

 	ESS nBLM System -- DETECTOR DESIGN AND MATERIALS SELECTION	CEA-ESS-DIA-RP-0039
	ESS-I	

RAPPORT - REPORT

ESS nBLM SYSTEM: DETECTOR DESIGN AND MATERIALS SELECTION FOR 84 DELIVERABLE DETECTORS PRODUCTION

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 	ESS nBLM System -- Materials Selection	CEA-ESS-DIA-RP-0039
	ESS-I	Page 2 / 16

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 	ESS nBLM System -- Materials Selection	CEA-ESS-DIA-RP-0039
	ESS-I	Page 3 / 16

SOMMAIRE - CONTENTS

1. Introduction.....	4
2. Related Documents	5
3. List of materials	5
3.1. <i>nBLM Chamber</i>	<i>6</i>
3.2. <i>Micromegas detector.....</i>	<i>9</i>
3.3. <i>Electronics.....</i>	<i>9</i>
3.4. <i>Gas system in detector side.....</i>	<i>11</i>
3.5. <i>Gas system (long tubes)</i>	<i>12</i>
4. Appendix 1	13
5. Appendix 2	14
6. Appendix 3	16

	ESS nBLM System -- Materials Selection	CEA-ESS-DIA-RP-0039
	ESS-I	Page 4 / 16

1. Introduction

The ESS nBLM system is part of the ESS BLM system that can be divided in three (3) sub-systems:

- a) Ionisation Chamber based BLM
- b) Advanced BLM
- c) Neutron sensitive BLM (nBLM)

The idea for the nBLM system is to use Micromegas detectors, specially designed to be sensitive to fast neutrons and insensitive to low energy photons (X- and γ -rays). In addition to this, the detectors (or part of them) shall be as insensitive as possible to the thermal neutrons as well. They will use mainly in the low energy part of the accelerator (MEBT, DTL and Spokes). More information of the system can be found in [1, 2, 5].

The detection of the fast neutrons is done with two different approaches. In one approach we use a hydrogen rich convertor in order to detect the proton recoils that are created by the elastic scattering of the incoming neutrons. In the second approach we use as convertor a material with high (n,α) cross-section, such as ^{10}B and we surround the detector with a neutron moderator (i.e. pure polyethylene). In order to reject incoming slow neutrons, we use an external neutron absorber like boron-rich rubber, with the cut-off energy to be determined by the absorber thickness. The gamma rejection in both detectors is based on the difference in the ionization between electrons and alphas or heavier ions.

Since the two approaches have complementary advantages, we propose the use of the two modules together or separated, depending on the location (see [9]) they are called “fast” and “slow” module respectively. Such a detector can cover the needs for fast response for safety reasons and high sensitivity to small fluxes for monitoring and diagnostic purposes. In both modules the Micromegas detector and the gas chamber are identical. The only differences between both modules is the neutron convertor and, in the case of the slow, the use of a layer of moderator and a layer of thermal neutrons absorbers.

At the present document, the detailed design of the nBLM detectors are presented together with a detailed list of the components and materials used for their fabrication. The aim of the document is to achieve the approval to initiate the production phase of the 84 modules (42 slow and 42 fast). Given the approval, we planned to request price offers from external contractors immediately aiming to order in September 2018 and to start detector assembling in November 2018. This document is released as part of the nBLM CDR1.2 document package, concerning only mechanical parts and detectors and gas system. It also includes the front-end electronics interface. It is discussed in advance to gain the time required for the ordering and arrival of the material. No design elements or materials will need to be modified.

In [Appendix 1](#) we show the neutron convertors, in [Appendix 2](#) detail of the detector and interface FEE cards and in appendix 3 [Appendix 3](#) the full set of drawings.

2. Related Documents

	Name of reference document	ESS reference
[1]	nBLM System PDR1.1	CHESS, ESS-0087794, 2016 December 2016
[2]	nBLM System PRD1.2	https://indico.esss.lu.se/event/835/ July 2017
[3]	ESS CEA IKCA – Schedule AIK 7.9	CHESS, ESS-0052571, 2016
[4]	ESS_IKC_BLM_Control_2017-10-04	
[5]	nBLM system CDR1.1	https://indico.esss.lu.se/event/948/ December 2017
[6]	Modes covered by nBLM system	https://indico.esss.lu.se/event/948/ December 2017
[7]	MonteCarlo Results: nBLM response to ESS scenarios, L. Segui	CHESS, ESS-0107320, 2017
[8]	Report regarding the MC simulation for BLM-focus on the nBLM, I. Dolenc-Kittelmann	CHESS, ESS-0066428, 2016
[9]	nBLM general overview, I. Dolenc-Kittelmann	https://indico.esss.lu.se/event/948/ December 2017

3. List of materials

In **Table 1** the list of mechanical materials used in common for the detector (both slow and fast) are summarized. In **Table 2** and **Table 3** the specific materials for the slow and fast module respectively are listed.

3.1. nBLM Chamber

Material	Use [Number in Appendix 3]	Dimensions	Quantity/ Placement	Supplier	Reference
Silicone VMQ-40 joints - Molded	Detectors gas tightness [13]	Diameter equi. 162mm, thickness 3.5mm	2/detector = 168 Enclosed in gas chamber	Sephat	http://www.sephat.fr/catalog/documents/CATALOGUE-1.pdf
Apiezon M High Vacuum Grease, Silicone-Free and Halogen-Free	To put within the joints -Not mandatory, better tightness for He	N/A	Very small quantity (<<1g) per joint	Apiezon	https://shop.apiezon.com/apiezon-m-grease-25g-tube-11-p.asp
Loctite 577 Thread sealant	To attach gas tubes to chamber	N/A	Very small quantity (<<1g) per gas tube. 2 gas tubes /detector = 168	Loctite (Available at CERN stores)	http://www.loctite.co.uk/loctite-4087.htm?nodeid=8802627256321&msdsLanguage=EN_GB&selectedTab=document
Aluminium	Chamber [11,16]	Appendix 3 (same for slow & fast)	42 Slow detectors	External contractor with better offer	Aluminium 6061
			42 Fast detectors		
Stainless steel	Gas tubes in chamber [12]	Appendix 3 (same for slow & fast)	2 x detector = 168	External contractor with better offer	316L
Aluminium	Cathode [10]	10 x 10 mm ² plate Appendix 3 (same for slow & fast)	1/detector =84	DVAI, 77220 Tournen-en-Brie	Al-5083
Aluminium	Faraday Cage [17]	Appendix 3	2/detector =168	External contractor with better offer	Aluminium 6061
Aluminium with engraved information	Faraday Cage connectors face [18]	Appendix 3 Figure 2	1/detector =84	External contractor with better offer	Aluminium 6061

316 Stainless steel tube fittings Swagelok SS-6M0-61	Gas tube fitting [21] Figure 1	Appendix 3	2/detector = 168	Swagelok	SS-6M0-61
Aluminium	Polyethylene supports [25,26,37]	Appendix 3	4/detector = 672	External contractor with better offer	Aluminium 6061
Aluminium	Detector support [34]	115 x 82 x 20 mm ³ Appendix 3	2/detector = 168	External contractor with better offer	Aluminium AU4G
Aluminium	Fast-slow union [48]	256x256x10 mm ³ Appendix 3	1/detector in 10 cases = 10	External contractor with better offer	Aluminium 6061
Stainless steel screws and bolts	Different sizes and types	Appendix 3	Several /detector	External contractor with better offer	N/A

Table 1: Material list for mechanical pieces of nBLM detector



Figure 1: SS-6M0-61 Swagelok Gas tube fitting. To connect face faraday cage to gas tube

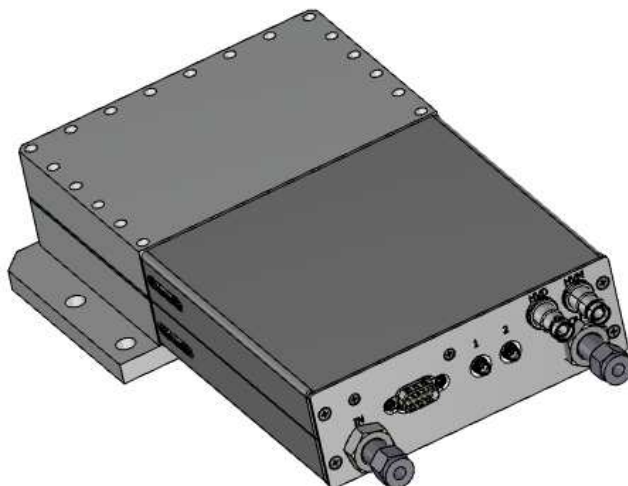


Figure 2: nBLM gas chamber with Faraday Cage. We can see the final connectors placed on the closing face of the Faraday Cage.

3.1.1. Pieces exclusive for slow detector

Material	Use [Number in Design]	Dimensions	Quantity/ Placement	Supplier	Reference
B4C	Neutron convertor for Slow detector Figure 7	Thickness 0.2-1.5µm B4C Deposited on the cathode (Appendix 1)	1/ slow detector = 42	Deposit done at Linkoping facility	https://europeanspallationsource.se/workshops-facilities#detector-coatings-workshop
Polyethylene	Neutron moderator [29,36, 41]	~7.5 kg /detector Appendix 3	Slow detector	External contractor with better offer	PE HD 500
MirroBor	Thermal neutron absorber [30-32,42-47]	2750cm2 x 5mm thickness Appendix 3	Slow detector	MirroTron	https://mirrotron.com/en/products/radiation-shielding

Table 2 : Material list for mechanical pieces exclusive of slow nBLM detector

3.1.2. Pieces exclusive for fast detector

Material	Use	Dimensions	Quantity/ Placement	Supplier	Reference
Mylar aluminized	Neutron convertor for fast detector Figure 8	Mylar 120 µm glued on a 10 x 10 mm2 Al plate (Appendix 1)	1/ fast detector = 42	Mylar: Good fellow Glue on Al: Araldite Glued at CEA/Saclay	Mylar: http://www.goodfellow.com/catalogue/GFCat41.php?ewd_token=Tk0jf63H3LoYSrRo5uQKxh1mpyvqS8&n=UAucnbOSVMB0zSEz1VKEUOutOH11ad&ewd_urlNo=GFcat411&Catite=ES301912&CatSearNum=1 Glue: Araldite® 2011

Table 3: Material list for mechanical pieces exclusive of fast nBLM detector

3.2. Micromegas detector

Material	Use	Dimensions	Quantity/ Placement	Supplier	Ref
FR4 PCB Board + Stainless steel mesh	Detector Readout Figure 9	190x150x1.6 mm	1/detector = 84 Enclosed in Al chamber	ELVIA + Bulk at CEA/Saclay	FR4
FR4 "square"	To protect mesh in detectors. Appendix 3 "cadre mesh" Figure 9	102 x 90 x0.2	1/detector = 84 Enclosed in gas chamber	ELVIA	FR4

Table 4 : Material list for Micromegas detector

3.3. Electronics

Material	Use [Number in Design]	Dimensions	Quantity/ Placement	Supplier	Ref
FR4 PCB Boards	Read the nBLM signal [2] Figure 9 Figure 10 Figure 11	See design Appendix 2 &3	1/detector = 84 For HV	External contractor with better offer	FR4
FR4 PCB Boards	Give HV to Micromegas [3] Figure 9 Figure 11	See design Appendix 2 &3	1/detector = 84 For signal + LV + amplifiers	External contractor with better offer	FR4
Signal connectors	Read the signal Figure 4	See reference	1/detector = 84	HARWIN	Harwin Gecko Screw- Lok Vertical DIL PC: G125-MV11005M2P G125-FV11005F1P
D-Sub Connectors	Power to FEE on board	See reference	1/detector = 84	ITT Cannon / Farnell	DEMP9PJK87
Satinless steel M3 screws	HV connection Between the cards Figure 3 Figure 10 And for power the cathode Figure 11	Detail in Figure 3 And Figure 11	Per detector	Standard screws	N/A
SMA connectors	To read the signals Figure 10	N/A	2 per signal card/detector = 168	Farnell	5-1814400-1

SHV connectors	For HV of mesh and drift	Figure 3 Figure 11	2/detector = 184	Radiall	R317580000
Eyelet with soldier wire	SHV to HV card connection inside Faraday cage Figure 3	~5cm wire	2/detector = 184	Radiall or similar	M3 5 R Type 22 AWG

Table 5 : Material list of FEE cards

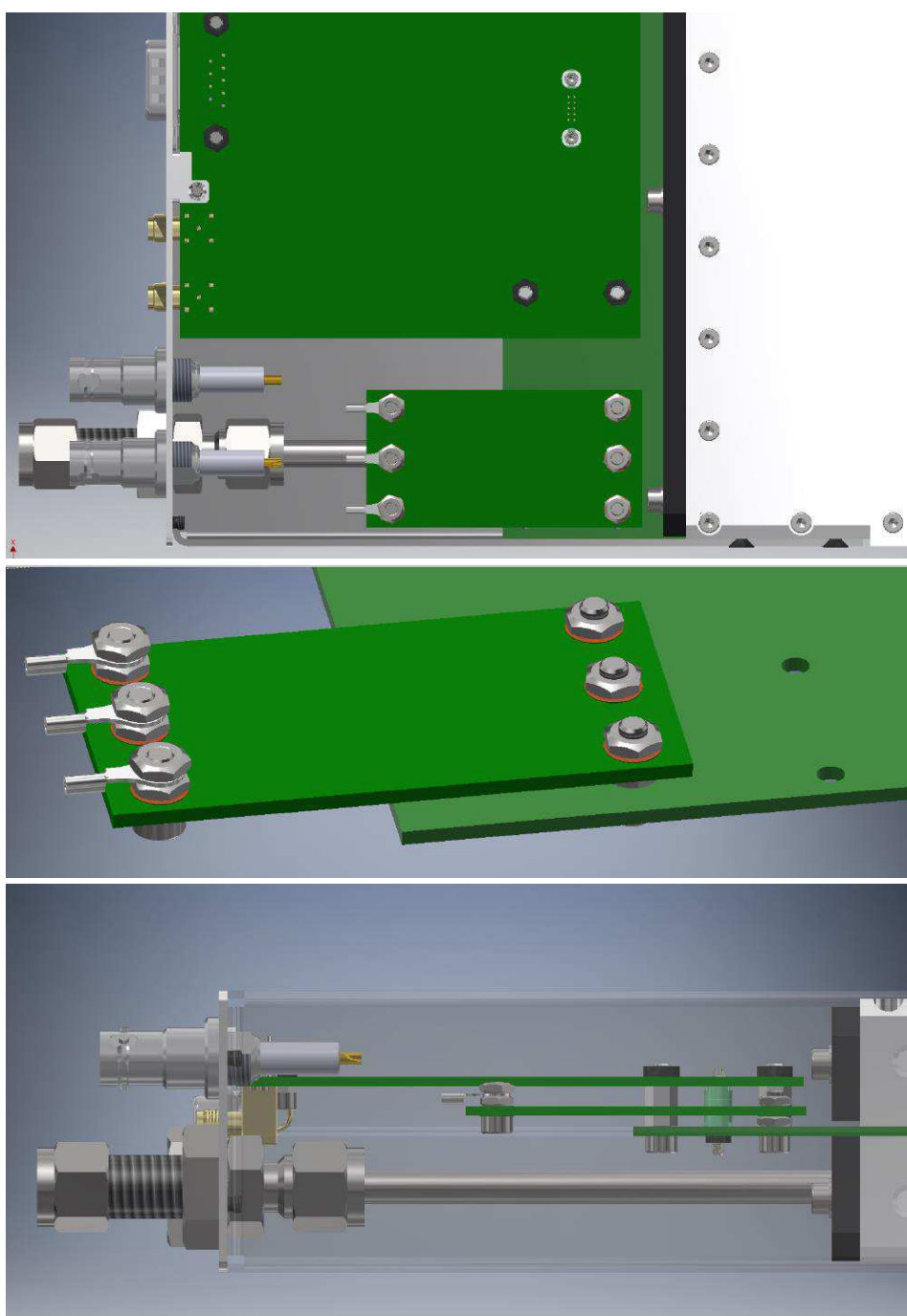


Figure 3: Schematic view of the HV and FEE cards connections for the nBLM detectors.



Figure 4: Harwin Gecko Screw-Lok Vertical DIL PC Tail Connector, with reference G125-MV11005M2P and G125-FV11005F1P (more info in HARWIN webpage or in document [5]).

3.4. Gas system in detector side

Material	Use	Dimensions	Quantity/ Placement	Supplier	Ref
Polyurethane gas tubes	To bring the gas from the gas pipes in stainless steel arriving to the tunnel to each detector placed close to the accelerator. Needs to be flexible in the positioning of the detectors during commissioning of the system.	Diameter of the tubes: 4/6 mm (inner/outer)	8 meters close to each DTL (at a distance of ~0.5-1m) 60 meters all along the spokes (at a distance of ~0.5-1m) Few meters between MB4 and MB5 Few meters between HB10 and HB115 Few meters close to first bend magnet	Festo	https://fr.rs-online.com/web/p/tuyaux-dair/1216292/
Stainless steel "Fast" couplers	To make the connection between long pipes and detectors and between detectors Figure 5	For 4/6 mm tubes	2/detector (168)	Serto	CO KA/B-SOS-6 EV http://www.serto.com/frfr/produits/produits-standards/schnellkupplungen/



Figure 5: Serto connector for gas interconnection between detectors

3.5. Gas system (long tubes)

Material	Use	Dimensions	Quantity/ Placement	Supplier	Ref
Stainless steel tubes	Bring gas In and OUT nBLM group of detectors	Different lengths	12 along accelerator	Under discussion with ESS	316L or 304 Under discussion with ESS
Stainless Steel Swagelok Tube Fitting	End of tubes to do further connections	From 8 to 6 mm Tube fitting Figure 6	2/tube = 24	Swagelok	SS-8M0-6-6M https://www.swagelok.com/en/catalog/Product/Detail?part=SS-8M0-6-6M
Stainless Steel Swagelok cap	To close the tubes temporarily until finish connections	316 Stainless Steel Cap for 6 mm OD Tubing Figure 6	2/tube = 24	Swagelok	SS-6M0-C https://www.swagelok.com/en/catalog/Product/Detail?part=SS-6M0-C

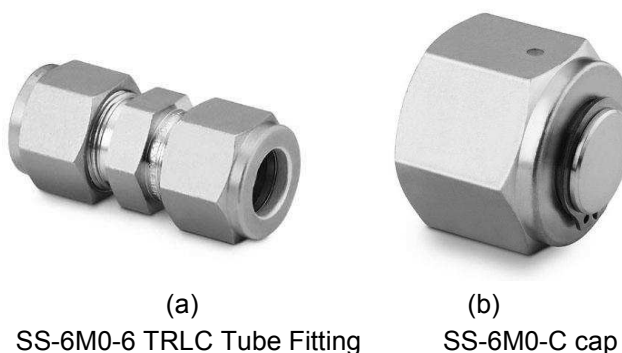


Figure 6: (a) Swagelok connector to terminate pipes that go from gas rack to close of the detectors (rest of connections later). They will need to be seal with an end-cap as in (b)

4. Appendix 1



Figure 7 : *Slow module cathode, without (left) and with (right) a 1.5 μm B₄C neutron convertor layer deposit done at the ESS Detector Coatings Workshop, Linkoping.*



Figure 8 : *Fast module cathode, with a 100 μm Mylar aluminized layer for neutron conversion.*

5. Appendix 2

Common design of nBLM detector & front-end electronics boards

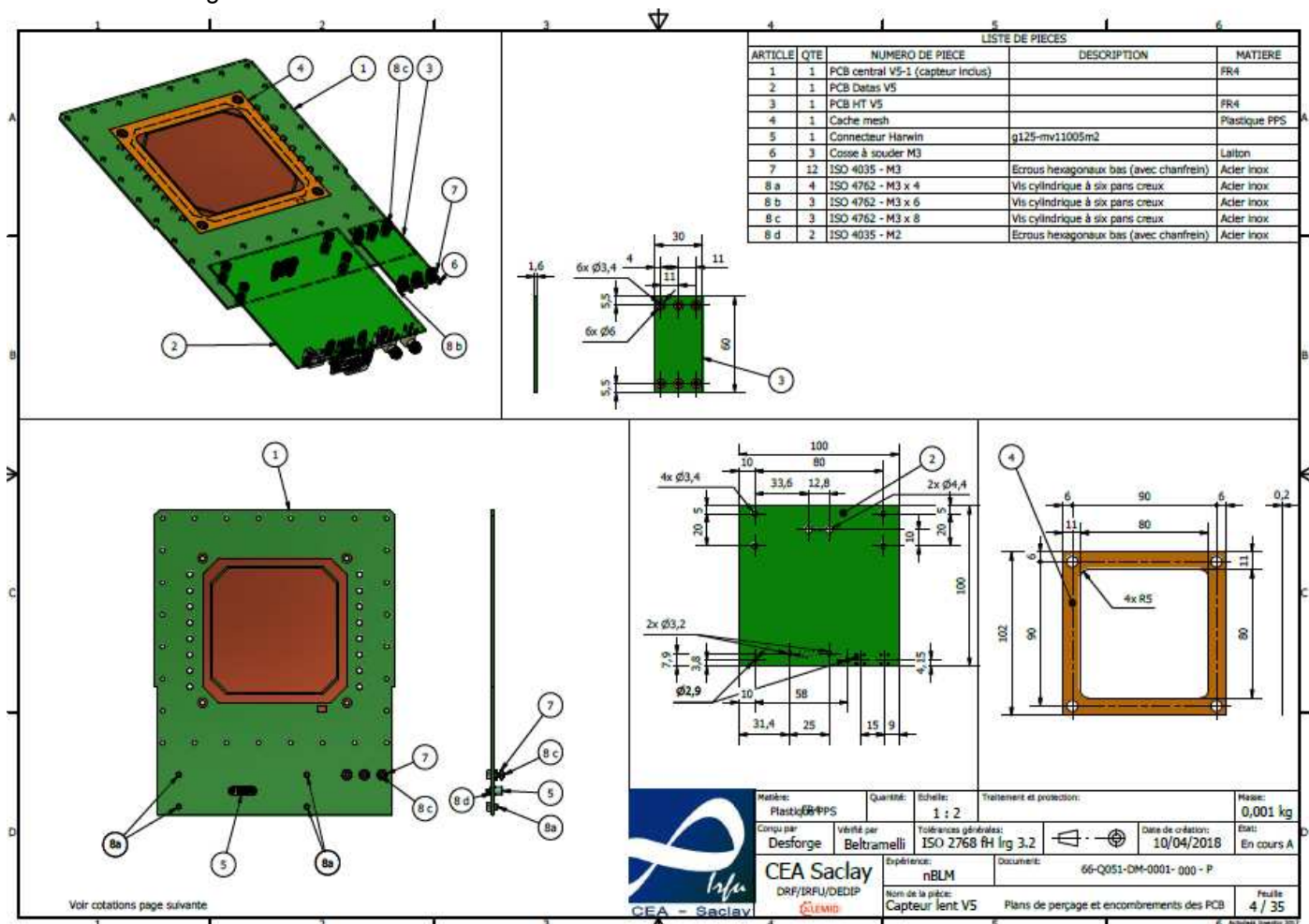


Figure 9 : Detector (1), FEE interface card (2) HV card (3) and mesh protection (4).

