Technical aspect of quantification and measurement of HRT

February 11, 2019

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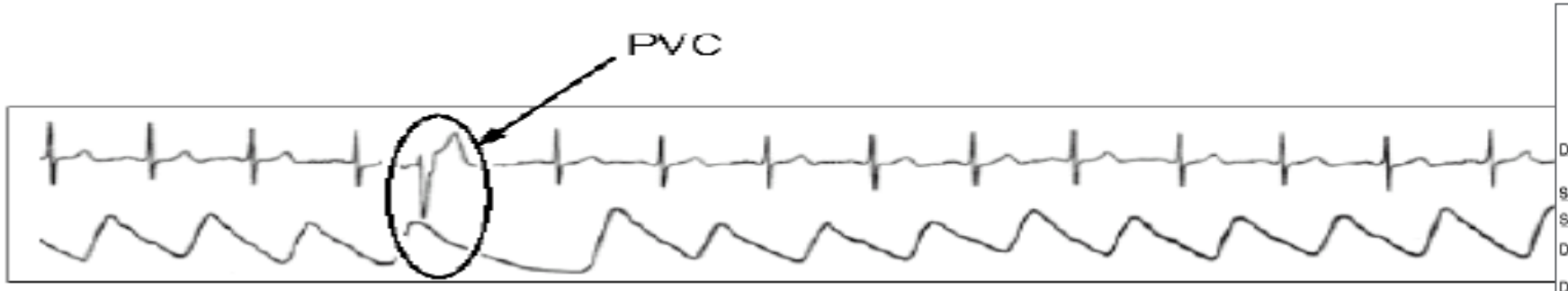
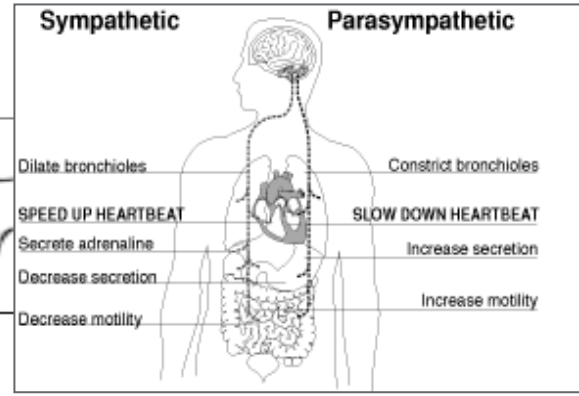
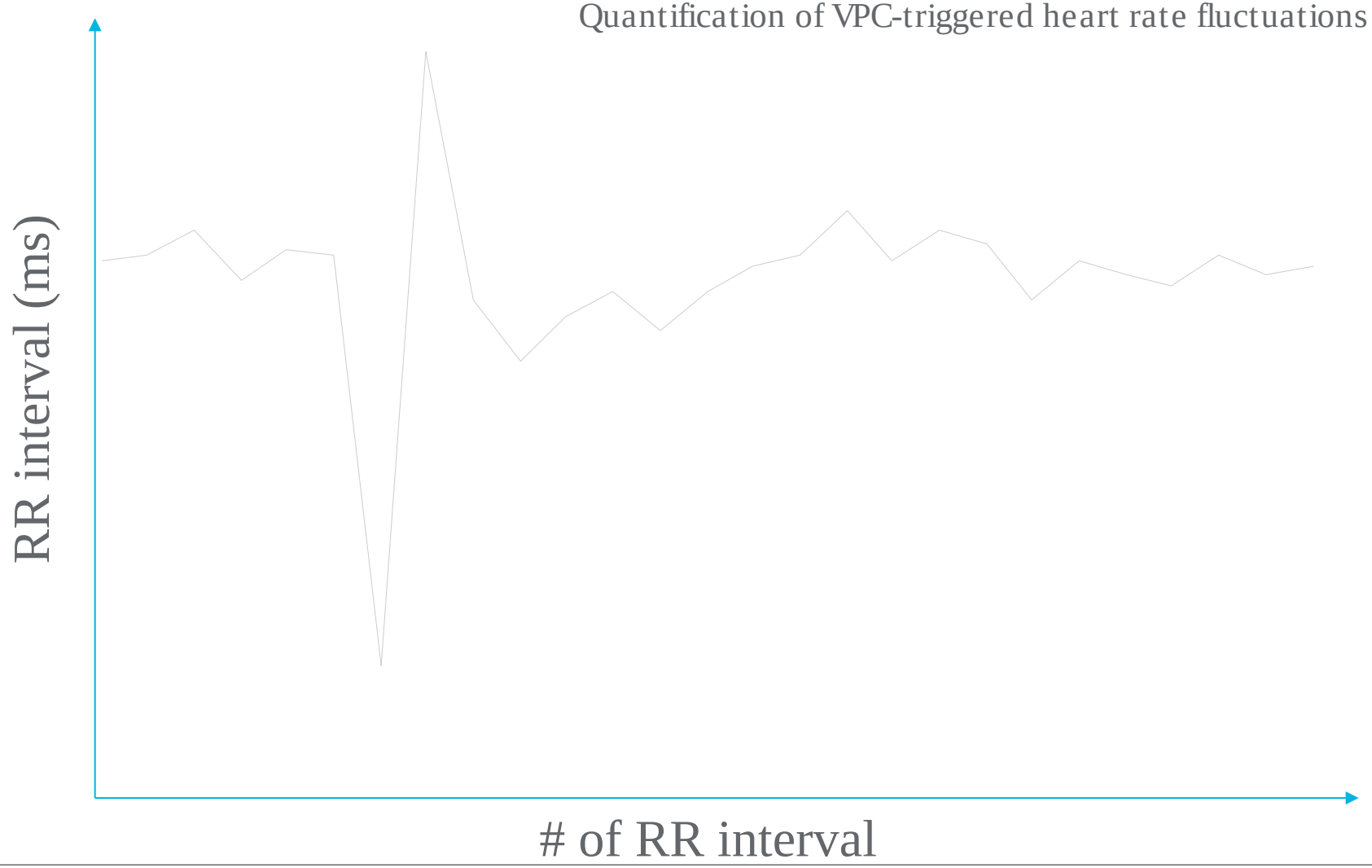
HRT - Measure of Autonomic Tone Changes in RR Interval after PVC





