AUTOMATION OF CALIBRATION SYSTEM FOR DARK ENERGY SURVEY

Jason Wise Physics '12 Sept. 23, 2011

Special thanks to: JP Rheault Dr. Darren DePoy TAMU Instrumentation Lab



What is DECal?

Spectrophotometric calibration for Dark Energy Survey camera at the Blanco Telescope, Chile

Measures transmission and reflection of light to calibrate

Will give calibrated flat field images through all filters (u, g, r, i, z, Y) and wavelengths

Measure changes in system over time to correct in viewing





The Screen:

- 1. Upgrade to current screen
- 2. Highly reflective Lambertian coating to diffuse light evenly
- 3. 16' x 16' screen with black ring





The Fiber:

- 1. Custom made from Fibertech Optica
- 2.75m long
- 3. 87 individual fibers divided into four21-fiber bundles and one 3-fiberbundle





Why automate?

- Old system required user to click buttons repeatedly

- 400nm, every 2nm = 200 exposures
- 5 filters = 1000 exposures
- 20s readout time each exposure
- 6 hours pressing a button every 20s per filter





DECalS:

- Automated software for DECal
- 2 Modes of use
 - TCP/IP server
 - Main mode of use by SISPI software
 - Has a comprehensive set of functions to control all devices
 - Expert Mode
 - To be used only to set up and debug system



Expert Mode:

| Filter Selection | ⊻ u | | g | | 🗆 r | | 🗆 i | | Z | | Y | |
|----------------------|------------|---|--------|---|--------|---|--------|---|--------|---|----------|---|
| Start Wavelength | 350 | з | 250 | 3 | 250 | з | 250 | 3 | 250 | 3 | 250 | з |
| Stop Wavelength | 1100 | з | 1100 | 1 | 1100 | з | 1100 | з | 1100 | 1 | 1100 | 1 |
| Wavelength Step | 10 | з | 10 | 3 | 10 | з | 10 | 3 | 10 | з | 10 | з |
| FWHM (nm) | 2 | з | 2 | 1 | 2 | з | 2 | 3 | 2 | 1 | 2 | з |
| Integration Time On | 2 | з | 2 | 1 | 2 | з | 2 | 3 | 2 | 1 | 2 | з |
| Integration Time Off | 2 | з | 2 | 1 | 2 | з | 2 | 3 | 2 | 1 | 2 | 1 |
| Exit Slit (mm) | 0.9 | з | 0.9 | 3 | 0.9 | з | 0.9 | 3 | 0.9 | з | 0.9 | 1 |
| Filter Wheel Filter | UV-S1 | • | LP-320 | • | LP-550 | • | LP-830 | • | Open | • | UVSP- | • |
| Select Gain | <1> | • | <2> | • | <3> | • | <3> | • | <4> | • | <4> | • |
| Select Grating | 660 | • | 660 | • | 900 | • | 660 | • | 900 | • | 900 | • |
| Wavelength Offset | | | | | | | | | | | | |
| Select Lamp | Quartz | • | Quartz | - | Quartz | • | Quartz | • | Quartz | • | Quartz | • |

Start



Expert Mode:

Current Information: **Overall Status** Taking Off Data Wavelength: 950 Filter: u - Filter Channel 0: Channel 1: Channel 2: Channel 3: Channel 0: Channel 1: Channel 2: Channel 3: Entrance Average Value: Average Value: 2,21055 1.70826 -0.000442 2.21053 0.00041 Slit Width: 0.851064 1,70809 0.000413 -0.000448 Standard Deviation: Standard Deviation: 0.564905 22.6769 0.000238 0.564911 22.6771 0.000239 0.000243 Exit Slit Width: 0.000232 0.9 Off Signal On Signal Grating: 1200 2.5 2.5 2.25 2.25 Blaze: 330 2 2 Lamp: Quartz (Side) 1.75 1.75 Front Shutter: 1.5 1.5 Closed 1.25 1.25 Side Shutter: Closed 1 1 Current Filter Wheel Filter: LP-320 0.75 0.75 0.5 0.5 Tempature 0: 26.97526 C 0.25 0.25 Tempature 1: N/A 0 -0.25 Tempature 2: N/A -0.25 Ó 20 40 60 80 100 120 140 160 180 200 20 40 60 80 100 120 140 160 180 200 0 Tempature 3: N/A Spectrometer Channel 0 \sim Working Status: Peak WL FWHM Channel 1 949.7023 2.602892 Data Best Fit Channe; 2 180 180 Channel 3 WL vs Avg Counts 160 160-2.25 140-140 120-120. 1.75 a 100-100 1.5 80-Coun 80 -1.25 00 60 **60** · 1 0.75 40 40 á 0.5 20 20 0.25 0 0 0 -20 --20 --0.25 -400.0 250.0 600.0 800.0 1100. 940.0 945.0 950.0 955.0 960.0 350 1100 Wave Length (nm) Wave Length (nm) Wave Length



Prototype Results:

- Results from our first prototype.
- Improved u-band accuracy
- Useful for Carnegie SN Project for photometry





To wrap it up:

DECal screen has already been shipped to Chile

✓ The rest of DECal will be shipped in a month and set up in time to test it on the Mosaic Camera

 \checkmark DECalS will allow the user to do other things while the system runs, saving a lot of time.