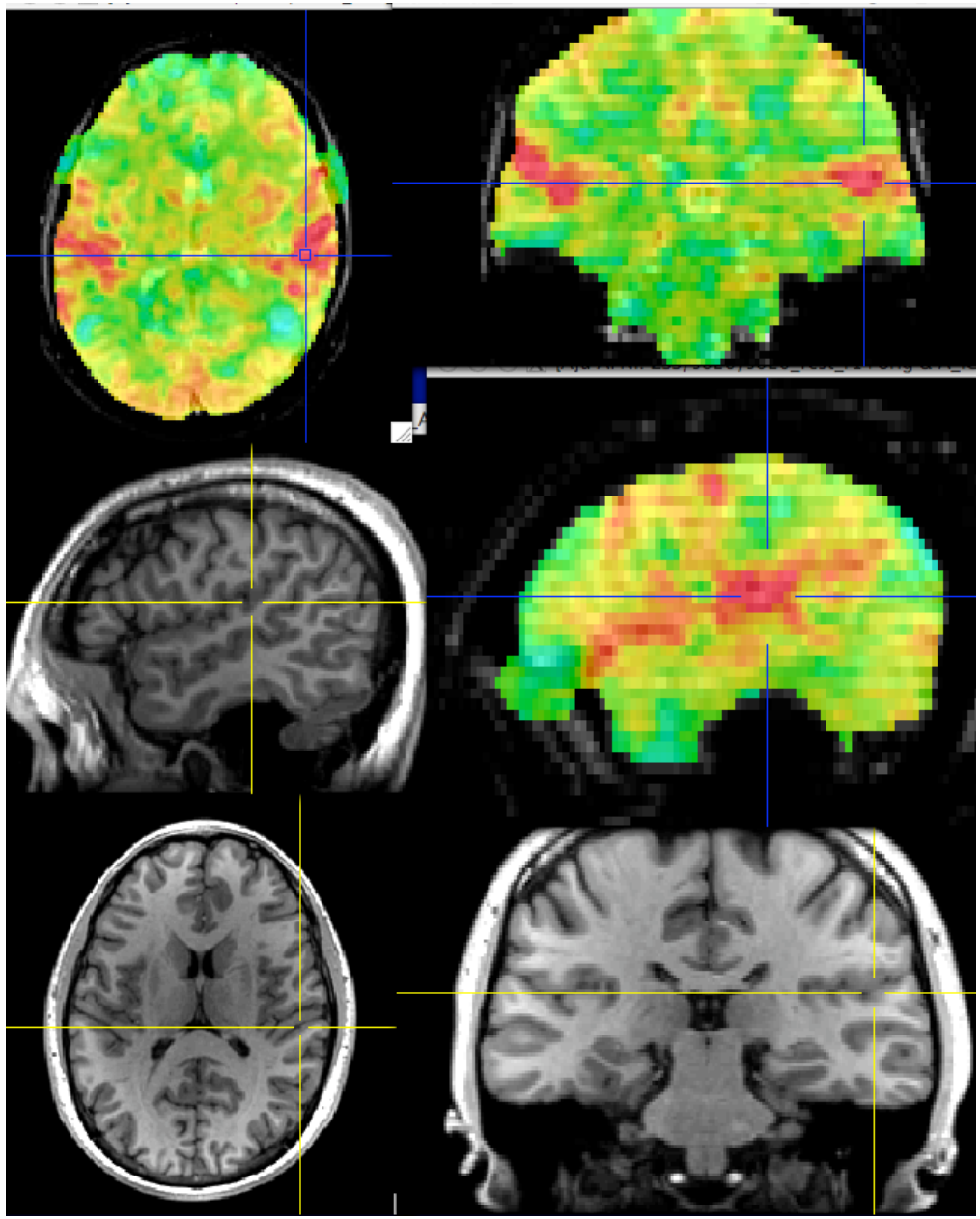
AFNI! InstaCorr

All data herein from Alex Martin, *et al.* [NIMH IRP]



