ANDICAM observations of red supergiants.

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ABSTRACT

Subject headings: stars: evolution — infrared: stars

1. ANDICAM

Info about the ANDICAM camera are available at:

$$http://www.astronomy.ohio-state.edu/ANDICAM/detectors.html$$

and

$$http://www.astro.yale.edu/smarts/ANDICAM/$$

2. Target list and charts

[1]USTC

[2]Laukona princess of Mars

SMARTS Consortium
CTIO 1.3m Telescope

ANDICAM Detector Characteristics

Updated: 2012 March 25

This page provides basic description of the ANDICAM's CCD and IR detectors, including pixel scales and FOV, orientation, gain and readout noise, and other useful data for observing planning and data analysis. The contents of this page should be considered definitive.

Contents:

CCD Array Parameters

The CCD for the ANDICAM is a Fairchild 447 2048x2048 CCD with 15-micron pixels. This device replaces the Loral CCD that failed during the 2002 season. At present the CCD is readout with one amplifier, but will be readout with 2 amplifies (one each for the top and bottom halves of the detector) later in 2003.

Scale and Orientation:
(All numbers are for 2x2 binning - Measured 2012 March 24).

Format: 1024x1024
Pixel Size: 30 microns
Pixel Scale: 0.371-arcsec/pixel
Field Rotation: 1.58° (E of N)
Field of View:
BVRI filters: ~6x6-arcminutes square [picture]
The red box indicates the approximate location of the IR channel FOV.

Neutral Density Filters: V+ND4 and I+ND4
5-arcminute diameter round filters.

Orientation: North=Up , East=Left (viewed with IRAF XImTool or SAOImage)

Readout Parameters:
Conversion Gain: 2.3 electrons/ADU
Readout Noise: 6.5 electrons (rms)
Linearity: <1% linear to 45000 ADU (ADC saturation at 65K ADU).
Readout Time: 47 seconds (42s readout + 5s pre-exposure setup/erase)

Raw Data Format:
1051x1028 pixels (binned 2x2 w/32 overscan columns):

```
BIASSEC = [2:16,3:1026]
DATASEC = [17:1040,3:1026]
TRIMSEC = [17:1040,3:1026]
```

The overscan section (BIASSEC) is on the *left-hand side* of the detector as readout, and is 15 pixels wide. The final useable area of the detector is 1024x1024 pixels (horizontal x vertical). There is an irregular vertical stripe along the left-hand side of the final CCD image due to the edge of the field stop (this is a small residual misalignment of the CCD channel optics). This schematic of a raw ANDICAM CCD frame illustrates the locations of the various regions [9Kb GIF].

www.astronomy.ohio-state.edu/ANDICAM/detectors.html

http://cds.u-strasbg.fr/ Astrophysics VizieR eso CDS La Repubblica.it - H... SAO/NASA ADS: AD... ESO News Centre de Données ... Sesame

IR Array Parameters

The IR Array for the ANDICAM is a Rockwell 1024x1024 HgCdTe "Hawaii" Array with 18-micron pixels. The array is readout in 4 quadrants. It is the same array we have been using all along. Starting Semester 2003B (August 2003), all IR images downloaded from CTIO will be binned 2x2 in software to give a better pixel scale match to the seeing.

Scale and Orientation:

Format: 512x512 after 2x2 binning
Effective Pixel Size: 36 microns
Image Pixel Scale: 0.276-arcsec/pixel
Field Rotation: -1.85° (W of N)
Image Field of View: ~2.4x2.4-arcmin square [picture]
Software Binning Details

Filters:

YJHK filters: ~2.4-arcminutes square.
Neutral Density Filters: H+ND4 and 10830+ND3 (2.4-arcmin square).
Orientation: N=right, E=up (viewed with IRAF)

Readout Parameters:

Conversion Gain: 7.2 electrons/ADU
Readout Noise: ~20 electrons (rms)
Bias: ~400 ADU
Linearity: <1% nonlinear to 5000 ADU (unbinned). Counts/pixel (unbinned) should not exceed 5000 ADU (sky+object) in a single exposure to avoid non-linearity.
Readout Time: 4 sec.

IR Array Notes:

The Hawaii HgCdTe array is flat to about 20%, with most of the variation being a gradient towards the right-hand side (North) side of the array.

Important Note: Starting with Semester 2003B (August 2003), raw IR images from ANDICAM will be software binned 2x2 to 36-micron effective pixels (0.274-arcsec/pixel). Details of this binning process may be found in the ANDICAM IR Array Binning document.

The 4-second readout time means that the minimum integration time with the array is also about 4 seconds (this is the time required to rest, pre-read, then post-read the array and take the difference). Integration times less than 4 seconds will be 4 seconds long.

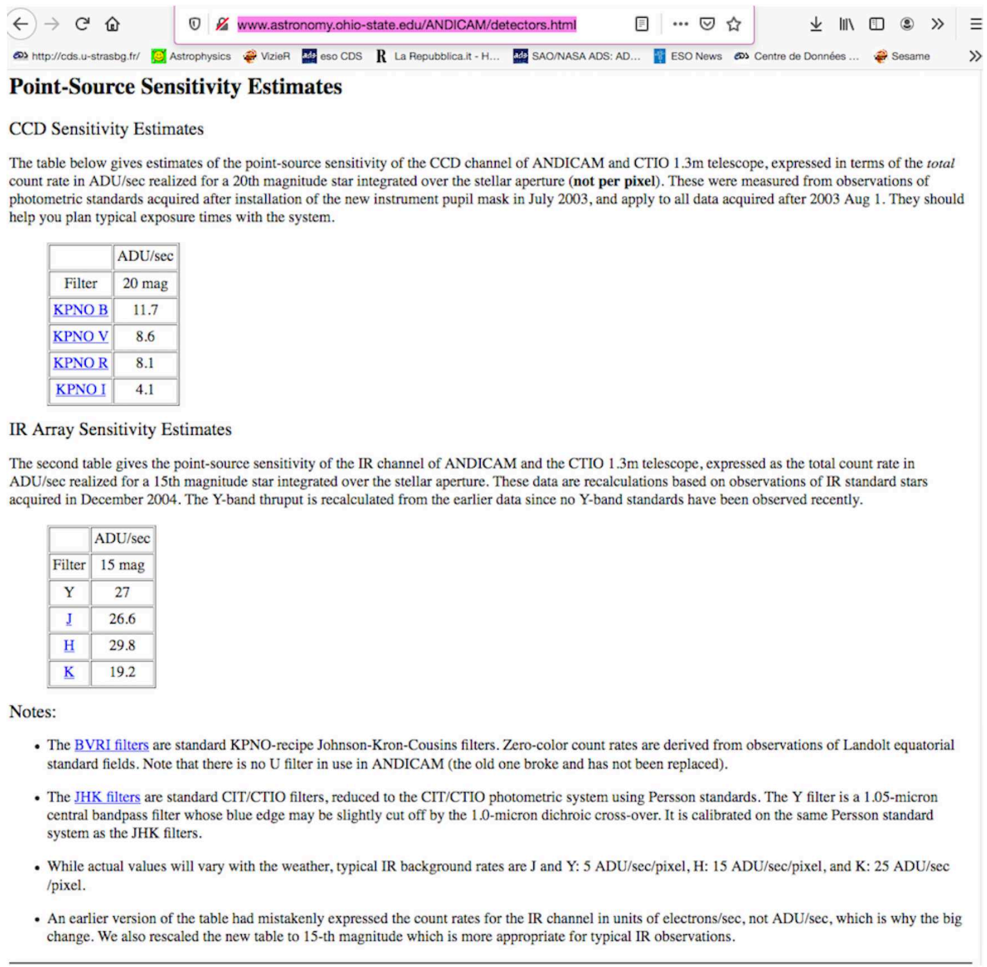
The IR array's response begins to become non-linear at about 5000 ADU/pixel (unbinned). Above this threshold, non-linearity exceeds 1% and will begin to affect the accuracy of photometry. Observers should plan single exposure times to keep the per-pixel counts in the unbinned images below 5000 ADU. Note that the delivered data are binned with a bad pixel mask, and single-pixel counts in that case can easily exceed 5000 ADU in **binned** pixels and be perfectly safe for photometry. You should, however, get nervous if the numbers exceed 15000 ADU, especially if the image PSFs are tightly confined, as one or more pixels in the *unbinned* original image could be approaching non-linearity.

The array has a round-shaped group of about 300 dead pixels located near the right/middle part of the array (see picture), and around 50 hot and dead pixels scattered randomly across the array. These are generally removed by taking at least 5 images at different dither positions. A dithering mirror throw of 20 units (5 arcseconds) is sufficient to remove most bad pixels.

Conversion Gain and readout noise quoted were measured by Nick Suntzeff (CTIO) in August 2004.

The IR and CCD channels are parfocal, with the IR field of view now located near the center of the CCD field (see this picture, the red box is the IR FOV). The alignment is not perfect, and changes depending on dithering position.

The pixel scale was measured in March 2012 using 11 ACR99 stars in an H-band image of the Stone et al. E field used for the CCD channel astrometric calibration (see above). There is also a small field rotation of -1.85° (W of N). The YJHK filter pixel scales are the same to within 0.001 arcsec/pixel. Note that the nominal pixel scale of 0.276 arcsec/pixel is larger than the pre-March 2012 scale of 0.271 arcsec/pixel, due to realignment of the internal Offner relay optics in February 2012.



www.astronomy.ohio-state.edu/ANDICAM/detectors.html

http://cds.u-strasbg.fr/ Astrophysics VizieR eso CDS La Repubblica.it - H... SAO/NASA ADS: AD... ESO News Centre de Données ... Sesame

Point-Source Sensitivity Estimates

CCD Sensitivity Estimates

The table below gives estimates of the point-source sensitivity of the CCD channel of ANDICAM and CTIO 1.3m telescope, expressed in terms of the *total* count rate in ADU/sec realized for a 20th magnitude star integrated over the stellar aperture (**not per pixel**). These were measured from observations of photometric standards acquired after installation of the new instrument pupil mask in July 2003, and apply to all data acquired after 2003 Aug 1. They should help you plan typical exposure times with the system.

	ADU/sec
Filter	20 mag
KPNO B	11.7
KPNO V	8.6
KPNO R	8.1
KPNO I	4.1

IR Array Sensitivity Estimates

The second table gives the point-source sensitivity of the IR channel of ANDICAM and the CTIO 1.3m telescope, expressed as the total count rate in ADU/sec realized for a 15th magnitude star integrated over the stellar aperture. These data are recalculations based on observations of IR standard stars acquired in December 2004. The Y-band thruput is recalculated from the earlier data since no Y-band standards have been observed recently.

	ADU/sec
Filter	15 mag
Y	27
J	26.6
H	29.8
K	19.2

Notes:

- The BVRI filters are standard KPNO-recipe Johnson-Kron-Cousins filters. Zero-color count rates are derived from observations of Landolt equatorial standard fields. Note that there is no U filter in use in ANDICAM (the old one broke and has not been replaced).
- The JHK filters are standard CIT/CTIO filters, reduced to the CIT/CTIO photometric system using Persson standards. The Y filter is a 1.05-micron central bandpass filter whose blue edge may be slightly cut off by the 1.0-micron dichroic cross-over. It is calibrated on the same Persson standard system as the JHK filters.
- While actual values will vary with the weather, typical IR background rates are J and Y: 5 ADU/sec/pixel, H: 15 ADU/sec/pixel, and K: 25 ADU/sec /pixel.
- An earlier version of the table had mistakenly expressed the count rates for the IR channel in units of electrons/sec, not ADU/sec, which is why the big change. We also rescaled the new table to 15-th magnitude which is more appropriate for typical IR observations.

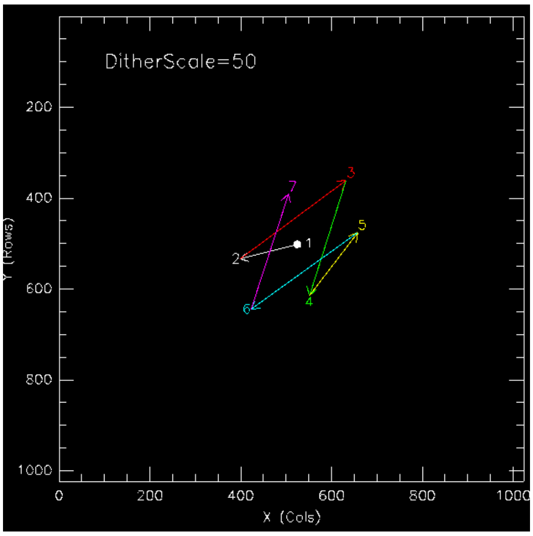


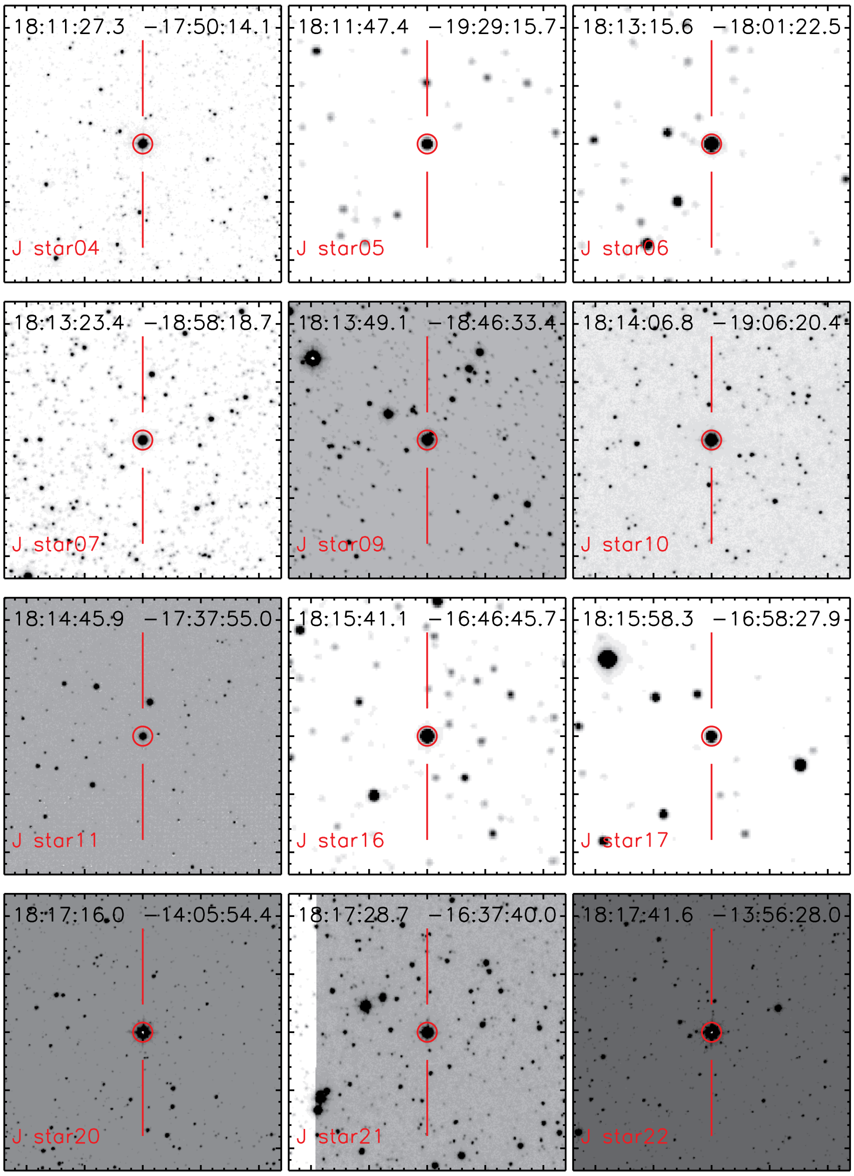
Fig. 1.— Default dither-scale is 40 (about 20 arcsec). During the run used 40 for single and 100 for the mosaic.

