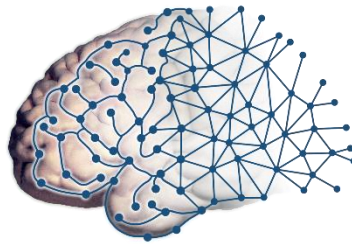


# **MRI Laboratory Safety Manual**



**UCLA**  
Brain Mapping Center

**Ahmanson-Lovelace Brain Mapping Center  
University of California, Los Angeles**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
Risks Associated with the MRI Lab .....	4
Safe Areas.....	4
Reduction of Risks.....	4
Tours and Training Exercises .....	5
Reporting of Safety Incidents or Near-Incidents.....	5
<b>SAFETY RELATED ITEMS IN THE MRI ENVIRONMENT .....</b>	<b>6</b>
Metal Screening .....	6
Implants.....	7
Tattoos .....	8
Metallic Tattoos are NOT safe .....	8
Standard Tattoos.....	8
Clothing During MRI Scanning .....	9
Ear Plugs and Headphones .....	9
Automated External Defibrillator (AED) .....	10
Medical Gases.....	10
ECG, Pulse and Respiratory Monitoring.....	10
MR Compatible Gurney .....	10
Procedure for transferring participants between scanner and gurney .....	11
Participant Squeeze Bulb.....	11
Siemens Squeeze Ball .....	11
Resonance Technology Squeeze Ball .....	12
Responding to a squeeze bulb alarm .....	12
<b>SAFETY POLICIES.....</b>	<b>13</b>
MRI Certified Safety Second .....	13
Door Security.....	13
Accurate Entry of Participant Height, Weight, Age and Sex .....	13
Temperature Control.....	13
Pregnancy .....	13
Obese or Large Participants.....	14
Children .....	14
Patient Populations .....	14
<b>SAFETY RELATED PROCEDURES.....</b>	<b>16</b>
Performing an Emergency Magnet Quench .....	16
Quench Procedure .....	16
Performing an Emergency Electrical Shutdown .....	17
Performing a Routine Electrical Shutdown.....	18
<b>HANDLING EMERGENCIES OR PROBLEMS .....</b>	<b>21</b>
Medical Emergencies .....	21
Fire Emergencies .....	23
Non-Fire Facility Emergencies.....	23
Audible Alarms.....	24
Participant Tingling or Muscle Twitches .....	26
Perspiration and Increased Pulse and Participants with Conditions Associated with Impaired Thermal Regulation .....	26

Door Failures .....	27
Unexpected Abnormal Looking Scans .....	27
<b>SPECIAL HAZARDS.....</b>	<b>28</b>
Laser Light Localizer Hazards .....	28
MRI Phantom Leak Hazards .....	28
Echoplanar (fMRI) Imaging Hazards .....	28
<b>DRESS CODE POLICY.....</b>	<b>29</b>
<b>ANNUAL MRI SAFETY RE-CERTIFICATION.....</b>	<b>30</b>
MRI Safety Training Details .....	30
<b>CONTACT INFORMATION.....</b>	<b>31</b>

## GENERAL INFORMATION

### **Risks Associated with the MRI Lab**

Used properly, the magnetic resonance imaging equipment contained within the MRI lab is quite safe; however, it poses serious risks to the unwary. Users of the lab should be completely familiar with this manual and with the procedures for protecting others from hazards. To minimize risks to participants and other members of the research team, **only personnel who have successfully completed the full ALBMC safety certification process are allowed access to the MR scan rooms, control rooms or equipment rooms.** Observers who have not been safety trained are **not permitted** to enter the MRI suite without special prior arrangements.

The main hazards in the lab are:

1. The “projectile effect” when heavy, sharp, or dangerous objects are hurled into the instrument. Even seemingly innocuous objects, such as hand tools, can be *lethal*.
2. Pacemaker damage: certain cardiac pacemakers can be damaged by exposure to magnetic fields, causing direct hazards to participants. Under no circumstances should persons with pacemakers enter the MRI suite at ALBMC.
3. As in many laboratories, the MRI lab contains wiring and circuitry that operate at dangerous voltages. Under no circumstances should users touch any exposed wiring, or any exposed terminals in the equipment cabinets.
4. Grossly improper scanner operation could result in excessive heating of the participant due to RF energy being deposited. This is easily avoided by operating the equipment according to the guidelines contained in the user manuals and set by the individual instructors.
5. Suffocation: in extreme cases, the imaging magnet may release large volumes of helium gas that can rapidly force all air out of the scan room. Normally, the helium gas would be vented through the roof. However, there is a small, but significant risk that the venting system could fail.

### **Safe Areas**

There are no areas in the MR suite that can be considered completely safe. The control room (Rooms 121), scanner rooms (Rooms 121A) and equipment rooms (Rooms 121B) all have risks associated with magnetic fields and/or electrical equipment. ALBMC safety certification is required for personnel to enter any of these areas.

### **Reduction of Risks**

The chief risk exposure in the lab is to entering personnel who are unfamiliar with the equipment and its hazards. Personnel working in the facility must be constantly vigilant of who is entering the console or scan room areas. Especially in emergency situations, you must ensure that no one

without proper training enters either of the scanner rooms, and even then, that they have adequately checked themselves for possible hazards such as projectiles. Many objects in the scanner control rooms and equipment rooms are **NOT MR compatible** and may become projectiles in the MR scanner rooms. You must never move any object from these rooms into the MR scanner rooms unless you are absolutely certain that the object is MR safe. Similarly, some objects in the MR scanner rooms may only be safe when kept at a distance from the MR scanner. **Only personnel explicitly authorized to do so should move objects in the scanner room that are labeled “Not MR safe.”** Only objects that are not ferromagnetic should be labeled with a “MR safe” label and this safe label should not be in red or orange. Unlabeled objects should be assumed **NOT** safe to move unless they are clearly non-metallic.

### **Tours and Training Exercises**

As interesting as the equipment is, please resist the temptation to show visitors the scanner “up close,” as this introduces the unnecessary risk of unwittingly exposing people to potential hazards. Tours or training exercises that would involve having non-safety trained personnel present in the scanners, control rooms or equipment rooms must be [authorized](#) in advance by Dr. Roger Woods and must be performed in compliance with any special requirements included as part of that authorization.

### **Reporting of Safety Incidents or Near-Incidents**

All incidents or near incidents must be reported to Dr. Roger Woods as soon as possible and no more than 24 hours after the incident. [Contact information](#) is available on the last page of this manual. When appropriate, such events must also be reported to the UCLA IRB.

Information in this manual that you believe to be incorrect or out-of-date should be reported to Dr. Roger Woods.

In any emergency, try to step through the following guidelines methodically and carefully. Review the safety features, policies and procedures in this manual regularly to assure that you do not need to take unfamiliar actions in a panic situation.

A printed copy of this safety manual is available in the Prisma control room. You should familiarize yourself with its location.

## SAFETY RELATED ITEMS IN THE MRI ENVIRONMENT

### **Metal Screening**

Anyone preparing to enter an MR scanner or control room must complete a metal screening form, and this form must be reviewed before access to the scanner or control room is granted. Separate forms are available for research participants and for all other individuals (e.g., family members of research participants, facilities personnel requiring on-time supervised access, etc.). Individuals who are safety certified at the ALBMC are not required to personally complete a formal written metal screening form about themselves but are responsible for verifying that they are personally safe to enter the scanner room.

