

# Output Folder Structure

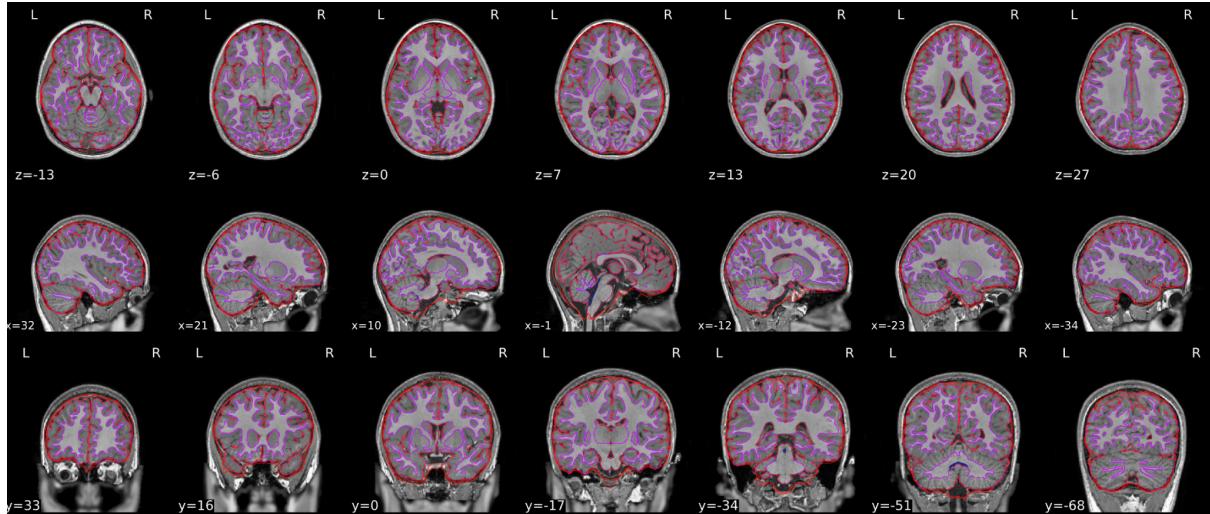
```
Result_dir
├── dataset_description.json
├── dwiqc.json
├── sub-01.html
└── sub-02.html
└── logs
    ├── CITATION.html
    ├── CITATION.md
    └── CITATION.tex
└── sub-01
    ├── anat
    │   ├── sub-01_desc-aseg_dseg.nii.gz
    │   ├── sub-01_desc-brain_mask.nii.gz
    │   ├── sub-01_desc-preproc_T1w.nii.gz
    │   ├── 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_confoundtsv
            ├── 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 [← for More information!](#)