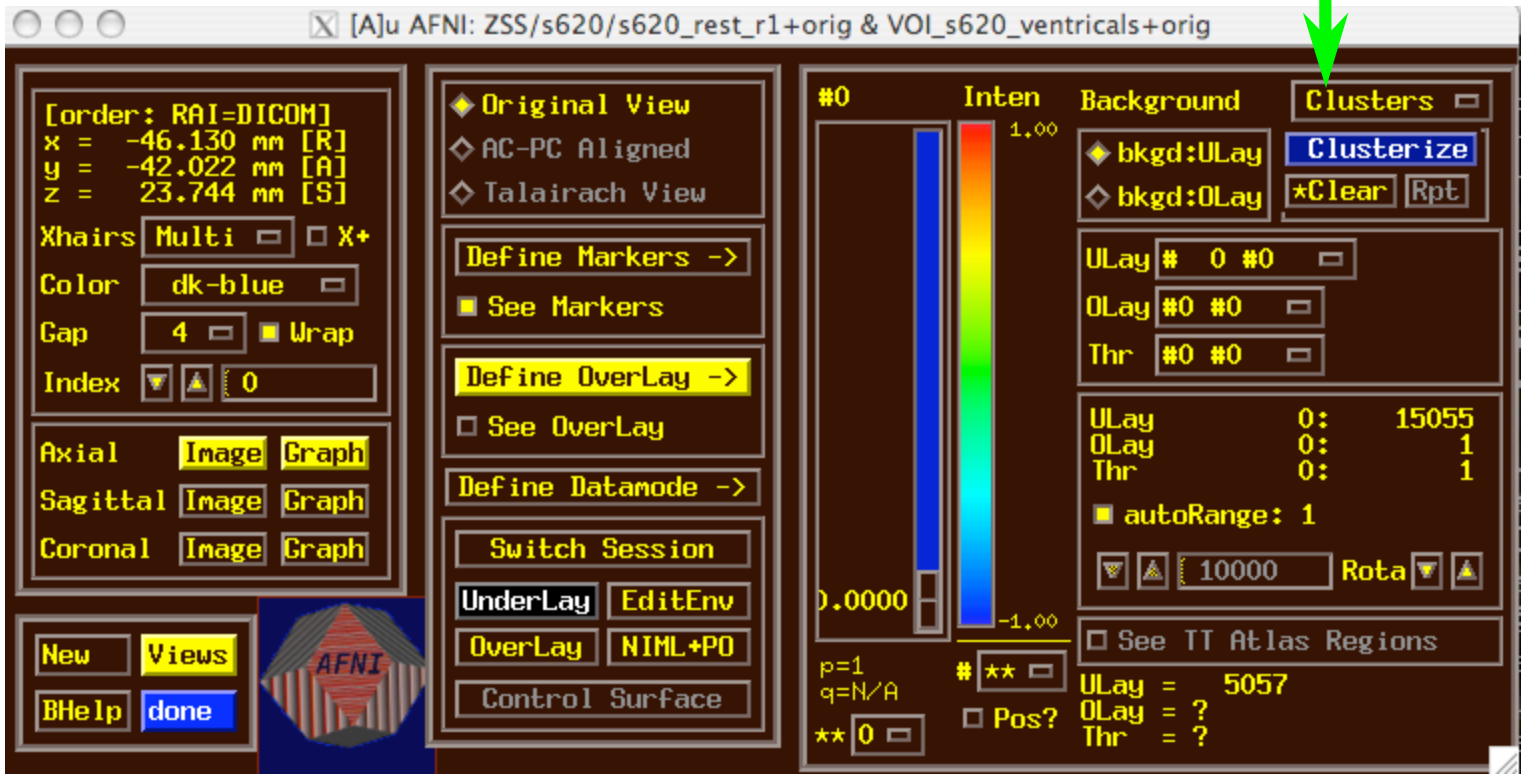
- On-the-fly **insta**ntaneous **corr**elation map of resting state data with interactively selected seed voxel
- **Setup phase**: prepares data for correlations (several-to-10+ seconds)
- **Correlation phase**: you select seed voxel, correlation map appears by ***magic***

InstaCorr: Outline of 2 Phases

- **Setup phase**:
  - ★ Masking: user-selected *or* Automask
  - ★ Bandpass and other filtering of voxel time series
  - ★ Blurring inside mask = the slowest part
- **Correlation phase**:
  - ★ Correlate selected seed voxel time series with all other prepared voxel time series
  - ★ Make new dataset, if needed, to store results
  - ★ Save seed time series for graphing
  - ★ Redisplay color overlay
  - ★ Optional: compute FDR curve for correlations
    - o This can be slow, so is not turned on by default

