Radiation Effects on LWS Detectors and Deglitching of LWS Data

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Glitches are caused by the effects of ionising particles (either a primary cosmic ray, interplanetary or belt electron, or a secondary generated in the spacecraft structure) on the detectors. There was roughly one glitch per ten seconds per detector during the normal period of LWS operation. These energetic particles cause a sudden jump in the ramp voltage, due to a quantity of charge being dumped on the integrating amplifier. They also cause a change in the detector responsivity which affects the following ramps.
Glitches were detected in the automatic pipeline processing for each observation with the LWS that was performed with a standard Astronomical Observation Template. We describe the method with which this deglitching was carried out and the curing processes that were used to reset the responsivity of the detectors to its nominal value.
Based on the findings from the deglitching algorithms we compare proton and electron fluences with average glitch rates and look for correlations. In particular we discuss the limits at which proton events and the Earth's radiation belts cause glitch rates so high that scientific observations with the LWS become impossible. From the glitch statistics one can also derive the energy distribution of the ionising radiation that hit the detectors. This energy spectrum agrees roughly with model predictions and therefore shows that it is in principle possible to predict the properties of the ionizing radiation to which the detectors of future missions will be exposed. This is important, because for the LWS we found that the effect of an ionising radiation hit on the detectors was rather different, and more severe, than had been predicted before launch: An ionising particle could cause the detector to become unstable and spike spontaneously for some seconds following a hit, resulting in a strongly increased noise and requiring a readjustment of the bias levels.