1. Hospital Valet Parking Entrance, Level 1;
2. Hospital Pedestrian Entrance, Level 2;
3. BITC Office, Level 3, Suite N305, Hospital Annex Bldg;
4. BITC 3T MRI Scanner, Level G, Suite CG-11;
5. Hospital Cox Hall Entrance, Level G;
6. Gate between Woodruff Research Bldg Level 2 and Hospital Level 1;
7. Elevator C;

From Entrance 1 (Hospital Valet Parking): Enter facing up of the map, turn left, walk 6yds around the front desk, turn right, walk 12yds, turn left facing the long corridor to the left of the map, walk 41yds, elevator C is at your right. Take Elevator C from Level 1 down to Level G [Green route]. Out of Elevator C at Level G, turn right immediately, walk 5yds, turn right, walk 19yds, before you reach the gate at the end of the corridor, there is a branch at your right. Turn right, walk 16yds, turn left, facing a long corridor to the top of the map, walk 36yds, Gate for Suite CG-11 is at your left. Push intercom button on the wall at the right side of the gate for entrance [Pink route].
From Entrance 2 (Hospital Pedestrian Entrance): Enter the door facing left of the map, you are in a hallway facing a long corridor. Walk straight for 43yds, elevator C is at your right. Take Elevator C from Level 2 down to Level G [Blue route]. Out of Elevator C at Level G, turn right immediately, walk 5yds, turn right, walk 19yds, before you reach the gate at the end of the corridor, there is a branch at your right. Turn right, walk 16yds, turn left, facing a long corridor to the top of the map, walk 36yds, Gate for Suite CG-11 is at your left. Push intercom button on the wall at the right side of the gate for entrance [Pink route].

From Entrance 3 (Bridge between Hospital Annex Level 2.5 to Hospital Level 1): Leaving Hospital Annex in the bridge, you are facing up of the map. Walk upstairs, the keep walking 23yds, turn right into a long corridor, walk half way to the end of the corridor for about 42yds, turn left facing a door like an office door at the end of a 17yd deep corridor. Walk to the door, open and go through it, you will be in the hospital. Walk straight for 25yds to the crossroad of the hospital. Turn right, walk 26yds, Elevator C is at your left. Take Elevator C from Level 1 down to Level G [Yellow route]. Out of Elevator C at Level G, turn right immediately, walk 5yds, turn right, walk 19yds, before you reach the gate at the end of the corridor, there is a branch at your right. Turn right, walk 16yds, turn left, facing a long corridor to the top of the map, walk 36yds, Gate for Suite CG-11 is at your left. Push intercom button on the wall at the right side of the gate for entrance [Pink route].

From Entrance 5 (Cox Hall Entrance in Emory Campus): Enter the turnstile facing right of the map, you are in a hallway facing a spiral stairway. Walk 35yds around the spiral stairway, you will be in front of Elevator H. Turn right, walk 5yds, turn left, walk 10yds, turn left, walk 5yds, Elevator G will be at your left. Turn right facing a corridor, walk 50yds to the end of it, turn right, walk 20yds, turn left, walk 31yds through an undecorated curved corridor, turn left, walk 5yds, turn right, walk 3yds, turn left, you will be facing an automatic gate. Walk 18yds to the gate, it will open automatically. Keep walking 24yds, before you reach the gate at the end of the corridor, there is a branch at your right. Turn right, walk 16yds, turn left, facing a long corridor to the top of the map, walk 36yds, Gate for Suite CG-11 is at your left. Push intercom button on the wall at the right side of the gate for entrance [Long Pink route].

From Entrance 6 (from Woodruff Memorial Research Bldg connector at Level 2): Enter the Hospital facing down on the map. Walk straight along the corridor for about 70yds to the Hospital corridor cross road, turn left into the corridor facing the right of the map. Walk 26yds, Elevator C is at your left [Red route]. Take Elevator C from Level 1 down to Level G. Out of Elevator C at Level G, turn right immediately, walk 5yds, turn right, walk 19yds, before you reach the gate at the end of the corridor, there is a branch at your right. Turn right, walk 16yds, turn left, facing a long corridor to the top of the map, walk 36yds, Gate for Suite CG-11 is at your left. Push intercom button on the wall at the right side of the gate for entrance [Pink route].
Scanner specifications:

1. Physical size [Plot courtesy Siemens]:

2. Basic Parameters:
   a. Up to 102 seamlessly integrated coil elements with 18 RF channels (32 RF channel upgrade is in our plan).
   b. TQ-engine gradient coil, maximum gradient field 45mT/m (72 mT/m effective), maximum gradient slew rate 200 Tesla/m/s (346 T/m/s effective).
   c. Largest anatomical coverage in one image 50x50 cm$^2$ FoV any direction.
   d. B$_0$ field Homogeneity: 0.25 ppm VRMS for a 40 cm (16 inch) DSV (diameter spherical volume) 1 ppm VRMS for a 50 cm (20 inch) DSV (diameter spherical volume)

3. BITC Floor Plan:
4. Available coils:

<table>
<thead>
<tr>
<th>Coil Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Channel head matrix coil</td>
<td>Receive only coil. General use for all brain studies, iPAT 2/3 acceleration to acquire images faster.</td>
</tr>
<tr>
<td>CP Head coil</td>
<td>Single CP channel Tx/Rx coil. Large volume, good for larger heads.</td>
</tr>
<tr>
<td>TEM Head coil</td>
<td>High homogeneous low SAR Tx/Rx coil. Good for Anatomical and DTI but not optimized for fMRI.</td>
</tr>
<tr>
<td>Spine matrix</td>
<td>Best for imaging spinal cord, and as a part for imaging torso organs.</td>
</tr>
<tr>
<td>Neck matrix</td>
<td>Work with 12 ch head matrix and spine matrix coils for imaging the whole spine.</td>
</tr>
<tr>
<td>Flexible Body matrix</td>
<td>6-elements x2. Work with spine matrix coil to image torso organs.</td>
</tr>
<tr>
<td>CP-extremity</td>
<td>knees</td>
</tr>
<tr>
<td>CP-waist</td>
<td>waists</td>
</tr>
<tr>
<td>Surface coil</td>
<td>local body parts (coming)</td>
</tr>
</tbody>
</table>
BITC Contacts:

<table>
<thead>
<tr>
<th>In care of</th>
<th>Name</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects</td>
<td>Xiaoping Hu (Director)</td>
<td>(404) 712-2615</td>
<td><a href="mailto:xhu3@emory.edu">xhu3@emory.edu</a></td>
</tr>
<tr>
<td>Scheduling &amp; Billing</td>
<td>Katrina Gourdet</td>
<td>(404) 712-2730</td>
<td><a href="mailto:bitc@bme.gatech.edu">bitc@bme.gatech.edu</a></td>
</tr>
<tr>
<td>3T human scanner</td>
<td>Robert Smith (MR Tech)</td>
<td>(404) 712-2003</td>
<td><a href="mailto:rsmith9@emory.edu">rsmith9@emory.edu</a></td>
</tr>
<tr>
<td>9.4T Animal scanner</td>
<td>Jaekun Park</td>
<td>(404) 712-1180</td>
<td><a href="mailto:jcpark2@emory.edu">jcpark2@emory.edu</a></td>
</tr>
<tr>
<td>Sequence dev.</td>
<td>Sinyeob Ahn</td>
<td>(404) 712-2699</td>
<td><a href="mailto:sinyeob.ahn@gmail.com">sinyeob.ahn@gmail.com</a></td>
</tr>
<tr>
<td>fMRI data analysis</td>
<td>Zhihao Li</td>
<td>(404) 712-2697</td>
<td><a href="mailto:zli8@emory.edu">zli8@emory.edu</a></td>
</tr>
<tr>
<td>fMRI data analysis</td>
<td>Xiangchuan Chen</td>
<td>(404) 712-2699</td>
<td><a href="mailto:xiangchuan.chen@bme.emory.edu">xiangchuan.chen@bme.emory.edu</a></td>
</tr>
<tr>
<td>DTI data analysis</td>
<td>Longchuan Li</td>
<td>(404) 712-2710</td>
<td><a href="mailto:lili36@emory.edu">lili36@emory.edu</a></td>
</tr>
<tr>
<td>MRS data analysis</td>
<td>Li Wei</td>
<td>(404) 712-2729</td>
<td><a href="mailto:lwei5@emory.edu">lwei5@emory.edu</a></td>
</tr>
<tr>
<td>Data access/coils/accessories/computation/missing data/general FAQ</td>
<td>Lei Zhou</td>
<td>(404) 712-2710</td>
<td><a href="mailto:lzhou5@emory.edu">lzhou5@emory.edu</a></td>
</tr>
</tbody>
</table>

BITC 3T normal operation hour:

8am – 6pm, Monday – Friday, University holidays exclude.

