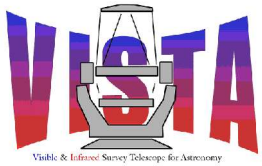
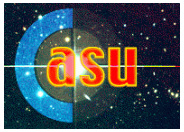


Data Flow System

Calibrating VISTA Data

Astronomy Unit
Queen Mary University of London

Jim Emerson



Cambridge Astronomical Survey Unit,
Institute of Astronomy, Cambridge

Simon Hodgkin, Peter Bunclark,
Mike Irwin, Jim Lewis

VISTA

Data Flow System

- 4-m Survey Telescope
- 1.65 deg diameter FOV
- Near-IR Camera

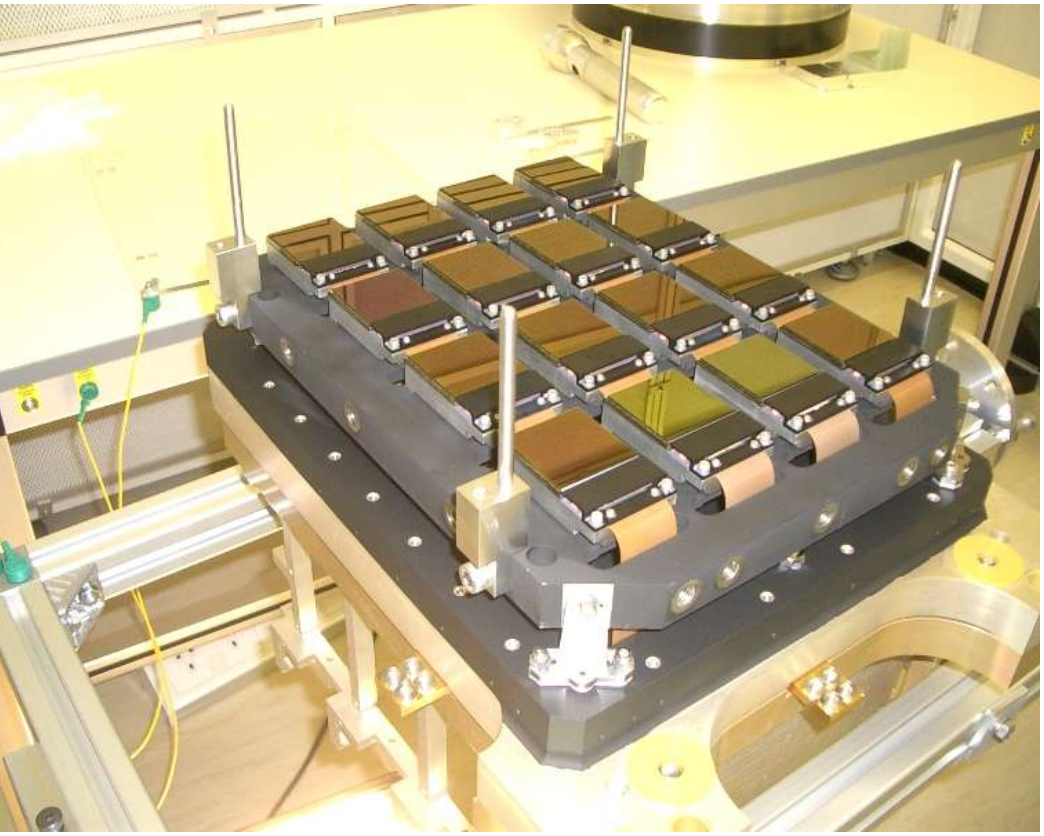
Telescope

tem

Camera

Focal Plane

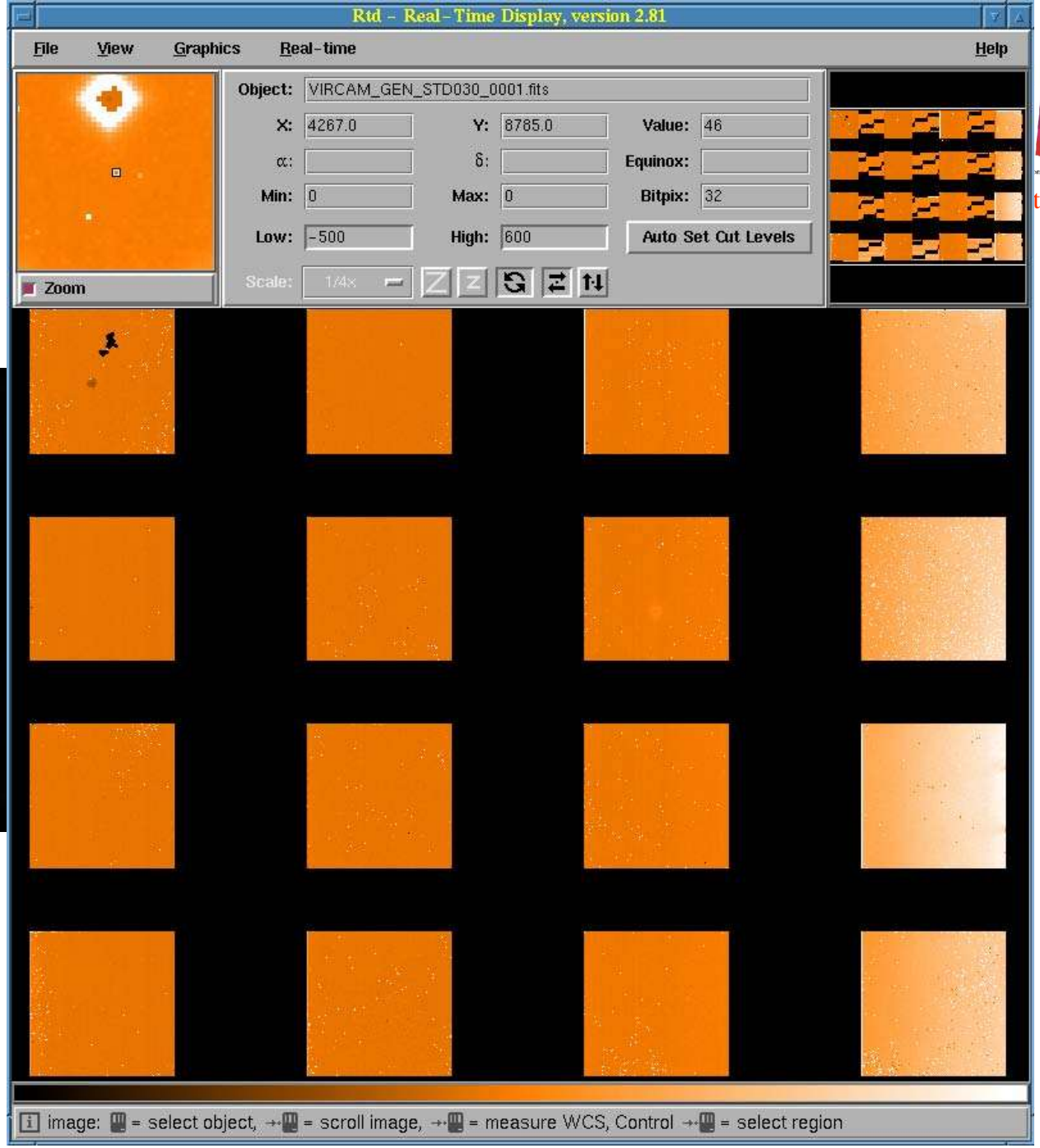
Data Flow System



- 16 Raytheon VIRGO 2k x 2k
- 4 x 4 sparse array
- spacings 90% & 42% of detector
- 0.34”pixels

1.65 deg diagonal

0.6 sq deg detector ‘pawprint’



tem

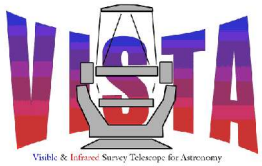
Types of Calibration

Data Flow System

calibrations characterize:

2. Transfer function (image in, DN out) of end-to-end system so that instrumental effects can be removed from the data.
   - VISTA has a wide field of view, so particular attention must be paid to variations across the field – illumination, etc etc
3. astrometric distortions of the images
4. photometric zero points and extinction coefficients
5. generate Quality-Control measures (see Riello's talk).

