

Foreshock field-aligned beams: new Cluster results

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The reduced particle distributions of Field-Aligned Beams observed upstream of the bow shock are examined in detail using Cluster spacecraft. Our study Based on the fact that the beam speed reflects θ_{Bn} value at the shock emission point, it appears that that both the reduced parallel and perpendicular distribution forms are strongly geometry dependent. Above a certain critical value of θ_{Bn} , the reduced distribution distributions are remarkably fitted my a Maxwellian. When the angle θ_{Bn} changes towards lower values, leading to smaller beam velocities, a high energy tail in the distribution appears. When the tail is present, the peak of the distribution remains Maxwellian. The more the high energy tail is developed, the more the beam speed (or equivalently θ_{Bn}) is small. Moreover, the examination of the angular distribution indicates that only particles having beam speed close to the beam speed are filed-aligned; for higher speed [tail of the distributions], particles propagate at a significant angle with respect to the magnetic field; this angle is energy-dependent. These new observations do not fit with any production mechanism at the shock or resulting from wave particle interaction upstream or within the shock layer. We favor the production of these skewed distributions take place at the shock surface.