BLOCK-NORMAL BASED VETO ANALYSIS

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for
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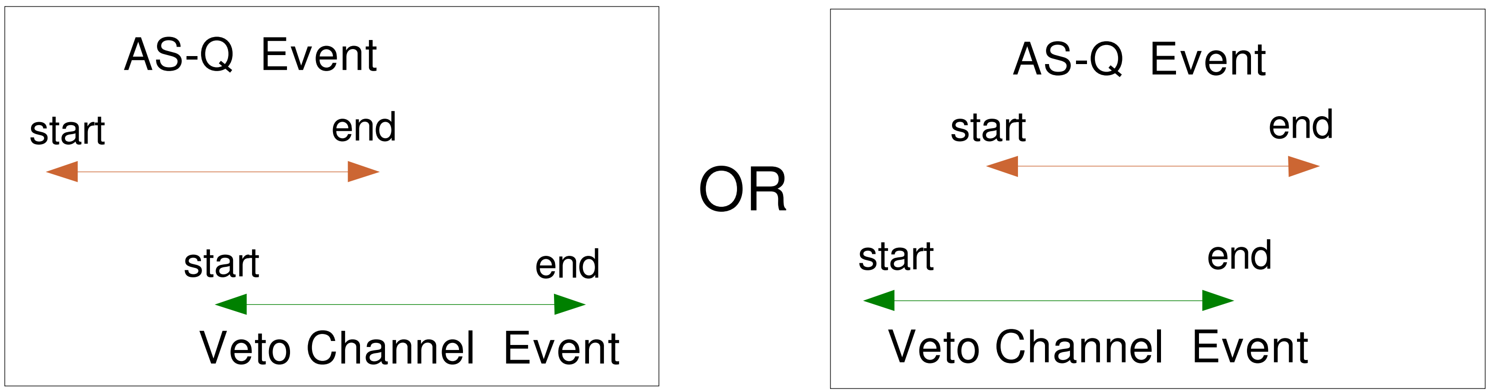
Outline of Talk

- Introduction to veto analysis with Block-Normal
- Figure of merit used for identifying a good veto
- Original strategy used for optimizing veto effectivess
- Problems associated with it
- Current methodology adopted for tuning veto parameters
- Veto safety studies *(from S3)*

Introduction

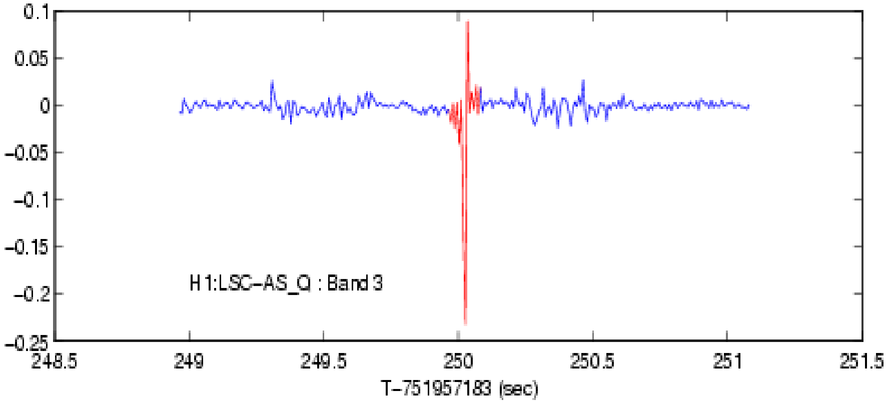
- Use SAME ETG (Block-Normal) to look for candidate events in various auxiliary channels as you use to identify events in AS-Q. Different ETGs see different things *(see A. Stuver's talk)*. Correspondingly same ETG should be used while searching for events in auxiliary channel as in AS-Q.

