Data Quality Report

VDQ group
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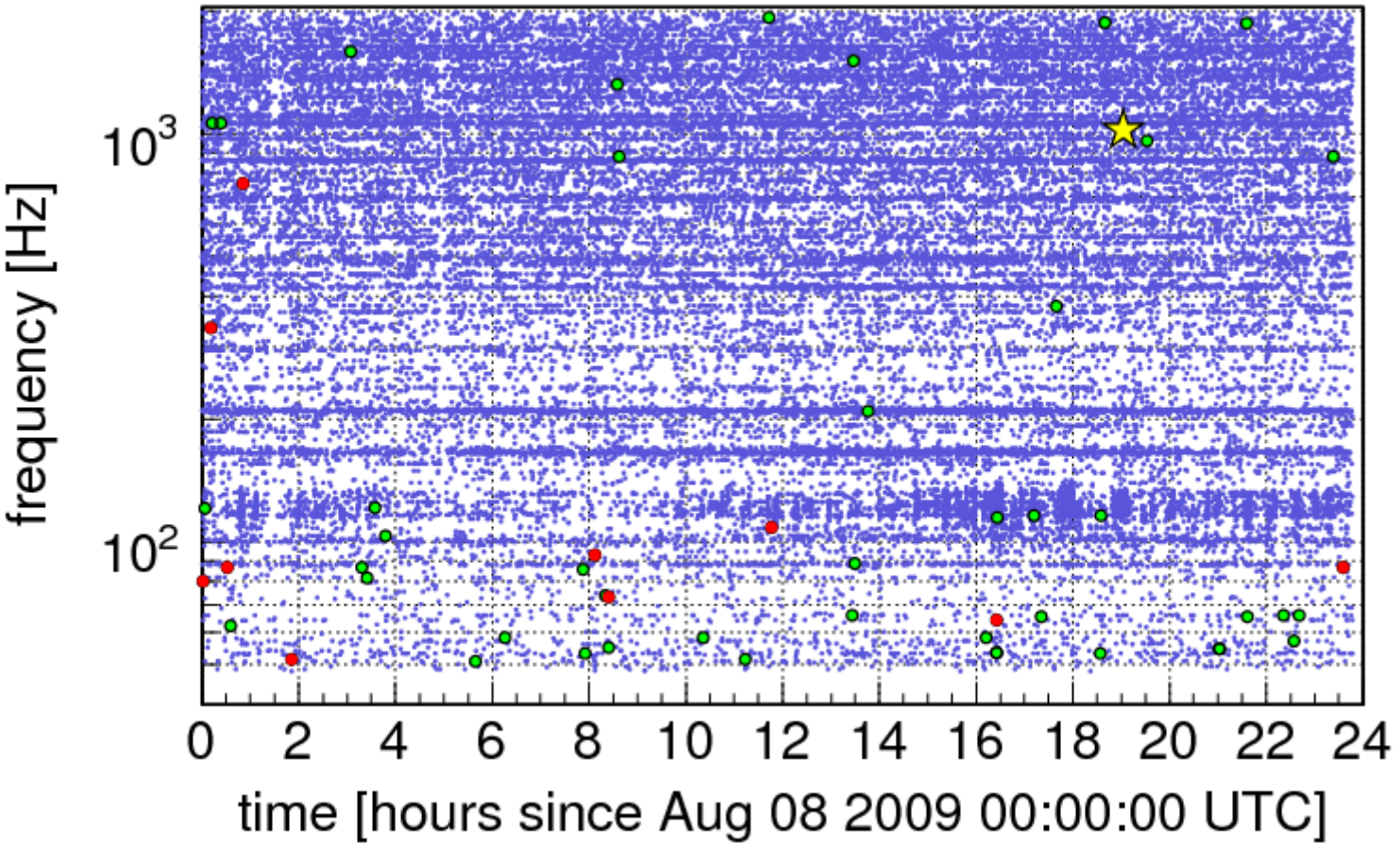
Virgo Data can be Very Good



