

Step-by-step procedure to detect and remove pacing artifacts from ECG signal:

1. Download ECGApp_final.m, kors.m, Test_file1.mat, Test_file2.mat.
2. Open the file (ECGApp_final.m) in Matlab.
3. Run
4. Click on '**Load ECG**' to load the test file.
5. Kors-transformed orthogonal leads X, Y, Z and 12-leads will be displayed in separate figures.
6. Click on '**Process**'
7. PC1 will be displayed with detected peaks (red circled) and locations (in sample) using default thresholds.
 - a. If thresholds need to be adjusted, turn on the **Custom Threshold** switch.
 - b. Put custom height and distance threshold and click **Process** to ensure all spikes in PC1 are detected.
8. If atrial artifacts are present and cannot be detected (in PC1 figure) using the above method (5 and 6), click on '**Step 2**'.
9. Check PC1 plot again.
10. If artifacts are still undetected (or in case of misdetection), click on '**Add**' or '**Remove**'. To remove a mis-detected location, select the location from '**Peak Index**' list and click on '**Remove**'. To add an undetected location, click on '**Add**' and provide the location (in sample) to the popped-up box.
11. After all the peaks are selected, click on '**Plot Results**'.
12. A new window will pop up with two separate lists of leads. One list belongs to the leads with artifacts and another without. Users can override algorithm decision by checking/unchecking boxes beside each lead. Click on '**Apply Correction**'.
13. Corrected (after removing pacing artifacts) 12-leads and orthogonal X, Y, Z leads will be displayed in the figure on top of the leads with pacing artifacts.
14. To change the artifact width, enable the switch under '**%Envelope/Sample**', to increase the width enter values below 0.3, to decrease the width enter values above 0.3 (default 0.3), alternatively, switch the method to **Sample** and enter the amount of data to remove, this value will be removed both before and after the artifact peak.
15. Click on '**Reviewed**' to move the processed file to 'Reviewed' folder.
16. If an error occurs, click on '**Error**' to move the file to 'Error' folder and review the file later.
17. If user decides that there are no pacing artifacts in the signal, click on '**No transformation**' to move the file to 'No change' folder.