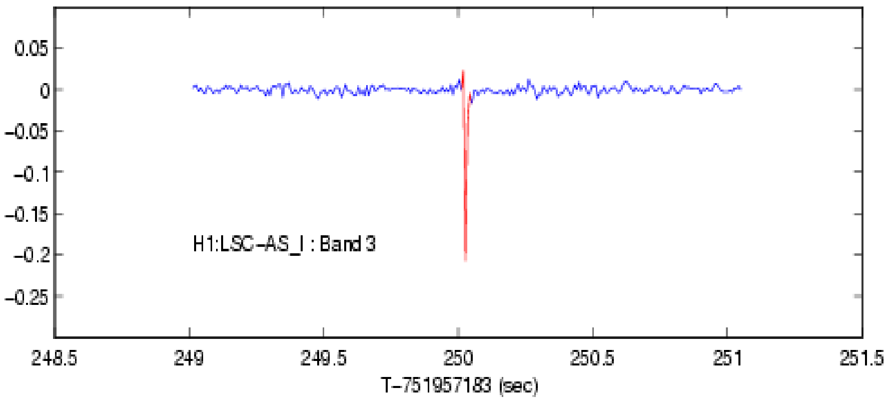
- An event is considered "vetoed" if there is overlap in duration between the AS-Q events and the auxiliary channel events within same frequency band



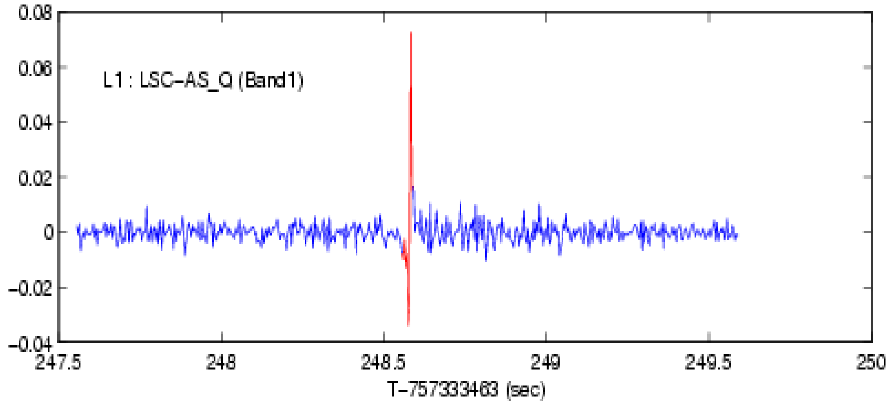
Some S3 Veto Examples

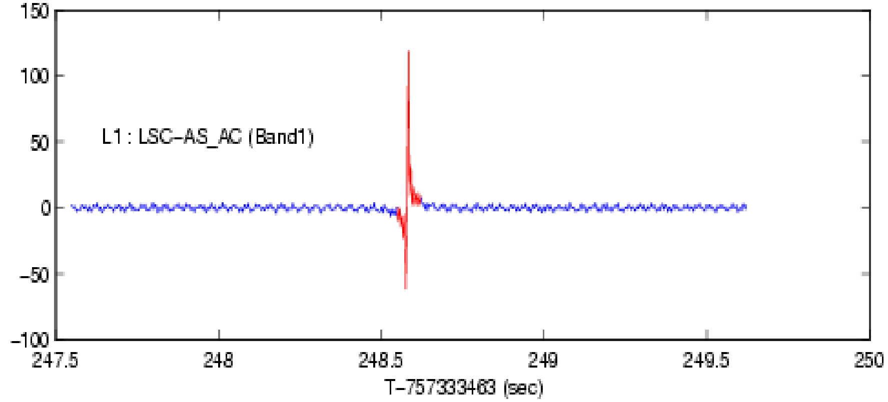
H1:LSC-AS_I (128-192 Hz)





