



## 7T MRI FACILITY

<b>SOP Number:</b>	<b>330.03</b>
<b>Title</b>	<b>7T MRI System Start-Up and Shutdown</b>

<b>Revision Chronology</b>		
<b>Version Number</b>	<b>Date</b>	<b>Changes</b>
<b>300.01</b>	<b>01 March 2010</b>	<b>New</b>
<b>300.02</b>	<b>21 January 2013</b>	<b>Updated procedures</b>
<b>300.03</b>	<b>27 October 2015</b>	<b>Update to New Siemens System</b>

**Associate Director Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**ROBARTS RESEARCH INSTITUTE**  
**CENTRE FOR FUNCTIONAL AND METABOLIC MAPPING:**  
**7T MRI FACILITY**

**Standard Operating Procedure #330.03**

**7T MRI System Start-Up and Shutdown**

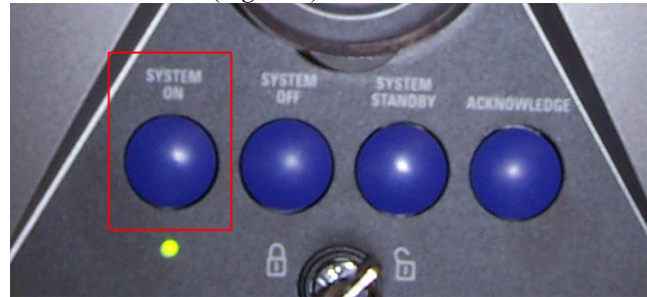
**1. Introduction**

- 1.1 Research involving Magnetic Resonance Imaging (MRI) at high magnetic field strengths presents unique hazards to both research subjects and individuals working within and around the MRI system. Consequently, the potential for serious personal injury is present due to the sheer magnitude and strength of the static magnetic field along with the immense flexibility of the research system and associated peripheral hardware.
- 1.2 Dangerous and potentially lethal levels of electricity are used by both the 3T and 7T MRI systems. Therefore it is important that all individuals working around the MRI systems be aware of the dangers and understand the safety issues concerning electricity. Current-carrying cables, connections, and junction points in the vicinity of the main magnetic field are particularly susceptible to damage due to the extreme Lorentz forces created through the normal operation of the system. Periodically, the effects of prolonged mechanical fatigue may result in breakage, thereby causing electrical arcing, sparking, and high heat levels before the system can shut down. In these instances there is a high potential for personal injury as well as the possibility of a fire being ignited.
- 1.3 Equipment in the 7T MRI Facility is sensitive to the order used in powering the system up and down. If the proper procedures are not followed, the equipment may be damaged or malfunction. Only authorized Level 2 MRI Personnel are permitted to perform these procedures.
- 1.4 Extensive training is required before performing any procedure on the 7T MRI system, see SOP#130: "MRI Personnel Training".

**2. 7T Start-Up Procedure**

- 2.1 If you are unsure of any of the steps in the following procedure, DO NOT continue. Contact the Associate Director, or the Senior Research MRI Technologist immediately.
- 2.2 **IMPORTANT:** In the event that there is power loss to the entire MRI system or one of the emergency electrical shutdown buttons has been depressed, DO NOT proceed any further. Contact the Associate Director or the Senior Research MRI Technologist immediately.
- 2.3 **Start-Up Procedure:**
  - 2.3.1 Ensure the SYSTEM power is OFF (ie. no LED light below SYSTEM ON button seen in Fig 1) and Tx Array Power is OFF before starting up system.