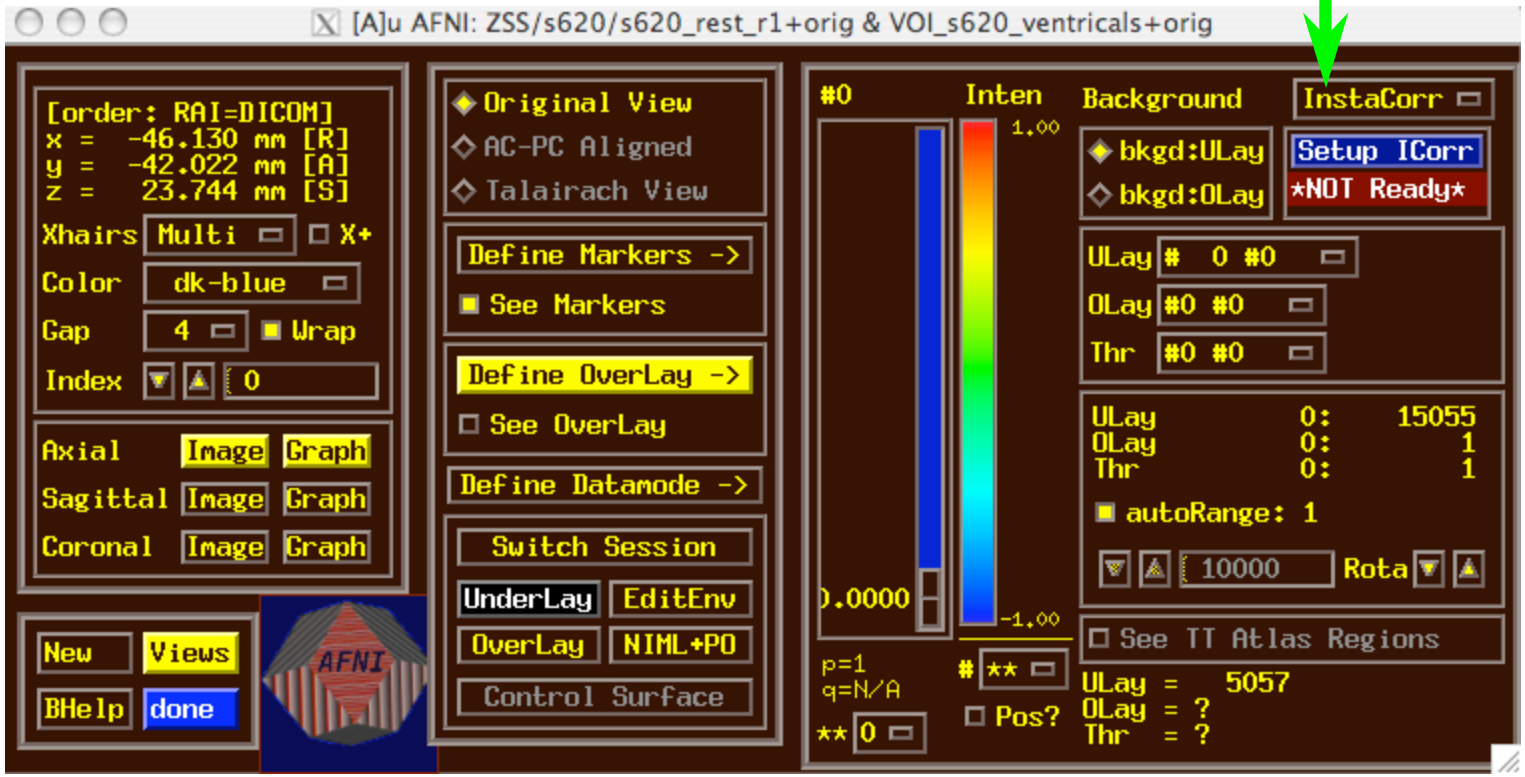
InstaCorr: Setup

- Open **Define Overlay**, choose **InstaCorr** from menu in top right corner



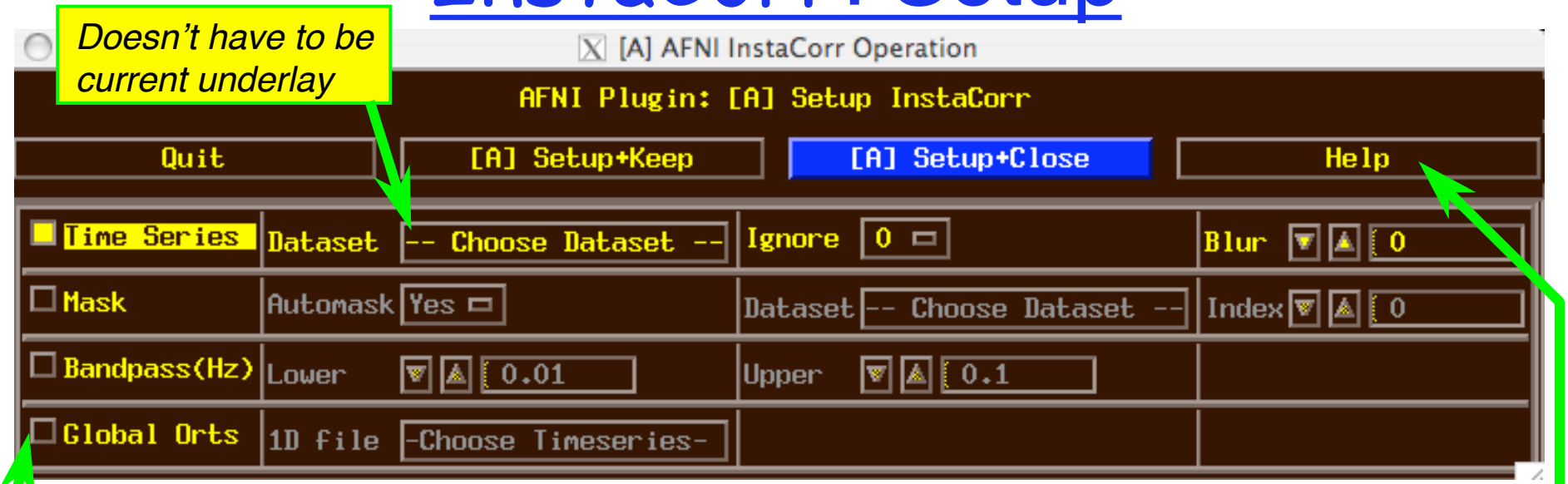
InstaCorr: Setup

- Open **Define Overlay**, choose **InstaCorr** from menu in top right corner



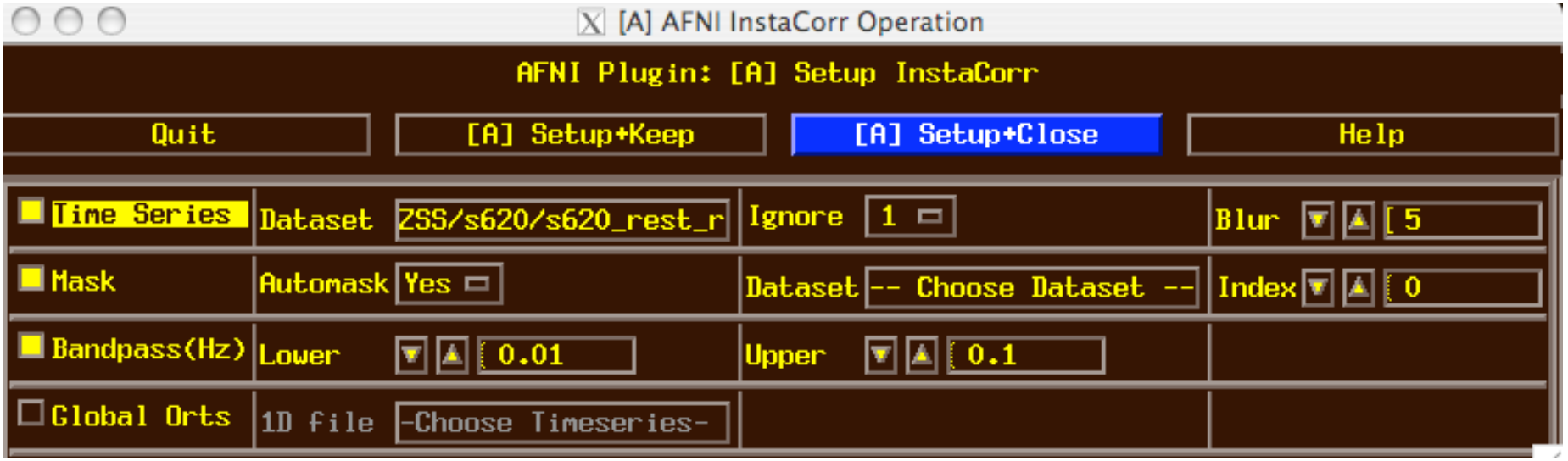
- Then press **Setup ICorr** button to get control panel

