Analysis of First NEOWISE-R IOC Scan Rate Test
14 December 2013

Technical memo WSDC D-T043

1. Introduction

This was the first of what may be a series of experiments designed to determine the optimal scan rates for the NEOWISE-R mission. During this test, data were acquired at eleven different *X* scan rates (while holding the *Y* scan rate constant) and at eleven different *Y* scan rates (while holding the *X* scan rate constant). Near-standard pipeline processing was used to derive metrics on the resulting image quality for each discrete rate. Discussion and analysis are presented below. These metrics are hereby delivered to Ned Wright so that he can determine the best scan rates to target for the survey (or next set of tests).

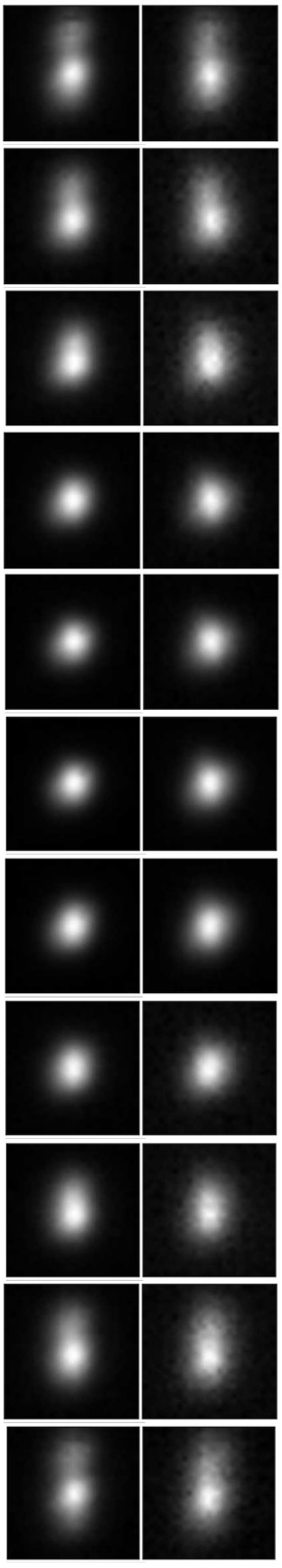
2. Analysis

A series of continuous framesets having similar scan rates were grouped into a "scan" for the purposes of data processing. Approximately 12-14 framesets were taken at each scan rate value.

a. Varying the *Y*-scan Rate

In the first set of eleven scans, the *X* scan rate was held near a commanded value of +0.0125 arcmin/sec while different values of the *Y* scan rate were used. Framesets for each of these discrete *Y* scan rates were assigned to scans 44210a through 44210k.

As input to *PSFmoments*, composite PSFs were generated for each scan using high-quality detections in the individual frames. The graphic below shows the composite PSFs for each of these scans. Shown from left to right in each row are the composite PSF for bands W1 and W2, the scan number, and the commanded *Y* scan rate.



44210a 3.7577′/s

44210d 3.7677′/s

44210e 3.7777′/s

44210h 3.7877′/s

44210i 3.7927′/s

44210k 3.7977′/s

44210j 3.8027′/s

44210g 3.8077′/s

44210f 3.8177′/s

44210c 3.8277′/s

44210b 3.8377′/s

Using the composite PSFs, a number of image quality metrics were derived. These metrics, along with other parameters, are listed in the table below, and are

- *ScanDesc*: short description of scan
- *MedianScanRateX*: The commanded *X*-axis scan rate (in arcmin/s)
- *MedianScanRateY*: The commanded *Y*-axis scan rate (in arcmin/s)
- *MedianScanRateZ*: The commanded *Z*-axis scan rate (in arcmin/s)
- *x*: *x*-pixel location (in pixels)
- *y*: *y*-pixel location (in pixels)
- *mom1x*: 1st moment, *x*-axis (in pixels)
- *mom1y*: 1st moment, *y*-axis (in pixels)
- *mom2x*: 2nd moment, *x*-axis (i.e., the semi-major axis, in pixels)
- *mom2y*: 2nd moment, *y*-axis (i.e., the semi-minor axis, in pixels)
- *r_major*: Major axis (in pixels; for plotting purposes, we multiply this quantity by 2.75/3.00 to convert from binned pixels to arcsec)
- *rbovera*: Axis ratio
- *rPHI*: Position angle, measured east of north (in degrees)
- *r_05p*: Semi-major axis of the half-power points (in arcsec)
- *r_01p*: Semi-major axis of the 0.1-power points (in arcsec)
- *bovera*: Axis ratio from the 0.1-power points
- *PHI*: Position angle, measured east of north, from the 0.1-power points (in degrees)
- *NoisePix*: Effective number of noise pixels in the PRF (in pixels)
- *SigNSPix*: 1-sigma uncertainty of *NoisePix* (in pixels)
- *Sigmom1x*: 1-sigma uncertainty of *mom1x* (in pixels)
- *Sigmom1y*: 1-sigma uncertainty of *mom1y* (in pixels)
- *Sigmom2x*: 1-sigma uncertainty of *mom2x* (in pixels)
- *Sigmom2y*: 1-sigma uncertainty of *mom2y* (in pixels)
- *Sigrmajor*: 1-sigma uncertainty of *r_major* (in arcsec)
- *SigPHI*: 1-sigma uncertainty of *rPHI* (in degrees)
- *Sigbovera*: 1-sigma uncertainty of *rbovera*
- *ScanStartUTC*: Frame date/time at start of scan.
- *ScanEndUTC*: Frame date/time at end of scan.
- *Frames-in-SAA*: The percentage of frames in the scan impacted by a passage through the South Atlantic Anomaly.

The most useful of these are *NoisePix*, *rbovera*, *rPHI*, *r_major*, and their associated errors, so it is on those metrics that we focus our attention in the subsequent discussion.

