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MRI Safety Manual:
Operator Guidelines and Protocols

SDSU Imaging Center
San Diego State University

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Contents

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Emergency

9-1-1

Non-Emergency

SDSU Campus Police – 619.594.1991

NB: Cell service at the center is very weak due to our location in the basement and the shielding in place to attenuate the magnetic field. Please be aware that you may not receive calls and calls may fail. When making emergency calls use the landlines located at the front desk and next to the console.

SDSU Imaging Center Safety Manual was written by Martin Sereno & Sean Molnar, 2019

INTRODUCTION

This document serves as a training and reference manual for Operators at the SDSU Imaging Center to ensure safety protocols are thoroughly understood and consistently followed during experiments using magnetic resonance imaging (MRI). To begin scanning at the Imaging Center, several requirements must first be met:

1) Attend the safety training course given onsite at the Imaging Center
2) Complete the operator training program under the guidance of a Trainer
3) Have your project approved by the Imaging Center Director or become paired with a Principle Investigator (PI)

It is the responsibility of an Operator to safely put human participants into the scanner and operate the console as well as be familiar with the SDSU Imaging Center's equipment, safety procedures, rules, and regulations. On average, training will last approximately 20 hours however this may vary across individuals. Operator Trainees (OT) are not allowed to operate the scanner without supervision by an SDSU Imaging Center Trainer. Completion of the safety training course is required for anyone who uses the MRI or works on any aspect of a project at the Imaging Center.

THE MAGNETIC RESONANCE ENVIRONMENT

MRI is an imaging technique that involves no ionizing radiation (that is, radiation that can cause chemical reactions or damage DNA, like X-rays, CT, PET). Instead, MRI only uses static magnetic fields (the main field; B_0), slowly changing magnetic fields (gradients), and RF (radio frequency) electromagnetic fields. Because of this, subjects can be repeatedly scanned with no harm, as long as standard safety procedures are followed. There are two primary features of an MRI magnet that under special circumstances have the potential to cause injury: (1) The strong magnetic field and (2) the RF transmit field.

The Magnetic Field

The strong static magnetic field is harmless to living tissue. The danger comes from loose metal objects and there are two counterintuitive features of the strong magnetic field surrounding an MRI magnet.

The first is that the field is ALWAYS ON, even when the magnet is not making noise, and even when all electrical power has been cut, with all the room lights off and every single LED on the magnet is off. The main superconducting coils are not “plugged in” and energy will continue to be present even when external power is gone.

The second feature is that it’s strength, as measured by the pull on a small piece of iron like a pair of pliers, goes from almost nothing to WAY beyond what you can manage to hang onto with your hands over a distance of a few feet. There is no bodily sensation upon entering this danger zone. Cinematic representations of magnetic fields are extremely misleading. Rely instead on your experience with a refrigerator magnet.

The primary danger due to the magnetic field is that it exerts an extremely strong force on ferromagnetic materials such as, but not restricted to, iron. However, some iron-containing alloys are non-magnetic (e.g., stainless steel). If in doubt, test the material in the console room with the small and medium sized magnets kept there. In addition, the web resource MRISafety.com holds a comprehensive list of items and their MR status.

Another key fact is that the attractive force is proportional to the weight of the ferromagnetic object. For iron objects, the force reaches 150 times the weight of the object for a 3T magnet. Thus, a small object without much iron in it (e.g., a metal screw), can be controlled in one hand (with careful attention). A small piece of iron weighing 5 pounds, by contrast, will experience a force approaching half a ton, easily enough to crush a bone.

Finally, with even a small, controllable piece of iron or other ferromagnetic material will rapidly accelerate toward the center of the bore if it is accidentally released near the magnet. If nothing is in the bore little damage may result. If an expensive head coil, motion camera, or mirror is in the bore the small flying object could damage it. Yet, if a person is in the bore they may be injured even by a very small object because it will “aim” for near the center of the bore, right where the head is. A larger object like an oxygen tank can be lethal. An important safety take-home message is: **Once a person gets anywhere close to the edge of the bore, the danger from flying metal objects begins and doesn’t stop until the person is safely out of the bore and away from the magnet.**

The RF Transmit Field

Under normal circumstances, the strong RF transmit field has very minor effects on tissue and the amount of RF energy deposited into tissue is strictly monitored and controlled by the magnet hardware and software. The total RF power deposited by most standard anatomical and functional MRI scans (e.g., FSPGR, MPRAGE, gradient echo EPI for fMRI, spin-echo EPI for DTI) is quite low. High RF power protocols such as turbo spin echo sequences (e.g., FSE, SPACE) are still safe, yet they can deposit 20x the RF power of a gradient echo sequence

However, if a long metal wire, or especially a loop of wire, is introduced into the magnet it can absorb a lot more RF energy from the transmit pulses than the human body can. It will then re-radiate this energy, and if near the body, will cause the tissue to burn. To avoid injury, long wires or loops must never be placed into the bore with a subject. To make a wire MRI-compatible (e.g., an MRI-compatible EEG lead) proper amounts of resistance is added at particular intervals to prevent the wire from resonating with the RF field and therefore picking up excess RF energy. Finally, tattoos are generally safe to scan. In extremely rare cases, tattoos can absorb RF and cause local heating, so in cases of permanent cosmetic tattoos (e.g., eye liner, full upper body), subjects should monitor for any heating.

RULES & GUIDELINES

We strive to maintain a safe, friendly, and stable environment providing flexible access to high quality MRI facilities while keeping rules and regulations to a bare necessary minimum. The basic set of guidelines all users are expected to know, and follow are:

1. Any researcher who will enter the magnet room must first attend a one-session SDSU Imaging Center Safety Training course offered every month.
2. Only qualified scanner Operators are allowed to run the scanner. Normal operating hours are Monday to Friday, 9am to 6pm. During these hours, normal, healthy adult participants can be scanned by a single qualified Operator (though we encourage there to be two Operators present, especially early in a study). Outside these hours, or whenever children (16 and under), patients, or other special populations are scanned, there must always be at least one additional Operator present.
3. No participants can be scanned without prior, written voluntary informed consent from the individual and IRB approval for the research project. Phantom scanning does not require ethical approval.
4. All participants must have filled out a 1-page *MRI Participant Screening Form* before entering the scanner environment (control room and magnet room). These must be filed in the appropriate box in the control room.
5. When a participant is in the scanner, the Operator can only leave the control room if another qualified Operator agrees to take over and replace them in the control room.
6. Always return equipment to its original location and state. This includes making sure all the equipment (e.g., projectors, screens, headphones, cushions, coils) is completely ready to be used by the next group. There are many labels on equipment and shelves to help.
7. Scanner bookings can be cancelled up to 48 hours before the original booked time, otherwise a percentage of the booked scanner hours will be charged for the cancelled time slot. This is to encourage cancelling booked hours far enough in advance so that other groups can potentially use them.
8. It is best to leave 30 min "open" time between bookings by different research groups to reduce set-up/tear-down friction between groups.
9. All operators should be familiar with the SDSU Imaging Center's *Incidental Findings Policy*.
10. All users need to be subscribed to our email list as this is our main way of communicating with the community.

NEW PROJECTS

Project Presentation

The first step is to prepare a short and informal public presentation of your research group's plan for a new scanning experiment. The Project Presentation meetings will be attended by the Imaging Center Director, Center Staff, and finally, any interested members of the local imaging research community. These meetings are scheduled on an ad hoc basis when 2 or more new presentations are pending (email the Center Director to get in the queue).

Project presentations provide an opportunity to vet and refine experimental procedures via suggestions from more experienced neuroimaging researchers. They also provide a way for members of the community who have never scanned before to learn the ropes. Finally, these meetings are crucial for building a coherent and friendly neuroimaging community around the new center. The public discussion often results in helpful modifications that improve the quality of these experiments.

Piloting

When preparing a new experiment, it is often necessary to do some basic pilot work to set up scanner pulse sequences or new stimulus/response equipment and programs. We break down pilot testing into informal equipment/stimulus/sequence set-up and pilot scans where human data is acquired.

Equipment/Stimulus/Sequence Testing

Once your project has been presented and approved, it is a good idea to test equipment and/or stimulation programs to ensure they are working correctly and to get scanning protocols in place. We encourage people to do this when the scanner is free on a first-come, first-served basis. Consult the online booking schedule (Calpendo) or ask Imaging Center Staff if the scanner is free (during normal operating hours, 9am to 6pm). You don't have to book this time and you won't be charged. Be aware, however, that if the scanner gets booked, even at short notice while your testing is going on, you will have to leave immediately.

Acquiring Human Pilot Data

After equipment, stimuli, and sequences are in place, it is a good idea to test your experiment with a knowledgeable participant or two from your lab to make sure your data and design are working as you think they are (this mainly applies to functional MRI studies). Scanner hours for this kind of pilot testing should be factored into the number of hours requested for the project, and should be booked as a regular scan (see Calpendo for more details). Lab members (or yourself) can serve as ideal subjects from which to obtain informed feedback on paradigm presentation, performance, and pacing. Screen them as you would any regular subject.

SCREENING FOR CONTRAINDICATIONS AND MRI SAFETY

It is the responsibility of the Operator assigned to the scan to ensure that everyone who enters the MRI Control Room has been properly screened for contraindications and is safe to be placed in the scanner. An Operator must be attentive and diligent about ensuring everyone is safe in the MR environment. The screening process for participants should begin during a participant's recruitment and extend across the entire length of their enrollment in the study. If the study protocol calls for participants to return, a screening process needs to take place every time they arrive at the Center. Remember, even if an individual has passed the screening in the past it does not imply that they will pass in the future.

Screening During Recruitment

During the recruitment process it is the responsibility of researchers to properly vet all potential participants for MR contraindications early on. This reduces the amount of time lost with individuals who, even if they pass all other qualifying measures, can not complete the imaging component of a study. It is better to know early on about their incompatibility rather than having to cancel a scan and risk forfeiting funds from your scanning budget. Feel free to digitize the questions on the *3T MRI Participant Screening Form* (located at mri.sdsu.edu/forms.html) into an electronic survey system (e.g., Qualtrics or Survey Monkey) to ensure all pertinent questions are addressed.

