

Radiation Report

INA1H94-SP Neutron Displacement Damage (NDD) Characterization



ABSTRACT

The INA1H94-SP was subjected to a one-time characterization to determine the effects of Neutron Displacement Damage (NDD) to the device parameters. A sample size of nine units was exposed to radiation testing per MIL-STD-883 (Method 1017 for Neutron Irradiation). The samples were dosed to exposure levels of 1×10^{12} n/cm², 5×10^{12} n/cm², and 1×10^{13} n/cm², with four samples evaluated per exposure level. Electrical testing was performed at Texas Instruments before and after neutron irradiation using the production test program for the device. Some level of degradation on the common-mode rejection ratio, offset voltage, and power supply rejection ratio specifications was observed and is discussed herein.

Table of Contents

1 Overview	2
2 Test Procedures	2
3 Facility	3
4 Results	4
4.1 Common-Mode Rejection Ratio Parametric Shift	4
4.2 Input Offset Voltage Parametric Shift	5
4.3 Power Supply Rejection Ratio Parametric Shift	6
5 Summary of Results	6
A Test Results	6

Trademarks

All trademarks are the property of their respective owners.

1 Overview

The INA1H94-SP is a radiation-hardened precision unity-gain difference amplifier with a very high input common-mode voltage range. The INA1H94-SP is a single, monolithic device that consists of a precision op amp and an integrated thin-film resistor network. The INA1H94-SP can accurately measure small differential voltages in the presence of common-mode signals up to $\pm 150\text{V}$. In many applications where galvanic isolation is not required, the INA1H94-SP can replace isolation amplifiers. The excellent 0.0005% typical nonlinearity, high common mode, and 500kHz bandwidth of the INA1H94-SP makes for a compelling sensor readout device.

Table 1-1 lists general device information and NDD testing conditions.

Table 1-1. Overview Information

TI Part Number	INA1H94-SP
SMD Number	5962R2121201VXC
Device Function	INA1H94-SP Radiation-Hardened, High Common-Mode Voltage Difference Amplifier
Technology	BICOM3-HV
Device Package	HKX (8-Pin CFP)
Unbiased Quantity Tested	12 units irradiated and 2 control/correlation units with no exposure
Lot Number Date Code	4001070 2413A
Exposure Facility	VPT Rad, Chelmsford, MA
Neutron Fluence (1-MeV Equivalent)	1.0×10^{12} , 5.0×10^{12} , 1.0×10^{13} n/cm ²
Irradiation Temperature	25°C
TI may provide technical, applications or design advice, quality characterization, and reliability data or service providing these items shall not expand or otherwise affect TI's warranties as set forth in the Texas Instruments Incorporated Standard Terms and Conditions of Sale for Semiconductor Products and no obligation or liability shall arise from Semiconductor Products and no obligation or liability shall arise from TI's provision of such items.	

2 Test Procedures

The INA1H94-SP samples was electrically pre-tested using the production automated test equipment program. General test procedures were as per MIL-STD-883, Method 1017.

Table 2-1. Neutron Irradiation Conditions

Serial Numbers	Sample Qty	Neutron Fluence (n/cm ²)	Bias
476, 477, 478, 479	4	1.0×10^{12}	Unbiased
480, 481, 482, 483	4	5.0×10^{12}	Unbiased
484, 485, 486, 487	4	1.0×10^{13}	Unbiased

Table 2-2. INA1H94-SP Specification Compliance Matrix

Parameter	Test Condition	INA1H94-SP Data Sheet (SBOSAA4)				Test Number
		MIN	TYP	MAX	Unit	
Gain Error	$V_S = \pm 9$, $V_{OUT} = \pm 7.5$ V, $T_A = -55^\circ\text{C}$ to 125°C , $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$	± 0.047	± 0.005		%	501.0
	$V_+ = 5$ V and $V_- = 0$ V, $V_{OUT} = 1.5$ V to 3.5 V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = 2.5$ V	± 0.047	± 0.005		%	501.1
Input offset voltage	$V_S = \pm 9$ $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$		± 350	± 3500	μV	250.2
	$V_+ = 5$ V and $V_- = 0$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = 2.5$ V		± 350	± 3500		250.1
Power-supply rejection ratio	$V_S = \pm 2$ V to ± 9 V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$	90 ± 31.6	120 ± 1		dB $\mu\text{V/V}$	450.2
	$V_S = 4$ V to 5 V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$		120 ± 1		dB $\mu\text{V/V}$	450.1
Common-mode rejection ratio	$V_S = \pm 9$ V, $f = \text{DC}$, $V_{CM} = \pm 150$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $\text{REF}_A = \text{REF}_B = 0$ V	84 ± 63	100 ± 10		dB $\mu\text{V/V}$	400.1, 900.1
	$V_S = \pm 9$ V, $f = \text{DC}$, $V_{CM} = \pm 150$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $\text{REF}_A = \text{REF}_B = 0$ V Flight model post HDR/LDR exposure	80 ± 100				
	$V_S = \pm 2.5$ V, $f = \text{DC}$, $V_{CM} = \pm 20$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $\text{REF}_A = \text{REF}_B = \text{GND}$	80 ± 100	100 ± 10		dB $\mu\text{V/V}$	400.3, 900.3
	$V_S = \pm 2.5$ V, $f = \text{DC}$, $V_{CM} = \pm 20$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $\text{REF}_A = \text{REF}_B = \text{GND}$ Flight model post HDR/LDR exposure	76 ± 158				
Input and Output Voltage Range	$V_S = \pm 9$ V, $V_{DIFF} = \pm 7.5$ V $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$	-7.5		7.5	V	800.3, 800.4
	$V_S = \pm 2.5$ V, $V_{DIFF} = \pm 1$ V $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$	-1		1		800.1, 800.2
Slew rate	$V_S = \pm 9$ V, $V_{OUT} = \pm 7.5$ V step $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$	1.7	5		$\text{V}/\mu\text{s}$	800.3, 800.4
	$V_+ = 5$ V and $V_- = 0$ V, $V_{OUT} = \pm 2$ V step $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{CM} = \text{REF}_A = \text{REF}_B = \text{GND}$	1.7	5			800.1, 800.2
Quiescent current	$V_S = \pm 9$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $I_O = 0$ mA	500	810	1100	μA	200.3, 200.4, 1000.3, 1000.4
	$V_+ = 5$ V and $V_- = 0$ V, $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, $I_O = 0$ mA	500	810	1100	μA	200.1, 200.2, 1000.1, 1000.2

3 Facility

VPT Rad performed neutron displacement damage irradiations in a low-enriched, open-pool, water moderated, thermal neutron reactor at the University of Massachusetts Lowell. The reactor uses flat-plate type fuel and has a maximum thermal energy output of up to 1 MW. The Fast Neutron Irradiator (FNI) faces one side of the reactor core. The experimental facility replaces three beam ports that originally existed on the left side of the research reactor. The FNI is designed to give a fast flux level $\geq 10^{11}$ n/cm²-s, with relatively low thermal fluence and gamma dose rates. Samples with a cross-sectional area as large as 30 cm (12 in) $\times$ 30 cm (12 in) and up to 15 cm (6 in) thick can be irradiated. The fast neutron flux is designed to be nearly uniform over the 30 cm (12 in) $\times$ 30 cm (12 in) area facing the core, and the fast fluence variation through the sample thickness is minimized through a single 180° rotation of the sample canister at the midpoint of the irradiation period. The fluences are calculated based on 1-MeV equivalences.

The neutron fluence rate is determined using the previously-measured neutron radiation field for the FNI, performed in accordance with ASTM standards (ASTM F1190), and correlated to the measured reactor power

level. The neutron dose is timed to meet the fluence specified for the irradiation. Neutron dosimetry meeting ASTM standards (ASTM E265) is used to track and make sure that irradiations meet the required minimum. The facility retains source design with the Defense Logistics Agency (DLA) Laboratory Suitability Program for ASTM Test Method 1017.

4 Results

There were no functional failures at any irradiation level. Some devices experienced parametric drift for common-mode rejection ratio (CMRR). All other tested parameters were observed to be within the test limits of the ATE program for the device, and as a result, within the data sheet specifications.

4.1 Common-Mode Rejection Ratio Parametric Shift

Common-mode rejection ratio (CMRR) is measured at different supply and common-mode voltage V_{CM} conditions. CMRR for the INA1H94-SP is specified as $\pm 10 \mu V/V$ typical and $\pm 63 \mu V/V$ minimum when powered with bipolar $V_S = \pm 9V$, supplies over the $V_{CM} = \pm 150V$ range pre-irradiation, and a minimum CMRR of $\pm 100 \mu V/V$ post irradiation. Similarly, CMRR for bipolar $V_S = \pm 2.5V$, supplies over the $V_{CM} = \pm 20V$ range is specified as $\pm 10 \mu V/V$ typical and $\pm 100 \mu V/V$ minimum before and after irradiation.

All of the devices exposed to neutron irradiation were found to have a shift in the common-mode rejection but remain within the specified data sheet limits. Values reported below are for the CMRR test with a supply $V_S = \pm 9V$ over the $V_{CM} = \pm 150V$ range. Full data for all ATE tests performed are included in the report appendix.

- Of the four samples tested to $1 \times 10^{12} \text{ n/cm}^2$, a mean post-irradiation CMRR value of $8.74 \mu V/V$ and maximum post-irradiation CMRR value of $13.81 \mu V/V$ were recorded. The maximum recorded magnitude change in CMRR was $1.02 \mu V/V$.
- Of the four samples tested to $5 \times 10^{12} \text{ n/cm}^2$, a mean post-irradiation CMRR value of $17.97 \mu V/V$ and maximum post-irradiation CMRR value of $27.26 \mu V/V$ were recorded. The maximum recorded magnitude change in CMRR was $2.360 \mu V/V$.
- Of the four samples tested to $1 \times 10^{13} \text{ n/cm}^2$, a mean post-irradiation CMRR value of $15.49 \mu V/V$ and maximum post-irradiation CMRR value of $22.38 \mu V/V$ were recorded. The maximum recorded magnitude change in CMRR was $3.80 \mu V/V$.

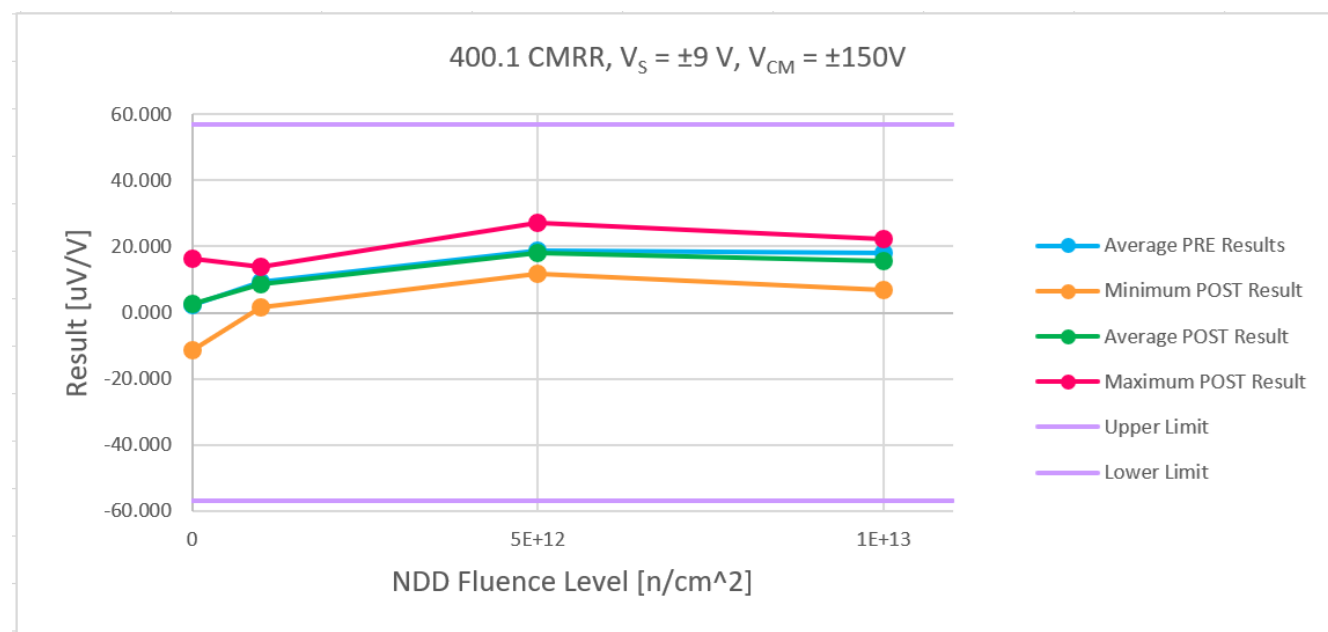


Figure 4-1. Sample CMRR NDD Graph

4.2 Input Offset Voltage Parametric Shift

Input offset voltage (V_{OS}) for the INA1H94-SP is specified as $\pm 350\mu\text{V}$ typical and $\pm 3500\mu\text{V}$ maximum over the temperature range of $T_A = -55^\circ\text{C}$ to 125°C . The input offset is measured at various supply voltages, with test limits of $\pm 3150\mu\text{V}$ for guardbanding purposes.

The devices exposed to neutron irradiation were found to have a measured input offset voltage within of the specified data sheet limits; but present offset error shifts. Values reported below are from one example test with the maximum supply $V_S = \pm 9\text{V}$ (test number 250.2). Full data for all ATE tests performed are included in the report appendix.

- Of the four samples tested to $1 \times 10^{12} \text{ n/cm}^2$, a mean post-irradiation V_{OS} magnitude of $100.2\mu\text{V}$ and maximum post-irradiation V_{OS} magnitude of $306.2 \mu\text{V}$ were recorded, with a average delta of $83.9\mu\text{V}$.
- Of the four samples tested to $5 \times 10^{12} \text{ n/cm}^2$, a mean post-irradiation V_{OS} magnitude of $759.5\mu\text{V}$ and maximum post-irradiation V_{OS} magnitude of $2499.8\mu\text{V}$ were recorded with an average delta of $-916.4\mu\text{V}$.
- Of the four samples tested to $1 \times 10^{13} \text{ n/cm}^2$, a mean post-irradiation V_{OS} magnitude of $997.3\mu\text{V}$ and maximum post-irradiation V_{OS} magnitude of $1462.4\mu\text{V}$ were recorded with a average delta of $912.0\mu\text{V}$.

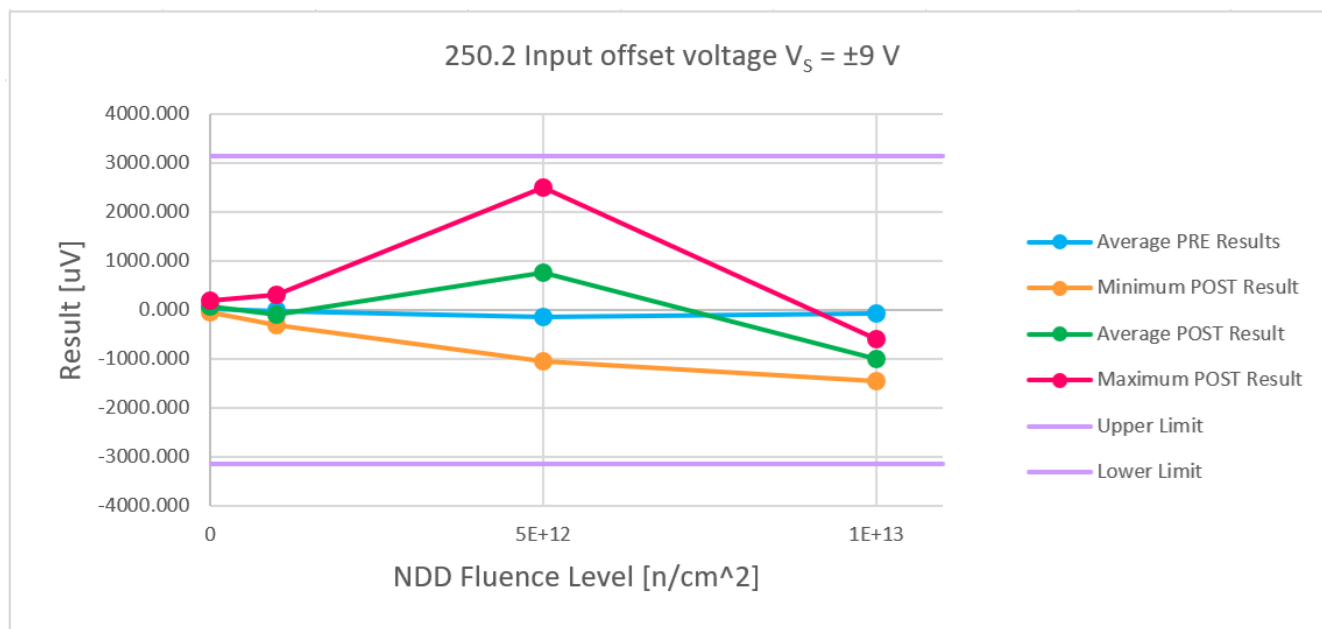


Figure 4-2. Sample Input Offset Voltage NDD Graph

4.3 Power Supply Rejection Ratio Parametric Shift

Power supply rejection ratio (PSRR) for the INA1H94-SP is specified as $\pm 1\mu\text{V/V}$ typical and $\pm 31.6\mu\text{V/V}$ minimum across the recommended operating temperature ($T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$). Power-supply rejection ratio was measured from $V_S = \pm 2\text{V}$ to $V_S = \pm 9\text{V}$, with test limits of $\pm 29\mu\text{V/V}$ for guardbanding purposes.

The PSRR performance of the tested samples remained within the data sheet specifications, with a minimum measured PSRR of $-13.02\mu\text{V/V}$ and a maximum PSRR shift of $12.29\mu\text{V/V}$ post irradiation. Full data for all ATE tests performed are included in the report appendix.

