



Laboratory Verification of the SLR 2000 Quadrant Microchannel Plate Photomultiplier Tube

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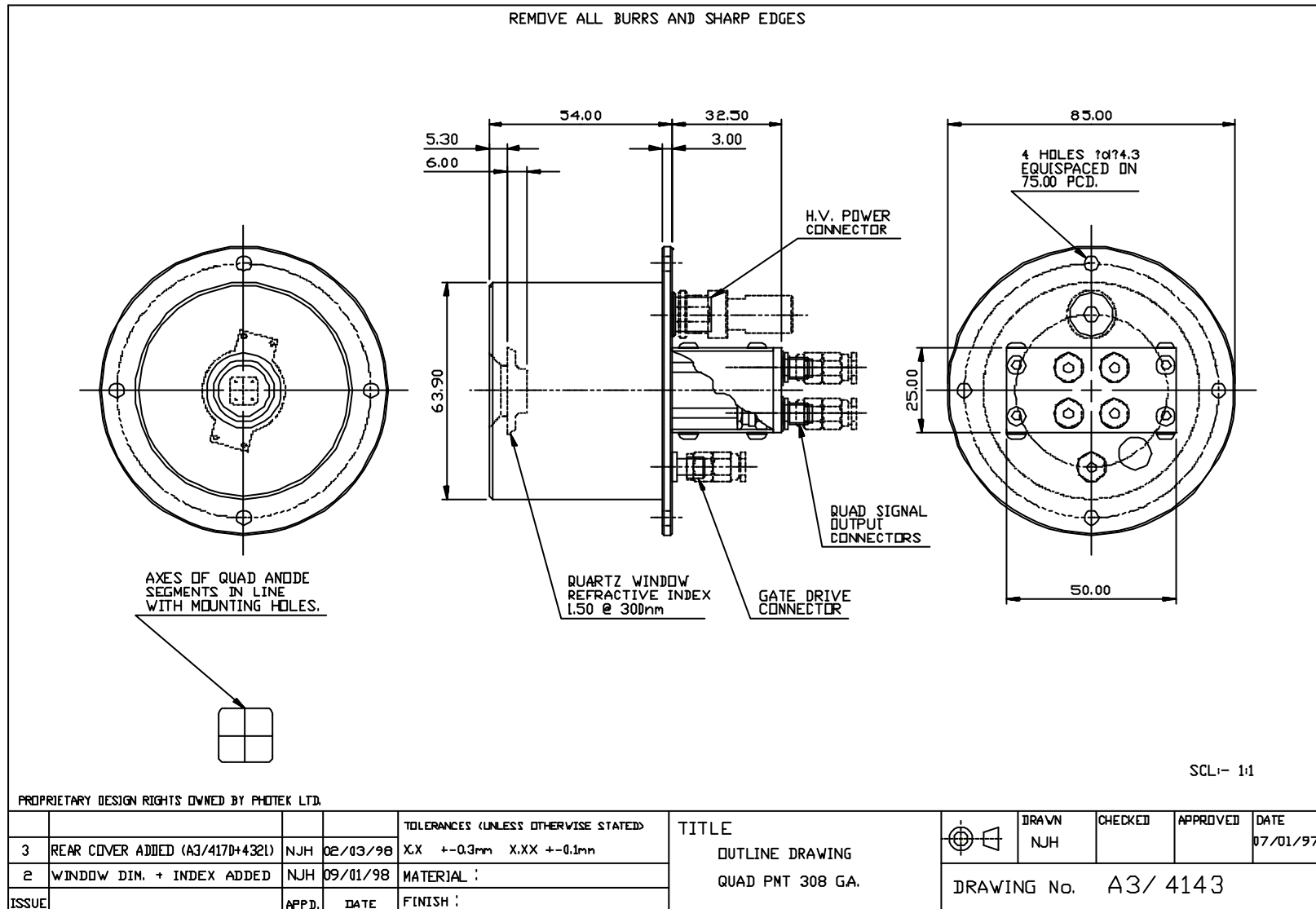
SLR 2000 Quadrant MCP



