A very first glance to S3 injections (vs S2)

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A first E10/S3 analysis by

Julien Sylvestre, Alan Weinstein reported at Nov LSC

Goals for Burst injections

- Do the Burst EventTriggerGenerators detect the injections? Where is the detection threshold? Does detection efficiency fall for high amplitude injections? (Does IFO lose lock?)

- Exercise all ETGs under development

- Quantitative comparisons of ETG-reconstructed with injected values of h_{rss} , f_0 , t_{start}

- Quantitative comparisons of ETG response to hardware and software injections with identical parameters
  - » We do SW injections with high statistics, to evaluate efficiency; real comparisons between SW and HW validates the SW efficiency evaluations

- Quantitative test of calibration information

- Monitor stability of IFO & ETG response over time

S2/S3 H1 Hardware Injections

- **Compare Q=9 Sine-Gaussian Hardware Injections in H1 between S2 and S3.**

- **Using Dyadic Haar Wavelet detection algorithm**
  - » Multiresolution time-frequency decomposition based on scaling in powers of two.
  - » Amplitude of pixels in each scale are Gaussian distributed (assuming white noise).
  - » Average background amplitude, $<A_{BG,\ scale}> = \text{std}(\{A_{PIX,\ scale}\})$
  - » Normalized pixel amplitude, $A_N = A_{PIX} / <A_{BG,\ scale}>$
  - » Threshold on normalized pixel amplitude, $|A_N| > 6$
  - » Clustered False Rate ~1 Hz for S2 Playground.

Efficiency Curves for Q=9 S.G.

S2 (57 Injections in H1)
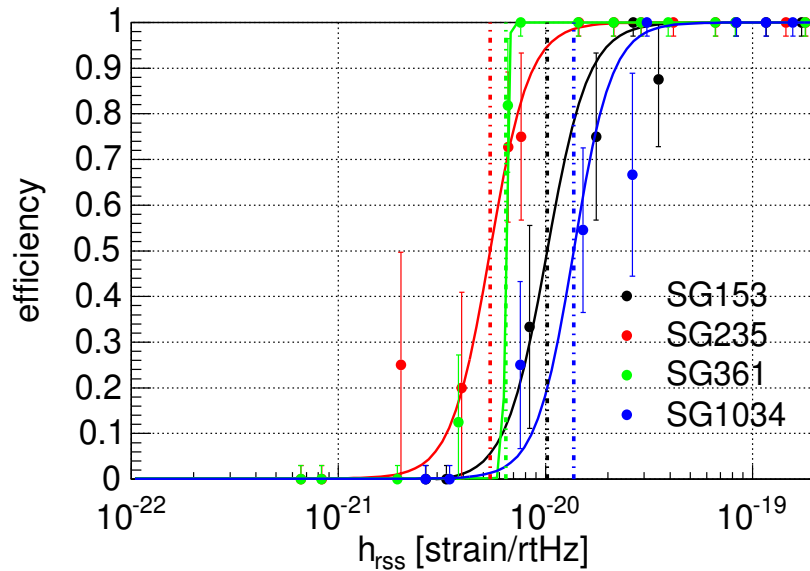
S3 (72 Injections in H1)
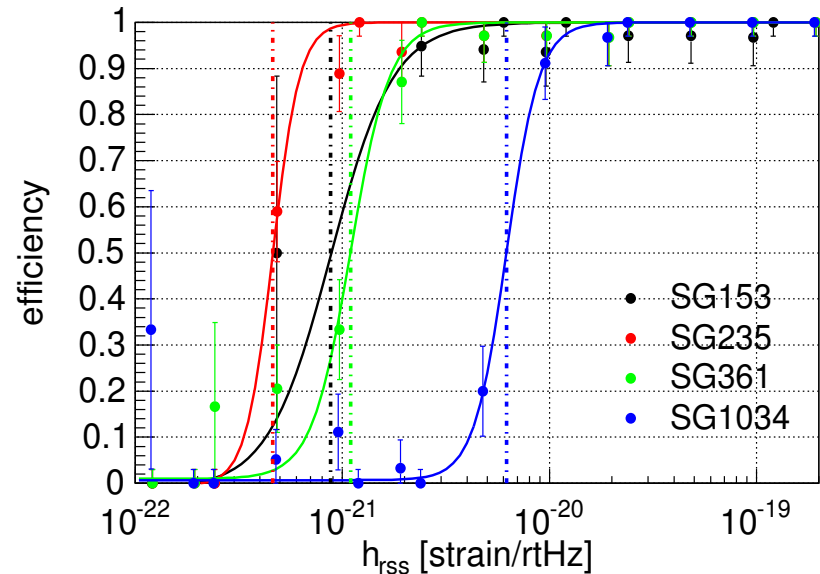
50% Efficiency:

153Hz	1.02×10^{-20}	235Hz	5.42×10^{-21}
361Hz	4.78×10^{-21}	1304Hz	1.37×10^{-20}

50% Efficiency:

153Hz	9.12×10^{-22}	235Hz	4.62×10^{-22}
361Hz	1.09×10^{-21}	1304Hz	6.21×10^{-21}

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S2/S3 Hardware Inj: Conclusions

- There is substantial improvement in the detectability in sine-gaussian hardware injections from S2 to S3 as expected from the corresponding improvements in detector noise.

- Detectability improves by a factor of 11.2 at 153 Hz, 11.7 at 235 Hz, 4.4 at 361 Hz, and 2.2 at 1304 Hz

- Glitch-rates and non-Gaussian noise are not factored into this analysis, which would impact the optimal threshold of any ETG tuned for a specific false-rate.