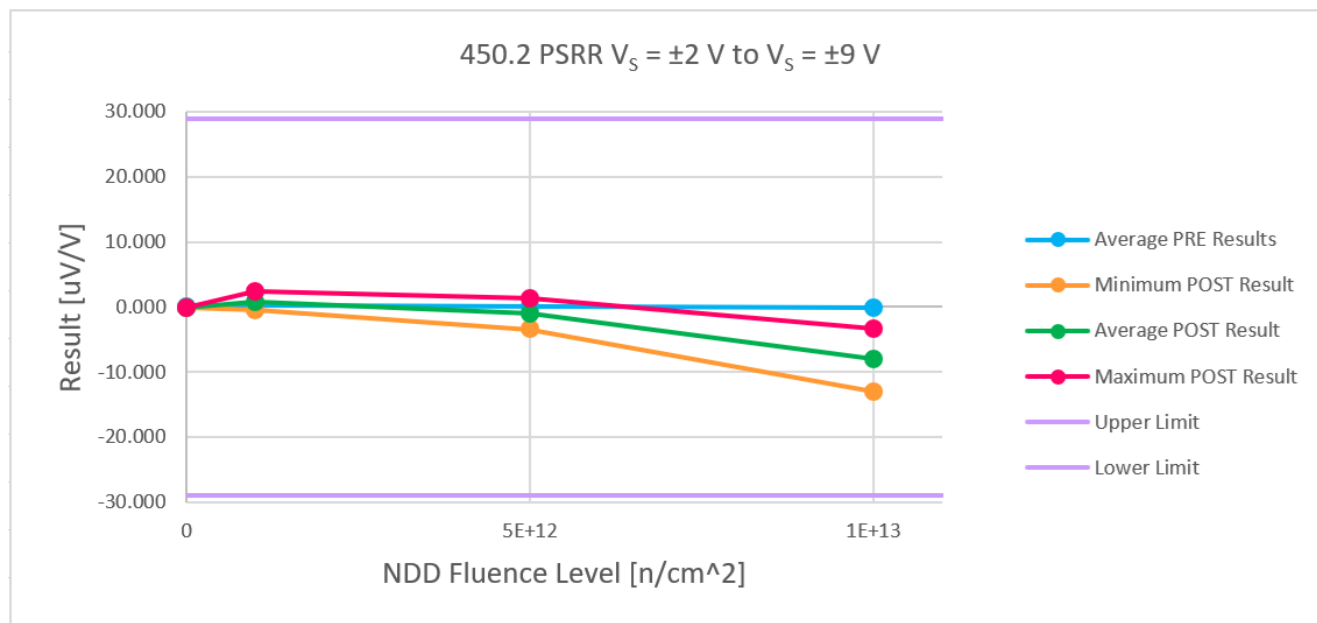


Figure 4-3. Sample PSRR NDD Graph

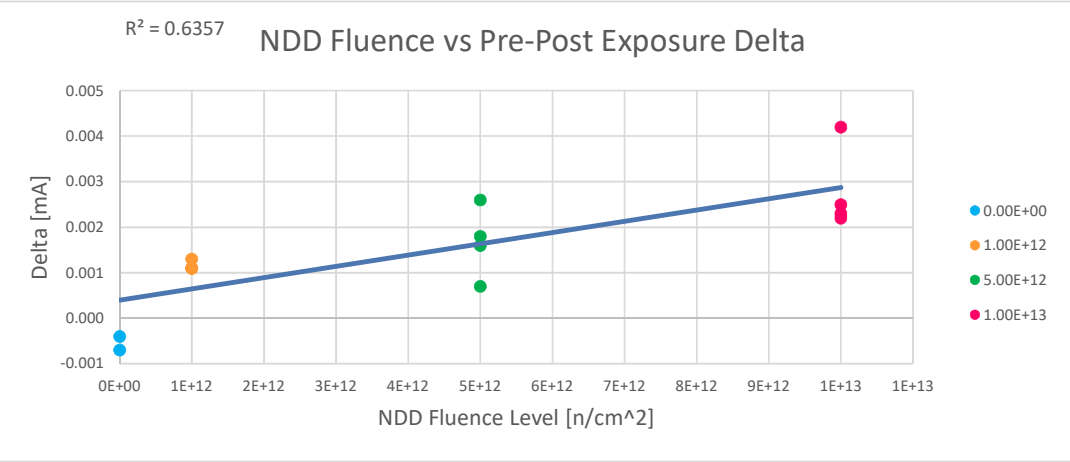
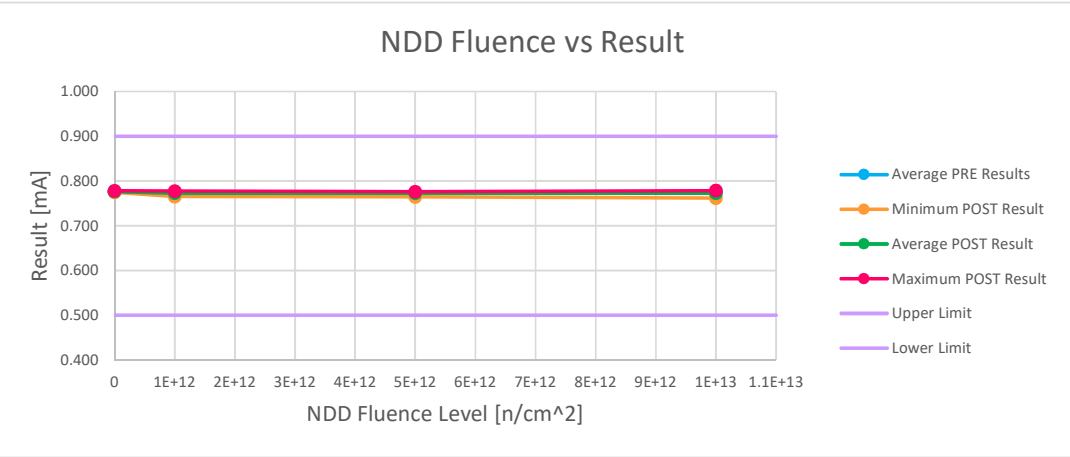
5 Summary of Results

While there were no functional failures at any irradiation level, parametric shift of parameters was readily apparent for the device when exposed to neutron irradiation. The parametric shift was more significant as the dosage increased beyond $1 \times 10^{12} \text{ n}/\text{cm}^2$. The specifications affected were the input offset voltage and CMRR.

A Test Results

This appendix contains the detailed test results.

DEVICE TEST: 200.1 IQ + 5V [mA]



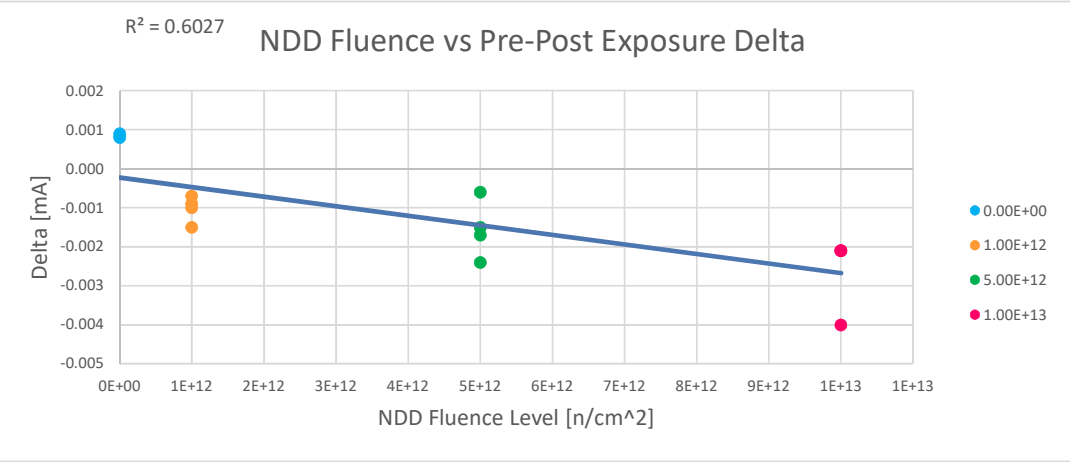
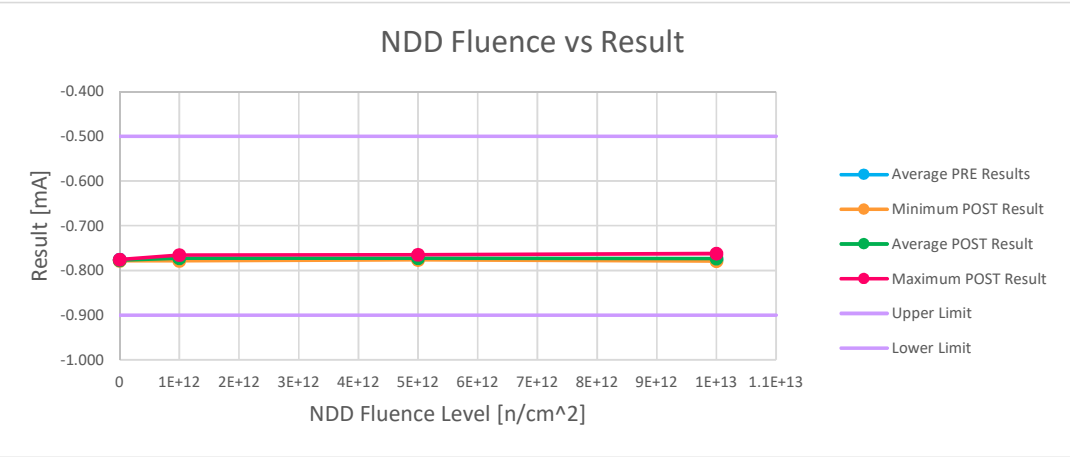
TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	0.775	0.776	0.777	0.002	0.775	0.776	0.778	0.002	-0.001	-0.001	0.000	0.000
1E+12	0.766	0.774	0.779	0.005	0.765	0.773	0.778	0.005	0.001	0.001	0.001	0.000
5E+12	0.767	0.774	0.778	0.005	0.765	0.773	0.776	0.005	0.001	0.002	0.003	0.001
1E+13	0.764	0.776	0.781	0.008	0.762	0.773	0.779	0.007	0.002	0.003	0.004	0.001

TEST RESULTS (LOWER LIMIT = 0.5 | UPPER LIMIT = 0.9) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	0.775	0.775	0.000
475	0E+00	CONTROL	0.777	0.778	-0.001
476	1E+12	NDD	0.779	0.778	0.001
477	1E+12	NDD	0.775	0.774	0.001
478	1E+12	NDD	0.775	0.774	0.001
479	1E+12	NDD	0.766	0.765	0.001
480	5E+12	NDD	0.778	0.776	0.002
481	5E+12	NDD	0.776	0.775	0.001
482	5E+12	NDD	0.767	0.765	0.002
483	5E+12	NDD	0.777	0.775	0.003
484	1E+13	NDD	0.764	0.762	0.002
485	1E+13	NDD	0.780	0.776	0.004
486	1E+13	NDD	0.781	0.779	0.002
487	1E+13	NDD	0.777	0.775	0.002

DEVICE TEST: 200.2 IQ 0V [mA]



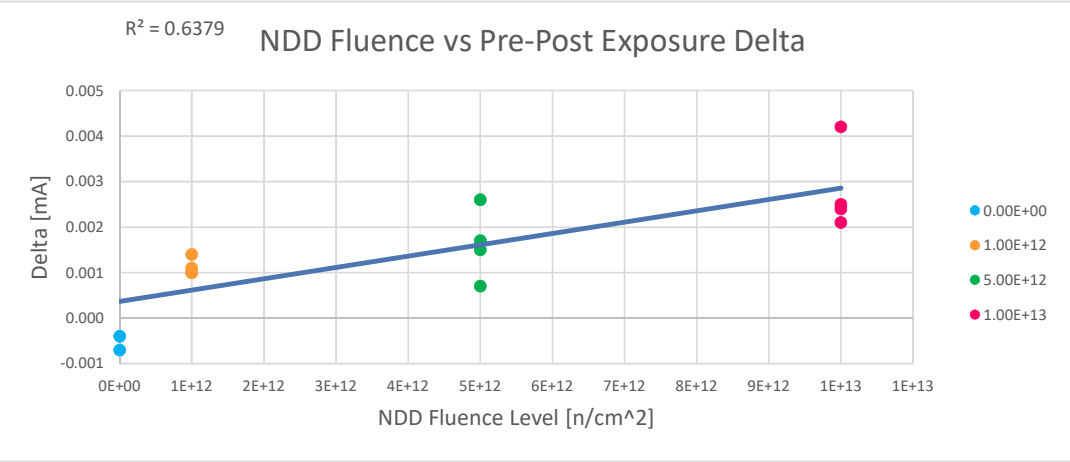
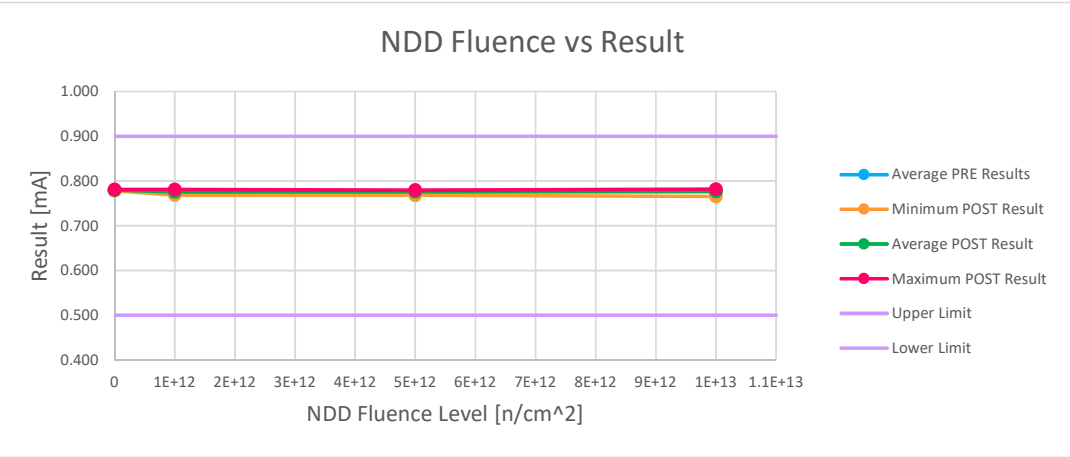
TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.777	-0.776	-0.775	0.002	-0.778	-0.777	-0.776	0.002	0.001	0.001	0.001	0.000
1E+12	-0.779	-0.774	-0.766	0.005	-0.778	-0.773	-0.765	0.005	-0.002	-0.001	-0.001	0.000
5E+12	-0.778	-0.774	-0.767	0.005	-0.776	-0.773	-0.765	0.005	-0.002	-0.002	-0.001	0.001
1E+13	-0.781	-0.776	-0.764	0.008	-0.779	-0.773	-0.762	0.007	-0.004	-0.003	-0.002	0.001

TEST RESULTS (LOWER LIMIT = -0.9 | UPPER LIMIT = -0.5) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.775	-0.776	0.001
475	0E+00	CONTROL	-0.777	-0.778	0.001
476	1E+12	NDD	-0.779	-0.778	-0.001
477	1E+12	NDD	-0.775	-0.774	-0.001
478	1E+12	NDD	-0.775	-0.774	-0.002
479	1E+12	NDD	-0.766	-0.765	-0.001
480	5E+12	NDD	-0.778	-0.776	-0.001
481	5E+12	NDD	-0.776	-0.775	-0.001
482	5E+12	NDD	-0.767	-0.765	-0.002
483	5E+12	NDD	-0.777	-0.775	-0.002
484	1E+13	NDD	-0.764	-0.762	-0.002
485	1E+13	NDD	-0.780	-0.776	-0.004
486	1E+13	NDD	-0.781	-0.779	-0.002
487	1E+13	NDD	-0.777	-0.775	-0.002

DEVICE TEST: 200.3 IQ + 9V [mA]



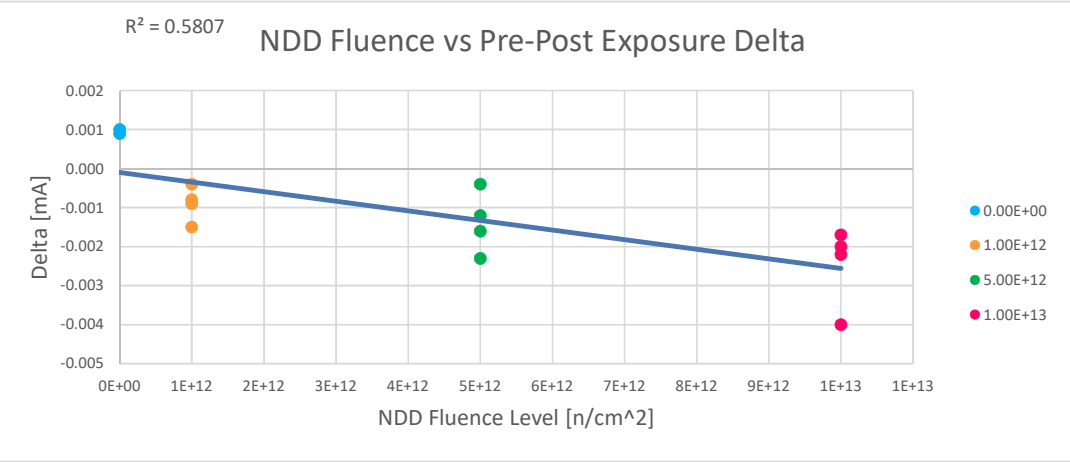
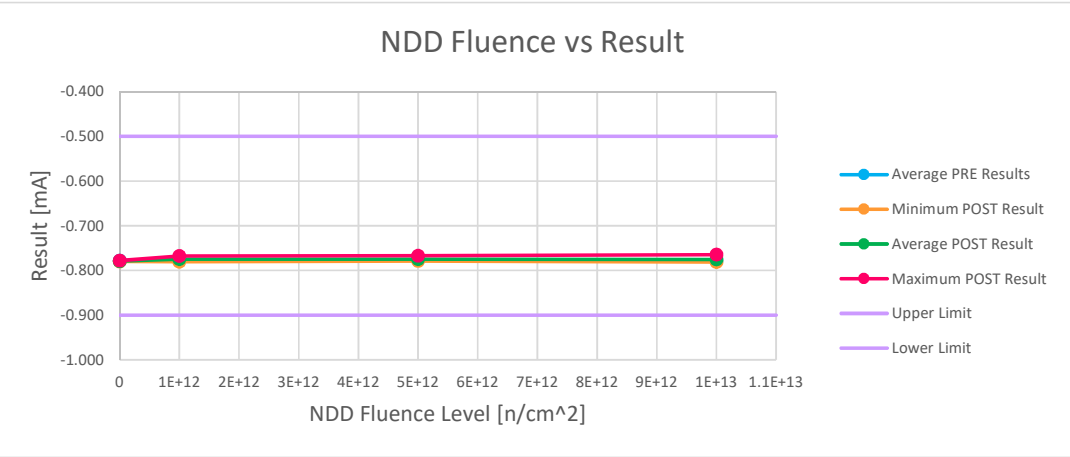
TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	0.778	0.779	0.780	0.002	0.778	0.780	0.781	0.002	-0.001	-0.001	0.000	0.000
1E+12	0.770	0.777	0.782	0.005	0.769	0.776	0.781	0.005	0.001	0.001	0.001	0.000
5E+12	0.770	0.777	0.781	0.005	0.768	0.776	0.779	0.005	0.001	0.002	0.003	0.001
1E+13	0.768	0.779	0.784	0.008	0.765	0.776	0.782	0.007	0.002	0.003	0.004	0.001

