

## **Section IV: The Scanner and Related Equipment**

### **1. Startup and Shutdown Console Control Computers for the 3T Verio**

Function check before switch on/switch off:

Is the display of the alarm box functioning?

Are all warning signs posted?

Are there fluids on the floor?

Magnetizable materials?

Is the patient table outside of the magnet bore?

Bringing the MRI computer up, or booting the computer, is a fairly simple procedure. If you come in to a black screen simply press any key or move the mouse and you will get into the normal operation mode (syngo).

From this point on, in order to use the scanners, you must have been approved by the research committee for scan time on the research magnets.

Caution: You must not operate the patient table while **syngo MR** is starting up.

If the screen remains black, **STOP** and contact the technical support staff to help.

If you are trained on the start-up and shutdown perform the following:

Turn the key in the alarm box 90 clock wise

Press the **System On** button

The **System On** LED at the alarm box lights up. The system is switched on. At the control computer, Windows NT and **syngo MR** are booted automatically.

*Switching on standby mode:*

In standby mode the measuring unit and patient table are switched off. The control computer (HOST) is operational. You can evaluate and report but not scan.

Press the **Host Standby** button of the alarm box.

If the system is switched on, all the components except for the HOST computer are switched off.

If the system is switched off, only the HOST computer is switched on.

If you press the **System On** button in standby mode the system is again ready for scanning.

*Switching the system off:*

First close **syngo MR**, then shutdown the system.

Select **System>End**, select **Shut Down All**, then confirm with **OK**.

if the message "**It is safe to turn off your computer**" appears:

Press the **System Off** button on the alarm box

Turn the key switch counter clockwise.

The system is now locked.

**\*\*Restart** is used when there has been a problem with the system software (screen freezes, image recon, scan control, etc.) but you would like to continue to scan after the system comes back up.

**\*end application** will end the processes that you are working on without shutting down the entire system.

**\*end system** will bring down the Numaris software.

**\*\*NOTE:** The systems can also be brought up and down by pressing the startup and shutdown buttons on the wall in the control room.

## **2. Table Controls & Table Stop Buttons**

Each of the magnets is equipped with a table that moves into and out of the scanner by using the joy sticks on the front of the magnet gantry. On both sides of each table are red table release buttons. Normal position for the buttons is in the OUT position. To remove the table rapidly, you only have to push one of the red buttons IN on either side of the table or on the microphone in the control room. The table may then be pulled out of the magnet bore manually.

To reset the table, pull joy stick down all the way and then move the joy stick all the way up, now table is reset.

## **3. Stereo/Headphones/Earplugs**

All subjects are required to wear ear protection while undergoing an MR exam. Earplugs and headphones are provided. Not only do the headphones serve as a communication device they are also part of the noise cancellation system which helps to drown out the knocking noise of the gradients. If the subject refuses all hearing protection, the scan cannot be performed.

## **4. Communicating with the Subject While They are in the Scanner**

It is important to maintain voice contact with the subject throughout the exam. The researcher should routinely establish contact between each sequence.

## **5. The Patient Alarm**

Every subject should be given the patient alarm ball to hold in their hand during the exam. The subject should be instructed to squeeze the ball if...

They need to speak with the investigator in between sequences.

They want to come out of the scanner immediately.

Something is hurting them.

Because the scanner cannot be put in a pause mode, if you stop a scan to speak to the subject, you will have to start the scan all over again from the beginning. For this reason, it is wise to advise the subject to squeeze the ball only in situations of pain, injury, or claustrophobia. If the investigator is communicating with the subject routinely between sequences, the subject will be less likely to squeeze the ball in the middle of a sequence to ask a non-emergent question.

## **6. The In Vivo Monitoring System**

The MR Research Facility has purchased an excellent MRI compatible monitoring system for use during MR exams. With this system we are able to do the following:

1. Obtain an ECG trace from the subject.
2. Obtain blood oxygen saturation percentages from the subject.
3. Obtain blood pressures from the subject.

