The VISTA Data Flow System

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Introduction to CASU

- Small group within the Institute of Astronomy, specialising in survey astronomy.
- Pipeline reduction of imaging data
  - APM (Schmidt Plates 1 x 40k x 40k)
  - INT Wide Field Camera (4 x 2k x 4k)
  - ESO WFI on 2.2m at La Silla (8 x 2k x 4k)
  - MOSAIC-1 on KPNO 4m (8 x 2k x 4k)
  - MOSAIC-2 on Blanco 4m at CTIO (8 x 2k x 4k)
  - AAO WFI on AAT (8 x 2k x 4k)
  - CIRSI on INT (4 x 1k x 1k)
  - INGRID on WHT (1k x 1k)
  - UFTI on UKIRT (1k x 1k)
  - WFCAM on UKIRT (4 x 2k x 2k)

Introduction to VDFS

- PPARC funded facility to provide an end-to-end data-flow system for VISTA and WFCAM.
- Quality control and calibration pipelines
  - Paranal and Garching
- Science pipeline for full calibration of science data.
  - Cambridge
- Science archive acts as the point of access of the reduced data. Plus some further processing.
  - WFAU, Edinburgh

Data Flow

- Raw telescope data is assessed by the summit pipeline (QC1)
- Shipped to Garching (discs)
- Shipped to CASU for science reduction and calibration. (discs)
- Calibrated data shipped to Edinburgh for archiving (ftp)

IR Data Reduction Worries

- IR detectors are currently inherently more unstable than optical CCDs.
  - Some odd electronic effects
- Sky emission > 100x brighter than most objects
  - And it's variable both spatially and temporally!
- Exposure times are short, so data rates are very high.
  - 200-500 Gb/night expected for VISTA public surveys
  - Rice tile compression can save factors of 3-4 in 32 bit integer data

