

WaveMon and Burst FOMs

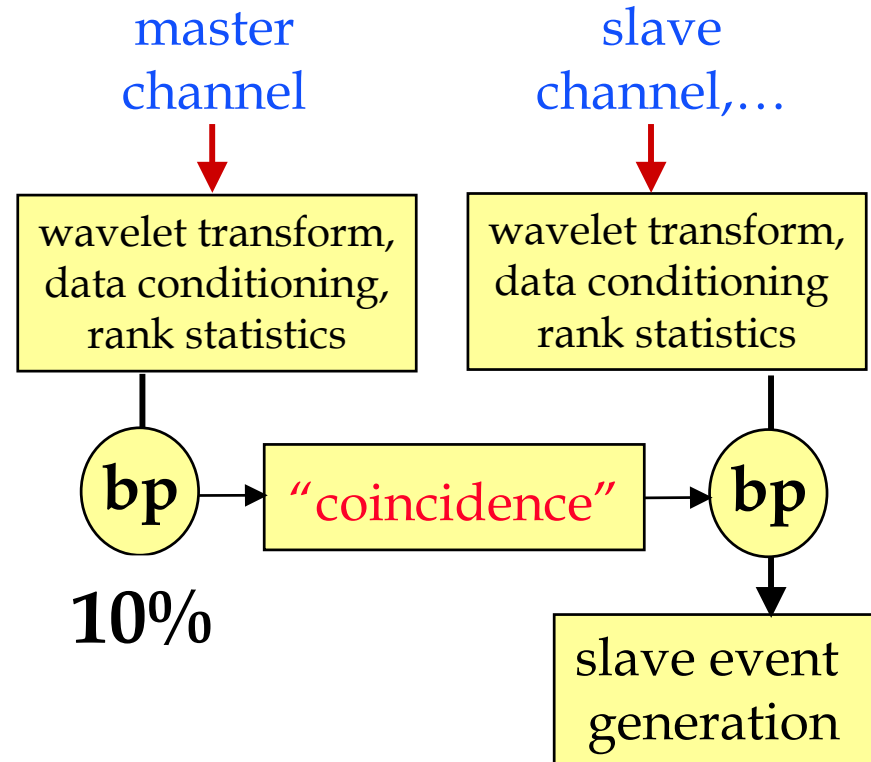
Sergey Klimenko

University of Florida

- **WaveMon**
- **WaveMon FOMs**
- **Summary & plans**



- DMT tool to monitor glitches
- Wavelet domain: complete time-frequency cluster analysis
- Same algorithms as for WaveBurst
- Fast: can monitor up to 60 channels in the frequency band up to 4 kHz.



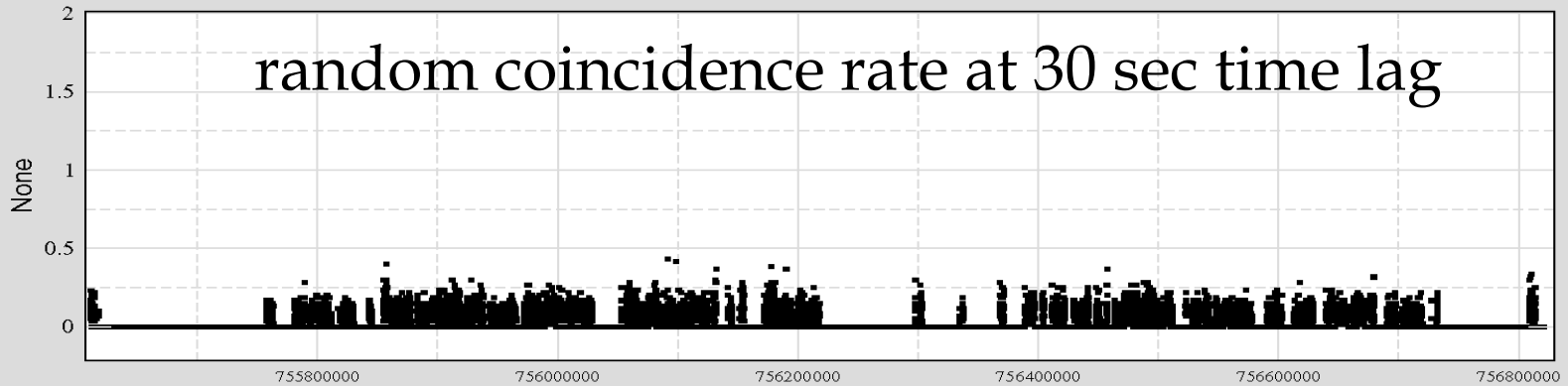
- detect glitches in slave channels coincident with master channel, which could be AS_Q channel → **inter-channel correlations**
- Slave triggers can be used as an efficient veto in the burst analysis (see Ken's and Laura's talks)



