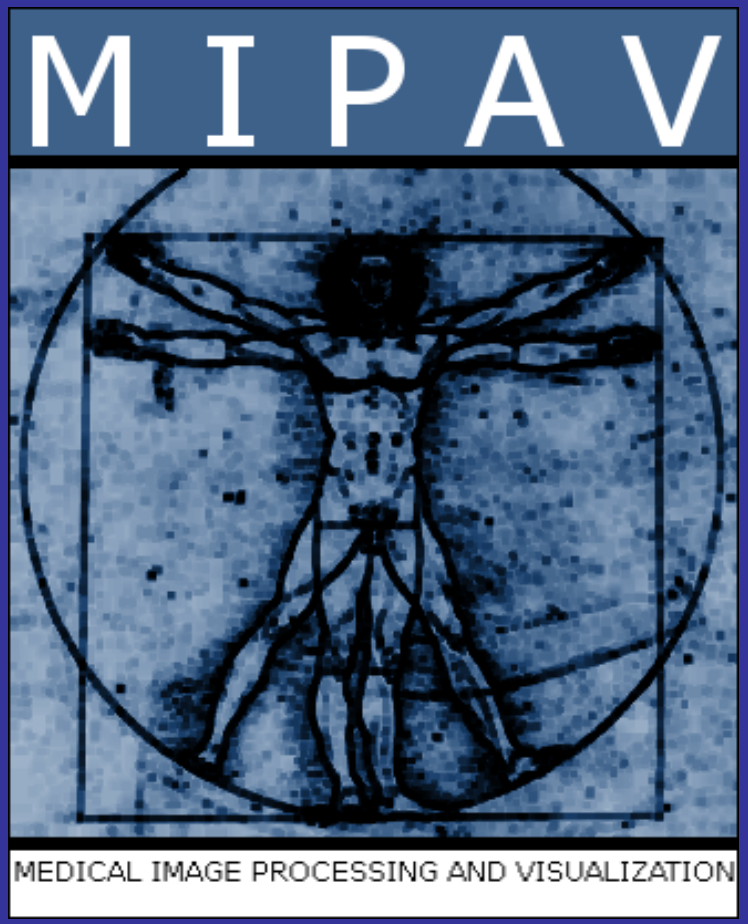

http://mipav.cit.nih.gov

Medical Image Processing, Analysis & Visualization in Clinical Research

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MIPAV Team

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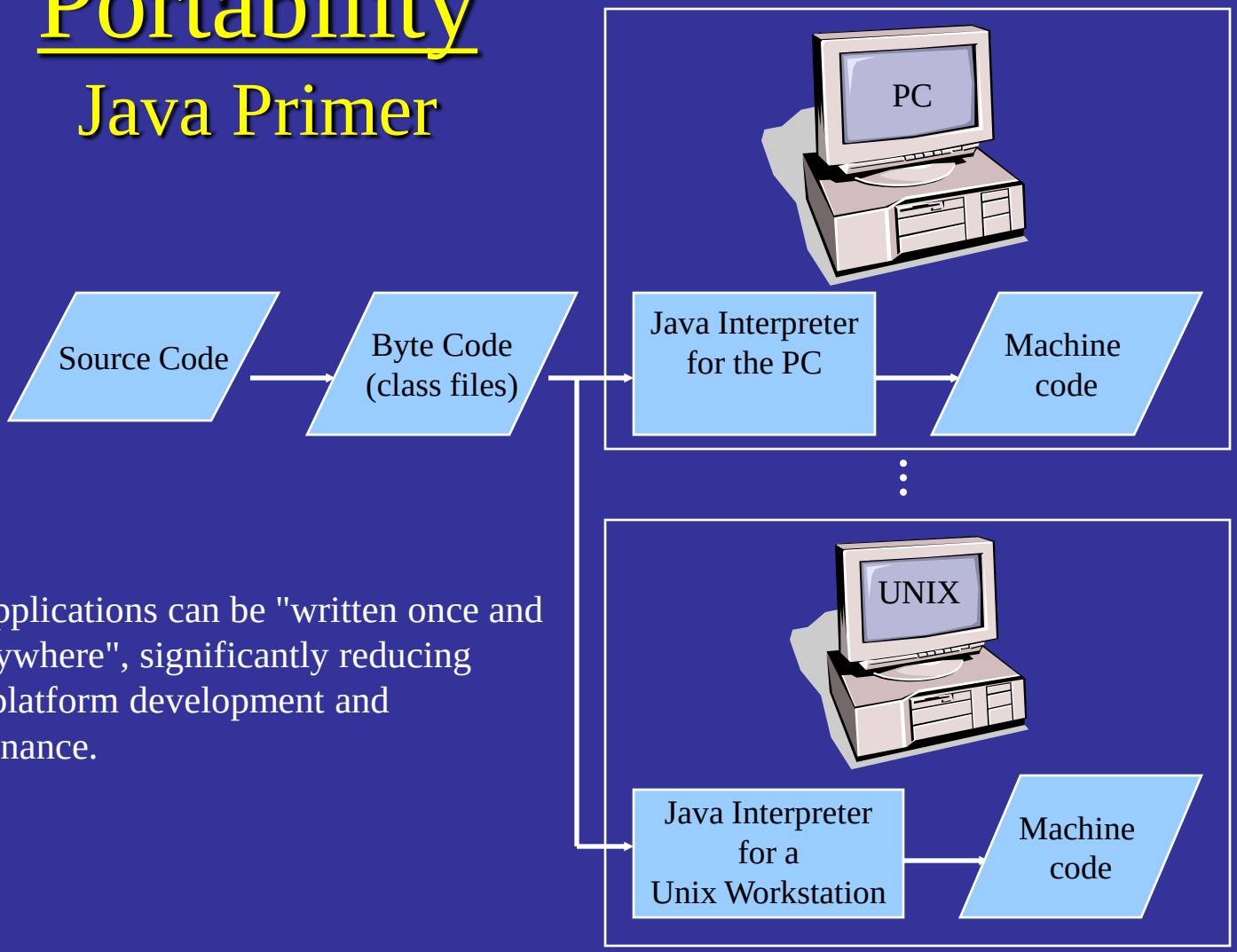
Requirements for an Image Quantification and Visualization Application

- **Portability**
  - cross-platform or platform-independent execution
- **Data format independence**
  - access to images: DICOM, Analyze, TIFF, Raw, …
- **Extensibility**
  - plugins and/or scripts
- **Scalability**
  - foundation to support the growth to larger and more intricate data structures
- **Usability**
  - coherent graphical user interface (GUI)

Portability

Java Primer



Java applications can be "written once and run anywhere", significantly reducing cross-platform development and maintenance.

Data Independence

- DICOM file reader/writer
- DICOM Query/Retrieve and “Catcher”
- Comprehensive file format support/conversion
  - http://mipav.cit.nih.gov/fileformat.html
- MIPAV XML file format

Extensibility
Plugins and Scripts

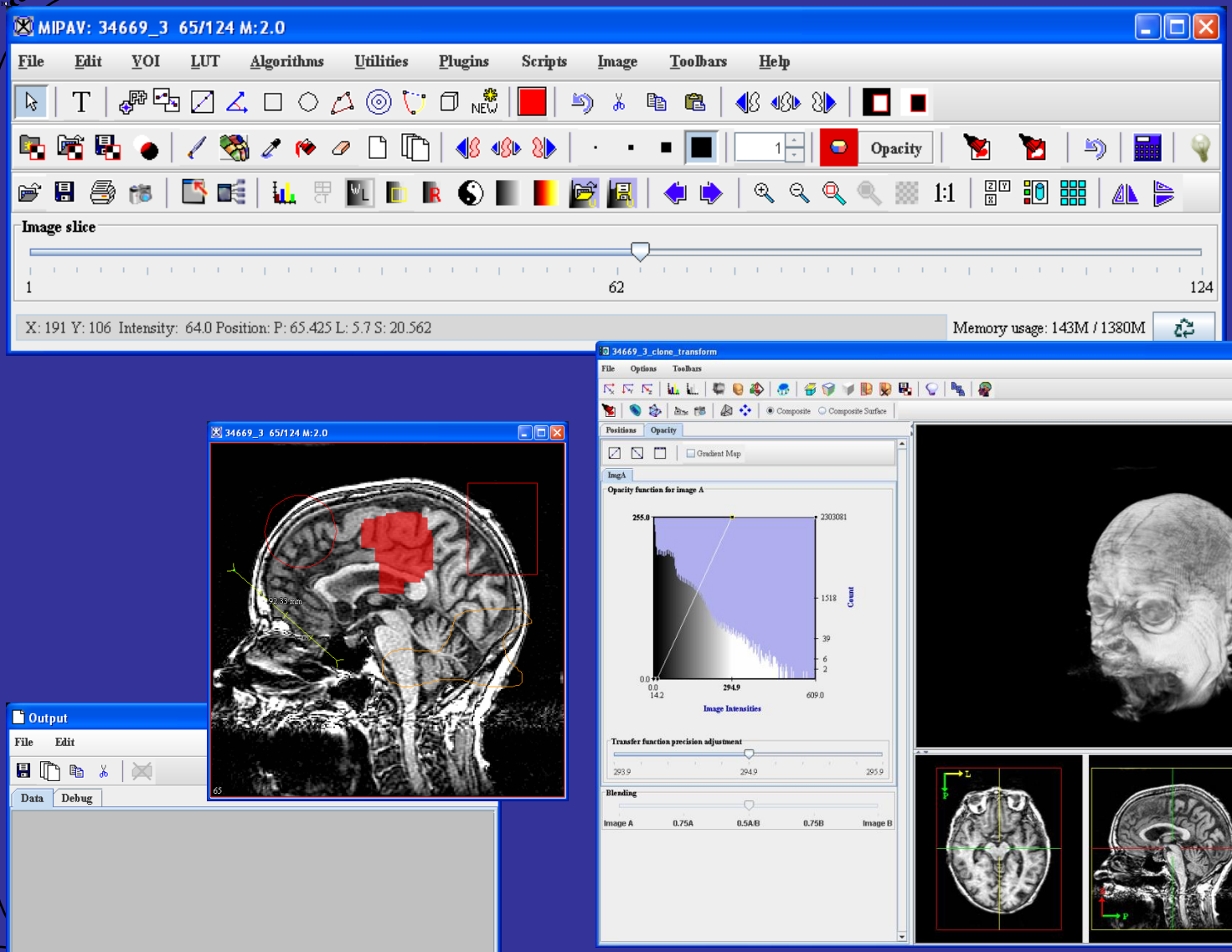
- **Plugins**
  - Functions written in Java using the MIPAV API.
- **Scripts**
  - Use MIPAV to record and save function(s) applied to image dataset(s).
  - Apply the script to any number of image datasets using the script wizard.

Scalability

- **Model Image is an n-dimensional structure.**
- **Algorithms can support up to 4D datasets.**
- **Viewers support 4D dataset with fusion.**

Usability

- **GUI elements**
- **Scripting system**
- **Command-line tools**


MIPAV: 34669_3 65/124 M:2.0
File Edit VOI LUT Algorithms Utilities Plugins Scripts Image Toolbars Help
Opacity
Image slice
1
62
124
X: 191 Y: 106 Intensity: 64.0 Position: P: 65.425 L: 5.7 S: 20.562
Memory usage: 143M / 1380M
34669_3 65/124 M:2.0
34669_3_clone_transform
File Options Toolbars
Positions Opacity
Opacity function for image A
Image Intensities
Transfer function precision adjustment
Blending
Image A
Image B
Output
File Edit
Data Debug

Functional Overview

GUI

Views – with data fusion

2D planar,
"Lightbox",
Cine (movie),
Multi-planar,
3D tri-planar,
Surface render, (supports 3D texture mapped volume rendering
Volume render

VOIs

32K
Manual and automated contouring

Algorithms

Filtering
Segmentation/classification
Measurement/quantification
Registration/fusion
Utilities
Plugins

Scripting

Data (Image) types: n-dimensional structure

(boolean, byte, unsigned byte, short, unsigned short, int, long, float, double, Complex, ARGB)

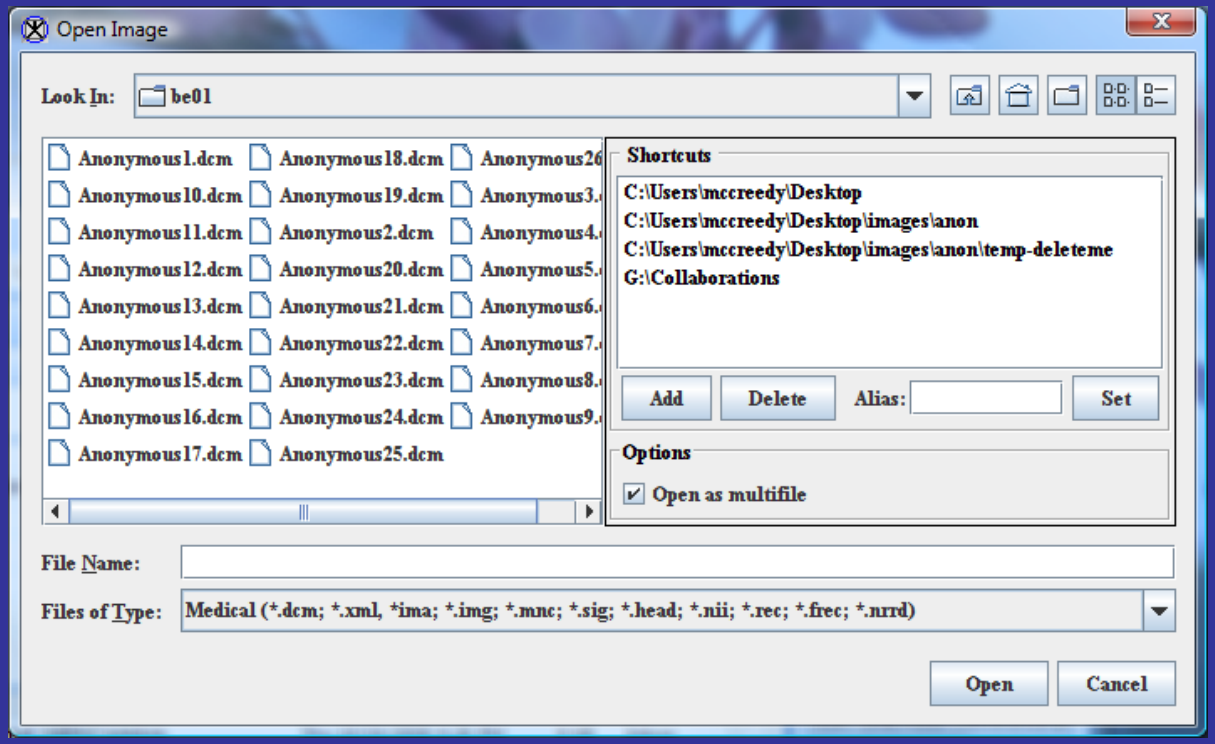
PACS

DICOM 3.0:
Query/Retrieve, Catcher

File types

(Raw, Analyze, DICOM 3.0, GE, Siemens, Bruker, Interfile, Micro cat, MINC, MRC, FITS, Cheshire, AFNI, TIFF, JPEG, GIF, BMP, AVI, QuickTime, Biorad, Ziess LSM510, XML, and more)

