The radial and longitudinal dependence of SEP intensities and fluences

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Solar Energetic Particles (SEPs) are an important hazard in the context of space weather. These particles bombard spacecraft and can cause instruments onboard to malfunction. At sufficiently high energies and dosages, they can also be extremely harmful to biological materials (human bodies) and are therefore one of the major safety concerns for the future manned spacecraft program. We now know that these particles are associated with Coronal Mass Ejection (CMEs) driven shocks. As a CME-driven shock propagates outward, particles are injected and accelerated at the shock front via a first order Fermi mechanism (aka diffusive shock acceleration). After being accelerated, the particles convect with the shock, diffuse both upstream and downstream of the shock and many eventually escape the shock complex after reaching far upstream (downstream). In this work, we present a model calculation of the SEP time intensity profile. The model is based on a 2D-ZEUS MHD code, which is used to simulate the solar wind. The shock is modeled using a shell model where particle convection and diffusion are followed numerically. When particles reach some distance ahead of the shock, they are can escape from the shock. Their subsequent motion is followed using a Monte-Carlo approach. This sophisticated model allows us to obtain a time intensity profile and instantaneous particle spectra at various locations. We will discuss the radial and longitudinal dependence of both the intensities and fluences.