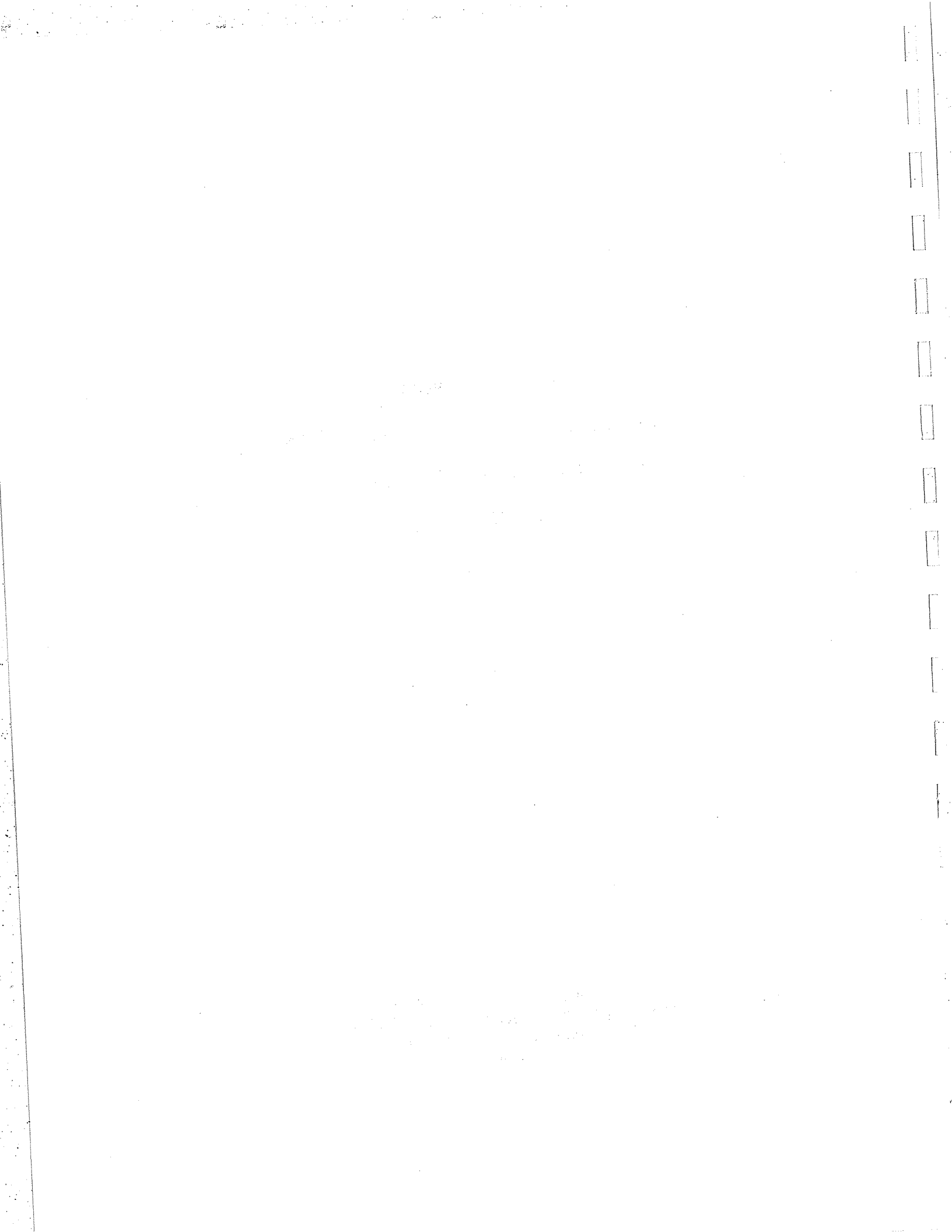


QUANTAR TECHNOLOGY
3300 SERIES OPEN-FACE MCP RAE SENSOR
PERFORMANCE TEST DATA REPORT
S/N 3394-3237

Quantar Technology Incorporated
2620A Mission Street, Santa Cruz, CA 95060, USA
Tel: 831-429-5227 FAX: 831-429-5131
www.quantar.com



QUANTAR TECHNOLOGY INC.

3300 SERIES OPEN-FACE MCP/RAE SENSOR
PERFORMANCE TEST DATA REPORT

TABLE OF CONTENTS / SUMMARY

1. **List of System Components:** Identifies Model Numbers, Options and Serial Numbers of major line items shipped with order. Reference document only.
2. **Final Performance Test Data Record:** For 3300 Series MCP/RAE Sensors, identifies product, options, serial number, test conditions and special comments.
3. **2-D Background Image Test:** Shows full 2-D active area image with no incident flux. This is residual background of detector. Color scale at left is averaged for 4 x 4 pixel region; due to limited computer display resolution versus data resolution, only every fourth pixel is plotted in each axis; actual counts per pixel must be determined by zooming in on pixel and reading cursor but generally actual counts per pixel can be estimated by multiplying color level shown by 4 for sparse counts. Most important is total counts per second, shown on Display Total divided by Accumulation Time.
4. **2-D Uniformity, Full Illumination:** Shows full 2-D active area image with entire detector area illuminated by either electrons or UV photons. Used primarily to detect regions of lower sensitivity. Gradual shading of response is generally due to non-uniformity of source incident flux. Generally, same conditions regarding color scale readout discussed above apply to this test as well.
5. **2-D Linearity Image:** Shows response to multiple pinhole pattern mask. Grid overlay enables estimation of deviation from perfect spatial linearity. Other image details not significant (large circles on some test masks).
6. **Pulse Height Distribution (PHD):** Shows statistical distribution of electron gain experienced by a large ensemble of events as they were detected by the system. Reflects gain of MCP's and also fixed gain of preamplifiers. Centroid of distribution is set by adjustment of high voltage bias to single or multiple MCP stages of detector. Can also be influenced considerably by type (e.g. electrons, UV photons), angle of incidence and kinetic energy (for particles) of incident flux. Centroid of distribution should be in range from 1.5 to 2.0 volts. Lower level discriminator is shown at approximately 0.3 to 0.4 volts (adjustable) on horizontal (gain) scale; upper level discriminator is a 5 volts (fixed). It is also desirable for the FWHM of the distribution to be as narrow as possible (typical range 80-100% for multistage units; 100-120% for single stage units), although centroid gain is more important.
7. **Spatial Resolution Tests:** Shows response of detector to pin hole spot pattern projected onto initial MCP surface or response to very narrow optical slit image (for optical detectors). Measured either as FWHM of spot/slit or 14-86% points for edge measurement. May be shown in dot pattern printout or connected line pattern printout or both.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
LABORATORY OF ORGANIC CHEMISTRY