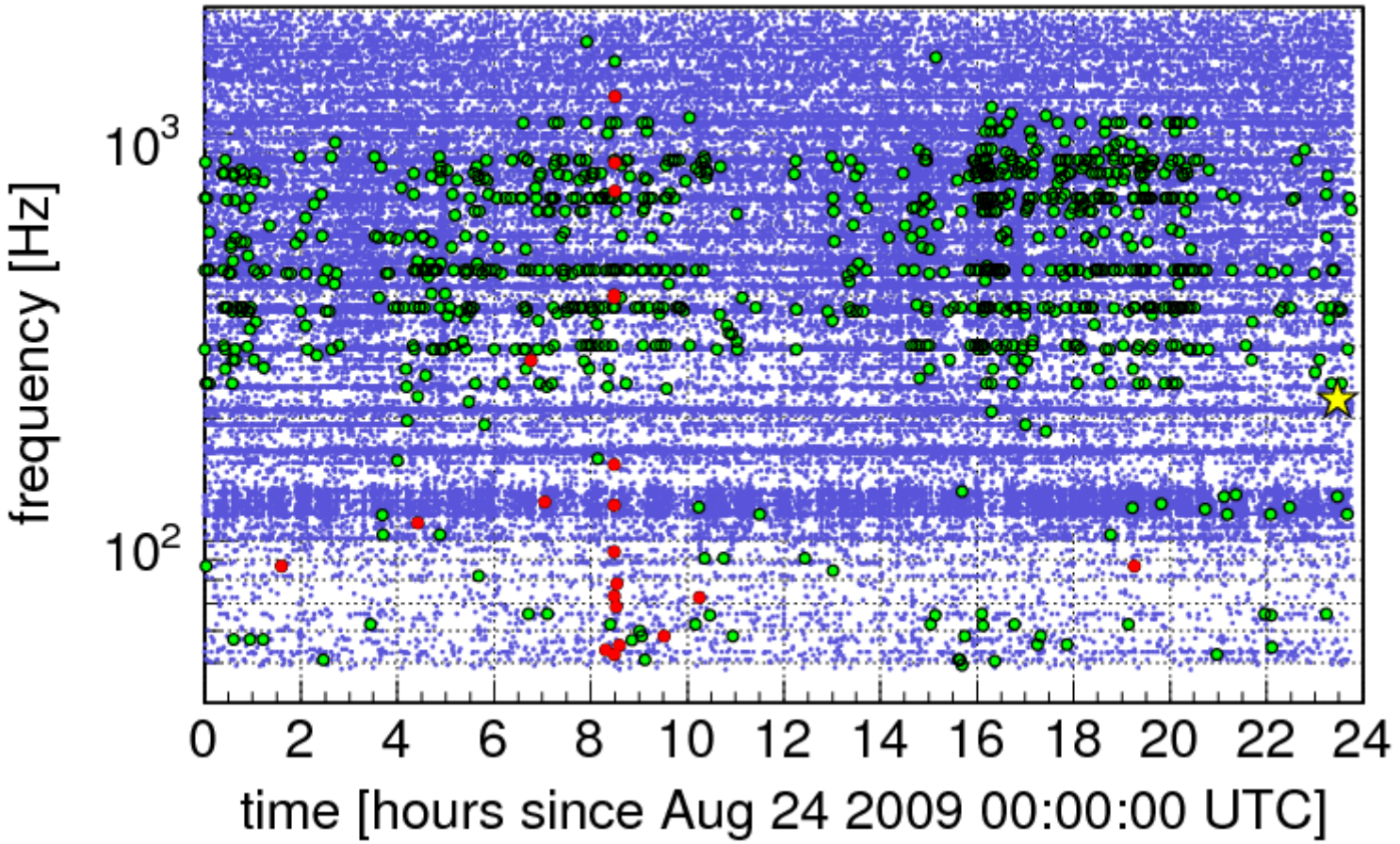
Noise is stationary

Glitch rate is low

Loud glitches are understood

8th of August = the best day so far in terms of data quality
~10 events with SNR>20 over the day
~50 events with SNR>10 over the day

Virgo Data can be Terrible



Glitch rate over the top

Very loud glitches

The main challenge is to understand the sources of noise in order to :

- **Correct them**
- **Flag them**

Tools

- **Omega Pipeline**
  Burst-like events ("low" frequency : 48-2048 Hz)
  Useful to study glitch characteristics (rate, SNR, frequency...)

