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Design, testing, and validating the CLIC module pre-alignment and alignment systems

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In order to produce a high luminosity at the interaction point, the Compact Linear Collider (CLIC) accelerators must preserve low emittance beams along both the main 22km linacs. A key factor in preserving a low emittance beam is the mechanical alignment and stability of the accelerator components.

The CLIC accelerators are divided into 'Two Beam Modules'(TBMs) which integrate a section of the power-delivering Drive Beam and the accelerating Main Beam. The Main Beam is accelerated within Acceleration Structures that require prealignment to within 14 μm of the Metrological Reference Network (MRN). To prevent a greater than 1% luminosity loss, the vertical jitter of the accelerator components must be kept below 1.4 μm RMS when the TBMs are exposed to the ground noise within the tunnel, and other sources of vibration.

A design of the TBMs is presented which includes active alignment, passive prealignment, and sufficient mechanical stability to meet the specification. Finite Element Analyses (FEA) are used to demonstrate the suitability of this design. The results of the testing of prototype SAS prealignment and active TBM positioning systems are discussed and shown to meet the CLIC alignment requirements. Opportunities for future testing and areas for further optimisation are identified and discussed.

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Footnotes

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Yes

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