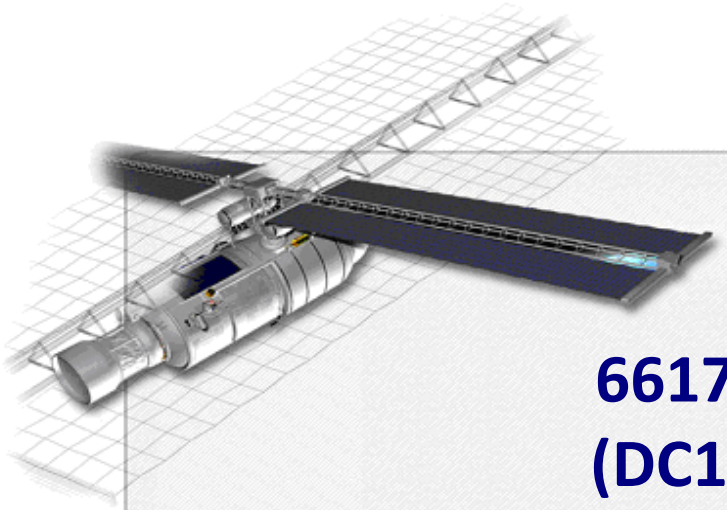
PROTONS DISPLACEMENT DAMAGE TEST REPORT



66179-002
(DC1124)
Single Channel Optocoupler
From
MICROPAC

TRAD/TP/66179/XXX1/ESA/YP/1104		Labège, April 16, 2012
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Issue : 0		
To: Marc POIZAT	Project/Program :	ESA Contract N°4000102571/10/NL/AF-Radiation Characterization of Laplace RH optocouplers, sensors and detectors

TABLE OF CONTENT

1 INTRODUCTION

This report includes the test results of 66179-002, a Single Channel Optocoupler from MICROPAC to evaluate displacement damage effects under proton irradiation. During January and February 2012, TRAD characterized this device for proton sensitivity at the KVI Facility, in GRONINGEN, The Netherlands using their AGOR cyclotron.
The objectives of the test are:

- to detect and measure the degradation of device parameters as a function of proton fluence,
- to determine if device parameters are within specified limits after exposure to final level of proton fluence.

2 DOCUMENTS

2.1 Applicable Documents

AD	1.	ESA contract	N°4000102571/10/NL/AF-Radiation Characterization of Laplace RH optocouplers, sensors and detectors
AD	2.	Irradiation Test Plan	ITP-TP-66179-MIC-ESA-1119, Iss.3, 08/02/12

2.2 Reference Documents

RD	1.	Datasheet 66179 by MICROPAC	GULL WING HERMETICALLY SEALED, SINGLE CHANNEL OPTOCOUPLER (Electrical Equivalent To 66099) dated 23/01/2007
RD	2.	MICROPAC certificate of traceability and conformance dated 25/07/2011	

3 DEVICE INFORMATION

3.1 Device description

This part is a single channel radiation tolerant hermetic optocoupler. It is hermetically sealed into a 10 Pin Gull Wing package. The 66179 optocoupler contains a proton tolerant 660nm GaAlAs LED optically coupled to a silicon planar NPN output phototransistor.

Type	66179-002
Manufacturer	MICROPAC
Function	Optocoupler
Package	10 Pin Gull Wing
Date Code	1124
Sample size	46 parts (3X15 test parts + 1 control sample)

3.2 Procurement information

75 parts reference 66179-002 were procured by TRAD and delivered by MICROPAC through its French distributor ISOTOPE ELECTRONICS.
Their quality level defined by the 002 extension number corresponds to a commercial standard operating in the temperature range of -55° to +100°C and temperature tested (hot & cold temperature) by the manufacturer prior delivery.
Parts were delivered separated in two lots (25 pcs and 50 pcs) from same date-code 1124 and together with a Certificate of Conformance [RD2].

3.3 External view

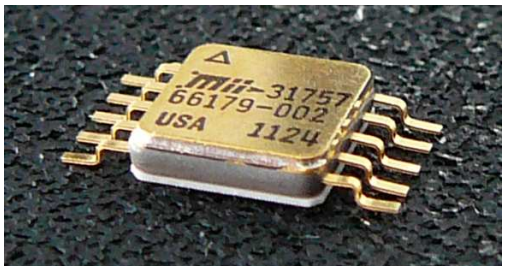


Figure 1: package marking

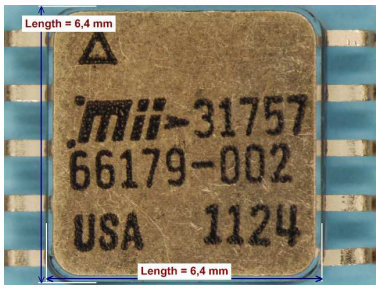


Figure 2: package marking

Figure 3: package back marking

3.4 Internal view

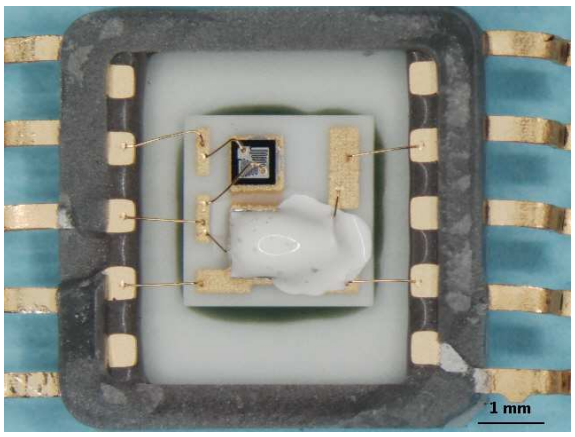


Figure 4: Internal view

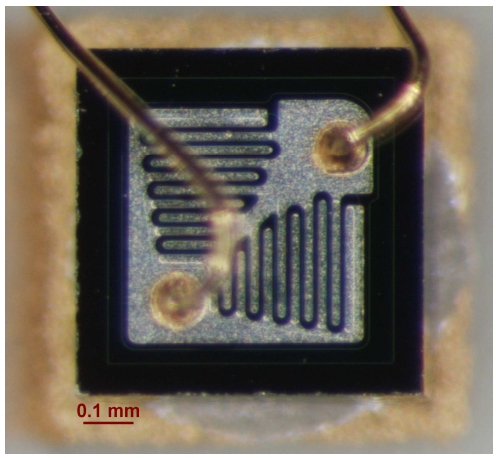


Figure 5: transistor die view

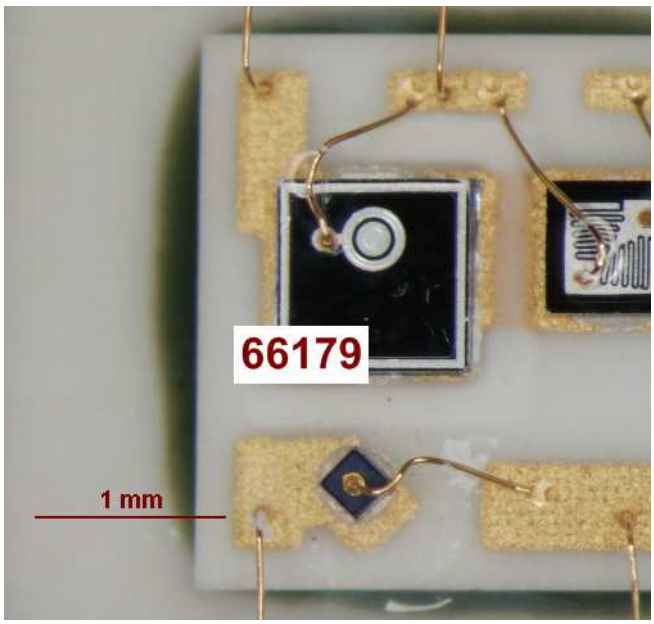


Figure 6: photodetector and LED view

3.5 Serialization

Each part is serialized to enable pre and post test identification and comparison.
Manufacturer device's package back marking (see external view) correspondence was kept as traceability information.

Serial Number			
P1 (30MeV)	P2 (60MeV)	P3 (190MeV)	Mode
1 (Control sample)			
2	2	2	Bias 1
3	3	3	Bias 1
4	4	4	Bias 1
5	5	5	Bias 1
6	6	6	Bias 1
7	7	7	Bias 2
8	8	8	Bias 2
9	9	9	Bias 2
10	10	10	Bias 2
11	11	11	Bias 2
12	12	12	Off
13	13	13	Off
14	14	14	Off
15	15	15	Off
16	16	16	Off

4 IRRADIATION MEANS AND CONDITIONS

4.1 AGORFIRM/KVI irradiation facility (The Nederlands)

AGORFIRM is a facility that uses a dedicated beam line of the AGOR cyclotron for irradiations with protons in air. The facility is available for radiation damage studies. The standard proton beams used for irradiations produced by this cyclotron have primary energies of 90, 150 and 190 MeV.
The standard irradiation field has a diameter of 70 mm and homogeneity of better than ± 3%.

Figure 7: samples installed for irradiation

4.2 Energy and Flux measurement

The energy resolution of the beam when leaving the cyclotron is typically better than 0.25%. However, at the DUT position the resolution is in the order of a few MeV due to scattering in air, the scatter system and, when used, the energy degrader.
The proton flux at the centre of the irradiation field is measured with a 10 mm diameter scintillator detector. During the irradiation, the flux is monitored with a Beam Intensity Monitor (BIM). Before an irradiation the BIM signal (in Monitor Units) is related to the scintillator signal to obtain the flux calibration in protons cm^{-2} per MU. This calibration is conducted for every field size and every energy used during an irradiation.

4.3 Experimental conditions

An Equivalent total fluence of 1E12 #/cm² of 10 MeV protons is required [AD2] for this TNID (Total Non-Ionizing Dose) evaluation test. Considering NIEL (Non Ionizing Energy Loss) value for 10 MeV proton (7.86E-03 MeV cm^2 g^{-1}), total fluence to be reached at each energy is:

30	MeV	8,22E+11 cm^{-2}
60	MeV	1,14E+12 cm^{-2}
190	MeV	1,91E+12 cm^{-2}

Five steps were defined to determine the component degradation under 30MeV, 60MeV, 190MeV proton irradiation. The test devices have been exposed to the following proton fluence levels:

p/cm2	1,70E+10	8,50E+10	1,70E+11	1,70E+12
Energy (MeV)	30	30	30	30
p/cm2	2,30E+10	1,15E+11	2,30E+11	1,14E+12
Energy (MeV)	60	60	60	60
p/cm2	4,00E+10	2,00E+11	4,00E+11	1,91E+12
Energy (MeV)	190	190	190	190

5 ELECTRICAL TESTS

Electrical parameters to be measured in pre and post exposure tests are described in the following table. Electrical tests are performed on each part using the test set-up hereunder. All required data are recorded for each device. Test conditions and limits are given in the applicable irradiation test plan [AD2] and shown hereafter.

5.1 Test set-up

TEST BOARD	TRAD/CT1/N/OPTO/ZIP14/BR/1109
TEST PROGRAM	66179_TP30MeV_XXX1_B1_V10.llb 66179_TP60MeV_XXX1_B1_V10.llb 66179_TP200MeV_XXX1_B1_V10.llb

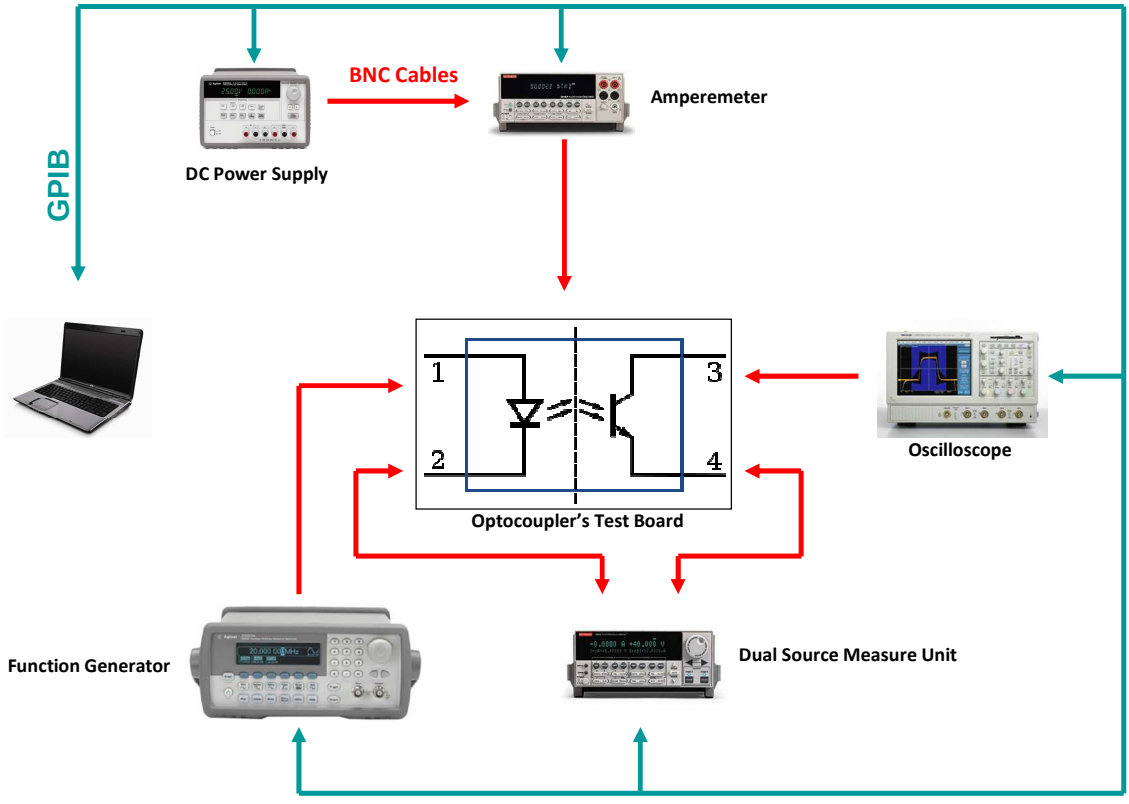


Figure 8: test principle

5.2 Test configuration

Samples were exposed to proton irradiation in three different modes - two on-modes (Figure 9 and Figure 10) and one off-mode (all terminal leads short-circuited) –

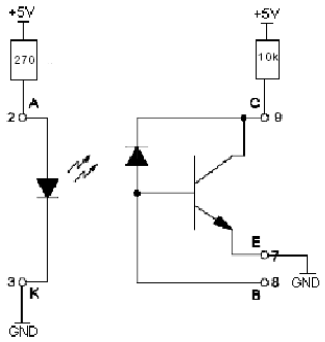


Figure 9: ON bias1

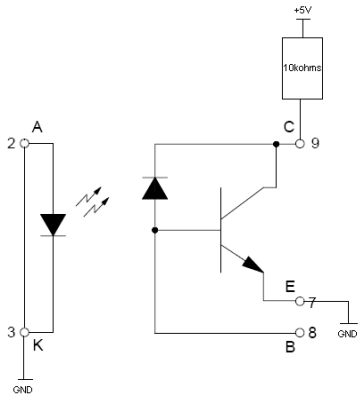


Figure 10: ON bias2

5.3 Electrical parameters

PARAMETER	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
Input Diode Static Reverse Current	I_R	V_R = 2V		100	µA
Input Diode Static Forward Voltage	V_F	I_F = 10mA	0,8	2	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 100µA, I_F = 0	40		V
Collector-EmitterBreakdown Voltage	$V_{(BR)CEO}$	I_C = 1mA, I_B = 0, I_F = 0	40		V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_C = 0, I_E = 100µA, I_F = 0	4		V
Collector-Emitter Cutoff Current	I_{CEO}	V_{CE} = 20V		100	nA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_F = 20mA, I_C = 10mA		0,3	V
Rise Time	tr	V_{CC}=10V,I_F=10mA, R_L=100Ω		20	µs
Fall Time	tf	V_{CC}=10V,I_F=10mA, R_L=100Ω		20	µs
Current Transfer Ratio	CTR1	V_{CE} = 5V, I_F = 1mA			%
Current Transfer Ratio	CTR2	V_{CE} = 5V, I_F = 2mA			%
Current Transfer Ratio	CTR3	V_{CE} = 5V, I_F = 10mA			%
Current Transfer Ratio	CTR4	V_{CE} = 5V, I_F = 20mA			%
Current Transfer Ratio	CTR5	V_{CE} = 20V, I_F = 10mA			%

Min/ Max values are those specified in the reference data-sheet [RD1].

Test measurements are performed at 25°C ± 10°C.

6 TEST HISTORY

Test sequence and all required conditions were executed as described in the test plan.
No incident during the test was noticed.

7 SUMMARY RESULTS

7.1 30 MeV proton irradiation summary results

Only the parameters with applicable test limits are shown hereunder.

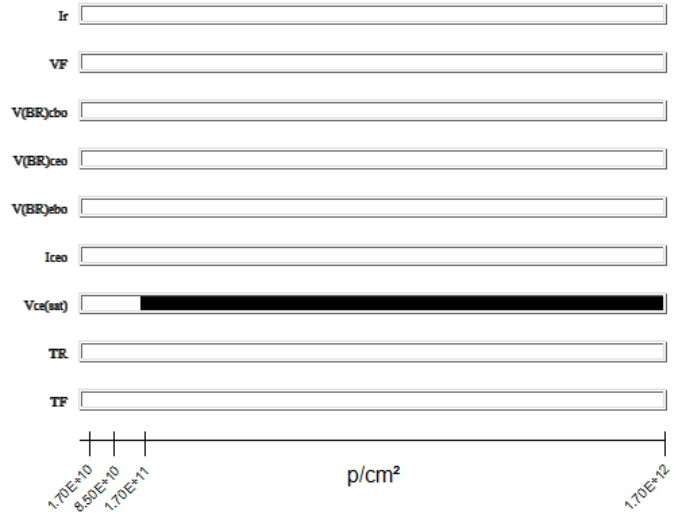


Figure 11: ON Bias 1 under 30 MeV protons

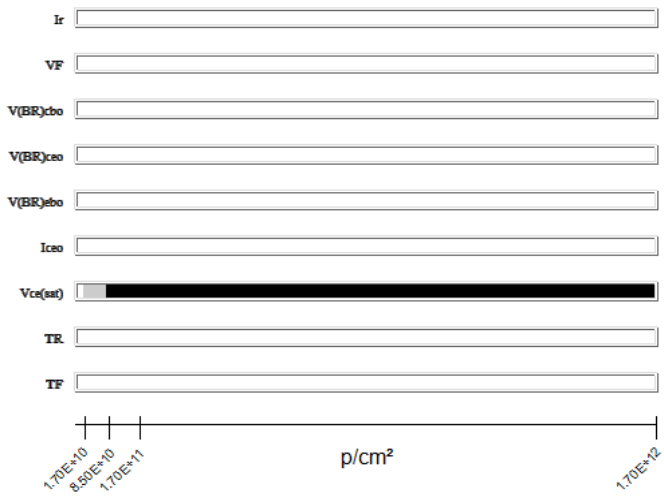


Figure 12: ON Bias 2 under 30 MeV protons

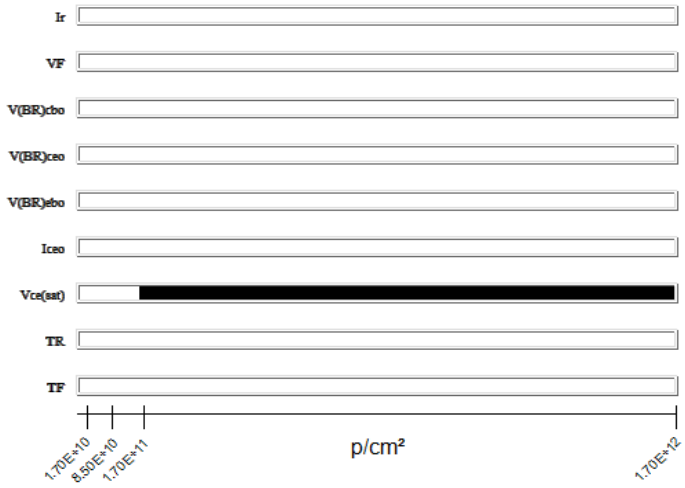


Figure 13: OFF Bias under 30 MeV protons

As shown in Figure 11 and Figure 13 and for all tested devices (ON bias 1/5parts and OFF mode/5parts), the parameter **Vce(sat)** is not measurable at step **1.7 E12.p/cm².**
Indeed the measured voltage at step 7 E12.n/cm2 is higher than 100V (test equipment limit).

The Figure 12 shows that, with the condition ON Bias2, the parameter **Vce(sat)** is not measurable at step **1.7 E11.p/cm².** However, as shown in the Figure hereunder only one component (N°11) from the five tested with ON Bias2 condition is out of specification at step 1.7 E11.p/cm².

Figure 14 : Vce(sat) function 30 MeV proton irradiation step for each component

7.2 60 MeV proton irradiation summary results

Only the parameters with applicable test limits are shown hereunder.

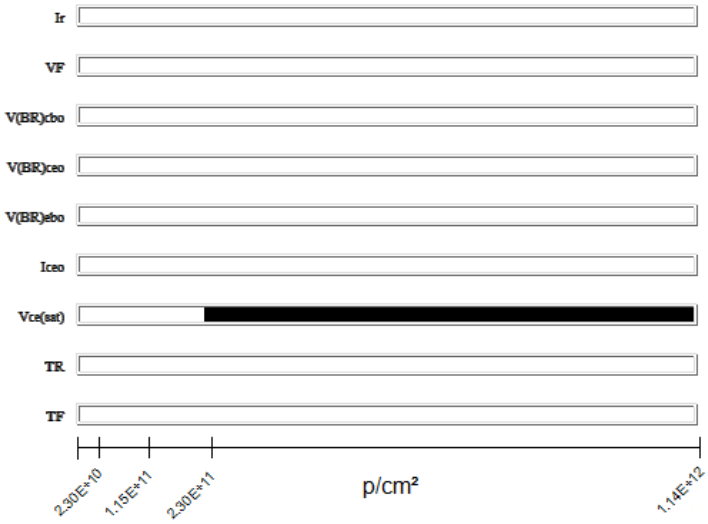


Figure 15: ON Bias 1 under 30 MeV protons

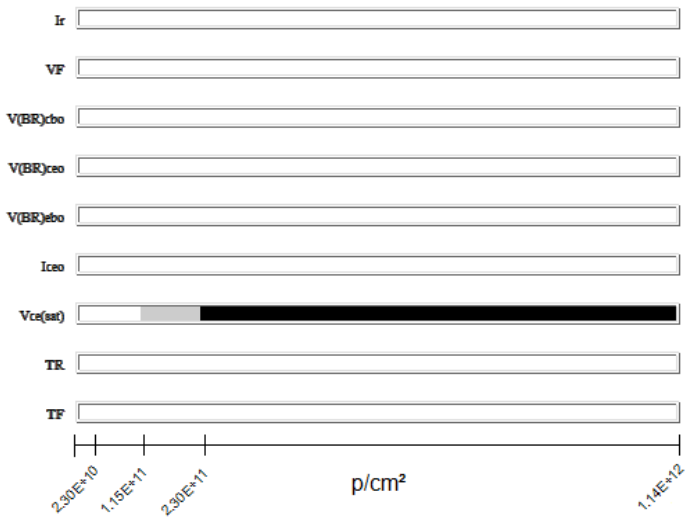
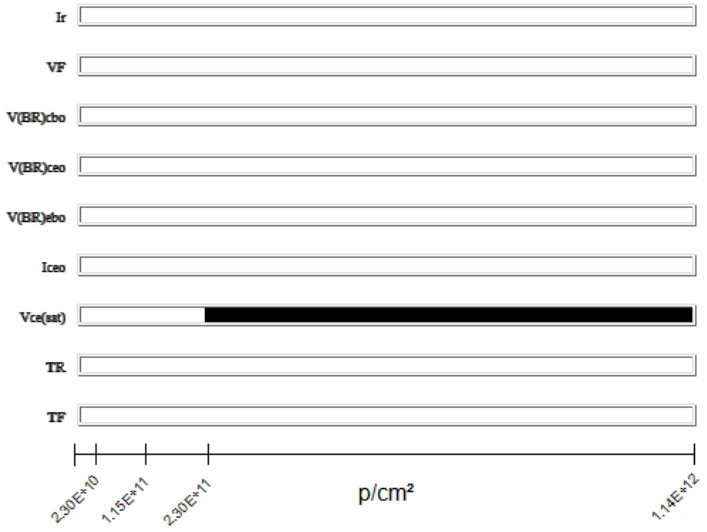


Figure 16: ON Bias 2 under 30 MeV protons



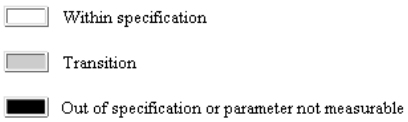


Figure 17: OFF Bias under 30 MeV protons

As shown in Figure 15 and in Figure 17, for all ten devices tested (ON bias 1 and OFF), the parameter **Vce(sat)** is not measurable at step **2,3E+11.p/cm².**
Indeed the measured voltage at step 7 E12.n/cm2 is higher than 100V (test equipment limit).

The Figure 16 shows that, with the condition ON Bias2, the parameter **Vce(sat)** is not measurable at step **2,3E+11.p/cm².** However as shown in the Figure 18 hereunder only one component (N°7) from the five tested with ON Bias2 condition is out of specification at step 1.7 E11.p/cm².

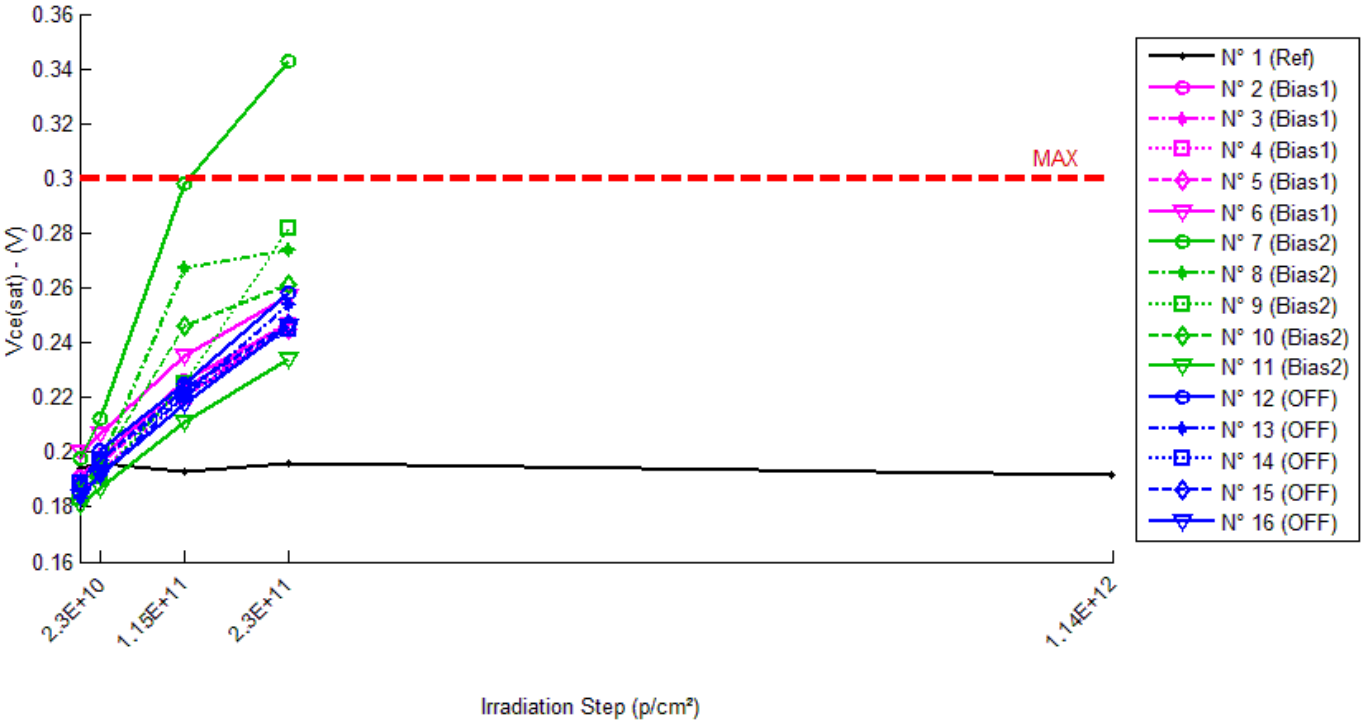


Figure 18: Vce(sat) function 60 MeV proton irradiation step for each component

7.3 190 MeV proton irradiation summary results

Only the parameters with applicable test limits are shown hereunder.

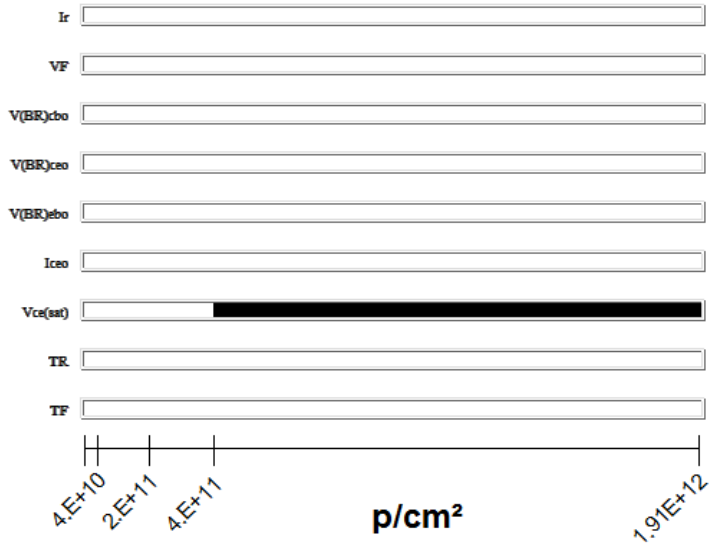


Figure 19: ON Bias 1 under 30 MeV protons

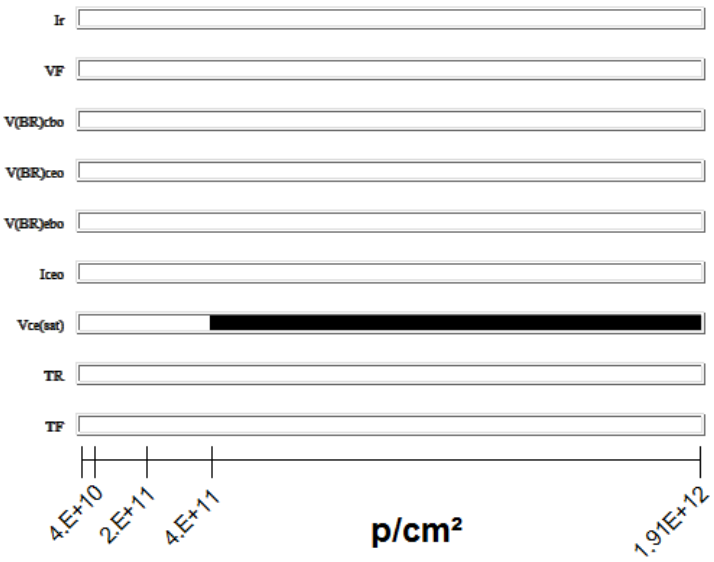
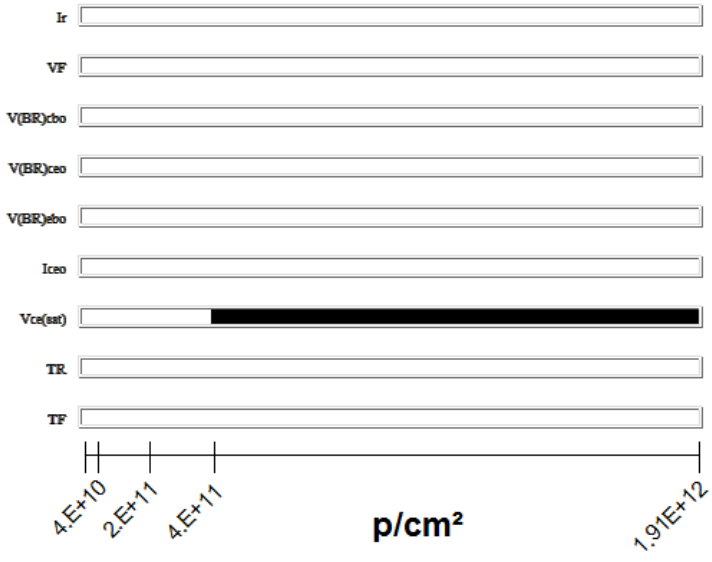


Figure 20: ON Bias 2 under 30 MeV protons



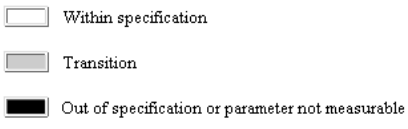


Figure 21: OFF Bias under 30 MeV protons

As shown in the above figures, for all devices tested, whatever the bias condition, the parameter **Vce(sat)** is not measurable at step **4 E+11.p/cm².**

8 CONCLUSION

Total fluence steady-state irradiation test using protons has been applied on **66179-002, Single Channel Optocoupler** from **MICROPAC:**

- up to 1.7E+12 protons/cm², with an energy of 30 MeV
- up to 1,14E+12 protons/cm², with an energy of 60 MeV
- up to 1,91E+12 protons/cm², with an energy of 190 MeV

The results indicate that:

For all components tested and all proton energy, Vce(sat) at final step is out of specification.

PARAMETERS	SYMBOLS	TEST CONDITIONS	Applicable specification			Measurement at final step
			Min	Max	Unit	
Collector-Emitter Saturation Voltage	VCE(SAT)	IF = 20mA, IC = 10mA		0.3	V	>100V*

(*) test equipment limit

- Under 30MeV proton Beam: All devices are functional up to 1.7 E+11 protons/cm² total fluence level, except on component tested with ON Bias 2 configuration which is out of specification at step 1.7 E11.p/cm².

- Under 60MeV proton Beam: All devices are functional up to 2.3 E+11 protons/cm² total fluence level, except on component tested with ON Bias 2 configuration which is in transition between steps 1.15 E11.p/cm² and 2.3E+11.p/cm².

- Under 190MeV proton Beam: All devices, whatever the Bias condition, are functional up to 4 E+11 protons/cm² total fluence level.

Average drift current transfer ratio are represented in next Figure depending on proton energy, CTR configuration and Bias condition at final irradiation step.

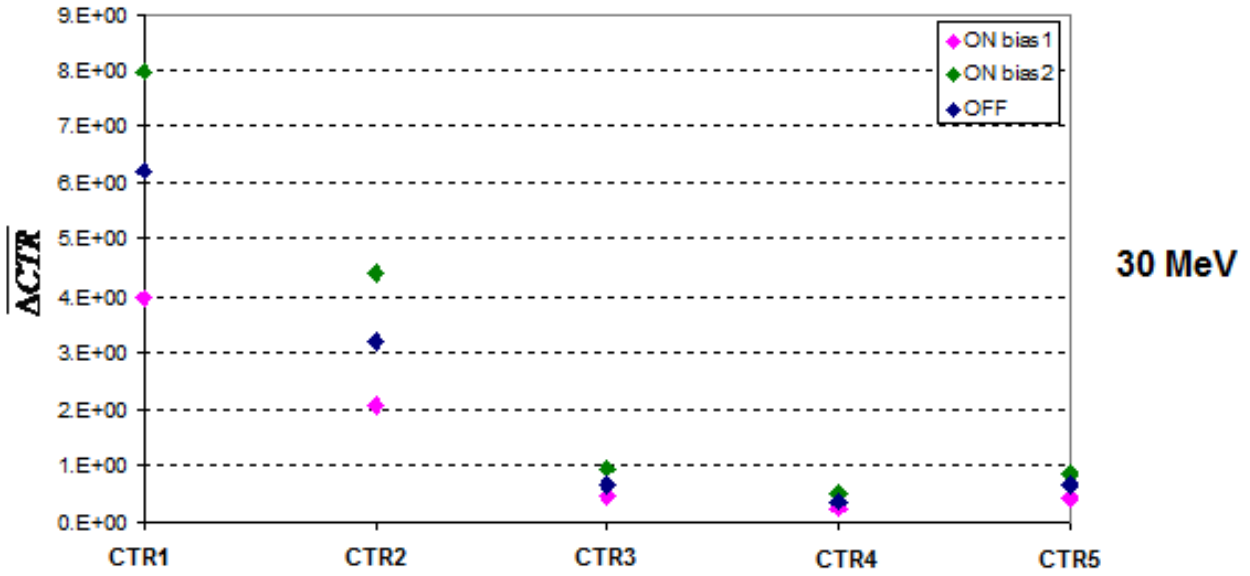


Figure 22: Average drift current transfer ratio under 30 MeV proton

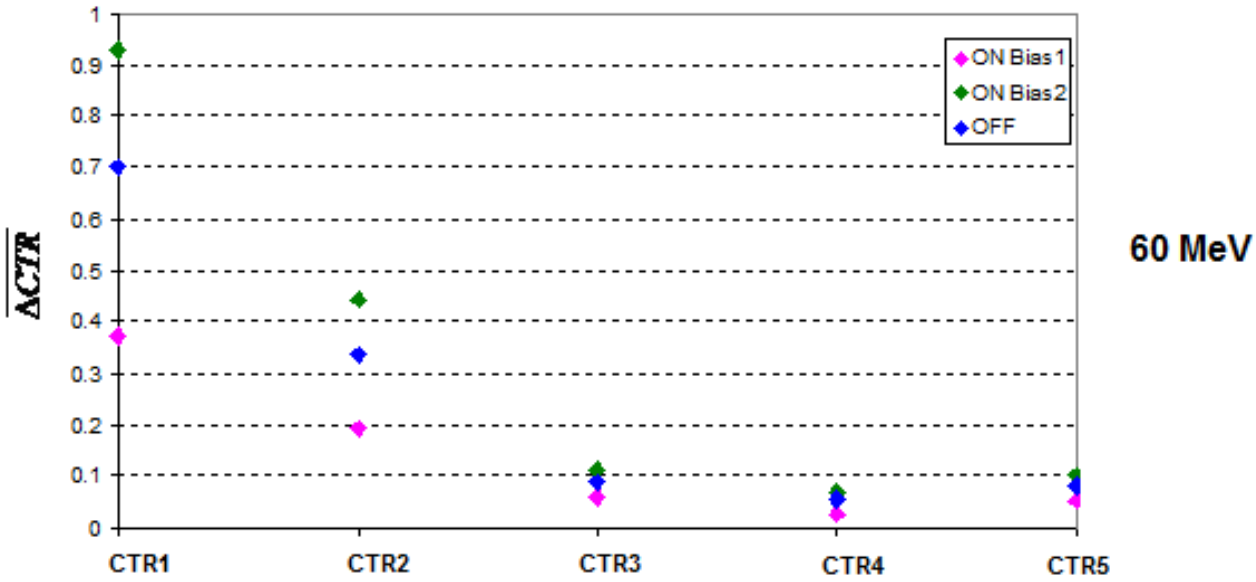


Figure 23: Average drift current transfer ratio under 60 MeV proton

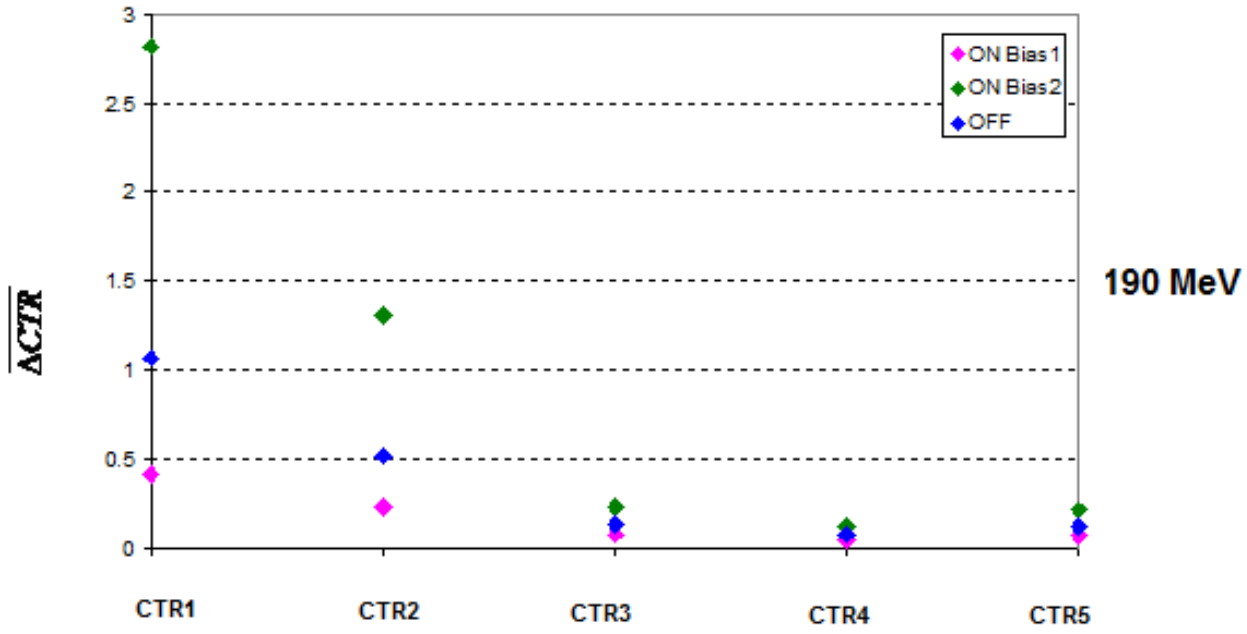


Figure 24: Average drift current transfer ratio under 190 MeV proton

CTR4 configuration (Vce = 5V; If = 20 mA) exhibits the smallest average parameter drift whatever the Bias condition.
Conversely, CRT1 configuration (Vce = 5V; If = 1 mA) exhibits the greater parameter degradation.

ON Bias1 configuration is the least sensitive mode for all CTR configuration.
Conversely, ON Bias2 configuration is the most sensitive configuration.

9 DETAILED TESTS RESULTS

The pre and post radiation test results are shown graphically in the following pages

- 30MeV: 9-2 to 9-29
- 60MeV: 10-2 to 10-29
- 190MeV: 11-2 to 11-29

The data is displayed in the following tables and graphs.

These graphs show parameter's shifts observed during the proton testing sequence. The Control sample results are shown on each graph (black curve).

When available in the device data-sheet/specification, the maximum/minimum/typical values are also shown (red dotted line).

The tables include drift calculation between each measurement step and the "0" proton/cm² step.