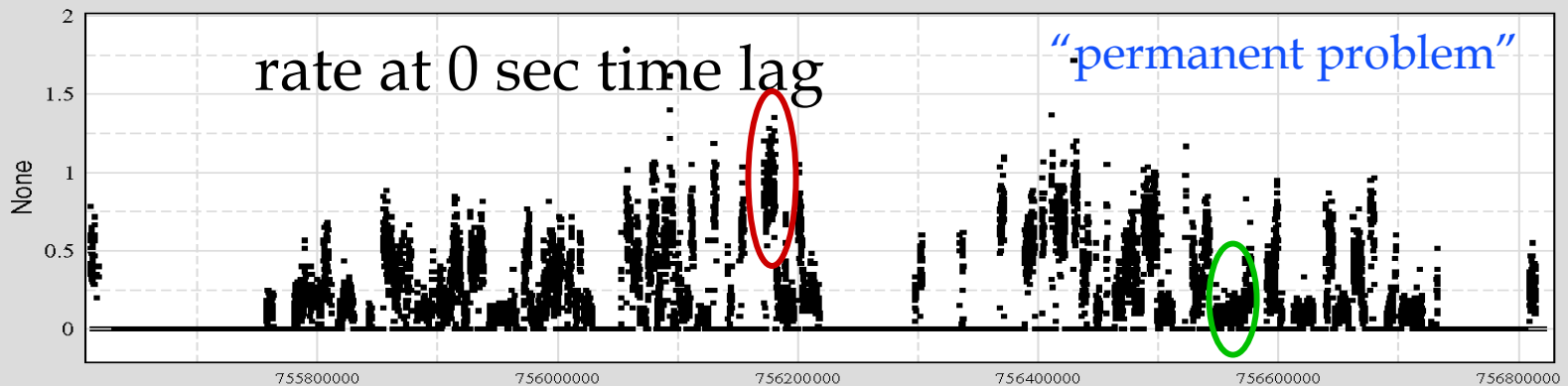
MEAN

Actual Trend Data available 20161 minutes from 03-12-16-11-59-47 to 03-12-30-11-59-47

