STEP 1
The data type of the image matrix is **int16** (16-bit integer).

The number of voxels in x,y,z direction for the anatomical image: 256 x 256 x 54

The voxel size (x,y,z) of the anatomical image (also called voxel resolution): -1 1 3 (mm)
(Note: the -1 comes from a flip along the X-axis)

The dim vector gives the dimension values (x,y,z) that we also see in GUI, thus for the anatomical file we should find dim = [256 256 54].

The mat matrix expresses the linear transformation from voxel space to mm (scanner) space. In particular, for a voxel \( p_{vox} = [x \ y \ z] \) to \( p_{mm} = mat \cdot p_{vox} \) in physical coordinates.

\[
p_{mm} = [a \ x + t_x \ ; \ b \ y + t_y \ ; \ c \ z + t_z]
\]

where \( a, b, c \) are the coefficient that are corresponding to the voxel size. This transformation is reversible by doing \( p_{vox} = mat \backslash p_{mm} \).

The field of view (FOV) is \([-256 256 162]\), which indicates the size of an image in the mm space (indeed, your cranium is not much larger than 25 cm, thus there is no need to acquire a larger image!), and can be found by multiplying the number of voxel in each direction by the voxel size in the corresponding direction:

\[
FOV = number_{voxel} \cdot size_{voxel}
= [256 256 54] \cdot [-1 1 3] = [-256 256 162] \text{(mm)}
\]

STEP 2
The voxel size of one of the functional images is (x,y,z): -3 3 3 (mm)
(Note: the resolution of a functional image is generally lower than the one of an anatomical image acquired on the same machine)

The volume of a functional scan corresponds to the entire volume from which the activation of voxels is acquired.

The number of slices acquired per volume corresponds to the number of pixel in the acquisition direction (usually z), thus here there are 64 slices (since the functional image dimension is 64x64x64).

The number of volumes acquired corresponds to the number of functional files (here 96), since each functional file contains one volume (acquired during a time TR – Time to Repeat).
STEP 3
\[ Y = X\beta + e \]

In the case of 2 regressors and the audio data set, we find:

\[ Y = 96 \times 1, \text{ where 96 is the number of functional files (Note: not in seconds, but in data points!)} \]
\[ X = 96 \times 2 \text{ by construction} \]
\[ \beta = 2 \times 1 \text{ since there are 2 regressors} \]
\[ e = 64 \times 1 \text{ by construction} \]

STEP 4
The translation and rotation windows present how much the functional images have been moved in order to match an image of reference (which is usually taken as the first image of the functional serie). The data are acceptable according to the criterion, as the subject moved less than half of a voxel (< 1.5mm) as it can be seen in the translation/rotation window.

A rigid–body transformation accounts for the movements that a subject might do with his head while being in the scanner (possible movements: 3 rotations, 3 translation). Therefore, 6 parameters are required to do a rigid-body registration.

Inter-subject alignment requires non-rigid transformation to distort the brains of each subject such that clear anatomical landmarks fit, since each subject has a different shape of skull and brain.

STEP 5
The two regressors used where:
- the regressor corresponding to the protocol of the experiment (corresponding to onsets/offsets of the auditory stimulus presented)
- the regressor accounting for the baseline (i.e. a constant, which is added by default)