- **WDF**
  Pipeline running over the full frequency range
  Useful to study high frequency glitches

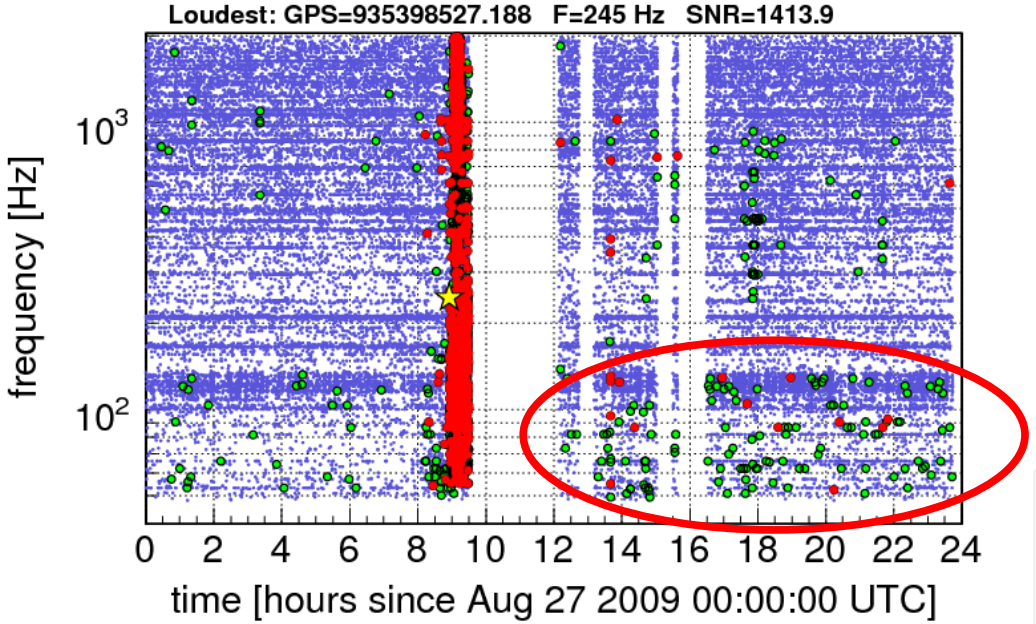
- **MBTA**
  CBC pipeline
  Complementary to Omega for the glitch study

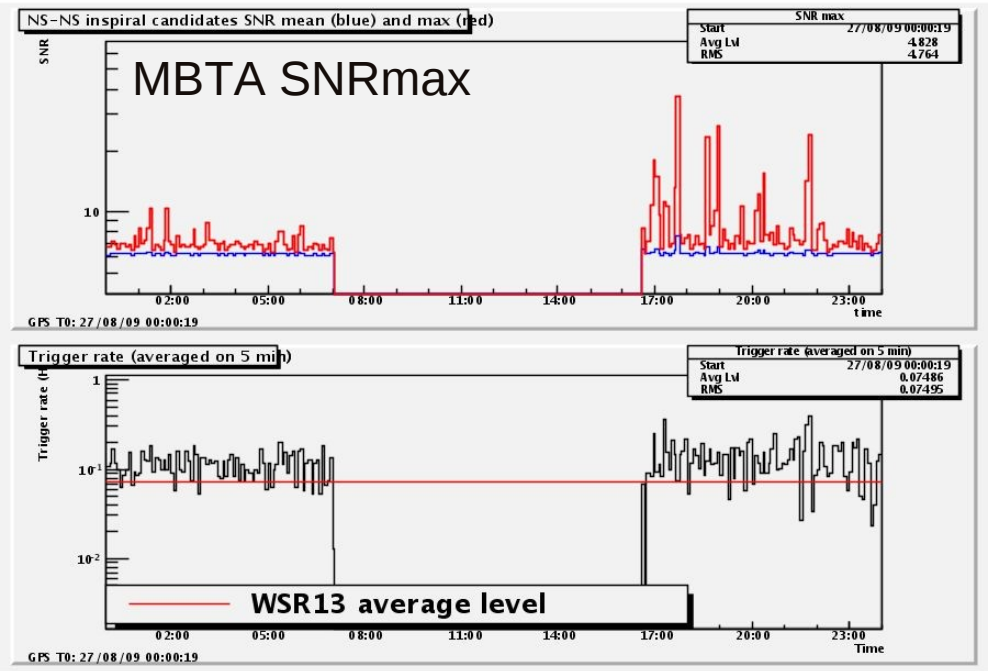
- **Omega Scans**
  Useful to study correlations dark fringe / aux. channels

