

DTI Scan Protocol for GE

For Brainlab:

- **iPlan 2.x**
- **iPlan 3.x**

In order to provide complete data sets for neurosurgery, you must provide **high resolution anatomical MRI data** in addition to the DTI data. The anatomical data may be acquired in the same study with the DTI data (but not necessarily).

If you need to import specific DTI scans which have not been acquired using this scan protocol, you can contact Brainlab support and provide a sample scan for review.

FoV (Field of View)	<ul style="list-style-type: none"> • Include region of interest • The patient should close their eyes during the scan
Patient Setup	<ul style="list-style-type: none"> • Supine and head first position only
GE Scan Properties	<ul style="list-style-type: none"> • Axial only • DTI scan sequence • 6 or more diffusion directions and one corresponding B0 • The B0 and the diffusion directions must have the same scan properties (number of slices, field of view, pixel and matrix size) • Repetitions allowed^a • Recommended slice thickness 3 mm or less
Angulation	<ul style="list-style-type: none"> • Not supported • Note: Angulation will cause a color shift in display of the fiber tracts in iPlan (e.g. red, blue, and green fibers). The amount of shift correlated to the amount of angulation
Matrix Size	<ul style="list-style-type: none"> • Any matrix size, but must be squared
Storage	<ul style="list-style-type: none"> • 16 bit DICOM format only • Store as single slices (Mosaic not supported) • Note: Please be aware that manipulating (e.g. anonymizing) patient data may also remove important diffusion information
Special Notes for GE	<ul style="list-style-type: none"> • Some GE scanners do not include the diffusion parameters in the DICOM header. If you experience this problem, contact Brainlab support. If required, refer to the GE DTI comment below. • GE DTI comment: _____

- a. iPlan 2.x: B0 and all directions must have same repetitions
iPlan 3.x: all directions must have same repetitions, B0 may be different

Any changes to the routine scan protocol normally used for the Brainlab system should be discussed and verified with the neurosurgery and radiology department.

If you need additional information, please contact your local Brainlab representative

Additional Recommendations

Safety	<ul style="list-style-type: none"> Brainlab recommends using a hand-held metal detector for a last check before patients or participants enter the scanner room. Inform patients early (ideally at scheduling) what to wear for the scan, and to avoid e.g. bras with metal wires, make-up etc.
Preparing the Patient	<ul style="list-style-type: none"> Patients should avoid smoking or drinking coffee before scans. Functional scanning sessions should not be scheduled directly after meals.
Restricting Motion	<ul style="list-style-type: none"> Instruct the patient to find a comfortable position before the scan begins. Simply telling them to stay as motionless as possible is not always sufficient to obtain optimal image quality. An example instruction: <i>“Please find a comfortable position in the scanner while we’re placing you into the tube. It is OK to wriggle around while we’re doing so. After finding a position in which you think you can lie comfortably for quite some time, please relax and try to move as little as possible, as your movements degrade the quality of our recording.”</i> If your scanner software allows for a check of image-to-image movements Brainlab recommends checking this after each scan sequence and discarding scans with strong movements (3-4 mm or sudden strong jumps, such as after a sneeze). If your scanner software has an in-line display option, Brainlab recommends having that window open during the scan, strong movements are visible in the in-line display and patients or participants can be advised in between scans via the intercom system. <p>Tip: a MR-safe vacuumable head pillow improves both patient comfort (provides neck support) and image quality.</p>
All scanners	<ul style="list-style-type: none"> Review the setting for slice gap, make sure that there is no slice gap or distance between slices - if this is not done, spaces are left between the acquired slices which reduce the reconstructability of white matter tracts The more diffusion directions are acquired the better, but usually more than 64 directions are unnecessary as more diffusion directions can provide only limited additional information if the spatial resolution (voxel size) is not increased as well A b-value of 1000 is advisable for an optimal imaging of white matter, please document the b-value used

DTI Scan Protocol for Philips

For Brainlab:

- **iPlan 2.x**
- **iPlan 3.x**

In order to provide complete data sets for neurosurgery, you must provide **high resolution anatomical MRI data** in addition to the DTI data. The anatomical data may be acquired in the same study with the DTI data (but not necessarily).

