AMANDA- Technical Note
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First Look at 1997 AMANDA Trigger Rates vs Time

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Abstract

We present a brief analysis of 1997 AMANDA-B and -A counting rates between days 95-216. They have been obtained from the extraction-log files, routinely sent back from pole. We clearly see non-statistical variations on various time scales. Variations of the Amanda-B counting rate range from a few Hz up to ~ 20 Hz. We also find sharp drops of the rate by ~ 3-15 Hz with a daily periodicity.

1 The Data

This analysis is based on the log-files that are generated by the Amanda-A/B extraction program run at the Pole. Runs analysed are run-500 through run-833 (i.e. days 95–216). The analysis is entirely based on the log-files corresponding to the individual binary files generated per run (rather then summing files for each run). As we understand, each binary output file is closed after a certain fixed amount of data written. The number of files is between 1 and 120 per run, with a the typical file duration is 2600-3000 s the longest runs last for almost for 4 days. The total number of log-files analyzed was 3647, a few of them contains unvalid information (for Am-A and/or Am-B).

The log-files were obtained from the locations at `tornado.uci.ps.edu` and `cosmic.uci.ps.edu`, they correspond to the complete mid august status.

The information available in the logfile are

(1) the total numbers of triggered events for Am-A and Am-B,

(2) the number of triggered events for most of the trigger types separately (unfortunately excluding e.g. Am-A triggers for Am-B events), and

(3) the N_{OM}-distributions (Multiplicity distributions) for all Am-A and all Am-B events.

We concentrated on the total rates rather then the mulipicity distributions.

For this analysis we treated each file individually, so that for each of them we got a single data 'point' consisting of several read variables. The variables in the log-files are (following P.Mock's comments):

```
'A-total':        total number of Am-A trigger
'B-total':          analogous
'Spase-A':        number of Spase-A triggers
'Spase-B':          analog.
'A resync':       nb. errors that caused a resync in A&B
'B resync':         analog.
'RawCoinCnt':
'CoinCnt':
'GaspCnt' :       number of GASP events
'UpDownCnt':      a filter
'Evts w/dup':     number of events with duplicate chans
'First time (A)': GPS-time [secs] of first Am-A event in file
'First time (B)':     analog.
'Delta time (A)': duration of file (last-first GPS-time) [secs]
'Delta time (B)':     analog.
'Overlap':        time overlap where A and B are running                together in the period of 'Delta time (B)'
```

A program `extract_log` has been written to read a set of log-files, extract the above variables and write them to an ascii-output file, one line per log-file. Further analysis then is done by reading this ascii-file to a paw-ntuple. The program (`extract_log`) as well as the resulting acsii-output file `extract_log_500-833.out`, and an example kumac will be placed on the web. It is the file `extract_log_500-833.out` that any further analysis can easily be done.

2 Results

2.1 File statistics

Whenever a time-dependence is shown, we plot the variable as function of the file start time ("GPS-time"). Rates are in Hz and are calculated by taking the Am-A and Am-B run duration. Amanda-A or -B trigger rate in the following means the rate of **all** triggered events, regardless of the trigger type (the information in the log-file does not allow to obtain the rate of pure Amanda-B triggers, i.e. excluding Spase/Gasp/Am-A.)

Fig.1: The Amanda-B run number versus the GPS-time. Here a steep rise indicates a period of short runs which can be interpreted as a relatively unstable Am-B operation phase, whereas a flat period indicates a quite stable phase (longer runs). One notices a steep rise around $t_{GPS} \sim 1.0 - 1.4 \cdot 10^7$ s ($\sim$ day 120–160).

Fig.2: The number of files as function of run numer. The gap between run 550 and 650 corresponds to the steep rise discussed for fig. 1.

Fig.3: The file number as a function of GPS-time, similar to fig. 2.

Fig.4: Histogram of file duration ("Delta time") for Amanda-B files, cut for $\leq$4000 s. Three peaks are seen, at $\sim$2600 s, 2700 s and 3100 s. The flat distribution towards 0 s is in accordance with a random length of the last file per run ("random run stop"). We note, that 12 files have durations larger than 4000 s, as can be seen in fig.5. We checked, that these are not "hanging" runs, i.e. last files of an unsuccessfully finished run. In turn, we found that e.g. runs 538 and 767, with lengths of 6200 and 5000 s for files 16 and 25 have a total of 30 and 93 files, respectively. If this large file duration is due to temporarily "hanging" runs, we expect untypically long time differences between neighbouring muon events (at least for a few), that would be seen in the δt_{event} distributions from the raw data files.

Fig.5: The file duration as function of the GPS time for all files. We see, that the right file duration peak ($\sim$3000 s) in fig.4 comes entirely from the first data taking period, $t_{GPS} \sim 1.1{\cdot}10^7$ s. If the trigger rate would be constant (see below), this drop in file duration corresponds to larger average length of the events written to the binary output files. The third file duartion peak in fig.4 is related with runs around $t_{GPS} \sim 1.6 \cdot 10^7$ s, a pronounced time to be discussed later.

2.2 Trigger Rates

Fig.6: Histogram of the Amanda-B trigger rate, for all files with non-zero duration (3629 files), and cutted for $\leq$100 Hz. We find two peaks, at $\sim$61 and $\sim$78 Hz. The width of the dominant peak is way above the statistical fluctuations ($\leq$0.2 Hz).

Fig.7: The Amanda-B trigger rate as function of GPS-time. The rate shows a lot of jumps, partially very abrupt, while staying within a corridor of about 10 % around 78 Hz. A few periods of rates between 100-200 Hz are observed. Note, that the pronounced drop in file duration as seen in fig.5 at $t_{GPS} \sim 1.1 \cdot 10^7$ s is seen as a characteristic structure, the rate seems to slightly rise thereafter. For a period of several days around $t_{GPS} \sim 1.6 \cdot 10^7$ s the rate falls to about 60 Hz (see fig.6). The first day is day $\sim$180 (June 29th), finally the rate is back to normal at day $\sim$190 (July 9th). This is also coinciding with the failure of a discriminator Camac Crate, reported around July, 6th (Gary and Robert, please correct or give details). We compared the multiplicity distributions for the 60 Hz and 78 Hz intervals, and see a clear drop of the high multiplicity rates. This would be consistent with a few OMs not properly operated for some time.

Fig.8: The Amanda-B trigger rate as function of GPS-time, like fig.7 - but zoomed in y-axis. We find indications of "smooth" changes in rate, following the abrupt changes.

Fig.9: The Amanda-B trigger rate as function of GPS-time, zoomed in time axis with respect to fig.8. The time corresponds to runs 805-815. One clearly sees a periodic drop of the rate to values even lower than 60 Hz. The period measured is about 80000 to 90000 seconds, i.e a daily period. That could point to a correlation with a daily process, e.g. time-dependent behaviour of the Pole-LAN availability. Remember, that the DAQ would be halted as long as the NFS-mounted disk might not be available. We could think about heavy data traffic initiated by other experiments, regular backups to a central server, or people using network for other reasons (the minimum in fig.9 at $t_{GPS} \sim 1.8 \cdot 10^7$ s corresponds to a sunday).

Fig.10: The distribution of the Amanda-A trigger rate, for all files with non-zero run duration, and cutted for $\leq$60 Hz. The distribution shows two peaks at $\sim$9 Hz and 18 Hz and is much broader than for Amanda-B.

Fig.11: The Amanda-A trigger rate as function of GPS-time. The plotted rate shows no regular behavior, except for short periods around t_{GPS} $\sim$1.5 and $1.8 \cdot 10^7$ s. Note that the end og the first period exactly coincides with the start of the 60 Hz-period for Amanda-B, see fig.7. Also, Amanda-B shows a sligthly different rate performance during that Amanda-B period.

Fig.12: The distribution of the Spase-Amanda-B trigger rate, showing a few peaks between 0.1 and 0.25 Hz.

Fig.13: The Spase-Amanda-B trigger rate as function of GPS-time. We note, that the second period of $\sim$0.25 Hz coincides exactly with the 60 Hz rate period of Amanda-B.

Fig.14: The Amanda-A rate versus the rate of Amanda-B. We make two strange observations: (1) The two states of Amanda-A (9 Hz and 17 Hz) seem to be (slightly) correlated with a change in Amanda-B trigger rate. (2) The 60 Hz Amanda-B period coincides with a 9–12 Hz period of Amanda-A (see also the remarks for fig.11).

Fig.15: The Spase-B rate versus the rate of Amanda-B. For the main part of the statistics, a slightly positive correlation between the two rates is visible (Am-B rate 70–85 Hz). For the 60 Hz period again, a strange correlation is present: the lower Amanda-B rate coincides with a higher Spase-B rate. An anticorrelation should be expected, if DAQ-dead time effects would be very large, i.e. normal Amanda-B events significantly "blocking" acceptance of Spase-B trigger (however not at that high level as obserevd: 0.15–0.25 Hz).

Fig.16: Finally, we give the GASP-Amanda-B trigger rate as function of GPS-time. We note that the first GASP activity roughly coincides with the start of the 60 Hz Amanda-B period.

3 Conclusions

We monitored the Amanda-B (and Amanda-A) trigger rates over the whole available period, days 95-216. "Short time" variations (hours–days) of a few Hz are present, as well as a $\sim$10 day period of 20 Hz lowered counting rate. It is possibly due to some OMs not properly operated (discriminators?). This period, as well as others, are correlated with the other detectors behaviour (seen in the corresponding Amanda-B trigger rates). Additionally, we find an about daily period of sharp drops of the Amanda-B trigger rate by a few Hz.

