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## A Beam-Based Production Target Monitor for the Mu2e Experiment at Fermilab

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Mu2e is an experiment currently under construction at Fermilab, which will search for coherent neutrinoless conversion of muons to electrons in the presence of an atomic nucleus. In order to maximize the number of stopped muons for conversion, Mu2e must ensure optimal pion production in the production solenoid, by aligning the proton beam with the production target to within  $\pm 0.5$  mm. However, the target cannot be instrumented directly, because any additional material in the production region can reabsorb pions. Additionally, the target will be at a high temperature, highly activated, and kept in a vacuum of  $10^{-5}$  torr, due to being radiation-cooled. The production region will also be under a strong magnetic field with a steep gradient produced by a superconducting solenoid, which requires heavy shielding around the target to protect the coils from heat and radiation. Given this harsh and complicated environment for the target, we chose to design a beam-based production target monitoring system which uses multi-wire proportional chambers outside the target's harsh environment to align the beam with the target.

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