MRI LAB REPORT.

I am from TEAM 2 : positioning of target

Brief Introduction on MRI :

This imaging modality uses the non -ionizing radiation(RF Radiation) to create useful diagnostic images . It produces 2D images . The basic concept behind MRI is that the subject is kept into strong magnetic field the, so the hydrogen ions/ atoms in the subject's body develops a magnetic moment. An MRI scanner consists of a large, powerful magnet in which the patient lies. A radio wave antenna is used to send signals to the body and then receive signals back. These returning signals are converted into images by a computer attached to the scanner. Imaging of almost any part of your body can be obtained in any plane. The four main components are the primary magnet, gradient magnets , radio frequency coils and a computer to handle this all. The primary magnetic field will make the hydrogen ion/atoms parallel or anti parallel to the magnetic field. This phenomena is called as longitudinal magnetisation . Majority of the the ions/atoms will align themselves in the low energy direction(anti parallel) . They hydrogen ions/ atoms will be shining along a axis with a certain frequency called as Larmour Frequency . The gradient coil generates the secondary magnetic field . It variates the field strength between the slices so that the precision frequency is altered. Different gradient coils are used to image differently (i.e in x, y and z plane) . The RF pulse will disturb the spinning of the ions/atoms and some of them will change their alignment from high energy state to low energy state or vice versa.

METHODS :

We had a watermelon, corn ,egg and tomato and our professor aligned them in a shape of a human body. If any human wants to have a MRI , its recommend they shouldn't have underwent any metallic transplant or wear any metallic object or accessories while going through a high magnetic filed which could be harmful for the study. The watermelon was fixed in a RF coil as shown in the picture . Then the magnetic field is turned ON and the process the starts .

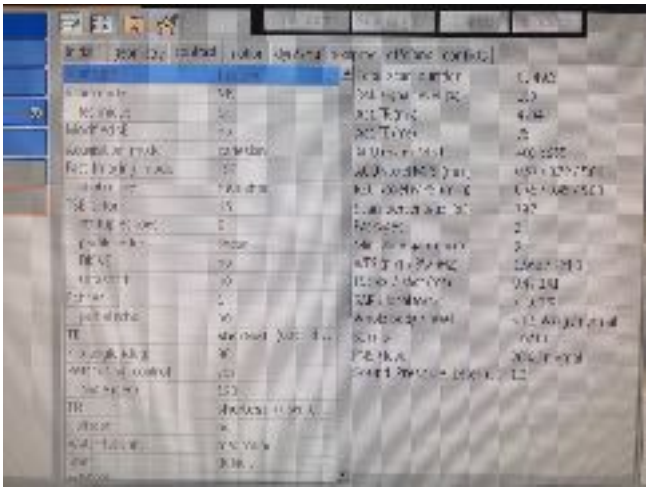
For humans, specific coils are customised and designed to take precise mRI of each body part . The machine takes the body part inside which has field of interest(not the whole body is necessary).

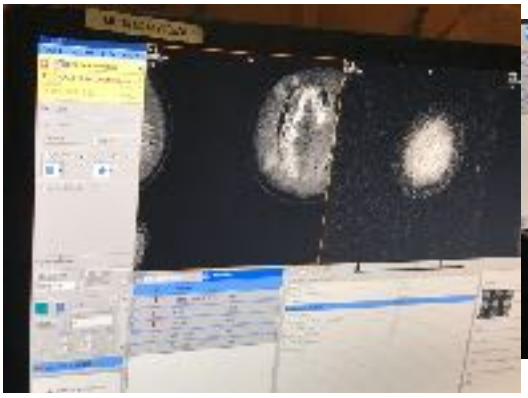


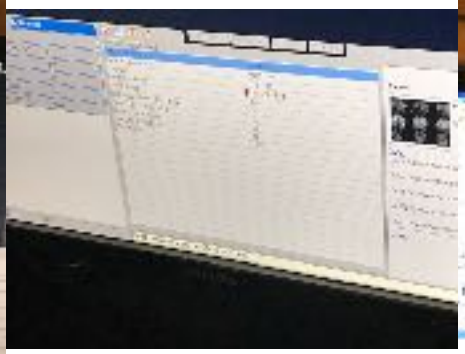

RESULTS : The GitHub link to the notebook has been provided.

OBSERVATION :

We observed that we can change quite many parameters and sequences while acquiring the image. The sequence is quite crucial as far as type of image is concerned as different sequences will be having different relaxation time and frequency of the successive RF pulses. We can change the sequence as per our requirement as its a hardware instruction which is set by the manufacturer. The execution of a particular sequence is done through a template shown in the picture. Like in the image shown we have a ‘ Spin Echo ‘ sequence which have 2 main parameters that is relaxation time and repetition time. We can alter them also by changing shot sequence. T**he relaxation time we observed was 4704 ms(time between two successive RF pulses) and echo time was 75 ms(Time for the echo to reach echo maximum) . The acquired matrix is different from the rows and columns of our image .**







There were not many issues while acquiring the image . We selected the sequence which take minimum time to complete as we had limited time period in the lab . Otherwise, all the images were observed and there was no artefact related to moving of the subject.

References :

[1] Klomp D, Konig W, Hoogduin H et al. Practical design of RF transmit and receive arrays. Proceedings of European Society of Magnetic Resonance in Medicine and Biology (ESMRMB) Congress, Leipzig, 2011.

[2] ‘Compliment MRI slides’ by Dr. Laura Curiel.

[3] MRI: The Basics: The Basics, By Ray Hashman Hashemi, William G. Bradley, Christopher J. Lisanti