

# Power Spectral Density Change Detector

*DMT monitor implementation*

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# Algorithm : Basic Idea

- Make a spectrogram
- Find time-frequency regions that differ in their statistical properties
- Make a statistical test for *relative* differences
  - A T-F region containing a transient will have a histogram that differs from other regions.
  - So, test if two observed histograms come from the same underlying probability distribution.
- Can be done without assumptions about the underlying true distribution → **chi-square test !!**

Advantage: no prior statistical model of the data required for setting thresholds. (No need to assume Gaussianity for example.)

# PSDCD

*Soumya D. Mohanty, PRD, 1999*

- Simplest implementation of this idea
- TF regions being compared are rectangles with width  $W$  in time and height unity in frequency
- Only pairs of rectangles at the same frequency are compared
- Statistical property tested for equality: Mean
- Using (modified) Student's t-test

Additional simple veto : consistency with a running pair-wise comparison

# DMT Monitor Implementation

- Background Monitor PSDCDmon
- Command line arguments
  - channel
  - threshold
  - tstep : input segment duration
  - tseg : tunes test to transient duration
  - nsubsegs : Determines detection efficiency
- Submits Triggers: start time, duration, lower and upper frequency, cluster size (to be included)

# Status / Future

- Can be run now as a monitor
- False alarm rate completely determined by monitor parameters and threshold. Need to write a helper code to find threshold using Monte Carlo simulation
- Minor bug needs to be corrected
- Will be applied to E7 data

# Code Details

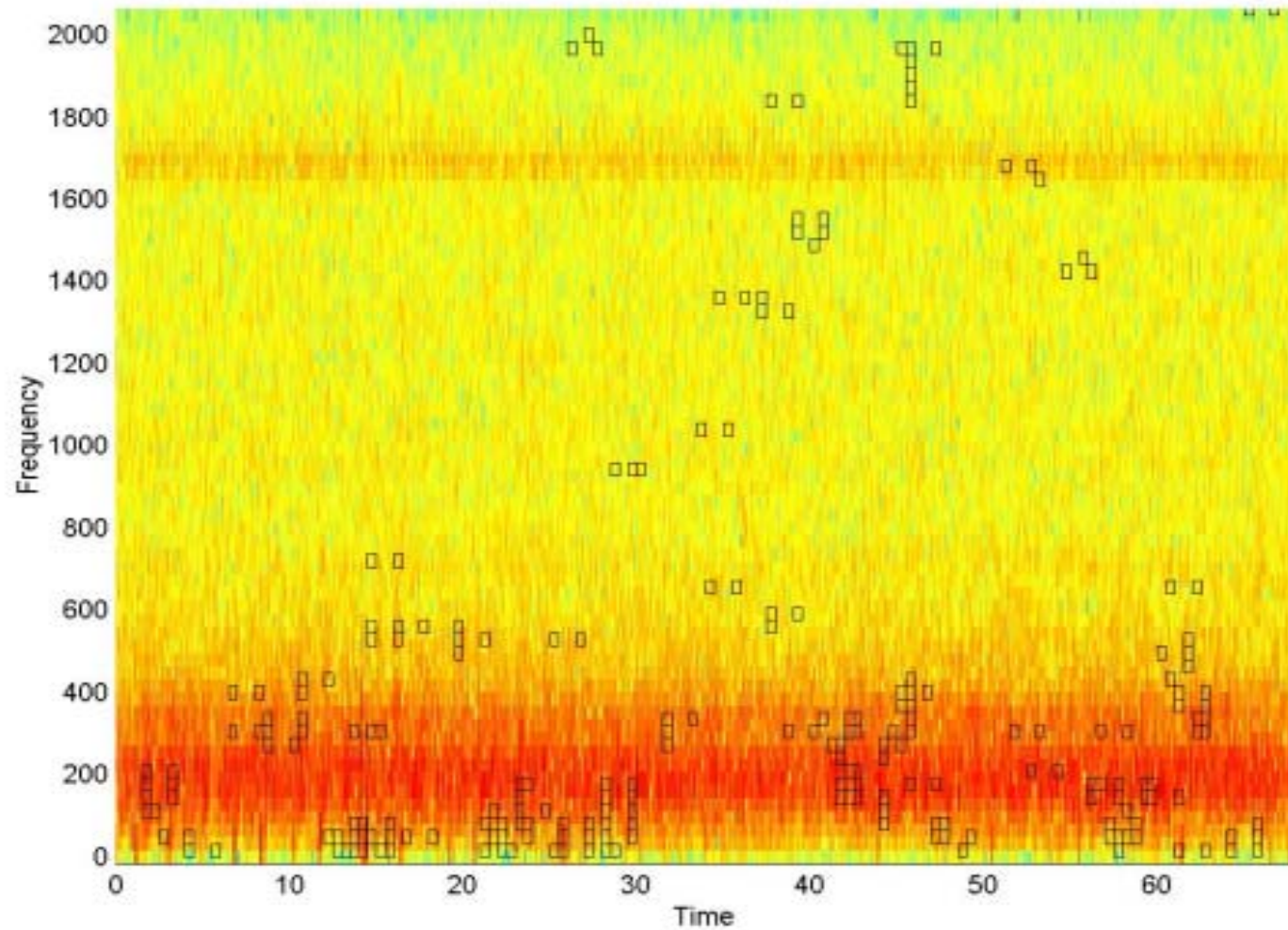
- Custom data container forms the base
  - Emulates Matlab Cell array for integer data
  - Vector of pointers to linked lists of vectors
- Class for Set Operations
- About 1500 lines of code
- Runs much faster than real time (for reasonable false alarm rates)

