Veto efficiency study of triple coincidence playground WaveBurst events using

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Outline:

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Introduction

- WaveMon DMT monitor: Time-frequency analysis in the wavelet domain, finds outliers coincident in AS_Q and other channels
- www.phys.ufl.edu/LIGO/bursts for documentation
- Producing off-line veto triggers from more than 65 channels (control, ACC, MIC, MAG, V, RADIO, QPD, WFS, AS_DC, SEIS, OPLEV) for each instrument
- glitchMon: trigger sample provided by Laura Cadonati. Help with file converting scripts from Alessandra Di Credico

Data processing status

- Using LLO DMT alvar (2 x 1 GHz) and Caltech GC DMT
- 100 % of L1 S2, 100 % of H1 S2 PG, 100 % of H2 S2 PG locked segments. Available for download (root files).
- This took four months! Many crashes (several times per day, both at LLO and Caltech) and slow machines…
- Need more computing resources on site to run off-time DMT jobs.

Dead time fraction calculations

- Chose a combination of produced veto triggers at certain thresholds from each IFO
- For instance
  - » L1: WaveMon CL 4.5 + glitchMon AS_DC 4σ
  - » H1: WaveMon CL 3.0 + glitchMon AS_DC 4σ
  - » H2: WaveMon CL 3.0 + glitchMon AS_DC 4σ

- Total dead time = total duration of all included triggers - overlaps
- Divide by total S2 PG triple live time

Veto of playground WaveBurst triggers (I)

- Veto efficiency: number of vetoed burst events divided by total number of bursts
- Studying veto efficiency on triple coincidence of non-zero lag time WaveBurst triggers (S2 playground)
- Checking for time difference (“gap”) between each WaveBurst
- Overlap (gap<0): Veto!

Veto of playground WaveBurst triggers (II)

- Tuning:
  - » Threshold on confidence of WaveMon triggers, e.g. CL>4.5
  - » Threshold on glitchMon triggers, e.g. amplitude>4σ
  - » Filters applied to glitchMon
  - » Gap condition
  - » Threshold on confidence of WaveBurst triggers
- veto safety: ignoring AS_I

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Results (I)

WaveBurst GC>1.3

IFO	WaveMon selection cut	Dead time fraction	Veto eff. (f<1100 Hz)	Veto eff. (f>=1100 Hz)	Veto eff. (full band)
L1	CL>4.5	3.6 %	25.5 %	39.2 %	37.1 %
H1	CL>3.0	0.2 %	0.7 %	0.9 %	0.8 %
H2	CL>3.0	0.9 %	10.6 %	20.9 %	19.3 %
L1, H1, H2	CL>4.5,3.0,3.0	4.6 %	32.5 %	51.6 %	48.7 %

