Output Folder Structure

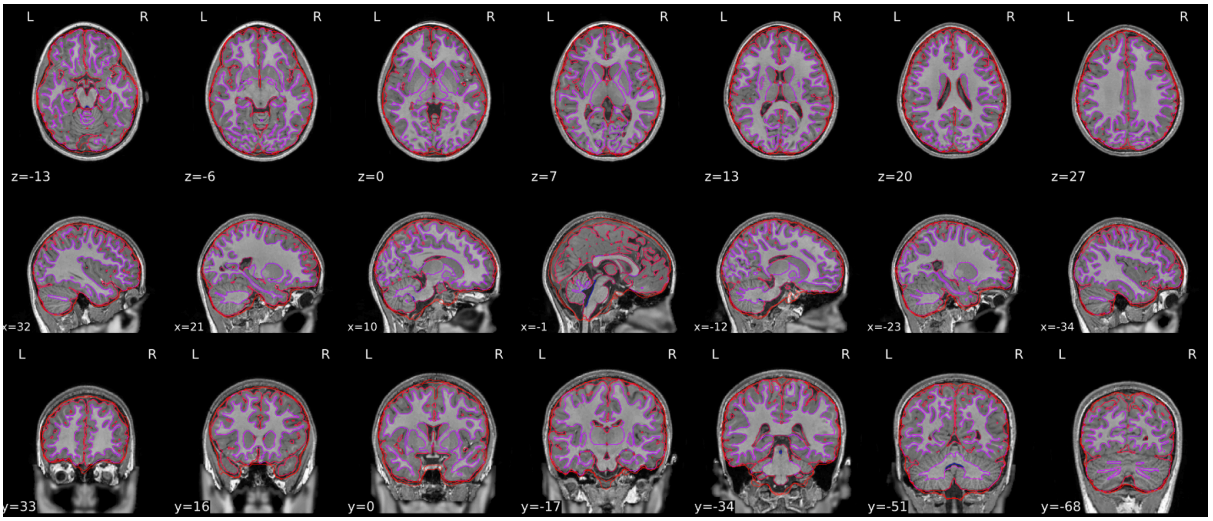
```
Result_dir
├── dataset_description.json
├── dwiqc.json
├── sub-01.html
├── sub-02.html
└── logs
    ├── CITATION.html
    ├── CITATION.md
    ├── CITATION.tex
└── sub-01
    ├── anat
    │   └── sub-01_desc-aseg_dseg.nii.gz
    │   └── sub-01_desc-brain_mask.nii.gz
    │   └── sub-01_desc-preproc_T1w.nii.gz
    │   └── sub-01_dseg.nii.gz
    │   └── sub-01_from-MNI152NLin2009cAsym_to-T1w_mode-image_xfm.h5
    │   └── sub-01_from-T1w_to-MNI152NLin2009cAsym_mode-image_xfm.h5
    │   └── sub-01_from-T1wACPC_to-T1wNative_mode-image_xfm.mat
    │   └── sub-01_from-T1wNative_to-T1wACPC_mode-image_xfm.mat
    ├── figures
    │   └── sub-01_seg_brainmask.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_carpetplot.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_coreg.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_desc-resampled_b0ref.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_desc-sdc_b0.svg
    │   └──sub-01_ses-HBNsiteRU_acq-64dir_dwi_denoise_ses_HBNsiteRU_acq_64dir_dwi_wf_denoising.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_final_denoise_wf_biascorr.svg
    │   └── sub-01_ses-HBNsiteRU_acq-64dir_sampling_scheme.gif
    │   └── sub-01_t1_2_mni.svg
    ├── log
    ├── ses-HBNsiteRU
    │   └── anat
    │   │   └── sub-01_ses-HBNsiteRU_acq-HCP_from-orig_to-T1w_mode-image_xfm.txt
    │   └── dwi
    │   │   └── sub-01_ses-HBNsiteRU_acq-64dir_confounds.tsv
    │   │   └── sub-01_ses-HBNsiteRU_acq-64dir_desc-ImageQC_dwi.csv
    │   │   └── sub-01_ses-HBNsiteRU_acq-64dir_desc-SliceQC_dwi.json
    │   │   └── sub-01_ses-HBNsiteRU_acq-64dir_dwiqc.json
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-brain_mask.nii.gz
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-eddy_cnr.nii.gz
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-preproc_dwi.b
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-preproc_dwi.bval
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-preproc_dwi.bvec
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-preproc_dwi.nii.gz
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_desc-preproc_dwi.txt
    │   │   └──sub-01_ses-HBNsiteRU_acq-64dir_space-T1w_dwiref.nii.gz
└── sub-02
```

HTML Output Interpretation

QSIPrep – Preprocessing pipeline for Diffusion MRI ← More information!