InstaCorr: Setup



- Mostly self-explanatory (I hope) — *cf.* **Help**
- **Global Orts** = extra time series to be projected out of dataset before correlation
  - ★ All columns in selected 1D file
  - ★ *e.g.*, movement parameters
  - ★ The first **Ignore** rows (time points) will be skipped
- When ready, press one of the **Setup** buttons

InstaCorr: Setup

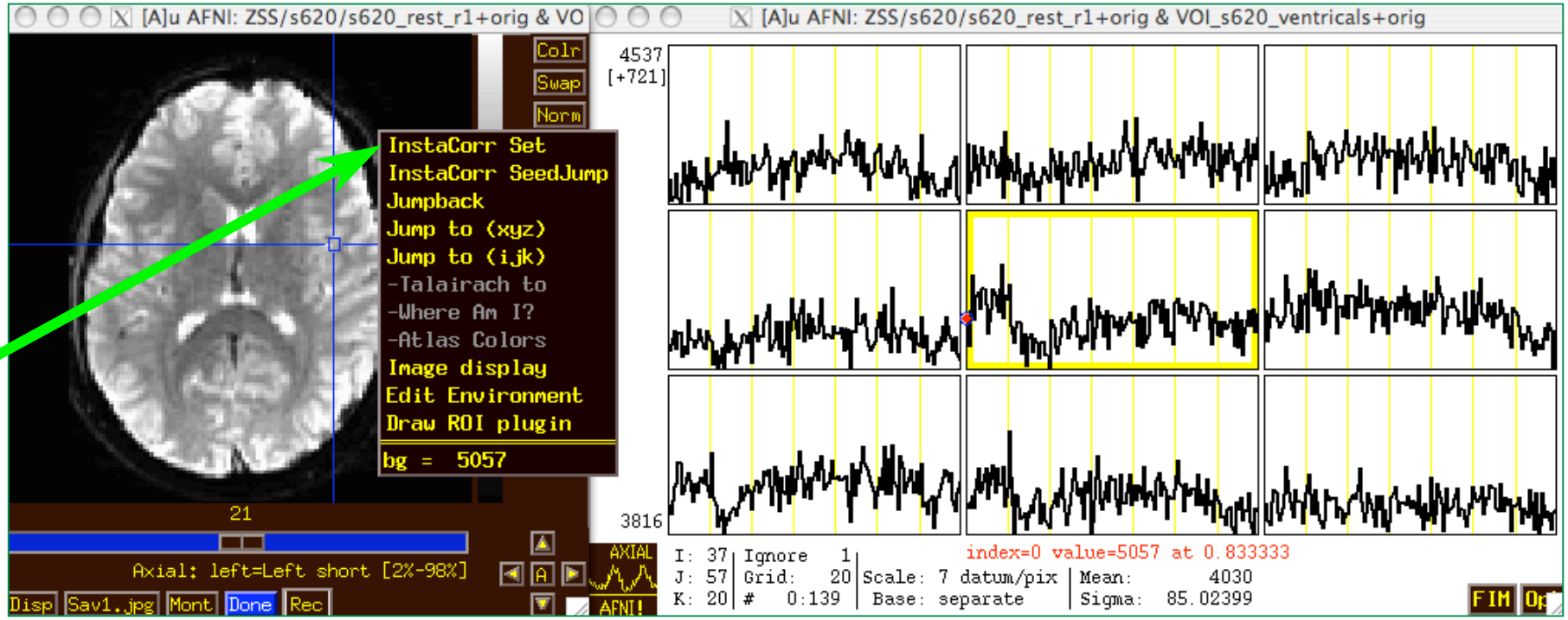


- Text output to shell window details the setup procedures:

```
++ InstaCorr preparations:
 + Automask from
  '/Users/rwcox/data/Resting/ZSS/s620/s620_rest_r1+orig.BRIK' has
  197234 voxels
 + Extracting dataset time series
 + Filtering 197234 dataset time series
 + bandpass: ntime=139 nFFT=160 dt=3.5 dFreq=0.00178571
  Nyquist=0.142857 passband indexes=6..56
 + Spatially blurring 139 dataset volumes
 + Normalizing dataset time series
++ InstaCorr setup: 197234 voxels ready for work: 15.43 sec
```