Trend Ch 2: L1:LSC-MICH_CTRL_FA_gws



Trend Ch 1: L1:LSC-MICH_CTRL_gws



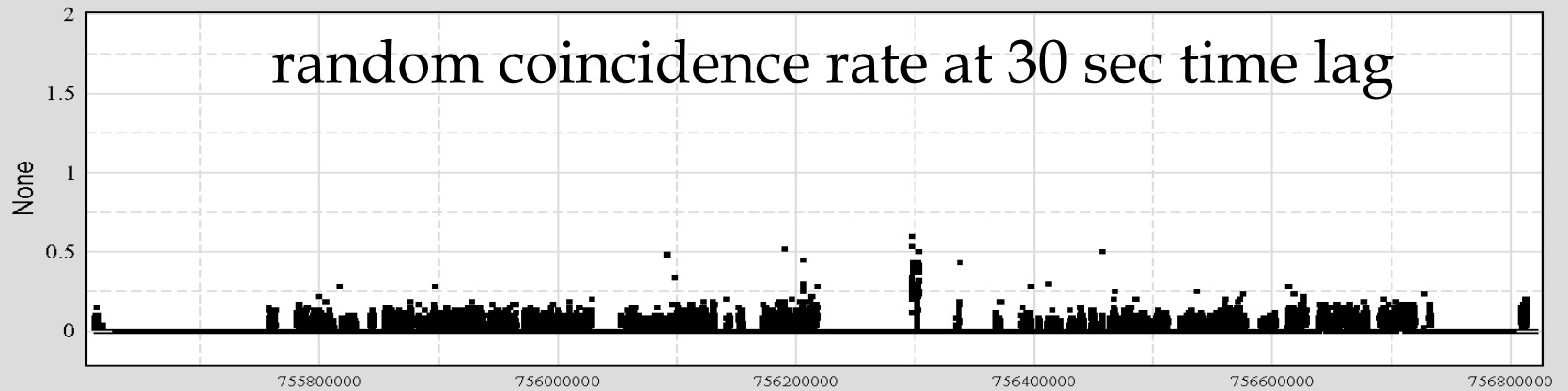
- good FOM ? – not really
- however, tells us that MICH_CTRL is efficient veto channel.



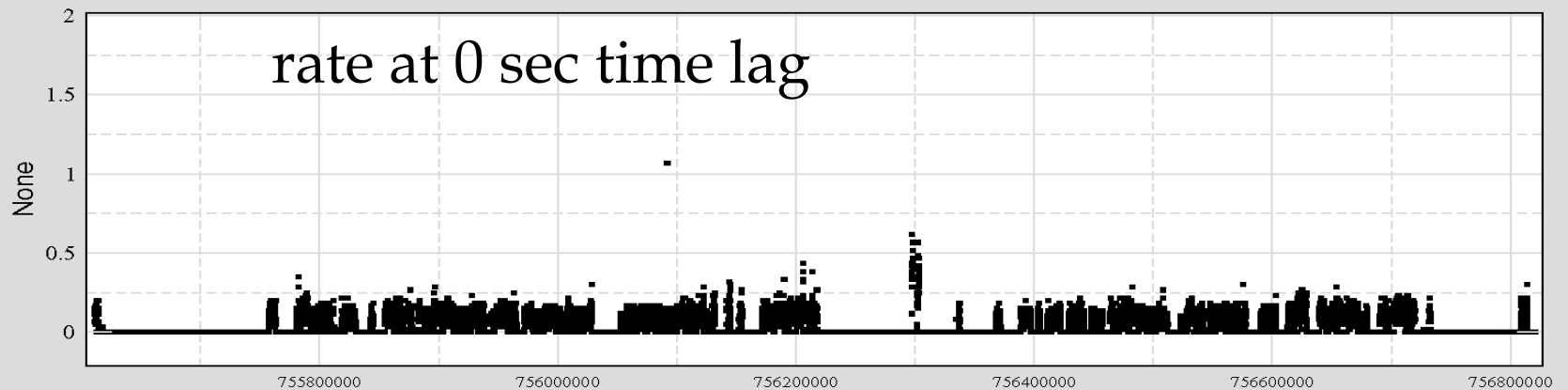
MEAN

Actual Trend Data available 20161 minutes from 03-12-16-11-59-47 to 03-12-30-11-59-47

Trend Ch 6: L1:LSC-REFL_I_FA_gws



Trend Ch 5: L1:LSC-REFL_I_gws



• good FOM ? - yes!

