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Digital Recordings of Aftershocks of the March 25, 1993, Scotts Mills, Oregon, earthquake

by

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INTRODUCTION

On March 25, 1993, a moderate earthquake occurred near the town of Scotts Mills, Oregon (figs. 1 and 2). The mainshock was located using data from the permanent network of seismograph stations in the region. The location was 45.0352°N, 122.6065°W, at a depth of 20.6 km. The magnitude was 5.7 M_L. Nearly 100 aftershocks were recorded by the permanent network and are shown in fig. 2. The mainshock caused significant structural damage to a number of unreinforced masonry structures in the epicentral area. Damage has been estimated at nearly $21 million (Madin and others, 1993).

The authors began installation and operation of eleven portable digital seismographs on March 25, 1993. The seismographs were operated for 8 days. The primary goal was to contribute data to aftershock locations (P– and S–wave arrival times) and to record data to improve focal mechanism studies of the aftershocks. We located seven seismographs in a rough circle approximately 10 km from the mainshock epicenter. An experiment involving 4 seismographs (at SAT, HOL, DIE, and ORT or ILG (see fig. 2)) located on a line radiating westward from the aftershock cluster was designed to record ground motion in the Willamette River flood plain. These data will be used for further analysis of site response.

Several more seismographs were operated in the epicentral area; the locations are shown in Figure 2. Four REFTEK instruments were installed by a group from USGS, Golden, and six GEOS instruments were operated by a team from USGS, Menlo Park.

This report is intended to facilitate the use of the digital seismograms by other researchers. Tables 1A and B give the location and sensor specifications for each recording station. Appendix A lists all of the trigger times of seismograms recorded by the network. Appendix B contains plots of the seismograms of earthquakes recorded by two or more seismographs. Appendix C is an example data file showing the format (DR–100). The data set is available directly from the author (D. Carver) on 9–track tape.

INSTRUMENTATION AND FIELD PROCEDURE

Each seismograph station consisted of a Sprengnether DR–200 (any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS) portable, self–triggering, digital recorder equipped with a triaxial seismometer. The operating characteristics of the DR–200 seismograph are described in detail by Carver and others (1986).

The velocity transducers used were Sprengnether S–6000 and Mark Products L–22 sensors. Table 1A shows the instrumentation and other operation parameters for each recording site. The record headers in the data set reflect the response characteristics of the seismometer in use at that station. Calibration of the transducers was performed each time recording tapes were changed. The DR–200 internal calibration routine consists of a positive and a negative 0.05 v constant current pulse followed by a positive and a negative 2.5 v constant current pulse. These pulses are sent by the DR–200 to the calibration coils inside the sensors. The DR–200 records the resulting motion of the sensor mass. The record headers in the data set contain the instrumental constants specified by the manufacturer corresponding to each seismometer component.

The DR–200 recording parameters were set up the same way for all installations. The recording parameters of the seismograph at the time of an event are written in the event header. Signals were high pass filtered at 0.2 Hz and low pass filtered (anti–alias) at 50 Hz with a 7–pole Butterworth filter. Sampling was done at 200 samples per second per channel. The 12–bit gain–ranged A/D has four gain levels (three steps) with a magnification of four (2 bits) per step and has an ideal dynamic range of 18 bits (however, because of the limitations of DR–100 format, we have processed only the most significant 16 bits). Gain was set initially at x10, but was later raised to x100 when it became apparent that the likelihood of a large aftershock was small.

The trigger algorithm was a simple short–term average versus long–term average (STA/LTA). Before an event was recorded, both of the horizontal channels were required to exceed a specified signal–to–noise ratio. The parameters of the trigger–algorithm were changed to accommodate the various sites and the general decrease in aftershock magnitude as time went by. The pre–event memory was set at 12.8 s, and total duration of recording varied from 15 to 30 s.

Seismometer placements were buried with the top of the case visible, allowing for frequent checks to insure that the seismometers were level. Seismometers were always oriented with channel 2, (the North–South component) aligned with magnetic North. Table 1B lists sensor specifications including their orientation with respect to the conventional (up, north, and east motion yields positive output). The correct orientations are included in the headers of the data files. Please note, however, that the plots in Appendix C are not corrected for orientation. Therefore, some components are reversed.

A portable master clock was used to determine seismograph clock corrections with a built–in time comparator. The seismograph clocks were compared each day with the master clock. Careful notes were kept of clock corrections for both the seismograph clocks relative to the master clock and the master clock relative to standard time from a GOES satellite time receiver.

Final clock corrections to the event trigger times were made in the event headers by first correcting the seismograph clock corrections for master–clock drift. The appropriate seismograph clock correction was then derived by linear interpolation between the two clock corrections closest to the trigger time. This procedure yielded corrected event trigger times that are accurate to within ± 5 ms of UTC. This conclusion is supported by Appendix A which includes graphical plots of instrument clock drift rates. The typical operation procedure was to install a station and start the internal clock automatically with a pulse from the master clock. Thus, the clocks started with a time correction of 0. The stations were usually visited every day to change recording tape (if necessary), check the system operation, and determine the seismograph's clock drift. Notes were taken in the field and later entered into the computer so that the time corrections could be computed.

FIELD OPERATIONS

Deployment of the temporary seismograph network began the evening after the mainshock. Three instruments were installed that night. Table 1A shows the installation dates and times for each of the recording sites. After initial deployment, the sites were visited each day, tapes were changed, and clock drift was determined. Clocks were generally allowed to run continuously; however, they were reset if the clock correction exceeded 70 ms.

Seismographs were replaced at DIE and LOM on days 086 and 088, respectively, when malfunctions became apparent. The seismograph at LOM apparently recorded both the actual aftershock ground motion and a calibration pulse each time the seismograph was triggered. We are investigating the source of the problem further. The compromised LOM data is included in the data set, because the data may be useful for some studies. Station ILG was moved to ORT for security reasons on day 089. Other than the move of ILG to ORT, all sensors remained in place and level throughout the experiment.

Preliminary station locations were determined from USGS 7.5 minute topographic maps. With the exception of ORT, all the stations were within 70 meters of structures shown on the maps. This aided in the accurate determination of station coordinates from the map. In some instances locations were also determined using a Magellan GPS NAV 1000 PRO hand–held GPS receiver. At three of the stations (WIL, ILG, and SAT) GPS locations were not available. At BYR, LAN, and LOM, the GPS locations quality indicators were very poor and the locations were discarded. At CAL, ORT, and SMI, the GPS locations differed from the map locations by 50–100 m and the map locations were judged to be more accurate. At DIE and HOL, the GPS and map locations were differed by 13 and 32 m, respectively. It was only at these two stations

that the GPS locations were judged as probably having the same accuracy as the locations derived from the map. The final adopted station locations are derived from the map work and are believed accurate to wtihin 10–20 m.

DATA SET DESCRIPTION

A total of 869 three–component digital seismograms was recorded beginning March 25 through April 1, 1993. All seismograph triggers (listed in Appendix B) have been included in the data set, regardless of whether or not they could be associated with a located earthquake. Earthquake seismograms recorded by three or more seismographs are shown in Appendix C. Appendix C also includes the output of a computer program that associates trigger times that occur at three or more stations using a sliding time window. The program also attempts to associate these times with aftershock origin time, location, and magnitude.

The original data cassettes recorded by the seismographs were played into an IBM–compatible PC using software called OL–V200 (Leland Bond, University of Washington, 1987). The data on the PC were then transferred to a micro–Vax computer via Pathworks, then converted to DR–100 format, a compact block–binary format. In DR–100 format each single–component file consists of a 512 byte header followed by data blocks. There is one integer leader record (256 2–byte integer) and one real header block (128 four–byte real), followed by one or more integer data blocks (256 two–byte integer).

Appendix D is a description of the DR–100 format used for the data. Each seismic record is stored as a separate file whose name is a unique 13–character string constructed from the trigger time (UTC), component, and station name. Characters 1–3 represent day of year (001–366), characters 4–5 = hour (00–23), characters 6–7 = minute (00–59), character 8 = second code (A–T, where A = 0.000 – 2.999, B = 3.000 – 5.999, ... T = 57.000 – 59.999), character 9 is the component code (4 is vertical–component velocity, 5 and 6 are North–South and East–West horizontal component velocity, character 10 is ".", and characters 11–13 are the three–letter station names.

Copies of the entire data set in DR–100 format on 9–track tape are available from the author:

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P.O. Box 25046, MS 966
Denver Federal Center
Denver, CO 80225
(303) 273–8552

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REFERENCES

Carver, D.L., Cunningham, D.R., and King, K.W., 1986, Calibration and acceptance testing of the DR–200 digital seismograph: U.S. Geological Survey Open–File Report 86–430, 2 p.

Madin, I.P., Priest, G.R., Mabey, M.A., Malone, S., Yelin, T.S., and Meir, D., 1993, March 25, 1993, Scotts Mills earthquake – western Oregon's wake–up call: Oregon Geology, v. 55, no. 3, p. 51–57.

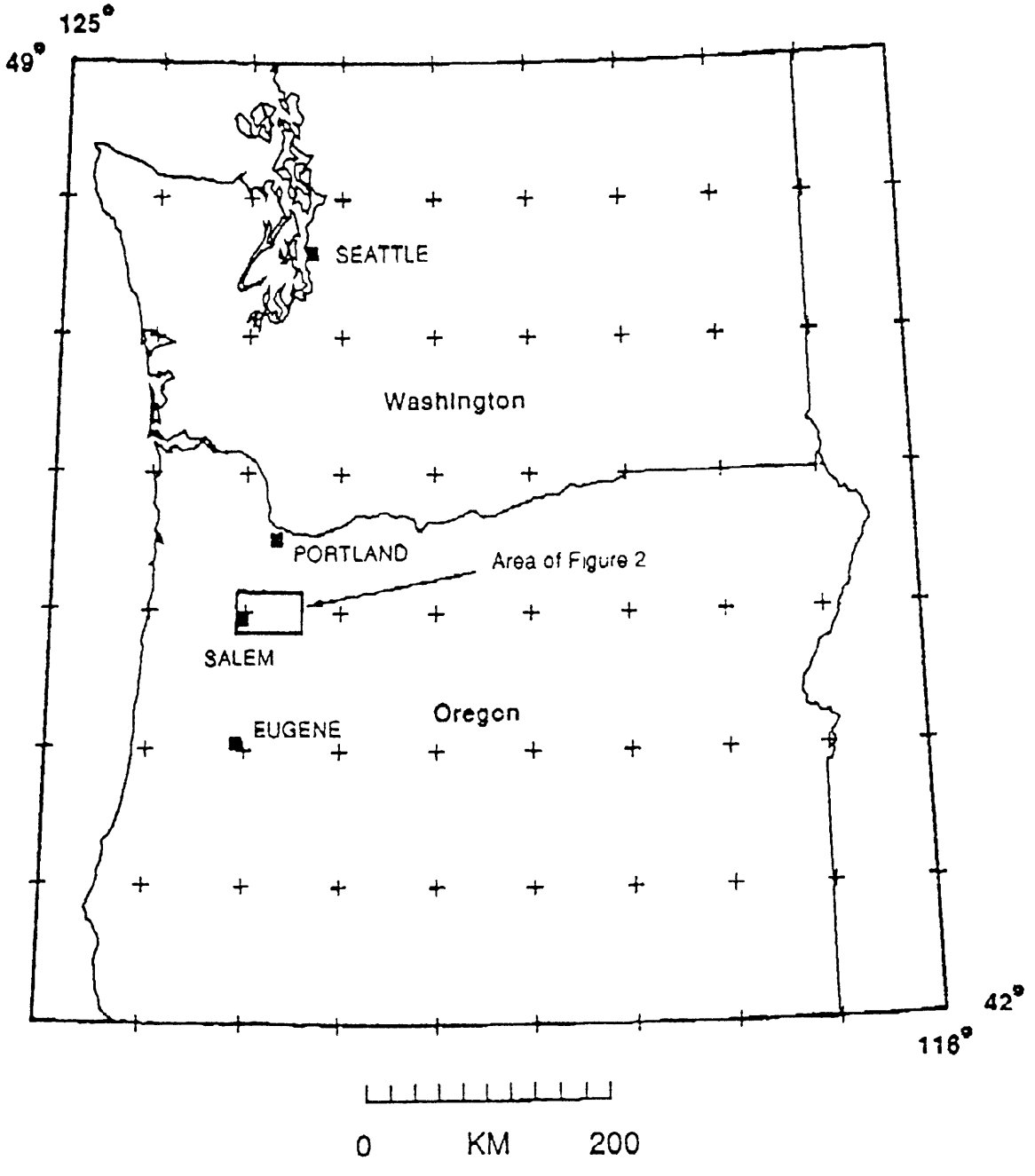


Figure 1—Map showing the location of the Scotts Mills earthquake study area in the Pacific Northwest.

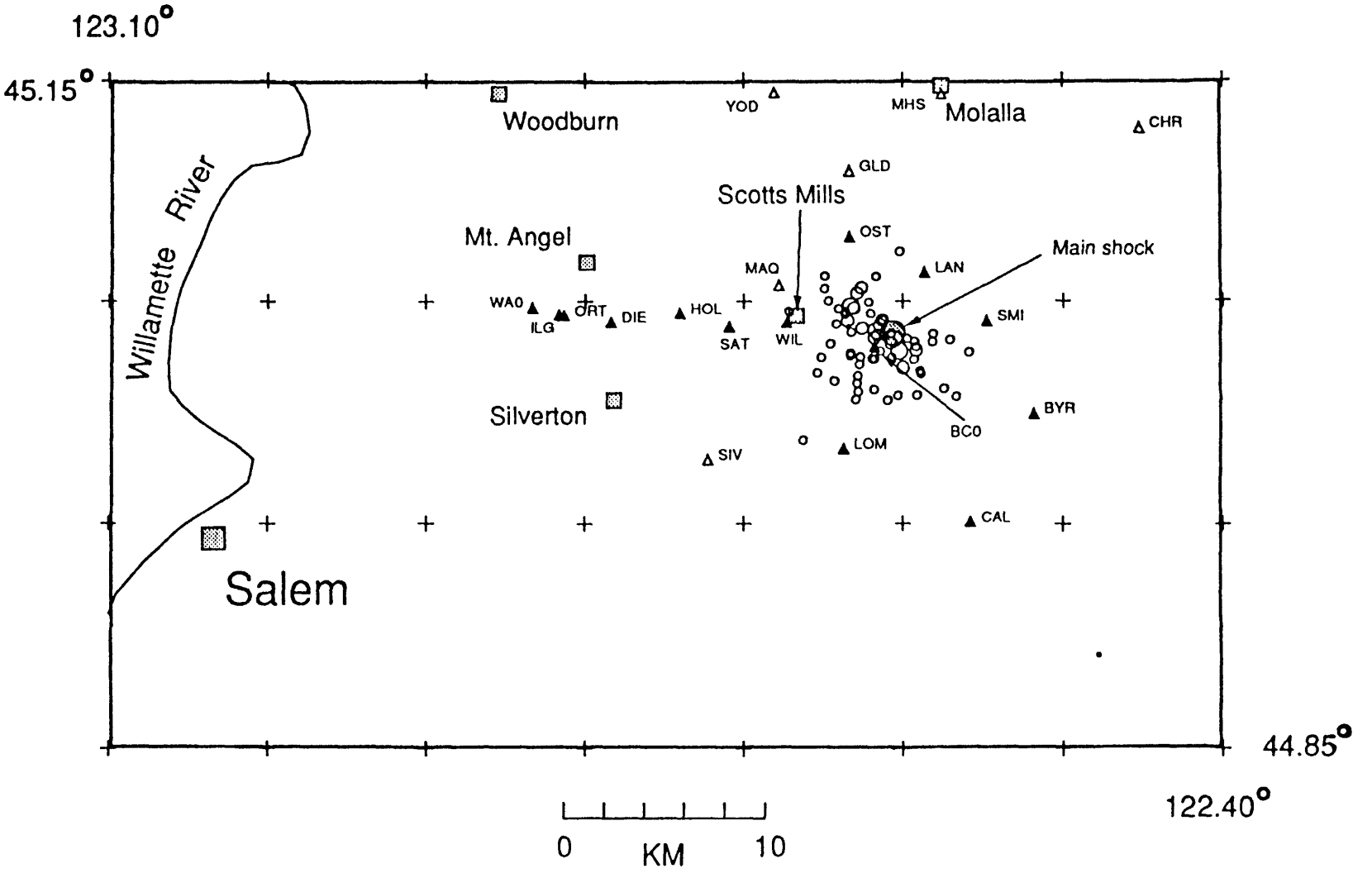


Figure 2--Map showing the Scotts Mills, Oregon area. Small circles represent aftershock locations made using the permanent seismograph network (T. Yelin, personal commun., 1993). Solid triangles represent locations of our DR-200 seismographs except stations WAO and BCO which were sites occupied by Reftek seismographs. GEOS seismographs were located at sites represented by open triangles.

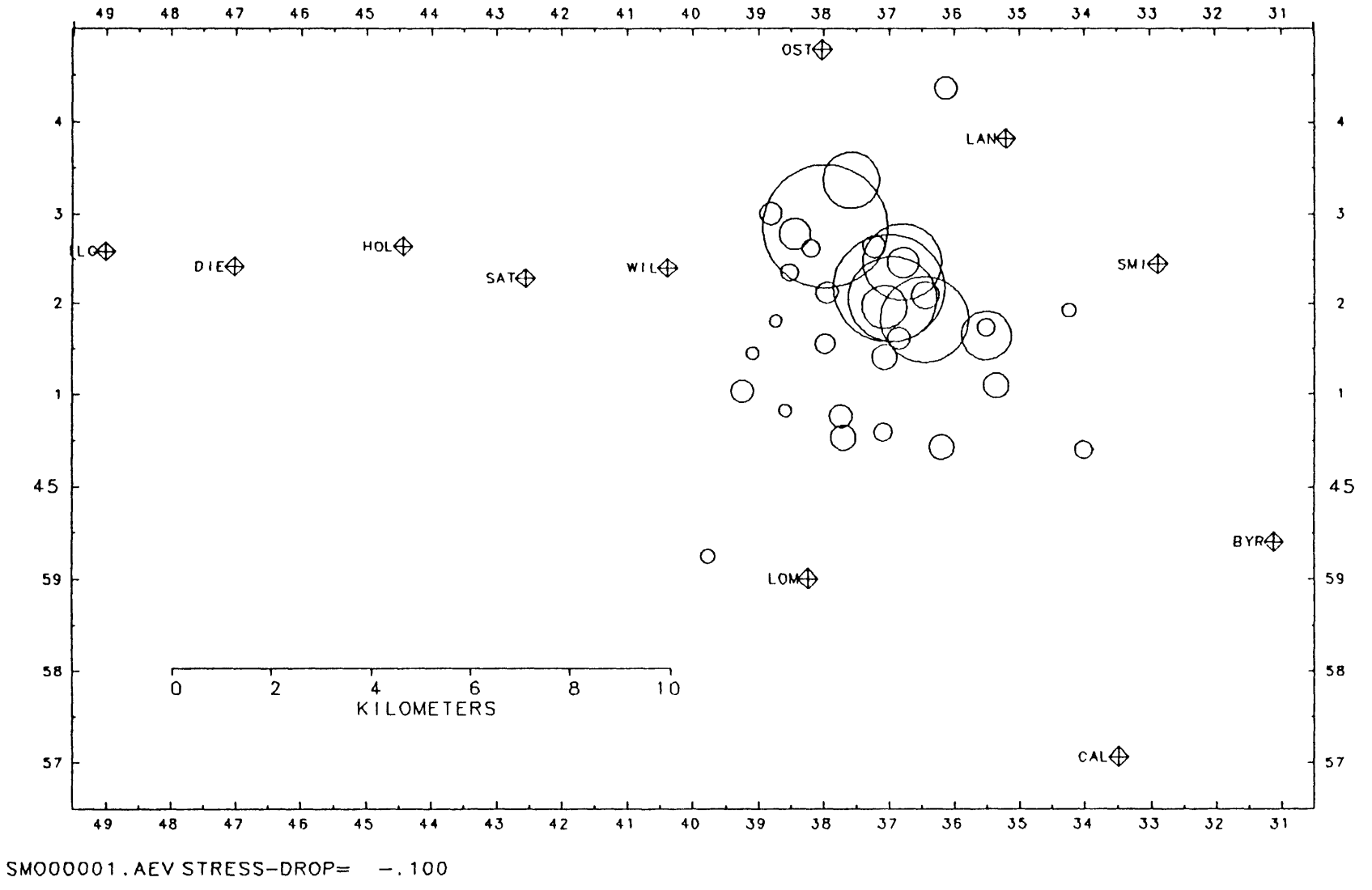


Figure 3--Map showing the Scotts Mills, Oregon area. Aftershocks that were recorded by two or more temporary DR 200 seismograph stations are indicated by circles. Diamonds show the station locations.

TABLE 1A. Recording station parameters

Station	Latitude(°N)	Longitude(°W)	Elevation(m)	Date Installed	Date Removed	Sensor	Placement
BYR	44.9990	122.5187	660	3/28/93@00:20	4/01/93@19:06	L–22	Buried
CAL	44.9511	122.5581	615	3/26/93@18:50	4/01/93@19:51	S–6000	Buried
DIE	45.0403	122.7838	064	3/27/93@21:08	4/01/93@23:38	S–6000	Buried
HOL	45.0442	122.7407	092	3/27/93@20:05	4/01/93@23:00	S–6000	Buried
ILG	45.0432	122.8168	052	3/27/93@22:05	3/29/93@20:45	S–6000	Buried
LAN	45.0636	122.5868	207	3/26/93@05:33	4/01/93@18:12	S–6000	Buried
LOM	44.9835	122.6373	277	3/26/93@22:50	4/01/93@21:54	S–6000	Buried
ORT	45.0431	122.8136	055	3/29/93@21:29	4/01/93@23:30	S–6000	Buried
OST	45.0797	122.6336	159	3/26/93@04:41	4/01/93@17:50	S–6000	Buried
SAT	45.0381	122.7093	181	3/27/93@23:20	4/01/93@22:43	S–6000	Buried
SMI	45.0409	122.5482	415	3/26/93@06:15	4/01/93@18:42	S–6000	Buried
WIL	45.0402	122.6731	216	3/26/93@22:00	4/01/93@21:54	S–6000	Buried

TABLE 1B. Sensor specifications

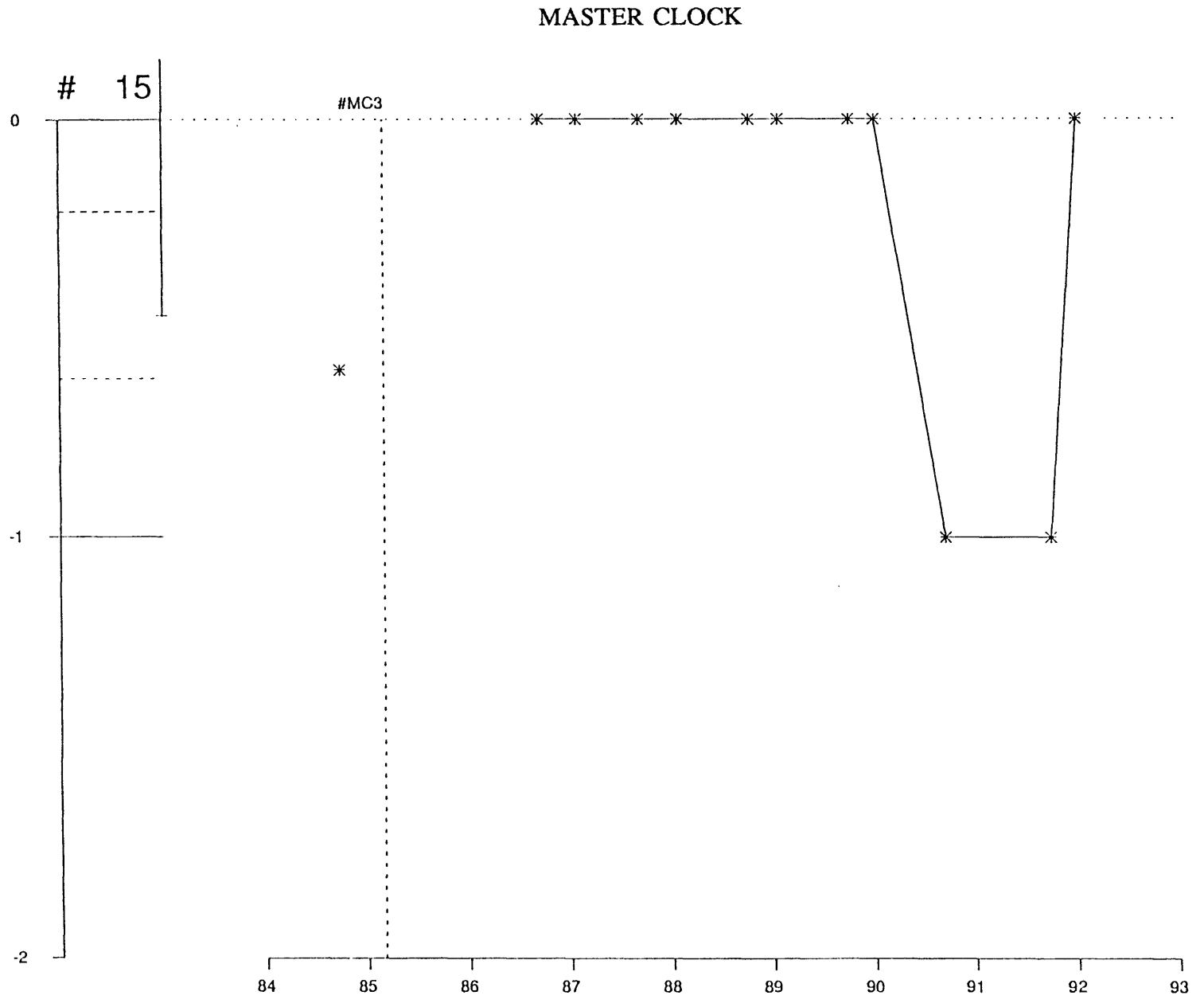
Sensor	Natural frequency (Hz)	Damping ratio	Effective generator constant (v/cm/sec)	Orientation Z	Radial (N–S)	Transverse (E–W)	Manufacturer
S–6000	1.7	0.6	1.20	000	180	090	Sprengnether
L–22	2.0	0.66	0.93	180	180	270	Mark Products

APPENDIX A.
Seismograph clock drift rates

APPENDIX A. Seismograph clock drift rates

Each autonomous seismograph has an internal clock which controls sample rate and provides the time of the initial sample of each trigger. Since the clocks are autonomous, they drift with respect to a Time Standard. We need to correct the time of each trigger so that all of the seismograph times are as correct as possible with respect to the Time Standard.

These plots show clock drift rates for a given seismograph. The serial number of the instrument is shown in the upper left. Station name is given in the upper center. There are two separate plots per page, but they both use the same vertical axis which is clock correction (given in milliseconds). The left plot gives the average clock correction per day of the clock during the deployment. The I–beam symbol shows the gross error as one standard deviation. The plot on the right has the Julian day as its horizontal axis. Plus or asterisk symbols are plotted for each clock correction measured in the field. Dotted lines connect the graphs where the clocks were reset to zero.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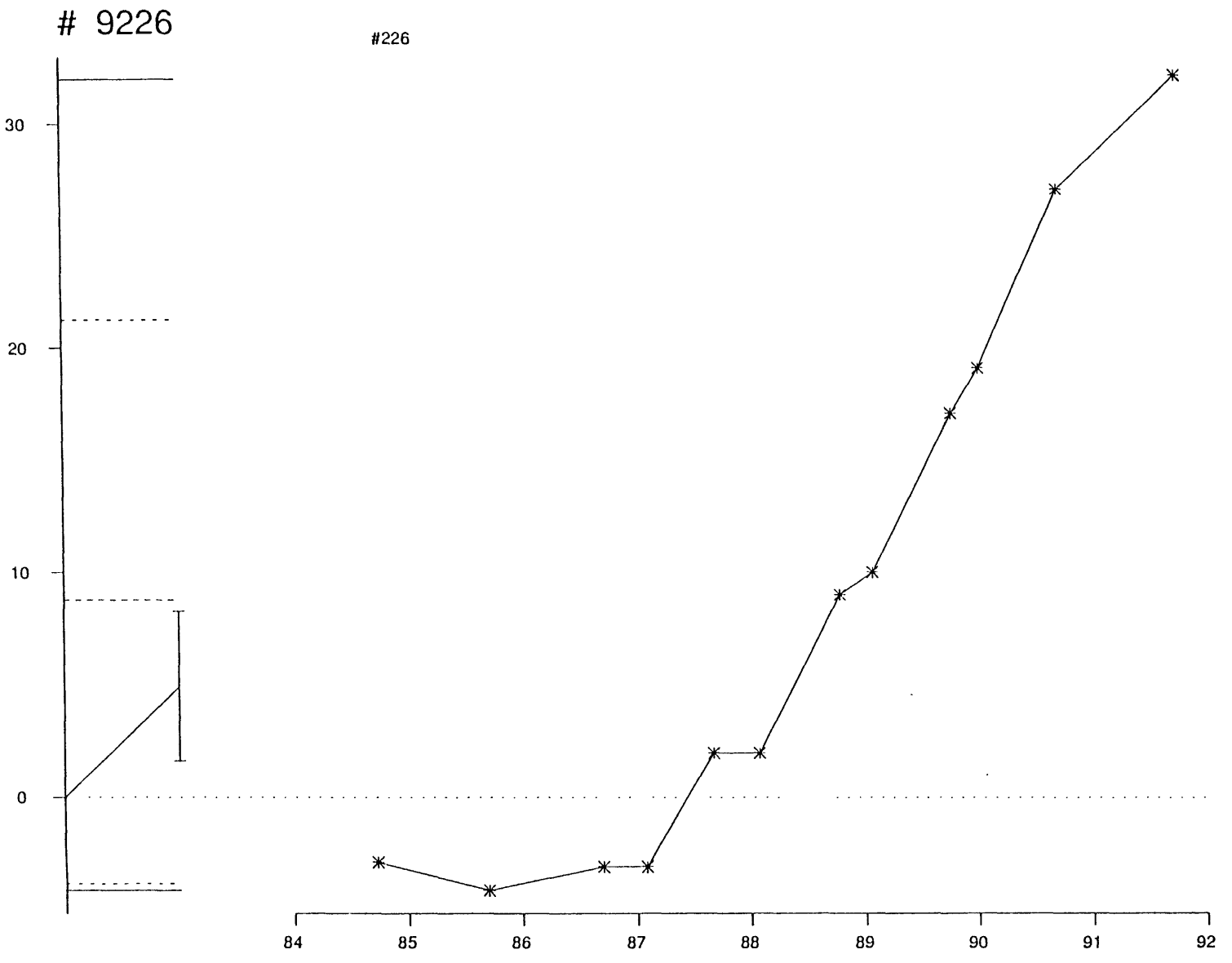
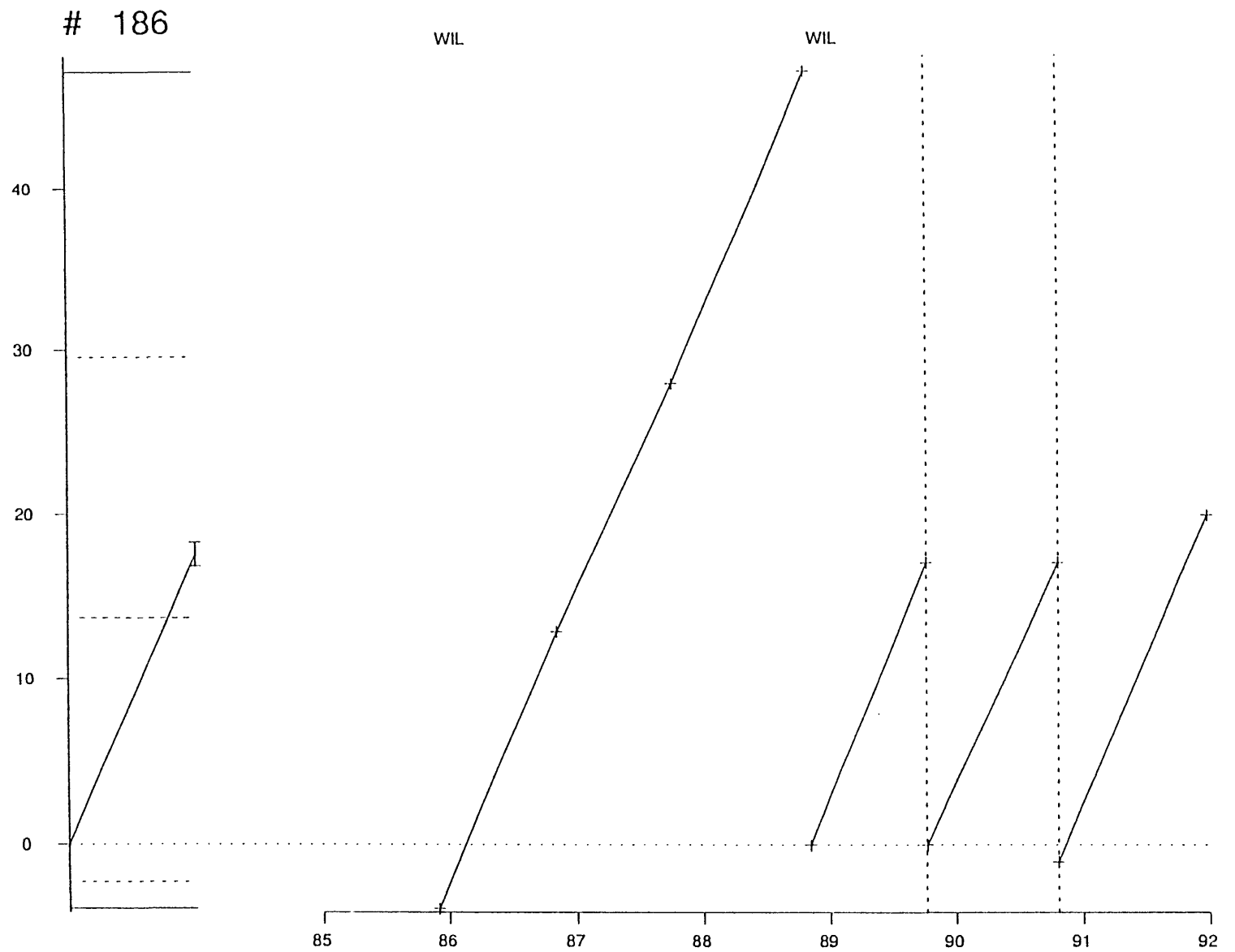
91
92
93

