



# **ABSOLUTE GRAVITY MEASUREMENTS AT THE CONRAD OBSERVATORIUM IN AUSTRIA IN JUNE 2008**

## **Final Report**

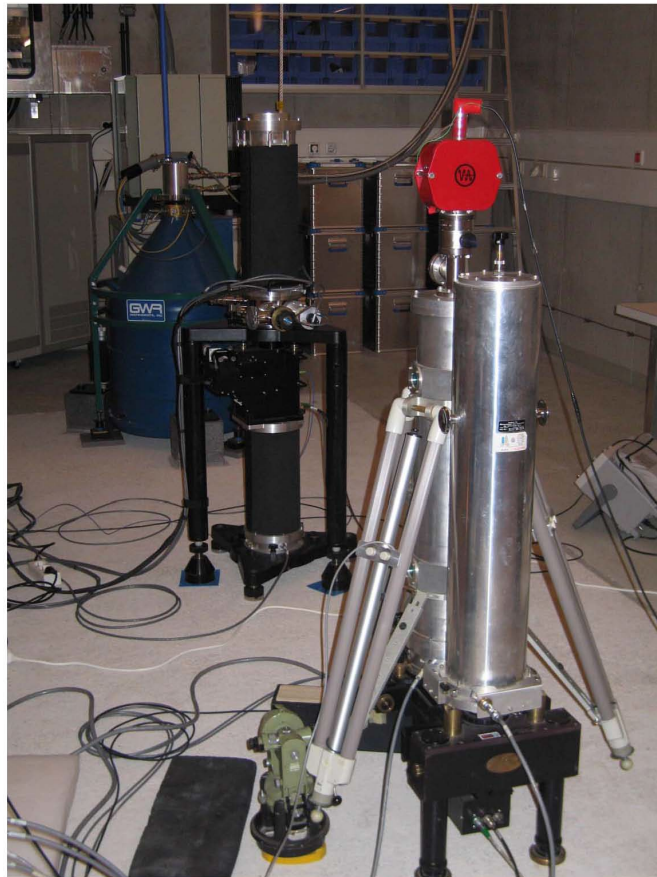
**September 21, 2008**

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## Foreword

This report contains the results of absolute gravity measurements carried out at the Conrad Observatorium in Austria in August 2007. The absolute gravimeter FG5#216 from the European Center for Geodynamics and Seismology was operated by Olivier Francis and Gilbert Klein from the University of Luxembourg. The main objective of this experiment was to calibrate the superconducting gravimeter: the absolute gravimeter operated simultaneously side-by-side with the superconducting gravimeter on the same pillar for approximately 3,5 days. The comparison between the times series from both instruments allows us to determine the scale or calibration factor of the superconducting gravimeter. During the experiment, the absolute gravimeter Jilag-6 from the Federal Office of Metrology and Surveying (BEV) occupied a site on the same pillar (see Figure 1).



**Figure 1.** Picture showing from the front to the back the absolute gravimeters Jilag-6 and FG5#216 and the superconducting Gravimeter on the same pillar.

In addition to the calibration of the superconducting gravimeter, a new absolute gravity site has been established next to the SG. The vertical gravity gradients and the gravity ties between the different sites were measured by Bruno Meurers with a Scintrex CG5.

We would like to thank Bruno Meurers and Norbert Blaumoser for their warm hospitality and help during our measurements.

This absolute gravity measurements campaign was funded by the University of Luxembourg.

## Data processing

Raw data from the absolute gravimeters consist of vectors of time and position of the falling object during the drops. To obtain the gravity value, a linear equation representing the equation of motion is fit to the raw data including the gravity gradient which has been measured with relative meters.

The data processing follows the protocol adopted during absolute gravimeters comparisons at the BIPM in Sèvres (Francis and van Dam, 2003). Geophysical corrections are applied to the raw gravity data: Earth tides using modeled tidal parameters, atmospheric pressure effect using a constant admittance, and the polar motion effect using pole positions from IERS.

