

# Outline

- Calibration of 1800-second SFTs
- Statistics and spectrum behavior

## 0-order method

Assume that at each moment in time the calibration for all frequencies is the calibration of the  $n$ -th bin.

Then we can calibrate in time domain.

The Fourier transform of the resulting data would not have correct calibration for bins other than  $n$ , but we can hope to have bin  $n$  calibrated correctly.

# Leakage

This method yields correct calibration for the  $n$ -th bin, but produces leakage into neighboring bins.

This leakage is dominated by the discontinuity in calibration functions at the ends of the segment.

*Solution:* use windowing to reduce leakage.

## 0-order method with windowing

Windowing is integral part of the method. Produces correctly normalized SFTs.

*Disadvantage:* a single SFT has increased noise level versus same SFT produced without windowing.

*Possible solution:* use overlapping segments

# ComputeFStatistic results, signal 1

IFO	SFT	psi	phi	cosi	$h \cdot 10^{21}$	Fstat	$A/Sh \cdot 10^{-40}$
H1	StOH	89.02	-267.7	-0.038	1.710	145.3	2.575
H1	0-HW	-1.78	-177.1	-0.042	1.809	98.3	1.553
H1	0-nw	-1.17	-177.3	-0.035	1.803	142.9	2.288
H1	AVG	-0.97	-102.5	-0.036	1.833	155.3	2.402
H1	EXP				1.560		
H2	StOH	-3.28	-175.8	0.025	1.668	64.4	1.485
H2	0-HW	-3.54	-174.8	0.013	1.556	35.8	0.945
H2	0-nw	-2.97	-176.3	0.022	1.730	65.4	1.418
H2	AVG	-3.15	-79.5	0.029	1.719	58.4	1.252
H2	EXP				1.660		
L1	StOH	-4.61	-230.4	-0.057	2.261	229.5	3.802
L1	0-HW	-3.89	-229.5	-0.041	2.336	164.9	2.452
L1	0-nw	-4.90	-230.3	-0.056	2.300	228.0	3.726
L1	AVG	-4.96	-202.9	-0.053	2.755	242.5	2.728
H1	EXP				2.000		

StOH - stitched 60-sec overlapped SFTs, Hann windowed

0-HW - 0-order method with Hann windowing

0-nw - 0-order method without windowing

AVG - averaged calibration SFTs produced by Xavier

EXP - expected (?) value

## ComputeFStatistic results, signal 2

IFO	SFT	psi	phi	cosi	$h \cdot 10^{21}$	Fstat	$A/Sh \cdot 10^{-40}$
H1	StOH	-0.93	-53.3	0.035	1.640	558.8	10.553
H1	0-HW	89.31	-143.3	0.049	1.756	383.7	6.237
H1	0-nw	89.01	-142.8	0.033	1.741	561.0	9.417
H1	AVG	89.16	-145.0	0.034	1.753	552.7	9.116
H1	EXP				1.560		
H2	StOH	-0.56	-52.9	0.005	1.585	311.1	7.781
H2	0-HW	0.79	-143.4	0.036	1.602	197.5	4.965
H2	0-nw	-0.76	-52.8	0.007	1.623	311.2	7.420
H2	AVG	-0.89	-344.2	0.020	1.721	304.6	6.345
H2	EXP				1.660		
L1	StOH	6.15	-17.4	-0.100	1.319	143.6	4.927
L1	0-HW	-81.41	-15.5	-0.073	1.376	98.4	3.133
L1	0-nw	6.23	-17.4	-0.101	1.325	142.2	4.826
L1	AVG	7.46	-134.9	-0.157	1.475	137.0	3.360
L1	EXP				2.000		

