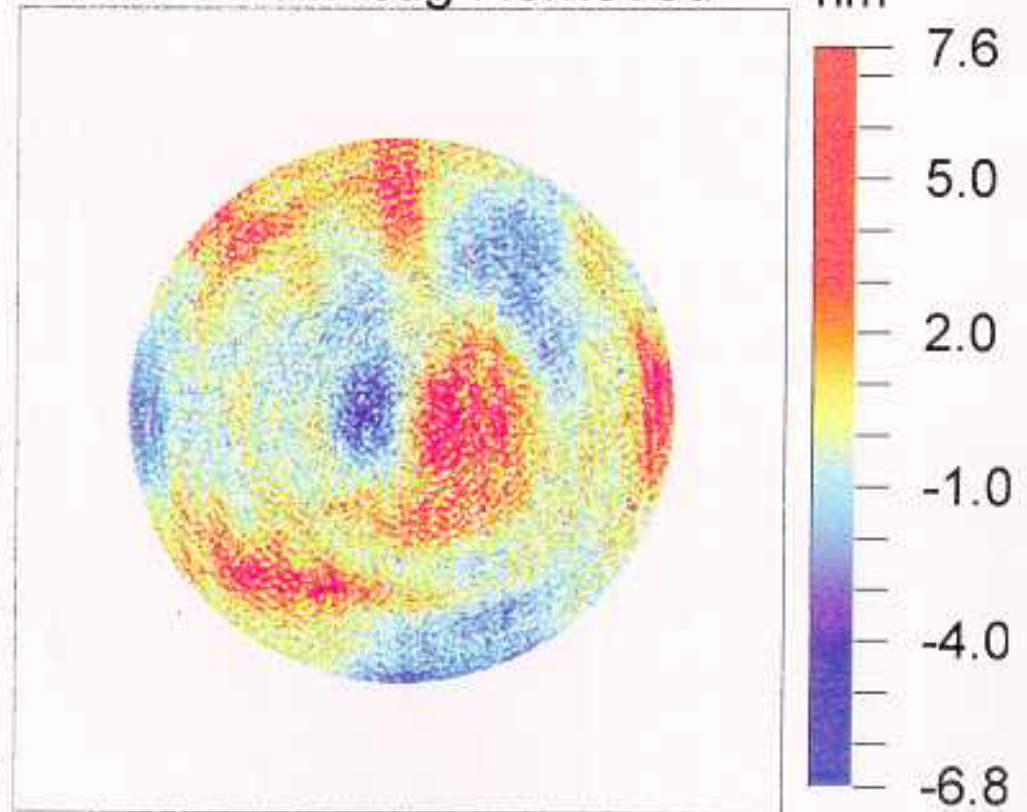
PV: 14.4 nm

RMS: 1.3 nm

Tilt Removed



Tilt/Power/Astig Removed



LADI CERTIFICATION DATA

Title: BS_32R

Date: 12/02/98

Diameter: 200 mm

Astig: -7.1 nm

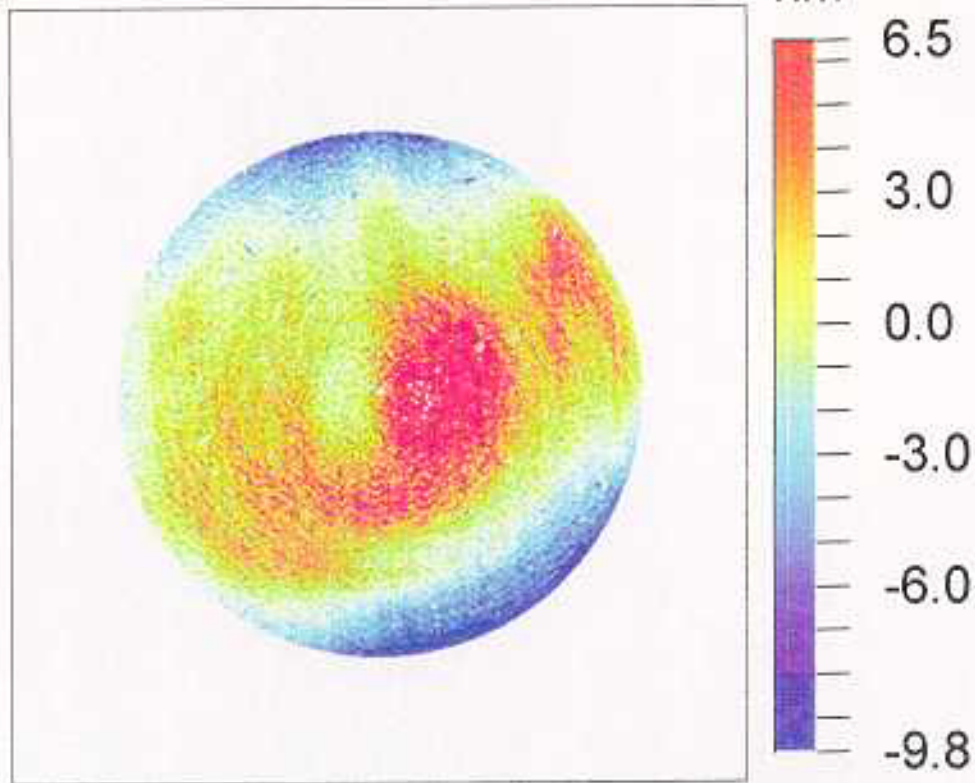
Power: -5.8 nm



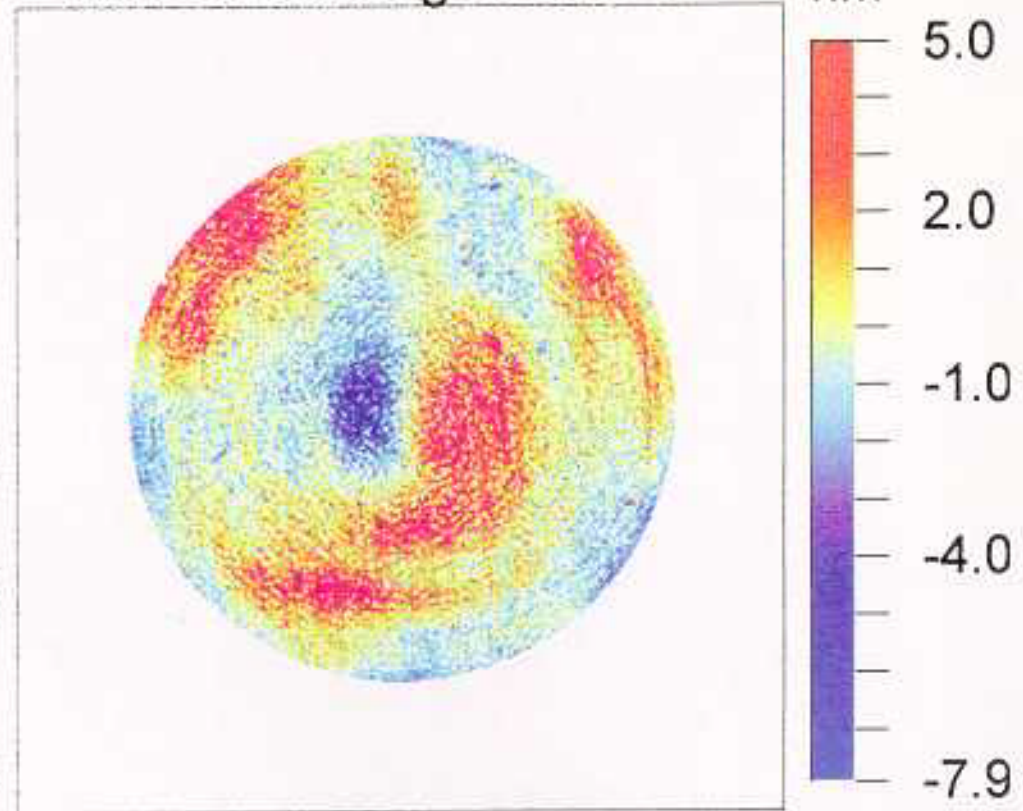
PV: 12.9 nm

RMS: 1.2 nm

Tilt Removed



Tilt/Power/Astig Removed



LADI CERTIFICATION DATA

Title: BS_3TR

Date: 12/02/98

Diameter: 200 mm

Astig: -6.1 nm

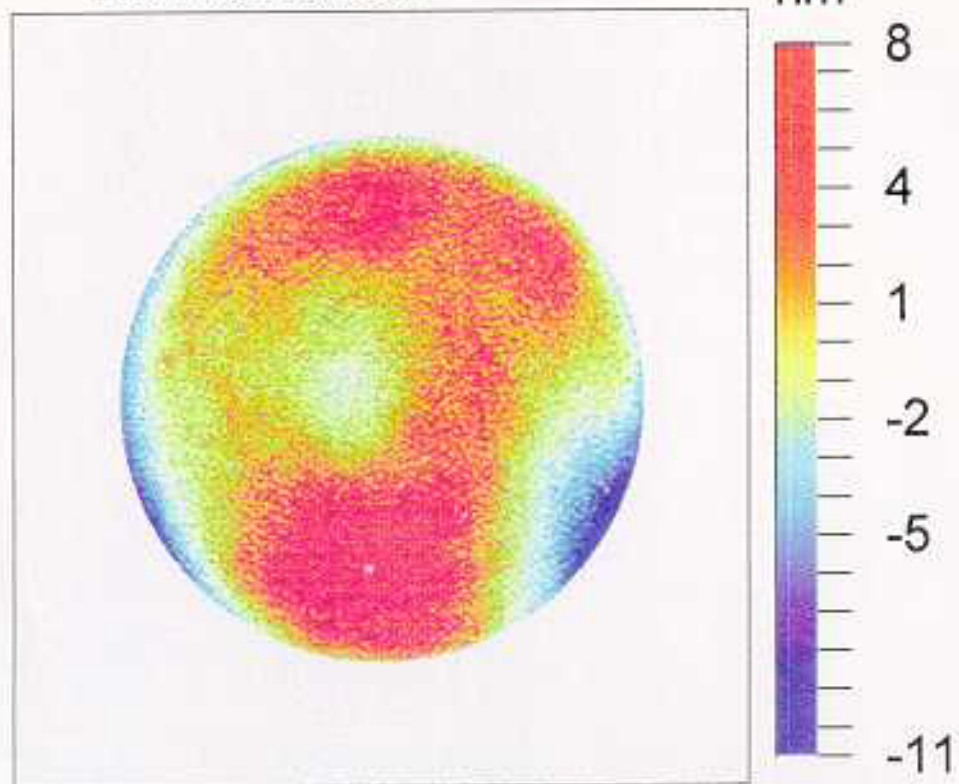
Power: -2.8 nm



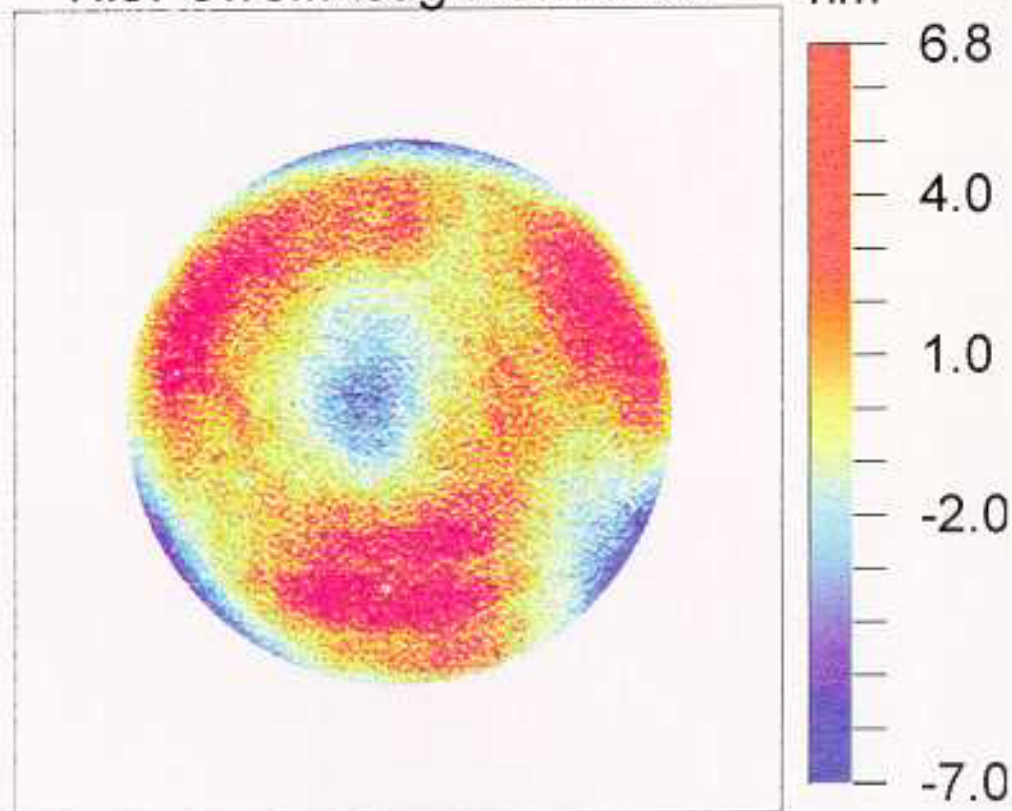
PV: 13.8 nm

RMS: 1.5 nm

Tilt Removed



Tilt/Power/Astig Removed



LIGO Certification Report **Surface Errors - Low**

1	Substrate Type:	Beamsplitter
2	Serial Number:	BS03-B
3	Physical quantity certified:	Surface Errors - Low Spatial Frequency
4	LIGO specification reference:	E960100-B-D
5	CSIRO measurement/inspection procedure reference:	HABA-LIGO-M-SL-A