Opening Images



Opening Images

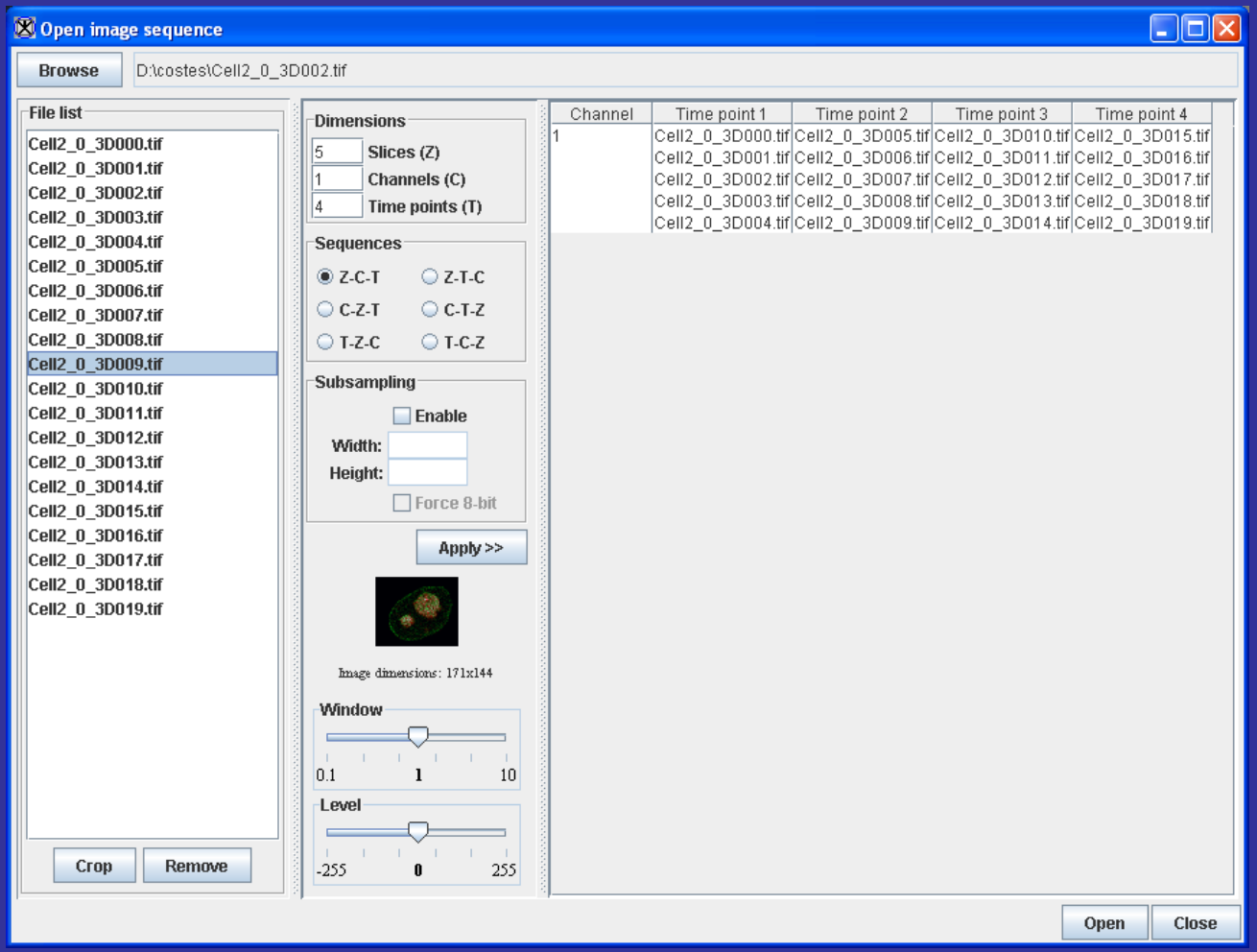
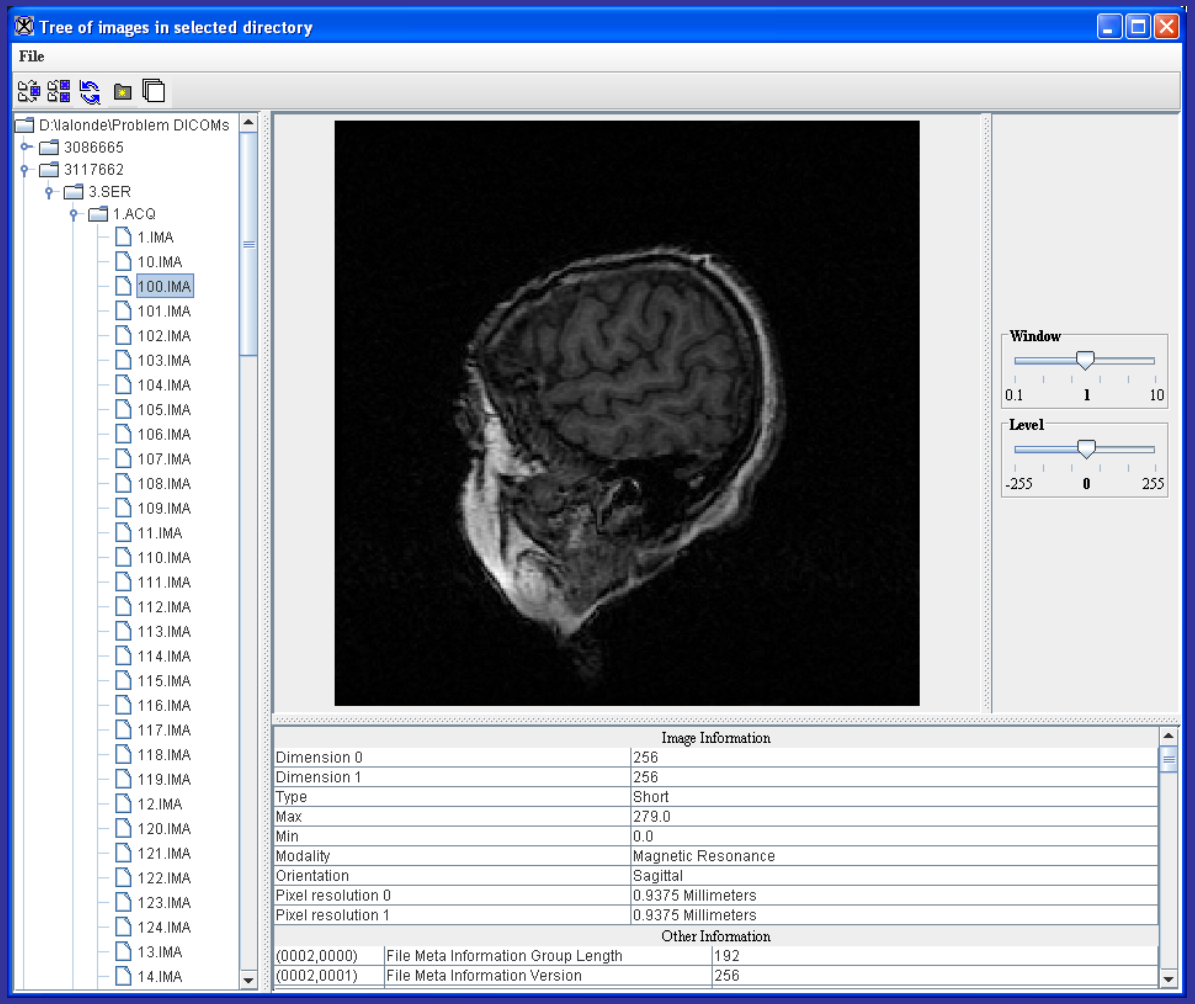
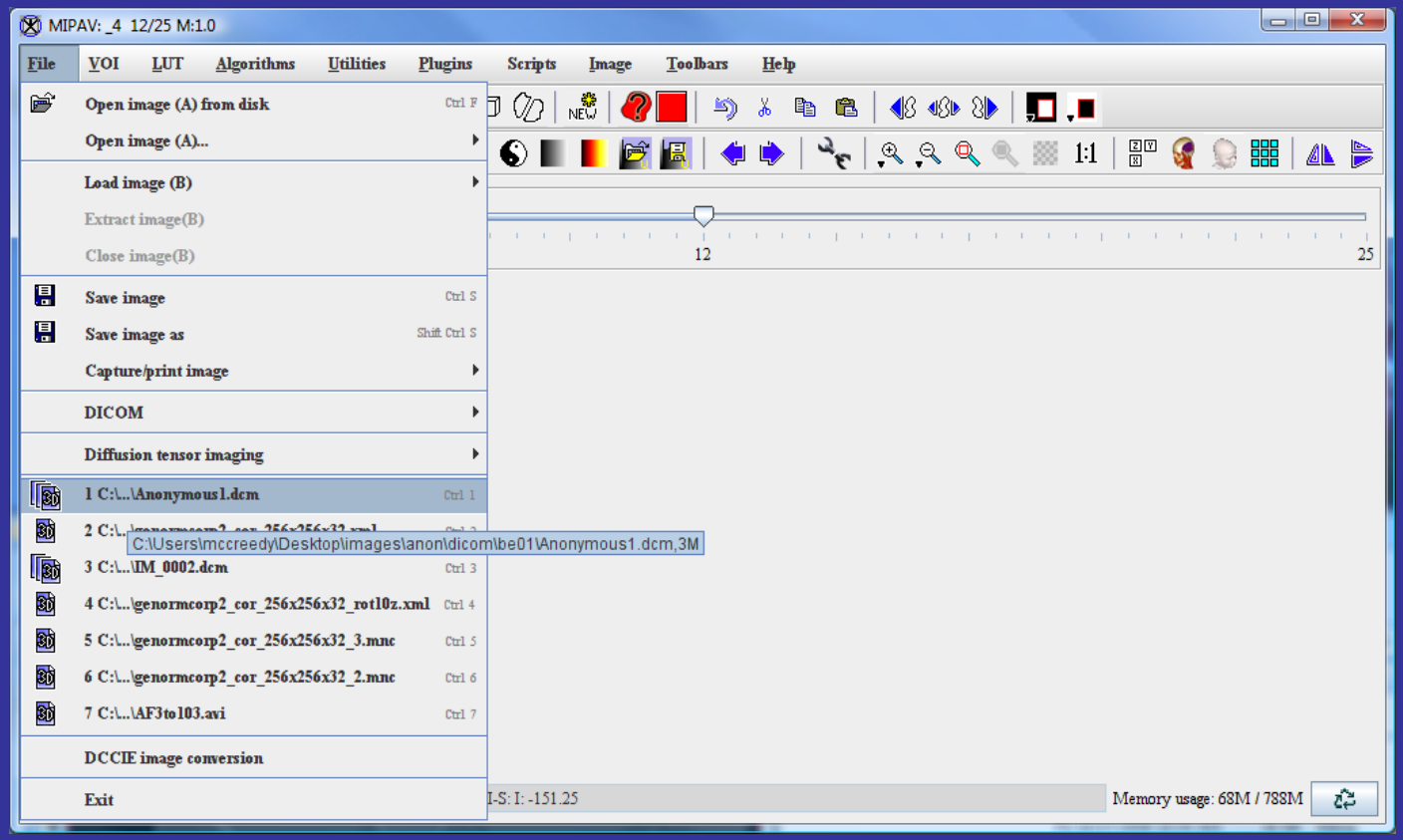


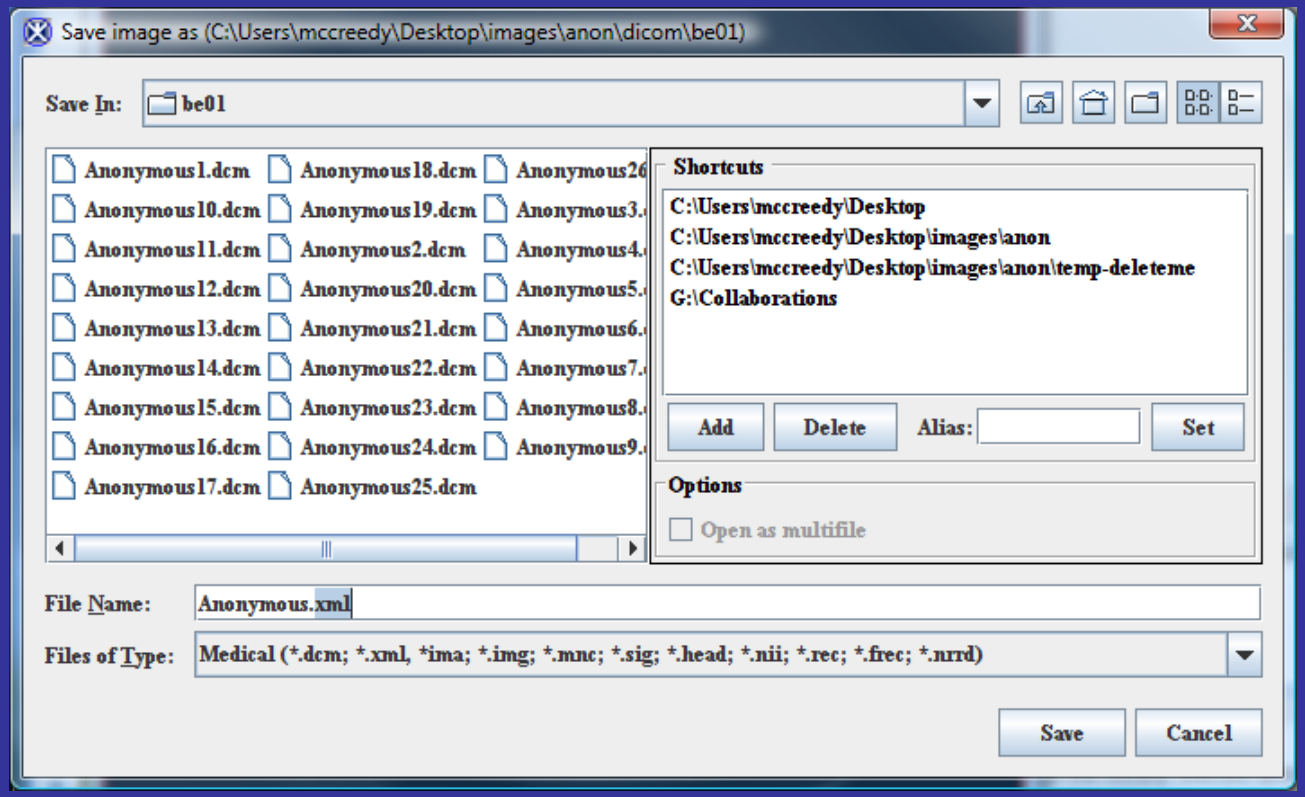
Image Browser



Opening Images



Saving Image As (use suffix)



Code Snapshot


```
int destExtents[] = new int[2];
destExtents[0] = image.getExtents()[0];    // X dim
destExtents[1] = image.getExtents()[1];    // Y dim

// Make a result image of Unsigned byte type
resultImage     = new ModelImage(ModelStorageBase.UBYTE, destExtents, “Result Image”, null);

int length = destExtents[0] *  destExtents[1];
for (int i = 0; i < length; i++){
    destImage.set(i, i%256);
}

ViewJFrameImage imageFrame;
ModelLUT LUTa    = new ModelLUT(ModelLUT.COOLHOT, 256, dimExtentsLUT);
        imageFrame = new ViewJFrameImage(resultImage, LUTa, new Dimension(610,200), userInterface);
```

Algorithms

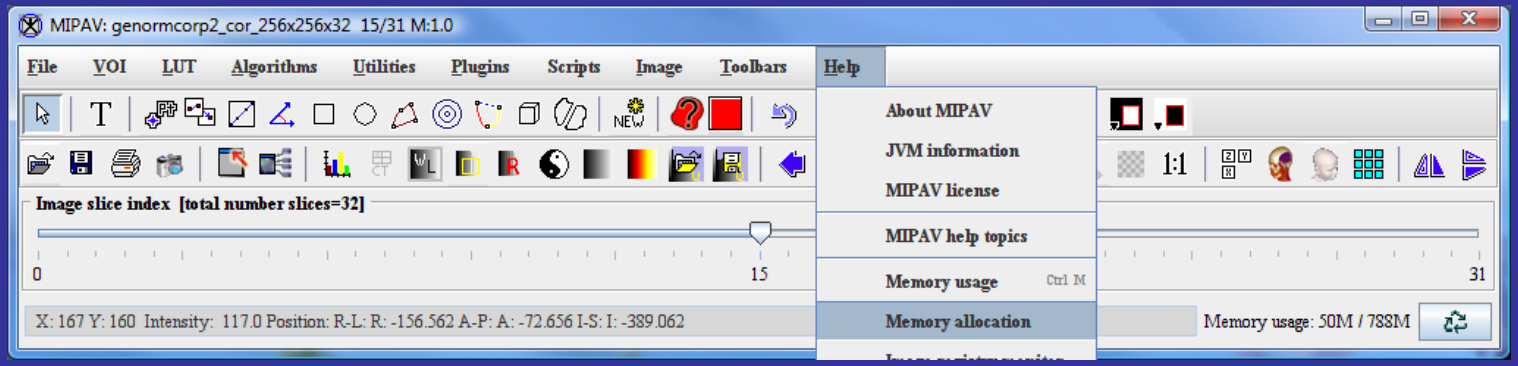
- Filters
- Calculation
- Registration
- Transformation
- Surface extraction
- Classification/Segmentation

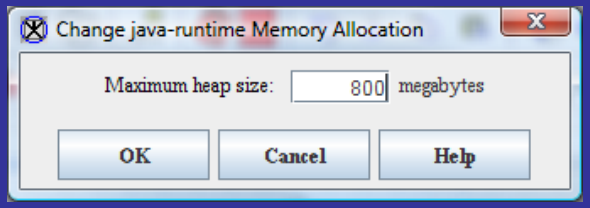
Download and Setup

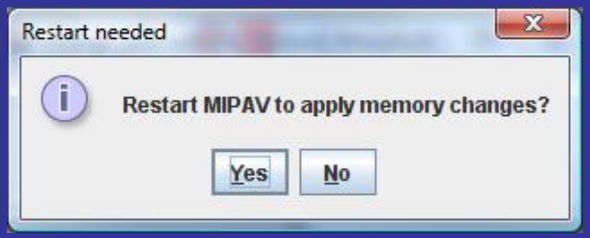
1. http://mipav.cit.nih.gov/download
2. Fill in form
3. Install (e.g. installMIPAV.exe)

** Nightly download - lastest changes but might have bugs.
** Archived releases also available.

Memory Allocation





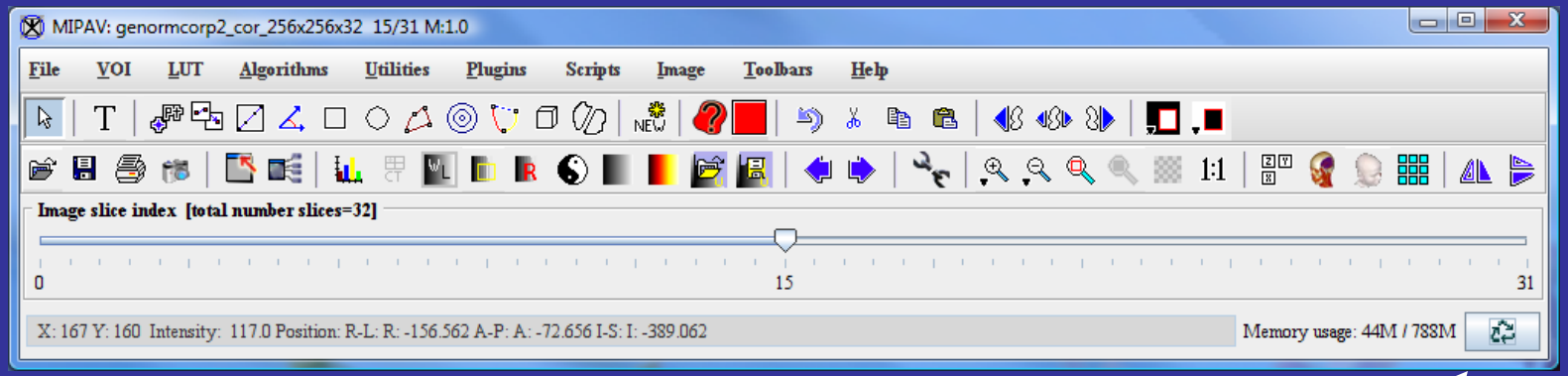


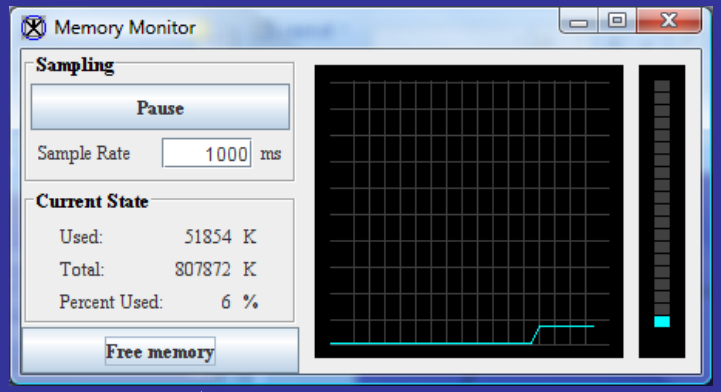
General Rules

- Do not exceed the computer's physical RAM. For example if the computer has 1GB do not exceed approx 800MB.