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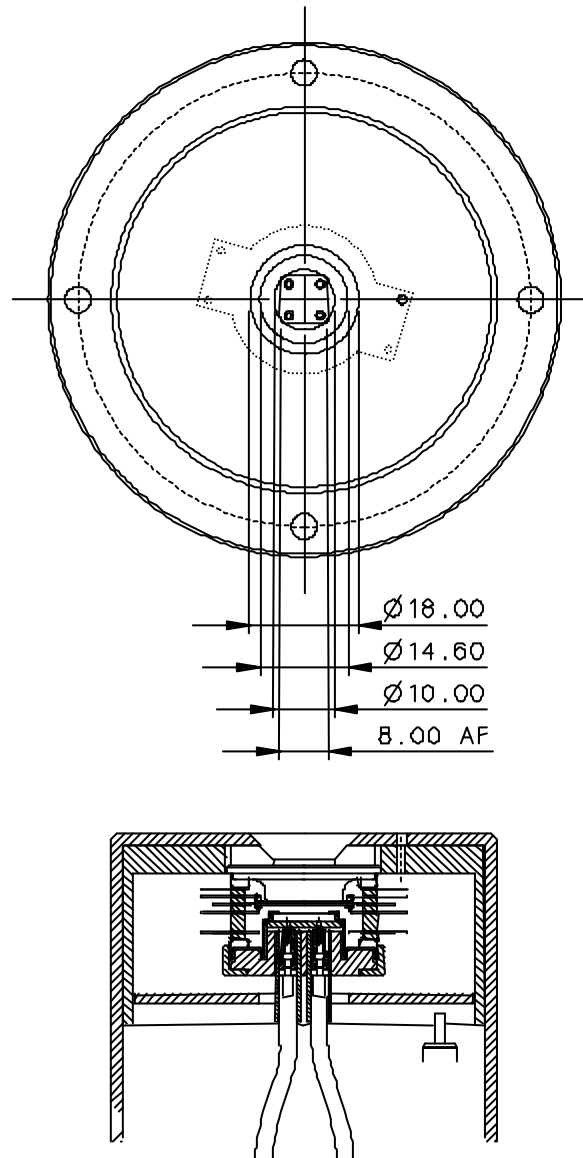
QMCP Mechanical Design



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QMCP Mechanical Design