For CTR values, the formula used is:

$$\text{Drift} = \frac{1}{\text{measurement (X protons/cm}^2\text{)}} - \frac{1}{\text{measurement (0 protons/cm}^2\text{)}}$$

For the other measurements the formula used is:

Drift value= measurement (X protons/cm²) - measurement (0 protons/cm²)

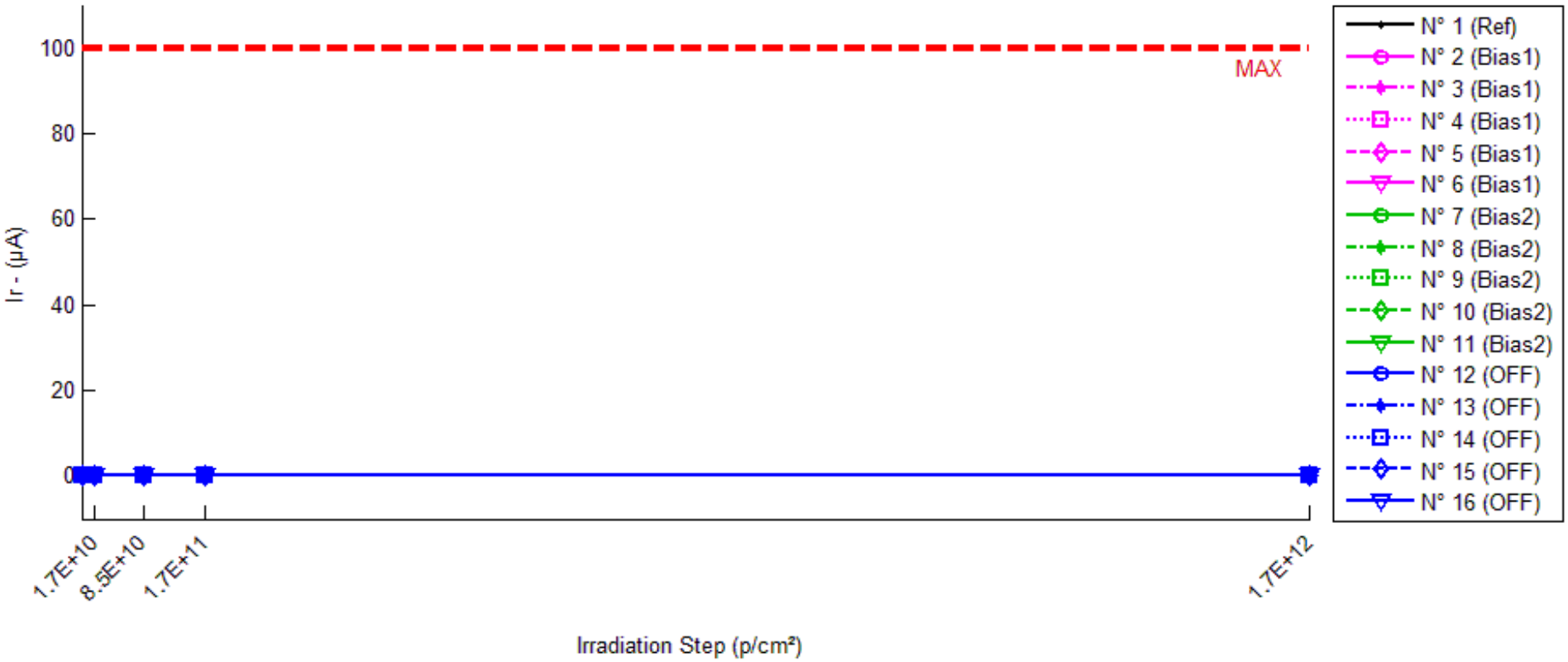
30 MeV proton / detailed results

CONTENTS

30 MeV proton / detailed results

1. Ir

Ta=25°C; VR = 2 V



30 MeV proton / detailed results

Ir . (µA) **Max = 100.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	1.487E-3	2.793E-5	1.034E-3	2.623E-4	2.591E-4
N° 2 (Bias1)	2.086E-3	6.565E-4	3.921E-4	2.300E-4	3.280E-5
N° 3 (Bias1)	3.944E-3	1.158E-3	4.936E-4	5.702E-5	5.039E-4
N° 4 (Bias1)	1.393E-5	4.746E-5	1.735E-4	3.985E-4	4.197E-5
N° 5 (Bias1)	3.042E-3	3.281E-4	3.791E-5	1.149E-4	4.989E-5
N° 6 (Bias1)	1.706E-3	5.947E-4	8.760E-4	3.717E-4	3.019E-4
N° 7 (Bias2)	2.323E-3	3.362E-4	1.016E-3	5.358E-5	4.432E-5
N° 8 (Bias2)	1.665E-3	3.165E-4	2.952E-5	3.891E-5	5.312E-5
N° 9 (Bias2)	3.149E-3	3.230E-4	8.137E-5	5.278E-5	4.880E-5
N° 10 (Bias2)	7.669E-4	2.839E-4	2.244E-6	1.741E-5	4.285E-5
N° 11 (Bias2)	5.003E-3	3.418E-4	4.830E-5	5.119E-5	4.692E-5
N° 12 (OFF)	1.960E-3	5.210E-4	1.134E-5	4.097E-5	1.683E-4
N° 13 (OFF)	5.203E-3	4.126E-5	6.561E-6	3.014E-4	6.739E-4
N° 14 (OFF)	1.225E-3	3.777E-4	1.582E-5	1.975E-4	7.265E-5
N° 15 (OFF)	1.487E-4	2.160E-4	1.125E-5	4.361E-5	4.725E-5
N° 16 (OFF)	6.398E-4	9.214E-5	3.619E-5	8.959E-5	2.791E-4

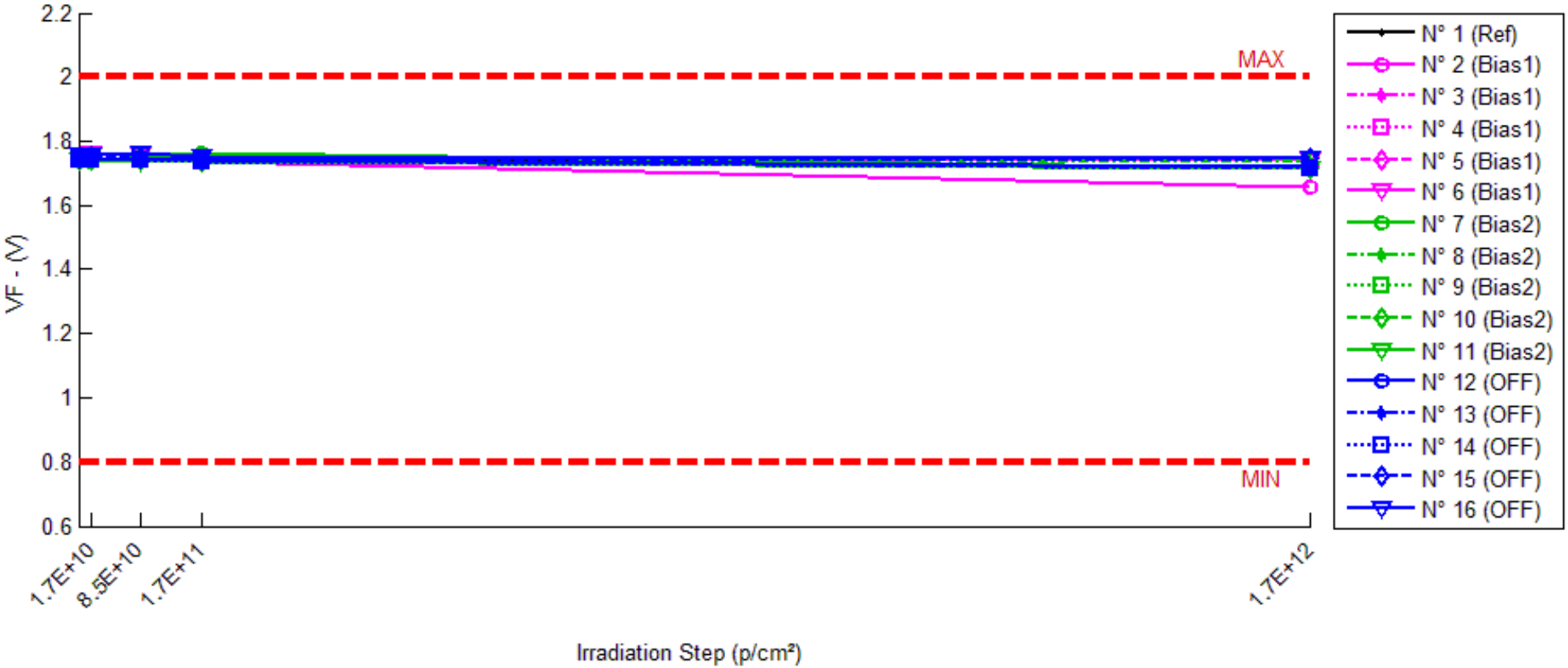
Delta [Ir]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	-1.459E-3	-4.529E-4	-1.225E-3	-1.228E-3
N° 2 (Bias1)	---	-1.430E-3	-1.694E-3	-1.856E-3	-2.053E-3
N° 3 (Bias1)	---	-2.786E-3	-3.450E-3	-3.887E-3	-3.440E-3
N° 4 (Bias1)	---	3.353E-5	1.596E-4	3.846E-4	2.804E-5
N° 5 (Bias1)	---	-2.714E-3	-3.004E-3	-2.927E-3	-2.992E-3
N° 6 (Bias1)	---	-1.111E-3	-8.302E-4	-1.334E-3	-1.404E-3
N° 7 (Bias2)	---	-1.987E-3	-1.307E-3	-2.269E-3	-2.279E-3
N° 8 (Bias2)	---	-1.349E-3	-1.636E-3	-1.626E-3	-1.612E-3
N° 9 (Bias2)	---	-2.826E-3	-3.068E-3	-3.096E-3	-3.100E-3
N° 10 (Bias2)	---	-4.830E-4	-7.647E-4	-7.495E-4	-7.241E-4
N° 11 (Bias2)	---	-4.661E-3	-4.954E-3	-4.952E-3	-4.956E-3
N° 12 (OFF)	---	-1.439E-3	-1.949E-3	-1.919E-3	-1.792E-3
N° 13 (OFF)	---	-5.162E-3	-5.196E-3	-4.902E-3	-4.529E-3
N° 14 (OFF)	---	-8.472E-4	-1.209E-3	-1.027E-3	-1.152E-3
N° 15 (OFF)	---	6.731E-5	-1.375E-4	-1.051E-4	-1.015E-4
N° 16 (OFF)	---	-5.477E-4	-6.036E-4	-5.502E-4	-3.607E-4
Average (OFF)	---	-1.602E-3	-1.764E-3	-1.924E-3	-1.972E-3
σ (OFF)	---	1.182E-3	1.497E-3	1.623E-3	1.372E-3
Average+3σ (OFF)	---	1.943E-3	2.726E-3	2.946E-3	2.142E-3
Average-3σ (OFF)	---	-5.146E-3	-6.254E-3	-6.794E-3	-6.087E-3
Average (Bias1)	---	-2.261E-3	-2.346E-3	-2.539E-3	-2.534E-3
σ (Bias1)	---	1.593E-3	1.689E-3	1.600E-3	1.611E-3
Average+3σ (Bias1)	---	2.517E-3	2.721E-3	2.261E-3	2.298E-3
Average-3σ (Bias1)	---	-7.040E-3	-7.413E-3	-7.338E-3	-7.366E-3
Average (Bias2)	---	-1.586E-3	-1.819E-3	-1.701E-3	-1.587E-3
σ (Bias2)	---	2.071E-3	2.006E-3	1.912E-3	1.775E-3
Average+3σ (Bias2)	---	4.629E-3	4.200E-3	4.034E-3	3.737E-3
Average-3σ (Bias2)	---	-7.800E-3	-7.838E-3	-7.435E-3	-6.911E-3

30 MeV proton / detailed results

2. VF

Ta=25°C; If = 10 mA



30 MeV proton / detailed results

VF . (V) **Min = 0.8 Max = 2.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	1.743	1.742	1.746	1.741	1.742
N° 2 (Bias1)	1.742	1.741	1.740	1.735	1.657
N° 3 (Bias1)	1.742	1.743	1.741	1.737	1.713
N° 4 (Bias1)	1.747	1.751	1.746	1.742	1.719
N° 5 (Bias1)	1.743	1.745	1.742	1.739	1.718
N° 6 (Bias1)	1.759	1.763	1.760	1.753	1.744
N° 7 (Bias2)	1.745	1.739	1.752	1.762	1.716
N° 8 (Bias2)	1.758	1.757	1.758	1.754	1.736
N° 9 (Bias2)	1.742	1.744	1.741	1.745	1.715
N° 10 (Bias2)	1.742	1.742	1.742	1.738	1.715
N° 11 (Bias2)	1.741	1.741	1.739	1.735	1.714
N° 12 (OFF)	1.743	1.744	1.743	1.740	1.718
N° 13 (OFF)	1.742	1.743	1.744	1.742	1.715
N° 14 (OFF)	1.742	1.742	1.742	1.738	1.713
N° 15 (OFF)	1.747	1.750	1.747	1.743	1.749
N° 16 (OFF)	1.756	1.759	1.765	1.753	1.747

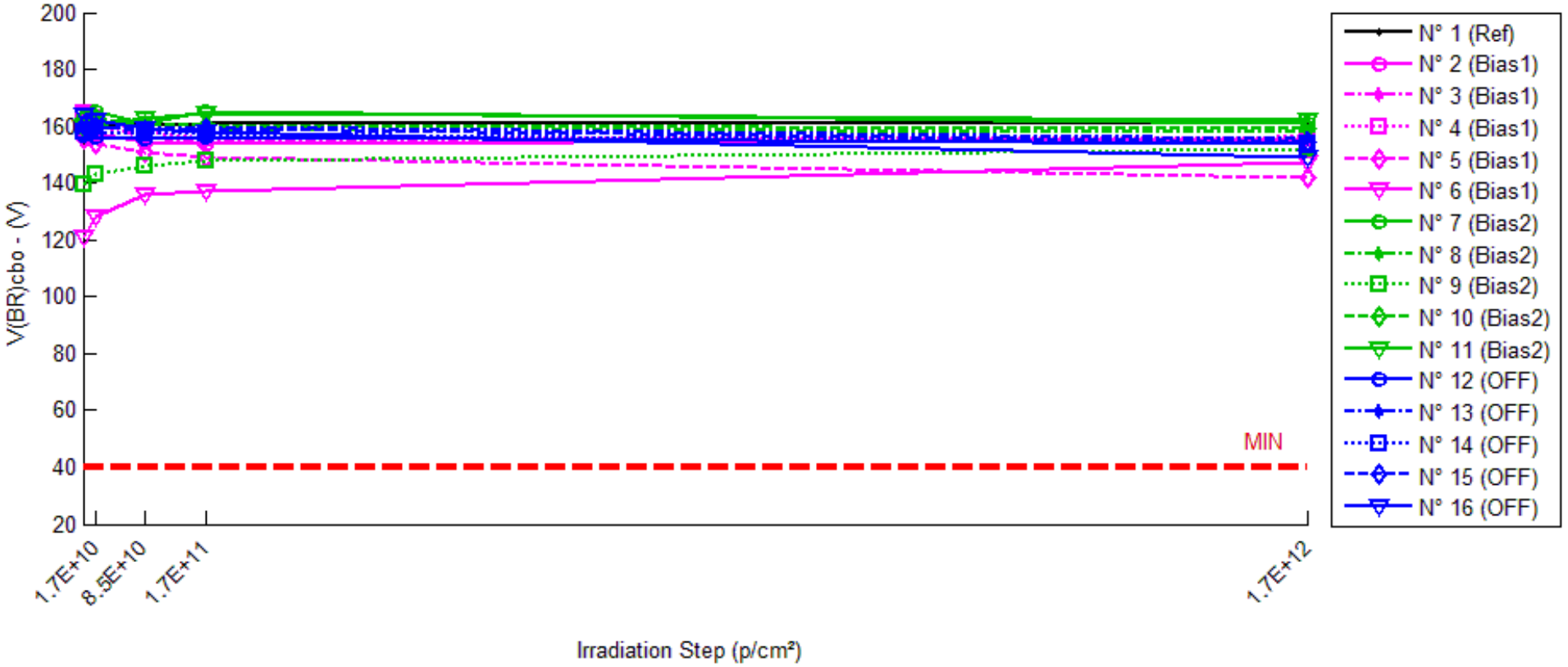
Delta [VF]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	-1.248E-3	3.184E-3	-2.175E-3	-1.347E-3
N° 2 (Bias1)	---	-8.540E-4	-1.523E-3	-6.852E-3	-8.443E-2
N° 3 (Bias1)	---	1.288E-3	-9.600E-4	-5.011E-3	-2.941E-2
N° 4 (Bias1)	---	3.573E-3	-1.904E-3	-4.945E-3	-2.819E-2
N° 5 (Bias1)	---	1.458E-3	-1.626E-3	-4.270E-3	-2.519E-2
N° 6 (Bias1)	---	3.593E-3	7.260E-4	-6.210E-3	-1.547E-2
N° 7 (Bias2)	---	-5.868E-3	7.451E-3	1.725E-2	-2.929E-2
N° 8 (Bias2)	---	-1.062E-3	7.770E-4	-3.730E-3	-2.178E-2
N° 9 (Bias2)	---	2.193E-3	-4.610E-4	3.216E-3	-2.685E-2
N° 10 (Bias2)	---	-2.190E-4	-5.760E-4	-4.805E-3	-2.699E-2
N° 11 (Bias2)	---	3.290E-4	-2.179E-3	-5.483E-3	-2.717E-2
N° 12 (OFF)	---	1.371E-3	-8.400E-5	-3.308E-3	-2.507E-2
N° 13 (OFF)	---	5.390E-4	1.734E-3	3.460E-4	-2.698E-2
N° 14 (OFF)	---	4.660E-4	-3.580E-4	-3.693E-3	-2.881E-2
N° 15 (OFF)	---	2.838E-3	1.540E-4	-4.401E-3	1.238E-3
N° 16 (OFF)	---	2.855E-3	8.750E-3	-2.968E-3	-8.532E-3
Average (OFF)	---	1.812E-3	-1.057E-3	-5.458E-3	-3.654E-2
σ (OFF)	---	1.856E-3	1.054E-3	1.047E-3	2.733E-2
Average+3σ (OFF)	---	7.380E-3	2.106E-3	-2.317E-3	4.544E-2
Average-3σ (OFF)	---	-3.757E-3	-4.221E-3	-8.598E-3	-1.185E-1
Average (Bias1)	---	-9.254E-4	1.002E-3	1.289E-3	-2.642E-2
σ (Bias1)	---	3.010E-3	3.755E-3	9.573E-3	2.774E-3
Average+3σ (Bias1)	---	8.105E-3	1.227E-2	3.001E-2	-1.809E-2
Average-3σ (Bias1)	---	-9.956E-3	-1.026E-2	-2.743E-2	-3.474E-2
Average (Bias2)	---	1.614E-3	2.039E-3	-2.805E-3	-1.763E-2
σ (Bias2)	---	1.180E-3	3.839E-3	1.840E-3	1.329E-2
Average+3σ (Bias2)	---	5.154E-3	1.355E-2	2.716E-3	2.224E-2
Average-3σ (Bias2)	---	-1.927E-3	-9.476E-3	-8.325E-3	-5.750E-2

30 MeV proton / detailed results

3. V(BR)cbo

Ta=25°C; Ic = 100 µA; If = 0



30 MeV proton / detailed results

V(BR)cbo . (V) **Min = 40.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	160.1	160.4	160.3	160.9	160.9
N° 2 (Bias1)	160.5	157.4	154.4	153.6	155.7
N° 3 (Bias1)	162.3	160.5	156.1	154.7	155.4
N° 4 (Bias1)	164.5	162.6	157.8	155.7	156.2
N° 5 (Bias1)	155.7	153.6	151.0	149.3	142.0
N° 6 (Bias1)	120.9	128.1	135.9	136.9	147.1
N° 7 (Bias2)	163.0	165.1	160.9	164.9	160.8
N° 8 (Bias2)	158.8	159.7	158.7	159.0	158.1
N° 9 (Bias2)	139.6	143.0	146.2	147.7	152.3
N° 10 (Bias2)	162.8	162.5	160.5	160.1	158.9
N° 11 (Bias2)	159.7	160.2	162.6	164.7	162.4
N° 12 (OFF)	157.0	156.0	155.4	156.2	153.7
N° 13 (OFF)	159.2	159.2	159.0	159.8	155.8
N° 14 (OFF)	158.2	157.8	157.1	157.2	154.0
N° 15 (OFF)	160.3	159.7	158.6	159.0	154.6
N° 16 (OFF)	163.8	161.9	159.2	157.8	149.0

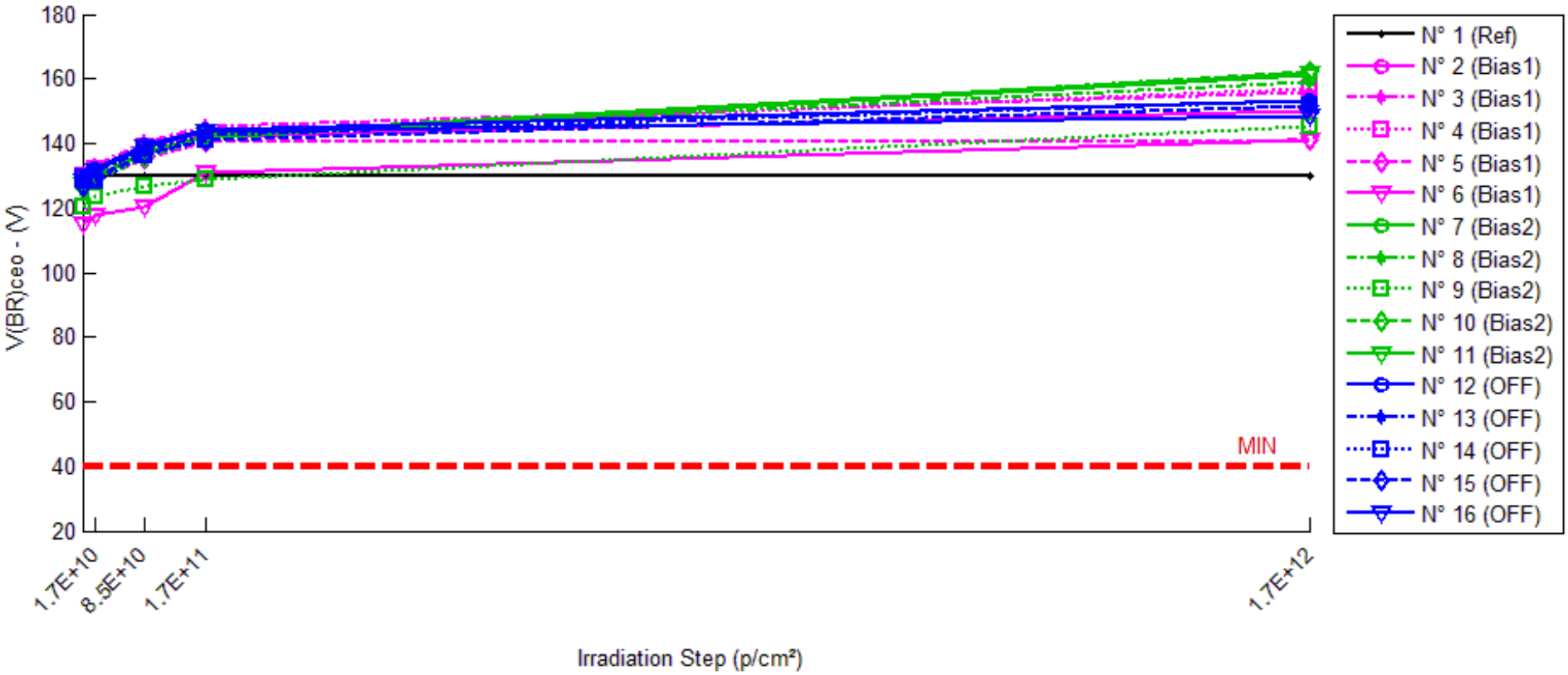
Delta [V(BR)cbo]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	3.200E-1	2.300E-1	7.500E-1	8.300E-1
N° 2 (Bias1)	---	-3.060E+0	-6.020E+0	-6.910E+0	-4.780E+0
N° 3 (Bias1)	---	-1.740E+0	-6.140E+0	-7.600E+0	-6.850E+0
N° 4 (Bias1)	---	-1.910E+0	-6.650E+0	-8.780E+0	-8.280E+0
N° 5 (Bias1)	---	-2.090E+0	-4.700E+0	-6.450E+0	-1.369E+1
N° 6 (Bias1)	---	7.230E+0	1.505E+1	1.601E+1	2.628E+1
N° 7 (Bias2)	---	2.080E+0	-2.110E+0	1.930E+0	-2.180E+0
N° 8 (Bias2)	---	9.200E-1	-8.000E-2	2.300E-1	-7.300E-1
N° 9 (Bias2)	---	3.340E+0	6.570E+0	8.050E+0	1.265E+1
N° 10 (Bias2)	---	-2.600E-1	-2.290E+0	-2.610E+0	-3.830E+0
N° 11 (Bias2)	---	4.600E-1	2.860E+0	4.940E+0	2.670E+0
N° 12 (OFF)	---	-1.020E+0	-1.560E+0	-7.900E-1	-3.350E+0
N° 13 (OFF)	---	-7.000E-2	-2.200E-1	5.600E-1	-3.420E+0
N° 14 (OFF)	---	-3.300E-1	-1.100E+0	-9.800E-1	-4.130E+0
N° 15 (OFF)	---	-6.000E-1	-1.690E+0	-1.310E+0	-5.670E+0
N° 16 (OFF)	---	-1.880E+0	-4.550E+0	-6.030E+0	-1.475E+1
Average (OFF)	---	-3.140E-1	-1.692E+0	-2.746E+0	-1.464E+0
σ (OFF)	---	4.248E+0	9.387E+0	1.052E+1	1.586E+1
Average+3σ (OFF)	---	1.243E+1	2.647E+1	2.882E+1	4.610E+1
Average-3σ (OFF)	---	-1.306E+1	-2.985E+1	-3.431E+1	-4.903E+1
Average (Bias1)	---	1.308E+0	9.900E-1	2.508E+0	1.716E+0
σ (Bias1)	---	1.419E+0	3.747E+0	4.134E+0	6.565E+0
Average+3σ (Bias1)	---	5.565E+0	1.223E+1	1.491E+1	2.141E+1
Average-3σ (Bias1)	---	-2.949E+0	-1.025E+1	-9.893E+0	-1.798E+1
Average (Bias2)	---	-7.800E-1	-1.824E+0	-1.710E+0	-6.264E+0
σ (Bias2)	---	7.083E-1	1.629E+0	2.518E+0	4.835E+0
Average+3σ (Bias2)	---	1.345E+0	3.063E+0	5.843E+0	8.240E+0
Average-3σ (Bias2)	---	-2.905E+0	-6.711E+0	-9.263E+0	-2.077E+1

30 MeV proton / detailed results

4. V(BR)ceo

Ta=25°C; Ic = 1 mA; Ib = 0; If = 0



30 MeV proton / detailed results

V(BR)ceo . (V) **Min = 40.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	129.9	129.9	129.9	130.0	130.0
N° 2 (Bias1)	127.8	130.0	136.6	142.1	150.3
N° 3 (Bias1)	130.6	133.1	140.6	145.2	155.9
N° 4 (Bias1)	129.7	131.9	138.7	143.3	157.2
N° 5 (Bias1)	126.5	128.7	135.2	140.7	140.8
N° 6 (Bias1)	115.2	117.9	120.2	131.1	140.8
N° 7 (Bias2)	126.6	129.3	137.2	142.3	161.0
N° 8 (Bias2)	126.7	129.6	136.7	141.9	158.9
N° 9 (Bias2)	120.5	123.5	126.9	128.9	145.2
N° 10 (Bias2)	126.0	128.7	135.8	141.6	162.3
N° 11 (Bias2)	127.4	130.0	137.0	142.8	161.9
N° 12 (OFF)	129.0	131.9	139.6	144.5	153.4
N° 13 (OFF)	128.6	131.3	137.9	142.6	153.5
N° 14 (OFF)	129.2	128.4	136.1	141.2	151.9
N° 15 (OFF)	126.6	129.5	136.6	141.3	151.9
N° 16 (OFF)	128.5	131.4	138.7	143.5	148.6

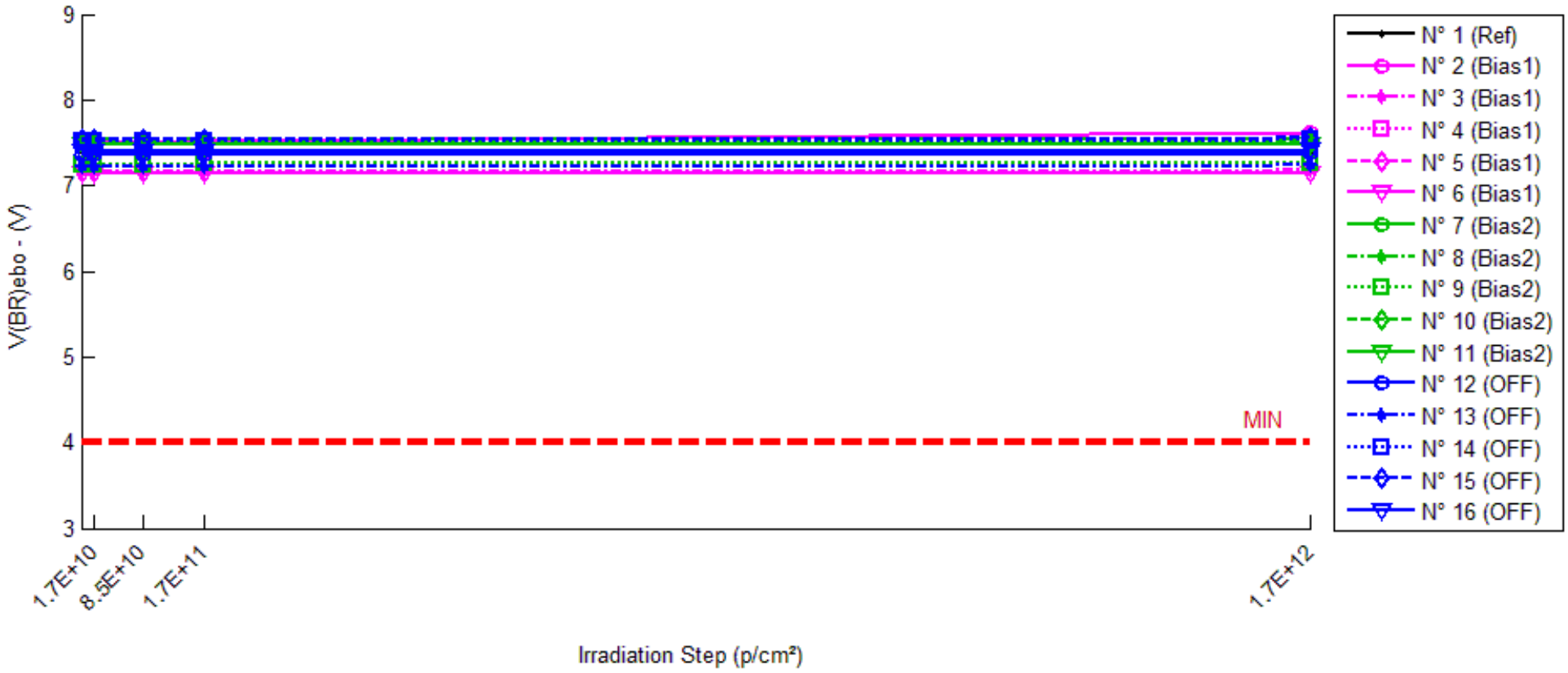
Delta [V(BR)ceo]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	4.000E-2	-2.000E-2	9.000E-2	1.100E-1
N° 2 (Bias1)	---	2.210E+0	8.810E+0	1.439E+1	2.255E+1
N° 3 (Bias1)	---	2.450E+0	1.002E+1	1.458E+1	2.534E+1
N° 4 (Bias1)	---	2.220E+0	8.980E+0	1.360E+1	2.751E+1
N° 5 (Bias1)	---	2.260E+0	8.770E+0	1.418E+1	1.434E+1
N° 6 (Bias1)	---	2.710E+0	5.070E+0	1.590E+1	2.558E+1
N° 7 (Bias2)	---	2.680E+0	1.056E+1	1.571E+1	3.437E+1
N° 8 (Bias2)	---	2.860E+0	1.001E+1	1.518E+1	3.217E+1
N° 9 (Bias2)	---	2.920E+0	6.390E+0	8.400E+0	2.465E+1
N° 10 (Bias2)	---	2.610E+0	9.750E+0	1.557E+1	3.625E+1
N° 11 (Bias2)	---	2.630E+0	9.580E+0	1.538E+1	3.449E+1
N° 12 (OFF)	---	2.890E+0	1.058E+1	1.548E+1	2.442E+1
N° 13 (OFF)	---	2.660E+0	9.280E+0	1.398E+1	2.493E+1
N° 14 (OFF)	---	-7.500E-1	6.940E+0	1.208E+1	2.280E+1
N° 15 (OFF)	---	2.940E+0	9.980E+0	1.475E+1	2.529E+1
N° 16 (OFF)	---	2.880E+0	1.017E+1	1.496E+1	2.003E+1
Average (OFF)	---	2.370E+0	8.330E+0	1.453E+1	2.306E+1
σ (OFF)	---	2.134E-1	1.893E+0	8.495E-1	5.188E+0
Average+3σ (OFF)	---	3.010E+0	1.401E+1	1.708E+1	3.863E+1
Average-3σ (OFF)	---	1.730E+0	2.652E+0	1.198E+1	7.501E+0
Average (Bias1)	---	2.740E+0	9.258E+0	1.405E+1	3.239E+1
σ (Bias1)	---	1.409E-1	1.646E+0	3.164E+0	4.560E+0
Average+3σ (Bias1)	---	3.163E+0	1.419E+1	2.354E+1	4.607E+1
Average-3σ (Bias1)	---	2.317E+0	4.321E+0	4.557E+0	1.871E+1
Average (Bias2)	---	2.124E+0	9.390E+0	1.425E+1	2.349E+1
σ (Bias2)	---	1.610E+0	1.448E+0	1.327E+0	2.158E+0
Average+3σ (Bias2)	---	6.955E+0	1.373E+1	1.823E+1	2.997E+1
Average-3σ (Bias2)	---	-2.707E+0	5.046E+0	1.027E+1	1.702E+1

30 MeV proton / detailed results

5. V(BR)ebo

Ta=25°C; Ic = 0; Ie = 100 µA; If = 0



30 MeV proton / detailed results

V(BR)ebo . (V) **Min = 4.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	7.401	7.405	7.402	7.409	7.409
N° 2 (Bias1)	7.505	7.508	7.508	7.515	7.629
N° 3 (Bias1)	7.170	7.169	7.168	7.170	7.180
N° 4 (Bias1)	7.242	7.243	7.246	7.249	7.267
N° 5 (Bias1)	7.492	7.493	7.495	7.497	7.503
N° 6 (Bias1)	7.137	7.134	7.135	7.144	7.140
N° 7 (Bias2)	7.472	7.486	7.479	7.486	7.501
N° 8 (Bias2)	7.527	7.531	7.532	7.537	7.541
N° 9 (Bias2)	7.246	7.245	7.250	7.252	7.258
N° 10 (Bias2)	7.518	7.519	7.519	7.516	7.519
N° 11 (Bias2)	7.481	7.482	7.486	7.485	7.489
N° 12 (OFF)	7.364	7.363	7.362	7.365	7.376
N° 13 (OFF)	7.217	7.218	7.218	7.224	7.235
N° 14 (OFF)	7.521	7.522	7.523	7.526	7.541
N° 15 (OFF)	7.540	7.542	7.541	7.542	7.560
N° 16 (OFF)	7.395	7.394	7.396	7.401	7.412

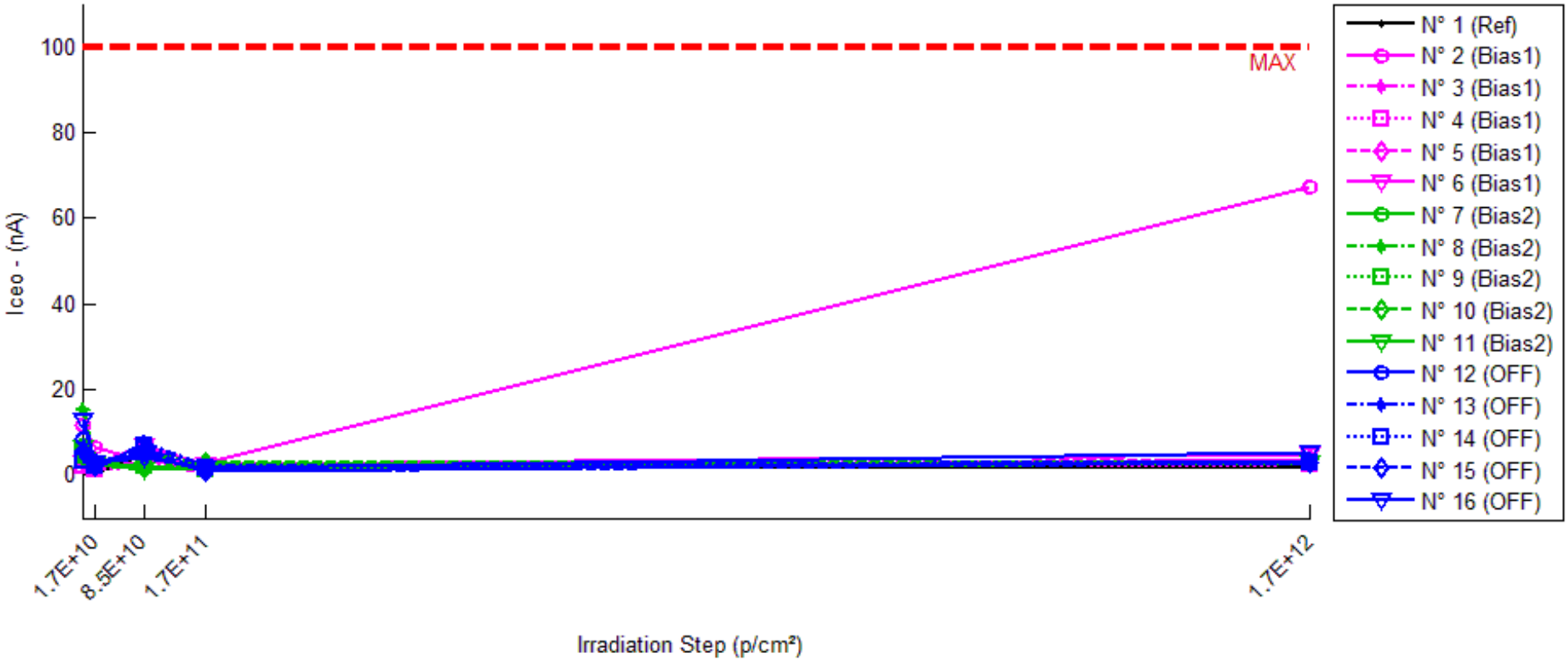
Delta [V(BR)ebo]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	3.924E-3	2.200E-4	7.173E-3	7.979E-3
N° 2 (Bias1)	---	3.022E-3	3.349E-3	9.927E-3	1.240E-1
N° 3 (Bias1)	---	-8.780E-4	-1.430E-3	6.150E-4	1.050E-2
N° 4 (Bias1)	---	7.580E-4	3.897E-3	7.389E-3	2.499E-2
N° 5 (Bias1)	---	5.710E-4	2.966E-3	4.790E-3	1.052E-2
N° 6 (Bias1)	---	-3.203E-3	-1.876E-3	7.003E-3	3.194E-3
N° 7 (Bias2)	---	1.445E-2	7.260E-3	1.374E-2	2.884E-2
N° 8 (Bias2)	---	4.868E-3	5.280E-3	1.040E-2	1.480E-2
N° 9 (Bias2)	---	-8.910E-4	4.197E-3	6.687E-3	1.189E-2
N° 10 (Bias2)	---	1.757E-3	1.649E-3	-1.300E-3	1.409E-3
N° 11 (Bias2)	---	1.009E-3	4.458E-3	4.050E-3	8.108E-3
N° 12 (OFF)	---	-2.350E-4	-1.518E-3	1.624E-3	1.224E-2
N° 13 (OFF)	---	9.120E-4	1.008E-3	6.482E-3	1.741E-2
N° 14 (OFF)	---	5.410E-4	2.241E-3	5.415E-3	2.051E-2
N° 15 (OFF)	---	1.497E-3	8.290E-4	2.255E-3	1.971E-2
N° 16 (OFF)	---	-8.600E-4	9.820E-4	6.127E-3	1.696E-2
Average (OFF)	---	5.400E-5	1.381E-3	5.945E-3	3.464E-2
σ (OFF)	---	2.294E-3	2.794E-3	3.493E-3	5.058E-2
Average+3σ (OFF)	---	6.936E-3	9.763E-3	1.642E-2	1.864E-1
Average-3σ (OFF)	---	-6.828E-3	-7.001E-3	-4.534E-3	-1.171E-1
Average (Bias1)	---	4.238E-3	4.569E-3	6.715E-3	1.301E-2
σ (Bias1)	---	6.073E-3	2.026E-3	5.793E-3	1.017E-2
Average+3σ (Bias1)	---	2.246E-2	1.065E-2	2.409E-2	4.352E-2
Average-3σ (Bias1)	---	-1.398E-2	-1.510E-3	-1.066E-2	-1.750E-2
Average (Bias2)	---	3.710E-4	7.084E-4	4.381E-3	1.737E-2
σ (Bias2)	---	9.317E-4	1.368E-3	2.272E-3	3.233E-3
Average+3σ (Bias2)	---	3.166E-3	4.812E-3	1.120E-2	2.706E-2
Average-3σ (Bias2)	---	-2.424E-3	-3.395E-3	-2.436E-3	7.667E-3

30 MeV proton / detailed results

6. Iceo

Ta=25°C; Vce=20V



30 MeV proton / detailed results

Iceo . (nA) **Max = 100.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	3.519	0.718	4.831	1.876	1.719
N° 2 (Bias1)	11.532	6.498	3.507	2.988	67.431
N° 3 (Bias1)	4.370	4.145	2.204	0.913	3.876
N° 4 (Bias1)	2.242	1.213	2.042	1.944	2.599
N° 5 (Bias1)	5.083	2.649	1.829	2.105	3.555
N° 6 (Bias1)	2.963	2.457	6.842	2.470	4.770
N° 7 (Bias2)	6.734	2.959	2.224	1.327	3.432
N° 8 (Bias2)	15.080	2.908	5.357	2.351	2.915
N° 9 (Bias2)	4.678	2.287	2.120	1.274	2.881
N° 10 (Bias2)	4.493	2.981	1.668	2.848	2.905
N° 11 (Bias2)	6.510	2.489	1.493	1.332	3.087
N° 12 (OFF)	8.575	3.507	5.006	1.044	3.360
N° 13 (OFF)	5.650	1.208	7.865	1.993	3.287
N° 14 (OFF)	3.118	2.310	7.022	1.742	3.045
N° 15 (OFF)	5.515	2.141	6.281	1.075	2.973
N° 16 (OFF)	12.968	3.089	4.206	1.784	5.454

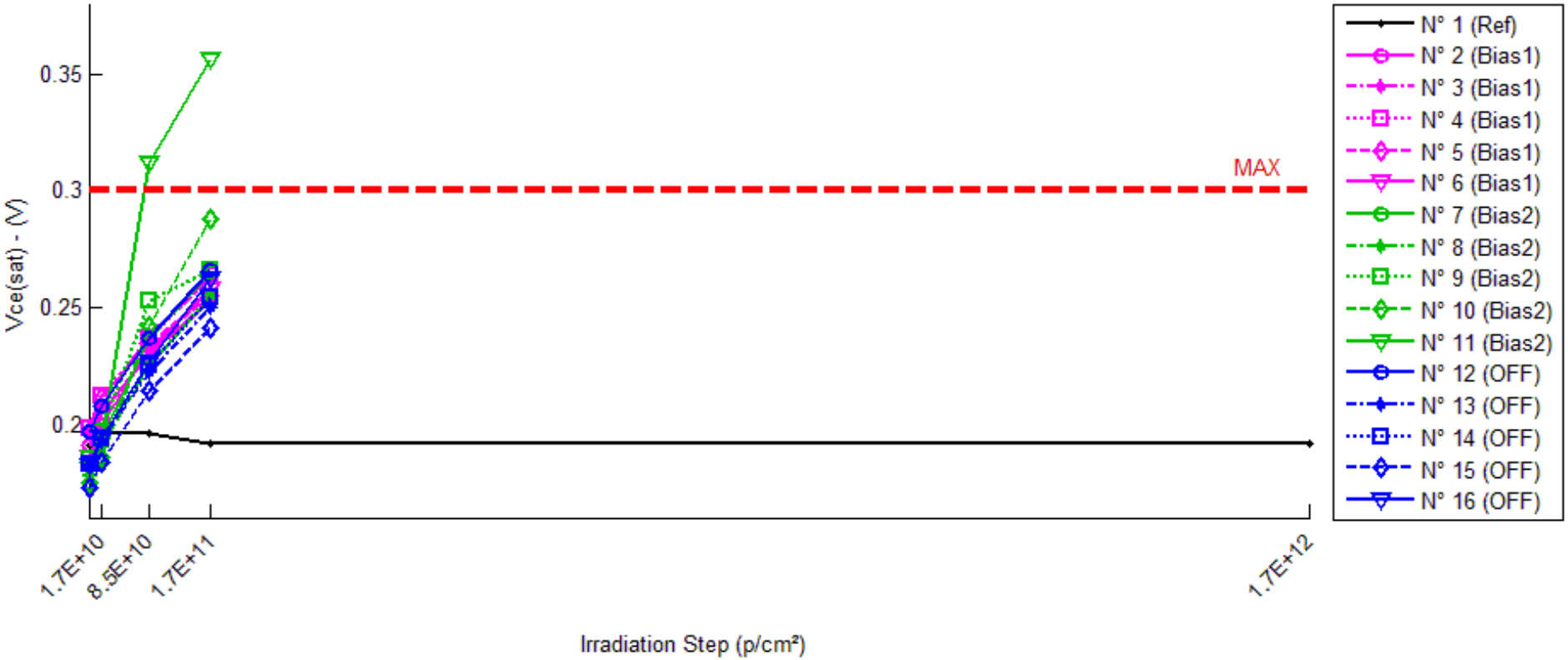
Delta [Iceo]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	-2.801E+0	1.312E+0	-1.642E+0	-1.800E+0
N° 2 (Bias1)	---	-5.034E+0	-8.025E+0	-8.544E+0	5.590E+1
N° 3 (Bias1)	---	-2.245E-1	-2.166E+0	-3.457E+0	-4.939E-1
N° 4 (Bias1)	---	-1.030E+0	-2.009E-1	-2.981E-1	3.567E-1
N° 5 (Bias1)	---	-2.434E+0	-3.254E+0	-2.977E+0	-1.527E+0
N° 6 (Bias1)	---	-5.057E-1	3.880E+0	-4.929E-1	1.807E+0
N° 7 (Bias2)	---	-3.775E+0	-4.510E+0	-5.407E+0	-3.302E+0
N° 8 (Bias2)	---	-1.217E+1	-9.724E+0	-1.273E+1	-1.216E+1
N° 9 (Bias2)	---	-2.391E+0	-2.558E+0	-3.404E+0	-1.797E+0
N° 10 (Bias2)	---	-1.512E+0	-2.825E+0	-1.645E+0	-1.588E+0
N° 11 (Bias2)	---	-4.021E+0	-5.017E+0	-5.178E+0	-3.423E+0
N° 12 (OFF)	---	-5.068E+0	-3.570E+0	-7.531E+0	-5.215E+0
N° 13 (OFF)	---	-4.442E+0	2.215E+0	-3.657E+0	-2.363E+0
N° 14 (OFF)	---	-8.078E-1	3.904E+0	-1.376E+0	-7.301E-2
N° 15 (OFF)	---	-3.374E+0	7.660E-1	-4.440E+0	-2.542E+0
N° 16 (OFF)	---	-9.879E+0	-8.762E+0	-1.118E+1	-7.513E+0
Average (OFF)	---	-1.846E+0	-1.953E+0	-3.154E+0	1.121E+1
σ (OFF)	---	1.975E+0	4.350E+0	3.332E+0	2.501E+1
Average+3σ (OFF)	---	4.079E+0	1.110E+1	6.843E+0	8.625E+1
Average-3σ (OFF)	---	-7.770E+0	-1.500E+1	-1.315E+1	-6.383E+1
Average (Bias1)	---	-4.774E+0	-4.927E+0	-5.673E+0	-4.455E+0
σ (Bias1)	---	4.261E+0	2.882E+0	4.227E+0	4.391E+0
Average+3σ (Bias1)	---	8.008E+0	3.719E+0	7.009E+0	8.718E+0
Average-3σ (Bias1)	---	-1.756E+1	-1.357E+1	-1.836E+1	-1.763E+1
Average (Bias2)	---	-4.714E+0	-1.089E+0	-5.638E+0	-3.541E+0
σ (Bias2)	---	3.314E+0	5.107E+0	3.803E+0	2.872E+0
Average+3σ (Bias2)	---	5.228E+0	1.423E+1	5.772E+0	5.075E+0
Average-3σ (Bias2)	---	-1.466E+1	-1.641E+1	-1.705E+1	-1.216E+1