Heart Rate Turbulence

Quantification of VPC-triggered heart rate fluctuations



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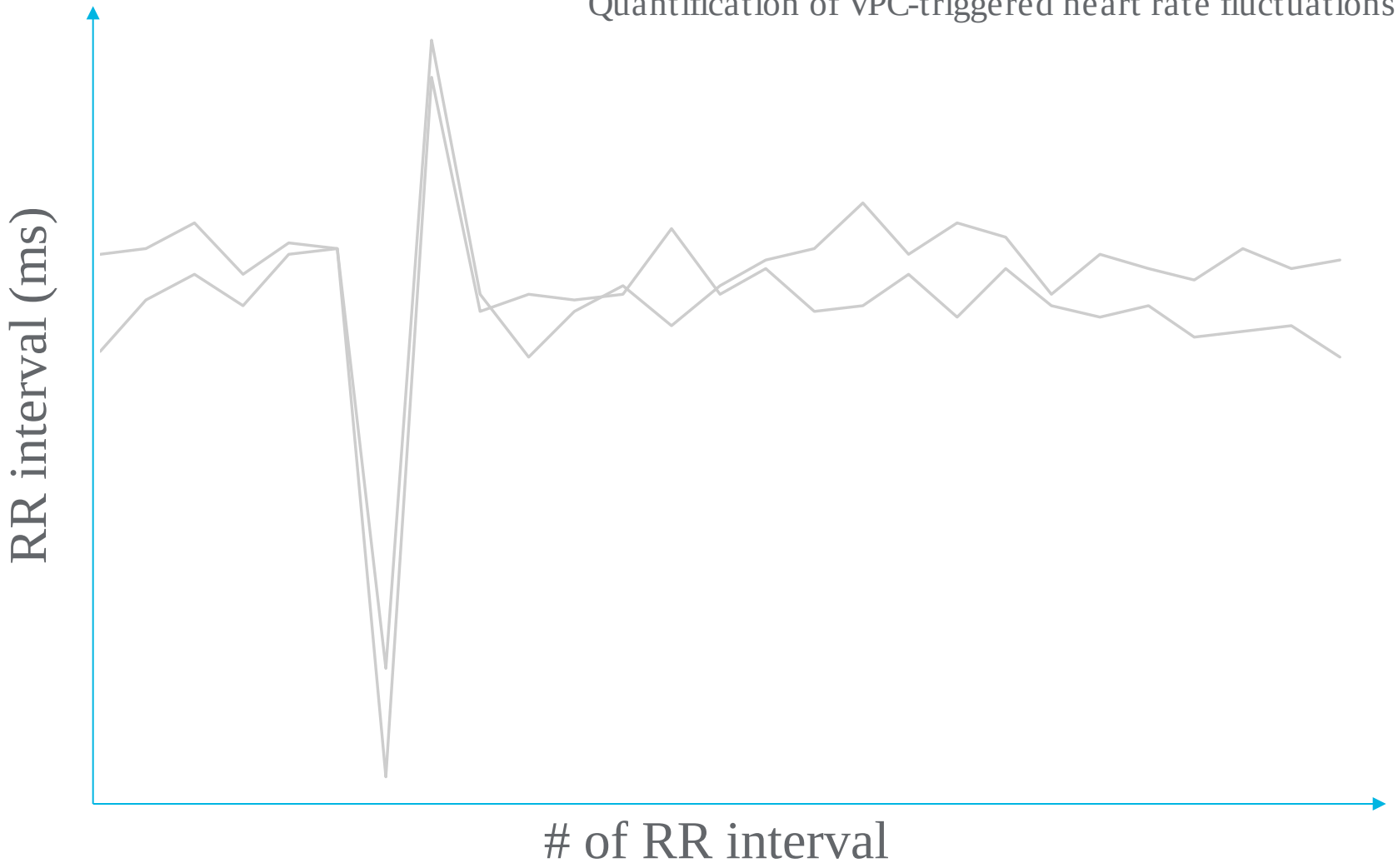

