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PACMAN study of FSI and micro-triangulation for the alignment of CLIC

CLIC (Compact LInear Collider) is a proposed 3 Tev e+/e- linear collider being studied at CERN. One of the main challenges in this study is to preserve the beam emittance growth of both the main linac and the beam delivery system in the vertical plane to below 10 nm. Such tolerances can only be achieved with beam based alignment which requires the pre-alignment of the components to 10 um over a sliding window of 200 m. In order to reach the desired precision and accuracy, PACMAN, a study on Particle Accelerator Components Metrology and Alignment to the Nanometre scale has been established at CERN. FSI (Frequency Scanning Interferometry) and Micro-Triangulation are among the technologies that are being studied to determine 3D coordinates of fiducials for the alignment of CLIC components. FSI is an absolute distance measuring technique that has the ability to make multiple simultaneous high precision length measurements. The Absolute Multiline system that will be used is an FSI system capable of making length measurements with an uncertainty of 10.5 um/m at a 95% confidence level. Micro-triangulation, on the other hand, is an automated angle measuring technique realised by QDaedalus system. The system mainly consists of a motorized total station and a CCD camera which replaces the eye-piece in a non-destructive way. Recent tests prove that it is possible to monitor points with micrometre precision in a range of a few metres and with a rate of about 50 Hz. This paper presents the two systems, the strategy for their validation in the frame of the CLIC project and the associated R&D plans.

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