Request for Information - ZTF filters

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1.0 Introduction:

Zwicky Transient Facility (ZTF) project at Caltech is requesting information regarding capability for fabrication of bandpass filters. Although this fully-funded project is in the detailed design phase, there is significant opportunity to refine the filter design to facilitate manufacturing.

We require three parts, each with a different passband, which we call g, r, and i. Similar filters are used elsewhere in astronomy, including the Sloan Digital Sky Survey and the Dark Energy Survey

This document is intended to be the basis for refinement of specifications. Initial responses should be discussions of specifications that are challenging, specifications that are easy, and suggestions of design changes that might make fabrication easier. Please direct responses to Dan Reiley at Caltech ([djr@astro.caltech.edu](mailto:djr@astro.caltech.edu), 626-395-4033)

2.0 Substrates (for all three parts):

Dimensions: 490mm W x430nm H x 6.3mm thick (small changes are possible, if helpful)

Clear aperture: 480mm W x420nm H

Material: Fused silica (Corning HPFS 7980 grade 3C, or better)

(Would another material facilitate fabrication? Is so, let’s discuss it.)

Wedge: <0.1mm ETD

Single-pass transmitted wave error in any 125 mm diameter sub-aperture: <180nm

3.0 Coated parts:

- Spectral properties (to be met over any 100mm aperture at f/2.4 in unpolarized light)

passbands: 396-548nm (g filter), 565-713nm (r filter), and 698-853nm (i filter), all +-5nm

minimum transmission in passbands: 80%

average transmission in passbands >=85%

transition bands: <10nm wide, transmission 0.5% - 80%, both sides

rejected wavelengths: 300-1100nm, neglecting transmission and transition bands

maximum transmission in the rejected wavelengths: <0.5%

for all parts, transmission at 557.7nm <1%

- Surface Quality: 80-50 scratch-dig

- Pinhole Limits: Generally consistent with 80-50 scratch-dig but none larger than 500 μm over any 50 mm aperture of the filter

- Durability: Mil-C-48479 (moderate abrasion)

- Sealing: Filter edges should be sealed to prevent moisture incursions into the substrate and should be made as black as possible to help mitigate scattered light from the filter edges.

- Radioisotope limits in filter substrate: U<0.8 ppm, Th<2.5 ppm, K<0.03% (by weight)

- Radioisotope limits in filter coatings: U<80 ppm, Th<250 ppm, K<3% (by weight)

- Ghost performance: The filter coatings should be designed to minimize in-focus ghost images from internal reflections between coating layers.

- Warping: Our application is in transmission, but we would like a readily-achieved mechanical specification on warping. Let’s discuss what makes sense.