

Inspired by the successes achieved by Cam Wade for the VLA, I have included some extra terms in the pointing equation in the VLBA pointing analysis program PTANAL. All of the terms are listed below. Previously, only the first 6 were used and that is all that the on-line system understands. The attached figures show a sample of early results. They are:

- Figure 1: 4cm data, April 26-30, 1991. Old style 6 parameter fit.
- Figure 2: Same data, new 13 parameter fit (no axis non-perpendicularity)
- Figure 3: 4cm data, May 2. Old style 6 parameter fit.
- Figure 4: May 2 data, April 26-29 parameters forced. Fit only for colimation offsets (az did not change, el was different by 5 arcseconds).
- Figure 5: 1cm data, May 14. Old style 6 parameter fit.
- Figure 6: May 14 data, 13 parameter fit (no axis non-perp.).
- Figure 7: May 14 data, April 26-29 paramaters forced. Fit only for colimation offsets.

It seems clear that major improvements in pointing can be made by including the two theta terms and the encoder axis offsets. The axis perpendicularity term might as well be added at the same time since it might be needed some day. From examination of the plots, I suspect that more terms may be needed but this will require considerable further study. We may need to resort to a lookup table for track roughness, something that is provided for in the ACU.

One problem with introducing the new terms is that some are highly correlated so the fit results may not be very meaningful physically. This is true for the sag, colimation offset, and encoder axis offset in elevation and for the encoder offset, the colimation offset, and the axis non-perpendicularity in azimuth. The basic problem is that we sample less than a quarter turn in elevation.

The terms: Term

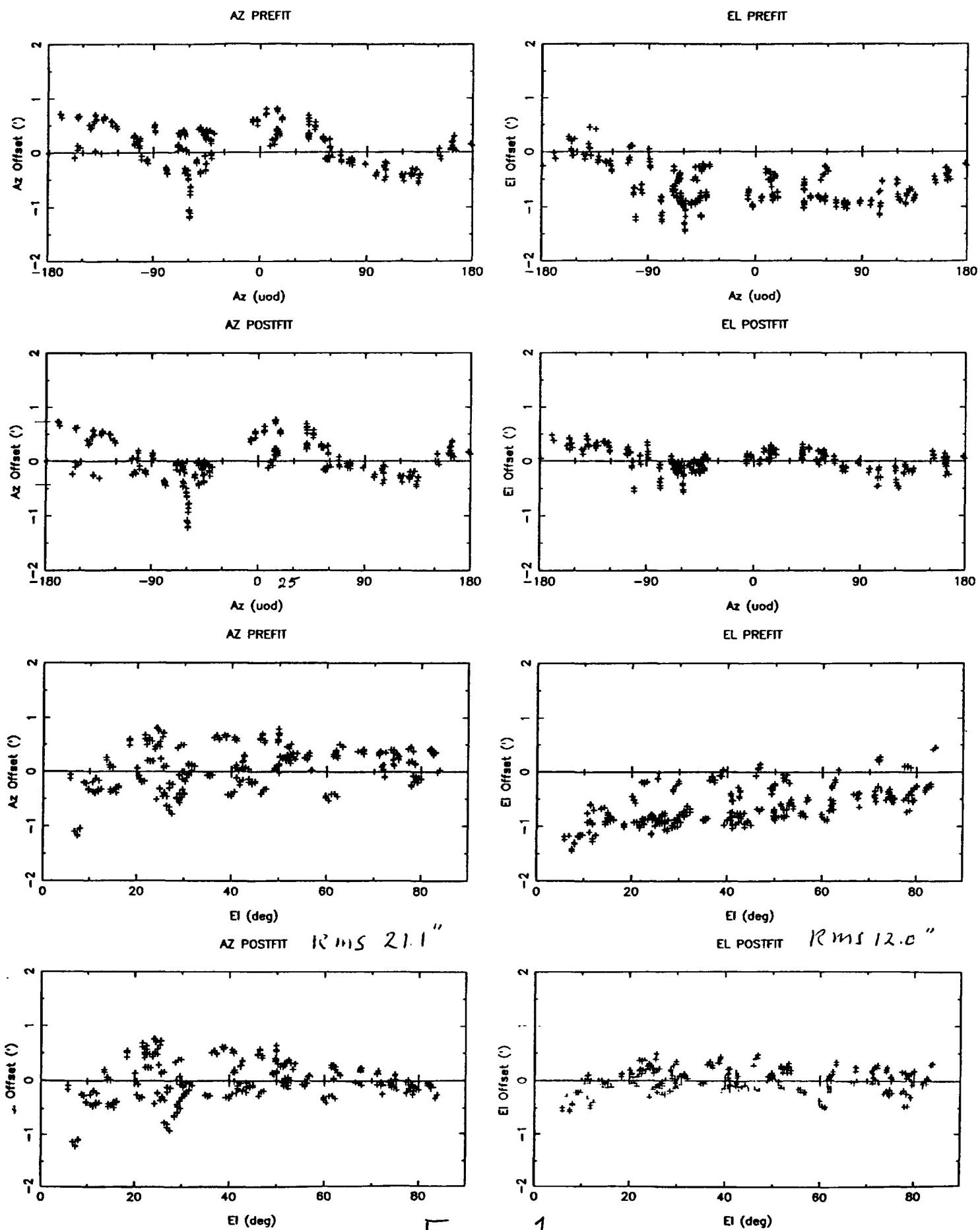
Functional Form.

		Az	El
1.	West Tilt	$\text{Cos}(\text{Az})\text{Sin}(\text{El})$	$-\text{Sin}(\text{Az})$
2.	North Tilt	$\text{Sin}(\text{Az})\text{Sin}(\text{El})$	$\text{Cos}(\text{Az})$
3.	Az. Encoder Offset	1.0	---
4.	Az. Colimation Offset	$\text{Cos}(\text{El})$	---
5.	Sag	---	$\text{Cos}(\text{El})$
6.	El. Colimation Offset	---	1.0
7.	Two Theta terms	$\text{Cos}(2\text{Az})\text{Cos}(\text{El})$	---
8.	"Potato Chip" terms	$\text{Sin}(2\text{Az})\text{Cos}(\text{El})$	---
9.		---	$\text{Cos}(2\text{Az})$
10.		---	$\text{Sin}(2\text{Az})$
11.	Axis Non-perpendicularity	$\text{Sin}(\text{El})$	---
12.	Az encoder axis offset	$\text{Cos}(\text{Az})\text{Cos}(\text{El})$	---
13.		$\text{Sin}(\text{Az})\text{Cos}(\text{El})$	---
14.	El encoder axis offset	---	$\text{Sin}(\text{El})$

Note: The $\text{Cos}(\text{El})$ term of the El encoder offset is degenerate with the sag. The El encoder offset and El colimation offset are also degenerate.

