

Honeywell Technology Solutions Lab Pvt Ltd
Plot No. 11, Survey No. 115, Road No. 2, IT PARK, Nanakramgud
IN-500019 Hyderabad

Att. *

**REPORT ISSUED BY THE RESEARCH ASSOCIATION OF THE TEXTILE
INDUSTRY, AITEX**

Nº 2020EP0517

Tests marked with * are not included within the scope of the ENAC accreditation

The test was carried out at Polígono Industrial Fuente del Jarro. C/ Ciudad de Gibraltar, 5; 46988 – Paterna (Valencia); which property is shared at 50% between research institutes AITEX and ITE.

APPLICANT

HONEYWELL TECHNOLOGY SOLUTIONS LAB PVT LTD

Date of reception 25/02/2020

Date Test Starting: 06/03/2020
Ending: 10/03/2020

IDENTIFICATION AND DESCRIPTION OF SAMPLES

REFERENCES
INFH25RBRTseries

TESTS CARRIED OUT

- ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING FOR EYE OR FACE PROTECTIVE PRODUCTS.

ELECTRIC ARC EXPOSURE TEST: DETERMINATION OF THE ARC RATING FOR EYE OR FACE PROTECTIVE PRODUCTS

Test results

The test program includes minimum of twenty individual panel arc trials.

The following test data was recorded for each trial:

Arc exposure electrical conditions: arc trial number, RMS arc current, peak arc current, arc voltage, arc duration, energy dissipated in arc, plots of arc current and arc voltage.

Temperature rise response from two monitor sensors for each panel in each trial, plot of average responses from two monitor sensors.

Pictures after arc exposure.

Video.

Essential test data and test results are presented in the following pages as follows:

Arc rating: ATPV or E_{BT50} or both and plots of the burn injury probability (ATPV) or break open probability (E_{BT50}) or both versus E_i .

Heat attenuation factor (HAF) and plot of HAF on E_i .

Test specimen description and order of layer.

Distance from an arc center line to the panel surface.

Subjective evaluation.

Pictures after arc exposure.

Ignition probability value (if determined during testing).

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Standard

ASTM F2178 – 17

Test conditions	
Date test	09/03/2020
Arc current	(8 ± 1) kA
Stainless steel electrodes, gap of the electrodes	(300 ± 5) mm
Distance between the electrodes and sample	(300 ± 5) mm
Fuse wire	0.5 mm
Number of samples tested	22

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Reference INFH25RBRTseries

Lens / Window description

Manufacturer Paulson Mfg
Model Number 4000-SPL
Colour ColorBronze
Thickness 0.06"
Material Polycarbonate

Hardhat Description

Manufacturer Honeywell Salisbury
Model SN10R03
Material Type I, Class E

Description of the tissue or joint tissue of capuz

Fabric system arc rating 27 cal/cm²
Arc rating test report number 2020EP0020
Number of layers 2

Description of fabric according to information provided by the customer

Multilayer system:

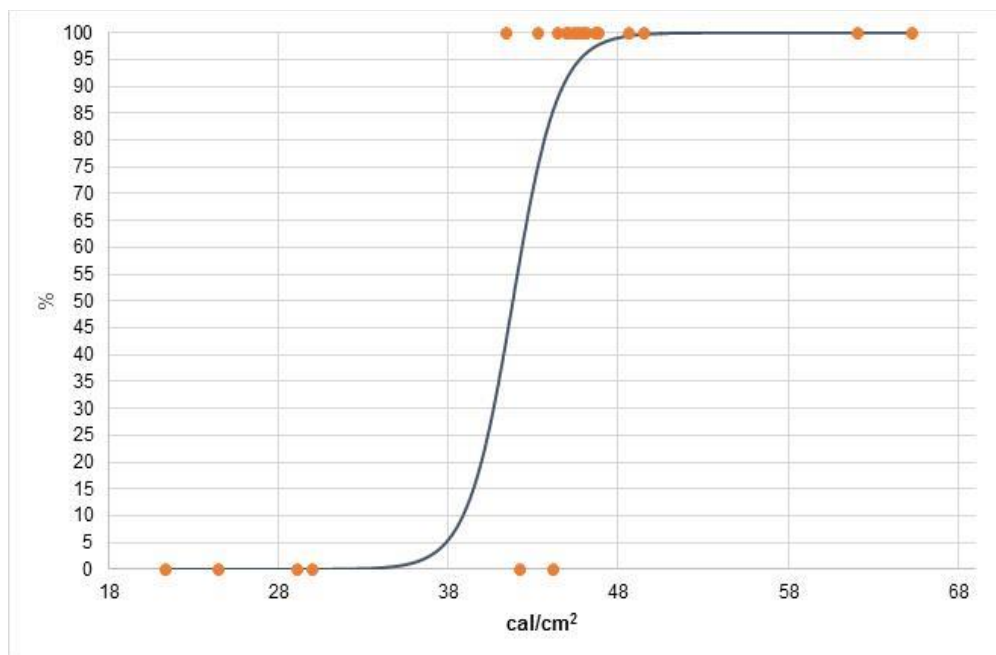
Layer 1: Red woven fabric style X-Fire N150, 93% M-aramid, 5% P-aramid, 2% anti-static, 150 g/m², manufacturer Teijin India.

Layer 2: Yellow + Grey woven fabric style T70+TV120, Spunlace 80% meta-aramid, 20% para-aramid, quilted to 120 GSM, woven fabric, Grey, 50% meta-aramid, 50% FR Lenzing, 200 g/m², manufacturer Iben China.

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Determination of E_{BT50} , 50% of Probability broken

