QDJSCO Corrections for 6.01 Data

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1 Introduction

The routine QDJSCO applies, amongst other corrections, a relative jet correction to transform jets anywhere in the detector back to an equivalent central jet in the eta range $0.2 < |\eta| < 0.7$. The relative jet correction was performed for the 1989 collider run, and documented in CDF note 1513. The determination of the 1992-3 relative jet correction for data processed with 6.01 production code was carried out almost exactly as before so you will reference 1513 for all the details.

2 The Method

In a perfect detector, dijet events should balance in P_t, with the effects of a third softer jet being neglected. However, CDF is not a perfect detector. With differing responses of the central, plug, and forward detectors, and cracks between detectors, a correction function must be generated.

Dijet events are selected with at least one leg in the detector eta range $0.2 < |\eta| < 0.7$, a region of flat response and well away from cracks. This jet is given the title of "trigger" jet. The other jet is allowed to roam anywhere in the detector and is termed the "probe" jet. The correction is constructed by plotting the ratio of $P_t^{Trigger}/P_t^{Probe}$ (derived from the missing E_t projection fraction) as a function of eta. Four of these plots are made for different $\sum P_t$ bins, were $\sum P_t = P_t^{Trigger} + P_t^{Probe}$. A smooth spline fit is made for each P_t range at each eta. This spline correction function will allow the interpolation of a jet with a given P_t and η back to an equivalent jet in the central region. This fit is performed for three cone sizes: 0.4, 0.7, and 1.0.

Table 1: Sum P_t ranges for each trigger.

Trigger	$\sum P_t$ (GeV)	$\int \mathcal{L}dt$ (pb^{-1})	Number of events that pass cuts		
			$\Delta R = 0.4$	$\Delta R = 0.7$	$\Delta R = 1.0$
JET20	$50 \rightarrow 110$	7.50	6513	10387	13036
JET50	$110 \rightarrow 150$	6.80	3126	4361	5148
JET70	$150 \rightarrow 210$	8.48	2184	3026	3613
JET100	> 210	7.79	2500	3496	4240

3 Data Sets and Cuts

The data sets used to produce the correction are the JET20, JET50, JET70, and JET100 triggers. The STREAM1 PADs are located in the following silo directories: //FNAL/CDF/PROD/STREAM1/PADnn/JmQ1-1P. Where nn is 01, 02, 03, and 04, and m = 1, 2, 3, and 4. Runs 41300 and above were used. The cuts employed on the PAD data are:

- At least one jet in the region $0.2 < |\eta| < 0.7$
- Two jets with $P_t > 15$ GeV/c
- No other jets with $P_t > 15$ GeV/c
- One primary vertex
- $|Z_{vertex}| < 60$ cm
- $\Delta\phi_{jet1-jet2} > 2.7$ radians
- Event passes COSFLT

In addition to the above, each trigger must have $\sum P_t$ in the ranges displayed in Table 1.

Due to the lower rate in the JET70 and JET100 triggers, different eta fit ranges were used. The number of events at high $|\eta|$ in the JET20 and JET50 triggers was small. To obtain a correction at high $|\eta|$, an average correction was employed over eta, not bin by bin. Table 2 shows the ranges used.

Table 2: Ranges used for averaging the fit and the total eta range used for each trigger.

Trigger	P_t range	η of average	η range fixed	η used in fit
JET20	$50 \rightarrow 110$	$2.55 < \|\eta\| < 3.25$	$2.75 < \|\eta\| < 3.55$	$\|\eta\| < 3.5$
JET50	$110 \rightarrow 150$	$2.55 < \|\eta\| < 3.25$	$2.75 < \|\eta\| < 3.55$	$\|\eta\| < 3.5$
JET70	$150 \rightarrow 210$	-	-	$\|\eta\| < 2.0$
JET100	> 210	-	-	$\|\eta\| < 2.0$

4 Results

Figures 1, 3, and 5 display the QDJSCO relative jet correction as a function of eta for each of the $\sum P_t$ bins. Figures 2, 4, and 6 show percent difference of the old from the new or

$$\frac{RELATIVE^{OLD} - RELATIVE^{NEW}}{RELATIVE^{NEW}} * 100. \quad (1)$$

The central response remains constant, as it should for this correction. The relative correction in the forward is closer to 1 than in 1989 when it was over correcting jet energies by about 15%. The central–plug crack appears a bit wider than in 1989.

