

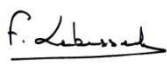

Company :

CPPM

**MECHANICAL TESTS ON
A OFP BASE PENETRATOR**

Tests performed in August 2019

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Approved by	A. CUCHET	Manager	

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1. ADMINISTRATIVE INFORMATIONS

1.1. ORDER GIVEN BY

CPPM
163, Avenue de Luminy – Case 902 -
13288 MARSEILLE
FRANCE

1.2. OBJECT OF THE ORDER

Mechanical tests on a penetrator base module OFP.

1.3. ORDER NUMBER

Order n° 0933L052760 of 18/07/2019.

1.4. DATE AND SITE OF TESTS

The tests have been performed at SOPAVIB laboratory on August 20th & 21st 2019.

1.5. REPRESENTATIVES OF BOTH COMPANIES

CPPM is represented by Mr. HENRY who ensures the co-ordination of tests.

SOPAVIB is represented by Mr. LABESSEDE who ensures the execution of tests.

1.6. RECORDS

1.6.1. File

The technical files numbered 2E18734 are saved during 5 years. This period should be increased on a written customer request.

1.6.2. Data

Measurements performed during tests are saved on external disk during 5 years. This period should be increased on a written customer request.

2. MATERIAL SUBMITTED TO TEST

2.1. CPPM REFERENCES

The specimen submitted to tests is a Penetrator Base Module OFP.

2.2. SOPAVIB REFERENCE

The specimen submitted to test has been identified BC18734.

3. TEST FACILITIES AND MEASUREMENT EQUIPMENTS USED

Ref.	Denomination	Validity
M109	Electrodynamics shaker (LDS, V8)	04/2020
M304	Digital control system (SIGNAL STAR)	01/2021
M317-56	Measurement accelerometer (P.C.B, M353B15)	01/2020
M317-58	Measurement accelerometer (P.C.B, M353B15)	07/2020

4. TEST PROGRAM

4.1. SCHEDULE

The test program is described below:

- Endurance sine test
- Shock test
- Bump test

4.2. SEVERITIES

4.2.1. Endurance sine test

Frequency bandwidth: from 5 to 150 Hz
Amplitudes: 4mm pk-pk from 5 to 25Hz
5g from 25 to 150Hz
Sweep speed: 1 oct/min
Number of axes:..... 3
Duration: 1 hour

4.2.2. Shock test

Waveform: half sine
Amplitude / duration: 15 g / 11 ms
Shock per axis:..... 3
Number of axes:..... 6 ($\pm X$, $\pm Y$, $\pm Z$)

4.2.3. Bump test

Waveform: half sine
Amplitude / duration: 10 g / 16 ms
Shock per axis:..... 500
Number of axes:..... 6 ($\pm X$, $\pm Y$, $\pm Z$)

5. TEST CONDITIONS

5.1. TEST FACILITIES DESCRIPTION

Tests are performed with an electrodynamic shaker referenced M109 controlled in real time by a digital control system referenced M304.

5.2. ORIENTATION REFERENCE

The specimen's position is defined in relation to the axes of the tri-rectangular reference system shown on photograph n°1 on page 10.

5.3. TEST FIXTURE

The specimen is tested rigidly fixed on the moving part of the test facility with a test fixture furnished by CPPM.

5.4. CONTROLS

Visual and functional tests are performed by CPPM representative.

5.5. METHODS

5.5.1. Sine vibration method

Test parameters are described in paragraph 4

Specifications of the standard IEC 68.2.6 test Fc are respected.

Sine vibrations transmitted are defined by their amplitude of displacement (a) and their frequency (f).

The acceleration amplitude obtained is the following:

$$\gamma = \frac{4\pi^2 f^2 a}{g} \quad \text{g : normalised acceleration gravity. } f \text{ in Hz, } a \text{ in m, } \gamma \text{ in g.}$$

Control is made at two points, on the maximum filtered signal of reference sensors located close to the specimen fixations.

