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Addressing of the HVsectors of the LAr Calorimeters

M. Mazzanti, G. F. Tartarelli

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The purpose of this note is to specify an addressing scheme for the high-voltage regions of all the liquid argon calorimeters. The main usage of this scheme will be done in the DCS control program of the high voltage. In case of need to operate on a single HV region or in case of failure, the affected sector will be communicated to the operator using this scheme. The scheme might be useful also to other programs (like offline programs).

The scheme consists of a (minimal) set of number and strings that univocally identifies one HV sector.

Requirements guiding the choice of the proposed scheme:

1. The scheme should be simple and straightforward so that the operator can quickly realize where a potential problem is.
2. It should be as close as possible to the one used during assembly of the detectors so that no further translation is needed to locate the region concerned.
3. It should have little or no redundancy. Moreover, a subset of the numbers used should be meaningful, i.e. should identify a larger calorimeter region.
4. It should be easy to implement in PVSSII (i.e. it should correspond to a datapoint) and in a relational database (table).
5. It should be the same for all calorimeters with no or little difference.
6. It should be compatible with what the offline uses or plans to use.

The proposed scheme will be the one used by the PVSSII HV control program with respect to the outside world (visualization, offline storage, …): internally the program will keep another scheme. The internal scheme will be hardware oriented and described in term of the high voltage modules (Iseg modules, not calorimeter modules).

Description of the variables

Each HV sector is identified by 6 (or less) numbers or strings. Their meaning depends on the type of detector.

Electromagnetic Barrel Calorimeter

In this scheme each HV region is identified by the following variables:

Det: It's the name of the detector: EMB

Mod: It's the module number. There are 16 modules along ϕ in each wheel: C00 to C15 for wheel C and A00 to A15 for wheel A. Wheel "C" is also known as wheel "P" and wheel "A" as wheel "M".

ϕ_s: corresponds to the feedthrough number: 0 or –1. Which is a ϕ subdivion in two of each module.

η_s: the η sector. There are 7 eta sectors: S1 to S7

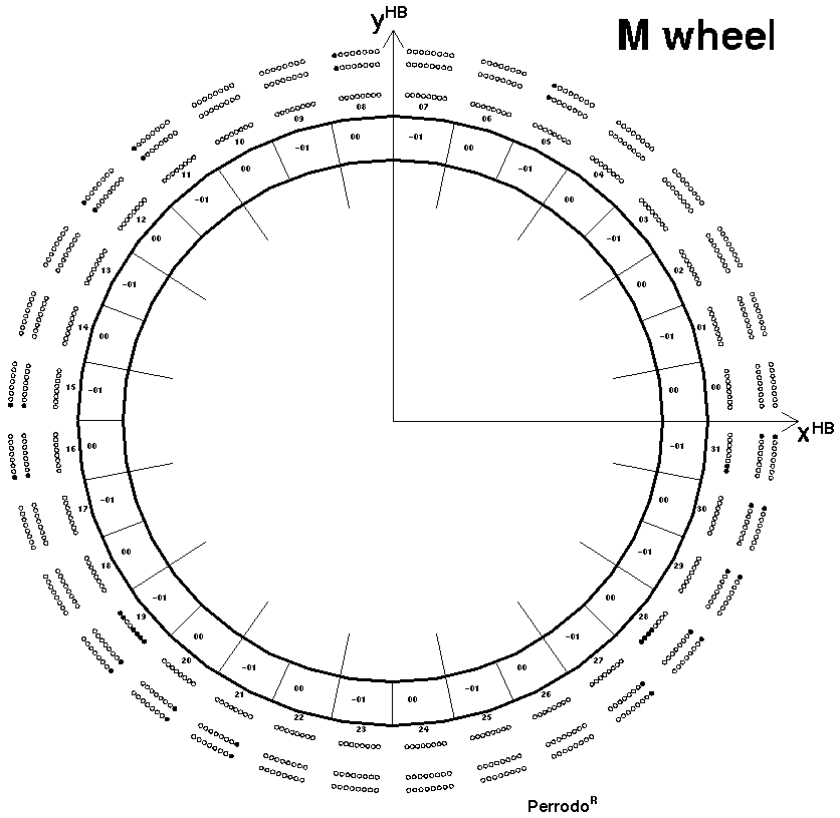
Gap: the Lar semigaps (lower or upper): L or H

ElectrodeList: it is a string that specifies which of the 32 electrodes has been connected to this HV line. Nominally there are 32 electrodes in each HV sectors but in some cases some electrodes have been isolated on a dedicated HV line. For example "0>31–24" means all 32 electrodes except electrode in gap 24 which is on a different line.