5 How to use the new QDJSCO

All of the arguments are the same. Anyone using development QDJSCO will automatically pick up the new version.

It should be stressed that only the relative correction has been changed. The other corrections (absolute, out of cone, underlying event) remain the same, but their output will be altered due to the new relative correction.

Table 3: Percent difference of old from new, $\Delta R = 0.4$. (See Eqn 1.)

Trigger	Selected eta ranges $\Delta R = 0.4$					
	-3.5 to -3.0	-2.0 to -1.6	-0.7 to -0.2	0.2 to 0.7	1.6 to 2.0	3.0 to 3.5
JET20	-8.6	-4.7	-0.1	-1.8	-8.0	-3.1
JET50	-5.8	-4.1	-0.2	-1.3	-6.6	-5.7
JET70	-	-3.7	-0.3	-1.0	-5.6	-
JET100	-	-2.5	-0.4	-0.4	-3.4	-

Table 4: Percent difference of old from new, $\Delta R = 0.7$. (See Eqn 1.)

Trigger	Selected eta ranges $\Delta R = 0.7$					
	-3.5 to -3.0	-2.0 to -1.6	-0.7 to -0.2	0.2 to 0.7	1.6 to 2.0	3.0 to 3.5
JET20	-10.1	-4.2	-0.9	-1.8	-8.5	-3.5
JET50	-5.0	-4.4	-0.4	-1.3	-7.0	-7.3
JET70	-	-4.6	0.0	-1.0	-6.0	-
JET100	-	-4.1	0.6	-0.4	-4.0	-

Table 5: Percent difference of old from new, $\Delta R = 1.0$. (See Eqn 1.)

Trigger	Selected eta ranges $\Delta R = 1.0$					
	-3.5 to -3.0	-2.0 to -1.6	-0.7 to -0.2	0.2 to 0.7	1.6 to 2.0	3.0 to 3.5
JET20	-13.7	-4.6	-0.6	-1.5	-9.9	-4.9
JET50	-4.2	-4.7	-0.2	-1.2	-8.1	-8.3
JET70	-	-4.8	0.1	-0.9	-6.8	-
JET100	-	-4.1	0.6	-0.5	-3.9	-

