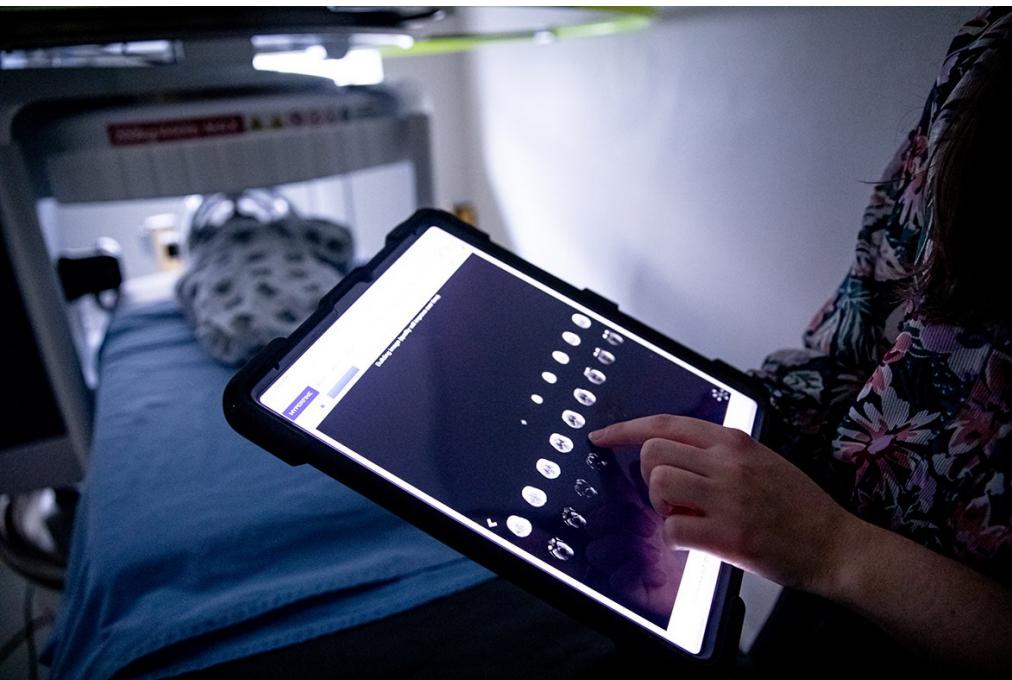


Quality Control (QC) of Hyperfine Scans

Layla Bradford

Jessica Ringshaw



Neurosciences
Institute



BILL & MELINDA
GATES foundation

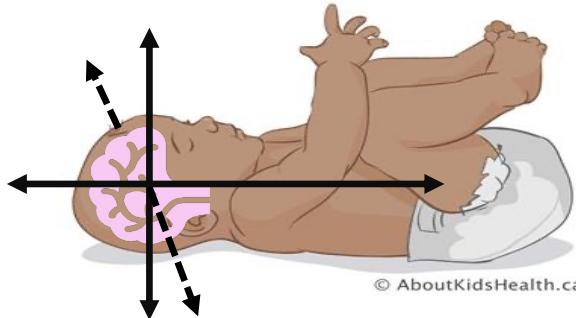
What we will cover in this session:

- ❖ Quality assessment post-acquisition
(Later: Approaches to acquiring good scans)
- ❖ What determines scan quality: Features of a good and bad scan
- ❖ SOP for QC
 - Using Flywheel for visual QC
 - Rating a scan
 - Reporting scan quality
 - Uploading QC report to Flywheel

Key Features for Assessing Scan Quality

(1) Positioning and Alignment

The positioning of the child's head (and brain) inside the scanner coil influences the quality of the image

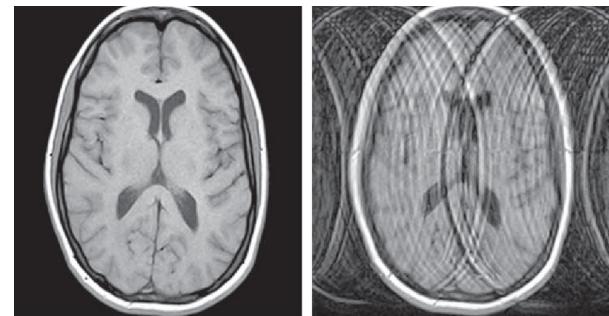


Features of good positioning and alignment include:

- Head positioning is straight and centered
- Symmetry of brain hemispheres
- Full brain in view

(2) Presence of Artifact

Artifact: Feature or irregularity on MRI scan that is not present in the original object → patient-related, signal processing-dependent, or hardware (machine)-related



Common types of artifact include:

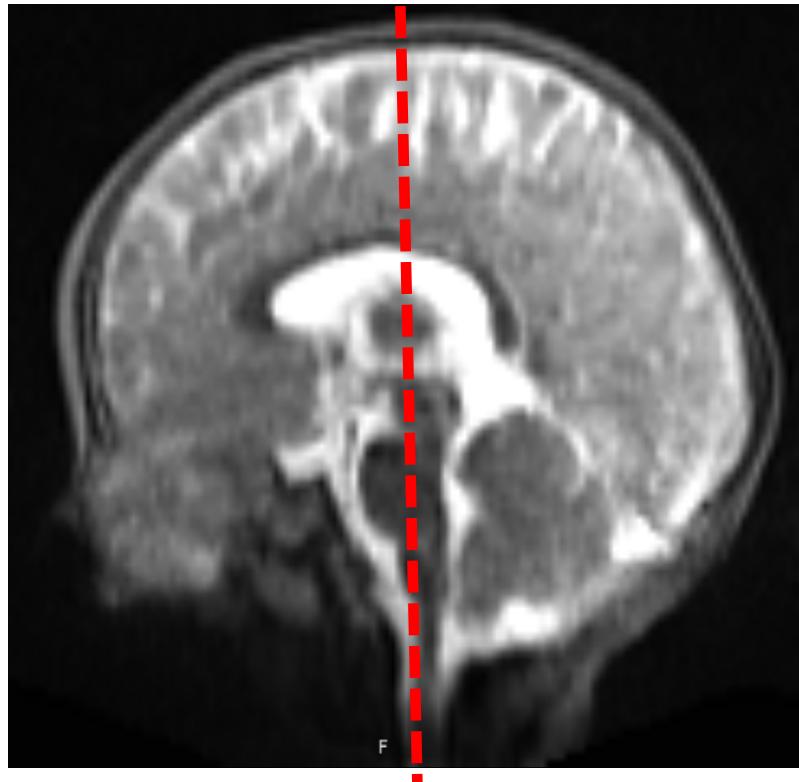
- Motion
- Interference
- Surface coil sensitivity