- For 32-bit Windows systems do not exceed 1,400MB

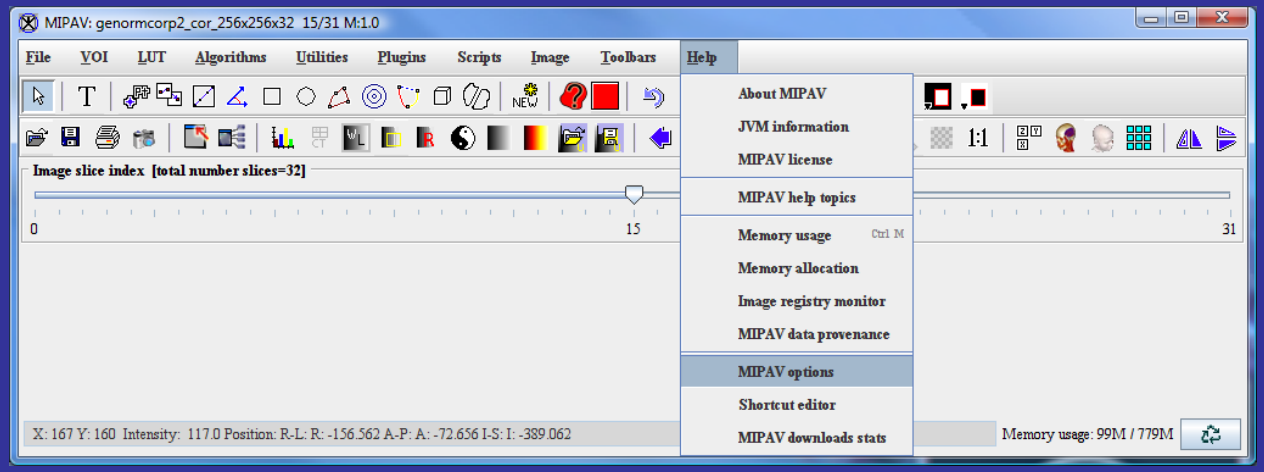
Memory Usage

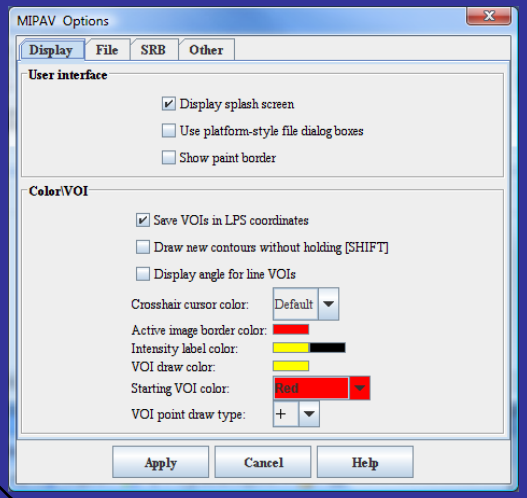


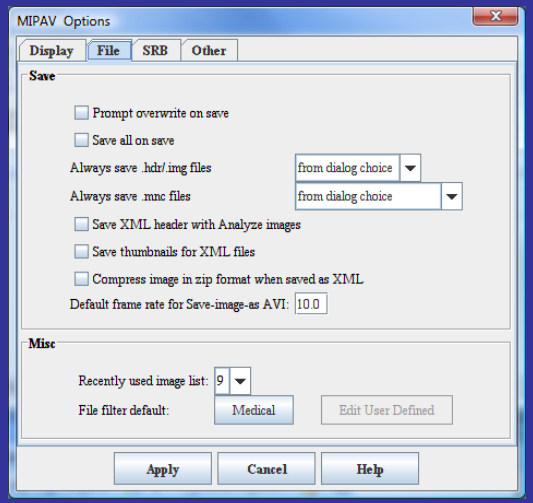


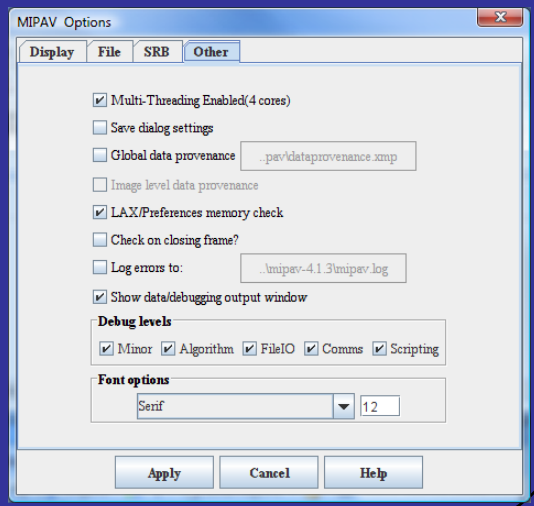
Press to recover memory

MIPAV Program Options









Digital Image Communication in Medicine (DICOM).

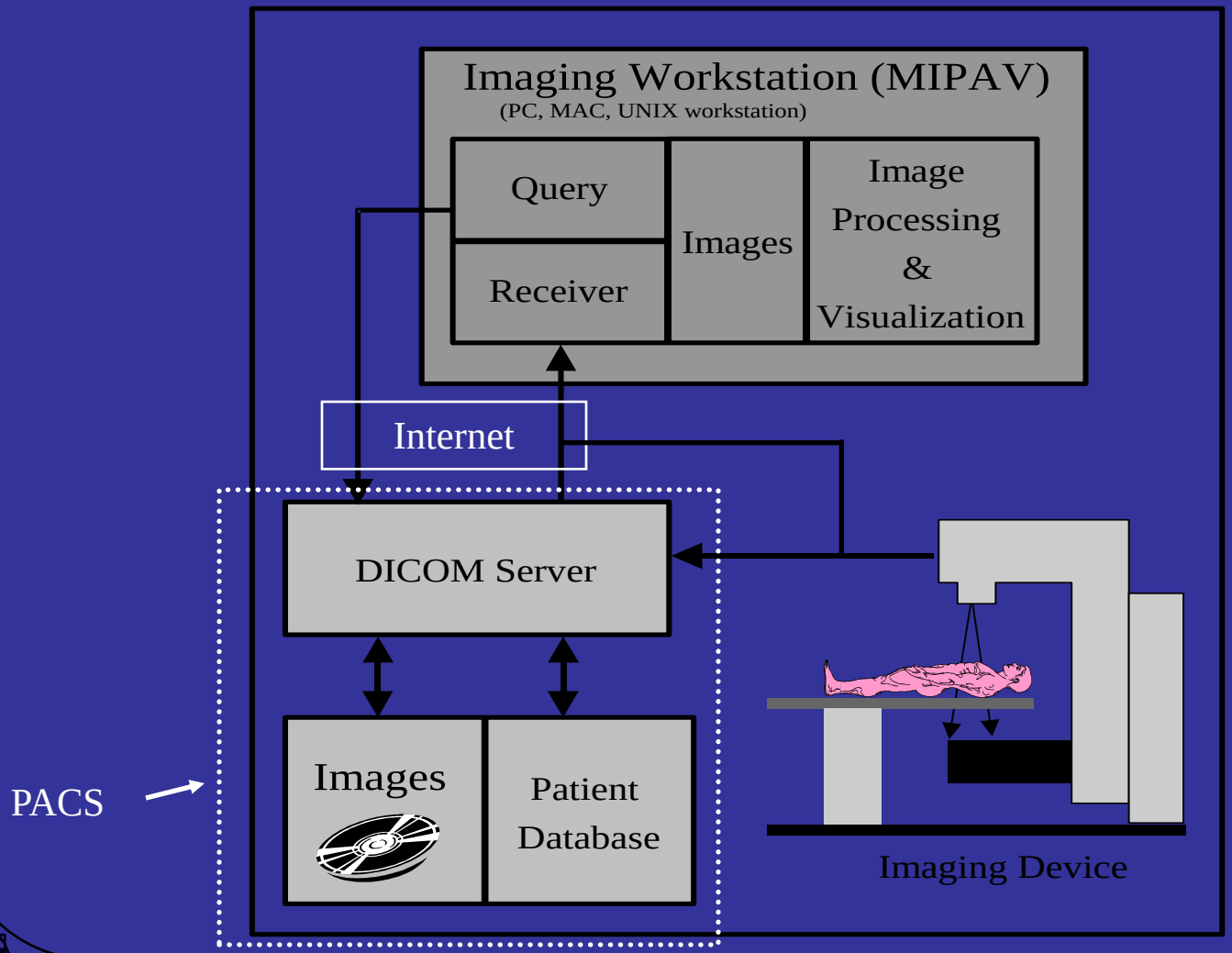
American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee in 1983 to develop a standard in Digital Image Communication in Medicine (DICOM).

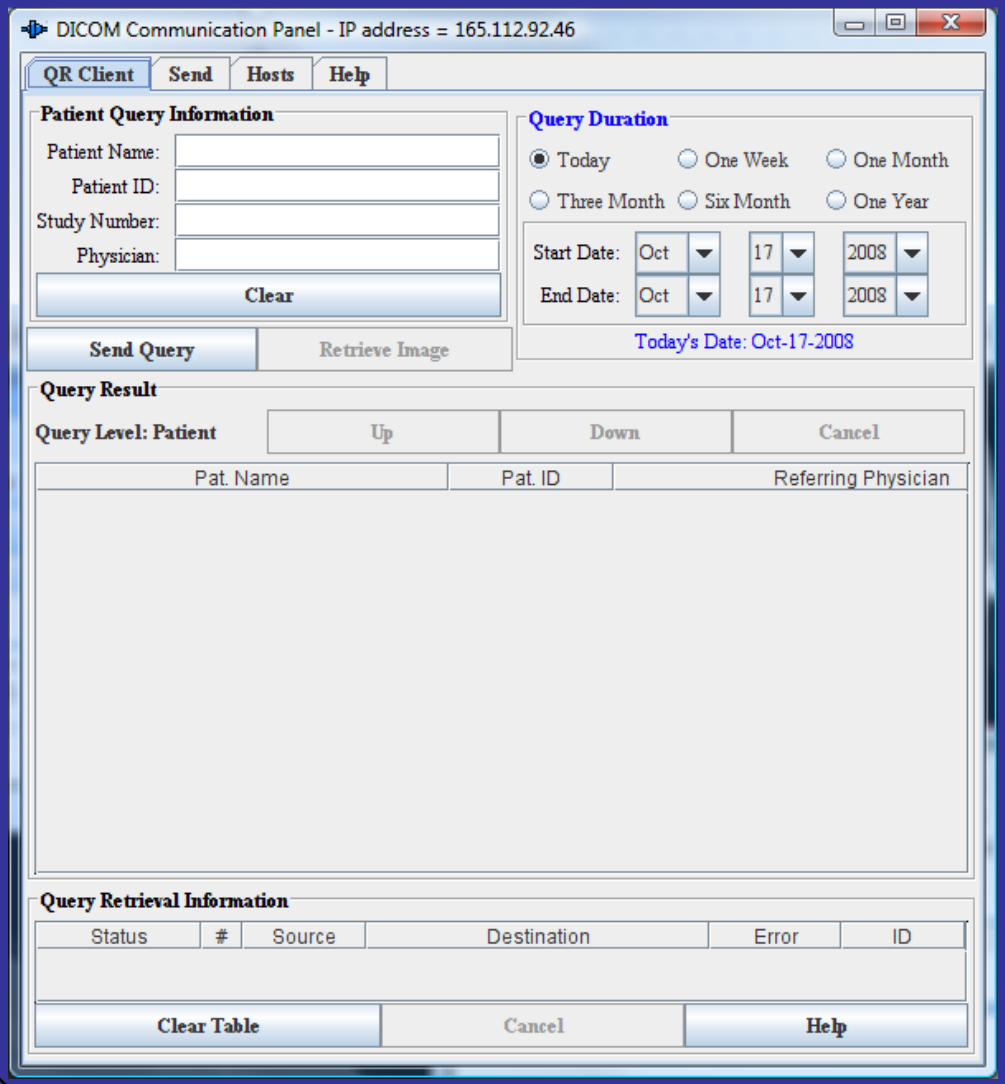
1. Promote communication of digital image information, regardless of device manufacturer

2. Facilitate the development and expansion of picture archiving and communication systems (PACS) that can also interface with other systems of hospital information

3. Allow the creation of diagnostic information databases that can be interrogated by a wide variety of devices distributed geographically.

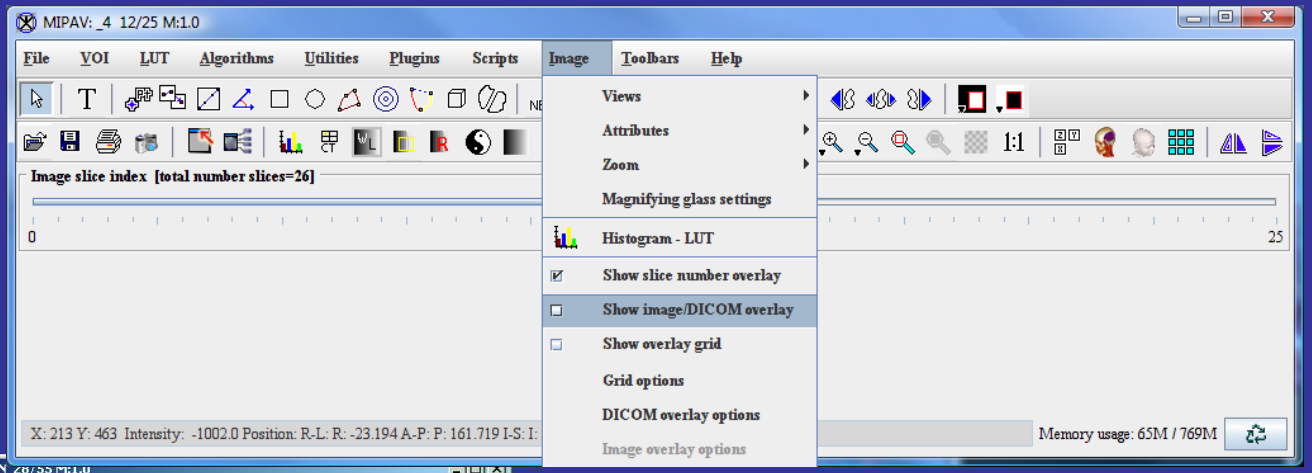
DICOM Model

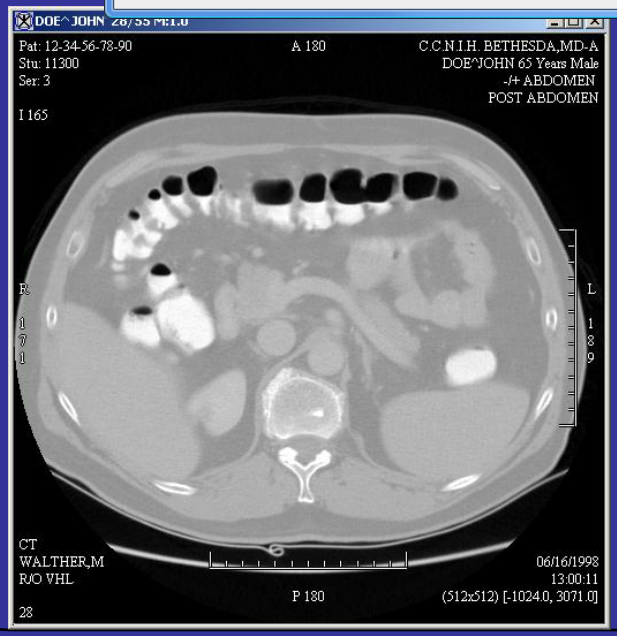

Imaging Workstation (MIPAV)
(PC, MAC, UNIX workstation)
Query
Receiver
Images
Image Processing & Visualization
Internet
DICOM Server
Images
Patient Database
PACS
Imaging Device

