Sensitivity to downstream materials

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June 21, 2004

Data sets with downstream lucite and aluminum were analyzed and compared to a standard set. The analysis in this report uses old code that since has been modified to better handle effects of downstream materials. Fitting results from the final analysis are not yet available.

1 Effects of downstream Lucite

The systematic set with downstream Lucite (set8anal1) was analyzed and compared to a standard set (set3anal1). Both sets were analyzed with the same executable and all other settings were identical. However, standard set3 was acquired with a different beam tune (pre-October). The comparison with a standard set with the same tune was done in the past (Blair's fits) and the results are posted. Energy calibrations show an endpoint energy of $-2 \pm 14keV$ and a resolution of $67 \pm 3keV$.

Figure 1 shows a comparison of the 1-dimensional normalized momentum and $\cos(\theta)$ histograms for the two cases. Figure 2 shows the difference between the normalized histograms of figure 1. An obvious structure is seen at large angles, particularly in the region $0.2 < cos(\theta) < 0.4$, which is outside the fiducial volume.

Below are the fitting results. The fiducial volume chosen is $20.00 < p < 50.00$ and $0.50 < cos(\theta) < 0.85$.

Data: spectrumStat(fiducial_bins=2160, fiducial_entries=2.63847e+06, min_bin_entries=513)
Base: spectrumStat(fiducial_bins=2160, fiducial_entries=1.67729e+07, min_bin_entries=3487)

$\chi 2 = 2265$
$ndf = 2156$
$confLevel = 0.05$
$\rho = (2.3 \pm 4.1) \times 10^{-3}$
$\delta = (-4.7 \pm 3.6) \times 10^{-3}$
$\xi = (-3.1 \pm 4.8) \times 10^{-3}$
$\eta = (125 \pm 228) \times 10^{-3}$

For comparison purposes, the results from a previous fit to a standard set that uses the same beam tune are shown below (note, however, that the runs used since have been modified after quality checks, etc).

$\chi 2 = 1416$
$ndf = 1424$

$conflevel = 0.56$
$\rho = (-2.8 \pm 2.7) \times 10^{-3}$
$\delta = (2.0 \pm 2.0) \times 10^{-3}$
$\xi = (-7.8 \pm 3.5) \times 10^{-3}$
$\eta = (-230 \pm 150) \times 10^{-3}$

2 Effects of downstream aluminum

The systematic set with downstream aluminum (set7anal1) was analyzed and compared to a standard set (set3anal1). Both sets were analyzed with the same executable and all other settings were identical. However, standard set3 was acquired with a different beam tune (pre-October). The comparison with a standard set with the same tune was done in the past (Blair's fits) and the results are posted.Energy calibrations show an endpoint energy of $15 \pm 11keV$ and a resolution of $75 \pm 3keV$.

Figure 3 shows a comparison of the 1-dimensional normalized momentum and $\cos(\theta)$ histograms for the two cases. Figure 4 shows the difference between the normalized histograms of figure 3. An obvious structure is seen at large angles, particularly in the region $0.2 < cos(\theta) < 0.6$.

Below are the fitting results. The fiducial volume chosen is $20.00 < p < 50.00$ and $0.50 < cos(\theta) < 0.85$.

Data: spectrumStat(fiducial_bins=2160, fiducial_entries=5.61344e+06, min_bin_entries=1104)
Base: spectrumStat(fiducial_bins=2160, fiducial_entries=1.67729e+07, min_bin_entries=3487)

$\chi 2 = 2150$
$ndf = 2156$
$conflevel = 0.53$
$\rho = (-8.1 \pm 3.0) \times 10^{-3}$
$\delta = (-7.5 \pm 2.7) \times 10^{-3}$
$\xi = (-2.9 \pm 3.5) \times 10^{-3}$
$\eta = (-540 \pm 168) \times 10^{-3}$

For comparion purposes, the results from a previous fit to a standard set that uses the same beam tune are shown below (note, however, that the runs used since have been modified after quality checks, etc).

