The numbering scheme for the E391a detector

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1 Introduction

This note describes the numbering scheme for the each components of the E391a detector. The identical number should be used for either in the online level or in the offline level; e.g., for the labeling of cables, data base tables, reconstruction code and for the Monte Carlo simulation code.

2 General Scheme

2.1 Naming convention

Figure 1 shows the schematic view of the E391a detector of current design, drawn with the GEANT3 detector simulator. It consists of the Front Barrel (indicated with green color), Central Barrel (yellow), CsI crystals (light blue), Collar Counters (purple), and the Charged Veto Counter (red).

The 'upstream section' is defined to include the Front Barrel and two collar counters located at the both endcap of it. The 'middle section' includes the Central Barrel. The 'downstream section' includes the CsI crystals, charged veto counters, three collar-counters and beam catcher.

2.2 Detector coordinate system

The coordinate origin is set at the center on the front-most surface of the Front Barrel. The z-axis is set parallel to the beam axis, the y-axis looks

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upwards on the vertical direction, and the x-axis looks on the horizontal direction defined as $\boldsymbol{x} = \boldsymbol{y} \times \boldsymbol{z}$. We call the polar angle of a vector as θ angle, and the azimuth angle as ϕ angle. The definition of the terminology of θ angle and ϕ angle is shown in Figure 2.

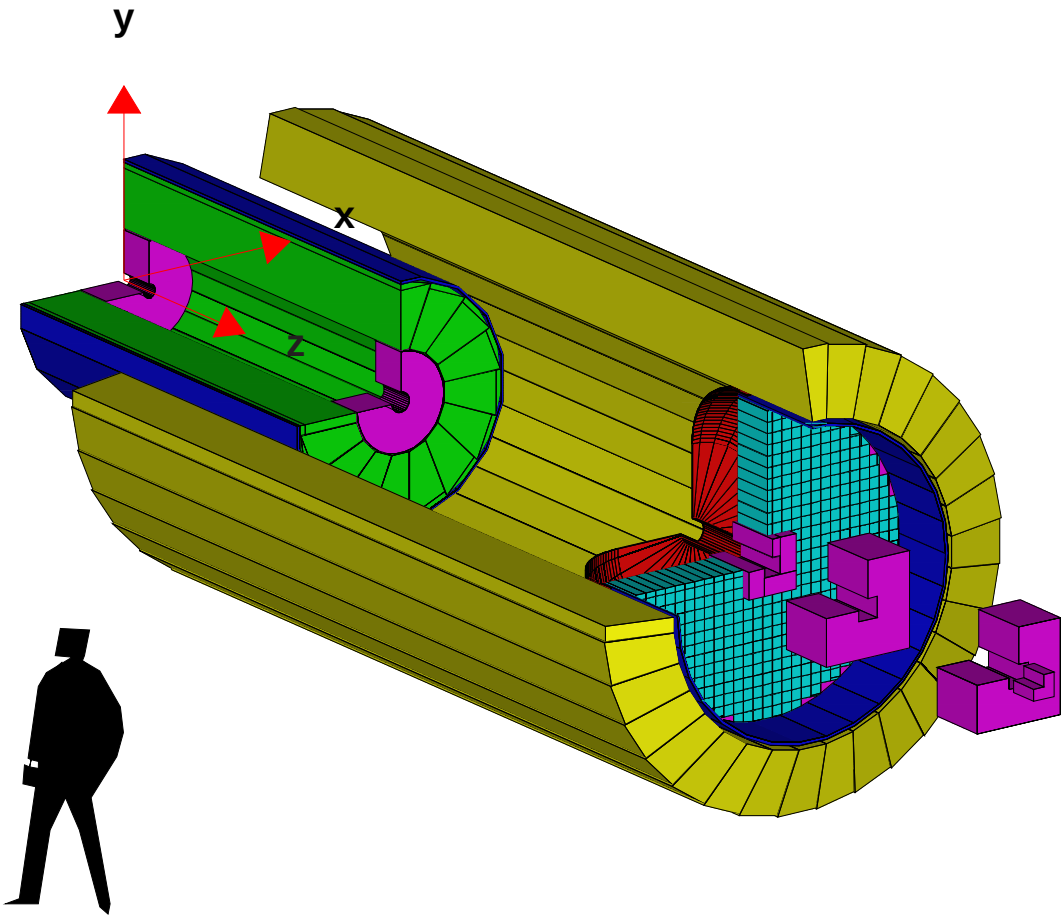

Figure 1: The cut-away view of the E391a detector, drawn with the GEANT3 detector simulator.