E_{BT50} : 41,8 cal/cm²



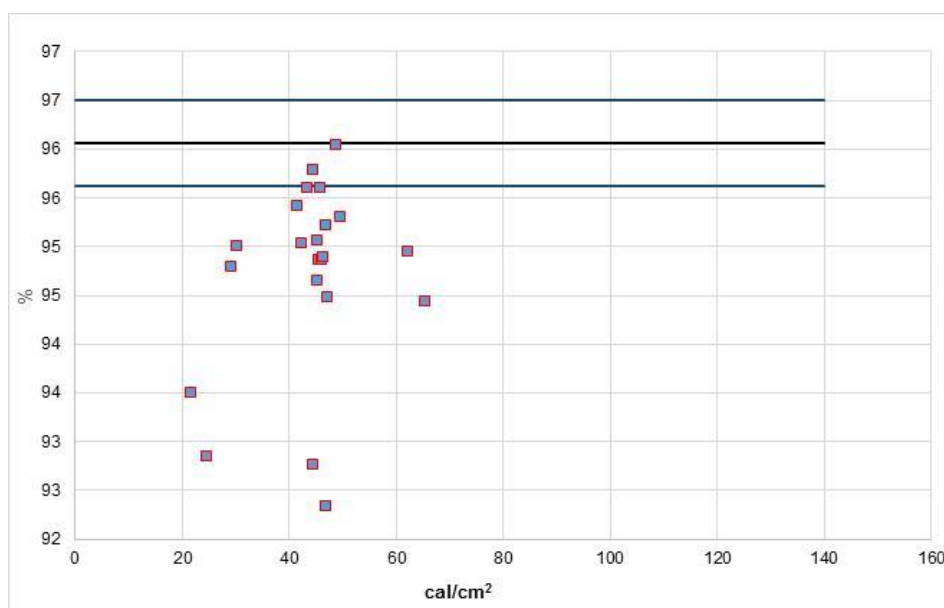
Probability%	5,0	10,0	20,0	30,0	40,0	50,0	60,0	70,0	80,0	95,0
E_i cal/cm ²	37,8	38,9	39,9	40,7	41,2	41,8	42,3	42,9	43,6	45,7

E_{BT50} points above	14
E_{BT50} points 20%	16
E_{BT50} points below	4
Points mix zone	4

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Determination of HAF, confidence Intervals 95%

HAF	96,1 %
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% HAF value :	96,1
Upper Confidence Level %:	96,5
Lower Confidence Level %:	95,6
Points above:	0
Points below:	20
Points between:	2
Total Points:	22

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Summary of measured energy and subjective evaluation:

Test	Time (ms)	Cycles 50Hz	Ei cal/cm ²	SCD cal/cm ²	HAF %	Burn	Break Open
1-A	895,6	44,78	46,8	-0,5	95,3	N	N
1-C	895,6	44,78	41,3	-0,67	95,6	N	Y
2-A	507,8	25,39	24,4	-0,33	92,4	N	N
2-C	507,8	25,39	21,3	-0,61	92,8	N	N
3-A	916,6	45,83	44,1	-0,31	94,5	N	Y
3-C	916,6	45,83	48,6	-0,42	95,4	N	Y
4-A	603,8	30,19	29,1	-0,31	92,9	N	Y
4-C	603,8	30,19	30,0	-0,36	93,5	N	Y
5-A	1203,8	60,19	65,2	-0,26	95,8	N	N
5-C	1203,8	60,19	62,1	-0,33	96,1	N	Y
6-A	936,4	46,82	45,0	-0,4	94,8	N	Y
6-C	936,4	46,82	45,4	-0,38	95,0	N	Y
7-A	887,2	44,36	42,1	-0,25	94,4	N	Y
7-C	887,2	44,36	45,9	-0,32	95,0	N	Y
8-A	917,8	45,89	45,6	-0,42	95,1	N	Y
8-C	917,8	45,89	46,7	-0,26	94,9	N	Y
9-A	886,8	44,34	46,1	-0,37	95,0	N	Y
9-C	886,8	44,34	45,0	-0,29	94,9	N	Y
10-A	876,6	43,83	49,5	-0,48	95,6	N	Y
10-C	876,6	43,83	43,2	-0,52	95,2	N	Y
11-A	908	45,4	46,6	-0,31	94,9	N	N
11-C	908	45,4	44,4	-0,18	94,7	N	N

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Summary of measured energy and subjective evaluation:

Test	After flame	Ablation	Melting	Dripping	Charring	Embrittlement	Deformation
1-A	7,1	Y	Y	N	Y	Y	N
1-C	5,4	Y	Y	N	Y	Y	N
2-A	1,9	Y	Y	N	Y	Y	N
2-C	2,1	Y	Y	N	Y	Y	N
3-A	3,6	Y	Y	N	Y	Y	N
3-C	3,9	Y	Y	N	Y	Y	N
4-A	5,3	Y	Y	N	Y	Y	N
4-C	4,6	Y	Y	N	Y	Y	N
5-A	5	Y	Y	N	Y	Y	N
5-C	4,4	Y	Y	N	Y	Y	N
6-A	7,4	Y	Y	N	Y	Y	N
6-C	6,2	Y	Y	N	Y	Y	N
7-A	4,3	Y	Y	N	Y	Y	N
7-C	3,9	Y	Y	N	Y	Y	N
8-A	5,1	Y	Y	N	Y	Y	N
8-C	3,9	Y	Y	N	Y	Y	N
9-A	4,2	Y	Y	N	Y	Y	N
9-C	4,4	Y	Y	N	Y	Y	N
10-A	4,9	Y	Y	N	Y	Y	N
10-C	3	Y	Y	N	Y	Y	N
11-A	1,6	Y	Y	N	Y	Y	N
11-C	2,3	Y	Y	N	Y	Y	N

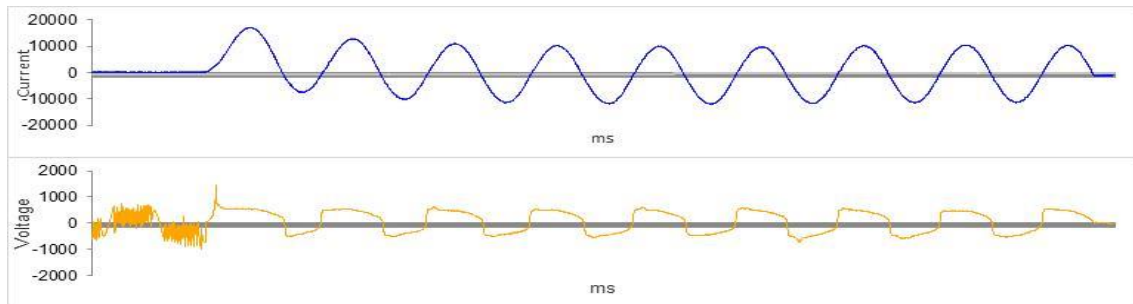
Y Yes N No

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Electrical current and response sensor response:

Calibration shot

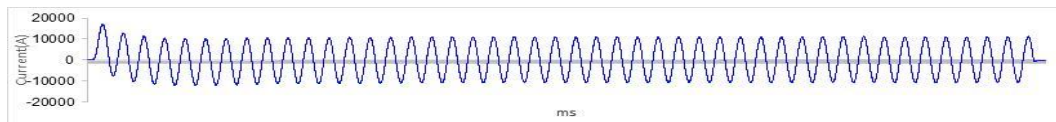
INITIAL CALIBRATION



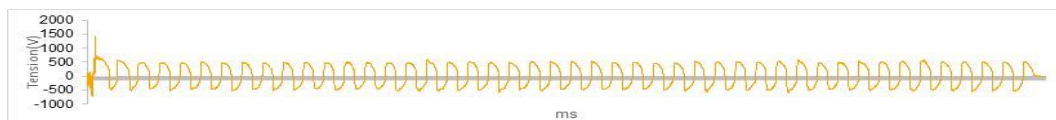
Ei Panel A	7,1 cal/cm ²	Ei Panel B	6,4 cal/cm ²	Ei Panel C	cal/cm ²
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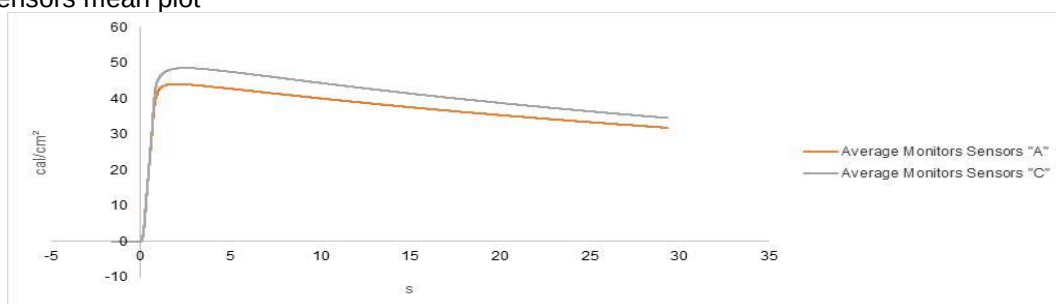
Shot 1
Current plot



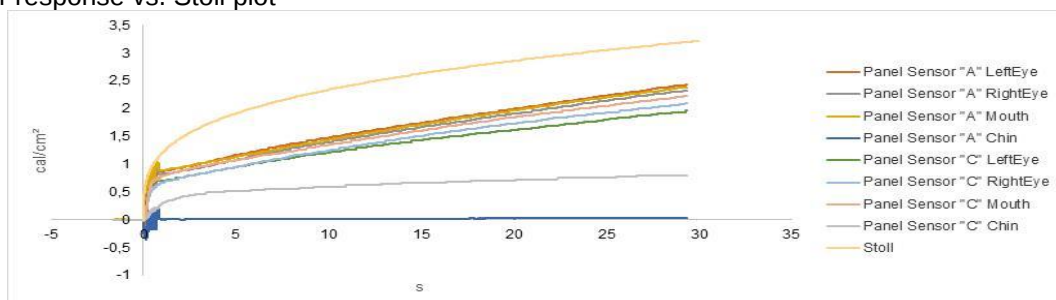
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

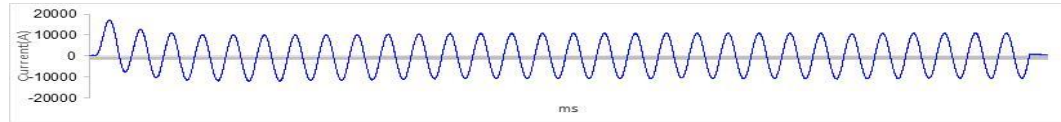


Current Total RMS (kA)	7,8	Current Peak (kA)	17,1	Arc Voltage (V)	1434,0
Duration (cycles nº)	45,8	Duration (ms)	916,6	Arc Energy (kJ)	2648,1
Arc Voltage (kJ)	402,4				

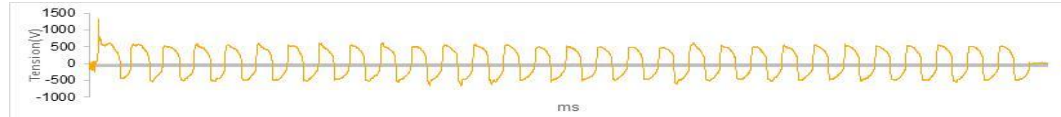
sensor response	PANEL A	PANEL C
Ei	44,10 cal/cm ²	48,56 cal/cm ²
SCD	-0,31 cal/cm ²	-0,42 cal/cm ²
HAF	94,49 %	95,43 %

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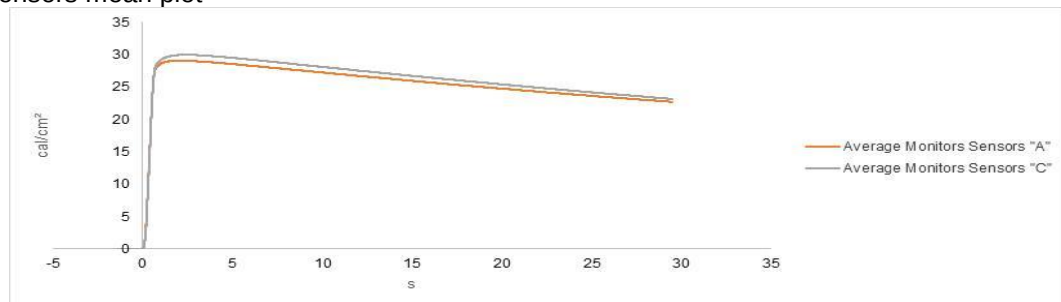
Shot 2
Current plot



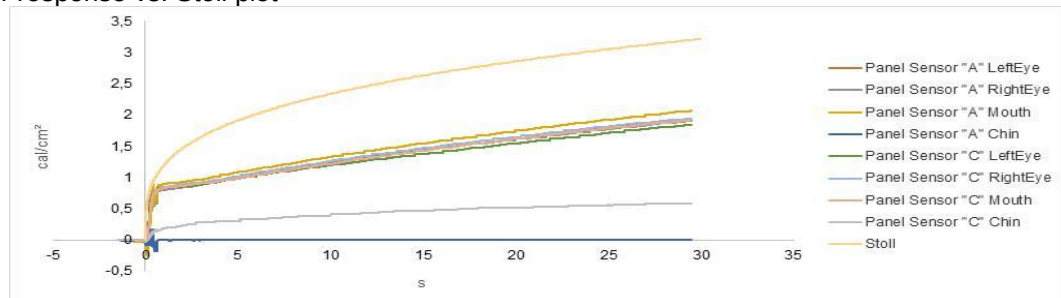
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

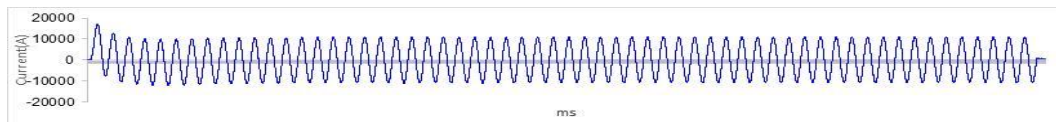


Current Total RMS (kA)	7,8	Current Peak (kA)	17,2	Arc Voltage (V)	1335,0
Duration (cycles nº)	30,2	Duration (ms)	603,7	Arc Energy (kJ)	1816,5
Arc Voltage (kJ)	421,0				

