

SINGLE EVENT EFFECTS TEST REPORT RHP51002

November 2025

Radiation Test Report	
Product:	RHP51002
Effective LET:	$\leq 79.9 \text{ MeV-cm}^2/\text{mg}$
Fluence:	$1\text{E}7 \text{ Ions/cm}^2$
Facilities:	TAMU
Tested:	November 2025

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Table 1
Part and test information.

Generic Part Number:	RHP51002
Date of Test:	November 1-3, 2025
Manufacturer:	Analog Devices, Inc.
Die Rev:	3094
Part Function:	Negative, Low Dropout Regulator
Part Technology:	BiCMOS
Package Style:	12-Lead MSOP
Interconnect:	Wire-bond
Test Equipment:	Power Supply (Keithley 2230G-30-6), DeweSoft Sirius-HS-8xLV, EL34243 electronic load

III. Test Facilities

The heavy-ion beam testing was carried out at the Texas A & M Cyclotron Facility. The test setup was in an air environment.

Facility: TAMU
Cocktail: 25 MeV/nuc
Fluence: $1 \times 10^7 \text{ cm}^{-2}$ (per run)
Ions: Ar, Ag

Table 2.
Heavy-ion specie, linear energy transfer (LET) value, range, and energy.

Ion	Effective LET (MeV·cm²/mg)
Ar	9.99
Ag	33.8

IV. Test Method

A. Test Setup

The devices under test (DUT) were de-processed to expose the die. The RHP51002 was configured, as shown in Figure 2. The EL34243 electronic load is set in constant resistance mode. The Supply Current, Voltage Output, VIOC and Power Good(PG) were recorded using a DeweSoft SIRIUSi-HS-8xLV Module.

Table 3: Configured Values

Name	Configured values SEL & SET
V _{in}	3.8V, 5V, 16V
V _{out} Load	6.6Ω, 22Ω
V _{out}	-3.3V

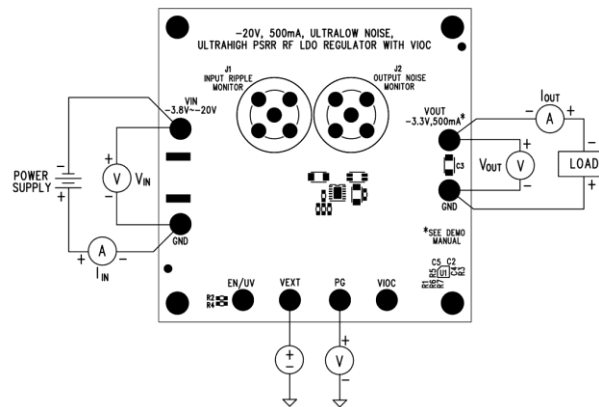


Figure 2. RHP51002 test setup

B. Irradiation procedure

SEL

1. The device was powered on and brought up to ~125°C.
2. The software to monitor the supply current and voltages was turned on.
3. The ion beam was turned on.
4. Once the fluence of 1e7 total ions was reached, the beam was turned off.

SET/SEU

1. The device was powered on and brought up to ~25°C.
2. The software to monitor the supply current, and voltages was turned on.
3. The ion beam was turned on.
4. Once the fluence of 1e7 total ions or 100 events was reached, the beam was turned off.

C. Other Test Conditions

Angles of Incidence: 0°, 45°

V. Results

SEL – No destructive latch-up events were observed on the RHP51002 to the highest effective LET tested at $79.9 \text{ MeV}\cdot\text{cm}^2/\text{mg}$. Four devices were tested at $V_{in} = 3.8\text{V}$ and $V_{in} = 16\text{V}$ at 125°C . The SEL plots are shown in Figures A1-A8 in the Appendix.

Table 3
SEL Test Runs

Run	Board	Ion	Input Voltage	Resistive Load	Angle	Effective LET	Flux	Fluence
3	1	Ag	3.8	6.6	45	79.9	$4.22\text{E}+04$	$9.99\text{E}+06$
27	3	Ag	3.8	6.6	45	79.9	$2.61\text{E}+04$	$5.47\text{E}+06$
29	4	Ag	3.8	6.6	45	79.9	$3.14\text{E}+04$	$1.00\text{E}+07$
21	5	Ag	3.8	6.6	45	79.9	$2.46\text{E}+04$	$1.00\text{E}+07$
1	1	Ag	5	6.6	45	79.9	$4.89\text{E}+04$	$1.00\text{E}+07$
2	1	Ag	16	22	45	79.9	$4.15\text{E}+04$	$1.00\text{E}+07$
26	3	Ag	16	22	45	79.9	$2.74\text{E}+04$	$4.51\text{E}+05$
28	4	Ag	16	22	45	79.9	$3.30\text{E}+04$	$9.99\text{E}+06$
20	5	Ag	16	22	45	79.9	$2.32\text{E}+04$	$1.00\text{E}+07$

SET – The highest effective LET tested was $79.9 \text{ MeV}\cdot\text{cm}^2/\text{mg}$. Four devices were tested at $V_{nominal}$ at 25°C . The SET plots are shown in the Appendix. The SET threshold for V_{out} was nominal Voltage $\pm 3\%$. The SET threshold for PG was set to nominal Voltage $\pm 20\%$. The VIOC threshold was set to nominal Voltage $\pm 10\%$. At higher LETs, the measurement cable length contributes to overshoot and undershoot. All of the SET data had the same form, with differing amplitude. Figures A44 – A47 zoom in on SETs at 2 LETs for each V_{in} .

Angles and degraders were used to obtain the LET values. The cross-sections are shown below for $V_{in} = 3.8\text{V}$ and $V_{in} = 16\text{V}$. The cross-section at the higher Input Voltage is much lower than at the lower Input Voltage. The onset for SET at the lower Input Voltage is estimated to be $\leq 14 \text{ MeVcm}^2/\text{mg}$ with the saturation around $6\text{e-}4$.

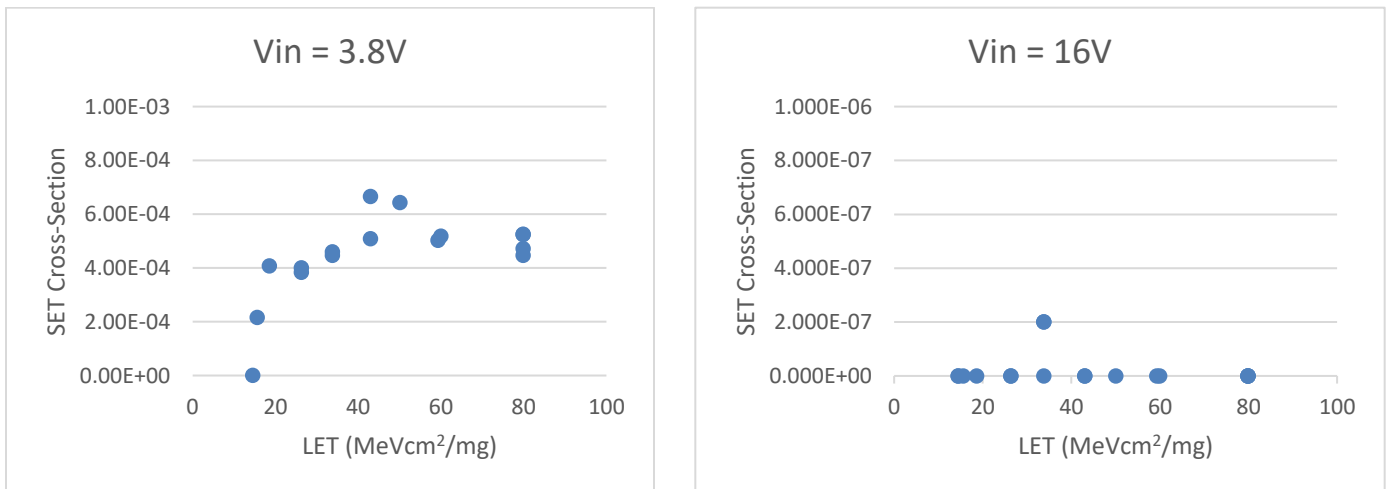


Figure 3: SET Cross-Section for $V_{in} = 3.8\text{V}$ and $V_{in} = 16\text{V}$

Table 4
SET Test Runs

Run	BD	Ion	Input Voltage (V)	Resistive Load (Ω)	Angle (deg)	Effective LET (MeVcm ² /mg)	Flux (ions/cm ² /s)	Fluence (ions/cm ²)	SET (Events) PG +/-20%	SET (Events) VIOC +/-10%	SET (Events) Vout +/-3%
4	1	Ag	3.8	6.6	45	79.90	3.84E+04	1.001E+07	4957	53	5244
33	3	Ag	3.8	6.6	45	79.90	3.59E+04	1.000E+07	1	156	4717
30	4	Ag	3.8	6.6	45	79.90	3.28E+04	9.993E+06	0	132	4459
22	5	Ag	3.8	6.6	45	79.9	2.18E+04	1.12E+06	599	10	586
5	1	Ag	16	22	45	79.90	3.32E+04	1.001E+07	7983	4052	0
32	3	Ag	16	22	45	79.90	3.71E+04	9.990E+06	0	4158	0
31	4	Ag	16	22	45	79.90	3.24E+04	1.000E+07	0	4821	0
23	5	Ag	16	22	45	79.9	2.08E+04	1.40E+06	1053	805	0
8	1	Ag	3.8	6.6	45	59.96	2.56E+04	1.001E+07	3891	201	5185
18	5	Ag	3.8	6.6	0	59.30	4.14E+04	3.800E+06	1955	18	1907
6	1	Ag	16	22	45	59.96	2.79E+04	9.998E+06	4666	9637	0
19	5	Ag	16	22	0	59.30	3.84E+04	2.072E+06	1436	1208	0
9	1	Ag	3.8	6.6	45	50.06	2.77E+04	1.000E+07	2297	144	6430
10	1	Ag	16	22	45	50.06	2.98E+04	9.991E+06	9399	2833	0
37	3	Ag	3.8	6.6	0	43.00	3.95E+04	9.994E+06	1	86	5082
17	5	Ag	3.8	6.6	0	43.00	4.52E+04	2.544E+06	1584	118	1694
36	3	Ag	16	22	0	43.00	3.81E+04	9.985E+06	1	5801	2
16	5	Ag	16	22	0	43.00	4.43E+04	1.000E+07	2	6155	2
12	1	Ag	3.8	6.6	0	33.80	3.47E+04	1.000E+07	812	260	4469
13	5	Ag	3.8	6.6	0	33.80	2.56E+04	1.001E+07	6291	634	4596
11	1	Ag	16	22	0	33.80	3.55E+04	1.001E+07	8160	1890	0
14	5	Ag	16	22	0	33.80	1.73E+04	1.000E+07	7243	5062	0
15	5	Ag	16	22	0	33.80	2.37E+03	2.480E+05	211	155	0
50	3	Ar	3.8	6.6	45	26.30	6.06E+04	1.001E+07	0	2	4009
52	4	Ar	3.8	6.6	45	26.30	1.16E+05	9.974E+06	0	359	3821
40	1	Ar	16	22	45	26.30	1.16E+05	1.004E+07	7342	5543	0
49	3	Ar	16	22	45	26.30	7.59E+04	9.990E+06	0	3593	0
51	3	Ar	3.8	6.6	45	18.53	1.14E+05	5.049E+06	0	2	2058
48	3	Ar	16	22	0	18.60	1.00E+05	9.967E+06	0	2156	0
41	1	Ar	16	22	0	15.60	1.09E+05	1.003E+07	5029	740	0
42	1	Ar	3.8	6.6	0	15.60	8.11E+04	9.963E+06	1	19	2150
45	3	Ar	3.8	6.6	0	14.50	1.16E+05	9.992E+06	0	5	4
46	3	Ar	16	22	0	14.50	1.06E+05	1.004E+07	0	3189	0
53	4	Ar	16	22	45	14.42	1.17E+05	9.973E+06	0	2269	0