We propose to monitor in the log-files the Amanda-B trigger rates for each OM individually to have an early check for misbehaviour of the system (i.e. just adding 300 numbers in the log-file). We add, that as in similar cases it would be very helpful to have a detailed run-logbook available.

A more detailed analysis of any further features not discussed here is easily possible. Use the one ascii-file `extract_log_500-833.out` and a one line kumac to generate the ntuple, as given on the web.

4 Appendix

The log-files are named like:

```
        'ab_rrr_ddd-yy-ff-ext-log'
               rrr : run number
               ddd : day
                yy : year
                ff : file in the run
         (e.g. 'ab_762_179-97-ext-log').
```

The structure of the 'log'-files:

```
     The files are ASCII code and contain:
        1.) An (almost) constant header.
        2.) Several ( two at the moment ) data arrays. Each of them is starts
            with a
               "### start histo ###"
            and ends with a
               "### end histo ###".
        3.) The relevant data for our analysis is placed here. And of format
            ( example )
               " A-total    =     28757  B-total    =    209716
                 Spase-A    =       392  Spase-B    =       390
                 A resync   =         0  B resync   =         0
                 RawCoinCnt =     20796  CoinCnt    =       523
                 UpDownCnt  =       516  GaspCnt    =        49
                 Evts w/dup =         0
                 First time = ( 18669801,  18669869)
                  Last time = ( 18672867,  18672584)
                 Delta time = (     3066,      2715)
                    Overlap = 2715 secs = 0.8 hours ".
        4.) End of file.
```

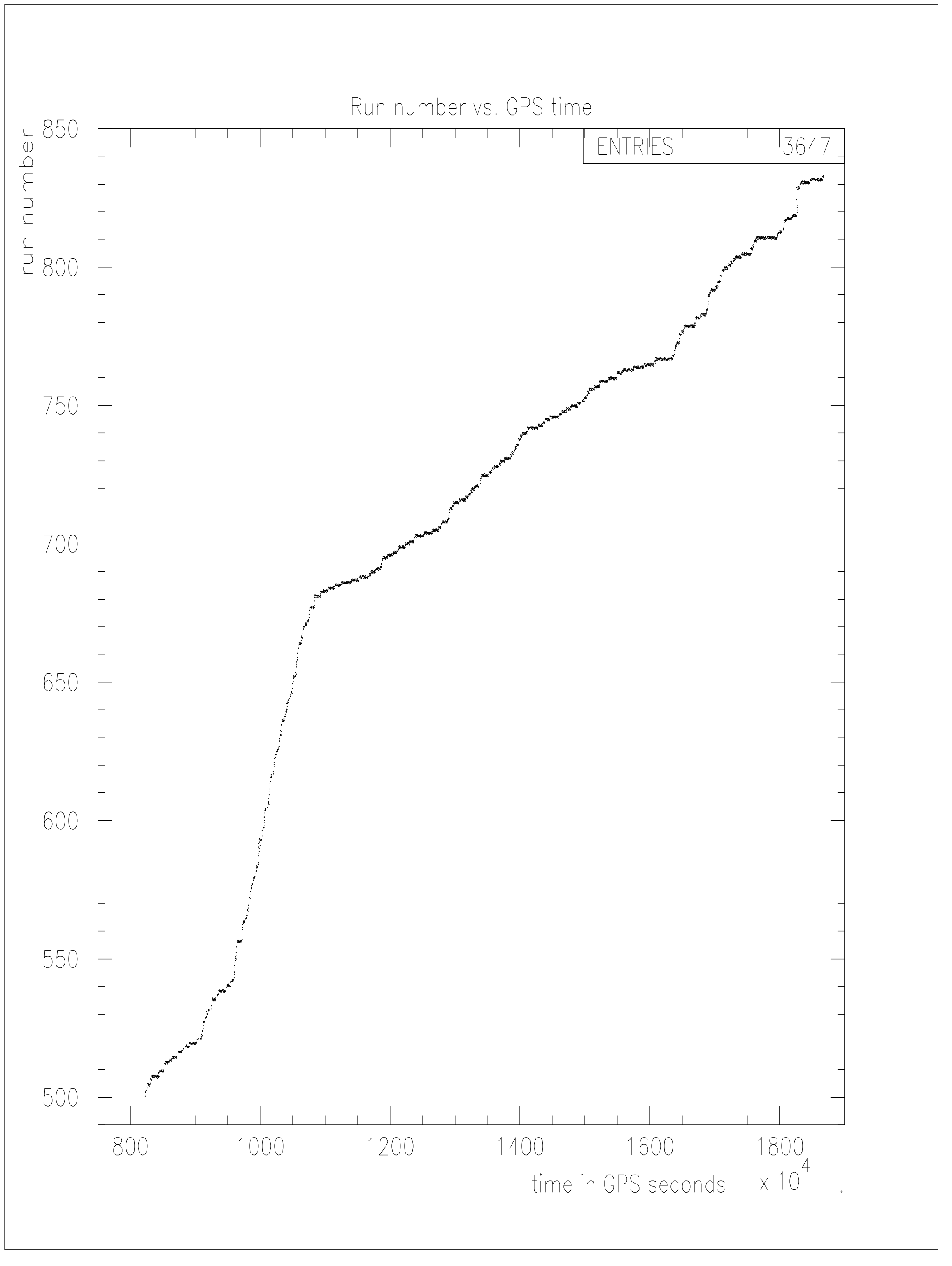

Run number vs. GPS time
ENTRIES 3647
run number
850
800
750
700
650
600
550
500
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 1:

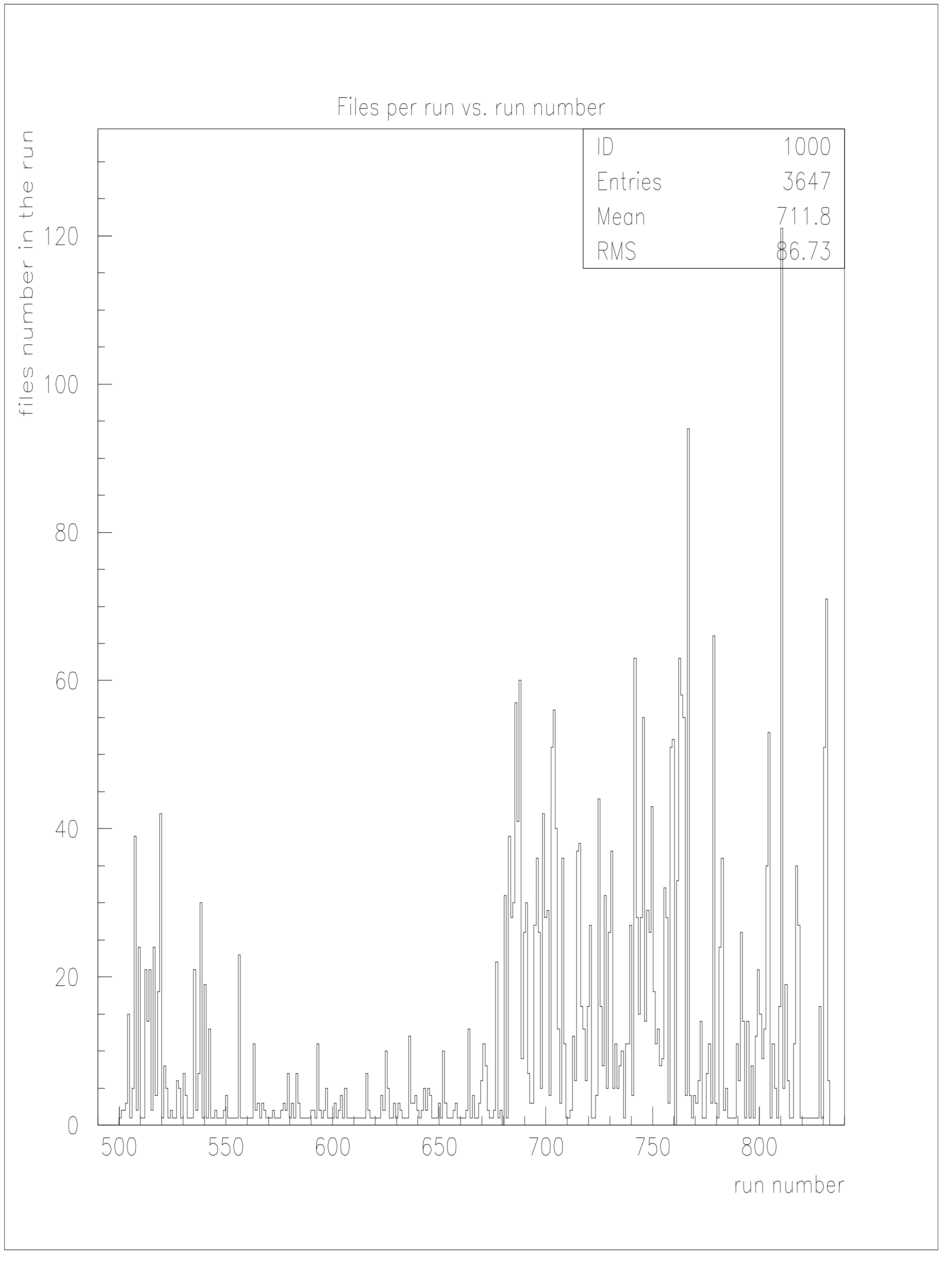

Files per run vs. run number
ID 1000
Entries 3647
Mean 711.8
RMS 86.73
files number in the run
0
20
40
60
80
100
120
500
550
600
650
700
750
800
run number