## Anatomical data processing

### Brain Mask & Tissue segmentation of T1w

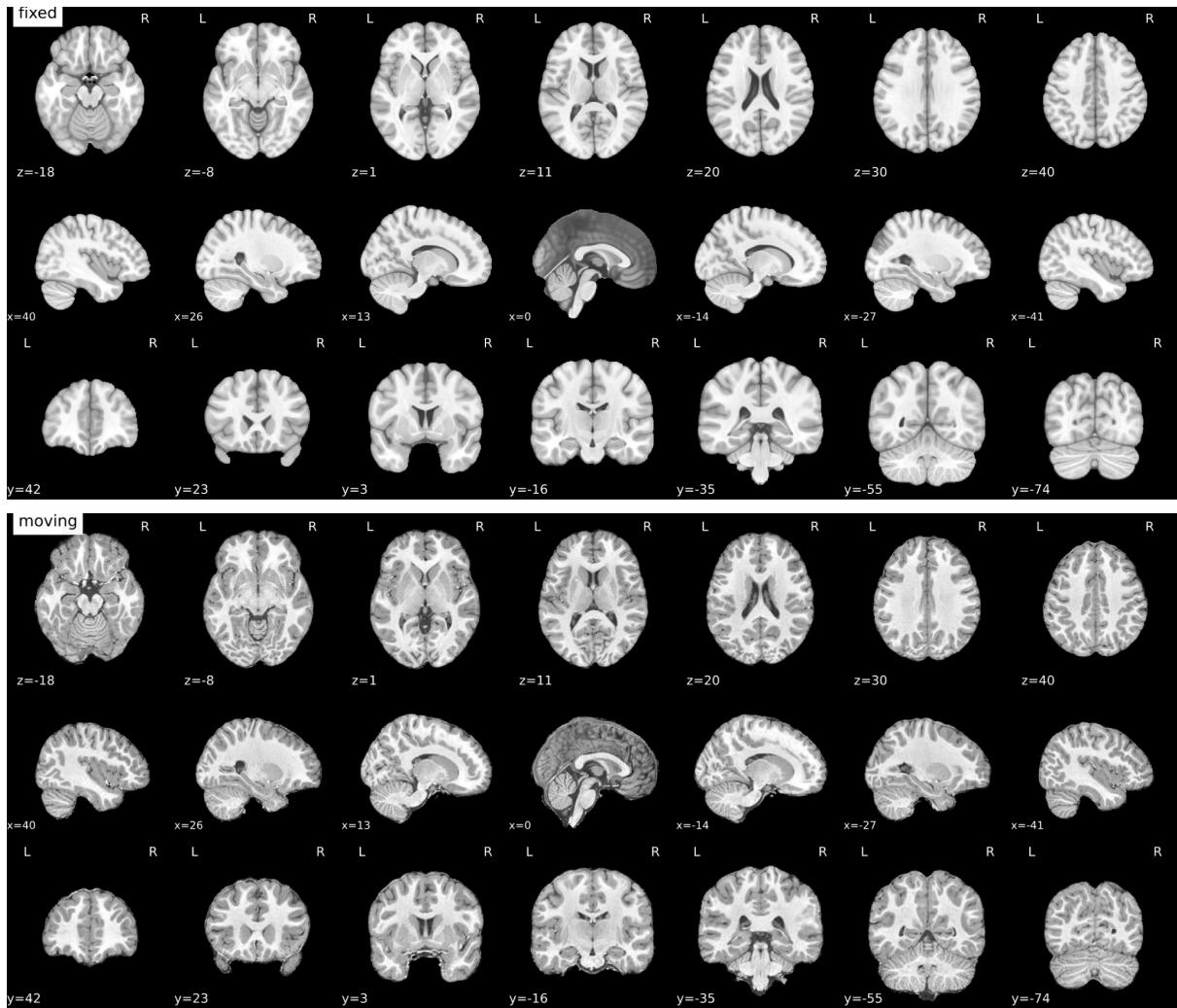


QSIPrep uses anatomical images (T1w or T2w) for robust brain extraction with SynthStrip from FreeSurfer. Visual inspection of the brain extraction process should focus on ensuring that no parts of the brain were accidentally removed and voxels outside the brain were successfully excluded from the brain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

- Brain mask: make sure the red line is going around the brain and does not stray into the dura or cut off pieces of the brain.