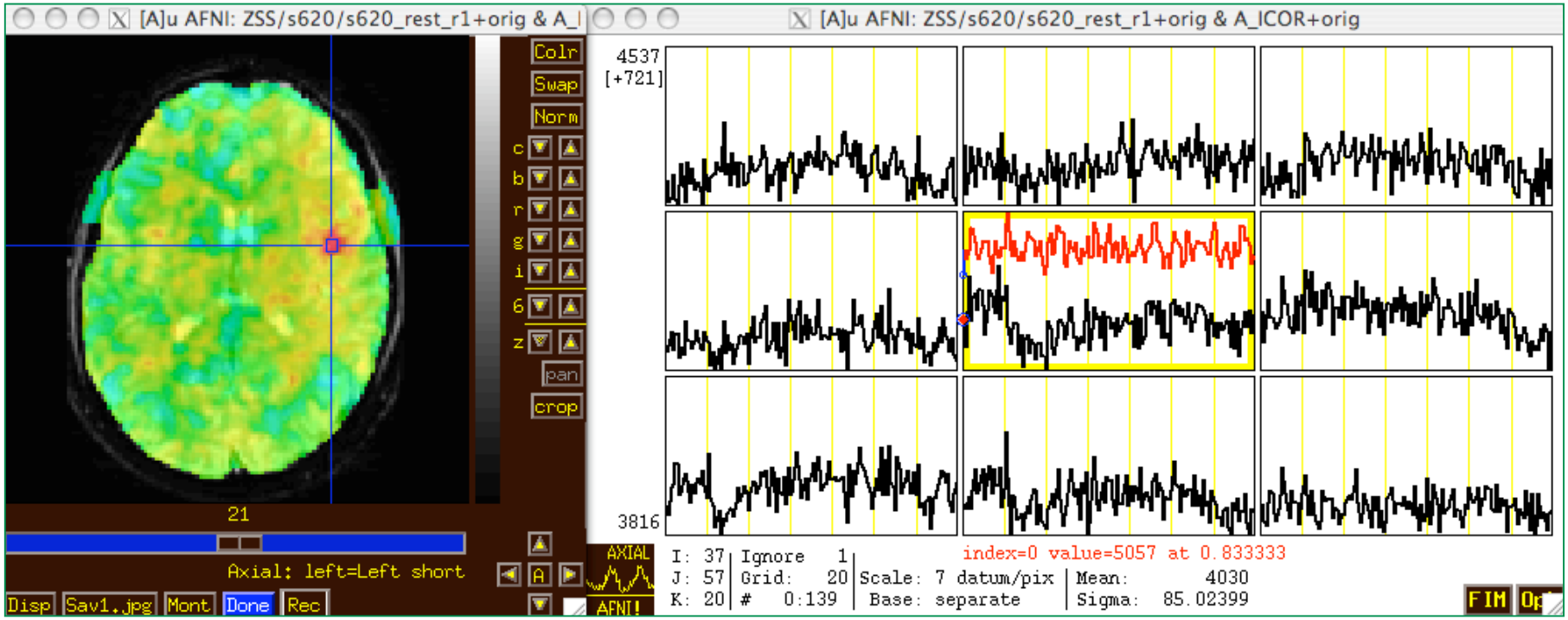
Most of the CPU time

InstaCorr: The Fun Part



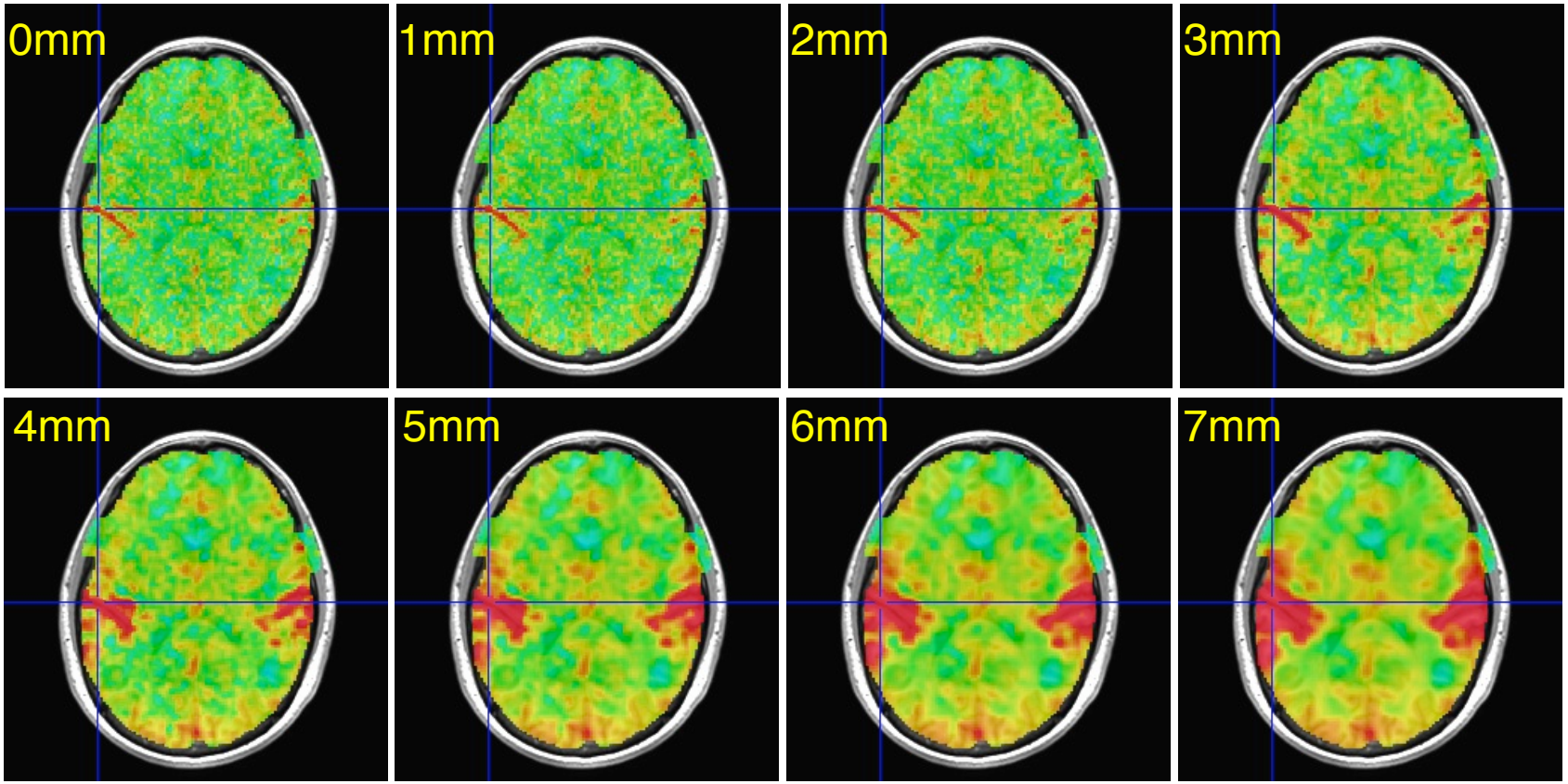
- In image viewer, set crosshairs to desired seed voxel
- **Right-click** popup menu → `InstaCorr Set`
- *Shortcut*: **Shift+Ctrl+Left-click** sets new crosshair location, then does `InstaCorr Set`
- `InstaCorr SeedJump` jumps focus to current seed