Appendix

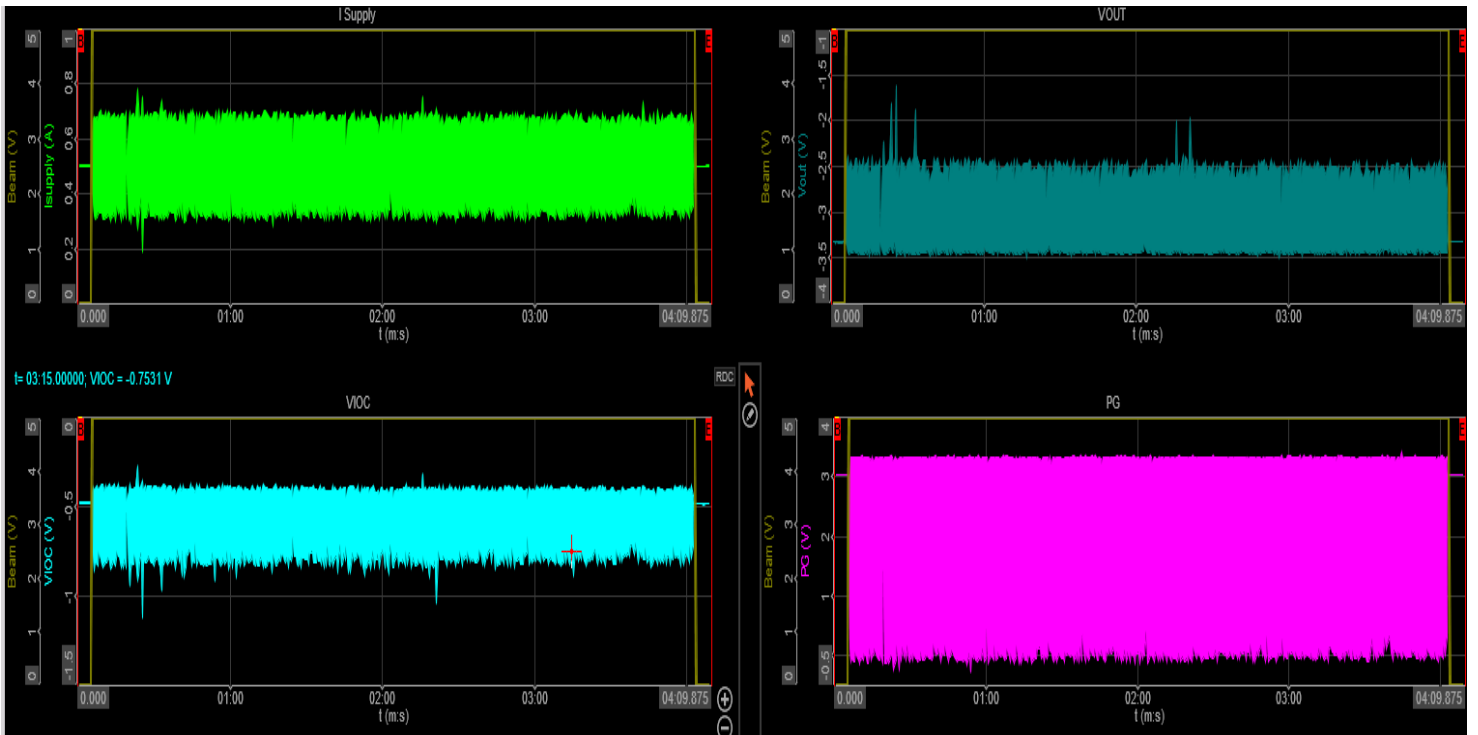


Figure A1: SEL Board 1, Run 3 $V_{in} = 3.8\text{V}$

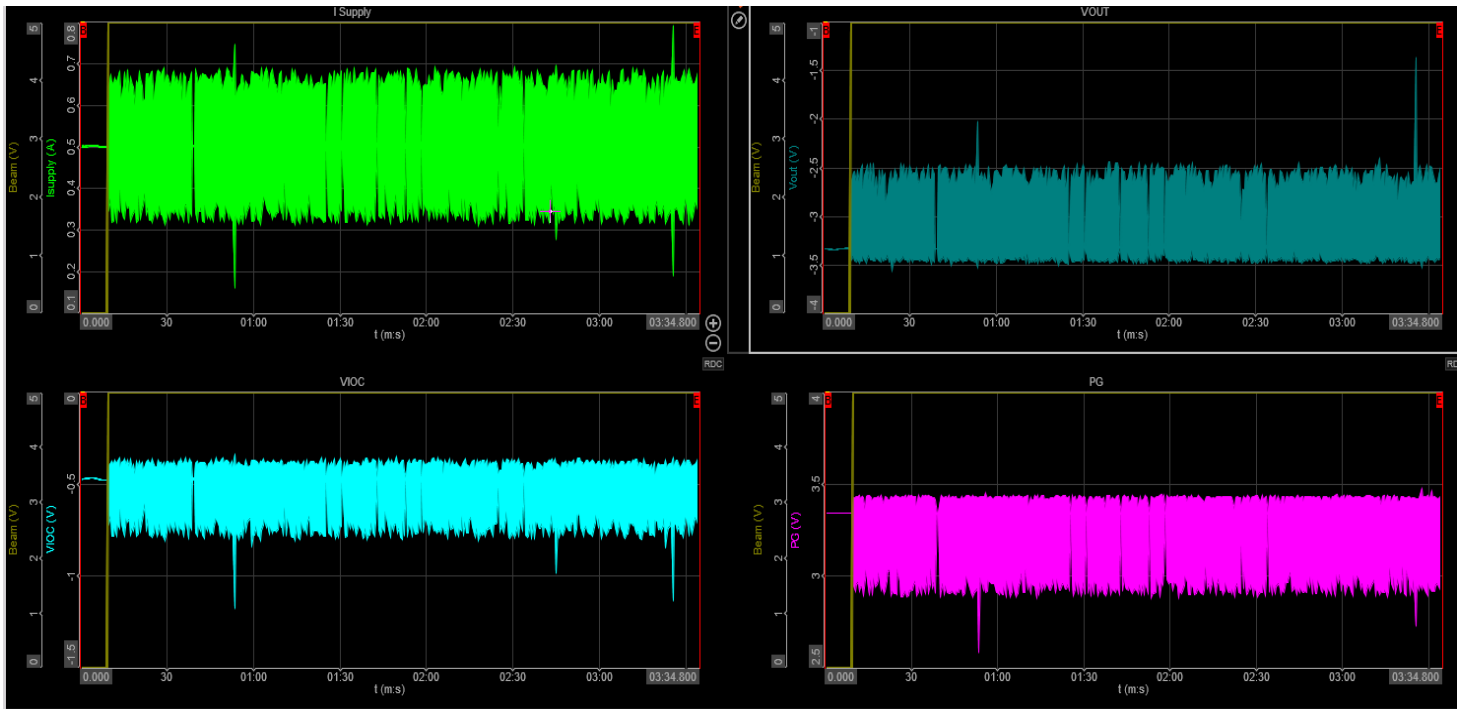


Figure A2: SEL Board 3, Run 27 $V_{in} = 3.8\text{V}$

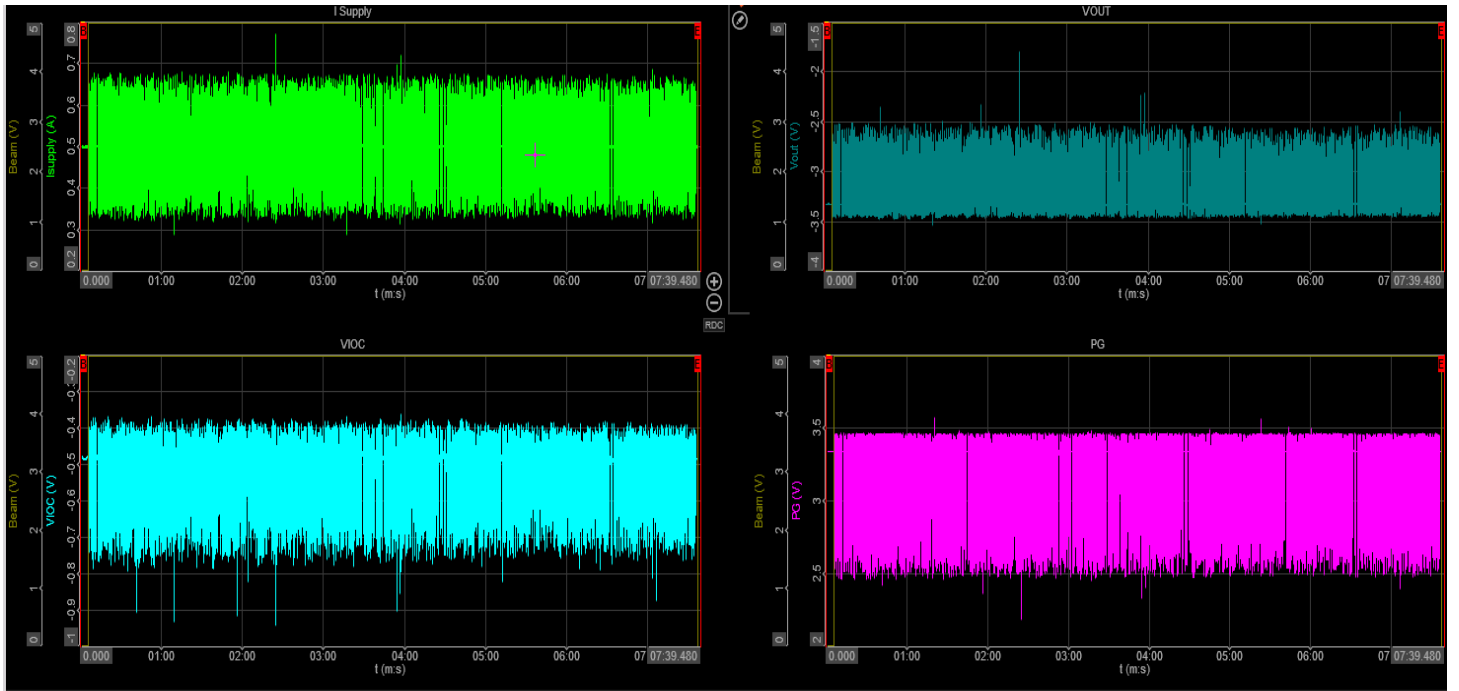


Figure A3: SEL Board 4, Run 29, $V_{in} = 3.8V$

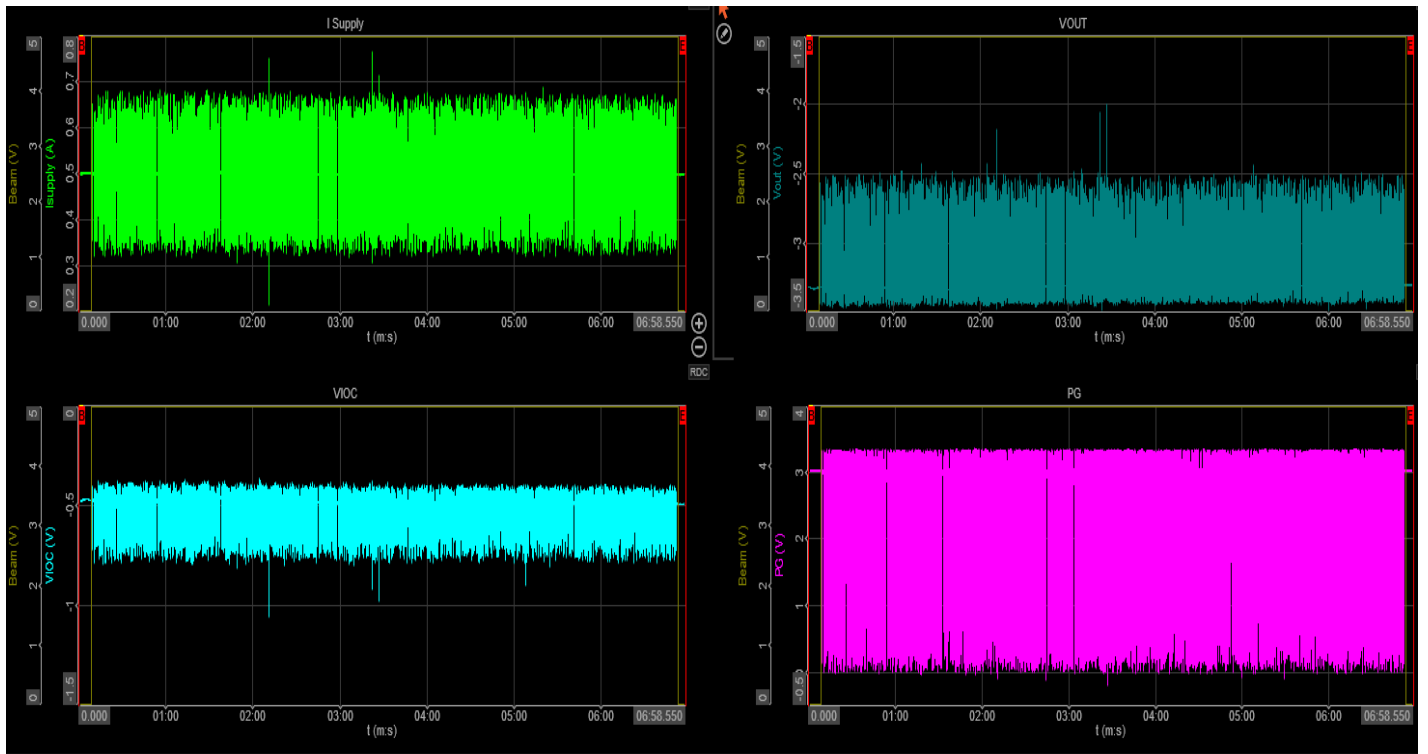


Figure A4: SEL Board 5, Run 21, $V_{in} = 3.8V$

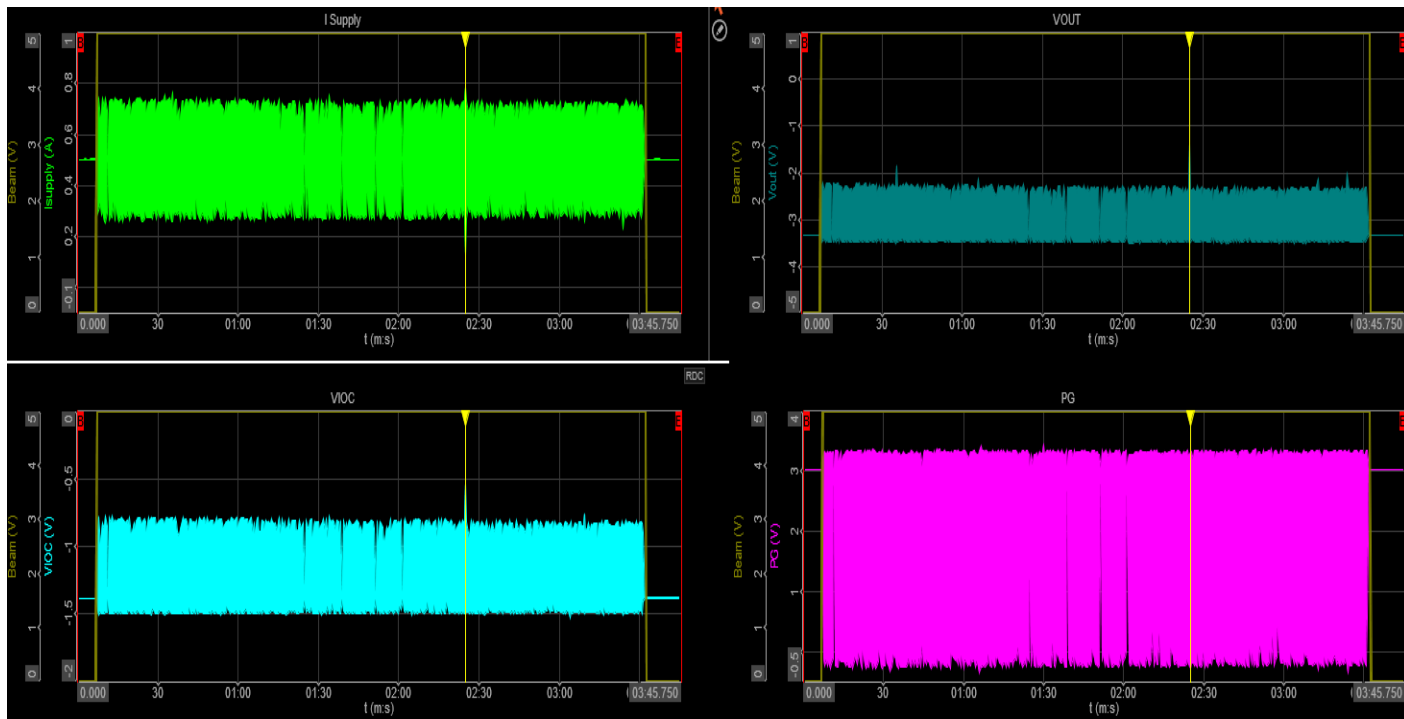


Figure A5: SEL Board 1, Run 1 $V_{in} = 5V$

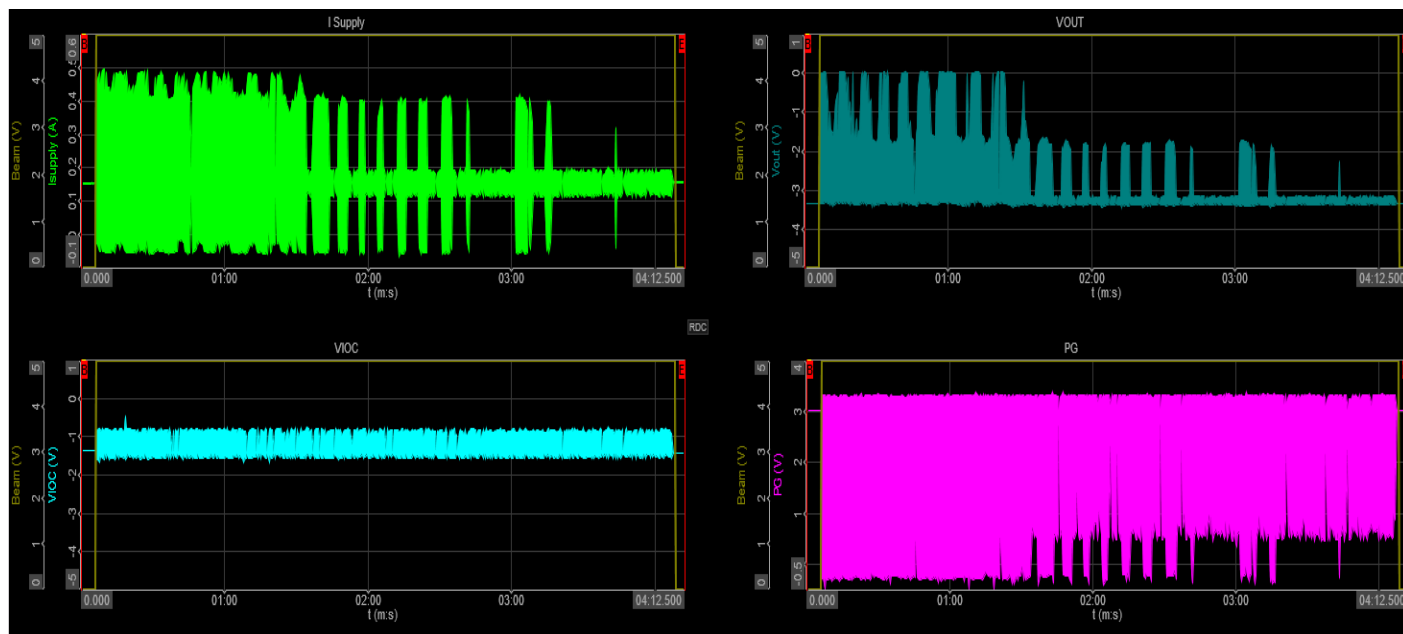


Figure A6: SEL Board 1, Run 2 $V_{in} = 16V$

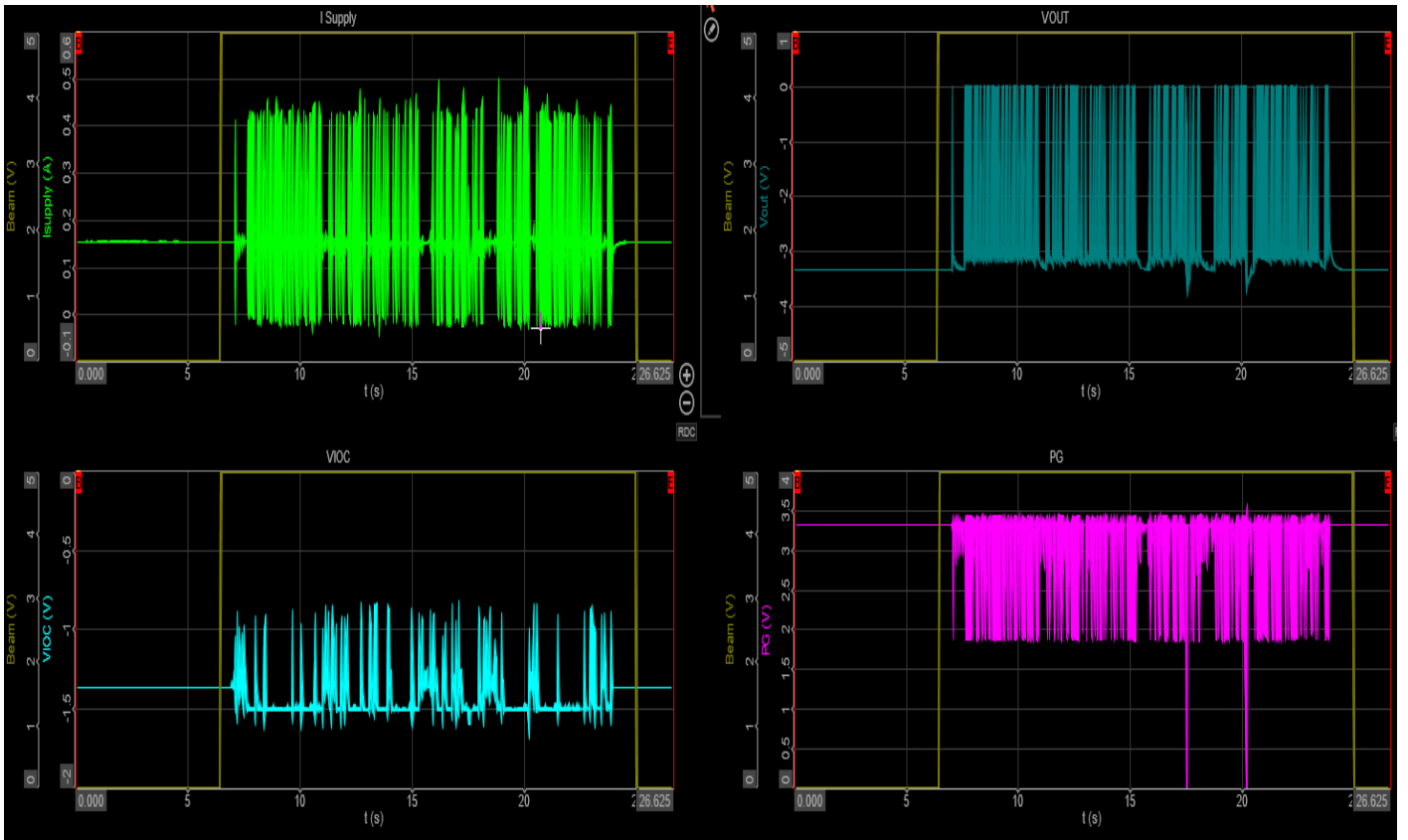


Figure A7: SEL Board 3, Run 26, $V_{in} = 16V$

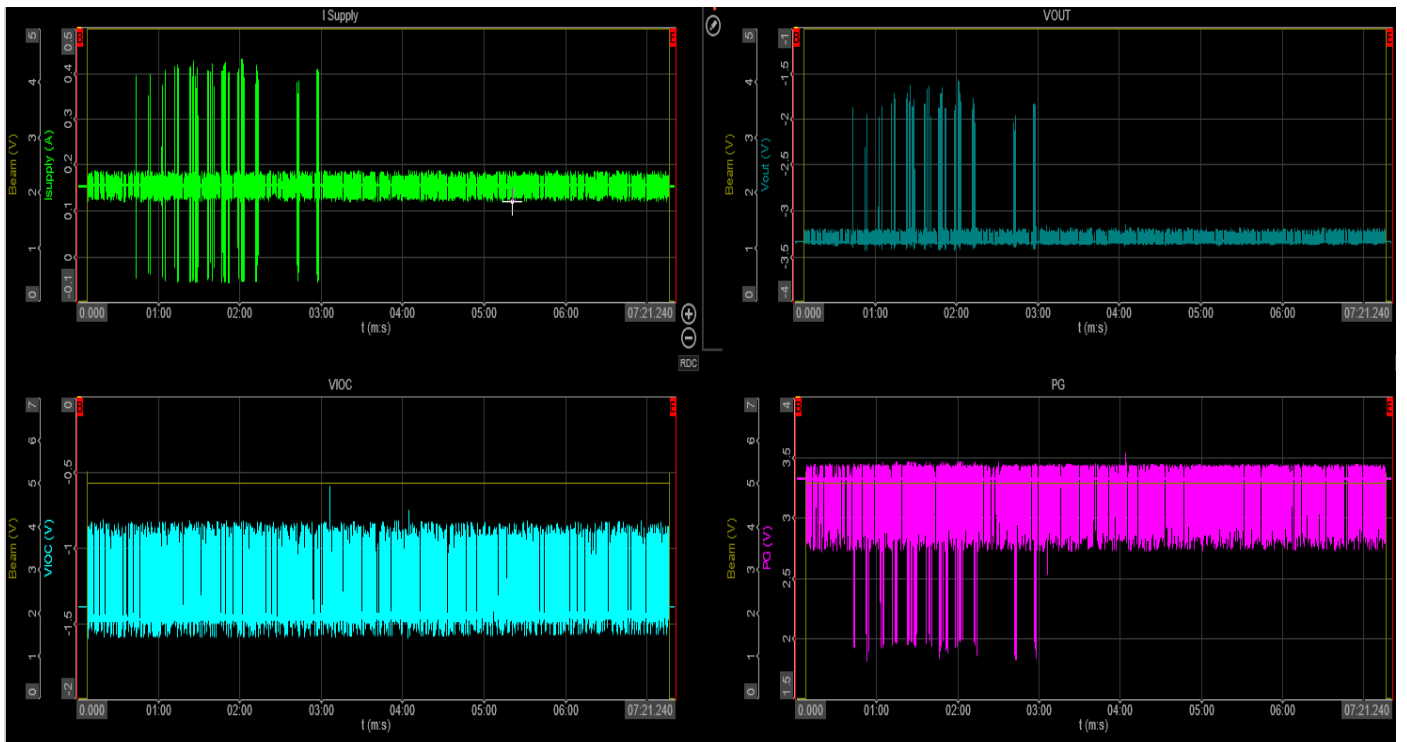


