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TLD Reader Internal ⁹⁰Sr Irradiator

Technical Notice

NIST Traceable Calibration Procedure

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1.0 Calibration

1.1 Preliminary

Components Required:

1. 10 TLD cards containing TLD-7776H (.015" x .015" x .010" x .015"). Divide the cards into 2 sets of 5 cards each. Each set should be visibly identifiable, for example, by using different colored aluminum substrates. All chips should be made from the same material batch.
2. Model 6600 or 8800 Automatic TLD Reader. The Reader should be set at the .40nC/nR conversion factor when running this test.
3. ⁹⁰Sr Irradiator (Device Under Test).
4. NIST Traceable Source (Secondary Standard).

TLD Reader TTP Setup:

Temperature

Preheat	165° C
Rate	15° C / sec
Max	260° C
Anneal	260° C

Time:

Preheat	10 sec
Acquire	16-2/3 sec
Anneal	10 sec

1.2 Procedure

NIST Traceable Irradiation

1. Obtain 10 TLD cards. Separate into 2 sets of 5 cards each. For the rest of this procedure, the 2 sets will be referred to as sets A and B.
2. Clear all of the cards by reading them 2 times. Let the cards sit in darkness for 1 ½ hours.
3. Expose card set A to about 50 mR using a Cs-137 NIST Traceable Source. Card set B are control cards and should not be irradiated. Make sure the Date, Time, and Exposure Values and Periods are recorded.
4. Let the Cards Fade for 1 ½ hours.
5. Read Card Sets A and B. Record the Date and Time.
6. Subtract the average response of card set B from each chip in card set A. The results = RESPONSE (NIST) for 20 values.
7. Divide all 20 values of the RESPONSE(NIST) results by the NIST EXPOSURE (in units of mR), for the appropriate channel, to obtain RESULTS(NIST) in resulting units of nC/mR.

1.0 Calibration (cont'd)**1.2 Procedure (cont'd)****DUT Irradiation**

1. Clear the 10 cards in sets A and B by reading twice.
2. Store card sets A and B in a dark place for 1 ½ hours.
3. Expose the card set A for 40.0 seconds on the DUT.
4. Store card set A along with B in a dark place for 1 ½ hours.
5. Read card sets A and B and record all results.
6. Subtract the average response of card set B from each chip in card set A. The results = RESPONSE (DUT) for 20 values.
7. Divide the twenty RESPONSE (DUT) values in nC by the Exposure Time Period (seconds), to obtain twenty RESULTS (DUT) values in terms of nC/second.

Final Calibration Result:

1. Divide RESULTS (DUT) nC/sec values by RESULTS (NIST) nC/mR values. This result in twenty CALIBRATION RESULTS values with units of mR/sec. Take the average and % standard deviation for individual TLD elements 1 thru 4.
2. Average the CALIBRATION RESULTS for all elements. Compute the Percent Standard Deviation for all elements. This is the FINAL CALIBRATION RESULT.
3. Enter the FINAL CALIBRATION RESULT into the TLD Reader Setup menu on the TLD Reader where the DUT Source resides.

1.0 Calibration (cont'd)

1.3 Results

NIST IRRADIATION

Preparation: Month/Day/Year Time of Day
 Exposure: _____ _____

NIST Exposure = TLD 1 TLD 2 TLD 3 TLD 4
 _____ _____ _____ _____ mR

(Card set A, NIST Irradiated Cards)

NO.	ID	DATE	TIME	READ				UNITS
				TLD 1	TLD 2	TLD 3	TLD 4	
1	_____	_____	_____	_____	_____	_____	_____	nC
2	_____	_____	_____	_____	_____	_____	_____	nC
3	_____	_____	_____	_____	_____	_____	_____	nC
4	_____	_____	_____	_____	_____	_____	_____	nC
5	_____	_____	_____	_____	_____	_____	_____	nC

(Card Set B, NIST Control Cards)

