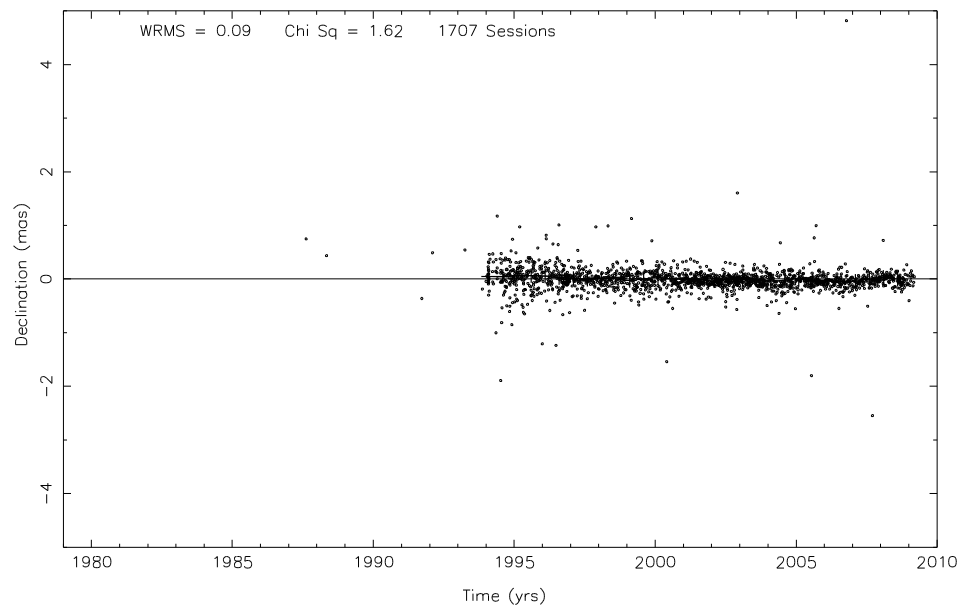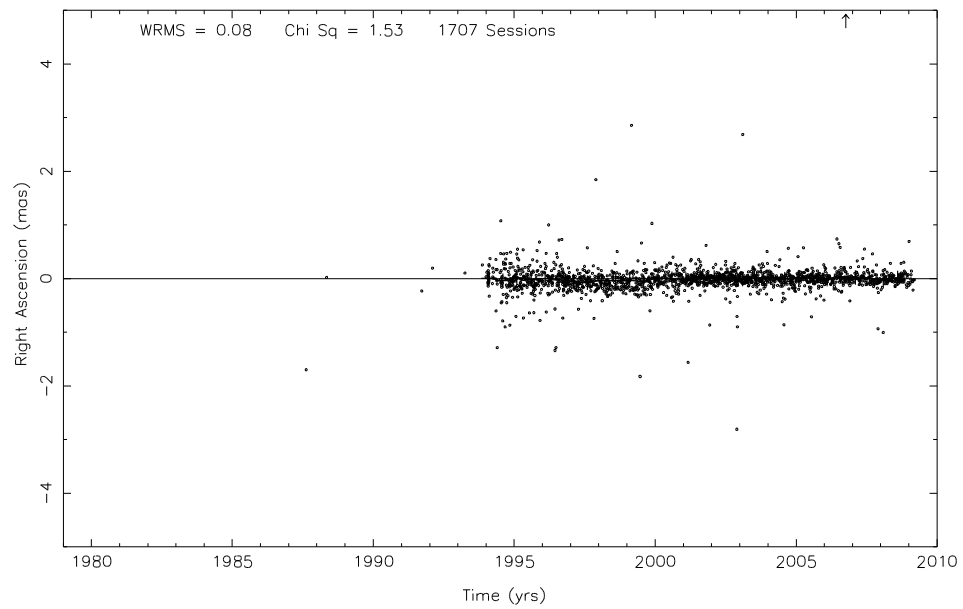# Preparations for the Next ICRF: Work at GSFC

David Gordon

Dan MacMillan

GSFC/NVI Inc.
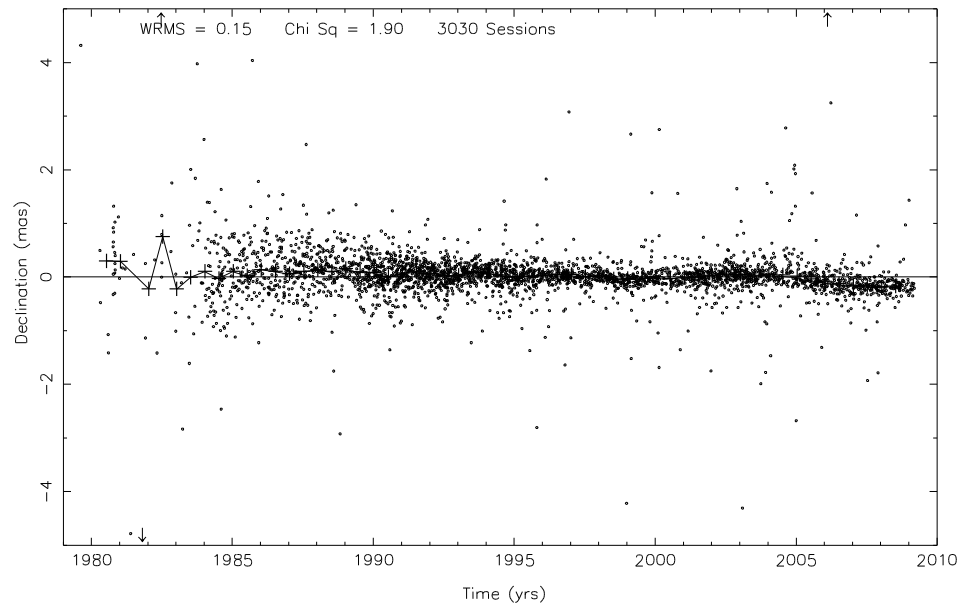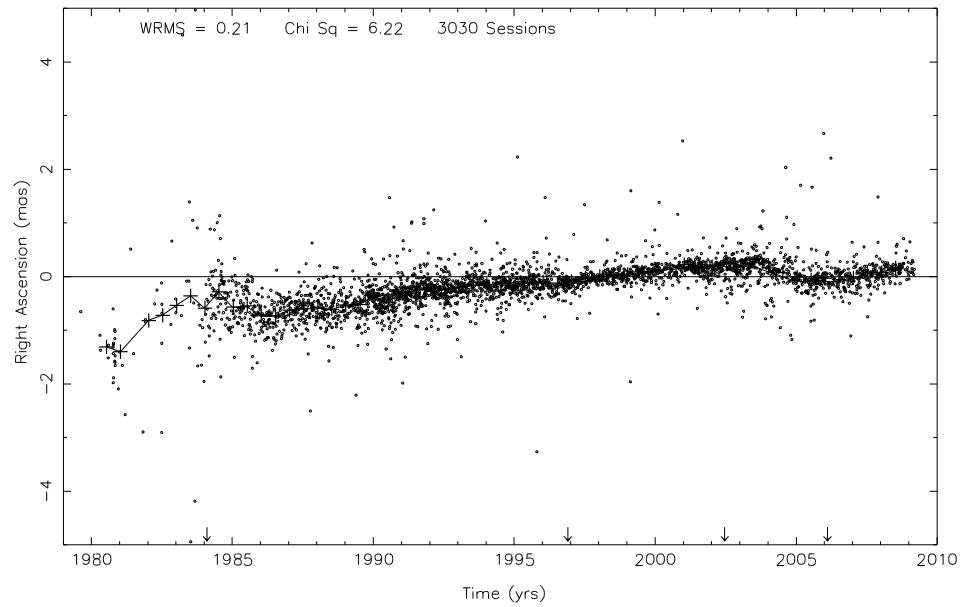
Time Series Analysis

- Stable Sources – for NNR constraint
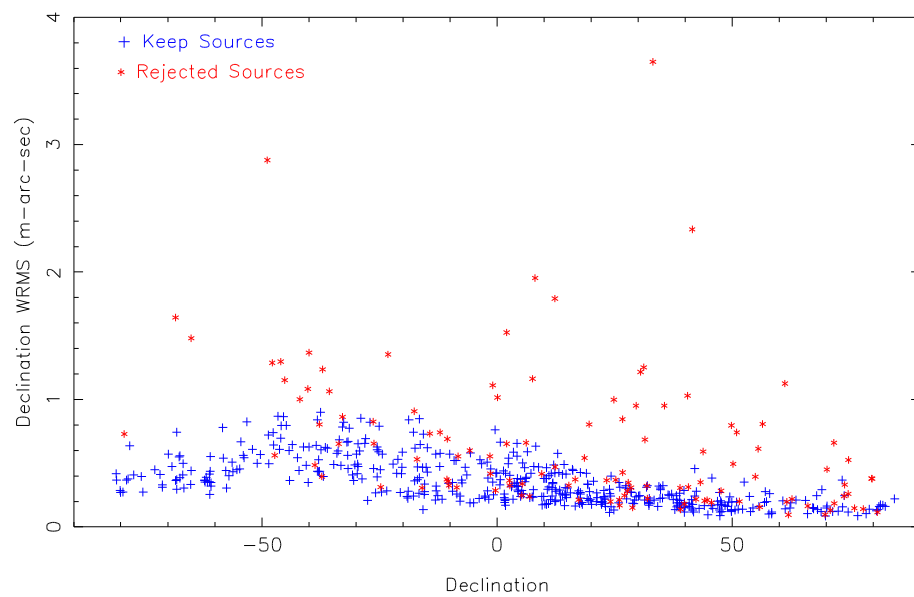
- Unstable sources – for special handling