Figure A8: SEL Board 4, Run 28, $V_{in} = 16V$

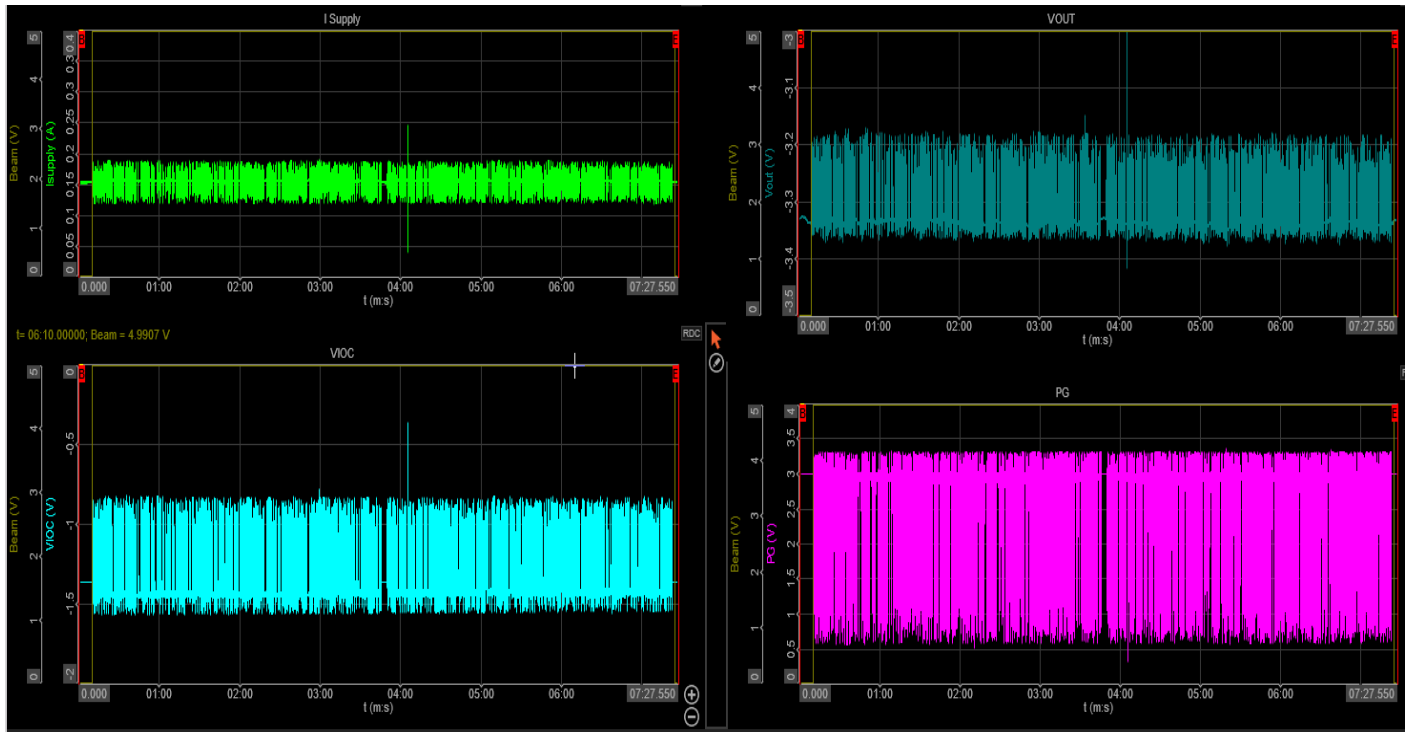


Figure A9: SEL Board 5, Run 20, $V_{in} = 16V$

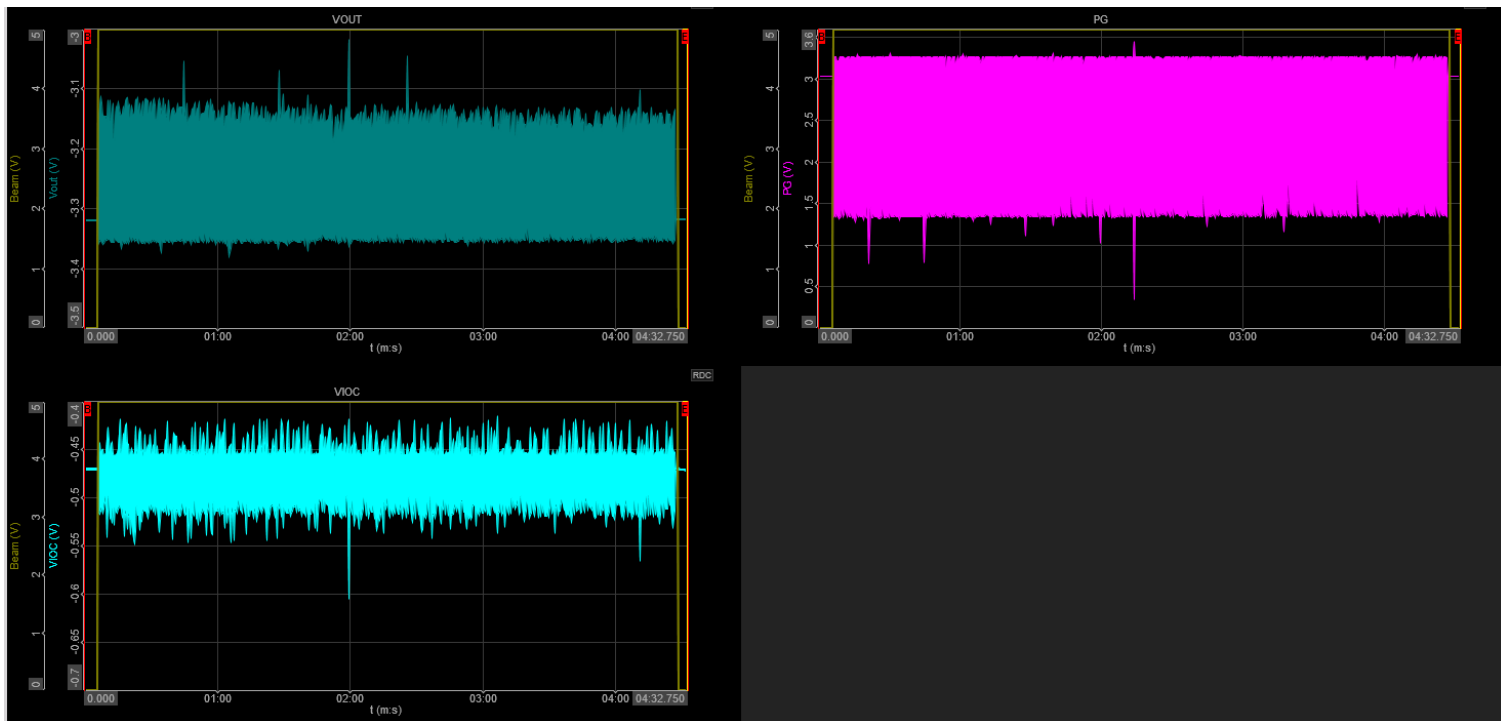


Figure A10: SET Board 1, Run 4, $V_{in} = 3.8V$, $79.9MeVcm^2/mg$

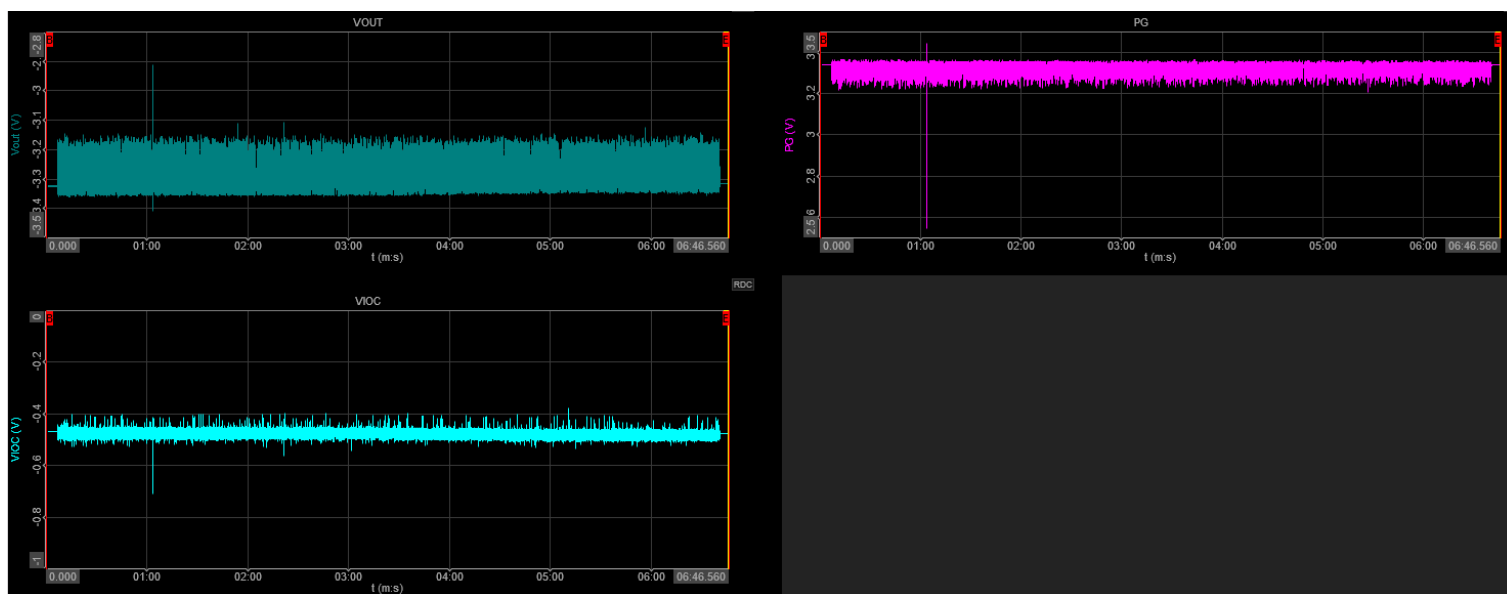


Figure A11: SET Board 3, Run 33, $V_{in} = 3.8V$, $79.9MeVcm^2/mg$

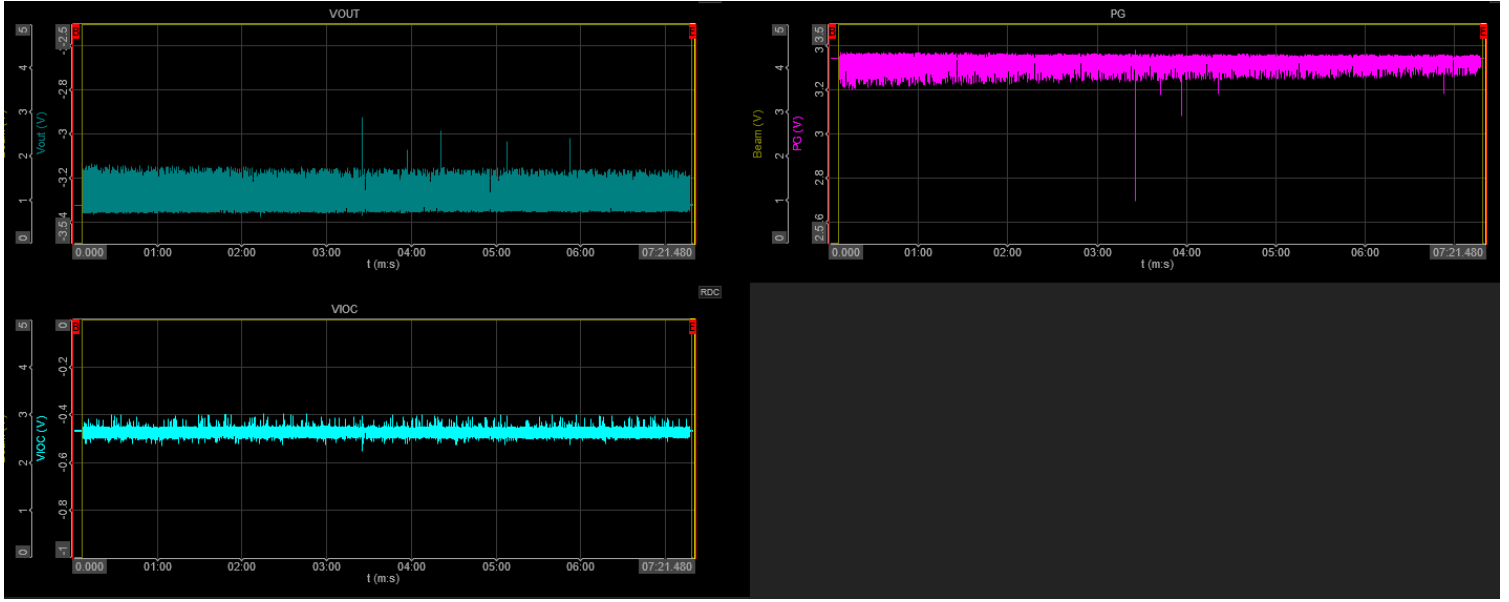


Figure A12: SET Board 4, Run 30, $V_{in} = 3.8V$, $79.9MeVcm^2/mg$

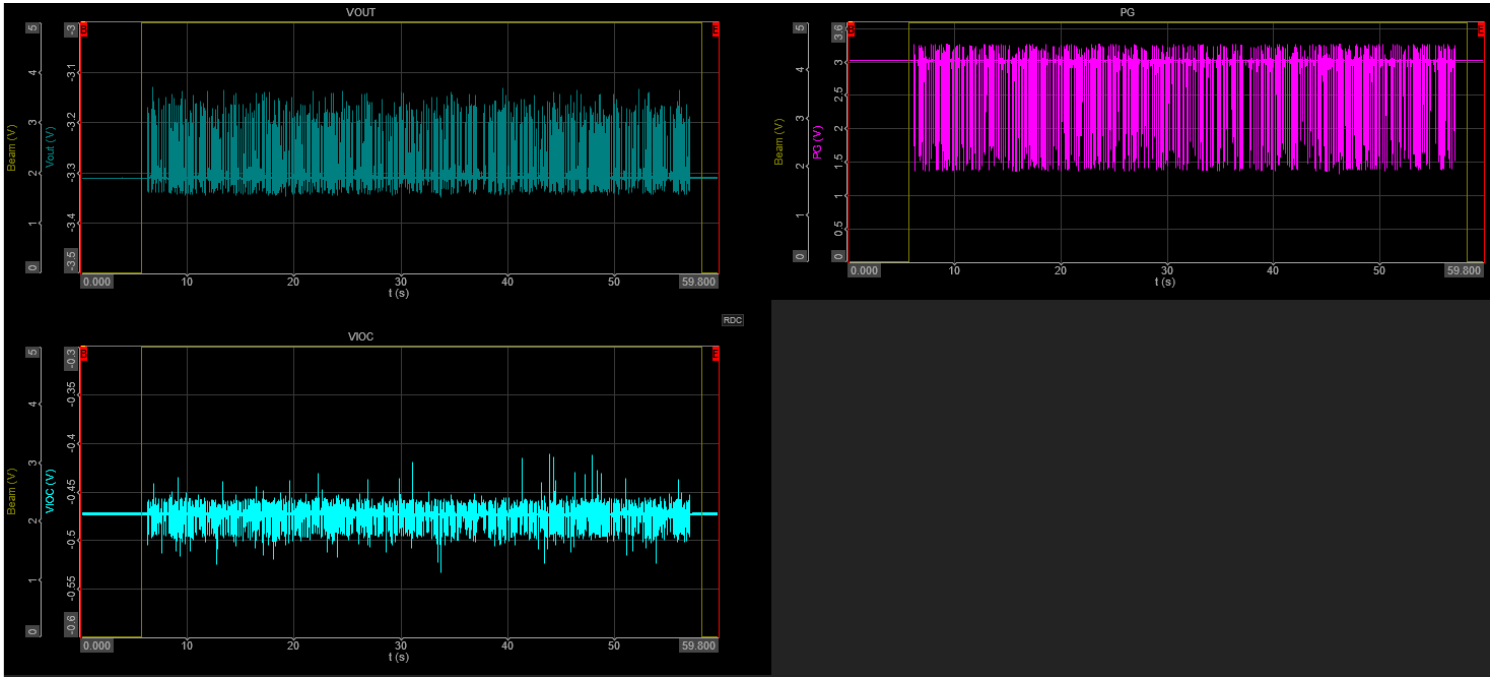


Figure A13: SET Board 5, Run 22, $V_{in} = 3.8V$, $79.9MeVcm^2/mg$

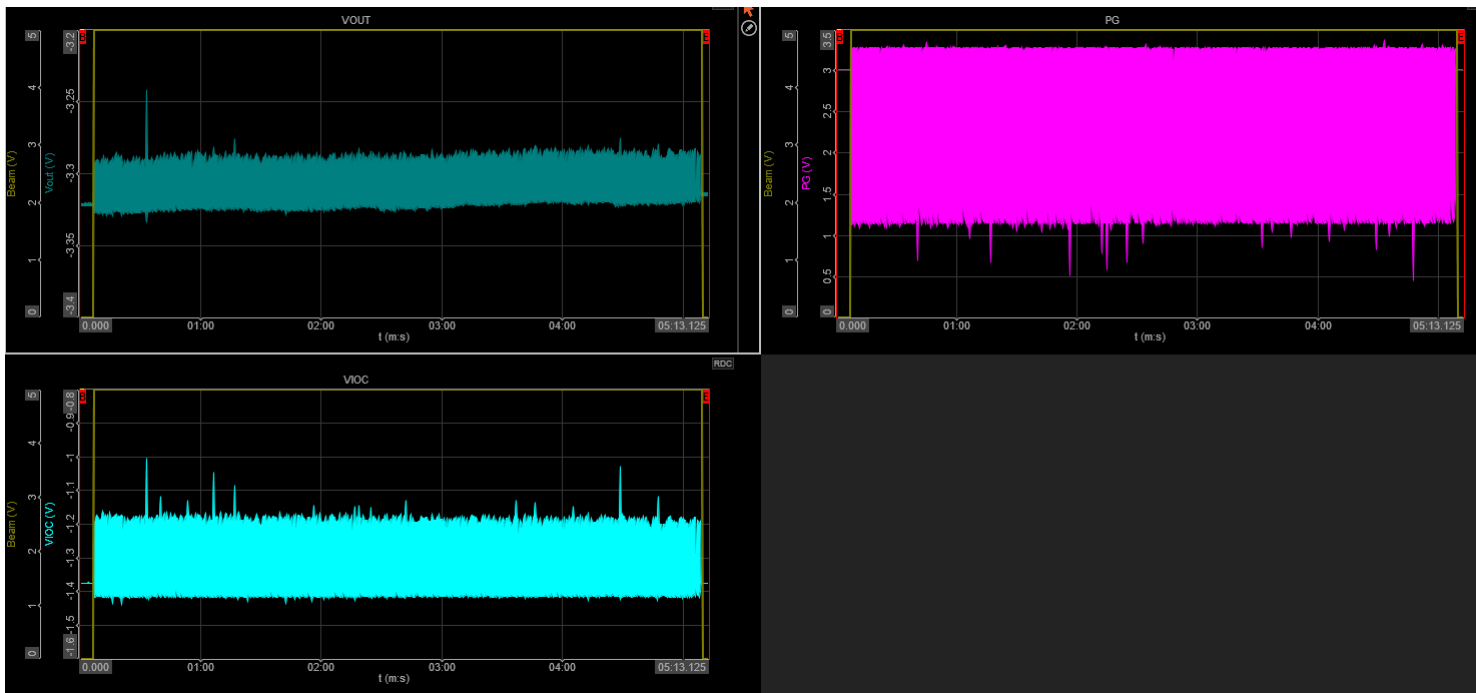


Figure A14: SET Board 1, Run 5, $V_{in} = 16V$, $79.9MeVcm^2/mg$

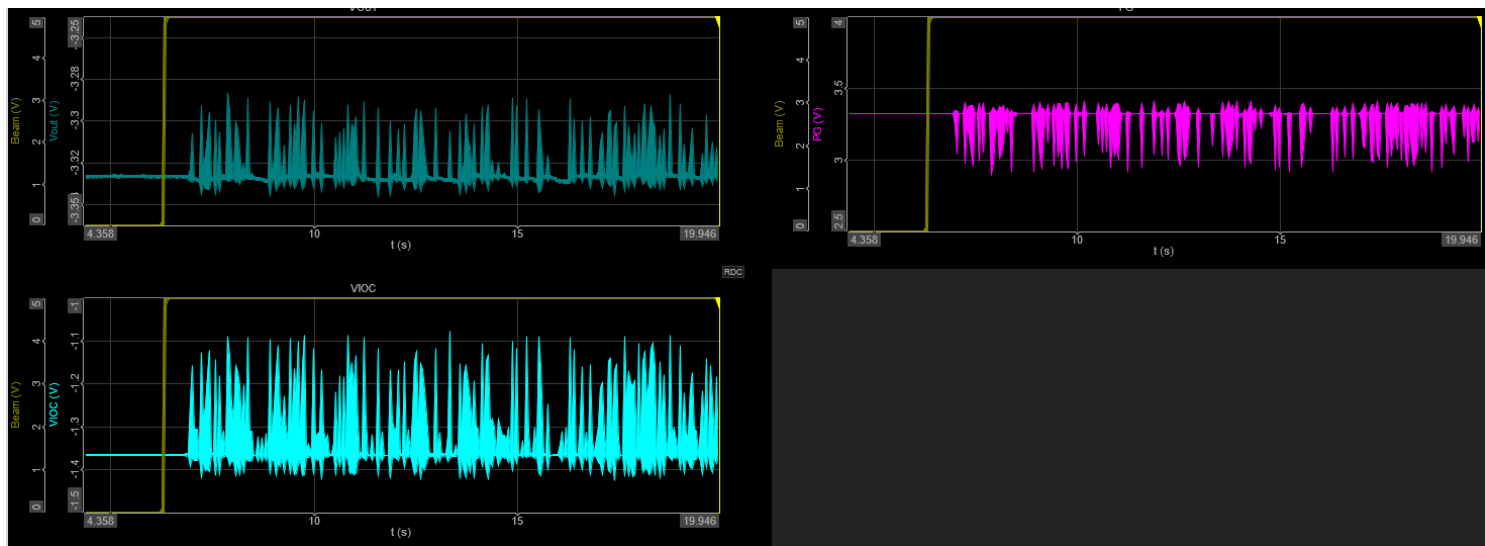