CHICAGO, ILLINOIS

TO THE HONORABLE CHIEF OF BUREAU OF CHEMISTRY
WASHINGTON, D. C.

FROM THE DIRECTOR OF THE LABORATORY OF ORGANIC CHEMISTRY
UNIVERSITY OF CHICAGO

Reference is made to the report of the Committee on the
Nomenclature of Organic Chemistry, published in 1956,
and to the recommendations of the International Union of
Pure and Applied Chemistry, adopted in 1958, concerning
the nomenclature of organic compounds.

The Committee on the Nomenclature of Organic Chemistry
has recommended that the name "carboxylic acid" be
used for the class of compounds which were previously
designated as "acids" and "carboxylic acids".

The Committee on the Nomenclature of Organic Chemistry
has also recommended that the name "carboxylic acid" be
used for the class of compounds which were previously
designated as "acids" and "carboxylic acids".

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designated as "acids" and "carboxylic acids".

QUANTAR TECHNOLOGY INC.

3300 SERIES OPEN-FACE MCP/RAE SENSOR
PERFORMANCE TEST DATA REPORT

LIST OF SYSTEM COMPONENTS
(filled box indicates an included item)

Customer Name: Michigan State U. / Oak Ridge NL

Quantar Sales Order #: 8440
Date of Shipment: 04 October 2007

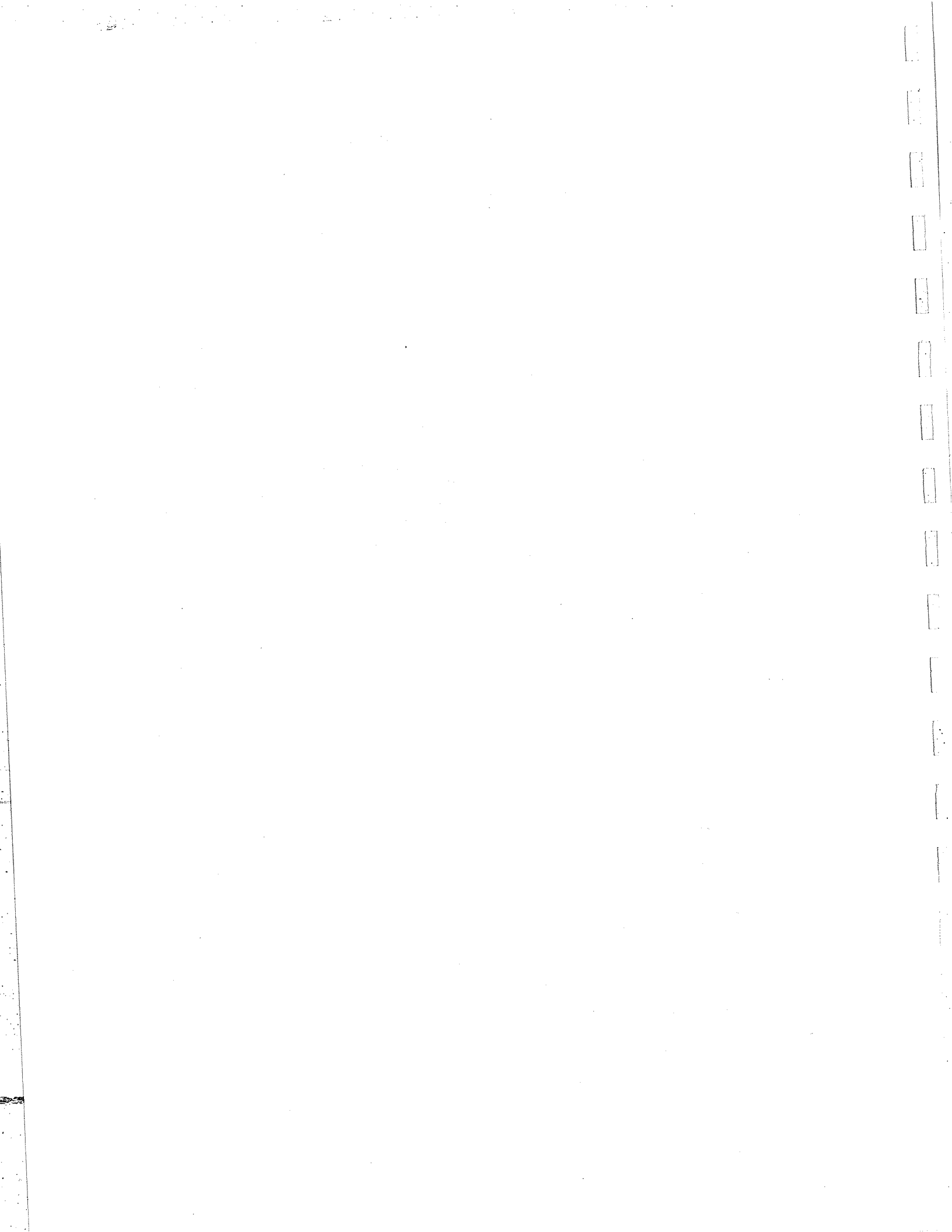
BASE SYSTEM COMPONENTS

SERIAL NUMBER

- | | | | |
|----|-------------------------------------|--|-----------|
| 1. | <input checked="" type="checkbox"/> | Model 339xA Open-Face MCP/RAE Sensor
(Shipped in special vacuum container) | 3394-3237 |
| | <input type="checkbox"/> | w/Option SE: Add Isolated Front Ring (installed) | |
| | <input type="checkbox"/> | w/Option Csl: Csl coated input MCP in place of standard (installed) | |
| | <input type="checkbox"/> | w/Option SH: RAE compatible with Model 2502A (installed) | |
| | <input type="checkbox"/> | w/Option SM: HOT MCPs in place of standard MCPs (installed) | |
| | <input type="checkbox"/> | w/Option X07: Sectional cutout in front ring for grazing incidenc (applied) | |
| | <input checked="" type="checkbox"/> | Specmisc: Blocks and pins for timing pick-off circuit addition mounted
on baseplate (no vacuum compatible capacitor/resistor
components available for circuitry) | |
| 2. | <input type="checkbox"/> | Model 2401B Position Analyzer, Analog Output | |
| | <input type="checkbox"/> | w/option 008/EC, 8-bit digital output, installed | |
| | <input type="checkbox"/> | w/option EM, Preamplifier, for 2 MCP sensor | |