$\chi 2 = 1530$
$ndf = 1424$

$conflevel = 0.03$
$\rho = (-10.2 \pm 3.2) \times 10^{-3}$
$\delta = (-5.3 \pm 2.3) \times 10^{-3}$
$\xi = (-10.4 \pm 4.1) \times 10^{-3}$
$\eta = (-640 \pm 180) \times 10^{-3}$

3 Conclusions

Effects of downstream materials are seen clearly when downstream Lucite or downstream aluminum are added. The effects are most pronounced at large angles on the downstream side, as can be seen from the comparison plots, where a reduction in the number of tracks is seen when downstream material is inserted.

The effect for downstream Lucite is mostly outside the fiducial volume (as can be seen from figure 2), and no statistically significant shifts are seen on the Michel parameters. However, for downstream aluminum, the effect extends into the fiducial region (see figure 4), and statistically significant shifts are seen on the Michel Parameters of about 2.5σ for ρ and δ.

The analysis code has been modified to identify back scattered tracks since then and similar histogram comparisons show significant improvement (see posting by Rob MacDonald 18-06-2004). The fits with the new code are not yet available, but a significant improvement is expected.

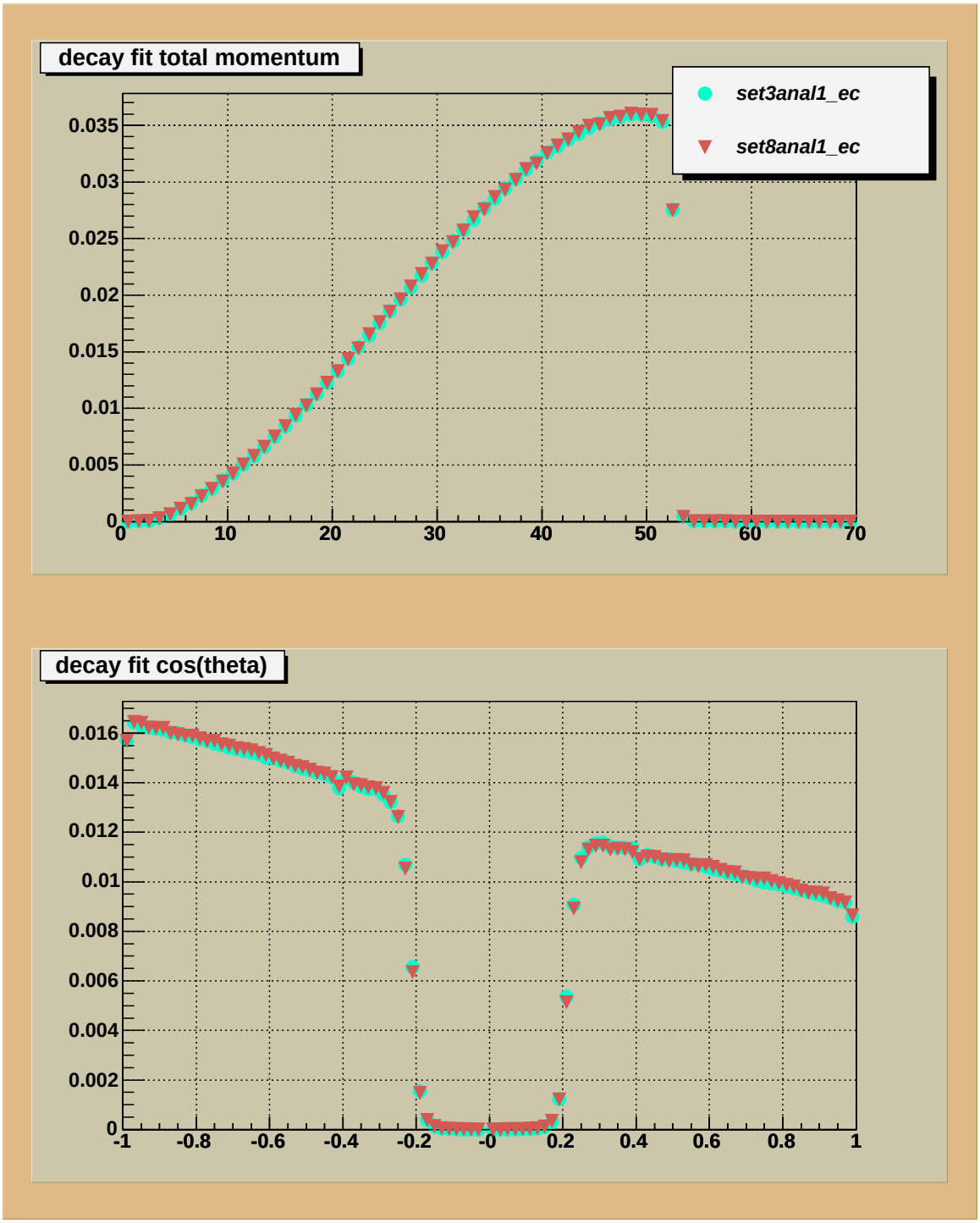

Figure 1: Momentum (top) and cos(θ) (bottom) distributions for the analysis of set8 (downstream Lucite).

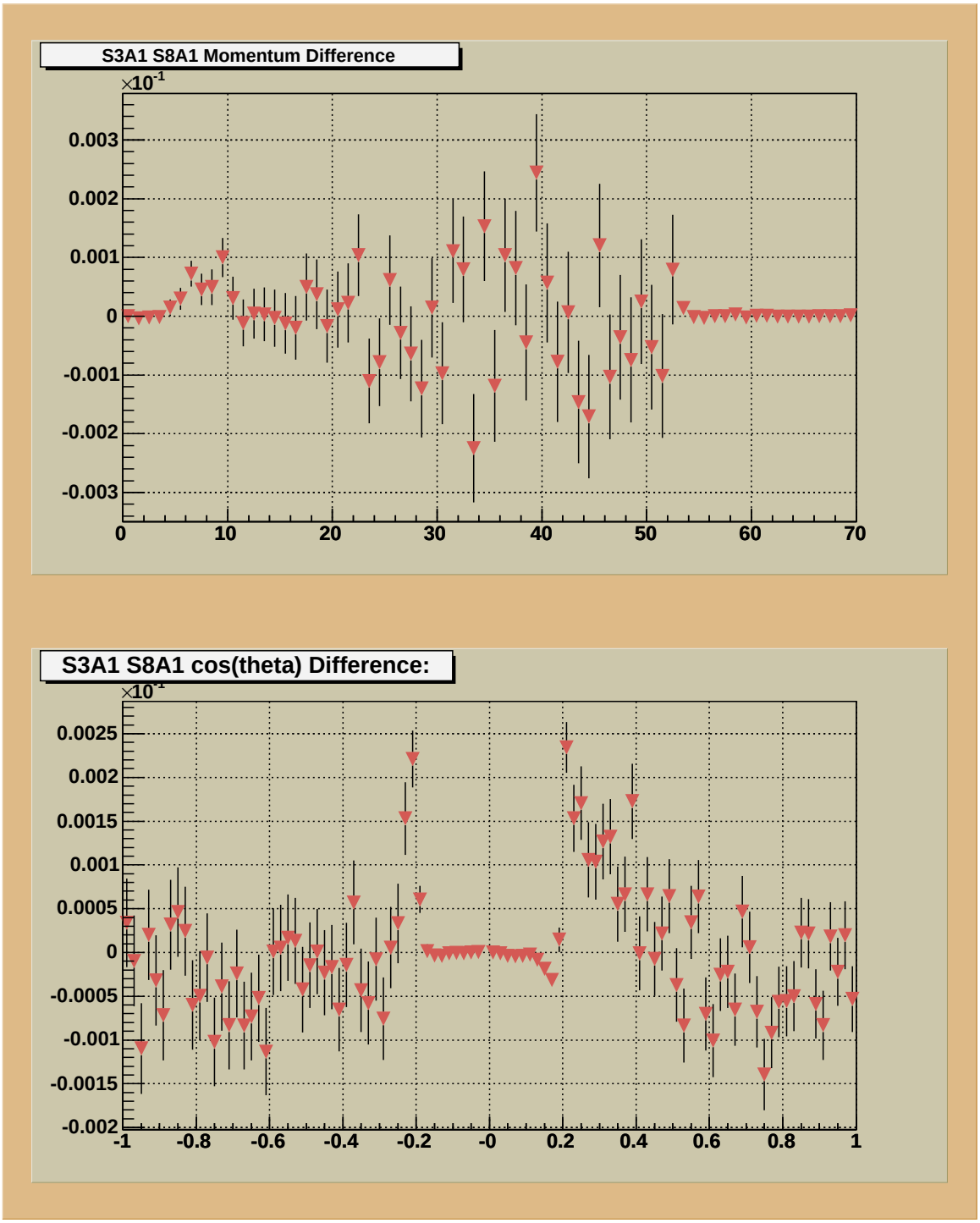

Figure 2: Momentum difference (top) and cos(θ) difference (bottom) for the analysis of set3 (standard set) and set8 (downstream Lucite).