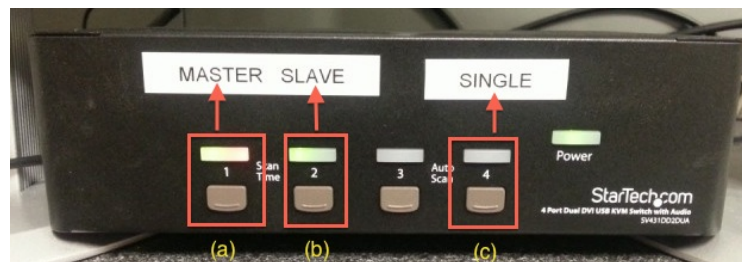
- 2.3.2 Press the **SYSTEM ON** button located on the Siemens wall control panel in the MR console room. (Figure 1)



(Figure 1) - **SYSTEM ON** button

- 2.3.2.1 Do **NOT** plug or unplug any RF coils, move the bed, or open any Syngo application (e.g. Neuro3D) while the system is booting. This may cause system errors and may necessitate a system reboot.
- 2.3.2.2 Note that the system takes approximately 20 minutes to boot
- 2.3.2.3 Wait for **BOTH** Master and Slave to show login and password screen
- 2.3.2.4 Log in to Master first [by clicking button 1 below (a)] and using the following user name and password:

**Username:** meduser  
**Password:** meduser1



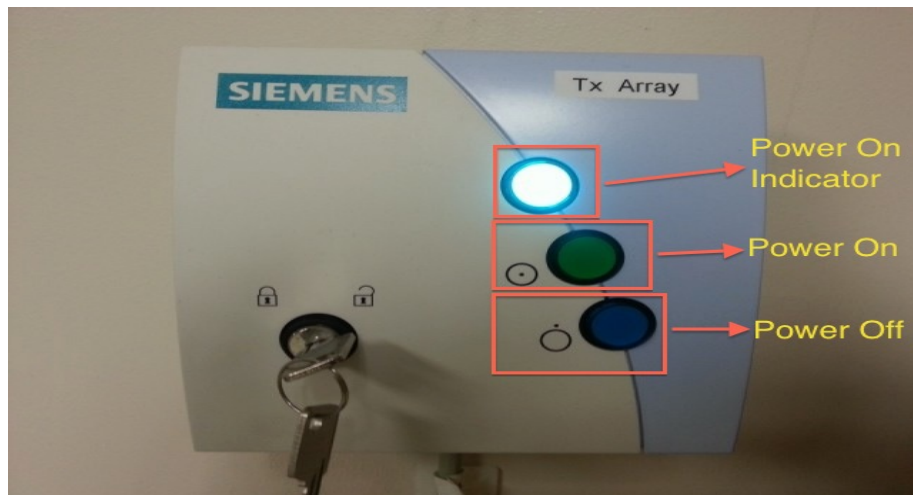
(Figure 2) - **MASTER/SLAVE Control Switch**

- 2.3.2.5 Wait for count to reach ~10 and then log in to Slave [by clicking button 2 above (b)] and using the following user name and password:
- Username:** meduser  
**Password:** meduser1
- 2.3.3 When the MASTER has completed booting you should hear **3 gradient knocks**. If you do not hear the 3 gradient knocks, contact the Associate Director or the Senior Research MRI technologist for assistance
- 2.3.4 Siemens Syngo software is now booted and now ready to **boot the Tx Array**:
- 2.3.4.1 Note that the system boots to a basic operational state. To gain full access to the system, including use of all Windows functions and programs, you must login as an Advanced User.

2.3.4.2 While on the **Slave** (Figure 2 above [button 2 {b}]):

2.3.4.2.1 **Advanced User** Login Procedure:

- 2.3.4.2.1.1 Press **Ctrl + Esc** to open the Windows Start Menu.
- 2.3.4.2.1.2 From the **Programs** menu, select **Advanced User**.
- 2.3.4.2.1.3 A new window will open prompting for the Advanced User password.
- 2.3.4.2.1.4 Contact MR Technologist or Facility Manager for password.
- 2.3.4.2.1.5 A confirmation message will appear stating: “Advanced usage is enabled.” Click on **OK**.