30 MeV proton / detailed results

7. Vce(sat)

Ta=25°C; If = 20 mA; Ic = 10 mA



30 MeV proton / detailed results

Vce(sat) . (V) **Max = 0.3**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	0.191	0.196	0.196	0.192	0.192
N° 2 (Bias1)	0.191	0.205	0.230	0.253	Not Measurable*
N° 3 (Bias1)	0.196	0.209	0.238	0.262	Not Measurable*
N° 4 (Bias1)	0.198	0.212	0.237	0.264	Not Measurable*
N° 5 (Bias1)	0.197	0.211	0.235	0.255	Not Measurable*
N° 6 (Bias1)	0.186	0.200	0.232	0.258	Not Measurable*
N° 7 (Bias2)	0.183	0.194	0.237	0.265	Not Measurable*
N° 8 (Bias2)	0.178	0.190	0.225	0.255	Not Measurable*
N° 9 (Bias2)	0.185	0.197	0.253	0.266	Not Measurable*
N° 10 (Bias2)	0.175	0.186	0.242	0.288	Not Measurable*
N° 11 (Bias2)	0.181	0.194	0.312	0.356	Not Measurable*
N° 12 (OFF)	0.197	0.208	0.237	0.266	Not Measurable*
N° 13 (OFF)	0.182	0.193	0.222	0.250	Not Measurable*
N° 14 (OFF)	0.183	0.194	0.225	0.254	Not Measurable*
N° 15 (OFF)	0.173	0.184	0.214	0.241	Not Measurable*
N° 16 (OFF)	0.182	0.194	0.227	0.262	Not Measurable*

* Not measurable with this test condition

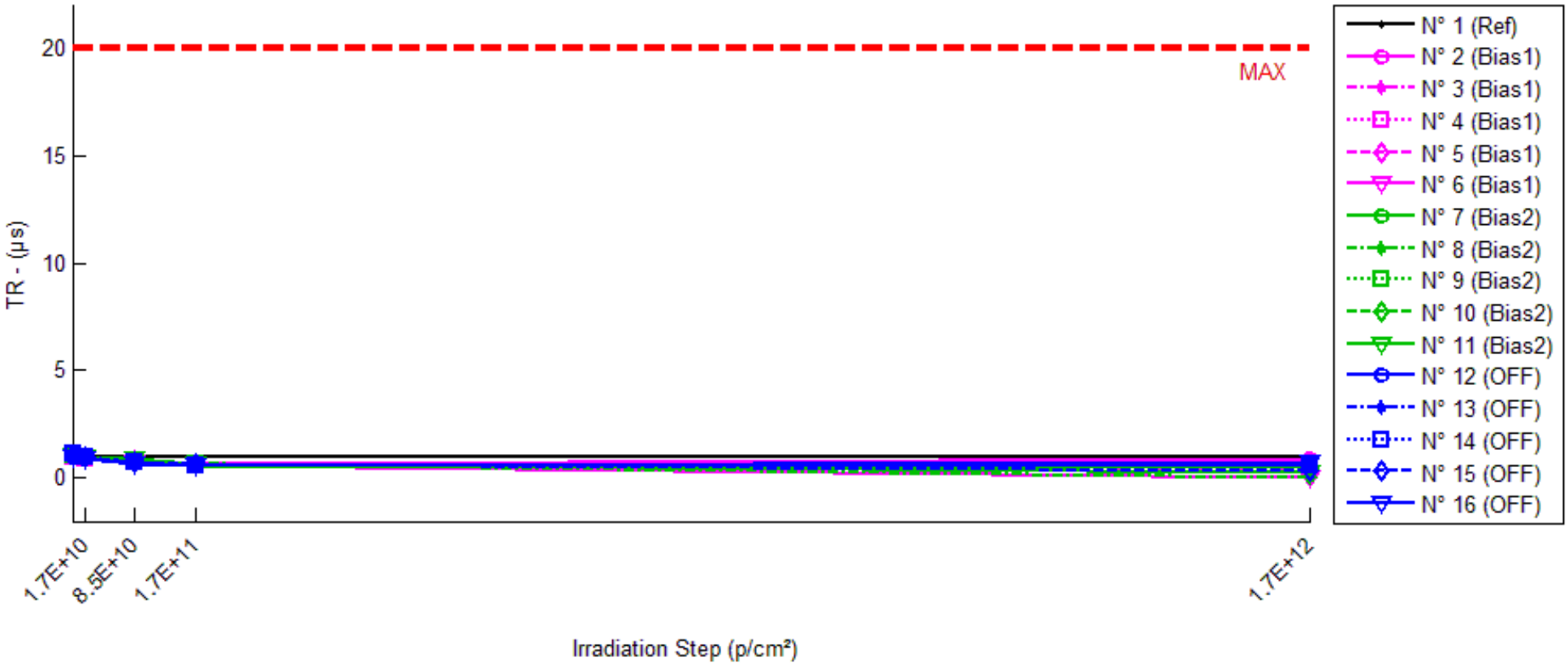
Delta [Vce(sat)]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	5.400E-3	5.594E-3	9.032E-4	1.024E-3
N° 2 (Bias1)	---	1.310E-2	3.835E-2	6.169E-2	NaN
N° 3 (Bias1)	---	1.349E-2	4.243E-2	6.651E-2	NaN
N° 4 (Bias1)	---	1.398E-2	3.941E-2	6.657E-2	NaN
N° 5 (Bias1)	---	1.337E-2	3.813E-2	5.786E-2	NaN
N° 6 (Bias1)	---	1.391E-2	4.540E-2	7.184E-2	NaN
N° 7 (Bias2)	---	1.097E-2	5.383E-2	8.154E-2	NaN
N° 8 (Bias2)	---	1.206E-2	4.723E-2	7.694E-2	NaN
N° 9 (Bias2)	---	1.235E-2	6.841E-2	8.135E-2	NaN
N° 10 (Bias2)	---	1.083E-2	6.678E-2	1.124E-1	NaN
N° 11 (Bias2)	---	1.275E-2	1.312E-1	1.751E-1	NaN
N° 12 (OFF)	---	1.059E-2	3.945E-2	6.825E-2	NaN
N° 13 (OFF)	---	1.101E-2	3.982E-2	6.793E-2	NaN
N° 14 (OFF)	---	1.098E-2	4.249E-2	7.157E-2	NaN
N° 15 (OFF)	---	1.112E-2	4.120E-2	6.789E-2	NaN
N° 16 (OFF)	---	1.247E-2	4.493E-2	8.031E-2	NaN
Average (OFF)	---	1.357E-2	4.074E-2	6.489E-2	NaN
σ (OFF)	---	3.707E-4	3.118E-3	5.322E-3	0.000E+0
Average+3σ (OFF)	---	1.468E-2	5.010E-2	8.086E-2	NaN
Average-3σ (OFF)	---	1.246E-2	3.139E-2	4.893E-2	NaN
Average (Bias1)	---	1.179E-2	7.349E-2	1.055E-1	NaN
σ (Bias1)	---	8.516E-4	3.346E-2	4.143E-2	0.000E+0
Average+3σ (Bias1)	---	1.435E-2	1.739E-1	2.298E-1	NaN
Average-3σ (Bias1)	---	9.239E-3	-2.689E-2	-1.881E-2	NaN
Average (Bias2)	---	1.123E-2	4.158E-2	7.119E-2	NaN
σ (Bias2)	---	7.179E-4	2.226E-3	5.327E-3	0.000E+0
Average+3σ (Bias2)	---	1.339E-2	4.826E-2	8.717E-2	NaN
Average-3σ (Bias2)	---	9.079E-3	3.490E-2	5.521E-2	NaN

30 MeV proton / detailed results

8. TR

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



30 MeV proton / detailed results

TR . (µs) **Max = 20.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	1.00	1.00	0.96	0.96	0.96
N° 2 (Bias1)	1.00	0.96	0.80	0.64	0.92
N° 3 (Bias1)	1.00	0.88	0.76	0.60	0.40
N° 4 (Bias1)	1.00	0.92	0.72	0.60	0.56
N° 5 (Bias1)	1.04	0.96	0.80	0.68	0.52
N° 6 (Bias1)	1.00	0.88	0.72	0.60	0.02
N° 7 (Bias2)	1.08	1.00	0.76	0.60	0.52
N° 8 (Bias2)	1.04	0.96	0.76	0.68	0.02
N° 9 (Bias2)	1.04	0.96	0.80	0.68	0.60
N° 10 (Bias2)	1.04	0.96	0.76	0.64	0.60
N° 11 (Bias2)	1.04	0.96	0.88	0.68	0.24
N° 12 (OFF)	1.00	0.92	0.72	0.60	0.60
N° 13 (OFF)	1.04	0.92	0.76	0.60	0.64
N° 14 (OFF)	1.12	1.00	0.76	0.60	0.60
N° 15 (OFF)	1.04	0.96	0.72	0.64	0.36
N° 16 (OFF)	1.00	0.88	0.68	0.60	0.72

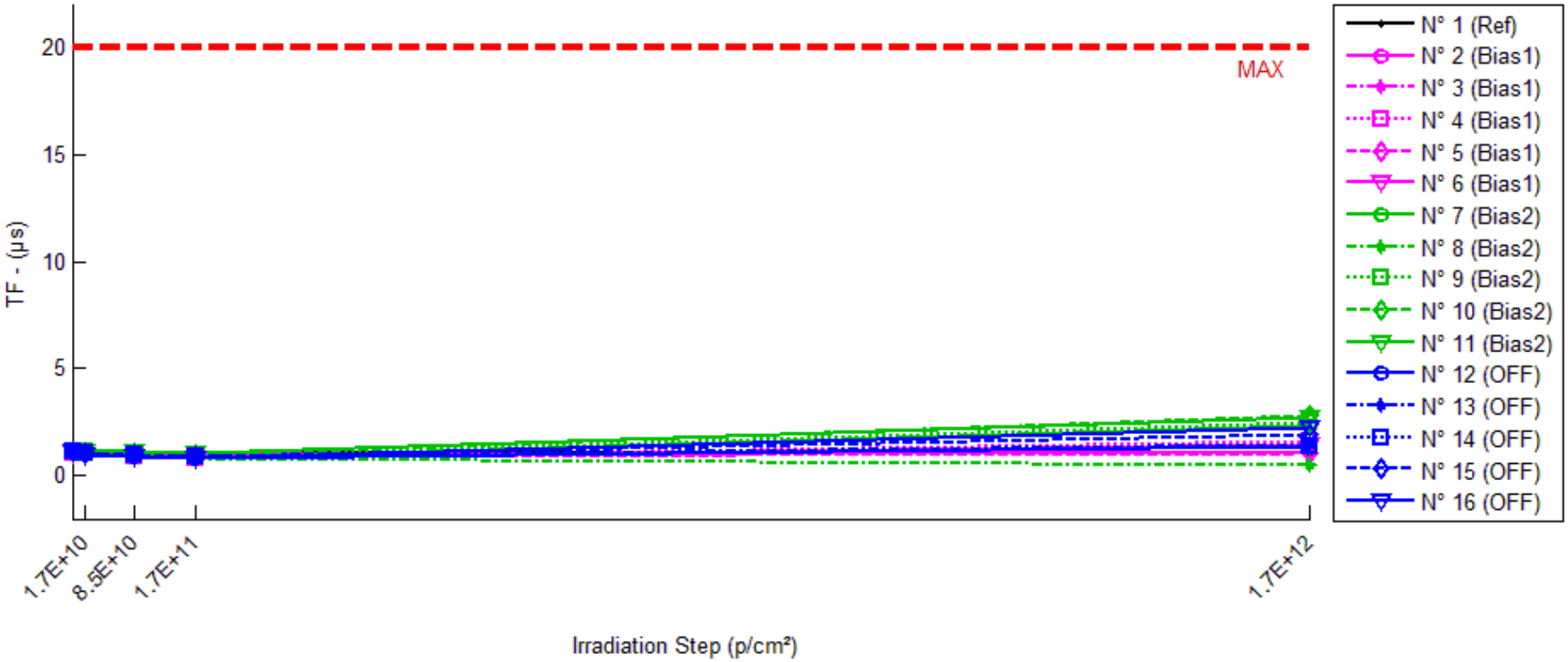
Delta [TR]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	0.000E+0	-4.000E-2	-4.000E-2	-4.000E-2
N° 2 (Bias1)	---	-4.000E-2	-2.000E-1	-3.600E-1	-8.000E-2
N° 3 (Bias1)	---	-1.200E-1	-2.400E-1	-4.000E-1	-6.000E-1
N° 4 (Bias1)	---	-8.000E-2	-2.800E-1	-4.000E-1	-4.400E-1
N° 5 (Bias1)	---	-8.000E-2	-2.400E-1	-3.600E-1	-5.200E-1
N° 6 (Bias1)	---	-1.200E-1	-2.800E-1	-4.000E-1	-9.800E-1
N° 7 (Bias2)	---	-8.000E-2	-3.200E-1	-4.800E-1	-5.600E-1
N° 8 (Bias2)	---	-8.000E-2	-2.800E-1	-3.600E-1	-1.020E+0
N° 9 (Bias2)	---	-8.000E-2	-2.400E-1	-3.600E-1	-4.400E-1
N° 10 (Bias2)	---	-8.000E-2	-2.800E-1	-4.000E-1	-4.400E-1
N° 11 (Bias2)	---	-8.000E-2	-1.600E-1	-3.600E-1	-8.000E-1
N° 12 (OFF)	---	-8.000E-2	-2.800E-1	-4.000E-1	-4.000E-1
N° 13 (OFF)	---	-1.200E-1	-2.800E-1	-4.400E-1	-4.000E-1
N° 14 (OFF)	---	-1.200E-1	-3.600E-1	-5.200E-1	-5.200E-1
N° 15 (OFF)	---	-8.000E-2	-3.200E-1	-4.000E-1	-6.800E-1
N° 16 (OFF)	---	-1.200E-1	-3.200E-1	-4.000E-1	-2.800E-1
Average (OFF)	---	-8.800E-2	-2.480E-1	-3.840E-1	-5.240E-1
σ (OFF)	---	3.347E-2	3.347E-2	2.191E-2	3.232E-1
Average+3σ (OFF)	---	1.240E-2	-1.476E-1	-3.183E-1	4.457E-1
Average-3σ (OFF)	---	-1.884E-1	-3.484E-1	-4.497E-1	-1.494E+0
Average (Bias1)	---	-8.000E-2	-2.560E-1	-3.920E-1	-6.520E-1
σ (Bias1)	---	0.000E+0	6.066E-2	5.215E-2	2.528E-1
Average+3σ (Bias1)	---	-8.000E-2	-7.401E-2	-2.355E-1	1.065E-1
Average-3σ (Bias1)	---	-8.000E-2	-4.380E-1	-5.485E-1	-1.410E+0
Average (Bias2)	---	-1.040E-1	-3.120E-1	-4.320E-1	-4.560E-1
σ (Bias2)	---	2.191E-2	3.347E-2	5.215E-2	1.513E-1
Average+3σ (Bias2)	---	-3.827E-2	-2.116E-1	-2.755E-1	-2.216E-3
Average-3σ (Bias2)	---	-1.697E-1	-4.124E-1	-5.885E-1	-9.098E-1

30 MeV proton / detailed results

9. TF

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



30 MeV proton / detailed results

TF . (µs) **Max = 20.0**

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	1.04	1.04	1.08	1.08	1.08
N° 2 (Bias1)	1.08	1.04	1.00	0.96	1.12
N° 3 (Bias1)	1.08	1.04	0.96	0.88	1.44
N° 4 (Bias1)	1.08	1.04	0.88	0.80	1.60
N° 5 (Bias1)	1.12	1.08	1.00	0.88	1.08
N° 6 (Bias1)	1.04	1.00	0.88	0.80	1.44
N° 7 (Bias2)	1.16	1.12	0.96	0.84	2.32
N° 8 (Bias2)	1.12	1.08	0.96	0.84	0.52
N° 9 (Bias2)	1.12	1.12	1.00	0.88	2.52
N° 10 (Bias2)	1.12	1.08	1.04	0.96	2.80
N° 11 (Bias2)	1.12	1.12	1.16	1.08	2.72
N° 12 (OFF)	1.12	1.04	0.92	0.80	1.36
N° 13 (OFF)	1.12	1.04	0.96	0.88	1.48
N° 14 (OFF)	1.12	1.08	1.00	0.88	1.40
N° 15 (OFF)	1.16	1.08	1.00	0.92	1.92
N° 16 (OFF)	1.12	1.00	0.88	0.84	2.24

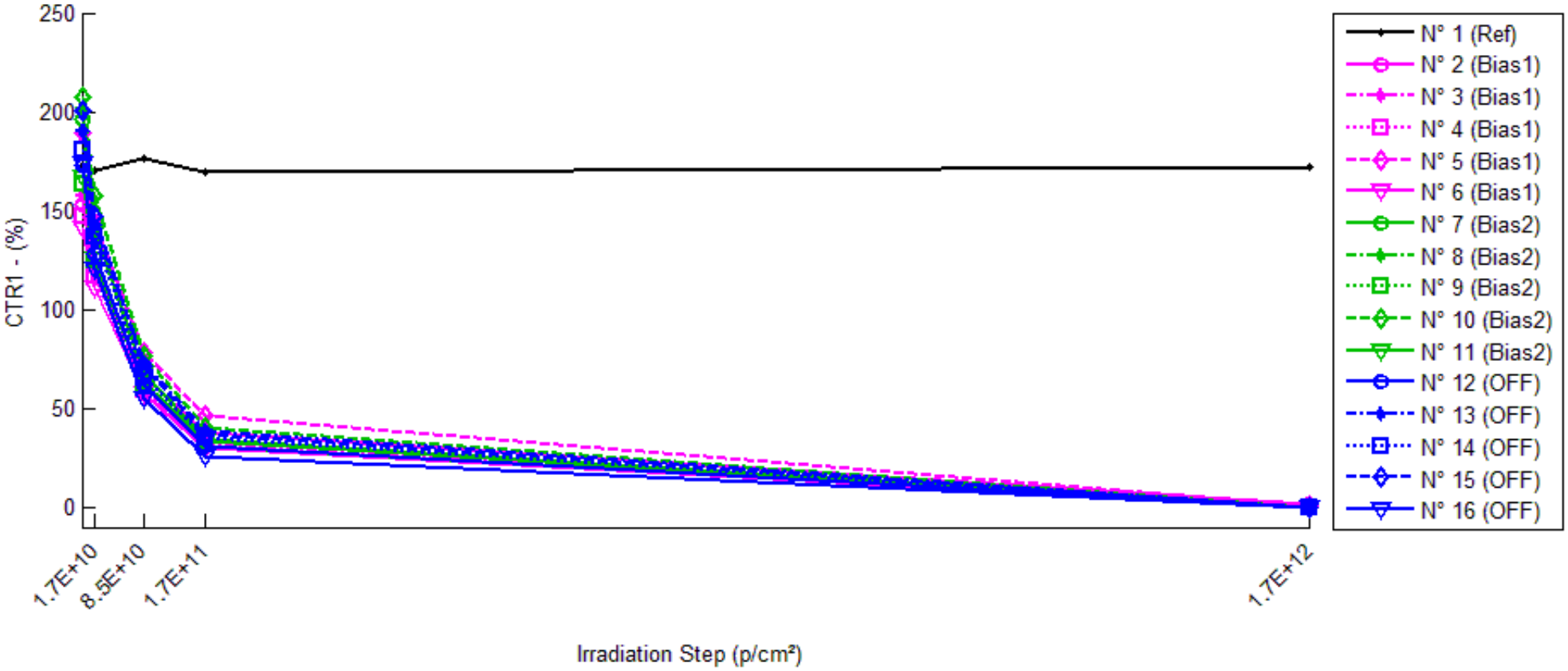
Delta [TF]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	0.000E+0	4.000E-2	4.000E-2	4.000E-2
N° 2 (Bias1)	---	-4.000E-2	-8.000E-2	-1.200E-1	4.000E-2
N° 3 (Bias1)	---	-4.000E-2	-1.200E-1	-2.000E-1	3.600E-1
N° 4 (Bias1)	---	-4.000E-2	-2.000E-1	-2.800E-1	5.200E-1
N° 5 (Bias1)	---	-4.000E-2	-1.200E-1	-2.400E-1	-4.000E-2
N° 6 (Bias1)	---	-4.000E-2	-1.600E-1	-2.400E-1	4.000E-1
N° 7 (Bias2)	---	-4.000E-2	-2.000E-1	-3.200E-1	1.160E+0
N° 8 (Bias2)	---	-4.000E-2	-1.600E-1	-2.800E-1	-6.000E-1
N° 9 (Bias2)	---	0.000E+0	-1.200E-1	-2.400E-1	1.400E+0
N° 10 (Bias2)	---	-4.000E-2	-8.000E-2	-1.600E-1	1.680E+0
N° 11 (Bias2)	---	0.000E+0	4.000E-2	-4.000E-2	1.600E+0
N° 12 (OFF)	---	-8.000E-2	-2.000E-1	-3.200E-1	2.400E-1
N° 13 (OFF)	---	-8.000E-2	-1.600E-1	-2.400E-1	3.600E-1
N° 14 (OFF)	---	-4.000E-2	-1.200E-1	-2.400E-1	2.800E-1
N° 15 (OFF)	---	-8.000E-2	-1.600E-1	-2.400E-1	7.600E-1
N° 16 (OFF)	---	-1.200E-1	-2.400E-1	-2.800E-1	1.120E+0
Average (OFF)	---	-4.000E-2	-1.360E-1	-2.160E-1	2.560E-1
σ (OFF)	---	0.000E+0	4.561E-2	6.066E-2	2.427E-1
Average+3σ (OFF)	---	-4.000E-2	8.211E-4	-3.401E-2	9.840E-1
Average-3σ (OFF)	---	-4.000E-2	-2.728E-1	-3.980E-1	-4.720E-1
Average (Bias1)	---	-2.400E-2	-1.040E-1	-2.080E-1	1.048E+0
σ (Bias1)	---	2.191E-2	9.209E-2	1.110E-1	9.429E-1
Average+3σ (Bias1)	---	4.173E-2	1.723E-1	1.250E-1	3.877E+0
Average-3σ (Bias1)	---	-8.973E-2	-3.803E-1	-5.410E-1	-1.781E+0
Average (Bias2)	---	-8.000E-2	-1.760E-1	-2.640E-1	5.520E-1
σ (Bias2)	---	2.828E-2	4.561E-2	3.578E-2	3.788E-1
Average+3σ (Bias2)	---	4.853E-3	-3.918E-2	-1.567E-1	1.689E+0
Average-3σ (Bias2)	---	-1.649E-1	-3.128E-1	-3.713E-1	-5.845E-1

30 MeV proton / detailed results

10.CTR1

Ta=25°C; Vce=5V; If=1mA



30 MeV proton / detailed results

CTR1 . (%)

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	173.21	170.15	176.78	169.81	171.99
N° 2 (Bias1)	152.80	121.30	66.01	38.09	2.03
N° 3 (Bias1)	157.69	119.97	59.48	31.74	0.28
N° 4 (Bias1)	147.45	116.68	59.18	32.41	0.22
N° 5 (Bias1)	189.24	144.09	78.57	46.28	0.44
N° 6 (Bias1)	141.38	110.75	57.42	30.40	0.11
N° 7 (Bias2)	196.15	140.29	67.92	34.16	0.15
N° 8 (Bias2)	201.26	143.24	63.73	30.49	0.07
N° 9 (Bias2)	163.24	124.64	62.97	34.53	0.15
N° 10 (Bias2)	207.19	157.20	76.50	40.74	0.16
N° 11 (Bias2)	167.14	125.96	62.60	33.61	0.15
N° 12 (OFF)	172.76	128.19	62.14	30.66	0.18
N° 13 (OFF)	190.20	142.59	73.10	38.52	0.26
N° 14 (OFF)	180.42	136.86	66.49	35.04	0.23
N° 15 (OFF)	200.53	147.48	71.57	37.07	0.17
N° 16 (OFF)	173.54	120.45	54.75	25.82	0.09

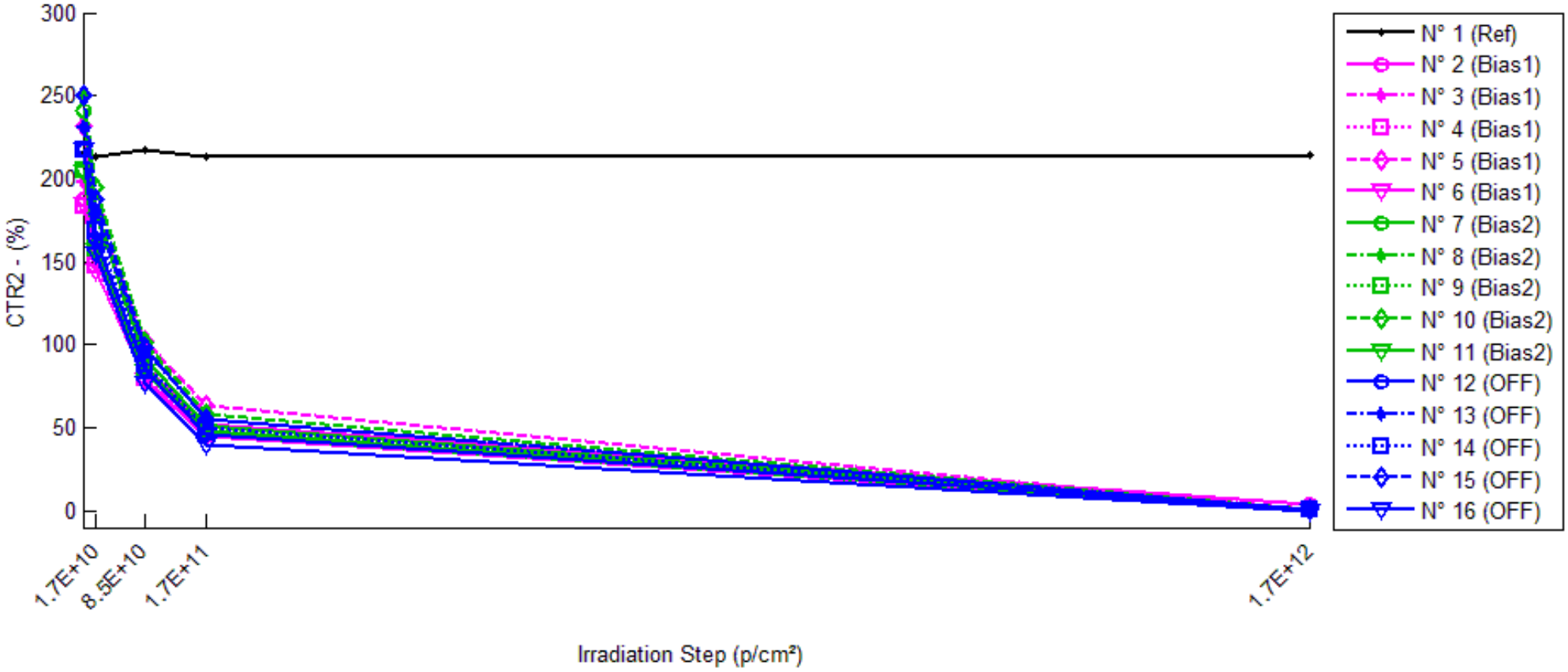
1/Delta [CTR1]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	1.040E-4	-1.164E-4	1.157E-4	4.119E-5
N° 2 (Bias1)	---	1.700E-3	8.604E-3	1.971E-2	4.854E-1
N° 3 (Bias1)	---	1.994E-3	1.047E-2	2.517E-2	3.512E+0
N° 4 (Bias1)	---	1.788E-3	1.012E-2	2.407E-2	4.573E+0
N° 5 (Bias1)	---	1.655E-3	7.443E-3	1.632E-2	2.283E+0
N° 6 (Bias1)	---	1.956E-3	1.034E-2	2.582E-2	8.947E+0
N° 7 (Bias2)	---	2.030E-3	9.624E-3	2.417E-2	6.749E+0
N° 8 (Bias2)	---	2.012E-3	1.072E-2	2.783E-2	1.349E+1
N° 9 (Bias2)	---	1.897E-3	9.756E-3	2.283E-2	6.527E+0
N° 10 (Bias2)	---	1.535E-3	8.246E-3	1.972E-2	6.168E+0
N° 11 (Bias2)	---	1.956E-3	9.990E-3	2.377E-2	6.868E+0
N° 12 (OFF)	---	2.012E-3	1.031E-2	2.683E-2	5.639E+0
N° 13 (OFF)	---	1.756E-3	8.421E-3	2.070E-2	3.889E+0
N° 14 (OFF)	---	1.764E-3	9.497E-3	2.300E-2	4.422E+0
N° 15 (OFF)	---	1.794E-3	8.985E-3	2.199E-2	5.727E+0
N° 16 (OFF)	---	2.540E-3	1.250E-2	3.296E-2	1.136E+1
Average (OFF)	---	1.819E-3	9.396E-3	2.222E-2	3.960E+0
σ (OFF)	---	1.512E-4	1.324E-3	4.067E-3	3.175E+0
Average+3σ (OFF)	---	2.272E-3	1.337E-2	3.442E-2	1.349E+1
Average-3σ (OFF)	---	1.365E-3	5.423E-3	1.002E-2	-5.566E+0
Average (Bias1)	---	1.886E-3	9.668E-3	2.367E-2	7.961E+0
σ (Bias1)	---	2.031E-4	9.016E-4	2.910E-3	3.103E+0
Average+3σ (Bias1)	---	2.496E-3	1.237E-2	3.240E-2	1.727E+1
Average-3σ (Bias1)	---	1.277E-3	6.963E-3	1.494E-2	-1.348E+0
Average (Bias2)	---	1.973E-3	9.942E-3	2.510E-2	6.208E+0
σ (Bias2)	---	3.337E-4	1.590E-3	4.955E-3	2.987E+0
Average+3σ (Bias2)	---	2.974E-3	1.471E-2	3.996E-2	1.517E+1
Average-3σ (Bias2)	---	9.720E-4	5.171E-3	1.023E-2	-2.754E+0

30 MeV proton / detailed results

11.CTR2

Ta=25°C; Vce=5V; If=2mA



30 MeV proton / detailed results

CTR2 . (%)

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	215.62	213.75	217.79	213.41	214.47
N° 2 (Bias1)	187.19	150.83	85.68	52.43	3.64
N° 3 (Bias1)	197.66	153.73	81.45	46.70	0.51
N° 4 (Bias1)	183.54	147.75	79.50	46.28	0.40
N° 5 (Bias1)	231.88	178.86	102.35	63.68	0.82
N° 6 (Bias1)	184.35	144.03	79.14	45.39	0.23
N° 7 (Bias2)	241.17	179.57	92.28	50.76	0.27
N° 8 (Bias2)	250.04	182.91	88.48	46.33	0.13
N° 9 (Bias2)	204.66	158.06	85.62	49.96	0.27
N° 10 (Bias2)	250.14	194.42	101.66	57.91	0.30
N° 11 (Bias2)	204.38	156.77	83.99	48.04	0.26
N° 12 (OFF)	216.93	164.34	85.38	46.01	0.33
N° 13 (OFF)	230.52	178.05	97.01	55.03	0.48
N° 14 (OFF)	217.60	168.67	88.01	49.72	0.41
N° 15 (OFF)	249.77	188.01	98.20	54.85	0.35
N° 16 (OFF)	217.31	154.93	76.46	39.82	0.18

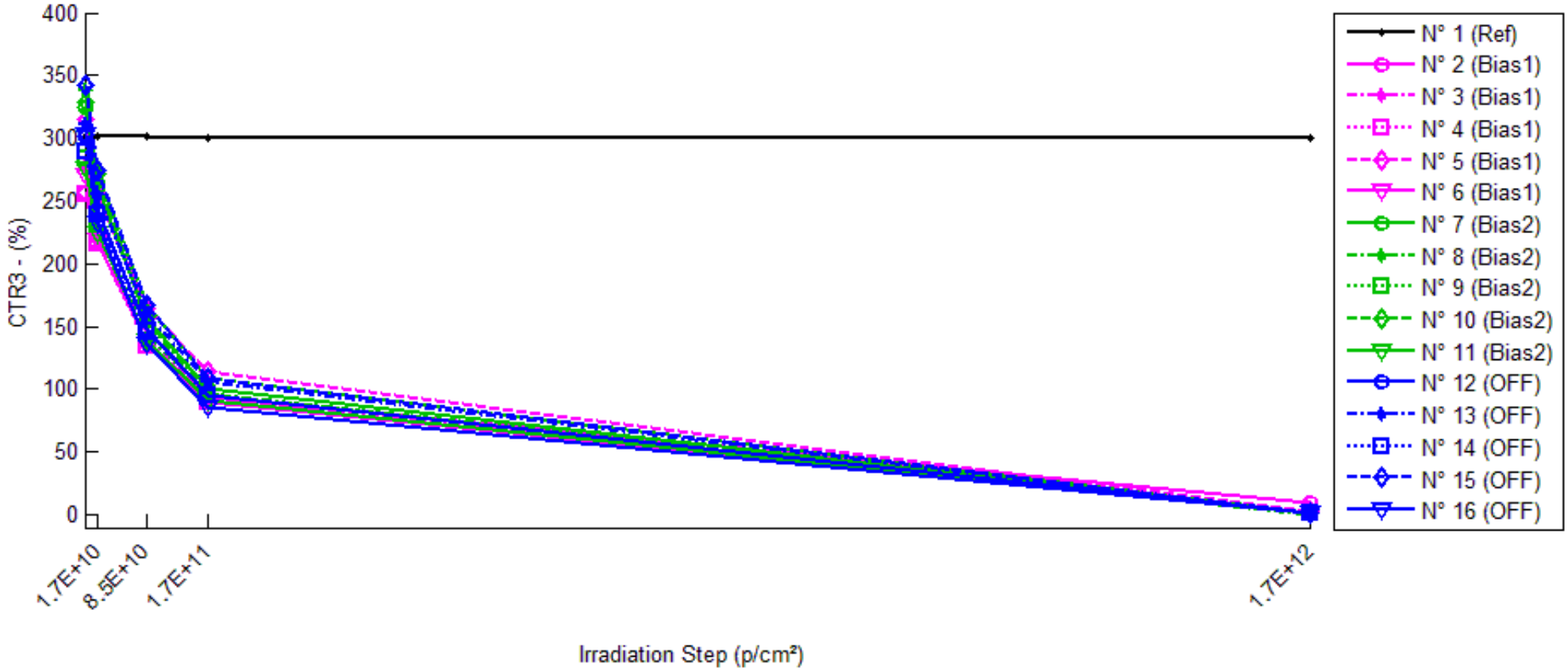
1/Delta [CTR2]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	4.053E-5	-4.628E-5	4.792E-5	2.488E-5
N° 2 (Bias1)	---	1.288E-3	6.329E-3	1.373E-2	2.694E-1
N° 3 (Bias1)	---	1.446E-3	7.218E-3	1.635E-2	1.963E+0
N° 4 (Bias1)	---	1.320E-3	7.130E-3	1.616E-2	2.515E+0
N° 5 (Bias1)	---	1.278E-3	5.458E-3	1.139E-2	1.215E+0
N° 6 (Bias1)	---	1.518E-3	7.212E-3	1.661E-2	4.347E+0
N° 7 (Bias2)	---	1.422E-3	6.691E-3	1.555E-2	3.722E+0
N° 8 (Bias2)	---	1.468E-3	7.303E-3	1.758E-2	7.431E+0
N° 9 (Bias2)	---	1.441E-3	6.794E-3	1.513E-2	3.649E+0
N° 10 (Bias2)	---	1.146E-3	5.839E-3	1.327E-2	3.383E+0
N° 11 (Bias2)	---	1.486E-3	7.014E-3	1.592E-2	3.858E+0
N° 12 (OFF)	---	1.475E-3	7.103E-3	1.712E-2	2.984E+0
N° 13 (OFF)	---	1.278E-3	5.971E-3	1.383E-2	2.058E+0
N° 14 (OFF)	---	1.333E-3	6.767E-3	1.552E-2	2.406E+0
N° 15 (OFF)	---	1.315E-3	6.179E-3	1.423E-2	2.839E+0
N° 16 (OFF)	---	1.853E-3	8.476E-3	2.051E-2	5.687E+0
Average (OFF)	---	1.370E-3	6.669E-3	1.485E-2	2.062E+0
σ (OFF)	---	1.066E-4	7.730E-4	2.251E-3	1.530E+0
Average+3σ (OFF)	---	1.690E-3	8.988E-3	2.160E-2	6.653E+0
Average-3σ (OFF)	---	1.050E-3	4.350E-3	8.095E-3	-2.529E+0
Average (Bias1)	---	1.393E-3	6.728E-3	1.549E-2	4.409E+0
σ (Bias1)	---	1.401E-4	5.495E-4	1.552E-3	1.698E+0
Average+3σ (Bias1)	---	1.813E-3	8.376E-3	2.015E-2	9.503E+0
Average-3σ (Bias1)	---	9.723E-4	5.080E-3	1.084E-2	-6.862E-1
Average (Bias2)	---	1.451E-3	6.899E-3	1.624E-2	3.195E+0
σ (Bias2)	---	2.368E-4	9.908E-4	2.709E-3	1.440E+0
Average+3σ (Bias2)	---	2.161E-3	9.872E-3	2.437E-2	7.515E+0
Average-3σ (Bias2)	---	7.405E-4	3.927E-3	8.114E-3	-1.125E+0

30 MeV proton / detailed results

12.CTR3

Ta=25°C; Vce = 5V; If = 10 mA



30 MeV proton / detailed results

CTR3 . (%)

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	301.52	301.06	301.90	300.61	300.69
N° 2 (Bias1)	256.37	216.22	137.36	94.49	9.39
N° 3 (Bias1)	277.07	229.10	141.23	93.94	2.21
N° 4 (Bias1)	255.12	216.60	135.18	89.45	1.75
N° 5 (Bias1)	314.69	255.56	163.90	114.52	3.41
N° 6 (Bias1)	270.66	218.66	135.52	90.13	1.29
N° 7 (Bias2)	324.36	262.36	156.45	101.29	1.27
N° 8 (Bias2)	338.54	266.35	154.17	96.16	0.67
N° 9 (Bias2)	284.48	230.49	143.97	96.14	1.19
N° 10 (Bias2)	328.58	272.24	167.71	109.33	1.33
N° 11 (Bias2)	276.38	223.91	139.11	91.65	1.12
N° 12 (OFF)	301.32	242.98	147.60	94.60	1.58
N° 13 (OFF)	310.50	255.80	160.75	105.43	2.10
N° 14 (OFF)	289.72	239.26	146.58	94.96	1.81
N° 15 (OFF)	342.34	274.93	167.75	108.65	1.77
N° 16 (OFF)	303.36	232.73	136.34	85.37	0.99

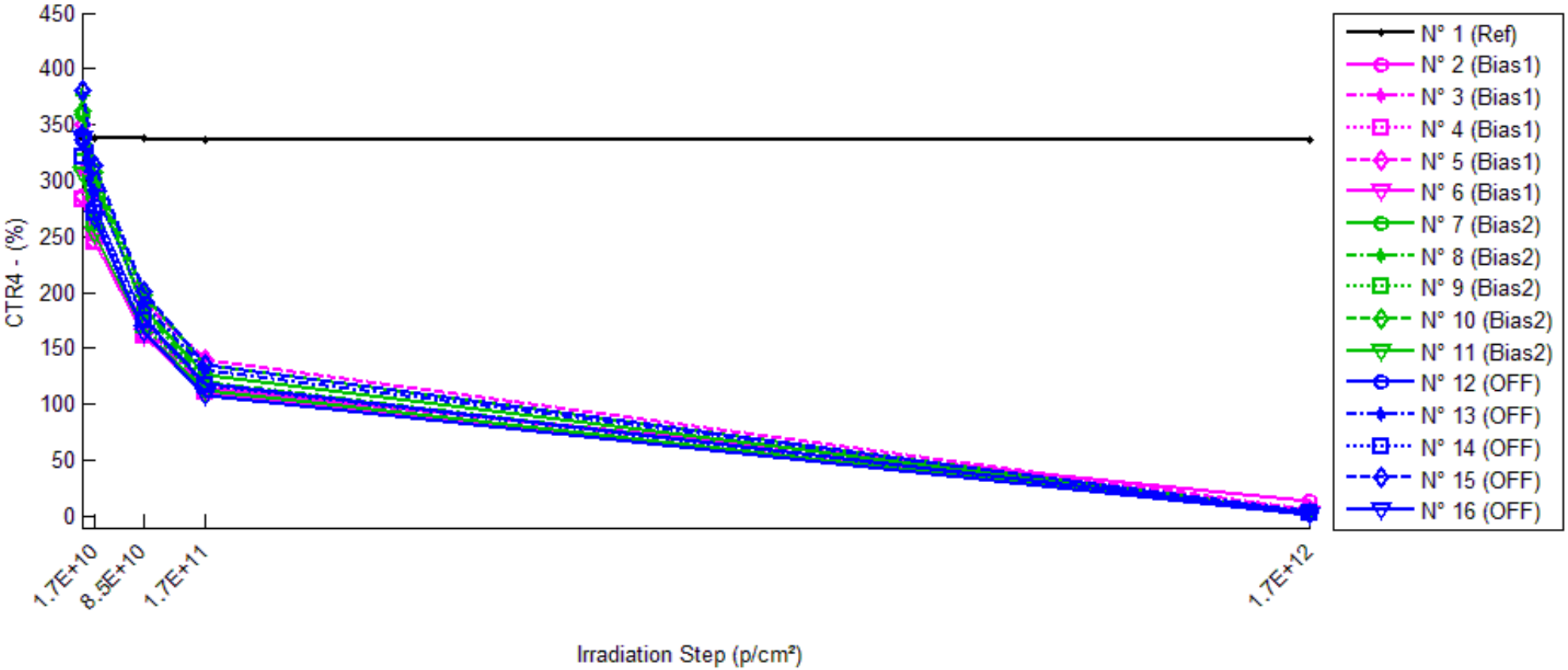
1/Delta [CTR3]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	5.147E-6	-4.126E-6	1.014E-5	9.153E-6
N° 2 (Bias1)	---	7.242E-4	3.379E-3	6.682E-3	1.025E-1
N° 3 (Bias1)	---	7.558E-4	3.471E-3	7.036E-3	4.481E-1
N° 4 (Bias1)	---	6.971E-4	3.478E-3	7.260E-3	5.672E-1
N° 5 (Bias1)	---	7.351E-4	2.924E-3	5.554E-3	2.904E-1
N° 6 (Bias1)	---	8.785E-4	3.684E-3	7.400E-3	7.710E-1
N° 7 (Bias2)	---	7.285E-4	3.309E-3	6.790E-3	7.841E-1
N° 8 (Bias2)	---	8.006E-4	3.533E-3	7.446E-3	1.481E+0
N° 9 (Bias2)	---	8.233E-4	3.431E-3	6.886E-3	8.351E-1
N° 10 (Bias2)	---	6.298E-4	2.919E-3	6.103E-3	7.502E-1
N° 11 (Bias2)	---	8.480E-4	3.571E-3	7.293E-3	8.881E-1
N° 12 (OFF)	---	7.968E-4	3.456E-3	7.252E-3	6.310E-1
N° 13 (OFF)	---	6.888E-4	3.000E-3	6.264E-3	4.725E-1
N° 14 (OFF)	---	7.280E-4	3.371E-3	7.080E-3	5.482E-1
N° 15 (OFF)	---	7.163E-4	3.040E-3	6.283E-3	5.617E-1
N° 16 (OFF)	---	1.000E-3	4.038E-3	8.418E-3	1.006E+0
Average (OFF)	---	7.581E-4	3.387E-3	6.786E-3	4.358E-1
σ (OFF)	---	7.054E-5	2.821E-4	7.403E-4	2.559E-1
Average+3σ (OFF)	---	9.698E-4	4.234E-3	9.007E-3	1.204E+0
Average-3σ (OFF)	---	5.465E-4	2.541E-3	4.565E-3	-3.319E-1
Average (Bias1)	---	7.660E-4	3.352E-3	6.904E-3	9.477E-1
σ (Bias1)	---	8.826E-5	2.625E-4	5.244E-4	3.027E-1
Average+3σ (Bias1)	---	1.031E-3	4.140E-3	8.477E-3	1.856E+0
Average-3σ (Bias1)	---	5.012E-4	2.565E-3	5.331E-3	3.950E-2
Average (Bias2)	---	7.860E-4	3.381E-3	7.059E-3	6.440E-1
σ (Bias2)	---	1.263E-4	4.180E-4	8.830E-4	2.103E-1
Average+3σ (Bias2)	---	1.165E-3	4.635E-3	9.708E-3	1.275E+0
Average-3σ (Bias2)	---	4.072E-4	2.127E-3	4.410E-3	1.315E-2