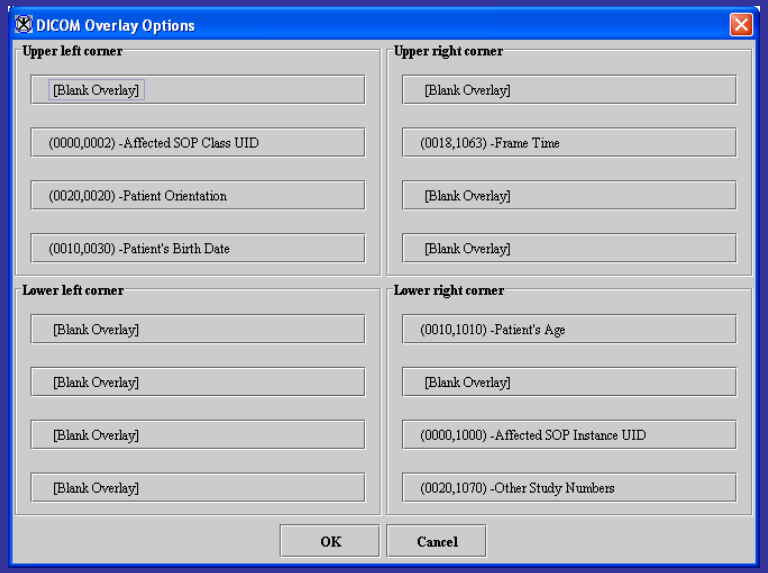


DICOM communication interface

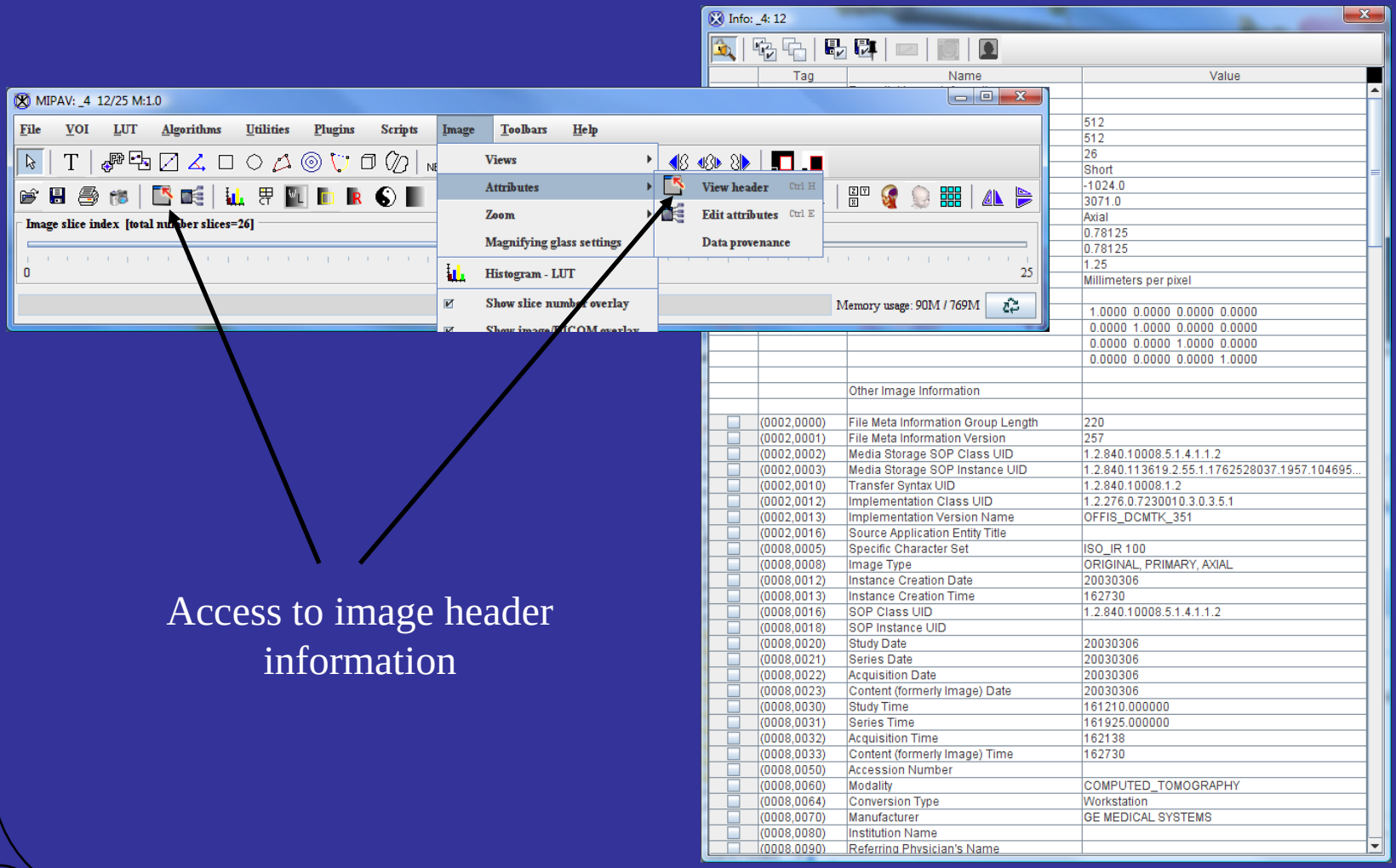
DICOM


MIPAV: _4 12/25 M:1.0
File VOI LUT Algorithms Utilities Plugins Scripts Image Toolbars Help
Views
Attributes
Zoom
Magnifying glass settings
Histogram - LUT
Show slice number overlay
Show image/DICOM overlay
Show overlay grid
Grid options
DICOM overlay options
Image overlay options
Image slice index [total number slices=26]
0
25
X: 213 Y: 463 Intensity: -1002.0 Position: R-L: R: -23.194 A-P: P: 161.719 I-S: I:
Memory usage: 65M / 769M


Pat: 12-34-56-78-90
Stu: 11300
Ser: 3
I 165
A 180
C.C.N.I.H. BETHESDA,MD-A
DOE^JOHN 65 Years Male
-/+ ABDOMEN
POST ABDOMEN
CT
WALTHER,M
R/O VHL
06/16/1998
13:00:11
P 180
(512x512) [-1024.0, 3071.0]
28

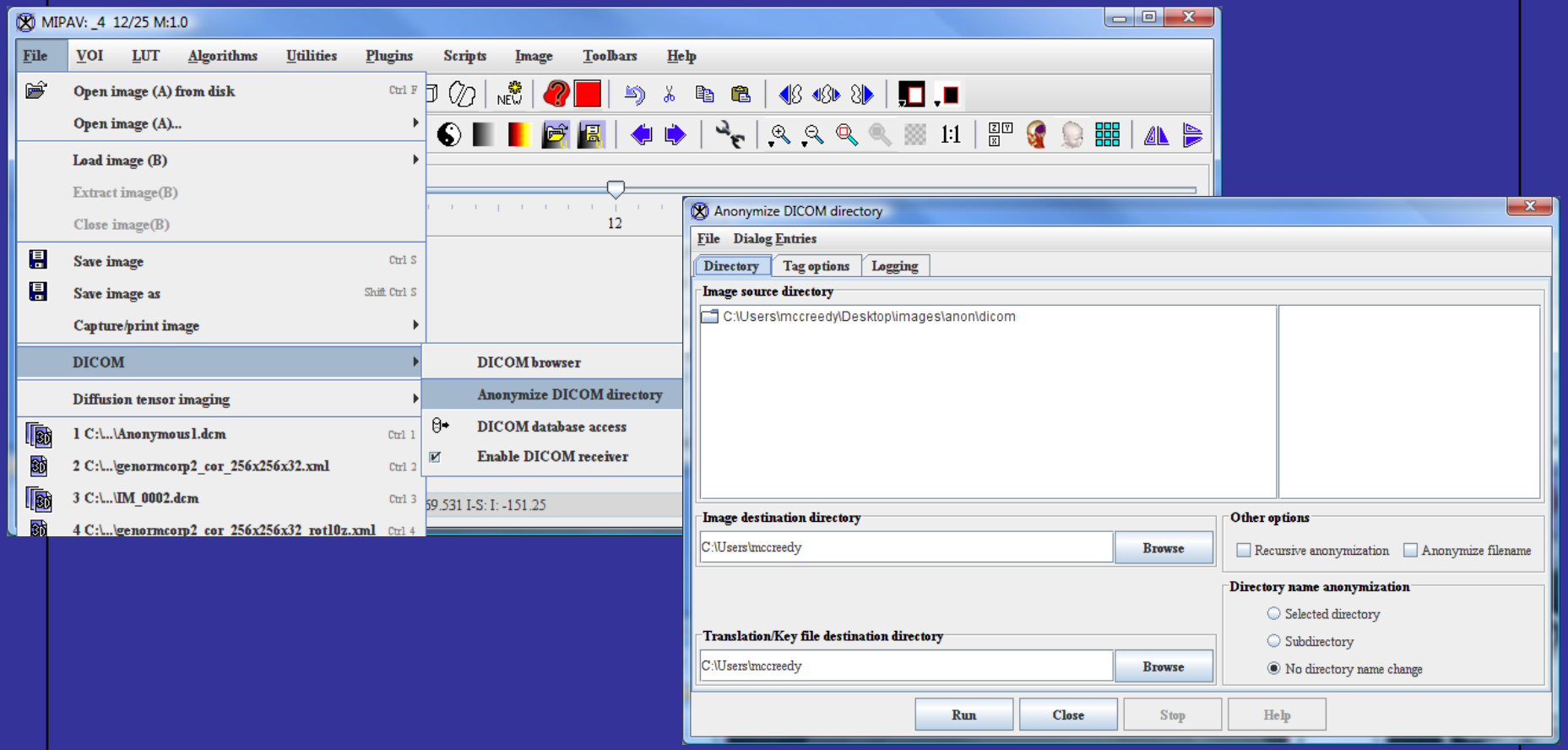

DICOM Overlay Options
Upper left corner
[Blank Overlay]
(0000,0002) -Affected SOP Class UID
(0020,0020) -Patient Orientation
(0010,0030) -Patient's Birth Date
Upper right corner
[Blank Overlay]
(0018,1063) -Frame Time
[Blank Overlay]
[Blank Overlay]
Lower left corner
[Blank Overlay]
[Blank Overlay]
[Blank Overlay]
[Blank Overlay]
Lower right corner
(0010,1010) -Patient's Age
[Blank Overlay]
(0000,1000) -Affected SOP Instance UID
(0020,1070) -Other Study Numbers
OK
Cancel

