

Guiding Tips

SIG Presentation

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Gear Choices

- Camera choice
 - Driver reliability and support
 - Consider pixel size, binning, sensitivity, field of view
 - Pay attention to ratio of image scales (guide setup vs. main imager)
 - Use monochrome sensor (sensitivity)
 - Look at the support forums before making a choice!

Gear Choices

- Mount choice
 - You won't get more than you pay for
 - Important things are mechanical design/build/assembly quality and customer support
 - Don't get faked out by s/w features, but do pay attention to ASCOM driver support
 - Look at the support forums!

Configuration Choices

- Use ASCOM mount interface rather than ST-4 if possible
 - Better diagnostics, avoidance of common guide cable failures
 - Scope pointing information is very useful to the guiding software
 - No difference in efficiency or accuracy when everything is working

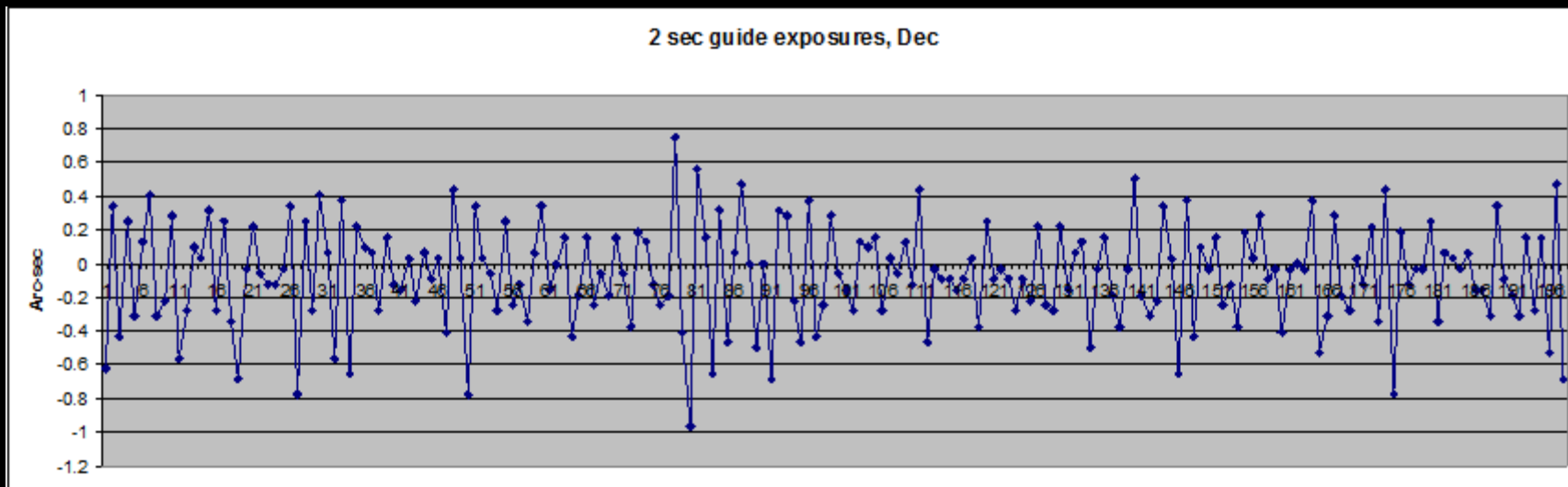
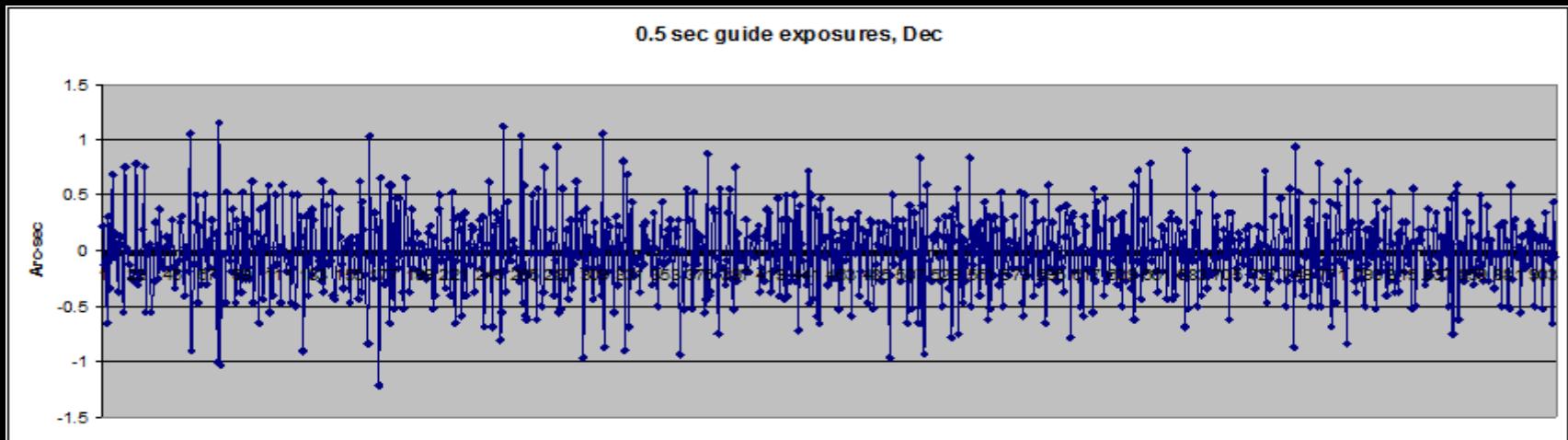
Configuration Choices