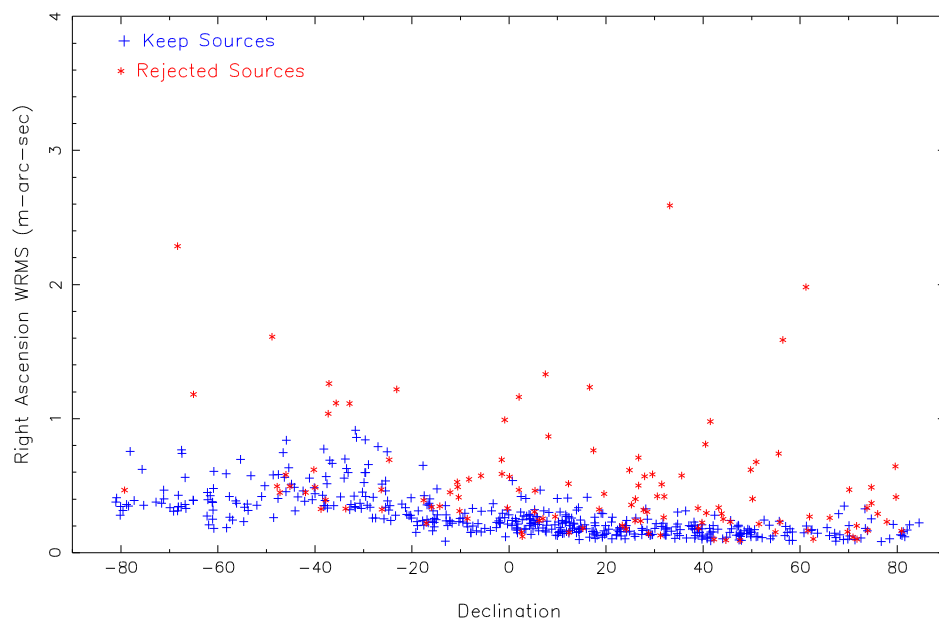1357+769/1357+769

0923+392/4C39.25

WRMS = 0.21   Chi Sq = 6.22   3030 Sessions
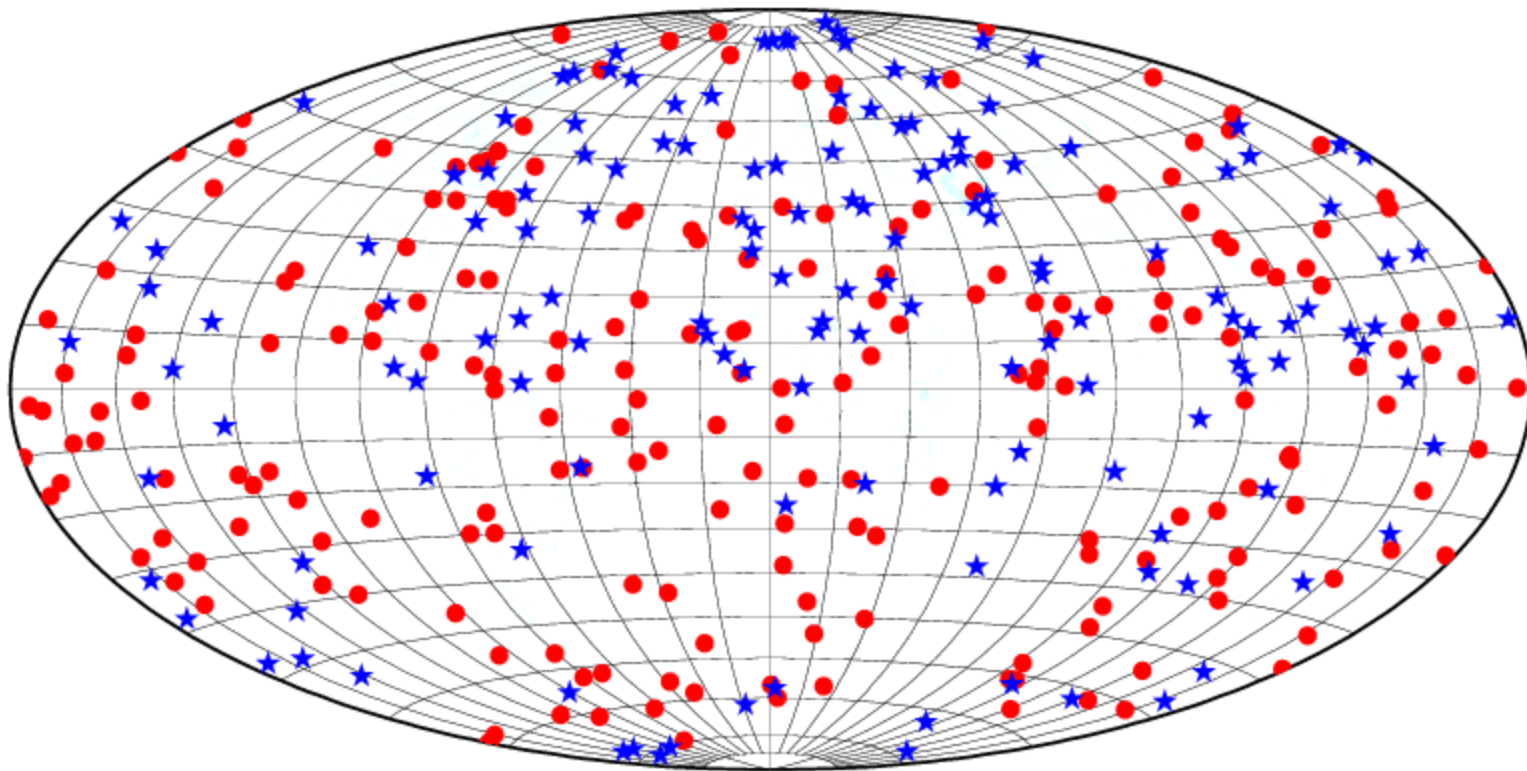
WRMS = 0.15   Chi Sq = 1.90   3030 Sessions

