

Automated Quality Control

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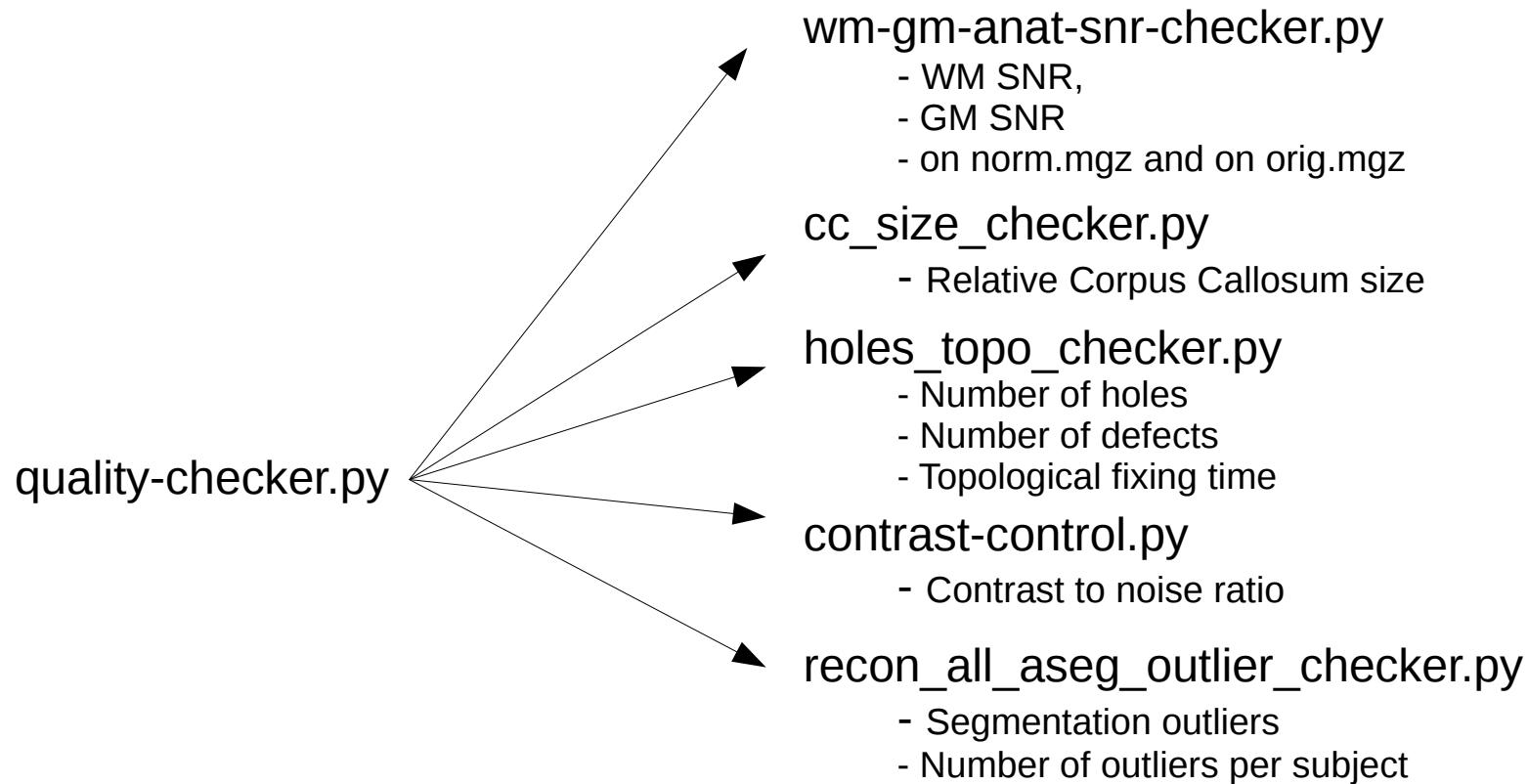
Introduction

- **Freesurfer QA tools available**
 - but not enough elaborated
 - Problems with version compatibility
- **Plan: QC pipeline after FS 6.0 processing**
- **Only based on Python 3**