Summary tables for W1 (top) and W2 (bottom) are given below. ASCII versions are included in the e-mail distribution:

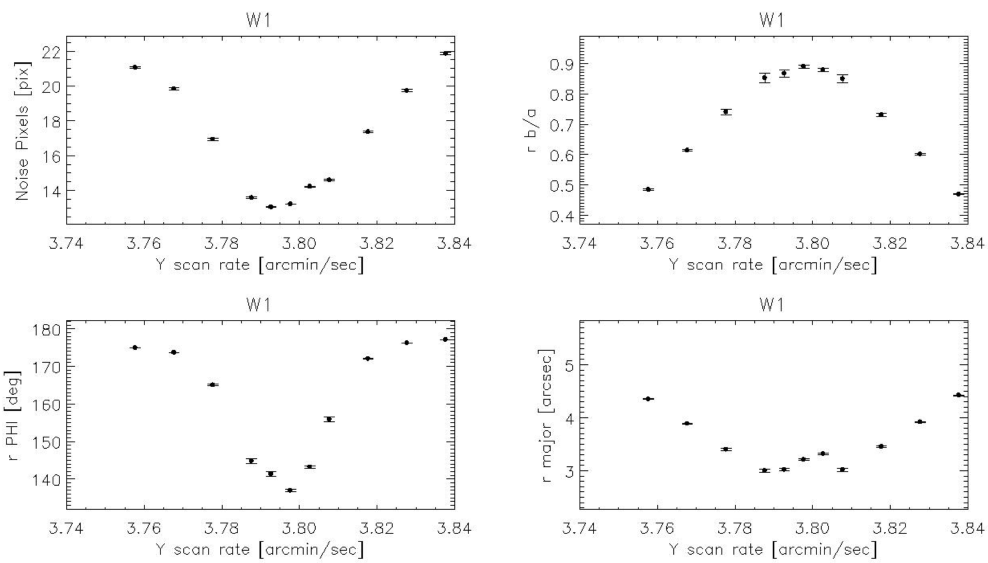
ScanDesc	MedianScanRateX	MedianScanRateY	MedianScanRateZ	x	y	mom1x	mom1y	mom2x	mom2y	r_major	rbovera	rPHI	r_05p	r_01p
char	r	r	r	r	r	r	r	r	r	r	r	r	r	r
	arcmin/s	arcmin/s	arcmin/s	pix	pix	pix	pix	pix	pix	pix		deg	arcsec	arcsec
44210a/w1	0.012500000186265	3.75769996643066	0.000000000000000	13.33	15.14	13.3331	15.1439	4.7461	2.5152	4.7461	0.4842	174.94	4.2839	10.5068
44210d/w1	0.012500000186265	3.76769995689392	0.000000000000000	13.36	14.47	13.3564	14.4685	4.2417	2.8506	4.2417	0.6140	173.69	3.8039	9.1571
44210e/w1	0.012500000186265	3.77769994735718	0.000000000000000	13.40	13.76	13.4033	13.7639	3.7107	3.0066	3.7107	0.7403	165.01	3.8199	7.6789
44210h/w1	0.012500000186265	3.78769993782043	0.000000000000000	13.40	13.46	13.3984	13.4609	3.2734	3.0543	3.2734	0.8525	144.79	4.5610	6.7260
44210i/w1	0.012500000186265	3.79270005226135	0.000000000000000	13.42	13.41	13.4212	13.4149	3.2952	3.1268	3.2952	0.8670	141.35	3.8400	6.3766
44210k/w1	0.012500000186265	3.79769992828369	0.000000000000000	13.41	13.39	13.4070	13.3909	3.5023	3.4123	3.5023	0.8902	136.92	3.8400	6.4896
44210j/w1	0.012500000186265	3.80270004272461	0.000000000000000	13.44	13.47	13.4391	13.4669	3.6241	3.4838	3.6241	0.8783	143.16	4.3911	6.9989
44210g/w1	0.012500000186265	3.80769991874695	0.000000000000000	13.42	13.49	13.4207	13.4856	3.2937	3.0613	3.2937	0.8492	155.91	4.4124	7.0071
44210f/w1	0.012500000186265	3.81769990921021	0.000000000000000	13.39	13.77	13.3938	13.7748	3.7697	3.0140	3.7697	0.7305	172.03	3.7889	7.7516
44210c/w1	0.012500000186265	3.82769989967346	0.000000000000000	13.38	14.37	13.3833	14.3652	4.2758	2.8145	4.2758	0.6014	176.22	3.9617	9.2452
44210b/w1	0.012500000186265	3.83769989013672	0.000000000000000	13.37	15.02	13.3723	15.0207	4.8260	2.4776	4.8260	0.4691	177.11	4.2839	10.5674

