Plane Alignments and Wire Positions

This is a quick note showing some preliminary results on plane alignments and wire positions. Figure 1 shows the plane position corrections for DC planes 1-22 (half stack) computed from a tracking iteration. The plane positions are corrected for by the average residuals at the end of each iteration. These shifts were determined from run 1790 acquired with a beam of pions at 120 MeV/c. A radius cut requiring the track to be within 5 cm was imposed at the track intersections with planes 1 and 22. The corrections on this plot are shown after 44 iterations, and the error bars show the amount of the correction at the last iteration.

Figure 2 shows the plane position correction at the end of each iteration for planes 11-15 (chosen as a sample). The iterations start assuming the nominal positions (i.e. zero shift/correction). For planes requiring large corrections the first few iterations result in large corrections, however the convergence becomes slow once the planes are adjusted so that they are close to their final positions. This is to be expected due to the correlations between the planes in the tracking.

An important point that relates to plane alignment is whether the resulting plane alignment puts the perpendicular to the planes at a zero angle with respect to the beam. I will refer to this angle as the alignment angle. Since a plane alignment is only relative to the other planes, in principle one can still get good tracking if the alignment angle is different from zero. However, if a magnetic field is present the spirals would reflect any deviations of this angle from zero. It turns out that one can still determine this alignment angle in the absence of a magnetic field; the elliptical shape of the isocrones in DME break the "rotational symmetry", so that any misalignment will show in both the tracking residuals and the overall tracking χ^2. Figure 3 demonstrates this point. Five different alignment angles were chosen, and the planes were shifted (in U or V) by the corresponding amounts. The zero angle has the minimum σ and χ^2. This alignment angle was computed from run 1856, and the plane shifts as plotted in figure 1 were incorporated.

Finally, figure 4 shows the wire shifts. This result is preliminary. In particular, some wire positions may have been determined without enough statistics. Nonetheless, the results show almost all wires within 10 microns of their nominal positions. Keep in mind that the accuracy of the tracking (and all the ingredients that go into it such as calibrations) are not likely to be accurate to more than 5-10 microns (at least at this stage).

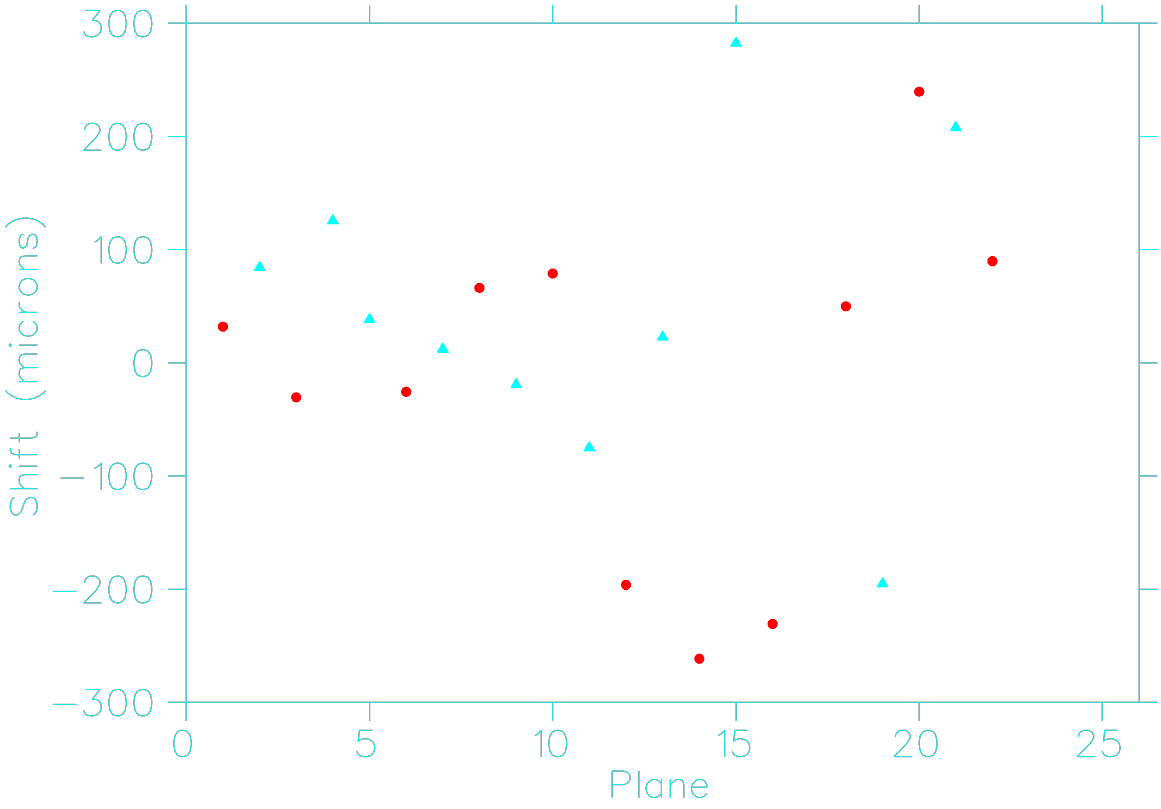

Figure 1: Plane position corrections as determined from run 1790.

