



DARK ENERGY
SURVEY

Plans for a Blanco System Response Engine

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DES Spectrophotometric Calibration

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- DES photometric calibration requirements
 - ~1% photometric precision
 - At all wavelengths (except possibly Y)
 - Across entire area and time span of survey
- Suggests we need spectrophotometric calibration
 - Allows for accurate and precise measurement of complete system response
 - Telescope, corrector optics, filter, CCDs



Broad system description

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- Light source
 - In coude room
 - Temperature controlled/stabilized
 - Provides both daily flat field and spectrophotometric calibration light
- Conduit to the top of the telescope
 - Fibers?
- Projection optics
- Reflecting screen
- Calibrated photodiode monitors
 - Top of telescope looking at the screen
 - On DECam focal plane



Potential Light Sources/filters

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- LEDs or Quartz Lamp to provide daily flats
 - Possibly also spectrophotometric source
- Tunable Laser
 - Excellent selection of wavelengths
 - No ultraviolet though
 - Expensive and require substantial support
- Acousto-optic Tunable Filter (AOTF)
 - Work over entire DECam wavelength range (340-1050 nm)
 - Low cost and high reliability
 - Easy to control
 - Polarized output
- Liquid Crystal Fabry-Perot Tunable Filter
 - Broad wavelength range (350-1050 nm)
 - Intermediate cost and high reliability
 - Very easy to control
 - Limited selection and vendors
- Very large number of narrow-band filters



Potential Light Sources/filters

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- Questions
 - How bright?
 - How many wavelengths?
 - Lifetime?
 - Operational constraints?
 - Temperature control
 - Other environmental control
 - Power
 - Cooling
 - Maintenance
 - Etc.?



Conduit to Top of Telescope

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- Need to get calibration light to top of telescope
- Use fibers
- Questions
 - How long
 - Stability
 - Routing
 - Etc.?



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Projection Optics

- Need to project calibration light onto screen
- Screen should be evenly illuminated
 - Need quantitative analysis of uniformity of illumination
 - Should control scattered light



Reflecting Screen

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- Need reflecting screen that mimics input pupil of telescope
 - Need quantitative analysis of reflection from projection system
- Existing flat field screen could be used?
- New screen from higher performance material could be fabricated
 - Better scattering properties
 - Little directionality
 - Highly reflective over broad wavelengths
 - May need to include NIR for use with other CTIO instruments
 - SORICSCREEN material a good candidate
 - Only available in ~1 m widths
 - Need seamstress



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Calibrated Photodiodes

- Monitor spectrophotometric input into telescope
 - Also monitor calibration system performance
- Place on top of telescope looking at screen
- Also place on DECam focal plane for additional check



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Control system

- Need control system
- Must coordinate with SISPI
- Probably will need to be automated to allow calibrations during day