StOH - stitched 60-sec overlapped SFTs, Hann windowed

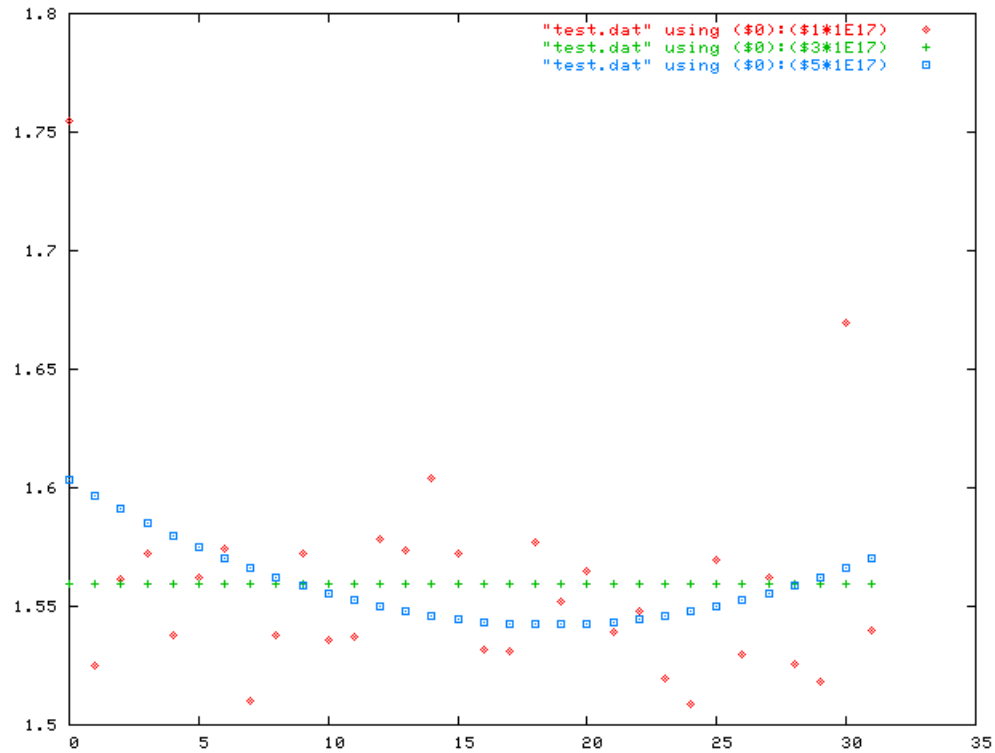
0-HW - 0-order method with Hann windowing