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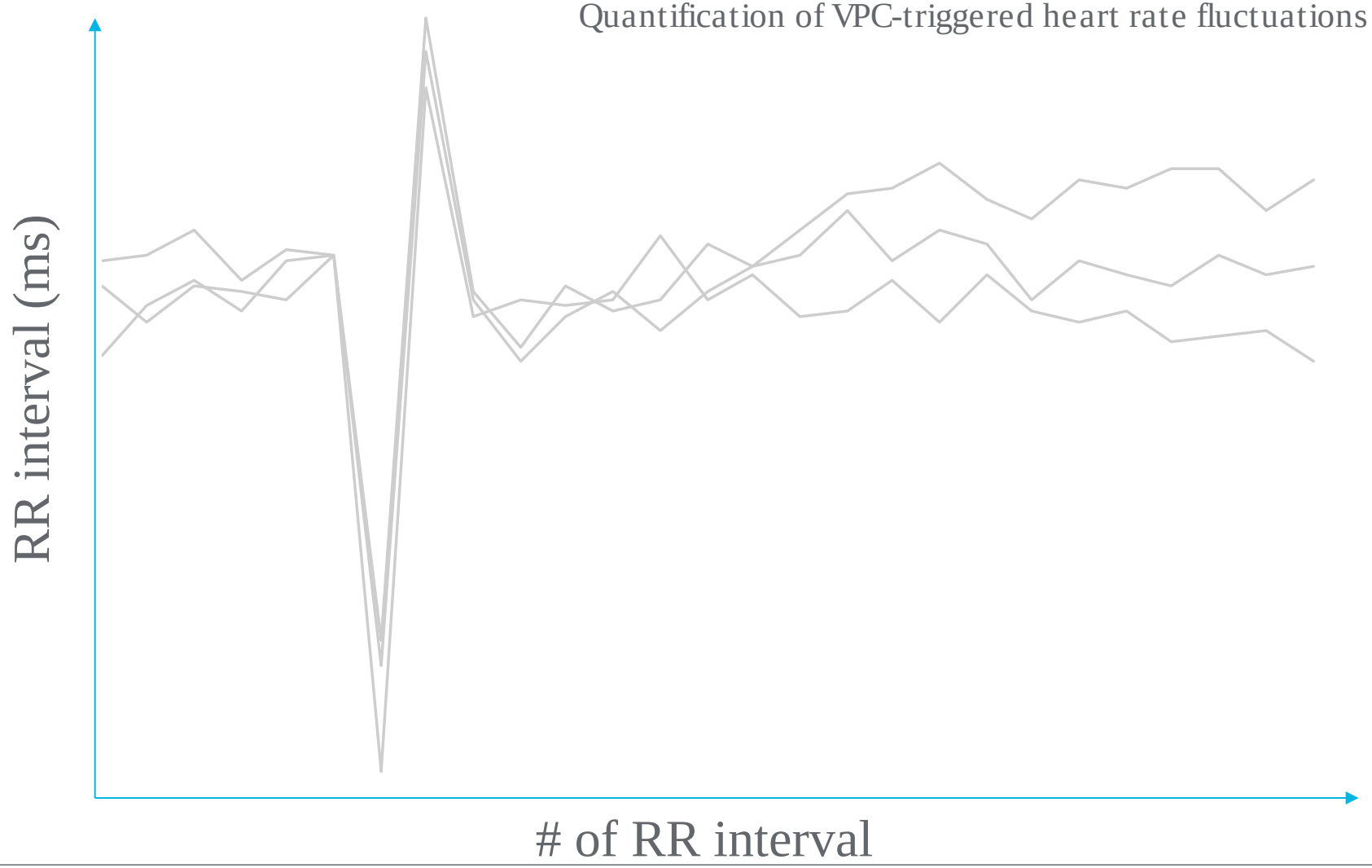
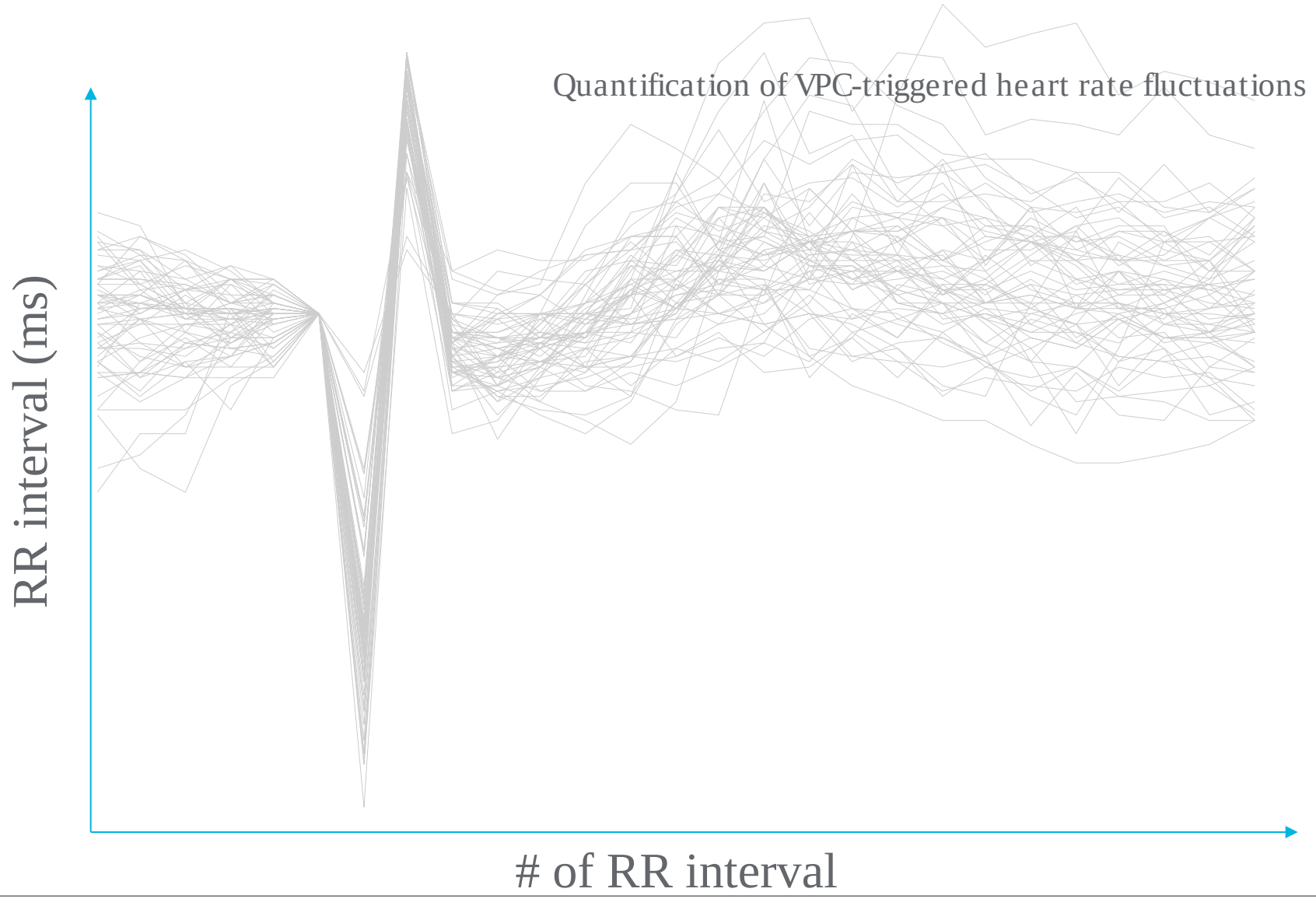
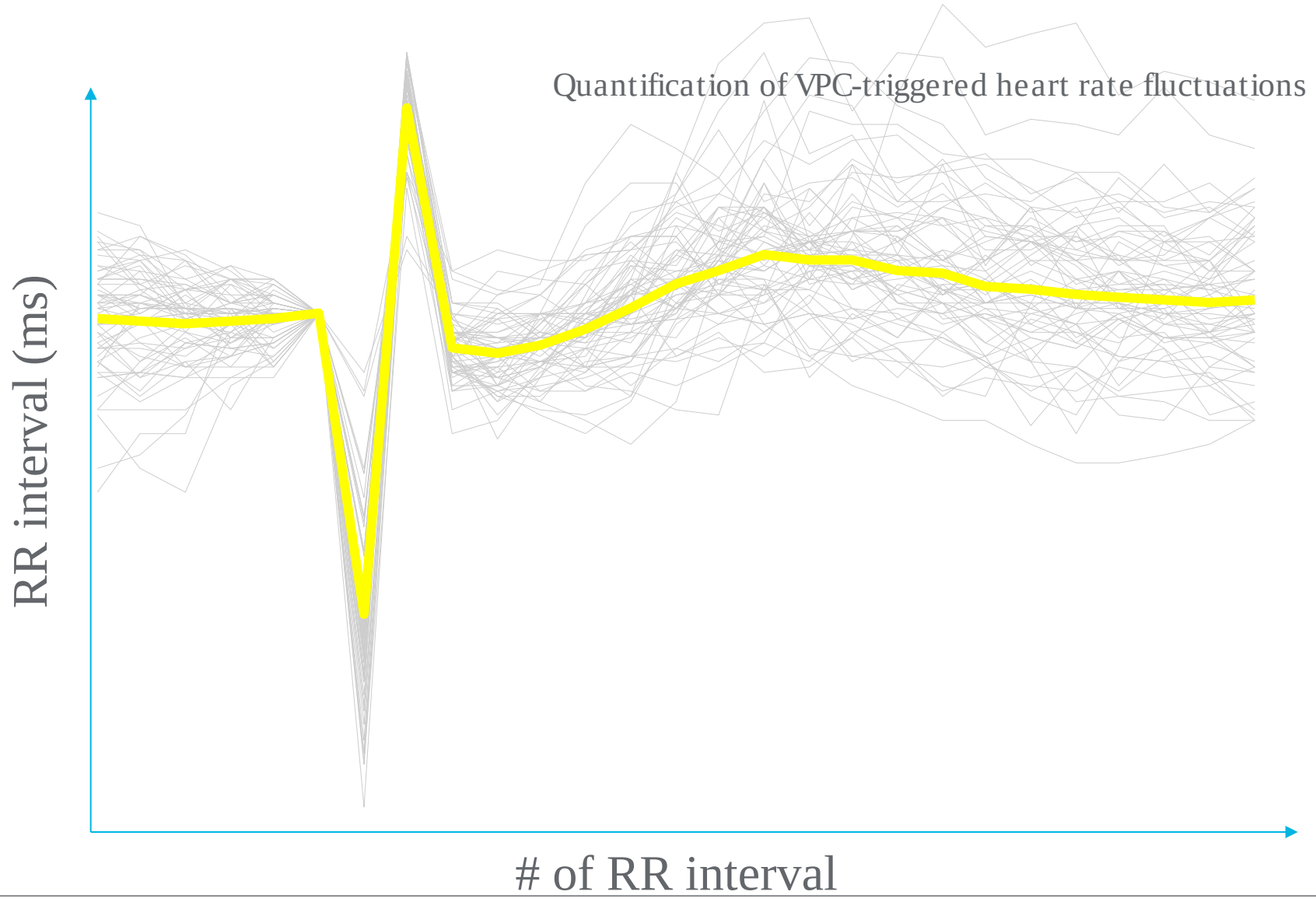


