Propellers in Saturn's rings

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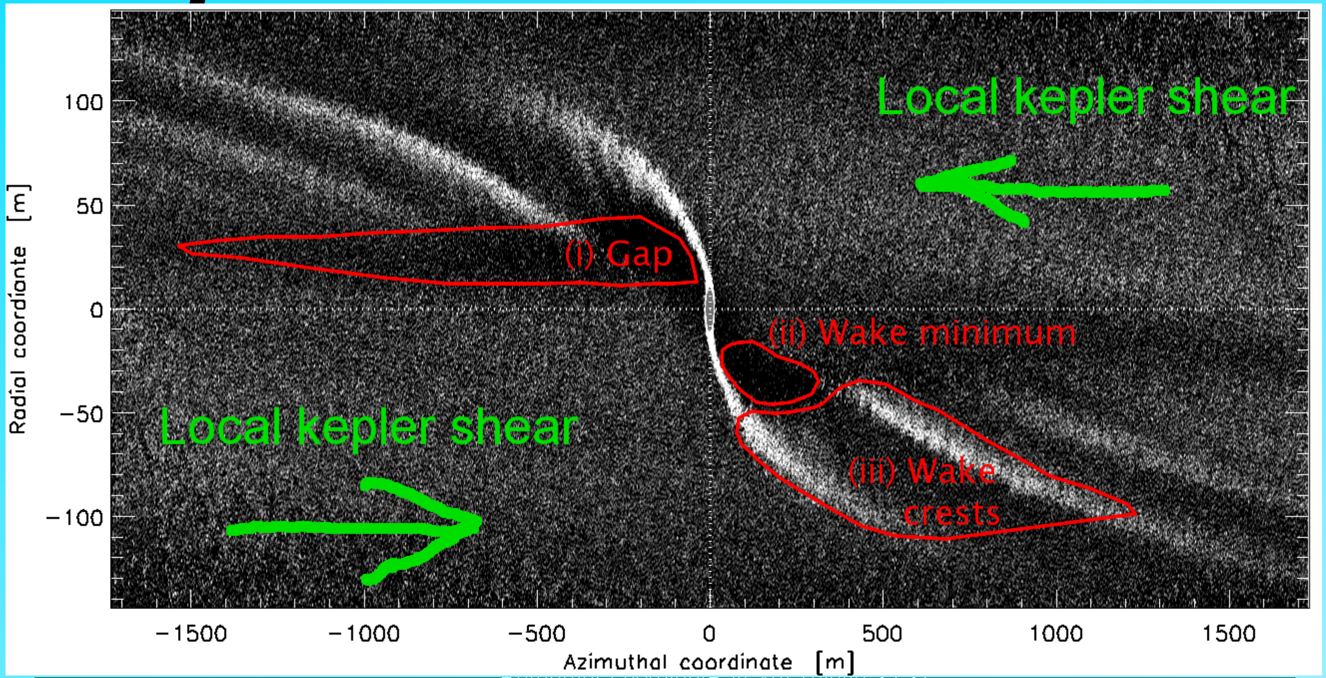
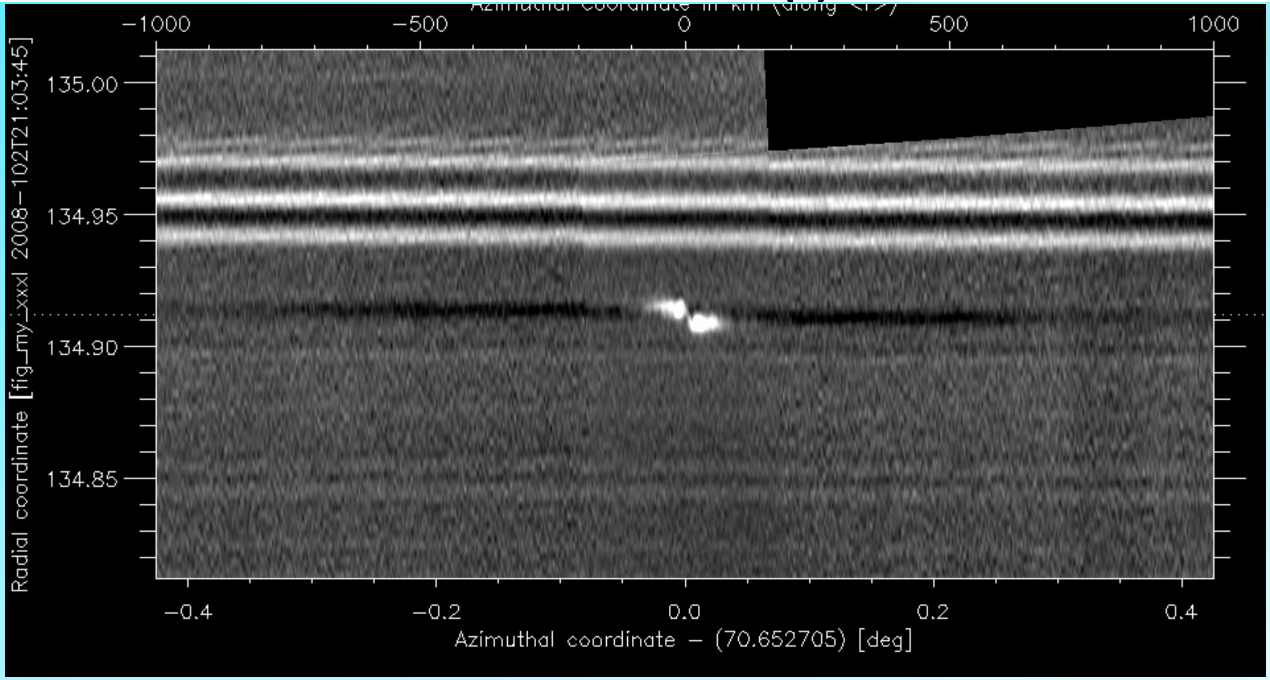
Propellers: traces embedded bodies



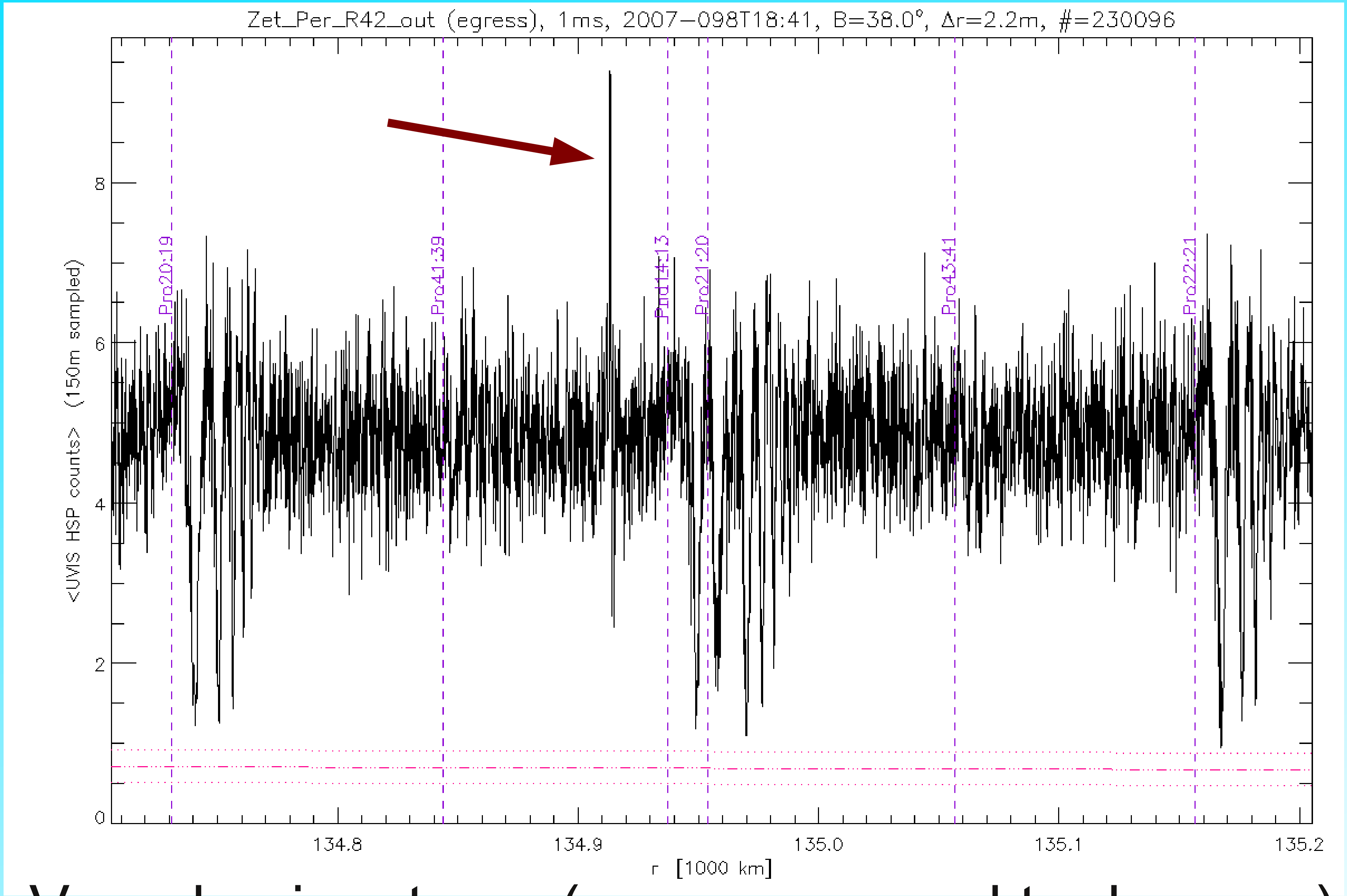
N-body simulation (w/o SG)