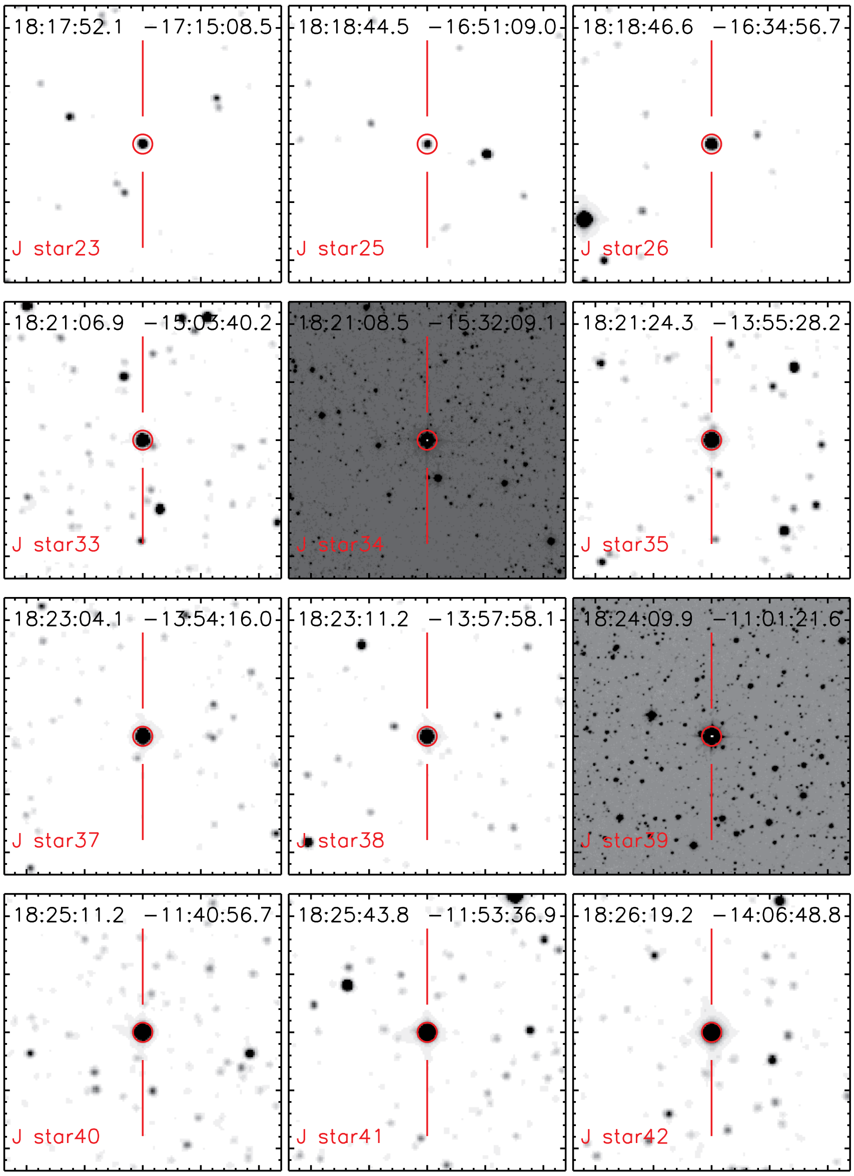
Table 1: List of targets

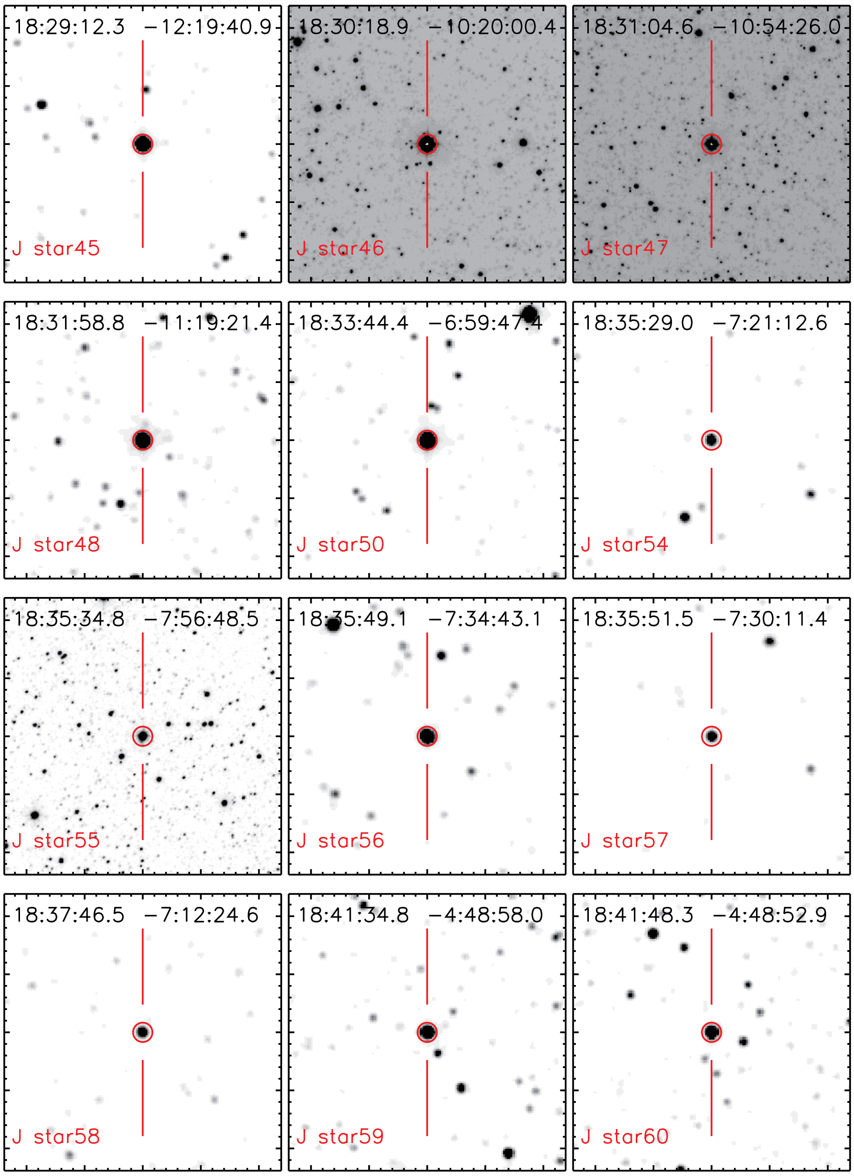
star04ij	272.863708	-17.837167
star05ij	272.947583	-19.487639
star06ij	273.314917	-18.022917
star07ij	273.347417	-18.971806
star09ij	273.454583	-18.775917
star10ij	273.528417	-19.105639
star11ij	273.691125	-17.631944
star16ij	273.921292	-16.779361
star17ij	273.992875	-16.974389
star20ij	274.316625	-14.098139
star21ij	274.369583	-16.627806
star22ij	274.423417	-13.941083
star23ij	274.467125	-17.252306
star25ij	274.685375	-16.852472
star26ij	274.694208	-16.582472
star33ij	275.278667	-15.061083
star34ij	275.285417	-15.535833
star35ij	275.351250	-13.924500
star37ij	275.767167	-13.904444
star38ij	275.796625	-13.966139
star39ij	276.041167	-11.022667
star40ij	276.296542	-11.682389
star41ij	276.432375	-11.893556
star42ij	276.580000	-14.113528
star45ij	277.301250	-12.328028
star46ij	277.578625	-10.333306
star47ij	277.769083	-10.907194
star48ij	277.995125	-11.322500
star50ij	278.434917	-6.996444
star54ij	278.870750	-7.353528
star55ij	278.894875	-7.946694
star56ij	278.954625	-7.578639
star57ij	278.964708	-7.503194
star58ij	279.443667	-7.206833
star59ij	280.394917	-4.816111
star60ij	280.451250	-4.814694
star61ij	280.571208	-4.688028
star62ij	280.676250	-4.681500
star63ij	280.686708	-4.565944
star64ij	280.717542	-3.771750
star65ij	280.783250	-3.940028
star66ij	281.109042	-3.591000
star67ij	281.685000	-3.401417
star68ij	281.686542	-3.058806
star69ij	281.973250	-1.787556
star70ij	282.124917	-2.197111
star72ij	283.643208	1.884583
star74ij	284.243792	1.581083
star75ij	284.517958	2.261417
star77ij	285.051208	3.207167
star78ij	285.075417	3.428111
star83ij	286.538833	5.978917
star84ij	287.607083	8.314444
star85ij	288.249667	9.800361
star86ij	288.254500	10.033167
star87ij	288.558875	10.467278
star91ij	290.435958	13.622889
rsgc1p3	279.470167	-6.865889
rsgc1p3	279.470167	-6.898944
rsgc1p5	279.470167	-6.898944
rsgc1p2	279.488292	-6.882694
rsgc1p1	279.503875	-6.865778
rsgc1p4	279.503875	-6.899194
rsgc2p5	279.791542	-6.084222
rsgc2p4	279.813125	-6.075917
rsgc2p4	279.813167	-6.075917
rsgc2p3	279.831125	-7.712694
rsgc2p3	279.833542	-6.045361
rsgc2p6	279.839958	-5.988361
rsgc2p1	279.854500	-7.686833
rsgc2p2	279.854500	-7.686833

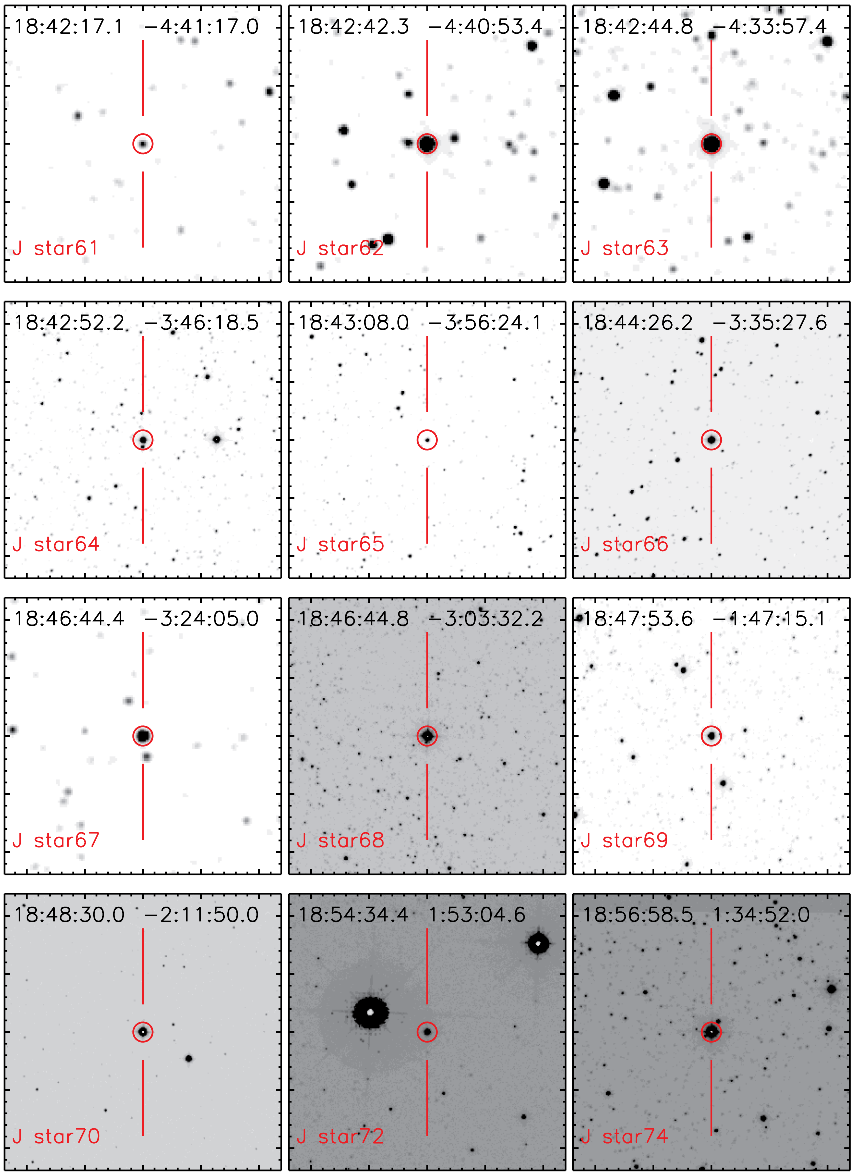
This list differs from that in the proposal. By rechecking the list, we noticed that while proposing for the best 58 targets by Messineo et al. 2016 (those with larger EWCO), we had erroneously listed the first 58 entries of that catalog with 94 targets (a wrong "if" statement in the macro that selected the targets and automatically provided integration times).

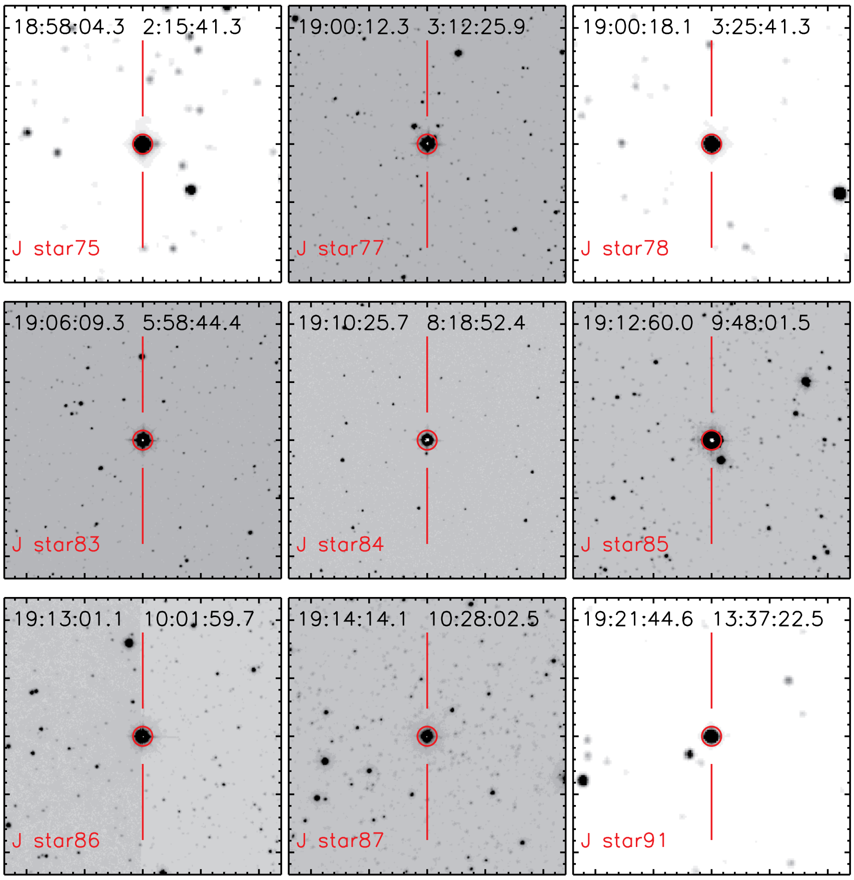
Fig. 2.— UKIDSS charts of the targets




18:17:52.1 −17:15:08.5
J star23
18:18:44.5 −16:51:09.0
J star25
18:18:46.6 −16:34:56.7
J star26
18:21:06.9 −15:05:40.2
J star33
18:21:08.5 −15:32:09.1
J star34
18:21:24.3 −13:55:28.2
J star35
18:23:04.1 −13:54:16.0
J star37
18:23:11.2 −13:57:58.1
J star38
18:24:09.9 −11:01:21.6
J star39
18:25:11.2 −11:40:56.7
J star40
18:25:43.8 −11:53:36.9
J star41
18:26:19.2 −14:06:48.8
J star42


18:29:12.3 −12:19:40.9
J star45
18:30:18.9 −10:20:00.4
J star46
18:31:04.6 −10:54:26.0
J star47
18:31:58.8 −11:19:21.4
J star48
18:33:44.4 −6:59:47.4
J star50
18:35:29.0 −7:21:12.6
J star54
18:35:34.8 −7:56:48.5
J star55
18:35:49.1 −7:34:43.1
J star56
18:35:51.5 −7:30:11.4
J star57
18:37:46.5 −7:12:24.6
J star58
18:41:34.8 −4:48:58.0
J star59
18:41:48.3 −4:48:52.9
J star60


18:42:17.1 −4:41:17.0
J star61
18:42:42.3 −4:40:53.4
J star62
18:42:44.8 −4:33:57.4
J star63
18:42:52.2 −3:46:18.5
J star64
18:43:08.0 −3:56:24.1
J star65
18:44:26.2 −3:35:27.6
J star66
18:46:44.4 −3:24:05.0
J star67
18:46:44.8 −3:03:32.2
J star68
18:47:53.6 −1:47:15.1
J star69
18:48:30.0 −2:11:50.0
J star70
18:54:34.4 1:53:04.6
J star72
18:56:58.5 1:34:52:0
J star74



18:58:04.3 2:15:41.3
J star75
19:00:12.3 3:12:25.9
J star77
19:00:18.1 3:25:41.3
J star78
19:06:09.3 5:58:44.4
J star83
19:10:25.7 8:18:52.4
J star84
19:12:60.0 9:48:01.5
J star85
19:13:01.1 10:01:59.7
J star86
19:14:14.1 10:28:02.5
J star87
19:21:44.6 13:37:22.5
J star91

Table 2: List of allocated time per semenster

16B-0106	2016B	39h		only one run out of 2 planned
16B-0106	2017A	45h	4.5n	
16B-0106	2017B	68h	6.8n	
16B-0106	2018A	45h	4.5n	
16B-0106	2018B	45h	4.5n	
16B-0106	2019A	45h	4.5n	
287 hours				

after the notification of time allocation each semester a report was filed.