If you need to import specific DTI scans which have not been acquired using this scan protocol, you can contact your Brainlab representative and provide a sample scan for review.

FoV (Field of View)	<ul style="list-style-type: none"> • Include region of interest • The patient should close their eyes during the scan
Patient Setup	<ul style="list-style-type: none"> • Supine and head first position only
Philips Scan Properties	<ul style="list-style-type: none"> • Axial only • DTI scan sequence • One corresponding B0 with • Diffusion directions (depends on scanner type): <ul style="list-style-type: none"> -Older version like NT 9.1.1:6 diffusion directions only -The newer version like 10.3.x, 11.1.x:6 or more diffusion directions • The B0 and the diffusion directions must have the same scan properties (number of slices, field of view, pixel and matrix size) • “Gradient Overplus” must be disabled • Repetitions allowed^a • Recommended slice thickness 3 mm or less
Angulation	<ul style="list-style-type: none"> • Version NT 9.x scanners: not supported • Version 10.3x, 11.1x scanners: supported • Note: Angulation will cause a color shift in display of the fiber tracts in iPlan (e.g. red, blue, and green fibers). The amount of shift correlates to the amount of angulation
Matrix/ Pixel Size	<ul style="list-style-type: none"> • Any matrix size, but must be squared
Storage	<ul style="list-style-type: none"> • 16 bit DICOM format only • Store as single slices. Enhanced images are not supported. • Note: Please be aware that manipulating (e.g. anonymizing) patient data may also remove important diffusion information

- a. iPlan 2.x: B0 and all directions must have same repetitions
iPlan 3.x: all directions must have same repetitions, B0 may be different

Any changes to the routine scan protocol normally used for the Brainlab system should be discussed and verified with the neurosurgery and radiology department.

If you need additional information, please contact your local Brainlab representative

Additional Recommendations

Safety	<ul style="list-style-type: none"> Brainlab recommends using a hand-held metal detector for a last check before patients or participants enter the scanner room. Inform patients early (ideally at scheduling) what to wear for the scan, and to avoid e.g. bras with metal wires, make-up etc.
Preparing the Patient	<ul style="list-style-type: none"> Patients should avoid smoking or drinking coffee before scans. Functional scanning sessions should not be scheduled directly after meals.
Restricting Motion	<ul style="list-style-type: none"> Instruct the patient to find a comfortable position before the scan begins. Simply telling them to stay as motionless as possible is not always sufficient to obtain optimal image quality. An example instruction: <i>“Please find a comfortable position in the scanner while we’re placing you into the tube. It is OK to wriggle around while we’re doing so. After finding a position in which you think you can lie comfortably for quite some time, please relax and try to move as little as possible, as your movements degrade the quality of our recording.”</i> If your scanner software allows for a check of image-to-image movements Brainlab recommends checking this after each scan sequence and discarding scans with strong movements (3-4 mm or sudden strong jumps, such as after a sneeze). If your scanner software has an in-line display option, Brainlab recommends having that window open during the scan, strong movements are visible in the in-line display and patients or participants can be advised in between scans via the intercom system. <p>Tip: a MR-safe vacuumable head pillow improves both patient comfort (provides neck support) and image quality.</p>
All scanners	<ul style="list-style-type: none"> Review the setting for slice gap, make sure that there is no slice gap or distance between slices - if this is not done, spaces are left between the acquired slices which reduce the reconstructability of white matter tracts The more diffusion directions are acquired the better, but usually more than 64 directions are unnecessary as more diffusion directions can provide only limited additional information if the spatial resolution (voxel size) is not increased as well A b-value of 1000 is advisable for an optimal imaging of white matter, please document the b-value used

DTI Scan Protocol for Siemens

For Brainlab:

- **iPlan 2.x**
- **iPlan 3.x**

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If you need to import specific DTI scans which have not been acquired using this scan protocol, you can contact Brainlab support and provide a sample scan for review.

