CERN Reference Systems

Reference Systems

Since its inception, CERN has adopted a unique reference system, the CERN Coordinates System (CCS), that has evolved to provide an appropriate level of detail to ensure the accuracy of the survey work for the accelerators and experiments as they increased in size.

CERN Coordinate System

The CCS is a right-handed 3D Cartesian coordinate system synonymous with its reference frame. It is used to define the relative position of all the accelerators and experiments at CERN.

The CCS is an evolution of a reference system established in the 1950’s for the construction of the Proton Synchrotron (PS) accelerator, a circular machine with a radius ~100 m. It was originally a 2D polar system in the plane of the PS, where all of the beamline elements have the same altitude. The principal point of the CCS, P0, is a geodetic pillar at the centre of the PS ring, and has been attributed false coordinates, so it is no longer the origin of the system. The XY-plane of the 3D Cartesian CCS system is still parallel to the plane of the machine, and the direction of the X-axis was given by two of the geodetic pillars positioned around the PS accelerator tunnel. Given that the accelerator is circular, and that the beamline around the ring has a constant altitude, it can be asserted that the Z-axis of the CCS, and the vertical direction at P0 (at the centre of the ring), are parallel. The Y-axis forms a right handed system and has an azimuth of 37.77864 gons at P0.

CERN Geodetic Reference Frame

P0 is the principal point of two topocentrically positioned horizontal datums, the first the IUGG Sphere and the second the IAG GRS80 reference ellipsoid.

Horizontal Geodetic Datums

CGRF Sphere, CGRF

Vertical Geodetic Datums

Sphere, Ellipsoid and Geoid models

Documentation