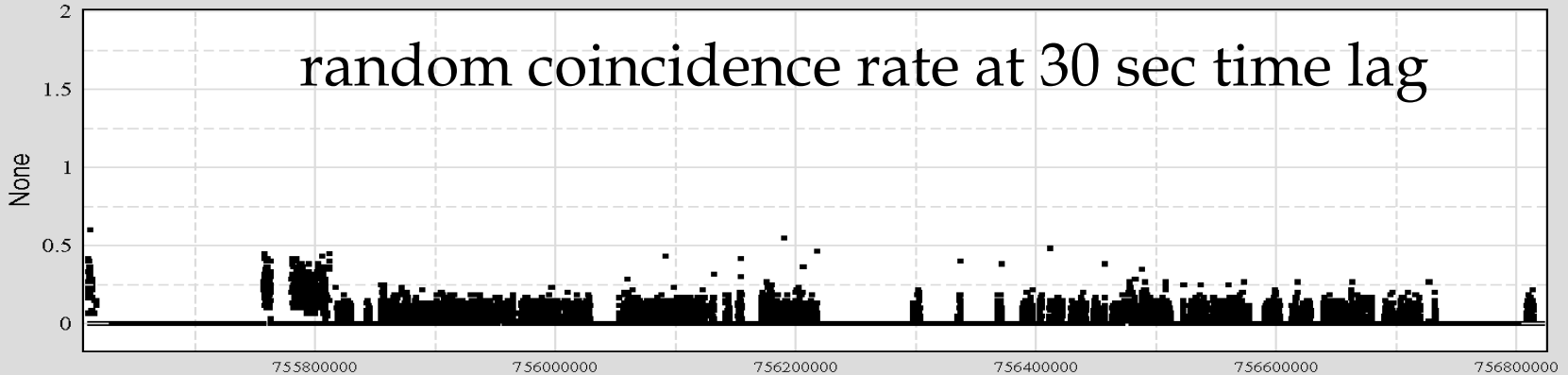


MEAN

Actual Trend Data available 20161 minutes from 03-12-16-11-59-47 to 03-12-30-11-59-47

