PSI test REPORT MARCH 2011

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Outline

- Devices under tests
- Experimental setup
- Beam setup and results
- Conclusions

Devices under test

DUT name	DUT type	Voltage
INA141	OpAmp	+/-15V

DUT name	DUT type	Voltage
OPA2227_1	OpAmp (1st board)	+/-15V
OPA2227_2	OpAmp (2nd board)	+/-5V and +/-18V

DUT name	DUT type	Voltage
TL072	OpAmp	+/-15V

DUT name	DUT type	Input Voltage
TL431	Voltage Reference	+15V

DUT name	DUT type	Input Voltage
TL432	Voltage Reference	+15V

DUT name	DUT type	Voltage
LM4041	Voltage Reference	+15V

Setup

- PIF facility at PSI
  - 230 MeV proton beam
  - Flux: up to 1.65E+08 p/cm²/s

- Experiment
  - Power supply E3633A for the input signal and the supply voltage to monitor the Single Event Latch up (SEL)
  - Power supply E3648A (double output) for powering the DUT
  - Tektronix DPO7254 oscilloscope (2.5GHz, 40GS/s) to monitor Single Event Transient (SET)
  - Data Acquistion Switch Unit Agilent 34970A for monitoring the DUT outputs. Six channels were sequentially monitored.

Setup
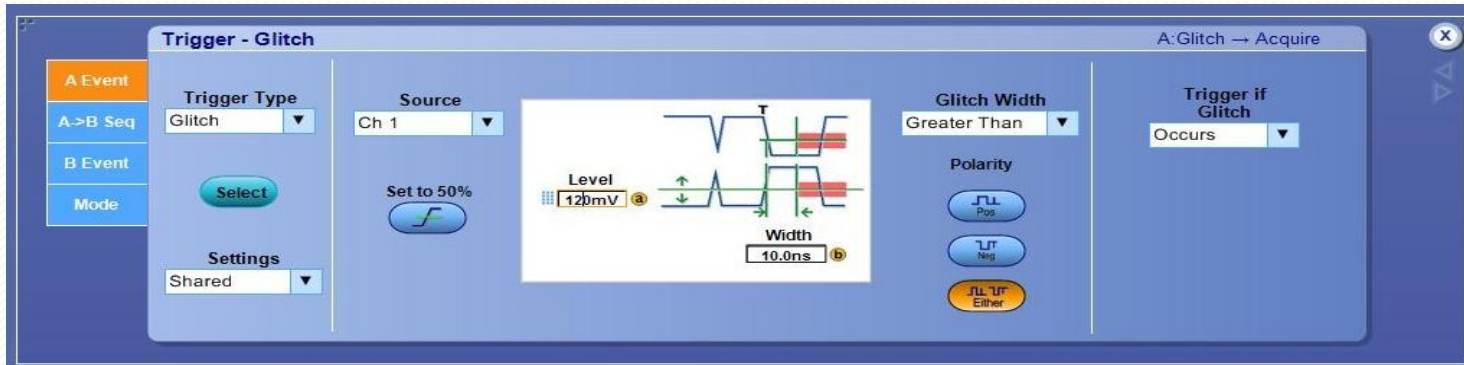
**SET**:
• Trigger on both slope for glitches

SEL:
• Current value to trigger the power OFF >**50 mA.**
• Monitoring the power supply output remotely (period 1 s)

Setup

Run #	DUT id	Width (ns)	Level (mV)
1	TL431	10	120
2	TL431	10	120
3	TL431	10	60
4	TL432	10	120
5	LM4041	5	120
6	LM4041	5	120
7	INA141	5	120
8	INA141	5	120
9	OPA2227_1	5	120
10	OPA2227_1	5	120
11	TL072	10	60
12	OPA2227_2	10	20
13	OPA2227_2	10	20

