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# The determination of Dione's gravity field after four Cassini flybys

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We present the expected accuracy in the determination of Dione's gravity field obtained through numerical simulations of all radio science flybys currently planned in the entire Cassini mission.
During its tour of the Saturn system, Cassini already performed two flybys of Dione dedicated to the determination of its mass and gravity field, in October 2005 and December 2011, respectively. Two additional radio science flybys are planned in June 2015 and August 2015.
The analysis of the Doppler data acquired during the closest approach of the second flyby allowed the first estimation of Dione's J2 and C22 but, given the limited amount of data, their estimation has a large correlation and cannot be considered fully reliable.
Here we infer the expected final accuracy in the determination of Dione's J2 and C22 by combining the available results from the already performed experiments with numerical simulations of future flybys.
The main observables considered in the analysis are two-way and three-way Doppler data obtained from the frequency shift of a highly stable microwave carrier between the spacecraft and the stations of NASA's Deep Space Network. White Gaussian noise was added to the simulated data, with a constant standard deviation for each tracking pass, obtained from an accurate noise budget of the Cassini mission.
For the two flybys to be carried out in 2015, we consider a continuous coverage during +/-18 hours around the closest approach, plus one tracking pass 36 hours before and after it. The data analysis is carried out using a global, multi-arc fit, and comparing the independent solutions obtained from each flyby and different multi-arc solutions.
The analysis of all four flybys is expected to provide the best, unconstrained, reliable estimation of the full quadrupole gravity field of Dione.