Gantry dual-drive synchronisation and beam geometry

gantry-synchronisation

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Application template; not a claim of a completed customer project.

Scope

Combined check of synchronisation error, beam deflection and rail parallelism for large machine tools, cutters and additive systems.

Equipment and configuration guidance

• Dual-axis autocollimator or two interferometers

• Bridge and targets

• Synchronous acquisition

Principle and calculation

Error = side difference; beam tilt = difference / span. Geometric and servo terms must be measured separately.

On-site checklist

• Encoder directions consistent

• Acquisition synchronised with motion

• Loaded and unloaded

• Terms separated

Limitations

Synchronisation varies with speed and acceleration; static geometry does not prove dynamic performance.

Detailed teaching example

Worked dual-drive synchronisation example over 1500 mm

Scenario and task

Teaching example: a gantry with a 1500 mm span shows a 45 μm side-to-side position difference, converted to beam tilt; geometry and servo error are separated.

Preparation and measurement steps

01. Confirm control mode, synchronisation tolerance and travel.

02. Place stations on both columns and the beam; record unloaded and loaded states.

03. Run at low and working speed, acquiring side-to-side difference and beam angle.

04. Separate geometric mismatch (rail parallelism) from control mismatch (gain, feed-forward).

Teaching example readings

• Steady side difference 45 μm, not transient jitter.

• Tilt 6186.09″, i.e. 45 μm over 1500 mm.

• Measure once with drives disabled and once while feeding to separate causes.

Calculation procedure

θ = arctan(45/1500) = 6186.09″. Present statically it is mechanical; only dynamic means gain or following error.

Example result and interpretation

A tilt of 6186.09″ produces squareness error of the same order on the workpiece.

Example verification checklist

• Sample synchronisation at both ends and the middle, not at one point.

• Beam sag adds to synchronisation error; measure them separately.

• Log whether servo parameters changed; never mix before/after data.

Document generated: 2026-11-16