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Stardust: An overview of the tracks in the aerogel (calibration, classification and particle size distribution)

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The NASA Stardust mission (1) to comet P/Wild-2 returned to Earth in January 2006 carrying a cargo of dust captured in aerogel and residue rich craters in aluminium foils (2). Aerogel is a low density, highly porous material (3, 4). The aerogel that was carried by Stardust in the cometary dust collector trays was a SiO2 aerogel, arranged in blocks 4 cm x 2 cm (front face) and 3 cm deep, with density which varied smoothly from 5 mg/cc at the front surface to 50 mg/cc at the rear surface (5). A first look at the whole cometary dust tray at NASA showed that there were many impact features in the aerogel. During the Preliminary Examination period about 15% of the aerogel blocks were removed and studied in detail. The tracks observed in these blocks were classified into three groups: Type A were long relatively narrow tracks of "carrot shape", Type B tracks were again fairly long but had a large bulbous region at the top and appear like the bowl and stem of a flute champagne glass, Type C were purely bulbous tracks with no stem emerging beneath them. Data on the sizes and relative populations of

these tracks will be given (also see (6)) along with a discussion of their implications for impactor composition. Laboratory calibrations of the impacts in aerogel have been carried out using glass beads and these permit an estimate of the size of the impactor based on the measured track properties (6). When applied to the tracks measured in the Stardust aerogel, a cumulative particle size distribution was obtained (7) which will be discussed.

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