$$ftp://ftp.noao.edu/noaoprop/report.tex.$$

The 2016B schedule with project IDs and time allocation information is located here:

$$http://www.astro.yale.edu/smarts/observing.html.$$

Instructions for preparing and submitting ANDICAM scripts for observations on the 1.3m: Go to:

$$http://www.astro.yale.edu/cgi-bin/ANDICAM/Obs/obsentry.pl$$

Instructions for picking up ANDICAM data for the SMARTS FTP Site: Please navigate to ftp://smarts.astro.yale.edu/. Each Project has a CCD directory and an IR directory as follows:

$$ftp://smarts.astro.yale.edu/pub/smarts13m/PROJECT-IDccd/$$

$$ftp://smarts.astro.yale.edu/pub/smarts13m/PROJECT-IDir/$$

3. Log of the dates of observations

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
	-					16B:log not available. First time user.
160808	-		IR			rccd160808.0068.fits, star57 broken sequence? star72ij us
160809	-		IR			star05,star17,star07,star55 broken sequence, repeated ob
160810	-		IR			star58,star11 broken sequence
160811	-	std	IR	std	ok	star40: 2 sequences
160812	-	std	IR	std	ok	
160815	-	std	IR	std	ok	all stars namd star20 — always use coordinates
160828	-		IR			
160829	-		IR			
160831	-		IR			
160901	-		IR			
	-					17A:log available
170418	-		IR			
170419	-		IR			
170420	-	std	IR	std	ok	
170421	-	std	IR	std	ok	
170422	-	std	IR	std	ok	
170423	-		IR			
170424	-		IR			
170425	-	std	IR	std	ok	
170426	-	std	IR	std	ok	
170427	-	std	IR	std	ok	
170428	-	std	IR	std	ok	
170429	-	std	IR	std	ok	
170430	-	std	IR	std	ok	
170501	-		IR			
170502	-	std	IR	std	ok	
170503	-	std	IR	std	ok	
170504	-	std	IR	std	ok	

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
170505	-		IR			
170506	-		IR			
170508	-		IR			
170509	-		IR			
170513	-		IR			
170515	-		IR			
170516	-		IR			
170521	-		IR			
170527	-		IR			
170530	-	std	IR	std	ok	
170531	-		IR			
170601	-		IR			
170603	-		IR			
170604	-		IR			
170605	-		IR			
170606	-	std	IR	std	ok	
170608	-	std	IR	std	ok	
170609	-	std	IR	std	ok	
170611	-	std	IR	std	ok	
170612	-	std	IR	std	ok	
170613	-		IR			
170614	-		IR			
170617	-		IR			
170618	-		IR			
170620	-		IR			
170623	-		IR			
170628	-		IR			
170629	-	std	IR	std	ok	
170630	-		IR			
170701	-		IR			
170702	-	std	IR	std	ok	
170706	-		IR			
170708	-		IR			
170709	-		IR			
170710	-	std	IR	std	ok	

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
	-					17B:log not all
						list from the yale database made
170801	-		IR-			
170802	-		IR-			
170803	-		IR-			
170805	-	std	IR-	std	ok	
170806	-		IR-			
170807	-		IR-			
170808	-		IR-			
170809	-		IR-			rccd170809.0044.fits to rccd170809.0075.fits no log
						binir170809.0162.fits to binir170809.0201.fits no log
170813	-		IR-			
170814	-		IR-			
170815	-		IR-			
170816	-		IR-	std	ok	ccd170816.0093 to ccd170816.0106 missing files !!!!!!star
170817	-		IR-			
170818	-		IR-			rccd170818.0040.fits to rccd170818.0064.fits no log
						binir170818.0164.fits to binir170818.0195.fits no log
170819	-		IR-			
170820	-		IR-			
170821	-		IR-			
170822	-		IR-			rccd170822.0026.fits to rccd170822.0090.fits no log
						binir170822.0099.fits to binir170822.0183.fits, no log
170823	-		IR-			
170824	-		IR-	std	ok	ccd170824.0068 to ccd170824.0074 missing files !!!!!! sta
170825	NO					same IR as those taken the night after..repetition)
170826	-	std	IR-	std	ok	in the log they are reported as 170825
170827	-	std	IR-	std	ok	
170828	-	std	IR-	std	ok	
170829	-		IR-			
170830	-		IR-			

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
170901	-		IR-			
170902	-		IR-			
170903	-		IR-			rccd170903.0025.fits to rccd170903.0060.fits no log
						binir170903.0129.fits to binir170903.0180.fits no log
170904	-	std	IR-	std	ok	
170905	-		IR-			
170906	-		IR-			
170907	-		IR-			
170908	-		IR-			
170910	-		IR-			
170911	-		IR-			rccd170911.0025.fits to rccd170911.0060.fits no log
						binir170911.0116.fits to binir170911.0157.fits no log
170914	-		IR-			
170915	-	std	IR-	std		rccd170915.0031.fits to rccd170915.0065.fits no log
						binir170915.0143.fits to binir170915.0182.fits no log
170916	-	std	IR-	std	ok	
170917	-	std	IR-	std	ok	
170918	-		IR-			star72 check sequence
170919	-		IR-			
170920	-		IR-			
170921	-	std	IR-	std	ok	
170922	-	std	IR-	std	ok	
170923	-	std	IR-	std	ok	
170924	-		IR-			
170925	-	std	IR-	std	ok	
170926	-	std	IR-	std	ok	
170928	-		IR-			
170929	-		IR-			
171002	-		IR-			
171003	-		IR-			
171004	-		IR			telemetry issue

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
18A run1						
180401	-		IR-		ok	
180402	-	std*	IR-	std*		ccddark
180403	-	std*	IR-	std*		
180404	-	std*	IR-	std*		
180405	-	std*	IR-	std*		
180406	-	std*	IR-	std*		
180407	-	std*	IR-	std*		
180408	-	std*	IR-	std*		
180409		std*		std*	ok	no log, but only dark taken
180410						no log, but only dark taken
180411	-	std*	IR-	std*		
180412	-		IR-	std*		
180413	-	std*	IR-	std*		
180414	-	std*	IR-	std*		
180415	-	std*	IR-	std*	ok	
180416	-		IR-	std*		CCD darks
180417	-		IR-	std*		
180418	-	std*	IR-	std*		
180419	-	std*	IR-	std*		
180423	-		IR-			CCD darks
180424	-	std*	IR-	std*		
180425						no log, only J100 flats
180426	-		IR-			

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
18B run1						
180430						CCD IR darks
180502		std*				CCD IR darks
180509						CCD IR darks
180516		std*				CCD IR darks
180524		std*				CCD IR darks
180529						CCD IR darks
180601	-		IR-			18A run2
180602	-		IR-			
180603	-	std*	IR-	std*		
180605						CCD IR darks
180606	-		IR-			
180608	-	std*	IR-	std*		CCD IR darks
180612	-		IR-	std*		CCD IR darks
180613	-	std*	IR-	std*		
180614	-	std*	IR-	std*		
180615	-		IR-			
180616	-	std*	IR-	std*		
180617	-	std*	IR-	std*		
180619	-		IR-			
180620	-		IR-			
180621	-		IR-			
180622	-	std*	IR-	std*		
180623	-		IR-			
180624		std*		std*		CCD IR darks and J100 flats

DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
19A run1						
180804					flat	IR darks
180808	-	std	IR-	std		IR darks
180809	-		IR-			
180810	-	std	IR-	std		
180811	-	std	IR-	std		
180812	-		IR-			
180813	-	std	IR-	std		
180814	-	std	IR-	std		
180815	-	std	IR-	std		
180816	-	std	IR-	std		
180817	-		IR-			
180818	-	std	IR-	std		
180819	-	std	IR-	std		J100 flats
180820	-	std		std		IR darks CCD dark
180823	-	std	IR-	std		no log
180824	-	std	IR-	std		
180825	-	std	IR-	std		no log
180826	-	std	IR-	std		
180827	-	std	IR-	std		
19B run2						
DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
190401	y	stdccd	IR-	std		nolog
190402	y	stdccd	IR-	std		
190403	y	stdccd	IR-	std		nolog
190404	y	stdccd	IR-	std		
190405	y	stdccd	IR-	std		
190406	y	stdccd	IR-	std	flat	
190407	y	stdccd	IR-	std		
190408	y	stdccd	IR-	std		
190409	y	stdccd	IR-	std		
190411	y	stdccd	IR-	std		CCD darks - IR darks
190412	y	stdccd	IR-	std		gap
190413	y	stdccd	IR-	std	flat	
190414	y	stdccd	IR-	std		
190415	y	stdccd	IR-	std		
190417	y	stdccd	IR-	std		
190418	no			–		IR flatsD100
190420	y	stdccd	IR-	std		
190421	y	stdccd	IR-	std		
190426	no			std		CCD darks, IR darks
190428	no			std	flat	

19B run2						
DATE	CCD	STDCCD	IR	IRSTD	flatIR	Comments
190502	y		IR-	std		
190503	y		IR-	std		
190504	y		IR-	std		
190505	y		IR-	std		
190506	no			–	flat	
190507	y		IR-	–		
190508	y		IR-	–		
190510	y		IR-	std		
190511	y		IR-	std		
190512	y		IR-	std	flat	
190513	y		IR-	std		
190514	y		IR-	std		
190516	y		IR-	std		
190517	y		IR-	–		
190519	no			–	flat	
190602	y		IR-	–		
190603	y		IR-	–		
190605	y		IR-	–		
190607	y		IR-	–		no night log
190608	y		IR-	–		
190609	y		IR-	–		
190611	y		IR-	–		
190612	y		IR-	–		
190620	y		IR-	–		
190621	y		IR-	–		
190622	y		IR-	–		
190624	y		IR-	–		
190625	y		IR-	–		
190627	y		IR-	–		
190629	y		IR-	–		
190630	y		IR-	–		
190702	y		IR-	–		
190703	y		IR-	–		
190704	y		IR-	–		
190705	y		IR-	–		
190706	y		IR-	–		
190707	y		IR-	–		

4. Pipeline IR steps

Location to retrieve the observed files.

$$ftpsmarts.astro.yale.edu$$

$$ftp://smarts.astro.yale.edu/pub/smarts13m/NOAO-16B-0106ccd/$$

$$ftp://smarts.astro.yale.edu/pub/smarts13m/NOAO-16B-0106ir/$$

Scripts are in the directory GENSCRIPTS. Data are saved in the directories RAW and REDUCED.

Copy in the disk all the observations, per run.
GENSCRIPTS: scripta to process each run.
MERGERUNS: scripta to merge the runs.
ls RAW
IRflats IRFLATS100 run-16B run-17A run-17B run-18A
Flats are in the directory IRflats and IRFLATS100.

To process each observations, one need to use these procedures:

- log.pro : create the of of the frames per target
- IRpipe_gen.pro : frames processing
- IRpipen2_gen.pro : point sources extraction
- IRpipen3_gen.pro : list of all sources in the central overlapping area of the frames (frame 0)(called by IRpipen2_cl_gen.pro)
- mypairs_gen.pro : astrometric alignment of catalog stars (called by IRpipen2_cl_gen.pro).
- calibphot.pro :automatic first rough calibration with 2MASS stars (called by IRpipen2_cl_gen.pro).

4.1. Log of the run

In each directory, run the log.pro routine to generate the log. Logs are created automatically with eclipse. A few extra columns are added to the keywords read from the fits-header:

cut1loc	(e.g. 14)	Jmag up. limit to select pairs (mypairs.pro)
cut2loc	(e.g 0)	used in calibphot.pro ($jmag < cutcal(= 13)andjmagltcu2loc$
fwhmxloc	daophot	recall relatic calib only for same FWHM
round1loc	daophot	
round2loc	daophot	
sharp1loc	daophot	
sharp2loc	daophot	
flagloc	quality flag	

flagloc=0	non-observed
1	perfect
2	can use, but nearby zeropoint (manually selected)
3	have not managed to use it, check again

Since my email had not been inserted in the list of users yet, in run 16B observatory logs were not received. Run17A all ok. Run17B some strange happenings with the logs, i.e. in two nights two observed stars are missing (present in the official log). Semenster still in public disk, but those files missing. Take note and ask at the very end. 18A all seems fine, though a few logs were not received.

In run 16B these four stars are missed in the images:
star83 binir160811.0221
star85 binir160811.0229
star87 binir160812.0186
star91 binir160812.0194
Those stars have been pointed with the wrong sign in the declination (OB ok).
Star04 and star 40 have flagloc=2.

In 17A:
1run:
a few stars are not precessable by the pipeline, a few counts or a few stars. Those are flagged with flagloc=3: pipen2= star22,star37,star74,star39,star40(nada),star42(nada),star46(nada) pipen3= star39,star40,sta
2run
pipen2= star06 (barely visible,2), star56(barely visible,3), star70 (2), star86 (3),star39 (3),star40 (3),star77 (3),star41 (1?),star46 (3)
Flats of 170730 and 170810 copied in January. Rerun the July-August files 17A.

4.2. Frame reduction.

IRpipe_gen.pro

1 read the log of the run (e.g. ../RAW/run-17B/IRframes/logall.out)

2 loop trough the objects

3 quick fix of the fits header (add CRVAL1,CRVAL2,CTYPE1,CTYPE2,CRPIX1,CRPIX2). Subroutine: fixradec.pro. Using the Telescope Right Ascension and Declination (very rough, but enough to later identify pairs of stars in the 2MASS catalog).

4 Subroutine createsky. Reads the set of frames inherent to the observation considered(e.g. from binir171003.0078.fits to binir171003.0085.fits). Create a sky image with the routine resistant_mean (2 sigma clipping). Save the sky image (e.g. binir171003.0078.sky.fits). Subtract the sky from every frame (e.g. binir171003.0078.sub.fits) and divide by the flatfield (e.g. binir171003.0078.subff.fits). Flat-fields are automatically associated with the Julian day.

4.3. Source detection: IRpipen2_gen.pro

Organization of the database: pick the right files.

- read the list of runs ../MERGERUNS/rawtables.tab
- repeated observations of a target in the same run are identified and run one after another.
- run: allgo, "star17ij", runnumber, flag_createastrometry(=0,1)
- read masterfile for the specified run e.g.,
  ../RAW/run-16B/IRframes/logall.out.edited
- read the masterfile "../MERGERUNS/master.tab"
  to uniquely link the names to the coordinates
  (Several obs carried by changing coordinates in the same OB, i.e. name remained unchanged).
  This way we assign a name to a coordinates initially and any further associations is based on coordinates. How many macros rewrite master.tab? several.
- read the 2mass catalog
  (current catalog location in run1, but some stars are not in run1, then uses run2)
  new directory to be tested IR/REDUCED/twomass/
- identify the star field in the localrun log
  cc= number of observations
  pp= indexes in the localrunlog
- looping trough the observations of the selected star
  if the star was observed and of good quality (flagloc=1 in localrun log),
  ten continue
- run the submodule irpipen2 (irpipen2old+irpipen3old)
- mypairs (external) : find pairs of stars between the 2mass catalog and the detected stars, to perform astrometric wcs. Do it only once and keep it [switch on with if(pair eq 1)]
- calibphot (external): performs a first guess calibration using the 2MASS pairs

4.3.1. Source detection: IRpipen2.pro

APERTURE photometry, relative shifts of tables, master table (x,y) (manual inspection of charts)

IRpipen2_gen.pro daophot list extracted in each frame (independently). Shift frame by frame located. masterlist should fix the problem. But you have to apply reverse shift.

- irpipen2,pp[j],input1, dirin,dirout
  e,g, 9 ../RAW/run-16B/IRframes/logall.out.edited ../RAW/run-16B/IRframesRED/ ../RAW/run-16B/IRframesRED/

- Detections of stars with DAOPHOT-find per frame, in principle better than masterfile, best points per frame taken

- Aperture DAOPHOT-phot
  fwhm=5
  apr=[fwhm/2.0+1.5]
  skyrad=[fwhm/2.0+2.0,fwhm/2.0+4.0]

- Typical every star is always observed with the same DIT and NDIT. ATTENTION DAOPHOT provides maginstrum=-2.5*log(counts)+25.
  mag[xc]=mag[xc]+2.5*alog10(time) taking into account the exposure times

- Shifting the coordinates over the reference coordinates (first frame,rough fix only one star)

- Register. Crosscorrelation, average xshift and yshift.

- Write table and save shift (also position of target star, meanwhile identify on a chart and click on it)
  cursor, xstar, ystar

- input:../RAW/IRframes/logall.out.edited and frame.subff.fits
  output: frame.subff.phot.tab

  binir160809.0196.subff.phot.tab
  binir160809.0197.subff.phot.tab
  binir160809.0198.subff.phot.tab
  binir160809.0199.subff.phot.tab
  binir160809.0200.subff.phot.tab
  binir160809.0201.subff.phot.tab

binir160809.0202.subff.phot.tab
binir160809.0203.subff.phot.tab

X	Y	mag	magerr	sky	skyerr	deltax	deltay	xxstar_ref	yystar_ref	sharp	round
310.	8.	21.	0.	-0.227	0.767	0.000	0.000	229.014	229.715	0.566	-0.613
213.	35.	20.	0.	1.362	0.810	0.000	0.000	229.014	229.715	0.516	-0.391

4.3.2. Source detection: IRpipen3_gen.pro

- irpipen3_gen,pp[j],input1, dirin,dirout
  e,g, 9 ../RAW/run-16B/IRframes/logall.out.edited ../REDUCED/run-16B/IRframesRED/
  ../REDUCED/run-16B/IRframesRED/

- for each field, loop trough the frame-tables (file.'subff.phot.tab',image.subff.fits)
  and crosscorrelate with the reference one, and build vector of multimeasures

- add missing stars (xref, yref)

- print a final list of stars detected at least in 3 frames (average and std are provided,
  (e.g. binir160809.0196.ave.tab)
  N X Y magave magerr skyave errsky nflux starxref staryref OBJECT
  1 373.748 22.831 19.353 0.034 1.939 0.152 5 237.756 230.140 star86ij
  2 450.623 139.334 19.337 0.025 2.160 0.199 7 237.756 230.140 star86ij
  magerr=sqrt(magave)/sqrt(n_elements(la))
  skyave=sqrt(skyave)/sqrt(n_elements(la))

- keep a file with the individual measurements,
  (e.g.) binir160809.0196.listall.tab

- input: ../IRframes/logall.out.edited
  frame.subff.phot.tab
  image.subff.fits

- output: frame+'ave.tab' average of collected measurements
  frame+'listall.tab' list of all collected measurements

4.3.3. Source detection: mypairs_gen.pro

- 1) fix wcs of the reference frame
  mypairs,pp[j],input1, dirin,dirout,dir2mass,root2mass

- input= ../IRframes/logall.out.edited
  file.'subff.fits'
  frame+ave.tab
  root2mass=twomass.'+rooto+'.tab

- output= frame+'pairs.tab.edited'
  RA-2mass DEC-2mass X Y N
  273.993005 -16.974407 229.014 229.715 1
  273.995133 -16.968340 306.073 258.522 2
  274.001456 -16.968794 296.052 338.301 3

- fixwcsnewedited, ffhh, ffim, pairsfile
  create frame0+subff_wcs.fits

4.3.4. Source detection: calibphot.pro

This macro performs a first calibration of the frames on 2MASS magnitudes. After, it follows a recabibration frame by frame (with respect to the first). To make sure we cut the catalogs roughly at the same point before crosscorrelating.

