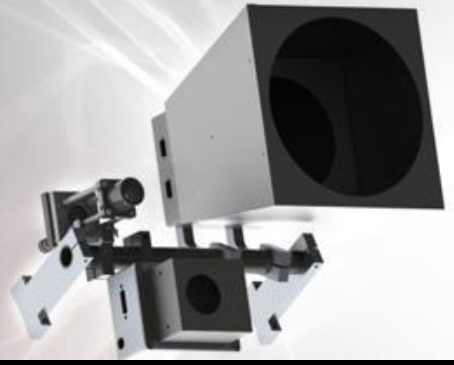
AUTOMATION OF CALIBRATION SYSTEM FOR DARK ENERGY SURVEY

ASTRONOMY

Jason Wise
Physics '12
Sept. 23, 2011

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

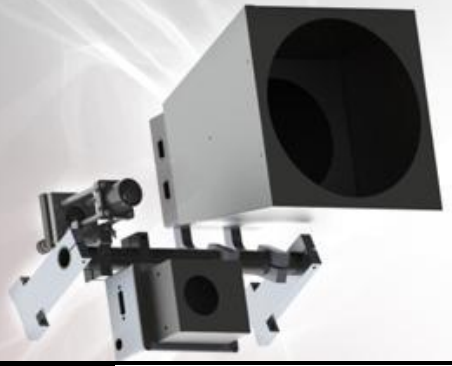


DARK ENERGY SURVEY
CALIBRATION

THE DARK ENERGY SURVEY

What is DECal?

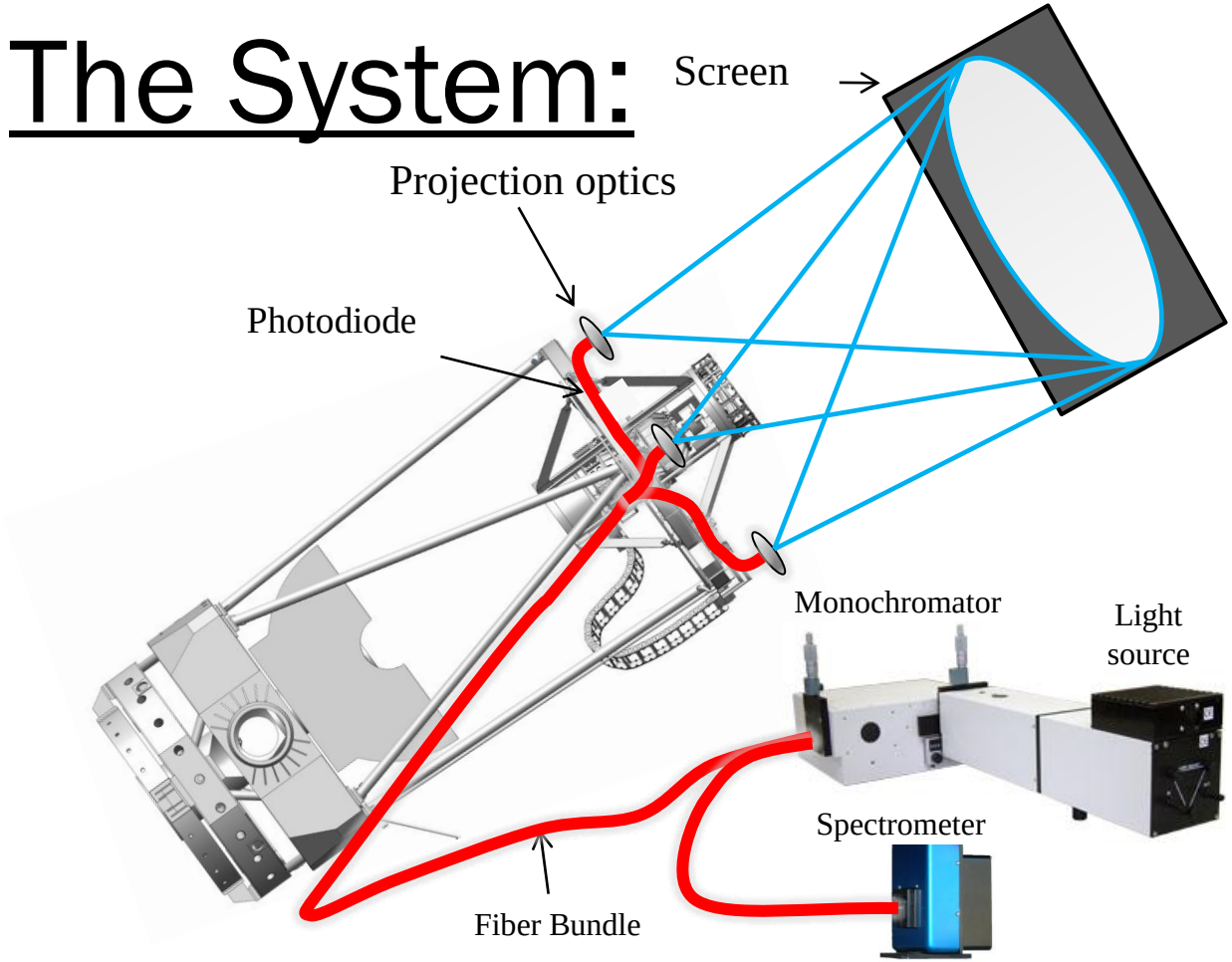
- Spectrophotometric calibration for Dark Energy Survey camera at the Blanco Telescope, Chile
  - Measures transmission and reflection of light to calibrate
- Will give calibrated flat field images through all filters (u, g, r, i, z, Y) and wavelengths
- Measure changes in system over time to correct in viewing

