



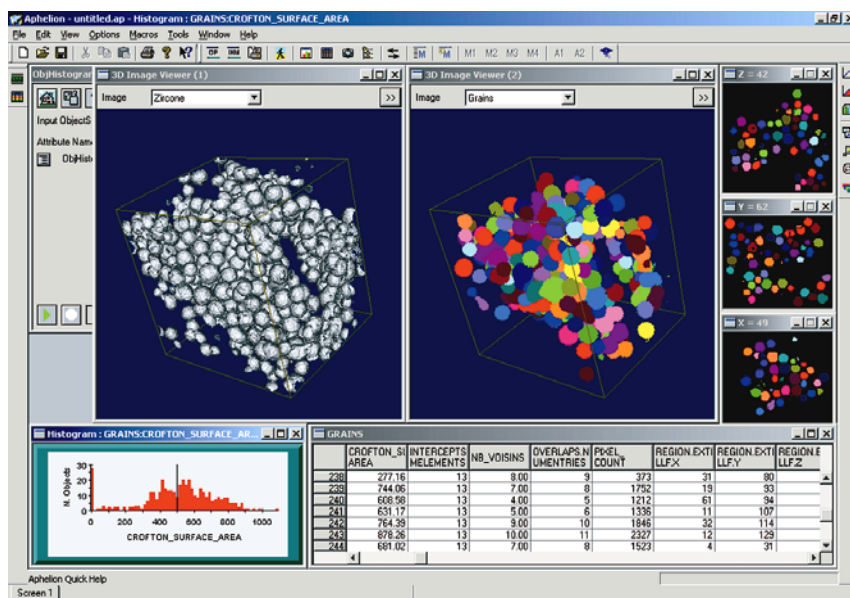
3D Extension Modules

Display, Process, and Analyze 3D Images

Aphelion™ users can now effectively process and display 3D images using virtually the same processing and analysis power provided for 2D images. The Aphelion™ product family now includes two optional modules for these functions: the 3D Image Display Module and the 3D Image Processing & Analysis Module. Using these powerful modules, images acquired from sensor devices such as transmission electron microscopes, confocal microscopes, medical scanners, and other 3D devices, can be easily processed, analyzed, and displayed using the Aphelion™ Graphical User Interface.

3D IMAGE DISPLAY MODULE

Aphelion™ Developer's extensive image display capabilities have been enhanced by adding 3D display to its Image Viewer component. The three images below show different modes of 3D image visualization. The new Aphelion™ 3D capabilities maintain the general *look and feel* of the popular Aphelion™ GUI. Users with 3D research projects or who are developing applications with 3D imaging content will find the Aphelion™ 3D tools indispensable to timely, effective completion of their work. Note, the 3D Image Display Module requires the installation of the 3D Image Processing Module.



The 3D Image Display module also includes the **Aphelion AVI® Recorder**, to record movies that capture changes in a 3D object, such as rotations, light position and intensity, and visualization modes.

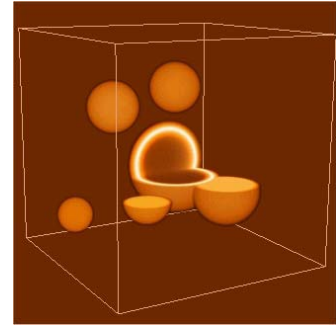
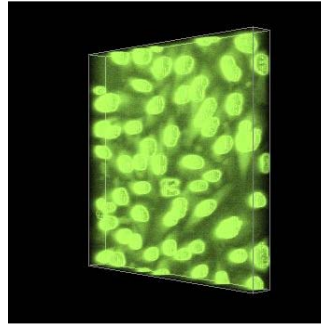
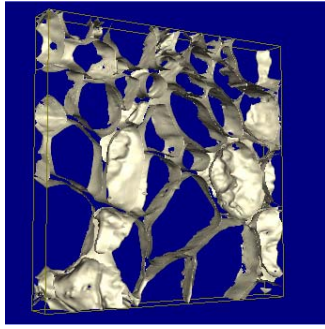
These movies can be saved as AVI files, or as series of TIFF®, JPEG®, or bitmap files to be easily integrated in presentations and web pages.

Image courtesy of Synchrotron of ESRF (Grenoble). Collaboration between GEMPPM (INSA, Lyon) and Center of Mathematical Morphology (Fontainebleau).

Adding **3D Image Display** to your application is easy with the Aphelion™ 3D Image Display Module. This Module is available as an ActiveX® component with the following capabilities:

- Display a 3D object as a set of slices, composite object, or isosurface
- Control light sources and viewing angles
- Control display context (intensity, zoom, etc.)
- Display cross-sections in X, Y and Z directions
- Control look-up tables and light intensities
- Mouse/keyboard control of 6 degrees of freedom





3D IMAGE PROCESSING MODULE

The Aphelion™ 2D image processing operators have been enhanced to handle 3D data including, for example, convolution, addition, subtraction, maximum, erosion, dilation, distance function, labeling, watershed, and threshold. Analysis of 3D images is supported by 3D measurements and 3D ObjectSet.