NO.	ID	DATE	TIME	READ				UNITS
				TLD 1	TLD 2	TLD 3	TLD 4	
1	_____	_____	_____	_____	_____	_____	_____	nC
2	_____	_____	_____	_____	_____	_____	_____	nC
3	_____	_____	_____	_____	_____	_____	_____	nC
4	_____	_____	_____	_____	_____	_____	_____	nC
5	_____	_____	_____	_____	_____	_____	_____	nC

Average _____ _____ _____ _____ nC

READ(Set A Cards) - AVG. READ(Set B Cards)

NO.		TLD 1	TLD 2	TLD 3	TLD 4	UNITS
1		_____	_____	_____	_____	nC
2		_____	_____	_____	_____	nC
3	RESPONSE (NIST)	_____	_____	_____	_____	nC
4		_____	_____	_____	_____	nC
5		_____	_____	_____	_____	nC

RESULTS (NIST) = RESPONSE (NIST) / EXPOSURE mR

NO.		TLD 1	TLD 2	TLD 3	TLD 4	UNITS
1		_____	_____	_____	_____	nC/mR
2		_____	_____	_____	_____	nC/mR
3	RESULTS (NIST)	_____	_____	_____	_____	nC/mR
4		_____	_____	_____	_____	nC/mR
5		_____	_____	_____	_____	nC/mR

1.0 Calibration (cont'd)

1.3 Results (cont'd)

DUT IRRADIATION

	Month/Day/Year	Time of Day
Preparation:	_____	_____
Exposure:	_____	_____
Read:	_____	_____

Exposure Time = 40.0 sec.

(Card set A, DUT Irradiated Cards)

NO.	ID	DATE	TIME	READ				UNITS
				TLD 1	TLD 2	TLD 3	TLD 4	
1	_____	_____	_____	_____	_____	_____	_____	nC
2	_____	_____	_____	_____	_____	_____	_____	nC
3	_____	_____	_____	_____	_____	_____	_____	nC
4	_____	_____	_____	_____	_____	_____	_____	nC
5	_____	_____	_____	_____	_____	_____	_____	nC

(Card Set B, DUT Control Cards)

NO.	ID	DATE	TIME	READ				UNITS
				TLD 1	TLD 2	TLD 3	TLD 4	
1	_____	_____	_____	_____	_____	_____	_____	nC
2	_____	_____	_____	_____	_____	_____	_____	nC
3	_____	_____	_____	_____	_____	_____	_____	nC
4	_____	_____	_____	_____	_____	_____	_____	nC
5	_____	_____	_____	_____	_____	_____	_____	nC

Average _____ nC

READ(Set A Cards) - AVG. READ(Set B Cards)

NO.		TLD 1	TLD 2	TLD 3	TLD 4	UNITS
1		_____	_____	_____	_____	nC
2		_____	_____	_____	_____	nC
3	RESPONSE (DUT)	_____	_____	_____	_____	nC
4		_____	_____	_____	_____	nC
5		_____	_____	_____	_____	nC

RESULTS (DUT) = RESPONSE (NIST) / EXPOSURE TIME

NO.		TLD 1	TLD 2	TLD 3	TLD 4	UNITS
1		_____	_____	_____	_____	nC/sec
2		_____	_____	_____	_____	nC/sec
3	RESULTS (DUT)	_____	_____	_____	_____	nC/sec
4		_____	_____	_____	_____	nC/sec
5		_____	_____	_____	_____	nC/sec

1.0 Calibration (cont'd)

1.3 Results (cont'd)

DUT Calibration Results = Results(DUT) / Results(NIST)

<u>No.</u>	<u>TLD 1</u>	<u>TLD 2</u>	<u>TLD 3</u>	<u>TLD 4</u>	<u>UNITS</u>
1	_____	_____	_____	_____	mR/sec
2	_____	_____	_____	_____	mR/sec
3	_____	_____	_____	_____	mR/sec
4	_____	_____	_____	_____	mR/sec
5	_____	_____	_____	_____	mR/sec
	Average				mR/sec
	%Standard Deviation				%

Final Calibration Result = _____
 Avg. of Avg. Calibration Results = _____ mR/sec
 % Standard Deviation = _____ %