Anatomical data processing

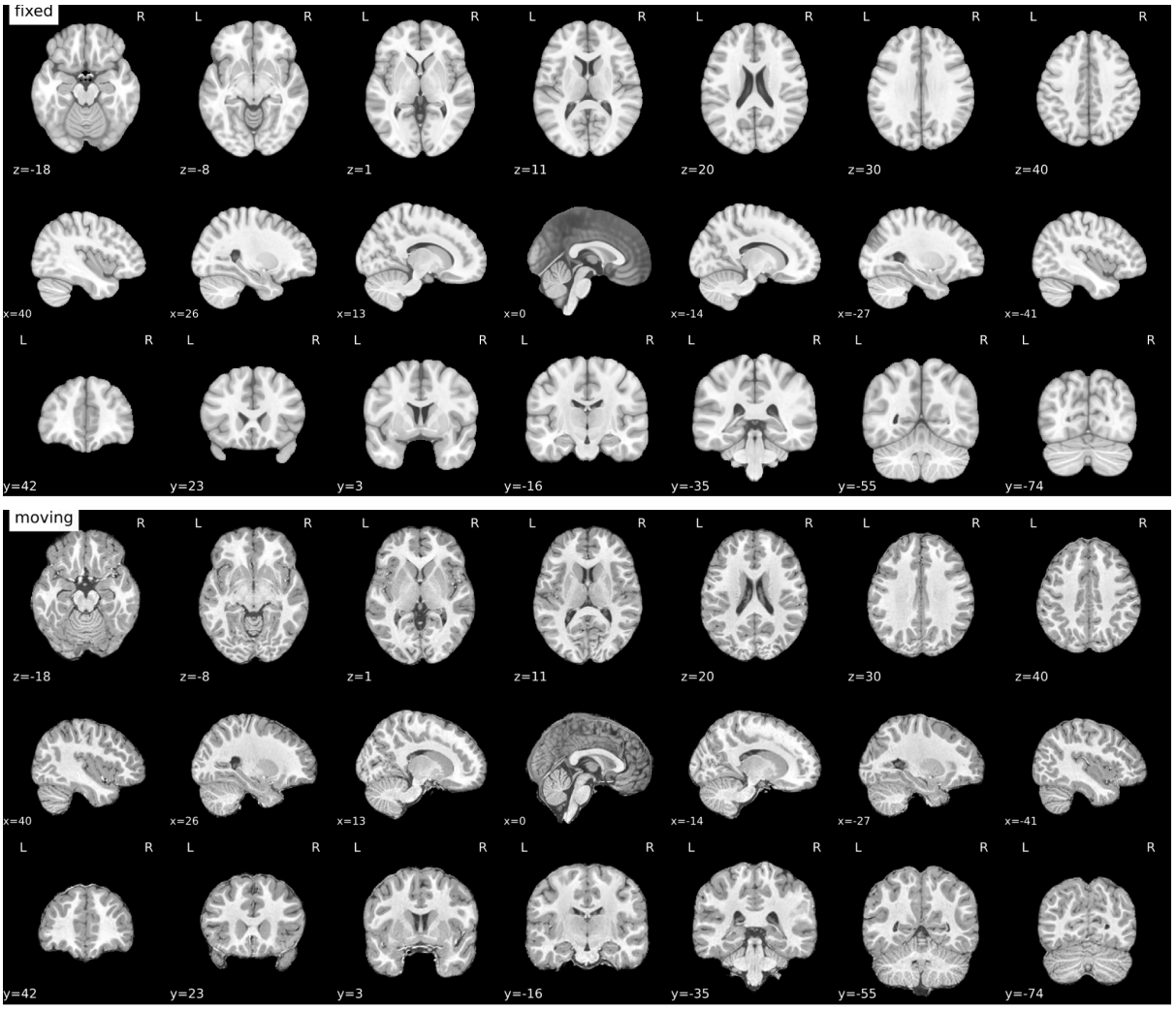
Brain Mask & Tissue segmentation of T1w



QSIprep uses anatomical images (T1w or T2w) for robust brain extraction with SynthStrip from FreeSurfer. Visual inspection of the brain extraction process should focus on ensuring that no parts of the brain were accidentally removed and voxels outside the brain were successfully excluded from the brain mask.

QSIprep uses the tool SynthSeg from FreeSurfer to estimate probability tissue maps for cerebrospinal fluid (CSF), gray and white matter. The boundaries between tissues are highlighted so it can be verified that the segmentation is precise and there were no gross errors.