For example (EMB, A00, –1, S1, L, 0>31–24) addresses module M00, feedthrough –1, sector 1, low ϕ, and the 31 semigaps (all but gap 24) that belong to the same HV line. Gap 24 will be addressed as (EMB, A00, –1, S1, L, 24).

This scheme has the advantage that it is very similar to what has been used during assembly. The first two numbers univocally identify a module. The following two numbers are a sort of (ϕ,η) coordinate inside the selected module. These four numbers, together with the Gap number, identify univocally half gaps of the $\Delta\eta x\Delta\phi$=0.2x0.2 geometrical region of the detector. Then, adding the fifth number (ElectrodeList) one identifies the line(s) –one or more in case of spare channels used – that supply this region of the detector.

This approach has the advantages that it is compact and is not redundant. Another approach, in which every single gap is addressed, would have the disadvantage that many gaps (the majority of the detector) which are fed by the same HV line would be duplicate in the addressing scheme.



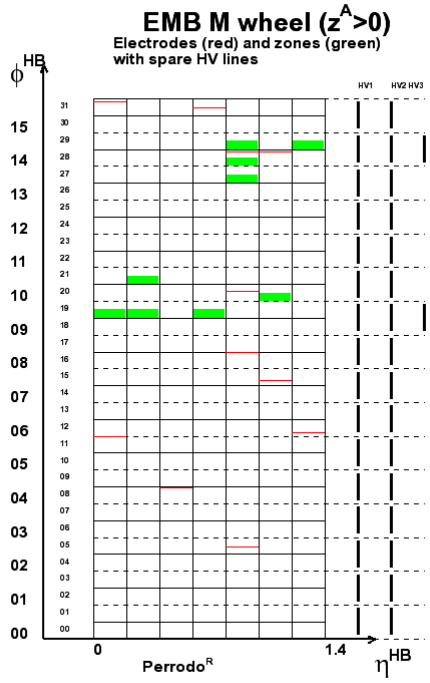


Figure 1 : Barrel electromagnetic (wheel M) sectors

Electromagnetic Endcap Calorimeters

We propose the following scheme for the electromagnetic endcap calorimeters:

Det: It's the name of the detector: EMEC

Mod: It's the module number along phi: C00 to C07 (also called as ECC0, ECC1,…)

ϕ_s: the feedthrough number which is a finer subdivision of the module along phi. It goes from 1 to 4 in the "Outer" wheel and from 1 to 8 in the "Inner" wheel (see picture).