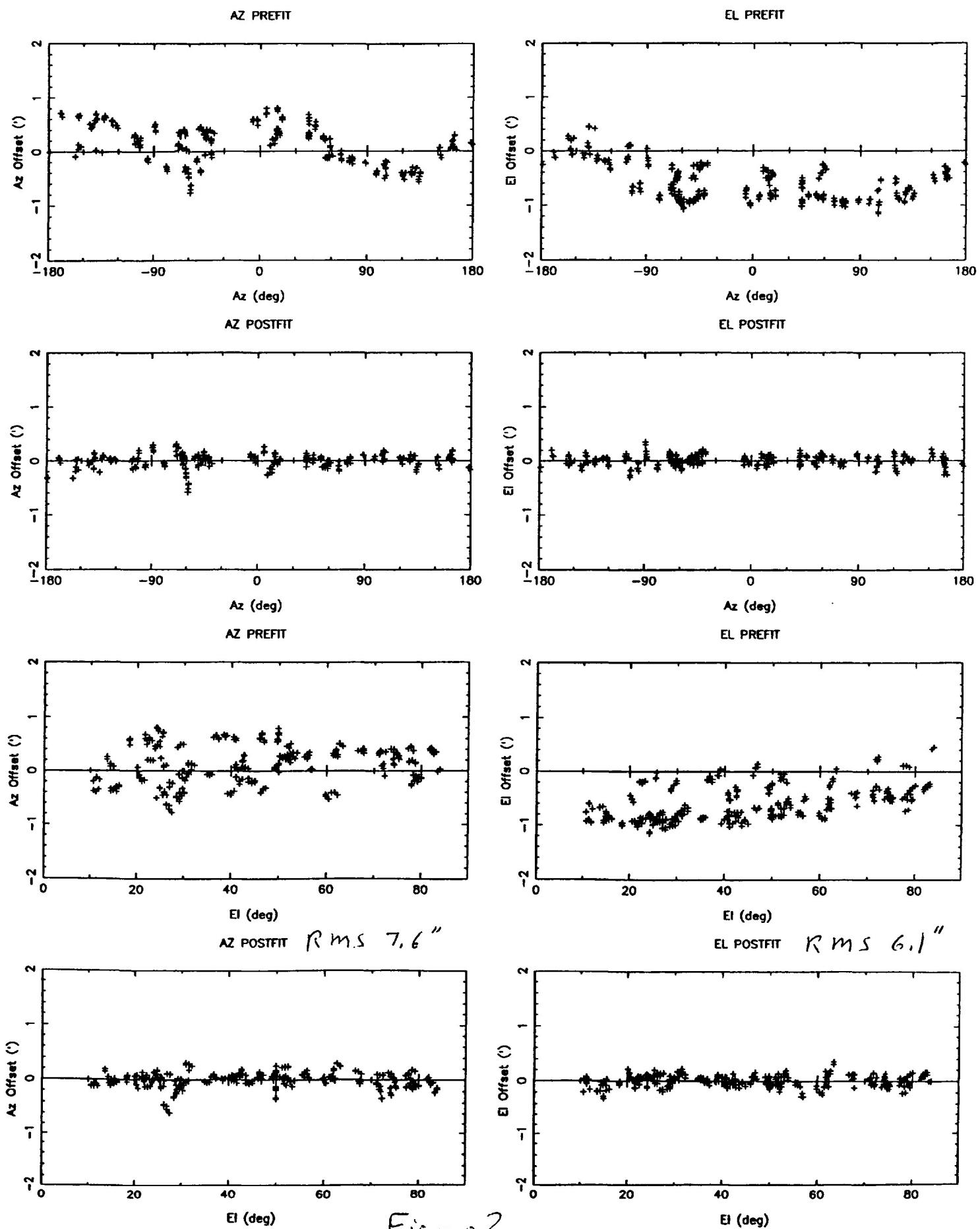
PT 4cm

29 Apr 1991



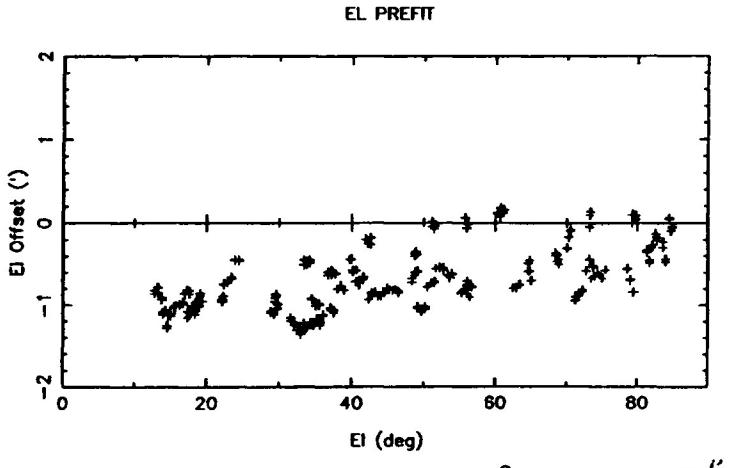
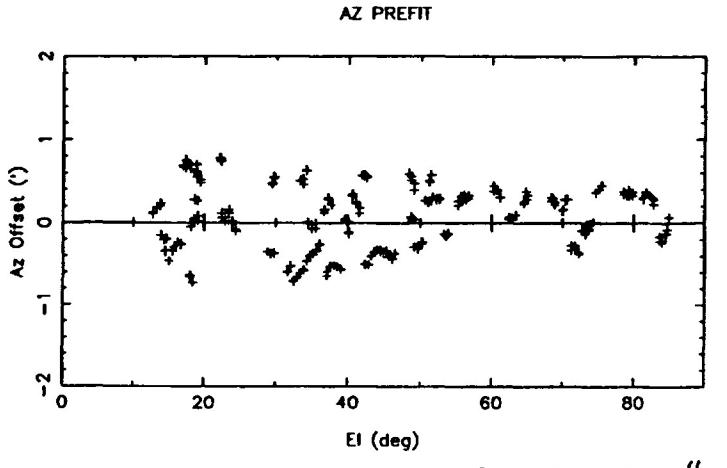
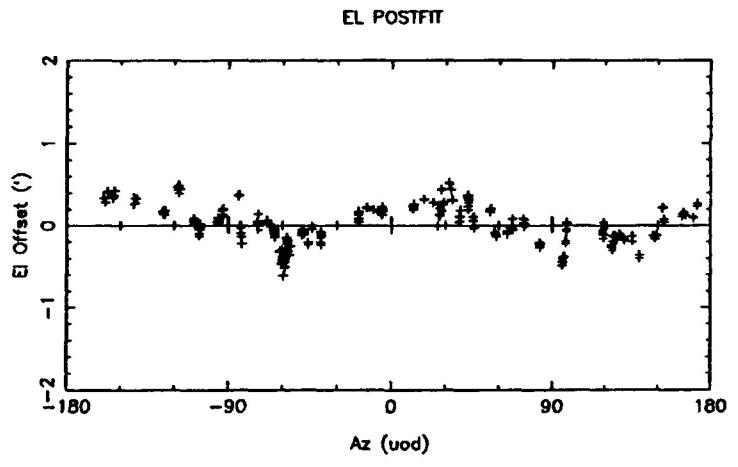
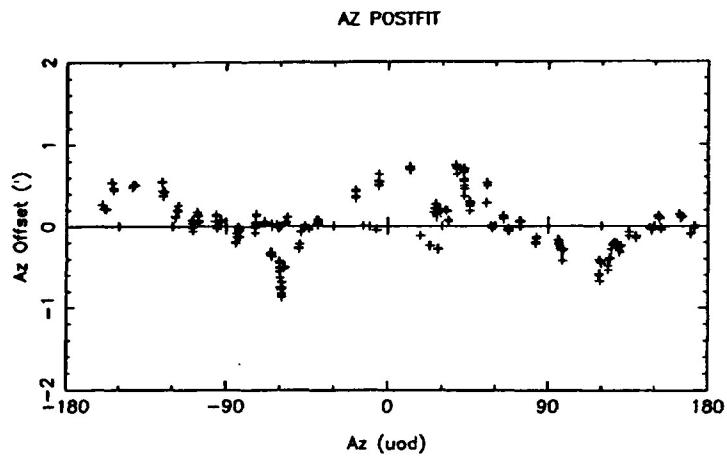
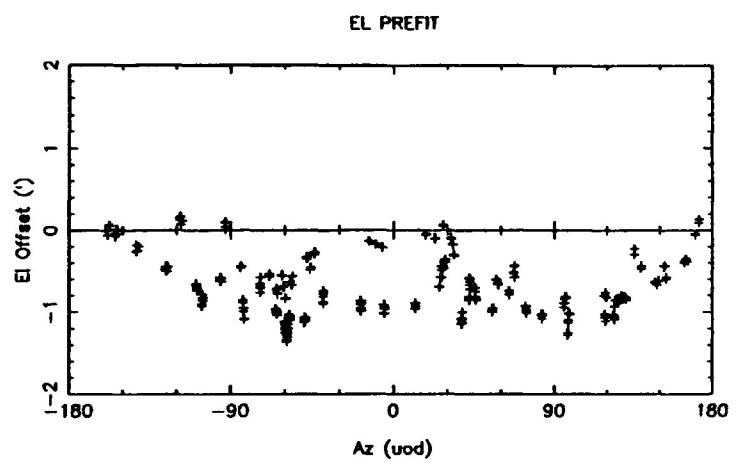
