

Checklist for BUCNI Operator Training


Please ensure that at the end of your training, you are familiar with all of the following equipment, procedures and information:

1. Scanner environment: Things to know

- a. Keep scanner door closed at all times when someone not entering/exiting (to prevent unexpected entrances)!!!
- b. Scanner bed operation
 - i. avoid injury due to pinch points
 - ii. emergency operation
 - iii. stopping & restarting
- c. Placement of coils and other equipment in scanner room
 - i. Participant head placement in coil & using the landmark laser
 1. align participants carefully in head coil
 2. laser should align just above participant's eyebrows
 3. top of head should be as close to back of coil as possible while still allowing participant to see through eye coils
 4. place nomoco cushions carefully and snugly around head
 5. use oblong neck cushion whenever possible
- d. Ensure participant not crossing limbs or linked hands
- e. Wires, projectors, and other equipment in scanner room
 - i. Know what they are, and make sure they are properly put back
- f. Headcoil plugs - be careful and gentle with them.
- g. Alert bulb check
 - i. Set up participant and move into bore; and once back at the console, ask the participant to squeeze the alert bulb. (This order eliminates the need to run between the scanner room and the console to turn the alarm off and to leave the door open at this point)
- h. Ensure all equipment is back where it belongs (e.g., head coils, mirrors, headphones, button boxes, projection screens, padding, blankets, etc)
- i. Use vitamin E tablets to mark laterality (optional)

2. Using the console: Things to know

- a. Scanner needs to be turned on first thing in the morning, turned off at night. Check scheduler to make sure you're the last person scanning.
- b. Correctly registering subjects
 - i. Use timestamp as subject name YYMMDDHHMMSS (no hyphens or dashes)
 - ii. Don't put real date of birth (data protection) put 01/01/1980
 - iii. Phantom: use 'PHANTOM deleteit' for registration (type PHA and search to find the relevant registration details)
 - iv. Enter correct weight in kg (you can use scale in reception)
- c. Use the BUCNI log book (this provides Patient ID)
- d. Communication with participant in scanner is important!
 - i. Unless you have discussed with the participant beforehand, talk to them before and after each scan to make sure they are OK and that they know what they are doing and what they should expect
 - ii. Remember to tell them what the experimental task is!

- e. Check that coils are on:
 - i. Vertical rectangles on the sides of the top squares should be grey and not red surrounding black.
 - ii. If not on, click on the bars to make them become grey with red borders.
- f. How to use localizer scans to do slice positioning (taking care to avoid accidentally turning off coils!)
- g. How to acquire a T1-weighted structural scan
- h. How to acquire T2*-weighted EPI data
- i. How to stop a scan in progress
- j. How to start an interrupted scan again (better to start a new scan)
- k. How to recognize the active scan versus planning for the next scan
- l. How to use (and not misuse) the inline viewing tool
 - i. Watch out for the  button which stops the scan
- m. How to use 3D and Neuro3D viewers
 - i. Do not use Neuro3D with multiband
 - ii. Better to use Neuro3D when not scanning (risk of crashing)
- n. How to warm up a cold scanner
 - i. Run a phantom scan for 10 minutes or so using EPI.
 - ii. No need to record a phantom run on the BUCNI log book.
- o. How to reboot the image reconstruction computer
- p. How to reboot the scanner, if necessary
 - i. Takes 5 minutes to shutdown, wait 30-60sec then restart.
 - ii. Do not touch the tower computer.
 - iii. Note patient has to come out and coil off and unplugged, with bed in home position for a good restart.
- q. How to get standard protocols from the folder "For General Use" (1.5 T) or "BUCNI Default" (3T)
- r. How to set up a new protocol (and relation to 12- vs. 32-channel coils)
 - i. Never change distance factor or TE
 - ii. Don't change orientation for special sequences,
 - iii. Don't tick Moco unless you know what you're doing
 - iv. Only change TR, number of slices, slice thickness, number of BOLD volumes
 - v. For sparse sampling, Delay in TR [BOLD card] = silent gap
 - vi. For all sequences: Top and bottom slices are not good data.
- s. How to setup fieldmap:
 - i. Run a normal EPI sequence (or a short EPI sequence), then follow with fieldmap sequence, open fieldmap, right click on EPI sequence, copy parameters > adjust volume, then see green & yellow cubes on the brain image.
 - ii. Then for subsequent EPI sequences, right click on the earlier one, copy "everything" to copy the slices positions.
 - iii. The fieldmap needs to be run after a first test (!) sequence of EPI, to make sure the shimming has been done already (so that all subsequent EPI runs have the same shim).
- t. How to copy parameters (e.g. position of slices) from one scan to another
 - i. Drag new scan B below scan A
 - ii. Double click on scan B to open it
 - iii. On scan A, right click, copy parameters