- **kleineWelle**
  Useful to spot correlation dark fringe / aux. channels

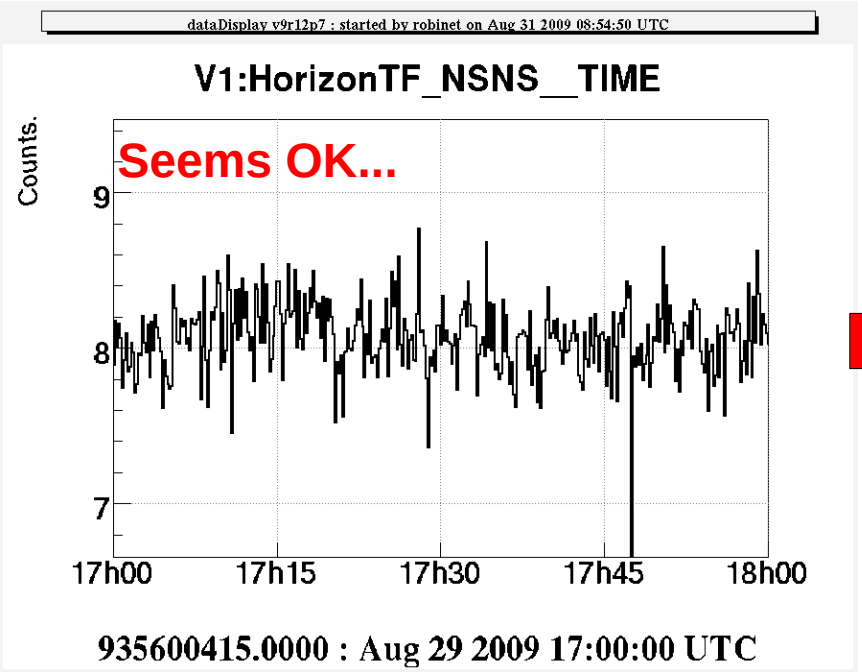
Recent News

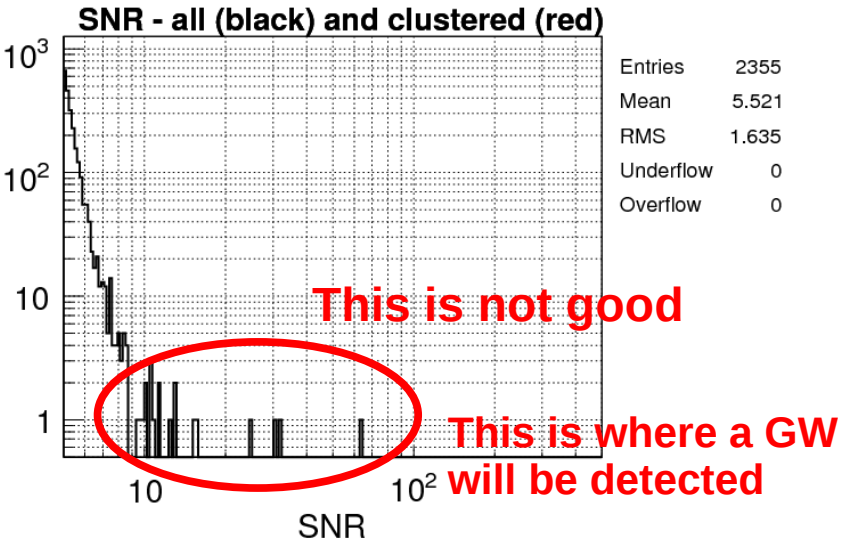
27th of August (commissioning) : Trigger rate 0.4Hz ⇒ 0.8Hz
TCS work ?