Note that if a participant answers yes to some of the questions on the *3T MRI Participant Screening Form* it does not necessarily warrant an automatic denial from the study. Please refer to the website, MRI Safety (mrisafety.com/TMDL_list.php) to determine if a reported object can be considered safe (e.g., IUDs) and email the SDSU Imaging Center Director for help making the final decision.

Upon Arrival to the Center

When reserving the MRI, it is important to allocate at least 30 minutes before the appointment to carefully screen the participant in the Testing Room located at the Center. Please go through the *3T MRI Participant Screening Form* again with the participant in person. Complete the top portion with appropriate participant information, taking care to assign them an SDSU Imaging Center *StudyID* with the correct format (YearMonthDayHourInitials -> YYMMDDHHII -> 19010113SM). This *StudyID* is what the participant will be identified by on the MRI Console and the directory under which the MRI data will be stored. Ensure each question is clearly articulated to the participant and that they understand what is being asked. The *3T MRI Participant Screening Form* needs to be completed and signed by both the Operator and the participant **before** entering the MRI Control Room.

Before Entering the MRI Room

Use the *MRI Operator Checklist* (see Appendix) located in the MRI Control Room to perform one last safety screen of the participant and any other individual about to enter the MRI Room. A quick run-through of this list reminds people to check for metallic items that could, affect the scanner and image quality, cause a headache if damaged (e.g., credit cards, iPhone, Watches), or risk hurting the participant. This is also a good time to remind the participant to use the restroom so scanning would not need to be paused midway through. Finally, if the protocol does not use the OptioAcoustic noise cancelling headphones, remember to give the participant earplugs and make sure they are properly in place.

Incidental Findings Policy

Operators will be trained on anonymized examples of incidental findings from previous scans. If the participant has selected YES to question 18 on the *MRI Participant Screening Form* an Operator may bring their attention to abnormalities found during imaging. We remind participants on the *MRI*

Participant Screening Form and verbally, that scans are not optimized for the detection of clinical abnormalities (e.g., we never use contrast, we often do not perform T2-weighted scans)

1. During scanning, each operator pages through the slices in a new subject's structural scan in all three planes using the Siemens Neuro 3D application on the console.
2. If something unusual is noted, the operator contacts the SDSU Imaging Center Director
3. If the imaging center director concludes more attention is needed, the images are referred to a neurologist
4. If the neurologist suggests that the incidental finding is alarming, SDSU Imaging Center Director will write a letter and detail in person what is seen in the brain images to the participant
5. The participant may obtain a copy of their imaging data if they request it.

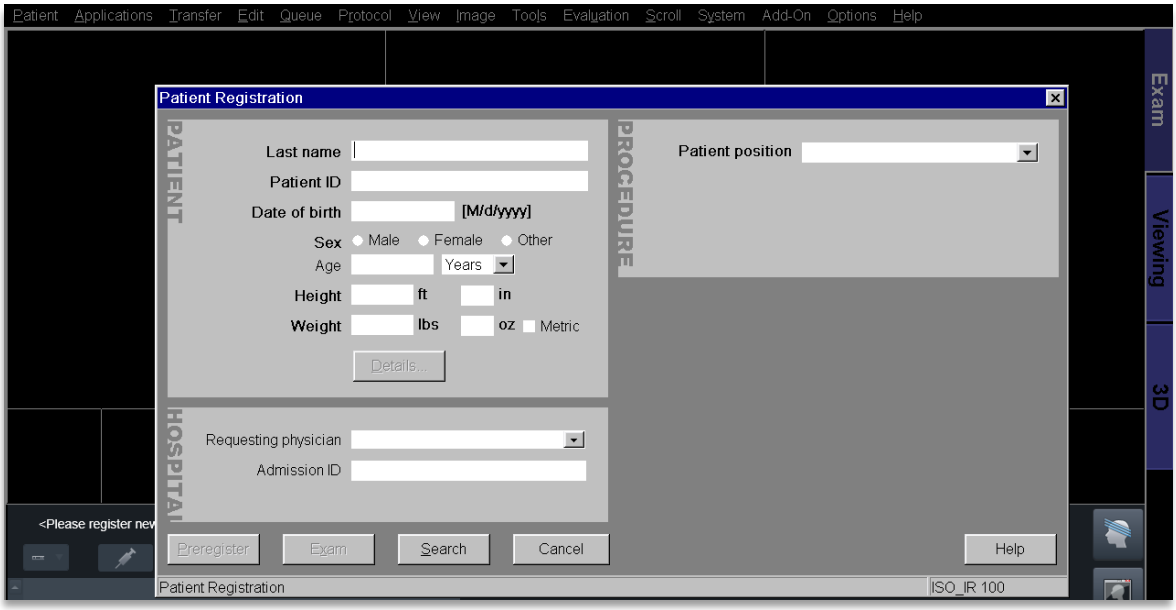
The SDSU Imaging Center Director has experience examining more than 10,000 scans at, Hillcrest UCSD Medical Center MRI, UCSD Thornton Hospital, UCSD Center for Functional MRI, and at Birkbeck/UCL Imaging Centre, London.

Operator Responsibilities & Safety Tips

1. No one enters the control room without the operator's approval. This includes both the participant(s) and the experimenters.
2. You have authority to ask individuals to leave the control room at any time and for any reason.
3. Do not allow cleaners, technicians, visitors, or anyone else into the control room. If someone requests access but you are uncertain of their standing with the Center, get a member of SDSU Imaging Center staff to help them.
4. Everyone who goes into the magnet room must be safety screened and checked for metal, including the participant, the experimenter, and yourself. If there is any doubt about the safety of entering the magnetic field, the individual may not go in.
5. Don't be persuaded by "expert subjects" – just because something was safe elsewhere or previously does not override SDSU Imaging Center safety procedures
6. Be sure that participants do not have damp clothing, excessive eye makeup, or excessive hair gel. All of these can result in contact burns.
7. Everyone entering the control room or magnet room is your responsibility.
8. Keep the door to the MRI Room closed and sealed when room is not in use. Do not let the door stay open.
9. No external equipment is allowed in the magnet room without prior approval from the Imaging Center Director or Manager. All approved devices will have accompanying documentation from an MRI Device Compatibility Form. If uncertain, the equipment may not enter the magnet room.

SIEMENS CONSOLE AND IMAGING CENTER SERVER

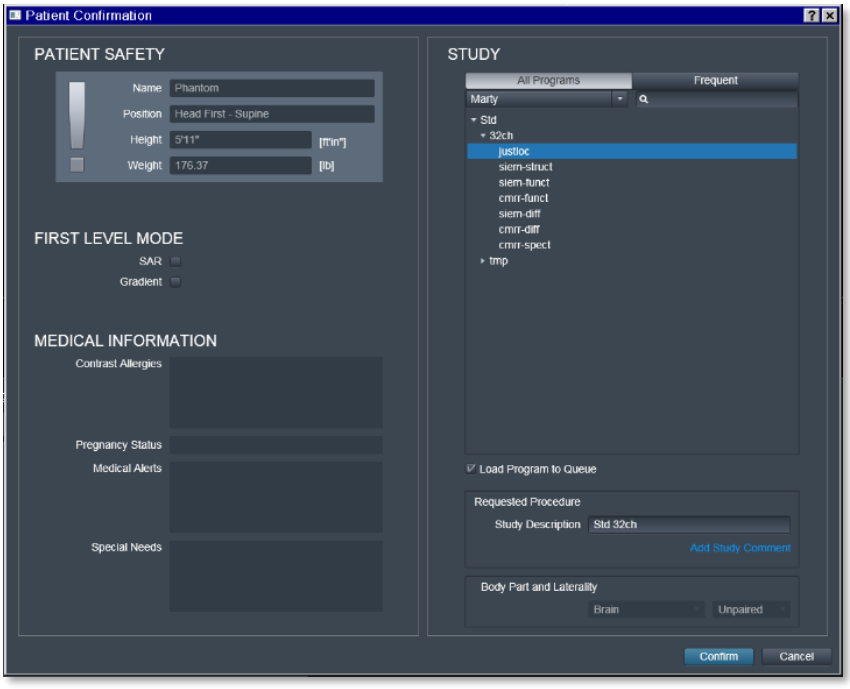
Participant Registration and Image Acquisition



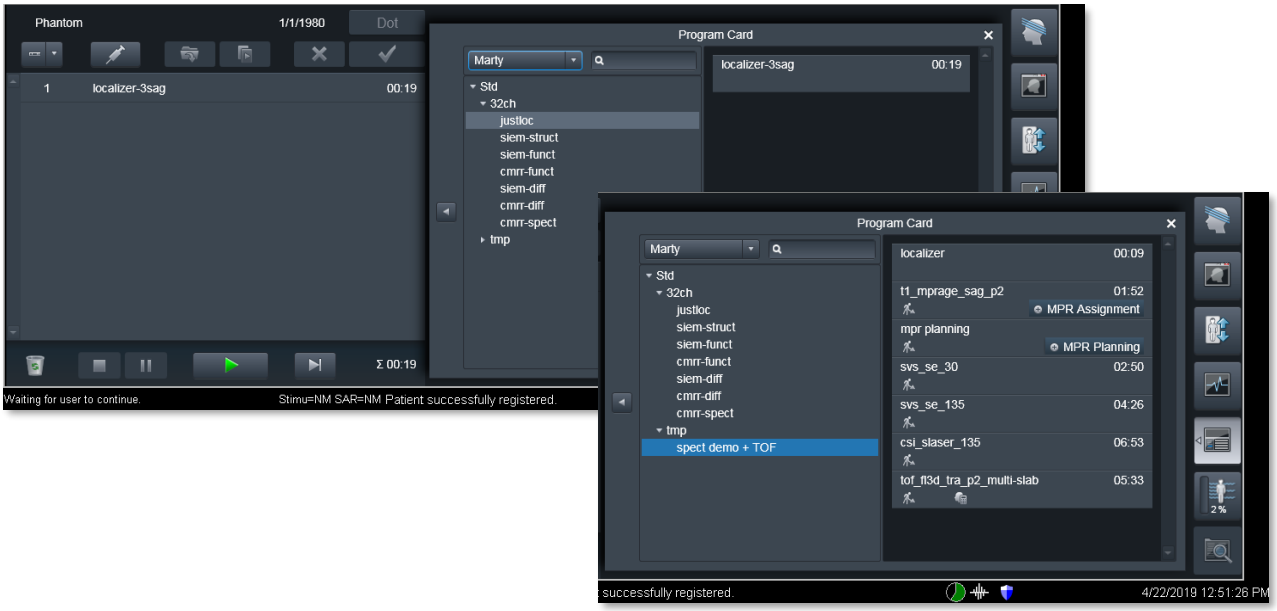
1. On the top-left of the console screen, select Patient -> Register, to open the *Patient Registration* window.
2. Use the *StudyID* (YYMMDDHHII) from the *3T MRI Participant Screening Form* to fill the Last Name box
3. Select the Patient ID box and it will auto-populate
4. To maintain anonymity, all participants have the same identifying information
   a. DOB = 01/01/1980, Height = 6' 0", Weight = 150lbs
5. Leave the Hospital section blank
6. Select the appropriate Patient Position -> Select *Exam*
7. The *Patient Confirmation* screen will appear. In the *Study* section, navigate to your user/lab profile and select the *justloc - Program Card* to load into your scan queue.