0-nw - 0-order method without windowing

AVG - averaged calibration SFTs produced by Xavier

EXP - expected (?) value

# Calibration approximation

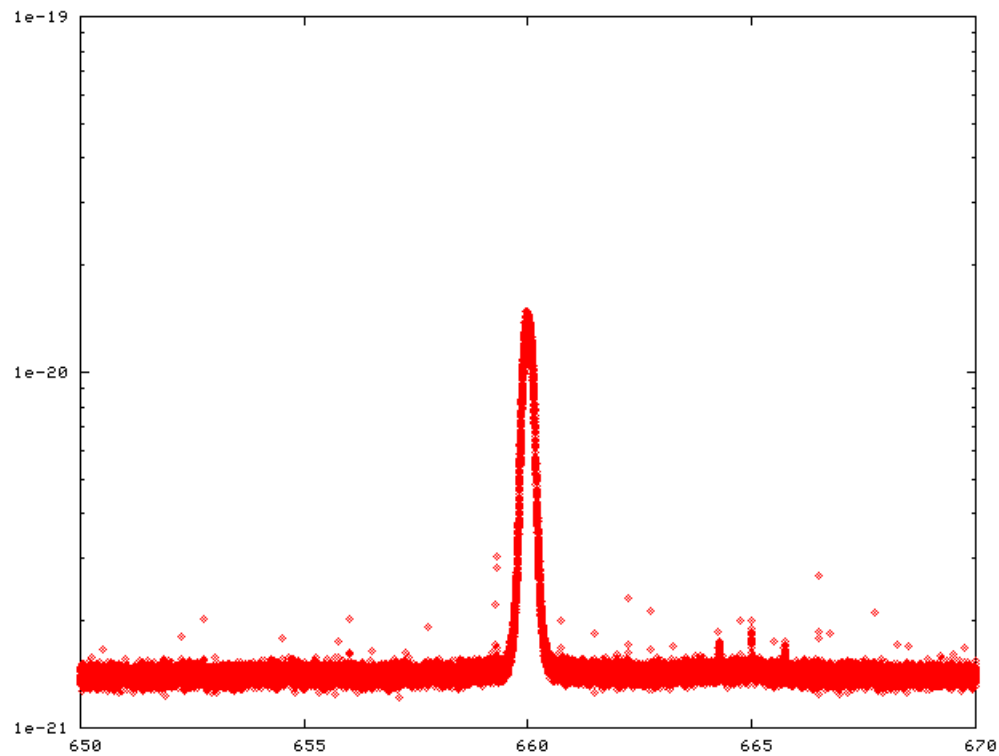


Constant and quadratic approximation to calibration coefficients for 1400Hz

# Statistics

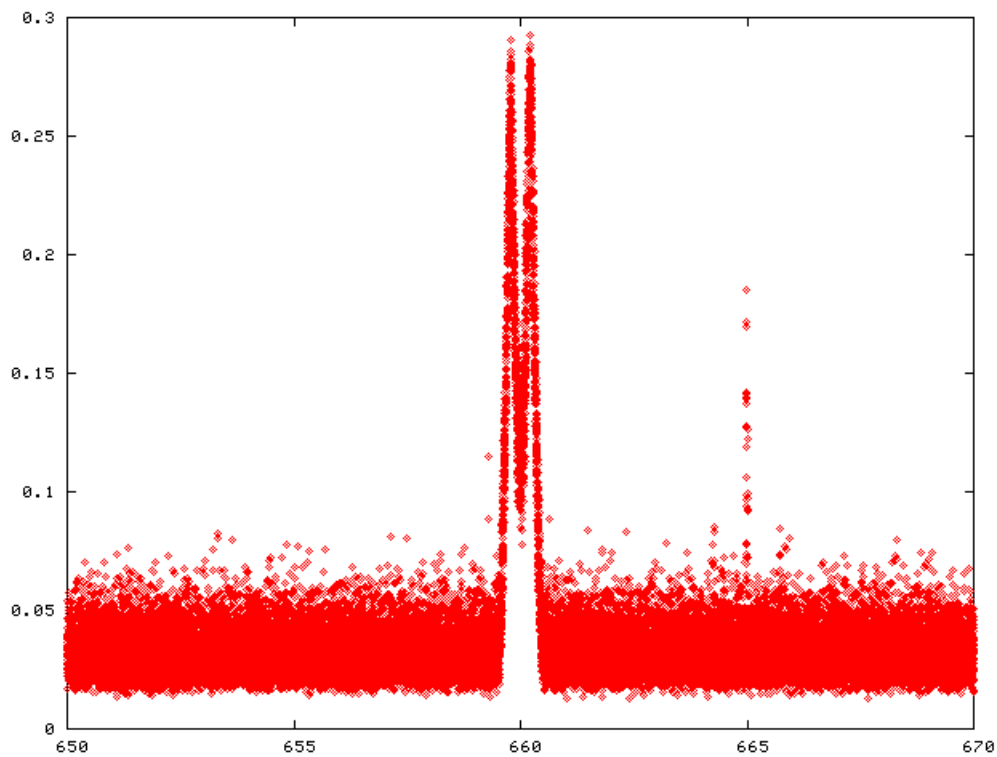
- Power statistic:  $\frac{\text{median}}{\ln(2)}$  for each bin
- Kolmogorov-Smirnov (KS) statistic
- KS count
- Non-exponential count