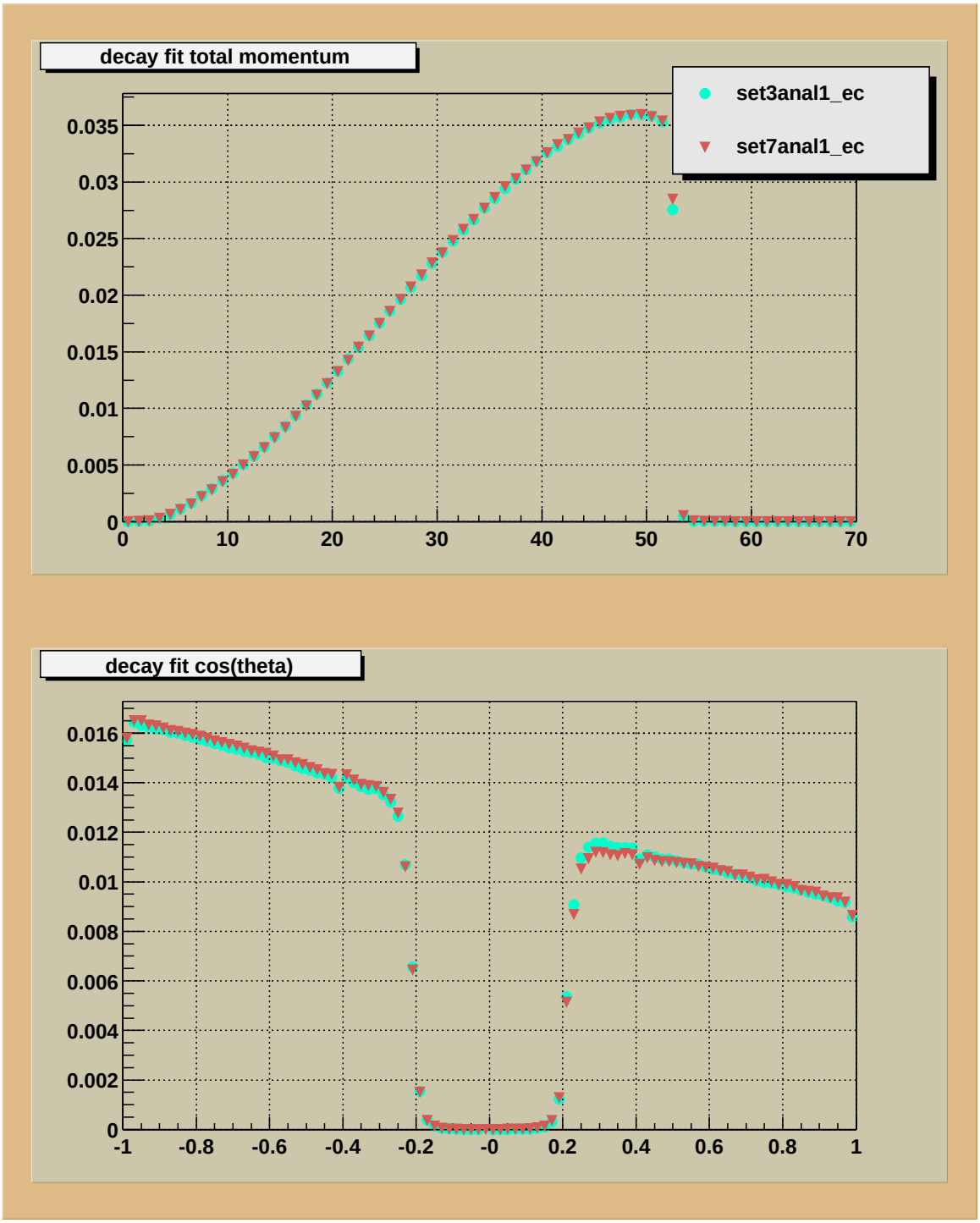

Figure 3: Momentum (top) and cos(θ) (bottom) distributions for the analysis of set7 (downstream aluminum).