gsf004a Time Series

GSFC NNR Sources
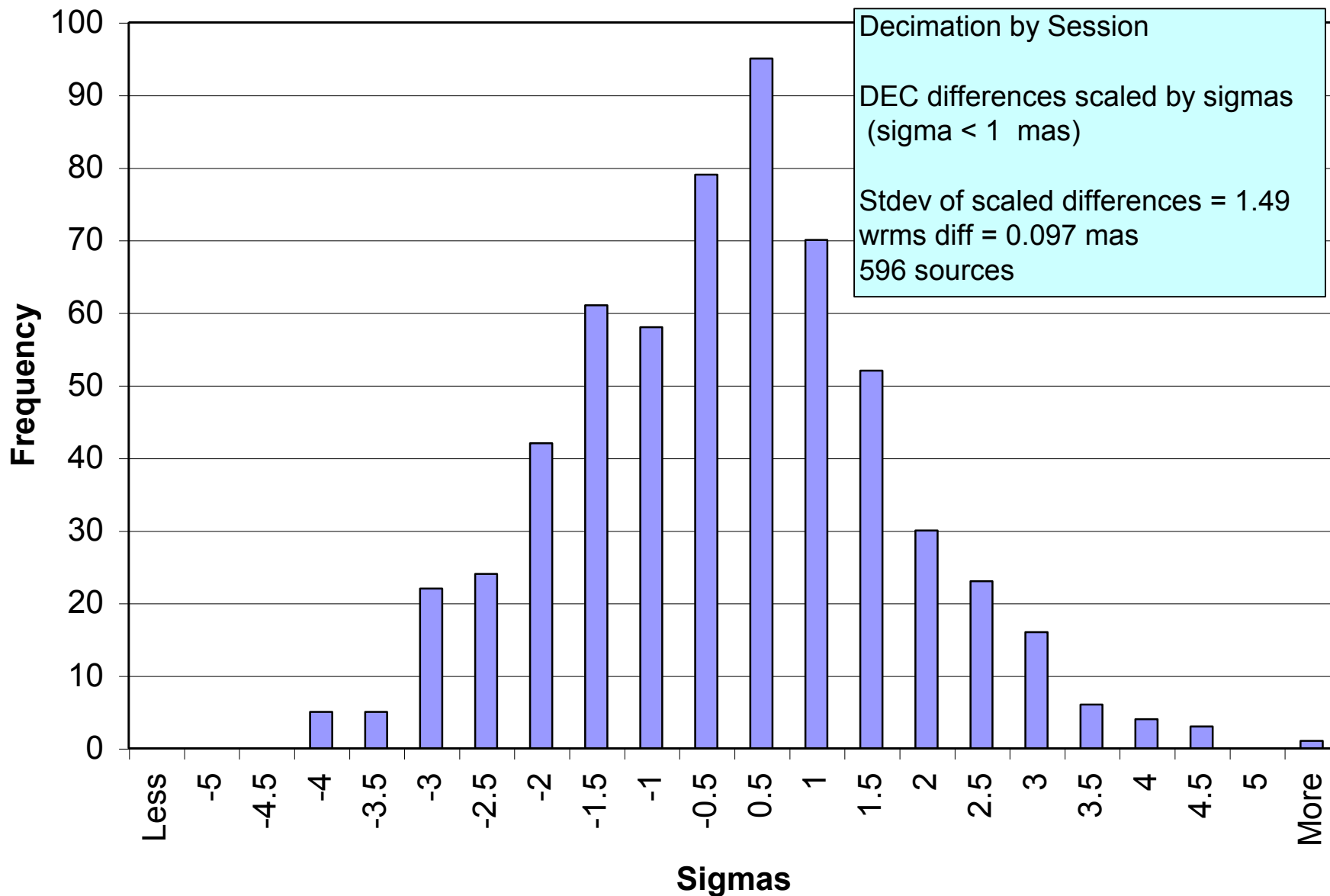

★ ICRF1 Defining (149)   ● Other Sources (213)
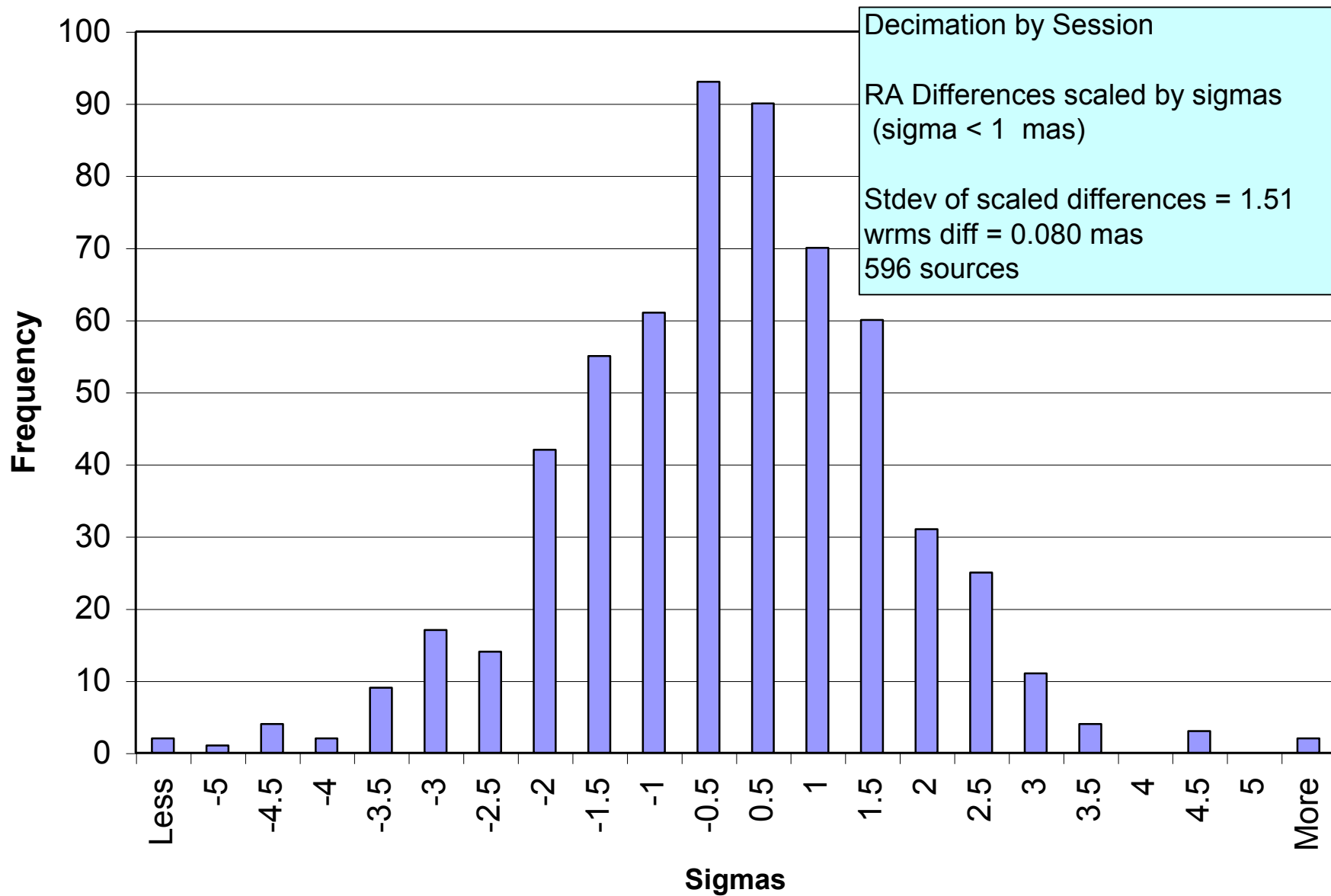
18 March 2009 22:22

Decimation Tests

- Session Decimation – 1/3 of sessions in 3 solutions

  Indicates a scaling factor of ~1.5

Decimation by Session

DEC differences scaled by sigmas
 (sigma < 1 mas)

Stdev of scaled differences = 1.49
wrms diff = 0.097 mas
596 sources

Decimation by Session

RA Differences scaled by sigmas
 (sigma < 1 mas)

Stdev of scaled differences = 1.51
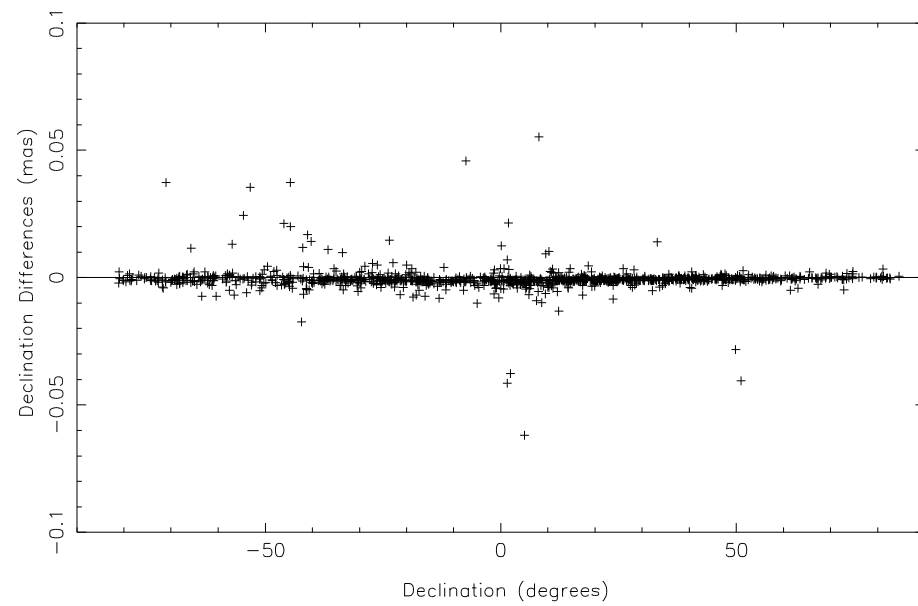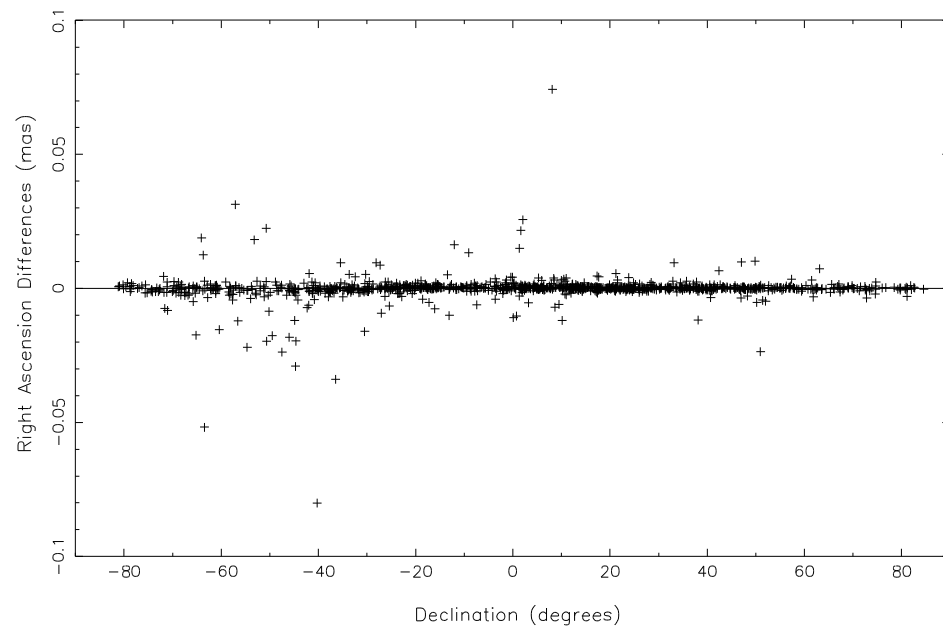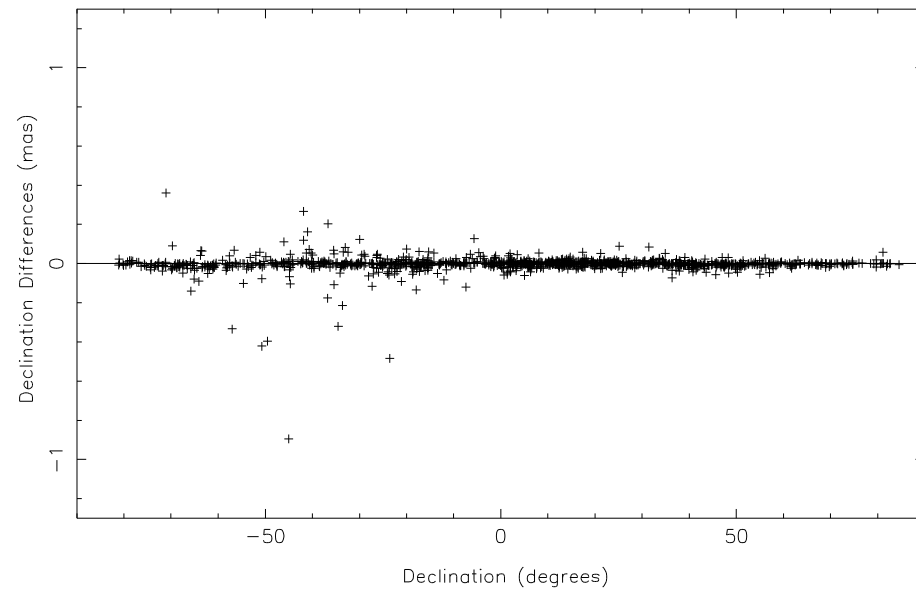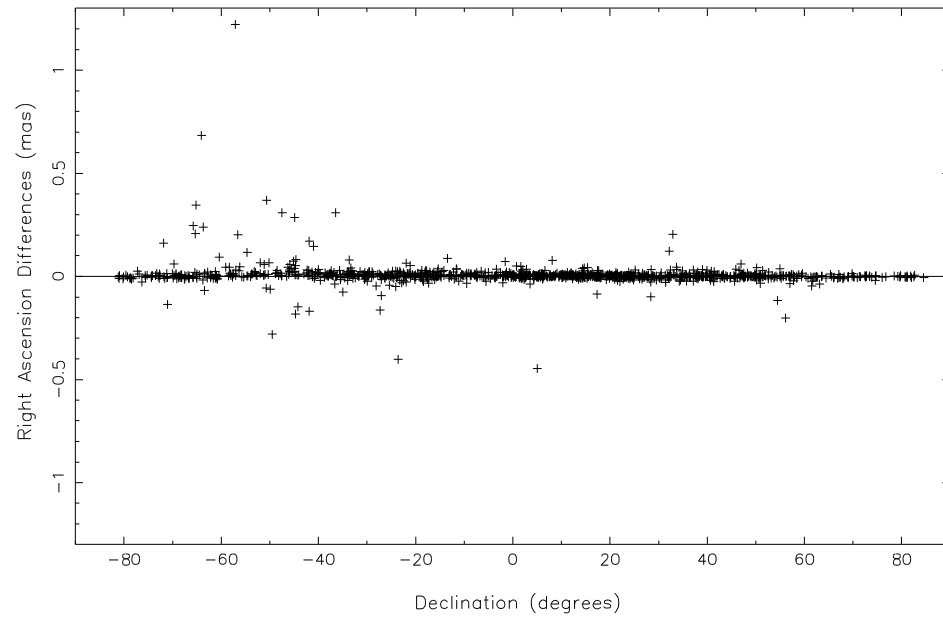wrms diff = 0.080 mas
596 sources