T1w to MNI registration

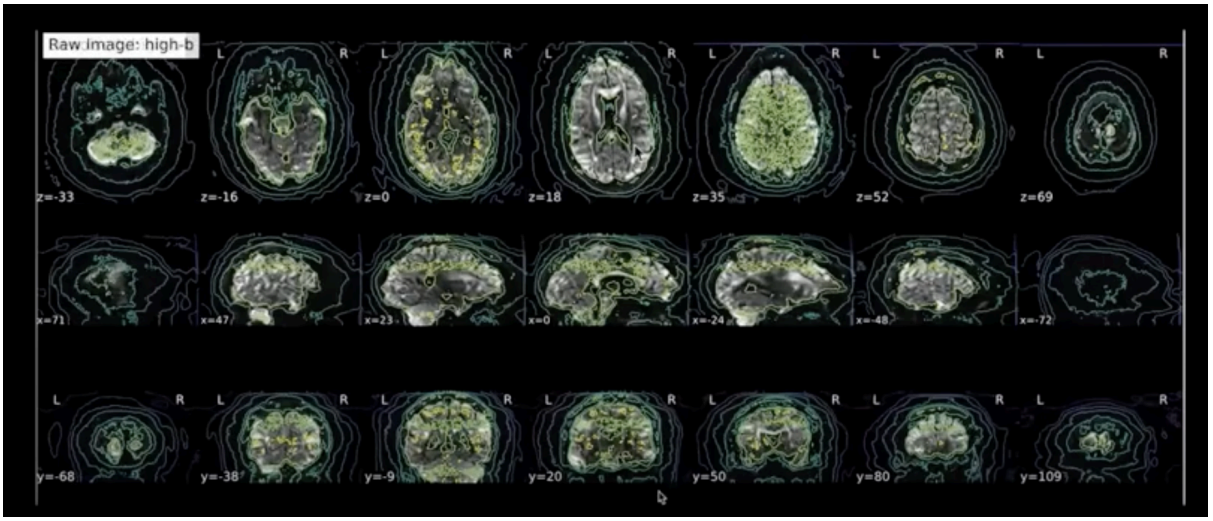


Optionally, QSIprep also normalizes the anatomical image and provides a registration matrix that can be used to normalize the co-registered dMRI image. The html contains an animation that can be used to verify that registration worked, ensuring that moving images match the orientation of fixed images and the anatomical structures are well-aligned.

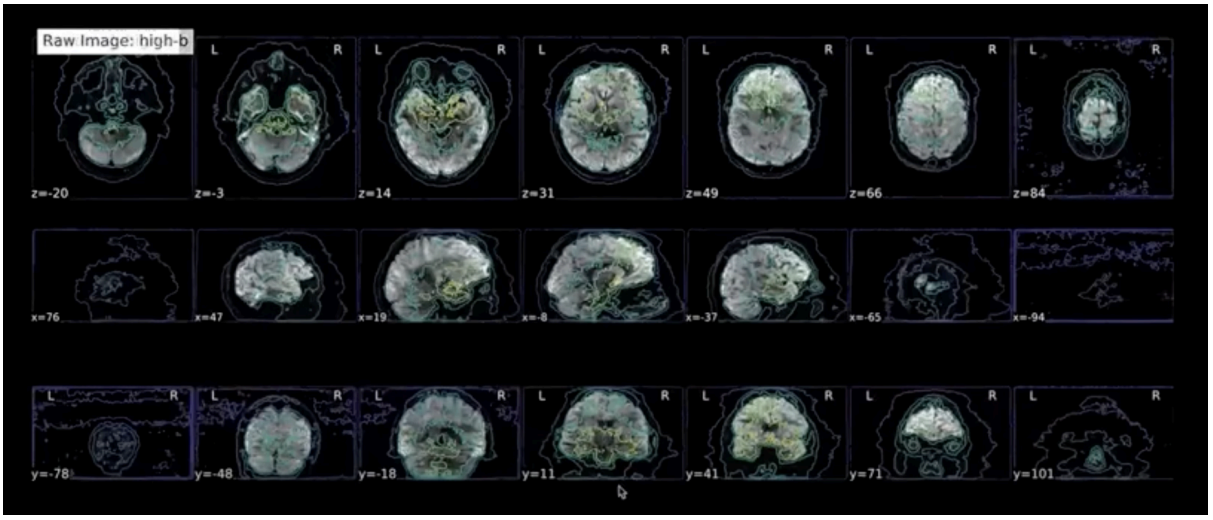
Denoising

DWI MP-PCA Denosing

bad example (overfit):