NOTE

When scanning Phantoms, enter *Phantom* into the Last Name box and select Search. Use the preregistered Phantom profile with the Patient ID number 000000



Once the localizer pulse sequence (*justloc: localizer-3sag*) is loaded into the queue, select the "Program Card" icon (third icon up from bottom on far right) and navigate to your intended Program. Click-drag the individual pulse sequences you want into the queue on the left to run them one at a time. You can also click-drag the current scan to copy the slice prescription for another functional run. This makes it much less likely for you to get mentally 'out of synch' with the queue and stay organized. This is especially helpful when you have to cancel, rearrange, or redo a scan.



Scanner Interface Focus vs. Operator Mental Focus

It is easy for the scanner Operator mental focus to get 'out of synch' with the scanner interface focus. For example, when a scan "won't run" — the interface says "waiting for slice positioning" or "waiting for user to continue" at lower left, but the user has mentally focused on a different scan in the queue and therefore gets stuck (fixed by rearranging queue, or clicking gray "X" (Cancel) button to the left of green check).

A related 'out of synch' problem is when the next scan loads while the current scan is running. It is easy to mistake the next-scan parameters in the lower right panel for the current scan (e.g., you have thought to check the TE or the number of volumes, and find a unexpected value, or a 'missing' tab). To be sure to see the parameters for the current scan, double-click the running scan in the cue to get a (non-editable) pop-up.

Quick Delete/Rearrange/Add/Save Scans

To quickly delete unopened scans (e.g., to rearrange a scan session), select a queued scan and use the Delete key (to the right of Backspace). If you start with the last queued, the last remaining is auto-selected, allowing repeated "Delete's".

To repeat/insert a scan (e.g., cancelled because of a stimulus program problem), right-click it, and select "Repeat and Open" (third from top).

To add a scan (can be from any user), browse to it using the dropdown in the "Program Card" display at middle right and click-drag it into the current queue at the left.

To save all the protocol parameters of a scan you just did (e.g., possibly modified after loading), to one of your "Programs" (list of protocols) for future use, open your Program for editing in "Dot Cockpit" (second icon available from lower right, third from the bottom "Program Card" icon), and click drag it there, and Save (floppy disk icon).

Copy Slice Prescription

A click-drag (or R-click -> "Repeat and Open") of a completed (or interrupted) scan auto-copies the slice prescription. To copy a slice prescription (block center and tilt) to a *different* type of scan, open (e.g., double-click) the next/different scan, then R-click a previously completed scan to copy slice prescription from, select Copy Parameters from pop-up, and accept default top choice in the what-to-copy list.

Watch out for unintended 'helpful' changes in parameters. For example, copying the slice prescription from a standard diffusion scan with A->P phase-encode direction to another diffusion scan in your protocol list with reversed phase-encode direction (e.g., "..." button was used to rotate phase encode 180 deg, to make it P->A) will confusingly change the phase encode direction to R->L, which can result in increased muscle stimulation from the concomitantly changed (hidden) readout direction.

A better method to reverse the phase-encode direction is to R-click the previous unreversed scan, select Repeat and Open, which will automatically copy the slice prescription, and then rotate the phase encode direction on the new scan 180 deg using the "..." button.

Selected Scan Won't Run

Scans will only initiate when in the first non-gray position within the queue list. To reposition the desired scan and allow it to run (e.g. you decide to jump out of order and run a scan that is located at the end of your protocol), left click and drag the scan to the top of the queue. If you had selected the play button to initiate the measurement before moving it, the scanning sequence will immediately begin when properly positioned.

Restarting a Scan

If you haven't started a scan, you can cancel its queue and still be able to use it. However, if you begin a scan and cancel before it is completed that sequence option will turn gray. To restart, R-click -> "Repeat and Open" on the gray scan to generate an executable copy which contains the previous manual FOV adjustments.

Hierarchy of Protocols

The Siemens "Dot Cockpit" protocol tree (formerly in "Exam Explorer") is a rigid 5-level-deep hierarchy:

```
tree (e.g., USER)
    region (e.g., SDSU)
        exam (e.g., "Marty")
            program (e.g., "siem-funct")
                protocol (e.g., "Em-2.5^3,s30,r1,e29,mb2,gr1,b2564")
```

Use Browse -> Organize Tree -> New Tree to create a tree, and R-click on an entry to create a new region, exam, or program. A level can be renamed by clicking on it in the tree at the left. The names of the first three levels will be included in the exported DICOM filename, so keep the level names brief and don't use spaces.

The verbose example protocol names specify scantype, voxelsize, slices, TR, TE, acceleration, and bandwidth, while fitting into the total number of characters that can be displayed.

Print a Copy of the Protocol

1. Within the Dot Cockpit navigate through the directories to the protocol list or individual pulse sequence you wish to print.
2. Right-click on the item and select *Print*.
3. Select *Print To .PDF* -> **U:/tmp/file_name.pdf** -> Select *Print*.
4. Open a command terminal -> switch to the **U:** drive -> **cd tmp** -> locate the appropriate file
5. **scp file_name.pdf username@sni05:/rawdata/username/tmp/**
6. Log into *SNI05* from your computer or server to retrieve the file. In some instances, you will need to change the permissions of the file in order to allow the transfer to complete.

Other Interface 'Gotchas'

- When tilting a block of slices, avoid touching the icons on the edges of the bounding box, which can result in inadvertent changes in slice count or in-plane field-of-view. Move the slice block around using the circle in the middle of the block, and tilt the block using the horizontal line through the middle of the block but avoiding the edge.

- For the 32-channel coil, don't accidentally click the representations of the top and bottom halves of the coil, which are the vertical gray strips at the left and right edges of the sagittal view. Clicking one of these toggles that coil-half OFF (empty) and ON (gray)!

- Be sure the head coil is plugged in before you Register a subject and open your protocols. If not, your protocols will be modified to use the body coil as the receive coil, greatly reducing your signal-to-noise. You can check this or correct it before starting a scan in: System -> Coils.

OptoAcoustics Headphones

The OptoAcoustics noise-cancelling headphones/microphone system is parallel to the Siemens intercom, which still works. You can continue to use the Siemens system if you prefer. The OptoAcoustics system consists of a noise-cancelling microphone, a pair of slim, noise-cancelling earphone units that fit into both 32- and 64-channel coils, and slim inflatable outer pillows that slip in between the headphones and head coil to evenly hold the headphones in place.

The gooseneck microphone (double optical microphone) permits recording completely un-artifacted vocal responses during scans and provides extremely clear subject feedback (disposable pop-filters in cabinet). In contrast to the Siemens intercom, the EPI beeps are completely suppressed, allowing you to even hear the subject whispering during a scan. It's worth telling subjects to speak very softly (also better for position stability). The headphones have piezoelectric drivers and each contains another optical microphone for noise cancellation, but also for recording exactly what the subject is hearing and for setting absolute stimulus sound pressure levels (SPL and spectrum visible on OptoAcoustics console). The OptoAcoustics feedback speaker can be switched between the subject microphone (what the subject is saying -- default: button out) and the headphone microphone (what the subject is hearing).

NOTE
Please refer to the OptoAcoustics manual for further information on headphone operation and troubleshooting tips.

Finally, the headphones have clear plastic covers for the black foam ear cushions which should be cleaned with alcohol between subjects rather than immediately discarded. They can be replaced at longer intervals.

OptoAcoustics Noise Cancellation System

The OptoAcoustics system uses an initial 16 sec period (after the first scanner pulse) to 'learn' the spectrum of the repeated noise. During this time, no audio stimulus should be presented. In order to obtain enough samples, the TR (repeated scanner sound) must be less than 3.6 sec. During this initial period, there is no noise cancellation. However, the sealed headphones themselves provide good attenuation of the scanner noise. If you repeat the same scan, you can skip this step, and therefore, reduce the initial 16 sec discarded data period on subsequent scans.