InstaCorr: The Fun Part



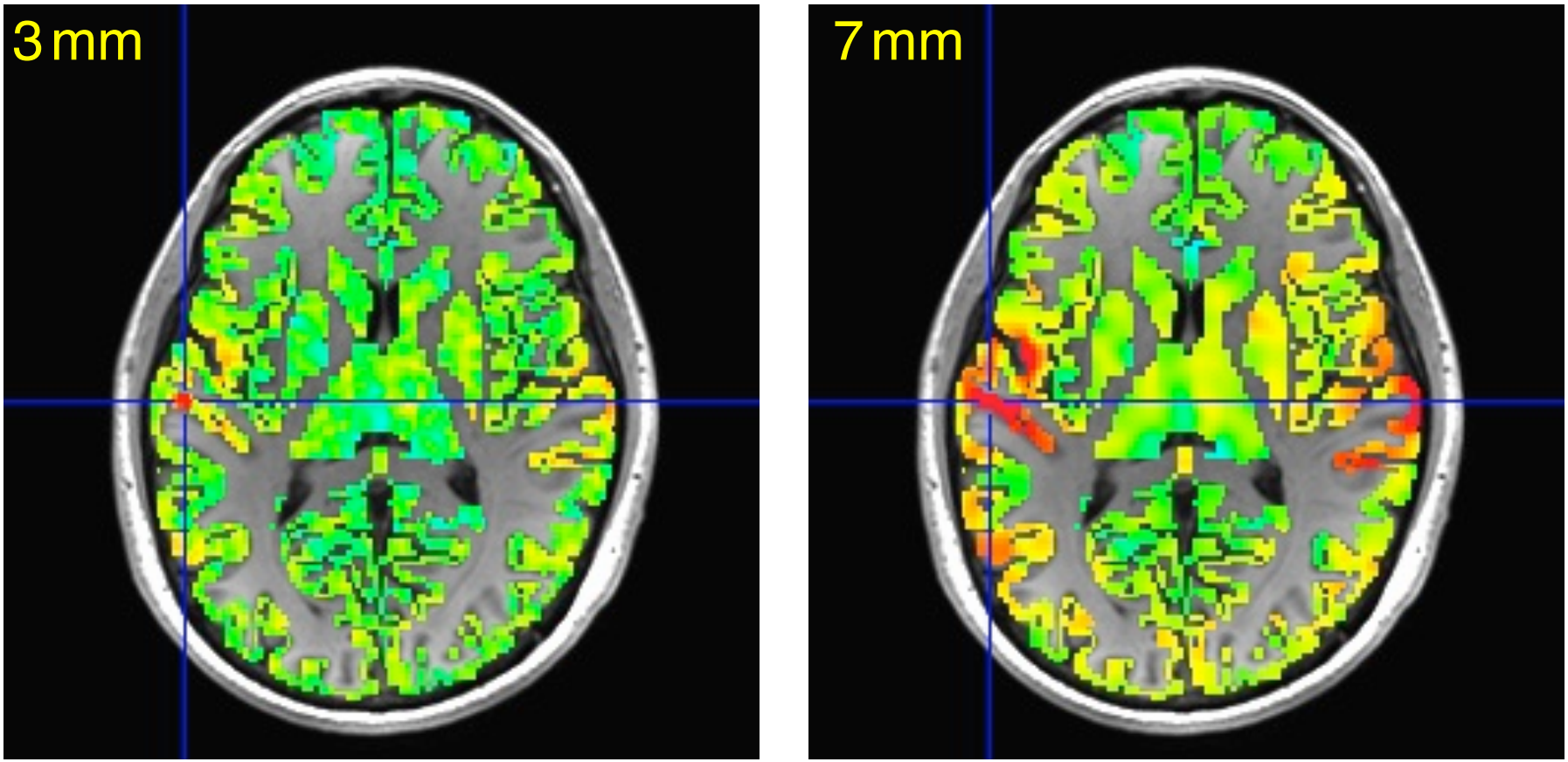
- In graph window:
  - ★ Set **`Ignore`** with **`FIM→Ignore`** menu (or **`I`** key)
  - ★ Set seed overlay with **`FIM→Pick Ideal`** menu
- When you change seed voxel, saved overlay time series will change (but you have to refresh graph to see it)