Bleriot: the largest known trans-Encke propeller.

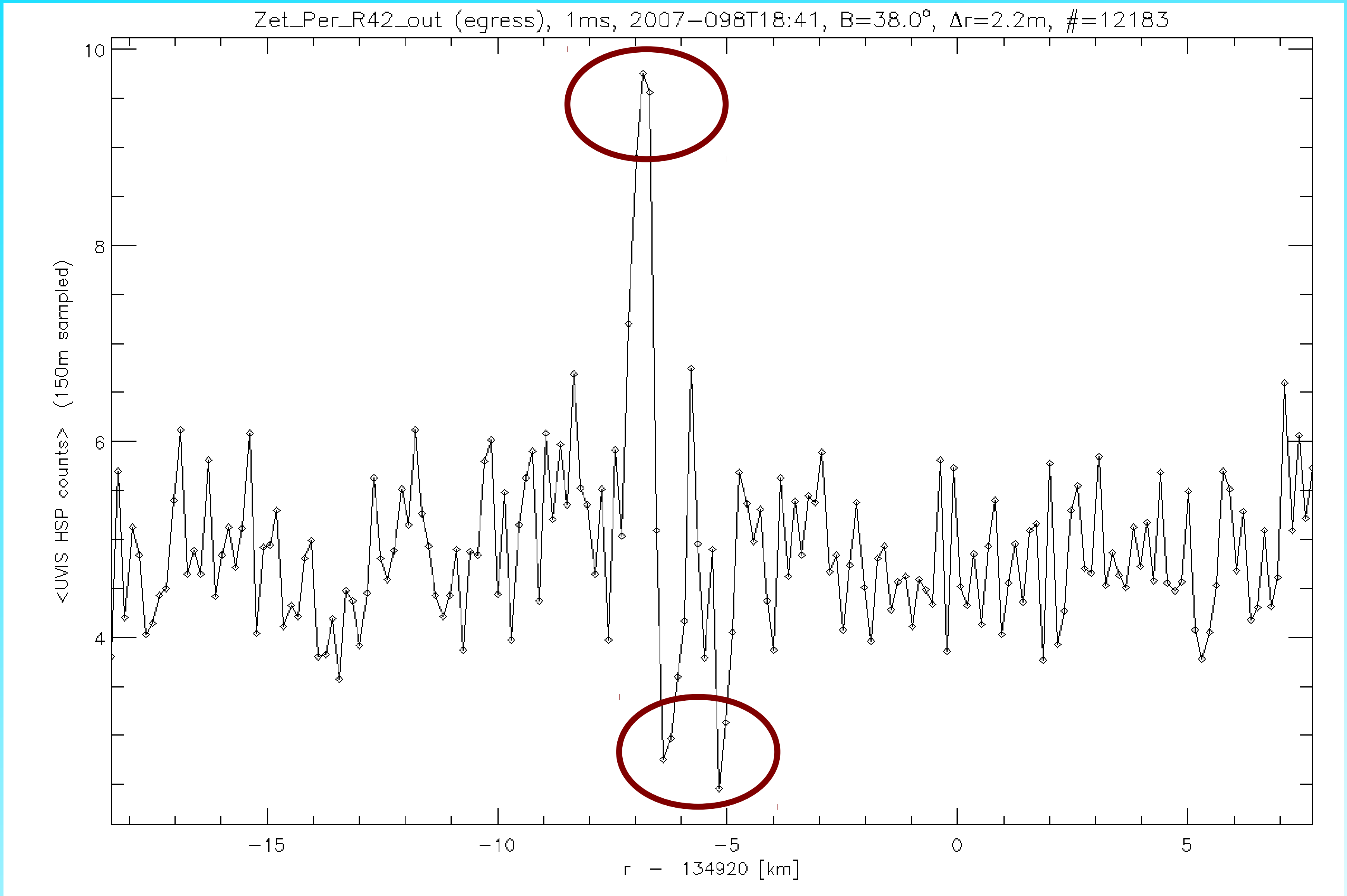
(N1586641169 and N1586641255, 3km/pixel, lit geometry)

Bleriot: Zet Per R42 occultation



Very dominant gap (even compared to dens. w.)

Bleriot: Zet Per R42 occultation



Possible interpretation: a gap + flanking wakes

Statistical significance of features

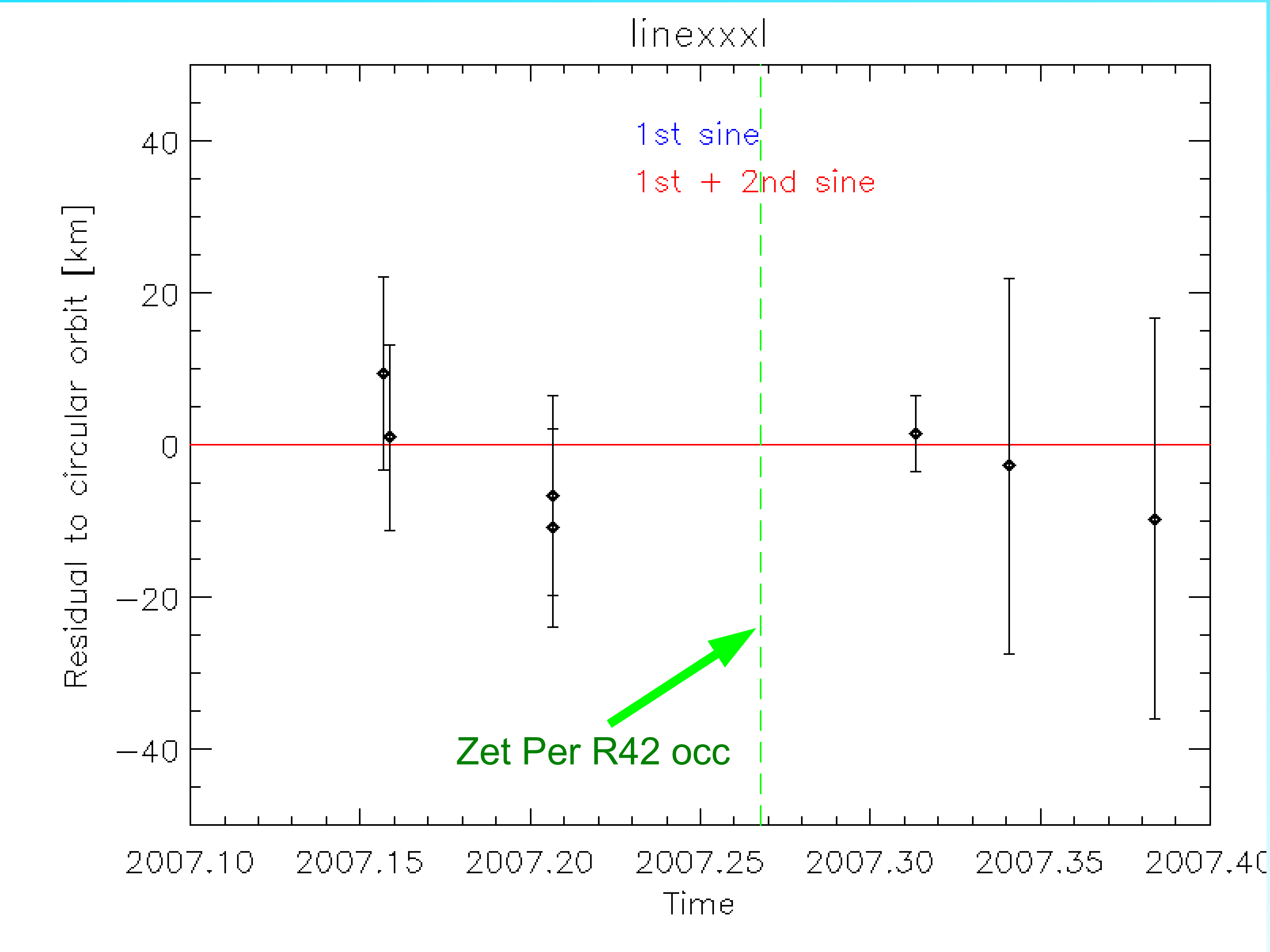
• Voyager Uranus data & Cassini F ring: M test based on Poisson statistics (J. Colwell)