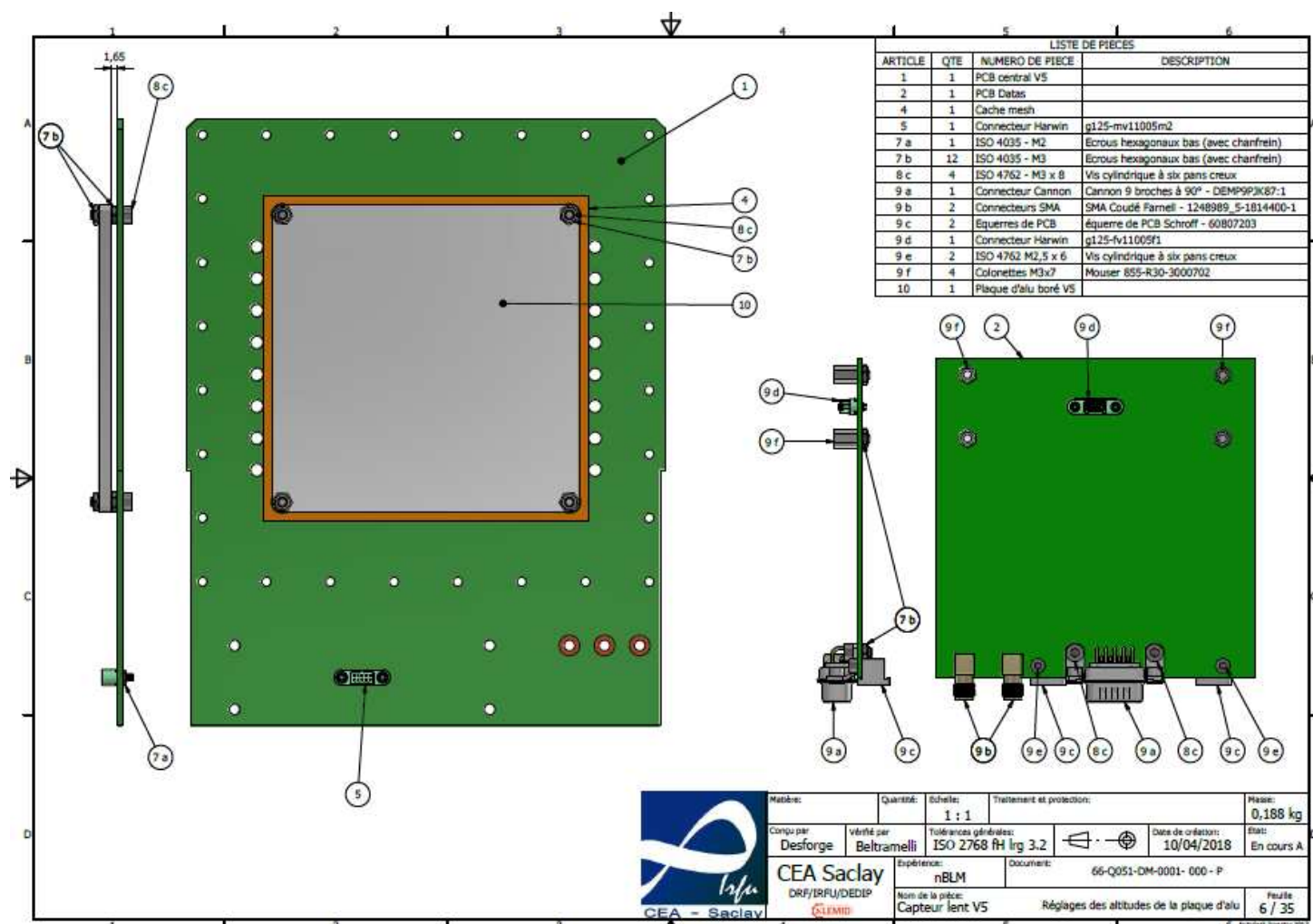


Figure 10: Details of the design of the FEE mezzanine card.

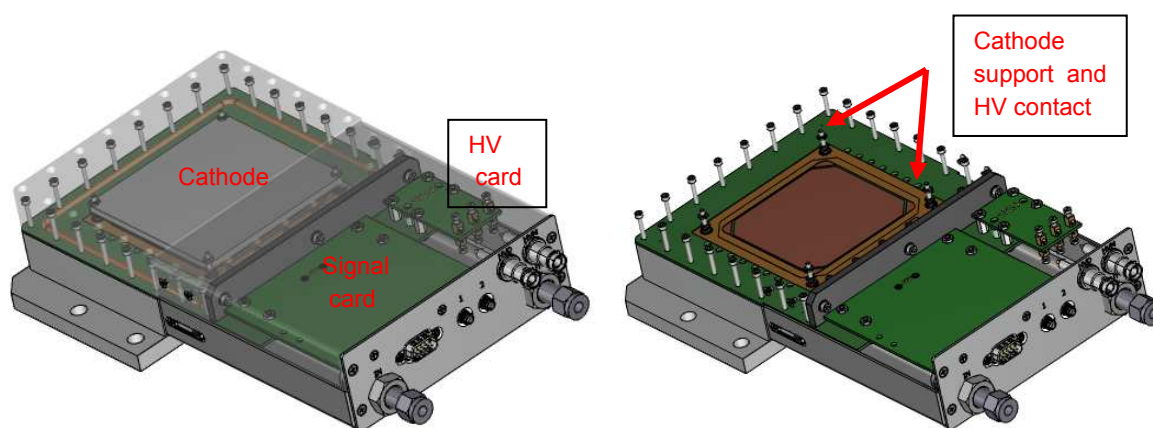
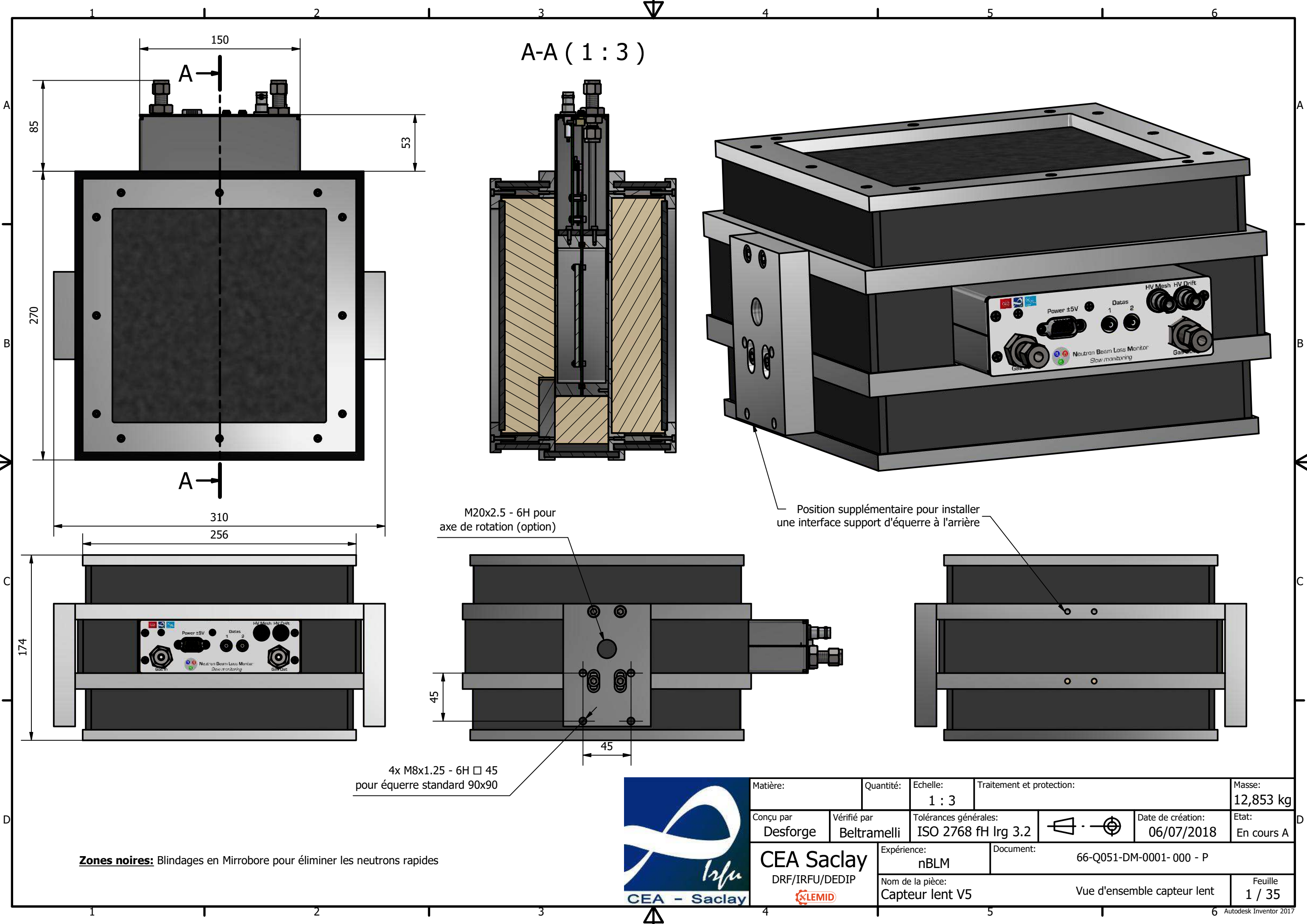


Figure 11: (Left) Detailed of the detector with the gas chamber and the Faraday cage transparent to show the interface cards between detector and out of detector. (Right) same but without the cathode as well to see the active surface of the Micromegas.

 	ESS nBLM System -- Materials Selection	CEA-ESS-DIA-RP-0039
	ESS-I	Page 16 / 16

6. Appendix 3

Drawings of the Common design of nBLM detector (chamber + Micromegas Detector)



A-A (1 : 3)

M20x2.5 - 6H pour
axe de rotation (option)

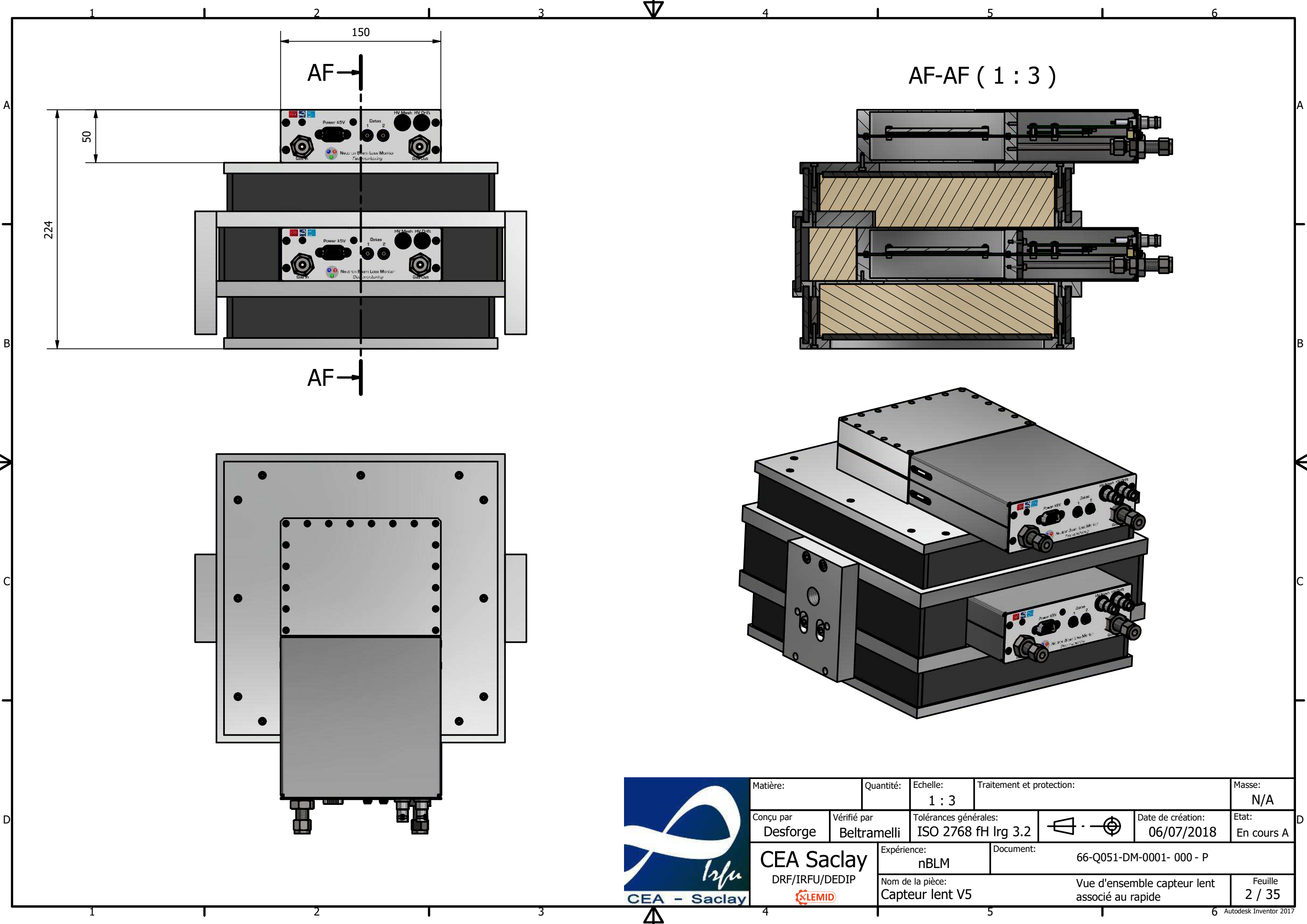
Position supplémentaire pour installer
une interface support d'équerre à l'arrière

4x M8x1.25 - 6H □ 45
pour équerre standard 90x90

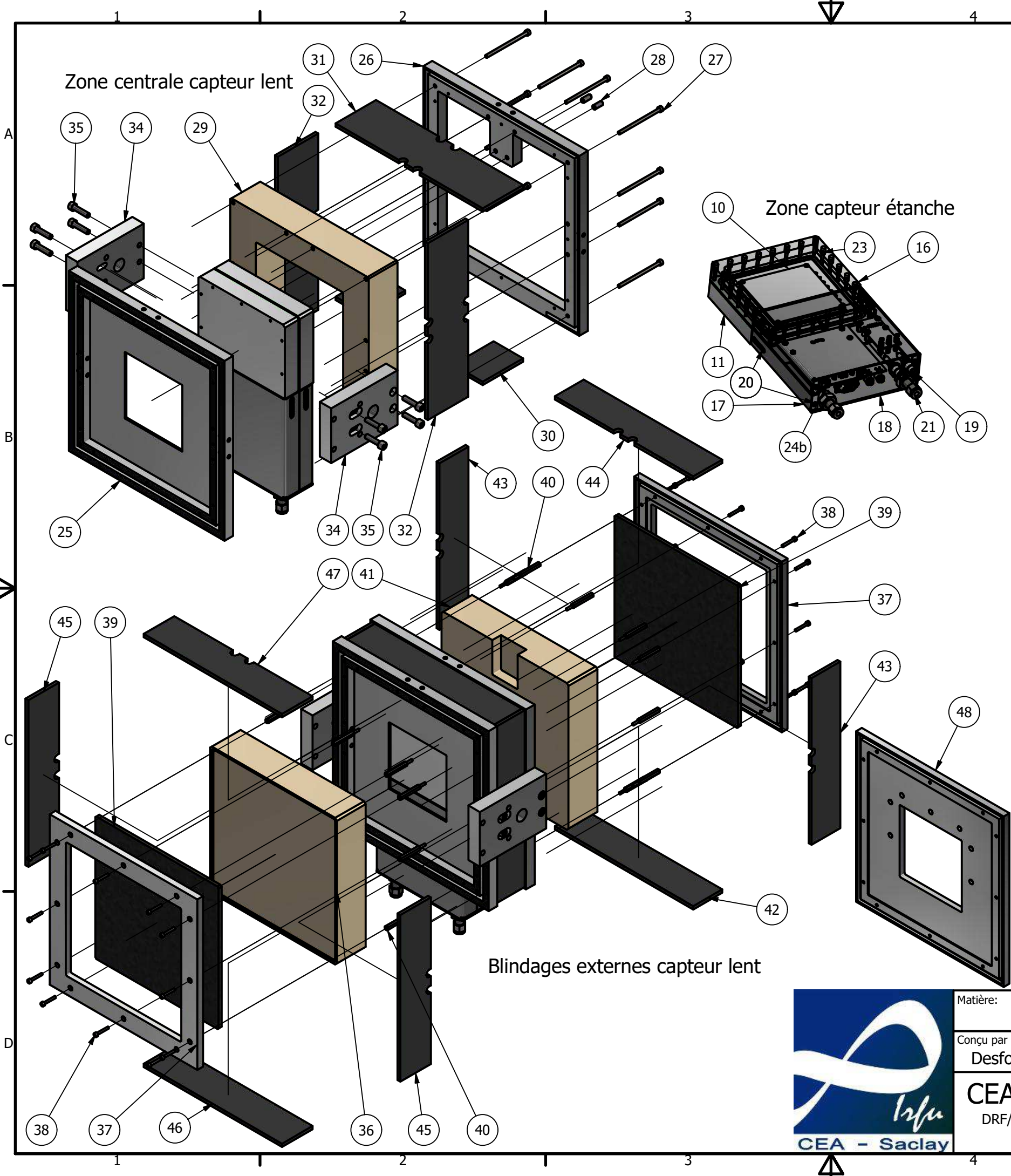
Zones noires: Blindages en Mirrobore pour éliminer les neutrons rapides



Matière:		Quantité:	Echelle:	Traitement et protection:		Masse:
			1 : 3			12,853 kg
Conçu par	Vérifié par	Tolérances générales:			Date de création:	Etat:
Desforge	Beltramelli	ISO 2768 fH lrg 3.2			06/07/2018	En cours A
CEA Saclay DRF/IRFU/DEDIP 		Expérience:	Document:			
		nBLM	66-Q051-DM-0001- 000 - P			
		Nom de la pièce:			Feuille	
		Capteur lent V5			1 / 35	
		Vue d'ensemble capteur lent				

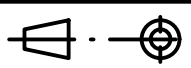


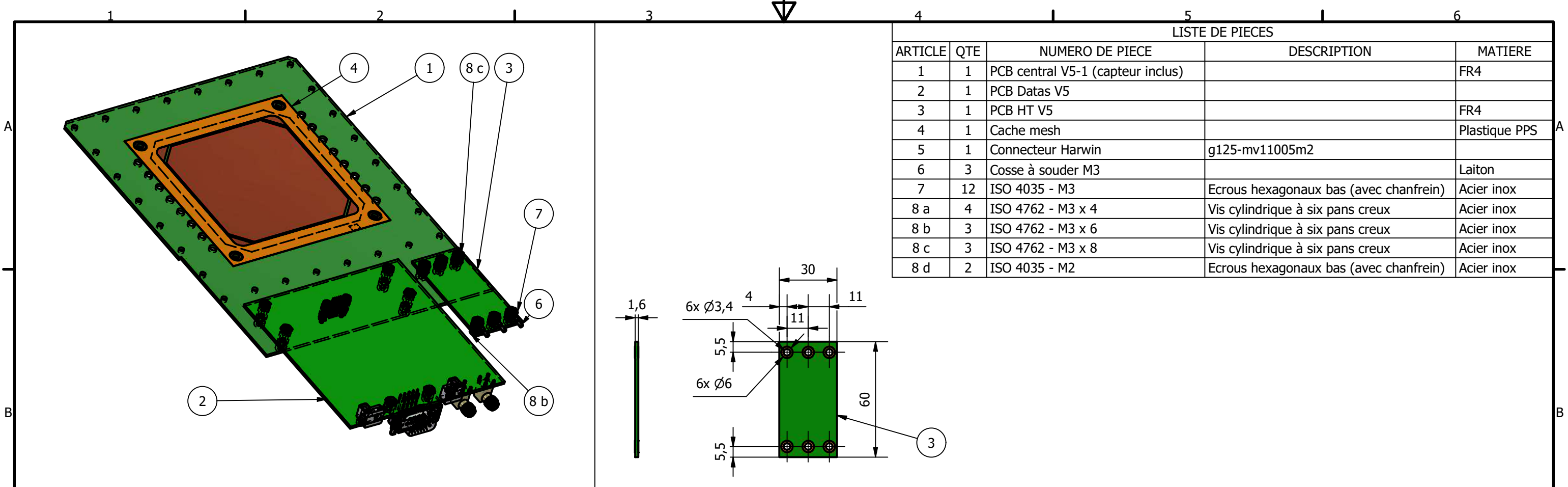
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			1 : 3			N/A
Conçu par	Vérifié par	Tolérances générales:			Date de création:	Etat:
Desforge	Beltramelli	ISO 2768 fH Irg 3.2			06/07/2018	En cours A
CEA Saclay		Expérience:	Document:			
DRF/IRFU/DEDIP		nBLM	66-Q051-DM-0001- 000 - P			
		Nom de la pièce:	Vue d'ensemble capteur lent		Feuille	
		Capteur lent V5	associé au rapide		2 / 35	



