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École polytechnique de Louvain (EPL)

epl

EEG frequency tagging to study active and passive rhythmic movements

Dissertation presented by
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for obtaining the Master's degree in
Biomedical Engineering

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Chapter 1

Appendix

1.1 Materials and Method

1.1.1 Calculation of the torque to raise up the finger

If L=9cm and D=1.4cm

$$Torque[Nm] = Force * L$$

$$\text{Force [N]} = \text{m*9,81}$$

(1.1)

With the assumption that the human body has the same weight than the water :

$$\begin{gathered}\text{m [Kg]} = \text{V}_{finger} * 1000 \\ V_{finger} = \pi * r^2 * L = \pi(0.007)^2 * 0.09 = 1,385 * 10^{-5} m^3 \\ \text{so } m = 0,014 \text{ [kg]} \\ \text{Force= } 0.136 \text{ [N]} \\ \text{Torque= } 0.0122 \text{ [Nm]} \quad (1.2)\end{gathered}$$

Figure 1.1: Motor torque

As the body is not composed of only water and to avoid the effects of muscle movement, the minimum torque was set at 0.122 [Nm].

1.1.2 Calculation of the resolution

A previous search indicates that during a tapping motion at a frequency of 1.25Hz, the flexion time corresponds to 0.1s and the extension time corresponds to 0.2s. So if the record is 1000Hz, the minimum resolution equal:
$resolution = \frac{30}{0.2 * 1000}$ =0.15 degree

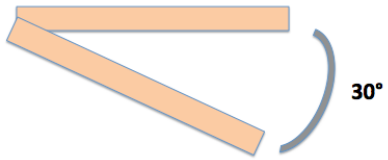


Figure 1.2: Motor resolution

1.1.3 ASCII table

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

Figure 1.3: Ascii Table [**?**]

1.1.4 Electronic circuit for the servomotor Dynamixel

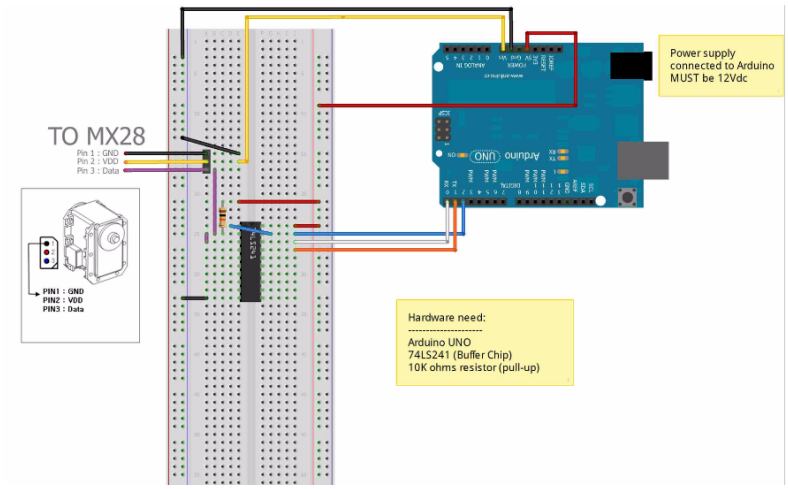


Figure 1.4: Electronic circuit for the servomotor Dynamixel [**?**].