6	Variations to the measurement/inspection procedure: (indicate Yes/No and attach separate sheet if Yes)	No
7	CSIRO Log Book Reference	LLN/0137-02 p 62
8	Team member responsible for measurement/inspection:	E Pavlovic
9	Measurement/inspection results reviewed by:	B Oreb

10. Results

	Low Frequency Surface Errors (nm)	
	80 mm aperture	200 mm aperture
Surface 1	1.2	1.3
Surface 2	0.8	1.5

Hardcopies of the phase maps over the central 200 mm with piston, tilt, power and astigmatism removed are enclosed with this certification in Attachment 1 for Side 1 and Attachment 2 for Side 2.

11. Certification

The measurements and inspection data presented in this report were obtained using the procedures outlined in the relevant CSIRO procedures document (sec. 5). These results have been reviewed against the LIGO specifications (sec. 4). Taking into account the variations (if any) from these measurement procedures noted in sec.6, CSIRO certifies the substrate to comply with the LIGO specification for this physical quantity.

Project Manager:  Chris Walsh
 Date: *22 Dec 98*

1	Substrate Type:	Beamsplitter
2	Serial Number:	BS03-B
3	Physical quantity certified:	Surface Errors - high spatial frequency
4	LIGO specification reference:	E960100-B-D
5	CSIRO measurement/inspection procedure reference:	HABA-LIGO-M-SH-A
6	Variations to the measurement/inspection procedure: (indicate Yes/No and attach separate sheet if Yes)	Data were analysed using PC-based software routines rather than HP-based routines.
7	CSIRO Log Book Reference	LLN/091
8	Team member responsible for measurement/inspection:	F Lesha
9	Measurement/inspection results reviewed by:	C Walsh

10. Results

10.1 Surface errors in nanometres averaged over sampling locations within central 80 mm:

Side 1: 0.17
Side 2: 0.14

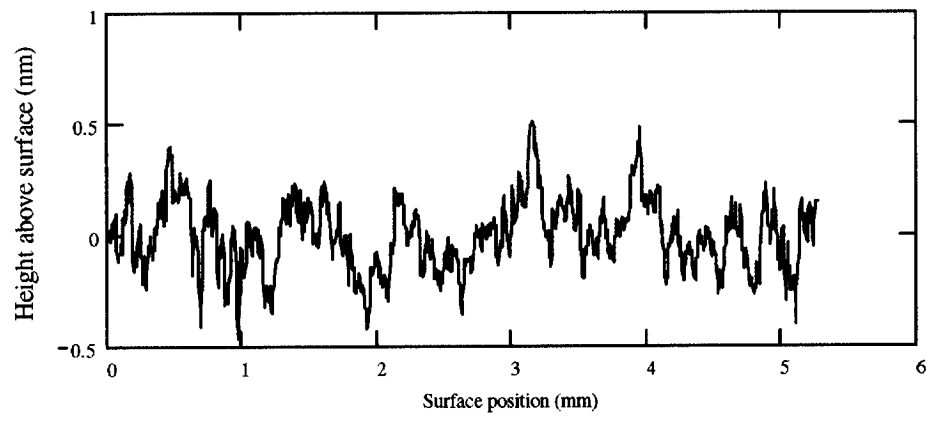
10.2 Surface errors in nanometres averaged over all sampling locations on surface:

Side 1: 0.18
Side 2: 0.19

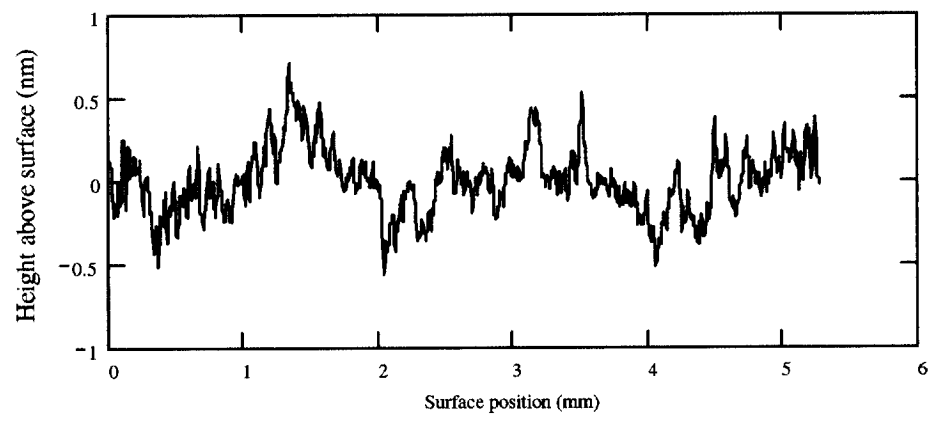
10.3 Surface errors in nanometres at different positions A through H on surface:

	A	B	C	D	E	F	G	H
Surface 1	0.18	0.17	0.17	0.16	0.17	0.20	0.18	0.21
Surface 2	0.20	0.08	0.16	0.15	0.12	0.39	0.22	0.20

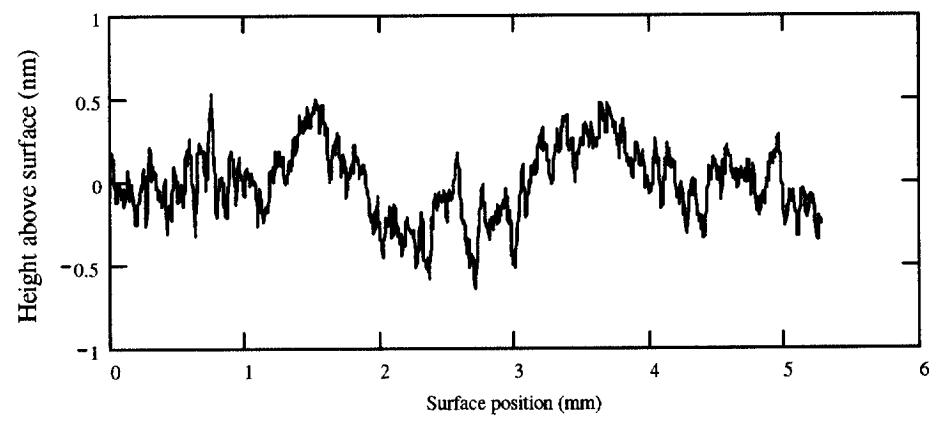
Two - dimensional surface maps at three central locations are available at the CSIRO ftp site under filenames of the form TMBS0YZAR.asc, where M is the objective used (M=2 for 2.5X, 4 for 40X), BS is the substrate type, 0Y is the number, Z = 1 or 2 is the side and A = A, B, C, ... is the sampling position and R indicates that the substrate has been re-worked. Hard copies of the data are at Attachment 3 (Side 1) and Attachment 4 (Side 2).



