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ESTIMATING MAGNETIC VECTOR POTENTIAL AND MAGNETIC HELICITY DENSITY USING CLUSTER OBSERVATIONS

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Magnetic helicity density is an interesting parameter to study turbulence and energy transfer in plasma systems as the total magnetic helicity it is an invariant of the system under certain conditions. To determine magentic helicity density one has to know the magnetic field as well as the magnetic vector potential, which is not directly accessible by observations. A method to estimate the value of the vector potential from cluster measurements will be presented. It will be demonstrated, how an estimate of the vector potential within the cluster tetrahedron can be calculated with numeric volume integration methods and how magnetic helicity density is derived from this as a final result. The integrity of this tools will be validated with the help of plausible examples of model data and the application on Cluster data to estimate magnetic helicity density will be presented.