

The Celestial Distribution of Stray-Light Events and Downlink Rates

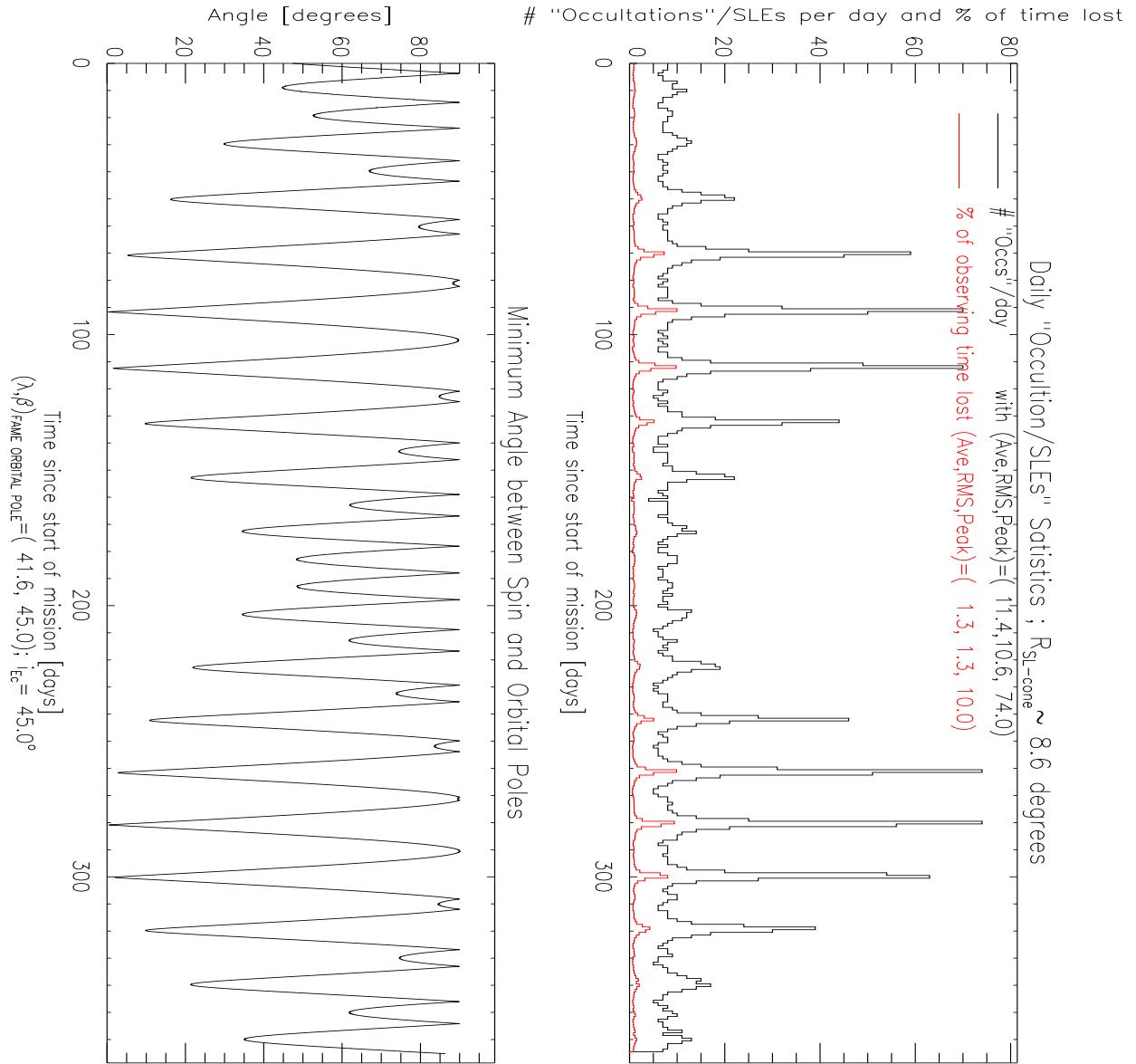
Rob P. Olling
USRA/USNO

olling@usno.navy.mil <http://ad.usno.navy.mil/~olling>

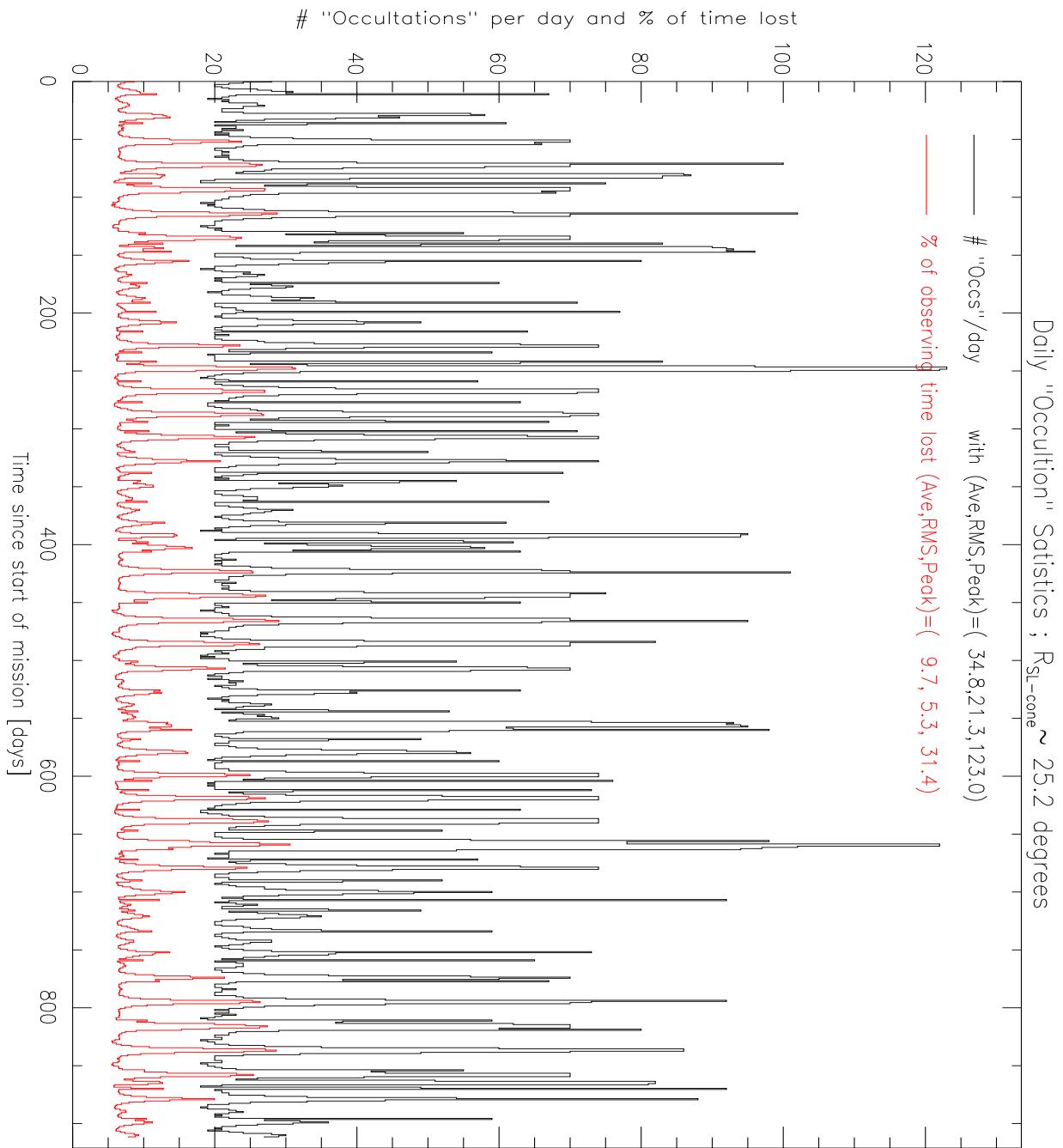
- Line-up of orbital pole and spin axis
 - Earth Occultations happen twice every spin period
 - FAME's equator points towards Earth → Low Downlink Rates
- Occultation Band and Low DLR band may follow Galactic Plane
- Need $\lambda_{OP} \sim \lambda_{GC}$ OR $\lambda_{OP} \sim \lambda_{GAC}$