Key Features for Assessing Scan Quality

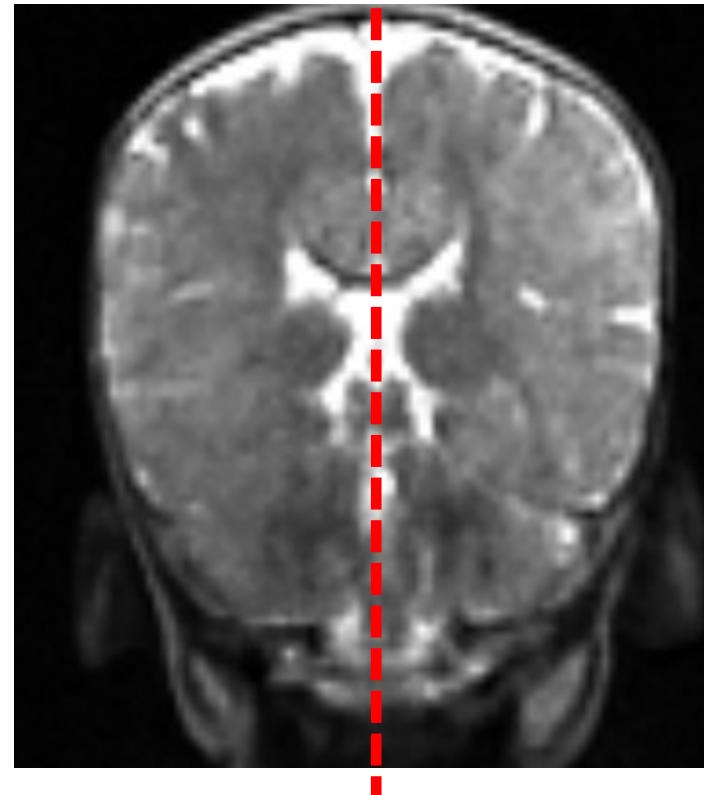
Positioning and Alignment

Positioning and Alignment

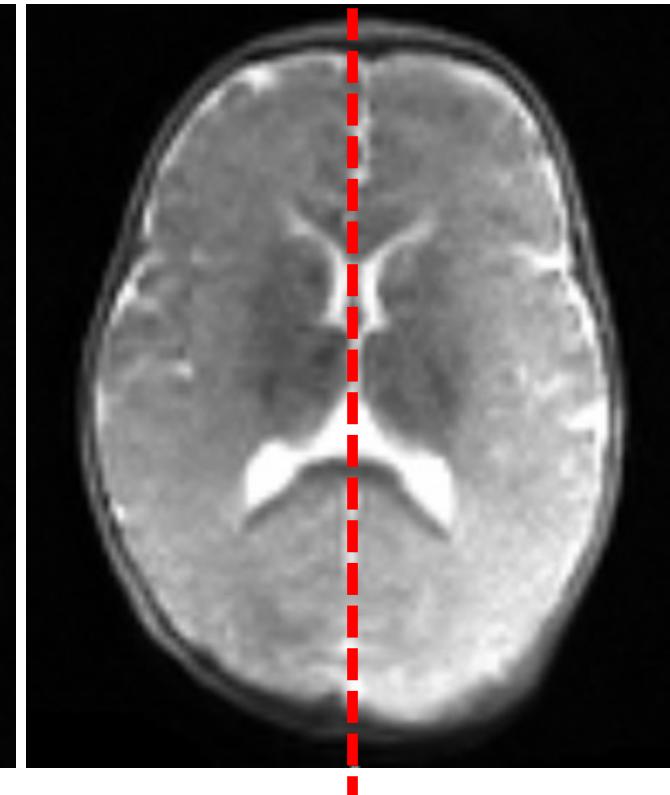
1. Head Positioning is straight & centered



Sagittal view: Midline
structures visible

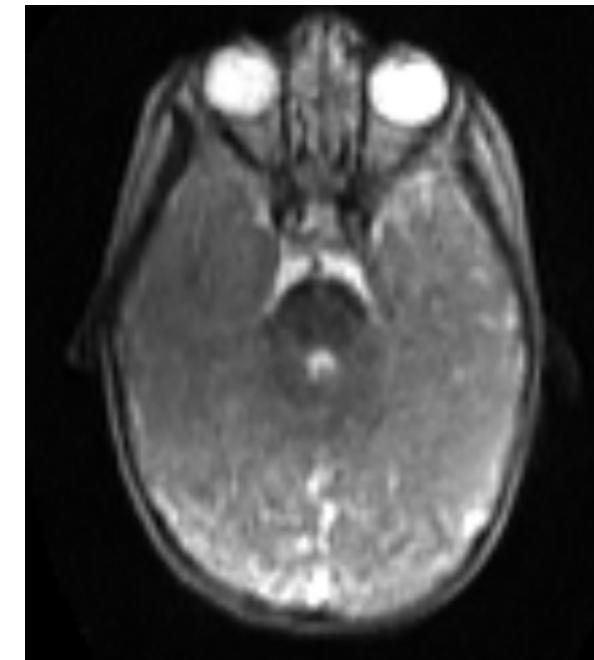
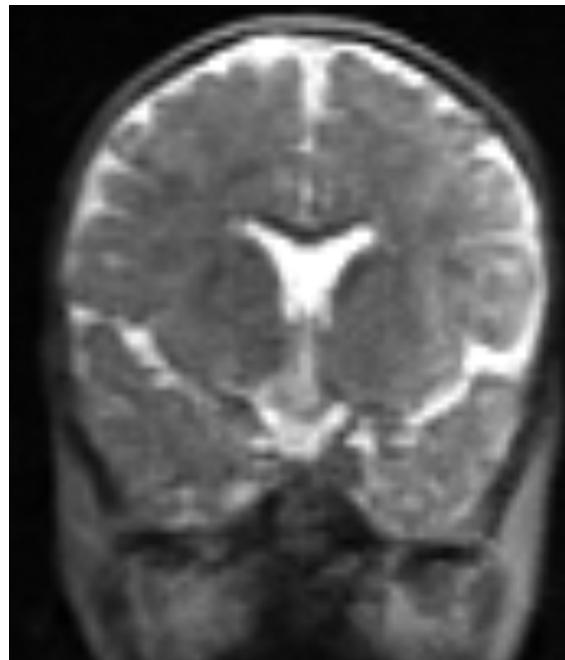
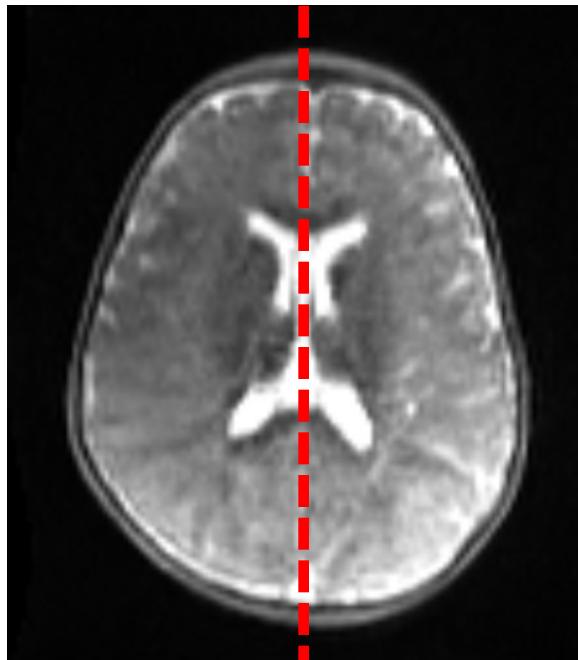


