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Wireless power transmission for HEP

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The emergence of fully electric vehicles and autonomous systems (e.g., cars,drones), combined with advancements in long-distance power transmission (e.g.,satellites), has accelerated the development of wireless power transmission technologies. These technologies aim to address critical challenges such as reducing the reliance on extensive cabling and minimizing noise interference, especially in high-energy physics experiments. In such environments, the large quantity of copper wires not only contributes to increased material costs and complexity but also serves as a potential source of noise and signal degradation. A promising solution lies in the use of laser-based wireless power transmission systems, where optical power converters are positioned close to or directly on front-end boards.

As part of the Wireless Allowing Data and Power Transfer (WADAPT) consortium, we have undertaken a pioneering study to explore the feasibility of using laser-based wireless power systems in experimental setups. The study centers around a 10W laser coupled with a dedicated photovoltaic cell (PVC), designed to convert laser energy into electrical power efficiently. The system was rigorously tested at varying distances between the laser source and the PVC to understand the influence of distance on power transmission efficiency and overall performance.

To ensure practical application, the system was successfully integrated with a voltage and power regulator, enabling it to power a silicon photomultiplier (SiPM). The SiPM, known for its sensitivity and precision in detecting low levels of light, is a critical component in many high-energy physics experiments. Using a precise light source, we conducted a comprehensive series of tests to evaluate how this novel power source affects the sensor's performance. Key parameters such as power conversion efficiency, noise levels, signal stability, and overall sensor functionality were carefully analyzed to ensure that the wireless power system meets the rigorous demands of experimental physics.

The results of wireless power transmission for a silicon sensor will be presented, highlighting its potential to transform the way power is delivered in complex experimental environments.

Secondary track

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