Operators Included in the Aphelion™ 3D Image Processing and Analysis Module

Analysis

ImgArea
 ImgAutoCorrelate
 ImgBandHistogram
 ImgBoundingBox
 ImgCompare
 ImgCorrelateWithTemplate
 ImgCountObjects
 ImgCrossCorrelate
 ImgFirstPoint
 ImgHistogram
 ImgLocalVariance
 ImgMoments
 ImgProfile
 ImgRange
 ImgTrace
 ImgVolume
 ObjAttributeRatio
 ObjHistogram
 ObjMoments
 ObjShape (Volume, Surface, Intercepts, Compactness, Sphericity)
 RegionStatistics

Arithmetic/Logic

ImgAbs
 ImgACos
 ImgAdd
 ImgAddConstant
 ImgAnd
 ImgASin
 ImgATan
 ImgBitAnd
 ImgBitDifference
 ImgBitNot
 ImgBitOr
 ImgBitXNor
 ImgBitXOr
 ImgBlend
 ImgCos
 ImgDivide
 ImgExp
 ImgExp10
 ImgInvert
 ImgLeftShift
 ImgLog
 ImgLog10
 ImgLogicalDifference
 ImgMask
 ImgMaximum

ImgMinimum
 ImgMultiply
 ImgMultiplyConstant
 ImgNAnd
 ImgNOor
 ImgNot
 ImgOr
 ImgRemainder
 ImgRightShift
 ImgSin
 ImgSqr
 ImgSqrt
 ImgSubtract
 ImgSubtractConstFloor
 ImgTan
 ImgXNor
 ImgXOr

Edge Detection

ImgExternalGradient
 ImgInternalGradient
 ImgLaplacian
 ImgMorphGradient

Filtering

ImgBoxFilter
 ImgConvolve
 ImgGaussianFilter
 ImgHighPass3x3
 ImgHighPass5x5
 ImgHighPass7x7
 ImgLaplacian
 ImgLaplacian3x3
 ImgLaplacian5x5
 ImgLaplacian7x7
 ImgLowPass3x3
 ImgLowPass5x5
 ImgLowPass7x7
 ImgMedian
 ImgMedian3x3
 ImgMedian5x5
 ImgMode
 ImgMode3x3
 ImgRankValueFilter
 ImgWallisFilter

Frequency Domain

ImgFFT
 ImgInverseFFT

Image Utilities

ImgClear
 ImgClip

ImgCopy
 ImgCreateGaussianNoise
 ImgCreateUniformNoise
 ImgCut
 ImgEqualizeHistogram
 ImgFill
 ImgFrame
 ImgFree
 ImgFreeAll
 ImgImport
 ImgLinearScale
 ImgMapThroughLUT
 ImgMultipleSubCopy
 ImgPaste
 ImgRead
 ImgReadSlices
 ImgSetName
 ImgSetType
 ImgSubCopy
 ImgWrite
 ImgWriteSlices

Mathematical Morphology

ImgAddReconsClose
 ImgAlternateSequential
 ImgAreaClose
 ImgAreaOpen
 ImgAutoMedian
 ImgBorderKill
 ImgBorderKillAndHoleFill
 ImgCatchmentBasins
 ImgClose
 ImgConstrainedCatchmentBasins
 ImgConstrainedWatershed
 ImgDilate
 ImgDilateReconsClose
 ImgErode
 ImgErodeReconsOpen
 ImgEuclideanDistance
 ImgExtendedRegionalMaxima
 ImgExtendedRegionalMinima
 ImgGeodesicDilate
 ImgGeodesicGraphDistance
 ImgGraphDistance
 ImgHoleFill
 ImgLocalMaxima
 ImgLocalMinima
 ImgMorphContrast
 ImgOpen
 ImgOpenSkeleton
 ImgReconstruct

ImgRegionalMaxima
 ImgRegionalMinima
 ImgSubtractReconsOpen
 ImgUltimateErodedSet
 ImgWatershed

Object Processing

RegionClose
 RegionDilate
 RegionErode
 RegionOpen
 RegionOverlap

Object Utilities

ObjAppend
 ObjCopy
 ObjDeleteAttribute
 ObjExport
 ObjFilter
 ObjFree
 ObjFree
 ObjFreeAll
 ObjImport
 ObjMerge
 ObjRead
 ObjSpatialAttributeToImage
 ObjWrite

Segmentation

ImgAdaptivePercentileThreshold
 ImgBlackTophat
 ImgClustersObj
 ImgClustersSplitConvex
 ImgClustersToLabels
 ImgEntropyThreshold
 ImgEntropyThresholdObj
 ImgExtremaThreshold
 ImgHysteresisThreshold
 ImgHysteresisThresholdObj
 ImgLabelsObj
 ImgMomentThreshold
 ImgMomentThresholdObj
 ImgRegionGrow
 ImgRegionGrowObj
 ImgSeededRegionGrow
 ImgThreshold
 ImgThresholdObj
 ImgWhiteTophat

Transforms

ImgColorCompose
 ImgColorToRGB
 ImgSc