Setup

GPIB Instruments
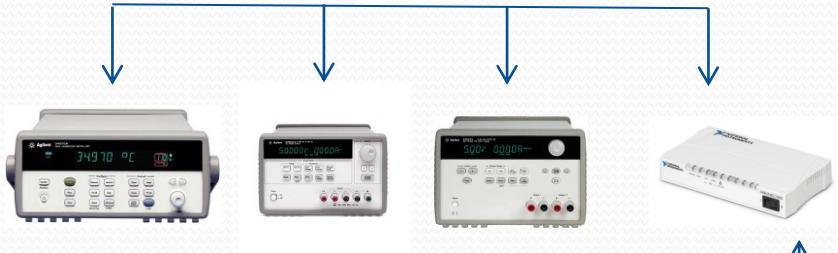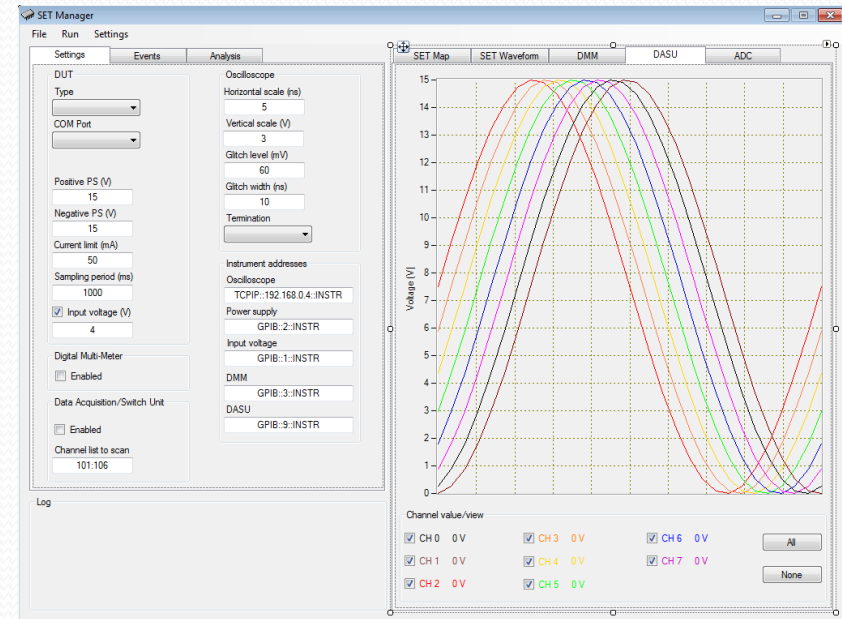