DICOM

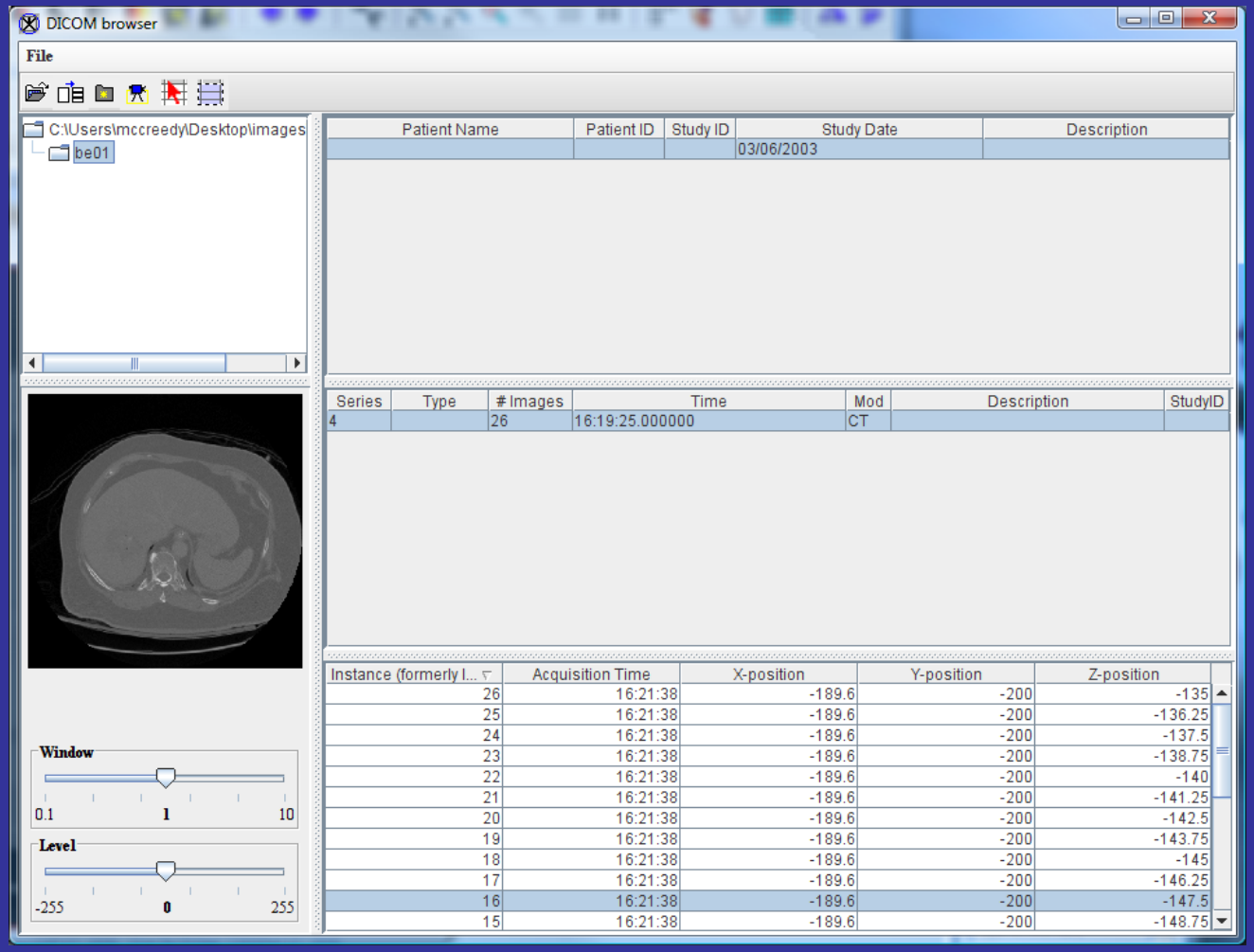


Access to image header information

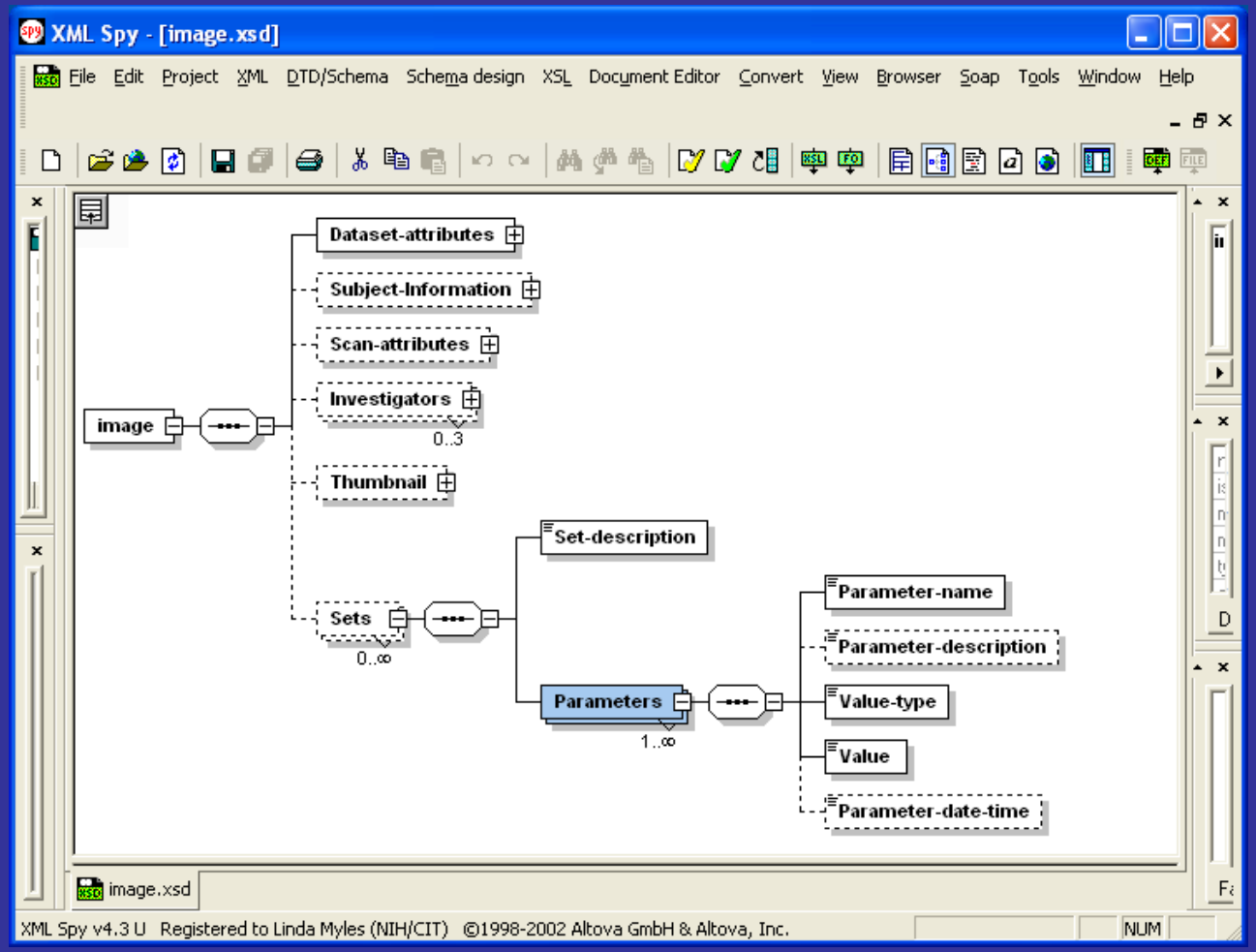
DICOM Anonymization



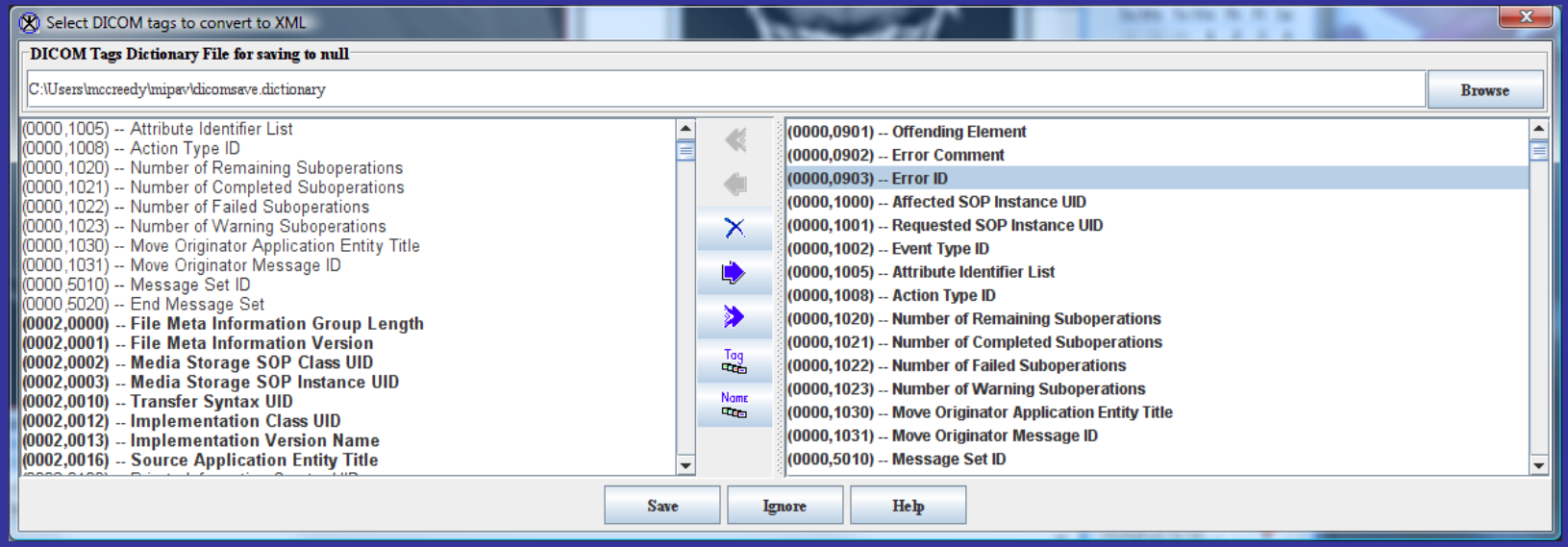
DICOM File Browser

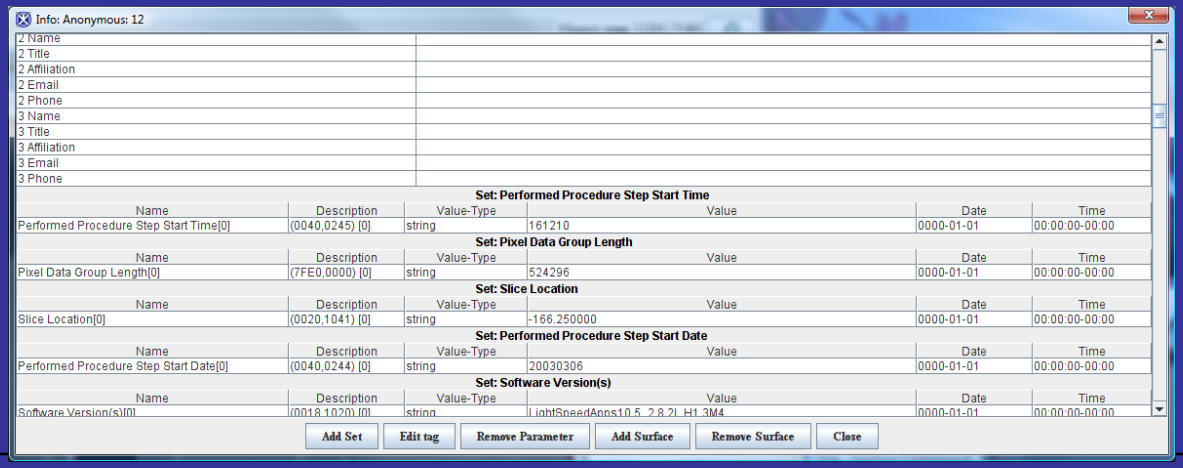


XML Schema File Format



XML Schema File Format





XML Schema File Format

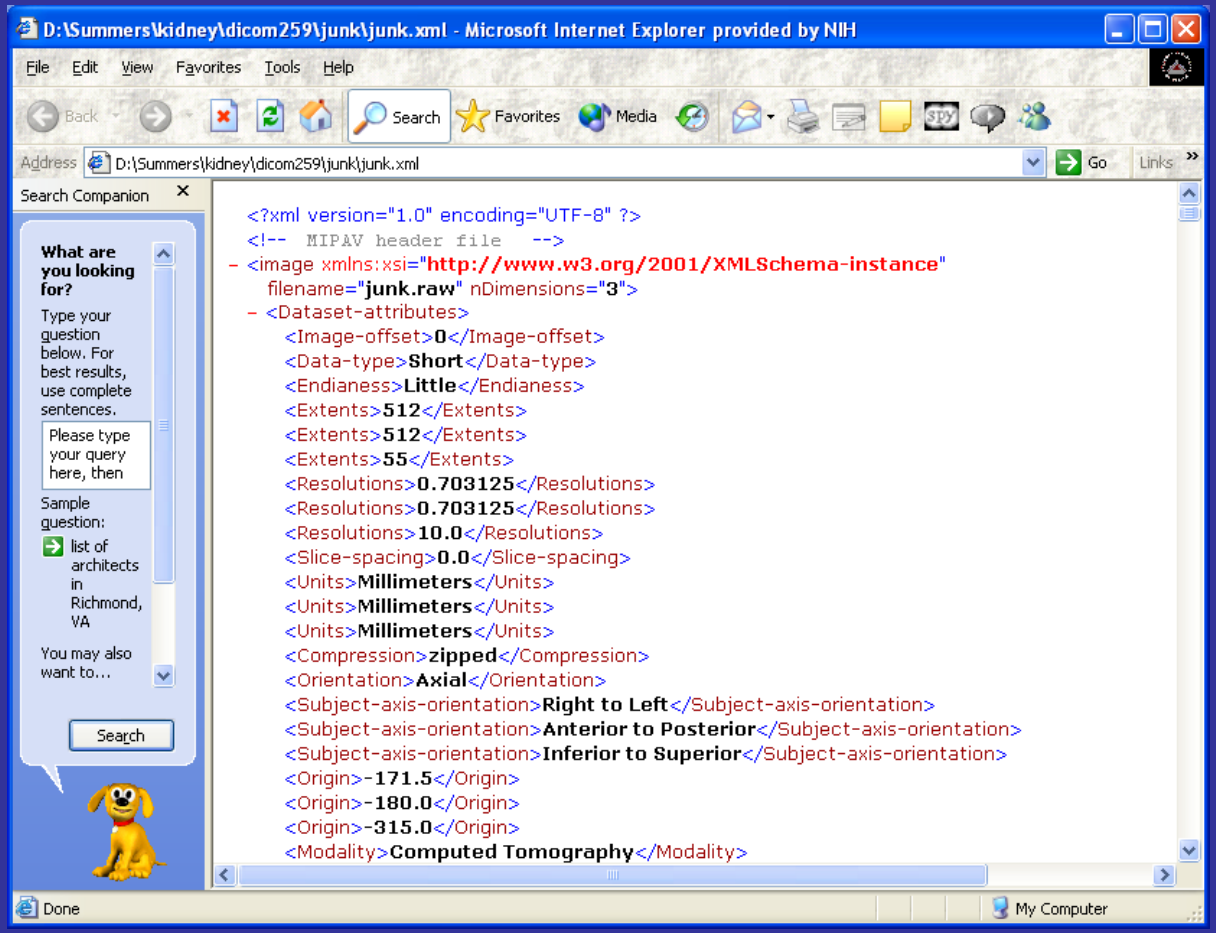
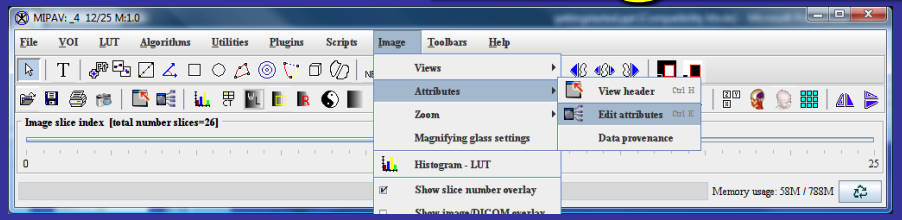
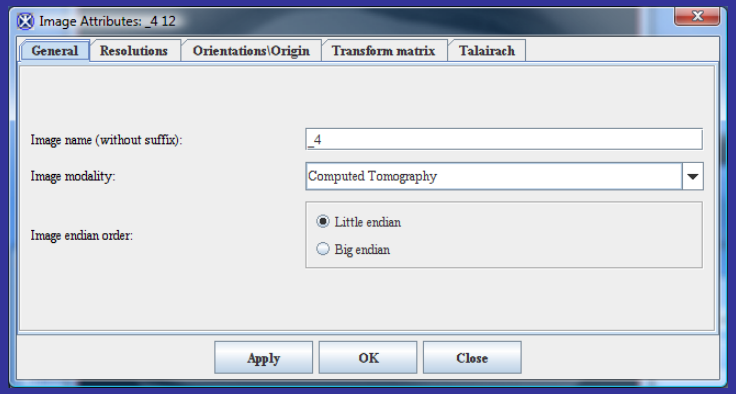
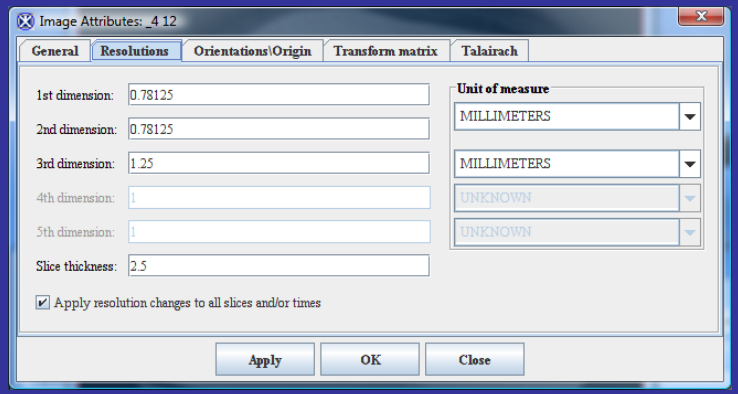
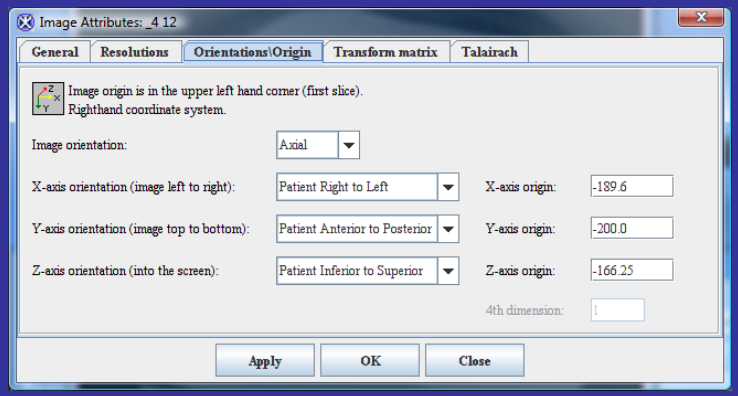


