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**Sensitivity of FIDA Diagnostics to Individual Fast-ion Orbits for use in Forward Modeling and Tomography**[1] L. STAGNER, W.W. HEIDBRINK, C.S. COLLINS, UCI, R.B. WHITE, G. KRAMER, PPPL, Y. TODO, NIFS, M.A. VAN ZEELAND, GA — In recent years, there has been an effort to determine the phase-space sensitivities of different fast-ion diagnostics–these "weight functions" are used for interpreting diagnostic signals, forward modeling, and in calculating tomographic reconstructions of the fast-ion distribution from Fast-ion D$\alpha$ (FIDA) measurements. Currently, weight functions are only calculated in velocity-space, neglecting spatial dimensions. This lack of spatial dependence makes it difficult to use weight functions in transport studies which require understanding of the interplay between different regions of configuration space. Extending velocity-space weight functions to constants of motion space allows different spatial locations to be coupled together via their intersecting orbits. These "orbit weights functions" offer a more fundamental approach toward interpreting and calculating fast-ion diagnostic signals. Calculation of orbit weight functions for the FIDA diagnostic are validated in a low-power, MHD-quiescent discharge. In a forward modeling application, theoretical predictions of distributions during Alfvén eigenmode activity are compared with data from the "critical gradient" experiment. The extension of velocity-space tomography to utilize orbit weight functions will also be outlined.

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