

Calorimeter cabling

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Design of the calorimeter cabling

CC Calorimeter cabling document v1.1 - DocDB 3206 - 16-10-2014

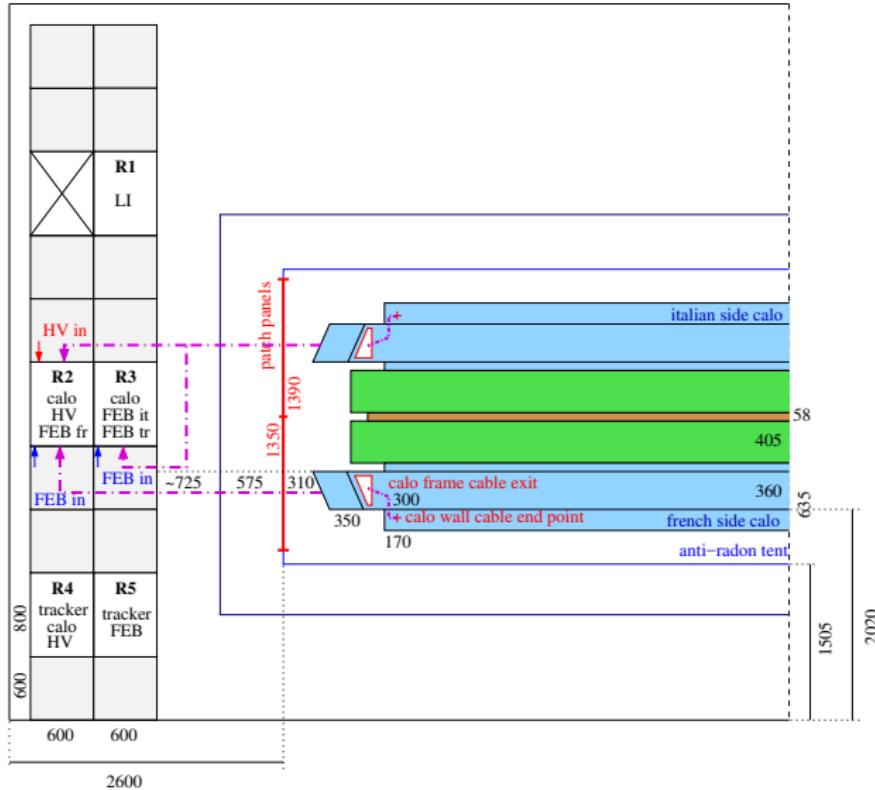
Changes since that document presented here

Four set of cables for the calorimeter:

- ▶ External HV harnesses
- ▶ External Signal harnesses
- ▶ Internal HV harnesses
- ▶ Internal Signal harnesses

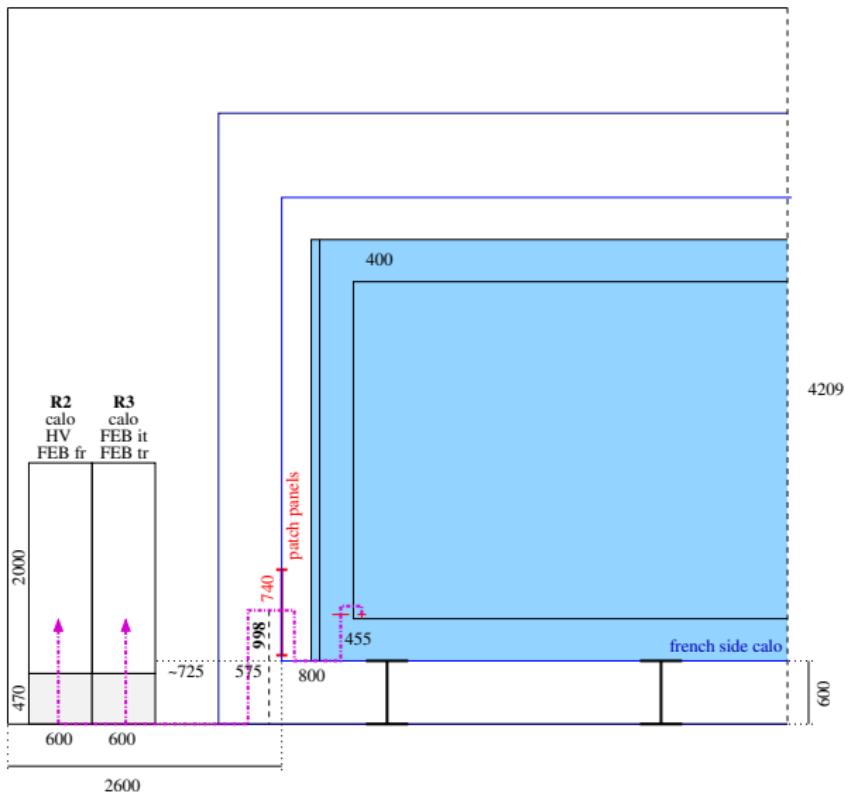
Dedicated sub-patch panels to connect the cables at the anti-radon tent

