# TrackEye Fixed Camera 3D

Throughout military test ranges worldwide there are an enormous amount of applications for measuring in three dimensions. This is the case when 3D data of any kind of object has to be analyzed.

The purpose is e.g. to study flight path behaviour, velocity, impact angles, distances between objects, etc.

If we observe an object from at least two cameras, and we know the internal parameters and the position/rotation of each camera, we can compute the 3D position (x, y & Z) of the object. The method used in TrackEye is called *triangulation.*
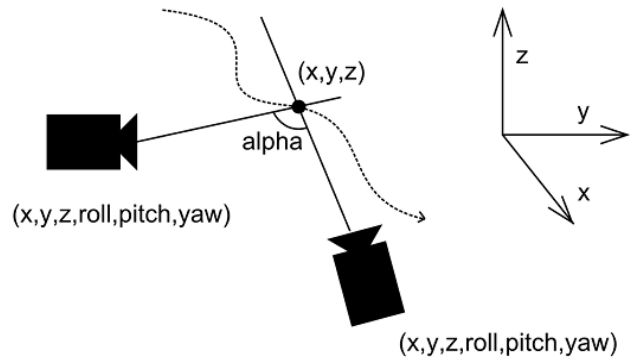
The first step in this process is to find the position and orientation of each camera used. This can be accomplished either as an off-line measurement assuming that cameras are not moved between calibration and actual test, or on-line, dynamically for each image allowing shaking/moving cameras.

There are two different main methods to acquire the position and rotation of a camera

- Using *surveyed* reference markers

- Using *arbitrary* markers visible from at least two cameras with at least one distance known between any two markers
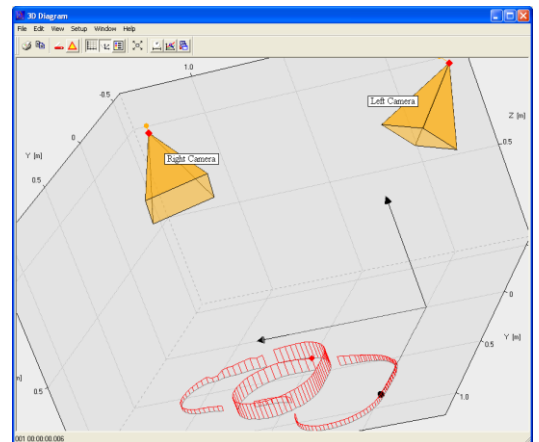
A number of five *surveyed* reference markers is sufficient to calculate the position and rotation of a camera. If the position is surveyed with e.g. a GPS, only two surveyed markers are needed to calculate the rotation.

Using not surveyed points, it is possible to calculate all camera positions and rotations relative to each other.

When the camera positions/rotations are known the 3D position of any number of objects, visible from at least two cameras, can be measured using intersection/trangulation methods.
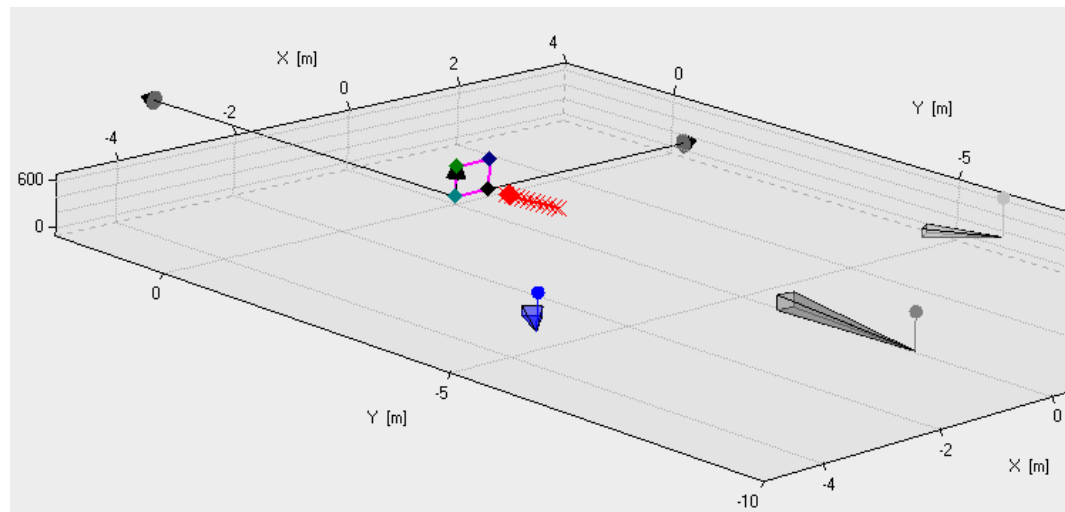
A bullet approaching its target observed by three cameras

TrackEye automatically synchronizes image sources with different frame frequencies/timing.

Output from the TrackEye 3D module is a sequence of x, y & z coordinates for each tracked point, defined in the coordinate system used.

TrackEye software modules required
- TrackEye Basic
- 3D

Optional

- Camera calibration
- TEMA Static 3D

3D from fixed cameras is an advanced application at any test range.

The TrackEye Fixed Camera 3D is the perfect tool.