Axial & coronal views: Midline is vertical



Positioning and Alignment

2. Symmetry: left and right hemisphere mirror each other



Ventricles are symmetrical and have a
butterfly-like appearance

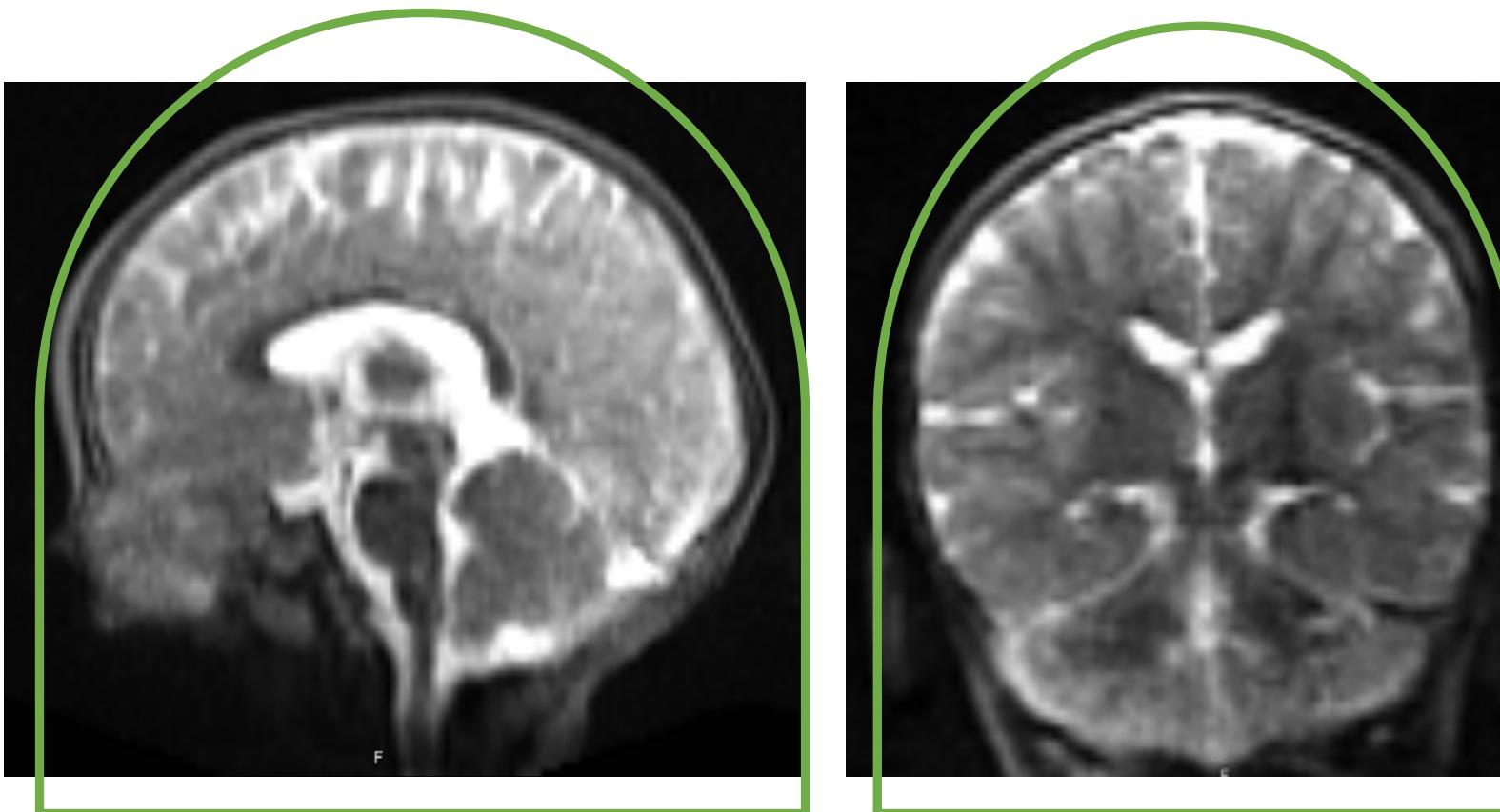


Both eyes are visible and are
similar in size and contrast intensity



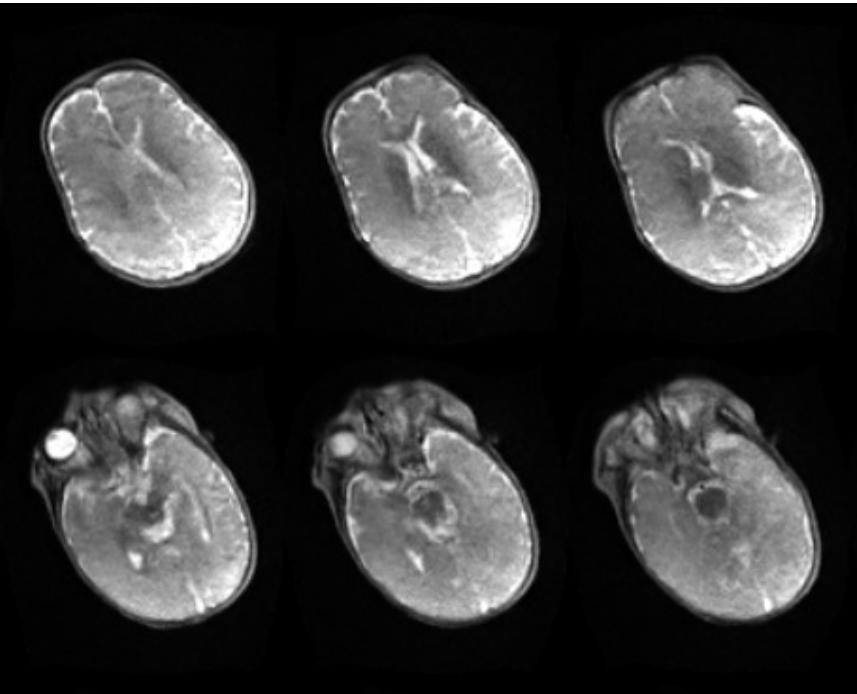
Positioning and Alignment

3. Full brain is in field of view



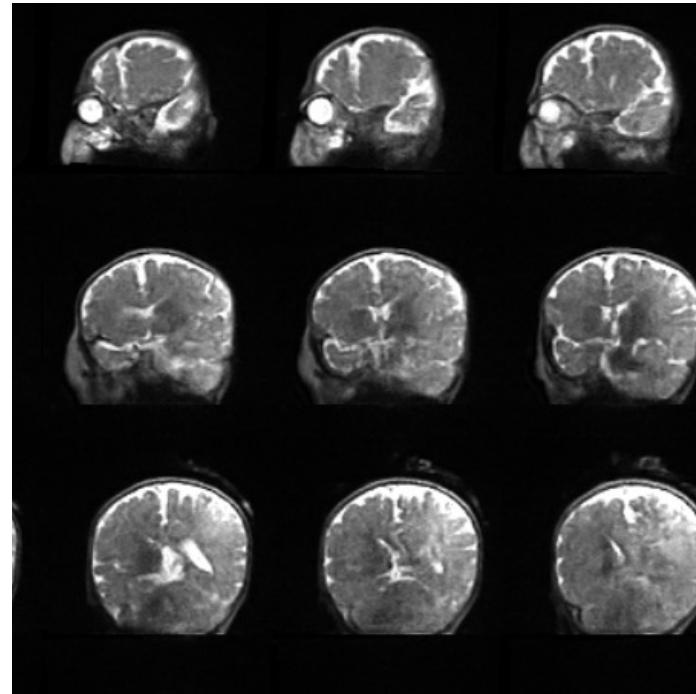
Full brain including brain stem and cerebellum is in the field of view (FOV)

