AnatQC

info@neuroinfo.org

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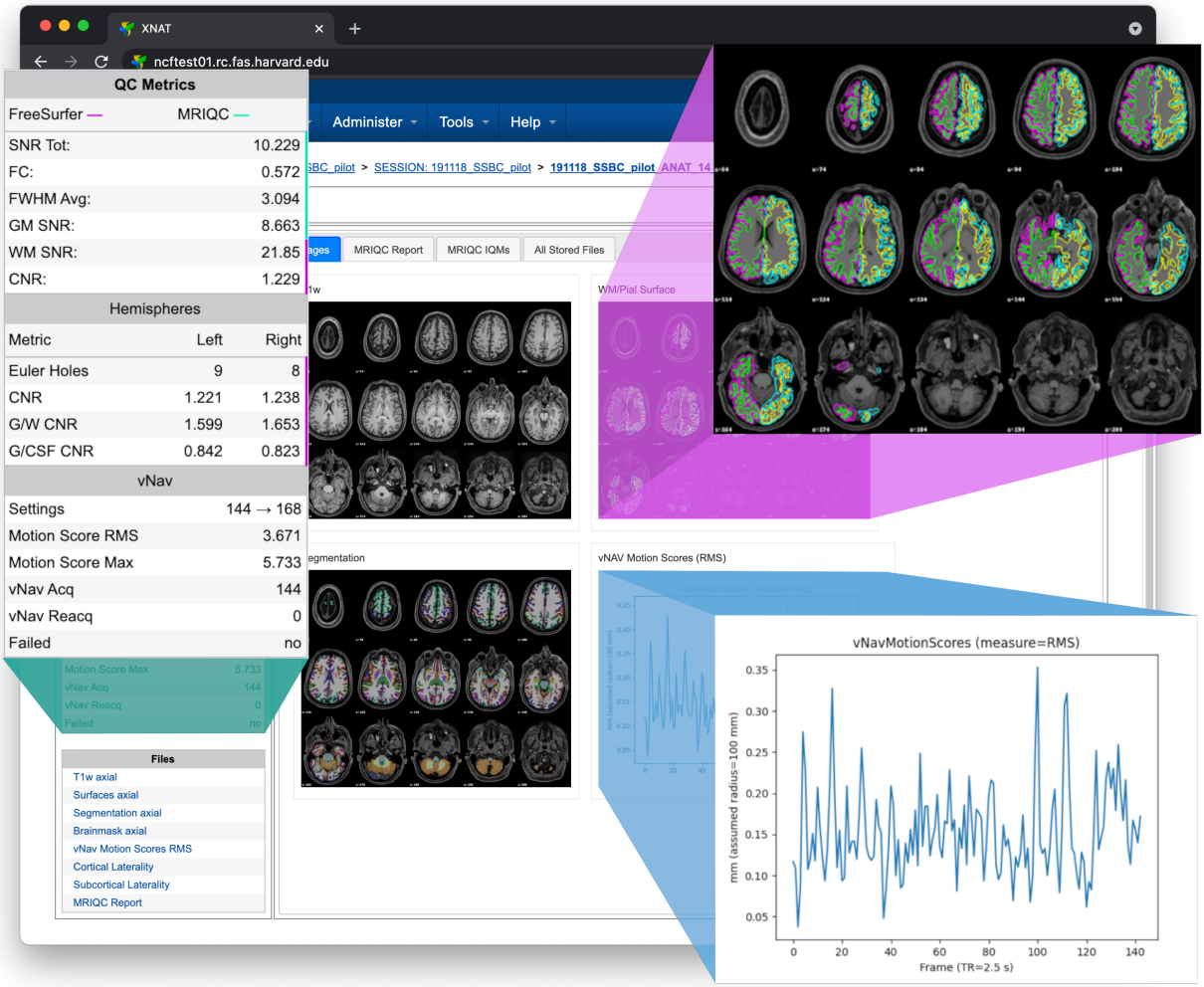
AnatQC is a high-resolution "anatomical" MRI quality control pipeline built on the FreeSurfer, MRIQC, and volumetric navigators software packages. Working closely with neuroimaging experts, we designed an ergonomic user interface for the XNAT informatics and data management platform that allows users to quickly assess image quality and use those insights to get ahead of issues within the data acquisition workflow.



CHAPTER

ONE

XNAT USER DOCUMENTATION

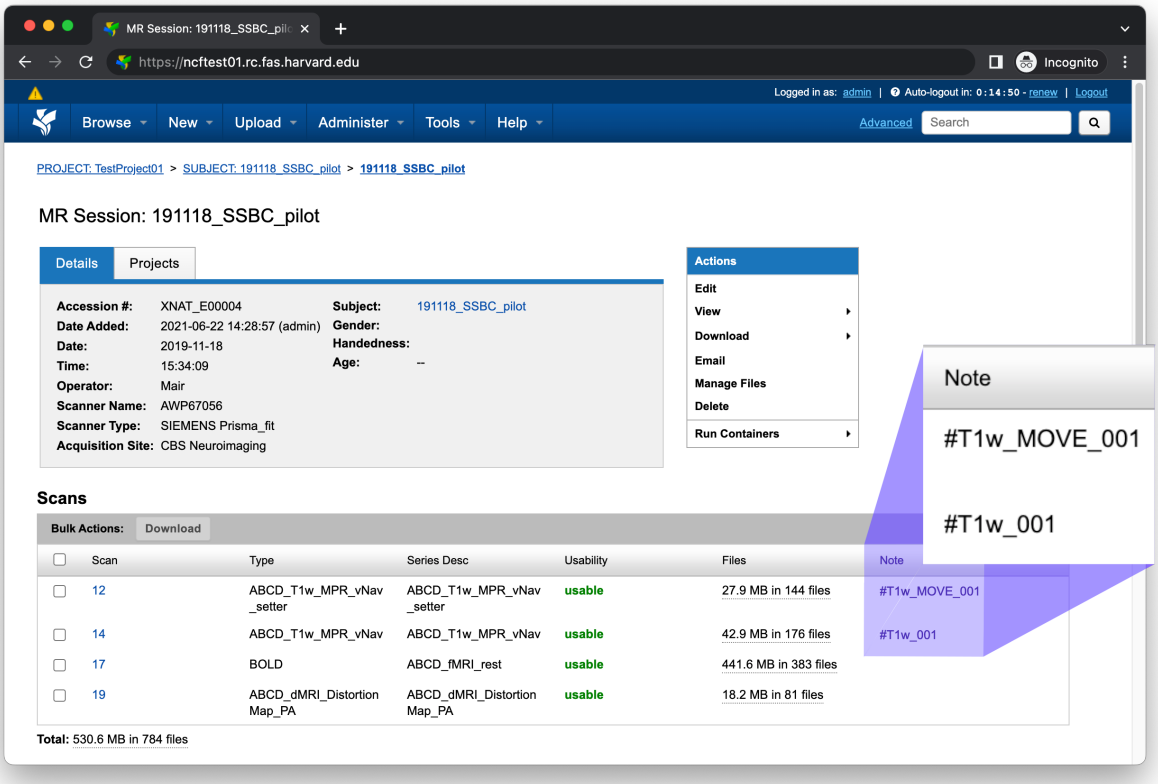
1.1 Tagging your scans

For AnatQC to discover T1w and vNav scans to process, you need to add notes to those scans in XNAT. You can add notes using the `Edit` button located within the `Actions` box on the MR Session report page

Type	Example series	Note
T1w	`ABCD_T1w_MPR_vNav`	`#T1w_001, #T1w_002, ..., #T1w_N`
vNav	`ABCD_T1w_MPR_vNav_setter`	`#T1w_move_001, #T1w_move_002, ..., #T1w_move_N`