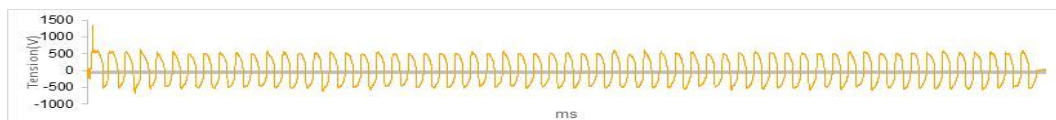
sensor response	PANEL A	PANEL C
Ei	29,07 cal/cm ²	29,96 cal/cm ²
SCD	-0,31 cal/cm ²	-0,36 cal/cm ²
HAF	92,86 %	93,51 %

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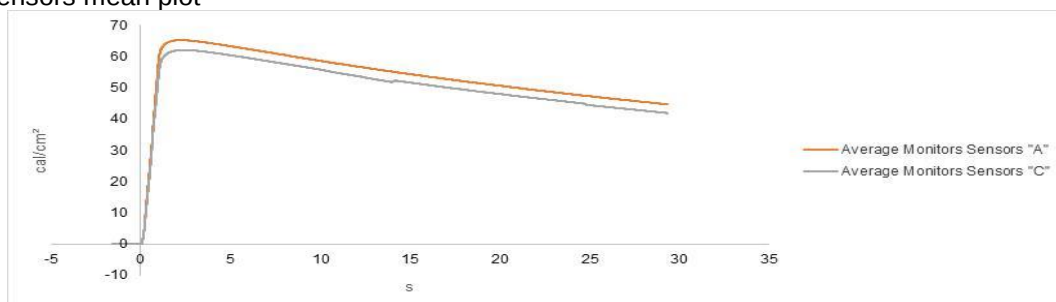
Shot 3
Current plot



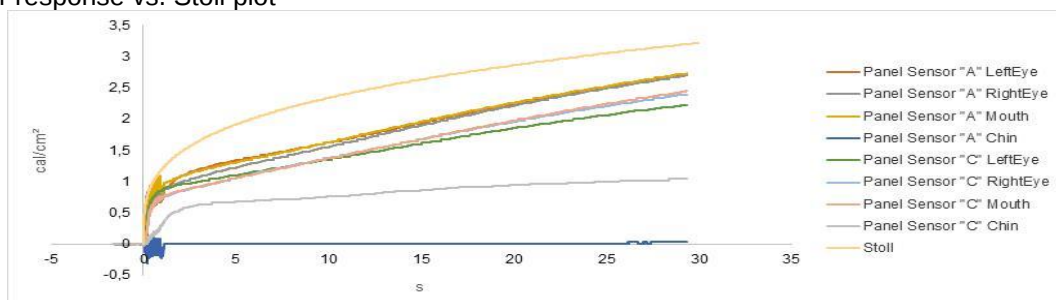
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

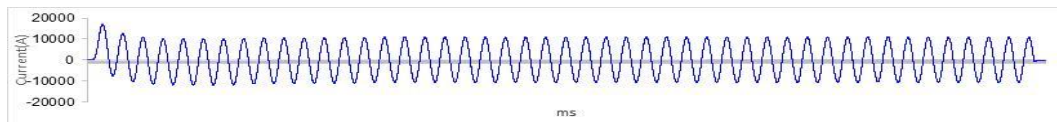


Current Total RMS (kA)	7,7	Current Peak (kA)	17,2	Arc Voltage (V)	1353,0
Duration (cycles n°)	60,2	Duration (ms)	1203,9	Arc Energy (kJ)	3589,5
Arc Voltage (kJ)	417,6				

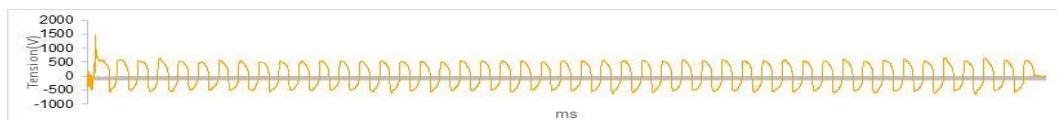
sensor response	PANEL A	PANEL C
Ei	65,20 cal/cm ²	62,07 cal/cm ²
SCD	-0,26 cal/cm ²	-0,33 cal/cm ²
HAF	95,80 %	96,06 %

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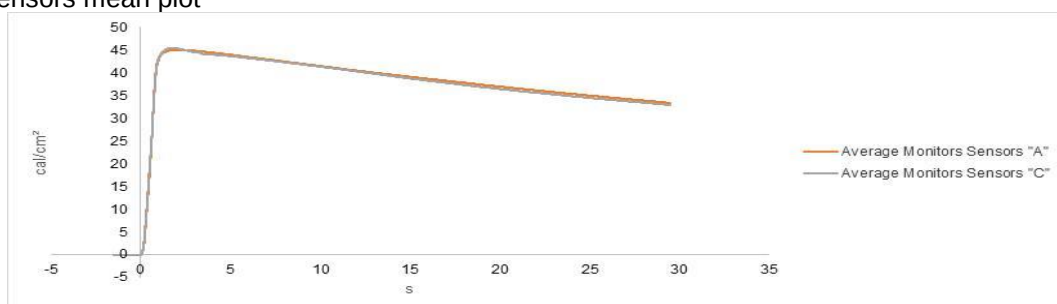
Shot 4
Current plot



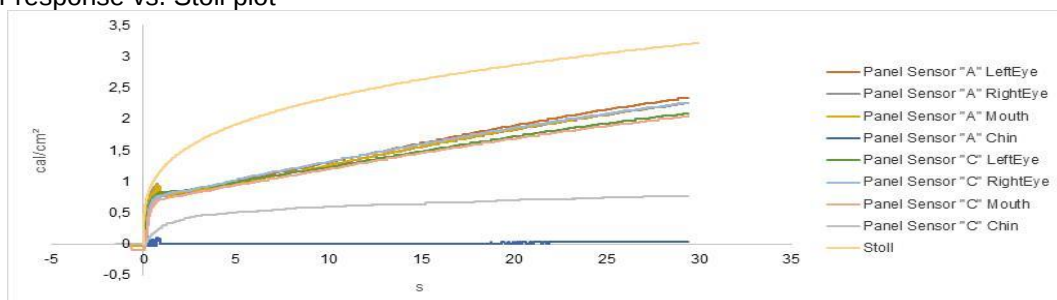
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