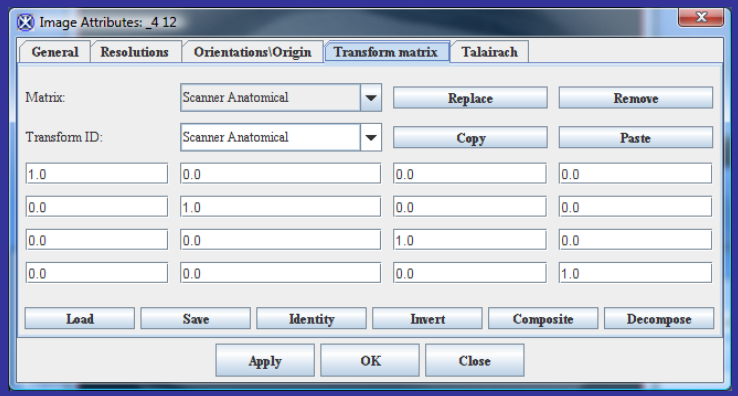
Image Attributes



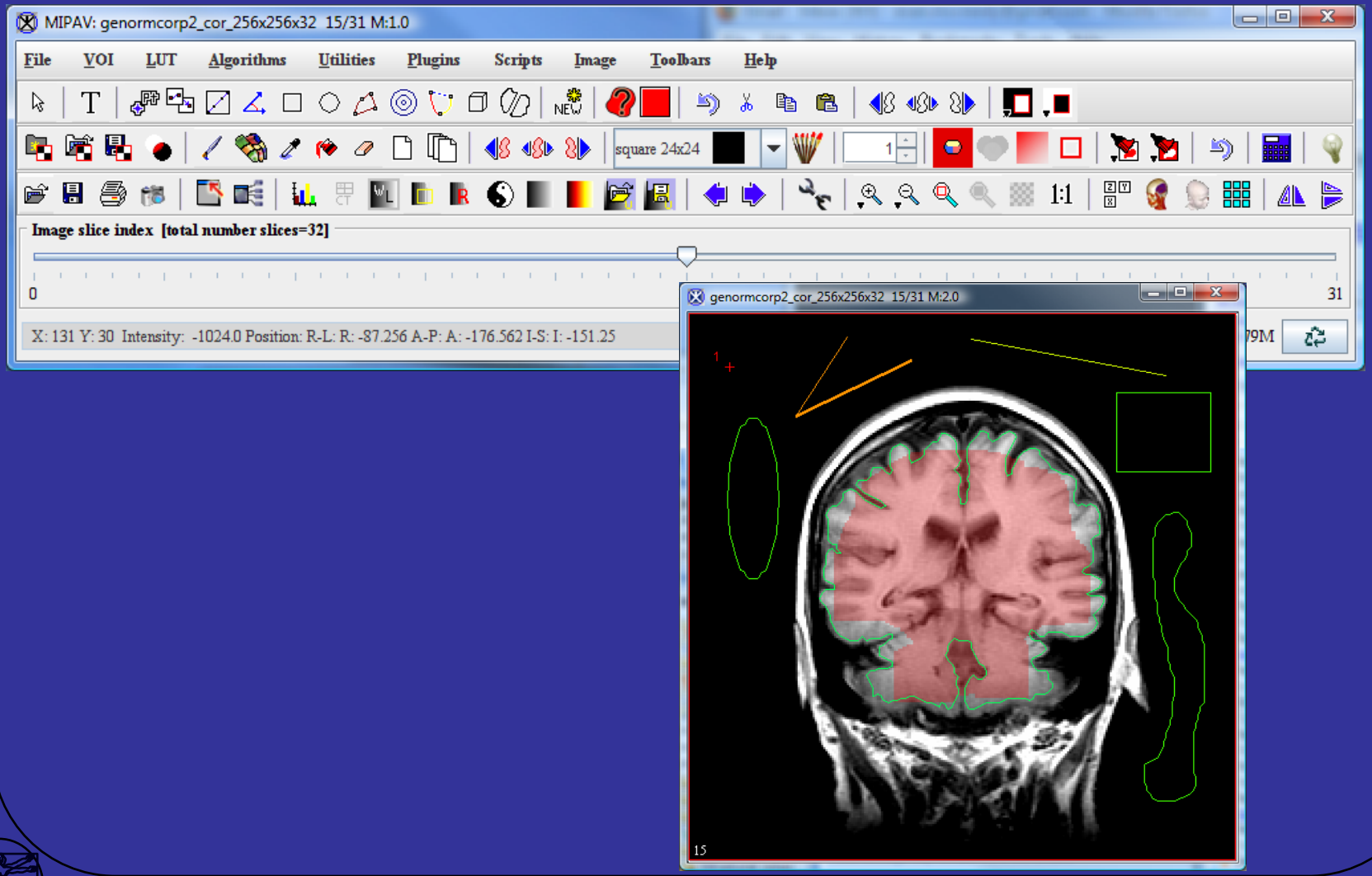




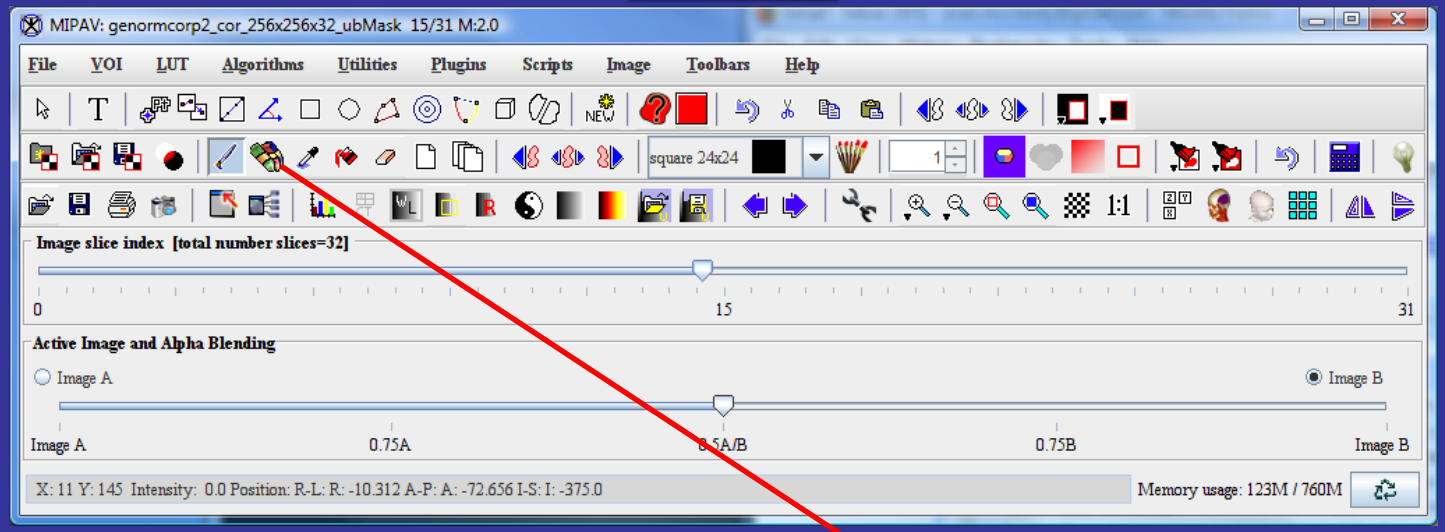


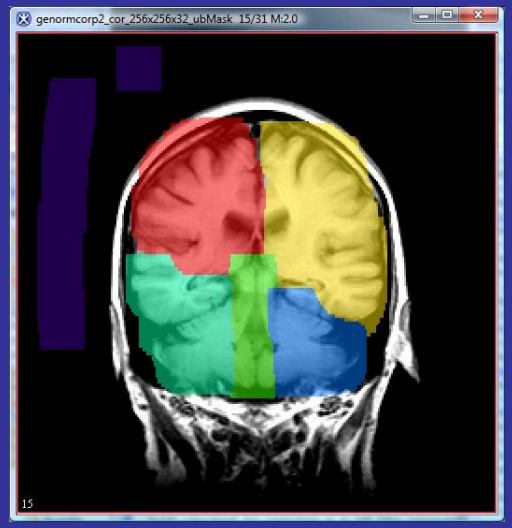


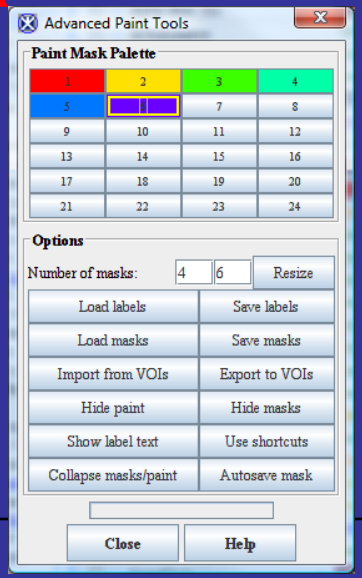
Volume of Interest (VOI)



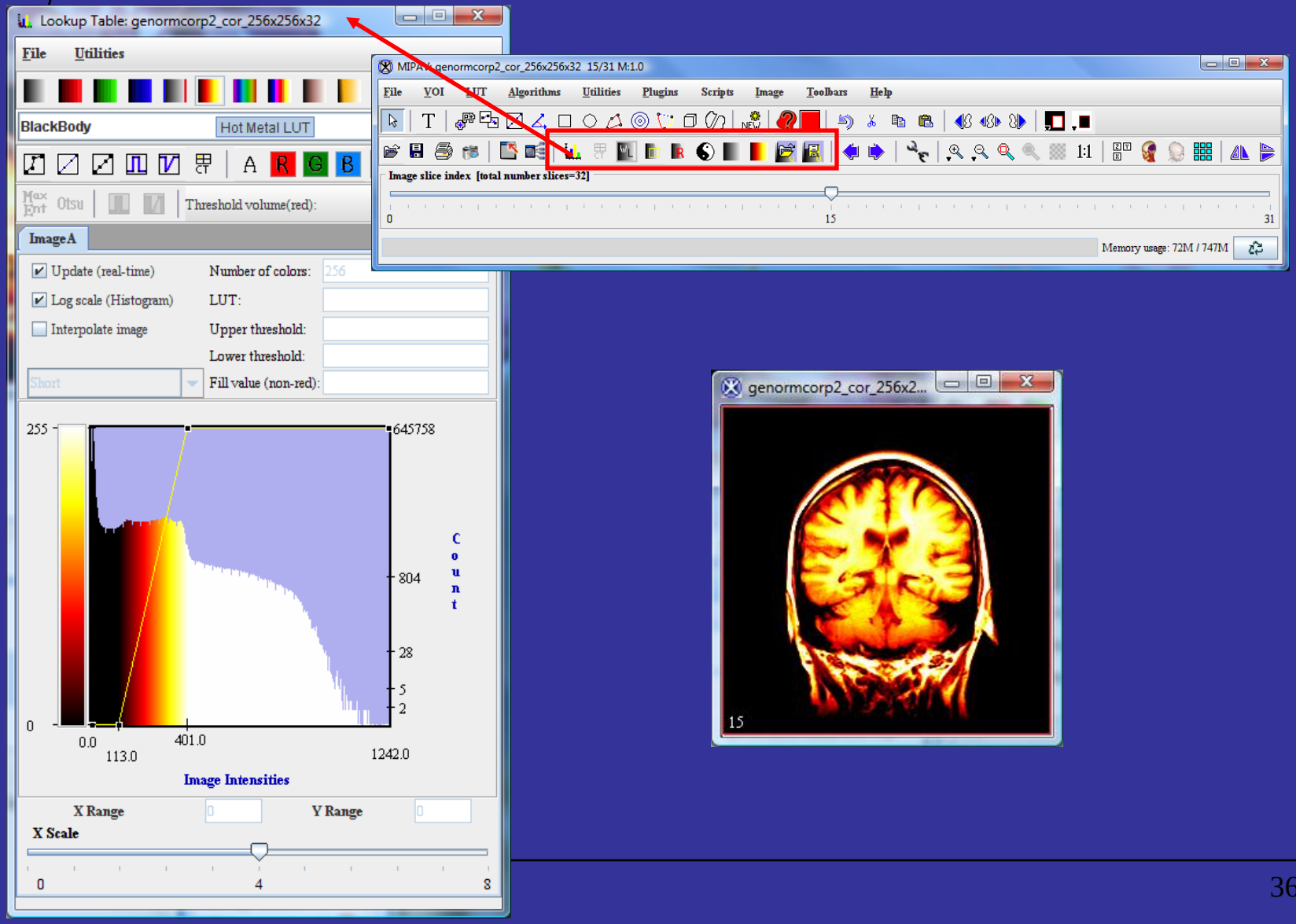
VOI


MIPAV: genormcorp2_cor_256x256x32_ubMask 15/31 M:2.0
File VOI LUT Algorithms Utilities Plugins Scripts Image Toolbars Help
square 24x24
Image slice index [total number slices=32]
0
15
31
Active Image and Alpha Blending
Image A
Image B
Image A
0.75A
0.5A/B
0.75B
Image B
X: 11 Y: 145 Intensity: 0.0 Position: R-L: R: -10.312 A-P: A: -72.656 I-S: I: -375.0
Memory usage: 123M / 760M

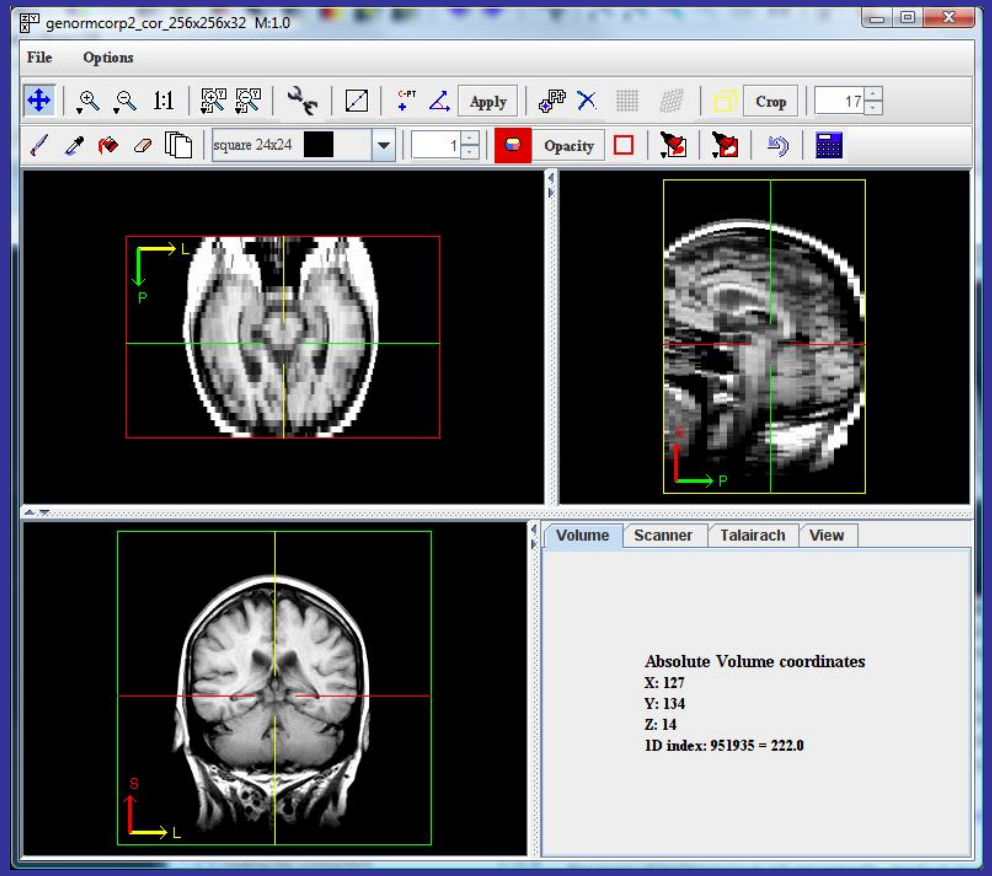

genormcorp2_cor_256x256x32_ubMask 15/31 M:2.0
15


Advanced Paint Tools
Paint Mask Palette
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20
21 22 23 24
Options
Number of masks: 4 6 Resize
Load labels
Save labels
Load masks
Save masks
Import from VOIs
Export to VOIs
Hide paint
Hide masks
Show label text
Use shortcuts
Collapse masks/paint
Autosave mask
Close
Help

Lookup Table (LUT)



Multi-planar and Lightbox



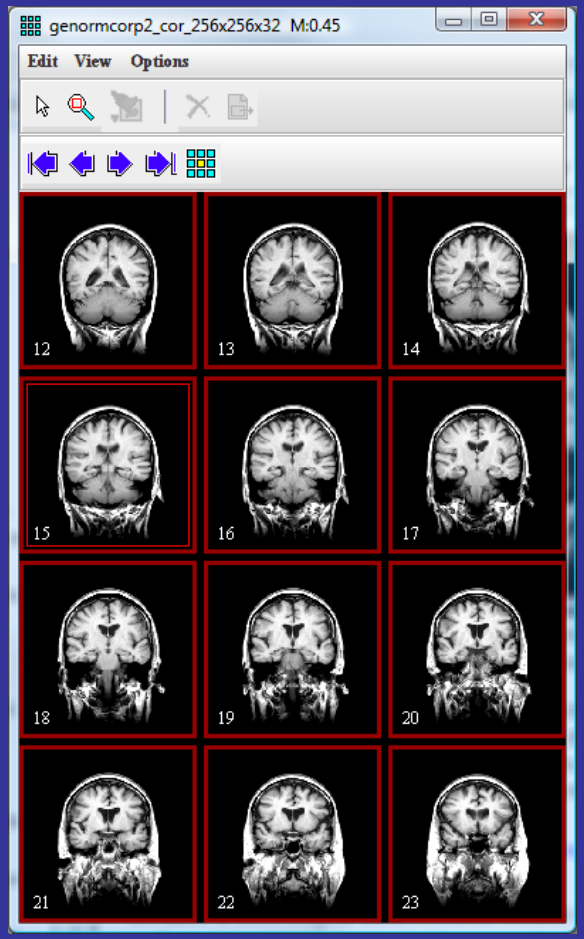
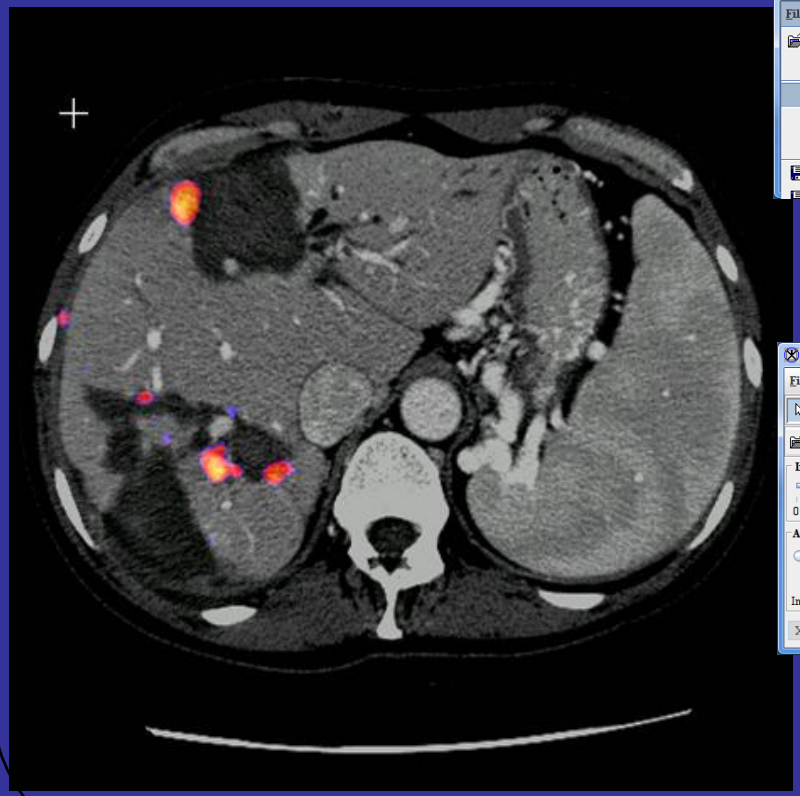
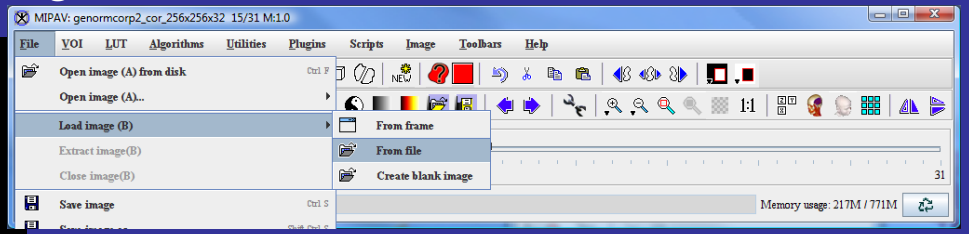
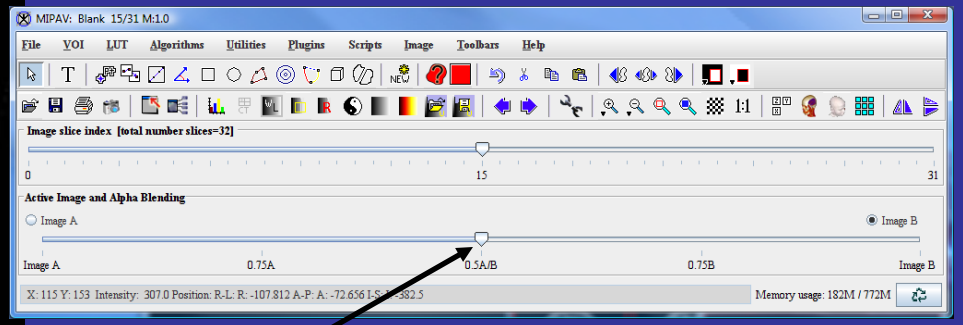