The image below displays an MR Session report page with populated notes

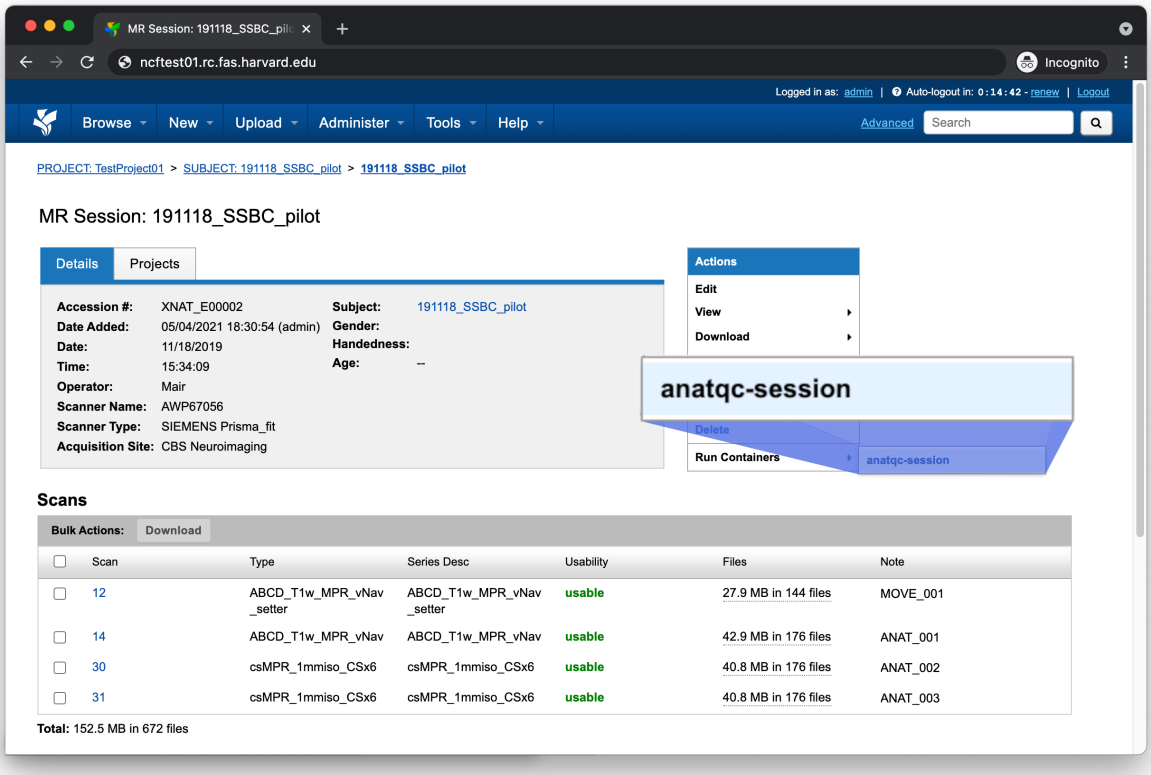
Note: Note that if a `T1w` scan has a corresponding `vNav` scan, they should be assigned matching numbers. For example, `#T1w_move_001` would correspond to `#T1w_001`.



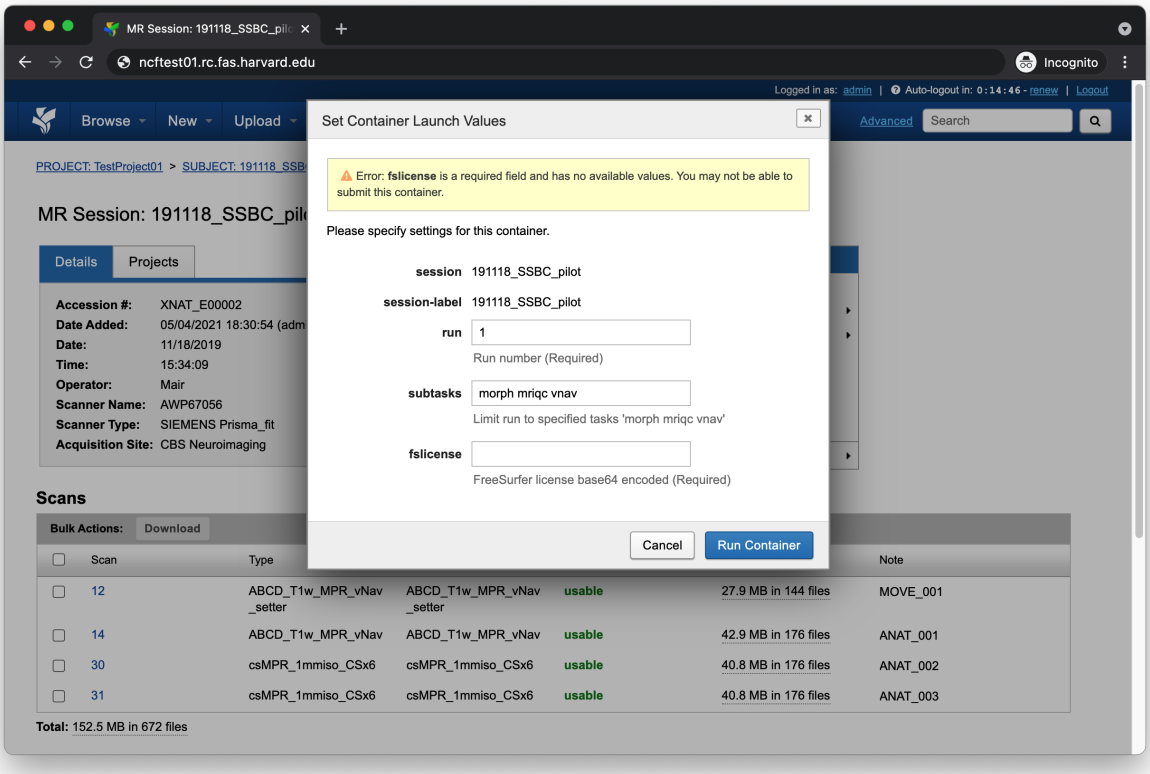
1.2 Running the pipeline

To run the AnatQC pipeline, use the `Run Containers > anatqc-session` button located within the `Actions` box on the MR Session report page

Note: If you don't see the `Run Containers` menu, please refer to Setting up the container.



This should bring up a small form with several configurable settings. Continue reading for a description of each setting



1.2.1 run

This should be set to the integer value of the scan you want to process. If there's a corresponding `move` scan, that scan will also be processed

T1w scan	run
#T1w_001	1
#T1w_002	2
#T1w_999	999

1.2.2 subtasks

Under most circumstances you'll want to leave this field set to its default value

```
morph mriqc vnav
```

1.2.3 fslicense

This field should be set to a base64 encoded FreeSurfer license. If you have a license file on a Linux or macOS machine, you can use the `openssl` command

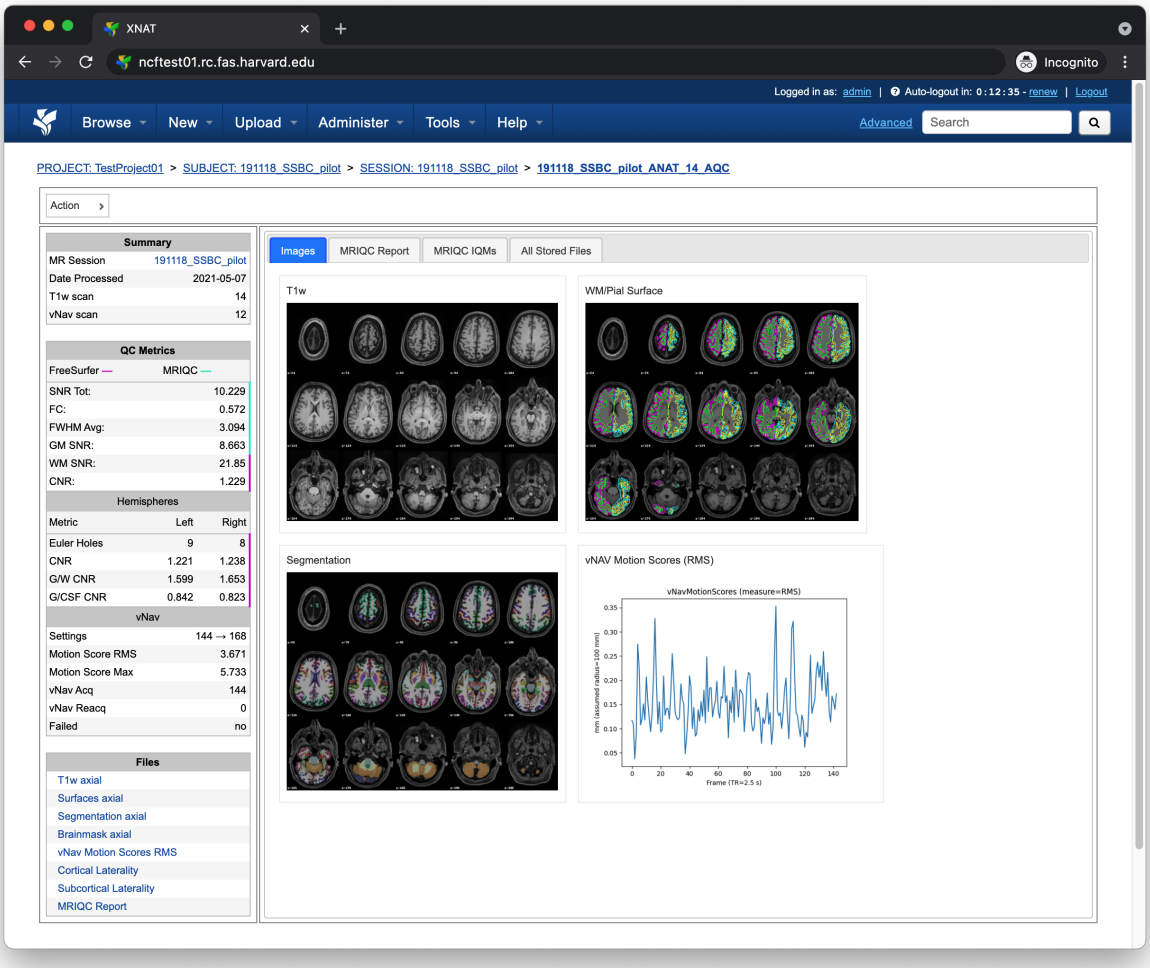
```
openssl base64 < license.txt
```

or you can use the `base64` command, if that utility is installed

```
base64 license.txt
```

1.3 Understanding the report page

The following section will break down each section of the AnatQC report page.