## **ECG & Cardiac Gating**

Currently there are several types of studies where cardiac gating is desirable. Cardiac gating functions to allow imaging in areas of the body where there is considerable motion. For example, when imaging the heart, cardiac gating is used to tell the computer to image all of the slices at the same point in the heart cycle every time the heart beats. This gives the appearance that the heart motion is frozen resulting in images with the appearance of little or no motion artifact.

Special attention must be given when attaching the electrode and leads to the subject's chest. Because you are placing the lead wires in a magnetic field, it is possible to induce an undesirable current in those wires which may burn the subject. It is imperative that the lead wires and the main ECG cable have no loops in them when placed on the subject. The main cable should not touch the sides of the magnet or the subject's skin as it is run out of the magnet bore. The cable should be run straight out of the bore with no loops and should not cross over the subject's body at any point. If you must get the cable from the subject's left side to the plug-in port on the right side of the table, run the cable down the left side of the subject, and then across the foot of the table. A washcloth, sheet or towel must be placed between the subject's skin and any wire that makes contact with the skin. If the subject has an IV in place do not cross the ECG cable or wire over the IV tubing.

### **Blood Pressure Monitor**

The blood pressure monitor is able to measure the subject's blood pressure non-invasively at prescribed intervals throughout the exam. The researcher may set a time interval at which the monitor will automatically inflate the cuff on the subject's arm while the subject is in the scanner. An updated BP reading is displayed with each interval's measurement.

The blood pressure cuff may be placed on either arm, but care should be taken not to place it on an arm which has an IV placed in it. Also, it is not uncommon for women who have undergone a mastectomy to have poor lymph circulation in the arm on the side of the mastectomy. Because of this, these subjects cannot usually withstand pressure placed on the arm of the same side as the mastectomy. For example, if the woman has had her right breast removed, you will want to put the BP cuff on her left arm. If she has had both breasts removed, ask her on which arm she prefers to have the cuff placed or utilize the leg for BP readings.

### **Blood Oxygen Saturation Monitor (Pulse Oximeter)**

The pulse oximeter when placed on the fingertip of the subject will display the subject's heart rate and percentage of oxygen in the blood. The pulse oximeter may be placed on any finger, however, we have found that it works best on the index or middle finger.

The corrugated cable running from the finger clip to the pulse ox monitor contains fragile fiber optic wires. It is important that this cable is not stepped on or crushed. Please be careful with it. Damage to the fiber optics or a break in the corrugated cover could cause the pulse ox to malfunction or produce RF artifacts.

**\*\*NOTE:** For safety purposes, it is strongly recommended that the pulse oximeter be placed on all subjects who are having an MR exam. If the subject should fall asleep in the scanner and become unresponsive the investigator will know whether or not the subject is O.K. or in distress based on the readouts from the pulse oximeter. This will save the investigator from having to stop the experiment to go into the magnet room to check on the subject. Also, if the subject should have heart failure or a breathing difficulty, the investigator will know immediately based on the readout from the pulse oximeter.

### **7. Removing Subjects from the MR Scanner**

If a subject requests to be removed from the magnet at any time, the investigator should do so promptly. Whether it be because of pain, illness, or claustrophobia, the investigator or technologist must never keep the subject in the MR scanner against their will. If a subject asks to be brought out, communicate with them to determine the problem. You may ask the subject if they can continue. If not, remove the subject immediately.

### **8. Starting a Scan/Stopping a Scan in Progress address procedure for all scanners**

To start a scan simply click on the "measurement" button on the control screen. If the scan has been "loaded", click on the "start" button to begin the scan. To stop a scan click on the stop button on the control screen.

### **9. Oxygen/Suction/Room Air Supplies**

Both 1.5T and the 3T scanner rooms are equipped with oxygen, suction, and room air channels. In the 1.5T, they are mounted on the wall to the left of the scanner. In the 3T they are mounted on the wall to the right of the scanner. Oxygen is marked by the green hose or regulator, suction is white, and room air is yellow.