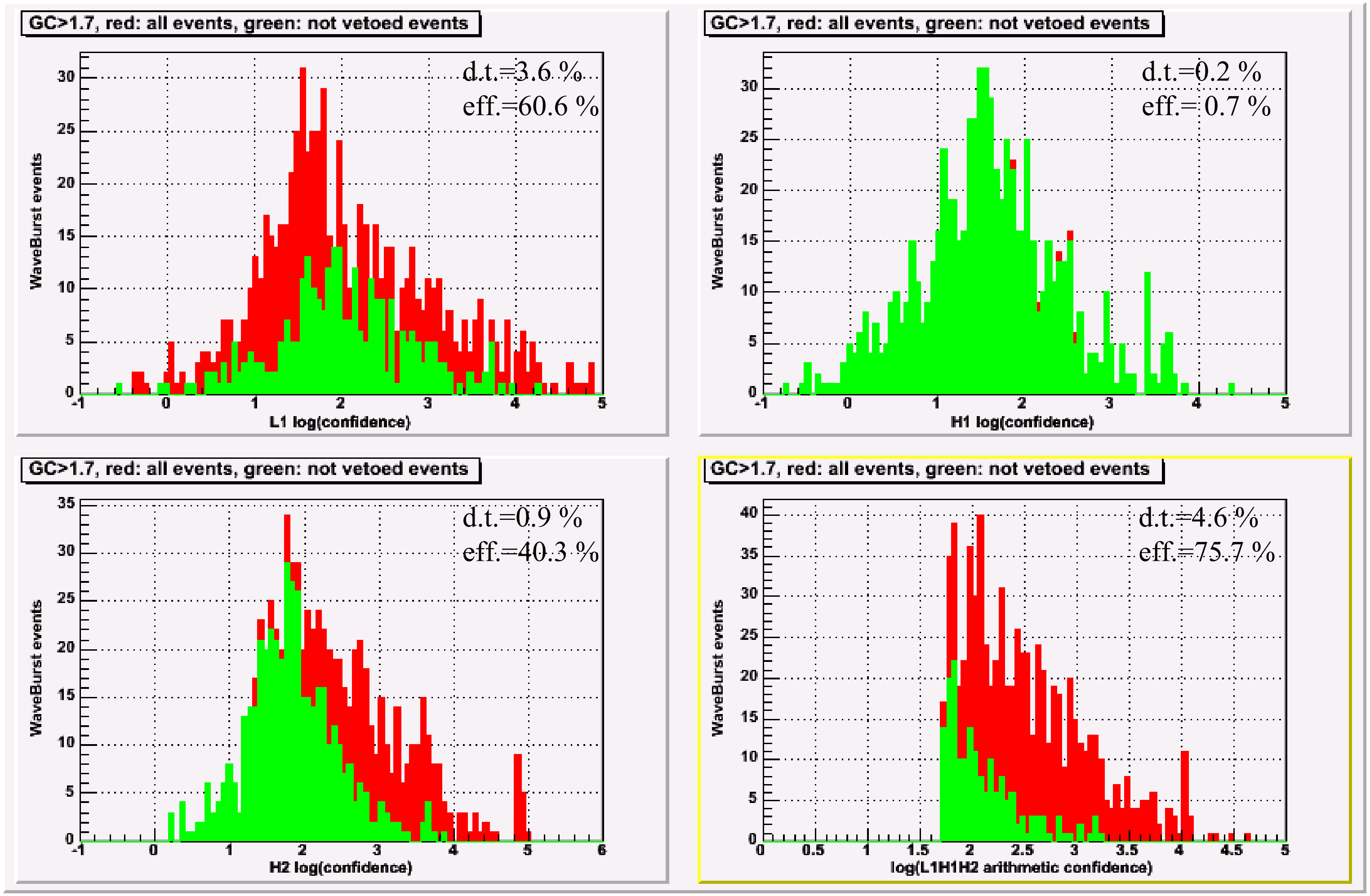
WaveBurst GC>1.7

IFO	WaveMon selection cut	Dead time fraction	Veto eff. (f<1100 Hz)	Veto eff. (f>=1100 Hz)	Veto eff. (full band)
L1	CL>4.5	3.6 %	39.5 %	61.9 %	60.6 %
H1	CL>3.0	0.2 %	0.0 %	0.7 %	0.7 %
H2	CL>3.0	0.9 %	27.9 %	41.1 %	40.3 %
L1, H1, H2	CL>4.5,3.0,3.0	4.6 %	55.8 %	77.0 %	75.7 %

L1 and H2 give a lot of efficient veto triggers.

VERY PRELIMINARY

Results (II)



Results (III)