# Sample results

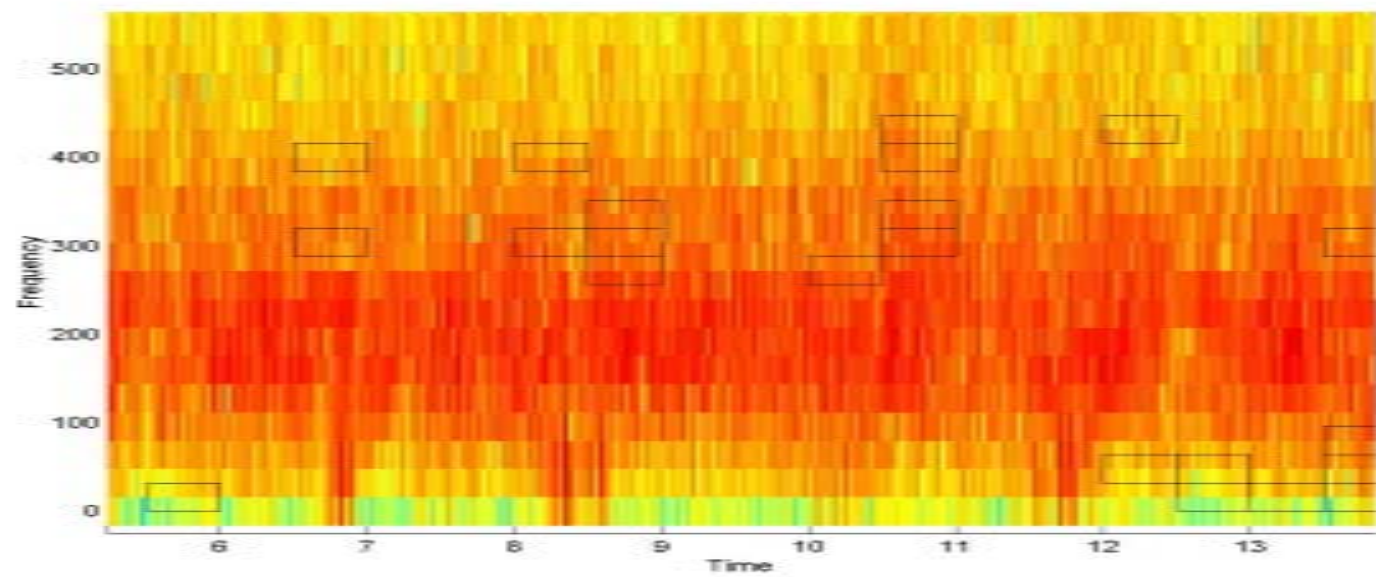
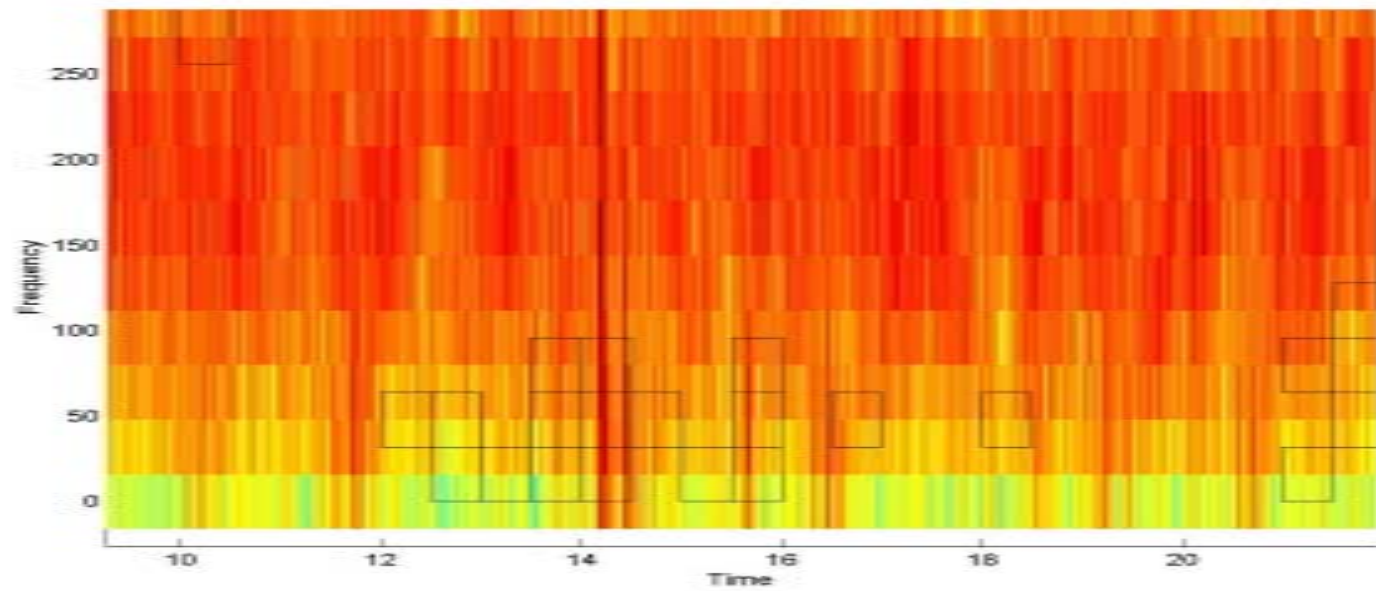
(Using Matlab code)

- DMT code output identical to Matlab code
- Output of PSDCD superimposed on spectrogram of the same data
- 68 sec of H2:LSC\_AS\_Q low-pass filtered and downsampled to 4096 Hz
- Data cleaned of lines using MBLT

$t_{seg}=0.5\text{sec}$ ,  $n_{subsegs}=16$ ,  $threshold=1.5$







tseg=1.0sec, nsubsegs=16, threshold=1.