Metrics

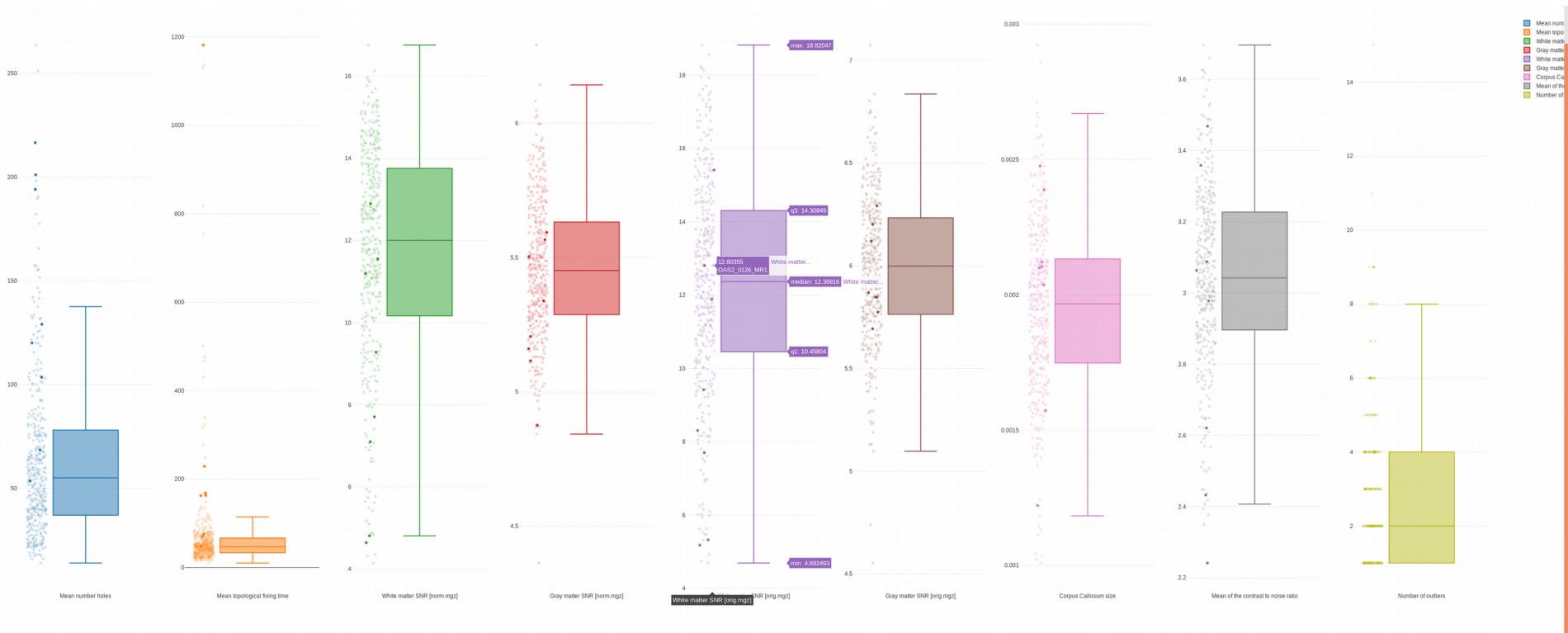
- **On the original image**
 - WM SNR: orig.mgz
 - GM SNR: orig.mgz
- **Freesurfer processed**
 - WM SNR: norm.mgz
 - GM SNR: norm.mgz
 - Contrast to noise ratio: rawavg.mgz
 - Number of defects: recon-all log file
 - Number of holes: recon-all log file
 - Topological fixing time: recon-all log file
 - Segmentation outliers: aseg.stats
 - Relative Corpus Callosum size: aseg.stats

