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Quantifying Light Loss in the Tagger Microscope for the GlueX Experiment

The GlueX Experiment research team at UConn has designed, fabricated, and installed a tagger microscope for the study of exotic mesons at Jefferson National Laboratory. Although confirmed to exist by the LHC at Cern, these particles are a hitherto unexplored prediction of the Standard Model. Our components are designed to produce them in large quantities so their properties can be studied. The tagger microscope is an array of scintillating fibers and light guides positioned to detect high energy electrons scattered from a diamond radiator which is positioned in the high-energy electron beam line in Hall D at Jefferson Lab. When an electron makes contact with a scintillating fiber, it creates a pulse of visible light that is transmitted, via fiber optic light guide, to an electronics board which measures the energy and time of the pulse. However, several installed fiber bundles are performing below our expectation. We believe their performance has been negatively affected by a combination of handling techniques during construction, fabrication procedures, and materials quality. I have examined the uninstalled fiber bundles and observed significant changes that occurred while following our standard construction procedures. Now I seek to quantify that damage using a pulsed laser diode testing apparatus, nicknamed “the Dark Box”, which measures light yield under conditions similar to those in the experimental hall at JLab. I am preparing representative test bundles to compare light yields across a variety of conditions. These results will allow us to make the most effective critiques of our current procedures and handling, as well as quantify the light loss from prior procedures for the benefit of future projects.