How long is the SLAC Gallery?

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The SLAC Communications Department contacted Metrology to inquire about the length of SLAC's Gallery, building 002.

Initially, Metrology's Alignment Engineering Group (AEG) proposed to import SLAC's orthophotos into a CAD platform (Microstation). A draftsman could then graphically pick two points at the Gallery's extreme and measure the distance between them (3074.8m). This would be a fast method of producing the length of the gallery, but could be in error by several meters due to photo rectification. The Communications Department required a more accurate measurement.
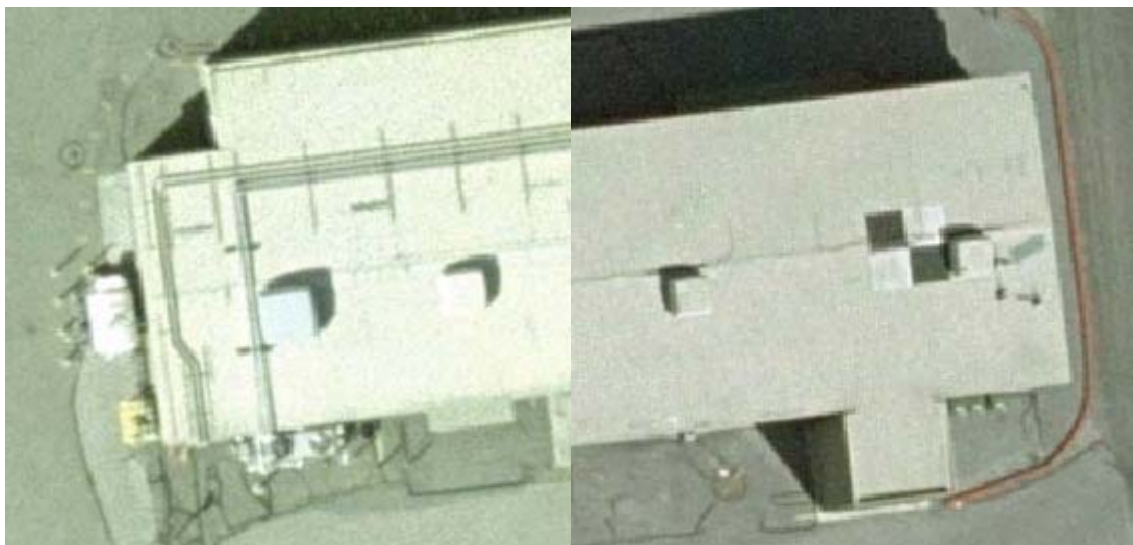

Figure 1: SLAC orthophotos of Gallery ends (west/east)

Survey crews of AEG measured the length of the gallery using two methods: an RTK GPS survey and a traditional traverse using a total station.

GPS (Leica System 500)
A GPS antenna was positioned approximately 15cm above the gallery roof near the four exterior corners of the gallery. A global position was measured at each corner and recorded. The length of the gallery was then computed by calculating the 3D distance between the two southerly points and between the two northerly points. The two distances agreed to within 4cm.

Figure 2: GPS measurement of Gallery east, photo courtesy of Michael Perry

Figure 3: GPS measurement of Gallery west, photo courtesy of Michael Perry

Table 1: GPS measured building corner coordinates (WGS84 ellipsoid, meters)				
ID	X	Y	Z	3D Distance
EAST_S	-2703162.507	-4291739.382	3854234.621	3073.773
WEST_S	-2705888.547	-4290363.988	3853880.955	
EAST_N	-2703160.725	-4291733.914	3854241.978	3073.734
WEST_N	-2705886.789	-4290358.692	3853888.169	

The GPS length of the Gallery is the average length of the observations minus the antenna pole diameter (1 inch): 3073.73m.

Traditional Traverse (Leica 1105)
A survey crew set 5 temporary points along the south gallery road. A traverse was run through these points. At both ends, a reflectorless observation was made to the southerly roof corners of the gallery structure. The measurements were run twice. A coordinate of (0,0,100) was assigned to the first point and onboard software computed the summation of each subsequent observation's coordinate. Prism offsets and atmospheric conditions were corrected by the onboard software.

Figure 4: Total station measurement of Gallery east, photo courtesy of Hans Imfeld

Table 2: Traversed building corner coordinates (local coordinate, meters)				
ID	Easting	Northing	Elevation	3D Distance
WEST	-7.375	15.387	104.529	3073.719
EAST	-1.377	3089.062	89.262	
WS	-7.339	15.392	104.571	3073.687
ES	-1.349	3089.035	89.186	

The traversed average length of the Gallery is: 3073.70m.

How long is the gallery? Since the two methods of observation have similar accuracy and in the interest of keeping it simple, AEG averaged the two methods and determined that the length of the Gallery is 3073.72m.