The Glitchiness as a Data Quality Indicator





From the analysis point of view,
the high-SNR events are just as important as the level of the horizon

This has to be taken into account when commissioning the interferometer

Soon, we will provide trend data plots to measure the glitchiness of the data

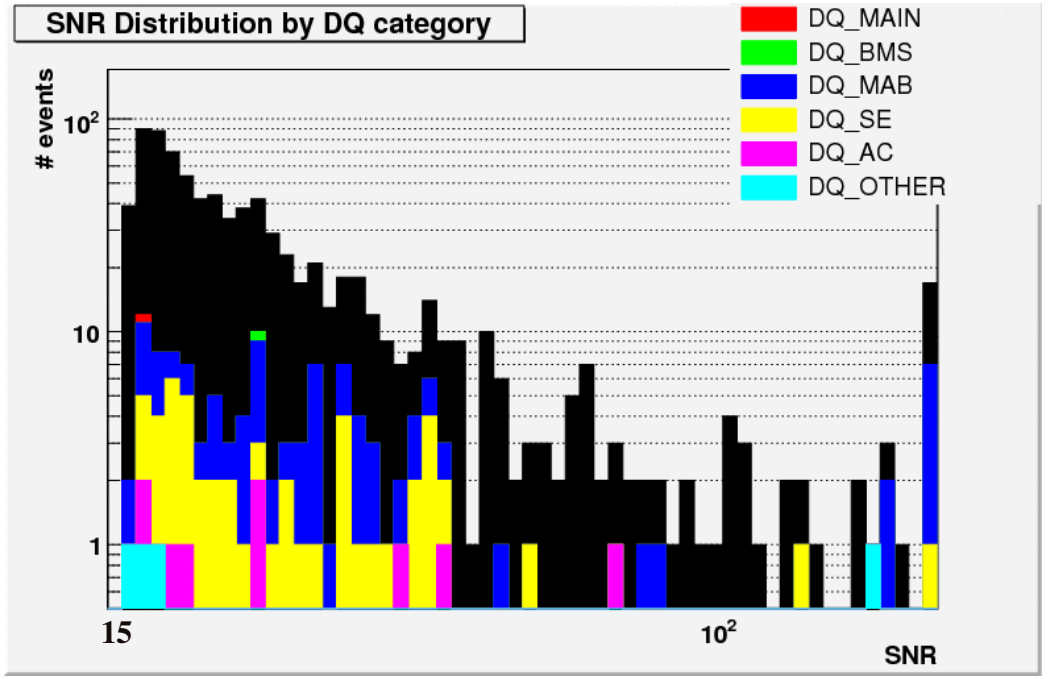
Data Quality Flags

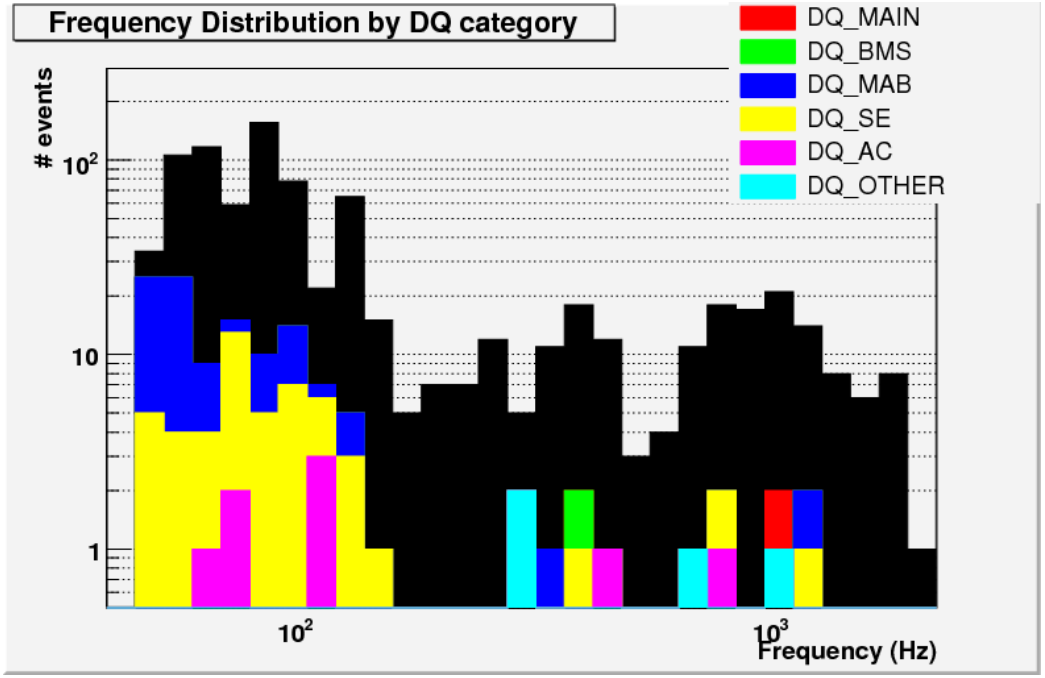
- **General flags** : HREC_QUALITY, PRE_LOCK_LOSS_10S...
- **Seismic** : based on the Band-RMS of seismic channels in different frequency bands (SE_*)
- **Magnetic** : based on the Band-RMS of magnetic channels in different frequency bands (MAB_*)
- **Acoustic** : based on the Band-RMS of acoustic channels in different frequency bands (AC_*)
- **Specific flags** : based on channels like : Sc_IB_SSFS_Corr or Bs_MOD_6MHz