Examples of poor positioning and alignment



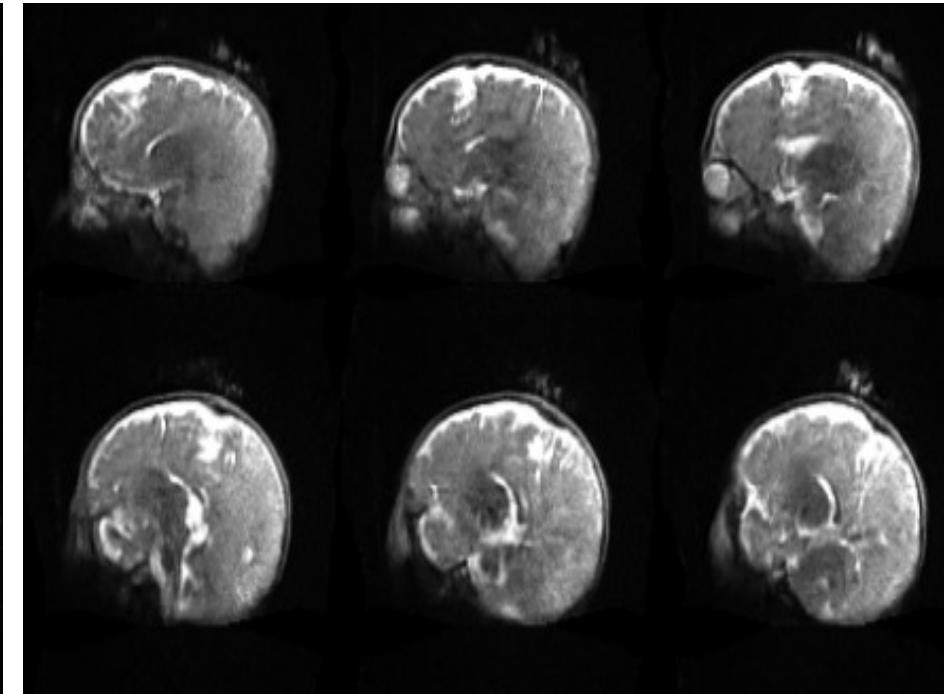
Axial View:

- Both eyes aren't visible
- Head is slanted



Coronal View:

- Both eyes aren't visible
- Not symmetrical
- Brain looks distorted



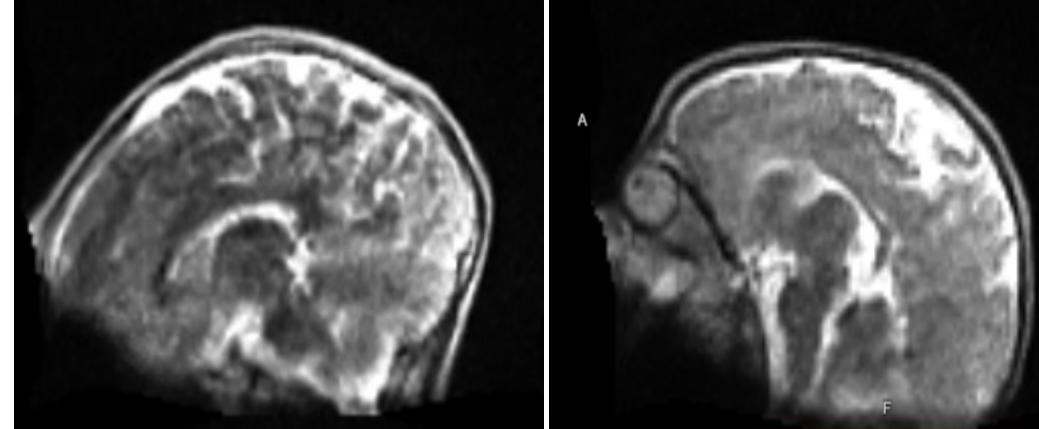
Sagittal View:

- Midline structures not visible

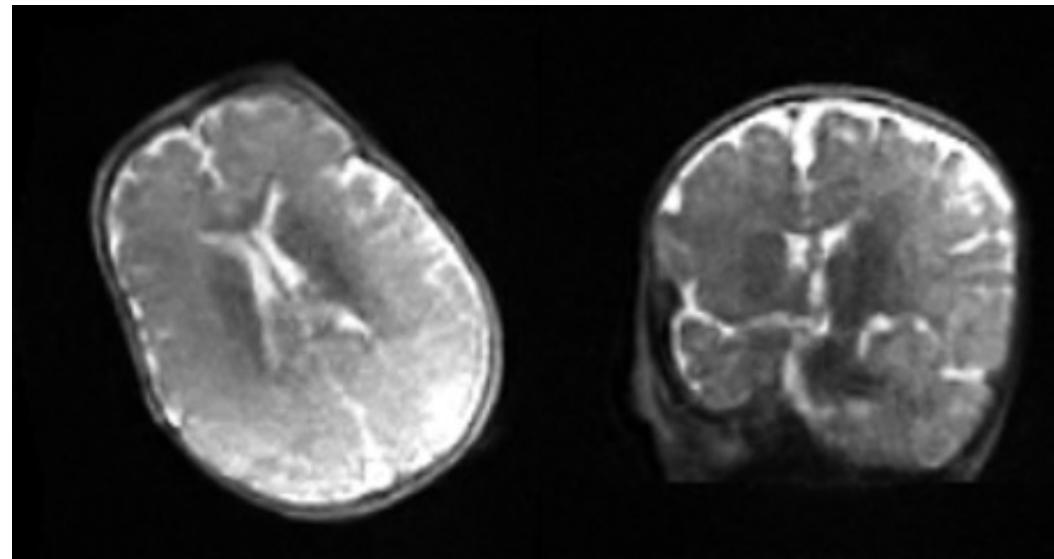
Examples of poor positioning and alignment



Tilted too far
forward or back
**Most noticeable
on sagittal axis*



Tilted or turner
towards left
or right shoulder
** Most noticeable
on the axial axis*



Key Features for Assessing Scan Quality

Checking for presence of artifact

Checking for the presence of artifact

Motion Artifact

- Most common artifact
- Due to patient movement

→ Blurry and/or streaky image

Surface Coil Sensitivity

- Due to contact between patient's head and surface of the coil
- Lack of insulation

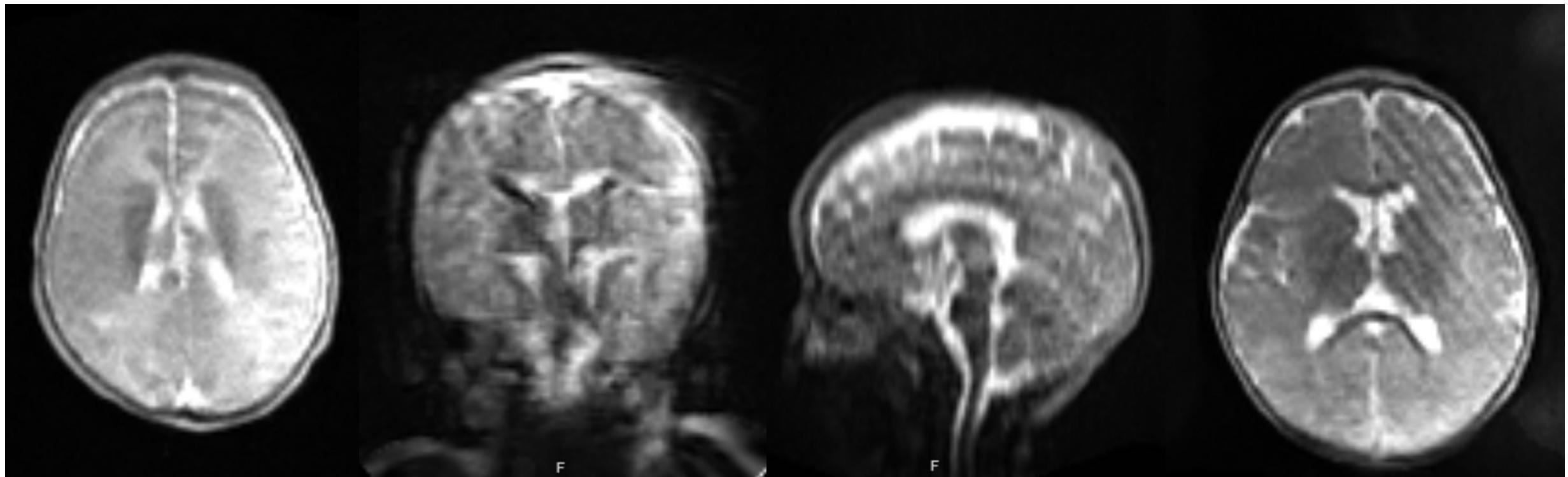
→ Bright contrast or distortion, signal drop-out