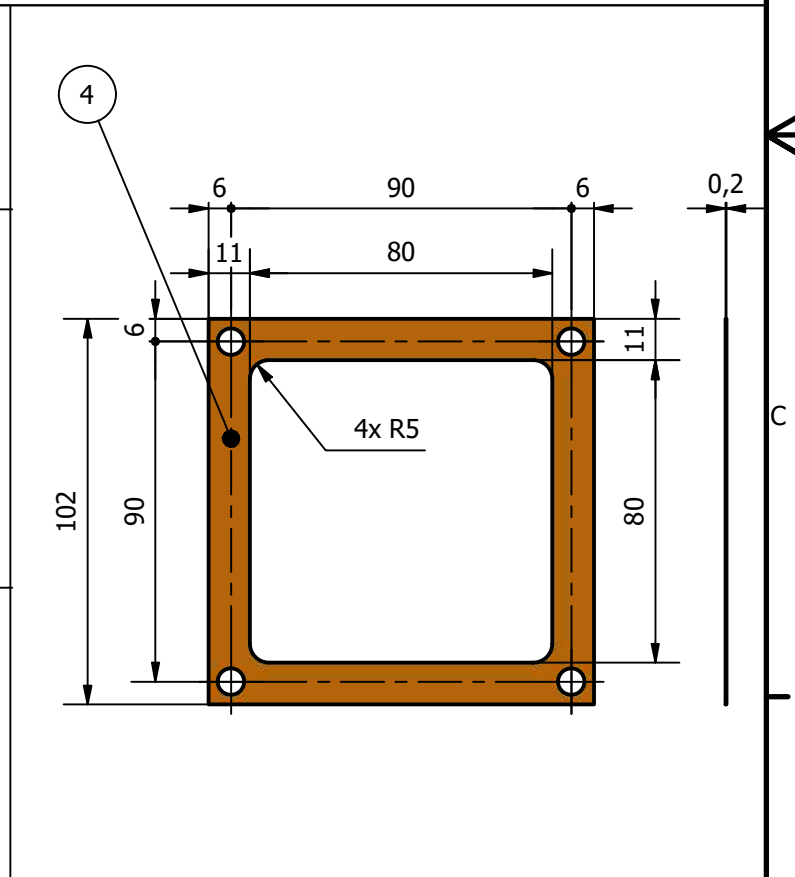
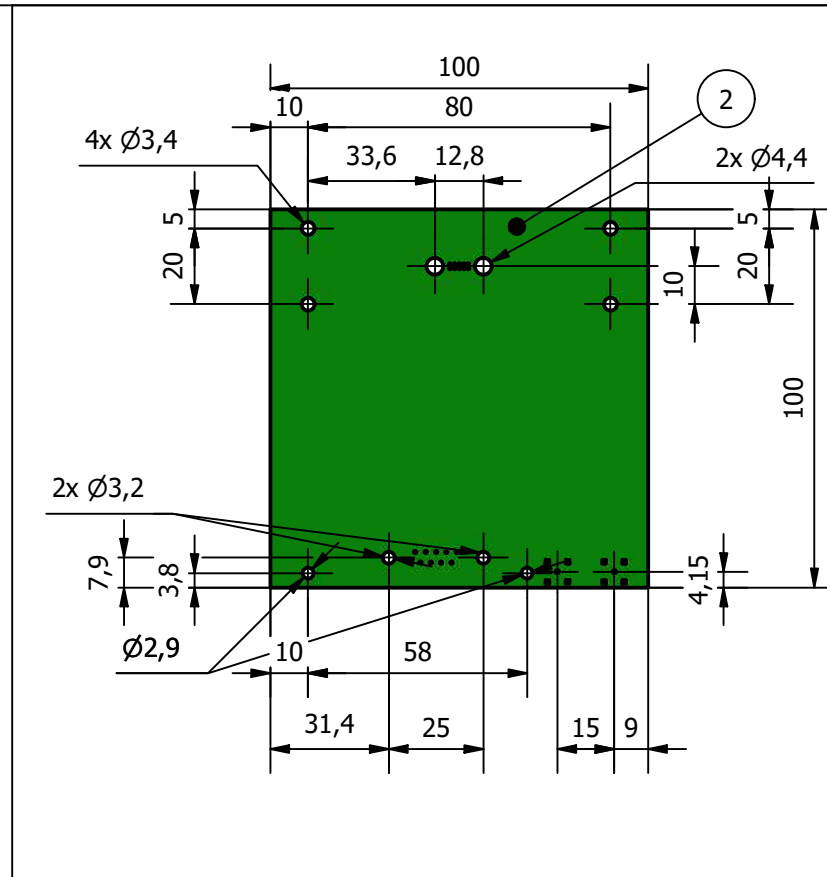
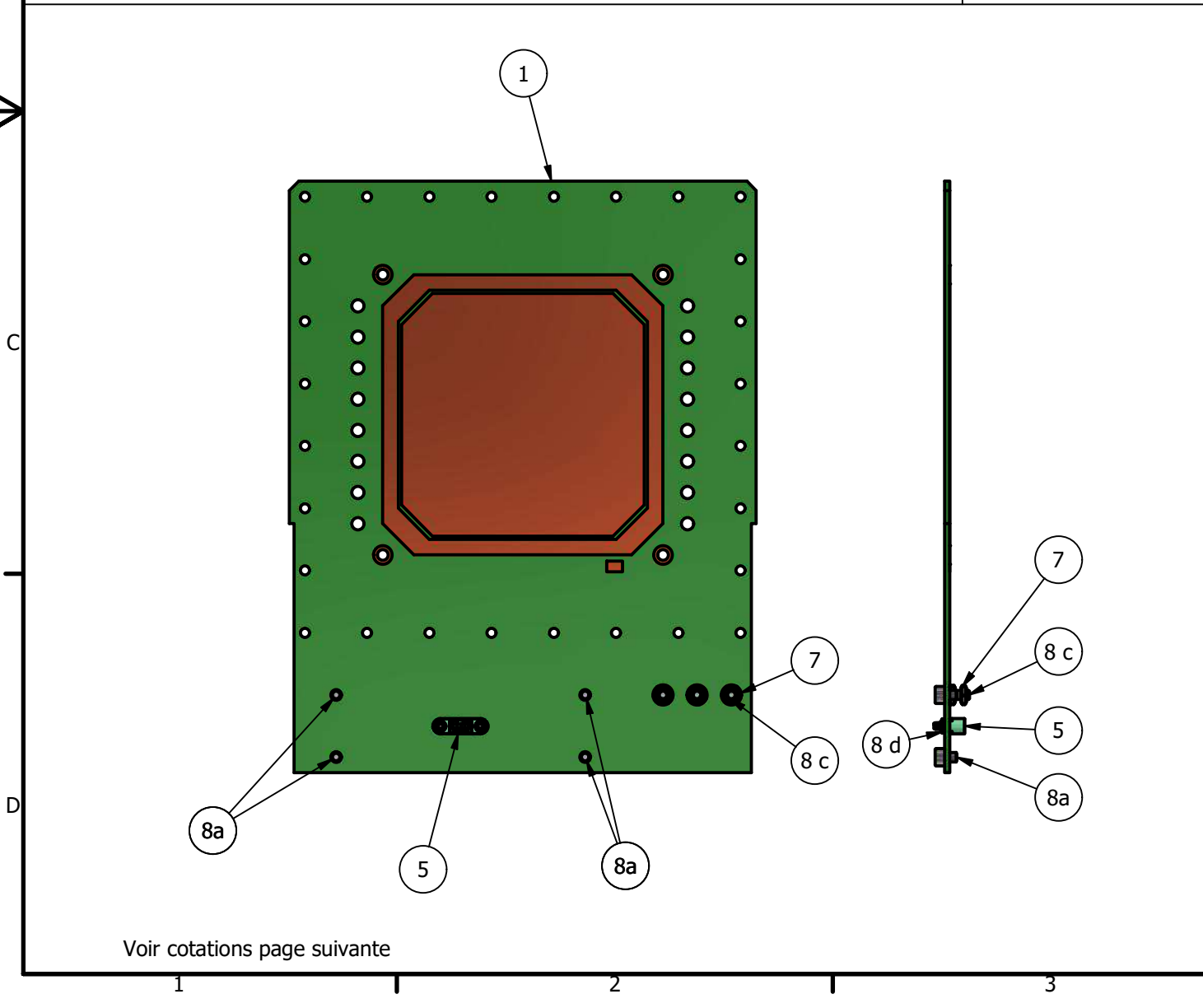
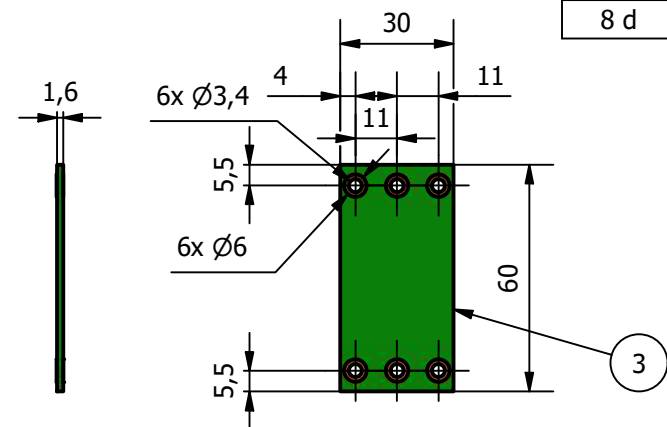
LISTE DE PIECES			
ARTICLE	QTE	NUMERO DE PIECE	DESCRIPTION
10	1	Plaque d'alu boré V4	
11	1	Demi boîte interne inférieure V5	
16	1	Demi boîte interne supérieure V5	
17	2	Capot interne électronique V5	
18	1	Face avant V5	
19	2	r317580000 - SHV étanche - corps	High voltage BNC
20	12	ISO 7046-1 - M3 x 4 - 4.8 - H	Vis à tête fraisée plate cruciforme
21	2	SS-6M0-61	Passe parroie Swagelok
22	4	ISO 4762 - M2,5 x 10	Vis cylindrique à six pans creux
23	28	ISO 4762 - M2,5 x 25	Vis cylindrique à six pans creux
24a	8	ISO 4762 - M3 x 4	Vis cylindrique à six pans creux
24b	2	ISO 7046-1 - M2,5 x 3 - 4.8 - H	Vis à tête fraisée plate cruciforme
25	1	Cadre externe inférieur V5	
26	1	Cadre externe supérieur V5	
27	10	ISO 4762 - M4 x 70	Vis cylindrique à six pans creux
28	2	HPC - BPM6	Vis à bille M6
29	1	Cadre blindage polyéthylène	Fourche centrale épaisseur 50
30	2	Bandes Mirrobore centrales FA v5	
31	1	Bande Mirrobore centrale arrière V5	
32	2	Bandes Mirrobore centrales latérales V5	
33	1	Zone capteur étanche V5-1 - lent	
34	2	Interface support d'équerre	pour blindage de 50 mm
35	8	ISO 4762 - M6 x 25	Vis cylindrique à six pans creux
36	1	Couvercle 50mm Polyéthylène bas V5	
37	2	Cadre de maintien des couvercles V5	
38	24	ISO 4762 - M3 x 20	Vis cylindrique à six pans creux
39	2	Plaque de Mirrobore 5 mm v5	
40	24	Colonettes M3x35	
41	1	Couvercle Polyéthylène	supérieur a encoche V5
42	1	Bandes Mirrobore externes V5	
43	2	Bandes Mirrobore externes V5 long	
44	1	Bandes Mirrobore externes arrière V5	
45	2	Bandes Mirrobore externes V5 long bas	
46	1	Bandes Mirrobore externes courtes bas V5	
47	1	Bandes Mirrobore externes arrière bas V5	
48	1	Cadre de maintien des couvercles	pour liaison avec détecteur rapide



Matière:	Quantité:	Echelle:	Traitement et protection:	Masse:
		1 : 5		12,853 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	 Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 000 - P	
Nom de la pièce: Capteur lent V5		Sous ensembles		Feuille 3 / 35

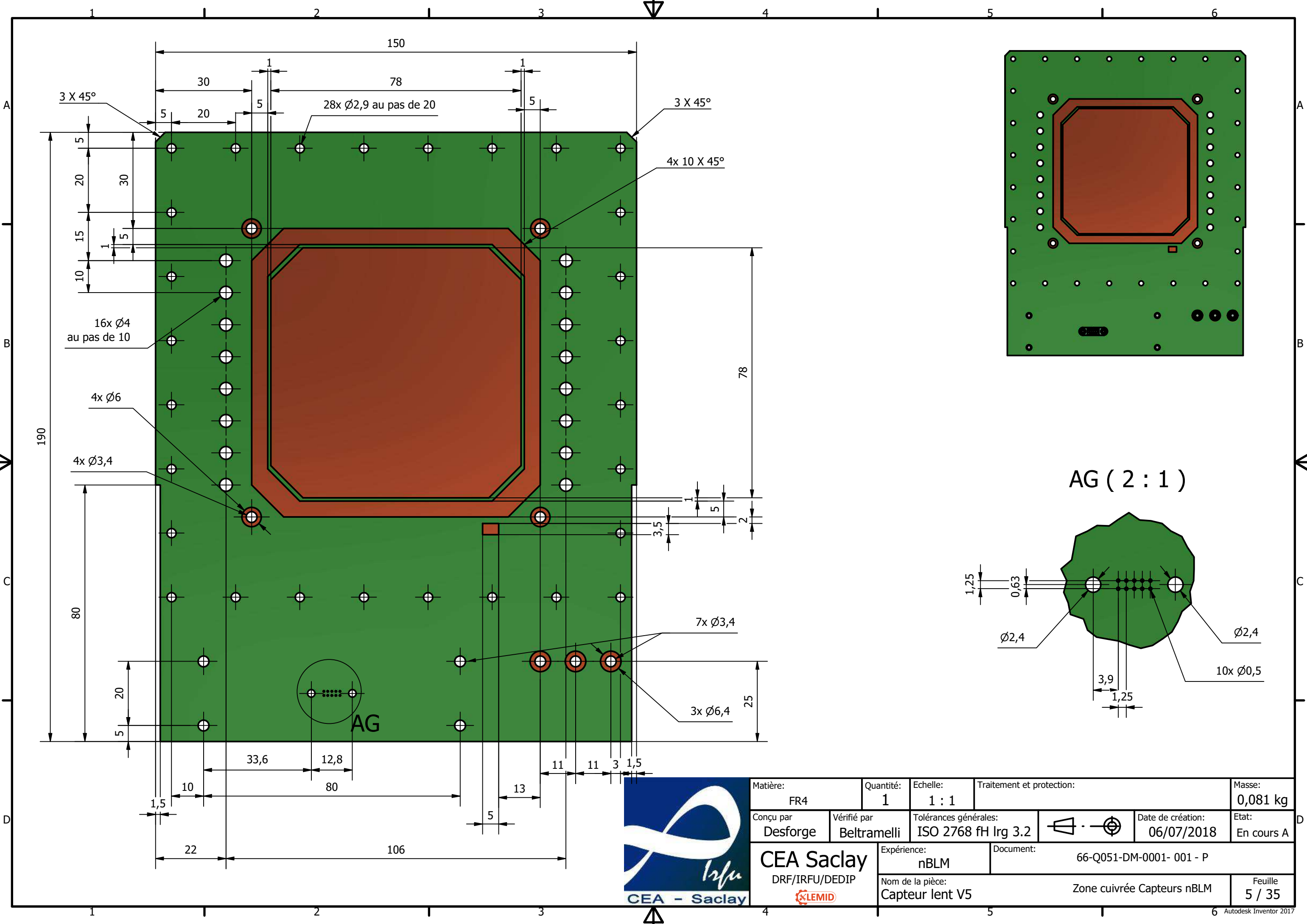


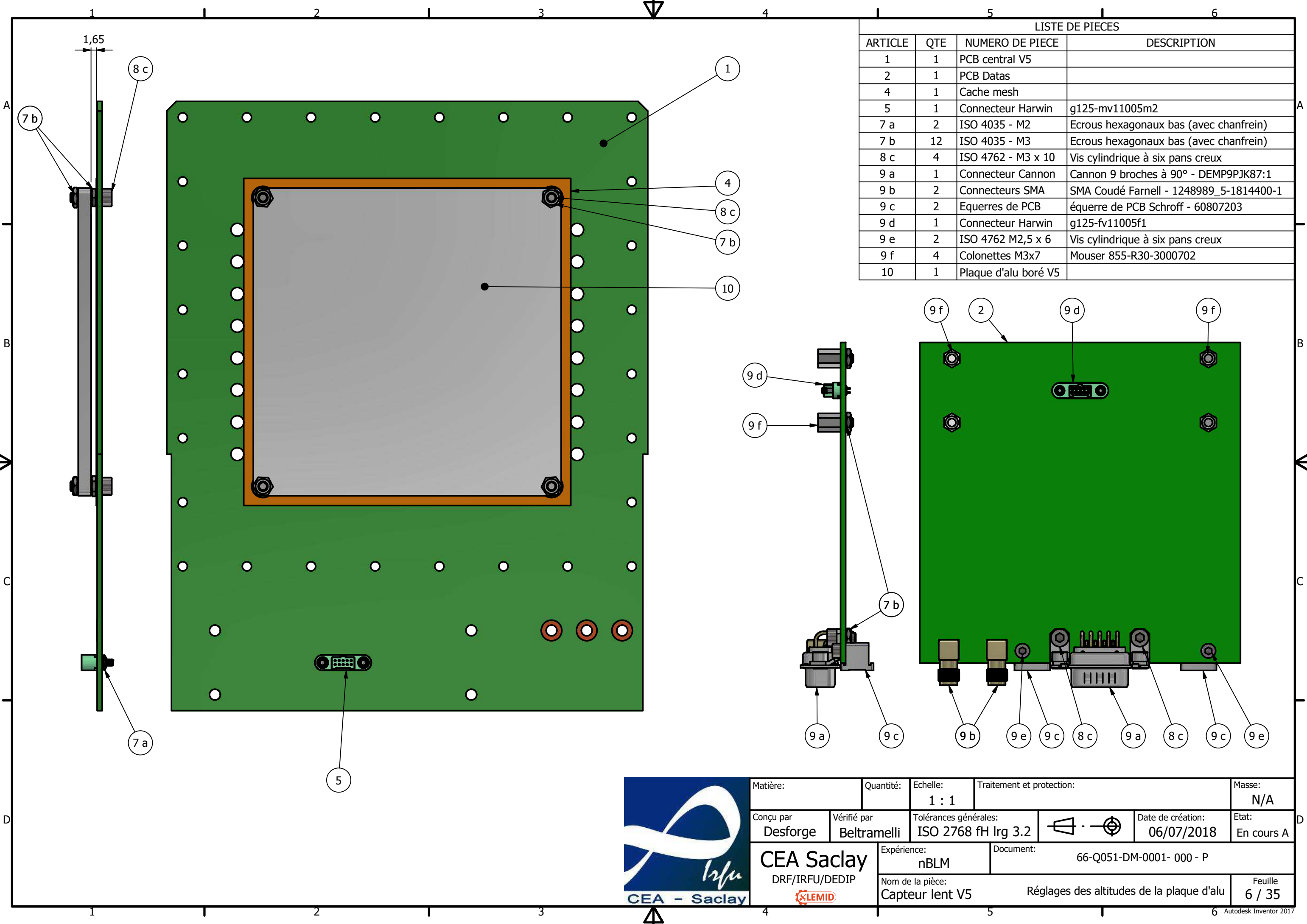
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2	1	PCB Datas V5		
3	1	PCB HT V5		FR4
4	1	Cache mesh		Plastique PPS
5	1	Connecteur Harwin	g125-mv11005m2	
6	3	Cosse à souder M3		Laiton
7	12	ISO 4035 - M3	Ecrous hexagonaux bas (avec chanfrein)	Acier inox
8 a	4	ISO 4762 - M3 x 4	Vis cylindrique à six pans creux	Acier inox
8 b	3	ISO 4762 - M3 x 6	Vis cylindrique à six pans creux	Acier inox
8 c	3	ISO 4762 - M3 x 8	Vis cylindrique à six pans creux	Acier inox
8 d	2	ISO 4035 - M2	Ecrous hexagonaux bas (avec chanfrein)	Acier inox



Matière: FR4 PPS	Quantité: 1	Echelle: 1 : 2	Traitement et protection:	Masse: 0,001 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 000 - P	
Nom de la pièce: Capteur lent V5		Plans de perçage et encombrements des PCB		Feuille 4 / 35

Voir cotations page suivante

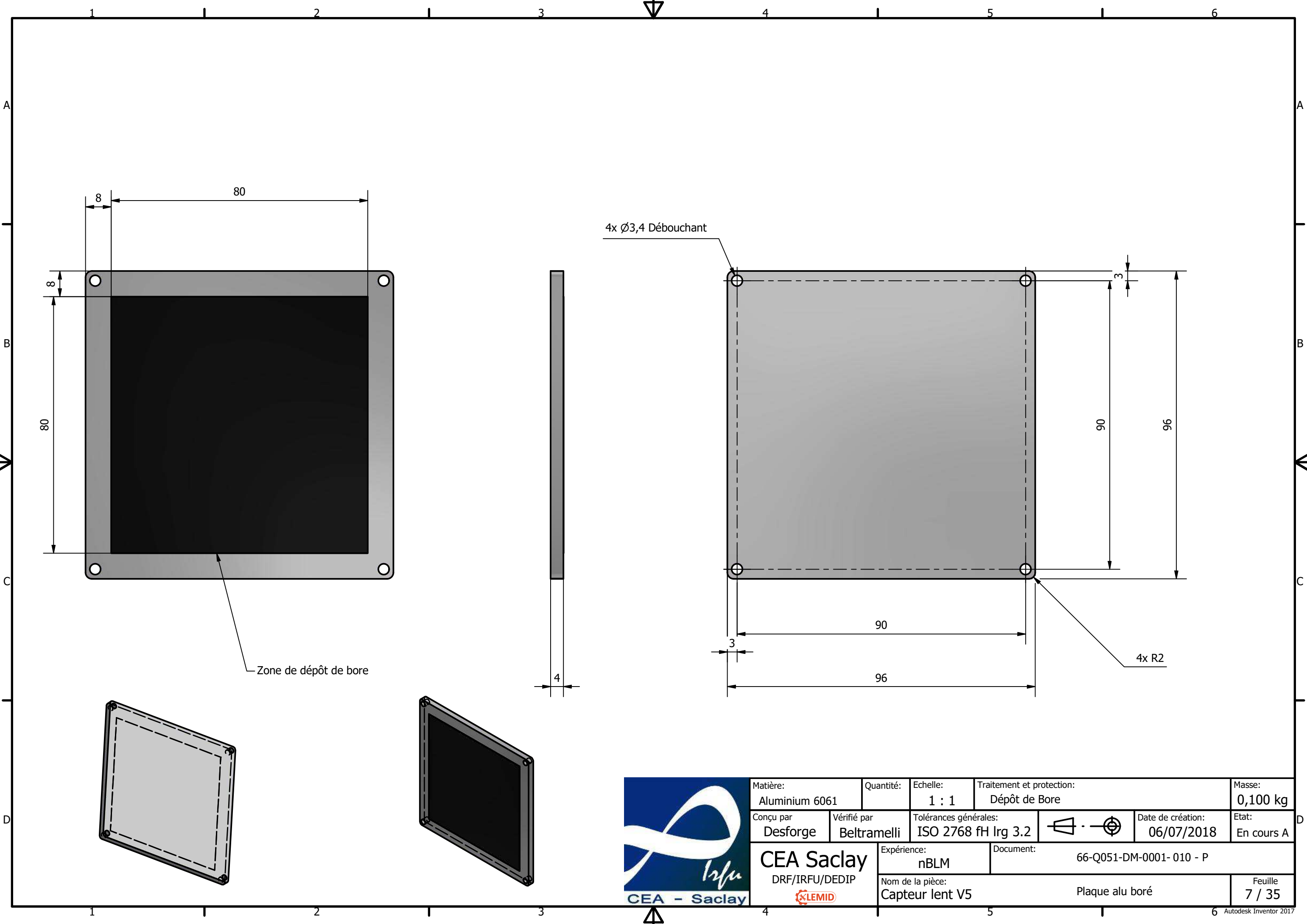




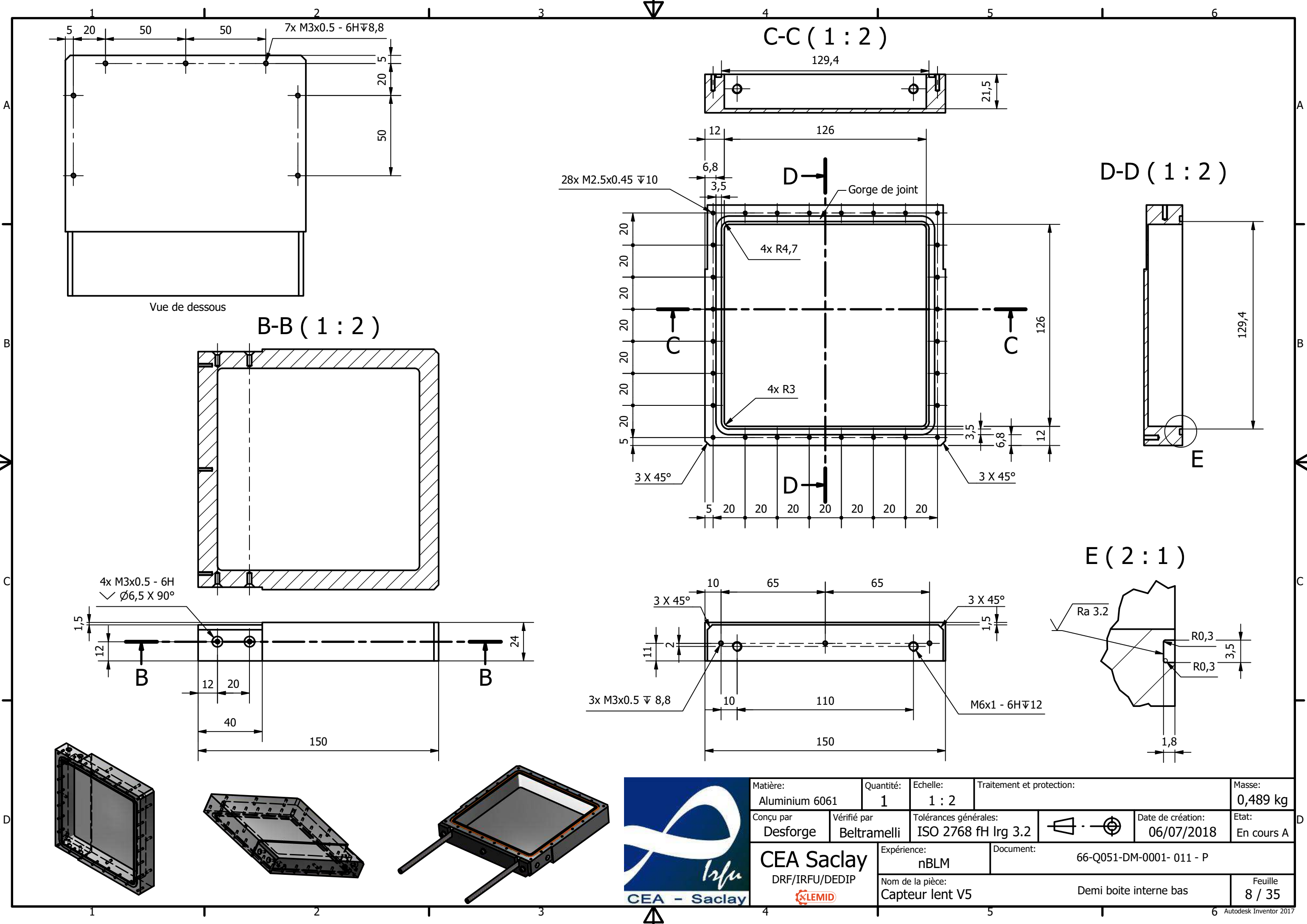
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2	1	PCB Datas	
4	1	Cache mesh	
5	1	Connecteur Harwin	g125-mv11005m2
7 a	2	ISO 4035 - M2	Ecrous hexagonaux bas (avec chanfrein)
7 b	12	ISO 4035 - M3	Ecrous hexagonaux bas (avec chanfrein)
8 c	4	ISO 4762 - M3 x 10	Vis cylindrique à six pans creux
9 a	1	Connecteur Cannon	Cannon 9 broches à 90° - DEMP9PJK87:1
9 b	2	Connecteurs SMA	SMA Coudé Farnell - 1248989_5-1814400-1
9 c	2	Equerres de PCB	équerre de PCB Schroff - 60807203
9 d	1	Connecteur Harwin	g125-fv11005f1
9 e	2	ISO 4762 M2,5 x 6	Vis cylindrique à six pans creux
9 f	4	Colonettes M3x7	Mouser 855-R30-3000702
10	1	Plaque d'alu boré V5	