1.1.5 Plan SolidWorks

Plan prototype 2

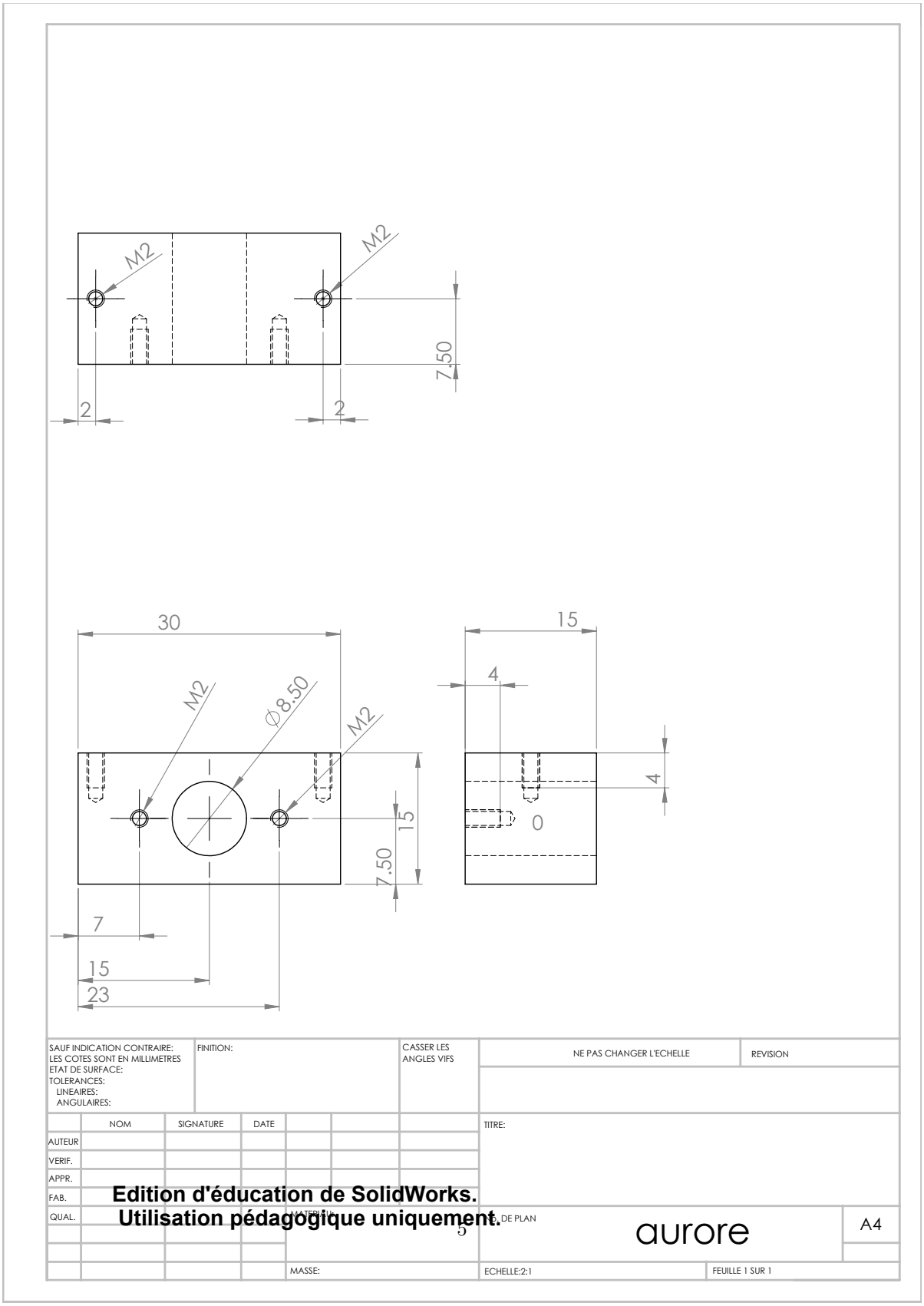


Figure 1.5: Plan of piece 1 of prototype 2

