

Design of a luminosity monitor for the P2 parity violating experiment at MESA

The P2 experiment at the future MESA accelerator in Mainz plans to measure the weak mixing angle $\sin^2(\theta_W)$ in parity violating elastic electron-proton scattering. The aim of the experiment is a very precise measurement of the weak mixing angle with an accuracy of 0.14% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3} \text{ GeV}^2$. In order to achieve this accuracy, it is necessary to monitor the stability of the electron beam and the liquid hydrogen target. Any helicity correlated fluctuation of the target density leads to false asymmetries.

Therefore, it is planned to install a luminosity monitor in forward direction close to the beam axis. The motivation and challenges for designing an air Cherenkov luminosity monitor will be discussed. Furthermore, I show the current prototype design with results from promising tests run with the electron beam of the Mainz MAMI accelerator and detailed simulation studies.

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