We introduce a new method of rotational image acquisition for four dimensional (4D) optical coherence tomography (OCT) of beating embryonic chick hearts. The rotational axis and the central A-scan of the OCT are identical. An out-of-phase image sequence covering multiple heartbeats is acquired at every angle of an incremental rotation of the deflection mirrors of the OCT system. Image acquisition is accomplished after a rotation of 180°. Comparison of a displayed live M-mode of the central A-scan with a reference M-mode allows instant detection of translational movements of the embryo. For calculation of 4D data sets we apply an image-based retrospective gating algorithm using the phase information of the common central A-scan present in all acquired images. This leads to cylindrical three-dimensional (3D) data sets for every time step of the cardiac cycle that can be used for 4D visualization. We demonstrate this approach and provide a video of a beating HH stage 16 embryonic chick heart generated from a 4D OCT data set using rotational image acquisition. The result is validated by comparison of calculated and original B-scan sequences (see Figure).