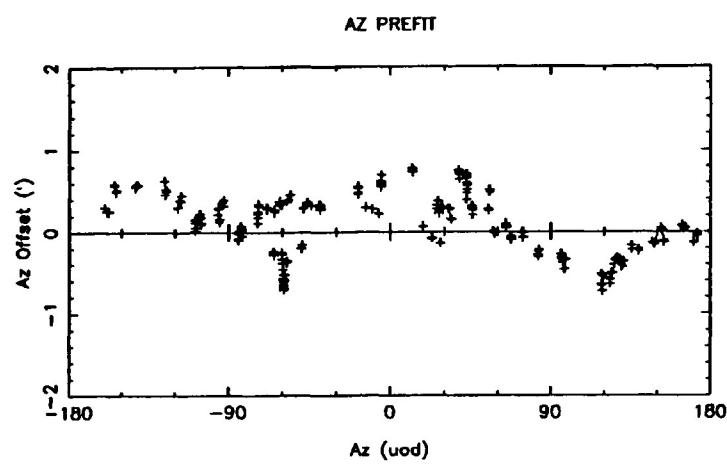
PT 4cm

29 Apr 1991



PT 4cm

2 May 1991



AZ POSTFIT RMS 21.0"

EL POSTFIT RMS 14.2"

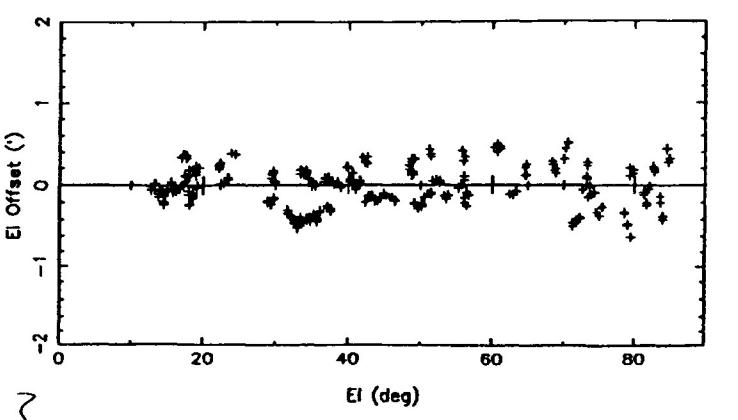
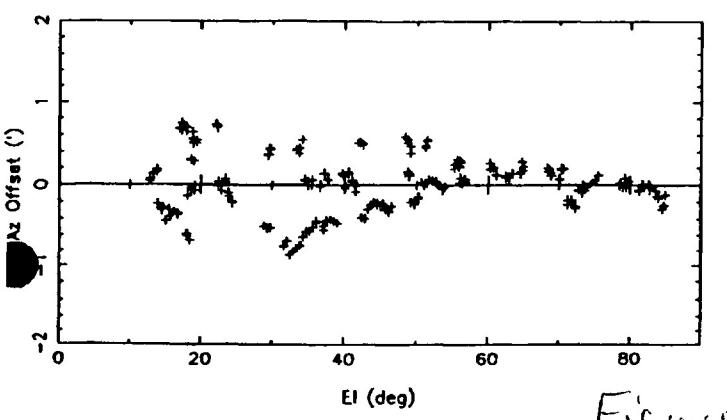
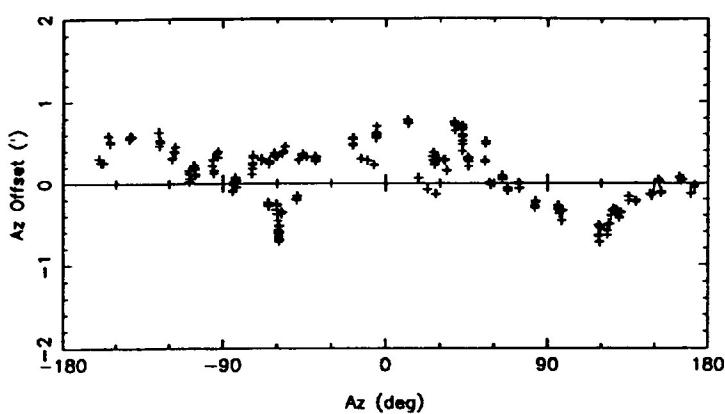