MASTER CLOCK

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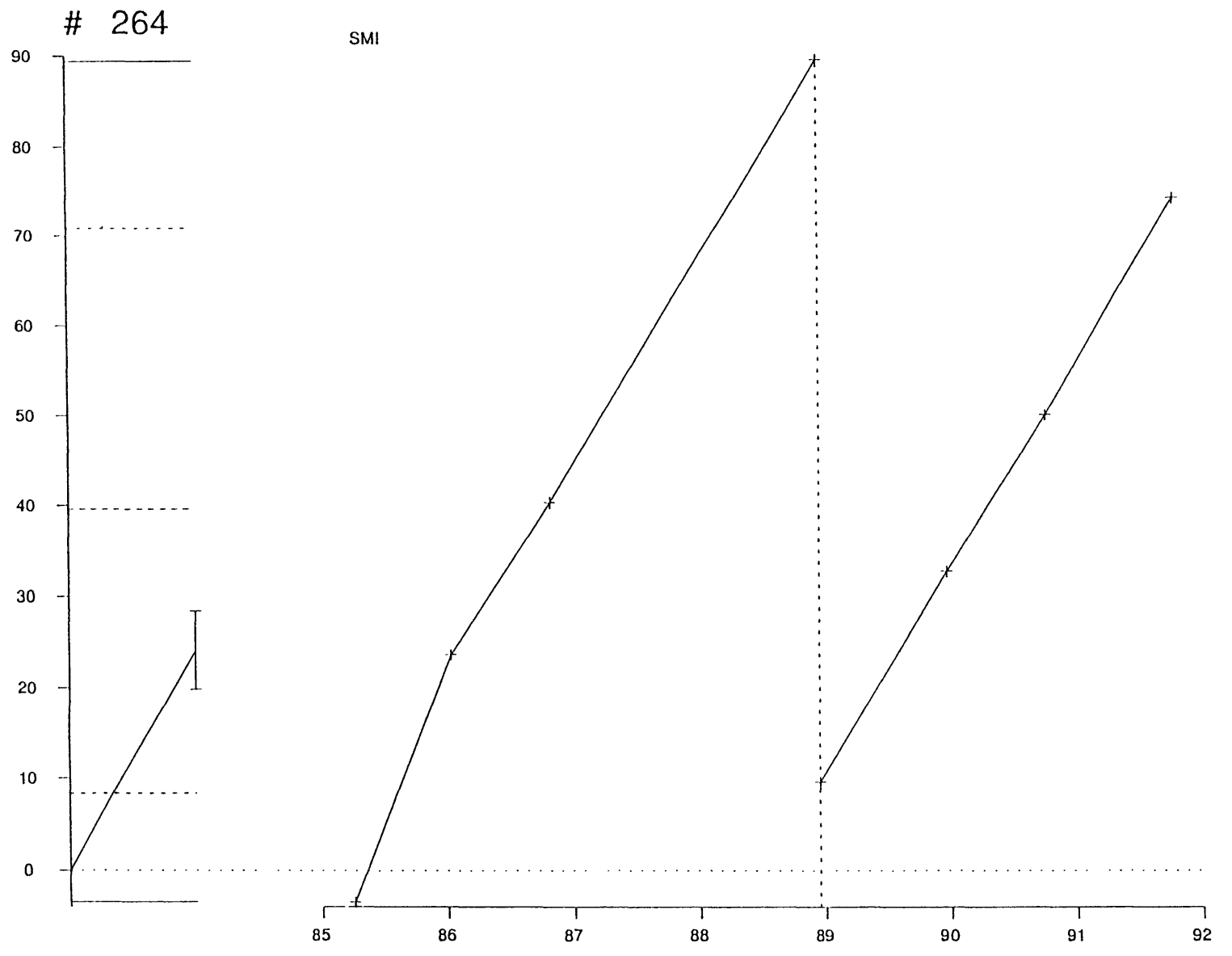
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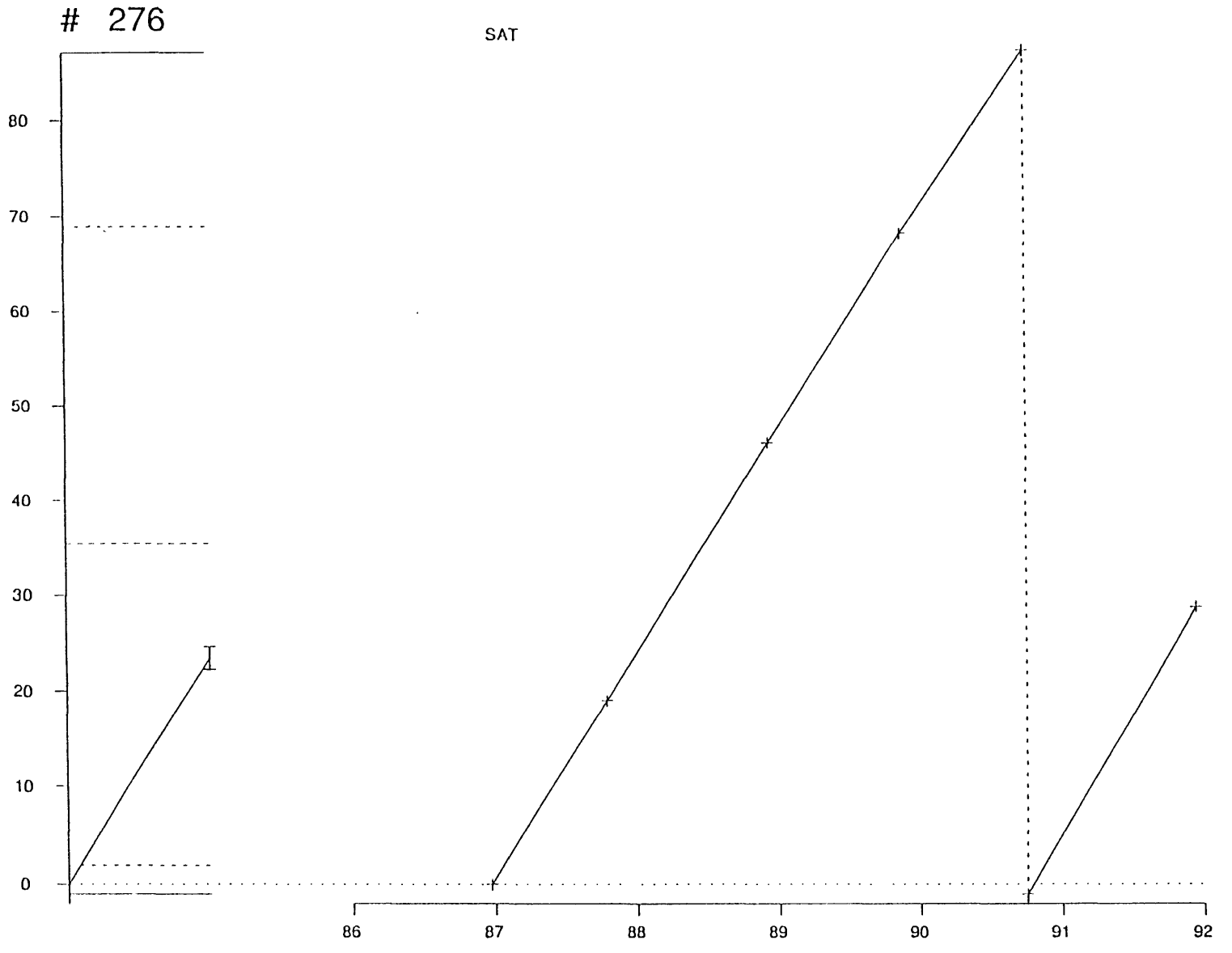
92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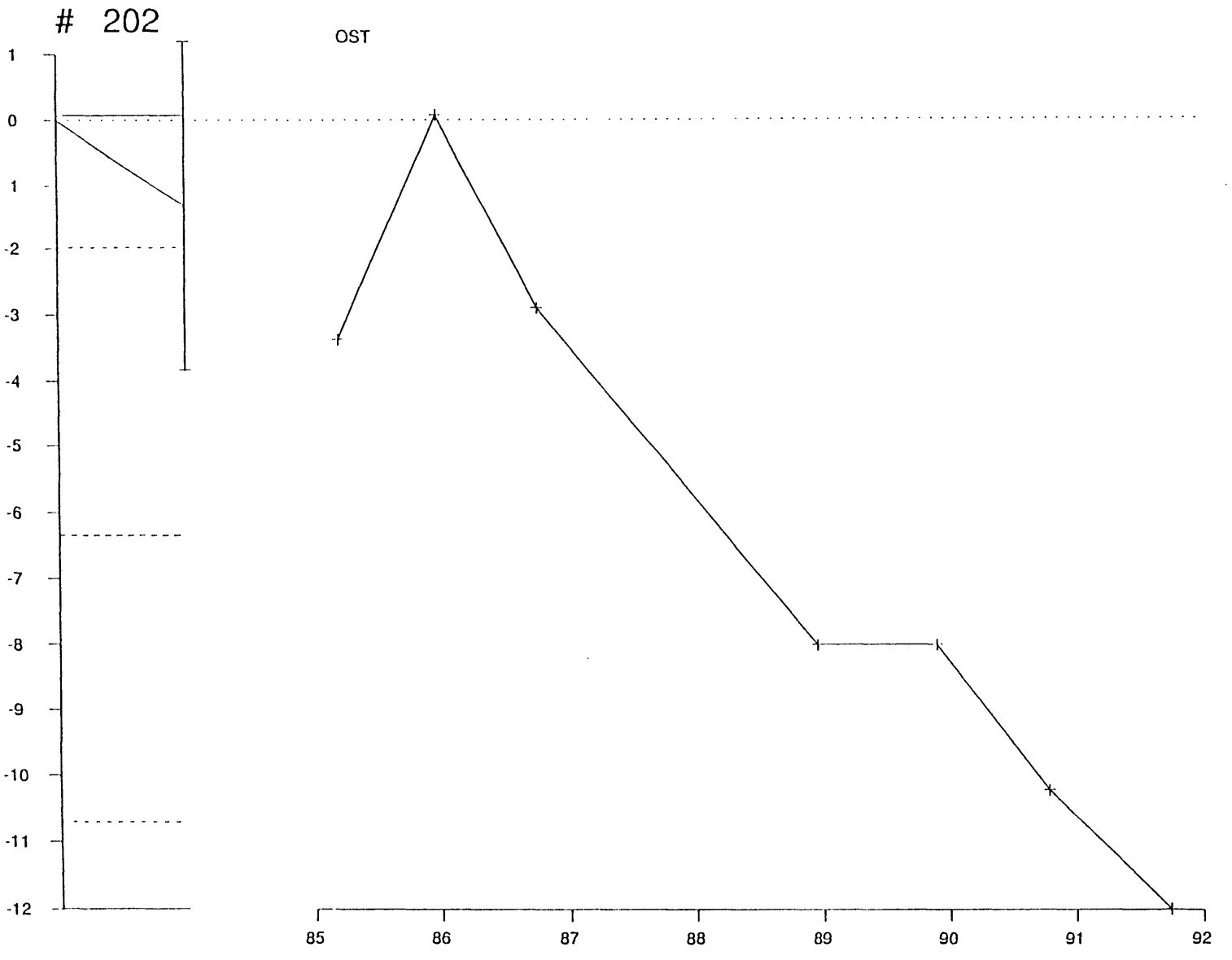
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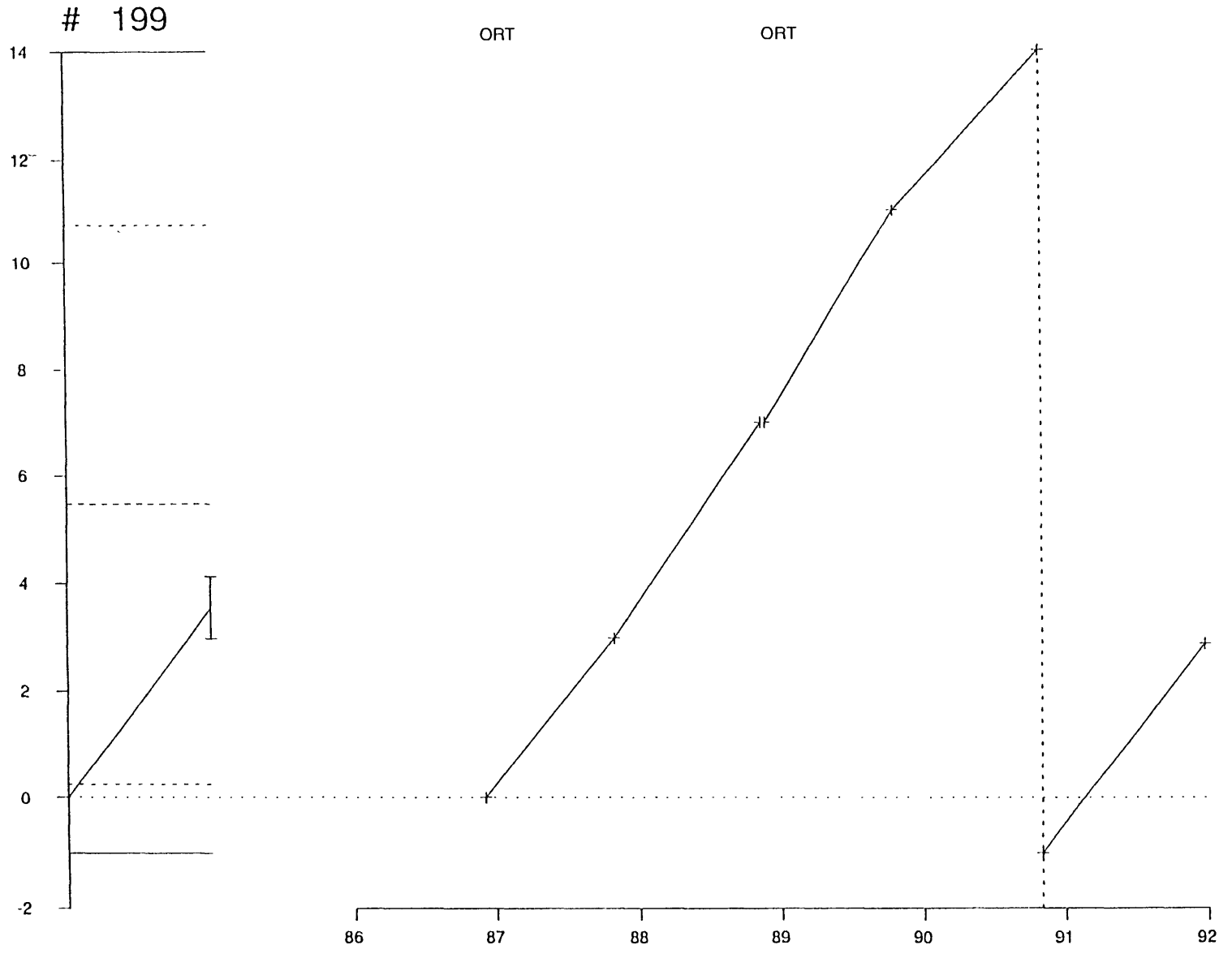
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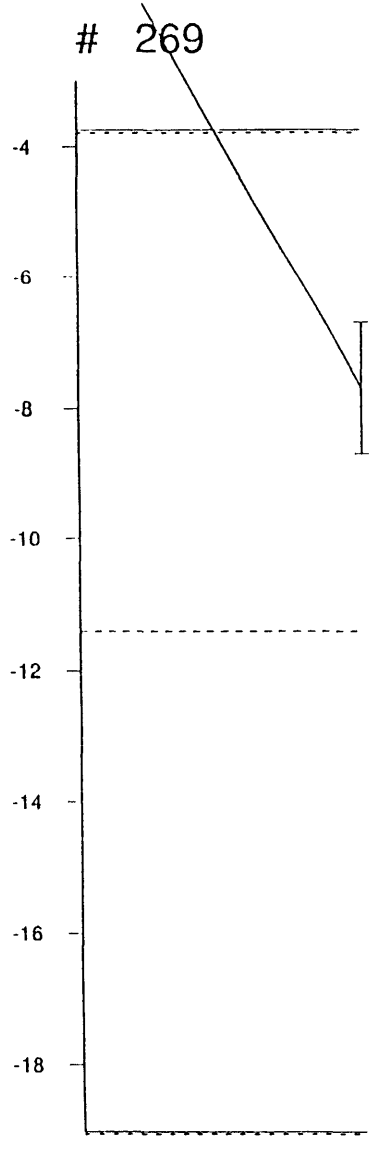
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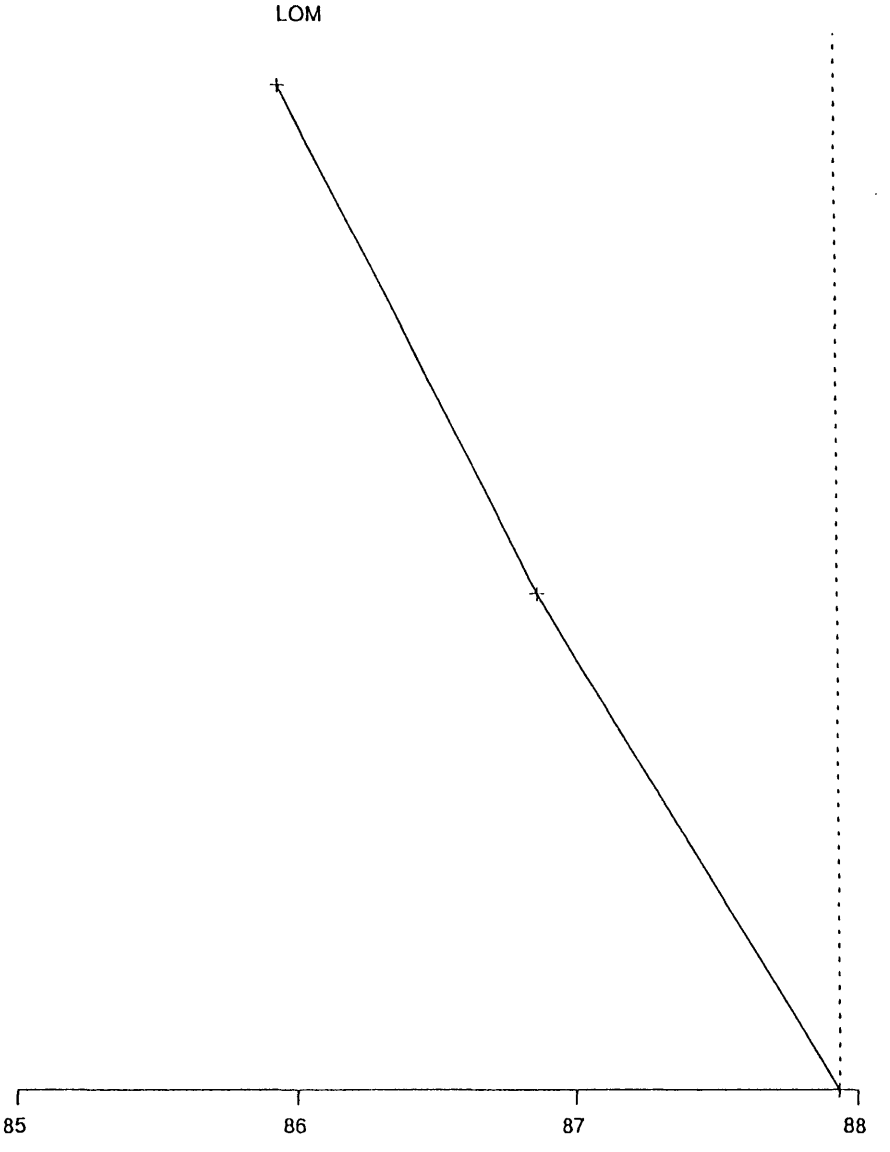
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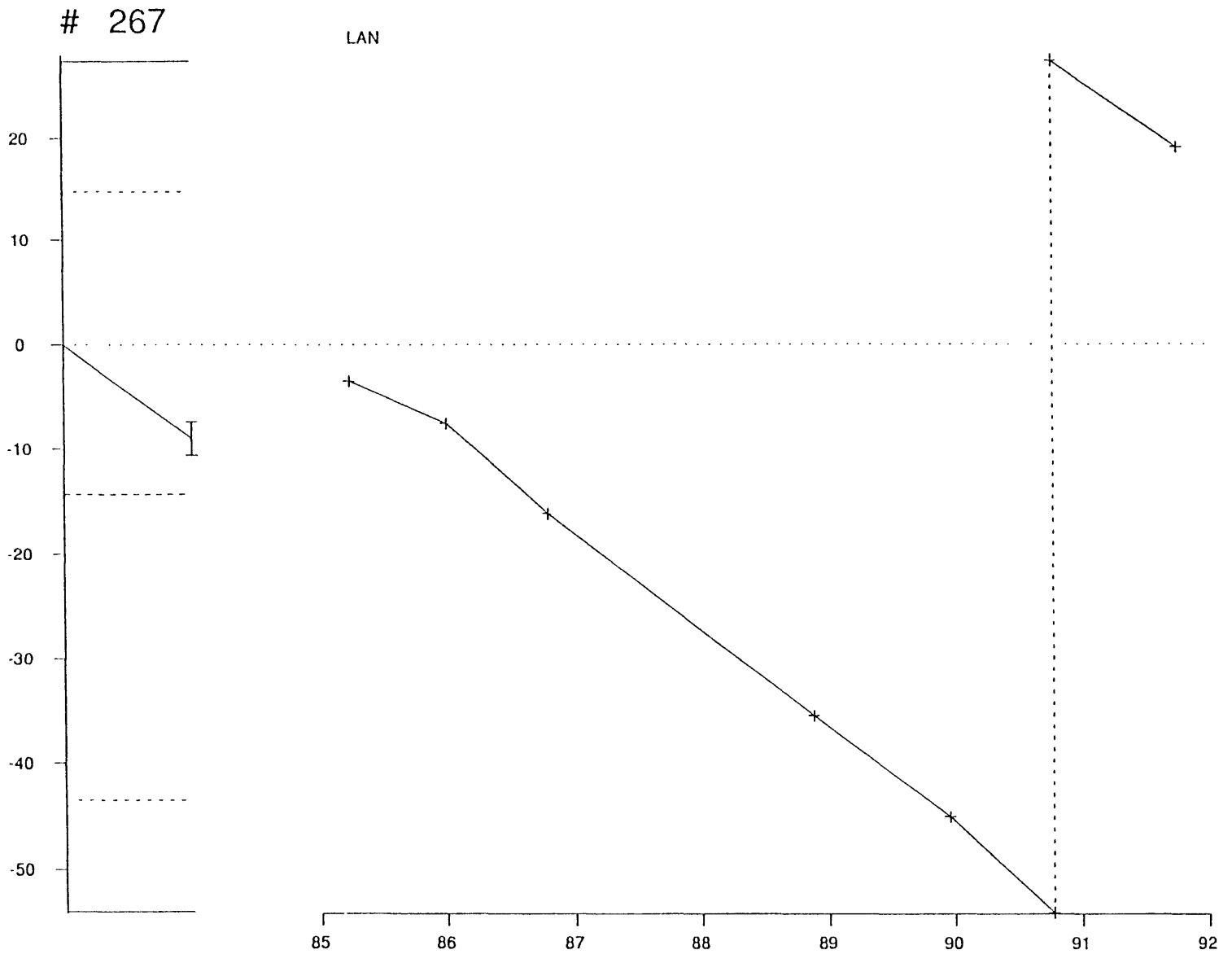
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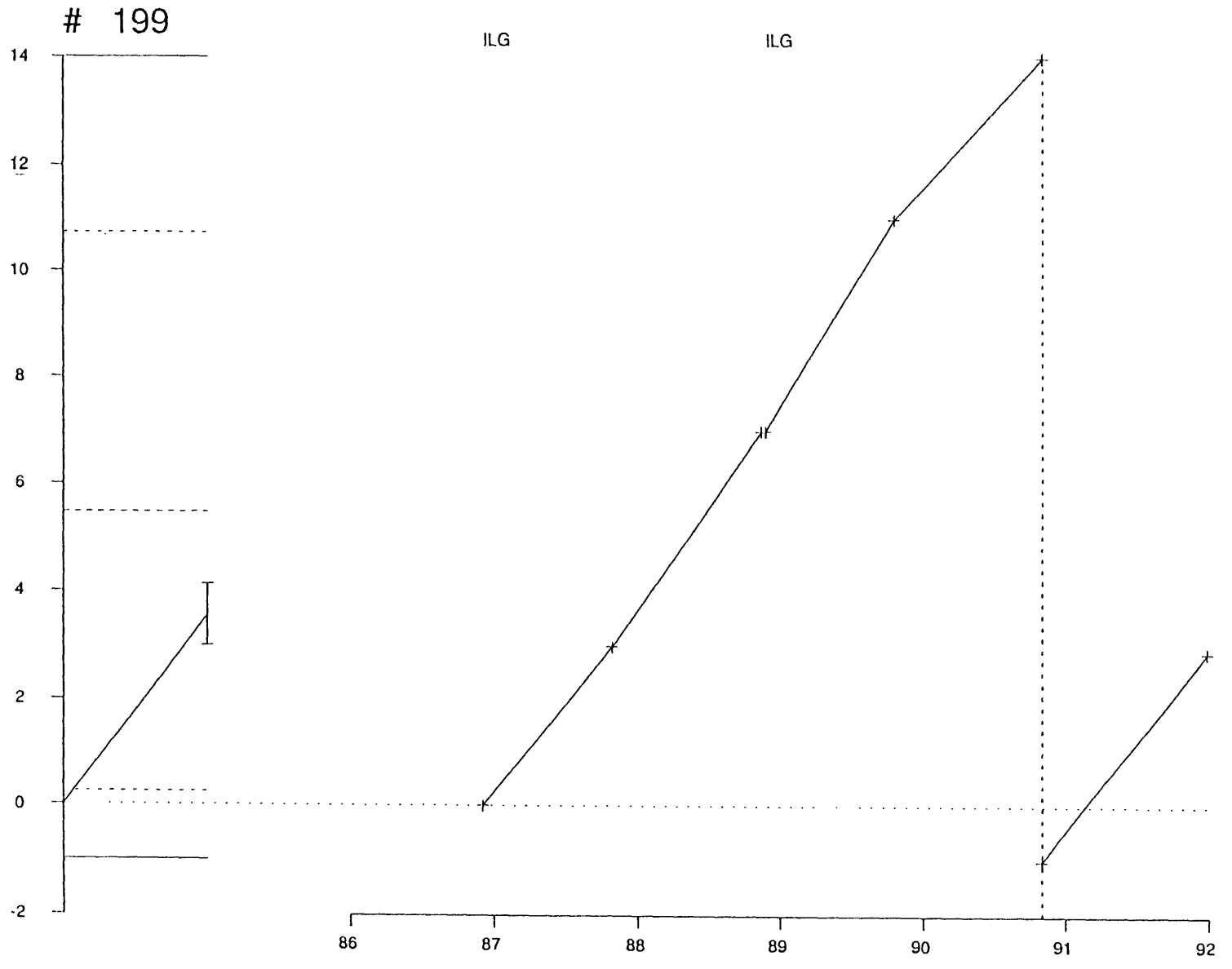
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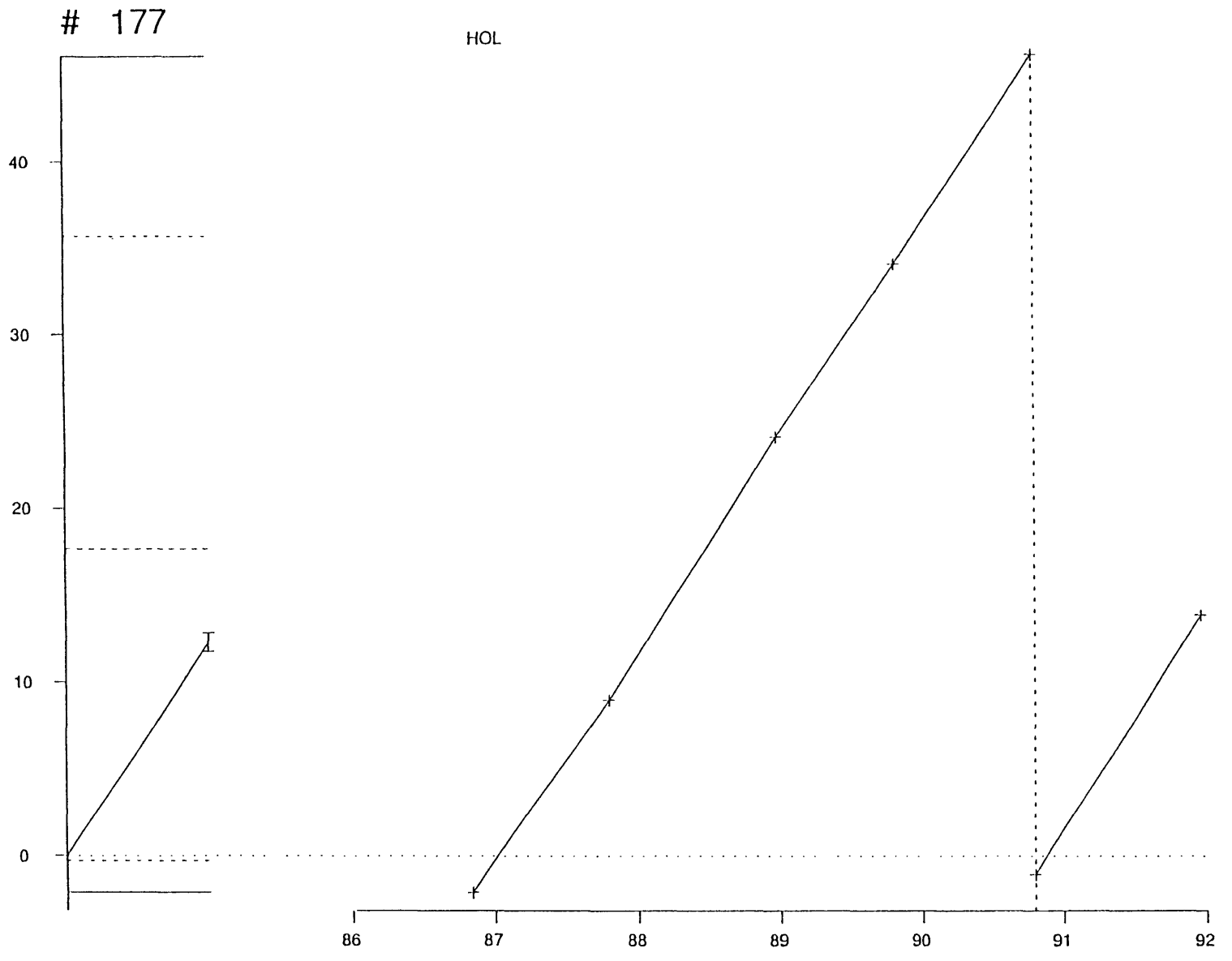
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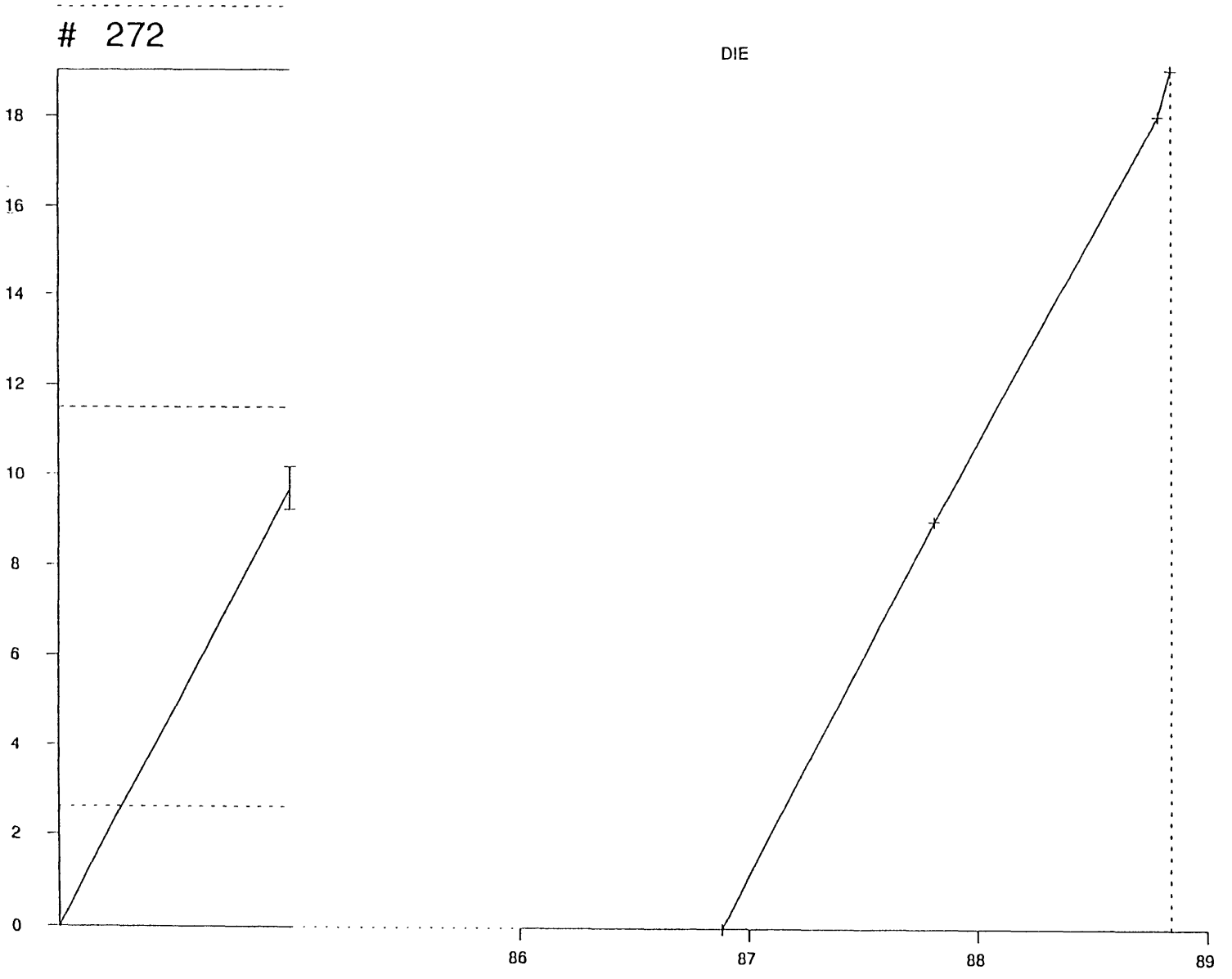
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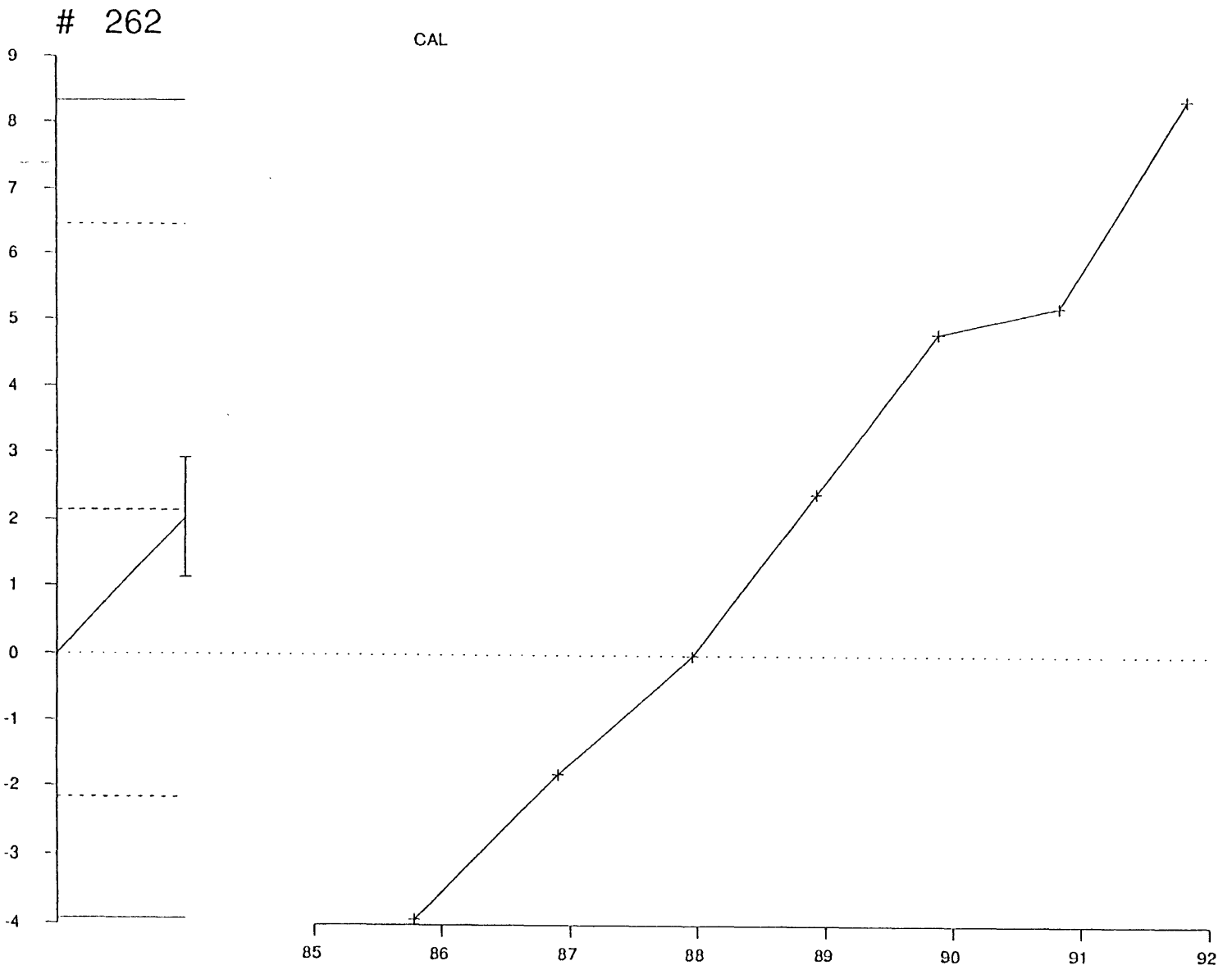
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CAL
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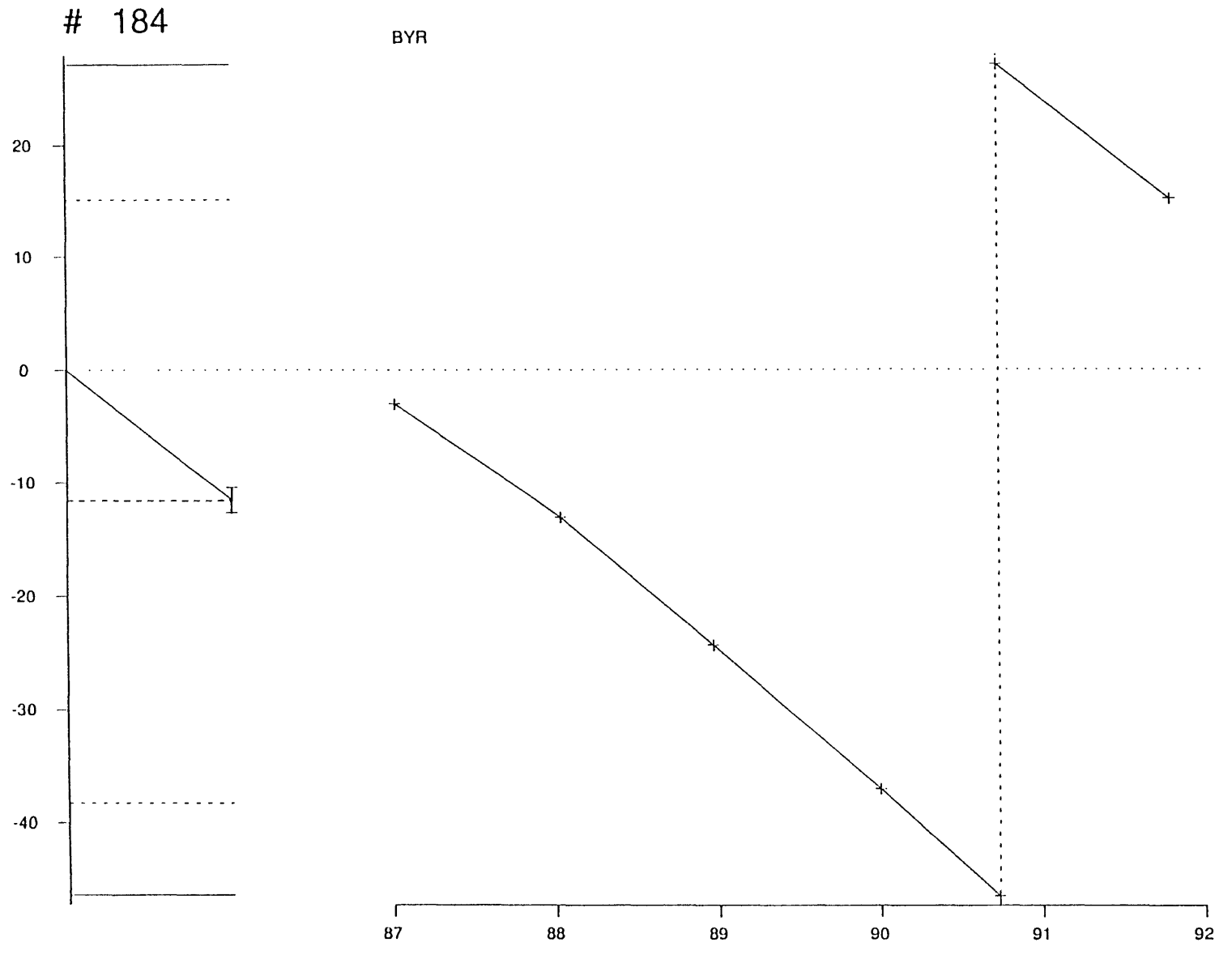
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BYR
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-10
-20
-30
-40
87
88
89
90
91
92

APPENDIX B.
Complete list of trigger times

PATH	DAY HR-MNS STA	LENGTH
E:\SMO\D\OST\A\0850444BA.OST		7361044
E:\SMO\D\OST\A\0850447TA.OST		7361277
E:\SMO\D\OST\A\0850518HA.OST		7363102
E:\SMO\D\LAN\A\0850607MA.LAN		7366057
E:\SMO\D\SMI\A\0850626DA.SMI		7367170
E:\SMO\D\SMI\A\0850628FA.SMI		7367295
E:\SMO\D\LAN\A\0850656GA.LAN		7368980
E:\SMO\D\LAN\A\0850709JA.LAN		7369767
E:\SMO\D\OST\A\0850709JA.OST		7369768
E:\SMO\D\LAN\A\0850735PA.LAN		7371345
E:\SMO\D\SMI\A\0850735PA.SMI		7371347
E:\SMO\D\OST\A\0850735PA.OST		7371347
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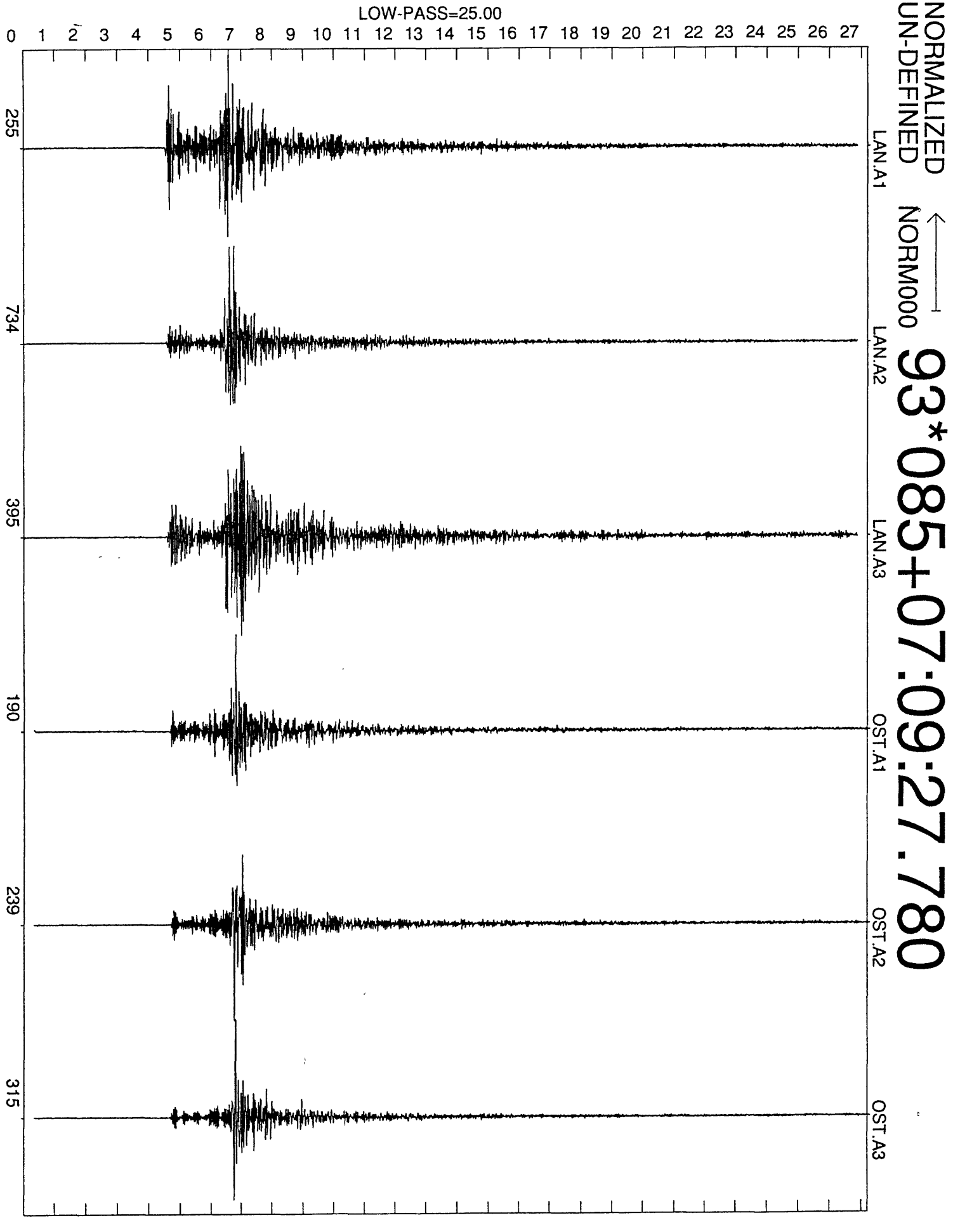
APPENDIX C.
Wave forms of earthquakes recorded at two or more stations

APPENDIX C. Waveforms of earthquakes recorded at two or more stations.

List of aftershocks recorded at two or more seismograph stations in the Scotts Mills, Oregon area. Seismic records were identified by a computer algorithm that found multiple triggers in a 10–s sliding–time window. Earthquakes are listed by the start time of the earliest associated record (Julian day, hour, minute are characters one through seven in the filename). Records (for a given three–letter station code) are indicated by the corresponding second–bin character, i.e., character eight in the filename – A = 0.000 – 2.999, B = 3.000 – 5.999, ...T = 57.000 – 59.999.

Three components are plotted for each station that recorded the aftershock. The traces are identified on the right by station name and component. A1 is the vertically oriented component, A2 is horizontally oriented North; A3 is horizontally oriented East. The peak velocity (expressed in cm/s) of the trace is shown in the left margin. All traces for each event are plotted at the same scale. Time proceeds from left to right and the numbers indicated below are seconds from the time of the first sample of the record.