- Segmentation: make sure the blue line follows the boundary between the white matter and the gray matter and isn't cutting off pieces of the white matter

## T1w to MNI registration

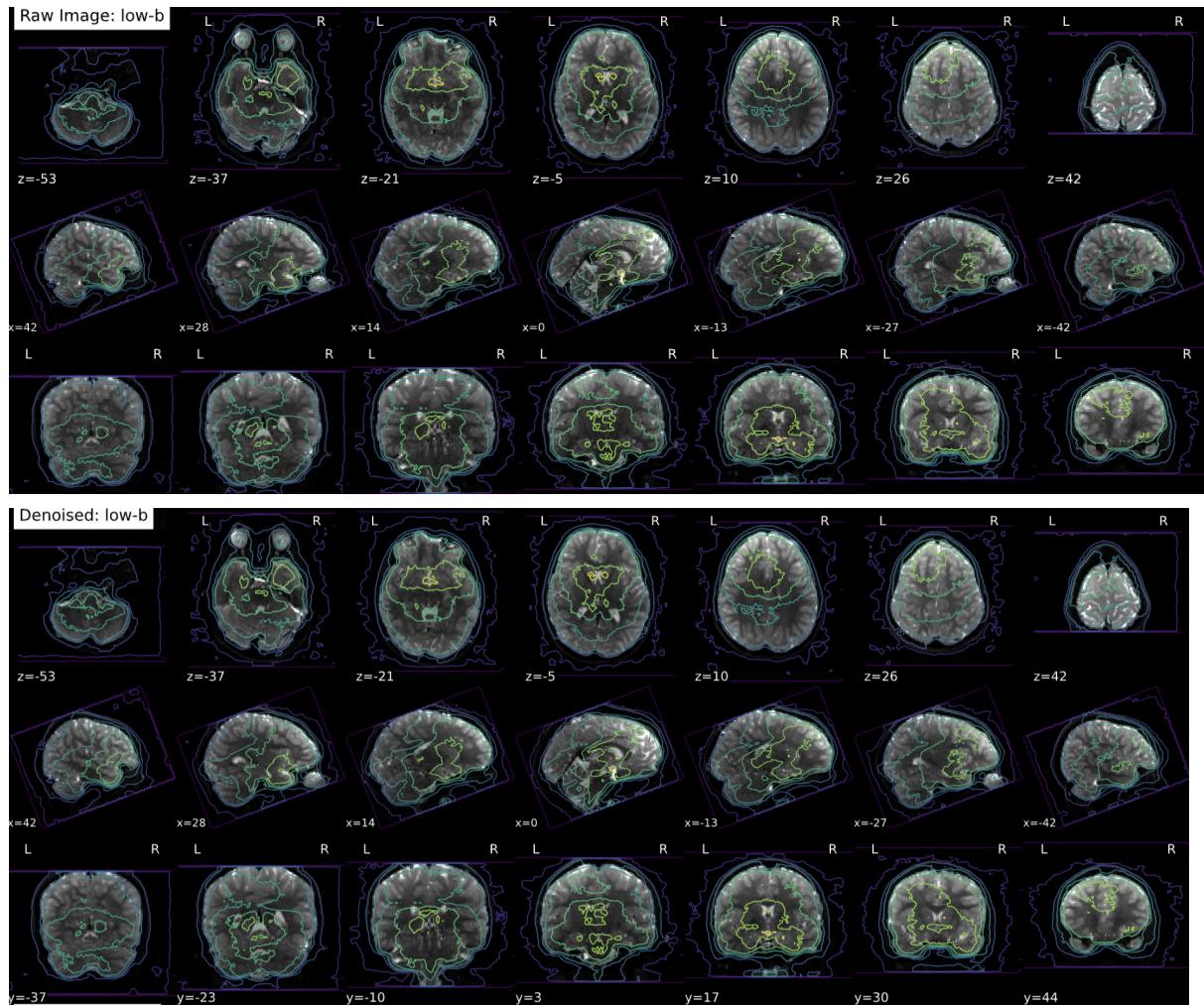


Optionally, QSIprep also normalizes the anatomical image and provides a registration matrix that can be used to normalize the co-registered dMRI image.

Ensuring that moving images match the orientation of fixed images and the anatomical structures are structurally well-aligned.