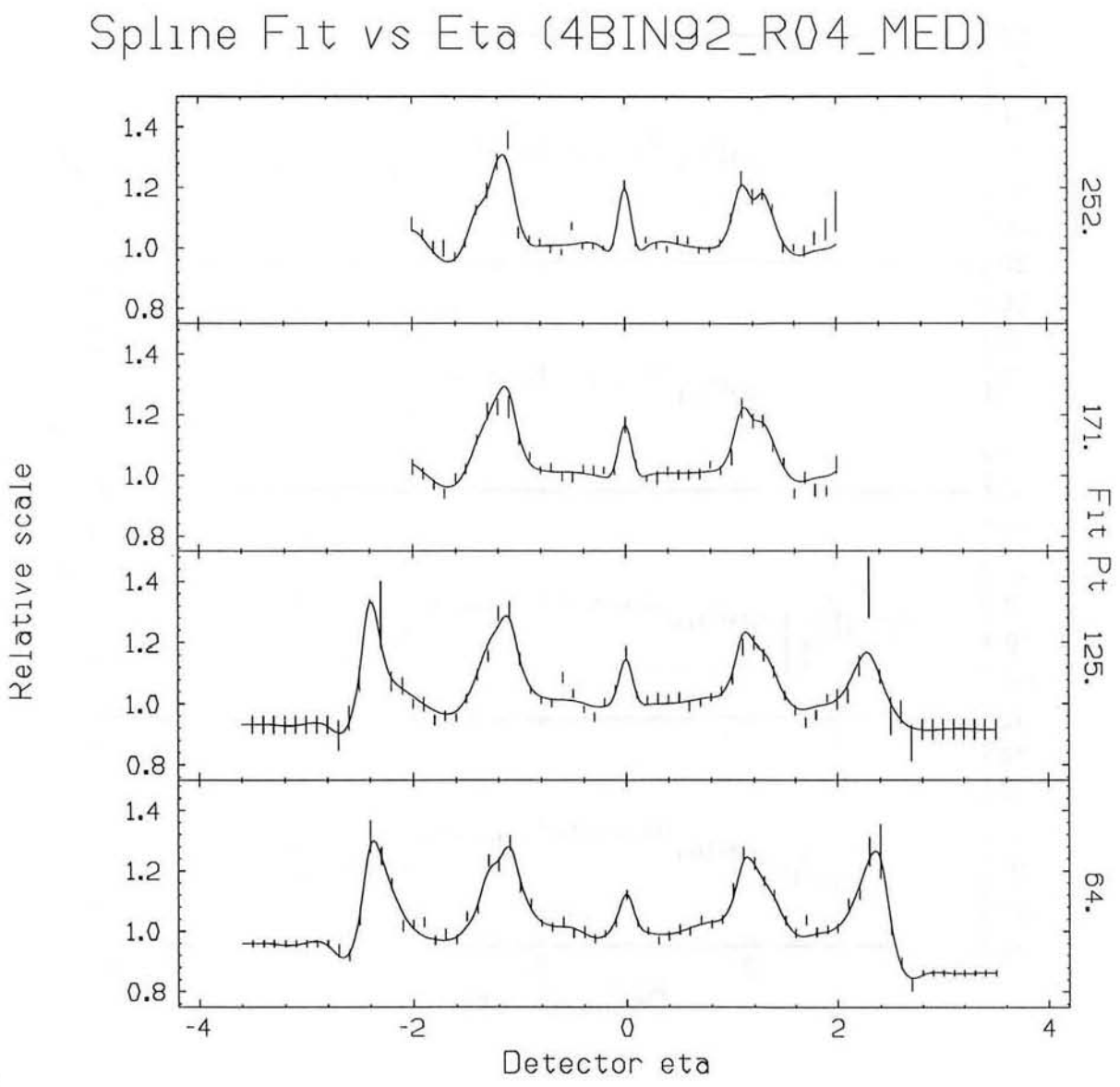

Figure 1: Relative QDJSCO correction for $\Delta R = 0.4$.

