Tunnel Surveys for New CERN Particle Accelerators

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ABSTRACT

At present extensive underground construction works take place at the European Organization for Nuclear Research (CERN) in Geneva, Switzerland. In the context of the Large Hadron Collider project (LHC), connecting tunnels between the existing ring accelerators LEP and SPS are built on the one hand. On the other hand further tunnels are constructed for the CNGS project (CERN neutrinos to Gran Sasso). Already for the excavation works highest accuracy demands were stated. Thus, the real axis of the tunnels must be centred within a 50 mm radius circle in the theoretical axis. The main difficulty from the point of view of surveying is the orientation transfer from the surface reference network to the tunnels, since tunnelling is started from shafts. A further crucial aspect of the survey are lateral refraction effects due to the small diameters of the tunnels (3 m). Grunder Ingenieure AG based in Hasle-Rüegsau, Switzerland, were mandated to carry out survey checks of the contractor's primary survey. Controlled traverses in the tunnels and trigonometric networks in and around the shafts are measured. Further, the plumbings in the shafts are independently controlled by an optical plummet. The height transfer in the tunnels is done by high spirit levelling. In order to fulfil the tolerance, the orientation transfer has to be carried out by gyroscopes, this being performed by the Institute of Geodesy, Bundeswehr University Munich.

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