The g-soft version 7.0 software from Microg-LaCoste Inc. was used for the processing. All the text outputs as well as some figures are compiled in the annexes of this report for future reference.

## Vertical Gravity Gradient

The vertical gravity gradient is needed to linearize the equation of motion but also to transfer the measured absolute gravity value from the reference height around 1.3 m to the floor. Bruno Meurers measured the vertical gravity gradient with his Scintrex CG5. He obtained a value -2.710 microGal/cm that we used to process the absolute gravity observations.

## Results of the absolute gravity measurements

The FG5#216 operated from Sunday 1<sup>st</sup> of June 2008 at 18:30 until Thursday 5<sup>th</sup> of June 2008 at 05:00. A total of 82 sets of 100 drops every 5 seconds were taken with a rate of 2 set per hour. It represents a total of 8200 drops. Sets 17 and 18 were excluded from the final data processing due to anomalous high noise level.

| Site                                 | Gravity value<br>/microgal | Set Standard Deviation<br>/microgal |
|--------------------------------------|----------------------------|-------------------------------------|
| <b>FG5#216 Absolute site @ 1.3 m</b> | <b>980 647 605.21</b>      | <b>0.82</b>                         |

## Reference

Francis O., van Dam T.M., Processing of the Absolute data of the ICAG01, Cahiers du Centre Européen de Géodynamique et de Séismologie, vol.22, 45-48, 2003. <https://doi.org/10.5281/zenodo.7890604>

## ANNEXES

| <b>STATION: CONRAD OBSERVATORIUM</b>                     |                                |                |  |
|--|--------------------------------|----------------|--|
| City:  | PERNITZ                        | Country:       | Austria  |
| Location:  | Conrad<br>Observatorium        | Particularity: |  |
| Situation:   | Gravity Room                   | Remarks:       | Site next to the<br>superconducting gravimeter |
| Date:  | 01-05 June 2008                |                |  |
| Code number:   |                                |                |  |
| Latitude:  | 47.92876 degrees               |                |  |
| Longitude:   | 15.86090 degrees               |                |  |
| Elevation:   | 1045.0 m                       |                |  |
| Gradient:  | -2.710 µgal/cm                 |                |  |
| Reference height:  | 0. 1280 m + 1.1652 m = 1.2932m |                |  |
| Meter:   | FG5                            |                |  |
| S/N:   | 216                            |                |  |
| <b>Tidal corrections using observed tidal parameters</b> |                                |                |  |
| <b>Polar motion correction</b>                           |                                |                | <b>Air pressure correction</b>                 |
| X-coordinate   | 0.1290                         | Arc seconds    | Nominal air pressure: 983.85 mbar              |
| Y-coordinate   | 0.5375                         | Arc seconds    | Barometric admittance factor: 0.3 µgal/mbar    |
| <b>Gravity</b>   |                                |                |  |
| Set gravity mean:  | <b>980 647 605.21</b>          | microgal       |  |
| Set std. dev.:   | 0.82                           | microgal       |  |
| Mean std. dev.:  | 4.60                           | microgal       |  |
| Number of sets:  | 80                             |                |  |
| Number of drops per set:                                 | 100                            |                |  |
| Drop interval:   | 10 seconds                     |                |  |
| Set interval:  | 30 minutes                     |                |  |
| Nominal/datum height:                                    | 1.30 m                         |                |  |
| Author: O. Francis                                       | University of Luxembourg       |                |  |
| Date: September 21, 2008                                 |                                |                |  |

# Project file

Micro-g Solutions g Processing Report  
File Created: 10/14/08, 15:45:06

Project Name: CO20080601  
g Acquisition Version: 1.082300  
g Processing Version: 7.070307

Company/Institution: University of Luxembourg  
Operator: Olivier Francis and Gilbert Klein