| | <input type="checkbox"/> | w/option EP, Preamplifier, for 5 MCP sensor | |
| | <input type="checkbox"/> | Other options | |
| 3. | <input type="checkbox"/> | Model 2502A Position Analyzer w/8-bit digital output, standard. | |
| | <input type="checkbox"/> | Other options | |

DATA SYSTEM COMPONENTS

- | | | | |
|----|--------------------------|--|--|
| 4. | <input type="checkbox"/> | Model 2251A MCA-Emulation Software, 1-D | |
| | <input type="checkbox"/> | Option 001, Add 2-D capability | |
| 5. | <input type="checkbox"/> | Model 2412A Histogramming Buffer Memory (installed in 2401B)
DEC-DRV11/DR-11C compatible version, 4x8 bit cable (XY) w/switch | |
| | <input type="checkbox"/> | Model 2415A Histogramming Buffer Memory (installed in 2401B) | |
| 6. | <input type="checkbox"/> | Model 2420B Parallel IO Interface (for PC-AT compatibles) | |
| 7. | <input type="checkbox"/> | Model 11001A GPIO Cable (2412/2415 to 2420) | |



HIGH-VOLTAGE SUPPLY COMPONENTS

SERIAL NUMBER

- 8. Model 25001A HV Bias Divider, 5 MCP w/PC
- Model 25002A HV Bias Divider, 5 MCP
- Model 25003A HV Bias Divider, 2 MCP
- w/Option 003, opt SE ring voltage on divider
- 9. Model 25016A Integrated Positive HV Power Supply and HV Bias Divider
- Model 25016A/001 Integrated Negative HV Power Supply and HV Bias Divider
- Model 25016A/002 Integrated Floating HV Power Supply and HV Bias Divider
- 10. Model 25020A HV Power Supply, 0-5 kV
- Model 25021A HV Power Supply, 0-1 kV
- Model 25022A HV Power Supply, 0-3 kV
- 11. Model 25050A HV Cable Set, for 5 MCP Sensor (5 ea 18" SHV, 1 ea 60" SHV)
- Model 25052A HV Cable Set, for 2 MCP Sensor (4 ea 18" SHV, 1 ea 60" SHV)

OTHER COMPONENTS

- 12. Oscilloscope, X-Y Monitor.
- 13. Model 25060A Extra Signal Cable Set, 4 ea 12" BNC-BNC
- 14. Other
- 15.

COMMENT ON TEST DATA

Detector refurbished (parts missing and in disarray), including installation of new MCPs and RAE. No bottom electrode mask installed.



QUANTAR TECHNOLOGY INC.

THE FOLLOWING TABLE SHOWS THE RESULTS OF THE PERFORMANCE TEST DATA REPORT

PERFORMANCE TEST DATA REPORT

QUANTAR TECHNOLOGY INC.

Model Number	Model Name
2010	2010
2011	2011
2012	2012
2013	2013
2014	2014
2015	2015
2016	2016
2017	2017
2018	2018
2019	2019
2020	2020
2021	2021
2022	2022
2023	2023
2024	2024
2025	2025
2026	2026
2027	2027
2028	2028
2029	2029
2030	2030

THE FOLLOWING TABLE SHOWS THE RESULTS OF THE PERFORMANCE TEST DATA REPORT

PERFORMANCE TEST DATA REPORT

TEST DATA

DATE OF TEST: 10/10/2023

TEST LOCATION: QUANTAR TECHNOLOGY INC.

