Procedures for conducting User QA on the scanner

Sample setup:

The User QA phantom is clearly labeled and is stored on one of the shelves to the side of the magnet. Note proper orientation of the bottle, with a solid black line labeled CENTER at the top:

Place the phantom in the 12-channel coil without any further padding or support. (Do not use the 32-channel coil for this test unless directed by BIC staff.) At this point the exact position of the phantom in the coil isn’t critical:
Drive the bed until the center of the 12-channel coil is close to the alignment laser. Turn the laser on. Align the 12-channel coil centering marks with the laser and leave the laser on. Move the phantom until the black CENTER line on the bottle is also aligned with the transverse laser mark. Turn the laser off. This assures that the phantom is properly centered in the 12-channel coil and that both the coil and bottle will be properly centered in the magnet.

This is how the phantom in the 12-channel coil should appear once it is properly aligned with the laser (small rotations of the bottle about the magnet axis aren’t important):

Send the patient bed to magnet isocenter. Ensure the magnet room door is closed.

**Patient registration:**

Close any prior patient registration. User QA data should be saved only under a dedicated entry in the patient database (to allow ease of tracking).

In the Patient Registration window, complete the “Last name” field with UserQA_YOURLASTNAME_DATE, e.g. UserQA_INGLIS_25July2012. Slight variations (such as caps or no caps) may be allowable, but ensure the prefix UserQA is present, and that your last name and today’s date are in a format that someone else can understand. Thus, UserQA_JIM_130712 is doubly bad, unless your last name is Jim in which case just the date is

User QA: 8\(^{th}\) August, 2012 version 2.
confusing, next year being 2013 and all. Better options would be UserQA_SMITH-JIM_12July2013 or UserQA_SMITH-J_13July2012, as appropriate.

However, if you are running User QA under certain circumstances then you should also add an appropriate suffix to the “Last name” field, as follows:

- If this is a test immediately following scanner startup, append _STARTUP to the patient name.
- If this is a test immediately following a scanner reboot (or restart) to resolve an issue, append _RESTART to the patient name.
- If this is a test immediately prior to shutting down the scanner for the night, append _SHUTDOWN to the patient name.

Thus, you might end up an entry something like UserQA_INGLIS_25Aug2012_STARTUP. The absence of a suffix indicates by default that the test was simply an “end of session” test and that the scanner was left on, with the bed out/up, ready for the next user.

Complete the Patient ID, Date of Birth, Sex and Weight fields using any appropriate values; the weight should be over 100 lbs or the scanner will issue a warning, otherwise these fields are irrelevant to the User QA protocol.

Select the Study, USER_QA_12ch_QA. (The User QA protocols are all stored under a separate entry, USER_QA, in the USER tree of the Exam Explorer.) The Patient position is Head first – Supine. If you want, enter your name as the Operator.

When you have completed all mandatory registration fields the Patient registration window should look something like this:
Running User QA:

Drag and drop the most recent protocol entry – the current protocol is called User_QA_24July2012 – into the exam queue. Acquisition will start automatically. There are two scans in the protocol: a localizer and a 50-volume EPI run. The total acquisition time, including shimming, is under three minutes.

Do not reposition the slices or alter any other parameters prior to acquiring the EPI. The axial slices have been preset at isocenter. There is no need to interact with the acquisition whatsoever. Just let it run.

There is no need to examine or analyze the User QA data unless you want to. You may monitor the EPI acquisition with the Inline Display window, or not, your choice. You may or may not want to view the EPIs in the Viewing window. Again it’s your choice. What’s most important is that the two acquisitions run through to completion with no errors. If the acquisition fails for some reason then it’s time to do some simple diagnostics. Did you forget to connect the RF coil? Is the phantom still on the shelf, not in the magnet? Did you fail to notice the red slash over the acquisition icon after the scanner booted? And if you can’t figure out why the acquisition is...
failing, it’s time to call BIC staff for assistance. You must also note the failure in the scanner logbook so that the next user can quickly verify the scanner status.

**Final actions:**

If the User QA tests acquired successfully, transfer the data to the Osirix Mac in order to preserve a record of your actions. Remember that data on the scanner PC is fair game to be removed by other users, and you may require proof that you did indeed acquire the User QA data as dictated by current policies! (BIC staff may also want to archive all User QA data for further analysis.) Then simply close the patient registration, remove the phantom and return it to a storage shelf. Leave the patient bed in the up, out position. (As noted below, you may leave the phantom in the 12-channel coil if you are shutting the scanner down.)

If the User QA tests failed for any reason then you may need to contact BIC staff and/or the next user. LEAVING THE SCANNER IN A NON-FUNCTIONAL STATE IS UNACCEPTABLE! Either continue with your diagnostics and trouble-shooting until you resolve the problem and the User QA routine can be completed, or send an email to the 3 T list announcing the scanner’s current status as inoperable.

