



**Jet Propulsion Laboratory**  
California Institute of Technology



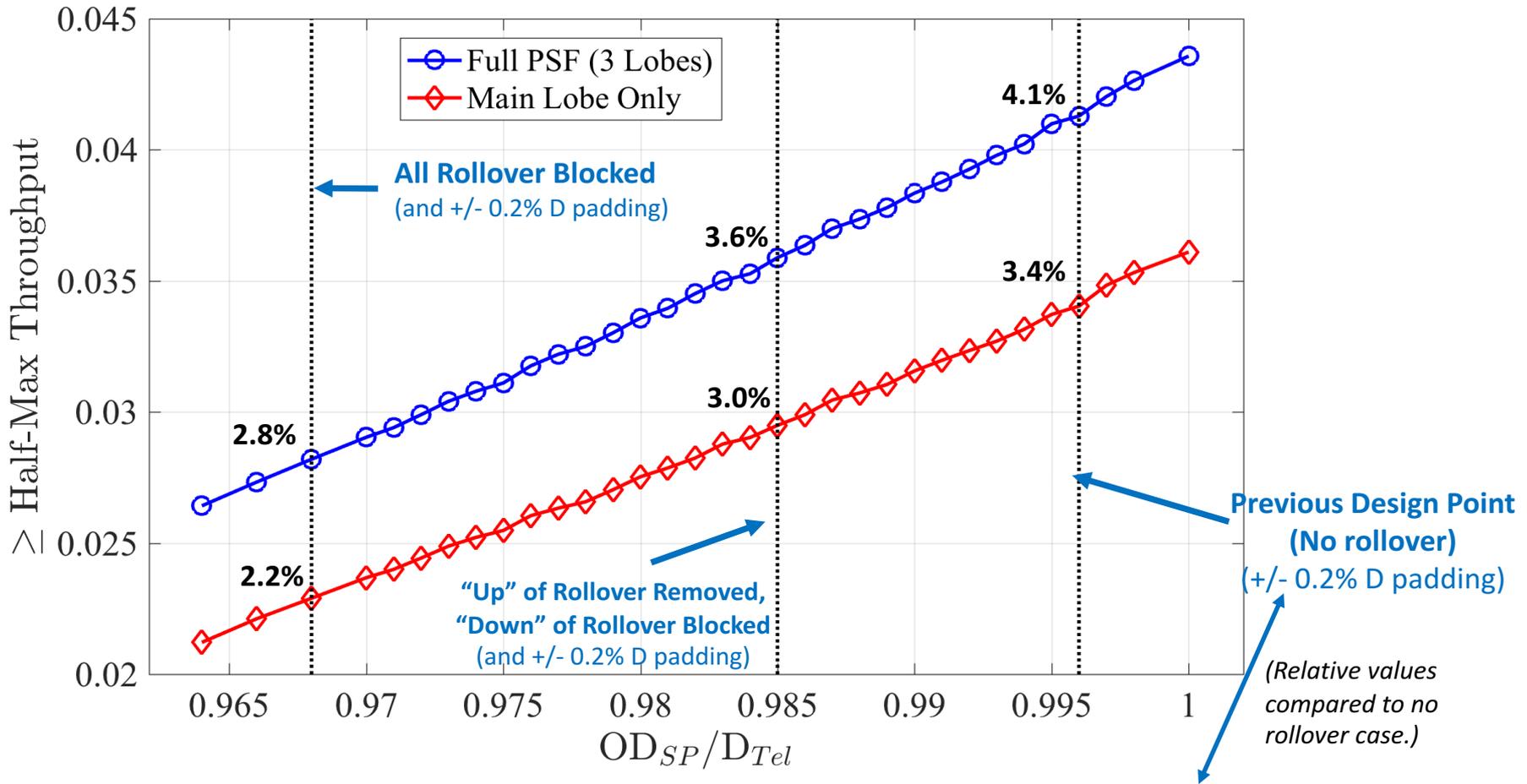
# WFIRST CGI SPC Design Sensitivity to Pupil Outer Diameter

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# SPC Throughput vs Outer Diameter (OD)

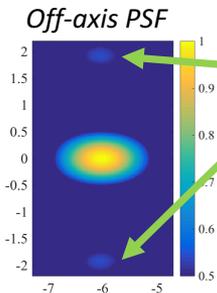
**Issue:** Shaped pupil (SP) mask needs to be undersized to block rollover on edge of primary mirror.



<b>&gt;= Half-Max Region</b>	<b>Relative Throughput</b> (Rollover partially corrected)	<b>Relative Throughput</b> (Rollover fully blocked)
Full PSF (3 Lobes)	88%	68%
Main PSF Lobe	88%	65%

# Various Details

- Cycle 6 WFIRST pupil used.
- For alignment tolerancing, 0.2%  $D_{\text{tel}}$  of padding added to each side of a pupil obscuration
  - (So each feature padded by 2 x 0.2% D in total)
- SPC design still optimized for 18% bandwidth, with same FPM and Lyot stop for all cases.
- Throughput calculated for off-axis source near center of dark hole ( $x=6 \lambda_0/D$ )
  - Throughput = energy under half-max of off-axis PSF, divided by total energy incident upon primary mirror



- Secondary lobe peaks are  $>$  half max, so throughput values are calculated with and without using the additional energy in the secondary lobes.
- Secondary lobes are blocked for separations  $\approx 4 \lambda_0/D$ .

- Optimizations performed at 1/4 manufacturing resolution (250 points across full pupil)