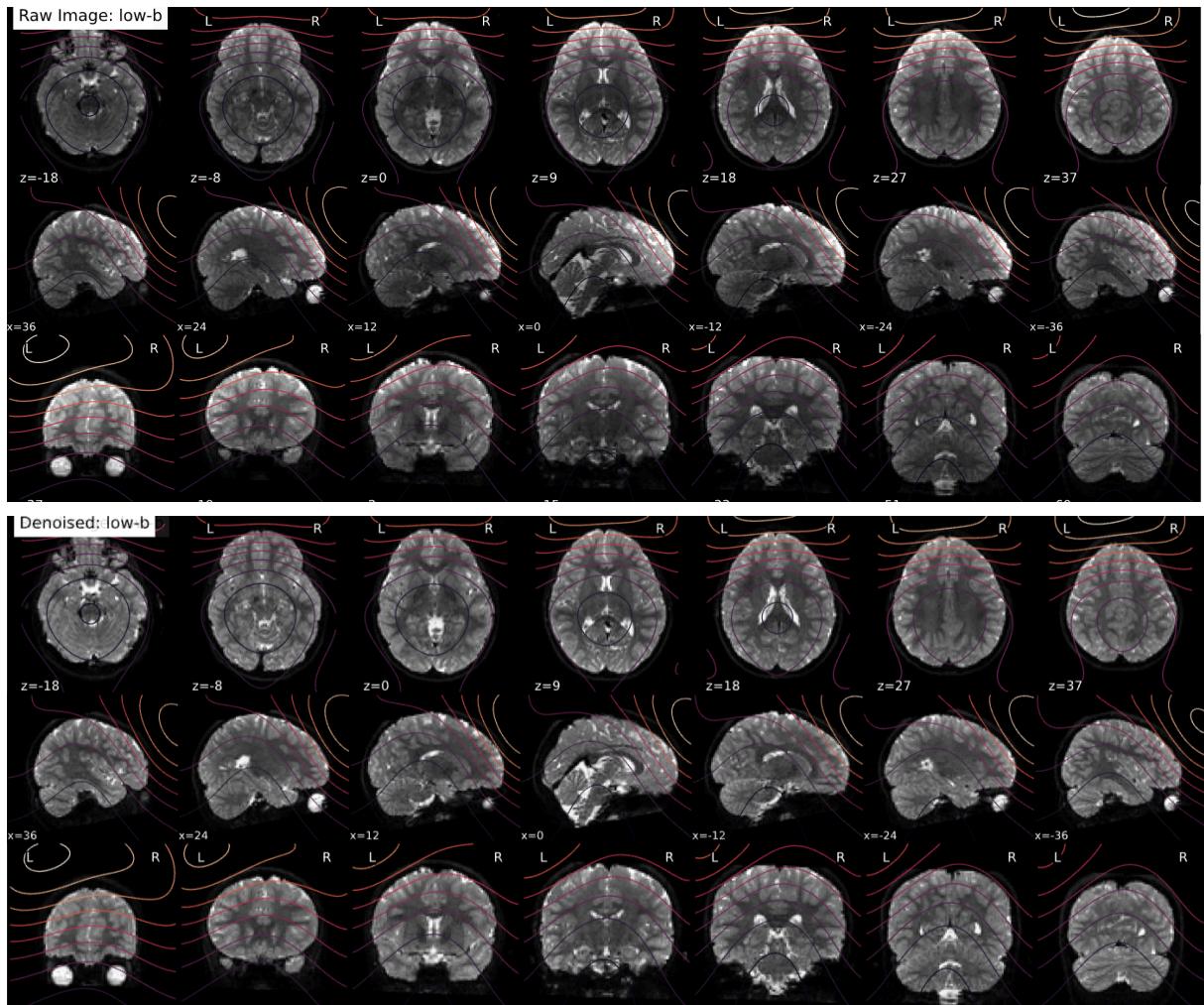
# Denoising

## DWI MP-PCA Denoising



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.