Figure 3

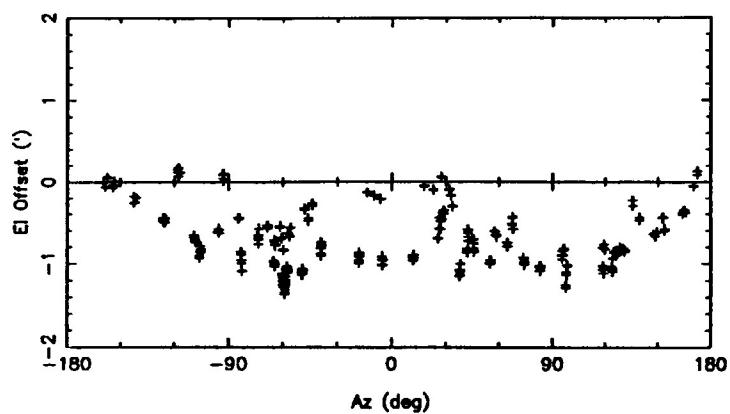
PT 4cm

2 May 1991

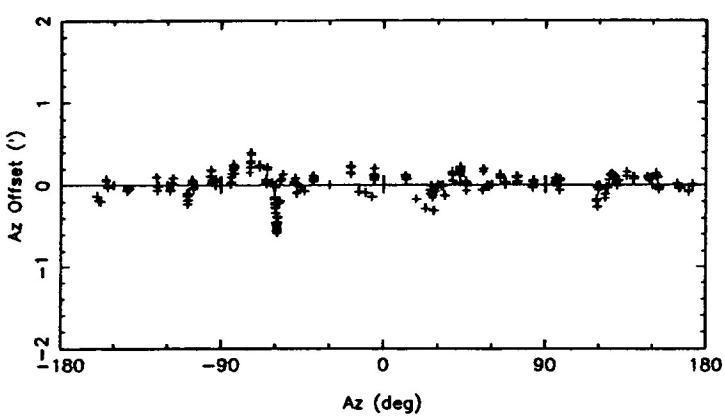
AZ PREFIT



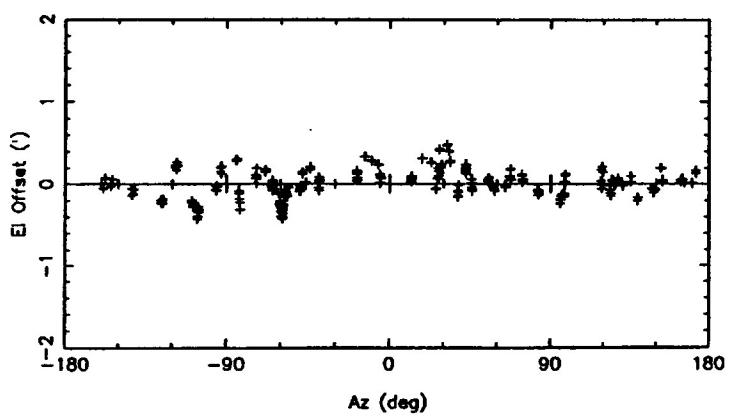
EL PREFIT



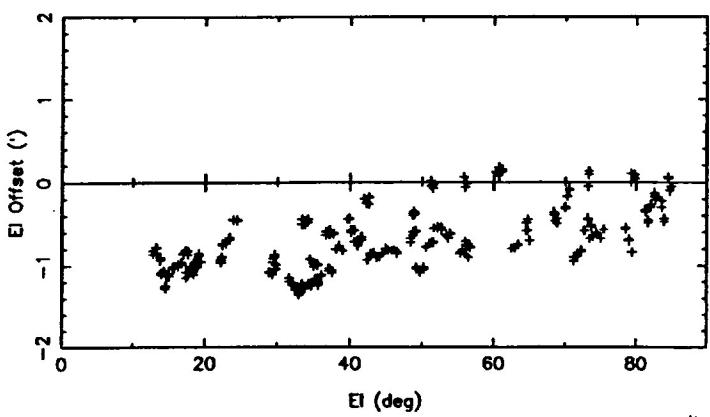
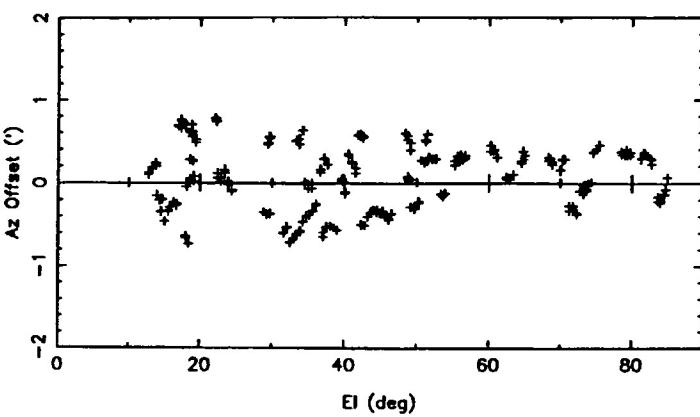
AZ POSTFIT