The computer algorithm also extracted hypocenter information for associated earthquakes from U.S. Geological Survey, Seattle summary files. The hypocenter data were provided by Tom Yelin (personal commun., 1993). We used versions of the summary files that were current at the time of writing this report in June 1993. These hypocenters will be refined during the lifetime of this report and are provided here only to help readers make preliminary correlations between earthquakes and seismograph recordings.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190
239
315
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LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
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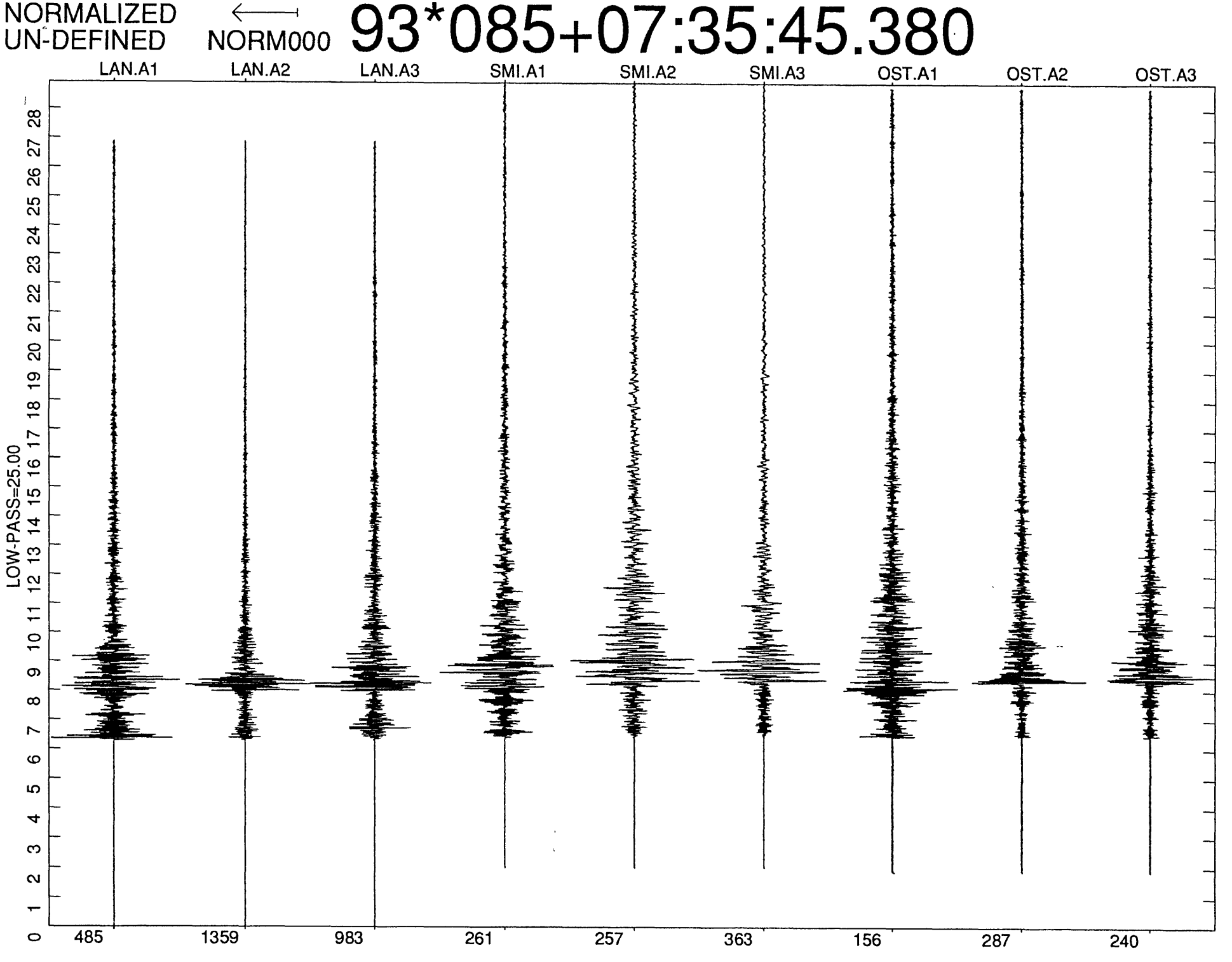
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SMI.A3
OST.A1
OST.A2
OST.A3
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983
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257
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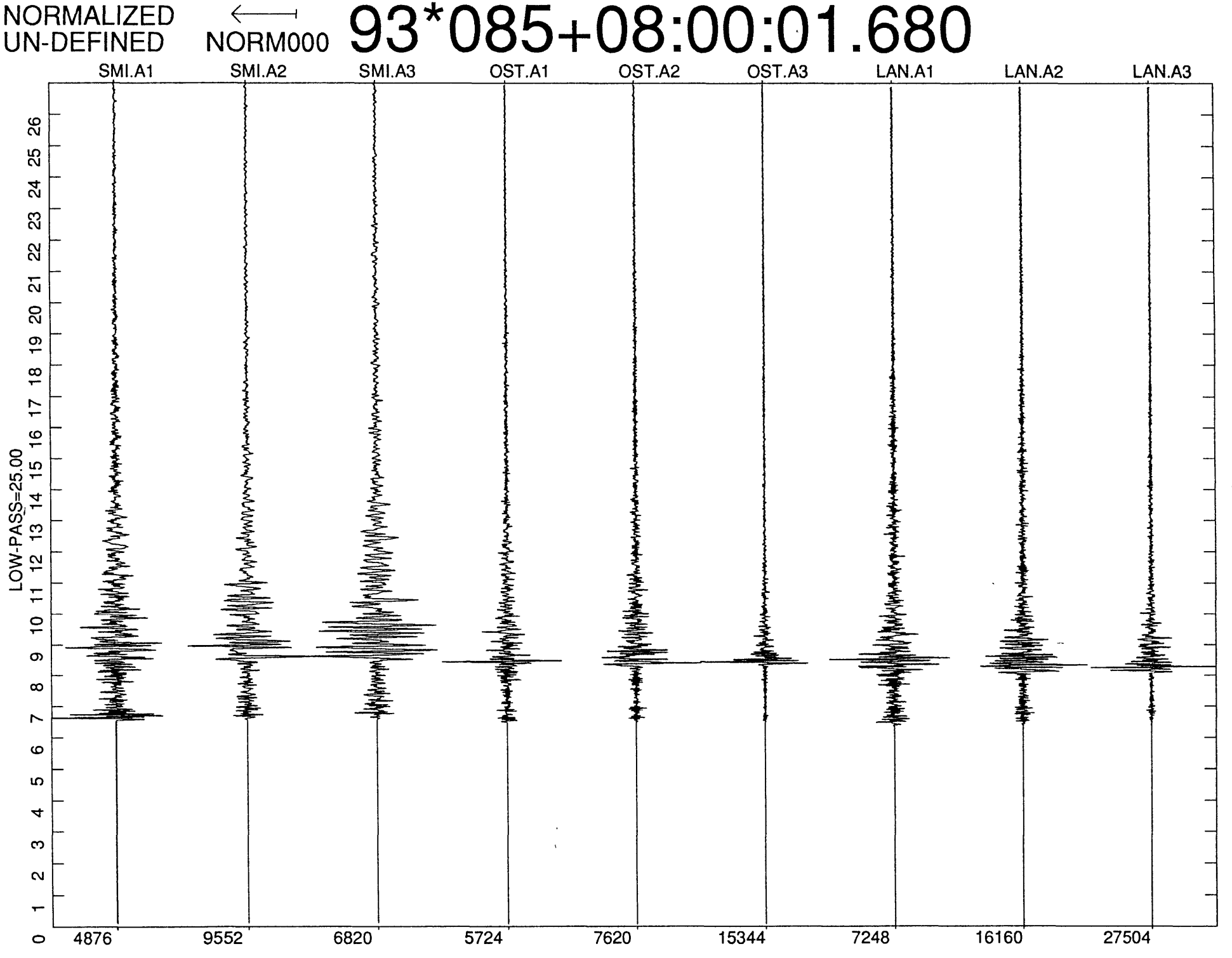
156
287
240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SMI.A3
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OST.A2
OST.A3
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LAN.A2
LAN.A3
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5724
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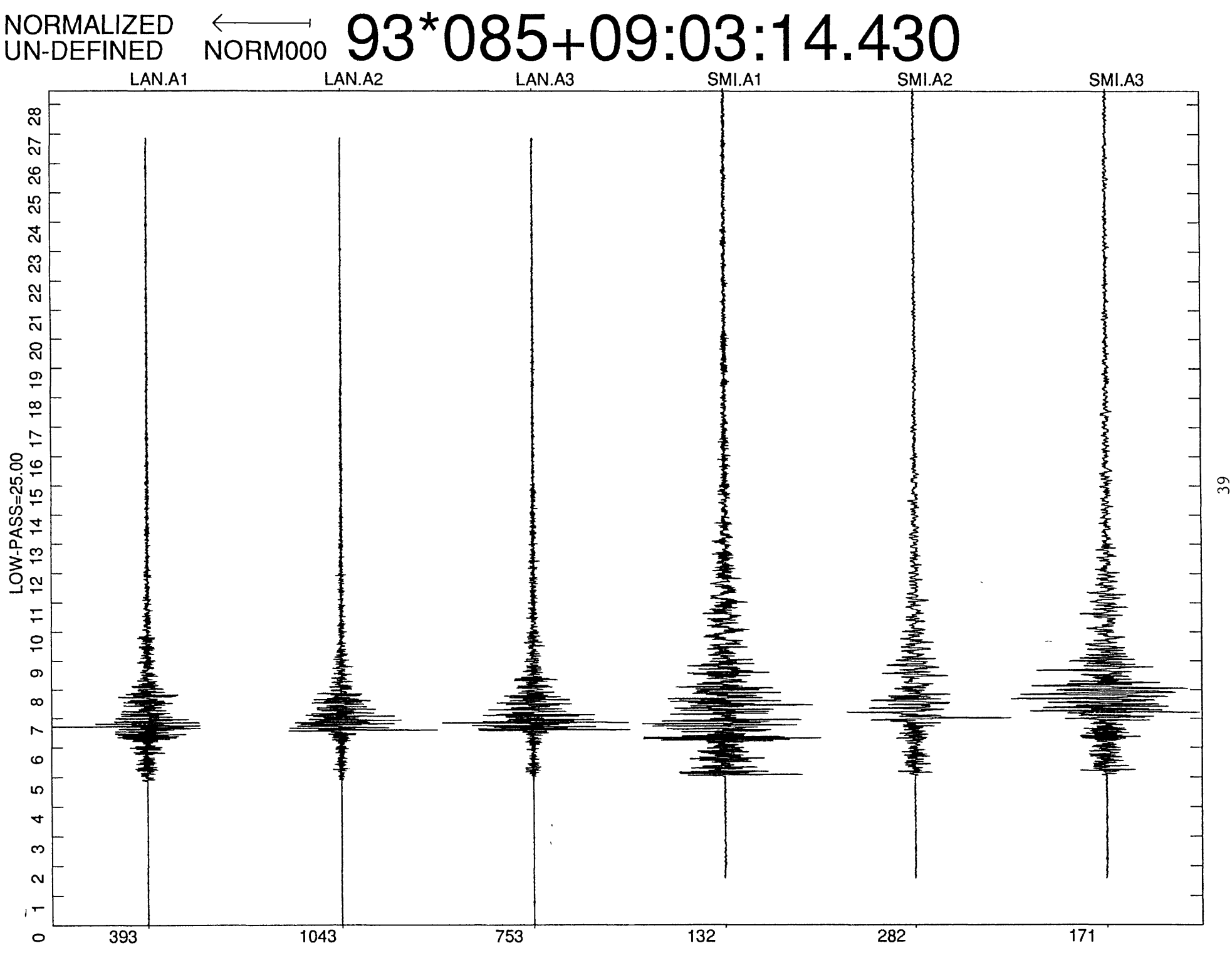
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LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
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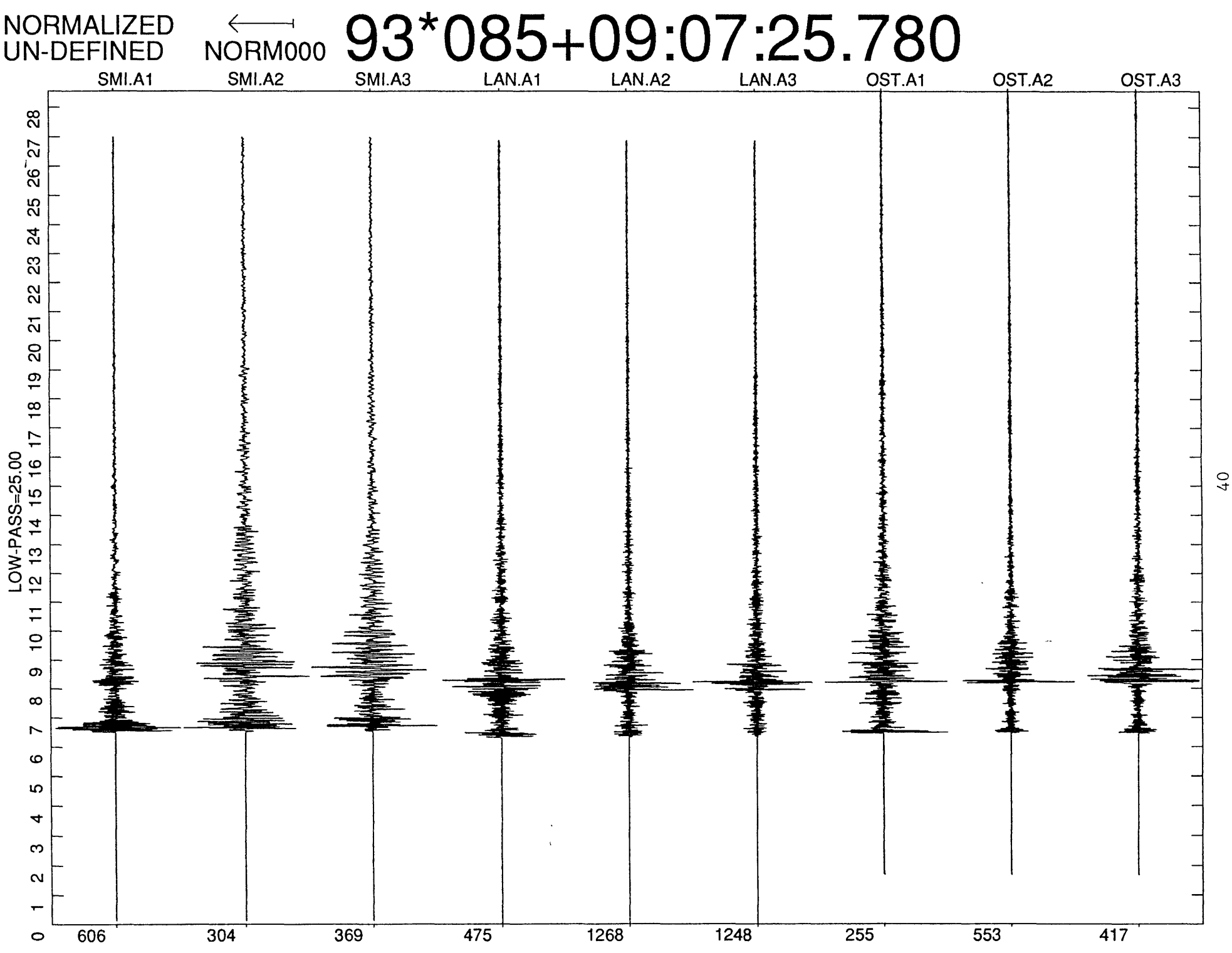
393
1043
753
132
282
171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SMI.A3
LAN.A1
LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
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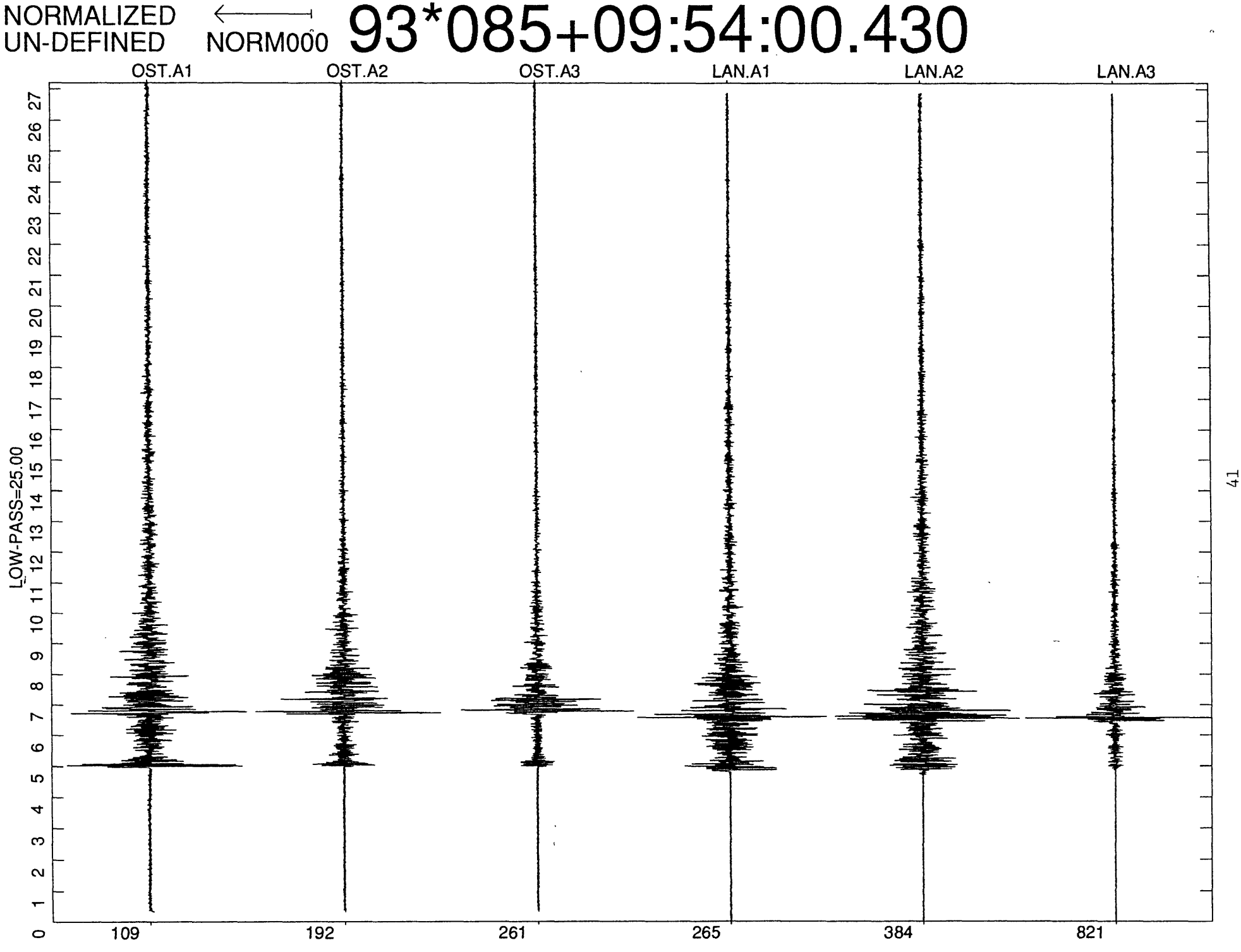
304
369
475
1268
1248
255
553
417
40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OST.A3
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LAN.A2
LAN.A3
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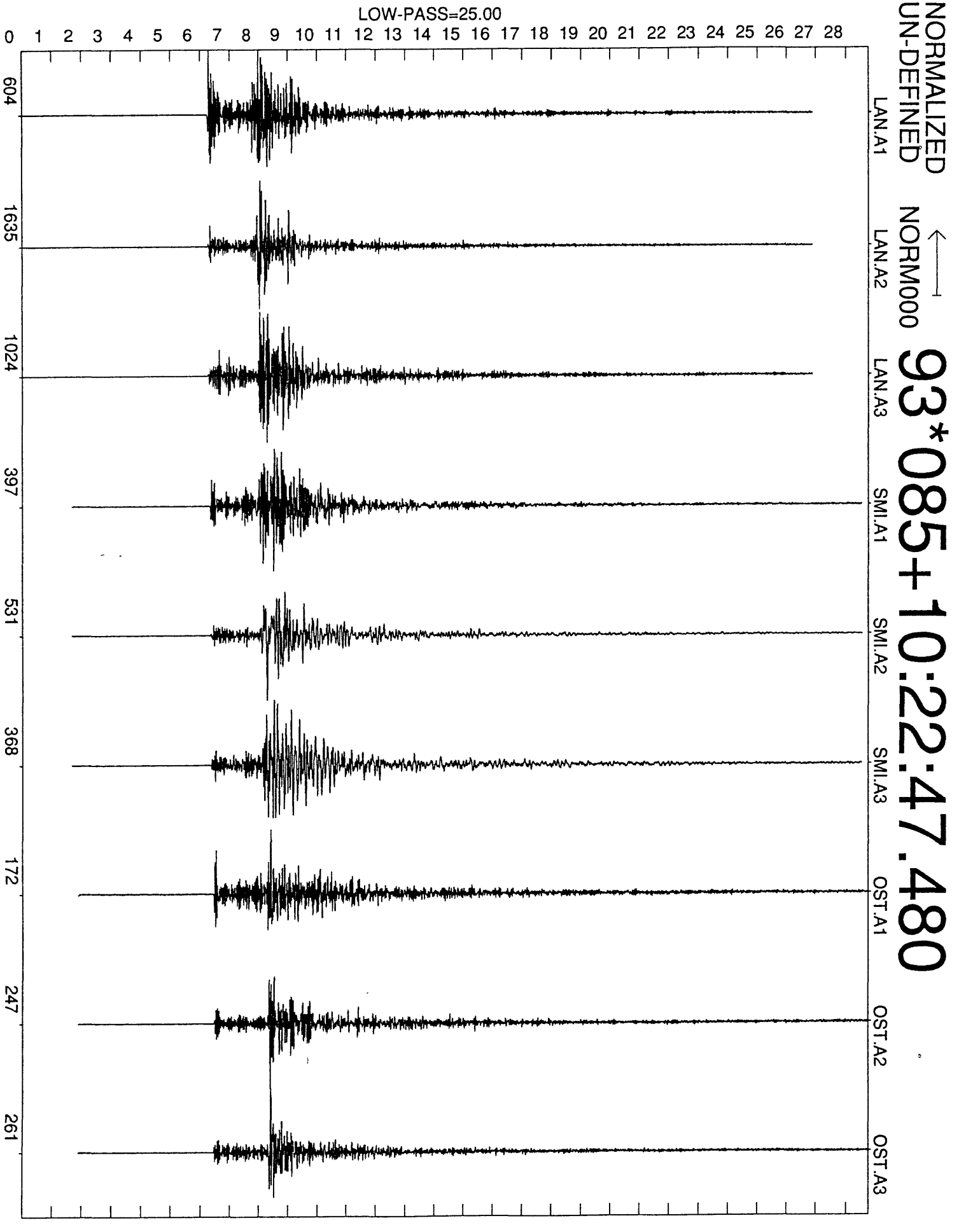
261
265
384
821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397
531
368
172
247
261
LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
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OST.A2
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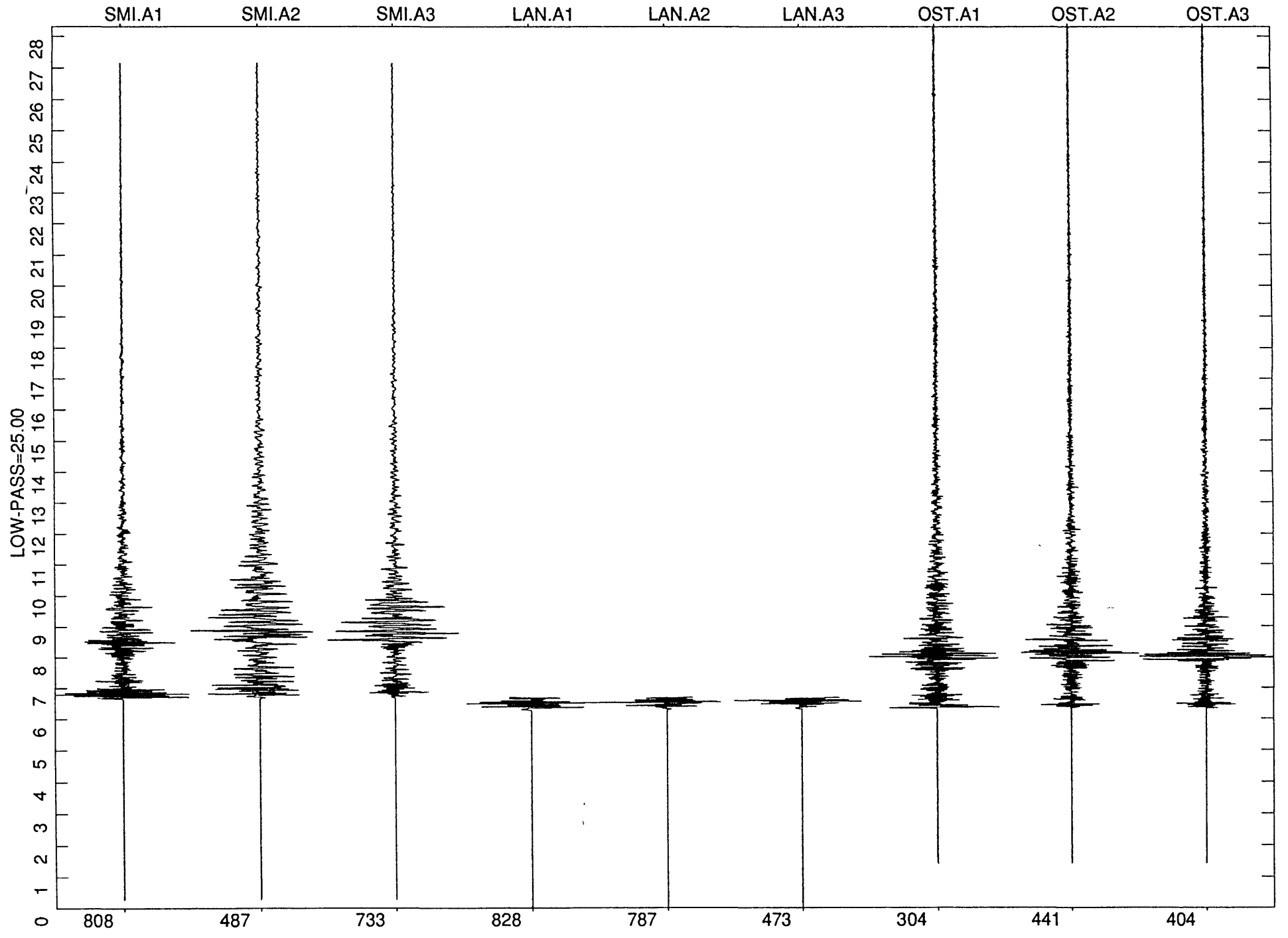
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LAN.A2
LAN.A3
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OST.A2
OST.A3
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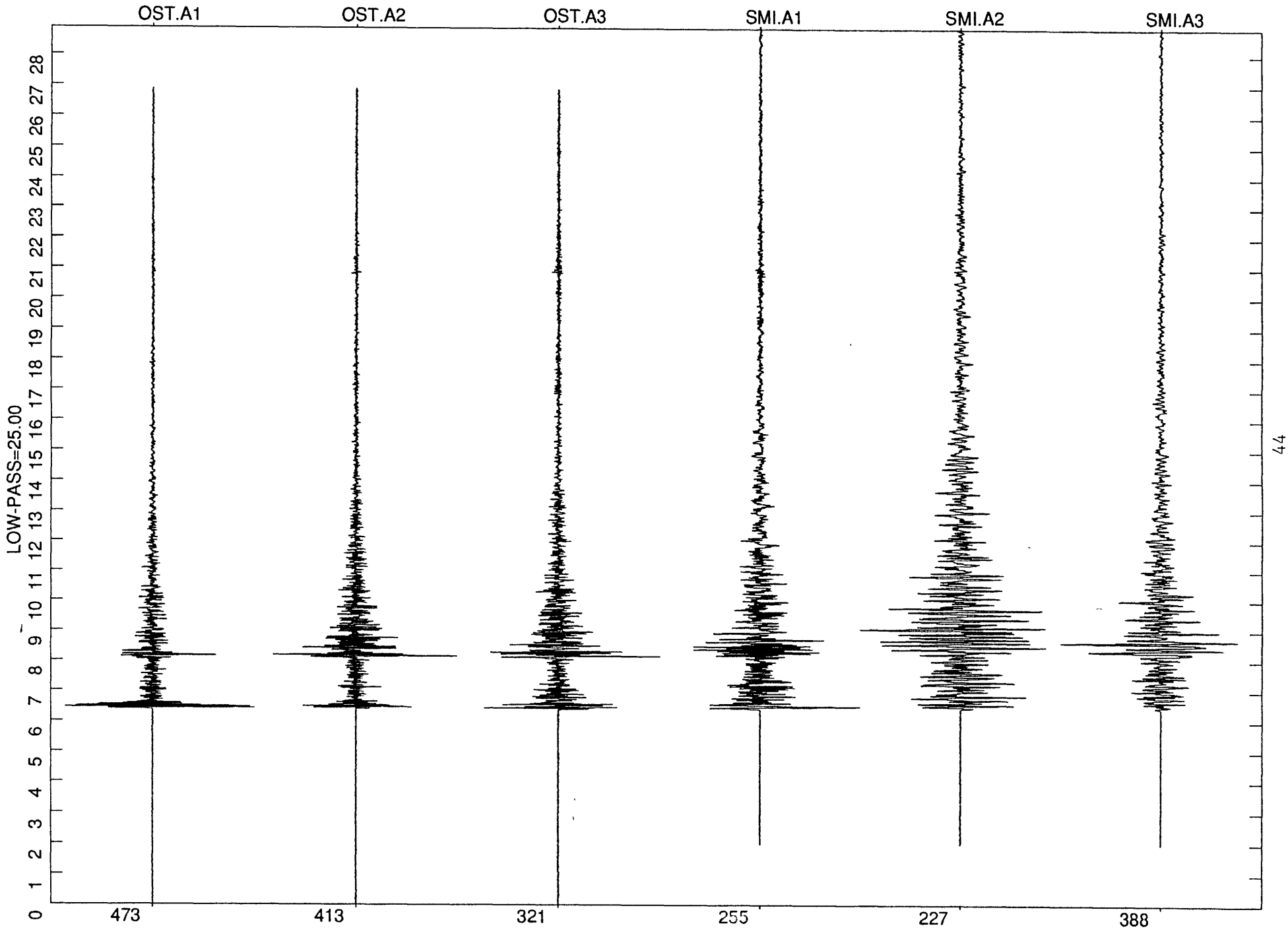
473
304
441
404
43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OST.A3
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SMI.A2
SMI.A3
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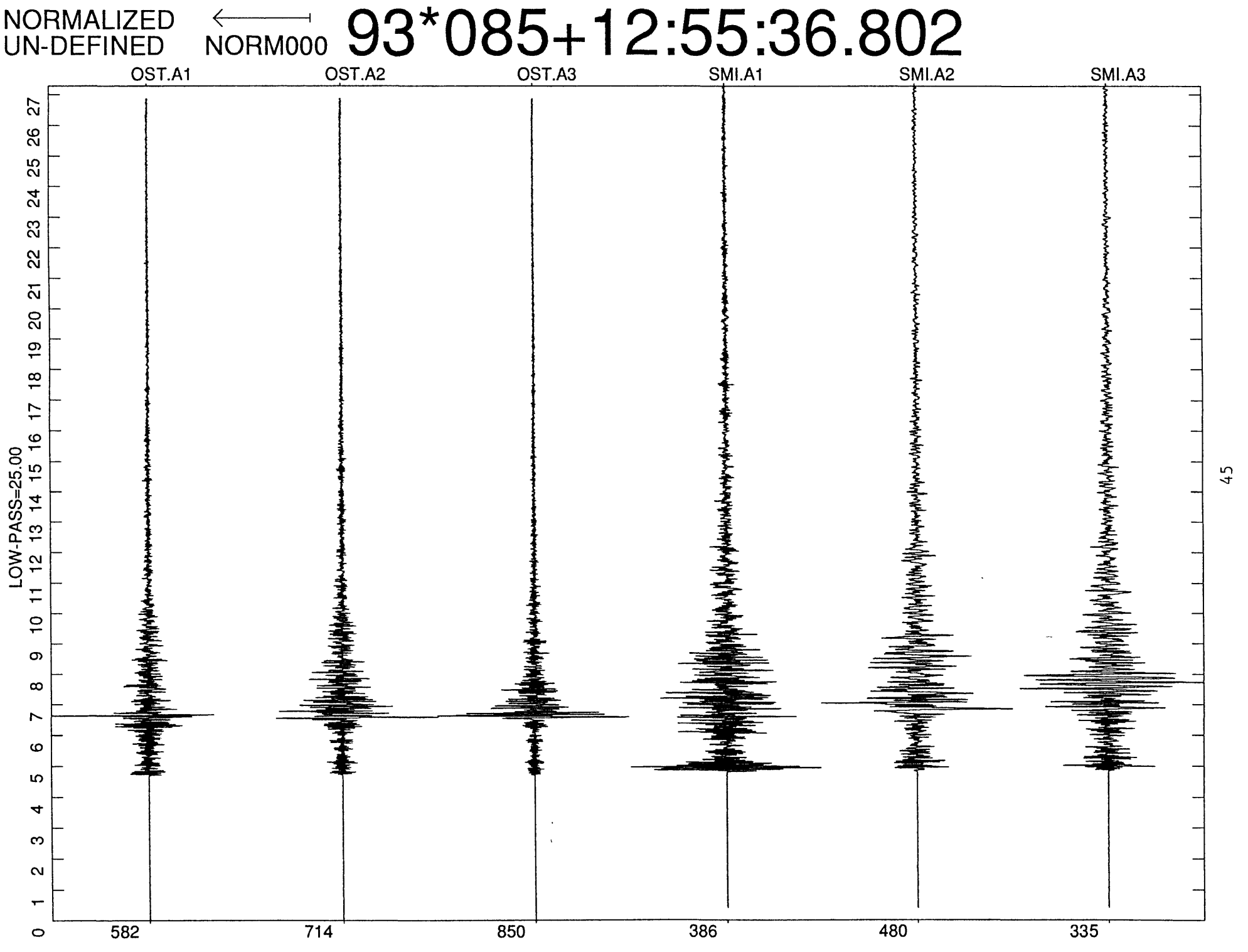
413
321
255
227
388
44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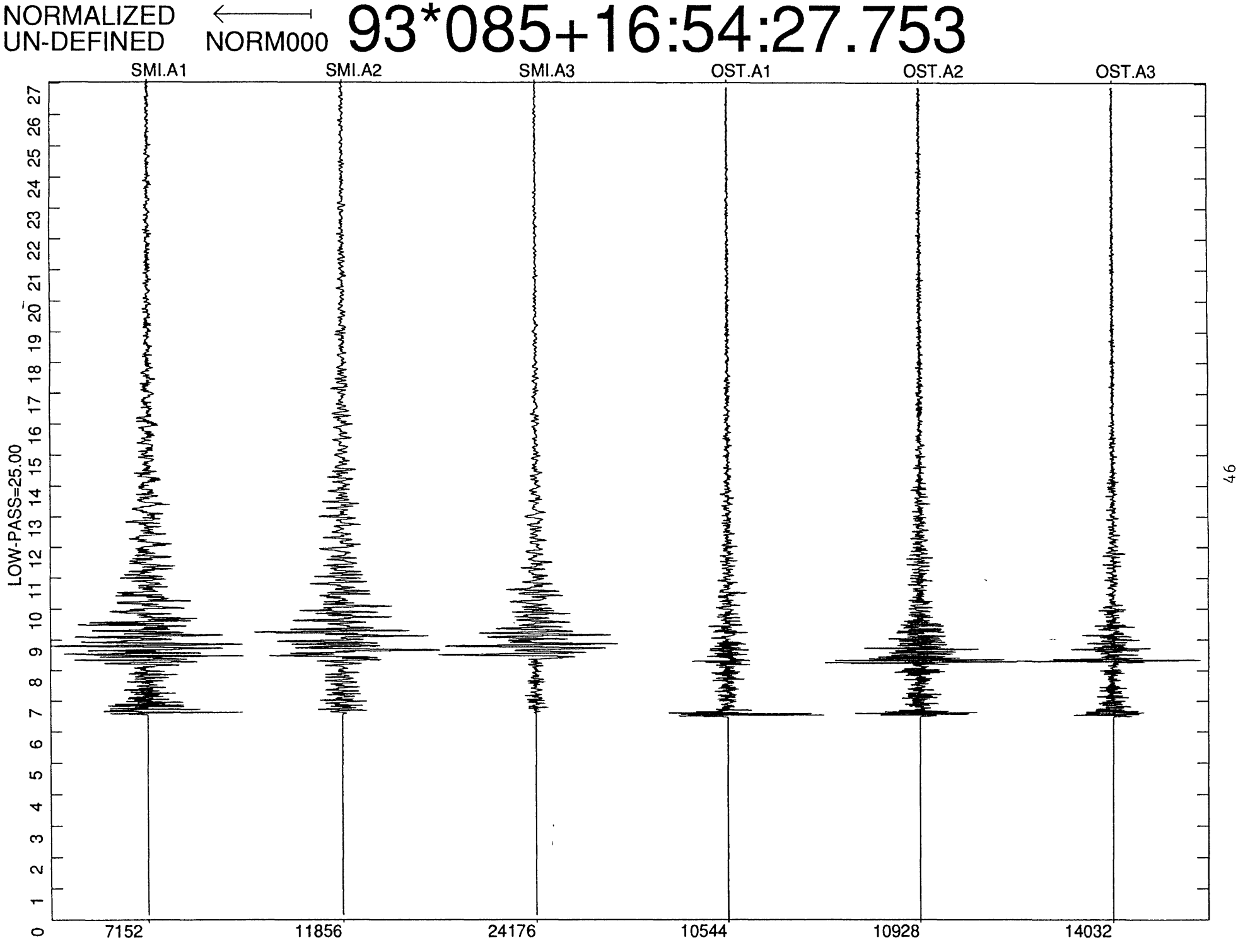
335
45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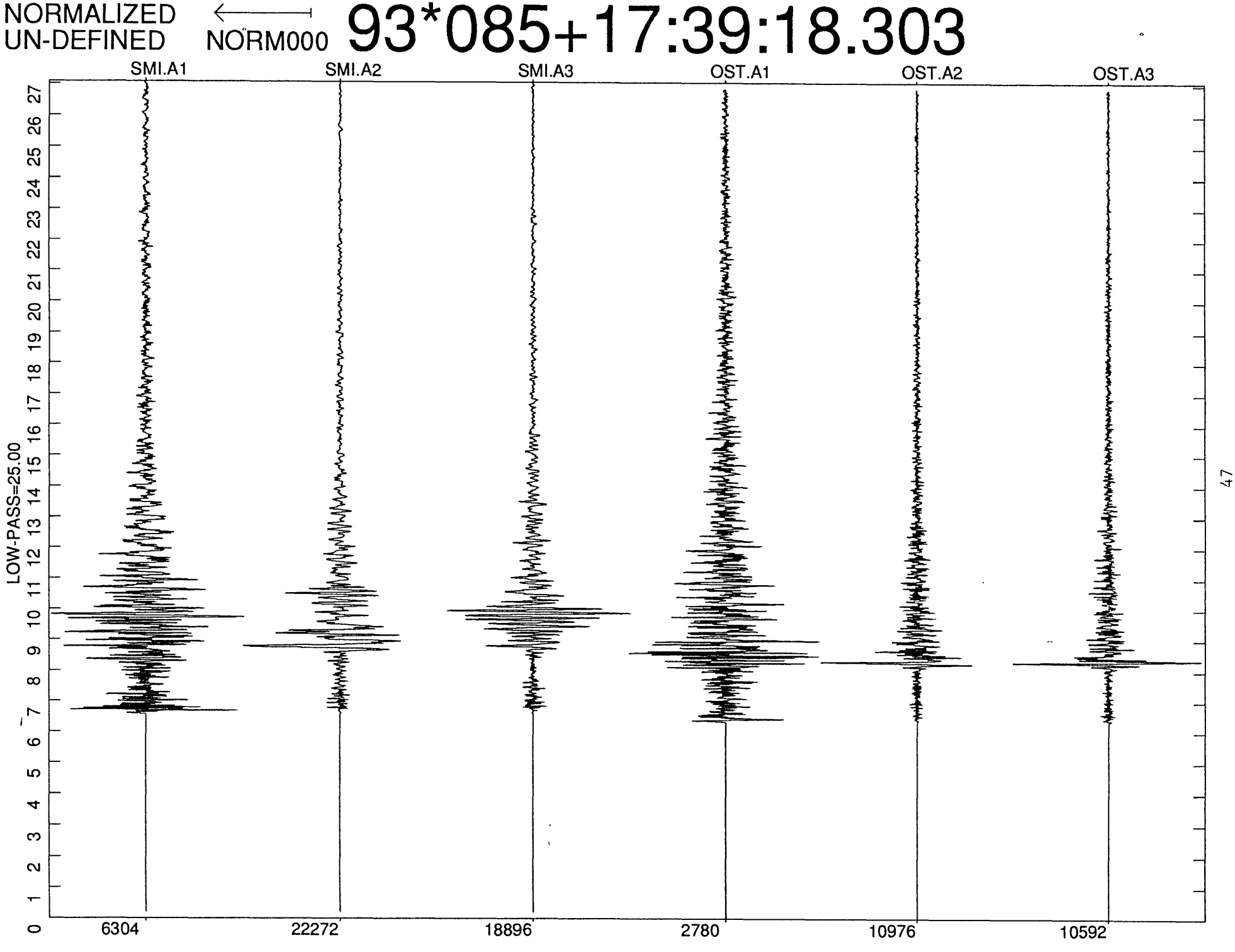
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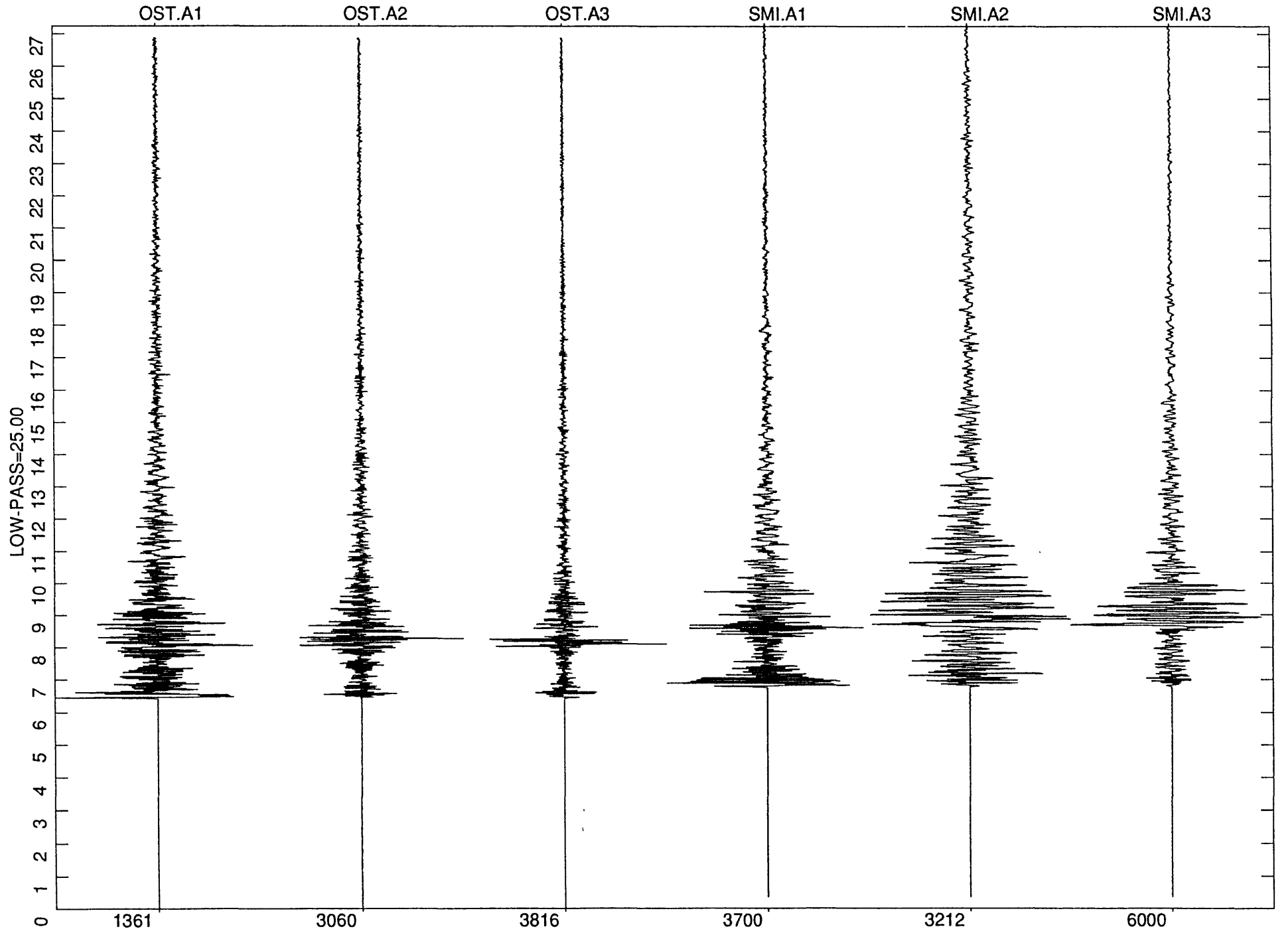
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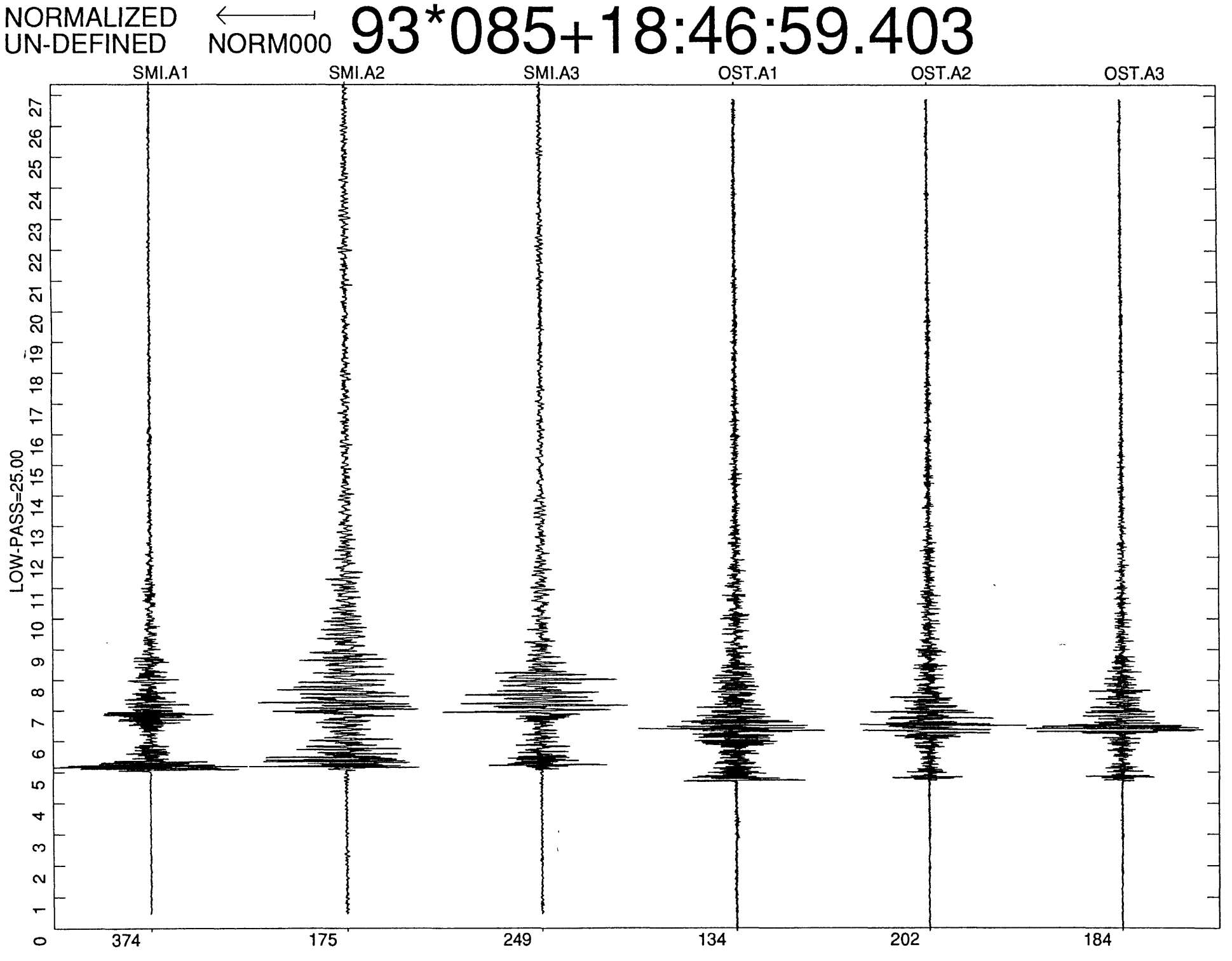
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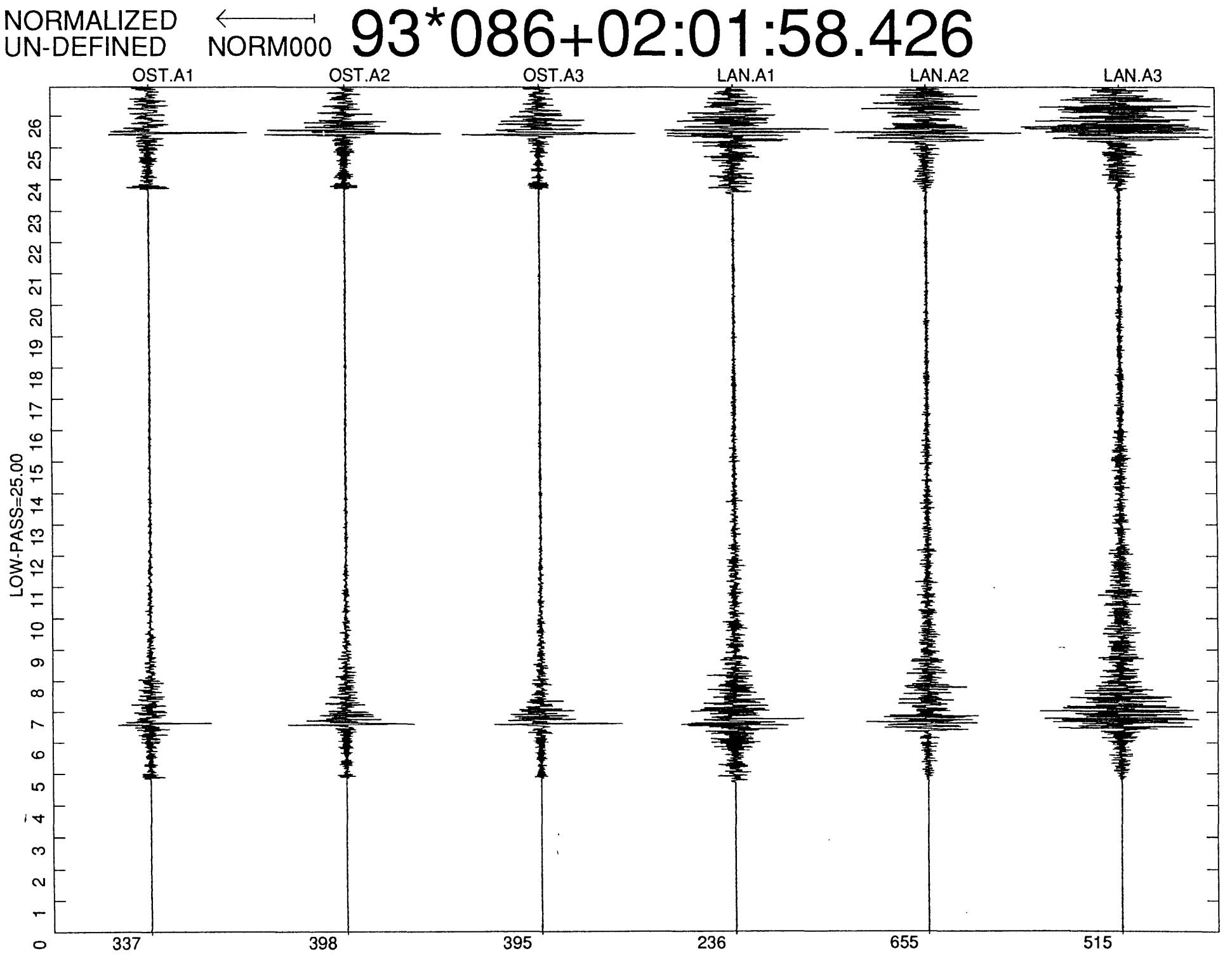
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515
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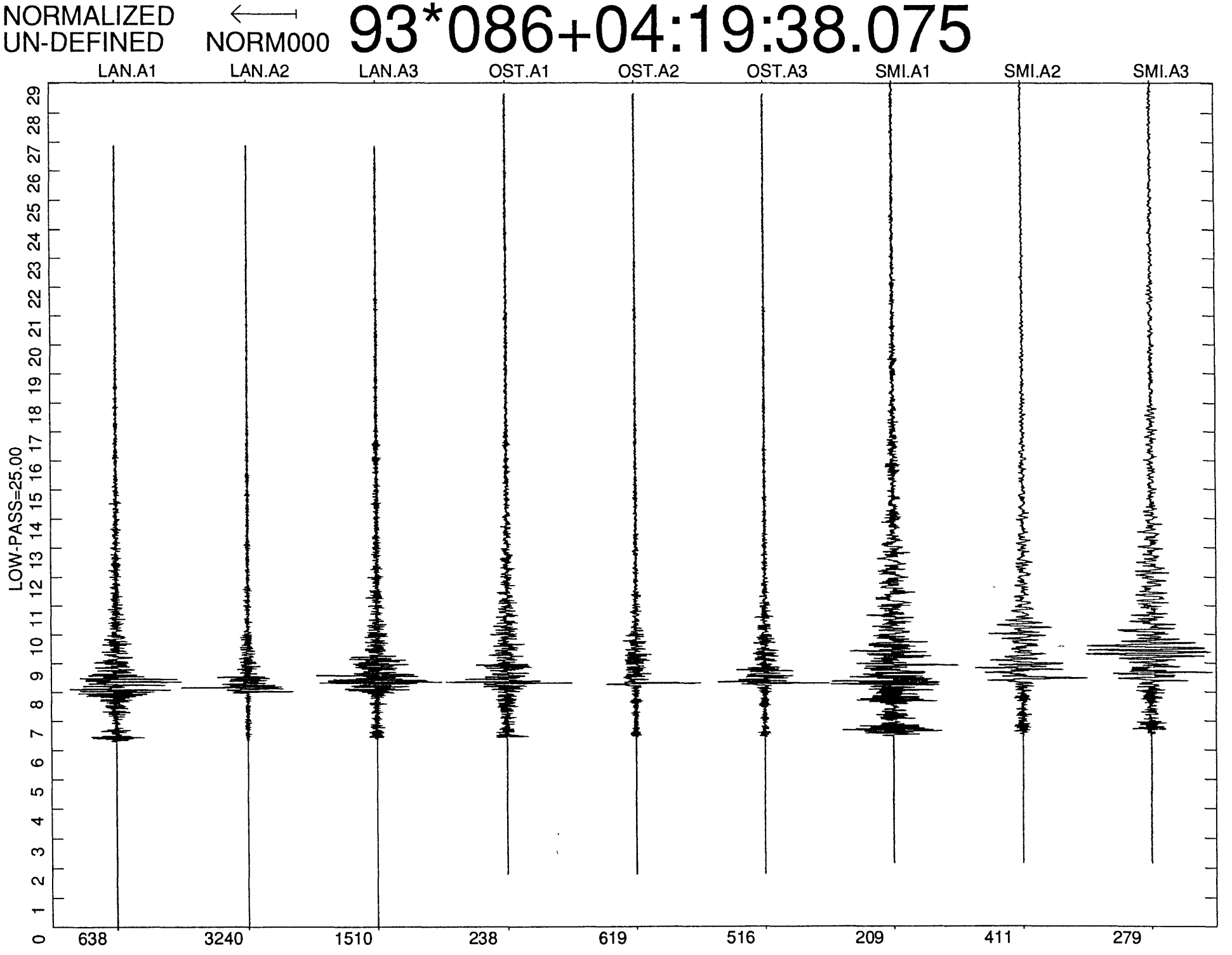
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LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
SMI.A1
SMI.A2
SMI.A3
LOW-PASS=25.00
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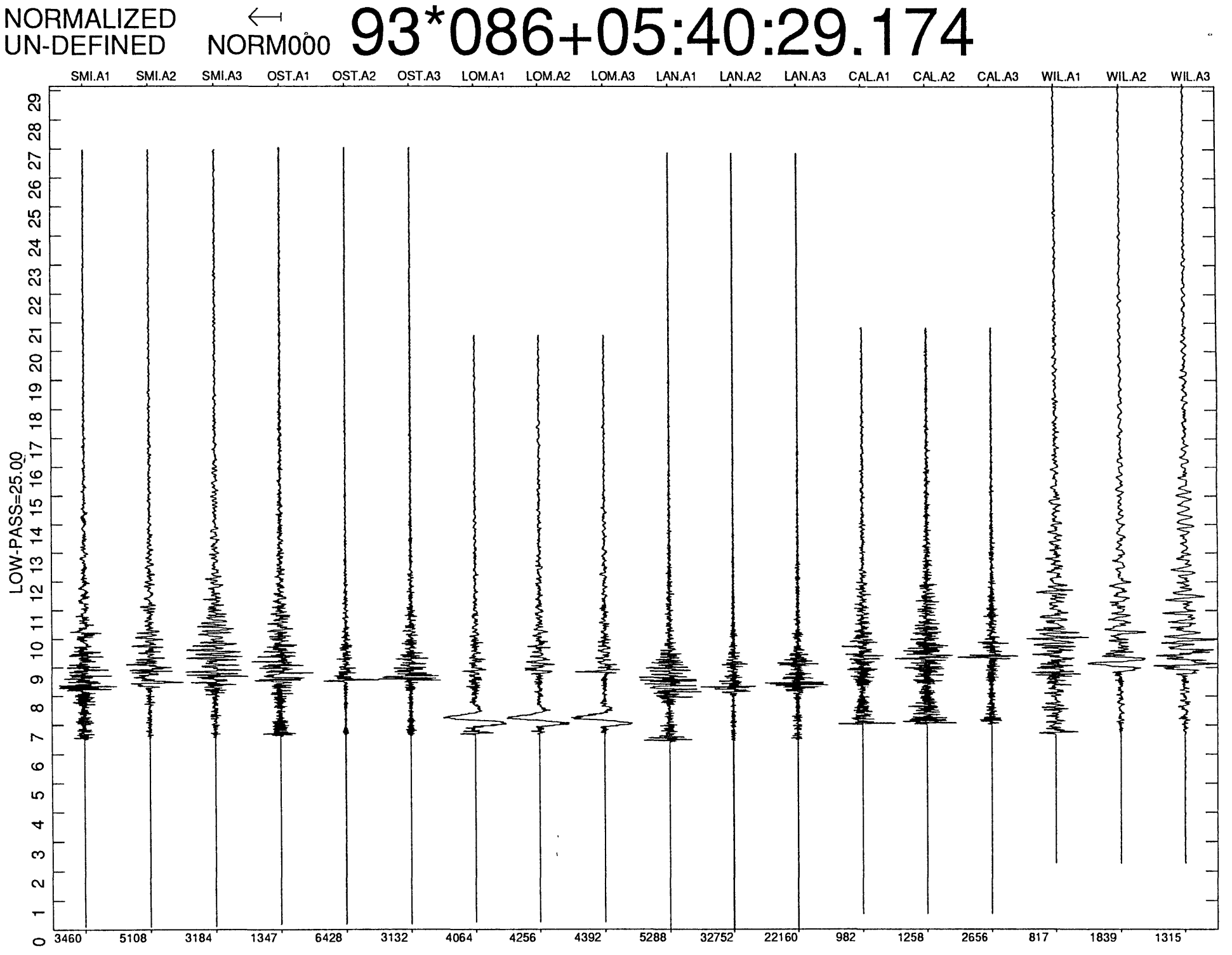
638
3240
1510
238
619
516
209
411
279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SMI.A3
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OST.A3
LOM.A1
LOM.A2
LOM.A3
LAN.A1
LAN.A2
LAN.A3
CAL.A1
CAL.A2
CAL.A3
WIL.A1
WIL.A2
WIL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
3460
5108
3184
1347
6428
3132
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4256
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5288
32752
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982
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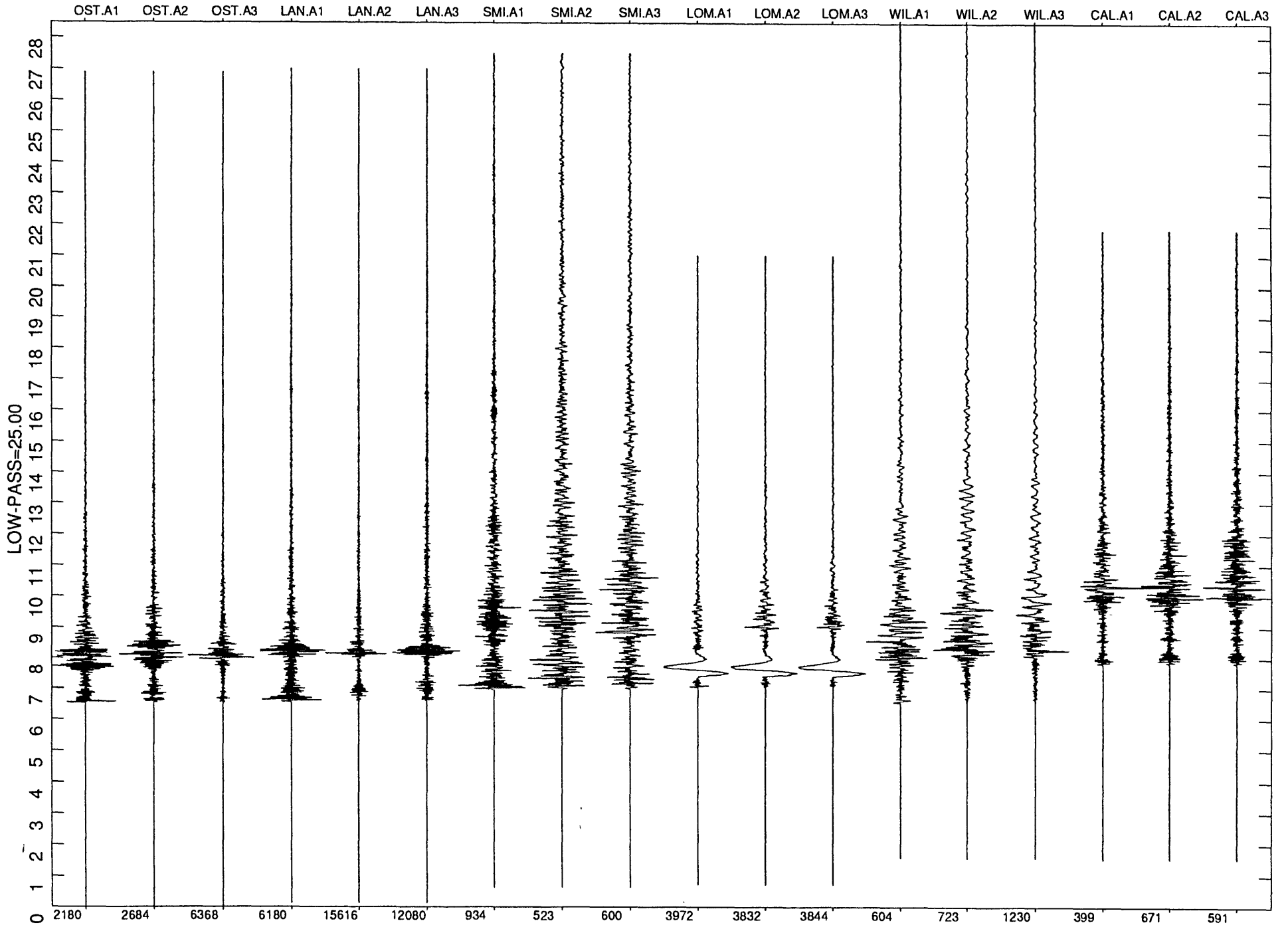
2656
817
1839
1315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OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
LOM.A1
LOM.A2
LOM.A3
WIL.A1
WIL.A2
WIL.A3
CAL.A1
CAL.A2
CAL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
2180
2684
6368
6180
15616
12080
934
523
600
3972
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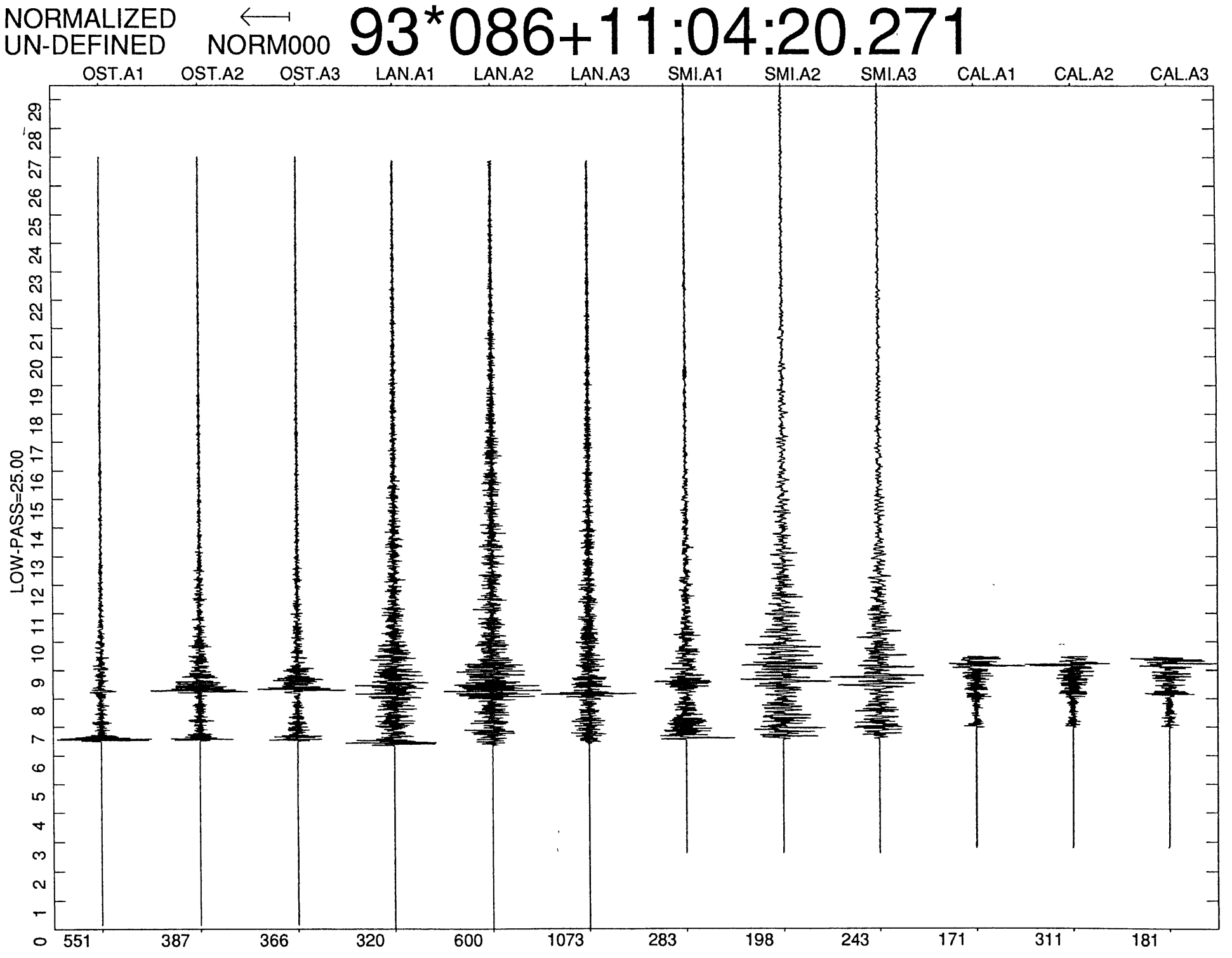
3844
604
723
1230
399
671
591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OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
CAL.A1
CAL.A2
CAL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
551
387
366
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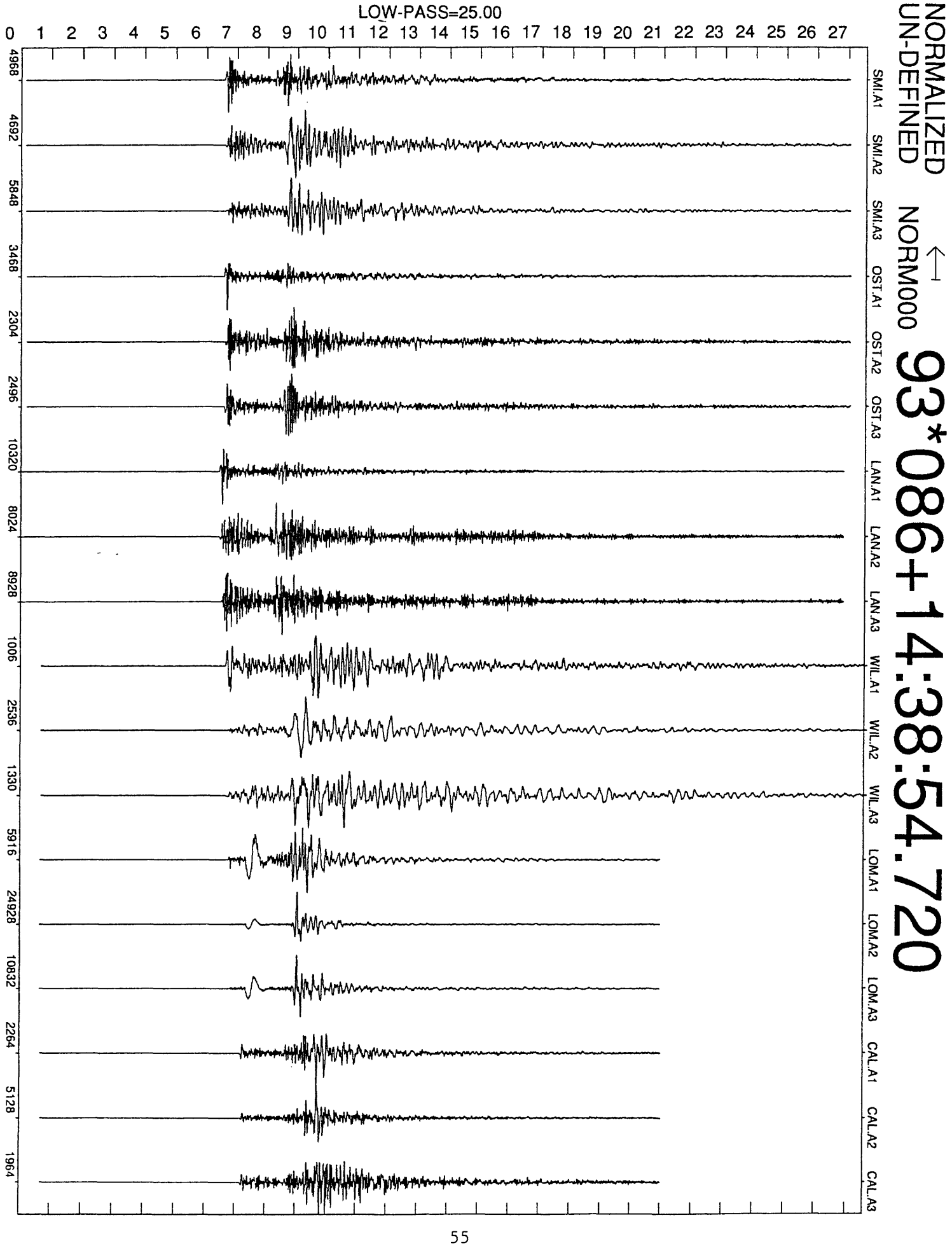
1073
283
198
243
171
311
181
54


