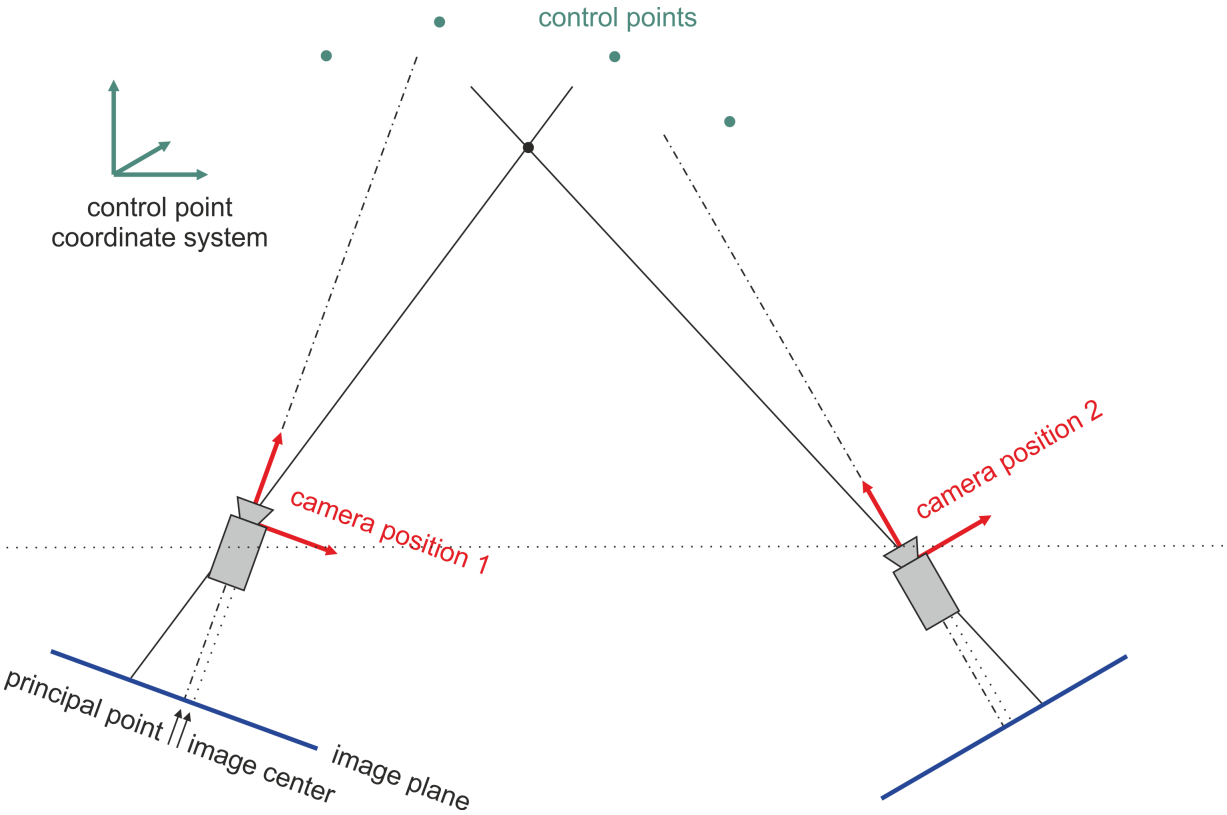
FalCon MovXact – 3D Image Analysis FAQ

- ***Which principles are behind a 3D motion analysis?***

Principle of stereoscopic analysis = intersection in space:



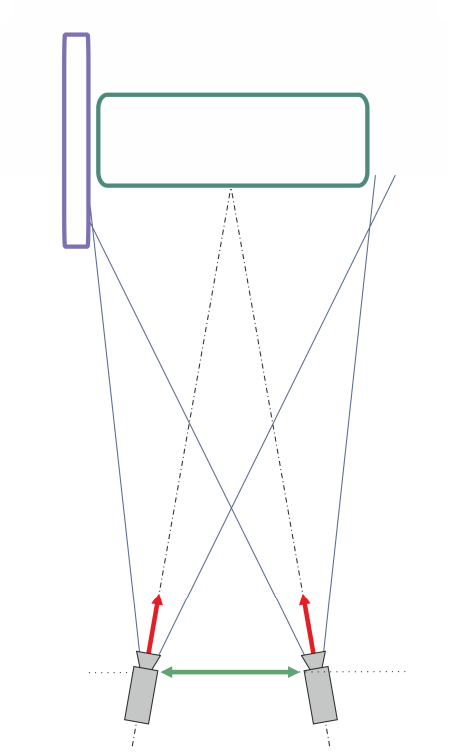
Requirements:

1. **Pre-measured 3D control points in the field of view**
   coordinates by means of metrology arms or photogrammetric systems
   in ASCII file
2. **Cameras and lenses are calibrated**
3. **Cameras run synchronously**
   trigger and recording sync
4. The resulting coordinated are by definition with respect to the coordinate system of the control points. For an optional transformation into a car coordinate system additional **3D reference control points** are necessary.

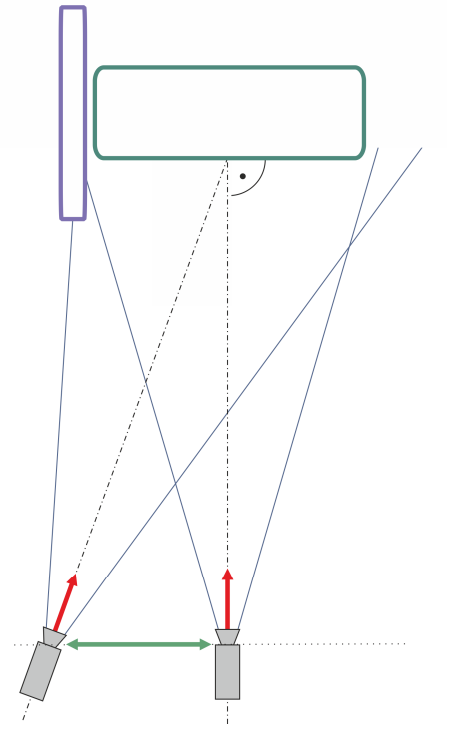
- ***How to setup the stereo cameras?***

- A stereo angle of 20° is recommended. Then both camera views generally allow to setup and track markers quite stably, because the markers are imaged not too much elliptically distorted.
- Positioning the cameras according to this specification and keeping the center of the test object in both images at the center, the stereo base results indirectly.
- The geometric ration of stereo base to object distance can be used as simple guideline: The measuring errors in the plane parallel to the stereo base in relation to the errors in direction of camera view can be expected in the same range as that ratio.

  A target ratio of 1:3 at a distance of 6 m to the test object results in a stereo base to be set of 2 m => 2 : 6.



cameras with symmetric axis angles ±10°



camera with orthogonal orientation and camera with side view at 20°

- Using onboard cameras on high-g sleds images often suffer from bothersome jittering. For compensation of this effect during the 3D evaluation it is necessary to calculate the camera positions dynamically.
  Note: For this the control points need to be visible during the full image sequence!

- ***Which terms are used for a 3D analysis?***

Camera Parameters	Interior orientation = calibrated focal length + principal point + distortion parameters (incl. fixed second zero crossing)
Camera Calibration	Calculation of the camera parameters
Camera Position	Exterior orientation (6D) = location (3D coordinates) and axis (3 angles) (method = resection in space)
Camera Axis	The camera can rotate by three angles: Tilt (“move up or down”) Axis (“move left or right”) Swing (“rotate around line of view”)
Control Point	Point on object or test target with known 3D coordinates
Image Point	Point in image with 2D coordinates
Unknown Point	Point to be measured: calculation of actual 3D coordinates with measured image coordinates, camera parameters and camera positions (method = intersection in space)
Object Point	Point in 3D space
Test Target	Object with pre-measured control points, also “test panel”