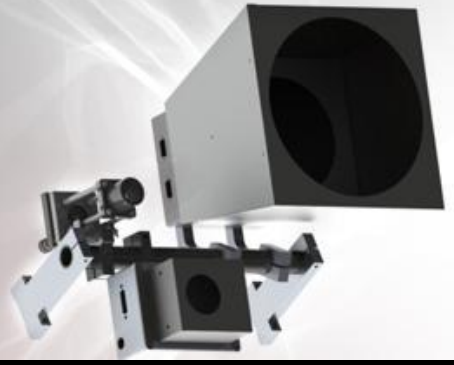


DARK ENERGY SURVEY CALIBRATION

THE DARK ENERGY SURVEY

The System:



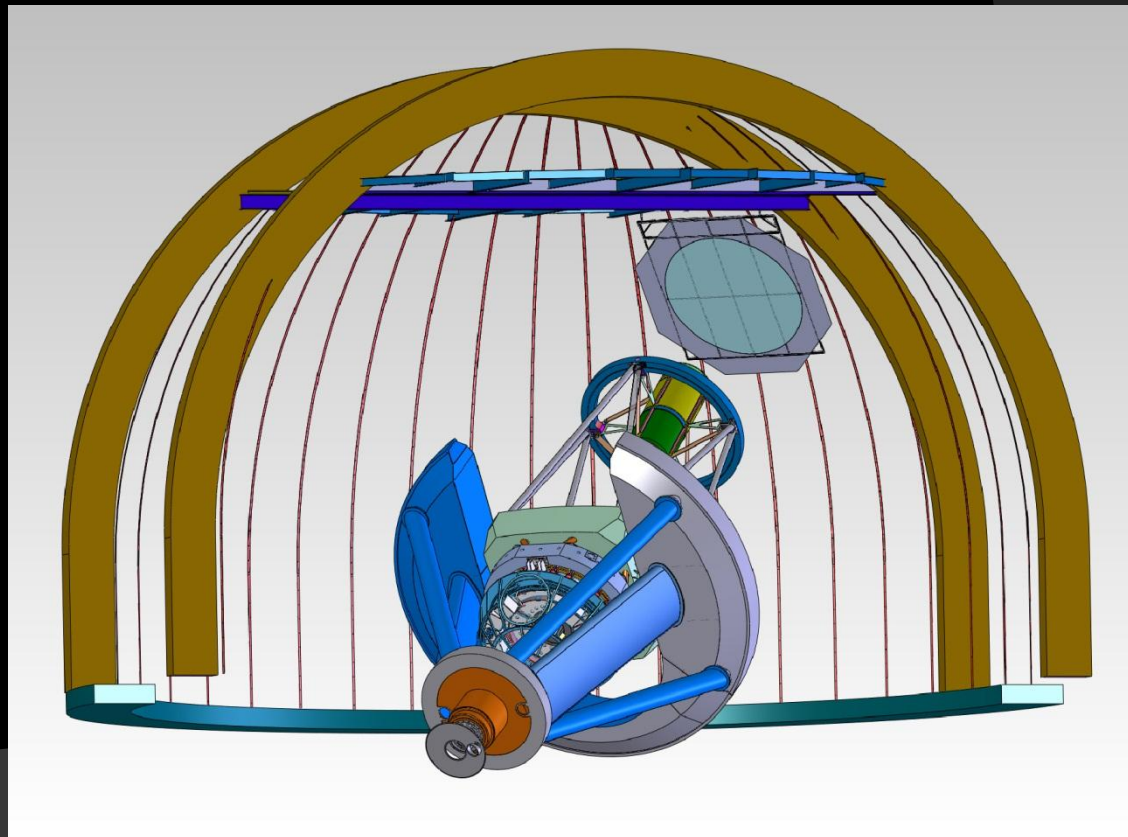


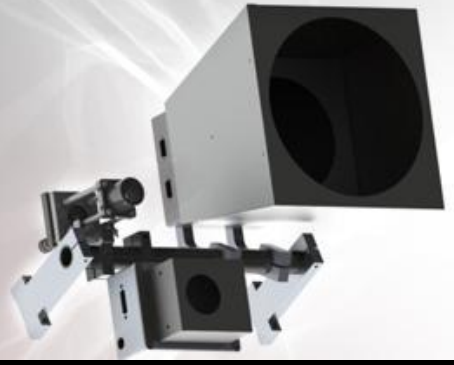
DARK ENERGY SURVEY CALIBRATION

THE DARK ENERGY SURVEY

The Screen:

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



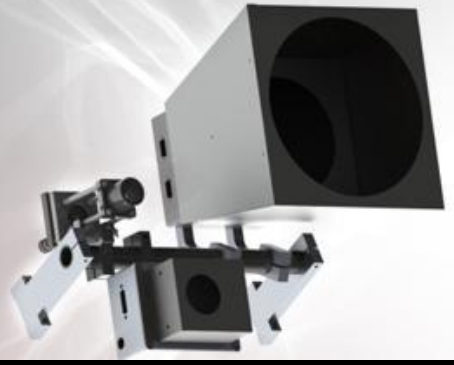


DARK ENERGY SURVEY CALIBRATION

THE DARK ENERGY SURVEY

The Fiber:

1. Custom made from Fibertech Optica
2. 75m long