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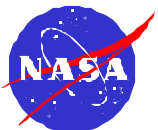
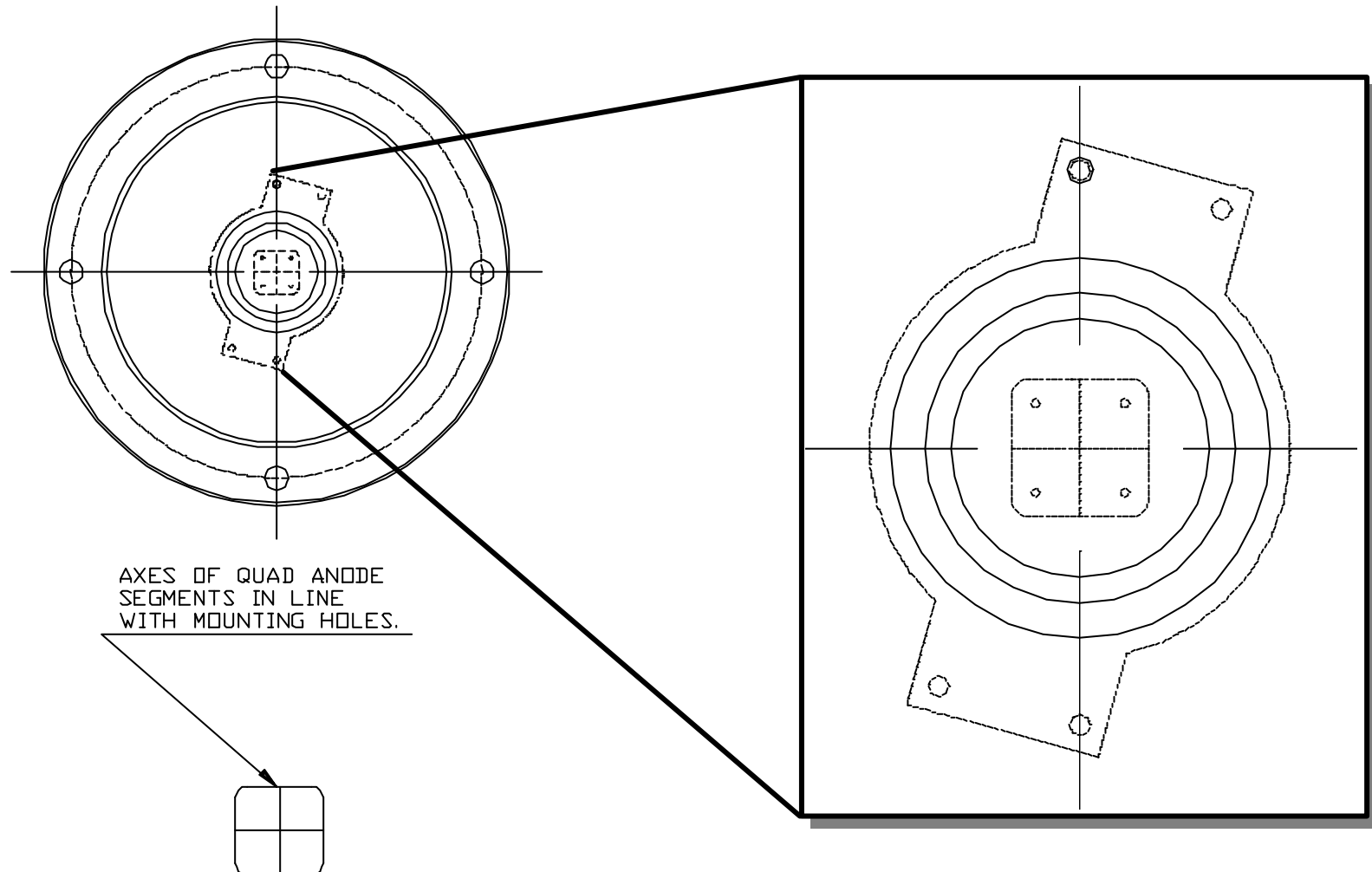
Quadrant Microchannel Plate (QMCP)