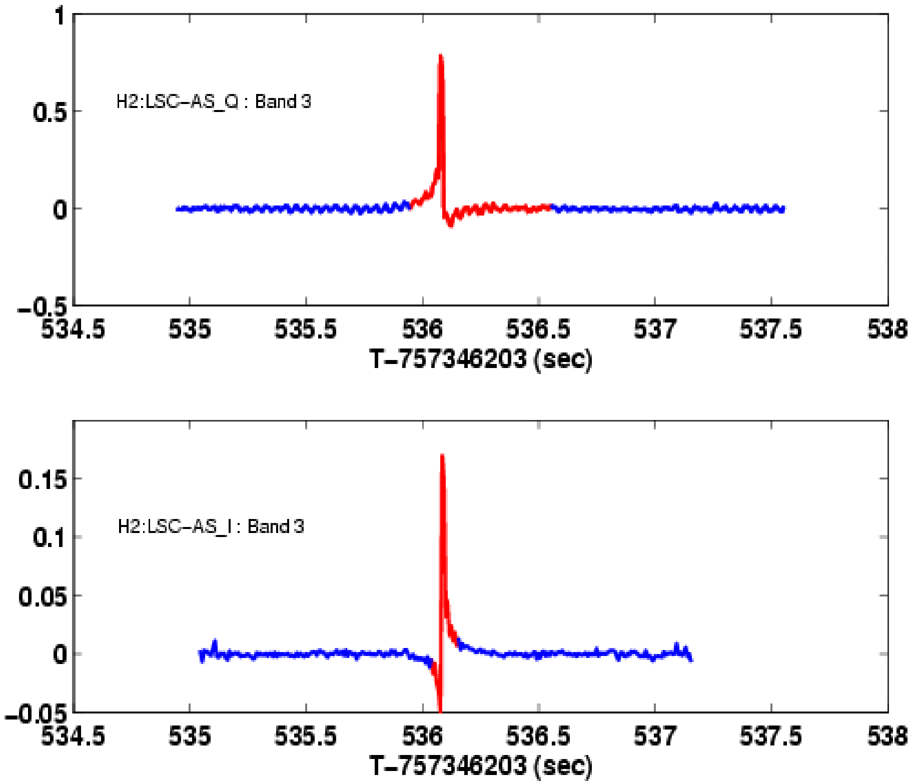
L1:LSC-AS_AC (512-640 Hz)



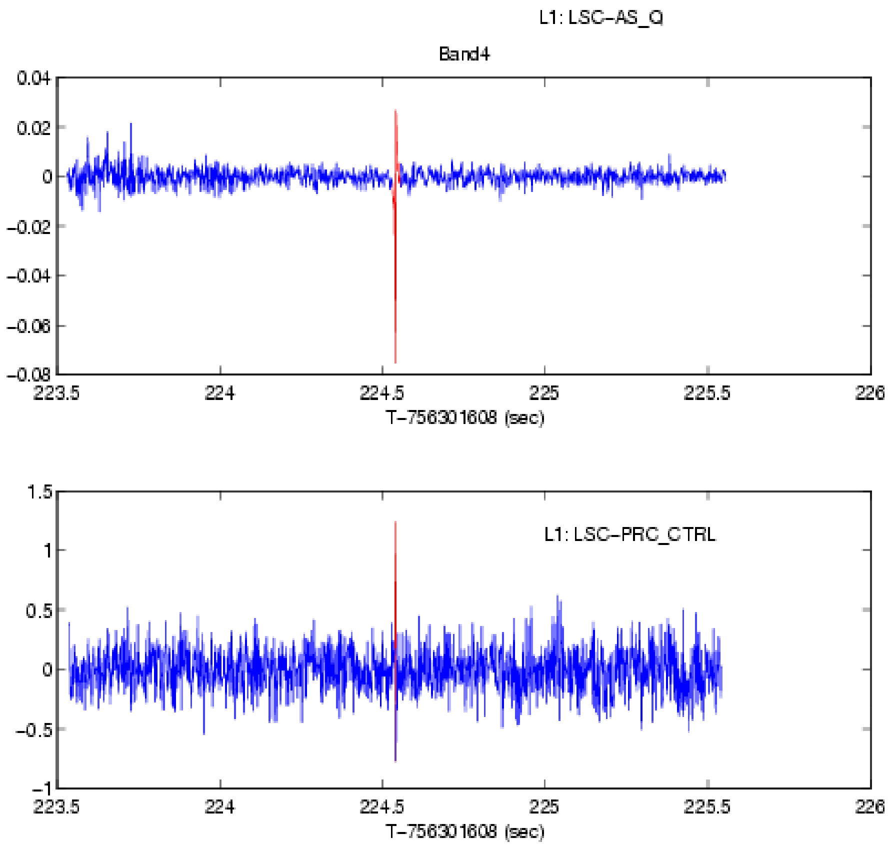


More S3 Vetoes

H2 LSC-AS_I (128-192 Hz)



L1: PRC_CTRL(704-1024 Hz)



Veto Figure of Merit

To identify a good veto, use FOM defined in LIGO-T030181-00-Z

FOM = (No of Events Vetoed) / (Veto Deadtime)

(No of Unvetoed Events)/ (Livetime - Veto Deadtime)