After hour scheduling is welcomed at no additional charge. However, you will have to contact Robert or other on-duty backup MRI operators to confirm that somebody will be available to operate the scanner for you.

Weekly backup MR operation coverage rotation table:

Lei Zhou  →  Robert Smith  →  Sinyeob Ahn  →  Xiangchuan Chen  →  Zhihao Li

Current 3T Calendar Status: Available

Current week’s backup MR operator: Lei Zhou (from today to the coming Sunday)

Next week’s backup MR operator: Robert Smith III (from next Monday)

Weekly Events:
(2 hrs grid, 7am-10pm
Dots show daily number of after hour scans)
Accessories

Video stimulation:

- Computer -> SANYO ET30L 4200 lm projector
- Projection area: 24” angular 4:3 (corners cut, and center lower part blocked if using 12 channel head coil.
- Optimal resolution: 1280x1024
- Maximum refresh rate 100Hz

Acoustic stimulation and intercom:

- Avotec -> plastic tubing to headset
- Nominal noise reduction: 28dBA head set, 30dBA ear plugs. Effective noise reduction ~26dBA combined due to bone coupling

Physiological monitoring:

- Present: Invivo through Matlab recording (SpO2), Blood pressure, ECG, customer made respiration monitor based on stomach motion
- Recording heart rate, respiration, ECG through customer sequences (Jaemin)
- Invivo physiological monitor is to be upgraded to model “Expression”

Response box:

- Current Design Model 932 (new!)
- Current Design legacy control unit (backup)
- Four button response boxes – byrgt or 12345
- More response device see http://www.curdles.com/technical/900respondedevices - purchase yourselves or ask BITC to acquire
- USB, serial interface

Eyetracking:

- Newly acquired Avotec RE 5721 near optical eye tracker. (not yet installed)

Timing:

- Either let the scanner trigger the computer that plays the paradigm, or use your paradigm to trigger the scanner

Misc: Presentation, E-prime, Matlab, Labview, Superlab... your choice.
Bad practice:

Fatal foreign objects: items with large iron/steel component, like chairs, gas bottle, non-MRI compatible stretcher and wheel chair, AC-DC converter, steel tool/toolboxes, surgical scissors, pliers, camera...

Other projectiles that could cause injury: pens, key chains, ...

Fatal implanted/life support objects: heart pacemaker, metal implants that are not rigidly affixed on a bone...

Injury or burn: Ear rings, finger rings, nose/lip rings or other metal ring attachment to the body, bracelets, carbon tattoo, metal eyeglass frame, clothes with metal threads or ring-shaped metal components/attachments, shoes with steel insert/heels, necklace with metal parts, hair pin, batteries, coins,...

Other items that may cause discomfort: belts, metal buttons,

Damage of property: Cell phones and other handheld electronics, watches, credit cards and other ID cards with magnetic strips or microchips, hearing aids, monitors, and most non-MRI compatible electronics,...

Image distortion or noise introduction: high frequency electronics working in MRI room, cables that are neither shielded nor filtered, minor metal attachment in hair (like elastic band with metal joint, metal coating in hair/body decorations, teeth braces, nonmagnetic metal in bones in imaged areas like implant or bullet residual etc.,...

Malfunction – most are not designed for MRI electronics.

Known MRI compatible items: bone attached implant installed after 1997, minor dental work, zippers (unless chest/abdomen area is imaged), all plastic glasses frames, contact lens, non-carbon tattoos, wigs, dentures, all plastic IV line,...
Cluster access:

Remote login:

Recommended x-server software: Cygwin, xwin32, MAC xterm

ssh -Y <username>@bitc.bme.emory.edu

use your username in place of <username>

Secure FTP access: WinScp (windows), Fetch (MAC), sftp or scp (linux)

Common Linux commands (all lower cases)(all italic phrases should be replaced with your targets):

