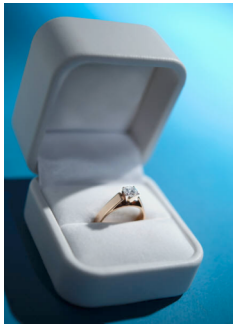
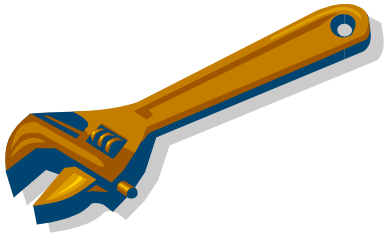


AFNI Jewel Box
AKA Tool Box, Treasure Chest or Miscellaneous Tools



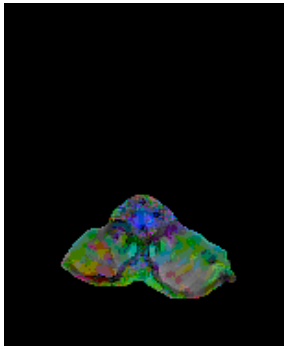
- There are more than 300 AFNI programs, plugins, and scripts
- Most come with help output or menus that provide a reminder about their usage; for most programs, the output of **`-help`** is the most up-to-date documentation. Some actually have more extensive documentation including white papers, publications and presentations available through website.

Dataset Creation and Conversion

- o Discussed in other lectures
- ➢ Discussed here

o **to3d**	Read image files, write AFNI format datasets
o **3dcopy**	Convert standard file format to AFNI or copy
3dAFNItoRaw	Convert AFNI dataset to binary n-tuples from n sub-bricks
3dAFNItoNIFTI	Convert AFNI dataset to NIFTI standard
3dANALYZEtoAFNI	Convert ANALYZE format dataset to AFNI format
3dMINCtoAFNI	Convert MINC format dataset to AFNI format
3dBRAIN_VOYAGERtoAFNI	Convert Brain Voyager vmr format dataset to AFNI format
3dCRUISEtoAFNI	Convert JHU Cruise format dataset to AFNI format
➢ **3dThreetoRGB**	Convert 3 scalar datasets to 1 RGB AFNI format dataset

```
3dcalc -prefix DTIevec -a 'DTI+orig.[9..11]' -c 'DTI00+orig.[18]‘ \
     -expr 'c*STEP(c-  0.25)*255*ABS(a)'
3dThreetoRGB -prefix DTIRGB -anat 'DTIevec+orig.[0]‘ \
     'DTIevec+orig.[1]' 'DTIevec+orig.[2]'
```



➢ **from3d** Write dataset slices into separate 2D slice image files

```
from3d -prefix xxx -raw -input anat+orig
```

For a single brick dataset with 256x256x41 slices outputs 41 256x256 image files that are each 131,072 bytes in length with the names xxx.001 through xxx.041

- Auxiliary Programs for Dataset Creation from Images

Ifile	Read GE realtime EPI files and runs to3d
Imon	Read GE realtime EPI files as they are created
Dimon	Read DICOM files as they are created, organize DICOM files, send to AFNI GUI in realtime.

Dimon -infile_prefix run1/image -dicom_org –GERT_reco -quit

rtfeedme	Send AFNI datasets to AFNI realtime plugin (afni –rt) and send DRIVE_AFNI commands
plugin: RT Options	Control options for AFNI-side realtime image input
abut	Create zero-filled slices to put into dataset gaps

Calculators

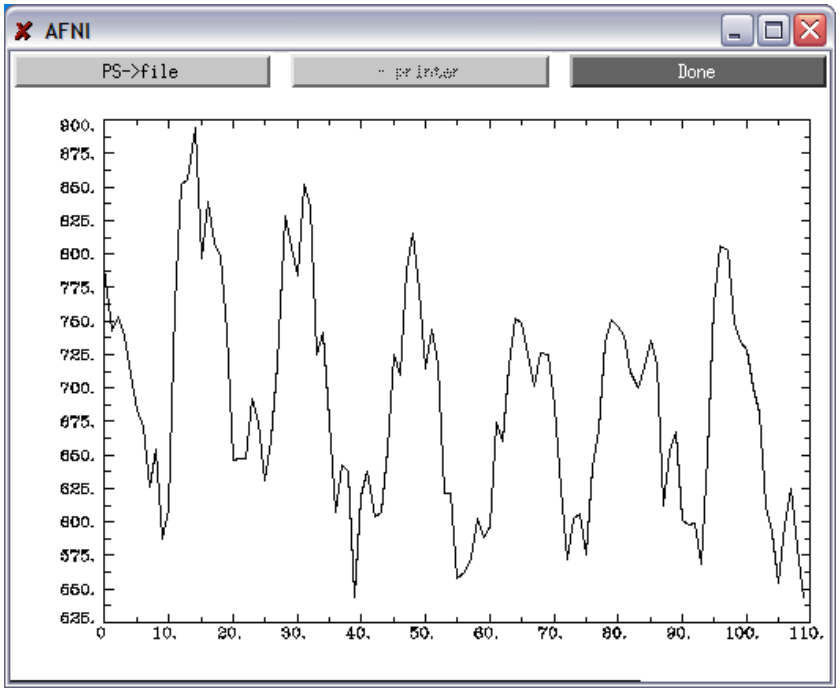
- **ccalc** Command line calculator

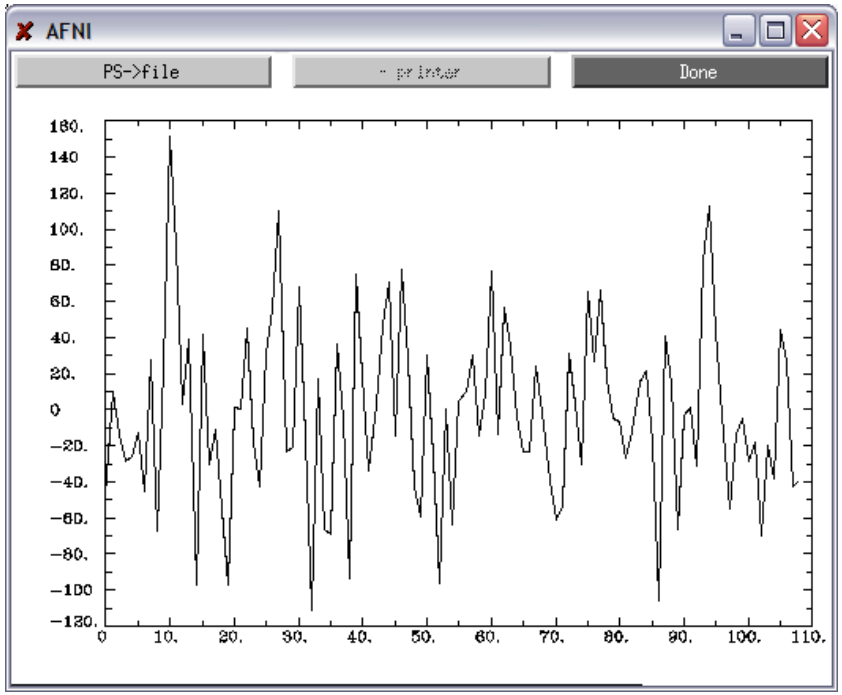
```
ccalc '3 * 4'
12.000000

ccalc -form '********\n%6.4f%%\n********' -eval '100*328/457'
********
0.7177%
********
```

- **1deval** 1D calculator (like 3dcalc for 1D files)

  Example: Calculate simple first derivative numerically for a column of numbers

```
1deval -a data.1D'[1]{0..98}' -b data.1D'[1]{1..99}' -expr '(b-a)/2'
```





- **3dcalc** Voxel-by-voxel general purpose calculator for 3D datasets

Useful for combining ROI masks in various ways

Useful for forming ‘conjunction tests’, and many other voxel-wise operations

```
3dcalc -prefix mask_17.2 -a stats+orig'[2]' -expr 'ispositive(a-17.2)'
3dcalc -prefix stat_mask -a stats+orig'[2]' -b mask+orig -expr
'a*ispositive(b)'
```

Example: convert dataset from short (16-bit signed integer) to floating point

```
3dcalc -prefix floatdata -a shortdata+orig  -datum float -expr 'a'
```

Example: calculate ROI statistics only on a specific slice (slice 17)

```
3dROIstats -mask '3dcalc(-a func_slim+orig[0] -expr equals(k,17))'
func_slim+orig
```

1dmatcalc Matrix calculator using 1D files

Useful for operations on vectors or matrices. Uses reverse polish notation stack oriented interface. Operations include matrix multiplication, addition, subtraction, pseudo-inverse, transpose, read and write.

```
1dmatcalc "&read(V.1D) &read(U.1D) &transp * &write(VUT.1D)"
1dmatcalc '&read(3cols.1D) 2 * &write(-)'
```

3dmatcalc "Applies" matrix to datasets

Multiplies matrix (m x n) by a vector of n voxels through time of 3D+time dataset creating a new dataset m sub-bricks long

3dcalc (continued)

Example: make right and left hemisphere masks from with aligned volumes

```
3dautomask -prefix M epi+orig
3dcalc -a M+orig -dicom -expr 'ispositive(x-3.5)' -prefix Mright
3dcalc -a M+orig -dicom -expr 'isnegative(x-3.5)' -prefix Mleft
```

Example: temporal median smoothing

```
3dcalc  -a fred+orig -b 'a[0,0,0,1]' -c 'a[0,0,0,-1]' -expr 'median(a,b,c)'
```

Example: create dataset following a 2D cosine periodic function centered around the center of each slice

```
3dcalc -prefix cos0.4 -a 256blank+orig. -expr 'cos(PI * 0.4 * sqrt( (x * x)+ (y * y)) )'
```