FoV (Field of View)	<ul style="list-style-type: none"> • Include region of interest • The patient should close their eyes during the scan
Patient Setup	<ul style="list-style-type: none"> • Supine and head first position only • For iPlan 3.0.3 and higher: feet first and prone also supported
Siemens Scan Properties	<ul style="list-style-type: none"> • Axial only • DTI scan sequence • Diffusion directions (depends on scanner type): <ul style="list-style-type: none"> -Siemens (Siemens Syngo version VB13A and newer): 6 or more diffusion directions, multiple repetitions of the B0^a -Siemens (Siemens Syngo versions older than VB13A): 6 or 12 diffusion directions only. One corresponding B0 • The B0 and the diffusion directions must have the same scan properties (number of slices, field of view, pixel and matrix size) • Repetitions allowed^b • Recommended slice thickness 3 mm or less
Angulation	<ul style="list-style-type: none"> • Supported • Note: Angulation will cause a color shift in display of the fiber tracts in iPlan (e.g. red, blue, and green fibers). The amount of shift correlates to the amount of angulation
Matrix Size	<ul style="list-style-type: none"> • Any matrix size, but must be squared
Storage	<ul style="list-style-type: none"> • 16 bit DICOM format only • Mosaic images supported (only iPlan 3.x) <p>Note: Please be aware that manipulating (e.g. anonymizing) patient data may also remove important diffusion information</p>
Special Notes for Siemens	<ul style="list-style-type: none"> • Modifying direction vectors can lead to incorrect tensor calculation. Any change to the original Siemens DTI sequences requires the data be verified by Brainlab support. If required, refer to the Siemens DTI comment below. • Siemens DTI comment: _____

a. If for some reason the direction vectors are not stored in the DICOM header (new version), then only 6, 10, 12, 20, 30, 64, or 265 directions are allowed. Rotation of the data volume is allowed.

b. iPlan 2.x: B0 and all directions must have same repetitions
iPlan 3.x: all directions must have same repetitions, B0 may be different

Any changes to the routine scan protocol normally used for the Brainlab system should be discussed and verified with the neurosurgery and radiology department.

If you need additional information, please contact your local Brainlab representative.

Additional Recommendations

Safety	<ul style="list-style-type: none"> Brainlab recommends using a hand-held metal detector for a last check before patients or participants enter the scanner room. Inform patients early (ideally at scheduling) what to wear for the scan, and to avoid e.g. bras with metal wires, make-up etc.
Preparing the Patient	<ul style="list-style-type: none"> Patients should avoid smoking or drinking coffee before scans. Functional scanning sessions should not be scheduled directly after meals.
Restricting Motion	<ul style="list-style-type: none"> Instruct the patient to find a comfortable position before the scan begins. Simply telling them to stay as motionless as possible is not always sufficient to obtain optimal image quality. An example instruction: <i>“Please find a comfortable position in the scanner while we’re placing you into the tube. It is OK to wriggle around while we’re doing so. After finding a position in which you think you can lie comfortably for quite some time, please relax and try to move as little as possible, as your movements degrade the quality of our recording.”</i> If your scanner software allows for a check of image-to-image movements Brainlab recommends checking this after each scan sequence and discarding scans with strong movements (3-4 mm or sudden strong jumps, such as after a sneeze). If your scanner software has an in-line display option, Brainlab recommends having that window open during the scan, strong movements are visible in the in-line display and patients or participants can be advised in between scans via the intercom system. <p>Tip: a MR-safe vacuumable head pillow improves both patient comfort (provides neck support) and image quality.</p>
All scanners	<ul style="list-style-type: none"> Review the setting for slice gap, make sure that there is no slice gap or distance between slices - if this is not done, spaces are left between the acquired slices which reduce the reconstructability of white matter tracts The more diffusion directions are acquired the better, but usually more than 64 directions are unnecessary as more diffusion directions can provide only limited additional information if the spatial resolution (voxel size) is not increased as well A b-value of 1000 is advisable for an optimal imaging of white matter, please document the b-value used