- iv. Select Centre of slice groups & ... or Slices & sat
- u. How to setup Autoalign:
 - i. Search in the register for autoalign, patient name opens up Talairach patient. AAScout (found in General Use sequences), put it after localizer.
 - ii. Open the EPI sequence, position slices, then apply, same for structural.
 - iii. Right click on black background, save as program, then open/register new patient.
 - iv. To use, run the autoalign localizer, then make sure it runs successfully (will tell you if it fails) then use same protocol you've set up.
- v. How to setup structural (MPRAGE/MDEFT/FLASH):
 - i. Don't rotate slab unless you know what you are doing
 - ii. Make sure that field of view is larger than right-left dimensions of head
 - iii. Watch out for A-P wrap if person has very long/big head (unusual)
- w. How to shutdown (and restart) scanner
 - i. Unplug head coil.
 - ii. Move bed to home position (i.e. outside, same height as scanner)
 - iii. On console, go to System Menu/End Session..., Shut Down System. Error messages will pop up, ignore them.
 - iv. This takes ~5 minutes, then says "It's ok to switch computer down."
 - v. Once the 'OK to switch off' message comes up, touch the 'System Off' button on the round control box on the wall to the upper right of the console. → ***This is NOT the quench button!!!!***
- x. How to turn on scanner:
 - i. Hit "System on" [top right on the wall]. The console computer will just turn on. Takes 10 minutes. Wait until you hear the 'clank' from the scanner before moving the patient bed or doing anything on the console.
 - ii. On rebooting, a few seconds after hitting "Power On", you should hear the fans on the Console PC under the desk temporarily run up to full blast for a few seconds. This is normal. In fact, if it *doesn't* occur, wait 5 minutes (to make sure the boot didn't already start and maybe you just didn't notice the fans), hit "System Off", and start over, with "System On".
- y. How to interpret error messages on the console (these are at the bottom of the screen):
 - i. If there is a wave crossed with yellow line: minor annoyance, often door sensor not working properly.
 - ii. If there is a head profile crossed with red line and/or wave crossed with red line, you can't run the scanner. Depending on the message, sometimes you just need wait. Try running another sequence (e.g. a structural).
 1. If that fails, try quitting the patient and re-registering
 2. Try rebooting the image reconstruction computer
 3. If that doesn't work, move bed into home position, re-landmark (laser) subject and reregister.
 4. If console doesn't allow you to do this, or bed is not functioning, get patient out and shut down the scanner then restart after 30s-1min.
 5. If after 2 reboots there is still a red line call BUCNI team.

3. BUCNI equipment. All operators should be familiar with and able to set up, use and trouble shoot the following equipment:

- a. Button boxes
- b. Confon headphones including the microphone
- c. Sensimetric headphones
 - i. These are in the small black box with a handle (or in the drawers underneath the windowsill in the 3T scanner)
 - ii. Put the grey sleeve tips (different sizes, should feel snug) on the blue or red ends (1.5 turn screw).
 - iii. Bring the earbud leads into the scanner room, and attach to the main leads that are hung above the front projector door the room by the front projector doors
 - 1. Place arrow on arrow, red on red, red tip should be in the right ear.
 - iv. Note that you have to be careful with putting people into the head coil with these, as they cannot be too tight.
 - v. The leads should not be coiled or entangled, just straight along the body
 - vi. The same goes for the long grey wire, which should not be looped, in particular within the scanner high field red circle marked on the floor.
 - vii. Sensimetrics are OK with DTI, EPI, T1 structural, but **NOT high RF sequences like T2 structural (clinical typically), they heat up.**
 - viii. The grey sleeve tips can be compressed due to suction if the outer ear shape or eardrum tension changes. If this happens ask the participant to open and close their jaw. Also make sure participants can hear out of both ears.
 - ix. After use, make SURE to clean the ear sleeves with Ecover washing up liquid and dry before replacing in Sensimetrics box.
- d. Sony amplifier (below front projector, 1.5 T; cabinet to the right of the console computer, 3T)
 - i. Default sound setting about 20, ALWAYS check volume!
 - ii. Black optical wire on desk for Mac,
 - iii. Cogent PC already setup
- e. In-bore camera (see Marty notes on monitor, 1.5T; Monitor to the left of the console computer, 3T)
- f. Ear plugs
 - i. Make sure to show participant how to roll in finger and insert into ear while holding in place with thumb
- g. Front projector [in flux – look at current set of directions; This applies to 1.5 T scanner only]
- h. Laptop connections
 - i. Plug trigger before starting Matlab.
 - ii. Yellow plug on the left, black on the right. Check cable is connected to cogent PC or laptop as appropriate
- i. Trigger simulator
 - i. Plug into the far right plug not middle one on the simulator for Cogent PC.
 - ii. Plug into the middle one (negative one) for Mac.
- j. MR compatible glasses
 - i. Watch out they are a tight fit with the 32 channel coil.
 - ii. If needed can put ear plugs in between the top and bottom of the head coil (coil has to be plugged in but doesn't need to have the top all the way down).