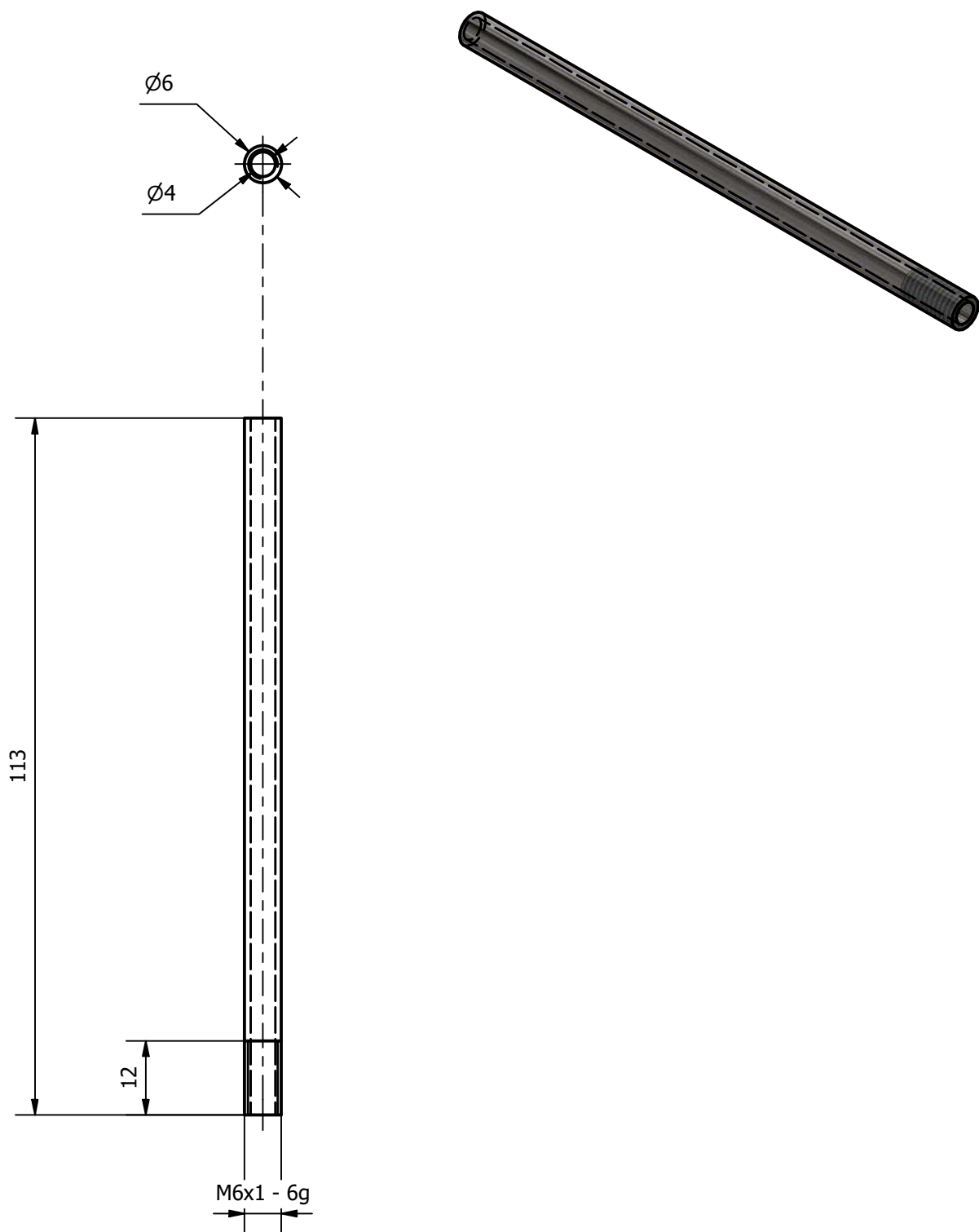


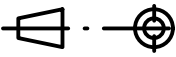
Matière:		Quantité:	Echelle:	Traitement et protection:		Masse:
			1 : 1			N/A
Conçu par	Vérifié par	Tolérances générales:			Date de création:	Etat:
Desforge	Beltramelli	ISO 2768 fH lrg 3.2			06/07/2018	En cours A
CEA Saclay		Expérience:	Document:			
DRF/IRFU/DEDIP		nBLM	66-Q051-DM-0001- 000 - P			
		Nom de la pièce:	Réglages des altitudes de la plaque d'alu			
		Capteur lent V5	Feuille			
					6 / 35	

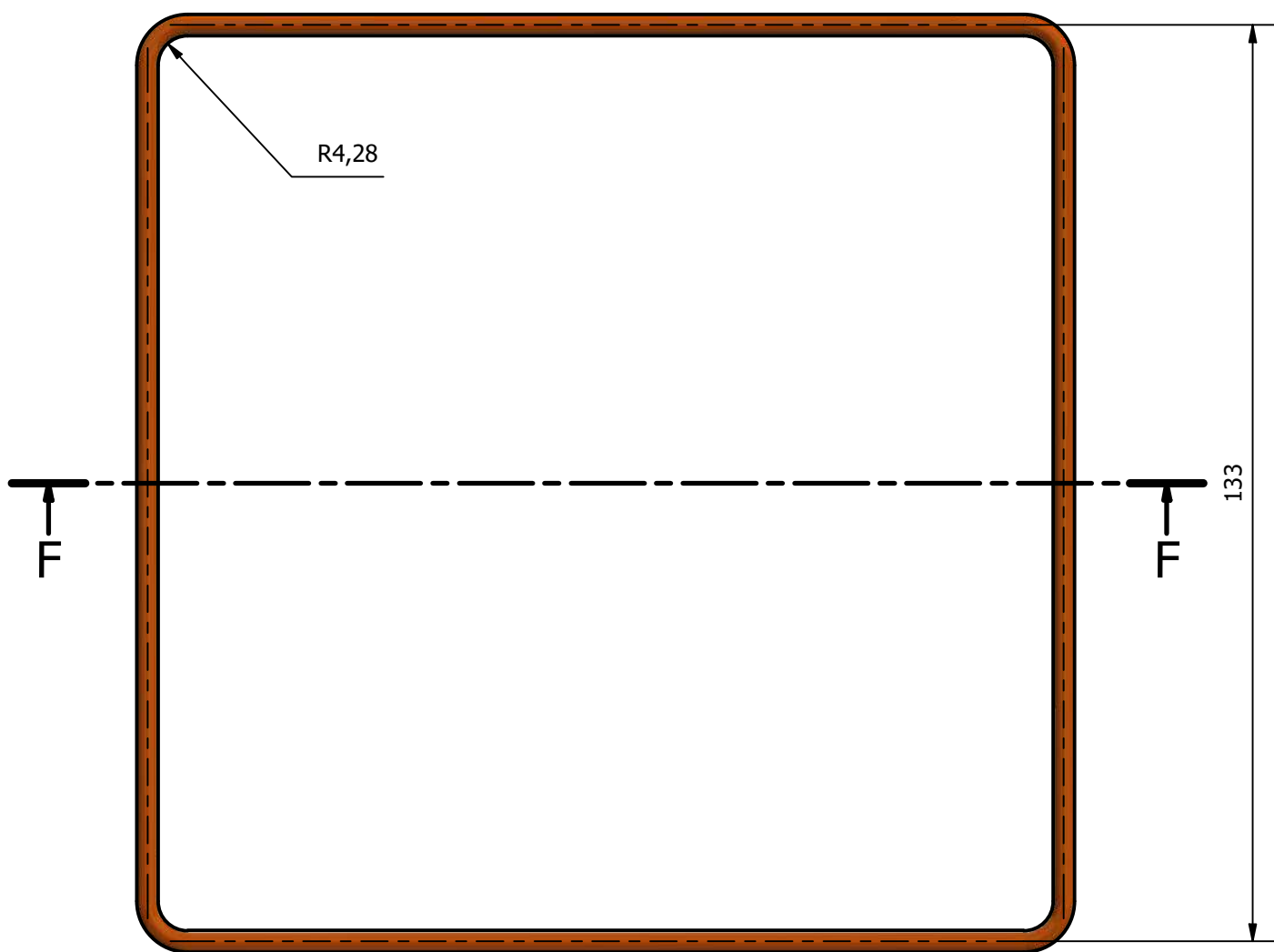
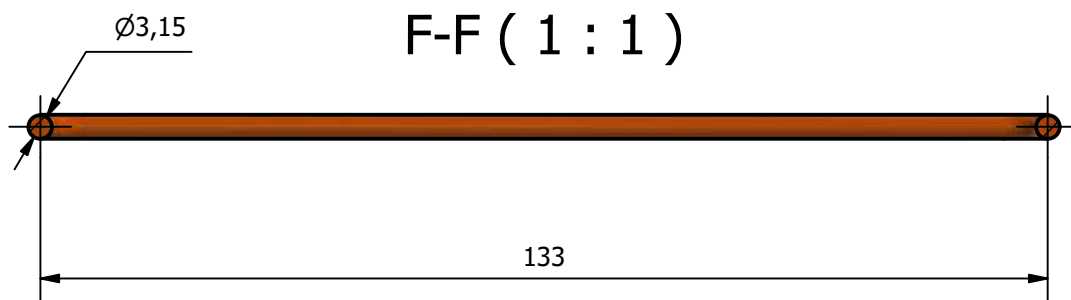


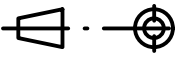
Matière: Aluminium 6061	Quantité:	Echelle: 1 : 1	Traitement et protection: Dépôt de Bore	Masse: 0,100 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	Date de création: 06/07/2018	Etat: En cours A
Expérience: nBLM		Document: 66-Q051-DM-0001- 010 - P		
Nom de la pièce: Capteur lent V5		Plaque alu boré		Feuille 7 / 35

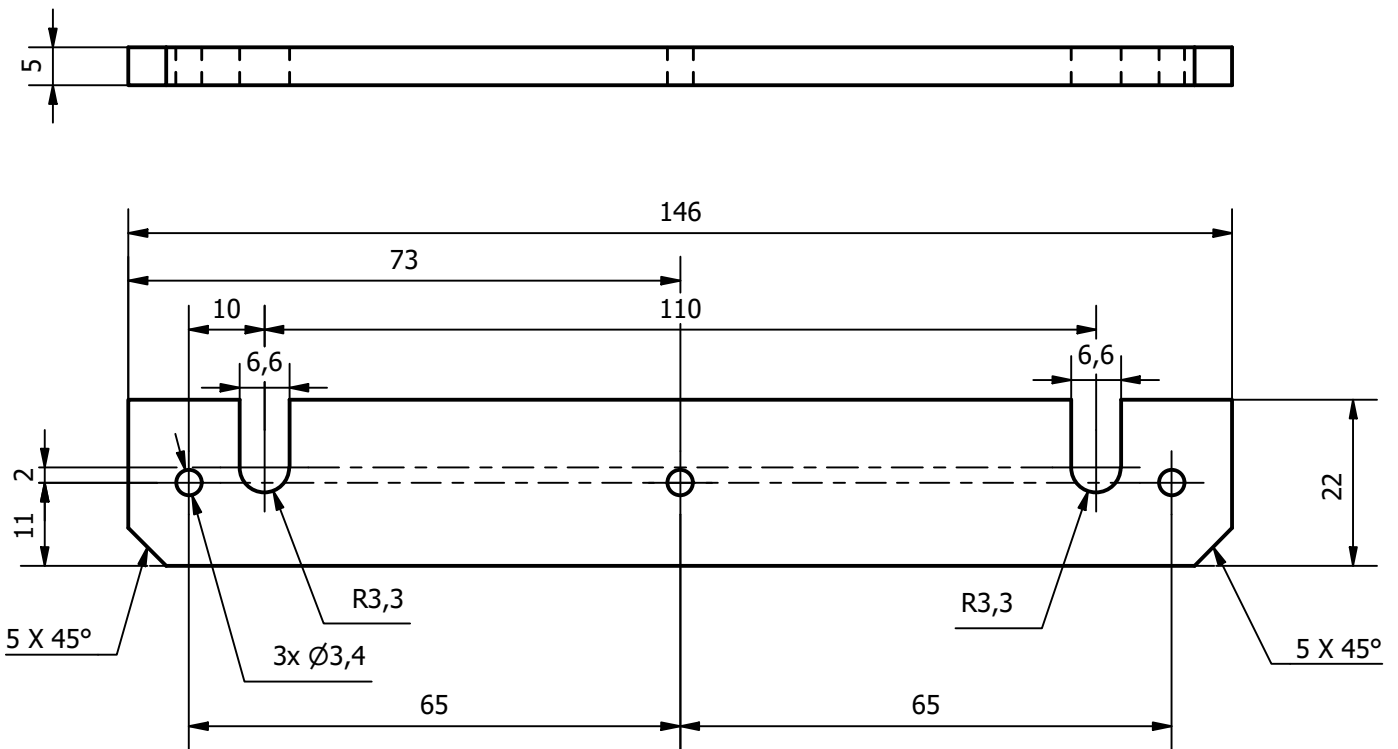
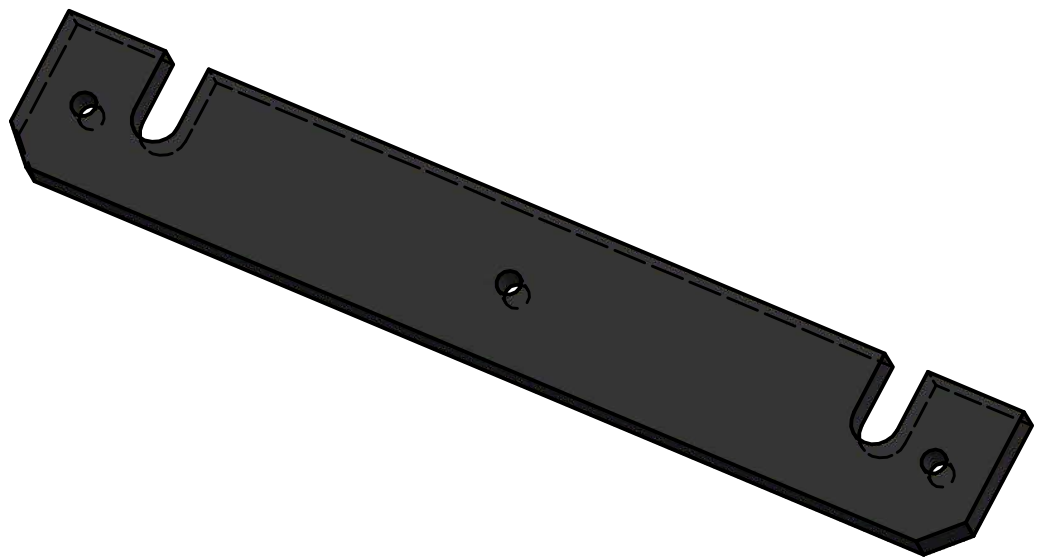


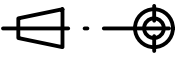


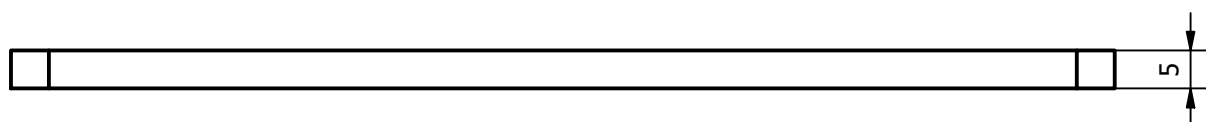
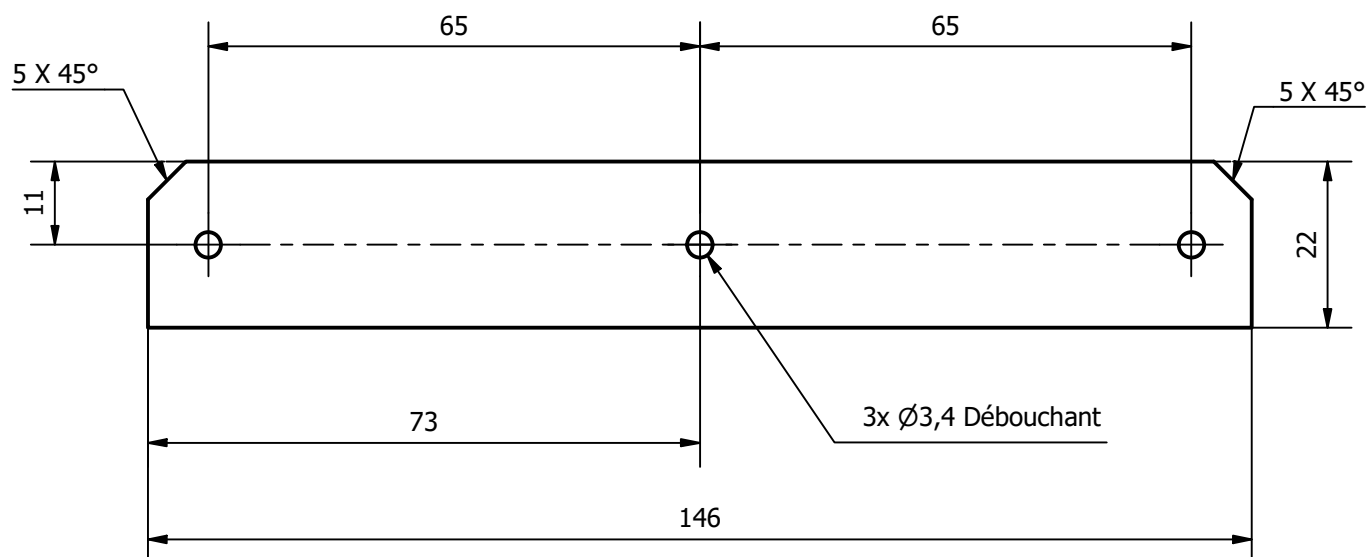
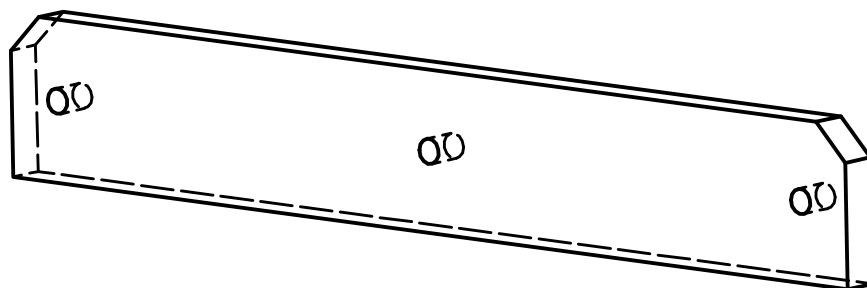
Matière: Acier inoxydable	Quantité: 2	Echelle: 1 : 1	Traitement et protection:	Masse: 0.014 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	 Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001- 012 - P	Feuille 9 / 35
Nom de la pièce: Capteur lent V5			Tube gaz (acier 316 L)	



Matière: Caoutchouc	Quantité: 2	Echelle: 1 : 1	Traitement et protection:	Masse: 0,004 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	 Date de création: 06/07/2018	Etat: En cours A
 CEA Saclay DRF/IRFU/DEDIP 	Expérience: nBLM	Document: 66-Q051-DM-0001- 013 - P		
	Nom de la pièce: Capteur lent V5	Joint	Feuille 10 / 35	

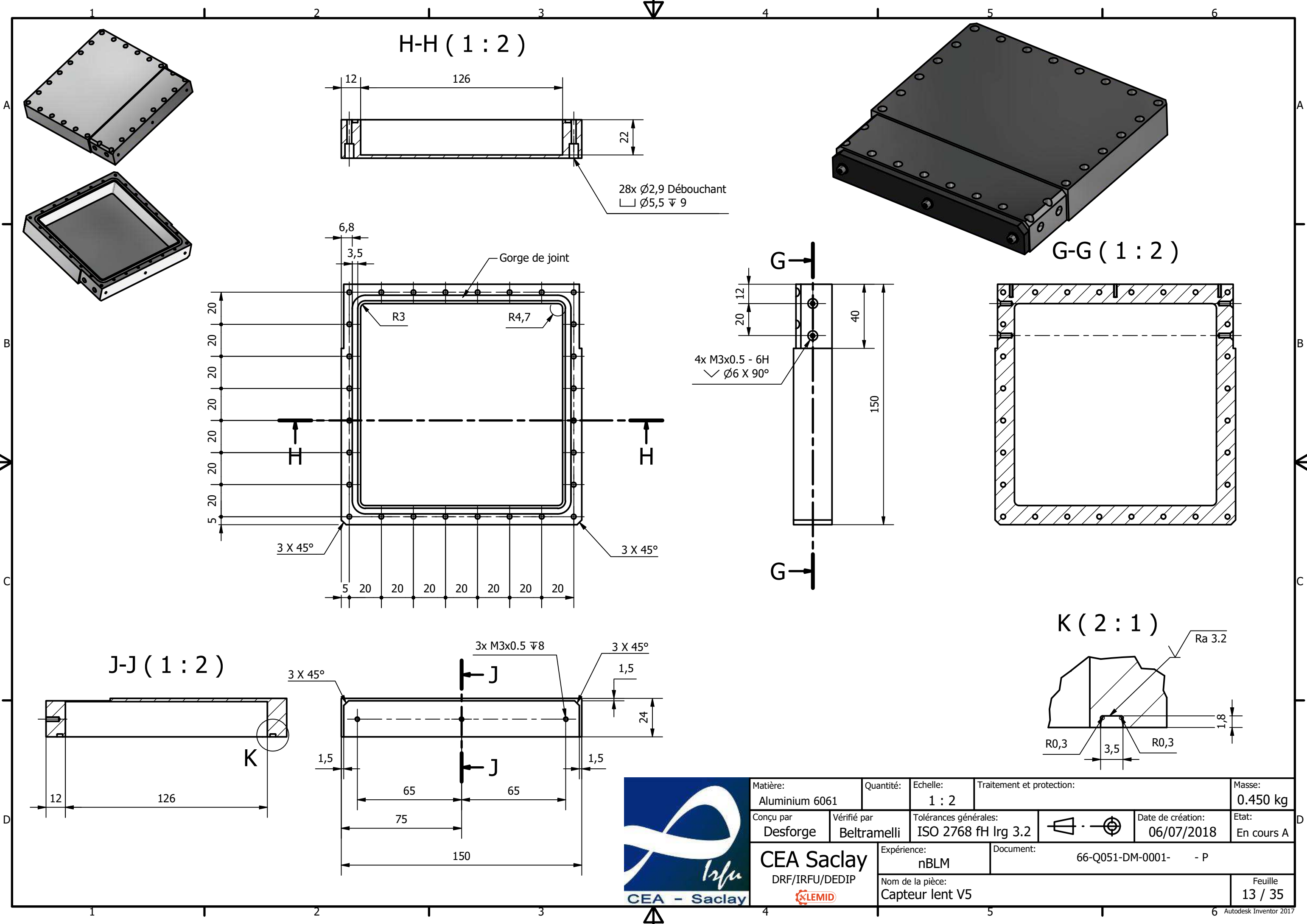


Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:	Masse: 0,014 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	 Date de création: 06/07/2018	Etat: En cours A
 CEA Saclay DRF/IRFU/DEDIP 	Expérience: nBLM	Document: 66-Q051-DM-0001- 014 - P	Feuille 11 / 35	
	Nom de la pièce: Capteur lent V5	Mirrobores interne bas		