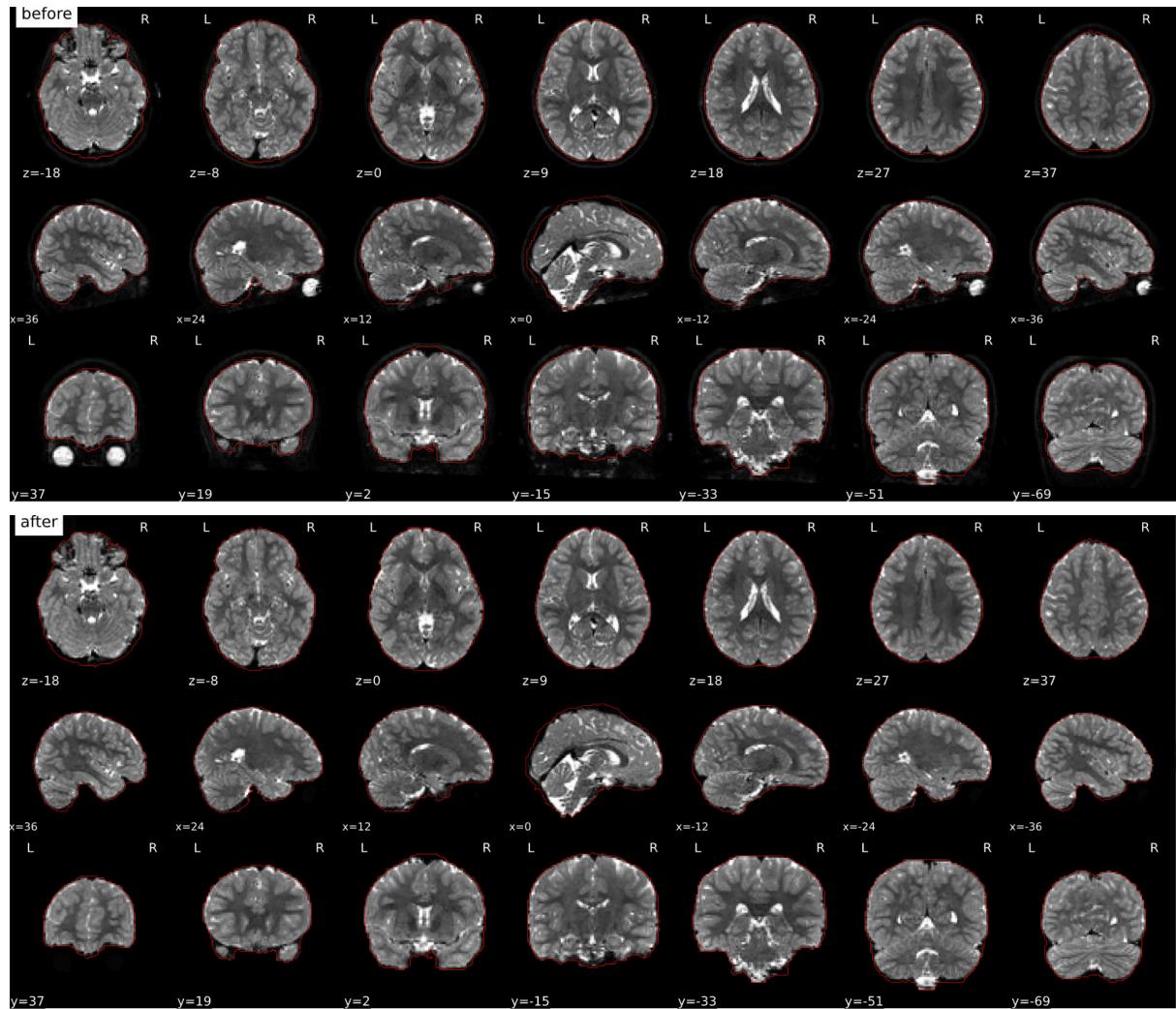
## Bias Field Correction



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.

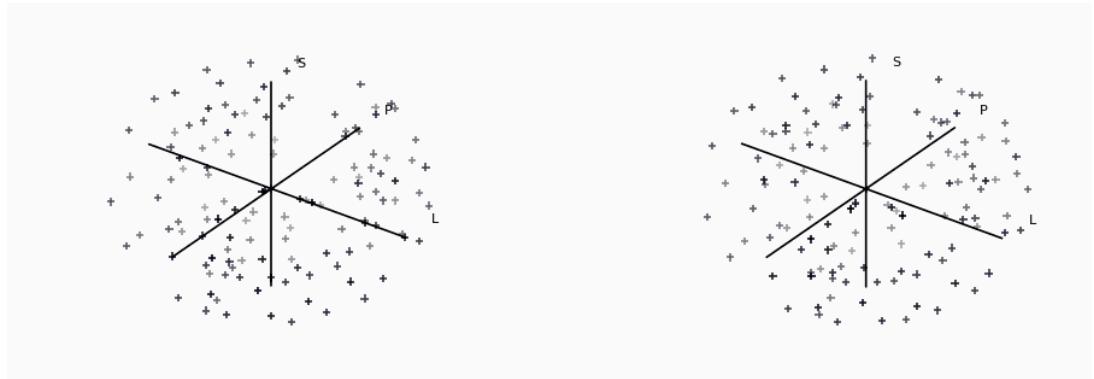
# Diffusion data processing

## b=0 Reference Image