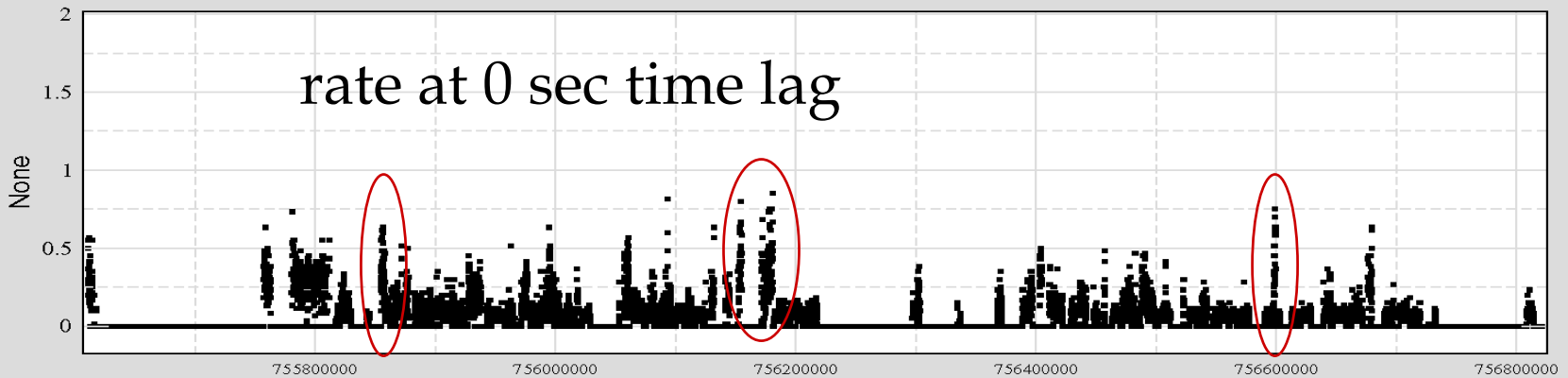
Trend Ch 8: L1:LSC-REFL_Q_FA_gws

random coincidence rate at 30 sec time lag



Trend Ch 7: L1:LSC-REFL_Q_gws

rate at 0 sec time lag

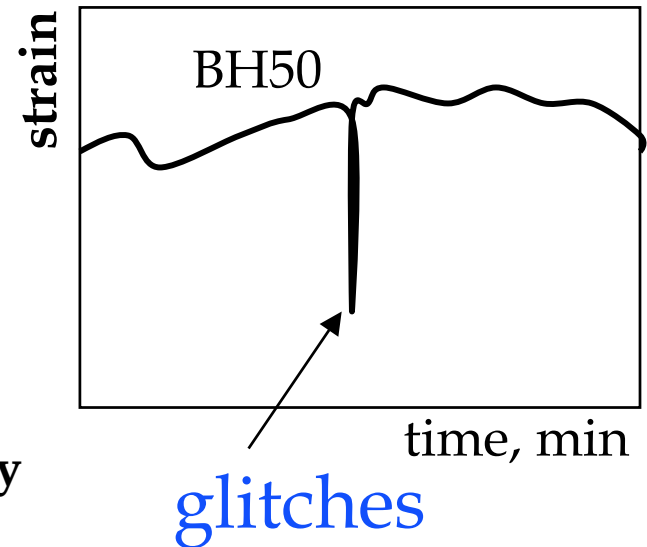




- **Purpose**
 - **display the performance of LIGO detectors to identify (new) problems during data taking runs**
 - **Sensitivity: range or strain (preferably for astro-motivated sources)**
 - **glitch rates**
 - **noise outliers (non-stationarity & non-Gaussianity)**
 - **latency**
 - **Short (few minutes) to be useful in control room**
 - **Long (hours-days) - could be useful for analysis.**
- WaveMon can produce short latency FOMs - 1 min**

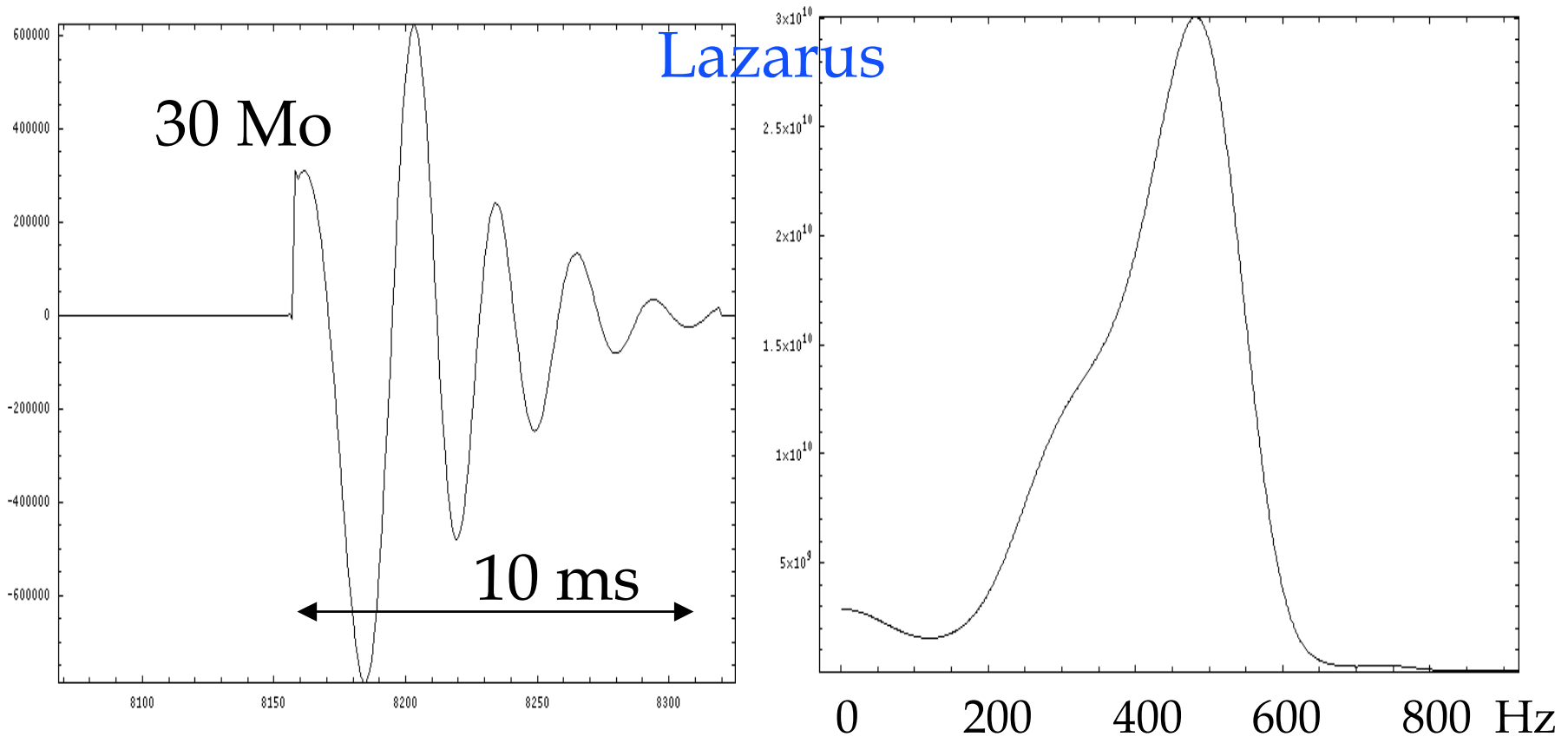
Sensitivity FOM (2)