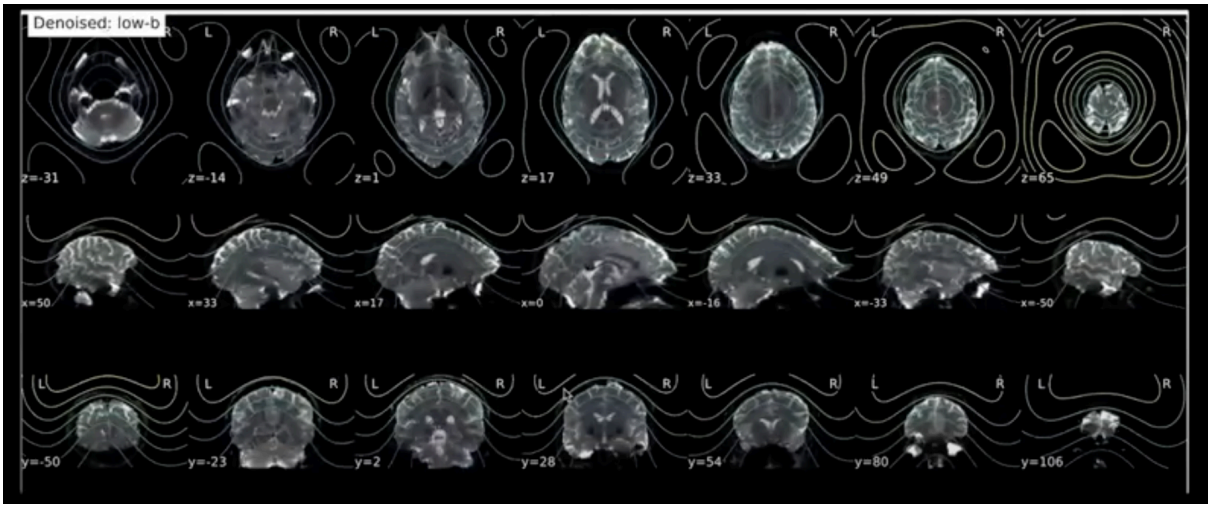


good example:



The contour map of the noise image calculated by MP-PCA patch, which shows the average magnitude of the noise that it's subtracting. The noise image should not have anatomical features in it, such as ventricles.