Data Quality Flags

The black surface of the histograms corresponds to not-flagged events (**= not understood**)

This is a log scale so **most of the glitches** are not understood !





Only loud events (Omega, SNR > 15, August)
Cumulative histograms

Interaction with Commissioners

Involvement of commissioners is VERY helpful.

Ex :

List of interesting events by Frederique Marion

Virgo Runs (VSR2)

marion - **09:03, Sunday 09 August 2009** (24146) ➔

Interesting events

I have collected a few interesting events that could be worth a look by the experts.
The specificity of these events is that they are seen only in photodiode channels (or channels derived from those) and that the wscan does not allow to identify their origin.
I have reported the SNR measured by MBTA, but most of them were also seen by Omega.
They are just examples and there are plenty of similar events, especially if less loud events are considered.

SNR: 43.8 GPS: 933717168.136 Local Time: Aug07,09-23:52:34
Seen in B1, B2, B5, some seismic disturbance in SETOBS01, but a bit later.
http://wwwcascina.virgo.infn.it/DataAnalysis/Burst/wonline/V1/2009/08/07/21/933717168.125/index.html

SNR: 85.9 GPS: 933793378.502 Local Time: Aug08,09-21:02:44
Seen in B1, B2, B5, some seismic noise at the WE but below DQ flag threshold, and nothing in B8.
http://wwwcascina.virgo.infn.it/DataAnalysis/Burst/wonline/V1/2009/08/08/19/933793378.488/index.html

SNR: 18.7 GPS: 933724891.284 Local Time: Aug08,09-02:01:17
Seen in B1_ACp, B1_ACq, B1_DC, would correspond to the usual definition of dust events.
http://wwwcascina.virgo.infn.it/DataAnalysis/Burst/wonline/V1/2009/08/08/00/933724890.660/index.html

And finally two moderately loud examples of events due to a disturbance in the alignment.
They are seen in B2_q1, B2_q2 and the alignement signals, but the origin of the disturbance is unclear.

SNR: 11.8 GPS: 933716637.196 Local Time: Aug07,09-23:43:43
http://wwwcascina.virgo.infn.it/DataAnalysis/Burst/wonline/V1/2009/08/07/21/933716637.196/index.html

SNR: 10.6 GPS: 933809722.139 Local Time: Aug09,09-01:35:08
http://wwwcascina.virgo.infn.it/DataAnalysis/Burst/wonline/V1/2009/08/08/23/933809721.824/index.html

Just a few hours later...

Gabriele Vajente identifies the faulty channel

Virgo Runs (VSR2)

Vajente - **16:51, Monday 10 August 2009** (24167) ➔

Trigger at Aug07,09-23:52:34

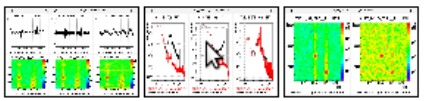
Following up the first MBTA trigger listed in **Interesting events**, I found it is composed of two distinct events (see first plot):
- the first one is centered around 2.5 kHz and shows sidebands spaced by 900 Hz
- the second one (0.1 s after the first) is centered around 1.7 kHz and shows sidebands spaced by 470 Hz.