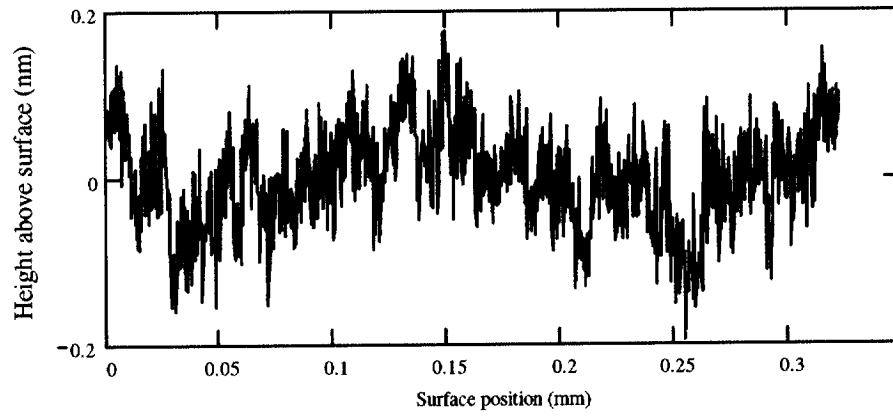
T2BS31AR.asc



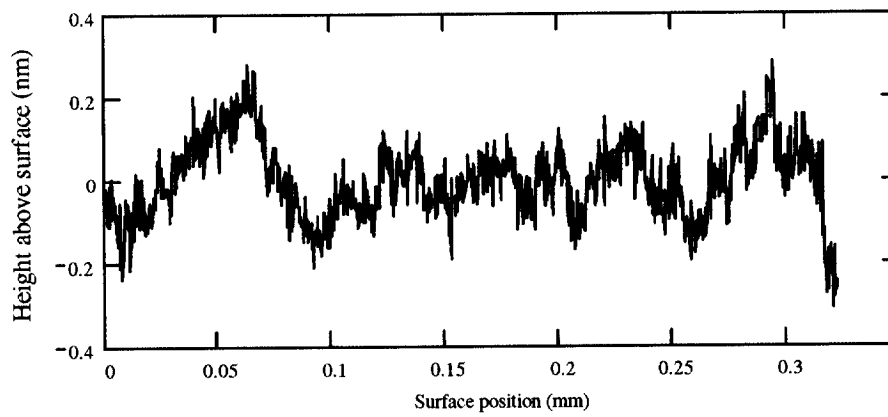
T2BS31BR.asc



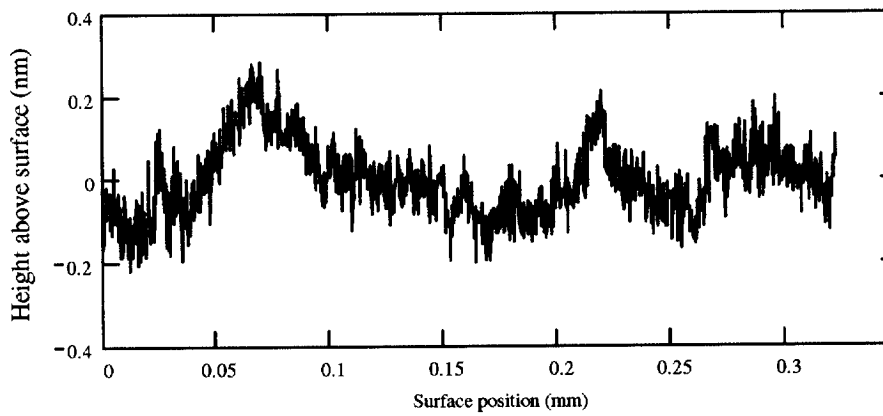
T2BS31CR.asc



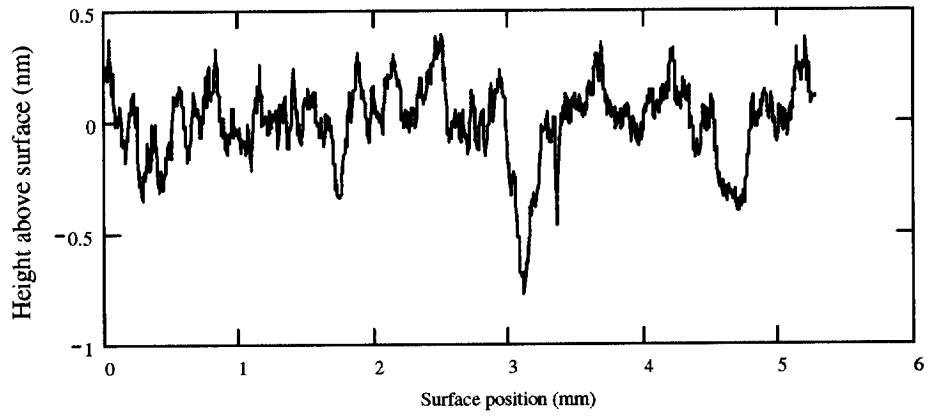
T4BS31AR.asc



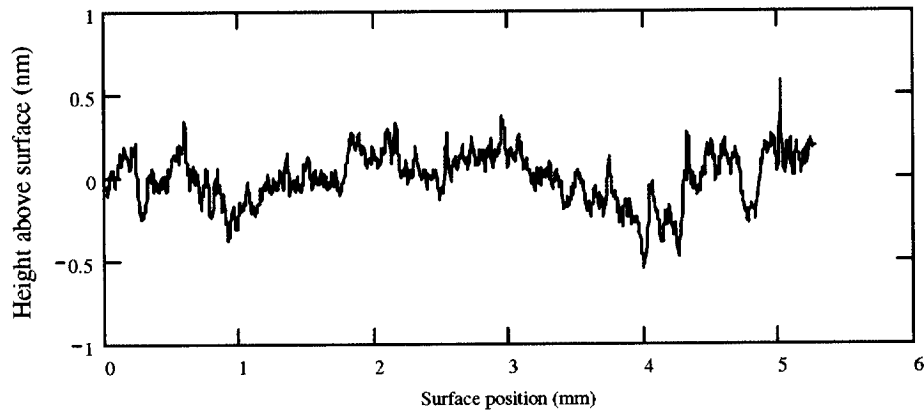
T4BS31BR.asc



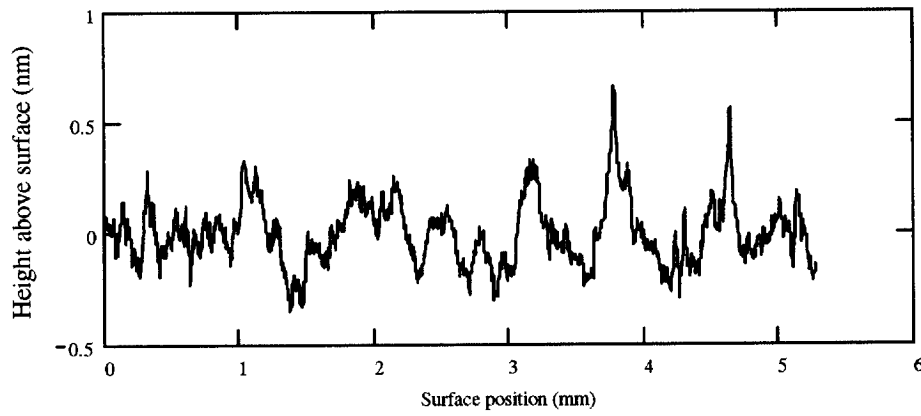
T4BS31CR.asc



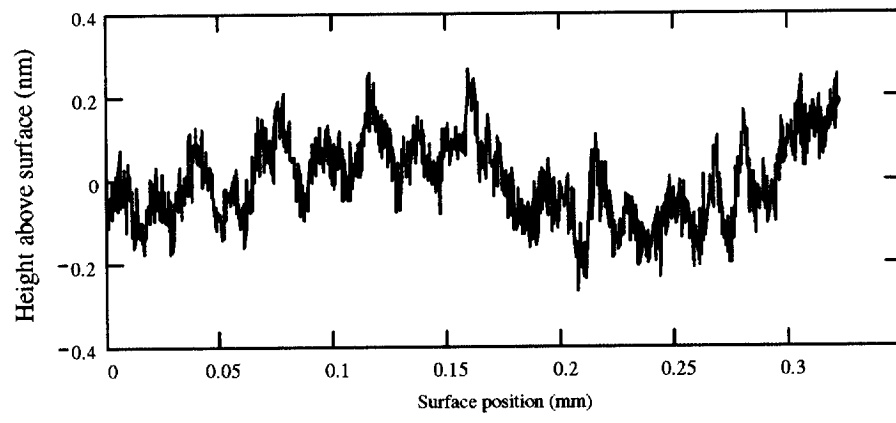
T2BS32AR.asc



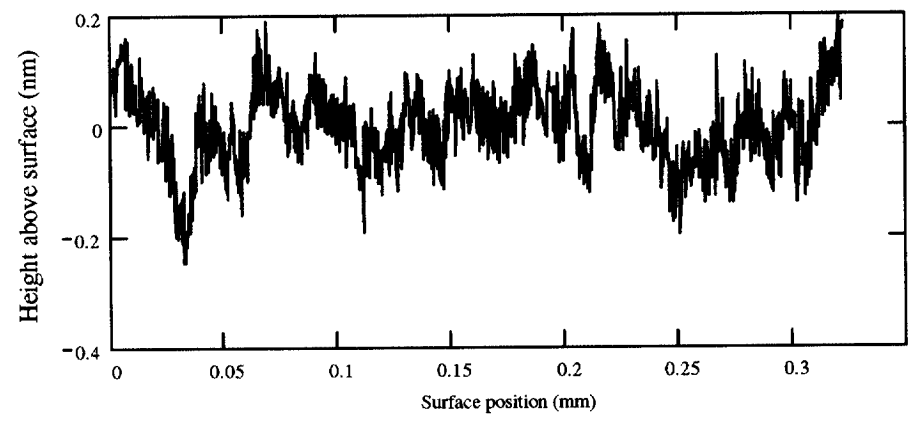
T2BS32BR.asc



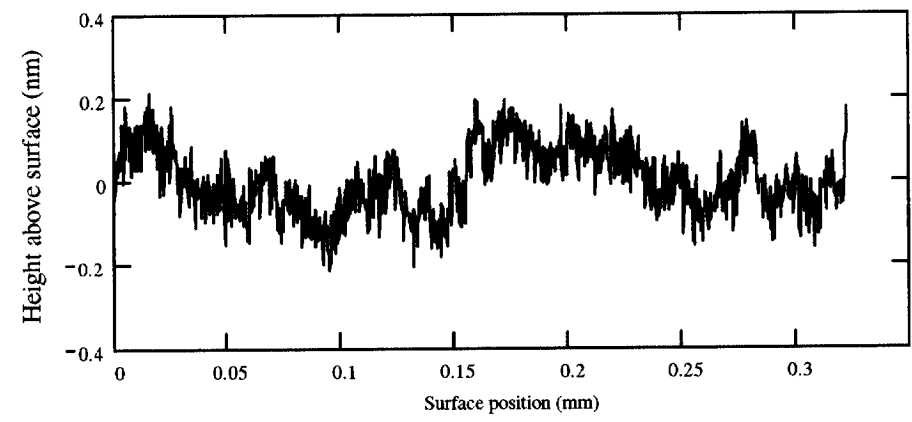
T2BS32CR.asc



T4BS32AR.asc



T4BS32BR.asc



T4BS32CR.asc

MIRROR



Research Electro-Optics Inc.

CERTIFICATE OF CONFORMANCE

Section 3.14/REO QC Manual, Q-001, Doc. No. V:QA:REO 014, Rev. "B", 09/13/96

Certificate of Conformance from: **Research Electro-Optics (REO) Inc.**
1855 South 57th. Court