TESTER: JOHN DOE

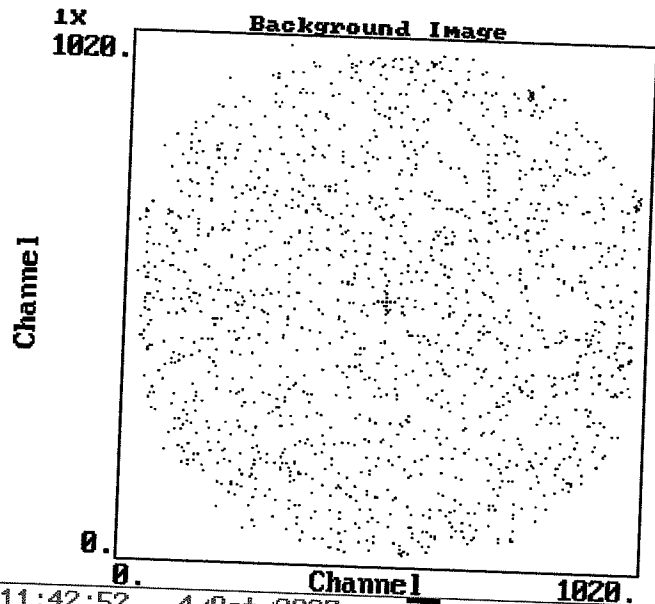
TEST NUMBER: 12345

TEST RESULTS: PASS

Item	Value	Unit
Weight	10.5	kg
Length	1.2	m
Width	0.8	m
Height	0.5	m
Volume	0.48	m³
Area	0.96	m²

SPECIAL COMMENTS: The test results are within the specified tolerance.

Signature of Test Engineer: [Signature]



Cursor:
 X 512
 Y 513
 Z 1.000
 Counts:
 0.6250
 0.5833
 0.5417
 0.5000
 0.4583
 0.4167
 0.3750
 0.3333
 0.2917
 0.2500
 0.2083
 0.1667
 0.1250
 0.0833
 0.0417

11:42:52 4/Oct/2007
 Status: FILE
 Elapsed Time: 300.000
 Counts on Screen: 1529.
 >

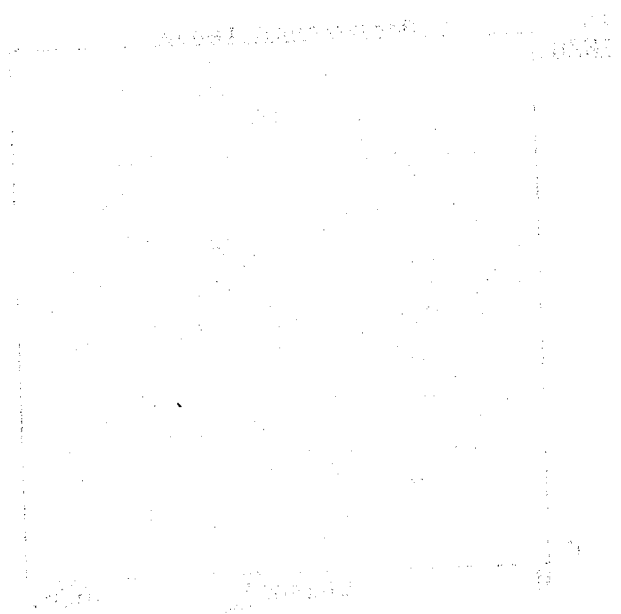
F1 Load Accum. File	F2 Save Accum. File
F3 Load Ref. File	F4 Turn Ref. Display On
F5 Turn Dir. Display On	F6 Set File Pattern *.MCA
F7 Set File Directory C:\SD\8440\	
F8 Erase File	F10 Return to Main Menu

Accumulator:
 Title: Background Image w/ grid Elapsed time: 300.000
 Customer: OC/Tokyo U. File: D:\8437\DRK3537G.MCA
 SO#s: 3437 Voltages: 0,1600,-100,1620,250
 Device S/N: 3395-3537-X03-X07-CsI Source Input: dark, no source input
 Device Type: 40mm 5P X07 OFS Strobe Rate (cps): 3.4
 HV Divider S/N: n/a Housing Temp(C): n/a Device Temp(C): n/a
 HVin Setting: n/a Comments: 40x20mm RAE replaced with standard
 with grid at 00

Use cursor keys to move cursor, Enter key to skip to next field
 Del key to remove a character
 Ins to enter 'insert' mode

F10+8 to clear text
 F10+9 to enter 'fixed' text mode

1971
1972
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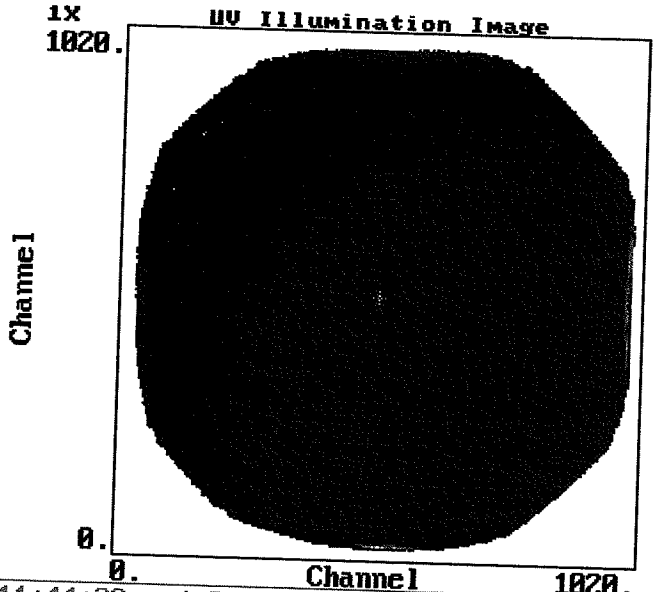