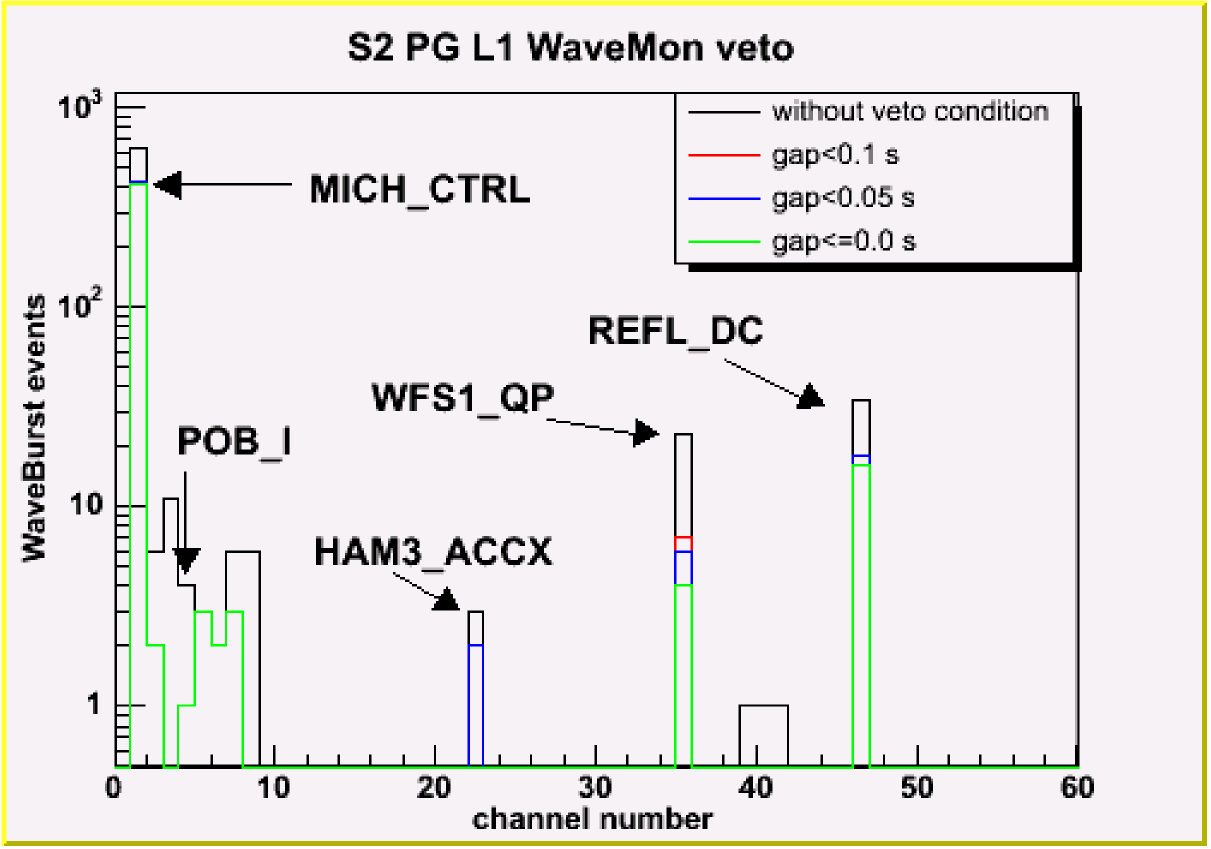
WaveBurst
GC>1.7

IFO	WaveMon selection cut	glitchMon channel	glitchMon threshold	Dead time fraction	Veto eff. (f<1100 Hz)	Veto eff. (f>=1100 Hz)	Veto eff. (full band)
L1, H1, H2	Not included	AS_DC no filter	4σ	1.6 %	32.6 %	43.3 %	42.6 %
L1, H1, H2	CL>4.5,3.0, 3.0	Not included	Not Included	4.6 %	55.8 %	77.0 %	75.7 %
L1, H1, H2	CL>4.5,3.0, 3.0	AS_DC no filter	4σ	5.3 %	58.1 %	81.6 %	80.2 %

Combination of WaveMon and glitchMon triggers increases efficiencies +5 % and dead times (a little).