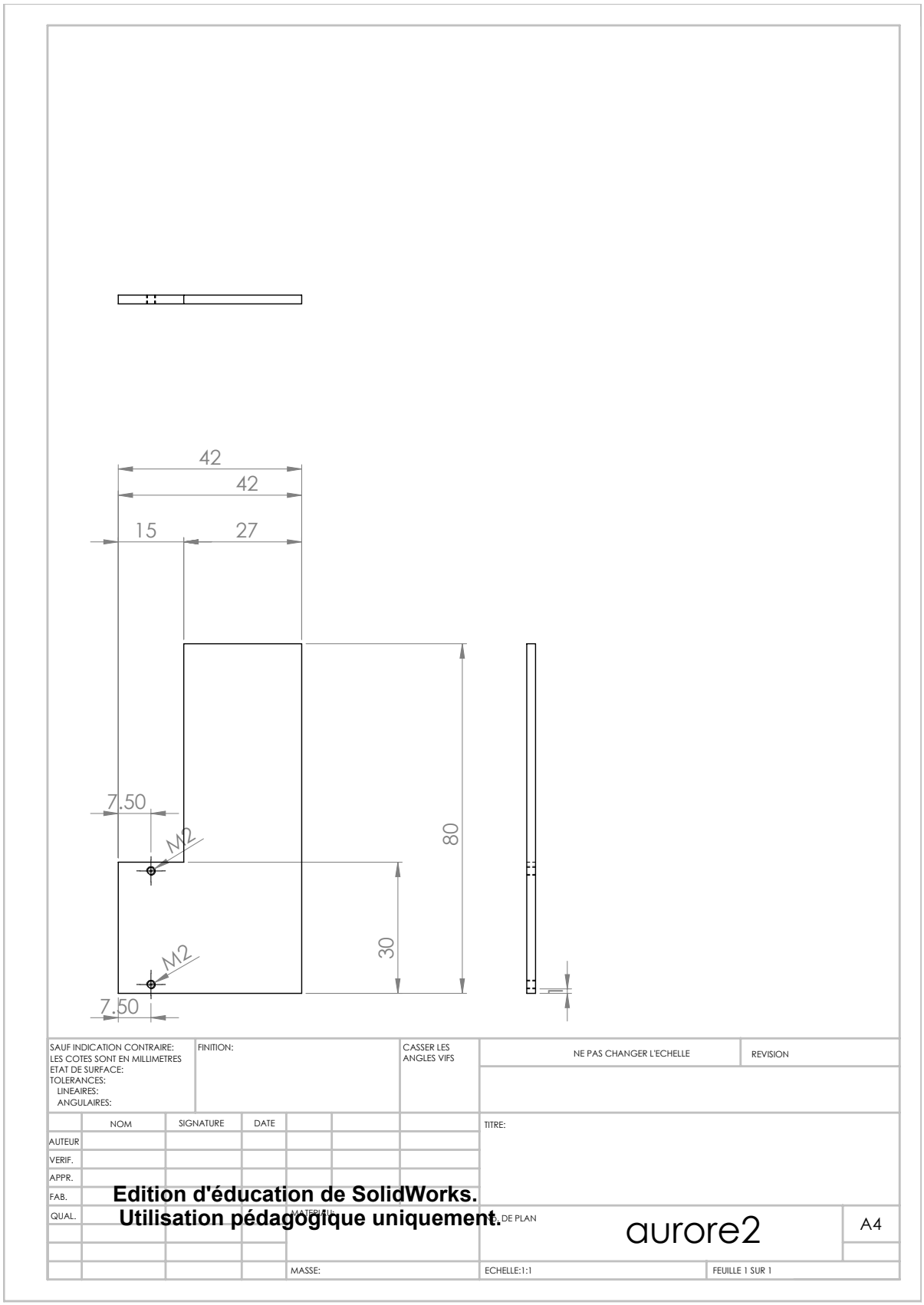


Figure 1.6: Plan of piece 2 of prototype 2

Plan prototype 3

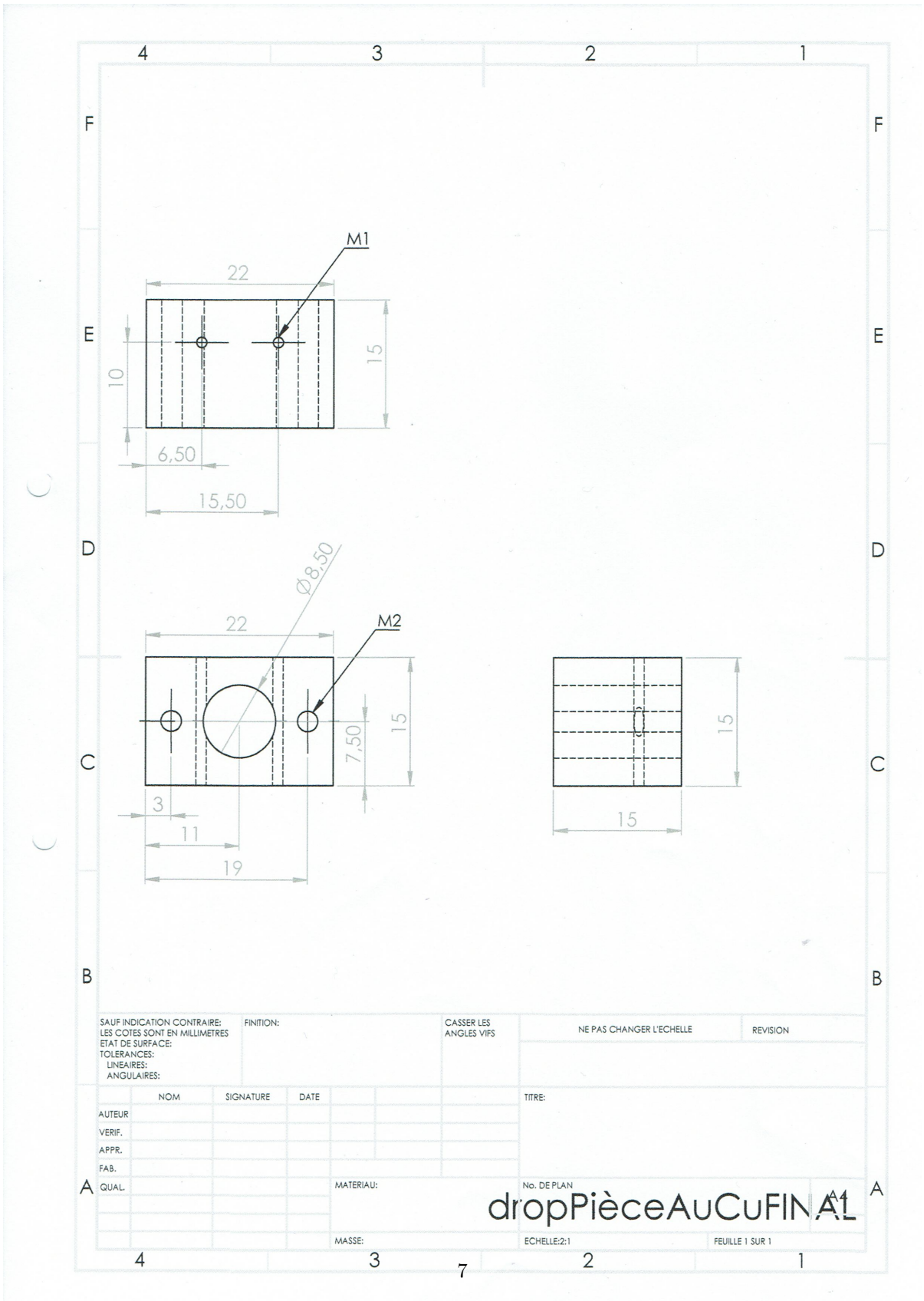


