Problem Description

The goal of this independent project is to design, tolerance, and mechanically mount the lenses for an interferometer diverger. The signal from the unit under test will be very small and so the returned light from any surface in the lens assembly could be significant. The interferometer will use a low coherence source and so color correction will also be critical. The coherence window will begin to bend away from the null configuration with more dispersion. A correction of better than 1/10 wave PV over a 20nm band will keep the coherence window flat. The RMS wavefront through the diverger is not critical, but should be well corrected, 1/2 wave RMS should be attainable for a 4 or 5 lens design. The lens must be corrected for some field of view to simplify alignment, .2 degrees FFOV was determined as a good margin and .5 degrees FFOV needs to be better than 2 wave RMS. The diverger will bring a collimated beam to focus in solution, so the last lens surface will interface with liquid.

Requirements

F/.615

Focal space in solution

Corrected for FOV of +/- 0.1 degrees

Entrance Pupil diameter of 20mm

Working distance in solution of at least 8mm

Better than 1/2 wave RMS wavefront error on axis

Better than 2 wave RMS wavefront error at .25 degrees

4 or 5 lens design

Color corrected over 640 to 680nm

Better than 1/10 wave PV color correction over 20nm band

Final surface as glass-solution interface

Final surface is flat

All performance metrics are after tolerance and assembly

Lenses can be removed from assembly if needed

Will be used for reverse ray tracing so knowing what the lens looks like is important

Additional Notes

Some design forms will have great nominal performance but tolerance poorly while others may have more elements but will tolerance better to produce a system with looser tolerances. It is important to also understand that since this diverger will be used for reverse ray tracing, a diverger that performs close to as designed but does not match the actual design will introduce error into its measurements. Because of this, the correct lens design may be the one with tighter tolerances to minimize number of elements and thus stray light while attaining the desired performance.