## Station Data

Name: Conrad Observatorium  
Site Code: next to SG  
Lat: 47.92876 Long: 15.86090 Elev: 1045.00 m  
Setup Height: 12.80 cm  
Transfer Height: 130.00 cm  
Actual Height: 129.32 cm  
Gradient: -2.710  $\mu\text{Gal}/\text{cm}$   
Nominal Air Pressure: 893.85 mBar  
Barometric Admittance Factor: 0.30  
Polar Motion Coord: 0.1290 " 0.5375 "  
Earth Tide (ETGTAB) Selected  
Potential Filename: C:\Program Files\Micro-g Solutions Inc\gWavefiles\Etcpot.dat  
Delta Factor Filename: G:\ABSOLU\DATA\INI\OceanLoad-Conrad Observatorium.dff  
Delta Factors

| Start    | Stop     | Amplitude | Phase  | Term |
|----------|----------|-----------|--------|------|
| 0.000000 | 0.002427 | 1.000000  | 0.0000 | DC   |
| 0.002428 | 0.249951 | 1.160000  | 0.0000 | Long |
| 0.721500 | 0.906315 | 1.154250  | 0.0000 | Q1   |
| 0.921941 | 0.974188 | 1.154240  | 0.0000 | O1   |
| 0.989049 | 0.998028 | 1.149150  | 0.0000 | P1   |
| 0.999853 | 1.216397 | 1.134890  | 0.0000 | K1   |
| 1.719381 | 1.906462 | 1.161720  | 0.0000 | N2   |
| 1.923766 | 1.976926 | 1.161720  | 0.0000 | M2   |
| 1.991787 | 2.002885 | 1.161720  | 0.0000 | S2   |
| 2.003032 | 2.182843 | 1.161720  | 0.0000 | K2   |
| 2.753244 | 3.081254 | 1.07338   | 0.0000 | M3   |
| 3.791964 | 3.937897 | 1.03900   | 0.0000 | M4   |

Ocean Load ON, Filename: G:\ABSOLU\DATA\INI\OceanLoad-Conrad Observatorium.olf  
Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa  
Amplitude ( $\mu\text{Gal}$ ): 1.110 0.365 0.096 0.129 0.224 0.035 0.095 0.034 0.000 0.000 0.000  
Phase (deg): 45.6 17.9 73.7 161.2 62.5 86.7 15.0 -146.8 0.0 0.0 0.0

## Instrument Data

Meter Type: FG5  
Meter S/N: 216  
Factory Height: 116.52 cm  
Rubidium Frequency: 10000000.00970 Hz  
Laser: WEO100 (187)  
ID: 632.99117754 nm ( 0.65 V)  
IE: 632.99119473 nm ( 0.19 V)  
IF: 632.99121259 nm (-0.20 V)  
IG: 632.99123023 nm (-0.43 V)  
IH: 632.99136890 nm (-1.88 V)  
II: 632.99139822 nm (-1.58 V)  
IJ: 632.99142704 nm (-1.30 V)  
Modulation Frequency: 8333.420 Hz

#### Processing Results

Date: 06/03/08

Time: 12:44:14

DOY: 155

Year: 2008

Time Offset (D h:m:s): 0 0:0:0

Gravity: 980647605.21  $\mu$ Gal

Set Scatter: 0.82  $\mu$ Gal

Measurement Precision: 0.09  $\mu$ Gal

Total Uncertainty: 0.09  $\mu$ Gal

Number of Sets Collected: 82

Number of Sets Processed: 80

Set #s Processed:

1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,  
41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,7  
5,76,77,78,79,80,81,82