- iii. For people with flat faces, glasses can steam up and impair vision, can put ear plugs between the cheeks and glasses to elevate them a bit and avoid steam building up.
- k. Phantoms (handling, leaks, and when to use them)
- l. Able to play music or videos to participants in scanner
 - i. If using the CogentPC to play a video or music, on the intercom press the middle button (with music note) so participants can hear the speaker.
- m. Chiller temperature gauge (should be below 10C)
 - i. Will alternate between two chillers, sometimes around 12C, which is fine.
- n. Equipment room - know that it exists.

4. Safety issues

- a. No one enters the control room without the operator's approval. This includes both the participant(s) and the experimenters.
- b. You have the right to ask anyone to leave the control room at any time and for any reason.
- c. Do not allow cleaners, technicians, visitors or anyone else into the control room. If someone requests access but you are uncertain, get a member of BUCNI staff to help them.
 - i. One exception: our cleaner Inga who comes every day has clearance for the console room as well as the scanner room itself
- d. Everyone who goes into the magnet room must be safety screened and metal checked including, the participant, the experimenter, and yourself. If there is any doubt about the safety of entering the magnetic field, the person may not go in.
 - i. When safety screening, model checking from hair to feet for any headpins (put hands through hair), earrings, necklaces etc. all the way down (participant mirrors the operator).
 - ii. Make sure everything has been taken out of pockets.
- e. Tattoos:
 - i. Make participants aware they might warm up or tingle and they should tell you if it happens. If you are running subjects who might be less able to do this (e.g., braindamaged patients), you need to have confirmation from them, their family and/or clinician.
- f. Don't be persuaded by "expert subjects" – just because something was safe elsewhere or previously does not override BUCNI safety procedures
- g. Be sure that participants do not have: damp clothing, eye makeup such as mascara, eyeliner, or eyeshadow, or excessive hair gel. All of these can result in contact burns.
- h. Anyone entering the control room or magnet room is your responsibility.
- i. Keep scanner door closed and latched pretty much all the time to avoid people barging into the magnet room.
- j. When people go into the control room or magnet room, the operator should follow them to make sure they haven't picked up something they shouldn't have.
- k. No external equipment is allowed in the magnet room without prior approval from Joerg.

All approved devices will have accompanying documentation from an MRI Device Compatibility Form. If uncertain, the equipment may not enter the magnet room.
- l. When a participant is in the scanner, the scan operator may not leave the control room unless another BUCNI qualified scan operator (i.e. not a certified user) agrees to take over and replace them in the control room

m. Always try to set-up all equipment before the participant arrives and take it down after the last one leaves. This minimizes risk to the participant.

5. Emergency procedures and unexpected events. All operators should know the emergency number at UCL (222) and the procedures for dealing with emergencies.

- a. When calling 222 operator/safety trained person should stay on the phone to describe location etc. until emergency people have arrived.
- b. Know how to deal with the following issues:
 - i. Fire
 - ii. Fire alarms
 - iii. Police (e.g., unruly participant or other)
 - iv. Removal of unconscious participant from scanner bed
- c. Equipment alarms:
 - i. Chiller alarms (next to small box with red LED to left of scanner door)
 - 1. if alarm sounds, stop scanning, and contact BUCNI team. (Do not stop attempting to contact until you get through to someone)
 - ii. Oxygen monitor (round disk panel to left of scanner door)
 - 1. If alarm sounds,
 - a. open scanner door and keep open
 - b. get participant out immediately
 - c. then close scanner door
 - d. Inform BUCNI team.
 - iii. Air conditioner alarms (larger beige box with two aircon controllers and two temperature displays above them)
 - 1. If alarm sounds, stop scanning
 - 2. Contact BUCNI team. (Do not stop attempting to contact until you get through to someone)
 - 3. If temperature is going up a lot (>30C) may indicate a fire, please be careful
 - a. if there is a fire, leave with participant, and press fire alarm on way out, making sure that everyone is out of the scanner suite