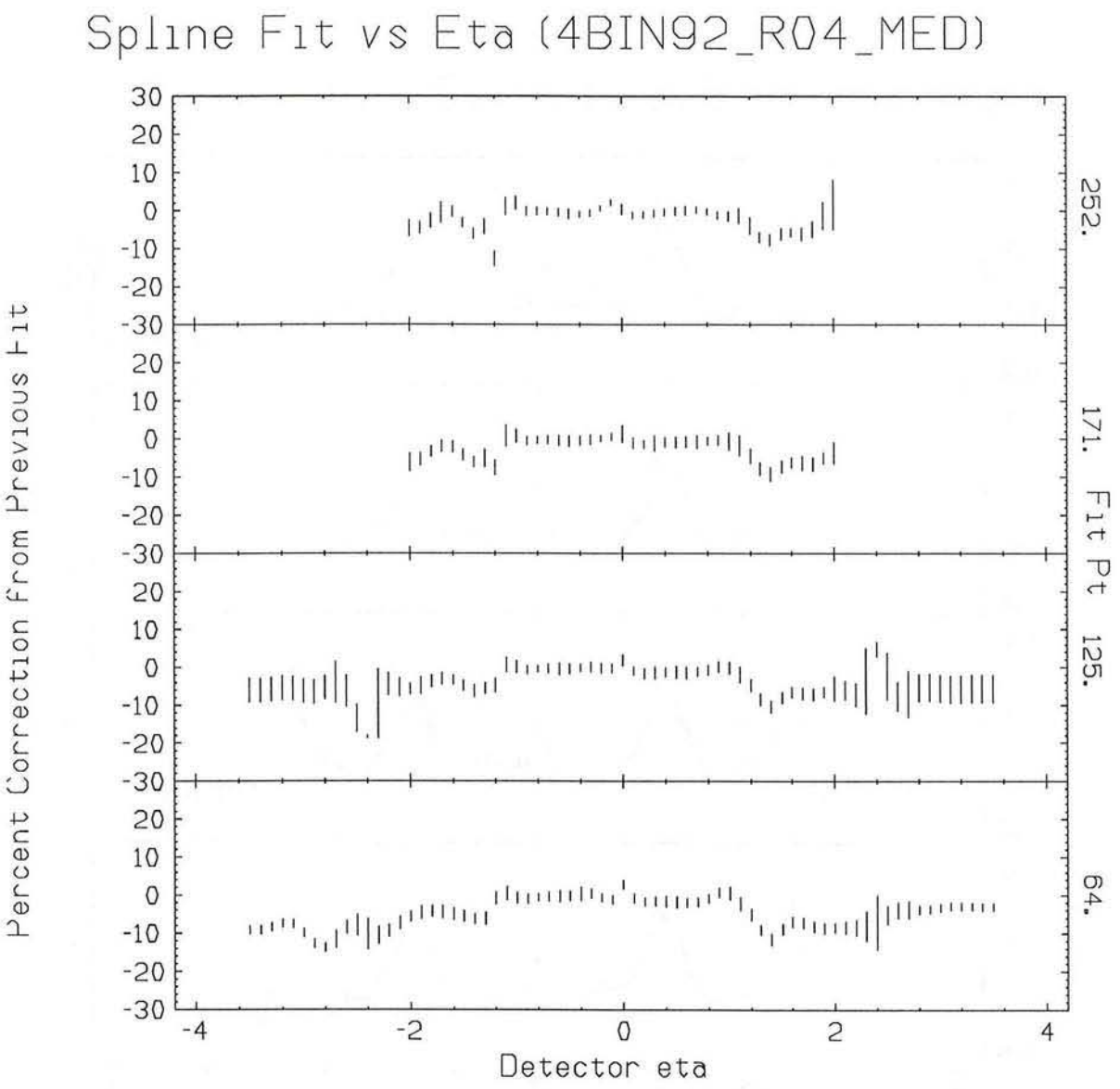

Figure 2: Percent correction from previous fit $\Delta R = 0.4$.