If there are any doubts regarding the metal screening responses, **do not allow the individual to enter the scanner room**. The fact that the individual has been scanned in an MR scanner previously (even at the ALBMC) is **never** a sufficient basis upon which to conclude that the participant can enter the scanner room safely, since risks vary according to magnetic field strength. Dental fillings, standard crowns and retainers do not constitute significant risks (though the latter, in particular, may produce unacceptable artifacts) and do not preclude scanning. **NOTE**, some retainers may cause the wall mounted metal detector to alarm. If this happens, you must hand wand the participant after to ensure the alarm was due to the retainer and not another metallic object. Metallic orthodontic braces will produce artifacts unacceptable for most brain research purposes and are subject to the same mandatory approval process as other medical implants. Please note, unacceptable artifacts due to dental work will not qualify for a refund." Screening participants for the type of [tattoo](#) that they have is also crucial for participant safety.

Before entering the scanner room, participants and staff must remove all objects from their person that might constitute a risk in the MR environment. It is the investigator's responsibility to assure that this has been done. Silver, gold and platinum jewelry is not ferromagnetic. Nonetheless, participants should remove jewelry before going in the scanner since these metals can still conduct electricity and therefore pose a risk for burns in the presence of time-varying magnetic fields. Jewelry that forms large loops is particularly hazardous.

Ferromagnetic screening wands, specifically designed for screening participants prior to MR examinations, are available in both scanner control rooms as an additional screen for metal hazards. These should only be used **after** all the conventional screening methods described above, not as a substitute for them. They should never be used to screen a participant who has not already been deemed safe for MR scanning since they do contain weak magnets that could potentially disrupt pacemakers or cause injurious movement of small metallic fragments in the eye. The wands need to be held one inch or less from the body to be fully effective and should not be rubbed directly over the eyes. For sensitive areas, participants can place their own hands over the area and be screened through their hands. The ferromagnetic screening wands are **NOT** MR compatible and should never be taken into the scanner rooms.

# Implants

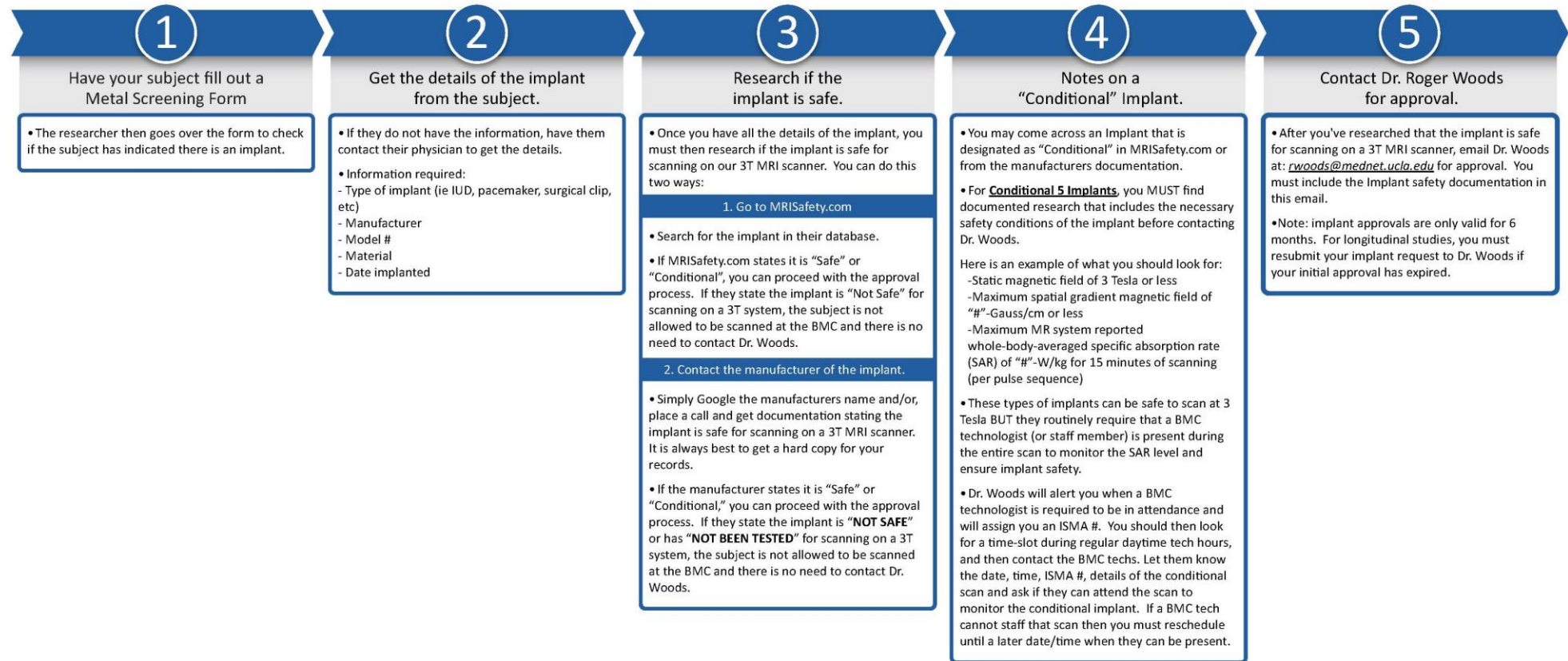
Some implanted metal devices have been established as safe for MR scanning. A recent copy of Shellock's book cataloguing implanted medical devices is available in the MR suite and up-to-date information is always available on the website <http://www.mrisafety.com>. If, in reviewing these resources, you believe that it is possible to safely scan your participant, you should contact Dr. Roger Woods to request authorization to scan the participant. Even if you are certain that the implanted metal does not constitute a risk, do not allow the individual into the scanner room unless you have obtained explicit authorization to do so. Qualified individuals (e.g., neuroradiologists or neurosurgeons) may request blanket authorization to assume responsibility for such authorizations for their own research protocols. [Click here for the website version of the below flow chart](#)

## Implant Approval Guidelines

### Steps to getting an Implant Approved

Only Dr. Roger Woods can approve the safety of an implant for subjects being scanned at the BMC.

- A subject's personal physician cannot approve the safety of an implant.
- A PI of a study cannot approve the safety of an implant.
- Just because a subject tells you that they have been scanned with this implant previously does not mean you can skip the approval process.
- Note: implant approvals are only valid for 6 months. For longitudinal studies, you must resubmit your implant request to Dr. Woods if your initial approval has expired.
- The approval process takes time and is not instantaneous. You should expect a reply in 24-48 hours. Therefore, you should have your subjects fill out the metal screening form as far in advance as possible to eliminate delays on the day of the scan or the possibility of having to cancel a scan due to an unapproved implant.