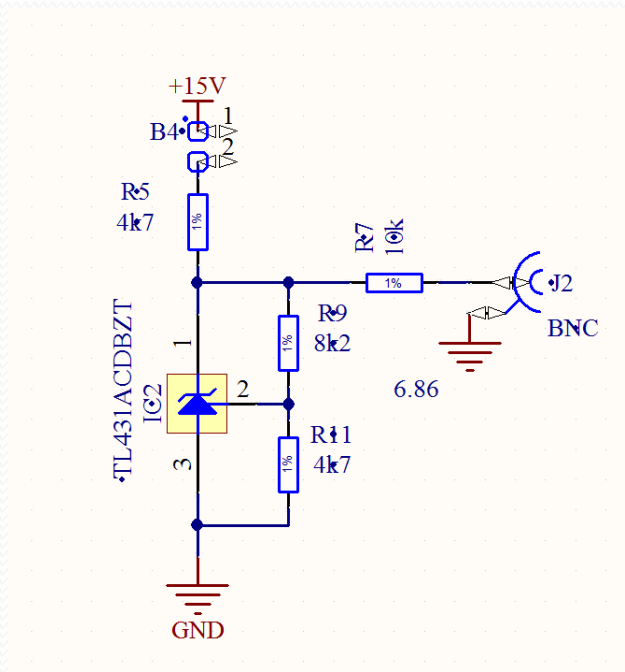Ethernet to GPIB

GUI interface for remote control and logging
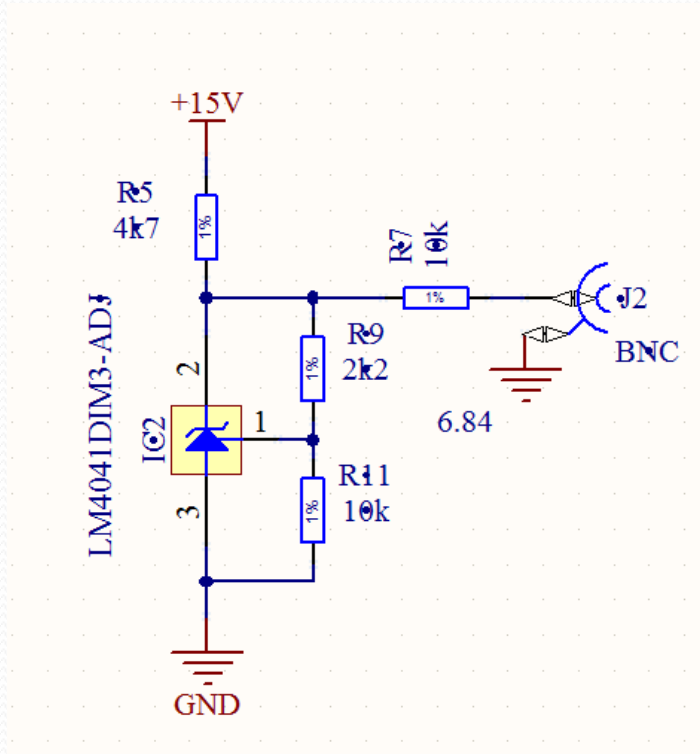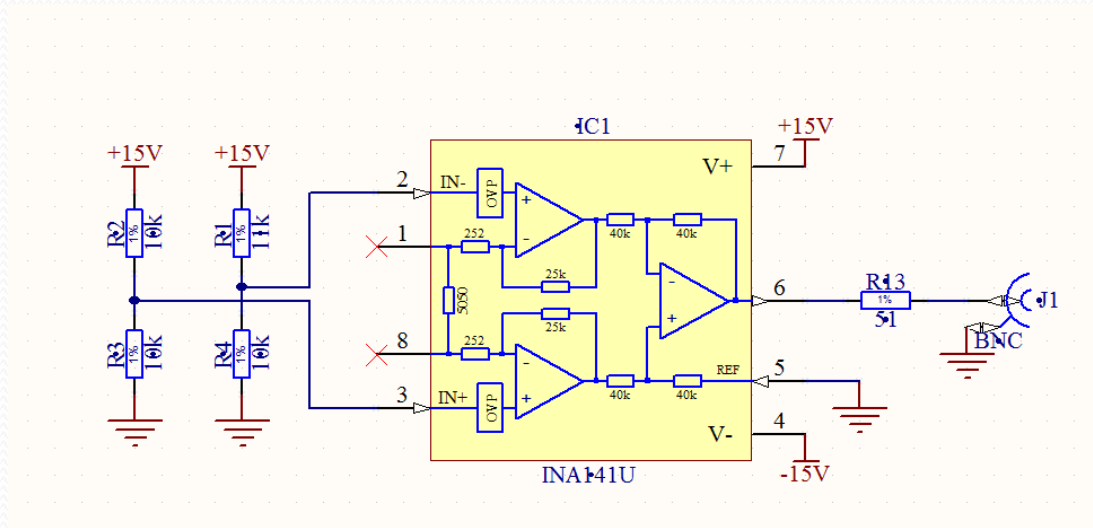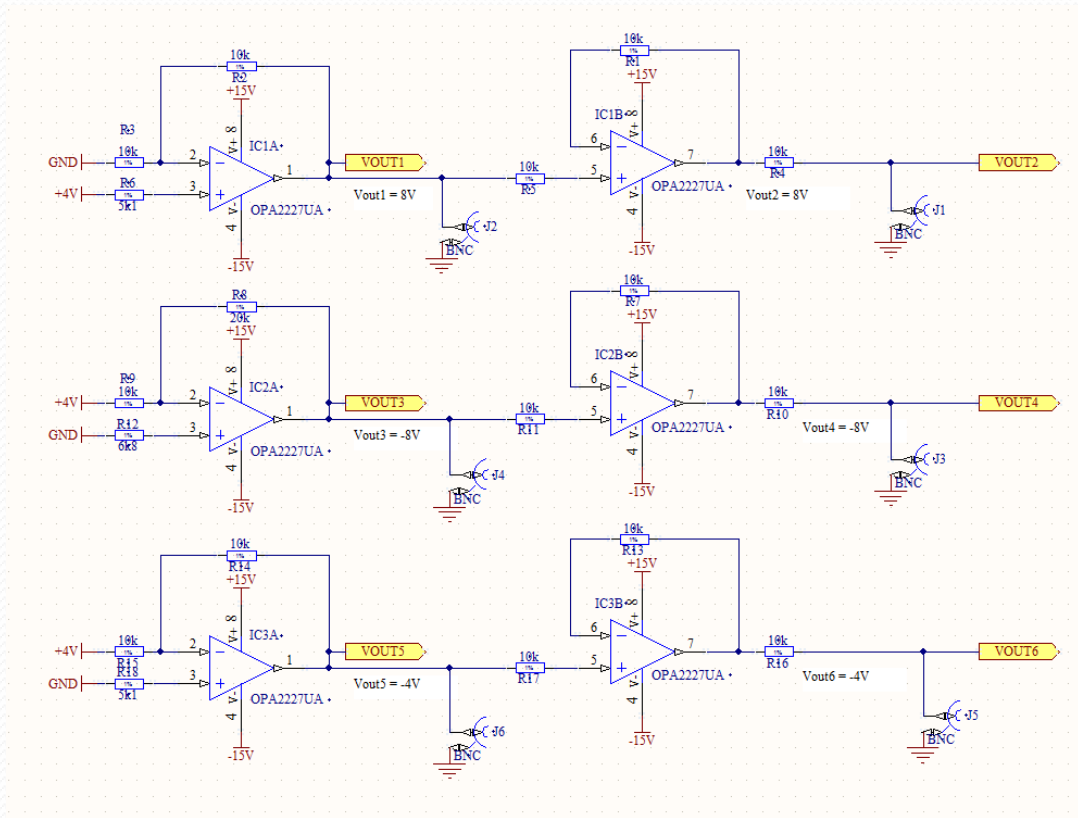
DUT
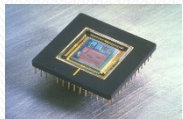
BEAM