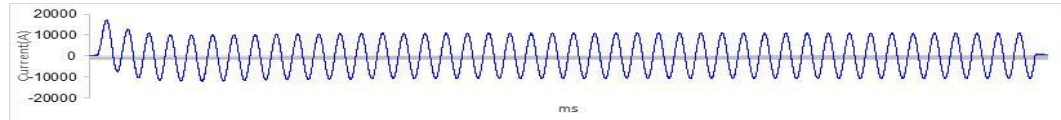


Current Total RMS (kA)	7,7	Current Peak (kA)	17,1	Arc Voltage (V)	1461,0
Duration (cycles nº)	46,8	Duration (ms)	936,5	Arc Energy (kJ)	2919,3
Arc Voltage (kJ)	437,7				

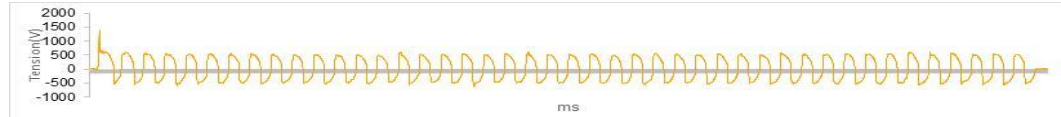
sensor response	PANEL A	PANEL C
Ei	45,01 cal/cm ²	45,39 cal/cm ²
SCD	-0,40 cal/cm ²	-0,38 cal/cm ²
HAF	94,80 %	95,02 %

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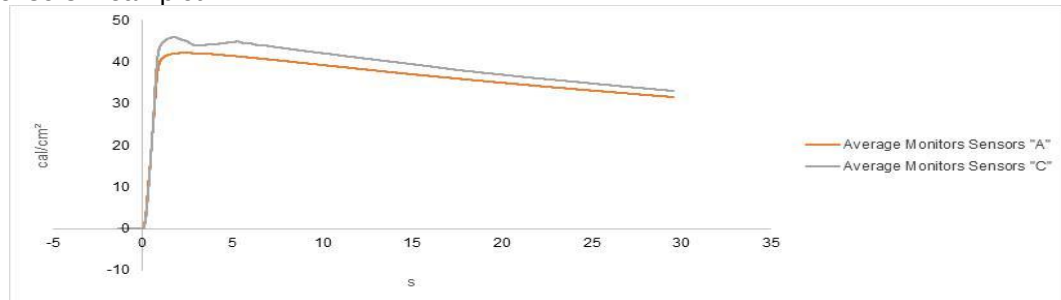
Shot 5
Current plot



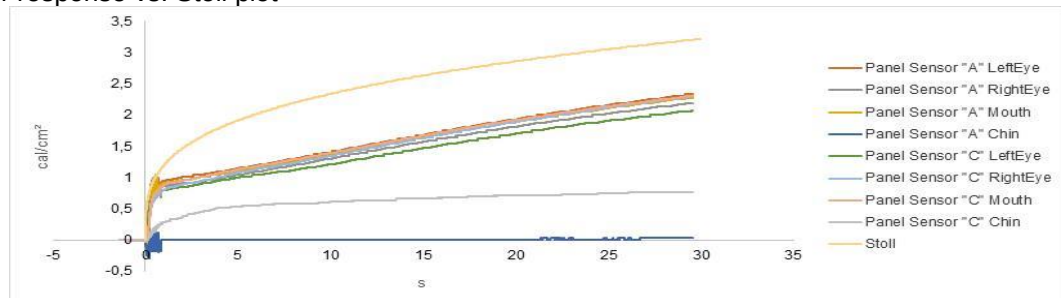
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

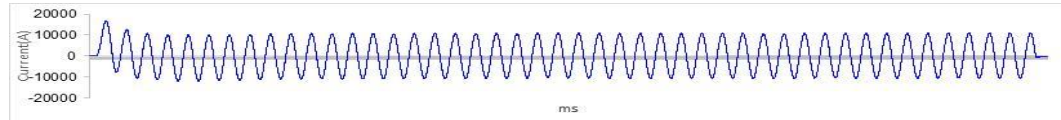


Current Total RMS (kA)	7,7	Current Peak (kA)	17,1	Arc Voltage (V)	1404,0
Duration (cycles nº)	44,4	Duration (ms)	887,3	Arc Energy (kJ)	2681,9
Arc Voltage (kJ)	422,9				

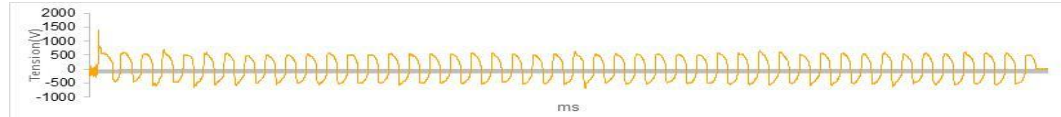
sensor response	PANEL A	PANEL C
Ei	42,14 cal/cm ²	45,93 cal/cm ²
SCD	-0,25 cal/cm ²	-0,32 cal/cm ²
HAF	94,45 %	94,96 %

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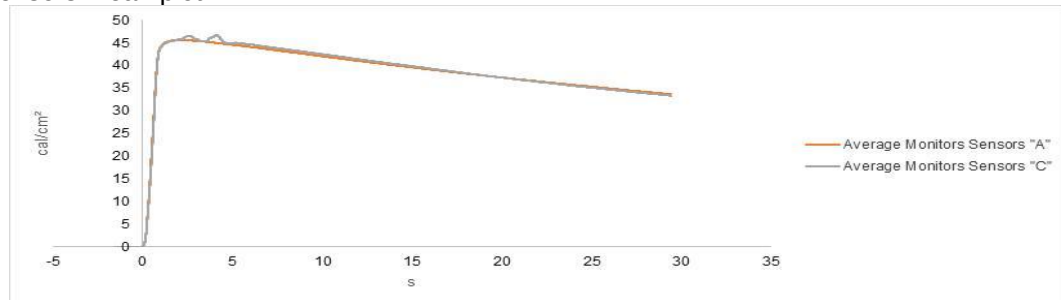
Shot 6
Current plot