- Think about the expected tracking accuracy
 - Typical guide camera will “see” a 5-7 μ tracking error
 - A typical human hair is 30-50 μ in thickness
- Pay close attention to cable routing
- Minimize crummy guide assembly components – thumb-screws, adjustable rings, sloppy focusers, long adapter tubes
- Use off-axis guider if main imaging scale is < 1 arc-sec/px. You *will* have differential flexure, it’s a question of how much it affects you

Chasing the Seeing

- You can't correct for seeing fluctuations – period
 - Try to use exposures of 2+ seconds to average out seeing behavior
 - Avoid sub-second exposures unless you're using an AO device

Seeing vs. Exposure Time



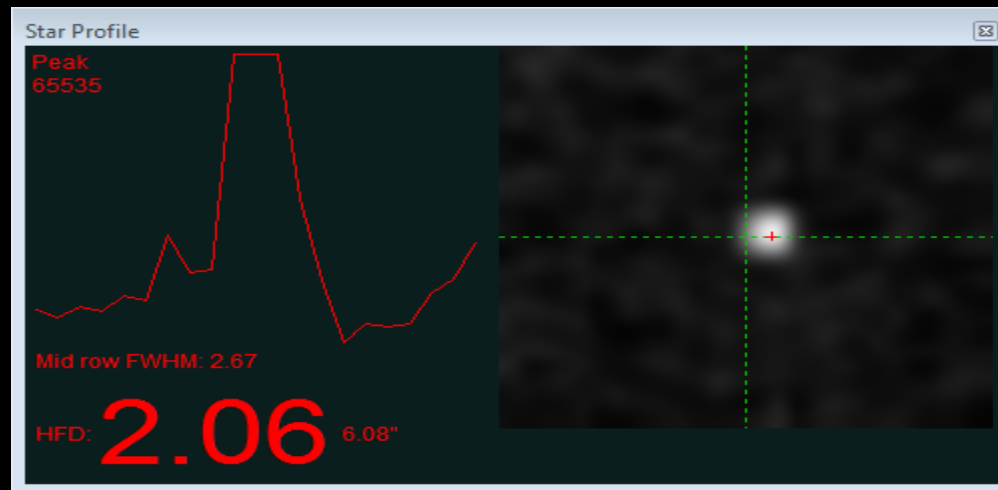
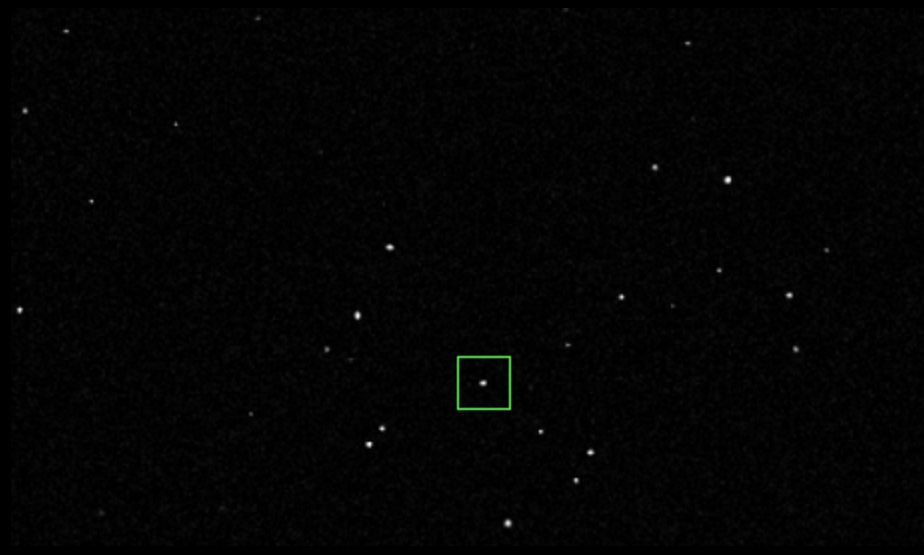
Camera Problems

- USB is the Achilles heel
 - Power, bandwidth, cheap laptops, USB3/2 mismatches, OS power management
 - Cheap cables and serial/USB adapters
 - Binning, region-of-interest help with bandwidth
- Camera drivers are the 2nd major source of problems, resulting in timeouts, apparent “hangs”, and corrupted frames

