

Impact on PID of the cluster counting DCH

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Outline

- Introduction
- Short description of the PID selectors in FastSim
- DCH with/without cluster counting in barrel region
- DCH with/without cluster counting in forward region



Introduction

→ The goal :

Study impact of the DCH with cluster counting on the PID selectors

→ Tool for the study :

FastSim and in particular PacPidCalib package

↑
Single particle generator + software for
automatic data processing.

More details one can find here:

http://mailman.fe.infn.it/superbwiki/index.php/FastSimDoc/PID_simulation

→ Parametrization :

The cluster counting DCH has been parametrized like an effective dEdx measurements with reduced errors.

Likelihood definition

- Likelihood ratios are the variables to cut on to select tracks.
- Example of Gaussian likelihood

$$LH = e^{(-\text{chi}^2)}/\text{norm}$$

Norm is usually not constant —► it really needs to be included in the computation

$$\text{chi}^2 = (\text{val}_{\text{meas}} - \text{val}_{\text{exp}})^2 / \text{err}^2$$

val_{meas} - measured quantity

val_{exp} - expected value = function(**reconstructed momentum, mass** ,)

err - measurement error

- Combine information from different detectors to better separate particles

$$LH_{\text{tot}} = LH_{\text{DRC_Cerenkov}} \times LH_{\text{DRC_PhotNum}} \times LH_{\text{DCH}} \times LH_{\text{TOF}} \times LH_{\text{SVT}}$$

LH set to constant if corresponding subdetector not touched by track.

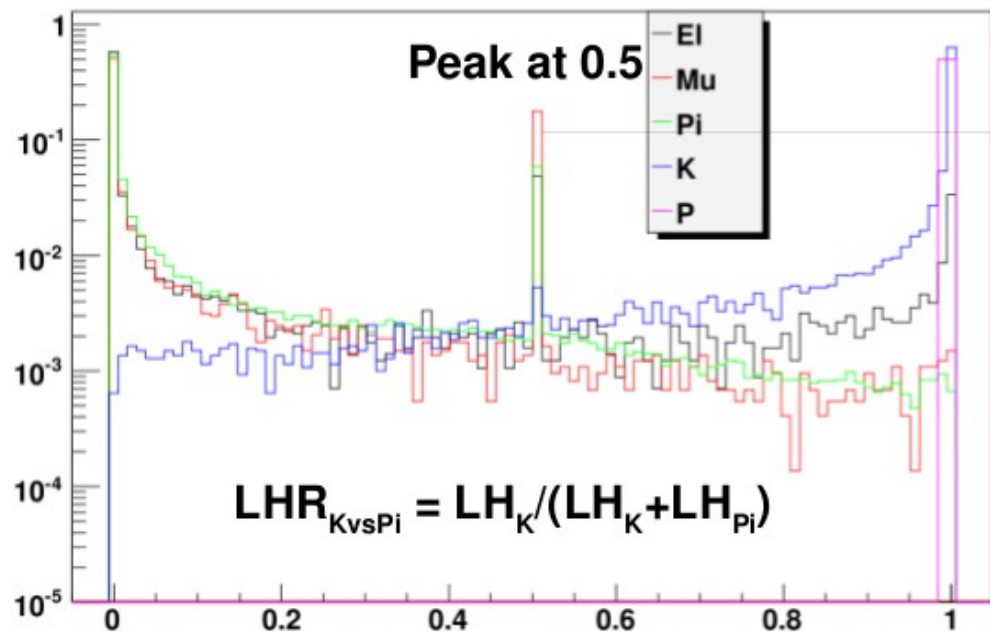
Currently $LH_{\text{SVT}} = LH_{\text{EMC_bwd}} = 1$

More details one can find here:

<http://agenda.infn.it/getFile.py/access?contribId=220&sessionId=5&resId=0&materialId=paper&confId=1742>

KvsPi DRC_isOk 0.7 < mom < 0.75 for electron

Entries 5428

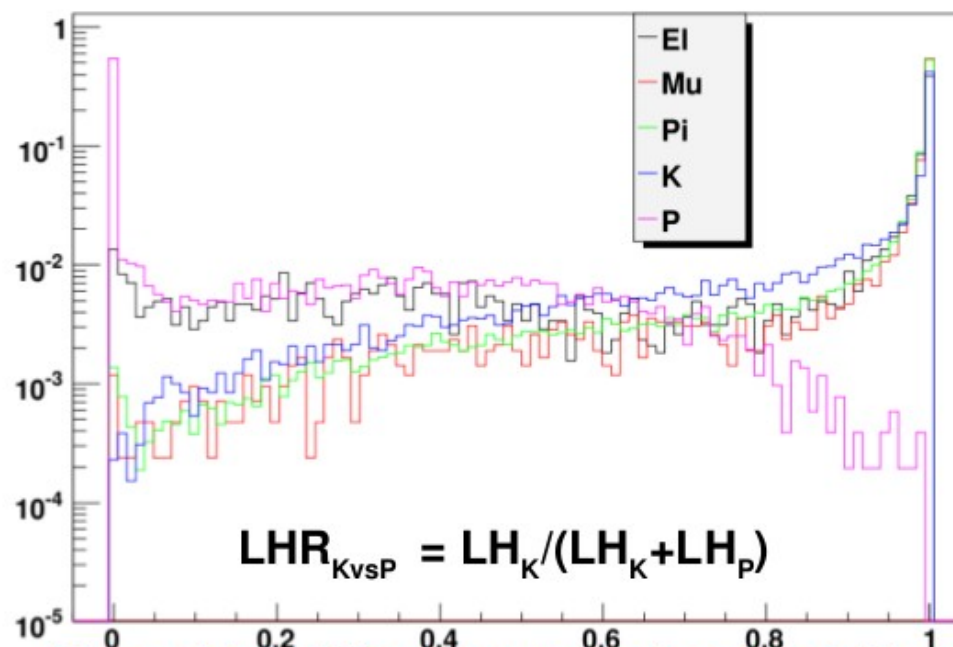


Example of likelihood distributions Truth-matched particles

- Tracks which have $LH_K = LH_{Pi} = 0$
or $LH_K = LH_{Pi} = 1$
- For more details look backup slides
- With cut on LHR_{KvsPi} electrons, muons and pions can be removed, but not protons
- With cut on LHR_{KvsP} and LHR_{PvsPi} protons can be removed
- Adapt cuts used for BaBar selectors

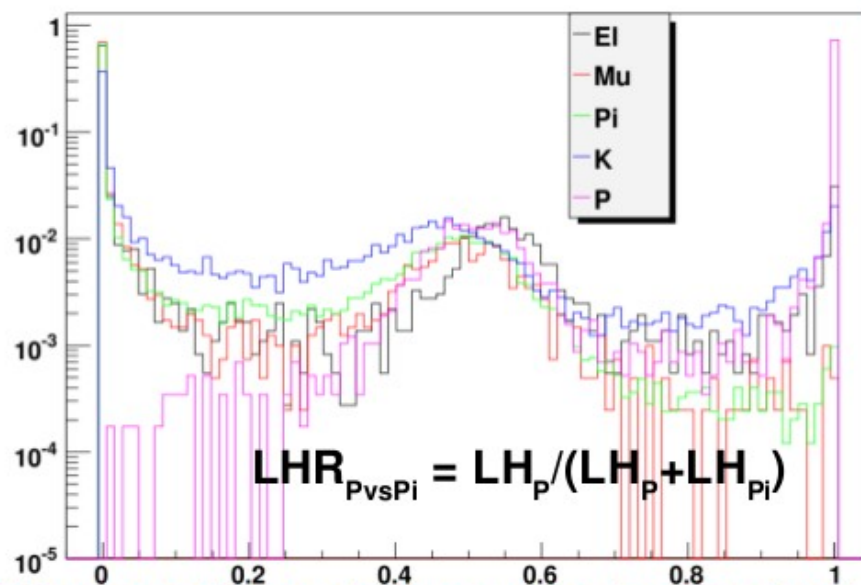
h1KvsP 1 < mom < 1.05 for electron

Entries 3852



h1PvsPi 1.25 < mom < 1.3 for electron

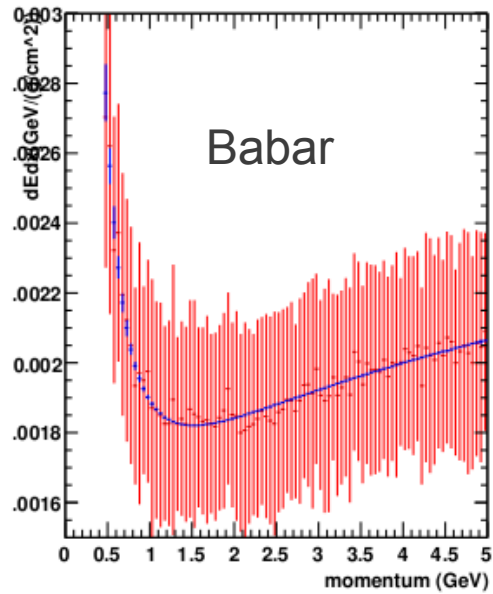
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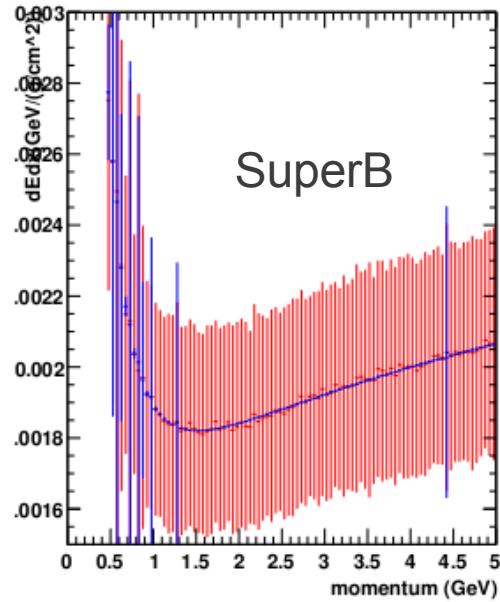
By applying different cuts on these variables, different selector tightness can be obtained

dE/dx measurements for kaons with different DCH configurations

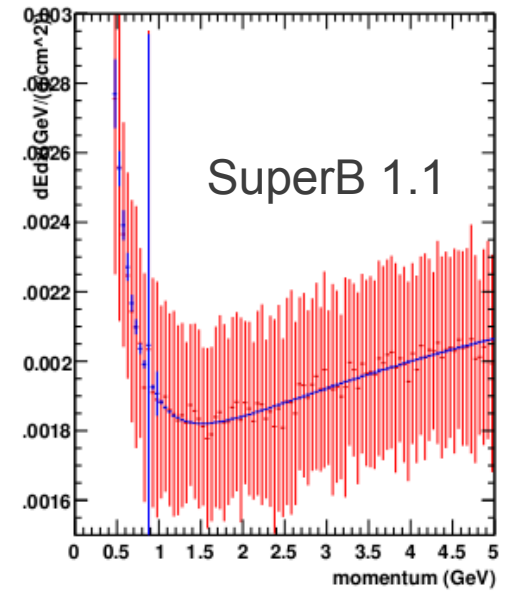
Profile meas dedx dch 36<=Theta<54 for kaon