Calibration Pipeline



Data Flow System

- Removes instrumental artefacts
- Combine pawprints component exposures offset by small jitters
- Calibrates each pawprint photometrically and astrometrically
- Provides Quality Control measures

- See Jim Lewis's talk

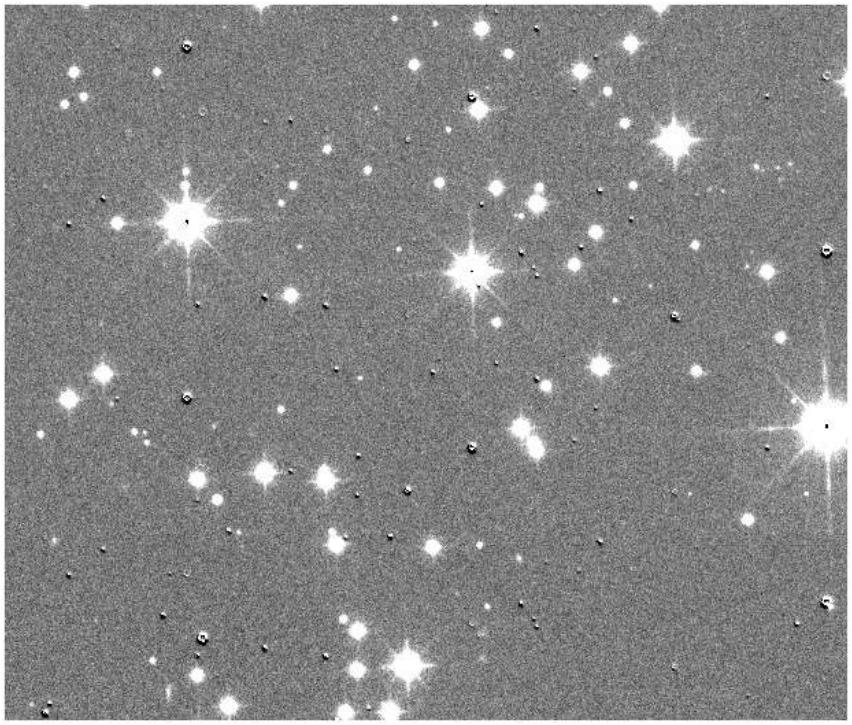
VISTA/WFCAM Similarity

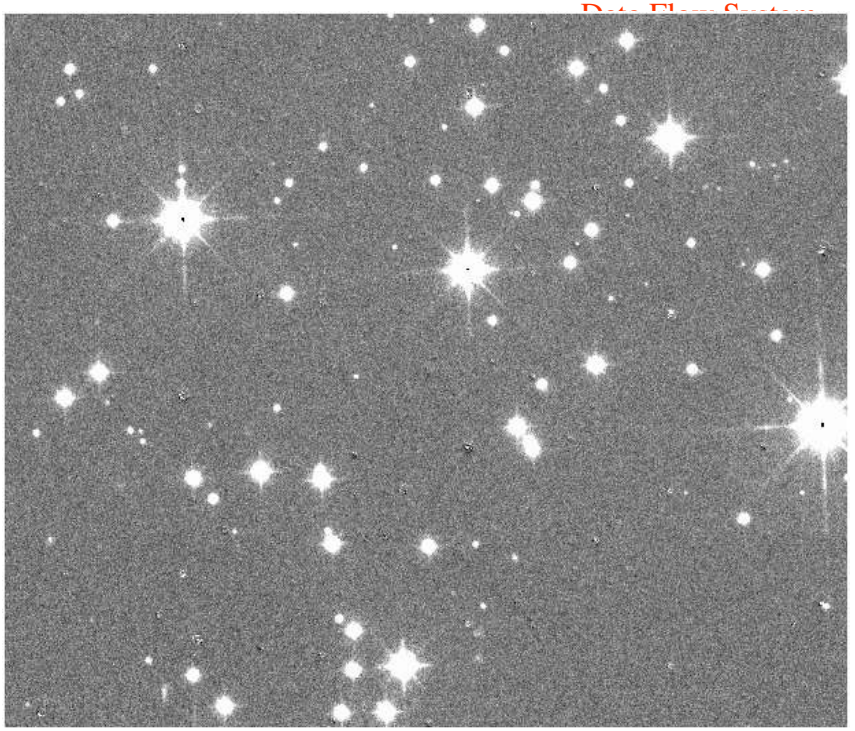
VISTA & WFCAM have similar data

	WFCAM	VISTA
Telescope	4-m (UKIRT)	4-m
2x2k Detectors	4 *x* Hawaii	16 *x* VIRGO
Pixel size	0.4 arcsec	0.34 arcsec

- How to mitigate risks in properly handling VISTA data (and archive volumes)?
- data flow system (developed in UK) designed to first handle already available WFCAM data
- Have learnt from this experience

Cross-Talk





•WFCAM has Cross talk from saturated images
=>‘bumps’ symmetrically above and below brightest stars.