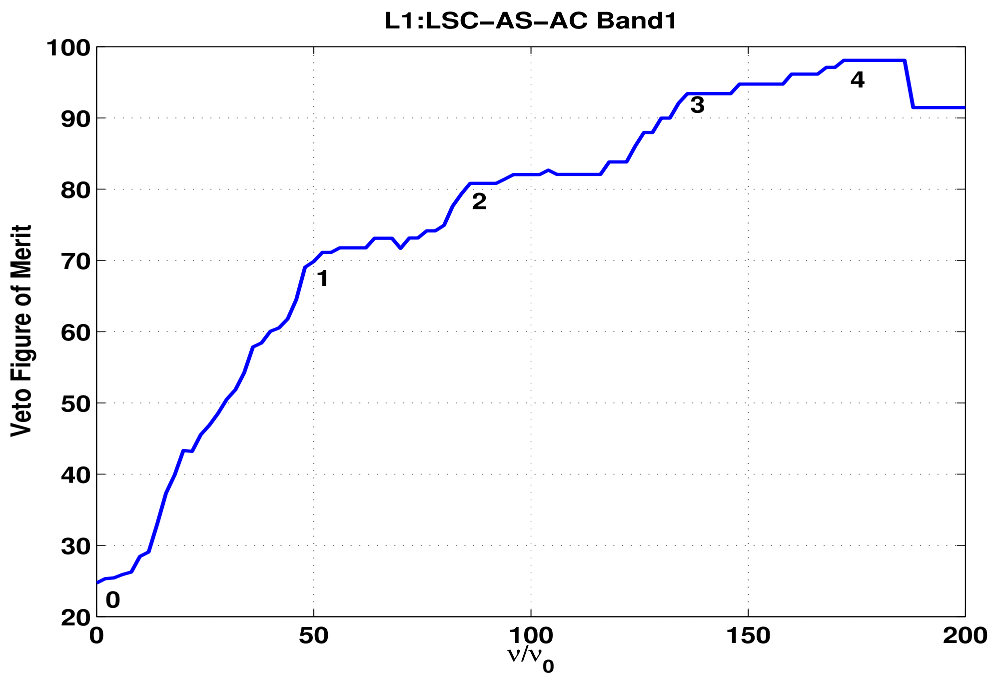
- If veto events independent of AS-Q events, then the rate of AS-Q events in the times selected by the vetoes will be equal to the rate of AS-Q events in the times not selected by the veto: i.e., the ratio will be unity.
- For an effective veto the above ratio would be greater than unity
- Some examples of good vetoes from S3 playground studies are : AS-I (H1, H2, L1) , AS-AC(L1), POB-I (H2, L1), RADIO-LVEA (L1) PRC-CTRL (H2, L1)

Optimizing Veto Effectiveness

Original strategy chosen was to tune Block-Normal parameters so as to maximize FOM. However,

- FOM can be high because the veto is effective at picking many AS-Q events or because the deadtime is very low. At highest FOM deadtime and number of vetoed AS-Q events is very low.
- FOM does not converge to a maximum value for some channels.

At point (4), only ~0.1 % of AS-Q events get vetoed
Deadtime = 0.001 %



Veto Strategy for S4

Instead of maximising Figure of Merit,

- Tune the parameters that control the generation of vetos until the probability that the FOM would, for an ineffective veto, exceed this value by chance is only 5 % .

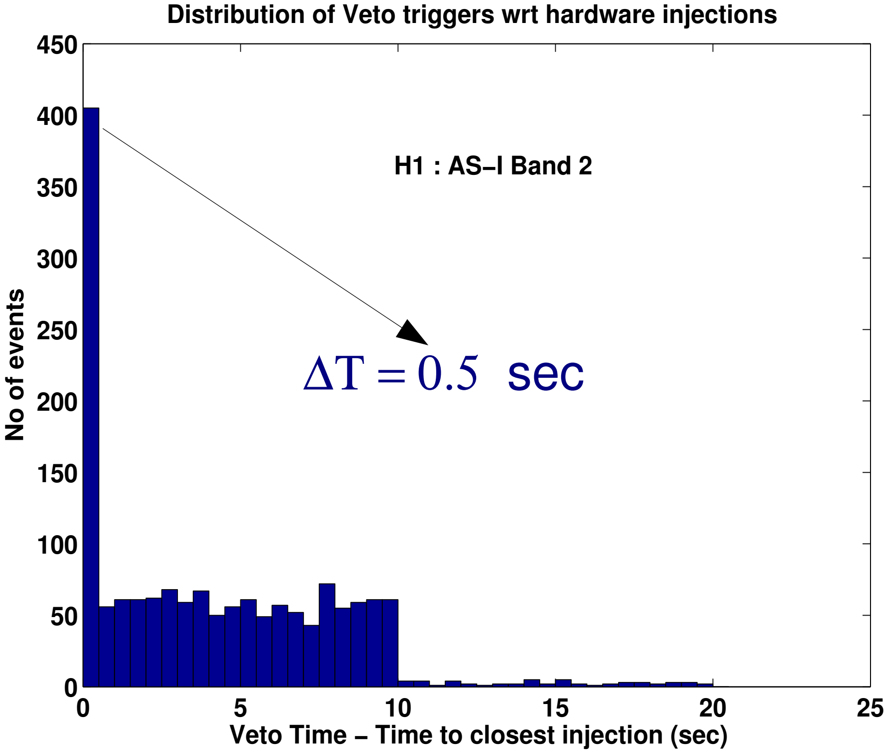
(See LIGO-T030181-00-Z for details)