InstaCorr: Effects of Blurring



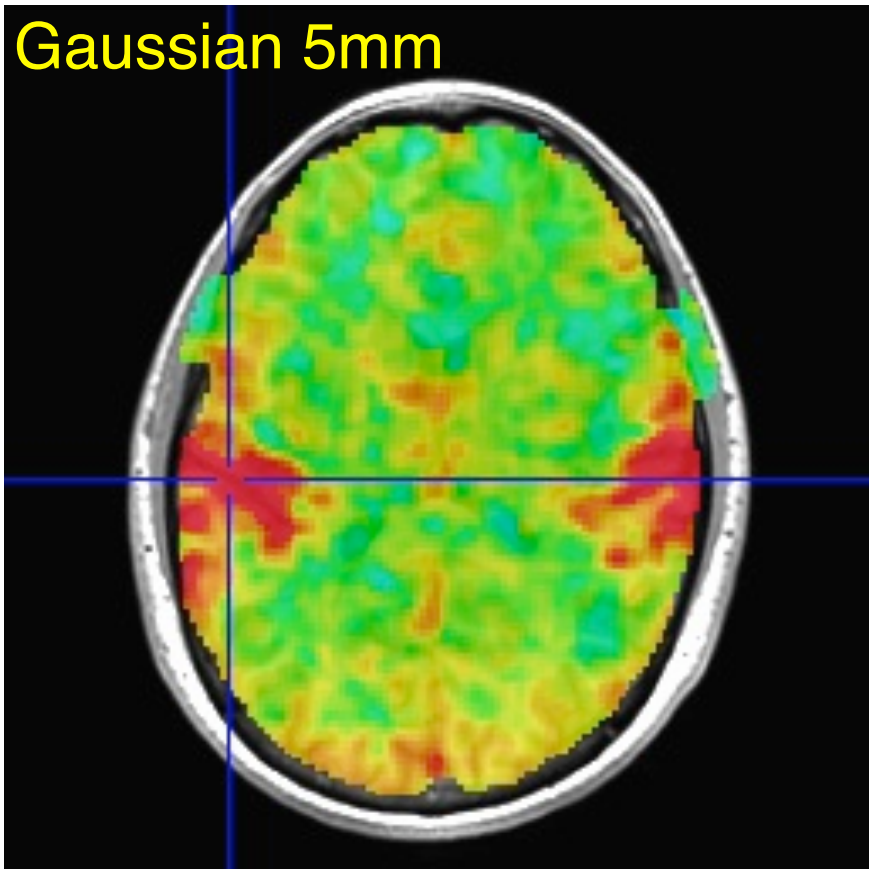
- Is this a pure vascular/cardiac effect being progressively smeared? Or real neural correlations seen via BOLD? Or some of both? *Venograms*?
  - ★ Dataset was RETROICOR-ized; mask is whole brain

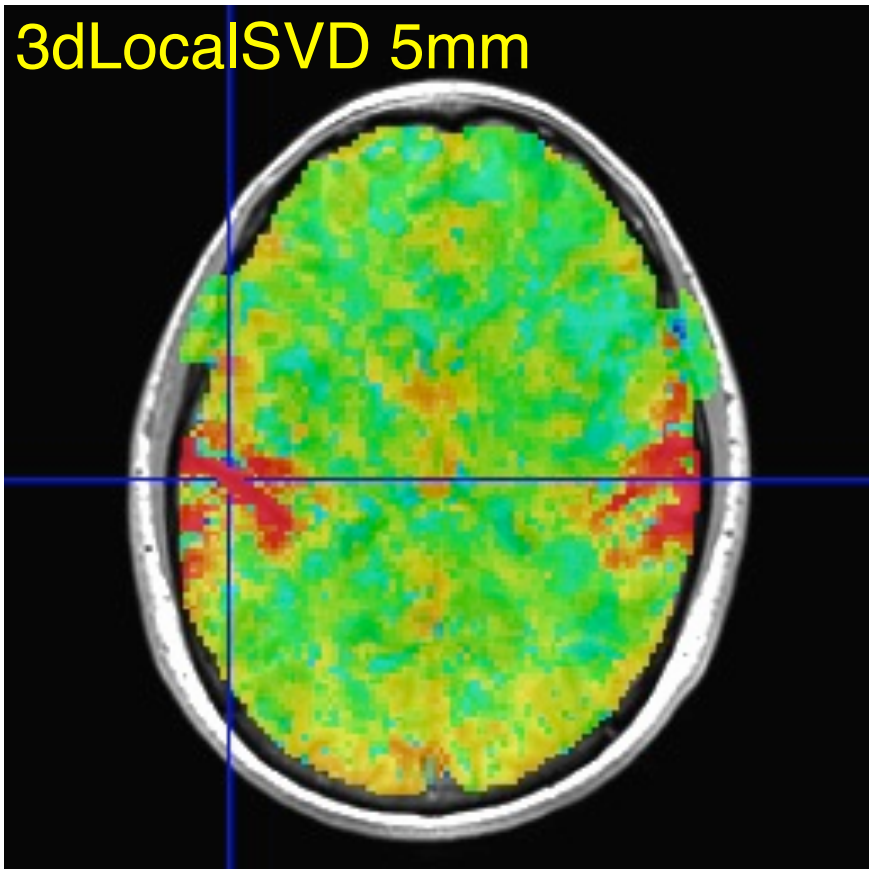
InstaCorr: Effects of Blurring



- Similar calculations, but with FreeSurfer-generated gray matter mask instead of Automask from EPI data
  - ★ Blurring is done only inside the mask
    - o Using a discrete PDE-based iterative approach