EL POSTFIT



AZ PREFIT



AZ POSTFIT $R_{\text{MS}} 9.5''$

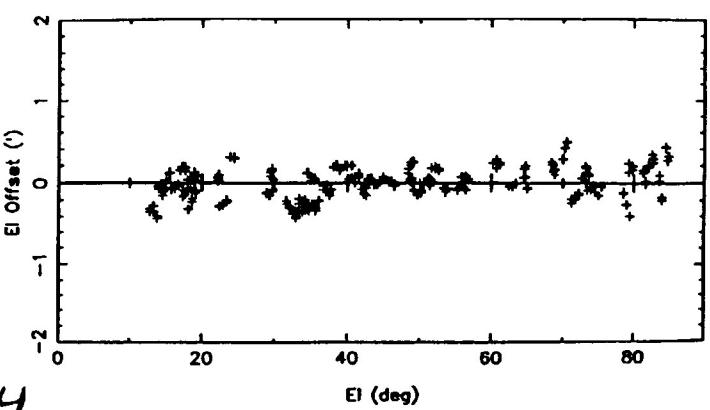
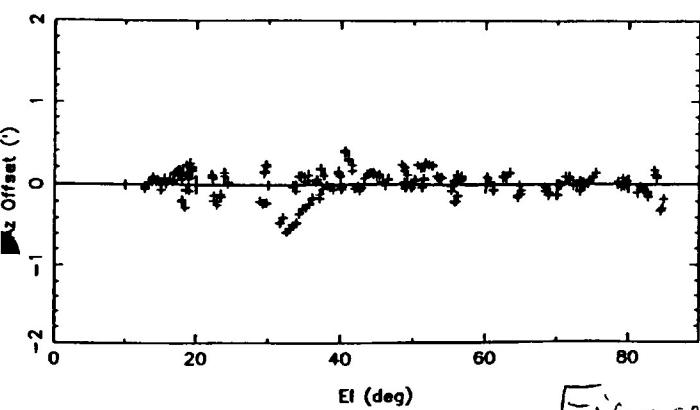
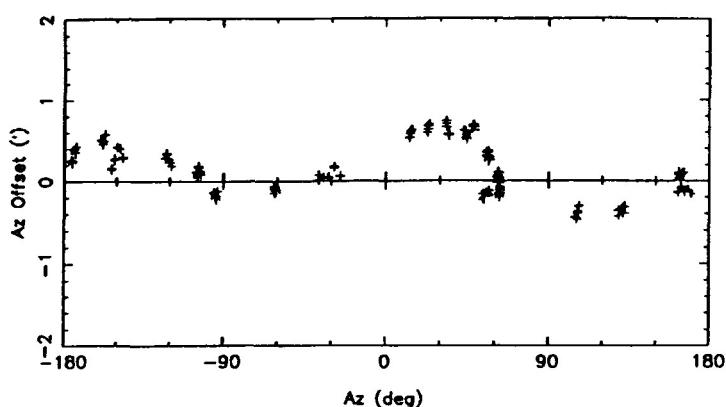


Figure 4

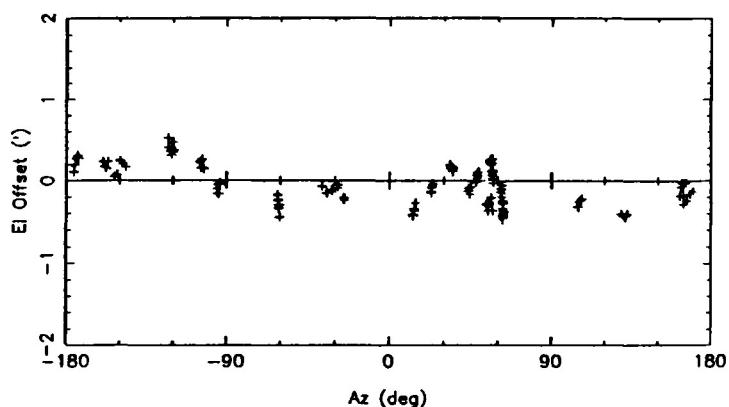
PT 1cm

14 May 1991

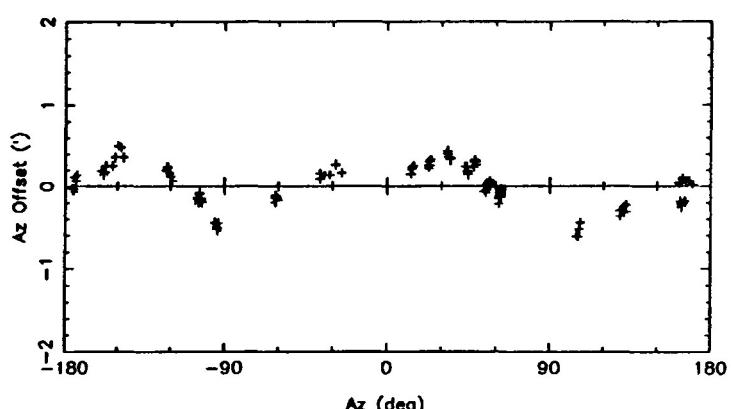
AZ PREFIT



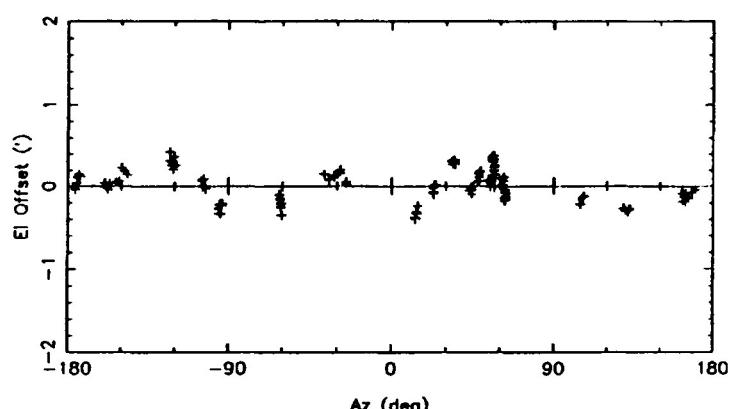
EL PREFIT



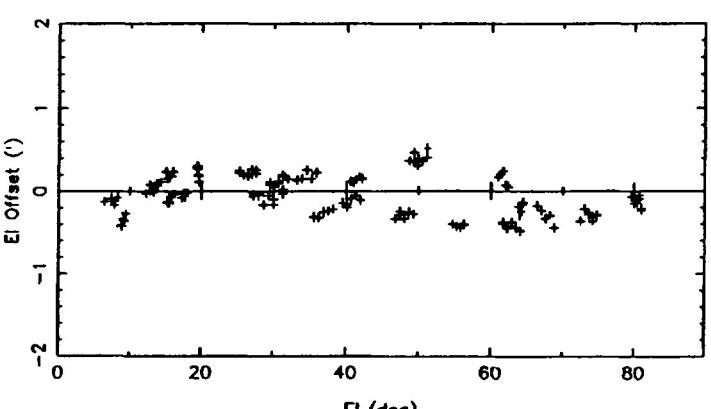
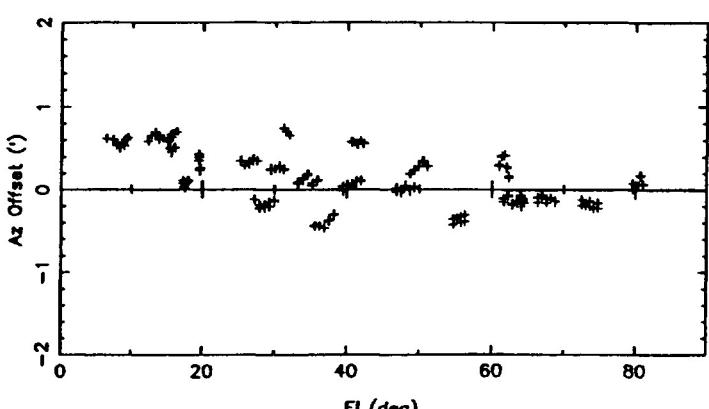
AZ POSTFIT



