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High-Power Targetry R&D for Next-Generation Accelerator Facilities

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As next-generation accelerator target facilities, for Neutrino Program such as the Long-Baseline Neutrino Facility (LBNF) or Muon Program such as Mu2e-II at Fermilab, become increasingly more powerful and intense, high power target systems face key technical challenges. Beam-intercepting devices such as beam windows and secondary particle-production targets are continuously bombarded by high-energy high-intensity pulsed proton beams to produce secondary particles for several High Energy Physics (HEP) experiments. Energy deposition from the primary beam induces near instantaneous heating (thermal shock) and microstructural changes (radiation damage) in the beam-intercepting materials. Both thermal shock and radiation damage ultimately degrade the performance and lifetime of targets and have been identified as the leading cross-cutting challenges of high-power target facilities. Several facilities have already had to limit their beam power because of the survivability of their targets and windows, rather than as a limitation of the accelerators themselves. As beam power in next-generation multi-megawatt accelerator target facilities continue to increase, there is a pressing need to address the material challenges to avoid limiting the scope of future HEP experiments.
After presenting the high power Targetry challenges facing next generation accelerators, I will highlight the most recent activities within the framework of RaDIATE collaboration and the critical materials R&D needs to address the challenges of multi-MW targets.

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