Structure

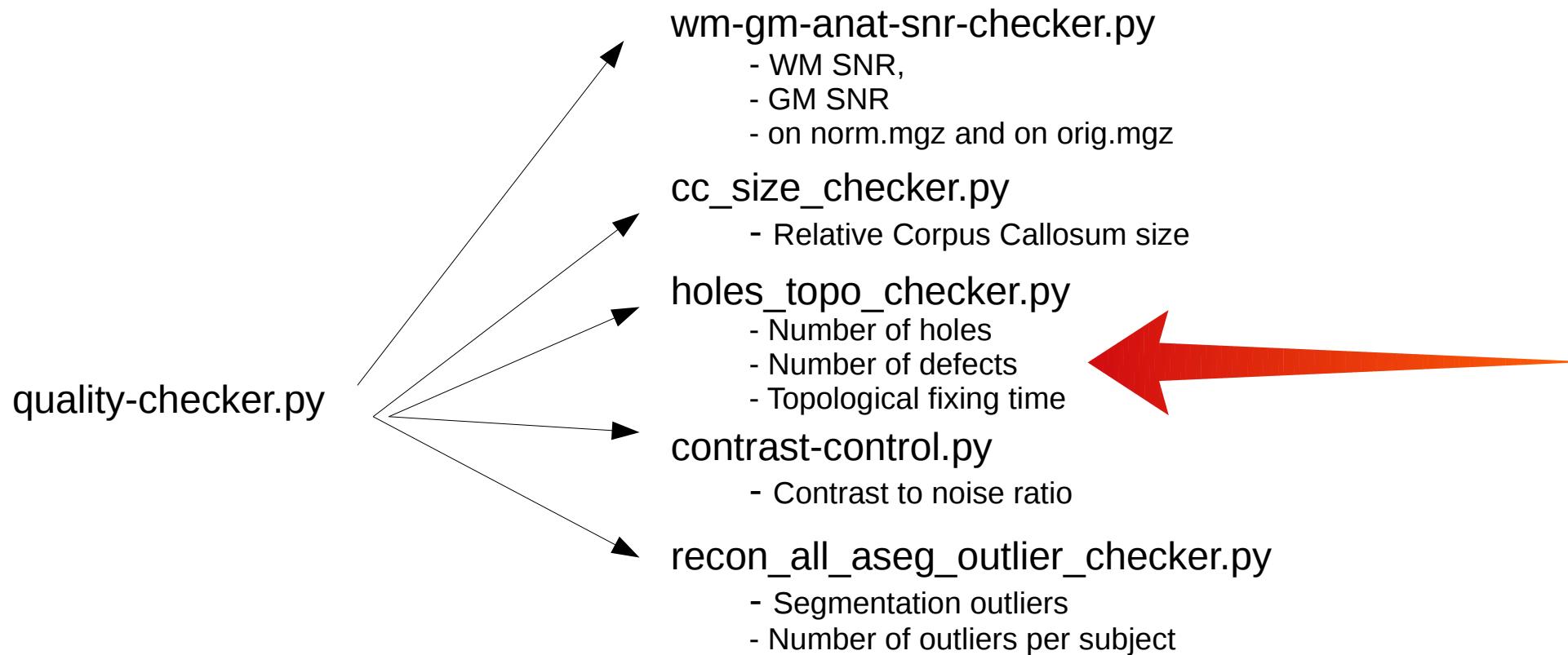


Output

file:///groups/ag-reuter/projects/adni-qc/qc-presentation/oasis2-summary-boxplot.html



Structure



Results: Number defects in orig.nofix

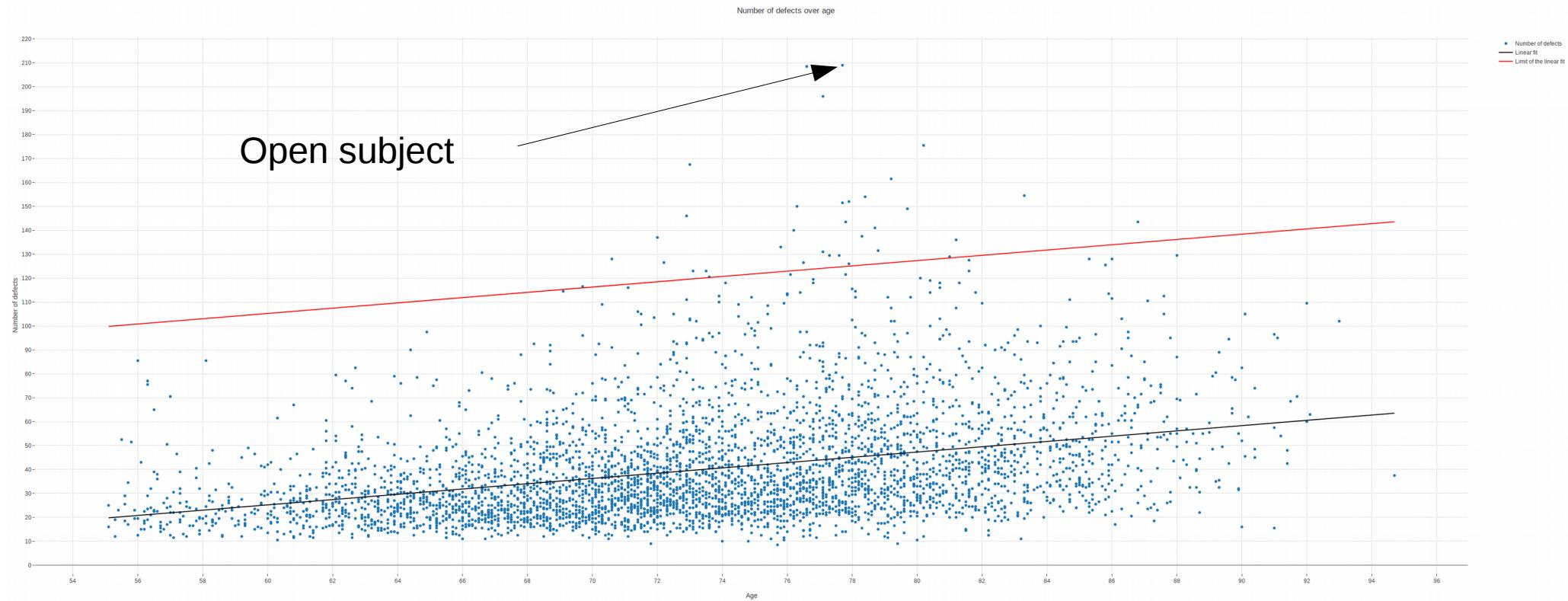
- **Interactive Plot**
 - **<file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-defects-boxplot.html>**