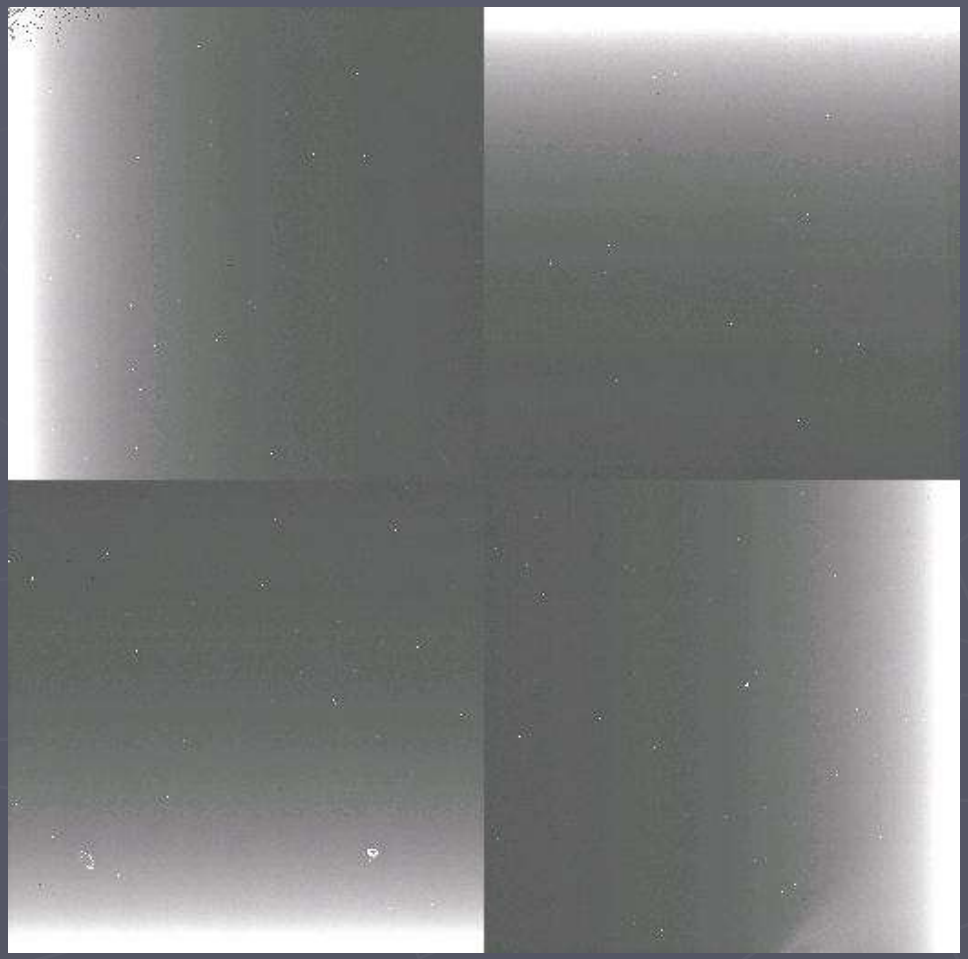
VDFS Pipeline Recipes

- Create master calibration frames (dark, twilight flats, confidence maps, etc)
- Linearity analysis
- Detector noise & dark current properties
- Persistence and crosstalk analysis
- Illumination correction analysis
- Full reduction recipes for standard star and programme fields

Processing Steps

- Reset correction (debias)
- Linearity correction
- Dark and reset anomaly correction

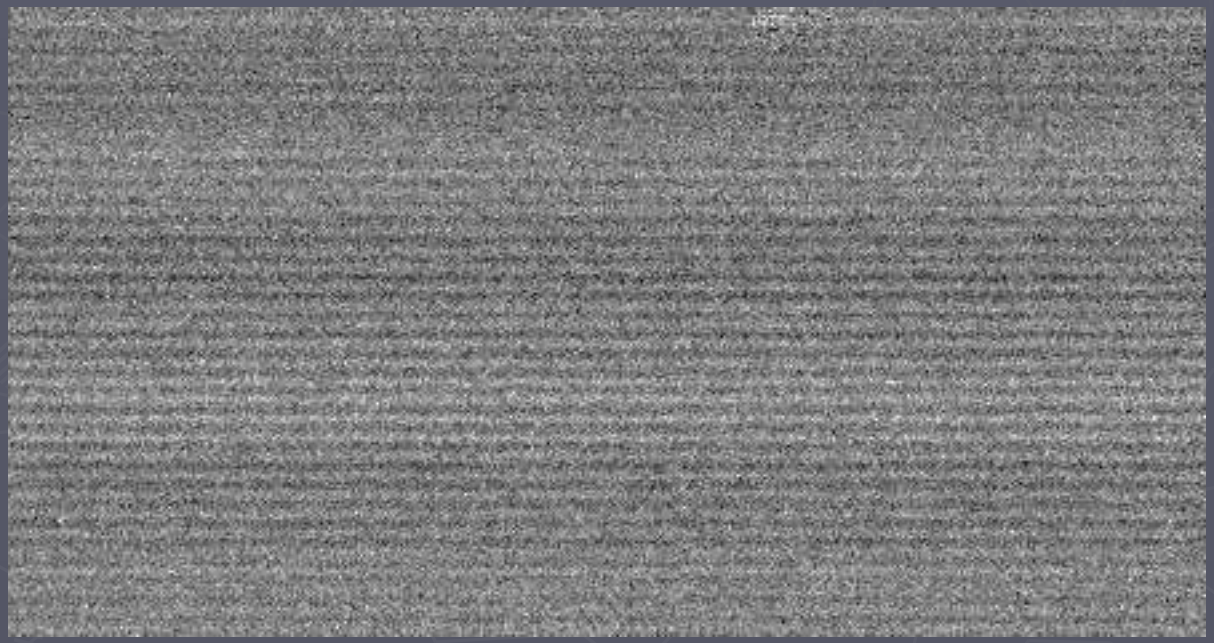
Reset Anomaly (WFCAM)