Figure 2:

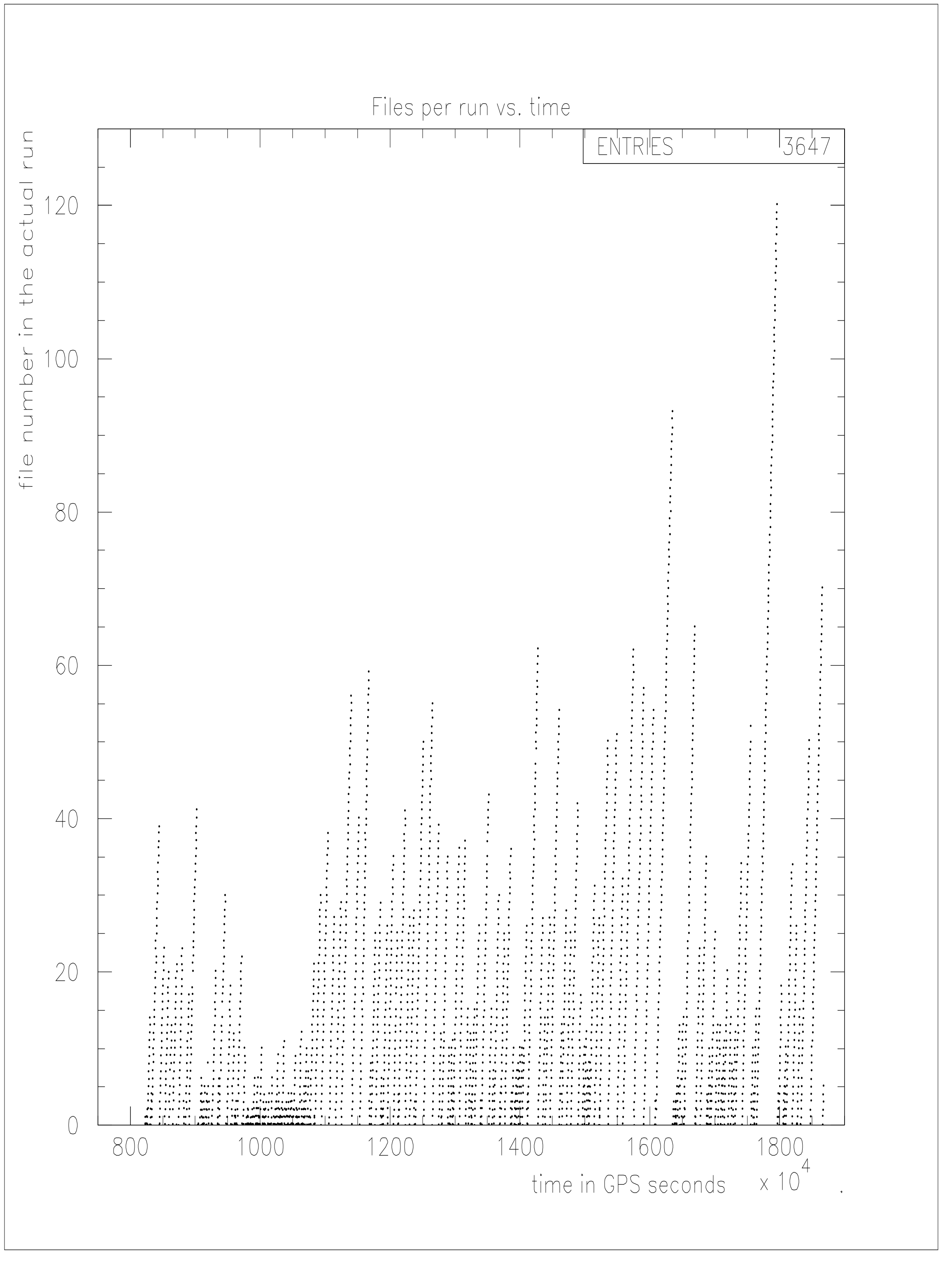
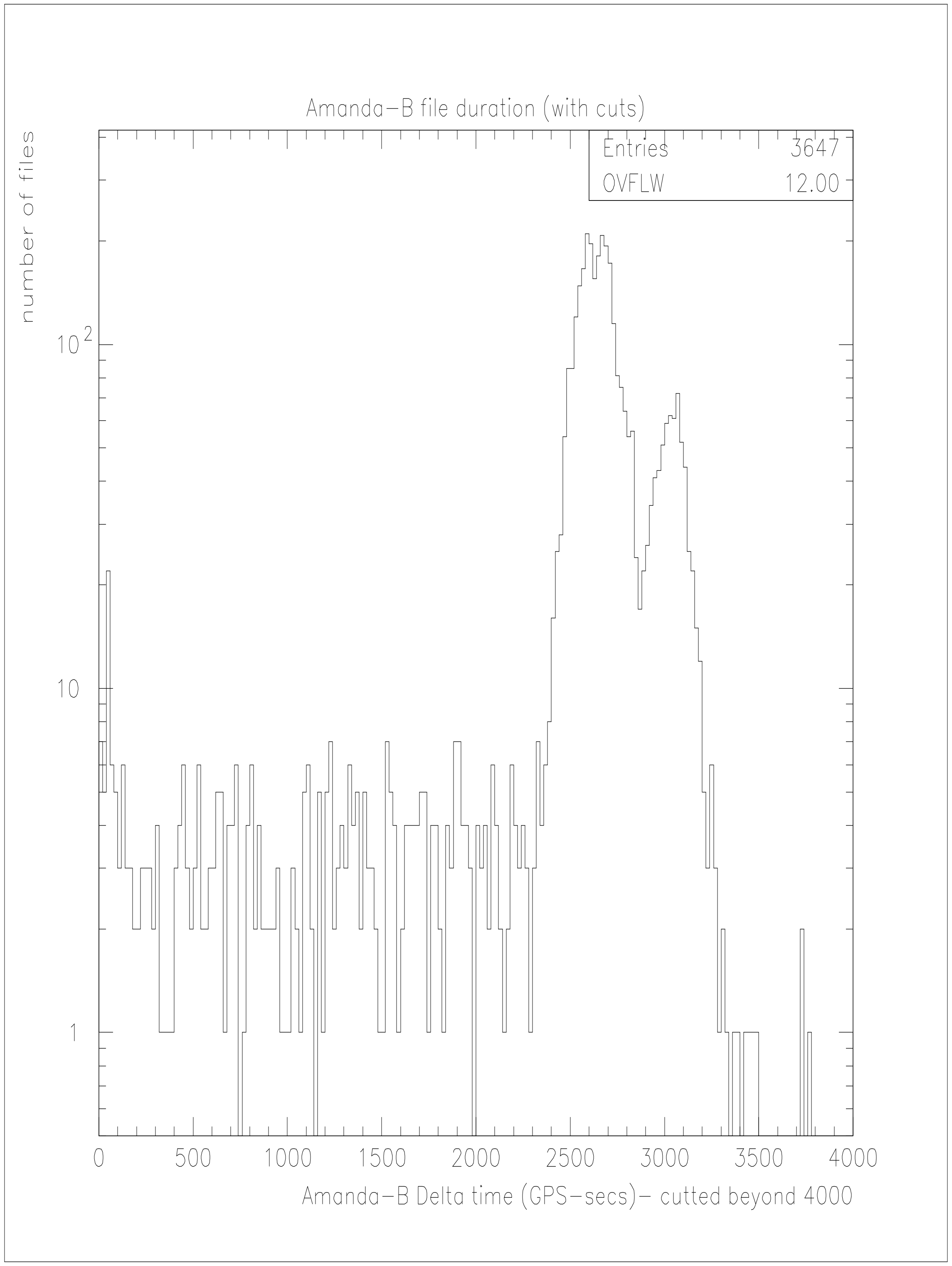

Files per run vs. time
ENTRIES 3647
file number in the actual run
0
20
40
60
80
100
120
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 3:



Amanda−B file duration (with cuts)
number of files
Entries 3647
OVFLW 12.00
10^2
10
1
0
500
1000
1500
2000
2500
3000
3500
4000
Amanda−B Delta time (GPS−secs)− cutted beyond 4000

Figure 4:

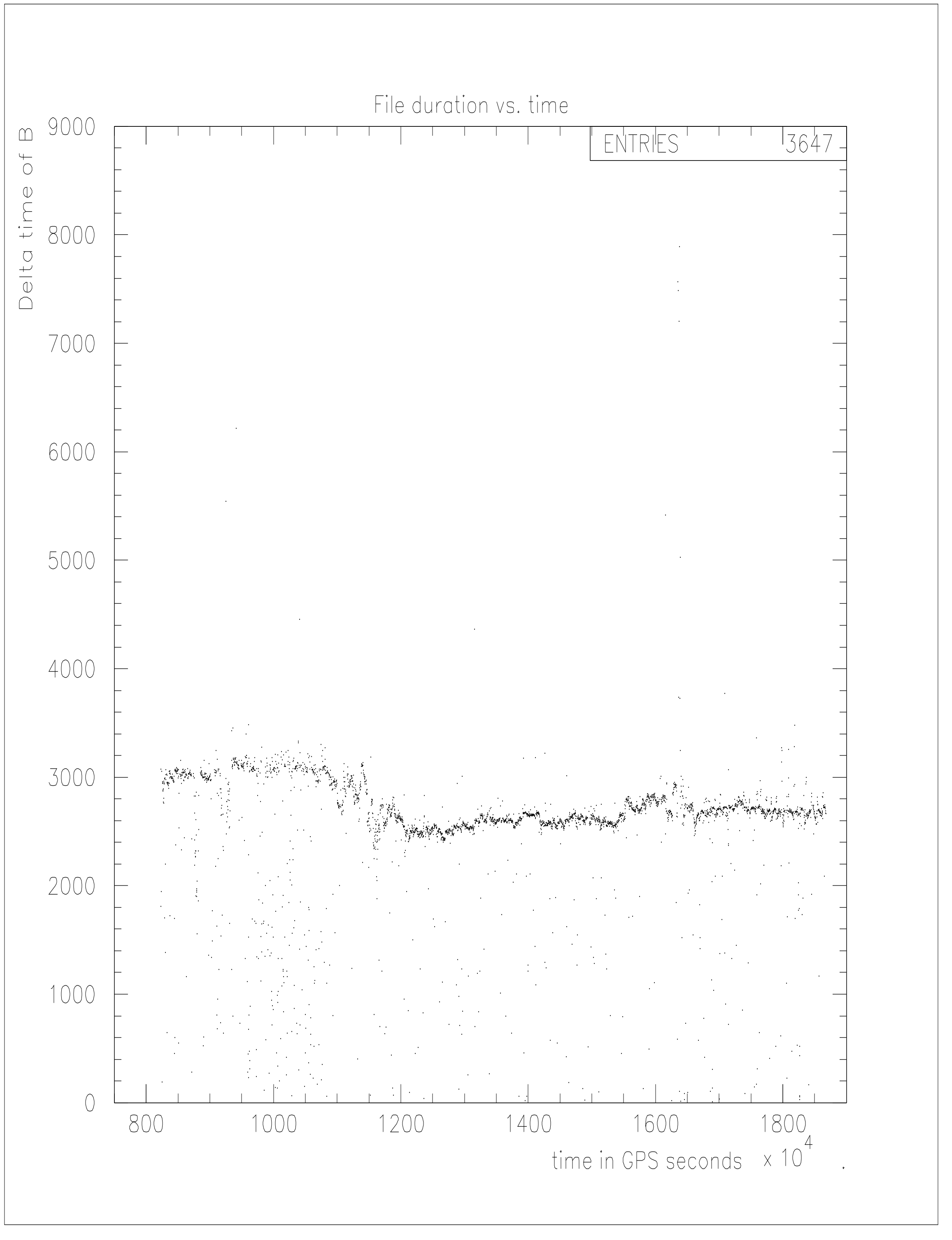
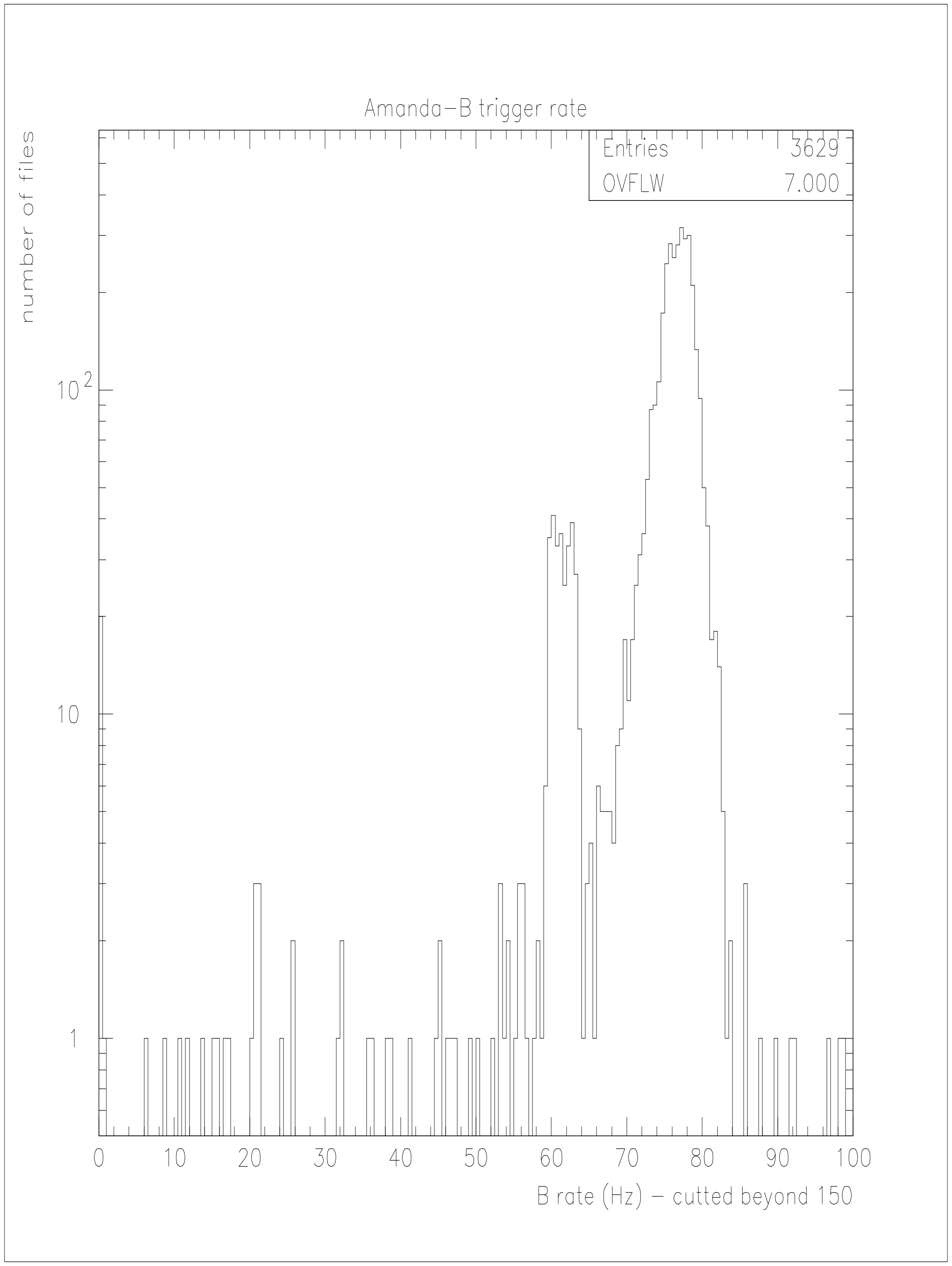

File duration vs. time
Delta time of B
ENTRIES 3647
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
800
1000
1200
1400
1600
1800
time in GPS seconds x 10^4

Figure 5:



Amanda−B trigger rate
number of files
Entries 3629
OVFLW 7.000
10^2
10
1
0
10
20
30
40
50
60
70
80
90
100
B rate (Hz) − cutted beyond 150

Figure 6:

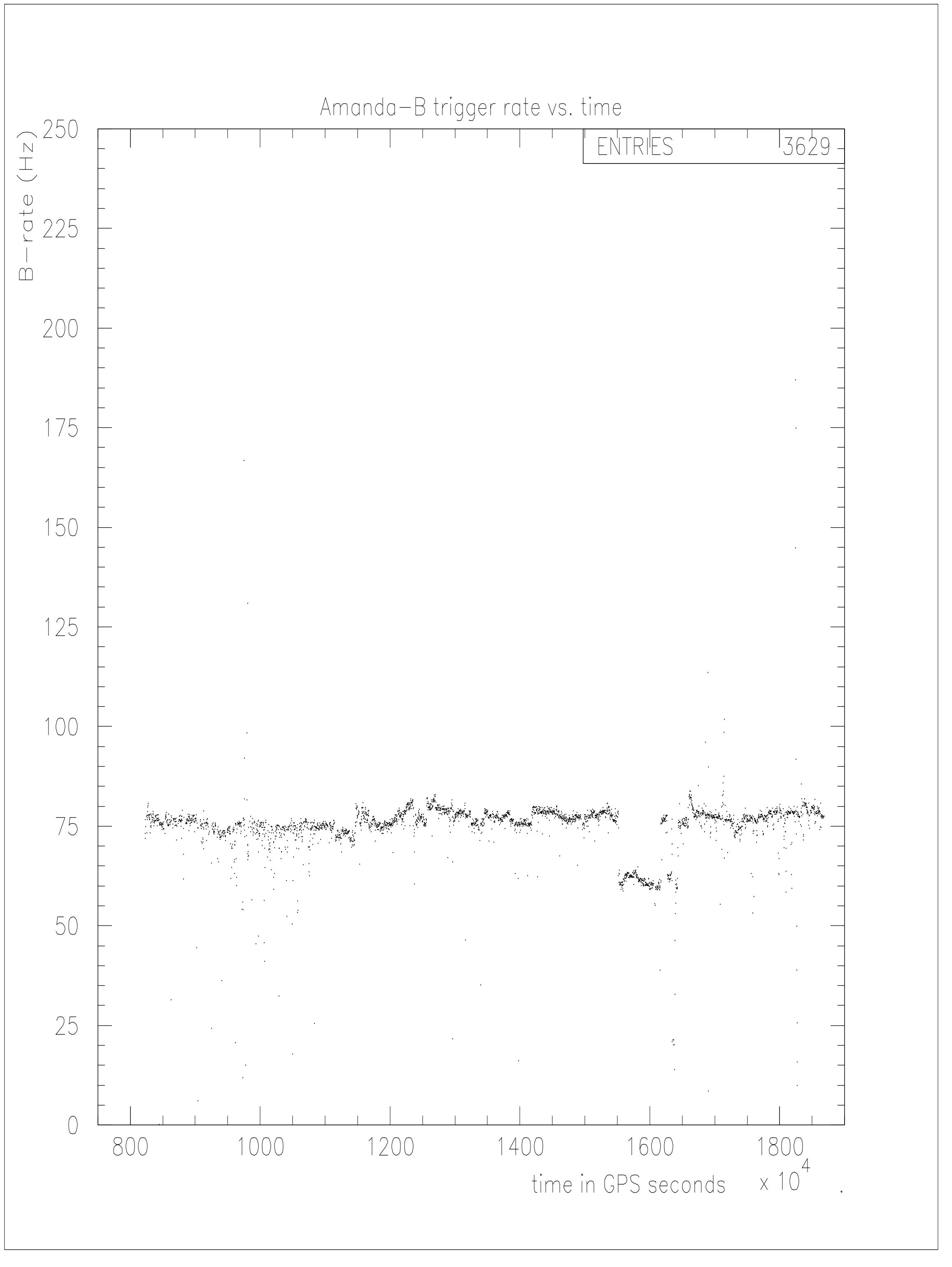

Amanda−B trigger rate vs. time
ENTRIES 3629
B−rate (Hz)
250
225
200
175
150
125
100
75
50
25
0
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 7:

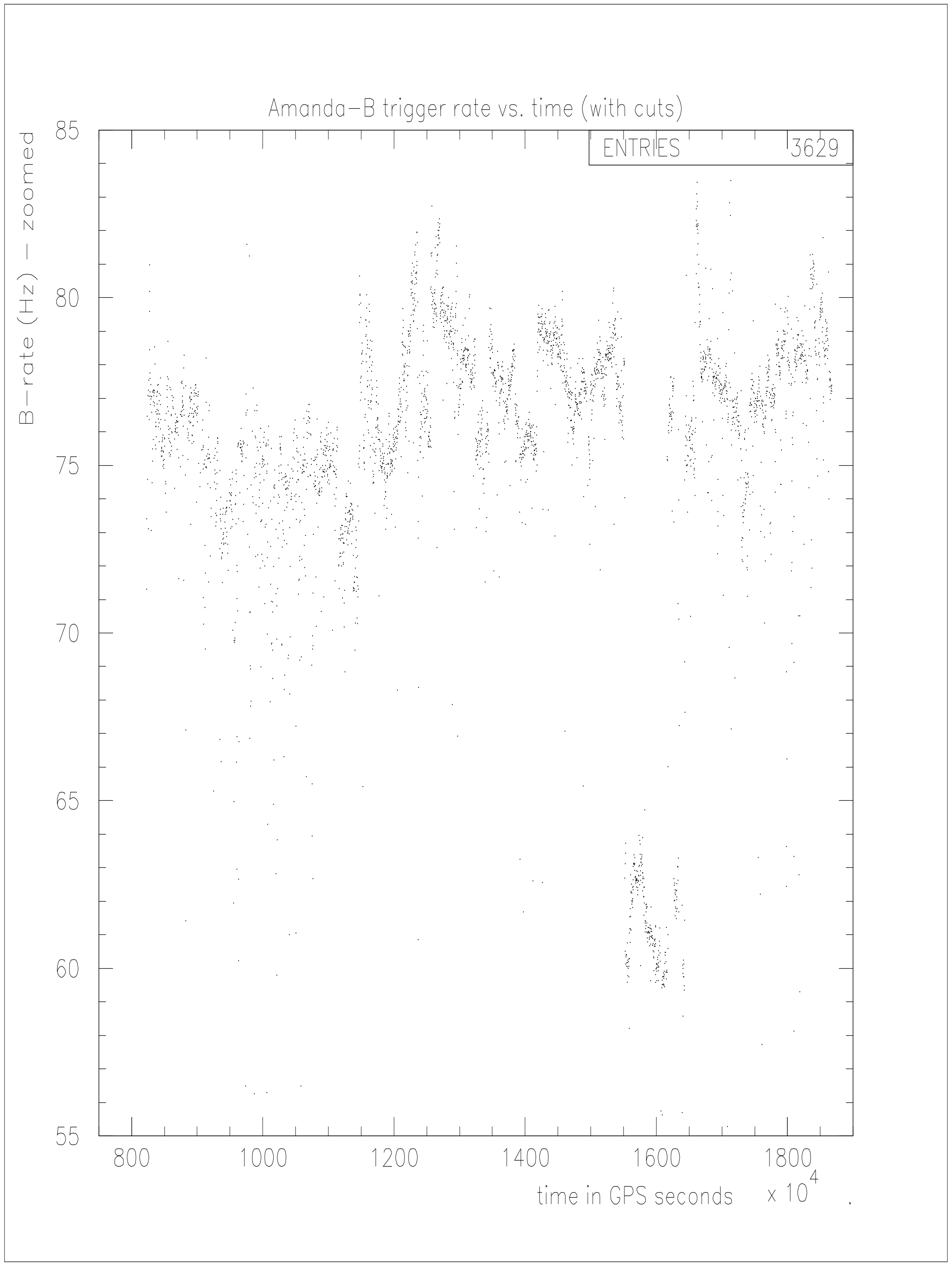

Amanda–B trigger rate vs. time (with cuts)
ENTRIES 3629
B–rate (Hz) – zoomed
85
80
75
70
65
60
55
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 8:

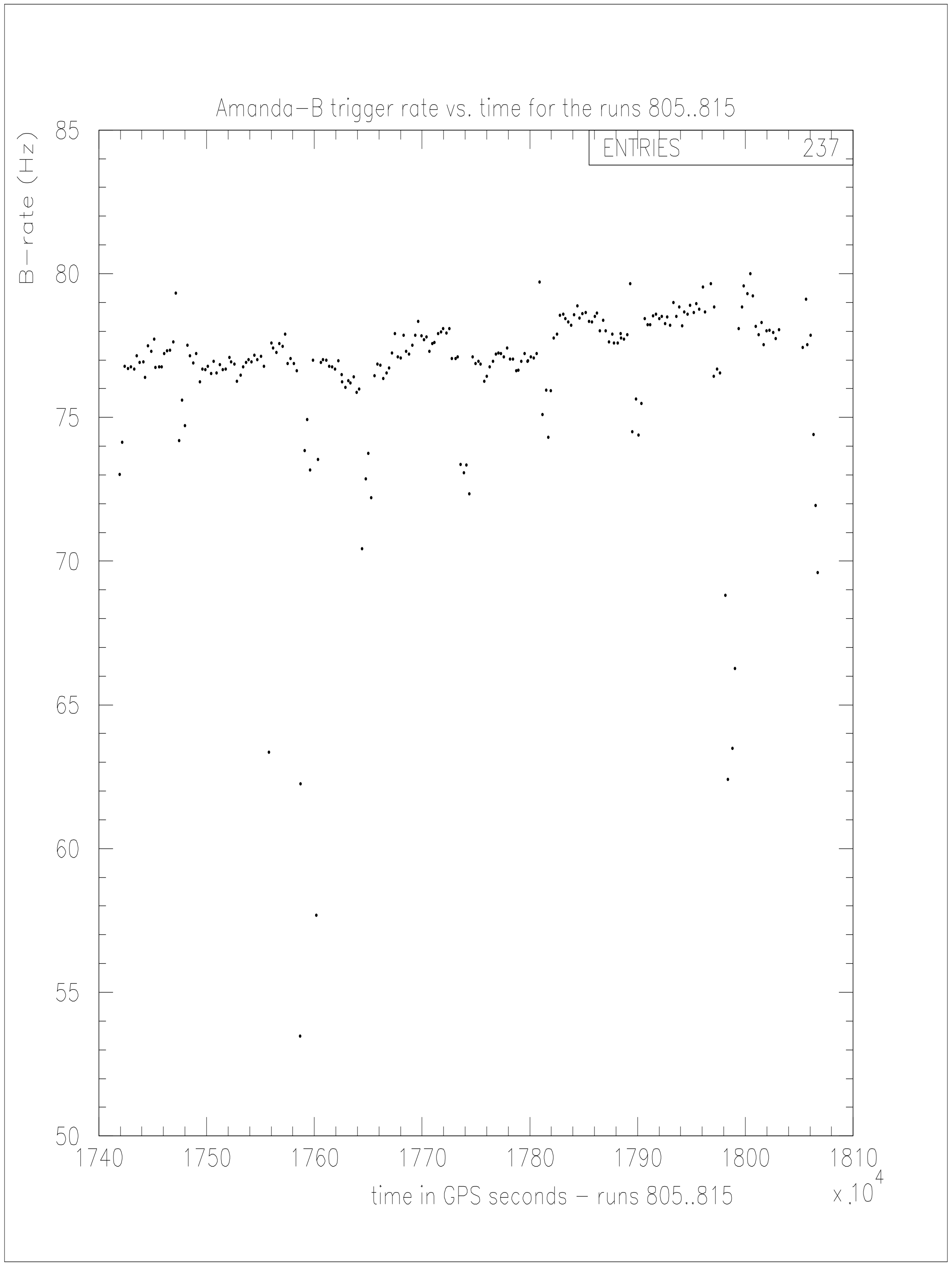
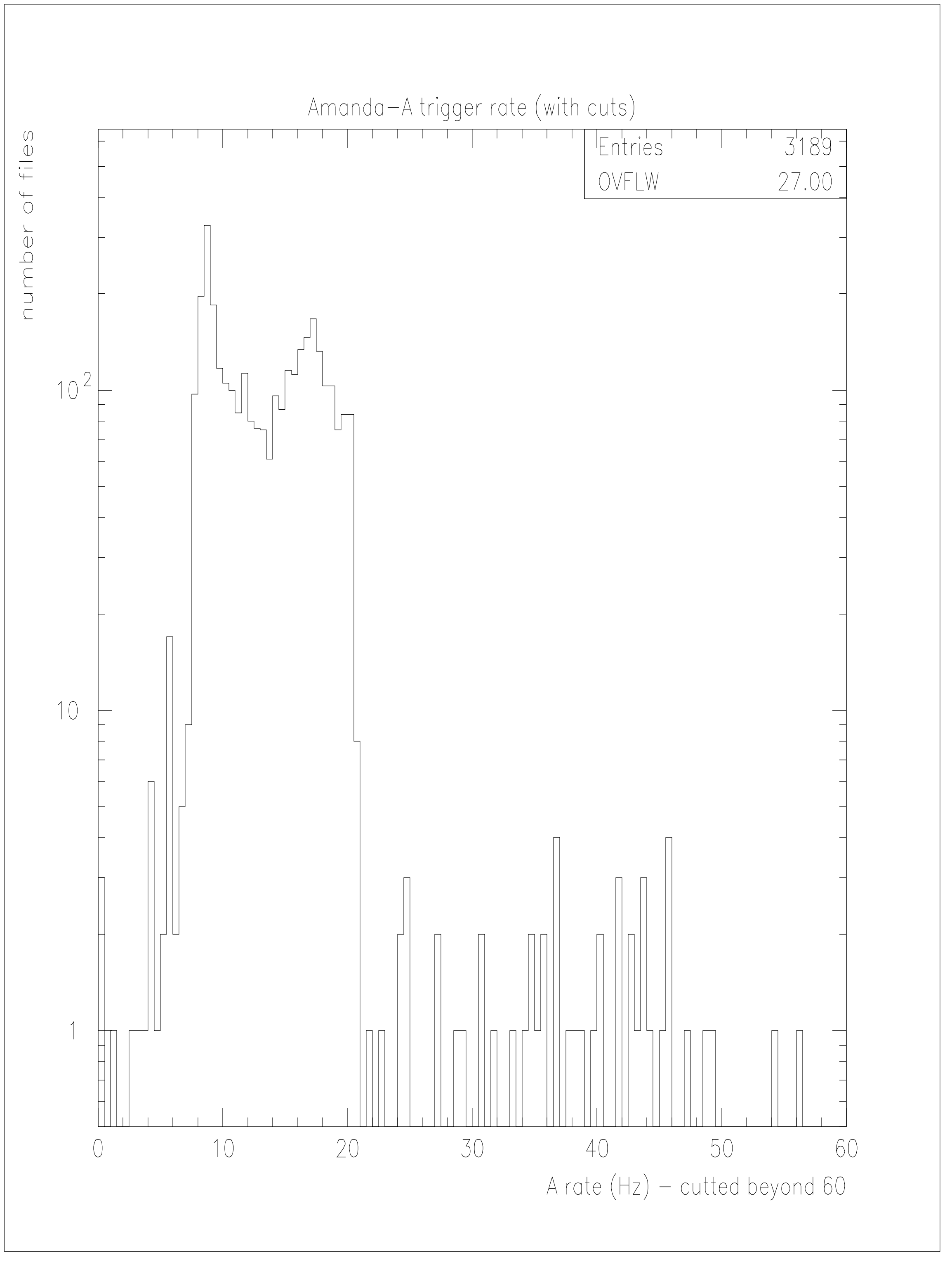