• But: **M test is not applicable** to main rings (microstructure changes significantly statistics, e.g. excess variance and autocorrelations)

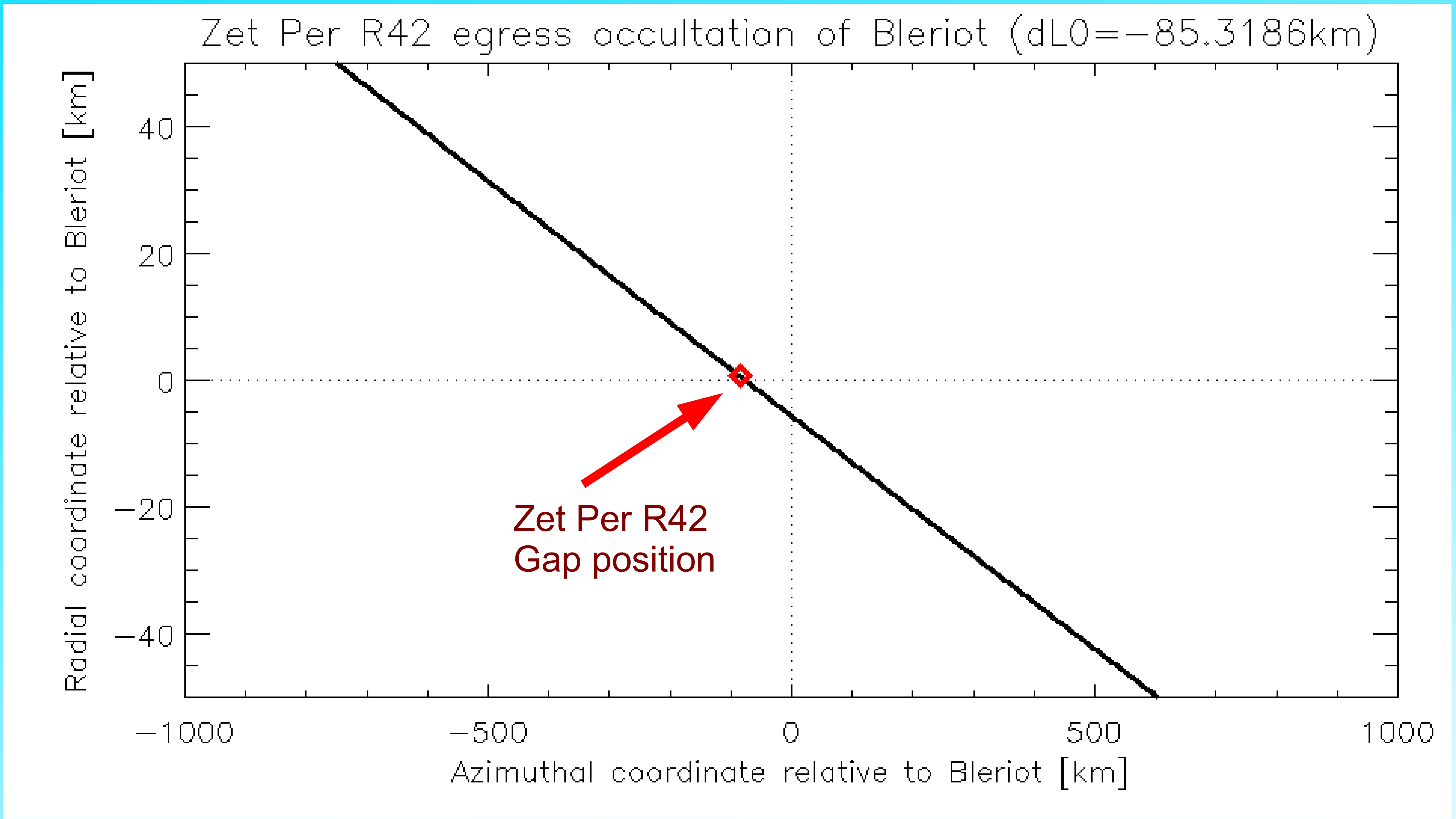
• T-test: do two data sets have same mean or not?

$$T = \frac{\bar{x} - \bar{y}}{\sqrt{\dfrac{\sum_{i=0}^{N-1} (x_i - \bar{x})^2 + \sum_{i=0}^{M-1} (y_i - \bar{y})^2}{(N + M - 2)} \left(\dfrac{1}{N} + \dfrac{1}{M}\right)}}$$

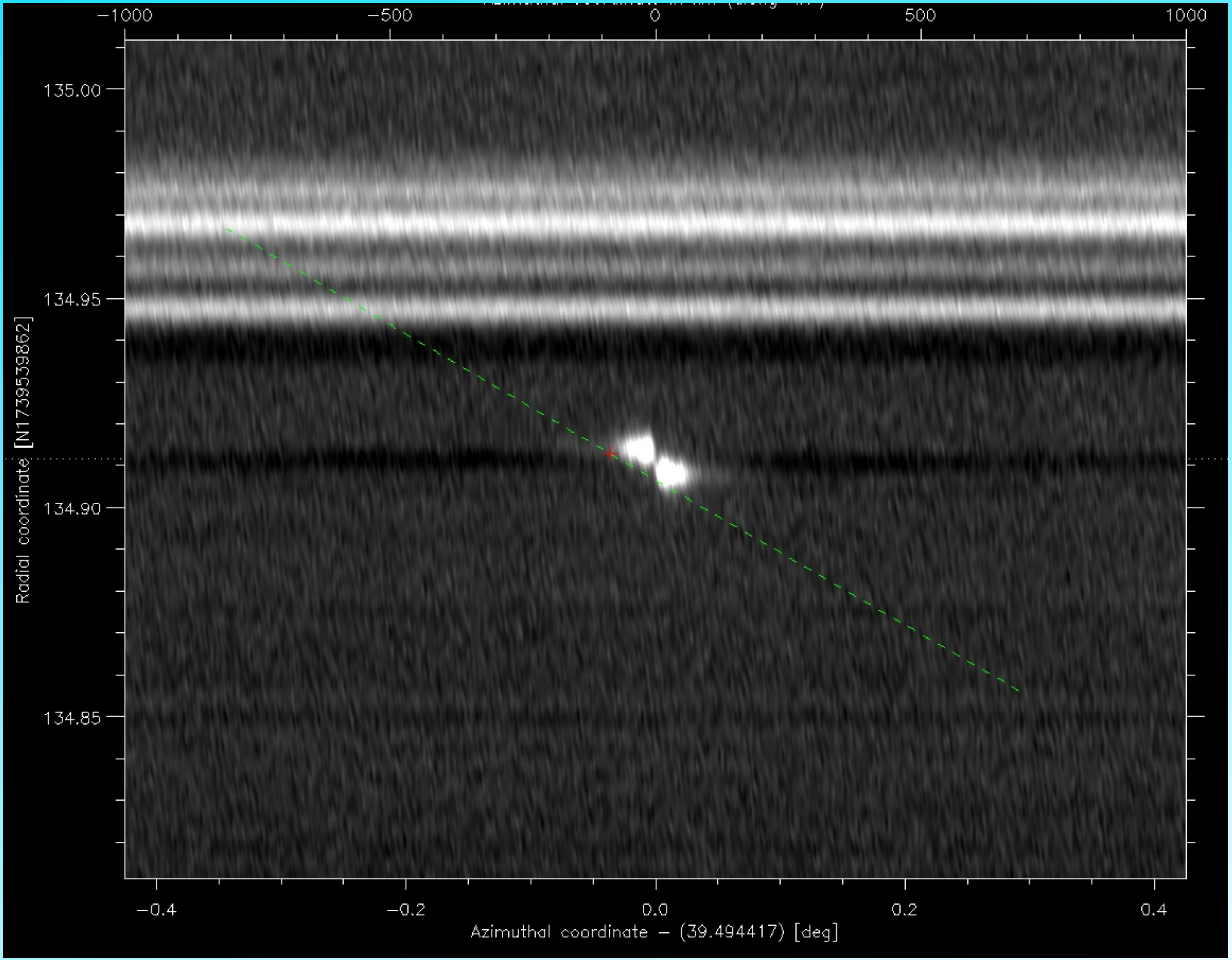
Bleriot motion: linear fit around Zet Per