1971

1971

1971

1971



- Cursor:
- 510
 - 510
 - 13.00
- Counts:
- 80.00
 - 74.67
 - 69.33
 - 64.00
 - 58.67
 - 53.33
 - 48.00
 - 42.67
 - 37.33
 - 32.00
 - 26.67
 - 21.33
 - 16.00
 - 10.67
 - 5.333

11:44:39 4/Oct/2007

Status: FILE

Elapsed Time: 800.000

Counts on Screen: 9.96E6

>

F1 Load Accum. File

F2 Save Accum. File

F3 Load Ref. File

F4 Turn Ref. Display On

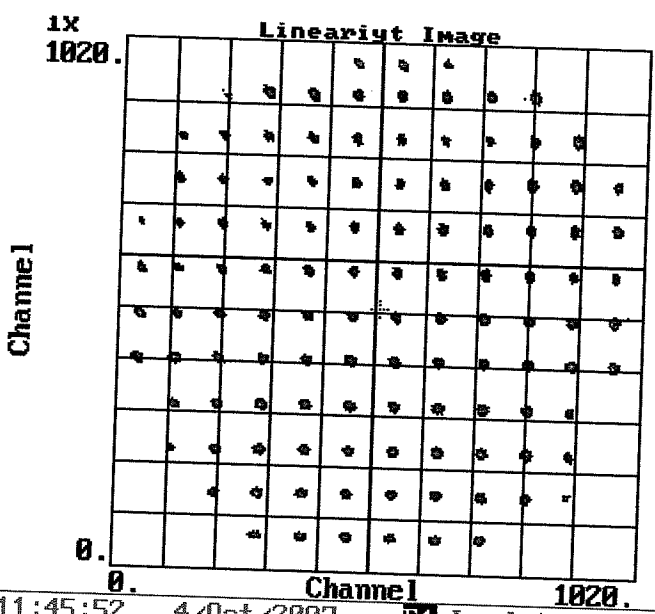
F5 Turn Dir. Display On

F6 Set File Pattern *.MCA

F7 Set File Directory C:\SD\8440\

F8 Erase File

F9 Return to Main Menu



- Cursor:
- 510
 - 510
 - 1.000
- Counts:
- 10.00
 - 9.333
 - 8.667
 - 8.000
 - 7.333
 - 6.667
 - 6.000
 - 5.333
 - 4.667
 - 4.000
 - 3.333
 - 2.667
 - 2.000
 - 1.333
 - 0.6667

11:45:52 4/Oct/2007

Status: FILE

Elapsed Time: 55.000

Counts on Screen: 2.09E8

>

F1 Load Accum. File

F2 Save Accum. File

F3 Load Ref. File

F4 Turn Ref. Display On

F5 Turn Dir. Display On

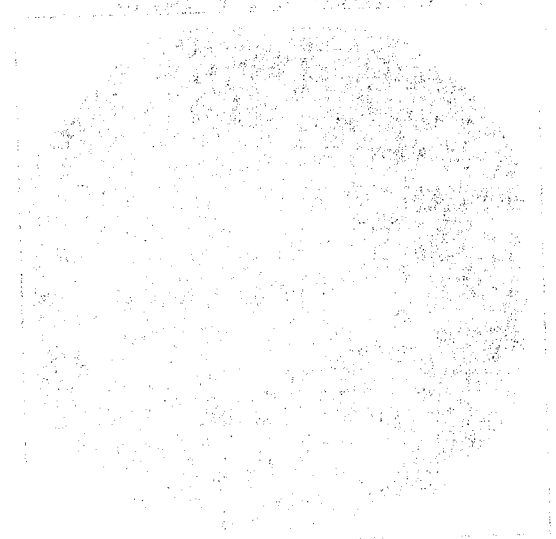
F6 Set File Pattern *.MCA

F7 Set File Directory C:\SD\8440\

F8 Erase File

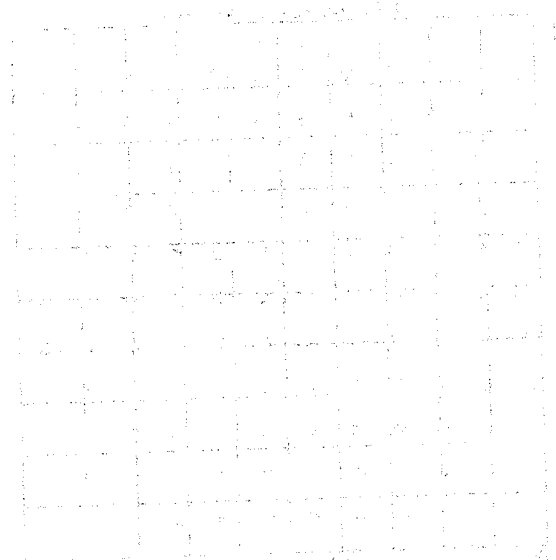
F9 Return to Main Menu

Handwritten notes on the left margin, including a list of numbers and possibly a name.