Figure 1.7: Plan of piece 1 of prototype 3

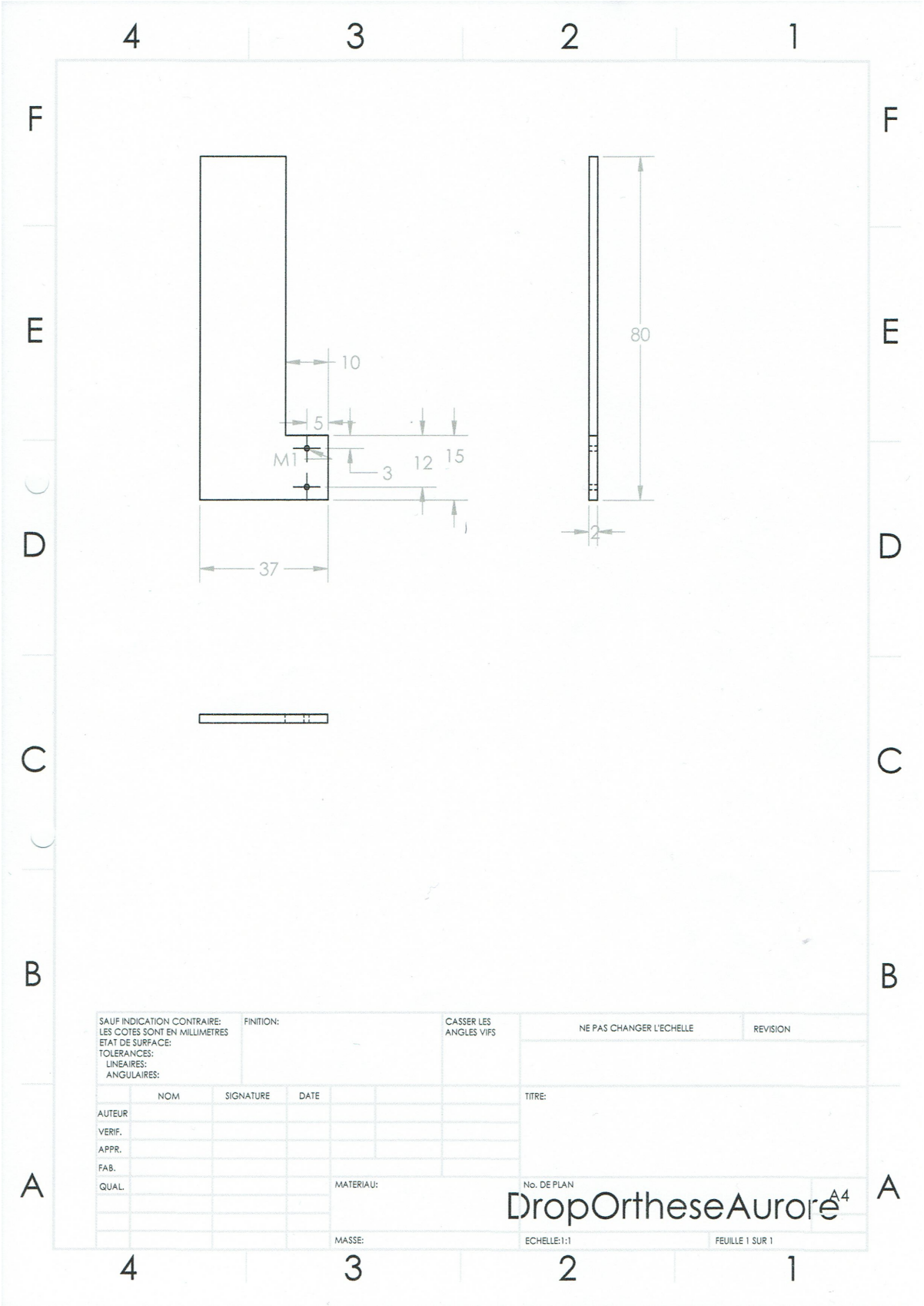


Figure 1.8: Plan of piece 2 of prototype 3