Session Type Tests

- Base solution: no mobile or regional sessions

- Add mobile sessions – only small RA/Dec differences.

- Add mobile, regional, ties sessions – larger RA/Dec differences (up to ~1.2 mas).
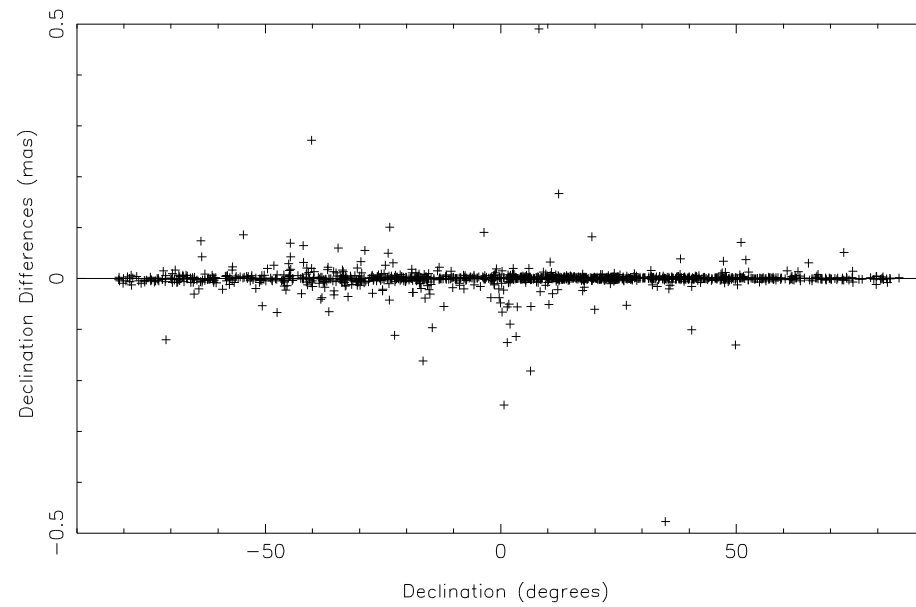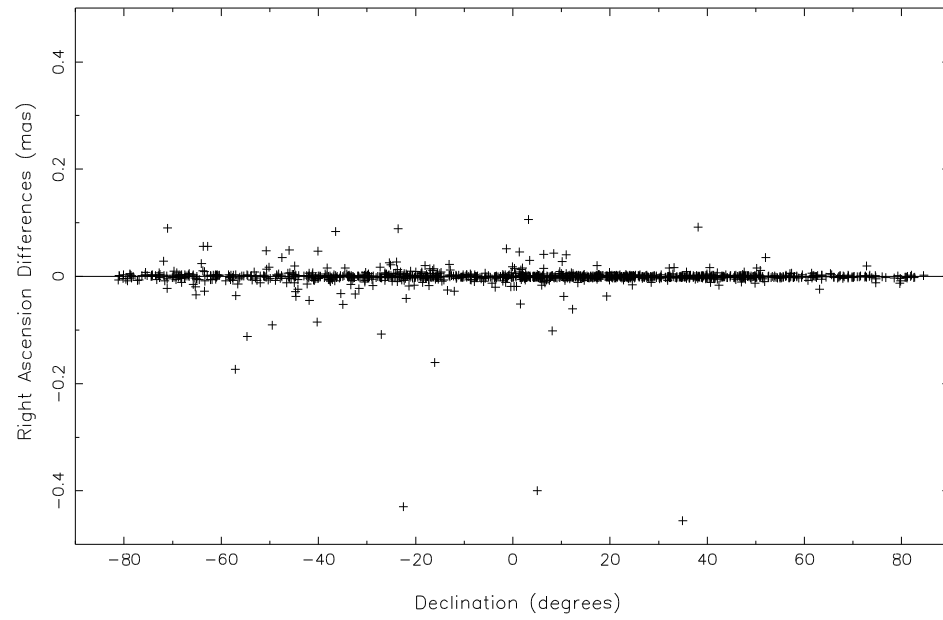
Adding Mobile Sessions

Adding Mobiles, Regionals, Ties
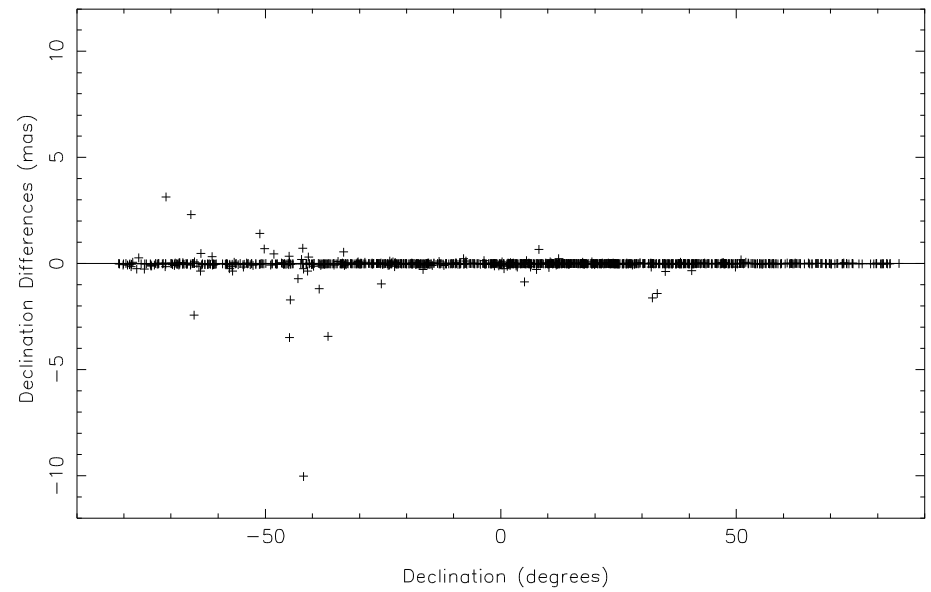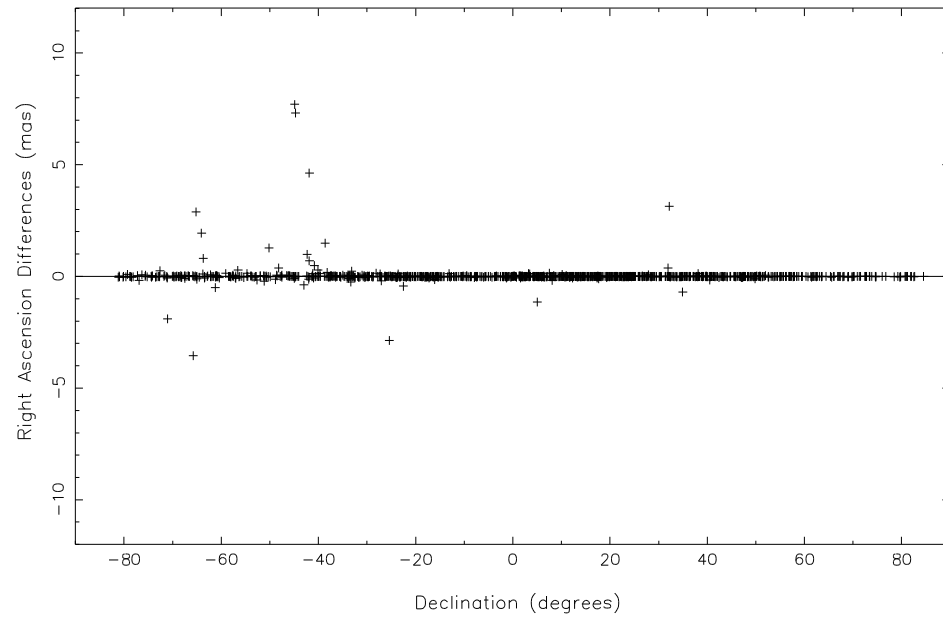
Start Time Tests