Number of Sets NOT Processed: 2

Set #s NOT Processed: 17,18

Number of Drops/Set: 100

Total Drops Accepted: 7931

Total Drops Rejected: 69

Total Fringes Acquired: 700

Fringe Start: 7

Processed Fringes: 613

GuideCard Multiplex: 4

GuideCard Scale Factor: 250

#### Acquisition Settings

Set Interval: 60 min

Drop Interval: 10 sec

Number of Sets: 100

Number of Drops: 100

#### Gravity Corrections

Earth Tide (ETGTAB): -22.45  $\mu$ Gal

Ocean Load: 0.01  $\mu$ Gal

Polar Motion: 0.43  $\mu$ Gal

Barometric Pressure: 0.53  $\mu$ Gal

Transfer Height: -1.84  $\mu$ Gal

Reference Xo: -0.82  $\mu$ Gal

#### Uncertainties

Sigma Reject: 3.00

Earth Tide Factor: 0.000

Average Earth Tide Uncertainty: 0.00  $\mu$ Gal

Ocean Load Factor: 0.00

Average Ocean Load Uncertainty: 0.00  $\mu$ Gal

Barometric: 0.00  $\mu$ Gal

Polar Motion: 0.00  $\mu$ Gal

Laser: 0.00  $\mu$ Gal

Clock: 0.00  $\mu$ Gal

System Type: 0.00  $\mu$ Gal

Tidal Swell: 0.00  $\mu$ Gal

Water Table: 0.00  $\mu$ Gal

Unmodeled: 0.00  $\mu$ Gal

System Setup: 0.00  $\mu$ Gal

Gradient: 0.00  $\mu$ Gal ( 0.00  $\mu$ Gal/cm)

# Set File

Source Data Filename: CO20080601  
g Acquisition Version: 1.082300  
g Processing Version: 7.070307