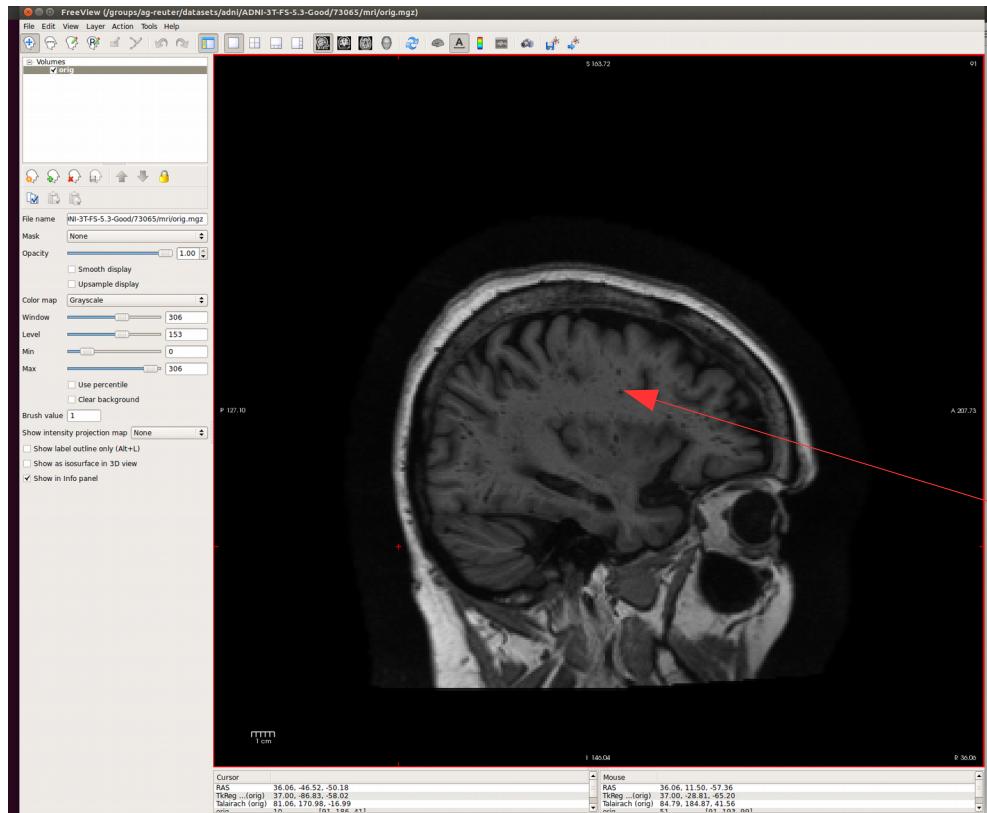
Results: Number defects

Number of defects detected: Arbitrary limit

- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-defects-scatter-limits.html>
- **Interactive Plot**



Results: Number defects



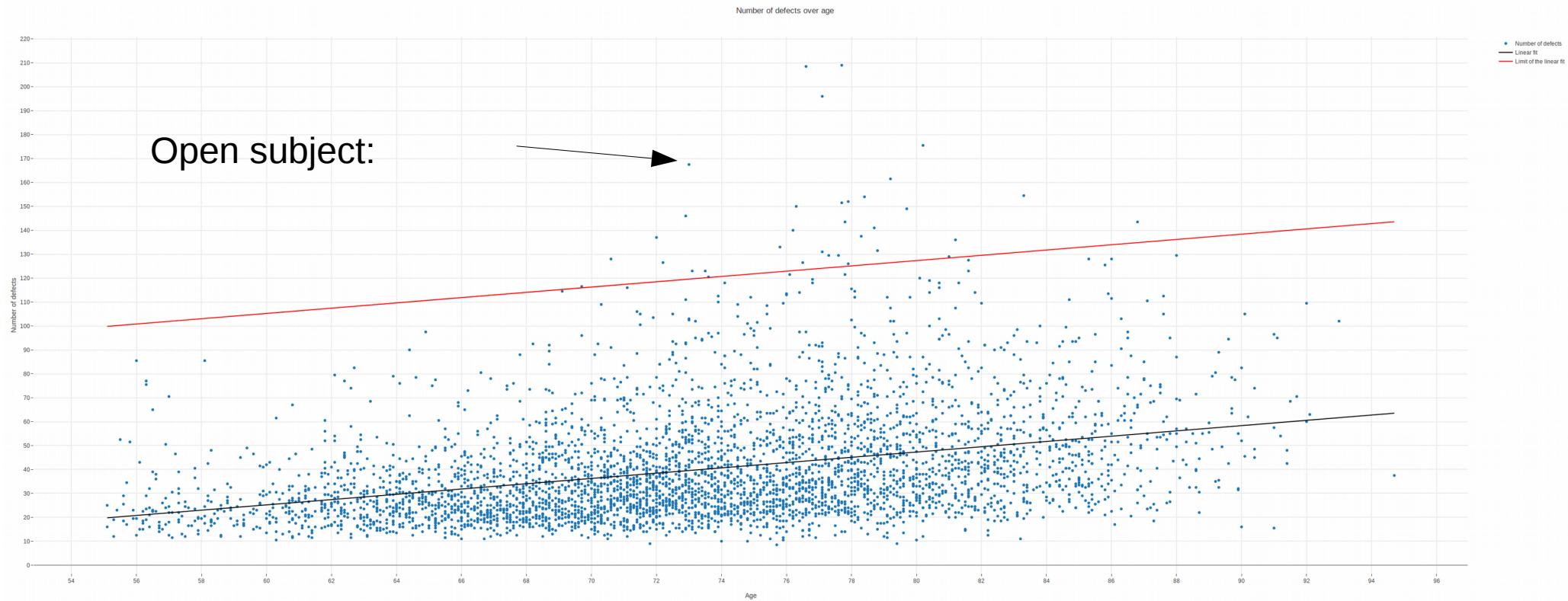
freeview /groups/ag-reuter/datasets/adni/ADNI-3T-FS-5.3-Good/73065/mri/orig.mgz