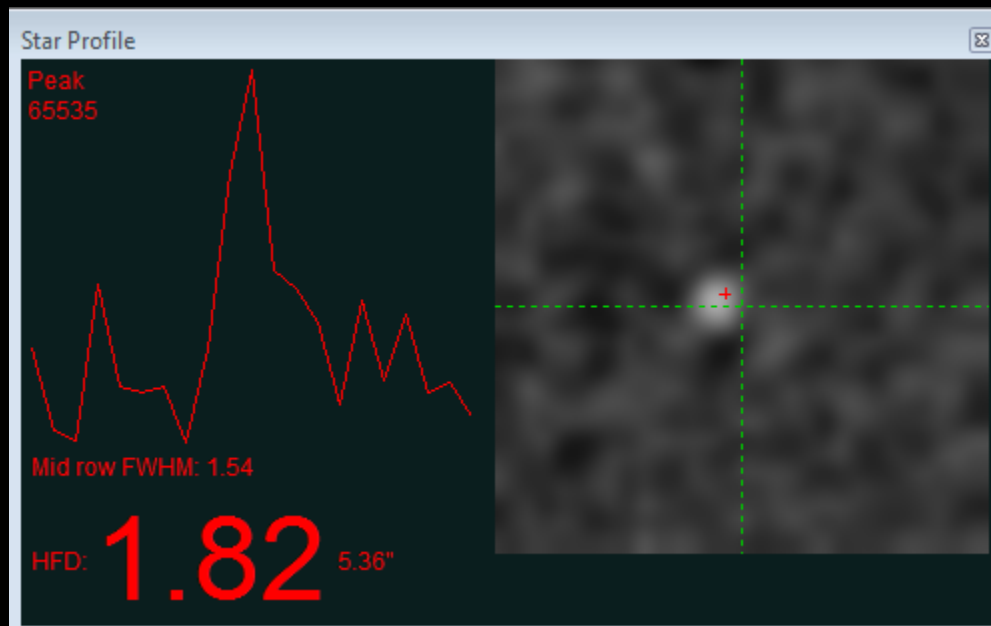
Camera Problems

- Sensor artifacts
 - Hot/warm pixels can look like stars
 - “Alpha particle” hits can disrupt guiding
 - Use dark frames or bad-pixel maps and guide s/w settings to avoid these problems
- Be sure the camera is well-focused – big, dim stars create guiding problems
- Let the guiding program choose the guide star to avoid saturated stars – what “looks good” probably isn’t