Amanda−B trigger rate vs. time for the runs 805..815
ENTRIES 237
B−rate (Hz)
85
80
75
70
65
60
55
50
1740
1750
1760
1770
1780
1790
1800
1810
time in GPS seconds − runs 805..815
x 10^4

Figure 9:



Amanda−A trigger rate (with cuts)
Entries 3189
OVFLW 27.00
number of files
10^2
10
1
0
10
20
30
40
50
60
A rate (Hz) − cutted beyond 60

Figure 10:

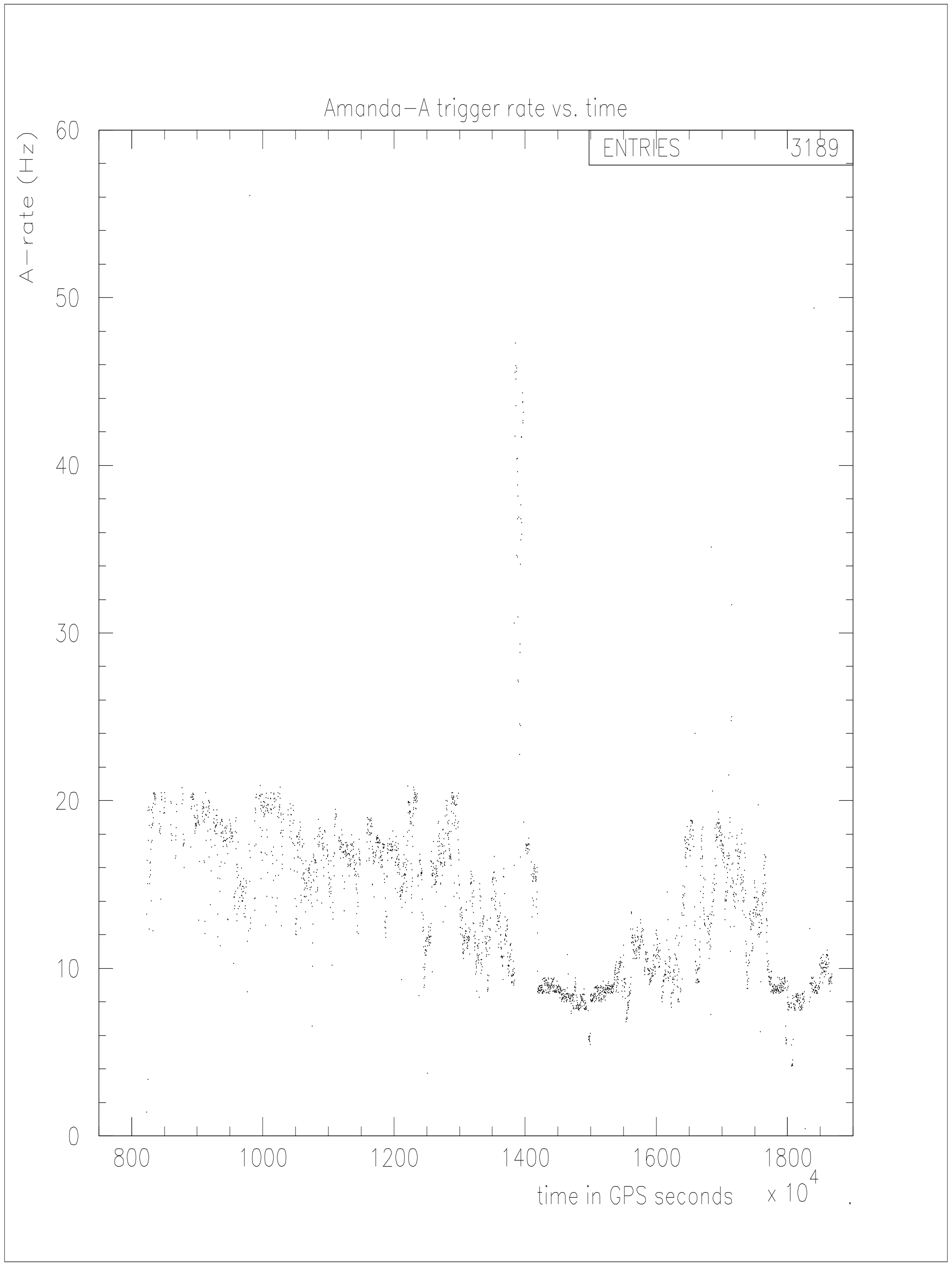

Amanda–A trigger rate vs. time
ENTRIES 3189
A–rate (Hz)
60
50
40
30
20
10
0
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 11:

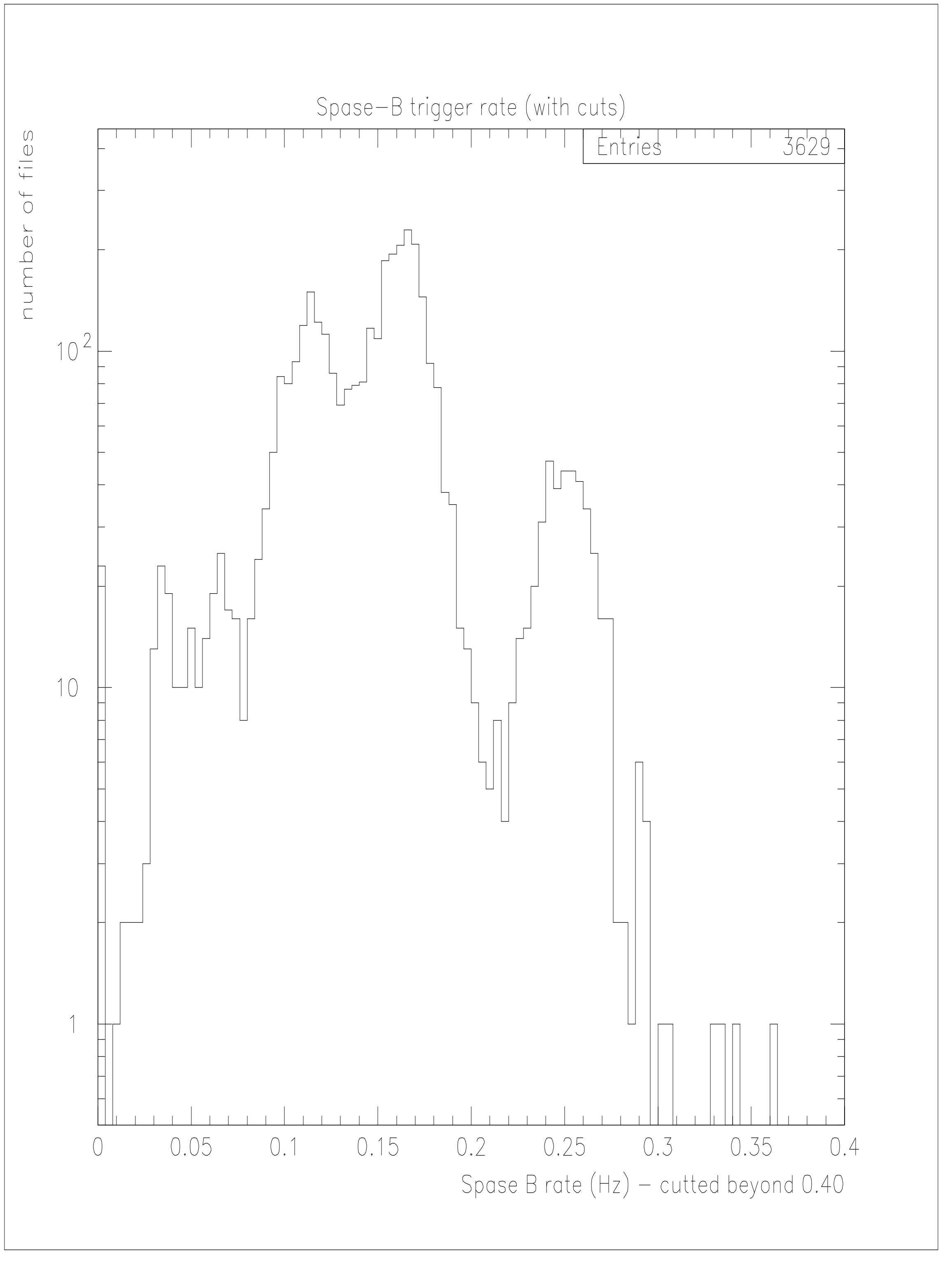
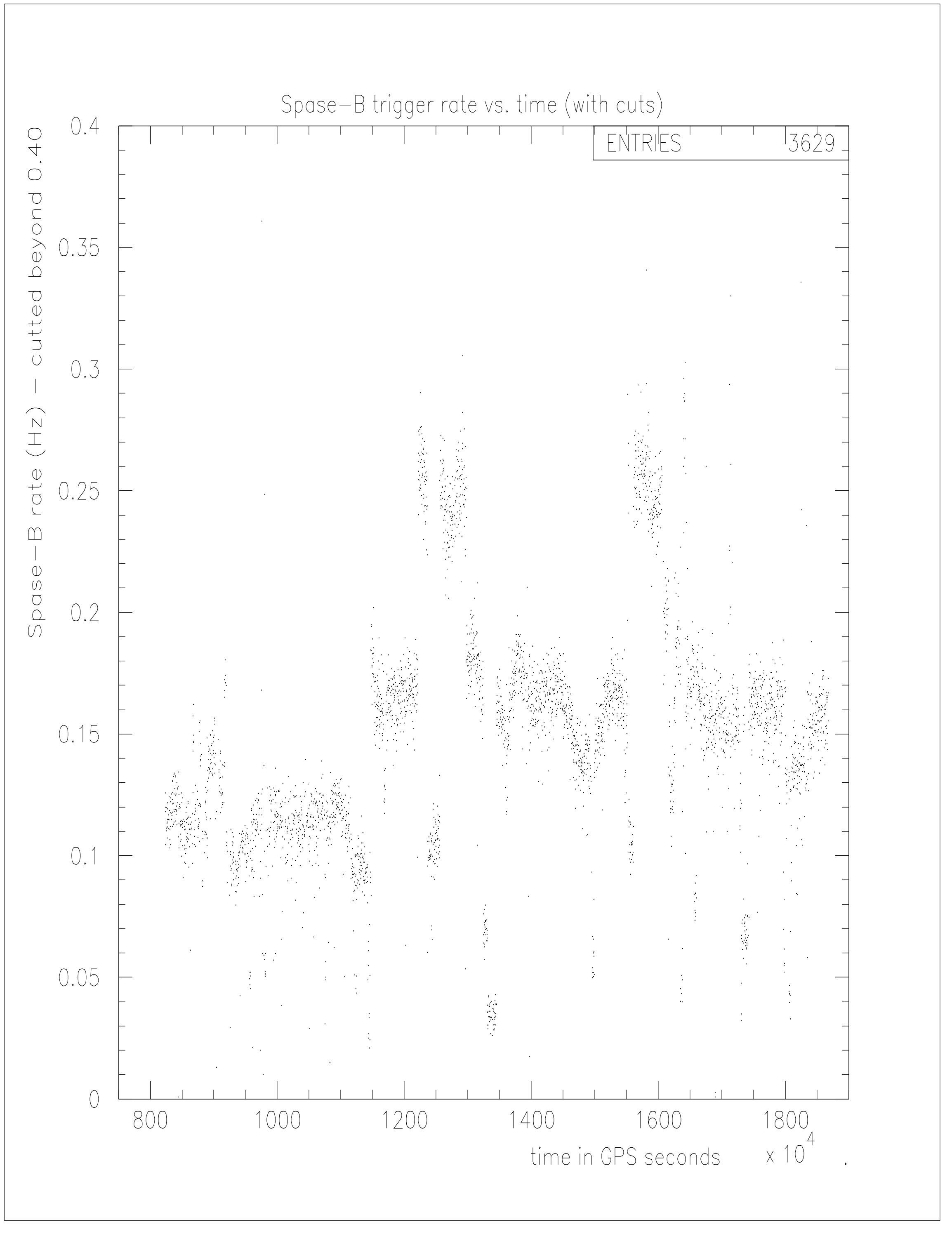

Spase−B trigger rate (with cuts)
Entries 3629
number of files
10^2
10
1
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Spase B rate (Hz) − cutted beyond 0.40

Figure 12:



Spase−B trigger rate vs. time (with cuts)
ENTRIES 3629
Spase−B rate (Hz) − cutted beyond 0.40
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 13:

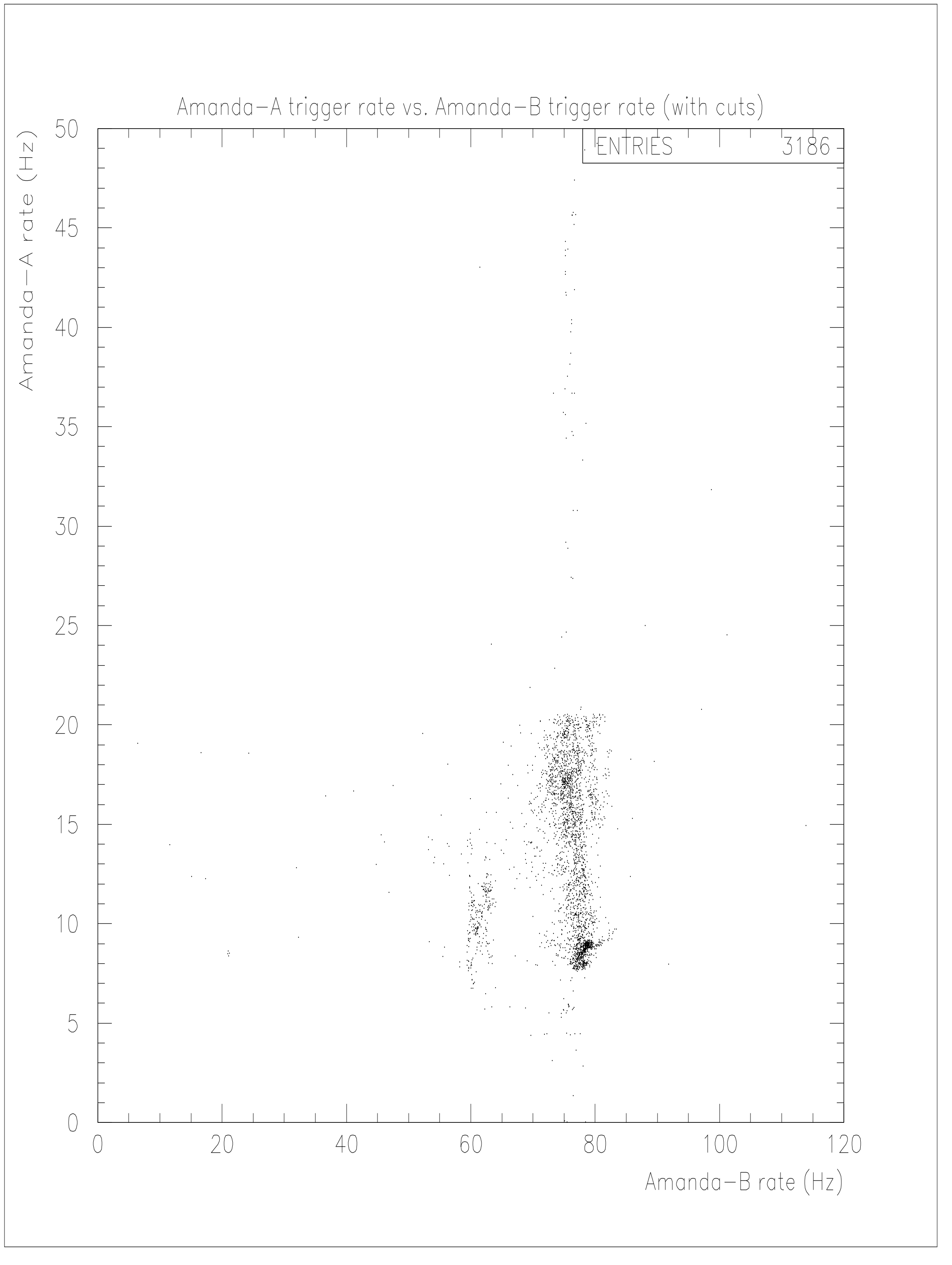

Amanda−A trigger rate vs. Amanda−B trigger rate (with cuts)
ENTRIES 3186
Amanda−A rate (Hz)
Amanda−B rate (Hz)
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120

