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CSC Strip, Wire, Chamber, and Electronics Conventions

R. Breedon, T. Cox, W. Ko
University of California, Davis, USA
J. Hauser[1], M. von der Mey
University of California, Los Angeles, USA
N. Bondar, T. Ferguson, I. Vorobiev
Carnegie Mellon University, Pittsburgh, USA
V. Karjavin, S. Khabarov
JINR,Dubna, Russia
D. Acosta, A. Madorsky, G. Mitselmakher, A. Korytov
University of Florida, Gainesville, USA
G. Apollinari, F. Borcherding, F. Geurts, O. Prokofiev, S. Lusin
FNAL, Batavia, USA
B. Bylsma, S. Durkin, J. Gilmore, T.Y. Ling
Ohio State University, Columbus, USA
M. Matveev, P. Padley, A. Tumanov
Rice University, Houston, USA
A. Golyash, L. Uvarov
PNPI, St. Petersburg
R. Loveless
University of Wisconsin, Madison, USA

Abstract

We present a labeling scheme for the endcap muon cathode strip chambers, including the order of strips, wire groups and layers within a chamber, as well as chambers within a trigger sector and sectors within a station. Basic information is also included about the

configuration of the peripheral crates of electronics and the cabling of chambers to electronics.

[1]Present contact author: hauser@physics.ucla.edu

Table of Contents

Introduction

This note serves a number of purposes:

- A consistent labeling scheme is given for the CSC muon stations (ME1/1, ME1/2, etc.).
- A finer-grained numbering scheme is given for CSC strips, wires, chambers positions in ϕ, etc.
- Trigger sectors are described.
- Peripheral crate positions and numbering are described.
- Slots within the peripheral crates are described.

The note also contains other important information about the correspondence between chambers, on-chamber electronics, and the position of readout and trigger electronics within "peripheral crates" mounted around the endcap iron disks.

Regarding numbering: the CSC community has decided to describe the counting of integer numbers as starting from 1, not starting from zero as is common particular for electronics. For instance, the wire group or strip number reported by electronics in the raw data stream will, in general, start from zero, and the number 1 will need to be added in software before conforming exactly to the numbers in this document. This issue can be addressed on a case-by-case basis.

Layout of CSC Chambers in CMS

The CMS detector lies on the North side of the LHC ring. The LHC x-axis (ϕ=0°) points toward the center of the ring (South), while the y-axis is vertical and to complete the right-handed coordinate system, the z-axis points West. Therefore, the West (Jura direction) endcap is at $+z$ and $+\eta$ (rapidity), while the East (Saleve direction) endcap is at $-z$ and $-\eta$, as shown in Figure 1. In the surface hall SX5 and underground cavern UX5, the side of CMS that sits closest to the access shaft is the $+z$ detector end.

As viewed from the interaction point (IP), ϕ increases in the conventional way of drawing, i.e. counterclockwise for the $-z$ endcap only, but ϕ increases *clockwise* for the $+z$ endcap.

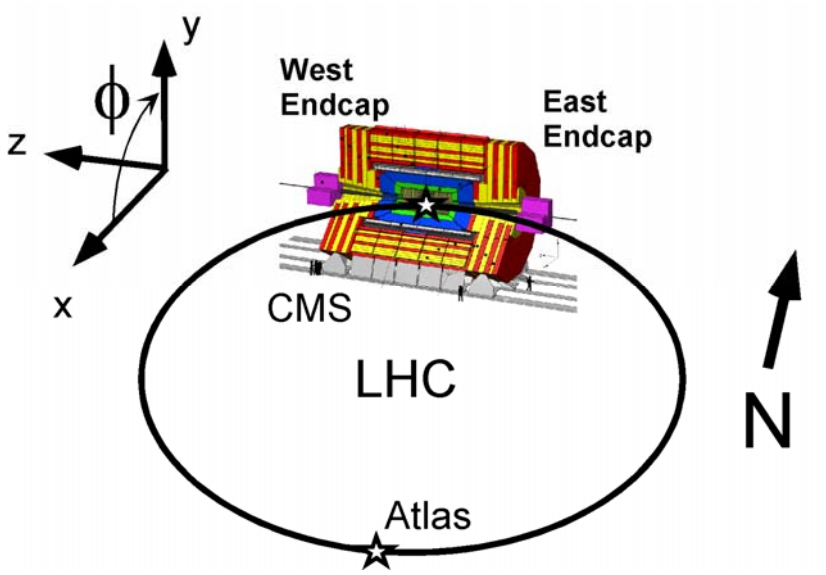


Figure 1. Overall CMS coordinate system

Stations 1 and 2 CSC chambers are mounted on the endcap iron disks on the sides closest to the IP. Conversely, in stations 3 and 4, chambers are mounted on the iron disks on the sides away from the IP. This is shown in `Figure 2`, which is similar to Figure 4.6.3 in the CMS Muon TDR.

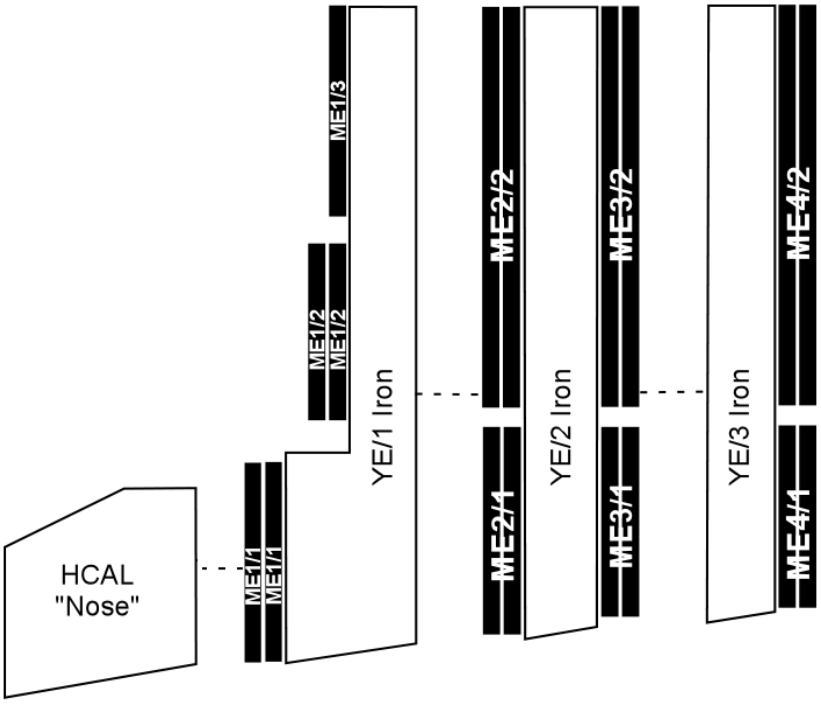


Figure 2. An r-z cross-section of the endcap muon system, showing the sides of the iron disks on which the various types of CSC chambers are mounted. (N.B. ME4/2 does not at present exist but might be built in a CMS upgrade.)

The chambers are named as ME<+->/<station>/<ring>/<phi index> :

- <+-> refers to + z or $-z$ endcap.
- The station index (1-4) refers to the depth of muon penetration.
- The ring index refers to the inner→outer radius, running 1-3 in station 1 and running 1-2 in stations 2, 3, and 4. In software, "ring 4" often refers to the tiny inner section of ME1/1 that has strips split from the ME1/1 outer section and covers roughly $2.1<|\eta|<2.5$.
- The phi index obviously runs from 1-18 for 20^o chambers and 1-36 for 10^o chambers.

For example ME+2/1/1…ME+2/1/18 are chamber names for all of the ME2/1 type chambers in the $+z$ (Jura direction) endcap.

Note that chamber phi index=1 does not mean that the chamber is centered on the ϕ=0° i.e. x-axis. In the endcap muon system, there are 10° and 20° chambers. Every ring of chambers starts in ϕ with a chamber that has an edge at approximately -5°. For 10° chamber types such as those in ME1, the first chamber spans approximately $-5°<\phi<5°$. In 20° chamber types such as ME2/1, ME3/1, and ME4/1, the first chamber spans approximately $-5°<\phi<15°$.

Starting at ϕ = -5°, the phi index of each chamber increases from 1 to 18 (for the 20° chambers) and 1 to 36 (for the 10° chambers) with increasing ϕ. In the positive η endcap, the chamber phi index increases *clockwise* as viewed from the IP; in the negative η endcap the chamber phi index increases *counterclockwise* as viewed from the IP.

Note that all chambers overlap slightly (5.0 strips) with neighbors in ϕ except in ME1/3 where there is no overlap. Note also that overlapping chambers with odd phi indices (1, 3, 5,…) are mounted against the iron while chambers with even phi indices (2, 4, 6,…) are mounted further from the iron disks on which they are mounted. This is true for both endcaps. For ME1/1, where such a statement is more ambiguous, we may say that the chambers with odd phi indices are mounted further from the IP than the chambers with even phi indices.

There are other ways to refer to particular CSC chambers; such as (described below) by trigger sector and chamber number within a trigger sector, or CSCID within a particular peripheral crate of electronics.

