

## aiBeadTracker

aiBeadTracker finds gold beads in a tilt series and tracks them to individual markers.

It is important for aiBeadTracker to rely on the initial coarse alignments. The more precise image shifts and image rotation are determined before hand, the better are the results of aiBeadTracker. In case that markers in higher tilt angles are not well tracked, check for the image rotation value which should be known +/- 1 degree.

aiBeadTracker can be used without a configuration file and all parameters can be provided by command line arguments. For convenience, parameters can also be given using a configuration file with the **-u** command line argument. Note: If a parameter is passed by file and by command line, the command line overrides the file.

Options are:

### CudaDeviceID

The deviceID of the GPU to use.

Argument for command line: **-d** or **--CudaDeviceID**

Type: **int**

Option is mandatory: **false**

Default value if not set: **0**

### Input

The file to process.

Argument for command line: **-i** or **--Input**

Type: **string**

Option is mandatory: **true**

### AlignBeamDeclination

Align for beam declination.

Argument for command line: **-alignBeamDecl** or **--AlignBeamDeclination**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **true**

### AlignInPlaneRotation

Align for in plane rotation.

Argument for command line: **-alignInPlaneRot** or **--AlignInPlaneRotation**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **true**

### AlignFixedInPlaneRotation

Align for a fixed / constant in plane rotation.

Argument for command line: **-alignFixedInPlaneRot** or **--AlignFixedInPlaneRotation**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **false**

Only applicable if **AlignInPlaneRotation** = true.

## AlignTilt

Align for tilt angles

Argument for command line: **-alignTilt** or **--AlignTilt**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **true**

## AlignMagnification

Align for magnification change.

Argument for command line: **-alignMag** or **--AlignMagnification**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **true**

## FixMagnificationOnFirstTilt

Ensures that the magnification change on the first recorded tilt is 1.

Argument for command line: **-fixMagInFirstTilt** or **--FixMagnificationOnFirstTilt**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **true**

Only applicable if **AlignMagnification** = true.

## AlignMaxIterations

Maximum number of optimization iterations to perform.

Argument for command line: **-alignIter** or **--AlignMaxIterations**

Type: **int**

Option is mandatory: **false**

Default value if not set: **10000**

## AlignZShift

Z shift to apply during marker alignment.

Argument for command line: **-alignZ** or **--AlignZShift**

Type: **float**

Option is mandatory: **false**

Default value if not set: **0**

## FixLowerTiltAngles

Increases the costs for modifying lower tilt angles and avoids changes in these lower tilts.

Argument for command line: **-fixTilt** or **--FixLowerTiltAngles**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **false**

## LowPassImage

Low pass filter applied to the image for bead detection. Mainly to reduce noise.

Argument for command line: **-lp1** or **--LowPassImage**

Type: **float**

Option is mandatory: **false**

Default value if not set: **400**

## LowPassEdge

Low pass filter applied to the image before edge detection. This value should be quite low.

Argument for command line: **-lp2** or **--LowPassEdge**

Type: **float**

Option is mandatory: **false**

Default value if not set: **200**

## LowPassCCMap

Low pass filter applied to the CC map before peak detection to reduce false positives.

Argument for command line: **-lp3** or **--LowPassCCMap**

Type: **float**

Option is mandatory: **false**

Default value if not set: **200**

## MinBeadSize

The smallest size of gold beads used in the sample in [nm].

Argument for command line: **-minBead** or **--MinBeadSize**

Type: **float**

Option is mandatory: **false**

Default value if not set: **5**

## MaxBeadSize

The largest size of gold beads used in the sample in [nm].

Argument for command line: **-maxBead** or **--MaxBeadSize**

Type: **float**

Option is mandatory: **false**

Default value if not set: **15**

## BeadIncrement

Speed up factor for scanning all bead sizes in the provided range.

Argument for command line: **-beadIncr** or **--BeadIncrement**

Type: **int**

Option is mandatory: **false**

Default value if not set: **2**

## MaxDistance

Theoretically, all gold beads remain on a line perpendicular to the tilt axis while going through all tilts of the tilt series. This parameter determines the maximum distance to that ideal line for a gold bead before being rejected. Note that this highly depends on the accuracy of the initial image rotation angles.

Argument for command line: **-maxDist** or **--MaxDistance**

Type: **float**

Option is mandatory: **false**

Default value if not set: **200**

## MaxCost

The maximum cost (summed distance of the reprojected bead) for a bead track during initialization.

Argument for command line: **-cost** or **--MaxCost**

Type: **float**

Option is mandatory: **false**  
Default value if not set: **200**

## MaxDistanceBead

The maximum distance allowed for tracking on the non initialization tilts.  
Argument for command line: **-maxDistBead** or **--MaxDistanceBead**  
Type: **float**  
Option is mandatory: **false**  
Default value if not set: **200**

## InitTilts

The tilt indices used for marker initialization.  
Argument for command line: **-initTilts** or **--InitTilts**  
Type: **List<int>**, a list of integer values  
Option is mandatory: **false**  
Default value if not set: **[]**

## PreFilterLimit

The maximum reprojection error allowed per bead before alignment.  
Argument for command line: **-preFilter** or **--PreFilterLimit**  
Type: **float**  
Option is mandatory: **false**  
Default value if not set: **20**

## FilterLimit

The maximum reprojection error allowed per bead after initial alignment.  
Argument for command line: **-filter** or **--FilterLimit**  
Type: **float**  
Option is mandatory: **false**  
Default value if not set: **10**

## Sensitivity

The sensitivity for peak detection, i.e. how many times a peak must be above the STD of the CCMAP in order to be accepted.  
Argument for command line: **-sens** or **--Sensitivity**  
Type: **float**  
Option is mandatory: **false**  
Default value if not set: **5**

## MinimumTiltCount

The minimum number of tilts a marker must appear or it is removed.  
Argument for command line: **-minTilts** or **--MinimumTiltCount**  
Type: **int**  
Option is mandatory: **false**  
Default value if not set: **5**

## GoldBeadFile

Save the detected gold beads in a separate file.

Argument for command line: **-beadFile** or **--GoldBeadFile**

Type: **string**

Option is mandatory: **false**

Default value if not set: **'goldbeads'**

## AlignmentFile

Save the tracked markers in a separate file. If empty, markers are stored directly inside tilt series metadata.

Argument for command line: **-alignFile** or **--AlignmentFile**

Type: **string**

Option is mandatory: **false**

Default value if not set: **'alignment'**

## AlignMarkers

Run marker alignment and filtering after marker detection.

Argument for command line: **-align** or **--AlignMarkers**

Type: **bool**

Option is mandatory: **false**

Default value if not set: **false**