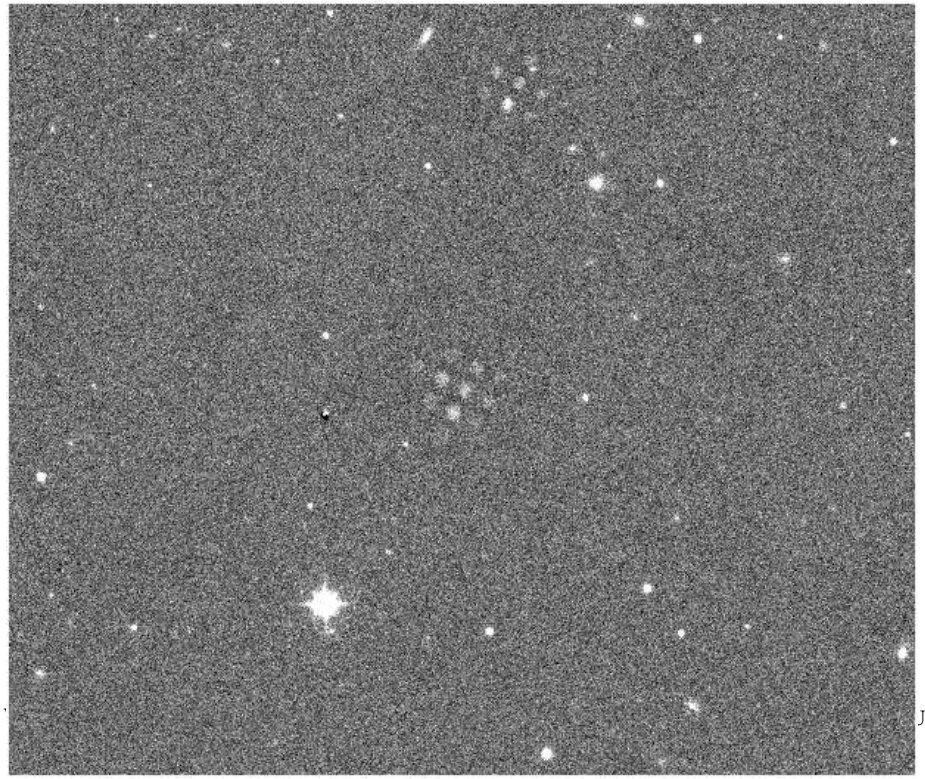
• WFCAM mostly (but not perfectly) correctable.

• VISTA???

