

# e1-6 Electron Fiducial Cuts

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## Abstract

This document describes the identification and removal of CLAS regions of low/zero efficiency and of border effects not reproducible by GSIM.

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TODO: SC Cuts and some DC sectors still show L/R asymmetries !

## 1 Fiducial Cuts

### 1.1 Introduction

Some Detector inefficiencies are not perfectly reproduced with GSIM and need to be removed with fiducial cuts. We consider two different approaches to identify fiducial regions:

- Cuts on the lab coordinates  $\phi, \theta, p$
- Cuts on Detector Coordinates

### 1.2 Cuts on the lab coordinates $\phi, \theta, p$

The fiducial cut in the lab coordinates has been determined during the  $\pi^0$  analysis in the  $\Delta(1232)$  region [2]. For each sector, an empirical cut on  $\phi$  is introduced as a function of theta and momentum:

$$\phi \leq \Delta\phi(\theta, p)$$

which is aimed to define regions of phase space whose distributions are flat in  $\phi$ . After careful study [1], the mathematical form of the cut depends on 6 parameters  $C_i$  and assumes the form:

$$\Delta\phi = C_4 (\sin(\theta - \theta_{cut}))^E$$

$$E = C_3 p^{C_5}$$

$$\theta_{cut} = C_1 + \frac{C_2}{p + C_6}$$

The  $\phi$  vs  $\theta$  distribution was plotted for 10 different momentum bins from 1.6 to 4.6 GeV. Fig. 1 shows one example ( $p = 1.9 - 2.2$  GeV) of such distributions. The  $\phi$  distributions are also plotted for  $\theta$  slices one degree wide as in Fig. 2 and the  $C_i$  parameters are adjusted empirically.

Figure 1:  $\phi$  versus  $\theta$  for sector 1 and  $p = 1.6 - 1.9$  GeV after the electron ID. Left: before fiducial cut. Right: before fiducial cut (box/gray) and after fiducial cut (color contour).

Figure 2:  $\phi$  distributions (sector 3) for different  $\theta$  and  $p = 1.9 - 2.2$  GeV. Black: before fiducial cut. Red: after fiducial cut. Čerenkov inefficiency (section ??) is responsible for some irregularities at  $\phi = 0$  (for example at  $\theta = 35.5^\circ - 36.5^\circ$ ) while drift chambers and time of flight inefficiency (section ??) causes other irregularities (for example at  $\theta = 42.5^\circ - 43.5^\circ$ ).

Table 1 shows the 6 parameters obtained. Fig. 3 shows the fiducial cut as a function of  $p$ ,  $\theta$  and  $\phi$  for sector 1.

Sector	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$
1	12.0	20.0	0.32	32.0	0.416667	0.14
2	//	20.7	0.36	34.0	//	//
3	//	20.2	0.32	32.0	//	//
4	//	20.5	0.32	32.0	//	//
5	//	20.5	0.29	32.0	//	//
6	//	20.0	0.32	32.0	//	//

Table 1: The 6 parameters for electron fiducial cut for each of the 6 sectors. Only  $C_2$ ,  $C_3$ ,  $C_4$  are sector dependent.

Figure 3: The electron fiducial cut for sector 1. The cut starting point moves back as the momentum increases (and  $\theta$  decreases). This causes the cut to narrow up with momentum because electrons are detected near the lower edges of the detectors.

## References

- [1] K. Park, Volker Burkert, *Private Communication*.
- [2] M.Ungaro,  $\pi^0$  *electroproduction from  $\Delta(1232)$  at high momentum transferred with CLAS*