LIGO-G020254-00-Z

Three Veto Schemes

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1) Measured Coupling

2) Outlier Rejection

3) Excess Coincidence

absGlitch

- **Monitor by R. Rahkola - glitchMon skeleton**
- **High- or band-pass filtering**
- **Glitch begins when count threshold is exceeded**
- **Glitch ends when no samples exceed threshold for select-able delay time**
- **Glitch size is the maximum count level reached during glitch**
- **Trigger optional**
- **Outputs rms and kurtosis**
- **Outputs a histogram of glitches; selectable binning**

1) Measured Coupling

Thresholds from PEM to AS_Q Coupling-Measurements

1) Generated PEM signals (e.g. banged trash cans) the night before the run, that were large enough to show up on AS_Q at several times the background rms for the effected frequency band.

2) Threshold calculated for PEM channel was, in counts:

$$\text{threshold} = PEM_{bang\_rms} \ (AS\_Q_{b.g.\_rms} / AS\_Q_{bang\_rms})$$

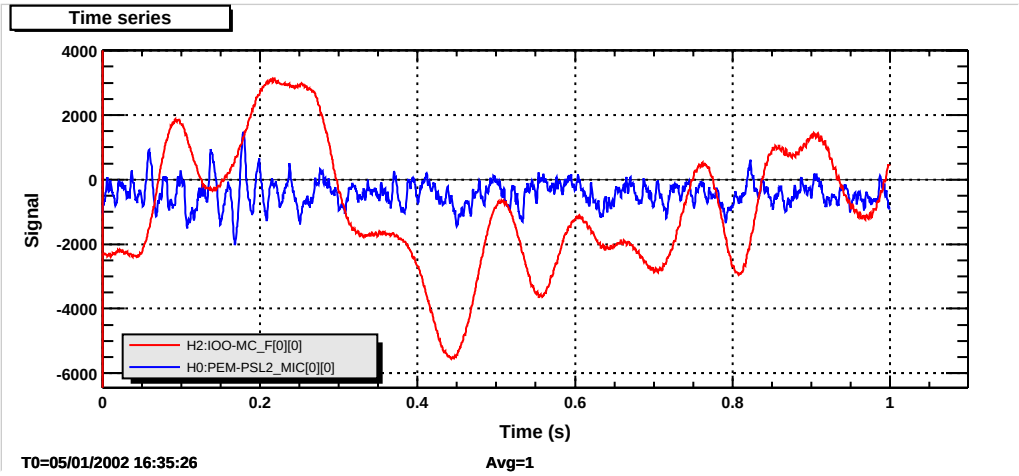
3) Highest threshold selected if multiple thresholds for multiple bands.

4) Ran absGlitch with these thresholds; using a 30 - 900 Hz band-pass and 0.25 s dead time on 694270001 to 694290000

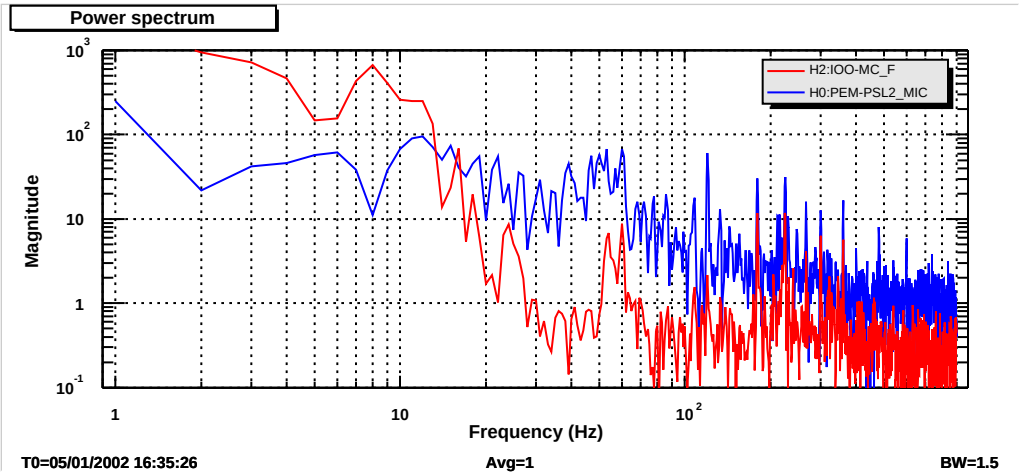
Channel	Threshold (counts)	Events	Fraction of time vetoed
H0:PEM-PSL2_MIC	1000	71	18/20000
H0:PEM-PSL2_ACCX	200	64	16/20000
H0:PEM-BSC1_MAG1X	15000	0	0
H0:PEM-BSC1_MAG1Y	15000	0	0
H0:PEM-BSC1_MAG1Z	15000	0	0
TOTAL			34/20000