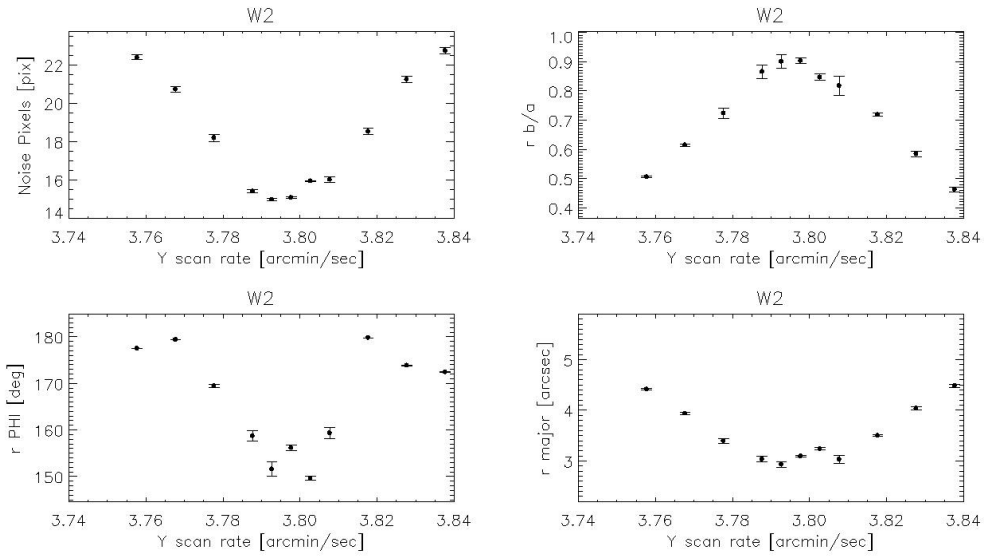
ScanDesc	bovera	PHI	NoisePix	SigNSPix	Sigmom1x	Sigmom1y	Sigmom2x	Sigmom2y	Sigrmajor	SigPHI	Sigbovera	ScanStartUTC	ScanEndUTC	Frames-in-SAA
char	r	r	r	r	r	r	r	r	r	r	r	char	char	r
		deg	pix	pix	pix	pix	pix	pix	arcsec	deg				percentage
44210a/w1	0.5100	174.00	21.055	0.045	0.0251	0.0282	0.0081	0.0081	0.0081	0.02	0.0018	2013-347T17:04:16.050	2013-347T17:07:46.225	0.00
44210d/w1	0.6200	172.00	19.841	0.065	0.0382	0.0409	0.0139	0.0147	0.0139	0.05	0.0037	2013-347T17:16:16.817	2013-347T17:18:46.225	0.00
44210e/w1	0.7500	161.00	16.931	0.056	0.0376	0.0385	0.0272	0.0297	0.0272	0.23	0.0091	2013-347T17:19:54.924	2013-347T17:22:26.225	0.00
44210h/w1	0.7700	144.00	13.577	0.034	0.0267	0.0268	0.0367	0.0401	0.0367	0.66	0.0147	2013-347T17:30:56.005	2013-347T17:33:26.225	0.00
44210i/w1	0.7900	136.00	13.040	0.027	0.0210	0.0210	0.0300	0.0328	0.0300	0.59	0.0120	2013-347T17:34:35.381	2013-347T17:37:06.225	0.00
44210k/w1	0.7700	137.00	13.212	0.013	0.0099	0.0099	0.0143	0.0156	0.0143	0.30	0.0055	2013-347T17:41:55.752	2013-347T17:46:02.926	0.00
44210j/w1	0.7300	145.00	14.220	0.016	0.0114	0.0114	0.0151	0.0165	0.0151	0.27	0.0055	2013-347T17:38:15.380	2013-347T17:40:46.225	0.00
44210g/w1	0.7600	152.00	14.588	0.043	0.0321	0.0324	0.0344	0.0376	0.0344	0.60	0.0137	2013-347T17:27:16.077	2013-347T17:29:46.225	0.00
44210f/w1	0.7500	170.00	17.368	0.054	0.0352	0.0360	0.0148	0.0160	0.0148	0.11	0.0048	2013-347T17:23:34.753	2013-347T17:26:06.225	0.00
44210c/w1	0.6100	174.00	19.737	0.063	0.0375	0.0393	0.0102	0.0104	0.0102	0.03	0.0027	2013-347T17:12:36.420	2013-347T17:15:06.225	0.00
44210b/w1	0.5200	175.00	21.859	0.065	0.0354	0.0385	0.0089	0.0086	0.0089	0.01	0.0018	2013-347T17:08:53.866	2013-347T17:11:26.225	0.00

ScanDesc	MedianScanRateX	MedianScanRateY	MedianScanRateZ	x	y	mom1x	mom1y	mom2x	mom2y	r_major	rbovera	rPHI	r_05p	r_01p
char	r	r	r	r	r	r	r	r	r	r	r	r	r	r
	arcmin/s	arcmin/s	arcmin/s	pix	pix	pix	pix	pix	pix	pix		deg	arcsec	arcsec
44210a/w2	0.012500000186265	3.75769996643066	0.000000000000000	13.36	14.77	13.3621	14.7671	4.8159	2.6644	4.8159	0.5054	177.50	4.6623	10.3576
44210d/w2	0.012500000186265	3.76769995689392	0.000000000000000	13.37	14.37	13.3713	14.3669	4.2942	2.8879	4.2942	0.6143	179.40	4.2579	9.1726
44210e/w2	0.012500000186265	3.77769994735718	0.000000000000000	13.40	13.65	13.4025	13.6488	3.7038	2.9315	3.7038	0.7230	169.43	3.7513	7.6869
44210h/w2	0.012500000186265	3.78769993782043	0.000000000000000	13.45	13.40	13.4453	13.3990	3.3071	3.1309	3.3071	0.8648	158.70	4.0642	6.8206
44210i/w2	0.012500000186265	3.79270005226135	0.000000000000000	13.43	13.43	13.4308	13.4258	3.1935	3.1453	3.1935	0.8997	151.56	3.9963	6.7972
44210k/w2	0.012500000186265	3.79769992828369	0.000000000000000	13.48	13.44	13.4758	13.4437	3.3746	3.3339	3.3746	0.9025	156.16	4.2929	6.9698
44210j/w2	0.012500000186265	3.80270004272461	0.000000000000000	13.48	13.47	13.4824	13.4707	3.5345	3.2733	3.5345	0.8460	149.58	4.4115	7.2926
44210g/w2	0.012500000186265	3.80769991874695	0.000000000000000	13.46	13.40	13.4625	13.4043	3.3053	2.9564	3.3053	0.8171	159.32	4.4815	7.3841
44210f/w2	0.012500000186265	3.81769990921021	0.000000000000000	13.51	13.59	13.5138	13.5892	3.8161	2.9998	3.8161	0.7181	179.80	3.8648	8.0586
44210c/w2	0.012500000186265	3.82769989967346	0.000000000000000	13.48	14.21	13.4821	14.2130	4.4050	2.8134	4.4050	0.5835	173.83	4.2525	9.8242
44210b/w2	0.012500000186265	3.83769989013672	0.000000000000000	13.41	14.64	13.4111	14.6371	4.8930	2.4786	4.8930	0.4627	172.42	4.8419	10.6543

