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Perturbation of phase space downstream by parameters upstream

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In a MW (p,xn) neutron facility GeV-range protons impinge a target where each proton generates an eventful history. As each history develops upstream towards downstream, the primary and subsequent secondaries penetrate the target and traverse the various components in the assembly (including the moderator and the reflector). Useful neutrons will survive and exit the beam line at the desired energy range at the desired timing. The remaining neutrons and other particles which emerge will require radiation protection and shielding attention. Nonetheless all emerging particles populate the emerging radiation phase space.

The irradiation conditions upstream (e.g. the beam energy and footprint, the target dimensions and composition) may perturb the emerging radiation phase space (downstream) to different extents. The emerging phase space could be more sensitive to some parameters and less sensitive to others. For instance, doubling the beam energy, doubling the beam size or doubling the target dimensions is unlikely to unanimously double the neutron fluence and footprint exiting the moderator. This study quantifies the perturbations.

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