5.5.2. Shock and bump test method

Test parameters are described in paragraph 4

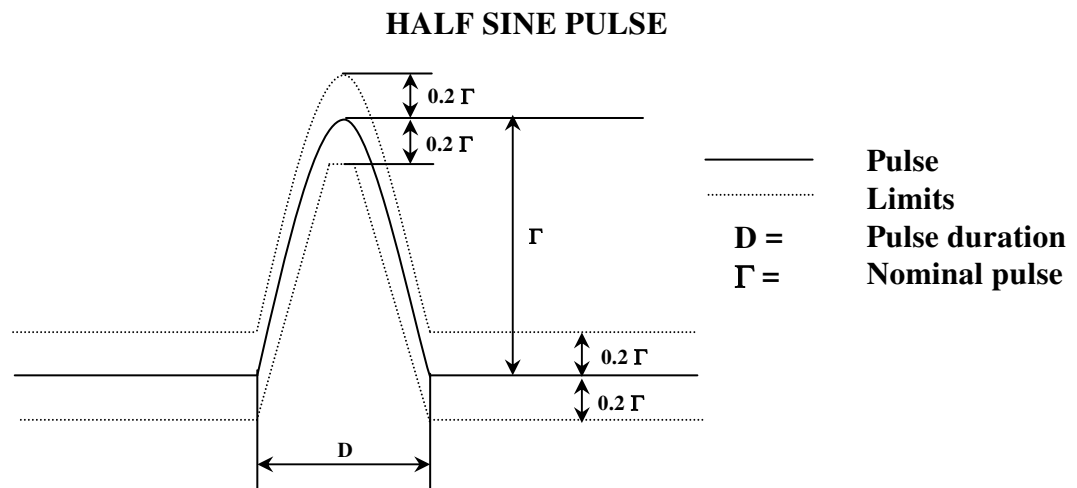
Prescriptions of the standard EN 68-2-27 are respected.

Half sine shocks are defined by their acceleration peak Γ in g and their duration D in ms as shown on the following scheme.

The test sequence is described below:

1 shock at -12 dB, 1 shock at -9 dB, 1 shock at -6 dB, 1 shock at -3 dB, X shocks at 0 dB

Control is made on the filtered signal of one reference sensor located close to the specimen fixations.



5.5.3. Data handling

Signals given by the accelerometric channels are filtered and directly analysed by the digital control system.

During sine vibration test:

- Acquisition is performed on the signal filtered at excitation frequency.
- Curves in appendix represent the acceleration level γ (in g) versus frequency.

During shock and bump test:

- Acquisition is performed on the signal filtered up to 500 Hz.
- Curves in appendix represent the acceleration level γ (in g) versus time.

6. TEST PROGRESS

Date, time	Axis	Observations
20/08/19 14h00	Y	➤ Endurance sine test Check: No visual damage. Normal work after test.
15h40		➤ Shock test: 15g / 11ms (3 positives and 3 negatives) Check: No visual damage. Normal work after test.
15h50		➤ Bump test: 10g / 16ms (500 positives and 500 negatives) Check: No visual damage. Normal work after test.
16h35	X	➤ Endurance sine test Check: No visual damage. Normal work after test.
21/08/19 10h00		➤ Shock test: 15g / 11ms (3 positives and 3 negatives) Check: No visual damage. Normal work after test.
10h05		➤ Bump test: 10g / 16ms (500 positives and 500 negatives) Check: No visual damage. Normal work after test.
11h30	Z	➤ Endurance sine test Check: No visual damage. Normal work after test.
13h30		➤ Shock test: 15g / 11ms (3 positives and 3 negatives) Check: No visual damage. Normal work after test.
13h35		➤ Bump test: 10g / 16ms (500 positives and 500 negatives) Check: No visual damage. Normal work after test.

7. TEST RESULTS

7.1. RESPECT TO STANDARD PRESCRIPTIONS.

Tests have been fully performed in accordance with standards prescriptions.