30 MeV proton / detailed results

13.CTR4

Ta=25°C; Vce = 5V; If = 20 mA



30 MeV proton / detailed results

CTR4 . (%)

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	338.02	337.48	337.77	337.15	336.94
N° 2 (Bias1)	285.73	245.26	161.63	114.25	12.94
N° 3 (Bias1)	309.21	261.38	169.04	116.89	4.00
N° 4 (Bias1)	283.67	245.47	161.33	110.64	3.16
N° 5 (Bias1)	350.25	290.19	191.89	139.47	5.85
N° 6 (Bias1)	305.67	251.43	161.06	111.00	2.49
N° 7 (Bias2)	359.05	297.75	185.86	126.60	2.45
N° 8 (Bias2)	375.43	302.95	184.30	120.45	1.36
N° 9 (Bias2)	316.70	262.16	170.41	118.00	2.26
N° 10 (Bias2)	362.86	307.16	198.50	135.19	2.51
N° 11 (Bias2)	306.22	253.40	164.44	112.32	2.10
N° 12 (OFF)	336.05	277.59	176.79	118.42	2.97
N° 13 (OFF)	344.02	290.19	190.92	130.73	3.73
N° 14 (OFF)	321.19	271.29	174.99	117.51	3.27
N° 15 (OFF)	381.44	313.91	200.29	135.79	3.30
N° 16 (OFF)	338.58	266.69	163.84	108.11	1.97

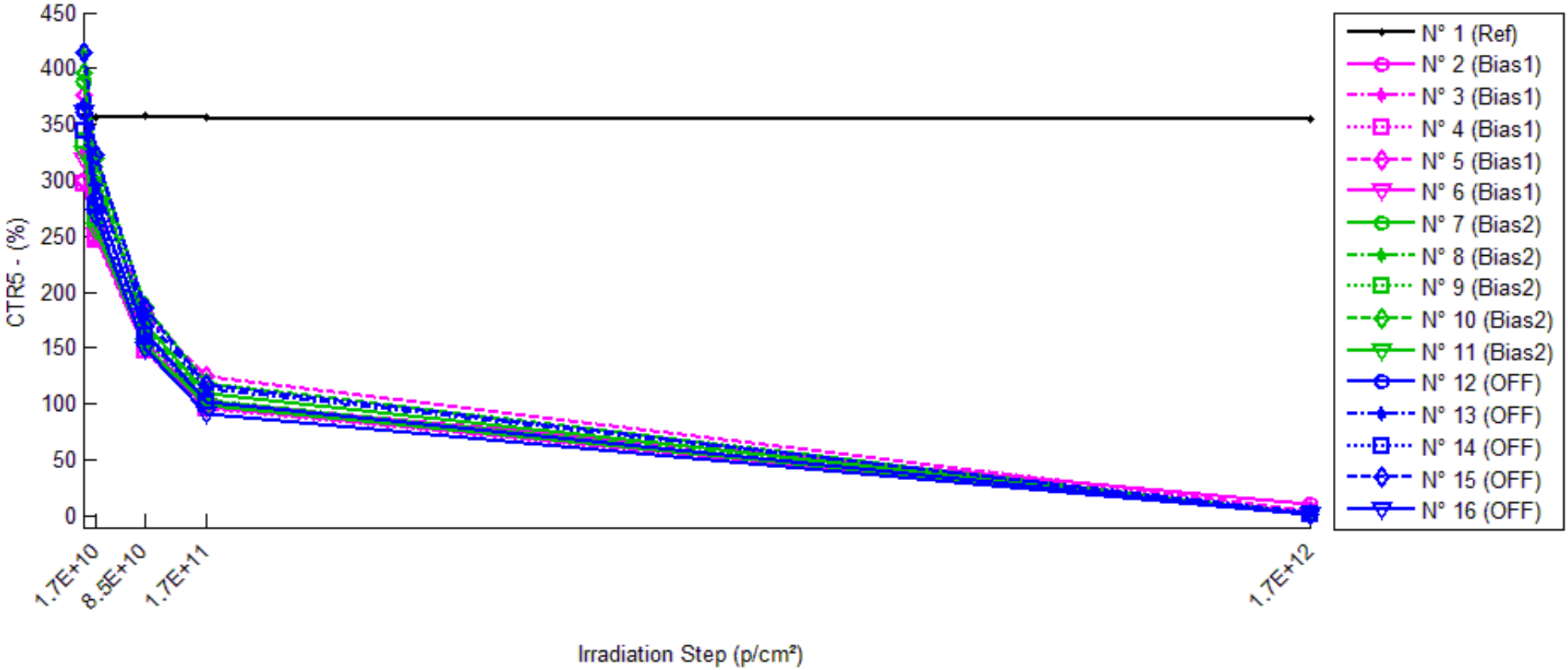
1/Delta [CTR4]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	4.702E-6	2.214E-6	7.656E-6	9.491E-6
N° 2 (Bias1)	---	5.774E-4	2.687E-3	5.253E-3	7.378E-2
N° 3 (Bias1)	---	5.917E-4	2.682E-3	5.321E-3	2.466E-1
N° 4 (Bias1)	---	5.487E-4	2.673E-3	5.514E-3	3.130E-1
N° 5 (Bias1)	---	5.909E-4	2.356E-3	4.315E-3	1.680E-1
N° 6 (Bias1)	---	7.057E-4	2.937E-3	5.738E-3	3.990E-1
N° 7 (Bias2)	---	5.733E-4	2.595E-3	5.113E-3	4.062E-1
N° 8 (Bias2)	---	6.373E-4	2.762E-3	5.639E-3	7.314E-1
N° 9 (Bias2)	---	6.570E-4	2.711E-3	5.317E-3	4.397E-1
N° 10 (Bias2)	---	4.997E-4	2.282E-3	4.641E-3	3.958E-1
N° 11 (Bias2)	---	6.807E-4	2.816E-3	5.637E-3	4.719E-1
N° 12 (OFF)	---	6.268E-4	2.681E-3	5.469E-3	3.340E-1
N° 13 (OFF)	---	5.392E-4	2.331E-3	4.742E-3	2.649E-1
N° 14 (OFF)	---	5.727E-4	2.601E-3	5.397E-3	3.024E-1
N° 15 (OFF)	---	5.640E-4	2.371E-3	4.743E-3	3.003E-1
N° 16 (OFF)	---	7.962E-4	3.150E-3	6.297E-3	5.037E-1
Average (OFF)	---	6.029E-4	2.667E-3	5.228E-3	2.401E-1
σ (OFF)	---	6.005E-5	2.063E-4	5.441E-4	1.260E-1
Average+3σ (OFF)	---	7.830E-4	3.286E-3	6.860E-3	6.180E-1
Average-3σ (OFF)	---	4.227E-4	2.048E-3	3.596E-3	-1.378E-1
Average (Bias1)	---	6.096E-4	2.633E-3	5.269E-3	4.890E-1
σ (Bias1)	---	7.324E-5	2.126E-4	4.163E-4	1.388E-1
Average+3σ (Bias1)	---	8.293E-4	3.271E-3	6.518E-3	9.053E-1
Average-3σ (Bias1)	---	3.899E-4	1.995E-3	4.021E-3	7.267E-2
Average (Bias2)	---	6.198E-4	2.627E-3	5.329E-3	3.411E-1
σ (Bias2)	---	1.037E-4	3.279E-4	6.420E-4	9.417E-2
Average+3σ (Bias2)	---	9.308E-4	3.610E-3	7.255E-3	6.235E-1
Average-3σ (Bias2)	---	3.088E-4	1.643E-3	3.403E-3	5.855E-2

30 MeV proton / detailed results

14.CTR5

Ta=25°C; Vce = 20V; If = 10 mA



30 MeV proton / detailed results

CTR5 . (%)

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	357.42	356.72	357.52	355.70	355.45
N° 2 (Bias1)	299.80	247.63	150.80	101.65	10.14
N° 3 (Bias1)	324.06	262.01	154.70	100.94	2.43
N° 4 (Bias1)	296.81	247.34	147.93	95.83	1.92
N° 5 (Bias1)	375.65	296.65	181.32	124.09	3.75
N° 6 (Bias1)	318.87	251.36	149.03	96.98	1.42
N° 7 (Bias2)	388.92	304.31	172.28	109.02	1.41
N° 8 (Bias2)	412.82	312.91	170.63	103.79	0.75
N° 9 (Bias2)	334.37	264.55	158.47	103.75	1.34
N° 10 (Bias2)	396.68	320.26	186.70	118.56	1.49
N° 11 (Bias2)	323.67	256.12	152.94	98.69	1.26
N° 12 (OFF)	360.15	282.82	163.68	102.60	1.78
N° 13 (OFF)	367.61	296.07	177.81	113.74	2.34
N° 14 (OFF)	344.31	277.57	161.88	102.45	2.02
N° 15 (OFF)	414.35	322.21	186.24	117.62	1.97
N° 16 (OFF)	361.27	268.07	149.57	91.90	1.10

1/Delta [CTR5]

	0.p/cm²	1.7E10.p/cm²	8.5E10.p/cm²	1.7E11p/cm²	1.7E12p/cm²
N° 1 (Ref)	---	5.438E-6	-7.779E-7	1.351E-5	1.550E-5
N° 2 (Bias1)	---	7.028E-4	3.296E-3	6.502E-3	9.533E-2
N° 3 (Bias1)	---	7.309E-4	3.378E-3	6.821E-3	4.082E-1
N° 4 (Bias1)	---	6.739E-4	3.391E-3	7.066E-3	5.181E-1
N° 5 (Bias1)	---	7.090E-4	2.853E-3	5.396E-3	2.643E-1
N° 6 (Bias1)	---	8.424E-4	3.574E-3	7.175E-3	6.992E-1
N° 7 (Bias2)	---	7.150E-4	3.233E-3	6.602E-3	7.082E-1
N° 8 (Bias2)	---	7.734E-4	3.438E-3	7.213E-3	1.335E+0
N° 9 (Bias2)	---	7.893E-4	3.320E-3	6.648E-3	7.415E-1
N° 10 (Bias2)	---	6.016E-4	2.835E-3	5.913E-3	6.690E-1
N° 11 (Bias2)	---	8.148E-4	3.449E-3	7.044E-3	7.880E-1
N° 12 (OFF)	---	7.592E-4	3.333E-3	6.970E-3	5.590E-1
N° 13 (OFF)	---	6.572E-4	2.904E-3	6.072E-3	4.251E-1
N° 14 (OFF)	---	6.983E-4	3.273E-3	6.857E-3	4.925E-1
N° 15 (OFF)	---	6.902E-4	2.956E-3	6.089E-3	5.047E-1
N° 16 (OFF)	---	9.624E-4	3.918E-3	8.113E-3	9.050E-1
Average (OFF)	---	7.318E-4	3.299E-3	6.592E-3	3.970E-1
σ (OFF)	---	6.509E-5	2.689E-4	7.167E-4	2.317E-1
Average+3σ (OFF)	---	9.271E-4	4.105E-3	8.742E-3	1.092E+0
Average-3σ (OFF)	---	5.365E-4	2.492E-3	4.442E-3	-2.981E-1
Average (Bias1)	---	7.388E-4	3.255E-3	6.684E-3	8.483E-1
σ (Bias1)	---	8.503E-5	2.509E-4	5.027E-4	2.754E-1
Average+3σ (Bias1)	---	9.939E-4	4.008E-3	8.192E-3	1.674E+0
Average-3σ (Bias1)	---	4.837E-4	2.502E-3	5.176E-3	2.208E-2
Average (Bias2)	---	7.535E-4	3.277E-3	6.820E-3	5.773E-1
σ (Bias2)	---	1.225E-4	4.049E-4	8.351E-4	1.893E-1
Average+3σ (Bias2)	---	1.121E-3	4.491E-3	9.325E-3	1.145E+0
Average-3σ (Bias2)	---	3.861E-4	2.062E-3	4.314E-3	9.379E-3

60 MeV proton / detailed results

CONTENTS

60 MeV proton / detailed results

1. Ir

Ta=25°C; VR = 2 V

60 MeV proton / detailed results

Ir . (µA) **Max = 100.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	5.263E-5	5.695E-5	4.580E-5	4.663E-5	8.452E-5
N° 2 (Bias1)	5.405E-5	3.502E-5	4.772E-5	5.133E-5	2.362E-5
N° 3 (Bias1)	5.242E-5	5.707E-5	4.860E-5	4.370E-5	5.120E-5
N° 4 (Bias1)	5.179E-5	8.528E-5	4.588E-5	4.898E-5	8.331E-5
N° 5 (Bias1)	5.045E-5	3.980E-5	1.406E-5	6.009E-5	7.006E-5
N° 6 (Bias1)	5.330E-5	6.277E-5	5.003E-5	7.493E-5	3.033E-5
N° 7 (Bias2)	5.217E-5	3.842E-5	6.390E-5	4.345E-5	4.957E-5
N° 8 (Bias2)	5.384E-5	7.612E-6	5.493E-5	5.351E-5	5.753E-5
N° 9 (Bias2)	5.292E-5	8.786E-6	4.110E-5	4.714E-5	4.248E-5
N° 10 (Bias2)	4.798E-5	5.736E-5	4.177E-5	3.875E-5	4.353E-5
N° 11 (Bias2)	5.053E-5	4.865E-5	2.034E-5	4.982E-5	1.646E-5
N° 12 (OFF)	4.986E-5	5.715E-5	6.461E-5	4.525E-5	5.124E-5
N° 13 (OFF)	5.254E-5	4.571E-5	6.047E-5	4.064E-5	4.341E-5
N° 14 (OFF)	5.150E-5	3.486E-5	4.714E-5	5.003E-5	5.359E-5
N° 15 (OFF)	4.986E-5	6.181E-5	3.502E-5	5.288E-5	4.894E-5
N° 16 (OFF)	5.246E-5	5.766E-5	5.066E-5	5.074E-5	9.875E-6

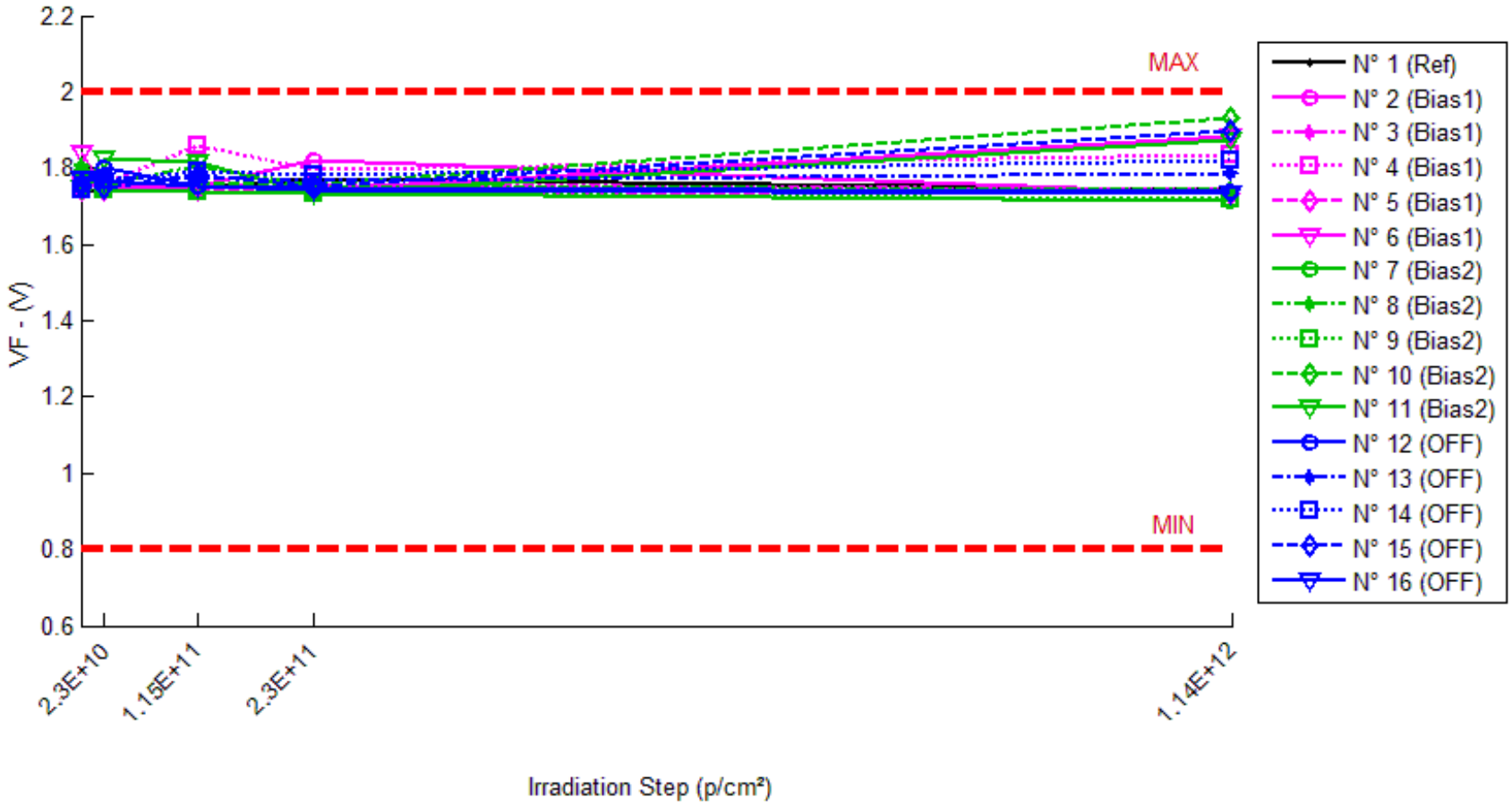
Delta [Ir]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	4.318E-6	-6.832E-6	-5.994E-6	3.190E-5
N° 2 (Bias1)	---	-1.903E-5	-6.329E-6	-2.724E-6	-3.043E-5
N° 3 (Bias1)	---	4.653E-6	-3.814E-6	-8.718E-6	-1.216E-6
N° 4 (Bias1)	---	3.349E-5	-5.910E-6	-2.808E-6	3.152E-5
N° 5 (Bias1)	---	-1.065E-5	-3.639E-5	9.640E-6	1.961E-5
N° 6 (Bias1)	---	9.473E-6	-3.269E-6	2.163E-5	-2.297E-5
N° 7 (Bias2)	---	-1.375E-5	1.174E-5	-8.719E-6	-2.600E-6
N° 8 (Bias2)	---	-4.623E-5	1.089E-6	-3.362E-7	3.687E-6
N° 9 (Bias2)	---	-4.414E-5	-1.182E-5	-5.785E-6	-1.044E-5
N° 10 (Bias2)	---	9.388E-6	-6.204E-6	-9.222E-6	-4.444E-6
N° 11 (Bias2)	---	-1.887E-6	-3.019E-5	-7.133E-7	-3.408E-5
N° 12 (OFF)	---	7.292E-6	1.475E-5	-4.611E-6	1.383E-6
N° 13 (OFF)	---	-6.832E-6	7.922E-6	-1.190E-5	-9.138E-6
N° 14 (OFF)	---	-1.664E-5	-4.359E-6	-1.467E-6	2.095E-6
N° 15 (OFF)	---	1.194E-5	-1.484E-5	3.018E-6	-9.227E-7
N° 16 (OFF)	---	5.197E-6	-1.803E-6	-1.719E-6	-4.258E-5
Average (OFF)	---	3.588E-6	-1.114E-5	3.403E-6	-6.967E-7
s (OFF)	---	2.027E-5	1.418E-5	1.219E-5	2.660E-5
Average+3s (OFF)	---	6.441E-5	3.138E-5	3.996E-5	7.911E-5
Average-3s (OFF)	---	-5.723E-5	-5.367E-5	-3.316E-5	-8.050E-5
Average (Bias1)	---	-1.932E-5	-7.078E-6	-4.955E-6	-9.574E-6
s (Bias1)	---	2.500E-5	1.564E-5	4.254E-6	1.459E-5
Average+3s (Bias1)	---	5.566E-5	3.983E-5	7.807E-6	3.421E-5
Average-3s (Bias1)	---	-9.431E-5	-5.399E-5	-1.772E-5	-5.336E-5
Average (Bias2)	---	1.923E-7	3.351E-7	-3.336E-6	-9.834E-6
s (Bias2)	---	1.169E-5	1.143E-5	5.512E-6	1.885E-5
Average+3s (Bias2)	---	3.525E-5	3.461E-5	1.320E-5	4.670E-5
Average-3s (Bias2)	---	-3.487E-5	-3.394E-5	-1.987E-5	-6.637E-5

60 MeV proton / detailed results

2. VF

Ta=25°C; If = 10 mA



60 MeV proton / detailed results

VF . (V) **Min = 0.8 Max = 2.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	1.739	1.743	1.750	1.774	1.743
N° 2 (Bias1)	1.749	1.764	1.751	1.821	1.732
N° 3 (Bias1)	1.759	1.749	1.752	1.756	1.745
N° 4 (Bias1)	1.761	1.760	1.859	1.797	1.833
N° 5 (Bias1)	1.744	1.741	1.743	1.739	1.734
N° 6 (Bias1)	1.839	1.748	1.754	1.744	1.883
N° 7 (Bias2)	1.785	1.743	1.738	1.735	1.716
N° 8 (Bias2)	1.807	1.759	1.807	1.752	1.741
N° 9 (Bias2)	1.745	1.743	1.739	1.734	1.718
N° 10 (Bias2)	1.768	1.762	1.756	1.760	1.931
N° 11 (Bias2)	1.750	1.823	1.816	1.734	1.876
N° 12 (OFF)	1.755	1.801	1.753	1.750	1.738
N° 13 (OFF)	1.767	1.770	1.777	1.769	1.785
N° 14 (OFF)	1.741	1.769	1.790	1.783	1.822
N° 15 (OFF)	1.757	1.750	1.781	1.752	1.898
N° 16 (OFF)	1.771	1.767	1.753	1.744	1.733

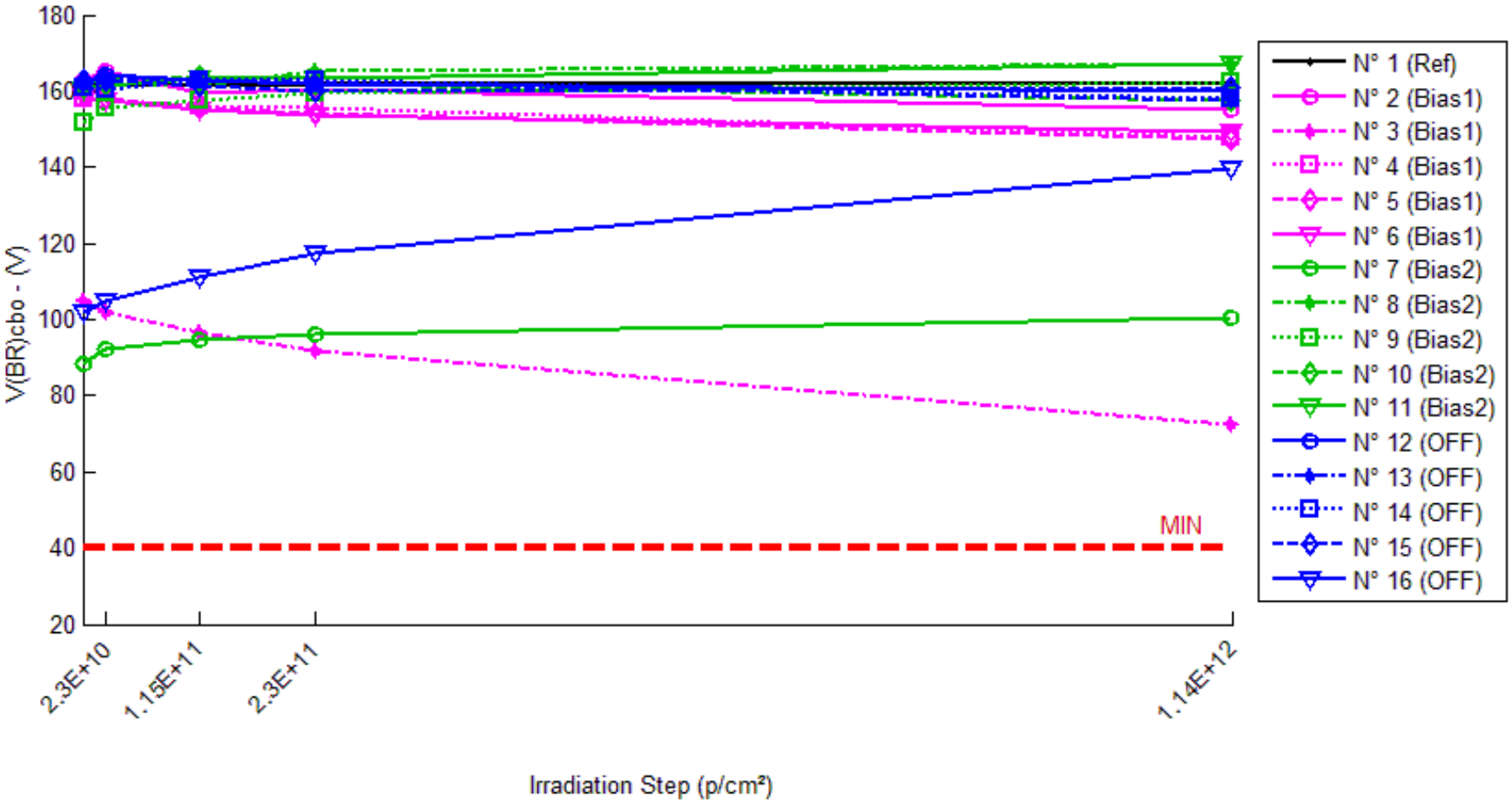
Delta [VF]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	4.549E-3	1.135E-2	3.515E-2	4.437E-3
N° 2 (Bias1)	---	1.406E-2	1.959E-3	7.193E-2	-1.794E-2
N° 3 (Bias1)	---	-9.777E-3	-7.072E-3	-3.607E-3	-1.450E-2
N° 4 (Bias1)	---	-1.446E-3	9.759E-2	3.531E-2	7.133E-2
N° 5 (Bias1)	---	-2.908E-3	-1.097E-3	-5.280E-3	-9.786E-3
N° 6 (Bias1)	---	-9.110E-2	-8.507E-2	-9.450E-2	4.426E-2
N° 7 (Bias2)	---	-4.230E-2	-4.734E-2	-5.058E-2	-6.906E-2
N° 8 (Bias2)	---	-4.752E-2	9.120E-4	-5.501E-2	-6.558E-2
N° 9 (Bias2)	---	-2.505E-3	-5.966E-3	-1.123E-2	-2.767E-2
N° 10 (Bias2)	---	-6.140E-3	-1.212E-2	-7.777E-3	1.633E-1
N° 11 (Bias2)	---	7.249E-2	6.592E-2	-1.669E-2	1.260E-1
N° 12 (OFF)	---	4.631E-2	-1.425E-3	-4.411E-3	-1.717E-2
N° 13 (OFF)	---	3.077E-3	9.834E-3	2.001E-3	1.762E-2
N° 14 (OFF)	---	2.724E-2	4.852E-2	4.201E-2	8.095E-2
N° 15 (OFF)	---	-7.337E-3	2.359E-2	-5.306E-3	1.407E-1
N° 16 (OFF)	---	-3.941E-3	-1.810E-2	-2.673E-2	-3.785E-2
Average (OFF)	---	-1.823E-2	1.262E-3	7.706E-4	1.467E-2
s (OFF)	---	4.165E-2	6.482E-2	6.203E-2	4.061E-2
Average+3s (OFF)	---	1.067E-1	1.957E-1	1.868E-1	1.365E-1
Average-3s (OFF)	---	-1.432E-1	-1.932E-1	-1.853E-1	-1.072E-1
Average (Bias1)	---	-5.196E-3	2.790E-4	-2.826E-2	2.539E-2
s (Bias1)	---	4.799E-2	4.114E-2	2.268E-2	1.108E-1
Average+3s (Bias1)	---	1.388E-1	1.237E-1	3.977E-2	3.579E-1
Average-3s (Bias1)	---	-1.492E-1	-1.231E-1	-9.629E-2	-3.071E-1
Average (Bias2)	---	1.307E-2	1.249E-2	1.513E-3	3.686E-2
s (Bias2)	---	2.298E-2	2.529E-2	2.510E-2	7.350E-2
Average+3s (Bias2)	---	8.200E-2	8.835E-2	7.680E-2	2.574E-1
Average-3s (Bias2)	---	-5.586E-2	-6.338E-2	-7.378E-2	-1.836E-1

60 MeV proton / detailed results

3. V(BR)cbo

Ta=25°C; Ic = 100 µA; If = 0



60 MeV proton / detailed results

V(BR)cbo . (V) **Min = 40.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	161.80	161.47	161.50	161.64	161.76
N° 2 (Bias1)	162.85	165.16	159.22	160.44	155.22
N° 3 (Bias1)	104.74	101.99	96.38	91.55	72.23
N° 4 (Bias1)	158.23	157.75	156.29	155.63	148.03
N° 5 (Bias1)	159.49	157.95	155.78	154.38	147.18
N° 6 (Bias1)	158.66	157.51	154.89	153.76	149.35
N° 7 (Bias2)	88.61	92.27	94.90	96.29	100.33
N° 8 (Bias2)	160.87	162.22	161.57	165.33	167.19
N° 9 (Bias2)	151.74	155.66	157.54	159.48	162.40
N° 10 (Bias2)	162.91	162.95	163.57	161.73	157.73
N° 11 (Bias2)	160.27	161.22	163.39	163.48	167.40
N° 12 (OFF)	162.50	164.22	162.61	161.93	160.03
N° 13 (OFF)	161.25	163.05	163.01	162.44	157.41
N° 14 (OFF)	160.93	160.59	163.03	162.71	157.82
N° 15 (OFF)	162.90	163.06	161.63	160.04	161.10
N° 16 (OFF)	101.82	105.05	111.26	117.48	139.75

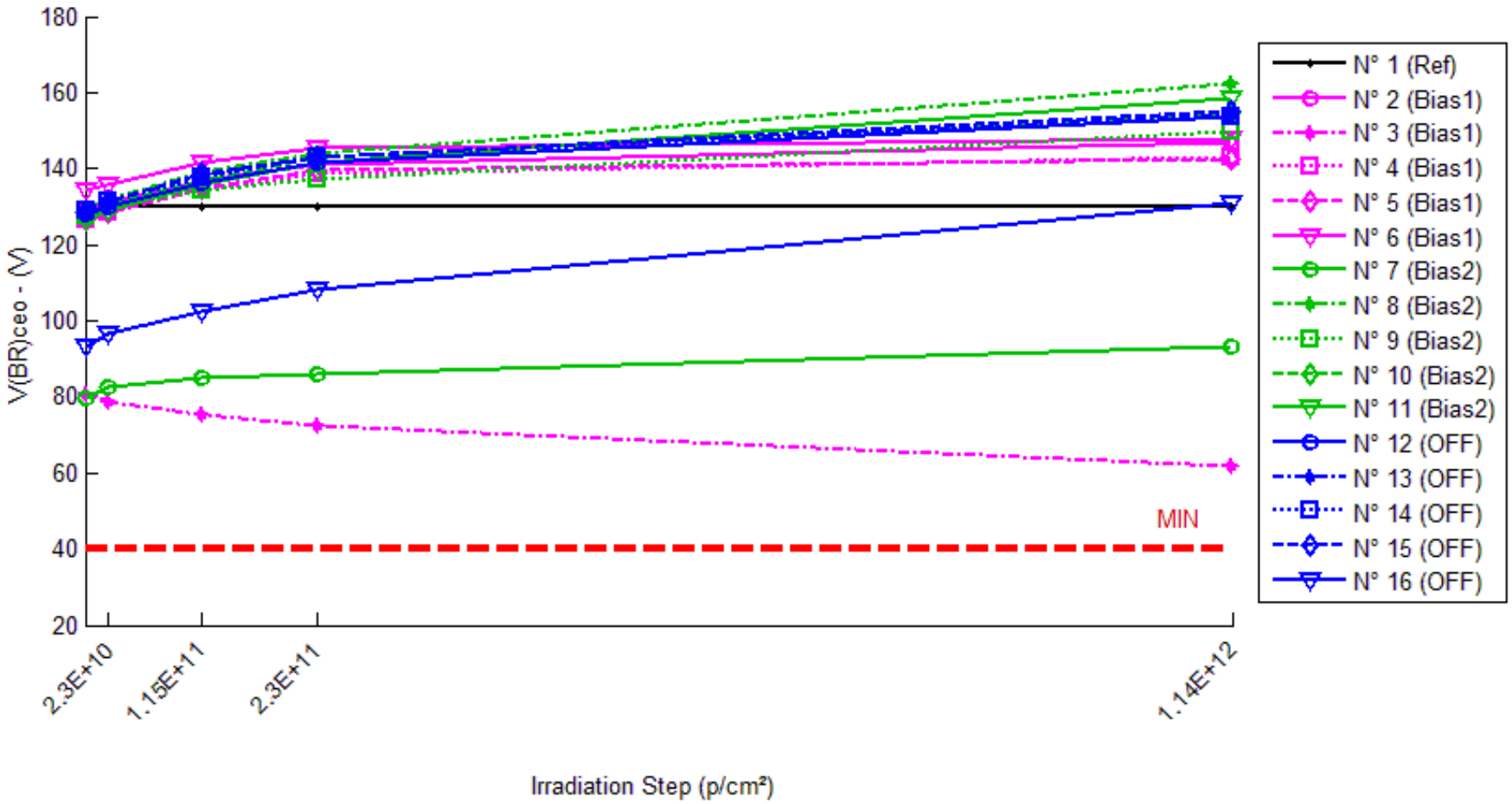
Delta [V(BR)cbo]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-3.320E-1	-3.020E-1	-1.639E-1	-4.420E-2
N° 2 (Bias1)	---	2.313E+0	-3.626E+0	-2.414E+0	-7.633E+0
N° 3 (Bias1)	---	-2.748E+0	-8.358E+0	-1.319E+1	-3.250E+1
N° 4 (Bias1)	---	-4.831E-1	-1.947E+0	-2.602E+0	-1.020E+1
N° 5 (Bias1)	---	-1.546E+0	-3.717E+0	-5.110E+0	-1.231E+1
N° 6 (Bias1)	---	-1.156E+0	-3.773E+0	-4.905E+0	-9.314E+0
N° 7 (Bias2)	---	3.663E+0	6.293E+0	7.685E+0	1.172E+1
N° 8 (Bias2)	---	1.347E+0	6.962E-1	4.455E+0	6.319E+0
N° 9 (Bias2)	---	3.928E+0	5.799E+0	7.746E+0	1.066E+1
N° 10 (Bias2)	---	4.770E-2	6.643E-1	-1.174E+0	-5.175E+0
N° 11 (Bias2)	---	9.452E-1	3.117E+0	3.211E+0	7.134E+0
N° 12 (OFF)	---	1.717E+0	1.070E-1	-5.658E-1	-2.469E+0
N° 13 (OFF)	---	1.803E+0	1.762E+0	1.194E+0	-3.839E+0
N° 14 (OFF)	---	-3.442E-1	2.102E+0	1.776E+0	-3.114E+0
N° 15 (OFF)	---	1.630E-1	-1.272E+0	-2.863E+0	-1.804E+0
N° 16 (OFF)	---	3.227E+0	9.437E+0	1.566E+1	3.793E+1
Average (OFF)	---	-7.240E-1	-4.284E+0	-5.644E+0	-1.439E+1
s (OFF)	---	1.887E+0	2.402E+0	4.399E+0	1.026E+1
Average+3s (OFF)	---	4.936E+0	2.921E+0	7.552E+0	1.640E+1
Average-3s (OFF)	---	-6.384E+0	-1.149E+1	-1.884E+1	-4.518E+1
Average (Bias1)	---	1.986E+0	3.314E+0	4.385E+0	6.133E+0
s (Bias1)	---	1.720E+0	2.691E+0	3.690E+0	6.720E+0
Average+3s (Bias1)	---	7.146E+0	1.139E+1	1.546E+1	2.629E+1
Average-3s (Bias1)	---	-3.174E+0	-4.759E+0	-6.686E+0	-1.403E+1
Average (Bias2)	---	1.313E+0	2.427E+0	3.040E+0	5.341E+0
s (Bias2)	---	1.426E+0	4.146E+0	7.282E+0	1.823E+1
Average+3s (Bias2)	---	5.592E+0	1.486E+1	2.489E+1	6.004E+1
Average-3s (Bias2)	---	-2.965E+0	-1.001E+1	-1.881E+1	-4.936E+1

60 MeV proton / detailed results

4. V(BR)ceo

Ta=25°C; Ic = 1 mA; Ib = 0; If = 0



60 MeV proton / detailed results

V(BR)ceo . (V) **Min = 40.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	130.16	130.13	130.11	130.16	130.16
N° 2 (Bias1)	129.09	130.91	136.51	141.29	146.90
N° 3 (Bias1)	80.56	78.81	75.23	72.27	61.70
N° 4 (Bias1)	126.81	128.67	134.09	138.78	143.18
N° 5 (Bias1)	126.35	128.44	134.62	139.75	142.50
N° 6 (Bias1)	134.21	135.94	141.67	145.67	148.07
N° 7 (Bias2)	79.91	82.78	85.01	86.19	93.06
N° 8 (Bias2)	129.40	131.72	139.18	144.13	162.14
N° 9 (Bias2)	127.79	129.97	134.19	137.10	149.69
N° 10 (Bias2)	128.63	130.79	136.96	143.04	154.66
N° 11 (Bias2)	126.81	129.02	135.82	141.66	158.25
N° 12 (OFF)	127.84	130.06	136.28	141.59	153.53
N° 13 (OFF)	128.93	131.32	138.06	142.91	154.38
N° 14 (OFF)	128.99	131.37	137.56	143.15	153.76
N° 15 (OFF)	128.93	131.44	138.84	143.25	155.28
N° 16 (OFF)	93.35	96.42	102.59	108.25	131.09

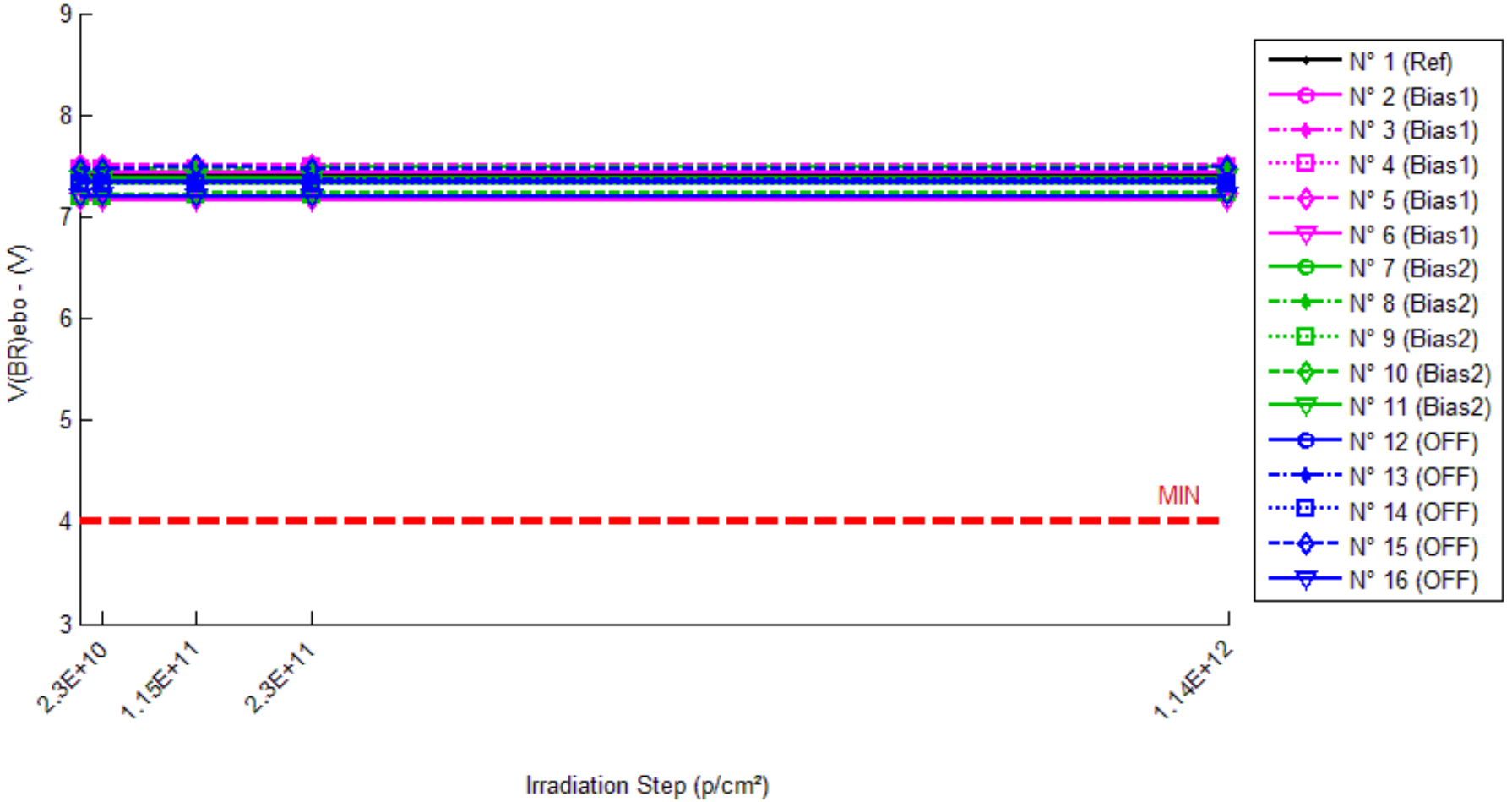
Delta [V(BR)ceo]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-3.130E-2	-5.480E-2	-7.200E-3	-3.000E-4
N° 2 (Bias1)	---	1.816E+0	7.414E+0	1.220E+1	1.780E+1
N° 3 (Bias1)	---	-1.755E+0	-5.337E+0	-8.289E+0	-1.886E+1
N° 4 (Bias1)	---	1.862E+0	7.279E+0	1.198E+1	1.637E+1
N° 5 (Bias1)	---	2.088E+0	8.267E+0	1.340E+1	1.615E+1
N° 6 (Bias1)	---	1.725E+0	7.458E+0	1.146E+1	1.386E+1
N° 7 (Bias2)	---	2.864E+0	5.094E+0	6.275E+0	1.314E+1
N° 8 (Bias2)	---	2.324E+0	9.785E+0	1.473E+1	3.274E+1
N° 9 (Bias2)	---	2.182E+0	6.396E+0	9.307E+0	2.189E+1
N° 10 (Bias2)	---	2.164E+0	8.326E+0	1.441E+1	2.603E+1
N° 11 (Bias2)	---	2.206E+0	9.003E+0	1.485E+1	3.143E+1
N° 12 (OFF)	---	2.220E+0	8.432E+0	1.375E+1	2.569E+1
N° 13 (OFF)	---	2.389E+0	9.127E+0	1.398E+1	2.545E+1
N° 14 (OFF)	---	2.388E+0	8.573E+0	1.417E+1	2.477E+1
N° 15 (OFF)	---	2.510E+0	9.912E+0	1.432E+1	2.636E+1
N° 16 (OFF)	---	3.069E+0	9.239E+0	1.490E+1	3.774E+1
Average (OFF)	---	1.147E+0	5.016E+0	8.150E+0	9.064E+0
s (OFF)	---	1.628E+0	5.801E+0	9.217E+0	1.568E+1
Average+3s (OFF)	---	6.031E+0	2.242E+1	3.580E+1	5.609E+1
Average-3s (OFF)	---	-3.737E+0	-1.239E+1	-1.950E+1	-3.797E+1
Average (Bias1)	---	2.348E+0	7.721E+0	1.191E+1	2.505E+1
s (Bias1)	---	2.950E-1	1.932E+0	3.917E+0	7.946E+0
Average+3s (Bias1)	---	3.233E+0	1.352E+1	2.366E+1	4.889E+1
Average-3s (Bias1)	---	1.463E+0	1.925E+0	1.634E-1	1.210E+0
Average (Bias2)	---	2.515E+0	9.057E+0	1.422E+1	2.800E+1
s (Bias2)	---	3.261E-1	5.905E-1	4.358E-1	5.472E+0
Average+3s (Bias2)	---	3.494E+0	1.083E+1	1.553E+1	4.442E+1
Average-3s (Bias2)	---	1.537E+0	7.285E+0	1.292E+1	1.158E+1

60 MeV proton / detailed results

5. V(BR)ebo

Ta=25°C; Ic = 0; Ie = 100 µA; If = 0



60 MeV proton / detailed results

V(BR)ebo . (V) **Min = 4.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	7.419	7.412	7.412	7.414	7.414
N° 2 (Bias1)	7.428	7.431	7.431	7.436	7.458
N° 3 (Bias1)	7.368	7.359	7.361	7.364	7.373
N° 4 (Bias1)	7.471	7.472	7.472	7.478	7.482
N° 5 (Bias1)	7.505	7.500	7.501	7.503	7.504
N° 6 (Bias1)	7.154	7.152	7.157	7.160	7.163
N° 7 (Bias2)	7.327	7.324	7.330	7.332	7.346
N° 8 (Bias2)	7.476	7.472	7.475	7.481	7.490
N° 9 (Bias2)	7.203	7.201	7.206	7.210	7.229
N° 10 (Bias2)	7.218	7.217	7.228	7.224	7.242
N° 11 (Bias2)	7.373	7.369	7.381	7.375	7.392
N° 12 (OFF)	7.341	7.342	7.340	7.341	7.354
N° 13 (OFF)	7.351	7.353	7.350	7.353	7.358
N° 14 (OFF)	7.321	7.316	7.325	7.327	7.332
N° 15 (OFF)	7.476	7.471	7.497	7.474	7.482
N° 16 (OFF)	7.202	7.206	7.204	7.202	7.209

