Some more combinations for measuring α for charm production

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1 Introduction

We provide more averages of α for charm production, based on table 3 in our recent publication [1]. The aditional numbers and figures were produced following a recent email conversation with Boris Kopeliovich (Valparaiso, and Max Planck Institut für Kernphysik Heidelberg), which started in November with an email from Stan Brodsky to Boris and his collaborator Ivan Schmidt (Valparaiso, Chile).

Boris is preparing a paper explaning our observations, and requested more and different averages we did not provide in our publication. He also points out one of his earlier publications [2] (which unfortunaltely we do not cite), where in fig. 2 α–values as low as 0.5 are shown for strange particle production.

We measured α (as in $\sigma \propto A^{\alpha}$) for 14 different charm particles and decay modes, produced by four beam particles, and in four x_F-bins. In the publication we provide the full table, as well as some selected averages: all charm, production of charm/anti-charm, leading/non-leading, and charm produced by baryon (Σ^-, p) and meson (π^-, π^+) beams.

We present here averages obtained from table 3 of the publication for the following conditions: Mesons (all D's) and Baryons produced by Σ^- (fig. 3, table 3) and π^- (fig. 2, table 2) as well as by any beam particle (fig. 1, table 1). For mesons, we also present leading and non-leading production by Σ^- (fig. 5, table 5) and π^- (fig. 4, table 4) beams.

In our publication we show a $3\,\sigma$ difference in the production of charm (averaged over all modes) with meson and baryon beams. Here we find in fig. 1 a $2.8\,\sigma$ difference in the production of Mesons and Baryons, averaged over all beam particles, with a $2.9\,\sigma$ difference with Σ^- beam alone (fig. 3).

2 Charm Mesons and Baryons produced by any beam particle

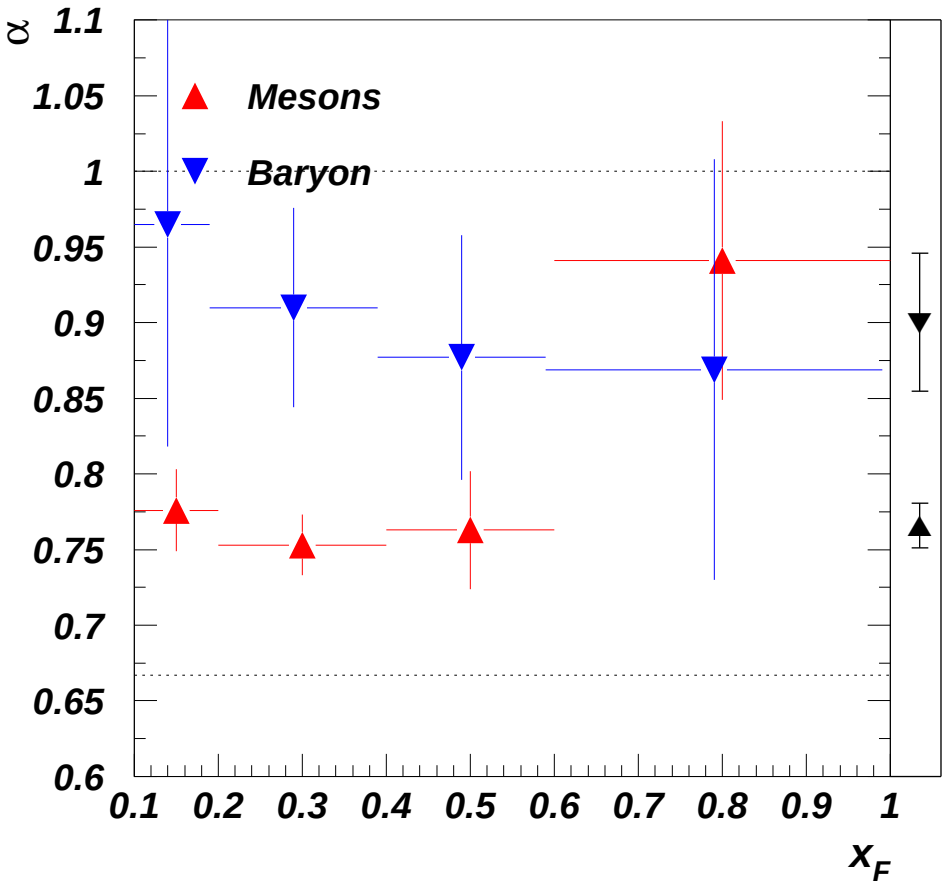

Figure 1: Charm Mesons and Baryons produced by any beam particle

Beam	Mode	α $0.1 < x_F < 0.2$	α $0.2 < x_F < 0.4$	α $0.4 < x_F < 0.6$	α $x_F > 0.6$	α Average
All Beams	Mesons	0.776 ± 0.027	0.753 ± 0.020	0.763 ± 0.039	0.941 ± 0.092	0.766 ± 0.015
All Beams	Baryons	0.965 ± 0.147	0.910 ± 0.066	0.877 ± 0.081	0.869 ± 0.139	0.900 ± 0.046

Table 1: Charm Mesons and Baryons produced by any beam particle

3 Charm Mesons and Baryons produced by π^-

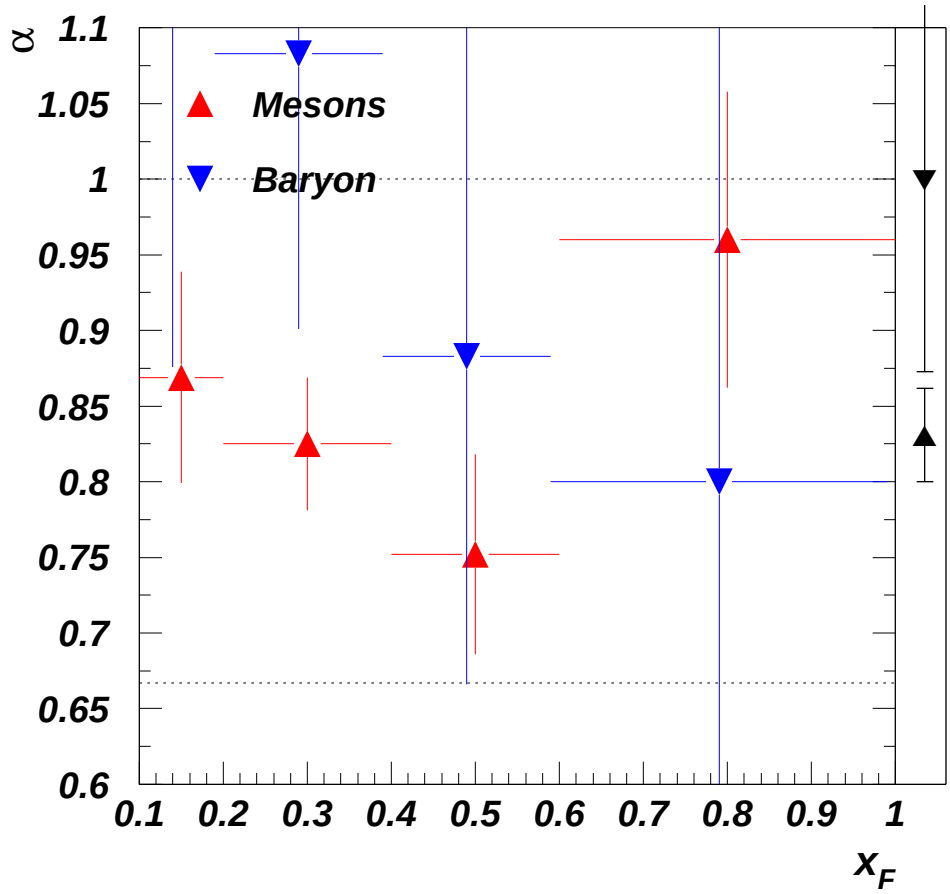

Figure 2: Charm Mesons and Baryons produced by π^-

Beam	Mode	α $0.1 < x_F < 0.2$	α $0.2 < x_F < 0.4$	α $0.4 < x_F < 0.6$	α $x_F > 0.6$	α Average
π^-	Mesons	0.869 ± 0.070	0.825 ± 0.044	0.752 ± 0.066	0.960 ± 0.098	0.831 ± 0.031
π^-	Baryons	1.416 ± 0.540	1.083 ± 0.182	0.883 ± 0.217	0.800 ± 0.370	1.000 ± 0.127

Table 2: Charm Mesons and Baryons produced by π^-

4 Charm Mesons and Baryons produced by Σ^-

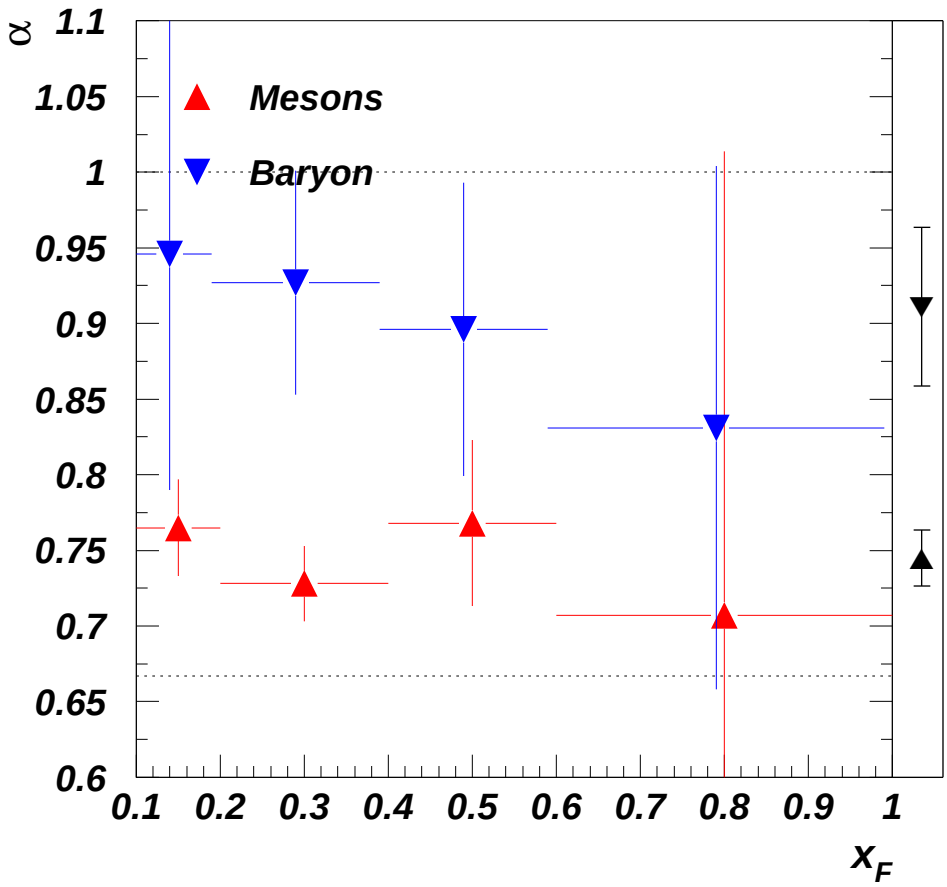

Figure 3: Charm Mesons and Baryons produced by Σ^-

Beam	Mode	α $0.1 < x_F < 0.2$	α $0.2 < x_F < 0.4$	α $0.4 < x_F < 0.6$	α $x_F > 0.6$	α Average
Σ^-	Mesons	0.765 ± 0.032	0.728 ± 0.025	0.768 ± 0.055	0.707 ± 0.307	0.745 ± 0.019
Σ^-	Baryons	0.946 ± 0.156	0.927 ± 0.074	0.896 ± 0.097	0.831 ± 0.173	0.911 ± 0.053

Table 3: Charm Mesons and Baryons produced by Σ^-

5 Leading/nonleading Charm Mesons produced π^-

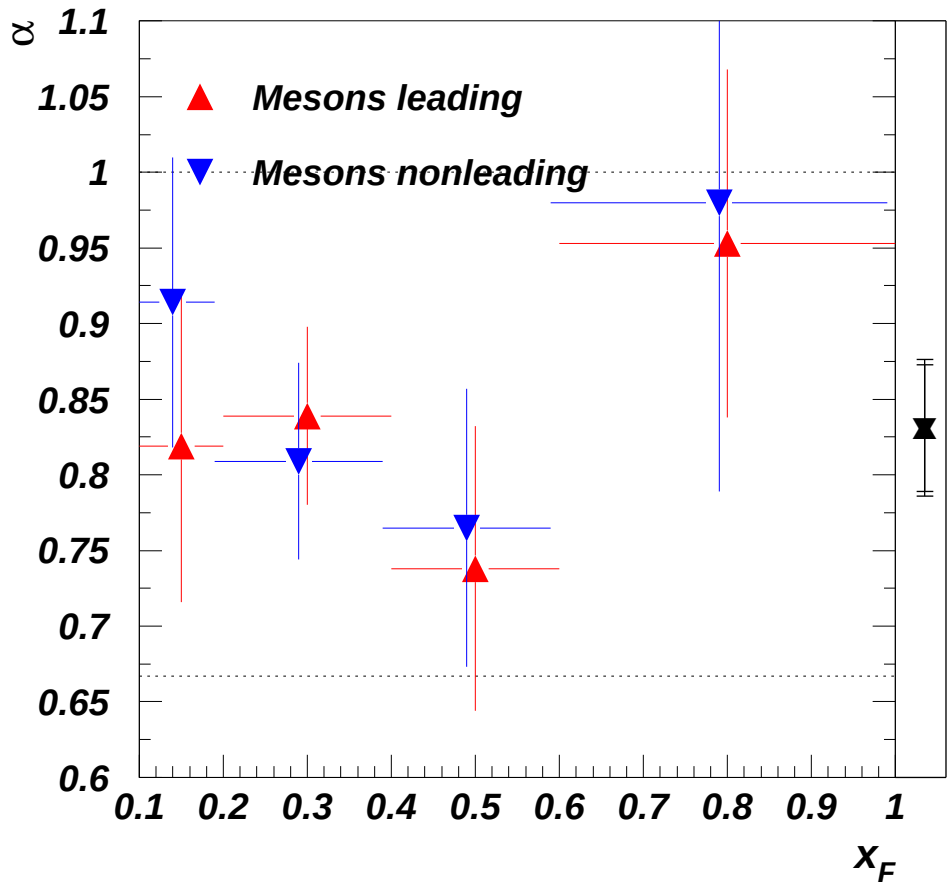

Figure 4: Leading/nonleading Charm Mesons produced π^-

Beam	Mode	α $0.1 < x_F < 0.2$	α $0.2 < x_F < 0.4$	α $0.4 < x_F < 0.6$	α $x_F > 0.6$	α Average
π^-	Mesons leading	0.819 ± 0.103	0.839 ± 0.059	0.738 ± 0.094	0.953 ± 0.115	0.831 ± 0.042
π^-	Mesons nonleading	0.914 ± 0.096	0.809 ± 0.065	0.765 ± 0.092	0.980 ± 0.191	0.831 ± 0.045

Table 4: Leading/nonleading Charm Mesons produced π^-

6 Leading/nonleading Charm Mesons produced Σ^-

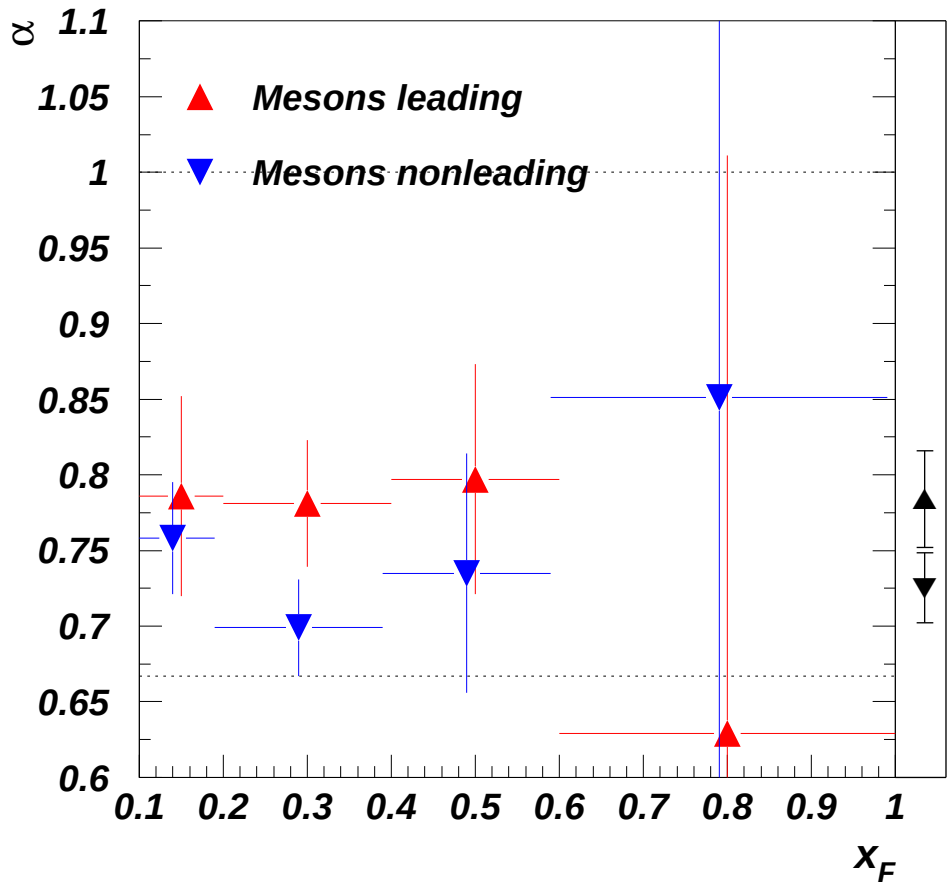

Figure 5: Leading/nonleading Charm Mesons produced Σ^-

Beam	Mode	α $0.1 < x_F < 0.2$	α $0.2 < x_F < 0.4$	α $0.4 < x_F < 0.6$	α $x_F > 0.6$	α Average
Σ^-	Mesons leading	0.786 ± 0.066	0.781 ± 0.042	0.797 ± 0.076	0.629 ± 0.382	0.784 ± 0.032
Σ^-	Mesons nonleading	0.758 ± 0.037	0.699 ± 0.032	0.735 ± 0.079	0.851 ± 0.518	0.725 ± 0.023

Table 5: Leading/nonleading Charm Mesons produced Σ^-

References

[1] A. Blanco-Covarrubias, J.Engelfried, *et al.* [SELEX Collaboration], "Nuclear Dependence of Charm Production," Eur. Phys. J. C **64**, 637 (2009) [arXiv:0902.0355 [hep-ex]].

[2] B.Z. Kopeliovich, J. Nemchik, I.K. Potashnikova, M.B. Johnson and I. Schmidt, "Breakdown of QCD factorization at large Feynman x," Phys. Rev. C **72**, 054606 (2005) [arXiv:hep-ph/0501260].