Strips, Wires, and Layers for Single Chambers

Non-ME1/1 Case

The CSC chambers are constructed as trapezoidal objects, and during assembly they lay on tables so that electronics can be mounted on top. In this configuration, the top plane of wires and strips (*i.e.* those closest to the electronics) is layer 1, and the bottom plane is layer 6, as shown in Figure 3. ME1/1 is a special case in this respect and is described in detail below. Wires are strung between the sides of the trapezoidal chambers, and wire group number always increases from inner radius to outer radius (1:*n*). Strips run from inner radius to outer radius at constant ϕ, and strip number increases from left to right (1:*n*) when one looks from the small "inner" end toward the large "outer" end of the chamber,

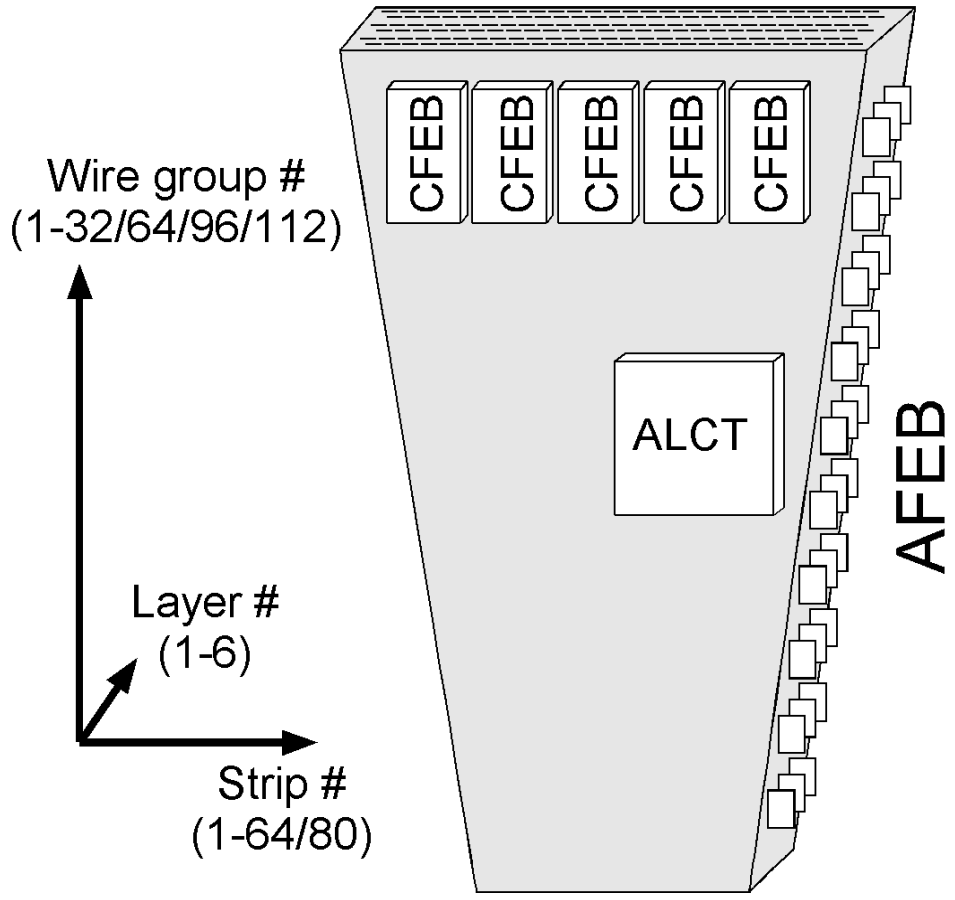


Figure 3. A view of a (non-ME1/1) CSC chamber with electronics on top and the corresponding definition of local CSC coordinates. (* Note that the number of wire groups is 1-32/48/64/96/112. Awaiting figure update using Canvas software)**

We can conclude that in the West (positive z, positive η) endcap, strip numbers in stations 1 and 2 are in increasing ϕ order, and strip numbers in stations 3 and 4 are in decreasing ϕ order. In the East (negative z, negative η) endcap, strip numbers in stations 1 and 2 are in decreasing ϕ order, while strip numbers in stations 3 and 4 are in increasing ϕ order. These statements are also true in ME1/1, although the reasons are different. This is summarized in Table 1.

Endcap	Station	Φ direction of strips ($1 \rightarrow n$)
$+z$ (West)	1	↑ (increasing)
"	2	↑
"	3	↓
"	4	↓
$-z$ (East)	1	↓
"	2	↓
"	3	↑
"	4	↑

Table 1. Direction in ϕ of increasing CSC strip number.

ME1/1 Case Only

The ME1/1 chambers differ from all other chambers in that within a single station the electronics are mounted facing alternately toward and away from the IP. For the chambers centered at ϕ=0°, 10°, 20°, etc.; the electronics face towards, away, towards etc. the IP, respectively.

ME1/1 is divided into two chambers in η, labeled ME1/1a inner part (by radius) and ME1/1b outer part. ME1/1b has 64 strips while ME1/1a has 48 strips. The 48 strips of ME1/1a are ganged 3:1 into 16 readout channels in a fashion that retains fine-grained position information, e.g. strips 1, 17, and 33 are ganged together into the first readout channel, and strips 16, 32, and 48 are ganged together into the last, 16th readout channel.

There are four versions of ALCT firmware depending both on chamber position in West or East Endcap and on-chamber electronics location away or towards the interaction region.
To summarize, the local coordinate definitions in the $+z$ (West) ME1/1 chambers are as follows:

- Wire numbers increase from inner to outer radius (same as other chambers)
- Strip numbers increase from 1-64 in *increasing* ϕ direction for ME1/1b.

- Strip numbers increase from 1-48 in *decreasing* ϕ direction for ME1/1a.
- Layer numbers increase going away from the IP.

In the –z (East) endcap ME1/1 chambers:

- Wire numbers increase from inner to outer radius (same as other chambers)
- Strip numbers increase from 1-64 in *increasing* ϕ direction for ME1/1b.
- Strip numbers increase from 1-48 in *decreasing* ϕ direction for ME1/1a.
- Layer numbers increase going away from the IP.

These points are illustrated in Figure 4.

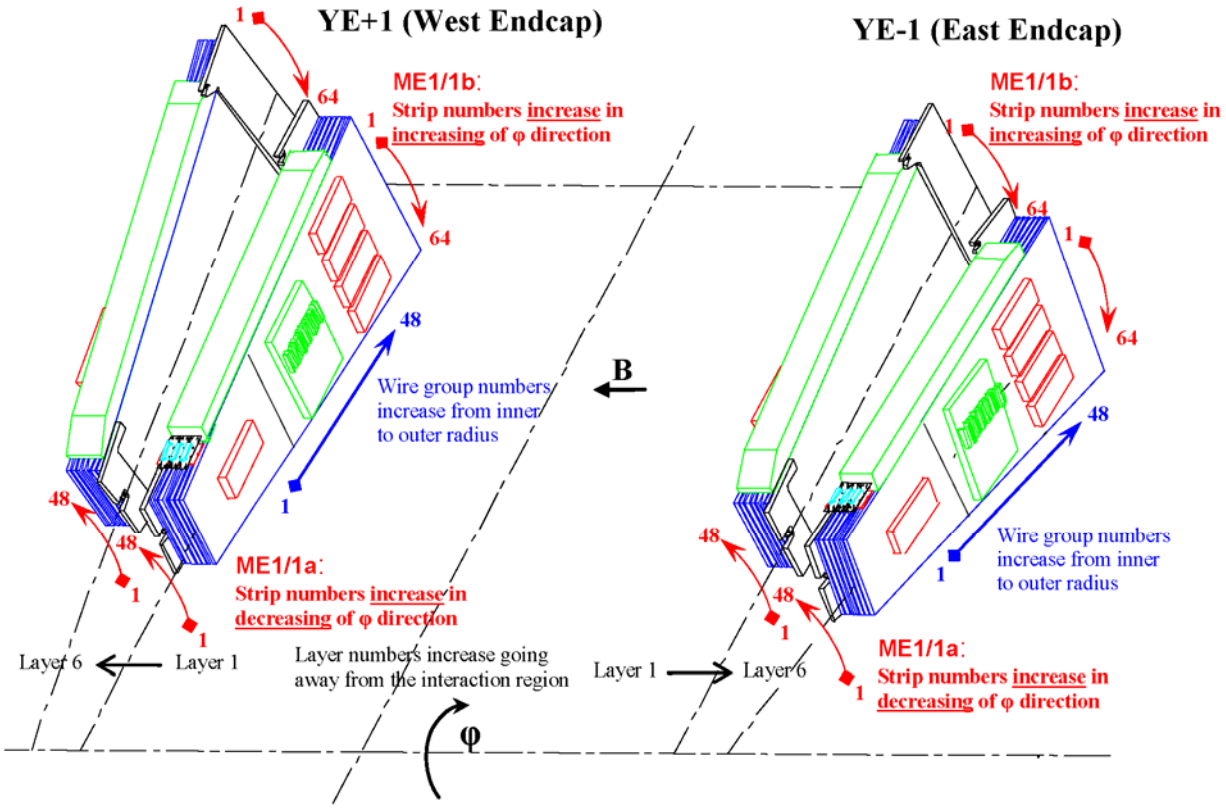


Figure 4. Orientation of layers and strips in the specific case of ME1/1 chambers (font problems: f=ϕ).

The Orientation of Strip Staggering

The CSC chambers contain strips milled on every cathode panel. In all types of chambers except ME1/1, strip 1 is indented by ½-strip in layers 1 (top), 3, and 5; with respect to strip 1 in layers 2, 4, and 6 (bottom), as shown in Figure 5. In ME1/1, there is no strip staggering.

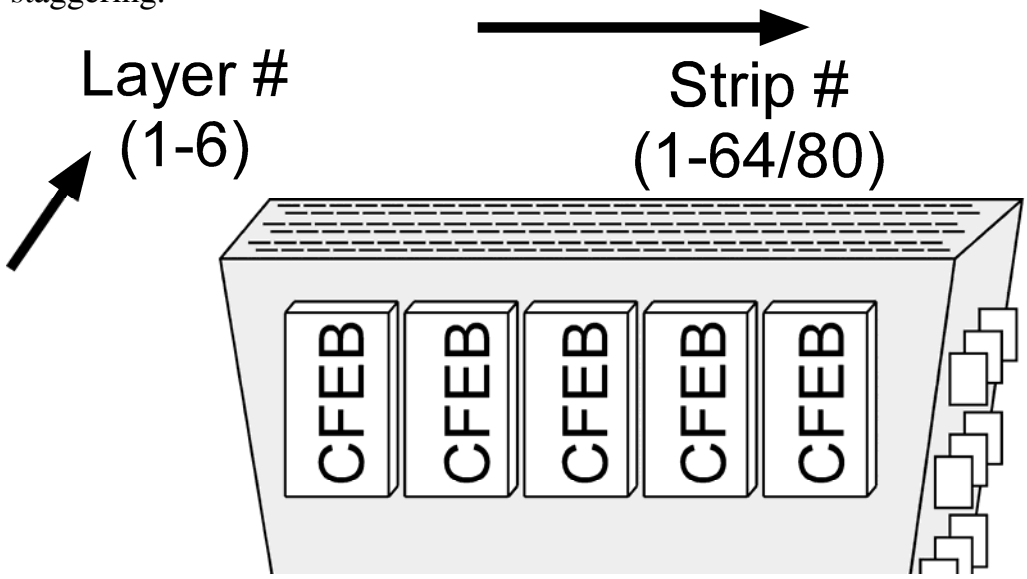


Figure 5. Staggering of strips in (non-ME1/1) CSC chambers. The first strip is indented by ½ strip in layers 1, 3, and 5 with respect to layers 2, 4, and 6.