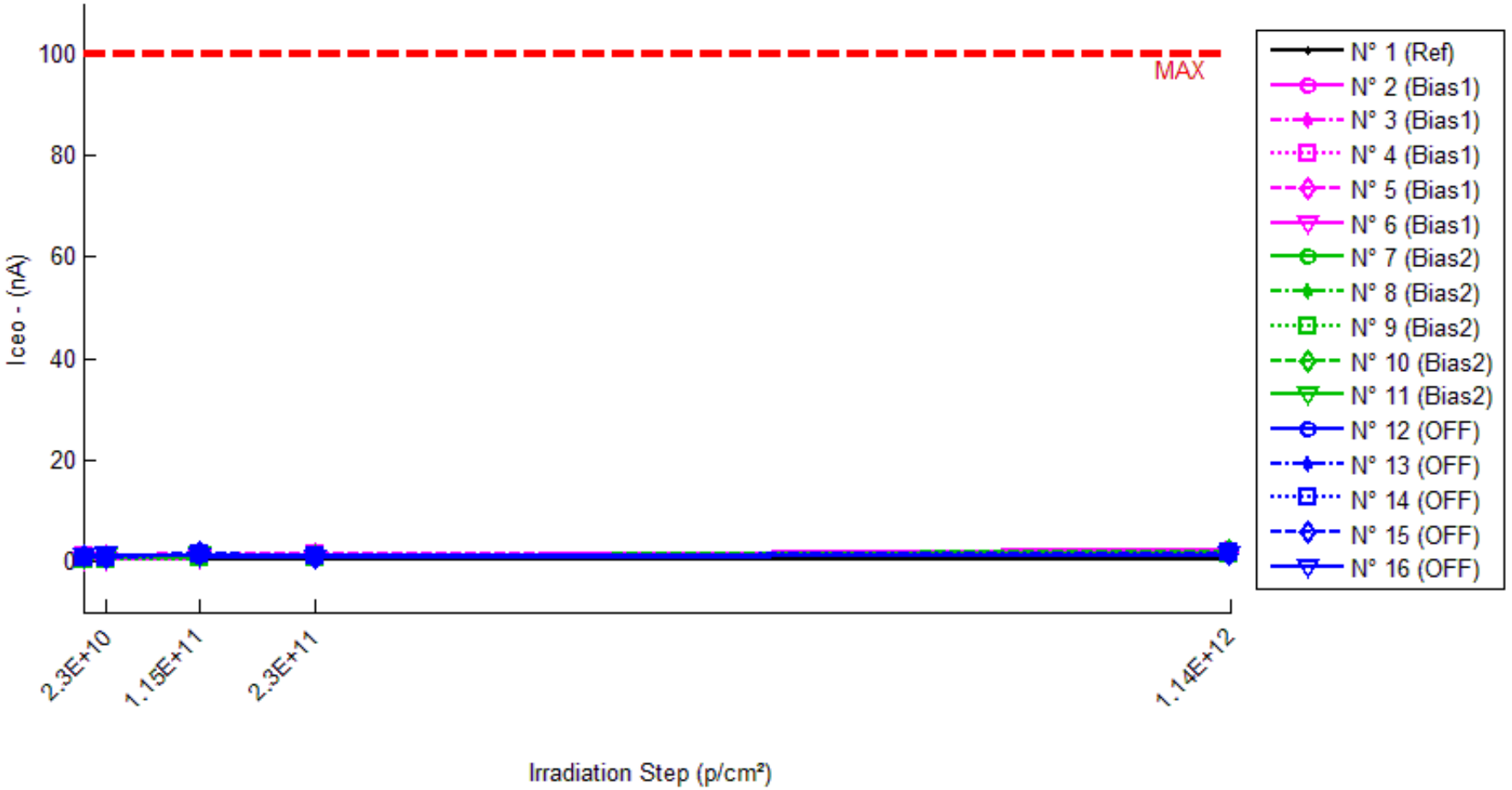
Delta [V(BR)ebo]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-6.305E-3	-7.113E-3	-4.548E-3	-4.473E-3
N° 2 (Bias1)	---	2.932E-3	2.740E-3	7.915E-3	2.966E-2
N° 3 (Bias1)	---	-8.229E-3	-6.215E-3	-4.058E-3	5.620E-3
N° 4 (Bias1)	---	4.050E-4	1.010E-4	6.974E-3	1.042E-2
N° 5 (Bias1)	---	-4.981E-3	-4.569E-3	-2.435E-3	-7.060E-4
N° 6 (Bias1)	---	-2.605E-3	2.475E-3	5.449E-3	8.714E-3
N° 7 (Bias2)	---	-2.674E-3	3.355E-3	5.093E-3	1.940E-2
N° 8 (Bias2)	---	-4.738E-3	-1.006E-3	4.854E-3	1.341E-2
N° 9 (Bias2)	---	-2.121E-3	2.275E-3	6.661E-3	2.622E-2
N° 10 (Bias2)	---	-9.320E-4	9.598E-3	5.942E-3	2.397E-2
N° 11 (Bias2)	---	-3.828E-3	7.305E-3	1.661E-3	1.855E-2
N° 12 (OFF)	---	1.632E-3	-1.159E-3	2.120E-4	1.372E-2
N° 13 (OFF)	---	1.499E-3	-1.646E-3	1.517E-3	6.365E-3
N° 14 (OFF)	---	-5.079E-3	3.572E-3	6.011E-3	1.025E-2
N° 15 (OFF)	---	-5.199E-3	2.062E-2	-2.131E-3	6.070E-3
N° 16 (OFF)	---	4.096E-3	1.974E-3	4.250E-4	7.573E-3
Average (OFF)	---	-2.496E-3	-1.094E-3	2.769E-3	1.074E-2
s (OFF)	---	4.386E-3	4.098E-3	5.591E-3	1.140E-2
Average+3s (OFF)	---	1.066E-2	1.120E-2	1.954E-2	4.493E-2
Average-3s (OFF)	---	-1.565E-2	-1.339E-2	-1.400E-2	-2.345E-2
Average (Bias1)	---	-2.859E-3	4.305E-3	4.842E-3	2.031E-2
s (Bias1)	---	1.480E-3	4.191E-3	1.917E-3	4.997E-3
Average+3s (Bias1)	---	1.581E-3	1.688E-2	1.059E-2	3.530E-2
Average-3s (Bias1)	---	-7.299E-3	-8.267E-3	-9.090E-4	5.318E-3
Average (Bias2)	---	-6.102E-4	4.673E-3	1.207E-3	8.796E-3
s (Bias2)	---	4.262E-3	9.177E-3	2.997E-3	3.210E-3
Average+3s (Bias2)	---	1.218E-2	3.220E-2	1.020E-2	1.843E-2
Average-3s (Bias2)	---	-1.340E-2	-2.286E-2	-7.783E-3	-8.349E-4

60 MeV proton / detailed results

6. Iceo

Ta=25°C; Vce=20V



60 MeV proton / detailed results

Iceo . (nA) **Max = 100.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	0.227	0.228	0.216	0.211	0.247
N° 2 (Bias1)	0.510	0.785	0.998	0.989	2.443
N° 3 (Bias1)	0.793	0.880	0.933	0.781	1.298
N° 4 (Bias1)	0.948	1.162	1.336	1.447	1.741
N° 5 (Bias1)	0.880	1.219	1.890	1.294	1.760
N° 6 (Bias1)	0.305	0.375	0.568	0.703	1.295
N° 7 (Bias2)	0.641	0.701	1.075	0.905	1.657
N° 8 (Bias2)	0.617	0.704	0.698	0.751	1.504
N° 9 (Bias2)	0.476	0.457	0.540	0.599	1.471
N° 10 (Bias2)	0.602	0.744	1.435	1.072	2.085
N° 11 (Bias2)	0.965	0.959	1.242	0.847	1.550
N° 12 (OFF)	0.860	0.970	1.146	0.957	1.410
N° 13 (OFF)	0.631	0.922	1.137	0.971	1.639
N° 14 (OFF)	0.589	0.735	1.307	1.233	1.894
N° 15 (OFF)	0.890	0.812	1.613	0.733	1.312
N° 16 (OFF)	0.894	1.292	1.215	0.829	1.269

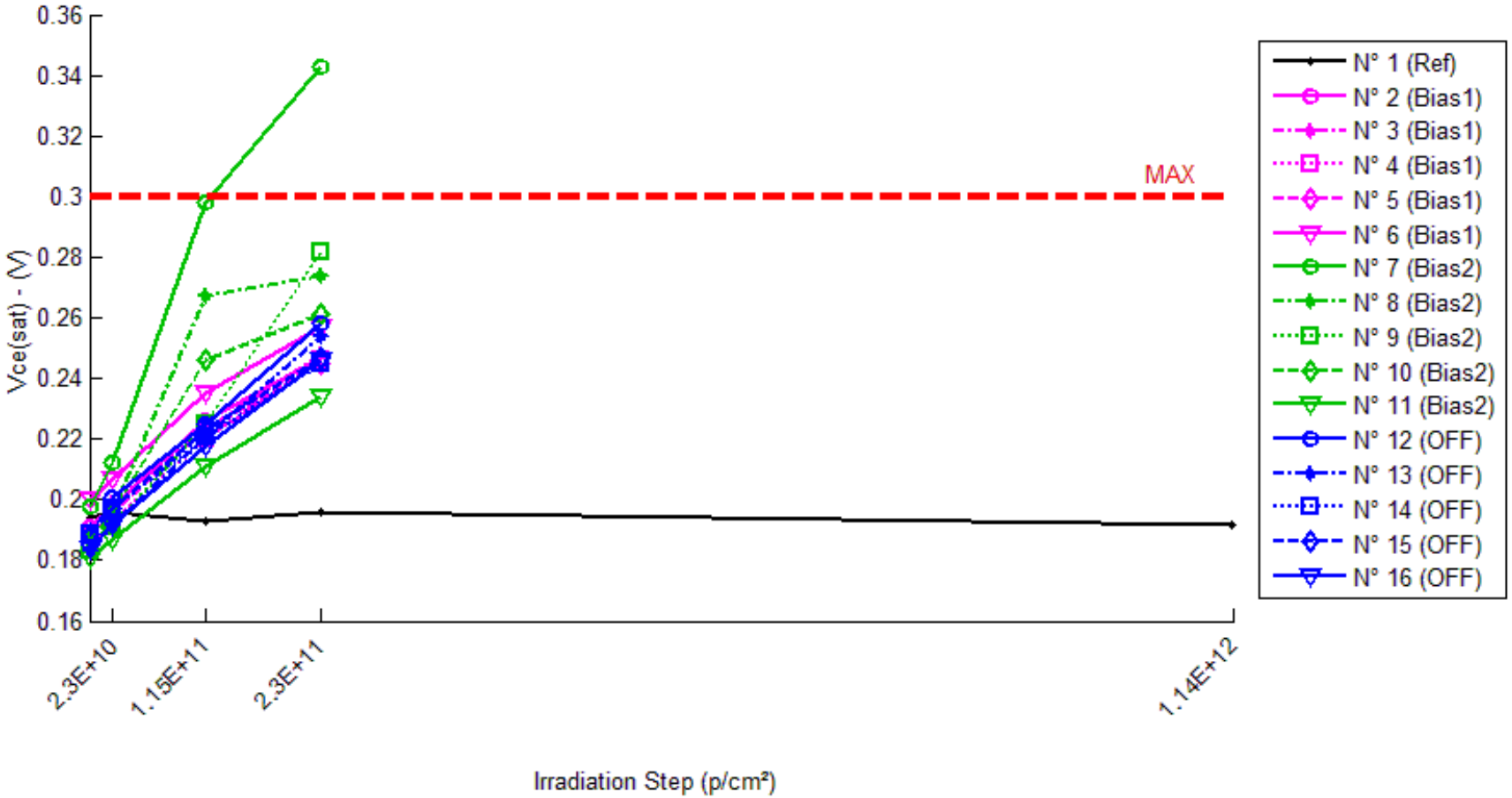
Delta [Iceo]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	1.478E-3	-1.046E-2	-1.562E-2	1.967E-2
N° 2 (Bias1)	---	2.750E-1	4.883E-1	4.794E-1	1.933E+0
N° 3 (Bias1)	---	8.627E-2	1.401E-1	-1.195E-2	5.046E-1
N° 4 (Bias1)	---	2.140E-1	3.872E-1	4.986E-1	7.923E-1
N° 5 (Bias1)	---	3.389E-1	1.010E+0	4.138E-1	8.802E-1
N° 6 (Bias1)	---	6.933E-2	2.627E-1	3.979E-1	9.897E-1
N° 7 (Bias2)	---	6.002E-2	4.348E-1	2.645E-1	1.016E+0
N° 8 (Bias2)	---	8.676E-2	8.099E-2	1.345E-1	8.869E-1
N° 9 (Bias2)	---	-1.849E-2	6.411E-2	1.230E-1	9.956E-1
N° 10 (Bias2)	---	1.420E-1	8.327E-1	4.696E-1	1.483E+0
N° 11 (Bias2)	---	-5.842E-3	2.768E-1	-1.177E-1	5.852E-1
N° 12 (OFF)	---	1.100E-1	2.862E-1	9.698E-2	5.504E-1
N° 13 (OFF)	---	2.914E-1	5.059E-1	3.394E-1	1.008E+0
N° 14 (OFF)	---	1.467E-1	7.189E-1	6.444E-1	1.305E+0
N° 15 (OFF)	---	-7.791E-2	7.233E-1	-1.568E-1	4.226E-1
N° 16 (OFF)	---	3.979E-1	3.211E-1	-6.544E-2	3.746E-1
Average (OFF)	---	1.967E-1	4.576E-1	3.556E-1	1.020E+0
s (OFF)	---	1.173E-1	3.353E-1	2.098E-1	5.412E-1
Average+3s (OFF)	---	5.487E-1	1.463E+0	9.849E-1	2.643E+0
Average-3s (OFF)	---	-1.553E-1	-5.483E-1	-2.738E-1	-6.036E-1
Average (Bias1)	---	5.289E-2	3.379E-1	1.748E-1	9.933E-1
s (Bias1)	---	6.649E-2	3.158E-1	2.149E-1	3.232E-1
Average+3s (Bias1)	---	2.524E-1	1.285E+0	8.196E-1	1.963E+0
Average-3s (Bias1)	---	-1.466E-1	-6.095E-1	-4.700E-1	2.376E-2
Average (Bias2)	---	1.736E-1	5.111E-1	1.717E-1	7.321E-1
s (Bias2)	---	1.818E-1	2.091E-1	3.245E-1	4.065E-1
Average+3s (Bias2)	---	7.191E-1	1.138E+0	1.145E+0	1.952E+0
Average-3s (Bias2)	---	-3.718E-1	-1.162E-1	-8.019E-1	-4.874E-1

60 MeV proton / detailed results

7. Vce(sat)

Ta=25°C; If = 20 mA; Ic = 10 mA



60 MeV proton / detailed results

Vce(sat) . (V) **Max = 0.3**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	0.194	0.196	0.193	0.196	0.192
N° 2 (Bias1)	0.191	0.198	0.226	0.247	Not Measurable
N° 3 (Bias1)	0.187	0.199	0.223	0.248	Not Measurable
N° 4 (Bias1)	0.183	0.193	0.220	0.246	Not Measurable
N° 5 (Bias1)	0.188	0.196	0.223	0.245	Not Measurable
N° 6 (Bias1)	0.200	0.207	0.235	0.257	Not Measurable
N° 7 (Bias2)	0.198	0.212	0.298	0.343	Not Measurable
N° 8 (Bias2)	0.188	0.196	0.267	0.274	Not Measurable
N° 9 (Bias2)	0.183	0.191	0.225	0.282	Not Measurable
N° 10 (Bias2)	0.187	0.196	0.246	0.261	Not Measurable
N° 11 (Bias2)	0.181	0.187	0.211	0.234	Not Measurable
N° 12 (OFF)	0.188	0.201	0.225	0.258	Not Measurable
N° 13 (OFF)	0.183	0.192	0.221	0.254	Not Measurable
N° 14 (OFF)	0.189	0.197	0.221	0.245	Not Measurable
N° 15 (OFF)	0.189	0.197	0.223	0.247	Not Measurable
N° 16 (OFF)	0.184	0.192	0.218	0.246	Not Measurable

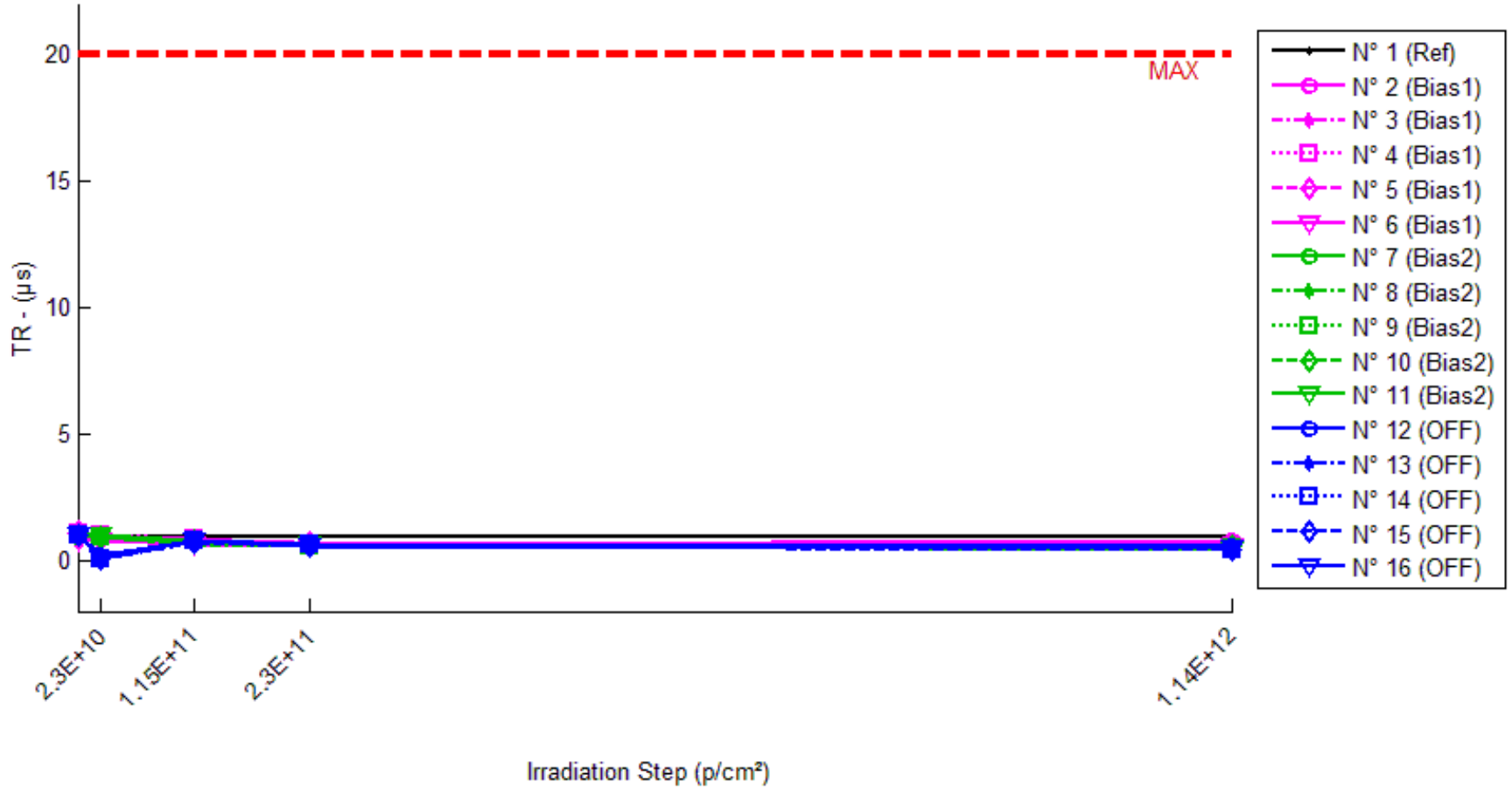
Delta [Vce(sat)]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	1.918E-3	-1.128E-3	2.127E-3	-1.649E-3
N° 2 (Bias1)	---	7.068E-3	3.443E-2	5.609E-2	NaN
N° 3 (Bias1)	---	1.150E-2	3.579E-2	6.130E-2	NaN
N° 4 (Bias1)	---	9.961E-3	3.725E-2	6.351E-2	NaN
N° 5 (Bias1)	---	7.813E-3	3.501E-2	5.609E-2	NaN
N° 6 (Bias1)	---	6.654E-3	3.503E-2	5.667E-2	NaN
N° 7 (Bias2)	---	1.385E-2	9.935E-2	1.445E-1	NaN
N° 8 (Bias2)	---	7.850E-3	7.896E-2	8.515E-2	NaN
N° 9 (Bias2)	---	8.021E-3	4.130E-2	9.827E-2	NaN
N° 10 (Bias2)	---	9.176E-3	5.885E-2	7.341E-2	NaN
N° 11 (Bias2)	---	6.100E-3	3.078E-2	5.370E-2	NaN
N° 12 (OFF)	---	1.375E-2	3.726E-2	7.038E-2	NaN
N° 13 (OFF)	---	9.357E-3	3.826E-2	7.094E-2	NaN
N° 14 (OFF)	---	8.272E-3	3.204E-2	5.579E-2	NaN
N° 15 (OFF)	---	7.673E-3	3.315E-2	5.749E-2	NaN
N° 16 (OFF)	---	7.843E-3	3.390E-2	6.159E-2	NaN
Average (OFF)	---	8.600E-3	3.550E-2	5.873E-2	NaN
s (OFF)	---	2.064E-3	1.092E-3	3.452E-3	0.000E+0
Average+3s (OFF)	---	1.479E-2	3.878E-2	6.909E-2	NaN
Average-3s (OFF)	---	2.409E-3	3.223E-2	4.837E-2	NaN
Average (Bias1)	---	8.999E-3	6.185E-2	9.101E-2	NaN
s (Bias1)	---	2.925E-3	2.782E-2	3.410E-2	0.000E+0
Average+3s (Bias1)	---	1.778E-2	1.453E-1	1.933E-1	NaN
Average-3s (Bias1)	---	2.226E-4	-2.161E-2	-1.129E-2	NaN
Average (Bias2)	---	9.379E-3	3.492E-2	6.324E-2	NaN
s (Bias2)	---	2.529E-3	2.697E-3	7.098E-3	0.000E+0
Average+3s (Bias2)	---	1.697E-2	4.301E-2	8.453E-2	NaN
Average-3s (Bias2)	---	1.792E-3	2.683E-2	4.194E-2	NaN

60 MeV proton / detailed results

8. TR

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



60 MeV proton / detailed results

TR . (µs) **Max = 20.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	1.00	0.96	0.96	1.00	0.96
N° 2 (Bias1)	1.00	0.96	0.84	0.68	0.80
N° 3 (Bias1)	1.04	0.96	0.80	0.72	0.50
N° 4 (Bias1)	1.08	1.00	0.84	0.68	0.60
N° 5 (Bias1)	1.12	0.96	0.80	0.72	0.40
N° 6 (Bias1)	0.80	0.76	0.64	0.56	0.60
N° 7 (Bias2)	0.96	0.92	0.72	0.60	0.48
N° 8 (Bias2)	1.00	0.96	0.68	0.56	0.52
N° 9 (Bias2)	1.04	0.92	0.76	0.60	0.48
N° 10 (Bias2)	1.00	0.92	0.76	0.60	0.56
N° 11 (Bias2)	1.04	1.00	0.76	0.64	0.44
N° 12 (OFF)	1.00	0.20	0.80	0.64	0.56
N° 13 (OFF)	1.04	0.10	0.76	0.64	0.48
N° 14 (OFF)	1.00	0.10	0.76	0.64	0.44
N° 15 (OFF)	1.04	0.10	0.72	0.60	0.40
N° 16 (OFF)	1.00	0.10	0.76	0.60	0.48

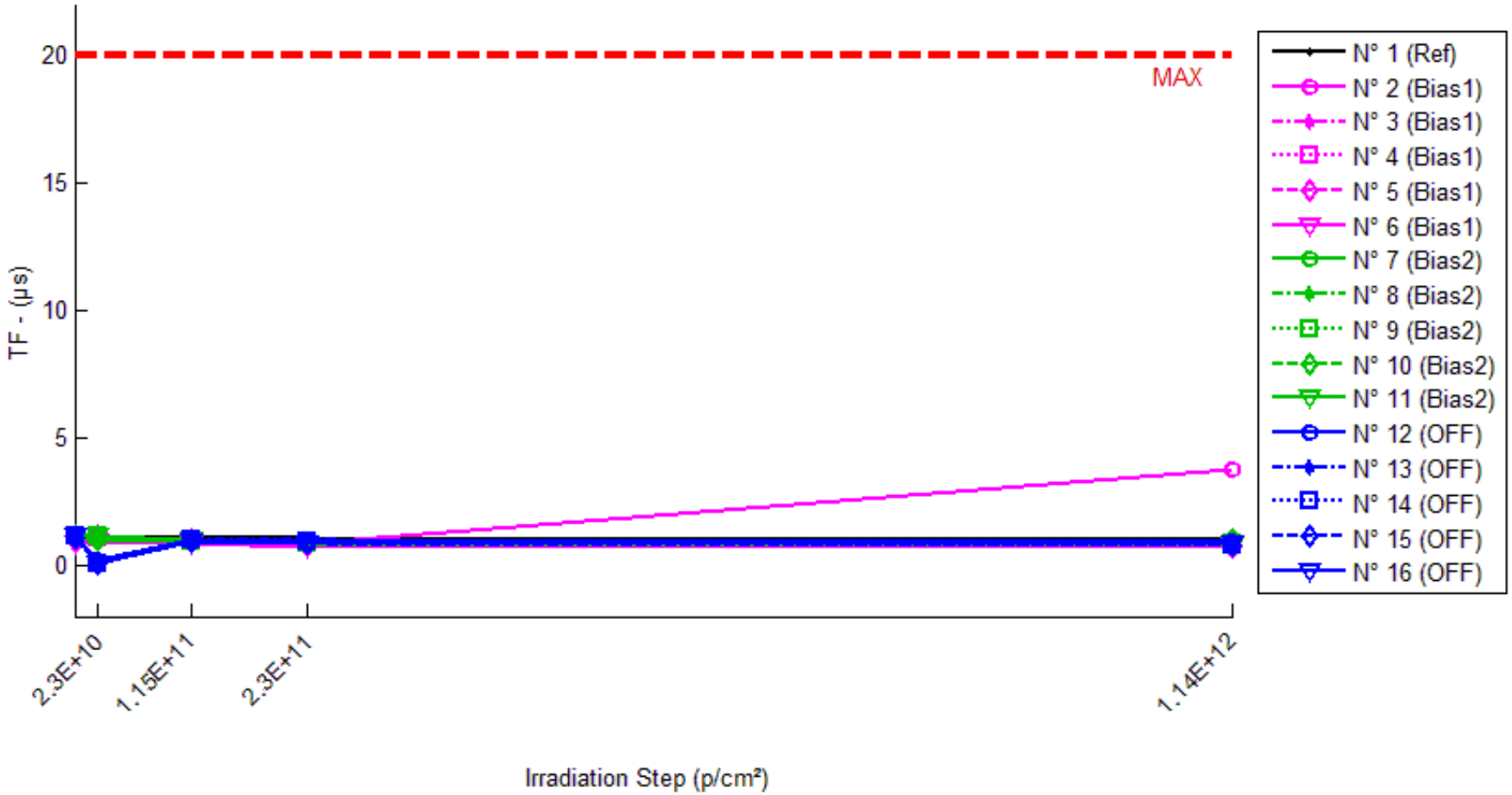
Delta [TR]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-4.000E-2	-4.000E-2	0.000E+0	-4.000E-2
N° 2 (Bias1)	---	-4.000E-2	-1.600E-1	-3.200E-1	-2.000E-1
N° 3 (Bias1)	---	-8.000E-2	-2.400E-1	-3.200E-1	-5.400E-1
N° 4 (Bias1)	---	-8.000E-2	-2.400E-1	-4.000E-1	-4.800E-1
N° 5 (Bias1)	---	-1.600E-1	-3.200E-1	-4.000E-1	-7.200E-1
N° 6 (Bias1)	---	-4.000E-2	-1.600E-1	-2.400E-1	-2.000E-1
N° 7 (Bias2)	---	-4.000E-2	-2.400E-1	-3.600E-1	-4.800E-1
N° 8 (Bias2)	---	-4.000E-2	-3.200E-1	-4.400E-1	-4.800E-1
N° 9 (Bias2)	---	-1.200E-1	-2.800E-1	-4.400E-1	-5.600E-1
N° 10 (Bias2)	---	-8.000E-2	-2.400E-1	-4.000E-1	-4.400E-1
N° 11 (Bias2)	---	-4.000E-2	-2.800E-1	-4.000E-1	-6.000E-1
N° 12 (OFF)	---	-8.000E-1	-2.000E-1	-3.600E-1	-4.400E-1
N° 13 (OFF)	---	-9.400E-1	-2.800E-1	-4.000E-1	-5.600E-1
N° 14 (OFF)	---	-9.000E-1	-2.400E-1	-3.600E-1	-5.600E-1
N° 15 (OFF)	---	-9.400E-1	-3.200E-1	-4.400E-1	-6.400E-1
N° 16 (OFF)	---	-9.000E-1	-2.400E-1	-4.000E-1	-5.200E-1
Average (OFF)	---	-8.000E-2	-2.240E-1	-3.360E-1	-4.280E-1
s (OFF)	---	4.899E-2	6.693E-2	6.693E-2	2.261E-1
Average+3s (OFF)	---	6.697E-2	-2.320E-2	-1.352E-1	2.503E-1
Average-3s (OFF)	---	-2.270E-1	-4.248E-1	-5.368E-1	-1.106E+0
Average (Bias1)	---	-6.400E-2	-2.720E-1	-4.080E-1	-5.120E-1
s (Bias1)	---	3.578E-2	3.347E-2	3.347E-2	6.573E-2
Average+3s (Bias1)	---	4.333E-2	-1.716E-1	-3.076E-1	-3.148E-1
Average-3s (Bias1)	---	-1.713E-1	-3.724E-1	-5.084E-1	-7.092E-1
Average (Bias2)	---	-8.960E-1	-2.560E-1	-3.920E-1	-5.440E-1
s (Bias2)	---	5.727E-2	4.561E-2	3.347E-2	7.266E-2
Average+3s (Bias2)	---	-7.242E-1	-1.192E-1	-2.916E-1	-3.260E-1
Average-3s (Bias2)	---	-1.068E+0	-3.928E-1	-4.924E-1	-7.620E-1

60 MeV proton / detailed results

9. TF

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



60 MeV proton / detailed results

TF . (µs) **Max = 20.0**

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	1.12	1.08	1.08	1.08	1.04
N° 2 (Bias1)	1.04	1.08	1.00	0.84	3.80
N° 3 (Bias1)	1.12	1.08	0.96	0.96	0.80
N° 4 (Bias1)	1.12	1.08	1.04	0.96	0.90
N° 5 (Bias1)	1.12	1.12	1.00	0.84	0.70
N° 6 (Bias1)	0.88	0.92	0.84	0.72	0.80
N° 7 (Bias2)	1.08	1.00	0.96	0.88	0.92
N° 8 (Bias2)	1.12	1.08	0.96	0.84	1.04
N° 9 (Bias2)	1.16	1.12	0.96	0.88	0.88
N° 10 (Bias2)	1.12	1.04	0.96	0.88	1.00
N° 11 (Bias2)	1.12	1.12	1.00	0.88	0.76
N° 12 (OFF)	1.08	0.20	1.00	0.92	0.92
N° 13 (OFF)	1.12	0.10	1.04	1.00	0.92
N° 14 (OFF)	1.12	0.10	1.00	0.96	0.76
N° 15 (OFF)	1.08	0.10	0.96	0.84	0.80
N° 16 (OFF)	1.12	0.10	0.96	0.88	0.84

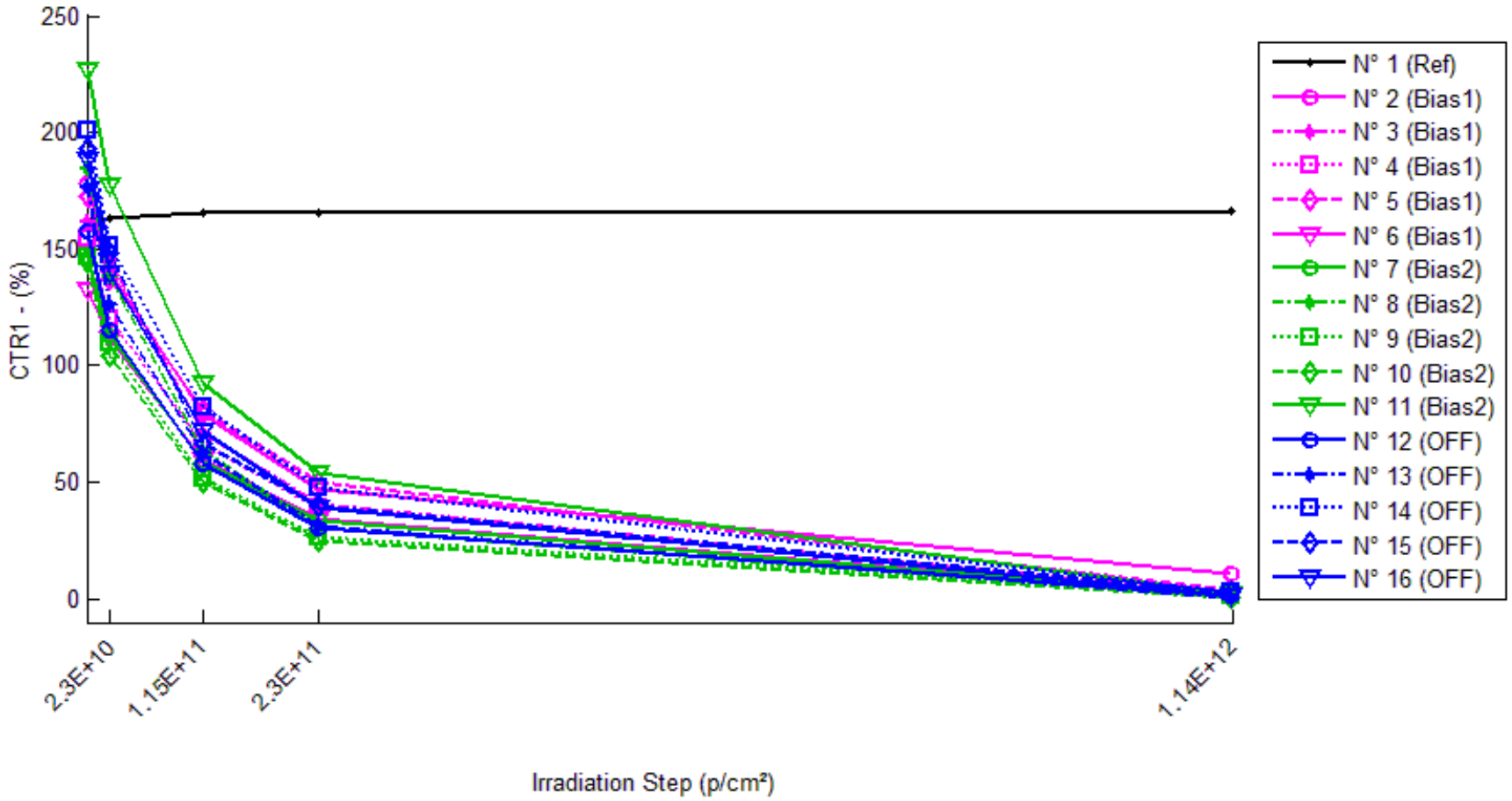
Delta [TF]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-4.000E-2	-4.000E-2	-4.000E-2	-8.000E-2
N° 2 (Bias1)	---	4.000E-2	-4.000E-2	-2.000E-1	2.760E+0
N° 3 (Bias1)	---	-4.000E-2	-1.600E-1	-1.600E-1	-3.200E-1
N° 4 (Bias1)	---	-4.000E-2	-8.000E-2	-1.600E-1	-2.200E-1
N° 5 (Bias1)	---	0.000E+0	-1.200E-1	-2.800E-1	-4.200E-1
N° 6 (Bias1)	---	4.000E-2	-4.000E-2	-1.600E-1	-8.000E-2
N° 7 (Bias2)	---	-8.000E-2	-1.200E-1	-2.000E-1	-1.600E-1
N° 8 (Bias2)	---	-4.000E-2	-1.600E-1	-2.800E-1	-8.000E-2
N° 9 (Bias2)	---	-4.000E-2	-2.000E-1	-2.800E-1	-2.800E-1
N° 10 (Bias2)	---	-8.000E-2	-1.600E-1	-2.400E-1	-1.200E-1
N° 11 (Bias2)	---	0.000E+0	-1.200E-1	-2.400E-1	-3.600E-1
N° 12 (OFF)	---	-8.800E-1	-8.000E-2	-1.600E-1	-1.600E-1
N° 13 (OFF)	---	-1.020E+0	-8.000E-2	-1.200E-1	-2.000E-1
N° 14 (OFF)	---	-1.020E+0	-1.200E-1	-1.600E-1	-3.600E-1
N° 15 (OFF)	---	-9.800E-1	-1.200E-1	-2.400E-1	-2.800E-1
N° 16 (OFF)	---	-1.020E+0	-1.600E-1	-2.400E-1	-2.800E-1
Average (OFF)	---	0.000E+0	-8.800E-2	-1.920E-1	3.440E-1
s (OFF)	---	4.000E-2	5.215E-2	5.215E-2	1.356E+0
Average+3s (OFF)	---	1.200E-1	6.846E-2	-3.554E-2	4.413E+0
Average-3s (OFF)	---	-1.200E-1	-2.445E-1	-3.485E-1	-3.725E+0
Average (Bias1)	---	-4.800E-2	-1.520E-1	-2.480E-1	-2.000E-1
s (Bias1)	---	3.347E-2	3.347E-2	3.347E-2	1.166E-1
Average+3s (Bias1)	---	5.240E-2	-5.160E-2	-1.476E-1	1.499E-1
Average-3s (Bias1)	---	-1.484E-1	-2.524E-1	-3.484E-1	-5.499E-1
Average (Bias2)	---	-9.840E-1	-1.120E-1	-1.840E-1	-2.560E-1
s (Bias2)	---	6.066E-2	3.347E-2	5.367E-2	7.797E-2
Average+3s (Bias2)	---	-8.020E-1	-1.160E-2	-2.300E-2	-2.208E-2
Average-3s (Bias2)	---	-1.166E+0	-2.124E-1	-3.450E-1	-4.899E-1

60 MeV proton / detailed results

10.CTR1

Ta=25°C; Vce=5V; If=1mA



60 MeV proton / detailed results

CTR1 . (%)

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	162.18	163.22	165.65	165.47	166.01
N° 2 (Bias1)	178.03	140.15	78.78	47.16	10.61
N° 3 (Bias1)	161.36	145.15	71.21	40.99	2.11
N° 4 (Bias1)	154.66	119.97	66.58	38.91	2.10
N° 5 (Bias1)	172.95	137.53	80.42	49.73	3.65
N° 6 (Bias1)	132.90	111.54	59.49	34.41	1.78
N° 7 (Bias2)	146.28	112.93	58.65	33.54	1.35
N° 8 (Bias2)	184.24	138.28	63.26	30.39	0.67
N° 9 (Bias2)	146.61	109.98	51.49	26.35	1.03
N° 10 (Bias2)	144.00	104.33	50.45	24.70	0.94
N° 11 (Bias2)	226.53	177.20	92.33	53.63	2.50
N° 12 (OFF)	157.46	114.92	57.92	30.51	1.18
N° 13 (OFF)	176.90	125.94	62.45	31.05	0.78
N° 14 (OFF)	200.87	151.33	82.66	47.44	2.85
N° 15 (OFF)	193.35	147.93	66.93	39.54	2.96
N° 16 (OFF)	188.18	139.49	71.97	39.36	1.41

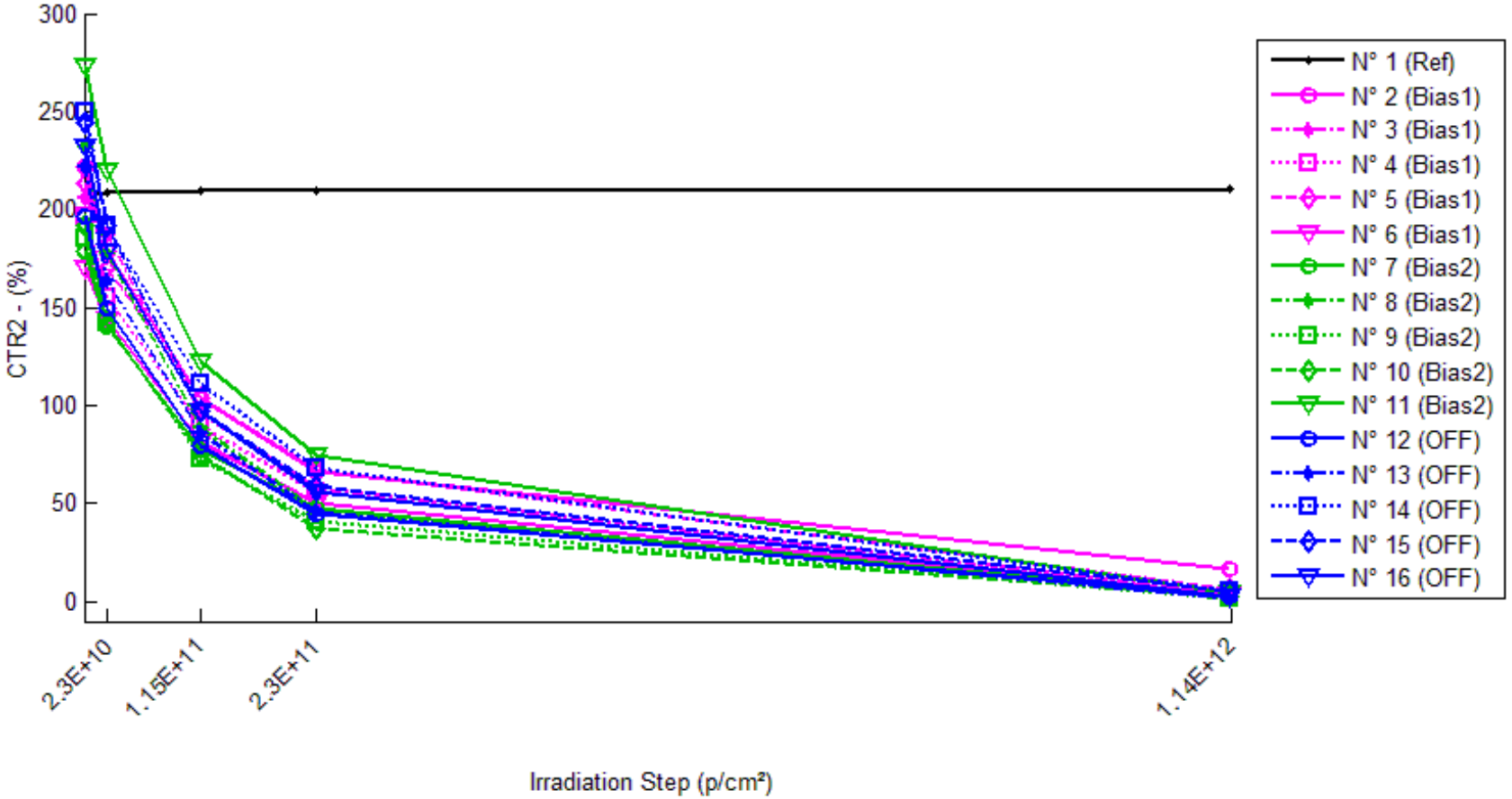
1/Delta [CTR1]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-3.905E-5	-1.289E-4	-1.224E-4	-1.423E-4
N° 2 (Bias1)	---	1.518E-3	7.076E-3	1.559E-2	8.861E-2
N° 3 (Bias1)	---	6.922E-4	7.845E-3	1.820E-2	4.687E-1
N° 4 (Bias1)	---	1.870E-3	8.553E-3	1.923E-2	4.697E-1
N° 5 (Bias1)	---	1.489E-3	6.654E-3	1.433E-2	2.684E-1
N° 6 (Bias1)	---	1.440E-3	9.286E-3	2.153E-2	5.556E-1
N° 7 (Bias2)	---	2.019E-3	1.022E-2	2.298E-2	7.350E-1
N° 8 (Bias2)	---	1.804E-3	1.038E-2	2.748E-2	1.495E+0
N° 9 (Bias2)	---	2.272E-3	1.260E-2	3.113E-2	9.663E-1
N° 10 (Bias2)	---	2.641E-3	1.288E-2	3.354E-2	1.057E+0
N° 11 (Bias2)	---	1.229E-3	6.417E-3	1.423E-2	3.951E-1
N° 12 (OFF)	---	2.351E-3	1.091E-2	2.643E-2	8.393E-1
N° 13 (OFF)	---	2.287E-3	1.036E-2	2.655E-2	1.273E+0
N° 14 (OFF)	---	1.630E-3	7.119E-3	1.610E-2	3.463E-1
N° 15 (OFF)	---	1.588E-3	9.768E-3	2.012E-2	3.324E-1
N° 16 (OFF)	---	1.855E-3	8.580E-3	2.009E-2	7.049E-1
Average (OFF)	---	1.402E-3	7.883E-3	1.778E-2	3.702E-1
s (OFF)	---	4.316E-4	1.070E-3	2.877E-3	1.895E-1
Average+3s (OFF)	---	2.697E-3	1.109E-2	2.641E-2	9.387E-1
Average-3s (OFF)	---	1.072E-4	4.672E-3	9.143E-3	-1.983E-1
Average (Bias1)	---	1.993E-3	1.050E-2	2.587E-2	9.298E-1
s (Bias1)	---	5.286E-4	2.590E-3	7.629E-3	4.066E-1
Average+3s (Bias1)	---	3.579E-3	1.827E-2	4.876E-2	2.150E+0
Average-3s (Bias1)	---	4.072E-4	2.727E-3	2.984E-3	-2.899E-1
Average (Bias2)	---	1.942E-3	9.348E-3	2.186E-2	6.992E-1
s (Bias2)	---	3.595E-4	1.517E-3	4.533E-3	3.898E-1
Average+3s (Bias2)	---	3.021E-3	1.390E-2	3.546E-2	1.869E+0
Average-3s (Bias2)	---	8.636E-4	4.796E-3	8.260E-3	-4.703E-1