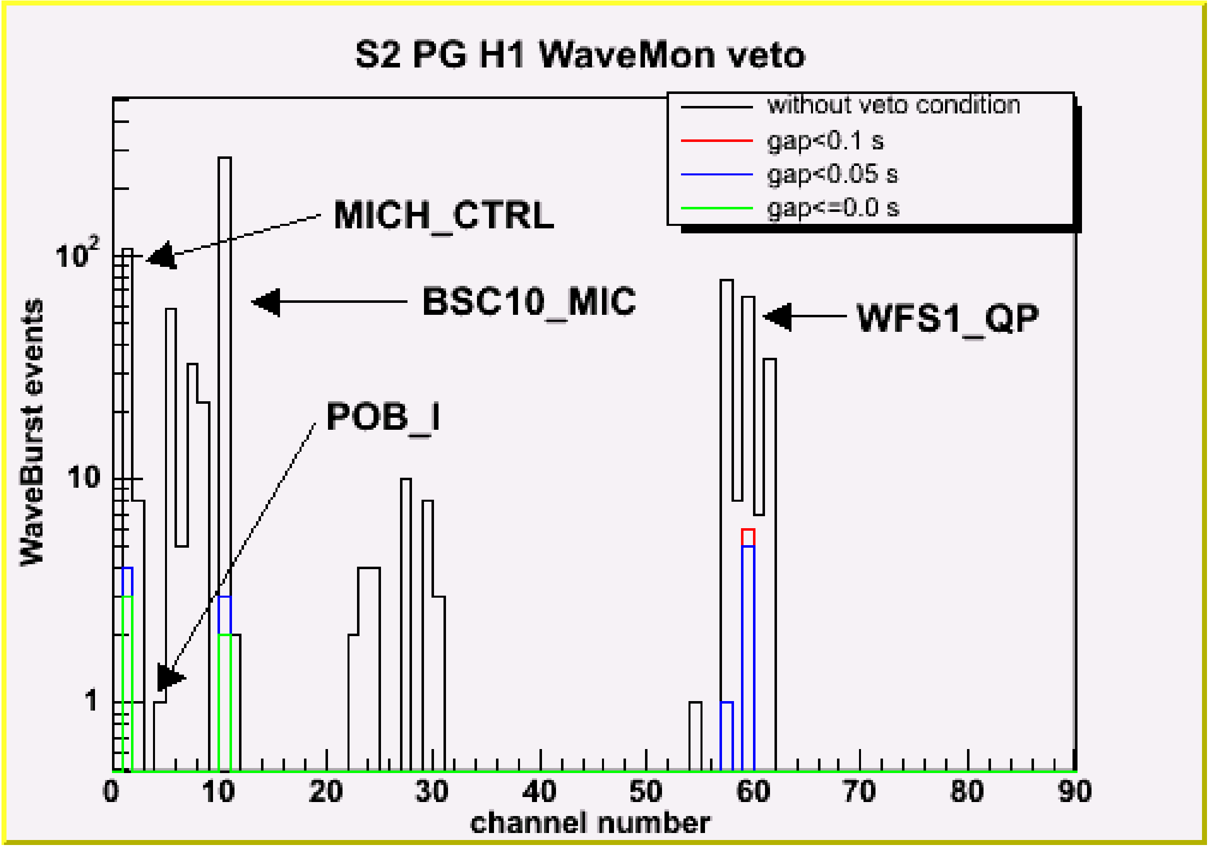
Results (IV)

- What WaveMon channels are efficient for veto?