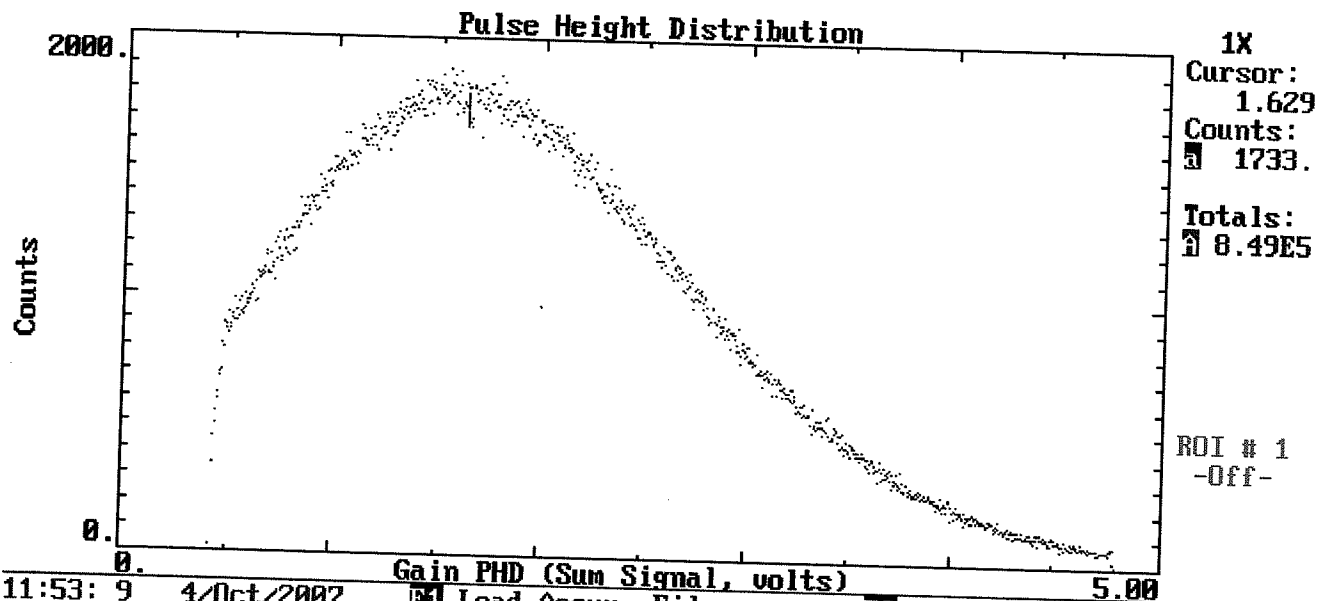
Vertical handwritten text, possibly a label or identifier, located to the right of the small diagram.

Another set of handwritten notes on the left margin, below the first set.



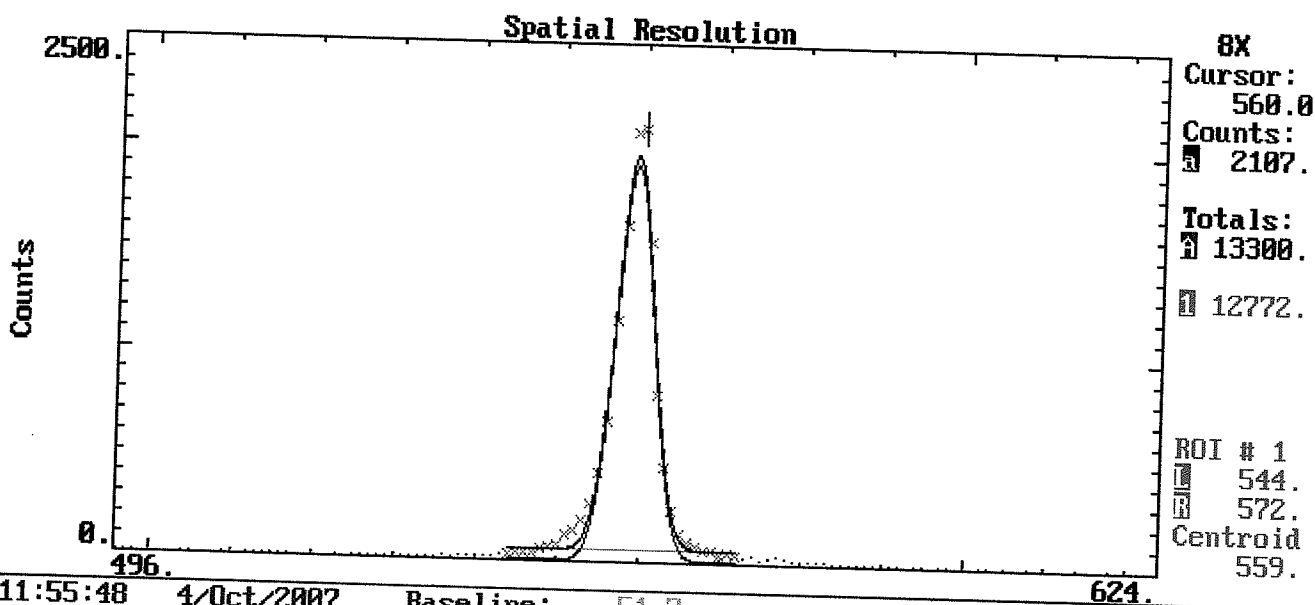
Vertical handwritten text, similar to the one above it, located to the right of the small diagram.