Lots of low intensity pixel in the white matter

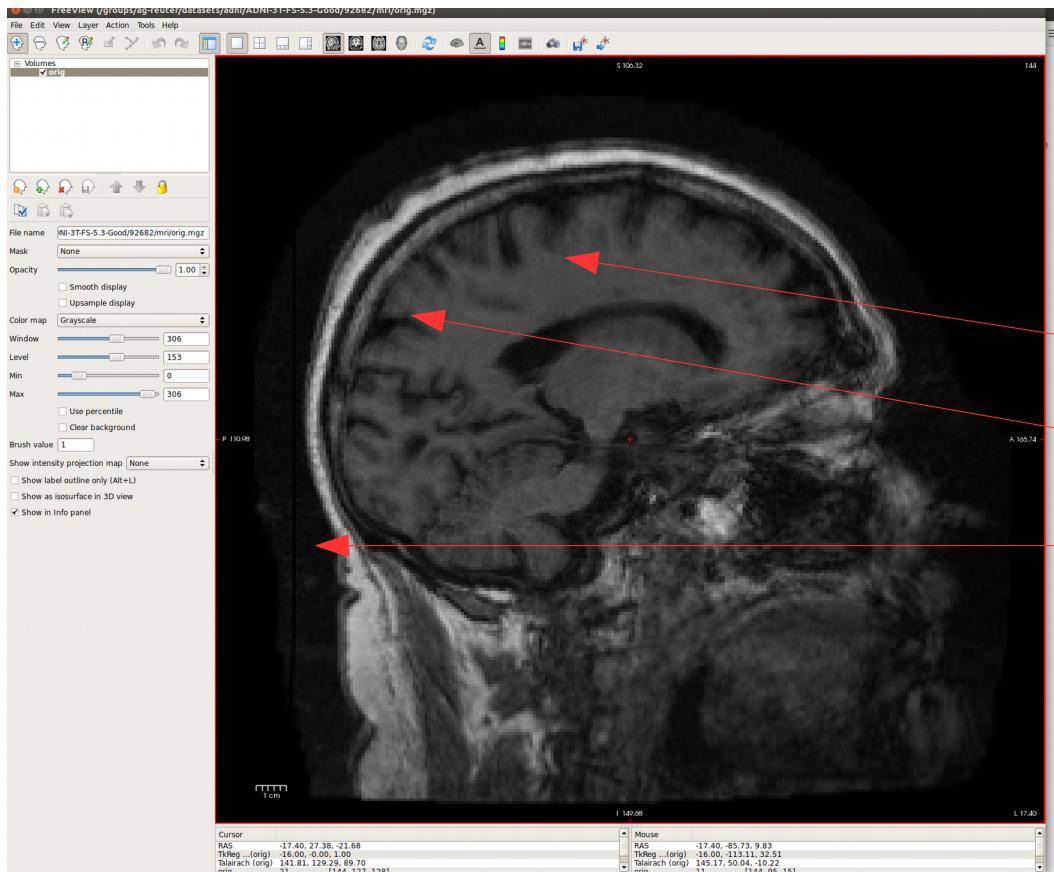
Results: Number defects

Number of defects detected: Arbitrary limit

- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-defects-scatter-limits.html>
 - [Interactive Plot](#)