Plan prototype 4: Final prosthesis

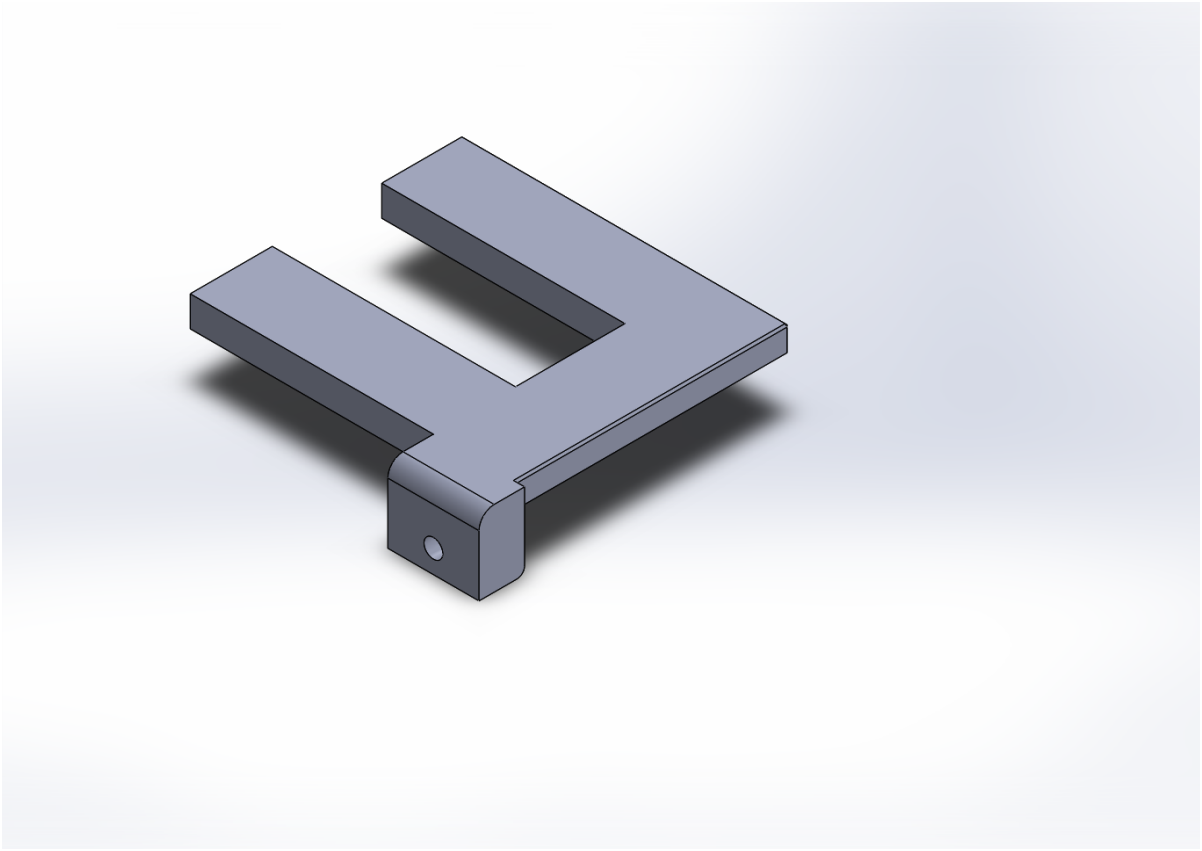


Figure 1.9: Piece 1 of the final prototype

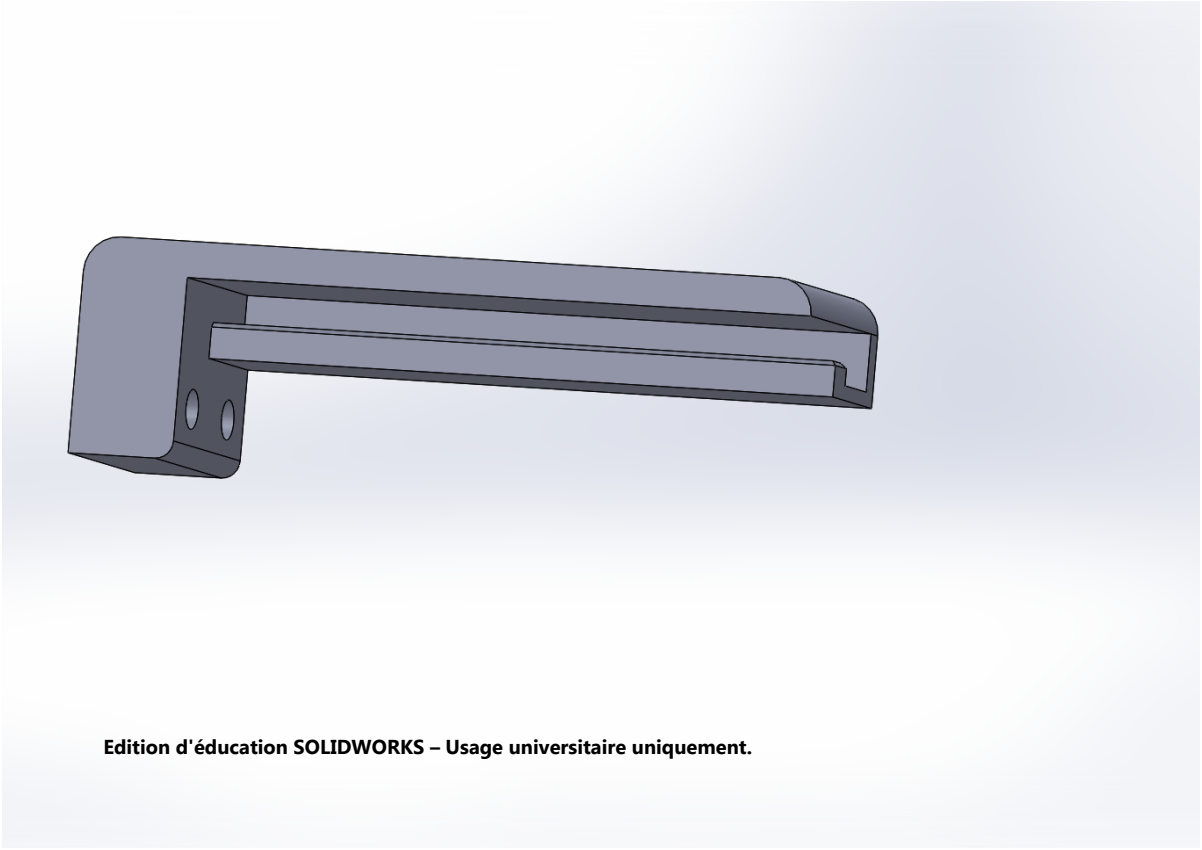