The Direction of Muon Bending

The magnetic field points along the $+z$-axis. The bending direction of endcap muons reverses along the muon trajectory: initially, the muon crosses the $+z$ solenoidal field lines, but around station 1 the magnetic field lines diverge in the $+r$ direction and the muon crosses the field lines in the opposite direction. From Figure 1, one can therefore tell that the positive muons traveling in either direction (East or West) will first bend in the $-\phi$ direction and then reverse at some point toward the $+\phi$ direction in traveling through the return flux of the muon system.

CSC Trigger Sectors

CSC Trigger Sector Numbers

For purposes of triggering, the first chamber of the first 60º muon sector starts at ϕ=15°. This location is determined by the first ϕ value at which chamber edges in the endcap line up with chamber edges in the barrel muon system (see Figure 6).

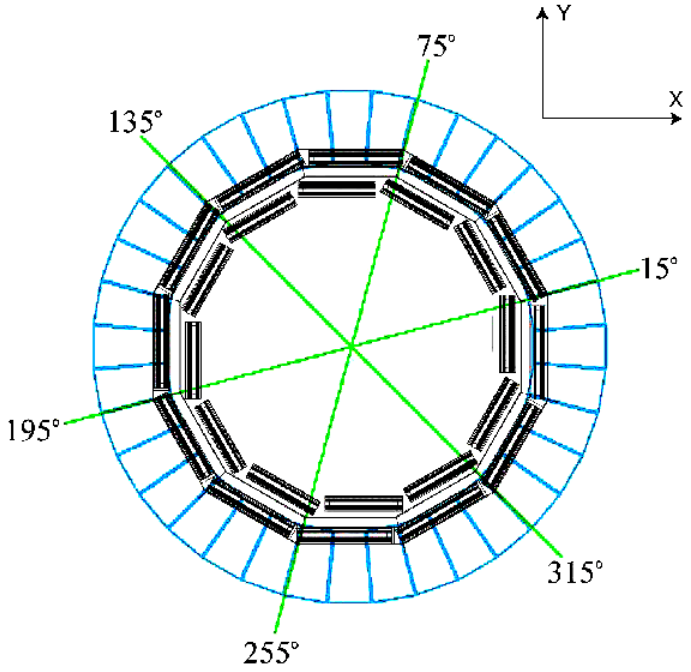


Figure 6. An *r*-ϕ cross-section view of the barrel muon system, with the positions of the outer ring of endcap muon chambers superimposed (looking East, or towards the –*z* endcap). This diagram shows the edges of the 60º trigger sectors (ME2, ME3, and ME4) and the position of the outer (large) chambers.

Note that a trigger sector has the same sense of ϕ in both endcaps. Therefore, in the $+\eta$ endcap the sector number increases clockwise as viewed from the IP, while in the $-\eta$ endcap the sector number increases counterclockwise as viewed from the IP, as shown in Figure 7.

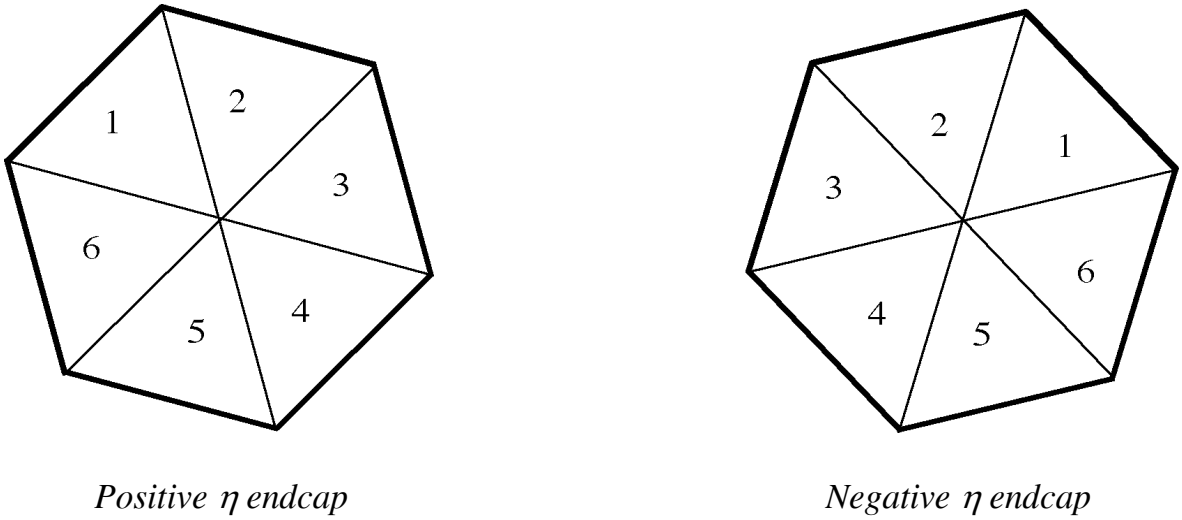


Figure 7. Endcap trigger sector numbering, as viewed from the IP.

Numbering of Chambers Within a CSC Trigger Sector

Each trigger sector in stations ME2, ME3, and ME4 consists of three 20° chambers and six 10° chambers. They are numbered as shown in Figure 8, as seen from the IP.

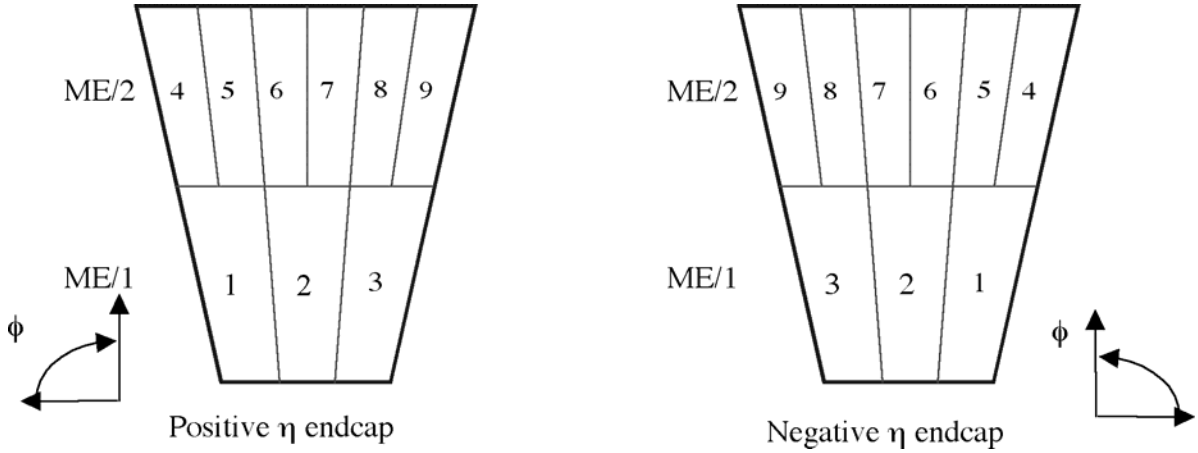


Figure 8. CSC chamber numbering in ME2, ME3, and ME4 within a 60-degree trigger sector, as seen from the IP. (ME4/2 chambers are a potential future upgrade.)

In station ME1 we have two 30° subsectors in each 60° sector. Each 30° subsector consists of nine 10° chambers. Note that cathode strips in ME1/1 are divided into inner-radius ME1/1a and outer-radius ME1/1b regions. As previously described, ME1/1a is read out, but it is not included in the CSC trigger. We number the chambers and sub-chambers in each 30° ME1 subsector from 1 to 12 (again, viewing from the IP) as shown in Figure 9.

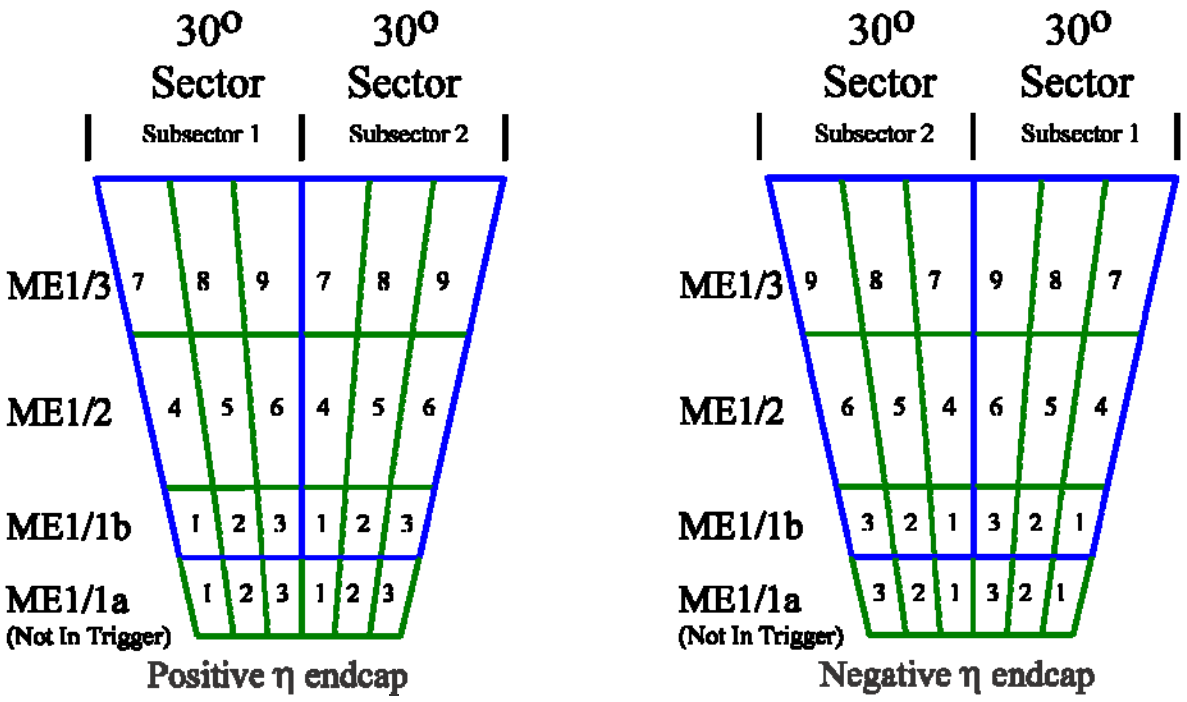


Figure 9. Numbering of CSC chambers within ME1 trigger sectors, as viewed from the IP.