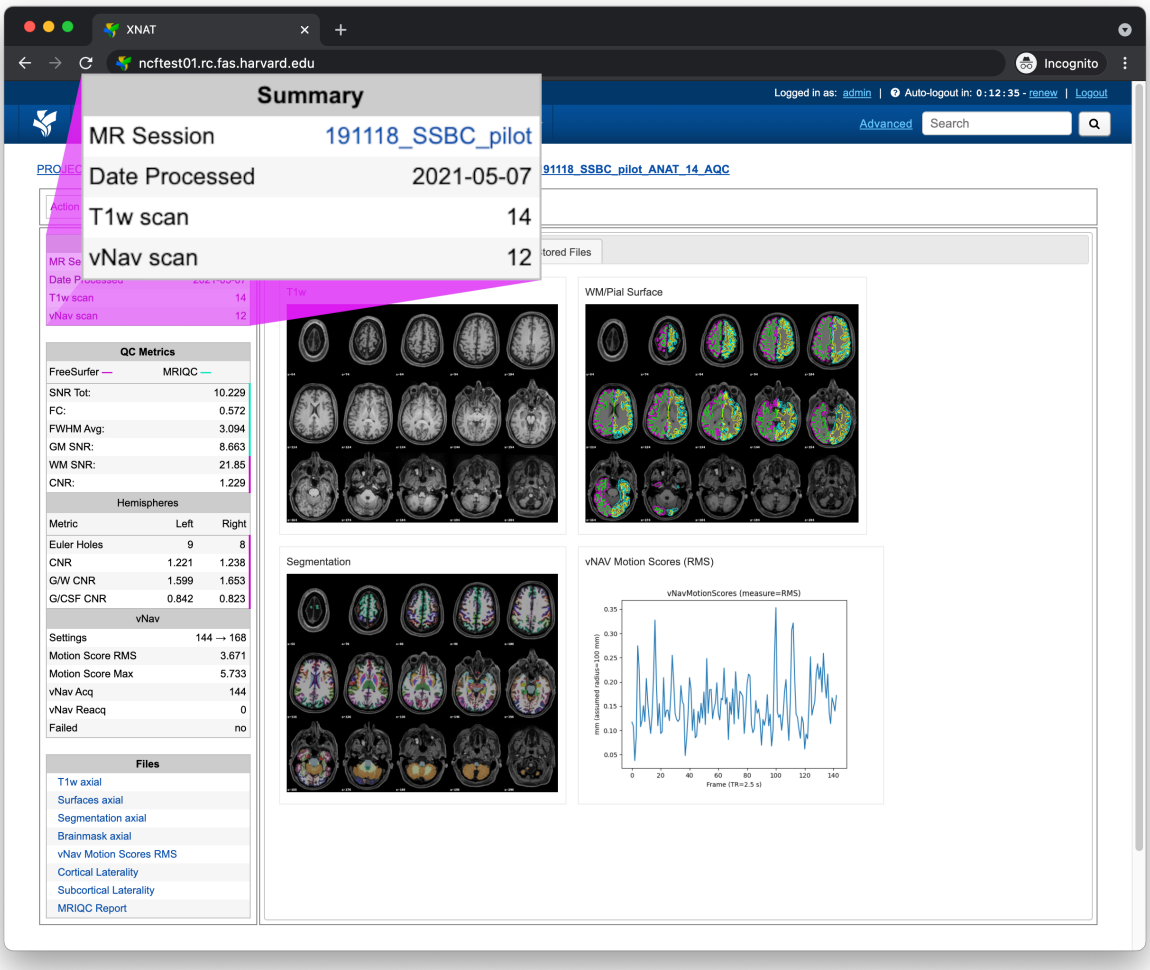


1.3.1 Left pane

The left pane is broken up into several distinct sections. Each section will be described below.

Summary

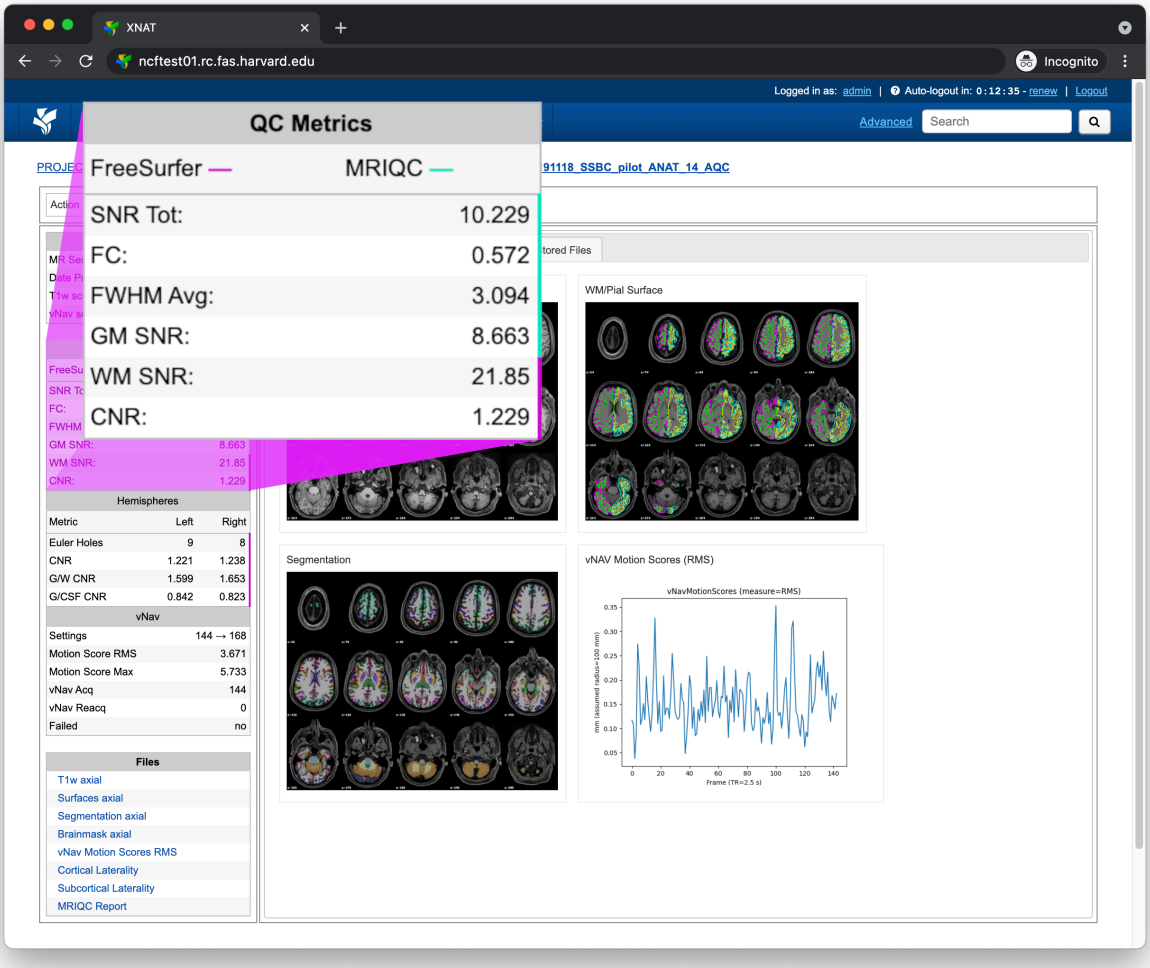
The `Summary` pane orients the user to what MR Session they're currently looking at and various processing details



Key	Description
MR Session	MR Session label
Date Processed	Processing date
T1w scan	T1-weighted scan used
vNav scan	vNav setter scan used (if present)

