

# Modified Rectangular Finite Impulse Response Filter for Stabilization of QT Measurement

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**Instruction:** In drug-safety studies, the measurements of QT intervals require to have a level of precision to detect small drug-induced prolongation. This paper discusses a modified approach of  $\beta$ -shaped FIR Filter to optimize the quality of signal and improve the stability of QT/QTc interval measurements.

**Methods:** the proposed filter is designed to have a time-dependent frequency characteristic based on pre-defined fiducial points of the EKG. The radius of regular  $\beta$ -shaped FIR filter is modified to obtain different frequency characteristics within QRS and the repolarization interval. This optimal filter is compared to its simple forms (including 5 radiuses). We compared the standard deviation of QT/QTc interval between the optimal filter and the single-radius filters (radius  $N=5, 10, 15, 20$ ). The evaluation of QTc stability was based on the standard deviations of QTc interval when measured from Holter ECG signals from 20 healthy subjects filtered with the proposed five versions of the  $\beta$ -shaped FIR filter.

**Results:** We included Holter ECG signal recorded at 1000Hz sampling frequency and 16 bit amplitude resolution. The study population included 6 females ( $45 \pm 9$  yrs) and 14 males ( $40 \pm 10$  yrs). The corresponding low-pass filters had a cutoff frequency equal to 110, 72, 47, 39, 26 Hz for  $N=3, 5, 8, 10, 15$ , respectively. The optimal filters combined frequency characteristics of the  $\beta$ -shaped FIR filter for  $N=15$  for the repolarization interval and  $N=3$  for the QRS interval. The variability of QTc duration of filtered signal with regular filter  $N=5, 10, 15, 20$  were calculated by averaging the standard deviation of QTc which was 10, 13, 10, 10 msec, respectively. These results correspond to 42%, 76%, 37% and 45% decrease stability in reference to the optimal filter.

**Conclusion:** The standard deviation of QTc interval with optimal filter revealed an averaged 50% increase of stability in comparison to other proposed filter.