Ethernet switch

Schematics

TL431/TL432

Schematics

LM4041

Schematics

INA141

Schematics

OPA2227/TL072

Beam Run

Run #	DUT id	Input Voltage	Energy [MeV]	Flux	Fluence	TID (Gy)
1	TL431	NA	230	1.65E+08	2.00E+11	102
2	TL431	NA	230	1.65E+08	1.70E+11	93
3	TL431	NA	230	1.60E+08	2.00E+10	10
4	TL432	NA	230	1.57E+08	3.80E+11	203
5	LM4041	NA	230	1.50E+08	3.80E+11	203
6	LM4041	NA	230	NA	NA	NA
7	INA141	300mV	230	1.50E+08	3.17E+11	170
8	INA141	300mV	230	1.50E+08	9.30E+10	50
9	OPA2227_1	4V	230	1.50E+08	1.00E+11	53
10	OPA2227_1	4V	230	1.50E+08	2.80E+11	150
11	TL072	4V	230	1.50E+08	3.74E+11	200
12	OPA2227_2	1V	230	1.50E+08	1.90E+11	102
13	OPA2227_2	0.5V	230	1.50E+08	2.10E+11	117

Cummulative TID

DUT id	Cumulative TID (Gy)
INA141	220
OPA2227_1	200
OPA2227_2	229
TL072	200
LM4041	333
TL431	205
TL432	203