7.2. ACCELEROMETRICS MEASUREMENTS

Curve n°1:.....Control accelerometer of the sine tests

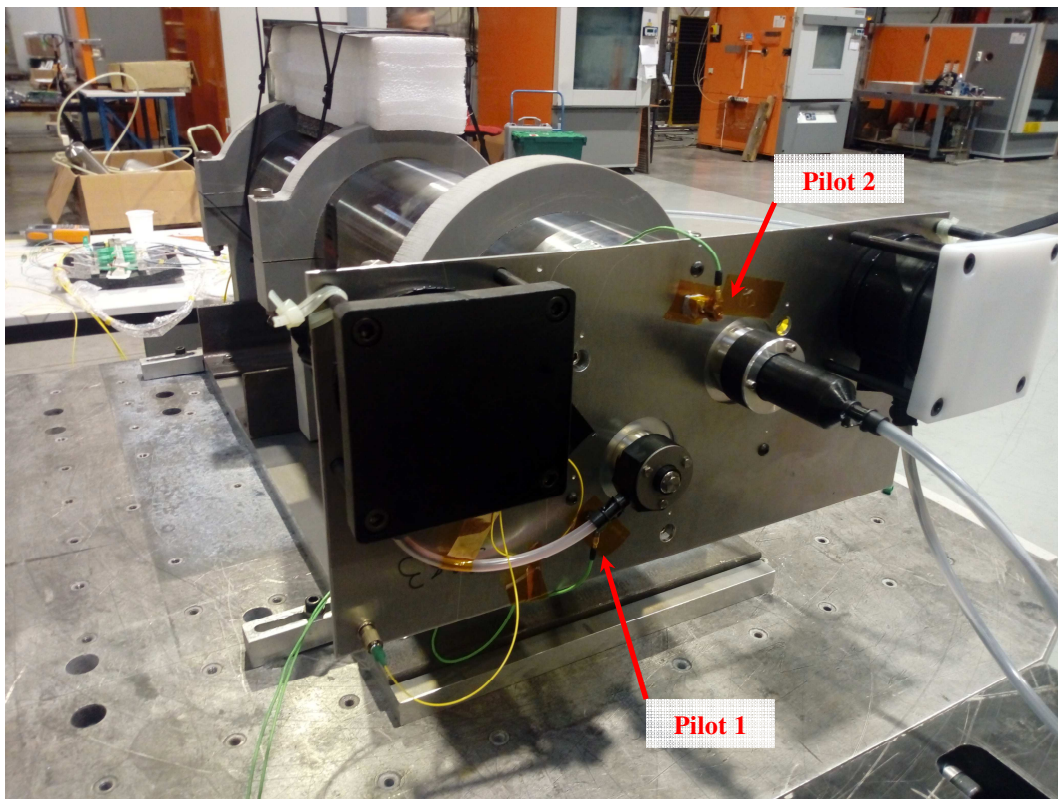
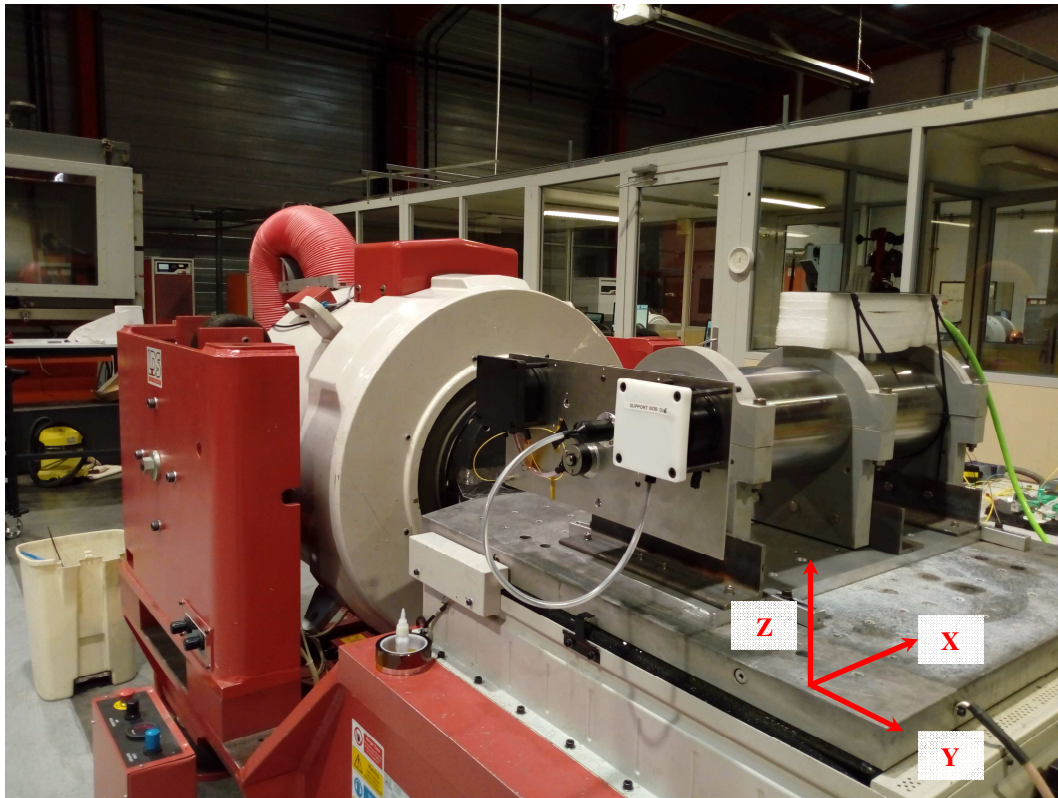
Curves n°2 and 3:Control accelerometer during shock tests (15g/11ms).