- Aug. 1979: Base solution
- Jan. 1990: A few RA/Dec differences up to ~.5 mas. Uncertainties increase slightly, up to ~8 µas.
- Jan. 1993: Some RA/Dec differences up to ~10 mas. Uncertainties increase by up to ~.1 mas.
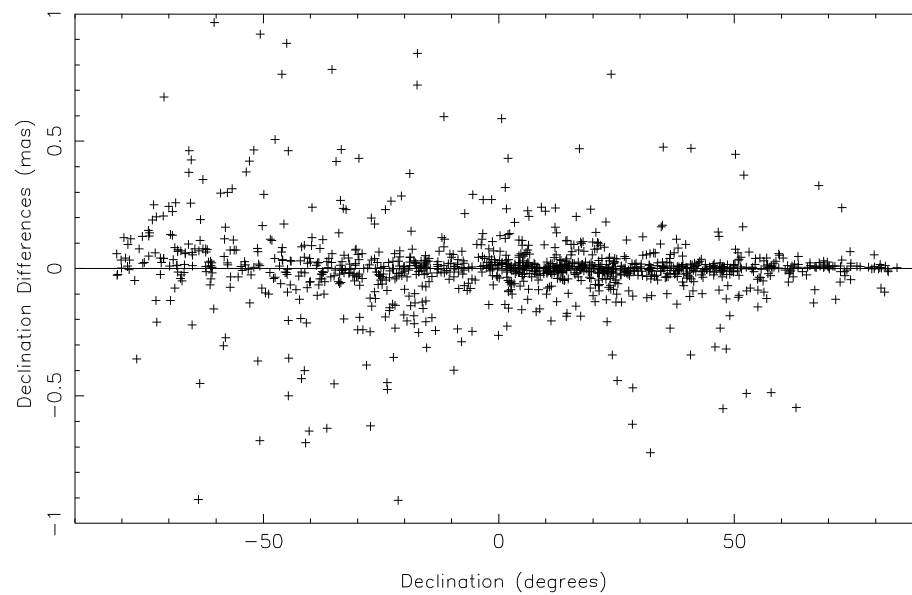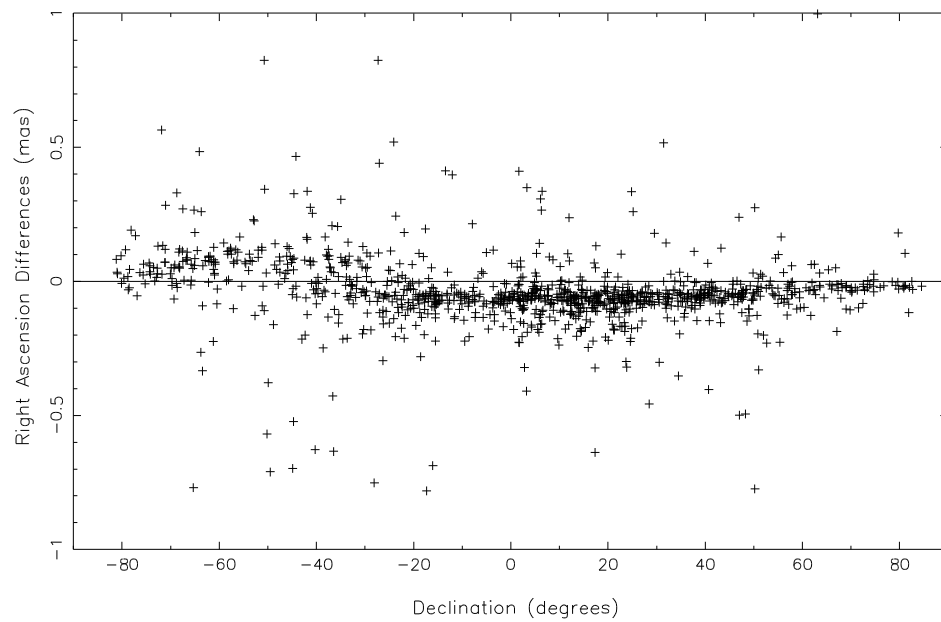
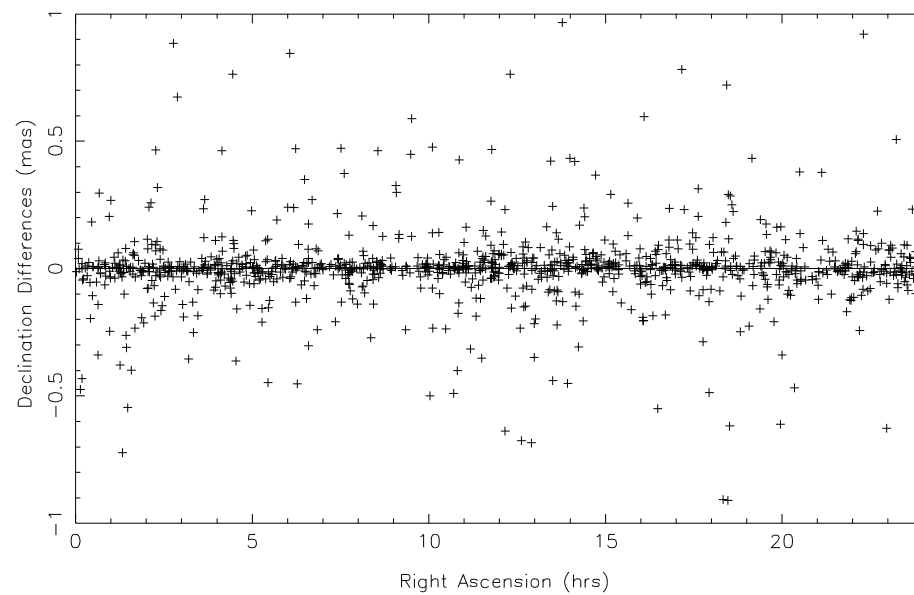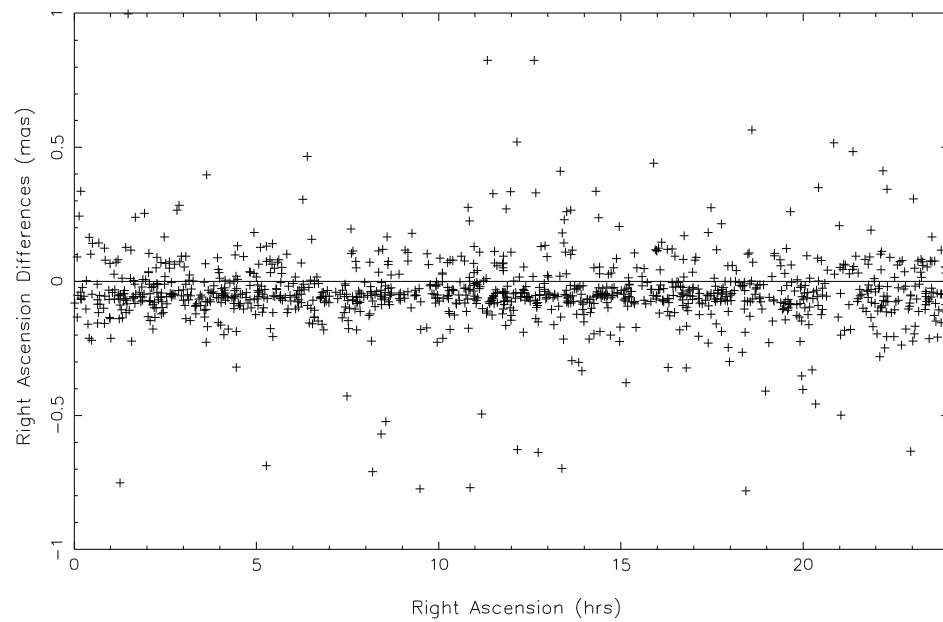Start Time: 1979 vs. 1990

Start Time: 1979 vs. 1993

TRF vs Baseline Solution

- Shows a rotation (76 µasec) about the Z-axis and some N/S distortion.