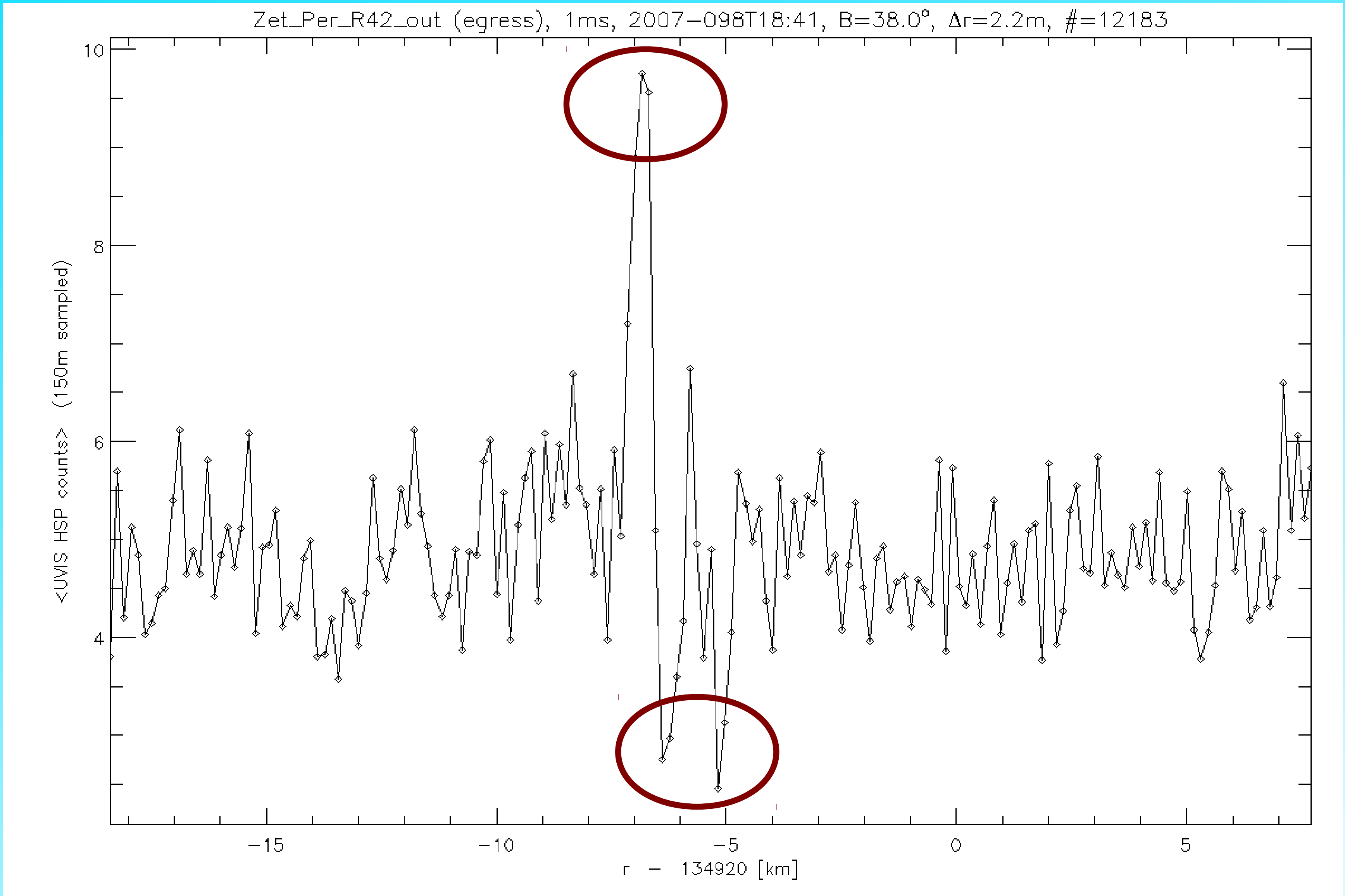
Bleriot: resulting Zet Per geometry



Zet Per geometry: hi-res ISS example



Bleriot: Zet Per R42 occultation



Interpretation: a gap + 2 flanking wakes

Zet Per vs Bleriot geometry uncertainty

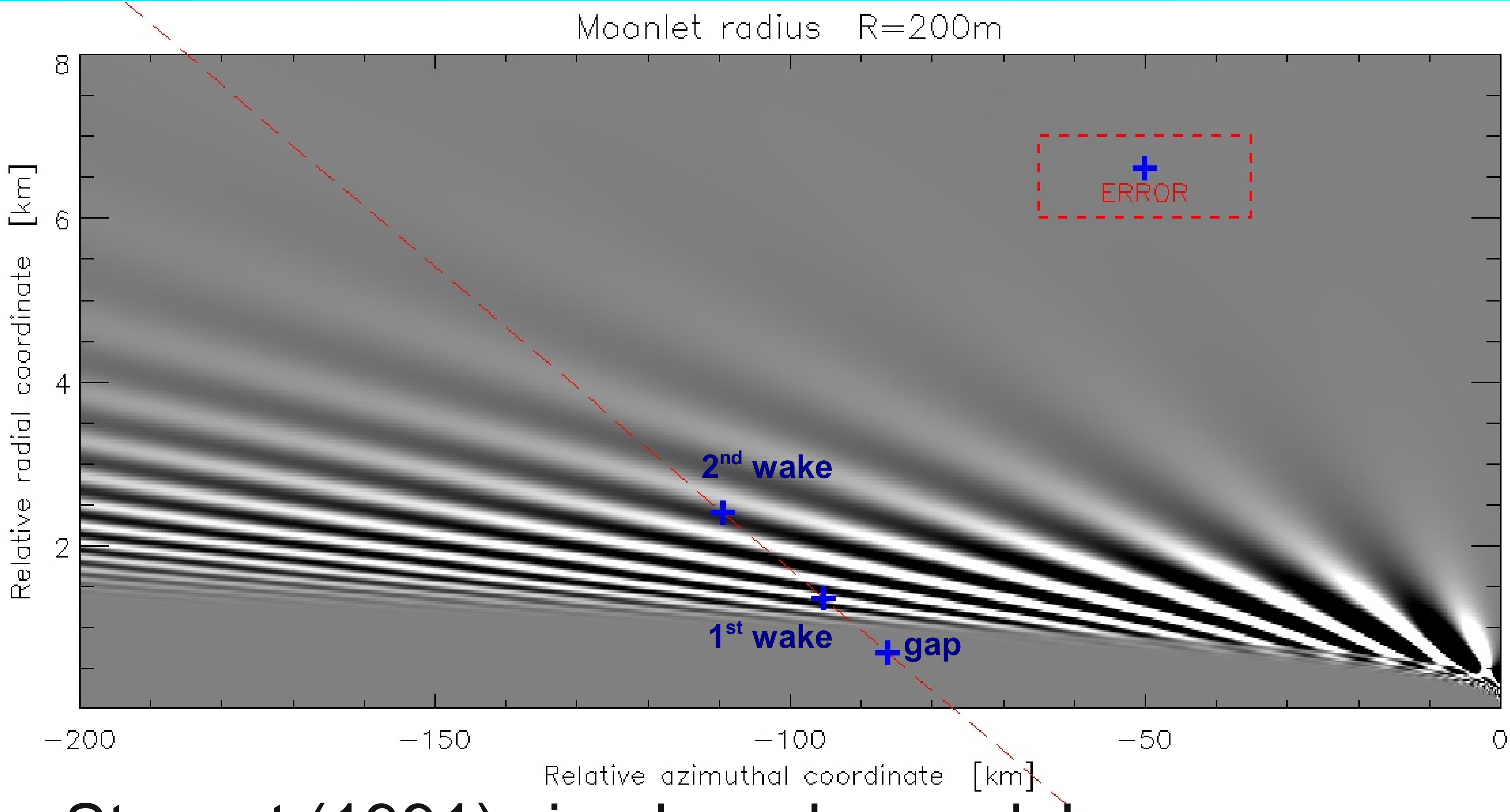
- Occ dR <= 0.5km (ring edges)
  (~100ms down-the-track)