Demonstrator top view: cables to the electronics



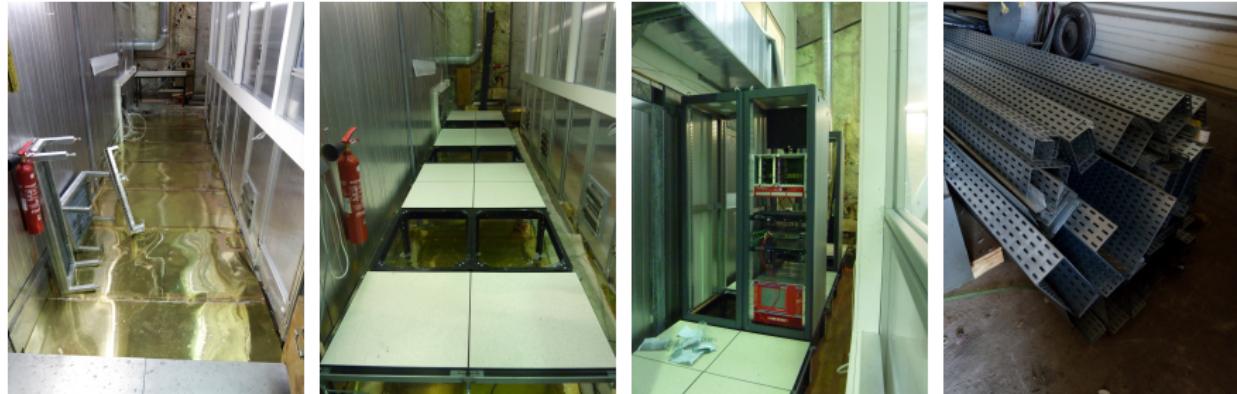
Numbers not definitive

Demonstrator front view: cables to the electronics



Numbers not definitive

Cable routing to the electronics platform



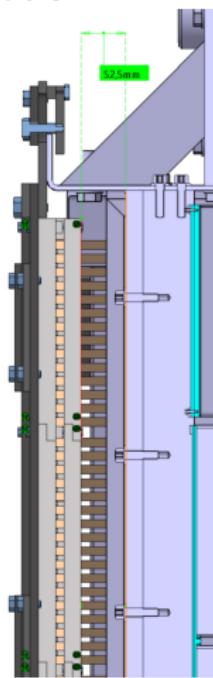
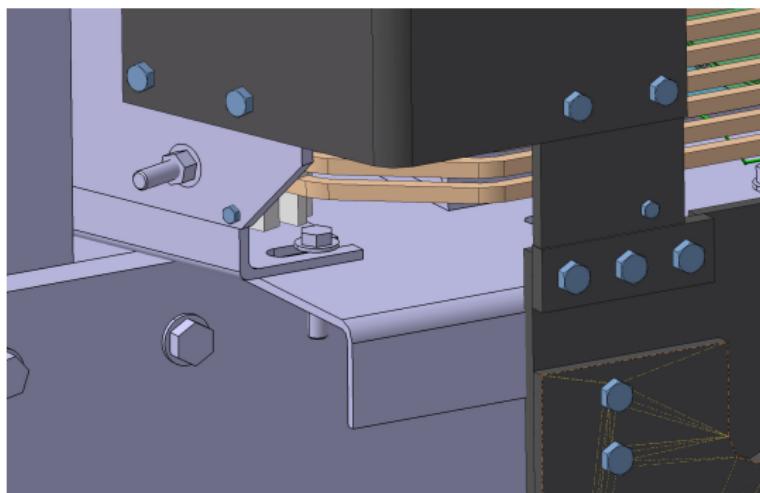
Some cable trays found at LAL already sent to LSM
→ need to design the path and to deal with signal cable extra-lengths

