Polarization Study Update

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Purpose of study

- The polarization of an incoming photon is changed by reflections from the WFIRST mirrors
- Typically the output photon has its X & Y phases changed by +1.9° at 450 nm, and -1.6° at 950 nm, at the edge of the pupil, less at the center of the pupil, and oscillating sinusoidaly in azimuth.
- These shifts are λ/90 pv, giving $C = 1\times10^{-7}$

Potential solutions

1. Reduce phase shifts by re-designing the mirror coatings (under study)

2. Insert a phase-corrector plate (ditto)

3. Insert polarization analyzer & separately record X & Y polarization states (baseline)

Progress to date

- Generate uniform set of refractive index values (Bala, done)
- Check consistency of commercial ray-trace programs (Zemax & Code V), so we can be sure that polarization calculations are correct (Mcguire & Rud, nearly done)
- Write independent code to check accuracy of polarization from mirror reflections (Traub, done)
- Results to date: agreement of all 3 codes, to at least 6 significant figures

Next steps

- Finish comparison calculations of 3 codes (Mcguire, Rud, Traub, this week)
- Calculate phase shifts for 450(100)950 nm, for the full WFIRST + CGI system, with baseline mirror coatings (Mcguire, Rud, next week)
- Calculate speckles with and without X, Y polarization analyzers, for all 3 coronagraph designs, for all 6 wavelength bands (Krist, end of June)
- Calculate science yield for imaging and IFS for all 18 cases, & publish paper (Traub, July)