- Occ dL???
  pessimistic 10 x dR <= 10km

- Bleriot dR <=50m (mean motion very precise)

- Bleriot dL <=10km (max scatter)

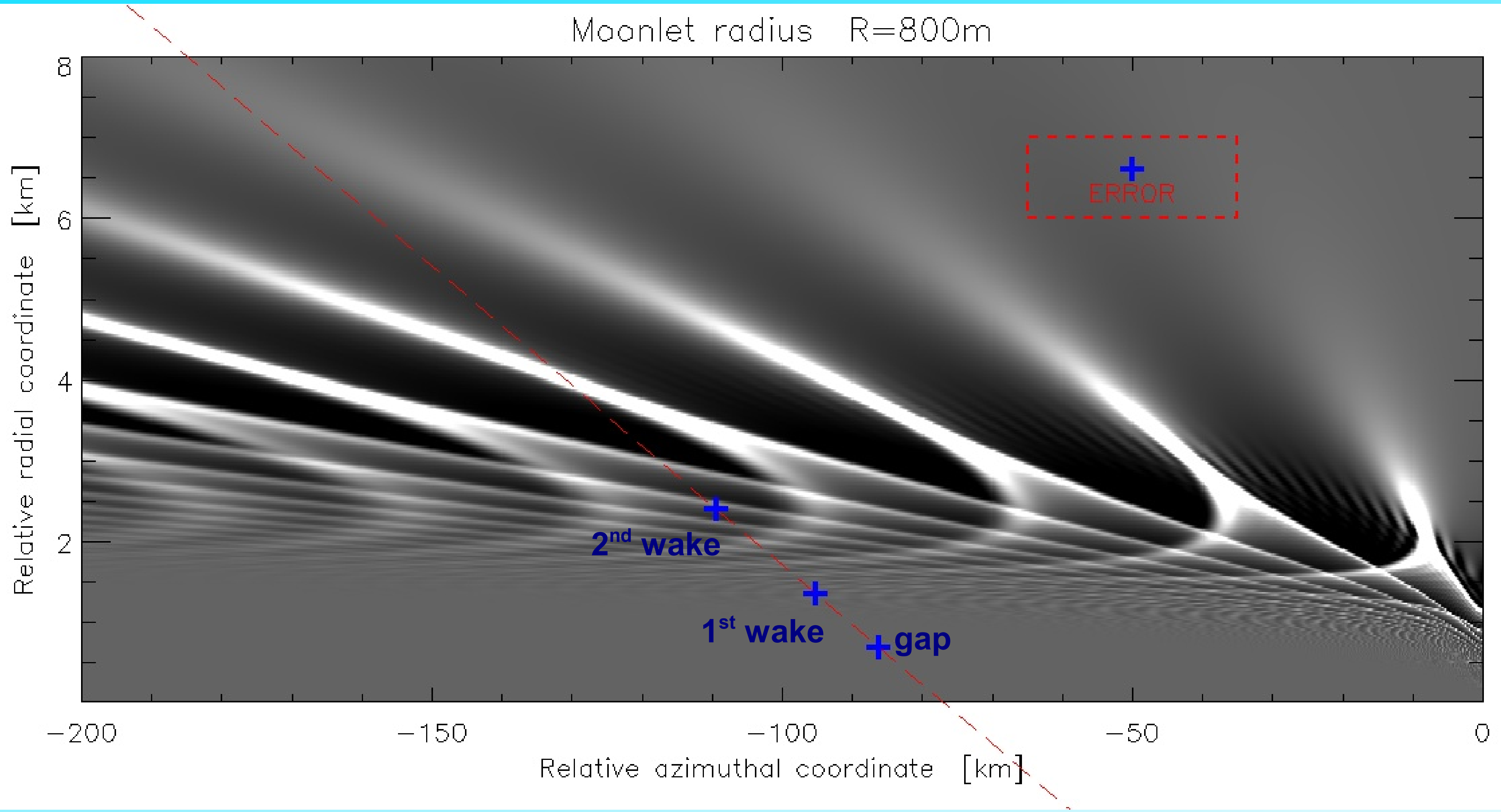
Bleriot in Zet Per: wake model



Stewart (1991) simple wake model

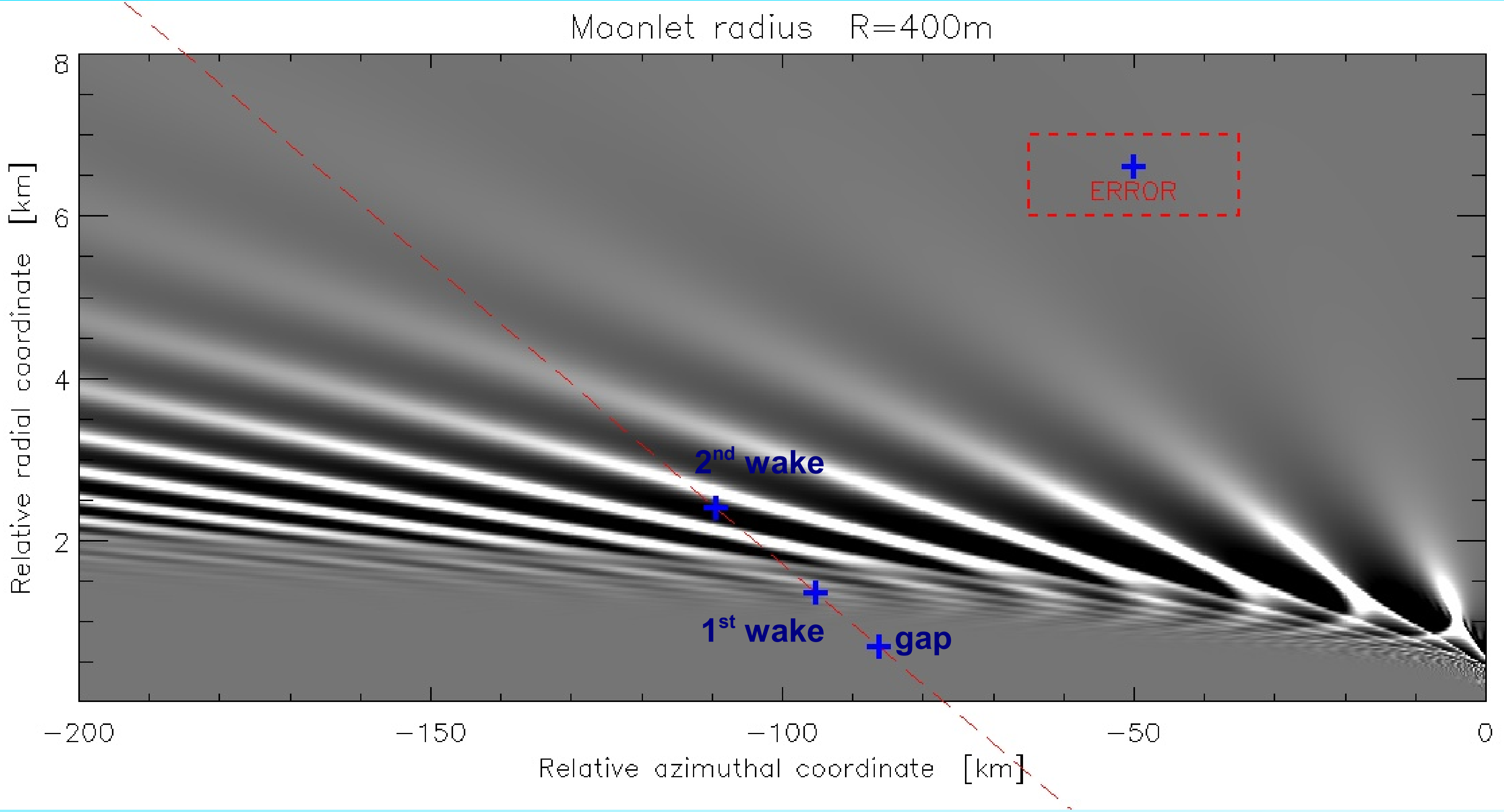
$R_{Bleriot}$=200m predicts too many wakes!