Need to define and order material to support the cables from the floor to the individual boards

Space between coil and calorimeter wall

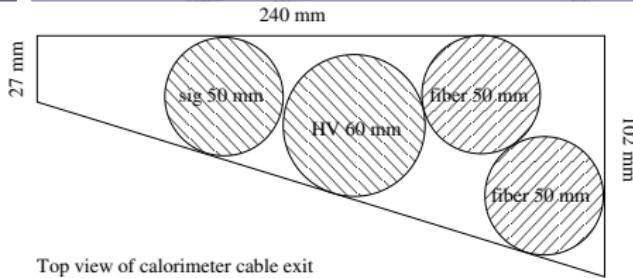
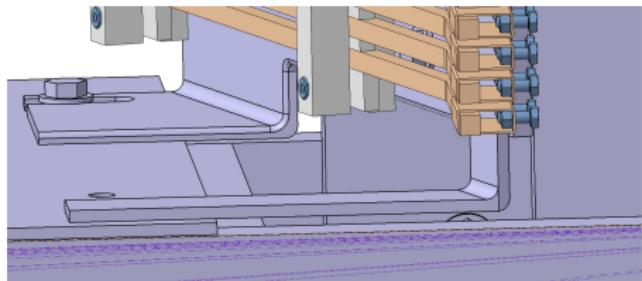
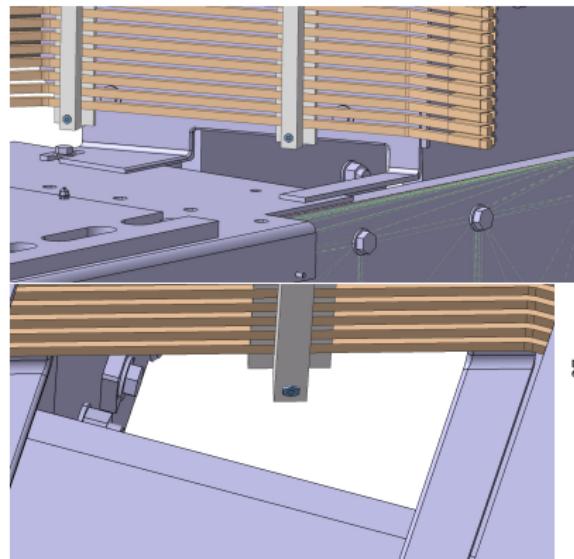
Not a lot of space to go through the coil and return yokes

Some 100 mm thick T pieces were foreseen to hold the calorimeter wall
but they have not been implemented finally
→ these positions could be used to implement cable holders



Path to the calorimeter PMTs

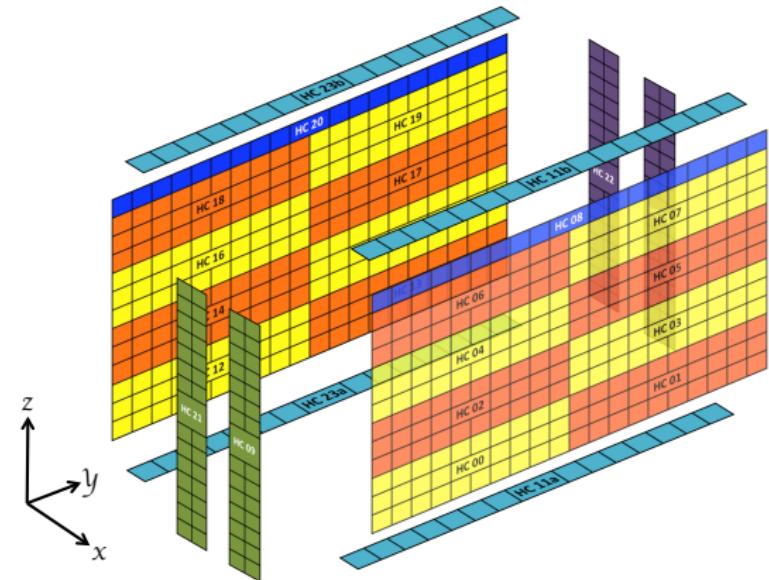
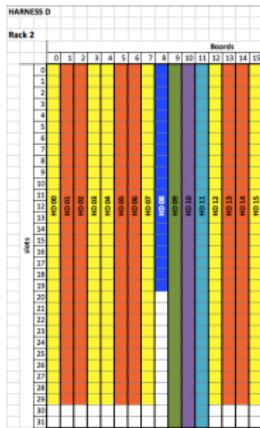
There is a path in the calorimeter frame → need to design a cable support to the anti-radon tent floor up to the patch panel