Both events are also visible in SSFS correction, with the same structure. This might indicate some common mode noise (like frequency noise) or something happening in one cavity only, since the SSFS will act to compensate the common part. However this last possibility seems unlikely, since looking at calibration data with large noise injected on WE only, one can see nothing in SSFS correction (see second plot).

The event is also visible on SSFS error signal, see third plot. Only the central frequencies are well visible. The SNR seems lower (the signal is limited by shot noise there). One might wildly guees that the origin is inside SSFS, but I won't bet anything on it...

I could not find any other hint on the origin of this trigger. However it could be vetoed looking at Sc_IB_SSFS_Corr.

Images/Files attached to this message:



The source of the glitches is identified

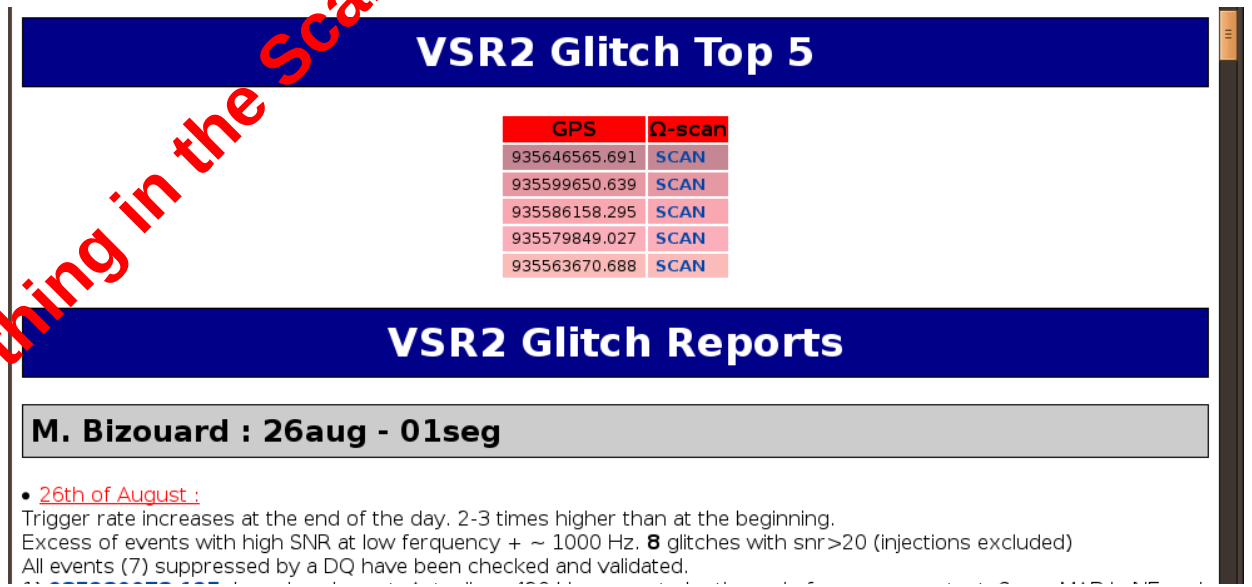
Now we have a DQ flag for these events

Glitch Web Page

In the VDQ group, we have set-up **Glitch Shifts**. Reports can be found there :
http://wwwcascina.virgo.infn.it/DataAnalysis/VDBdoc/dqonline_shiftlist.html

Loudest glitches are looked "in the eyes".
Most of the investigations are done with the Omega-Scans.
It is often not sufficient and about 70-80 % of the glitches are not understood !

Nothing in the Scans !



TOP 5 of the most problematic glitches
Please have a look

Loudest glitches day by day

Conclusions

• Through the online pipelines, we witnessed periods of time when the interferometer worked in (almost) ideal conditions… Unfortunately, it never lasts.

• The detection of GW will only be possible when high-SNR glitches are understood.

• The VDQ group aims at understanding the sources of glitch to be able to flag noisy periods of time.

• For the moment the efficiency of this task is ~20-30%.

• This efficiency could be much improved with the help of the commissioners. They have the best understanding of the interferometer.

• Please have a look at the loudest glitches (dedicated web page). Your input in the glitch hunt can be very helpful.