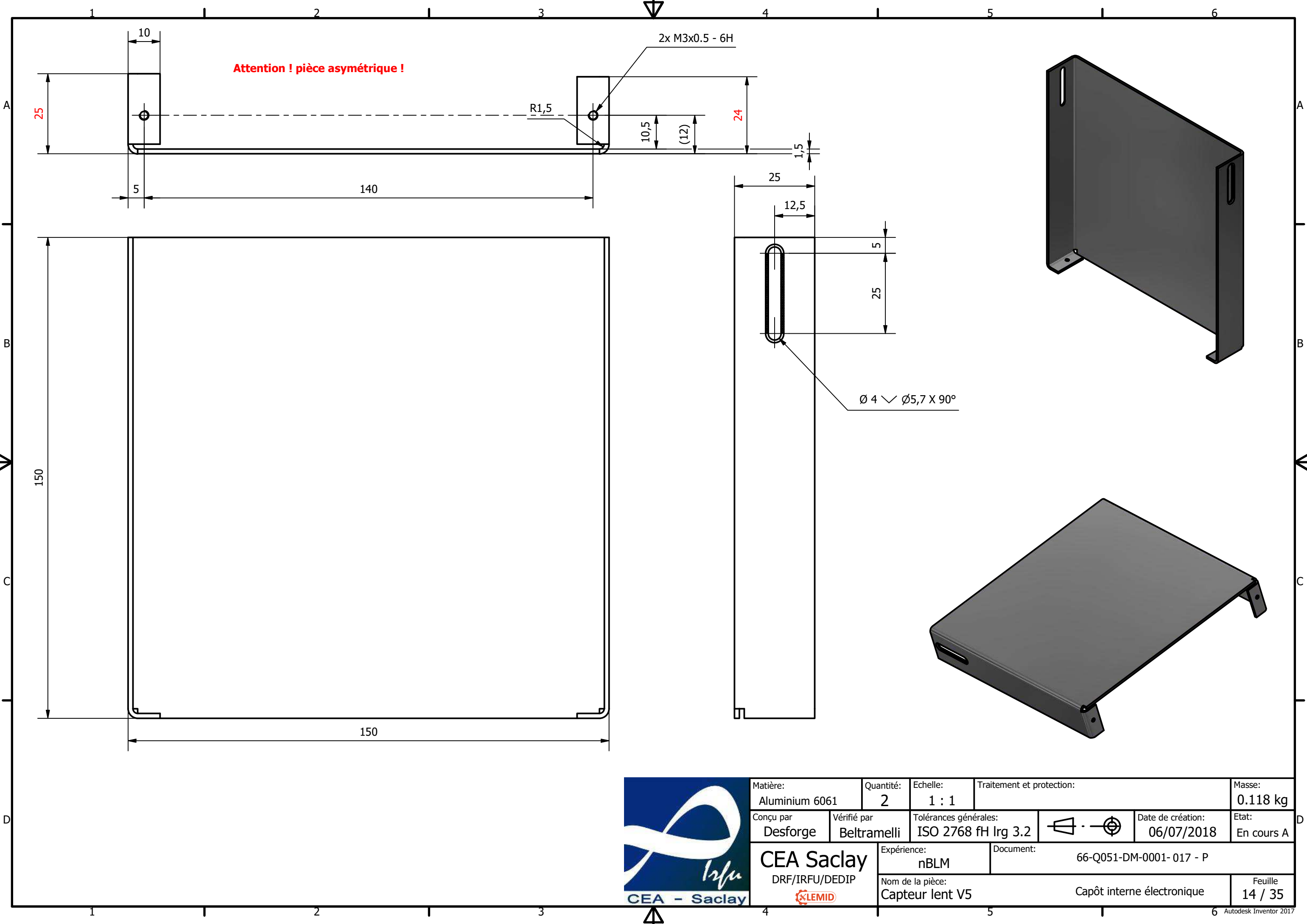


Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:	Masse: 0,015 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 015 - P	Feuille 12 / 35
Nom de la pièce: Capteur lent V5		Bande de Mirrobore interne haut		

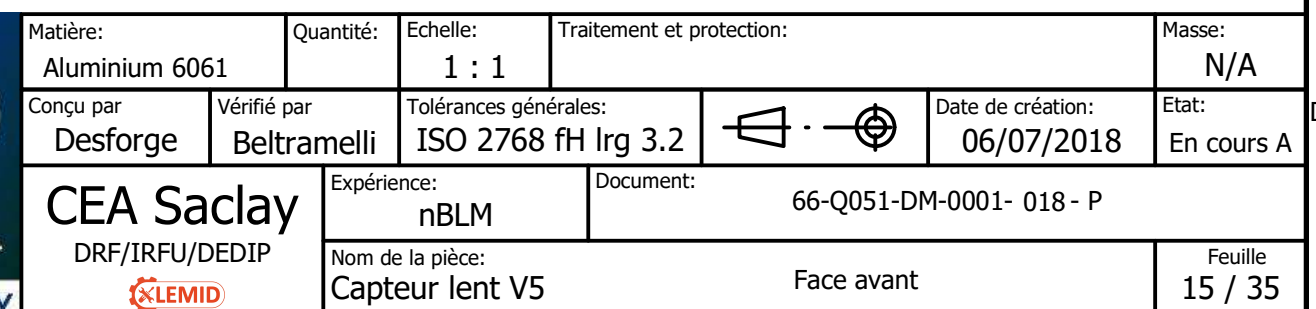
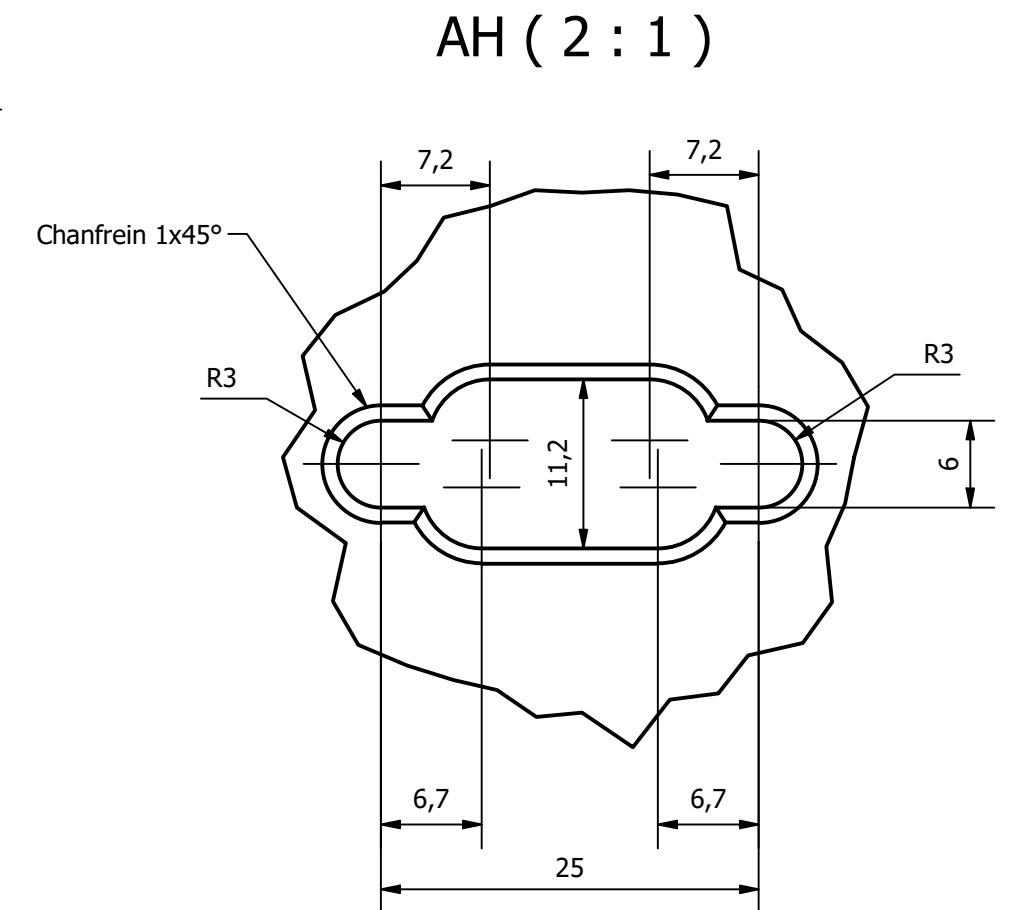
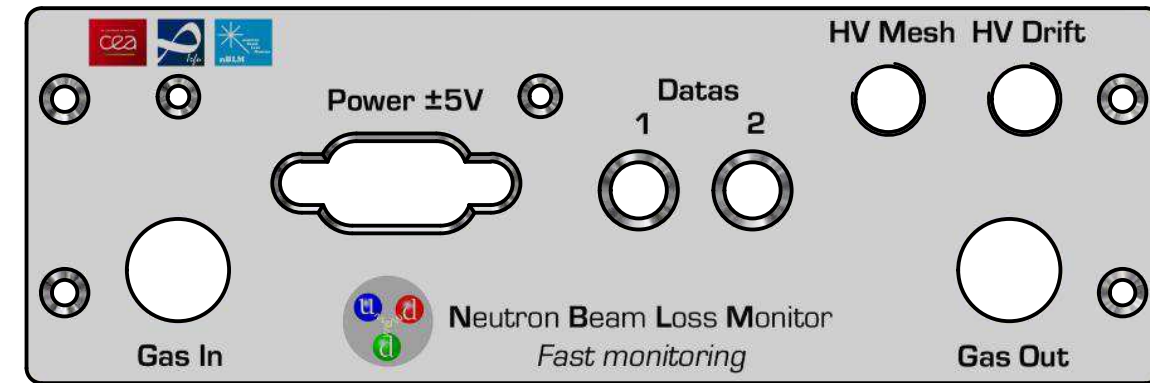


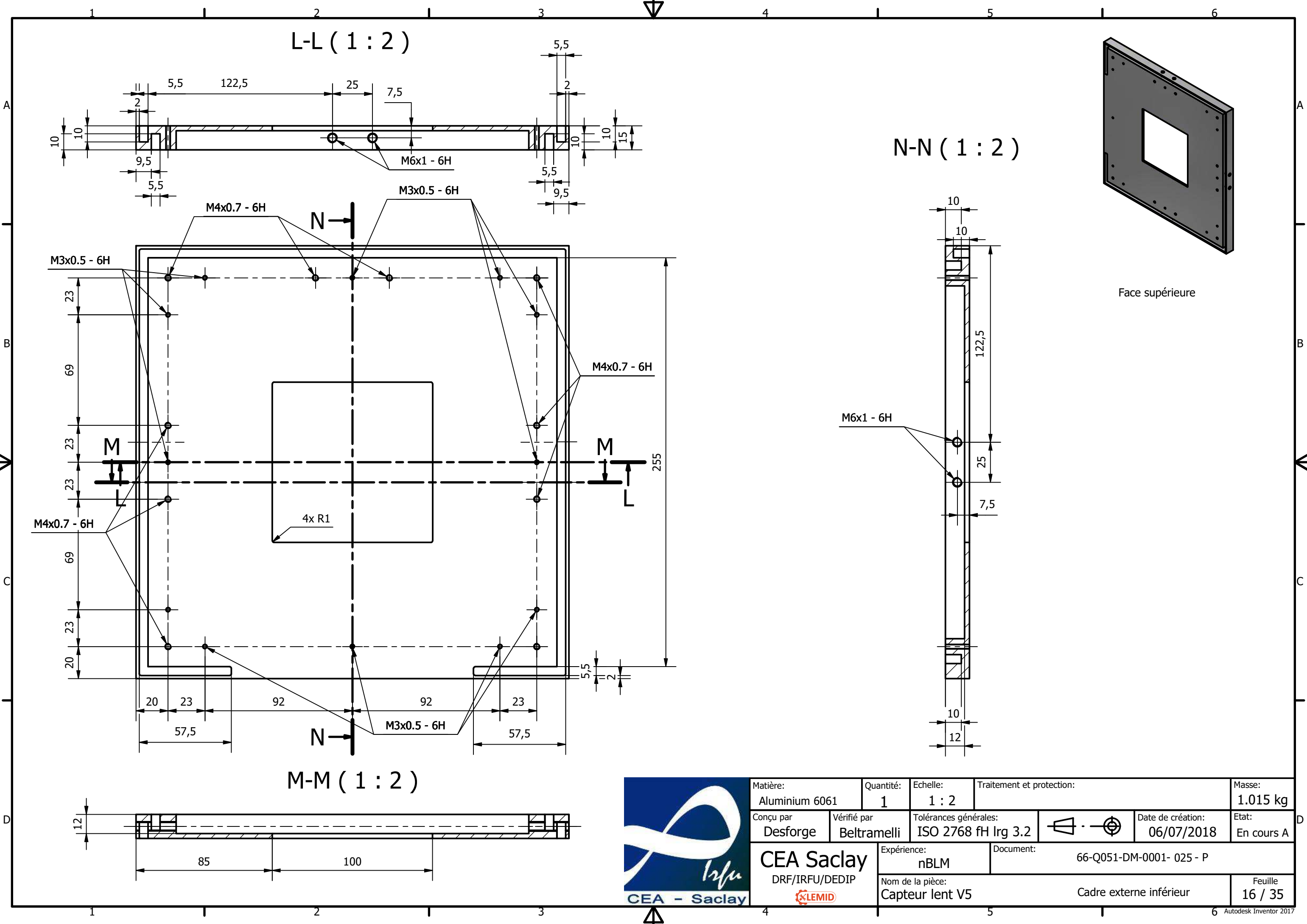


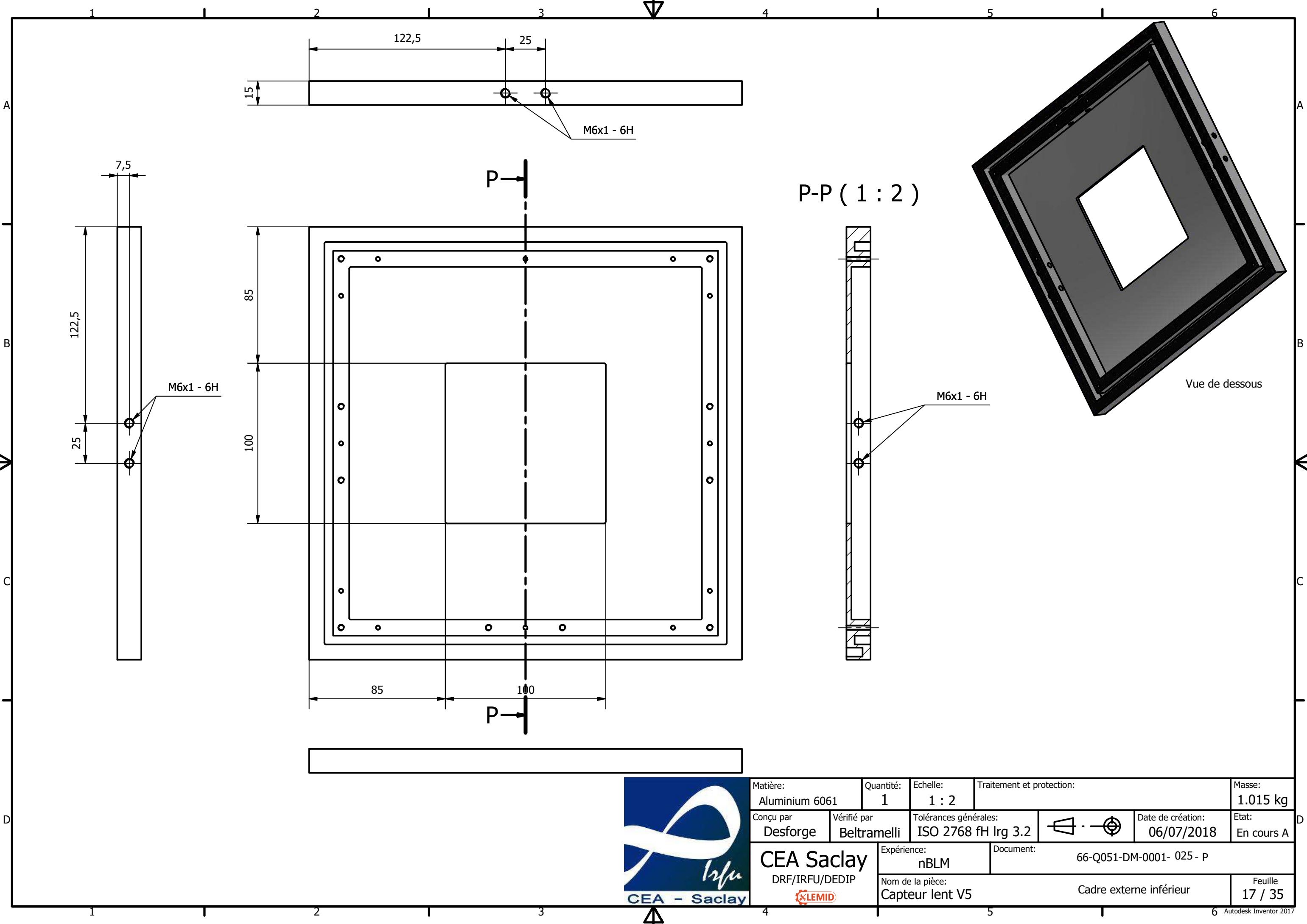
Matière: Aluminium 6061	Quantité:	Echelle: 1 : 2	Traitement et protection:	Masse: 0.450 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- - P	
Nom de la pièce: Capteur lent V5				Feuille 13 / 35



Matière: Aluminium 6061	Quantité: 2	Echelle: 1 : 1	Traitement et protection:		Masse: 0.118 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP	Expérience: nBLM	Document: 66-Q051-DM-0001- 017 - P			
Nom de la pièce: Capteur lent V5	Capôt interne électronique				Feuille 14 / 35

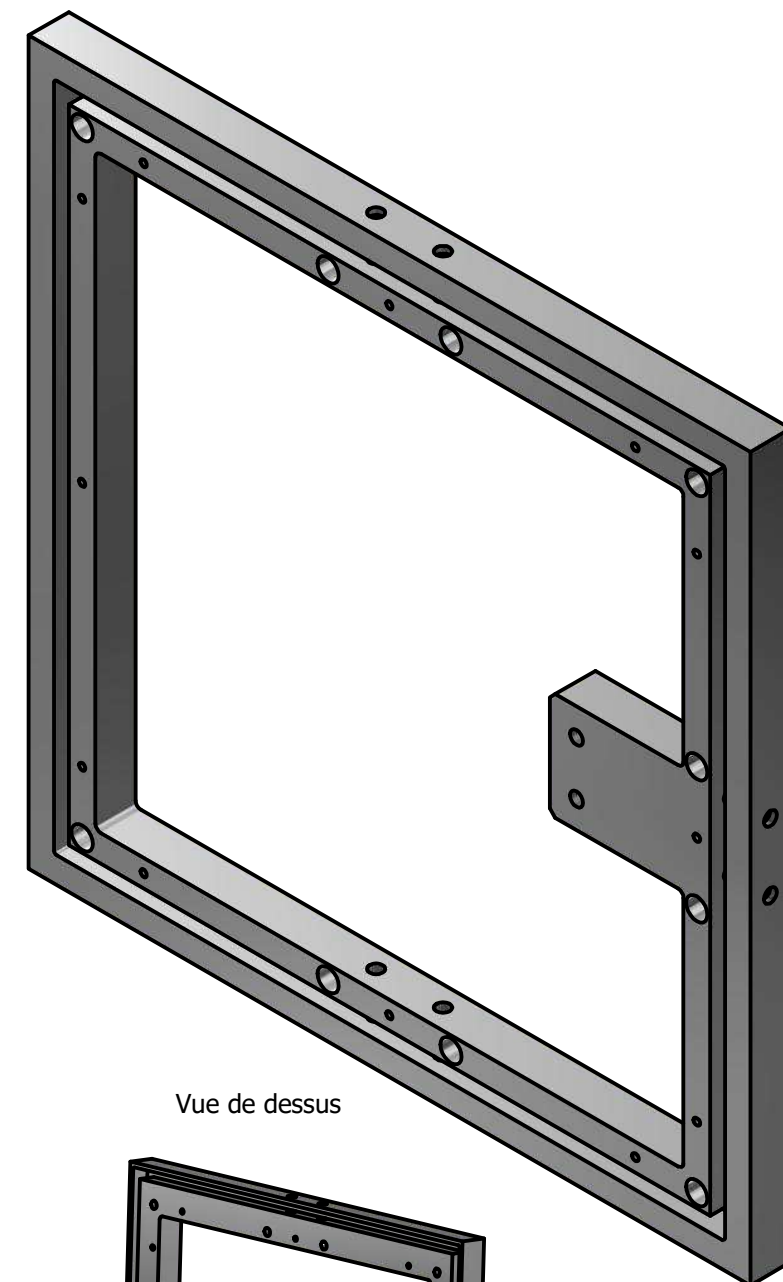
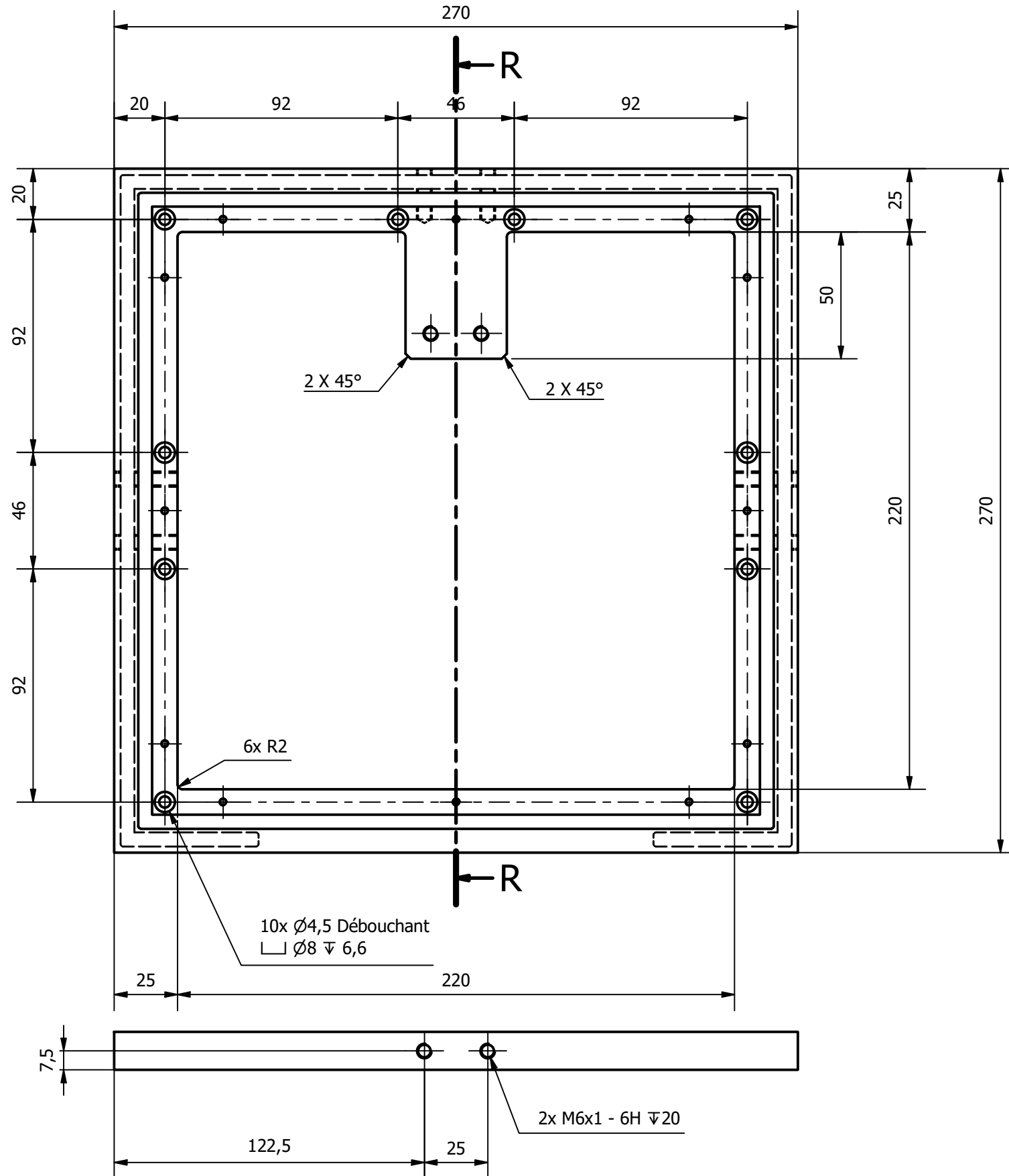
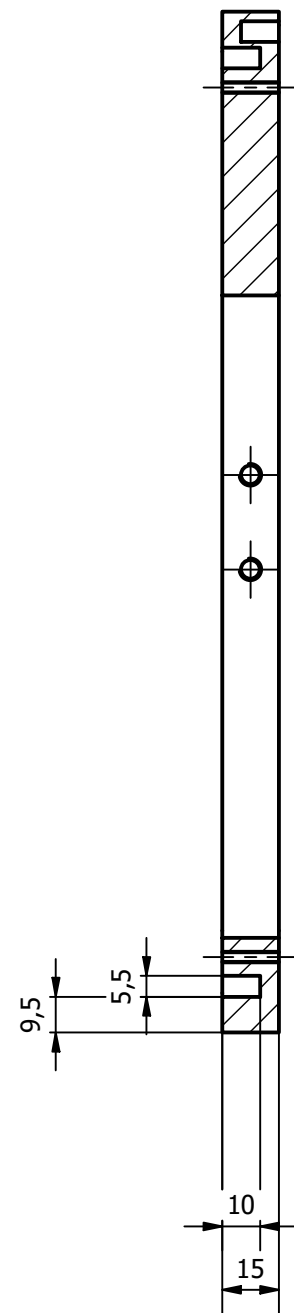