ScanDesc	bovera	PHI	NoisePix	SigNSPix	Sigmom1x	Sigmom1y	Sigmom2x	Sigmom2y	Sigrmajor	SigPHI	Sigbovera	ScanStartUTC	ScanEndUTC	Frames-in-SAA
char	r	r	r	r	r	r	r	r	r	r	r	char	char	r
		deg	pix	pix	pix	pix	pix	pix	arcsec	deg				percentage
44210a/w2	0.5600	177.00	22.383	0.122	0.0655	0.0711	0.0160	0.0139	0.0160	0.02	0.0031	2013-347T17:04:16.050	2013-347T17:07:46.225	0.00
44210d/w2	0.6500	175.00	20.716	0.159	0.0909	0.1008	0.0192	0.0176	0.0192	0.01	0.0047	2013-347T17:16:16.817	2013-347T17:18:46.225	0.00
44210e/w2	0.8100	167.00	18.193	0.183	0.1134	0.1162	0.0535	0.0581	0.0535	0.40	0.0177	2013-347T17:19:54.924	2013-347T17:22:26.225	0.00
44210h/w2	0.8500	148.00	15.409	0.089	0.0638	0.0644	0.0586	0.0641	0.0586	1.12	0.0234	2013-347T17:30:56.005	2013-347T17:33:26.225	0.00
44210i/w2	0.8300	142.00	14.983	0.070	0.0504	0.0502	0.0571	0.0625	0.0571	1.55	0.0240	2013-347T17:34:35.381	2013-347T17:37:06.225	0.00
44210k/w2	0.8100	137.00	15.080	0.032	0.0220	0.0221	0.0228	0.0249	0.0228	0.57	0.0091	2013-347T17:41:55.752	2013-347T17:46:02.926	0.00
44210j/w2	0.7700	141.00	15.939	0.036	0.0240	0.0240	0.0287	0.0314	0.0287	0.43	0.0106	2013-347T17:38:15.380	2013-347T17:40:46.225	0.00
44210g/w2	0.7800	152.00	16.024	0.130	0.0904	0.0924	0.0835	0.0914	0.0835	1.21	0.0326	2013-347T17:27:16.077	2013-347T17:29:46.225	0.00
44210f/w2	0.7300	172.00	18.523	0.176	0.1017	0.1040	0.0189	0.0191	0.0189	0.01	0.0058	2013-347T17:23:34.753	2013-347T17:26:06.225	0.00
44210c/w2	0.6000	169.00	21.238	0.177	0.1016	0.1050	0.0335	0.0347	0.0335	0.11	0.0084	2013-347T17:12:36.420	2013-347T17:15:06.225	0.00
44210b/w2	0.5600	173.00	22.729	0.172	0.0909	0.0980	0.0344	0.0357	0.0344	0.08	0.0074	2013-347T17:08:53.866	2013-347T17:11:26.225	0.00

In the graphics below, the image quality metrics *NoisePix* (upper left panel), *rbovera* (upper right), *rPHI* (lower left), and *r_major* (lower right) and their associated 1-sigma uncertainties are plotted as a function of the *Y*-axis scan rate for each scan group. The first plot shows W1, and the second shows W2.

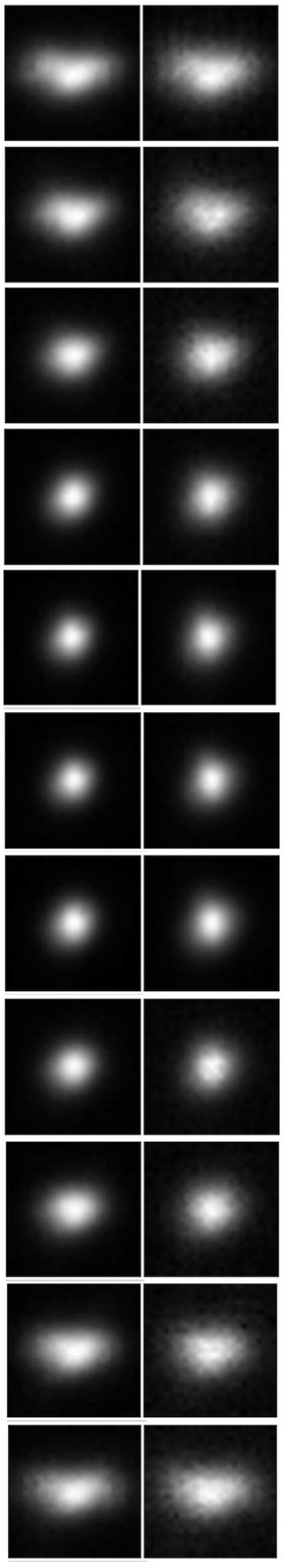




b. Varying the *X*-scan Rate

In the second set of eleven scans, the *Y* scan rate was held near a commanded value of 3.7977 arcmin/sec while the *X* scan rate was varied. Framesets for each of these discrete *X* scan rates were assigned to scans 44211a through 44211k.

The image below shows the composite PSFs for each of these scans.



