

Science Use Case (SUC) for the Pan-Andromeda Archaeological Survey (PAndAS) [P.I. Alan McConnachie]

Brief summary of main science goals:

To obtain accurate g, i photometry of stars in the outer regions of M31/M33 (D~800kpc), 3 – 4 magnitudes below the tip of the red giant branch (g~25.5, i~24.5 @ S/N=10) over a contiguous area of > 300 sq. degrees. These data will allow us to identify and analyse new satellites of M31 and M33 (globular clusters and dwarf galaxies), and to explore the structure, sub-structure and star formation history of the outer regions of these galaxies down to extremely low surface brightness (~32 – 33mags/sq.arcsec), to compare and constrain cosmological models of galaxy formation.

1. Access to, and monitoring of, data

I need to be able to download the CFHT raw observations for my CFHT project within a few days of the observation being taken (so that data of insufficient quality has time to be reinserted back into the queue as necessary).

I need an interface on my desktop that allows me to issue a query that tells me which observations have been completed for my project, and which lists the IQ of each field and any comments made by the observer or other team member.

The result of the query should include a map of the survey area which highlights regions that are completed, regions which are planned but not yet observed, regions where poor quality data have been taken, and regions where the observations are partially complete.

The result of the query should include a way to determine the IDs for each individual field/observation (private ID, CFHT file name...)

I should be able to bring up a tool to examine the images. I need to be able to add comments based on that examination. These comments should be persistent and appear to all team members (and all other users at a later date) when they issue a query to check observational progress.

I should be able to flag any observations of insufficient quality which will need to be re-observed and, ideally, this flag should appear to observers at the telescope so that they know this observation needs to be retaken.

I should be able to retrieve the data onto my desktop.

I should be able to move the data into a storage space that is accessible by all team members.

2. Data Reduction (Photometry and Astrometry)

I need to do a query that gives me a table which summarises the status of the data reduction for all fields e.g., first pass photometric/astrometric calibration at the individual frame level complete? Images stacked?

I need to be able to automatically identify all (point) sources and measure their magnitudes (photometry of extended sources not required). Aperture photometry is sufficient, although the option of PSF-fitting would be extremely useful for fields closer to the main body of M31 and M33.

I need to cross correlate stellar positions with the numerous unsaturated 2MASS point sources available per field to obtain an accurate astrometric calibration.

I need to be able to identify all common (point source) objects between adjoining fields and use this overlap to obtain a global photometric/astrometric calibration for all fields (on completion of survey, this will include over 300 individual fields) and produce a catalogue of sources with duplicates removed.

I need to merge the g and i catalogues together to obtain a complete source catalogue

3. Querying the database

I need to be able to retrieve statistical confidence maps for all image products.

I need to be able to query the database to obtain Data Quality Control (DQC) measures for each object (and lists of objects), including measurements of seeing, average stellar shape, aperture corrections, sky background, noise levels, limiting magnitudes.

I need to be able to query the database to obtain stacked and/or mosaiced data for individual fields or areas centered on specific coordinates.

I need to be able to retrieve lists of all identified objects from the database, selecting on DQC measures, morphological classification in individual filters, magnitude, RA/Dec etc.

I need to be able to overlay these lists on the corresponding images to visually identify all sources.

Ideally, I should be able to query databases to find extant imaging of these fields in other filters.

All Cols need to be able to Query the database and download the lists/images, described above, onto their desktop for further analysis regardless of geographical location.