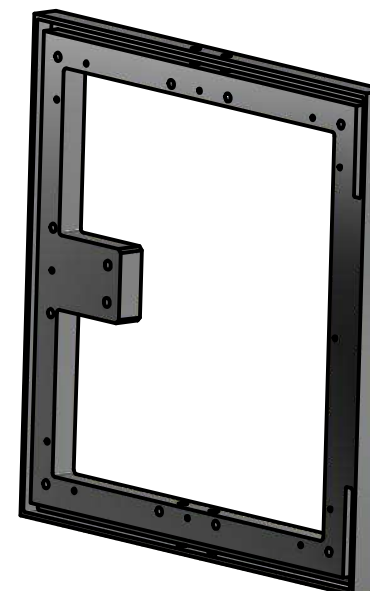


Matière: Aluminium 6061	Quantité: 1	Echelle: 1 : 2	Traitement et protection:		Masse: 1.015 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 025 - P		
Nom de la pièce: Capteur lent V5		Cadre externe inférieur			Feuille 17 / 35

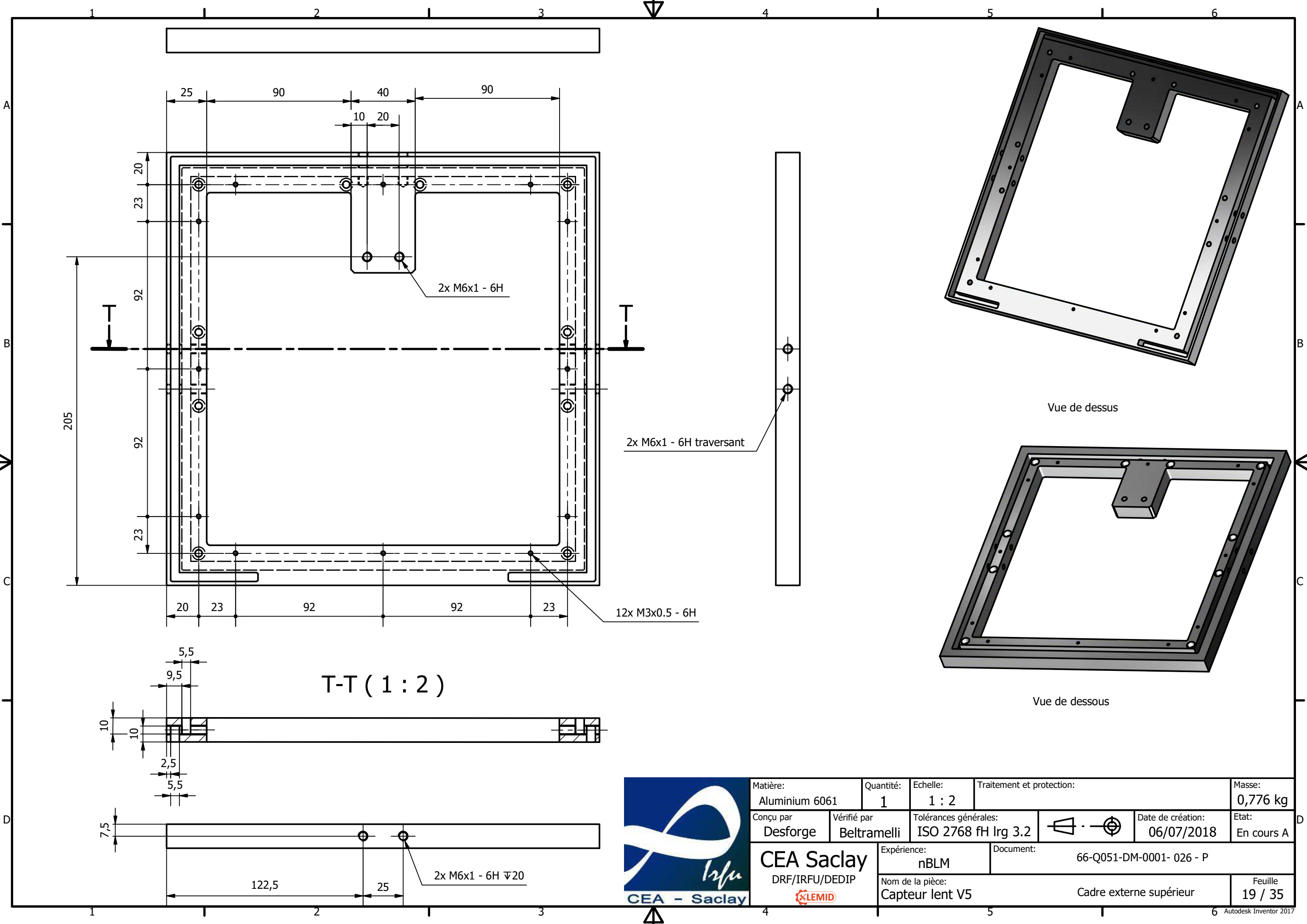
R-R (1 : 2)



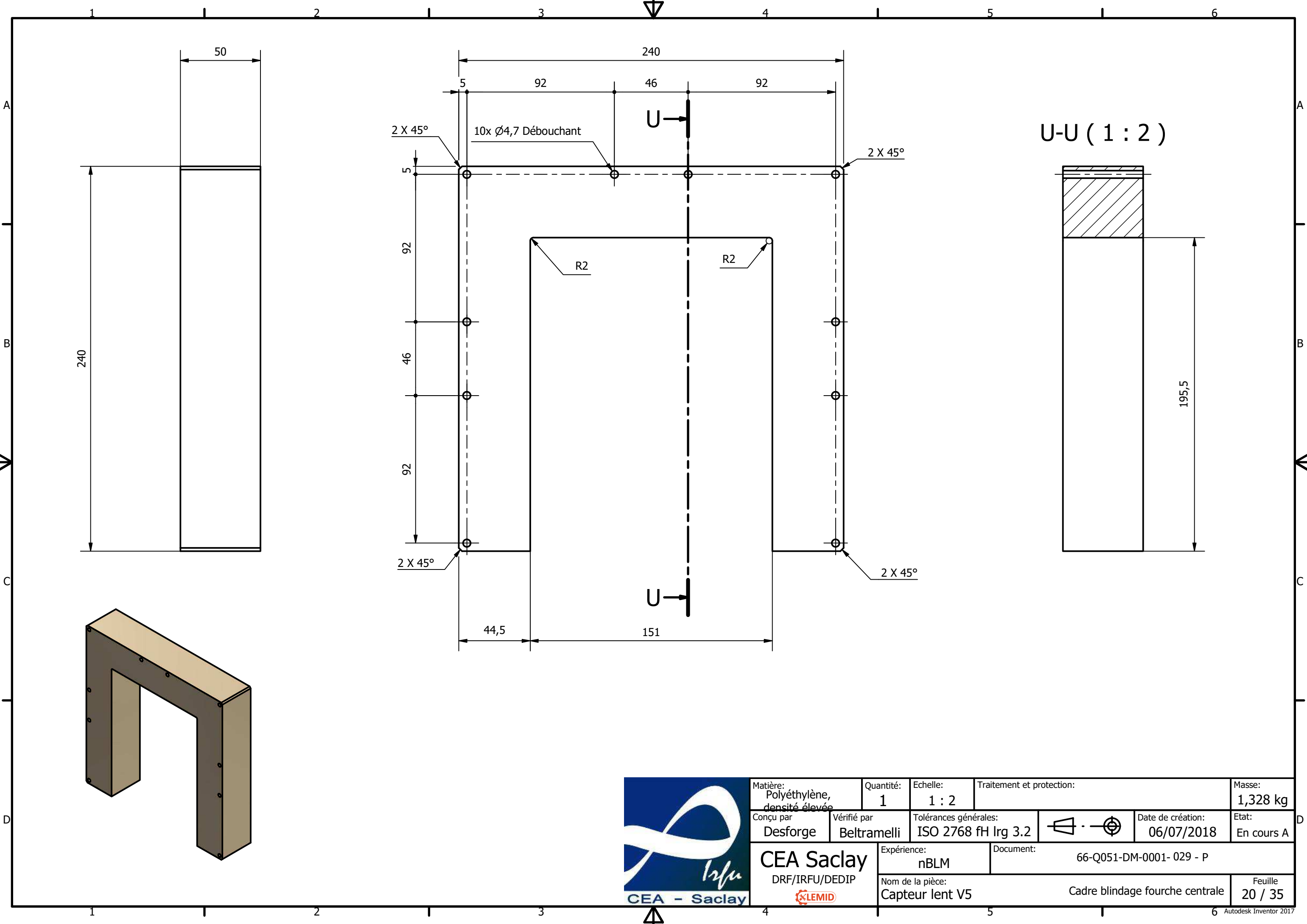
Vue de dessus

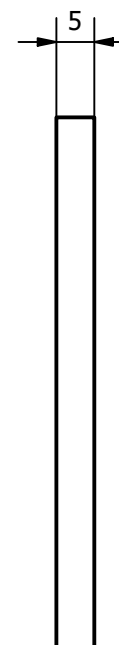
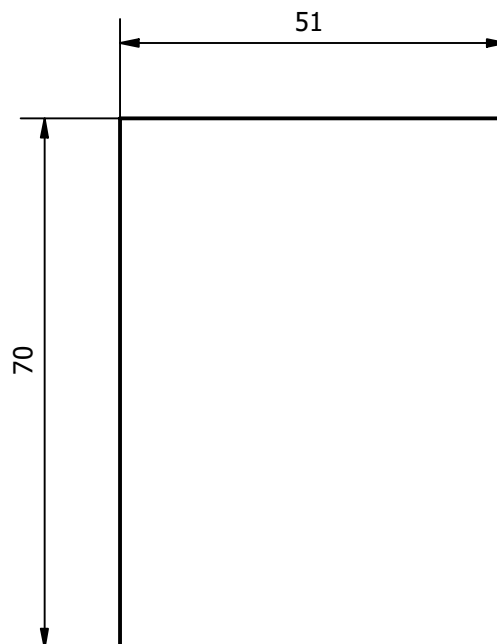


Matière: Aluminium 6061	Quantité: 1	Echelle: 1 : 2	Traitement et protection:	Masse: 0,776 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 026 - P	
Nom de la pièce: Capteur lent V5		Cadre externe supérieur		Feuille 18 / 35

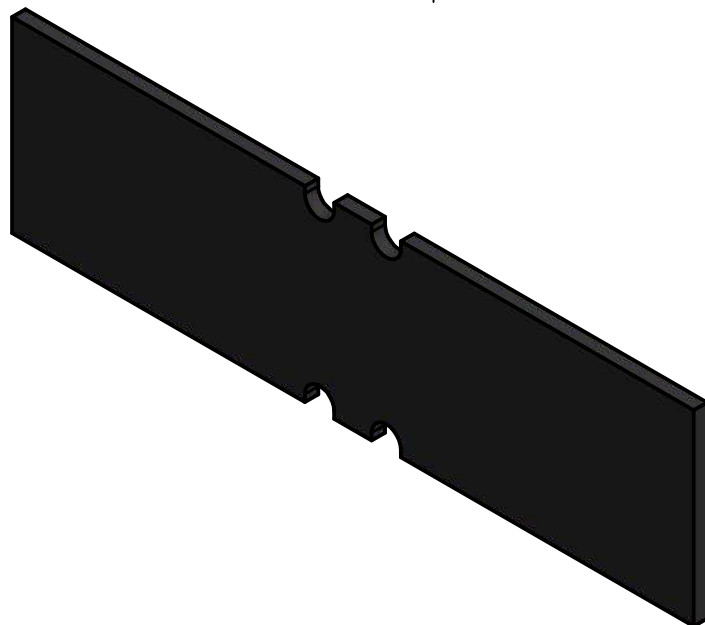
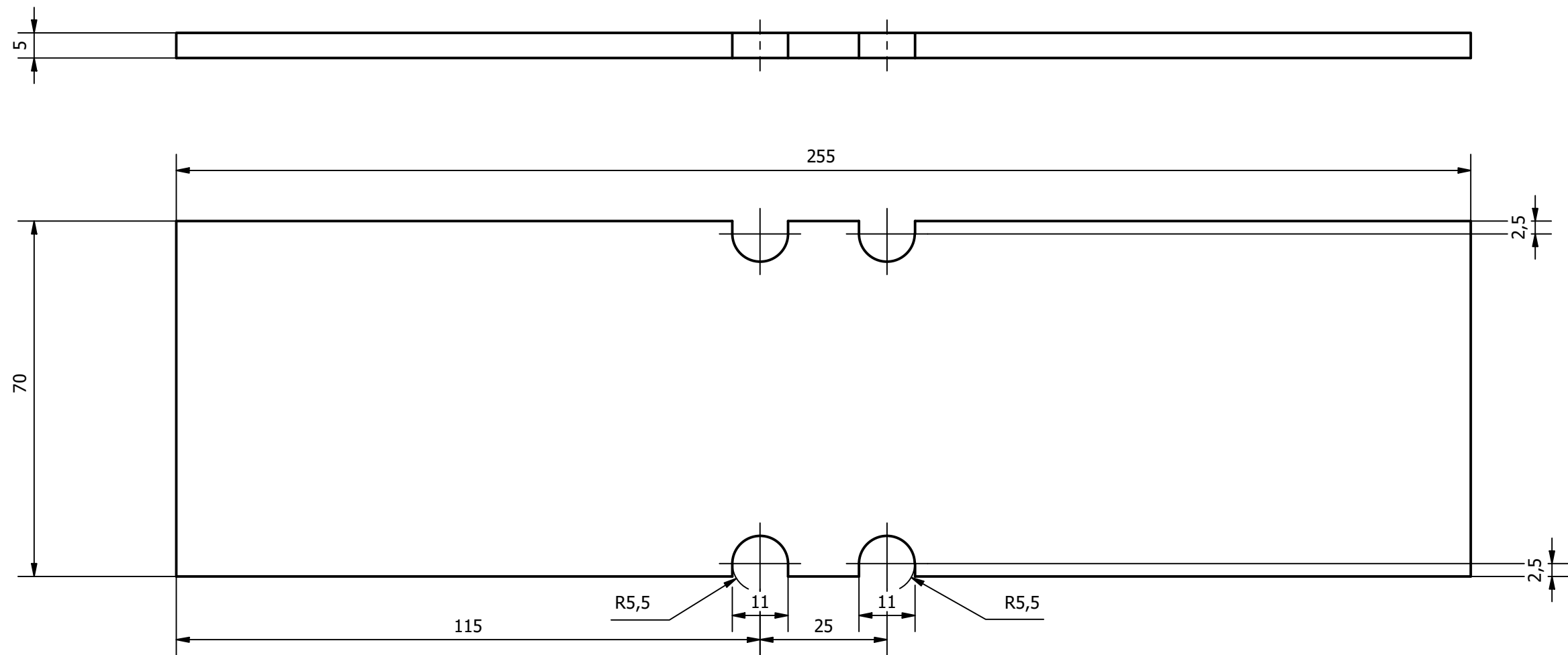


Matière: Aluminium 6061	Quantité: 1	Echelle: 1 : 2	Traitement et protection:	Masse: 0,776 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 026 - P	
Nom de la pièce: Capteur lent V5			Cadre externe supérieur	Feuille 19 / 35



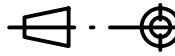


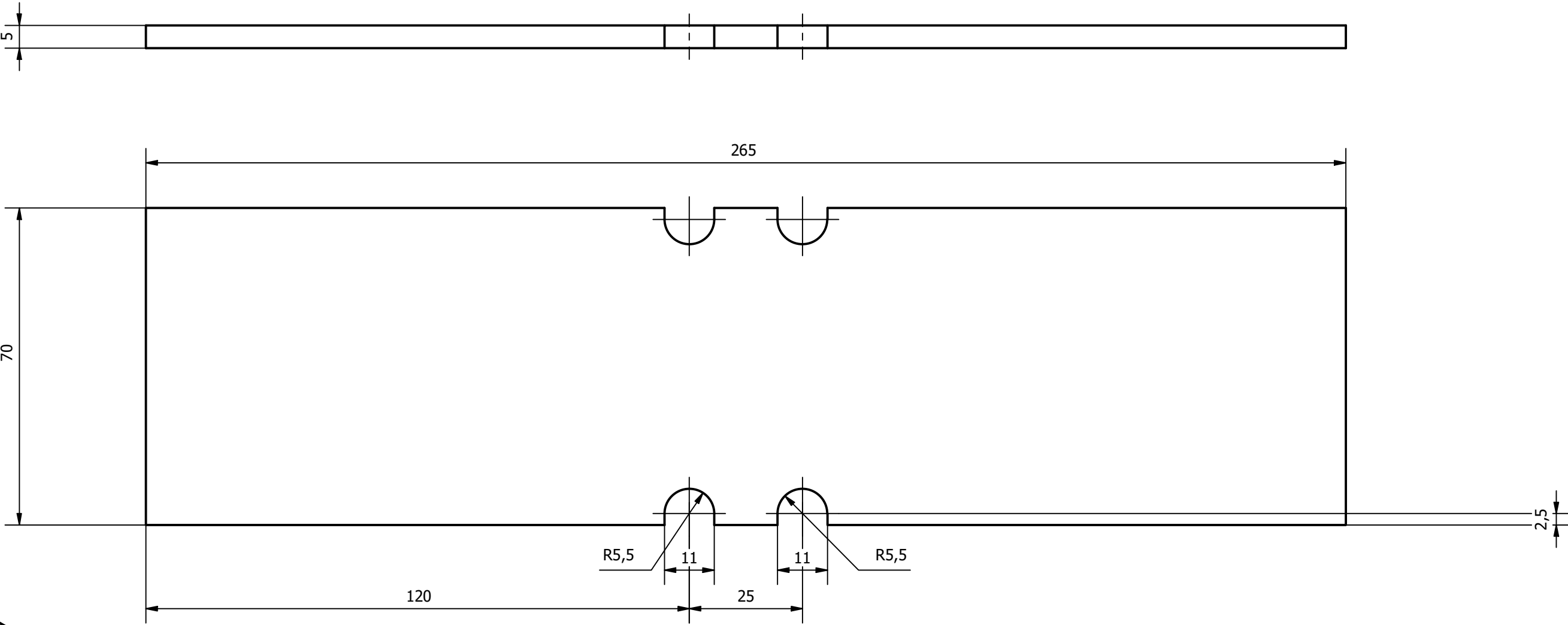
Matière: Caoutchouc	Quantité: 2	Echelle: 1 : 1	Traitement et protection:		Masse: 0,017 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001- 030 - P		
		Nom de la pièce: Capteur lent V5	Bande Mirrobore centrale FA		Feuille 21 / 35



Note: pièce symétrique

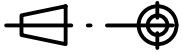


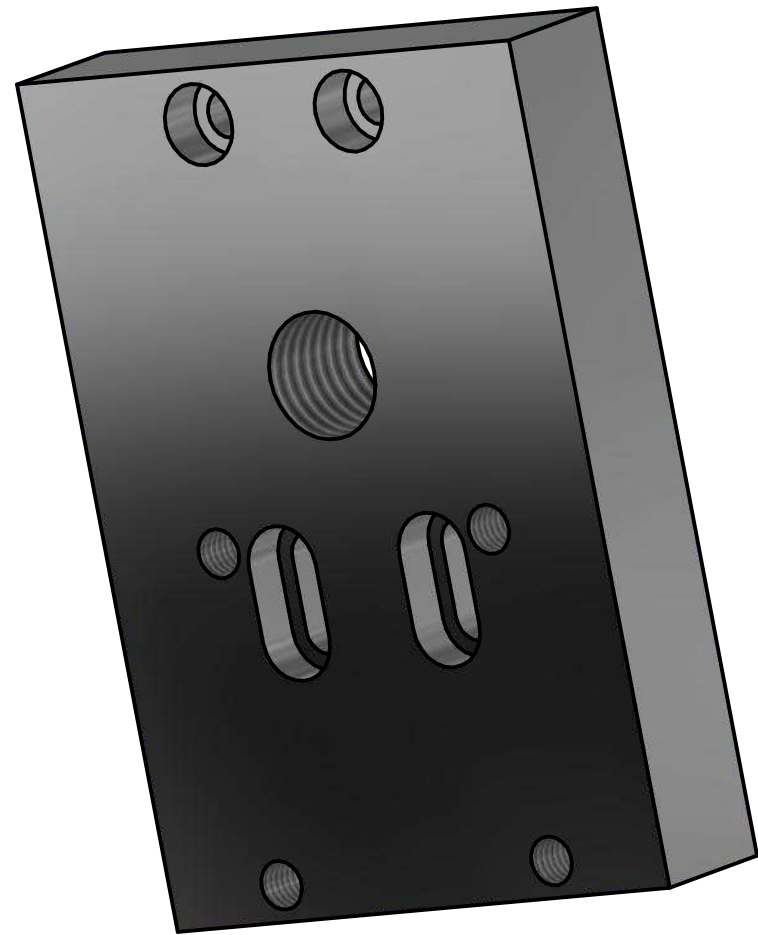
Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:	Masse: 0,082 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	 Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 031 - P	
Nom de la pièce: Capteur lent V5		Bande Mirrobore centrale arrière		Feuille 22 / 35