Heart Rate Turbulence



Heart Rate Turbulence



HRT Algorithm

Turbulence Onset (TO)

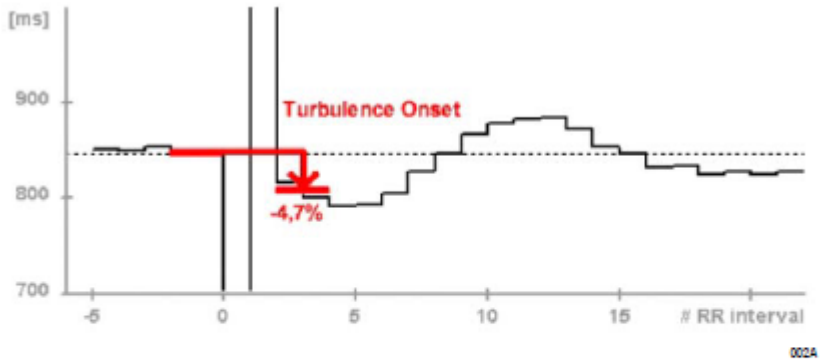


Figure 2

Figure 2 shows Turbulence Onset (TO) the percentage difference between the average value of the first two normal intervals following the PVC and the last two normal intervals preceding the PVC. Initially, TO is determined for each individual PVC, followed by the determination of the average value of all individual measurements.

Turbulence Slop (TS)

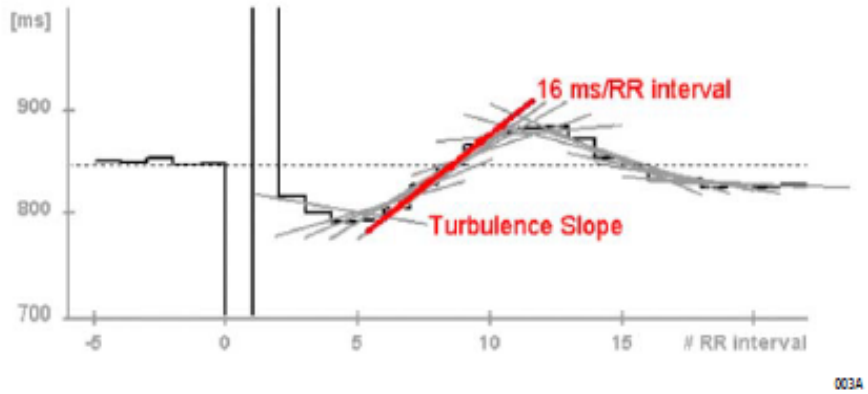


Figure 3

Figure 3 shows the TS, the steepest slope of a linear regression line through five consecutive measurement points in the averaged tachogram. The TS calculations are based on the averaged tachogram and expressed in milliseconds per RR interval.