Features:

- Quadrant anode to facilitate pointing corrections
- Fast Rise Time ~ 180 ps
- Low Timing Jitter ~ 40 ps
- Low Timing Offset between quadrants ~8 ps
- 12% - 14% Quantum Efficiency @ 532nm
- 3×10^6 Gain
- 5 Vdc TTL Trigger Input
- Four Outputs



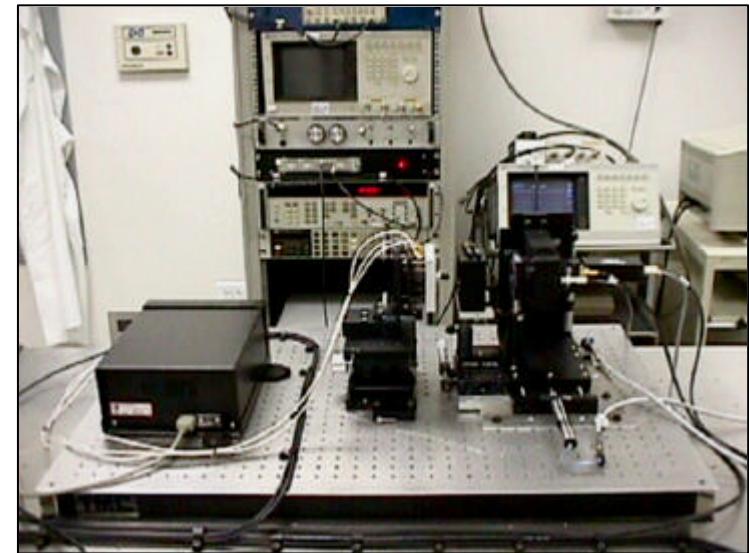
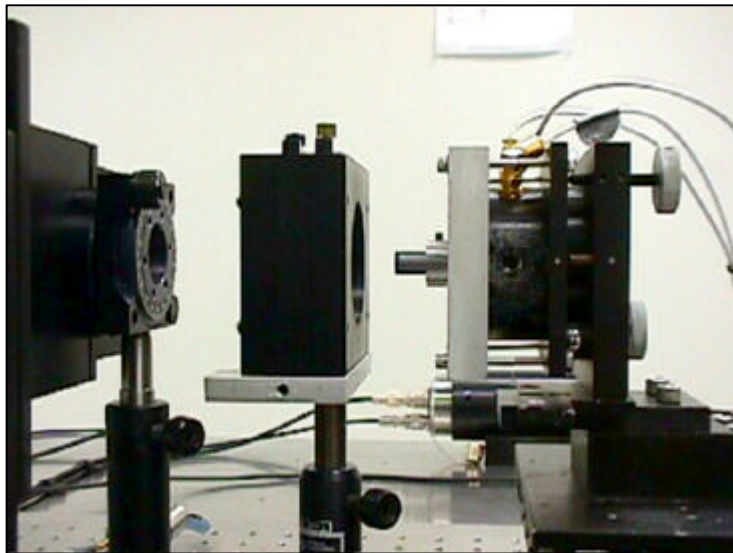
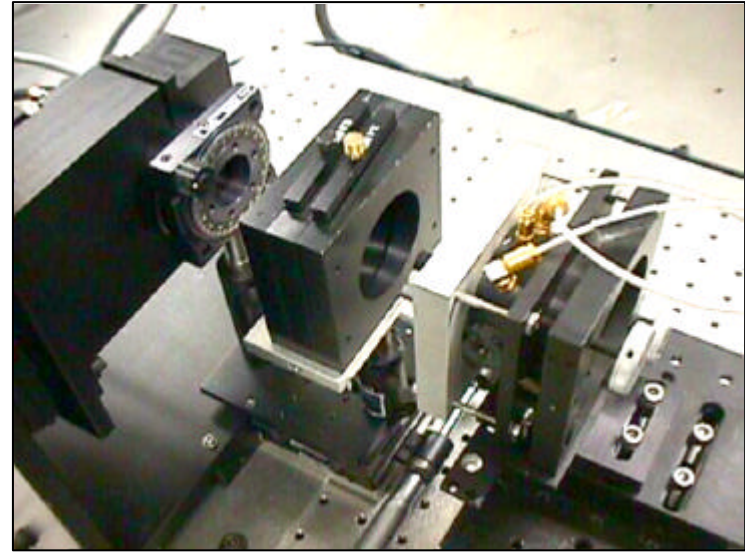
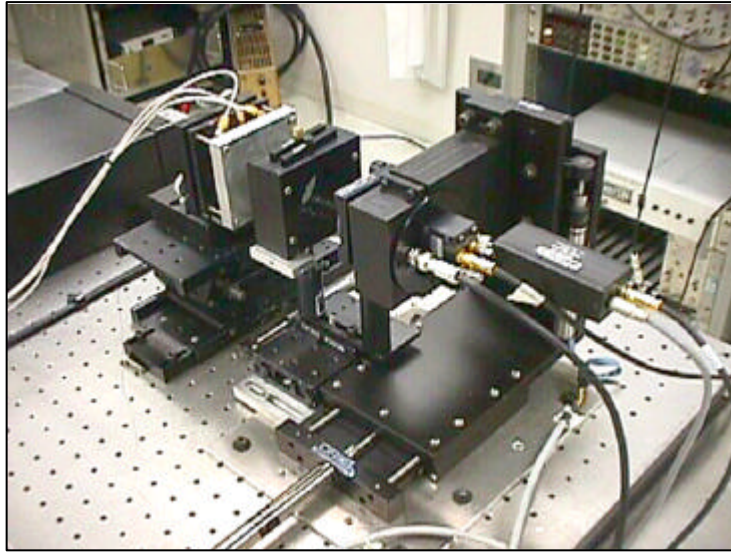
Quadrant Anode



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QMCP Laboratory Test Set Up



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Laboratory Equipment

- **Photek** **GM 150-20 Gating Unit**
- **Opto Electronics** **PLS20 Pulsed Diode Laser**
- **Opto Electronics** **PD10 Picosecond Photodetector**
- **Avtech** **AVRH-1-PS Pulse Generator**
- **Hewlett Packard** **54120 Digital Sampling Oscilloscope**