Choosing a Bad Star



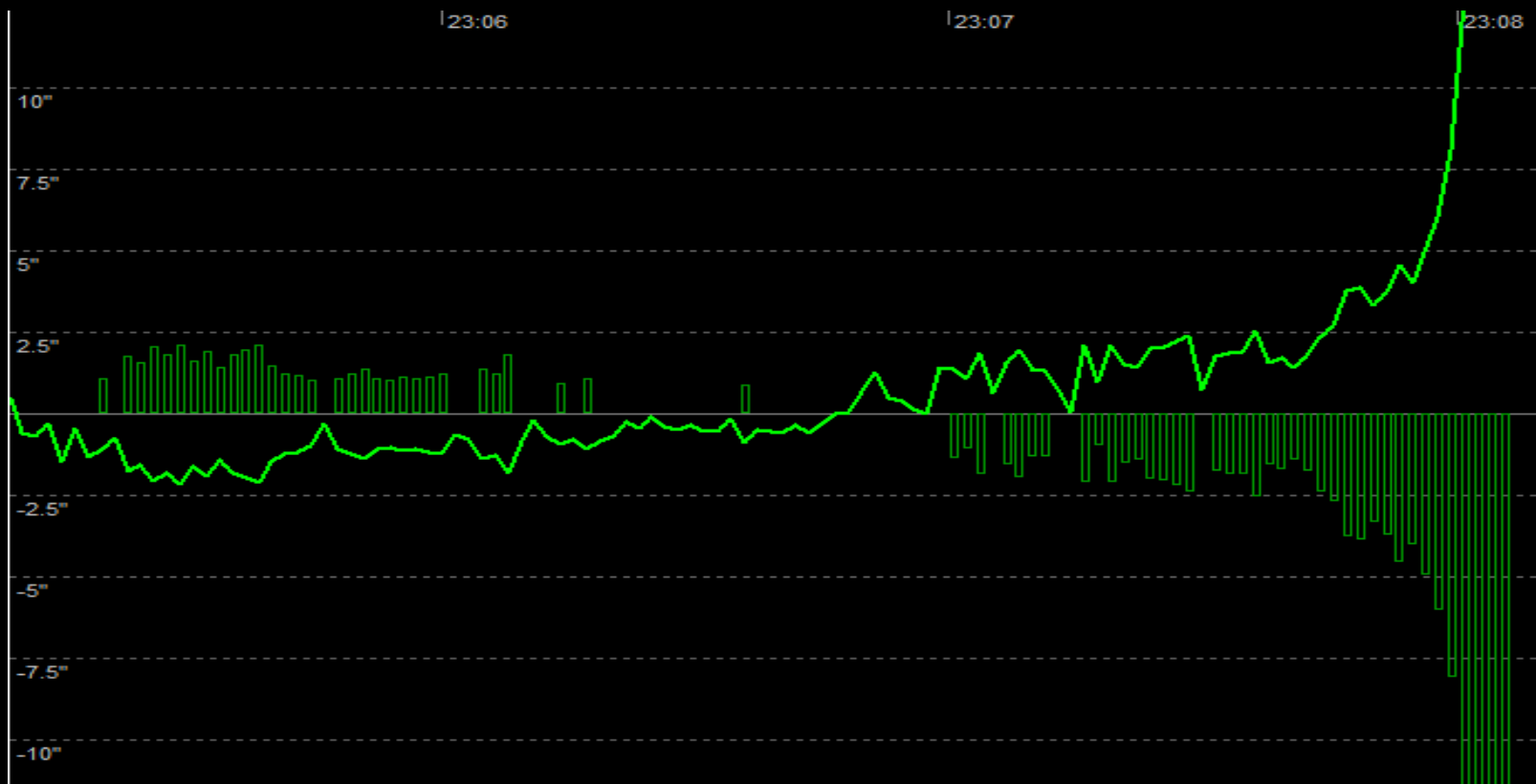
Auto-selecting a star



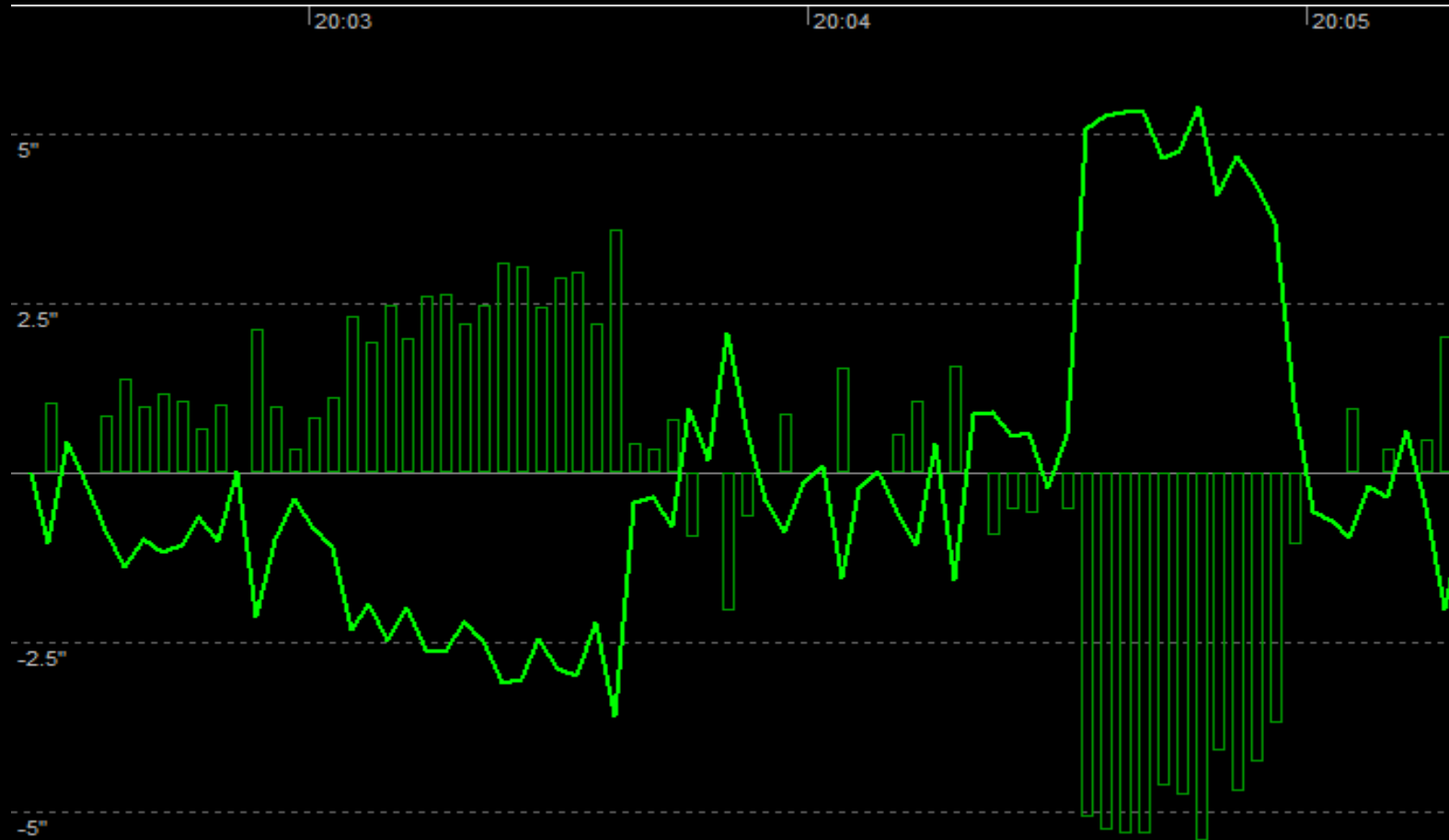
Mount Problems

- Most chronic guiding problems are caused by mount hardware
 - Guiding can't "fix" a bad mount
 - Large Dec backlash, large RA periodic error, stiction/binding in the drive systems
- Study the mount's behavior with guiding disabled
 - know your enemy
- Use PEC if the mount supports it
- Use faster mount guide speeds: 0.7 to 1.0x sidereal rates

