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SHADOW4: The Popular Ray Tracing Revived for Evolving Synchrotron Sources

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For the synchrotron radiation community, "SHADOW"refers to a ray tracing program conceived by Franco Cerrina[1], widely used for the simulation of synchrotron radiation beamlines, recently in modern contexts within the OASYS environment [2].

Throughout three generations of synchrotron radiation sources, SHADOW helped in the design and upgrade of many beamlines, contributing to a deeper comprehension of pertinent issues surrounding synchrotron sources and reflecting, refracting and diffracting optics at photon energies covering the soft, tender and hard X-ray range. SHADOW has demonstrated its reliability during four decades of utilization, as shown in hundreds of user publications. The evolution of the SHADOW code and its interfaces have followed a cyclical pattern: after SHADOW2 [3], the interface ShadowVUI [4] was created, then SHADOW3 [5], followed by OASYS/ShadowOUI [6].

In light of both immediate and long-term considerations, a decision has been made to undertake a comprehensive overhaul of SHADOW, resulting in the development of an object-oriented package named SHADOW4, fully implemented in Python. Several compelling rationales have driven this initiative, among them being the imperative modernization of the Fortran-based SHADOW3 kernel. This modernization is crucial as the existing framework presents a potential bottleneck, imperiling the program's sustainability in light of the evolving landscape of engineering and programming education. Python was the natural choice because the OASYS ecosystem is python-based and SHADOW4 and its new interface OASYS1-SHADOW4 are fully integrated into

OASYS. SHADOW4 uses modern and standard software engineering concepts that will permit a larger community of developers to help with new resources, tutorials, and documents. Python's inherent portability ensures facile deployment of SHADOW4 across different platforms, including Windows, macOS, and Linux. The OASYS interface systematically generates SHADOW4 scripts, affording users the flexibility to customize and tailor calculations to their specifications, incorporating features such as variable scanning and the development of digital twins for integration with AI tools.

In summary, the advent of SHADOW4 guarantees the perpetuation of SHADOW's legacy, poised to serve as an indispensable resource for forthcoming generations of synchrotron light sources. We will present the new code, guaranteeing its functionality akin to previous versions, alongside its contemporary interface, and seamless integration into OASYS, and elucidate with examples the benefits compared to its predecessors.

References

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I plan to submit also conference proceedings

Yes

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