Simple statistics on datasets

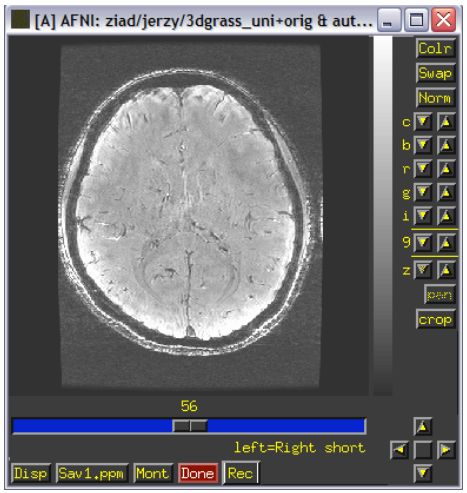
- **3dTstat** Various statistics of multi-brick datasets, voxel-by-voxel, across sub-bricks
- **3dMean** Average datasets together, voxel-by-voxel, across datasets
- **3dLocalstat** Find simple statistical values for "neighborhoods" around each voxel

```
3dLocalstat -nbhd 'rect(0,0,1)' -stat min -prefix 3dgrass_minip
  3dgrass_uni+orig
```

- **3dBrickStat** Return simple statistical values of voxel values (max, min, count) over a whole dataset (results only, useful for scripting)

```
3dBrickStat -slow -min -max "DT+orig[18]"
3dcalc -prefix RGB3EVA255scaled -a 'DT+orig.[9..11]' -c 'DT+orig.[18]' -
  expr 'c*255*ABS(a)/'`3dMax "DT+orig.[18]"`
```

3dExtrema, 3dMaxima, Maxima plug-in Find coordinates of all local maxima (or minima) across sub-bricks and return list or mask dataset for those voxels



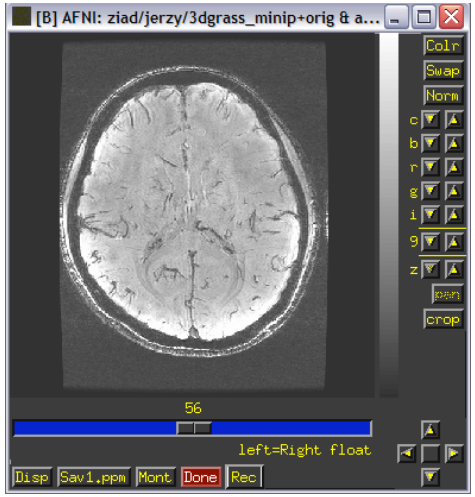


Image Filters

- Smoothing and filtering datasets
  - **3dmerge** Various spatial filters, thresholds, clustering and averaging

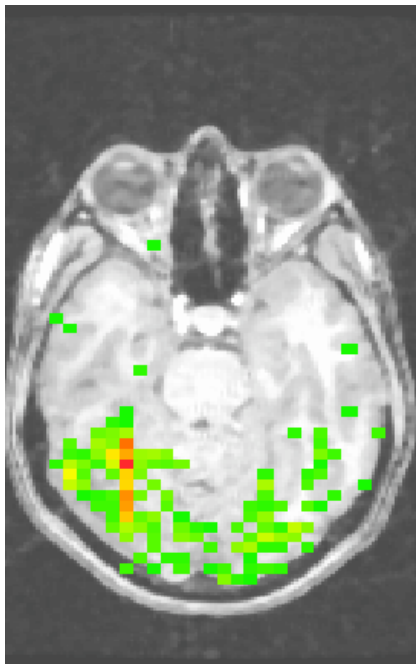
```
3dmerge -1filter_aver 8 -prefix funcFaver8 funcslim+orig
```

  3danisosmooth Anisotropical smoothing (preserves edges)

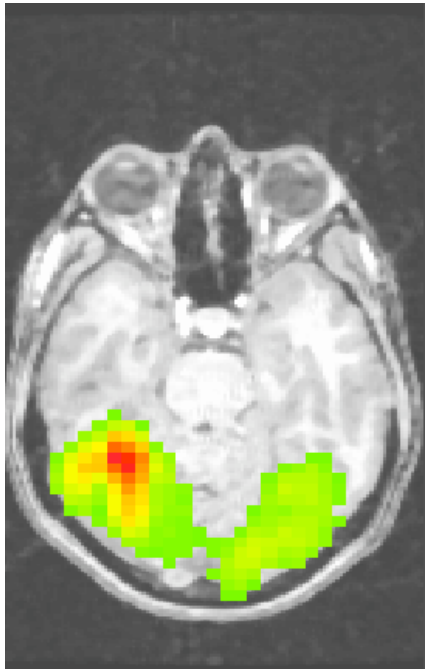
```
3danisosmooth -iters 4 -matchorig -3D -prefix anat_as -viewer
anat+orig
```

  3dWinsor Nonlinear order statistics filter for spatial smoothing

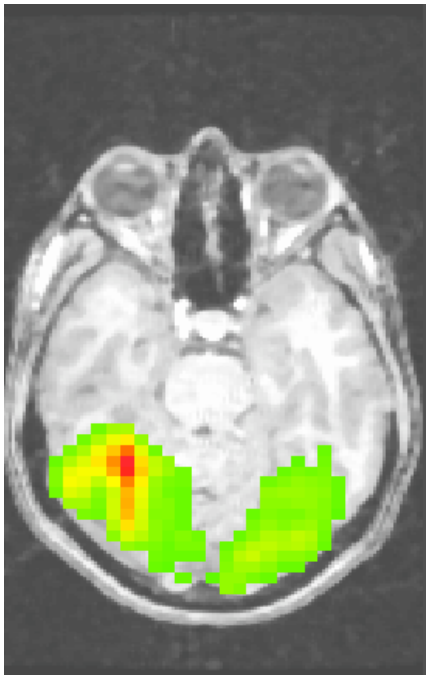
  3dUniformize Correct for image intensity non-uniformity in anatomical datasets