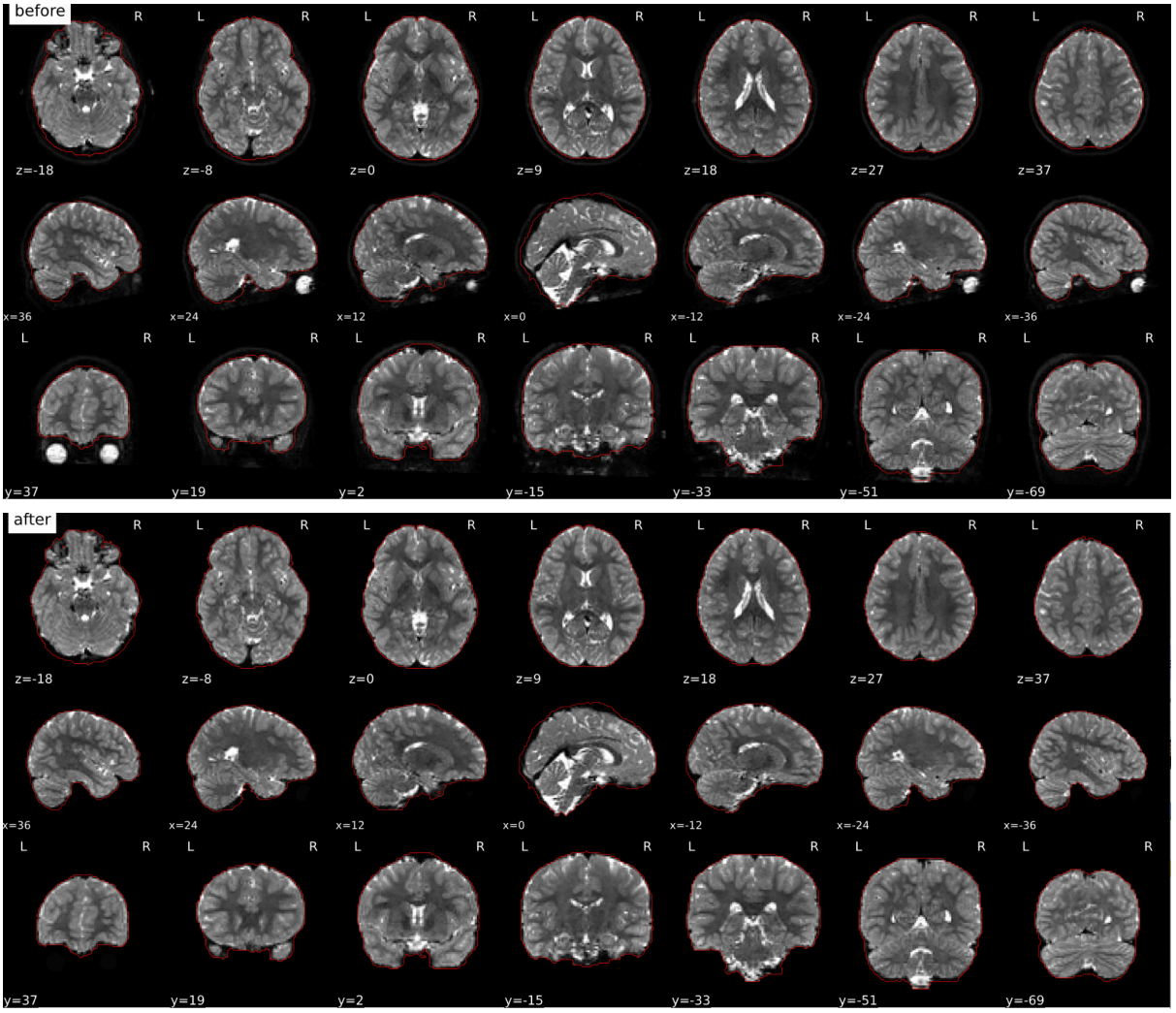
Bias Field Correction



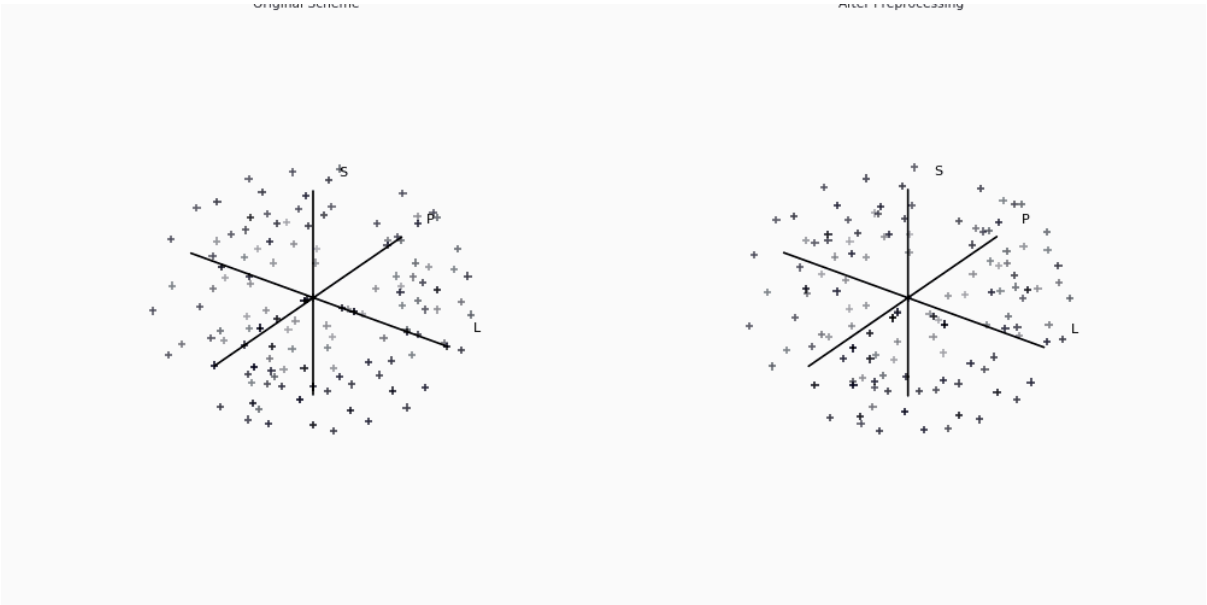
Raw image and its intensity normalized are plotted. The bias is plotted as a contour map. Compared to the raw image: low-b, the denoised image might have higher intensity near the coil, and lower intensity at the middle of the brain. The denoised image should have a more normalized image across the slices.