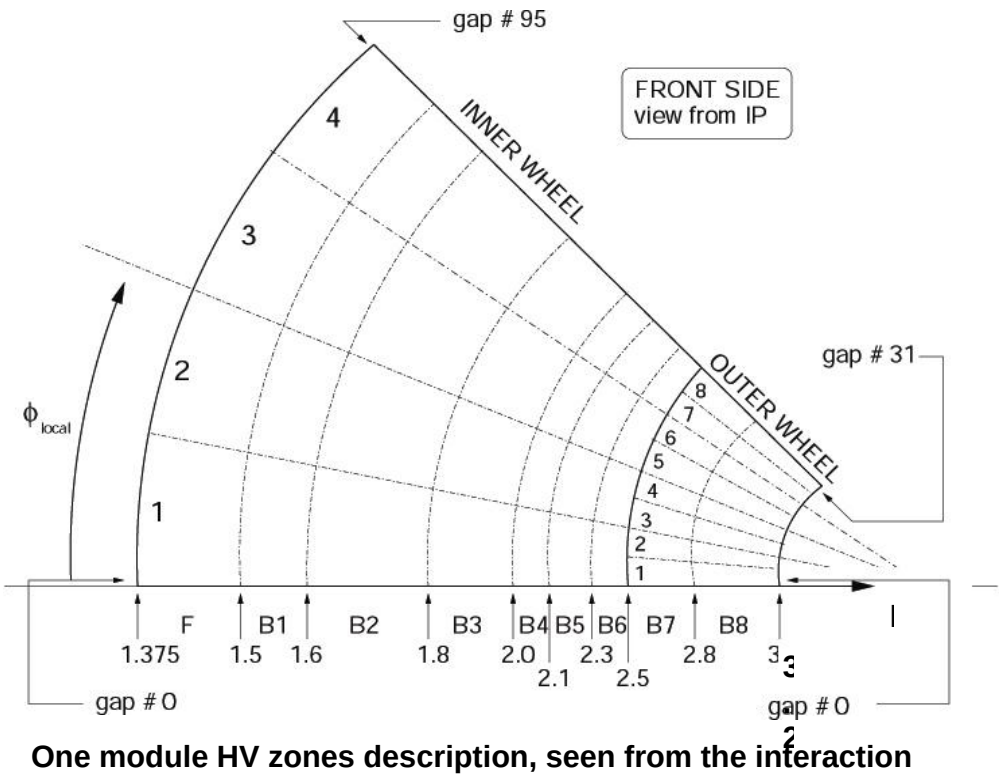
η_s: the η sectors. There are 9 eta sectors called: F, B1, B2, B3, B4, B5 and B6 (outer wheel) and B7, B8 (inner wheel). See picture.

Gap: the Lar semigap (upper or lower): L or H.

ElectrodeList: like the electromagnetic barrel, it is a string that specifies which of the electrodes in the HV sector has been connected to this HV line.

Again (Det, Mod) identifies an endcap module and the couple (ϕ_s,η) identifies the HV sector inside the module. There are 24 electrodes in each of these HV sectors in the outer wheel. However, they are numbered from 0 to 95 (0>23 if ϕ_s=1, 24>47 if ϕ_s=2, etc..) . In the inner wheel there are 32 electrodes in total and 4 electrodes for each HV sector: 0>3 if ϕ_s=1, 4>7 if ϕ_s=2, etc.

The cabling scheme of the inner wheel in H6 is different: there are 4 sectors ϕ_s of 8 electrodes each. To be checked.



One module HV zones description, seen from the interaction point. "Inner" and "outer" are switched by mistake.

