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References :

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2. Cahier des Clauses Techniques Particulieres (CCTP) pour la réalisation des harnais de lecture de l'électronique argon liquide, ORSAY 22 of July 1996.
3. Cable length distribution for the LArg EC Calorimeter, D.Sauvage , P.Cornebise, P.Imbert 21.01.98.
4. Cabling Scheme for the Hadronic EC Calorimeter, W.Frieser et al (LARG note-065) 30.04.98.
5. Cabling of EM calorimeters, J.Colas et al 18.08.97.
6. Specification book for the mother boards and the cabling of the barrel EM presampler, JY.Hostachy et al ATL-AL-ISN-ES-8.0, September 98.
7. The LARG Slow Control Status Report, L.Poggioli (LARG note-xxx) 21.09.98.
8. Last cable Specifications for the EMB module, J.Colas et al 16.10.98.

Abstract[(1)]

This document gives the impedance, nominal length and quantity of cold cables. It updates the market technical specifications.

Calorimeter sub systems and concerned people :

	LARG calorimeter sub systems	Harness type	contact persons
1	Front End electronics		J.Colas, C.de-la.Taille, V.Radeka
2	AXON market follow up	all harnesses	W.Bonivento, P.Imbert
3	Test bench and labeling	all harnesses	E.Collet, P.Cornebise
4	Monitoring, all sub systems		L.Poggioli
5	Cryostat integration, barrel / end cap	B (pigtails)	B.Mansoulie / A.Fallou V.Vuillemin
6	Feedthroughs barrel / end cap		D.Rahm / M.Lefebvre
7	Barrel, EMB / PS	A & B	P.Perrodo / J.Y.Hostachy
8	End Cap, PS + EMEC	A & B	D.Sauvage
9	End Cap, HEC1 + HEC2 / FCAL	B	H.Oberlack / L.Shaver

Summary table	A harnesses		B harnesses		single stripped wires (50 ohm)
	50 ohm	25 ohm	50 ohm	25 ohm	
number for the experiment	1836	1264	2048	1324	2580
length for the experiment	396.558 km	233.264 km	128.820 km	82.560 km	5.428 km
Spare harnesses number	###	###	224	139	###
Spare harnesses length	10 km	6 km	16.054 km	8.026 km	###
total harnesses number for the experiment	6472 (up to 53 types of harness)				**###**
total cable length for the experiment	846.630 km				
grand total number of A&B harnesses	**6835 (of which 363 spare)**				**###**
grand total length of coaxial cables	**886.710 km (of which 40.080 km spare)**				

(1) this document is available on http://edms.cern.ch/ click on ATLAS → ATL, user: guest & no password. Than click LArg Calorimeter and Electronics under document ref ATL-AL-EP-0001.

I. Introduction :

This document includes specifications of cables involved in the market with the AXON company such as A & B harnesses for the EM calorimeters & presamplers and B harnesses for HEC & FCAL.

In the barrel system, PS & EM A & B harnesses are defined according to reports [6, 8]. Up to now, B harnesses lengths are a CAD estimate.

In the End Cap system, PS & EMEC A harnesses are defined according to report [3]. B harnesses lengths have been checked on a mock-up at Marseille. HEC B harnesses lengths have been checked on a mock-up at Munich, and FCAL ones on a mock-up at Arizona.

N.B :

All electrical schemes are available on http://www.lal.in2p3.fr/ATLAS/elec/harnais/

II. Barrel system :

table 1, A harnesses, 50 ohm impedance, electromagnetic detector :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
1	0	356[(1)]	227.84 m	128	29.164 km	2A-2B
2	0	331[(1)]	211.84 m	128	27.116 km	3A-3B
3	0	296[(1)]	189.44 m	128	24.248 km	4A-4B
4	0	282[(1)]	180.48 m	128	23.101 km	5A-5B
5	0	245[(1)]	156.80 m	128	20.070 km	6A-6B
6	0	201[(1)]	128.64 m	128	16.466 km	7A-7B
7	0	153[(1)]	97.92 m	128	12.534 km	8A-8B
8	1, calibration	303[(2)]-438[(3)]	215.52 m	64	13.793 km	15A
9	2, calibration	{328-348-378-513}[(4)] 132[(5)]-{463-483}[(6)]	236.44 m	64	15.132 km	15B
total				**1024**	**181.624 km**	

[(1)] one bundle of 64 coaxial cables.
[(2)] 12 bundles of 4 coaxial cables each.
[(3)] 4 bundles of 4 coaxial cables each.
[(4)] 3 bundles of 4 coaxial cables each.
[(5)] 2 bundles of 4 coaxial cables each.
[(6)] one bundle of 4 coaxial cables.