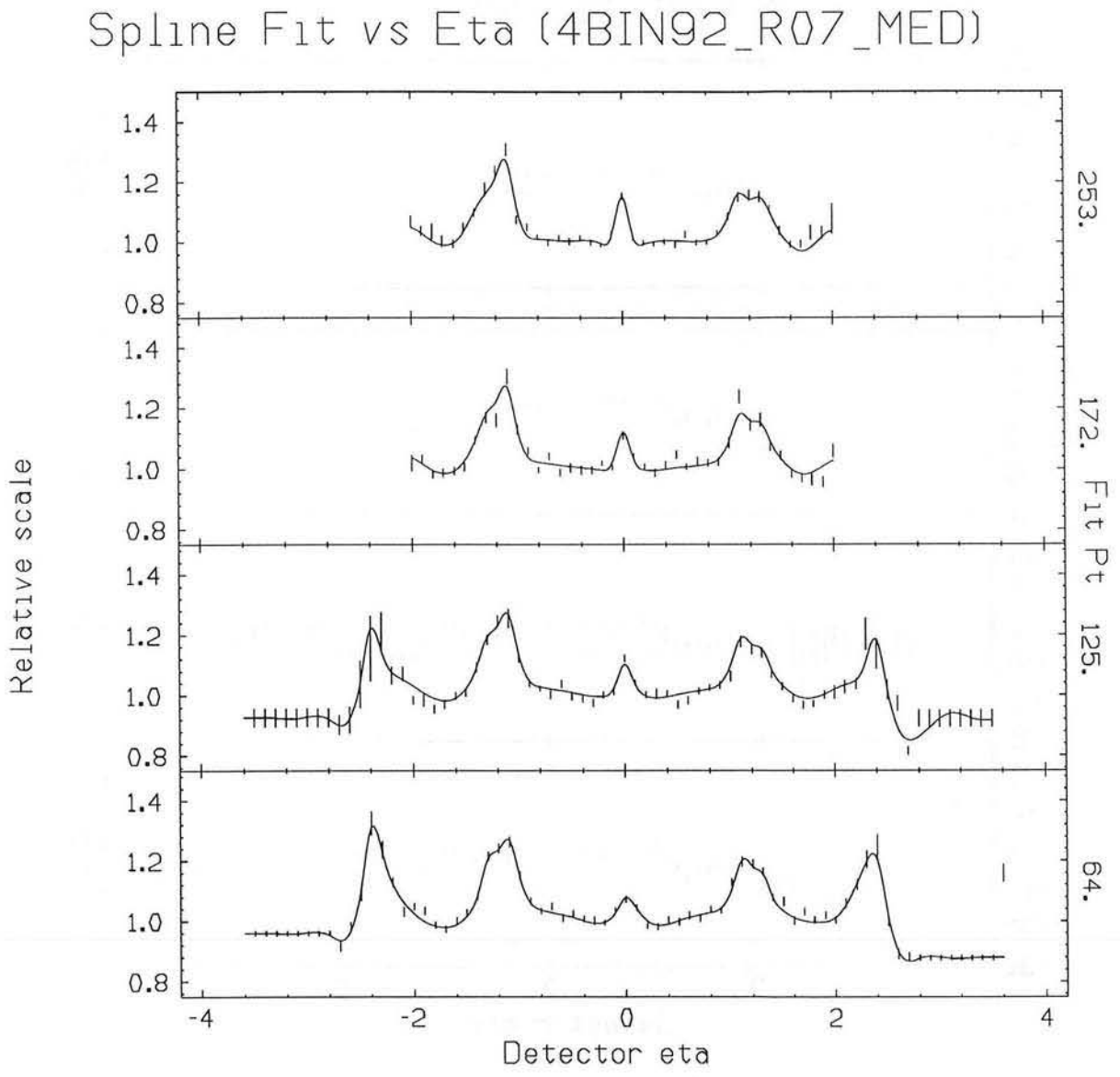

Figure 3: Relative QDJSCO correction for $\Delta R = 0.7$.