LOW-PASS=25.00
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4968
4692
5848
3468
2304
2496
10320
8024
8928
1006
2536
1330
5916
24928
10832
2264
5128
1964
SMI.A1
SMI.A2
SMI.A3
OST.A1
OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
WIL.A1
WIL.A2
WIL.A3
LOM.A1
LOM.A2
LOM.A3
CAL.A1
CAL.A2
CAL.A3
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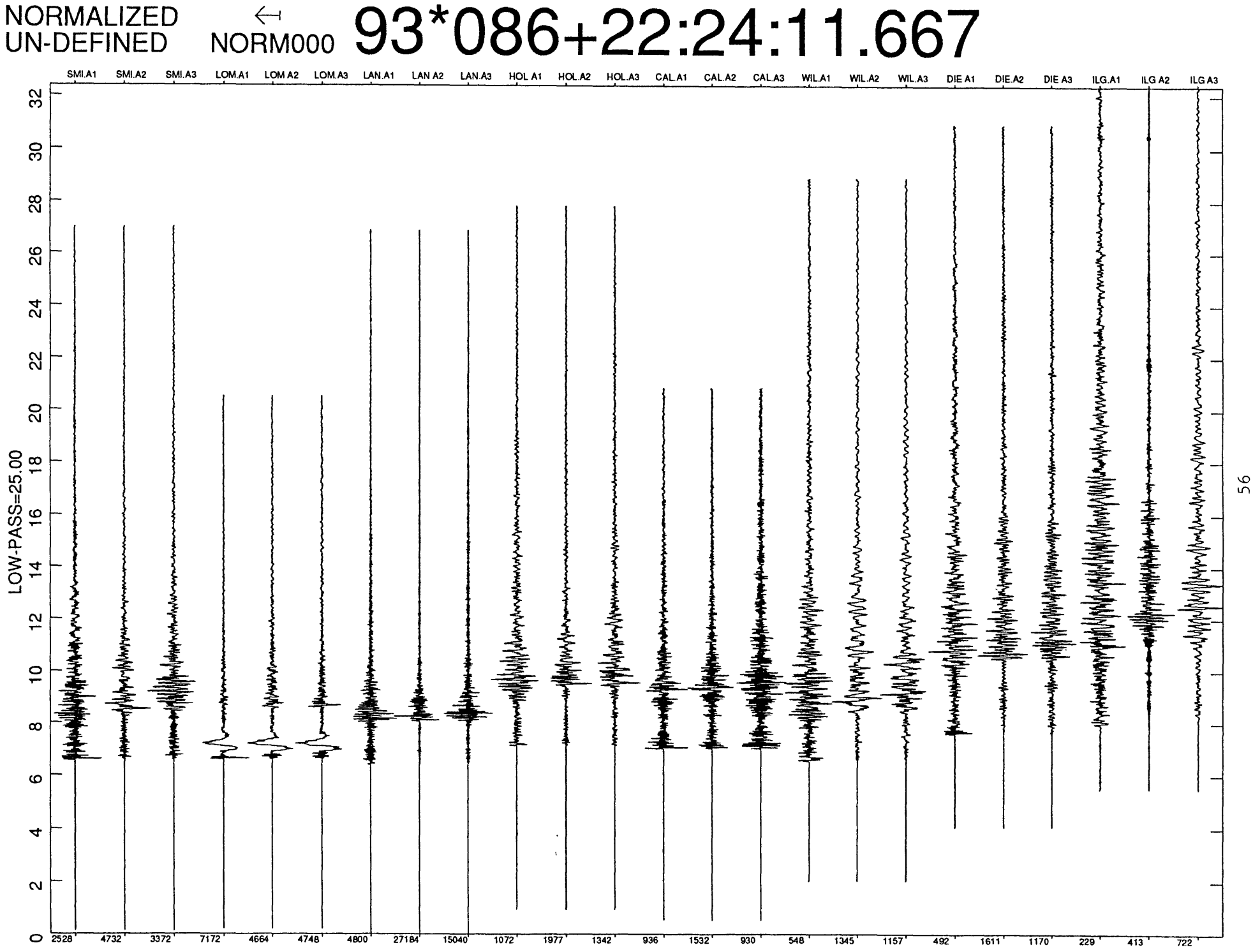
UN-DEFINED
NORM000
93*086+14:38:54.720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UN-DEFINED
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93*086+22:24:11.667
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SMI.A2
SMI.A3
LOM.A1
LOM.A2
LOM.A3
LAN.A1
LAN.A2
LAN.A3
HOL.A1
HOL.A2
HOL.A3
CAL.A1
CAL.A2
CAL.A3
WIL.A1
WIL.A2
WIL.A3
DIE.A1
DIE.A2
DIE.A3
ILG.A1
ILG.A2
ILG.A3
LOW-PASS=25.00
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
2528
4732
3372
7172
4664
4748
4800
27184
15040
1072
1977
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1532
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548
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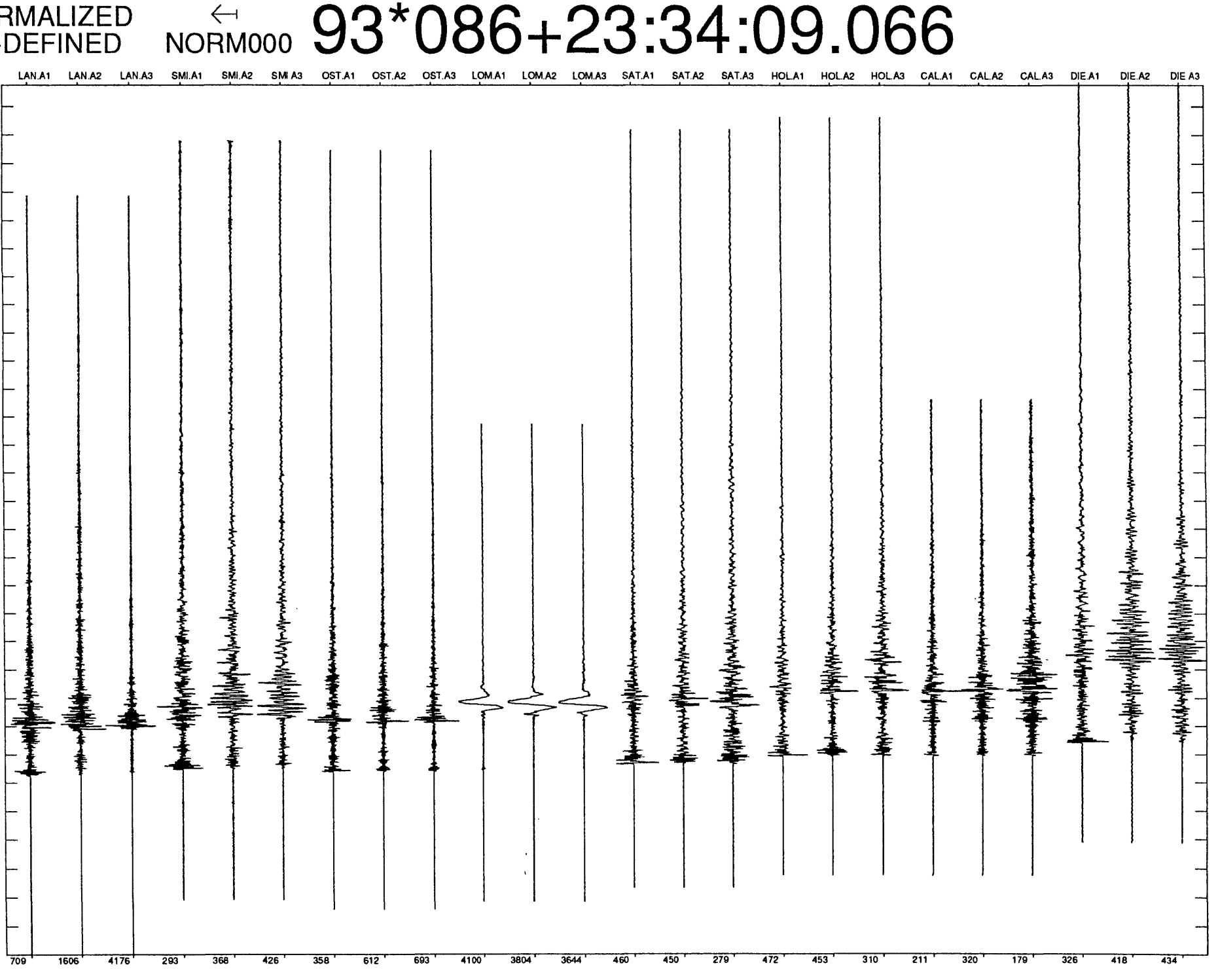
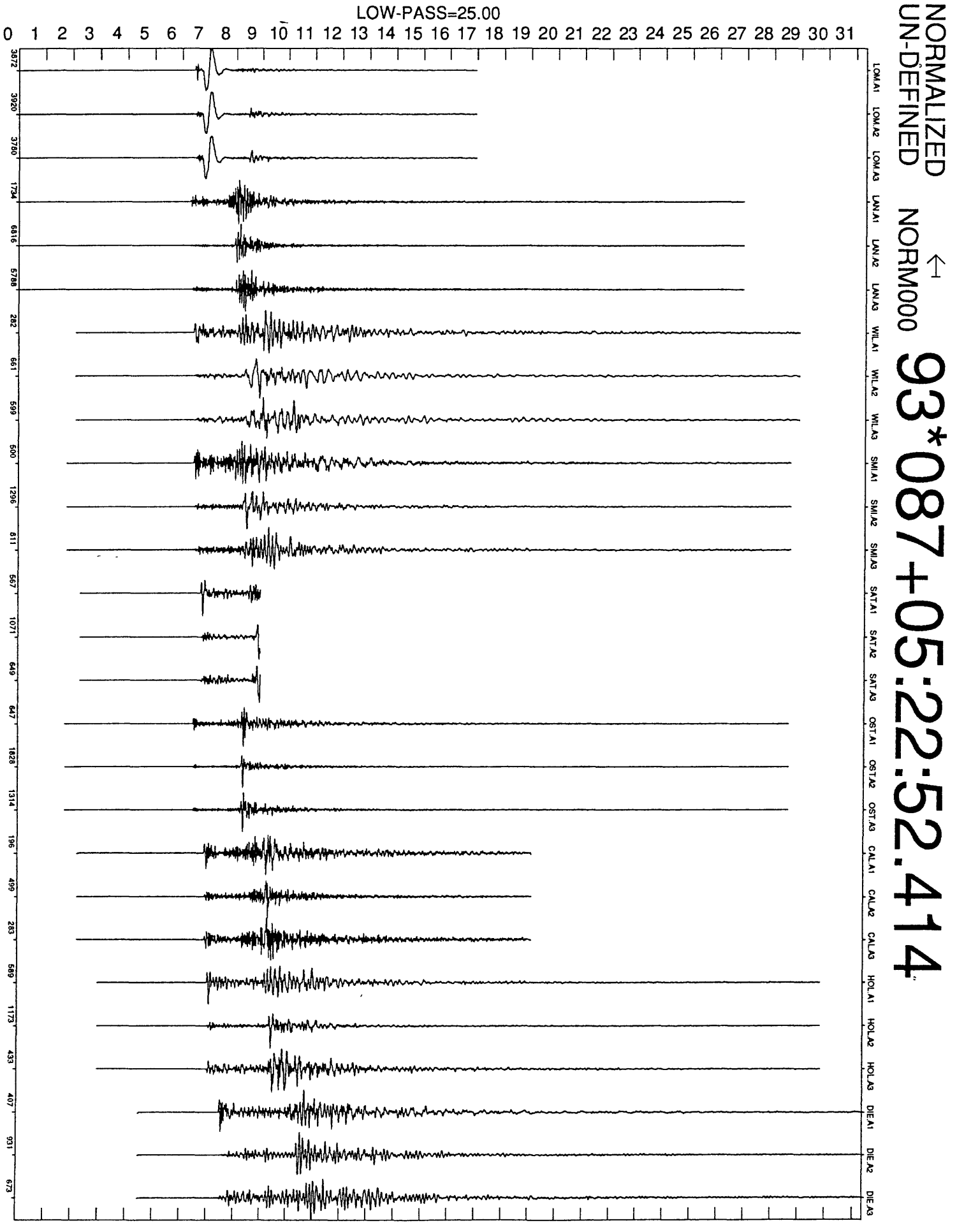
1157
492
1611
1170
229
413
722

NORMALIZED
UN-DEFINED

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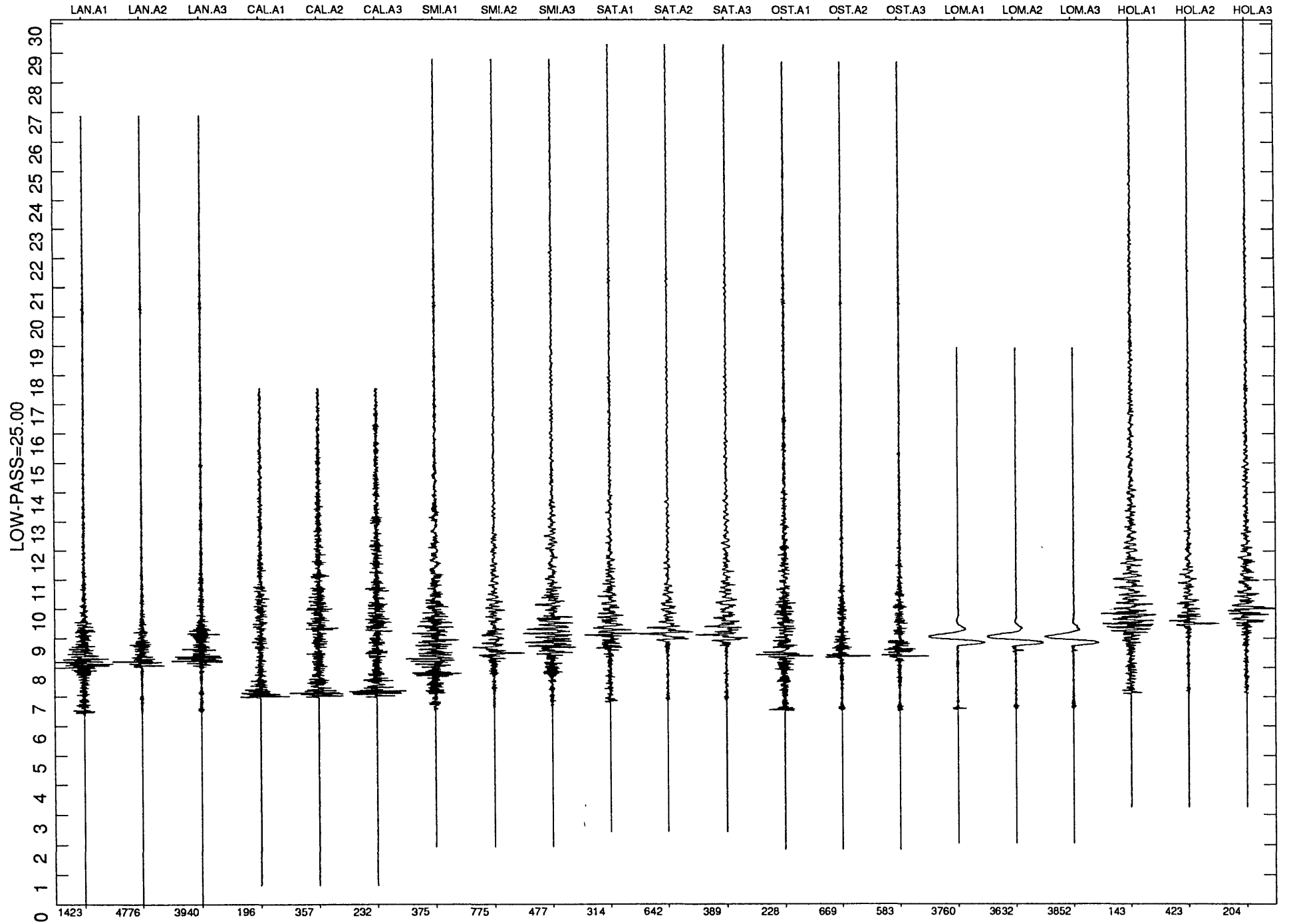
NORMALIZED
UN-DEFINED
NORM000
93*087+05:22:52.414
3672 LOM.A1
3920 LOM.A2
3780 LOM.A3
1734 LAN.A1
6816 LAN.A2
5788 LAN.A3
282 WIL.A1
661 WIL.A2
599 WIL.A3
500 SMI.A1
1296 SMI.A2
811 SMI.A3
567 SAT.A1
1071 SAT.A2
649 SAT.A3
647 OST.A1
1828 OST.A2
1314 OST.A3
196 CAL.A1
499 CAL.A2
283 CAL.A3
569 HOL.A1
1173 HOL.A2
433 HOL.A3
407 DIE.A1
931 DIE.A2
673 DIE.A3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NORM000
93*087+07:43:47.163
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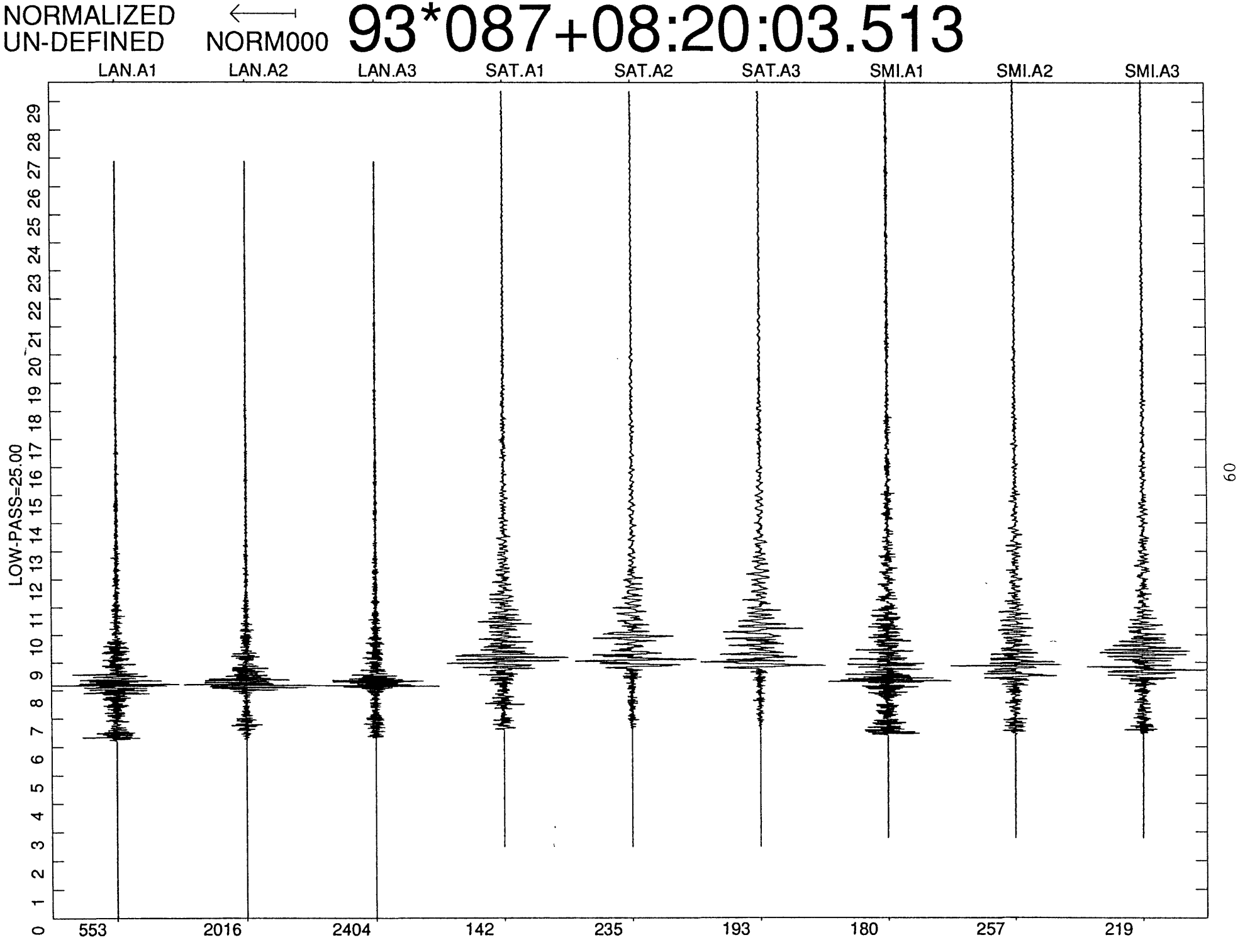
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1423 4776 3940 196 357 232 375 775 477 314 642 389 228 669 583 3760 3632 3852 143 423 204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93*087+08:20:03.513
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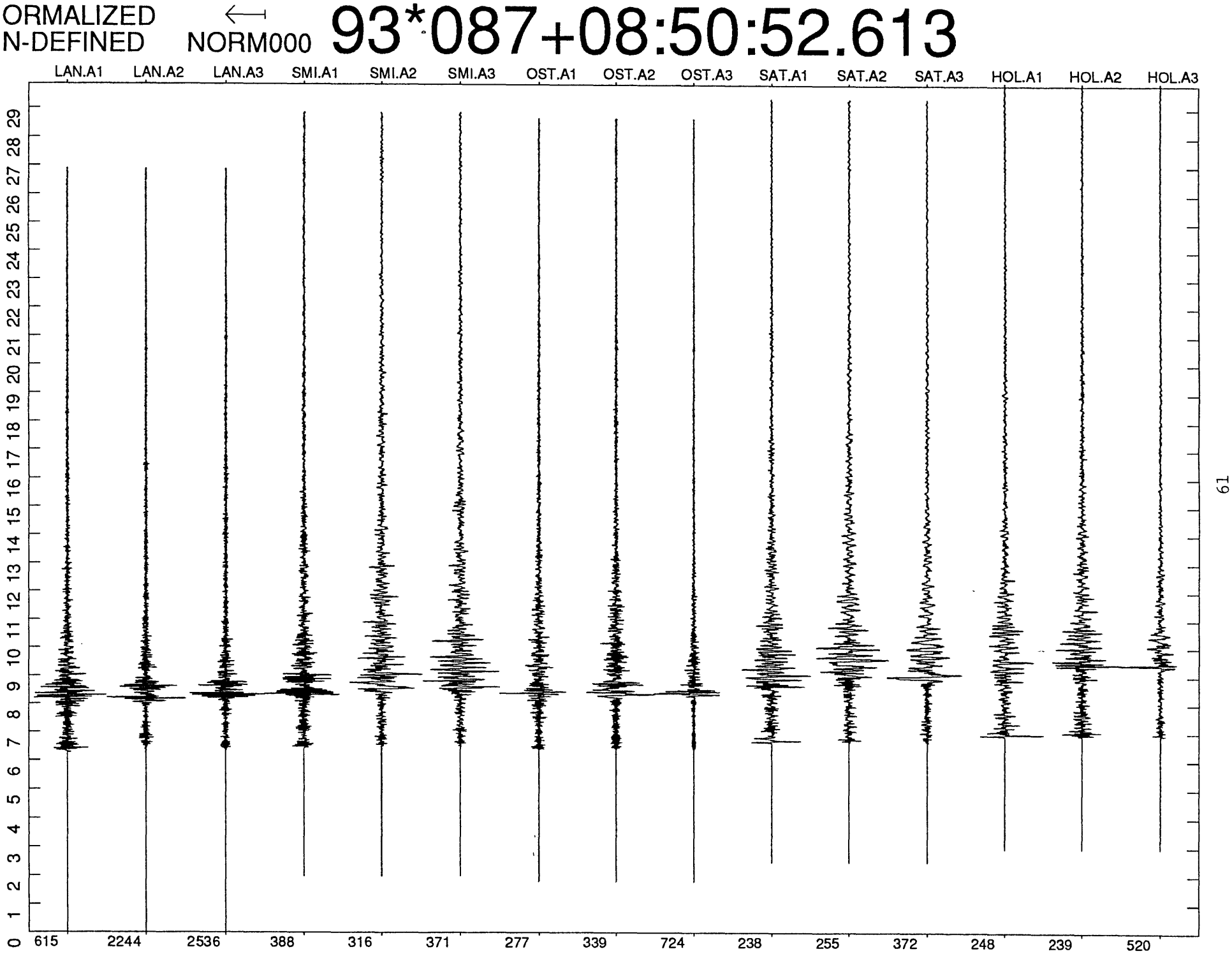
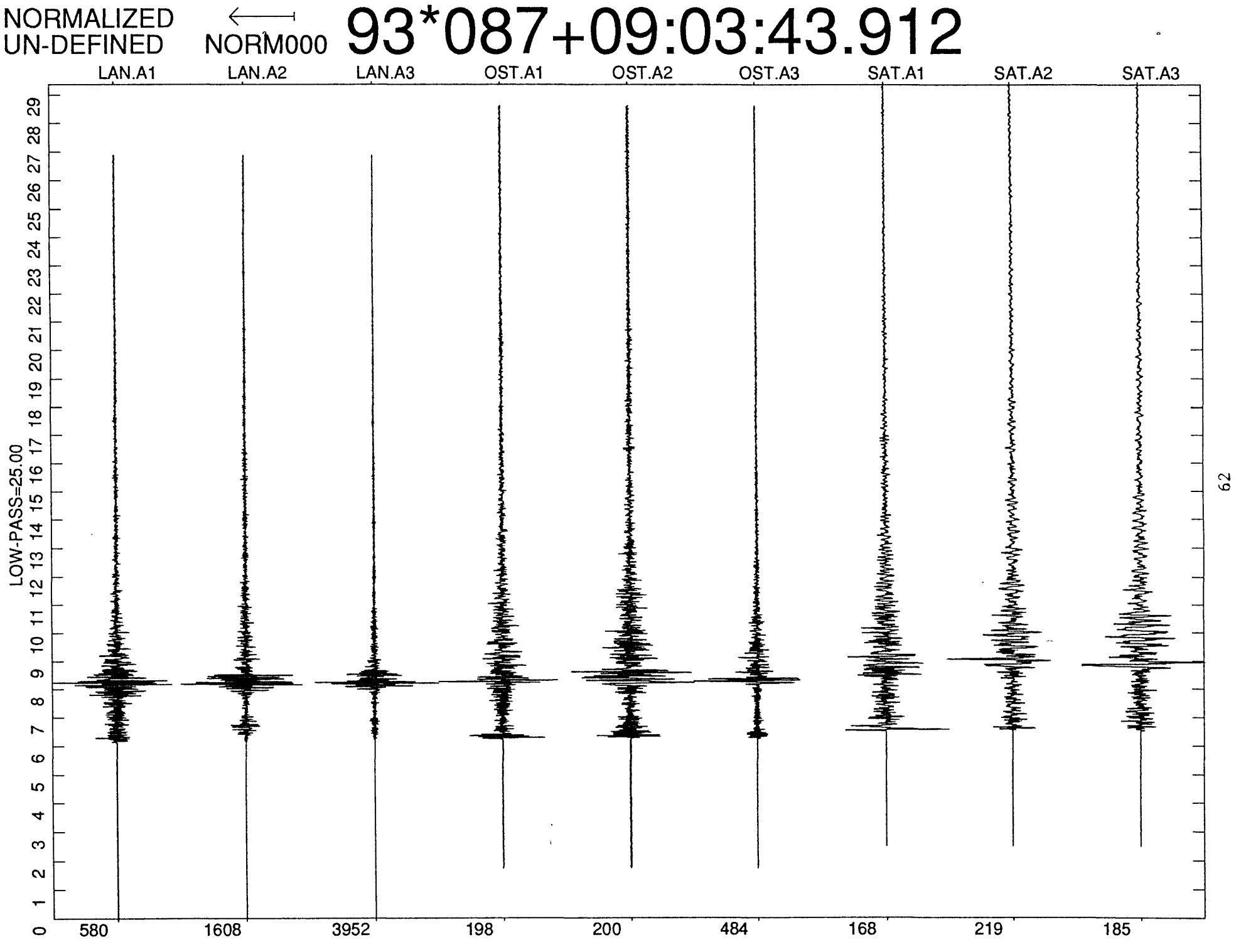
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
SMI.A1
SMI.A2
SMI.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
553
2016
2404
142
235
193
180
257
219
60