- if(magx[pp[j]] gt 0 and flagx[pp[j]] eq 1) then begin

- calibphot,pp,input1,dirin,dirout,root2mass
  extract ra,dec, and Jmag of reference stars

- input=../IRframes/logall.out.edited
  frame.subff.fits
  frame+'pairs.tab.edited'
  frame+ave.tab

- fixwcs, dirout,ffhh, ffim , xfind, yfind,mag,raselt,decselt,jmagselt,jerrselt,root+string(newind,f='(f05.0)'),r
  2MASS precut at sel =where(Jmag lt 15,cc)
  ind=where(raselt ne 99.99d0 and jmagselt lt cutcal and jmagselt gt cutmax[pp])
  res=moment(j2MASS[ind]-magInst[ind]) (magInstr have been normalized to texp=1s)
  2 sigma clipping in DELTA
  used points are marked in red in the eps
  deltamag=res[0]=zeropoint

- print, eps files and updated final calibrated file of stars
  output=frame+subff_wcs.fits (for all frames)
  frame.ave2.tab (added wcs)
  frame+ave2.eps (delta J vs J2mass)
  frame+ave2.chart.eps (map)

- binir160809.0196.ave2.tab
  id X Y mag magerr sky skyerr nframe xstarREF ystarREF starname rafind decfind raselt decselt jmagselt jerrselt deltamag stddelta
  deltamag=res[0]=zeropoint

4.4. master.tab

4.4.1. master.pro

A master.tab is needed because one can associate in a unique manner the star name with the coordinates. Enter the name, get the coordinates. With the coordinates enter the local runlog and get the index on the observation.
Program to quickly check observed stars and non observed (it only lists the first obs, in case of repetitions).

- input = rawtables.tab master.tab
  output= master.tab, master.tab.bk

- read existing master.tab

- read logs (rawtables.tab)

- checklist, log[2], RAref, DECref, Nframe3, ExpT3, frame3, flag3, nobs3
  extracts Nframe ExpT Framestart flag (of the first obs) nobs=cc (number of repetitions in the log)

- flags all initialised to 0, then filled with the nightlog flagloc (1,2,3)
  0 non-observed
  1 perfect
  2 can use, but use a zeropoint close to this obs (manually selected)
  3 have not managed to use it, check again, you may do better in a few cases

- Notes: by rerunning master.pro flags are re-read from log (flaglog)

4.4.2. calibrun_v7.pro

Master file for a specific run. It takes into account the repetitions. To have the whole master, just coadd the master per run.

- calstar, myrun_RUN (e.g. calstar, 1,2,3,4,5,6,7,8,9,10,11)
  nrun=myrun-1 INDEX

readcol, "rawtables.tab", log, dirin, f='(a,a)'
outrun='master_run'+strtrim(myrun,2)+'.tab'

- read existing master.tab and loop through the stars (flag=flag not used, interesting only Nobs (repetitions))

- assumes as a reference always the first epoch

- loops
  for j=0,n_elements(raref)-1 do begin
  if(OBJECTref[j] ne 'none') then begin it fails in the 4 missing stars of run1
  If is already reduced
  if(magref[j] gt 0 or mag2[j] gt 0 or mag3[j] gt 0 or mag4[j] gt 0 or mag5[j] gt 0 or mag6[j] gt 0 or mag7[j] gt 0) then begin
  cutcal=13. this value should all be in a file...
  if (namexx eq "star05ij") then cutcal=11.5d0 even expections
  if (namexx eq "star06ij") then cutcal=11.5d0
  if (namexx eq "star09ij") then cutcal=11.5d0
  if (namexx eq "star21ij") then cutcal=10.5d0
  if (namexx eq "star33ij") then cutcal=10.5d0
  for pk=0, rep[0]-1 do begin
  fileout=star86ij288.254500.14_0.tab
  fileouteps=star86ij288.254500.14_0.tab.eps

- calibrel, mylog, popo, Raref[pp], decref[pp], cutcal, zepref=zepref,
  it reads the flag from the run log – localflag – and the reference log Reads the file log.ref.tab.
  The zeropoints and instr. mag from the file_ave2.tab of that run
  mag =mag+zeropoint
  zepref =zpref[0]+25 (25 added arbitrarily by daophot-idl)
  zpreferr =zperrref[0]
  zerop2 =zp[0]+25
  zpoint2err=zperr[0]

- recal (only if flagx=1)
  re-calculating resid1[0] residual shift with 2MASS
  re-calculating resid2[0] residual shift with 2MASS
  (this time using 2MASS, mag_ref, mag_run, ie. 2 andicam fields).
  resid=mean of differences of (2mass_mag- andicam_cal_mag) of stars in ref_frame in run_frame

and in 2MASS.
zeropointrefx=zepref[0];;+resid1[0] (not added, but it is an additive component)
zeropointx=zerop2[0];;+resid2[0]
zeropoint are unchanged
Once assumed a reference frame one could move to internal calibration
Print a star list for each field (e.g. tmp/star91ij290.435958.16_0.tabcal.stars), i.e. the list of neighbouring stars to be used as a calibrators, the list of reference stars used is saved in masterflag.edited.tab. Automatically created as stars in the wanted range of mag end within 2 sigma, cleaned by hand very often (e.g. tmp/star85ij288.249667.13_0.tabcal.stars.ed) and used in calibrun_fix.pro.

- print in tmp/
comparison of the n=0 obs in run 8 with the ref obs.
star91ij290.435958.18_0.tab
star91ij290.435958.18_0.tab.eps
star91ij290.435958.18_0.tabcal.stars

- print output file (e.g. master_run10.tab)
NAME, RA,DEC, flag1, nobs1, frame1, Nframeref, ExpTref,cutref,cutmaxref,magref, errref, flagx, rep, framex, tablecross, Nframex, ExpTx, zeropointrefx,zpreferr,resid1, zeropointx, zpoint2err,resid2, magx,errx, julien

4.4.3. calibrun_fix.pro

It reruns the calibration on a specific list of calibrators, visually inspected and selected. The master file for a specific run is recopied (cp master_run4.tab master_run4.tabrev), so to be able to re-check the night zeropoint and to identify secondary calibrators (the obs itself). It takes into account the repeteated observations.

- go
reads the master.tab and loop trough the objects

- read the calibrator names: masterflag.edited.tab and loops through the stars
star04ij 272.863708 -17.837167 star04ij272.863708.14_0.tabcal.stars 3
star05ij 272.947583 -19.487639 star05ij272.947583.11_0.tabcal.stars 3
star06ij 273.314917 -18.022917 star06ij273.314917.11_0.tabcal.stars 3
star07ij 273.347417 -18.971806 star07ij273.347417.11_0.tabcal.stars.ed 3

- contactenate all master_runX.tab and extracts all observations of that star : extracted.tab

- i) read the calibrators' file, e.g. star56ij278.954625.110_1.tabcal.stars (epock 1 versus epock 10, magnitudes are those from the first epock listed);
  ii) and match it with each star list extracted from the various observations
  (e.g., star54ij278.870750.14_0.tab....star54ij278.870750.19_0.tab)
  iii) recalculate the mean delta and std:
  delta=magcal-magrunX
  res=moment(delta)

- apply the correction $magrunX[la] = magrunX[la] + res[0]$

- print again each runX_log with recalibrated magnitudes (master_run1.tabrev) and with the recalculated night zeropoints:
  zeropointxrun[la]=zeropointxrun[la]+res[0]
  same sign

- print again each recalibrated list of stars extracted in that field and from that run-observation and matched to the reference epock (e.g. star25ij274.685375.14_0.tabrev for run 4, these name files are read in extracted.tab).

- generate a plot of each star and its calibrators with plsecondtwo.pro

- calibrators are saved in masterflag.edited.tab star25ij274.685375.14_0.tabcal.stars.ed and the magnitudes there saved are used to recalibrate the zpoints. This is not necessarely corresponding to the obs listed in logref.tab as a reference obs. Follow this in details.

4.4.4. plsecondtwo.pro

- read the list of calibrators' files "masterflag.edited.tab"
- make a master log of all observations contained in each run-log: $catmaster_run * tabrev > mymaster$
- extract all entries inherent to the selected target
- match the list of calibrators with each list of extracted magnitudes per single observation (e.g. star25ij274.685375.14_0.tabrev)
- plot julian days versus the delta magnitudes for the target and calibrators., For sick of clarity, for every star, its variations of magnitudes with respect to the reference epoch are arbitrarely shifted. file with the diagram: star39ijcal.eps
  file: with statistics and calibrators' magnitudes star39ijcal.std

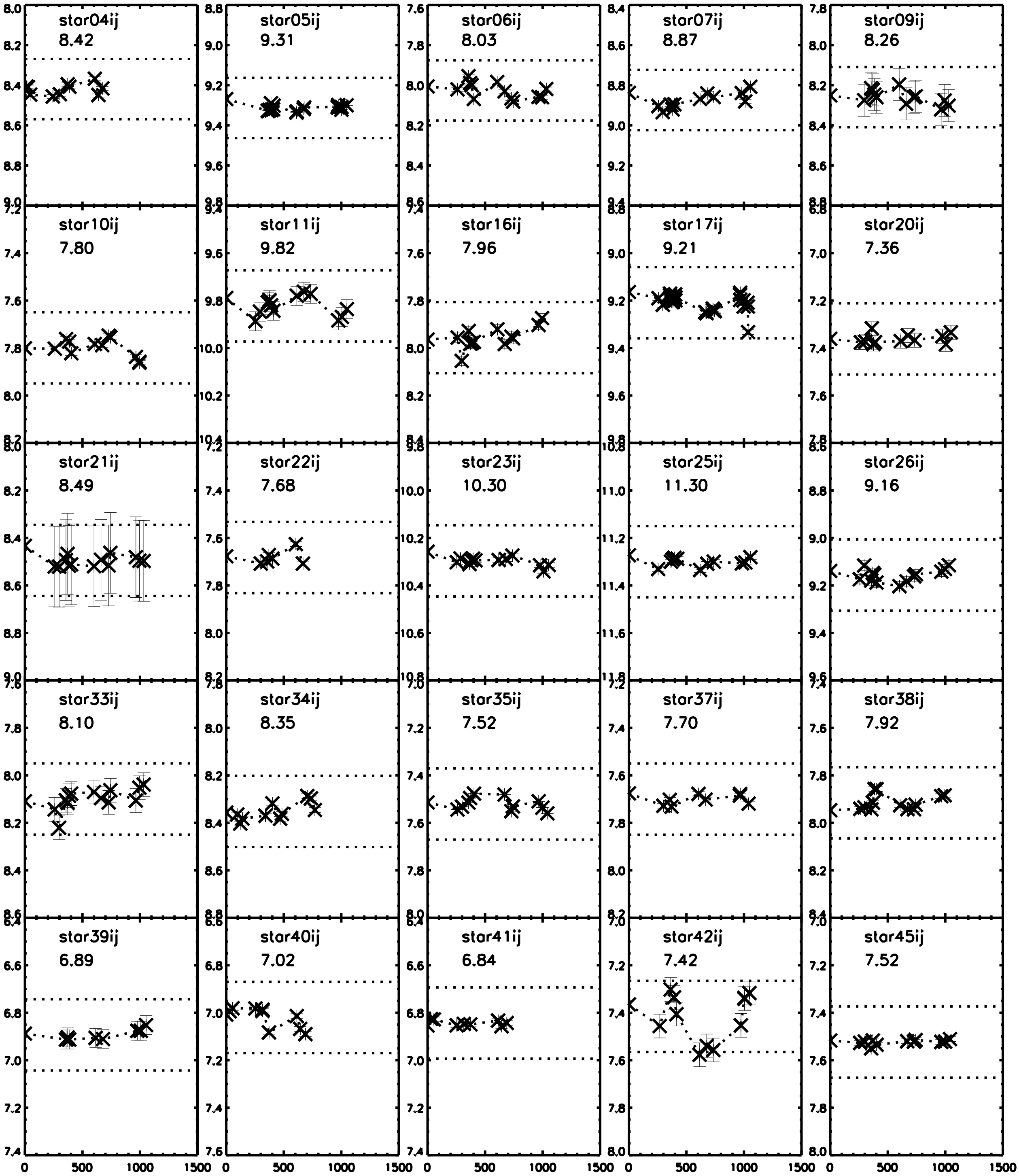
  first line: nobs, cc, cal_ave, cal_std, target_ave
  where nobs is the number of observations, cc the number of calibrators, cal_ave is the average of the It is followed by the calibrators' table:

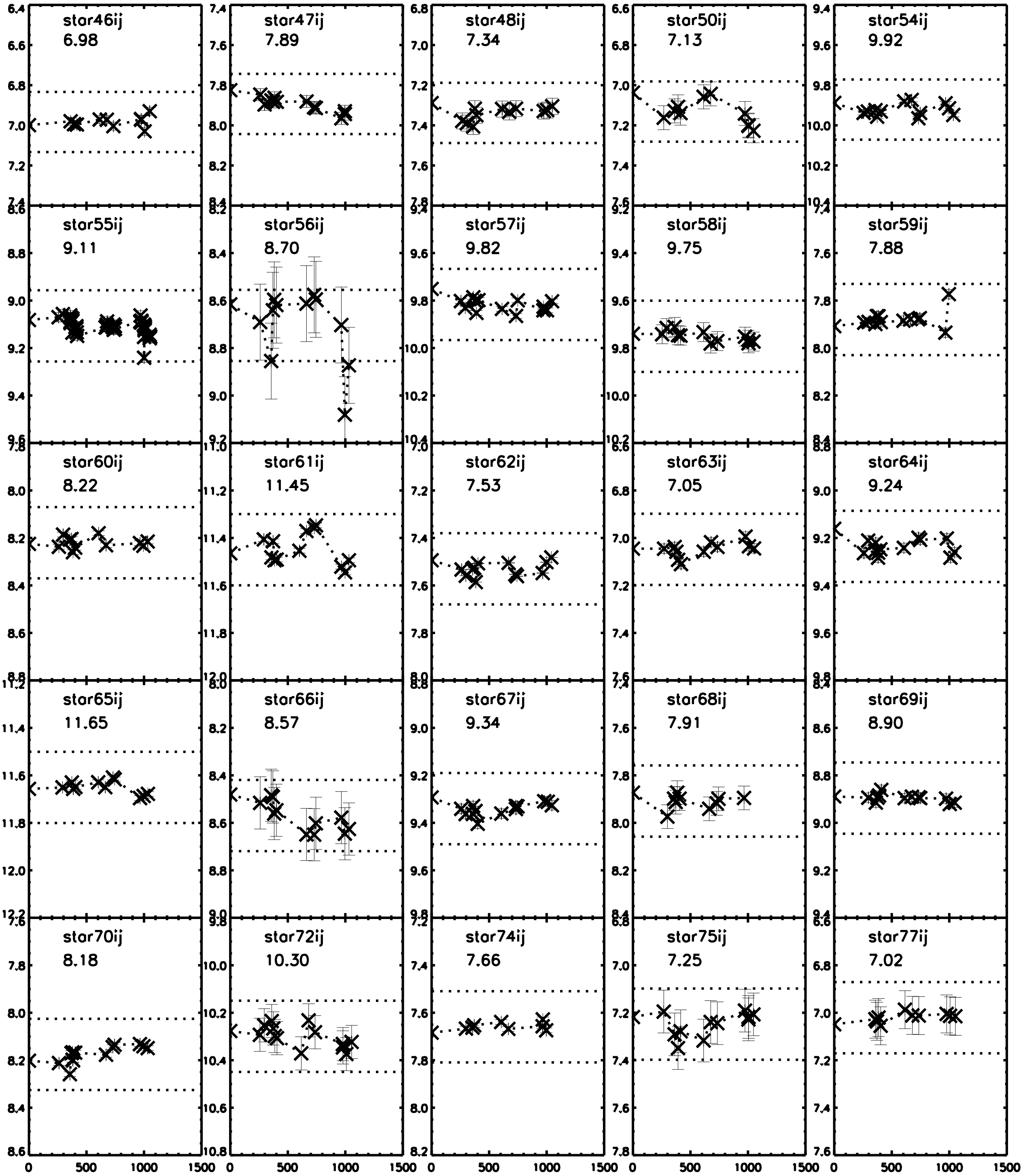
4.4.5. plfirst.pro

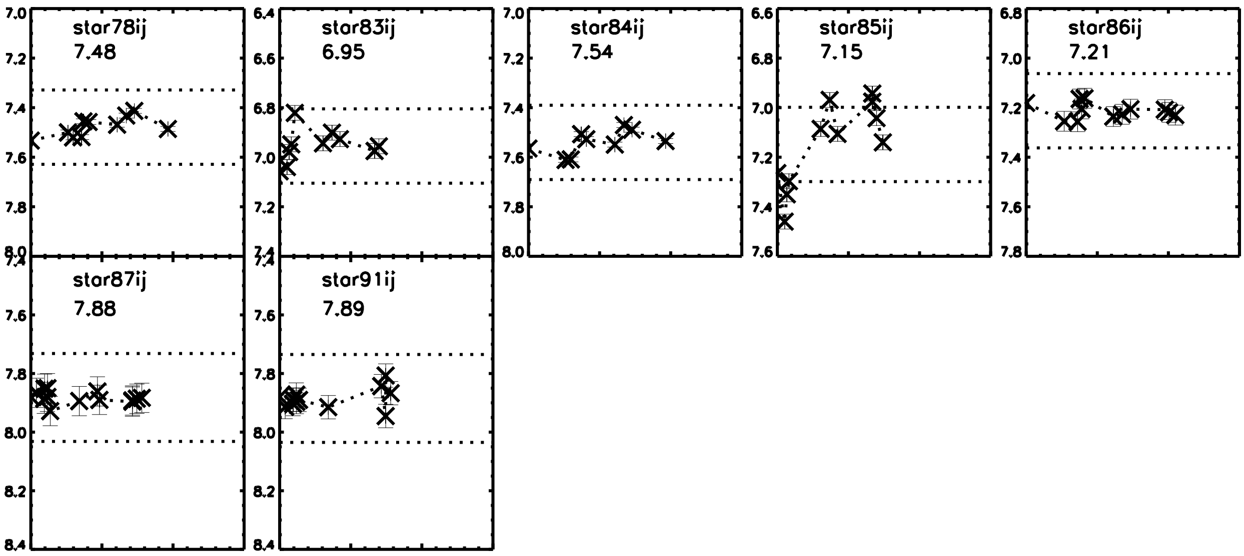
It reads the master_runxx.tabrev files to generate light curves for every single star. we need a plot of the calibrator with julian day versus magnitudes....bring along julian day.

panel1.eps panel2.eps panel3.eps

Julianday_1	cal1_mag1	cal2_mag1
Julianday_2	cal1_mag2	cal2_mag2


star04ij
8.42
star05ij
9.31
star06ij
8.03
star07ij
8.87
star09ij
8.26
star10ij
7.80
star11ij
9.82
star16ij
7.96
star17ij
9.21
star20ij
7.36
star21ij
8.49
star22ij
7.68
star23ij
10.30
star25ij
11.30
star26ij
9.16
star33ij
8.10
star34ij
8.35
star35ij
7.52
star37ij
7.70
star38ij
7.92
star39ij
6.89
star40ij
7.02
star41ij
6.84
star42ij
7.42
star45ij
7.52
0
500
1000
1500


star46ij
6.98
star47ij
7.89
star48ij
7.34
star50ij
7.13
star54ij
9.92
star55ij
9.11
star56ij
8.70
star57ij
9.82
star58ij
9.75
star59ij
7.88
star60ij
8.22
star61ij
11.45
star62ij
7.53
star63ij
7.05
star64ij
9.24
star65ij
11.65
star66ij
8.57
star67ij
9.34
star68ij
7.91
star69ij
8.90
star70ij
8.18
star72ij
10.30
star74ij
7.66
star75ij
7.25
star77ij
7.02
0
500
1000
1500


star78ij
7.48
star83ij
6.95
star84ij
7.54
star85ij
7.15
star86ij
7.21
star87ij
7.88
star91ij
7.89

5. Macros for the two clusters

The flats is different because the observations are carried out with a D=100 (rather than the standard D=40).

Flats reduced are
HUNTING/monitoring/IR/RAW/IRFLATS100/
Flats are automatically selected, as the nearby in time.

5.1. IRpipe_cl_gen.pro

See the description of IRpipe_gen.pro. The only difference is in the FLATS.

5.2. IRpipen2_cl_gen.pro

See the description of IRpipen2_gen.pro.
Difference are: coordinates of the first reference object (clicked position) are not saved (it was the target position in the single star macros). For each of the 7 frames, the wcs is updated (relative linear shift) and saved. Frames are combined with Hcongrid.

5.2.1. *irpipen2*

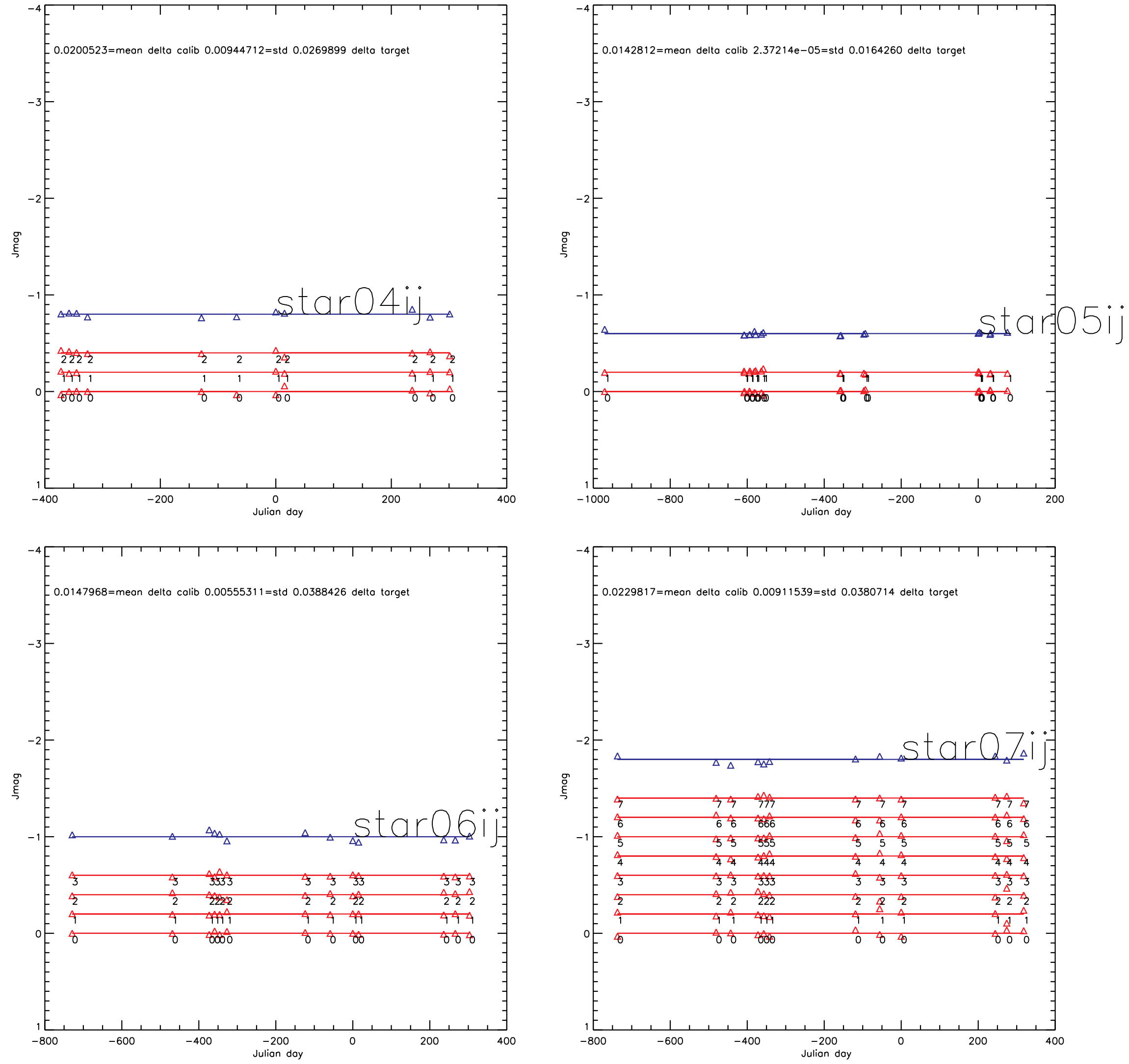
irpipen,pp[j],input1, dirin,dirout,root,nn,Npos

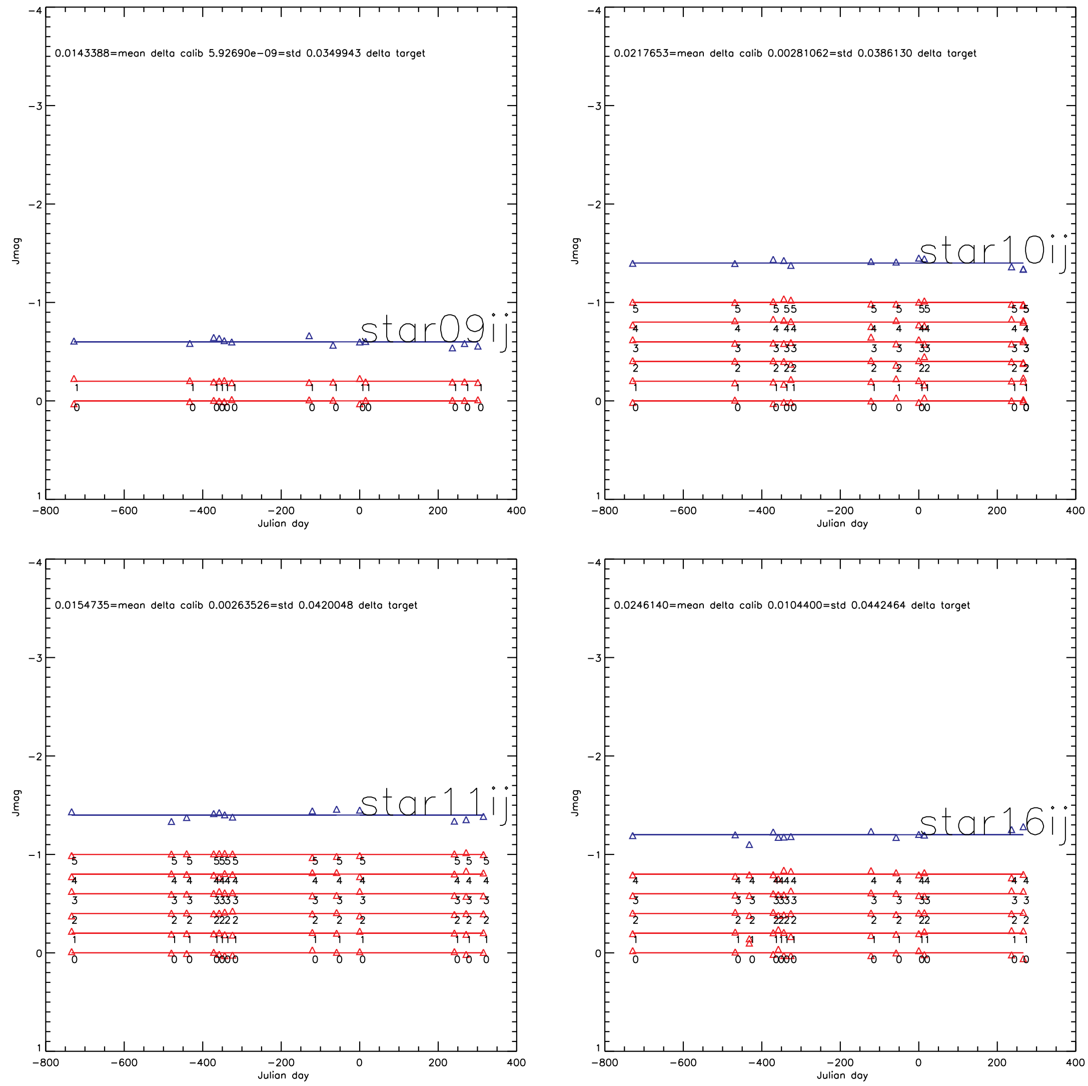
loop trough the 7 frames and extract quick source list.
$newphot = dirout + root + string(newind, f =' (f05.0)') +' subff.phot.tab'$

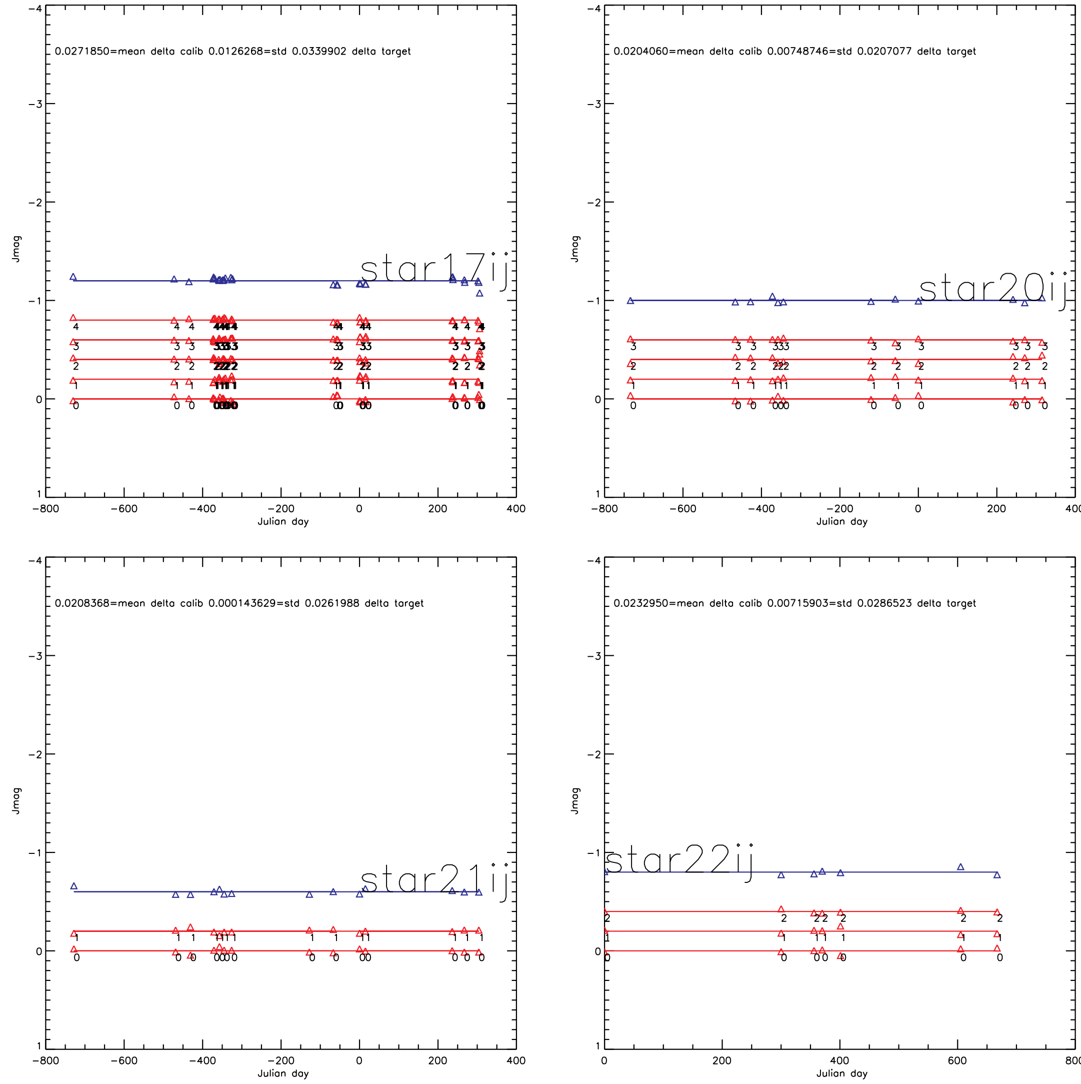
relative shifts are calculated and fits headers fixed
$newframe2 = dirout + root + string(newind, f =' (f05.0)') +' subff.pix.fits'$