Results: Number defects

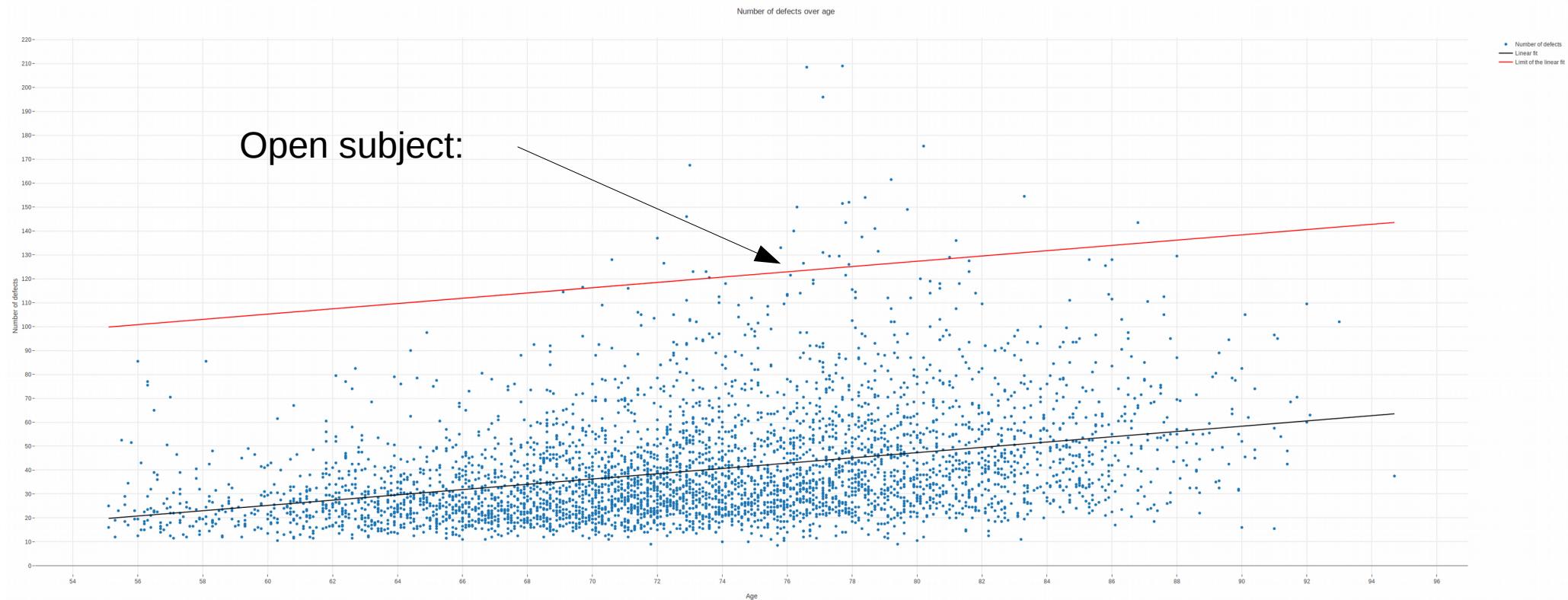


- **freeview /groups/ag-reuter/datasets/adni/AD NI-3T-FS-5.3-Good/92682/mri/orig.mgz**
- **No WM/GM contrast**
- **“Ringing” lines**
- **Full vertical line**