Persistence

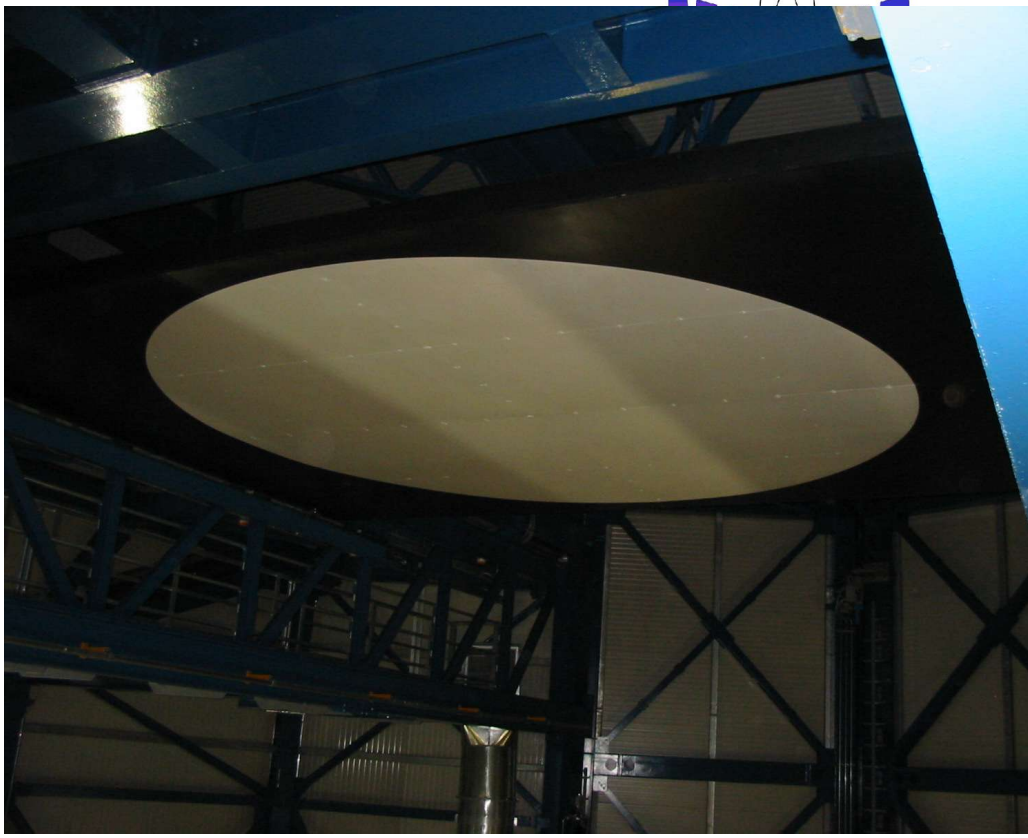
Data Flow System

- On a sequence of (monthly) dates choose a fairly empty field with a nearly saturated star.
- Take an exposure and then a sequence of dark frames to measure the characteristic decay time.



WFCAM hard to correct.
VISTA???

Dome ‘flat’ screen

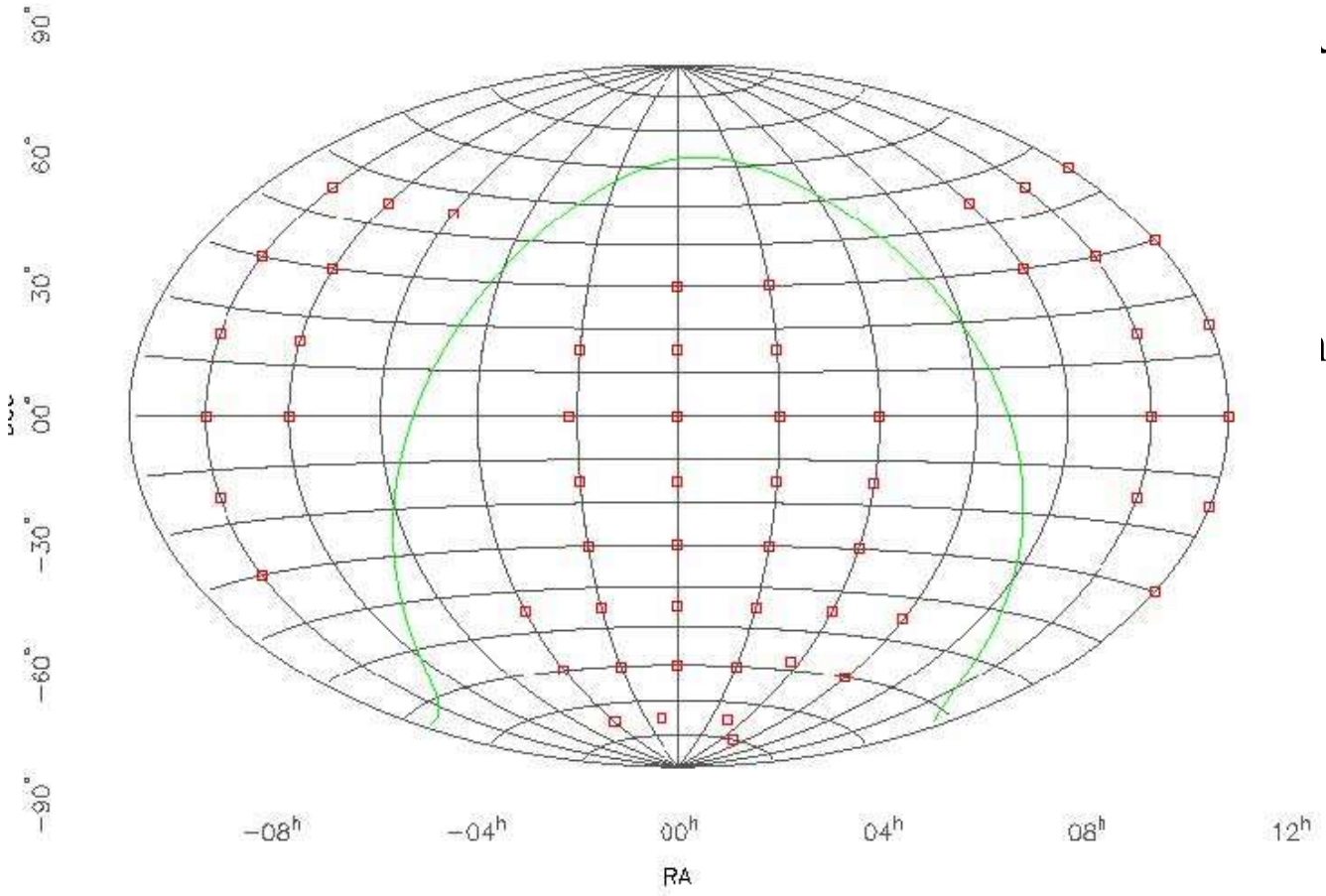


- Not used for flatfielding
- For Monitoring
  - instrument performance
  - image structure
  - confidence maps
- Linearisation:
  Take series of differently timed dome screen observations under constant illumination.
- with pixel timing => true linear value for each pixel & bad-pixel maps for each detector