QC Metrics

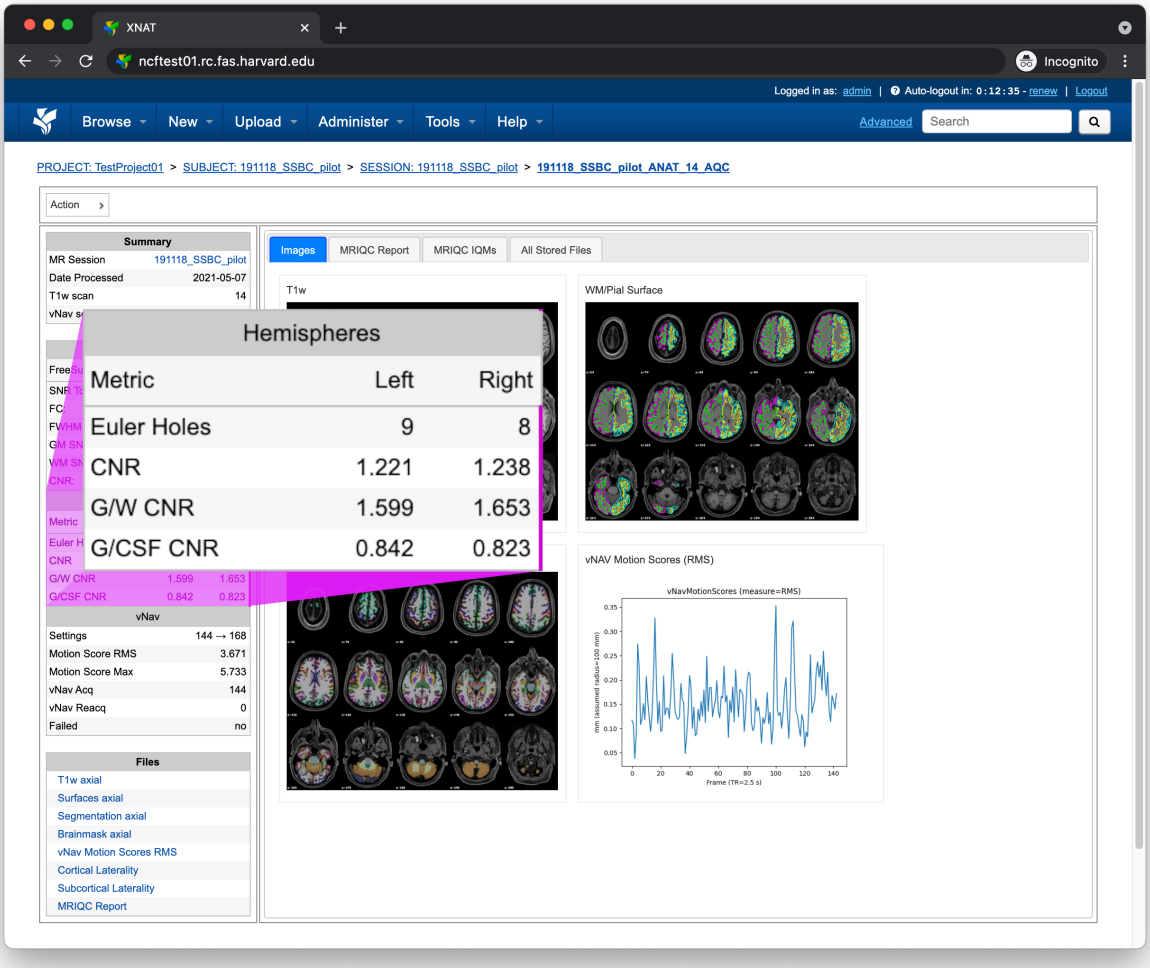
The `QC Metrics` pane displays quality control metrics computed *over the entire volume*



Metric	From	Description
SNR Tot	MRIQC	Signal-to-noise ratio
EFC	MRIQC	Entropy Focus Criterion
FWHM Avg	MRIQC	FWHM of spatial distribution of voxel intensities
GM SNR	MRIQC	Gray matter signal-to-noise ratio
WM SNR	FreeSurfer	White matter signal-to-noise ratio
CNR	FreeSurfer	Contrast-to-noise ratio

Hemispheres

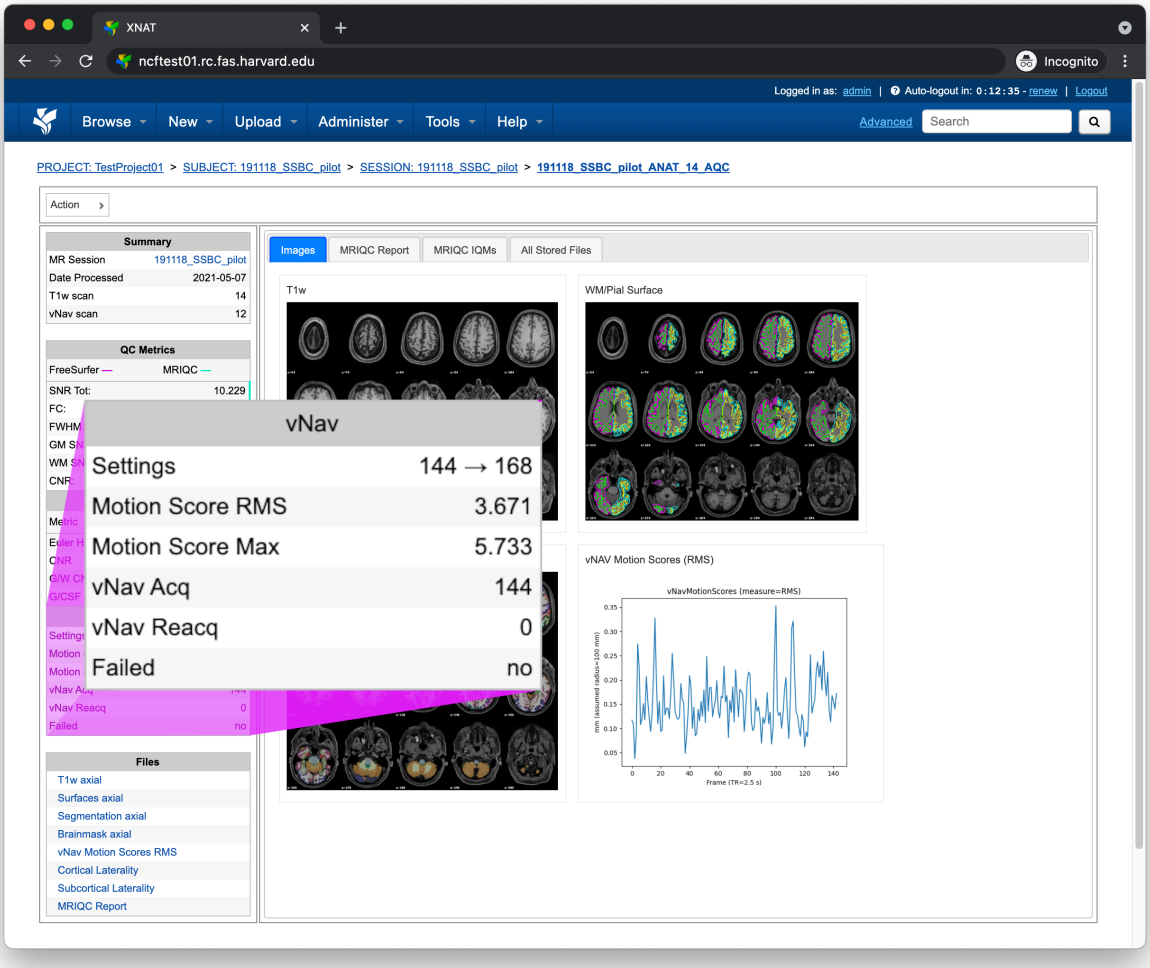
The `Hemispheres` pane displays quality control metrics computed *over each hemisphere*