| Set | Time     | DOY | Year | Gravity       | Sigma | Error | Uncert | Tide     | Load   | Baro  | Polar | Transfer | Refxo  | Temp   | Pres    | Accep | Reject |
|-----|----------|-----|------|---------------|-------|-------|--------|----------|--------|-------|-------|----------|--------|--------|---------|-------|--------|
| 1   | 19:38:12 | 153 | 2008 | 980647604.313 | 3.965 | 0.407 | 0.407  | -72.406  | 1.179  | 1.841 | 0.433 | -1.843   | -0.827 | 27.879 | 899.986 | 95    | 5      |
| 2   | 20:38:09 | 153 | 2008 | 980647604.870 | 4.968 | 0.502 | 0.502  | -64.500  | 1.072  | 1.717 | 0.433 | -1.843   | -0.823 | 27.973 | 899.572 | 98    | 2      |
| 3   | 21:38:15 | 153 | 2008 | 980647603.624 | 4.656 | 0.466 | 0.466  | -63.193  | 0.706  | 1.517 | 0.433 | -1.843   | -0.828 | 27.829 | 898.907 | 100   | 0      |
| 4   | 22:38:15 | 153 | 2008 | 980647605.464 | 4.230 | 0.425 | 0.425  | -69.316  | 0.171  | 1.576 | 0.433 | -1.843   | -0.833 | 27.726 | 899.103 | 99    | 1      |
| 5   | 23:38:11 | 153 | 2008 | 980647605.177 | 4.343 | 0.437 | 0.437  | -80.636  | -0.399 | 1.532 | 0.433 | -1.843   | -0.822 | 27.609 | 898.956 | 99    | 1      |
| 6   | 00:38:15 | 154 | 2008 | 980647605.105 | 4.454 | 0.445 | 0.445  | -92.474  | -0.863 | 1.433 | 0.433 | -1.843   | -0.825 | 27.581 | 898.626 | 100   | 0      |
| 7   | 01:38:15 | 154 | 2008 | 980647605.146 | 4.689 | 0.469 | 0.469  | -98.774  | -1.102 | 1.349 | 0.433 | -1.843   | -0.818 | 27.557 | 898.347 | 100   | 0      |
| 8   | 02:38:15 | 154 | 2008 | 980647605.043 | 4.630 | 0.463 | 0.463  | -93.905  | -1.057 | 1.356 | 0.433 | -1.843   | -0.807 | 27.551 | 898.370 | 100   | 0      |
| 9   | 03:38:13 | 154 | 2008 | 980647605.276 | 4.100 | 0.412 | 0.412  | -74.281  | -0.738 | 1.321 | 0.433 | -1.843   | -0.801 | 27.552 | 898.253 | 99    | 1      |
| 10  | 04:38:15 | 154 | 2008 | 980647605.225 | 4.119 | 0.412 | 0.412  | -39.551  | -0.225 | 1.329 | 0.433 | -1.843   | -0.819 | 27.553 | 898.282 | 100   | 0      |
| 11  | 05:38:21 | 154 | 2008 | 980647603.895 | 5.265 | 0.532 | 0.532  | 6.815    | 0.351  | 1.331 | 0.433 | -1.843   | -0.810 | 27.560 | 898.285 | 98    | 2      |
| 12  | 06:38:14 | 154 | 2008 | 980647604.486 | 5.172 | 0.520 | 0.520  | 57.786   | 0.841  | 1.318 | 0.433 | -1.843   | -0.809 | 27.570 | 898.244 | 99    | 1      |
| 13  | 07:38:15 | 154 | 2008 | 980647605.730 | 4.762 | 0.476 | 0.476  | 104.894  | 1.119  | 1.284 | 0.433 | -1.843   | -0.823 | 27.647 | 898.129 | 100   | 0      |
| 14  | 08:38:15 | 154 | 2008 | 980647604.828 | 4.558 | 0.456 | 0.456  | 139.328  | 1.109  | 1.295 | 0.433 | -1.843   | -0.821 | 27.962 | 898.165 | 100   | 0      |
| 15  | 09:38:15 | 154 | 2008 | 980647605.831 | 4.510 | 0.451 | 0.451  | 154.475  | 0.807  | 1.266 | 0.433 | -1.843   | -0.835 | 28.228 | 898.069 | 100   | 0      |