NORMALIZED
UN-DEFINED

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NORM000
93*087+09:03:43.912
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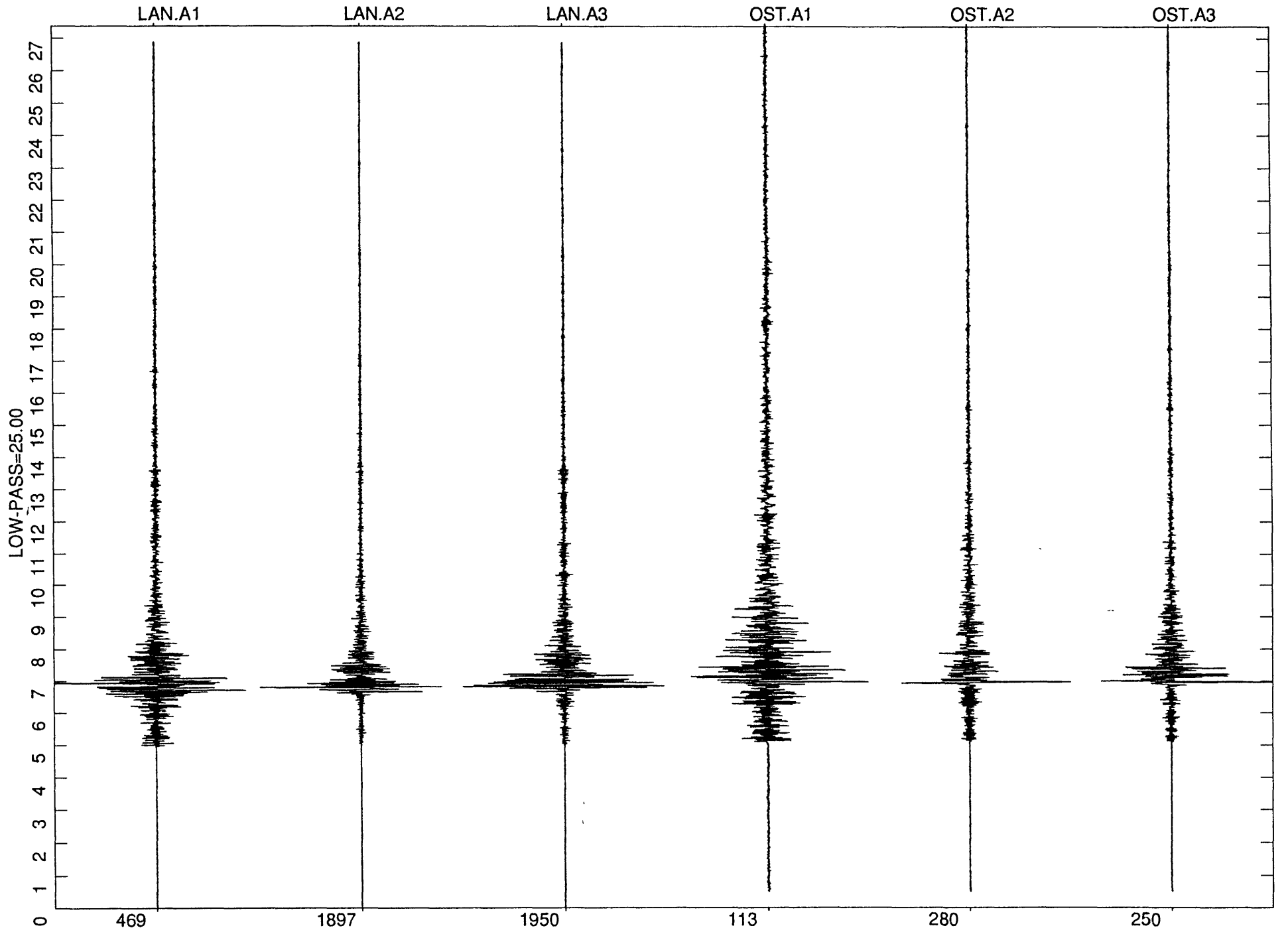
LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
SAT.A1
SAT.A2
SAT.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
580
1608
3952
198
200
484
168
219
185
62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UN-DEFINED
NORM000
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LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
LOW-PASS=25.00
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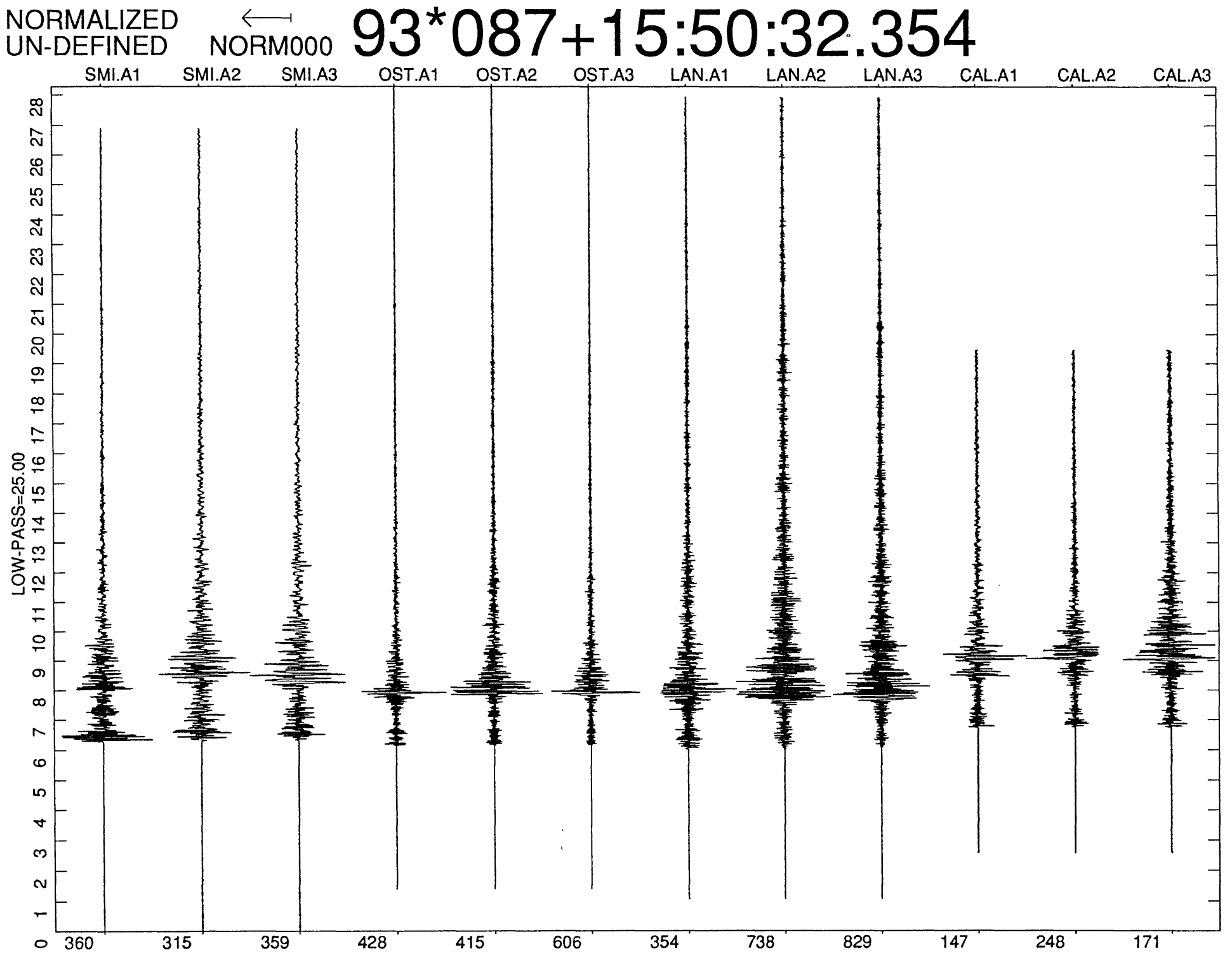
469
1897
1950
113
280
250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UN-DEFINED
NORM000
93*087+15:50:32.354
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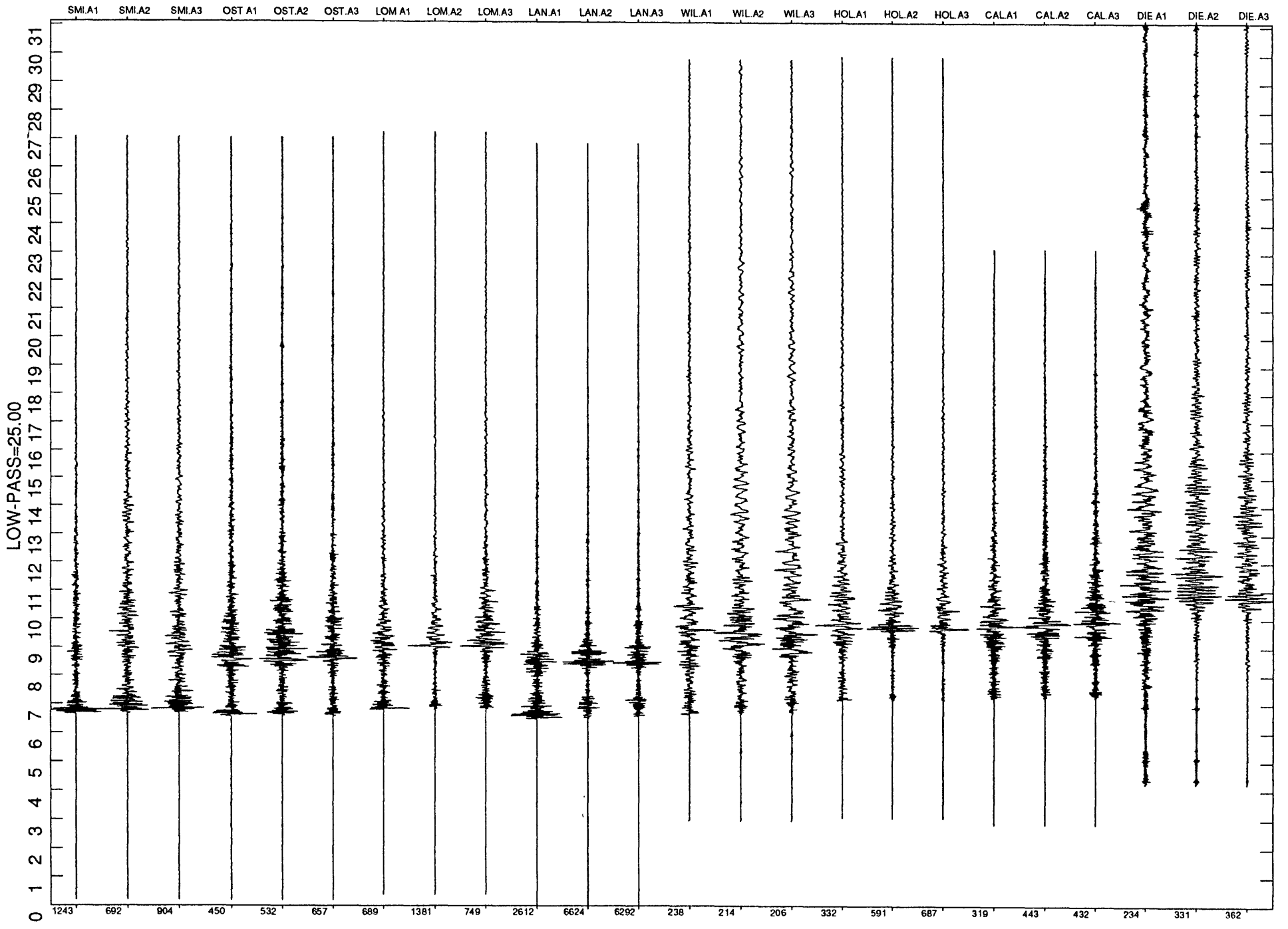
SMI.A2
SMI.A3
OST.A1
OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
CAL.A1
CAL.A2
CAL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
360
315
359
428
415
606
354
738
829
147
248
171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UN-DEFINED
NORM000
93*088+00:16:27.407
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SMI.A2
SMI.A3
OST.A1
OST.A2
OST.A3
LOM.A1
LOM.A2
LOM.A3
LAN.A1
LAN.A2
LAN.A3
WIL.A1
WIL.A2
WIL.A3
HOL.A1
HOL.A2
HOL.A3
CAL.A1
CAL.A2
CAL.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
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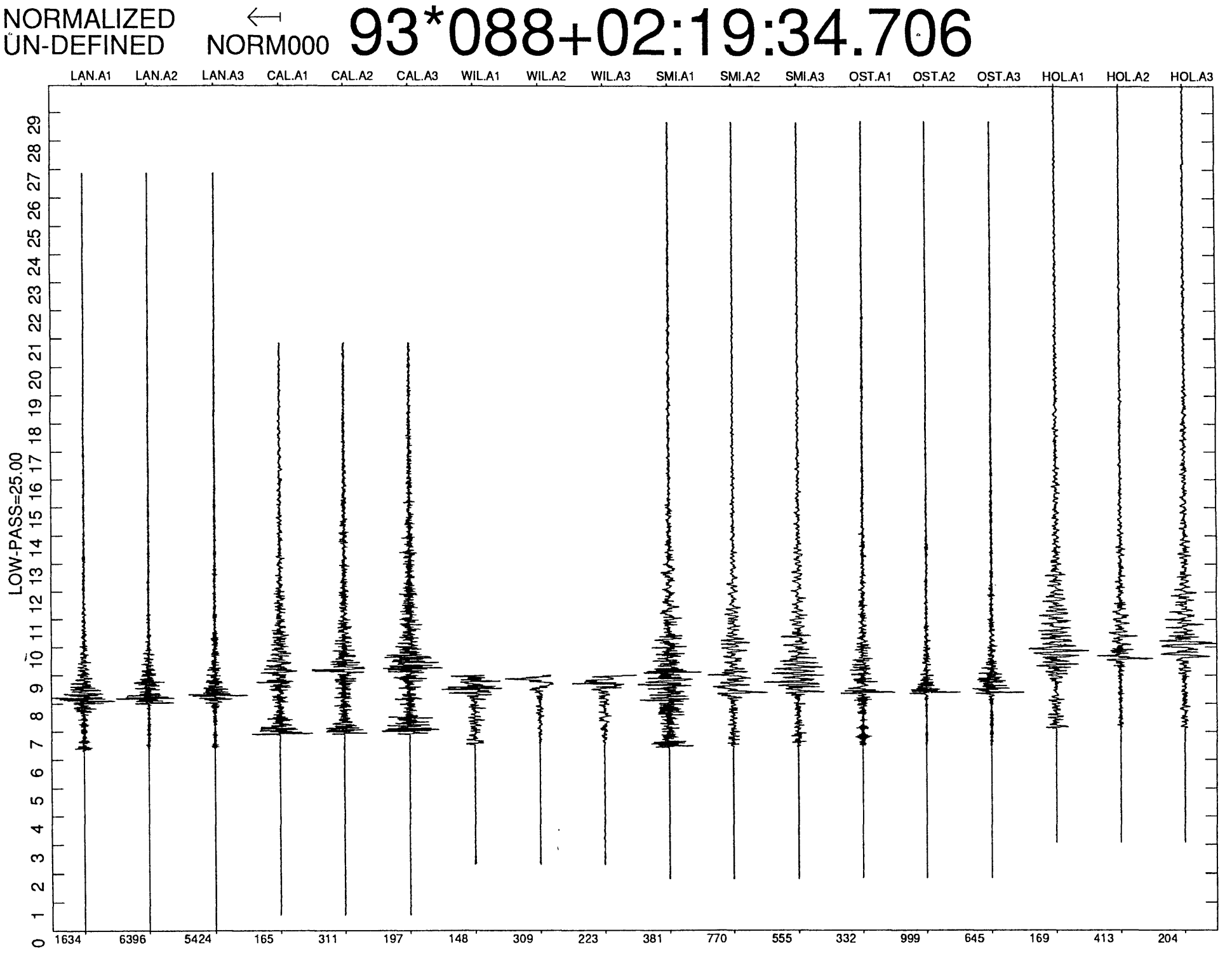
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LAN.A2
LAN.A3
CAL.A1
CAL.A2
CAL.A3
WIL.A1
WIL.A2
WIL.A3
SMI.A1
SMI.A2
SMI.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
1634
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165
311
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148
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770
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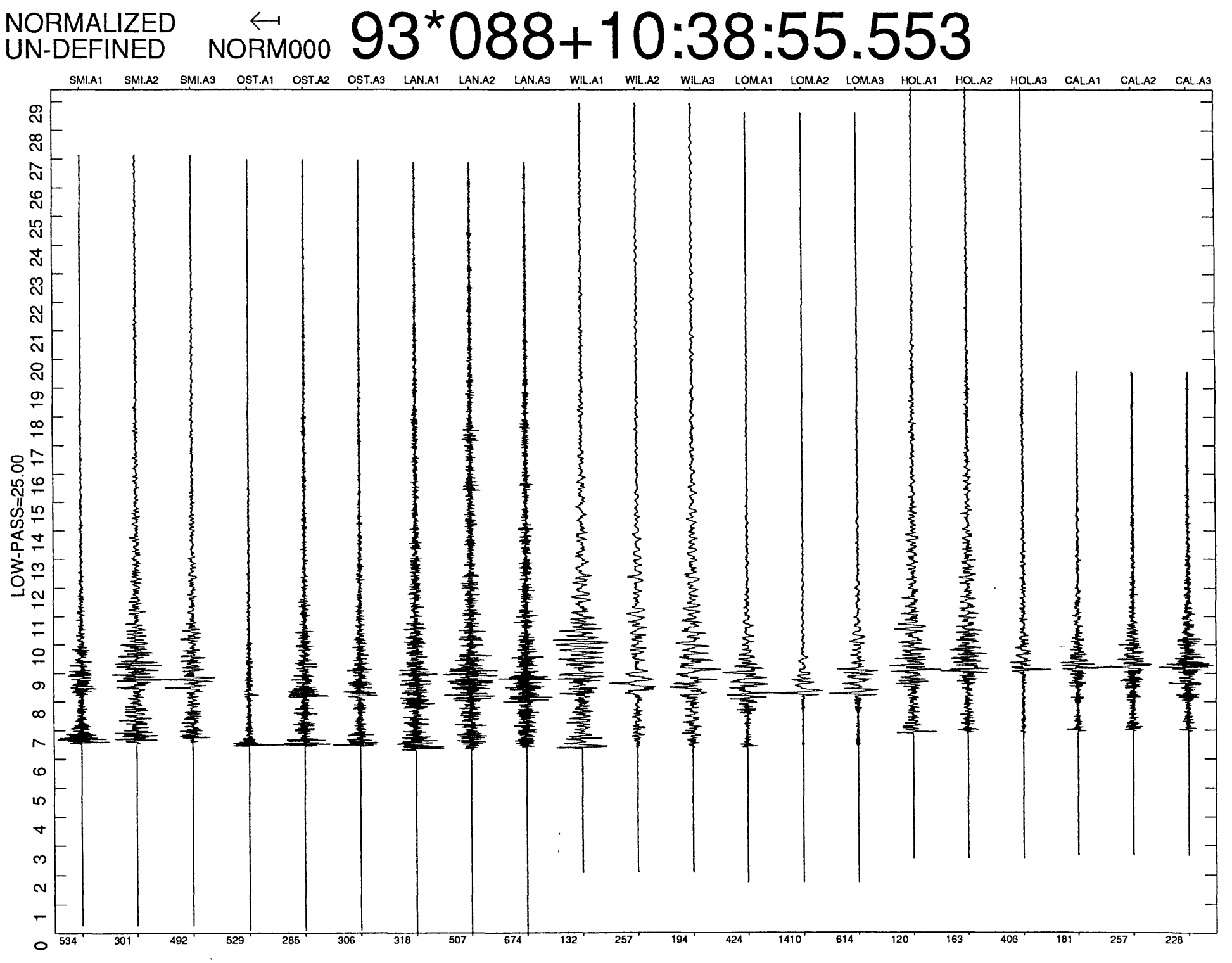
204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NORM000
93*088+10:38:55.553
SMI.A1 SMI.A2 SMI.A3 OST.A1 OST.A2 OST.A3 LAN.A1 LAN.A2 LAN.A3 WIL.A1 WIL.A2 WIL.A3 LOM.A1 LOM.A2 LOM.A3 HOL.A1 HOL.A2 HOL.A3 CAL.A1 CAL.A2 CAL.A3
LOW-PASS=25.00
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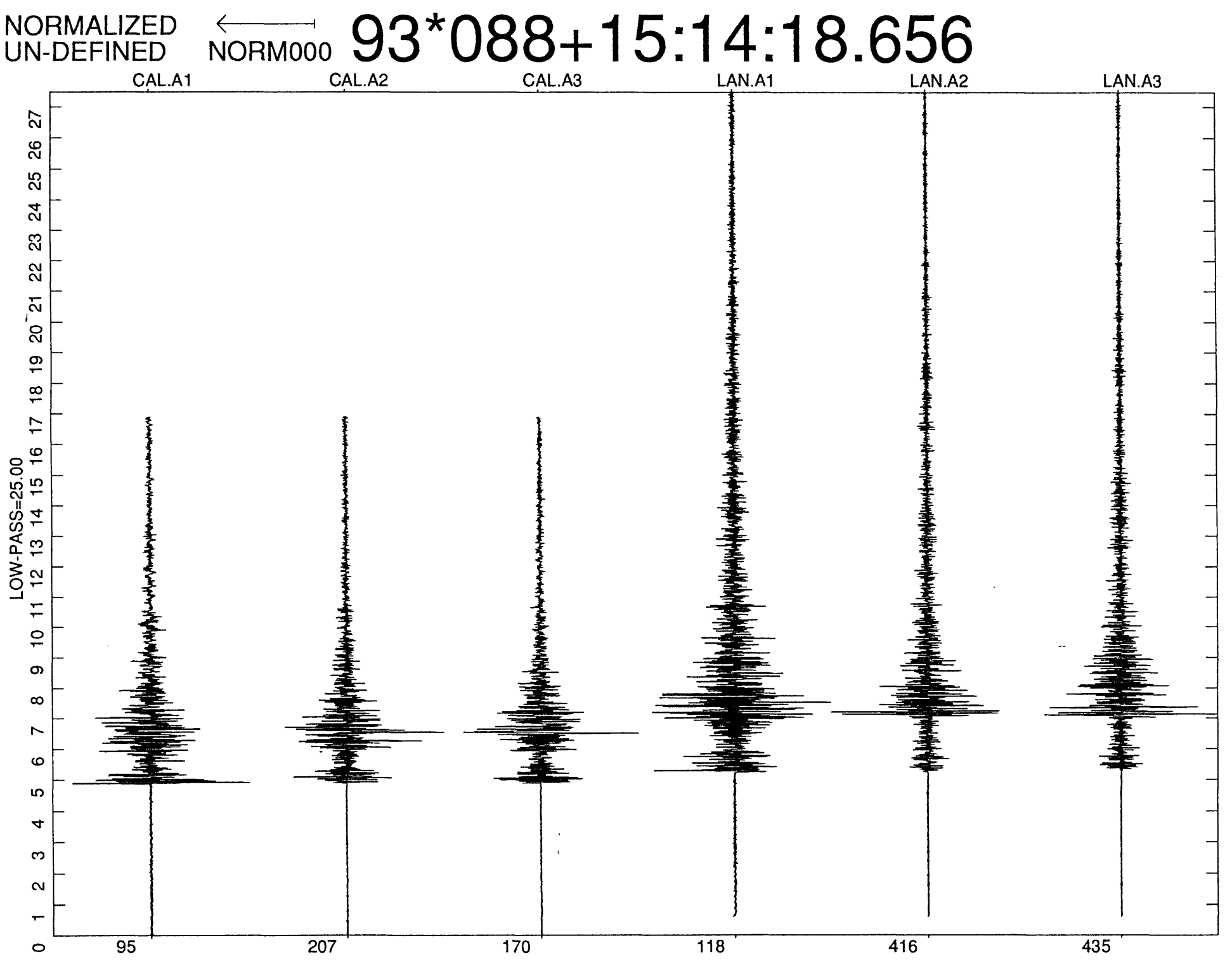
534 301 492 529 285 306 318 507 674 132 257 194 424 1410 614 120 163 406 181 257 228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CAL.A1
CAL.A2
CAL.A3
LAN.A1
LAN.A2
LAN.A3
LOW-PASS=25.00
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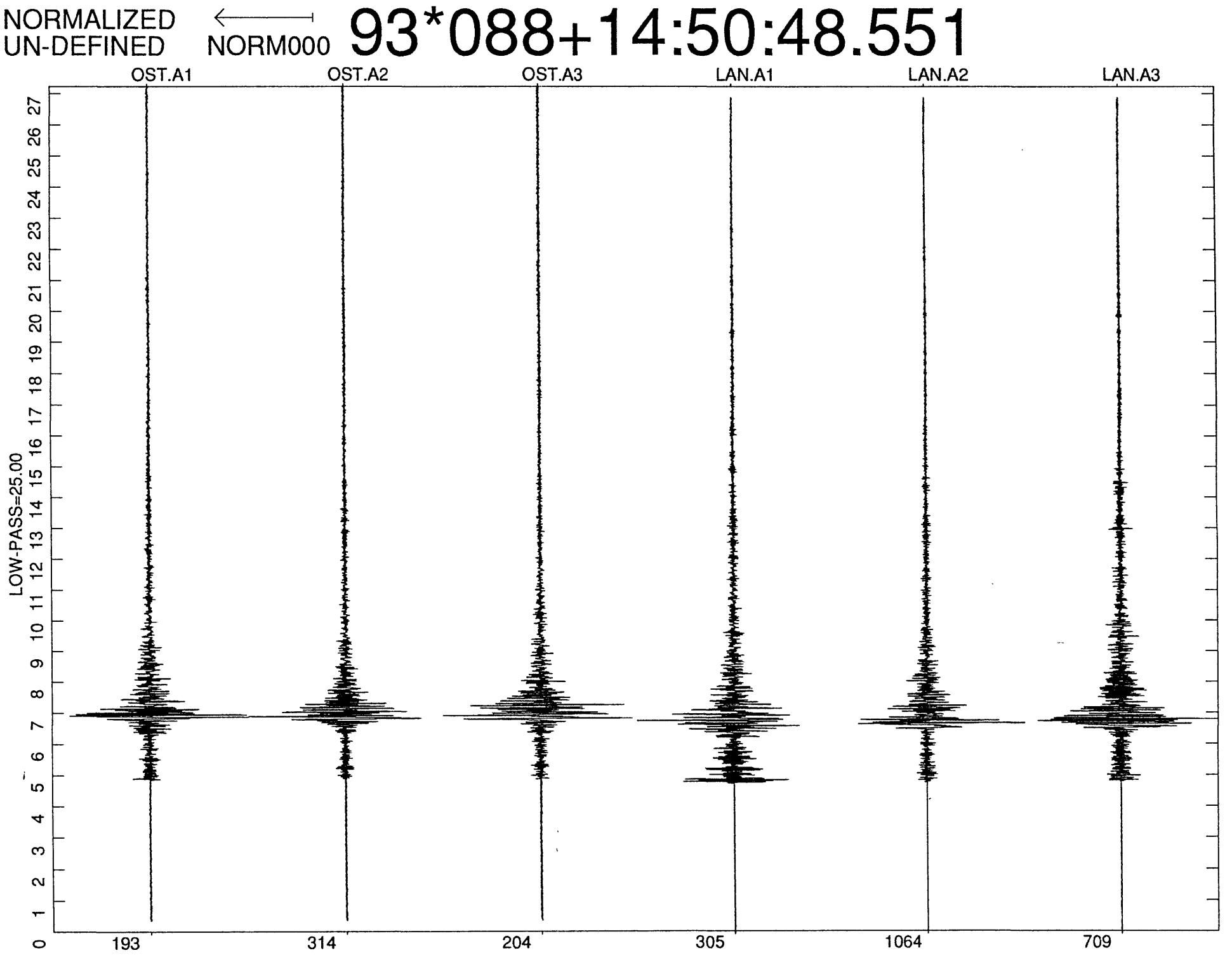
95
207
170
118
416
435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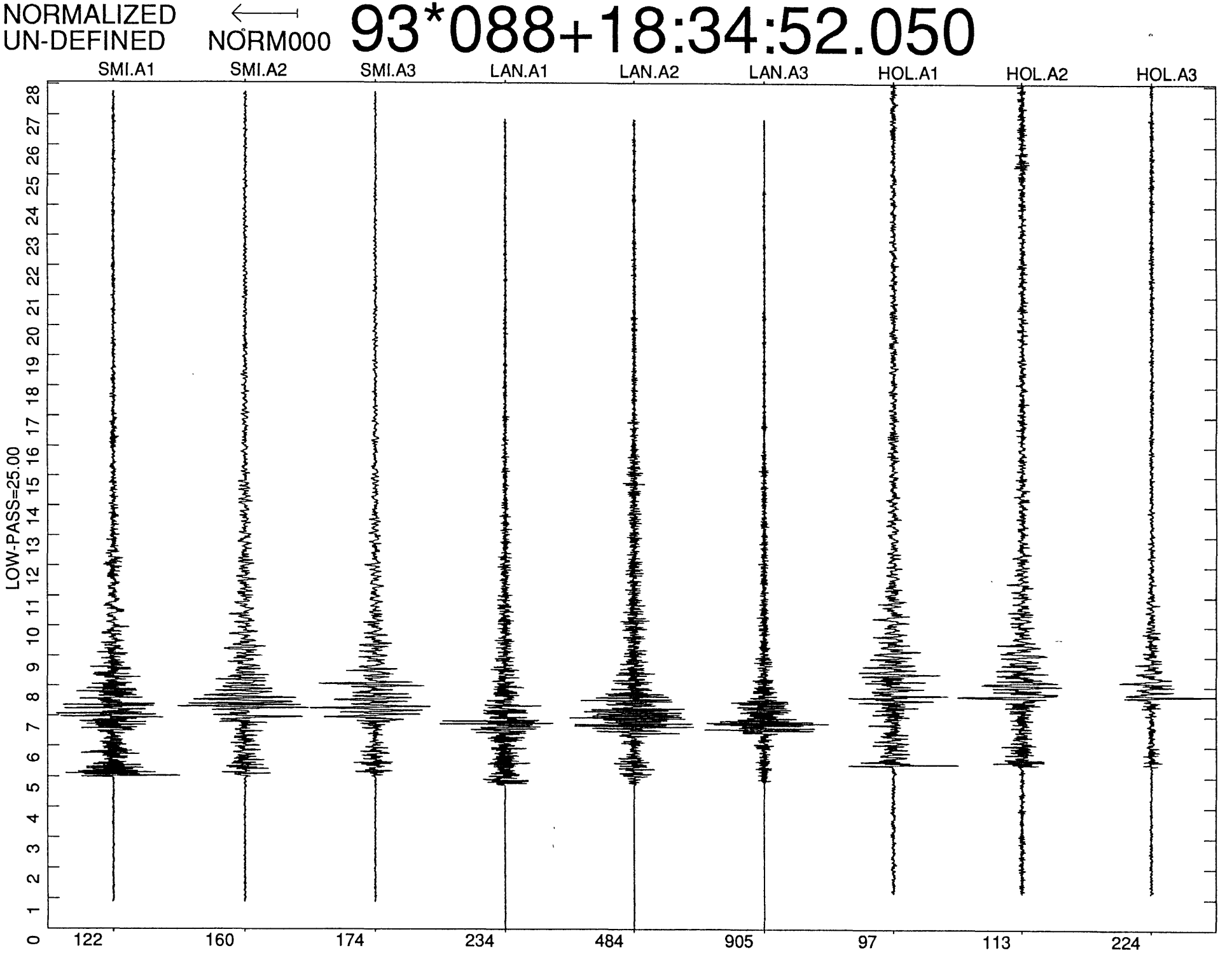
OST.A1
OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
193
314
204
305
1064
709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93*088+18:34:52.050
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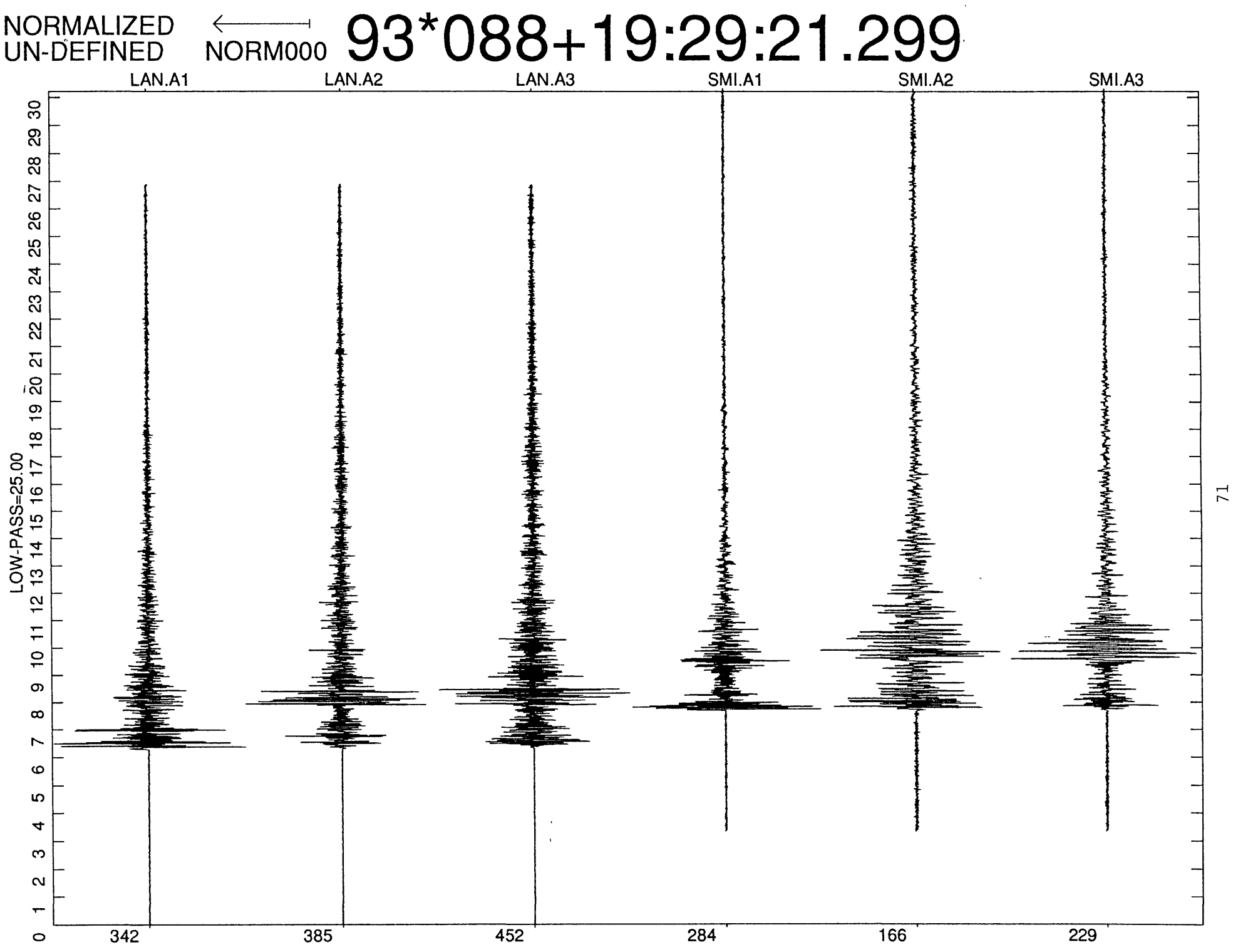
SMI.A2
SMI.A3
LAN.A1
LAN.A2
LAN.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
122
160
174
234
484
905
97
113
224
70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93*088+19:29:21.299
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LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
LOW-PASS=25.00
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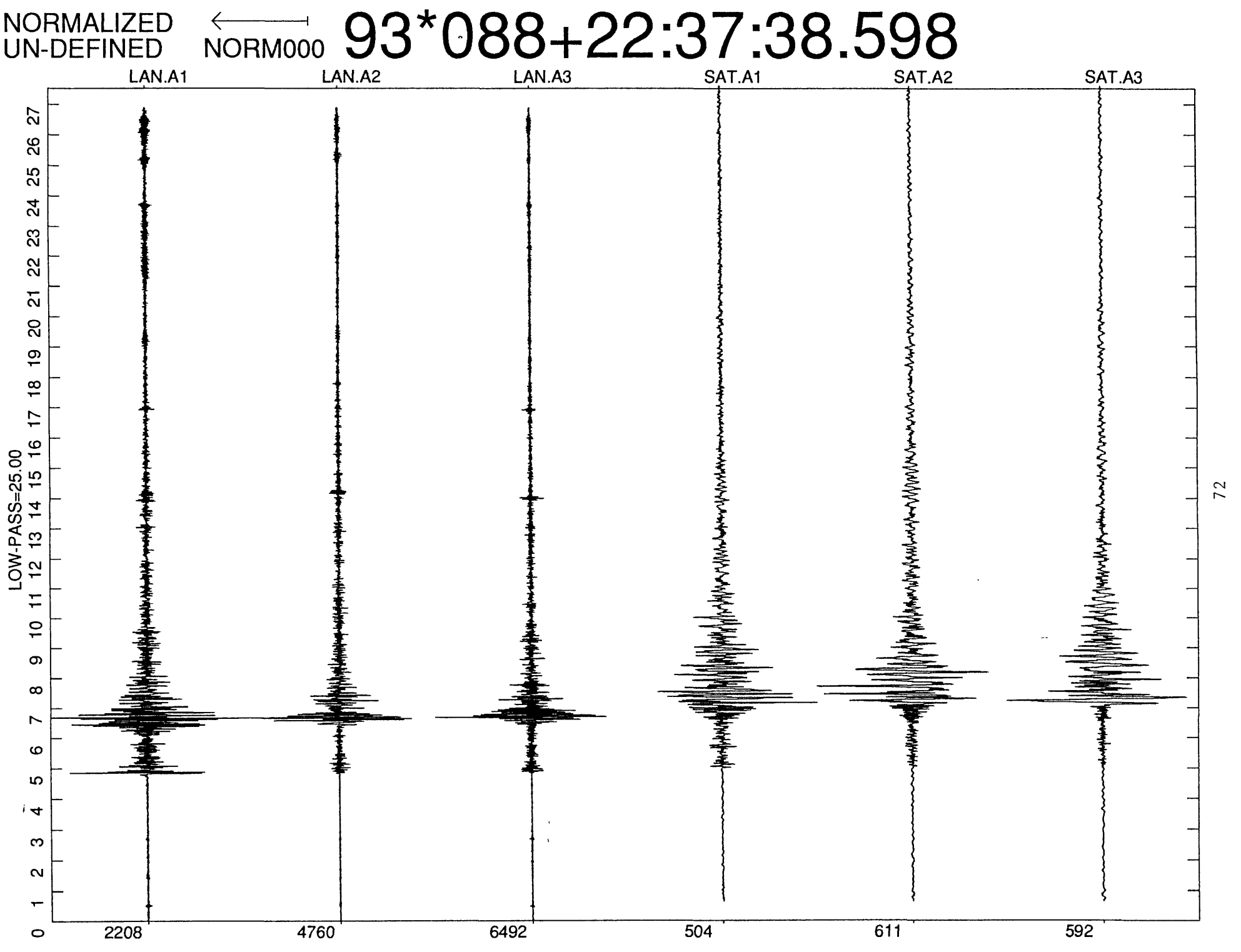
342
385
452
284
166
229
71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UN-DEFINED
NORM000
93*088+22:37:38.598
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LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
LOW-PASS=25.00
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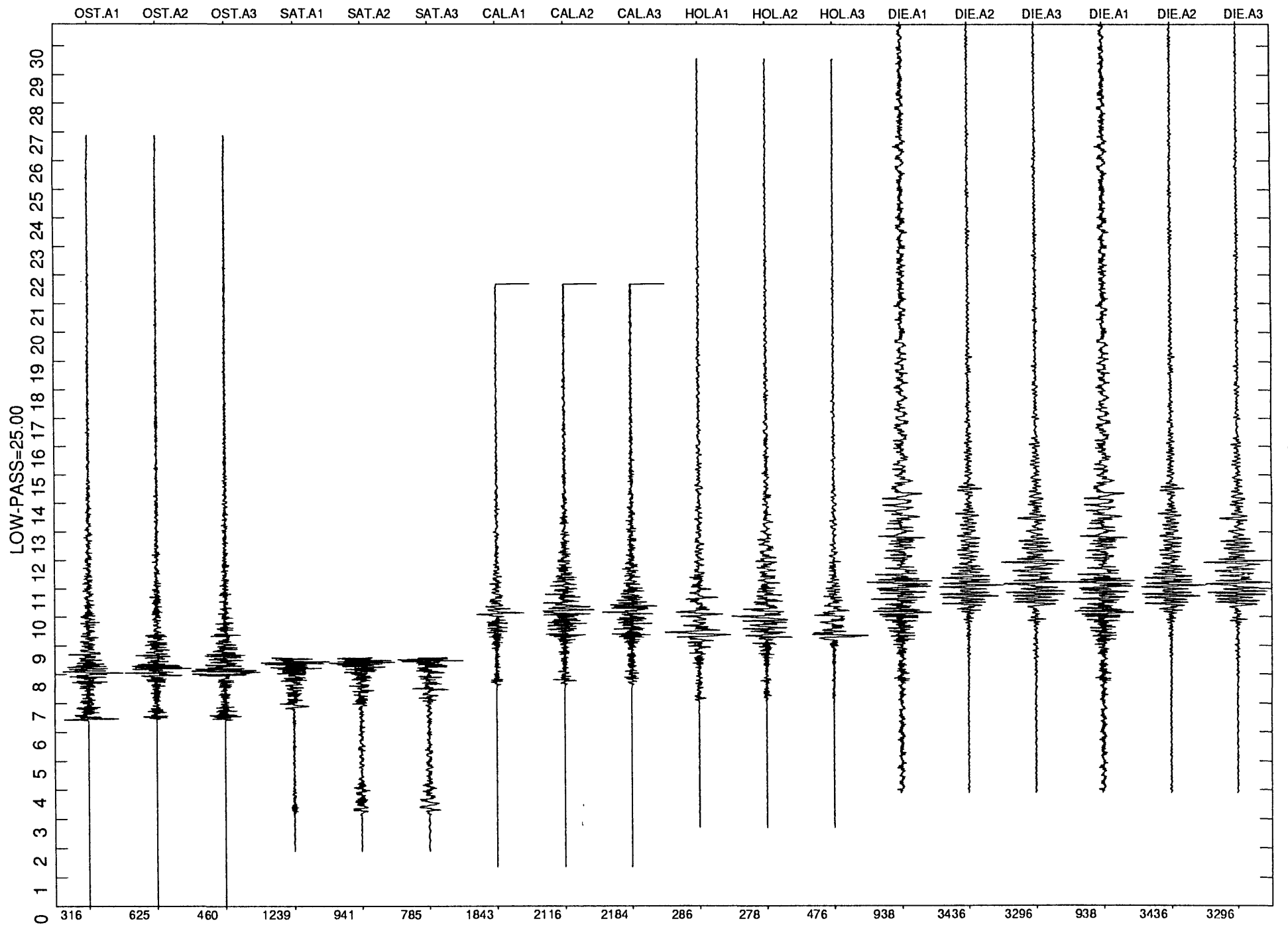
2208
4760
6492
504
611
592
72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93*088+22:47:41.796
OST.A1
OST.A2
OST.A3
SAT.A1
SAT.A2
SAT.A3
CAL.A1
CAL.A2
CAL.A3
HOL.A1
HOL.A2
HOL.A3
DIE.A1
DIE.A2
DIE.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
316
625
460
1239
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785
1843
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2184
286
278
476
938
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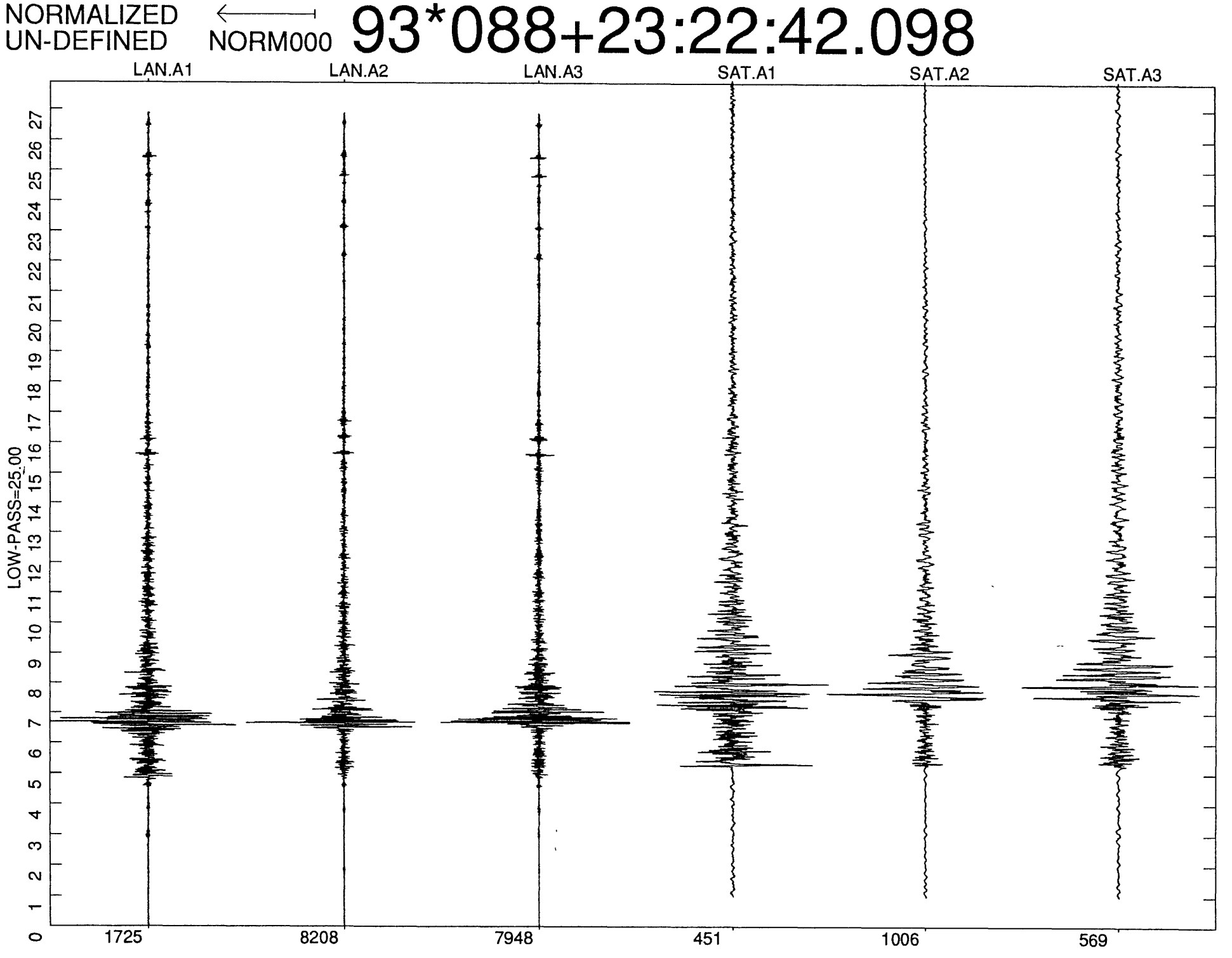
938
3436
3296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LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
LOW-PASS=25.00
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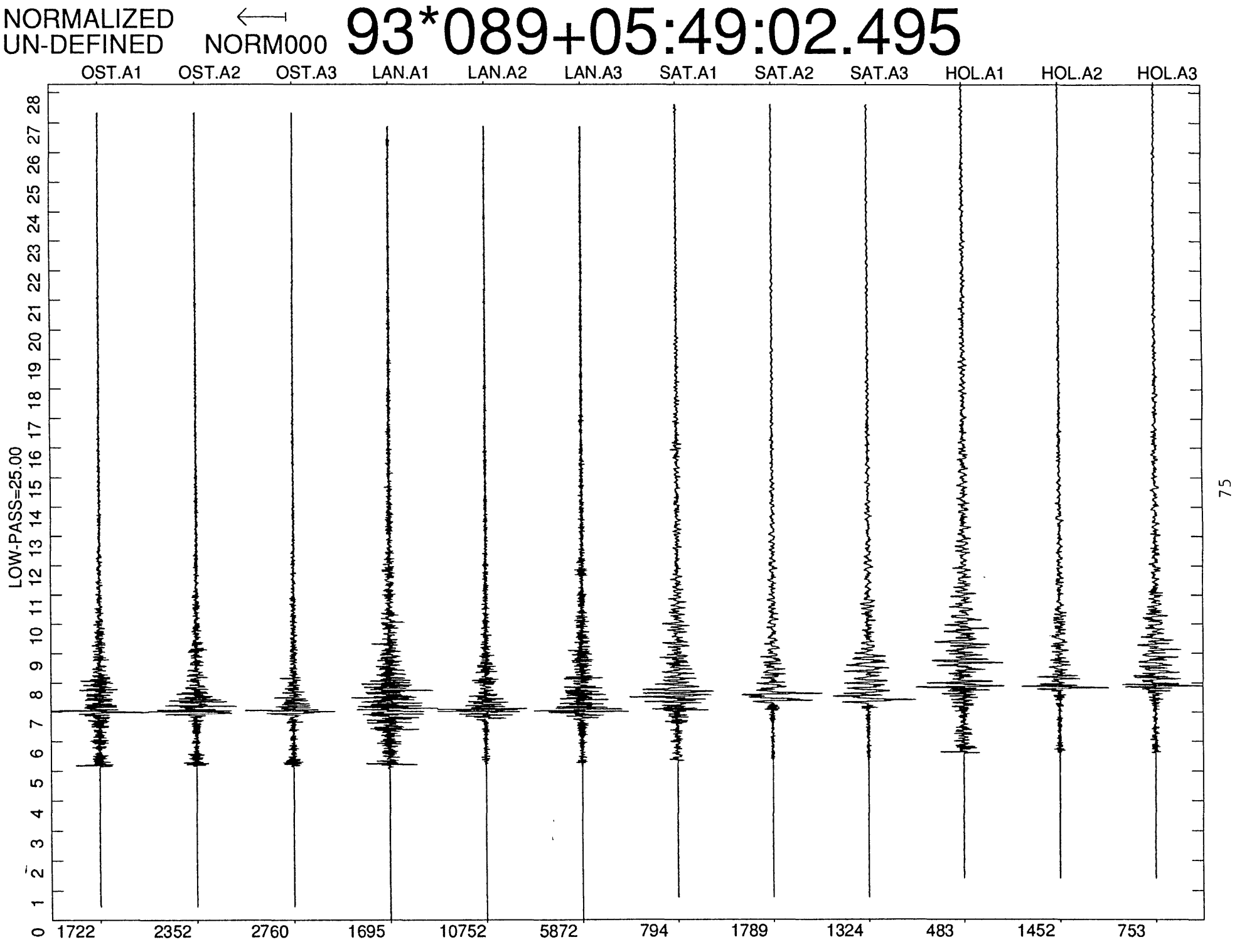
1725
8208
7948
451
1006
569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OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
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2352
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1695
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794
1789
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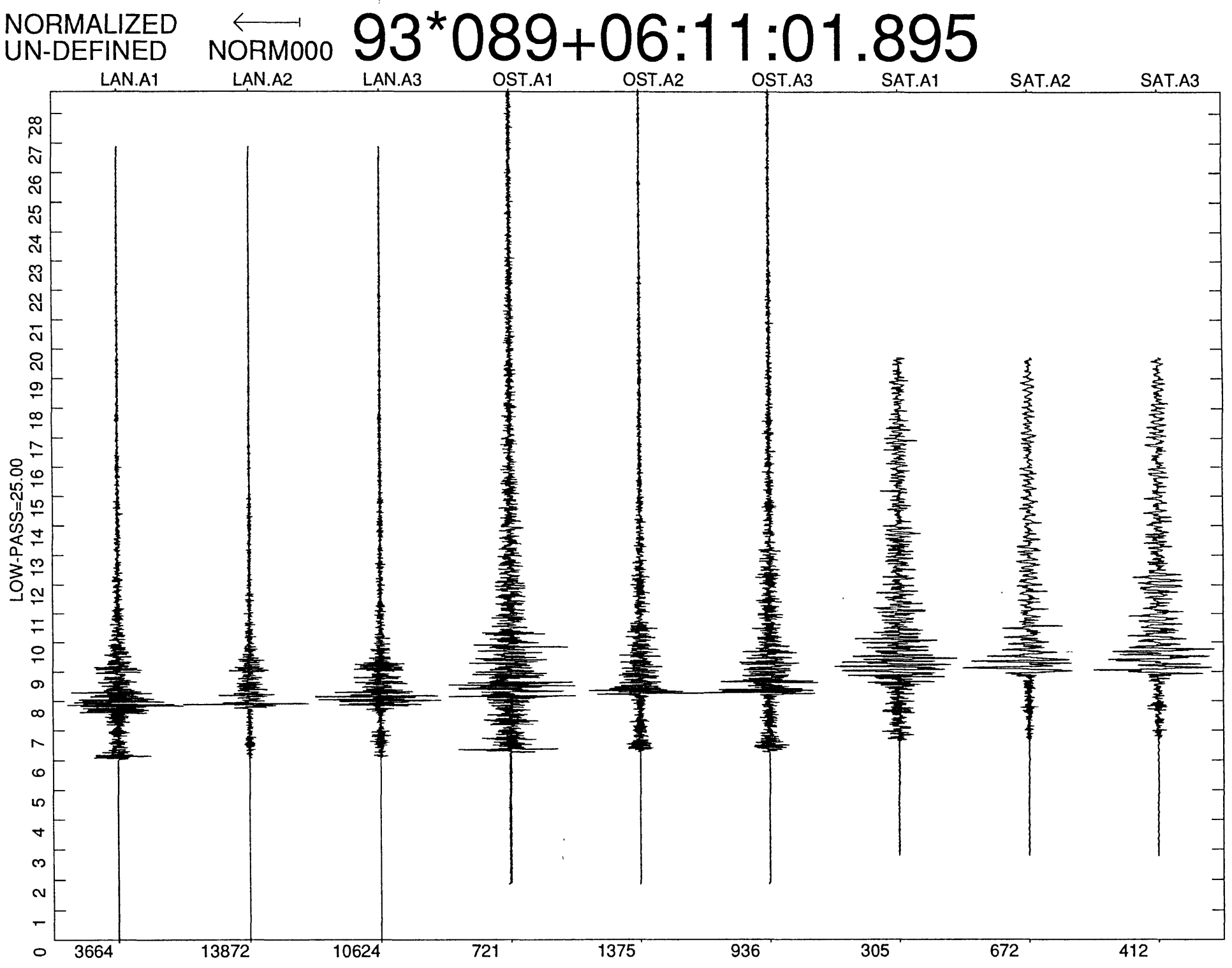
1452
753
75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93*089+06:11:01.895
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LAN.A2
LAN.A3
OST.A1
OST.A2
OST.A3
SAT.A1
SAT.A2
SAT.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
3664
13872
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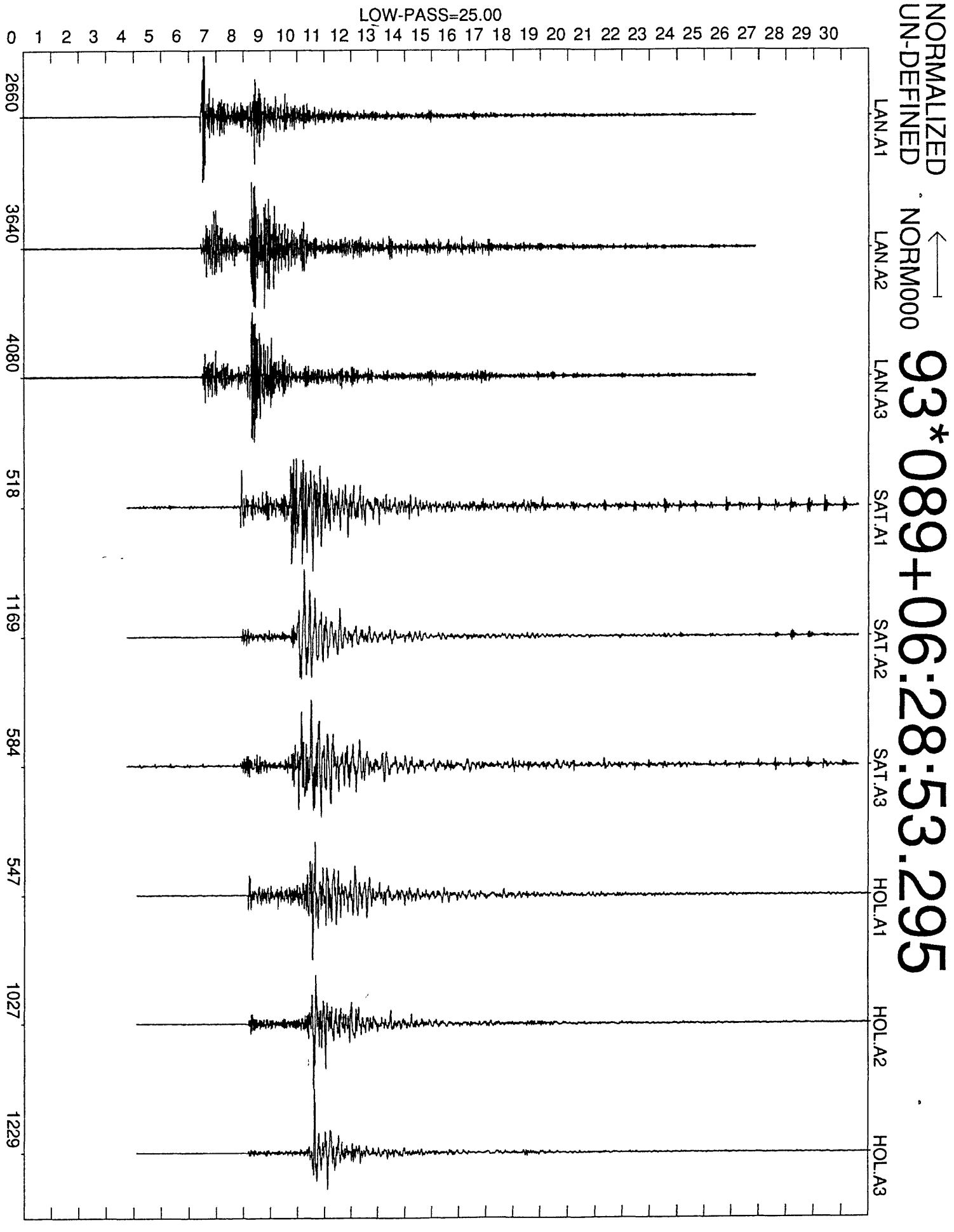
305
672
412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NORM000
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2660
LAN.A1
3640
LAN.A2
4080
LAN.A3
518
SAT.A1
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SAT.A2
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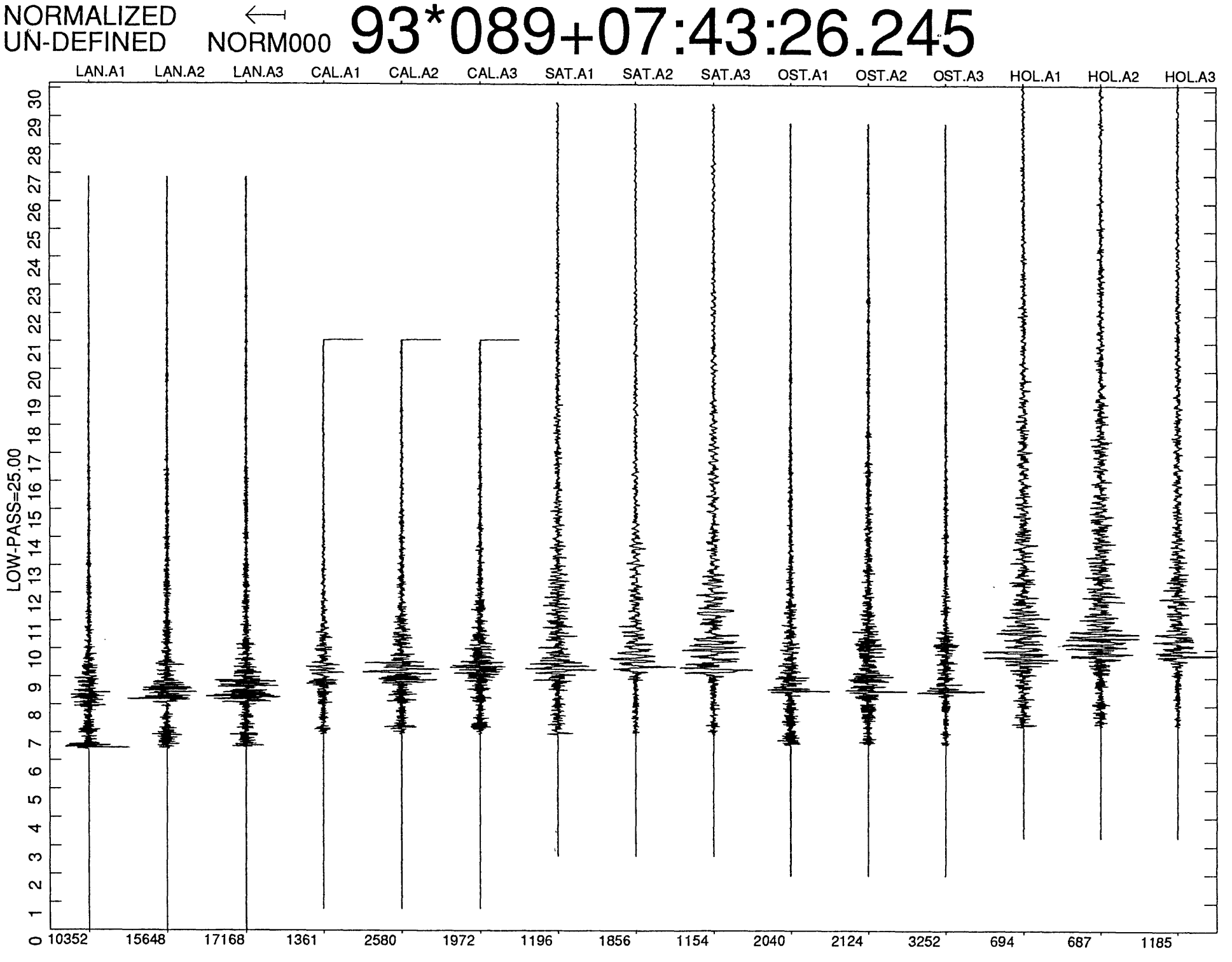
SAT.A3
547
HOL.A1
1027
HOL.A2
1229
HOL.A3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CAL.A1