2.3 General numbering order of the detector components

Since most of the detector components are designed and located symmetric to the ϕ direction on the $r-\phi$ plane (i.e. $x-y$ plane), it should be convenient to define the ordering of the detector components according to the ϕ direction. As for the order of z-direction, it is natural to define it from $-z$ to $+z$, and for the radial direction it should be from inner to outer.

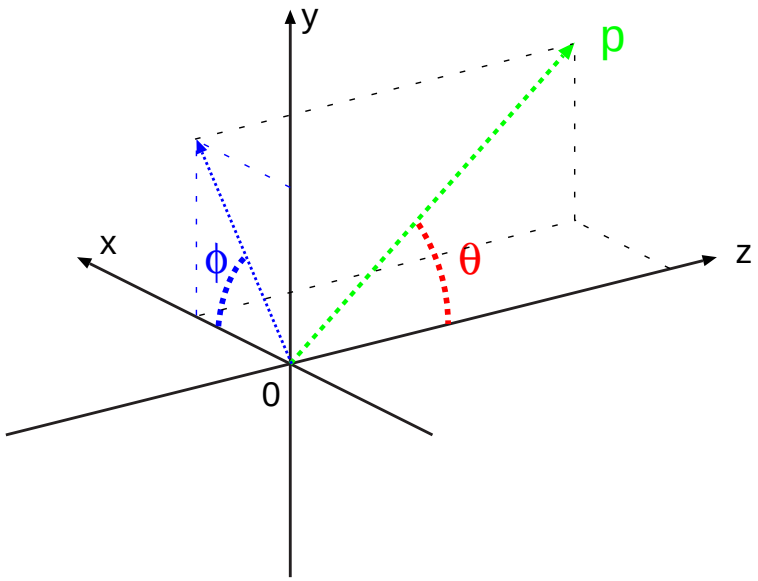

Figure 2: The definition of the terminology of θ angle and ϕ angle.

3 Numbering of each detector section

3.1 Collimator 6

The Collimator 6 is the upmost-stream detector-component located inside the beamline. It is instrumented with the scintillator plates that will detect the survived charged-particle on the beamline. Since we have 2 segments of the readout for the Collimator 6, it is numbered as '0' for the segments on the $+x$-axis, and '1' for the segments on the $-x$-axis. Figure 3 shows this scheme.

3.2 Front Barrel

The Front Barrel is segmented into 16 modules. They are numbered from '0' to '15', starting on the x-axis and proceeding as ϕ increases; counterclockwise when looking in the $-z$ direction as shown in Figure 4.

3.3 Central Barrel

The Central Barrel is segmented into 32 modules. They are numbered from '0' to '31', starting on the x-axis and proceeding as ϕ increases; similar to the Front Barrel as shown in Figure 4.

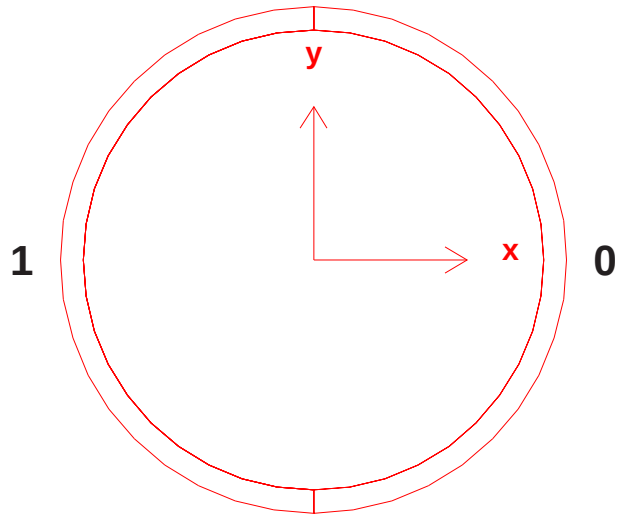

Figure 3: The assignment of segment number of the Collimator 6.

3.4 CsI crystals and Small-Edge Calorimator

Inside the CsI support cylinder, the CsI crystals and the small-edge calorimators that fill the gap between the crystals and the cylinder are installed.

The numbering scheme of them is only the exception which does not follow the general scheme, since the CsI-crystal array does not form a symmetrical structure in ϕ.

Figure 5 shows the cross section of the array of the block of CsI crystal and small-edge calorimator on the $r - \phi$ plane. We have 568 blocks in total.