Occultations and θ_{EFe}

Stray-Light Radius, $R_{SLE} = 8^\circ.6$



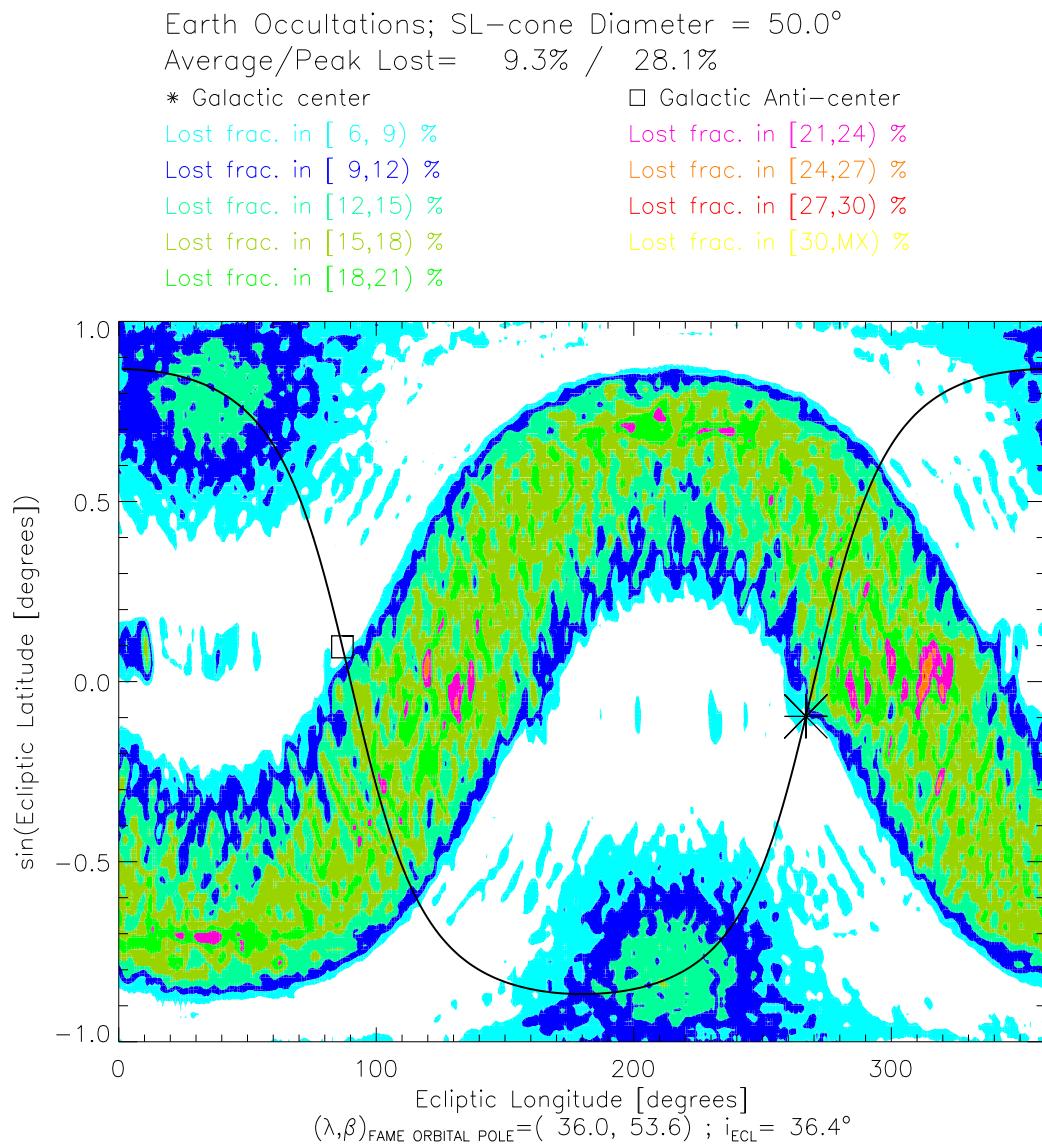
Occultations with $R_{SLE} = 25^\circ$



Lost-Fractions Correlate Strongly with Stray-Light Radius

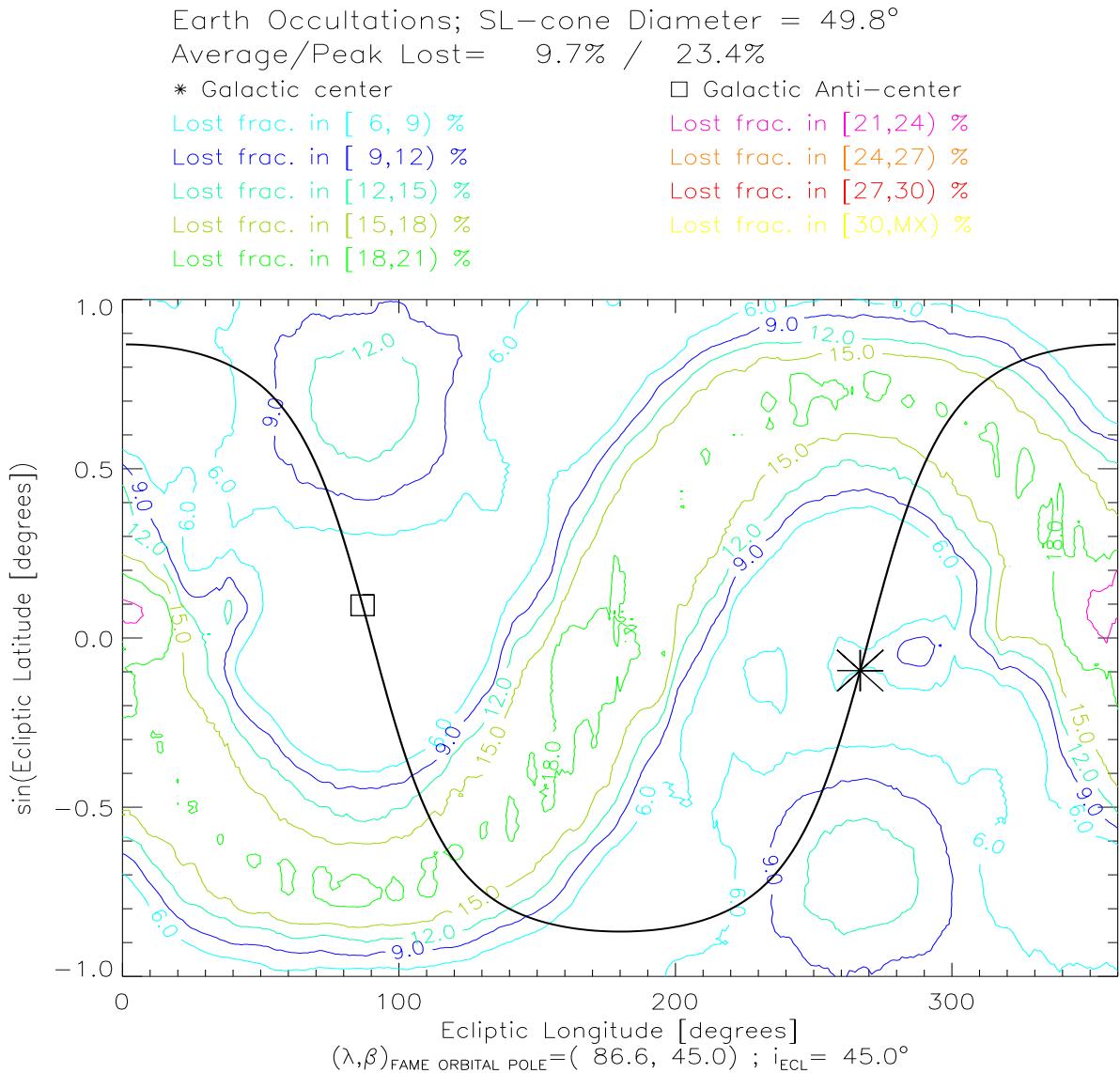
- Fraction of Lost Observations due to SLEs
 $F_{OBS,LOST} = 3.4\% \times (R_{SLE}/15^\circ)^2$
- Fraction of Rotations that contain an SLE
 $F_{ROT,SLE} = 17\% \times (R_{SLE}/15^\circ)$
- Fraction of time with *next* SLE within 1 spin
 $F(\Delta T_{SLE} \leq 1) = 25\% \times (R_{SLE}/15^\circ)$