Metric	From	Description
Euler Holes	FreeSurfer	Estimate of the number of surface defects
CNR	FreeSurfer	Global contrast-to-noise ratio
G/W CNR	FreeSurfer	Gray and white matter contrast-to-noise ratio
G/CSF CNR	FreeSurfer	Gray matter and cerebrospinal fluid contrast-to-noise ratio

vNav

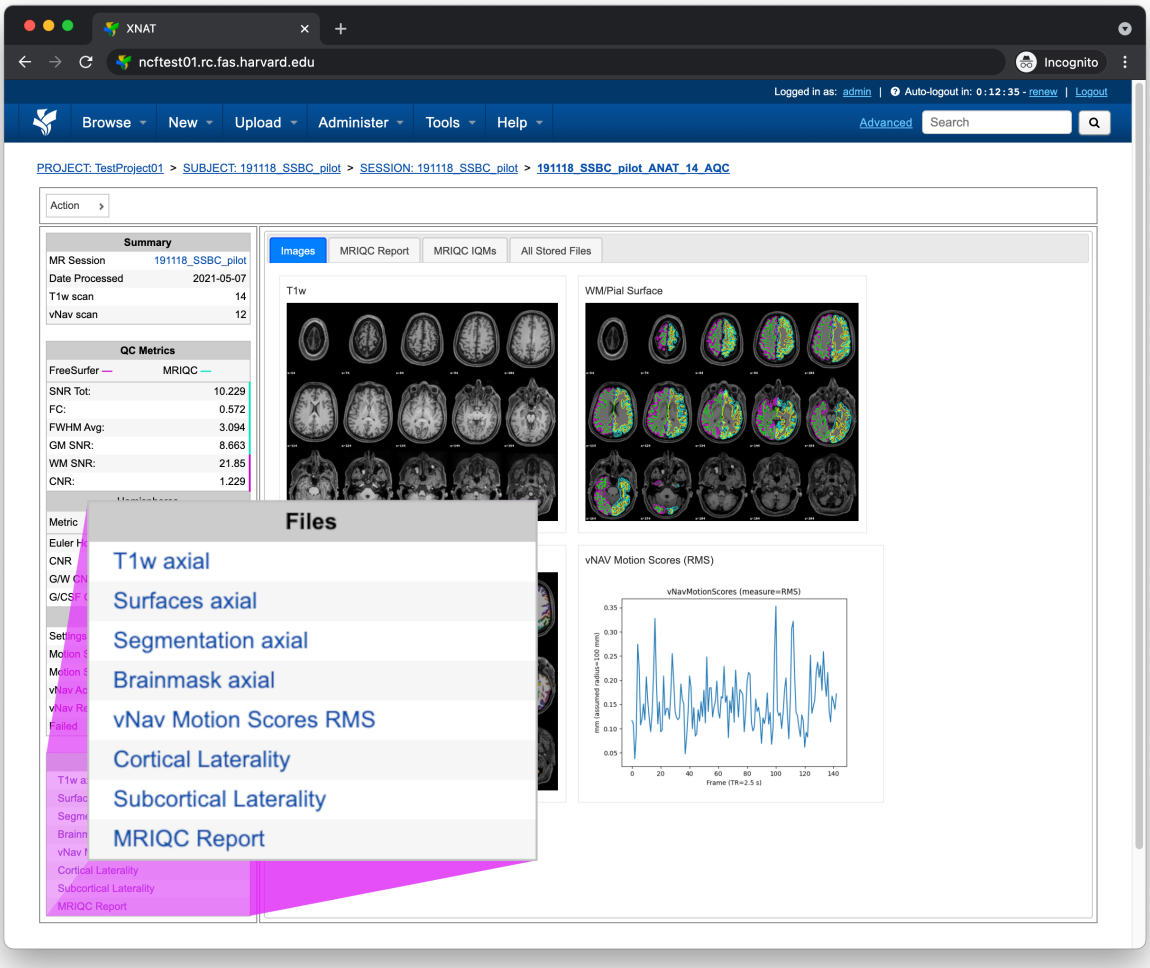
The `vNav` pane displays vNav specific quality control metrics, but *only* if a vNav scan was processed



Metric	Description
Settings	Minimum and maximum number of navigators allowed
Motion Score RMS	Root mean square of motion scores
Motion Score Max	Maximum motion score
vNav Acq	Total number of navigators collected
Failed	vNav failure detected

Files

The `Files` pane contains the most commonly requested files. Clicking on any of these files will display that file in the browser



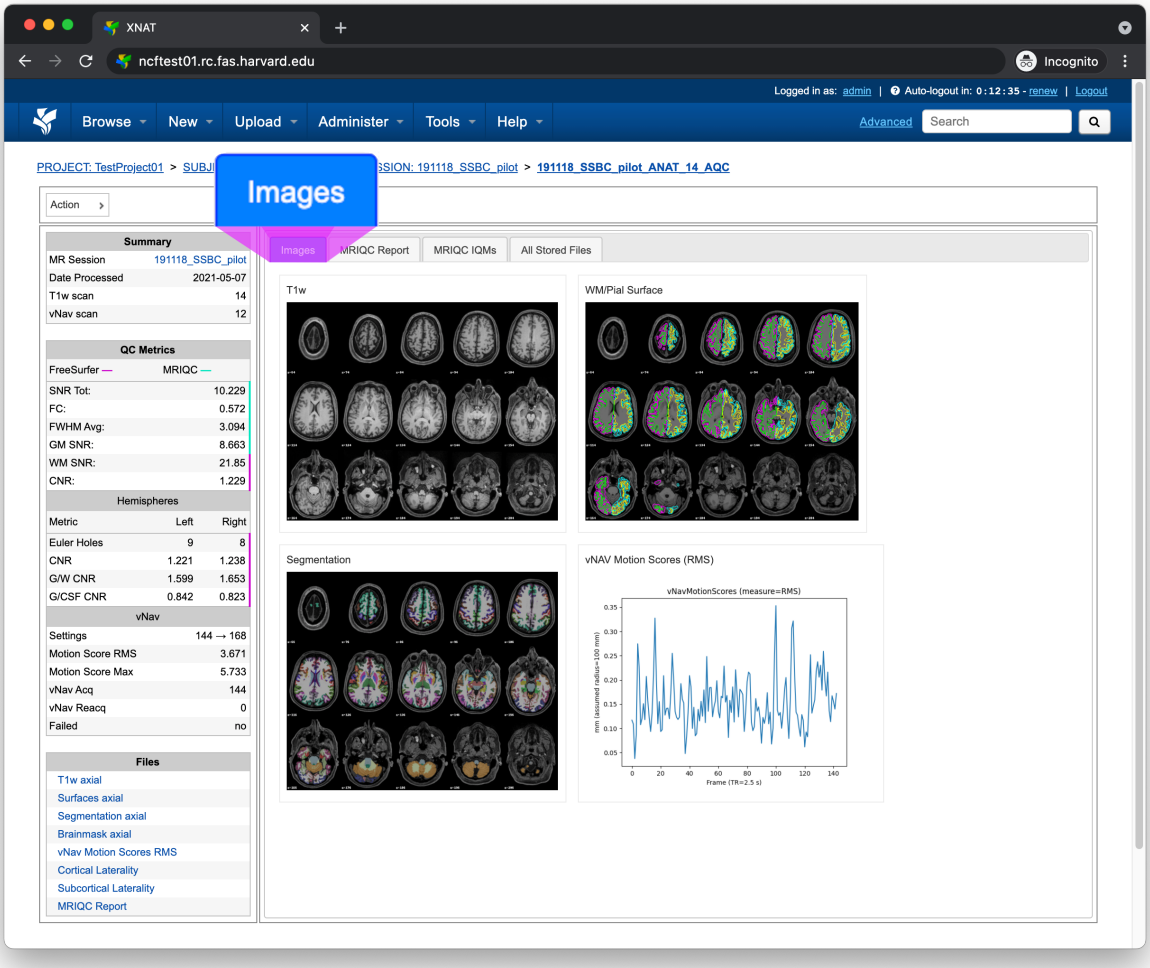
File	Description
T1w axial	T1-weighted image, axial plane
Surfaces axial	FreeSurfer surface boundaries, axial plane
Segmentation axial	FreeSurfer segmentations, axial plane
Brainmask axial	FreeSurfer brain mask, axial plane
vNav Motion Scores RMS	vNav motion scores RMS plot
Cortical Laterality	Cortical region volume laterality plot
Subcortical Laterality	Subcortical region volume laterality plot
MRIQC Report	MRIQC HTML report

1.3.2 Tabs

To the right of the *left pane* you'll find a tab container. The following section explains the contents of each tab.