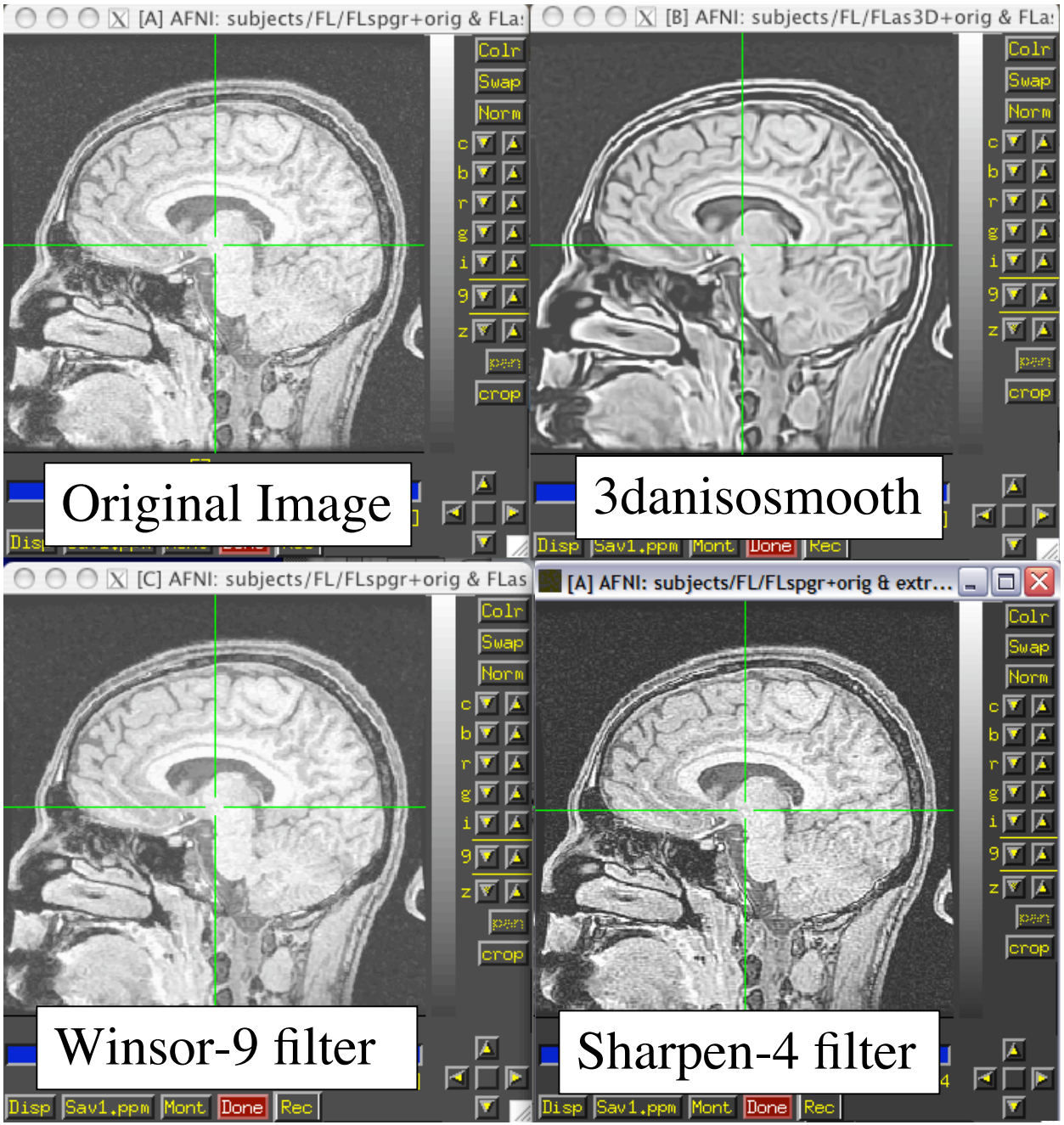
Original



3dmerge -1filter_aver 8



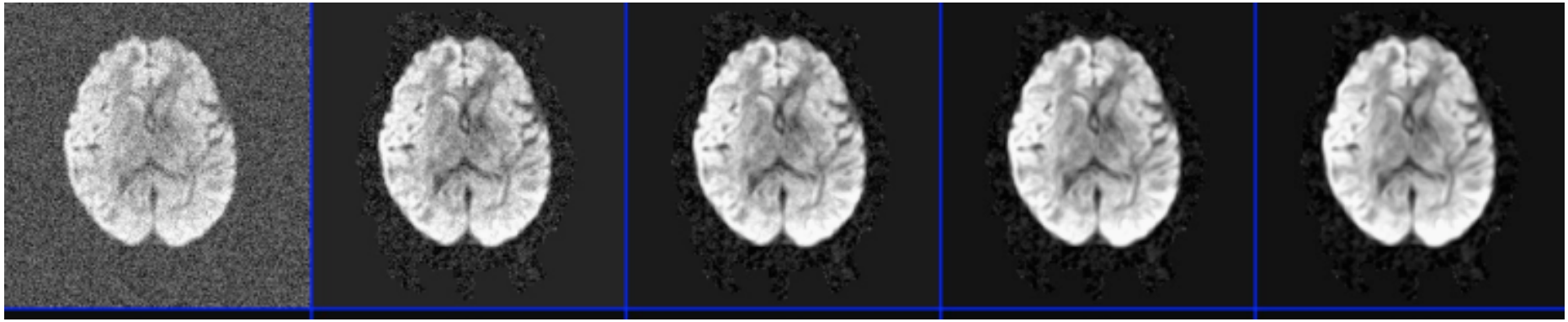
3dmerge -1blur_fwhm 8

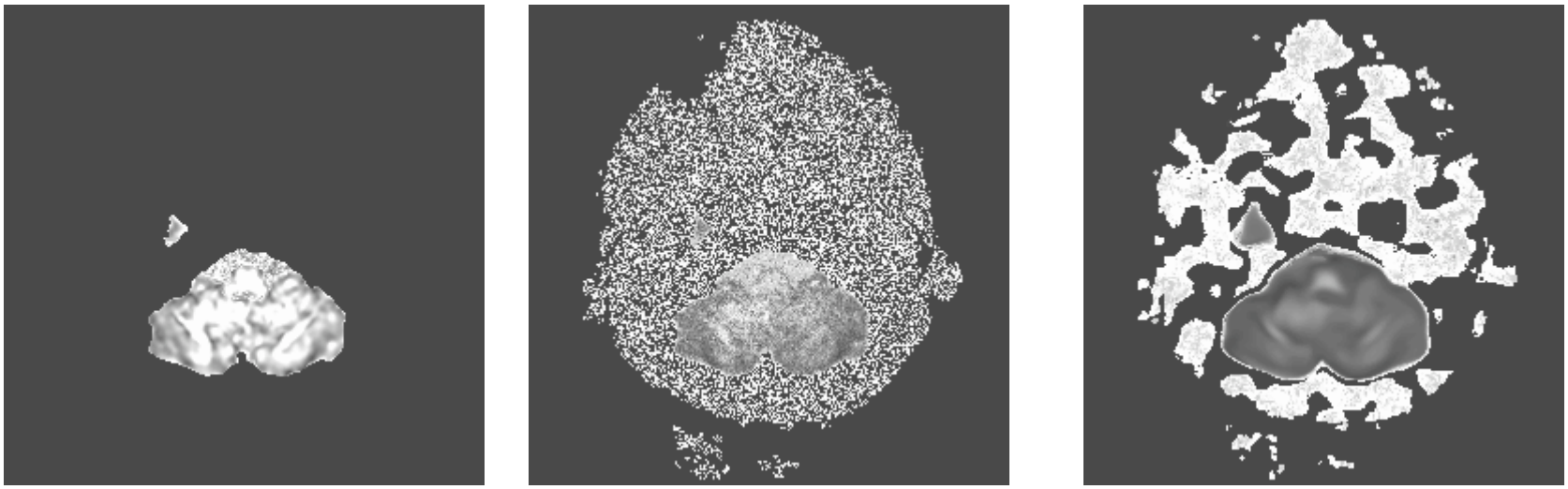


Spatial sharpening filter options

Display options

3danisosmooth - DWI/DT data

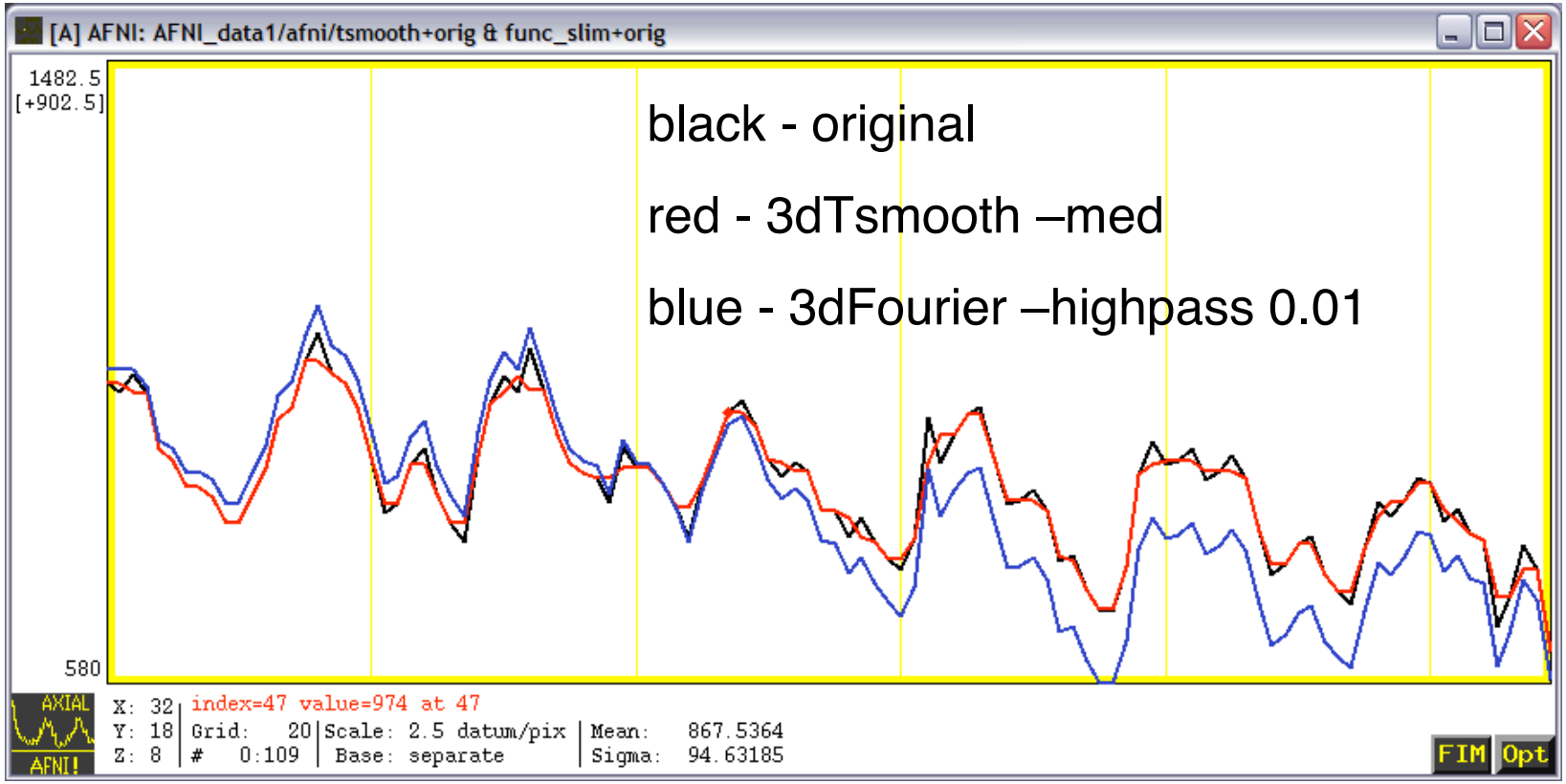




Fractional Anisotropy (FA) maps (original, with added noise from DWI data, 3danisosmooth)

3D+time Pre-Processing Programs

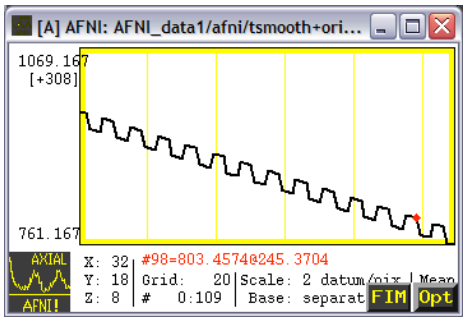
- **3dTshift** Shift slices to a common time origin (temporal interpolation)
- **3dDespike** Remove spikes from voxel time series
- **3dDetrend** Remove trends from voxel time series
- **3dFourier** FFT-based lowpass and highpass filtering
- **3dTsmooth** Smooth time series in the time domain



3D+time Analysis Programs

Regression of individual datasets

- **3dDeconvolve** Multiple linear regression and deconvolution
  Supercedes 3dfim, 3dfim+
  plugin: Deconvolution Interactive deconvolution
- **3dNLfim** Nonlinear regression
  plugins: Nlfit & Nlerr
  square wave fit



3dTcorrelate Correlate two input datasets, voxel-by-voxel

3dAutoTcorrelate Correlate each voxel with every other voxel

3dpc Principal component analysis

3ddelay estimate delay response between a time series and a reference time series