TEST RESULTS (LOWER LIMIT = 0.5 | UPPER LIMIT = 0.9) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	0.778	0.778	0.000
475	0E+00	CONTROL	0.780	0.781	-0.001
476	1E+12	NDD	0.782	0.781	0.001
477	1E+12	NDD	0.778	0.777	0.001
478	1E+12	NDD	0.778	0.777	0.001
479	1E+12	NDD	0.770	0.769	0.001
480	5E+12	NDD	0.781	0.779	0.002
481	5E+12	NDD	0.779	0.778	0.001
482	5E+12	NDD	0.770	0.768	0.002
483	5E+12	NDD	0.780	0.778	0.003
484	1E+13	NDD	0.768	0.765	0.002
485	1E+13	NDD	0.784	0.779	0.004
486	1E+13	NDD	0.784	0.782	0.002
487	1E+13	NDD	0.781	0.778	0.002

DEVICE TEST: 200.4 IQ - 9V [mA]



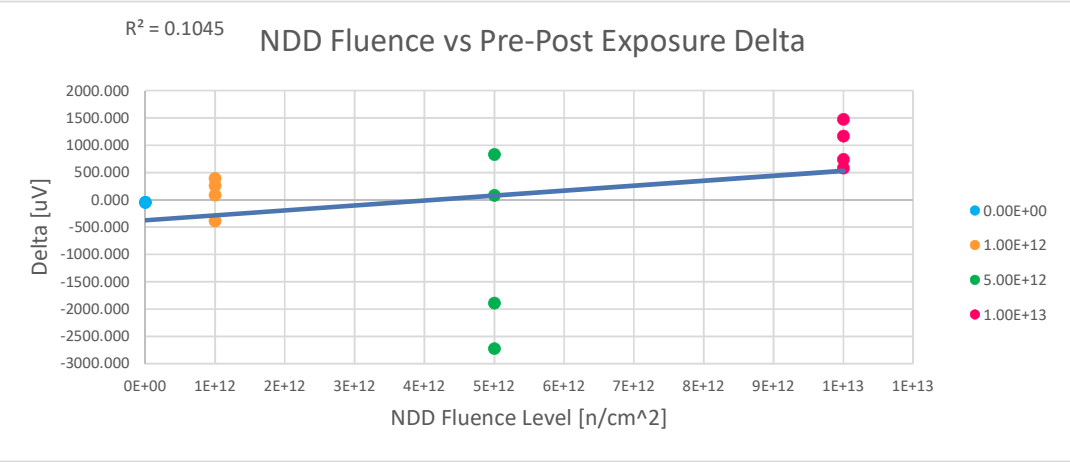
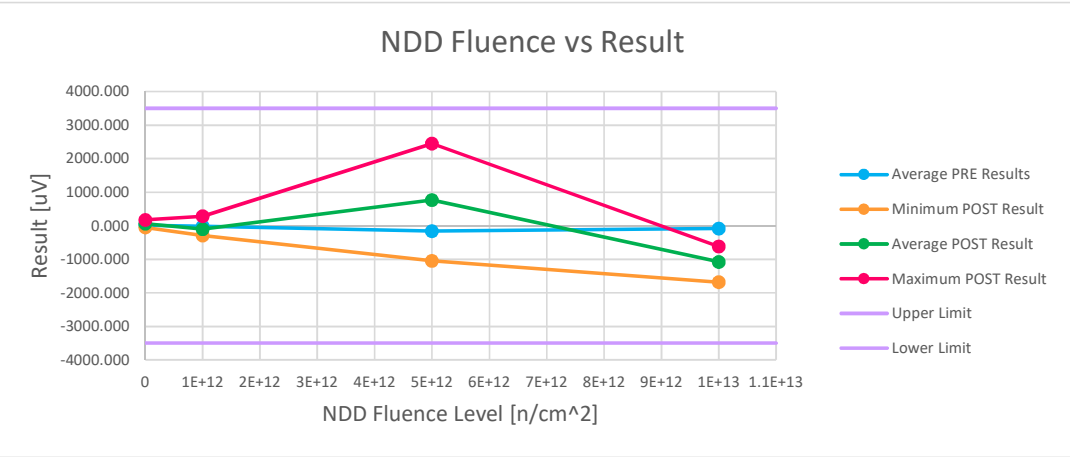
TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.779	-0.778	-0.777	0.002	-0.780	-0.779	-0.778	0.001	0.001	0.001	0.001	0.000
1E+12	-0.781	-0.776	-0.769	0.005	-0.781	-0.775	-0.768	0.005	-0.002	-0.001	0.000	0.000
5E+12	-0.780	-0.776	-0.769	0.005	-0.779	-0.775	-0.767	0.005	-0.002	-0.001	0.000	0.001
1E+13	-0.783	-0.778	-0.767	0.008	-0.781	-0.775	-0.765	0.007	-0.004	-0.002	-0.002	0.001

TEST RESULTS (LOWER LIMIT = -0.9 | UPPER LIMIT = -0.5) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.777	-0.778	0.001
475	0E+00	CONTROL	-0.779	-0.780	0.001
476	1E+12	NDD	-0.781	-0.781	0.000
477	1E+12	NDD	-0.777	-0.777	-0.001
478	1E+12	NDD	-0.777	-0.776	-0.002
479	1E+12	NDD	-0.769	-0.768	-0.001
480	5E+12	NDD	-0.780	-0.779	-0.001
481	5E+12	NDD	-0.778	-0.777	0.000
482	5E+12	NDD	-0.769	-0.767	-0.002
483	5E+12	NDD	-0.779	-0.777	-0.002
484	1E+13	NDD	-0.767	-0.765	-0.002
485	1E+13	NDD	-0.783	-0.779	-0.004
486	1E+13	NDD	-0.783	-0.781	-0.002
487	1E+13	NDD	-0.780	-0.778	-0.002

DEVICE TEST: 250.1 VOS 5V [uV]

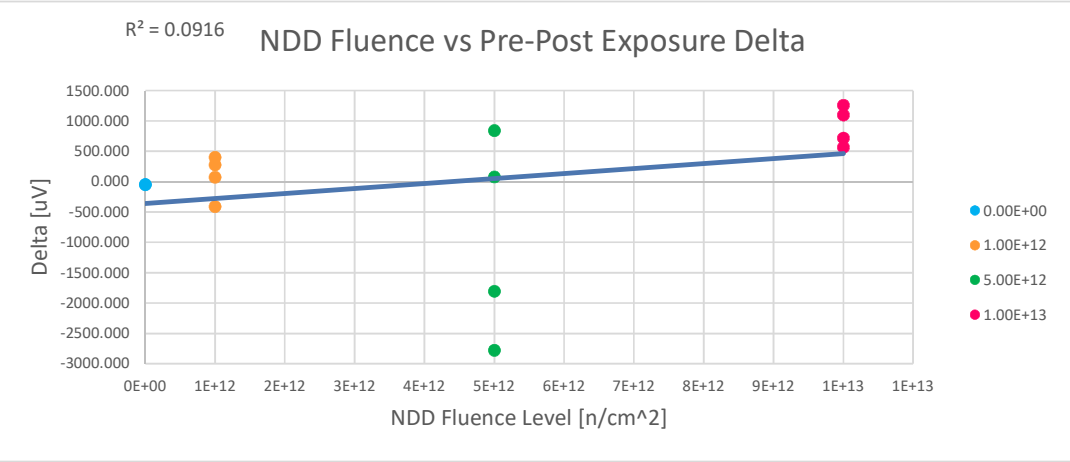
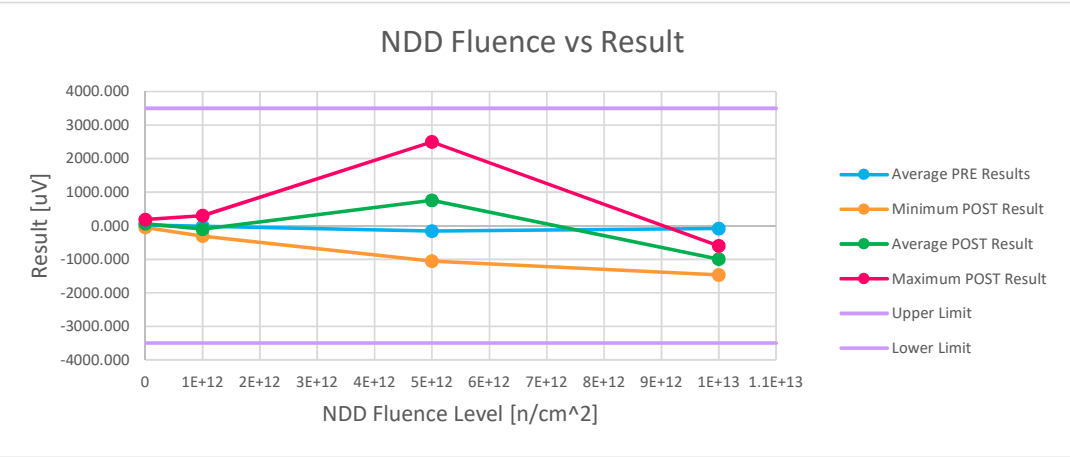


TEST RESULTS (LOWER LIMIT = -3500 UPPER LIMIT = 3500) [uV]					
Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-92.657	-50.561	-42.096
475	0E+00	CONTROL	126.719	173.465	-46.746
476	1E+12	NDD	-31.440	-294.437	262.997
477	1E+12	NDD	-40.252	-129.375	89.123
478	1E+12	NDD	-102.895	286.043	-388.938
479	1E+12	NDD	116.830	-278.233	395.063
480	5E+12	NDD	-275.406	2449.447	-2724.853
481	5E+12	NDD	-217.431	-1050.333	832.902
482	5E+12	NDD	-228.006	-309.195	81.189
483	5E+12	NDD	80.926	1971.150	-1890.224
484	1E+13	NDD	122.433	-619.528	741.961
485	1E+13	NDD	-207.578	-1682.931	1475.353
486	1E+13	NDD	-102.854	-1273.118	1170.264
487	1E+13	NDD	-148.635	-732.495	583.860

TEST STATISTICS [uV]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-92.657	17.031	126.719	155.122	-50.561	61.452	173.465	158.410	-46.746	-44.421	-42.096	3.288
1E+12	-102.895	-14.439	116.830	93.115	-294.437	-104.001	286.043	270.432	-388.938	89.561	395.063	342.721
5E+12	-275.406	-159.979	80.926	162.570	-1050.333	765.267	2449.447	1706.994	-2724.853	-925.247	832.902	1660.699
1E+13	-207.578	-84.159	122.433	144.244	-1682.931	-1077.018	-619.528	494.496	583.860	992.860	1475.353	405.998

DEVICE TEST: 250.2 VOS +-9V [uV]

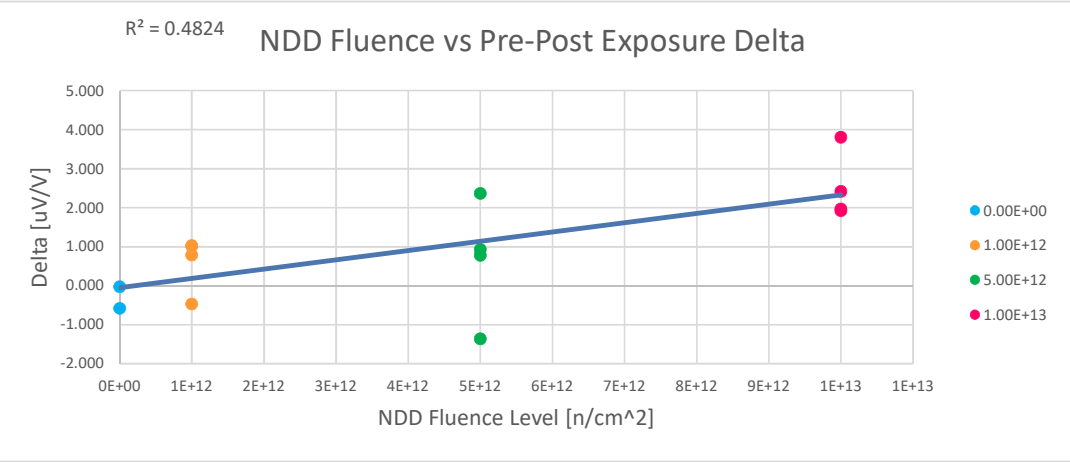
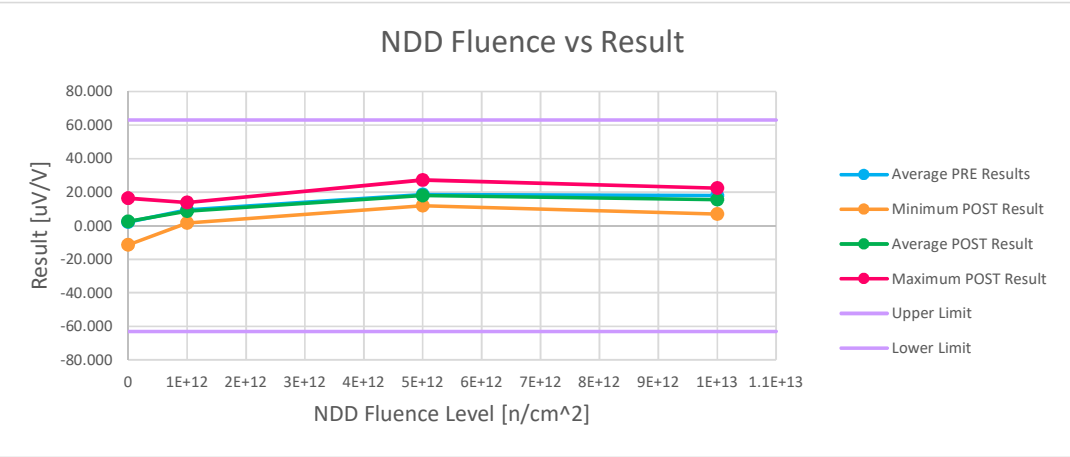


TEST RESULTS (LOWER LIMIT = -3500 UPPER LIMIT = 3500) [uV]					
Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-93.149	-50.040	-43.109
475	0E+00	CONTROL	132.823	182.853	-50.030
476	1E+12	NDD	-30.623	-306.228	275.605
477	1E+12	NDD	-43.659	-115.528	71.869
478	1E+12	NDD	-109.106	303.061	-412.167
479	1E+12	NDD	118.357	-282.055	400.412
480	5E+12	NDD	-279.090	2499.787	-2778.877
481	5E+12	NDD	-213.848	-1055.588	841.740
482	5E+12	NDD	-225.455	-301.967	76.512
483	5E+12	NDD	90.654	1895.555	-1804.901
484	1E+13	NDD	120.975	-599.709	720.684
485	1E+13	NDD	-204.094	-1462.397	1258.303
486	1E+13	NDD	-103.553	-1204.424	1100.871
487	1E+13	NDD	-154.868	-722.858	567.990

TEST STATISTICS [uV]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-93.149	19.837	132.823	159.786	-50.040	66.407	182.853	164.680	-50.030	-46.570	-43.109	4.894
1E+12	-109.106	-16.258	118.357	96.089	-306.228	-100.188	303.061	281.882	-412.167	83.930	400.412	357.378
5E+12	-279.090	-156.935	90.654	167.488	-1055.588	759.447	2499.787	1706.895	-2778.877	-916.382	841.740	1666.852
1E+13	-204.094	-85.385	120.975	143.567	-1462.397	-997.347	-599.709	405.221	567.990	911.962	1258.303	321.736

DEVICE TEST: 400.1 Half CMRR +150V [uV/V]