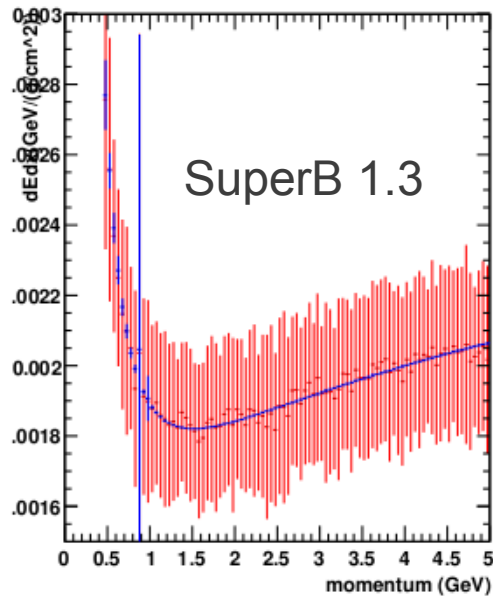
Profile meas dedx dch 36<=Theta<54 for kaon



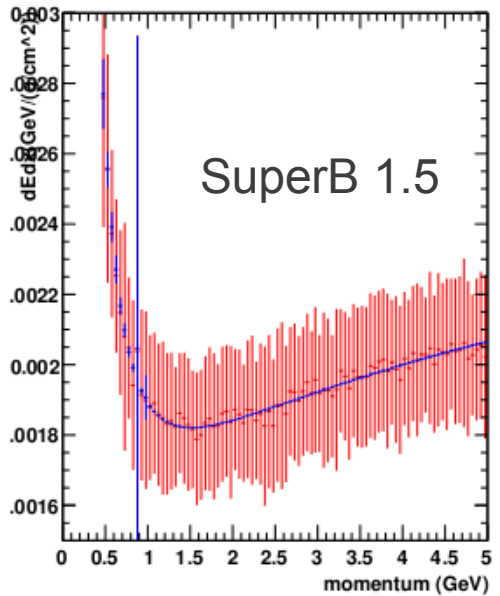
Profile meas dedx dch 36<=Theta<54 for kaon



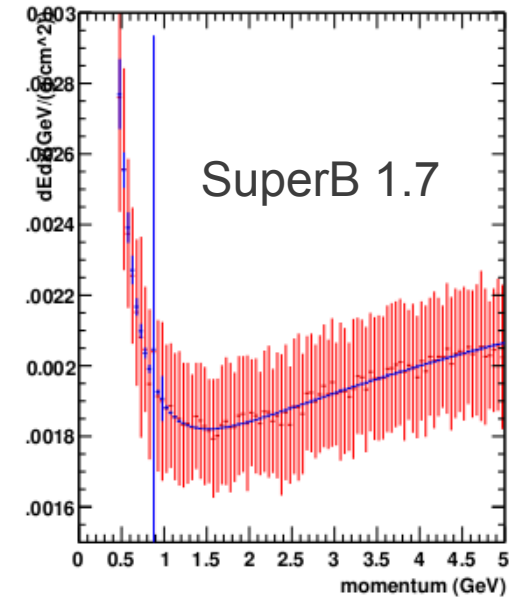
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Profile meas dedx dch 36<=Theta<54 for kaon

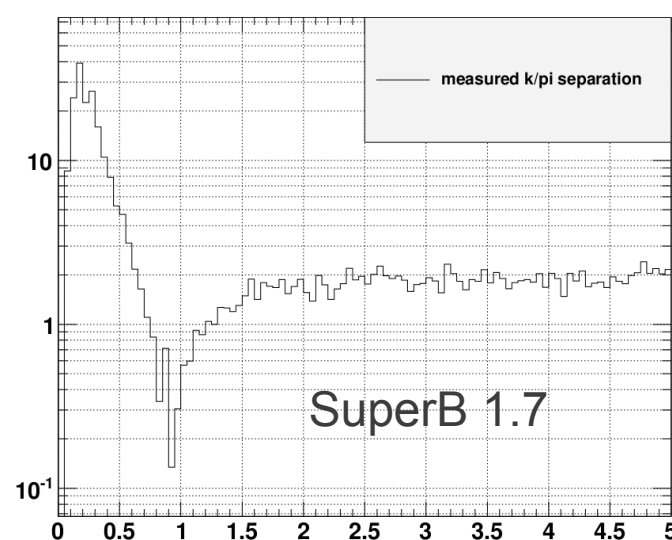
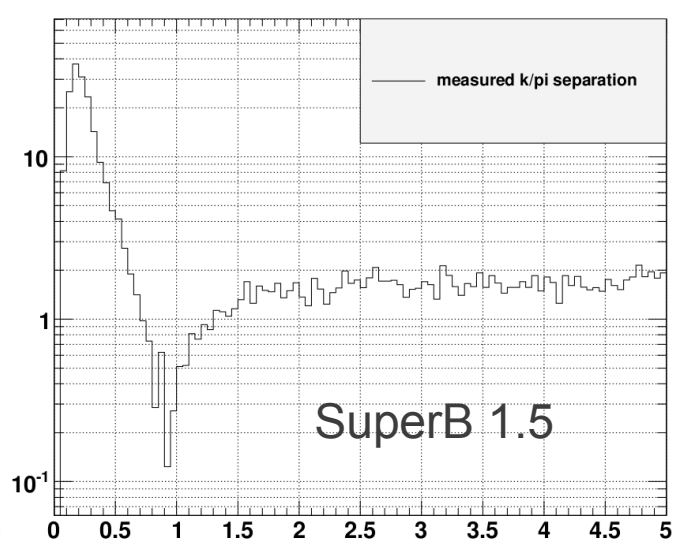
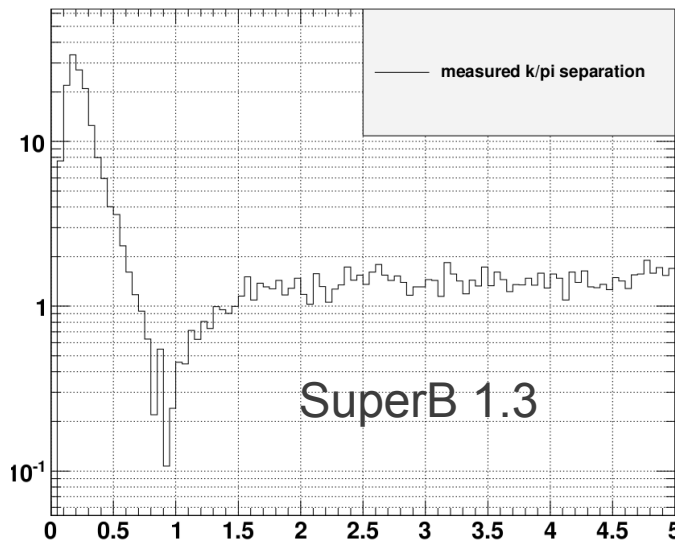
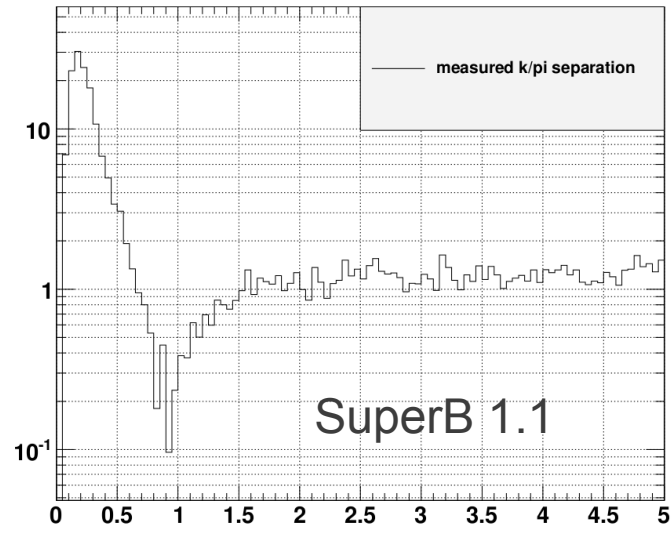
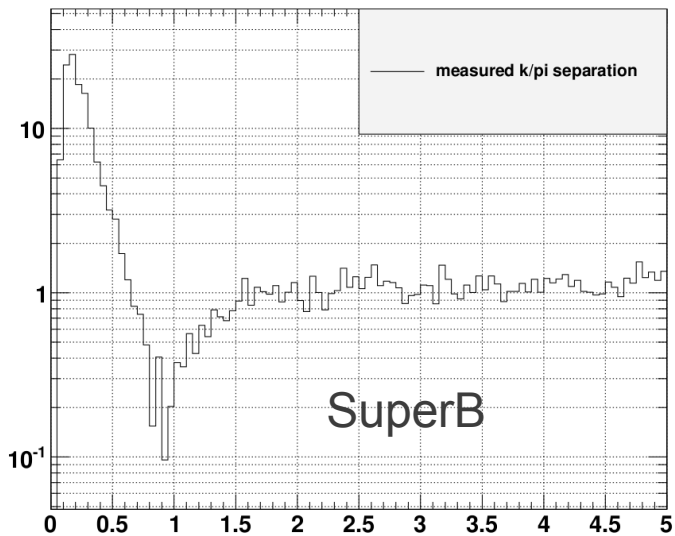
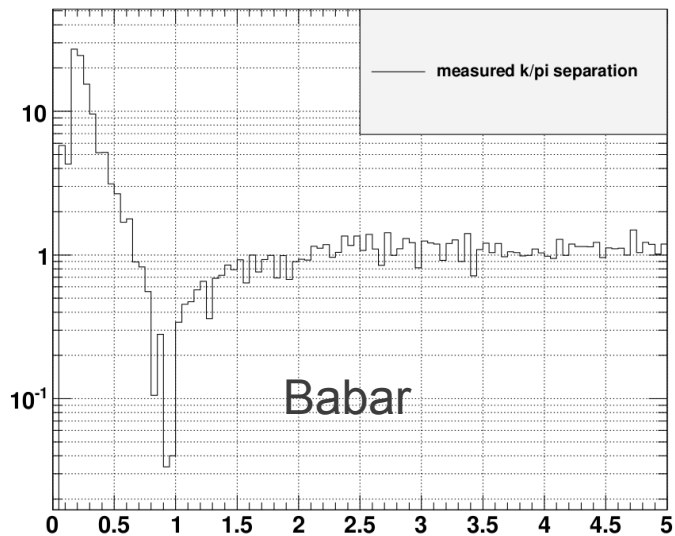


Profile meas dedx dch 36<=Theta<54 for kaon



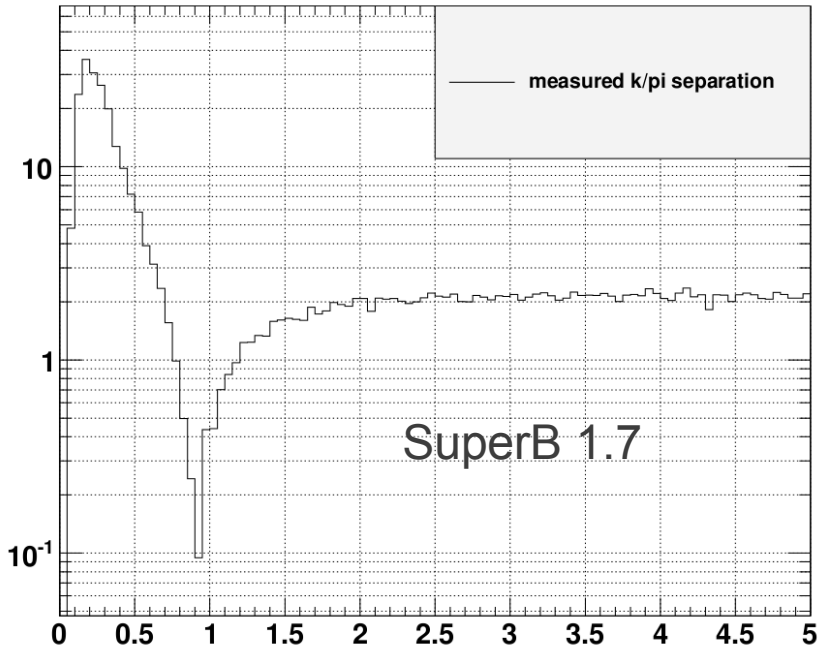
K/pi separation with/without cluster counting (DCH)

➔ Cluster counting of the DCH effectively parametrized by the dE/dx measurement with different errors



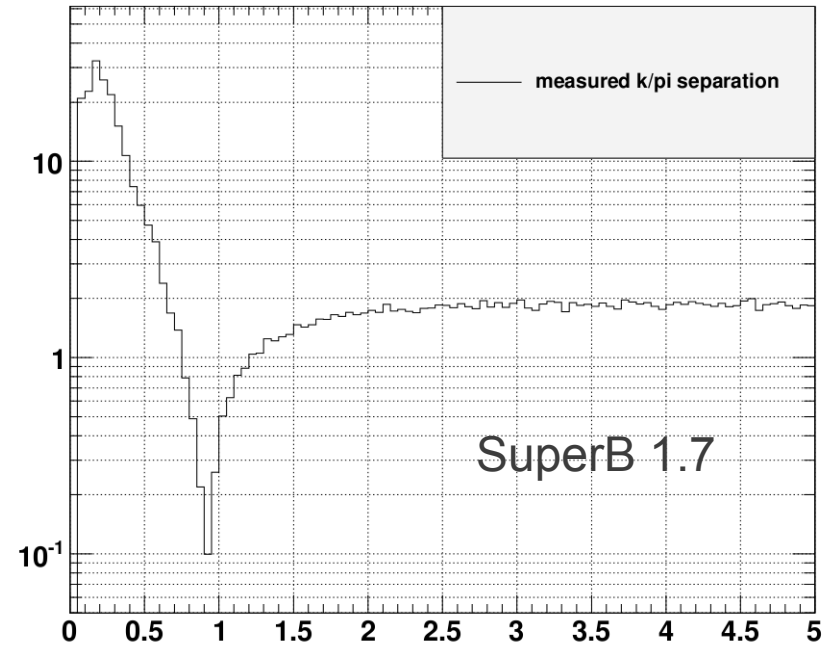
K/pi separation in different theta regions

pion - kaon separation of the DCH Profile meas dedx dch 18<=Theta<36 for pion



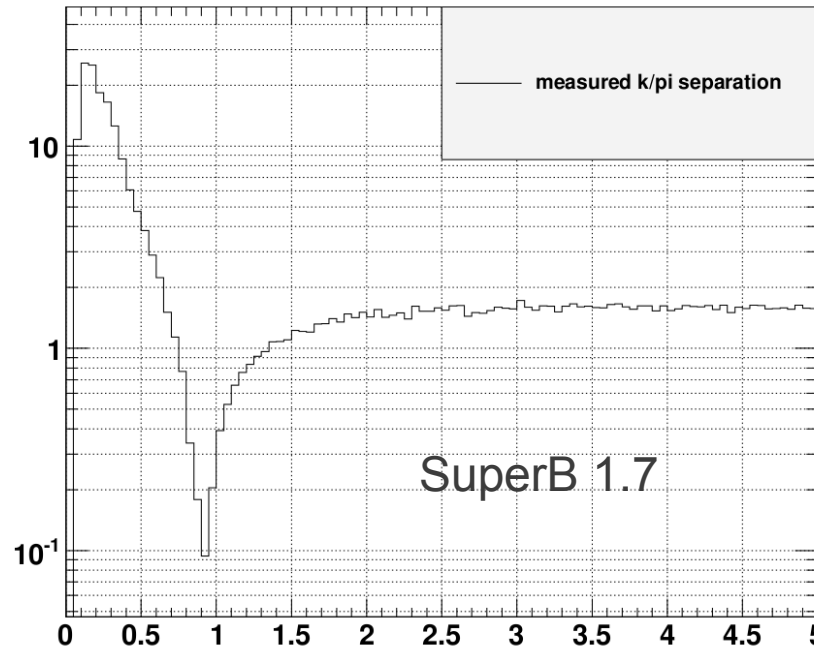
Forward region

pion - kaon separation of the DCH Profile meas dedx dch 36<=Theta<54 for pion



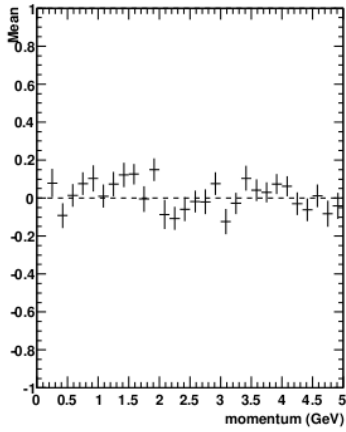
pion - kaon separation of the DCH Profile meas dedx dch 90<=Theta<108 for pion

Barrel region

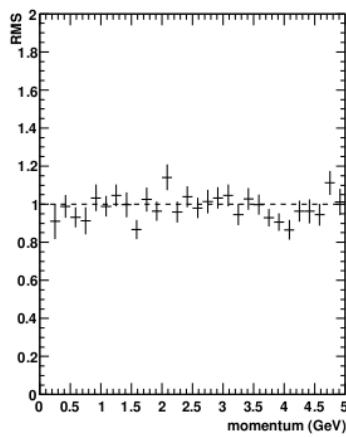


Mean and RMS of the pulls

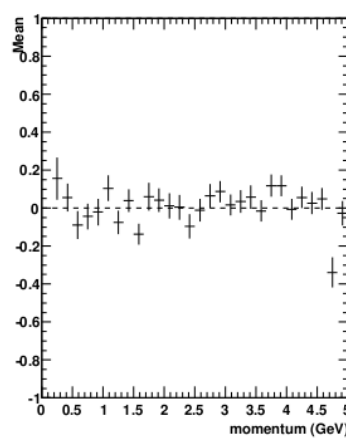
Mean dch $36 \leq \Theta < 54$ for kaon



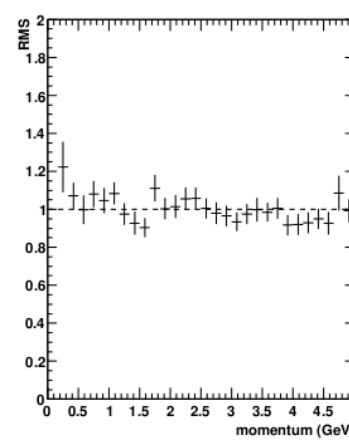
RMS dch $36 \leq \Theta < 54$ for kaon



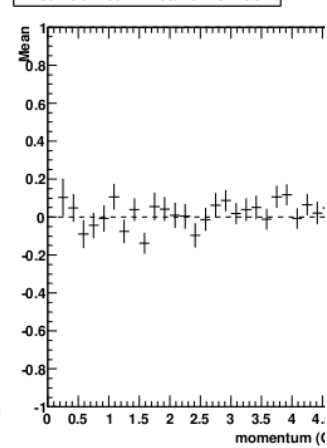
Mean dch $36 \leq \Theta < 54$ for kaon



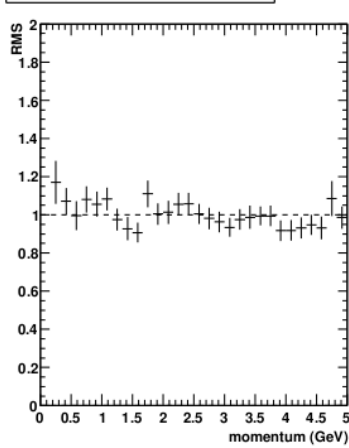
RMS dch $36 \leq \Theta < 54$ for kaon



Mean dch $36 \leq \Theta < 54$ for kaon



RMS dch $36 \leq \Theta < 54$ for kaon

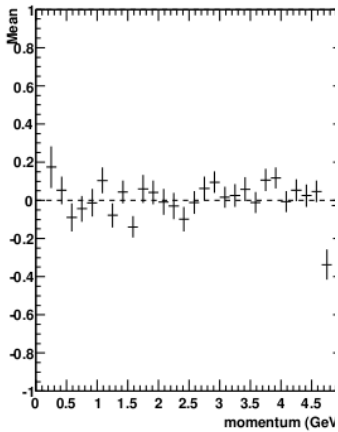


Babar

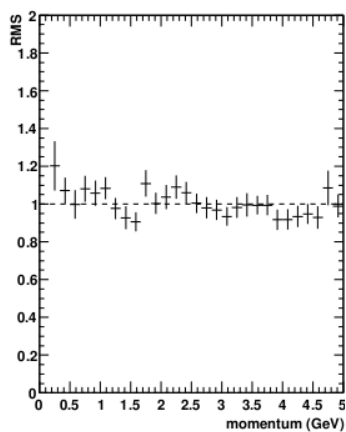
SuperB

SuperB 1.1

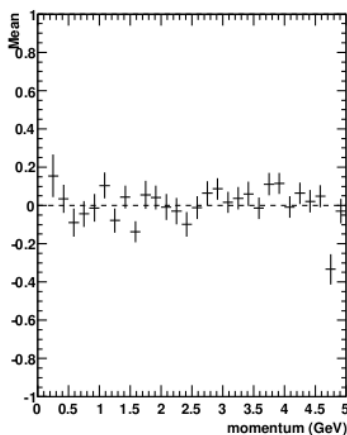
Mean dch $36 \leq \Theta < 54$ for kaon



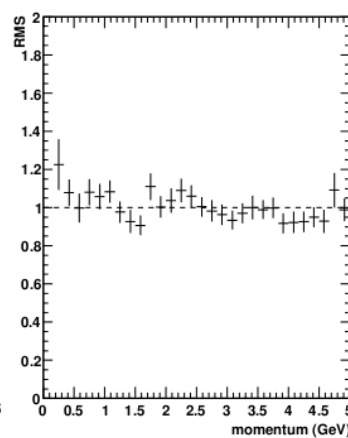
RMS dch $36 \leq \Theta < 54$ for kaon



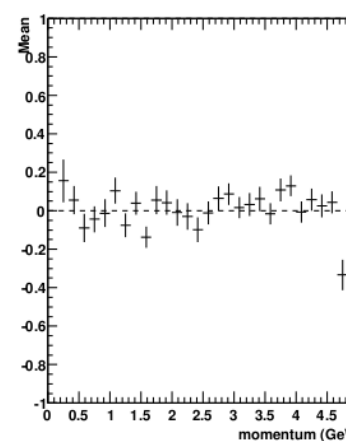
Mean dch $36 \leq \Theta < 54$ for kaon



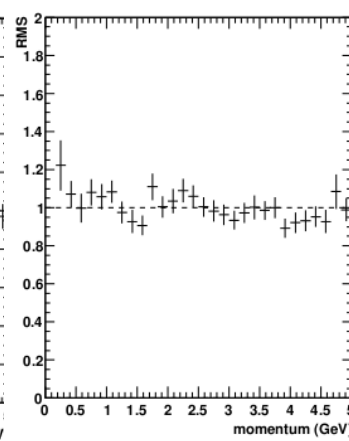
RMS dch $36 \leq \Theta < 54$ for kaon



Mean dch $36 \leq \Theta < 54$ for kaon



RMS dch $36 \leq \Theta < 54$ for kaon

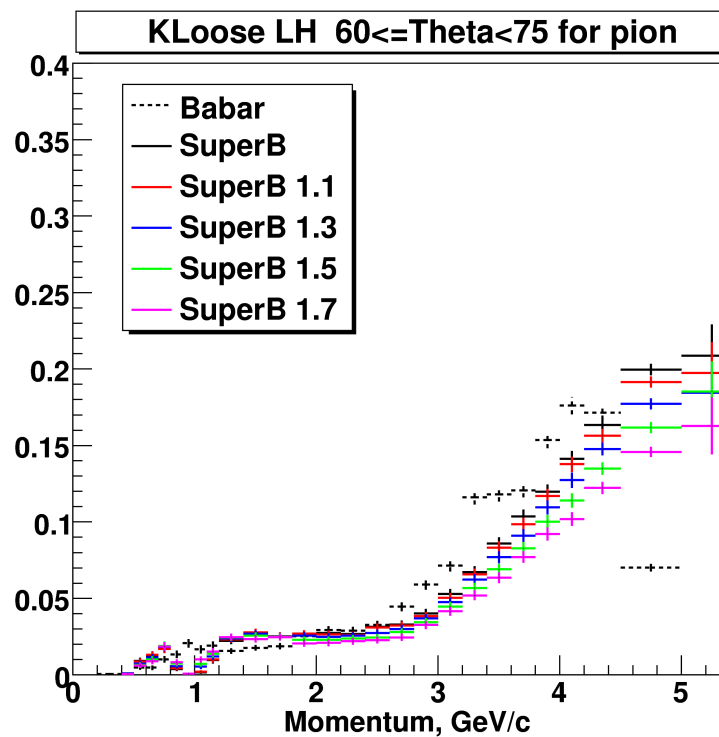
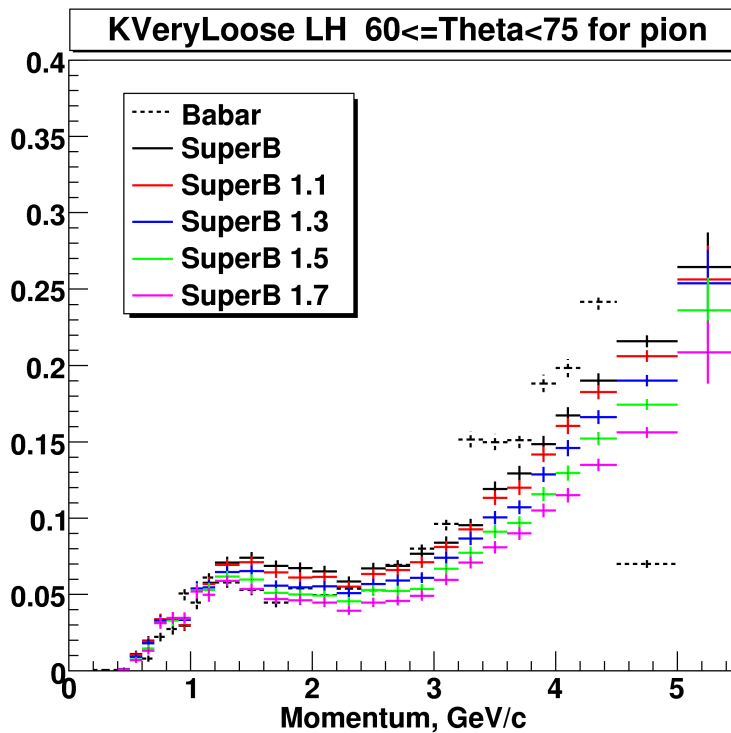
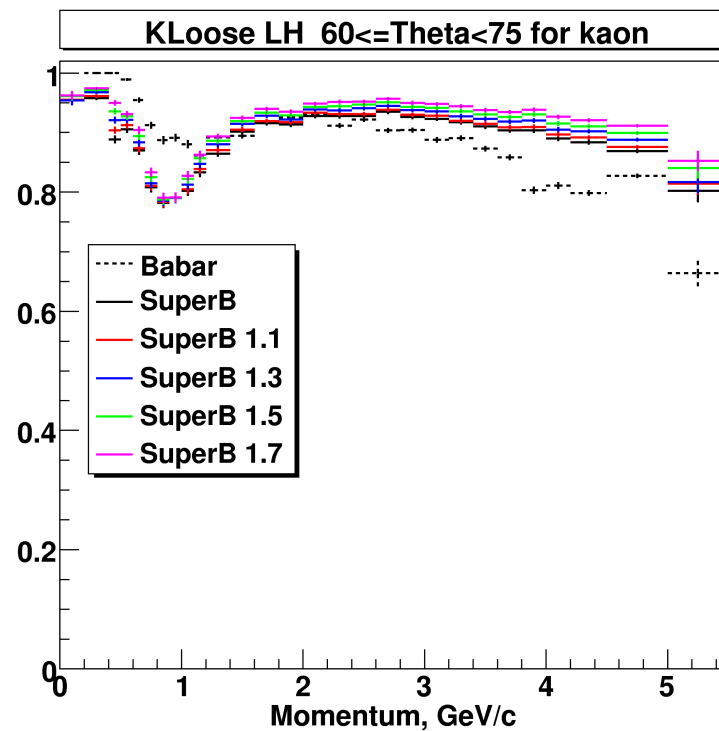
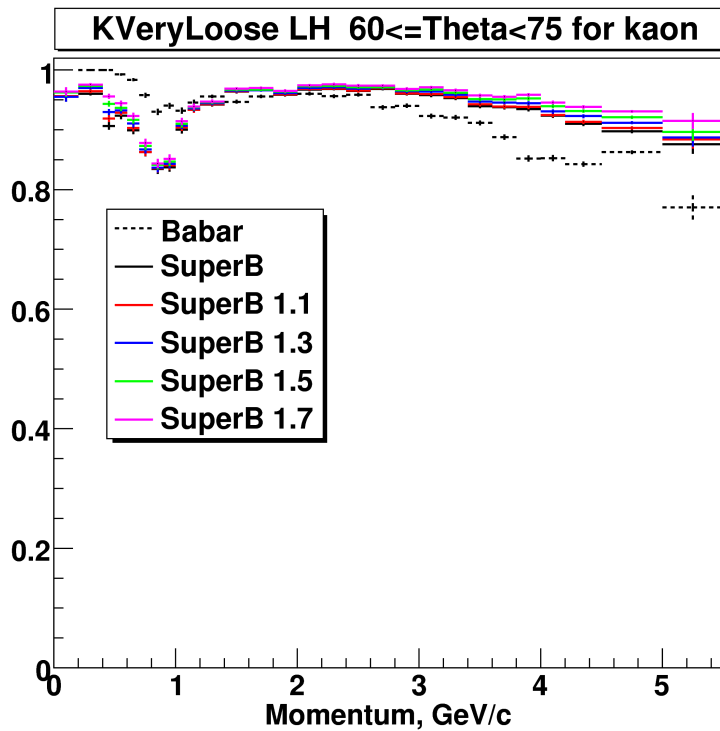


SuperB 1.3

SuperB 1.5

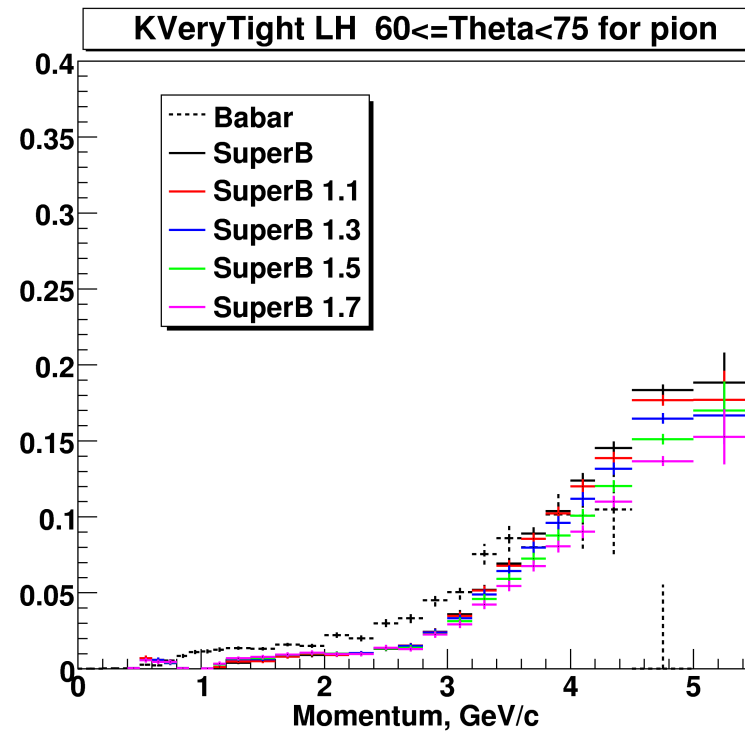
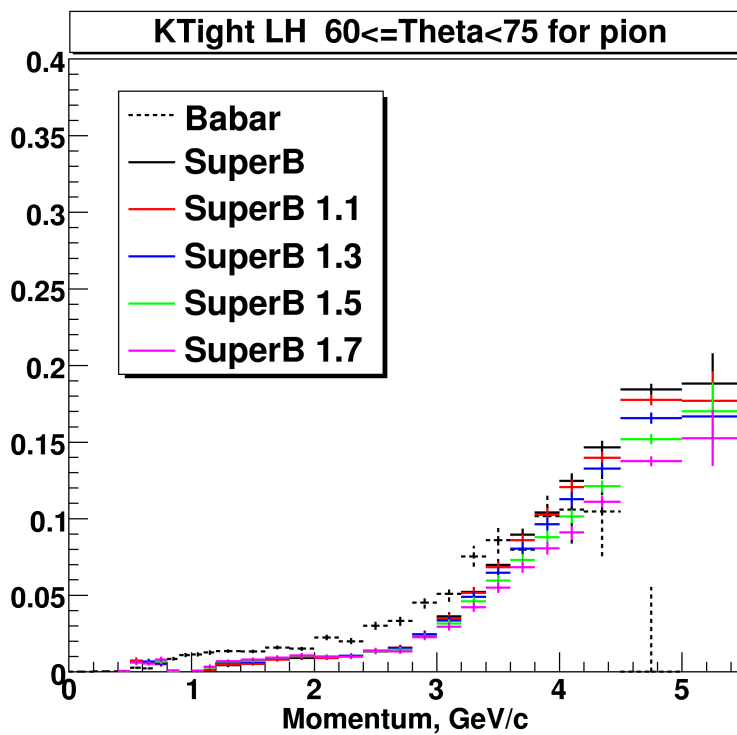
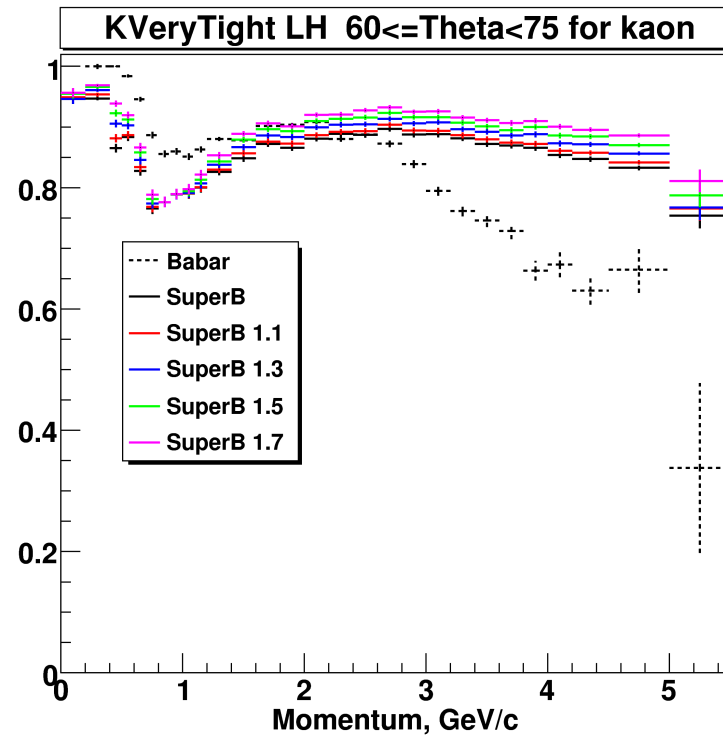
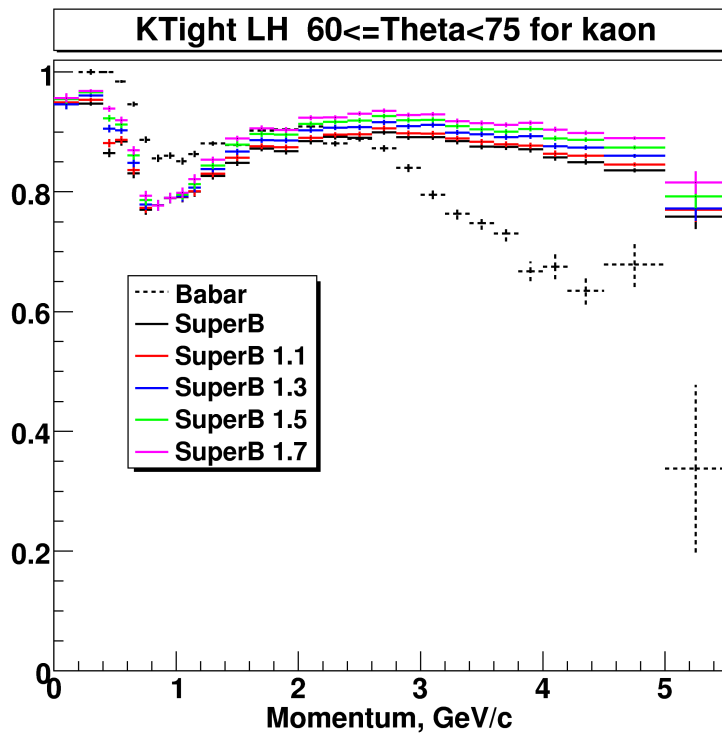
SuperB 1.7

Kaon selectors for different DCH configurations



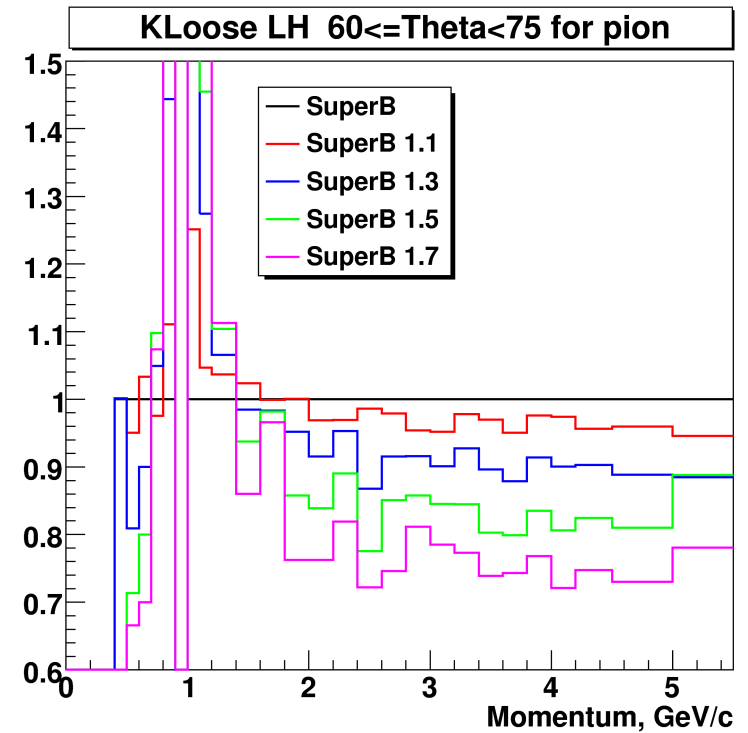
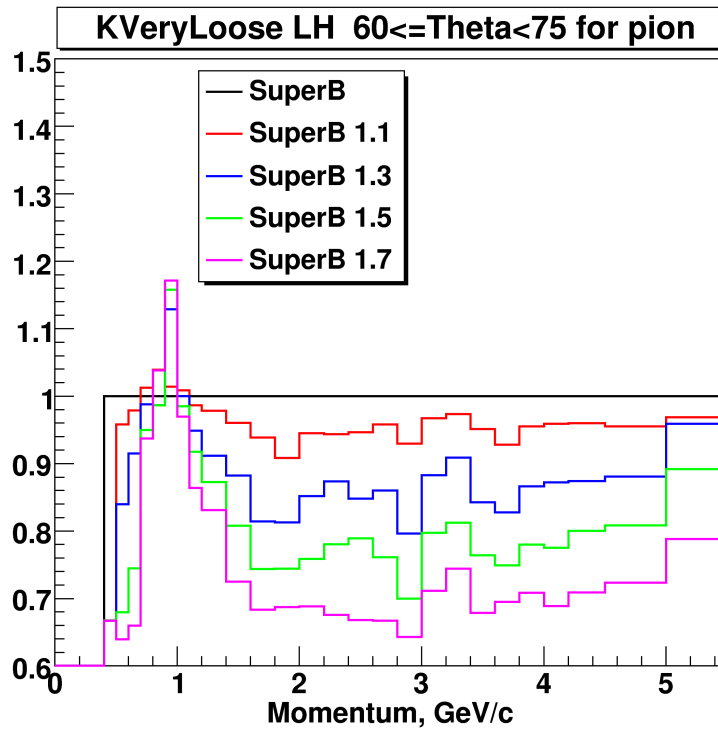
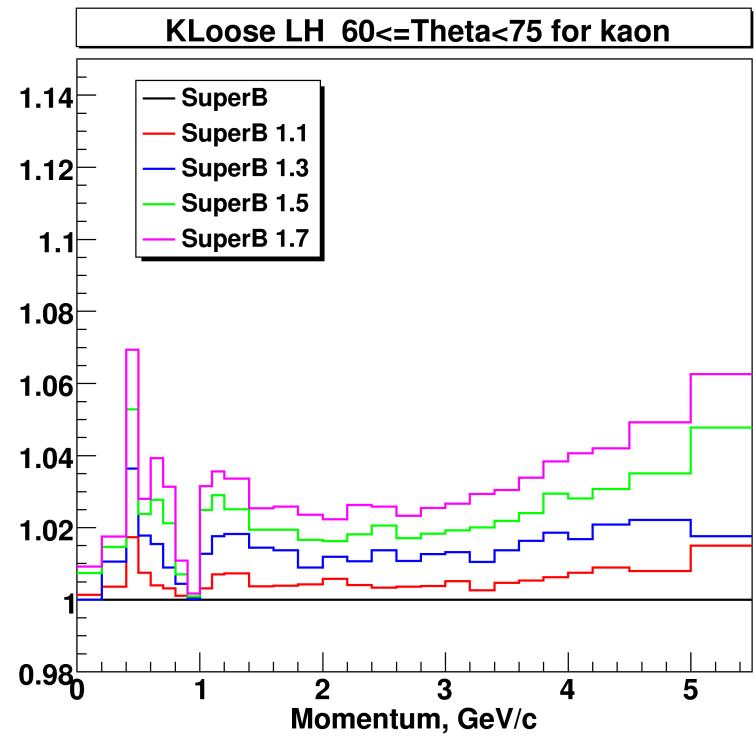
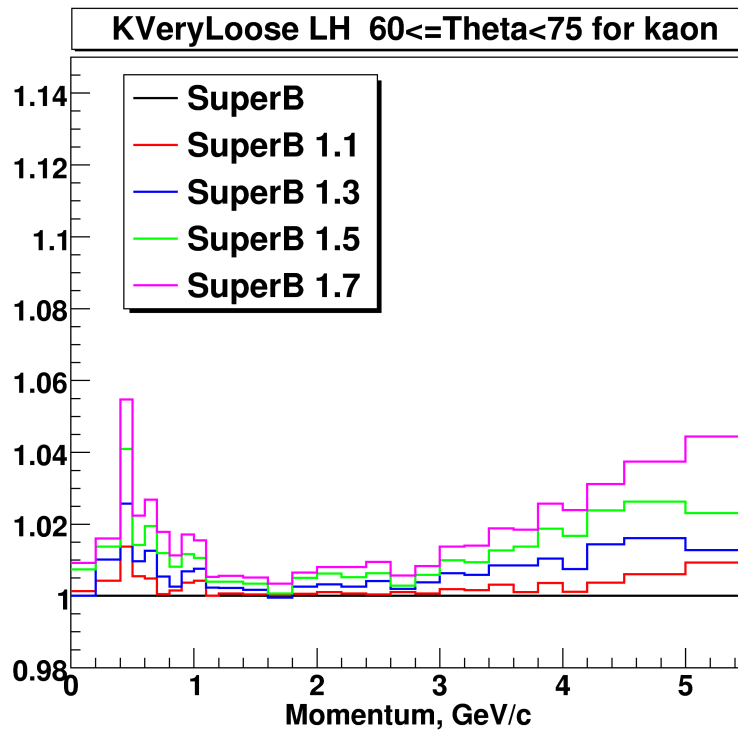
Barrel region

Kaon selectors for different DCH configurations



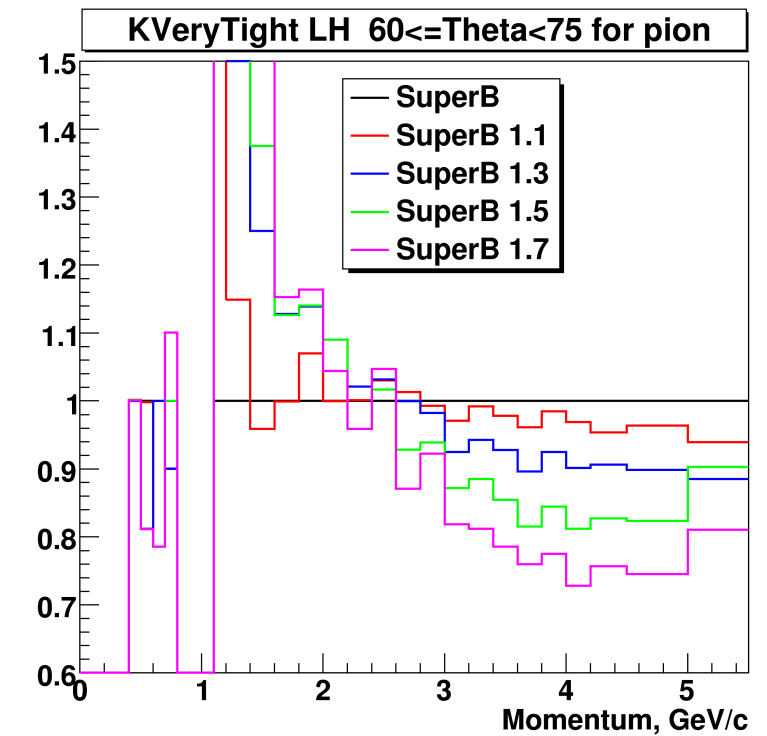
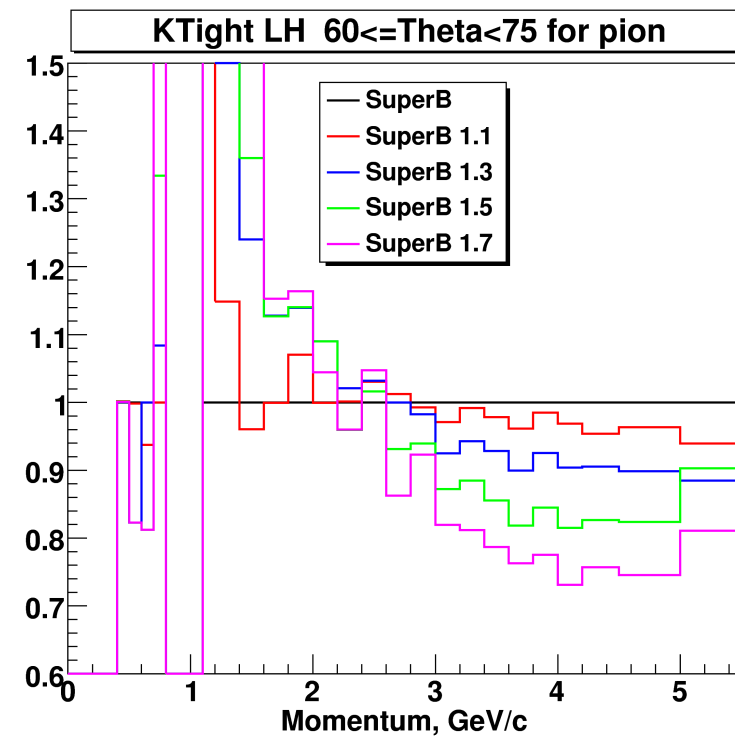
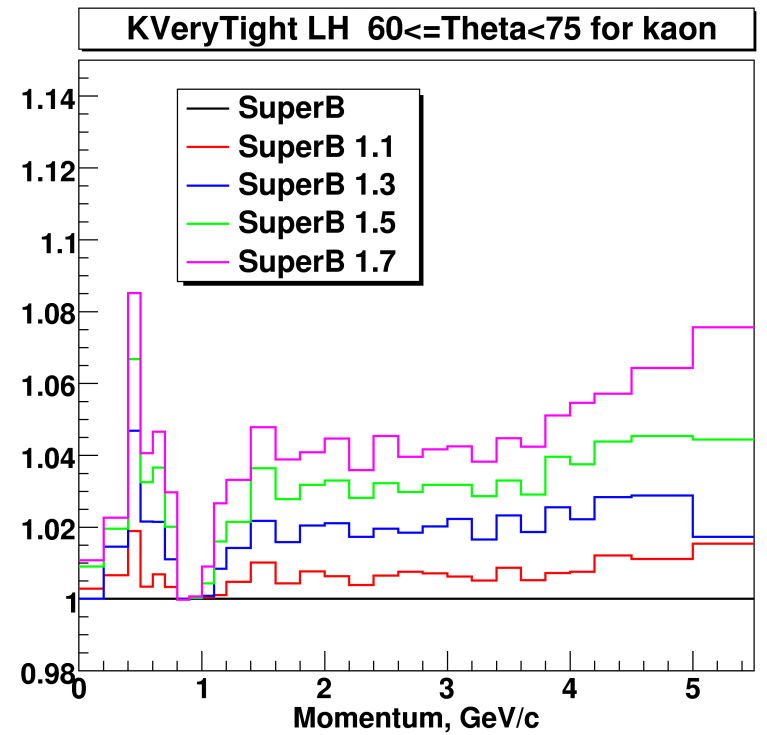
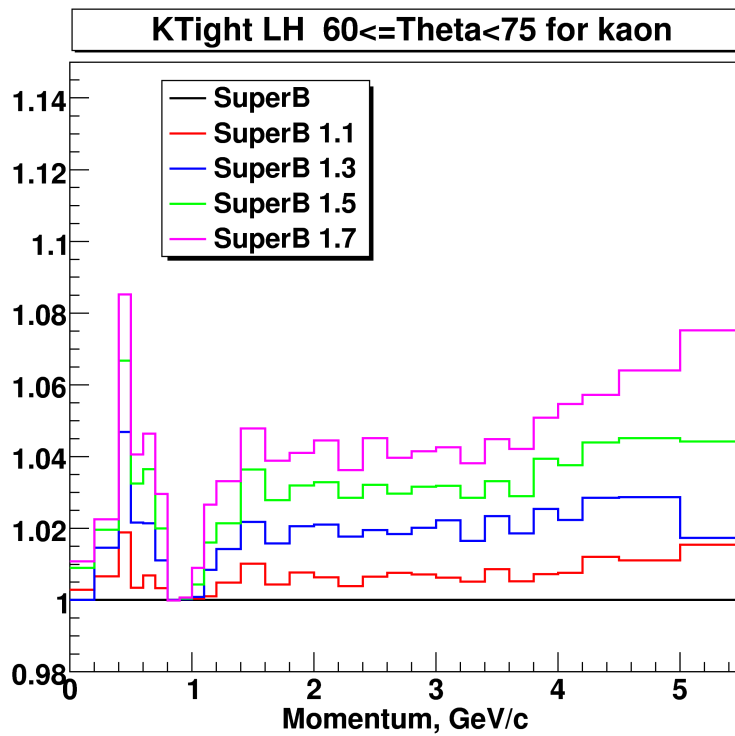
Barrel region

Relative gain



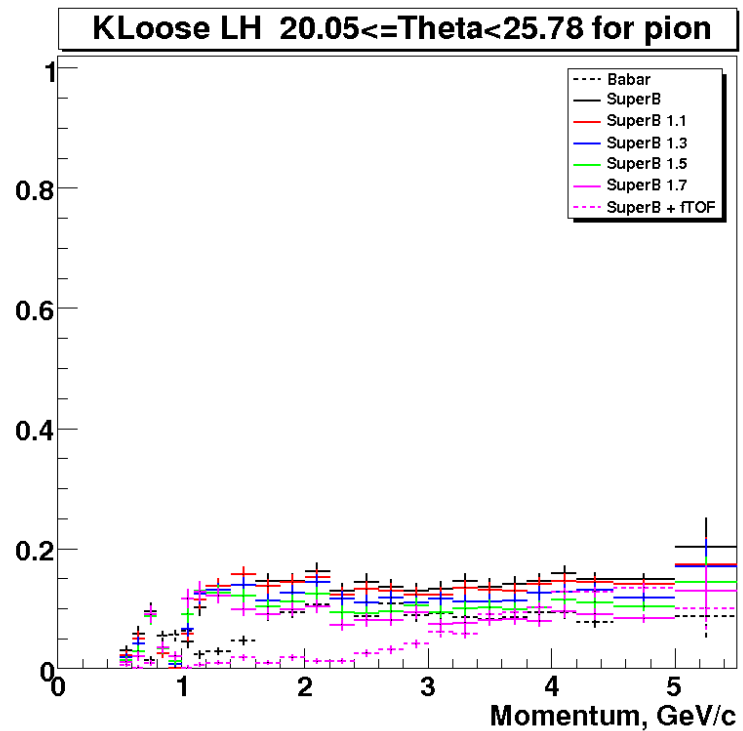
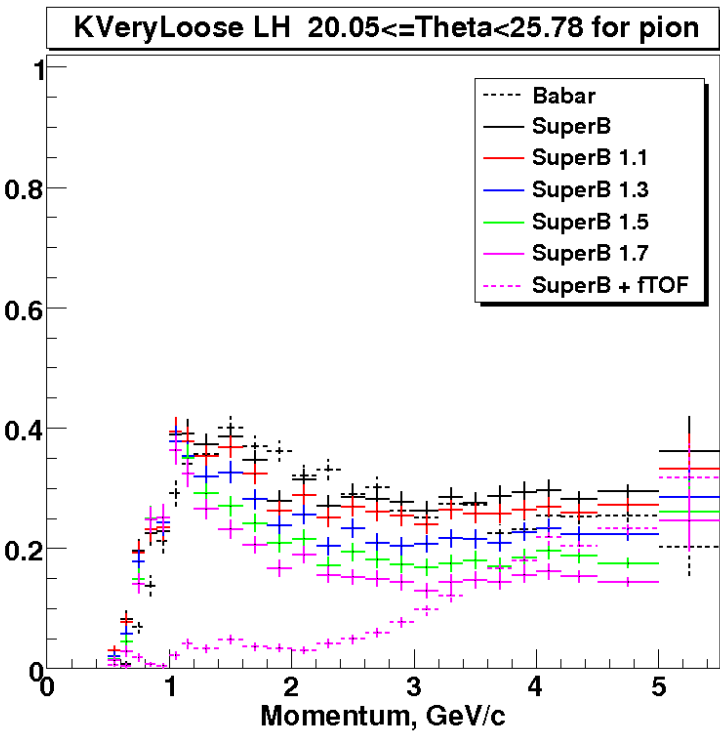
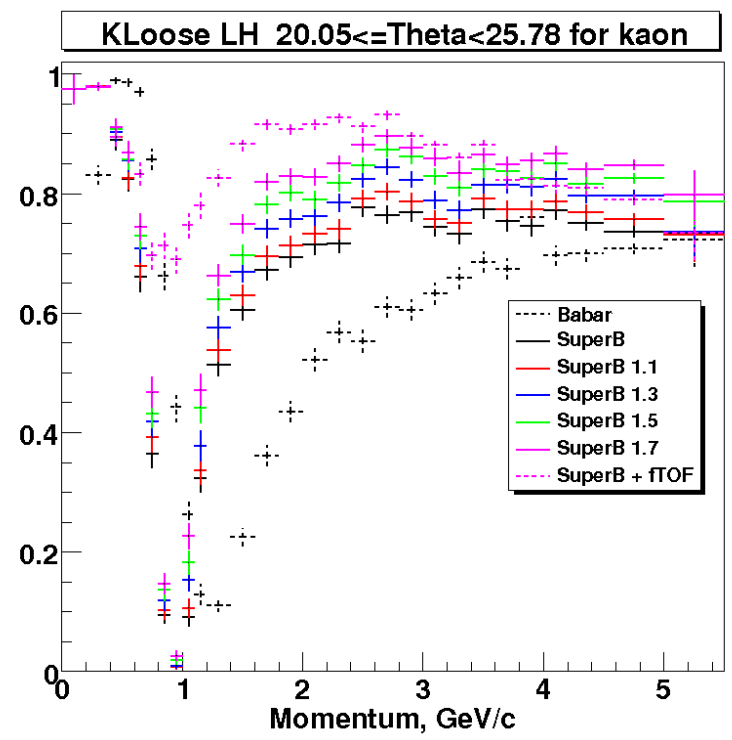
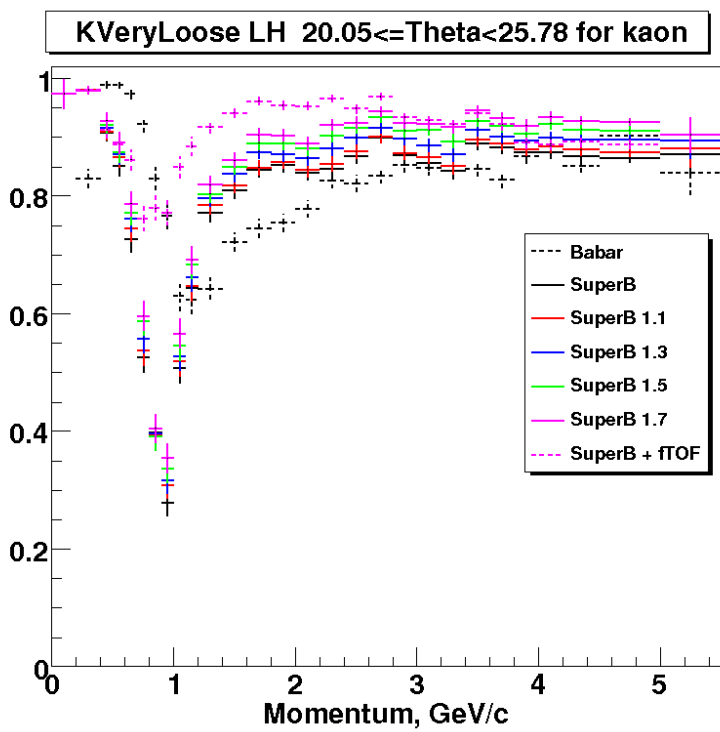
Barrel region

Relative gain



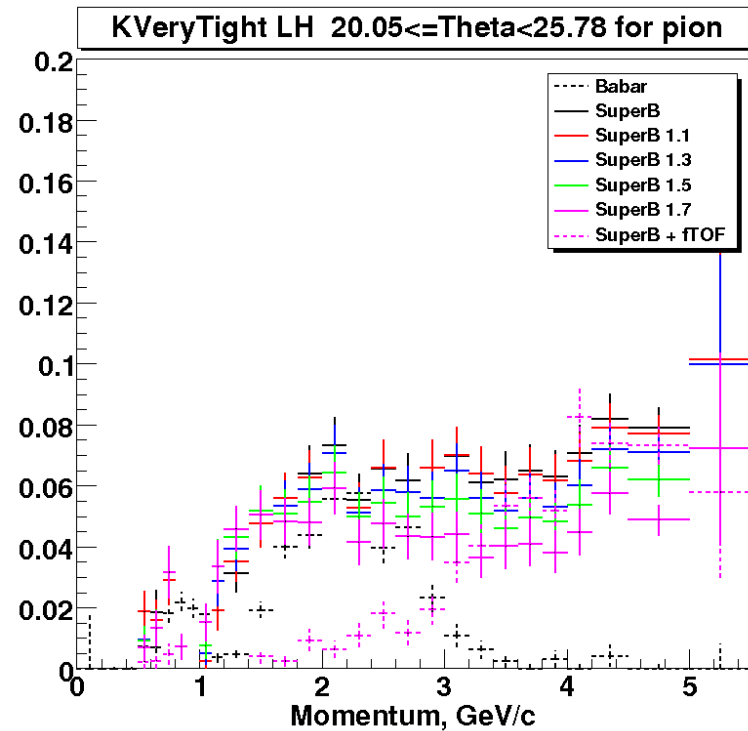
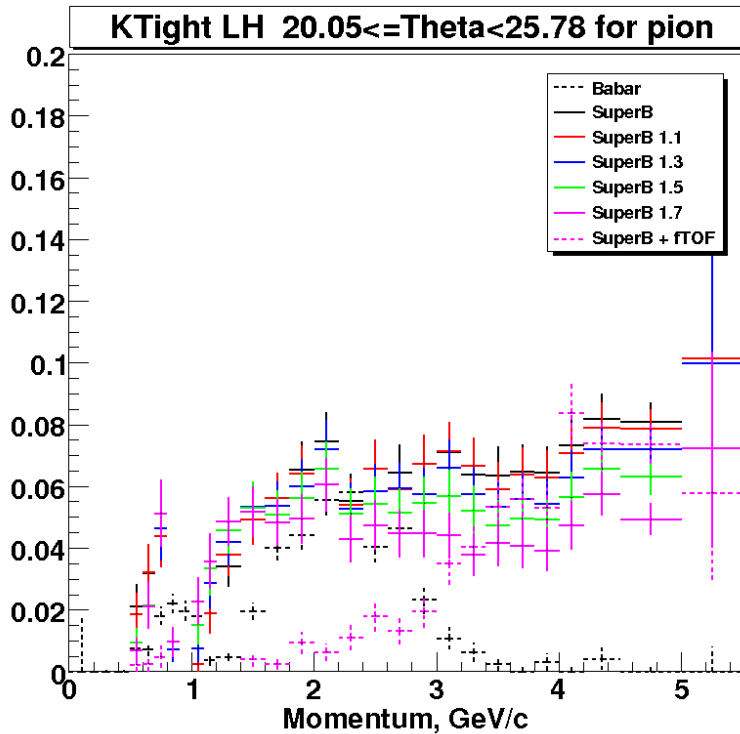
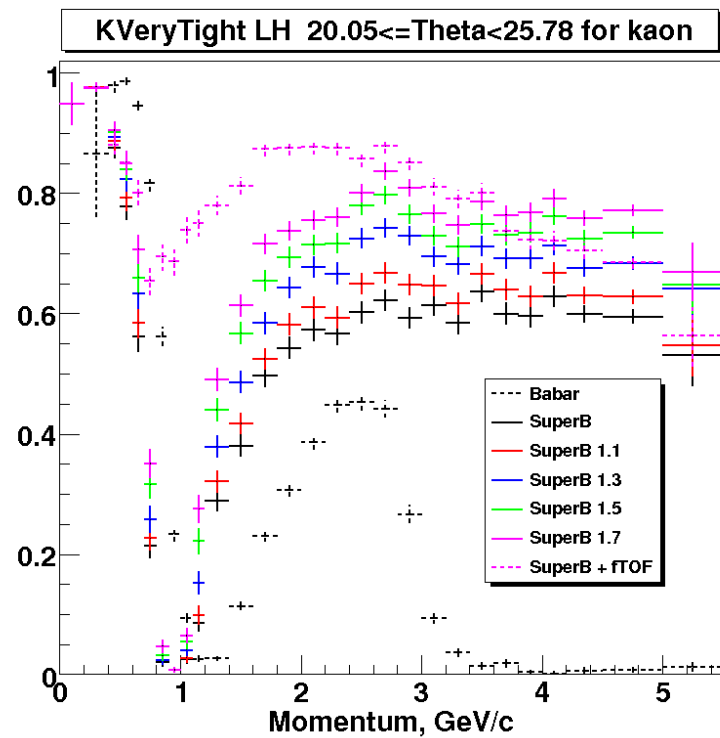
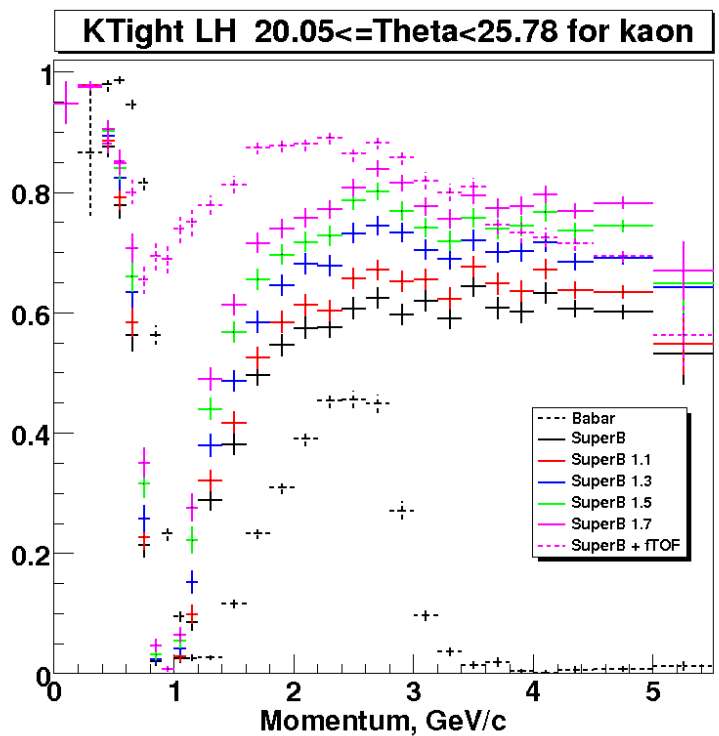
Barrel region

Kaon selectors for different DCH configurations



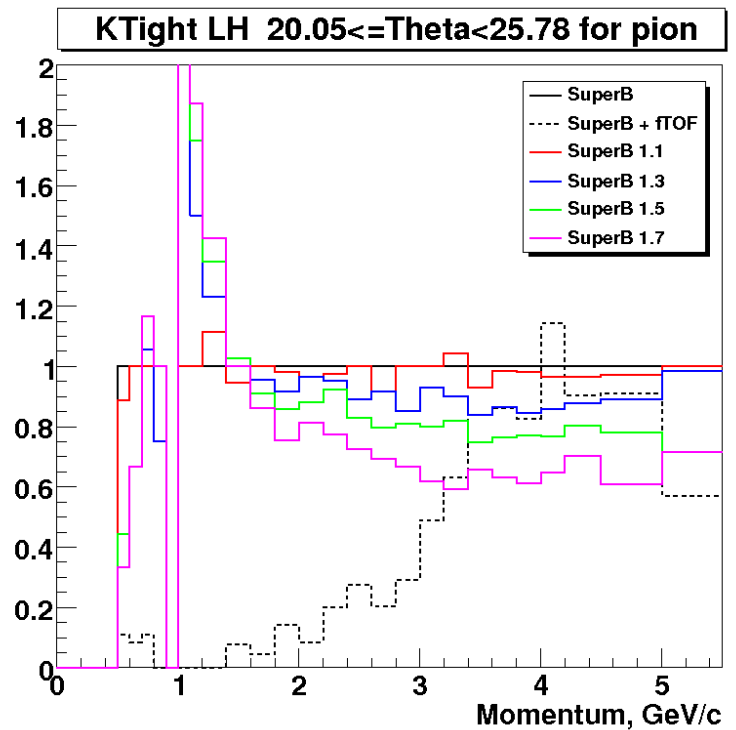
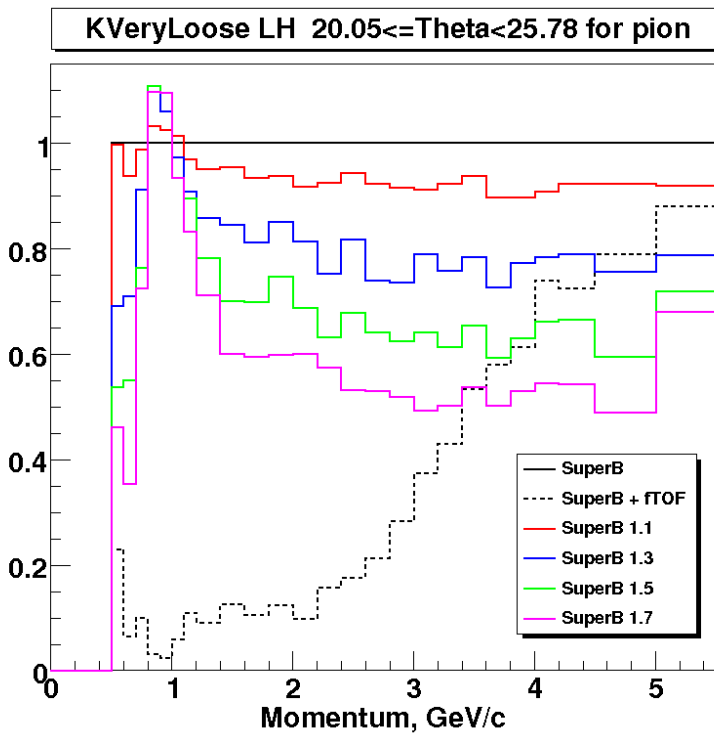
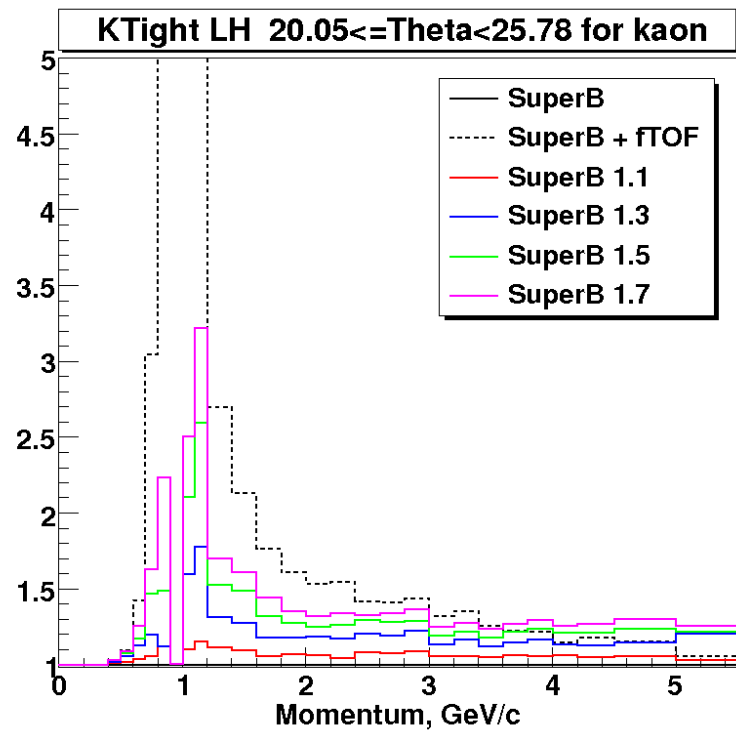
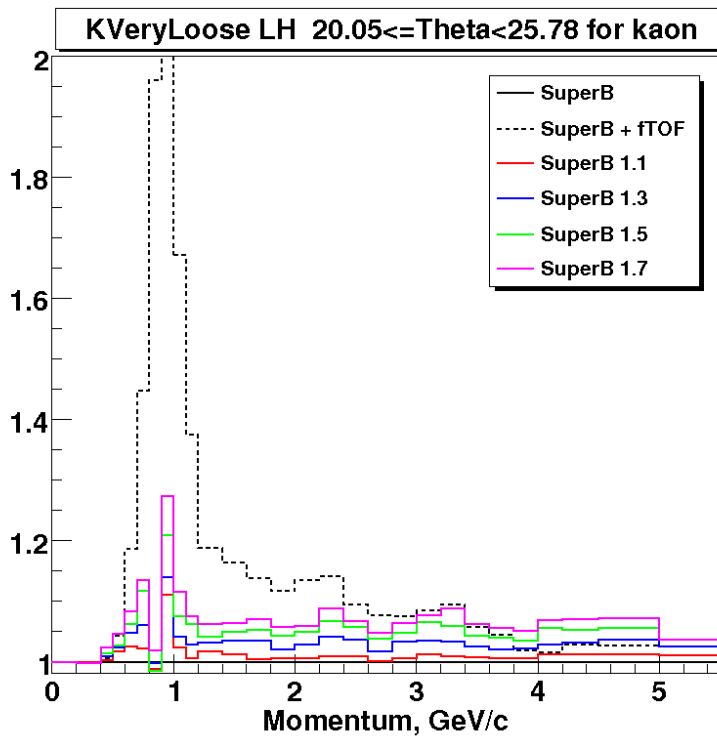
Forward region

Kaon selectors for different DCH configurations



Forward region

Relative gain



Forward region