44211a -0.0275′/s

44211d -0.0175′/s

44211e -0.0075′/s

44211h +0.0025′/s

44211i +0.0075′/s

44211k +0.0125′/s

44211j +0.0175′/s

44211g +0.0225′/s

44211f +0.0325′/s

44211c +0.0425′/s

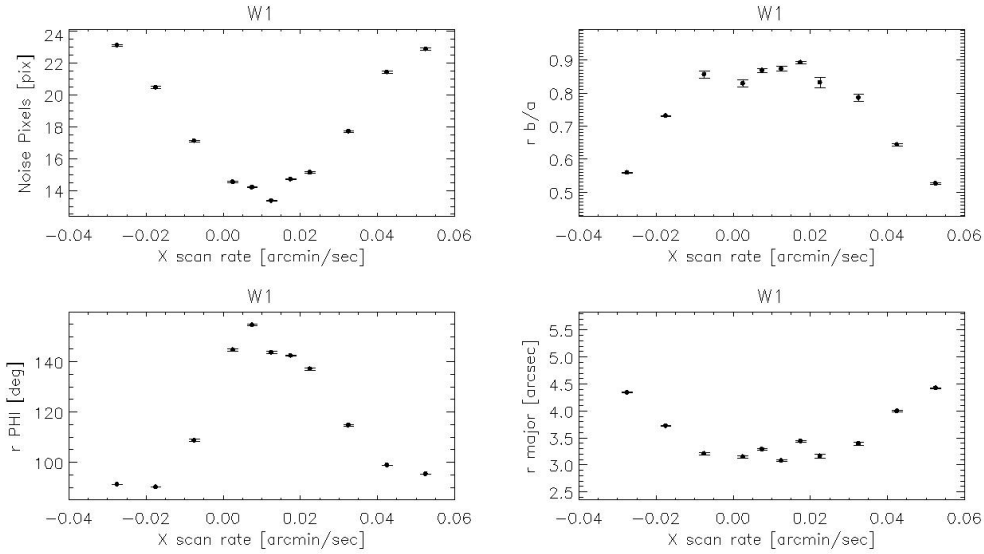
44211b +0.0525′/s

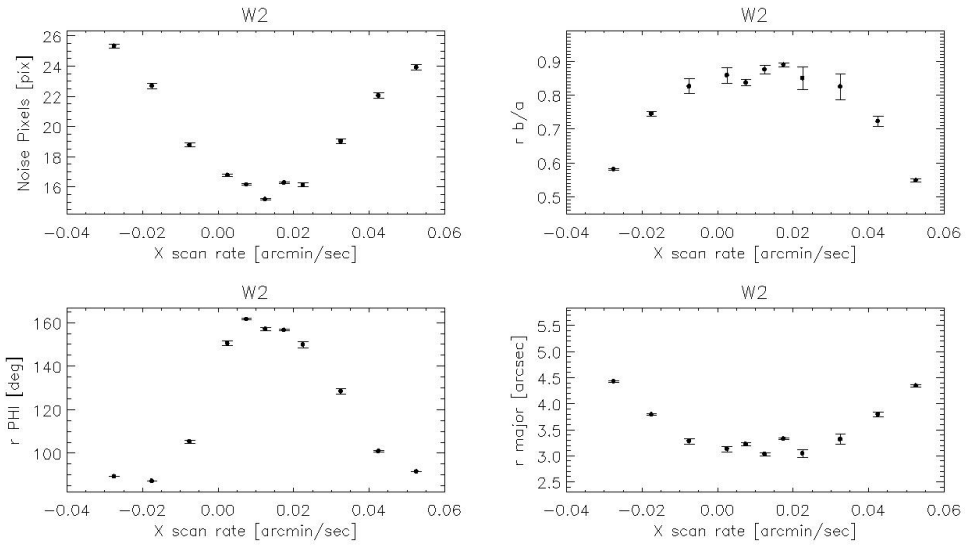
Summary tables for W1 (top) and W2 (bottom) are shown below. ASCII versions are included in the e-mail distribution:

ScanDesc	MedianScanRateX	MedianScanRateY	MedianScanRateZ	x	y	momIx	momIy	momIx	momIy	r_major	rbovera	rPHI	r_dSp	r_dSp	bovera	PHI	NoisePix	SigNSPix	SigmomIx	SigmomIy	SigmomIx	SigmomIy	Sigmajor	SigPHI	Sigbovera	ScanStartUTC	ScanEndUTC	Frames-in-SAA
char	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	char	char	r
	arcmin/s	arcmin/s	arcmin/s	pix	pix	pix	pix	pix	pix	pix		deg	arcsec	arcsec		deg	pix	pix	pix	pix	pix	pix	arcsec	deg				percentage
4421la/w1	-0.0274999905859088	3.79769992828369	0.00000000000000	13.88	13.88	13.8761	13.8762	4.7371	2.8985	4.7371	0.5591	91.20	6.1852	10.8362	0.6080	92.00	23.106	0.050	0.0272	0.0277	0.0059	0.0054	0.0059	0.00	0.0012	2013-347T17:53:52.242	2013-347T17:57:22.926	0.00
4421la/w1	-0.0175000007450	3.79769992828369	0.00000000000000	13.20	13.69	13.1959	13.6895	4.0684	3.2455	4.0684	0.7304	90.15	5.2361	0.9501	0.7080	92.00	20.467	0.062	0.0361	0.0369	0.0071	0.0073	0.0071	0.00	0.0021	2013-347T18:06:52.289	2013-347T18:10:22.926	100.00
4421la/w1	-0.0074999993832362	3.79769992828369	0.00000000000000	13.33	13.58	13.3322	13.5823	3.4997	3.2707	3.4997	0.8560	100.60	4.1343	7.3410	0.8400	103.00	17.107	0.053	0.0340	0.0351	0.0207	0.0314	0.0207	0.46	0.0100	2013-347T18:09:12.305	2013-347T18:12:02.926	0.00
4421lb/w1	0.0024999999441121	3.79769992828369	0.00000000000000	13.40	13.45	13.4032	13.4455	3.4344	3.1147	3.4344	0.9207	144.70	4.0546	7.0892	0.7480	140.00	14.526	0.031	0.0223	0.0225	0.0293	0.0321	0.0293	0.42	0.0111	2013-347T18:23:02.305	2013-347T18:23:02.926	0.00
4421l1/w1	0.0074999993832362	3.79769992828369	0.00000000000000	13.41	13.41	13.4054	13.4123	3.5869	3.4080	3.5869	0.9503	154.60	3.0408	6.7231	0.7780	146.00	14.106	0.022	0.0147	0.0148	0.0154	0.0168	0.0154	0.26	0.0057	2013-347T18:24:12.288	2013-347T18:26:42.926	0.00
4421lb/w1	0.0125000001862645	3.79769992828369	0.00000000000000	13.39	13.41	13.3937	13.4052	3.3552	3.2053	3.3552	0.8729	143.70	3.0408	6.3766	0.7980	136.00	13.349	0.017	0.0130	0.0131	0.0170	0.0195	0.0170	0.35	0.0070	2013-347T18:31:32.289	2013-347T18:37:29.726	0.00
4421l1/w1	0.0175000000745686	3.79769992828369	0.00000000000000	13.41	13.44	13.4136	13.4447	3.7586	3.6613	3.7586	0.9919	142.45	3.0408	6.7478	0.7980	143.00	14.695	0.015	0.0099	0.0100	0.0124	0.0136	0.0124	0.23	0.0044	2013-347T18:27:52.278	2013-347T18:30:22.926	0.00
4421la/w1	0.0225000004470270	3.79769992828369	0.00000000000000	13.39	13.44	13.3987	13.4486	3.4496	3.1392	3.4496	0.8315	137.10	4.3454	6.9681	0.8000	134.00	15.118	0.040	0.0282	0.0284	0.0388	0.0425	0.0388	0.56	0.0146	2013-347T18:16:52.326	2013-347T18:19:22.926	0.00
4421lf/w1	0.0324999988079071	3.79769992828369	0.00000000000000	13.38	13.45	13.3814	13.4484	3.7041	3.1836	3.7041	0.7853	114.73	4.0851	7.0736	0.7780	117.00	17.707	0.040	0.0311	0.0312	0.0324	0.0395	0.0324	0.32	0.0111	2013-347T18:13:12.261	2013-347T18:15:42.926	0.00
4421lc/w1	0.0425000004470035	3.79769992828369	0.00000000000000	13.17	13.63	13.1695	13.6388	4.3680	3.8712	4.3680	0.6436	98.84	5.4472	9.7804	0.6380	97.00	21.428	0.063	0.0378	0.0371	0.0162	0.0173	0.0162	0.07	0.0043	2013-347T18:02:12.339	2013-347T18:04:42.926	57.14
4421ld/w1	0.0524999983368072	3.79769992828369	0.00000000000000	13.17	13.69	13.1743	13.6941	4.8251	2.7780	4.8251	0.5261	95.39	5.8238	10.7930	0.5580	92.00	22.876	0.060	0.0374	0.0369	0.0115	0.0116	0.0115	0.03	0.0025	2013-347T17:58:32.198	2013-347T18:01:02.926	0.00