Bleriot in Zet Per: wake model



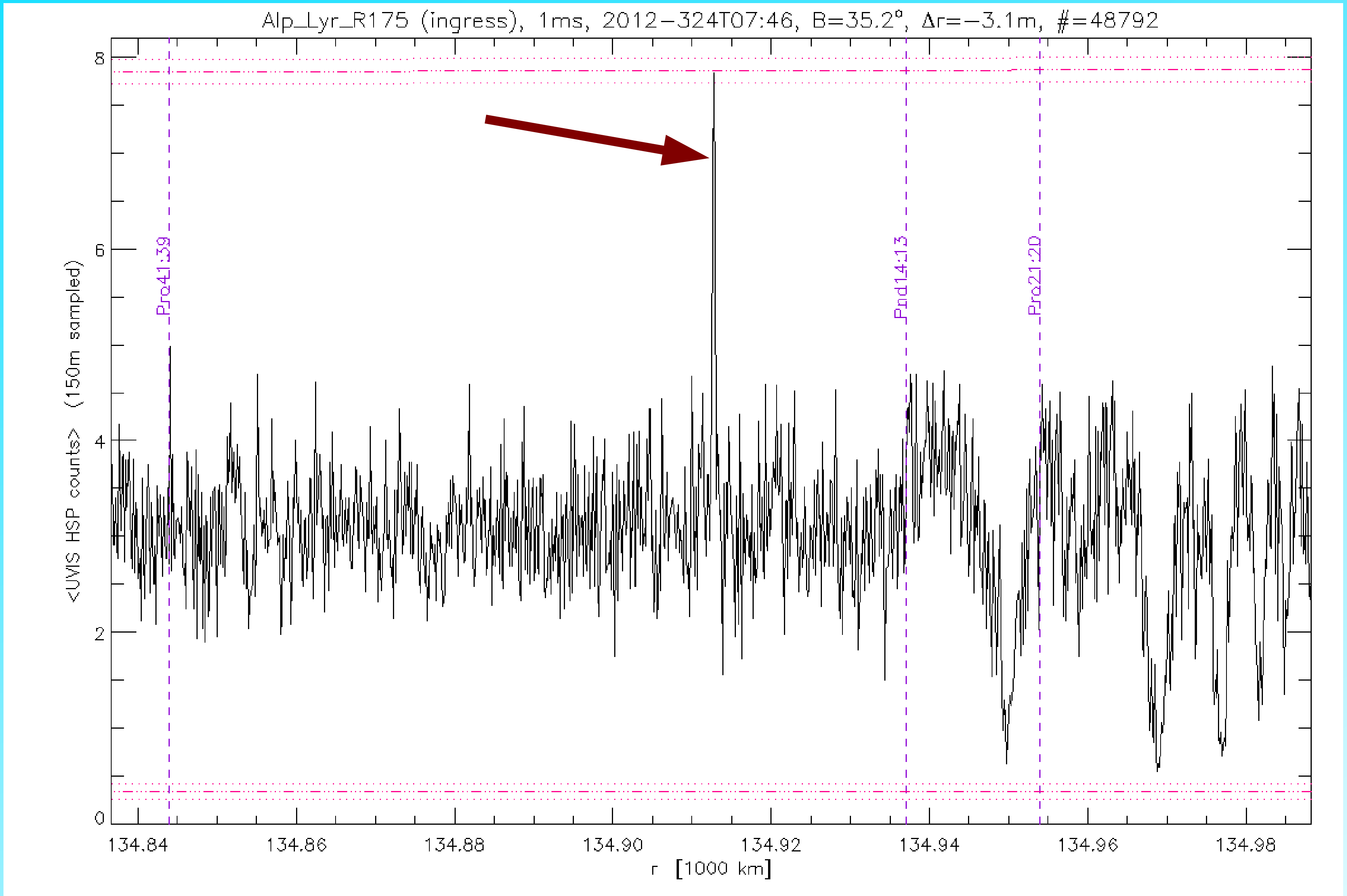
$R_{Bleriot}$=800m predicts too few wakes!