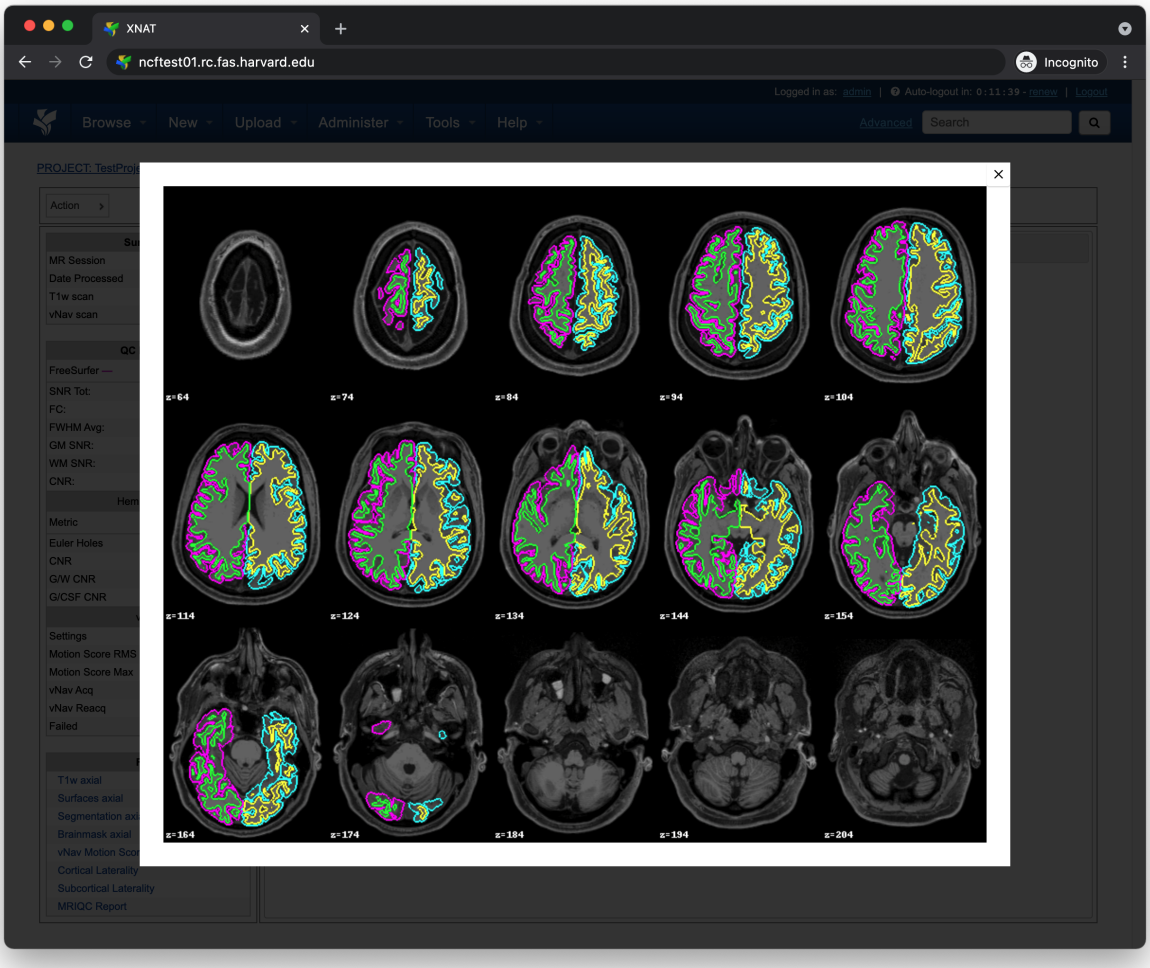
Images

The `Images` tab displays a zoomed out view of the T1-weighted image, FreeSurfer surface boundaries, FreeSurfer segmentations, and vNav RMS motion scores



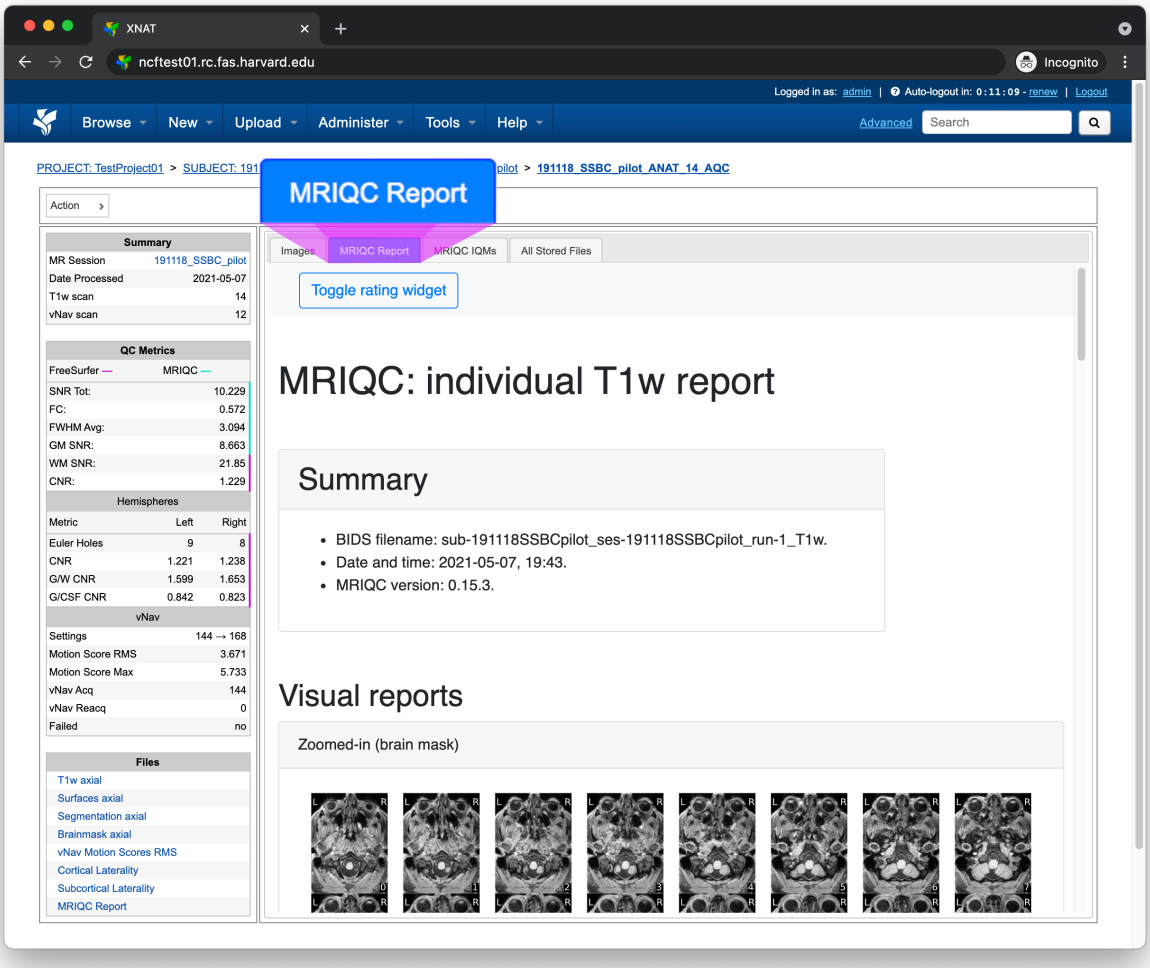
Clicking on an image within the `Images` tab will display a larger version of that image in the browser

Note: AnatQC automatically crops and centers each brain slice for improved visibility. For this reason, slices will often appear larger than their native size.



