Jet Propulsion Laboratory
California Institute of Technology

Trade Study: SPC Core Throughput vs WFIRST Pupil Inner Diameter

A.J. Riggs

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Overview

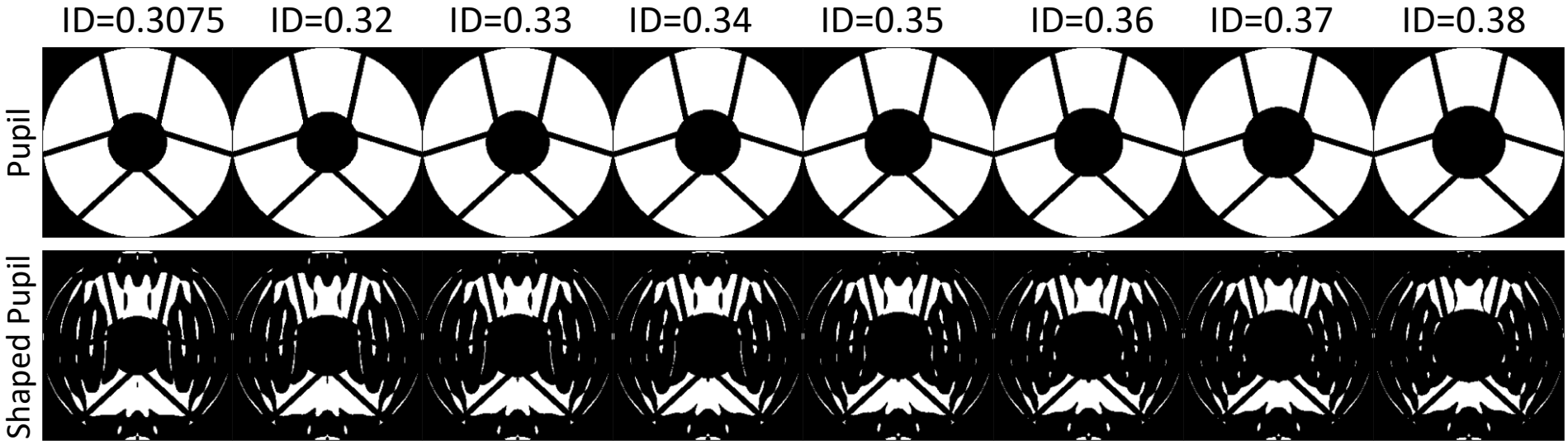
Goal:

- Quantify the effect of increasing the effective inner diameter of the telescope pupil for WFI stray-light baffling.

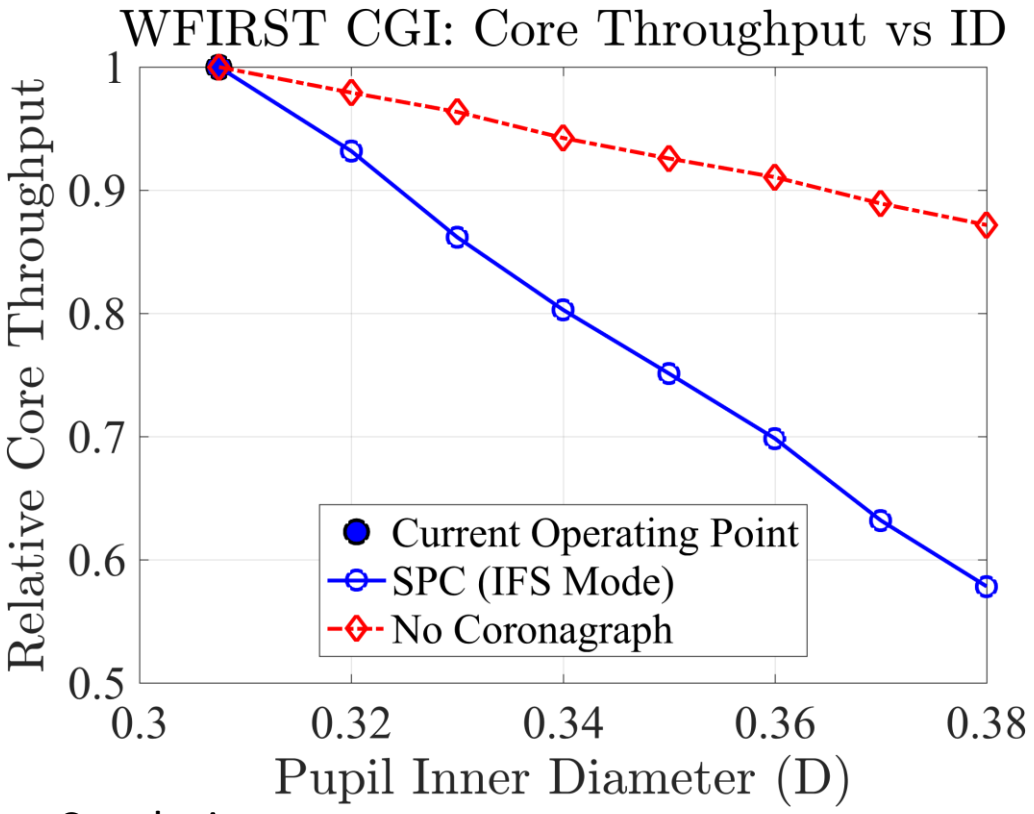
Approach

- Re-optimize the CGI's SPC (IFS-mode) for pupils with different IDs.
- Compute and compare the core throughput* for different pupil IDs.

* Core throughput = energy under FWHM of main PSF lobe for off-axis source



Results



***Note**: all values are normalized to the throughput value for the Cycle 6 pupil (with ID=0.3075D)*

Conclusions:

- SPC core throughput falls off much faster than core throughput of the telescope's PSF.
- Relative to Cycle 6 WFIRST pupil, an ID=0.38D secondary obstruction would reduce SPC throughput to 58% of current level
  - ➢ Large decrease in science yield

Various Details

- Cycle 6 pupil used. Nominal ID=0.3075D
- SPC design still optimized for 18% bandwidth, with same FPM and Lyot stop for all cases.
- Conservative amount of pupil padding (for alignment) used (0.2% of D) as input for SP optimization.
- Core throughput calculated for off-axis source near center of dark hole (x=6 lambda/D)
- Optimizations performed at ¼ manufacturing resolution (250 points across full pupil)