ScanDesc	MedianScanRateX	MedianScanRateY	MedianScanRateZ	x	y	momIx	momIy	momIx	momIy	r_major	rbovera	rPHI	r_dSp	r_dSp	bovera	PHI	NoisePix	SigNSPix	SigmomIx	SigmomIy	SigmomIx	SigmomIy	Sigmajor	SigPHI	Sigbovera	ScanStartUTC	ScanEndUTC	Frames-in-SAA
char	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	char	char	r
	arcmin/s	arcmin/s	arcmin/s	pix	pix	pix	pix	pix	pix	pix		deg	arcsec	arcsec		deg	pix	pix	pix	pix	pix	pix	arcsec	deg				percentage
4421la/w2	-0.0274999905859088	3.79769992828369	0.00000000000000	13.28	13.85	13.2826	13.8582	4.0362	3.0698	4.0362	0.5086	89.23	6.1720	10.9095	0.6200	91.00	25.332	0.115	0.0617	0.0612	0.0127	0.0113	0.0127	0.81	0.0026	2013-347T17:53:52.242	2013-347T17:57:22.926	0.00
4421la/w2	-0.0175000000745686	3.79769992828369	0.00000000000000	13.33	13.72	13.3291	13.7195	4.1354	3.3798	4.1354	0.7446	87.28	5.2229	9.2438	0.7200	87.00	22.677	0.174	0.0931	0.0954	0.0209	0.0215	0.0209	0.00	0.0061	2013-347T18:05:52.289	2013-347T18:08:22.926	100.00
4421la/w2	-0.0074999993832362	3.79769992828369	0.00000000000000	13.47	13.51	13.4665	13.5188	3.5778	3.2318	3.5778	0.8252	105.28	4.2407	8.0274	0.7800	106.00	18.791	0.153	0.0953	0.0958	0.0609	0.0666	0.0609	0.77	0.0220	2013-347T18:09:12.305	2013-347T18:12:02.926	0.00
4421lb/w2	0.0024999999441121	3.79769992828369	0.00000000000000	13.52	13.47	13.5180	13.4677	3.4139	3.2851	3.4139	0.8577	158.41	3.7265	7.0324	0.8800	151.00	16.775	0.079	0.0523	0.0530	0.0593	0.0648	0.0593	1.02	0.0229	2013-347T18:20:32.305	2013-347T18:23:02.926	0.00
4421l1/w2	0.0074999993832362	3.79769992828369	0.00000000000000	13.58	13.44	13.5810	13.4373	3.5167	3.2195	3.5167	0.8363	161.51	3.8731	7.0682	0.8600	166.00	16.149	0.051	0.0338	0.0334	0.0265	0.0298	0.0265	0.27	0.0090	2013-347T18:24:12.288	2013-347T18:26:42.926	0.00
4421lb/w2	0.0125000001862645	3.79769992828369	0.00000000000000	13.47	13.44	13.4742	13.4353	3.3862	3.1658	3.3862	0.8747	157.01	4.1386	6.7883	0.8400	148.00	15.179	0.042	0.0297	0.0302	0.0236	0.0323	0.0236	0.61	0.0119	2013-347T18:31:32.289	2013-347T18:37:29.726	0.00
4421l1/w2	0.0175000000745686	3.79769992828369	0.00000000000000	13.46	13.44	13.4595	13.4442	3.6208	3.5361	3.6208	0.8899	156.59	4.1169	7.1983	0.8200	143.00	16.288	0.029	0.0178	0.0188	0.0171	0.0187	0.0171	0.33	0.0063	2013-347T18:27:52.278	2013-347T18:30:22.926	0.00
4421lg/w2	0.0225000004470270	3.79769992828369	0.00000000000000	13.44	13.41	13.4383	13.4134	3.3193	3.0857	3.3193	0.8492	149.01	4.1587	7.0908	0.8300	138.00	16.145	0.118	0.0758	0.0753	0.0824	0.0981	0.0824	1.42	0.0325	2013-347T18:16:52.326	2013-347T18:19:22.926	0.00
4421lf/w2	0.0324999988079071	3.79769992828369	0.00000000000000	13.43	13.53	13.4762	13.5276	3.6178	3.2640	3.6178	0.8246	120.35	4.1183	7.4711	0.8500	124.00	19.828	0.147	0.0899	0.0907	0.1072	0.1174	0.1072	1.36	0.0304	2013-347T18:13:12.261	2013-347T18:15:42.926	0.00
4421lc/w2	0.0425000004470035	3.79769992828369	0.00000000000000	13.46	13.63	13.4644	13.6086	4.1393	3.2746	4.1393	0.7227	100.07	5.0022	9.9889	0.7400	98.00	22.043	0.193	0.1051	0.1050	0.0497	0.0538	0.0497	0.38	0.0147	2013-347T18:02:12.339	2013-347T18:04:42.926	57.14
4421ld/w2	0.0524999983368072	3.79769992828369	0.00000000000000	13.28	13.64	13.2772	13.6395	4.7382	2.8414	4.7382	0.5478	91.50	5.7634	10.8631	0.5900	90.00	23.919	0.176	0.0938	0.0936	0.0197	0.0182	0.0197	0.82	0.0042	2013-347T17:58:32.198	2013-347T18:01:02.926	0.00

In the graphics below, W1 *NoisePix* , *rbovera*, *rPHI*, and *r_major* and their associated 1-sigma uncertainties are plotted as a function of the *X*-axis scan rate for each scan group. The first plot shows W1, and the second shows W2.





3. Conclusions

a. *Y*-scan Rate

The composite PSFs for the varying *Y* scan rates are well behaved and the metrics derived from them are easily understood.

Our quick assessment, done by examining the W1 and W2 metrics, shows that the best *Y*-scan rate likely falls between 3.7927 and 3.7977 armin/s.

b. *X*-scan Rate

The composite PSFs for the varying *X* scan rates are also well behaved and the metrics derived from them are easily understood.

Our quick assessment, done by examining the W1 and W2 metrics, shows that the best *X*-scan rate is likely very close to +0.0125 arcmin/s.