table 2, A harnesses, 50 ohm impedance, presampler & monitoring :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
10	6	{335-306-275-241}[(1)]	185.12 m	64 + 4[(3)]	12.588 km	1A
11	7	{203-158-106-058}[(1)]	84.00 m	64 + 4[(3)]	5.712 km	1B
12	10, monitoring	500[(2)]	320.00 m	32	10.240 km	14B
total				**160 + 8**	**28.540 km**	

[(1)] one bundle of 16 coaxial cables.
[(2)] one bundle of 64 coaxial cables; including cryostat & cryogenic probes.
[(3)] additional harnesses to cable the 4 spare modules.

table 3, A harnesses, 25 ohm impedance, EMB :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
13	3	{187-243-293-337-368}[1] 360[3]	200.64 m	128	25.682 km	9A-9B
14	4	{081-093-132-255}[1] {137-188}[2]	96.88 m	128	12.401 km	10A-10B
15	0	303[4]	193.92 m	128	24.822 km	11A-11B
16	0	231[4]	147.84 m	128	18.924 km	12A-12B
17	0	137[4]	87.68 m	128	11.223 km	13A-13B
18	0	045[4]	28.80 m	64	1.843 km	14A
total				**704**	**94.895 km**	

[1] one bundle of 8 coaxial cables.
[2] 2 bundles of 8 coaxial cables each.
[3] 3 bundles of 8 coaxial cables each.
[4] one bundle of 64 coaxial cables.

table4, B harnesses, 25 & 50 ohm impedance, EMB & PS :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
19	pigtail, 50 ohm	100[1]	64.00 m	512	32.768 km	1A to 4A 1B to 4B
20	pigtail, 50 ohm	075[1]	48.00 m	704	33.792 km	5A to 8A, 5B to 8B 15A, 14B-15B
sub total 50 ohm				**1216**	**66.560 km**	
21	pigtail, 25 ohm	075[1]	48.00 m	704	33.792 km	9A to 13A, 14A 9B to 13B
sub total 25 ohm				**704**	**33.792 km**	
total 25 & 50 ohm				**1920[2]**	**100.352 km**	

[1] one bundle of 64 coaxial cables.
[2] 1920 = 64(number of feedthroughs) x 30(number of connectors per feedthrough).

table 5, single stripped wires, 50 ohm impedance, PS internal cabling & cryo monitoring :

type	electrical scheme	coaxial cable length cm	number of coax/length	total cable length / type
22	12, no connectors	298	64 + 4[1]	0.203 km
23	12	300	64 + 4[1]	0.204 km
24	12	306	64 + 4[1]	0.208 km
25	12	313	64 + 4[1]	0.213 km
26	12	322	64 + 4[1]	0.219 km
27	12	339	64 + 4[1]	0.231 km
28	12	358	64 + 4[1]	0.243 km
29	12	392	64 + 4[1]	0.267 km
30	12 monitoring	600 (end cap cryostats)	580	3.480 km
total				**5.268 km**

[1] additional harnesses to cable the 4 spare modules.

III. End Cap system :

table 6, A harnesses, 50 ohm impedance, EMEC, PS & monitoring :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	Feedthrough
31	0	390[(1)]	249.60 m	56	13.978 km	#
32	0	410[(1)]	262.40 m	128	33.587 km	#
33	0	420[(1)]	268.80 m	56	15.053 km	#
34	0	435[(1)]	278.40 m	120	33.408 km	#
35	0	455[(1)]	291.20 m	80	23.296 km	#
36	0	490[(1)]	313.60 m	24	7.526 km	#
37	8, calibration	490[(1)]	313.60 m	96	30.106 km	15A-15B (std) 3A-4A-3B-4B (hec)
38	9, pre sampler	490[(1)]	313.60 m	40	12.544 km	1A-1B (std+special)
38bis	12, pre sampler	011[(2)]	#	1456 wires	0.160 km	PS internal cabling
39	10, monitoring	600[(1)]	384.00 m	44	16.896 km	14A-14B (std)
total for end cap A & C				**644**	**186.394 km**	

[(1)] one bundle of 64 coaxial cables. [(2)] single stripped coaxial cables.