Interference Artifact

- Due to electrical interference from an outside source or a malfunction of the scanner's hardware

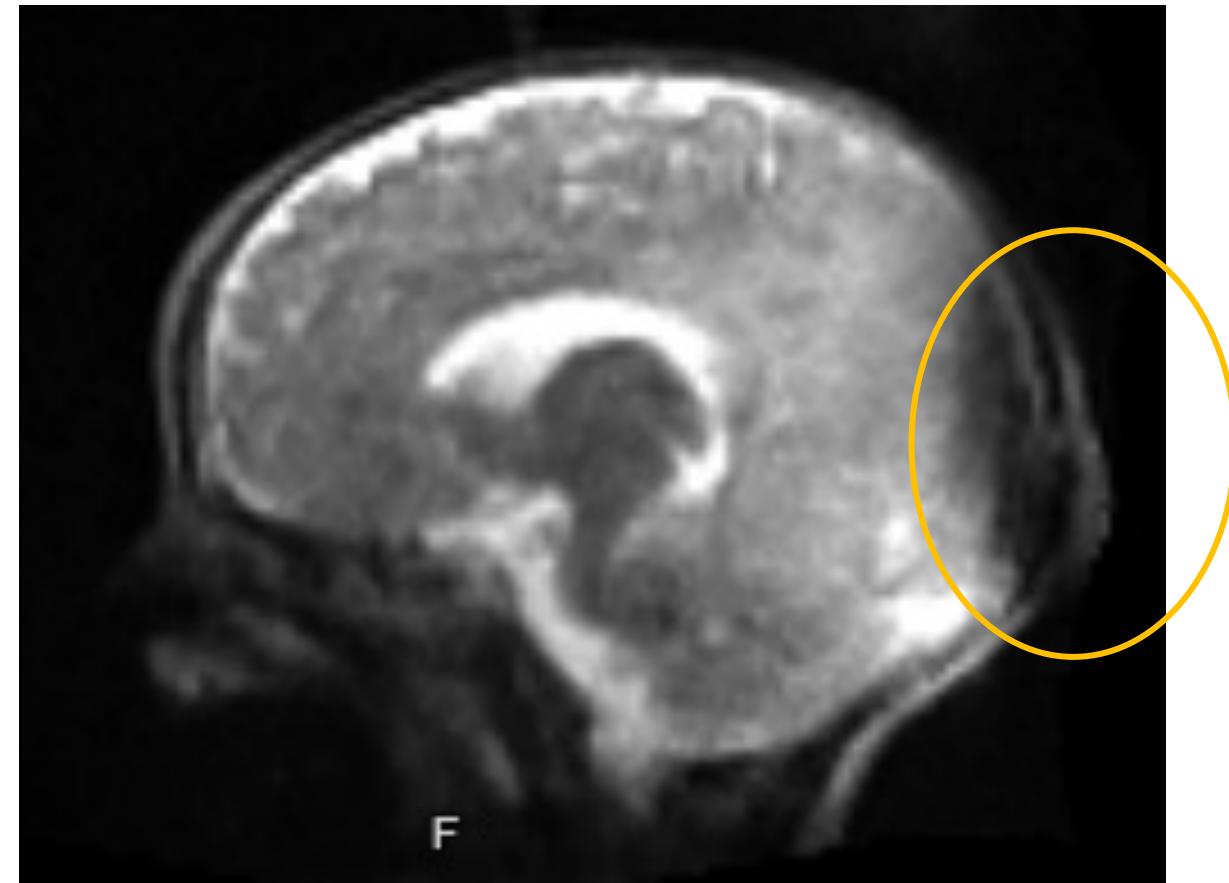
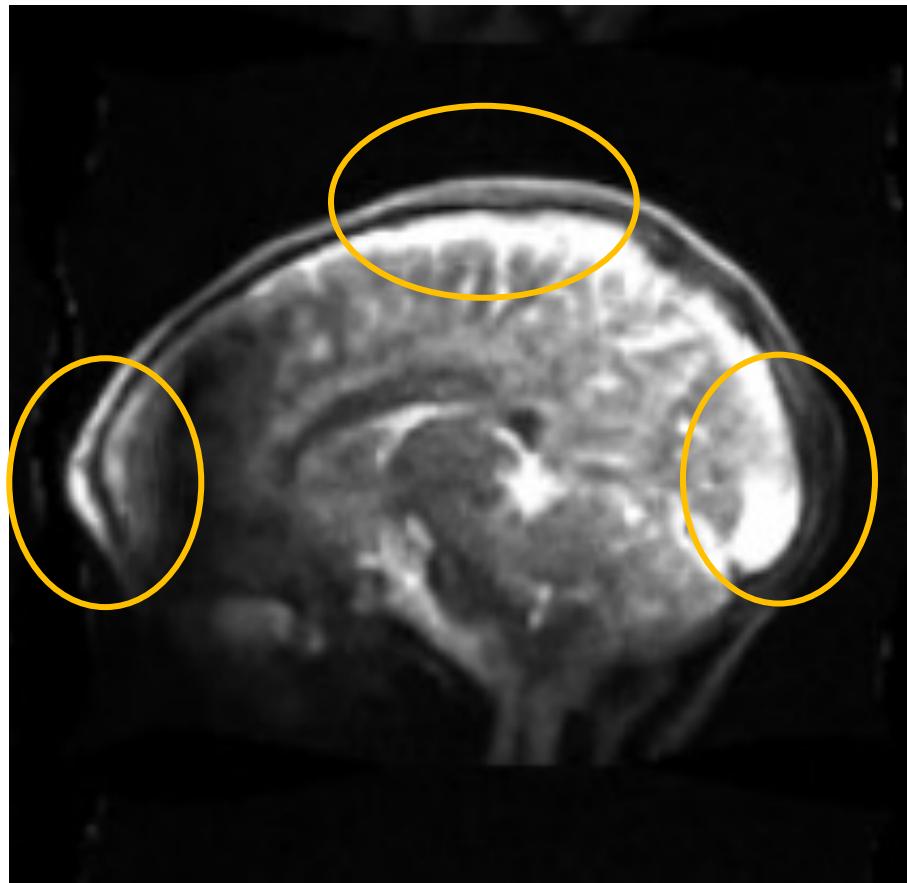
→ Distorted, wavy linear bands, streaking, or hyperintensity