Boulder, Colorado 80301
(303) 938-1960, Fax (303) 447-3279

Research Electro-Optics (REO), Inc. hereby certifies that the items listed below have been inspected and tested to the extent necessary to conform with all the requirements of the noted Purchase Order, drawing, and applicable specification(s). Inspection and test data are on file at our facility and will be furnished to customer upon request.

- Date of shipment : 22 Feb 99
- Customer Name, Purchase Order No. : Cal Tech / LIGO PC162519
- Customer Part Number & Revision : LIGO-980069-00-D
- Part Description : Beam Splitter
- REO Job No. : OPT05831 511 0X917
OPS00743 Run No.: 521 0X919
- Qty. Shipped/Lot No. : 2 ea Beam Splitter, BS03, BS04
2 ea. FS witness PC.

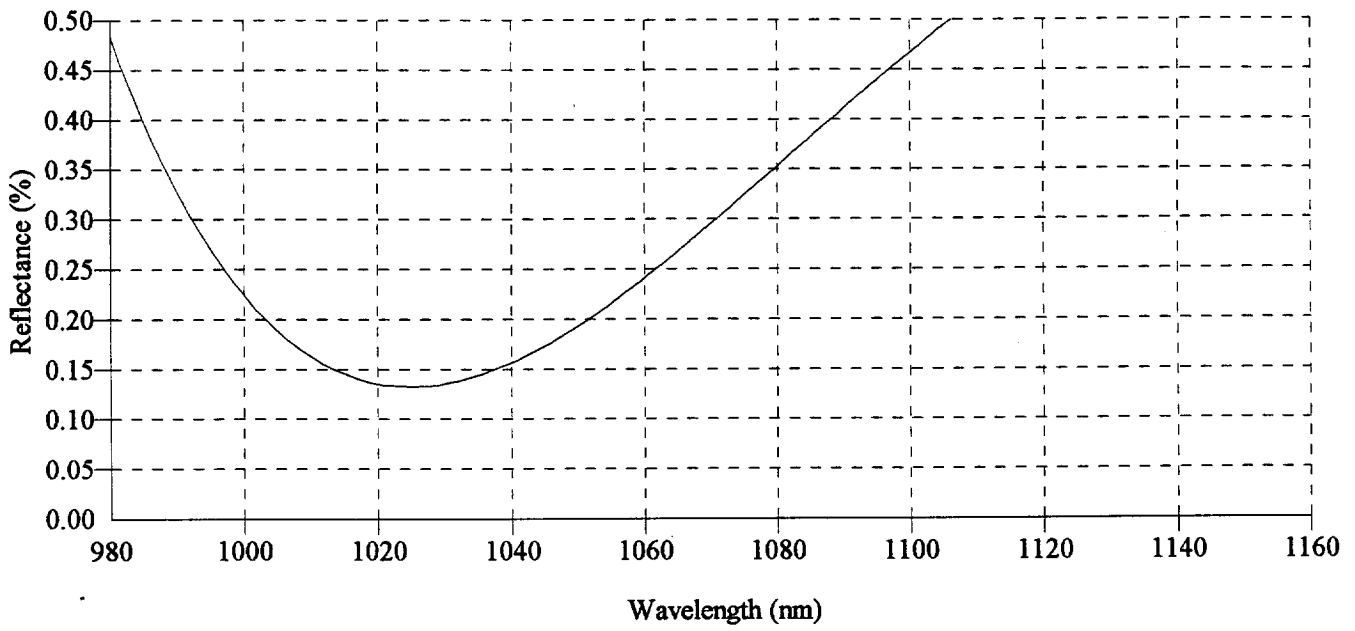
Test data (included)

