STARDUST DYNAMIC SCIENCE AT WILD 2: FIRST LOOK. J. D. Anderson,[1], E. L. Lau[1], B. C. Clark[2], S. W. Asmar[1], [1]Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109-8099, john.d.anderson@jpl.nasa.gov, [2]Lockheed-Martin Astronautics Company

The Dynamic Science investigation on the STARDUST mission has been described previously (Anderson et al., JGR-Planets **108**). The data delivered by the STARDUST Project is multifold, but basically it consists of radio Doppler data from the Deep Space Network (DSN) and attitude control data (ACS) from the spacecraft. Doppler data were successfully recorded by JPL's Navigation System (closed-loop data) and also by its Radio Science System (open-loop data) at DSN stations DSS43 near Canberra Australia and at DSS14 at Goldstone California. Attitude control data were also successfully delivered to the Dynamic Science Team. Here we describe a preliminary analysis of the data.

Beyond a closest approach distance of 150 km, a Doppler detection of a the Wild 2 nucleus mass was not expected. The current best estimate of the closest approach distance is 236.4 km, and as expected, any mass signal in the Doppler data is hopelessly buried in the noise. We have attempted to fit the data to a mass model with no success. However, analysis of the Doppler data and the ACS data for particle impacts on the spacecraft's Whipple shields is in progress, and will be reported at the meeting.

The DSS43 closed-loop Doppler residuals are plotted in Figure 1 as a function of time from the current best estimate of the time of Wild 2 closest approach, 2 January 2004, 19:43:11.7 UTC, Earth-receive time at the station. The two outlying Doppler points are coincident with the times of High Gain Antenna (HGA) to Medium Gain Antenna (MGA) switch at 19:37:35 UTC and MGA to HGA switch at 19:51:42 UTC, as indicated by amplitude changes in the radio carrier wave. Note the transient frequency jumps right at the times of the antenna switches. This provides a good check that the Doppler data is synchronized properly with spacecraft events. The light time at closest approach between the spacecraft and DSS43 is 21.6624 minutes.

A linear polynomial and a small frequency increase at 35.5 ± 7.8 seconds can be removed from the residuals nearest to closest approach, where the effect of the roll maneuver is linear. The resulting Doppler residuals are shown in Figure 2. The analysis and interpretation of these residuals is in progress.

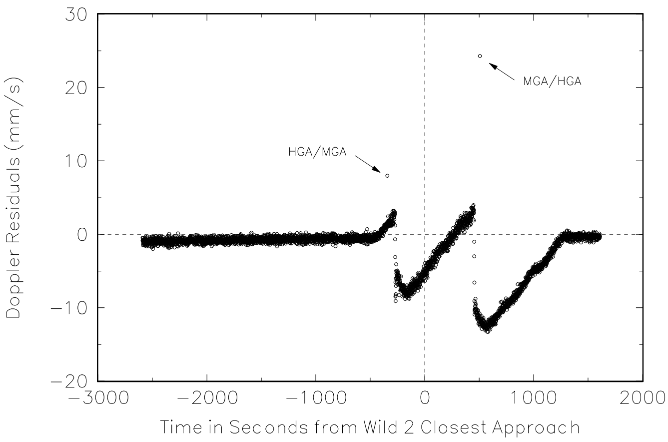

Figure 1: Plot of two-way Doppler data recorded at DSS43. The relatively large changes in the Doppler shift are caused by a combination of thruster firings for the roll maneuvers and the resulting motion of the antenna being tracked. The two outlying points marked by arrows are the result of two antenna switches causing a brief loss of lock to the radio carrier wave.

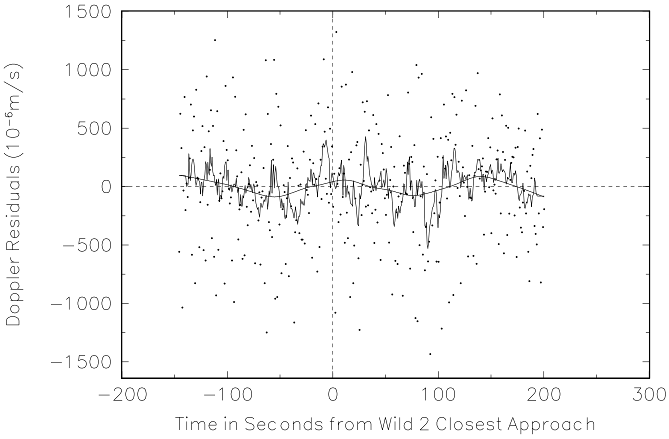

Figure 2: Doppler residuals nearest Wild 2 closest approach after removal of the linear drift obvious in Figure 1. The small-amplitude sine wave in the residuals results from an application of a low-pass filter. The jagged curve results from an application of a 13-point Savitsky-Golay smoothing algorithm, which has the desired property of preserving spikes.

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