Image Fusion

The loading of two images into the same frame

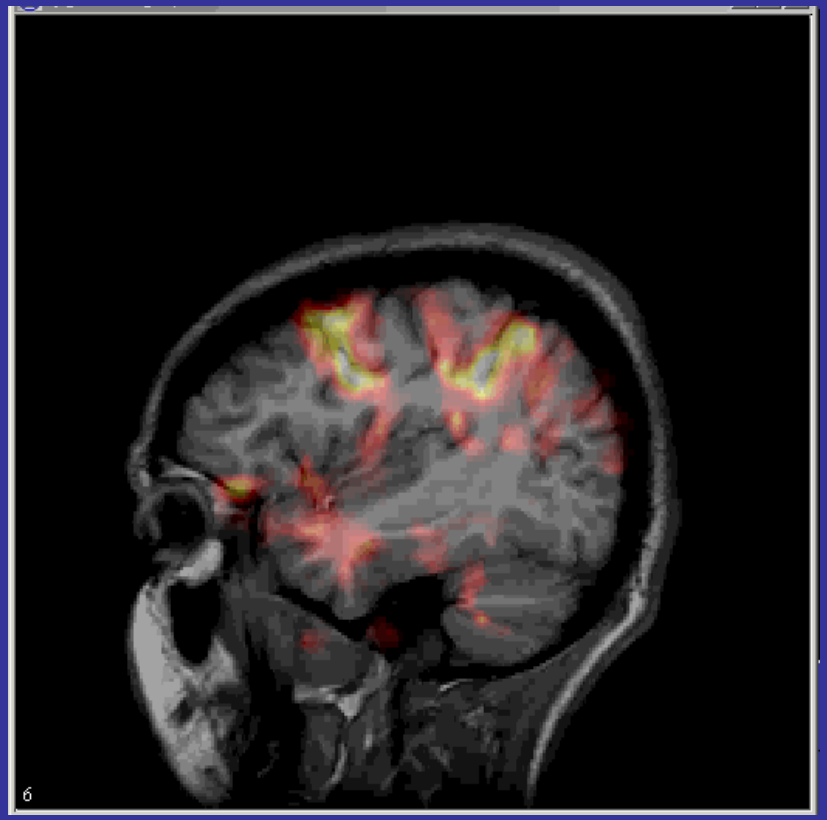




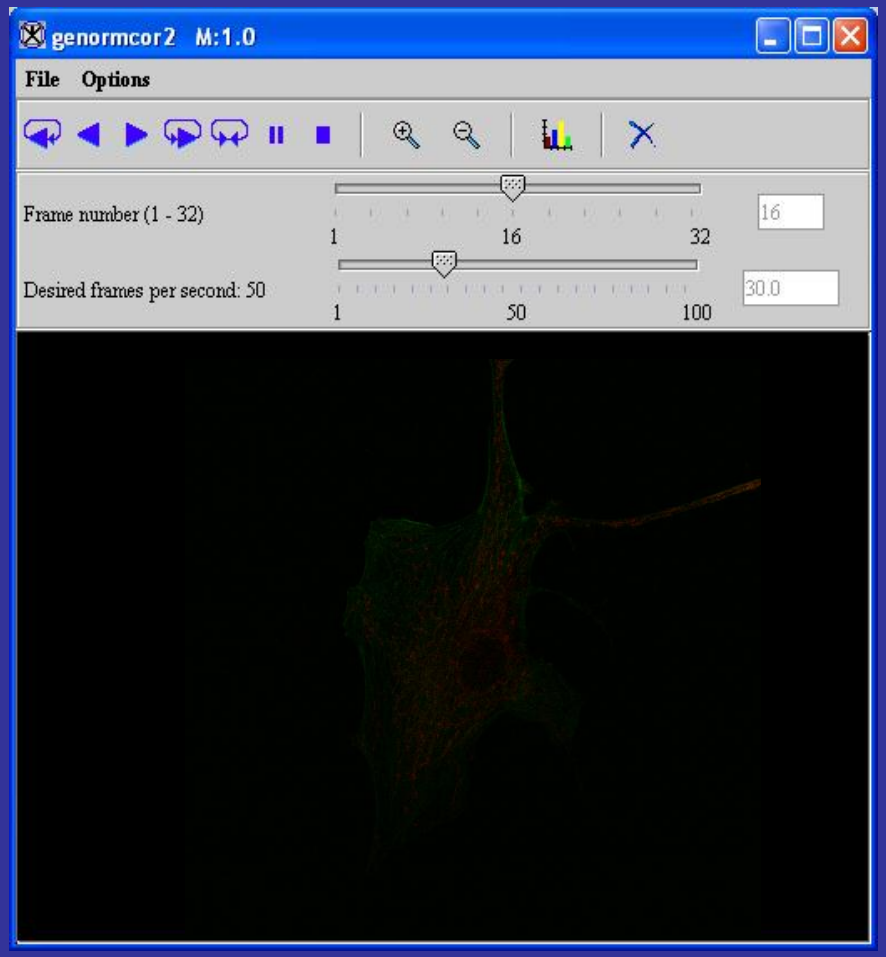


Controls blending between the two images

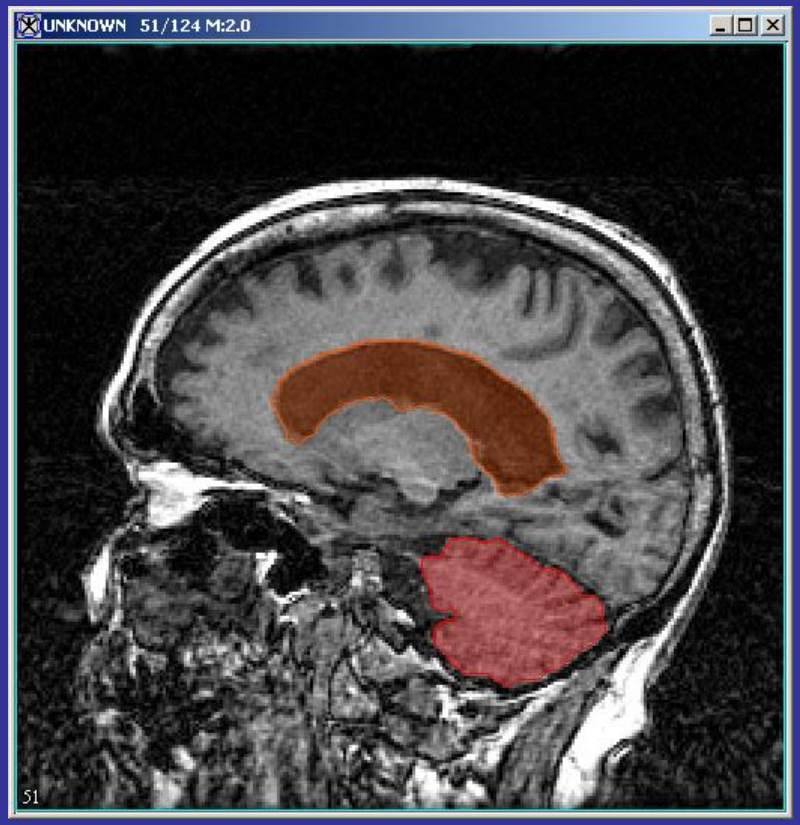
Structural MRI and Functional MRI

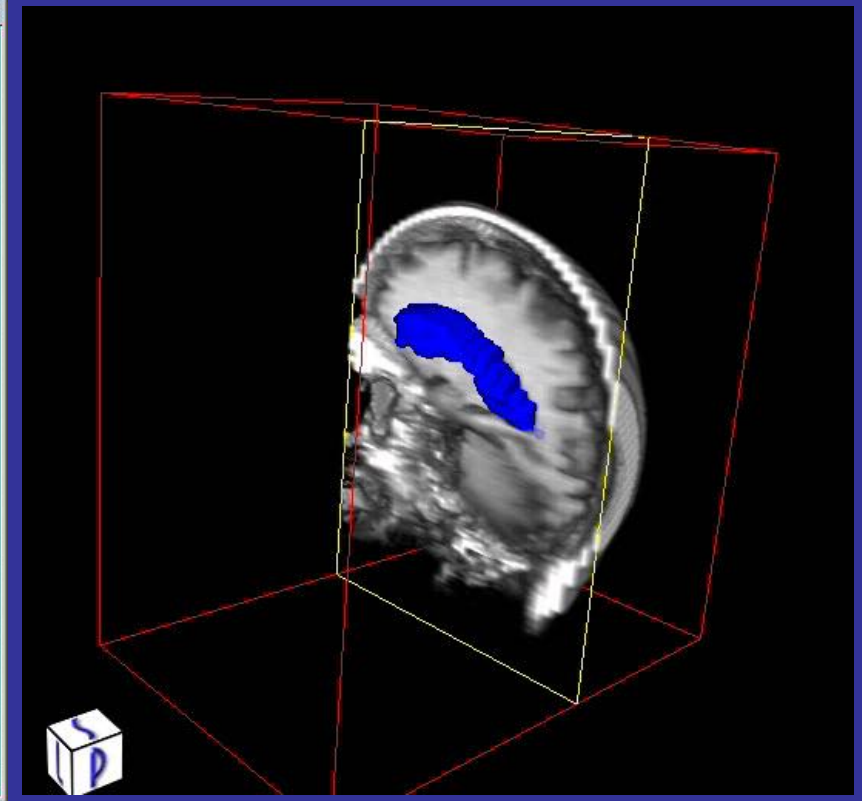


Animation Tool

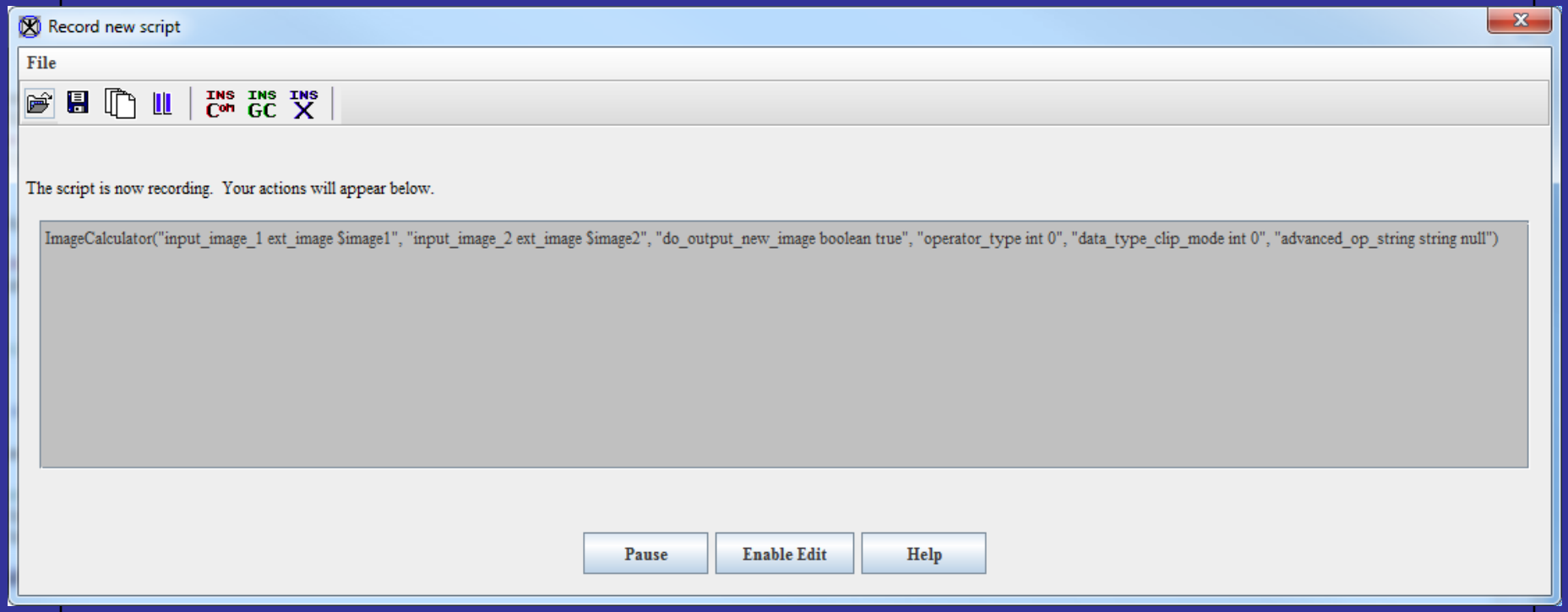


Masks and Surfaces

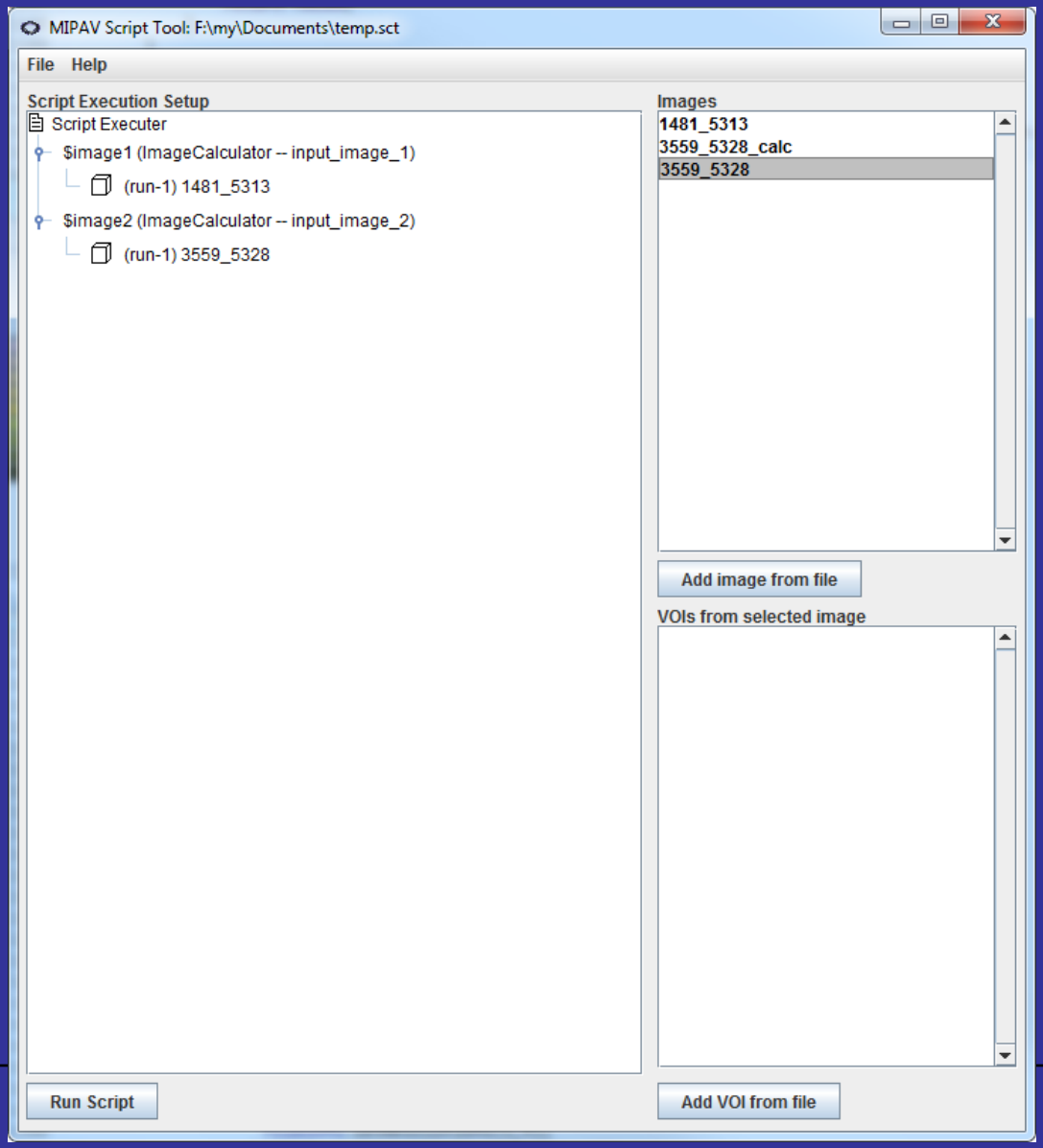




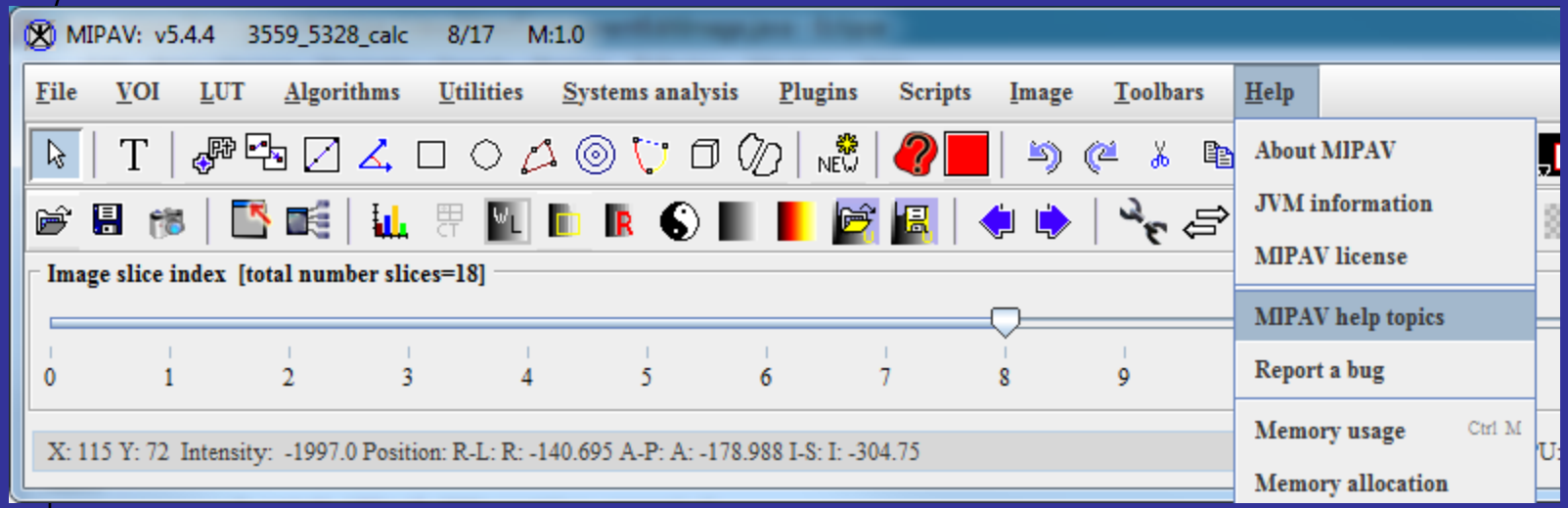
Scripting - Record



Scripting - Run



Help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About MIPAV
JVM information
MIPAV license
MIPAV help topics
Report a bug
Memory usage Ctrl M
Memory allocation
Image slice index [total number slices=18]
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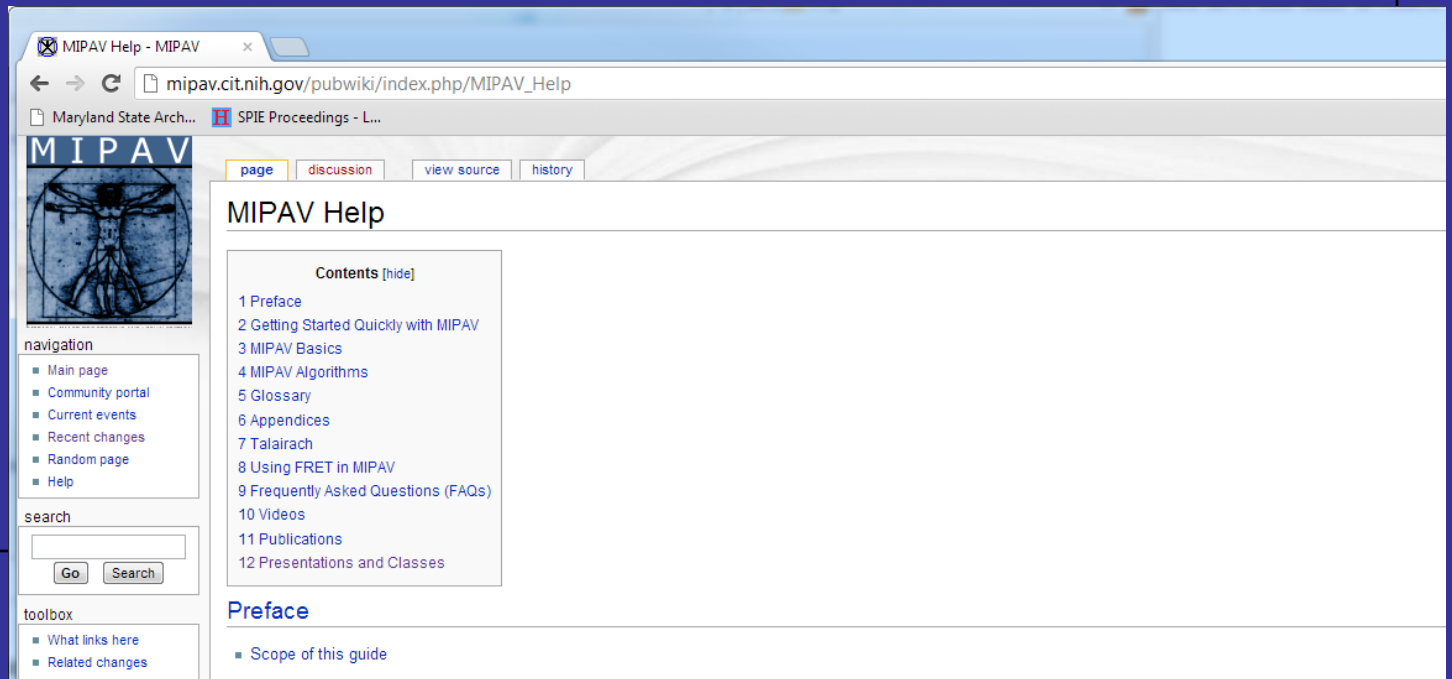
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mipav.cit.nih.gov/pubwiki/index.php/MIPAV_Help
Maryland State Arch...
SPIE Proceedings - L...