Comment:

Certified by: [Signature], 2/22/99
Quality Assurance
Verified by: [Signature], 22, Feb, 99
Engr/Tech

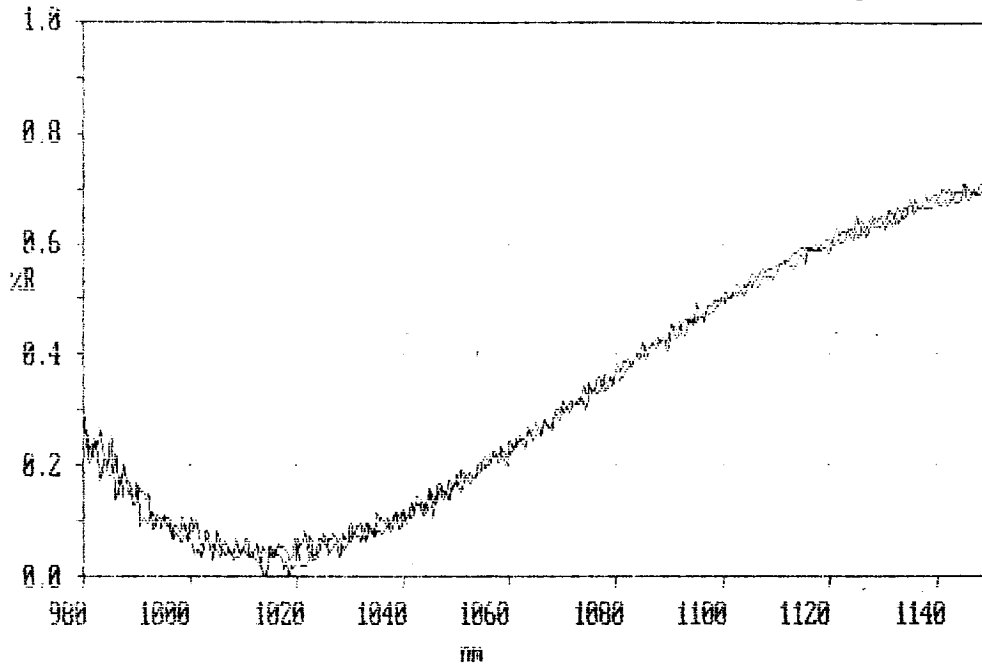
NOTE
Certificate must accompany the package to be shipped or attached to the outside of the same box to which the "Packing Slip" envelope is attached.

LAR45PA: Reflectance



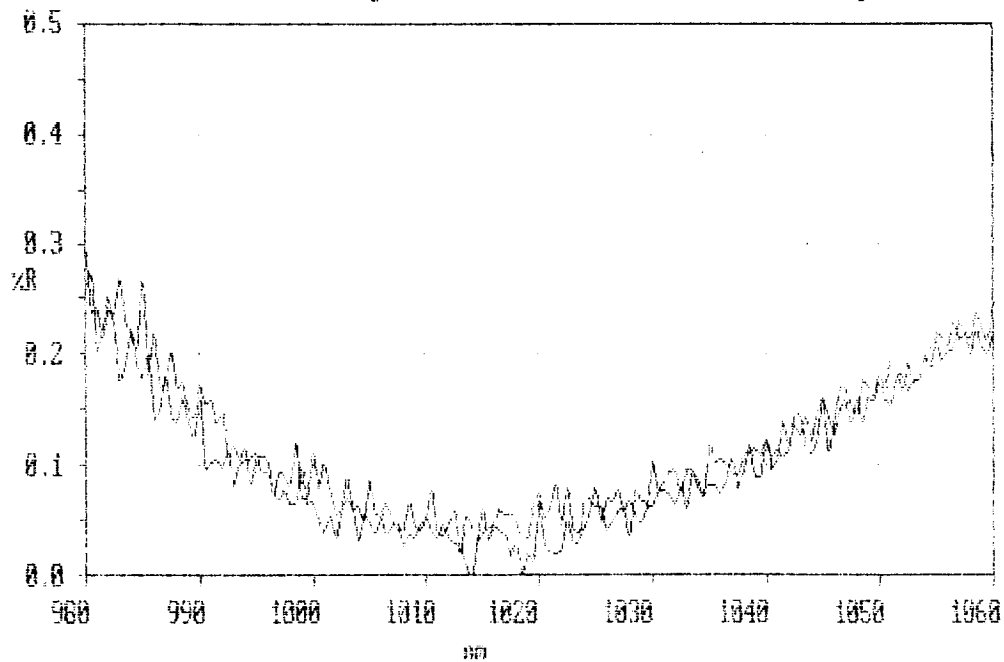
Model of #OX918 @ 0°

Y: user003; 1150.0 - 980.0 nm; pts 341; int 0.50; ord 0.0177 - 0.7115 %R
Inf: #0X919, AR @ 1064nm, 45 deg, BS03,04, 1" FS witness, baked, 0 deg scan