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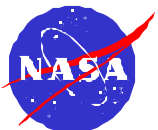
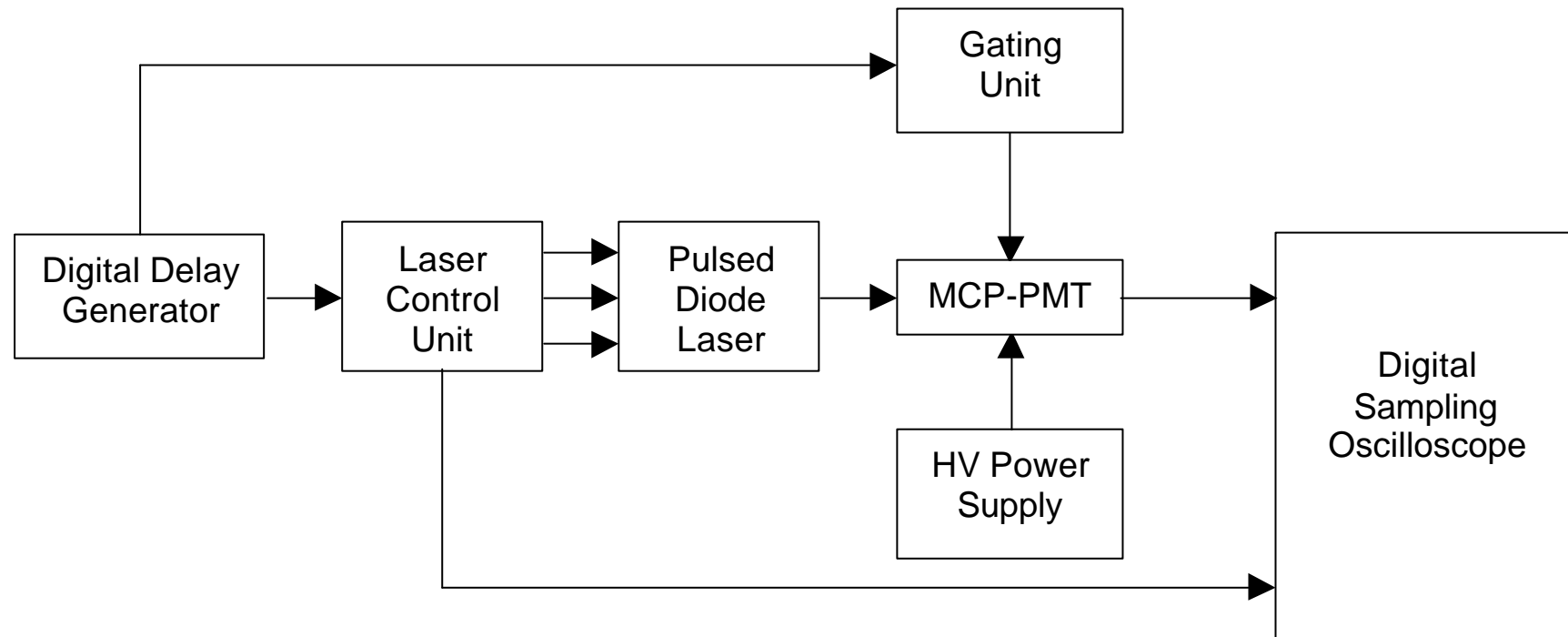
Laboratory Equipment Equipment and Parameter Measurement Values

- All equipment was within manufactures calibration specifications and within manufacturers calibration period
- QMCP Rise Time and Timing Jitter values were decoupled from individual rise time and timing jitter values of the pertinent laboratory equipment