Definitions for Peripheral Crate Electronics

Peripheral Crate Numbers

why we need this?

One peripheral crate of electronics contains one 60° trigger sector of electronics in ME2, ME3, and ME4. However, in ME1, one peripheral crate contains one 30° trigger subsector of electronics. The peripheral crates are in racks placed as close as possible to the chambers to which they are connected.

Peripheral crates are identified as Crate (or VME) <station>/<ϕ index>. Since this is a non-sequential scheme, we may call this the "**peripheral crate name**", to be distinguished from "peripheral crate number" which is a different association that goes sequentially 1-60 as explained later.

The peripheral crates ϕ indexes are the same as the trigger sectors in CSC stations ME2, ME3, and ME4, i.e. the crate with ϕ index 1 covers 15°<ϕ<75°, crate 2 covers 75°<ϕ<135°, and so on. This is shown in `Figure 10` below. To give an example, peripheral crates in ME2 (+ endcap) are denoted VME+2/1,…, VME+2/6.

In station 1, however, in order to match the RPC system, peripheral crate ϕ index=1 is defined as the one covering the ϕ range of -15° to 15°. Therefore, in ME1 the first 60°

trigger sector corresponds to peripheral crates with ϕ indices 2 and 3, and the last 60° trigger sector corresponds to peripheral crates with ϕ indices 12 and 1. This is shown in Figure 11 below. To give an example, the peripheral crate names of the ME1 crates in the + endcap are denoted VME+1/1, VME+1/2,…, VME+1/12.

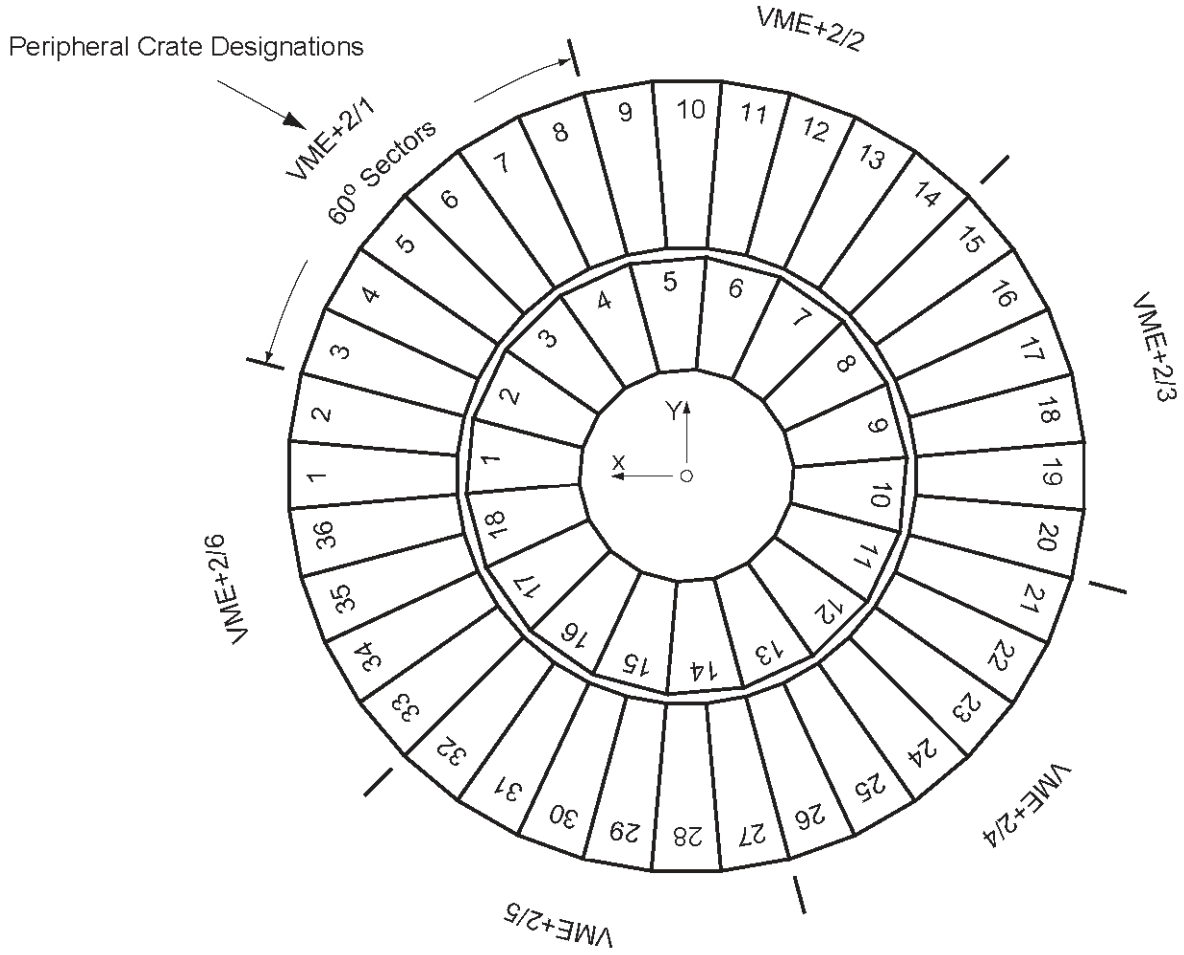


Figure 10. An *r*-ϕ cross-section of the ME2, ME3, and ME4 endcap muon stations viewed from *z*=negative infinity, showing the positions of chambers, trigger sectors, and correspondence to peripheral crate names, denoted as VME<station>/<phi index>. On the +*z* side, this is the same view as *from* the IP, while on the –*z* side, this is a view looking *towards* the IP.

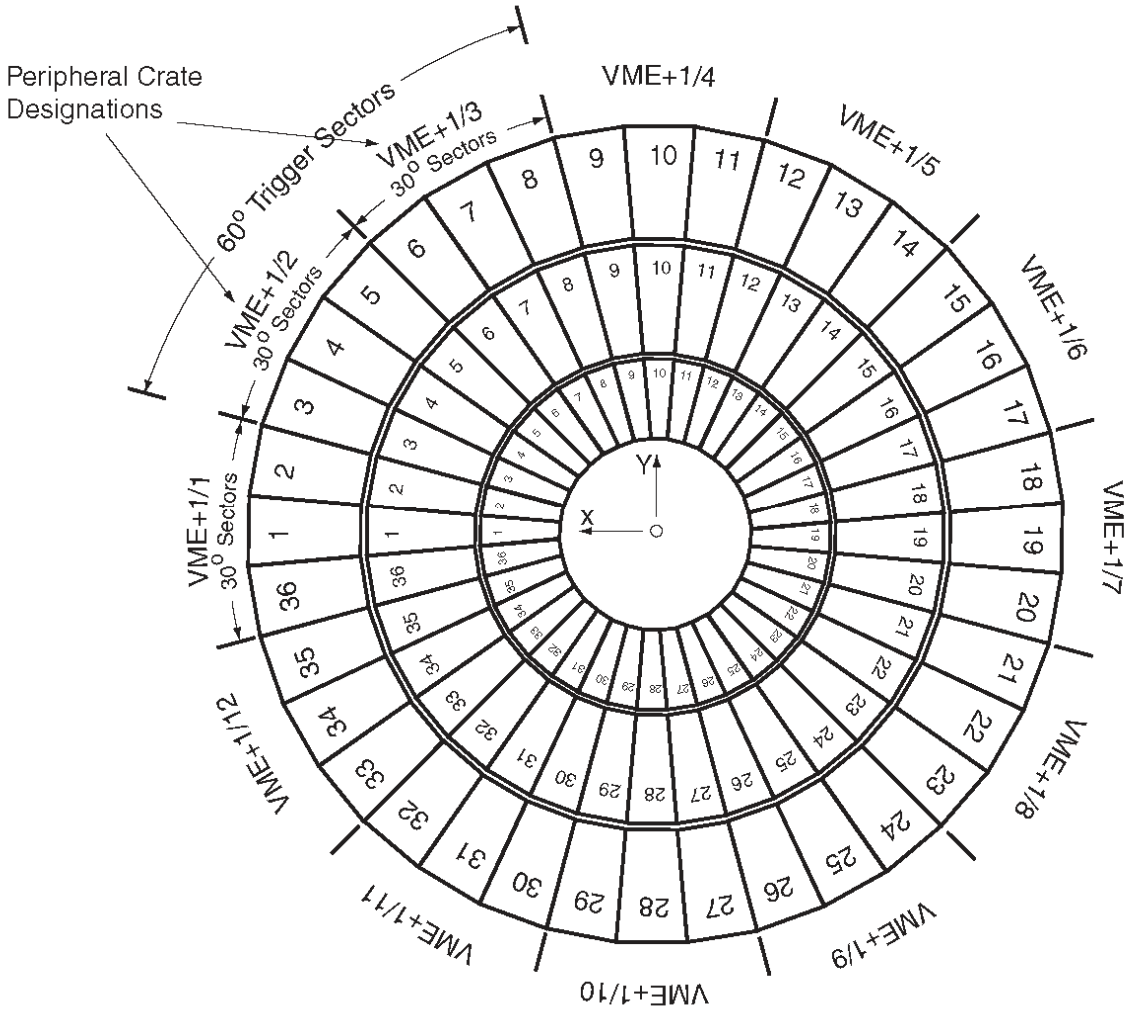


Figure 11. An *r*-ϕ cross-section of the ME1 endcap muon station as viewed from *z*=negative infinity, showing the positions of chambers, trigger sectors, and correspondence to peripheral crate names. On the +*z* side, this is the same view as *from* the IP, while on the –*z* side, this is a view looking *towards* the IP.