CAL.A2
CAL.A3
SAT.A1
SAT.A2
SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
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687
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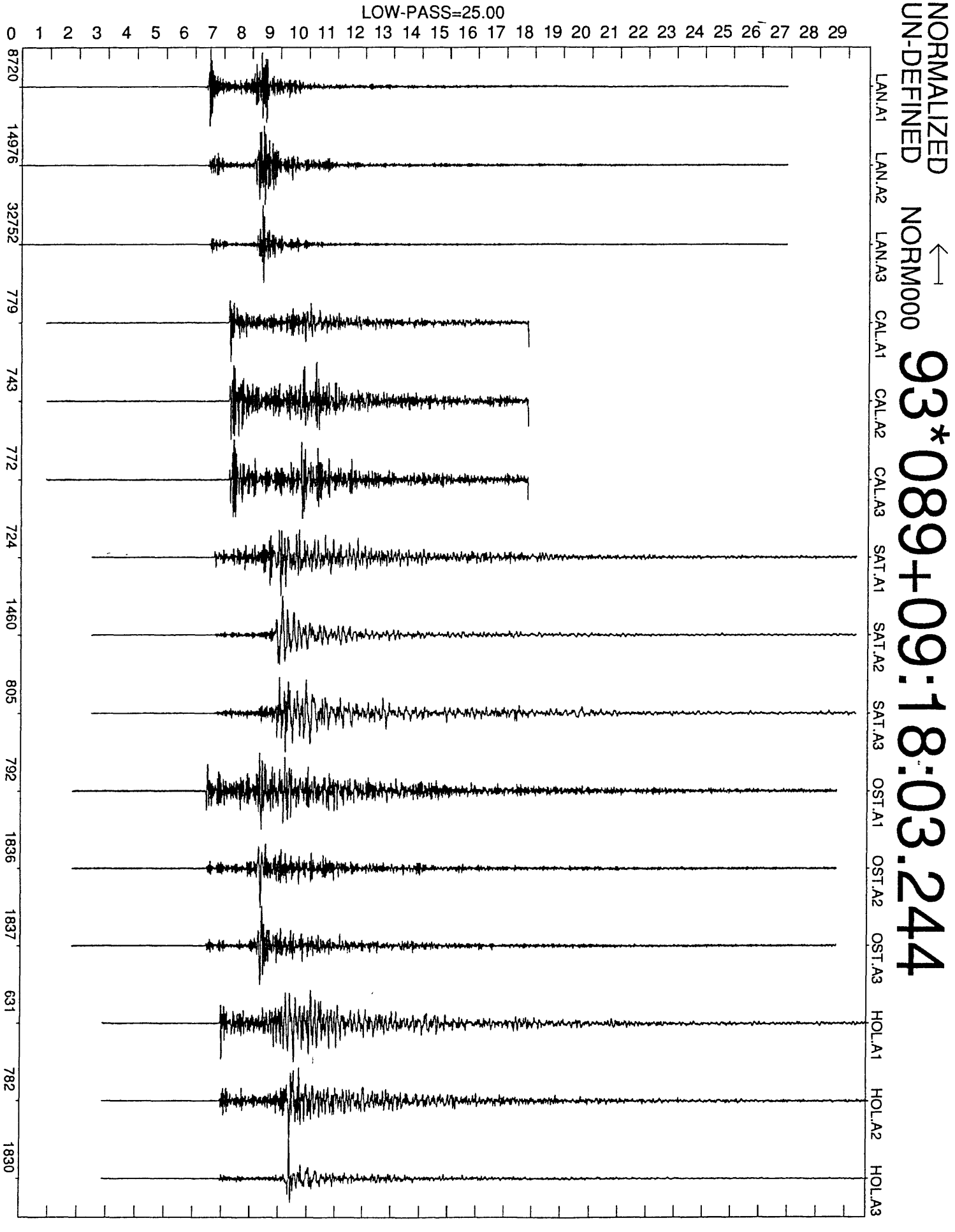
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8720
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32752
779
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724
1460
805
792
1836
1837
631
782
1830
LAN.A1
LAN.A2
LAN.A3
CAL.A1
CAL.A2
CAL.A3
SAT.A1
SAT.A2
SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
NORMALIZED
UN-DEFINED
NORM000
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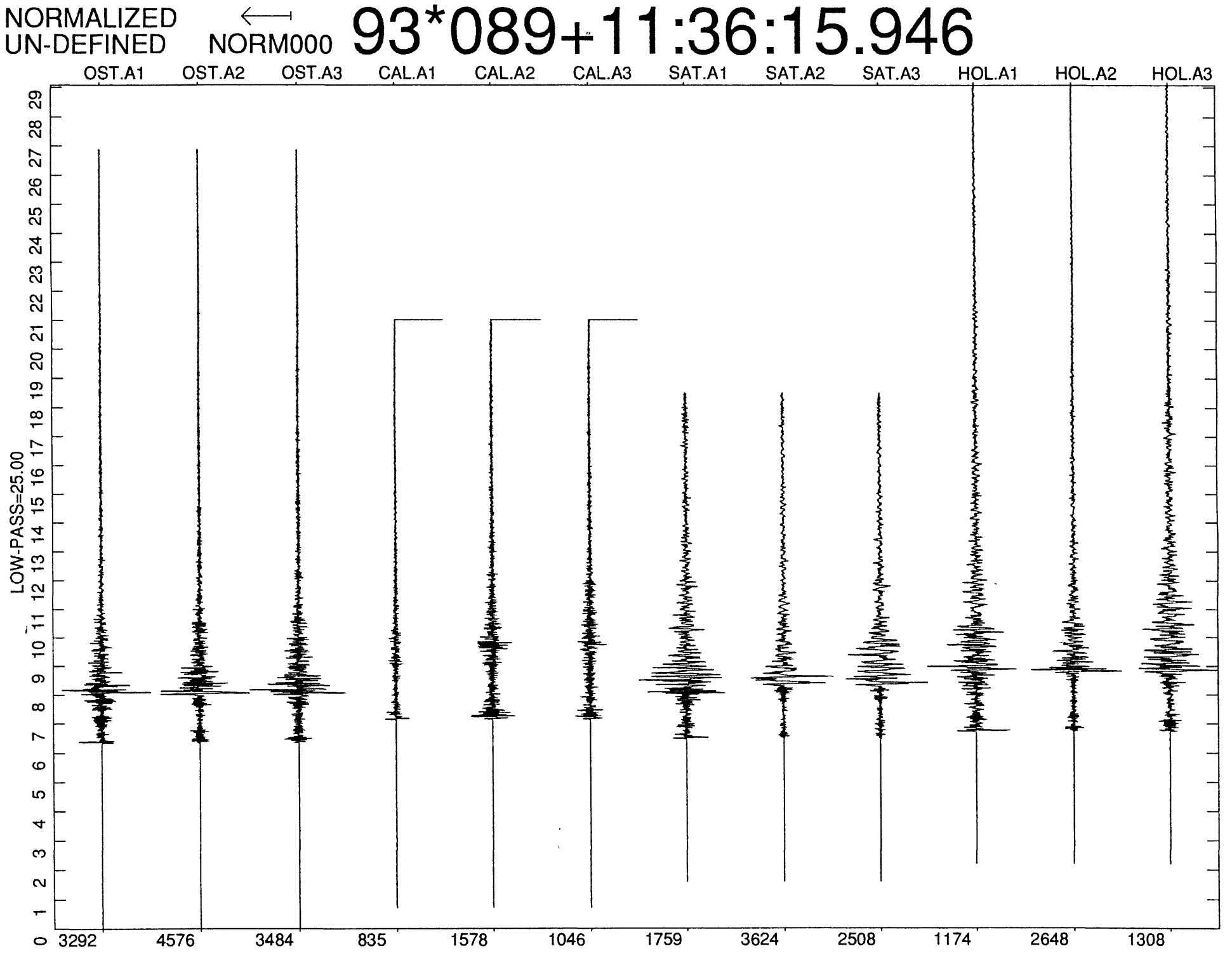
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OST.A2
OST.A3
CAL.A1
CAL.A2
CAL.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
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835
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1046
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3624
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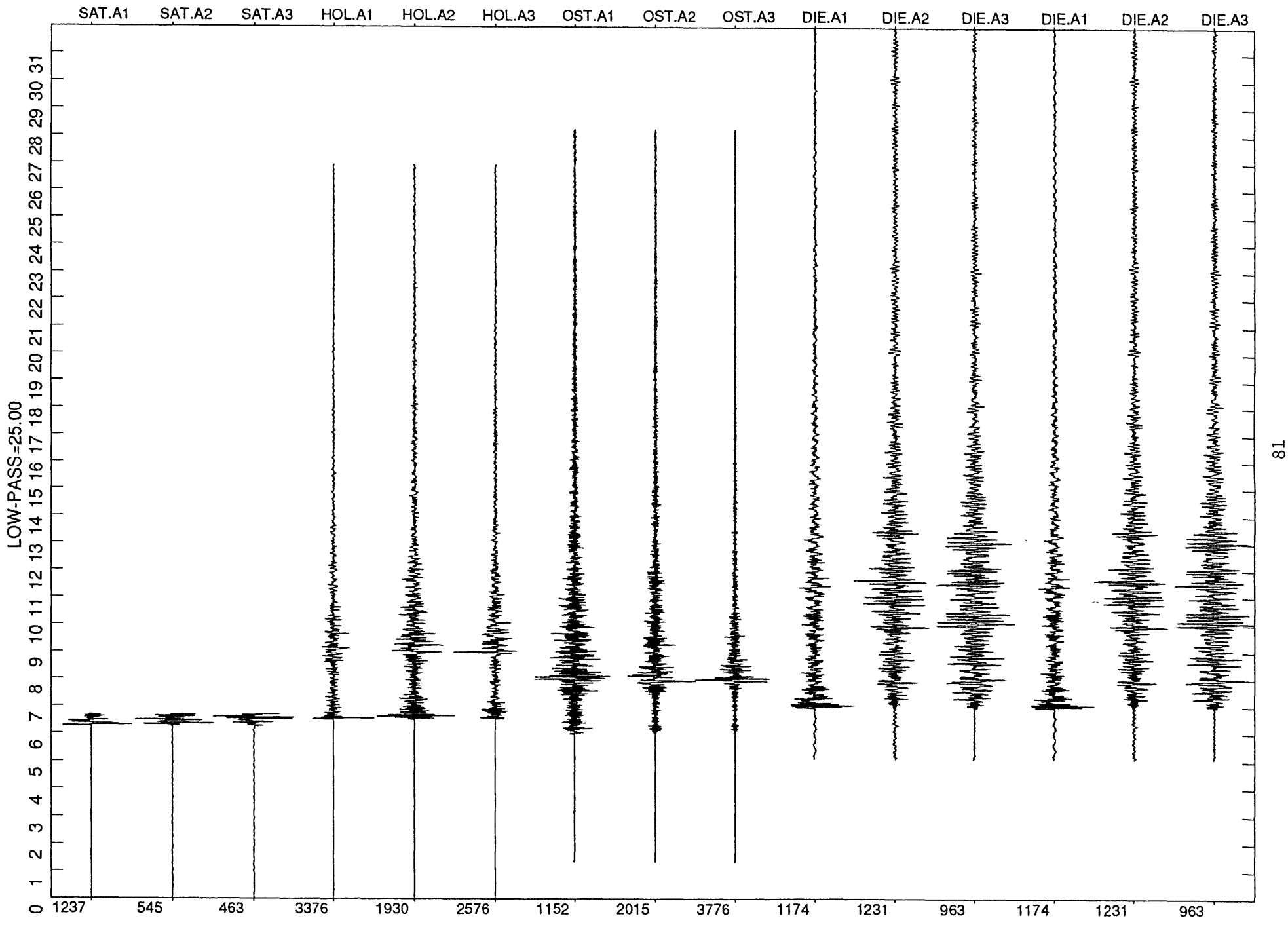
1174
2648
1308
80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NORM000
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SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
OST.A1
OST.A2
OST.A3
DIE.A1
DIE.A2
DIE.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
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3376
1930
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1152
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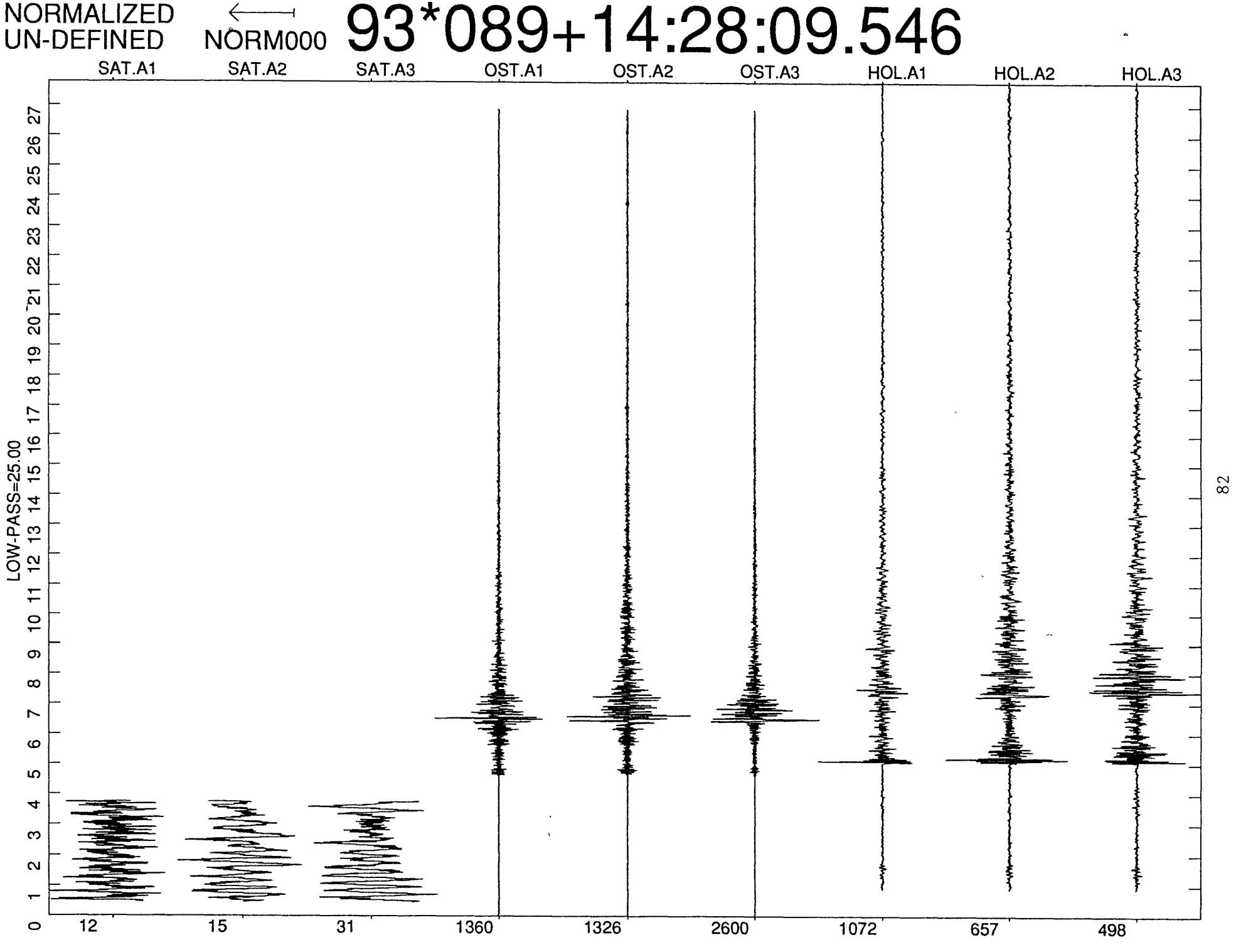
963
81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SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
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15
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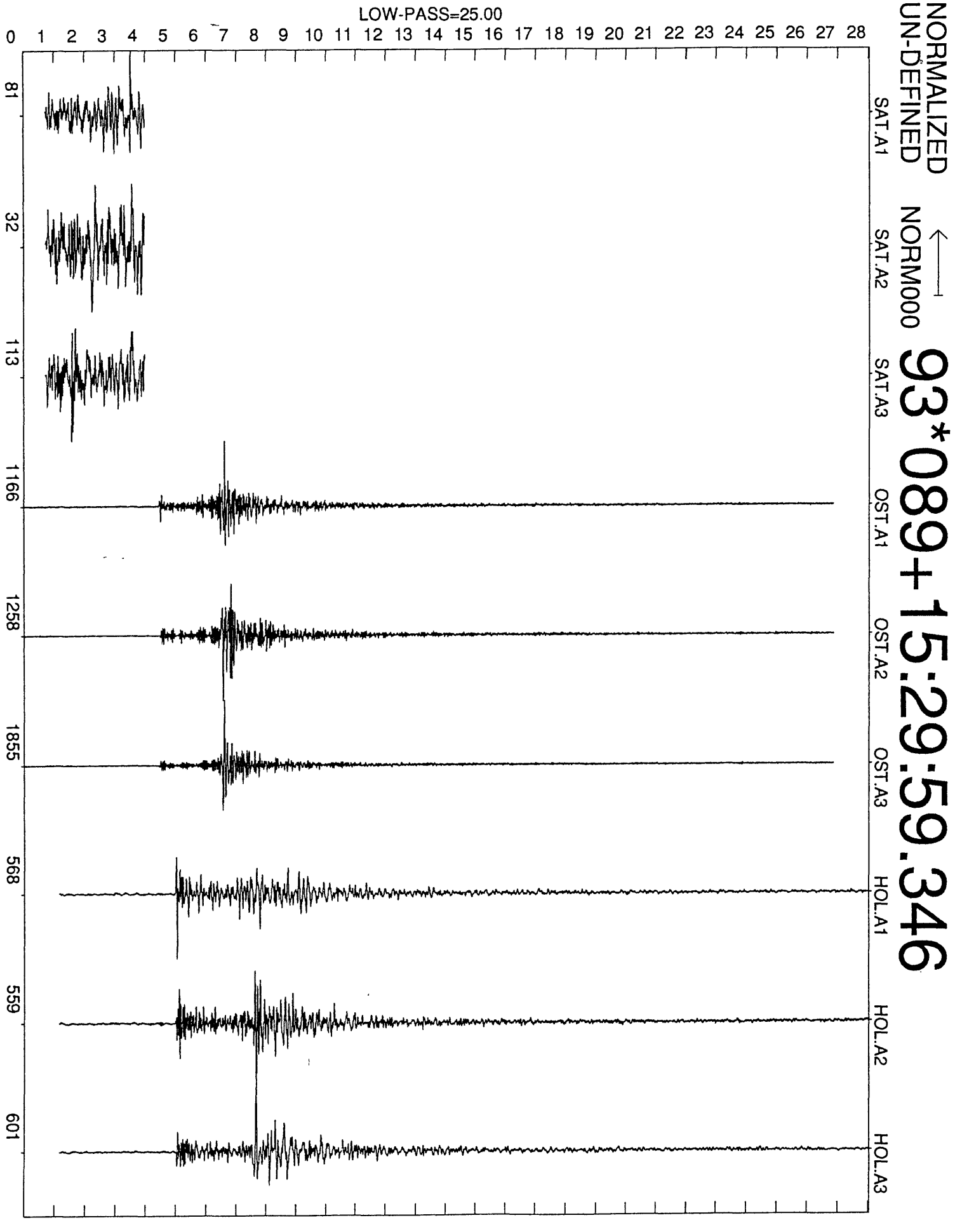
1360
1326
2600
1072
657
498
82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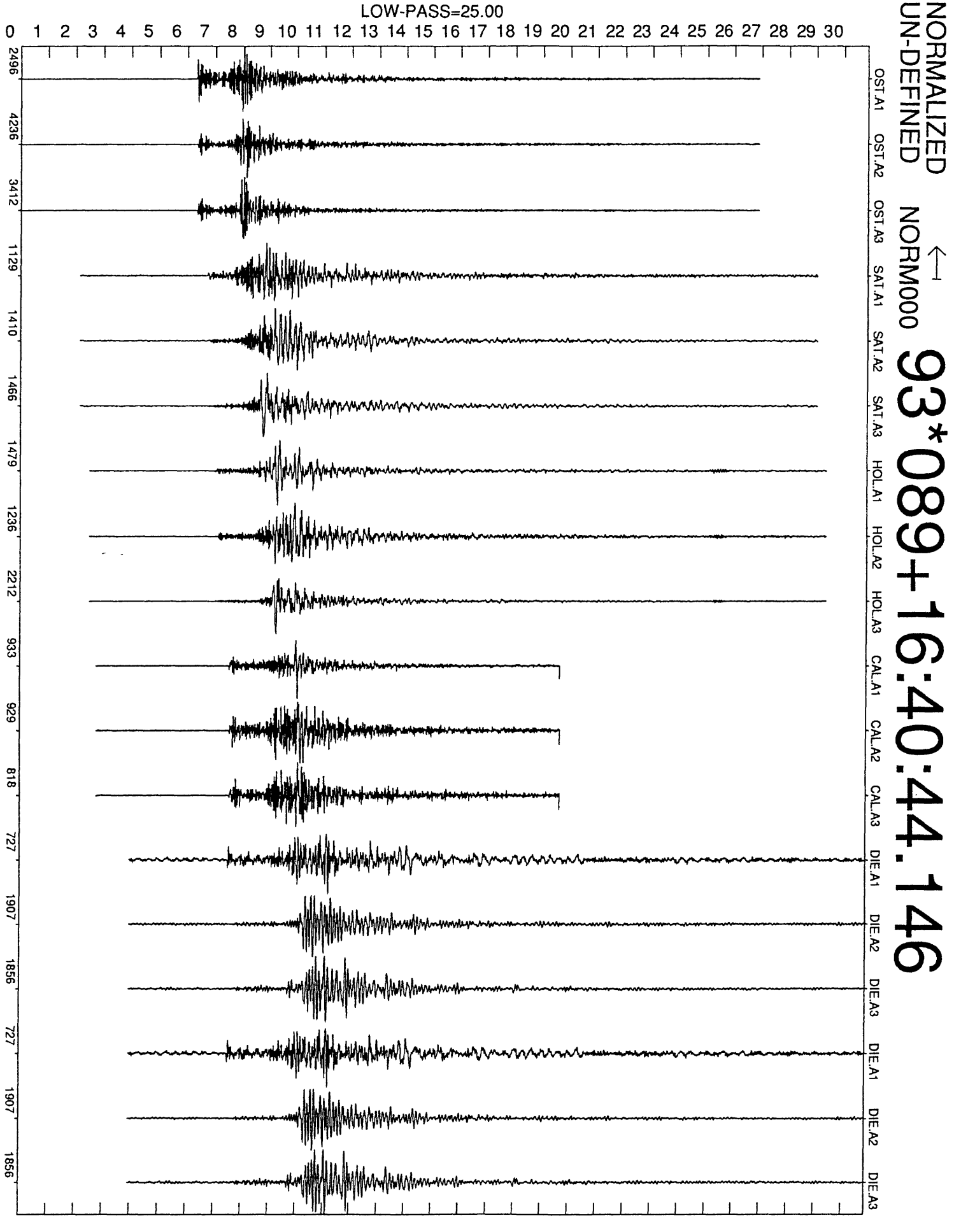
NORMALIZED
UN-DEFINED
NORM000
93*089+15:29:59.346
81
32
113
1166
1258
1855
568
559
601
SAT.A1
SAT.A2
SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3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UN-DEFINED
NORM000
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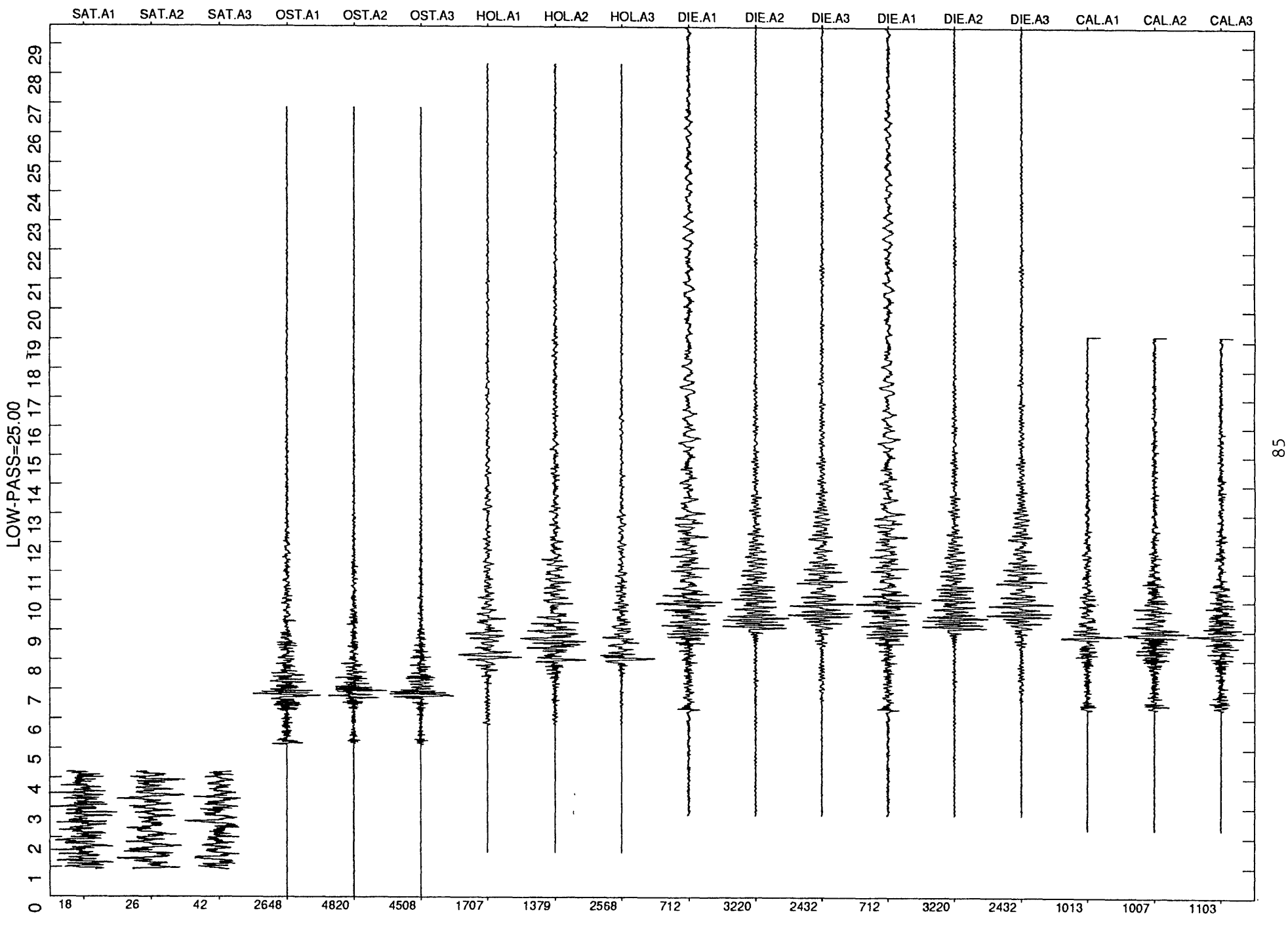
2496 OST.A1
4236 OST.A2
3412 OST.A3
1129 SAT.A1
1410 SAT.A2
1466 SAT.A3
1479 HOL.A1
1236 HOL.A2
2212 HOL.A3
933 CAL.A1
929 CAL.A2
818 CAL.A3
727 DIE.A1
1907 DIE.A2
1856 DIE.A3
727 DIE.A1
1907 DIE.A2
1856 DIE.A3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SAT.A1
SAT.A2
SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
DIE.A1
DIE.A2
DIE.A3
DIE.A1
DIE.A2
DIE.A3
CAL.A1
CAL.A2
CAL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
18
26
42
2648
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4508
1707
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2568
712
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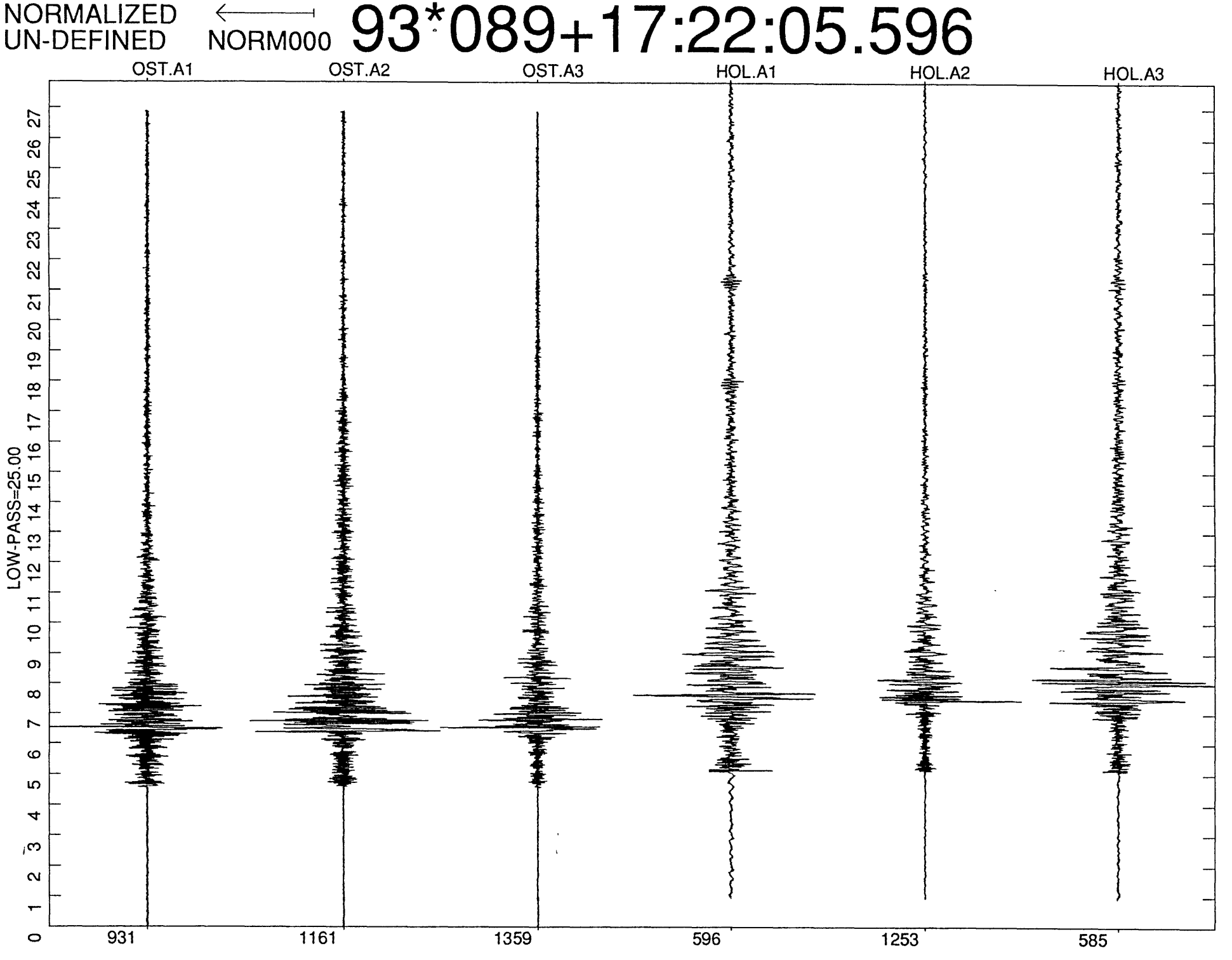
2432
712
3220
2432
1013
1007
1103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NORM000
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OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
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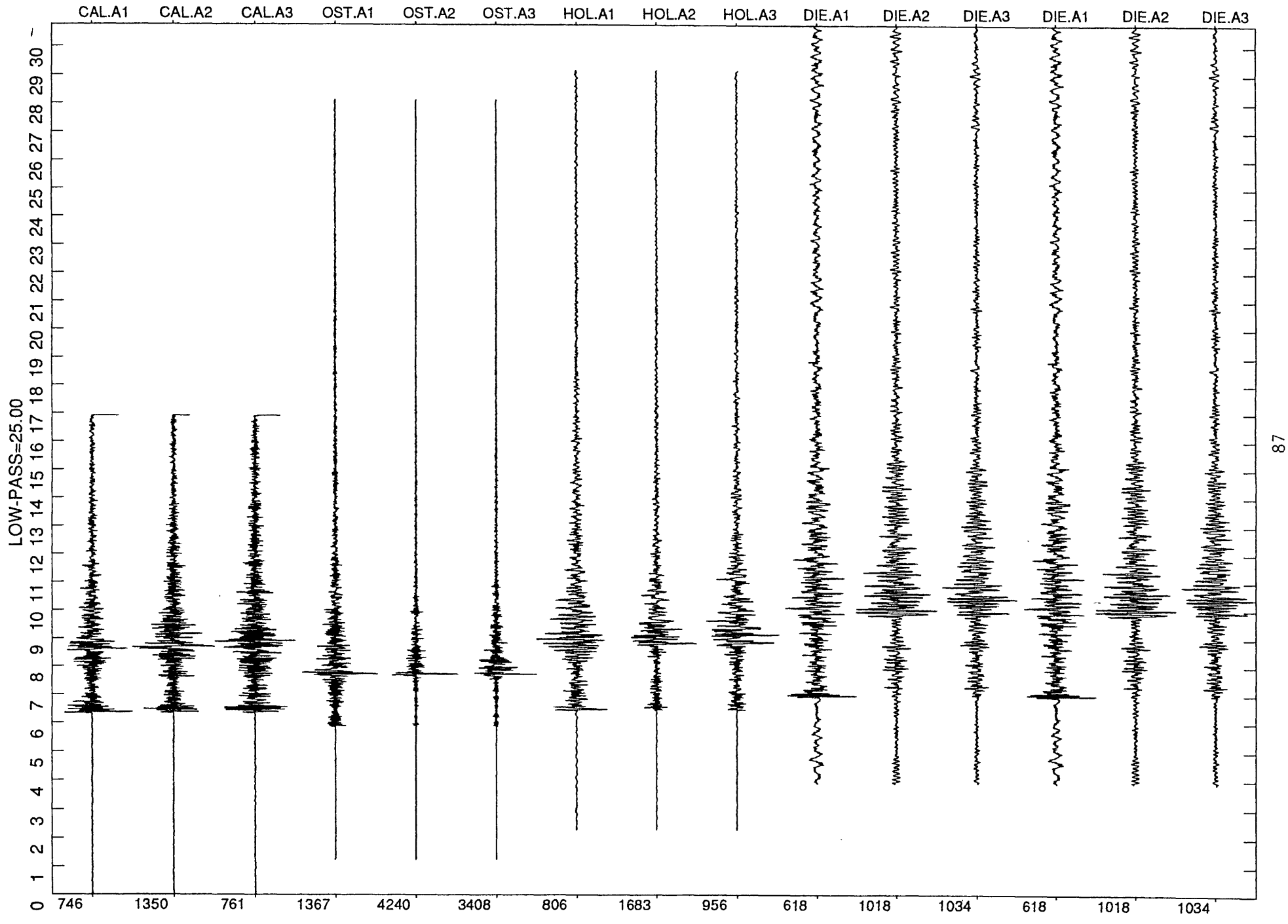
931
1161
1359
596
1253
585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CAL.A1
CAL.A2
CAL.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
DIE.A1
DIE.A2
DIE.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
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1367
4240
3408
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618
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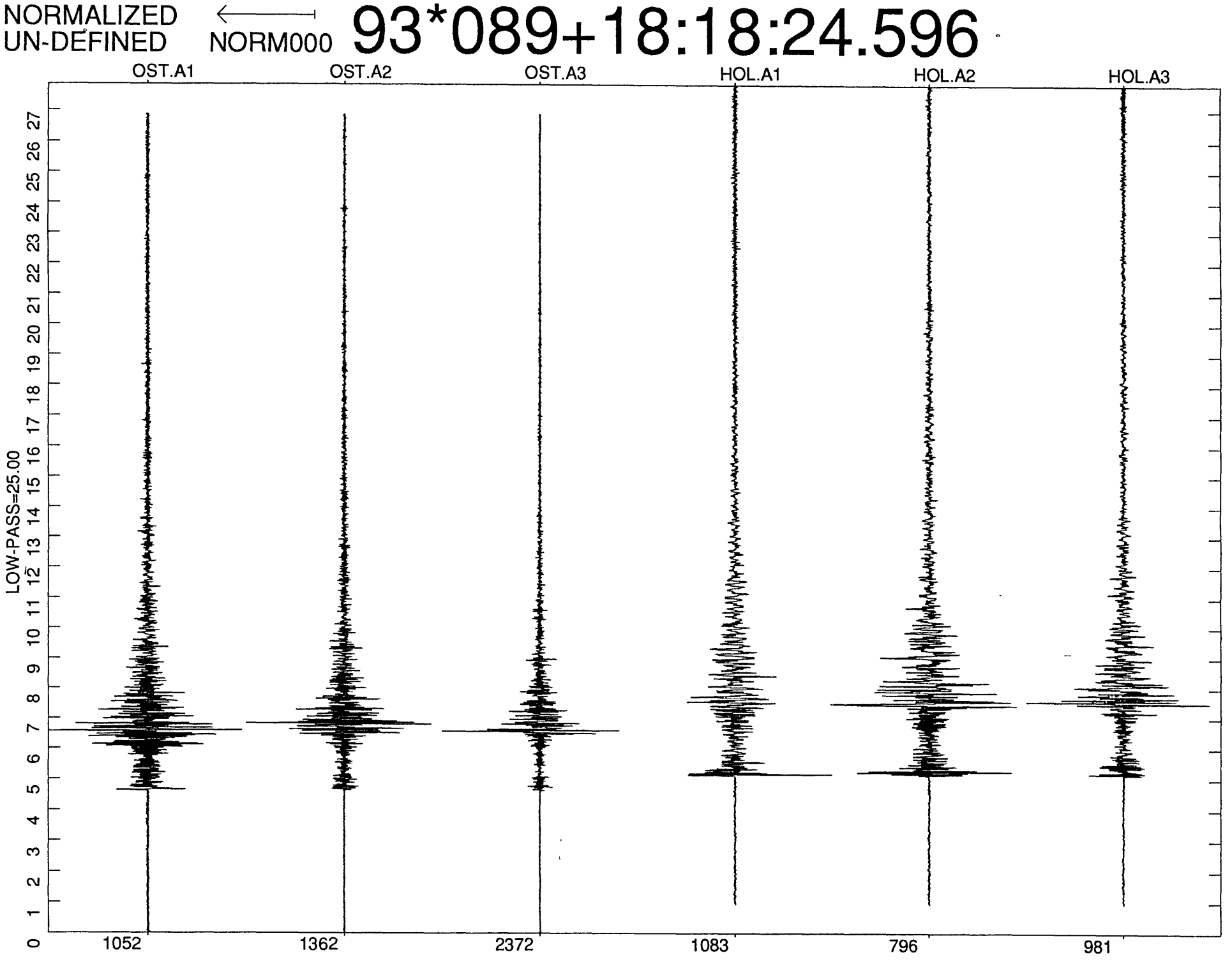
618
1018
1034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UN-DEFINED
NORM000
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OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
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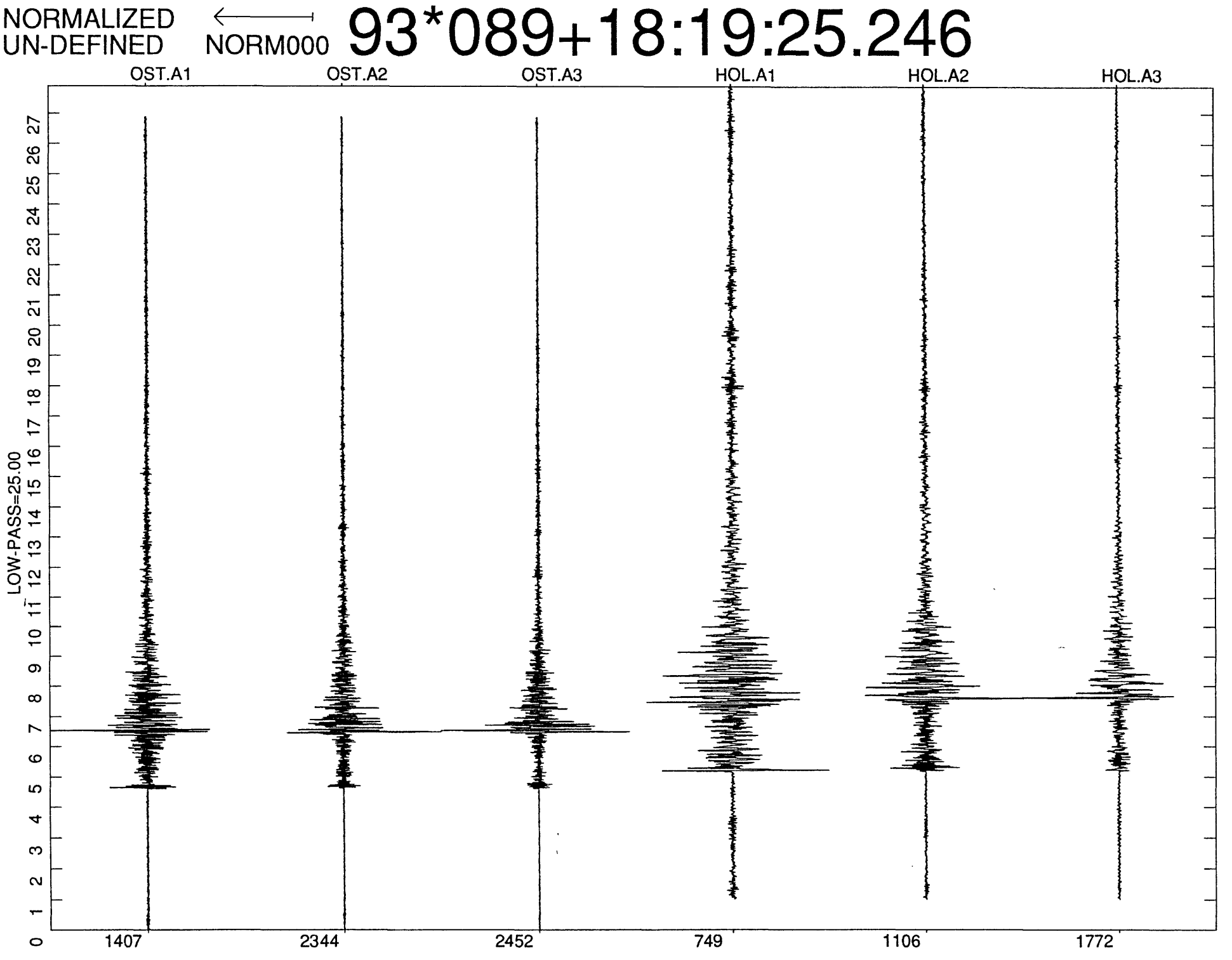
1052
1362
2372
1083
796
981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NORM000
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OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
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1407
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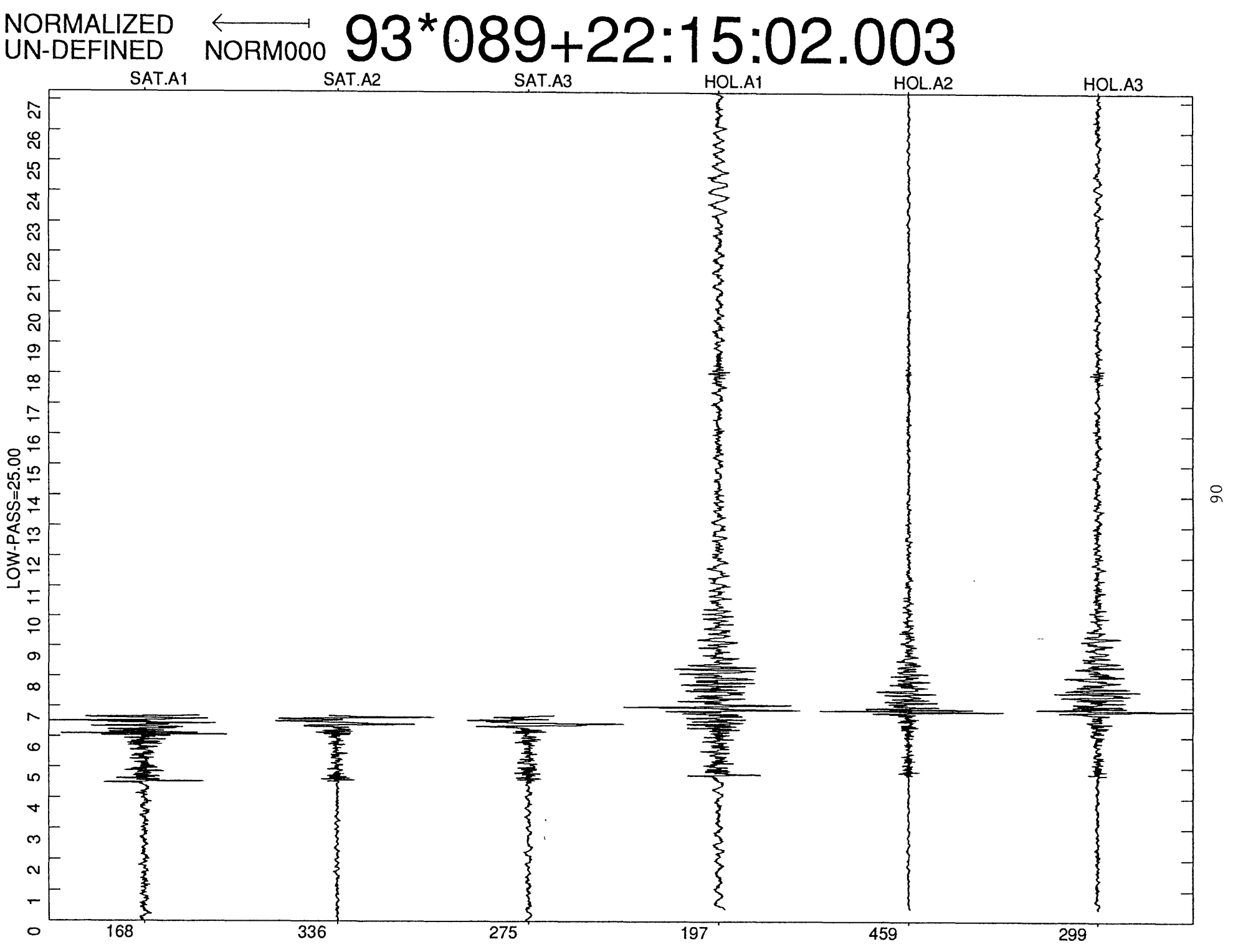
749
1106
1772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UN-DEFINED
NORM000
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SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
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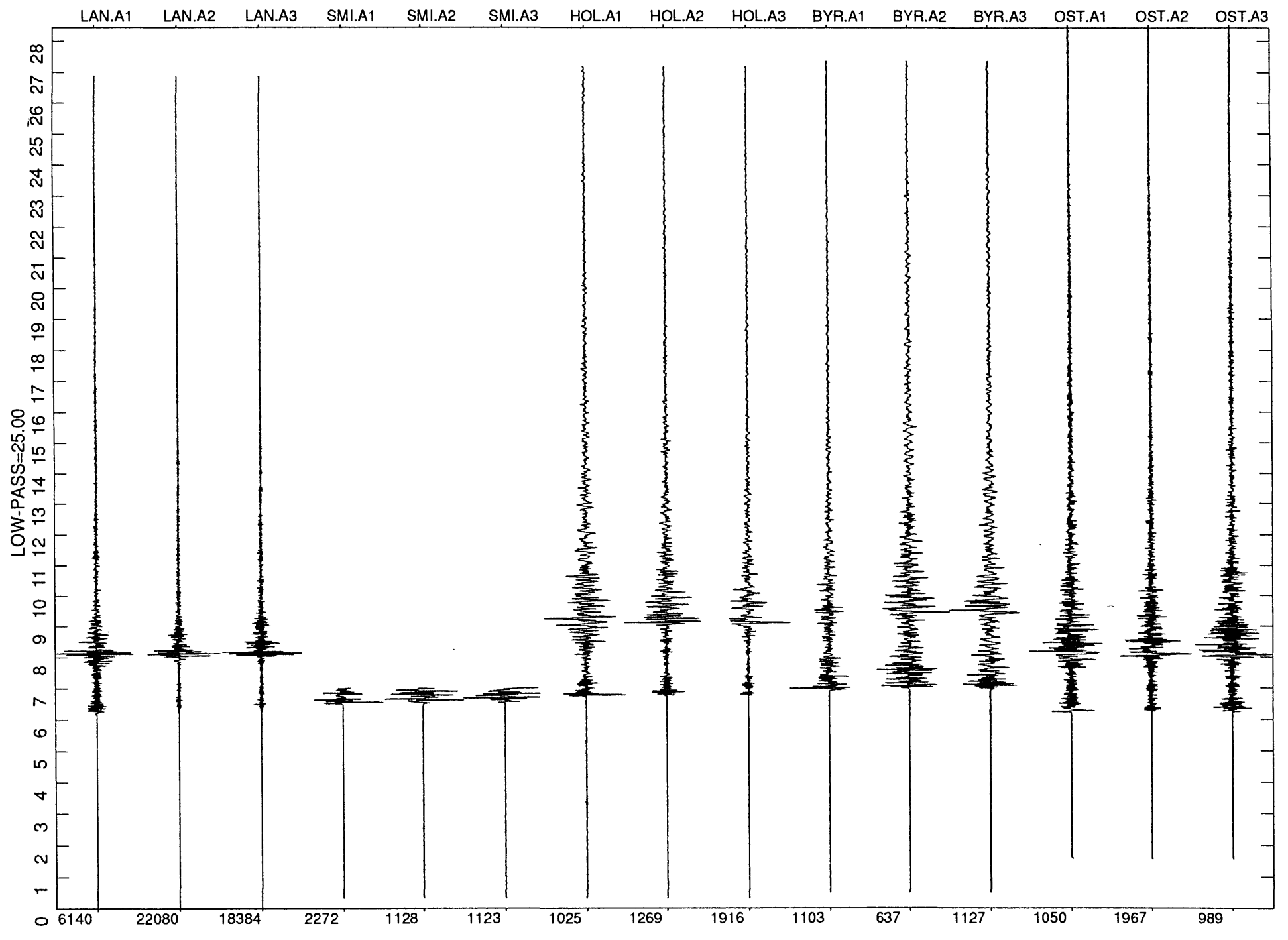
168
336
275
197
459
299
90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UN-DEFINED
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LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
HOL.A1
HOL.A2
HOL.A3
BYR.A1
BYR.A2
BYR.A3
OST.A1
OST.A2
OST.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
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2272
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1025
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1916
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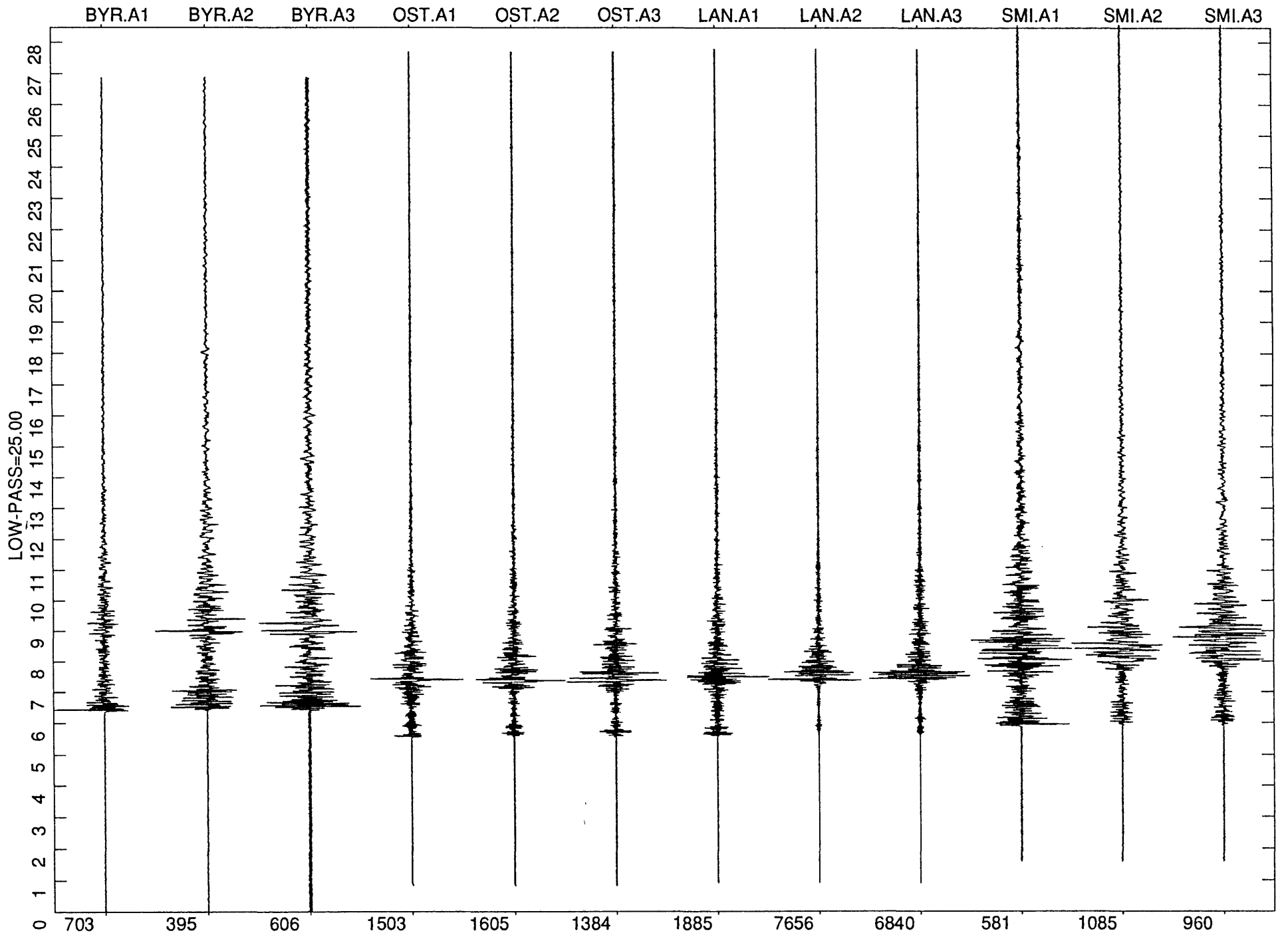
1127
1050
1967
989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BYR.A2
BYR.A3
OST.A1
OST.A2
OST.A3
LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
703
395
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1605
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6840
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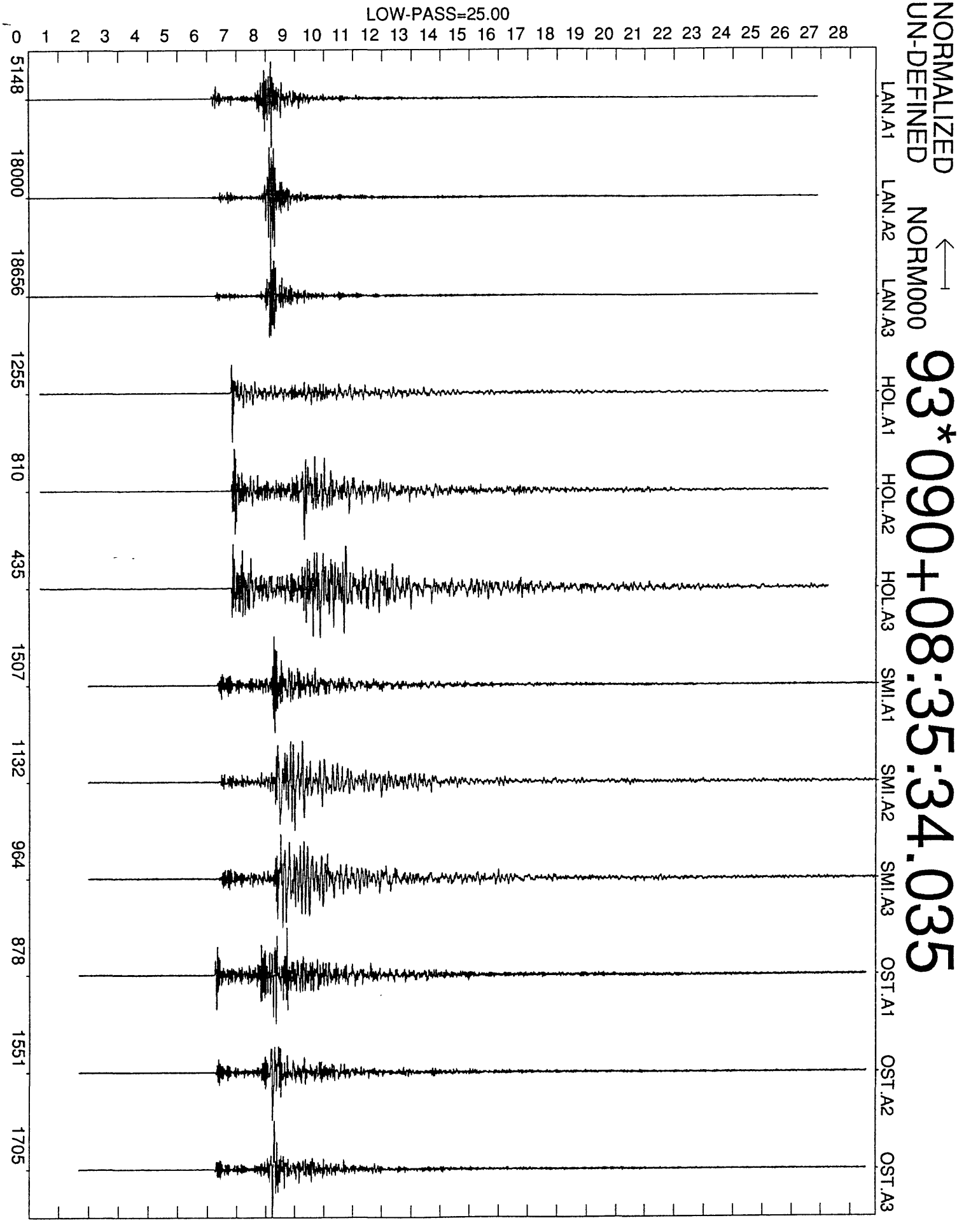
960
92