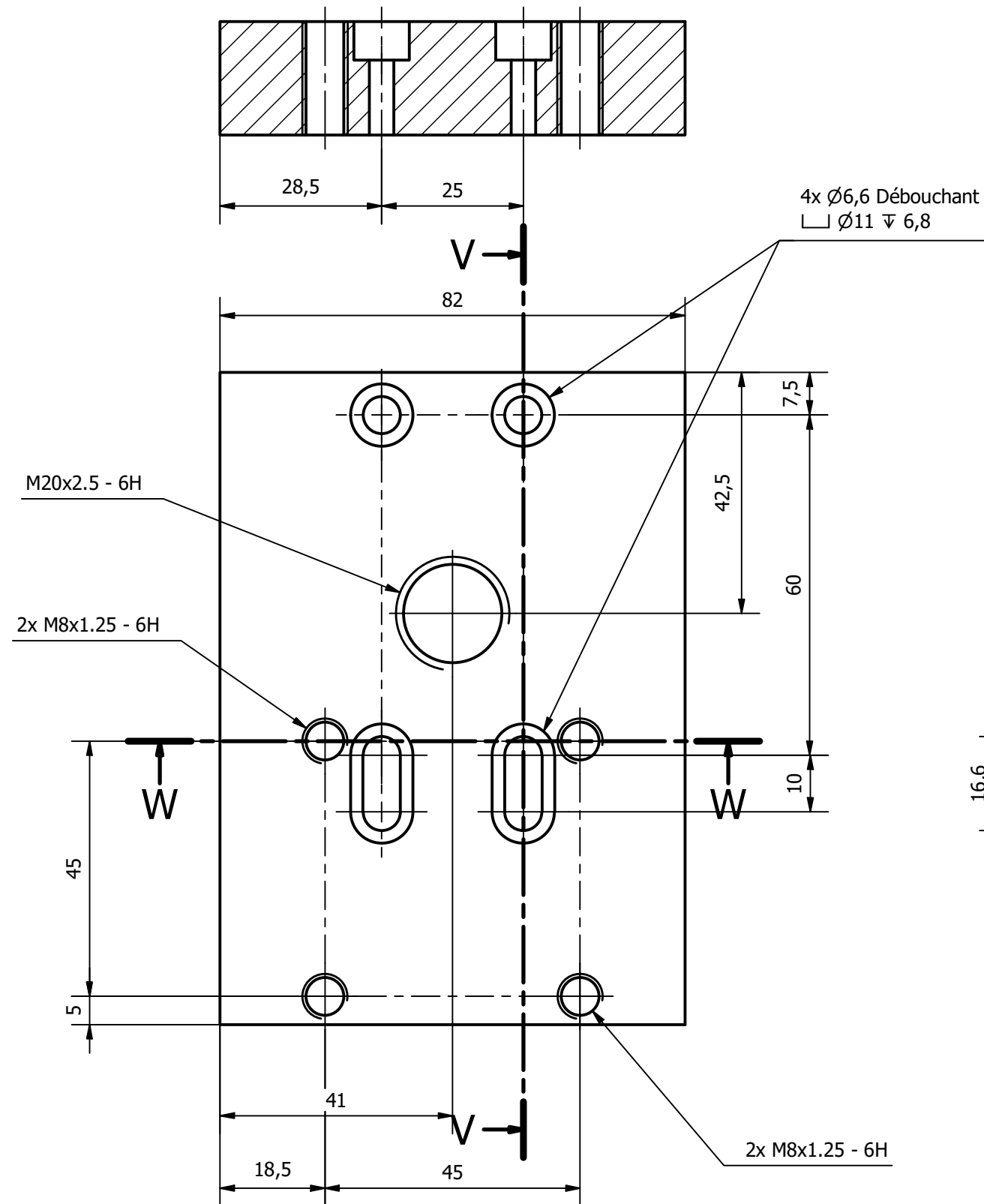
Note: pièce symétrique



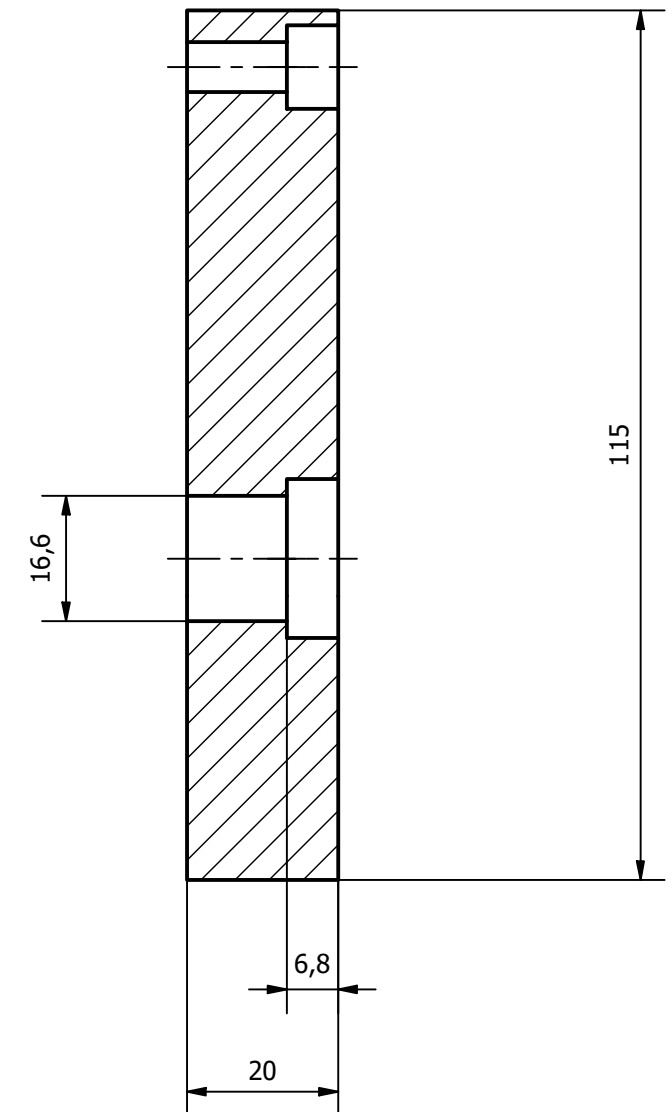
Matière: Caoutchouc	Quantité: 2	Echelle: 1 : 1	Traitement et protection:	Masse: 0,085 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	 Date de création: 06/07/2018	Etat: En cours A
Expérience: nBLM		Document: 66-Q051-DM-0001- 032 - P		
Nom de la pièce: Capteur lent V5		Bande Mirrobore centrale latérale		Feuille 23 / 35



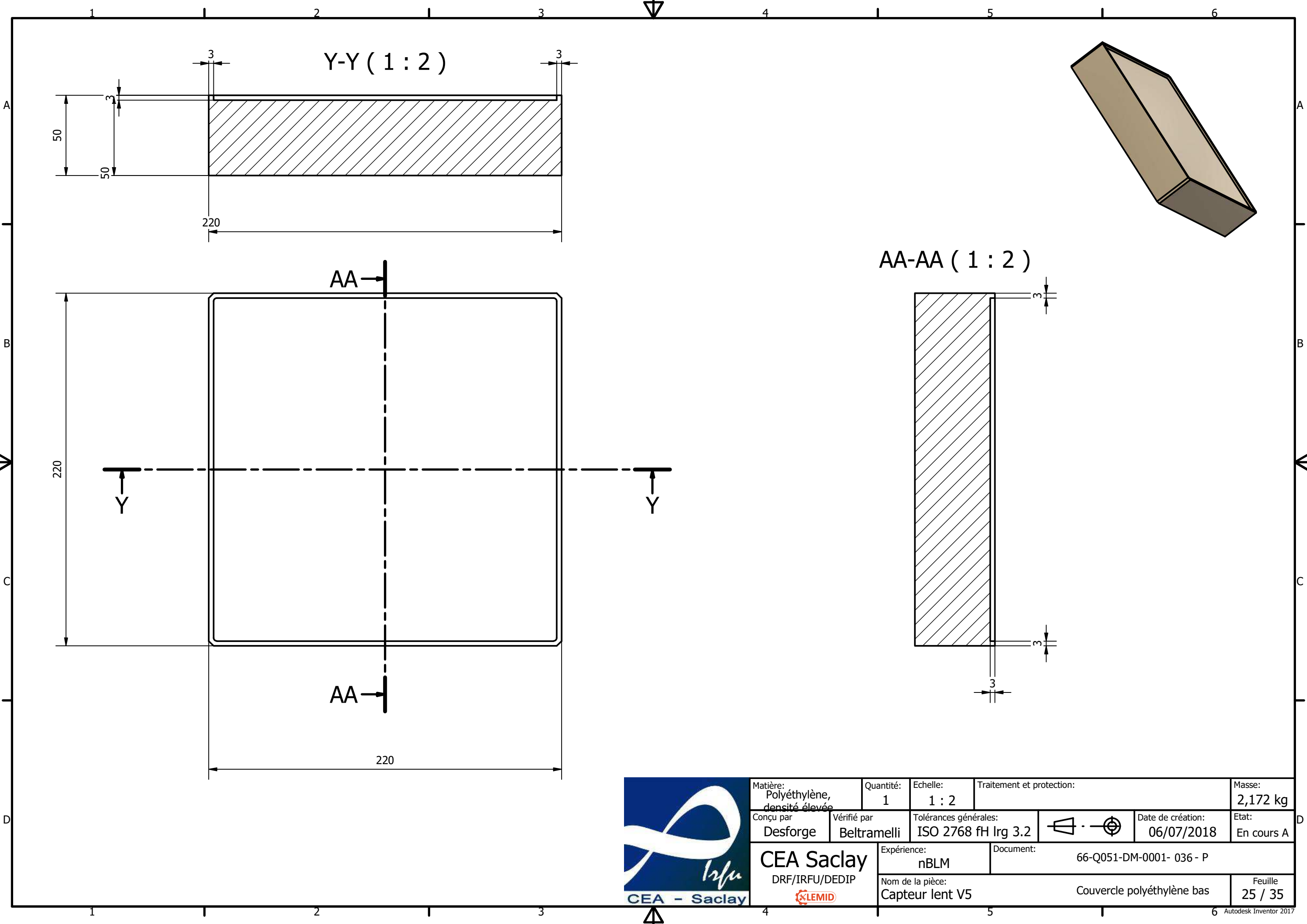
W-W (1 : 1)

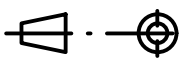


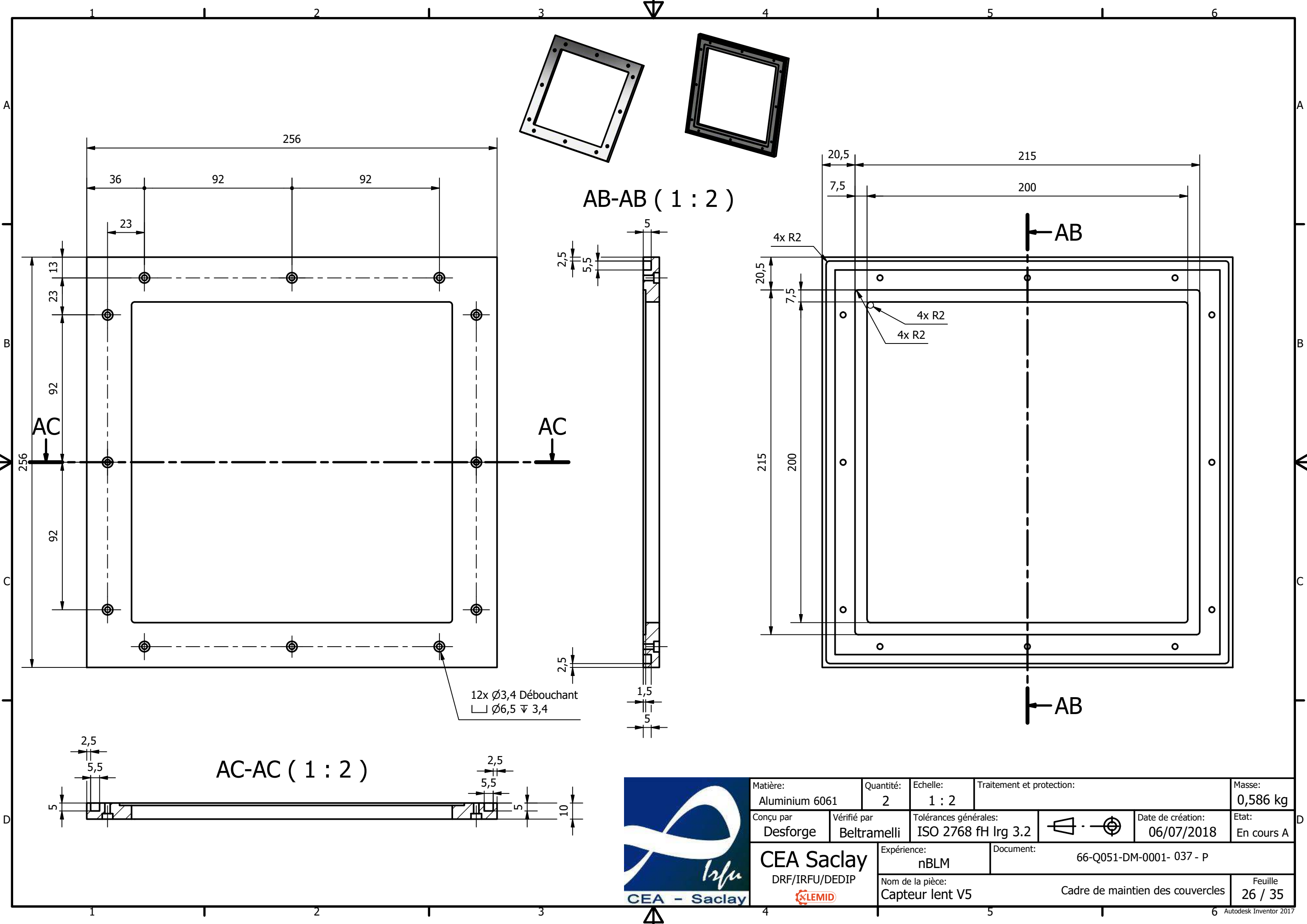
V-V (1 : 1)



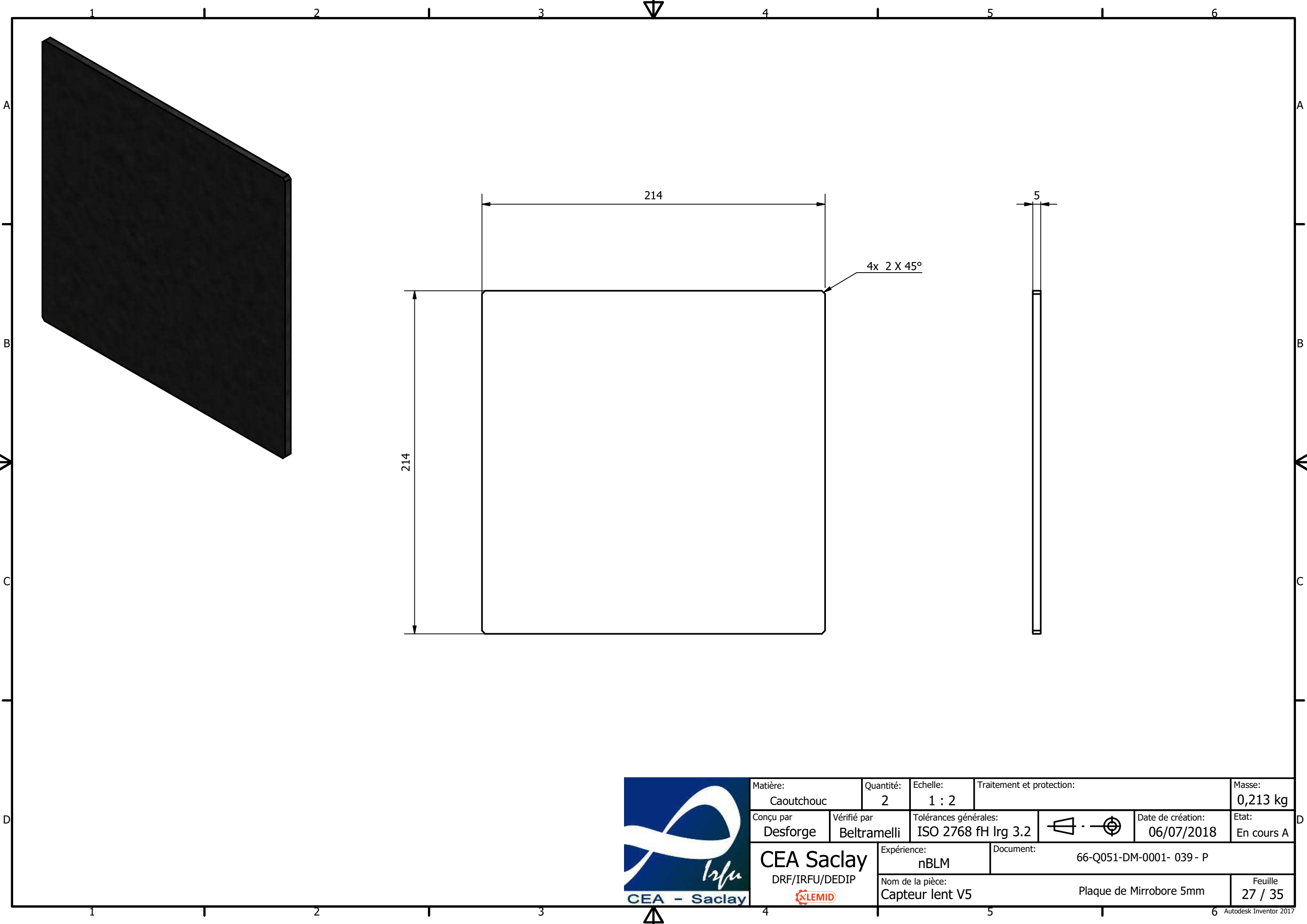
Matière: Aluminium AU4G	Quantité: 2	Echelle: 1 : 1	Traitement et protection:	Masse: 0.484 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 034 - P	
Nom de la pièce: Capteur lent V5			Interface support d'équerre	Feuille 24 / 35



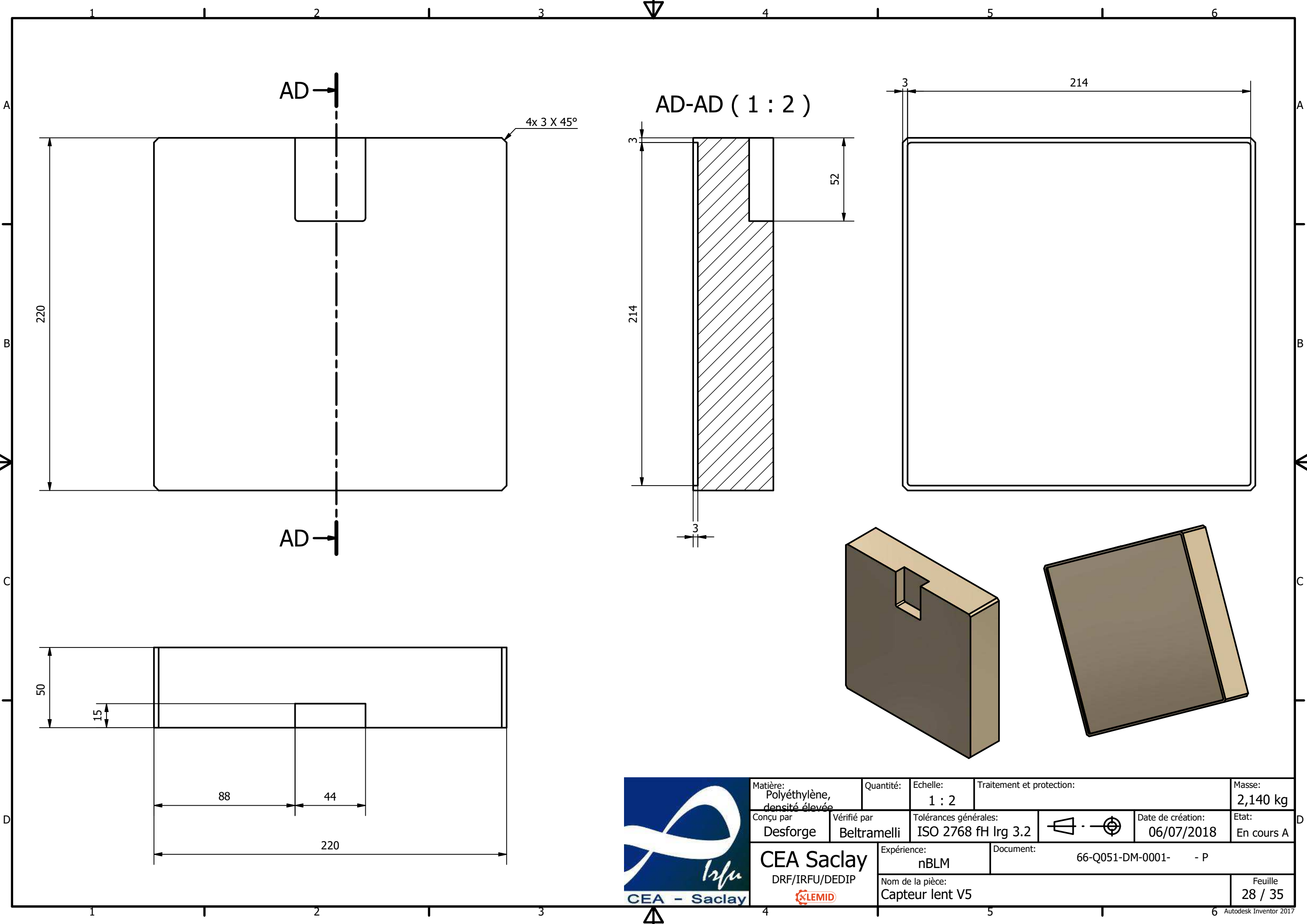
Matière: Polyéthylène, densité élevée	Quantité: 1	Echelle: 1 : 2	Traitement et protection:		Masse: 2,172 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2		Date de création: 06/07/2018	Etat: En cours A
Expérience: nBLM		Document: 66-Q051-DM-0001- 036 - P			
Nom de la pièce: Capteur lent V5		Couvercle polyéthylène bas			Feuille 25 / 35