Two other well-defined notations for peripheral crates are also used:

- "**Peripheral crate number**": the 1:1 correspondance of MPCs to Sector Processors allows a 6-bit or [5..0] crate number. For this purpose, crates in the +*z* endcap are numbered 1-30, and crates in the -*z* endcap are numbered 31-60 (according to CMS conventions, smaller numbers are generally associated with +*z* side). Crates 1-12 (31-42) are used for ME1, crates 13-18 (43-48) are ME2, crates 19-24 (49-54) are ME3, and crates 25-30 (55-60) are ME4 for the +*z* (-*z*) endcaps, respectively. The crate numbers increase with phi exactly as in the VME+1/1 scheme. This is shown in Table 3. This peripheral crate number is also used in setting crate addresses (hardware switches) on the PCMB boards. This number is in fact the same as an 8-bit **DMB_CRATE** number sent in HEADER2 of the DMB data format.

Peripheral Crate Racks

In stations ME2-4, racks holding 2 peripheral crates are stationed at approximately 60^{o} intervals. Station 4 peripheral crates are located in racks holding only one crate. The positions of the peripheral crates within the racks are described in Table 2 and Table 3. A rack-centric graphical representation of which peripheral crates (referenced by peripheral crate name) is shown in Figure 12.

Peripheral Crate					Chamber Type and Chamber ϕ Index								
	Crate ϕ	Trigger Sector	Rack (+,-)	Position in Rack	ME(+,-)(1)/1			ME(+,-)(1)/2			ME(+,-)(1)/3		
VME(+,-) (1)	1	6	X3(J,V)31	Top	36	1	2	36	1	2	36	1	2
	2	1	X5(U,E)31	Bottom	3	4	5	3	4	5	3	4	5
	3		X5(U,E)31	Top	6	7	8	6	7	8	6	7	8
	4	2	X5(R,L)31	Top	9	10	11	9	10	11	9	10	11
	5		X5(R,L)31	Bottom	12	13	14	12	13	14	12	13	14
	6	3	X3(A,S)31	Top	15	16	17	15	16	17	15	16	17
	7		X3(A,S)31	Bottom	18	19	20	18	19	20	18	19	20
	8	4	X1(R,L)31	Top	21	22	23	21	22	23	21	22	23
	9		X1(R,L)31	Bottom	24	25	26	24	25	26	24	25	26
	10	5	X1(U,E)31	Bottom	27	28	29	27	28	29	27	28	29
	11		X1(U,E)31	Top	30	31	32	30	31	32	30	31	32
	12	6	X3(J,V)31	Bottom	33	34	35	33	34	35	33	34	35
Crate Slot Numbers				TMB	2	4	6	8	10	14	16	18	20
				DMB	3	5	7	9	11	15	17	19	21
	Crate ϕ	Trigger Sector	Rack (+,-)(2,3,4)	Station (2,3,4) Pos. in Rack	ME(+,-)(2,3,4)/1			ME(+,-)(2,3,4)/2					
VME(+,-) (2,3,4)	1	1	X5(U,E)(41,41,51)	(top,bot,bot)	2	3	4	3	4	5	6	7	8
	2	2	X5(R,L)(41,41,51)	(top,bot,bot)	5	6	7	9	10	11	12	13	14
	3	3	(+) X3A(41,41,51)	(top,bot,top)	8	9	10	15	16	17	18	19	20
			(-) X3S(41,41,51)	(bot,top,top)									
	4	4	X1(R,L)(41,41,51)	(bot,top,top)	11	12	13	21	22	23	24	25	26
	5	5	X1(U,E)(41,41,51)	(top,bot,bot)	14	15	16	27	28	29	30	31	32
	6	6	(+) X3J(41,41,51)	(bot,top,bot)	17	18	1	33	34	35	36	1	2
			(-) X3V(41,41,51)	(top,bot,bot)									
Crate Slot Numbers				TMB	2	4	6	8	10	14	16	18	20
				DMB	3	5	7	9	11	15	17	19	21

Table 2. Cross-references between CSC chambers, peripheral racks, peripheral crate ϕ indices, and slots for electronics boards are listed. Rack notation, e.g. X3J31, follows CMS-wide convention. The "X" refers to "on-detector", the "3" labels the height, and so on. This may be viewed using a convenient "Rack Wizard", see https://oraweb.cern.ch/pls/cmsintegration/docs/EMDH.html (N.B. ME4/2 chambers do not currently exist but might be built in the future as part of a CMS detector upgrade).

Trigger Sector	**1**		**2**		**3**		**4**		**5**		**6**	
Crate #	***Bot***	***Top***	***Bot***	***Top***	***Bot***	***Top***	***Bot***	***Top***	***Bot***	***Top***	***Bot***	***Top***
Station 1+	**2**	**3**	**5**	**4**	**7**	**6**	**9**	**8**	**10**	**11**	**12**	**1**
Station 2+		**13**		**14**		**15**	**16**			**17**	**18**	
Station 3+	**19**		**20**		**21**			**22**	**23**			**24**
Station 4+	**25**		**26**			**27**		**28**	**29**		**30**	
Station 1-	**32**	**33**	**35**	**34**	**37**	**36**	**39**	**38**	**40**	**41**	**42**	**31**
Station 2-		**43**		**44**	**45**		**46**			**47**		**48**
Station 3-	**49**		**50**			**51**		**52**	**53**		**54**	
Station 4-	**55**		**56**			**57**		**58**	**59**		**60**	

Table 3. Peripheral crate numbers corresponding to particular trigger sectors and stations in +z and -z endcaps.

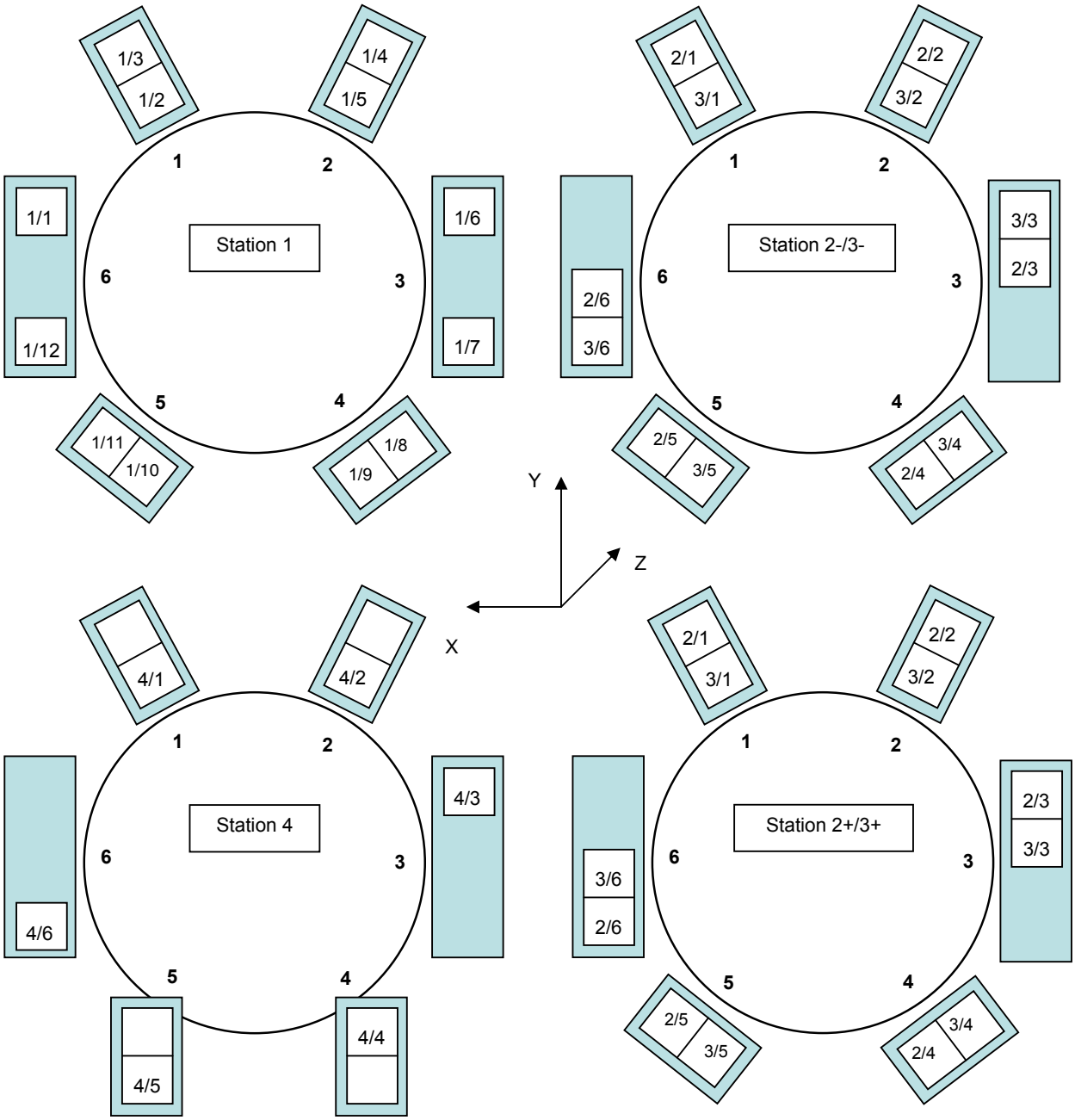


Figure 12. View of the peripheral crate racks, showing which peripheral crates (referenced by crate name) are held in each rack.