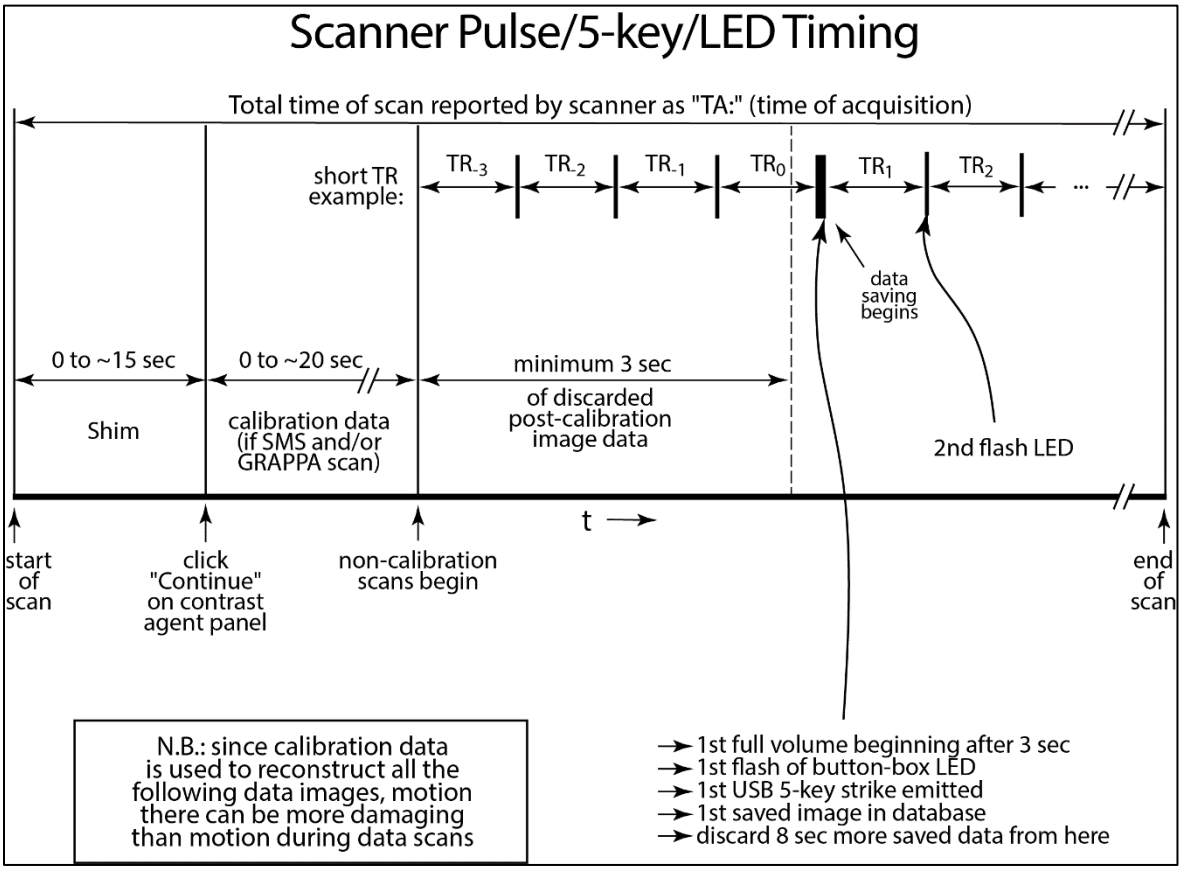
The audio input to the system is via a 3.5mm stereo headphone jack (LINE1) on the back of the OptoAcoustics control unit (in laptop cable bundle on desktop). An optical audio input is also accepted (LINE2). The noise-cancelled output of the microphone can be recorded along with the scanner trigger pulse via a stereo USB audio connection to the OptoAcoustics control unit. The stereo audio signal heard by the subject (after noise cancellation) can be recorded via the green analog stereo 3.5mm jack on front of the PC-like box under the desk.

Finally, the microphone signal can be fed back into the headphones to enable more naturalistic speaking (Self-Hearing dial).

How To Train the System

1. Turn on OptoAcoustic desktop unit (back panel)
2. "Start" (touchscreen)
3. Setup mic/headphones/inflate-pads, move patient table into bore
4. "Calibrate" (touchscreen, soft 'whoosh' in each ear)
5. "Learn" (touchscreen => waits for scanner pulses)
6. Start scan (noise cancellation starts 16s after 1st scanner pulse)
7. Start your soundtrack (16s after first scanner pulse)

Scanner Pulse Sequence



Rebooting the Scanner

If you are the last Operator using the scanner for the day or a localizer scan has failed (marked by a head with a red line through it displayed on the bottom toolbar) you may need to shut down and reboot the scanner.

REMEMBER

Even if the MRI console is shutdown and the lights are all dark on the scanner, THE MAGNET IS ALWAYS ON.

Cleanly Shut Down the Scanner

1. System -> End Session -> Shutdown System -> Yes
2. Wait about 3min until “OK to turn off computer” appears
3. Press blue “System Off” button on the Alarm Box (NOT the Quench button!)
4. Wait ~15 seconds

Boot the Scanner

1. Press the blue “System On” button on the Alarm Box (NOT the Quench button)
2. Wait ~8 minutes. After the interface is up on the console monitor for ~ 1min, there should be 3 scanner beeps.
3. Run localizer scan on a phantom
4. If localizer fails – contact the SDSU Imaging Center Director or Manager

Just Reboot Measurement & Recon

1. System -> Control -> Measurement & Recon (Tab) -> Reboot
2. Wait ~5 minutes

Transfer Data: MRI Console to SNI05

Color Index

GREEN - Paths and arguments that can be typed verbatim into a terminal
ORANGE - Information which needs to be defined by the user

Instructions

Once scanning is complete it is important to transfer your DICOM files to the Imaging Center server (SNI05) as soon as possible. The MRI console will be cleared by the SDSU Imaging Center Manager every Friday. Any data that has not been moved to SNI05 by the end of the week will be lost. To transfer your data:

1. Select Patient -> Browser from the primary console screen
2. Select your entire study in the Patient Browser window
    1. If you select a single scan, only that one item will be transferred
    2. It is okay to select either the main folder or the first subfolder
3. Click Patient Browser -> Transfer -> Export to Off-Line
    1. The other *Transfer* menu at top of screen won't work
    2. Don't use *Send To…*
4. On pop-up, go to "Path:" dropdown and select:
    1. **\\sni05\meduser\exported**
5. Append YYMMDDHHII (year\month\day\hour\initials) format directory:
    1. **\\sni05\meduser\exported\YYMMDDHHII**
    2. If you forget this step all your files will end up in a pile in the exported directory
    3. Always follow YYMMDDHHII format so directories sort chronologically
6. Select "OK" to create directory and start transfer
    1. If you are the first person of the day to transfer data, you may get a *Connect As…* pop-up. Login as user *Meduser* with *Advanced User* password.

To view transfer progress: Patient Browser -> Transfer -> Local Job Status; or select the *phone/floppydisk* icon on the bottom toolbar will open the *Local Job Status* window. Don't select *Network Job Status* from the Transfer drop-down menu.

It is important to double check that all your data has successfully transferred to SNI05. On the SNI05 command terminal…

```
>>    cd /rawdata/meduser/exported/subjectID
>>    ima2brik -list
```

This will display a compacted list of each scan in the directory and some pertinent details to help confirm the correct data has been imported.

CAUTION

The file transfer system from the MRI Console to SNI05 does not overwrite files. If you had created a new subject directory, started to transfer data, yet canceled before completion. Starting a new transfer will not replace the files that are currently in the directory. Be sure to go onto SNIO5, delete the directory, and restart exporting the data from the beginning.

Convert DICOM Files to Nifti and AFNI Formats

After your data is securely on SNI05 you can collapse the individual DICOM files into complete volumes for faster transfer to external storage. This process can be completed via both the meduser account and your Lab's User account. Through the command terminal, navigate to the directory which holds the subject data you wish to convert. Run **ima2brik** without any arguments to display instructions and execution options.

```
>>  cd /rawdata/meduser/exported/subjectID
>>  ima2brik (add the argument which suits your format needs)
```

The reformatted data will be outputted to directories (zzAFNI, zzANALYZE, and/or zzNIFTI) within the subject folder.

Generate Video of Brain for Participants

Participants of an MRI experiment are often given a copy of their reconstructed brain. On SNI05, there are a series of functions which will allow you to generate those files with the Linux command terminal. After you have transferred the MR data from the console to SNI05 and converted the DICOM files into AFNI format you can generate the .mpg files

```
>>  cd /rawdata/meduser/exported/subjectID
>>  ima2brik -afni
>>  cd zzAFNI
>>  mri2mpg scan+orig.BRIK
```

Transfer Data: SNI05 to Personal Lab

Transferring the MR data to your lab for additional analysis and storage can be accomplished several ways, two of which are detailed here.

> *CAUTION*
>
> Please do not connect thumb-drives or external hard drives directly to the server. Connecting drives can unknowingly transfer harmful files to the server and damage the system

Transferring Data via Secure File Transfer Protocol (sftp):

Secure file transfer protocol allows you to navigate between both local and remote terminals through the same command line. This enables you to find the appropriate location for your data before transferring. Standard Linux commands will control the remote terminal you logged into via **sftp** (e.g., SDSU Imaging Center Server). Adding a lower-case L onto the commands will allow navigation on your local computer (e.g., Lab Server).

Examples: { **ls** = list contents in current directory on *remote terminal* }
{ l+ls (**lls**) = list contents in current directory on *local terminal* }
{ **cd** = change directory on *remote terminal* }
{ l+cd (**lcd**) = change directory on *local terminal* }

Personal Lab Terminal:

1. Login with your User ID to SDSU Imaging Center Server (SNI05)
2. On the remote terminal (SNI05), navigate to file location
3. On local terminal (Lab), navigate to file destination
4. Run **get** command with recursive argument (**-r**)
5. Check all data has transferred and Exit

```
>>  sftp UserID@sni05
>>  cd /rawdata/meduser/exported/subjectID
>>  lcd /home/path
>>  get -r -p subjectID/zzAFNI
```

Transferring Data via Secure Copy (scp)

Secure copy allows you to quickly transfer data in one command once you know where the data is and exactly where you want to transfer it to.

SNI05 Terminal:

>> scp -r /rawdata/meduser/exported/subjectID/zzAFNI usrname@Lab IP address:/path

Personal Lab Terminal:

>> scp -r UserID@sni05:/rawdata/meduser/exported/subjectID/zzAFNI :/path

EMERGENCIES

Regardless of severity, in the event of any emergency it is important to remain calm, composed, and in control. At least two researchers, one being the Operator assigned to the booking, are required to be present for MRI research involving a human participant. Work together to ensure the safety of the participant, call emergency services, and contact the SDSU Imaging Center Directory (Marty Sereno: 619.639.5425)

Quench Procedure

> "During a quench, the super conductivity of the magnet is lost. The energy of the magnetic field is converted into heat. The magnet field falls off to 20 mT within approx. 20 seconds. The liquid helium (coolant) boils off rapidly during this process and is released to the outside via the exhaust vent line. The escape of gaseous helium via the exhaust live is very noisy due to the high gas flow and you can hear a loud roaring noise for several minutes."
>
> (Siemens 2015)

Do not quench, in the event an object (e.g., air cylinder, chair, laptop) is stuck to the scanner but there is no bodily harm or immediate danger to the researchers and participants.

