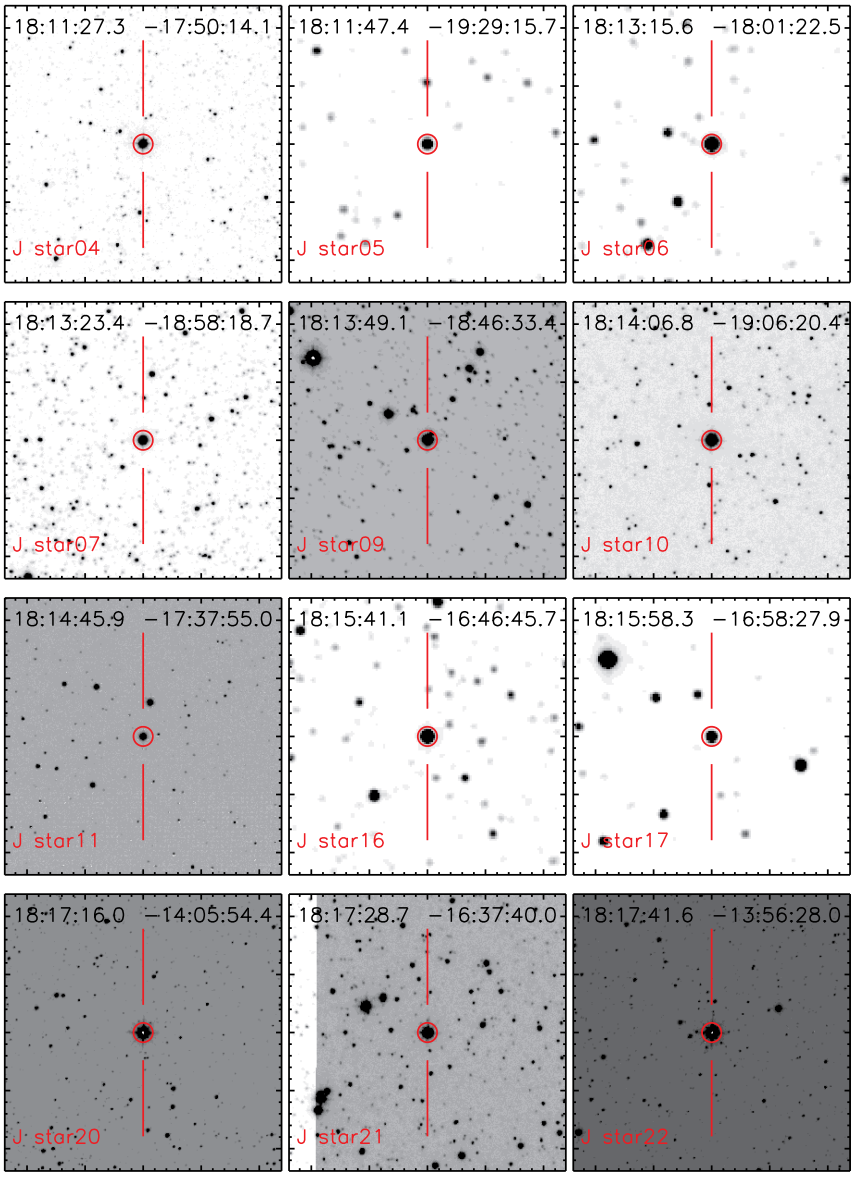
Fig. 2.— UKIDSS charts of the targets



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

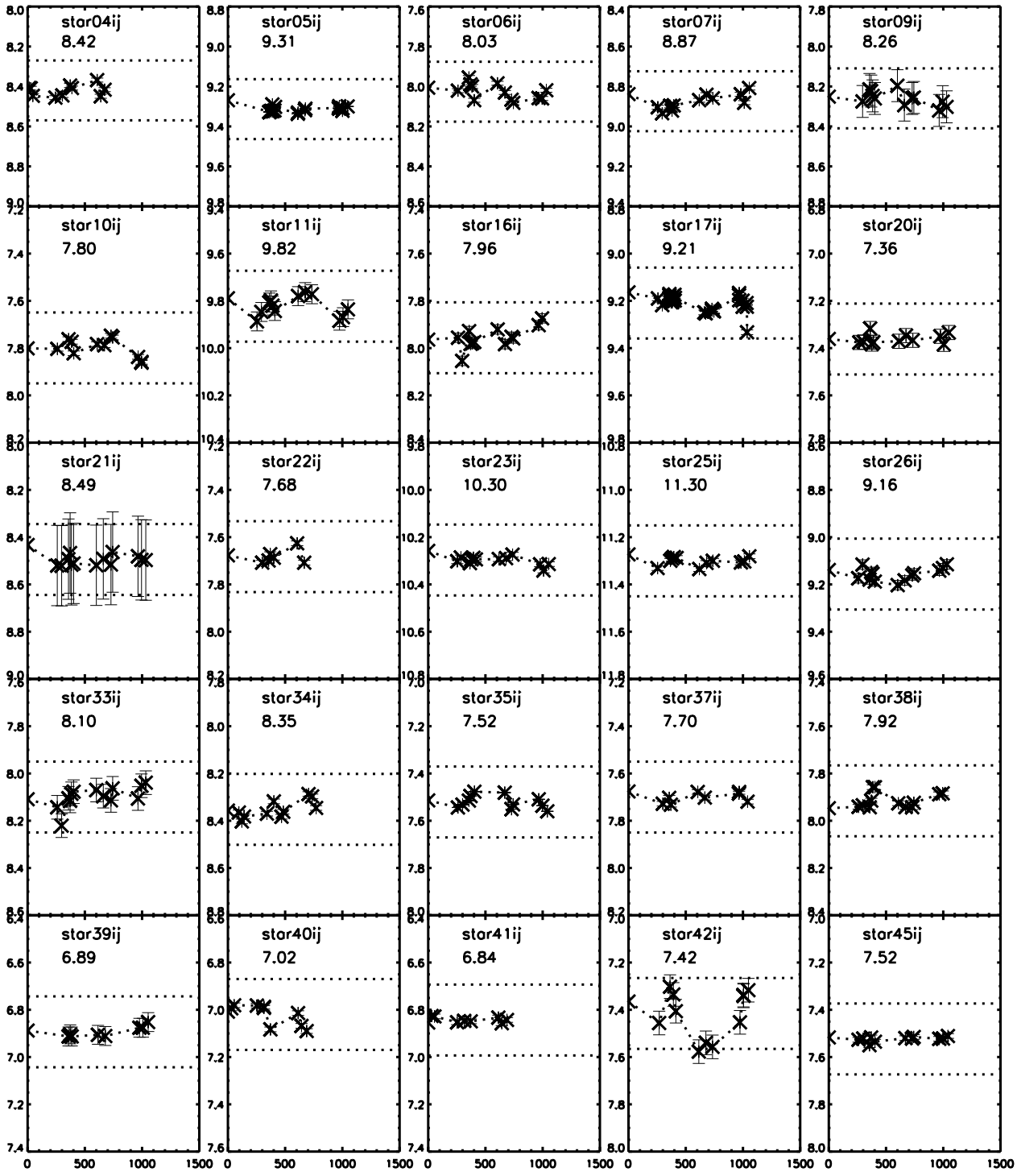
- output= frame+'pairs.tab.edited'
  RA-2mass DEC-2mass X Y N
  273.993005 -16.974407 229.014 229.715 1
  273.995133 -16.968340 306.073 258.522 2
  274.001456 -16.968794 296.052 338.301 3

- 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


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