Figure A15: SET Board 3, Run 32, $V_{in} = 16V$, $79.9Me$

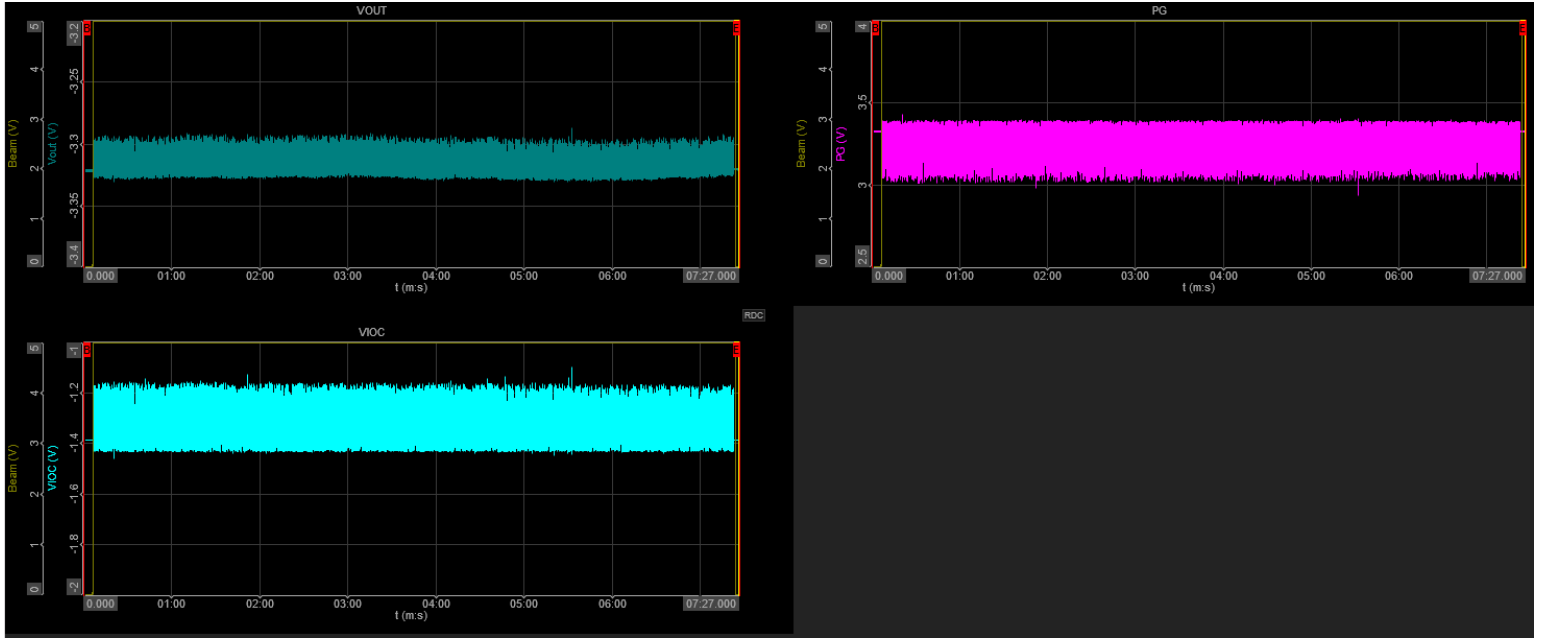


Figure A16: SET Board 4, Run 31, $V_{in} = 16V$, $79.9MeVcm^2/mg$

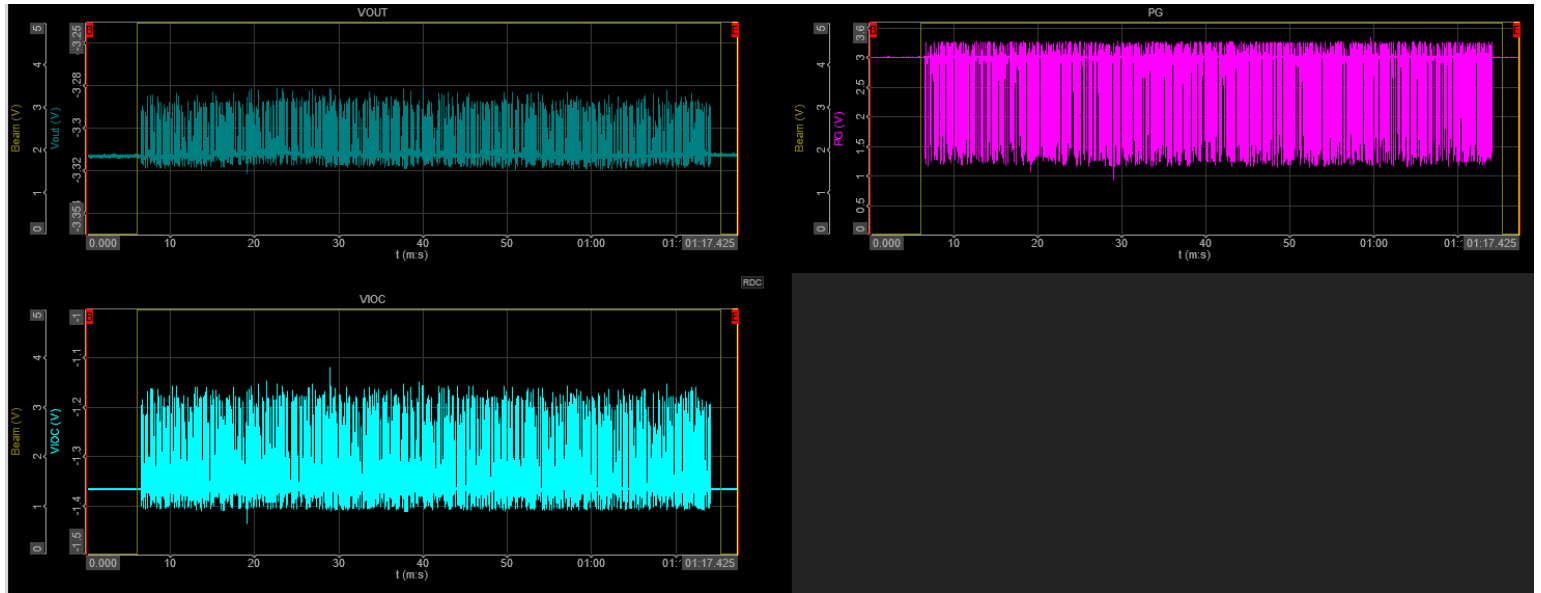


Figure A17: SET Board 5 Run 23, $V_{in} = 16V$, $79.9MeVcm^2/mg$

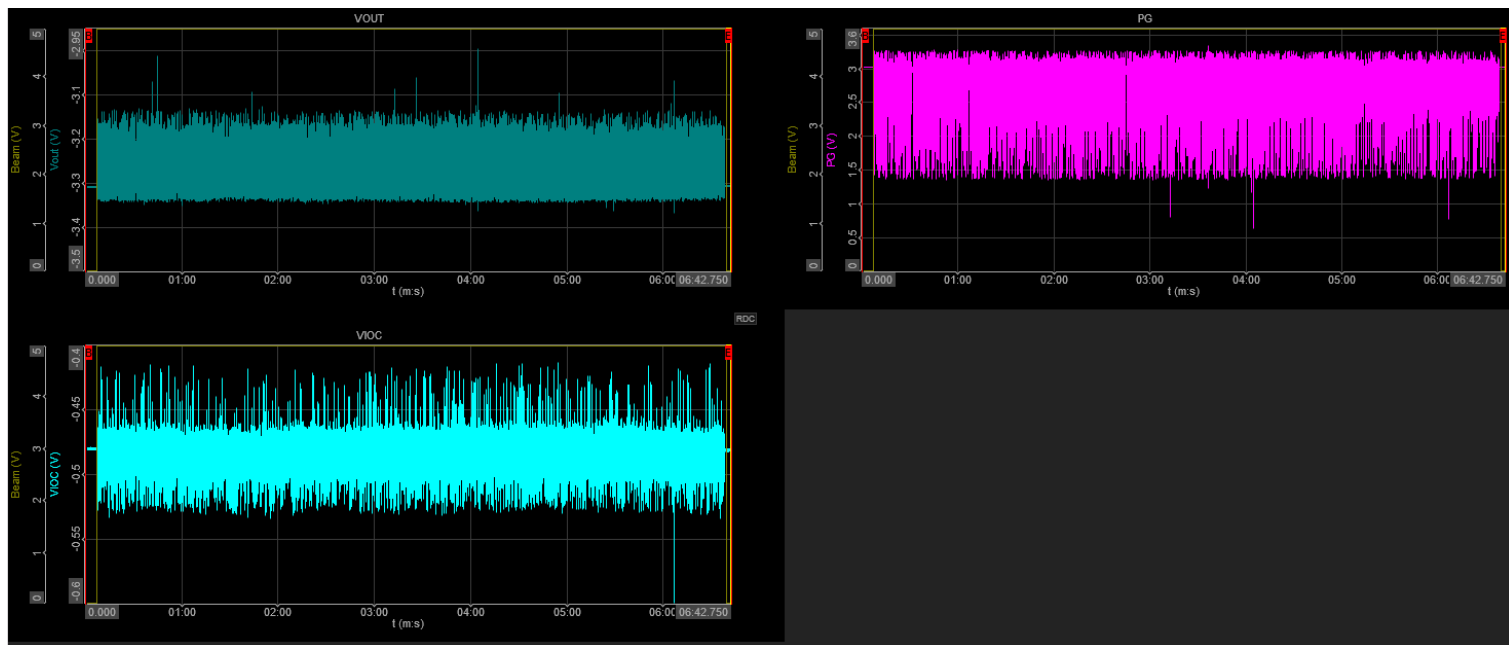


Figure A18: SET Board 1 Run 23, $V_{in} = 3.8V$, $59.96MeVcm^2/mg$

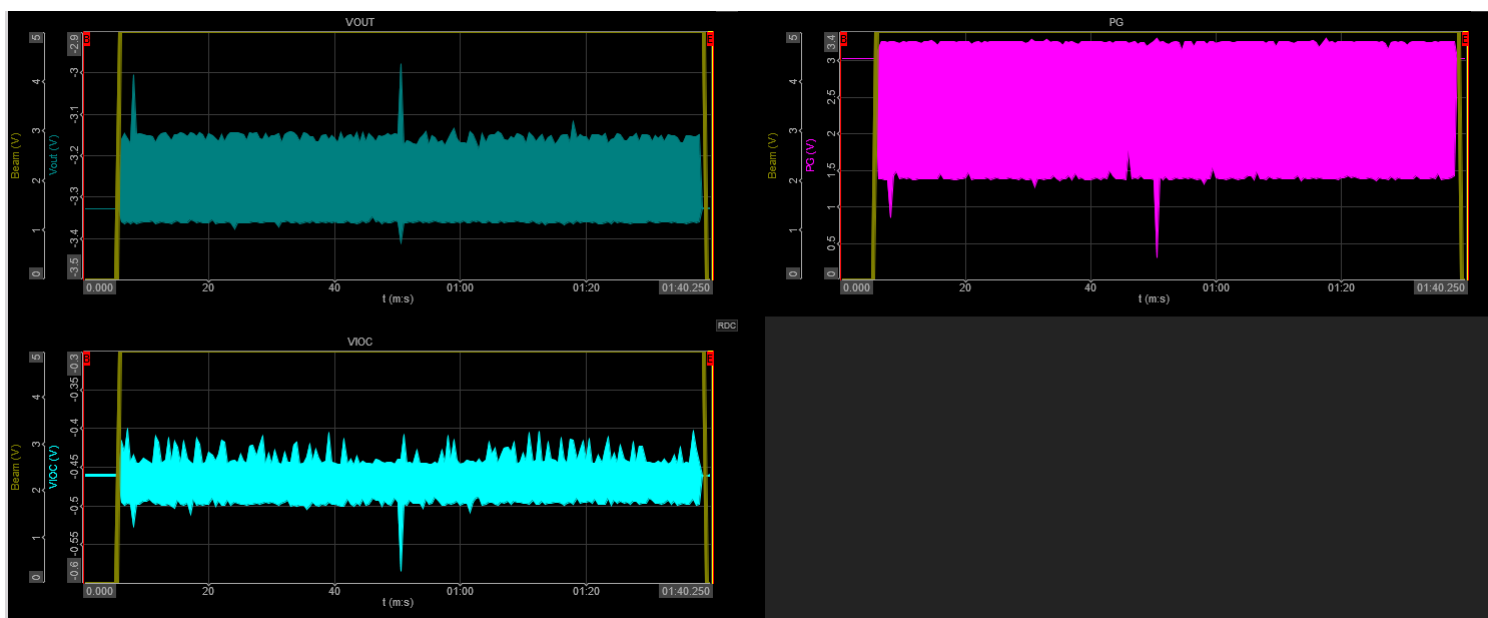


Figure A19: SET Board 5 Run 18, $V_{in} = 3.8V$, $59.3MeVcm^2/mg$

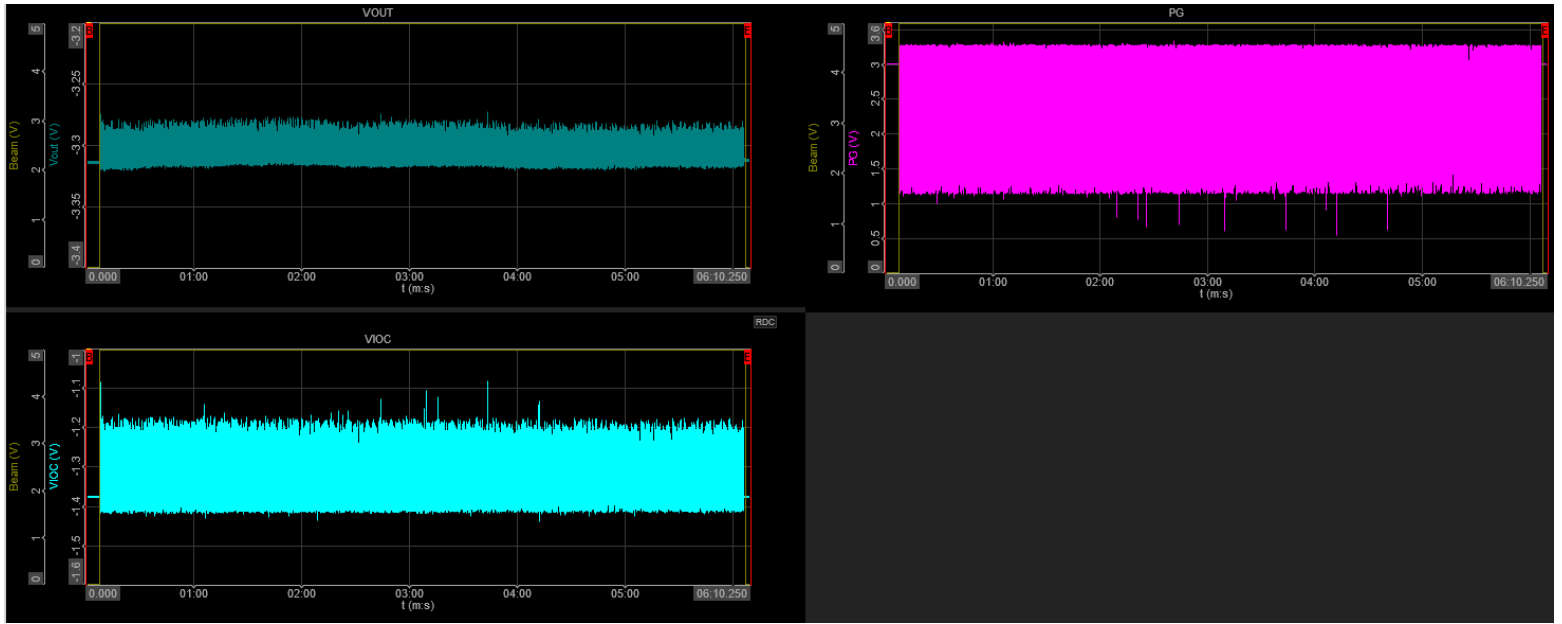


Figure A20: SET Board 1 Run 6, $V_{in} = 16V$, $59.96MeVcm^2/mg$

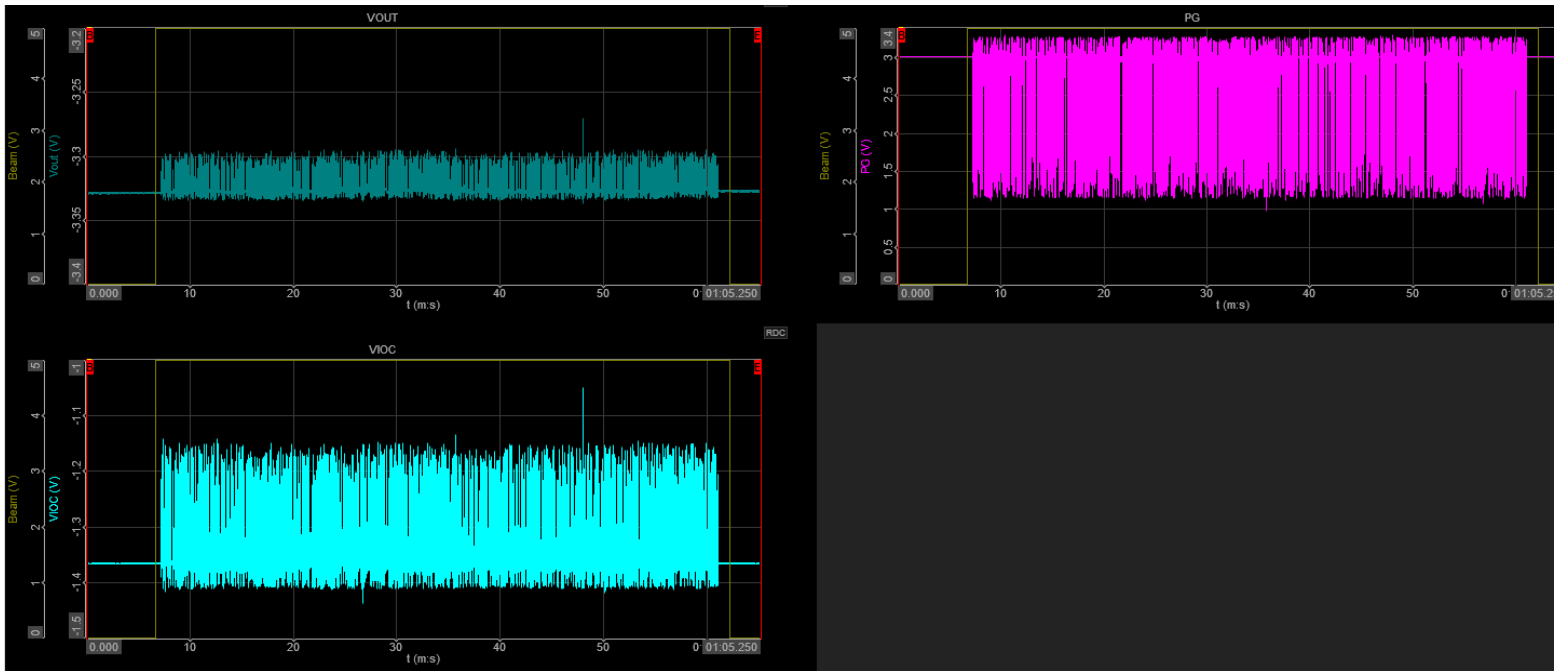


Figure A21: SET Board 5 Run 19, $V_{in} = 16V$, $59.3MeVcm^2/mg$