6. Incidental findings

- i. On safety form, make sure that participant has checked and initialled screening form for " Would you like to be informed yourself if something unusual was found in your brain scan?" and " I acknowledge that these scans are not optimized for detection of clinical abnormalities."
 - 1. If these are not checked and initialled, don't scan.
- ii. If you DO spot something unusual:
 - 1. Don't say anything to the participants (or parents); just continue as normal.
 - 2. Transfer data normally, and write down BUCNI code and participant number.
 - 3. Email this information to Fred. They will follow up with you.

7. Participants' discomfort

- i. Do not force participants to stay in if they are uncomfortable, check the participant is ok to continue regularly.
- ii. Peripheral nerve stimulation
 1. Usually happens in chest muscles, finger twitches
 2. Generally happens with structural or DTI scans
 3. Tell participant to move their body a little bit to change the orientation of the nerves/muscles
 4. If it continues, stop scanning
 5. Fill the peripheral nerve stimulation form and leave on the main reception desk.

8. Transferring and saving data: Avanto Scanner

- a. Transfer between console and Leo
 - i. Make sure to hit refresh on the patient browser before starting transfer, and then select the whole participant directory (not just one scan).
 - ii. Bottom of the screen, check for Accepted and the Success of transfer (same again on Leo). Transfer data after each subject (too many in a row doesn't work well).
- b. Export data to disk
 - i. On Leo, export to H:\TEMP\YYYYMMDDII.
 - ii. If job aborted, export again and save to a different name YYYYMMDDII2.
 - iii. To transfer onto the mac, use WinSCP (remember to refresh regularly).
 - iv. Then once on the mac, get rid of the extra "2", making sure there isn't a double on the mac. Files are backed up only if named correctly and in the right folder: fmridata.
 - v. Use ima2brik for checking data
 1. Open terminal window (green window)
 2. Go into your participant's directory (... \fmri-data\YYYYMMDD)
 3. Run ima2brik -list to make sure all the data has transferred before burning onto DVDs.
 4. Don't delete anything on the mac even after burning DVDs.
 - vi. Burn two DVDs – one for BUCNI and one for PI
 - vii. Verify contents of DVD
 - viii. If DVDs are stuck in the DVD burner, run "drutil eject" in the Terminal window (green window)
 - ix. Note: For new study, check very quickly the data, using ima2brik -nifti or DICOM import in SPM. Don't wait until end of study to check image quality and that the experiment is working!

9. Transferring and saving data: Prisma Scanner

- a. Transfer between console and BUC13
 - i. Make sure to hit refresh on the patient browser before starting transfer, and then select the whole participant directory (not just one scan).

- ii. Bottom of the screen, check for Accepted and the Success of transfer. Transfer data after each subject (too many in a row doesn't work well).
- b. On BUC13, open the terminal and access the folder where DCM files are stored
→ cd /dicom
- c. Copy data from /Dicom to Buc02 (computer in the main reception room):
→ scp -r [NAME OF DATASET]/ meduser@buc02.psychol.ucl.ac.uk:~/fmri-data
- d. On BUC02, you can convert the Dicom files using dcm2niix. That function is installed on Buc02.

10. BUCNI rules and regulations:

- a. Only BUCNI qualified scan operators are allowed to run the scanner. This means that operators are the ONLY ones who touch the buttons on the scanner, or on the console (!)
- b. Normal operating hours are Monday to Friday, 9am to 6pm. During these hours, normal, healthy adult participants can be scanned by a single qualified operator. Outside these hours, a second, safety-trained person must also be present when scanning. When scanning children (16 and under), patients, or other special populations there must be two qualified scan operators present.
- c. No participants can be scanned without prior, written ethical approval. Phantom scanning does not require ethical approval.
- d. All participants must have filled out an MRI Safety Screening form before entering the scanner environment. These must be filed in the box labelled Form1 in the control room.
- e. All participants must have completed a consent form prior to entering the scanner.
- f. When scanning a participant, the BUCNI logbook must be filled in. This is where their Patient ID is found.
- g. Operators must be up-to-date on the MRI Safety Training (every 18 months). Failure to do this will result in having operator status suspended until the safety refresher can be attended.
- h. Operators must do a refresher course every 18 months. Failure to do this will result in having operator status suspended until the refresher can be attended.