60 MeV proton / detailed results

11.CTR2

Ta=25°C; Vce=5V; If=2mA



60 MeV proton / detailed results

CTR2 . (%)

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	208.06	208.22	209.66	209.67	210.55
N° 2 (Bias1)	221.38	179.16	104.05	66.10	16.32
N° 3 (Bias1)	206.27	187.40	95.94	58.26	4.13
N° 4 (Bias1)	196.94	155.10	89.95	55.73	4.11
N° 5 (Bias1)	213.77	170.37	103.65	66.87	6.40
N° 6 (Bias1)	170.19	143.72	81.52	50.09	3.47
N° 7 (Bias2)	179.14	140.42	77.58	47.21	2.57
N° 8 (Bias2)	231.67	177.55	88.38	46.56	1.38
N° 9 (Bias2)	184.91	142.29	72.88	40.91	2.01
N° 10 (Bias2)	192.17	142.49	74.32	37.10	2.31
N° 11 (Bias2)	273.72	219.75	122.41	74.45	4.85
N° 12 (OFF)	196.90	149.36	79.45	44.81	2.44
N° 13 (OFF)	221.88	163.89	85.84	46.10	1.70
N° 14 (OFF)	249.83	191.76	111.01	67.84	5.33
N° 15 (OFF)	244.02	192.08	96.82	58.65	5.80
N° 16 (OFF)	232.24	178.37	96.94	56.45	2.86

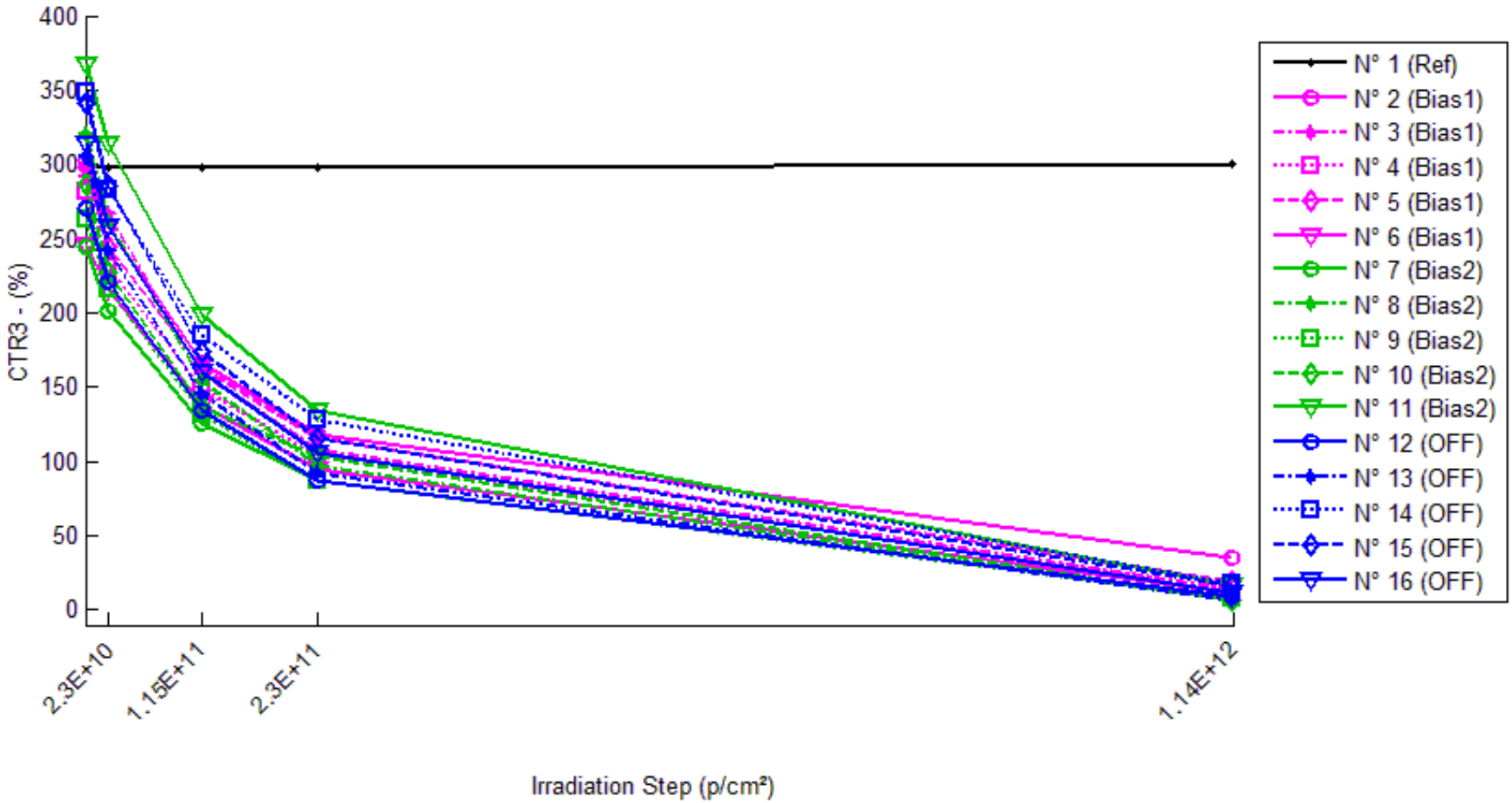
1/Delta [CTR2]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	-3.730E-6	-3.659E-5	-3.696E-5	-5.688E-5
N° 2 (Bias1)	---	1.065E-3	5.093E-3	1.061E-2	5.675E-2
N° 3 (Bias1)	---	4.881E-4	5.575E-3	1.232E-2	2.371E-1
N° 4 (Bias1)	---	1.370E-3	6.040E-3	1.287E-2	2.380E-1
N° 5 (Bias1)	---	1.192E-3	4.970E-3	1.028E-2	1.515E-1
N° 6 (Bias1)	---	1.082E-3	6.391E-3	1.409E-2	2.822E-1
N° 7 (Bias2)	---	1.539E-3	7.308E-3	1.560E-2	3.838E-1
N° 8 (Bias2)	---	1.316E-3	6.998E-3	1.716E-2	7.179E-1
N° 9 (Bias2)	---	1.620E-3	8.314E-3	1.903E-2	4.909E-1
N° 10 (Bias2)	---	1.814E-3	8.252E-3	2.175E-2	4.272E-1
N° 11 (Bias2)	---	8.973E-4	4.516E-3	9.779E-3	2.026E-1
N° 12 (OFF)	---	1.617E-3	7.508E-3	1.724E-2	4.049E-1
N° 13 (OFF)	---	1.595E-3	7.143E-3	1.718E-2	5.834E-1
N° 14 (OFF)	---	1.212E-3	5.006E-3	1.074E-2	1.836E-1
N° 15 (OFF)	---	1.108E-3	6.230E-3	1.295E-2	1.683E-1
N° 16 (OFF)	---	1.301E-3	6.010E-3	1.341E-2	3.451E-1
Average (OFF)	---	1.039E-3	5.614E-3	1.203E-2	1.931E-1
s (OFF)	---	3.311E-4	6.067E-4	1.589E-3	8.975E-2
Average+3s (OFF)	---	2.033E-3	7.434E-3	1.680E-2	4.623E-1
Average-3s (OFF)	---	4.583E-5	3.794E-3	7.265E-3	-7.615E-2
Average (Bias1)	---	1.437E-3	7.077E-3	1.666E-2	4.445E-1
s (Bias1)	---	3.508E-4	1.543E-3	4.479E-3	1.867E-1
Average+3s (Bias1)	---	2.490E-3	1.171E-2	3.010E-2	1.005E+0
Average-3s (Bias1)	---	3.849E-4	2.447E-3	3.227E-3	-1.155E-1
Average (Bias2)	---	1.366E-3	6.379E-3	1.430E-2	3.371E-1
s (Bias2)	---	2.289E-4	9.877E-4	2.839E-3	1.713E-1
Average+3s (Bias2)	---	2.053E-3	9.342E-3	2.282E-2	8.510E-1
Average-3s (Bias2)	---	6.798E-4	3.416E-3	5.786E-3	-1.768E-1

60 MeV proton / detailed results

12.CTR3

Ta=25°C; Vce = 5V; If = 10 mA



60 MeV proton / detailed results

CTR3 . (%)

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	299.05	297.48	297.73	297.77	299.78
N° 2 (Bias1)	302.22	258.66	166.43	117.79	35.79
N° 3 (Bias1)	291.83	266.91	159.43	108.14	14.59
N° 4 (Bias1)	282.01	231.37	148.98	103.85	14.03
N° 5 (Bias1)	297.37	244.14	162.81	115.46	18.83
N° 6 (Bias1)	246.16	215.84	137.49	95.04	11.30
N° 7 (Bias2)	244.43	201.11	126.03	86.93	9.67
N° 8 (Bias2)	320.37	261.69	154.21	96.85	6.39
N° 9 (Bias2)	263.71	216.52	131.30	87.23	8.50
N° 10 (Bias2)	287.00	227.10	136.97	103.10	7.33
N° 11 (Bias2)	367.31	313.38	199.09	134.60	16.93
N° 12 (OFF)	270.20	220.44	134.61	87.12	9.54
N° 13 (OFF)	304.90	242.02	145.33	92.10	7.20
N° 14 (OFF)	348.42	282.35	184.60	127.60	18.10
N° 15 (OFF)	340.85	285.62	173.52	115.37	16.38
N° 16 (OFF)	314.53	258.69	160.40	105.91	11.16

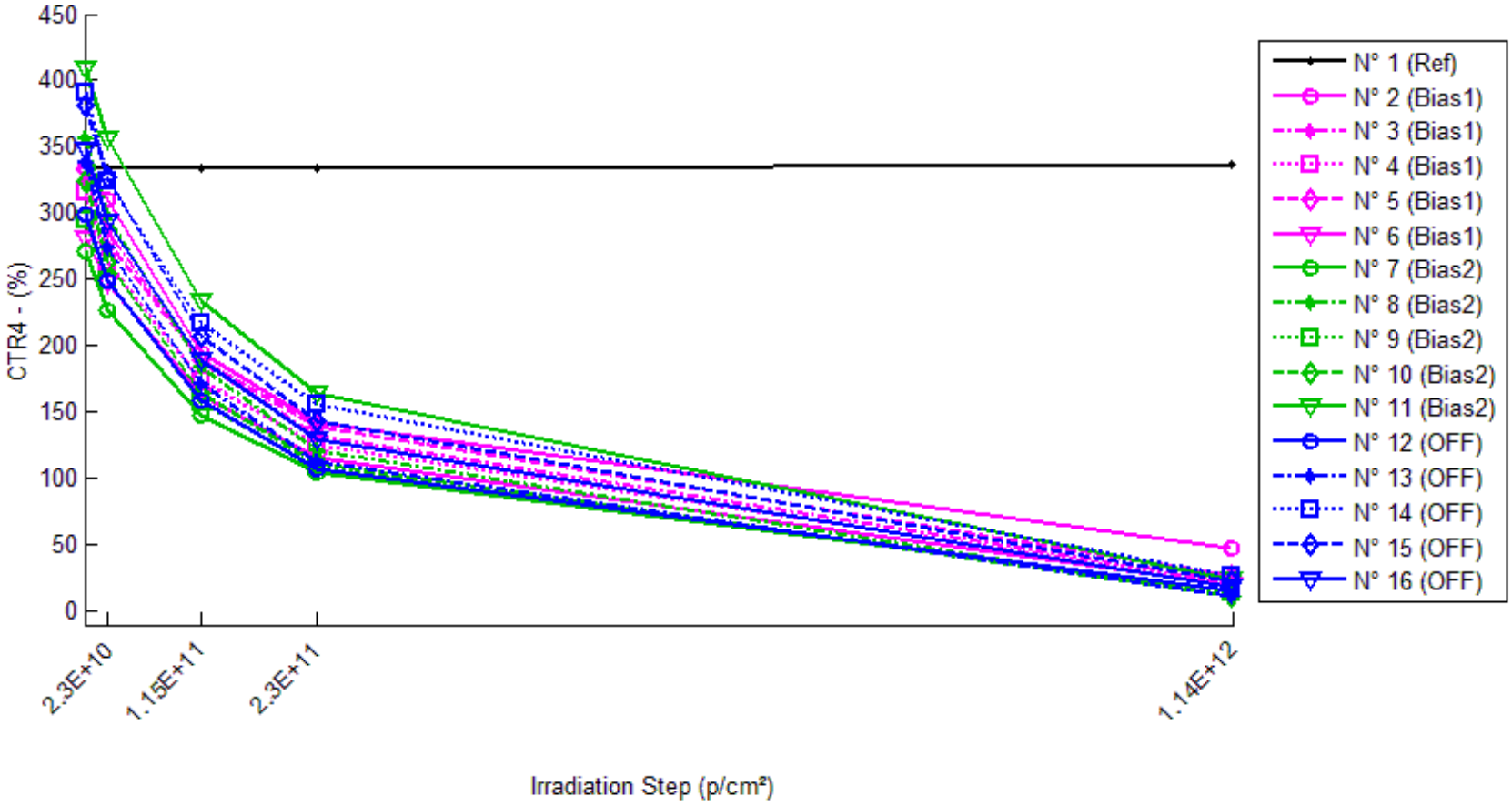
1/Delta [CTR3]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	1.764E-5	1.484E-5	1.432E-5	-8.164E-6
N° 2 (Bias1)	---	5.573E-4	2.700E-3	5.181E-3	2.463E-2
N° 3 (Bias1)	---	3.200E-4	2.846E-3	5.821E-3	6.510E-2
N° 4 (Bias1)	---	7.761E-4	3.167E-3	6.083E-3	6.775E-2
N° 5 (Bias1)	---	7.332E-4	2.779E-3	5.299E-3	4.974E-2
N° 6 (Bias1)	---	5.706E-4	3.211E-3	6.460E-3	8.442E-2
N° 7 (Bias2)	---	8.812E-4	3.844E-3	7.413E-3	9.932E-2
N° 8 (Bias2)	---	6.999E-4	3.363E-3	7.204E-3	1.534E-1
N° 9 (Bias2)	---	8.265E-4	3.824E-3	7.672E-3	1.139E-1
N° 10 (Bias2)	---	9.190E-4	3.817E-3	6.215E-3	1.330E-1
N° 11 (Bias2)	---	4.686E-4	2.300E-3	4.707E-3	5.633E-2
N° 12 (OFF)	---	8.354E-4	3.728E-3	7.777E-3	1.011E-1
N° 13 (OFF)	---	8.521E-4	3.601E-3	7.578E-3	1.355E-1
N° 14 (OFF)	---	6.716E-4	2.547E-3	4.967E-3	5.239E-2
N° 15 (OFF)	---	5.673E-4	2.829E-3	5.734E-3	5.813E-2
N° 16 (OFF)	---	6.862E-4	3.055E-3	6.262E-3	8.645E-2
Average (OFF)	---	5.914E-4	2.940E-3	5.769E-3	5.833E-2
s (OFF)	---	1.799E-4	2.330E-4	5.352E-4	2.250E-2
Average+3s (OFF)	---	1.131E-3	3.639E-3	7.374E-3	1.258E-1
Average-3s (OFF)	---	5.166E-5	2.241E-3	4.163E-3	-9.160E-3
Average (Bias1)	---	7.590E-4	3.430E-3	6.642E-3	1.112E-1
s (Bias1)	---	1.823E-4	6.626E-4	1.214E-3	3.678E-2
Average+3s (Bias1)	---	1.306E-3	5.417E-3	1.028E-2	2.215E-1
Average-3s (Bias1)	---	2.121E-4	1.442E-3	2.999E-3	8.378E-4
Average (Bias2)	---	7.225E-4	3.152E-3	6.464E-3	8.672E-2
s (Bias2)	---	1.199E-4	5.032E-4	1.202E-3	3.386E-2
Average+3s (Bias2)	---	1.082E-3	4.662E-3	1.007E-2	1.883E-1
Average-3s (Bias2)	---	3.627E-4	1.642E-3	2.857E-3	-1.486E-2

60 MeV proton / detailed results

13.CTR4

Ta=25°C; Vce = 5V; If = 20 mA



60 MeV proton / detailed results

CTR4 . (%)

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	336.07	334.17	334.30	334.17	336.64
N° 2 (Bias1)	334.60	310.40	194.39	141.98	47.09
N° 3 (Bias1)	324.88	286.47	188.41	132.57	22.42
N° 4 (Bias1)	315.88	263.65	174.58	125.03	21.00
N° 5 (Bias1)	333.01	278.04	189.90	138.93	27.41
N° 6 (Bias1)	281.36	247.53	163.49	116.07	19.59
N° 7 (Bias2)	271.35	227.33	147.39	105.05	15.69
N° 8 (Bias2)	355.98	298.40	184.10	120.90	11.28
N° 9 (Bias2)	295.49	248.68	157.93	108.67	14.36
N° 10 (Bias2)	324.08	262.73	164.34	111.95	11.21
N° 11 (Bias2)	408.41	355.54	233.46	164.22	24.59
N° 12 (OFF)	299.00	249.50	159.35	106.81	15.19
N° 13 (OFF)	337.66	274.18	170.83	112.48	11.98
N° 14 (OFF)	391.03	323.73	217.75	156.20	27.23
N° 15 (OFF)	381.52	326.52	208.10	143.54	22.36
N° 16 (OFF)	348.31	293.58	189.28	129.65	17.81

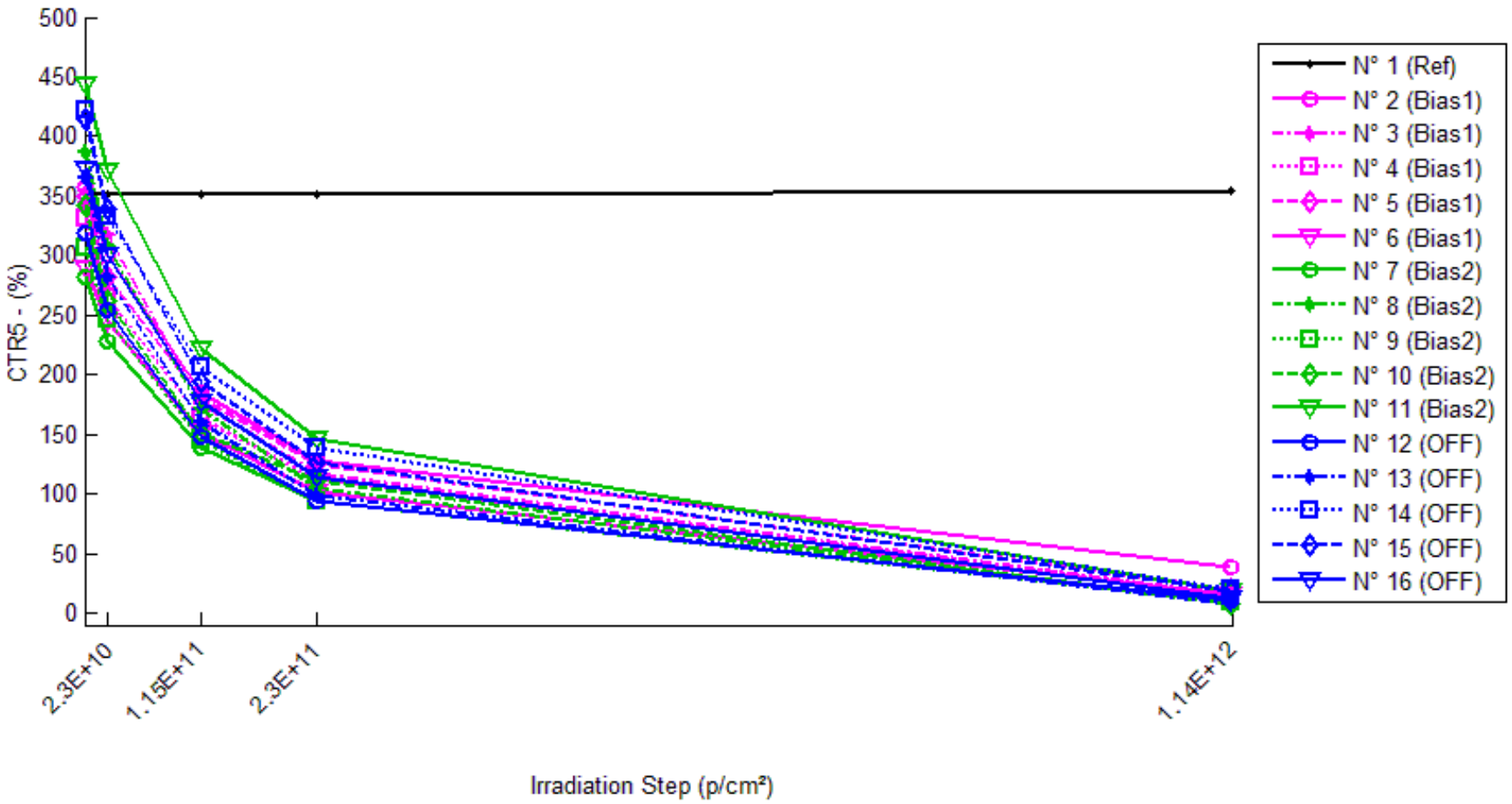
1/Delta [CTR4]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	1.697E-5	1.577E-5	1.699E-5	-5.001E-6
N° 2 (Bias1)	---	2.329E-4	2.156E-3	4.055E-3	1.825E-2
N° 3 (Bias1)	---	4.127E-4	2.229E-3	4.465E-3	4.152E-2
N° 4 (Bias1)	---	6.272E-4	2.562E-3	4.832E-3	4.446E-2
N° 5 (Bias1)	---	5.937E-4	2.263E-3	4.195E-3	3.348E-2
N° 6 (Bias1)	---	4.857E-4	2.562E-3	5.061E-3	4.750E-2
N° 7 (Bias2)	---	7.136E-4	3.099E-3	5.834E-3	6.005E-2
N° 8 (Bias2)	---	5.421E-4	2.623E-3	5.462E-3	8.586E-2
N° 9 (Bias2)	---	6.371E-4	2.948E-3	5.818E-3	6.626E-2
N° 10 (Bias2)	---	7.206E-4	2.999E-3	5.847E-3	8.613E-2
N° 11 (Bias2)	---	3.641E-4	1.835E-3	3.641E-3	3.823E-2
N° 12 (OFF)	---	6.635E-4	2.931E-3	6.017E-3	6.250E-2
N° 13 (OFF)	---	6.857E-4	2.892E-3	5.929E-3	8.053E-2
N° 14 (OFF)	---	5.316E-4	2.035E-3	3.845E-3	3.416E-2
N° 15 (OFF)	---	4.415E-4	2.184E-3	4.346E-3	4.211E-2
N° 16 (OFF)	---	5.352E-4	2.412E-3	4.842E-3	5.327E-2
Average (OFF)	---	4.705E-4	2.354E-3	4.522E-3	3.704E-2
s (OFF)	---	1.579E-4	1.936E-4	4.229E-4	1.173E-2
Average+3s (OFF)	---	9.442E-4	2.935E-3	5.790E-3	7.223E-2
Average-3s (OFF)	---	-3.270E-6	1.774E-3	3.253E-3	1.851E-3
Average (Bias1)	---	5.955E-4	2.701E-3	5.320E-3	6.731E-2
s (Bias1)	---	1.481E-4	5.159E-4	9.525E-4	1.999E-2
Average+3s (Bias1)	---	1.040E-3	4.249E-3	8.178E-3	1.273E-1
Average-3s (Bias1)	---	1.512E-4	1.153E-3	2.463E-3	7.338E-3
Average (Bias2)	---	5.715E-4	2.491E-3	4.996E-3	5.452E-2
s (Bias2)	---	1.016E-4	4.071E-4	9.600E-4	1.810E-2
Average+3s (Bias2)	---	8.764E-4	3.712E-3	7.876E-3	1.088E-1
Average-3s (Bias2)	---	2.666E-4	1.270E-3	2.116E-3	2.149E-4

60 MeV proton / detailed results

14.CTR5

Ta=25°C; Vce = 20V; If = 10 mA



60 MeV proton / detailed results

CTR5 . (%)

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	353.24	351.66	352.06	351.52	354.62
N° 2 (Bias1)	358.21	300.42	184.66	127.72	38.19
N° 3 (Bias1)	344.07	317.91	176.26	116.80	15.70
N° 4 (Bias1)	331.46	265.73	164.06	111.79	15.12
N° 5 (Bias1)	350.36	281.24	179.76	124.81	20.28
N° 6 (Bias1)	290.01	244.41	150.32	102.14	14.82
N° 7 (Bias2)	282.73	228.23	137.96	93.51	10.48
N° 8 (Bias2)	386.81	307.54	171.45	104.81	6.99
N° 9 (Bias2)	307.22	247.31	144.08	94.05	9.26
N° 10 (Bias2)	341.43	262.54	150.66	111.65	8.03
N° 11 (Bias2)	444.31	371.11	222.41	146.30	18.45
N° 12 (OFF)	318.30	253.53	147.92	93.62	10.30
N° 13 (OFF)	365.43	281.39	160.42	99.26	7.92
N° 14 (OFF)	421.58	332.86	206.41	139.37	19.65
N° 15 (OFF)	413.77	338.86	193.88	126.03	17.77
N° 16 (OFF)	373.47	300.07	177.23	114.09	12.15

1/Delta [CTR5]

	0.0E10.p/cm²	2.3E10.p/cm²	11.5E10.p/cm²	23.0E10.p/cm²	114.0E10.p/cm²
N° 1 (Ref)	---	1.276E-5	9.535E-6	1.391E-5	-1.099E-5
N° 2 (Bias1)	---	5.370E-4	2.624E-3	5.038E-3	2.339E-2
N° 3 (Bias1)	---	2.391E-4	2.767E-3	5.655E-3	6.079E-2
N° 4 (Bias1)	---	7.462E-4	3.078E-3	5.928E-3	6.314E-2
N° 5 (Bias1)	---	7.014E-4	2.709E-3	5.158E-3	4.646E-2
N° 6 (Bias1)	---	6.433E-4	3.204E-3	6.342E-3	6.402E-2
N° 7 (Bias2)	---	8.447E-4	3.711E-3	7.157E-3	9.192E-2
N° 8 (Bias2)	---	6.663E-4	3.247E-3	6.956E-3	1.405E-1
N° 9 (Bias2)	---	7.884E-4	3.685E-3	7.377E-3	1.047E-1
N° 10 (Bias2)	---	8.800E-4	3.709E-3	6.028E-3	1.216E-1
N° 11 (Bias2)	---	4.439E-4	2.246E-3	4.584E-3	5.196E-2
N° 12 (OFF)	---	8.027E-4	3.619E-3	7.540E-3	9.392E-2
N° 13 (OFF)	---	8.173E-4	3.497E-3	7.338E-3	1.235E-1
N° 14 (OFF)	---	6.323E-4	2.473E-3	4.803E-3	4.852E-2
N° 15 (OFF)	---	5.343E-4	2.741E-3	5.518E-3	5.386E-2
N° 16 (OFF)	---	6.550E-4	2.965E-3	6.087E-3	7.964E-2
Average (OFF)	---	5.734E-4	2.876E-3	5.624E-3	5.156E-2
s (OFF)	---	2.026E-4	2.511E-4	5.408E-4	1.728E-2
Average+3s (OFF)	---	1.181E-3	3.630E-3	7.247E-3	1.034E-1
Average-3s (OFF)	---	-3.438E-5	2.123E-3	4.002E-3	-2.711E-4
Average (Bias1)	---	7.247E-4	3.320E-3	6.420E-3	1.021E-1
s (Bias1)	---	1.766E-4	6.319E-4	1.148E-3	3.346E-2
Average+3s (Bias1)	---	1.255E-3	5.215E-3	9.864E-3	2.025E-1
Average-3s (Bias1)	---	1.948E-4	1.424E-3	2.977E-3	1.750E-3
Average (Bias2)	---	6.883E-4	3.059E-3	6.257E-3	7.989E-2
s (Bias2)	---	1.201E-4	4.896E-4	1.173E-3	3.065E-2
Average+3s (Bias2)	---	1.049E-3	4.528E-3	9.777E-3	1.719E-1
Average-3s (Bias2)	---	3.280E-4	1.590E-3	2.738E-3	-1.208E-2

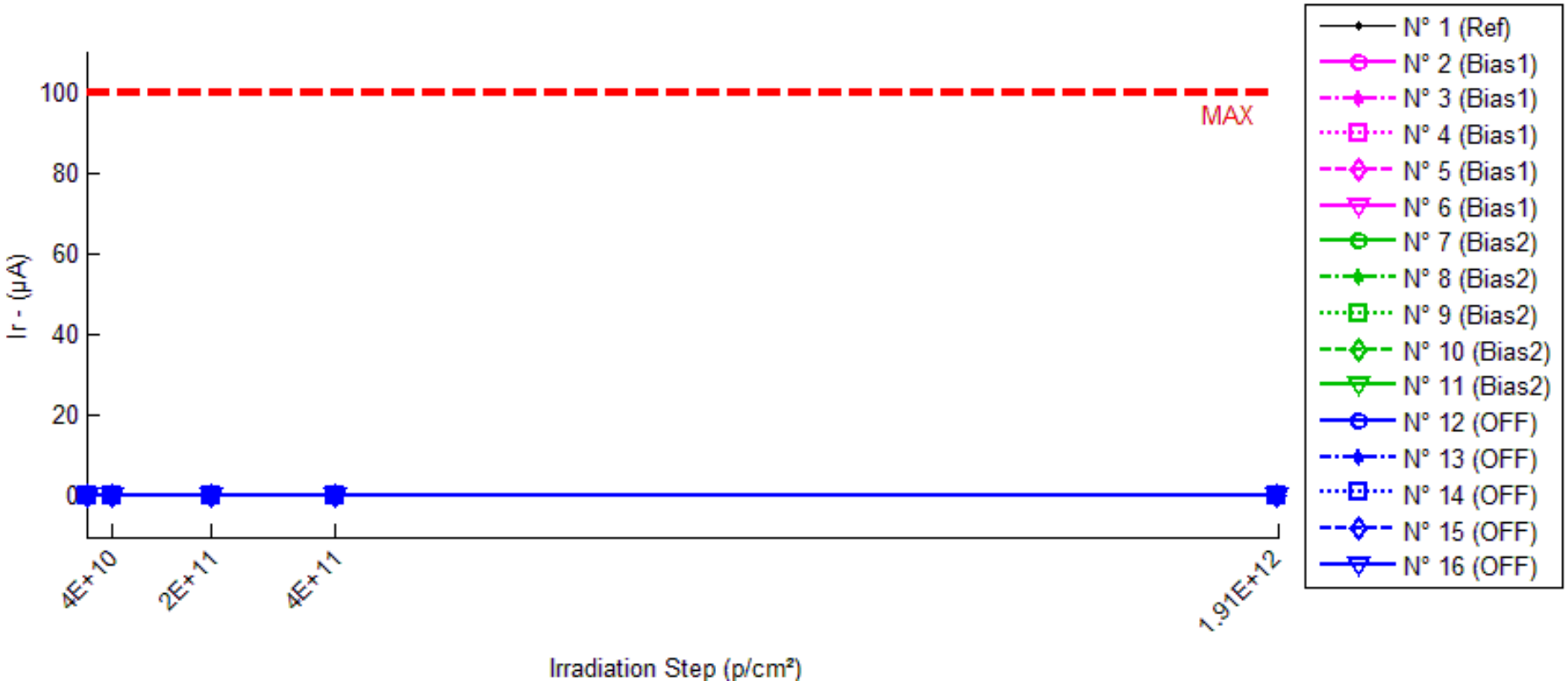
190 MeV proton / detailed results

CONTENTS

190 MeV proton / detailed results

1. Ir

Ta=25°C; VR = 2 V



190 MeV proton / detailed results

Ir . (µA) **Max = 100.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	1.853E-4	1.081E-4	1.708E-5	2.445E-5	2.152E-5
N° 2 (Bias1)	1.465E-4	1.170E-4	2.902E-5	6.670E-5	5.888E-6
N° 3 (Bias1)	3.879E-5	1.343E-4	4.017E-5	6.373E-5	3.732E-5
N° 4 (Bias1)	6.725E-5	1.219E-4	2.031E-5	4.780E-5	2.093E-5
N° 5 (Bias1)	9.462E-5	1.017E-4	2.772E-5	8.083E-5	4.005E-5
N° 6 (Bias1)	2.021E-4	2.011E-4	4.323E-5	8.067E-6	8.989E-6
N° 7 (Bias2)	5.861E-5	4.747E-5	3.208E-5	2.621E-5	4.650E-5
N° 8 (Bias2)	4.667E-5	7.898E-5	3.879E-5	4.197E-5	5.534E-5
N° 9 (Bias2)	2.613E-5	1.909E-5	4.223E-5	1.305E-5	4.893E-5
N° 10 (Bias2)	9.277E-5	9.043E-5	5.073E-5	1.063E-4	5.518E-5
N° 11 (Bias2)	1.092E-4	3.959E-5	5.061E-5	1.250E-4	5.023E-5
N° 12 (OFF)	1.314E-5	1.523E-5	7.504E-5	1.662E-4	2.890E-5
N° 13 (OFF)	2.095E-4	1.632E-5	6.829E-5	8.552E-5	4.943E-5
N° 14 (OFF)	3.548E-5	3.020E-5	1.233E-4	5.601E-5	5.178E-5
N° 15 (OFF)	1.578E-5	2.098E-5	5.572E-5	1.044E-4	9.436E-5
N° 16 (OFF)	1.118E-4	2.471E-5	2.839E-5	1.707E-4	6.867E-5

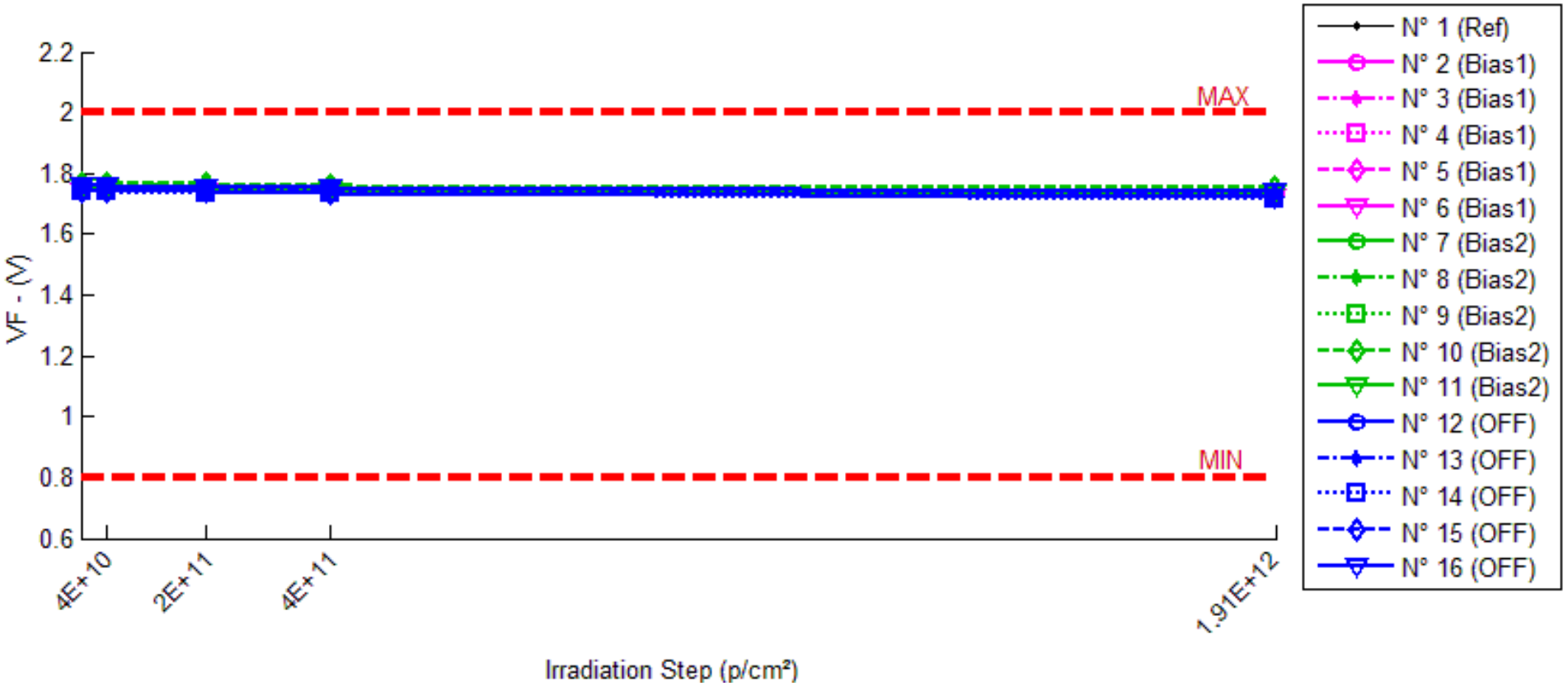
Delta [Ir]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	-7.721E-5	-1.682E-4	-1.608E-4	-1.638E-4
N° 2 (Bias1)	---	-2.951E-5	-1.175E-4	-7.980E-5	-1.406E-4
N° 3 (Bias1)	---	9.552E-5	1.384E-6	2.494E-5	-1.466E-6
N° 4 (Bias1)	---	5.465E-5	-4.694E-5	-1.945E-5	-4.631E-5
N° 5 (Bias1)	---	7.042E-6	-6.689E-5	-1.379E-5	-5.457E-5
N° 6 (Bias1)	---	-1.049E-6	-1.589E-4	-1.941E-4	-1.931E-4
N° 7 (Bias2)	---	-1.115E-5	-2.653E-5	-3.240E-5	-1.211E-5
N° 8 (Bias2)	---	3.231E-5	-7.879E-6	-4.694E-6	8.676E-6
N° 9 (Bias2)	---	-7.041E-6	1.609E-5	-1.308E-5	2.280E-5
N° 10 (Bias2)	---	-2.347E-6	-4.204E-5	1.350E-5	-3.760E-5
N° 11 (Bias2)	---	-6.962E-5	-5.859E-5	1.584E-5	-5.897E-5
N° 12 (OFF)	---	2.096E-6	6.191E-5	1.530E-4	1.576E-5
N° 13 (OFF)	---	-1.932E-4	-1.413E-4	-1.240E-4	-1.601E-4
N° 14 (OFF)	---	-5.280E-6	8.781E-5	2.054E-5	1.631E-5
N° 15 (OFF)	---	5.198E-6	3.994E-5	8.865E-5	7.859E-5
N° 16 (OFF)	---	-8.705E-5	-8.336E-5	5.897E-5	-4.309E-5
Average (OFF)	---	2.533E-5	-7.776E-5	-5.643E-5	-8.722E-5
σ (OFF)	---	4.956E-5	6.223E-5	8.558E-5	7.772E-5
Average+3σ (OFF)	---	1.740E-4	1.089E-4	2.003E-4	1.459E-4
Average-3σ (OFF)	---	-1.233E-4	-2.645E-4	-3.132E-4	-3.204E-4
Average (Bias1)	---	-1.157E-5	-2.379E-5	-4.165E-6	-1.544E-5
σ (Bias1)	---	3.675E-5	2.914E-5	1.993E-5	3.332E-5
Average+3σ (Bias1)	---	9.867E-5	6.362E-5	5.563E-5	8.452E-5
Average-3σ (Bias1)	---	-1.218E-4	-1.112E-4	-6.396E-5	-1.154E-4
Average (Bias2)	---	-5.565E-5	-6.992E-6	3.943E-5	-1.851E-5
σ (Bias2)	---	8.586E-5	9.974E-5	1.034E-4	9.010E-5
Average+3σ (Bias2)	---	2.019E-4	2.922E-4	3.497E-4	2.518E-4
Average-3σ (Bias2)	---	-3.132E-4	-3.062E-4	-2.708E-4	-2.888E-4

190 MeV proton / detailed results

2. VF

Ta=25°C; If = 10 mA



190 MeV proton / detailed results

VF . (V) **Min = 0.8 Max = 2.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	1.744	1.740	1.743	1.743	1.743
N° 2 (Bias1)	1.744	1.744	1.741	1.739	1.725
N° 3 (Bias1)	1.748	1.748	1.745	1.743	1.729
N° 4 (Bias1)	1.743	1.742	1.738	1.736	1.722
N° 5 (Bias1)	1.746	1.745	1.742	1.740	1.727
N° 6 (Bias1)	1.743	1.742	1.739	1.737	1.724
N° 7 (Bias2)	1.753	1.756	1.752	1.750	1.738
N° 8 (Bias2)	1.758	1.760	1.758	1.754	1.743
N° 9 (Bias2)	1.740	1.742	1.738	1.735	1.721
N° 10 (Bias2)	1.766	1.768	1.765	1.763	1.757
N° 11 (Bias2)	1.754	1.756	1.752	1.748	1.738
N° 12 (OFF)	1.742	1.743	1.739	1.736	1.720
N° 13 (OFF)	1.747	1.747	1.743	1.741	1.727
N° 14 (OFF)	1.740	1.740	1.736	1.734	1.716
N° 15 (OFF)	1.742	1.743	1.740	1.737	1.723
N° 16 (OFF)	1.758	1.759	1.756	1.754	1.741

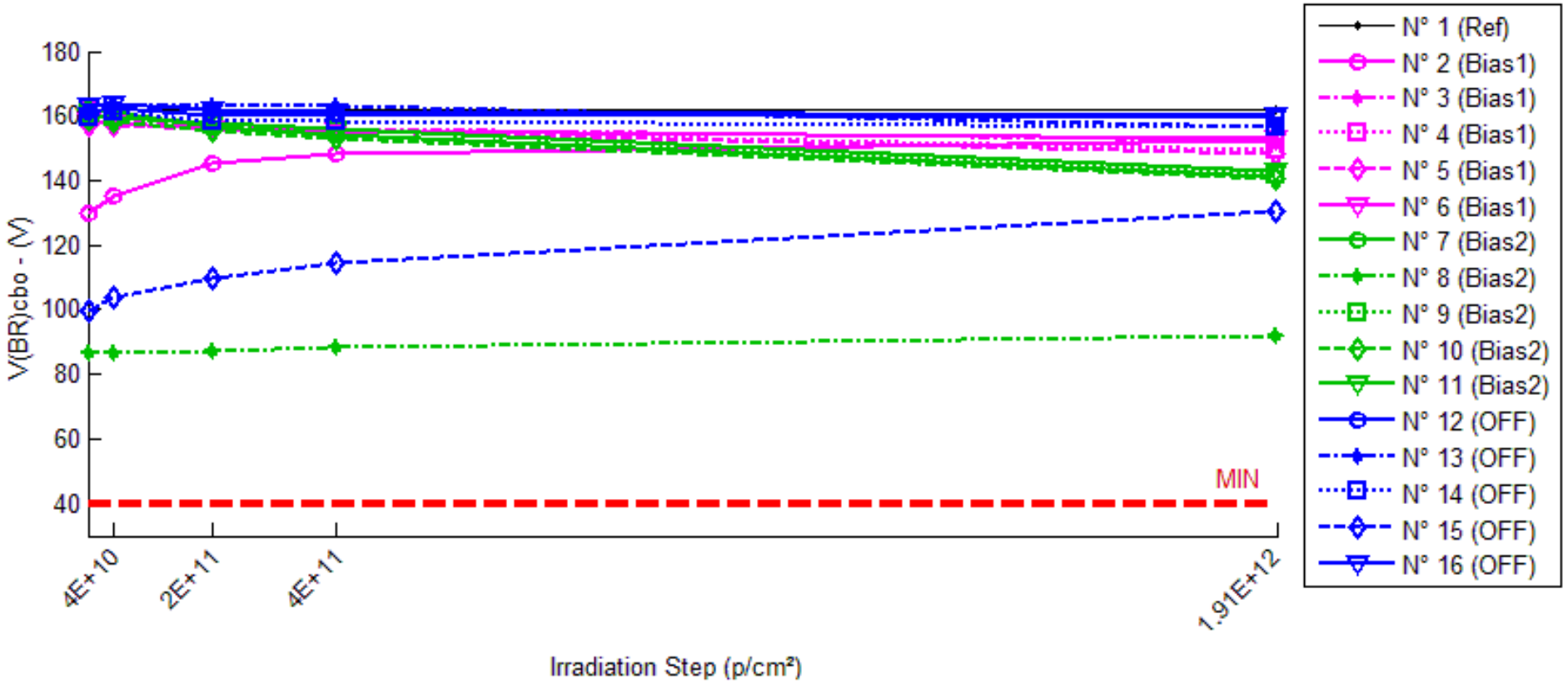
Delta [VF]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	-3.318E-3	-9.100E-5	-5.390E-4	-4.550E-4
N° 2 (Bias1)	---	2.610E-4	-3.085E-3	-4.682E-3	-1.868E-2
N° 3 (Bias1)	---	-7.200E-4	-3.817E-3	-5.828E-3	-1.938E-2
N° 4 (Bias1)	---	-7.040E-4	-4.303E-3	-6.449E-3	-2.069E-2
N° 5 (Bias1)	---	-5.190E-4	-3.507E-3	-5.813E-3	-1.886E-2
N° 6 (Bias1)	---	-8.290E-4	-3.858E-3	-5.893E-3	-1.932E-2
N° 7 (Bias2)	---	2.146E-3	-1.437E-3	-3.714E-3	-1.590E-2
N° 8 (Bias2)	---	2.092E-3	-7.370E-4	-4.165E-3	-1.495E-2
N° 9 (Bias2)	---	1.549E-3	-1.754E-3	-4.740E-3	-1.905E-2
N° 10 (Bias2)	---	2.642E-3	-1.680E-4	-2.759E-3	-8.643E-3
N° 11 (Bias2)	---	1.179E-3	-1.942E-3	-5.924E-3	-1.663E-2
N° 12 (OFF)	---	1.774E-3	-2.363E-3	-5.112E-3	-2.152E-2
N° 13 (OFF)	---	2.060E-4	-4.043E-3	-6.058E-3	-1.977E-2
N° 14 (OFF)	---	-6.700E-5	-3.677E-3	-6.281E-3	-2.407E-2
N° 15 (OFF)	---	1.068E-3	-2.248E-3	-4.855E-3	-1.894E-2
N° 16 (OFF)	---	8.980E-4	-2.225E-3	-3.570E-3	-1.652E-2
Average (OFF)	---	-5.022E-4	-3.714E-3	-5.733E-3	-1.939E-2
σ (OFF)	---	4.409E-4	4.519E-4	6.439E-4	7.865E-4
Average+3σ (OFF)	---	8.206E-4	-2.358E-3	-3.801E-3	-1.703E-2
Average-3σ (OFF)	---	-1.825E-3	-5.070E-3	-7.665E-3	-2.175E-2
Average (Bias1)	---	1.922E-3	-1.208E-3	-4.260E-3	-1.503E-2
σ (Bias1)	---	5.676E-4	7.404E-4	1.179E-3	3.881E-3
Average+3σ (Bias1)	---	3.624E-3	1.014E-3	-7.236E-4	-3.390E-3
Average-3σ (Bias1)	---	2.188E-4	-3.429E-3	-7.797E-3	-2.668E-2
Average (Bias2)	---	7.758E-4	-2.911E-3	-5.175E-3	-2.016E-2
σ (Bias2)	---	7.300E-4	8.773E-4	1.082E-3	2.829E-3
Average+3σ (Bias2)	---	2.966E-3	-2.793E-4	-1.928E-3	-1.168E-2
Average-3σ (Bias2)	---	-1.414E-3	-5.543E-3	-8.422E-3	-2.865E-2