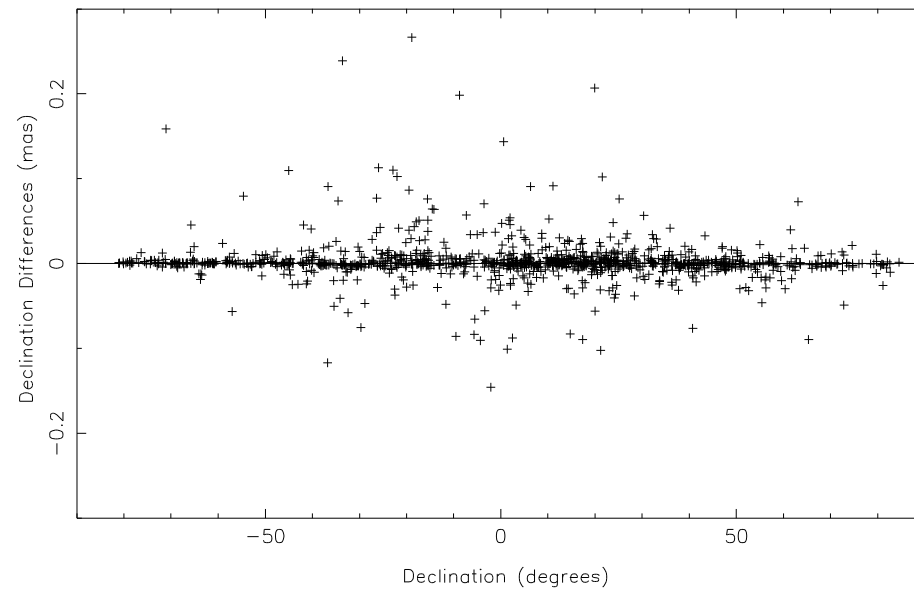- Small increase in average uncertainties.

TRF vs. Baseline Solution

TRF vs. Baseline Solution

Pressure Loading Tests

- Pressure loading On vs. Off: Random RA/Dec differences up to ~.2 mas.Uncertainties unchanged.

Pressure Loading ON vs. OFF
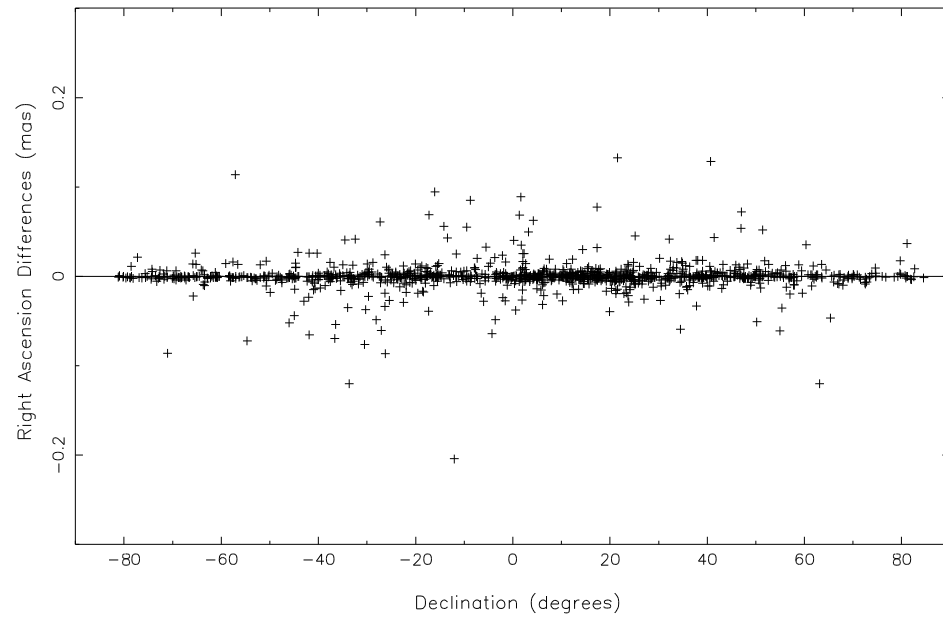
Gradient Tests

- Apply apriori model + solve for residuals (base solution).

- Solve for total gradients. Declination dependence, up to ~.17 mas.

- Apply apriori model only. Smaller declination dependence, but more scatter, uncertainties decrease.

- No gradients. Declination dependence, up to ~.5 mas.