Oddball Events



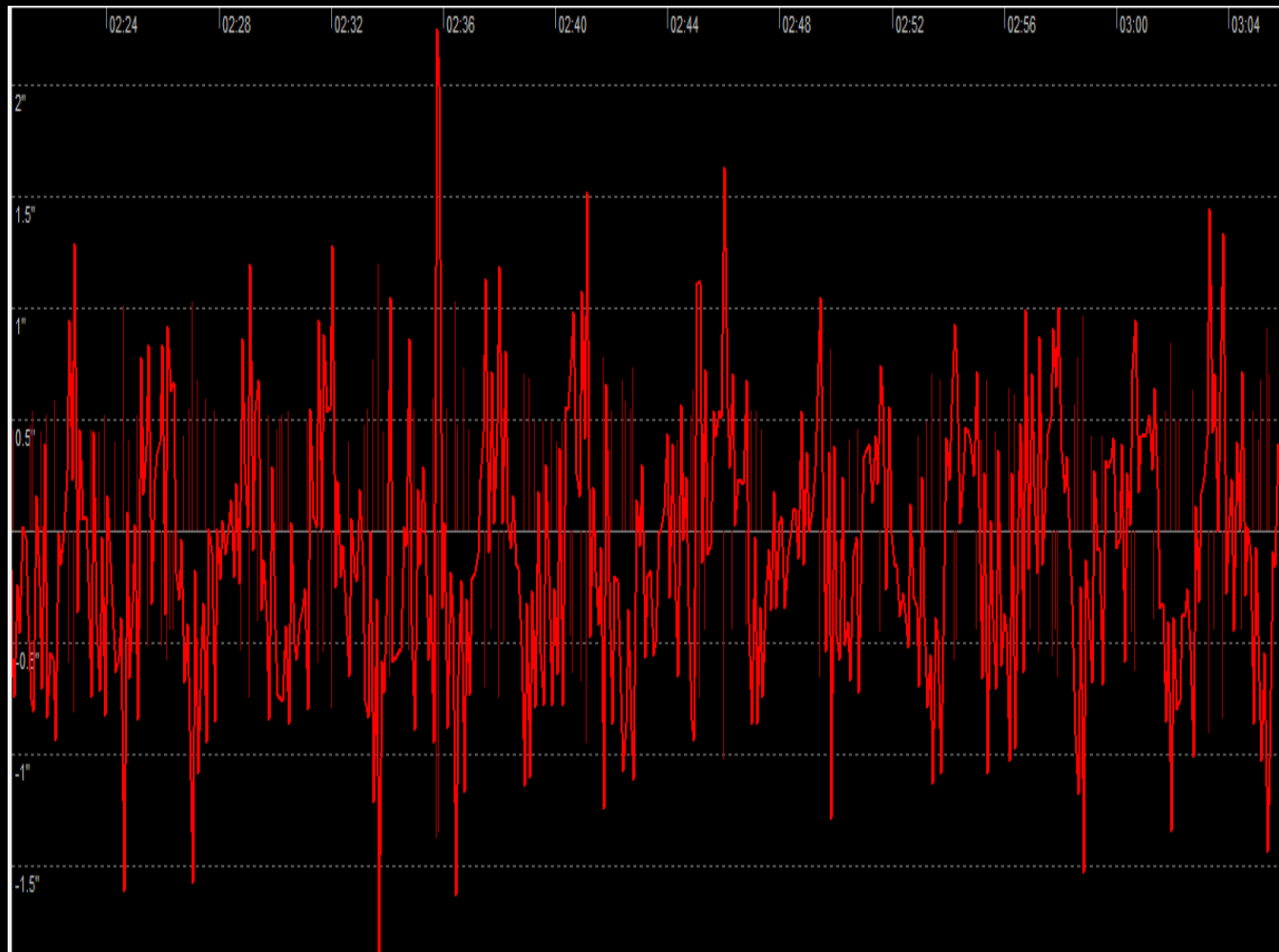
Typical Dec Backlash



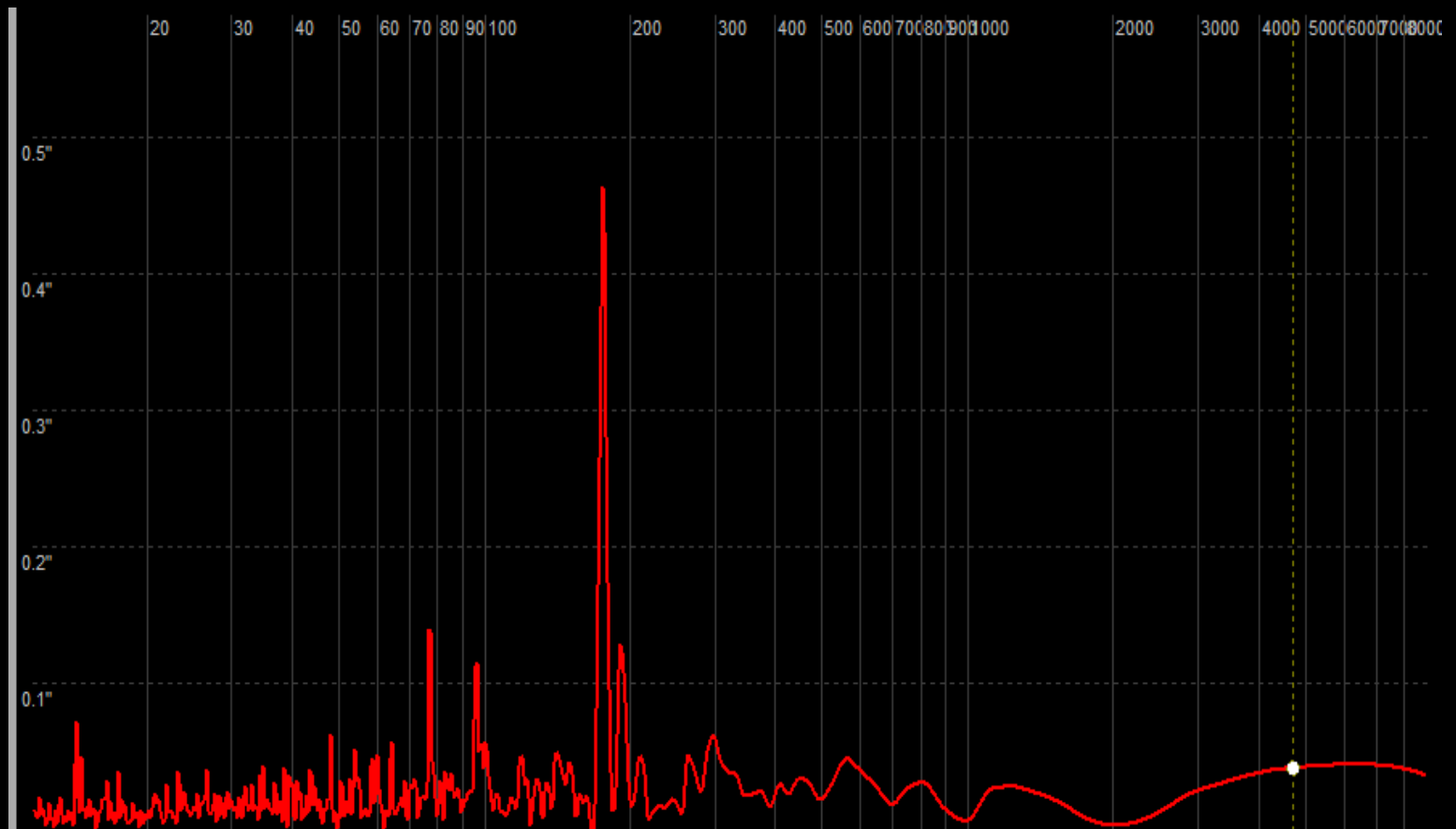
Dec Backlash and Stiction



Residual RA Periodic Error



Residual RA Periodic Error



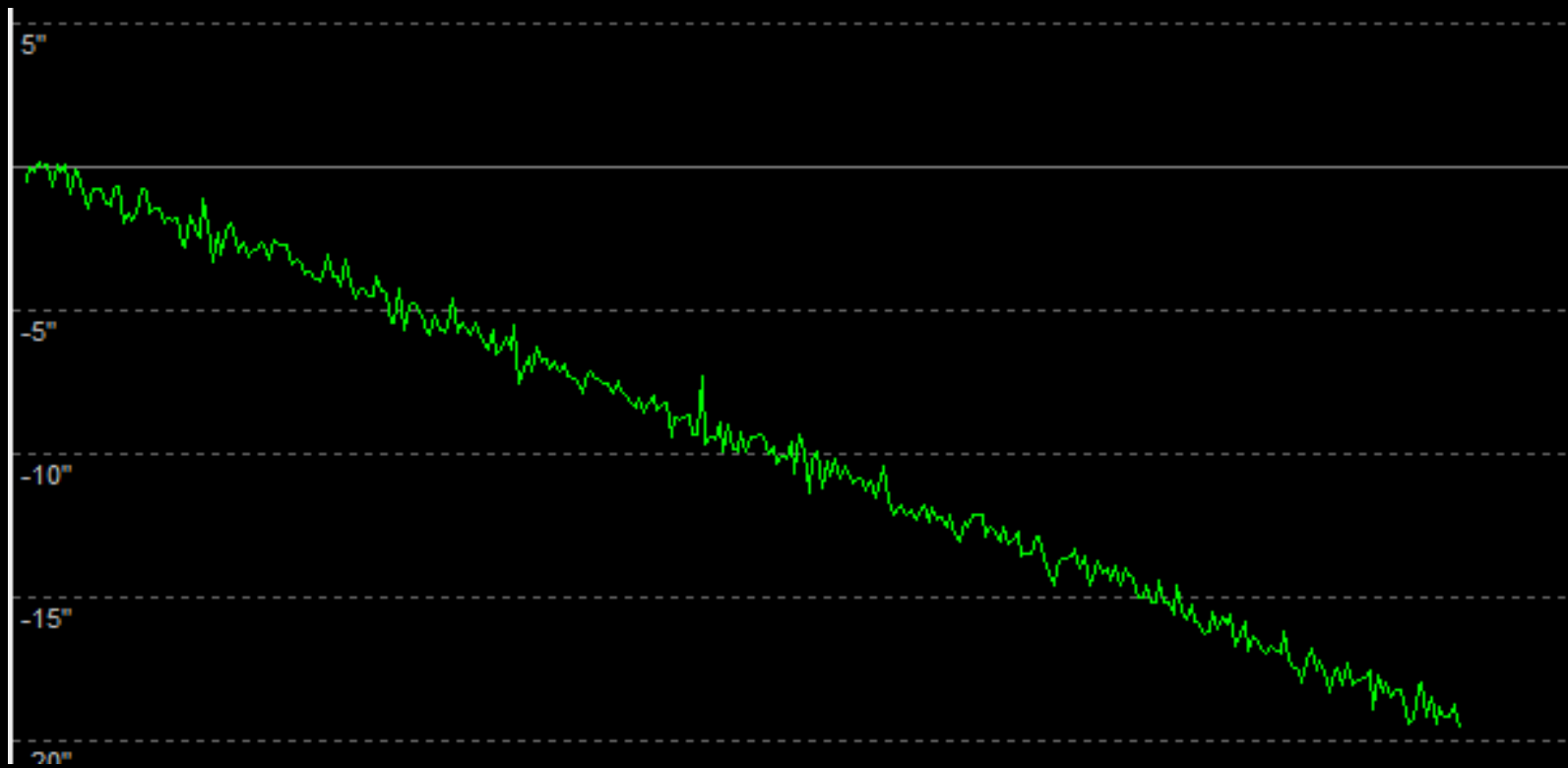
Frequency/Period Analysis

Measuring Mount Performance



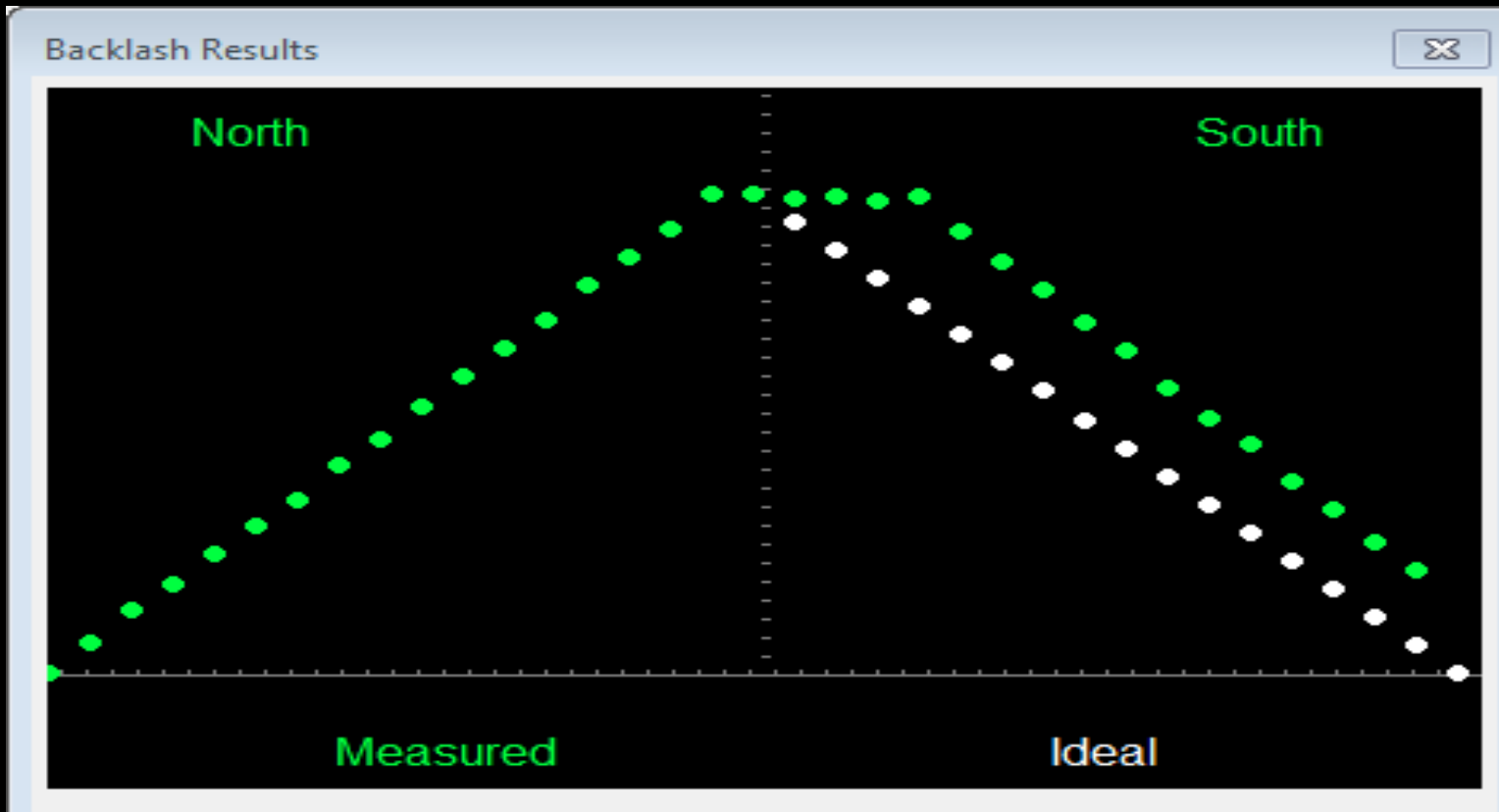
Residual RA Periodic Error

Measuring Mount Performance



Dec Drift from Polar Alignment Error

Measuring Mount Performance

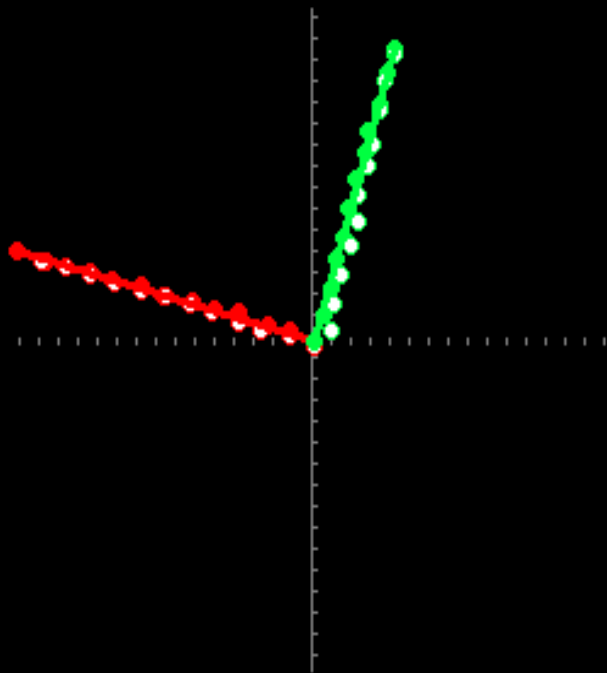


Dec Backlash