11:53: 9 4/Oct/2007
 Status: FILE
 Elapsed Time: 29.000

[F1] Load Accum. File	[F2] Save Accum. File
[F3] Load Ref. File	[F4] Turn Ref. Display On
[F5] Turn Dir. Display On	[F6] Set File Pattern *.MCA
[F7] Set File Directory C:\SO\8440\	[F10] Return to Main Menu
[F9] Erase File	

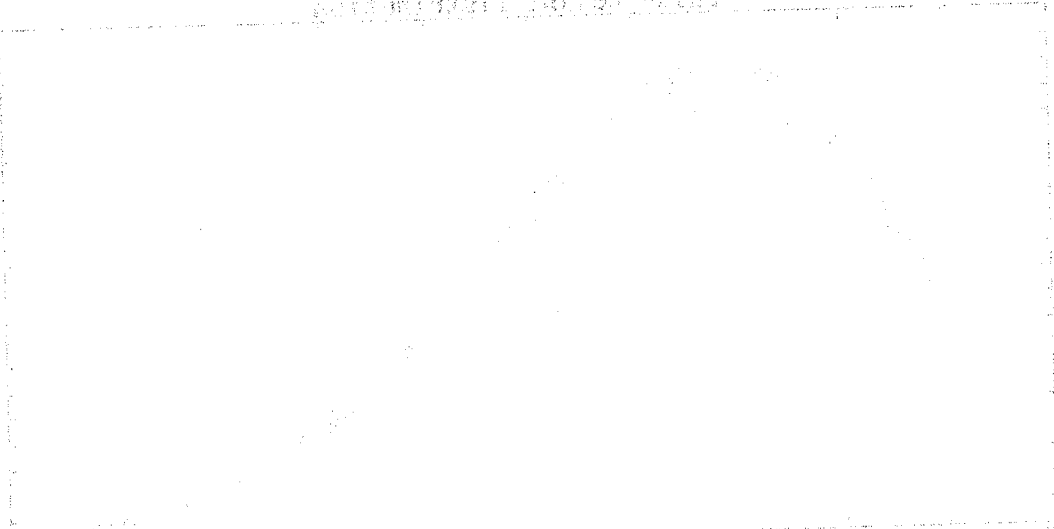


11:55:48 4/Oct/2007
 Status: FILE
 Elapsed Time: 300.000

Baseline: 51.7	
Peak at 559.17	
Area 10938.	
FWHM 5.35	
[F9] Turn Fit Table Off	[F10] -> Main Menu X ² =334.

PHYSICAL PROPERTIES

100
1000
10000
100000



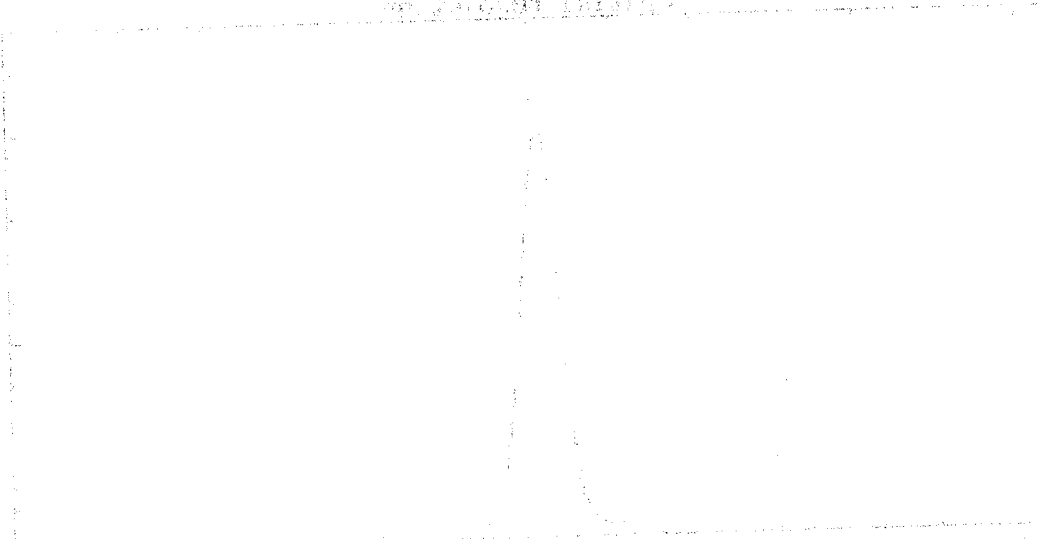
1000

Time

Graph showing the relationship between physical properties and time. The curve starts at the origin, rises steeply, and then levels off, indicating a constant value after an initial period of change.

PHYSICAL PROPERTIES

100
1000
10000
100000



1000

Time

Graph showing the relationship between physical properties and time. The curve starts at the origin, rises steeply, and then levels off, indicating a constant value after an initial period of change.

PHOTONIS

PHOTONIS USA, INC.
 P.O. Box 1159
 Sturbridge, MA 01566
 USA

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 F +1-508-347-3849
 www.photonis.com

SHIPPING DATA SHEET

Ship Date: 9-26-07

Part Number: 31339

Serial Number: 956-4IX-18

MECHANICAL

Outside Dimension:*	50.04mm	L/D Ratio:*	46:1
Minimum Quality Area:*	40.00mm	Bias Angle:*	8°
Channel Diameter:*	10µm	Solid Glass Border:	YES
Center to Center Spacing:*	12µm	Open Area Ratio:	67%
Thickness:*	0.46mm		

ELECTRICAL

Voltage	Bias Current (µAmps)	Gain
700v	30.4	9.3×10^2
1000v	45.1	2.4×10^4

* Nominal dimensions. All electrode material is high purity nichrome unless noted.