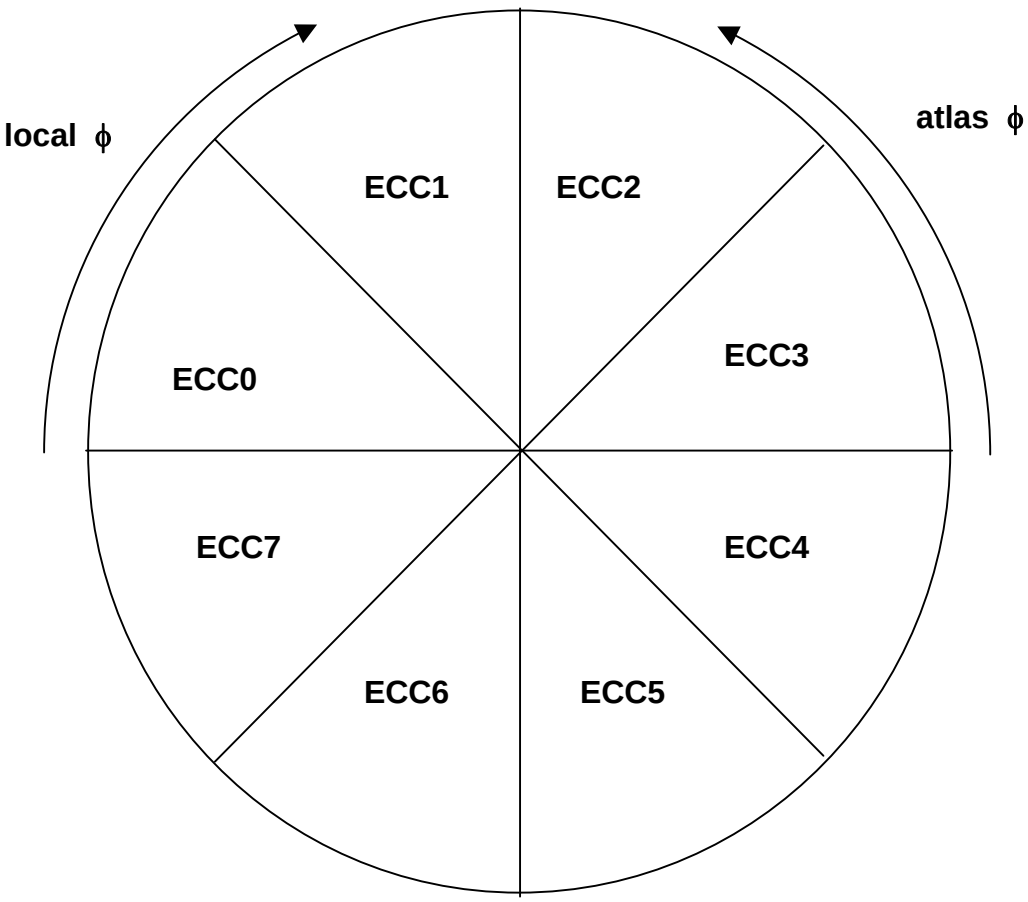


Figure 2 : Electromagnetic endcap numbering scheme

Barrel Presampler

Scheme for the barrel presampler:

Det: It's the name of the detector: EMBPS

Mod: It's the module number along phi: A00 to A31 for wheel A and C00 to C31 for wheel C.

ϕ_s: the feedthrough number: NOT USED, set to 0.

η_s: the η sector. There are 4 sector in eta: S1 to S4.

Gap: the Lar semigap : L or H.

ElectrodeList: set to a dummy string as there is no special cabling done in the PS.

Endcap Presampler

Scheme for the endcap presampler (to be checked):

Det: It's the name of the detector: EMECPS

Mod: ?

ϕ_s: ?

η_s: ?

Gap: ?

ElectrodeList: ?

Hadronic endcap (HEC)

Each hadronic endcap consists of 4 wheels: HEC1, divided in section 1 and section 2 and HEC2, divided in section 3 and 4 (see figure). Section 1 contains 8 cell (1–8), section 2 contains 16 cells (9–24), section 3 contains 8 cells (25–32) and section 4 contains 8 cells (33–40). Each cell is a 8.5 mm Lar gap. Each gap needs four HV lines: two for each side of the central PAD board and one for each of the two EST boards in the gap.

Scheme for the hadronic endcap:

Det: It's the name of the wheel: HEC

Mod: It's the module number along phi: C01 to C32 (A01 to A32)

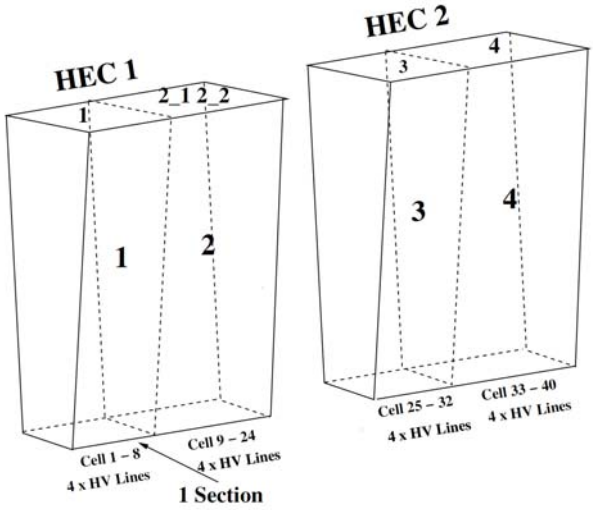
ϕ_s: NOT USED; set to 0

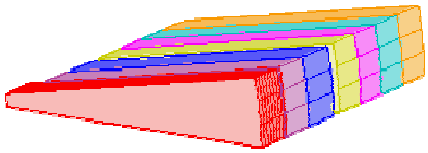
η_s: the four section of the HEC wheel: S1 to S4