- **strain(t) (or range(t)) @ 50% detection efficiency**
for few selected waveforms (ad hoc & astro-motivated)
 - BH-BH mergers (10, 50, 80 Mo)
 - Gaussians (broadband)
- **run-time simulation**
 - do injections with various strains
 - run WM to find injections
 - calculate strain at 50% detection efficiency
 - report strain(t) at 1/minute rate
- **latency - 1 min**



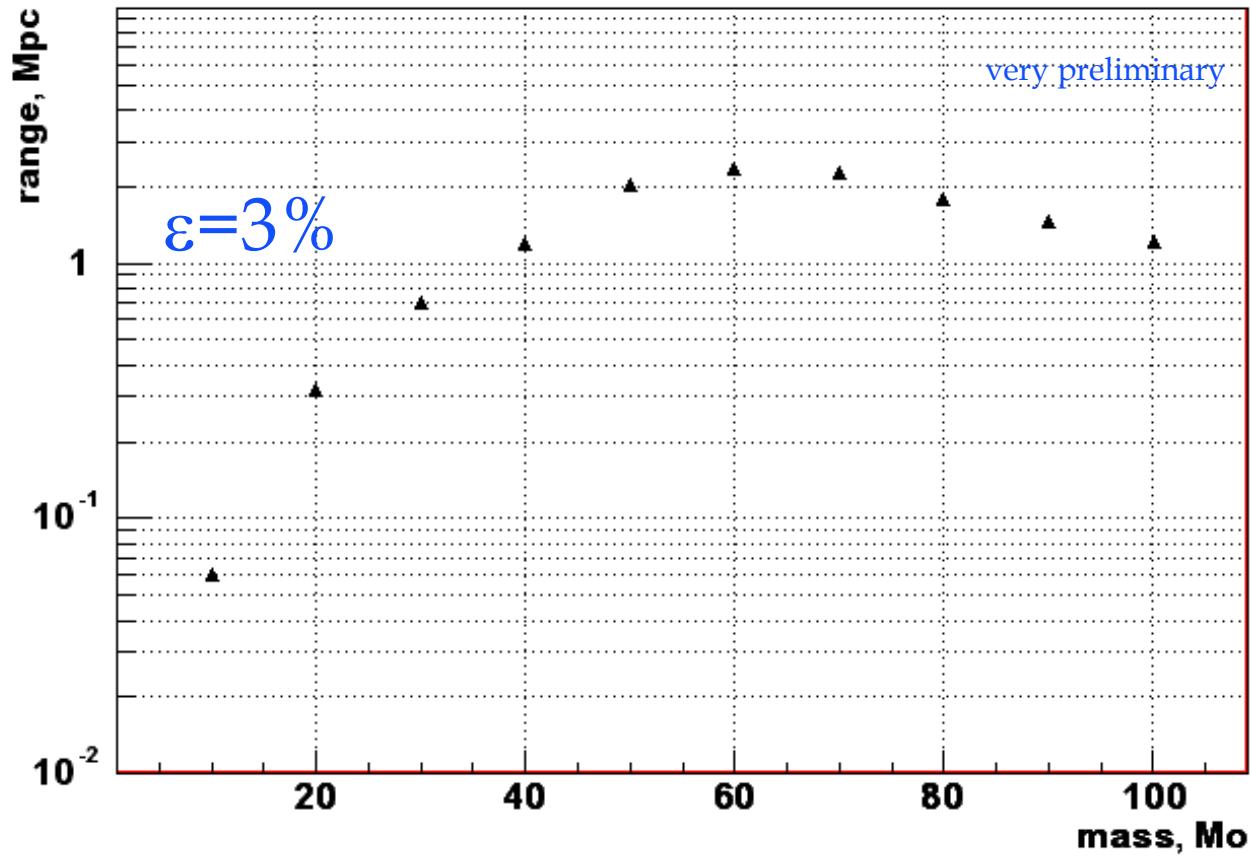


- Lazarus (J.Baker et al, astro-ph/0202469v1)
- Effective one body (Damour, Iyer, Sathyaprakash)



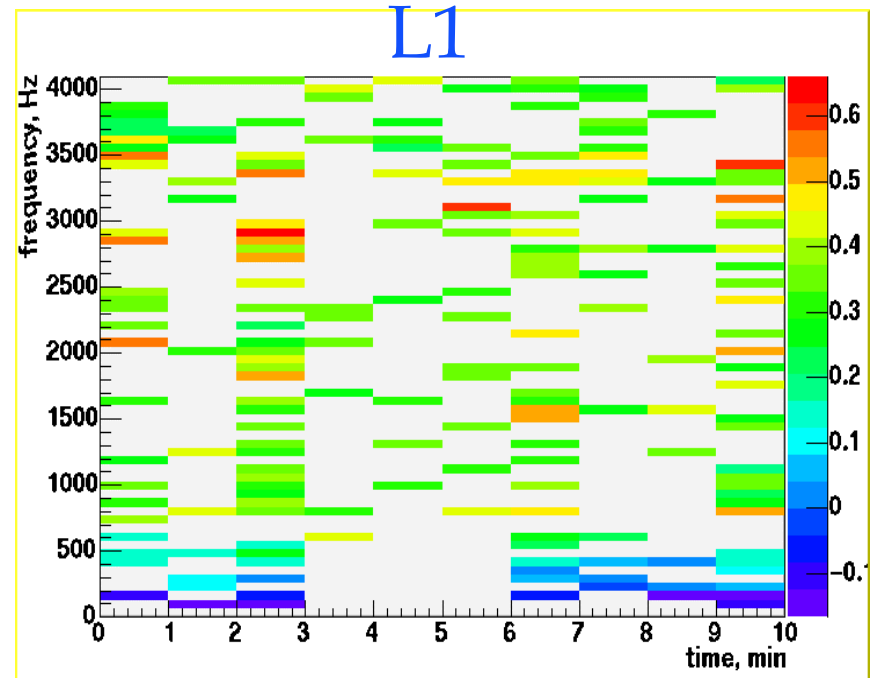
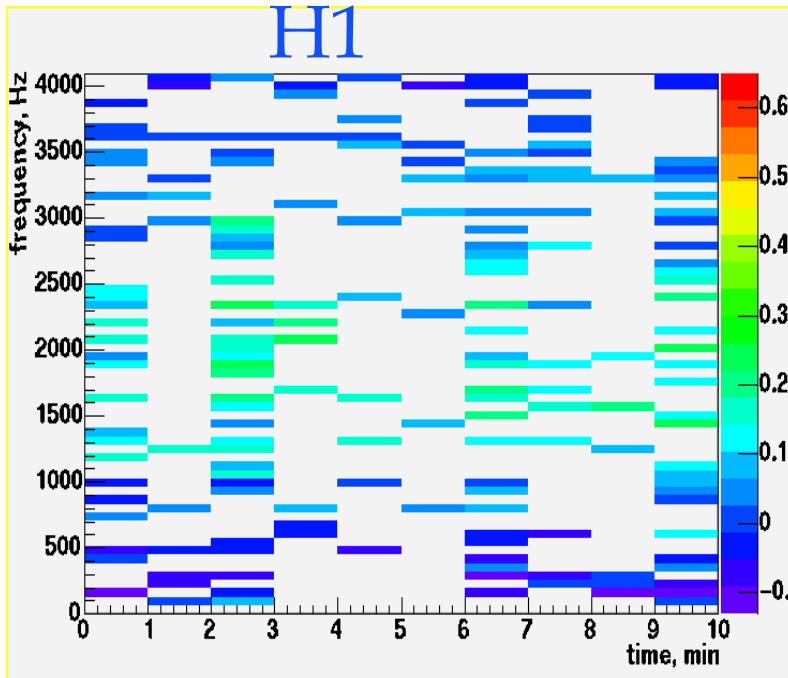