Results - OpAmp

- No SEL, no SET were observed (many trigger setup were tested)
- Drift observed on the outputs for all DUT
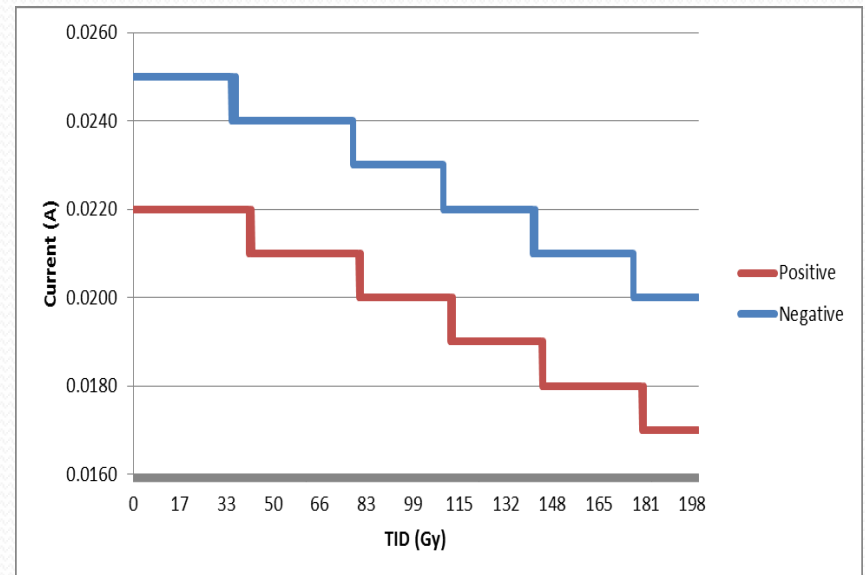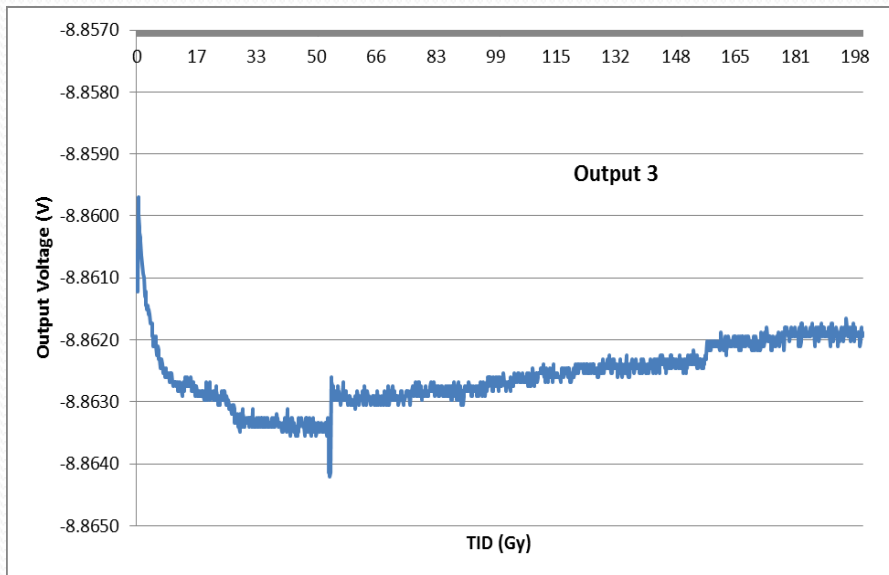- Drift observed on power supplies for OPA2227 and TL072

- INA141
  - Outputs remain stables until 100Gy
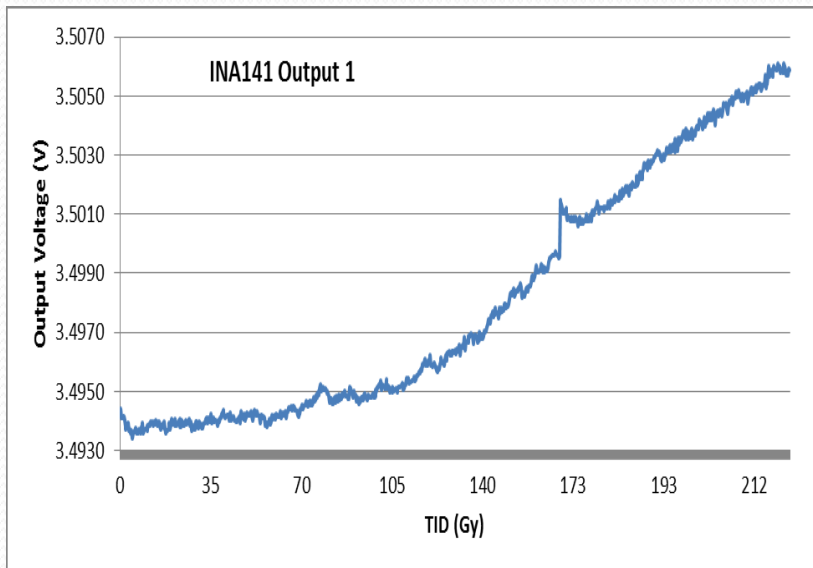
| TID (Gy)	Drift 1 (mV)	Drift 2 (mV)	Drift 3 (mV)
100	0.8	0.2	0.3
220	11.6	15.9	12.7