Mount Problems

- Adopt a strategy to manage Dec backlash
 - Re-mesh the gears if possible but don't tighten so much that binding occurs
 - Use uni-directional guiding if the backlash is still > 3 secs or so
- Don't use mount-implemented backlash correction
- Make sure the calibration results look sensible
- Don't obsess over polar alignment – errors < 5 arc-min aren't likely to bother you

Checking the Calibration



Right Ascension Declination

Last Mount Calibration

RA steps:	12	Dec steps:	11
Camera angle:	-164.5	Orthogonality error:	1.1
RA rate:	15.048 a-s/sec 5.107 px/sec	Dec rate:	14.912 a-s/sec 5.061 px/sec
Expected RA rate:	15.0 a-s/sec	Expected Dec rate:	15.0 a-s/sec
Binning:	1	Created:	7/30/2018 7:49:46 PM

Mount Configuration

Modified:	7/31/2018 7:23:25 PM	Focal length:	350 mm
Image scale:	2.95 a-s/px Binning: 1	Side-of-pier:	East
RA Guide speed:	1.01x	Dec Guide speed:	1.01x
Declination	0.5	Rotator position:	N/A

Improving Your Results

- Look at guiding performance in units of arc-sec RMS over 10-20 min periods
- Adjust min-move settings based on the night's seeing – min-move settings offer the greatest leverage
- Let your main images be your guide
 - Round stars
 - Reasonable star sizes compared to 10-sec unguided images

Improving Your Results

- Watch for differential flexure
 - Guiding looks fine w/ no big excursions of the guide star, but
 - Stars in main image are elongated
- Some simple tests
 - Blink through a series of unaligned images, see if the stars “march” in one direction
 - Stack a sequence of images without aligning them, look for growing elongation