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ERRATUM: "DETERMINING TITAN'S SPIN STATE FROM CASSINI RADAR IMAGES" (2008, AJ, 135, 1669)

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We previously reported an initial determination of Titan's rotational state from fits to overlapping radar images. We have since discovered a coding error in software used to make these fits, which led to systematic offsets of 1–2 km in recovered positions. While our principal results remain qualitatively unchanged, with this error corrected, the pole movement we previously reported (our weakest result) is now counterindicated. Our revised best fit is essentially the same as the "best-fit no pole wobble" result discussed at the top of the second column on page 1675.

The determined pole location did not change significantly after the bug fix and thus we still conclude that the spin axis is not in the plane formed by Titan's orbit normal and the normal to the Laplace plane. Due to the correlations between pole wobble and spin rate (see Figure 3 on page 1672), the new best fit has a spin rate that differs from the synchronous value by an amount that is three times smaller than the value reported in the paper. The pole location changed by less than 0.01 deg ($\sim$500 m on the surface) and rate of increase in spin decreased by a factor of 2 from the previous fit. The new best-fit parameter values with 1σ error bars are: pole right ascension 39.4934 ± 0.0249 deg, pole declination 83.4368 ± 0.0024 deg, spin rate 22.57731 ± 0.00011 deg/day (0.00033 deg/day greater than synchronous spin rate), derivative of pole right ascension -6.52 ± 4.20 deg/century, derivative of pole declination -0.2212 ± 0.3567 deg/century, and derivative of spin rate 0.0247 ± 0.0050 deg/day/century.

The corrected version of Table 3 (below) shows the residual systematic and random error of the several candidate models discussed in the paper. Fixing the bug reduced the residual systematic error of all the fitted models. The four models in which spin rate is allowed to vary from synchronous either due to a change in spin rate (Column 5, numbered from the left) or a change in its time derivative (Column 6) or both (Columns 7 and 8) have lower residual systematic errors and thus better represent the data than do the purely synchronous fit (Column 3). For this reason, an asynchronous spin rate is still supported by the data, although efforts (e.g., Mitchell 2009) to quantitatively interpret the asynchroneity should take our revised determination into account. On the other hand, as depicted by Columns 7 and 8, allowing the pole movement terms to vary from the predicted (IAU Titan) values results in no significant improvement in the fit, thus large short-term pole movement is not supported by the data. In fact, the best-fit values and error bars for the pole movement are consistent with the long-term pole trends that were predicted prior to the Cassini mission.

Table 3
Random and Systematic Error Residuals for Various Fits (Corrected Values)

Error Metric	IAU Titan	Best-fit Pole Location Only	Best-fit for Spherical Titan	Best-fit Constant Spin Rate	Best-fit Synchronous Spin Rate	Best-fit No Pole Wobble	Best Overall Fit
e_{rand} (km)	0.9795	0.9596	0.8731	0.9318	0.9567	0.9466	0.9438
e_{sys} (km)	18.7639	1.6855	1.4911	0.8418	0.5712	0.4420	0.4295

REFERENCES

Mitchell, J. L. 2009, ApJ, 692, 168