Quench, if there is a person in the bore in harm or life-threatening danger due to a ferrous object pinning them to the scanner.

There are two quench buttons located in the Imaging Center. The first (1) is located directly to the left of the MRI Console in the Control Room and the second (2) is situated inside the MRI Room on the left wall.

1. Lift the plastic cover and push the button
2. Quickly remove the participant from the bore and move everyone out of the MRI Room

Quench Vent Failure

> "If the vent line fails in part or fully, gaseous helium will enter the examination room. In this case the air conditioning unit will not be able to ensure sufficient air exchange and the following hazardous situations may arise:
>
> - Poor visibility due to strong fog in the upper area of the room
> - Rise in pressure in the MRI Room
> - Hypothermia and risk of suffocation (e.g. in case of large leaks)
>
> Due to such hazardous conditions as acute hypothermia and suffocation, rescue attempts must not be performed by a single person. Persons not directly involved in the rescue should leave the examination room as well as adjacent rooms. A filter (gas mask) without its own oxygen supply does not protect against suffocation through helium."
>
> (Siemens 2015)

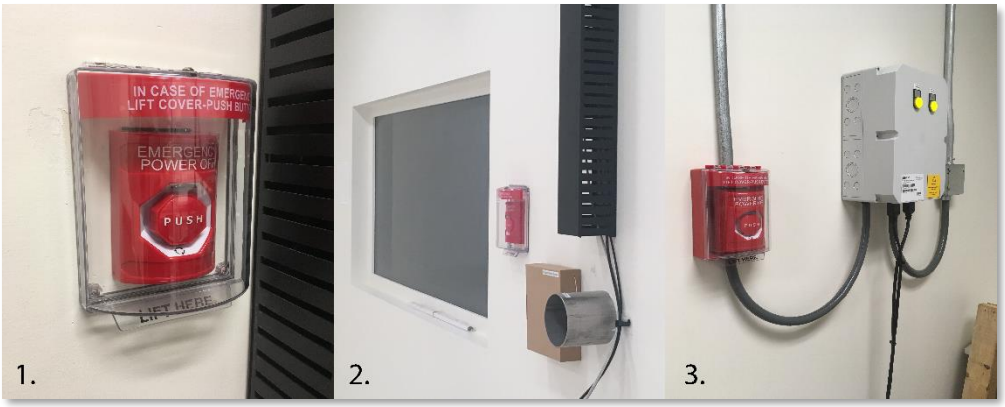
Use the following procedure in case of a sudden release of gaseous helium into the magnet room (GE Medical Systems, 2003).

1. Do not panic
    - Staying calm helps you remain focused and remember your planned method of action
2. Use the intercom to tell the participant to stay calm and remain on the table
3. Prop open the door between the MRI Console Room and hallway to promote air circulation
4. Prop open the door to the MRI Room.
    - If helium is venting into the MRI Room, the door may not open
    - If door cannot be opened, break the window to the MRI Room to relieve pressure
5. Enter the MRI Room and help the patient exit
    - Helium rises, so stay near the floor when evacuating
6. Evacuate all personnel from the area until the air is restored to normal

Emergency Power Off Procedure

In an event where you need to quickly cut power to the MRI there are three *Emergency Power Off* terminals located throughout the Imaging Center:

1. MRI Control Room next to the door to the magnet
2. MRI Room next to the viewing window
3. Equipment Room across from the Siemens server and helium pump cabinets



Fire

If there is an electrical fire in the MRI Console Room, MRI Room, or Equipment Room press the red *Emergency Power Off* button to cut the power supply. **Do not quench** unless an individual is in immediate harm.

The red fire extinguishers located directly outside the Imaging Center in the hallway are ferromagnetic and **NOT** allowed into the MRI room. Even in the event of a fire, the magnetic field is still present and will exert tremendous force on the extinguisher.

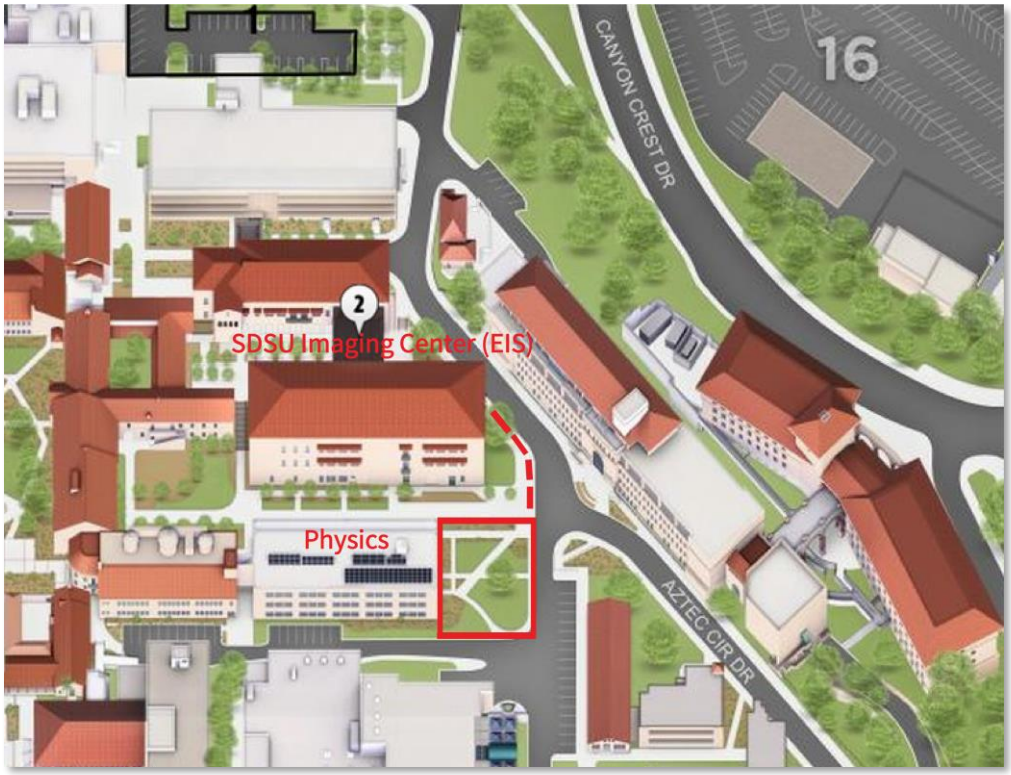
REMEMBER

Engaging the *Emergency Power Off* does not reduce or change the strength of the static magnetic field inside the MRI Room

Emergency personnel such as EMTs and firefighters should not enter the MRI Room.

Evacuation Location

The Operator assigned to the booked scan is responsible for the safety of the participant and other individuals assisting with the experiment at the Imaging Center. If an evacuation is necessary, check all the rooms in the Center and escort everyone to the lawn of the physics building (pictured below).

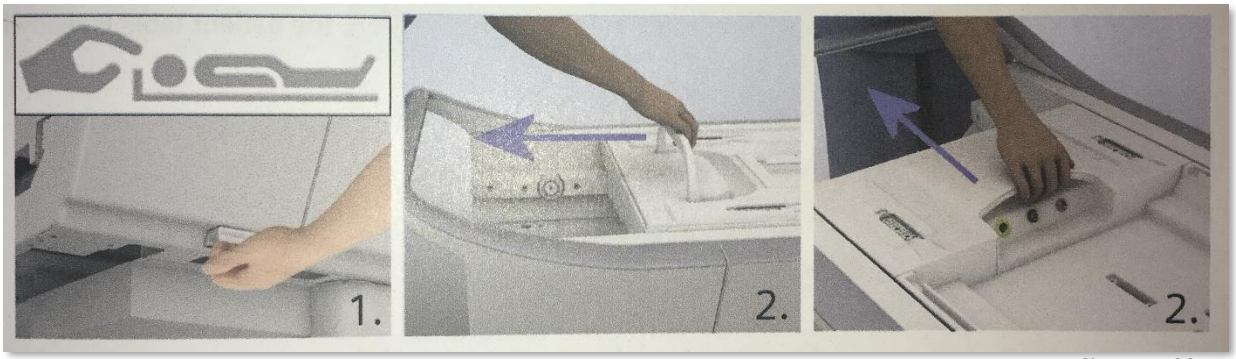


Manually Moving Patient Tabletop

In the event of a quench with a failing quench pipe, fire with strong smoke development, an emergency situation with the participant, or the MRI room loses power, the Operator may use the manual override to withdraw the bed from the bore.

1. Pull the Emergency release located at the bottom right of the fixed table

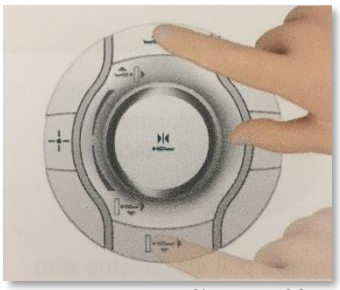
2. Use the handle at the foot of the sliding bed to pull the participant out



Siemens, 2015

To reset the emergency release:

1. Push the emergency release back into its original position while shifting the bed silghtly in any direction until to audibly locks into position
2. A prompt will appear on the MRI screen instructing you to simultaneouly press the **Table Up/Inward** and **Table Down/Outward** buttons on the MRI Control Unit
3. Press the **Home** button to complete the resetting process


Siemens, 2015

Helium Pump

The helium pump should always be on. When it's on, the magnet makes a periodic 'tweet' once a second. After a power cut, even a brief glitch, the helium pump may (very occasionally) not restart properly. If you are at the magnet when this happens, or if you don't hear this 'magnet heartbeat', try power cycling the helium pump in the equipment room (right most cabinet).