## Tattoos

### **Metallic Tattoos are NOT safe**

Metallic tattoos are a relatively new type of temporary tattoo and are NOT MR safe, posing a significant risk of burns. Such tattoos are always exclusionary for MR scanning. As the name implies, these have a metallic appearance and are typically applied whole to the skin surface like a stamp or decal rather than being injected under the skin like standard tattoo ink. Note that metallic tattoos are sometimes used to enhance standard tattoos, so the fact that placement of a given tattoo involved standard tattooing procedures does not necessarily imply that there is not also a metallic tattoo component. Standard tattoos never have a metallic appearance, so any tattoo having a reflective metallic appearance is always exclusionary.

### **Standard Tattoos**

Although a rare occurrence, standard tattoos have resulted in burns during MRI procedures. Tattoos vary substantially in size, shape, ink, etc., and no standardized procedure is available to assure with certainty that any given tattoo is completely safe. Consequently, **all human participants with tattoos should be advised of the risk of burns and told to notify staff immediately of any discomfort during MRI at a tattoo site.** If discomfort occurs, scanning must be stopped immediately and cautiously resumed only if a new corrective measure (e.g., application of a cold compress, e.g., a cold wet towel, to the tattoo site) has been taken. If a cold compress has already failed to prevent discomfort, the scan must be discontinued.

To minimize risks, the default tattoo-related policies below are in place in the BMC. These policies can be overridden (e.g., to permit facial tattoos) if the IRB has been properly informed of the risks and has specifically approved a more permissive policy for your research study. This [cover letter](#) should be included with any IRB amendments requesting a deviation from BMC's default policy. Also, please note that even when following the BMC default tattoo policies, it is the responsibility of the PI and the IRB to determine whether tattoo-related risks need to be explicitly discussed in consent forms.

*The following categories of human participants with tattoos are **excluded** from MRI scanning by the default policy:*

- Participants who are unable to promptly and reliably report discomfort at a tattoo site during scanning due to cognitive impairment, sedation, young age, or other factors
- Participants who have previously suffered any tattoo related burn during MR scanning
- Participants who have previously had MRI scans discontinued before completion due to tattoo related discomfort
- Participants with facial (including tattooed permanent makeup/microblading), scalp, or genital tattoos other than small tattooed dots applied medically to mark radiation treatment portals
- Participants with neck tattoos that cannot be covered with a cold compress during MRI scanning due to coil or task constraints
- Participants with large tattoos (> 20 cm length) that cannot be covered with a cold compress during MRI due to physical or task constraints



*The following categories of human participants with tattoos must always have a cold compress applied to the tattoo(s) during MRI scanning under the default policy:*

- Participants who have previously experienced tattoo related discomfort during MRI procedures but who do not meet the exclusion criteria above
- Participants who have experienced tattoo related discomfort during the current MRI procedure but who do not meet the exclusion criteria above
- Participants with neck tattoos
- Participants with large tattoos (> 20 cm length)

Please do not email photos of tattoos to BMC staff to inquire about their compliance with the default policies. Any ambiguities (e.g., "Does this tattoo extend onto the participant's face or not?") should automatically err on the side of the more restrictive, safer policy. Unlike medical implants, tattoos do not require prior approval by Dr. Woods. If your study has IRB approval for a tattoo policy that is less restrictive than the BMC default policy, please provide a courtesy notification to BMC technologists of this fact in advance when scheduling participants known to have tattoos that would be disqualifying under the default policy.

### **Clothing During MRI Scanning**

It is **required** that research participants be changed into BMC provided MR safe gown tops and pajama pants. Please note that underclothing may also pose a safety risk unless made entirely of cotton or linen, particularly if metallic fasteners are present. If underclothing is not cotton it will also need to be removed.

No athletic or workout underclothing can be worn during MRI scanning, including, but not limited to compression wear, sport underwear, sport bras, etc. Such items are increasingly manufactured with metallic antimicrobial components invisibly woven into the fabric, posing an unacceptable risk of avoidable burns.

Absolutely forbidden: 1) underclothing designated as "anti-microbial", "anti-odor", "heat-retaining" or otherwise indicating any special properties of the fabric; 2) underclothing made of any fabric marketed with a specific brand-name (i.e. zircon fabric)

The research team may elect to allow research subjects to wear underclothing not forbidden above during MR scanning, but should be aware that this potentially entails some risk that cannot necessarily be mitigated by looking at clothing labels, even if labelled as 100% cotton. PI's are responsible for determining how these risks should be managed and may wish to include these risks in consent and IRB materials. The BMC cannot endorse any particular underclothing product as MR safe and recommends following the [ACR whitepaper guidelines](#) (specifically pages 14 and 35) unless there is a compelling reason not to do so. Researchers should consider that each item of underclothing increases the potential risk and that brassieres are currently more likely than underpants to contain unsafe materials.

### **Ear Plugs and Headphones**

Anyone in the scanner room while the scanner is in operation must be provided with and must use hearing protection in the form of earplugs and/or headphones to avoid hearing injury from

the acoustic noise generated by the scanner. According to the Prisma documentation, if you are using the Siemens headphones you **MUST** also provide the participant with earplugs for additional hearing protection. The FDA requires 30 dB or greater for hearing protection and the Siemens headphones alone only provide 13 dB. However, the Resonance Technology headphones are sufficient to use alone without earplugs.

### **Automated External Defibrillator (AED)**

**An automated external defibrillator (AED) is located in a white cabinet the imaging wing hallway near the back exit to the building just adjacent to the MRI suite.** The AED and associated equipment are not MR safe and should **NEVER** be brought into an MR scan room. **A participant in need of resuscitation must be removed from the scan room using the MR compatible gurney before AED equipment and supplies can be safely used.**

### **Medical Gases**

**Both scan rooms are equipped with compressed air and suction from tubes that hang from the ceiling.** Medical oxygen is not available in the scan room. **An oxygen tank is located in the TMS Lab, room 159.** The oxygen tank is NOT MR compatible.

### **ECG, Pulse and Respiratory Monitoring**

The scanner is equipped with leads and devices that can be used for ECG, pulse or respiratory monitoring. These are primarily intended for acquisition of gated scan images but can also be used for monitoring purposes. Only specially designed electrodes can be safely used for monitoring and must be used in strict accordance with the manufacturer's guidelines. If you need to perform physiologic monitoring, you must first obtain special training on the proper use of the monitoring equipment. Note that the magnetic field alters the contours of the electrocardiogram.

**If a patient requires the use of a defibrillator (defibrillation should NEVER be performed in the scanner room), monitoring electrodes applied for use in the scanner should be removed first to avoid electrical burns.**

### **MR Compatible Gurney**

An MR compatible gurney is available in the MR suite. The gurney is a vital piece of safety equipment and **should not be removed from the MR suite under any circumstances** other than for evacuation of a non-ambulatory person from the building in the event of a fire or earthquake. The MR compatible gurney should not be taken to the hospital to pick up or deliver a patient. Such patients should be brought to the ALBMC using standard transport equipment and transferred to the MR compatible gurney in the ALBMC. An MR compatible wheelchair is also available and no other gurney or wheelchair should ever be brought into either of the scanner rooms. The MR compatible gurney should be stored in the Prisma (3 Tesla) scanner room when not in use. The MR compatible wheelchair is stored in the Prisma (3 Tesla) scanner room.

The MR compatible gurney has a weight limit of 400 pounds, so no participant (even if ambulatory) weighing more than 400 pounds should enter the scanner room. For a 200-pound person, a minimum of two people are typically required to transfer a person on or off the gurney.

