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**The comparison of  $\Delta x$  and  $\Delta y$  distribution  
for Monte-Carlo and real data in the  
DIRAC setup.**

O.Gorchakov

GENEVA  
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# 1 Preface

The aim of this work was to compare for the  $\pi^+(p)\pi^-$ -pairs the widths of  $\Delta x$  and  $\Delta y$  (a difference of  $x(y)$  coordinates of  $\pi^+$  and  $\pi^-$  at the level of the target) distributions for Monte-Carlo and real data in the DIRAC setup. In this way it is possible to check if the last version GEANT-DIRAC description of multiple scattering process in MSGC and SFD is close to real MS one. First such kind distributions were used for study the MS in the DIRAC forward detectors in [1]. For the MC case the generator of long-lived pions([2]) was used also to make the MC  $\pi^+\pi^-$ -pairs to be close to real pairs, where “long-lived pions” means the pions which are created at the decays of long-lived particles; in the [2] it is shown that mainly these particles are  $\eta, \eta', \Lambda$  and  $K_S^0$ , but only the last two, which decay far from the target, can modify the shape of  $\Delta x$  and  $\Delta y$  distributions.

The real data files and the GEANT-DIRAC output files were analyzed by ARIANE.

# 2 Results

There were selected the  $\pi^+\pi^-$ -pairs with the total momentum from 2.6 to 9.0 GeV/c. As the momentum distribution for MC and real pairs are a bit different then the MC events were weighted to get the same momentum distribution as for real data. Also this momentum range was divided into three intervals(2.6-4.2-5.6-9.0GeV/c). For all of these intervals the distributions of  $\Delta x$  and  $\Delta y$  of  $\pi^+$  and  $\pi^-$  are shown on Fig. 1 and 2, for MC and real data. The distributions were fitted by the Gaussian.

We see that the  $\sigma_{MC}$  is very close to  $\sigma_{real}$ .

The distributions of  $\Delta x/\sigma_{\Delta x}(\Delta y/\sigma_{\Delta y})$  for  $\pi^+\pi^-$ -pair at the level of the target for MC and real data are shown on Fig. 3. The fact the value of  $\sigma(\Delta x/\sigma_{\Delta x})$  for real data is higher than for MC one can be explained that in the case of real data the background conditions is a bit higher than for MC one.

The distributions of  $\Delta x(\Delta y)$  of  $\pi^+$  and  $\pi^-$  at the level of the target for different intervals of pair momentum and for short- and long-lived sources of pions are shown of Fig. 4 and 5. We see that the contribution of long-lived sources increases the value of  $\sigma$  by 2% and depends on the pair momentum slightly.

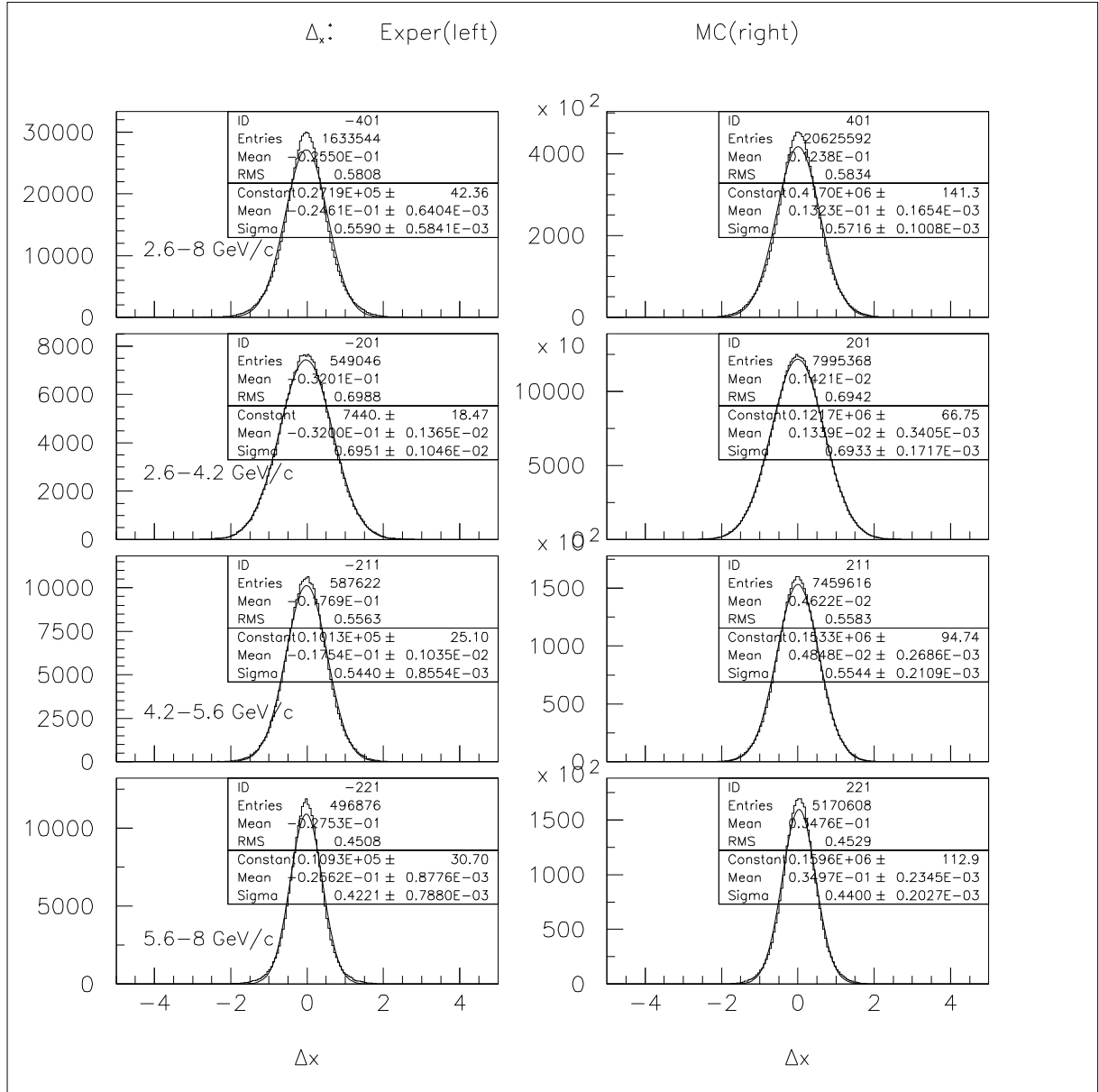


Figure 1: *MC and real data. The distributions of  $\Delta x$ (cm) of  $\pi^+$  and  $\pi^-$  at the level of the target for different intervals of pair momentum.*

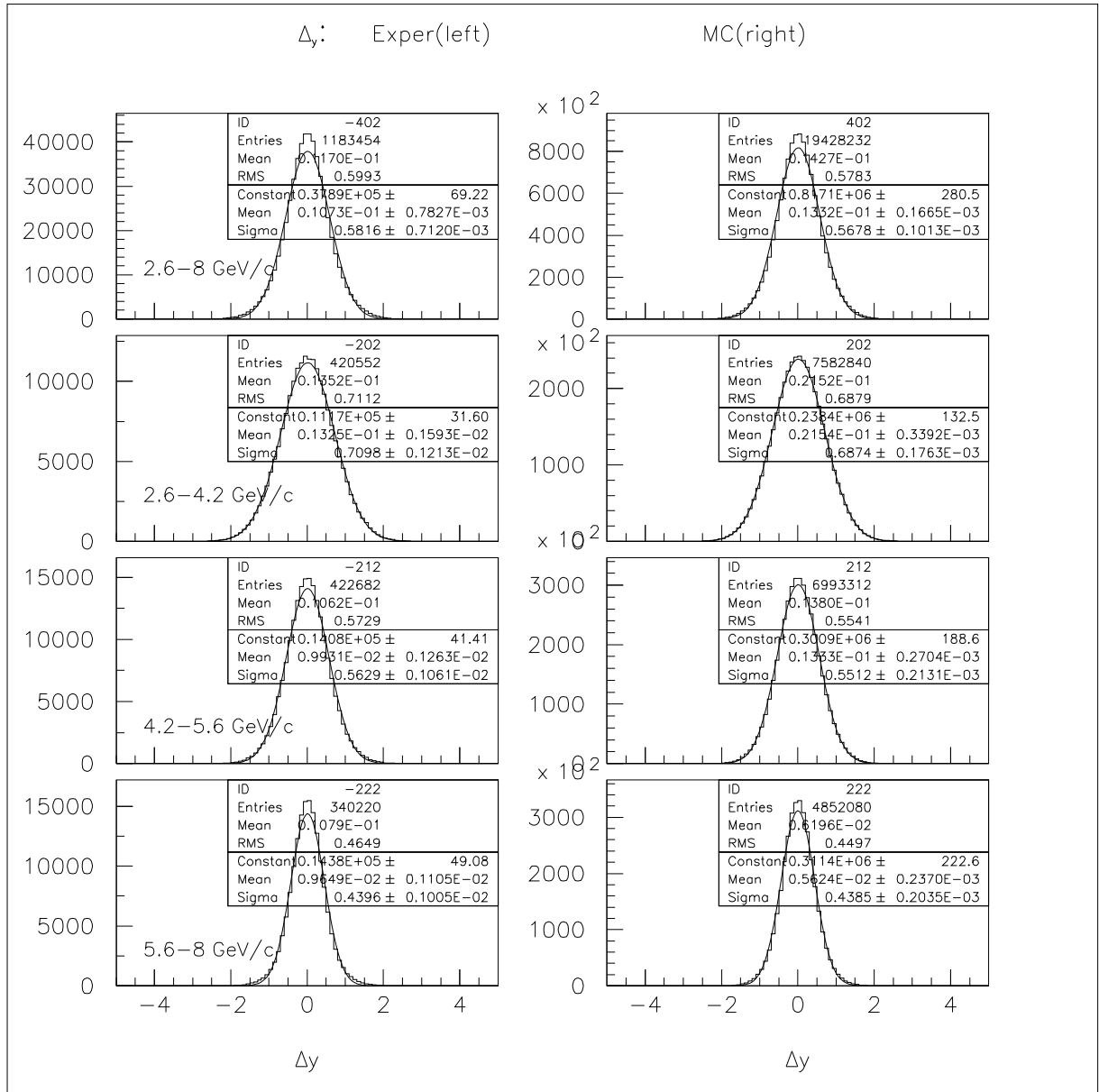


Figure 2: MC and real data. The distributions of  $\Delta y$ (cm) for  $\pi^+$  and  $\pi^-$  at the level of the target for different intervals of pair momentum.

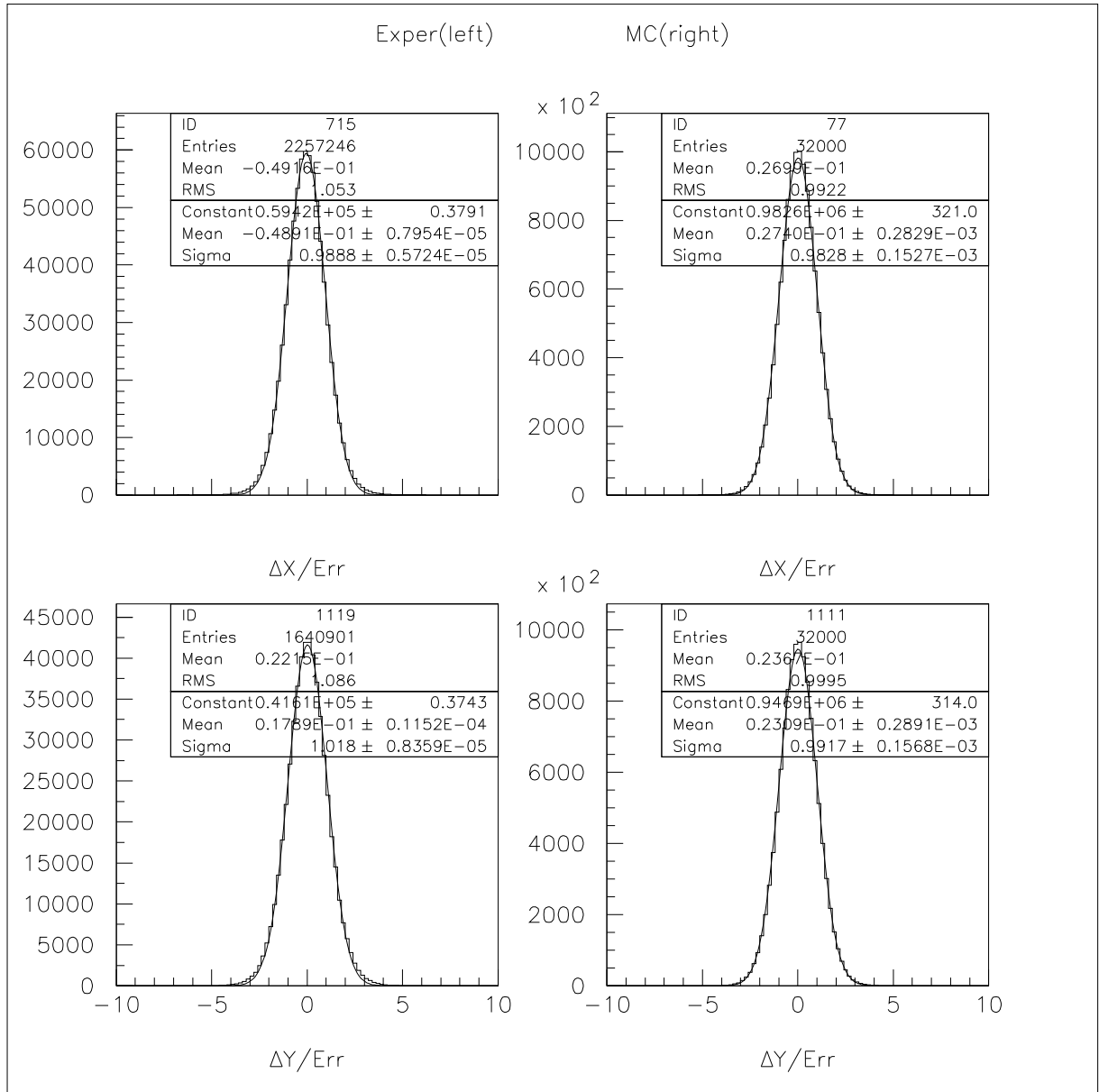


Figure 3: MC and real data. The distributions of  $\Delta x/\sigma_{\Delta x}$  for  $\pi^+\pi^-$ -pair at the level of the target.

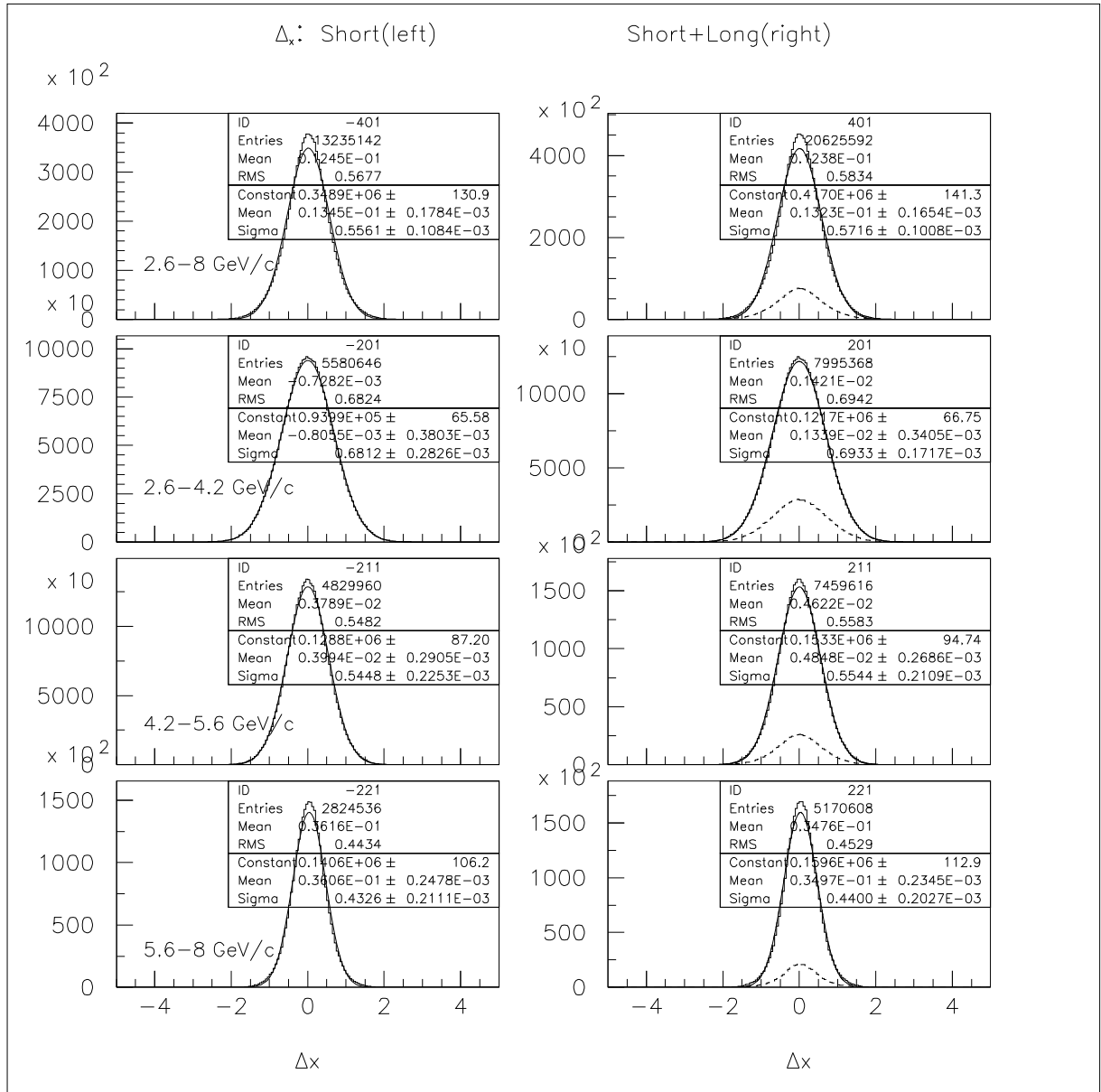


Figure 4: The MC data. The distributions of  $\Delta x$ (cm) of  $\pi^+$  and  $\pi^-$  at the level of the target for different intervals of pair momentum. Left: only the short-lived pion sources are taken into account. Right: the short- and long-lived pion sources are taken into account(dashed - contribution of long-lived one).

## References

- [1] Study of multiple scattering in upstream detectors in DIRAC, B. Adeva, A. Romero, O. Vazquez Doce [Santiago] , DIRAC Note 2005-16.
- [2] On pions which go from long path decayed particles, O.Gorchakov [JINR], DIRAC Note 2007-03.

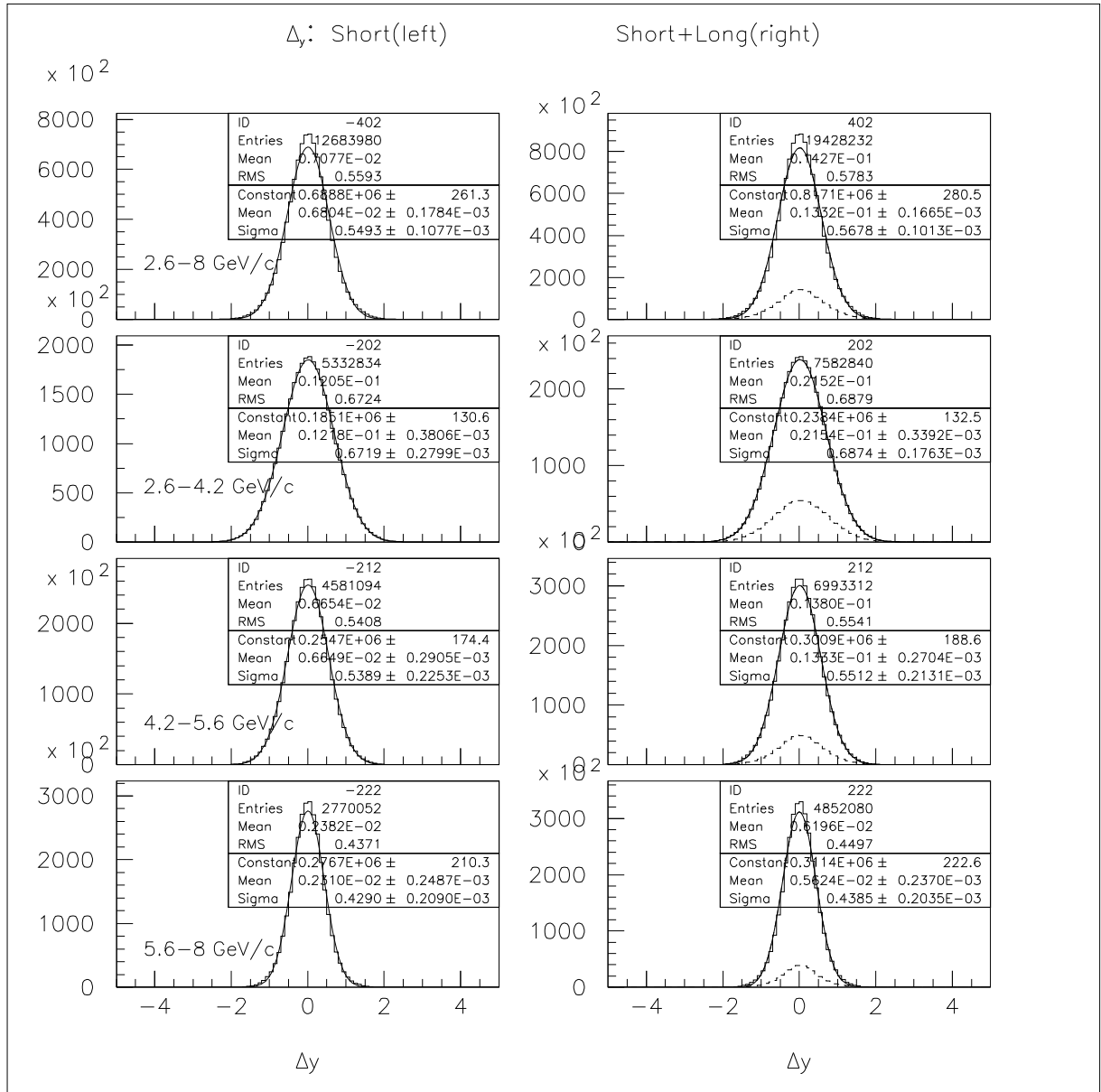


Figure 5: The MC data. The distributions of  $\Delta y$  (cm) of  $\pi^+$  and  $\pi^-$  at the level of the target for different intervals of pair momentum. Left: only the short-lived pion sources are taken into account. Right: the short- and long-lived pion sources are taken into account (dashed - contribution of long-lived one).