Twilight (flat) fields

Data Flow System

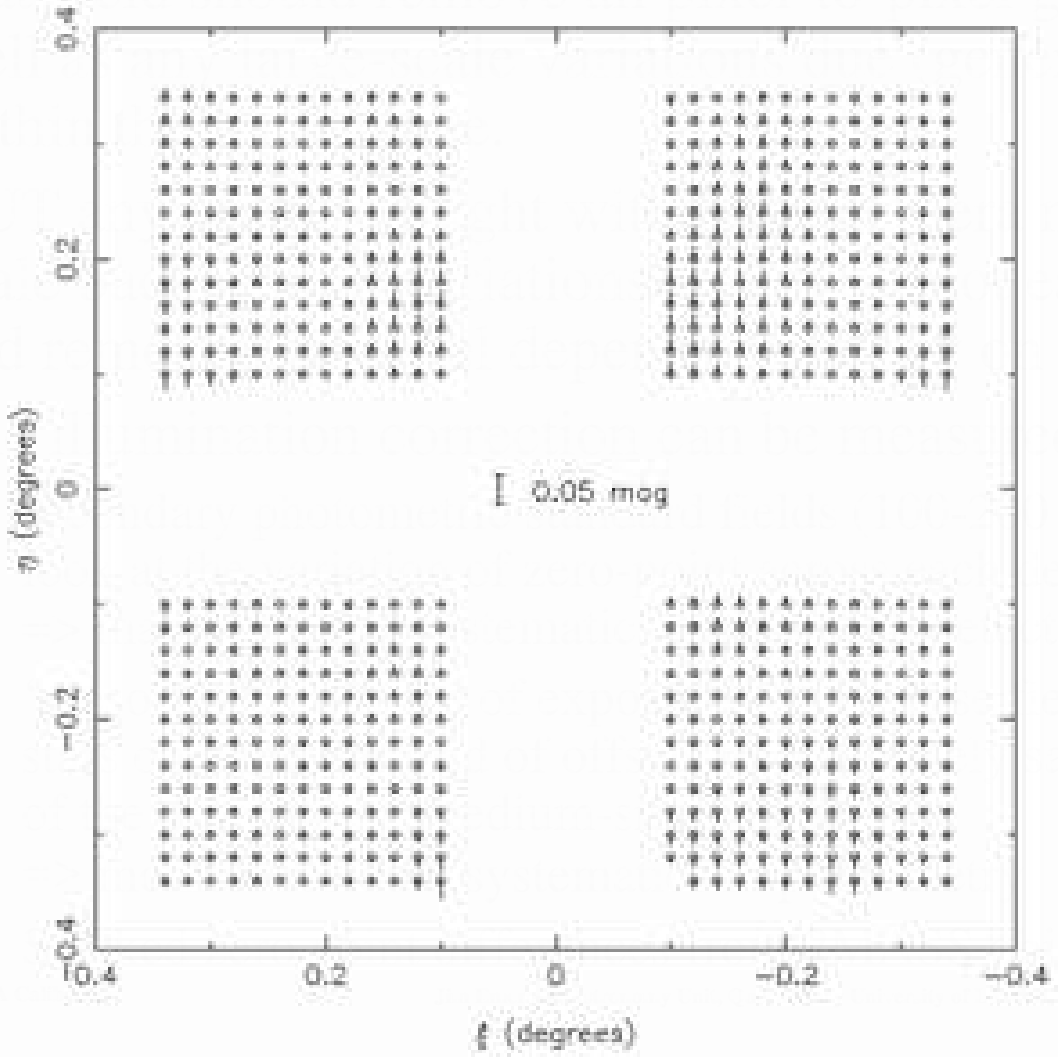
- ures



detector

Illumination Correction

Data Flow System



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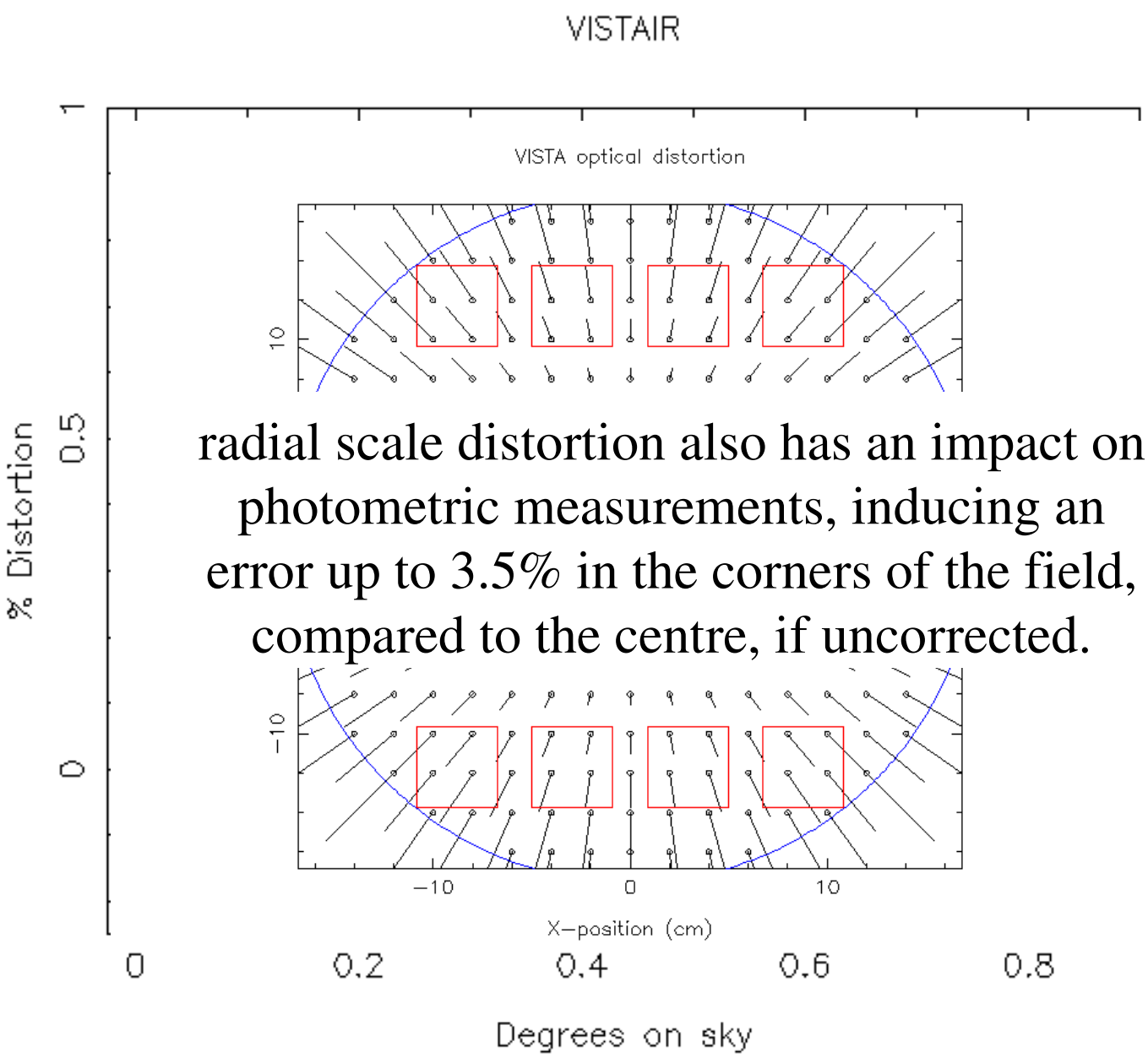


radial scale distortion also has an impact on photometric measurements, inducing an error up to 3.5% in the corners of the field, compared to the centre, if uncorrected.

s

lial term.