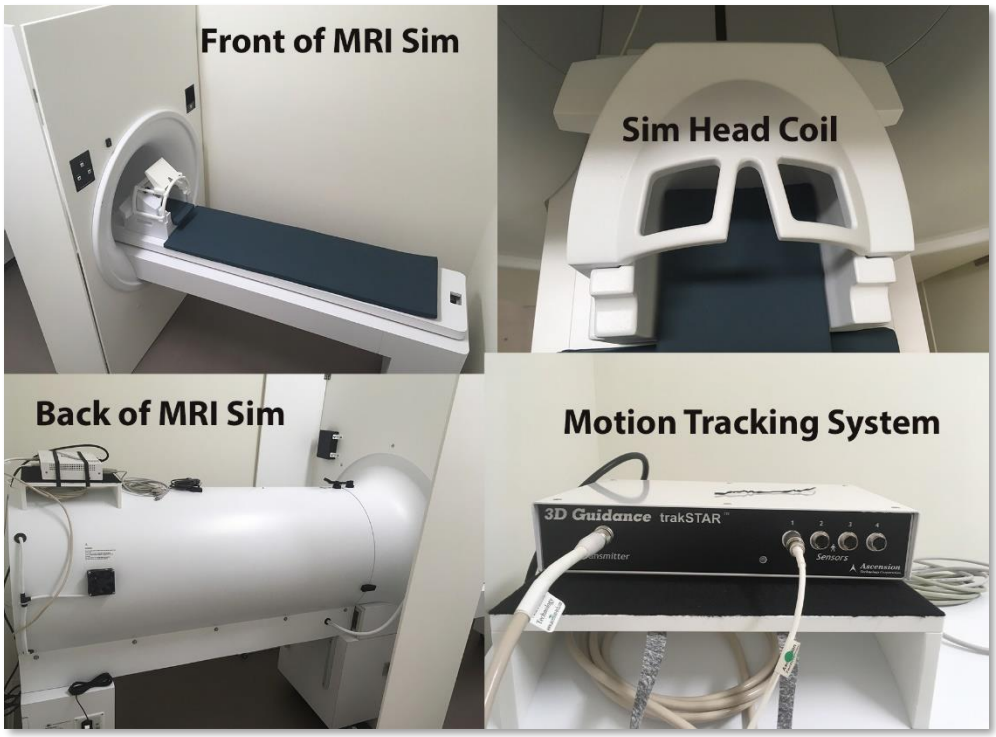
<u>How To Power Cycle the Helium Pump:</u>

1. Rotate the black *Main Power* switch 90° to the left
2. Wait 2 to 3 seconds
3. Rotate the power switch back to its original 12 o'clock (On) position
4. Quiet the alarm in the MRI Control Room by pressing the Bell button located on the Quench control terminal. DO NOT QUENCH.
5. Please report all issues regarding the helium pump to SDSU Imaging Center staff immediately.

THE MRI SIMULATOR

The MRI Simulator is located in the Testing Room and is available for booking through Calpendo. This equipment is designed to help researchers determine if a potential participant can remain calm and motionless within a confined space. PIs and Operators are encouraged to reserve the MRI Simulator during recuritment to help screen participants before committing to booking them in the real scanner. When used properly, the MRI Simulator can help participants feel comfortable in the bore and reduce the possibility of appointment cancellation and/or attrition. The MRI Simulator can aid researchers in several ways…

- Determine if an individual is able to remain still and calm
- Help an individual acclimate to the novel environment
- Train an individual to minimize head and body movement via MoTrack
- Allow a participant to experience and adjust to the sounds of an MRI via SimFX



Simulator Protocol

Prepare Simulator

1. Turn on the MRI Simulator on by flipping the white switch located at the base of the machine
2. Turn on the 3D Guidance trackSTAR box sitting on top of the MRI Simulator
3. Wake up the desktop computer at the simulator console
4. Start MoTrak Software
5. Start SimFX Software (if necessary)

Situate Participant in Simulator

1. Have the participant situate themselves on the simulator table as they would in the real scanner.
2. Secure the the motion tracking sensor to the participants forehead with the transpore tape provided.
3. Position the top of the coil and/or mirror.
4. Three buttons located to the left of the table control the lights, fan, and moving the table into the bore.
   a. For the table, press the button once to initiate movement; it is not necessary to hold the button down.
5. Move the table into the bore and instruct the participant to adjust the mirror so that they can see the screen clearly.

NOTE

To use the MoTrak motion sensor in tandem with the head coil remove the padding and feed the sensor cable out the bottom and around the coil so it is not pinched by the anterior component of the head coil.

Upon Completion of MRI Simulator Use

1. Return the table back to its original position and help participant off of the simulator
2. Close MoTrak and SimFX Software
3. Turn off the trackSTAR hardware
4. Put MRI Simulator Computer in Sleep mode
5. Turn off MRI Simulator

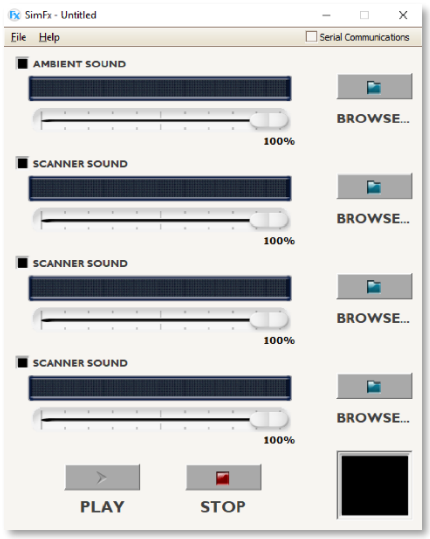
MoTrak

The MoTrak system consists of a monitor at the simulator console (1) and one for the participant inside the bore (2). Begin tracking by pressing the running man icon on the toolbar (3), option to save tracking data if you want, and zero the marker by selecting the red dot/crosshair icon (4).

For more detailed information please reference the MoTrak manual.

SimFX

The SimFx software enables a researcher to play a combination of MRI and ambient sounds while a participant is in the bore. Select the appropriate sound you would like to play and set both the desktop volume and SimFX volume to 50% to start. Select *play* and slowly increase the SimFX volume slider to the desired loudness.

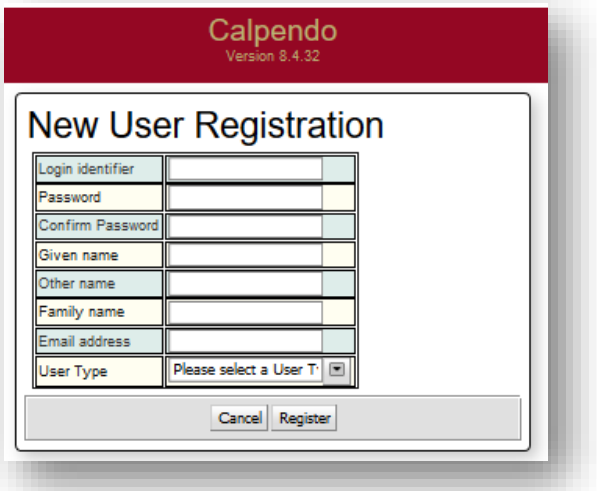


CAUTION

DO NOT exceed 50% loudness on the desktop volume controls. The speakers within the MRI Simulator are capable of being very loud. Going too high when the participant is in the bore can potentially damage both their hearing and the MRI Simulator speakers.

CALPENDO

User Registration



1. Please visit – https://sdsu-bic.calpendo.com

2. Select **Resister New User** at the bottom of the login screen

3. Please fill out all fields
   - **Login Identifier:** Use the first letter of your first name proceeded by your last name
   - **Password:** A minimum of 8 characters with at least one number and one non-alphanumeric character
   - **Given Name:** First Name
   - **Other Name:** Alias or nickname (Not Required)
   - **Family Name:** Last name
   - **Email:** University Email
   - **User Type:** Please select the title that appropriately fits your role
     - **PI (Principal Investigator):** The researcher overseeing the execution of the project
     - **Operator:** An individual who has received safety training and been personally certified by SDSU Imaging Center staff to scan patients/subjects
     - **Operator Trainee:** An individual who has received safety training but not operator training. Must be accompanied by an operator when in the Control Room, Equipment Room, and MRI Room
     - **Research Coordinator:** An individual who reserves the MRI, testing room, and/or parking for various research projects but is not safety trained

4. Once a user registration request is submitted, it needs to be approved by the SDSU Imaging Center team. The applicant will be notified of their approval or denial by email.

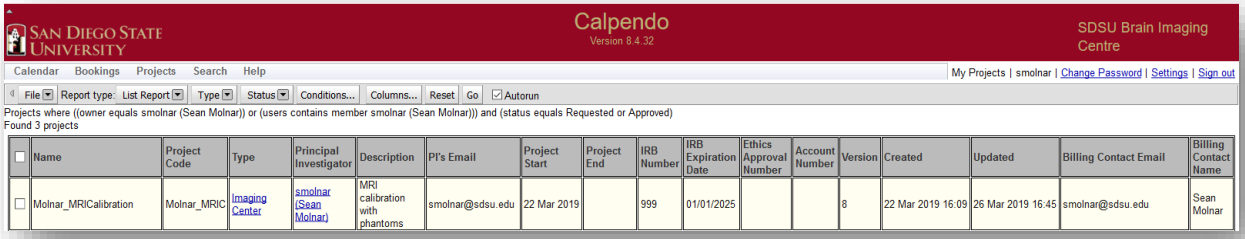
Creating a Project

1. Select **Projects -> Create Project** from the toolbar at the top of the page

2. Fill in the text fields with the appropriate information
   - **PI:** Principal Investigator of the study
   - **PI's Email:** University or organization email
   - **Project Full Title:** Title of the research project as it appears on IRB or grant documents
   - **Project Start:** Today's date
   - **Project End:** Projected end date (Not Required)
   - **Description:** Short description of your study
   - **Type:** Select your department
   - **IRB Number:** ID number from review board associated with the project
   - **IRB Exp. Date:** Expiration date noted on IRB paperwork
   - **Billing Contact Name:** Point of contact for sending invoices
   - **Users:**
     - The user creating the project is automatically attached to the project. Add additional users/accounts to the project via the drop-down menu
3. Select **Save**
4. Select **Create** to officially submit the project for review and approval by the SDSU Imaging Center