**Running User QA immediately after scanner startup or restart:**

None of the above actions should be performed prior to the scanner completing its full boot cycle, which takes 15 minutes. Wait until you have heard the three gradient beeps and the red slash across the acquisition icon at the bottom of the screen has vanished, and only then connect the coil, drive the bed or register the patient. Simply put, LEAVE THE SCANNER ALONE UNTIL IT HAS FULLY BOOTED! If you try to “save time” by registering the patient, connecting/disconnecting an RF coil, or aligning the patient bed before the startup procedure has fully completed then you can expect to generate errors that may or may not require you to restart the scanner to fix. That’s no time saving at all. So no “short cuts” please.

Once the scanner has booted completely, follow the registration and positioning procedures as above, and run the User QA routine exactly as described in the prior sections.

**Running User QA before scanner shutdown:**

Follow the registration, positioning and acquisition procedures as above. Once the test is complete, drive the bed out of the magnet but leave it up (at magnet height). You may also leave the User QA sample in-place inside the 12-channel coil because it will be needed by whoever starts the scanner back up.

Note that there is no need to run User QA prior to a restart or reboot. The pre-shutdown test is specifically designed to ascertain the scanner status as functional (or not) before the scanner is shut down for the night.

When to run User QA:

The policies covering User QA are broadcast to the 3 T email list and are indicated on a note at the top of the Siemens host PC. You may also be asked to run User QA by BIC staff in order to help troubleshoot a problem. At the time of writing, User QA must be run in the following situations:

- After scanner startup
- Before scanner shutdown
- Any time you are running a new custom pulse sequence
- Any time you change the system on-resonance frequency for any reason

If you encounter any of these situations and are unable to run User QA for some reason, ensure you make a note to that effect in the user logbook and notify the BIC manager by email.

Logging User QA:

Add a comment in the scanner logbook whenever you run User QA. Include the name of the User QA file (the patient name you used when registering) and mention whether things were okay or not. Use the "Notes" column in the logbook. Some examples:

UserQA_INGLIS_08Aug2012_STARTUP: Some "soft" errors during startup, ignored. Scanner ok.

UserQA_INGLIS_08Aug2012_SHUTDOWN: Ok.


Note that on startup or shutdown the scanner always produces nonsensical errors that can either be ignored or acknowledged by clicking the OK button that pops up. Thus, unless the scanner either fails to work properly after its warm-up period, or fails to shut down all the way to the Windows screen, there's no need to mention these “soft” errors in the logbook.

Basic Troubleshooting:

Please try these procedures first before seeking assistance. At least nine problems out of ten reported to BIC staff end up being tied to user error in some fashion. Often the error results from a lack of experience or training, so if you are rusty or never received the in-person user training then you are strongly encouraged to attend the next session! Scanner startup and shutdown are covered in the Intro User Training course. So, really, if you think of yourself as a qualified...
scanner operator then you have no excuse not to know already the basic startup and shutdown procedures.

*Scanner won’t initiate a measurement:*

Check the RF coil connectors for bent pins before you connect them, ensure there is no debris in the plugs, and ensure that the connectors are properly seated/connected before starting the User QA routine. If you run into a problem then you should run the bed out and double-check the connections/connectors first.

*Failure to wait for the scanner to boot fully before moving the patient bed or changing/connecting/disconnecting an RF coil:*

Done too soon, these changes alter the state that the scanner thinks it’s in and it isn’t able to track the change. Then, when you try to initiate a scan there is a mismatch between the hardware state and the state the scanner has recorded in software. The solution is simple: always wait until the scanner has fully booted, as indicated by three gradient beeps AND disappearance of the red slash across the acquisition icon at the bottom of the PC screen. If you do run into this problem because of your impatience, congratulations, you now get to reboot the scanner and wait several more minutes! Typically, a simple reboot will suffice – this process keeps the RF amplifier online and takes just a few minutes, as indicated by the red slash disappearing from across the acquisition icon - but if that fails then your only option is to fully shut down the scanner, wait for about a minute and then restart it. Now you have to wait the full 15 mins for the reboot.

*“System measurement won’t converge.”*

This problem indicates the scanner can’t find the water resonance frequency within the 600 Hz range it checks; it starts from the previously used on-resonance frequency. The prior resonance frequency may be inappropriate for the current sample because the previous sample wasn’t aqueous, or it had a property (such as a strange geometry) that caused a large frequency shift, or the prior user may have set the scanner off-resonance for an experimental reason and forgot to set the frequency back. However it happened the fix is the same. Open the Localizer scan (that you are trying but failing to run) then select the System tab. Next, select the Transmitter/Receiver tab. Locate the parameter, Frequency 1H. This is the scanner on-resonance frequency in MHz. It should be very close to 123.255214 MHz. Given the aforementioned 600 Hz search range, if you find a frequency much different from 123.254-123.256 MHz then enter the value 123.255214 Hz as a starting point and retry the acquisition.