Motion Artifact

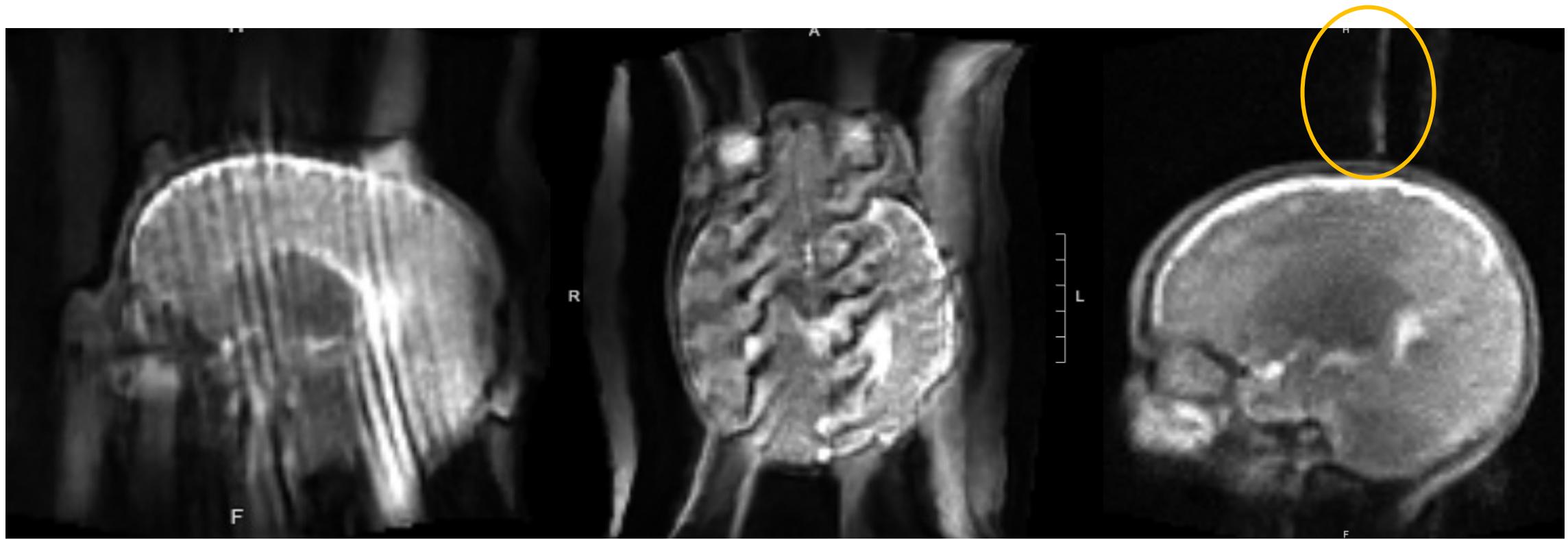


Surface Coil Sensitivity

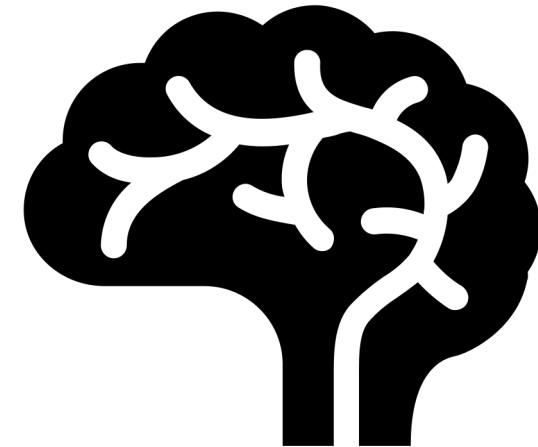
This type of artifact is most notable on the sagittal view



Interference Artifact



Let's review some cases together!



Standard Operating Procedure (SOP) for Quality Control (QC) checks

- ✓ Using Flywheel to conduct visual QC
- ✓ Rating a scan
- ✓ Reporting scan quality on QC spreadsheet
- ✓ Uploading QC spreadsheet to Flywheel

Quality Control SOP: Using Flywheel to Conduct visual QC checks

- Visual inspection should be done as soon as possible after scanning
- Early review of the scans ensures any issues with quality are flagged and resolved quickly