Top view of calorimeter cable exit

HV harnesses mapping

24 harnesses + 2 spares to be built



HIGH VOLTAGE HARNESSES MAPPING : C & D

HV harnesses

External HV harnesses of 31 channels:

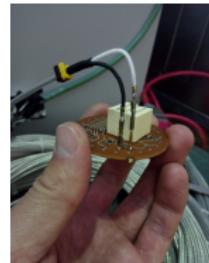
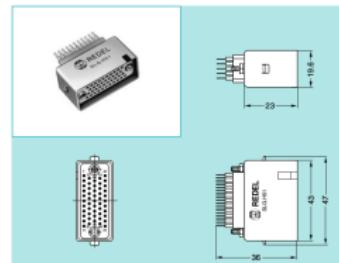
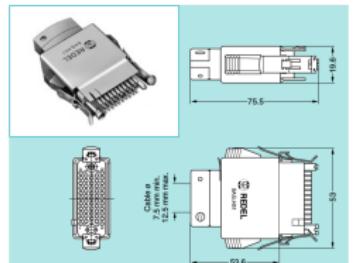
- ▶ Radial connector 52 pins on CAEN HV board side
- ▶ HV cable $37 \times 0.14 \text{ mm}^2$ 3 kV
- ▶ Redel S Male 51 contacts

Internal HV harnesses of 31 channels:

- ▶ Redel S Female 51 contacts
- ▶ Individual 2.8 mm cables Axon P547101
- ▶ Souriau pins

Five inches PMTs need an extra 10 nF capacitor: the first idea was to implement them on the patch-panel but it seems no longer possible with multipin connectors

→ adapt it to the PMT divider side



HV connectors pins assignments

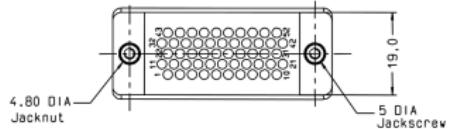
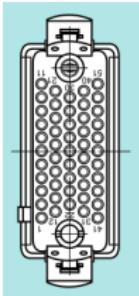


Table 2 – 52 pin connector assignment

| | | | | | | | | | |
|----|---------|----|---------|----|---------|----|---------|----|--------|
| 1 | N.C. | 11 | Return | 22 | N.C. | 32 | Return | 43 | N.C. |
| 2 | N.C. | 12 | N.C. | 23 | N.C. | 33 | N.C. | 44 | N.C. |
| 3 | HVOUT23 | 13 | N.C. | 24 | HVOUT12 | 34 | HVOUT6 | 45 | HVOUT0 |
| 4 | HVOUT24 | 14 | HVOUT18 | 25 | HVOUT13 | 35 | HVOUT7 | 46 | HVOUT1 |
| 5 | HVOUT25 | 15 | HVOUT19 | 26 | HVOUT14 | 36 | HVOUT8 | 47 | HVOUT2 |
| 6 | HVOUT26 | 16 | HVOUT20 | 27 | HVOUT15 | 37 | HVOUT9 | 48 | HVOUT3 |
| 7 | HVOUT27 | 17 | HVOUT21 | 28 | HVOUT16 | 38 | HVOUT10 | 49 | HVOUT4 |
| 8 | HVOUT28 | 18 | HVOUT22 | 29 | HVOUT17 | 39 | HVOUT11 | 50 | HVOUT5 |
| 9 | INT_A | 19 | HVOUT29 | 30 | HVOUT31 | 40 | N.C. | 51 | N.C. |
| 10 | INT_B | 20 | HVOUT30 | 31 | SHIELD | 41 | N.C. | 52 | SHIELD |
| | | | | 21 | Return | 42 | Return | | |