3. 87 individual fibers divided into four 21-fiber bundles and one 3-fiber bundle

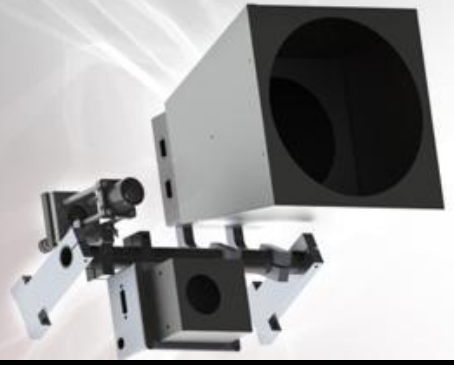


DARK ENERGY SURVEY
CALIBRATION

THE DARK ENERGY SURVEY

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

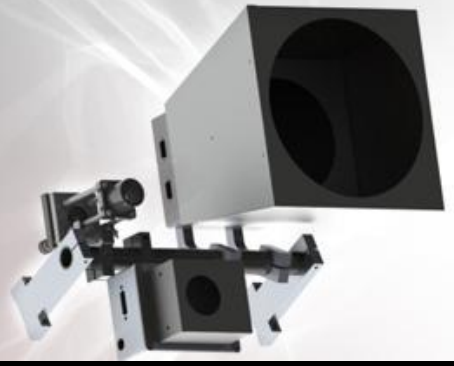


DARK ENERGY SURVEY
CALIBRATION

THE DARK ENERGY SURVEY

DECaIS:

- Automated software for DECaI
- 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



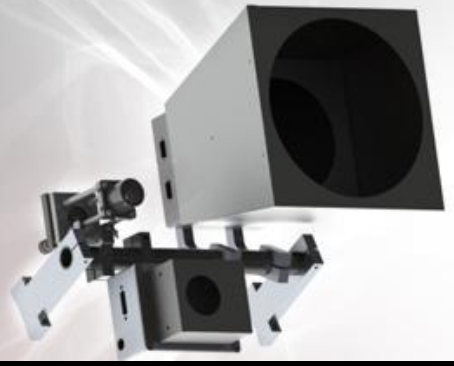
DARK ENERGY SURVEY CALIBRATION

THE DARK ENERGY SURVEY

Expert Mode:

Filter Selection	u	g	r	i	z	Y
Start Wavelength	350	250	250	250	250	250
Stop Wavelength	1100	1100	1100	1100	1100	1100
Wavelength Step	10	10	10	10	10	10
FWHM (nm)	2	2	2	2	2	2
Integration Time On	2	2	2	2	2	2
Integration Time Off	2	2	2	2	2	2
Exit Slit (mm)	0.9	0.9	0.9	0.9	0.9	0.9
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

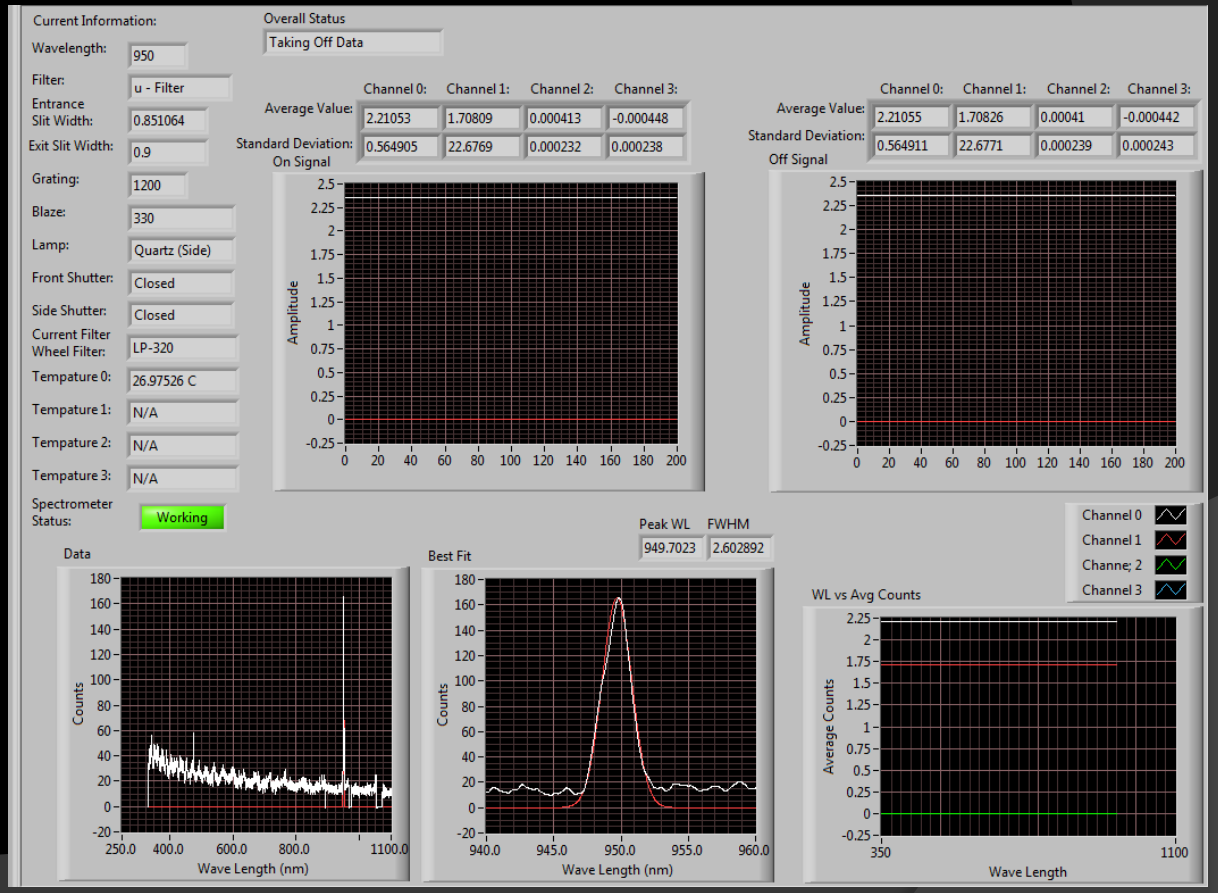
Start

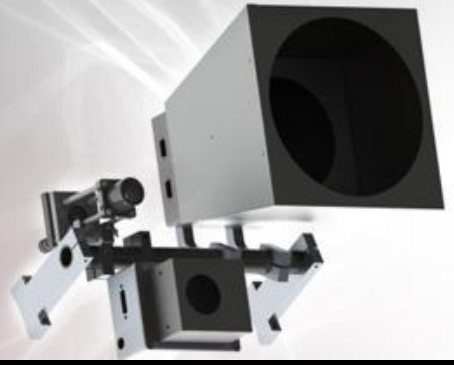