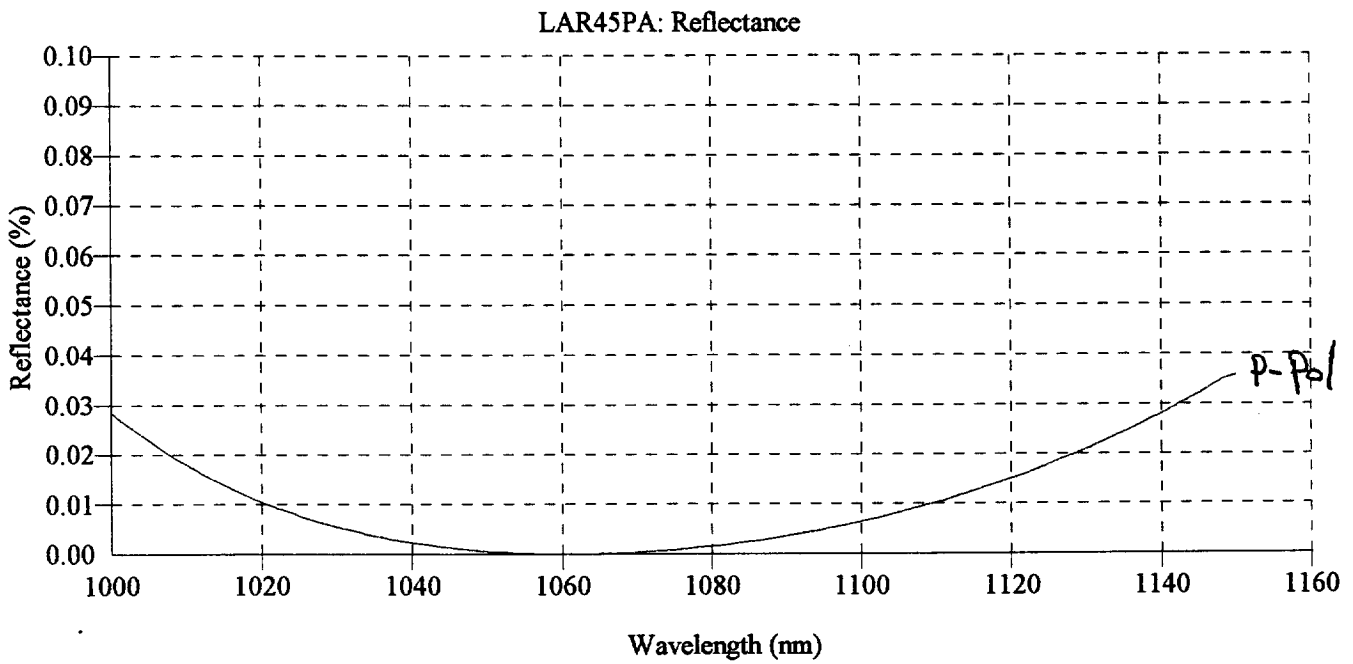


R = 70 ppm
@ 1053 nm
@ 45°
P-Pol

X: user004; 1150.0 - 980.0 nm; pts 341; int 0.50; ord -0.006 - 0.7183 %R
Inf: #0X919, AR @ 1064nm, 45 deg, BS03,04, 1" FS witness, baked, 0 deg scan



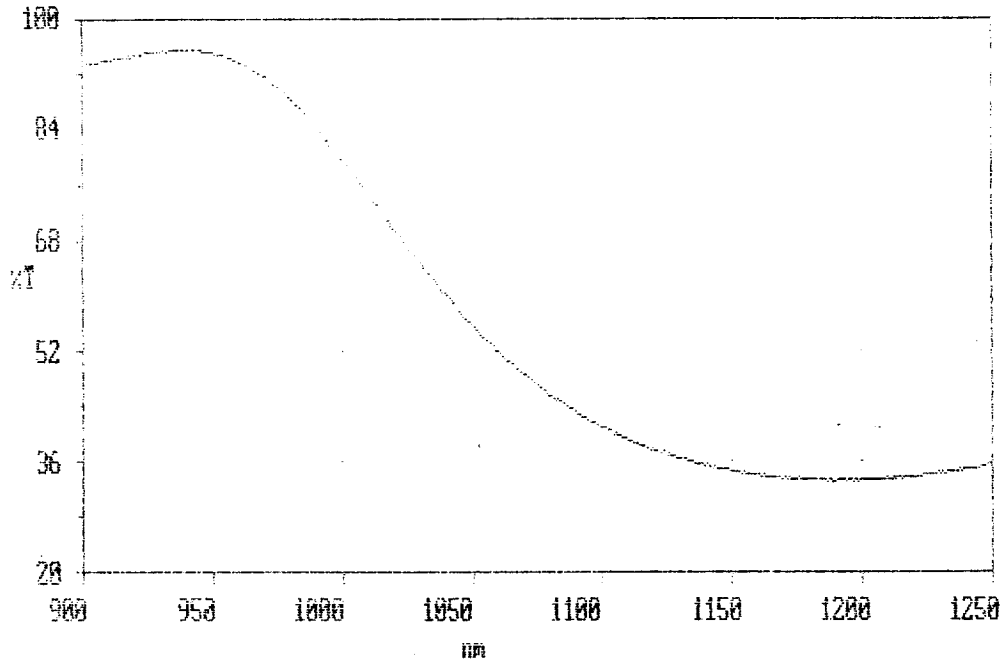
BSØ3 (Re. coat)



Model of #0X918 at 45°
witness piece measured
with Laser.

$$R = 187 \text{ ppm} @ 1053 \text{ nm}$$

X: user004: 1250.0 - 900.0 nm; pts 1751; int 0.20; ord 33.085 - 95.870 %T
Inf: #0X917, Beamsplitter for BS03, BS04, baked, 1" FS witness, 0 degree scan



T = 50.5%
R = 49.5%
@ 1053 nm
@ 45°
P-Pol

X: user004: 1250.0 - 900.0 nm; pts 1751; int 0.20; ord 33.350 - 95.609 %T
Inf: #0X917, Beamsplitter for BS03, BS04, baked, 1" FS witness, 0 degree scan