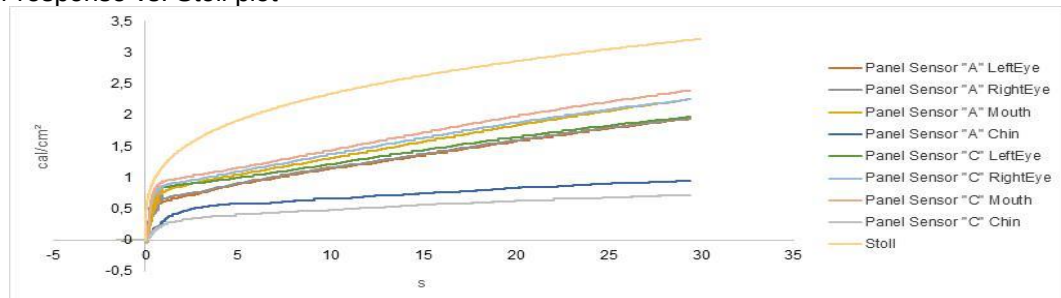
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

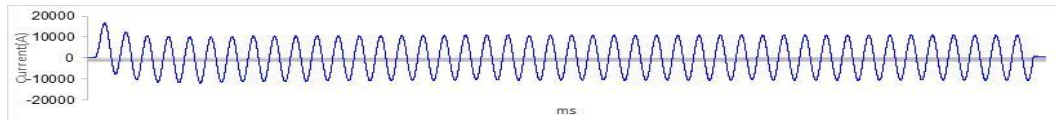


Current Total RMS (kA)	7,6	Current Peak (kA)	16,9	Arc Voltage (V)	1401,0
Duration (cycles nº)	45,9	Duration (ms)	917,8	Arc Energy (kJ)	2798,0
Arc Voltage (kJ)	432,8				

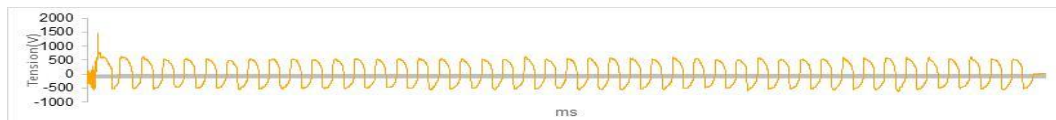
sensor response	PANEL A	PANEL C
Ei	45,61 cal/cm ²	46,73 cal/cm ²
SCD	-0,42 cal/cm ²	-0,26 cal/cm ²
HAF	95,07 %	94,88 %

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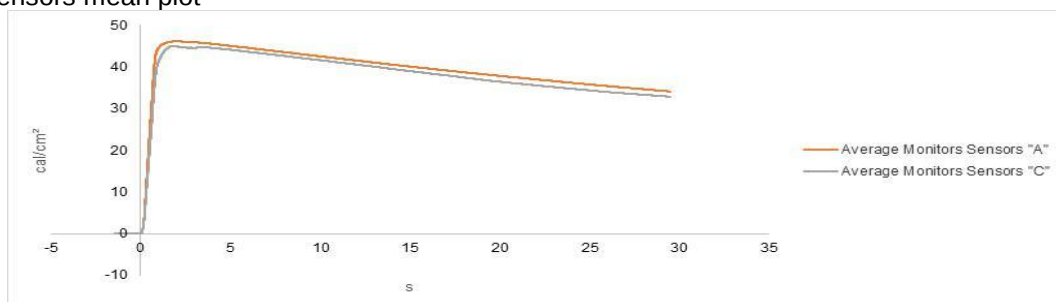
Shot 7
Current plot



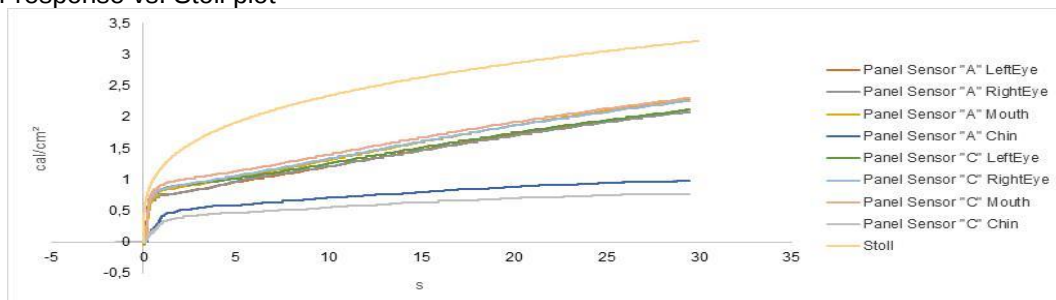
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

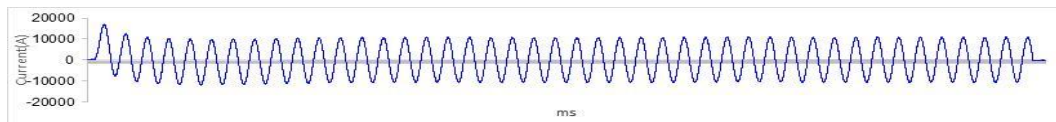


Current Total RMS (kA)	7,6	Current Peak (kA)	16,7	Arc Voltage (V)	1461,0
Duration (cycles nº)	44,3	Duration (ms)	886,8	Arc Energy (kJ)	2703,0
Arc Voltage (kJ)	432,0				

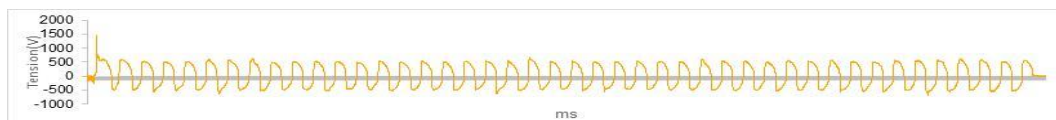
sensor response	PANEL A	PANEL C
Ei	46,10 cal/cm ²	44,96 cal/cm ²
SCD	-0,37 cal/cm ²	-0,29 cal/cm ²
HAF	95,04 %	94,88 %

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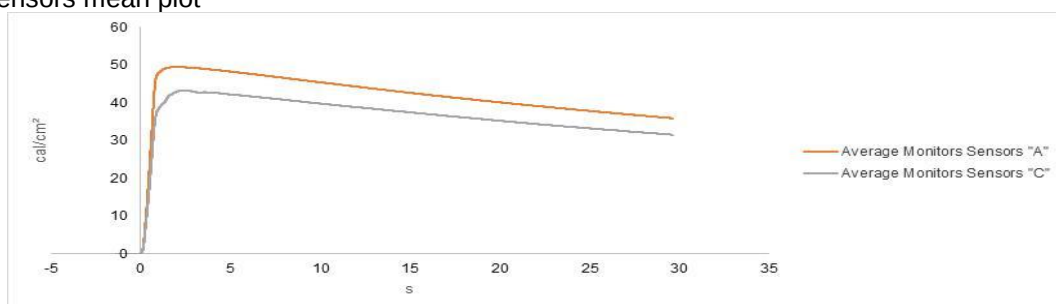
Shot 8
Current plot