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>passwd</td>
<td>Change your password</td>
</tr>
<tr>
<td>exit</td>
<td>Log out</td>
</tr>
<tr>
<td>cd &lt;dir&gt;</td>
<td>Change directory to &lt;dir&gt;</td>
</tr>
<tr>
<td>chmod permission fn</td>
<td>Change file permission, permission in three digits mode. User/group/global. 4 is for read, 2 for write, 1 for execute. chmod 740 fn means to make your file executable and editable by yourself, and can be read by users in your group, and no access to anybody else.</td>
</tr>
<tr>
<td>clear</td>
<td>Clear the screen</td>
</tr>
<tr>
<td>cp oldfile newfile</td>
<td>Copy files</td>
</tr>
<tr>
<td>date</td>
<td>Tells you current date time</td>
</tr>
<tr>
<td>diff file1 file2</td>
<td>Find difference of two text files</td>
</tr>
<tr>
<td>df</td>
<td>displays how much space on the disks (hard drive partitions) is free</td>
</tr>
<tr>
<td>du --sh dir</td>
<td>Tell you how much spaces you used in dir</td>
</tr>
<tr>
<td>find dir --name phrase</td>
<td>Find files contain phrase in their name under dir</td>
</tr>
<tr>
<td>grep phrase file</td>
<td>Find lines contain phrase in file</td>
</tr>
<tr>
<td>head -lines filename</td>
<td>displays the first few lines of a file; -lines specifies the number of lines, starting at the top</td>
</tr>
<tr>
<td>kill -9 process</td>
<td>Kill a process by its process number which can be figured by ps</td>
</tr>
<tr>
<td>killall name</td>
<td>Kill all processes with the same name. Note only processes under your name are killed</td>
</tr>
<tr>
<td>less filename</td>
<td>Browse through a text file</td>
</tr>
<tr>
<td>ln -s target linkname</td>
<td></td>
</tr>
<tr>
<td>locate file</td>
<td>Find where is the file</td>
</tr>
<tr>
<td>man command</td>
<td>Find the manual for a command</td>
</tr>
<tr>
<td>mkdir newdir</td>
<td>Create a new directory</td>
</tr>
<tr>
<td>mv oldfile newfile</td>
<td>Rename a file or move a file to elsewhere</td>
</tr>
<tr>
<td>nano</td>
<td>A text file editor</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>ps</code></td>
<td>Displays information about your processes/jobs/programs which are running on the server</td>
</tr>
<tr>
<td><code>rm filename</code></td>
<td>Remove or delete file. Use option <code>-r</code> to remove entire directory. Note that file cannot be recovered after removal</td>
</tr>
<tr>
<td><code>rsync</code></td>
<td>Remote synchronize files/folders to another Linux machine</td>
</tr>
<tr>
<td><code>screen</code></td>
<td>Create an embedded screen to keep your program running after you log out. Use <code>screen -r</code> to retrieve your screen. Use <code>ctrl-a-d</code> to hide the screen</td>
</tr>
<tr>
<td><code>sh command</code></td>
<td>Run a command script without making it executable</td>
</tr>
<tr>
<td><code>ssh node</code></td>
<td>Log in a different node</td>
</tr>
<tr>
<td><code>tail -lines filename</code></td>
<td>Displays the last few lines of a file; <code>-r</code> displays the lines in reverse order; <code>-lines</code> specifies the number of lines, starting at the end of the file, you want to see</td>
</tr>
<tr>
<td><code>tar xfvz file.tgz</code></td>
<td>Expand a gzipped tar ball</td>
</tr>
<tr>
<td><code>tar cfvz file.tgz files</code></td>
<td>Make a gzipped tar ball</td>
</tr>
<tr>
<td><code>top</code></td>
<td>Monitor running processes</td>
</tr>
<tr>
<td><code>vi</code></td>
<td>Another text editor</td>
</tr>
<tr>
<td><code>w</code></td>
<td>See who are logged on</td>
</tr>
<tr>
<td><code>wc</code></td>
<td>Word count</td>
</tr>
</tbody>
</table>

MRI tools on the cluster:

- **FSL** – [http://www.fmrib.ox.ac.uk/fsl/](http://www.fmrib.ox.ac.uk/fsl/) [FMRI, MRI and DTI brain imaging tool pack]
- **Freesurfer** – [http://surfer.nmr.mgh.harvard.edu/](http://surfer.nmr.mgh.harvard.edu/) [reconstruction of the brain’s cortical surface]
- **SPM** – [http://www.fil.ion.ucl.ac.uk/spm/](http://www.fil.ion.ucl.ac.uk/spm/) [Statistical Parametric Mapping]
- **HAMMER** – [https://www.rad.upenn.edu/sbia/projects/3d_hammer.html](https://www.rad.upenn.edu/sbia/projects/3d_hammer.html) [high-dimensional warping of brain images]
- **Stimulate** – [http://www.cmrr.umn.edu/stimulate/](http://www.cmrr.umn.edu/stimulate/) [fMRI]
- **LCModel** – [http://s-provencher.com/pages/lcm.html](http://s-provencher.com/pages/lcm.html) [MRS data analysis]
- **dcm2nii** – [http://www.cabiatl.com/mricro/mricron/dcm2nii.html](http://www.cabiatl.com/mricro/mricron/dcm2nii.html) [DICOM to NIfTI conversion]
- **mcverter** – [http://lcni.uoregon.edu/~jolinda/MRIConvert/](http://lcni.uoregon.edu/~jolinda/MRIConvert/) [Dicom conversion]
- **siemens_info** – Extract Siemens dicom header