Veto candidate: microphone burst

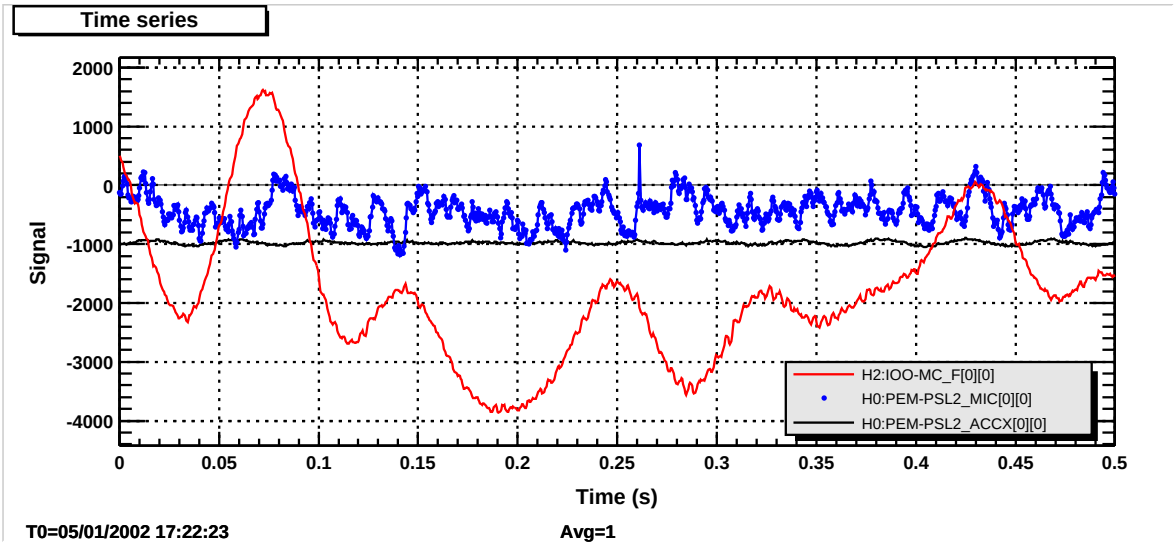
One of the 10 largest mic. candidates, 694270001 - 694290000



Not visible on AS_Q or MC_F time series; possibly visible in MC_F power spectra



Possibly unwanted veto: single bin glitch



8 of 10 largest microphone glitches were single bin (during 694270001 - 694290000)

10 of 10 largest accelerometer glitches were single bin

absGlitch outputs glitch length so single bin vetos could be excluded; histograms “single” bin glitches separately

2) Outlier rejection

Setting thresholds for outlier vetoes

1) RMS run of absGlitch. Used 1 hour of LHO data to obtain rms and kurtosis for 218 channels

2) AWK routine prepared configuration files with histogram bin widths calculated from rms and kurtosis.

3) Histogram run of absGlitch. Only locked periods were used for H1 and H2. 1 Hz high-pass and 0 dead time on 694270001 to 694290000

4) AWK routine used histograms to prepare configuration files with thresholds set to reject outliers using an approximate interquartile range method: threshold = 7 * level below which the absolute value of 1/2 of the data points lie.

5) "Veto" run of absGlitch.

Total time "vetoed" out of 20000 seconds for all "working" PEM channels (112), except BSC9_MAG and TILT: less than 362.25 s ; 2%

We have also used a similar scheme for time quota vetoes

Channels producing highest veto rates

Channel	Threshold (counts)	Events	Vetoed time (s) out of 20000
H0:PEM-BSC9_MAGZ	415.811	47729	9433.7
H0:PEM-BSC9_MAGX	768.194	38228	7370.051
H0:PEM-COIL_MAGZ	19031.4	3589	175.809
H0:PEM-MY_TILTY	11.0548	3010	99.2383
H0:PEM-EY_TILTY	11.0337	2078	75.6211
H0:PEM-EX_TILTY	13.8524	2241	68.8164
H0:PEM-EX_TILTX	14.8922	2222	67.375
H0:PEM-MY_TILTX	12.105	2013	59.543
H0:PEM-EY_SEISZ	193.68	318	30.0117
H0:PEM-EY_SEISY	169.786	250	26.1367
H0:PEM-LVEA_TILTX	16.3148	787	22.1797
H0:PEM-MX_TILTX	15.9372	697	20.6953
H0:PEM-EY_SEISX	182.763	187	16.9062
H0:PEM-LVEA_TILTX	16.3148	787	22.1797
H0:PEM-MX_TILTX	15.9372	697	20.6953
H0:PEM-EY_SEISX	182.763	187	16.9062
H0:PEM-BSC10_ACC2Z	277.904	79	15.5454
H0:PEM-BSC5_ACCZ	364.907	68	11.8887
H0:PEM-MX_TILTY	18.0079	316	11.75
H0:PEM-BSC10_ACC1Z	301.122	75	11.0898
H0:PEM-BSC5_MIC	7327.53	46	6.08887

3) Excess Coincidence

Thresholds from coincidence rate differences between aligned and misaligned time series

Using intersite environmental burst correlations program, a modification of glitchMon

MICROPHONE to MC_F; 1s misalignment; coincidence window: 0.25s, only 1 event allowed per second; total time: 46410 s; H0:PEM-PSL2_MIC; H2:IOO-MC_F

Threshold (sigma)	Events	Offset time series events	(on - off)	sqrt(on+off)
>= 4.25	4	0	4	2
3.975 to 4.25	3	6	-3	3
3.7 to 3.975	47	53	-6	10
3.425 to 3.7	362	368	-6	27.0
3.15 to 3.425	2213	2226	-13	66.6

Set the veto level at 4.25 sigma for a total of 4 vetoed seconds in the playground set

Excess coincidence may help set MICH burst vetoes

MICH to AS_Q; window: 0.1s, only 1 event allowed per second; H2:LSC-AS_Q and H2:LSC-MICH_CTRL; Total time 46410 s

Threshold (sigma)	Events	Offset time series events	(on - off)	sqrt(on+off)
>= 10	657	97	560	27.5
9.15 to 10	88	25	63	10.6
8.3 to 9.15	81	21	60	10.1
7.45 to 8.3	110	29	81	11.8
6.6 to 7.45	143	45	98	13.7
5.75 to 6.6	189	42	147	15.2
4.9 to 5.75	226	73	153	17.3
4.05 to 4.9	363	155	208	22.8
3.2 to 4.05	1711	1335	376	43.0

Set MICH veto threshold at level where (on - off) coincidence rate during bursts deviates from (on - off) rate when MICH is burst free; use absolute instead of sigma thresholds.

This scheme may require us to fix the MICH bursts in order to get a burst-free run..... probably a good idea anyway.