For any non-ambulatory participant or any ambulatory participant at significant risk for a medical emergency, staff sufficient to transfer the patient onto the gurney must be present in the MR suite at all times when the participant is in the scanner room.

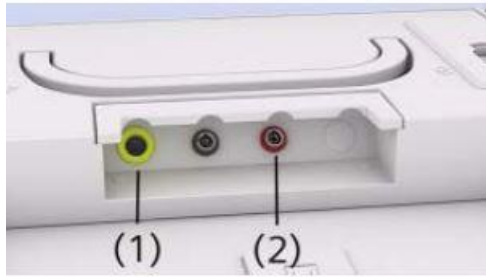
### **Procedure for transferring participants between scanner and gurney**

1. Make sure that the gurney is free of magnetic objects (oxygen bottles, IV poles, etc.) before bringing it into the scan room.
2. If possible, make advance preparations by making sure that the participant is lying on a sheet.
3. Move the scanner bed out of the gantry and adjust its height to match the gurney's.
4. Lower one gurney side rail and position this side of the gurney next to the scanner bed.
5. Lock all four wheels of the gurney.
6. With at least one person on each side of the participant, slip the edge of the white slide board under the side of the patient that corresponds to the direction in which the participant will be moved. If necessary, lower the other gurney side rail in preparation for transfer.
7. Slide the participant across the slide board. The person standing next to the gurney should use his or her weight to hold the gurney firmly against the scanner bed during the transfer.
8. Once the participant is well situated on the bed or gurney, remove the slide board from beneath the participant from whichever side is most convenient.
9. Put up the gurney side rails if appropriate and unlock the gurney wheels.
10. Visually inspect to verify that nothing is physically caught before moving the gurney away from the scan bed.

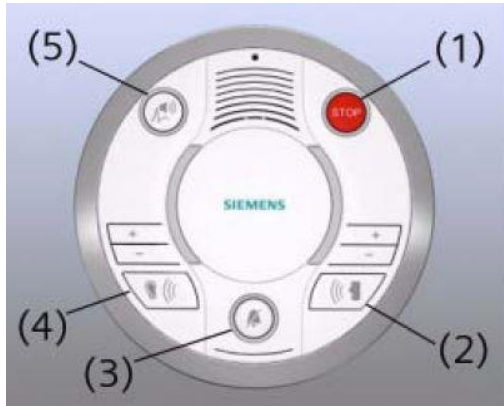
### **Participant Squeeze Bulb**

#### **Siemens Squeeze Ball**

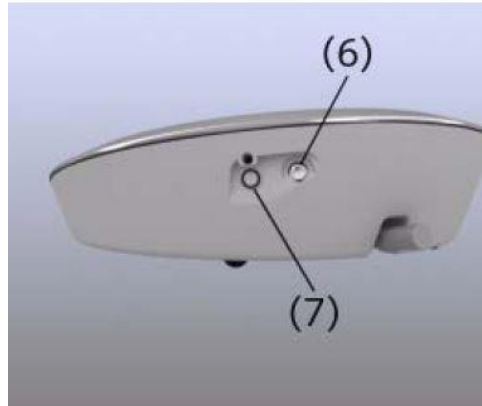
The scanners are equipped with a squeeze bulb that allows the participant to set off an audible alarm to attract the operator's attention. The squeeze bulb should be made available to participants unless some alternative method of constant monitoring (e.g., another person in the scanner room) is in effect. Use of the squeeze bulb or some comparable form of continuous participant monitoring is mandatory if you are operating the scanner in "Level 1" mode, which has an increased risk of magnetostimulation or participant heating due to RF energy deposition or if you are scanning a participant who has a tattoo or permanent eyeliner. The squeeze bulb plugs into the red connector at the foot of the bed. If the participant squeezes the squeeze bulb, a continuous audible alarm is emitted via the intercom and the intercom alarm button lights up.



Prisma squeeze bulb connector at the foot of the bed is labeled (2) and the hose connector is red



The “STOP” button is labeled (1)  
 The talk button is labeled (2)  
 The reset patient alert button is labeled (3)



The reset table stop button is labeled (7)

### Resonance Technology Squeeze Ball

The Resonance Technology squeeze ball is connected to the Res Tech headphones in the Prisma scanner ONLY. It is the circular button, at the junction of the headphone cables that lays on the chest/abdomen. This squeeze ball may be used instead of the Siemens squeeze ball if you are using the Res Tech headphones and intercom.

### Responding to a squeeze bulb alarm

1. If a scan is ongoing, click the “Stop Icon” button on the console using the mouse.
2. To stop the audible alarm:
3. For the Res Tech system, press the Res Tech intercom talk button
4. For the Siemens system, press the patient alert button (#3)
5. While holding down on the appropriate intercom talk button, speak to the participant to determine why the squeeze bulb was pressed. **Make sure that the volume is turned up so that you can hear the participant’s response.**
6. If necessary, enter the room to further investigate and/or correct the problem.

## **SAFETY POLICIES**

### **MRI Certified Safety Second**

At least two BMC MRI safety certified people (not including the participant/patient or the participant/patient's friends and family) **MUST** be present for all human MRI scans, including non-scanning sessions where human participants will be brought inside the MRI scanner room. All human research studies require a primary and "safety second" researcher in order to successfully rescue/assist the participant in an emergency, especially those involving patients at significant risk of a life-threatening medical event. A "safety second" is not required during phantom or non-human MRI scans.

### **Door Security**

The fingerprint keypad access door to the Prisma suite should never be left open when the room is not in use. The non-keypad door to the scanner room should also be kept closed when the room is not in use.

### **Accurate Entry of Participant Height, Weight, Age and Sex**

The scanners require that the participant's height, weight, age and biological sex be entered before scanning. Accurate information must be provided to ensure that FDA limits for energy deposition are not exceeded. Per manufacturer recommendation, the biological sex must be used during registration to provide appropriate safeguards. "Other" is not appropriate when scanning human participants due SAR safety requirements. Weights should be correct to within five pounds. Incorrect information should **never** be entered in an effort to get the scanner to conduct a study that it otherwise would not perform because FDA limits would be exceeded.

### **Temperature Control**

In regulating energy deposition in the participant's body in accordance with FDA guidelines, the scanners assume that the ambient temperature in the room does not exceed 72° and that the relative humidity does not exceed 60%. Consequently, the thermostat should never be set for a room temperature higher than 72°. Blankets are available for participant comfort if needed. Please note that only cotton, linen or paper should be used for bed covering or blankets since radiofrequency energy may cause heating of synthetic sheets or blankets.

### **Pregnancy**

Although there is no evidence that participation in an MR study by a pregnant woman would be harmful to her fetus, current guidelines for the use of MRI in clinical settings recommend that MRI studies be delayed until after the pregnancy when possible. Consequently, it is laboratory policy that:

1. Pregnant women may not undergo MR studies unless the study itself is specifically designed to investigate pregnancy with IRB approval.

2. Except for members of the research team, women who are pregnant (including a pregnant parent or spouse of a research participant) are not allowed into the scanner room at any time.
3. Pregnant members of the research team are allowed in the scanner room (e.g., for positioning a participant), but are not to remain in the scanner room while the scanner is in operation.
4. It is not laboratory policy to require pregnancy testing for research participants.