190 MeV proton / detailed results

3. V(BR)cbo

Ta=25°C; Ic = 100 µA; If = 0



190 MeV proton / detailed results

V(BR)cbo . (V) **Min = 40.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	161.76	162.16	161.89	161.99	162.03
N° 2 (Bias1)	130.05	135.25	145.09	148.52	152.22
N° 3 (Bias1)	158.97	158.23	156.73	156.03	152.69
N° 4 (Bias1)	162.09	161.05	157.08	155.22	149.32
N° 5 (Bias1)	157.46	157.22	156.13	155.43	148.00
N° 6 (Bias1)	158.24	157.64	155.74	155.43	152.75
N° 7 (Bias2)	161.80	161.05	156.70	154.39	141.02
N° 8 (Bias2)	86.86	86.76	87.24	88.24	91.69
N° 9 (Bias2)	160.84	159.81	157.44	155.73	141.86
N° 10 (Bias2)	159.09	158.39	155.51	153.03	140.70
N° 11 (Bias2)	159.74	159.53	157.82	156.26	143.23
N° 12 (OFF)	161.62	162.74	160.34	160.75	159.64
N° 13 (OFF)	160.93	162.96	162.98	162.97	156.65
N° 14 (OFF)	159.30	161.21	158.34	158.12	156.40
N° 15 (OFF)	99.84	103.76	109.48	114.45	130.49
N° 16 (OFF)	162.82	163.57	161.81	161.13	160.43

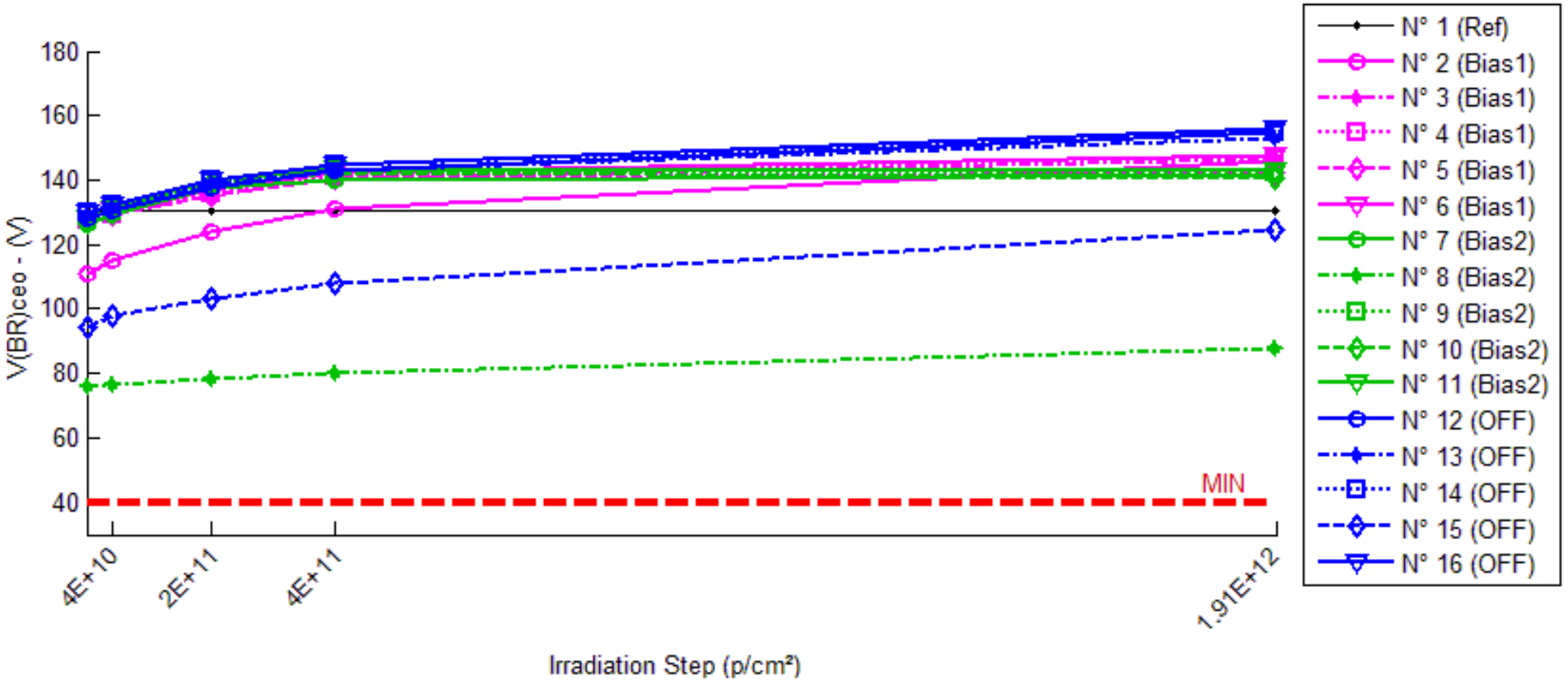
Delta [V(BR)cbo]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	3.927E-1	1.253E-1	2.228E-1	2.671E-1
N° 2 (Bias1)	---	5.202E+0	1.504E+1	1.848E+1	2.217E+1
N° 3 (Bias1)	---	-7.329E-1	-2.238E+0	-2.935E+0	-6.282E+0
N° 4 (Bias1)	---	-1.043E+0	-5.010E+0	-6.872E+0	-1.278E+1
N° 5 (Bias1)	---	-2.484E-1	-1.333E+0	-2.033E+0	-9.465E+0
N° 6 (Bias1)	---	-5.904E-1	-2.500E+0	-2.810E+0	-5.489E+0
N° 7 (Bias2)	---	-7.540E-1	-5.100E+0	-7.407E+0	-2.078E+1
N° 8 (Bias2)	---	-1.010E-1	3.740E-1	1.380E+0	4.824E+0
N° 9 (Bias2)	---	-1.026E+0	-3.395E+0	-5.107E+0	-1.898E+1
N° 10 (Bias2)	---	-6.983E-1	-3.571E+0	-6.056E+0	-1.838E+1
N° 11 (Bias2)	---	-2.155E-1	-1.919E+0	-3.481E+0	-1.651E+1
N° 12 (OFF)	---	1.120E+0	-1.275E+0	-8.673E-1	-1.979E+0
N° 13 (OFF)	---	2.026E+0	2.053E+0	2.035E+0	-4.285E+0
N° 14 (OFF)	---	1.913E+0	-9.598E-1	-1.178E+0	-2.897E+0
N° 15 (OFF)	---	3.916E+0	9.634E+0	1.461E+1	3.064E+1
N° 16 (OFF)	---	7.463E-1	-1.005E+0	-1.688E+0	-2.393E+0
Average (OFF)	---	5.174E-1	7.917E-1	7.657E-1	-2.369E+0
σ (OFF)	---	2.634E+0	8.080E+0	1.008E+1	1.402E+1
Average+3σ (OFF)	---	8.420E+0	2.503E+1	3.100E+1	3.968E+1
Average-3σ (OFF)	---	-7.385E+0	-2.345E+1	-2.947E+1	-4.442E+1
Average (Bias1)	---	-5.590E-1	-2.722E+0	-4.134E+0	-1.397E+1
σ (Bias1)	---	3.884E-1	2.065E+0	3.398E+0	1.061E+1
Average+3σ (Bias1)	---	6.062E-1	3.473E+0	6.059E+0	1.788E+1
Average-3σ (Bias1)	---	-1.724E+0	-8.918E+0	-1.433E+1	-4.581E+1
Average (Bias2)	---	1.944E+0	1.689E+0	2.583E+0	3.818E+0
σ (Bias2)	---	1.226E+0	4.645E+0	6.879E+0	1.502E+1
Average+3σ (Bias2)	---	5.622E+0	1.563E+1	2.322E+1	4.888E+1
Average-3σ (Bias2)	---	-1.734E+0	-1.225E+1	-1.806E+1	-4.125E+1

190 MeV proton / detailed results

4. V(BR)ceo

Ta=25°C; Ic = 1 mA; Ib = 0; If = 0



190 MeV proton / detailed results

V(BR)ceo . (V) **Min = 40.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	130.26	130.37	130.27	130.30	130.32
N° 2 (Bias1)	110.65	114.93	123.94	131.13	145.93
N° 3 (Bias1)	126.88	129.06	135.42	140.85	146.78
N° 4 (Bias1)	127.34	129.37	135.67	141.13	146.29
N° 5 (Bias1)	127.09	129.09	135.34	140.60	142.40
N° 6 (Bias1)	128.32	130.39	136.80	142.39	147.42
N° 7 (Bias2)	126.56	129.31	137.74	140.01	141.60
N° 8 (Bias2)	76.03	76.58	78.27	80.32	87.52
N° 9 (Bias2)	129.64	132.25	139.87	142.76	142.34
N° 10 (Bias2)	126.76	129.77	138.90	142.63	140.78
N° 11 (Bias2)	128.14	131.10	140.13	143.75	143.19
N° 12 (OFF)	128.10	130.41	137.40	142.97	154.98
N° 13 (OFF)	128.87	131.33	138.56	143.15	152.78
N° 14 (OFF)	129.96	132.42	139.83	144.44	155.02
N° 15 (OFF)	94.12	97.86	103.47	108.20	124.61
N° 16 (OFF)	129.64	132.39	139.74	144.46	155.92

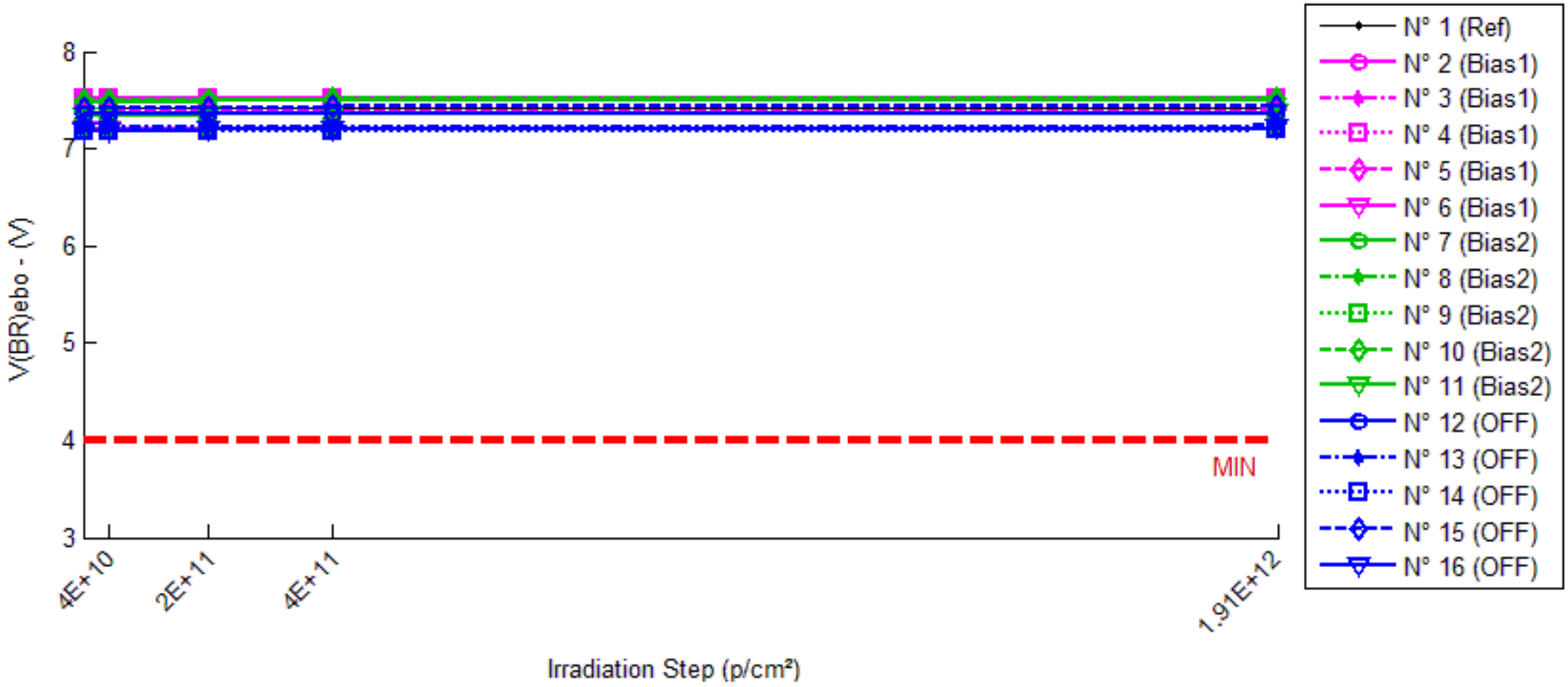
Delta [V(BR)ceo]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	1.092E-1	6.100E-3	3.360E-2	5.830E-2
N° 2 (Bias1)	---	4.284E+0	1.330E+1	2.049E+1	3.528E+1
N° 3 (Bias1)	---	2.177E+0	8.535E+0	1.396E+1	1.989E+1
N° 4 (Bias1)	---	2.030E+0	8.327E+0	1.379E+1	1.895E+1
N° 5 (Bias1)	---	2.005E+0	8.253E+0	1.351E+1	1.531E+1
N° 6 (Bias1)	---	2.065E+0	8.483E+0	1.407E+1	1.910E+1
N° 7 (Bias2)	---	2.752E+0	1.118E+1	1.346E+1	1.504E+1
N° 8 (Bias2)	---	5.516E-1	2.240E+0	4.290E+0	1.150E+1
N° 9 (Bias2)	---	2.610E+0	1.022E+1	1.312E+1	1.270E+1
N° 10 (Bias2)	---	3.007E+0	1.214E+1	1.587E+1	1.402E+1
N° 11 (Bias2)	---	2.966E+0	1.199E+1	1.561E+1	1.506E+1
N° 12 (OFF)	---	2.311E+0	9.300E+0	1.487E+1	2.688E+1
N° 13 (OFF)	---	2.453E+0	9.691E+0	1.428E+1	2.390E+1
N° 14 (OFF)	---	2.467E+0	9.872E+0	1.449E+1	2.507E+1
N° 15 (OFF)	---	3.734E+0	9.351E+0	1.407E+1	3.048E+1
N° 16 (OFF)	---	2.745E+0	1.009E+1	1.481E+1	2.627E+1
Average (OFF)	---	2.512E+0	9.379E+0	1.516E+1	2.171E+1
σ (OFF)	---	9.929E-1	2.194E+0	2.982E+0	7.792E+0
Average+3σ (OFF)	---	5.491E+0	1.596E+1	2.411E+1	4.508E+1
Average-3σ (OFF)	---	-4.666E-1	2.799E+0	6.219E+0	-1.672E+0
Average (Bias1)	---	2.378E+0	9.554E+0	1.247E+1	1.366E+1
σ (Bias1)	---	1.033E+0	4.159E+0	4.736E+0	1.548E+0
Average+3σ (Bias1)	---	5.478E+0	2.203E+1	2.668E+1	1.831E+1
Average-3σ (Bias1)	---	-7.229E-1	-2.923E+0	-1.740E+0	9.021E+0
Average (Bias2)	---	2.742E+0	9.662E+0	1.450E+1	2.652E+1
σ (Bias2)	---	5.763E-1	3.387E-1	3.407E-1	2.492E+0
Average+3σ (Bias2)	---	4.471E+0	1.068E+1	1.553E+1	3.400E+1
Average-3σ (Bias2)	---	1.013E+0	8.646E+0	1.348E+1	1.905E+1

190 MeV proton / detailed results

5. V(BR)ebo

Ta=25°C; Ic = 0; Ie = 100 µA; If = 0



190 MeV proton / detailed results

V(BR)ebo . (V) **Min = 4.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	7.412	7.420	7.413	7.414	7.415
N° 2 (Bias1)	7.513	7.513	7.516	7.515	7.526
N° 3 (Bias1)	7.505	7.506	7.509	7.509	7.516
N° 4 (Bias1)	7.506	7.507	7.511	7.511	7.518
N° 5 (Bias1)	7.383	7.384	7.386	7.386	7.391
N° 6 (Bias1)	7.196	7.198	7.203	7.204	7.210
N° 7 (Bias2)	7.484	7.484	7.490	7.491	7.503
N° 8 (Bias2)	7.353	7.357	7.352	7.356	7.363
N° 9 (Bias2)	7.215	7.215	7.221	7.227	7.237
N° 10 (Bias2)	7.498	7.496	7.500	7.507	7.524
N° 11 (Bias2)	7.345	7.346	7.352	7.362	7.374
N° 12 (OFF)	7.362	7.359	7.365	7.365	7.376
N° 13 (OFF)	7.224	7.223	7.227	7.225	7.231
N° 14 (OFF)	7.178	7.180	7.183	7.183	7.194
N° 15 (OFF)	7.424	7.423	7.426	7.427	7.432
N° 16 (OFF)	7.186	7.187	7.192	7.193	7.211

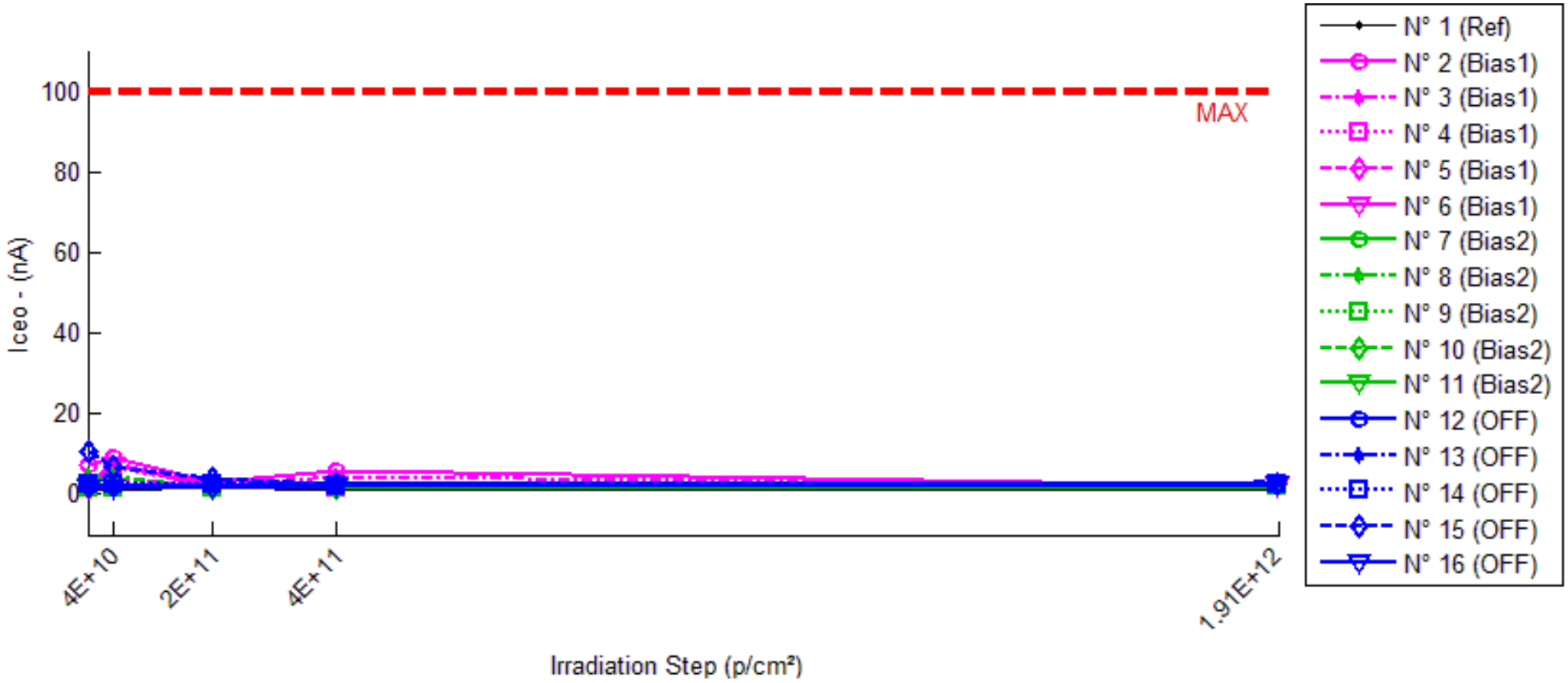
Delta [V(BR)ebo]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	8.174E-3	1.265E-3	2.408E-3	3.023E-3
N° 2 (Bias1)	---	-2.900E-4	2.836E-3	1.824E-3	1.254E-2
N° 3 (Bias1)	---	1.196E-3	4.083E-3	4.401E-3	1.192E-2
N° 4 (Bias1)	---	1.278E-3	5.003E-3	5.357E-3	1.235E-2
N° 5 (Bias1)	---	5.290E-4	2.642E-3	2.920E-3	7.542E-3
N° 6 (Bias1)	---	2.265E-3	6.621E-3	7.558E-3	1.368E-2
N° 7 (Bias2)	---	-8.210E-4	5.552E-3	6.850E-3	1.883E-2
N° 8 (Bias2)	---	3.266E-3	-1.137E-3	2.613E-3	9.515E-3
N° 9 (Bias2)	---	1.000E-6	6.212E-3	1.211E-2	2.205E-2
N° 10 (Bias2)	---	-2.774E-3	1.424E-3	8.447E-3	2.538E-2
N° 11 (Bias2)	---	1.199E-3	7.280E-3	1.656E-2	2.867E-2
N° 12 (OFF)	---	-2.214E-3	3.223E-3	3.547E-3	1.463E-2
N° 13 (OFF)	---	-1.120E-4	3.828E-3	1.621E-3	7.673E-3
N° 14 (OFF)	---	1.403E-3	5.084E-3	4.968E-3	1.626E-2
N° 15 (OFF)	---	-7.630E-4	2.775E-3	2.980E-3	8.031E-3
N° 16 (OFF)	---	9.390E-4	6.077E-3	6.956E-3	2.479E-2
Average (OFF)	---	9.956E-4	4.237E-3	4.412E-3	1.160E-2
σ (OFF)	---	9.489E-4	1.643E-3	2.220E-3	2.362E-3
Average+3σ (OFF)	---	3.842E-3	9.167E-3	1.107E-2	1.869E-2
Average-3σ (OFF)	---	-1.851E-3	-6.927E-4	-2.248E-3	4.518E-3
Average (Bias1)	---	1.742E-4	3.866E-3	9.315E-3	2.089E-2
σ (Bias1)	---	2.254E-3	3.571E-3	5.292E-3	7.344E-3
Average+3σ (Bias1)	---	6.936E-3	1.458E-2	2.519E-2	4.292E-2
Average-3σ (Bias1)	---	-6.588E-3	-6.845E-3	-6.561E-3	-1.142E-3
Average (Bias2)	---	-1.494E-4	4.197E-3	4.014E-3	1.427E-2
σ (Bias2)	---	1.435E-3	1.363E-3	2.036E-3	7.020E-3
Average+3σ (Bias2)	---	4.155E-3	8.286E-3	1.012E-2	3.534E-2
Average-3σ (Bias2)	---	-4.454E-3	1.092E-4	-2.093E-3	-6.786E-3

190 MeV proton / detailed results

6. Iceo

Ta=25°C; Vce=20V



190 MeV proton / detailed results

Iceo . (nA) **Max = 100.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	1.315	1.182	1.453	1.190	1.373
N° 2 (Bias1)	7.431	9.356	3.113	5.932	2.116
N° 3 (Bias1)	2.377	7.726	1.959	4.564	2.009
N° 4 (Bias1)	2.493	6.708	2.182	1.851	2.219
N° 5 (Bias1)	1.591	4.023	1.897	1.835	2.578
N° 6 (Bias1)	2.253	7.347	2.088	1.675	1.980
N° 7 (Bias2)	2.883	1.968	1.784	1.611	2.321
N° 8 (Bias2)	4.292	4.570	1.761	1.706	2.471
N° 9 (Bias2)	1.598	1.638	1.729	1.985	2.325
N° 10 (Bias2)	2.489	2.228	1.714	1.733	2.397
N° 11 (Bias2)	2.033	1.972	1.714	1.748	2.414
N° 12 (OFF)	2.411	1.879	2.334	2.098	2.570
N° 13 (OFF)	1.968	1.816	2.571	2.363	2.953
N° 14 (OFF)	2.747	2.370	2.473	2.058	2.472
N° 15 (OFF)	10.465	6.770	3.820	2.642	2.562
N° 16 (OFF)	1.735	1.793	1.759	1.931	2.641

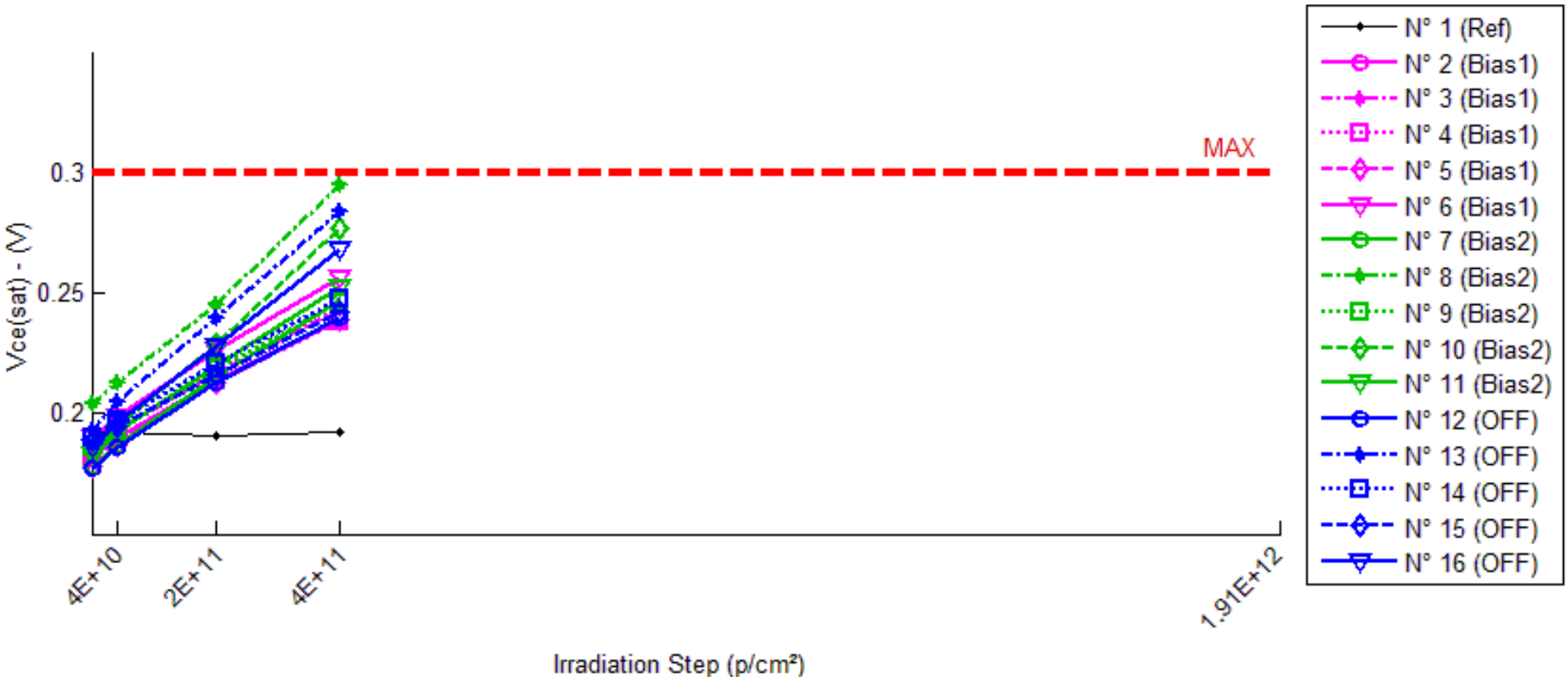
Delta [Iceo]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	-1.331E-1	1.383E-1	-1.241E-1	5.838E-2
N° 2 (Bias1)	---	1.925E+0	-4.318E+0	-1.499E+0	-5.314E+0
N° 3 (Bias1)	---	5.349E+0	-4.176E-1	2.187E+0	-3.679E-1
N° 4 (Bias1)	---	4.215E+0	-3.109E-1	-6.425E-1	-2.743E-1
N° 5 (Bias1)	---	2.432E+0	3.063E-1	2.443E-1	9.865E-1
N° 6 (Bias1)	---	5.093E+0	-1.653E-1	-5.782E-1	-2.738E-1
N° 7 (Bias2)	---	-9.143E-1	-1.098E+0	-1.272E+0	-5.616E-1
N° 8 (Bias2)	---	2.784E-1	-2.530E+0	-2.586E+0	-1.821E+0
N° 9 (Bias2)	---	3.965E-2	1.311E-1	3.870E-1	7.273E-1
N° 10 (Bias2)	---	-2.612E-1	-7.758E-1	-7.567E-1	-9.197E-2
N° 11 (Bias2)	---	-6.122E-2	-3.187E-1	-2.855E-1	3.810E-1
N° 12 (OFF)	---	-5.319E-1	-7.749E-2	-3.134E-1	1.588E-1
N° 13 (OFF)	---	-1.512E-1	6.032E-1	3.950E-1	9.858E-1
N° 14 (OFF)	---	-3.770E-1	-2.745E-1	-6.895E-1	-2.752E-1
N° 15 (OFF)	---	-3.694E+0	-6.645E+0	-7.823E+0	-7.903E+0
N° 16 (OFF)	---	5.810E-2	2.389E-2	1.962E-1	9.061E-1
Average (OFF)	---	3.803E+0	-9.811E-1	-5.763E-2	-1.049E+0
σ (OFF)	---	1.552E+0	1.886E+0	1.398E+0	2.450E+0
Average+3σ (OFF)	---	8.458E+0	4.676E+0	4.137E+0	6.300E+0
Average-3σ (OFF)	---	-8.522E-1	-6.638E+0	-4.253E+0	-8.397E+0
Average (Bias1)	---	-1.837E-1	-9.184E-1	-9.026E-1	-2.732E-1
σ (Bias1)	---	4.523E-1	1.014E+0	1.122E+0	9.925E-1
Average+3σ (Bias1)	---	1.173E+0	2.123E+0	2.464E+0	2.704E+0
Average-3σ (Bias1)	---	-1.541E+0	-3.960E+0	-4.269E+0	-3.251E+0
Average (Bias2)	---	-9.392E-1	-1.274E+0	-1.647E+0	-1.225E+0
σ (Bias2)	---	1.556E+0	3.020E+0	3.479E+0	3.770E+0
Average+3σ (Bias2)	---	3.729E+0	7.787E+0	8.789E+0	1.008E+1
Average-3σ (Bias2)	---	-5.608E+0	-1.033E+1	-1.208E+1	-1.253E+1

190 MeV proton / detailed results

7. Vce(sat)

Ta=25°C; If = 20 mA; Ic = 10 mA



190 MeV proton / detailed results

Vce(sat) . (V) **Max = 0.3**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	0.192	0.192	0.191	0.192	0.192
N° 2 (Bias1)	0.183	0.190	0.214	0.239	Not Measurable
N° 3 (Bias1)	0.186	0.193	0.217	0.244	Not Measurable
N° 4 (Bias1)	0.181	0.189	0.214	0.238	Not Measurable
N° 5 (Bias1)	0.178	0.187	0.213	0.239	Not Measurable
N° 6 (Bias1)	0.190	0.199	0.226	0.256	Not Measurable
N° 7 (Bias2)	0.178	0.187	0.215	0.247	Not Measurable
N° 8 (Bias2)	0.204	0.213	0.245	0.295	Not Measurable
N° 9 (Bias2)	0.186	0.193	0.218	0.246	Not Measurable
N° 10 (Bias2)	0.184	0.195	0.229	0.277	Not Measurable
N° 11 (Bias2)	0.183	0.192	0.220	0.252	Not Measurable
N° 12 (OFF)	0.177	0.186	0.213	0.240	Not Measurable
N° 13 (OFF)	0.193	0.205	0.240	0.284	Not Measurable
N° 14 (OFF)	0.190	0.197	0.221	0.248	Not Measurable
N° 15 (OFF)	0.189	0.195	0.216	0.242	Not Measurable
N° 16 (OFF)	0.186	0.196	0.228	0.268	Not Measurable

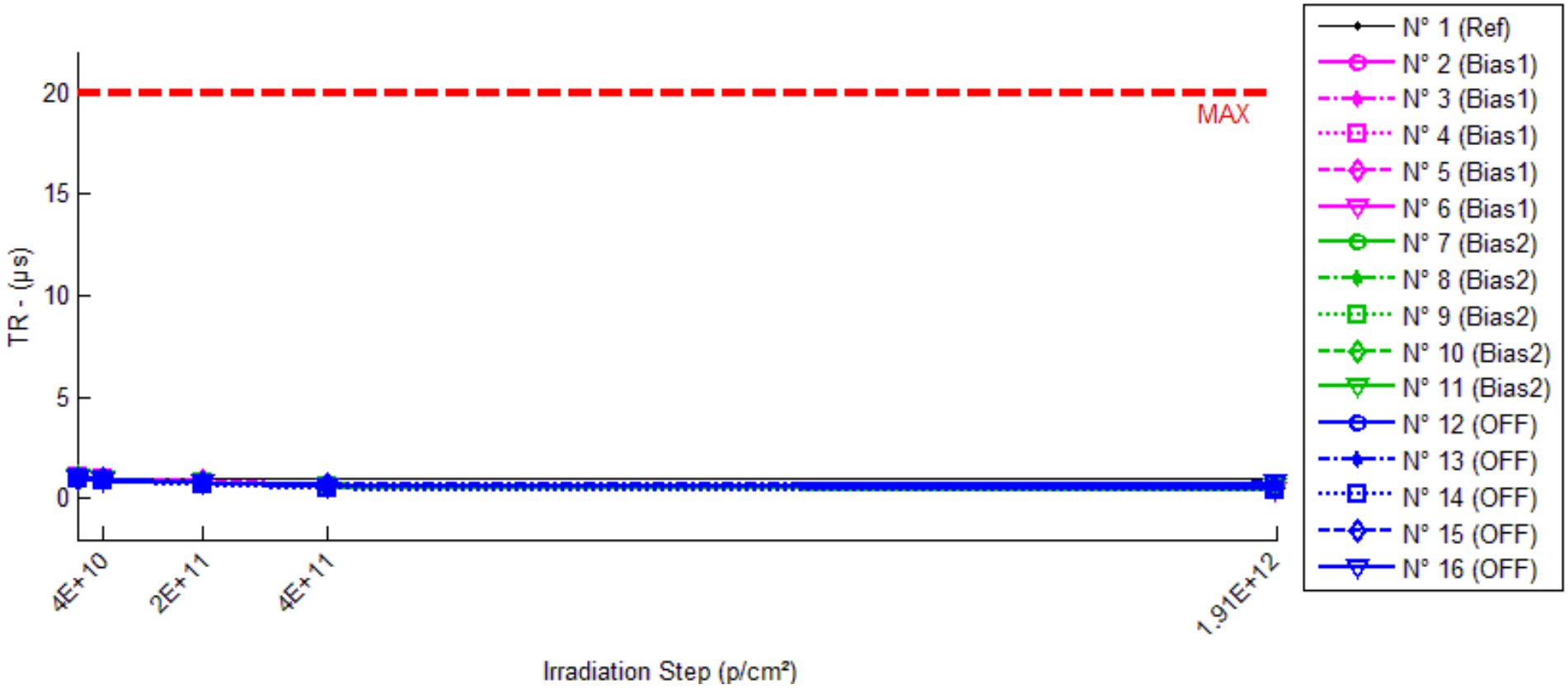
Delta [Vce(sat)]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	7.770E-5	-2.081E-4	-7.110E-5	8.610E-5
N° 2 (Bias1)	---	6.841E-3	3.048E-2	5.514E-2	1.237E+2
N° 3 (Bias1)	---	7.119E-3	3.115E-2	5.864E-2	1.303E+2
N° 4 (Bias1)	---	8.420E-3	3.308E-2	5.735E-2	1.229E+2
N° 5 (Bias1)	---	9.020E-3	3.471E-2	6.080E-2	1.232E+2
N° 6 (Bias1)	---	8.739E-3	3.554E-2	6.532E-2	1.312E+2
N° 7 (Bias2)	---	8.902E-3	3.641E-2	6.824E-2	1.355E+2
N° 8 (Bias2)	---	9.274E-3	4.153E-2	9.183E-2	9.523E+1
N° 9 (Bias2)	---	7.515E-3	3.186E-2	6.062E-2	1.325E+2
N° 10 (Bias2)	---	1.083E-2	4.481E-2	9.297E-2	1.394E+2
N° 11 (Bias2)	---	9.274E-3	3.687E-2	6.879E-2	1.380E+2
N° 12 (OFF)	---	8.601E-3	3.572E-2	6.266E-2	1.334E+2
N° 13 (OFF)	---	1.199E-2	4.702E-2	9.090E-2	1.408E+2
N° 14 (OFF)	---	6.994E-3	3.062E-2	5.800E-2	1.372E+2
N° 15 (OFF)	---	5.888E-3	2.743E-2	5.342E-2	1.251E+2
N° 16 (OFF)	---	9.863E-3	4.134E-2	8.160E-2	1.437E+2
Average (OFF)	---	8.028E-3	3.299E-2	5.945E-2	1.263E+2
σ (OFF)	---	9.847E-4	2.188E-3	3.868E-3	4.106E+0
Average+3σ (OFF)	---	1.098E-2	3.955E-2	7.106E-2	1.386E+2
Average-3σ (OFF)	---	5.074E-3	2.643E-2	4.785E-2	1.139E+2
Average (Bias1)	---	9.160E-3	3.830E-2	7.649E-2	1.281E+2
σ (Bias1)	---	1.183E-3	4.995E-3	1.488E-2	1.857E+1
Average+3σ (Bias1)	---	1.271E-2	5.328E-2	1.211E-1	1.838E+2
Average-3σ (Bias1)	---	5.609E-3	2.331E-2	3.184E-2	7.241E+1
Average (Bias2)	---	8.668E-3	3.642E-2	6.931E-2	1.360E+2
σ (Bias2)	---	2.398E-3	7.927E-3	1.614E-2	7.233E+0
Average+3σ (Bias2)	---	1.586E-2	6.021E-2	1.177E-1	1.577E+2
Average-3σ (Bias2)	---	1.474E-3	1.264E-2	2.090E-2	1.143E+2

190 MeV proton / detailed results

8. TR

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



190 MeV proton / detailed results

TR . (µs) **Max = 20.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	0.96	0.96	1.00	0.96	1.00
N° 2 (Bias1)	1.00	0.96	0.84	0.68	0.48
N° 3 (Bias1)	1.04	0.96	0.84	0.68	0.48
N° 4 (Bias1)	1.04	0.96	0.84	0.64	0.44
N° 5 (Bias1)	1.04	1.00	0.88	0.68	0.52
N° 6 (Bias1)	1.04	1.00	0.84	0.60	0.44
N° 7 (Bias2)	1.04	1.00	0.80	0.64	0.44
N° 8 (Bias2)	0.96	0.92	0.76	0.68	0.68
N° 9 (Bias2)	0.96	0.92	0.76	0.64	0.60
N° 10 (Bias2)	1.08	0.96	0.80	0.68	0.60
N° 11 (Bias2)	1.04	0.96	0.76	0.64	0.64
N° 12 (OFF)	1.00	0.96	0.76	0.68	0.52
N° 13 (OFF)	1.00	0.96	0.84	0.68	0.80
N° 14 (OFF)	0.96	0.88	0.72	0.56	0.40
N° 15 (OFF)	1.00	1.00	0.84	0.68	0.52
N° 16 (OFF)	1.00	0.92	0.76	0.60	0.76