LOW-PASS=25.00
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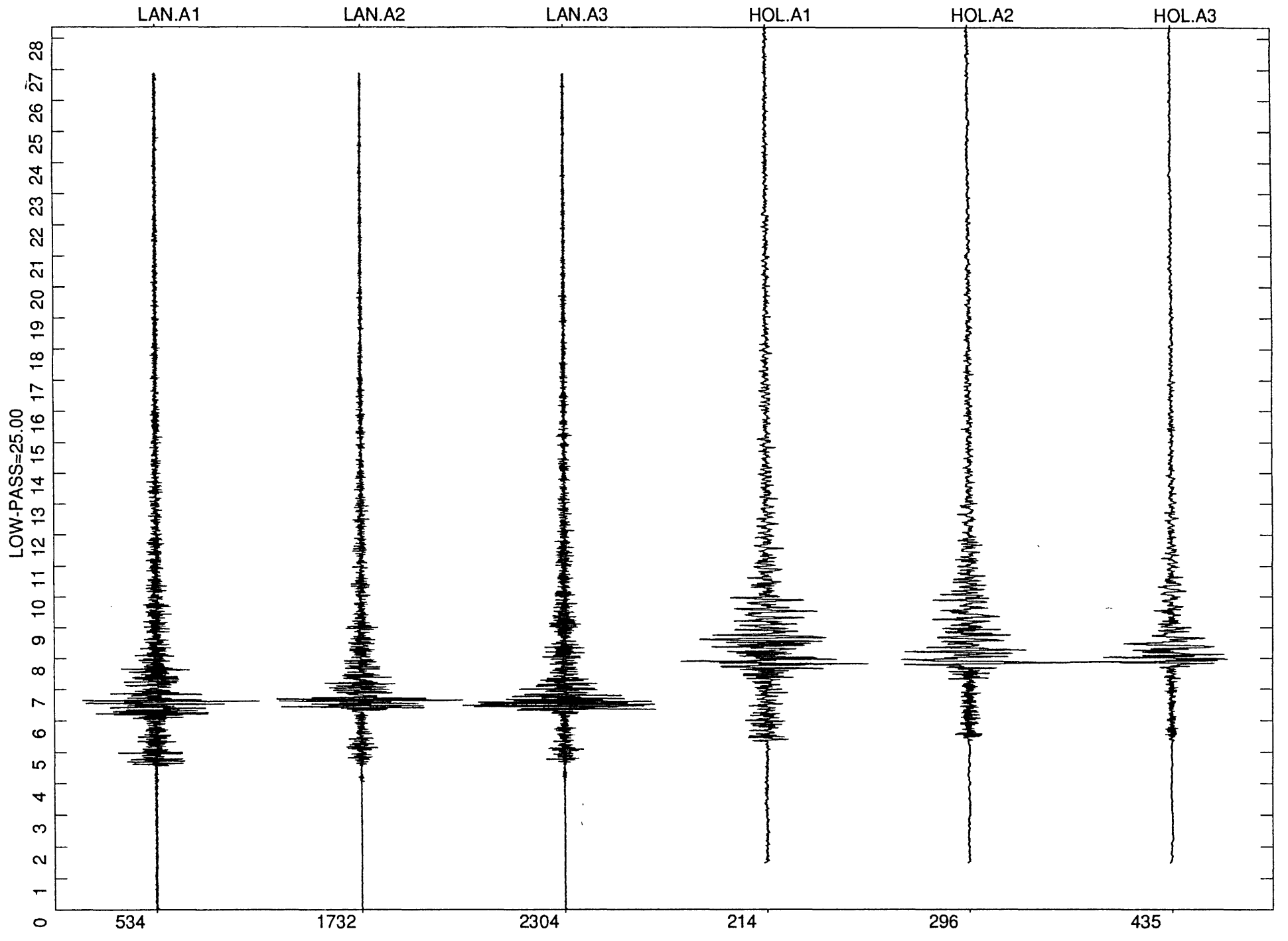
5148
18000
18656
1255
810
435
1507
1132
964
878
1551
1705
LAN.A1
LAN.A2
LAN.A3
HOL.A1
HOL.A2
HOL.A3
SMI.A1
SMI.A2
SMI.A3
OST.A1
OST.A2
OST.A3
NORMALIZED
UN-DEFINED
NORM000
93*090+08:35:34.035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UN-DEFINED
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93*090+09:01:59.984
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LAN.A2
LAN.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
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534
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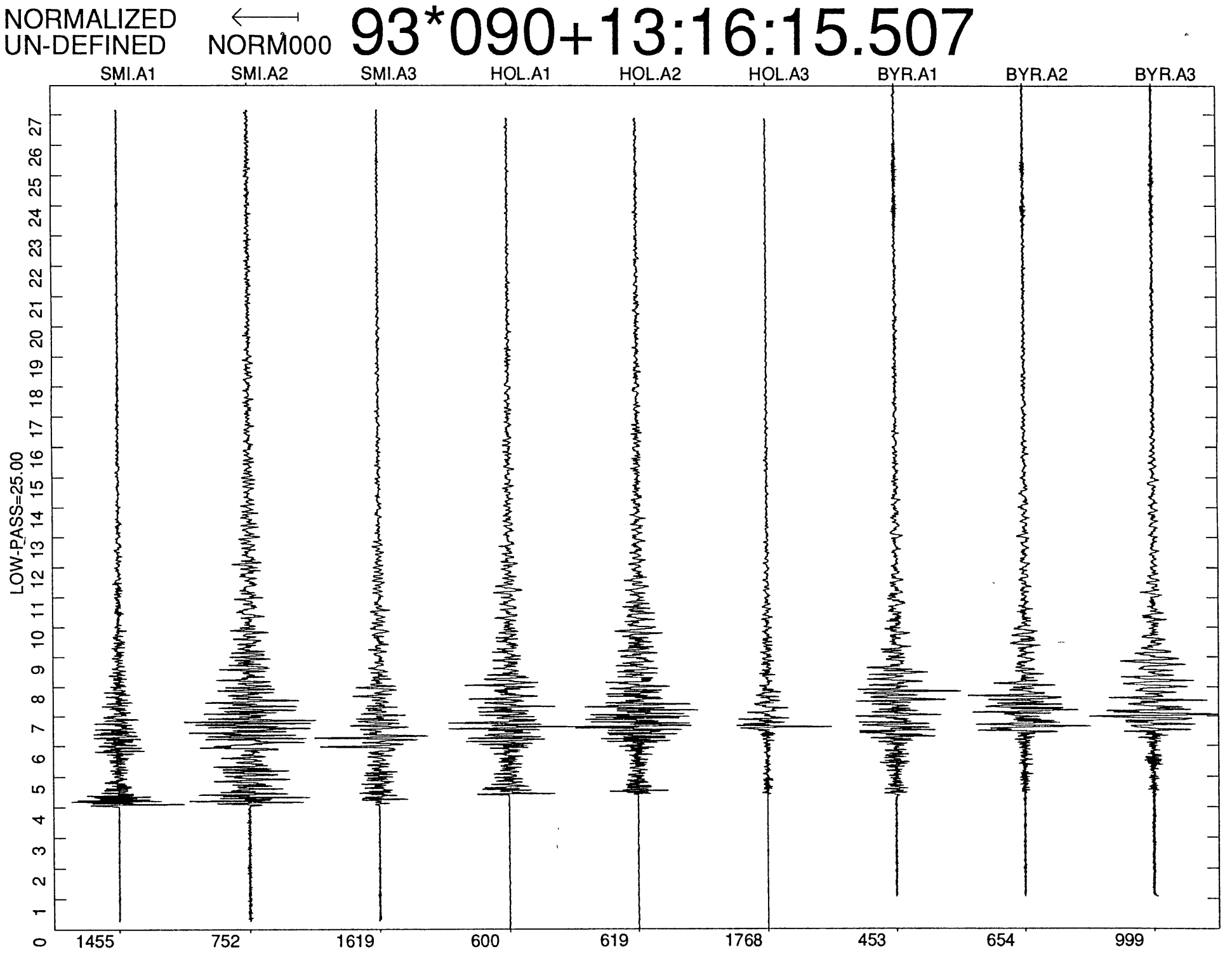
2304
214
296
435
94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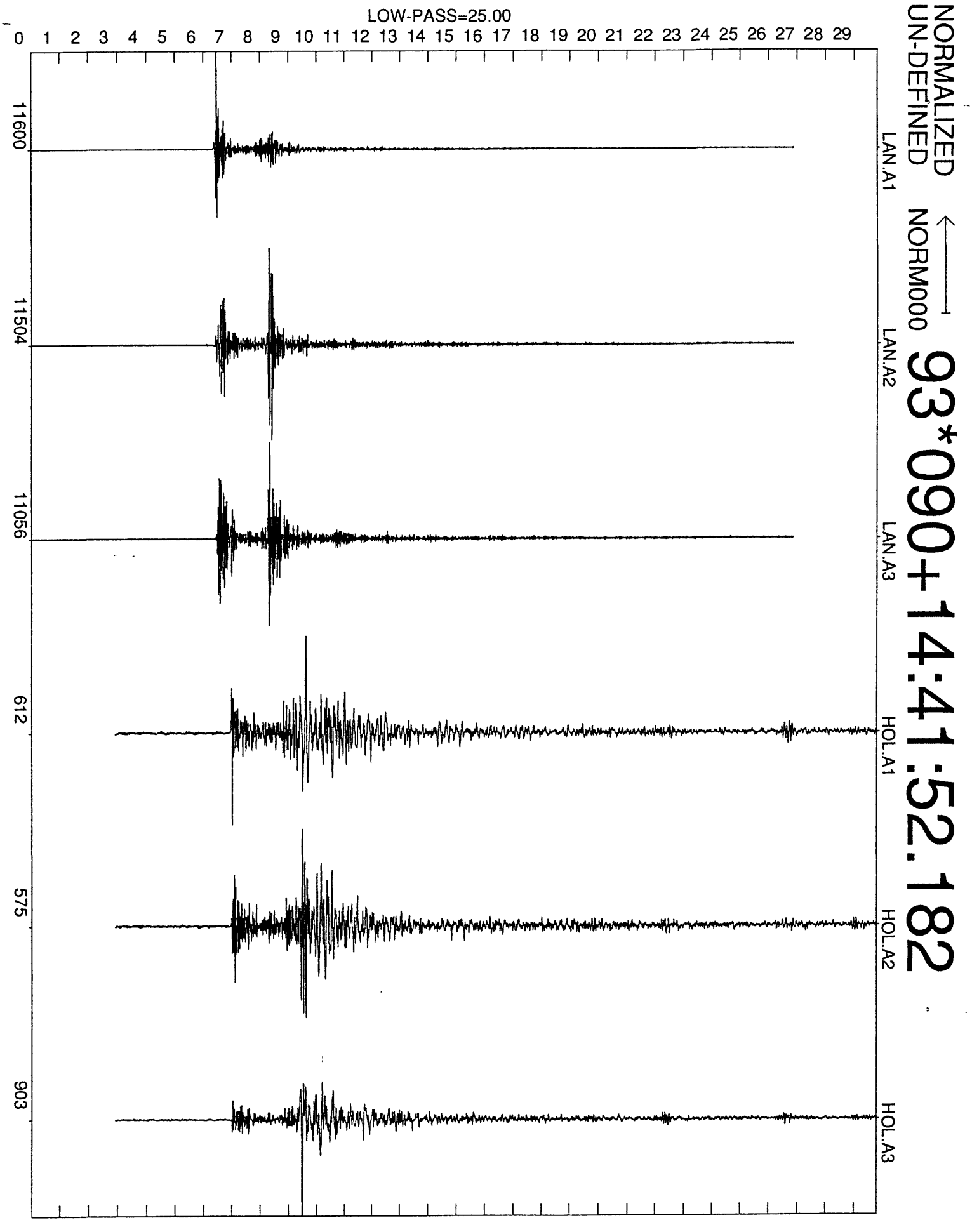
SMI.A2
SMI.A3
HOL.A1
HOL.A2
HOL.A3
BYR.A1
BYR.A2
BYR.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
1455
752
1619
600
619
1768
453
654
999
95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11600
11504
11056
612
575
903
LAN.A1
LAN.A2
LAN.A3
HOL.A1
HOL.A2
HOL.A3
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UN-DEFINED
NORM000
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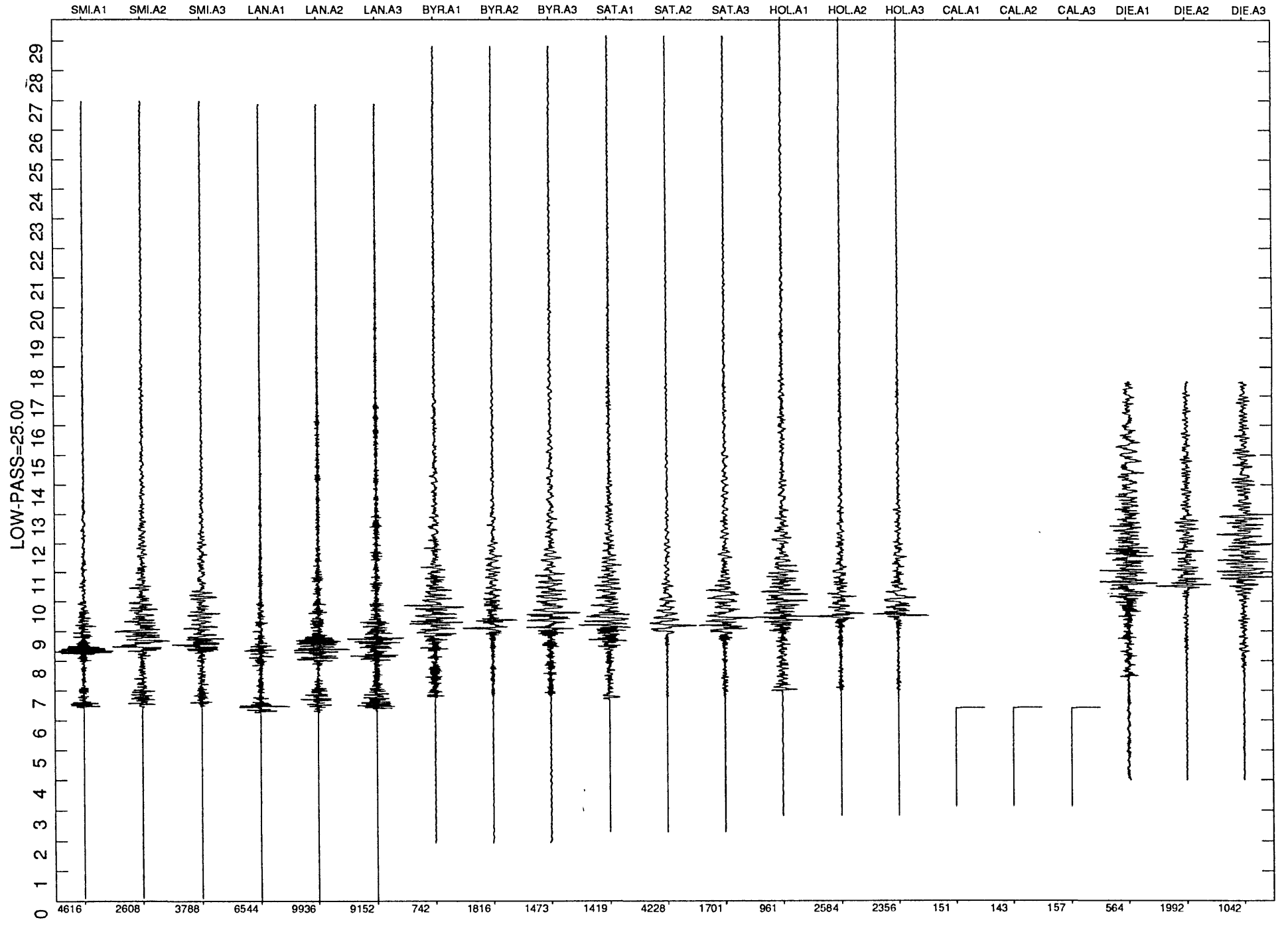
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93*090+19:29:04.731
SMI.A1
SMI.A2
SMI.A3
LAN.A1
LAN.A2
LAN.A3
BYR.A1
BYR.A2
BYR.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
CAL.A1
CAL.A2
CAL.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
4616
2608
3788
6544
9936
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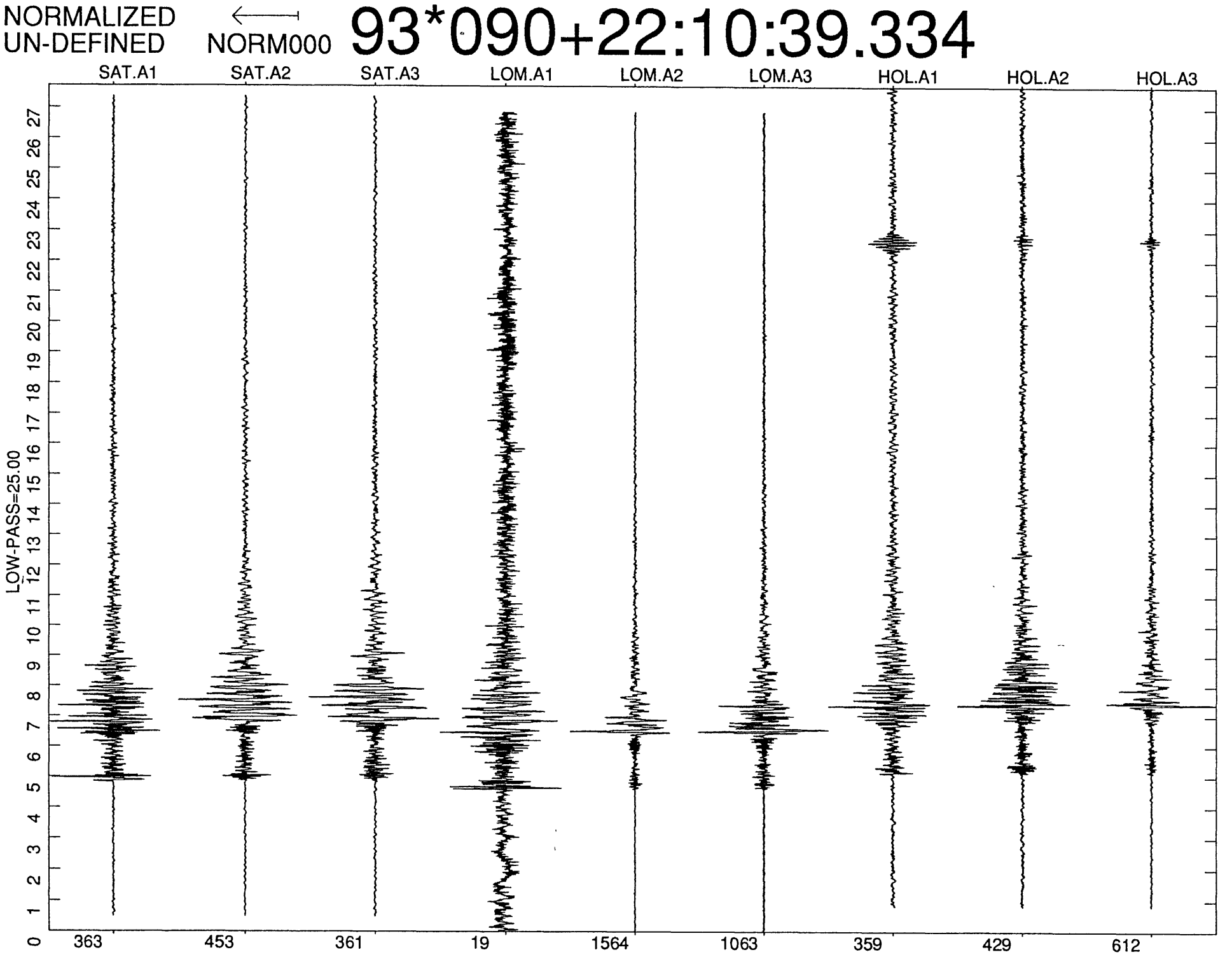
742
1816
1473
1419
4228
1701
961
2584
2356
151
143
157
564
1992
1042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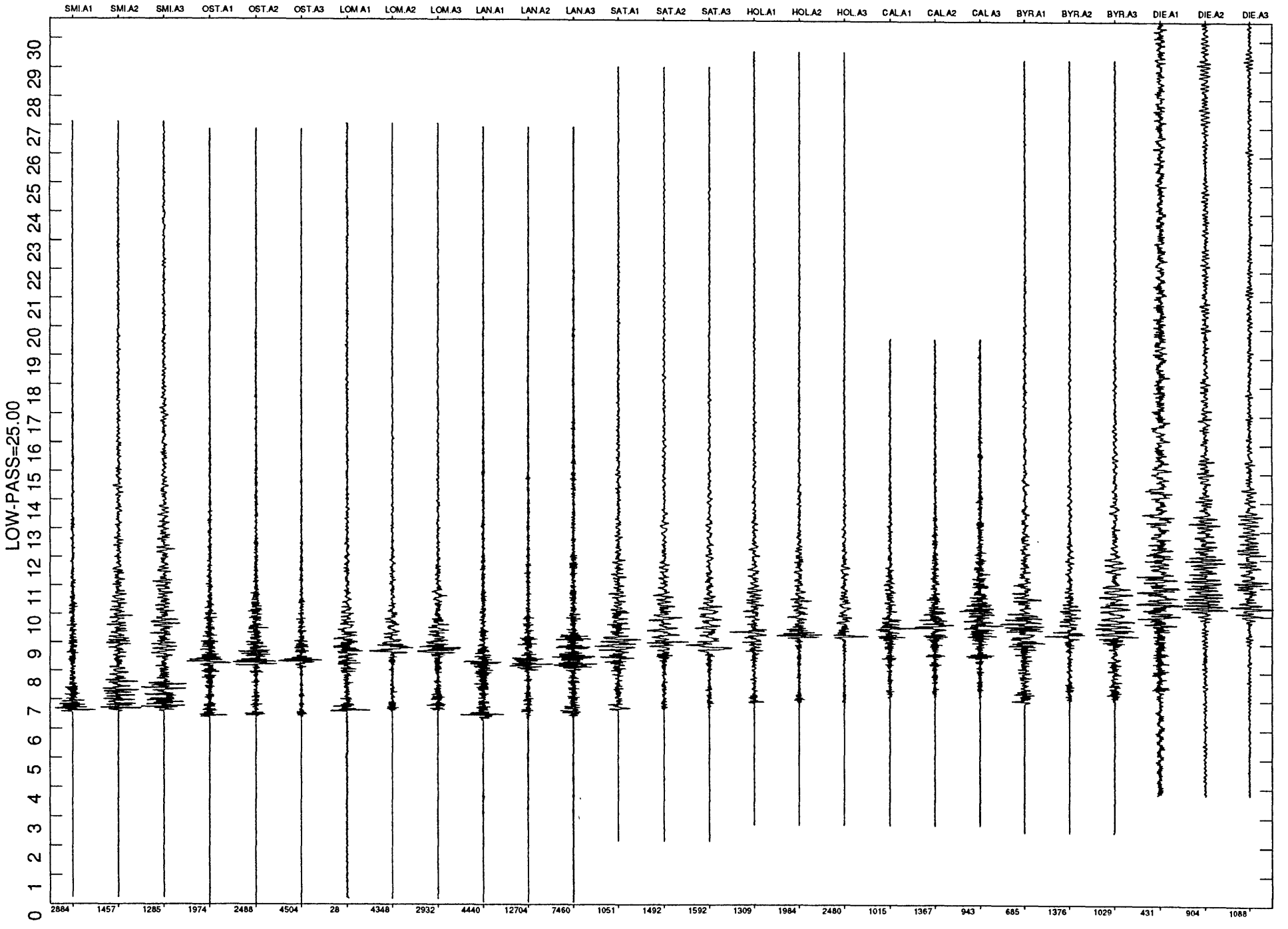
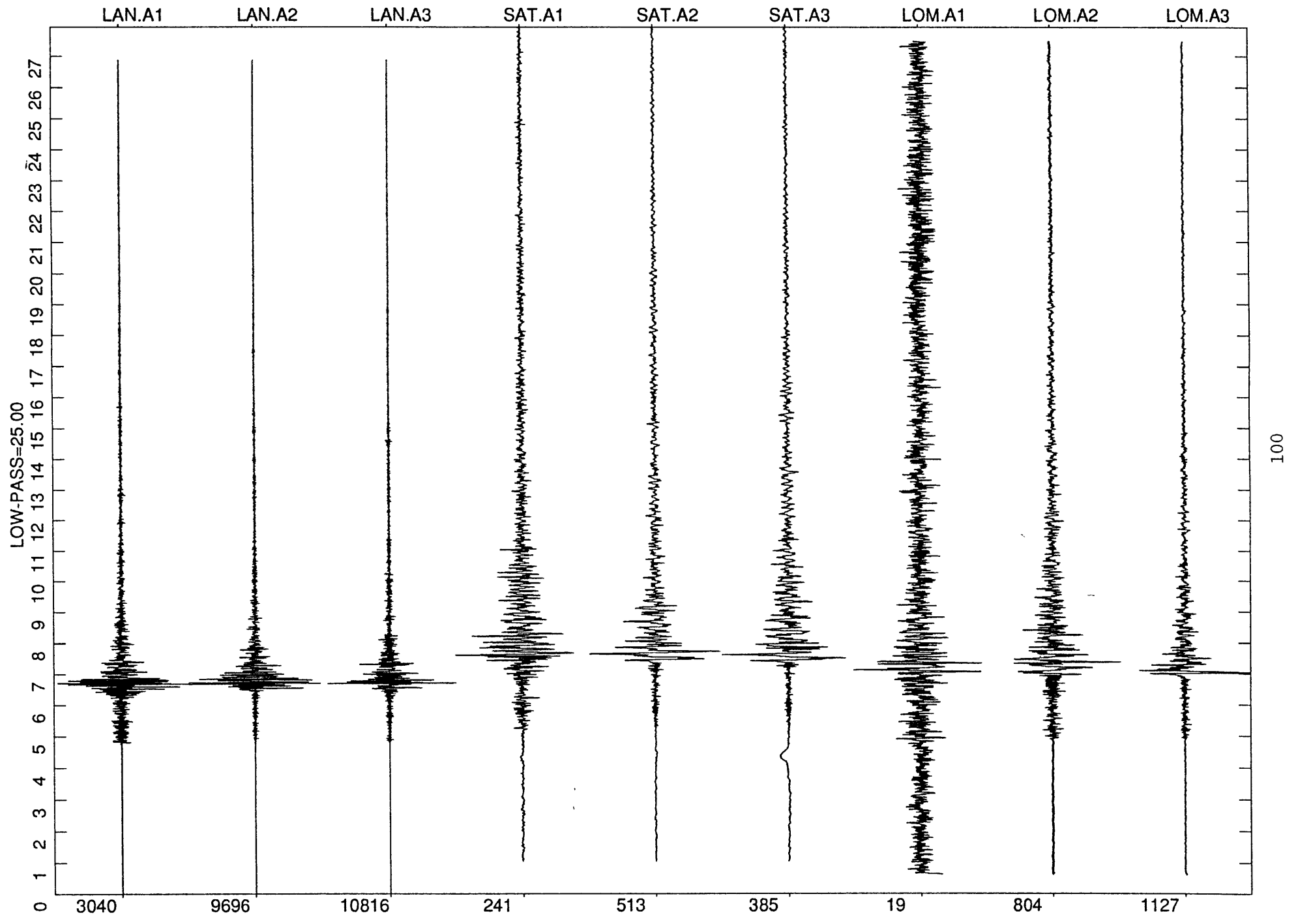
SAT.A2
SAT.A3
LOM.A1
LOM.A2
LOM.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
363
453
361
19
1564
1063
359
429
612
98

NORMALIZED
UN-DEFINED

NORM000

93*090+23:43:55.143

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UN-DEFINED
NORM000
93*091+01:09:19.579
LAN.A1
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
LOM.A1
LOM.A2
LOM.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
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10816
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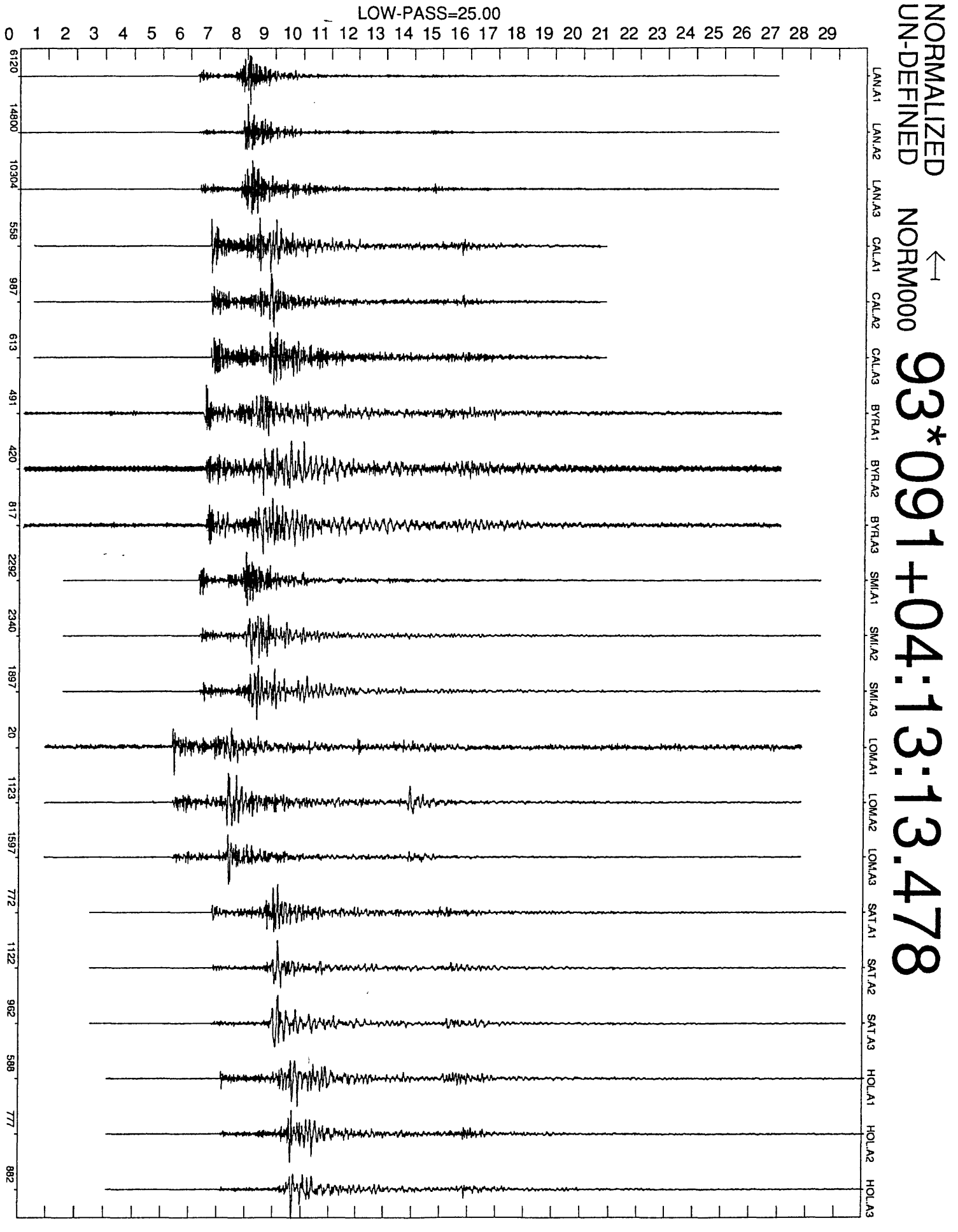
513
385
19
804
1127