### **Obese or Large Participants**

Participants weighing more than 400 pounds should not be scanned. This is the weight limit for the MR compatible gurney that might be needed to transfer the patient off the table during an emergency. The Prisma 3.0 Tesla scanner bed is designed to support weights up to 550 pounds. Even participants weighing substantially less than 400 pounds should never be allowed to sit at the distal end of either of the scanner beds, since they are not designed to support the full weight of a large participant applied at full mechanical advantage.

To avoid burns or peripheral nerve stimulation, a minimum distance of 5 mm should be maintained between the participant's body and the wall of the scanner tunnel. MR pads or cotton sheets available in the MR scan rooms can be used to assure this distance is maintained.

### **Children**

Children may only enter the scan rooms as participants in an IRB approved research study of children. Children not involved in the research study (e.g., the sibling of a research participant) may not enter the scan room and may only be present in the control room if under constant, direct parental supervision. A parent cannot provide such direct supervision while being scanned as a research participant. Equipment room doors must be kept closed whenever children are present.

All safety precautions applicable to adult participants are applicable and if anything, more important in children. Careful metal screening, accurate entry of age, sex and weight, and use of "Standard Mode" scanning options whenever possible are important steps in minimizing risks to this population.

### **Patient Populations**

Although located near the UCLA Medical Center, the ALBMC is not a part of the UCLA Hospital or clinics. The hospital does not provide any emergency services for patients undergoing studies in the ALBMC. For example, in the event of a medical emergency, you must call 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone, not the hospital operator, and LA County paramedics will respond, not the hospital code team. To reduce the likelihood of adverse outcome in the event of a medical emergency, the following policies apply to all patient studies:

1. All hospital inpatients undergoing studies in the ALBMC must be accompanied by a physician or nurse familiar with the patient's medical condition. The only exception to

this policy pertains to patients who are admitted to the CRC (clinical research center) as a result of participation in a research study and who would otherwise not be hospitalized.

2. All patients (inpatients or outpatients) at significant risk of a life-threatening medical event (e.g., cardiac arrest, respiratory arrest, generalized or complex partial seizure) must be accompanied by a physician familiar with the patient's medical condition and qualified to treat the life-threatening condition.
3. Staffing adequate to assure the patient's safety in the event of an emergency must be present at all times. For example, if the patient is obese and not ambulatory, sufficient personnel to transfer the patient onto a gurney in the event of a fire or medical emergency must remain with the patient throughout the study. If the patient is confused, staffing sufficient to assure that the patient does not get up and fall from the exam table during the examination must be present.
4. Solo scanning of patients at significant risk of a life-threatening medical event on nights or weekends is not acceptable.
5. Careful attention must be given to metal screening of patients with impaired cognitive abilities.

## SAFETY RELATED PROCEDURES

### Performing an Emergency Magnet Quench

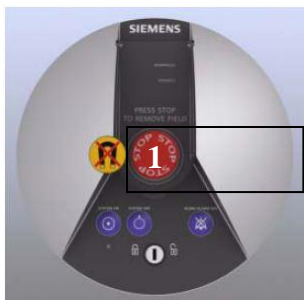
Users of the ALBMC facility should only quench the magnet in the event that the magnetic field itself poses an immediate risk to life or major property. Two such circumstances are:

1. A metal object is lodged in the scanner in a way that poses an immediate serious threat to a person (e.g., the person is pinned to the magnet by a metal object that is causing internal injuries).
2. Fire personnel determine that there is *no other alternative* to entering the room with axes or other heavy gear when fighting a fire.

If the absence of a major emergency, facility users should never quench the magnet by themselves, even if they are convinced that a magnet quench will ultimately be necessary (e.g., if a large object has been drawn into the magnet but poses no immediate risk to a person).

### Quench Procedure

1. Locate and press the QUENCH BUTTON in the control room or scanner room. The magnetic field will fall to a safe level within 20 seconds.
2. In the control room, the quench button is located on the top portion of the Siemens wall mounted control boxes located just to the right of the window. The Prisma control room quench button is covered by a tamper evident plastic cover. The quench button itself has the word “STOP” printed three times around its perimeter. Lift the plexiglass cover and press the button.



Prisma control room quench button is labeled (1) in the picture



Prisma scan room quench button is behind the plexiglass cover

3. In the scanner room, the quench button is mounted on the south wall, which is immediately to your left when you are standing at the foot of the scanner bed looking towards the scanner. The scanner room quench button is mounted at a height of almost



six feet. The scanner room quench button is covered with a plexiglass cover that has a yellow background with a red “X” a black “0” and the words “Emergency use only” printed in red. The button itself has the word “STOP” printed three times around its perimeter. Lift the plexiglass plastic cover and press the button.

4. When the magnet is quenched, the helium in the scanner boils off. Although the helium should vent out of the room to the rooftop, you should make sure the door to the scanner room is wide open before quenching the magnet. If possible, you should remove yourself and the participant from the scanner room before quenching the magnet to minimize the chance of asphyxiation in the event that the helium is improperly vented.
5. If emergency medical assistance is needed, dial 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone and request medical assistance as detailed in the [Medical Emergencies](#) section of this manual.
6. The helium vent ducts become dangerously cold during a quench. Do not touch them.
7. Immediately notify an ALBMC staff member that you have quenched the magnet. [Contact information](#) is located on the last page of this manual.
8. At best, it will be many hours before the scanner can be returned to service. If uninjured, your research participant should be sent home.

### **Performing an Emergency Electrical Shutdown**

The following events should prompt an emergency electrical shutdown:

1. You see smoke or fire coming from the scanner, equipment room or console.
2. Flooding has carried or is threatening to carry water into electrical equipment.

**Electrical shutdowns do not turn off the magnetic field—the magnet is always on unless the magnet has been quenched.**

Emergency Electrical Shutdown Procedure

1. Locate and press one of the large red electrical shutdown buttons in the scanner room or control room. **Make sure that it is the electrical shutdown button, NOT the quench button.** The electrical shutdown buttons in the Prisma Suite are all contained within clear boxes and they are labeled “EMERGENCY POWER OFF!”
2. Buttons are located as follows:
  - a. Prisma (3T) Control Room: Next to the Siemens control box located to the right of the window
  - b. Prisma (3T) Scanner Room: On the wall immediately to your left when you enter the room



- c. The emergency electrical shutdown button is red with no writing on the button
3. Electrical shutdown immediately stops all power to the scanner, the scanner equipment and the console computers. It does not turn off the lights. Also, power to the stimulation equipment will not be interrupted, so be aware that electrical or fire hazards may still be present.
4. In the case of fire or medical emergency, dial 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone.
5. Remove your participant from the scanner room. Pull the “emergency release handle,” which, is located on the right side of the foot of the table if you are facing the scanner and pull the bed out of the gantry manually using the handle at the foot of the table.
6. Notify ALBMC staff that you have performed an Emergency Electrical shutdown. [Contact information](#) is located on the last page of this manual.
7. Circumstances that justify an emergency electrical shutdown do not typically justify quenching the magnet. **Do not** quench the magnet unless there is a specific reason to do so (possible reasons for quenching the magnet are discussed in the [magnet quench](#) section of this manual).
8. If uninjured, send your participant home. It will take at least a couple of hours to restore the scanner to operational status.