The block number is assigned as follows :

1. Numbering begins from the lowest row, proceeds from $-x$ to $+x$ position. As there are nine blocks in the lowest row, the number should be from '0' to '8'.

2. Move one row up, proceed from $-x$ to $+x$ position. There are 13 blocks so they should be from '9' to '21'.

3. Move up the row one by one and repeat the same procedure up to the number '567'.

This will reflect the actual piling up procedure of the crystal. This scheme also allow us to do the test of CsI system, each time after piling up one low, with simple numbering scheme on the DAQ for small number of channel.

3.5 Collar counters

There are five Collar Counters in the E391a detector system. Two are located at the both endcap position of the Front Barrel, one is at the CsI section, two are at the downstream section. The design and the structure except for the one at the CsI section have not decided in detail yet, so currently we assign the single number for them as 'CC01','CC02','CC03','CC04' and 'CC05' (**C**ollar **C**ounter), from upstream one to downstream one. Figure 6 shows their location.

CC03, which is at the CsI section, will segmented into four modules consisting of the sandwich-structure of scintillator and tungsten plates. Each module can be numbered as CC03-1 to CC03-4, starting on the x-axis and proceeding as ϕ increases; counterclockwise when looking in the $-z$ direction as shown in Figure 7.

3.6 Charged Veto counters

Charged Veto counter consists of 32 segments of fan-shaped scintillator-plate. They are numbered from '0' to '31', in general way; starting on the x-axis and proceeding as ϕ increases; counterclockwise when looking in the $-z$ direction as shown in Figure 8.

