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Dust Grain Detection by the Solar Orbiter Radio and Plasma Wave instrument

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Hypervelocity dust impacting the spacecraft body can be either partly or totally destroyed and evaporated and then creates a cloud of charged particles. Electrons and ions generated by such impacts can consequently influence the spacecraft potential and/or measurements of on-board scientific instruments. Electric field instruments are sensitive to these disturbances and typically register signals generated by dust impacts as short pulses. Once they are distinguished from other signals, they can be used for the detection of dust grains by spacecraft (even without dedicated dust detectors).

Solar Orbiter is equipped with the RPW (Radio and Plasma Wave) instrument including three electric field antennas allowing such detection. The time domain sampler (TDS) subsystem of RPW provides typically short electric field waveforms (62.5 ms) sampled at a rate of 262.1 kHz

We have analyzed individual electric field waveforms of dust impacts detected by Solar Orbiter RPW/TDS and sorted into different categories (typical dust impact, impacts with the complex response, misinterpreted events, and suspicious events). Typical dust impacts are compared with an expected signal based on a model of dust impacts. The reliability of dust detection (fraction of misinterpreted and suspicious events) is evaluated with respect to the distance from the Sun.