### **Performing a Routine Electrical Shutdown**

You should initiate a routine electrical shutdown if you believe that a situation is developing that might predispose the equipment to electrical damage or that might soon warrant an emergency electrical shutdown. **Electrical shutdowns do not turn off the magnetic field—the magnet is always on unless the magnet is quenched.** A routine electrical shutdown requires about 5 minutes to complete. **If an emergency electrical shutdown becomes warranted at any time, you should follow the emergency electrical shutdown procedure described in the [emergency electrical shutdown](#) section of this manual,** even if you have already initiated a routine electrical shutdown. Situations that would warrant a routine electrical shutdown include:

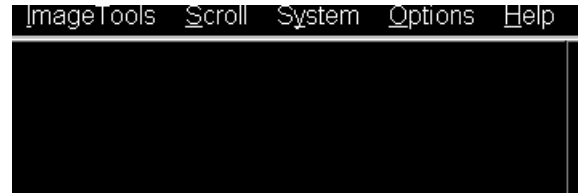
1. Receiving notice that an electrical outage in the building is likely
2. Development of a minor water leak that is not expected to flood electrical equipment before a routine shutdown can be completed
3. Alarms sounding indicating that the magnet has quenched or that helium is unacceptably low (a routine warning message on the console that the helium needs to be refilled and instructing you to call service is not an alarm and does not warrant an electrical shutdown).

4. Error messages from the scanner console indicating that correction of a problem requires rebooting the equipment.
5. Failure of the scanner bed to respond to its controls

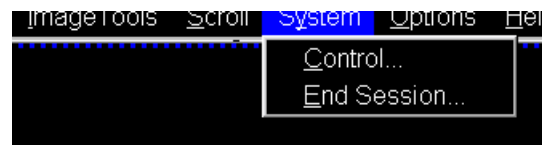
Per the manufacturer’s updated recommendations, a routine electrical shutdown should NOT be routinely performed at the end of the day. The scanner should be left in operational status.

#### Routine Electrical Shutdown Procedure

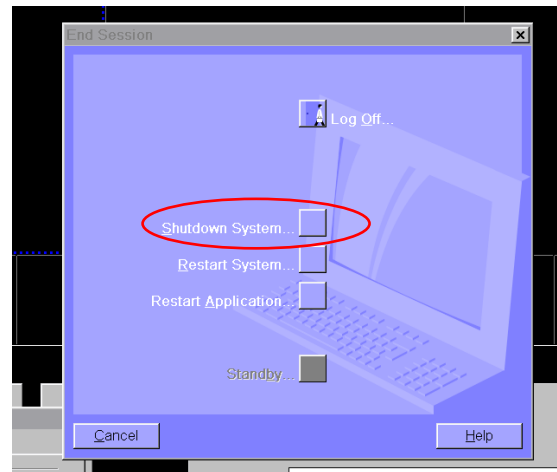
1. Click the System tab at the top of the screen



2. Click on “End Session”



3. Click “Shutdown System”



4. In the confirmation dialog box that appears, click “Yes”
5. It will take approximately 5 minutes before you see “it is now safe to turn off your computer”
6. Press the blue “system off” button on the Siemens scanner control box located on the wall next to the MR Scanner window
7. Notify ALBMC staff that you have performed a Routine Electrical shutdown. [Contact information](#) is located on the last page of this manual.



8. *If it is appropriate to restore power (wait at least 5min), press the blue “power on” button located on the Siemens control box next to the control room window. The system will need approximately 15 minutes to reinitialize. To avoid subsequent problems, make sure that the bed is completely out of the gantry at its home position and that the top head coil is attached and plugged in before restoring power.*

## HANDLING EMERGENCIES OR PROBLEMS

### Medical Emergencies

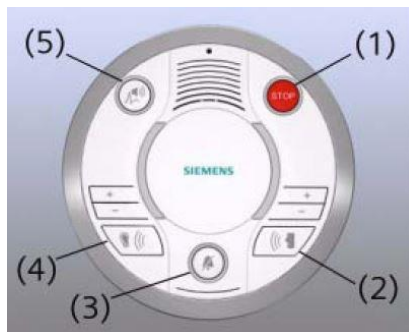
The following procedures are designed on the assumption that a physician or nurse is not immediately available in the MR laboratory at the time of the emergency. If a physician or nurse is present, the medical recommendations may be adjusted as deemed medically appropriate for the participant's condition. However, all non-medical aspects of these guidelines, **particularly those related to removing the person from the magnet or scanner room must be followed** to avoid unnecessary injury to the participant or personnel.

1. If (**and only if**) the medical emergency involves the participant being pinned to the magnet by a metal object held in place by the magnetic field, quench the magnet following the procedure described the [magnet quench](#) section of this manual.
2. Call 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone describe the event and advise the person taking the report that the building is a secure building and that you will provide access via the back door, which is the entry closest to you. Give the location as:

**AHMANSON-LOVELACE BRAIN MAPPING CENTER  
660 Charles Young Drive South**

**Room 121 (3 Tesla MRI scanner)  
(310) 825-6627**

3. Open the back door of the building so that emergency personnel will be able to enter when they arrive.
4. If the emergency involves a participant in the magnet and there is power to the scanner:
  - a. Use the mouse to click on the stop icon in the lower left of the console screen, or alternatively, press the "STOP" button (#1) on the Siemens intercom to abort the scan.
  - b. Remove the participant from the scanner by pressing the home button on the gantry.



Intercom stop is labeled (1)

5. If the emergency involves a participant in the magnet and the power is out or the table is stuck:

- a. Pull the “emergency release handle” which is located on the right side of the foot of the table if you are facing the scanner
- b. Using the handle at the foot of the table, manually pull out the scanner bed completely out of the scanner bore. The scanner bed cannot be detached from the scanner.



6. Remove the participant from the scanner room:

- a. Get the MR compatible gurney and slide board (stored in the Prisma 3T scanner room—Room 121A). Only an MR compatible gurney or wheelchair should be used in the scanners. Never bring a standard gurney or wheelchair into the scanner room.
- b. Lock the gurney wheels and stabilize the gurney against the scanner bed using your own body
- c. Transfer the participant onto the gurney using the slide board to reduce friction—at least two people (one on each side) are required to safely transfer a 200-pound participant. The gurney can support up to 400 pounds.
- d. Set the slide board aside
- e. Put up the side rails and unlock the gurney wheels
- f. Wheel the gurney from the scanner room into the hallway
- g. For medical emergencies, an AED is located in a white cabinet in the imaging wing hallway near the building’s back door. **Never bring the AED into the scanner room. It is NOT MR safe.**



7. **Under no circumstances should a code team or emergency personnel untrained in MR safety enter the scan room. Always remove the participant from the instrument first!**

8. Provide medical assistance in accordance with your training and experience while awaiting arrival of the paramedics. Consider the following options:

- a. Initiate CPR if the person is pulseless or not breathing.
- b. Use the AED to provide Advanced Cardiac Life Support measures if you have the appropriate training to do so.
- c. Provide oxygen from the green canister (NOT MR compatible) located on the crash cart in the Sonata/Mock Scanner room, room 125.
- d. Contact one of the licensed physicians with offices in the ALBMC to help with medical care. See specific [contact information section](#) of this manual.