(Figure 3) – Tx Array Power Controller

2.3.4.3 Boot the **Transmit Array** system (While on Slave):

- 2.3.4.3.1.1 Press **Ctrl + Esc** to open the Windows Start Menu.
- 2.3.4.3.1.2 From the **Programs** menu, select **TX\_Array\_Boot**.
- 2.3.4.3.1.3 TX Array boot script will initiate – follow the prompts:
  - 2.3.4.3.1.3.1 ‘Please confirm to boot the TX-Array now’: Type: **y** and hit **ENTER**
  - 2.3.4.3.1.3.2 ‘Power on the TX-Array Now! Please confirm with yes <y> or cancel <n>’: Push the power button on the TX array box (Figure 3 above) and Type: **y** and hit **ENTER**
  - 2.3.4.3.1.3.3 when you see message: ‘TX-Array start-up procedure finished’ hit **ENTER**

2.3.4.4 While on the **Master** (Figure 2 above [button 1 {a}]):

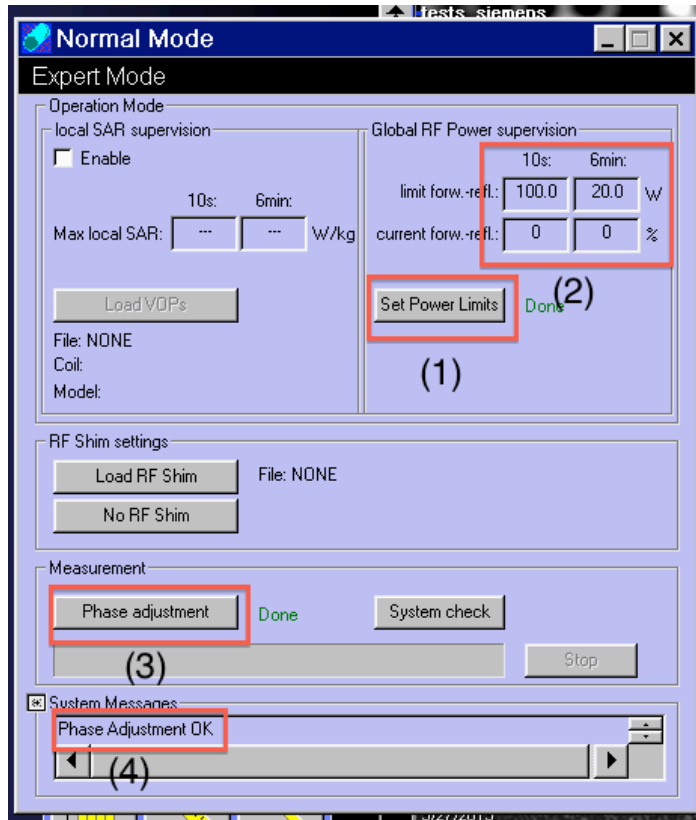
2.3.4.4.1 **Advanced User** Login Procedure:

- 2.3.4.4.1.1 Press **Ctrl + Esc** to open the Windows Start Menu.

- 2.3.4.4.1.2 From the **Programs** menu, select **Advanced User**.
- 2.3.4.4.1.3 A new window will open prompting for the Advanced User password.
- 2.3.4.4.1.4 Contact MR Technologist or Facility Manager for password.
- 2.3.4.4.1.5 A confirmation message will appear stating: “Advanced usage is enabled.” Click on **OK**.

2.3.4.5 Open the **TX Array User Interface** (Figure 4)

- 2.3.4.5.1.1 Press **Ctrl + Esc** to open the Windows Start Menu.
- 2.3.4.5.1.2 From the **Programs** menu, select **TX\_Array\_UI**.