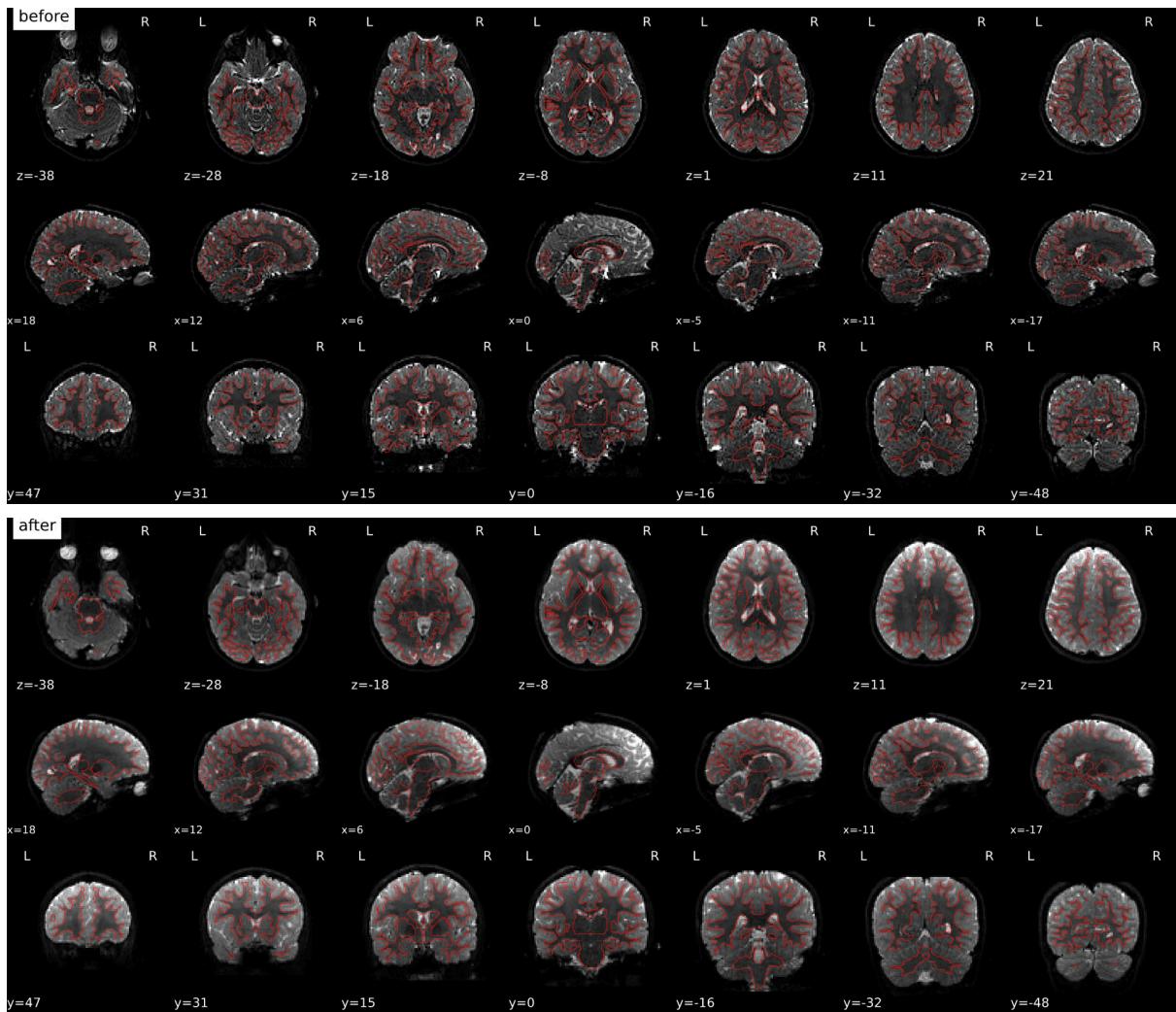
b=0 template and final mask output. The T1 and signal intersection mask is blue, their xor is red and the entire mask is plotted in cyan. You should see a good alignment after using the mask.

