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Fiducialisation and Initial Alignment of the CLIC Components within a Micrometric Accuracy

We propose a new solution to fiducialise the 3 major components of the CLIC collider: quadrupoles, BPM and accelerating structures. This solution is based on the use of a Copper/Beryllium wire to materialize the reference axes of the components (respectively their magnetic axis, electromagnetic axis and electric zero axis) and to determine their position in the common support assembly coordinate system and with respect to the fiducials. These alignment targets will be used later to align the support assembly in the tunnel. With such a method, several components of different types, supported by a dedicated adjustment system can be fiducialised and pre-aligned with respect to the same wire, at the same time, at a high accuracy in the environment of a 3D CMM. Alternative solutions based on Frequency Scanning Interferometry and micro-triangulation are also under development, to perform or check such fiducialisation and initial alignment directly in the tunnel, after the transport of the components on their common support. Complementary studies have also been undertaken on the development of a new seismic sensor, on a high stiffness nano-positioning system with a millimetric stroke, on miniature rotating search coils and on the extrapolation of the uncertainties of measurements considering variations of temperature. These developments are part of the PACMAN project (a study on Particle Accelerator Components'Metrology and Alignment to the Nanometre scale), an innovative Doctoral Programme, where 10 PhD students hosted at CERN work towards their PhD thesis. The methods and tools developed are presented, as well as the first obtained results.

Summary

We propose a new solution to fiducialise the 3 major components of the CLIC collider: quadrupoles, BPM and accelerating structures. This solution is based on the use of a Copper/Beryllium wire to materialize the reference axes of the components (respectively their magnetic axis, electromagnetic axis and electric zero axis) and to determine their position in the common support assembly coordinate system and with respect to the fiducials. These alignment targets will be used later to align the support assembly in the tunnel. With such a method, several components of different types, supported by a dedicated adjustment system can be fiducialised and pre-aligned with respect to the same wire, at the same time, at a high accuracy in the environment of a 3D CMM. Alternative solutions based on Frequency Scanning Interferometry and micro-triangulation are also under development, to perform or check such fiducialisation and initial alignment directly in the tunnel, after the transport of the components on their common support. Complementary studies have also been undertaken on the development of a new seismic sensor, on a high stiffness nano-positioning system with a millimetric stroke, on miniature rotating search coils and on the extrapolation of the uncertainties of measurements considering variations of temperature. These developments are part of the PACMAN project (a study on Particle Accelerator Components'Metrology and Alignment to the Nanometre scale), an innovative Doctoral Programme, where 10 PhD students hosted at CERN work towards their PhD thesis. The methods and tools developed are presented, as well as the first obtained results.

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