# H1 power statistic during S2: good



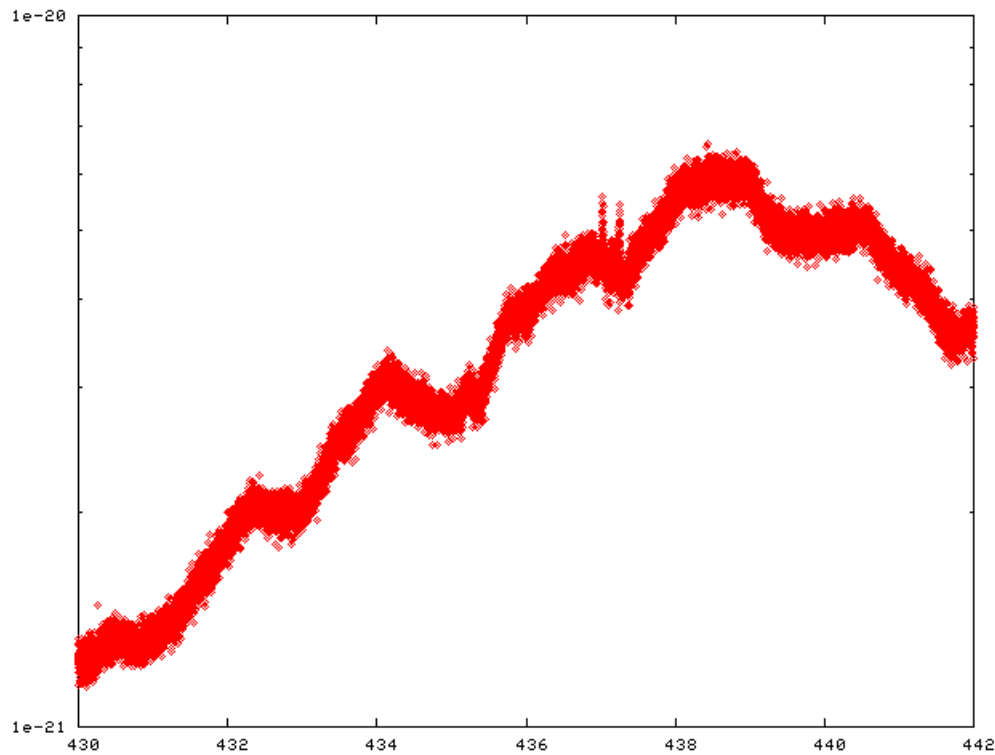
$\sqrt{Sh}$  for band 650-670 Hz

# H1 Kolmogorov-Smirnov statistic for the same band



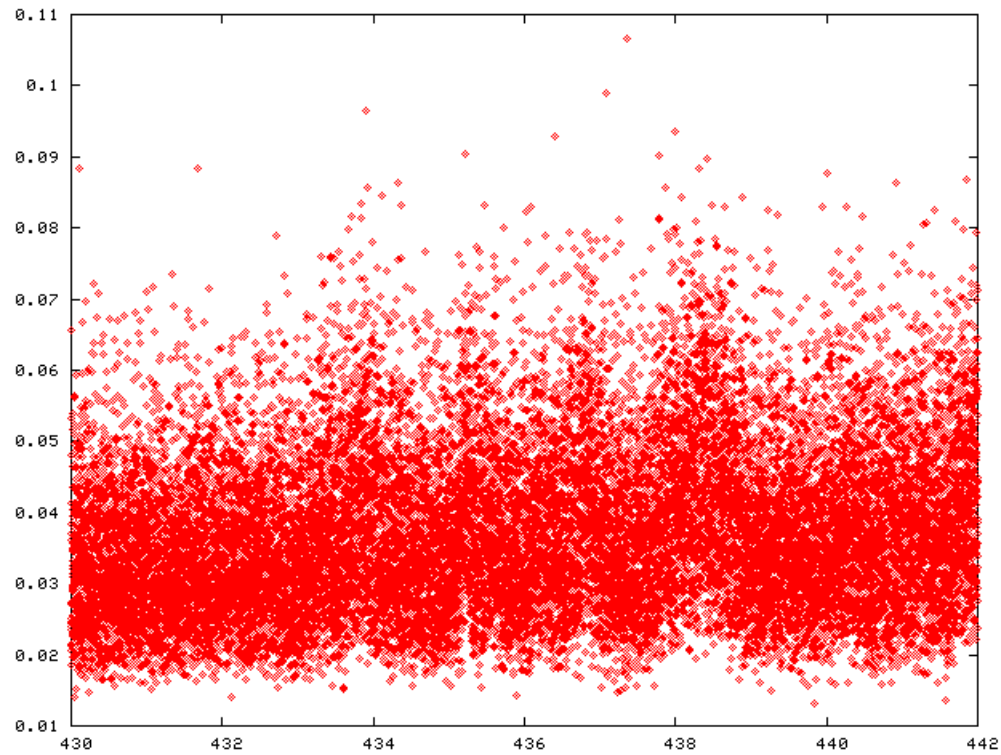
KS statistic for band 650-670 Hz

# H1 power statistic during S2: not so good



$\sqrt{Sh}$  for band 430-442 Hz