LOW-PASS=25.00
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6120
14800
10304
558
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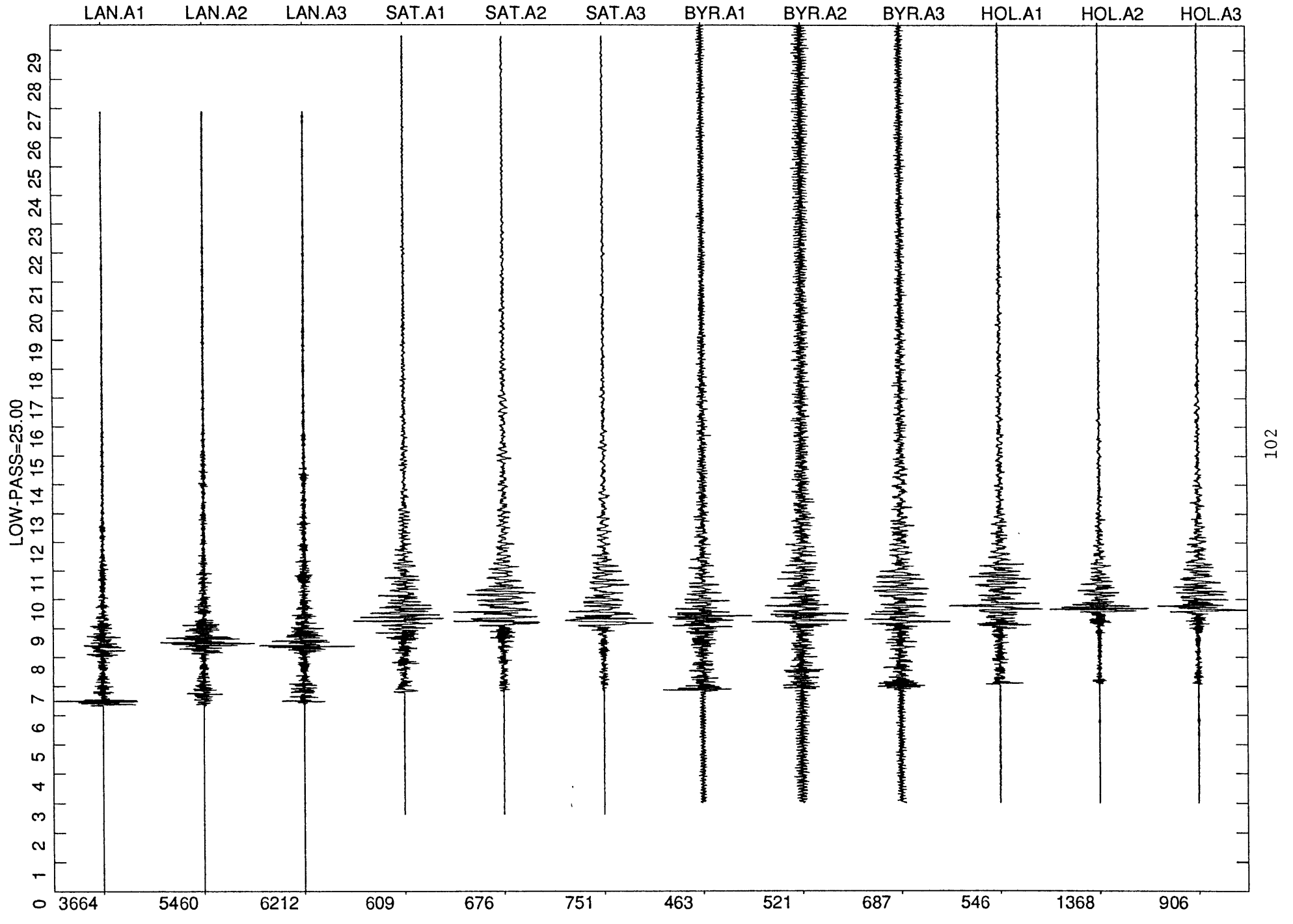
2340
1897
20
1123
1597
772
1122
962
588
777
882
LAN.A1
LAN.A2
LAN.A3
CAL.A1
CAL.A2
CAL.A3
BYR.A1
BYR.A2
BYR.A3
SMI.A1
SMI.A2
SMI.A3
LOM.A1
LOM.A2
LOM.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
NORMALIZED
UN-DEFINED
NORM000
93*091+04:13:13.478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NORM000
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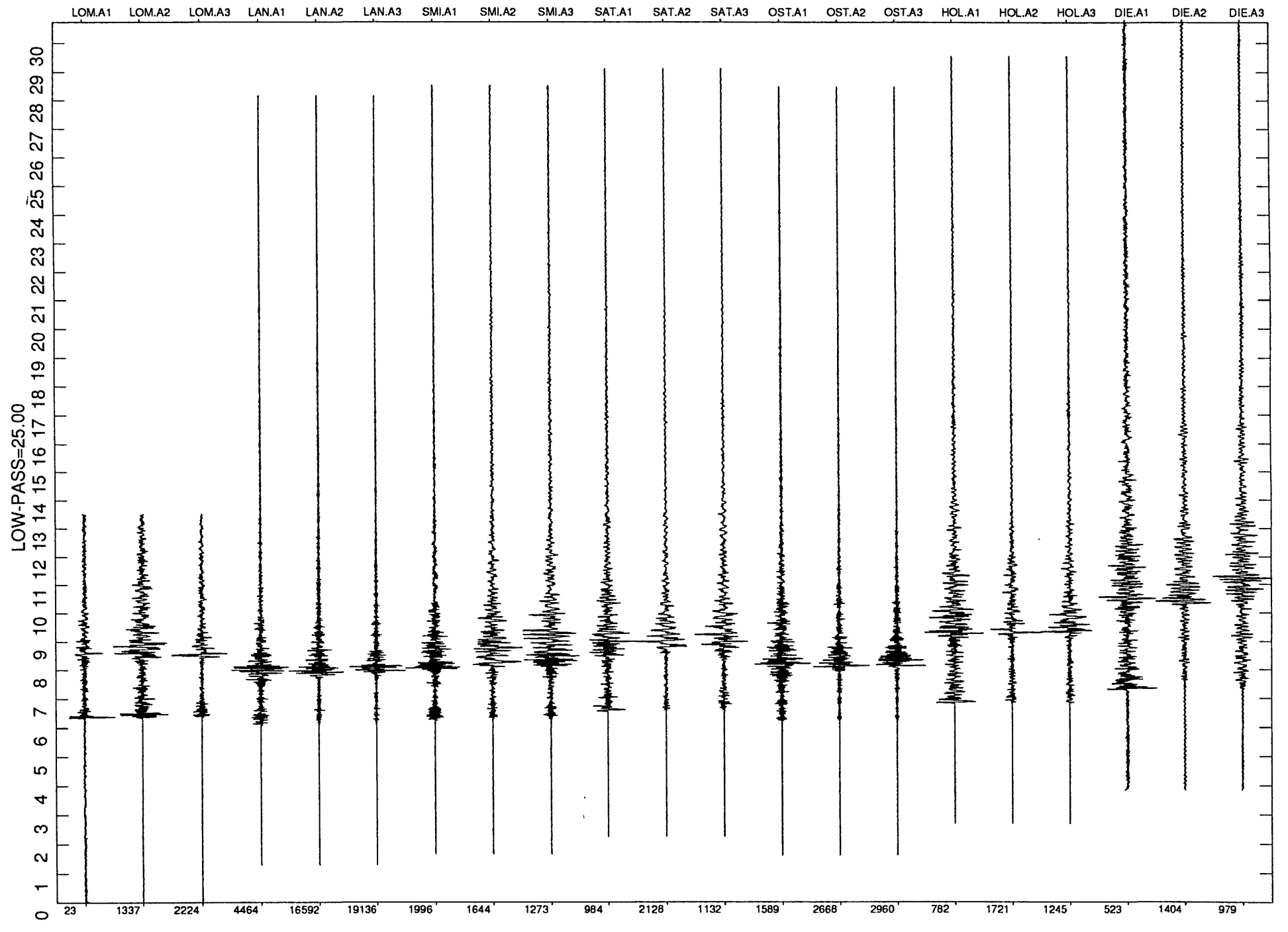
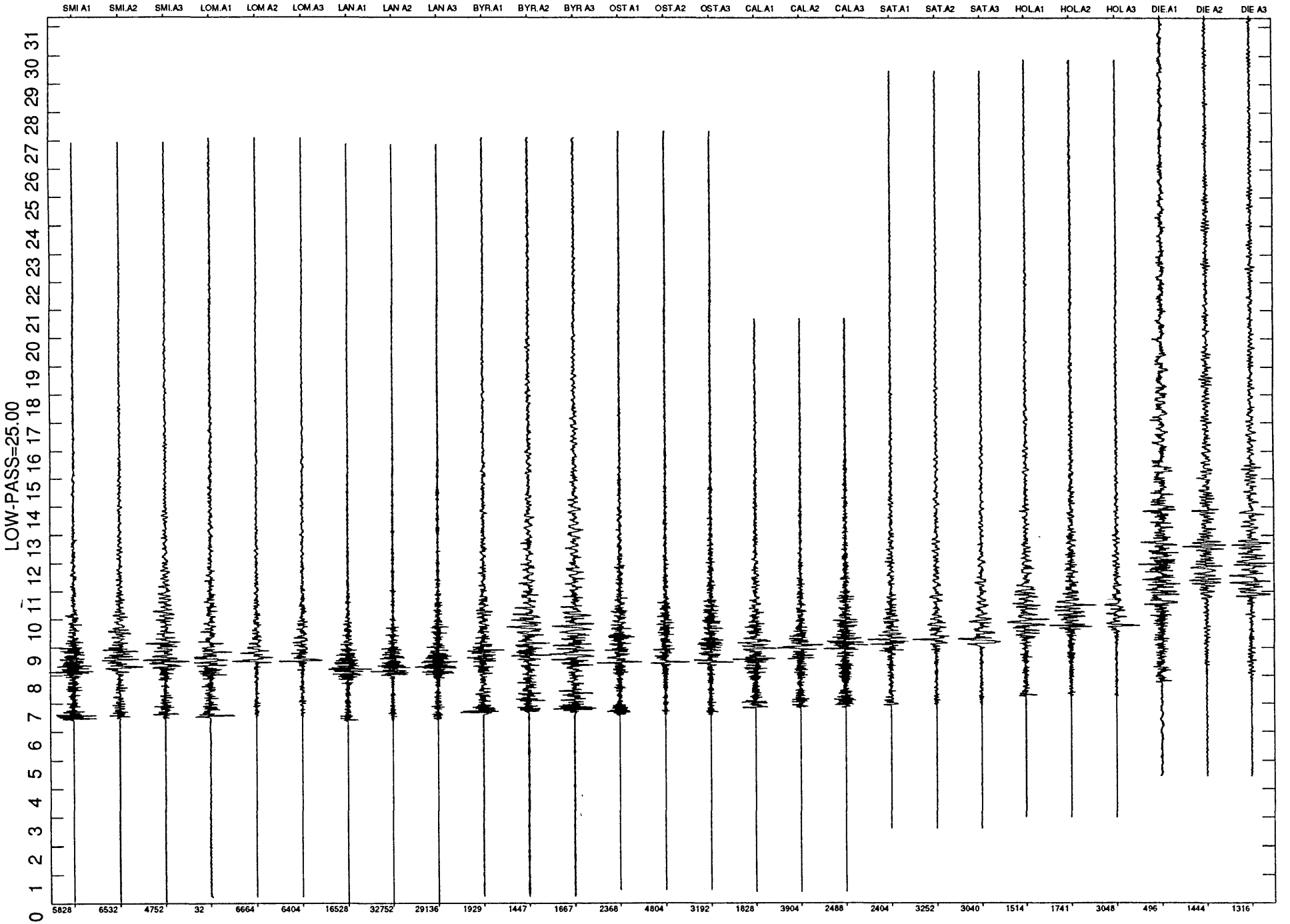
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
BYR.A1
BYR.A2
BYR.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
3664
5460
6212
609
676
751
463
521
687
546
1368
906
102


NORMALIZED
UN-DEFINED
NORM000
93*091+04:35:58.689
LOM.A1
LOM.A2
LOM.A3
LAN.A1
LAN.A2
LAN.A3
SMI.A1
SMI.A2
SMI.A3
SAT.A1
SAT.A2
SAT.A3
OST.A1
OST.A2
OST.A3
HOL.A1
HOL.A2
HOL.A3
DIE.A1
DIE.A2
DIE.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
23
1337
2224
4464
16592
19136
1996
1644
1273
984
2128
1132
1589
2668
2960
782
1721
1245
523
1404
979

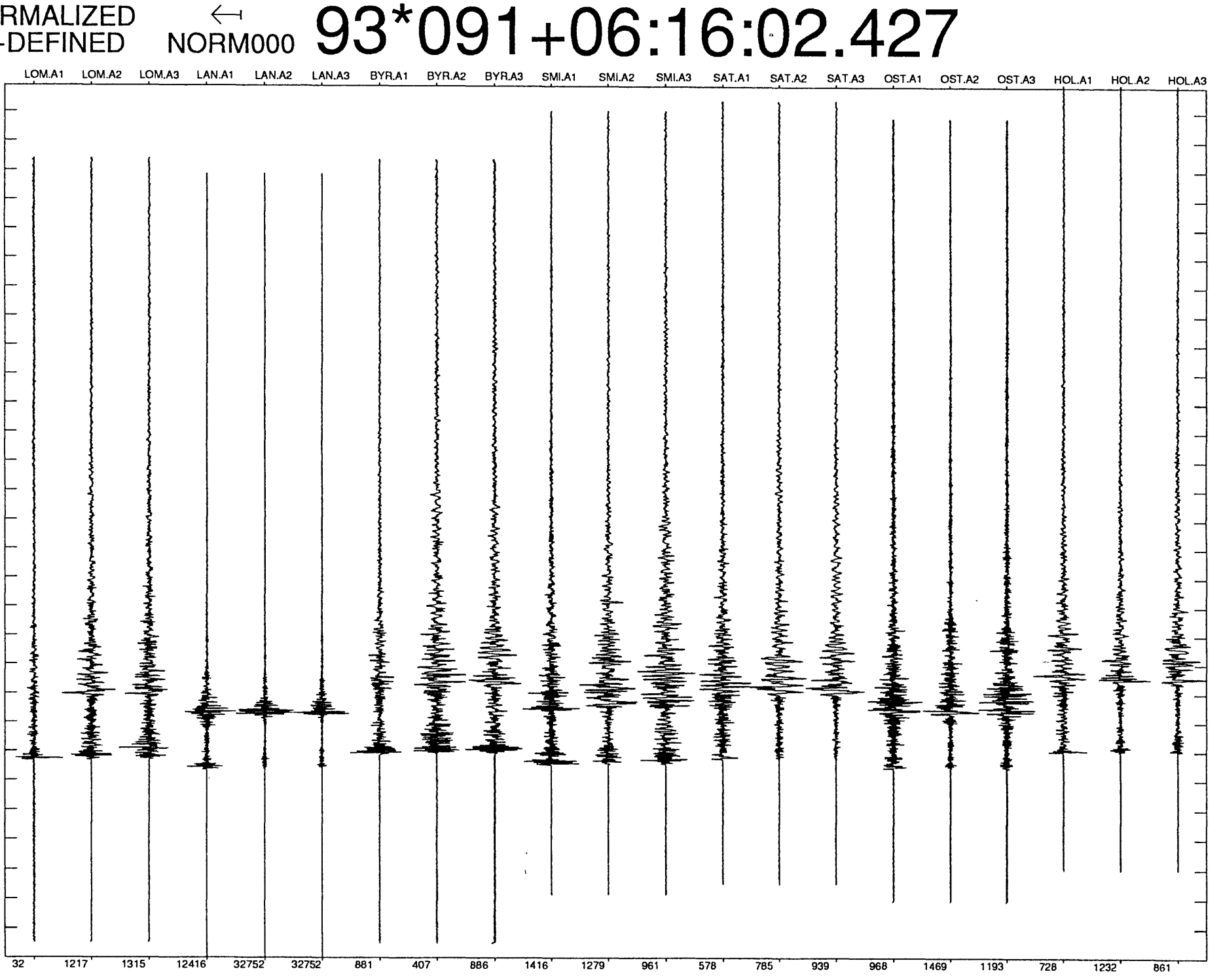
NORMALIZED
UN-DEFINED

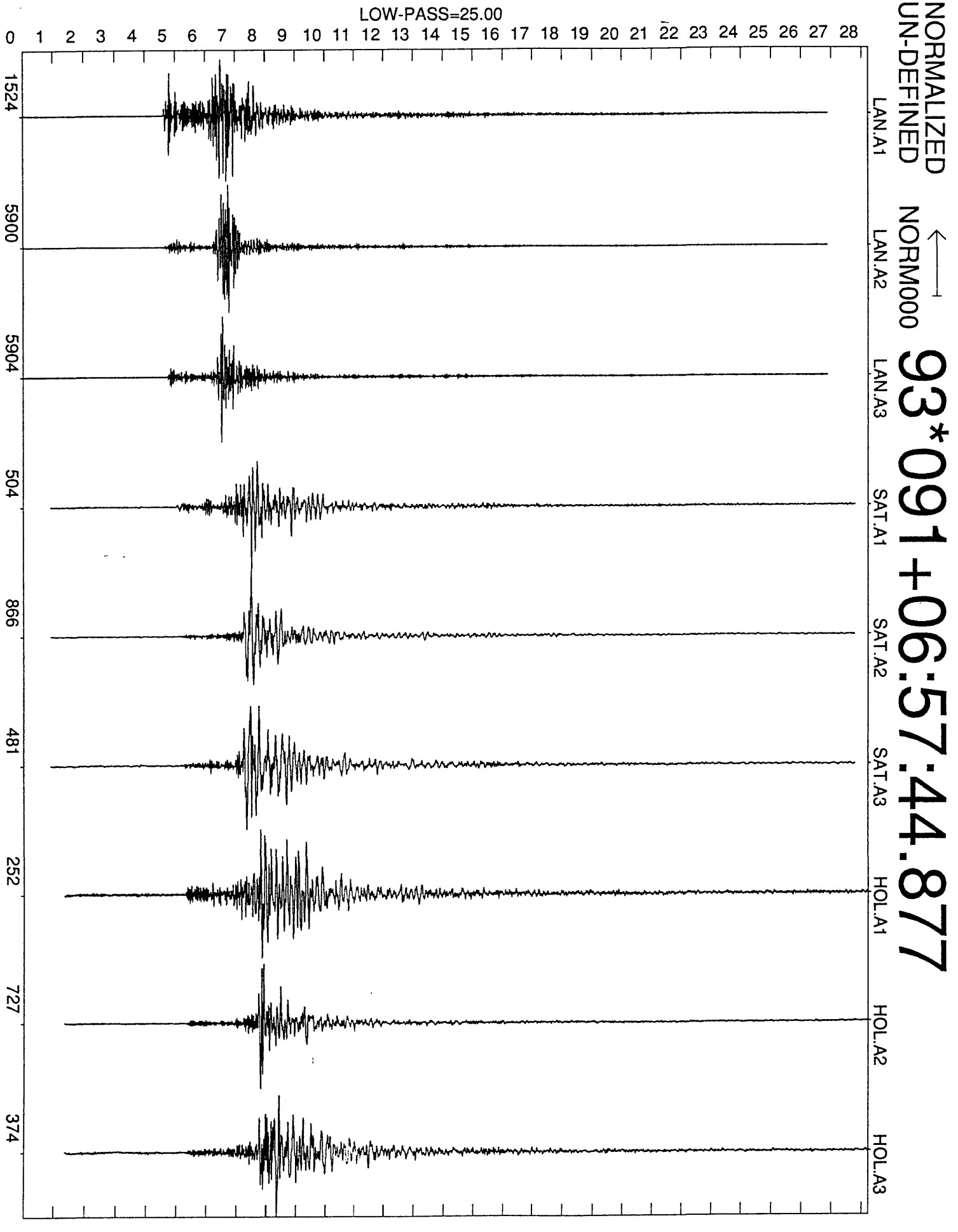
NORM000

93*091+05:10:51.728

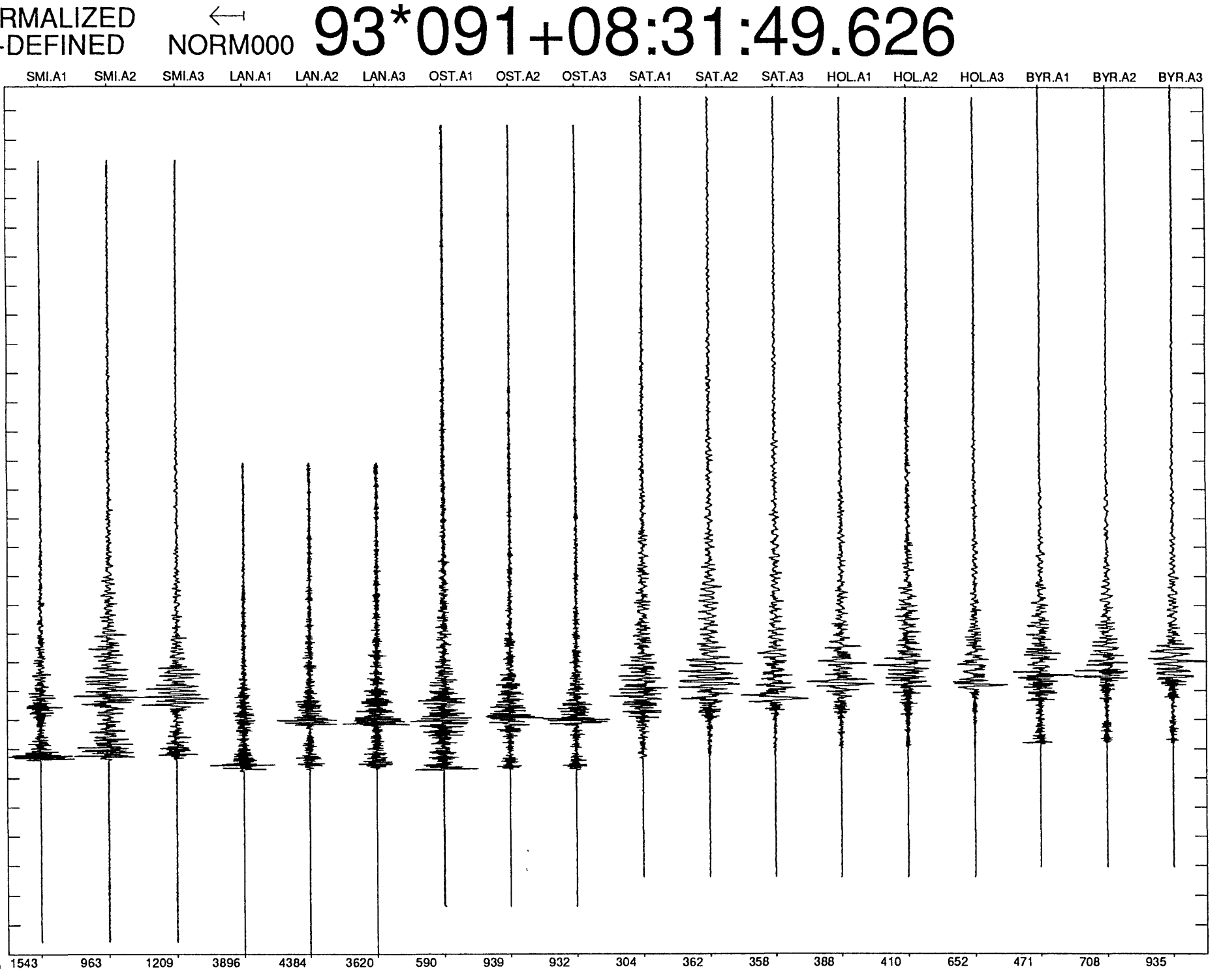


NORMALIZED
UN-DEFINED




LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
1524
5900
5904
504
866
481
252
727
374
LAN.A1
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
NORMALIZED
UN-DEFINED
NORM000
93*091+06:57:44.877

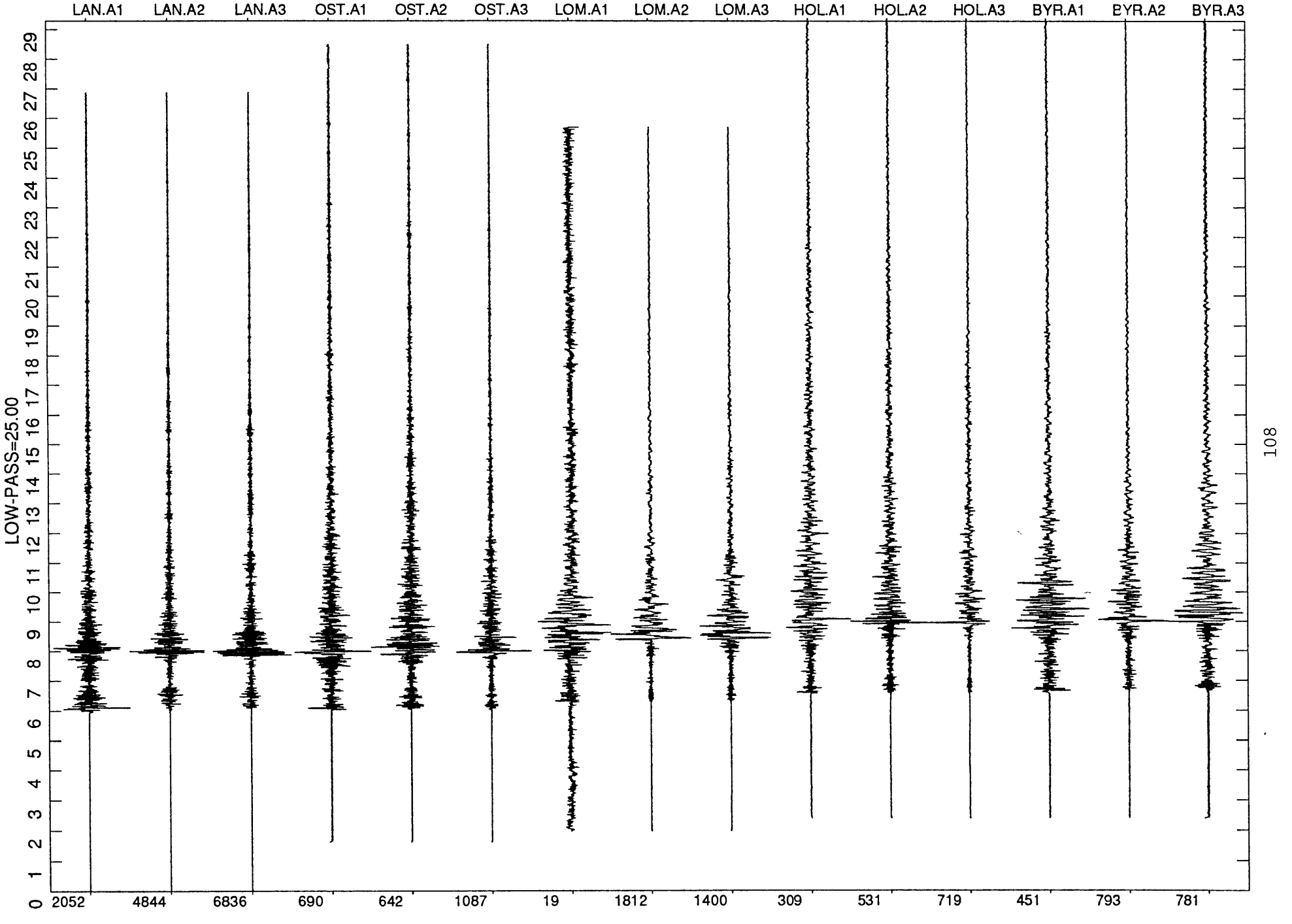
NORMALIZED
UN-DEFINED

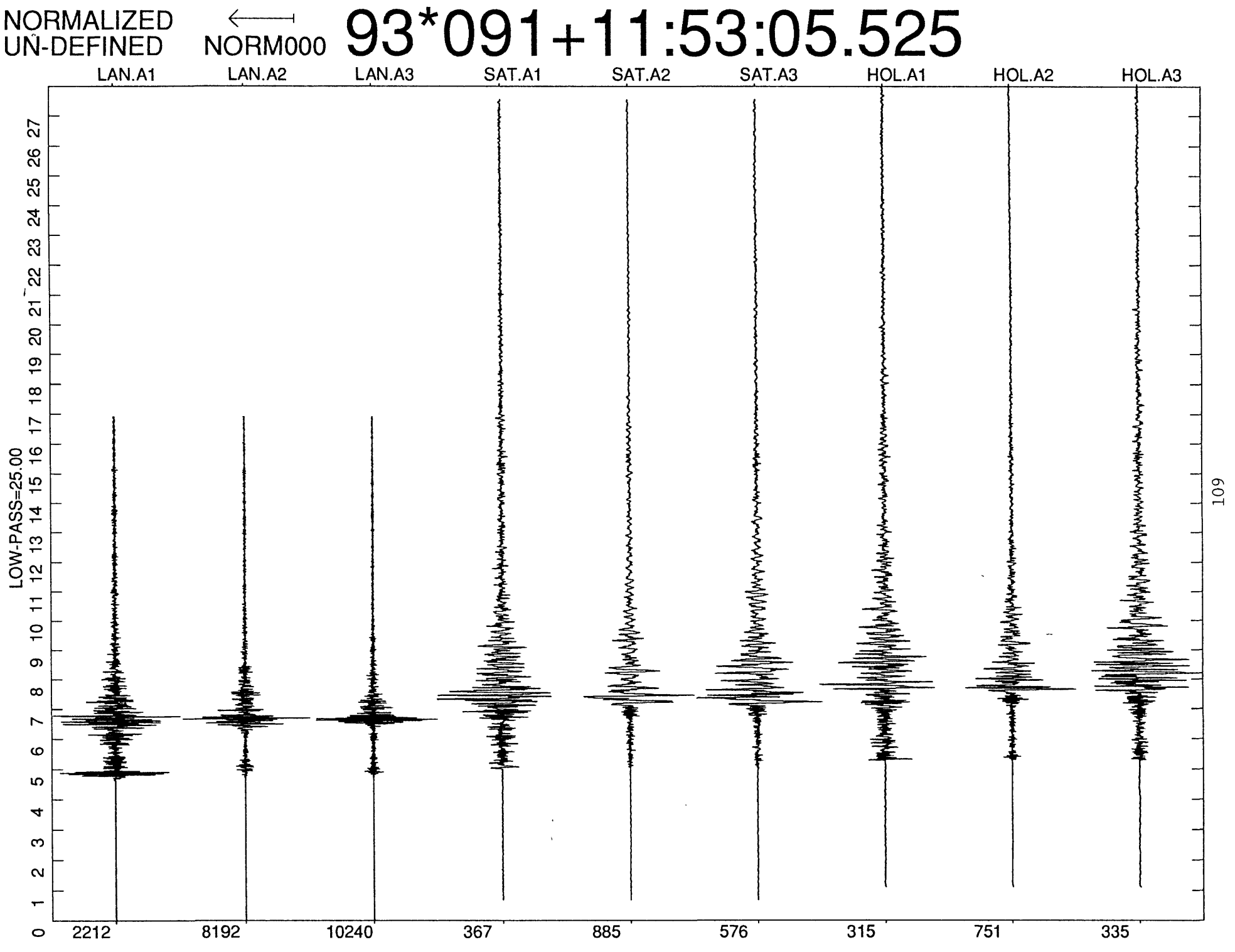


107

NORMALIZED
UN-DEFINED

93*091+10:18:18.526

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UN-DEFINED
NORM000
93*091+11:53:05.525
LAN.A1
LAN.A2
LAN.A3
SAT.A1
SAT.A2
SAT.A3
HOL.A1
HOL.A2
HOL.A3
LOW-PASS=25.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
2212
8192
10240
367
885
576
315
751
335
109

```
|'10' EVN#0036 TIM=93*085+05:18:26.15 HYP=+45:01.83-122:36.46-017.22 MAG=+2.80
E:\SMO\D\OST\A\0850518HA.OST      7363102


|'11' EVN#0037 TIM=93*085+07:35:48.87 HYP=+45:00.44-122:36.20-017.41 MAG=+1.70
E:\SMO\D\LAN\A\0850735PA.LAN      7371345
E:\SMO\D\SMI\A\0850735PA.SMI      7371347
E:\SMO\D\OST\A\0850735PA.OST      7371347


|'12' EVN#0038 TIM=93*085+08:00:05.32 HYP=+45:02.06-122:36.95-016.67 MAG=+2.80
E:\SMO\D\SMI\A\0850800AA.SMI      7372801
E:\SMO\D\OST\A\0850800AA.OST      7372801
E:\SMO\D\LAN\A\0850800AA.LAN      7372801


|'13' EVN#0039 TIM=93*085+09:03:16.41 HYP=+45:01.04-122:39.25-020.18 MAG=+1.60
E:\SMO\D\LAN\A\0850903EA.LAN      7376594
E:\SMO\D\SMI\A\0850903FA.SMI      7376595


|'14' EVN#0040 TIM=93*085+10:22:50.74 HYP=+45:01.74-122:35.51-029.75 MAG=+1.40
E:\SMO\D\LAN\A\0851022PA.LAN      7381367
E:\SMO\D\SMI\A\0851022QA.SMI      7381369
E:\SMO\D\OST\A\0851022QA.OST      7381369


|'15' EVN#0041 TIM=93*085+12:45:22.19 HYP=+45:00.83-122:38.59-024.07 MAG=+1.10
E:\SMO\D\OST\A\0851245GA.OST      7389918
E:\SMO\D\SMI\A\0851245GA.SMI      7389920


|'16' EVN#0042 TIM=93*085+12:55:38.89 HYP=+45:01.62-122:36.86-008.13 MAG=+1.60
E:\SMO\D\OST\A\0851255MA.OST      7390536
E:\SMO\D\SMI\A\0851255MA.SMI      7390537


|'17' EVN#0043 TIM=93*085+16:54:31.57 HYP=+45:02.18-122:37.00-014.13 MAG=+3.00
E:\SMO\D\SMI\A\0851654JA.SMI      7404867
E:\SMO\D\OST\A\0851654JA.OST      7404867


|'18' EVN#0044 TIM=93*085+17:39:21.56 HYP=+45:02.86-122:37.98-021.37 MAG=+3.10
E:\SMO\D\SMI\A\0851739GA.SMI      7407558
E:\SMO\D\OST\A\0851739GA.OST      7407558


|'19' EVN#0045 TIM=93*085+18:43:47.83 HYP=+45:03.37-122:37.58-017.19 MAG=+2.40
E:\SMO\D\OST\A\0851843OA.OST      7411423
E:\SMO\D\SMI\A\0851843OA.SMI      7411424


|'1A' EVN#0046 TIM=93*086+05:40:32.84 HYP=+45:01.65-122:35.51-014.37 MAG=+2.30
E:\SMO\D\SMI\B\0860540JA.SMI      7450829
E:\SMO\D\OST\B\0860540JA.OST      7450329
E:\SMO\D\LOM\A\0860540JA.LOM      7450329
E:\SMO\D\LAN\B\0860540JA.LAN      7450329
E:\SMO\D\CAL\A\0860540JA.CAL      7450329
E:\SMO\D\WIL\A\0860540KA.WIL      7450831


|'1B' EVN#0047 TIM=93*086+06:46:06.95 HYP=+45:02.79-122:38.44-005.38 MAG=+1.90
E:\SMO\D\OST\B\0860646AA.OST      7454762
E:\SMO\D\LAN\B\0860646AA.LAN      7454762
E:\SMO\D\SMI\B\0860646BA.SMI      7454763
E:\SMO\D\LOM\A\0860646BA.LOM      7454763
E:\SMO\D\WIL\A\0860646BA.WIL      7454764
E:\SMO\D\CAL\A\0860646BA.CAL      7454764


|'1C' EVN#0048 TIM=93*086+13:41:18.45 HYP=+44:59.25-122:39.77-011.53 MAG=+1.20
E:\SMO\D\LAN\B\0861341FA.LAN      7479675


|'1D' EVN#0049 TIM=93*086+14:38:58.12 HYP=+45:02.47-122:36.80-020.43 MAG=+2.70
```

```
E:\SMO\D\SMI\B\0861438SA.SMI      7483134
E:\SMO\D\OST\B\0861438SA.OST      7483134
E:\SMO\D\LAN\B\0861438SA.LAN      7483134
E:\SMO\D\WIL\A\0861438SA.WIL      7483135
E:\SMO\D\LOM\A\0861438SA.LOM      7483135
E:\SMO\D\CAL\A\0861438SA.CAL      7483135


|'1E' EVN#0050 TIM=93*086+22:24:15.32 HYP=+45:01.97-122:37.08-015.42 MAG=+2.20
E:\SMO\D\SMI\C\0862224DA.SMI      7511051
E:\SMO\D\LOM\B\0862224DA.LOM      7511051
E:\SMO\D\LAN\C\0862224DA.LAN      7511051
E:\SMO\D\HOL\A\0862224EA.HOL      7511052
E:\SMO\D\CAL\B\0862224EA.CAL      7511052
E:\SMO\D\WIL\B\0862224EA.WIL      7511053
E:\SMO\D\DIE\A\0862224FA.DIE      7511055
E:\SMO\D\ILG\A\0862224FA.ILG      7511057


|'1F' EVN#0051 TIM=93*086+22:31:14.05 HYP=+45:01.45-122:39.09-007.00 MAG=+1.10
E:\SMO\D\LAN\C\0862231DA.LAN      7511471


|'1G' EVN#0052 TIM=93*086+23:34:12.66 HYP=+45:01.41-122:37.08-017.37 MAG=+1.70
E:\SMO\D\LAN\C\0862334DA.LAN      7515249
E:\SMO\D\SMI\C\0862334DA.SMI      7515250
E:\SMO\D\OST\C\0862334DA.OST      7515250
E:\SMO\D\LOM\B\0862334DA.LOM      7515250
E:\SMO\D\SAT\A\0862334DA.SAT      7515251
E:\SMO\D\HOL\A\0862334DA.HOL      7515251
E:\SMO\D\CAL\B\0862334DA.CAL      7515251
E:\SMO\D\DIE\A\0862334EA.DIE      7515252


|'1H' EVN#0053 TIM=93*087+05:22:56.06 HYP=+45:02.10-122:36.45-012.47 MAG=+1.80
E:\SMO\D\LOM\B\0870522RA.LOM      7536172
E:\SMO\D\LAN\C\0870522RA.LAN      7536172
E:\SMO\D\WIL\B\0870522SA.WIL      7536174
E:\SMO\D\SMI\C\0870522SA.SMI      7536174
E:\SMO\D\SAT\A\0870522SA.SAT      7536174
E:\SMO\D\OST\C\0870522SA.OST      7536174
E:\SMO\D\CAL\B\0870522SA.CAL      7536174
E:\SMO\D\HOL\A\0870522SA.HOL      7536175
E:\SMO\D\DIE\A\0870522SA.DIE      7536176


|'1I' EVN#0054 TIM=93*087+07:43:50.64 HYP=+45:00.60-122:37.10-016.06 MAG=+1.40
E:\SMO\D\LAN\C\0870743PA.LAN      7544627
E:\SMO\D\CAL\B\0870743PA.CAL      7544627
E:\SMO\D\SMI\C\0870743QA.SMI      7544629
E:\SMO\D\SAT\A\0870743QA.SAT      7544629
E:\SMO\D\OST\C\0870743QA.OST      7544629
E:\SMO\D\LOM\B\0870743QA.LOM      7544629
E:\SMO\D\HOL\A\0870743QA.HOL      7544630


|'1J' EVN#0055 TIM=93*087+08:20:06.93 HYP=+45:01.81-122:38.74-014.55 MAG=+1.10
E:\SMO\D\LAN\C\0870820BA.LAN      7546803
E:\SMO\D\SAT\A\0870820BA.SAT      7546805
E:\SMO\D\SMI\C\0870820CA.SMI      7546806


|'1K' EVN#0056 TIM=93*087+08:50:56.05 HYP=+45:02.65-122:37.23-014.46 MAG=+1.60
E:\SMO\D\LAN\C\0870850RA.LAN      7548652
E:\SMO\D\SMI\C\0870850SA.SMI      7548654
E:\SMO\D\OST\C\0870850SA.OST      7548654
E:\SMO\D\SAT\A\0870850SA.SAT      7548655
E:\SMO\D\HOL\A\0870850SA.HOL      7548655


|'1L' EVN#0057 TIM=93*087+09:03:47.10 HYP=+45:02.63-122:38.19-013.09 MAG=+1.40
E:\SMO\D\LAN\C\0870903OA.LAN      7549423
E:\SMO\D\OST\C\0870903PA.OST      7549425
E:\SMO\D\SAT\A\0870903PA.SAT      7549426


|'1M' EVN#0058 TIM=93*087+15:50:35.93 HYP=+45:02.13-122:37.95-007.76 MAG=+1.60
E:\SMO\D\SMI\C\0871550KA.SMI      7573832
E:\SMO\D\OST\C\0871550LA.OST      7573833
E:\SMO\D\LAN\C\0871550LA.LAN      7573833
```

```
E:\SMO\D\CAL\B\0871550LA.CAL     7573834

|'1N' EVN#0059 TIM=93*087+23:26:17.88 HYP=+45:00.54-122:37.70-017.91 MAG=+1.70
E:\SMO\D\LOM\C\0872326EA.LOM     7601174
E:\SMO\D\LAN\C\0872326EA.LAN     7601174
E:\SMO\D\WIL\B\0872326FA.WIL     7601176
E:\SMO\D\SMI\C\0872326FA.SMI     7601176
E:\SMO\D\OST\C\0872326FA.OST     7601176
E:\SMO\D\HOL\B\0872326FA.HOL     7601177
E:\SMO\D\DIE\B\0872326GA.DIE     7601178

|'1O' EVN#0060 TIM=93*088+00:16:30.95 HYP=+45:02.47-122:36.79-006.74 MAG=+1.90
E:\SMO\D\SMI\C\0880016JA.SMI     7604187
E:\SMO\D\OST\C\0880016JA.OST     7604187
E:\SMO\D\LOM\C\0880016JA.LOM     7604187
E:\SMO\D\LAN\C\0880016JA.LAN     7604187
E:\SMO\D\WIL\B\0880016KA.WIL     7604190
E:\SMO\D\HOL\B\0880016KA.HOL     7604190
E:\SMO\D\CAL\B\0880016KA.CAL     7604190
E:\SMO\D\DIE\B\0880016KA.DIE     7604191

|'1P' EVN#0061 TIM=93*088+02:19:38.18 HYP=+45:01.10-122:35.36-017.34 MAG=+1.70
E:\SMO\D\LAN\C\0880219LA.LAN     7611574
E:\SMO\D\CAL\B\0880219LA.CAL     7611575
E:\SMO\D\WIL\B\0880219MA.WIL     7611576
E:\SMO\D\SMI\C\0880219MA.SMI     7611576
E:\SMO\D\OST\C\0880219MA.OST     7611576
E:\SMO\D\HOL\B\0880219MA.HOL     7611577

|'1Q' EVN#0062 TIM=93*088+10:38:59.02 HYP=+45:01.56-122:37.98-025.57 MAG=+1.50
E:\SMO\D\SMI\C\0881038SA.SMI     7641535
E:\SMO\D\OST\C\0881038SA.OST     7641535
E:\SMO\D\LAN\C\0881038SA.LAN     7641535
E:\SMO\D\WIL\B\0881038TA.WIL     7641537
E:\SMO\D\LOM\C\0881038TA.LOM     7641537
E:\SMO\D\HOL\B\0881038TA.HOL     7641538
E:\SMO\D\CAL\B\0881038TA.CAL     7641538

|'1R' EVN#0063 TIM=93*088+22:47:45.80 HYP=+45:03.01-122:38.81-015.41 MAG=+1.60
E:\SMO\D\OST\C\0882247NA.OST     7685261
E:\SMO\D\SAT\B\08822470A.SAT     7685263
E:\SMO\D\CAL\C\08822470A.CAL     7685263
E:\SMO\D\HOL\B\08822470A.HOL     7685264
E:\SMO\D\DIE\D\0882247PA.DIE     7685265
E:\SMO\D\DIE\C\0882247PA.DIE     7685265

|'1S' EVN#0064 TIM=93*089+07:43:29.84 HYP=+45:00.41-122:34.02-018.42 MAG=+1.40
E:\SMO\D\LAN\D\0890743IA.LAN     7717406
E:\SMO\D\CAL\C\0890743JA.CAL     7717407
E:\SMO\D\SAT\B\0890743JA.SAT     7717408
E:\SMO\D\OST\D\0890743JA.OST     7717408
E:\SMO\D\HOL\C\0890743JA.HOL     7717409

|'1T' EVN#0065 TIM=93*089+11:41:49.97 HYP=+45:02.36-122:38.52-016.85 MAG=+1.40
E:\SMO\D\SAT\B\0891141PA.SAT     7731706
E:\SMO\D\HOL\C\0891141PA.HOL     7731707
E:\SMO\D\OST\D\0891141QA.OST     7731708
E:\SMO\D\DIE\D\0891141RA.DIE     7731712
E:\SMO\D\DIE\C\0891141RA.DIE     7731712

|'1U' EVN#0066 TIM=93*089+16:56:23.03 HYP=+45:04.37-122:36.13-009.32 MAG=+1.60
E:\SMO\D\SAT\B\0891656GA.SAT     7750580
E:\SMO\D\OST\D\0891656GA.OST     7750580
E:\SMO\D\HOL\C\0891656HA.HOL     7750581
E:\SMO\D\DIE\D\0891656HA.DIE     7750582
E:\SMO\D\DIE\C\0891656HA.DIE     7750582
E:\SMO\D\CAL\C\0891656HA.CAL     7750582

|'1V' EVN#0067 TIM=93*090+08:35:37.95 HYP=+45:01.93-122:34.24-010.37 MAG=+1.20
E:\SMO\D\LAN\E\0900835LA.LAN     7806934
E:\SMO\D\HOL\D\0900835LA.HOL     7806934
```

```
E:\SMO\D\SMI\E\0900835LA.SMI      7806935
E:\SMO\D\OST\E\0900835LA.OST      7806935


|'1W' EVN#0068 TIM=93•091+05:10:55.34 HYP=+45:00.77-122:37.74-014.13 MAG=+1.60
E:\SMO\D\SMI\F\0910510RA.SMI      7881051
E:\SMO\D\LOM\D\0910510RA.LOM      7881051
E:\SMO\D\LAN\F\0910510RA.LAN      7881051
E:\SMO\D\BYR\C\0910510RA.BYR      7881051
E:\SMO\D\OST\F\0910510RA.OST      7881052
E:\SMO\D\CAL\D\0910510RA.CAL      7881052
E:\SMO\D\SAT\D\0910510SA.SAT      7881054
E:\SMO\D\HOL\E\0910510SA.HOL      7881054
E:\SMO\D\DIE\F\0910510SA.DIE      7881056


|$$$$$$$$$$$$$$$$$$$$$$$$ Mapped Events =    33 $$$$$$$$$$$$$$$$$$$$$$$$
|>HYPO71< "Event-Summary-List" Filespec = SMO.EVN
|Time-Period=0850518I,0910510S
|Latitude=+44:56&,+45:05
|Longitude=-122:49&,-122:30&
|Depth-Range=005.38,029.75
|Magnitude=+1.10,+3.10
|Ordered-Arrival-List Filespec = ..\D.OAR
|Pre-Event <---> Travel-Time Window in Seconds =  10
|Minimum STI's/EVENT =  1, Number of STI's = 16
|# 1  STI='BYR'= +44:59.40-122:31.12  Arrivals =    1
|# 2  STI='CAL'= +44:57.07-122:33.49  Arrivals =   15
|# 3  STI='DIE'= +45:02.42-122:47.03  Arrivals =   12
|# 4  STI='HOL'= +45:02.65-122:44.44  Arrivals =   15
|# 5  STI='ILG'= +45:02.59-122:49.01  Arrivals =    1
|# 6  STI='LAN'= +45:03.82-122:35.21  Arrivals =   24
|# 7  STI='LOM'= +44:59.01-122:38.24  Arrivals =   11
|# 9  STI='OST'= +45:04.78-122:38.02  Arrivals =   28
|#10  STI='SAT'= +45:02.29-122:42.56  Arrivals =   11
|#11  STI='SMI'= +45:02.45-122:32.89  Arrivals =   25
|#12  STI='WIL'= +45:02.41-122:40.39  Arrivals =    9
```

APPENDIX D.
DR-100 File Specification

APPENDIX D. DR-100 FORMAT FILE SPECIFICATION

Organization

IHEADR (integer header) records(s)	integer*2 IHEADR(256)
+	
RHEADR (real header) records(s)	real*4 RHEADR(128)
+	
IBUFFR (data) records	integer*2 IBUFFR(256)

INTEGER HEADER (IHEADR)

N	Description of IHEADR (N)	Example
I001	Extra IHEADR records that follow	0
I002	Extra ASCII records that follow	0
I003	Default integer value	-32768
I004	Integer(0)/real(1) data	-32768
I005	DBS(0)/no DBS(1) switch	1
I010	Year	81
I011	Julian Day of year	156
I012	Hour	03
I013	Minute	00
I014	Seconds	06
I015	Milliseconds	171
I020	DR-200 Serial number	214
I021	Event number	13
I030	Number of components	3
I031	Number of data records	12
I032	Index of last sample in last data block	
I041	Vertical orientation [1] (0=up)	0
I042	Horizontal orientation [2]	0
I254	Motion [3]	2
I255	Component [4]	1

Notes:

[1] Channel *1,2,3: Usual values: 0,90,90 (Z,N,E)(degrees, 0=up)

[2] Channel *1,2,3: Usual values: 0,0,90 (Z,N,E)(degrees, clockwise from 0=north)

[3] ACC: 1; VEL: 2; DIS: 3

[4] Channel *1,2,3: 1,2,3

* I010 through I015 specify the time of the first sample in the file

* total samples in file = (I031-1) x 256 + I032

REAL HEADER (RHEADR)

N	Description of RHEADR(N)		Example
R001	Extra RHEADR records that follow		0.
R002	Default real value		–0.3E–38
R005	Sample rate [samples/sec]		200.32
R006	Component sample time lag [sec]		0.
R010	Event latitude [deg] [2]		37.987
R011	Latitude adjustment [arc minutes] [2]		52.344
R012	Event longitude [deg] [2]		–115.876
R013	Longitude adjustment [arc minutes] [2]		15.099
R014	Depth [Km]		12.5
R015	Magnitude		3.1
R016	Moment		2.5E–22
R039	Transducer type [1]		VEL
R040	Latitude, station [deg] [2]		38.753
R041	Latitude adjustment [arc minutes] [2]		34.589
R042	Longitude, station [deg] [2]		–116.567
R043	Longitude adjustment [arc minutes] [2]		45.900
R044	Elevation [m]		1158
R046	Digitizing constant [counts/V]		204.8
R047	Corner frequency, anti–aliasing filter [Hz]	50.	
R048	Number poles, anti–aliasing filter		7
R049	Natural frequency, transducer [Hz]		1.0
R050	Damping coefficient, transducer		0.7
R051	Generator constant, [V/(cm/sec)]		.50
R052	Amplifier gain, Kth component [dB]		54.
R053	Generator constant [V/(m/sec)]		120.
R060	Clock correction [ms]		0.034
R061	Factor multiplying sample values		1.E+10

Notes:

[1] VEL, FBA, SMA

[2] Coordinates may be entered as decimal degrees or degrees/minutes. In the first case, enter degrees and decimal parts in RHEADR(10), RHEADR(12), RHEADR(40), and RHEADR(42); in the second case, enter degrees parts in RHEADR(10), RHEADR(12), RHEADR(40), and RHEADR(42) and minutes parts in RHEADR(11), RHEADR(13), RHEADR(41), and RHEADR(43).

* Ground motion = COUNTS/(R046 x R051 x G) where G = 10(R052/20)

DATA RECORDS (IBUFFR)

N	Description of IBUFFR(N)	Example
1–256	Amplitude of sample [COUNTS]	1897