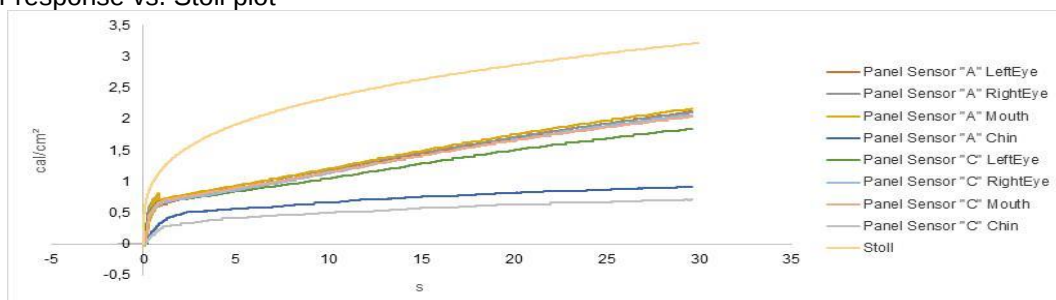
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

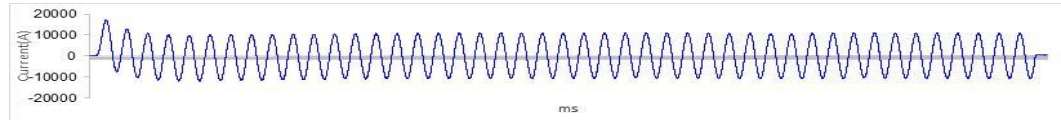


Current Total RMS (kA)	7,6	Current Peak (kA)	17,0	Arc Voltage (V)	1470,0
Duration (cycles nº)	43,8	Duration (ms)	876,6	Arc Energy (kJ)	2604,8
Arc Voltage (kJ)	421,8				

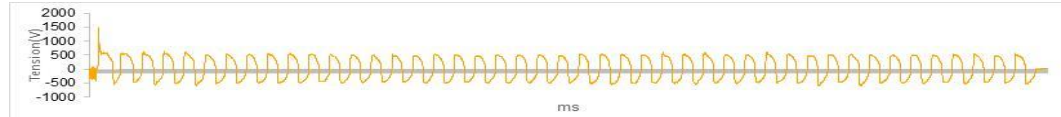
sensor response	PANEL A	PANEL C
Ei	49,46 cal/cm ²	43,23 cal/cm ²
SCD	-0,48 cal/cm ²	-0,52 cal/cm ²
HAF	95,62 %	95,23 %

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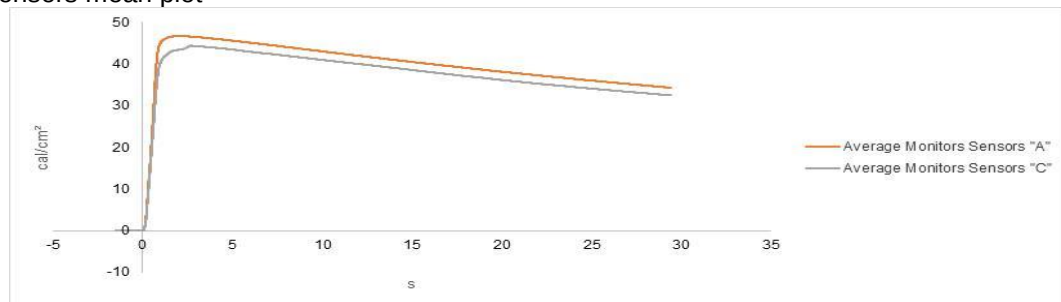
Shot 9
Current plot



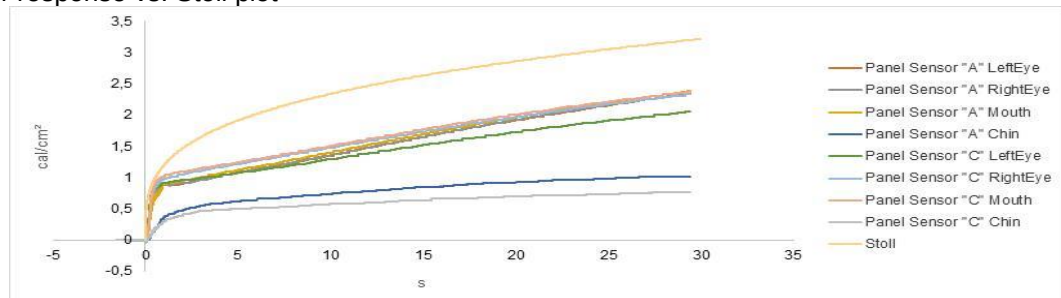
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

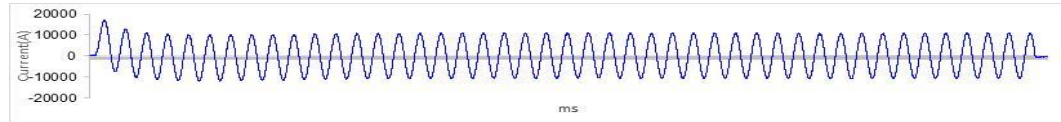


Current Total RMS (kA)	7,7	Current Peak (kA)	17,1	Arc Voltage (V)	1479,0
Duration (cycles nº)	45,4	Duration (ms)	907,9	Arc Energy (kJ)	2666,7
Arc Voltage (kJ)	413,7				

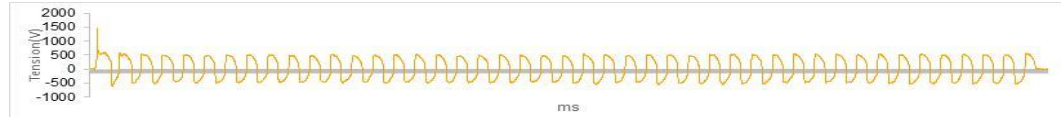
sensor response	PANEL A	PANEL C
Ei	46,65 cal/cm ²	44,35 cal/cm ²
SCD	-0,31 cal/cm ²	-0,18 cal/cm ²
HAF	94,90 %	94,66 %