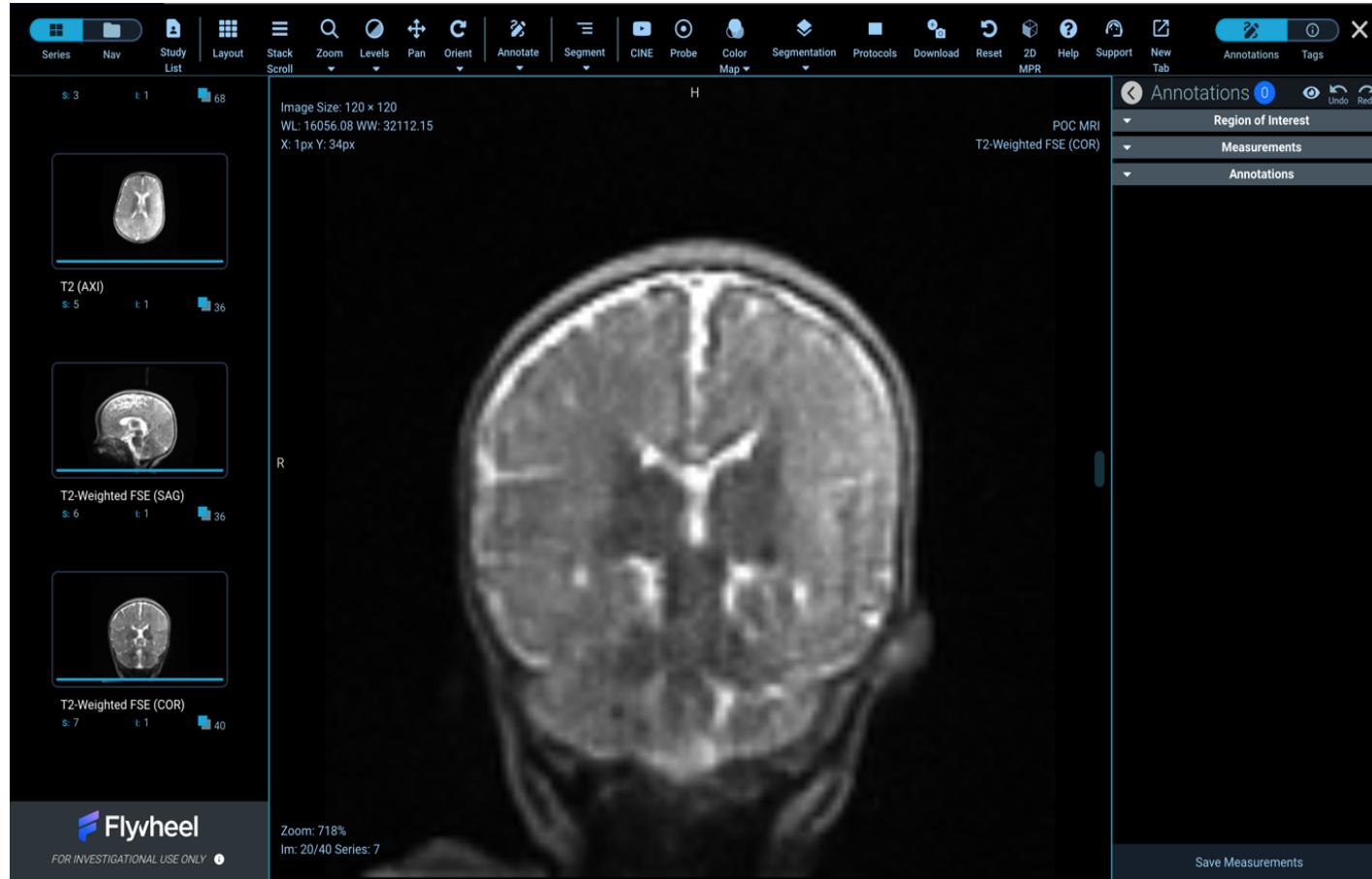


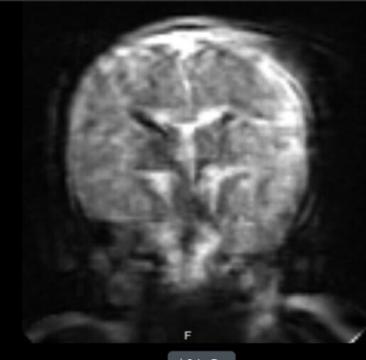
Figure 4 Flywheel Viewer: When the viewer is launched you can select the different acquisitions on the left. Scroll through the images with your arrow buttons.

- Assess scan quality in real time during acquisition
- Formal assessment on Flywheel viewer after upload
 - 1. Select 'Sessions' tab in your project then select the subject scanning session for review
 - 2. Select 'Launch in Viewer' button on the top right of the screen
 - 3. Check each acquisitions and rate quality in QC spreadsheet

Rating Scans: What is good/poor quality?

- Scan quality can be ambiguous
- Flag and review uncertainties on Flywheel
- Refer to the expertise of the broader UNITY/PRISMA community: **Collective Minds Radiology**

1. Check Collective Minds to see if a similar image has been shared and what the community thought
2. If still not clear - Label as unsure in the visual QC log
3. Share case on Collective Minds to open a discussion within the consortium



A grayscale MRI axial slice of a head. There is a prominent, dark, irregular artifact in the center-right area, likely representing motion or electrical interference. A small 'F' label is visible at the bottom left, and a '\$01' label with a camera icon is at the bottom right.

Layla Bradford
University of Capetown, South Africa
@layla-bradford
08-Aug-2023 10:46

Motion or electrical interference artefact?
#Hyperfine #UNITY #artifact #lowfieldMRI #paediatric

5 replies

Johan Dehem
MD
Jan Yperman Ziekenhuis, Belgium
@johan-dehem
08-Aug-2023 17:15

looks like motion artefact to me

John Evans
PhD
Cardiff University, Wales, UK
@john-evans
10-Aug-2023 09:56

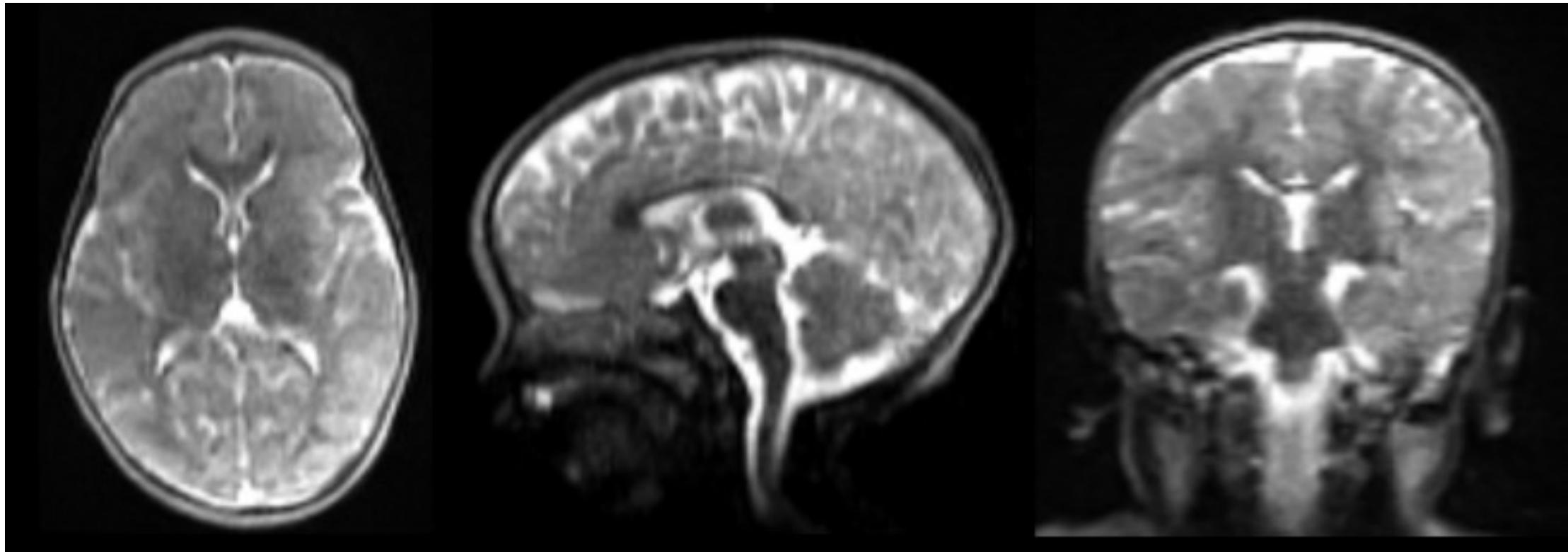
I agree - it looks like motion. Were the other scans in the exam affected too?

Able Khosa
Training & Research Unit of Excellence (TRUE), Malawi
@able-khosha
11-Aug-2023 11:05