| 16  | 10:38:15 | 154 | 2008 | 980647606.431 | 4.952 | 0.495 | 0.495  | 147.372  | 0.285  | 1.285 | 0.433 | -1.843   | -0.807 | 28.386 | 898.134 | 100   | 0      |
| 19  | 13:38:17 | 154 | 2008 | 980647604.282 | 4.320 | 0.434 | 0.434  | 25.243   | -1.244 | 1.011 | 0.433 | -1.843   | -0.834 | 28.474 | 897.220 | 99    | 1      |
| 20  | 14:38:15 | 154 | 2008 | 980647604.302 | 4.199 | 0.420 | 0.420  | -24.003  | -1.308 | 0.864 | 0.433 | -1.843   | -0.816 | 28.503 | 896.730 | 100   | 0      |
| 21  | 15:38:15 | 154 | 2008 | 980647604.359 | 3.568 | 0.357 | 0.357  | -64.178  | -1.061 | 0.756 | 0.433 | -1.843   | -0.819 | 28.594 | 896.371 | 100   | 0      |
| 22  | 16:38:15 | 154 | 2008 | 980647604.670 | 3.942 | 0.394 | 0.394  | -90.457  | -0.559 | 0.701 | 0.433 | -1.843   | -0.829 | 28.291 | 896.187 | 100   | 0      |
| 23  | 17:38:15 | 154 | 2008 | 980647605.437 | 3.804 | 0.380 | 0.380  | -101.682 | 0.078  | 0.694 | 0.433 | -1.843   | -0.841 | 28.269 | 896.165 | 100   | 0      |
| 24  | 18:38:13 | 154 | 2008 | 980647604.897 | 3.645 | 0.366 | 0.366  | -100.231 | 0.694  | 0.684 | 0.433 | -1.843   | -0.824 | 28.114 | 896.131 | 99    | 1      |
| 25  | 19:38:15 | 154 | 2008 | 980647604.018 | 3.997 | 0.400 | 0.400  | -91.044  | 1.140  | 0.778 | 0.433 | -1.843   | -0.838 | 27.996 | 896.443 | 100   | 0      |
| 26  | 20:38:15 | 154 | 2008 | 980647604.574 | 4.096 | 0.410 | 0.410  | -80.139  | 1.307  | 0.799 | 0.433 | -1.843   | -0.836 | 27.953 | 896.513 | 100   | 0      |
| 27  | 21:38:15 | 154 | 2008 | 980647605.392 | 4.212 | 0.421 | 0.421  | -72.863  | 1.157  | 0.718 | 0.433 | -1.843   | -0.817 | 27.902 | 896.242 | 100   | 0      |
| 28  | 22:38:10 | 154 | 2008 | 980647605.199 | 3.994 | 0.401 | 0.401  | -72.425  | 0.731  | 0.620 | 0.433 | -1.843   | -0.829 | 27.860 | 895.915 | 99    | 1      |
| 29  | 23:38:11 | 154 | 2008 | 980647605.729 | 5.089 | 0.511 | 0.511  | -79.027  | 0.137  | 0.488 | 0.433 | -1.843   | -0.832 | 27.866 | 895.476 | 99    | 1      |
| 30  | 00:38:14 | 155 | 2008 | 980647607.067 | 4.891 | 0.494 | 0.494  | -89.771  | -0.472 | 0.313 | 0.433 | -1.843   | -0.816 | 27.840 | 894.893 | 98    | 2      |
| 31  | 01:38:16 | 155 | 2008 | 980647605.939 | 4.645 | 0.467 | 0.467  | -99.381  | -0.939 | 0.202 | 0.433 | -1.843   | -0.823 | 27.794 | 894.524 | 99    | 1      |
| 32  | 02:38:14 | 155 | 2008 | 980647605.490 | 4.270 | 0.429 | 0.429  | -101.665 | -1.147 | 0.169 | 0.433 | -1.843   | -0.838 | 27.831 | 894.412 | 99    | 1      |
| 33  | 03:38:13 | 155 | 2008 | 980647605.579 | 4.191 | 0.421 | 0.421  | -91.272  | -1.042 | 0.286 | 0.433 | -1.843   | -0.829 | 27.802 | 894.803 | 99    | 1      |
| 34  | 04:38:14 | 155 | 2008 | 980647605.604 | 3.915 | 0.393 | 0.393  | -65.293  | -0.651 | 0.377 | 0.433 | -1.843   | -0.822 | 27.761 | 895.107 | 99    | 1      |