Gradients: Mean+Residual vs. Total
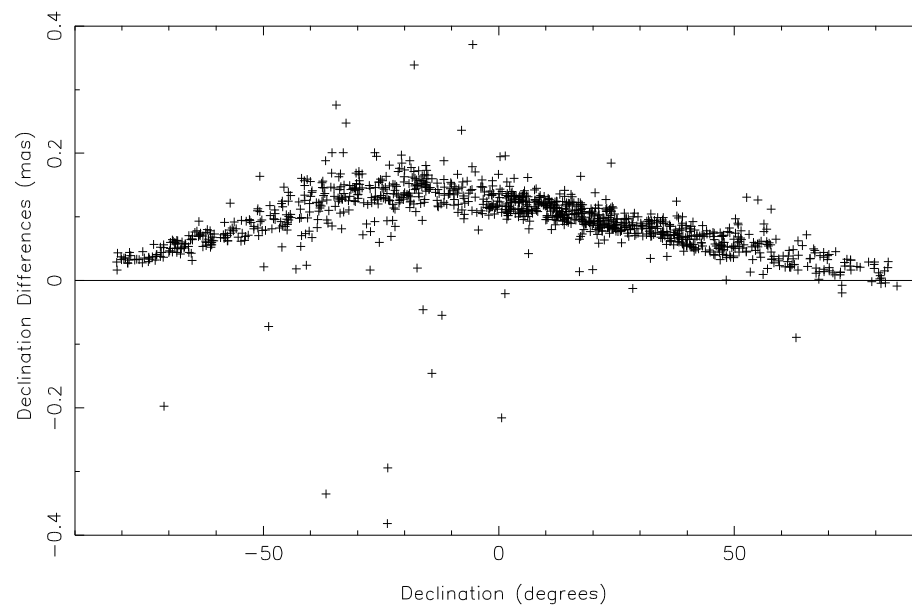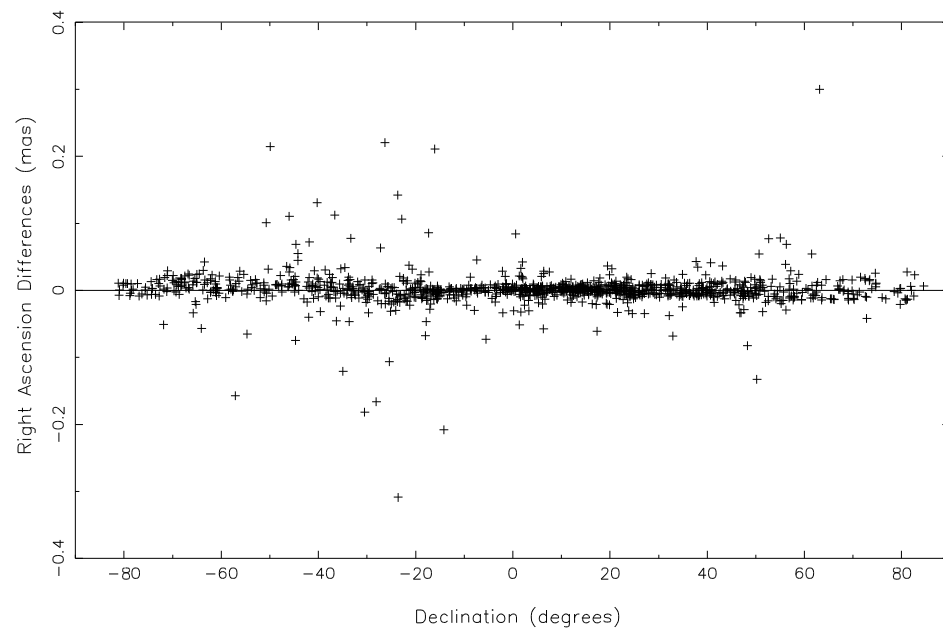
Gradients: Mean+Residual vs. Mean
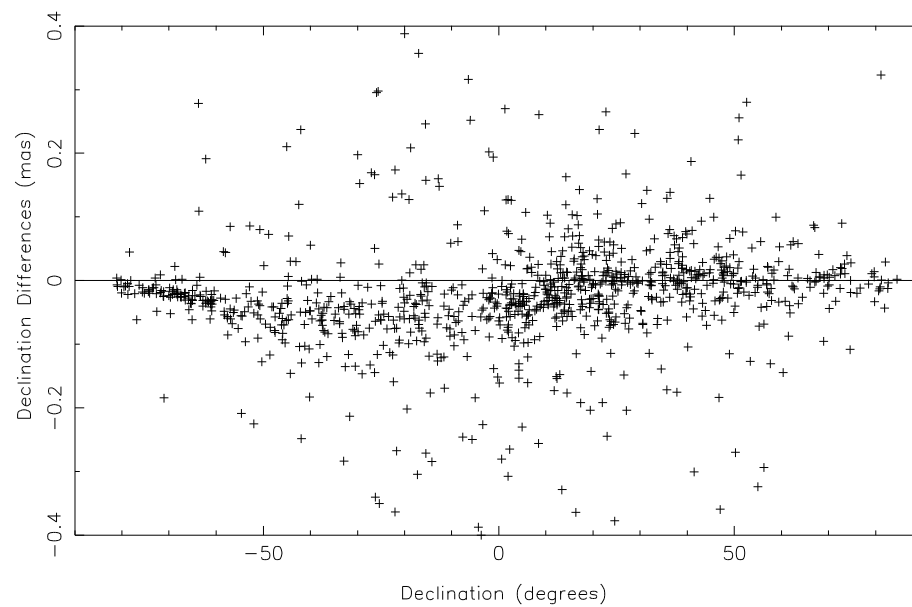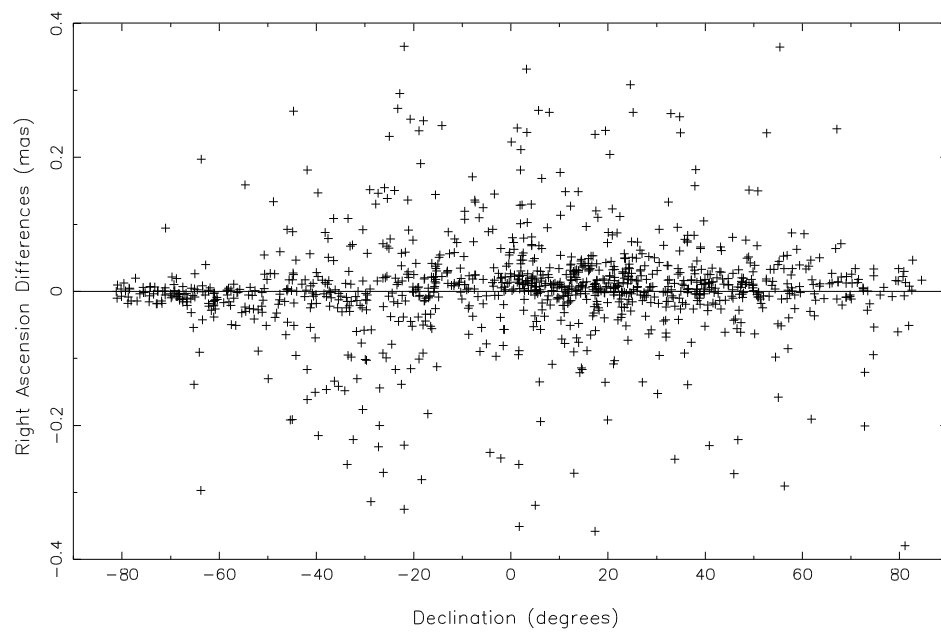
Gradients: Mean+Residual vs. No Gradients
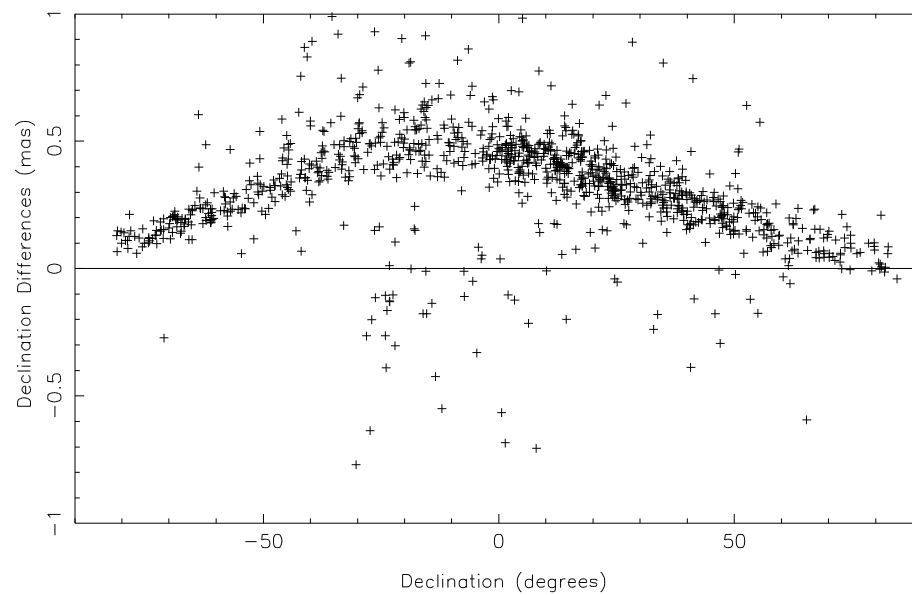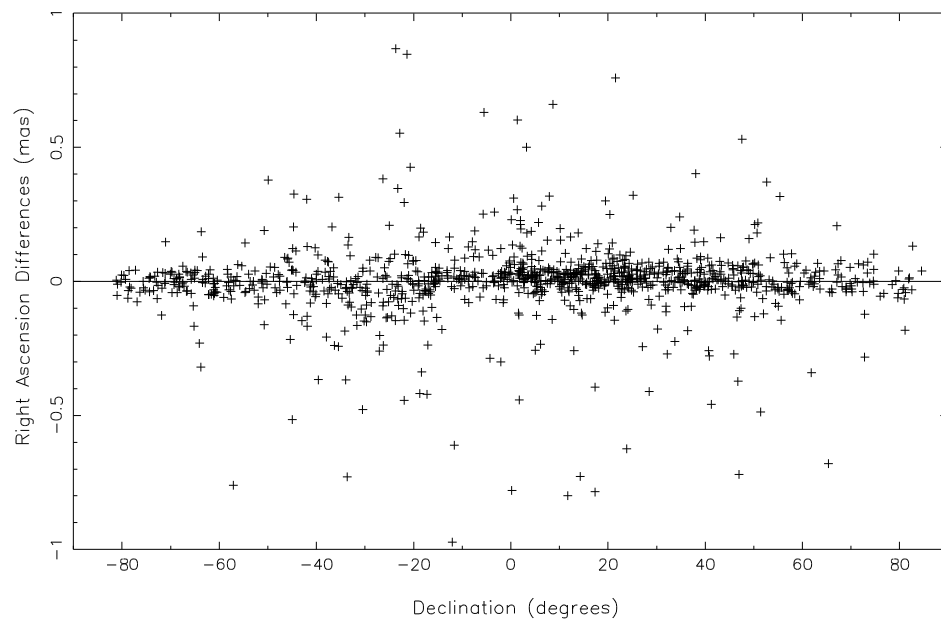
NMF vs VMF Test

- Random RA/Dec differences, up to ~.8 mas. Small increases in uncertainties (few μasec).

NMF vs. VMF
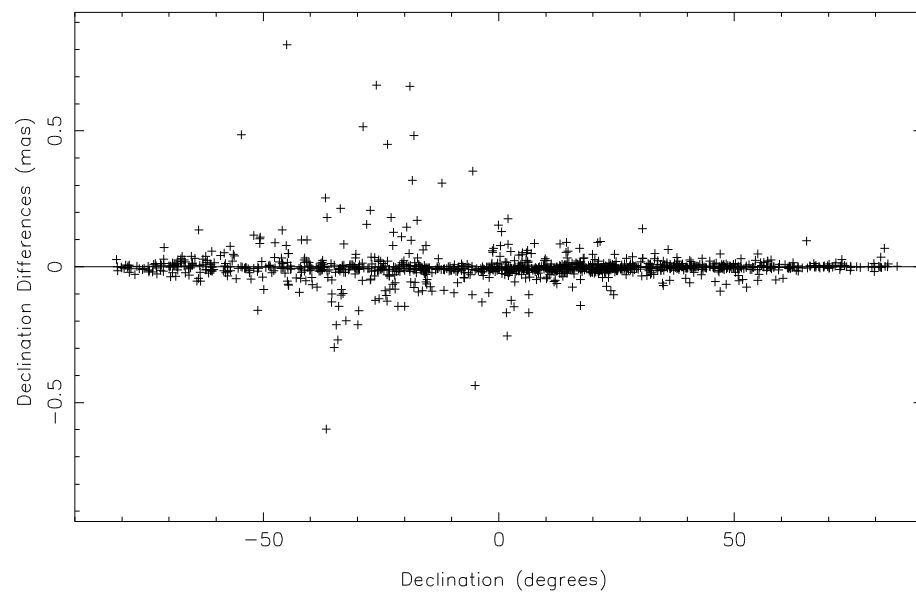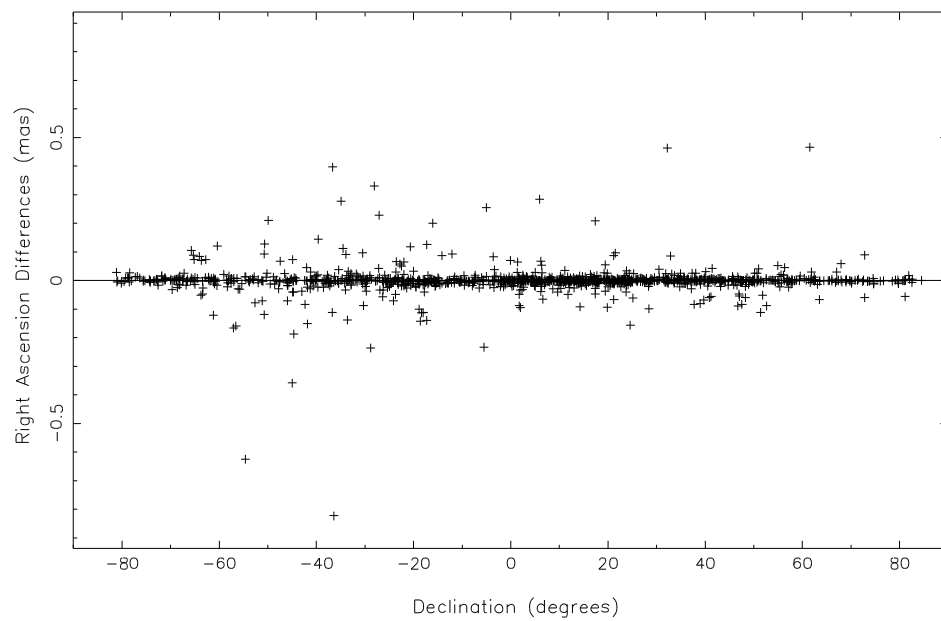
VCS Test

- Included the 24 VCS (VLBA Calibrator Survey) sessions. Adds 2059 sources. Little overall differences. But some very large differences, indicating some clean up of the sessions is still needed.