Diffusion data processing

b=0 Reference Image

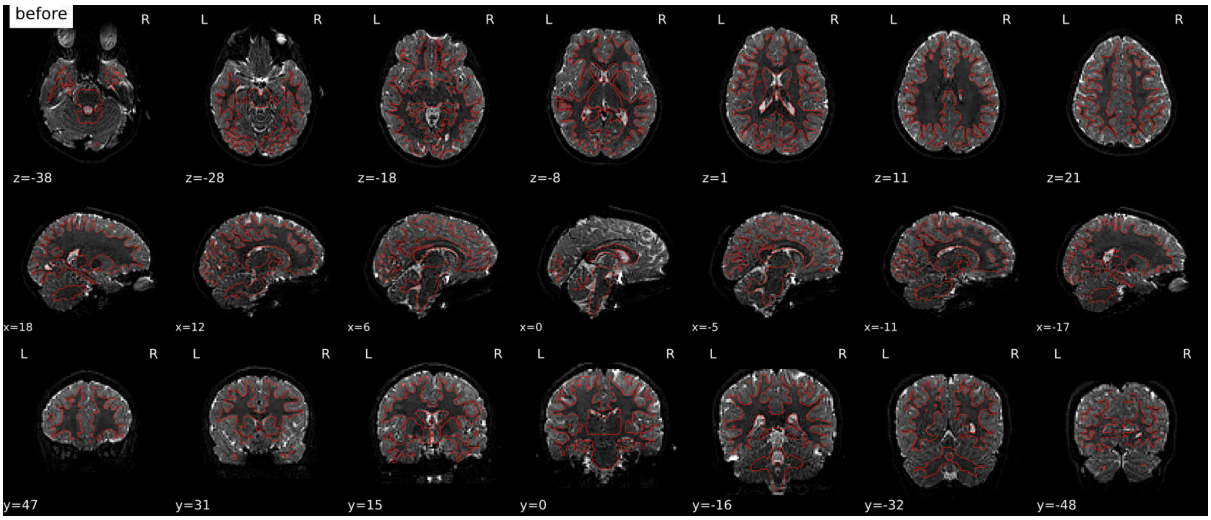


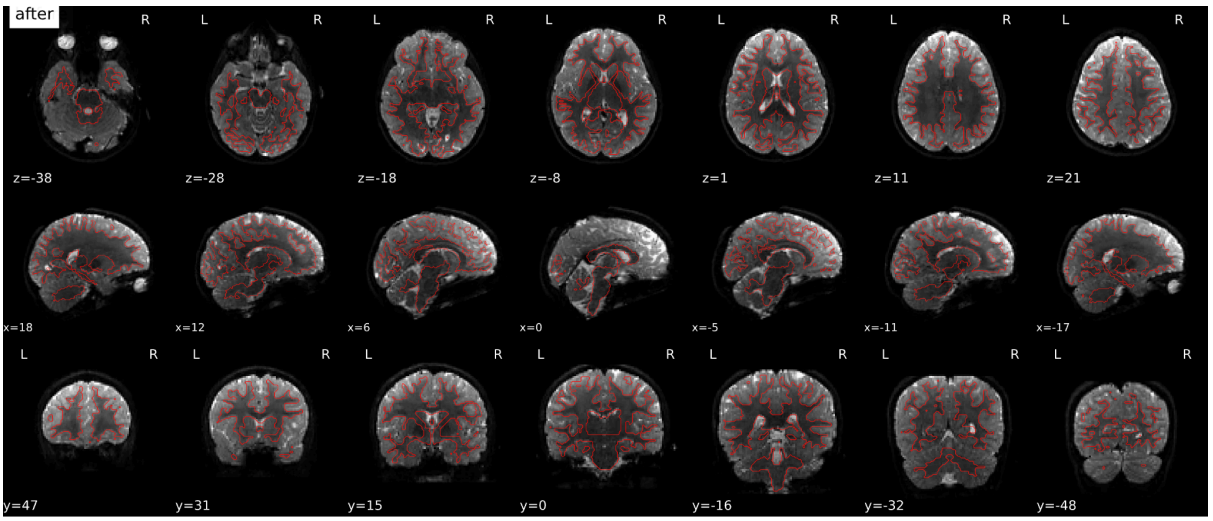
DWI Q-space sampling scheme before and after correction



The gradients should be rotated during preprocessing. This animation can be used to verify that they have indeed been rotated and that the new scheme follows the appropriate direction along the main axes.