- S2 noise
- average over all sky





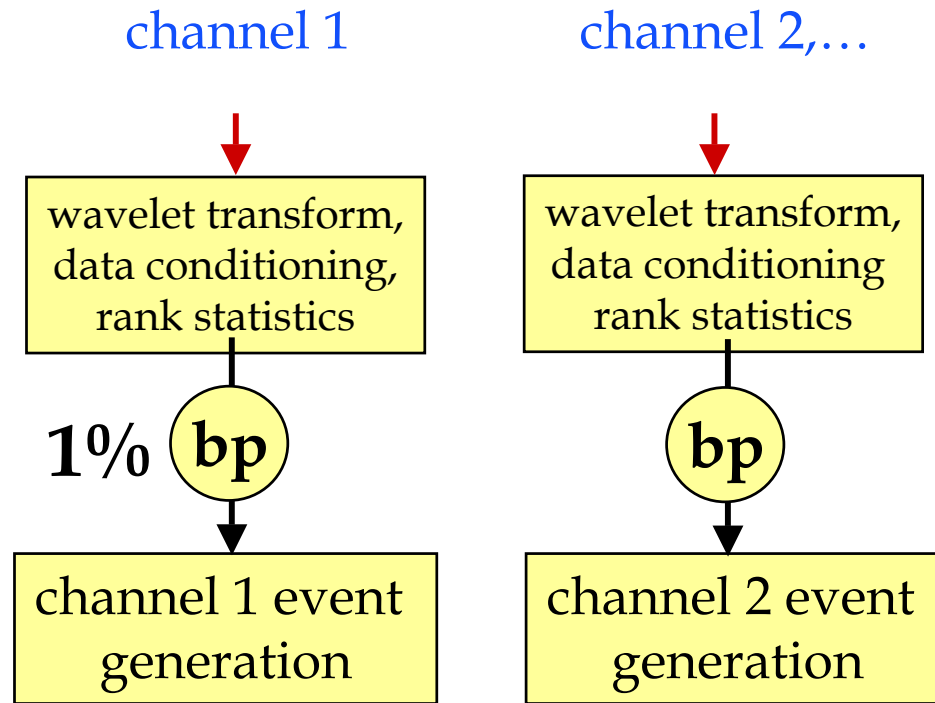
Compare Gaussian and non-parametric statistics



$$ratio = \ln \frac{Gaussian_confidence}{non - parametric_confidence}$$



- **WaveMon**
 - Can help identify source of glitches in the GW channel by looking at correlation with auxiliary channels
 - Produce veto triggers and rate trends
 - Can produce meaningful FOM for astro-motivated waveforms → detectable burst strength(t)
- **Plans**
 - incorporate real-time calibration for AS_Q channel
 - implement simulation engine → strength(t) FOM
 - get ready for S4



- Simple reconfiguring of the “double channel WM”
- Preserves all WaveMon functionality
- higher threshold (bpp \sim 1%)

can be used to produce strain/range FOM for single IFO