GC>1.7
CL>4.5

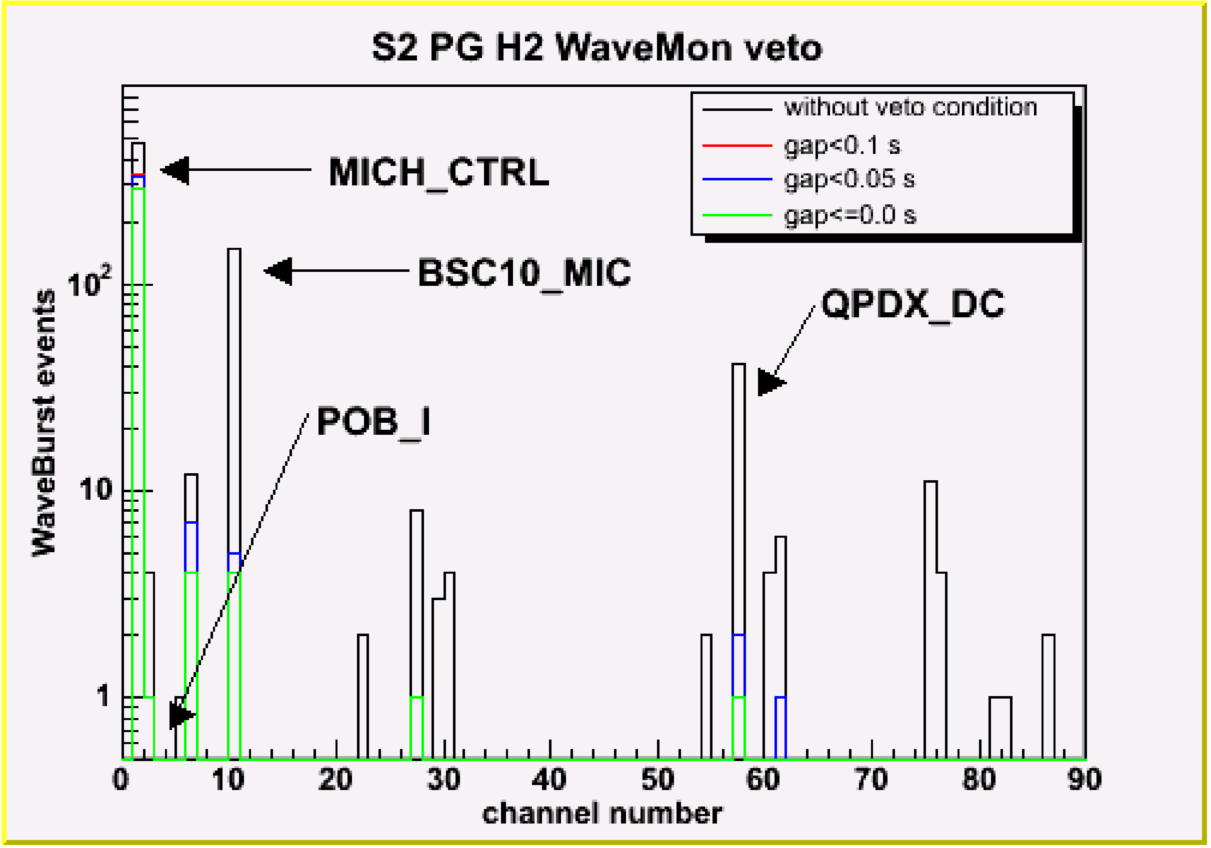
Results (V)



GC>1.7
CL>3.0

Very different compared to L1 and H2.

Results (VI)



GC>1.7
CL>3.0

Results (VII)

WaveBurst
GC>1.7

IFO	WaveMon selection cut	WaveMon channels	glitchMon channel	glitchMon threshold	Dead time fraction	Veto eff. (f<1100 Hz)	Veto eff. (f>=1100 Hz)	Veto eff. (full band)
L1, H1, H2	CL>4.5,3.0, 3.0	All channels	Not included	Not included	4.6 %	55.8 %	77.0 %	75.7 %
L1, H1, H2	CL>4.5,3.0, 3.0	MICH_CTRL only	Not included	Not Included	<4.6%	51.2 %	75.4 %	74.0 %
L1, H1, H2	CL>4.5,3.0, 3.0	All channels	AS_DC no filter	4σ	5.3 %	58.1 %	81.6 %	80.2 %
L1, H1, H2	CL>4.5,3.0, 3.0	MICH_CTRL only	AS_DC no filter	4σ	<5.3 %	55.8 %	80.5 %	79.0 %

MICH_CTRL is the channel producing most veto triggers in L1 and H2

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Summary

- Veto efficiency 76 % with a dead time fraction 4.6 % for triple coincident playground WaveBurst events using WaveMon triggers
- Veto efficiency 80 % with a dead time fraction 5.3 % by adding glitchMon AS_DC triggers
- MICH_CTRL is the most efficient channel
- The gap condition is not so critical (0.1 s OK) for MICH_CTRL but might be important for other channels (statistics low)
- Detailed results at
  - » www.ligo-la.caltech.edu/~franzen/S2_invest.html
  - » www.ligo-la.caltech.edu/~franzen/WBveto5.html

Plans

- Need to determine corrected WaveMon dead time fractions by testing against AS_Q software injections at time of auxiliary channel glitches.
- Analyze S3 data
- Therefore need (much) more (working) computer power! (Solution: Condor at LLO?)
- Summarize results in a note