(Figure 4) – TX Array User Interface

2.3.4.5.2 Set power limits by clicking on ‘Set Power Limits’  
[Figure 4 (1)]

2.3.4.5.2.1 Enter Username and Password:

- 2.3.4.5.2.1.1 Username: **meduser**
- 2.3.4.5.2.1.2 Password: **meduser1**

2.3.4.5.2.2 Set **10s** and **6min** limits to **100.0W** and **20.0W** respectively [Figure 4 (2)]

2.3.4.6 Open the **High Order Shim Window**:

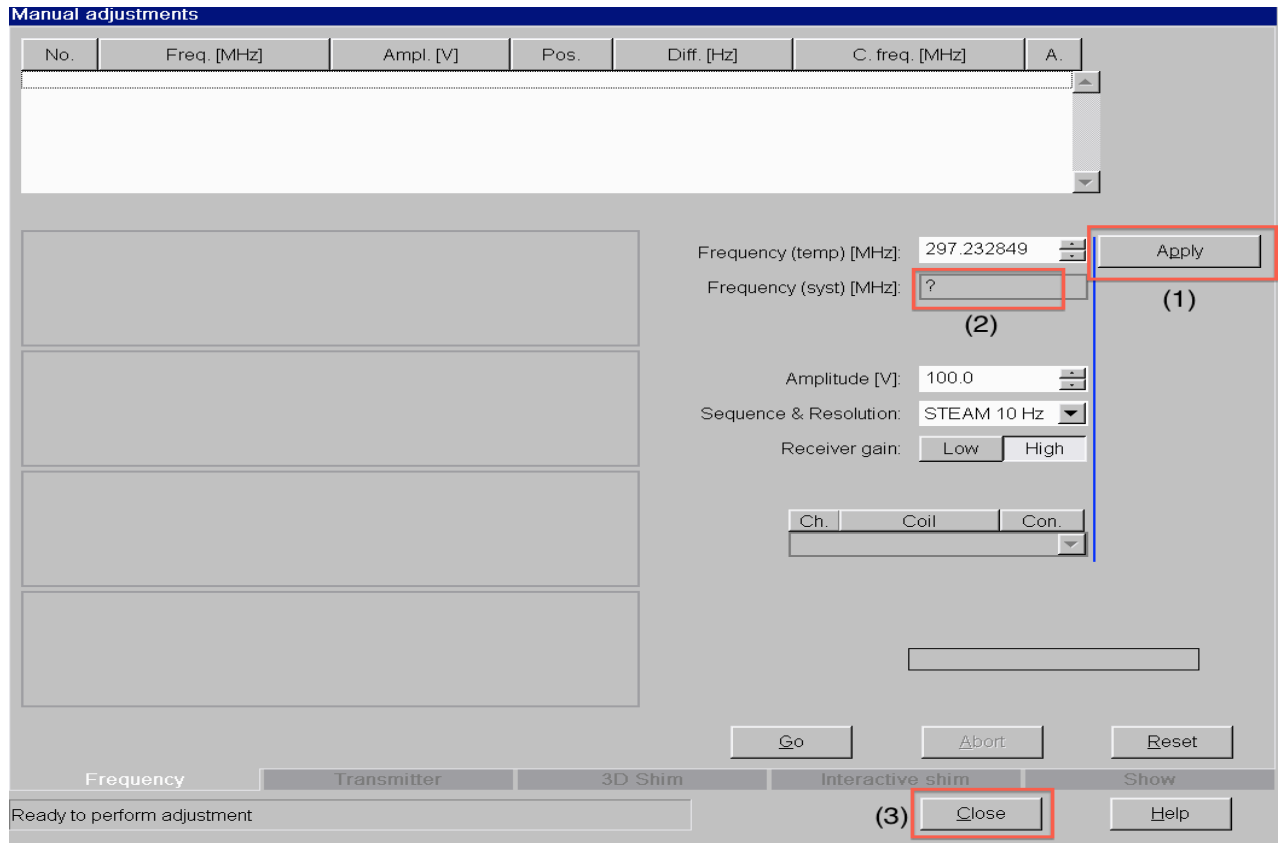
- 2.3.4.6.1.1 Press **Ctrl + Esc** to open the Windows Start Menu.
- 2.3.4.6.1.2 From the **Programs** menu, select **3<sup>rd</sup> Order ShimSet**.