table 7, A harnesses, 25 ohm impedance, EMEC :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	Feedthrough
40	0	325[(1)]	208.00 m	32	6.656 km	#
41	0	340[(1)]	217.60 m	96	20.890 km	#
42	0	360[(1)]	230.40 m	80	18.432 km	#
43	0	375[(1)]	240.00 m	128	30.720 km	#
44	0	390[(1)]	249.60 m	88	21.965 km	#
45	0	440[(1)]	281.60 m	96	27.034 km	#
46	0	495[(1)]	316.80 m	40	12.672 km	#
total for end cap A & C				**560**	**138.369 km**	

[(1)] this length corresponds to one bundle of 64 coaxial cables.

table 8, B harnesses, 25 & 50 ohm impedance, EMEC, PS & monitoring :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type
47	pigtail, 50 ohm	90[(1)]	57.60 m	704[(2)]	40.550 km
48	pigtail, 25 ohm	90[(1)]	57.60 m	560	32.256 km
total 25 & 50 ohm				**1264[(3)]**	**72.806 km**

[(1)] one bundle of 64 coaxial cables.

[(2)] 704 = 632 + 32(PS, std f-t) + 32(monitoring, std f-t) + 8(PS, special f-t), {72 free connectors}.

[(3)] 1264 = 2(end cap A & C)x{20(standard & special feedthroughs per end cap)x30(F-T connectors) + 4(HEC+EMEC feedthroughs per end cap)x8(number of EMEC connectors)}.

table 9, B harnesses, 50 ohm impedance, HEC1, HEC2 & monitoring :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
49	14, signal	265[(1)]	169.60 m	64	10.854 km	5A to 8A, 5B to 8B
50	15, signal	265[(1)]	169.60 m	32	5.428 km	9A-10A, 9B-10B
51	11, calibration, monitoring (T°C)	265[(1)]	169.60 m	32	5.428 km	12A-12B 11A-11B
	total for end cap A & C			**128[(2)]**	**21.710 km**	

[(1)] one bundle of 64 coaxial cables.

[(2)] 128 = 8(HEC+EMEC f-t)x22(HEC connectors) - 48(low voltage connectors).

table 10, B harnesses, 25 ohm impedance, FCAL & monitoring :

type	electrical scheme	overall length (L cm)	cable length per harness	number of harnesses	total cable length / type	F-T connector
52	pigtail, 25 ohm, signal, calibration, monitoring	430[(1)]	275.20 m	60	16.512 km	1A-15A 1B-15B
	total for end cap A & C			**60**	**16.512 km**	

[(1)] one bundle of 64 coaxial cables.

IV. Spare :

The number of B harnesses corresponds to that needed to equip the spare feedthroughs (10%).

Due to the wide range of A harnesses lengths, coils of 25 and 50 ohm cables corresponding to 2.5% of a total cable length, will be added to the market together with the appropriate type and number of connectors.

table 11, feedthroughs number :

		feedthroughs for the experiment	**Spare of f-t**	Spare of B harnesses f-t **+ real** (type)	cable length (km) 50 ohm	25ohm
1	Barrel	64	**6**	48(19), 66(20), 66(21)	6.240	3.168
2	EMEC, standard f-t	2x16	**3**	54**+15**(47), 36**+12**(48)	3.974	2.765
3	EMEC, special f-t	2x4	**1**	12(47), 18(48)	0.692	1.037
4	HEC & EMEC f-t	2x4	**1**	4(47), 4(48), 8**+3**(49), 4**+3**(50), 4**+3**(51)	5.148	0.230
5	FCAL f-t	2x1	**0**	0**+3** (52)	0	0.826
6	**total spare of B harnesses**			**224 (50Ω) / 139 (25Ω)**	**16.054**	**8.026**
7	**total spare of equivalent A harnesses**				**10.000**	**6.000**

table 12, connectors number :

	ATI		micro-d male/female		low profile (4-8 pins)		low profile MPI (8 pins)
	barrel	end cap	barrel	end cap	barrel	end cap	
experiment	1920	1500	1920+1896[1]	1324+1204	2048+12800	1536+8192	1024
spare 2%	**40**	**30**	**2x38**	**2x25**	**40 + 260**	**30 +164**	**20**
f-t spare	180	183	180	158	#	#	200
total	3853		6808		25070		1244

[(1)] of which 8 additional connectors to cable the 4 spare modules of PS barrel.

V. Dimensions, fabrication tolerances and labeling :

• The overall length (L) used in this report includes the connector envelope as shown in figure 1. To calculate the total cable length, it was assumed that L corresponded to the actual cable length.