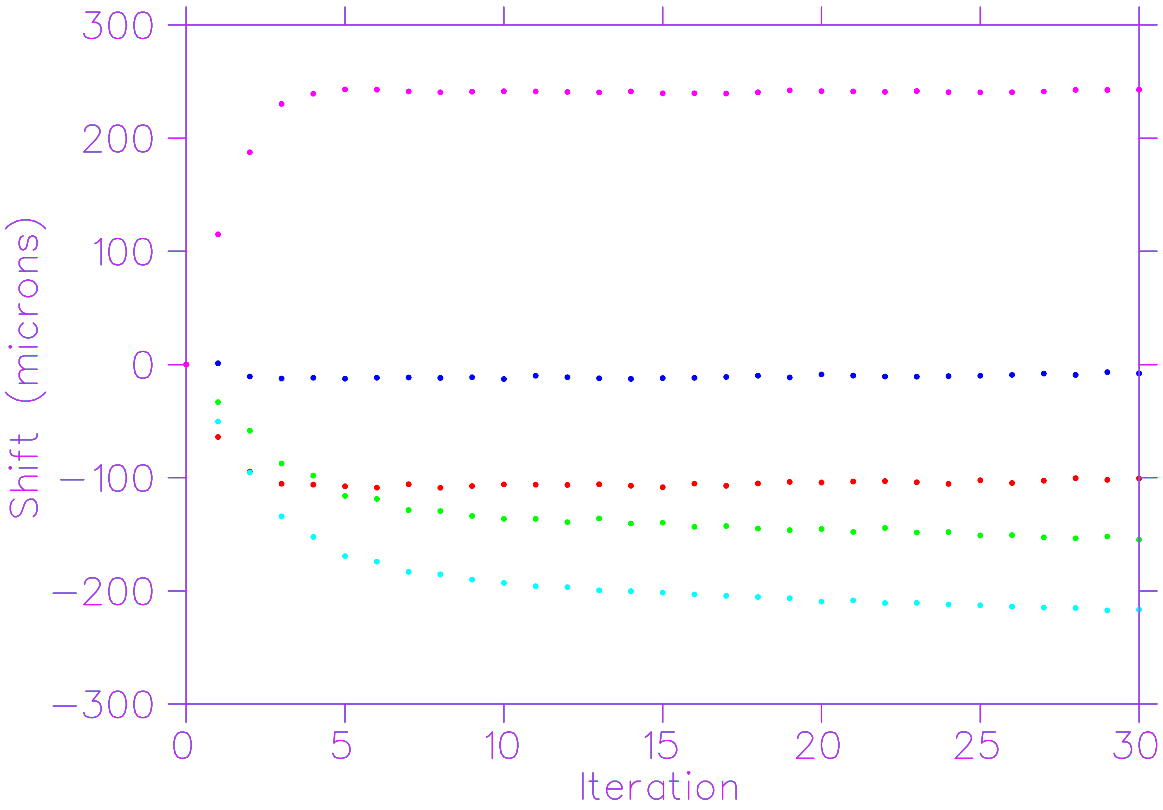

Figure 2: Plane position corrections at the end of each iteration for planes 11-15.