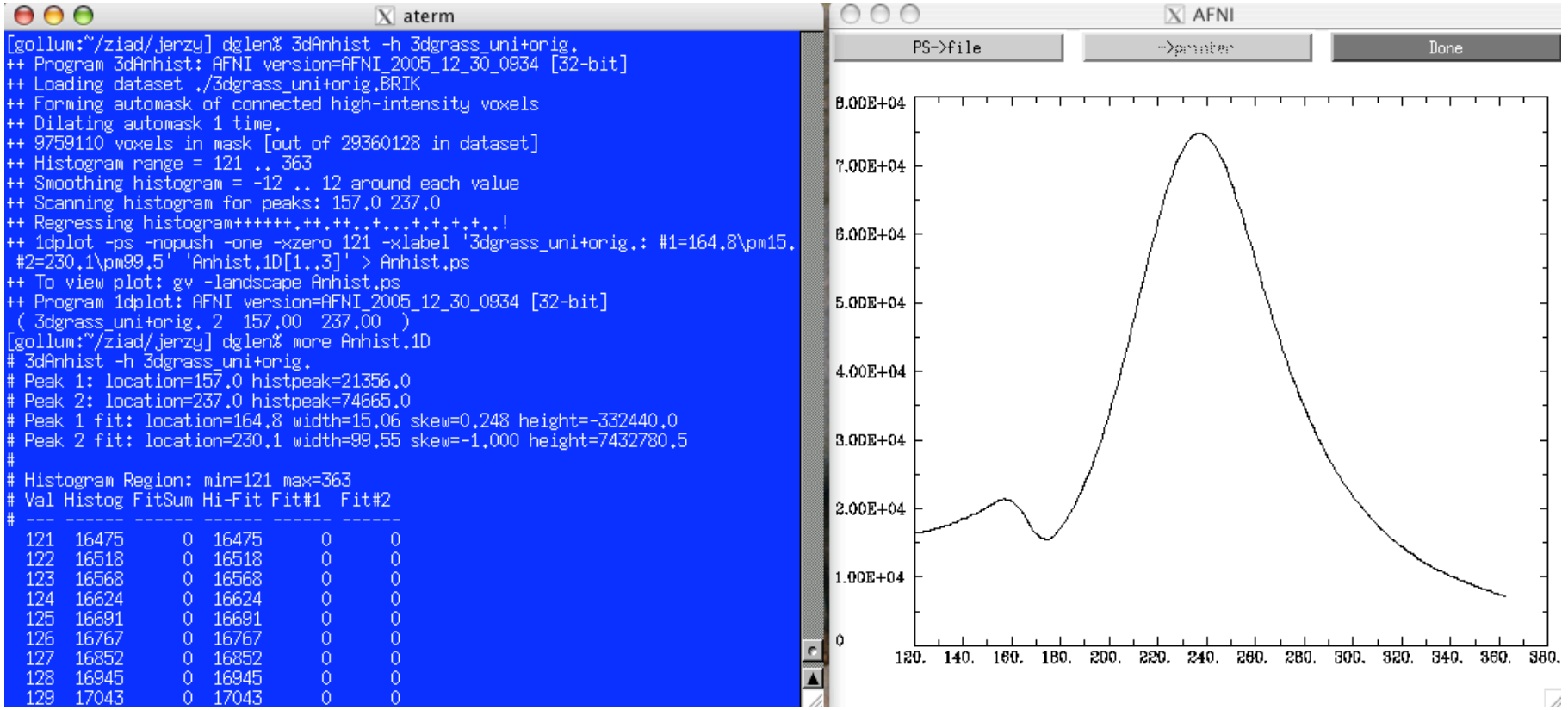
Model 1D Time Series Generators

sqwave Generate a square wave (on / off cycles)

- **waver** Generate hemodynamic responses to stimulus time series

- Dataset Histogram Programs
  - **3dAnhist** Create and plot “Anatomy” histogram of dataset, print peaks

```
3dAnhist -h 3dgrass+orig
```

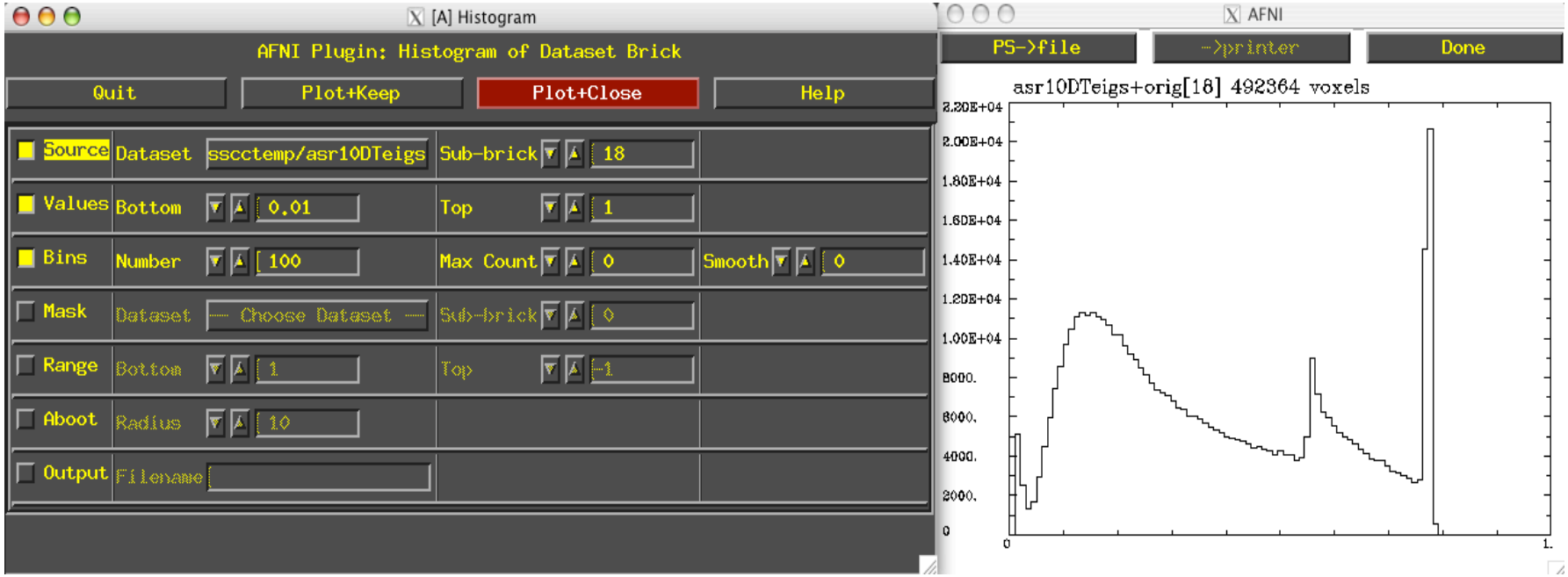


- Dataset Histogram Programs

➢ **3dhistog** Create histogram of dataset to a file

```
% 3dhistog -nbin 0 zork+orig
#Magnitude Freq Cum_Freq
0.000000 77821 77821
1.000000 1 77822
2.000000 1 77823
3.000000 0 77823
4.000000 1 77824
-----
```

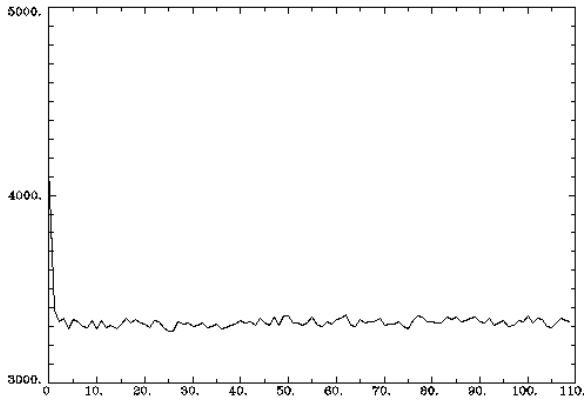
➢ **plugin: Histogram** Interactively graphs histogram of a dataset (or ROI)



ROI Generation and Usage Programs

- **plugin:** **Draw Dataset** Manually draw ROI mask datasets
- **3dAutomask** Generate a brain-only mask from an EPI dataset
- **3dmaskave** Calculate dataset values averaged over an ROI
- **3dROIstats** Calculate dataset values from multiple ROIs
- **3dmaskdump** Output voxel values in an ROI or a dataset

```
3dmaskdump -ibox 32 18 10 -noijk > voxelvstime.1D
1dtranspose voxelvstime.1D
1dplot voxelvstime.1D &
```



3dUndump Input text values into a dataset (inverse of 3dmaskdump)

3dGetrow Output voxel values for a row/column in x,y,z space

ROI Generation and Usage Programs (Continued)

3dOverlap Create mask that is overlap of nonzero voxels from multiple datasets

3dfractionize Resample a mask dataset to a different resolution

- **whereami** get atlas region name for coordinates (now vice-versa too)

```
whereami -13 68 -11 anat+tlrc
+++++++ nearby Atlas structures +++++++

Focus point (LPI)=
     13 mm [R], -68 mm [P], -11 mm [I] {T-T Atlas}
     13 mm [R], -69 mm [P], -17 mm [I] {MNI Brain}
     14 mm [R], -77 mm [P],  -7 mm [I] {MNI Anat.}

Atlas TT_Daemon: Talairach-Tournoux Atlas
   Focus point: Left  Declive
   Within 1 mm: Left  Culmen
   Within 5 mm: Left  Lingual Gyrus
          -AND- Left  Brodmann area 18
   Within 6 mm: Left  Brodmann area 19
   Within 7 mm: Left  Fusiform Gyrus
```

Dataset File Utilities

- **3dinfo** Print out information from the header

  Example from command line: **3dinfo astrip+orig**

  Example from afni GUI: **Define Datamode → Misc → Anat Info**

```
Dataset File:    astrip+orig
Identifier Code: XYZ_8qmBAapL9YwE3I Creation Date: Wed Jun 9 11:54:12
2004
Dataset Type:    Spoiled GRASS (-spgr)
Byte Order:             MSB_FIRST [this CPU native = LSB_FIRST]
Data Axes Orientation:
   first  (x) = Anterior-to-Posterior
   second (y) = Superior-to-Inferior
   third  (z) = Left-to-Right   [-orient ASL]
R-to-L extent:   -74.000 [R] -to-   73.600 [L] -step-   1.200 mm[124
voxels]
A-to-P extent:  -119.531 [A] -to-  119.531 [P] -step-   0.938 mm[256
voxels]
I-to-S extent:  -119.531 [I] -to-  119.531 [S] -step-   0.938 mm[256
voxels]
R-to-L center:    -0.200 [R]
A-to-P center:     0.000 [P]
I-to-S center:    -0.000 [I]
Number of values stored at each pixel = 1
   -- At sub-brick #0 '#0' datum type is short:           0 to
733

---HISTORY---
[cox@elrond: Mon Jun 14 16:04:31 2004] 3dIntracranial -min_val 30
   -anat fred+orig -prefix astrip
```

Dataset File Utilities (continued)