# H1 Kolmogorov-Smirnov statistic for the same band

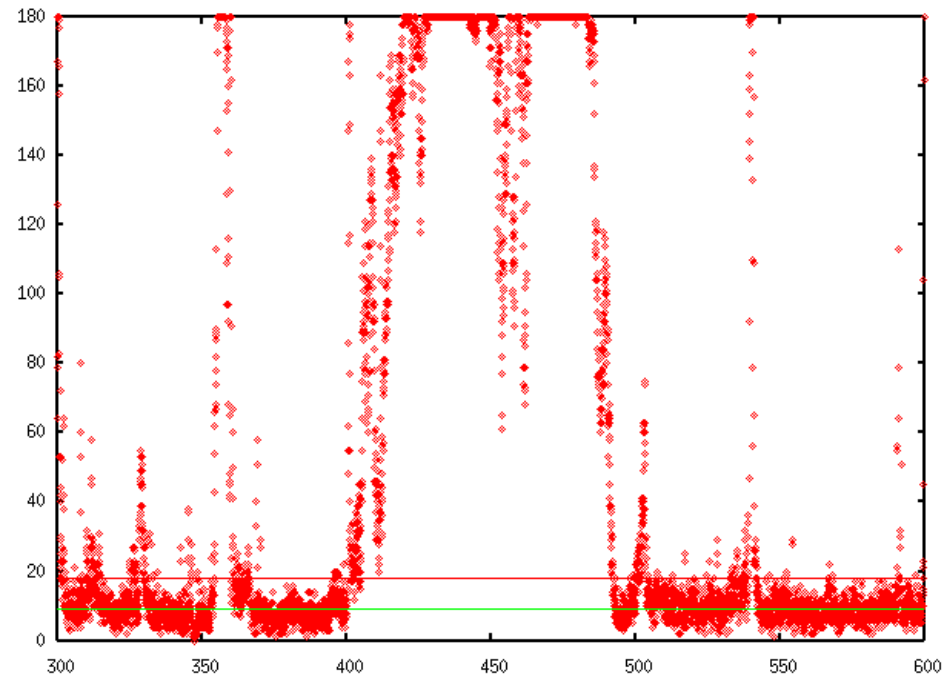


KS statistic for band 430-442 Hz

## Non-exponential count

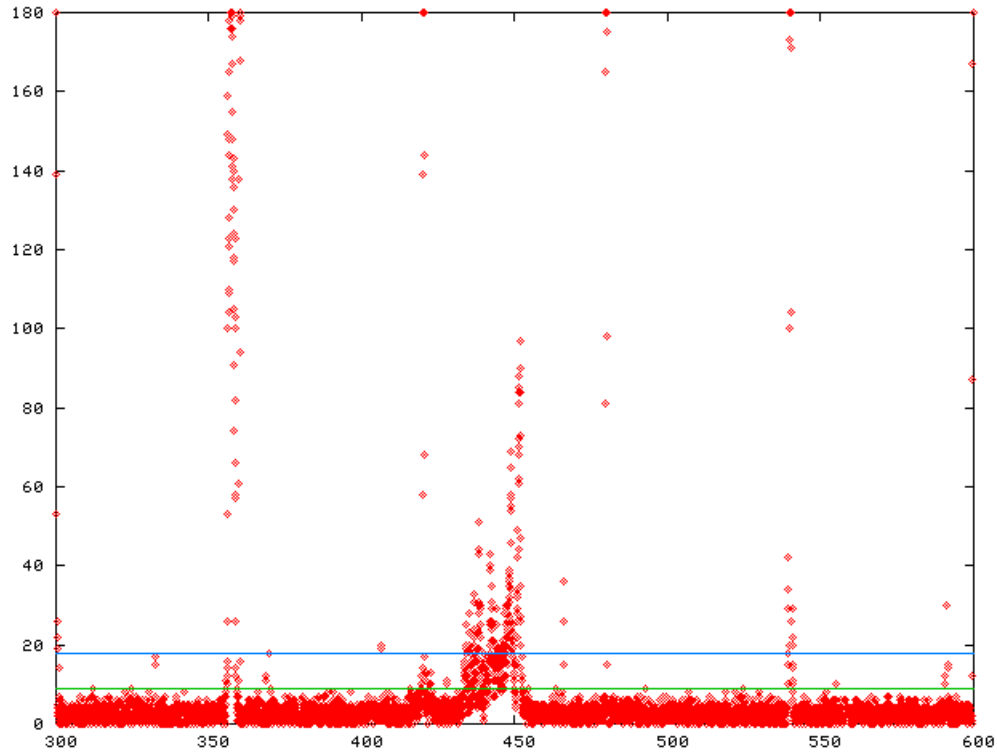
Non-exponential count is defined as a number of times Kolmogorov-Smirnov