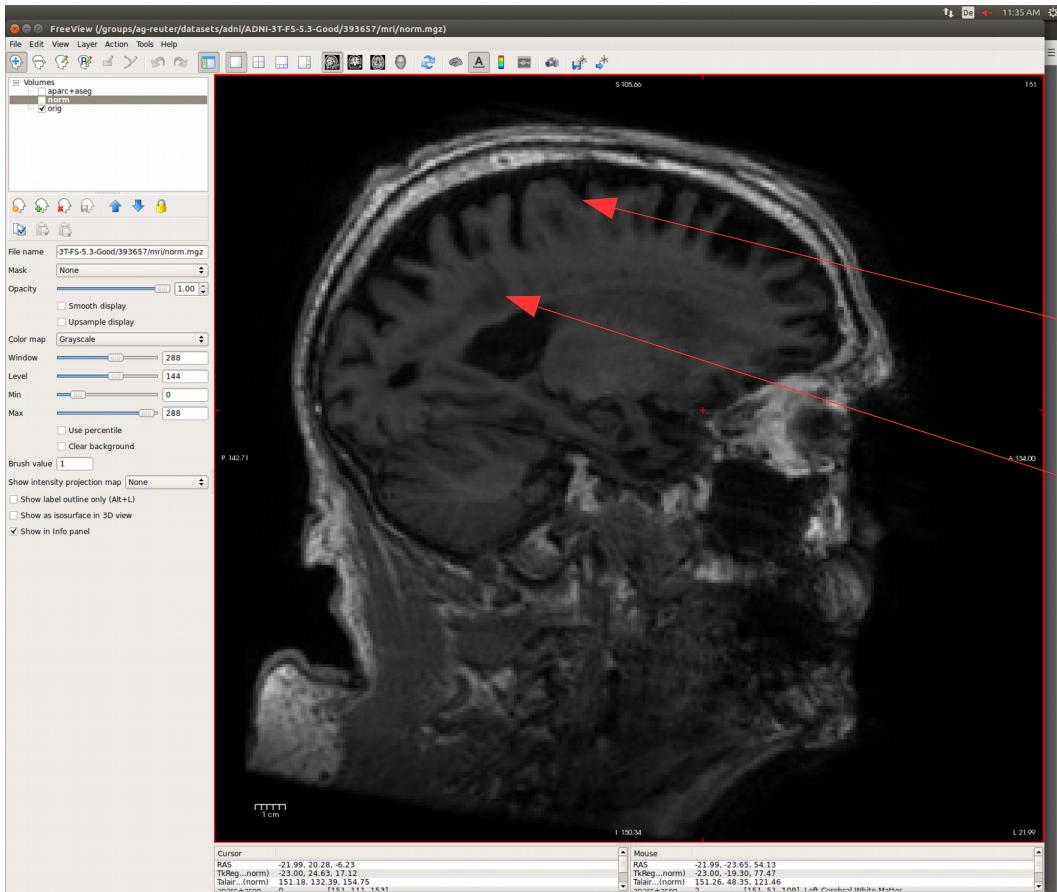
Results: Number defects

Number of defects detected: Arbitrary limit

- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-defects-scatter-limits.html>
 - [Interactive Plot](#)



Results: Number defects



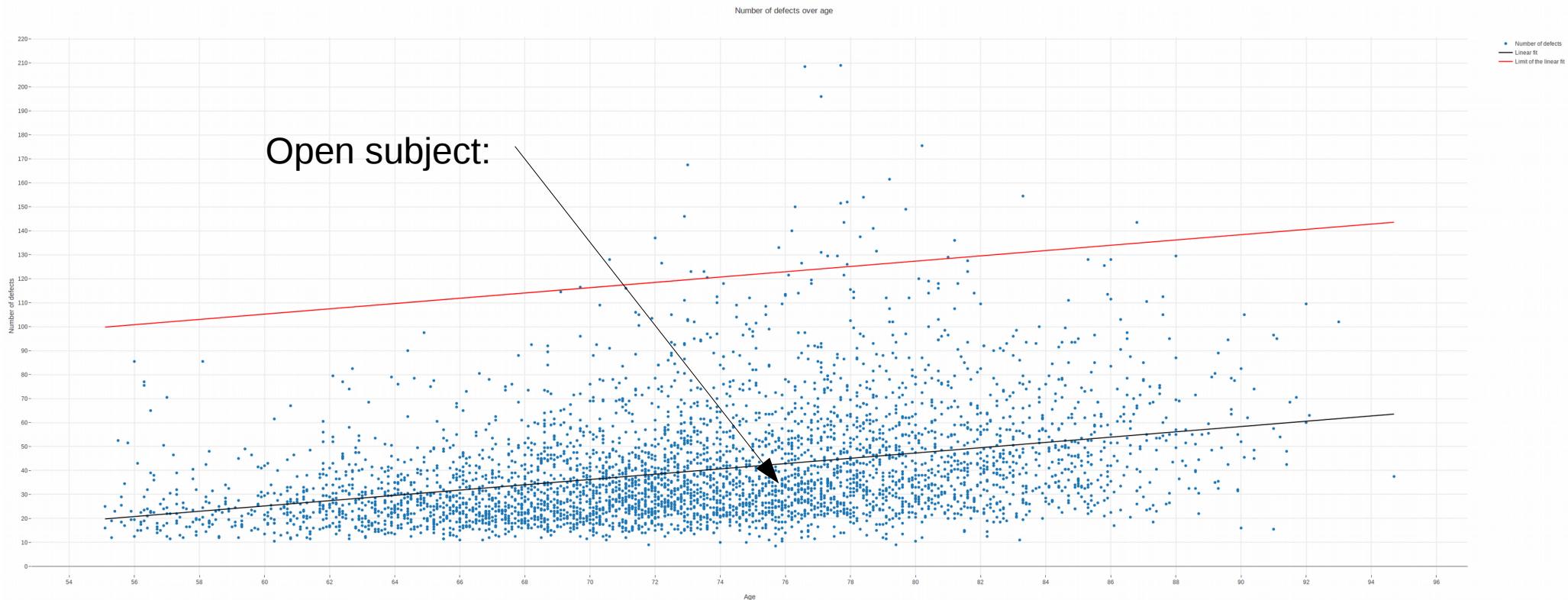
freeview /groups/ag-reuter/datasets/adni/ADNI-3T-FS-5.3-Good/393657/mri/orig.mgz