Bleriot in Zet Per: wake model

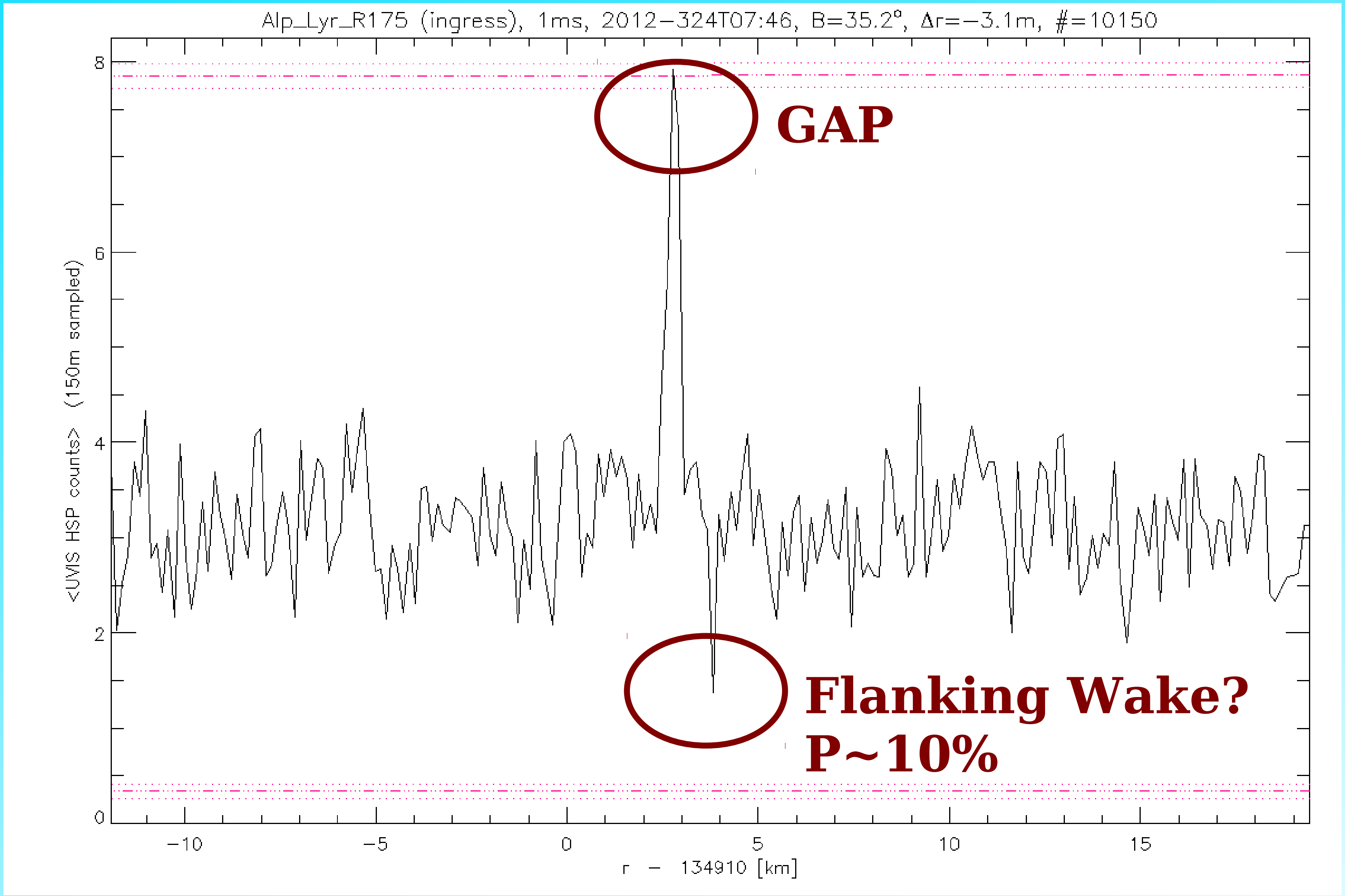


$R_{Bleriot}$=400m looks like a possible solution

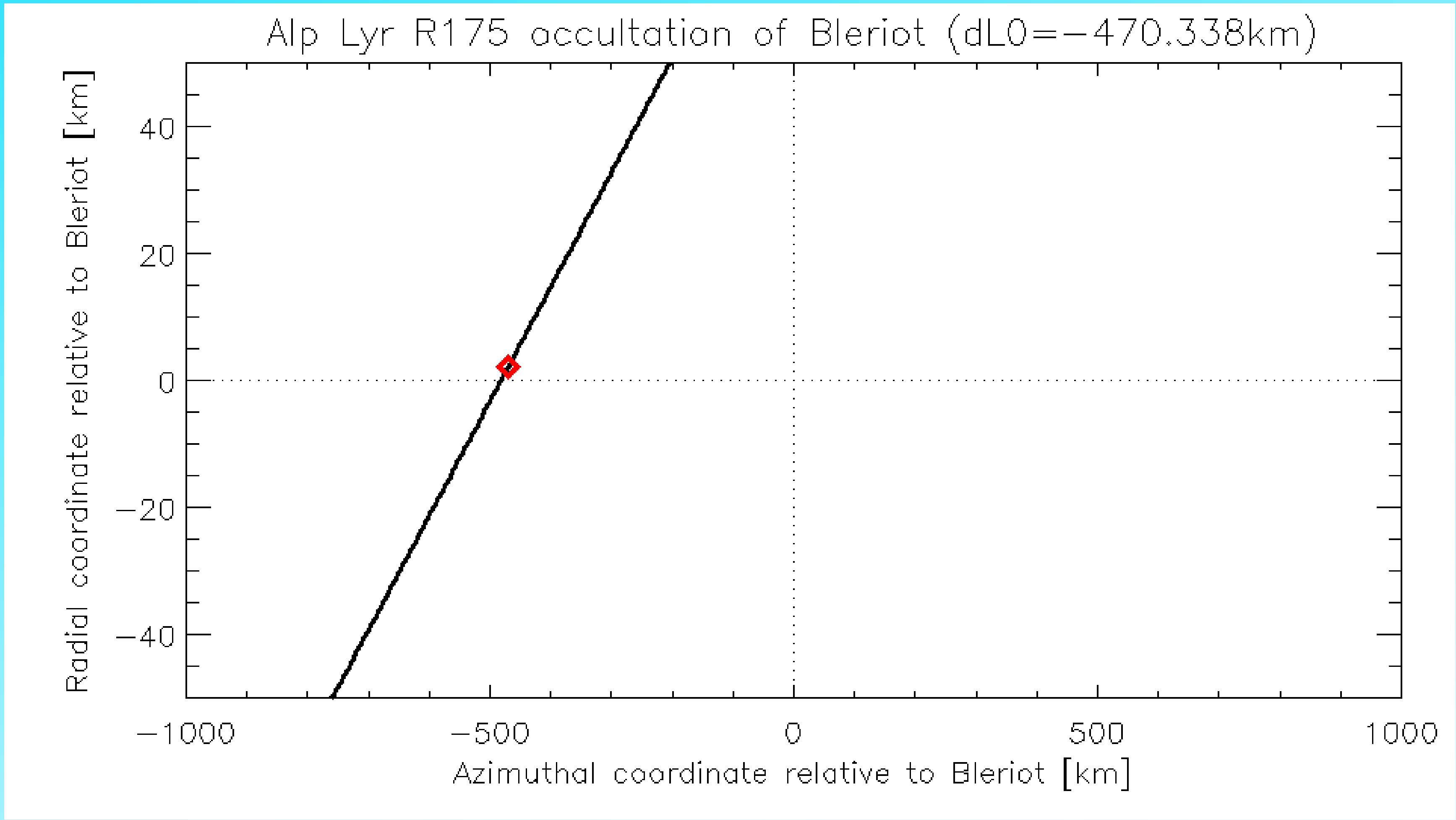
Bleriot new detection: Alp Lyr R175



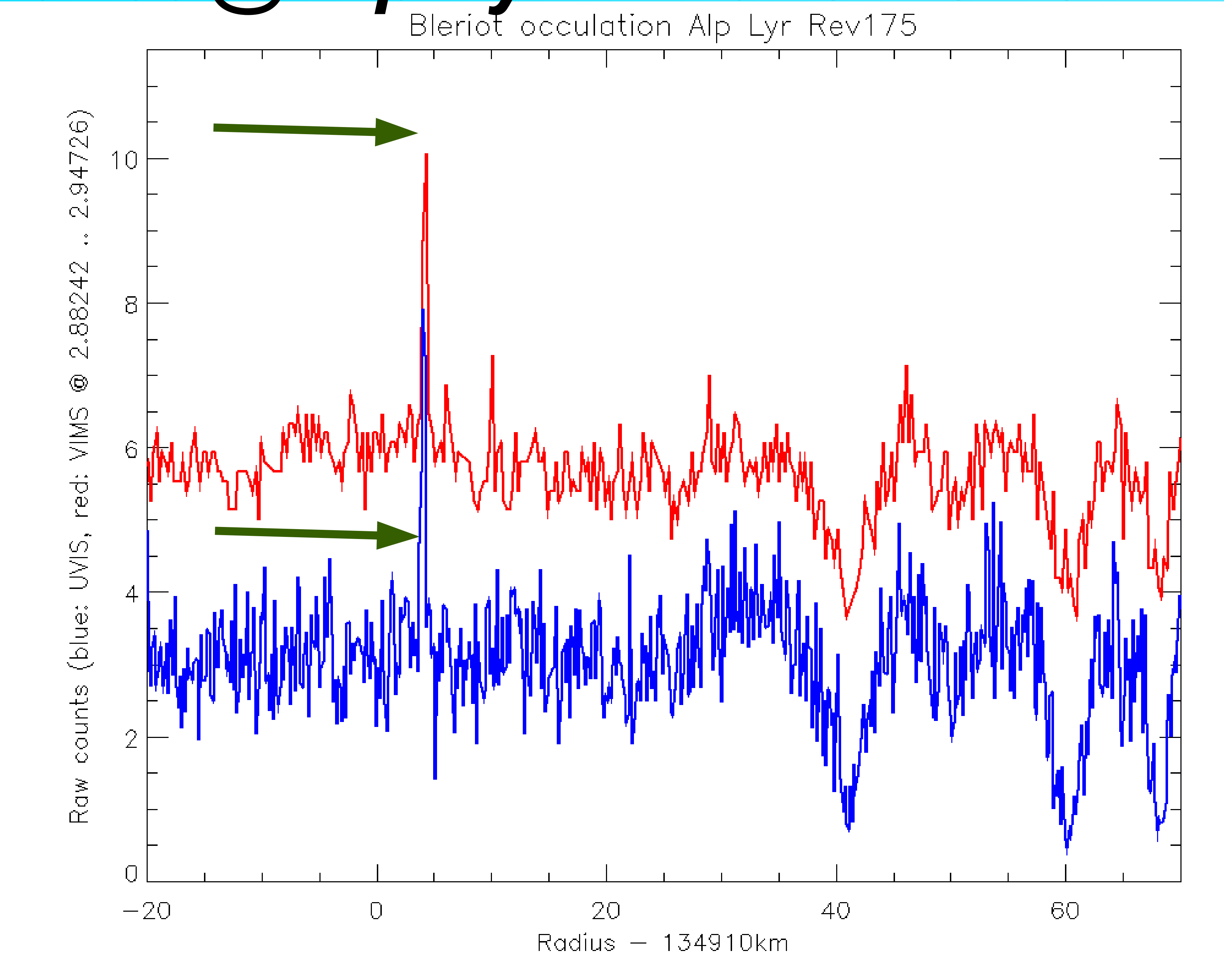
Bleriot new detection: Alp Lyr R175

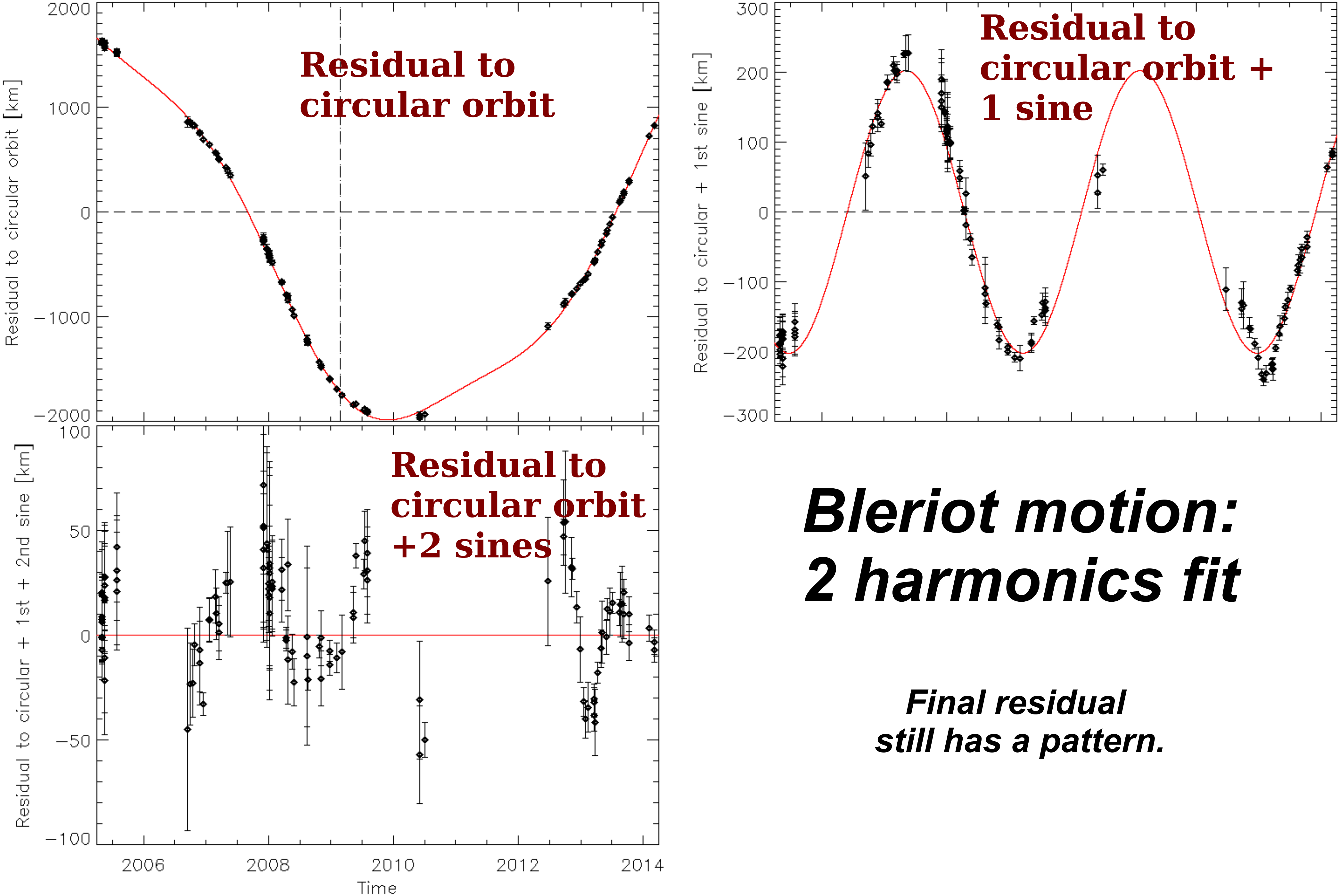


Bleriot new detection: Alp Lyr R175



Bleriot @ Alp Lyr R175: UVIS vs VIMS

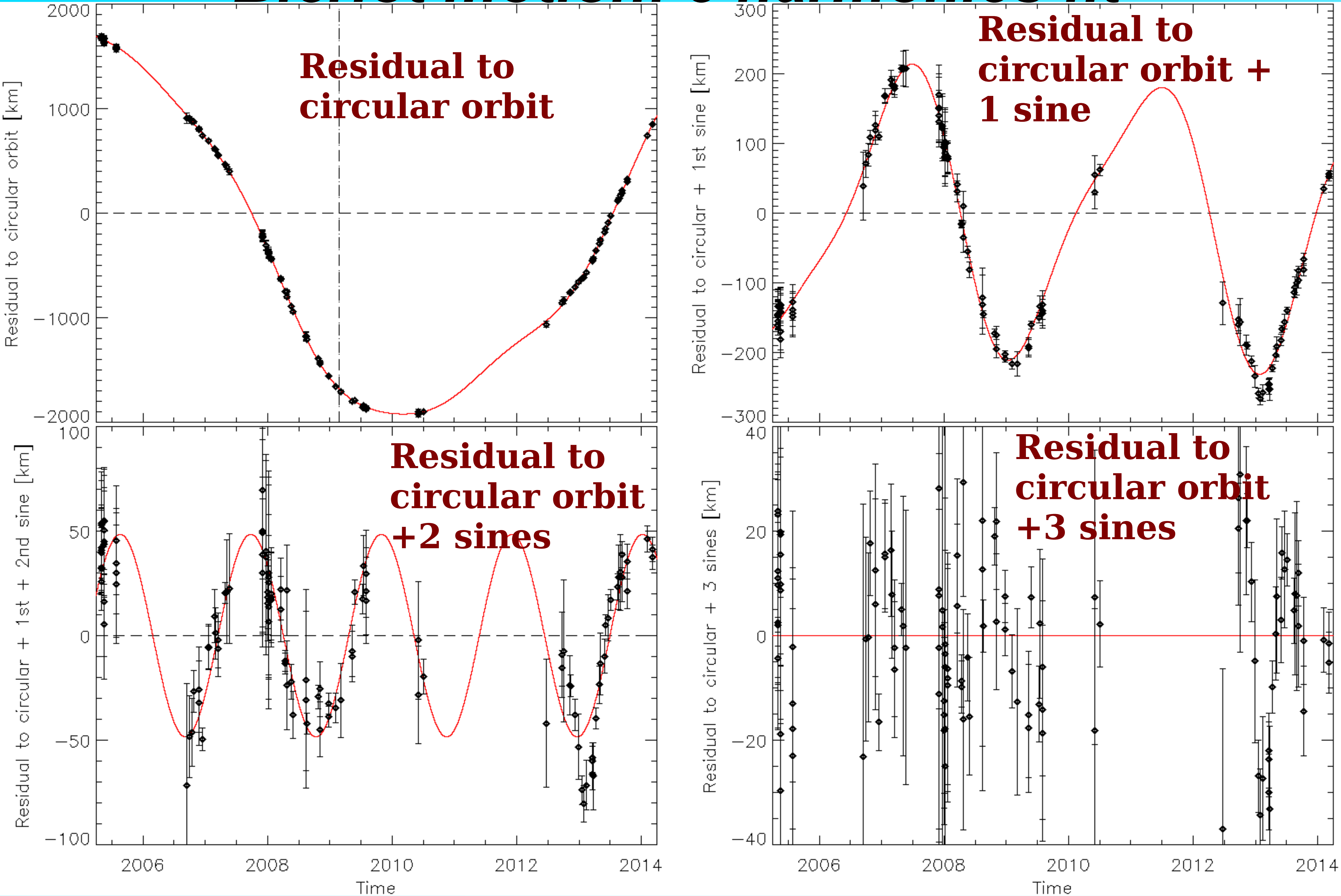




Bleriot motion: 2 harmonics fit

Final residual still has a pattern.

Bleriot motion: 3 harmonics fit



Summary

- 2 UVIS (+1 VIMS) occultation of Bleriot

- Bleriot shape: gap + wakes.

- Images show propeller wakes.

- Bleriot embedded body of ~400m in size. Consistent with other estimates!

- 2 sines fit to Bleriot motion: 2400km + 230km amplitudes (30km rms). 3rd sine with 40km amplitude leaves rms<20km.