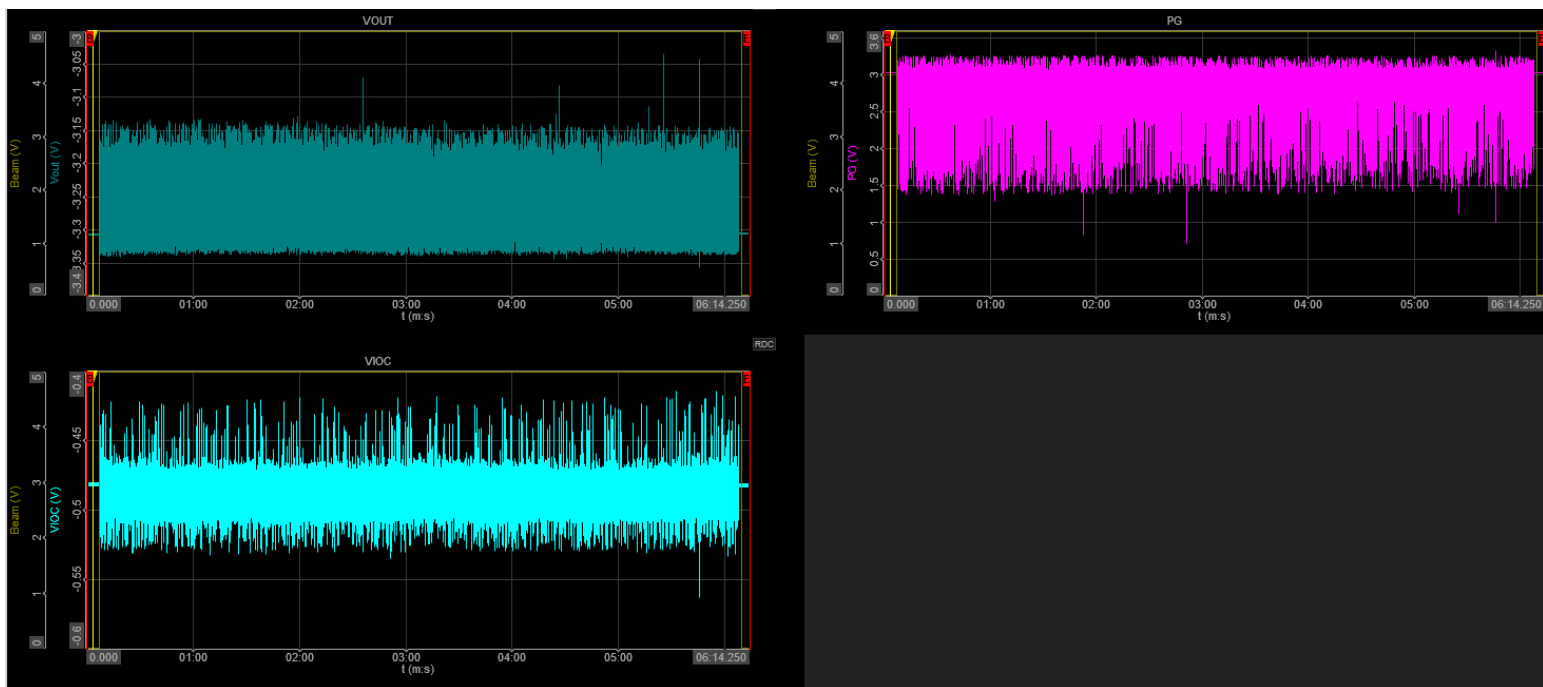


Figure A22: SET Board 1 Run 9, $V_{in} = 3.8V$, $50.06MeVcm^2/mg$

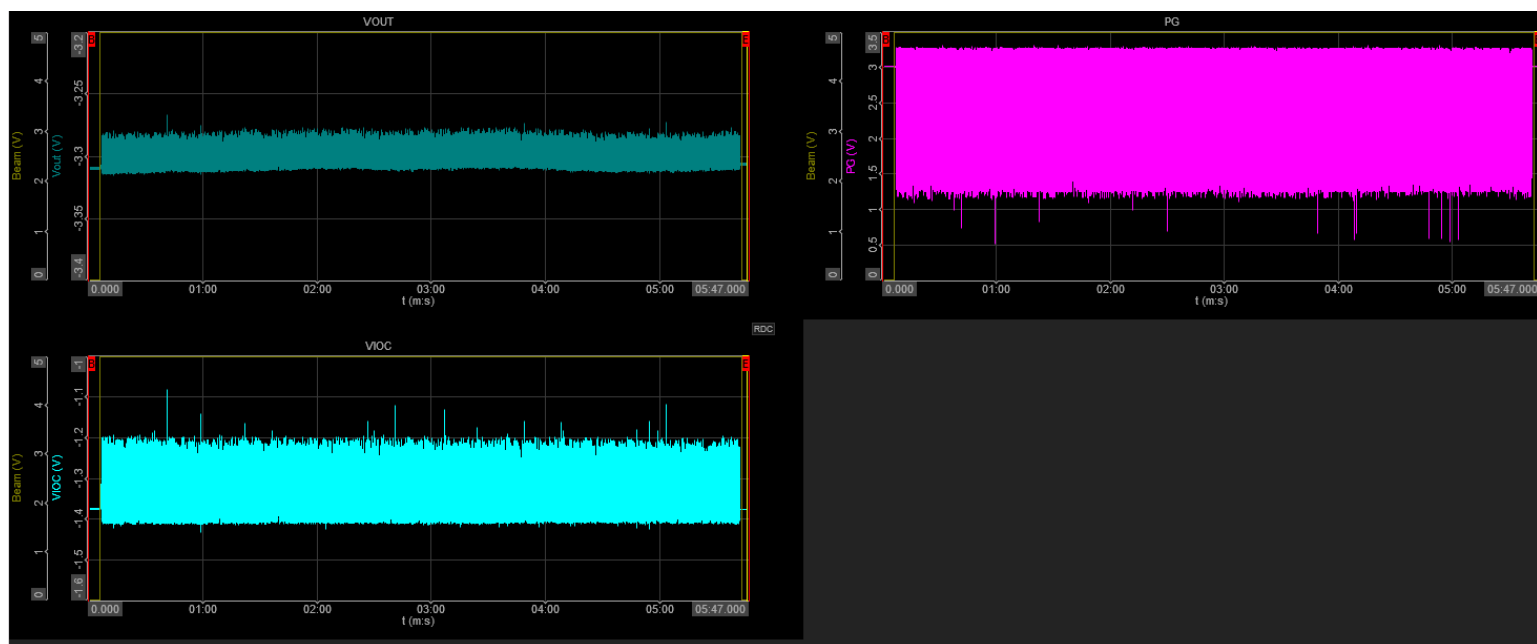


Figure A23: SET Board 1 Run 10, $V_{in} = 16V$, $50.06MeVcm^2/mg$

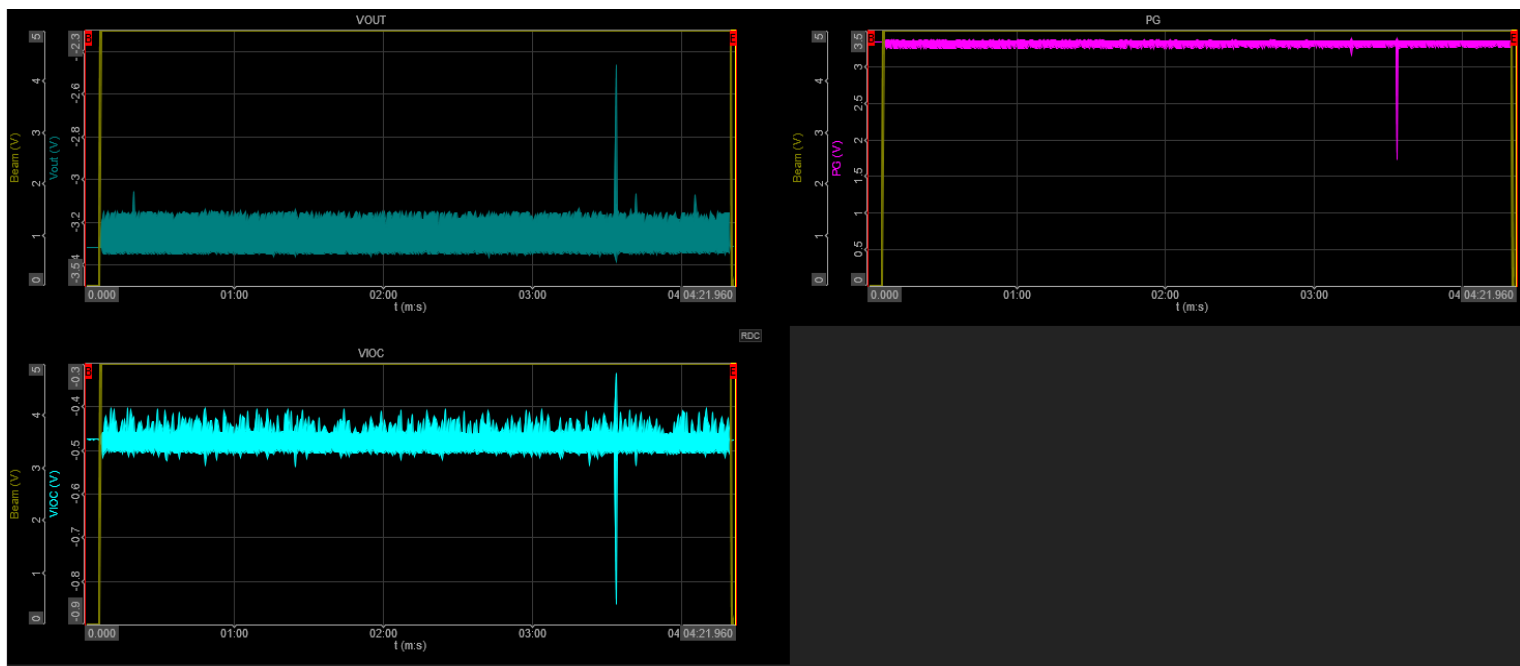


Figure A24: SET Board 3 Run 37, $V_{in} = 3.8V$, $43MeVcm^2/mg$

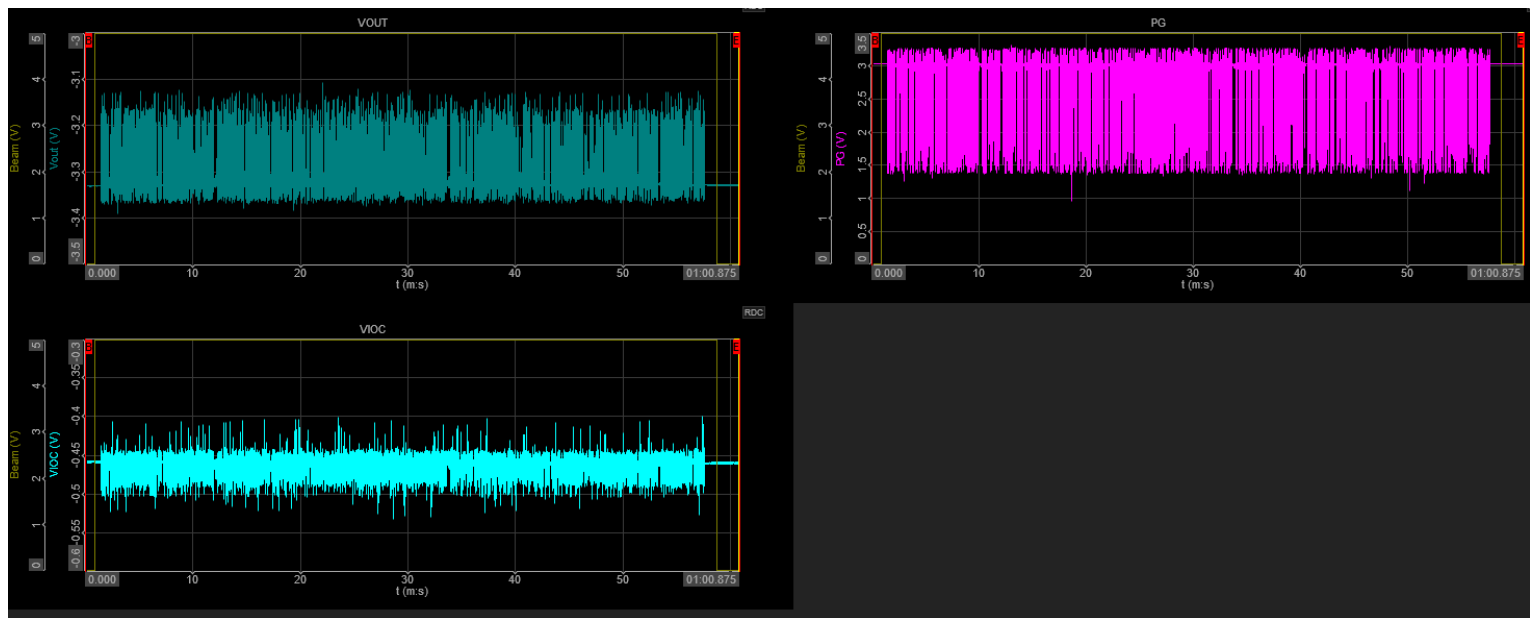


Figure A25: SET Board 5 Run 17, $V_{in} = 3.8V$, $43MeVcm^2/mg$

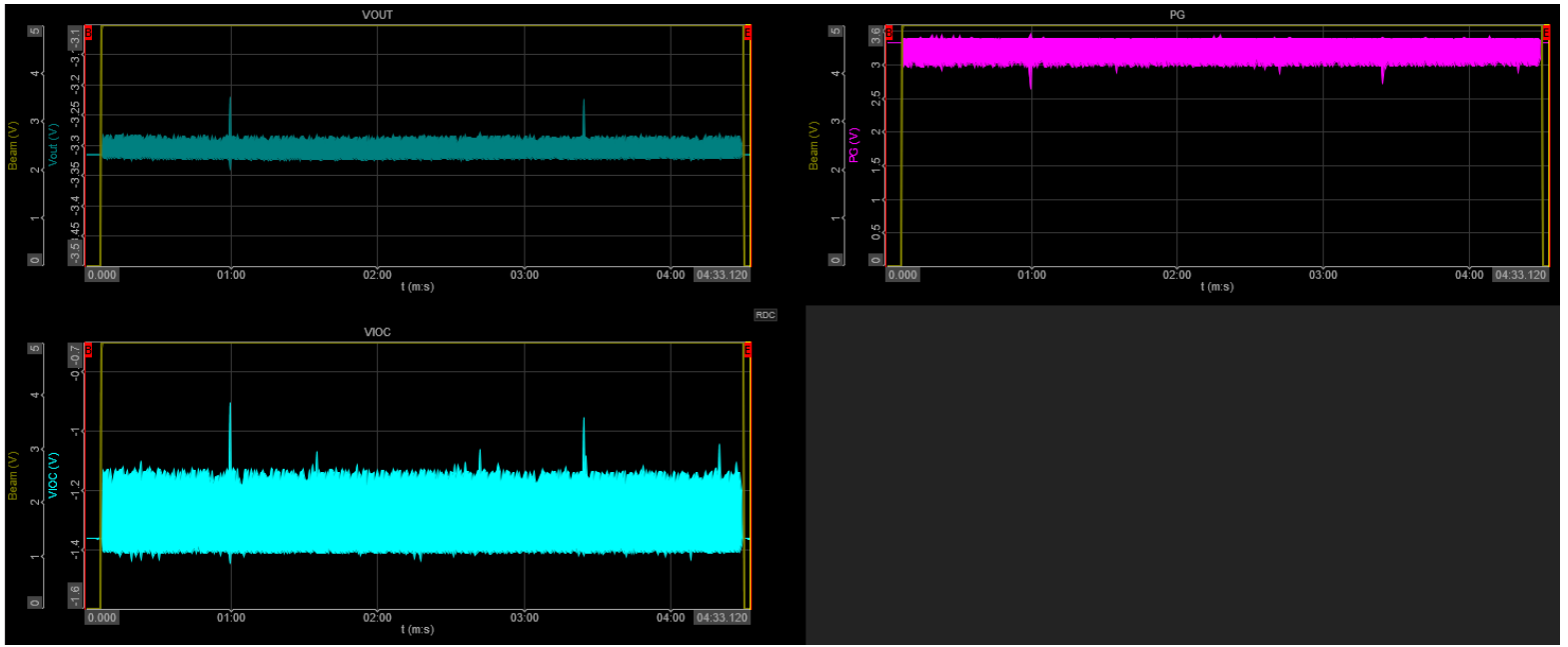


Figure A26: SET Board 3 Run 36, $V_{in} = 16V$, $43MeVcm^2/mg$

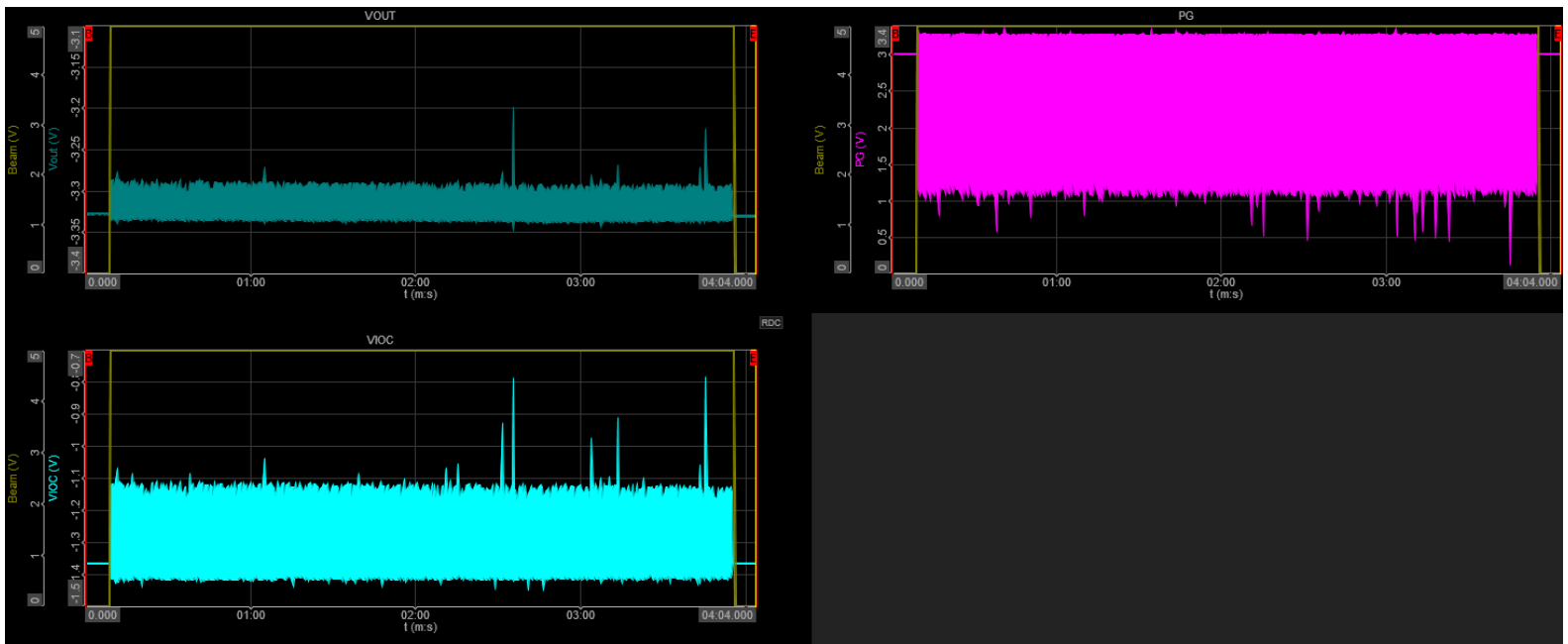


Figure A27: SET Board 5 Run 16, $V_{in} = 16V$, $43MeVcm^2/mg$

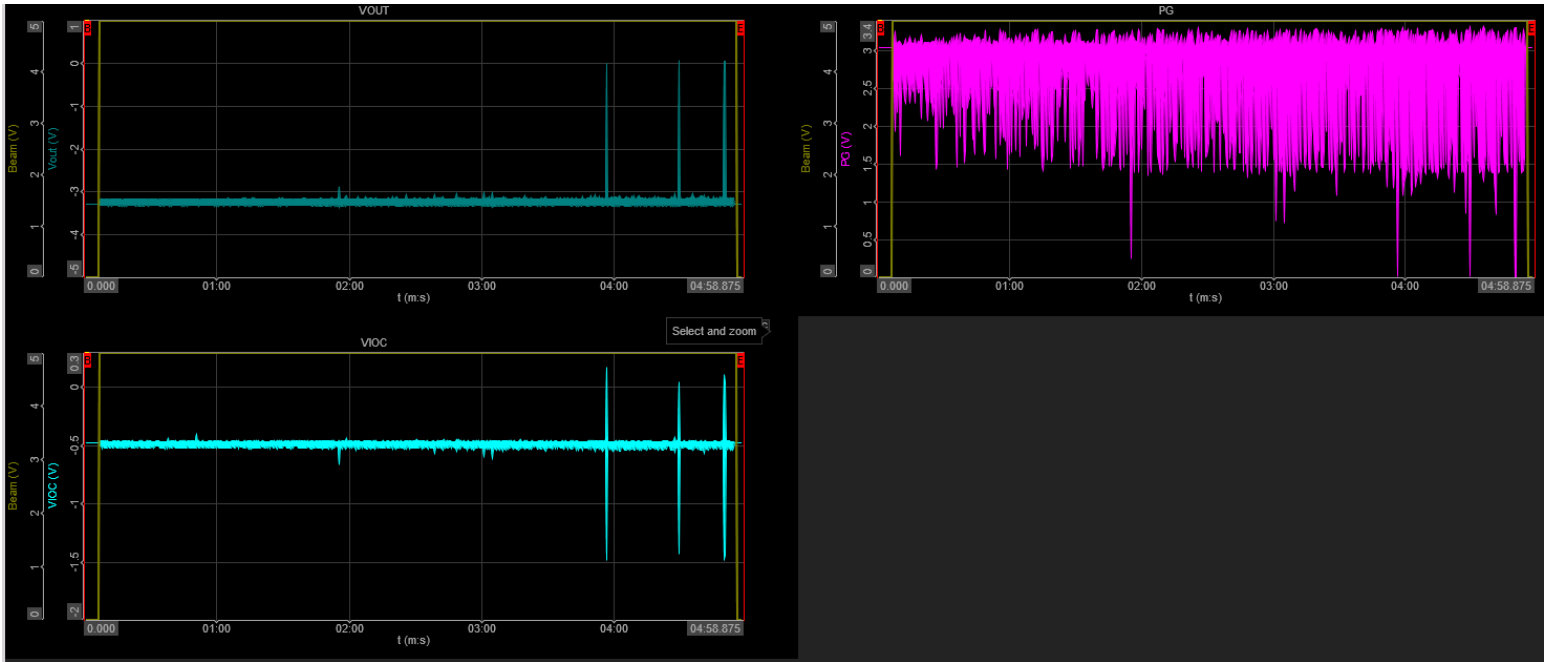