QMCP Laboratory Test Set Up

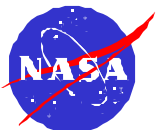
Rise Time and Timing Jitter



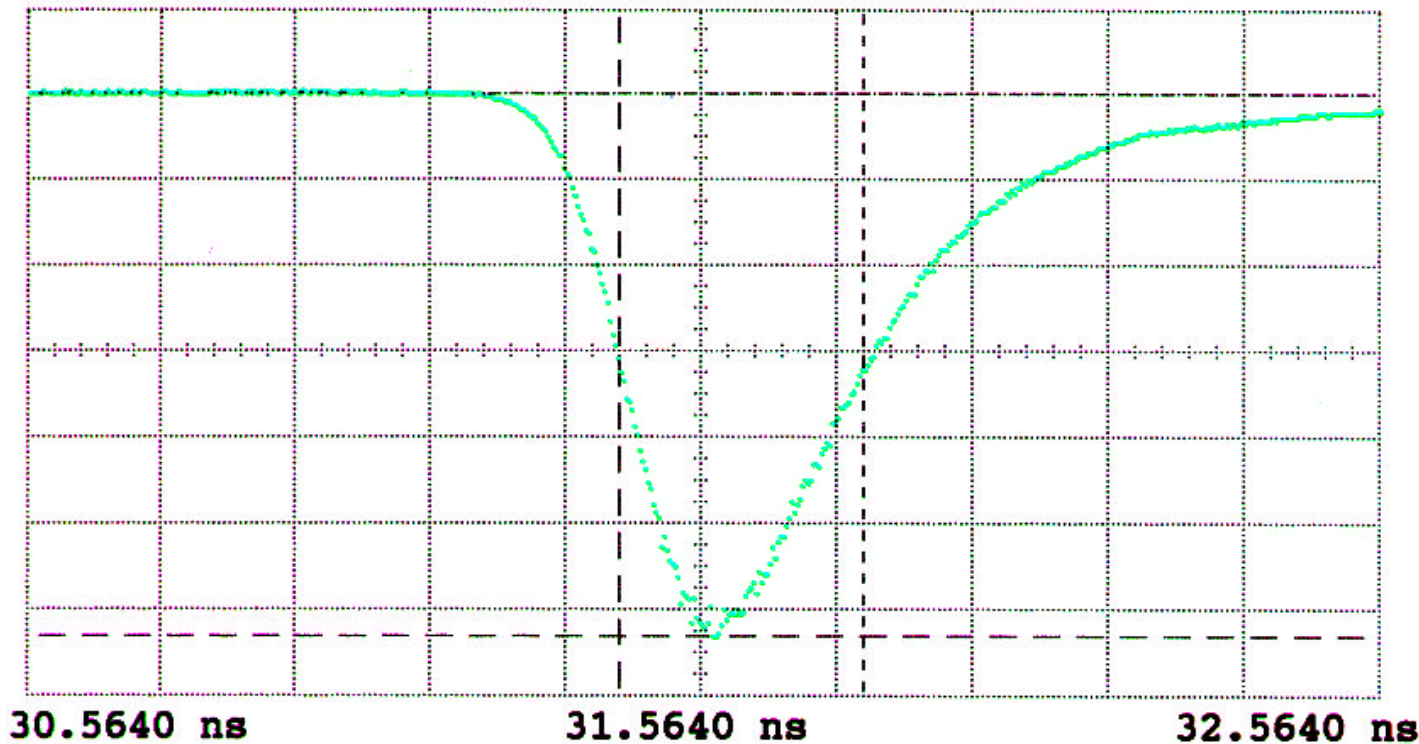
Rise Time Measurement

Purpose:

- Quantify the time of transition between the 10 percent and the 90 percent points on the leading edge of the QMCP output pulse



QMCP Rise Time



Ch. 2 = 400.0 mVolts/div
Timebase = 200 ps/div
Ch. 2 Parameters
Rise Time = 507.4 ps
- Width = 360.8 ps
Preshoot = 495.0 m%

Offset = -1.207 Volts
Delay = 31.5640 ns
P-P Volts = 2.5375 Volts
Fall Time = 185.2 ps
Overshoot = 0.000 %