statistic rejects hypothesis that data corresponding to a bin is exponentially distributed for bins from a narrow band (for example  $0.1\text{Hz}=180$  bins)

# H1, for entire S2



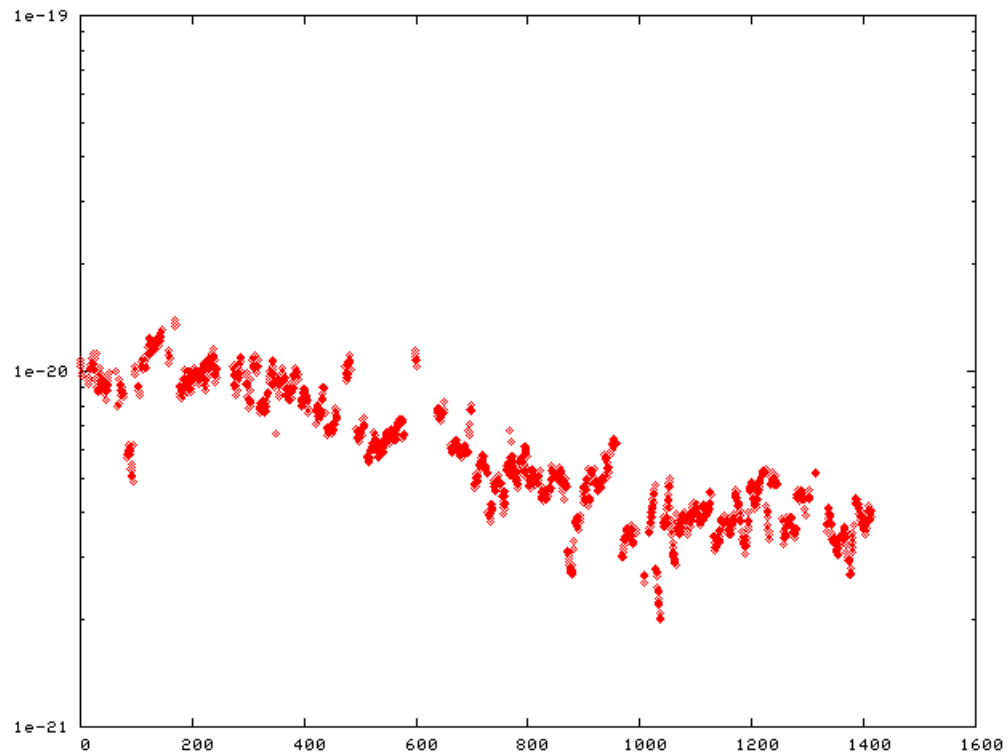
Non exponential count of 300-600 Hz band of H1, during S2  
run