Curves n°4 and 5:Control accelerometer during bump tests (10g/16ms).

7.3. CONTROLS

Controls are performed by CPPM representative.

Photograph n° 1: General views during test



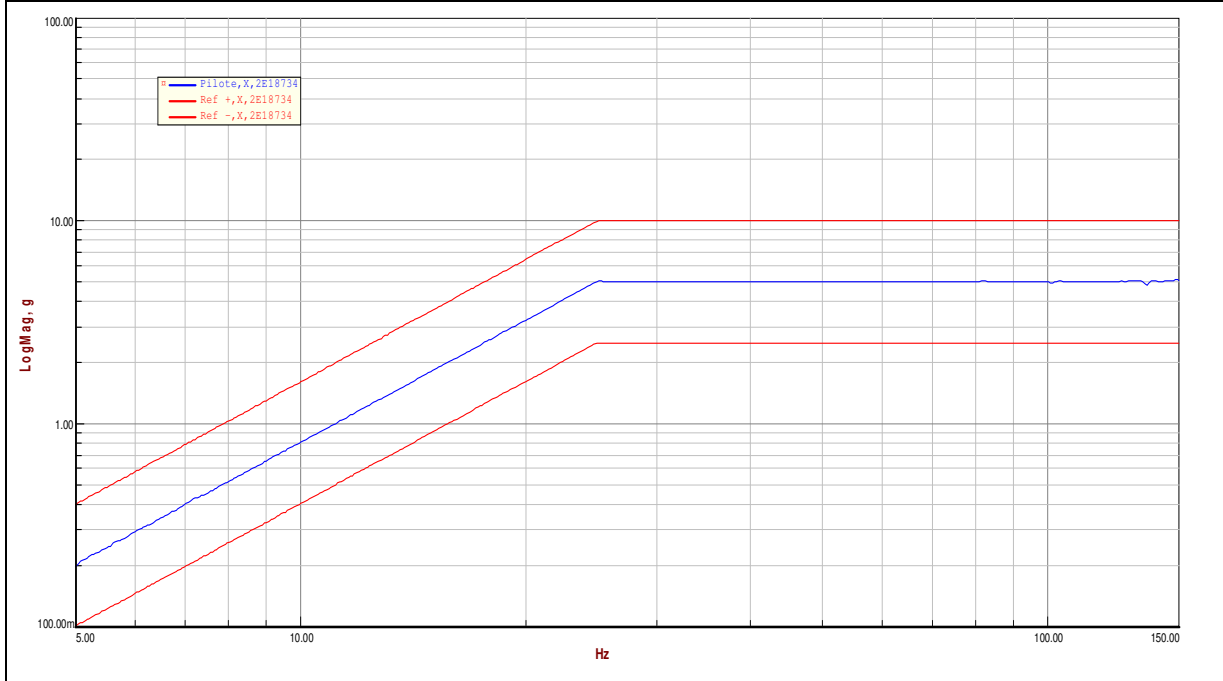
APPENDIX

Accelerometric measurements..... Curves n° 1 to 5

Curve n° 1

Test ref. : 2E18734	Specimen : OFP BASE PENETRATOR	Axes : X, Y, Z
Date : 20/08/19	Title : Sine tests	Function : FFT