Range: 179 ps to 181 ps across 4 quadrants



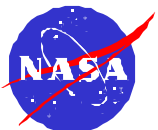
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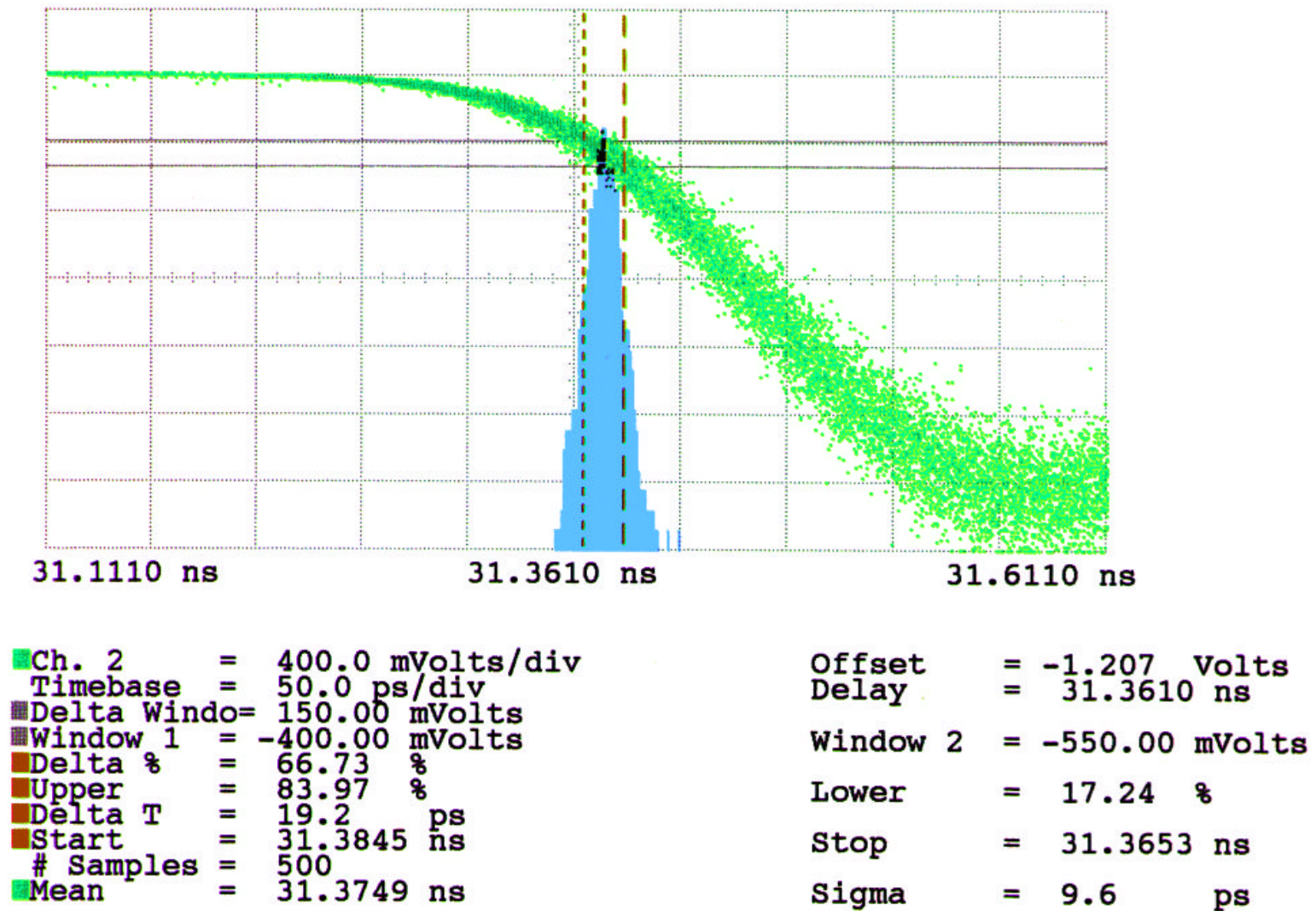
Timing Jitter Measurement

Purpose:

- Quantify the variation in the transit time of a receive signal through the QMCP as measured at the 50% point of the rising edge of the receive signal



