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The uncertainty of local background magnetic field orientation in anisotropic plasma turbulence

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In order to resolve and characterize anisotropy in turbulent plasma flows a proper estimation of the background magnetic field is crucially important. Various approaches to calculate the background magnetic fields, ranging from local fields to globally averaged fields, are commonly used in the analysis of turbulent data. Here we investigate how the uncertainty in the orientation of a scale dependent background magnetic field influences the ability to resolve anisotropy. Therefore we introduce a quantitative measure, the *uncertainty angle*, which characterizes the uncertainty of the orientation of the background magnetic field turbulent structures are exposed to. The angle uncertainty can be used as a condition to estimate the ability to resolve anisotropy with certain accuracy. We apply our description to resolve spectral anisotropy in fast solar wind data. We show that if the uncertainty angle grows too large, the power of the turbulent fluctuations is attributed to false local magnetic field angles, which affects the spectral anisotropy. However, the anisotropy in the spectral index remains intact until very large averaging widths due to unequal change of power depending on the frequency. The frequency dependent angle uncertainty is a measure which can be applied to any turbulent system.