Graphical representations of the peripheral crate locations according to peripheral crate number are shown below for the +*z* endcap in Figure 13 and for the -*z* endcap in Figure 14 as viewed from *z*=negative infinity (i.e. *from* the IP for the +*z* endcap and *towards* the IP for the –*z* endcap).

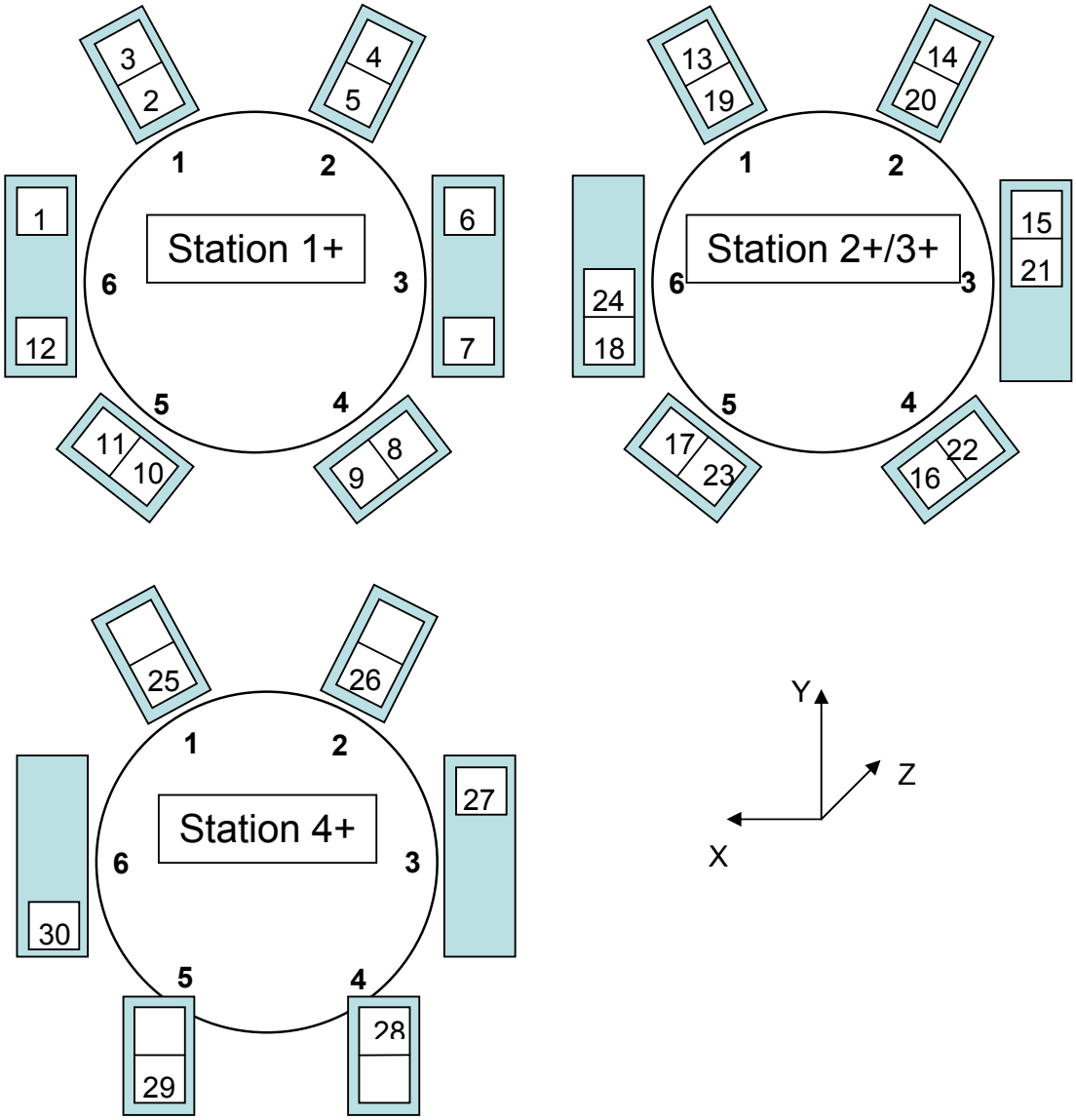


Figure 13 The +z endcap peripheral crate numbers and locations in racks and correspondances to trigger sectors, for station ME1 (upper left), ME2 and ME3 (upper right), and ME4 (lower left).

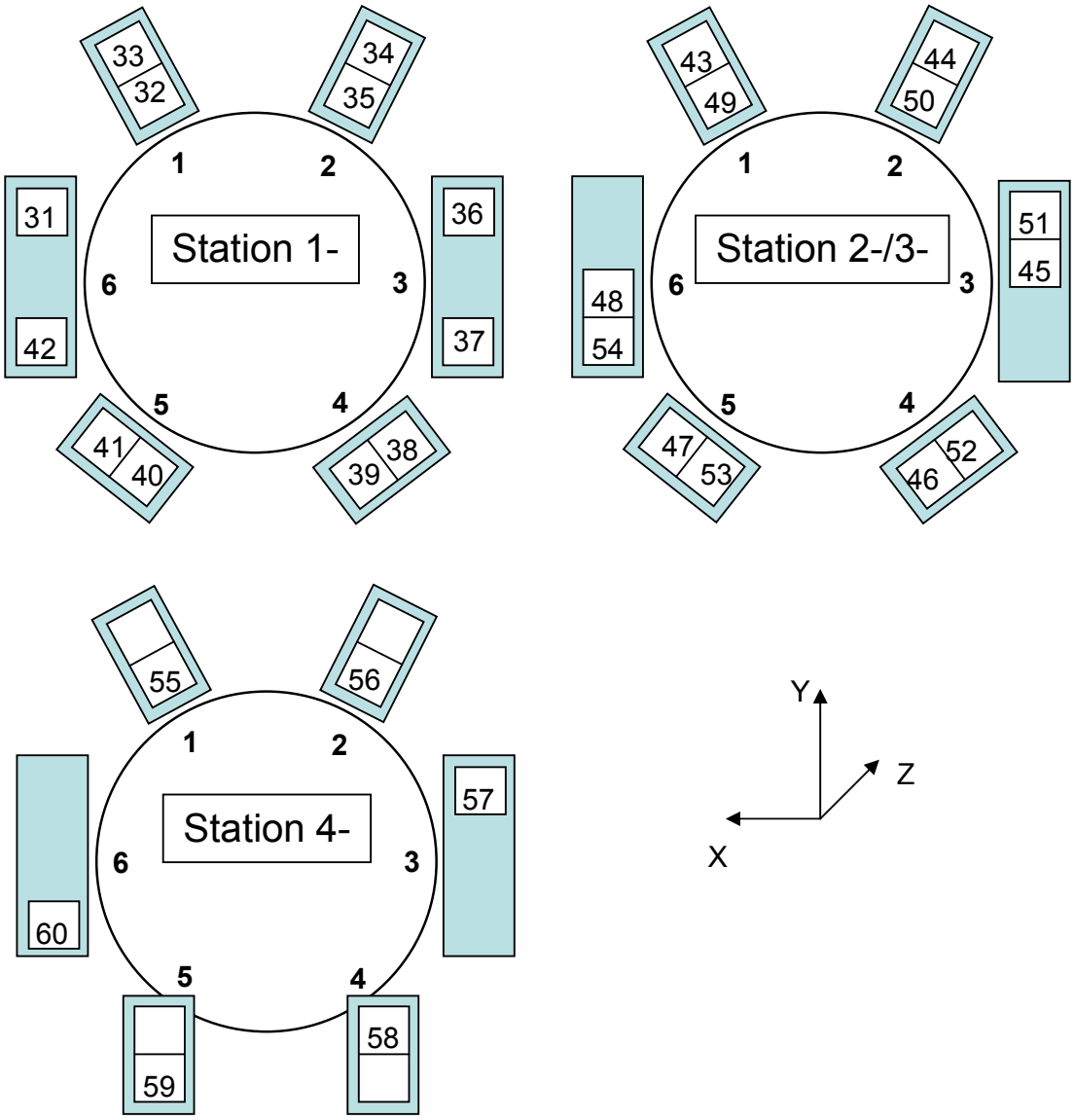


Figure 14 The –*z* endcap peripheral crate numbers and locations in racks and correspondances to trigger sectors, for station ME1 (upper left), ME2 and ME3 (upper right), and ME4 (lower left).

Peripheral Crate Slots, CSCIDs, and DMBIDs:

The 9U VME peripheral crates contain slots 1-21, with slot 1 on the left. Within each peripheral crate, slot 1 is always used for the VME Crate Controller, Slot 12 is for the MPC (Muon Port Card), and Slot 13 for the CCB (Clock and Control Board). All of the remaining slots are used by TMB/DMB (Trigger MotherBoard/Data-acquisition MotherBoard) pairs.

There is one TMB/DMB board pair occupying two slots for each chamber. The order of the TMB/DMB pairs in each peripheral crate from left (slot 1) to right is in order of chamber number within a trigger sector, i.e. from 1 to 9, also known as CSCID. The slot positions also correspond to "DMBIDs" that appear in the offline data stream, which are simply the crate slot of TMB/DMB board pairs divided by 2. The correspondence between CSCIDs, DMBIDs and the trigger sector chamber numbers is listed below:

TMB/DMB Slots	CSCID = Chamber Number in Trigger Sector	DMBID
2/3	1	1
4/5	2	2
6/7	3	3
8/9	4	4
10/11	5	5
14/15	6	7
16/17	7	8
18/19	8	9
20/21	9	10

Table 4. CSC peripheral crate cross-reference between TMB/DMB board slots, CSCIDs, and DMBIDs.

In ME2, ME3, and ME4, the TMB/DMB order corresponds to the ϕ order of chambers, with the TMB/DMB board pairs corresponding to inner-radius chambers (MEn/1) occupying the lower-numbered slots (2/3, 4/5, and 6/7), followed by the TMB/DMB pairs for outer-radius (MEn/2) chambers occupying the higher-numbered slots (8/9, 10/11, 14/15, 16/17, 18/19, 20/21). An example is shown in Figure 15.