| | | | | | | | | | | |
|----|-----|-----|-----|-----|-----|-----|----|----|----|----|
| 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 |
| NC | HV5 | HV4 | HV3 | HV2 | HV1 | HV0 | NC | NC | G | NC |

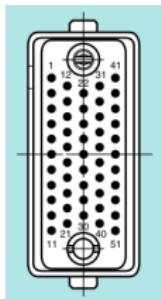


| | | | | | | | | | |
|----|------|------|-----|-----|-----|-----|----|----|----|
| 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 |
| NC | HV11 | HV10 | HV9 | HV8 | HV7 | HV6 | NC | G | G |

| | | | | | | | | |
|------|------|------|------|------|------|------|----|----|
| 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 |
| HV31 | HV17 | HV16 | HV15 | HV14 | HV13 | HV12 | NC | NC |

| | | | | | | | | | |
|----|------|------|------|------|------|------|------|----|----|
| 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 |
| G | HV30 | HV29 | HV22 | HV21 | HV20 | HV19 | HV18 | NC | NC |

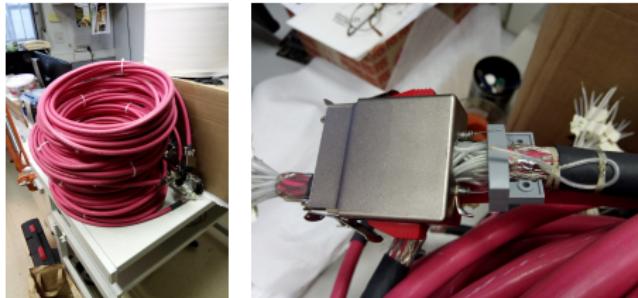
| | | | | | | | | | | |
|----|----|----|------|------|------|------|------|------|----|----|
| 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| G | NC | NC | HV28 | HV27 | HV26 | HV25 | HV24 | HV23 | NC | NC |



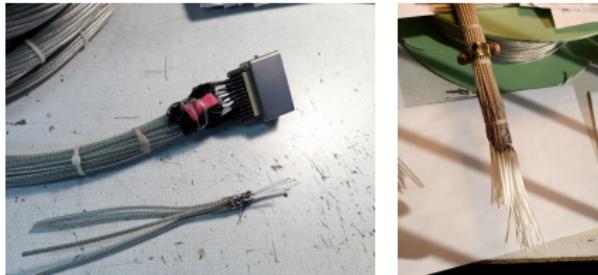
Status of HV harnesses construction

External harnesses almost finished but many issues encountered:

- ▶ Pins not holding in the Radiall connector: discussions with Caen + documentation AN6224-A996 produced
- ▶ Redel connectors had to be adapted to the CERN cable
- ▶ Redel connector screws pulled-out by the cable