Figure 1.10: Piece 2 of the final prototype

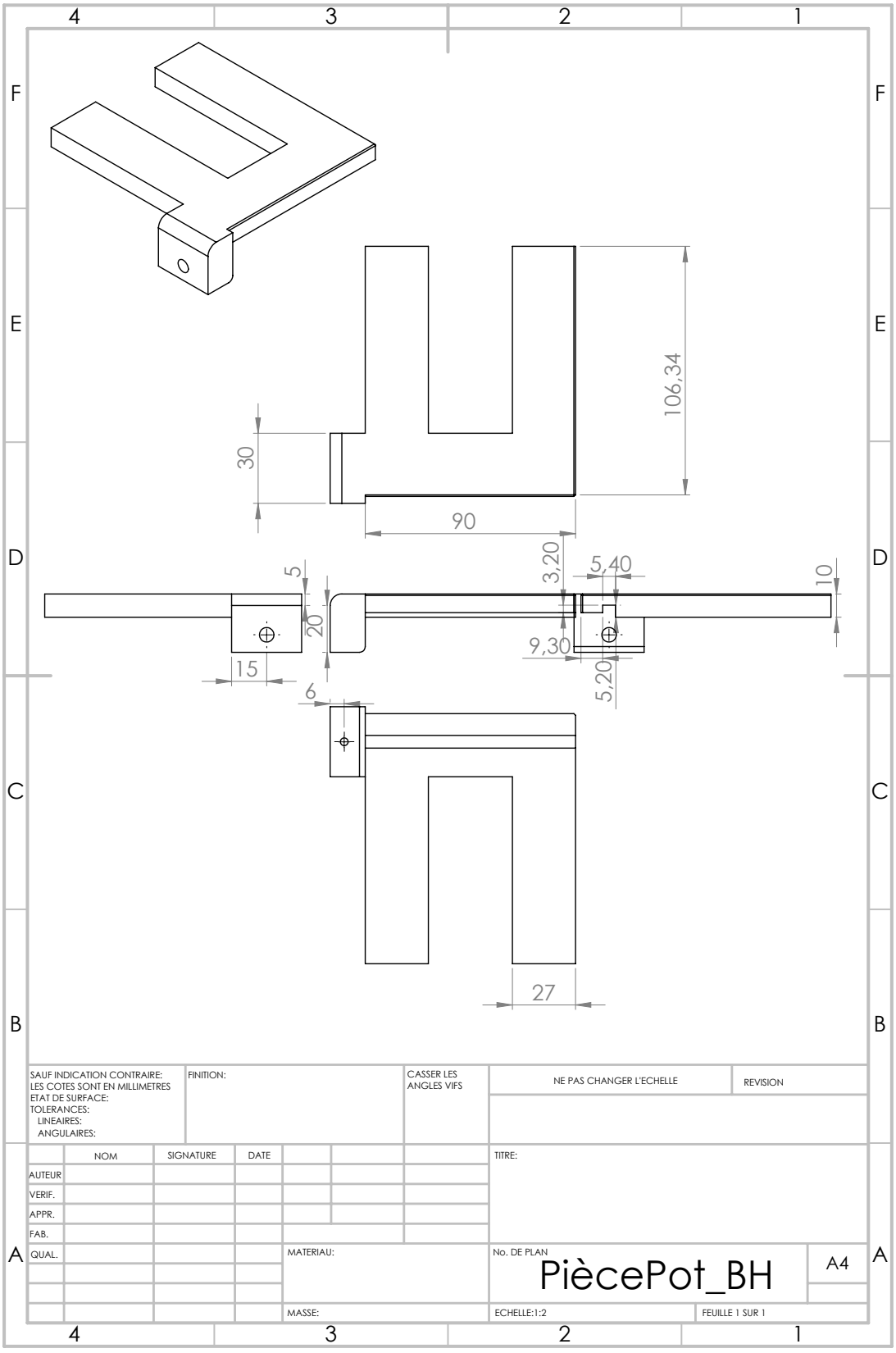
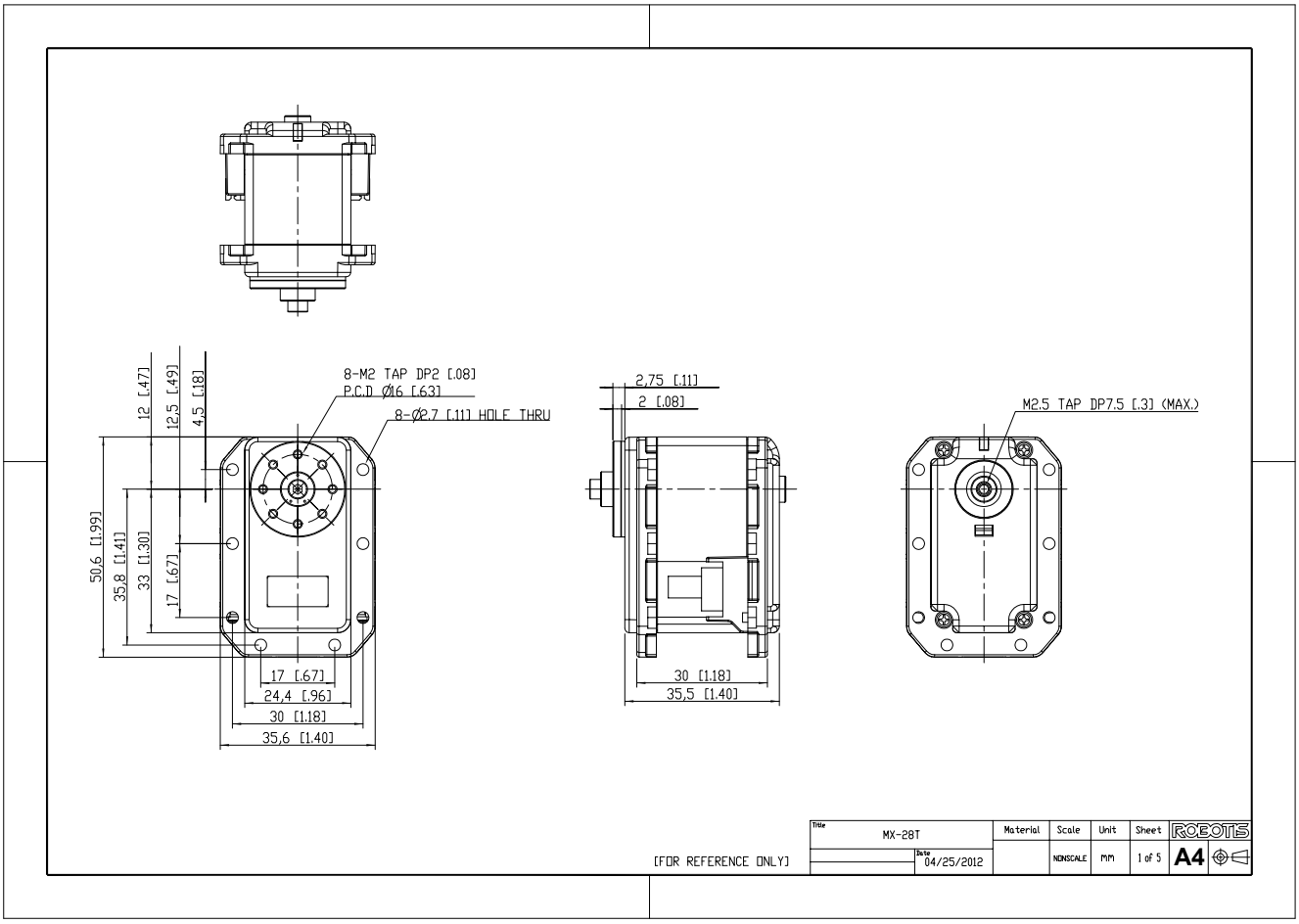