$$TO = 100 * ((RR_1 + RR_2) - (RR_{-2} + RR_{-1})) / (RR_{-2} + RR_{-1})$$

HRT Algorithm

Filter

- HRT quantification can only deliver usable result if the triggering event was a true PVC(not an artifact).
- PVC is free from arrhythmia, artifacts and false classification

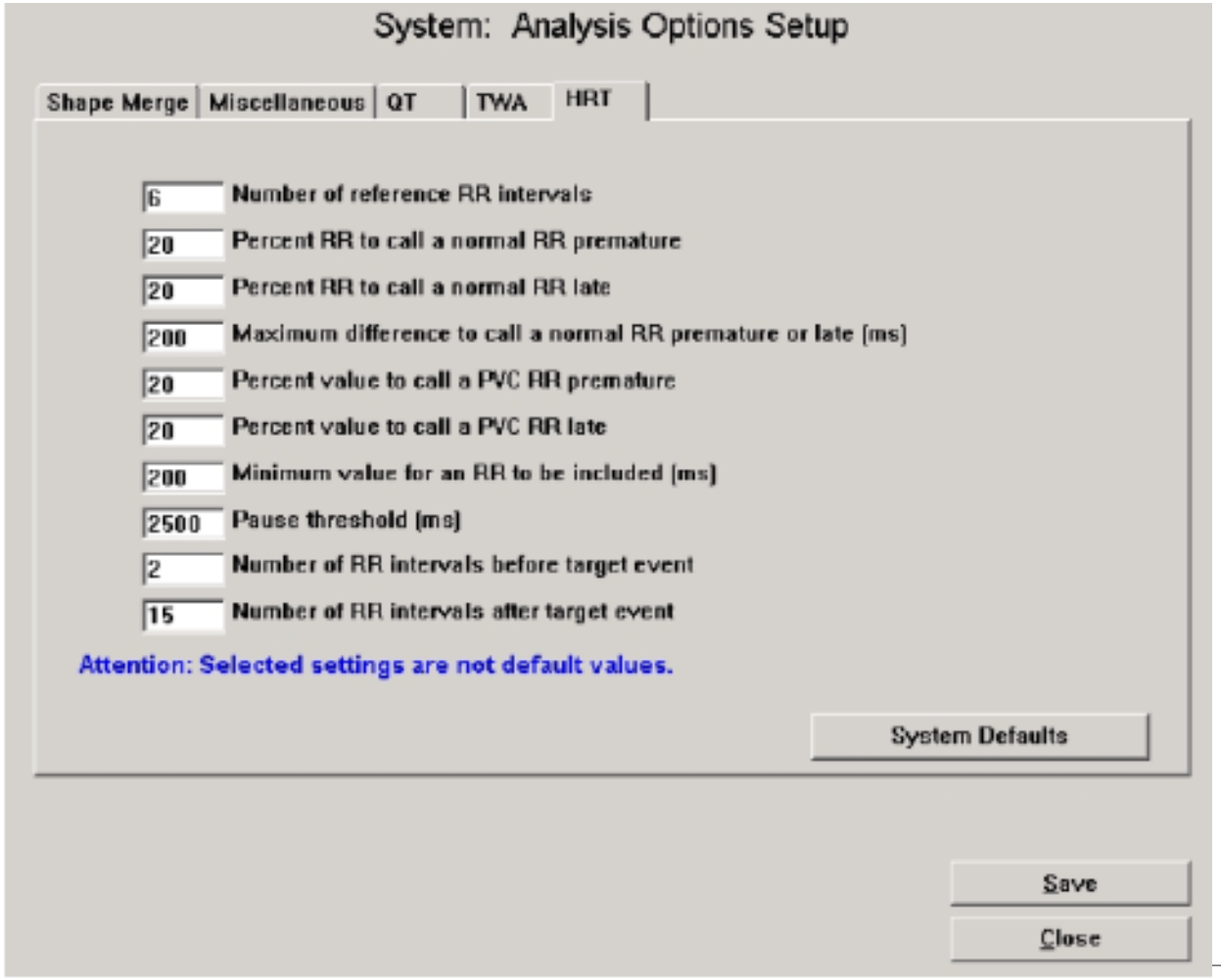
  - < 200 milliseconds
  - > 2500 milliseconds
  - > 200 milliseconds difference to the preceding sinus interval
  - > 20% difference to the reference interval (mean of the 5 last sinus intervals)

  In addition, the HRT calculations are limited to PVCs:

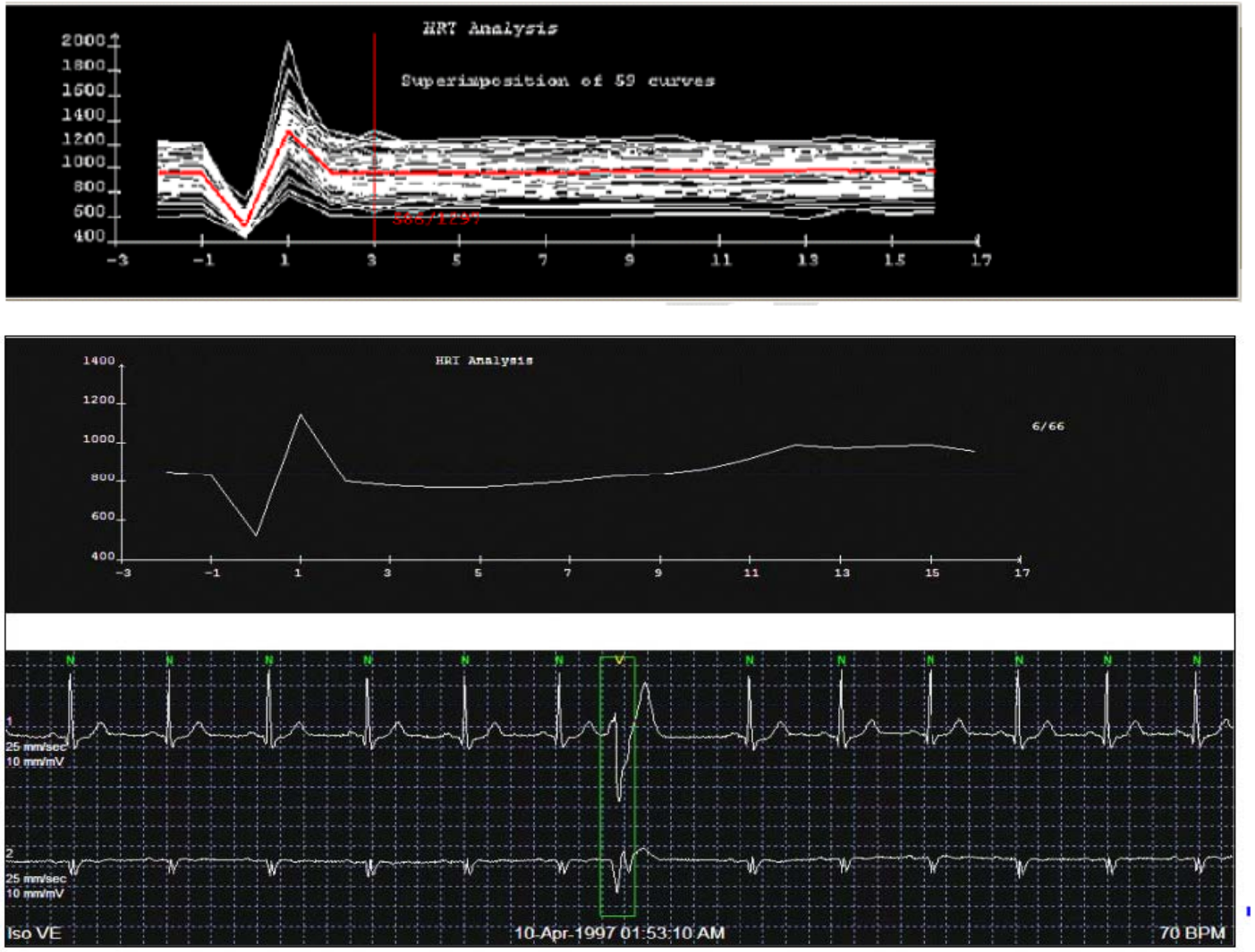
  - with a minimum prematurity of 20%
  - with a post-extrasystole interval which is at least 20% longer than the normal interval
  - having 2 normal RR intervals before
  - having 15 normal RR intervals after

Analysis option definition

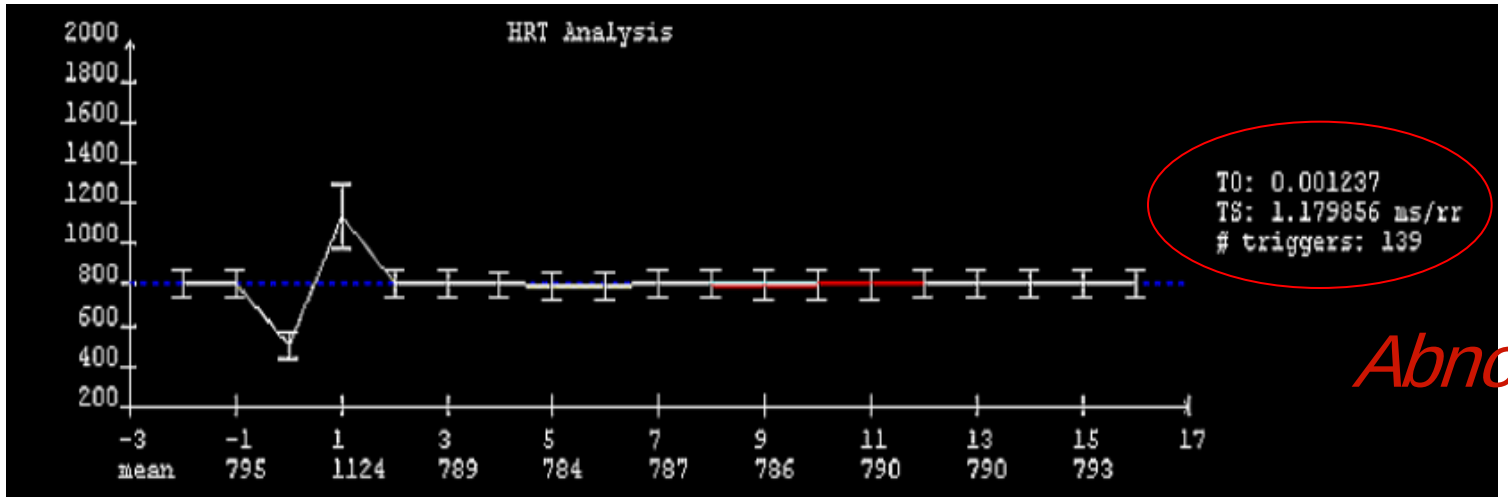
System>>System option>Analysis option>HRT