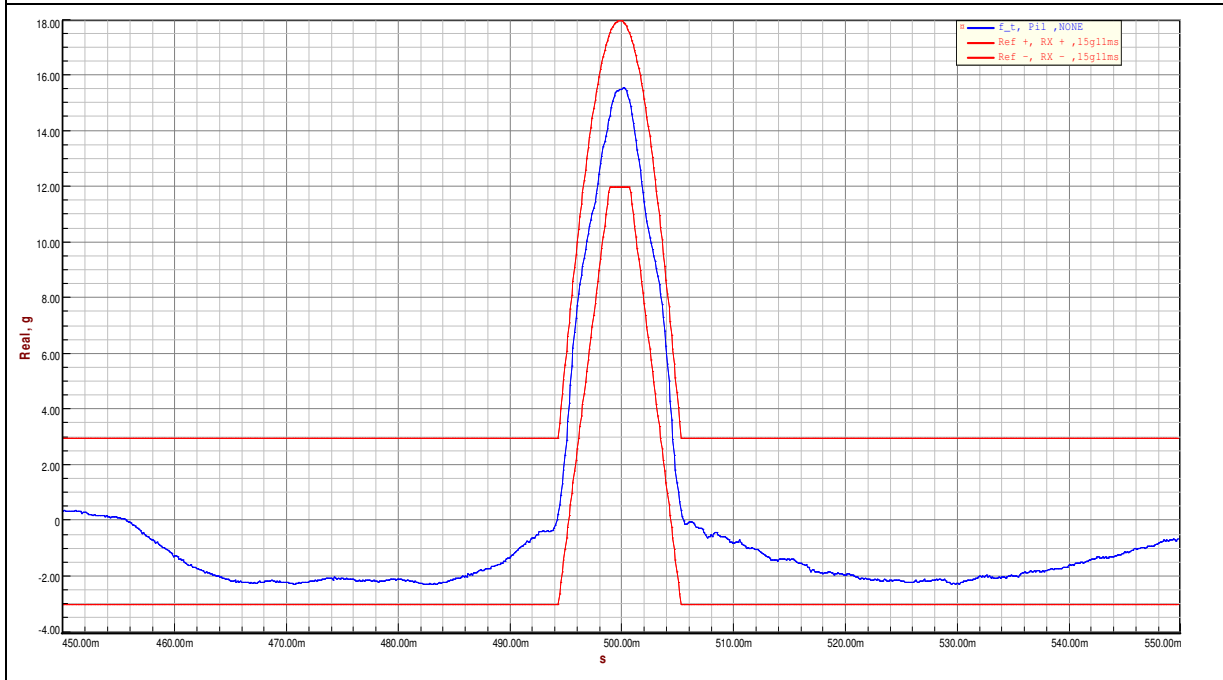
CONTROL + LIMITS



Curve n° 2

Test ref. : 2E18734	Specimen : OFP BASE PENETRATOR	Axes: X, Y, Z
Date : 20/08/19	Title : Shock test (15g/11ms)	Function : g(t)