Results – OpAmp

- OPA2227
  - Decrease of the power consumption (5mA)
  - Drift on the outputs is less than 1mV excepted for output 3 which is around 3.5mV

Results - OpAmp

- TL072
  - Decrease of the power consumption: 35mA on positive, 20mA on negative
  - Drift on the outputs is dependent of the configuration
    - Output 1 & 2 (+8V): ~500uV
    - Output 3 & 4 (-8.8V): ~3.2mV from 0 to 34Gy, outputs remain stables after
    - Output 5 & 6 (-4V): ~1mV from 0 to 34Gy, 2mV from 34 to 200Gy
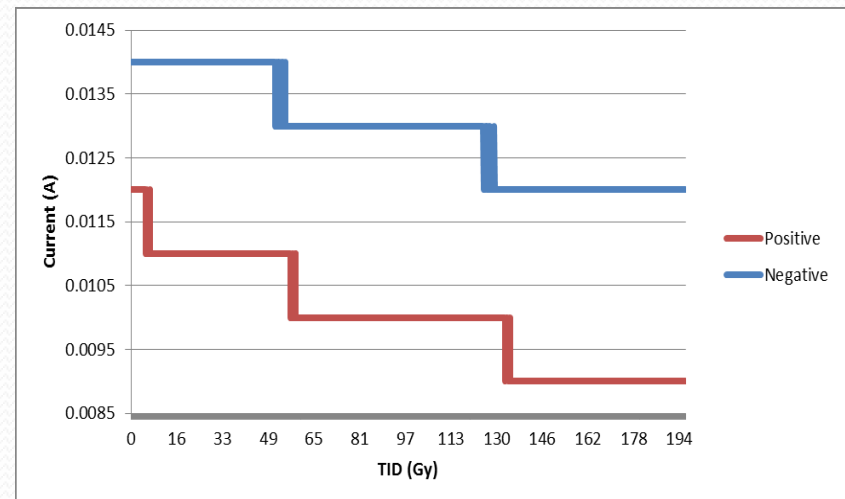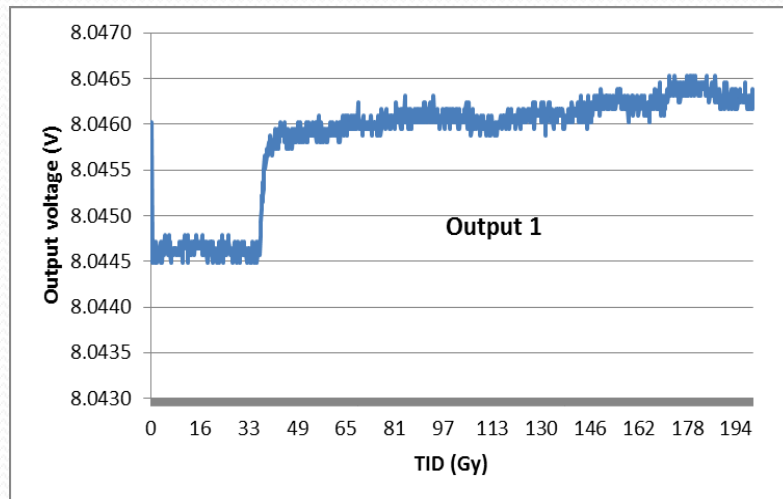
Results – Reference Voltage