An explicit cross-reference between peripheral crate slots and chamber ϕ indices (rather than by CSCID) may be found in Table 2 above, which also lists the relevant rack and trigger sector or 30^{o} sector (in ME1) number.

In ME1, the same pattern is followed for TMB/DMB board pairs in a peripheral crate: ME1/1 chambers occupy the lower-numbered slots (2/3, 4/5, 6/7), ME1/2 chamber

occupy the middle-numbered slots (8/9, 10/11, 14/15), and ME1/3 TMB/DMB board pairs occupy the higher-numbered slots (16/17, 18/19, 20/21). An example is shown in Figure 16.

ME1/1 is a special case in that the chamber is divided into inner-radius ME1/1a strips and outer-radius ME1/1b strips. In each ME1/1 chamber, there are 48 inner ME1/1a strips and 64 outer ME1/1b strips per layer. As previously described, the ME1/1a strips are ganged 3:1 so that there are only 16 readout strips per layer. The ME1/1a and ME1/1b strips are connected to the same TMB/DMB board pair, with the information from ME1/1b strips going to the top 4 front-panel connectors, and the ganged information from ME1/1a strips going to the bottom-most front-panel connector.

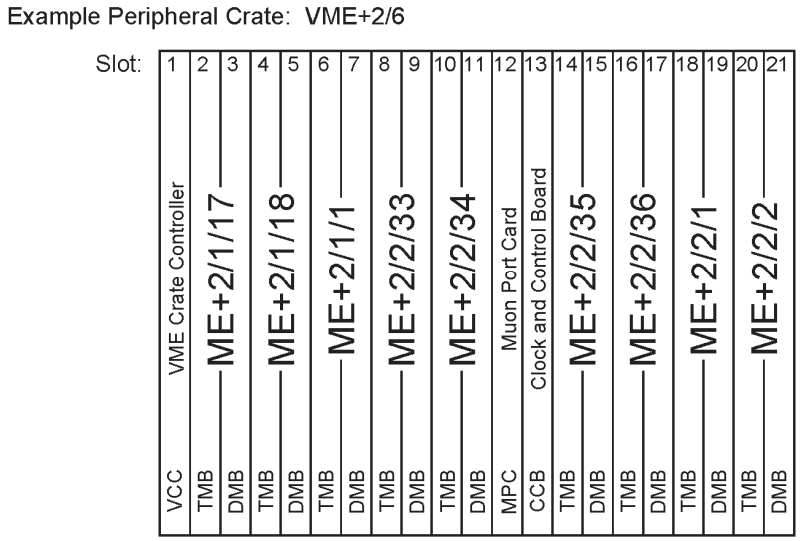


Figure 15. ME2-4 type example of the arrangement of slots in peripheral crates to TMB/DMB board pairs and other modules (CCB, MPC, Controller).

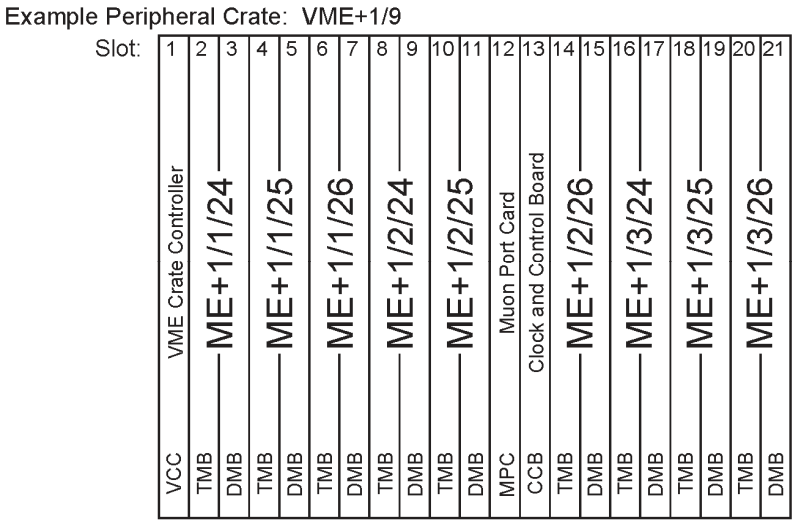


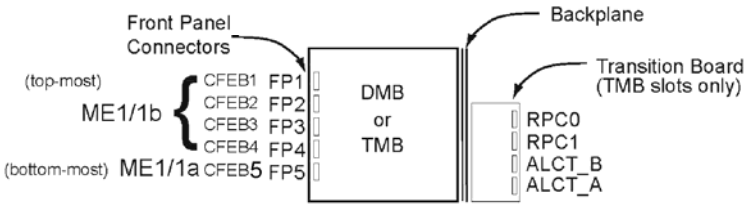
Figure 16. ME1 type example of the arrangement of slots in peripheral crates to TMB/DMB board pairs and other modules (CCB, MPC, Controller) in ME1.

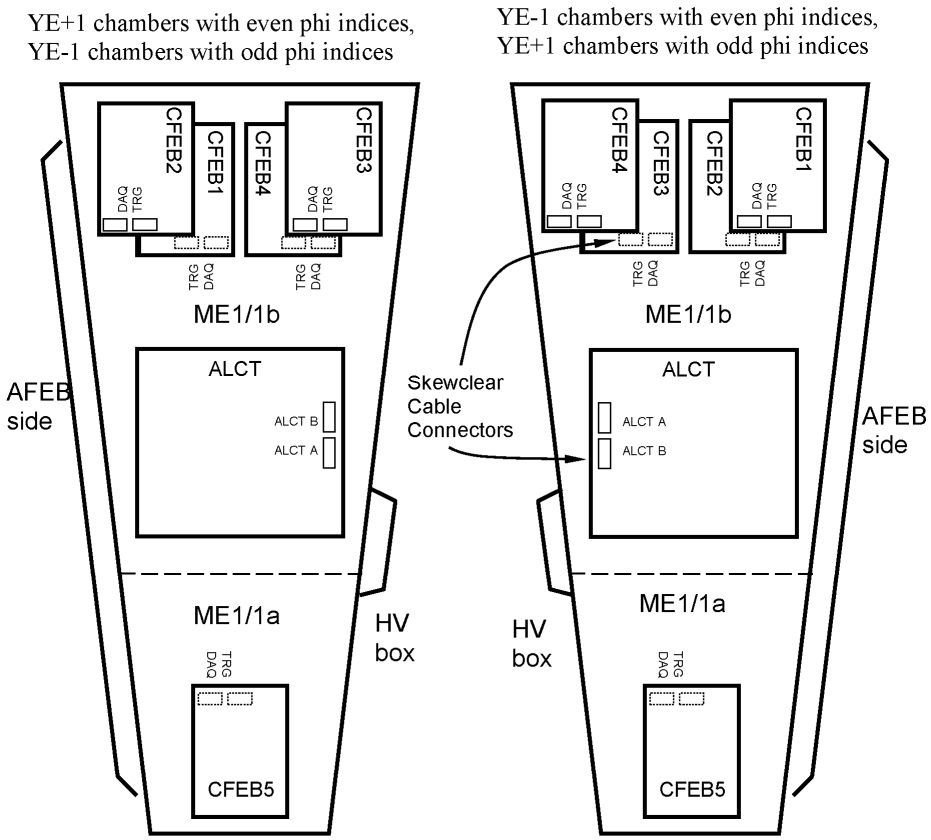
Appendix A: CSC System Connection Diagrams shows explicitly the DAQ and Trigger cable connections for three types of chambers:

1. Figure 17 shows connections for all types of chambers except for ME1/3 and ME1/1.
2. Figure 18 shows connections for ME1/3 chambers.

Front Panel Connections: ME1/1a and ME1/1b

The TMBs and DMBs are connected to CFEBs via Skewclear cables.
The CFEBs for ME1/1b are designated CFEB1 thru CFEB4 with CFEB1 near the HV side of the chamber and CFEB4 near the Anode side on the wide end.
There is only one CFEB for ME1/1a on the narrow end.
The top-most Skewclear connection on the TMB or DMB corresponds to CFEB1 on ME1/1b and the next to bottom connection to CFEB4 on ME1/1b.
The bottom-most connector corresponds to CFEE5 on ME1/1a.





3. Figure 19 shows connections for ME1/1 (a and b sub-chambers).

Appendix A: CSC System Connection Diagrams

Front Panel Connections: ME2,3,4 /1, /2 and ME1/2

The TMBs and DMBs are connected to CFEBs via Skewclear cables.
The CFEBs are designated CFEB1 thru CFEB5 with CFEB1 near the HV side of the chamber and CFEB5 near the Anode side.
The top-most Skewclear connection on the TMB or DMB corresponds to CFEB1 and the bottom-most to CFEB5.