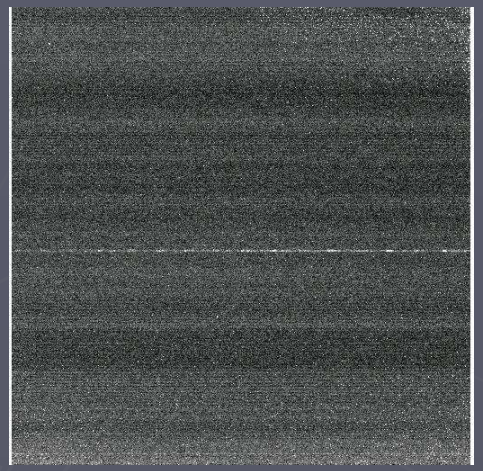
Processing Steps

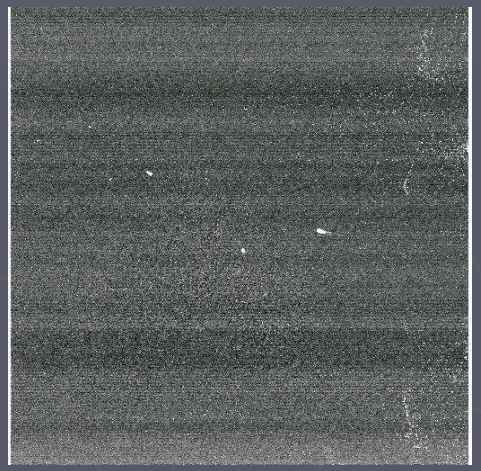
- Reset correction
- Linearity correction
- Dark and reset anomaly correction
- Flat field correction
- Background correction (defringing)
- Destriping

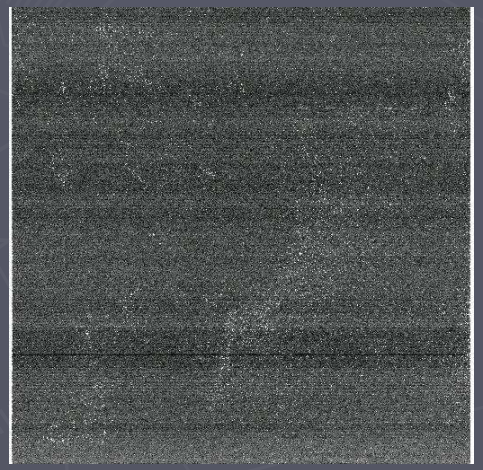
Stripes Close Up (VISTA)

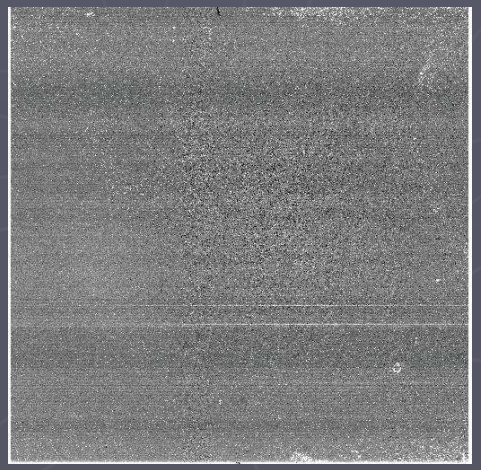


Stripes (VISTA)