- **3dAttribute** Print out a single or all header attributes

```
3dAttribute -name ORIGIN epi_r1+orig
 ORIGIN = 118.125 118.125 -69
3dAttribute -name BRICK_STATS 3dgrass_uni+orig.
 BRICK_STATS = 0 4480
```

3dnewid Assign a new ID code to a dataset

- **3drefit** Lets you change attributes in a dataset header

Example: change orientation code and location of origin

```
3drefit -orient LPI -zorigin 30 fred+orig
```

Example: anonymize dataset

```
3drefit -denote fred+orig
```

3dNotes Lets you put text notes into a dataset header

plugin: **Dataset NOTES** Interactive header notes editor

nifti_tool Displays, modifies, copies nifti structures in datasets

- Programs for Changing Dataset Spatial Structure

  3daxialize Rewrite dataset with slices in different direction

  3dresample Rewrite dataset in new orientation, with new voxel size

  3dLRflip Flip dataset Left to Right

- Programs for Assembling Sub-bricks into 4D Datasets

  - **3dTcat** Assemble a 3D+time dataset from multiple input sub-bricks

  3dbucket Assemble a bucket dataset from multiple input sub-bricks

- Programs for Changing Slice Structure

  3dZcat Glue multiple sub-bricks together along the z-axis

  3dZcutup Cut slices out of a dataset to make a 'thinner' dataset

  3dZeropad Add zero slices around the edges of a dataset

  Can also cut planes off edges of dataset to deal with a smaller dataset

```
3dZeropad -R 4 -L 6 -I 2 -S 3 -prefix fred_pad
  fred+orig
```

  3dZregrid Interpolate a dataset to a different slice thickness

- Spatial Transformations of Dataset Geometry

3drotate	Rigid body rotation of dataset in 3D
3dWarp	Non-rigid transformation of 3D coordinates
3dAnatNudge	Try to align EPI and structural volumes automatically
plugin: Nudge Dataset	Align EPI and structural volumes manually
3dTagalign	Align datasets by matching manually placed 'tags'
plugin: Edit Tagset	Place 'tags' in a dataset interactively
○ **adwarp**	Transform dataset using warp from dataset header
Vecwarp	Transform 3-vectors using warp from dataset header

- Dataset File Manipulation

3dcopy	Copy a dataset to make new files
3drename	Rename dataset files
3ddup	Make an 'empty' duplicate (warp-on-demand) of a dataset

Volume Segmentation Tools

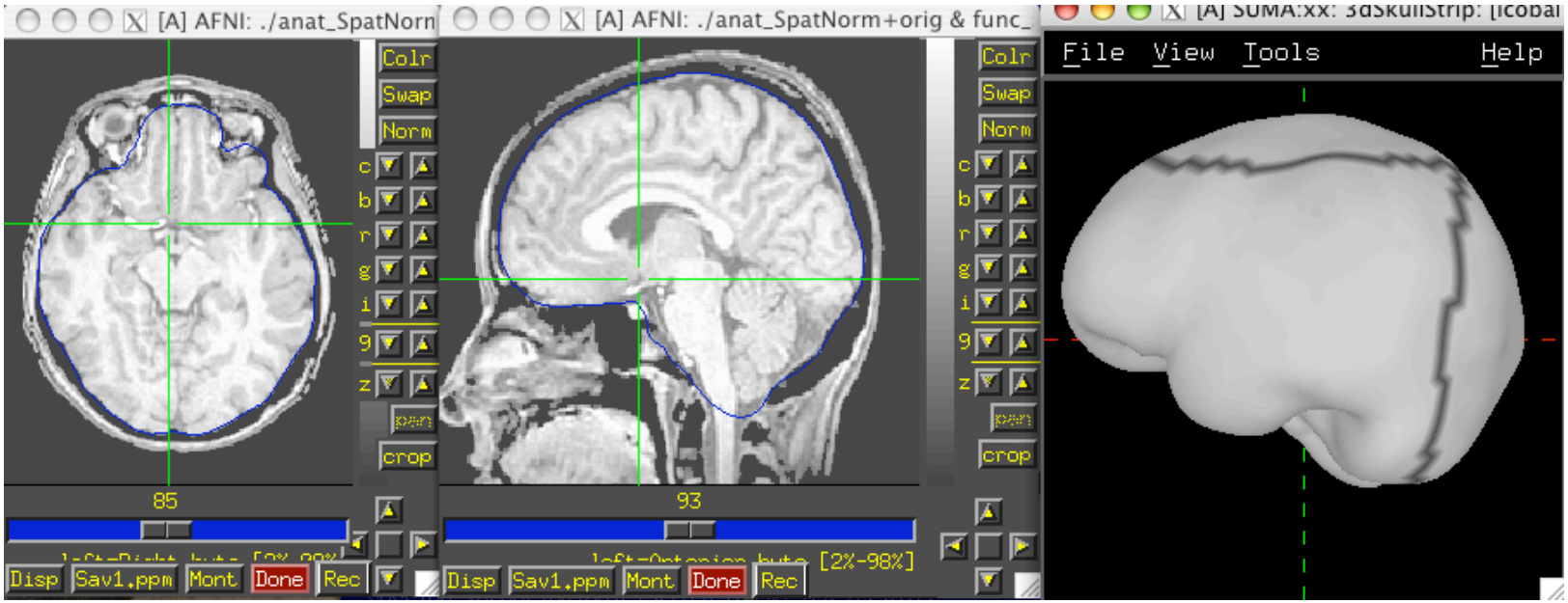
- **3dIntracranial** -- Strip the scalp and other non-brain tissue from a high-resolution T1-weighted dataset

```
3dIntracranial -anat fred+orig -prefix fred_strip
```

- **3dSkullStrip** -- Improves upon 3dIntracranial, creates a brain-only mask

```
3dSkullStrip -input fred_anat+orig -prefix fred_strip \
    -no_avoid_eyes -niter 750 -ld 50
```

Also GyrusFinder plug-in, 3dAnhist, 3dClipLevel, 3dAutomask, 3dclust, 3dmerge, 3dUniformize



- Computation of Various Numbers from Datasets

3ddot	Dot product (correlation coefficient) of 2 sub-bricks
3dclust	Find connected clusters of nonzero voxels
3dFWHM	Estimate Full Width Half Max of dataset spatial correlation

- Simulated Dataset Generators

3dTSgen	Generate 3D+time dataset from 1D model and noise
3dClustSim	Simulate datasets and estimate statistical power (Monte Carlo multiple comparison correction)
3dConvolve	Simulate datasets via convolution
3dInvFMRI	Compute stimulus time series given activation map and 3D+time dataset

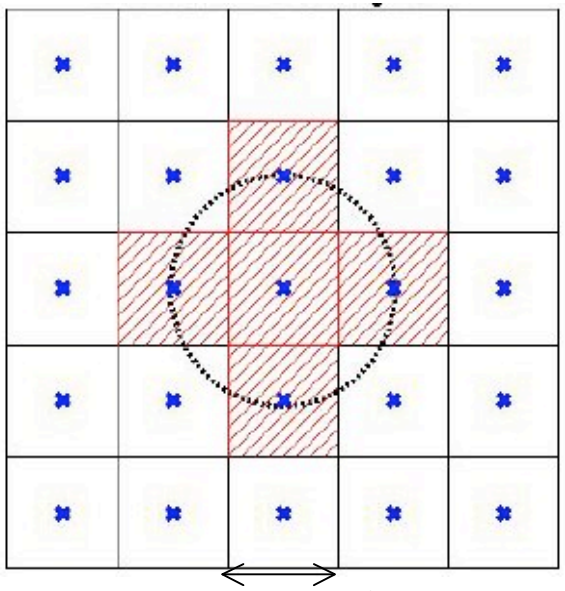
- Programs for Dealing with 1D Time Series

1dcat	Concatenate columns from multiple 1D files row by row
1dplot	Graph the columns as the y-values in a graph
1dtranspose	Transpose (interchange) rows and columns

Spatial Utilities

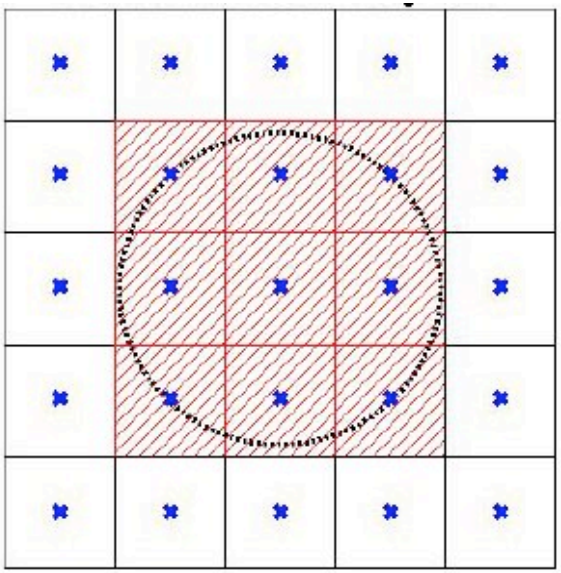
- **3dclust** -- Find clusters of "active" voxels and print out a report about them
  - "Active" means nonzero (survives thresholding operation)
  - Clusters are defined by a connectivity radius parameter **rmm**:

rmm = 1.01 mm
clusters nearest neighbors



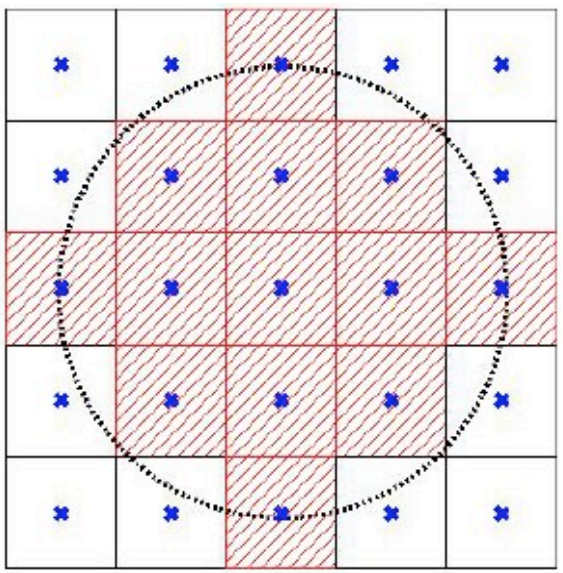
1 mm voxels

rmm = 1.415 mm (1.734 -3D)
clusters next nearest neighbors



Clustering actually takes place in 3D

rmm = 2.01 mm
clusters 2nd next nearest neighbors



  - Clustering starts by finding some nonzero voxel
  - All nonzero voxels closer than **rmm** millimeters (center-to-center distance) to the given voxel are included in the cluster
  - Cluster then grows outwards from all newly included voxels, using rmm again