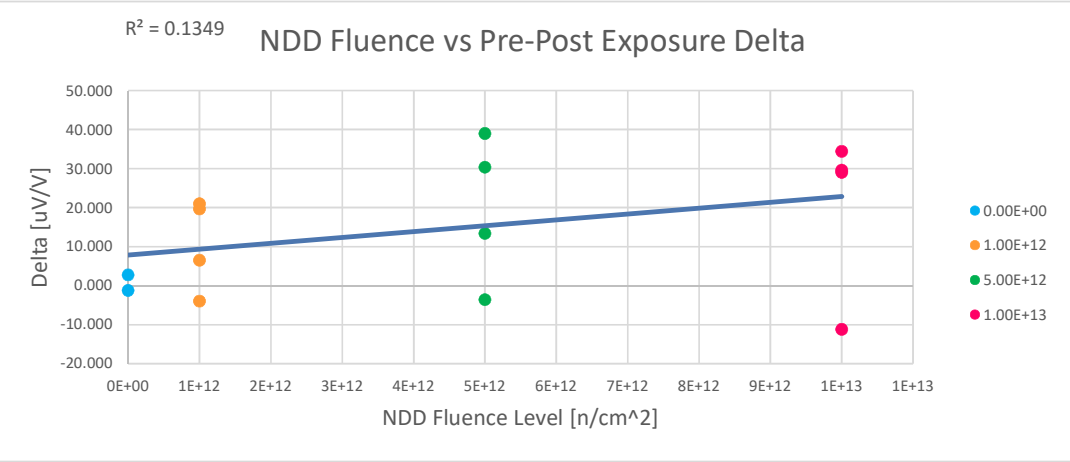
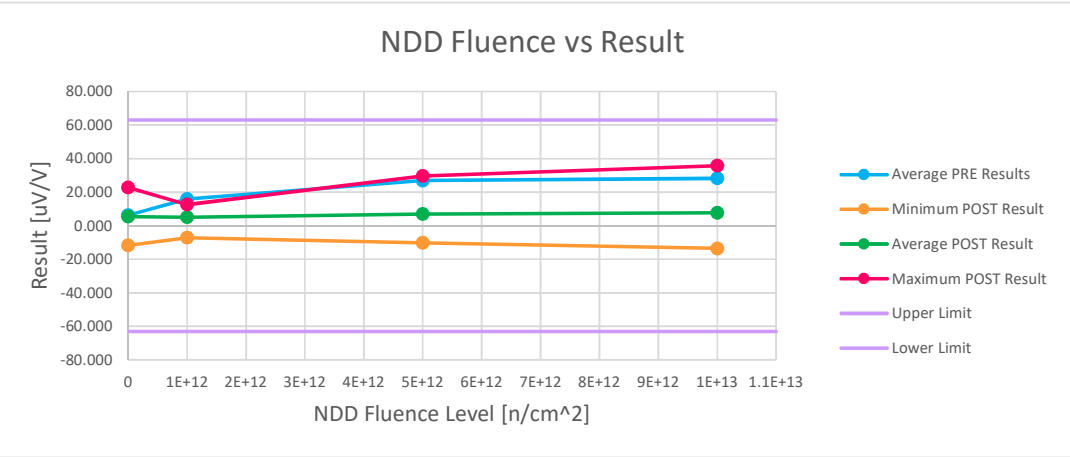
TEST RESULTS (LOWER LIMIT = -63 | UPPER LIMIT = 63) [uV/V]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-12.040	-11.459	-0.581
475	0E+00	CONTROL	16.436	16.462	-0.026
476	1E+12	NDD	14.829	13.808	1.021
477	1E+12	NDD	9.100	9.568	-0.468
478	1E+12	NDD	2.465	1.685	0.780
479	1E+12	NDD	10.913	9.895	1.018
480	5E+12	NDD	25.896	27.260	-1.364
481	5E+12	NDD	18.364	16.004	2.360
482	5E+12	NDD	12.646	11.871	0.775
483	5E+12	NDD	17.648	16.725	0.923
484	1E+13	NDD	26.178	22.378	3.800
485	1E+13	NDD	8.928	7.008	1.920
486	1E+13	NDD	14.599	12.638	1.961
487	1E+13	NDD	22.341	19.928	2.413

TEST STATISTICS [uV/V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-12.040	2.198	16.436	20.136	-11.459	2.502	16.462	19.743	-0.581	-0.304	-0.026	0.392
1E+12	2.465	9.327	14.829	5.162	1.685	8.739	13.808	5.082	-0.468	0.588	1.021	0.713
5E+12	12.646	18.639	25.896	5.466	11.871	17.965	27.260	6.555	-1.364	0.673	2.360	1.535
1E+13	8.928	18.012	26.178	7.737	7.008	15.488	22.378	7.005	1.920	2.524	3.800	0.880

DEVICE TEST: 400.3 Half CMRR +20V [uV/V]

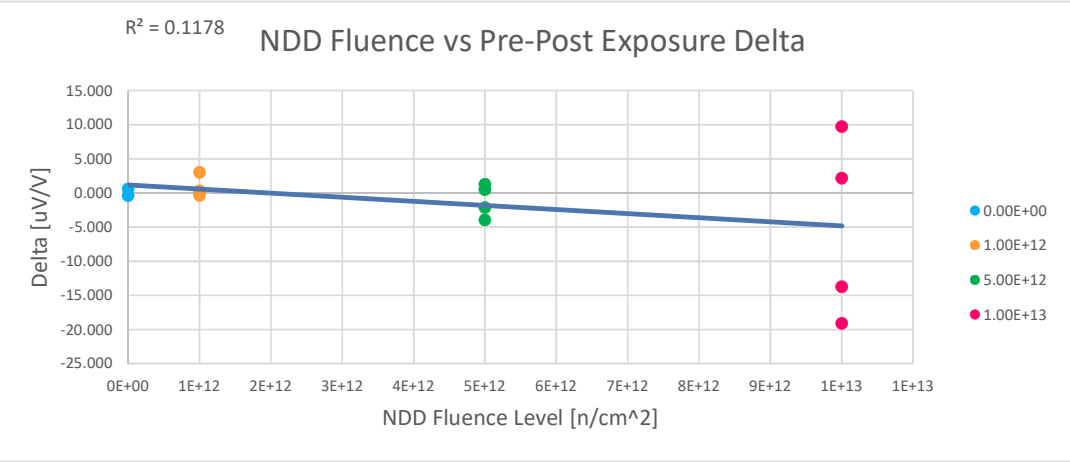
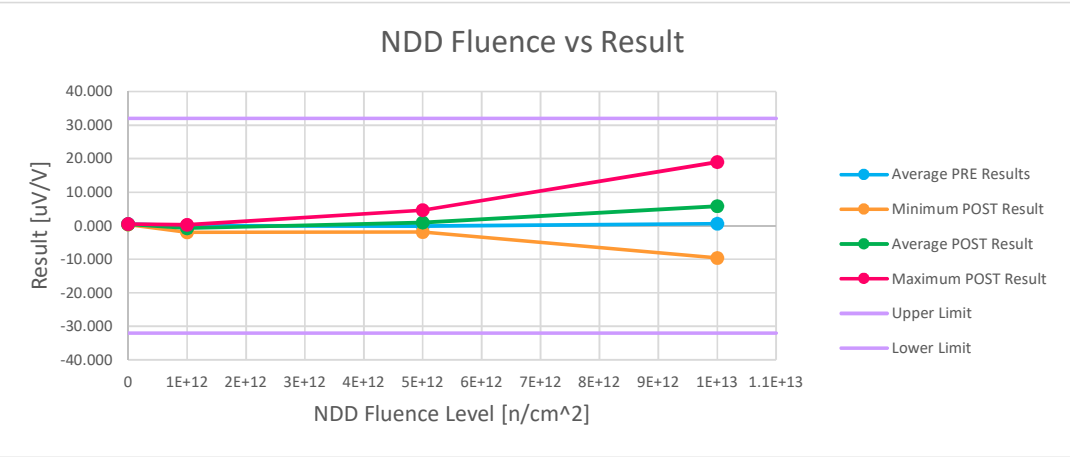


TEST RESULTS (LOWER LIMIT = -63 UPPER LIMIT = 63) [uV/V]					
Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-12.955	-11.726	-1.229
475	0E+00	CONTROL	25.503	22.743	2.760
476	1E+12	NDD	25.254	5.573	19.681
477	1E+12	NDD	13.830	-7.141	20.971
478	1E+12	NDD	8.634	12.593	-3.959
479	1E+12	NDD	15.828	9.343	6.485
480	5E+12	NDD	33.353	3.001	30.352
481	5E+12	NDD	25.986	29.583	-3.597
482	5E+12	NDD	19.169	5.822	13.347
483	5E+12	NDD	28.897	-10.105	39.002
484	1E+13	NDD	39.680	10.640	29.040
485	1E+13	NDD	16.107	-13.521	29.628
486	1E+13	NDD	24.651	35.827	-11.176
487	1E+13	NDD	32.546	-1.908	34.454

TEST STATISTICS [uV/V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-12.955	6.274	25.503	27.194	-11.726	5.509	22.743	24.373	-1.229	0.766	2.760	2.821
1E+12	8.634	15.887	25.254	6.942	-7.141	5.092	12.593	8.645	-3.959	10.795	20.971	11.815
5E+12	19.169	26.851	33.353	5.950	-10.105	7.075	29.583	16.532	-3.597	19.776	39.002	18.878
1E+13	16.107	28.246	39.680	10.157	-13.521	7.760	35.827	21.153	-11.176	20.487	34.454	21.247

DEVICE TEST: 450.1 PSRR 4V_5V [uV/V]



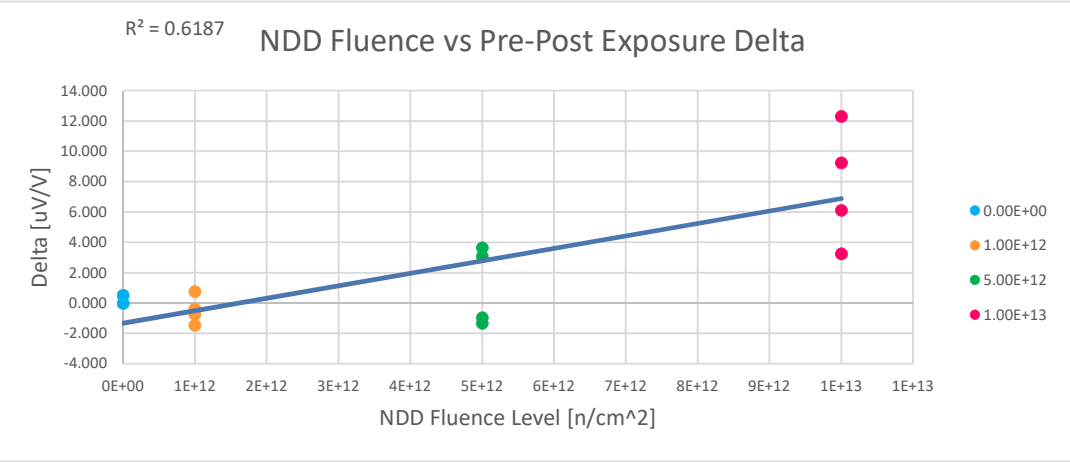
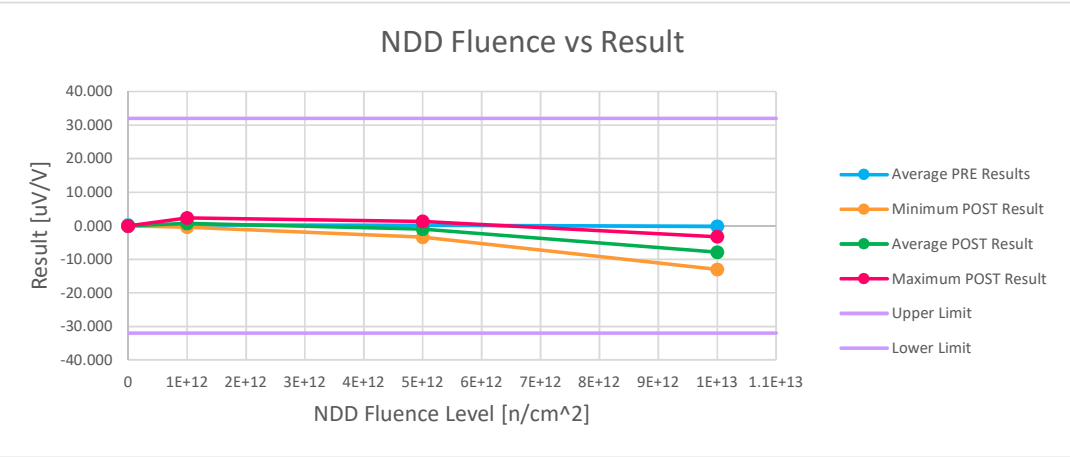
TEST RESULTS (LOWER LIMIT = -32 | UPPER LIMIT = 32) [uV/V]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.040	0.352	-0.391
475	0E+00	CONTROL	1.115	0.531	0.584
476	1E+12	NDD	-0.056	0.279	-0.335
477	1E+12	NDD	1.036	-1.980	3.016
478	1E+12	NDD	-0.506	-0.589	0.083
479	1E+12	NDD	-0.375	-0.711	0.336
480	5E+12	NDD	0.733	4.676	-3.943
481	5E+12	NDD	-0.571	-1.849	1.279
482	5E+12	NDD	-0.019	-0.519	0.499
483	5E+12	NDD	-0.513	1.588	-2.101
484	1E+13	NDD	1.063	14.794	-13.731
485	1E+13	NDD	0.121	-9.606	9.727
486	1E+13	NDD	-0.081	18.980	-19.060
487	1E+13	NDD	1.294	-0.893	2.187

TEST STATISTICS [uV/V]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.040	0.537	1.115	0.816	0.352	0.441	0.531	0.127	-0.391	0.096	0.584	0.690
1E+12	-0.506	0.025	1.036	0.700	-1.980	-0.750	0.279	0.931	-0.335	0.775	3.016	1.519
5E+12	-0.571	-0.093	0.733	0.603	-1.849	0.974	4.676	2.845	-3.943	-1.067	1.279	2.401
1E+13	-0.081	0.599	1.294	0.680	-9.606	5.819	18.980	13.376	-19.060	-5.219	9.727	13.445

DEVICE TEST: 450.2 PSRR +-2V_+9V [uV/V]



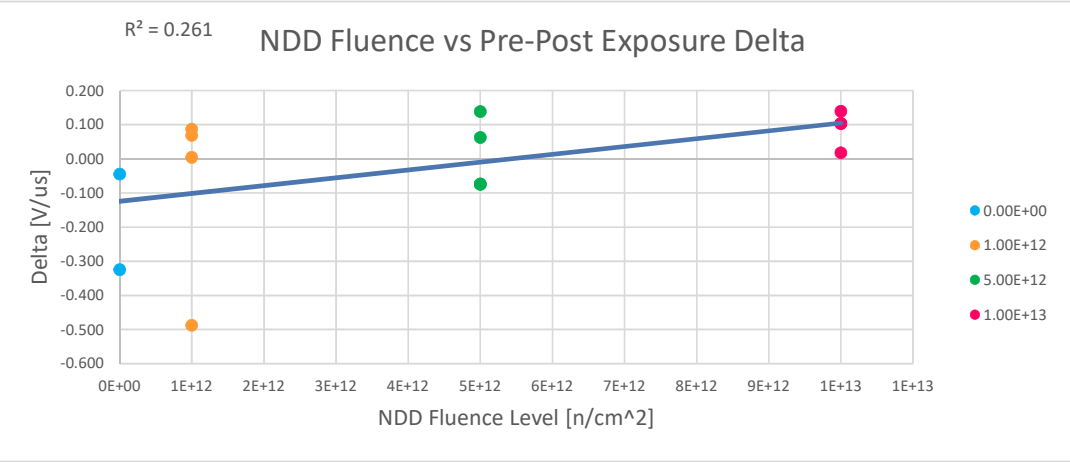
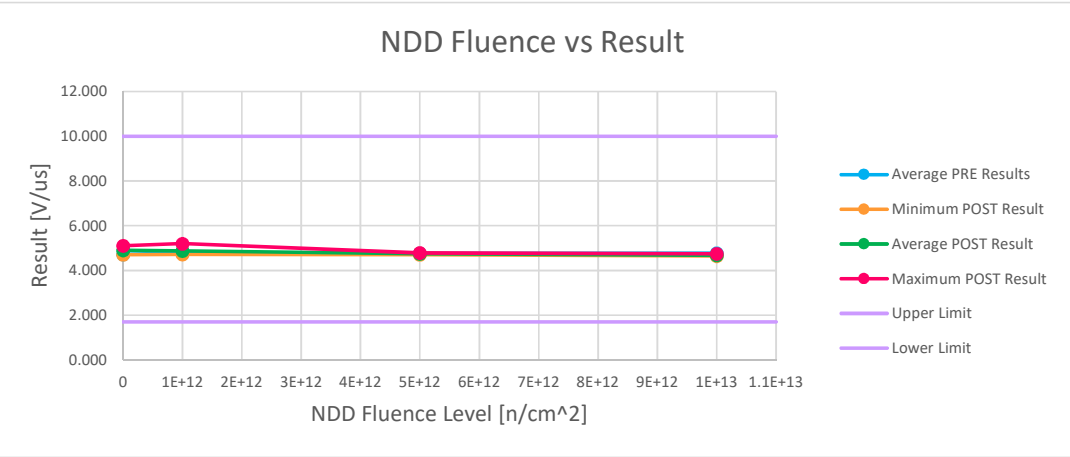
TEST RESULTS (LOWER LIMIT = -32 | UPPER LIMIT = 32) [uV/V]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.101	-0.087	-0.014
475	0E+00	CONTROL	0.431	-0.072	0.503
476	1E+12	NDD	-0.217	0.162	-0.380
477	1E+12	NDD	0.872	2.330	-1.458
478	1E+12	NDD	0.393	-0.370	0.763
479	1E+12	NDD	-0.038	0.710	-0.748
480	5E+12	NDD	-0.142	0.825	-0.967
481	5E+12	NDD	0.224	-3.412	3.636
482	5E+12	NDD	0.166	-2.916	3.082
483	5E+12	NDD	0.015	1.348	-1.333
484	1E+13	NDD	-0.028	-3.273	3.244
485	1E+13	NDD	-0.178	-6.282	6.104
486	1E+13	NDD	-0.735	-13.024	12.289
487	1E+13	NDD	0.194	-9.045	9.238

TEST STATISTICS [uV/V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.101	0.165	0.431	0.376	-0.087	-0.079	-0.072	0.010	-0.014	0.244	0.503	0.366
1E+12	-0.217	0.252	0.872	0.486	-0.370	0.708	2.330	1.168	-1.458	-0.456	0.763	0.928
5E+12	-0.142	0.066	0.224	0.164	-3.412	-1.039	1.348	2.471	-1.333	1.105	3.636	2.617
1E+13	-0.735	-0.187	0.194	0.396	-13.024	-7.906	-3.273	4.147	3.244	7.719	12.289	3.908

DEVICE TEST: 500.1 Slew Rate Rising 5V [V/us]



