

Segmentation (1)

Fiduciary marker, neuron segmentation (Ilastik; Fig 1)



Pan-nuclear segmentation (StarryNite; Fig 2)



Relevant features are segmented.

Generate internal coordinate systems (2)

Center and align to X-axis (Fig 3)



Embryo center of mass and AP-axis identified.



Identify head (Fig 3)



Unrotate developmental rotations (CPD; Fig 4)



Embryo internal coordinate system is established.

Map test coordinates to reference (3)

Temporal alignment (least squares; Fig 2)



Scale test to reference (moments of inertia; Fig 3)



Estimate initial DV – LR angle (Fig 3)



Map early time point to reference (CPD; Fig 3)



Map all time points to reference using
summed rotations (CPD; Fig 3)



Test embryo is roughly aligned to reference.



3D fine correction, map all time points to
corresponding reference time points (CPD)



Test embryo is precisely aligned to reference.