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KENO Lifetimes

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In small bare systems operating in the vicinity of delayed critical, the difference between the adjoint-weighted neutron generation time and the fission lifespan can be as small as a few percent. However, in reflected systems, the difference between these two quantities can be several orders of magnitude. This is clearly illustrated in Figs. 1 and 2.

In Fig. 1, we compare the adjoint-weighted neutron generation time as obtained from DANTSYS (i.e., from an α -eigenvalue solution), the fission lifespan as estimated by MCNP4B, and the neutron generation time estimated by KENO-Va for a small bare uranium sphere. Note that near delayed critical, all three quantities are nearly equal.

In Fig. 2, we make the same comparison for a uranium sphere surrounded by a thick graphite reflector. As can be seen, the neutron generation time calculated by KENO-Va and the fission lifespan estimated by MCNP4B agree very well over the entire range of k_{eff} . However, both the KENO generation time and the MCNP4B fission lifespan are several orders of magnitude larger than the adjoint-weighted neutron generation time predicted by DANTSYS.

In conclusion, the prompt neutron generation time predicted by KENO-Va corresponds to the fission lifespan of a prompt neutron in a given system. The fission lifespan is the average time from birth-to-fission and, in general, is not a good approximation for the adjoint-weighted neutron generation time that appears in the point-kinetic model.

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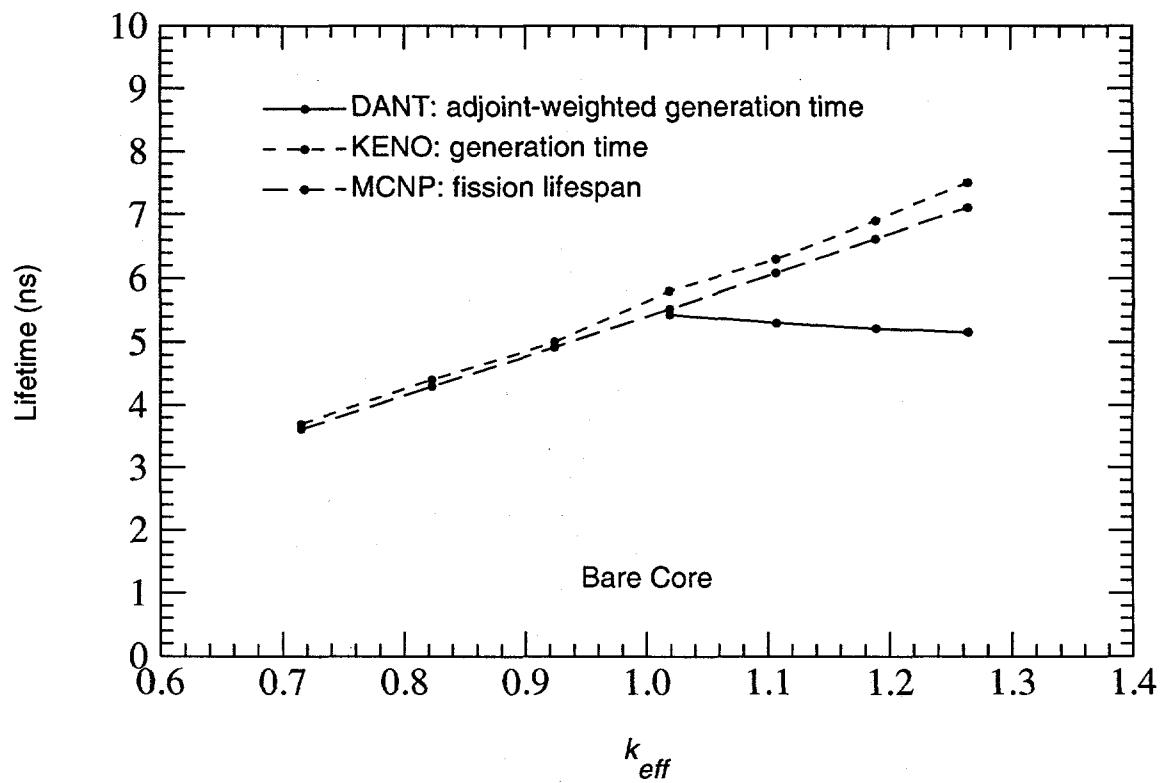


Fig. 1. Comparison of lifetimes estimated by KENO-V.a, MCNP4B, and DANTSYS for a small bare uranium sphere.

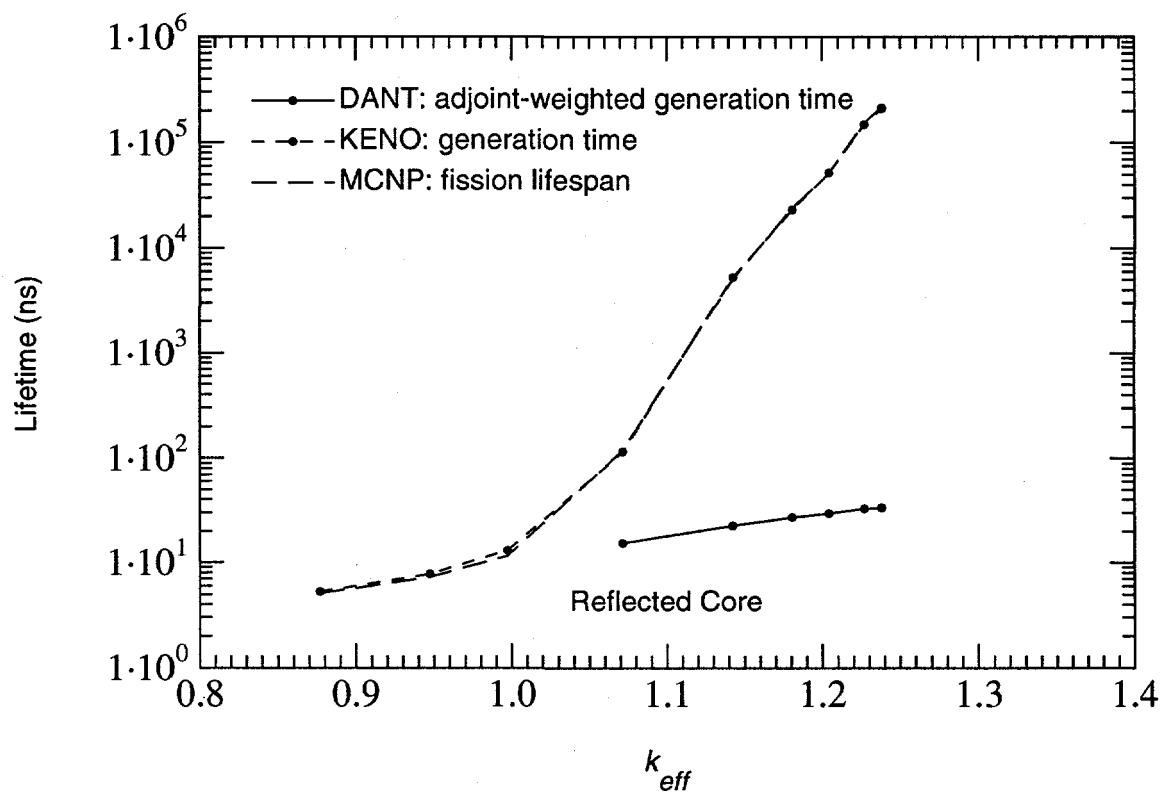


Fig. 2. Comparison of lifetimes estimated by KENO-V.a, MCNP4B, and DANTSYS for a uranium sphere surrounded by a thick graphite reflector.