Sky Distribution of Occultation Zone



Good Polar Longitudes

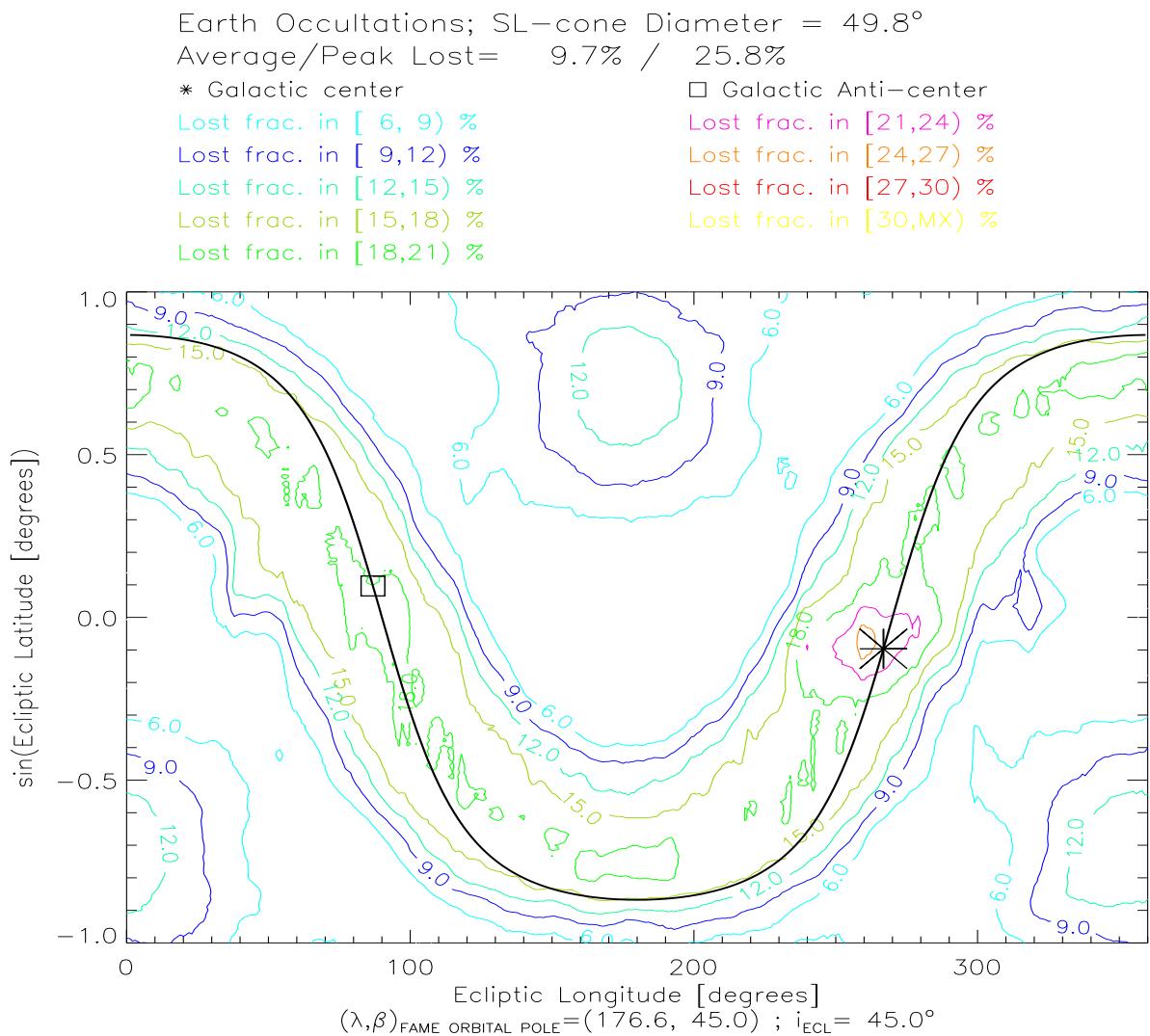
$$\lambda_{pole}^{best} = 86^\circ.8 \text{ or } \lambda_{pole}^{best} = 266^\circ.8, \pm 15^\circ$$