Reviewing Projects

1. Select **Projects -> My Projects**

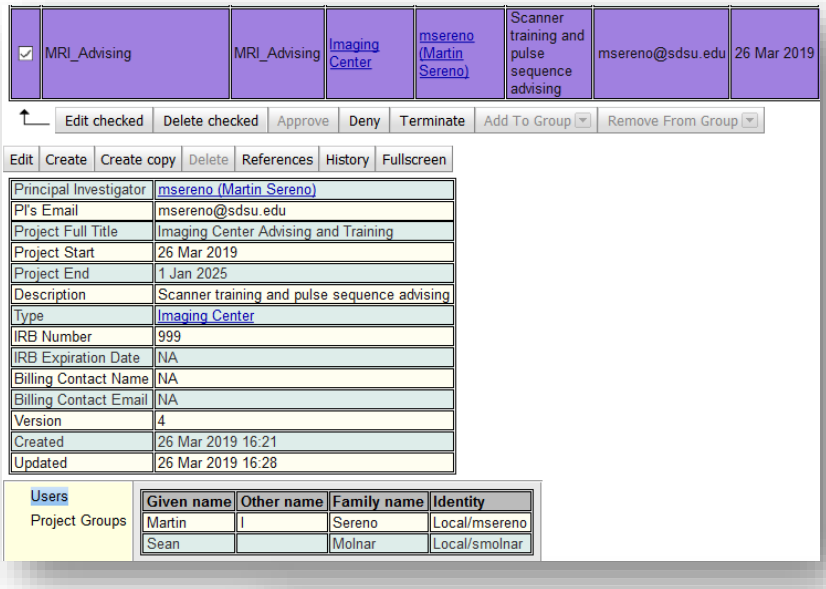


Project Code

- Upon approval, a unique project code will be assigned the study. It will typically consist of the PI's last name and an abbreviated version of the project title (e.g., Molnar_MRICalibration)

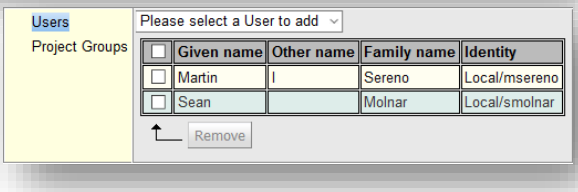
Adding a User on a Preexisting Project

1. Select the project you would like to add a user to. The row will change color and a summary window will open below detailing the project info in a more concise manner



2. Select **Edit** from the toolbar at the top of the summary window

3. This will make the option, "**Please select a User to add"**, appear at the top of the **Users** sub-window. This is similar to the option available when first creating a project

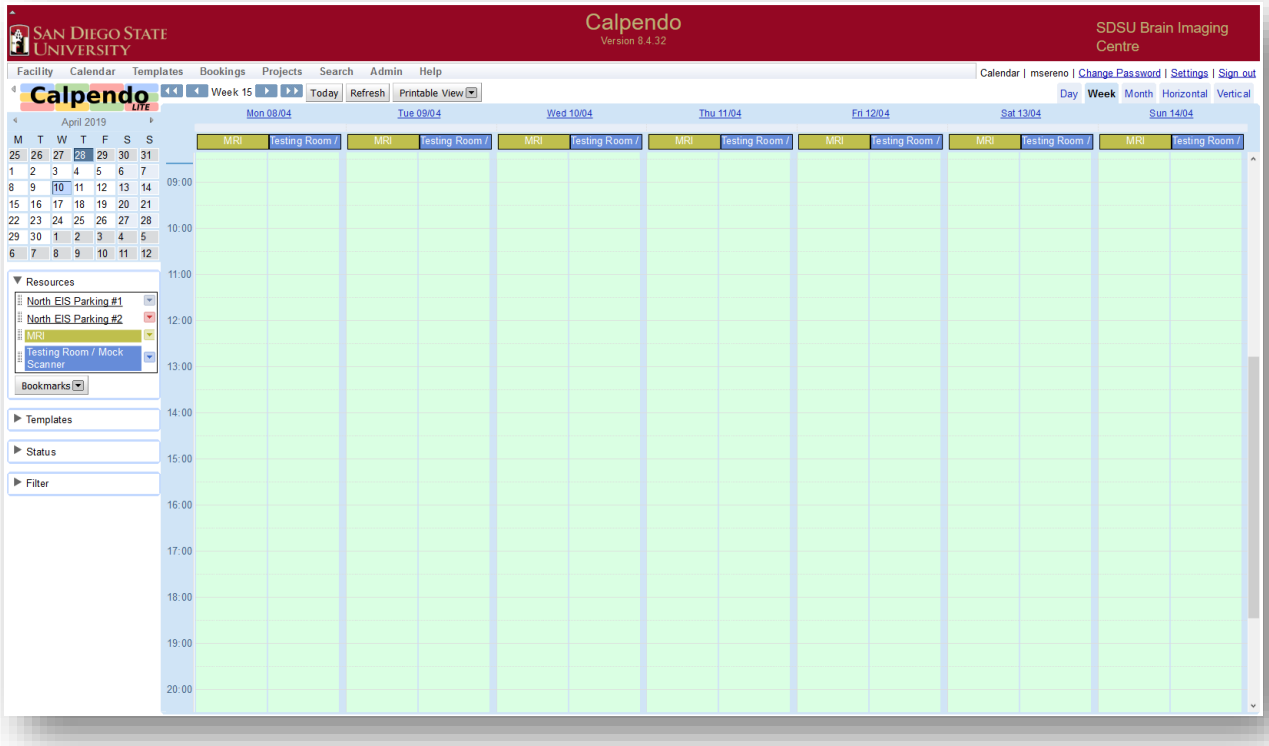


4. Select the users from the list to add to the project and **Save**

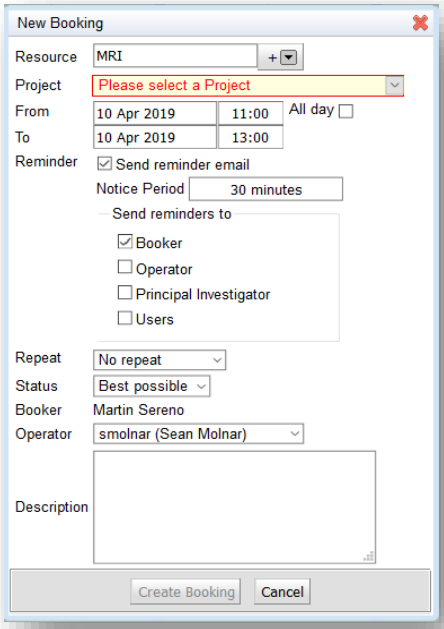
Booking

Making a Reservation

1. Select **Calendar** from the toolbar



2. In the **MRI** calendar column, highlight (left-click & drag), and select the amount of time you would like to reserve. A box titled **New Booking** will appear.



3. Complete the **New Booking** form and select **Create Booking**
   - **Resource:** MRI, Testing Room/Mock Scanner, Parking
   - **Project:** Select a project from the available options
   - **From/To:** Date, time, and duration of reservation
   - **Reminder:** To whom reminders will be sent
   - **Repeat:** Do not adjust
   - **Status:** Do not adjust
   - **Booker:** User making the reservation
   - **Operator:** Select an operator from the list of users
   - **Description:** Space for anonymized subject ID's or short description
     (Do not include identifying or sensitive subject information in the description box)
   - **Scan Type:** Select the option that best characterizes your scan
     i. **Phantom –** Testing pulse sequences and MRI procedures with a phantom
     ii. **Pilot –** Refining research protocols with an approved individual in the MRI
     iii. **Subject –** Study is underway with recruited participants

Cancelling a Booking

6. Select the booking that needs to be removed
7. Select **Edit -> Cancel Booking** at the bottom of the booking page
8. Choose the appropriate reason and add a short explanation for removing the booking, select **Cancel Booking** again.

Cancellation Policy

1. A booking can be cancelled up to 48hrs before the scheduled start time and your project account will not be billed for the cost of the scanner.

2. If a booking is cancelled less than 48hrs from the scheduled start time and it has not been replaced by another scan (e.g., another participant or a different research team) the PI will be billed for time that was originally booked.

3. Moving a booking to a different date will be considered a new booking and the original time slot will need to be filled if the change occurred less than 48hrs from the scheduled start time.

4. It is good to be in touch with other labs that utilize the MRI so you can reach out and see if they can take the booking. As long as the time slot is filled by a replacement, the original booked project and PI will not be charged for the scanner time.

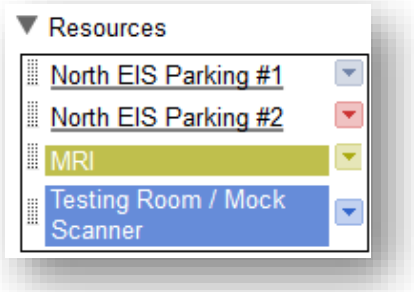
5. Please do not make a booking with the intent of having it serve as a place holder. Only reserve the time once you have confirmed the participant can meet their responsibilities to the study.

There is no automatic alert through Calpendo notifying the Operator or scheduler that a cancelled scan will still be billed. It is the responsibility of the PI and individual creating the booking to understand that a cost will be incurred. Let myself or Marty know if a participant has cancelled and you need help finding a project to take the time slot.