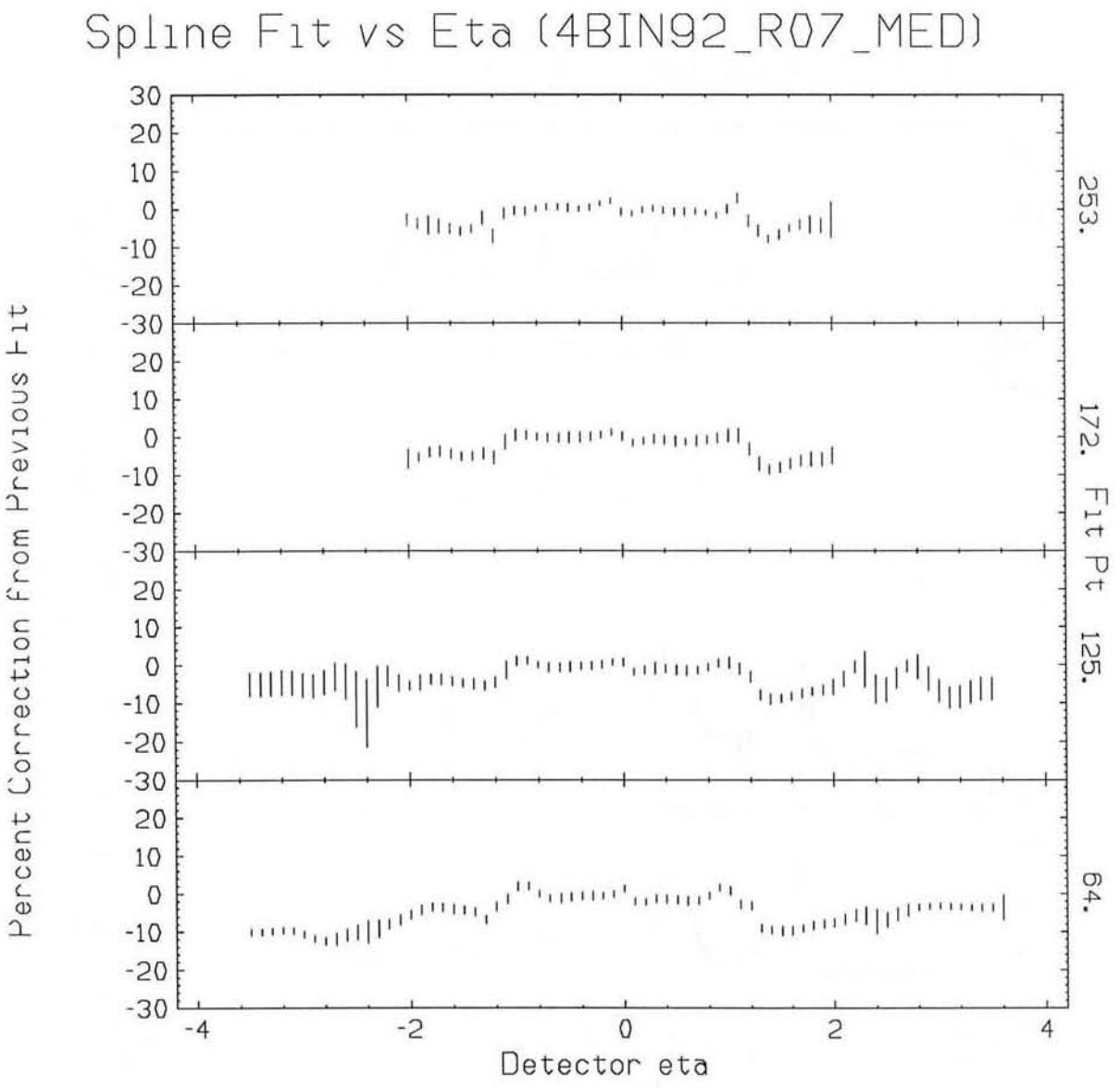

Figure 4: Percent correction from previous fit $\Delta R = 0.7$.

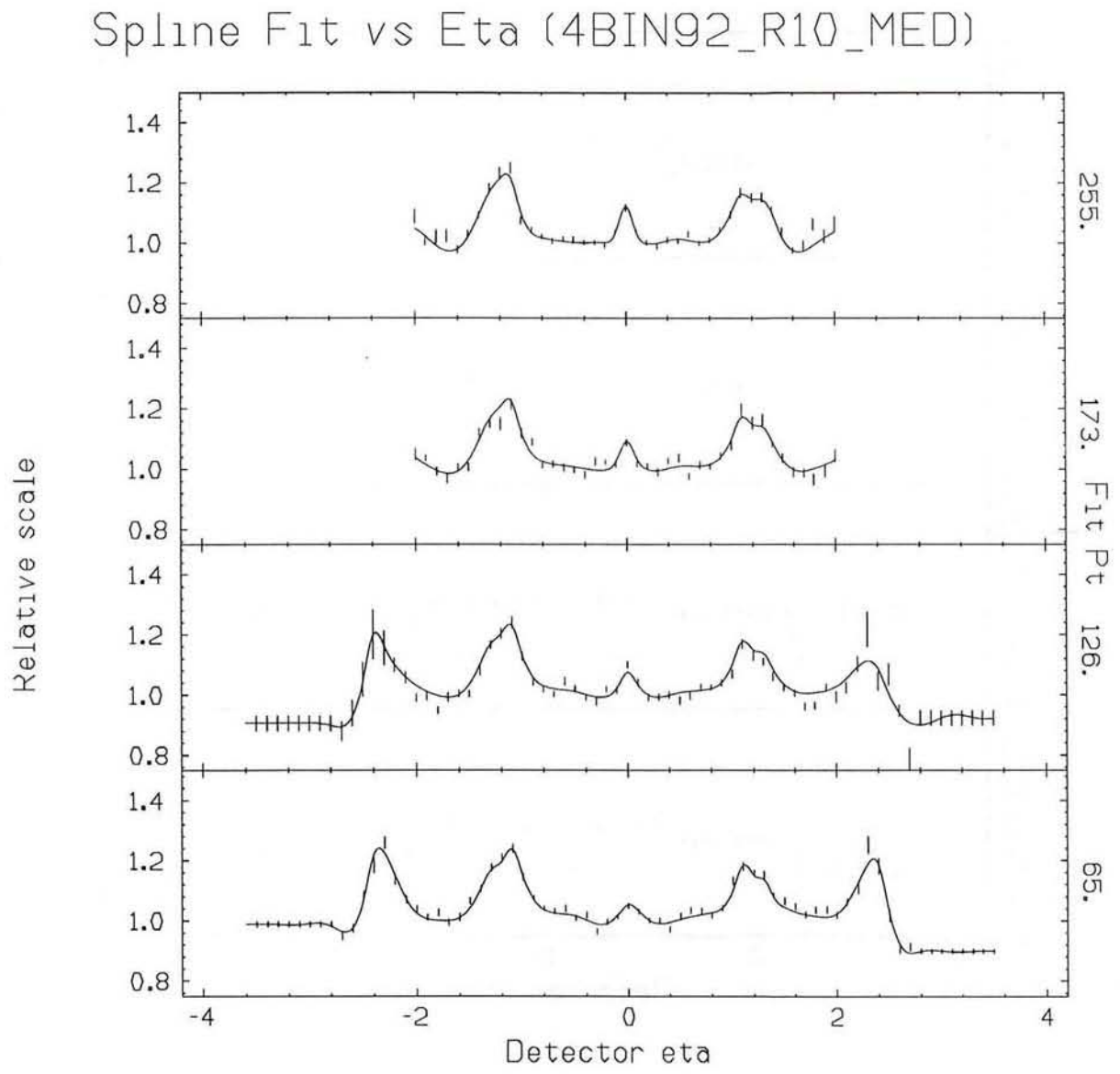

Figure 5: Relative QDJSCO correction for $\Delta R = 1.0$.