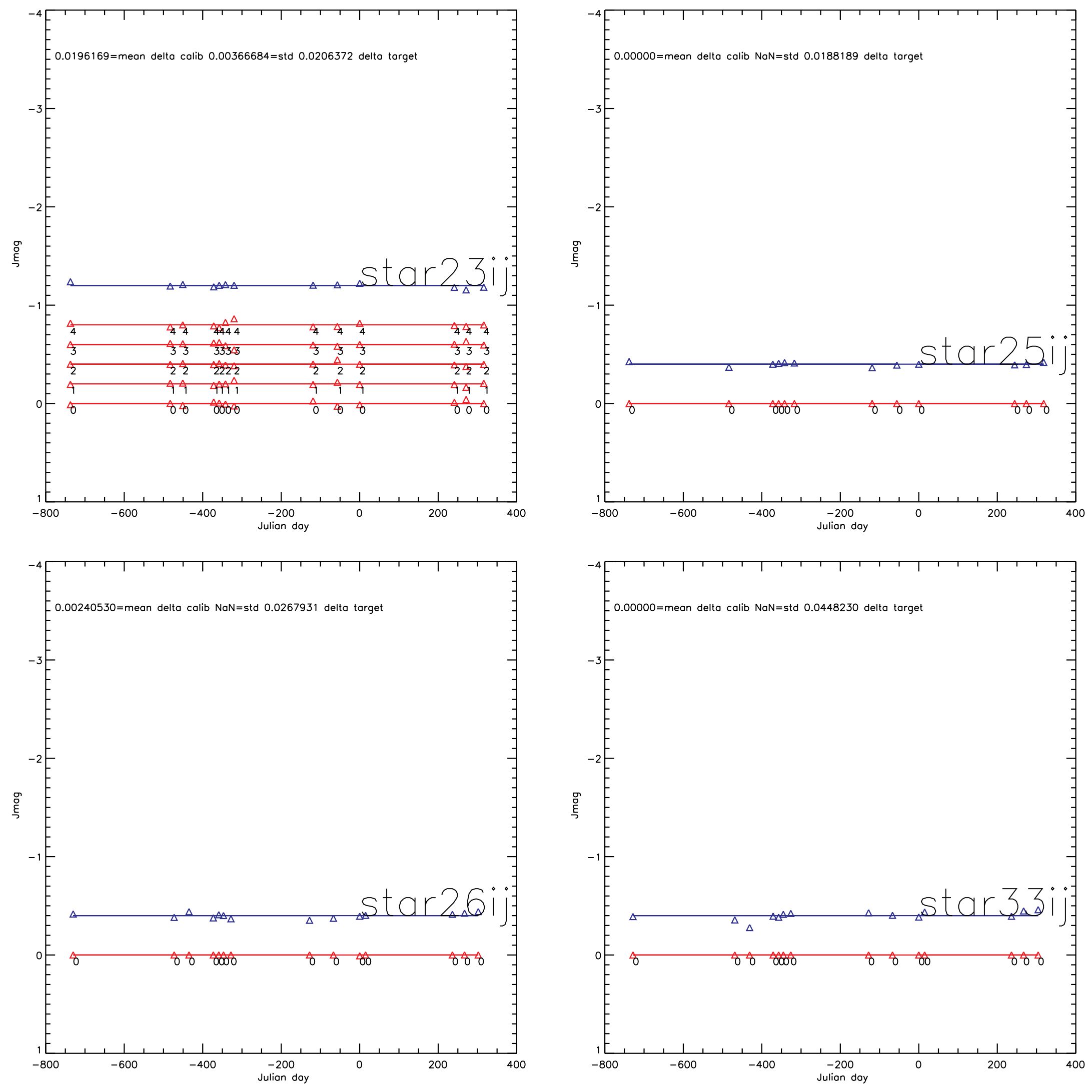
5.2.2. *mosaic the 7 positions*

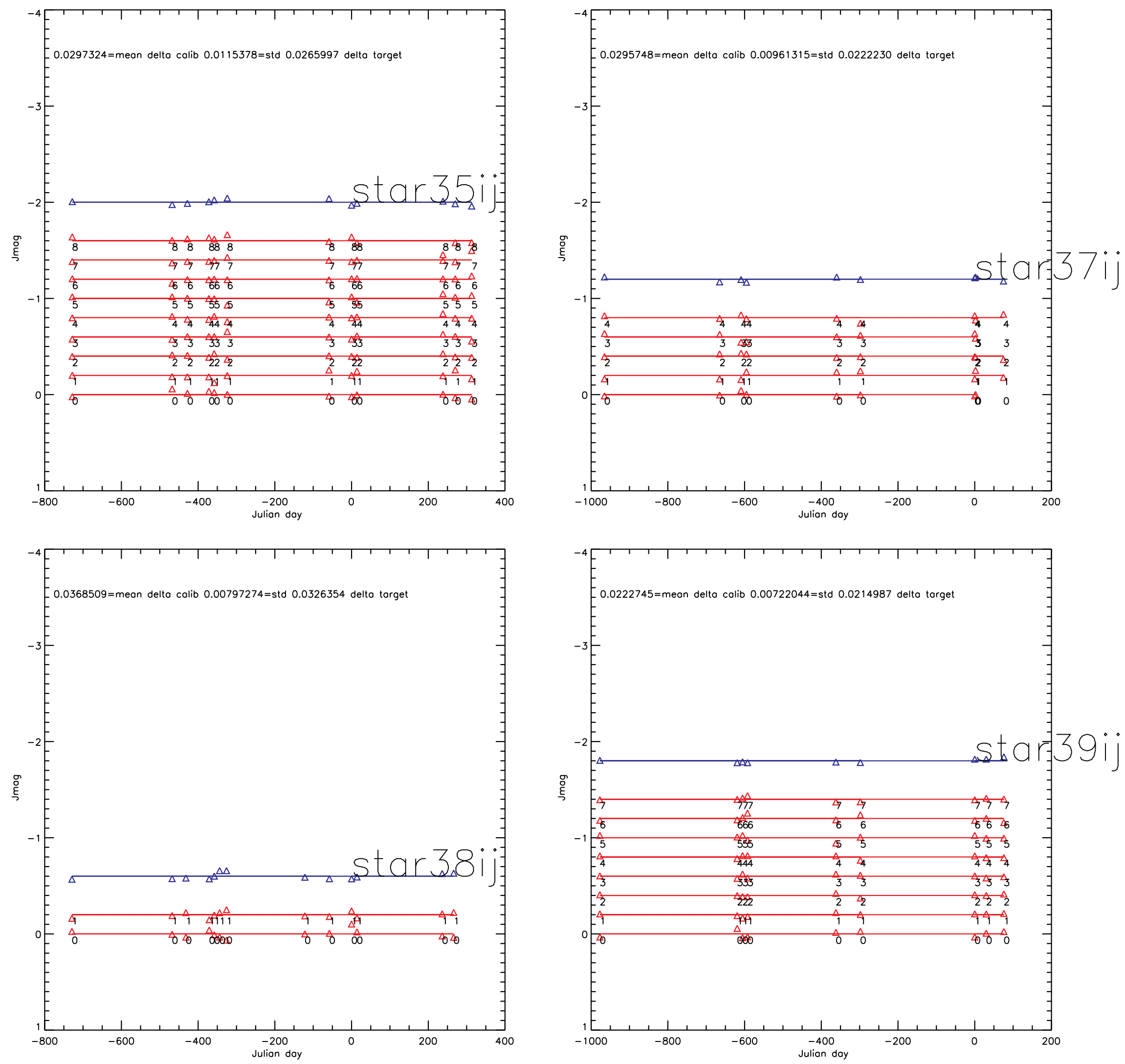
$mosai, dirin, dirout, root, nn, Npos, superfile$
Mosaic of the 7 frames already aligned with Hastrom
$hastrom, lan, hh, href, interp = 0, missing = 0$ the nearest neighour method (flux is conserved) is used to resample the images to a common frame.
A mosaic is created by averaging the cube (number of coverage is not uniform): simple average.

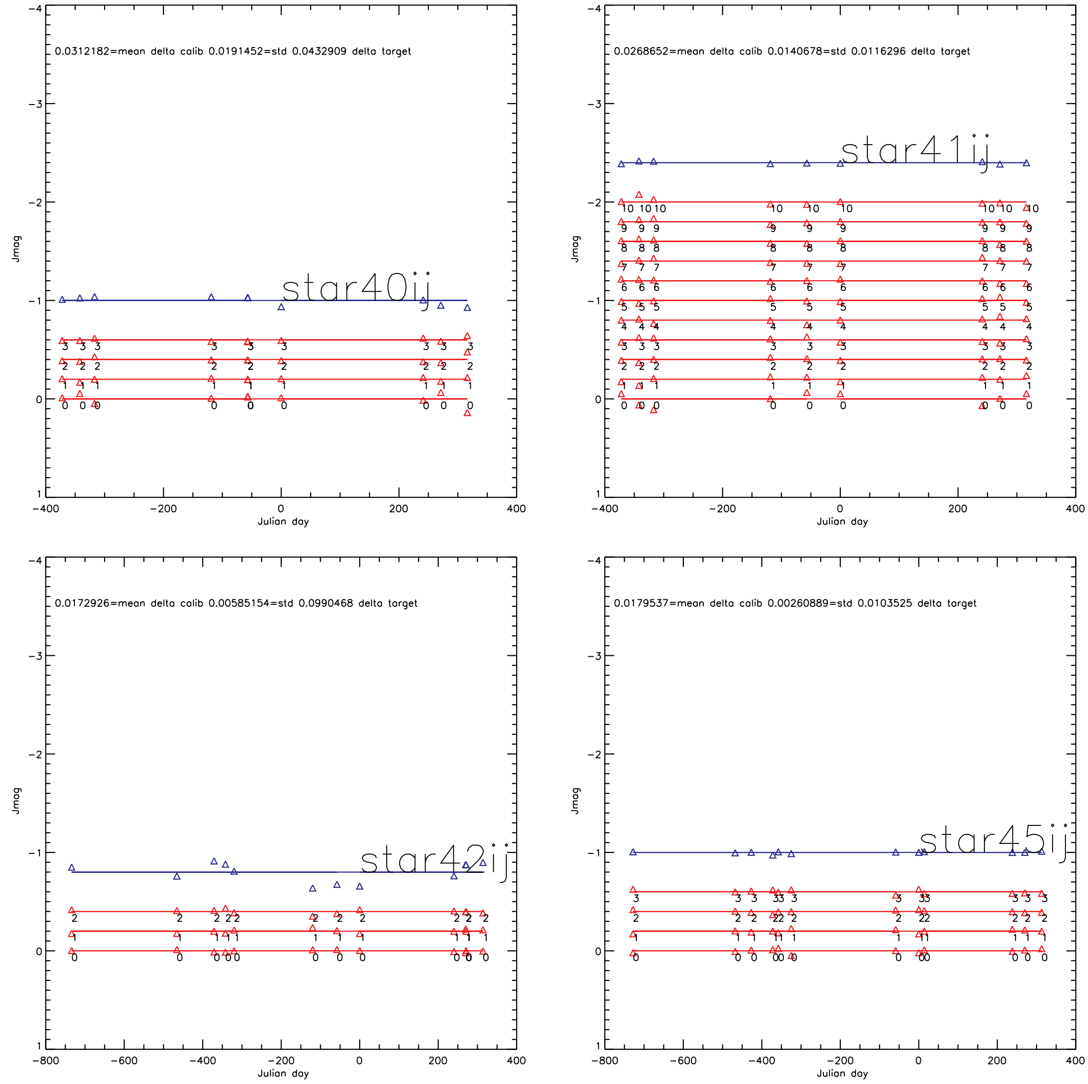

0.0200523=mean delta calib 0.00944712=std 0.0269899 delta target
star04ij
Jmag
Julian day
0.0142812=mean delta calib 2.37214e-05=std 0.0164260 delta target
star05ij
Jmag
Julian day
0.0147968=mean delta calib 0.00555311=std 0.0388426 delta target
star06ij
Jmag
Julian day
0.0229817=mean delta calib 0.00911539=std 0.0380714 delta target
star07ij
Jmag
Julian day

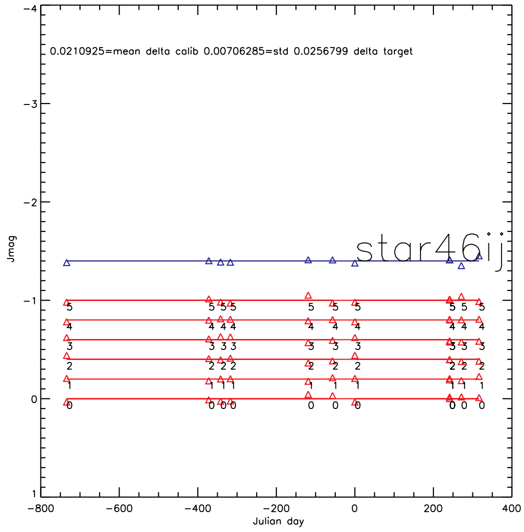

0.0143388=mean delta calib 5.92690e−09=std 0.0349943 delta target
star09ij
0.0217653=mean delta calib 0.00281062=std 0.0386130 delta target
star10ij
0.0154735=mean delta calib 0.00263526=std 0.0420048 delta target
star11ij
0.0246140=mean delta calib 0.0104400=std 0.0442464 delta target
star16ij
Jmag
Julian day

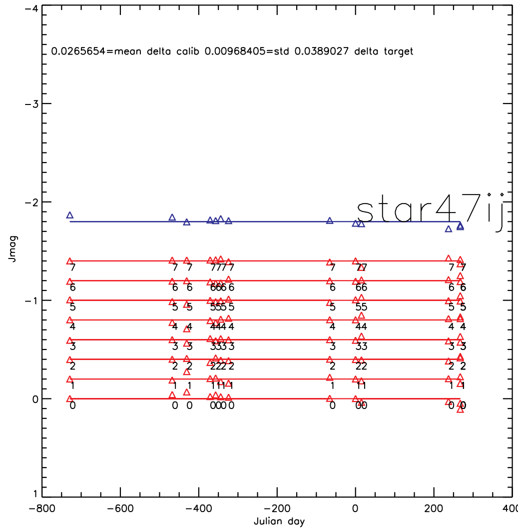

0.0271850=mean delta calib 0.0126268=std 0.0339902 delta target
star17ij
Jmag
Julian day
0.0204060=mean delta calib 0.00748746=std 0.0207077 delta target
star20ij
Jmag
Julian day
0.0208368=mean delta calib 0.000143629=std 0.0261988 delta target
star21ij
Jmag
Julian day
0.0232950=mean delta calib 0.00715903=std 0.0286523 delta target
star22ij
Jmag
Julian day

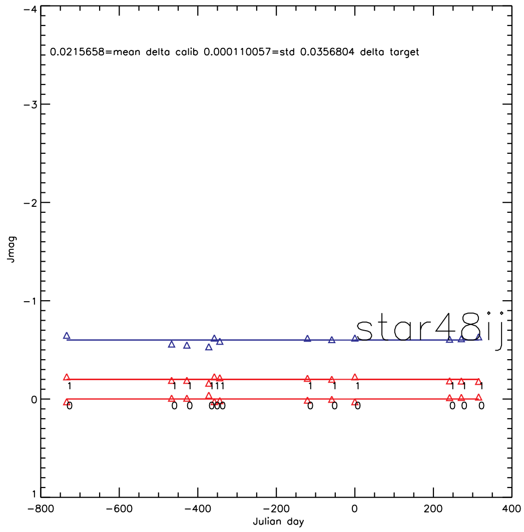

0.0196169=mean delta calib 0.00366684=std 0.0206372 delta target
star23ij
0.00000=mean delta calib NaN=std 0.0188189 delta target
star25ij
0.00240530=mean delta calib NaN=std 0.0267931 delta target
star26ij
0.00000=mean delta calib NaN=std 0.0448230 delta target
star33ij
Jmag
Julian day

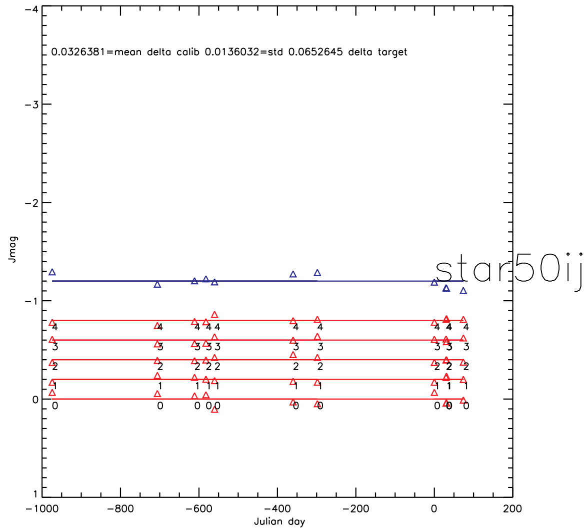

0.0297324=mean delta calib 0.0115378=std 0.0265997 delta target
star35ij
Jmag
Julian day
0.0295748=mean delta calib 0.00961315=std 0.0222230 delta target
star37ij
Jmag
Julian day
0.0368509=mean delta calib 0.00797274=std 0.0326354 delta target
star38ij
Jmag
Julian day
0.0222745=mean delta calib 0.00722044=std 0.0214987 delta target
star39ij
Jmag
Julian day