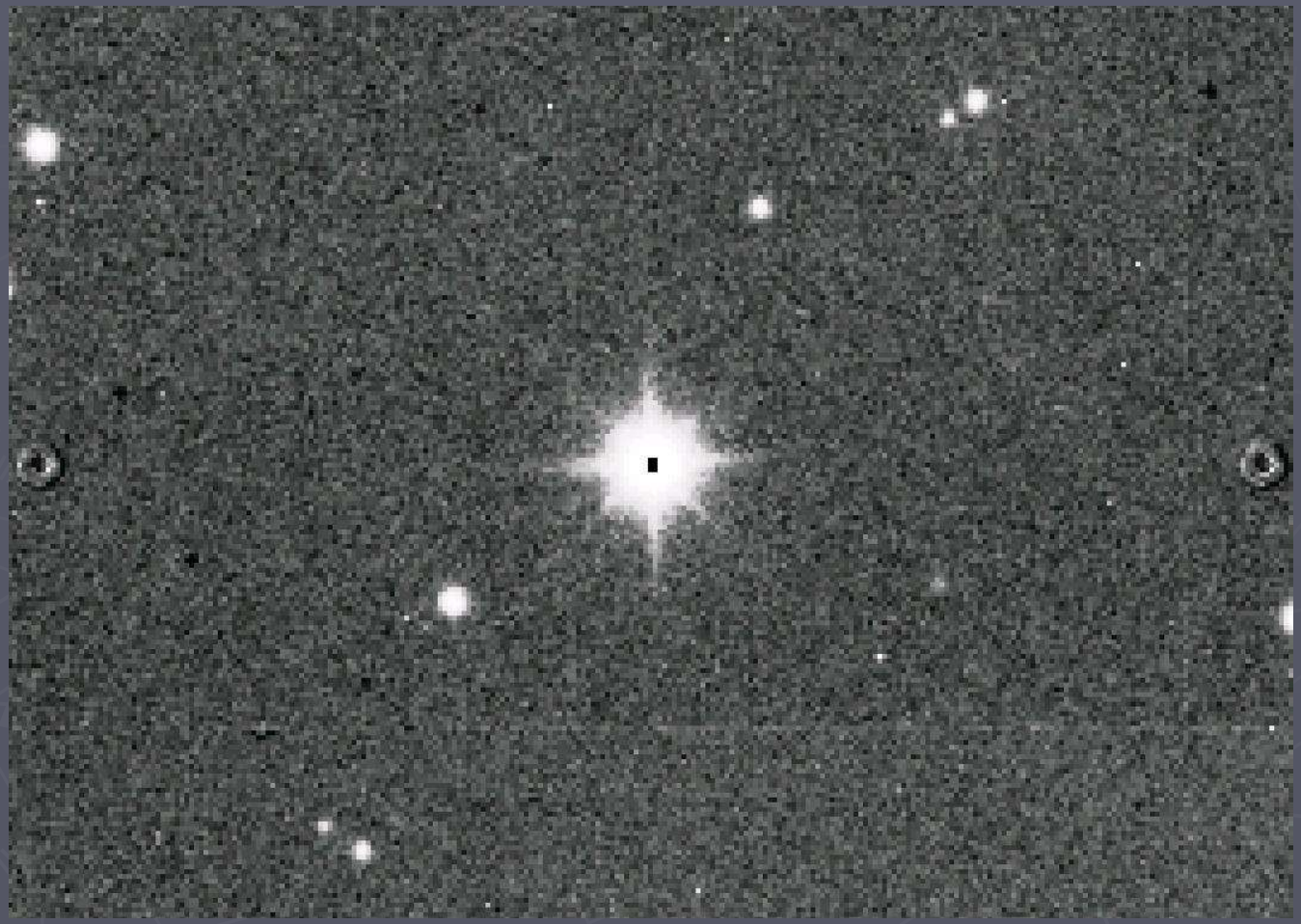




Processing Steps

- Reset correction
- Linearity correction
- Dark and reset anomaly correction
- Flat field correction
- Background estimation and subtraction (defringing)
- Destriping
- Image persistence and detector crosstalk removal

Crosstalk (WFCAM)



Processing Steps

- Reset correction
- Linearity correction
- Dark and reset anomaly correction
- Flat field correction
- Background estimation and subtraction (defringing)
- Destriping
- Image persistence and detector crosstalk removal
- Interleaving
- Dithering/Jittering
- Catalogue generation
- Astrometric calibration
- Photometric zeropoint calibration
- (Tiling)

Summit & Garching Pipelines

- QC1 parameters
  - e.g. photometric zeropoints, astrometric fit quality
- Written using ESO qfits/CPL infrastructure
  - Both use the same software modules
- Reduce a pawprint
- Amount of processing can be scaled down
- Calibration images (flats etc) from a master library.

Cambridge Pipeline

- Full reduction
  - Tiling and sky correction
- Catalogue generation is done for both pawprints and tiles
- Results shipped to WFAU
- Some of the same CPL based modules reused. Some additional modules required.

Current Status of VISTA Pipelines

- Version 0.4 ESO pipelines currently being tested
- Version 0.5 to be released end of February
  - Full compliment of recipes (almost!)
  - PAE
- WFCAM pipeline is a prototype for the extra functionality required by Cambridge VISTA pipeline

A Typical Recipe Run…

```
jim@dhcpsec56(~){22}> esorex vircam_jitter_microstep_process --ext=0 all.sof

     ***** ESO Recipe Execution Tool, version 3.6  *****

[ INFO  ] vircam_jitter_microstep_process: Beginning work on extension 1

Segmentation violation
jim@dhcpsec56(~){23}>
```