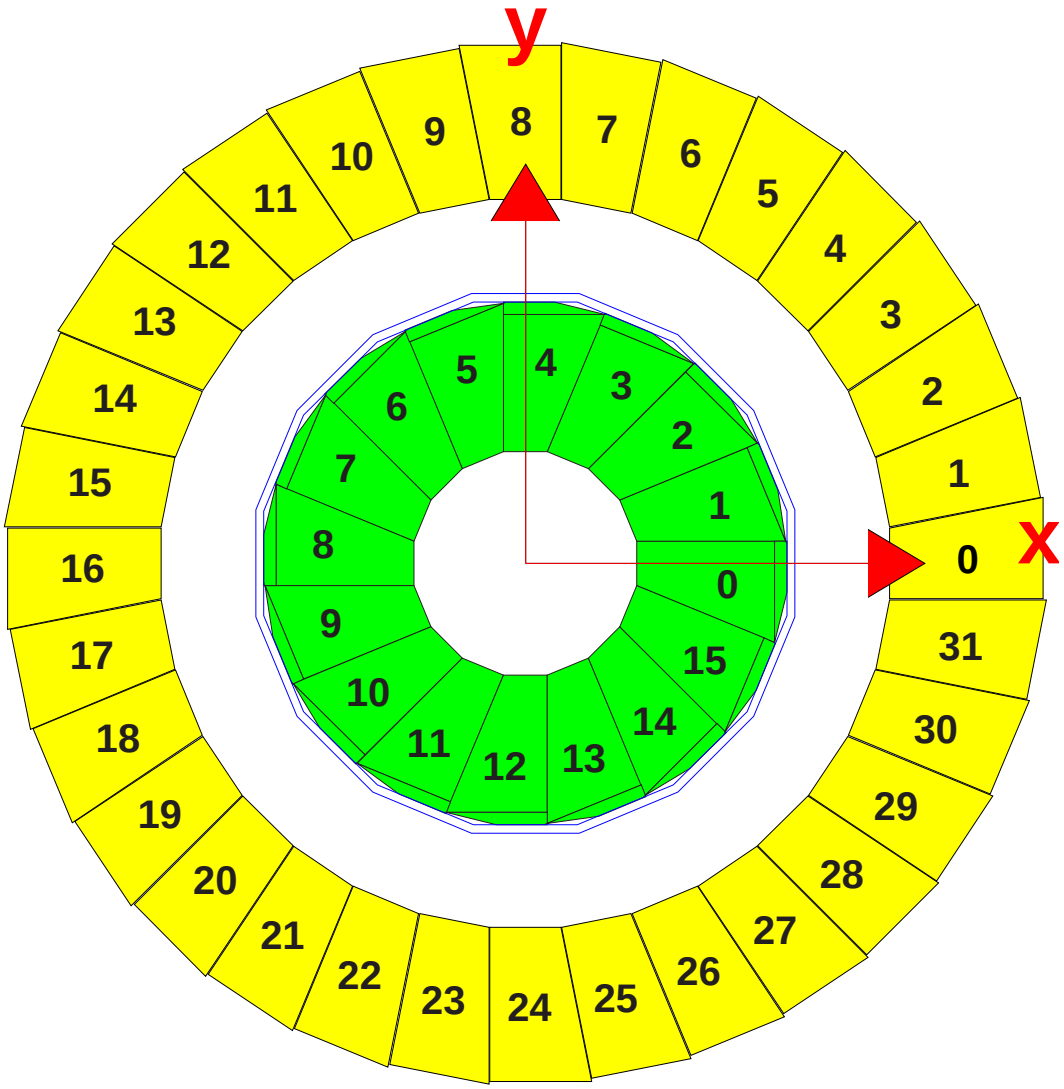

Figure 4: The assignment of segment number of the Barrel.

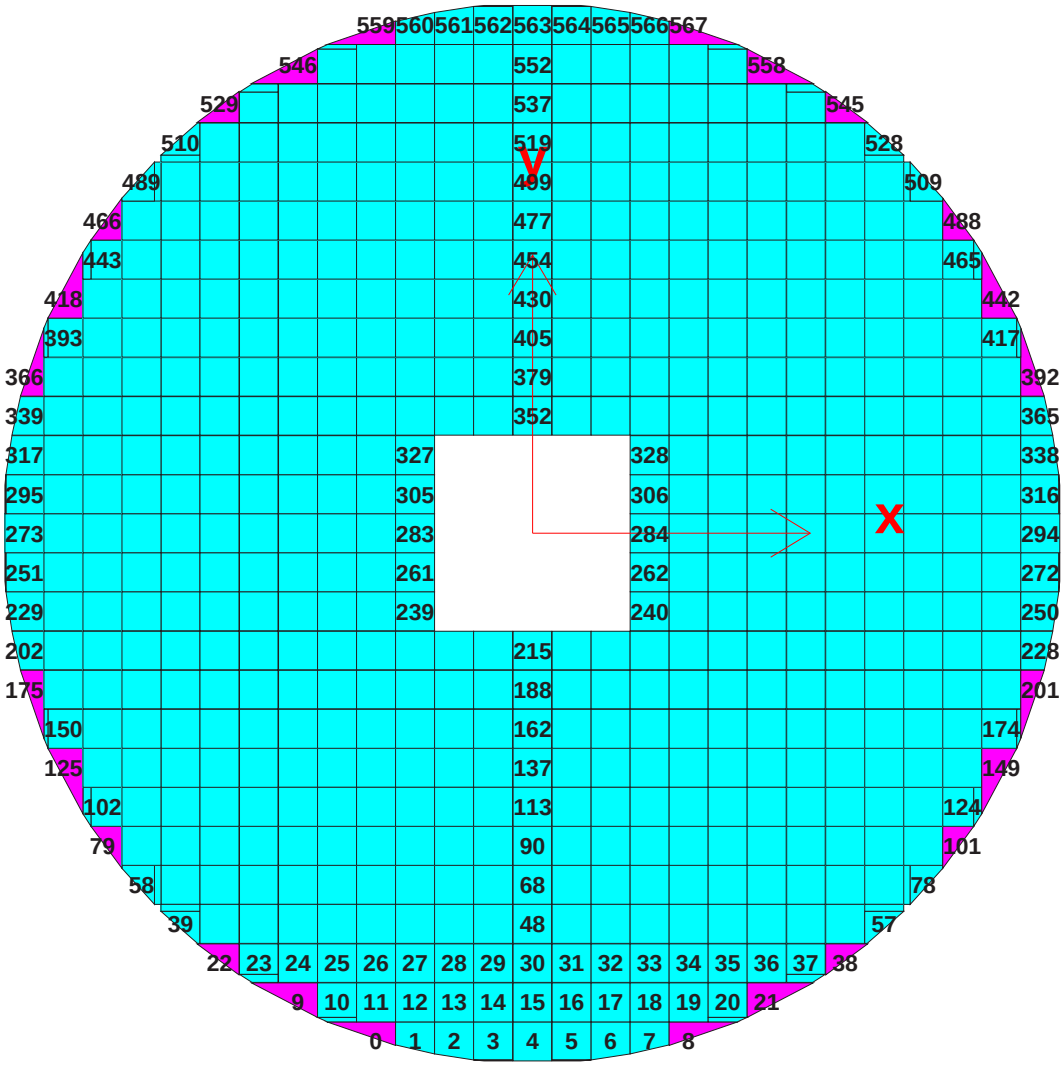

Figure 5: The cross-section of the CsI array and small-edge calorimators with the block number.