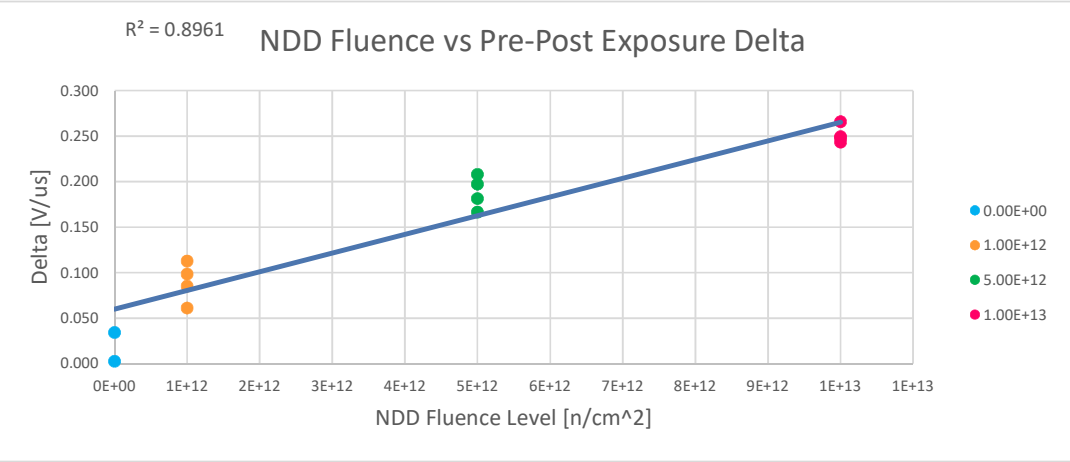
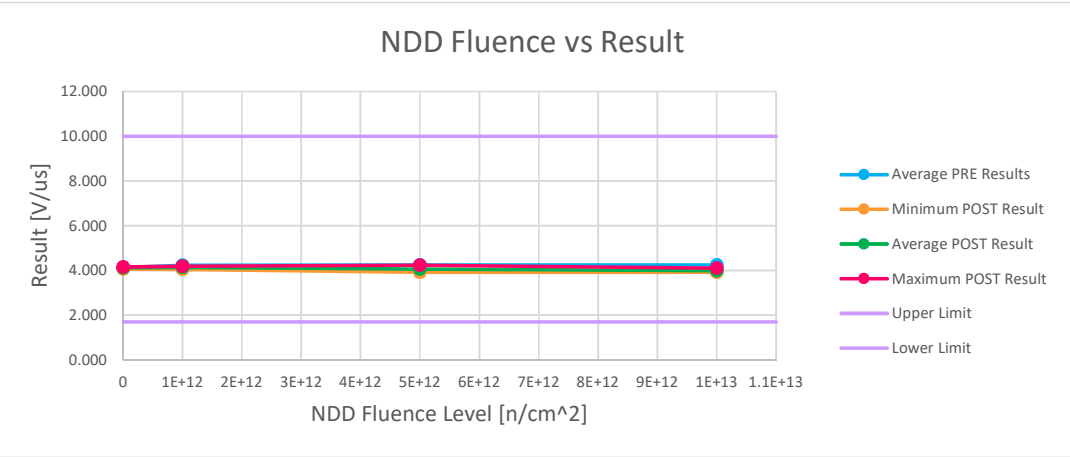
TEST RESULTS (LOWER LIMIT = 1.7 | UPPER LIMIT = 10) [V/us]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	4.778	5.102	-0.324
475	0E+00	CONTROL	4.663	4.707	-0.044
476	1E+12	NDD	4.714	5.201	-0.487
477	1E+12	NDD	4.849	4.844	0.005
478	1E+12	NDD	4.813	4.726	0.087
479	1E+12	NDD	4.784	4.715	0.069
480	5E+12	NDD	4.789	4.726	0.063
481	5E+12	NDD	4.848	4.708	0.139
482	5E+12	NDD	4.715	4.788	-0.073
483	5E+12	NDD	4.661	4.735	-0.074
484	1E+13	NDD	4.790	4.650	0.140
485	1E+13	NDD	4.850	4.747	0.103
486	1E+13	NDD	4.661	4.643	0.018
487	1E+13	NDD	4.783	4.678	0.105

TEST STATISTICS [V/us]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	4.663	4.721	4.778	0.081	4.707	4.904	5.102	0.279	-0.324	-0.184	-0.044	0.198
1E+12	4.714	4.790	4.849	0.057	4.715	4.871	5.201	0.227	-0.487	-0.081	0.087	0.272
5E+12	4.661	4.753	4.848	0.082	4.708	4.739	4.788	0.034	-0.074	0.014	0.139	0.105
1E+13	4.661	4.771	4.850	0.079	4.643	4.679	4.747	0.047	0.018	0.091	0.140	0.052

DEVICE TEST: 500.2 Slew Rate Falling 5V [V/us]



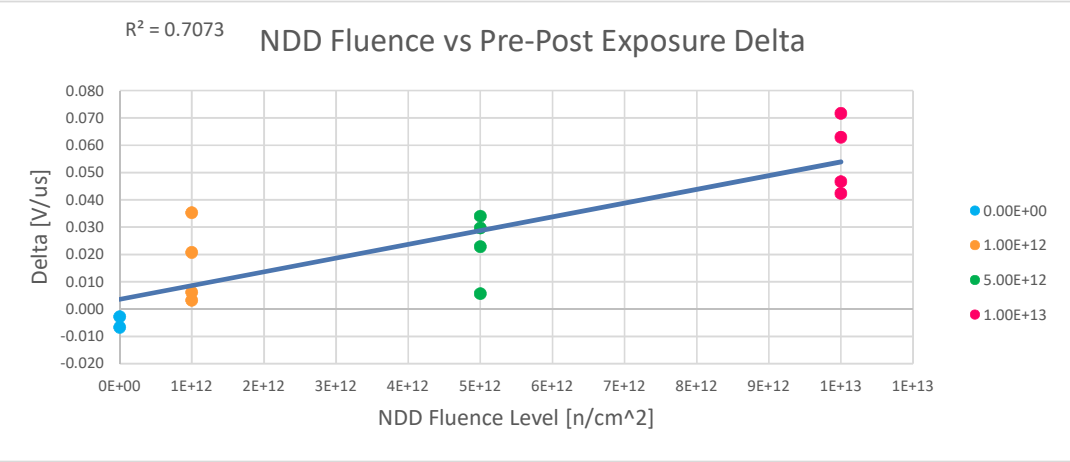
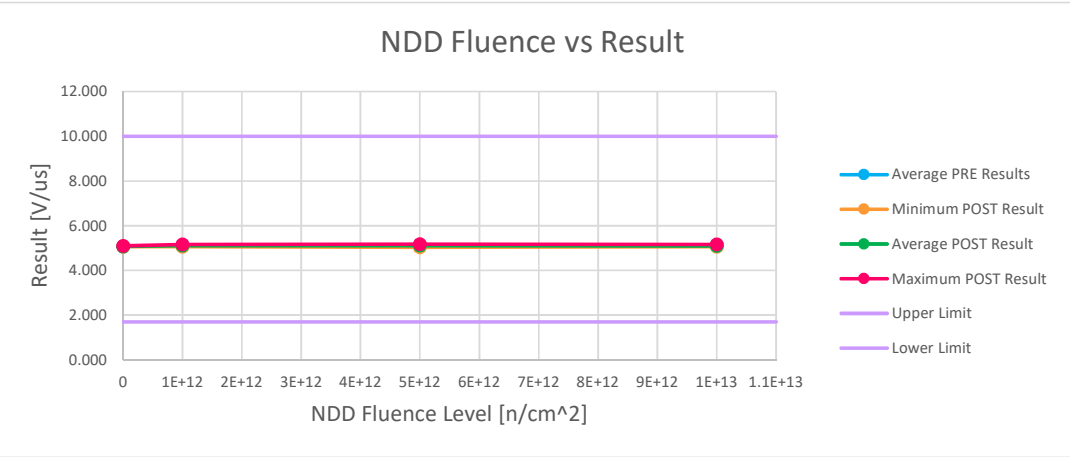
TEST STATISTICS [V/us]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	4.101	4.131	4.160	0.042	4.067	4.112	4.158	0.064	0.003	0.018	0.034	0.022
1E+12	4.140	4.227	4.301	0.076	4.054	4.138	4.189	0.062	0.061	0.089	0.113	0.022
5E+12	4.120	4.248	4.413	0.126	3.922	4.060	4.232	0.136	0.166	0.188	0.208	0.018
1E+13	4.160	4.243	4.353	0.090	3.916	3.991	4.105	0.087	0.243	0.252	0.266	0.010

TEST RESULTS (LOWER LIMIT = 1.7 | UPPER LIMIT = 10) [V/us]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	4.101	4.067	0.034
475	0E+00	CONTROL	4.160	4.158	0.003
476	1E+12	NDD	4.278	4.180	0.098
477	1E+12	NDD	4.301	4.189	0.113
478	1E+12	NDD	4.140	4.054	0.085
479	1E+12	NDD	4.190	4.129	0.061
480	5E+12	NDD	4.413	4.232	0.181
481	5E+12	NDD	4.267	4.101	0.166
482	5E+12	NDD	4.193	3.985	0.208
483	5E+12	NDD	4.120	3.922	0.197
484	1E+13	NDD	4.179	3.930	0.249
485	1E+13	NDD	4.279	4.013	0.266
486	1E+13	NDD	4.160	3.916	0.243
487	1E+13	NDD	4.353	4.105	0.248

DEVICE TEST: 500.3 Slew Rate Rising 9V [V/us]



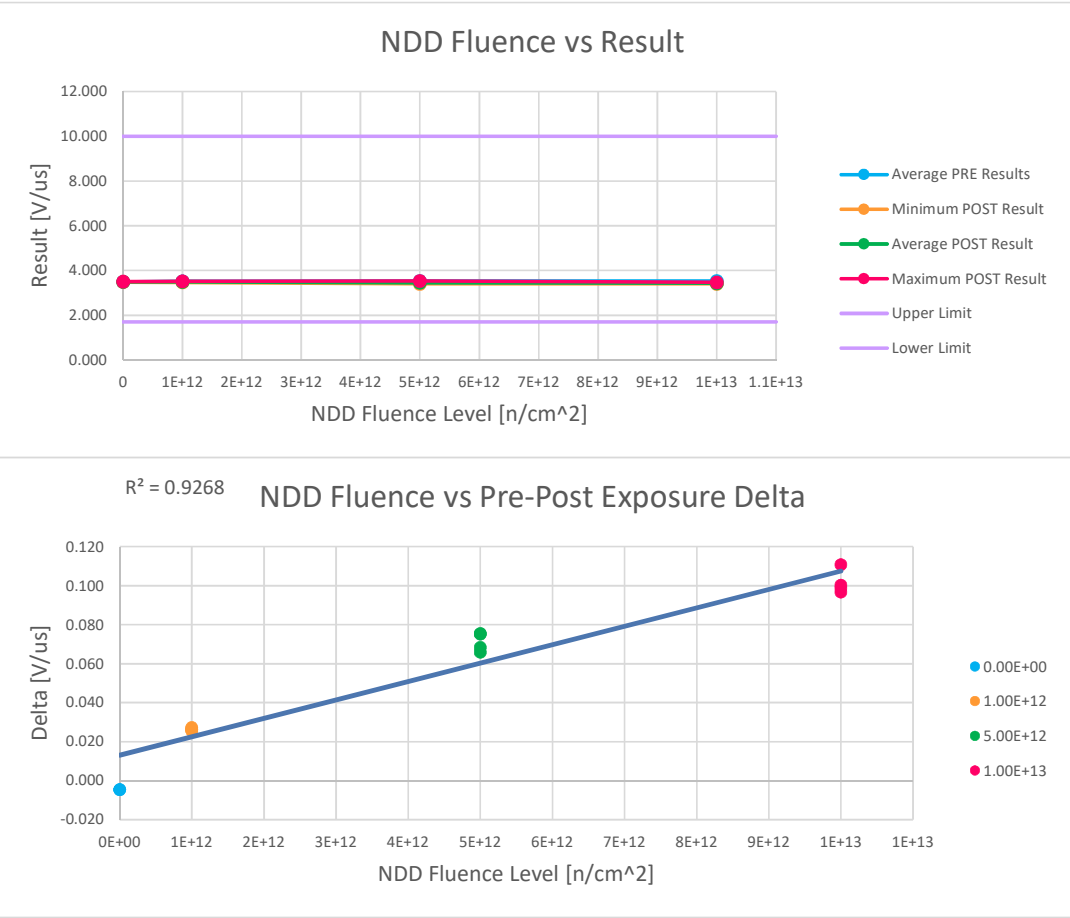
TEST STATISTICS [V/us]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	5.055	5.073	5.090	0.025	5.058	5.077	5.097	0.028	-0.007	-0.005	-0.003	0.003
1E+12	5.076	5.125	5.164	0.037	5.055	5.109	5.158	0.045	0.003	0.016	0.035	0.015
5E+12	5.068	5.134	5.207	0.060	5.034	5.111	5.178	0.060	0.006	0.023	0.034	0.012
1E+13	5.095	5.149	5.206	0.048	5.052	5.093	5.159	0.048	0.042	0.056	0.072	0.014

TEST RESULTS (LOWER LIMIT = 1.7 | UPPER LIMIT = 10) [V/us]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	5.055	5.058	-0.003
475	0E+00	CONTROL	5.090	5.097	-0.007
476	1E+12	NDD	5.134	5.130	0.003
477	1E+12	NDD	5.164	5.158	0.006
478	1E+12	NDD	5.076	5.055	0.021
479	1E+12	NDD	5.128	5.092	0.035
480	5E+12	NDD	5.207	5.178	0.030
481	5E+12	NDD	5.153	5.130	0.023
482	5E+12	NDD	5.108	5.102	0.006
483	5E+12	NDD	5.068	5.034	0.034
484	1E+13	NDD	5.128	5.065	0.063
485	1E+13	NDD	5.168	5.096	0.072
486	1E+13	NDD	5.095	5.052	0.042
487	1E+13	NDD	5.206	5.159	0.047

DEVICE TEST: 500.4 Slew Rate Falling 9V [V/us]



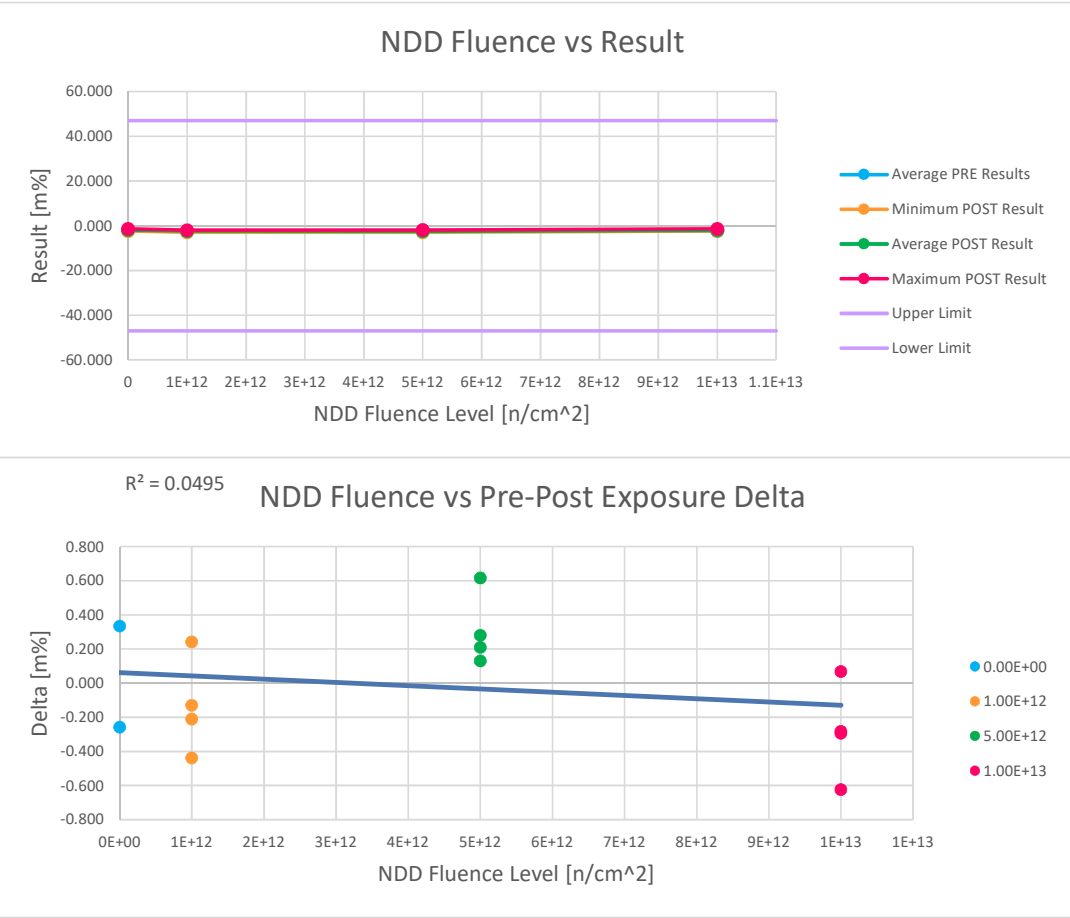
TEST RESULTS (LOWER LIMIT = 1.7 | UPPER LIMIT = 10) [V/us]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	3.474	3.479	-0.005
475	0E+00	CONTROL	3.501	3.506	-0.005
476	1E+12	NDD	3.540	3.515	0.026
477	1E+12	NDD	3.546	3.519	0.027
478	1E+12	NDD	3.494	3.467	0.027
479	1E+12	NDD	3.508	3.481	0.026
480	5E+12	NDD	3.592	3.526	0.066
481	5E+12	NDD	3.539	3.470	0.068
482	5E+12	NDD	3.505	3.429	0.075
483	5E+12	NDD	3.479	3.404	0.075
484	1E+13	NDD	3.505	3.405	0.100
485	1E+13	NDD	3.543	3.432	0.111
486	1E+13	NDD	3.500	3.403	0.097
487	1E+13	NDD	3.568	3.469	0.099

TEST STATISTICS [V/us]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	3.474	3.488	3.501	0.019	3.479	3.492	3.506	0.019	-0.005	-0.005	-0.005	0.000
1E+12	3.494	3.522	3.546	0.025	3.467	3.496	3.519	0.026	0.026	0.026	0.027	0.001
5E+12	3.479	3.529	3.592	0.049	3.404	3.457	3.526	0.054	0.066	0.071	0.075	0.005
1E+13	3.500	3.529	3.568	0.032	3.403	3.427	3.469	0.031	0.097	0.102	0.111	0.006