- Clustering actually takes place in 3D:
  - Assume cubical voxels with grid size L mm
  - $L < \textbf{rmm} < \sqrt{2}\,L \Rightarrow$ connect voxels that share a common face
  - $\sqrt{2}\,L < \textbf{rmm} < \sqrt{3}\,L \Rightarrow$ connect voxels that share a common edge
  - $\sqrt{3}\,L < \textbf{rmm} < 2L \Rightarrow$ connect voxels that share a corner
  - Larger values of **rmm** will jump over zero voxels
- You can override actual voxel size (which may not be cubical) by using the **`-dxyz=1`** command line switch, which then pretends that voxel size L=1
- Sample report: **`3dclust -1thresh 0.47 7 600 fred_epi+orig`**

```
Cluster report for file fred_epi+orig
[Connectivity radius     = 7.00 mm Volume threshold = 600.00 ]
[Single voxel volume     = 98.4 (microliters) ]
[Voxel datum type        = short ]
[Voxel dimensions        = 3.750 mm x 3.750 mm x 7.000 mm ]
Mean and SEM based on Absolute Value of voxel intensities:
```

Volume	CM RL	CM AP	CM IS	minRL	maxRL	minAP	maxAP	minIS	maxIS	Mean	SEM	Max Int	MI RL	MI AP	MI IS
3839	2.3	-15.3	4.4	-11.0	10.0	-28.1	-5.6	-9.4	20.6	0.0069	4.8e-04	0.0176	3.0	-13.1	5.6
2067	16.0	56.8	9.4	3.0	24.0	39.4	65.6	1.9	16.9	0.0059	4.3e-04	0.0107	17.0	61.9	13.1
1772	38.4	-5.3	0.2	24.0	52.0	-13.1	-1.9	-9.4	5.6	0.006	5.1e-04	0.0111	31.0	-1.9	-1.9
1575	-18.4	-36.7	4.5	-25.0	-18.0	-43.1	-28.1	-9.4	13.1	0.0072	0.001	-0.0181	-18.0	-43.1	5.6
1477	-1.4	-65.8	-31.7	-4.0	10.0	-69.4	-58.1	-39.4	-28.1	0.0109	0.001	-0.0201	-4.0	-65.6	-31.9
1280	24.5	-30.0	1.4	24.0	31.0	-35.6	-24.4	-9.4	9.4	0.0053	4.9e-04	-0.0089	24.0	-35.6	5.6
1181	0.7	-50.9	0.6	-4.0	10.0	-54.4	-46.9	-13.1	5.6	0.0071	0.0011	-0.0154	-4.0	-50.6	5.6
886	42.9	-28.8	-10.9	38.0	52.0	-31.9	-20.6	-13.1	-5.6	0.0059	7.7e-04	0.0096	38.0	-31.9	-9.4
689	33.2	-4.7	17.8	31.0	38.0	-9.4	-1.9	13.1	24.4	0.0074	0.0011	0.0133	31.0	-1.9	20.6
14766	9.8	-20.1	-1.8							0.0069	2.7e-04				

- **-1thresh 0.47**=threshold to apply to dataset; **7** = **rmm**; **600** = volume of smallest cluster to report (in mm^3 = microliters)

- Image Registration Programs
  - **3dvolreg** Volumetric registration (rigid body in 3D)
    3dWarpDrive Extension of 3dvolreg to include warping
    3dImReg Slice-by-slice registration (rigid body in 2D)

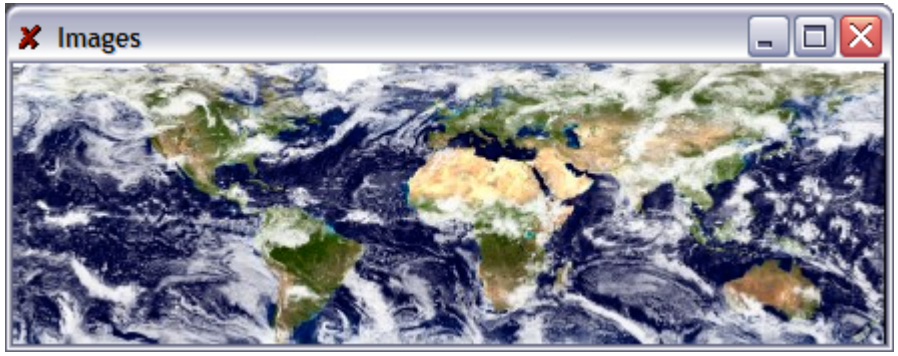
- Miscellaneous File Manipulations
  2swap Byte pair swap: ab ba
  4swap Byte quad swap: abcd dcba
  24swap Mixed 2 and 4 byte swaps in same file
  strblast Find a string in a file and replace it with junk (anonymize)
  byteorder Report the byteorder of the current CPU

- Miscellaneous Utilities
  byteorder Report the byteorder of the current CPU
  cdf Compute probabilities, thresholds for standard distributions
  count Generate numbered strings for command line scripts
- Image File Header Printouts
  dicom_hdr Print information from a DICOM file
  ge_header Print information from a GE I. file
  mayo_analyze Print information from an ANALYZE .hdr file
  siemens_vision Print information from a Siemens Vision .ima file

Miscellaneous Visualization Tools

- **`aiv`** AFNI Image Viewer program

  aiv ~/abin/splash_earth.jpg &



- plugin: **`Render[new]`** Interactive volume rendering
- plugin: **`Dataset#N`** Graph extra dataset time series in AFNI graph viewer

Group Dataset Statistical Analysis Programs

3dttest	Paired and unpaired t-tests
3dANOVA	1-way ANOVA (fixed effects)
3dANOVA2	2-way ANOVA (fixed, random, mixed effects)
3dANOVA3	3-way ANOVA (fixed, random, mixed effects)
GroupAna	n-way ANOVA - 1 to 5 ways (Matlab script)
3dFriedman	Nonparametric Friedman test for randomized complete block design experiments
3dKruskalWallis	Nonparametric Kruskal-Wallis test for comparison of multiple treatments
3dWilcoxon	Nonparametric Wilcoxon test signed-rank test for paired comparisons of two samples
3dMannWhitney	Nonparametric 3dMannWhitney two-sample test
3dRegAna	Voxel-wise multiple linear regression group analysis
3dFDR	False Discovery Rate analysis for thresholding of voxelwise statistics
3dClustSim	Alpha probability simulations for Monte Carlo analysis of clusters

Diffusion Tensor Imaging (DTI) Programs

- **3dDWItoDT** -- For diffusion weighted image (DWI) data, calculate the diffusion tensor image (DTI) data.
  - Uses traditional linear or an iterative non-linear method to compute diffusion tensor. Computes eigenvalues, eigenvectors, fractional anisotropy, mean diffusivity

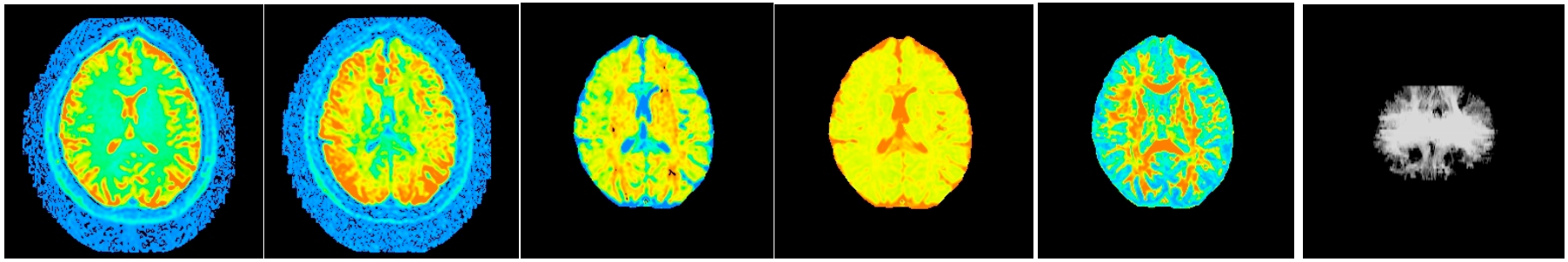
3dTeig -- From DTI data compute eigenvalues, eigenvectors and fractional anisotropy.

3dDTtoDWI -- Compute diffusion weighted volumes based on the diffusion tensor and an ideal B0 volume with no gradient.

Useful for testing purposes only.

DTIStudioFibertoSegments -- Takes output of fiber tracking from DTIStudio.

Popular DTI program from Johns Hopkins. Output can be displayed in SUMA.