Figure 1.11: Plan of the final prototype

1.1.6 Plan Dynamixel MX-28T



1.2 Result

1.2.1 New topography by subject

Topography of the subjects according to the frequency of interest

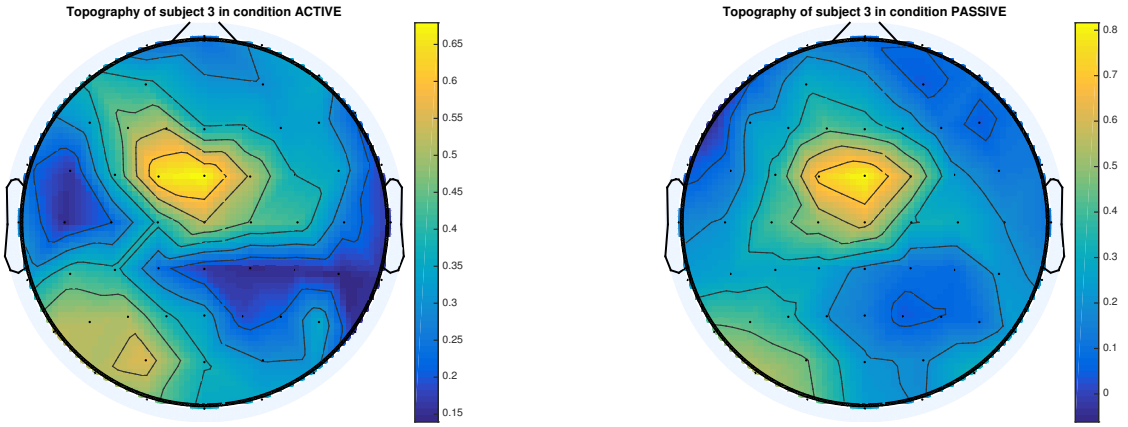


Figure 1.12: Subject 3 topography for the active and passive condition

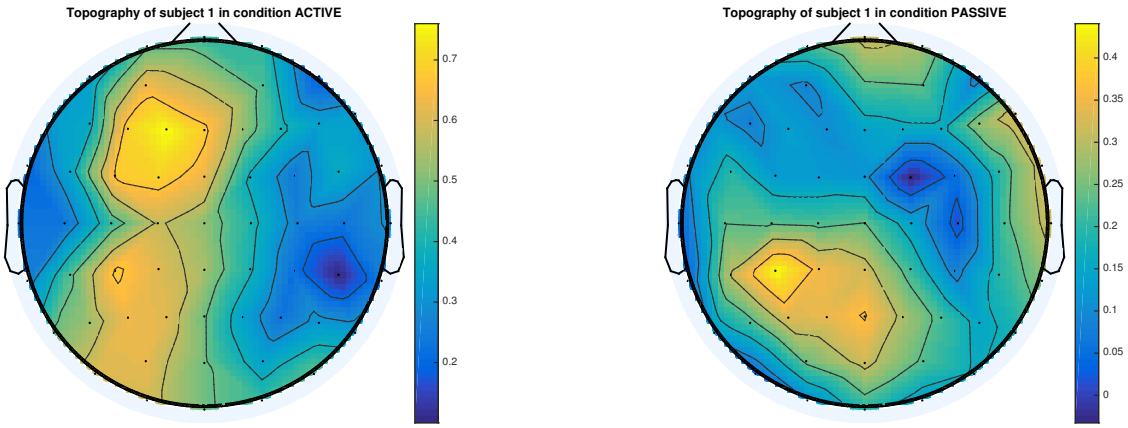


Figure 1.13: Subject 1 topography for the active and passive condition

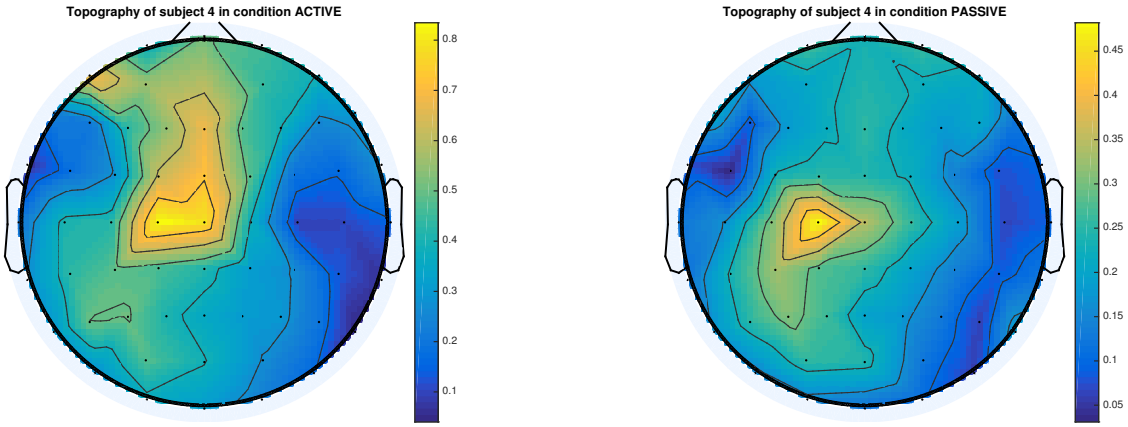