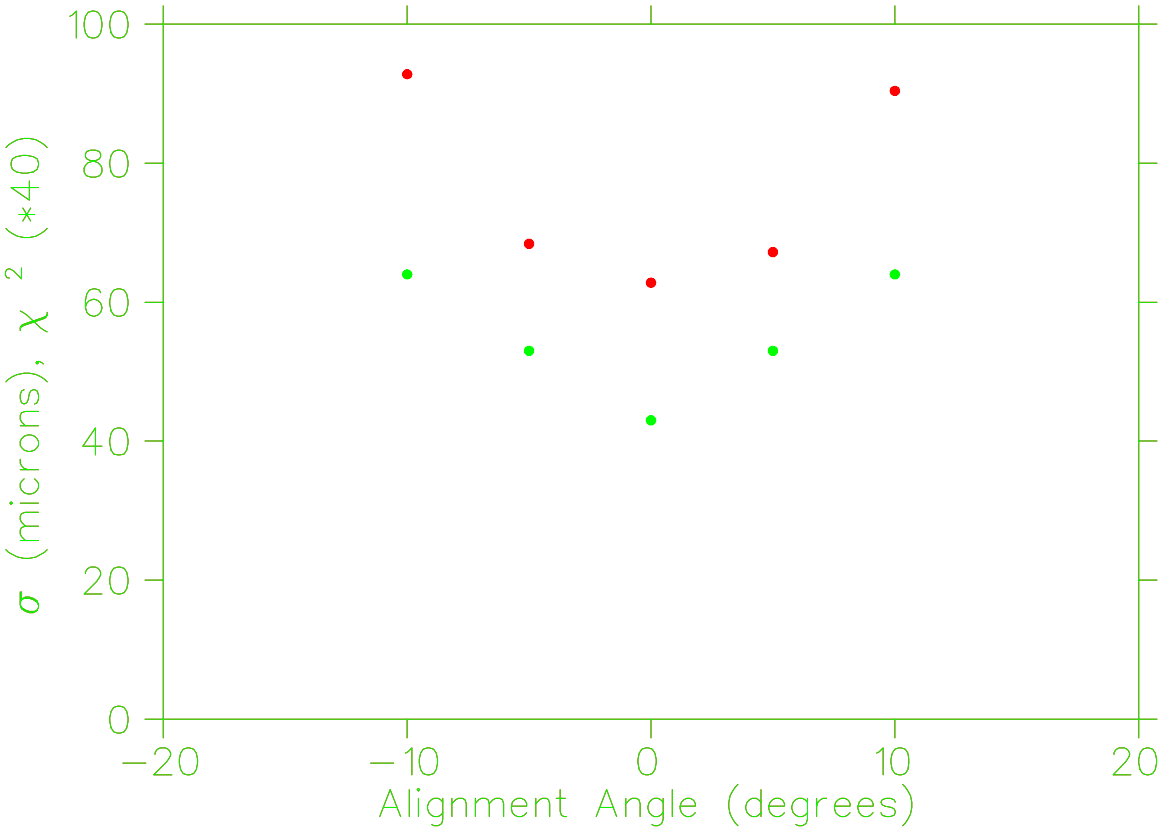

Figure 3: χ^2 and σ for five alignment angles determined from run 1857.

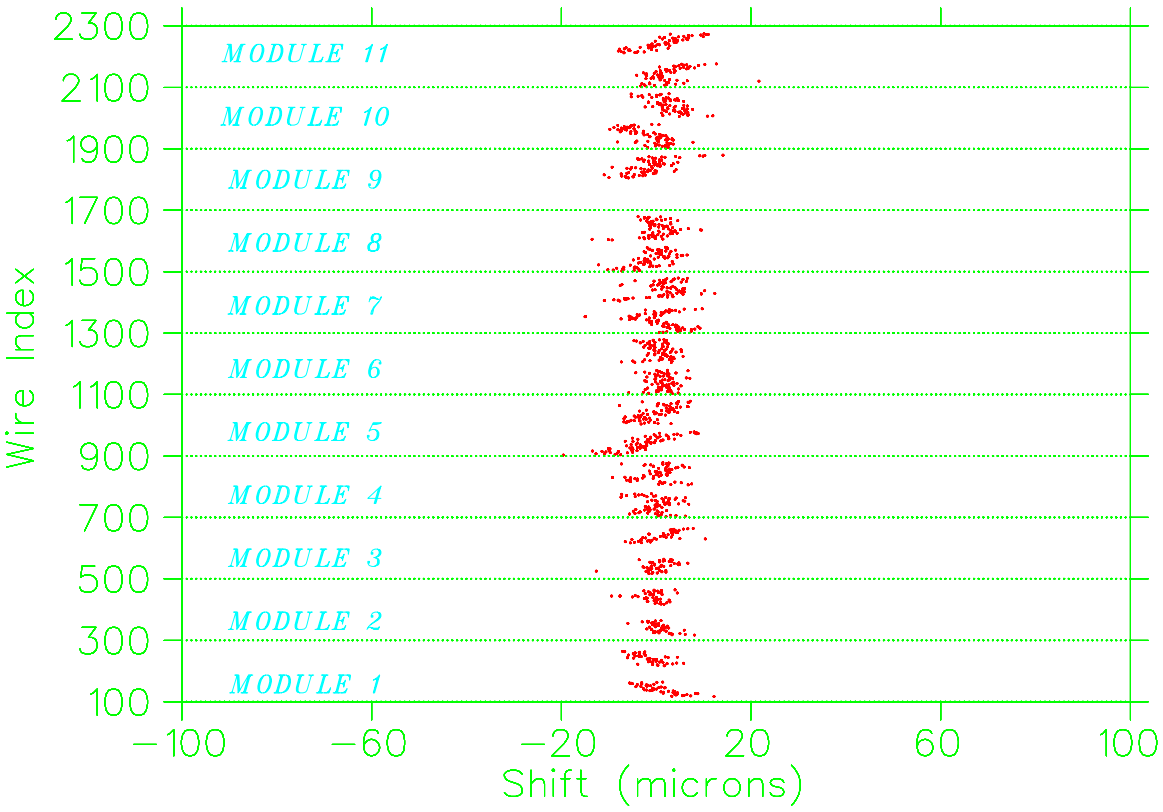

Figure 4: Wire shifts (from their nominal positions) determined from run 1856 after plane position corrections are incorporated.