Motion artefact

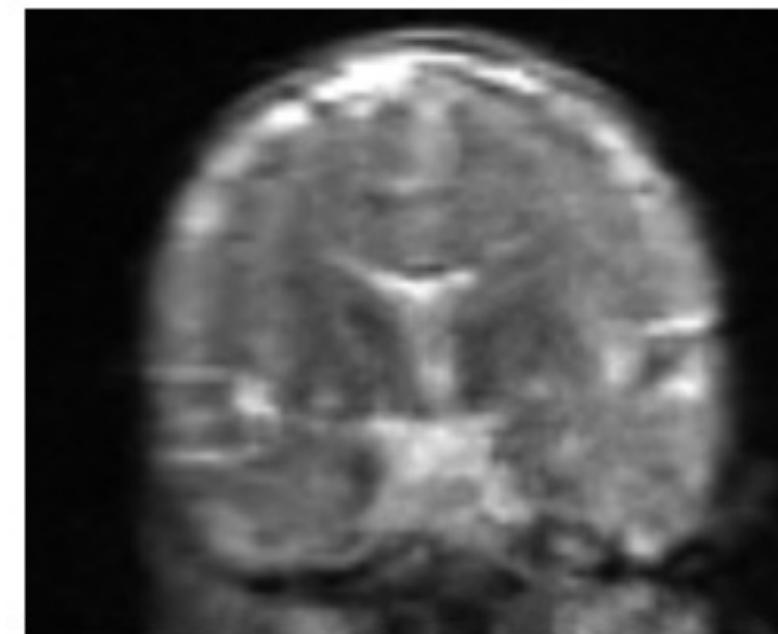
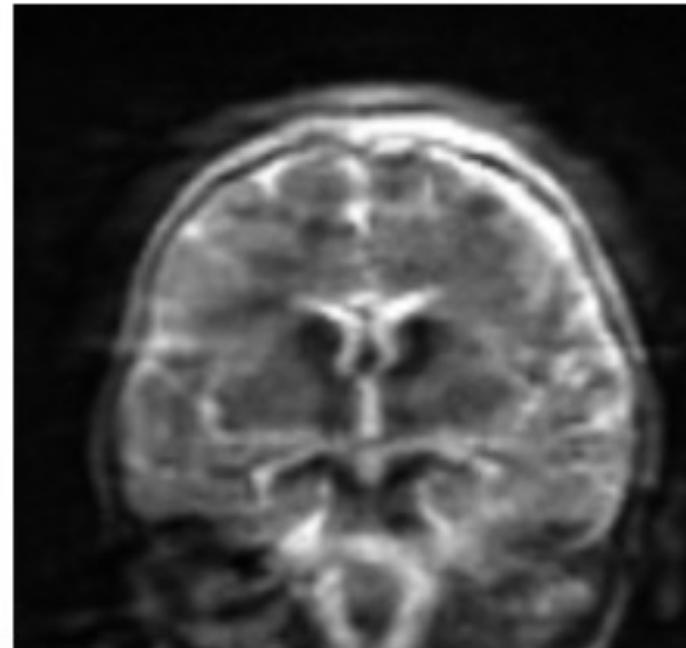
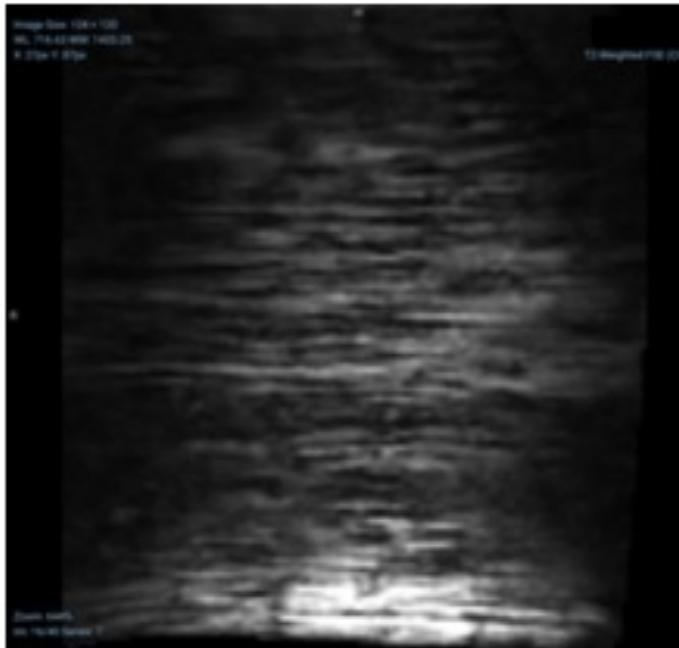
Rating Scans: What is good/poor quality?

“GOOD”



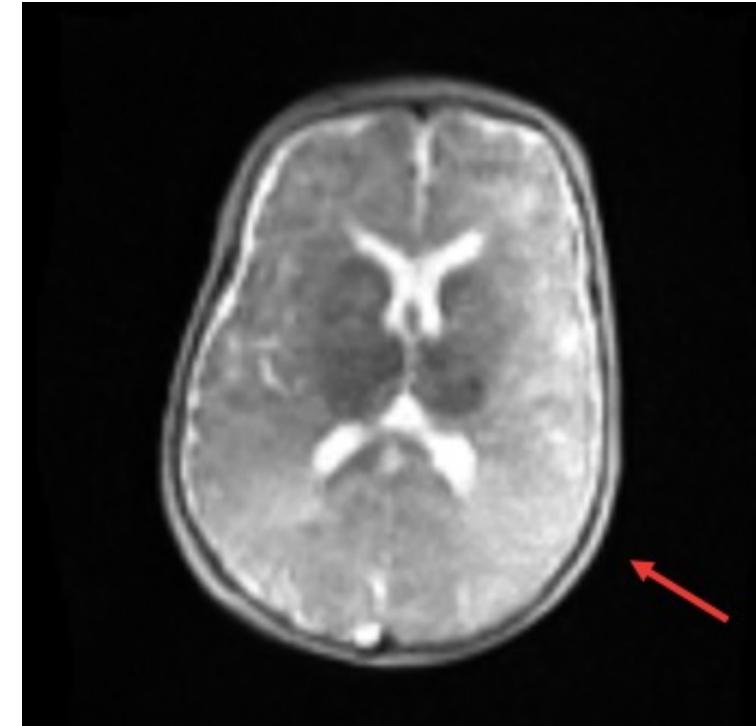
Rating Scans: What is good/poor quality?

“POOR”



Rating Scans: What is good/poor quality?

“UNSURE”



If you are unsure of the quality, share with the broader community on collective minds for input

Quality Control SOP: Rating & Recording on Visual QC Spreadsheet

Download the Visual QC spreadsheet from Google Drive and customize by renaming it to your study and using your chosen unique subject IDs

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	subject_id	t2-axial	t2-axial-QC	t2-sagittal	t2-sagittal-QC	t2-coronal	t2-coronal-QC	t1-axial	t1-axial-QC	dwi	dwi-QC	flair-axial	flair-axial-QC	Complete (complete/incomplete)	Overall
2	beta001	✓	Good	✓	Good	✓	Unsure	✓	Good	✓	Poor	✓	Poor	Complete	Yes
3	beta002	✓	Good Poor Unsure	□	□	□	□	□	□	□	□	□	□	□	□
4		□		□	□	□	□	□	□	□	□	□	□	□	□
5		□		□	□	□	□	□	□	□	□	□	□	□	□
6		□		□	□	□	□	□	□	□	□	□	□	□	□
7		□	□	□	□	□	□	□	□	□	□	□	□	□	□
8		□	□	□	□	□	□	□	□	□	□	□	□	□	□
9		□	□	□	□	□	□	□	□	□	□	□	□	□	□
10		□	□	□	□	□	□	□	□	□	□	□	□	□	□
11		□	□	□	□	□	□	□	□	□	□	□	□	□	□
12		□	□	□	□	□	□	□	□	□	□	□	□	□	□
13		□	□	□	□	□	□	□	□	□	□	□	□	□	□
14		□	□	□	□	□	□	□	□	□	□	□	□	□	□

https://drive.google.com/drive/folders/1BTJXzsh_7Ckzc3dBSzVEO92I8jJ_FCqA?usp=sharing

Uploading QC document to Flywheel

The QC document should be synced with Flywheel. Under the ‘information’ tab for the project upload the document ‘Visual-QC.csv’. This name should remain consistent in order to track changes and to automate processes across projects.

The screenshot shows the 'Information' tab selected in the top navigation bar of a Flywheel project page. The page is titled 'demo / UNITY (fw://unity/demo)'. On the left, there are tabs for 'Description', 'Sessions', 'Subjects', 'Information' (which is highlighted in blue), 'Analyses', and 'Data Views'. The 'Information' section contains two main sections: 'Custom Information' and 'Attachments'. The 'Custom Information' section has a 'Save' button and a 'Reset' button. It displays a message: 'No custom fields have been added yet.' The 'Attachments' section has 'Create' and 'Upload' buttons. It displays a message: 'No attachments have been added yet.' To the right, there is a 'Quick Tip' box with the following text:
You can add custom information and metadata about your project here.
Notes can be used to inform users of specific details of the project and its data as they change over time.
A project's notes are visible to all users with access to the project.

Questions

