6.4. SLAC METROLOGY DEPARTMENT CONTRIBUTION

The SLAC Metrology Department's Alignment Engineering Group will perform survey measurements using at least one laser tracker and a set of Spherically Mounted Retroreflectors (SMRs) placed in cups mounted at points on the LAT. The Alignment Engineering Group will provide surveyors and survey engineers as well as a FARO or similar laser tracker with moveable stand and 1-½" SMRs for the job.

Laser trackers are surveying instruments that take advantage of a portable interferometer that measures highly accurate distances as well as high resolution encoders that measure both horizontal and vertical angles. A typical 3D measurement thus consists of one distance and two angles.

The FARO laser tracker is capable of two modes of operation: Interferometer mode and SuperADM (Super Absolute Distance Measurement) mode. The interferometer mode is more accurate but limiting since the laser beam can not be broken when the SMR is moved from the laser tracker nest to a target. By using the SuperADM mode obstructions that temporarily break the beam are not a problem, allowing surveys to be completed much faster although of somewhat less accuracy. For the LAT either mode will be employed as appropriate.

The quoted accuracy of the FARO laser tracker is 10µm + 0.8µm/m in distance when using the interferometer mode and 20µm + 0.8µm/m in distance for the SuperADM mode. Angular accuracy for both modes is 18µm + 3µm/mfor either horizontal or vertical measurements. A common practice for high-accuracy alignment involves creating a survey network of observations through the combination of multiple measurements taken from different laser tracker locations. The overall accuracy of any particular target (SMR) mounted on the LAT or elsewhere can be improved by using a least-squares adjustment of the observations (see also Sections 7.1.2 and 7.1.3). Weighting observations a-priori, adjusting them and analyzing a-posteriori information provides a statistical assessment of the true accuracy of not only the targets of interest but of each set-up of the laser tracker.