Resources on the Calendar

- The SDSU Imaging Center has four resources available for booking through Calpendo
    - Magnetic Resonance Imaging (MRI) – Siemens Prisma 3T
    - Testing Room / Mock Scanner
    - North EIS Parking #1
    - North EIS Parking #2

1. To aid in booking multiple resources at a time, a User can change which of the four SDSU Imaging Center resources are displayed on the Calendar page
2. Open the **Resources** dropdown menu to the left of the calendar
    - Select a single resource with a standard left-click
    - Select multiple resources with Ctrl+ left-click



SAN DIEGO STATE UNIVERSITY

SDSU Imaging Center Operator Certification

Operator Name (print):_____ email:_____

Department & Lab:_____

PI Name (print):_____ email:_____

I have completed the scanner operator-training course at the SDSU Imaging Center. I have attended the safety seminar and practices scanner operation sufficiently for independent use of the Siemens Prisma 3.0T scanner. I understand that my primary role as a designated Operator is to ensure the safety of the experimental subjects and any investigators or observers present at the study. I will only use and modify the scanner and ancillary equipment in the way that I was trained to. I understand and agree to follow the safety policies of the Center outlined below.

Designated Operator

1. The certified Operator identified on the Calpendo booking calendar (and not the PI) is in charge of, and responsible, for insuring the safety of everyone involved with the experiment. There should be no more than 3 persons present in the control room during scanning, unless it is necessary for a study and approved by the Center Director.
2. The designated operator moderates' access to the scanner room. Only screened subjects and persons who have received the official safety training and certification at the Center are allowed access.

Screening Procedures

3. All experimental subjects will fill out the safety screening form during recruitment; well in advance of a scanning session. The safety screening form must be completed again, in person, with the subject before they enter the MRI Control Room. The Operator then reviews the safety checklist with the subject before they enter the magnet room. The safety screening form is to be filled out each scanning session and filed with the Center. Each item on the checklists will be verbally explained to the subject and their response verified by the Operator.
4. If there are any concerns about the subject's accuracy while completing the screening form, the Operator will screen the subject manually with the metal detecting wands before they enter the magnet room. If there is any doubt, do not run the subject
5. If there is any question about whether it is safe to scan an experimental subject, the subject will not be scanned.
6. No metal objects or equipment will be brought into the magnet room unless they have been previously approved by the Center Director. These objects/equipment need to be tagged as magnet safe. No metal objects of any kind will be brought into the magnet room while the subject is on the scanner table or while anyone is standing near the bore of the magnet.

Protecting Against Acoustic Noise

7. The Operator will ensure that the experimental subject and anyone else remaining in the magnet rom during scanning wears adequate hearing protection provided by the Center.

Ethical Scanning

8. The Operator will remain in voice contact with the subject between scans at all times. The subject will be informed how to use the alarm button (squeeze-ball). If at any time the subject complains of discomfort or requests that the study be stopped, the Operator will stop the study. The subject can decide to stop at any time.
9. The Operator will allocate enough time to clean and return equipment to their designated area, return the MRI table to its original position, close any data on the MRI Console, and clean the Control Room before the next research group arrives to use the MRI.
10. The Operator will conclude scanning as scheduled and reflected on Calpendo to respect the time of other researchers. If the Operator exceeds their original booking and there is no researcher waiting, they will extend the booking times on Calpendo to accurately reflect the scanning time used.

Reporting Problems and Complaints

11. The Operator will be responsible for reporting malfunctions of a scanner and ancillary equipment to Center staff

Reporting Safety-Related Incidents

12. The Operator must report any incidents that involve safety issues to the Center Director (msereno@sdsu.edu) immediately

Maintaining Operator Status

13. The certified Operator is expected to attend fMRI users' meeting and follow e-updates issues by the Center. In case of non-operation for more than 4 months the Operator needs to schedule a refresher hands-on session.

I understand these policies and agree to follow them for every study at the Center.

_____ _____

Operator Signature Date Trainer Name and Signature Date

REFERENCES

Siemens Healthcare GmbH. (2015). System Owner Manual: MAGNETOM Prisma/Prisma fit. Erlangen, DE: Author.

Working Safely. (2003). GE Medical Systems MR 3.0T Signa ExciteTM Learning and Reference Guide, Chapter 2.

Appendix

SAN DIEGO STATE UNIVERSITY

3.0 T MRI OPERATOR CHECKLIST	SDSU Imaging Center 5500 Campanile Drive, SD, CA, 92182 Engineering & Interdisciplinary Sciences Complex Lower Level, Suite 16 Tel: (619).594.2949
This form to be used for: Last minute checks by MRI scanner operator immediately before subject enters the scan room *Instructions for completing this form, and duplicate forms available from https://mri.sdsu.edu/forms.html*	

Certify that there are no absolute contraindications to MRI…….

1.	☐ Yes ☐ No	Do you have a heart pacemaker?
2.	☐ Yes ☐ No	Is there a possibility of metal in your head? (e.g. aneurysm clips, do not include dental work)
3.	☐ Yes ☐ No	Is there a possibility of metal in your eyes or have you ever needed an eyewash having worked with metals?
4.	☐ Yes ☐ No	Do you have an implanted medical device? (cochlear implant, metal ear tubes, tens unit, bone stimulator, insulin or other medication pump, automatic defibrillator, internal pacing wires).
5.	☐ Yes ☐ No	Have you had any metallic dental implants (posts, crowns)?
6.	☐ Yes ☐ No	Have you had any bone, tendon, spine or joint surgery?
7.	☐ Yes ☐ No	[*Research subjects only:*] Do you weigh more than 300 lbs (135 kg)?

***** If any of the above are checked "yes, the subject CAN NOT enter the scanner *****

Last-minute checks…….

☐ Yes ☐ No	All pockets are empty	☐ Yes ☐ No	Credit cards
☐ Yes ☐ No	Keys / coins	☐ Yes ☐ No	Pens
☐ Yes ☐ No	Use Restroom	☐ Yes ☐ No	Belt
☐ Yes ☐ No	Hair pins / barrettes	☐ Yes ☐ No	Metal Buttons
☐ Yes ☐ No	Watch / Jewelry	☐ Yes ☐ No	Clothing with metal (underwire bra)
☐ Yes ☐ No	Safety pins	☐ Yes ☐ No	Shoes with metal shank / toecap
☐ Yes ☐ No	Paper clips	☐ Yes ☐ No	Hearing aid
☐ Yes ☐ No	Glasses	☐ Yes ☐ No	Removable dentures
☐ Yes ☐ No	Piercings	☐ Yes ☐ No	Transdermal Patch (e.g. Nicotine, birth control)
☐ Yes ☐ No	Wigs	☐ Yes ☐ No	Implant held in place by a magnet

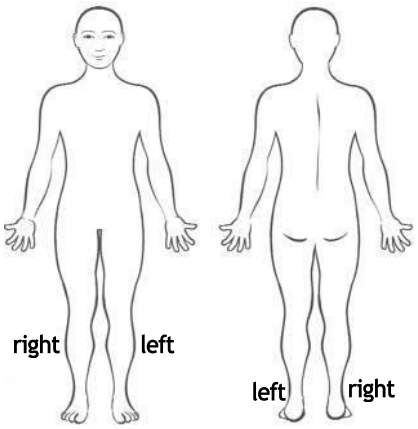
Ear plugs in place and working

SAN DIEGO STATE UNIVERSITY

3T MRI PARTICIPANT SCREENING FORM

SDSU Imaging Center
Archive completed form at Center
version 1.1

Principle Investigator / Lab:	StudyID/Name (e.g., 19062411MS) ***use format YYMMDDHHII:***
Participant: (last name) (first name) (middle initial)	
Date of birth:	Weight:
Email:	
Mail Address: (number/street) (city) (zip code)	
Phone: (home) (work) (cell)	



Please answer each of the following questions, which are designed to find out if there is anything that could be hazardous to your safety or that might interfere with the MRI scan. If you check yes, give more information (e.g., type of material, how long ago). Use diagram to indicate approximate body location.

1. ☐ Yes ☐ No Do you have an implanted medical device? (e.g., heart pacemaker, cochlear implant, metal airtubes, TENS unit, bone stimulator, insulin or other medication pump, automatic defibrillator)
2. ☐ Yes ☐ No Is there a possibility of metal in your head? (e.g., aneurysm clips, CSF shunt, not dental fillings)
3. ☐ Yes ☐ No Is there a possibility of metal in your eyes? (have you needed an eyewash for metal work?)
4. ☐ Yes ☐ No Have you had any stents, clips or surgery to any of your vessels (e.g. surgery on blocked arteries, carotid artery vascular clamp, coronary stent, aortic clips, IVS filter, coils to block arteries)
5. ☐ Yes ☐ No Have you had any metallic dental implants (e.g., posts, crowns)?
6. ☐ Yes ☐ No Have you had any bone, tendon, spine or joint surgery?
7. ☐ Yes ☐ No Do you suffer from claustrophobia or do you get uncomfortable in enclosed spaces (e.g., in a elevator)
8. ☐ Yes ☐ No Do you have any medical problems when you lie flat on your back? (breathing, back pain, nausea)
9. ☐ Yes ☐ No Do you have metal anywhere else in your body? (e.g., spinal rods, dental work, piercings, shrapnel, buckshot, bullets) – please indicate where on the diagram above
10. ☐ Yes ☐ No Do you have a tattoo(s), tattooed eyeliner, or tattooed eyebrows?
11. ☐ Yes ☐ No Have you had any medical condition that prevented you from completing an MRI exam in the past?
12. ☐ Yes ☐ No Are you suffering from asthma or do you have allergies to any medication you have taken recently?
13. ☐ Yes ☐ No Have you had any previous surgery? (mark location on your body the diagram above)
    Details:_____Date(s): _____
14. ☐ Yes ☐ No Do you have a transdermal medicated patch? (e.g., nicotine, contraceptive, medicated pain relief)
15. ☐ Yes ☐ No Do you wear a hearing aid, or dentures, or a wig, or colored contact lenses? (tick "Yes" if any apply)
16. ☐ Yes ☐ No [female] Is there any possibility that you may be pregnant?
17. ☐ Yes ☐ No [female] Do you have an intrauterine device (IUD) containing copper?
18. ☐ Yes ☐ No Would you like to be informed if we notice something unusual in your brain scan?
19. [Initial]_____ I acknowledge that these scans are *not* optimized for detection of clinical abnormalities.

Name of Participant/Subject (please print)	Signature	Date
		/ /
Name of Operator (please print)	Signature	Date
		/ /