Calibration: Photometric-0

Data Flow System

- Goal 2% calibration accuracy
- Two *independent* methods:
  i. from 2MASS all-sky point source catalogue.
  ii. from routine observations of standard star fields

- Zeropoints derived for each image
- allows monitoring of effective Zero Points at ~few % level.
- Subsequent inter-detector comparisons enable residual errors in the gain correction to be detected and calibrated.
- Offline analysis => measure of median zeropoint for the night, associated error (and scatter), indicative of photometric quality

Calibration: Photometry-1

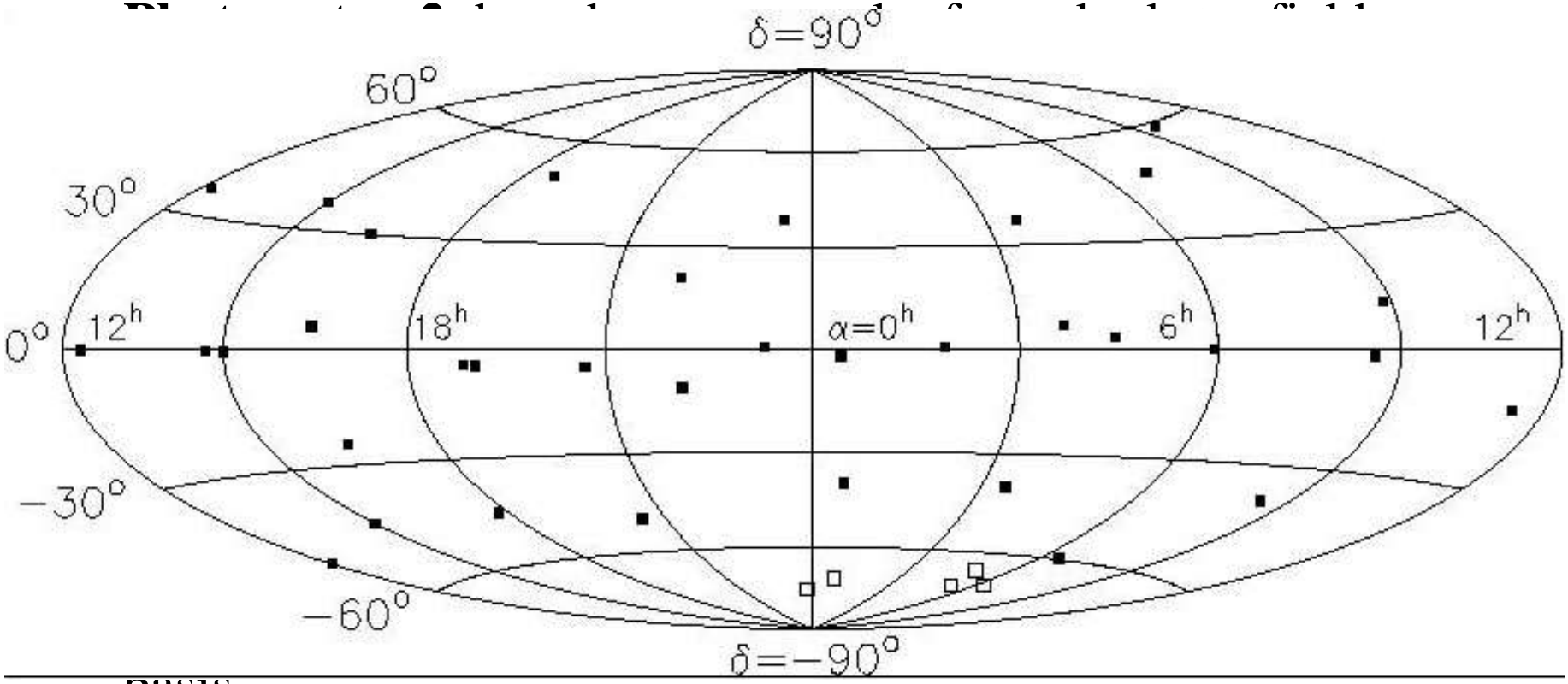
Data Flow System

- **Photometry-1**: based on 2MASS
- Initial photometric calibration for all filters based on 2MASS photometric system which is globally consistent to ~1% (Nikolaev et al. 2000).
- colour equations to convert 2MASS to VISTA instrumental system (with some colour s/n cuts)
- enables each detector image to be calibrated directly from 2MASS stars that fall within field of view.

- Analysis of WFCAM data wrt UKIRT standards
  => 2MASS calibration delivers product frame-by-frame photometric zero-points at the +/-2% level (with factored-in extinction tracking).

Calibration: Photometry-2

Data Flow System



basis.

- *Touchstone* fields provide information on the stability
- used to measure illumination correction.

Extinction

Extinction monitored

- from zeropoints of the 2MASS stars in each pawprint
- from zeropoints in individual *Touchstone* fields
- through each (photometric) night assuming a fixed zero point and measuring *Touchstone* fields over a range of airmass.

v System

Data Flow System

The End