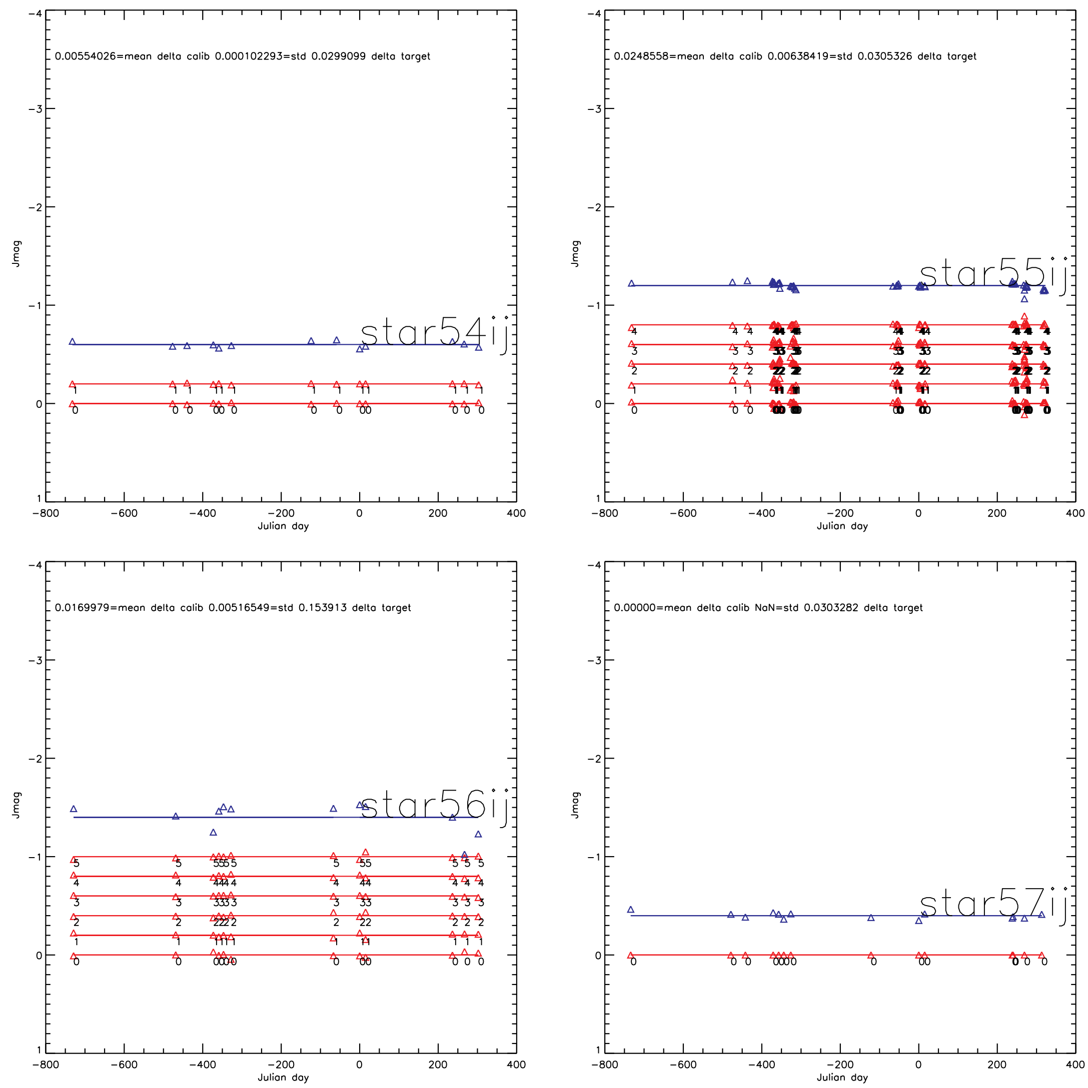

0.0312182=mean delta calib 0.0191452=std 0.0432909 delta target
star40ij
0.0268652=mean delta calib 0.0140678=std 0.0116296 delta target
star41ij
0.0172926=mean delta calib 0.00585154=std 0.0990468 delta target
star42ij
0.0179537=mean delta calib 0.00260889=std 0.0103525 delta target
star45ij
Jmag
Julian day

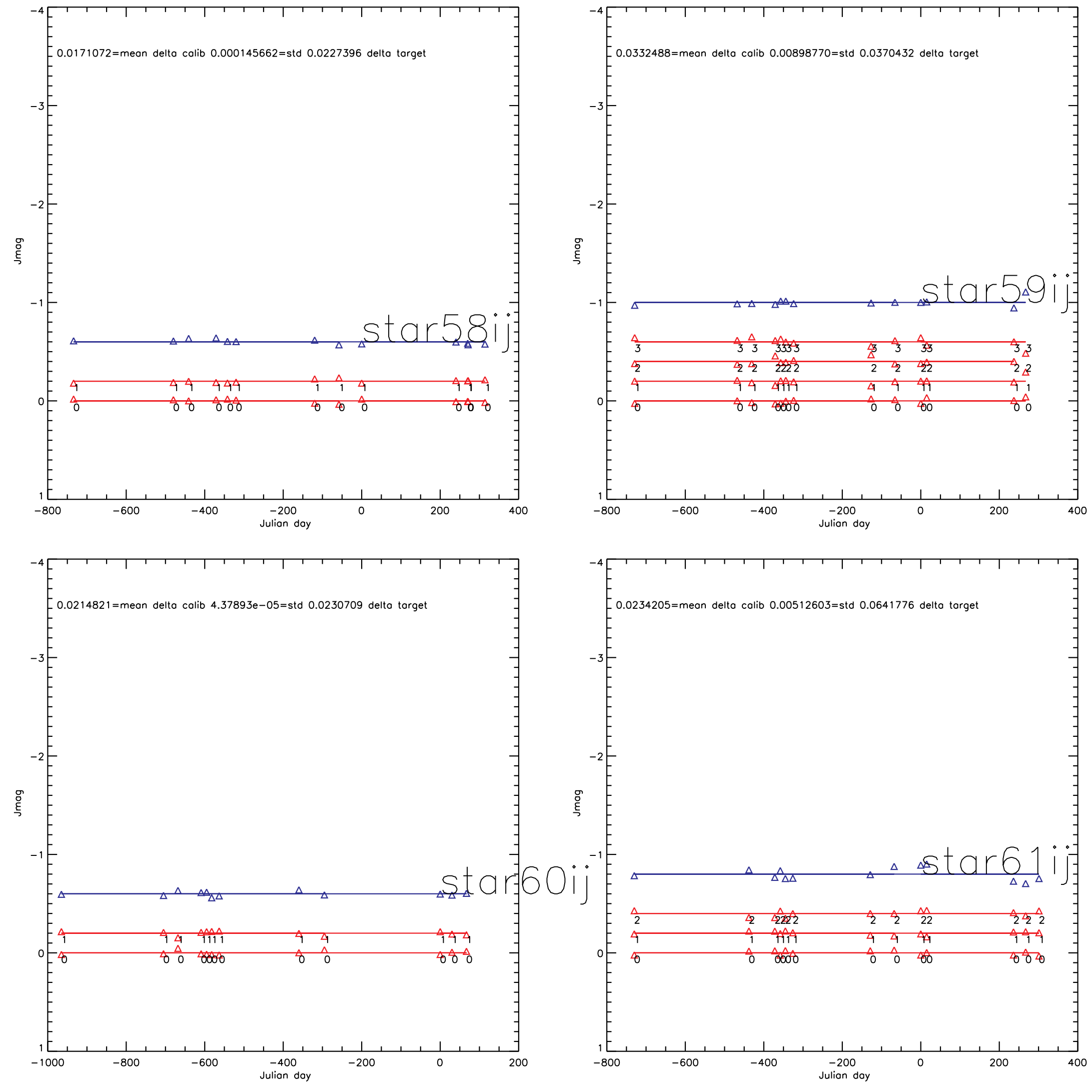

0.0210925=mean delta calib 0.00706285=std 0.0256799 delta target
star46ij
Jmag
Julian day

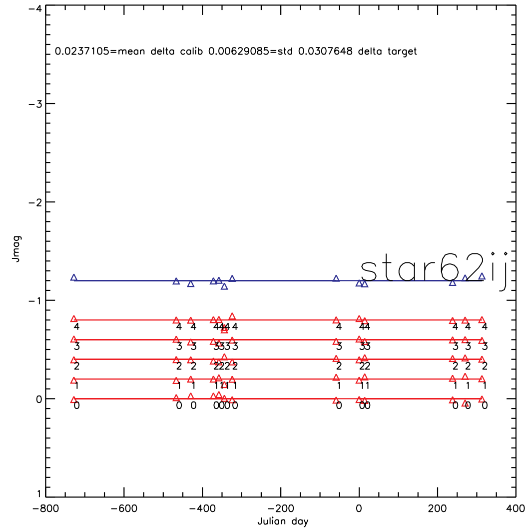

0.0265654=mean delta calib 0.00968405=std 0.0389027 delta target
star47ij
Jmag
Julian day

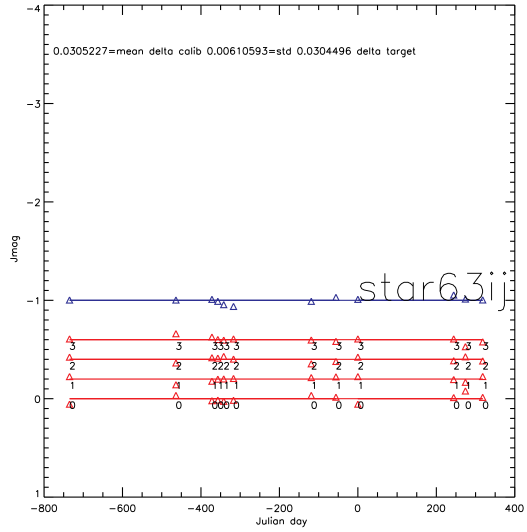

0.0215658=mean delta calib 0.000110057=std 0.0356804 delta target
star48ij
Jmag
Julian day

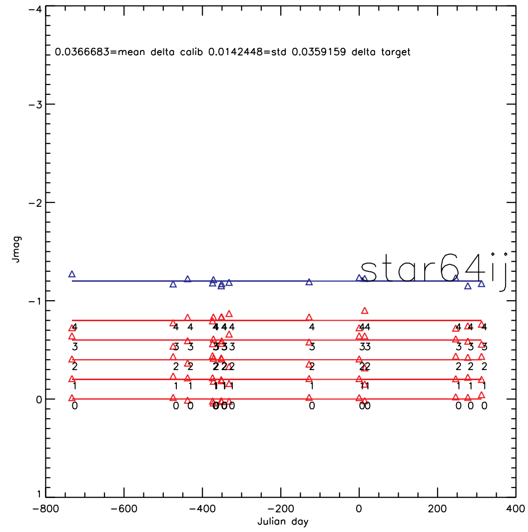

0.0326381=mean delta calib 0.0136032=std 0.0652645 delta target
star50ij
Jmag
Julian day

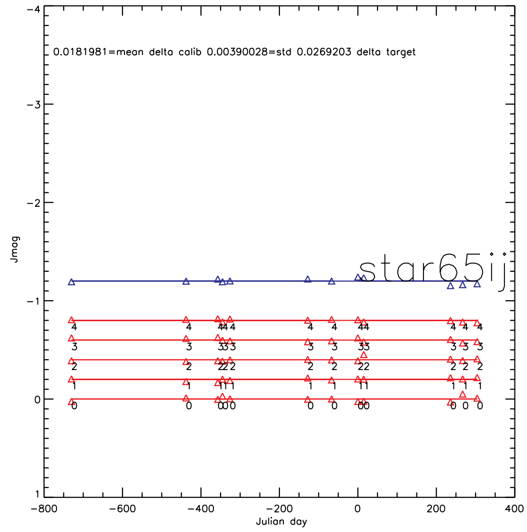

0.00554026=mean delta calib 0.000102293=std 0.0299099 delta target
star54ij
Jmag
Julian day
0.0248558=mean delta calib 0.00638419=std 0.0305326 delta target
star55ij
Jmag
Julian day
0.0169979=mean delta calib 0.00516549=std 0.153913 delta target
star56ij
Jmag
Julian day
0.00000=mean delta calib NaN=std 0.0303282 delta target
star57ij
Jmag
Julian day

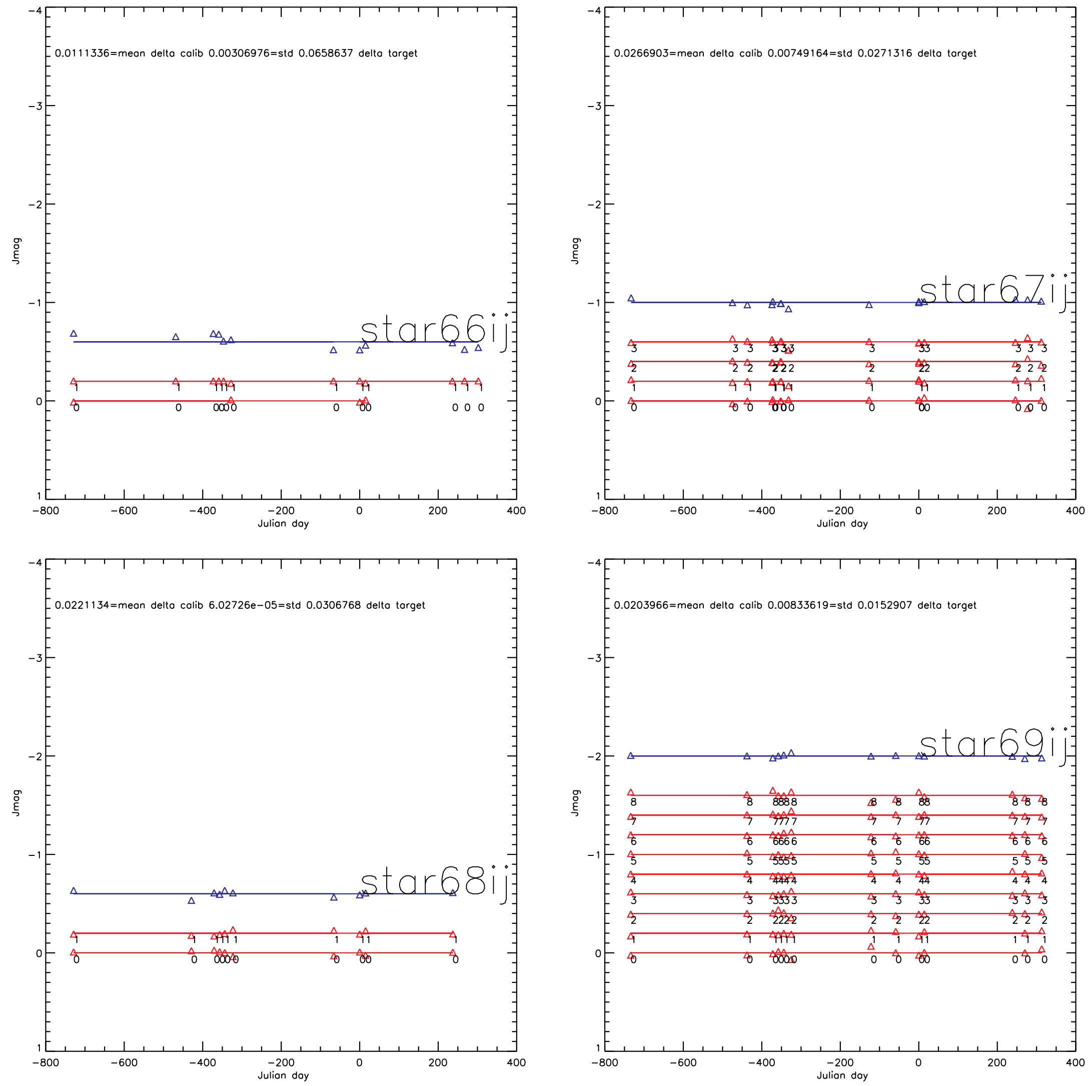

0.0171072=mean delta calib 0.000145662=std 0.0227396 delta target
star58ij
0.0332488=mean delta calib 0.00898770=std 0.0370432 delta target
star59ij
0.0214821=mean delta calib 4.37893e−05=std 0.0230709 delta target
star60ij
0.0234205=mean delta calib 0.00512603=std 0.0641776 delta target
star61ij
Jmag
Julian day