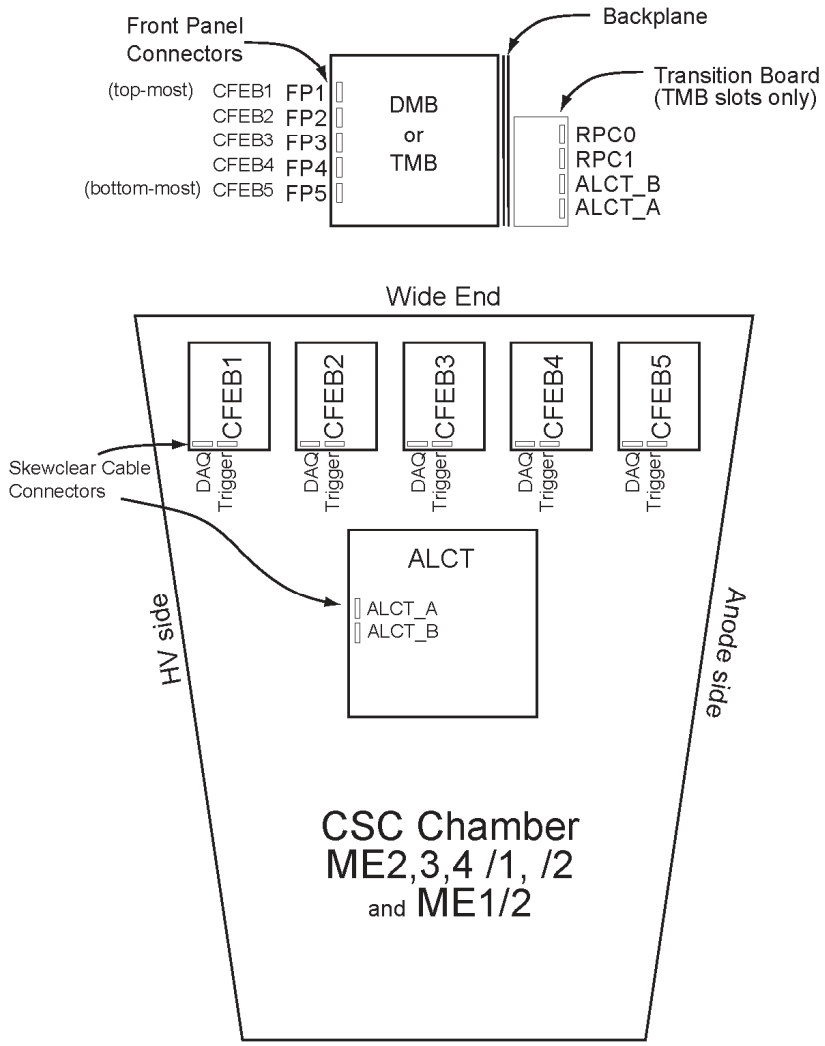


Figure 17. Cable connections for all types of chambers *except* ME1/3 and ME1/1. Explicitly, these are ME1/2, ME2/1, ME2/2, ME3/1, ME3/2, and ME4/1

Front Panel Connections: ME1/3

The TMBs and DMBs are connected to CFEBs via Skewclear cables.
The CFEBs are designated CFEB1 thru CFEB4 with CFEB1 near the HV side of the chamber and CFEB4 near the Anode side.
The top-most Skewclear connection on the TMB or DMB corresponds to CFEB1 and the next to bottom-most to CFEB4.
The bottom-most connector is left unused.

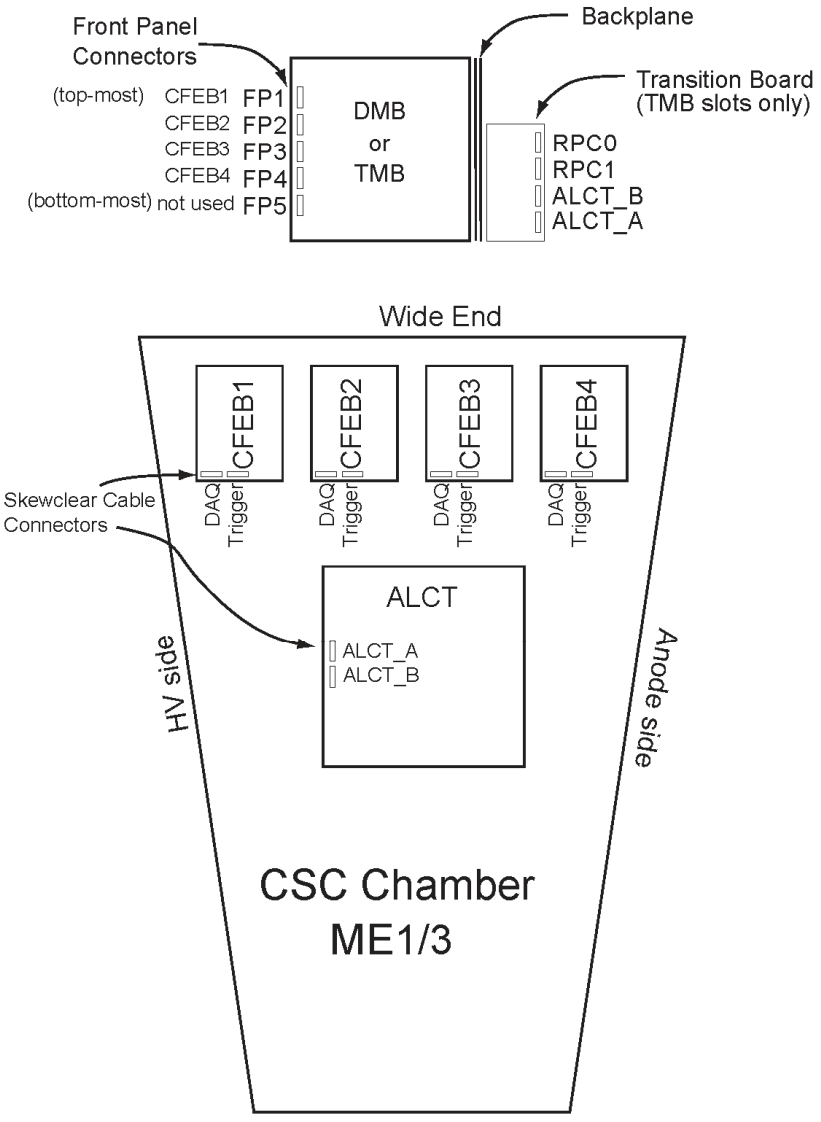
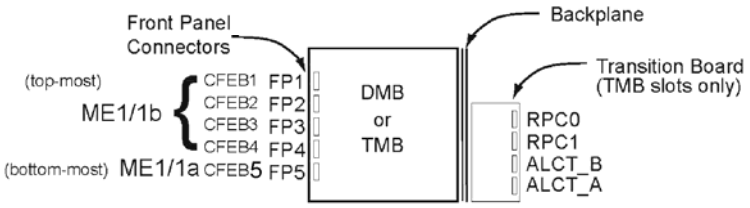


Figure 18. Cable connections for ME1/3 chambers.

Front Panel Connections: ME1/1a and ME1/1b

The TMBs and DMBs are connected to CFEBs via Skewclear cables.
The CFEBs for ME1/1b are designated CFEB1 thru CFEB4 with CFEB1 near the HV side of the chamber and CFEB4 near the Anode side on the wide end.
There is only one CFEB for ME1/1a on the narrow end.
The top-most Skewclear connection on the TMB or DMB corresponds to CFEB1 on ME1/1b and the next to bottom connection to CFEB4 on ME1/1b.
The bottom-most connector corresponds to CFEE5 on ME1/1a.



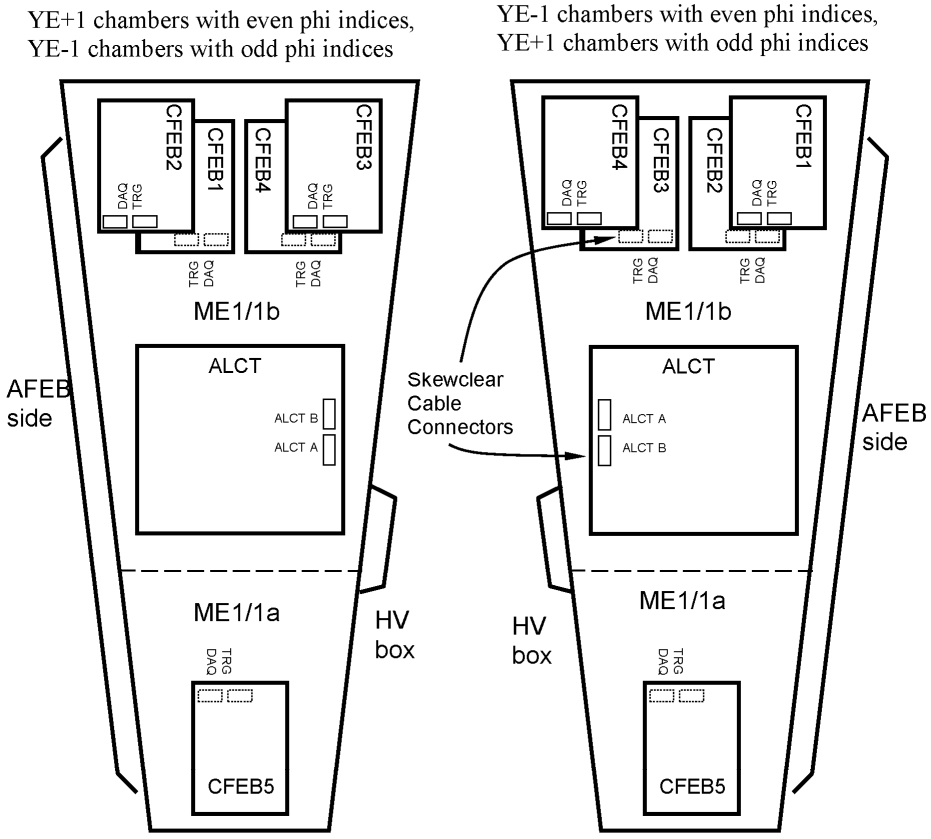


Figure 19. Cable connections for ME1/1 chambers (ME1/1a and ME1/1b sub-chambers).

Document Revision History:

1998 Feb.: original version written by Jay Hauser and posted on the Web only.
1999 Nov., CMS note IN-00/004 version 1.0: modified by Benn Tannenbaum for distribution as a CMS note and to include information about labeling within a sector.
2002 Aug., CMS note version 2.0: Modified by Jay Hauser, Vladimir Karjavin, and Serguei Khabarov to include ME1/1 orientation and improve quality of figures, add captions.
2005 Nov., CMS note version 2.2 or 2.3 (JH). Text for peripheral crate and slot numbering added, and several figures from Ben Bylsma.
2006 Aug.-Sept., CMS note version 2.4 and 2.5 (JH) Add table of contents, cleaned up and updated the text and figures. Peripheral crate naming and numbering and rack locations are clarified.
2007 March, CMS note version 2.5, continued development. (JH) reverse crate numbers by endcap: $+z$ side are now 1-30 and $-z$ side are now 31-60. **dmb_crate** number now the same as peripheral crate number. Minor updates to figures and text.
2007 April: uploaded as a new CMS note IN-2007/024.