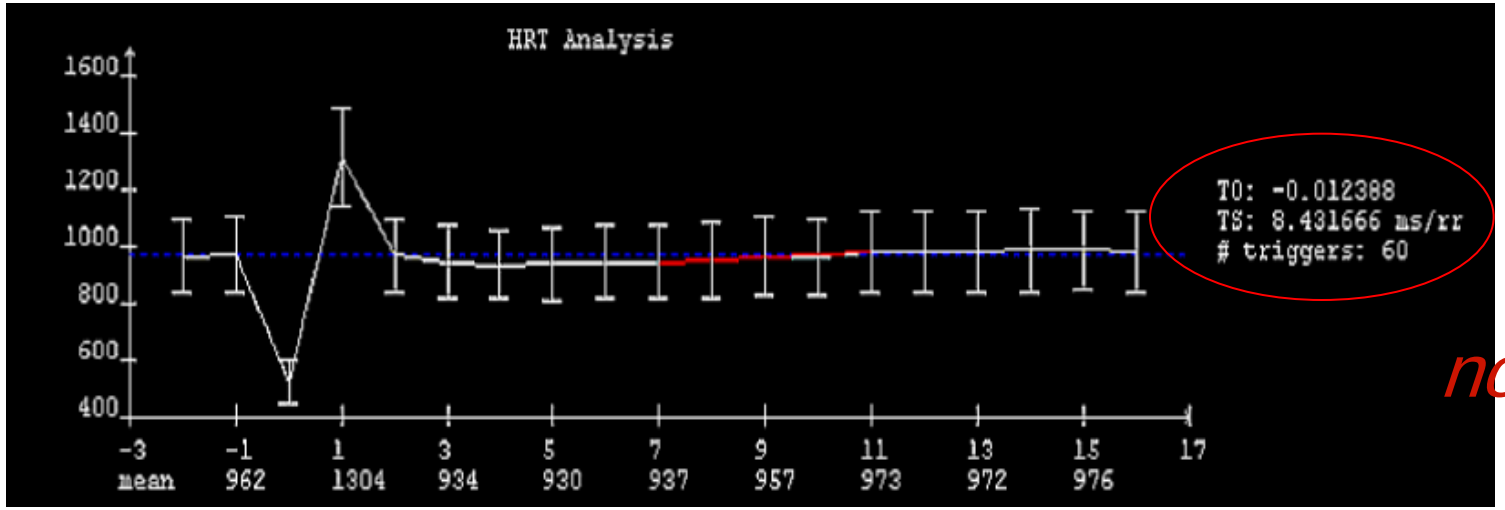
HRT Screen In MARS



Heart Rate Turbulence



Abnormal HRT



normal HRT

Quiz

Which scenario is the high risk result?