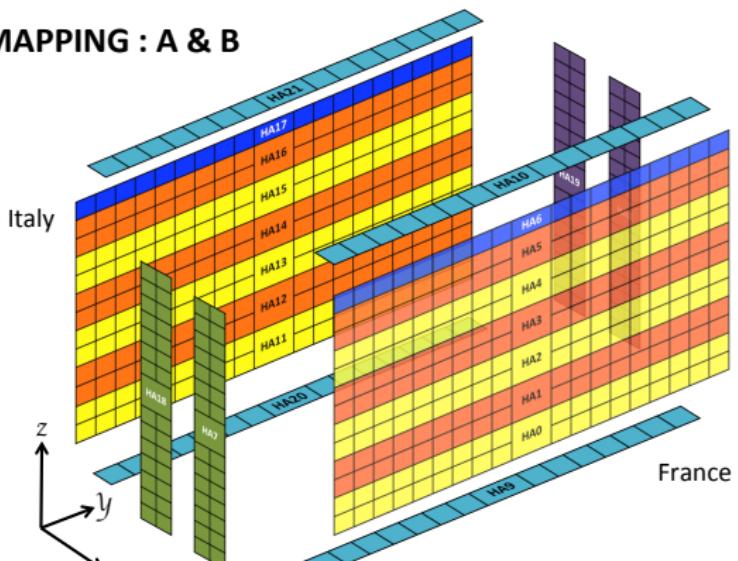
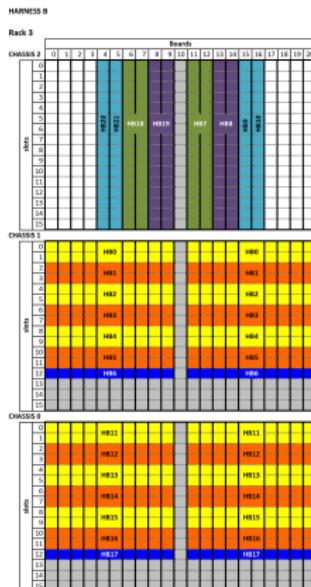
Internal harnesses still under test (grounding and extra 5" capacitor)



Signal harnesses mapping

22 harnesses + 2 spares to be built

SIGNAL HARNESSES MAPPING : A & B



Signal harnesses

The signal Mate-n-lok pins used at the LSM are not fine

The multi-channel patch-panel connector showed cross-talk (DocDB 3773)

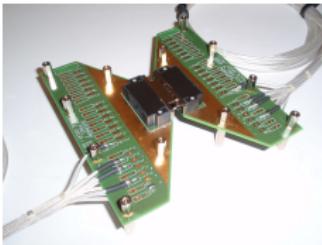
External signal harnesses of 20 channels (+ 1 spare ?):

- ▶ MCX male connector on the Wavecatcher FEB board side
- ▶ M17/93 RG 178 natural 2.9 mm
- ▶ MCX male connector on the patch panel side

Internal HV harnesses of 31 channels:

- ▶ MCX female jack connector on the patch panel side
- ▶ M17/93 RG 178 natural 2.9 mm
- ▶ Souriau pins instead of Mate-n-lok pins

No issues expected for cables production will start after HV harnesses



Calorimeter wall cabling

Routing along the wall in line alternating HV and signal lines

The weight of the cables will be important → need to add a support



Internal cable lengths

Not final numbers: need to be validated

Tableau des longueurs de cable HT du patch panel au PMT

| 115 | 145 | 175 | 205 | 235 | 265 | 295 | 325 | 355 | 385 | 415 | 445 | 475 | 505 | 535 | 565 | 595 | 625 | 655 | 685 | |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 1230 | 1260 | 1290 | 1320 | 1350 | 365 |
| 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 1230 | 1260 | 1290 | 1320 | 335 |
| 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 1230 | 1260 | 1290 | 305 |
| 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 1230 | 1260 | 275 |
| 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 1230 | 245 |
| 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 1200 | 215 |
| 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 1170 | 185 |
| 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 1140 | 155 |
| 540 | 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 1110 | 125 |
| 510 | 540 | 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 1080 | 95 |
| 480 | 510 | 540 | 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 1050 | 65 |
| 450 | 480 | 510 | 540 | 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 1020 | 35 |
| 420 | 450 | 480 | 510 | 540 | 570 | 600 | 630 | 660 | 690 | 720 | 750 | 780 | 810 | 840 | 870 | 900 | 930 | 960 | 990 | 5 |

Toutes les longueurs sont données en cm

Pour les cables signaux rajouter 20 cm par longueur

Cable lengths and routing for the tracker PMTs needed

Still to order

- ▶ 720 MCX male connectors ~ 1.6 k€ 1-2 months delivery
- ▶ 720 MCX female connectors ~ 2.3 k€ available 3/04/2018
- ▶ Souriau pins replacing Mate-n-lok (already ordered ?)
- ▶ New cable winding machine ~ 1 k€ (1/2 for SuperNEMO)
- ▶ Capacitors for 272 5" PMTs + radiopurity selection