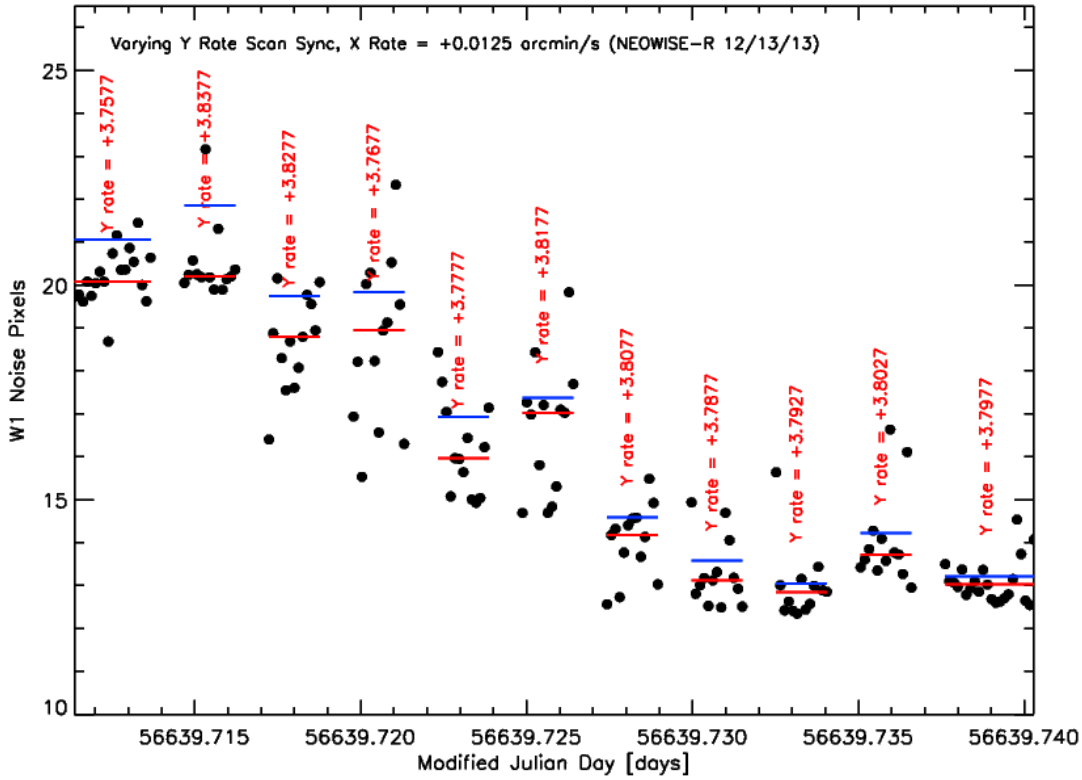
c. Summary

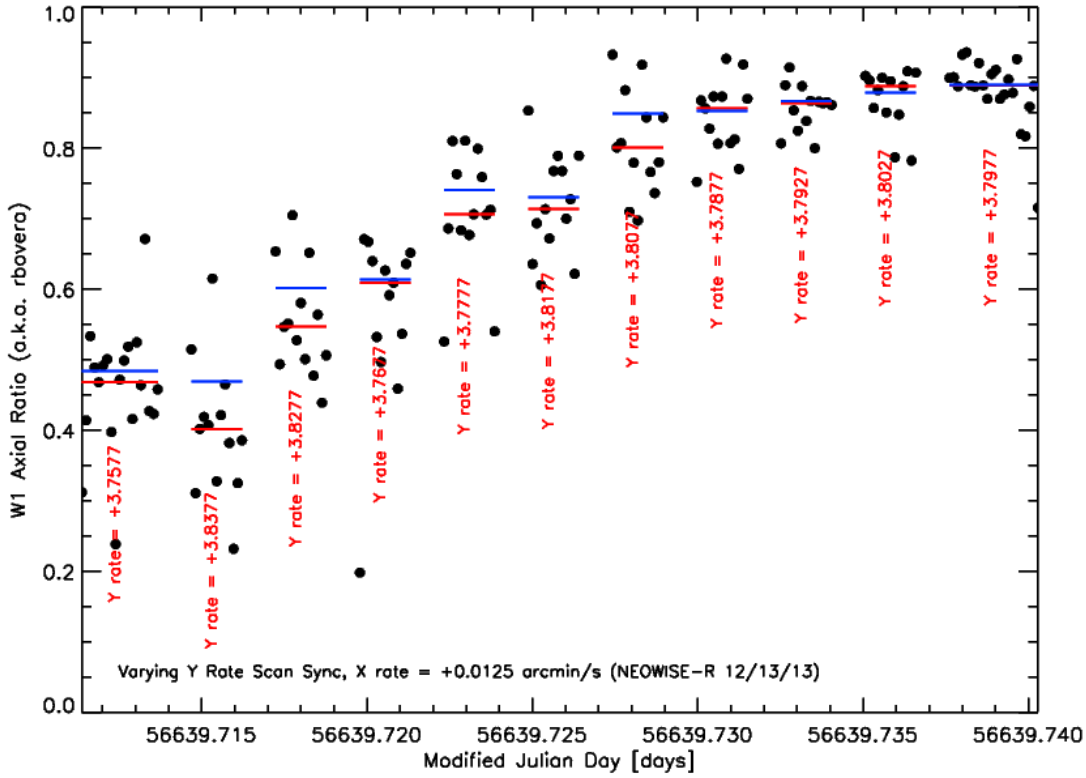
Ned Wright will use the data tabulated above to make a more rigorous determination of the best parameters to use in subsequent observations.