Figure 1.14: Subject 4 topography for the active and passive condition

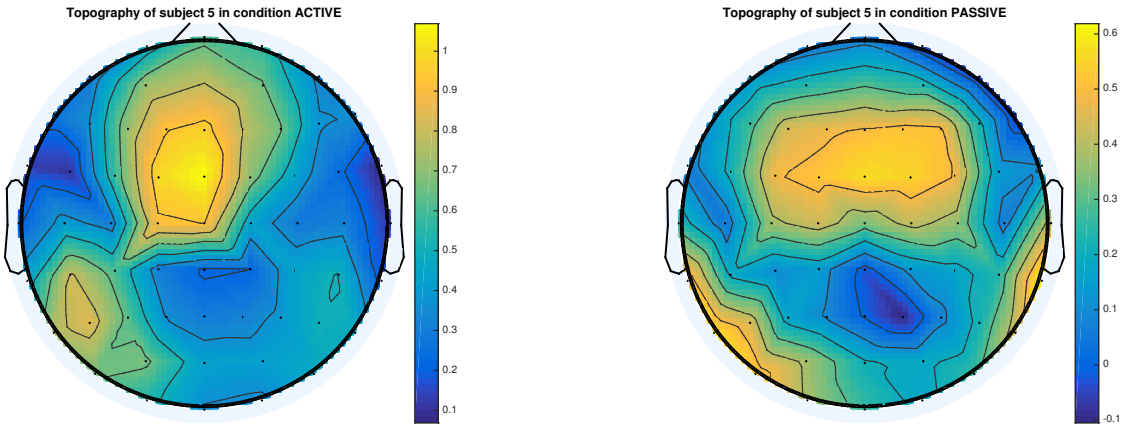


Figure 1.15: Subject 5 topography for the active and passive condition

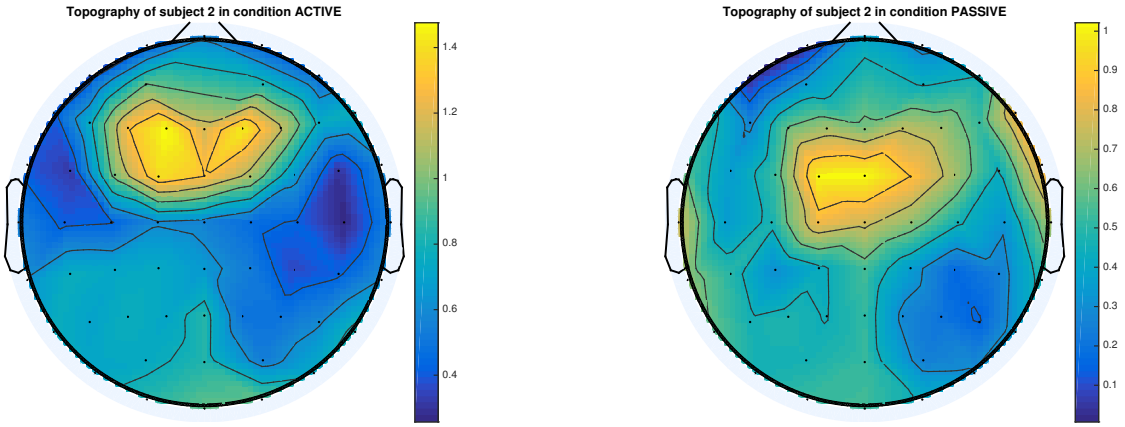


Figure 1.16: Subject 2 topography for the active and passive condition

1.2.2 Topography of the temporal analysis

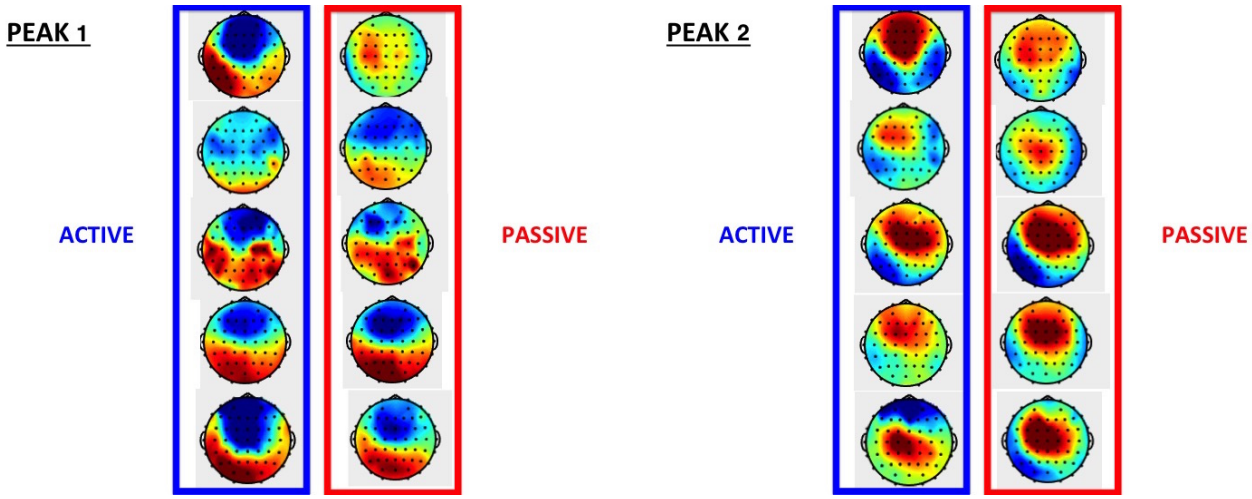


Figure 1.17: Topography by participant according to the components a) 1 , b) 2