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A rotary mount for submicrometric positioning of a stretched wire axis within a coordinate measuring machine

As part of its role as world-wide leader in high energy particle physics, CERN studies the feasibility of a Compact Linear Collider (CLIC). One of the biggest challenges of this electron-positron collider is the alignment required for all the components acting on the beam: thousands of components will have to be assembled and aligned at the micrometre level. PACMAN, a study on Particle Accelerator Components Metrology and Alignment to the Nanometre scale, is a Marie-Skłodowska Curie Program supported by the European Commission (FP7 Program) whose aim is to develop and build a pre-alignment bench on which components are assembled and aligned to the required accuracy using a stretched wire.
During the process of this measurement, the centre of a stretched wire is aligned with respect to the reference axis of the components. The Cu-Be wire with a diameter of 0.1 mm considered for this task has been evaluated and its quality led to the conclusion that a form measuring sensor should be used to increase the precision of the measurement. The Shape Evaluating Sensor: High Accuracy & Touchless SESHAT is being designed for this task: its challenge is to measure the form error of this stretched wire with 0.1 µm accuracy and its axis position with 0.5 µm precision on the coordinate measuring machine. The singularity of the SESHAT' s design is an opening in the radial direction. Indeed, this paper introduces the requirements: no magnetic fields created, high accuracy on the positioning, low error motion, and open on the side; and it describes and discusses the technical solutions: from the material to use to the bearings, including the kind of sensor.

Summary

A rotatory mount is being designed in CERN to determine the position of the axis of a 0.1 mm in diameter stretched wire with a sub-micron repeatability.

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