SPECIAL COATINGS

Type:	Input [] Output [] Both []
-------	-------------------------------

Tested By: JA / PG

SPECIAL FEATURES

S.O. 8440
 Michigan State U. / ORNL
 sensor S/N 3394-3237
 10/2007
 Vin



1911

1912

1913

1914

1915

1916

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www.photonis.com

SHIPPING DATA SHEET

Ship Date: 9-26-07

Part Number: 31339

Serial Number: 956-41IX-28

MECHANICAL

Outside Dimension:*	50.04mm	L/D Ratio:*	46:1
Minimum Quality Area:*	40.00mm	Bias Angle:*	8°
Channel Diameter:*	10µm	Solid Glass Border:	YES
Center to Center Spacing:*	12µm	Open Area Ratio:	67%
Thickness:*	0.46mm		

ELECTRICAL

Voltage	Bias Current (µAmps)	Gain
700v	30.8	7.7×10^2
1000v	45.8	2.2×10^4

* Nominal dimensions. All electrode material is high purity nichrome unless noted.

SPECIAL COATINGS

Type:	Input [] Output [] Both []
-------	-------------------------------

Tested By: JA/PG

SPECIAL FEATURES

S.O. 8440
Michigan State U. / ORNL
Sensor S/N 3394-3237
10/2007
Vout

1900

1900

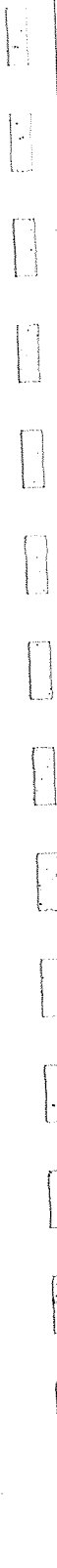
1900

1900

1900

1900

1900



PHOTONIS

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NOTICE

Microchannel Plates (MCP) and MCP-based devices must be adequately stored to ensure proper performance and longevity. PHOTONIS' Handling and Storage of Microchannel Plates Procedure which is enclosed, details proper storage techniques. Any deviation from the recommended storage procedures will void the warranty.

If you have any storage questions, please contact our Customer Service Department at 1-800-648-1800 (USA only) or 1-508-347-4010.

Thank you for your cooperation in this matter. We appreciate your business.



PHOTONIS

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www.photonis.com

STORAGE, HANDLING, and OPERATION of MICROCHANNEL PLATES

STORAGE

Because of their structure and the nature of the materials used in manufacture, care must be taken when handling or operating MCPs. The following precautions are strongly recommended:

Containers in which microchannel plates are shipped are *not suitable* for storage periods exceeding the delivery time. Upon delivery to the customer's facility, microchannel plates must be transferred to a suitable long term storage medium.

- The most effective long-term storage environment for an MCP is an oil free vacuum.
- A continuously purged dry box which utilizes a dry inert gas, such as argon or nitrogen, is also suitable.
- Desiccator type cabinets which utilize silica gel or other solid dessicants to remove moisture have been proven *unacceptable*.

HANDLING

- Shipping containers should be opened only under class 100 Laminar flow clean-room conditions.
- Personnel should always wear clean, talc-free, class 100 clean-room compatible, vinyl gloves when handling MCPs. No physical object should come in contact with the active area of the wafer. The MCP should be handled by its solid glass border using clean, degreased tools fabricated from stainless steel, Teflon™ or other ultra-high vacuum-compatible materials. Handling MCPs with triceps should be limited to trained, experienced personnel.
- MCPs without solid glass border should be handled *very* carefully with great care taken to contact the outer edges of the plate only.
- All ion barrier MCPs should be placed in their containers with the ion barrier facing down.
- The MCP should be protected from exposure to particle contamination. Particles which become affixed to the plate can be removed by using a single-hair brush and an ionized dry nitrogen gun.
- The MCP should be mounted only in fixtures designed for this purpose. Care should be taken due to electrical potentials involved.
- **CAUTION:** Voltages must not be applied to the device while at atmospheric pressure. Pressure should be 1×10^{-5} or lower at the microchannel plate before applying voltage. Otherwise, damaging ion feedback or electrical breakdown will occur.

Operation

- A dry-pumped or well-trapped/diffusion-pumped operating environment is desirable.
- A poor vacuum environment will most likely shorten MCP life or change MCP operating characteristics.
- A pressure of 1×10^{-6} or better is preferred. Higher pressure can result in high background noise due to ion feedback.
- MCPs may be vacuum baked to a temperature of 380°C (**no voltage applied**).
- MCPs with low or standard bias currents may be operated at a maximum temperature of 350°C. Contact PHOTONIS Technical Service to determine maximum operating temperature for MCPs with the EDR option.

When a satisfactory vacuum has been achieved, voltages may be applied. It is recommended that this be done slowly and carefully. Current measuring devices in series with power supplies aid in monitoring MCP behavior. Voltage drop across the meter should be taken into consideration when calculating the applied voltage.

- Voltage should be applied to the MCP in 100 volt steps. If current is being monitored, no erratic fluctuations should appear. If fluctuations do appear, damage or contamination should be suspected and the voltage should be turned off. The assembly should then be inspected before proceeding.
- Maximum voltage that may be applied across a single MCPs is:
 - L/D 40:1 is 1000 volts.
 - L/D 60:1 is 1200 volts
 - L/D 80:1 is 1400 volts
- Higher potentials may result in irreversible damage.



IMPORTANT INFORMATION

EXPORT RESTRICTIONS

Microchannel plates in this shipment may be subject to export controls and restrictions. These products may be covered under one or more of the following regulations:

State Department ITAR 121-5 Category XII

Commerce Department Export Administration
Regulations Part 774 Category 6A002

These controlled products are shipped to a United States destination and buyer assumes responsibility for compliance with all applicable export regulations.

