



Contribution ID: 57

Type: **Poster**

Multiple Laser Tracker Synchronization for Vibration Analysis

Measuring the mechanical coupling and rigidity of a large apparatus presents unique challenges for 3D metrology. In this case the motion of well separated points attached to a rotor blade must be rapidly and repeatedly measured and the resulting data synchronized. This presentation describes the methodology and results for the mechanical coupling test of the magnetic field mapping system (FMS) for the Mu2e experiment at Fermi National Accelerator Laboratory. Three laser trackers, 2 API Radians and an API T3, simultaneously measured the position of three cylindrical corner cube reflectors mounted on the FMS while the system was in motion and after coming to rest. The laser trackers took measurements at 83Hz for the T3 and 100Hz for the Radians, with fine spatial resolution, resulting in over 20,000 points measured per instrument in observation cycle. The laser tracker hardware and utilized software are unable to synchronize the three independent data streams directly during the measurement process. Instead a custom software program was developed to perform this synchronization of the data sequences during post-processing using features of the targets motion common to all three fiducial locations.

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