Figure A28: SET Board 1 Run 12, $V_{in} = 3.8V$, $33.8MeVcm^2/mg$

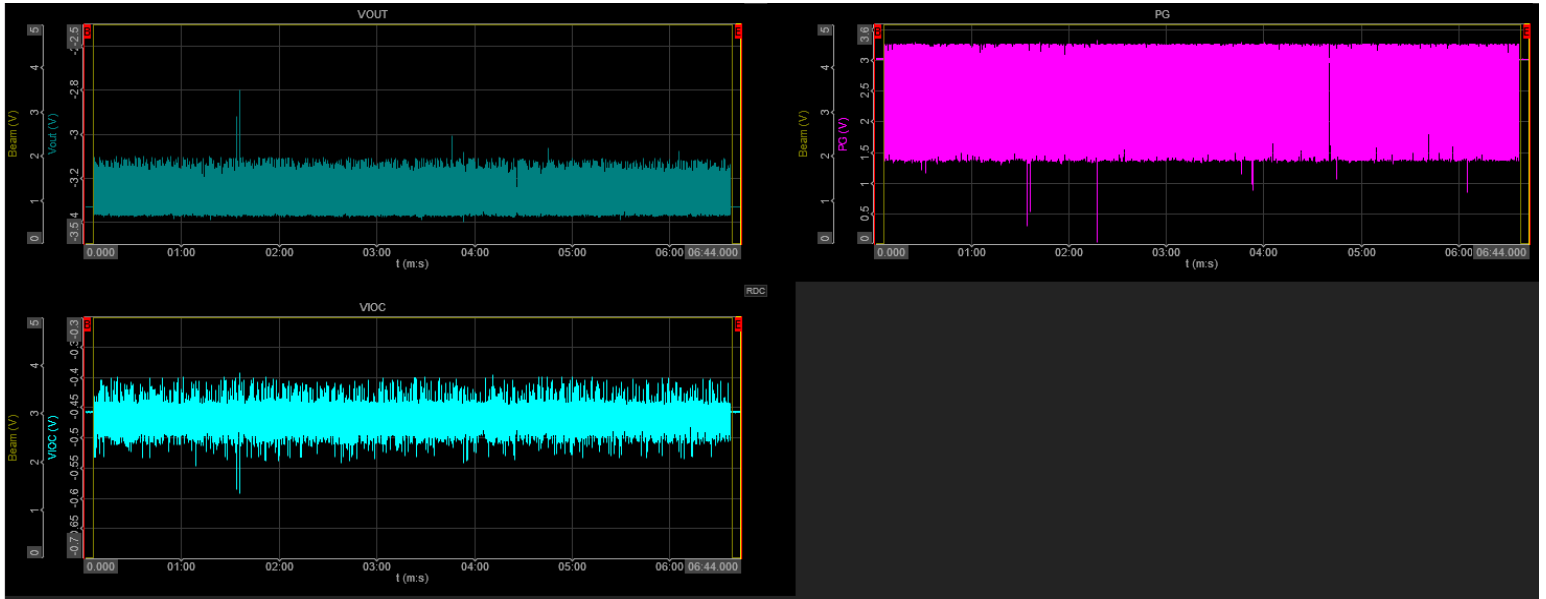


Figure A29: SET Board 5 Run 13, $V_{in} = 3.8V$, $33.8MeVcm^2/mg$

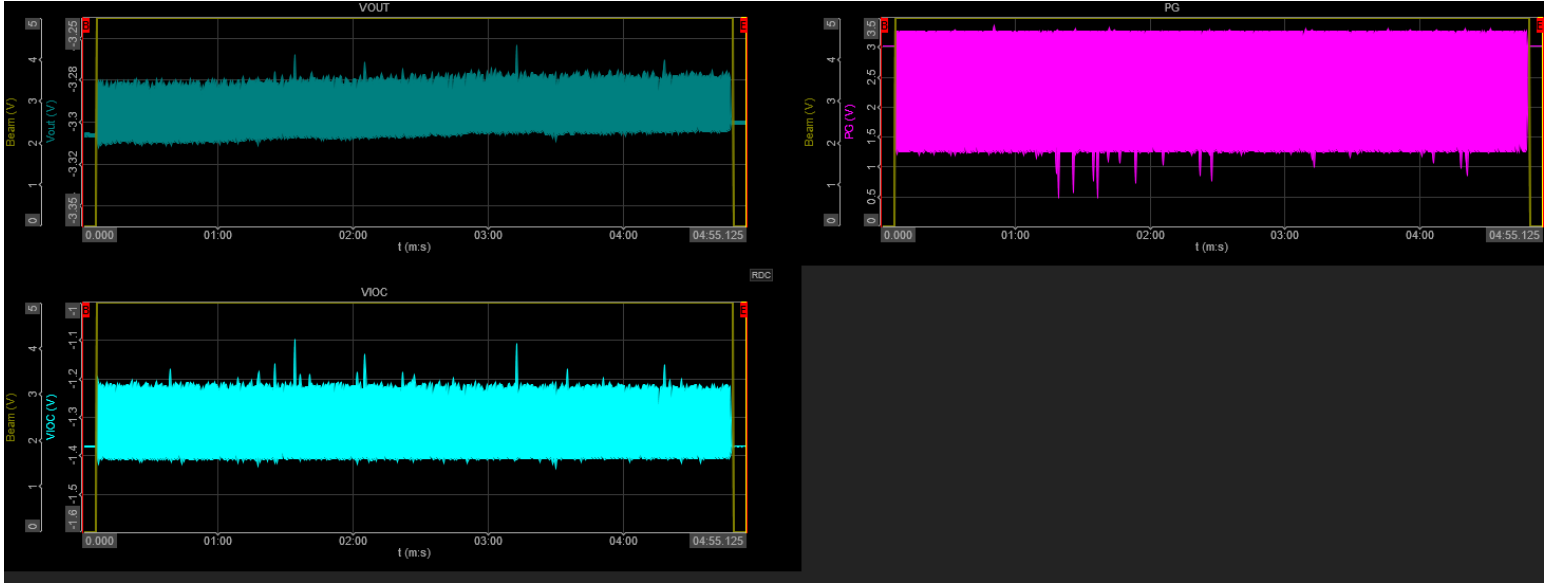


Figure A30: SET Board 1 Run 11, $V_{in} = 16V$, $33.8MeVcm^2/mg$

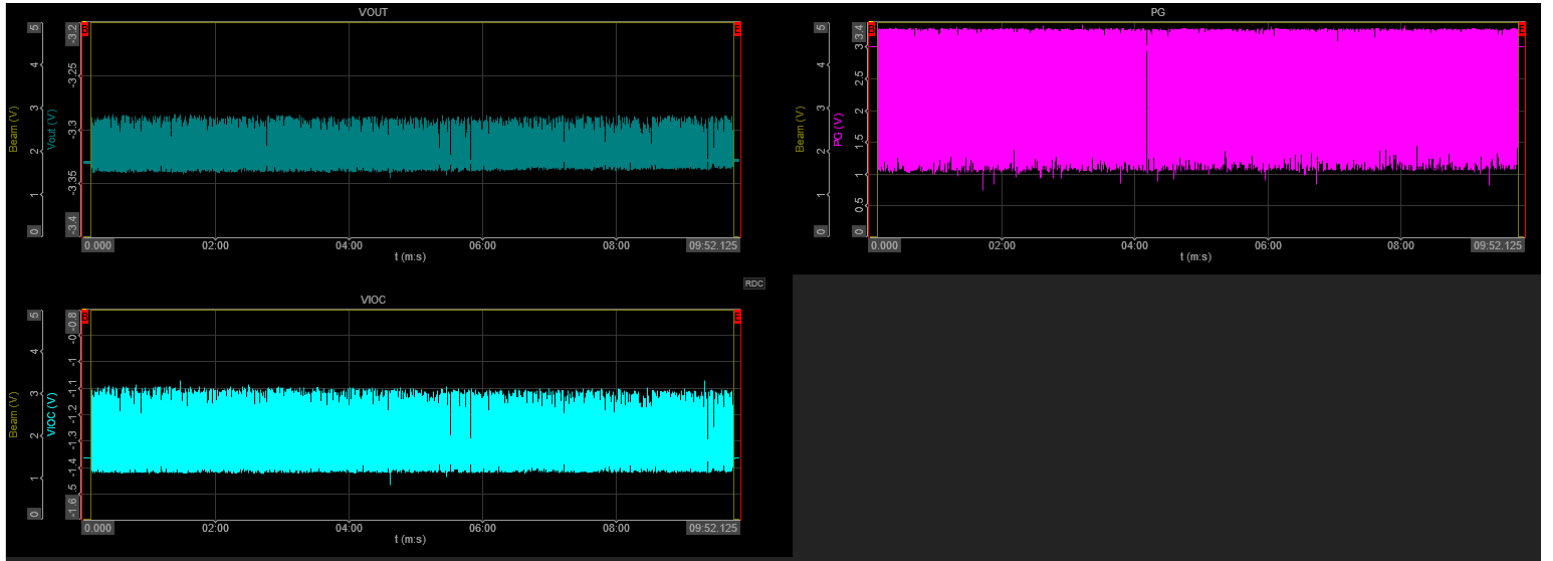


Figure A31: SET Board 5 Run 14, $V_{in} = 16V$, $33.8MeVcm^2/mg$

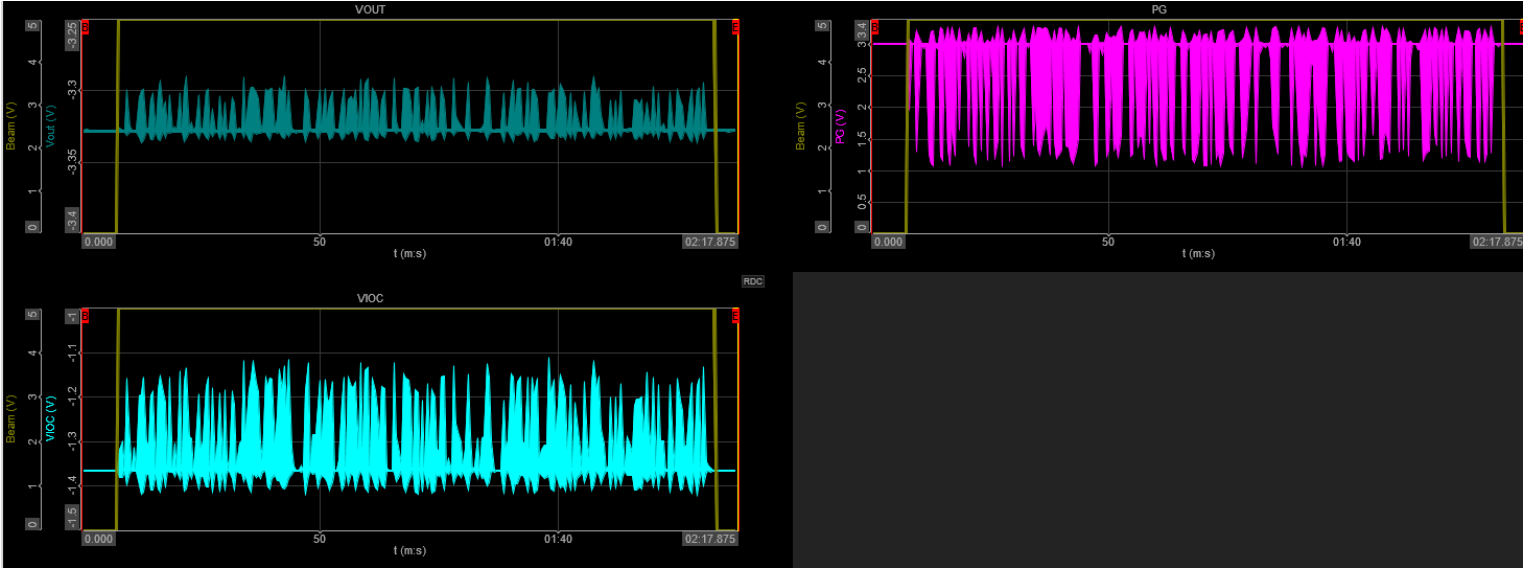


Figure A32: SET Board 5 Run 15, $V_{in} = 16V$, $33.8MeVcm^2/mg$

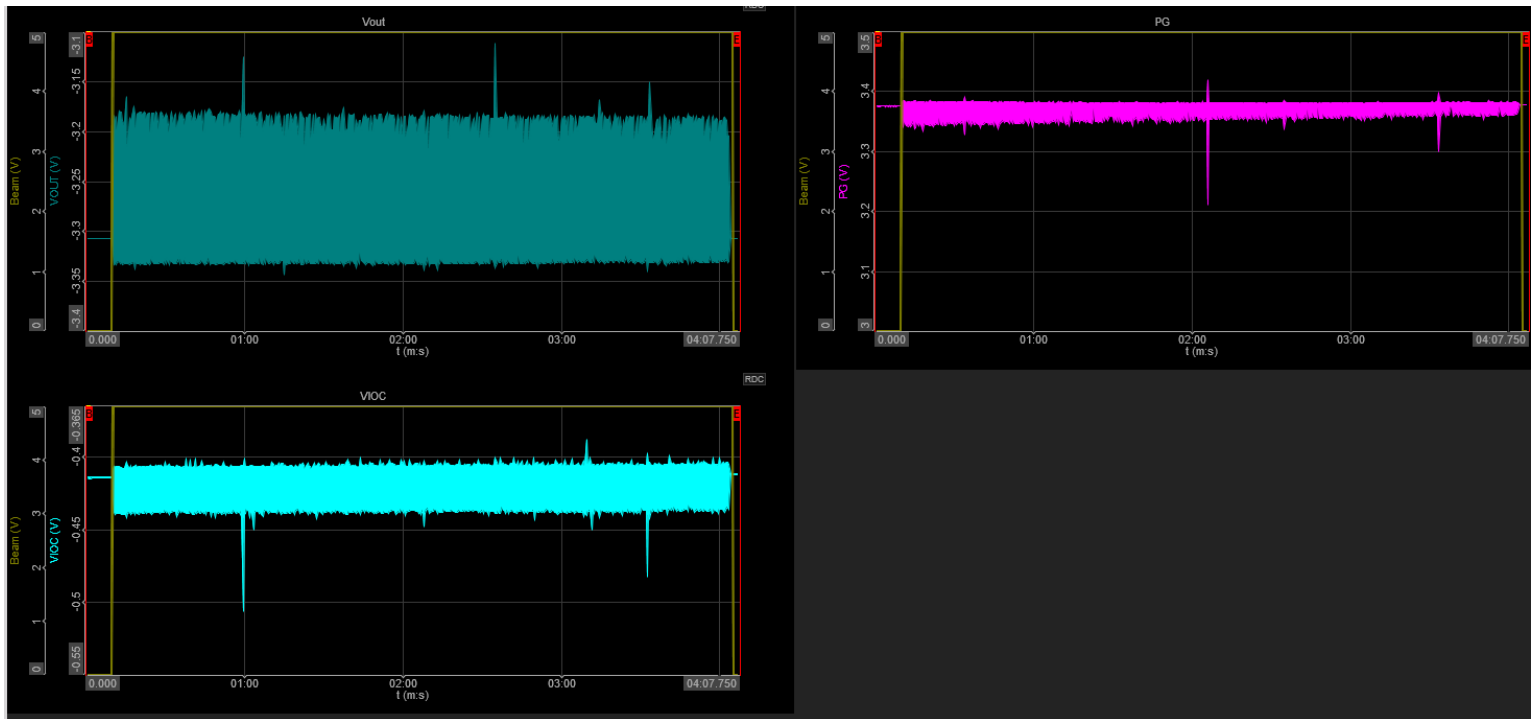


Figure A33: SET Board 3 Run 50, $V_{in} = 3.8V$, $26.3MeVcm^2/mg$

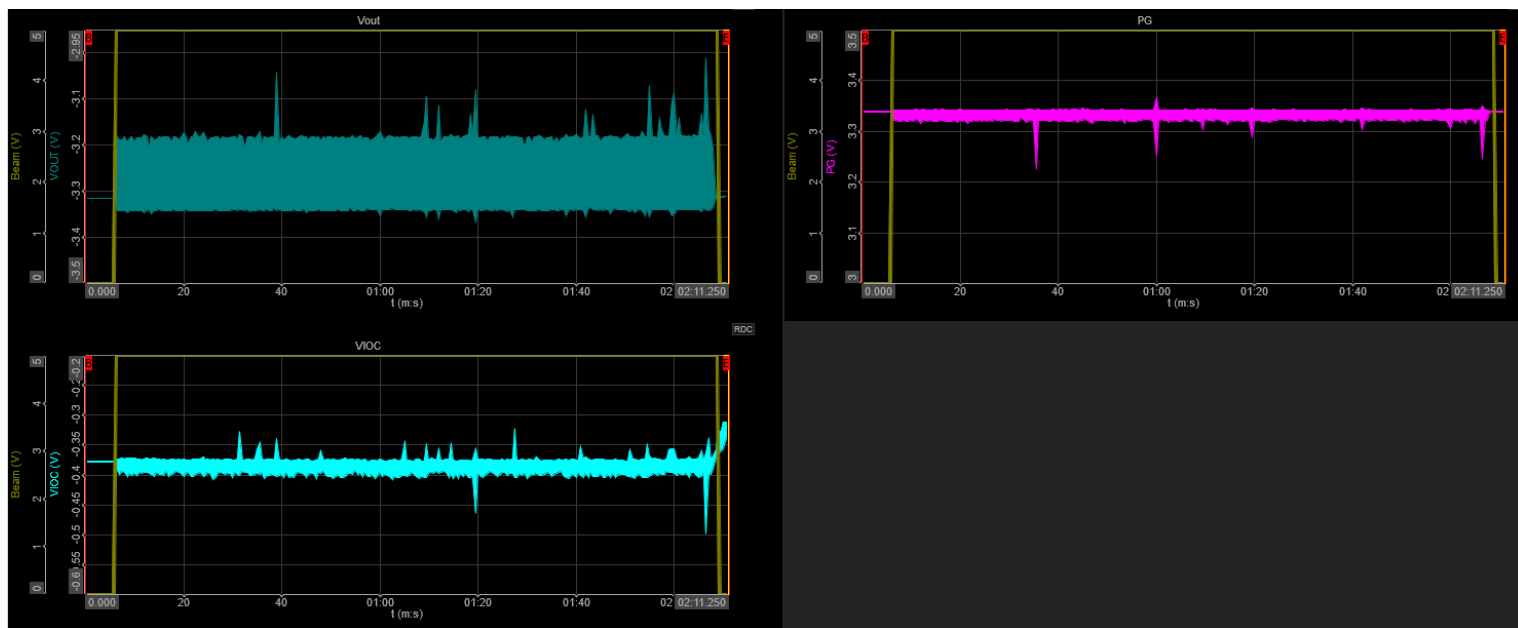


Figure A34: SET Board 4 Run 52, $V_{in} = 3.8V$, $26.3MeVcm^2/mg$

