Sawteeth are periodic relaxations of the core plasma which occur when the central safety factor, $q_0$, is below 1. They consist of a ramp-phase during which temperatures and particle densities evolve slowly, and a fast crash that flattens these quantities inside the mixing radius, $\rho_{\text{mix}}$. For peaked pre-crash profiles, the crash decreases the values close to the magnetic axis and increases them just inside $\rho_{\text{mix}}$. At the inversion radius, $\rho_{\text{inv}}$, which does not necessarily coincide with the position of the $q = 1$ flux surface, the values remain unchanged.

Sawtooth crashes can help to avoid impurity accumulation in the hot plasma centre, and to get rid of helium ash in a fusion reactor. On the other hand, large sawtooth crashes can trigger neoclassical tearing modes (NTMs). Sawtooth control therefore does not necessarily aim at avoiding sawteeth but at keeping them small and frequent.

The necessary feedback quantity from the plasma for sawtooth control is the crash time. Due to different time-scales of ramp and crash phase, the task is to detect fast changes, edges, in the time traces of detector signals observing the crash. However, edge detection for a single time trace is often not sufficiently reliable, because the crash can be invisible, e.g. close to $\rho_{\text{inv}}$.

The spatial distribution of losses (difference of values after and before the crash) can discriminate sawtooth crashes from other events, like ELMs, and distinguish partial crashes, where the flattening does not reach the magnetic axis. Since for partial crashes neither impurity expulsion nor current redistribution (which is probably important for the ability of NTM triggering) can be expected to be similar to that of normal crashes, a distinction is important.

We present a sawtooth detection algorithm with two variants for edge detection, which is applied to ECE and Soft X-ray data from ASDEX Upgrade discharges. The emphasis is on automatic operation without user interaction, which is a prerequisite for real-time application, and on largely unprejudiced detection, allowing abrupt changes in $\rho_{\text{inv}}$, sawtooth period and amplitude. The information from multiple signals is used on the one hand to increase the detection reliability and on the other hand for event recognition by subsequent loss profile analysis. The various sawtooth types studied include crashes that appear inverted in radiation profiles, a phenomenon often observed with tungsten wall coverage in combination with central wave heating, which can thus also be expected for ITER.