Comparison of Maher's and Valpo's Alignment

This brief report is in response to some of the questions that Maher had raised comparing his alignment to that done by the Valpo group. The main issues are.

1. In translational alignment, while both alignments give means in the residuals to a few microns, there are offset differences up to about 300 microns in the translational offsets determined by the two methods.

2. In rotational alignment, Maher doesn't see a need for an alignment whereas the Valpo group finds offsets up to 1 mRad.

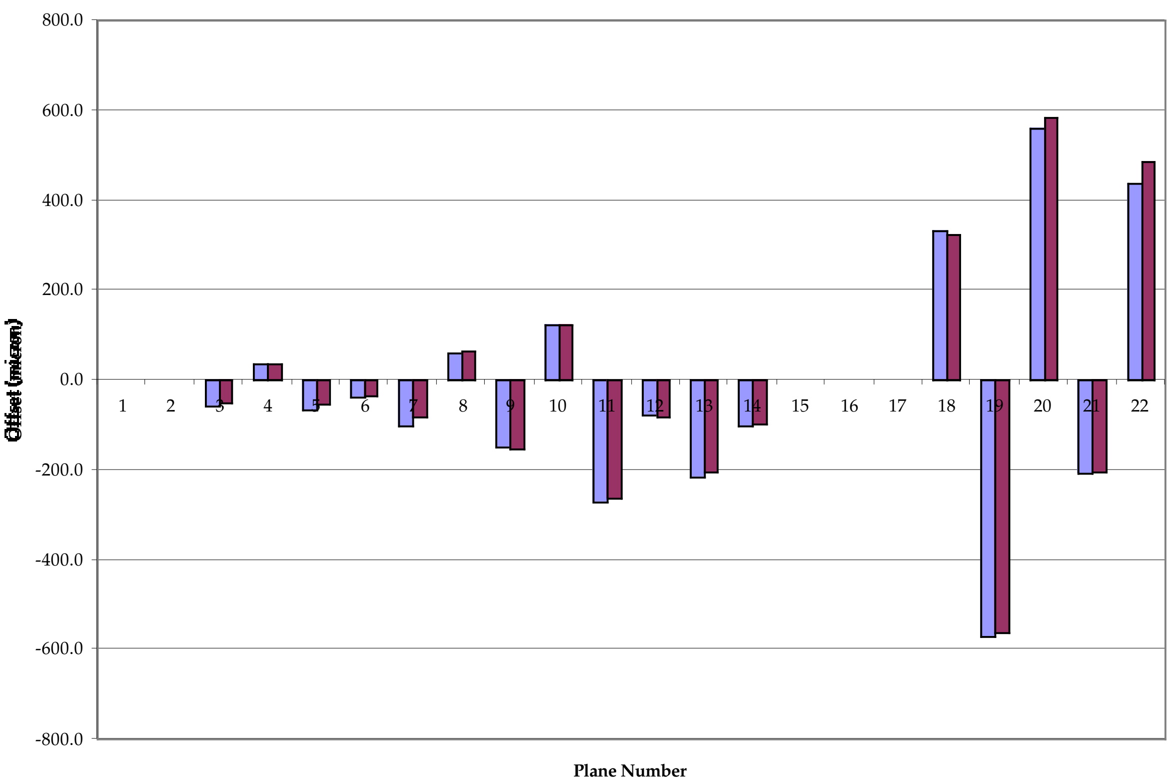
Translational Offsets

I do not think we could compare the two sets of parameters. All we could compare is the net result of the alignment (i.e. the means, sigmas etc.). The parameters depend on the planes one hold fixed. Now the line connecting the two fixed planes may not be parallel to the z-axis (defined by the magnetic field). The next step of the alignment is to align this axis of the fixed planes with the magnetic field. For this we need the magnetic field. At present Don and Danny are working on this. Once this is done all the offsets will change. This alignment cannot be done for the August/September data.

I am not sure if Maher holds any planes fixed or not. Whether they are held fixed or not, the alignment will define some axis in the detector, which needs to be aligned with the magnetic field.

The only way one could compare the two sets of parameters is by holding the same planes fixed in both sets. Since we did not have access to Maher's parameters, we have read them off of the graph, and normalized the parameters by making the offsets of planes 1, 2, 15, and 16 (the ones we held fixed) zero. In the plot below, we have compared the Valpo offsets with the 'normalized' Maher offsets. They appear identical. This explains why both sets gave similar means for residuals.

This also shows that an alignment is complete only when all aspects of the alignment are done. It is not possible to compare intermediate values, unless properly normalized.



Rotational Offsets

Just as in translational alignment, in rotational alignment one need to fix two planes. As mentioned in the June collaboration meeting and in the report for the September meeting, the fixing of two planes may introduce a twist in the detector. The next step in the alignment is to take out the twist. This can be done with the magnetic field. Until this is done, the alignment is not complete. The current offsets are relative to the planes that are fixed.

Even though Maher doesn't think there is a need for rotational alignment, we do see a significant need. Rotational misalignments do not show up in residuals if one integrates over the entire chamber. They will show up only if you look at u planes with v > 0 and v < 0 or at v planes with u > 0 and u < 0. We have done that and the results are shown in the plot below. The analysis was done with the 'best' translational offsets but with no rotational offsets. For each plane there are two means (one each for events on either side). You can see very clearly how the means are shifted in either direction, the effect of rotational misalignment. For plane 22, they are both in the same direction, because the translational offsets I used in the analysis were not the final ones for that plane.