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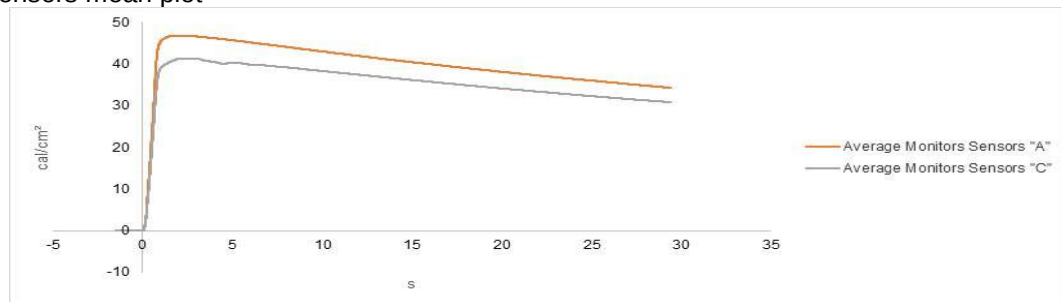
Shot 10
Current plot



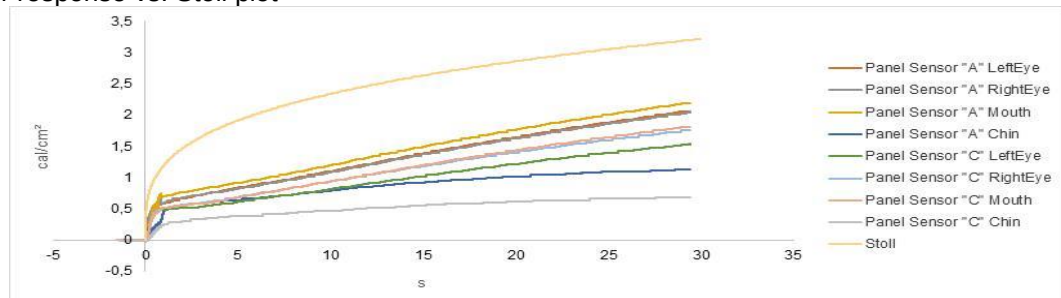
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot

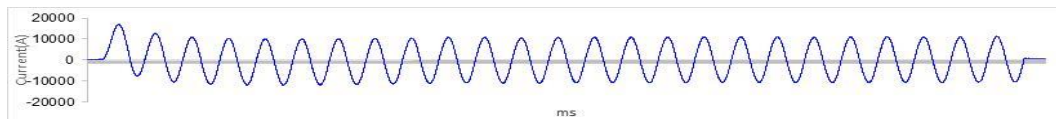


Current Total RMS (kA)	7,7	Current Peak (kA)	17,1	Arc Voltage (V)	1455,0
Duration (cycles nº)	44,8	Duration (ms)	895,6	Arc Energy (kJ)	2619,8
Arc Voltage (kJ)	409,5				

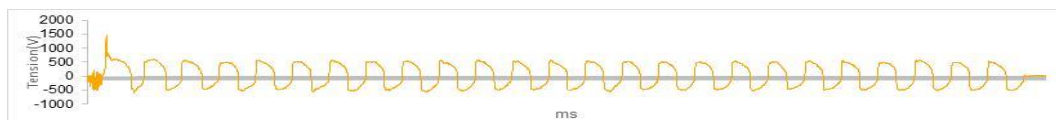
sensor response	PANEL A	PANEL C
Ei	46,80 cal/cm ²	41,33 cal/cm ²
SCD	-0,50 cal/cm ²	-0,67 cal/cm ²
HAF	95,31 %	95,61 %

>>>

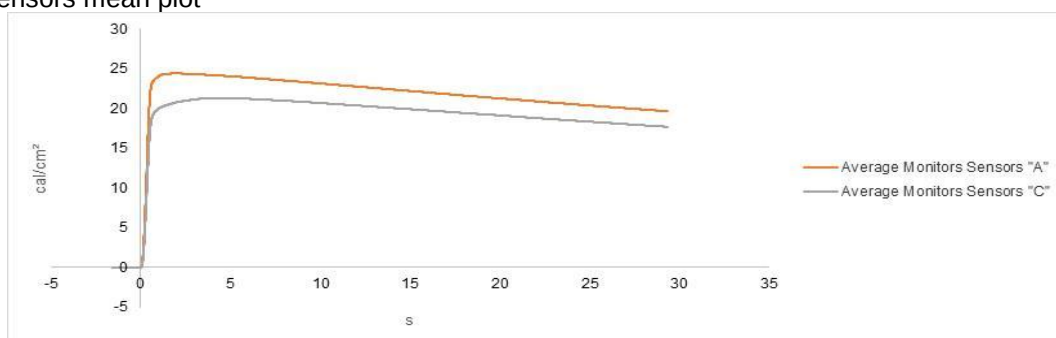
Shot 11
Current plot



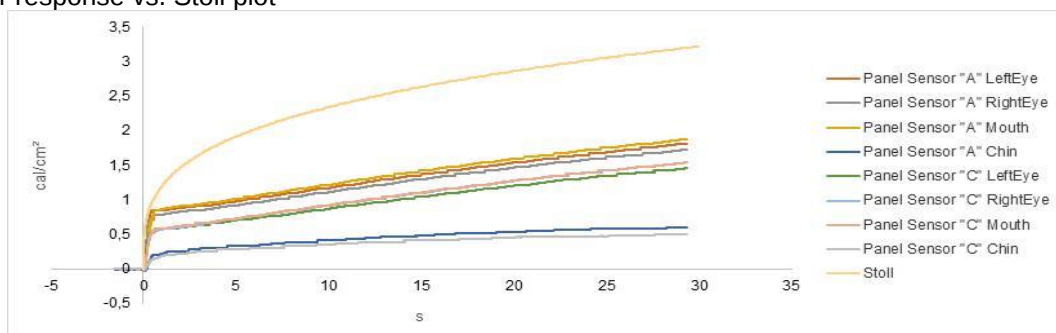
Voltage plot



Reference sensors mean plot



Panel sensor response vs. Stoll plot



Current Total RMS (kA)	7,8	Current Peak (kA)	17,1	Arc Voltage (V)	1446,0
Duration (cycles nº)	25,4	Duration (ms)	507,9	Arc Energy (kJ)	1529,4
Arc Voltage (kJ)	420,2				

sensor response	PANEL A	PANEL C
Ei	24,39 cal/cm ²	21,29 cal/cm ²
SCD	-0,33 cal/cm ²	-0,61 cal/cm ²
HAF	92,35 %	92,78 %

>>>

Tested material pictures:



>>>

Summary of results:

E_{BT50}	41,8 cal/cm ²
HAF	96,1 %

Arc Flash PPE category according to standard NFPA70E Edition 2018 Table 130.7 (C) (16) - Personal Protective Equipment (PPE)

PPE Category	Minimum Arc Rating (cal/cm ²)
1	4
2	8
3	25
4	40

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