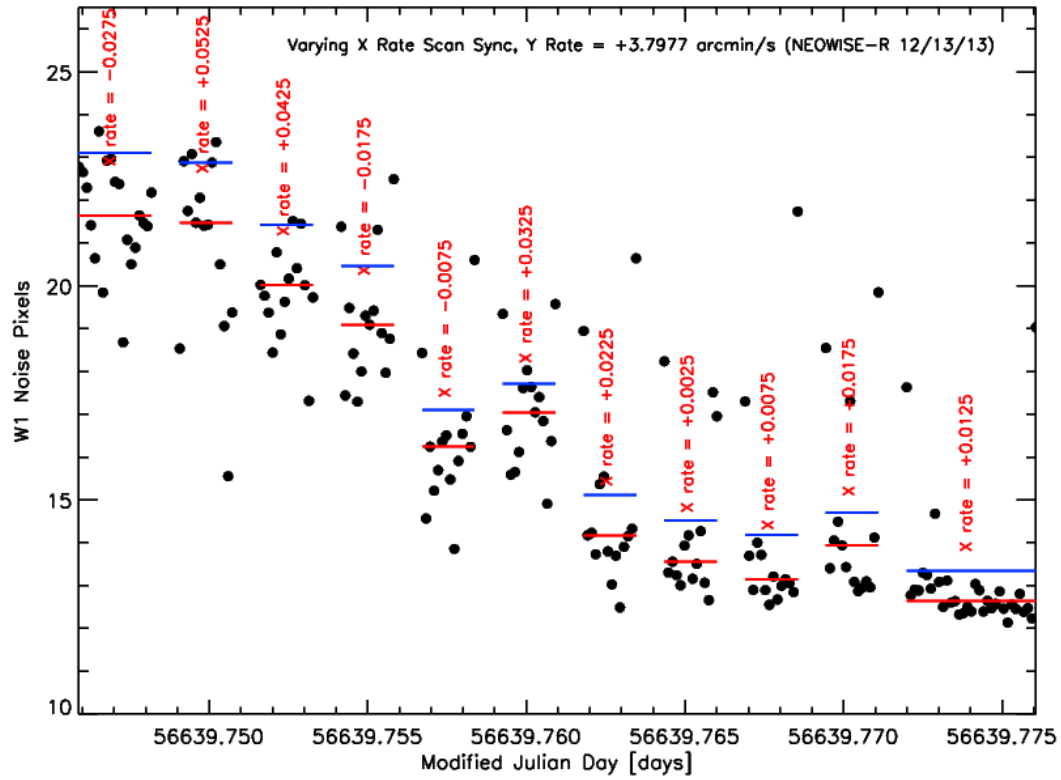
4. Appendix

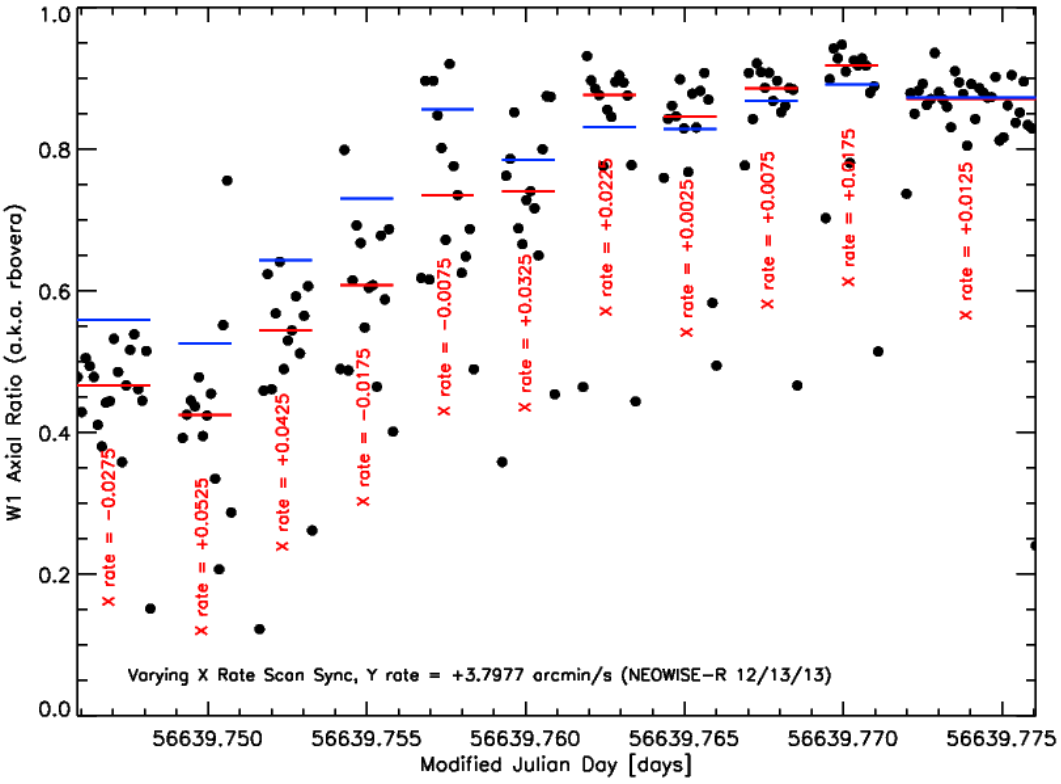
As a check of scan-averaged image metrics, we include the following plots that show the frame-based W1 *NoisePix* values and the W1 *rbovera* values plotted as a function of time. The first pair of plots shows the Y-rate test, and the second pair shows the X-rate test. The red horizontal bars on each plot show the median value in each set of frames, and the extent of the bar is drawn to show the full time range of the scan over which this median value is computed. The blue bars show these same metrics as determined at the scan level (from section 2 above).

There can be small amounts of image smearing at the beginning and end of each scan. These frames are not eliminated by *PSFmoments*, so they are included in the scan-averaged metrics. As an example, we checked all frames in scans 44211i and 44211j and found that only frames 001 and 015 (the first and last framesets in each) are smeared, as judged by the plot showing aperture *minus* PSF mag as a function of mag. (For brevity, these plots, which appear on the webQA pages, are not reproduced here.) Because affected frames are few in number, these do not adversely affect the scan-based metrics.


Varying Y Rate Scan Sync, X Rate = +0.0125 arcmin/s (NEOWISE-R 12/13/13)
W1 Noise Pixels
Modified Julian Day [days]
Y rate = +3.7577
Y rate = +3.8377
Y rate = +3.8277
Y rate = +3.7677
Y rate = +3.7777
Y rate = +3.8177
Y rate = +3.8077
Y rate = +3.7877
Y rate = +3.7927
Y rate = +3.8027
Y rate = +3.7977


Varying Y Rate Scan Sync, X rate = +0.0125 arcmin/s (NEOWISE-R 12/13/13)
W1 Axial Ratio (a.k.a. rbovera)
Modified Julian Day [days]
Y rate = +3.7577
Y rate = +3.8377
Y rate = +3.8277
Y rate = +3.7677
Y rate = +3.7777
Y rate = +3.8177
Y rate = +3.8077
Y rate = +3.7877
Y rate = +3.7927
Y rate = +3.8027
Y rate = +3.7977





Authors: D. Kirkpatrick, C. Gelino, S. Fajardo-Acosta – IPAC/Caltech