Susceptibility distortion correction (Topup)





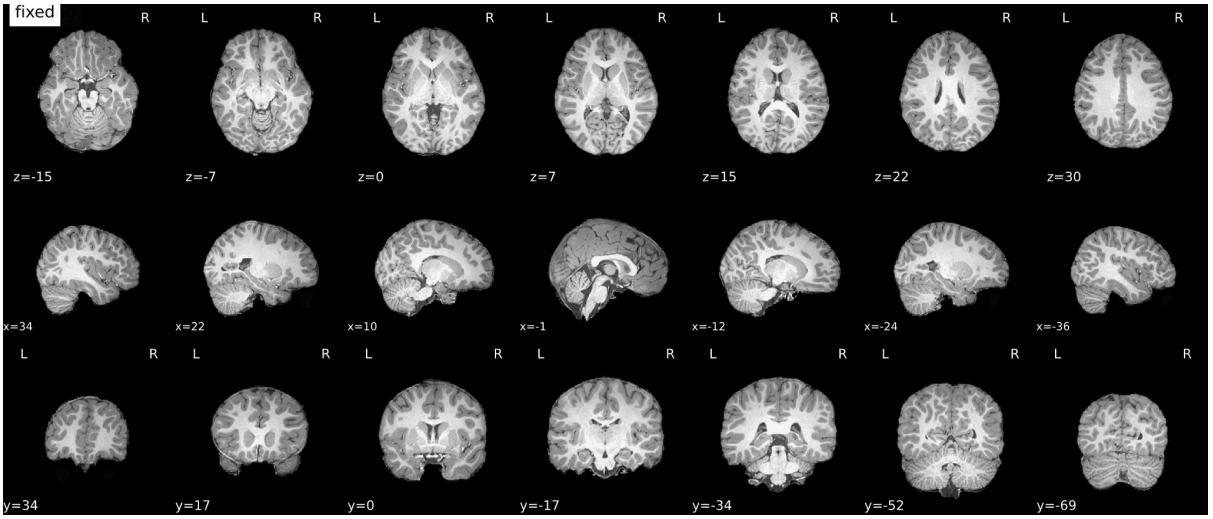
The above screenshot of the animation included in the html report shows a diffusion-weighted image before and after correcting for susceptibility distortion. The image before the correction still exhibits this distortion, but the second image should be anatomically correct, if the correction has been successfully applied.

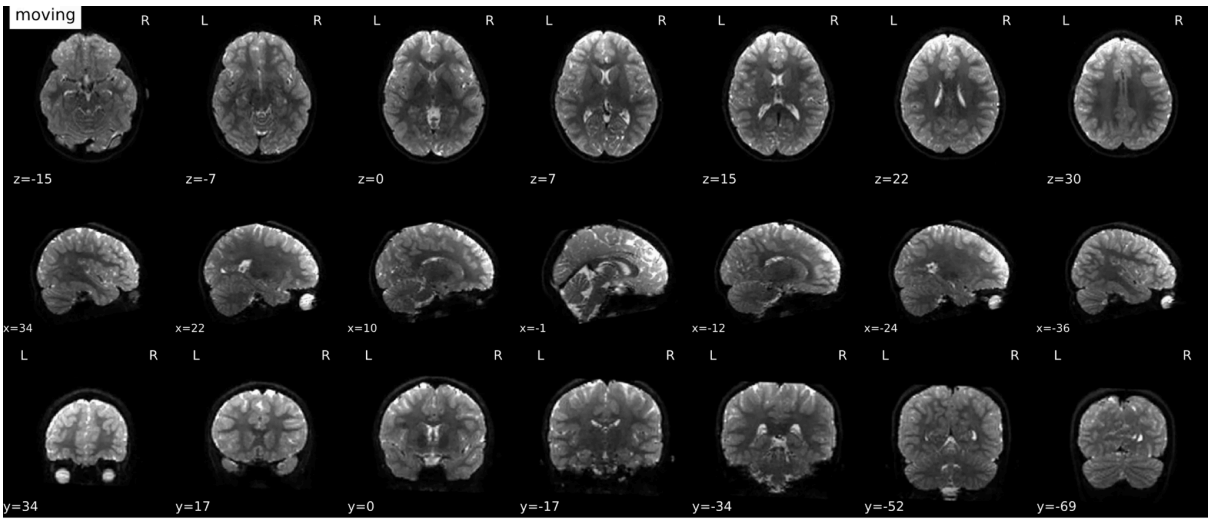
The blue contour line shows the white matter and gray matter interface from the tissue segmentation based on the T1w.

B0 magnetic field inhomogeneities can cause localized geometric distortions, which can affect subsequent analyses (e.g. tractography), rendering them unreliable.

There are different approaches to correct for this distortion. QSIprep offers three possibilities. When two or more echo-planar images (EPI) with opposing phase-encoding polarities are available, QSIprep can use TOPUP from FSL along with eddy current and head motion correction.