Figure 14:

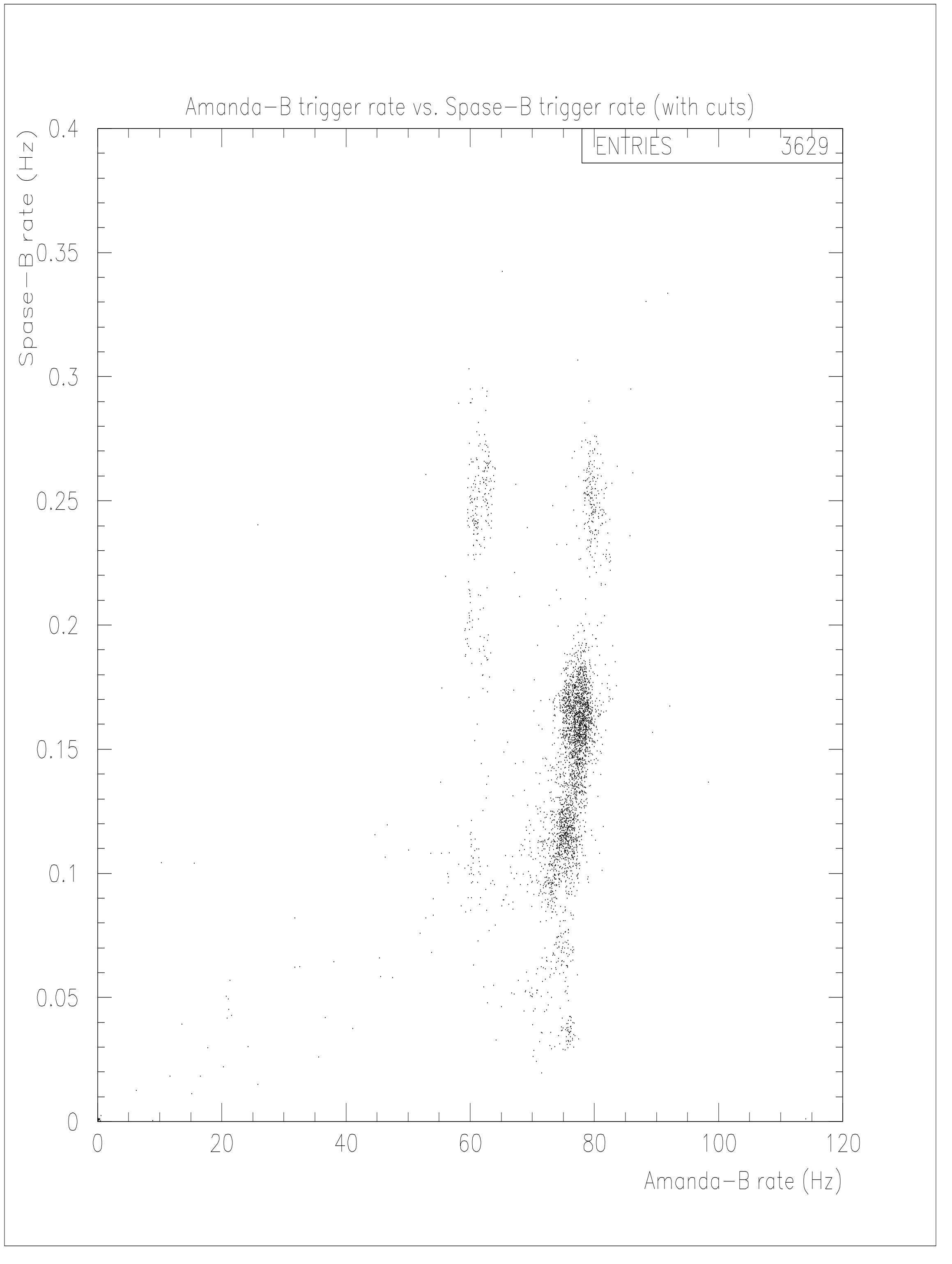

Amanda–B trigger rate vs. Spase–B trigger rate (with cuts)
ENTRIES 3629
Spase–B rate (Hz)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
20
40
60
80
100
120
Amanda–B rate (Hz)

Figure 15:

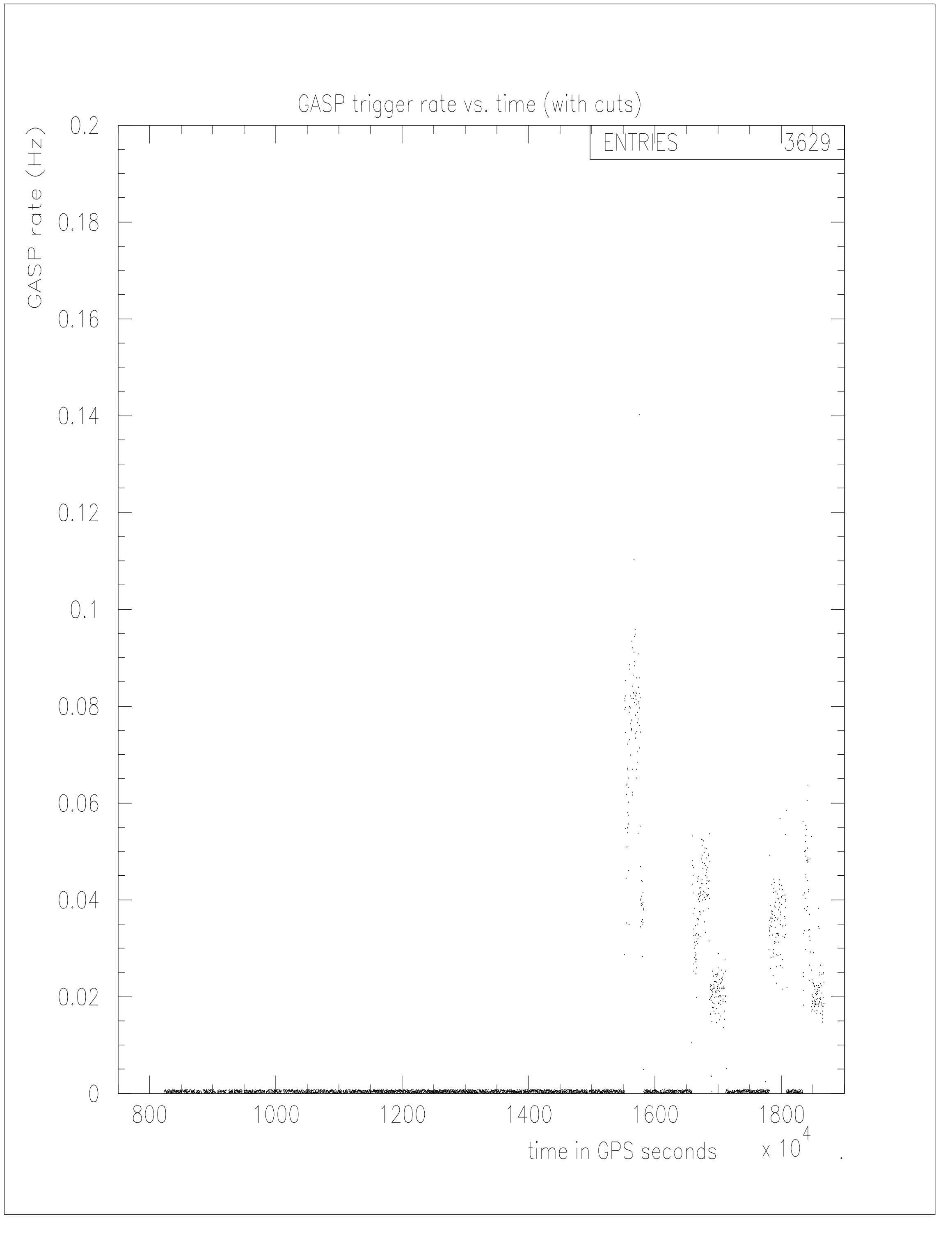

GASP trigger rate vs. time (with cuts)
ENTRIES 3629
GASP rate (Hz)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
800
1000
1200
1400
1600
1800
time in GPS seconds
x 10^4

Figure 16: