

# Global analysis of $q_T$ distributions in $2b_*$ parametrization

## *Internal note*

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### Abstract

I summarize the results of our fits in the  $2b_*$  prescription

## 1 Best-fit parameters

The investigated parametrization of  $S_{NP}(b, Q)$  is

$$S_{NP}(b, Q) = b^2 \left[ a_1 + a_2 \ln \left( \frac{Q}{2Q_0} \right) + a_3 \ln(100x_A x_B) \right].$$

Note that  $a_3$  is identical to the combination  $g_1 g_3$  in the BLNY parametrization. This parametrization of  $S_{NP}(b, Q)$  can be called from Legacy by choosing `inonpert=8` and `iflag_c3=21` (24) for  $C_3 = b_0$  ( $C_3 = 2b_0$ ).

In addition to the best-fit parameter set  $\mathbf{a}_{best} = \{a_1, a_2, a_3\}$ , we quote six “extreme” parameter sets  $\mathbf{a}_{(i)}^\pm$  ( $i = 1, 2, 3$ ), which can be used to estimate correlated  $1\sigma$  errors for any observable  $X$  (e.g.,  $d\sigma/dq_T$ ) within the Hessian method approach. The employed method is identical to that used in the latest CTEQ and MRST analyses to estimate the PDF errors for arbitrary hadronic observables. Each extreme set corresponds to the increase of the global  $\chi^2$  by 1 from the best-fit  $\chi^2$  along one of three eigenvectors of the Hessian matrix in space of the parameters  $a_i$ . The  $1\sigma$  error in  $X$  can be estimated by

$$\delta X = \frac{1}{2} \sqrt{\sum_{i=1}^3 \left( X(\mathbf{a}_{(i)}^+) - X(\mathbf{a}_{(i)}^-) \right)^2}.$$

The best-fit parameters for  $C_3 = b_0$  are  $b_{max} = 1.5 \text{ GeV}^{-1}$ ,  $Q_0 = 1.6 \text{ GeV}$ , and

$$a_1 = (0.201 \pm 0.011) \text{ GeV}^2, \quad a_2 = (0.184 \pm 0.018) \text{ GeV}^2, \quad a_3 = (-0.026 \pm 0.007) \text{ GeV}^2.$$

The parameters of six extreme sets  $\mathbf{a}_i^\pm$  are quoted in Table 1.

The best-fit parameters for  $C_3 = 2b_0$  are  $b_{max} = 1.5 \text{ GeV}^{-1}$ ,  $Q_0 = 1.6 \text{ GeV}$ , and

$$a_1 = (0.247 \pm 0.016) \text{ GeV}^2, \quad a_2 = (0.158 \pm 0.023) \text{ GeV}^2, \quad a_3 = (-0.049 \pm 0.012) \text{ GeV}^2.$$

The parameters of six extreme sets  $\mathbf{a}_i^\pm$  are quoted in Table 2.

Set/parameter	$a_1$	$a_2$	$a_3$
$\mathbf{a}_{(1)}^+$	0.208	0.198	-0.034
$\mathbf{a}_{(1)}^-$	0.192	0.168	-0.017
$\mathbf{a}_{(2)}^+$	0.21	0.169	-0.024
$\mathbf{a}_{(2)}^-$	0.192	0.199	-0.029
$\mathbf{a}_{(3)}^+$	0.208	0.195	-0.024
$\mathbf{a}_{(3)}^-$	0.193	0.174	-0.029

Table 1: Parameters of the six “extreme” sets  $\mathbf{a}_{(i)}^\pm$  ( $i = 1, 2, 3$ ) for  $C_3 = b_0$ .

Set/parameter	$a_1$	$a_2$	$a_3$
$\mathbf{a}_{(1)}^+$	0.262	0.181	-0.059
$\mathbf{a}_{(1)}^-$	0.233	0.135	-0.039
$\mathbf{a}_{(2)}^+$	0.240	0.182	-0.055
$\mathbf{a}_{(2)}^-$	0.254	0.134	-0.044
$\mathbf{a}_{(3)}^+$	0.232	0.153	-0.057
$\mathbf{a}_{(3)}^-$	0.262	0.162	-0.042

Table 2: Parameters of the six “extreme” sets  $\mathbf{a}_{(i)}^\pm$  ( $i = 1, 2, 3$ ) for  $C_3 = 2b_0$ .

## 2 Scan over $b_{max}$ *cum figuris*

### 2.1 Global $\chi^2$ and best-fit parameters

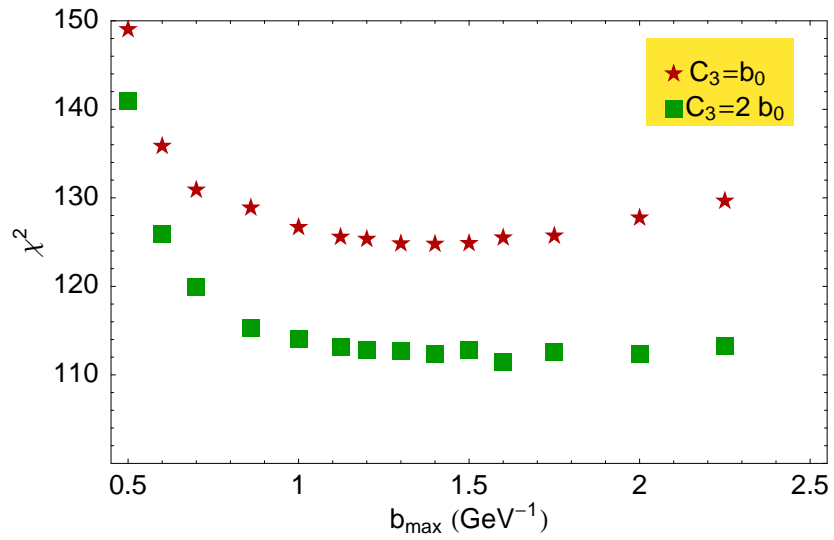


Figure 1:  $\chi^2$  vs.  $b_{max}$

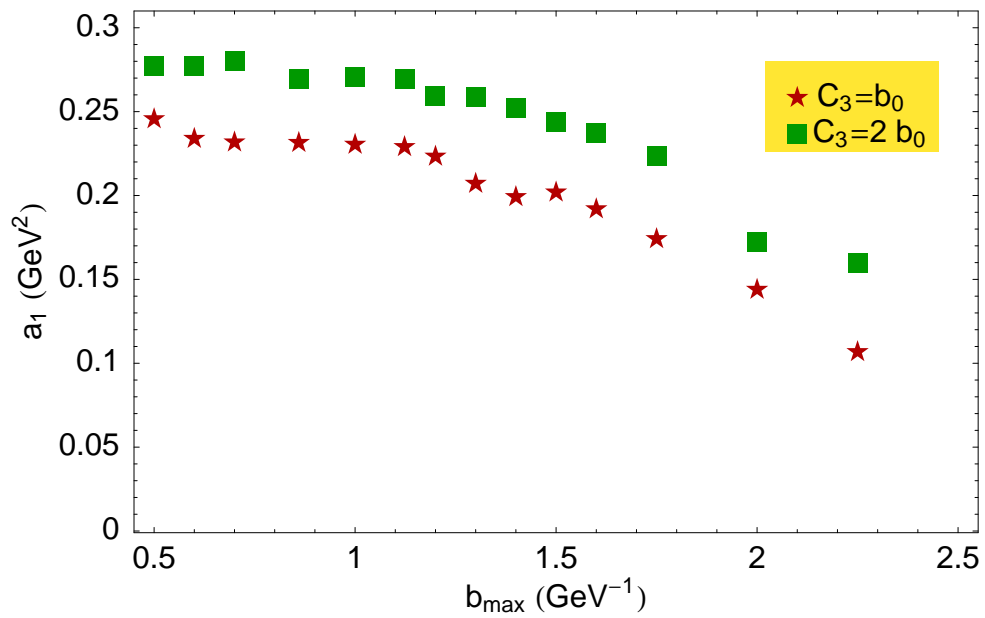


Figure 2:  $a_1$  vs.  $b_{max}$

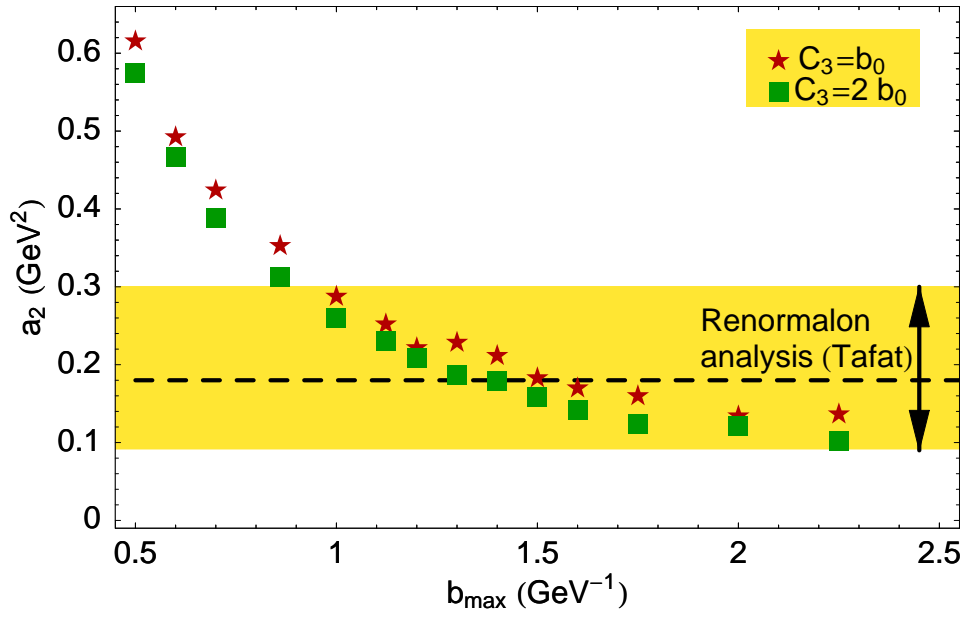


Figure 3:  $a_1$  vs.  $b_{max}$

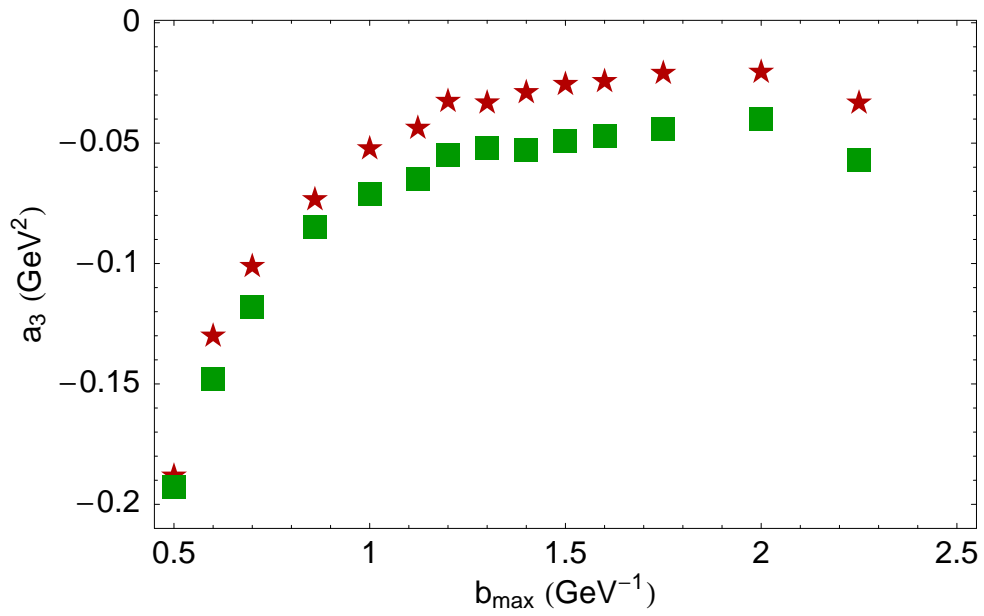


Figure 4:  $a_3$  vs.  $b_{max}$

## 2.2 Normalizations of the experimental data

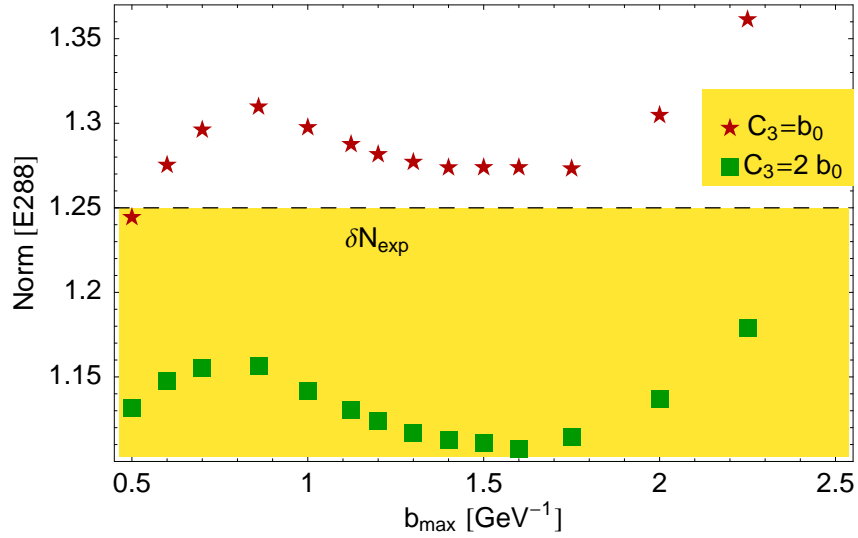


Figure 5: The normalization adjustment parameter  $N_{E288}$  multiplying the E288 data. The values of  $N_{E288}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{\text{exp}} = 25\%$ .

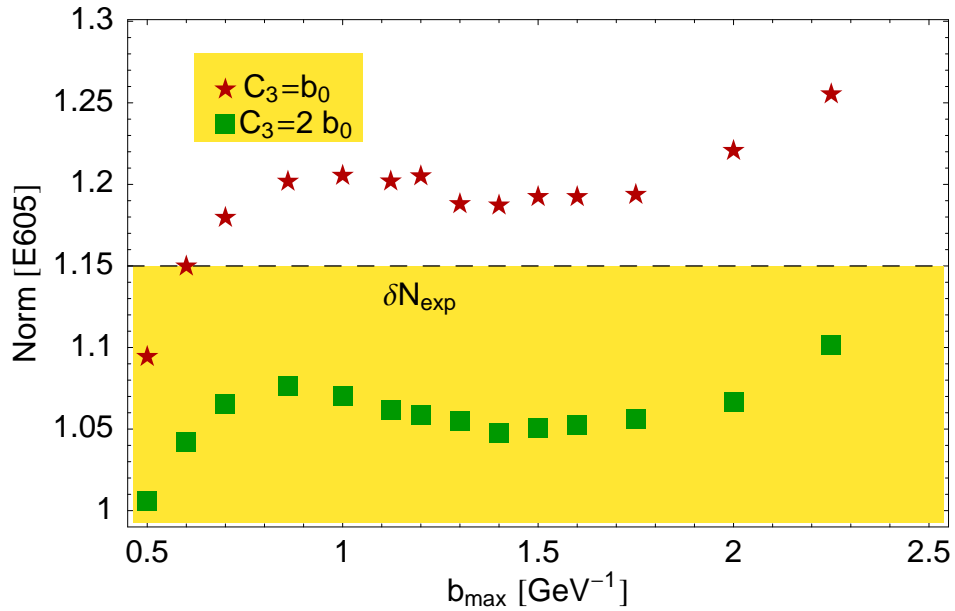


Figure 6: The normalization adjustment parameter  $N_{E605}$  multiplying the E605 data. The values of  $N_{E605}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{\text{exp}} = 15\%$ .

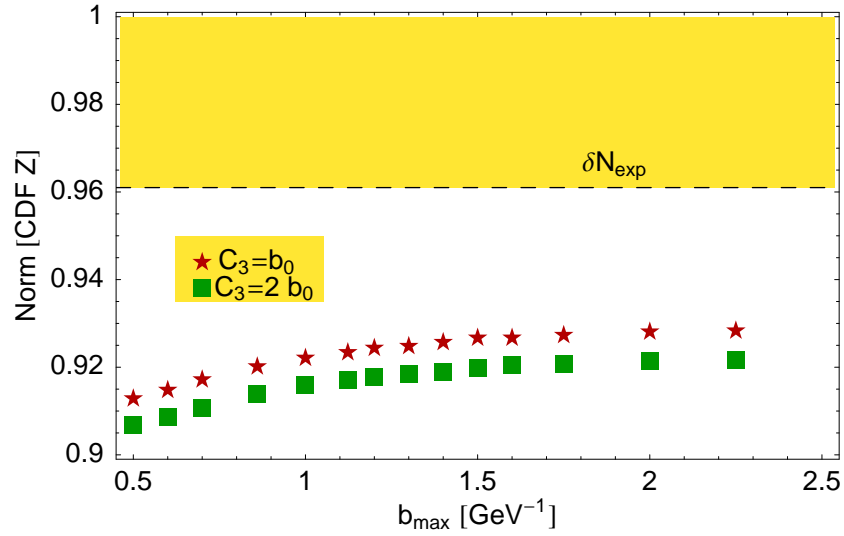


Figure 7: The normalization adjustment parameter  $N_{CDF}$  multiplying the CDF data. The values of  $N_{CDF}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{exp} = 3.343\%???$ .

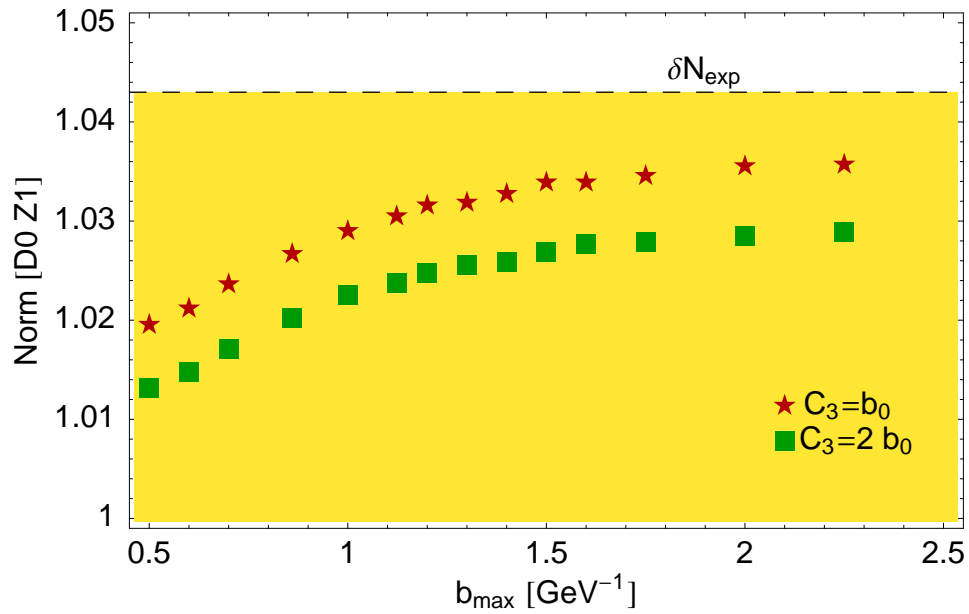


Figure 8: The normalization adjustment parameter  $N_{D0}$  multiplying the  $D\bar{0}$  data. The values of  $N_{D0}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{exp} = 4.5\%???$ .

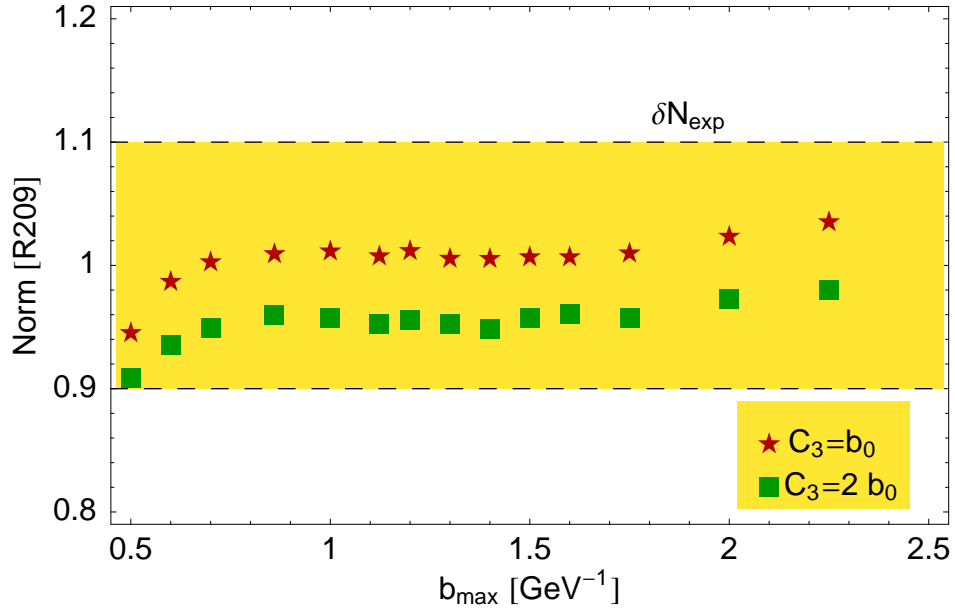


Figure 9: The normalization adjustment parameter  $N_{R209}$  multiplying the R209 data. The values of  $N_{R209}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{exp} = 10\%$ .

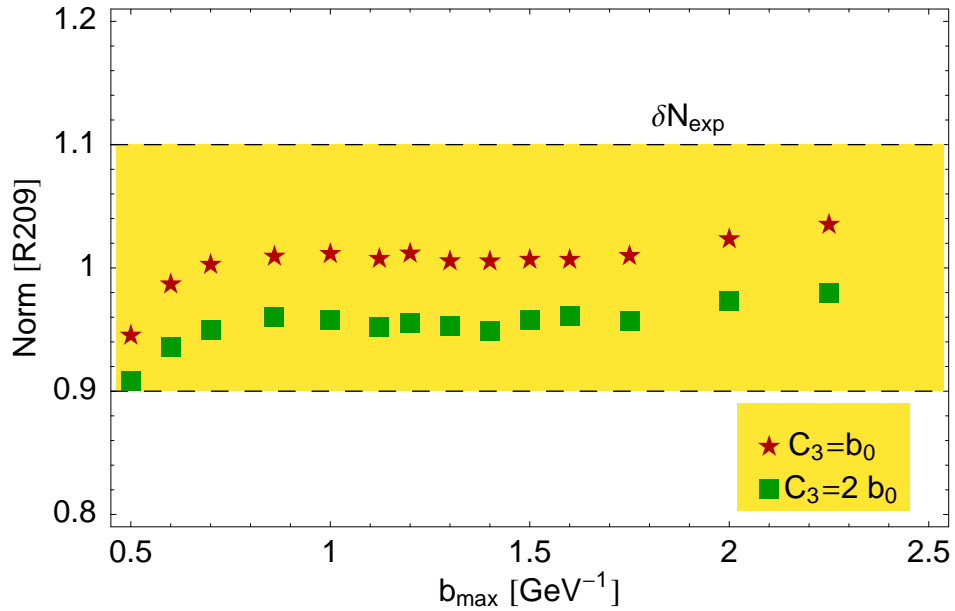


Figure 10: The normalization adjustment parameter  $N_{R209}$  multiplying the R209 data. The values of  $N_{R209}$  within the shaded area deviate from unity by less than one published standard deviation  $\delta N_{exp} = 10\%$ .

### 2.3 $\chi^2$ for individual experiments

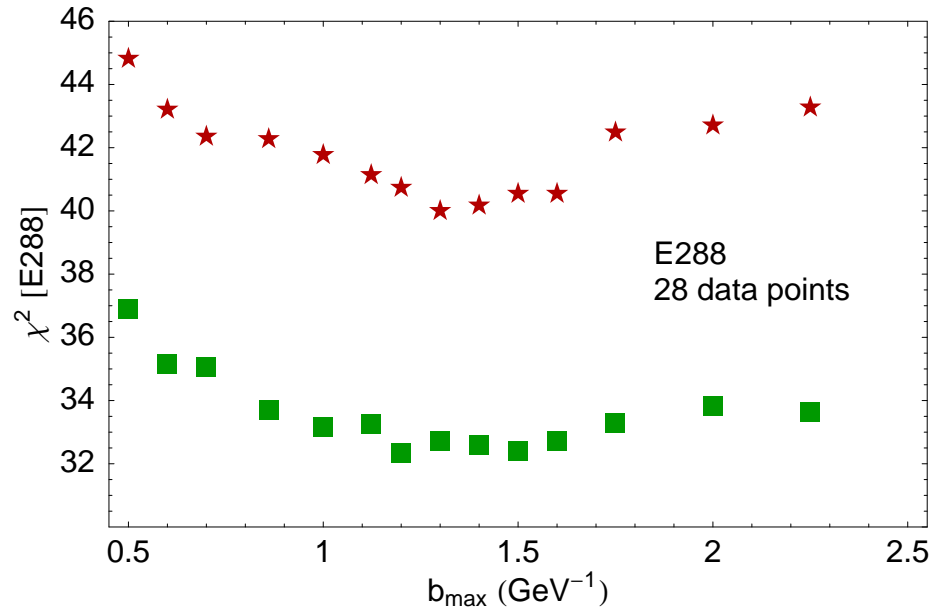


Figure 11: E288

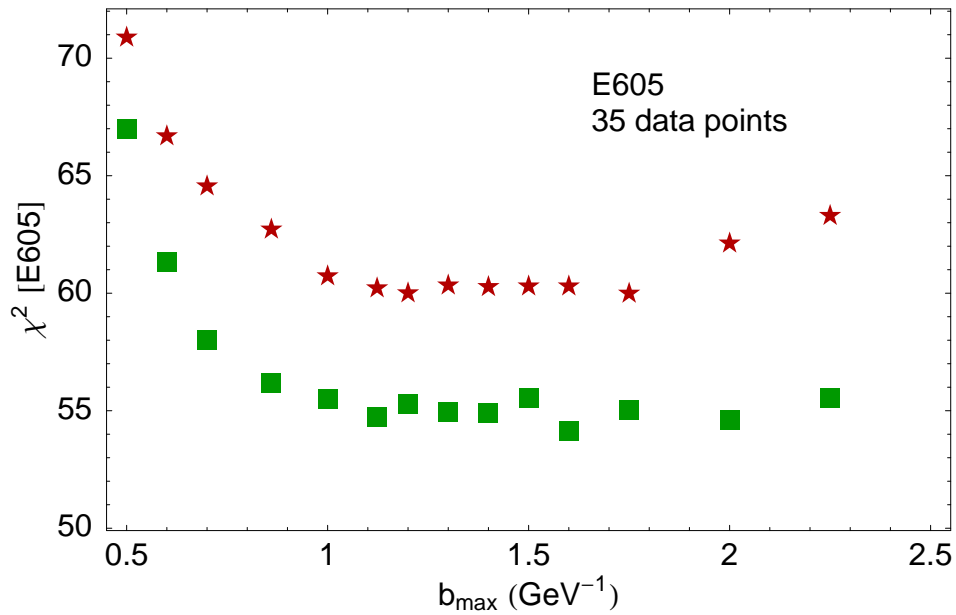


Figure 12: E605

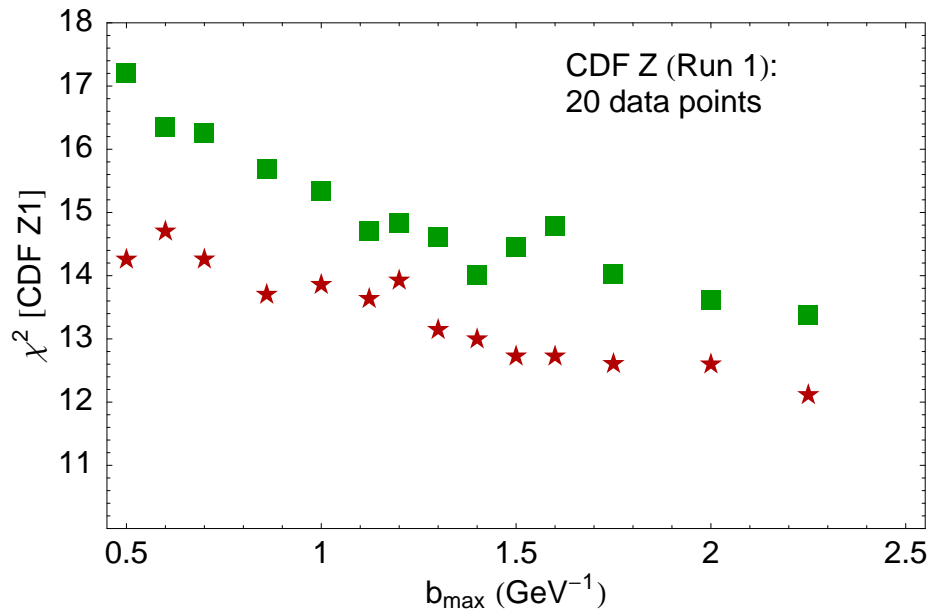


Figure 13: CDF

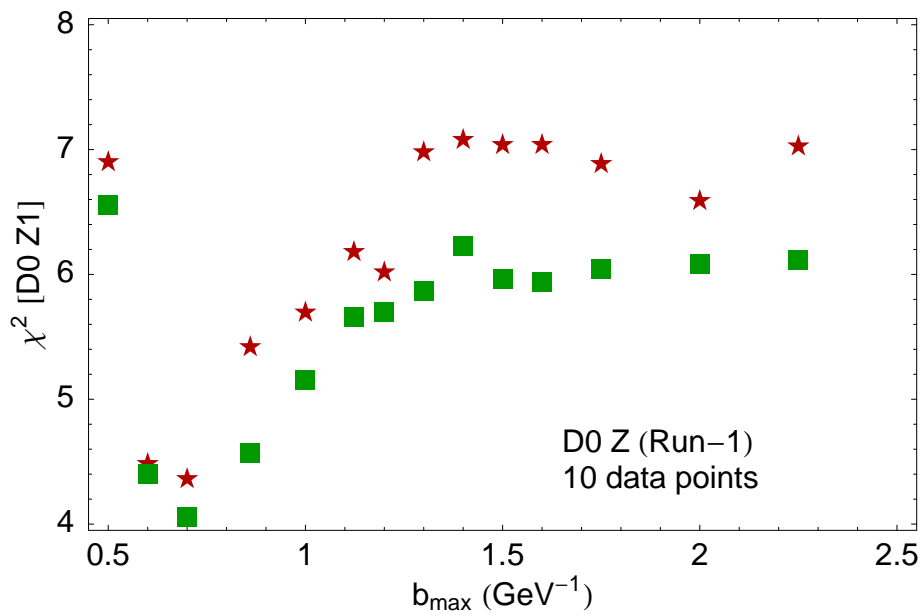


Figure 14: DØ

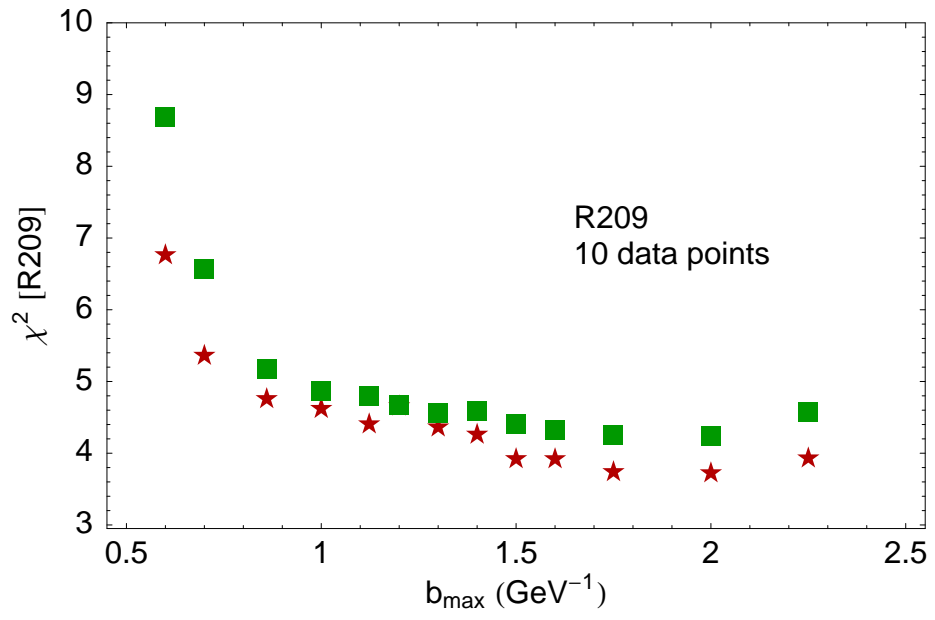


Figure 15: R209

## 2.4 $a$ vs $b_{max}$

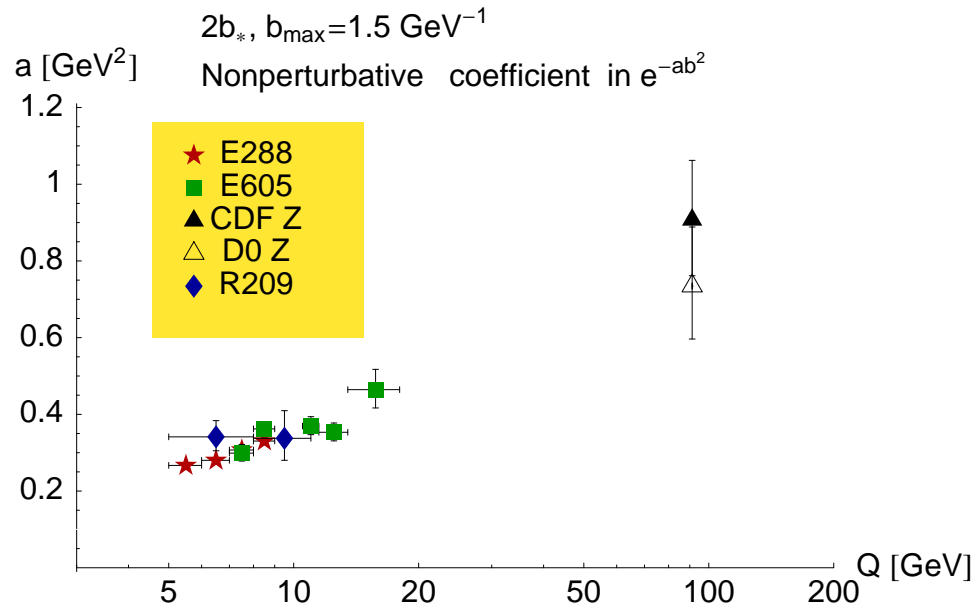


Figure 16:  $a(Q)$  vs.  $Q$