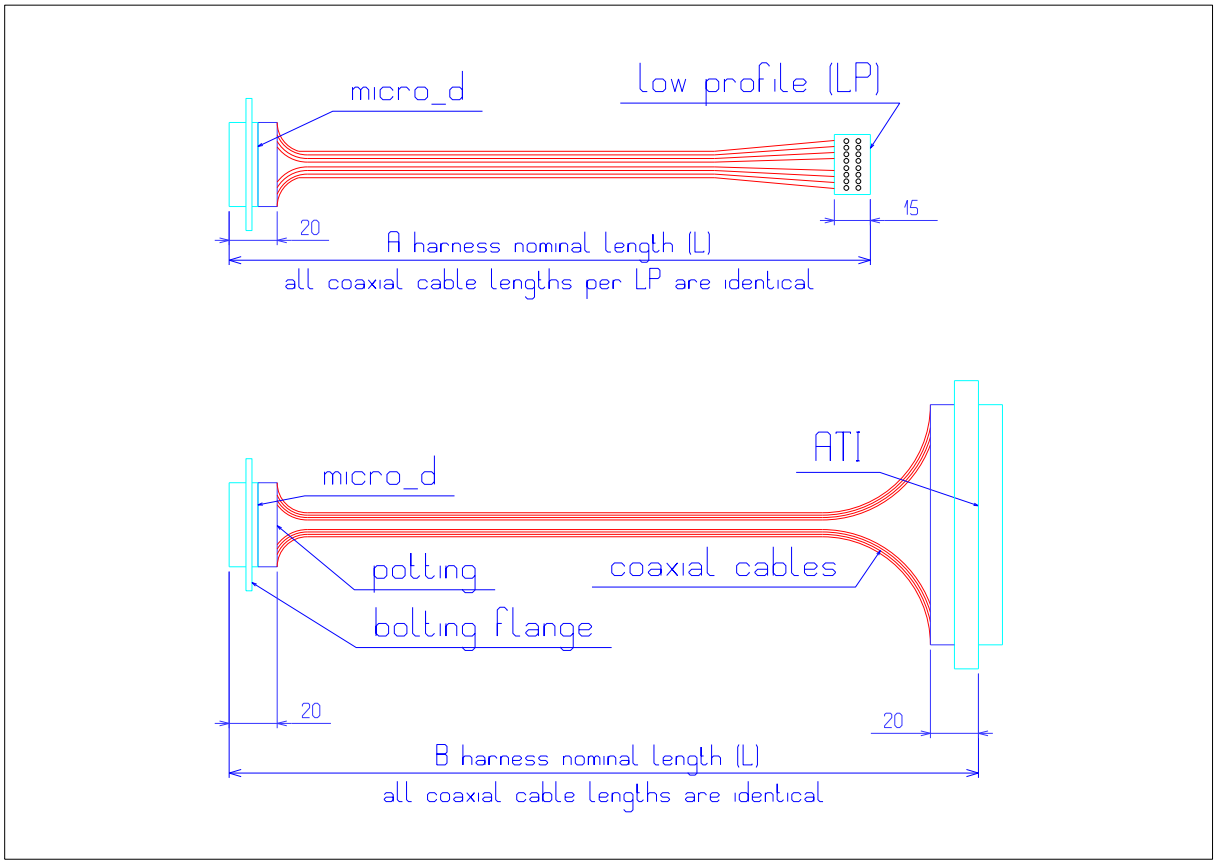

Figure 1, detail of the overall length (L) for A and B harnesses.

• Due to the production constraints, AXON tolerances correspond to +0 and -2 cm relative to the nominal length (L). For safety, an extra cable length of 2 cm has been added everywhere.

• **A harnesses labeling :**

. micro-d female	**0025** (serial number)	**12A**[(1)] or **325**[(2)]	**25 Ω** (impedance)
. low profile	**02** (id, 1 to 8 or 1 to 16)	**12A**[(1)] or **325**[(2)]	**25 Ω** (impedance)
. stripped ends	**42** (identification number, 1 to 64).		

[(1)] *pin carrier of the feedthrough.* [(2)] *nominal length (cm) of the EMEC or PS_EC harness.*

• **B harnesses labeling :**

. ATI	**6400** (serial number)	**06B** (pin carrier of the feedthrough)	**50 Ω** (impedance)
. micro-d male	**6400** (serial number)	**06B** (pin carrier of the feedthrough)	**50 Ω** (impedance)
. low profile MPI	**0124** (serial number)	**05A** (pin carrier of the feedthrough)	**3** (id number, 1 to 8)

The following example shows the proposed format of A & B harnesses label :

0025	12A or 325	25