DWI | DWI q1 | Dxx | λ_1 | FA - non-linear | fibers

Scripts

@SUMA_Make_Spec_FS – convert Freesurfer surfaces to SUMA spec files

@SUMA_Make_Spec_SF – convert SureFit surfaces to SUMA spec files

@auto_tlrc – automatic transformation of dataset to match Talairach template

@CommandGlobb – execute AFNI commands for multiple datasets

@make_stim_file – make stim file for 3dDeconvolve from user input or file

@2dwarper – sample script to align slices of a time series dataset

@GetAfniOrient – return orientation code for a dataset (e.g. RAI)

@UpdateAfni – sample script for updates (also AFNI_UPDATER)

Scripts (continued)

@4Daverage – sample script for calculating means of multiple datasets

@GetAfniPrefix - pull the prefix part of the name out of dataset

@VolCenter –return the center coordinate of a dataset

@AfniOrient2RAImap –return index map of the RAI directions

@GetAfniView – return view part of name of dataset

@align_partial_oblique – align a partial T1 dataset with a full dataset

@AfniOrientSign – code for orientation relative to RAI (1 1 1);
LPS (-1 -1 -1)

@NoExt – remove specified file extensions from end of filename

@Align_Centers - align centers of dataset(s) to a base dataset

@Purify_1D – extract columns from 1D files

Scripts (continued)

@Center_Distance – return distance between two centers

@RenamePanga – create AFNI datasets from GE realtime data

@clip_volume – crop or zero out parts of a volume

@CheckForAfniDset – check for existence of AFNI datasets

@SUMA_AlignToExperiment – align anatomical volume to experimental volume

@fix_FSsphere – fix Freesurfer spherical surface

@DTI_studio_reposition – match DTIStudio analyze file format to parent AFNI dataset

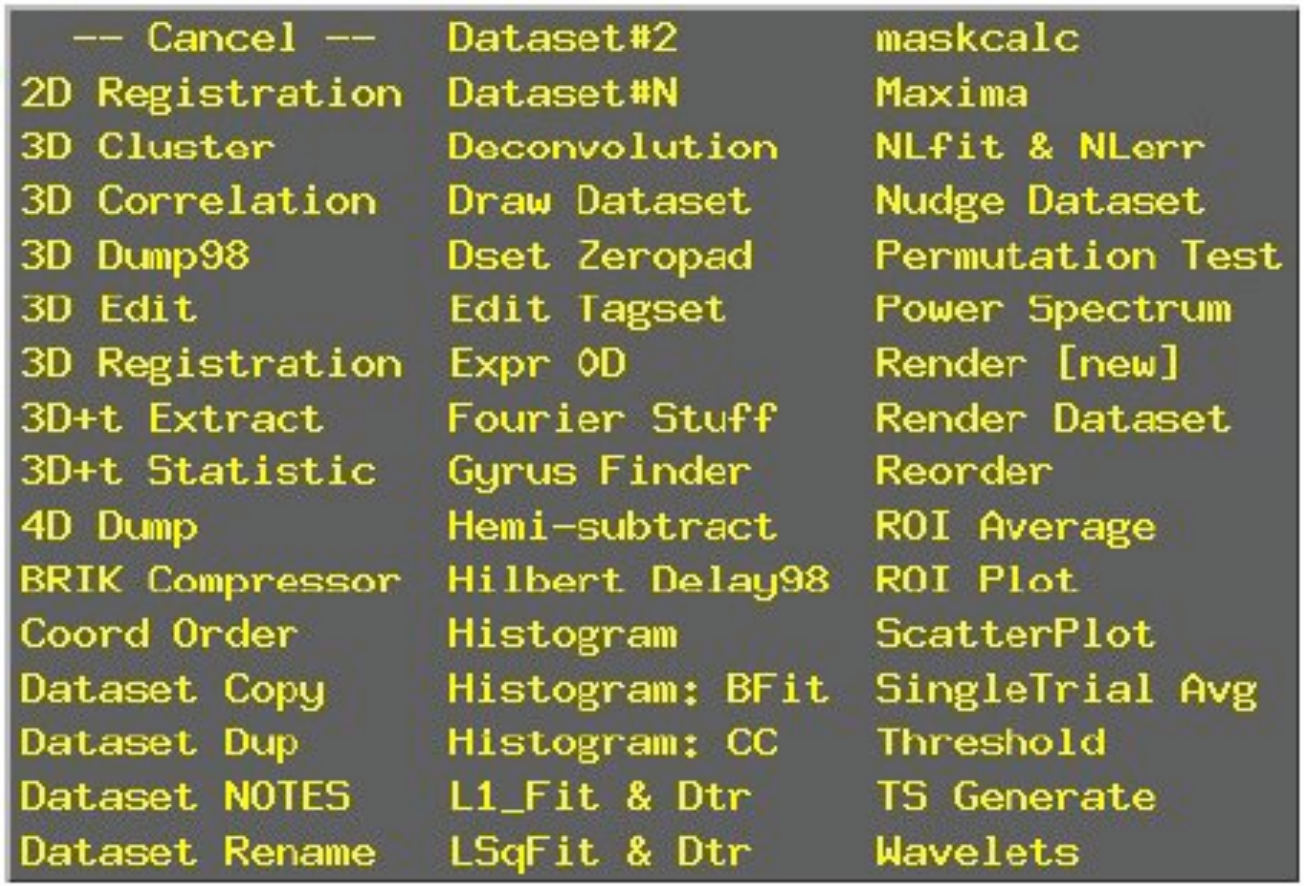
@parse_afni_name – return the path, prefix, view and sub-brick selection from dataset name

@parse_name – return path, prefix and extension from any file name

@FromRAI - return equivalent other coordinates (e.g. LPS) given RAI coordinates

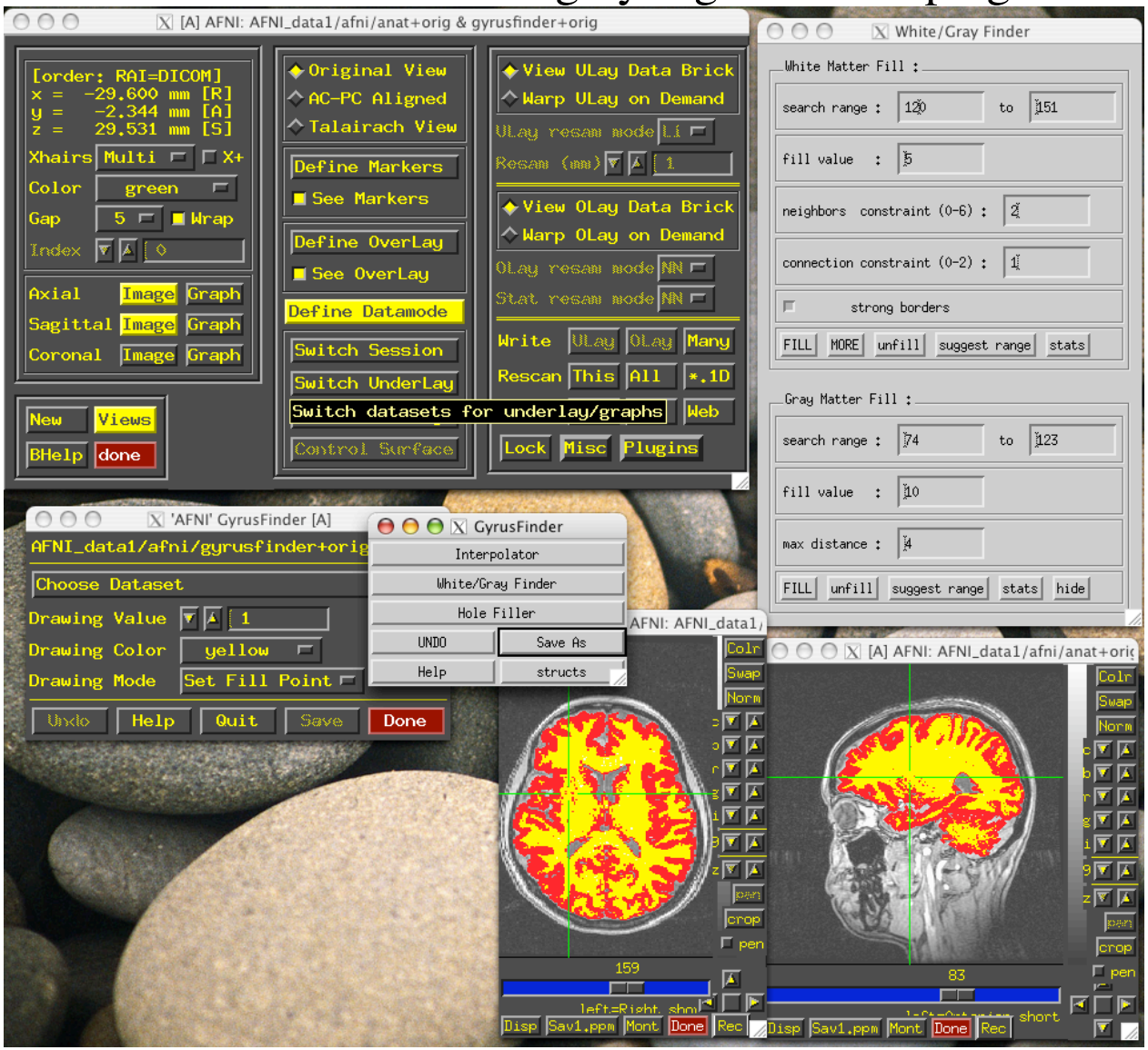
@ToRAI – return equivalent RAI coordinates

Plug-ins


-- Cancel --
2D Registration
3D Cluster
3D Correlation
3D Dump98
3D Edit
3D Registration
3D+t Extract
3D+t Statistic
4D Dump
BRIK Compressor
Coord Order
Dataset Copy
Dataset Dup
Dataset NOTES
Dataset Rename
Dataset#2
Dataset#N
Deconvolution
Draw Dataset
Dset Zeropad
Edit Tagset
Expr 0D
Fourier Stuff
Gyrus Finder
Hemi-subtract
Hilbert Delay98
Histogram
Histogram: BFit
Histogram: CC
L1_Fit & Dtr
LSqFit & Dtr
maskcalc
Maxima
NLfit & NLerr
Nudge Dataset
Permutation Test
Power Spectrum
Render [new]
Render Dataset
Reorder
ROI Average
ROI Plot
ScatterPlot
SingleTrial Avg
Threshold
TS Generate
Wavelets