DEVICE TEST: 501.0 GERR +5V [m%]



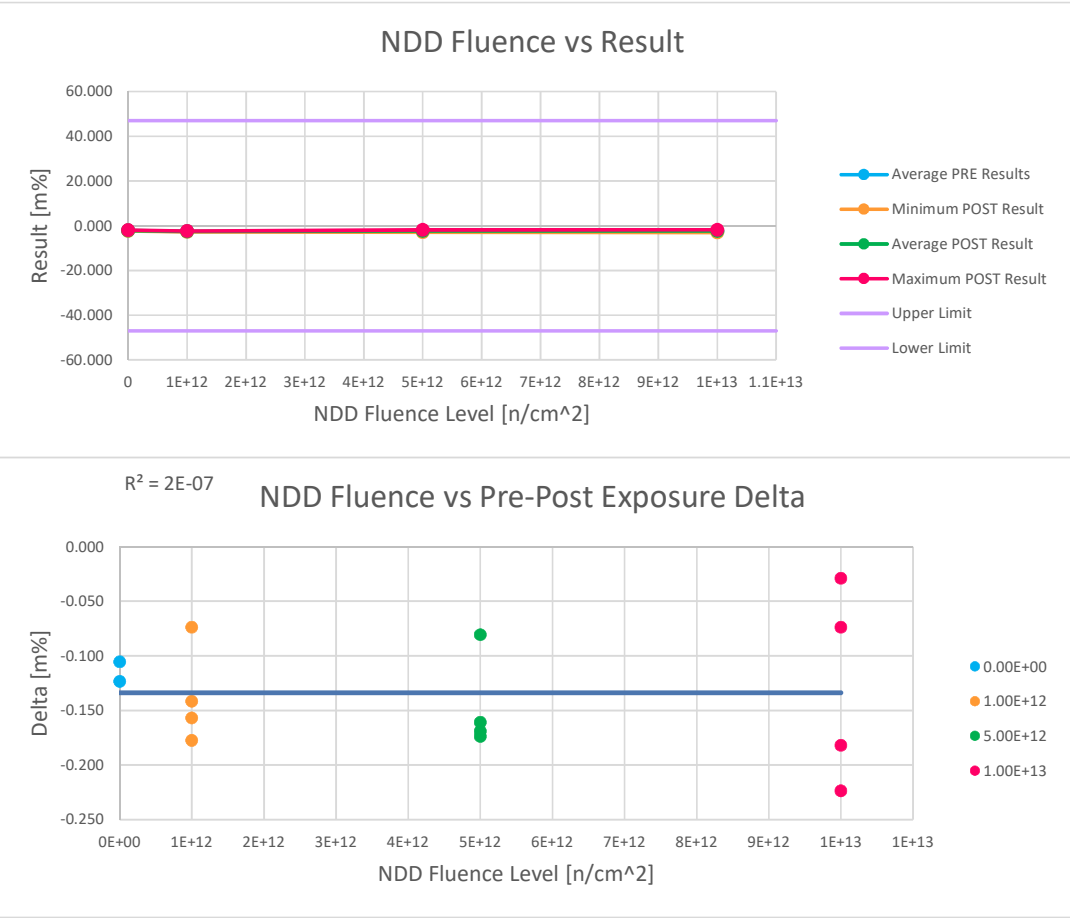
TEST RESULTS (LOWER LIMIT = -47 | UPPER LIMIT = 47) [m%]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-1.683	-1.425	-0.258
475	0E+00	CONTROL	-2.042	-2.376	0.335
476	1E+12	NDD	-2.393	-1.955	-0.438
477	1E+12	NDD	-2.719	-2.962	0.242
478	1E+12	NDD	-2.599	-2.389	-0.211
479	1E+12	NDD	-2.247	-2.119	-0.128
480	5E+12	NDD	-2.661	-2.871	0.210
481	5E+12	NDD	-2.508	-2.788	0.280
482	5E+12	NDD	-1.652	-2.269	0.618
483	5E+12	NDD	-1.803	-1.935	0.132
484	1E+13	NDD	-2.653	-2.361	-0.292
485	1E+13	NDD	-1.950	-1.327	-0.623
486	1E+13	NDD	-2.525	-2.243	-0.282
487	1E+13	NDD	-1.910	-1.978	0.068

TEST STATISTICS [m%]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-2.042	-1.862	-1.683	0.254	-2.376	-1.901	-1.425	0.673	-0.258	0.039	0.335	0.419
1E+12	-2.719	-2.490	-2.247	0.211	-2.962	-2.356	-1.955	0.441	-0.438	-0.134	0.242	0.283
5E+12	-2.661	-2.156	-1.652	0.503	-2.871	-2.466	-1.935	0.443	0.132	0.310	0.618	0.214
1E+13	-2.653	-2.259	-1.910	0.385	-2.361	-1.977	-1.327	0.462	-0.623	-0.282	0.068	0.282

DEVICE TEST: 501.1 GERR +9V [m%]



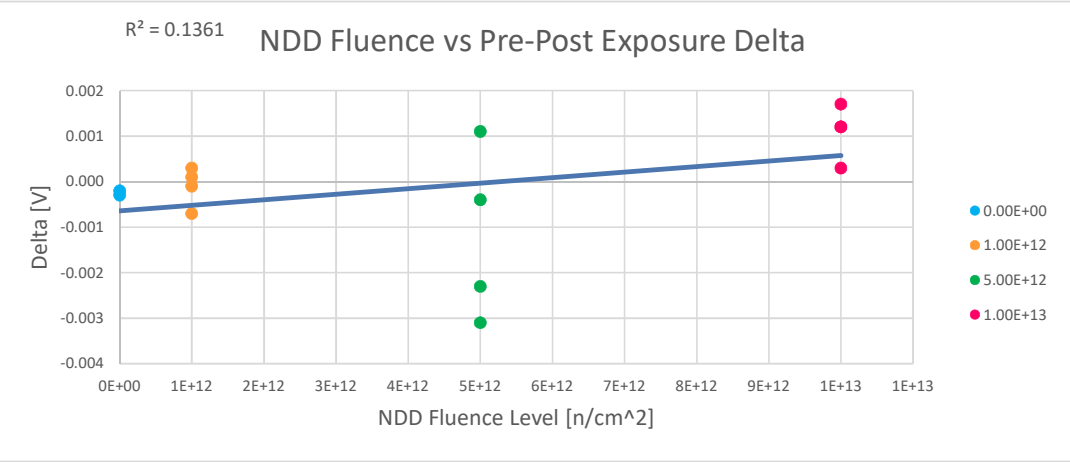
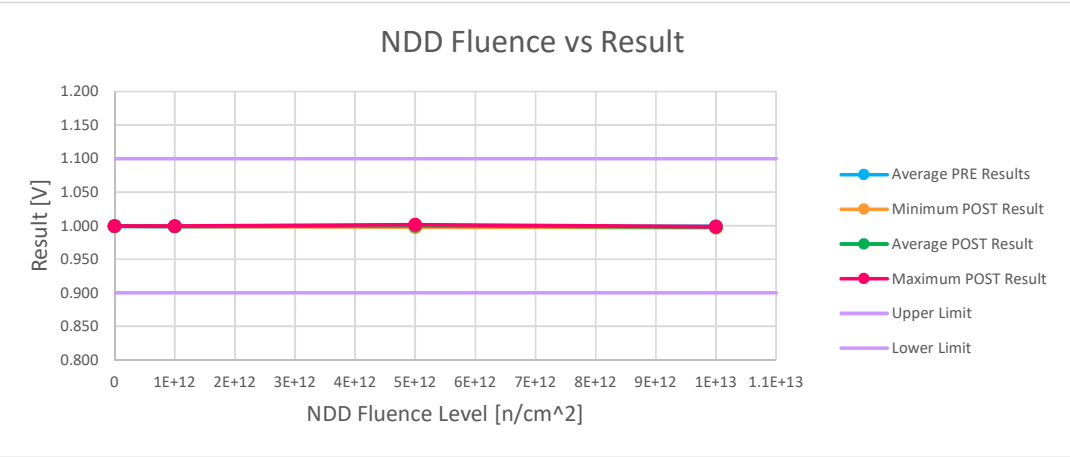
TEST RESULTS (LOWER LIMIT = -47 | UPPER LIMIT = 47) [m%]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-2.108	-1.985	-0.124
475	0E+00	CONTROL	-2.432	-2.327	-0.105
476	1E+12	NDD	-2.567	-2.410	-0.157
477	1E+12	NDD	-2.949	-2.771	-0.178
478	1E+12	NDD	-2.765	-2.691	-0.074
479	1E+12	NDD	-2.470	-2.328	-0.142
480	5E+12	NDD	-3.116	-2.942	-0.174
481	5E+12	NDD	-2.632	-2.463	-0.169
482	5E+12	NDD	-2.152	-1.991	-0.161
483	5E+12	NDD	-1.949	-1.868	-0.081
484	1E+13	NDD	-3.137	-3.063	-0.074
485	1E+13	NDD	-2.071	-2.041	-0.029
486	1E+13	NDD	-2.581	-2.357	-0.224
487	1E+13	NDD	-2.025	-1.843	-0.182

TEST STATISTICS [m%]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-2.432	-2.270	-2.108	0.229	-2.327	-2.156	-1.985	0.242	-0.124	-0.114	-0.105	0.013
1E+12	-2.949	-2.688	-2.470	0.213	-2.771	-2.550	-2.328	0.214	-0.178	-0.138	-0.074	0.045
5E+12	-3.116	-2.462	-1.949	0.521	-2.942	-2.316	-1.868	0.490	-0.174	-0.146	-0.081	0.044
1E+13	-3.137	-2.453	-2.025	0.521	-3.063	-2.326	-1.843	0.535	-0.224	-0.127	-0.029	0.091

DEVICE TEST: 800.1 SW+ 5V [V]



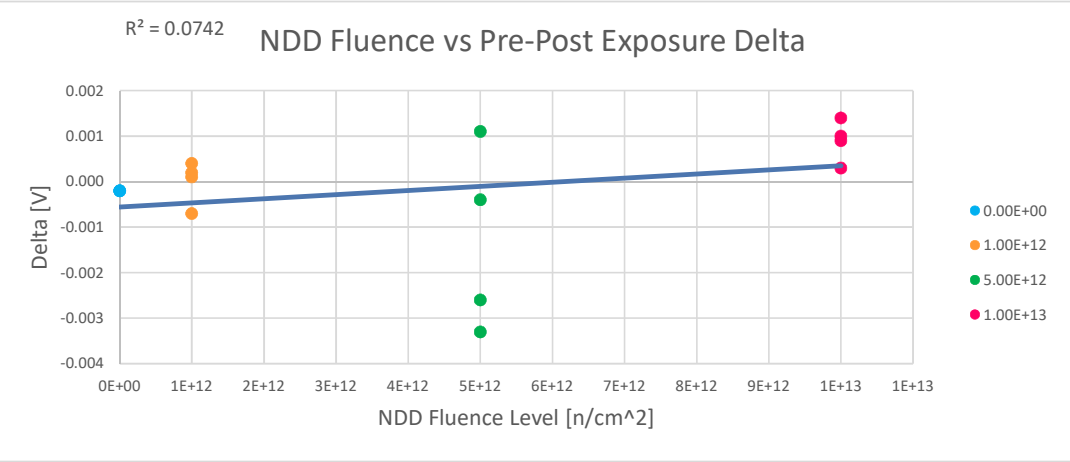
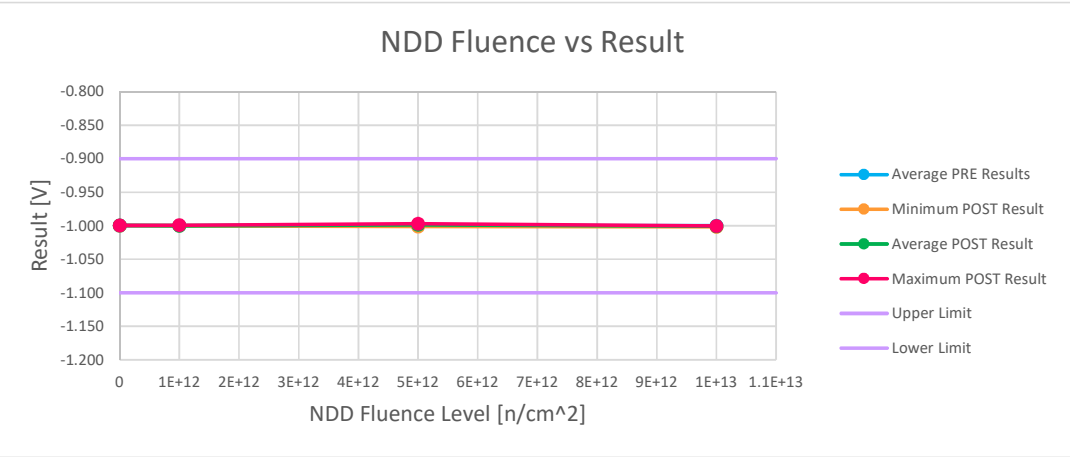
TEST RESULTS (LOWER LIMIT = 0.9 | UPPER LIMIT = 1.1) [V]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	0.999	0.999	0.000
475	0E+00	CONTROL	0.999	0.999	0.000
476	1E+12	NDD	0.999	0.999	0.000
477	1E+12	NDD	0.999	0.999	0.000
478	1E+12	NDD	0.999	1.000	-0.001
479	1E+12	NDD	0.999	0.999	0.000
480	5E+12	NDD	0.999	1.002	-0.003
481	5E+12	NDD	0.999	0.998	0.001
482	5E+12	NDD	0.999	0.999	0.000
483	5E+12	NDD	0.999	1.002	-0.002
484	1E+13	NDD	0.999	0.998	0.001
485	1E+13	NDD	0.999	0.997	0.002
486	1E+13	NDD	0.999	0.998	0.001
487	1E+13	NDD	0.999	0.999	0.000

TEST STATISTICS [V]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	0.999	0.999	0.999	0.000	0.999	0.999	0.999	0.000	0.000	0.000	0.000	0.000
1E+12	0.999	0.999	0.999	0.000	0.999	0.999	1.000	0.000	-0.001	0.000	0.000	0.000
5E+12	0.999	0.999	0.999	0.000	0.998	1.000	1.002	0.002	-0.003	-0.001	0.001	0.002
1E+13	0.999	0.999	0.999	0.000	0.997	0.998	0.999	0.001	0.000	0.001	0.002	0.001

DEVICE TEST: 800.2 SW- 5V [V]



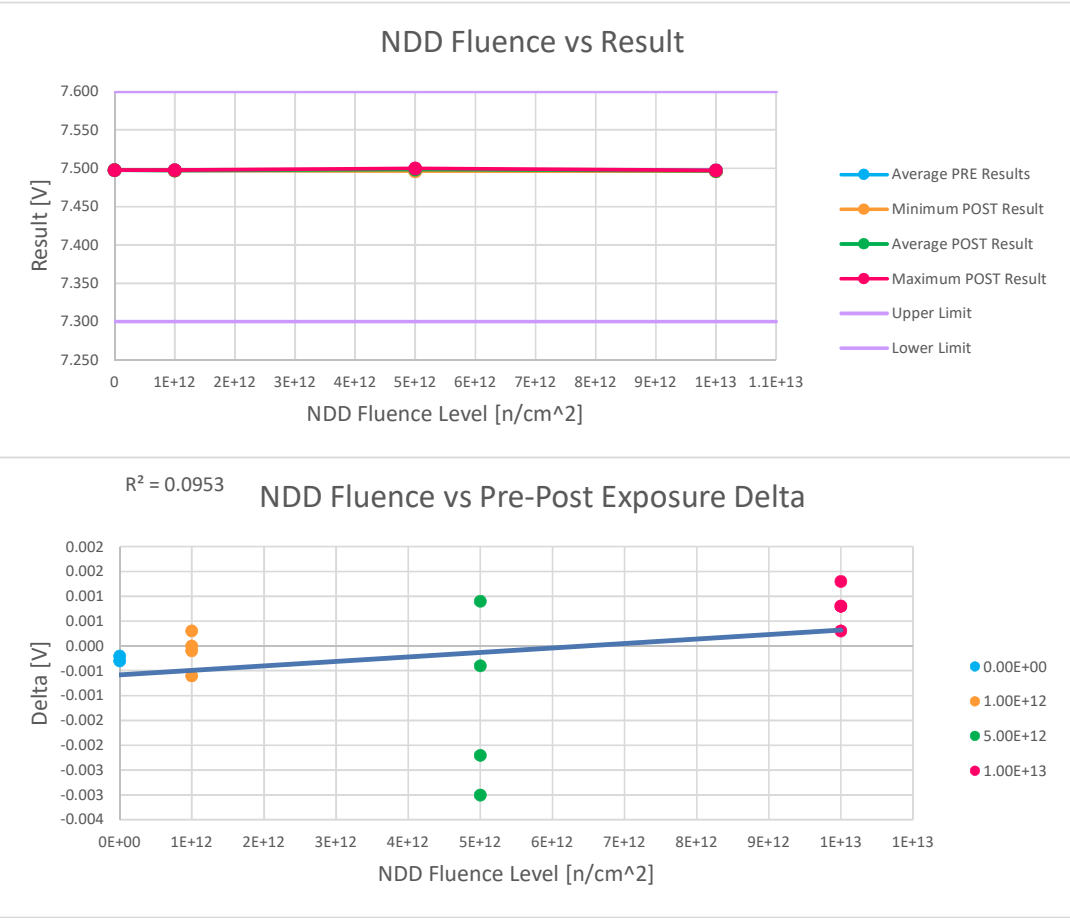
TEST RESULTS (LOWER LIMIT = -1.1 | UPPER LIMIT = -0.9) [V]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-1.000	-1.000	0.000
475	0E+00	CONTROL	-1.000	-1.000	0.000
476	1E+12	NDD	-1.000	-1.000	0.000
477	1E+12	NDD	-1.000	-1.000	0.000
478	1E+12	NDD	-1.000	-0.999	-0.001
479	1E+12	NDD	-1.000	-1.000	0.000
480	5E+12	NDD	-1.000	-0.997	-0.003
481	5E+12	NDD	-1.000	-1.001	0.001
482	5E+12	NDD	-1.000	-1.000	0.000
483	5E+12	NDD	-1.000	-0.997	-0.003
484	1E+13	NDD	-1.000	-1.001	0.001
485	1E+13	NDD	-1.000	-1.002	0.001
486	1E+13	NDD	-1.000	-1.001	0.001
487	1E+13	NDD	-1.000	-1.000	0.000