- **Poor WM/GM Contrast**
- **WM Lesion**

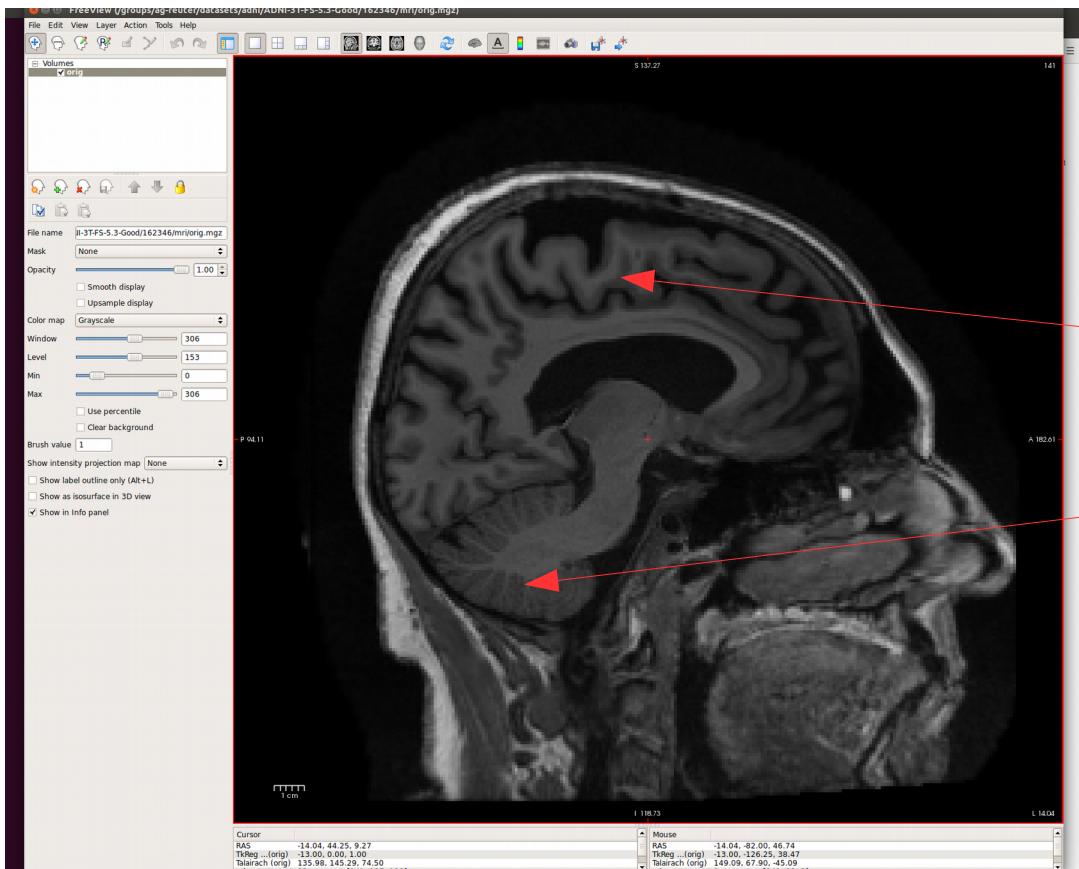
Results: Number defects

Number of defects detected: Arbitrary limit

- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-defects-scatter-limits.html>
- **Interactive Plot**



Results: Number defects



- **freeview /groups/ag-reuter/datasets/adni/AD NI-3T-FS-5.3-Good/162346/mri/orig.mgz**
- **Very good WM/GM contrast**
- **Even the cerebellum very sharp**

Problems: WM lesion: illness biasing metrics?

- Interactive Plot
- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-illness-defects-scatter.html>



Possible other factors: Sex?

- Interactive Plot
- <file:///groups/ag-reuter/projects/adni-qc/qc-presentation/age-sex-defects-scatter.html>



Conclusion

- **No big difference whether SNR is computed on norm.mgz or orig.mgz**
- **Useful metrics:**
 - Number of defects/Number of holes/Topological fixing time: Blurriness, motion artifacts
 - Contrast to Noise ratio/Gray Matter SNR: Match well with the actual GM/WM contrast

Conclusion

- **Not very useful for QC:**
 - WM SNR: Matches more with Hypointensities, rather than bad quality
 - Relative Volume of Corpus callosum: Does not match with false segmentation
 - Segmentation outliers: outliers segmentation not due to a false segmentation

Discussion: What to do next?

- **How to define a bad quality?**
 - Thresholds: Limit the false negative or the false positive
 - Thresholds based on standard deviations
- **Which other metrics useful (MRI QC):**
 - Foreground-background energy ration
 - Goodness of fit of air mask to χ^2 distribution
- **Shape analysis**