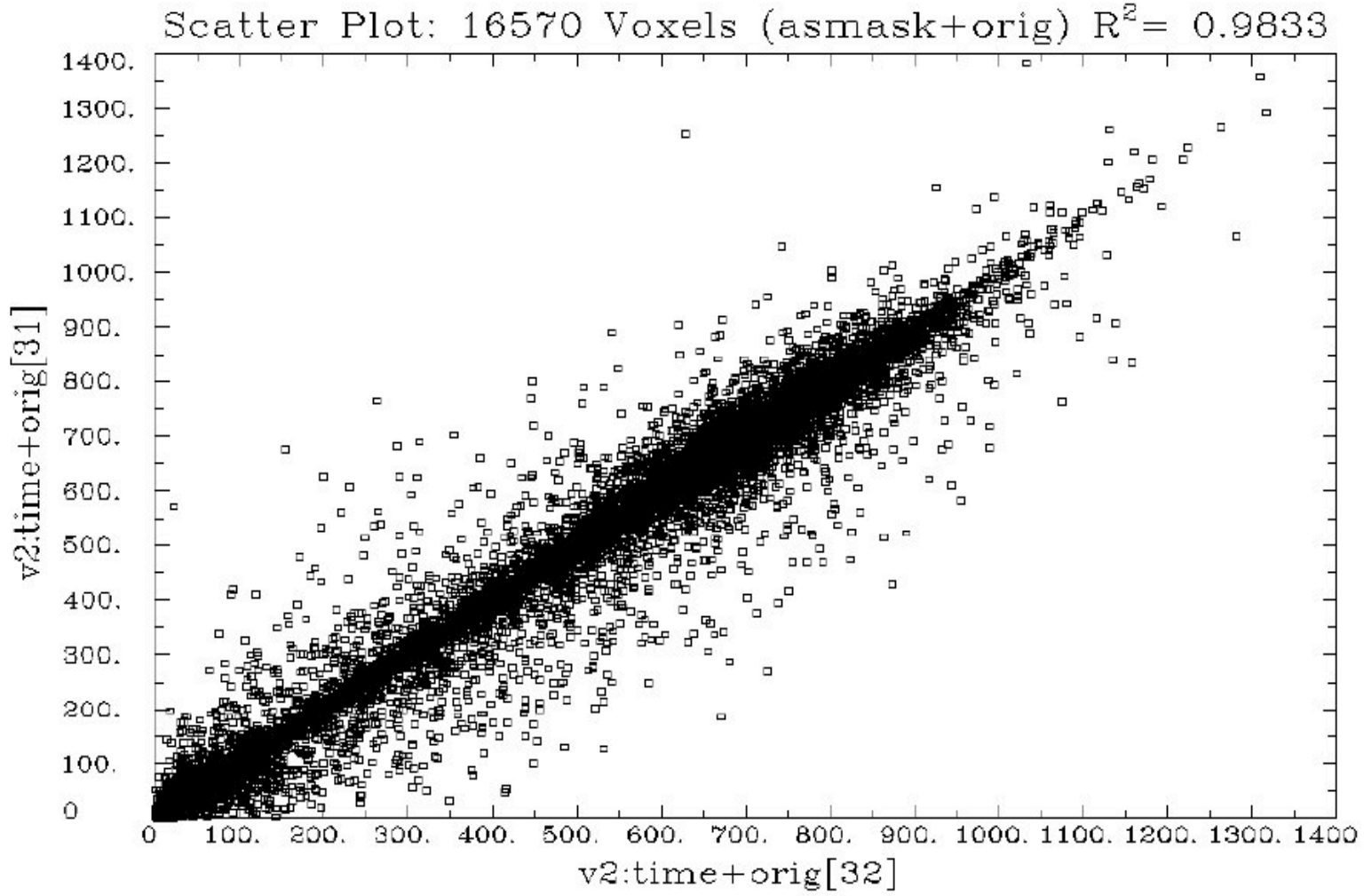
GyrusFinder

Semi-automatic white/gray segmentation plug-in



1. Use blank copy (Dataset copy). Also set See OverLay.
2. Start Gyrus finder plug-in, and choose copy dataset
3. Set fill point in white matter (middle button)
4. Suggest range in white/gray finder window
5. Select Fill
6. Unfill and adjust search range, neighbor and connection constraints
7. Do gray matter Fill
8. Save data

ScatterPlot plug-in



Environment Variables and .afnirc

- Operation of AFNI is affected by many Unix environment variables
  - Full documentation is in file README.environment (in AFNI distributions)
  - Environment variables can be set in your shell startup file (e.g., .cshrc) or in AFNI's startup file (.afnirc), in your home directory
  - Some environment variables can be set from the pseudo-plugin
  - **`Define Datamode → Misc → Edit Environment`**
- *Some* useful environment variables (there are many more)
  - **`AFNI_PLUGINPATH`** gives the directory where AFNI will look for plugins when it starts up
  - **`AFNI_SESSTRAIL`** gives the number of directory levels to show in the Switch Session chooser
  - **`AFNI_HINTS`** can be used to turn off the popup hints (tooltips)
  - **`AFNI_COMPRESSOR`** can be used to tell AFNI programs to compress .BRIK files when they are written out
  - **`AFNI_AUTOGZIP`** can be used to tell AFNI programs to gzip compress .BRIK files if they appear like "good" candidates for compression (e.g., ROI datasets)

- **AFNI_LEFT_IS_LEFT** can be used to have axial and coronal images displayed with the subject's left on the display left (default is subject's left on the display right: radiological order)
- **AFNI_ALWAYS_LOCK** can be used to turn on inter-controller Lock at startup
- **AFNI_NOSPLASH** can be used to hide the AFNI splash window (but why?!)
- **AFNI_ENFORCE_ASPECT** can be used to make defective window managers (KDE, Gnome) keep the image window aspect ratios when resizing (I then also recommend setting the window manager so that it doesn't redraw the windows during resizing operations)

- Sample .afnirc file:

```
***ENVIRONMENT
AFNI_LEFT_IS_LEFT      = YES    // images show subject's left on screen left
AFNI_graph_width       = 512    // in pixels
AFNI_graph_height      = 384
AFNI_graph_ggap        = 6      // gap between sub-graphs
AFNI_graph_data_thick  = 1      // use thick lines for data graphs
AFNI_SPLASHTIME        = 1.0    // shorten the splash screen display
AFNI_ALWAYS_LOCK       = YES    // locking windows together
AFNI_ENFORCE_ASPECT    = YES
AFNI_AUTOGZIP          = YES    // 02 Mar 2001
```

- See README.environment and README.setup for details on all environment variables and other setup issues

AFNI GUI Plugouts and command line options

```
#!/bin/tcsh
# '.afni.startup_script' in current directory.
# AFNI will automatically read such a file at
# startup and carry out its orders.
# ---------------------------------------
# Sample script to generate image file
# sss.jpg from the anat+tlrc and func+tlrc
# datasets. See file README.driver for a list
# of all the functions you can invoke to drive
# AFNI from the outside. See file
# README.environment for other settings that
# can influence the way AFNI operates.

# Set environment variables to force square
# pixels in saved image, and linear
# interpolation in the functional overlay
# volumes

setenv AFNI_IMAGE_SAVESQUARE YES
setenv AFNI_resam_func Li
setenv AFNI_resam_thr Li
```

```
# Start AFNI with plugouts enabled
afni -yesplugouts &
# Give AFNI 4 seconds to get started
sleep 4
# Drive AFNI to set up the desired
# image, save it, then quit
plugout_drive -verb -host localhost \
-com "SWITCH_UNDERLAY A.anat" \
-com "SWITCH_OVERLAY A.func" \
-com "SET_VIEW A.tlrc" \
-com "OPEN_WINDOW A.axialimage \
    mont=5x5:5:2:green" \
-com "SET_DICOM_XYZ A.0 0 0" \
-com "SET_XHAIRS A.OFF" \
-com "SET_FUNC_RANGE A.777" \
-com "SET_THRESHNEW A.0.666 *" \
-com "SET_PBAR_NUMBER A.9" \
-com "SET_FUNC_VISIBLE A.+" \
-com "SAVE_JPEG A.axialimage sss.jpg" \
-com "QUIT"
```

Or …

```
afni -com 'OPEN_WINDOW A.axialimage' \
-com 'SWITCH_UNDERLAY A.fred' \
-com 'SET_VIEW A.tlrc' \
somedirectory
```

Matlab Library

Opening and Saving AFNI datasets

BrikInfo

BrikLoad

WriteBrik

Functions that deal with voxel coordinates

AFNI_XYZcontinuous2Index

AFNI_Index2XYZcontinuous

AFNI_CoordChange

Functions that deal with extracting and selecting slices a la AFNI

GetAfniSlice

GetAfniSliceTriplet

ACE Exam

Examination to become an **A**FNI **C**ertified **E**xpert (first step on the road to glory)

1. Explain the difference between 'Min-to-Max' and '2%-to-98%' in the AFNI image viewer. Why is 2%-to-98% the default?
2. What does the 'R' key do when typed into an AFNI image viewer window? What about in a graph viewer window?
3. On some systems, it is possible to drag an image viewer window so that its aspect ratio (height/width) is not preserved; in this situation, the image becomes distorted. Describe at least 2 ways to bring the image viewer quickly back into the correct aspect ratio.
4. What does the 'Project' menu button do in the AFNI image viewer Disp control panel?
5. When you have 2 (or more) AFNI controllers open, can you lock their threshold sliders so that they move together? If so, how?
6. In an AFNI graph viewer window, how can you get a display of the time series that is the average of all the sub-graphs currently being shown?
7. Suppose you are showing a time series graph of a very long 3D+time dataset, and want to only see the points between time indexes 200..400 displayed in the graphs. How can you do this?
8. Explain the 3 different baseline modes available in an AFNI graph viewer.
9. On most systems, the AFNI interface shows the cursor as an arrow pointing to the upper left, but this arrow changes shape and color slightly when you move it over certain controls. What does this cursor shape change mean?
10. Given a list of coordinates, describe one way to create an AFNI dataset that equals 1 at each point inside a sphere of radius 5 about each coordinate in the list, and equals zero at all other points.
11. Explain why it is better to use the 3dcopy program to make a copy of an AFNI dataset (.HEAD and .BRIK files) rather than use the Unix 'cp' command twice.
12. How do you get AFNI '3d' programs to treat a .1D file with a single column of numbers as a 1-voxel 3D+time dataset?
13. How do you get AFNI to automatically compress output .BRIK files with gzip?