Worst Polar Longitude

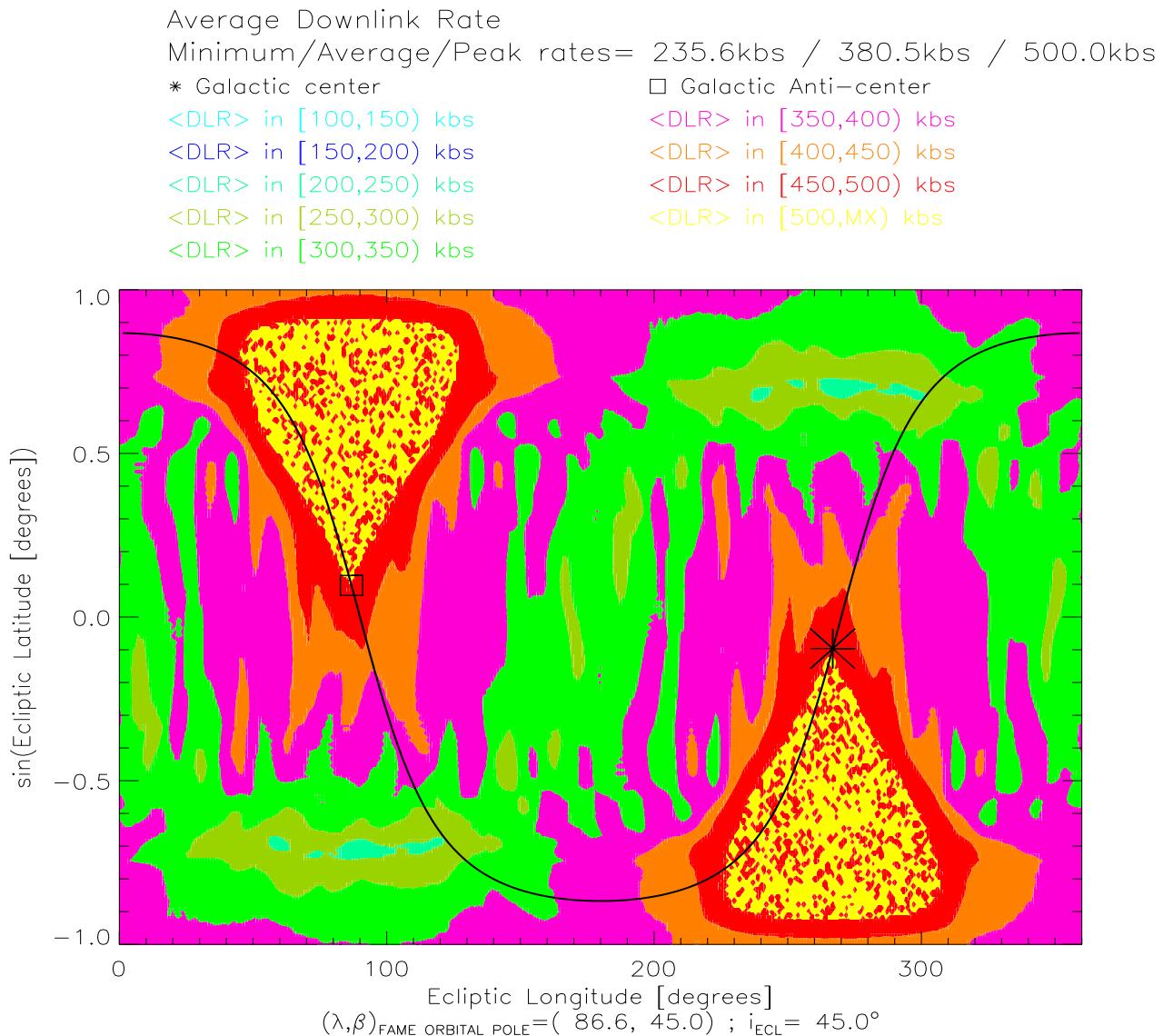
Occultation zone overlaps with Galactic Plane

$$\lambda_{pole}^{worst} = 177^\circ \pm 25^\circ$$



Downlink Rate Distribution

$$\lambda_{pole} = \lambda_{pole}^{best}$$



Occultation/DLR & Galactic Plane Alignment

- Occultation band *can* follow Galactic Plane
- Low-DLR band *can* follow Galactic Plane
- Best possible case: $\lambda_{OP}^{best} = 87^\circ / 267^\circ, \pm 15^\circ$
Actual pole will drift from $\lambda_{OP} = 100^\circ$ to 80°
Can be optimized for the Galaxy by a shift of
 -3° : drifting from $87+10=97^\circ$ to $87-10=77^\circ$.
- Worst possible case: $\lambda_{OP}^{worst} = 177^\circ \pm 25^\circ$
- Actual case: $\lambda = 100^\circ - 80^\circ$ ($11/\text{04} \longrightarrow 11/\text{09}$)