9. Notify ALBMC staff. [Contact information](#) is located on the last page of this manual.

## **Fire Emergencies**

1. In case of fire, call 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone. Give the location as:

**AHMANSON-LOVELACE BRAIN MAPPING CENTER  
660 Charles Young Drive South**

**Room 121 (3 Tesla MRI scanner)  
(310) 825-6627**

2. If smoke or fire is coming from the scanner, equipment room or console, perform an emergency electrical shutdown as described in the [emergency electrical shutdown](#) section of this manual.
3. If you are scanning and smoke or fire is NOT coming from the scanner, equipment room or console, stop the scan by clicking the stop icon in the bottom left of the console screen with the mouse.
4. Remove the participant from the scanner using the home button on the gantry and escort the participant out of the building.
5. If time permits, initiate a [routine electrical shutdown](#) by selecting “End” from the “System” menu at the far right at the console.
6. If you determine that it is necessary or appropriate to attempt to extinguish a fire in the scanner room yourself (e.g., if your participant is on fire), use one of the blue and white MR compatible fire extinguishers in the MR suite. NEVER BRING A STANDARD RED FIRE EXTINGUISHER FROM ELSEWHERE IN THE BUILDING INTO THE SCANNER ROOM.
7. Do not return to the building until advised by fire personnel that it is safe to do so.
8. Contact ALBMC staff to advise them that there was a fire in the building. [Contact information](#) is located on the last page of this manual.

## **Non-Fire Facility Emergencies**

- Unscheduled Power Shutdowns
  - Earthquakes
  - Magnet Quench (catastrophic boil-off of helium)
  - Water Leaks
  - Foreign Metal Objects in the Magnet
1. Perform a [routine electrical shutdown](#), or if circumstances such as a rapid flooding threaten to reach the equipment before a routine shutdown could be completed, perform

an [emergency electrical shutdown](#). Both shutdown procedures are described in the [shutdown](#) sections of this manual.

2. Remove the participant from the scanner.
3. If appropriate, evacuate the building and do not return until advised that it is safe to do so.
4. Notify an ALBMC staff member of the emergency. [Contact information](#) is located on the last page of this manual.

### **Audible Alarms**

You should never scan while an audible scanner-related alarm is sounding. If you cannot identify and correct the underlying problem, your study should be discontinued. If an audible alarm is sounding, investigate the following possibilities:

1. The alarm might be the building fire alarm. This extremely loud alarm is audible throughout the building, is associated with flashing lights in the hallways, and would be difficult to mistake for a scanner related alarm. Even if you suspect that the fire alarm has been triggered accidentally, you **MUST** do the following:
  - a. If you are scanning, stop the scan by clicking the stop icon in the bottom left of the console screen with the mouse.
  - b. Remove the participant from the scanner using the home button on the gantry.
  - c. Assist the participant off the bed (if appropriate, use the MR compatible wheelchair or gurney).
  - d. Accompany the participant out of the building via the nearest accessible exit.
  - e. Do not reenter the building until told that it is safe to do so by fire personnel.
  - f. Contact ALBMC staff to advise them that there was a fire in the building. [Contact information](#) is located on the last page of this manual.
2. The alarm might have been triggered by someone squeezing the squeeze bulb. Look to see if the patient alarm button on the intercom is lit. If it is, see the [participant squeeze ball](#) section of this manual. You will be able to continue your study if this is the source of the alarm.



3. The helium level might be low or the magnet might have quenched spontaneously due to an earthquake or as a result of someone pressing the quench button. Check the Siemens control box located in the control room immediately to the right of the window. If the warning LED is lit, there could be a potential issue such as low helium, power problems, compressor problems, battery problems and/or communications errors. You can press the alarm silencer to stop the audible alarm, but **do not scan**. Notify ALBMC staff of the problem and send your participant home.



The warning LED is labeled (1)

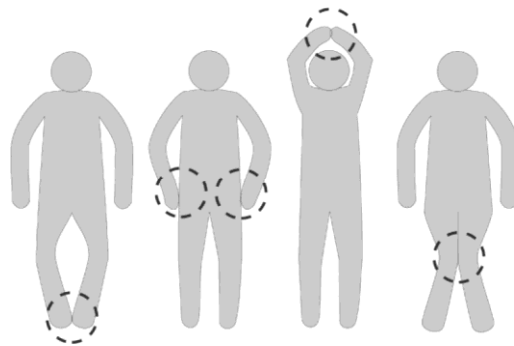
The alarm silencer is labeled (2)

4. The alarm might be a building related alarm. Check the annunciator panel in the hallway near the building exit for an LED indicating the source of the problem. If the LED's indicate a problem that is outside the MR suite, you will generally be able to continue your study. Facilities should automatically be notified of alarms appearing on this board.
5. The alarm might be might related to the Oxygen Sensors:
  - a. A PureAire Aircheck O2 Systems oxygen sensor is located in the Prisma control room. In the unlikely event of helium venting into the scanner room, these sensors will generate a low oxygen alarm. A normal oxygen level is 20.8-20.9%.
  - b. Low Oxygen Level Alarm - STOP SCANNING IMMEDIATELY
  - c. The oxygen monitors will emit an audible alarm if the oxygen level drops to 19.5%. An LED will light up on the front panel, and the display will alert you to the oxygen level AND/OR the error message. If the alarm sounds and the display indicates a low oxygen level, immediately check on your participant, open the door to the scanner room and remove the participant from the scanner room in the safest manner possible (i.e. MR safe gurney or MR safe wheelchair if needed). If your participant needs medical attention, call 911 from a campus phone (NOT 8-911) or 310-825-1491 from a cell phone. Please alert BMC staff immediately if there is a decrease in oxygen in the scanner room.
  - d. Other Errors - IT IS SAFE TO SCAN IF THE OXYGEN LEVELS ARE NORMAL
  - e. If a voltage or surge problem occurs, it is possible that the device will alarm, that the LED light will come on AND/OR that an error message will be displayed, despite normal oxygen levels in the room. In this case, verify that your participant is fine and ALWAYS verify that the oxygen level is normal (20.8-20.9%) before resuming scanning. If the error is non-oxygen related, please contact BMC MRI staff by email to let them know the details of the problem.

## **Participant Tingling or Muscle Twitches**

Tingling or muscle twitches are potential physiologic effects of time varying magnetic fields. Such effects are particularly likely to occur with echo-planar imaging in fMRI studies. To minimize the likelihood of such magnetostimulation, operate the scanner in “Standard Mode.” In this mode, only 1% of participants should experience such effects. However, the scanner may refuse to scan certain participants with certain pulse sequences in “Standard Mode”. If you operate in “Level 1” operating mode, up to 50% of participants may experience magnetostimulation with certain pulse sequences.

Complaints of tingling or muscle twitches should prompt rescreening for any metal objects that might have been previously overlooked and verification that participant positioning does not form potential loops. For echo planar imaging, selecting a phase encoding direction that is anterior-posterior (when this is an option) should reduce the likelihood of magnetostimulation. Note that the sensory input associated with magnetostimulation will pose an unwanted confound in fMRI studies.



