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TARGET MODERATOR SYSTEM - NEUTRONICS

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Presentations in this session touched on both broad and specific issues associated with spallation target-system design, including: a) radioisotope production and their influence on radioactivity release, disposal issues, corrosion, and effects on component lifetime; b) experimental measurement of neutrons per proton versus proton energy; c) benchmark measurements of thermal neutron fluxes from a reference SPSS target system; d) neutronic studies for a ESS reference target system; e) basic neutronic studies of wing and flux-trap moderator geometries; and e) benchmark neutronic calculations of some reference LPSS target systems.

The temporal production/destruction of radionuclides from a spallation target system are important for analyzing accident scenarios, estimating waste streams, determining long-term disposal requirements, appraising corrosion issues, and evaluating component lifetimes. The choice of proton energy for a spallation source needs continued study; the issues include energy deposition, radiation damage, neutronic and geometric coupling between targets and moderators, and accelerator requirements. Neutronic data and results demonstrate the neutronic advantage of Hg compared to Ta and W as a target material for the ESS SPSS. The issues of a Hg target for an SPSS rests not in neutronics, but with engineering, materials, and (perhaps) safety details.

The choice between wing-moderator and flux-trap moderator geometry is buried in the neutronic details of the target system and the specifics of the target station layout. Neutronic brightness from a wing moderator is hard to beat. Flux-trap moderators respond to bulk neutron production more so than wing moderators. Flux-trap moderator performance in backscattering geometry holds some promise compared to transmission geometry. Compromises must be made to balance neutron intensities between fore and aft moderators in wing geometry. The neutronic performance of an LPSS flux-trap moderator can be significantly altered by the choice of reflector materials and geometry.

Keywords: Target, Moderator, Reflector, Target System