The Beam Measurements at PHIN Photo-Injector at CERN


The demonstration of the high charge and the stability along the pulse train are the important issues for CTF3 and the CLIC drive beam. A new photo-injector for CTF3 and CLIC drive beam has been designed and installed by collaboration between LAL, CCLRC and CERN within the framework of the CARE program. Beam based measurements have been made during the commissioning runs of the PHIN 2008 and 2009 including measurements of the emittance, using multi-slit technique. After the first beam measurements, the results were analyzed and compared with PARMELA simulations, an optimum working point has been proposed for the photo-injector.

Beam Size Measurements

During the 2009 run beam scans have been performed with respect to different laser spot sizes of 2, 3, 4 mm at 5.5, 5.2 and 5.7 MeV, respectively. The asymmetric behavior that has been observed in the different laser spot sizes of 2, 3, 4 mm at 5.5, 5.2 and 5.7 MeV, during the 2009 run beam scans have been performed with respect to the limited focus region is still under investigation, it could be related to the limited resolution of the optical system or a saturation effect.

Data Analysis of Multi-Slit Method for Emittance Measurement

The beam measurements revealed the expected density focusing along the pulse train. The emittance along the pulse train has been measured using the multi-slit technique. The optimum background level was determined and used as the input for drive beam simulations. The main goal will be to study the current limitations and future modifications in the set-up for the implementation of PHIN photo-injector as the CLIC drive beam electron source.

The emittance measurements have been improved with respect to the previous run by replacing the CCD camera with an intensified and gated camera called the Vidicon detector. The beam size has been done for an envelope of the envelope on the beam. The systematic difference for the emittance is measured as a function of the beam size. A polynomial background subtraction has been used for the envelope calculation. The systematic difference for the emittance is measured as a function of the beam size.

Conclusion and Outlook

The beam measurements have been performed with respect to the expected density focusing along the pulse train. The emittance along the pulse train has been measured using the multi-slit technique. The optimum background level was determined and used as the input for drive beam simulations. The main goal will be to study the current limitations and future modifications in the set-up for the implementation of PHIN photo-injector as the CLIC drive beam electron source.

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