- Such a veto tuning pipeline is currently being run to obtain best veto channels and parameters and this is being used in the Block-Normal analysis pipeline

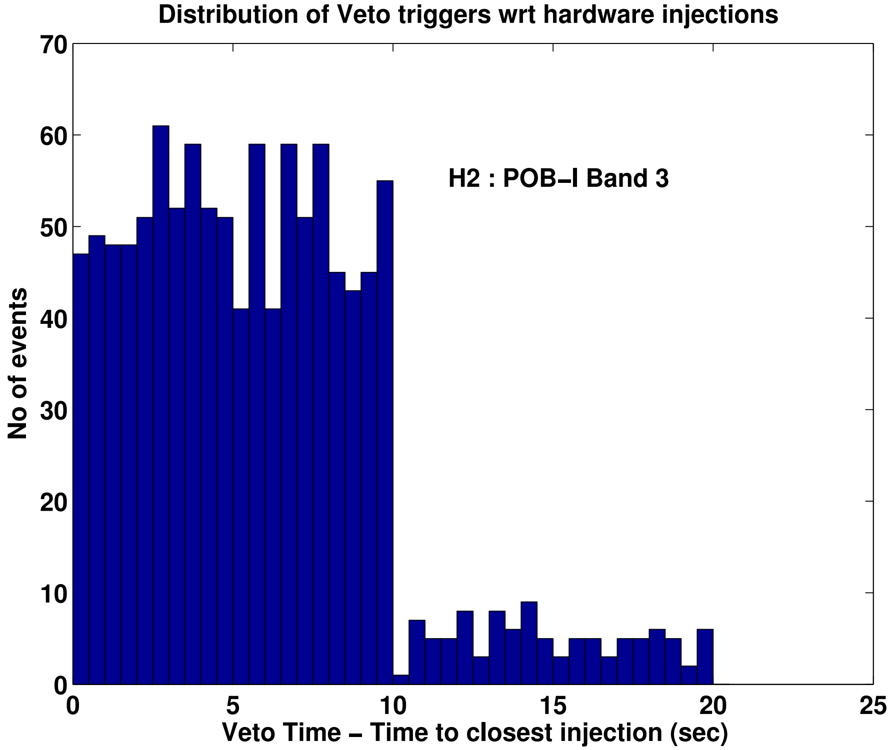
S3 Veto Safety Studies

Used 2 methods to judge which channels are coupled to AS-Q

- Compare observed events around the time of hardware injections ($\Delta T = 0.5$ sec) with false foreground events



Unsafe veto channel



Safe veto channel

S3 Veto Safety Studies

- Use same FOM used to identify good veto channels to assess which auxiliary channels are coupled to AS-Q . Look for overlap between AS-Q events and veto channel events around the hardware injection times ($\Delta T = 0.5$ sec).

SUMMARY :

- AS-I (for H1 and H2) is not a safe veto channel .
- For H2, POB-I and PRC-CTRL safe veto channels .
- For L1, number of hardware injections too few to make firm conclusions .

CONCLUSIONS

- We have developed a Figure of Merit for identifying and characterizing the effectiveness of a veto.
- We can use this strategy to optimize effectiveness of a veto.
- We are using this strategy and tuning to determine a good selection of veto channels and to optimize their performance on the S4 data.
- Veto safety studies based on analysis of S3 hardware injections, indicate that AS-I (for H1 and H2) NOT a safe veto channel.