Add VCS Ssessions

Thermal Deformation Test

- Applied thermal antenna structure model. Random RA/Dec differences up to ~.1 mas. Uncertainties unchanged.

Thermal Deformation Applied

Differences Between CRF Sensitivity Solutions and Base CRF Solution

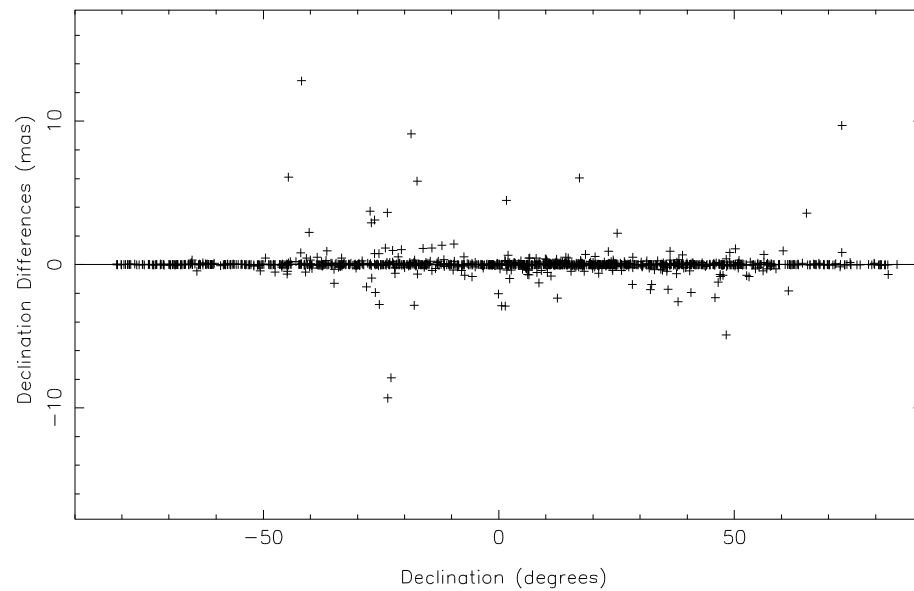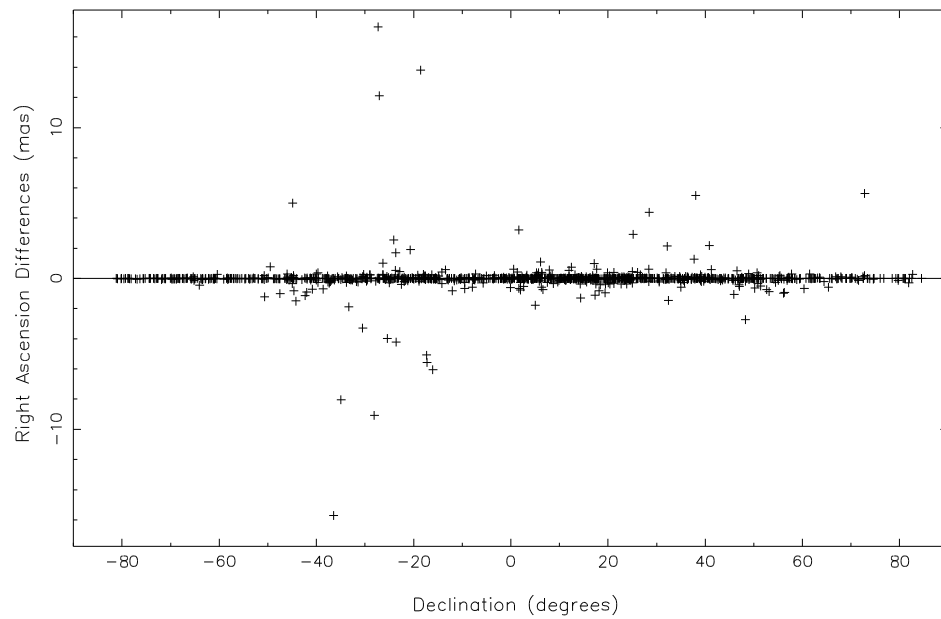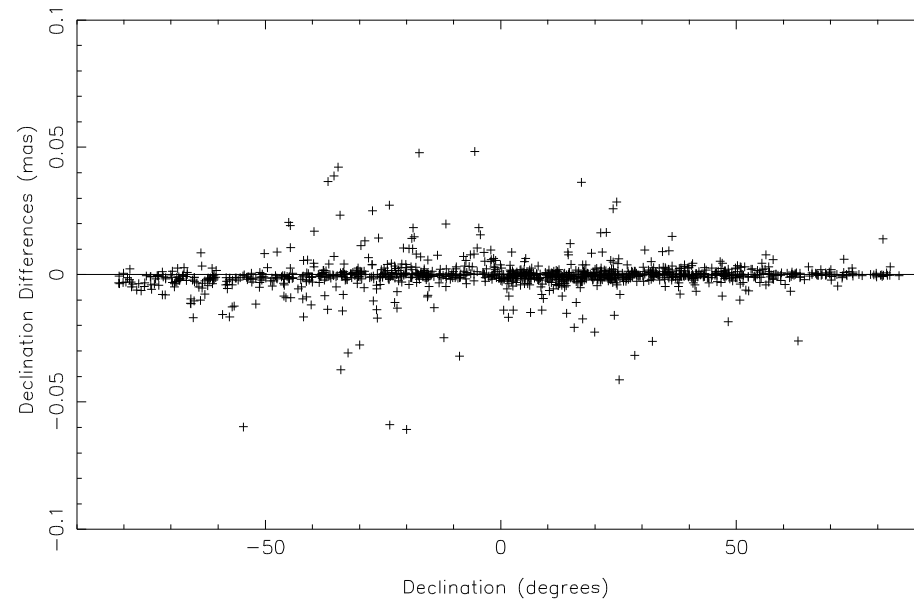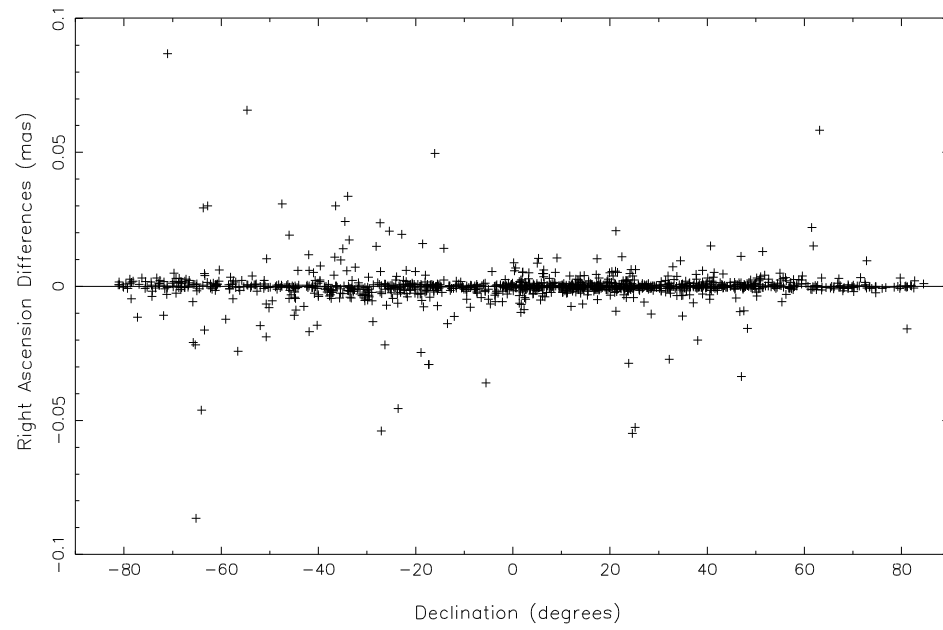| Solution Tests	Declination (uas)		Right Ascension (uas)		Rotation Angles (uas)		
	mean	wrms	mean	wrms	X	Y	Z
No gradient estimated	285	151	-9	17	61	19	-25
Gradient estimated No apriori	77	40	0	3	16	2	-2
Mean gradient a priori No gradient estimated	-11	29	-6	14	-1	15	-15
93JAN04 - 08DEC04	0	18	0	14	-1	5	4
Baseline solution: site positions estimated	4	16	5	22	6	-13	76
90JAN02 - 08DEC04	1	11	1	8	0	2	1
Add mobiles, regionals, ties, weak small networks	-2	5	0	5	2	-1	-3
VMF	-3	5	-1	3	-1	2	-1
No pressure loading	0	3	0	2	2	1	0
Axis offset estimation	1	2	0	1	-1	1	0
Add mobiles	-1	2	-1	2	0	0	-1
Thermal Deformation	0	1	0	0	0	0	0

Biggest Problems

- Gradients and gradient apriori file.
- Handling of the TRF?