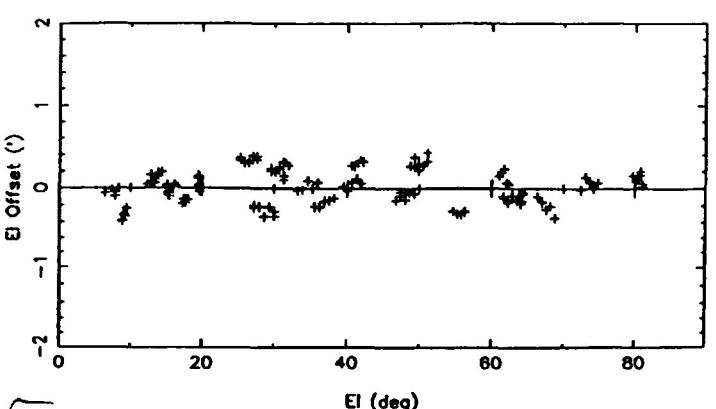
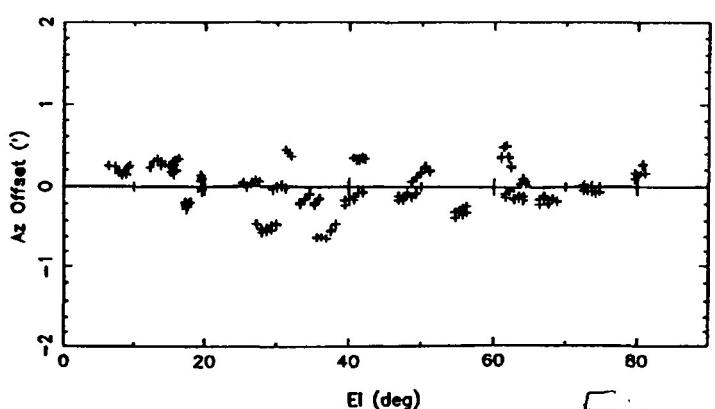
EL POSTFIT