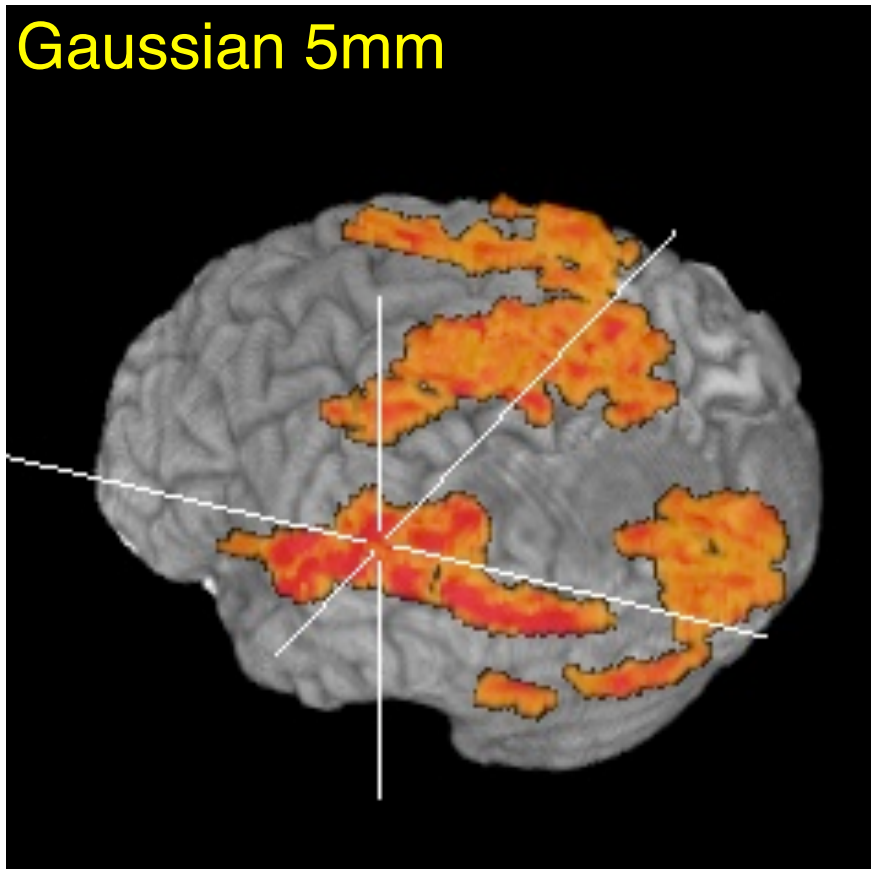
InstaCorr: SVD-based "Blurring"

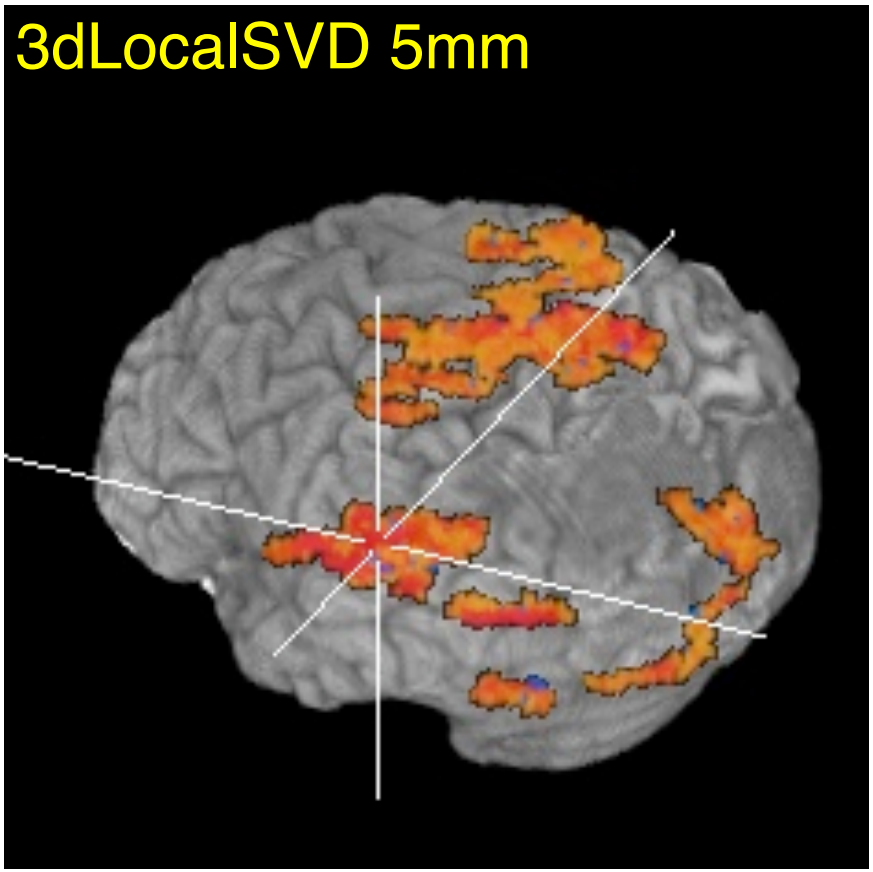




- Similar calculations, with Automask from EPI data, using `3dLocalSVD` over 5 mm radius sphere (67 voxels)
  - ★ Project each vector onto 2-dim principal subspace
  - ★ Too slow to do interactively (at this time)

InstaCorr: SVD-based "Blurring"





- Volume rendering of **InstaCorr** maps (threshold at r=0.5)
  - ★ Renderer updates automatically if **DynaDraw** is on
- SVD smoothing has cleaner spatial structure?
  - ★ Or has it lost some information?

InstaCorr: Options and Notions

- Underlay doesn't have to be EPI data; could be anat
  - ★ Can use **InstaCorr** in multiple AFNI controllers
- FDR: **setenv AFNI_INSTACORR_FDR YES**
  - ★ Will slow things down by a significant factor
- Saving **A_ICOR** dataset: overwrites previous copies

- Future Possibilities:
  - ★ Select ROI-based Orts to be detrended?
    - o Based on ROIs from FreeSurfer or atlases?
  - ★ Or multiple seeds (partial + multiple correlations)?
  - ★ Interactive local SVD "smoothing"? (needs speedup)
  - ★ Group analysis **InstaCorr** (in standardized space)
    - o Not quite "Insta" any more; ≈0.1×#Subjects sec per seed
    - o External script to do subject setups?
  - ★ Use time series subsets? (*e.g.*, for block design data)