Participant positioning loops that predispose to magnetostimulation or burns

## **Perspiration and Increased Pulse and Participants with Conditions Associated with Impaired Thermal Regulation**

Perspiration and an increased pulse rate may result from energy deposition in the body during scanning. Energy deposition in the body is carefully regulated by the scanner in accordance with FDA guidelines. If your participant develops these symptoms, you should verify that the participant’s age, height and weight were entered correctly when registering the patient, since these parameters may influence the calculated energy deposition. You should also verify that the room temperature does not exceed 72° and the humidity does not exceed 60% since the calculated energy deposition limits assume that they do not. The Prisma will measure the temperature and may refuse to scan certain sequences if the temperature exceeds 71.6°. For participants who have medical conditions such as fever, diabetes, pregnancy, or cardiovascular disease that can impair thermal regulation, you should operate the scanner in “Standard Mode” if possible, since energy deposition is not a concern in this mode. Children or elderly participants are also at increased risk of overheating. If you do scan participants with conditions associated with impaired thermal regulation in “Level 1” mode, you should be attentive to signs or symptoms of overheating and stop the scan if overheating is suspected. “Level 1” mode should be avoided if possible, in participants who are unable to communicate reliably (e.g., children, sedated participants, stroke patients). Adjusting the fan in the scanner may be helpful in reducing the likelihood of overheating in participants.

## **Door Failures**

Switches on both sides of the scanner room doors operate the pneumatic devices that assure that the doors are appropriately sealed against radiofrequency leaks. **Both switches must be in the up position for the door to seal.** You should not scan if the doors do not properly seal since your data can be potentially contaminated. It is possible in the event of a door malfunction that you might be unable to open the door and if you are inside the scanner room you might find yourself trapped. You should never close the scanner door from the inside if no one is on the outside to provide assistance should this occur. If you do find yourself trapped in the Prisma (3.0T) scanner room it may be necessary to forcefully disconnect the tubing that operates the pneumatic seal or to break the glass between the scanner room and corresponding control room.

## **Unexpected Abnormal Looking Scans**

If you encounter a scan that does not look normal to you, do not panic. If you are not a radiologist or neurologist qualified to interpret the scan, the abnormality may be benign or even a normal variant. To allow the potential problem to be appropriately addressed by qualified personnel:

1. Make sure that you acquire a whole brain structural study that can be reviewed.
2. Make sure that you have valid contact information for the participant.
3. If possible, contact ALBMC medical staff so that the study can be reviewed immediately. [Contact information](#) is provided on the last page of this manual. **Any abnormalities that you believe to constitute a medical emergency must be brought immediately to the attention of ALBMC medical staff, even if arrangements are already underway to provide appropriate medical care.**
4. If ALBMC staff are not available for immediate review, bring the suspected abnormality to ALBMC medical staff attention at the earliest opportunity.
5. Advise the participant that the study will be reviewed by qualified personnel and make sure that the participant knows how to contact you to follow up if this review is not completed immediately.
6. You may continue your study as planned unless you are certain that the participant is disqualified from your study by the abnormal finding or unless the participant prefers that the study be discontinued.
7. Review your IRB protocol and/or contact the study principal investigator to make sure that you follow any protocol defined procedures for dealing with possible abnormalities.

## **SPECIAL HAZARDS**

### **Laser Light Localizer Hazards**

On the 3.0 Tesla Prisma scanner, a laser is available for landmarking the patient's position in the scanner. Participants should be instructed to keep their eyes closed while the laser light is turned on to avoid eye injury. If the laser light appears as a spot rather than as crosshairs, it should be turned off immediately and you should notify one of the designated [ALBMC staff](#) that it needs repair.

### **MRI Phantom Leak Hazards**

The MR phantoms used to calibrate the scanners are sealed and should not show any evidence of leakage. The contents of some of the phantoms are potentially hazardous. If a phantom develops a leak, protective clothing (gloves, lab coat, goggles and, if the contents have become aerosolized, a face mask) should be worn while cleaning the leak. The contents should be disposed of as hazardous materials (i.e., not simply poured down the drain). Informed ALBMC staff immediately, so they can initiate proper cleanup and disposal procedures. [Contact information](#) is located on the last page of this manual.

### **Echoplanar (fMRI) Imaging Hazards**

Echoplanar imaging, used in fMRI, utilizes rapidly changing gradients and is associated with higher voltages than many other MR imaging modalities. The risk of magnetostimulation is increased with echoplanar imaging. The risk of magnetostimulation can be reduced by choosing a phase-encoding direction that is oriented anterior-posterior when this is an option.

## DRESS CODE POLICY

All ALBMC faculty, staff and researchers should adhere to the UCLA dress code policy to maintain a professional appearance while working with human participants in the Center.

Research participants may be nervous or anxious and need reassurance that the individuals operating the scanners and equipment are professional. Please review the [UCLA guidelines for dress code](#).

In addition to the UCLA dress code policy, all researchers who are working in biohazard approved areas, which include the Prisma scanner and control room, must also comply with proper [biohazard attire](#) at all times. When working in such areas you must wear closed toe shoes and clothing that completely covers your legs (shorts and short skirts are not allowed). Lab coats are also highly recommended, but not required at this time. Please note, even if your lab does not work with biohazardous materials you still must follow the guidelines when working in a designated biohazard area.

**Biohazard areas at BMC include:**

**PET scanner room (115A), Radiochemistry lab (117), Prisma control room (121), Prisma scanner room (121A) and the 7T lab (139).**

## ANNUAL MRI SAFETY RE-CERTIFICATION

Once a year (on or before the anniversary of your MRI Safety Certification date) you will need to recertify. This is done online via the [Brain Mapping Database](#). It is the user's responsibility to maintain certification. If certification lapses access to the MRI laboratories will be revoked.

1. Review the MRI Safety Manual
2. Log onto the [BMC Database](#)
3. At the left side of the screen you will see "Safety," click the "MR Safety Recertification" link and take the quiz

### [MRI Safety Training Details](#)

## CONTACT INFORMATION

**For medical emergencies, dial 911.** For non-medical emergencies, please contact the BMC emergency line. For day of implant approvals, contact Dr. Woods (be sure to leave a voice/text message with pertinent information). For non-urgent MRI inquires, contact BMC techs via email.

Name	Office	Pager	Home/Cell	Email
Roger Woods, MD	(310) 794-4057	11424	(818) 981-5002/ (818) 425-5598	<a href="mailto:rwoods@mednet.ucla.edu">rwoods@mednet.ucla.edu</a>
Mirella Dapretto, PhD	(310) 206-2960	n/a	(310) 476-6960	<a href="mailto:mirella@ucla.edu">mirella@ucla.edu</a>
Ludmila Budilo	(310) 825-2699	n/a	(310) 210-2511	<a href="mailto:lbudilo@mednet.ucla.edu">lbudilo@mednet.ucla.edu</a>
BMC Techs	(424) 652-6290	n/a	n/a	bmctechs@mednet.ucla.edu
<b>BMC Emergency Line</b>	<b>(323) 999-1593</b>	<b>n/a</b>	<b>(323) 999-1593</b>	<b>n/a</b>

UCLA Page Operator can be reached at 56301 (or 310-825-6301 from an off-campus phone)