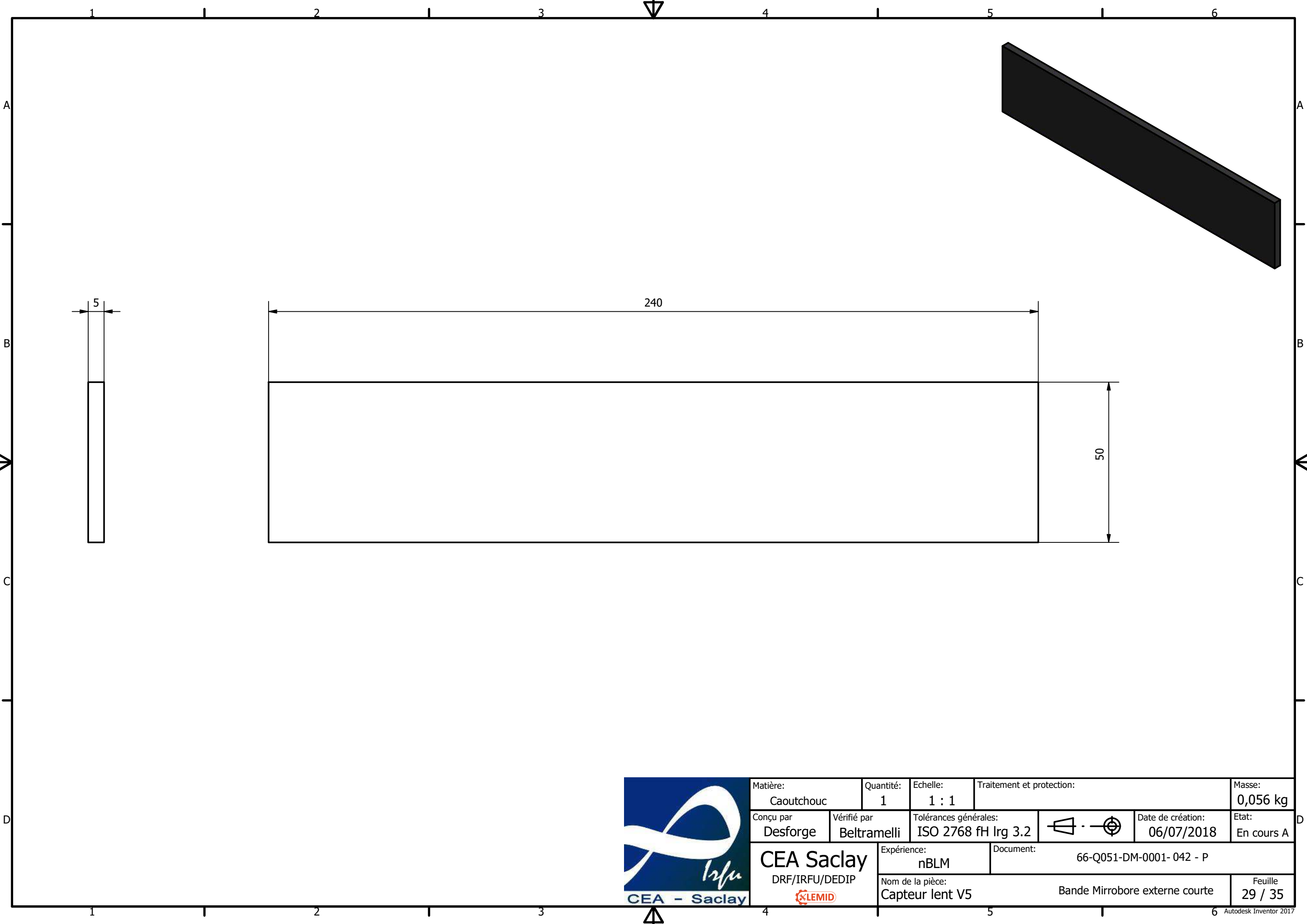
Matière: Aluminium 6061	Quantité: 2	Echelle: 1 : 2	Traitement et protection:	Masse: 0,586 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 037 - P	
Nom de la pièce: Capteur lent V5		Cadre de maintien des couvercles		Feuille 26 / 35



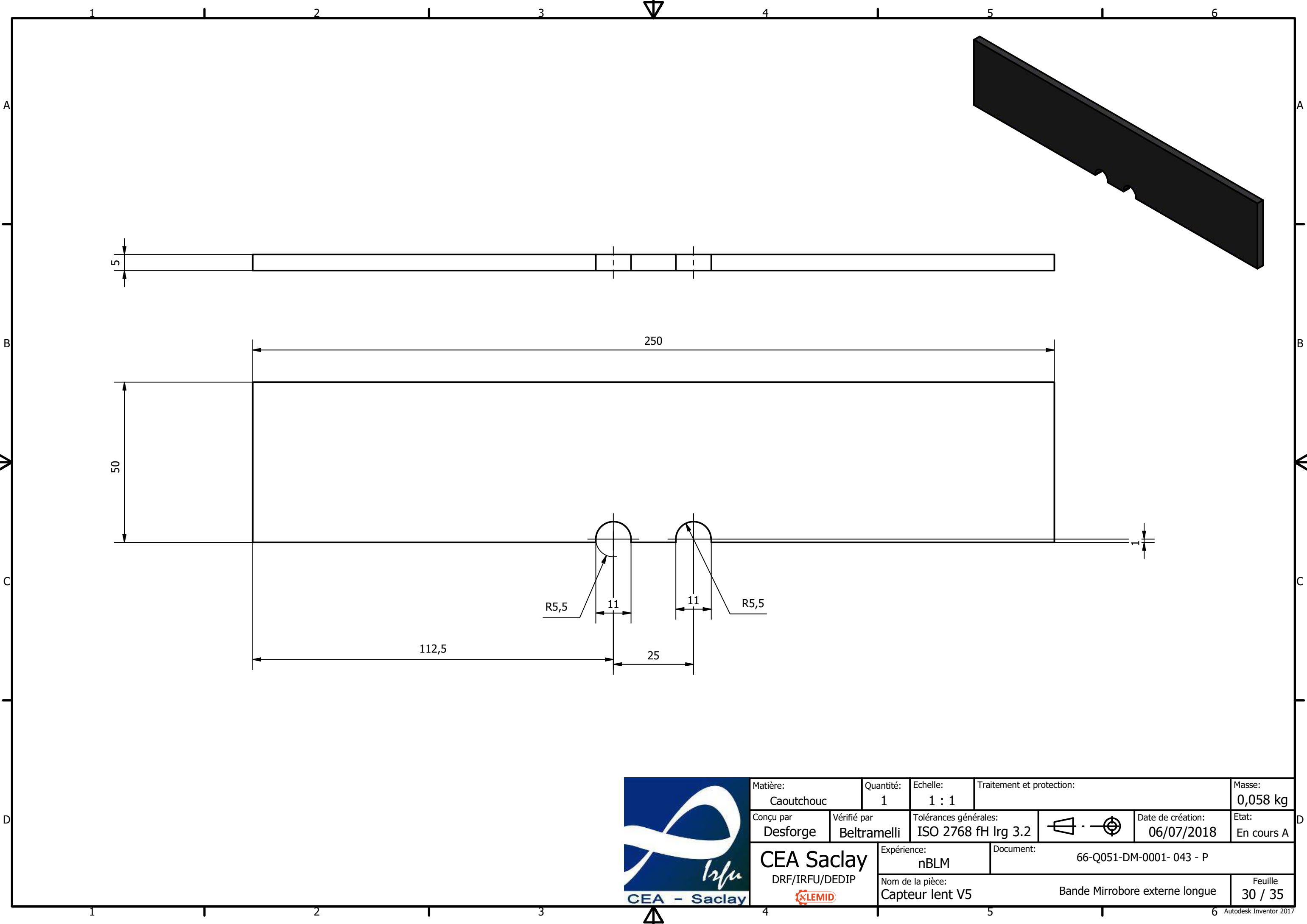
Matière: Caoutchouc	Quantité: 2	Echelle: 1 : 2	Traitement et protection:			Masse: 0,213 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2		Date de création: 06/07/2018	Etat: En cours A	
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001- 039 - P			
		Nom de la pièce: Capteur lent V5		Plaque de Mirrobore 5mm		
		Feuille 27 / 35				



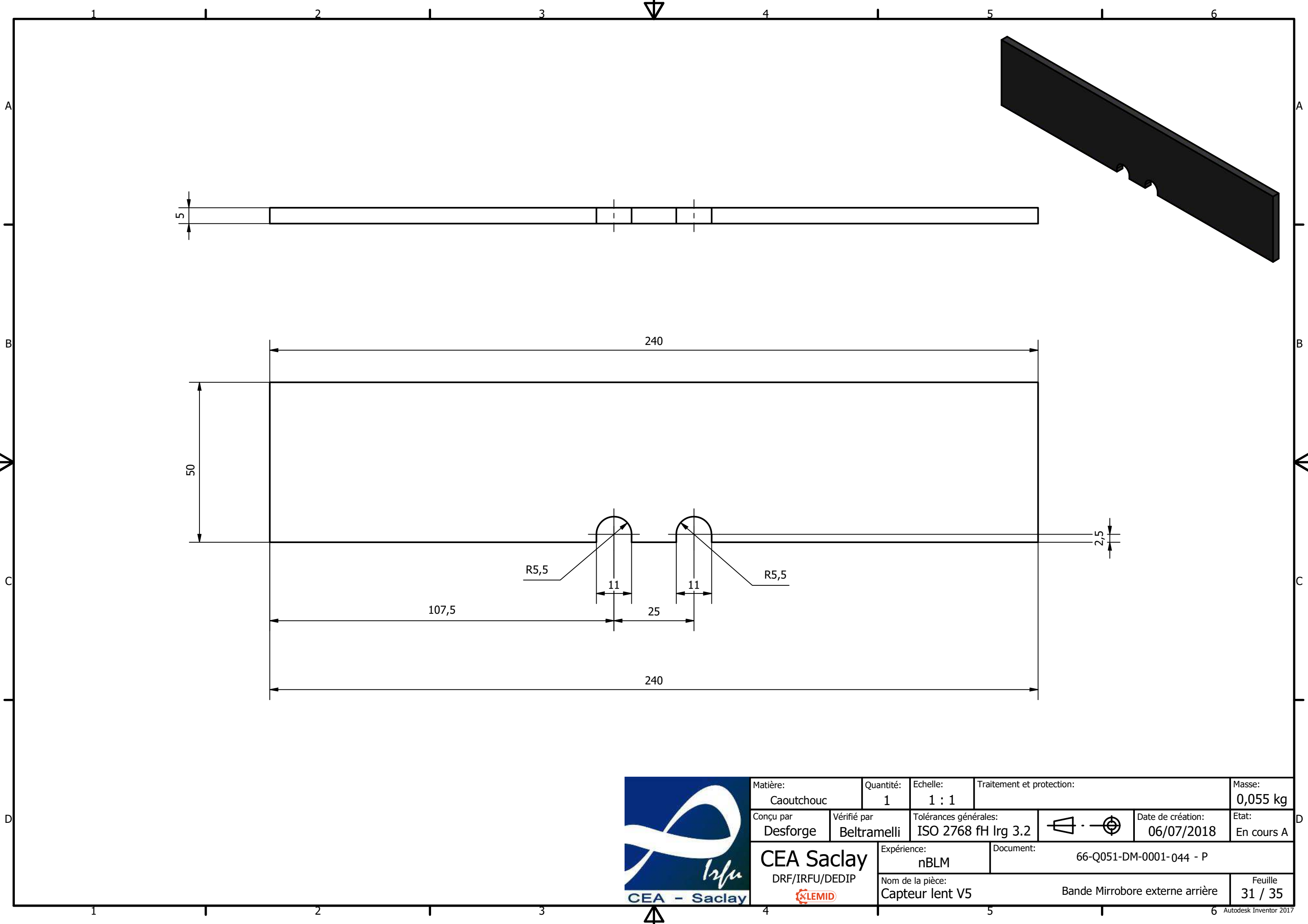
Matière: Polyéthylène, densité élevée	Quantité:	Echelle: 1 : 2	Traitement et protection:	Masse: 2,140 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2	Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- - P	
Nom de la pièce: Capteur lent V5				Feuille 28 / 35



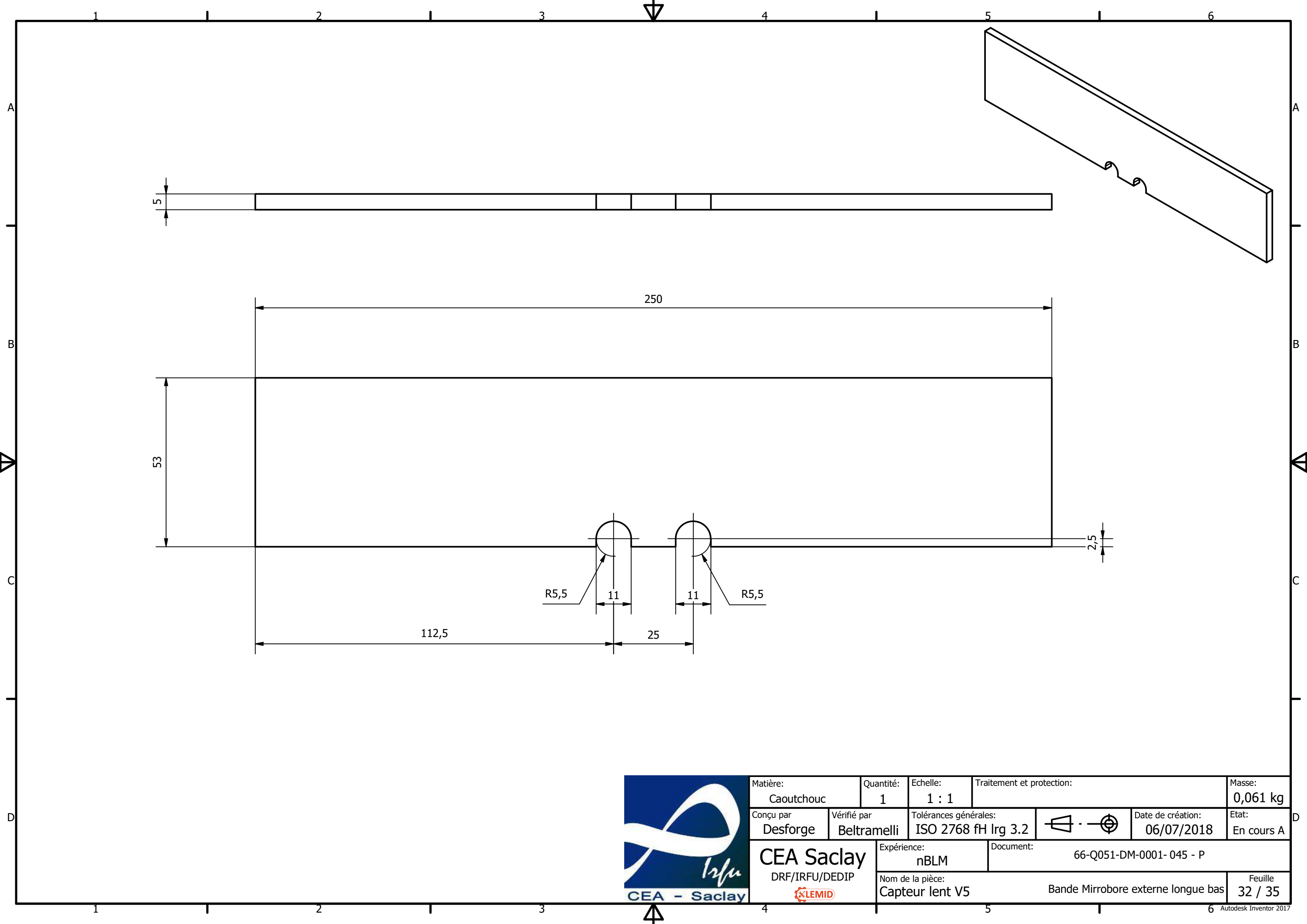
Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:			Masse: 0,056 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH Irg 3.2		Date de création: 06/07/2018	Etat: En cours A	
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001- 042 - P			
		Nom de la pièce: Capteur lent V5			Feuille 29 / 35	
		Bande Mirrobore externe courte				



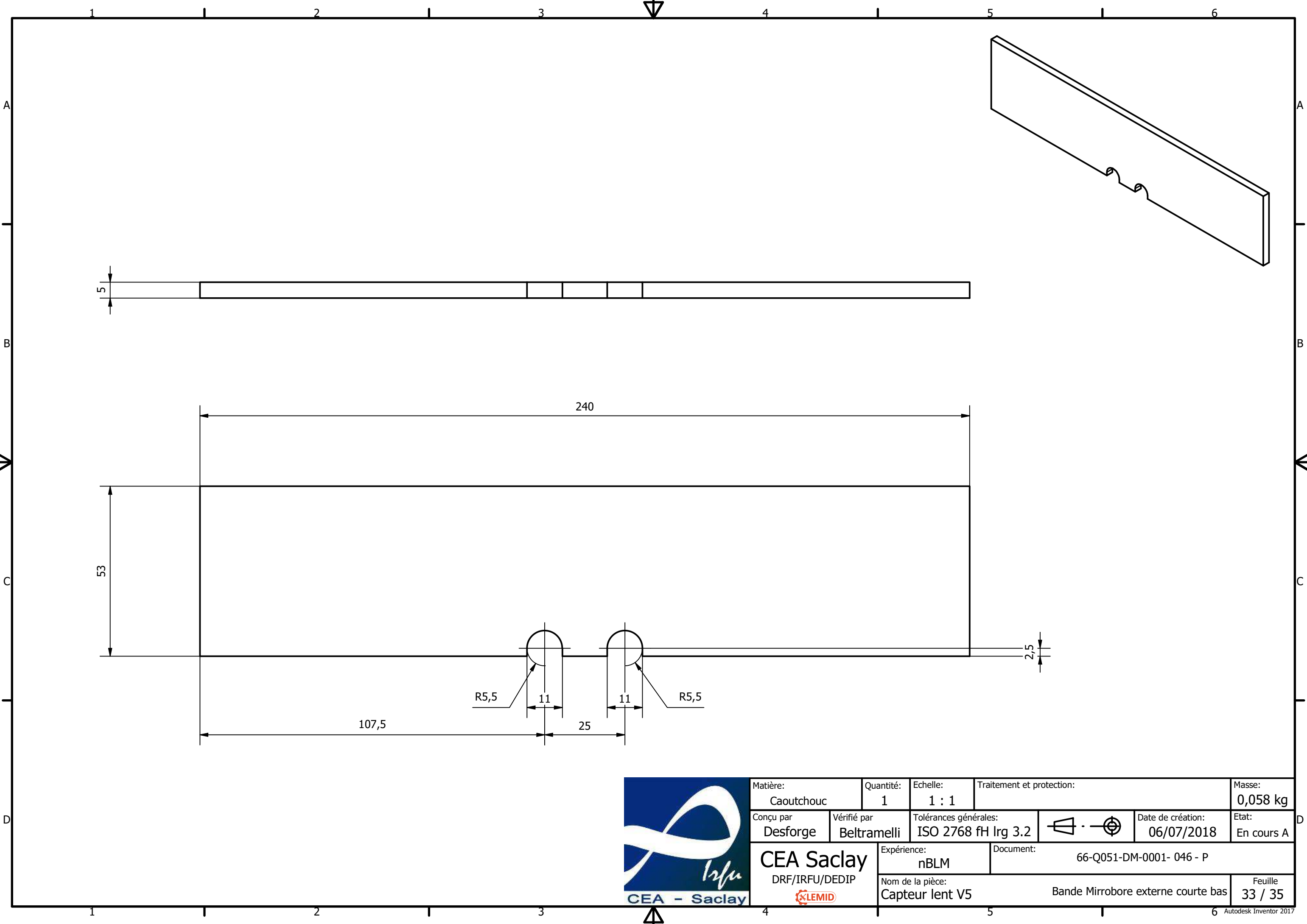
Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:		Masse: 0,058 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 043 - P		
Nom de la pièce: Capteur lent V5		Bande Mirrobore externe longue			Feuille 30 / 35

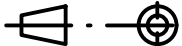


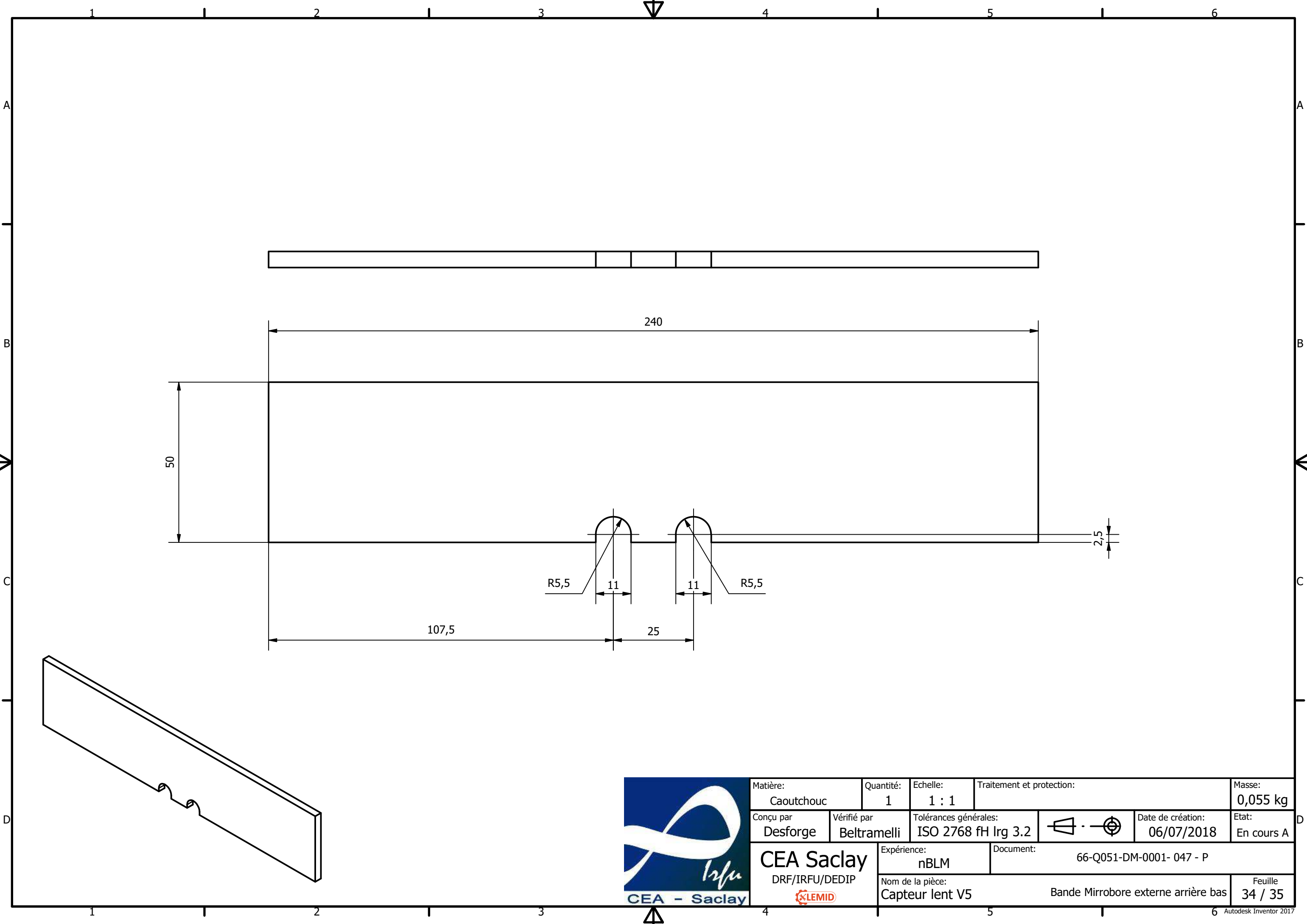
Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:		Masse: 0,055 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001-044 - P		
		Nom de la pièce: Capteur lent V5	Bande Mirrobore externe arrière		Feuille 31 / 35



Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:		Masse: 0,061 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 045 - P		
Nom de la pièce: Capteur lent V5		Bande Mirrobore externe longue bas			Feuille 32 / 35



Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:	Masse: 0,058 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2	 Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP		Expérience: nBLM	Document: 66-Q051-DM-0001- 046 - P	
Nom de la pièce: Capteur lent V5		Bande Mirrobore externe courte bas		Feuille 33 / 35



Matière: Caoutchouc	Quantité: 1	Echelle: 1 : 1	Traitement et protection:		Masse: 0,055 kg
Conçu par Desforge	Vérifié par Beltramelli	Tolérances générales: ISO 2768 fH lrg 3.2		Date de création: 06/07/2018	Etat: En cours A
CEA Saclay DRF/IRFU/DEDIP 		Expérience: nBLM	Document: 66-Q051-DM-0001- 047 - P		
		Nom de la pièce: Capteur lent V5	Bande Mirrobore externe arrière bas		Feuille 34 / 35

