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Mu2e Target Station design and radiation levels

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One of the main parts of the Mu2e experimental setup is its Target Station in which negative pions are generated in interactions of the 8-GeV primary proton beam with a tungsten target; a large-aperture 5-T superconducting production solenoid (PS) enhances pion collection. The heat and radiation shield (HRS) is a 33 ton water-cooled bronze shield which protects the PS coils and the first TS coils from interactions from the production target located inside the PS.The HRS protects the PS and the first TS coils; the beam dump absorbs the spent beam. In order for the PS superconducting magnet to operate reliably the sophisticated HRS was designed and optimized for the performance and cost. The beam dump was designed to both accumulate the spent beam and keep its temperature and air activation in the hall at the allowable level. Comprehensive MARS15 simulations have been carried out to optimize all the parts while keeping the maximum muon yield. To determine the magnitude of the DPA damage effect on the residual resistivity ratio RRR) as well as the annealing cycle of PS, calculations have been done involving recent KEK measurements with Al and Cu samples. Prompt and residual radiation dose levels in and outside the Mu2e building are determined. MARS15 results on neutron fluxes and energy spectra are compared those from the MCNPX code. Results of simulations of critical radiation quantities and their implications on the overall Target Station design will be discussed.

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