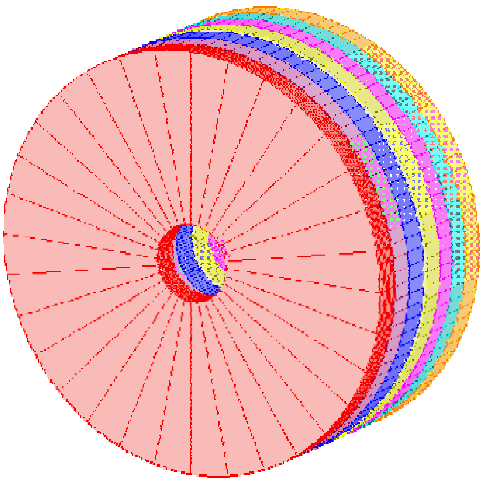
Gap: the 4 HV lines in a gap: PAD1, EST1, EST2, PAD2

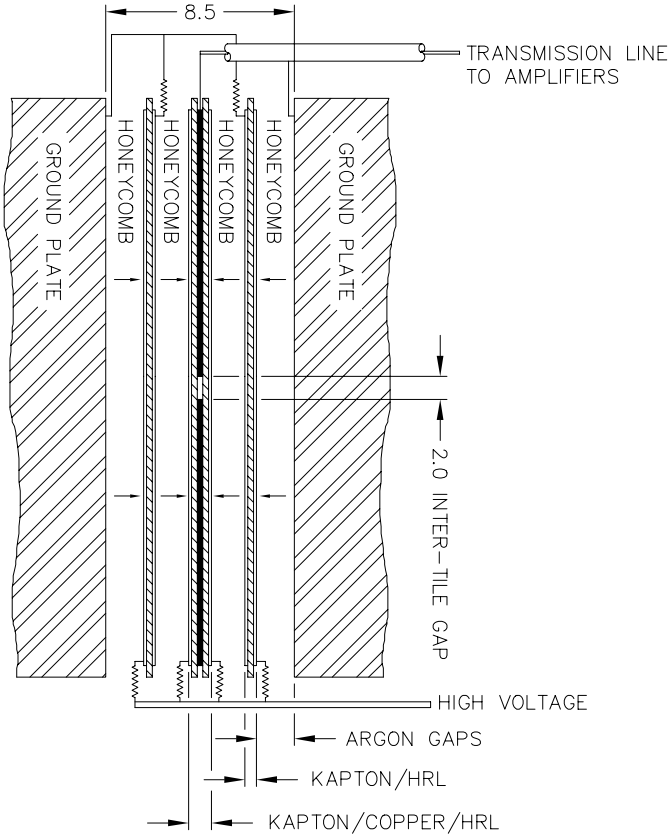
ElectrodeList: the gaps powered by this HV line: 1>8 (S1), 9>24 (S2), 25>32 (S3),…

In H6 there were only 3 sections of the HEC.


HEC 1
1
2_1 2_2
1
2
Cell 1 – 8
4 x HV Lines
Cell 9 – 24
4 x HV Lines
1 Section
HEC 2
3
4
3
4
Cell 25 – 32
4 x HV Lines
Cell 33 – 40
4 x HV Lines






8.5
TRANSMISSION LINE
TO AMPLIFIERS
GROUND PLATE
HONEYCOMB
HONEYCOMB
HONEYCOMB
HONEYCOMB
GROUND PLATE
2.0 INTER-TILE GAP
HIGH VOLTAGE
ARGON GAPS
KAPTON/HRL
KAPTON/COPPER/HRL

Forward calorimeter

Scheme for the barrel presampler: TO BE WRITTEN, NEED INFO

Other attributes of each HV line

The following attributes are added to each HV line, after the geographical description:

N_{ele}: It is the total number of electrodes powered by this HV line.

V_{nom}: It's the nominal voltage for this HV line.

V_{max}: It's the maximum voltage that can be applied to this line.

F_1: It's a flag that tells if the channel is good or bad. It is the final quality flag for ATLAS

F_2: It's another flag that tells the quality of the channel. It is a temporary flag used for testing.

The other variables are for online use only.

References

1. P. Perrodo, Frame and numbering definitions for the ATLAS electromagnetic barrel calorimeter, ATL-AB-EN-0013.
2. P. Perrodo et al., Cabling procedure for the ATLAS EMB modules, ATL-AB-EN-0014.
3. EMEC info and figures from Cedric Cerna.