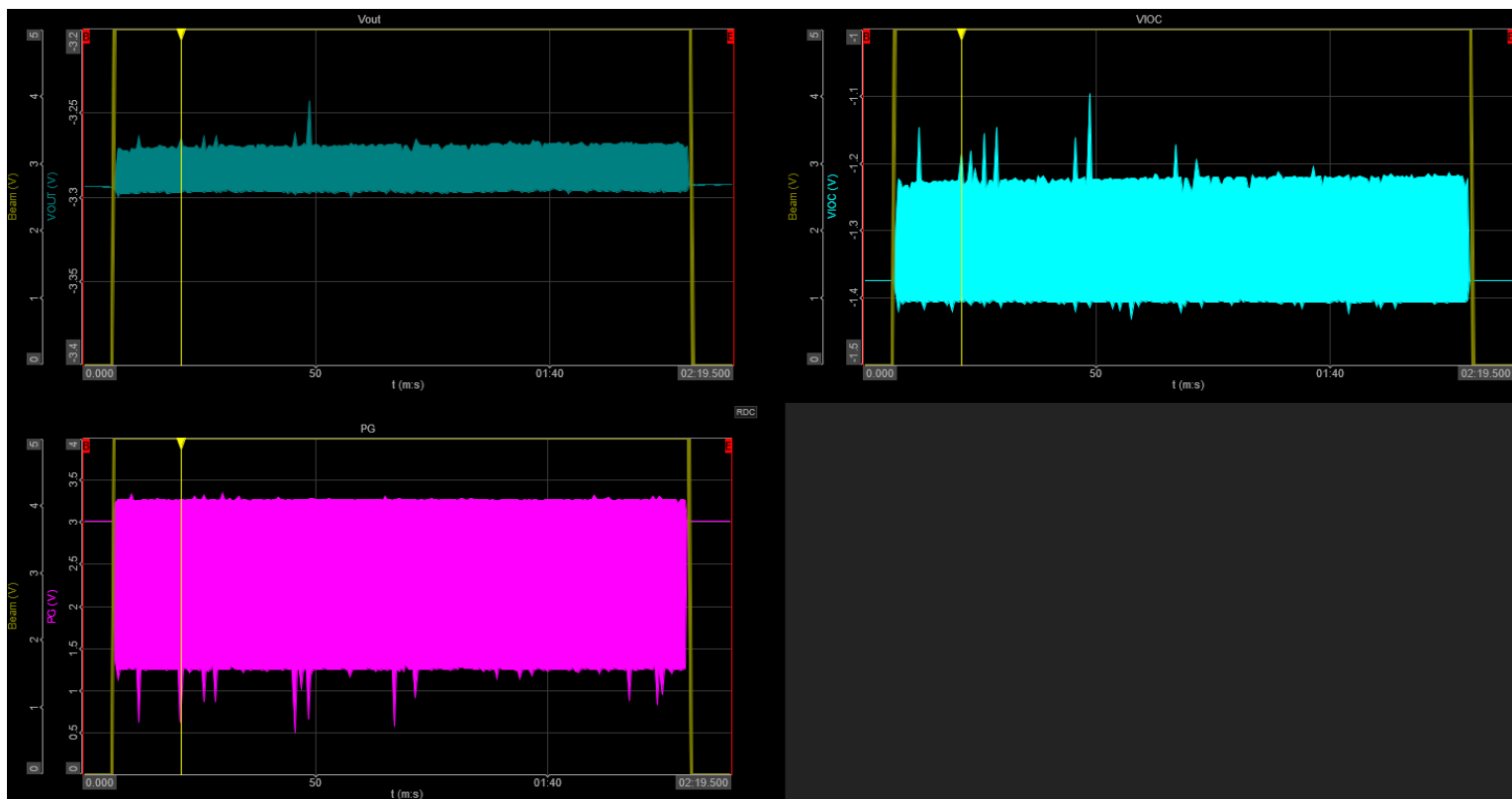


Figure A35: SET Board 1 Run 40, $V_{in} = 16V$, $26.3MeVcm^2/mg$

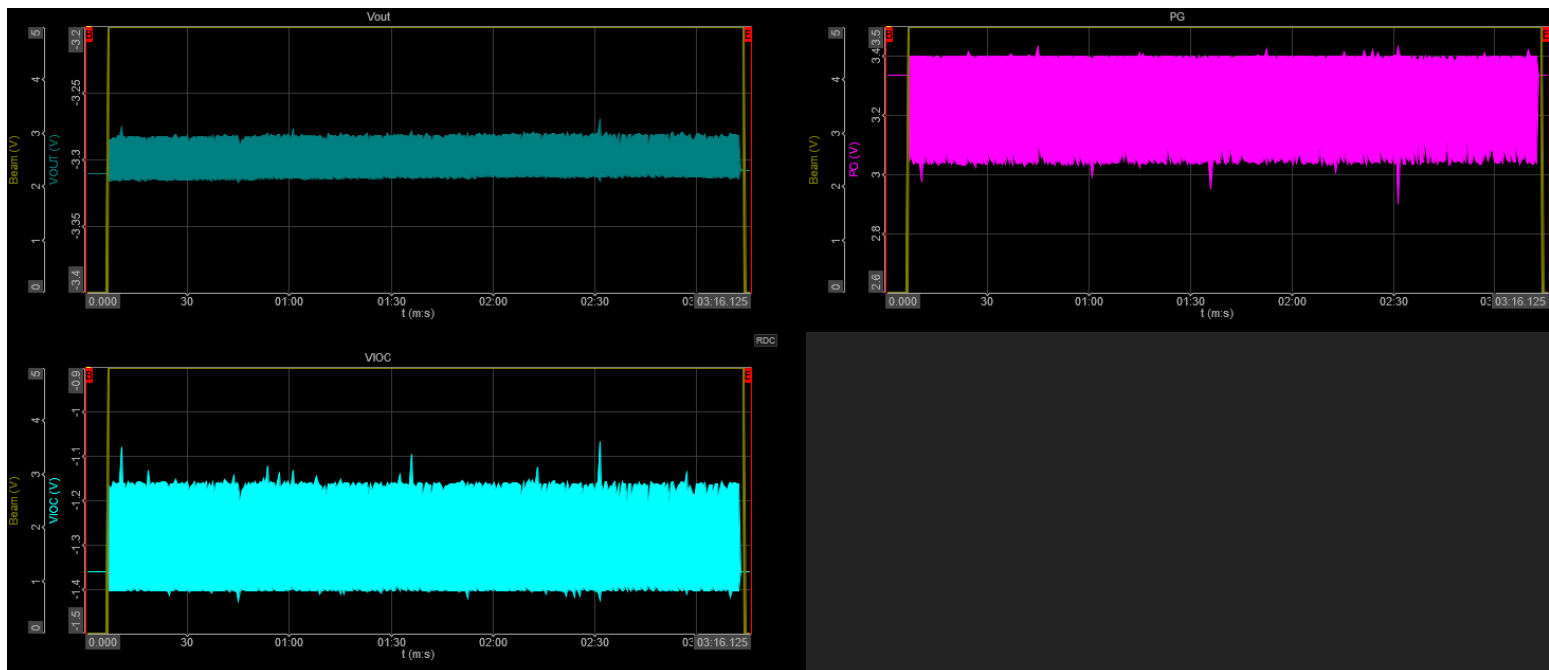


Figure A36: SET Board 3 Run 49, $V_{in} = 16V$, $26.3MeVcm^2/mg$

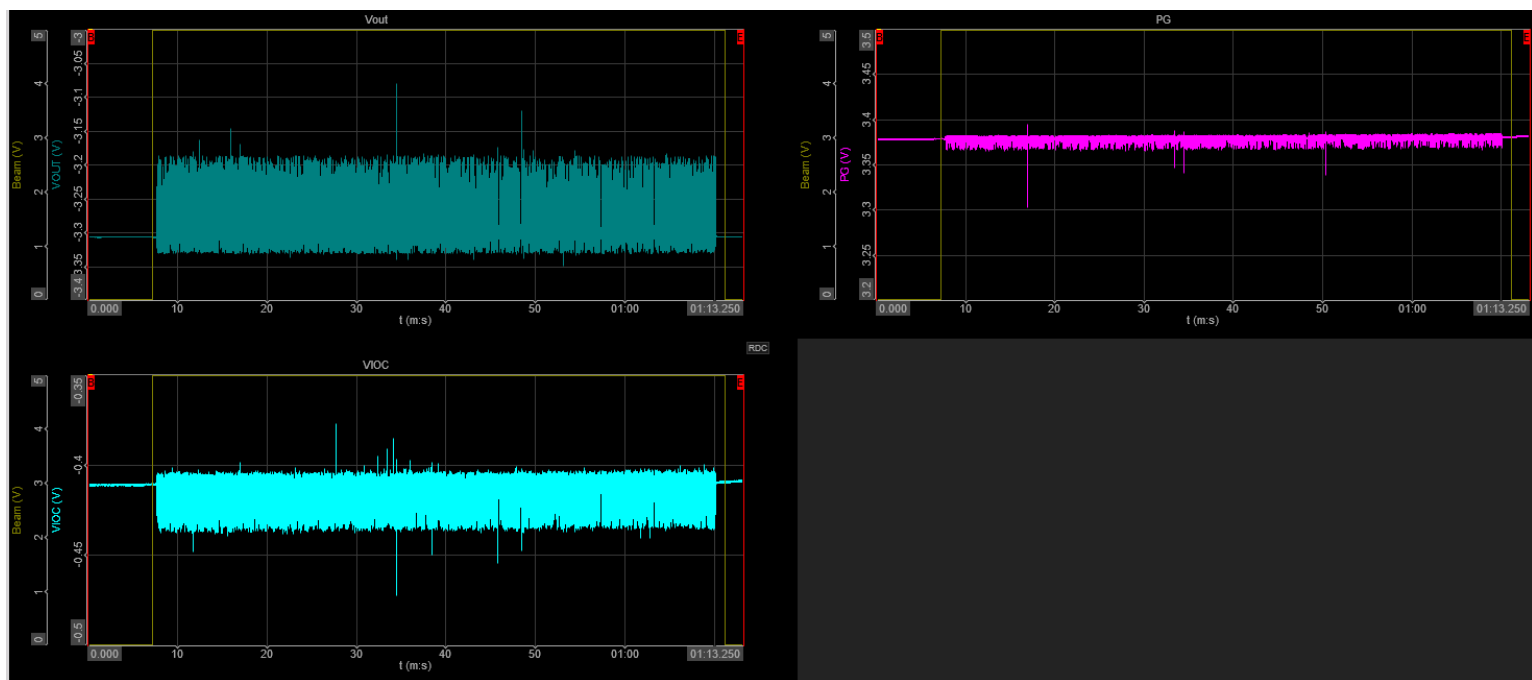


Figure A37: SET Board 3 Run 51, $V_{in} = 3.8V$, $18.53MeVcm^2/mg$

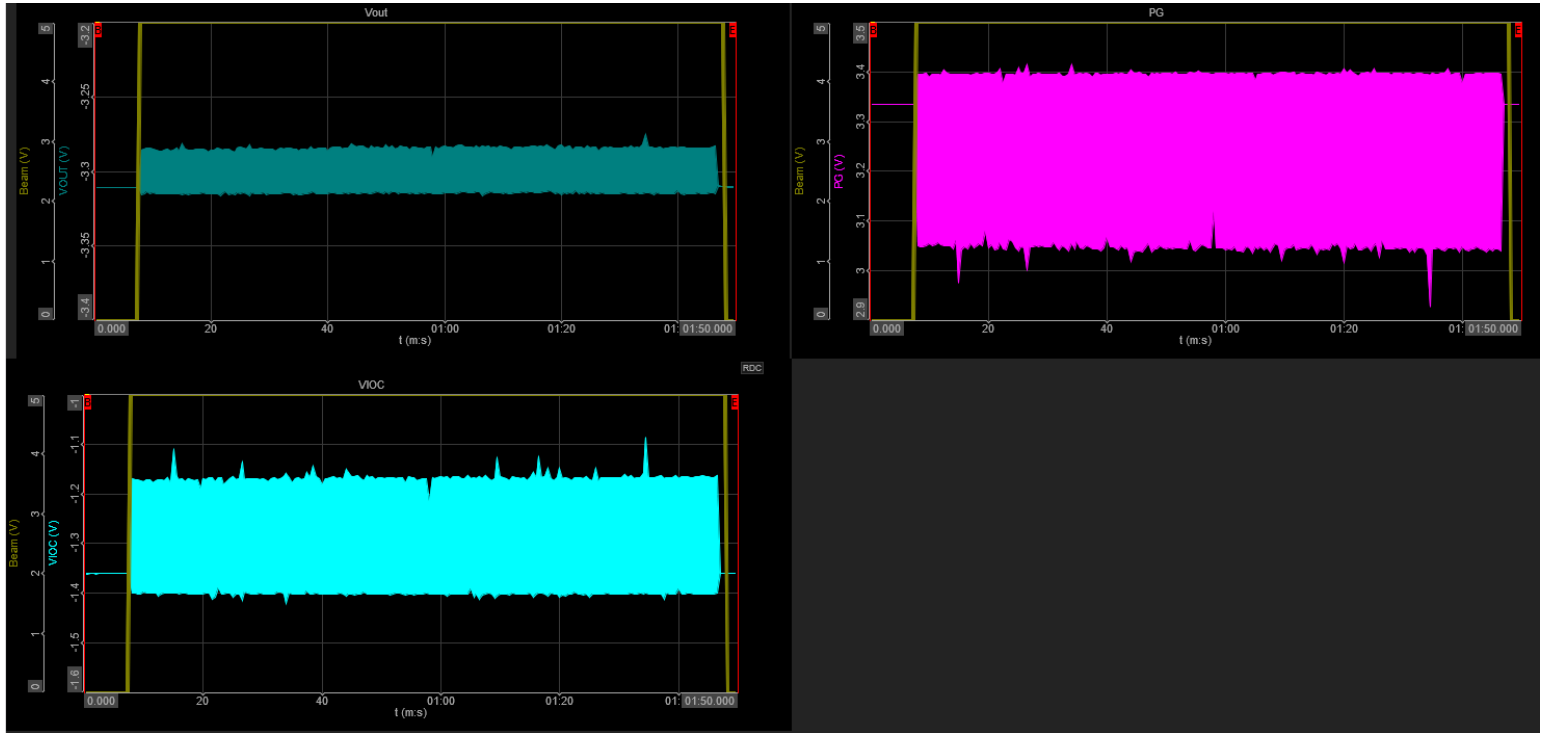


Figure A38: SET Board 3 Run 48, $V_{in} = 16V$, $18.6MeVcm^2/mg$

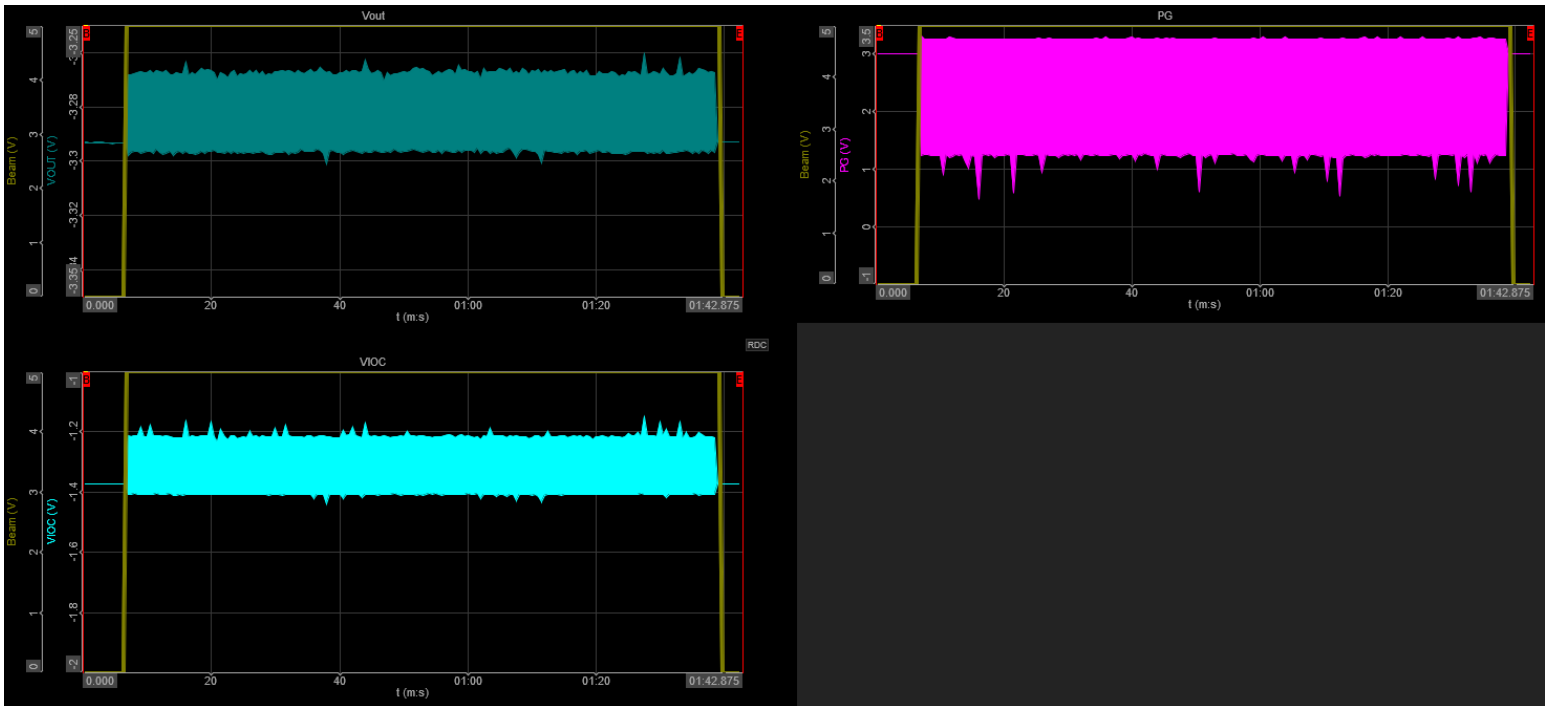


Figure A39: SET Board 1 Run 41, $V_{in} = 16V$, $15.6MeVcm^2/mg$

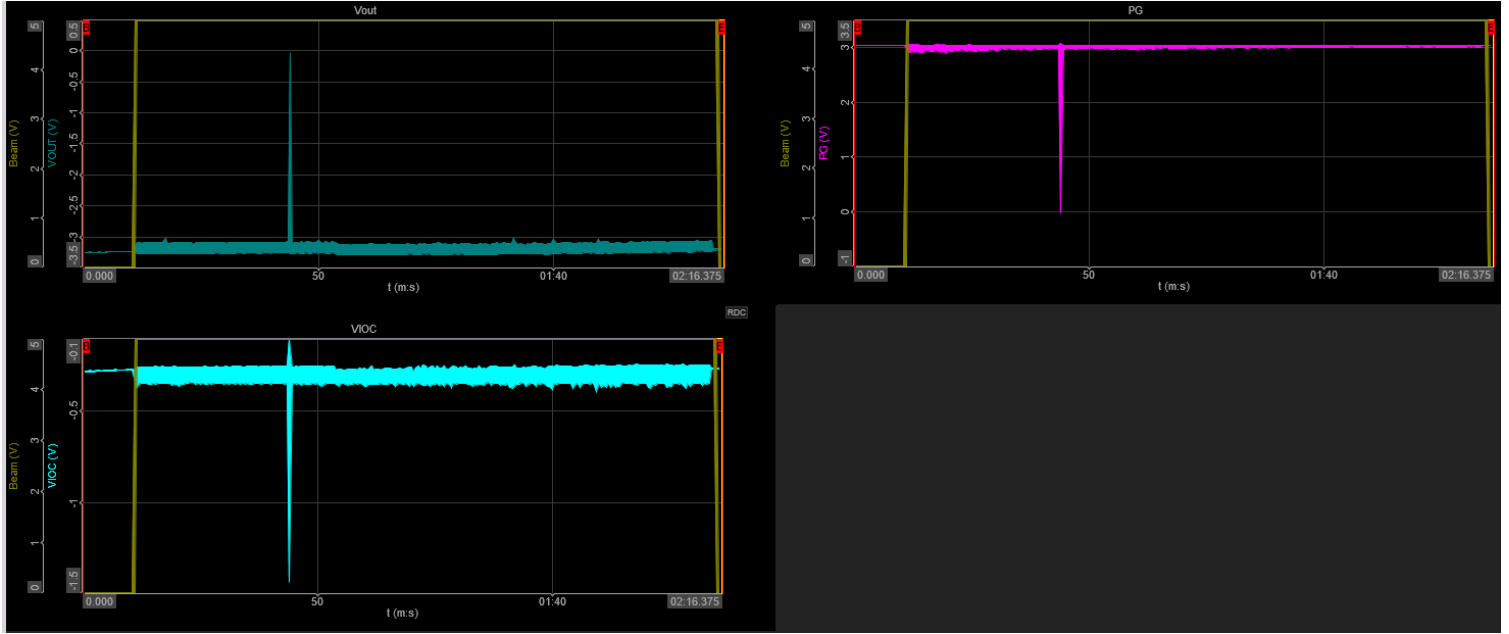


Figure A40: SET Board 1 Run 42, $V_{in} = 3.8V$, $15.6MeVcm^2/mg$

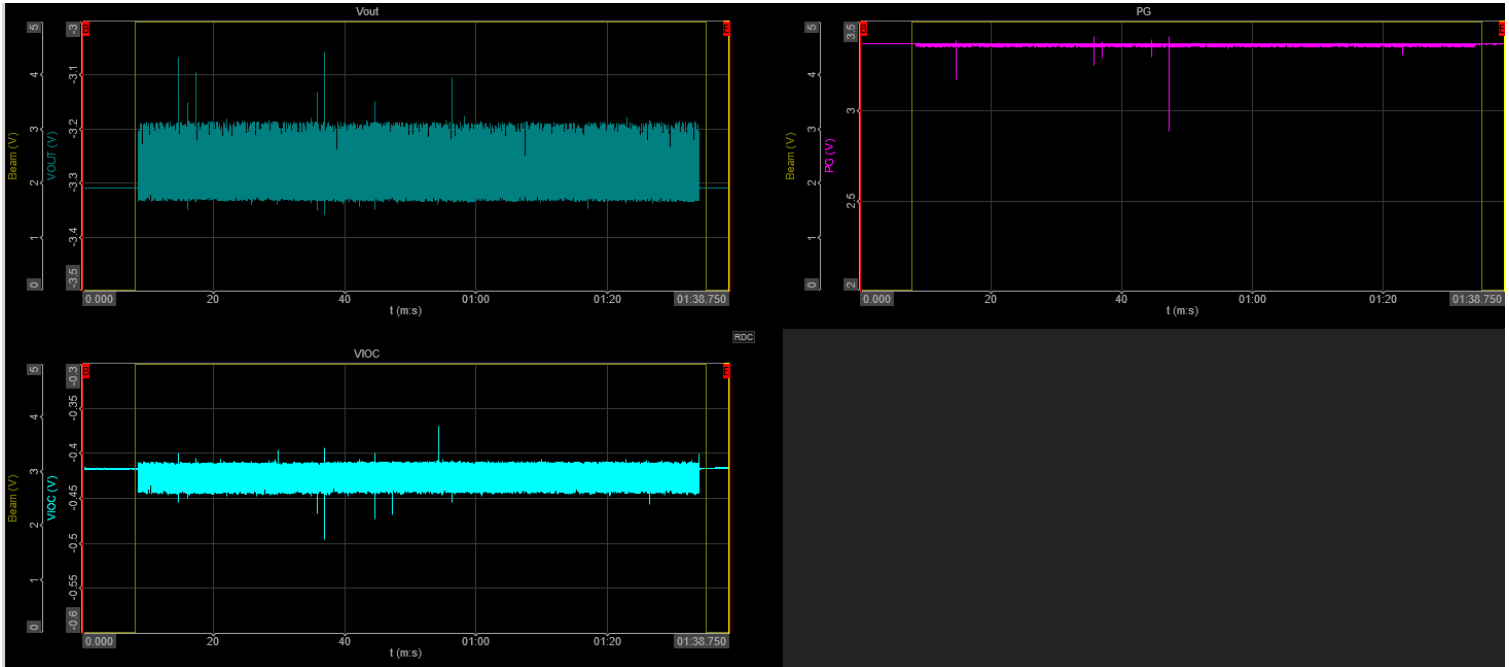


Figure A41: SET Board 3 Run 45, $V_{in} = 3.8V$, $14.5MeVcm^2/mg$

