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Simulated Validation of the ITER XRCS Core using Ray-Tracing Algorithm YEVGENIY YAKUSEVICH, UC Santa Barbara, Santa Barbara, CA, USA, NOVIMIR PABLANT, Princeton Plasma Physics Laboratory, Princeton, NJ, USA, JAMES KRING, Auburn University, Auburn, AL, USA, ZHIFENG CHENG, Huazhong University of Science and Technology, Wuhan, China, MAARTEN DE-BOCK, ITER Organization, St. Paul-lez-Durance, France — We present a simulated experimental validation of the ITER X-Ray Crystal Spectroscopy Core (XRCS Core), a novel spectrometer design that incorporates graphite pre-reflectors to distance the detectors away from the reactor plasma's neutron and thermal fluxes. This validation was accomplished through a virtual model of the spectrometer, consisting of a Highly Oriented Pyrolytic Graphite (HOPG) pre-reflector, a germanium spherical crystal, and a Pilatus detector, as well as a model of an x-ray emitting ITER plasma with realistic geometry, temperature profile, and emissivity profile. The model took into account Bragg reflections with finite rocking curves, the mosaic crystallite structure of pyrolytic graphite, and the x-ray emissions of Xe^{44+} and Xe^{51+}. We used a new python-based ray-tracing algorithm of our own design, dubbed XICSRT, to simulate the x-ray optics of the spectrometer. XICSRT can model the distribution of x-ray impact points on the detector and the individual optical elements, outputting expected photon counts in real units. As part of the validation, we investigated how the spectrometer would tolerate optics misalignment. We intend to release XICSRT as a tool to aid in the development of x-ray spectrometers for future nuclear fusion reactors.

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