AUTOGUIDING

- Power up the Mallincam but do not start the Mallincam Program.
- Start TheSky6 and connect to the telescope.
- Click on the MetaGuide icon located on the Alcyone computer desktop.
- Click 'Setup'.
- On the Scope Setup tab, click 'ASCOM Chooser'. Generic hub is already selected.
- Click 'OK' in the ASCOM Telescope Chooser window.
- Click 'OK' on the Scope Setup tab.
- Select and approximately centre your guide star.
- Click 'Full Calibrate' on the Scope Setup tab.
- See below for more detailed instructions.

Approximately center the star in the field and press FullCalibrate to calibrate the view orientation and scale. A dialog and progress bar will appear in the upper left. Do not interact with the telescope or the application until the calibration completes. The star should never leave the view; if it does, cancel the calibration. Make sure the telescope is not bumped or leaned on during this procedure, and that it goes to completion. If you have just one bright star in the view, the crosshairs should stay on it steadily – but if there are other bright stars that pull the crosshairs away, simply press Lock and the crosshairs will turn red, indicating they are locked on to that one star. The star may drift about and the crosshairs will track – but abrupt motion may lose the lock. In most cases, it is best to lock the star during calibration. If you want to choose a different star, such as one that is more centered or one that is not saturated, simply ctrl-click on the star and it will be locked.

If the view is disturbed by hot pixels, see the section below on hot pixel removal.

The calibration process moves the mount in a '+' pattern to determine both the scale and orientation of the guide camera. The guide camera need not be aligned in any particular way. There is a quicker calibration, QuickCal, described below – but this one should take about 1-5 minutes on a typical mount – mainly slowed by declination backlash. QuickCal avoids this delay and can be much faster.

The motion in RA should be fairly rapid since there is little or no backlash in the constantly-moving RA drive, but the calibration may stall for some time in the declination direction when declination reverses. This is entirely dependent on the behavior of the declination gears, so don't be alarmed if the calibration seems to stall when it begins the vertical part of the '+' motion. Note that the final part of the '+' motion will be short and leave the star a bit off center at the completion. You may be able to improve the declination performance by adjusting backlash compensation features in the mount controller.

Note that the calibration procedure will set the calibration factor so the image scale is exact. Furthermore, it will determine the orientation of the E/W direction in the field, and whether the N/S direction is inverted. Although the E/W and N/S alignment of the view does not matter for the calibration, it is sometimes convenient to have RA motion nearly along the horizontal axis so that drift in Y corresponds to N/S drift. If you want to orient the guide camera N/S E/W, use the crosshair feature (checkbox at the bottom of the main dialog) and move the star back and forth as you rotate the camera until it is aligned to the crosshair.

ASCOM is able to deduce much more information from the calibration process than GPUSB or LPT because it can tell which whether guide commands move the telescope north or south. This is described in more detail later.

Once the telescope is calibrated, the guiding-related features such as Guide and Center will be enabled.
If you ever exit MetaGuide and return to it with no changes at all to the telescope and camera, you may recover the previous calibration by selecting UsePrevCal in the Setup dialog. You must manually save the setup values in a .mg file using Save or Save As, otherwise the session values will be lost.
To center a star approximately in the field, just press the Center button. This may take some time if the declination backlash is large. This behaves differently when guiding, as described below.
To begin guiding, just select Guide and the star location will be stored and maintained. The location of the star in the field does not matter at the time Guide is pressed. You should probably Lock the star also.
The Center button takes on a different meaning during guiding. Instead of simply bringing the star near the center, during guiding Center will make the target location be the center of the screen. This will slowly bring the star to the exact center of the screen and keep it there.
Note that once you press Guide, the guide error plot starts scrolling – showing errors in E/W (white) and N/S (red) on a +/- 4" scale. This plot is updated every 0.5 seconds, independent of the video rate. The ability to provide a steady update of guide errors at this rate is unique to MetaGuide and its video guiding methods, and is very helpful in tuning the guide parameters.
There are many ways to tune guiding, including the usual RA and Dec. aggressiveness (here on a scale to 1.0 rather than 10), along with NFrames, which is the number of frames to use in calculating a star location; AccepFrac, which is the fraction of frames that are actually used in the average (the rest of them are lower quality and not included in the centroid calculation); and GuidePeriod, which is the time between corrections. These and more parameters are described in detail below – but the basic idea is to set aggressiveness so that corrections are made quickly, but do not overshoot and cause oscillations. GuidePeriod is related, and should neither be too fast nor too slow. For my CGE I correct every second and typically use a frame rate of 8 fps and NFrames=5. This amounts to approximately 5/8s "exposure" and a correction every second. The total integration time (NFrames/FrameRate) should not exceed the guide period.
Since MetaGuide relies on small corrections, it may be best to set the RA guide rate on the mount to a small value around 0.25x sidereal. On the other hand, Dec. motion may be limited by backlash, so its guide rate may be best set at 0.9x sidereal – along with tuning Dec. backlash so that it is somewhat responsive in both directions, but does not overshoot. But starting values of 0.5 and 0.5 should work.

To summarize, autoguiding just requires connecting to the mount, finding and focusing a guidestar, entering the declination (if not using ASCOM), pressing FullCalibrate, then pressing Guide.