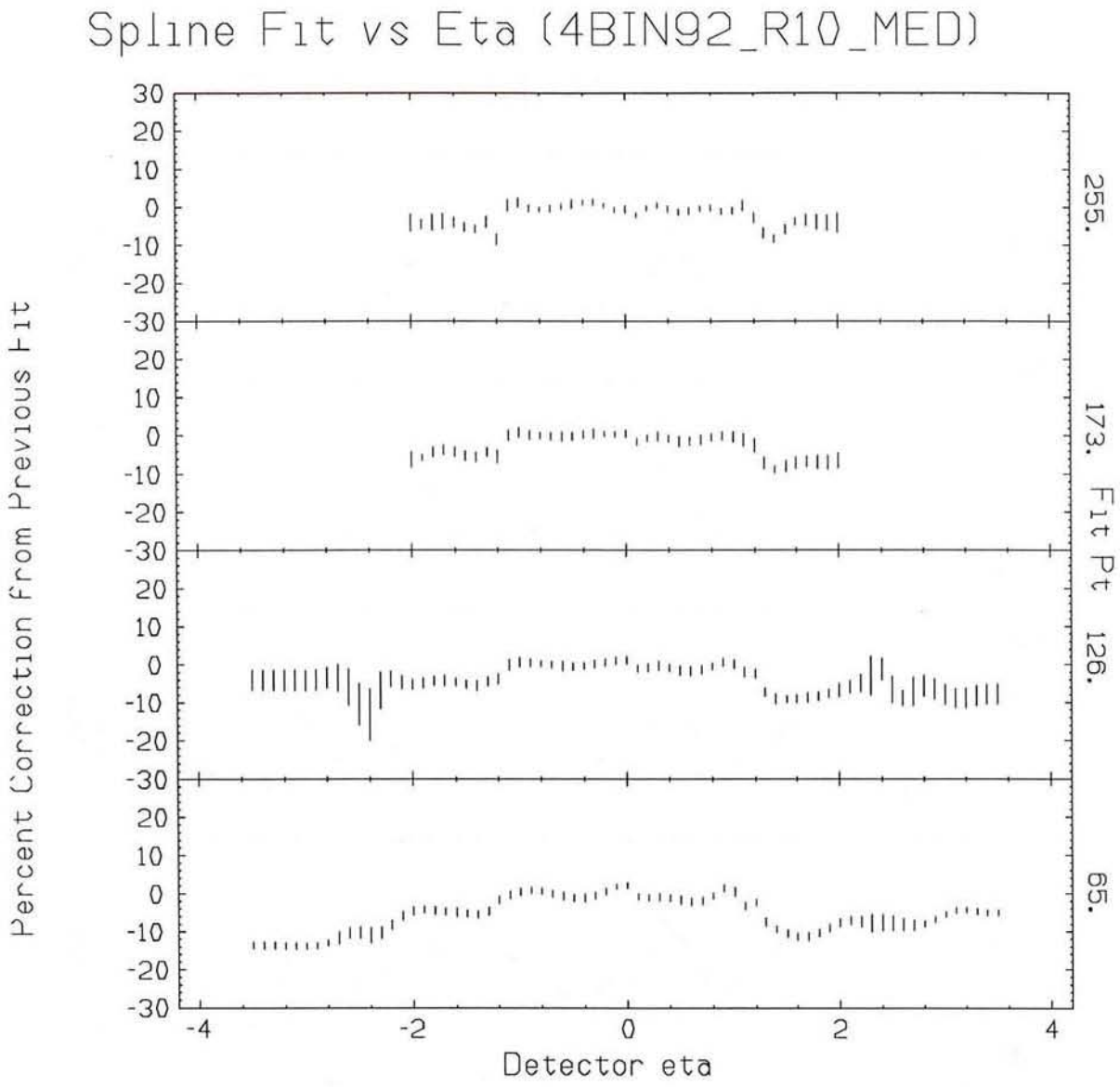

Figure 6: Percent correction from previous fit $\Delta R = 1.0$.