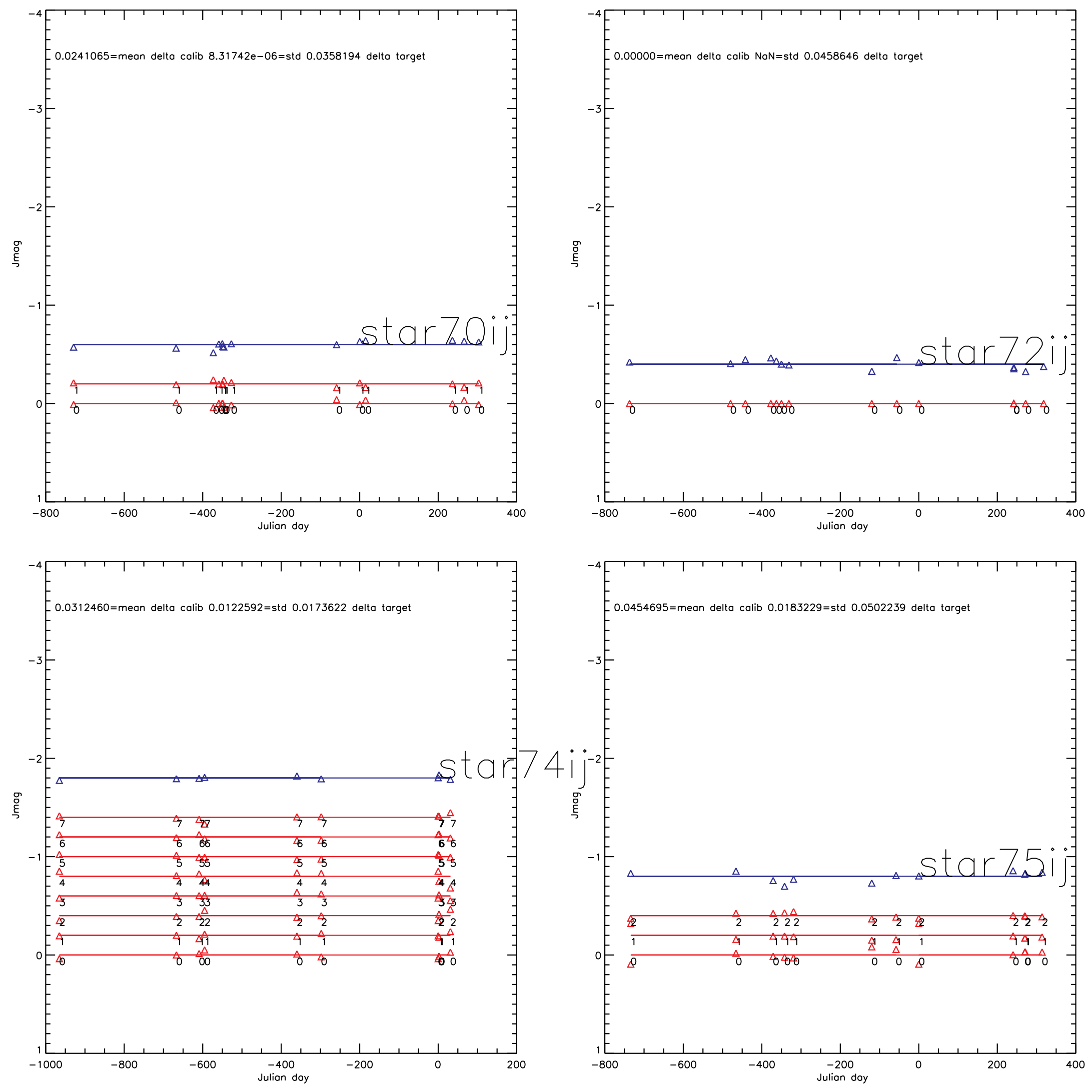

0.0237105=mean delta calib 0.00629085=std 0.0307648 delta target
star62ij
Jmag
Julian day

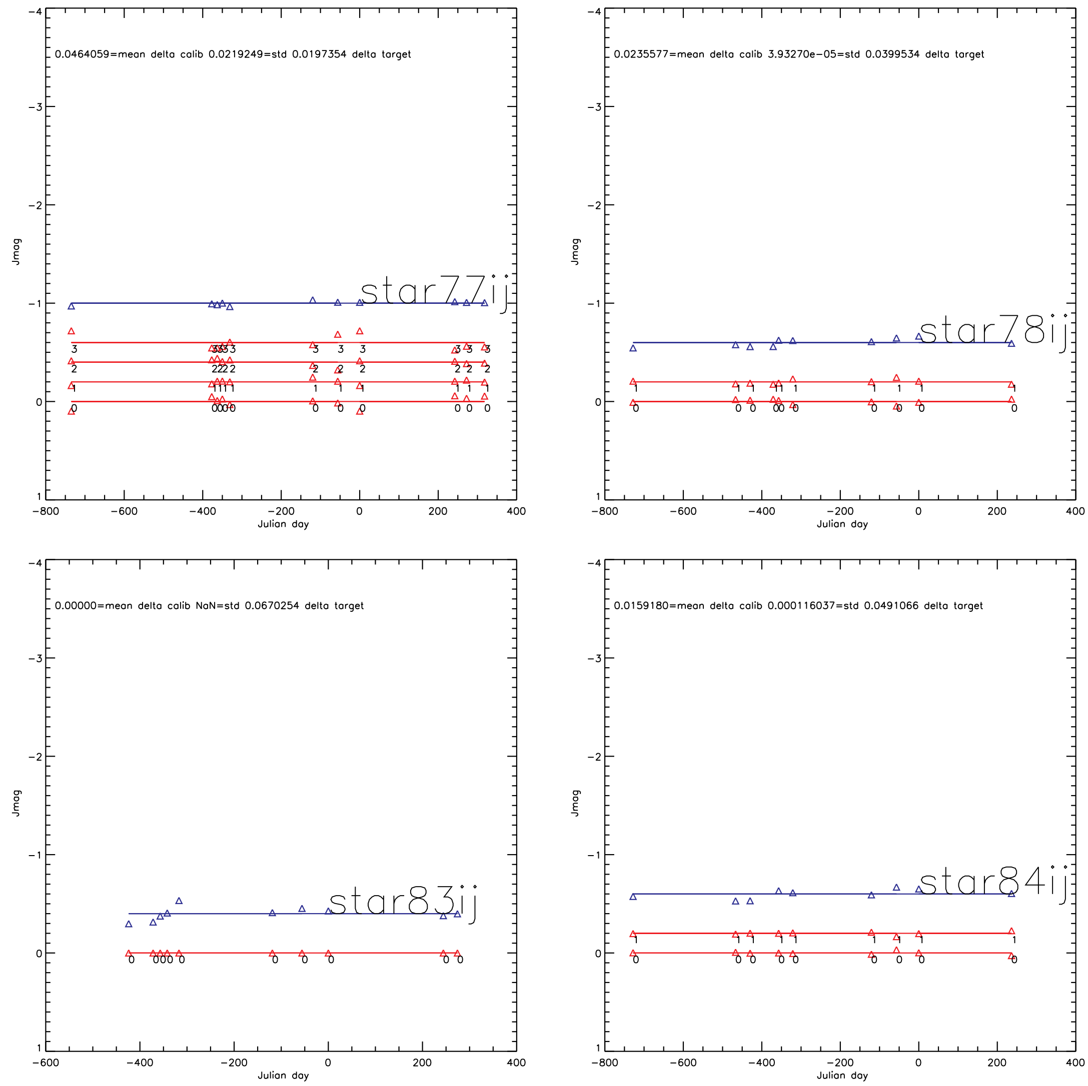

0.0305227=mean delta calib 0.00610593=std 0.0304496 delta target
star63ij
Jmag
Julian day


0.0366683=mean delta calib 0.0142448=std 0.0359159 delta target
star64ij
Jmag
Julian day

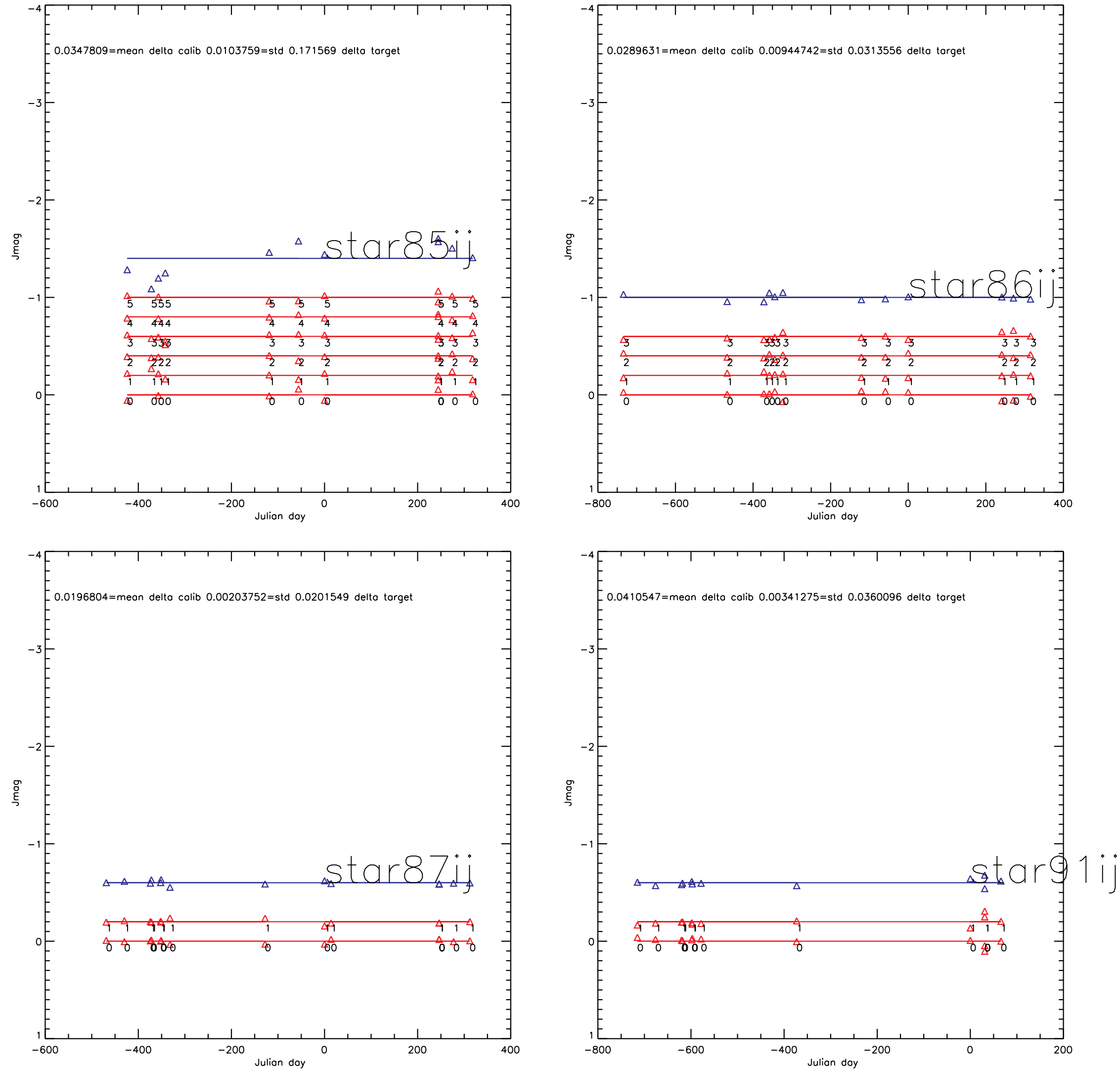

0.0181981=mean delta calib 0.00390028=std 0.0269203 delta target
star65ij
Jmag
Julian day


0.0111336=mean delta calib 0.00306976=std 0.0658637 delta target
star66ij
0.0266903=mean delta calib 0.00749164=std 0.0271316 delta target
star67ij
0.0221134=mean delta calib 6.02726e-05=std 0.0306768 delta target
star68ij
0.0203966=mean delta calib 0.00833619=std 0.0152907 delta target
star69ij
Jmag
Julian day


0.0241065=mean delta calib 8.31742e−06=std 0.0358194 delta target
star70ij
Jmag
Julian day
0.00000=mean delta calib NaN=std 0.0458646 delta target
star72ij
Jmag
Julian day
0.0312460=mean delta calib 0.0122592=std 0.0173622 delta target
star74ij
Jmag
Julian day
0.0454695=mean delta calib 0.0183229=std 0.0502239 delta target
star75ij
Jmag
Julian day



0.0464059=mean delta calib 0.0219249=std 0.0197354 delta target
star77ij
Jmag
Julian day
0.0235577=mean delta calib 3.93270e-05=std 0.0399534 delta target
star78ij
Jmag
Julian day
0.00000=mean delta calib NaN=std 0.0670254 delta target
star83ij
Jmag
Julian day
0.0159180=mean delta calib 0.000116037=std 0.0491066 delta target
star84ij
Jmag
Julian day


0.0347809=mean delta calib 0.0103759=std 0.171569 delta target
star85ij
0.0289631=mean delta calib 0.00944742=std 0.0313556 delta target
star86ij
0.0196804=mean delta calib 0.00203752=std 0.0201549 delta target
star87ij
0.0410547=mean delta calib 0.00341275=std 0.0360096 delta target
star91ij
Jmag
Julian day

ttnamet	OBJECT	nobs	ncal	calmean	calstd	targetave	targetstd
star04ij	star04ij	8	3	25.54727	23.28988	8.42287	0.02286
star05ij	star05ij	13	2	0.01589	0.00004	9.31623	0.01875
star06ij	star06ij	10	4	0.01475	0.00500	8.02060	0.04144
star07ij	star07ij	9	8	0.01977	0.00633	8.88422	0.03423
star09ij	star09ij	10	2	0.01550	0.00000	8.24750	0.02890
star10ij	star10ij	9	6	0.02276	0.00381	7.78167	0.02451
star11ij	star11ij	10	6	0.01609	0.00179	9.81120	0.03844
star16ij	star16ij	11	5	0.02467	0.01274	7.96355	0.02399
star17ij	star17ij	26	5	0.01899	0.00285	9.20685	0.02717
star20ij	star20ij	9	4	0.01941	0.00628	7.36344	0.02027
star21ij	star21ij	11	2	0.02304	0.00018	8.49564	0.02953
star22ij	star22ij	7	3	0.02329	0.00716	7.68243	0.02865
star23ij	star23ij	10	5	0.01951	0.00536	10.28870	0.01443
star25ij	star25ij	9	1	0.00000	NaN	11.30122	0.02081
star26ij	star26ij	11	1	0.00271	NaN	9.16300	0.02438
star33ij	star33ij	11	1	0.00000	NaN	8.09955	0.02381
star34ij	star34ij	8	4	0.01544	0.00491	8.36750	0.02483
star35ij	star35ij	9	9	0.02363	0.00792	7.51600	0.02602
star37ij	star37ij	6	5	0.03061	0.01074	7.70317	0.02375
star38ij	star38ij	11	2	0.03838	0.00790	7.92155	0.03294
star39ij	star39ij	6	8	0.02549	0.00767	6.90583	0.00950
star40ij	star40ij	7	4	0.01762	0.00860	7.00386	0.03606
star41ij	star41ij	6	11	0.02669	0.01684	6.84283	0.01254
star42ij	star42ij	8	3	0.01978	0.00815	7.44325	0.10781
star45ij	star45ij	9	4	0.01777	0.00178	7.52333	0.01061
star46ij	star46ij	7	6	0.02294	0.00855	6.98829	0.01386
star47ij	star47ij	10	8	0.02294	0.00864	7.87780	0.02729
star48ij	star48ij	9	2	0.02205	0.00003	7.34422	0.03919
star50ij	star50ij	7	5	0.03689	0.01542	7.09643	0.05018
star54ij	star54ij	10	2	0.00537	0.00005	9.92340	0.03265
star55ij	star55ij	36	5	0.01982	0.00646	9.09975	0.02153
star56ij	star56ij	9	6	0.01756	0.00640	8.64156	0.08727
star57ij	star57ij	10	1	0.00000	NaN	9.81200	0.03380
star58ij	star58ij	9	2	0.01957	0.00024	9.74356	0.02335
star59ij	star59ij	11	4	0.02629	0.00695	7.88445	0.01332
star60ij	star60ij	9	2	0.03248	0.00004	8.21189	0.04110
star61ij	star61ij	10	3	0.02441	0.00604	11.42820	0.05645
star62ij	star62ij	10	5	0.02549	0.00835	7.53560	0.02912
star63ij	star63ij	9	4	0.02330	0.00584	7.05856	0.02866
star64ij	star64ij	11	5	0.03648	0.01399	9.23200	0.03558

Masked border stars and circular bad pixel feature.

5.2.3. datapoints list on the mosaic

quickpos, pp[j], input1, dirin,dirout,root,nn,Npos

5.2.4. absolute photometry with 2MASS shifts

mypairscl,pp[j],input1, dirin,dirout,dir2mass,root2mass

5.2.5. reextract datapoints list – masterlist

quickpos, pp[j], input1, dirin,dirout,root,nn,Npos

ttnamet	OBJECT	nobs	ncal	calmean	calstd	targetave	targetstd
star65ij	star65ij	9	5	0.01689	0.00359	11.63878	0.01795
star66ij	star66ij	9	2	0.03188	0.03471	8.55200	0.06761
star67ij	star67ij	12	4	0.02433	0.01058	9.34633	0.02667
star68ij	star68ij	9	2	0.02329	0.00009	7.90600	0.03538
star69ij	star69ij	10	9	0.02052	0.00940	8.89110	0.01353
star70ij	star70ij	11	2	0.02506	0.00009	8.18491	0.03453
star72ij	star72ij	10	1	0.00000	NaN	10.28140	0.04048
star74ij	star74ij	6	8	0.02610	0.00595	7.66233	0.01520
star75ij	star75ij	8	3	0.05449	0.02139	7.26638	0.05185
star77ij	star77ij	8	4	0.04928	0.02094	7.02462	0.02215
star78ij	star78ij	9	2	0.02330	0.00002	7.47767	0.04228
star83ij	star83ij	8	1	0.00000	NaN	6.95213	0.07556
star84ij	star84ij	8	2	0.01247	0.00010	7.54025	0.05344
star85ij	star85ij	7	6	21.28346	23.27239	7.16029	0.26234
star86ij	star86ij	9	4	0.02634	0.00490	7.20933	0.03638
star87ij	star87ij	10	2	0.02137	0.00295	7.87870	0.02324
star91ij	star91ij	8	2	0.01631	0.00810	7.89500	0.01555