TEST STATISTICS [V]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-1.000	-1.000	-1.000	0.000	-1.000	-1.000	-1.000	0.000	0.000	0.000	0.000	0.000
1E+12	-1.000	-1.000	-1.000	0.000	-1.000	-1.000	-0.999	0.000	-0.001	0.000	0.000	0.000
5E+12	-1.000	-1.000	-1.000	0.000	-1.001	-0.999	-0.997	0.002	-0.003	-0.001	0.001	0.002
1E+13	-1.000	-1.000	-1.000	0.000	-1.002	-1.001	-1.000	0.001	0.000	0.001	0.001	0.000

DEVICE TEST: 800.3 SW+ 9V [V]



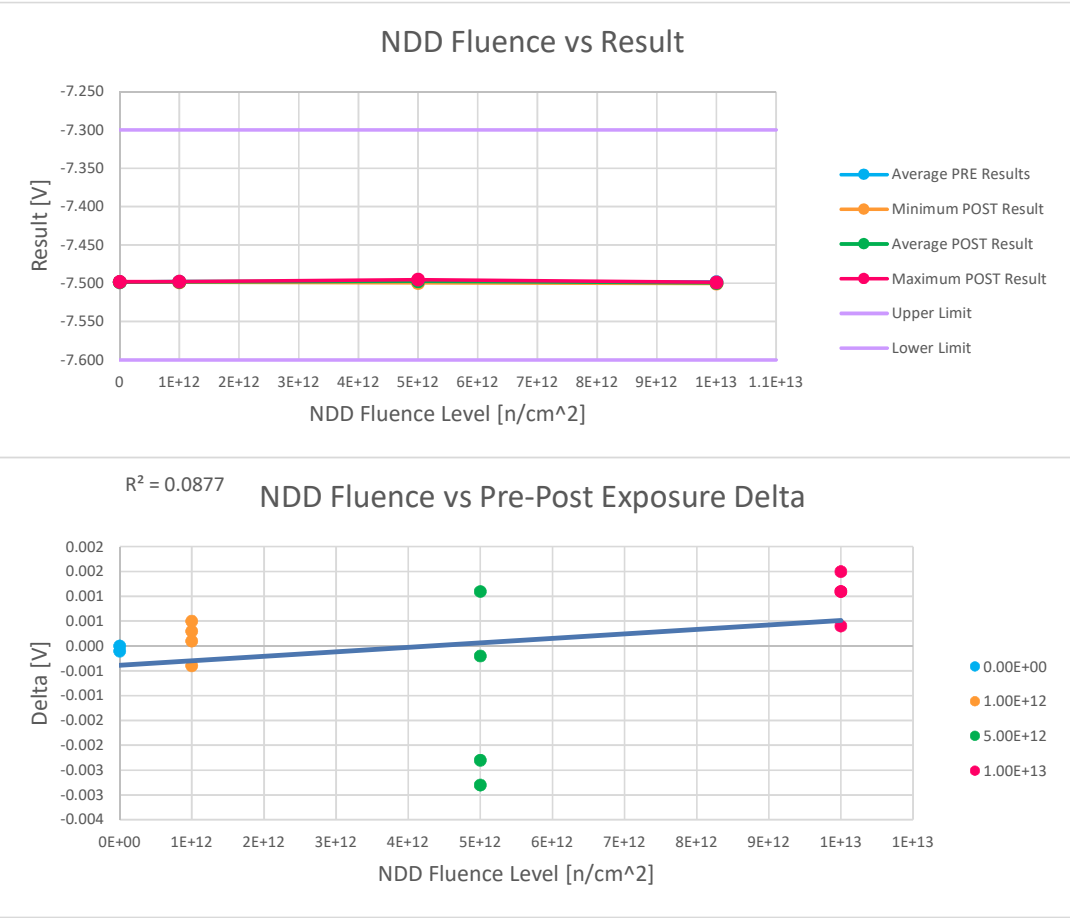
TEST RESULTS (LOWER LIMIT = 7.3 | UPPER LIMIT = 7.6) [V]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	7.498	7.498	0.000
475	0E+00	CONTROL	7.497	7.498	0.000
476	1E+12	NDD	7.497	7.497	0.000
477	1E+12	NDD	7.497	7.497	0.000
478	1E+12	NDD	7.497	7.498	-0.001
479	1E+12	NDD	7.498	7.497	0.000
480	5E+12	NDD	7.497	7.500	-0.003
481	5E+12	NDD	7.497	7.496	0.001
482	5E+12	NDD	7.497	7.498	0.000
483	5E+12	NDD	7.498	7.500	-0.002
484	1E+13	NDD	7.497	7.496	0.001
485	1E+13	NDD	7.497	7.496	0.001
486	1E+13	NDD	7.497	7.496	0.001
487	1E+13	NDD	7.498	7.497	0.000

TEST STATISTICS [V]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	7.497	7.497	7.498	0.000	7.498	7.498	7.498	0.000	0.000	0.000	0.000	0.000
1E+12	7.497	7.497	7.498	0.000	7.497	7.497	7.498	0.000	-0.001	0.000	0.000	0.000
5E+12	7.497	7.497	7.498	0.001	7.496	7.498	7.500	0.002	-0.003	-0.001	0.001	0.002
1E+13	7.497	7.497	7.498	0.000	7.496	7.496	7.497	0.001	0.000	0.001	0.001	0.000

DEVICE TEST: 800.4 SW- 9V [V]



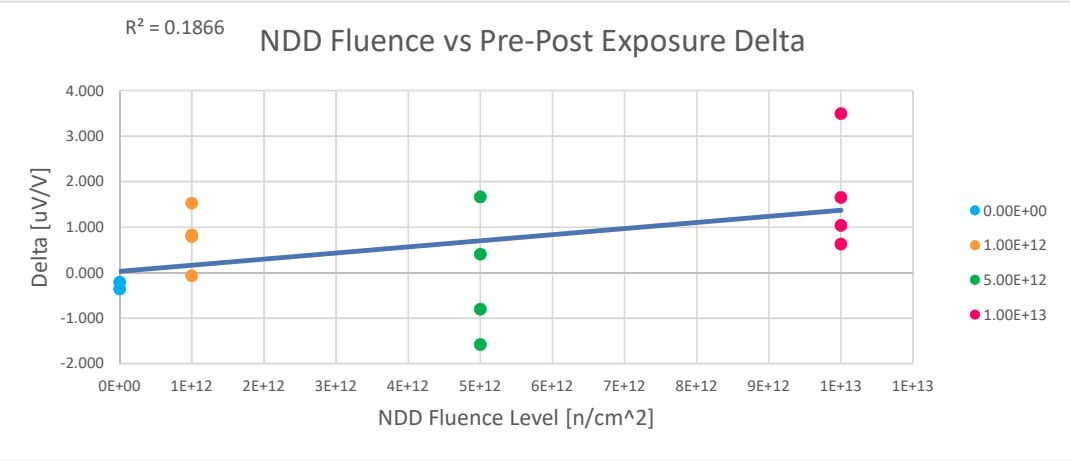
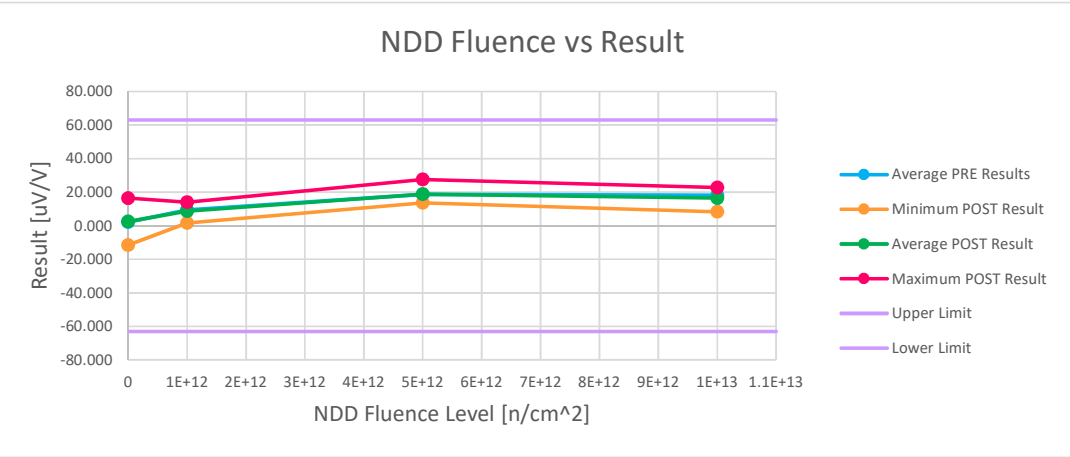
TEST RESULTS (LOWER LIMIT = -7.6 | UPPER LIMIT = -7.3) [V]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-7.499	-7.499	0.000
475	0E+00	CONTROL	-7.498	-7.498	0.000
476	1E+12	NDD	-7.498	-7.499	0.000
477	1E+12	NDD	-7.498	-7.498	0.000
478	1E+12	NDD	-7.498	-7.498	0.000
479	1E+12	NDD	-7.498	-7.499	0.001
480	5E+12	NDD	-7.498	-7.495	-0.003
481	5E+12	NDD	-7.498	-7.500	0.001
482	5E+12	NDD	-7.499	-7.499	0.000
483	5E+12	NDD	-7.499	-7.496	-0.002
484	1E+13	NDD	-7.498	-7.499	0.001
485	1E+13	NDD	-7.499	-7.500	0.002
486	1E+13	NDD	-7.498	-7.499	0.001
487	1E+13	NDD	-7.499	-7.499	0.000

TEST STATISTICS [V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-7.499	-7.498	-7.498	0.000	-7.499	-7.498	-7.498	0.000	0.000	0.000	0.000	0.000
1E+12	-7.498	-7.498	-7.498	0.000	-7.499	-7.498	-7.498	0.000	0.000	0.000	0.001	0.000
5E+12	-7.499	-7.498	-7.498	0.000	-7.500	-7.497	-7.495	0.002	-0.003	-0.001	0.001	0.002
1E+13	-7.499	-7.498	-7.498	0.001	-7.500	-7.499	-7.499	0.001	0.000	0.001	0.002	0.000

DEVICE TEST: 900.1 Half CMRR -150V [uV/V]

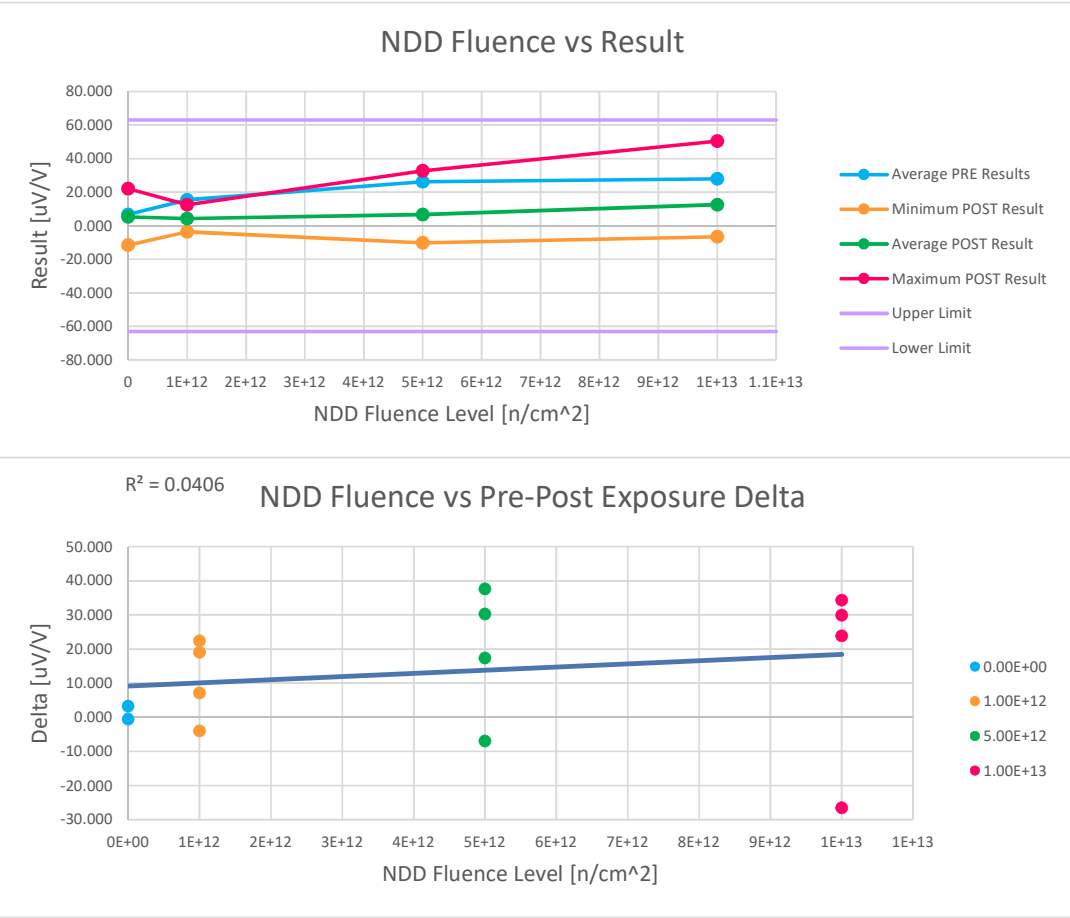


TEST RESULTS (LOWER LIMIT = -63 UPPER LIMIT = 63) [uV/V]					
Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-11.881	-11.518	-0.363
475	0E+00	CONTROL	16.257	16.467	-0.210
476	1E+12	NDD	14.882	14.054	0.828
477	1E+12	NDD	9.352	9.420	-0.068
478	1E+12	NDD	2.509	1.715	0.794
479	1E+12	NDD	10.953	9.429	1.524
480	5E+12	NDD	26.041	27.622	-1.581
481	5E+12	NDD	18.210	17.805	0.405
482	5E+12	NDD	12.894	13.696	-0.802
483	5E+12	NDD	17.603	15.942	1.661
484	1E+13	NDD	26.291	22.796	3.495
485	1E+13	NDD	9.047	8.422	0.625
486	1E+13	NDD	14.607	13.570	1.037
487	1E+13	NDD	22.284	20.634	1.650

TEST STATISTICS [uV/V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-11.881	2.188	16.257	19.897	-11.518	2.475	16.467	19.788	-0.363	-0.286	-0.210	0.108
1E+12	2.509	9.424	14.882	5.162	1.715	8.655	14.054	5.115	-0.068	0.770	1.524	0.652
5E+12	12.894	18.687	26.041	5.448	13.696	18.766	27.622	6.138	-1.581	-0.079	1.661	1.419
1E+13	9.047	18.057	26.291	7.719	8.422	16.356	22.796	6.595	0.625	1.702	3.495	1.268

DEVICE TEST: 900.3 Half CMRR -20V [uV/V]



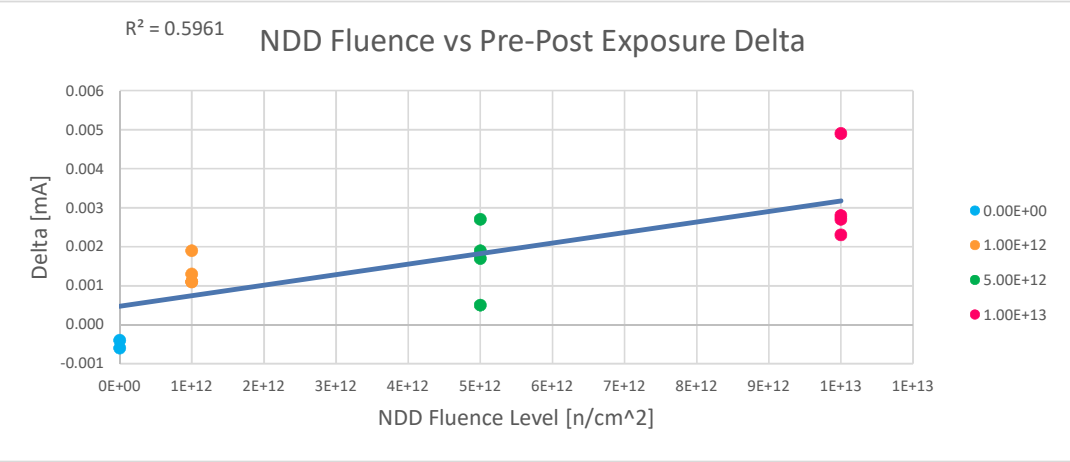
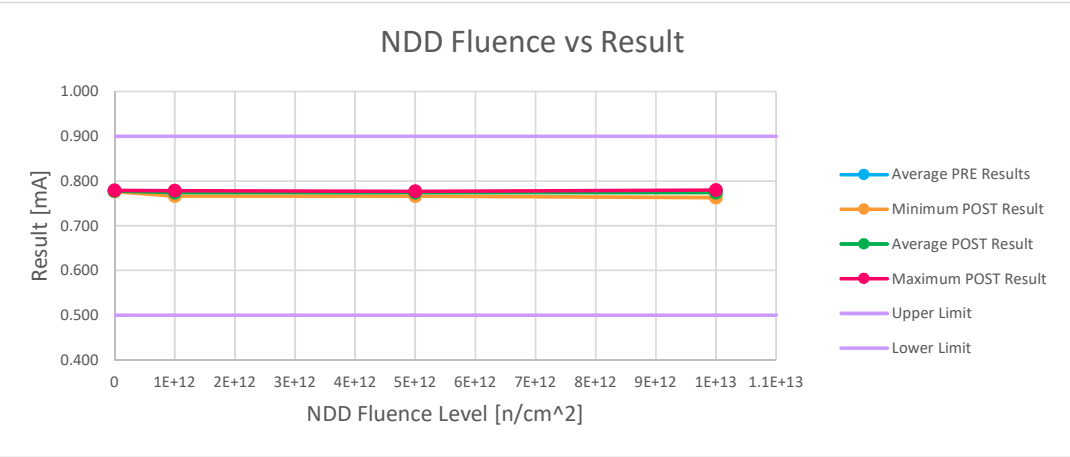
TEST RESULTS (LOWER LIMIT = -63 | UPPER LIMIT = 63) [uV/V]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-12.013	-11.522	-0.491
475	0E+00	CONTROL	25.518	22.208	3.310
476	1E+12	NDD	23.671	1.259	22.412
477	1E+12	NDD	15.376	-3.635	19.011
478	1E+12	NDD	8.536	12.495	-3.959
479	1E+12	NDD	14.147	6.968	7.179
480	5E+12	NDD	33.368	3.114	30.254
481	5E+12	NDD	25.858	32.795	-6.937
482	5E+12	NDD	18.422	1.093	17.329
483	5E+12	NDD	27.426	-10.180	37.606
484	1E+13	NDD	37.712	7.827	29.885
485	1E+13	NDD	17.223	-6.621	23.844
486	1E+13	NDD	24.010	50.501	-26.491
487	1E+13	NDD	32.923	-1.418	34.341