AZ PREFIT



AZ POSTFIT $R_{rms} = 15.2''$



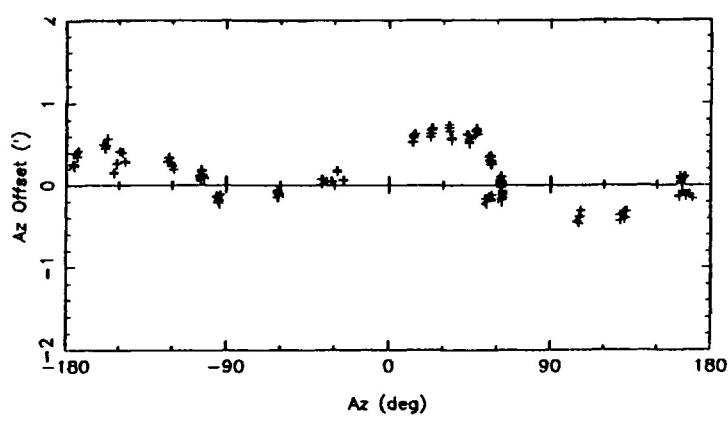
EL POSTFIT $R_{rms} = 11.6''$

Figure 5

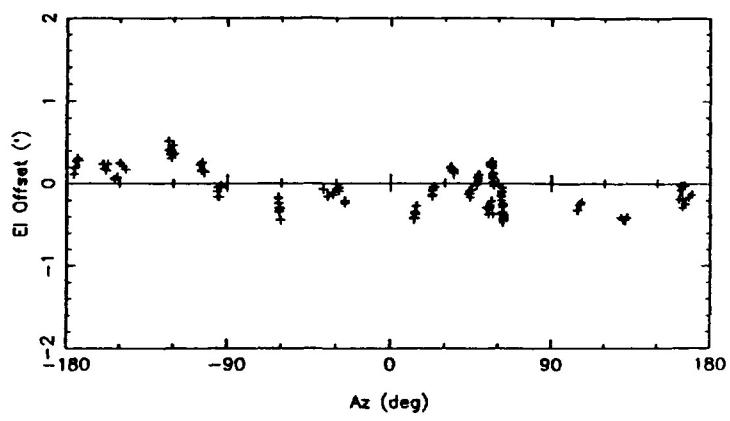
PT 1cm

14 May 1991

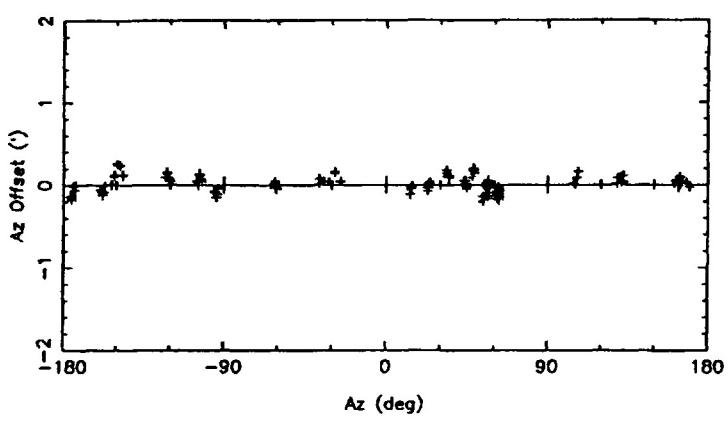
AZ PREFIT



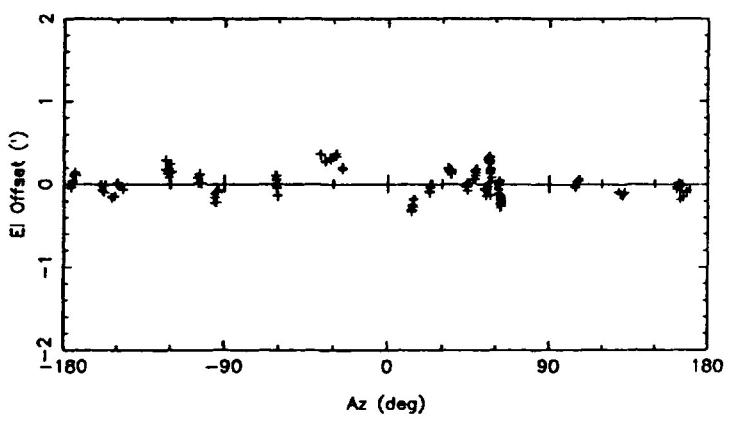
EL PREFIT



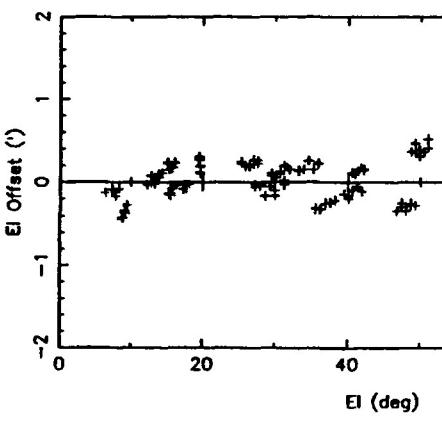
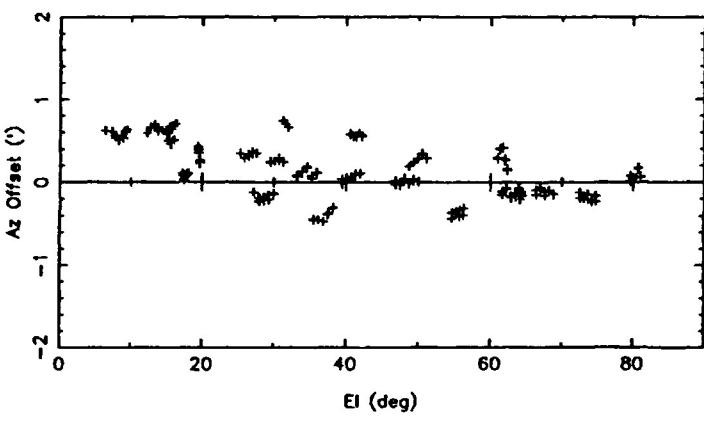
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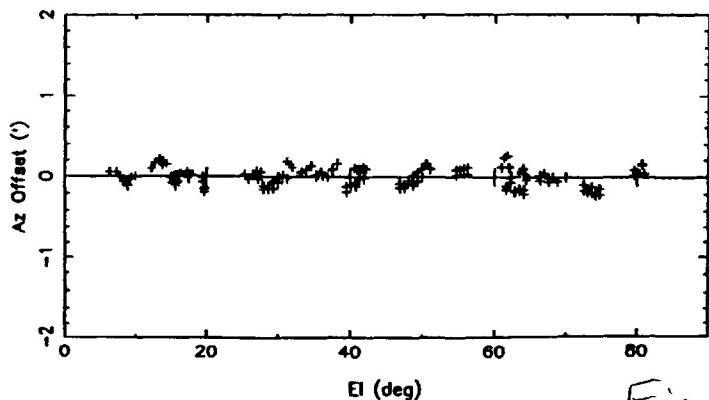
EL POSTFIT



AZ PREFIT



AZ POSTFIT RMS 5.9"



EL POSTFIT RMS 9.3"

