Determination of Solar Energetic Particle anisotropies based on four-sector measurements - Study based on STEREO/SEPT in preparation of SolO/EPT

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With the launch of Solar Orbiter (SolO) Solar Energetic Particles (SEPs) can be observed at a radial distance of 0.284 to 0.9 AU and an inclination out of the ecliptic up to 34 degree. The properties of SEP observations carry information about their source at the Sun as well as their transport through the interplanetary medium. Their energy is mostly determined close to the Sun. As SEPs propagate outward along the Interplanetary Magnetic Field (IMF) the pitch-angle with respect to the local field is systematically focused due to the radially decreasing IMF. However, stochastic changes are induced by scattering at fluctuations of the IMF. Often the first order anisotropy of SEPs is calculated to disentangle imprints of source and transport. Strong anisotropies indicate periods of weak pitch-angle scattering. Although many modeling and observational studies are based on the anisotropy, its uncertainty is often neglected which could result in inaccurate conclusions. Therefore, we propose a new method based on a bootstrap approach where we consider (1) directional instrument responses, (2) the variation of the magnetic field, and (3) the stochastic nature of detection. Here, we present our procedure and final results for different SEP events using measured data of the IMF and particle fluxes by the Solar Electron and Proton Telescope (SEPT) on board of each STEREO spacecraft. The SEPT provides four viewing directions with a view cone of 0.66 sr each on a three axis stabilized spacecraft. In contrast the Electron and Proton Telescope (EPT) on board SolO also consists of four viewing directions but each telescope has a much smaller view cone of 0.21 sr. Due to the very similar instrument setup we can apply our method both to the SEPT and EPT.