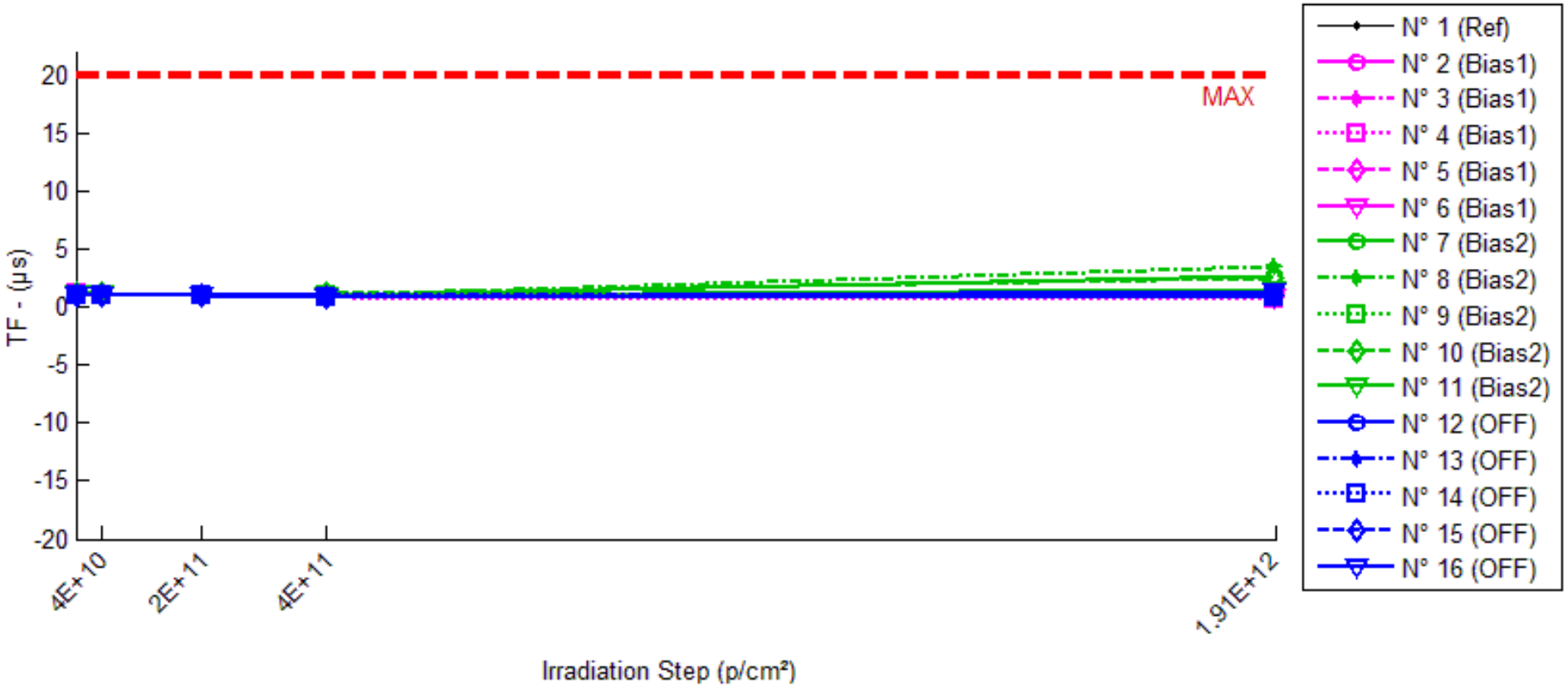
Delta [TR]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	0.000E+0	4.000E-2	0.000E+0	4.000E-2
N° 2 (Bias1)	---	-4.000E-2	-1.600E-1	-3.200E-1	-5.200E-1
N° 3 (Bias1)	---	-8.000E-2	-2.000E-1	-3.600E-1	-5.600E-1
N° 4 (Bias1)	---	-8.000E-2	-2.000E-1	-4.000E-1	-6.000E-1
N° 5 (Bias1)	---	-4.000E-2	-1.600E-1	-3.600E-1	-5.200E-1
N° 6 (Bias1)	---	-4.000E-2	-2.000E-1	-4.400E-1	-6.000E-1
N° 7 (Bias2)	---	-4.000E-2	-2.400E-1	-4.000E-1	-6.000E-1
N° 8 (Bias2)	---	-4.000E-2	-2.000E-1	-2.800E-1	-2.800E-1
N° 9 (Bias2)	---	-4.000E-2	-2.000E-1	-3.200E-1	-3.600E-1
N° 10 (Bias2)	---	-1.200E-1	-2.800E-1	-4.000E-1	-4.800E-1
N° 11 (Bias2)	---	-8.000E-2	-2.800E-1	-4.000E-1	-4.000E-1
N° 12 (OFF)	---	-4.000E-2	-2.400E-1	-3.200E-1	-4.800E-1
N° 13 (OFF)	---	-4.000E-2	-1.600E-1	-3.200E-1	-2.000E-1
N° 14 (OFF)	---	-8.000E-2	-2.400E-1	-4.000E-1	-5.600E-1
N° 15 (OFF)	---	0.000E+0	-1.600E-1	-3.200E-1	-4.800E-1
N° 16 (OFF)	---	-8.000E-2	-2.400E-1	-4.000E-1	-2.400E-1
Average (OFF)	---	-5.600E-2	-1.840E-1	-3.760E-1	-5.600E-1
σ (OFF)	---	2.191E-2	2.191E-2	4.561E-2	4.000E-2
Average+3σ (OFF)	---	9.727E-3	-1.183E-1	-2.392E-1	-4.400E-1
Average-3σ (OFF)	---	-1.217E-1	-2.497E-1	-5.128E-1	-6.800E-1
Average (Bias1)	---	-6.400E-2	-2.400E-1	-3.600E-1	-4.240E-1
σ (Bias1)	---	3.578E-2	4.000E-2	5.657E-2	1.220E-1
Average+3σ (Bias1)	---	4.333E-2	-1.200E-1	-1.903E-1	-5.805E-2
Average-3σ (Bias1)	---	-1.713E-1	-3.600E-1	-5.297E-1	-7.900E-1
Average (Bias2)	---	-4.800E-2	-2.080E-1	-3.520E-1	-3.920E-1
σ (Bias2)	---	3.347E-2	4.382E-2	4.382E-2	1.610E-1
Average+3σ (Bias2)	---	5.240E-2	-7.655E-2	-2.205E-1	9.099E-2
Average-3σ (Bias2)	---	-1.484E-1	-3.395E-1	-4.835E-1	-8.750E-1

190 MeV proton / detailed results

9. TF

Ta=25°C; Vcc = 10 V; If = 10 mA; RL = 100 Ohms



190 MeV proton / detailed results

TF . (µs) **Max = 20.0**

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	1.08	1.12	1.12	1.04	1.12
N° 2 (Bias1)	1.12	1.08	1.00	0.92	0.76
N° 3 (Bias1)	1.12	1.08	1.00	0.88	0.80
N° 4 (Bias1)	1.12	1.08	0.96	0.84	0.72
N° 5 (Bias1)	1.16	1.12	1.08	0.92	0.76
N° 6 (Bias1)	1.12	1.12	1.00	0.84	0.80
N° 7 (Bias2)	1.12	1.12	1.00	1.04	2.60
N° 8 (Bias2)	1.08	1.04	1.00	1.00	3.56
N° 9 (Bias2)	1.04	1.04	1.00	0.92	1.36
N° 10 (Bias2)	1.12	1.16	1.08	1.16	2.44
N° 11 (Bias2)	1.12	1.12	1.00	1.00	1.52
N° 12 (OFF)	1.12	1.08	0.96	0.92	0.84
N° 13 (OFF)	1.12	1.12	1.04	1.00	1.24
N° 14 (OFF)	1.04	1.00	0.96	0.84	0.84
N° 15 (OFF)	1.08	1.08	1.00	0.88	0.92
N° 16 (OFF)	1.04	1.08	1.04	0.84	1.36

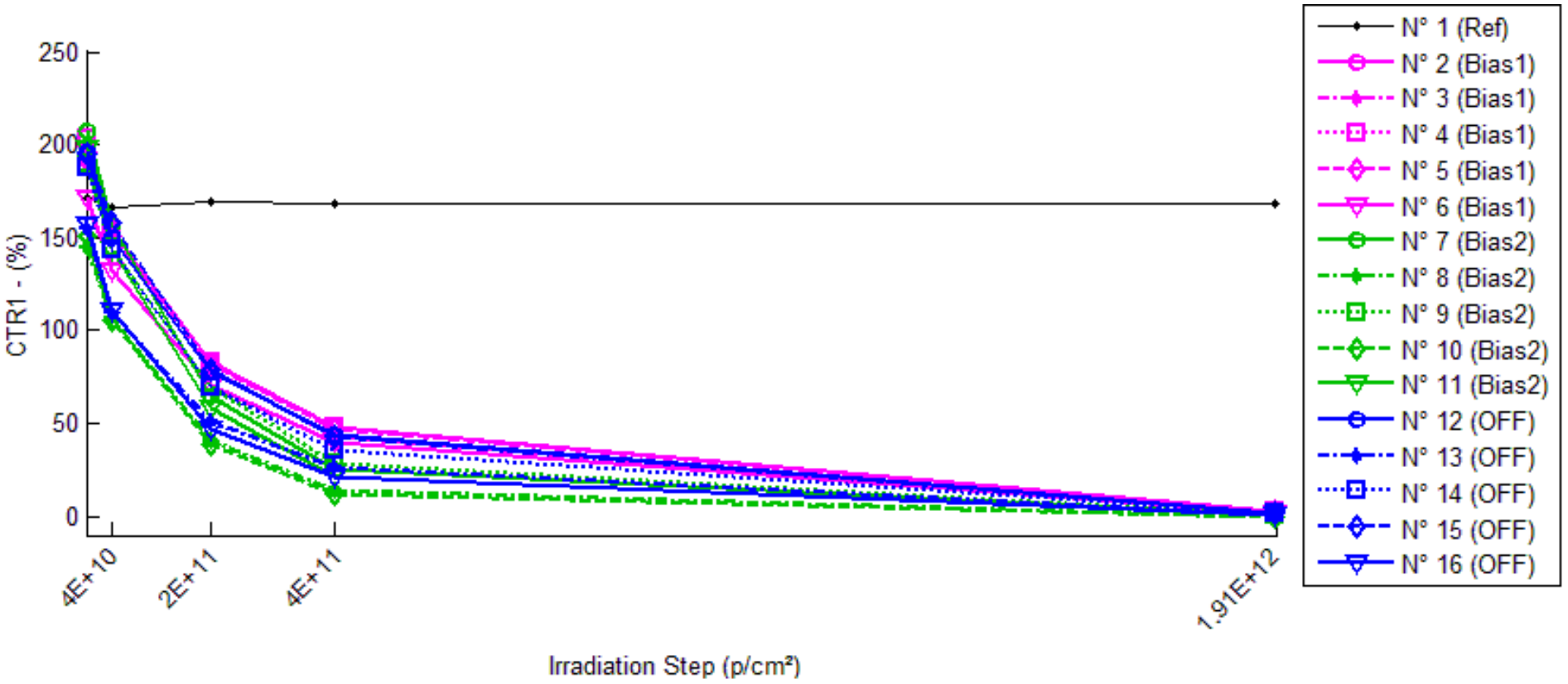
Delta [TF]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	4.000E-2	4.000E-2	-4.000E-2	4.000E-2
N° 2 (Bias1)	---	-4.000E-2	-1.200E-1	-2.000E-1	-3.600E-1
N° 3 (Bias1)	---	-4.000E-2	-1.200E-1	-2.400E-1	-3.200E-1
N° 4 (Bias1)	---	-4.000E-2	-1.600E-1	-2.800E-1	-4.000E-1
N° 5 (Bias1)	---	-4.000E-2	-8.000E-2	-2.400E-1	-4.000E-1
N° 6 (Bias1)	---	0.000E+0	-1.200E-1	-2.800E-1	-3.200E-1
N° 7 (Bias2)	---	0.000E+0	-1.200E-1	-8.000E-2	1.480E+0
N° 8 (Bias2)	---	-4.000E-2	-8.000E-2	-8.000E-2	2.480E+0
N° 9 (Bias2)	---	0.000E+0	-4.000E-2	-1.200E-1	3.200E-1
N° 10 (Bias2)	---	4.000E-2	-4.000E-2	4.000E-2	1.320E+0
N° 11 (Bias2)	---	0.000E+0	-1.200E-1	-1.200E-1	4.000E-1
N° 12 (OFF)	---	-4.000E-2	-1.600E-1	-2.000E-1	-2.800E-1
N° 13 (OFF)	---	0.000E+0	-8.000E-2	-1.200E-1	1.200E-1
N° 14 (OFF)	---	-4.000E-2	-8.000E-2	-2.000E-1	-2.000E-1
N° 15 (OFF)	---	0.000E+0	-8.000E-2	-2.000E-1	-1.600E-1
N° 16 (OFF)	---	4.000E-2	0.000E+0	-2.000E-1	3.200E-1
Average (OFF)	---	-3.200E-2	-1.200E-1	-2.480E-1	-3.600E-1
σ (OFF)	---	1.789E-2	2.828E-2	3.347E-2	4.000E-2
Average+3σ (OFF)	---	2.167E-2	-3.515E-2	-1.476E-1	-2.400E-1
Average-3σ (OFF)	---	-8.567E-2	-2.049E-1	-3.484E-1	-4.800E-1
Average (Bias1)	---	-4.441E-17	-8.000E-2	-7.200E-2	1.200E+0
σ (Bias1)	---	2.828E-2	4.000E-2	6.573E-2	8.868E-1
Average+3σ (Bias1)	---	8.485E-2	4.000E-2	1.252E-1	3.860E+0
Average-3σ (Bias1)	---	-8.485E-2	-2.000E-1	-2.692E-1	-1.460E+0
Average (Bias2)	---	-8.000E-3	-8.000E-2	-1.840E-1	-4.000E-2
σ (Bias2)	---	3.347E-2	5.657E-2	3.578E-2	2.514E-1
Average+3σ (Bias2)	---	9.240E-2	8.971E-2	-7.667E-2	7.142E-1
Average-3σ (Bias2)	---	-1.084E-1	-2.497E-1	-2.913E-1	-7.942E-1

190 MeV proton / detailed results

10.CTR1

Ta=25°C; Vce=5V; If=1mA



190 MeV proton / detailed results

CTR1 . (%)

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	171.84	166.60	169.40	168.47	167.99
N° 2 (Bias1)	192.04	153.74	83.08	48.01	2.73
N° 3 (Bias1)	196.73	152.45	78.39	43.21	1.95
N° 4 (Bias1)	203.51	154.23	82.88	48.15	2.74
N° 5 (Bias1)	196.34	150.49	82.18	47.51	2.69
N° 6 (Bias1)	171.03	132.11	70.25	39.55	2.07
N° 7 (Bias2)	206.97	156.72	64.72	25.34	0.55
N° 8 (Bias2)	144.92	106.29	40.93	14.14	0.26
N° 9 (Bias2)	190.12	144.52	69.14	28.86	0.99
N° 10 (Bias2)	150.82	106.01	39.23	12.30	0.20
N° 11 (Bias2)	197.92	143.66	58.82	21.09	0.42
N° 12 (OFF)	196.18	150.18	77.98	43.80	1.79
N° 13 (OFF)	154.67	110.11	51.62	26.18	0.78
N° 14 (OFF)	187.63	143.39	69.86	36.20	1.32
N° 15 (OFF)	194.86	157.96	78.94	42.58	1.51
N° 16 (OFF)	156.95	110.30	46.96	21.20	0.48

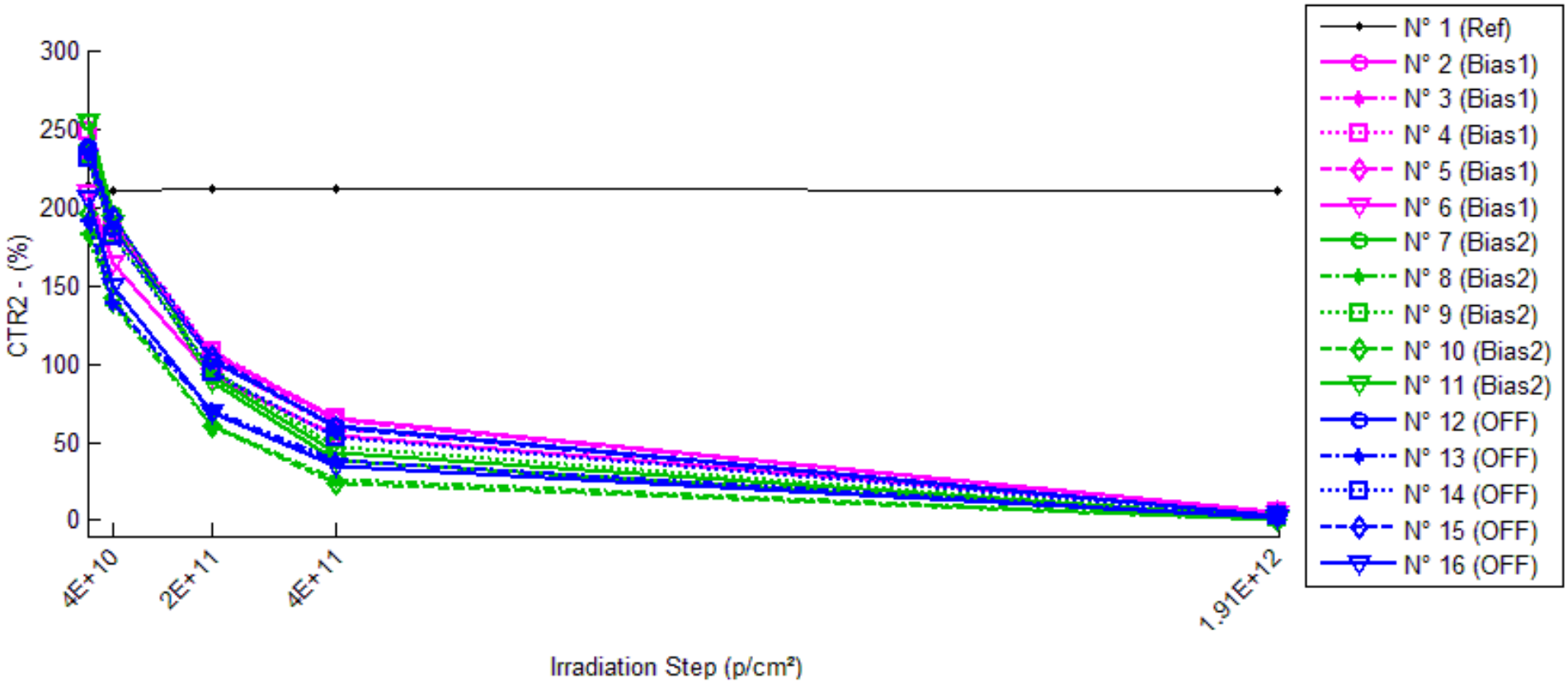
1/Delta [CTR1]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	1.827E-4	8.368E-5	1.161E-4	1.332E-4
N° 2 (Bias1)	---	1.297E-3	6.829E-3	1.562E-2	3.605E-1
N° 3 (Bias1)	---	1.476E-3	7.674E-3	1.806E-2	5.070E-1
N° 4 (Bias1)	---	1.570E-3	7.152E-3	1.585E-2	3.594E-1
N° 5 (Bias1)	---	1.552E-3	7.075E-3	1.596E-2	3.664E-1
N° 6 (Bias1)	---	1.722E-3	8.387E-3	1.944E-2	4.783E-1
N° 7 (Bias2)	---	1.549E-3	1.062E-2	3.463E-2	1.825E+0
N° 8 (Bias2)	---	2.508E-3	1.753E-2	6.381E-2	3.885E+0
N° 9 (Bias2)	---	1.659E-3	9.204E-3	2.939E-2	1.002E+0
N° 10 (Bias2)	---	2.803E-3	1.886E-2	7.466E-2	4.993E+0
N° 11 (Bias2)	---	1.908E-3	1.195E-2	4.236E-2	2.390E+0
N° 12 (OFF)	---	1.561E-3	7.726E-3	1.773E-2	5.524E-1
N° 13 (OFF)	---	2.617E-3	1.291E-2	3.173E-2	1.276E+0
N° 14 (OFF)	---	1.645E-3	8.984E-3	2.229E-2	7.524E-1
N° 15 (OFF)	---	1.199E-3	7.537E-3	1.836E-2	6.557E-1
N° 16 (OFF)	---	2.695E-3	1.492E-2	4.079E-2	2.077E+0
Average (OFF)	---	1.524E-3	7.423E-3	1.699E-2	4.143E-1
σ (OFF)	---	1.550E-4	6.204E-4	1.685E-3	7.227E-2
Average+3σ (OFF)	---	1.988E-3	9.285E-3	2.204E-2	6.311E-1
Average-3σ (OFF)	---	1.059E-3	5.562E-3	1.193E-2	1.975E-1
Average (Bias1)	---	2.085E-3	1.363E-2	4.897E-2	2.819E+0
σ (Bias1)	---	5.463E-4	4.303E-3	1.945E-2	1.607E+0
Average+3σ (Bias1)	---	3.724E-3	2.654E-2	1.073E-1	7.641E+0
Average-3σ (Bias1)	---	4.466E-4	7.238E-4	-9.380E-3	-2.003E+0
Average (Bias2)	---	1.943E-3	1.042E-2	2.618E-2	1.063E+0
σ (Bias2)	---	6.724E-4	3.320E-3	9.899E-3	6.317E-1
Average+3σ (Bias2)	---	3.960E-3	2.038E-2	5.588E-2	2.958E+0
Average-3σ (Bias2)	---	-7.381E-5	4.548E-4	-3.517E-3	-8.324E-1

190 MeV proton / detailed results

11.CTR2

Ta=25°C; Vce=5V; If=2mA



190 MeV proton / detailed results

CTR2 . (%)

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	214.27	210.70	212.84	211.79	211.72
N° 2 (Bias1)	234.25	190.29	107.07	64.80	4.97
N° 3 (Bias1)	240.25	189.51	102.23	59.38	3.65
N° 4 (Bias1)	249.09	192.27	108.12	65.96	4.96
N° 5 (Bias1)	238.73	185.29	105.55	64.07	4.85
N° 6 (Bias1)	210.14	165.04	91.97	54.41	3.76
N° 7 (Bias2)	254.95	196.62	92.46	43.02	1.23
N° 8 (Bias2)	182.65	137.85	60.95	25.62	0.55
N° 9 (Bias2)	234.33	183.03	96.13	47.22	2.08
N° 10 (Bias2)	196.03	142.19	60.67	23.81	0.42
N° 11 (Bias2)	254.96	190.51	88.70	38.90	0.94
N° 12 (OFF)	239.44	186.31	101.75	60.53	3.37
N° 13 (OFF)	191.19	139.16	69.96	38.04	1.54
N° 14 (OFF)	232.02	181.82	94.81	52.78	2.54
N° 15 (OFF)	236.82	194.33	104.31	59.67	2.94
N° 16 (OFF)	205.90	149.98	69.15	34.18	1.07

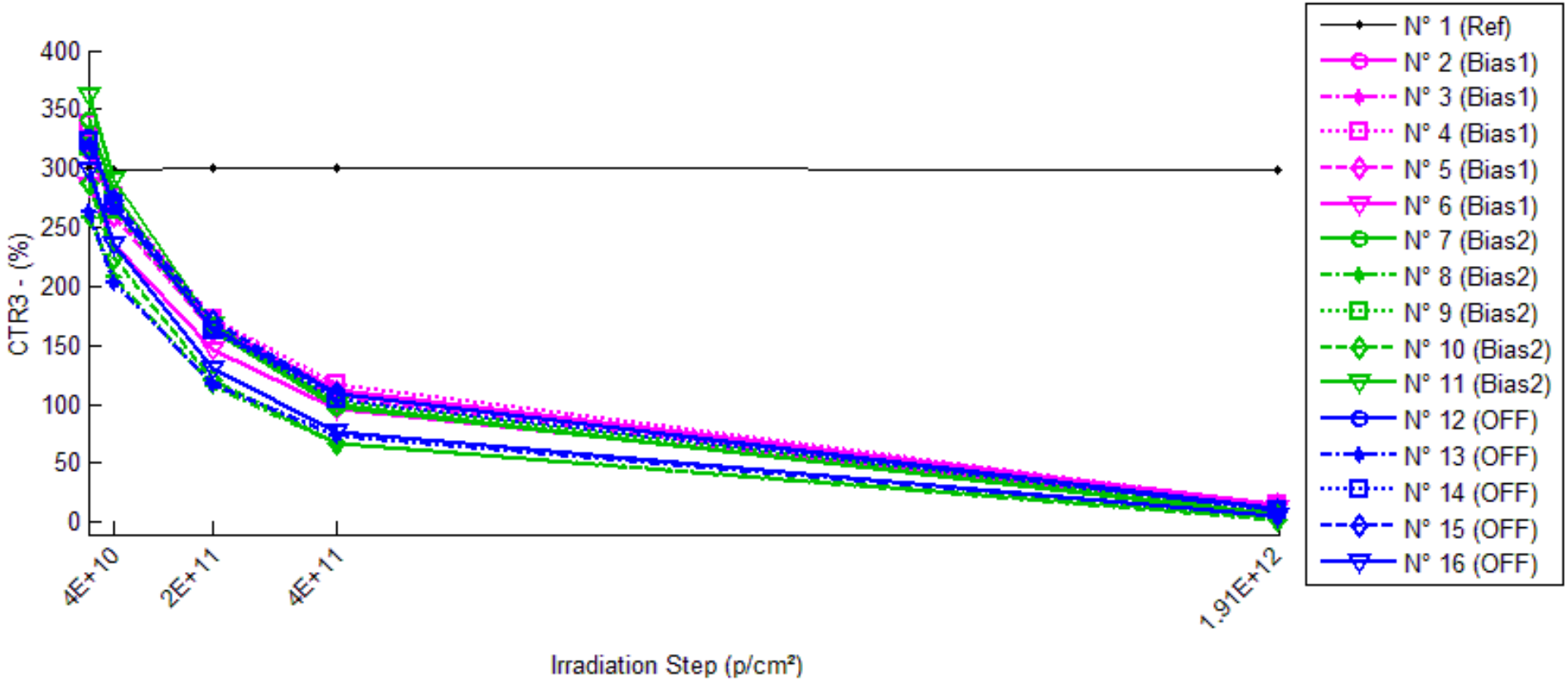
1/Delta [CTR2]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	7.903E-5	3.134E-5	5.448E-5	5.613E-5
N° 2 (Bias1)	---	9.861E-4	5.071E-3	1.116E-2	1.970E-1
N° 3 (Bias1)	---	1.114E-3	5.619E-3	1.268E-2	2.696E-1
N° 4 (Bias1)	---	1.186E-3	5.235E-3	1.115E-2	1.976E-1
N° 5 (Bias1)	---	1.208E-3	5.286E-3	1.142E-2	2.019E-1
N° 6 (Bias1)	---	1.300E-3	6.114E-3	1.362E-2	2.610E-1
N° 7 (Bias2)	---	1.164E-3	6.893E-3	1.932E-2	8.114E-1
N° 8 (Bias2)	---	1.779E-3	1.093E-2	3.356E-2	1.825E+0
N° 9 (Bias2)	---	1.196E-3	6.135E-3	1.691E-2	4.766E-1
N° 10 (Bias2)	---	1.932E-3	1.138E-2	3.690E-2	2.356E+0
N° 11 (Bias2)	---	1.327E-3	7.351E-3	2.179E-2	1.059E+0
N° 12 (OFF)	---	1.191E-3	5.652E-3	1.234E-2	2.922E-1
N° 13 (OFF)	---	1.956E-3	9.064E-3	2.106E-2	6.449E-1
N° 14 (OFF)	---	1.190E-3	6.238E-3	1.464E-2	3.889E-1
N° 15 (OFF)	---	9.233E-4	5.364E-3	1.254E-2	3.365E-1
N° 16 (OFF)	---	1.811E-3	9.605E-3	2.440E-2	9.284E-1
Average (OFF)	---	1.159E-3	5.465E-3	1.201E-2	2.254E-1
σ (OFF)	---	1.173E-4	4.140E-4	1.101E-3	3.658E-2
Average+3σ (OFF)	---	1.511E-3	6.707E-3	1.531E-2	3.352E-1
Average-3σ (OFF)	---	8.072E-4	4.223E-3	8.702E-3	1.157E-1
Average (Bias1)	---	1.479E-3	8.538E-3	2.569E-2	1.305E+0
σ (Bias1)	---	3.527E-4	2.434E-3	8.949E-3	7.689E-1
Average+3σ (Bias1)	---	2.538E-3	1.584E-2	5.254E-2	3.612E+0
Average-3σ (Bias1)	---	4.214E-4	1.237E-3	-1.154E-3	-1.001E+0
Average (Bias2)	---	1.414E-3	7.185E-3	1.700E-2	5.182E-1
σ (Bias2)	---	4.449E-4	1.997E-3	5.442E-3	2.670E-1
Average+3σ (Bias2)	---	2.749E-3	1.318E-2	3.332E-2	1.319E+0
Average-3σ (Bias2)	---	7.947E-5	1.194E-3	6.690E-4	-2.828E-1

190 MeV proton / detailed results

12.CTR3

Ta=25°C; Vce = 5V; If = 10 mA



190 MeV proton / detailed results

CTR3 . (%)

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	300.48	299.26	300.11	299.59	299.50
N° 2 (Bias1)	314.57	266.89	167.20	111.87	14.98
N° 3 (Bias1)	322.76	268.53	163.06	105.41	11.89
N° 4 (Bias1)	337.94	275.36	172.16	116.53	15.45
N° 5 (Bias1)	320.94	259.55	163.12	109.99	14.60
N° 6 (Bias1)	285.73	236.28	146.97	96.76	11.74
N° 7 (Bias2)	341.26	278.81	162.86	98.38	6.54
N° 8 (Bias2)	258.20	208.37	116.37	66.20	3.09
N° 9 (Bias2)	318.48	264.84	164.87	103.18	9.41
N° 10 (Bias2)	287.26	223.90	121.23	66.65	2.60
N° 11 (Bias2)	362.29	290.34	167.41	99.23	5.46
N° 12 (OFF)	326.60	267.51	164.09	108.95	11.68
N° 13 (OFF)	262.48	203.57	118.01	73.90	6.00
N° 14 (OFF)	322.24	269.05	163.05	104.11	9.66
N° 15 (OFF)	316.89	272.00	169.99	109.22	10.53
N° 16 (OFF)	299.38	235.99	130.09	76.65	5.23

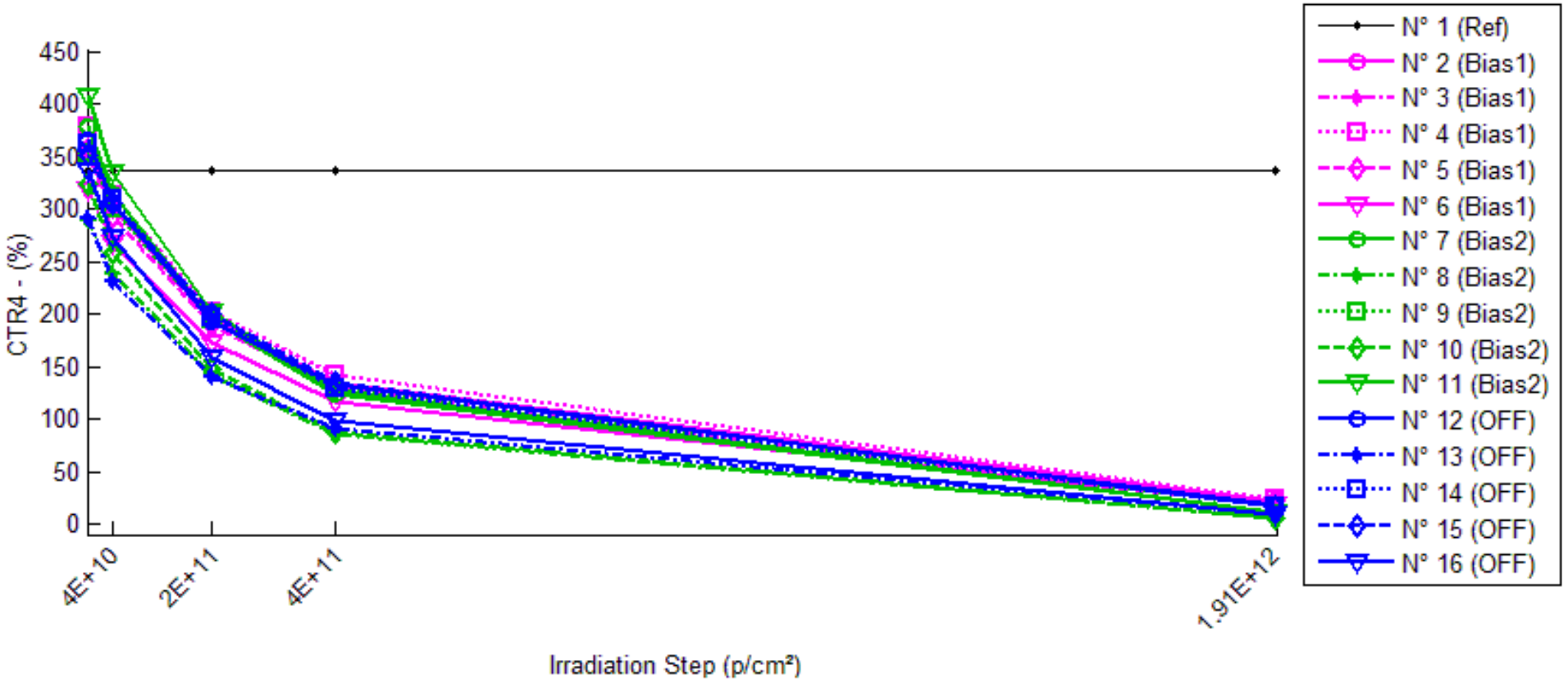
1/Delta [CTR3]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	1.354E-5	4.013E-6	9.864E-6	1.089E-5
N° 2 (Bias1)	---	5.679E-4	2.802E-3	5.760E-3	6.358E-2
N° 3 (Bias1)	---	6.257E-4	3.035E-3	6.389E-3	8.102E-2
N° 4 (Bias1)	---	6.724E-4	2.849E-3	5.623E-3	6.178E-2
N° 5 (Bias1)	---	7.370E-4	3.015E-3	5.976E-3	6.538E-2
N° 6 (Bias1)	---	7.325E-4	3.304E-3	6.835E-3	8.168E-2
N° 7 (Bias2)	---	6.563E-4	3.210E-3	7.235E-3	1.500E-1
N° 8 (Bias2)	---	9.261E-4	4.720E-3	1.123E-2	3.193E-1
N° 9 (Bias2)	---	6.360E-4	2.925E-3	6.552E-3	1.031E-1
N° 10 (Bias2)	---	9.851E-4	4.768E-3	1.152E-2	3.815E-1
N° 11 (Bias2)	---	6.840E-4	3.213E-3	7.317E-3	1.804E-1
N° 12 (OFF)	---	6.763E-4	3.032E-3	6.117E-3	8.258E-2
N° 13 (OFF)	---	1.102E-3	4.664E-3	9.723E-3	1.629E-1
N° 14 (OFF)	---	6.134E-4	3.030E-3	6.501E-3	1.004E-1
N° 15 (OFF)	---	5.208E-4	2.727E-3	6.000E-3	9.178E-2
N° 16 (OFF)	---	8.972E-4	4.347E-3	9.706E-3	1.878E-1
Average (OFF)	---	6.671E-4	3.001E-3	6.116E-3	7.069E-2
σ (OFF)	---	7.201E-5	1.974E-4	4.954E-4	9.817E-3
Average+3σ (OFF)	---	8.831E-4	3.593E-3	7.603E-3	1.001E-1
Average-3σ (OFF)	---	4.511E-4	2.409E-3	4.630E-3	4.124E-2
Average (Bias1)	---	7.775E-4	3.767E-3	8.772E-3	2.269E-1
σ (Bias1)	---	1.648E-4	8.993E-4	2.399E-3	1.182E-1
Average+3σ (Bias1)	---	1.272E-3	6.465E-3	1.597E-2	5.814E-1
Average-3σ (Bias1)	---	2.831E-4	1.069E-3	1.574E-3	-1.276E-1
Average (Bias2)	---	7.621E-4	3.560E-3	7.609E-3	1.251E-1
σ (Bias2)	---	2.355E-4	8.791E-4	1.931E-3	4.712E-2
Average+3σ (Bias2)	---	1.469E-3	6.197E-3	1.340E-2	2.664E-1
Average-3σ (Bias2)	---	5.559E-5	9.228E-4	1.817E-3	-1.628E-2

190 MeV proton / detailed results

13.CTR4

Ta=25°C; Vce = 5V; If = 20 mA



190 MeV proton / detailed results

CTR4 . (%)

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	337.19	336.17	337.01	336.55	336.47
N° 2 (Bias1)	349.07	301.41	195.20	134.81	21.79
N° 3 (Bias1)	357.84	303.76	191.49	127.65	17.74
N° 4 (Bias1)	377.37	313.61	201.38	141.04	22.85
N° 5 (Bias1)	355.97	293.29	188.72	131.78	21.21
N° 6 (Bias1)	317.52	267.68	172.30	116.12	17.33
N° 7 (Bias2)	377.85	314.94	193.97	123.33	11.57
N° 8 (Bias2)	288.65	238.48	141.66	86.32	5.82
N° 9 (Bias2)	353.23	300.27	195.41	129.31	15.72
N° 10 (Bias2)	324.02	258.93	148.16	87.63	5.02
N° 11 (Bias2)	406.81	333.80	202.18	127.22	10.07
N° 12 (OFF)	365.18	305.01	193.33	132.74	17.98
N° 13 (OFF)	290.99	231.08	139.48	90.95	9.70
N° 14 (OFF)	361.55	308.20	195.59	128.96	15.55
N° 15 (OFF)	350.78	306.18	200.47	133.97	16.40
N° 16 (OFF)	336.78	272.37	157.98	97.59	8.99

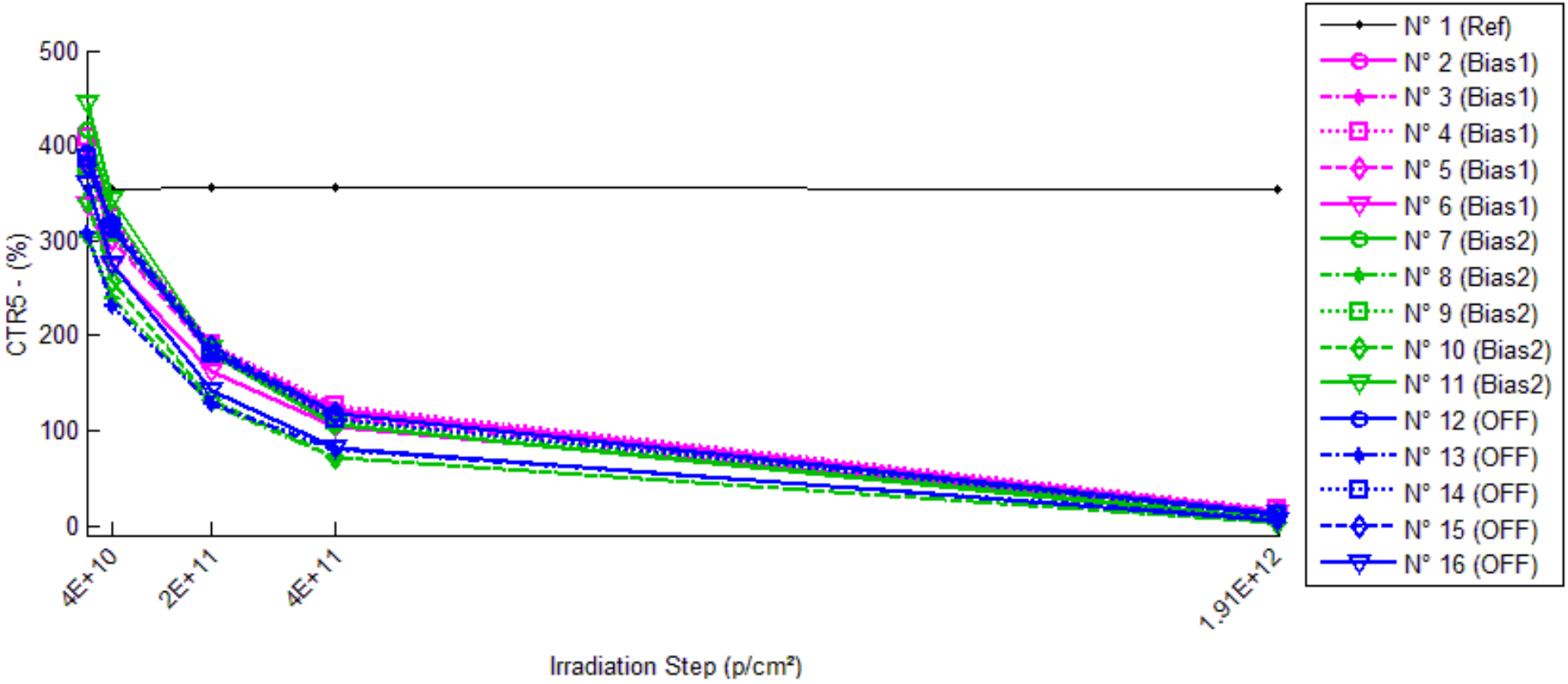
1/Delta [CTR4]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	9.019E-6	1.612E-6	5.644E-6	6.314E-6
N° 2 (Bias1)	---	4.530E-4	2.258E-3	4.553E-3	4.302E-2
N° 3 (Bias1)	---	4.975E-4	2.428E-3	5.039E-3	5.357E-2
N° 4 (Bias1)	---	5.388E-4	2.316E-3	4.440E-3	4.112E-2
N° 5 (Bias1)	---	6.004E-4	2.490E-3	4.779E-3	4.433E-2
N° 6 (Bias1)	---	5.864E-4	2.654E-3	5.462E-3	5.456E-2
N° 7 (Bias2)	---	5.287E-4	2.509E-3	5.462E-3	8.381E-2
N° 8 (Bias2)	---	7.289E-4	3.595E-3	8.120E-3	1.685E-1
N° 9 (Bias2)	---	4.994E-4	2.286E-3	4.902E-3	6.076E-2
N° 10 (Bias2)	---	7.758E-4	3.663E-3	8.326E-3	1.959E-1
N° 11 (Bias2)	---	5.377E-4	2.488E-3	5.403E-3	9.684E-2
N° 12 (OFF)	---	5.403E-4	2.434E-3	4.795E-3	5.289E-2
N° 13 (OFF)	---	8.909E-4	3.733E-3	7.559E-3	9.964E-2
N° 14 (OFF)	---	4.788E-4	2.347E-3	4.989E-3	6.155E-2
N° 15 (OFF)	---	4.153E-4	2.138E-3	4.614E-3	5.814E-2
N° 16 (OFF)	---	7.022E-4	3.361E-3	7.277E-3	1.083E-1
Average (OFF)	---	5.352E-4	2.429E-3	4.855E-3	4.732E-2
σ (OFF)	---	6.135E-5	1.553E-4	4.097E-4	6.272E-3
Average+3σ (OFF)	---	7.193E-4	2.895E-3	6.084E-3	6.614E-2
Average-3σ (OFF)	---	3.512E-4	1.963E-3	3.626E-3	2.850E-2
Average (Bias1)	---	6.141E-4	2.908E-3	6.442E-3	1.212E-1
σ (Bias1)	---	1.281E-4	6.642E-4	1.641E-3	5.802E-2
Average+3σ (Bias1)	---	9.983E-4	4.901E-3	1.137E-2	2.952E-1
Average-3σ (Bias1)	---	2.298E-4	9.158E-4	1.518E-3	-5.289E-2
Average (Bias2)	---	6.055E-4	2.802E-3	5.847E-3	7.611E-2
σ (Bias2)	---	1.919E-4	7.004E-4	1.444E-3	2.581E-2
Average+3σ (Bias2)	---	1.181E-3	4.904E-3	1.018E-2	1.535E-1
Average-3σ (Bias2)	---	2.979E-5	7.011E-4	1.515E-3	-1.329E-3

190 MeV proton / detailed results

14.CTR5

Ta=25°C; Vce = 20V; If = 10 mA



190 MeV proton / detailed results

CTR5 . (%)

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	356.17	354.02	355.86	355.05	354.82
N° 2 (Bias1)	377.67	313.10	185.69	121.07	16.07
N° 3 (Bias1)	387.26	313.75	180.13	113.17	12.76
N° 4 (Bias1)	408.49	322.96	190.90	125.99	16.57
N° 5 (Bias1)	384.41	302.06	180.53	118.95	15.73
N° 6 (Bias1)	338.14	272.85	161.81	104.03	12.62
N° 7 (Bias2)	417.26	330.38	181.09	105.82	7.06
N° 8 (Bias2)	303.58	238.95	127.12	70.72	3.35
N° 9 (Bias2)	378.81	307.67	182.08	110.88	10.15
N° 10 (Bias2)	340.78	257.51	131.94	70.81	2.81
N° 11 (Bias2)	444.85	344.36	185.72	106.61	5.92
N° 12 (OFF)	392.06	312.33	181.53	117.70	12.66
N° 13 (OFF)	306.95	231.39	128.72	79.39	6.60
N° 14 (OFF)	386.45	314.29	180.57	112.37	10.52
N° 15 (OFF)	379.82	318.52	189.15	118.27	11.44
N° 16 (OFF)	359.40	274.47	142.91	82.30	5.67

1/Delta [CTR5]

	0p/cm²	4E10.p/cm²	2E11.p/cm²	4E11.p/cm²	1.91E12.p/cm²
N° 1 (Ref)	---	1.704E-5	2.429E-6	8.834E-6	1.072E-5
N° 2 (Bias1)	---	5.460E-4	2.738E-3	5.612E-3	5.960E-2
N° 3 (Bias1)	---	6.050E-4	2.969E-3	6.254E-3	7.578E-2
N° 4 (Bias1)	---	6.483E-4	2.790E-3	5.489E-3	5.789E-2
N° 5 (Bias1)	---	7.092E-4	2.938E-3	5.806E-3	6.097E-2
N° 6 (Bias1)	---	7.077E-4	3.223E-3	6.656E-3	7.628E-2
N° 7 (Bias2)	---	6.302E-4	3.125E-3	7.053E-3	1.393E-1
N° 8 (Bias2)	---	8.910E-4	4.572E-3	1.085E-2	2.949E-1
N° 9 (Bias2)	---	6.104E-4	2.852E-3	6.379E-3	9.592E-2
N° 10 (Bias2)	---	9.489E-4	4.645E-3	1.119E-2	3.525E-1
N° 11 (Bias2)	---	6.560E-4	3.137E-3	7.132E-3	1.667E-1
N° 12 (OFF)	---	6.511E-4	2.958E-3	5.946E-3	7.644E-2
N° 13 (OFF)	---	1.064E-3	4.511E-3	9.339E-3	1.484E-1
N° 14 (OFF)	---	5.941E-4	2.950E-3	6.311E-3	9.245E-2
N° 15 (OFF)	---	5.067E-4	2.654E-3	5.822E-3	8.475E-2
N° 16 (OFF)	---	8.609E-4	4.215E-3	9.369E-3	1.735E-1
Average (OFF)	---	6.432E-4	2.932E-3	5.963E-3	6.610E-2
σ (OFF)	---	6.971E-5	1.896E-4	4.840E-4	9.130E-3
Average+3σ (OFF)	---	8.524E-4	3.500E-3	7.415E-3	9.349E-2
Average-3σ (OFF)	---	4.341E-4	2.363E-3	4.511E-3	3.871E-2
Average (Bias1)	---	7.473E-4	3.666E-3	8.520E-3	2.099E-1
σ (Bias1)	---	1.597E-4	8.680E-4	2.302E-3	1.088E-1
Average+3σ (Bias1)	---	1.227E-3	6.270E-3	1.543E-2	5.364E-1
Average-3σ (Bias1)	---	2.681E-4	1.062E-3	1.614E-3	-1.167E-1
Average (Bias2)	---	7.353E-4	3.458E-3	7.357E-3	1.151E-1
σ (Bias2)	---	2.253E-4	8.421E-4	1.831E-3	4.315E-2
Average+3σ (Bias2)	---	1.411E-3	5.984E-3	1.285E-2	2.446E-1
Average-3σ (Bias2)	---	5.943E-5	9.314E-4	1.864E-3	-1.435E-2