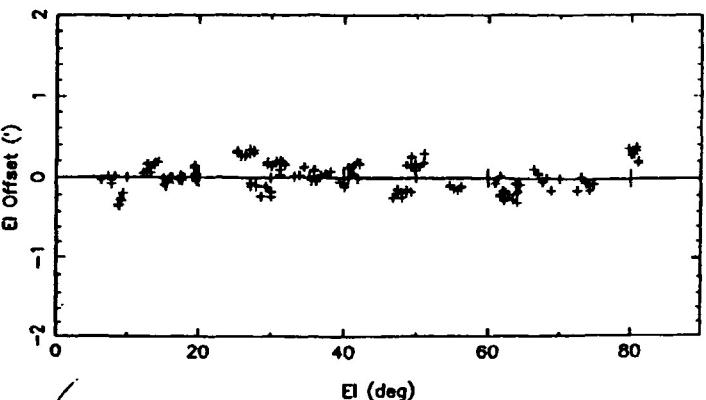
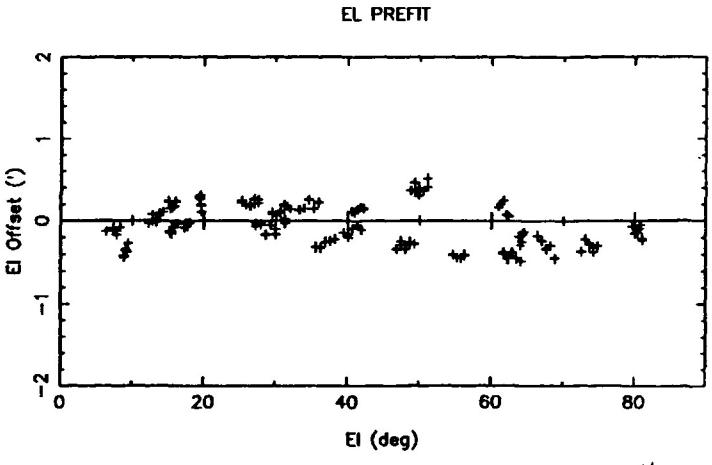
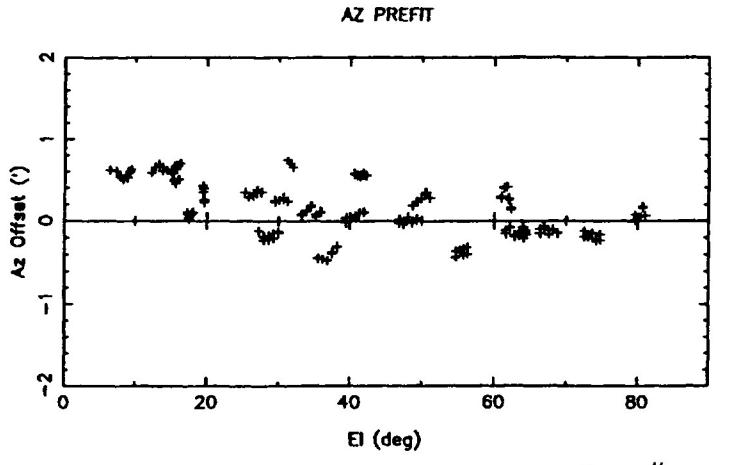
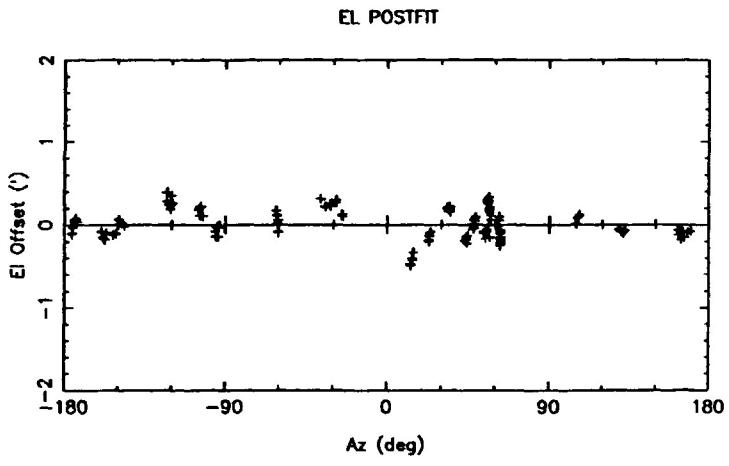
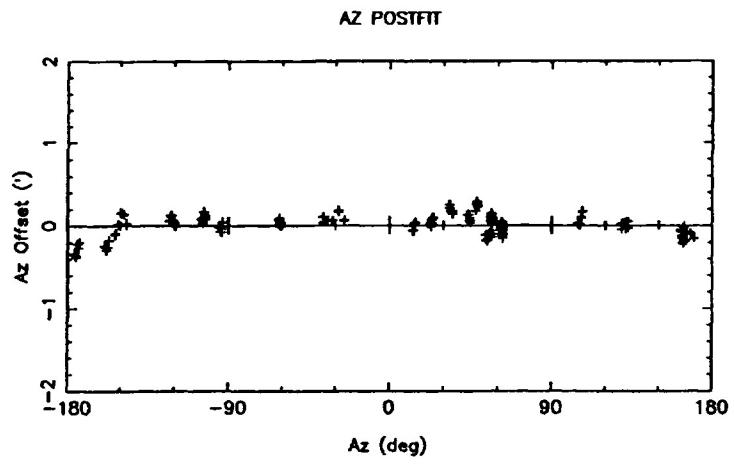
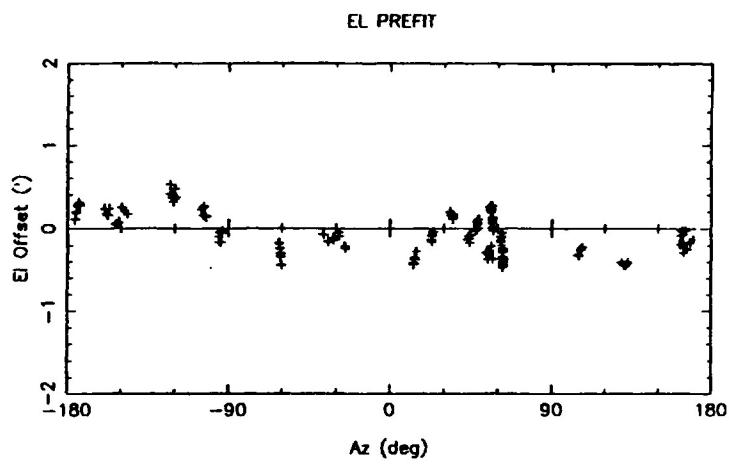
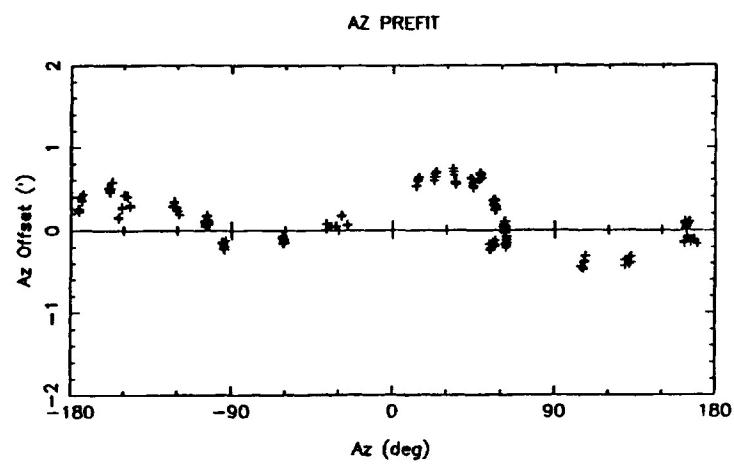


Figure 6

PT 1cm

14 May 1991



AZ POSTFIT RMS 8.0 "

EL POSTFIT RMS 10.4 "

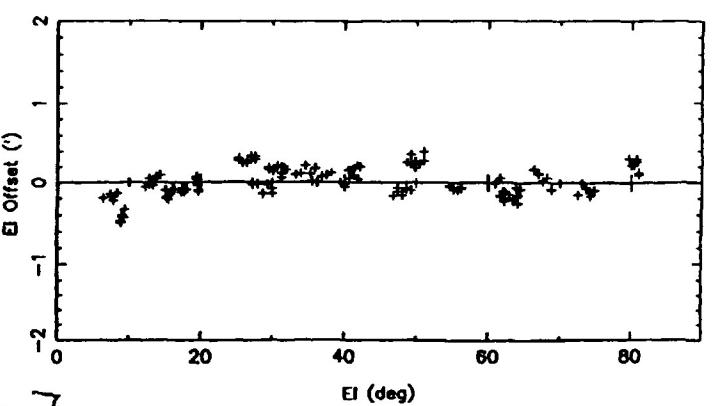
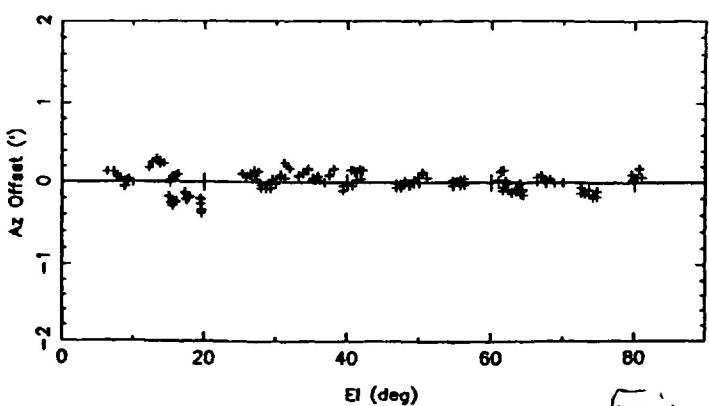


Figure 7