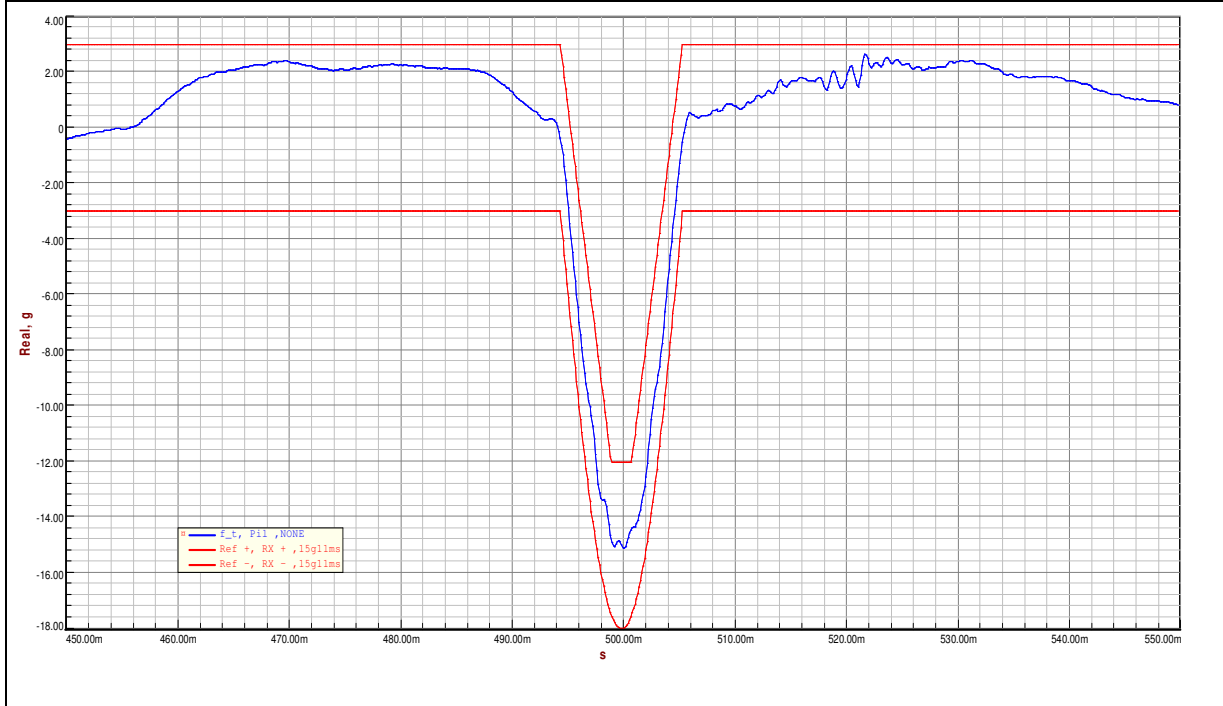
CONTROL + LIMITS



Curve n° 3

Test ref. : 2E18734	Specimen : OFP BASE PENETRATOR	Axes: X, Y, Z
Date : 20/08/19	Title : Shock test (15g/11ms)	Function : g(t)

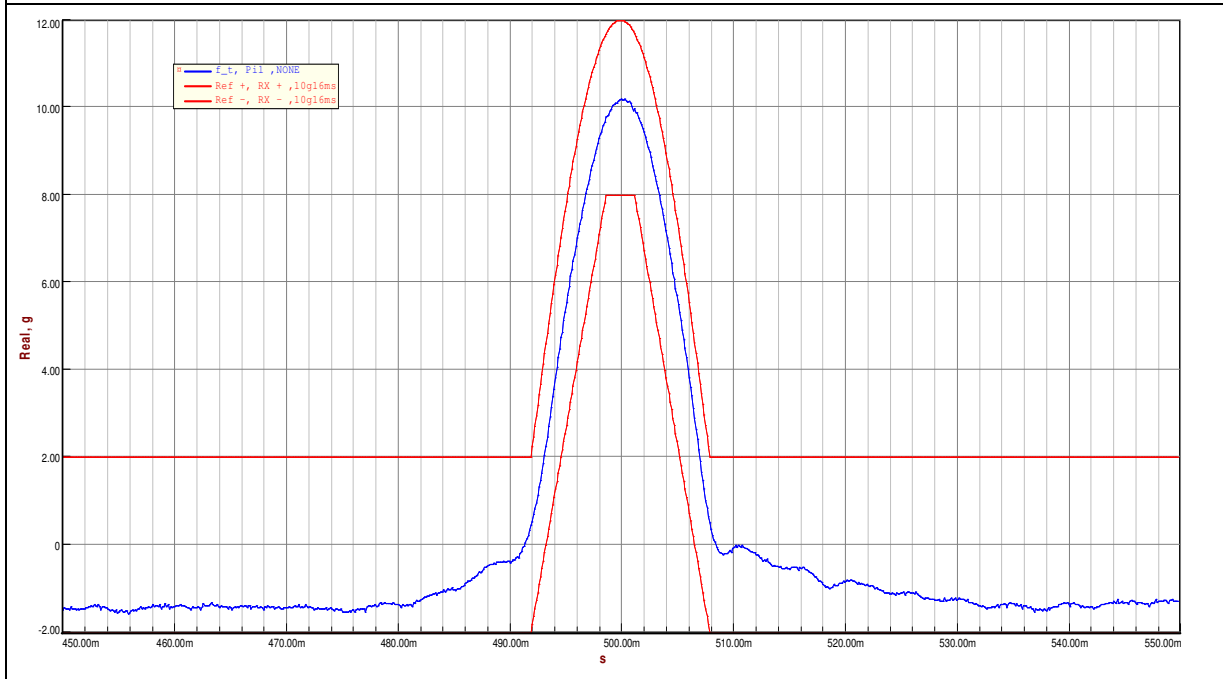
CONTROL + LIMITS



Curve n° 4

Test ref. : 2E18734	Specimen : OFP BASE PENETRATOR	Axes: X, Y, Z
Date : 20/08/19	Title : Bump test (10g/16ms)	Function : g(t)

CONTROL + LIMITS



Curve n° 5

Test ref. : 2E18734	Specimen : OFP BASE PENETRATOR	Axes: X, Y, Z
Date : 20/08/19	Title : Bump test (10g/16ms)	Function : g(t)

CONTROL + LIMITS