TEST STATISTICS [uV/V]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-12.013	6.753	25.518	26.538	-11.522	5.343	22.208	23.851	-0.491	1.410	3.310	2.688
1E+12	8.536	15.433	23.671	6.247	-3.635	4.272	12.495	6.988	-3.959	11.161	22.412	12.009
5E+12	18.422	26.269	33.368	6.150	-10.180	6.706	32.795	18.350	-6.937	19.563	37.606	19.554
1E+13	17.223	27.967	37.712	9.140	-6.621	12.572	50.501	25.982	-26.491	15.395	34.341	28.253

DEVICE TEST: 1000.1 IQ + 5V [mA]



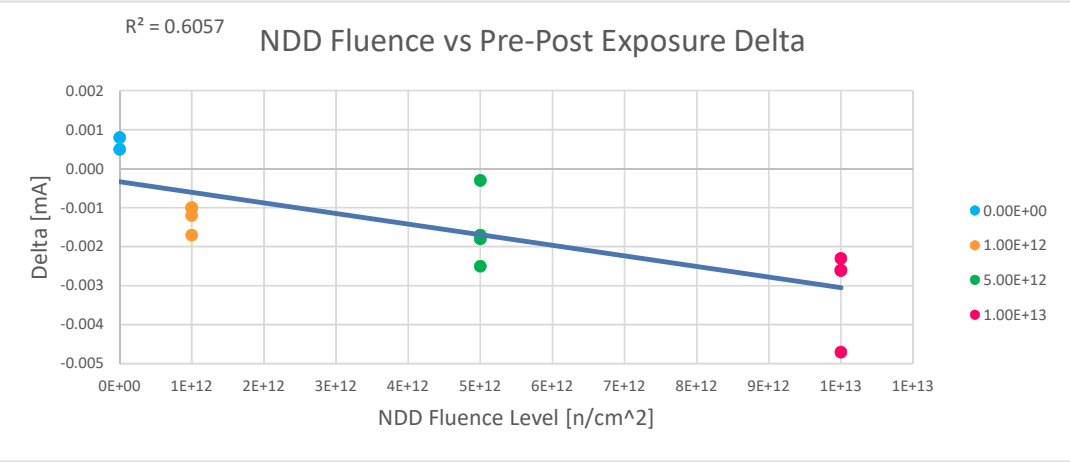
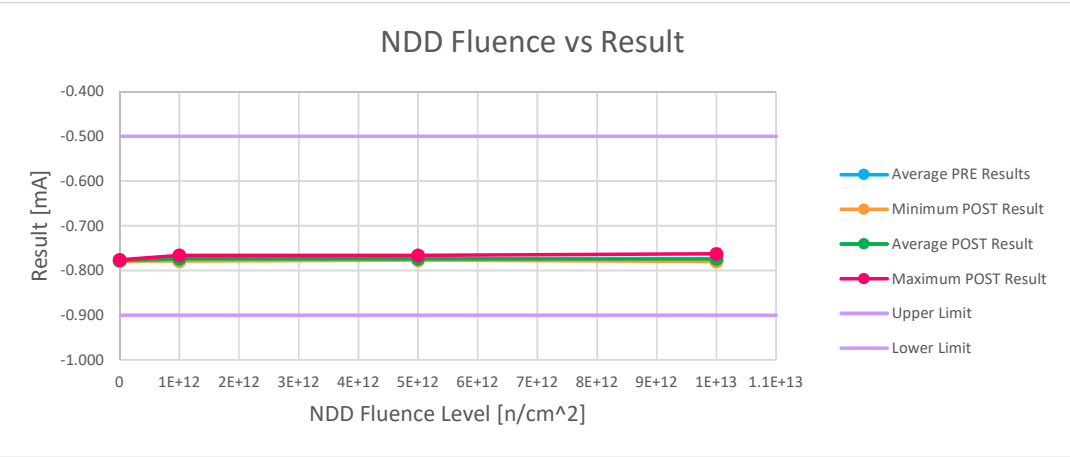
TEST STATISTICS [mA]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	0.776	0.777	0.778	0.002	0.776	0.778	0.779	0.002	-0.001	-0.001	0.000	0.000
1E+12	0.768	0.775	0.780	0.005	0.767	0.774	0.779	0.005	0.001	0.001	0.002	0.000
5E+12	0.768	0.776	0.779	0.005	0.766	0.774	0.777	0.005	0.001	0.002	0.003	0.001
1E+13	0.766	0.777	0.782	0.008	0.763	0.774	0.780	0.007	0.002	0.003	0.005	0.001

TEST RESULTS (LOWER LIMIT = 0.5 | UPPER LIMIT = 0.9) [mA]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	0.776	0.776	0.000
475	0E+00	CONTROL	0.778	0.779	-0.001
476	1E+12	NDD	0.780	0.779	0.001
477	1E+12	NDD	0.776	0.775	0.001
478	1E+12	NDD	0.776	0.774	0.002
479	1E+12	NDD	0.768	0.767	0.001
480	5E+12	NDD	0.779	0.777	0.002
481	5E+12	NDD	0.777	0.776	0.001
482	5E+12	NDD	0.768	0.766	0.002
483	5E+12	NDD	0.779	0.776	0.003
484	1E+13	NDD	0.766	0.763	0.003
485	1E+13	NDD	0.782	0.777	0.005
486	1E+13	NDD	0.782	0.780	0.002
487	1E+13	NDD	0.779	0.776	0.003

DEVICE TEST: 1000.2 IQ 0V [mA]



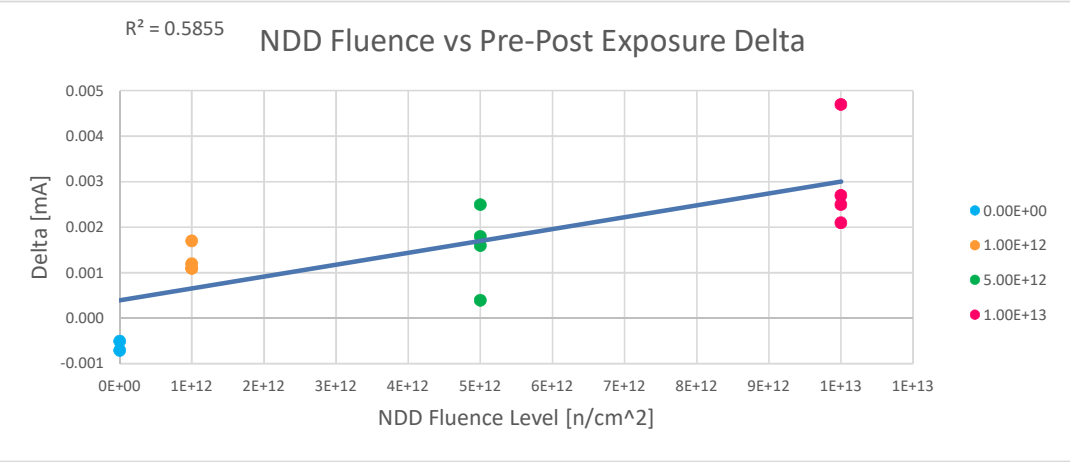
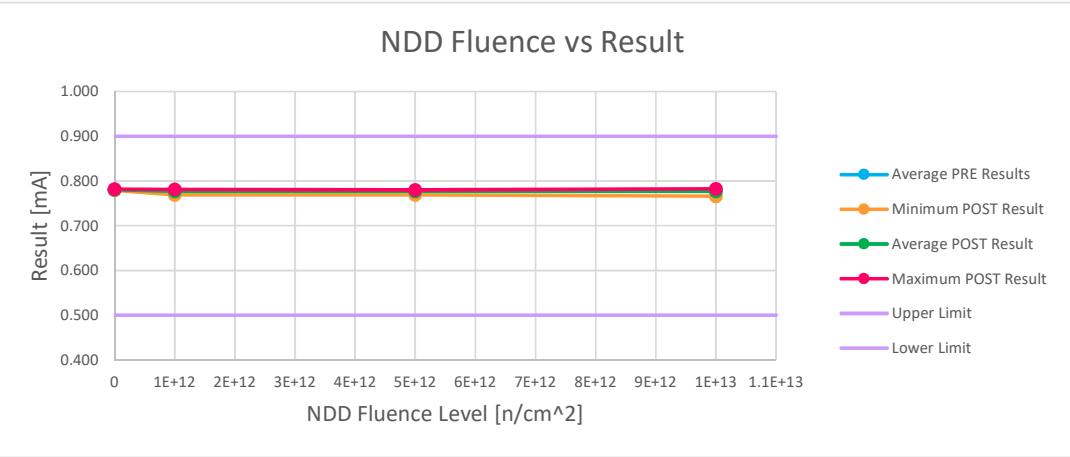
TEST STATISTICS [mA]

Fluence (n/cm ²)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.778	-0.777	-0.776	0.002	-0.779	-0.778	-0.776	0.002	0.000	0.001	0.001	0.000
1E+12	-0.780	-0.775	-0.768	0.005	-0.779	-0.774	-0.767	0.005	-0.002	-0.001	-0.001	0.000
5E+12	-0.779	-0.775	-0.768	0.005	-0.777	-0.774	-0.766	0.005	-0.002	-0.002	0.000	0.001
1E+13	-0.782	-0.777	-0.766	0.008	-0.780	-0.774	-0.763	0.007	-0.005	-0.003	-0.002	0.001

TEST RESULTS (LOWER LIMIT = -0.9 | UPPER LIMIT = -0.5) [mA]

Serial #	Fluence (n/cm ²)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.776	-0.776	0.000
475	0E+00	CONTROL	-0.778	-0.779	0.001
476	1E+12	NDD	-0.780	-0.779	-0.001
477	1E+12	NDD	-0.776	-0.775	-0.001
478	1E+12	NDD	-0.776	-0.775	-0.002
479	1E+12	NDD	-0.768	-0.767	-0.001
480	5E+12	NDD	-0.779	-0.777	-0.002
481	5E+12	NDD	-0.777	-0.777	0.000
482	5E+12	NDD	-0.768	-0.766	-0.002
483	5E+12	NDD	-0.778	-0.776	-0.002
484	1E+13	NDD	-0.766	-0.763	-0.003
485	1E+13	NDD	-0.782	-0.777	-0.005
486	1E+13	NDD	-0.782	-0.780	-0.002
487	1E+13	NDD	-0.779	-0.776	-0.003

DEVICE TEST: 1000.3 IQ + 9V [mA]



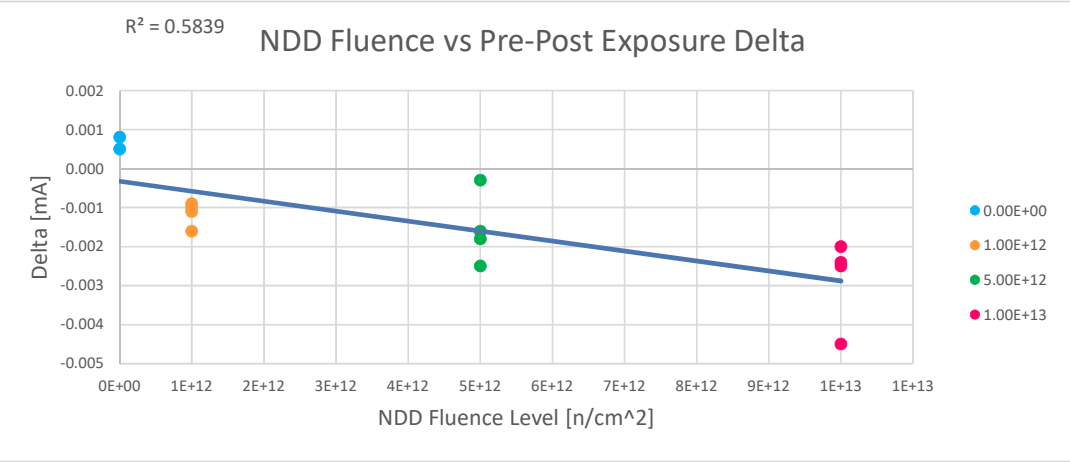
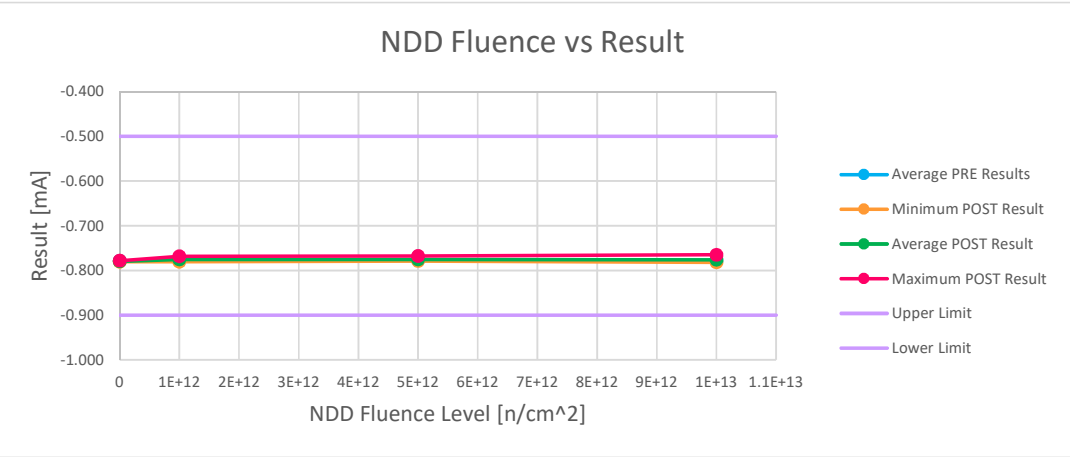
TEST RESULTS (LOWER LIMIT = 0.5 | UPPER LIMIT = 0.9) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	0.779	0.779	-0.001
475	0E+00	CONTROL	0.781	0.782	-0.001
476	1E+12	NDD	0.783	0.782	0.001
477	1E+12	NDD	0.779	0.778	0.001
478	1E+12	NDD	0.779	0.777	0.002
479	1E+12	NDD	0.771	0.769	0.001
480	5E+12	NDD	0.782	0.780	0.002
481	5E+12	NDD	0.780	0.779	0.000
482	5E+12	NDD	0.771	0.769	0.002
483	5E+12	NDD	0.781	0.779	0.003
484	1E+13	NDD	0.769	0.766	0.003
485	1E+13	NDD	0.785	0.780	0.005
486	1E+13	NDD	0.785	0.783	0.002
487	1E+13	NDD	0.782	0.779	0.002

TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	0.779	0.780	0.781	0.002	0.779	0.781	0.782	0.002	-0.001	-0.001	-0.001	0.000
1E+12	0.771	0.778	0.783	0.005	0.769	0.777	0.782	0.005	0.001	0.001	0.002	0.000
5E+12	0.771	0.778	0.782	0.005	0.769	0.777	0.780	0.005	0.000	0.002	0.003	0.001
1E+13	0.769	0.780	0.785	0.008	0.766	0.777	0.783	0.007	0.002	0.003	0.005	0.001

DEVICE TEST: 1000.4 IQ - 9V [mA]



TEST STATISTICS [mA]

Fluence (n/cm^2)	Pre Exposure Min	Pre Exposure Avg	Pre Exposure Max	Pre Exposure Std	Post Exposure Min	Post Exposure Avg	Post Exposure Max	Post Exposure Std	Min Delta	Avg Delta	Max Delta	Std Delta
0	-0.780	-0.779	-0.778	0.002	-0.781	-0.780	-0.778	0.002	0.001	0.001	0.001	0.000
1E+12	-0.782	-0.777	-0.769	0.005	-0.781	-0.776	-0.768	0.005	-0.002	-0.001	-0.001	0.000
5E+12	-0.781	-0.777	-0.770	0.005	-0.779	-0.776	-0.768	0.005	-0.003	-0.002	0.000	0.001
1E+13	-0.784	-0.779	-0.768	0.008	-0.782	-0.776	-0.765	0.007	-0.004	-0.003	-0.002	0.001

TEST RESULTS (LOWER LIMIT = -0.9 | UPPER LIMIT = -0.5) [mA]

Serial #	Fluence (n/cm^2)	Exposure Conditions	Pre Result	Post Result	Delta
474	0E+00	CONTROL	-0.778	-0.778	0.001
475	0E+00	CONTROL	-0.780	-0.781	0.001
476	1E+12	NDD	-0.782	-0.781	-0.001
477	1E+12	NDD	-0.778	-0.777	-0.001
478	1E+12	NDD	-0.778	-0.776	-0.002
479	1E+12	NDD	-0.769	-0.768	-0.001
480	5E+12	NDD	-0.781	-0.779	-0.002
481	5E+12	NDD	-0.779	-0.778	0.000
482	5E+12	NDD	-0.770	-0.768	-0.002
483	5E+12	NDD	-0.780	-0.778	-0.003
484	1E+13	NDD	-0.768	-0.765	-0.002
485	1E+13	NDD	-0.783	-0.779	-0.004
486	1E+13	NDD	-0.784	-0.782	-0.002
487	1E+13	NDD	-0.781	-0.778	-0.002

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2025, Texas Instruments Incorporated