# H1, during end of S2



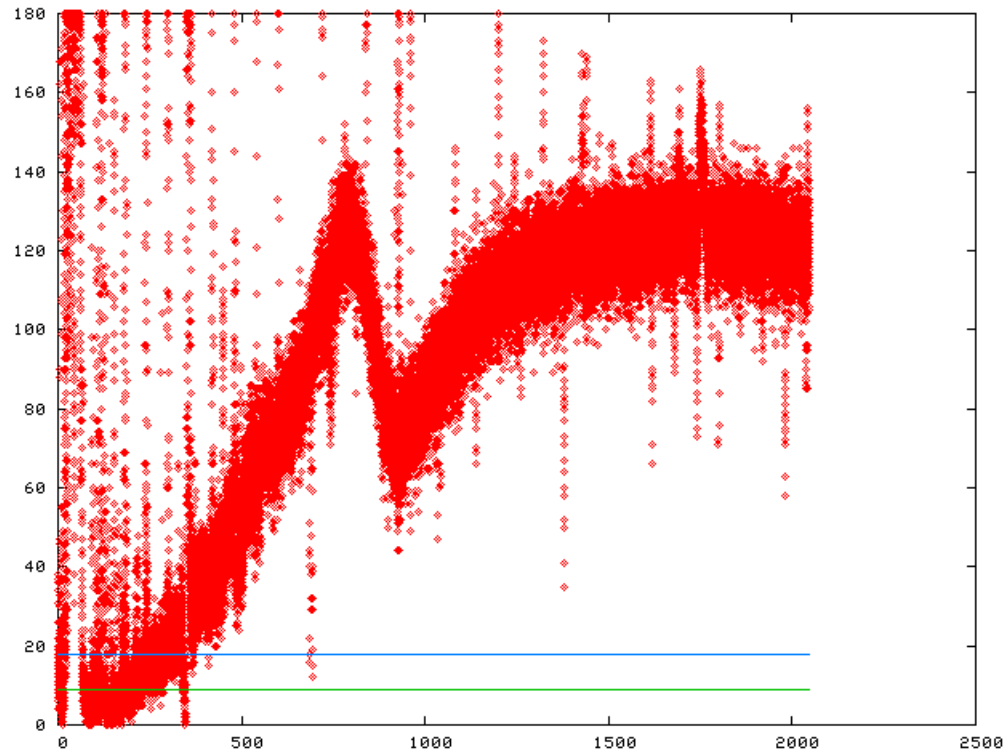
Non exponential count of 300-400 band of H1, during S2 run,  
using only segments after GPS 733022373

Reason for odd behavior:



Cross section of 430-442 Hz band of H1, during S2 run, X axis is hours since GPS 729276634

L1: not so good



L1 non-exponential count using data after GPS 730829734