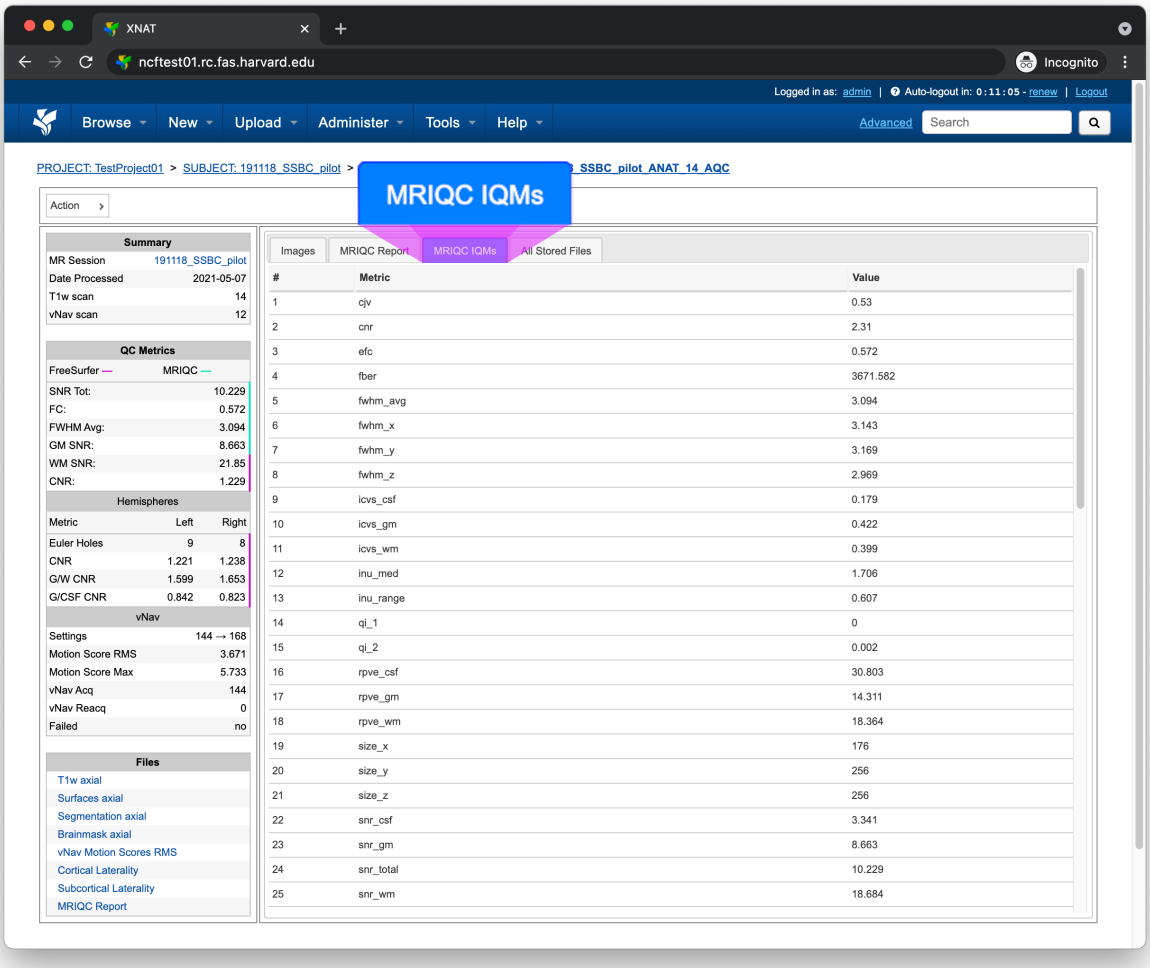
MRIQC Report tab

The `MRIQC Report` tab displays the complete MRIQC HTML report



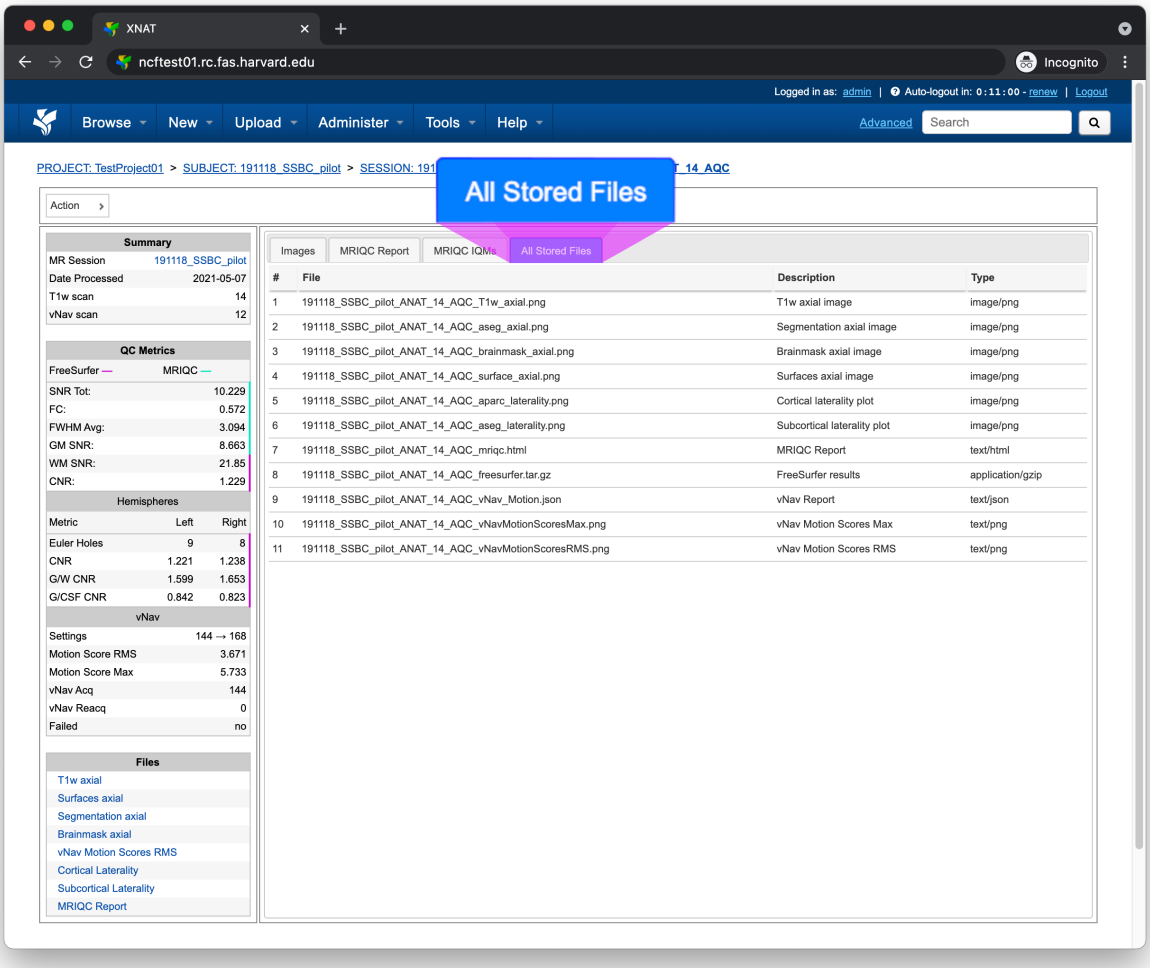
MRIQC IQMs

The `MRIQC IQMs` tab displays all of the MRIQC Image Quality Metrics. These metrics can also be found within the MRIQC HTML Report



All Stored Files

The `All Stored Files` tab contains a list of *every file* stored by AnatQC



Note: Clicking on a file within the `All Stored Files` tab will download that file.

File	Description
`*_AQC_T1w_axial.png`	T1-weighted image, axial plane
`*_AQC_aseg_axial.png`	FreeSurfer segmentations, axial plane
`*_AQC_brainmask_axial.png`	FreeSurfer brain mask image, axial plane
`*_AQC_surface_axial.png`	FreeSurfer surface boundaries, axial plane
`*_AQC_aparc_laterality.png`	FreeSurfer parcellation laterality plot
`*_AQC_aseg_laterality.png`	FreeSurfer segmentation laterality plot
`*_AQC_mriqc.html`	MRIQC HTML report
`*_AQC_freesurfer.tar.gz`	FreeSurfer results
`*_AQC_vNav_Motion.json`	vNav processing output
`*_AQC_vNavMotionScoresMax.png`	vNav motion max plot
`*_AQC_vNavMotionScoresRMS.png`	vNav motion RMS plot

CHAPTER

TWO

DEVELOPER DOCUMENTATION

2.1 Installation

At the moment, the only supported way to install AnatQC is *within a container*.

2.1.1 downloading a container

There are prebuilt versions of AnatQC on Docker Hub. You can pull the latest version by running

```
docker pull neuroinformatics/anatqc
```

or you can pull a specific version e.g., `0.4.0` by running

```
docker pull neuroinformatics/anatqc:0.4.0
```

2.1.2 building a container

To build AnatQC as a container, grab the latest Dockerfile from the repository and run

```
docker build -t anatqc:latest - < Dockerfile
```

Now you can run `anatQC.py` using `docker run`

```
docker run anatqc:latest --help
```

2.2 XNAT Installation

The following section will describe how to build and configure AnatQC as a XNAT plugin.

2.2.1 building the plugin

Clone the `xnat-1.7.6` branch from the `github.com/harvard-nrg/anatqc` repository

```
git clone -b xnat-1.7.6 --single-branch https://github.com/harvard-nrg/anatqc
```

Change into the repository directory and compile the plugin using Gradle

```
./gradlew jar
```

