

Abstract

The GlueX experiment at Jefferson Lab in Newport News, Virginia is a major new initiative in experimental nuclear physics aimed at understanding the strong nuclear force that binds quarks together in the atomic nucleus. The experiment uses a 9 GeV polarized photon beam to produce a new class of particles whose existence is predicted by the reigning theory of strong interactions. The polarized photon beam is produced when a high-energy electron beam passes through a thin window known as a “radiator” comprised of a highly-perfect diamond crystal. To meet the requirements for GlueX, the diamond radiator must be sliced from a large single crystal and then thinned down to a thickness of 20 microns. Element Six, the world leader in production of high-quality synthetic diamonds, has demonstrated ability to thin their diamonds down to about 50 microns. Below that thickness, there are no viable commercial options for thinning these diamonds. However, within the last two years the Instrumentation Group at Brookhaven National Lab has demonstrated a laser ablation technique for thinning diamonds that is capable of achieving the 20 micron thickness required for GlueX. The BNL group estimates that replicating their setup at UConn would cost about \$100,000. However there is a laser currently out of service within the UConn Physics Department that has the required capabilities, and can be refurbished for this purpose at a small fraction of this cost. Prof. Eyler, the owner of this laser, has agreed to loan it to the PI for the duration of this project. This proposal requests funds for the period January 2010 – January 2011 to refurbish this laser and demonstrate the cutting of a single diamond wafer. Successful demonstration of this capability would give the group unique capabilities within the field of experimental nuclear physics, and place UConn in an excellent position to request funds from the Department of Energy to enhance these capabilities and apply them to produce the 30-50 diamond radiators required for GlueX.