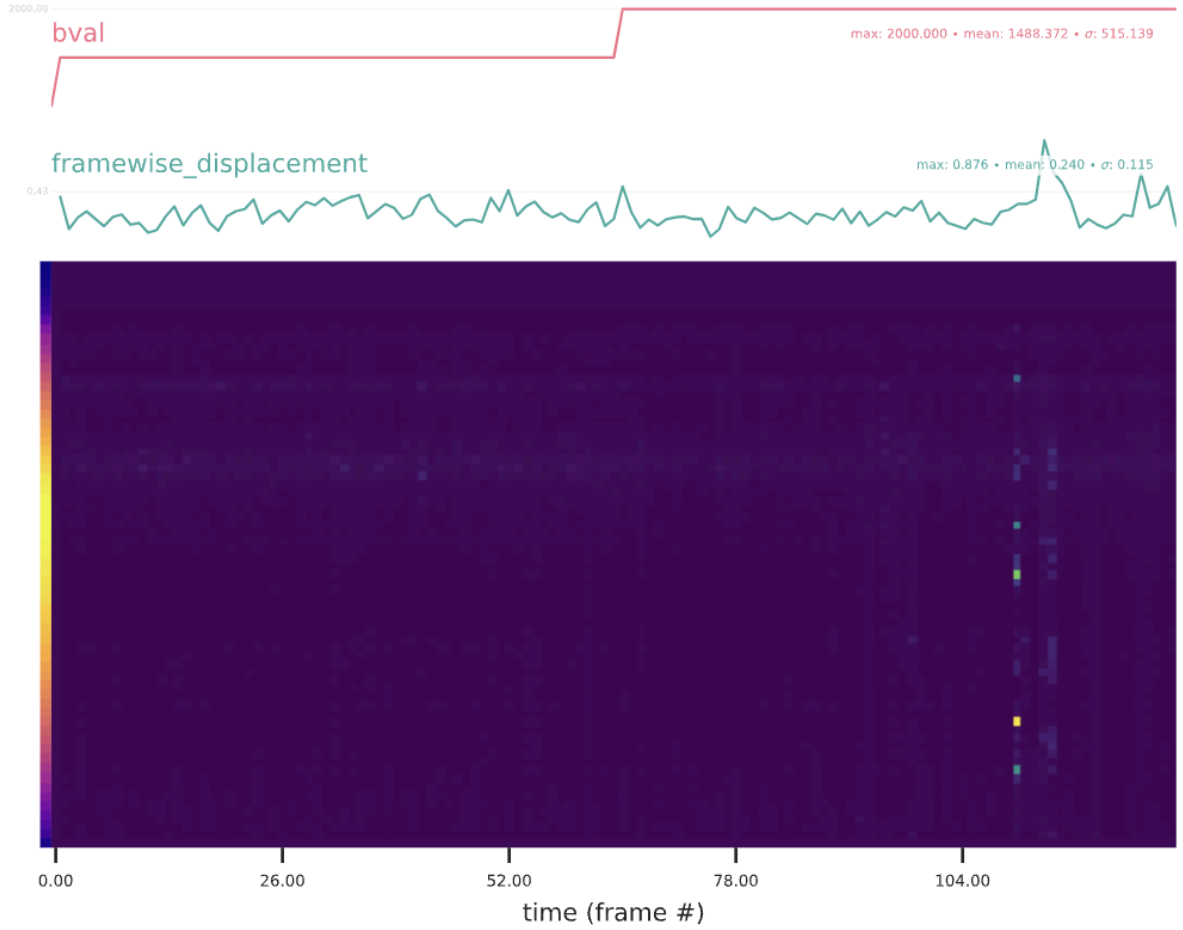
b=0 to anatomical reference registration





The animation shows the results of the registration from the original diffusion space of the b=0 volume to structural space. Fixed refers to the image that was used as reference (T1w) and moving refers to the image that was transformed (b=0).

DWI summary



Carpet plot is volume by time, they plot the cross-correlation or standard deviation value between each raw slice and the HMC model signal resampled into that slice.

Eddy shows the carpet plot of what is the standard deviation of the slice at a certain image number. Slices with more outliers appear more yellow, while fewer outliers is more blue

dwiqc.json

QSIPrep produces dwiqc.json files that can be used by an interactive QC tool with dmriprep viewer. You just need to put the directory to the dwiqc.json.
There is an unlisted youtube walkthrough that shows how to use this.
their repo is here: https://github.com/nipreps/dmriprep-viewer