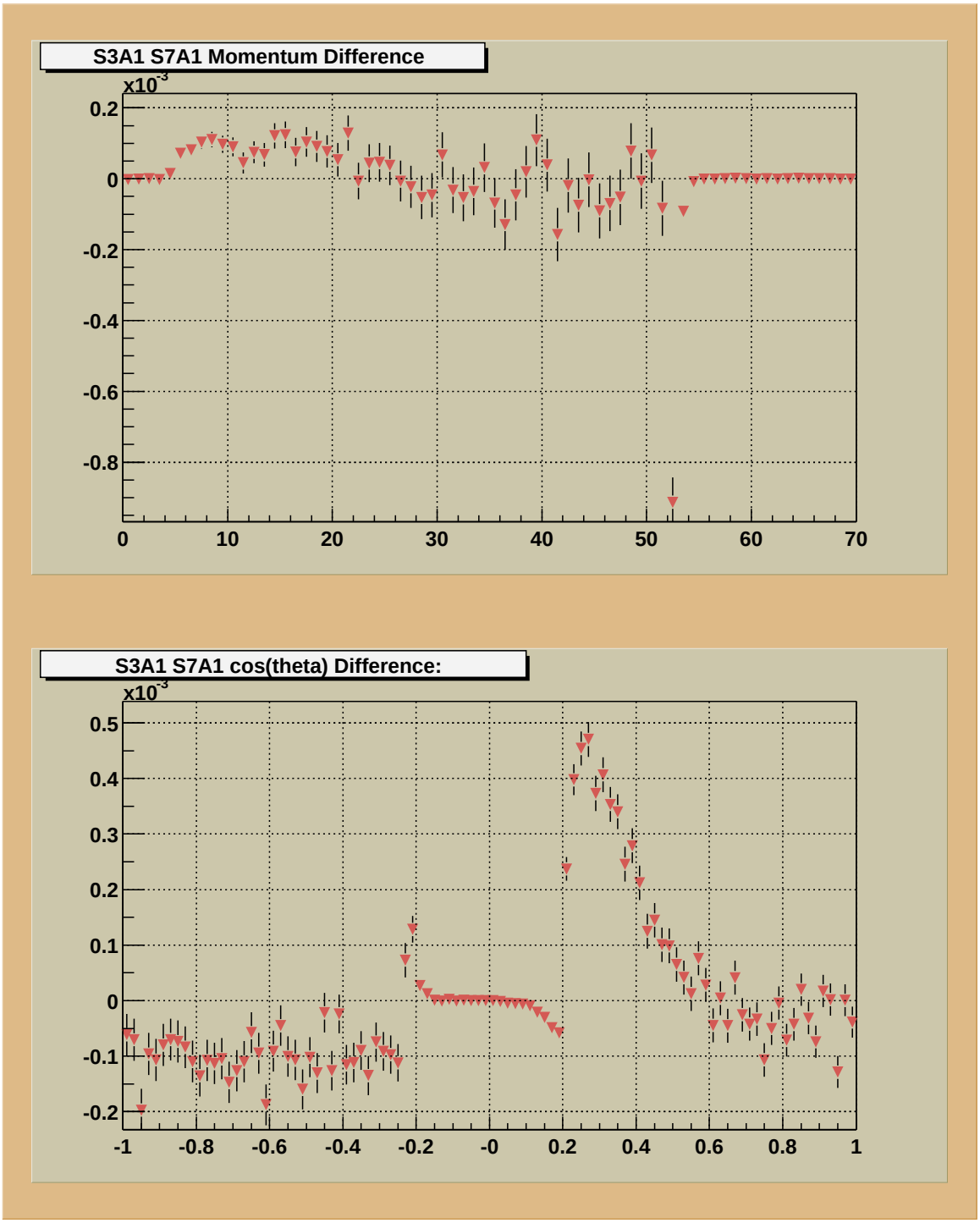

Figure 4: Momentum difference (top) and cos(θ) difference (bottom) for the analysis of set3 (standard set) and set8 (downstream aluminum).