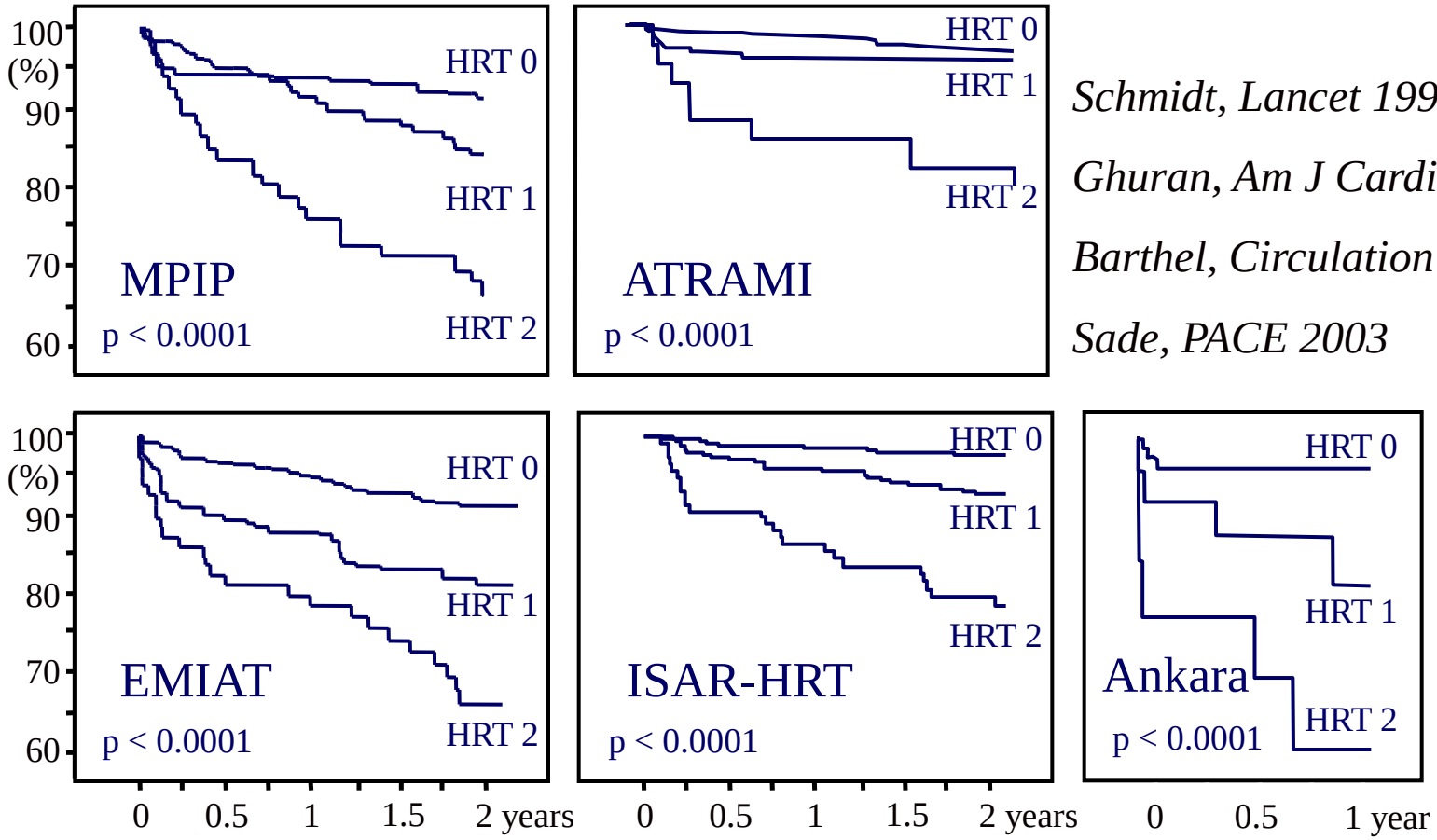
Scenario 1 — TO > 0%, or

Scenario 2 — TS < 2.5 milliseconds/RR interval, or

Scenario 3 — TO > 0% and TS < 2.5 milliseconds/RR interval

Heart Rate Turbulence

HRT & Survival in Post MI Patients



Schmidt, Lancet 1999

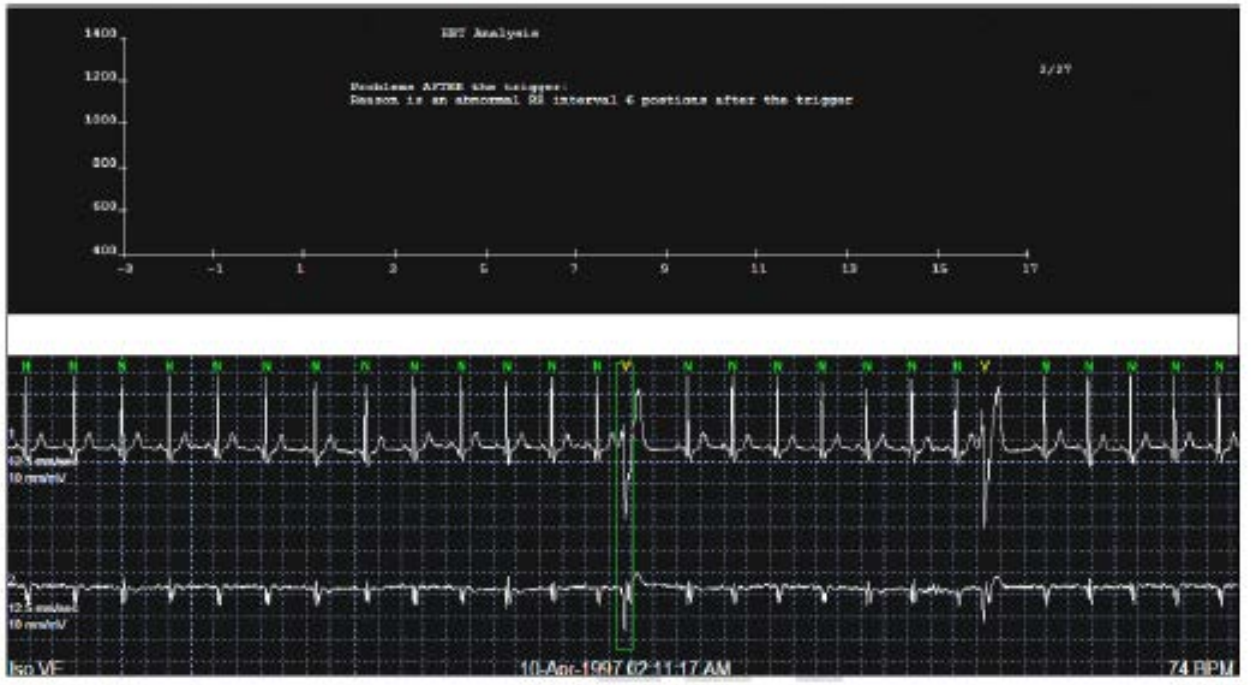
Ghuran, Am J Cardiol 2002

Barthel, Circulation 2003

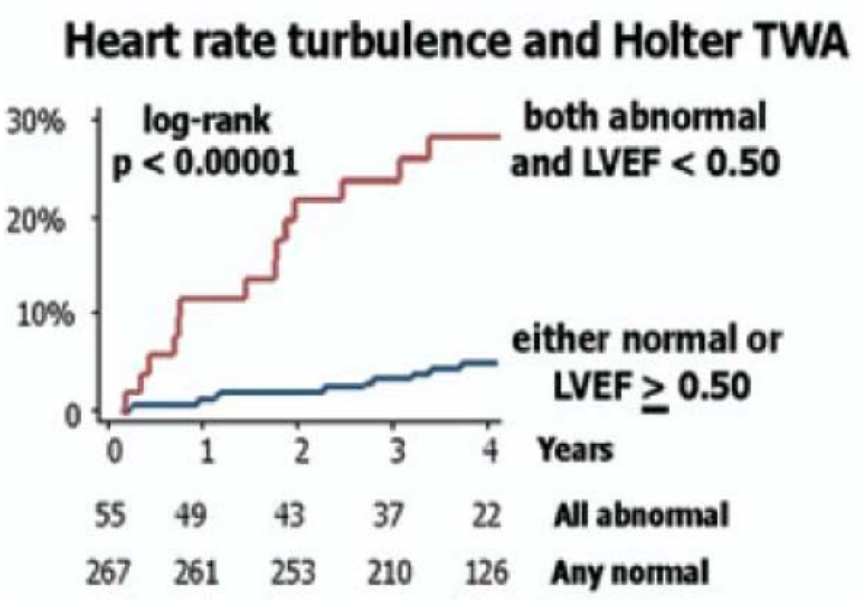
Sade, PACE 2003

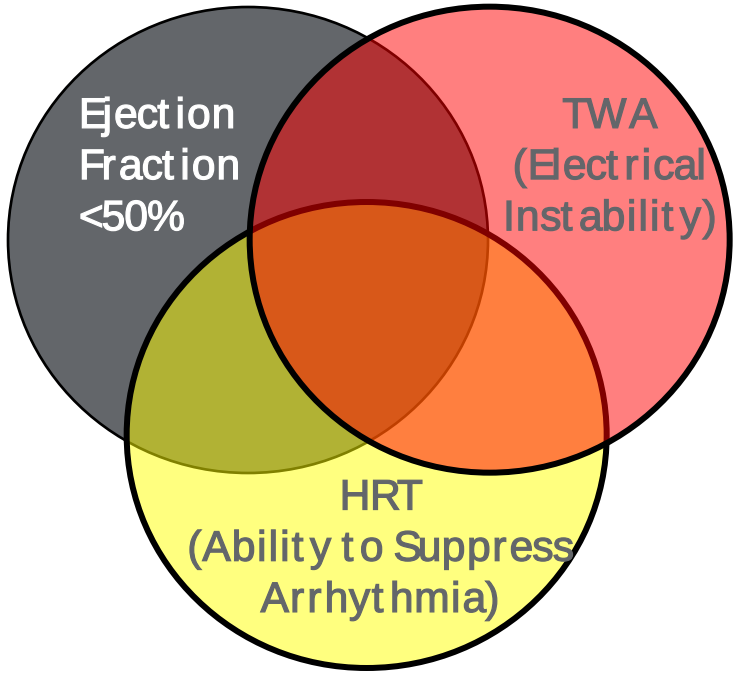
Limits of HRT analysis

HRT is not always measurable. HRT obviously cannot be measured in patients who do not have PVCs, Also it cannot be measured in patients with pacemaker or episodes of atrial fibrillation for the duration of the Holter recording



EF + ECG Identifiers
Increases Selection Accuracy





Exner, D.V., et al., Noninvasive risk assessment early after a myocardial infarction the REFINE study. ***JAm Coll Cardiol, 2007***

JACC

322 patients, post MI EF < 50%, followed 47 months

Testing > ***10-14 weeks post MI***