DARK ENERGY SURVEY CALIBRATION

THE DARK ENERGY SURVEY

Expert Mode:



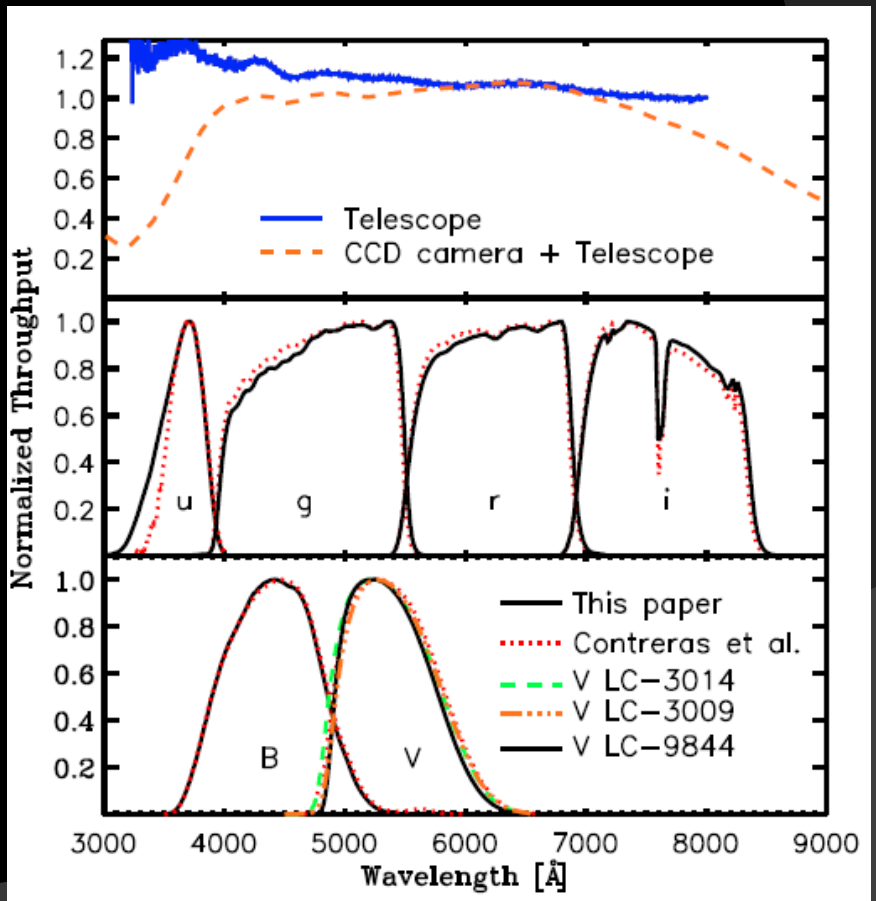


DARK ENERGY SURVEY CALIBRATION

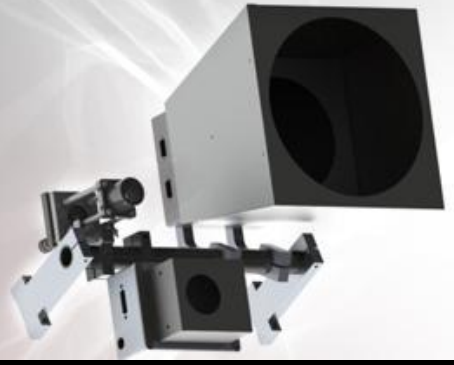
THE DARK ENERGY SURVEY

Prototype Results:

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



Stritzinger *et al.* Fig. 2



DARK ENERGY SURVEY
CALIBRATION

THE DARK ENERGY SURVEY

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