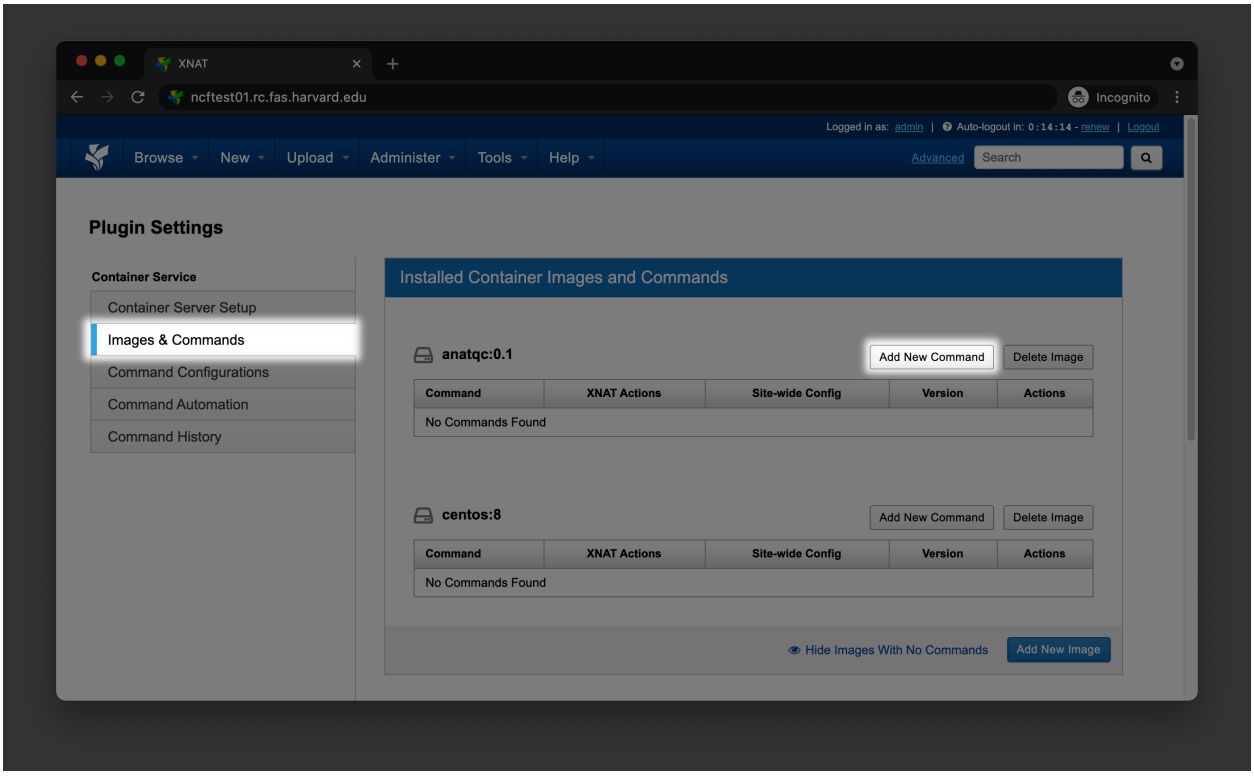
Once the plugin has been compiled, move the resulting `.jar` into your XNAT plugins directory

```
mv ./build/libs/anatqc-plugin-1.0.0.jar ${XNAT_HOME}/plugins/
```

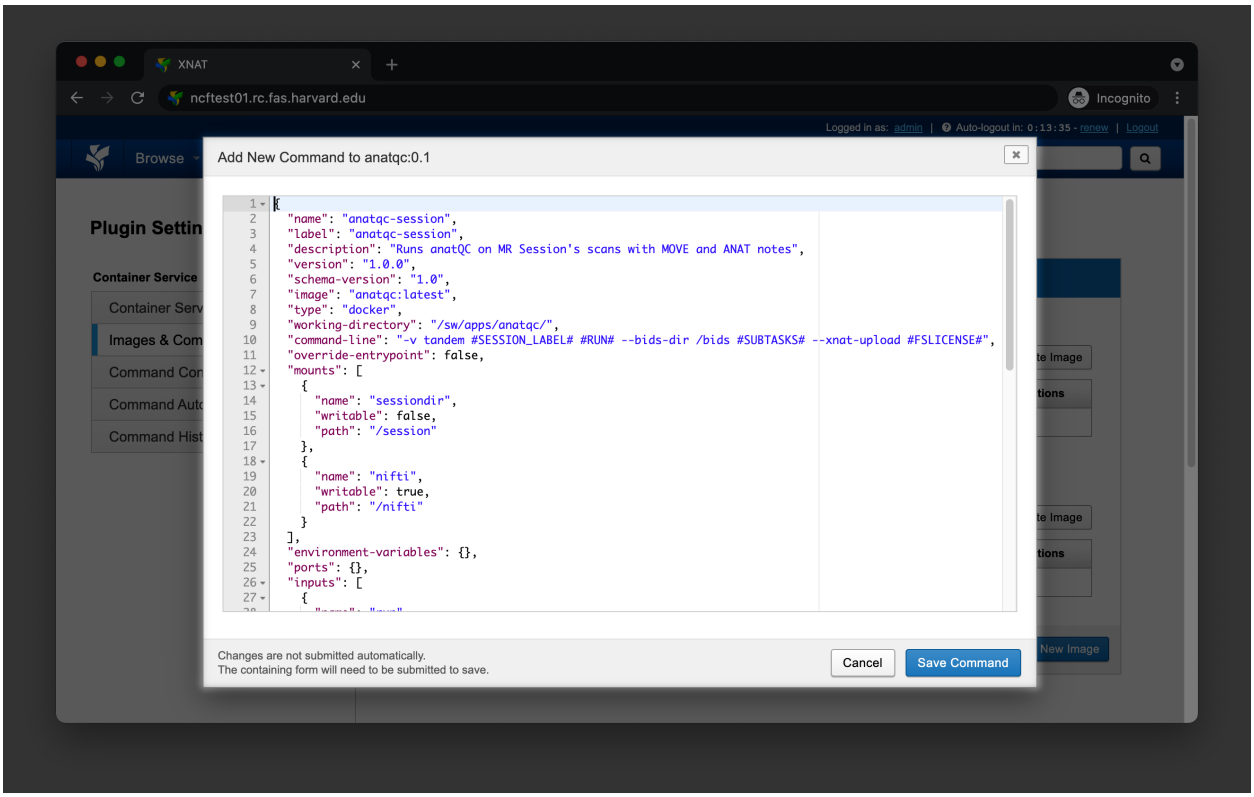
2.2.2 setting up the container

Note: This documentation assumes you have successfully *built the container* and that the container is being served from a local Docker daemon e.g., `unix:///var/run/docker.sock` on your XNAT server.

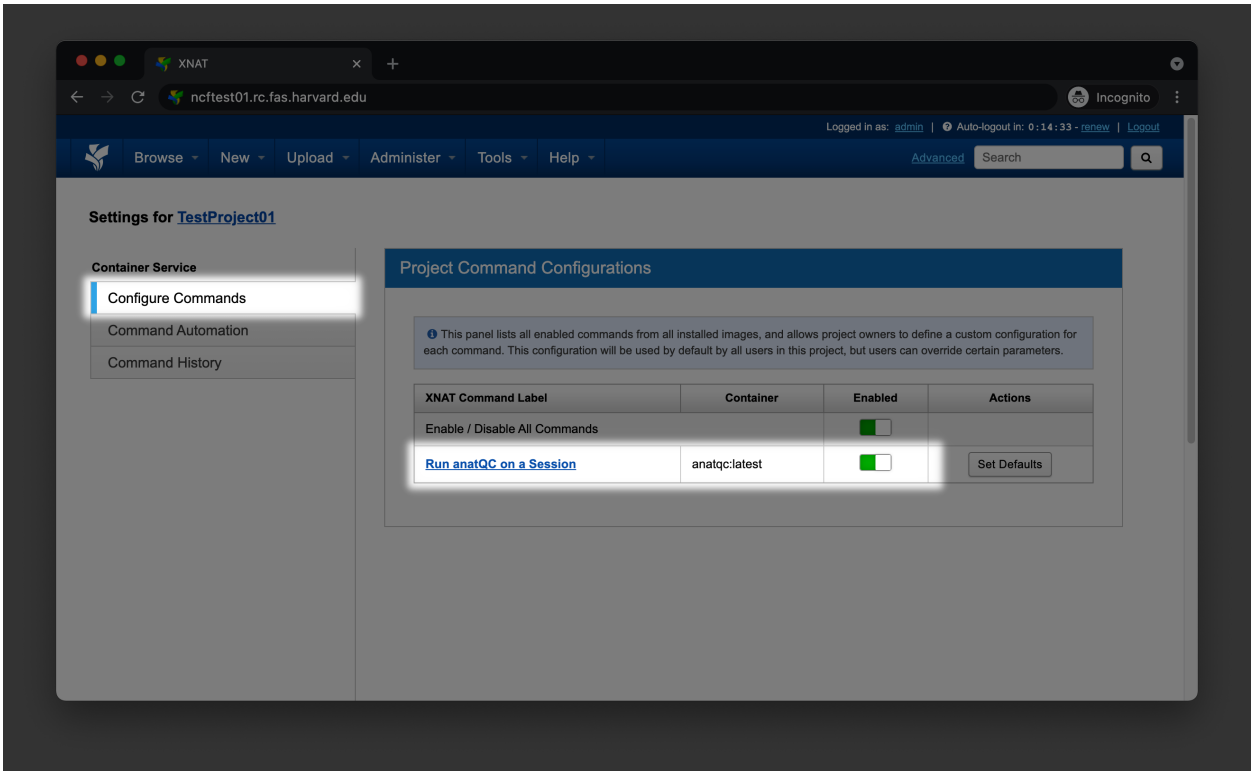
To setup the container within XNAT, go to `Administer` > `Plugin Settings` > `Images & Commands`, find the AnatQC container, and click `Add New Command`



You should see a small dialog box where you can configure your command. Paste the content from command.json.



Navigate to your Project's home page and click on `Project Settings` in the `Actions` box. Select `Configure Commands` and enable the new command for your project



CHAPTER

THREE

INDICES AND TABLES

- genindex
- modindex
- search