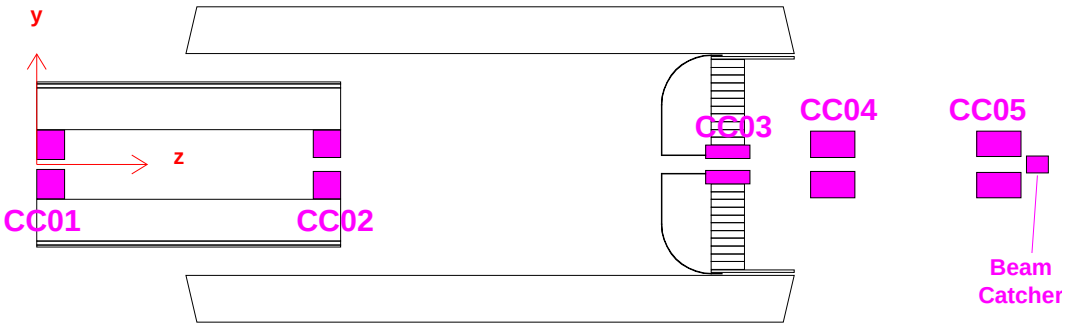

Figure 6: The location of Collar Counters in the cutview on the $y - z$ plane of the E391a detector .

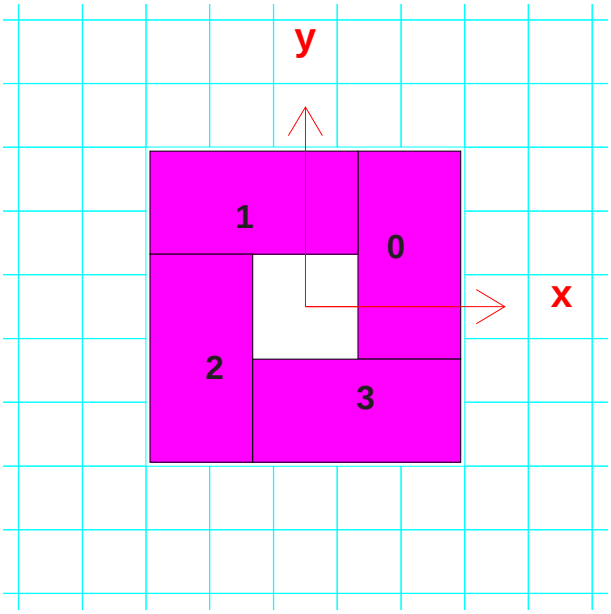

Figure 7: The cross-section of the Collar Counter CC03 showing that CC03 consists of four modules.

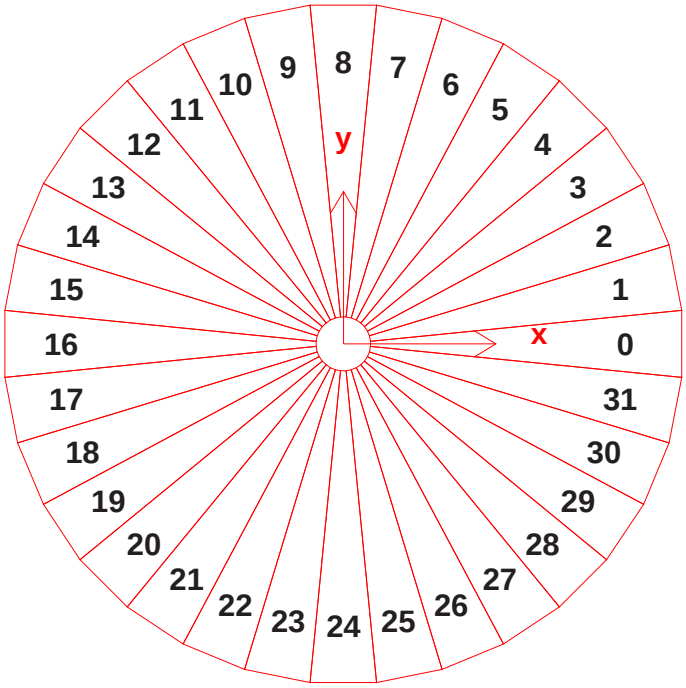

Figure 8: The schematic view of the Charged Veto Counter with segment number.