Brain Computer Interfaces (BCIs) use brain signals to communicate with the external world. The main challenges to address are speed, accuracy and adaptability. Here, a novel algorithm for P300 based BCI spelling system is presented, specifically suited for single-trial detection of EventRelated Potentials (ERPs) by combining spatial filtering and new feature extraction methods. The adaptive spatial filtering technique, axDAWN, removes the need for calibration of the system thereby improving the overall speed of the system. Besides, axDAWN enhances the P300 response to target stimuli. The wavelet decomposition and entropy of the recorded ERPs are shown to be correlated with the presence of the P300 responses. The proposed scheme is validated thoroughly in a P300 speller and provides a solution to achieve high accuracy results for single-trial detection of ERPs, being the system user independent.