QMCP Jitter



Range: 39 ps to 47 ps across 4 quadrants

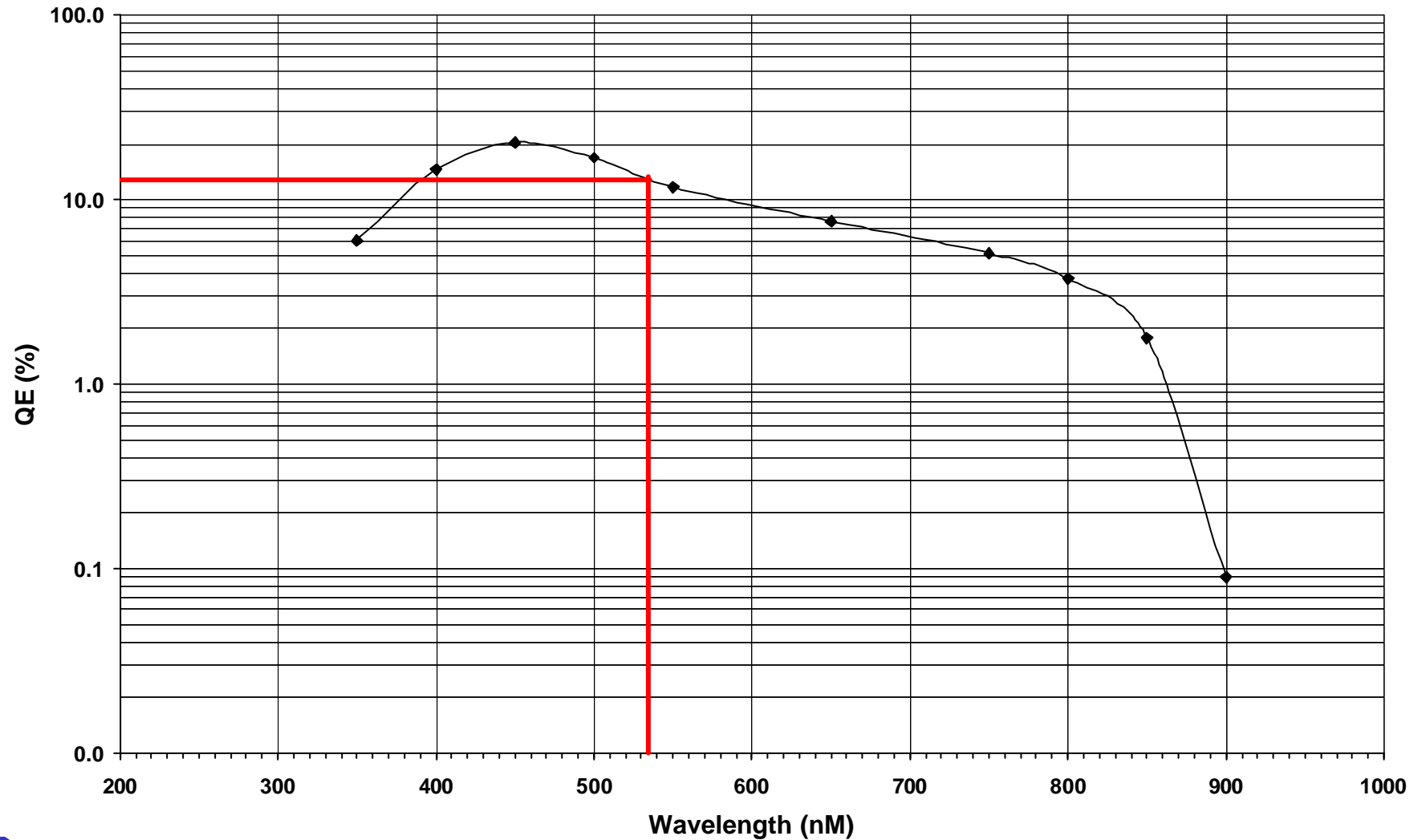


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QMCP Spectral Response per Manufacturer

Serial Number: 42981001



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QMCP Performance Matrix

Characteristic	Specification	QMCP 41981001	QMCP 42981001	Test Method	Result
		Tested Value	Tested Value		
Expected Input to Detector	532 nm @ 2KHz	N/A	N/A	N/A	N/A
Rise Time	<125 ps all quadrants	Q1-178 ps Q2-178 ps Q3-172 ps Q4-174 ps	Q1-180 ps Q2-179 ps Q3-179 ps Q4-181 ps	Lab Measurement	Accepted
Timing Offset	0 ps between all quadrants	6 ps	8 ps	Lab Measurement	Accepted
Timing Jitter at Anode (Method 1)	<28 ps RMS on any quadrant, <40 ps between any two	Q1-34 ps Q2-34 ps Q3-37 ps Q4-45 ps	Q1-39 ps Q2-42 ps Q3-42 ps Q4-47 ps	Lab Measurement	Accepted
Gain	3X10 ⁶ with a Goal of 10X10 ⁶	3.5X10 ⁶ @ -4700	3X10 ⁶ @ -4400	Manufacturers Data Sheet	Accepted
External Gating	<20 ns turn-on	~3 ns	~3 ns	Lab Measurement	Accepted
Anode Output Connectors	Four SMA Connectors	Concur	Concur	Lab Observation	Accepted
Active Cathode Area	12 mm	8mm	8mm	Lab Measurement	Accepted
Anode Structure	Quadrant - 4 pie shaped wedges of 90 degrees each	Quadrant - 4 square shaped wedges	Quadrant - 4 square shaped wedges	Lab Measurement	Accepted
Quantum Efficiency	>15% @ 532	12.59%	13.60%	Manufacturers Data Sheet	Accepted
High Voltage Bias Supply	External DC power supply	Concur	Concur	Lab Observation	Accepted
Mounting	Precision mounting with quadrant axis indexed	Concur	Concur	Lab Measurement	Accepted



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