ULTRACAM Pipeline Software

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Requirements:

1. *To provide fully-reduced data for the observer.*
2. *To provide the observer with an idea of what the data are like in near real-time.*

Goal:

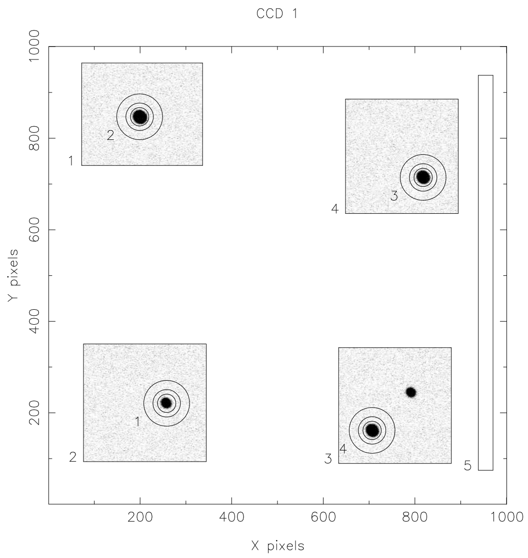
- *To produce fully-reduced data in near-real time.*

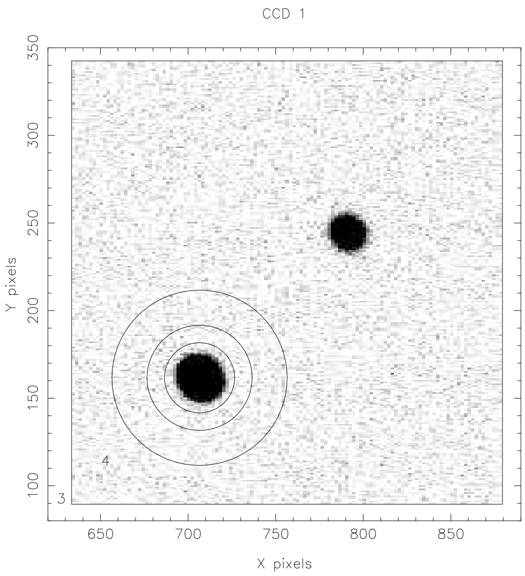
Preparatory Tasks

Concentrate upon *stellar photometry*.

First one needs the ability to perform various *preparatory* tasks:

- Prepare flat-field, bias, dark and bad-pixel frames.
- Identify target and comparison stars in each CCD.
- Define star and sky photometric apertures.
- Characterise the noise properties of each CCD (and possibly each readout)





Time-critical Tasks

The *time-critical* element of the pipeline must do the following:

1. Load flat-field, bias, dark and bad-pixel frames.
2. Load the photometric apertures.
3. Define the methods e.g. of centroiding.
4. Identify the next frame to be reduced (if any).
5. Load the next frame.
6. Centroid the apertures.
7. Estimate the sky background and extract fluxes while applying dark, bias, flat-field and bad-pixel corrections.
8. Save the results to disk.
9. Return to step 4.

Of these steps, step 6, that of centroiding is the trickiest.

Implementation

The nature of ULTRACAM data and the tasks that the pipeline has to perform have led me to the following decisions:

- While I may borrow techniques from standard photometry packages, they will be of no direct use.
- The code will be written in C++ to handle the data structures.
- The code will consist of a suite of stand-alone routines.
- The time-critical element will be a single program to minimise overheads.

Interfacing with the ATC – I.

Much of the pipeline is stand-alone, but there are a few areas of overlap with the Data Acquisition System (DAS) side of ULTRACAM:

What is the next frame?

Get files with http requests (Chris Tierney).

Q:

1. How do I know when I can do this?
2. How do I know what file to ask for or do I just get the current file?
3. What will I get?
4. Should the data go to the reduction program or should I send it straight to disk and have the reduction program pick it up (my preferred option)?

Interfacing with the ATC – II.

Window definition

Q:

1. Will the DAS need my input for defining windows?
2. I am happy if not, but if yes
   (a) how should the information be transferred?
   (b) what restrictions need be obeyed by the windows?

Variation of CCD parameters

Q:

1. Given two corners of each CCD will be used for readout, will fundamental parameters such as readout noise, bias level and gain vary according to the region of the CCD?

Timescales

I estimate that it will require 2 months to complete the initial implementation of the pipeline software.

I am aiming for completion in mid-September.

Speed and functionality are the main aims here; at this stage it will be possible to estimate the frame rates that the pipeline will be able to handle. Beyond this point I expect to work on providing graphical user interfaces for the programs and writing the user's guide.