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)



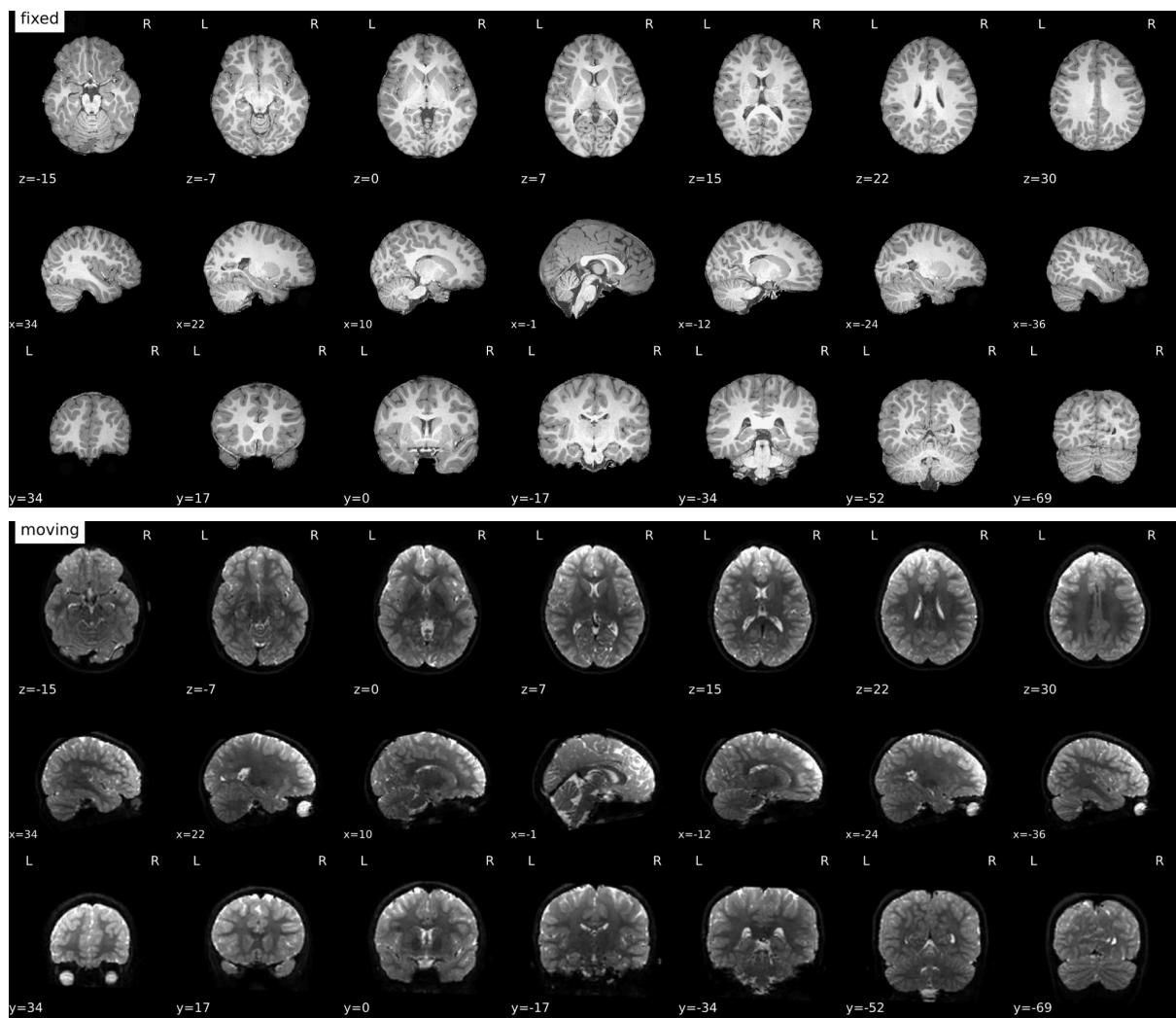
The above screenshot of the animation included in the html report shows a diffusion-weighted image before and after correcting for susceptibility distortion. The image before the correction still exhibits this distortion. The second image should be anatomically correct, if the correction has been successfully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

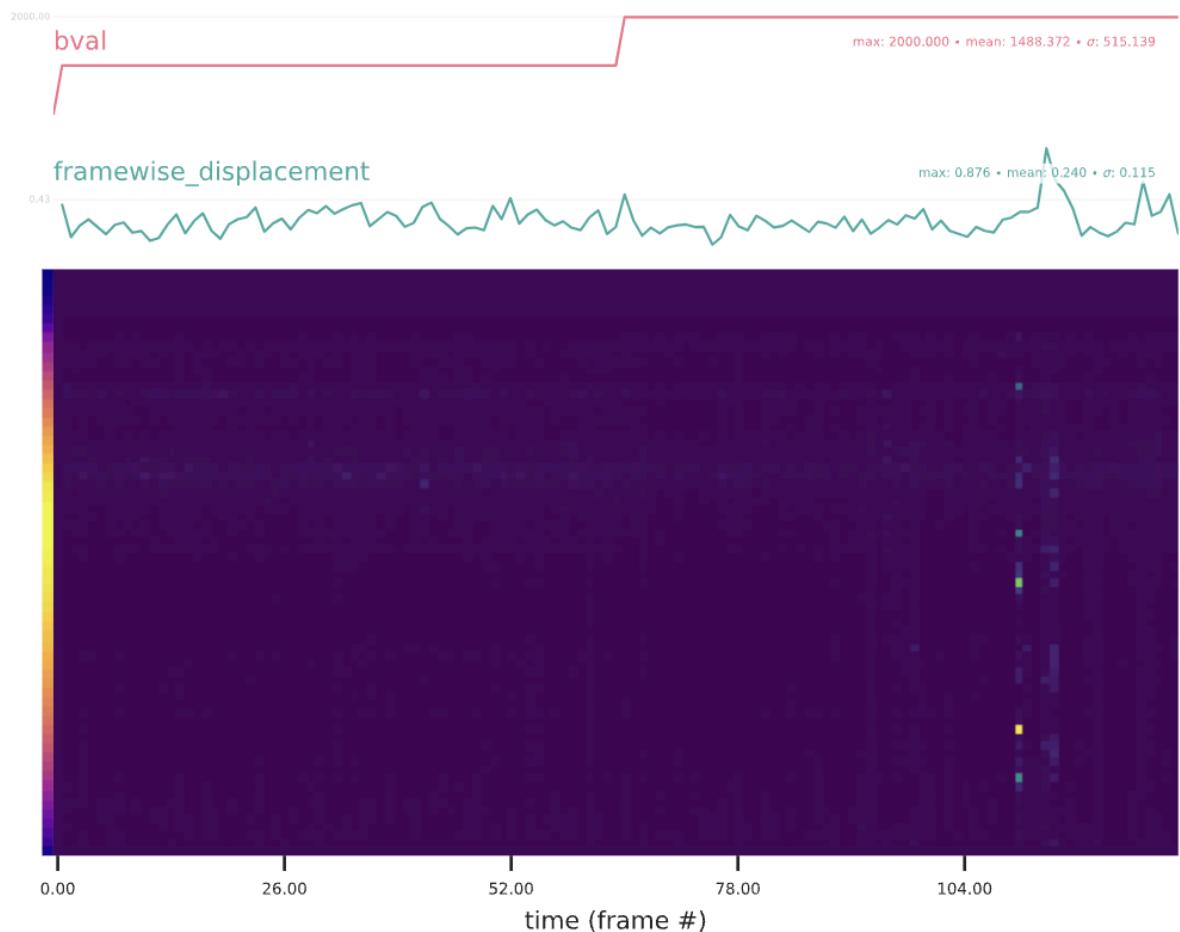
There are different approaches to correct for this distortion. QSIprep offers three possibilities. When two or more echo-planar images (EPI) with opposing phase-encoding polarities are available, QSIprep can use TOPUP from FSL along with eddy current and head motion correction.

### 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). We should see a good alignment. fix (T1w) and moving (b=0) should have different parts of the brain gaining more contrast.

## 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>