- No SEL, no SET were observed
- Drifts on the output were observed for all voltage references
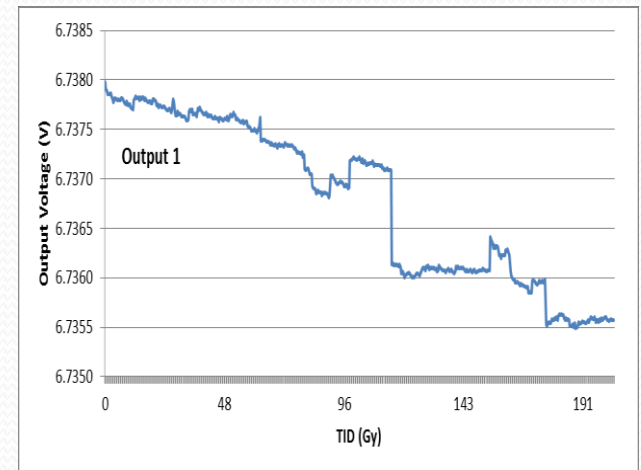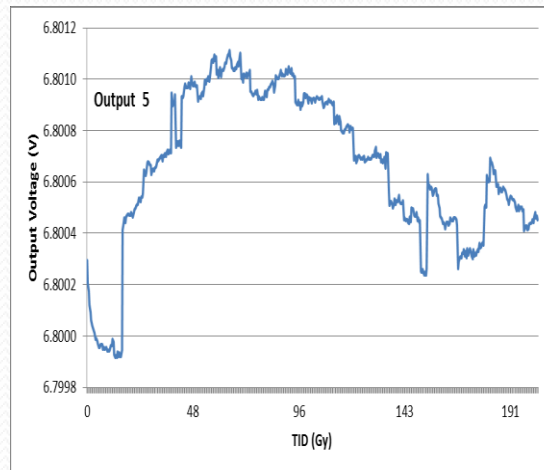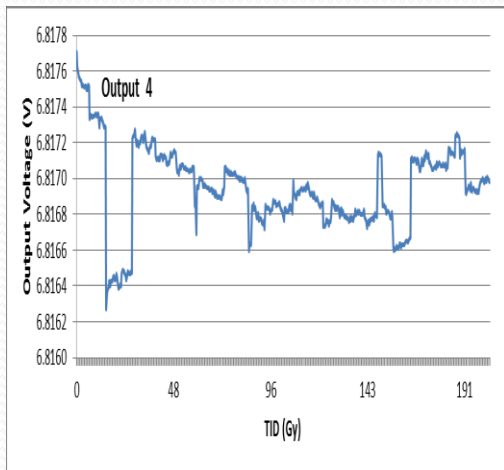- No fluctuations were observed on the power supply
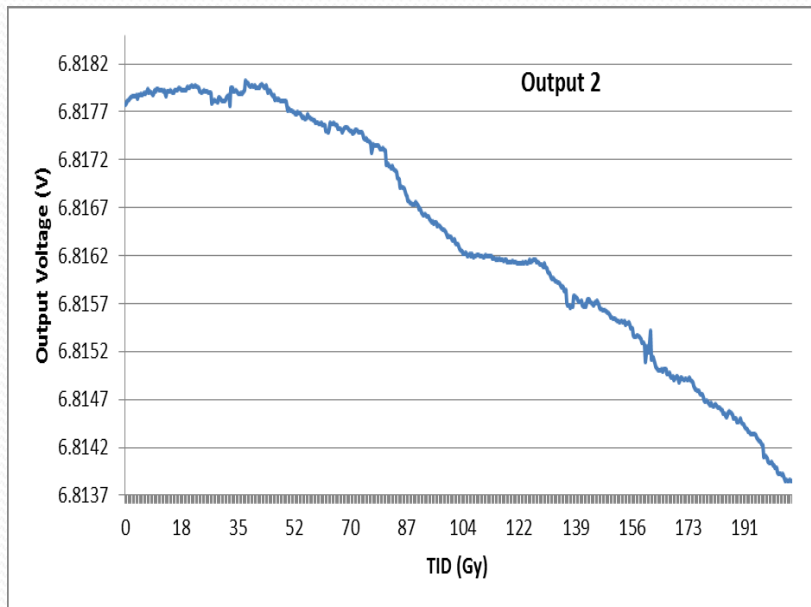
Output 2 of the TL431

- TL431
  - The outputs remain quite stable until a TID of 60Gy
  - ~4.6mV from 60Gy to 205Gy

Results – Reference Voltage

- LM4041
  - Drift difficult to observe
  - Outputs fluctuate within 1mV
  - Drift of 2.5mV was observed on first output

Conclusions

- No SEL and no SET were observed

- Drifts were observed on both outputs and power supplies for OPA2227 and TL072

- Drifts were also observed on voltage references
  - Outputs can remain stable until a given and then degrade quickly