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Bug Report

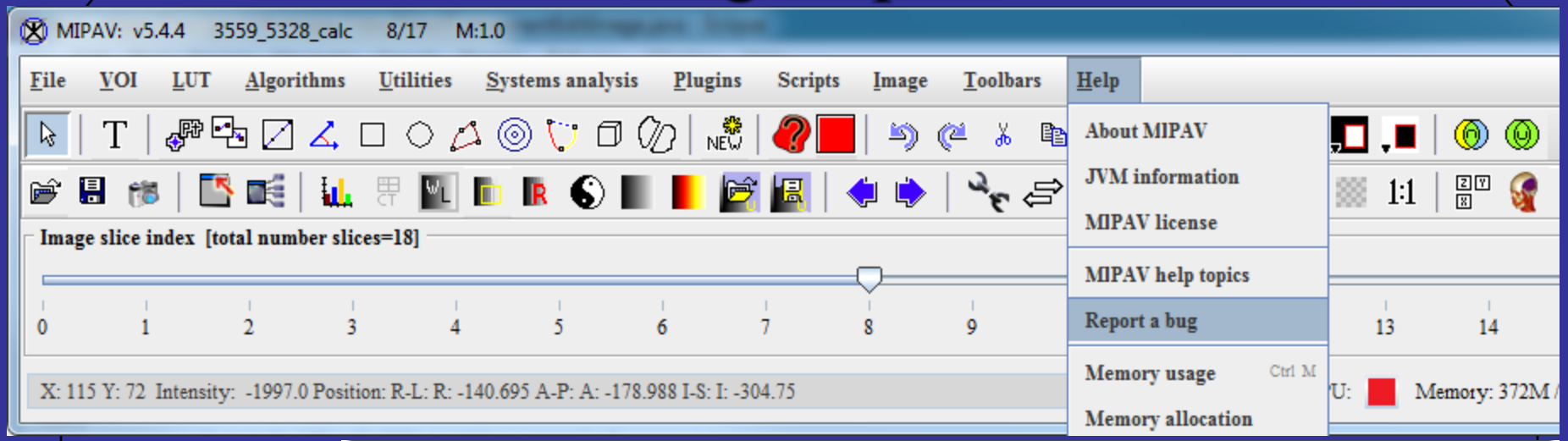
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Image slice index [total number slices=18]
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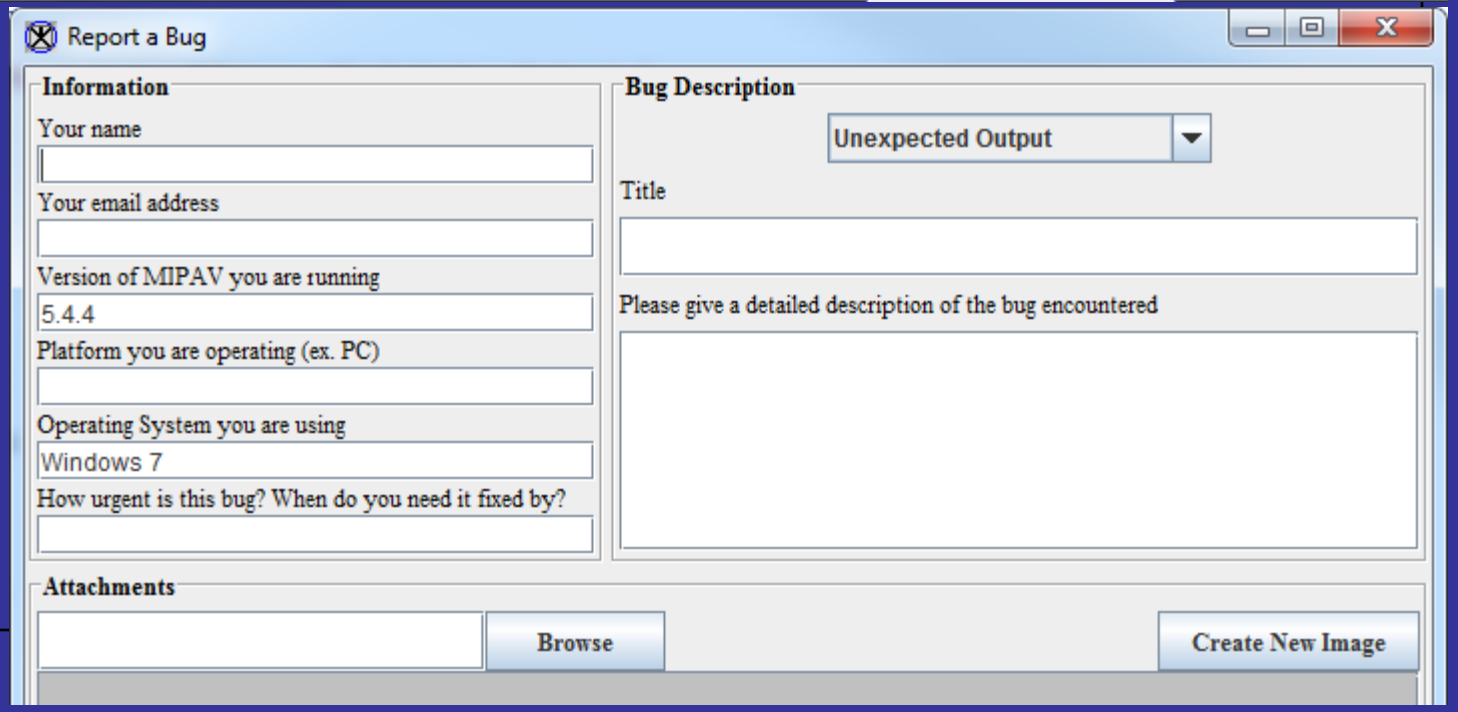
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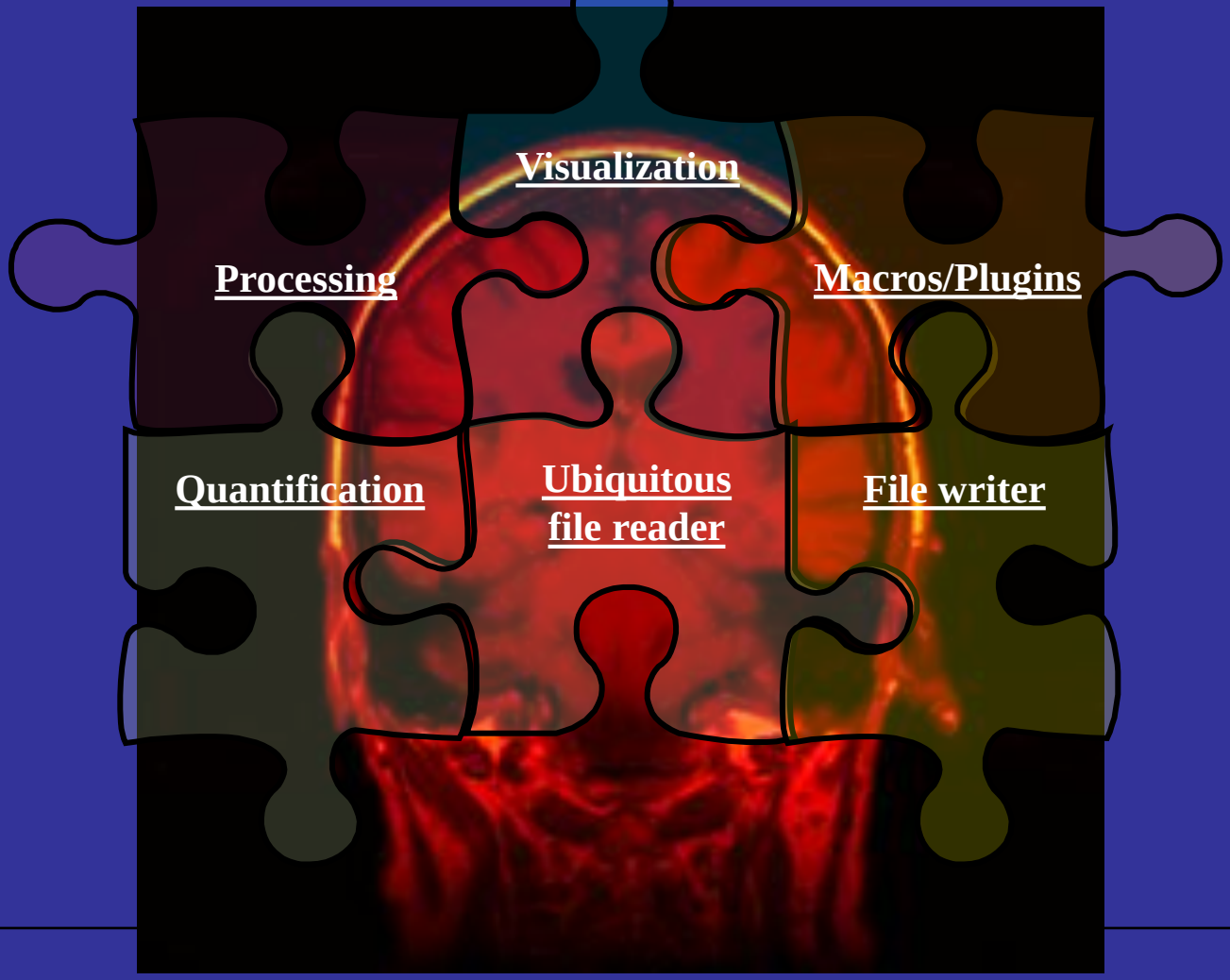
Information
Your name
Your email address
Version of MIPAV you are running
5.4.4
Platform you are operating (ex. PC)
Operating System you are using
Windows 7
How urgent is this bug? When do you need it fixed by?
Bug Description
Unexpected Output
Title
Please give a detailed description of the bug encountered
Attachments
Browse
Create New Image

MIPAV


Visualization
Processing
Macros/Plugins
Quantification
Ubiquitous file reader
File writer

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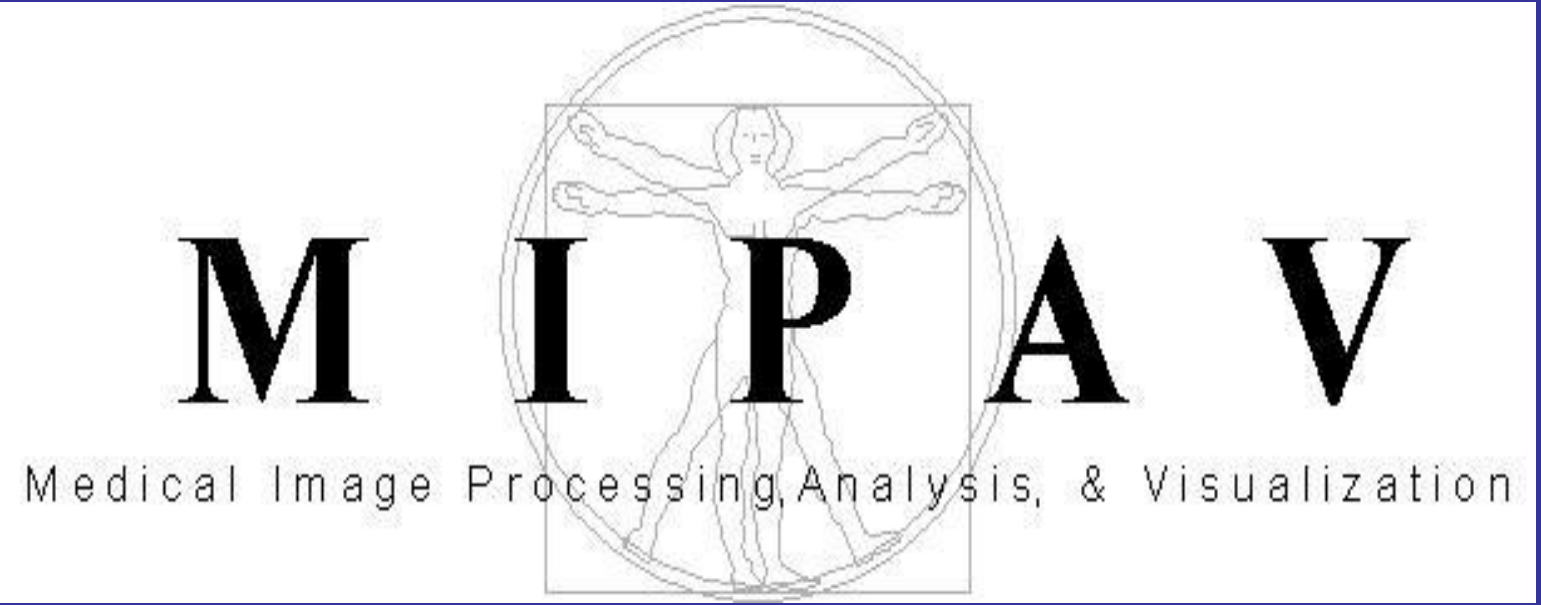

SenseneyJ@mail.nih.gov