Other convenient softwares:  
- **ImageJ** for windows – image measurement and statistics;  
- **GIMP** – an adobe photoshop alternative;  
- **Foxit PDF** – an alternative to adobe acrobat;  
- **virtualbox** – virtual machine manager in linux;
Sun Grid Engine basics:
- qsub – submit a job to the batch scheduler
- qstat – examine the job queue
- qdel – delete a job from the queue
- qhost – check hosts load

Sample script:
```bash
#!/bin/sh
#
#$ -S /bin/sh        (shell)
# Make sure that the .e and .o file arrive in the working directory
#$ -cwd
#Merge the standard out and standard error to one file
#$ -j y
#$ -q veryshort.q     (which queue are you going to use)
/bin/echo Here I am: `hostname`. Sleeping now at: `date`
/bin/echo Running on host: `hostname`.
/bin/echo In directory: `pwd`
/bin/echo Starting on: `date`
# Send mail at submission and completion of script
#$ -m be
#$ -M deadline@kronos
time=60
if [ $# -ge 1 ]; then
  time=$1
fi
sleep $time
echo Now it is: `date`
```

Q: How loud is the MRI?
A: About 80~90dBA for anatomical, 90~103dBA for BOLD, and 100~110dBA for DTI. Tone is mainly decided by TR per line, typically 600~1200Hz. Effective noise attenuation is about 26dBA.

Q: Are my bad images BITC’s responsibility?
A: RF interference (H/V lines), gradient spikes, and missing coil element (global uneven images) are BITC’s responsibility; motion artifacts (blurred images), respiration artifacts, mass variability artifacts are not BITC’s responsibility. Head motion control methods should be determined by the PI or designated personnel. Available options are: sponge stuffing, tape down single or multiple points, and personalized head mold.
Q: What’s a typical protocol:
A: localizer – 10s; T1-mprage 1x1x1mm – 4-7m; BOLD 3x3x4mm – 2s TR, 180 rep -> 6m;
Fieldmap – 3m; DTI 2x2x2mm – 15m for 64+5 dir

Q: How may I bring in my stimulation?
A: Carry in your laptop, or use our accessory PC.

Q: Who will be in charge if Robert is not available?
A: See our webpage for after hour MR coverage.

Q: Something does not seem to be functioning properly, what to do?
A: Contact Lei Zhou ASAP!

Q: Is this large bodied subject OK?
A: Generally, it will be very difficult to put someone weighing 260+ lbs in scanner.

Q: Subject is not cooperative, can you do something?
A: No, we have to respect the subjects’ wish. If they change their mind in the middle of any scan, we must stop and tell them this is OK.

Q: A subject needs medical supervising, can you do it?
A: No, you will have to bring a licensed/trained nurse down with the subject to handle any medical supervision needs.

Q: If a subject is late, can we push down others’ on the schedule to finish?
A: If the subject is more than 15 minutes late, the scan is subject to be cut short or cancelled unless all PIs scheduled for the rest of the day agree to be pushed back. However, you are always welcome to reschedule at a later time to finish dropped scans.

Q: I want to reload some old images back to the scanner/satellite console. Is it OK?
A: Yes. All images acquired after 2007 should be able to be loaded back to the scanner.

Q: Can I do animal study on your human 3T?
A: Yes. However, in the IACUC approval, it has to be specified that your team will do the full animal care job including scanner clean up and after scan sterilization.

Q: I need some scan information that does not appear in the dicom header, what can I do?
A: Try our script siemens_info dicom.dcm destination. This will extract Siemens’ private header into text mode. Then you may use any text viewer to read the output dicom.dcm.nfo

Q: My subjects have difficult to keep their head still, is there better ways to restrain?
A: Yes. For most of normal subject, we do only soft sponge padding to help keeping their head still. This posts minimal mental disturbance to the subjects. However, if requested, we can also use crossed tape or even personalize head molding. But this will distract the subject a lot and may not be a preferred choice for functional studies.