2.3.4.7 Run **Phase Adjustment**:

- 2.3.4.7.1 Register a new study as seen in *Figure 5* below, and hit **'Exam'**
- 2.3.4.7.2 Drag localizer over to active sequence list and open the protocol
- 2.3.4.7.3 From menu, select **Options** → **Adjustments** to open the manual adjustments screen (*Figure 6*)
- 2.3.4.7.4 Beside 'Frequency (temp)[MHz] – click **Apply** (*Figure 6*, button 1) to set system frequency (*Figure 6*, [2])
- 2.3.4.7.5 Click **Close** (*Figure 6*, [3])
- 2.3.4.7.6 On the TX Array user Interface, click **Phase adjustment** (*Figure 4*, [3])
- 2.3.4.7.7 Under System Messages (*Figure 4* [4]) you should see **Phase Adjustment OK**

The screenshot displays a 'New Study Registration' form with four main sections: PATIENT, PROCEDURE, HOSPITAL, and INSTITUTION. The PATIENT section includes fields for Last name (phase\_adjustment), First name, Title, Patient ID (15.05.28-10:15:28-DST-1.3.12.2.110), Date of birth (5/28/1990), Sex (Male selected), Age (25), Height, and Weight (100.00). The PROCEDURE section includes Accession No, Request ID, Requested procedure(s) (Menon MS), Study list (Menon MS), Add and Delete buttons, Study (Menon MS), Study comment, and Patient position (Head First - Supine). The HOSPITAL section includes Referring physician, Requesting physician, and Admission ID. The INSTITUTION section includes Institution name, 1. Performing physician, and 1. Operator (ts). At the bottom, there are buttons for Preregister, Exam, Search, Cancel, and Help. The text 'ISO IR 100' is visible in the bottom right corner.

(Figure 5) – New Study Registration



(Figure 6) – Adjustments Page

2.3.4.8 **\*\*The System is now completely Booted and ready to use\*\***

2.3.4.9 Occasionally the system will not boot properly, either due to the system not being shut down properly or internal system errors. In these instances you may NOT hear the 3 knocks from the magnet.

2.3.4.9.1 If the system does NOT boot properly, a full system shutdown and restart is required. Proceed with the “7T Shutdown Procedure” in Section 3.

3. **7T Shutdown Procedure**

- 3.1 If you are unsure of any of the steps in the following procedure, DO NOT continue. Contact the Associate Director or the Senior Research MRI Technologist immediately.
- 3.2 Be sure all coil cables are unplugged from the table, that power to the bed is also turned off, and that the bore light and fan are both turned off as well.
- 3.3 Before shutdown, close all open patients from viewing tab, TX Array User Interface and

the 3<sup>rd</sup> Order ShimSet window

3.4 Switch to Slave (*Figure 2* above [button 2]), from the menu select: **System → End Session**.

3.4.1 A window will open with the following options:

- 3.4.1.1 Log Off
- 3.4.1.2 Shutdown System
- 3.4.1.3 Restart System
- 3.4.1.4 Restart Application

3.4.2 Select **Shutdown System**.

3.4.3 A verification window will pop up with the message: “Do you really want to shut down the system?” Click on “**Yes**”.

3.5 Switch back to Master (*Figure 2* above [button 1]), select: **System → End Session**.

3.5.1 A window will open with the following options:

- 3.5.1.1 Log Off
- 3.5.1.2 Shutdown System
- 3.5.1.3 Restart System
- 3.5.1.4 Restart Application

3.5.2 Select **Shutdown System**.

3.5.3 A verification window will pop up with the message: “Do you really want to shut down the system?” Click on “**Yes**”.

3.6 Wait for the message: “***It is now safe to turn off your computer***” on both the Master and the Slave.

3.7 Press the **SYSTEM OFF** button on the Siemens control panel. (*Figure 7* – below)



(*Figure 7*) - **SYSTEM OFF** button

3.8 The system should be OFF at this point.

3.9 Once the system is shut down, power off the Tx Array unit by pressing the ‘**Power Off**’ Button (*Figure 3* – above)

**\*\*The system is now completely shut down\*\* -- Be sure Room is locked and the key is put away**