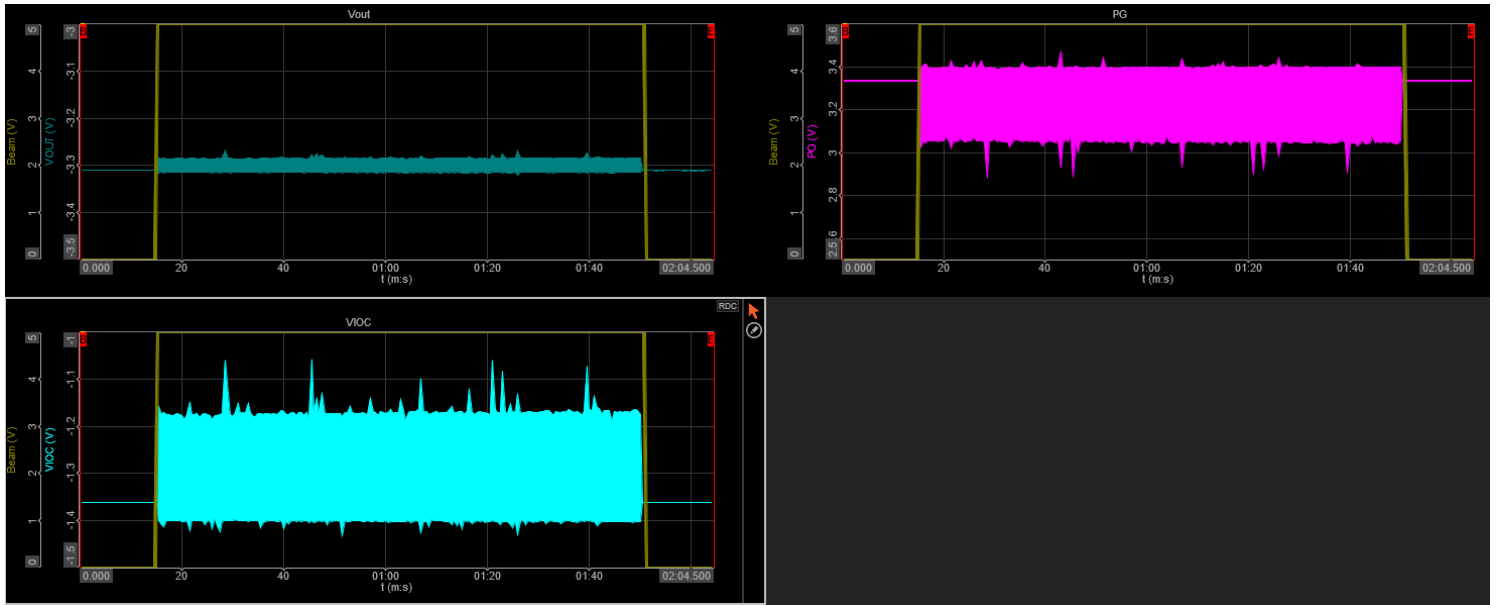


Figure A42: SET Board 3 Run 46, $V_{in} = 16V$, $14.5 \text{ MeV cm}^2/\text{mg}$

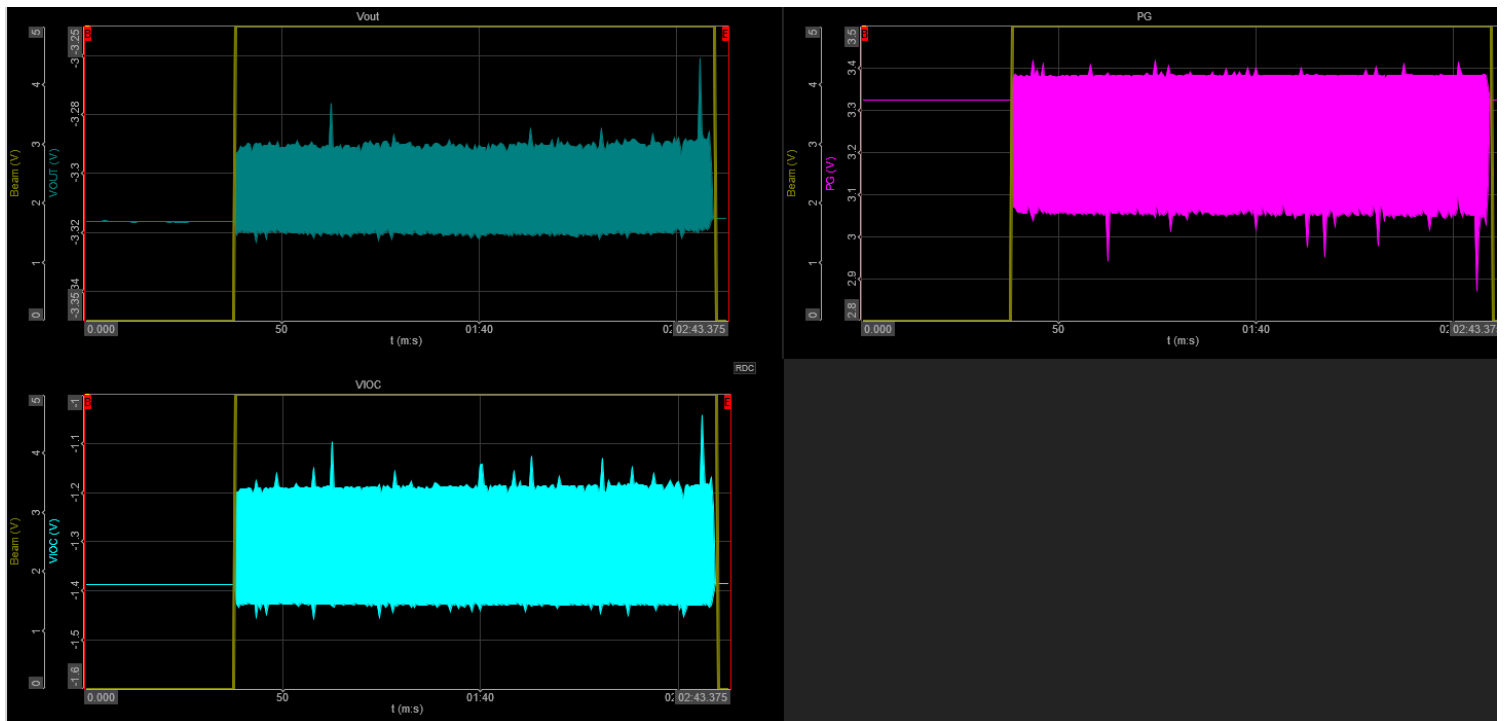


Figure A43: SET Board 4 Run 53, $V_{in} = 16V$, $14.42 \text{ MeV cm}^2/\text{mg}$

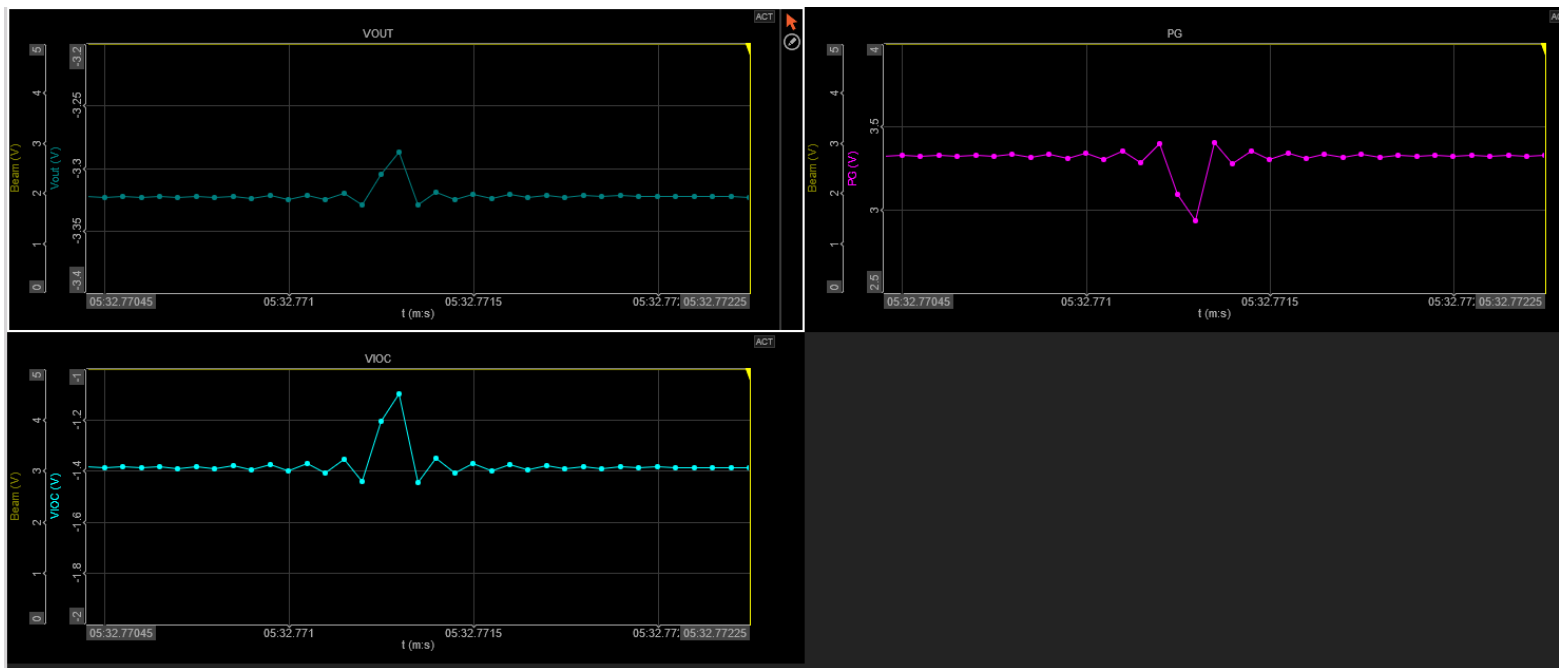


Figure A44: SET Board 4 Run 31, $V_{in} = 16V$, $79.9MeVcm^2/mg$

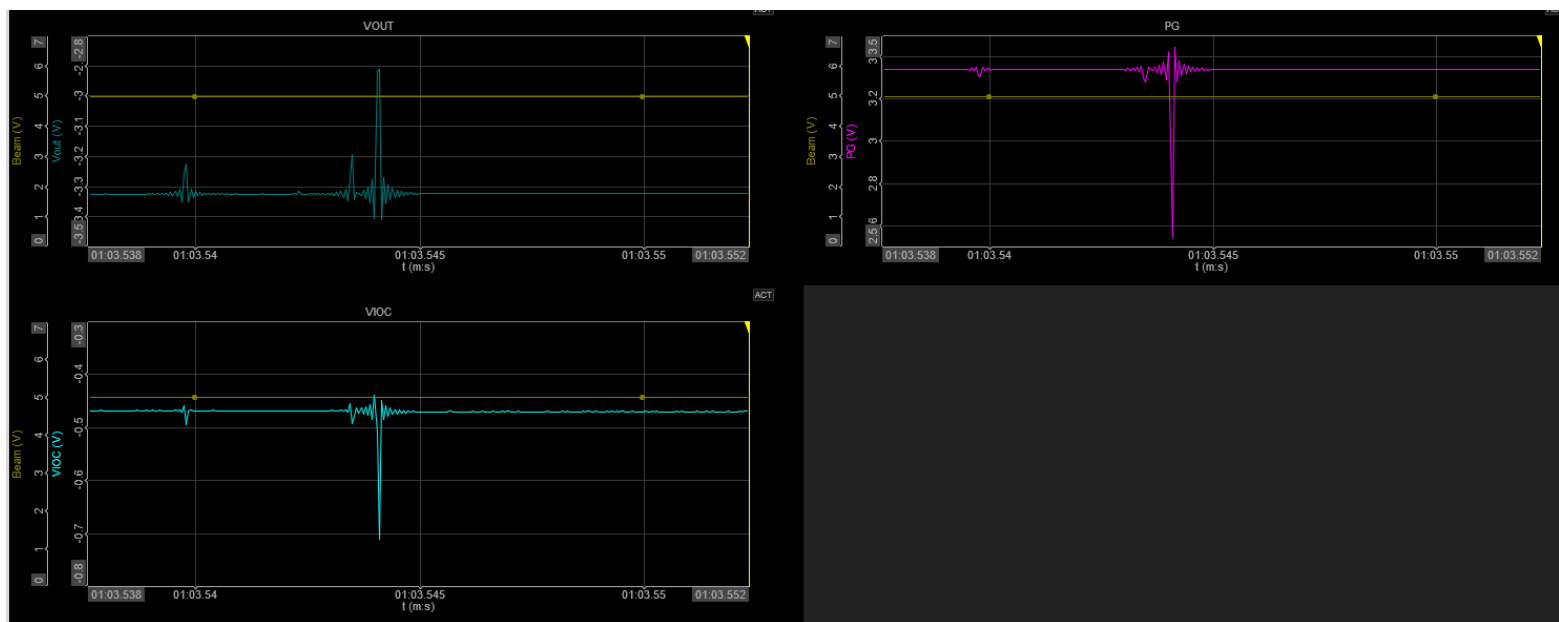


Figure A45: SET Board 3 Run 33, $V_{in} = 3.8V$, $79.9MeVcm^2/mg$

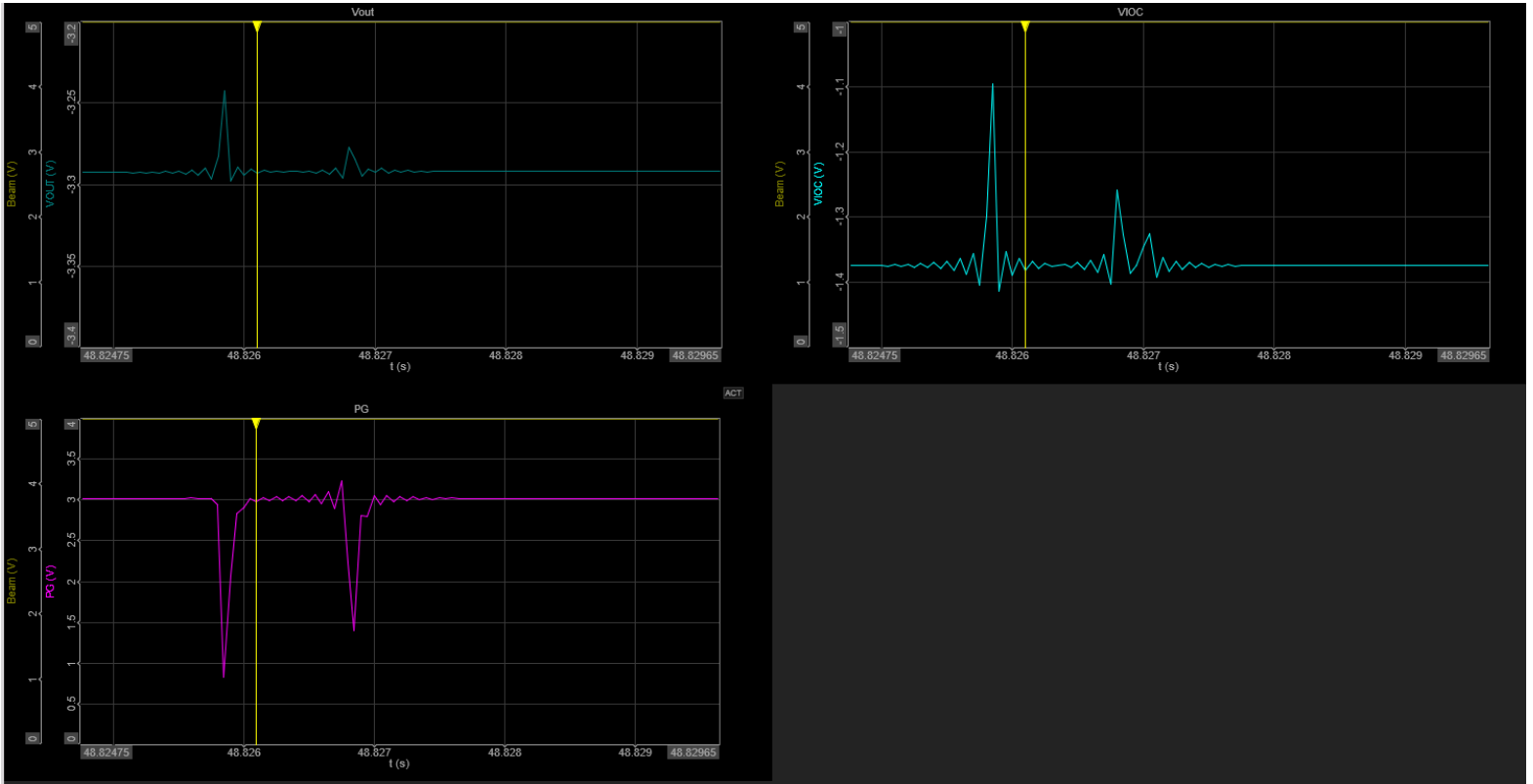


Figure A46: SET Board 1 Run 40, $V_{in} = 16V$, $26.3MeVcm^2/mg$

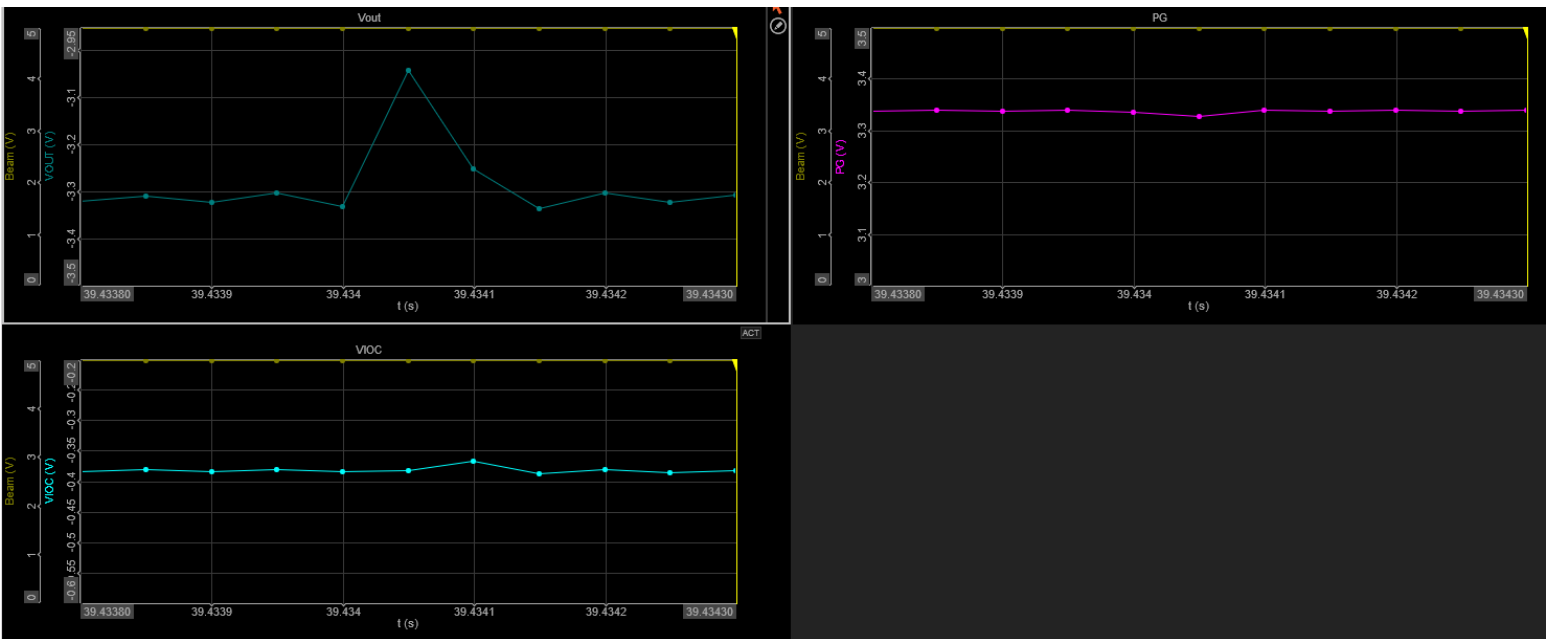


Figure A47: SET Board 4 Run 52, $V_{in} = 3.8V$, $26.3MeVcm^2/mg$