

The Stanford Linear Accelerator Center Goes Linear

At Stanford's SLAC Linear Accelerator Laboratory in Menlo Park California, we find the two-mile long linear accelerator, also known as the Linac. The Linac is used to drive a Coherent Light Source which produces X-ray pulses more than a billion times brighter than X-rays produced in a synchrotron. The ultrafast X-rays generated by the LCLS are analogous to a super high speed flash used in stop motion photography, only on a molecular level.

The LCLS is home to five instruments dedicated to honing the unique properties of the X-Ray generator. The latest addition being the CXI: Coherent X-Ray Imagine device.

The CXI will make use of the powerful and short bursts of X-rays delivered by the LCLS to take high resolution images of sub-micron sized particles. The key to this device is that the short pulses of the unique X-ray delivery allow for the targets to be imaged with out damage due to radiation, a normal side effect in synchrotron X-ray sources.

The CXI mechanical design team had a problem. They needed to accurately control the imaging device without complicated homing routines to initialize their position. They needed absolute position to avoid moving the expensive vacuum systems upon power-up or power loss as this could be detrimental to the delicate experiments. The design team turned to Newall Electronics for the linear position encoding of their 4 ton device stand. Newall's SHG-A2 Absolute Linear Encoder is used to close the feed back loop of the 18 axes of motion used to align and focus the targets with the x-ray beam with a 1 um system resolution. The device will have the capability of aligning to the LCLS beam even when the beam is not accessible by the CXI device.

The CXI scientific programs include; Imaging of Reproducible Biomolecules, Protein Nanocrystallography, Imaging of Nanoparticles, Imaging of Hydrated Living Cells, X-ray Matter Interactions, and Pump-Probe Imaging.

These are real world applications, providing real world solutions. Some day the CXI may take a 3-D scan of a harmful virus resulting in the generation of a geometrically matched protein, inhibiting the virus.

Given the design criteria of zero movement upon power-up and 1 um positioning, the Newall linear encoders were selected. The SHG-A2 absolute encoder provides a true absolute position immediately upon power-up with out the aid of batteries or power back up. True position is acquired as soon as power is applied to the encoder, regardless of power out duration or if the system has been moved. The SHG-A2 supplies a 1 um system resolution while holding a 10 um/m accuracy. The encoder technology and design offers the added benefit of a robust linear sensor and easy installation.

Newall's absolute positioning system will maximize critical laboratory time by avoiding complex homing routines. The CXI instrumentation counts on the Newall linear encoders for absolute positioning, precision and accuracy, as well as a compact and durable design.

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