|    |          |     |                    |        |       |       |          |        |        |       |        |        |        |         |     |   |
|----|----------|-----|--------------------|--------|-------|-------|----------|--------|--------|-------|--------|--------|--------|---------|-----|---|
| 35 | 05:38:13 | 155 | 2008 980647605.534 | 4.207  | 0.423 | 0.423 | -24.457  | -0.076 | 0.527  | 0.433 | -1.843 | -0.812 | 27.771 | 895.605 | 99  | 1 |
| 36 | 06:38:11 | 155 | 2008 980647605.663 | 4.278  | 0.430 | 0.430 | 26.695   | 0.535  | 0.598  | 0.433 | -1.843 | -0.827 | 27.769 | 895.845 | 99  | 1 |
| 37 | 07:38:15 | 155 | 2008 980647606.748 | 5.012  | 0.501 | 0.501 | 80.600   | 1.022  | 0.664  | 0.433 | -1.843 | -0.824 | 27.790 | 896.063 | 100 | 0 |
| 38 | 08:38:15 | 155 | 2008 980647606.272 | 5.235  | 0.524 | 0.524 | 127.928  | 1.254  | 0.709  | 0.433 | -1.843 | -0.824 | 28.031 | 896.213 | 100 | 0 |
| 39 | 09:38:14 | 155 | 2008 980647606.154 | 4.126  | 0.417 | 0.417 | 160.069  | 1.164  | 0.711  | 0.433 | -1.843 | -0.819 | 28.277 | 896.221 | 98  | 2 |
| 40 | 10:38:13 | 155 | 2008 980647606.338 | 4.325  | 0.437 | 0.437 | 170.941  | 0.766  | 0.786  | 0.433 | -1.843 | -0.811 | 28.329 | 896.469 | 98  | 2 |
| 41 | 11:38:15 | 155 | 2008 980647604.800 | 4.459  | 0.446 | 0.446 | 158.445  | 0.153  | 0.751  | 0.433 | -1.843 | -0.840 | 28.378 | 896.352 | 100 | 0 |
| 42 | 12:38:10 | 155 | 2008 980647605.586 | 4.644  | 0.472 | 0.472 | 125.073  | -0.525 | 0.729  | 0.433 | -1.843 | -0.836 | 28.214 | 896.281 | 97  | 3 |
| 43 | 13:38:06 | 155 | 2008 980647605.242 | 4.829  | 0.488 | 0.488 | 77.095   | -1.105 | 0.659  | 0.433 | -1.843 | -0.818 | 28.433 | 896.048 | 98  | 2 |
| 44 | 14:38:09 | 155 | 2008 980647604.024 | 4.397  | 0.446 | 0.446 | 23.125   | -1.441 | 0.653  | 0.433 | -1.843 | -0.820 | 28.407 | 896.026 | 97  | 3 |
| 45 | 15:38:15 | 155 | 2008 980647605.276 | 4.124  | 0.412 | 0.412 | -27.724  | -1.446 | 0.543  | 0.433 | -1.843 | -0.834 | 28.175 | 895.661 | 100 | 0 |
| 46 | 16:38:13 | 155 | 2008 980647605.504 | 4.947  | 0.500 | 0.500 | -67.880  | -1.118 | 0.576  | 0.433 | -1.843 | -0.822 | 28.156 | 895.772 | 98  | 2 |
| 47 | 17:38:15 | 155 | 2008 980647604.690 | 12.359 | 1.236 | 1.236 | -93.248  | -0.534 | 0.581  | 0.433 | -1.843 | -0.802 | 28.046 | 895.786 | 100 | 0 |
| 48 | 18:38:17 | 155 | 2008 980647604.975 | 5.857  | 0.589 | 0.589 | -103.322 | 0.165  | 0.676  | 0.433 | -1.843 | -0.832 | 28.017 | 896.104 | 99  | 1 |
| 49 | 19:37:50 | 155 | 2008 980647604.372 | 4.801  | 0.501 | 0.501 | -101.194 | 0.805  | 0.732  | 0.433 | -1.843 | -0.811 | 27.916 | 896.289 | 92  | 8 |
| 50 | 20:38:15 | 155 | 2008 980647603.611 | 5.023  | 0.502 | 0.502 | -92.088  | 1.244  | 0.625  | 0.433 | -1.843 | -0.833 | 27.918 | 895.933 | 100 | 0 |
| 51 | 21:38:15 | 155 | 2008 980647603.821 | 4.910  | 0.491 | 0.491 | -82.189  | 1.368  | 0.549  | 0.433 | -1.843 | -0.815 | 27.883 | 895.679 | 100 | 0 |
| 52 | 22:38:20 | 155 | 2008 980647603.999 | 5.026  | 0.505 | 0.505 | -76.457  | 1.156  | 0.454  | 0.433 | -1.843 | -0.821 | 27.907 | 895.364 | 99  | 1 |
| 53 | 23:38:15 | 155 | 2008 980647604.431 | 4.784  | 0.478 | 0.478 | -77.509  | 0.671  | 0.355  | 0.433 | -1.843 | -0.815 | 27.903 | 895.033 | 100 | 0 |
| 54 | 00:38:12 | 156 | 2008 980647605.156 | 4.216  | 0.424 | 0.424 | -84.826  | 0.041  | 0.348  | 0.433 | -1.843 | -0.828 | 27.860 | 895.012 | 99  | 1 |
| 55 | 01:38:15 | 156 | 2008 980647605.282 | 4.184  | 0.418 | 0.418 | -94.972  | -0.571 | 0.127  | 0.433 | -1.843 | -0.823 | 27.864 | 894.274 | 100 | 0 |
| 56 | 02:38:15 | 156 | 2008 980647604.949 | 3.755  | 0.376 | 0.376 | -102.440 | -1.004 | 0.139  | 0.433 | -1.843 | -0.822 | 27.881 | 894.314 | 100 | 0 |
| 57 | 03:38:13 | 156 | 2008 980647605.734 | 3.921  | 0.394 | 0.394 | -101.249 | -1.148 | 0.128  | 0.433 | -1.843 | -0.829 | 27.865 | 894.276 | 99  | 1 |
| 58 | 04:38:17 | 156 | 2008 980647606.468 | 4.338  | 0.436 | 0.436 | -86.609  | -0.965 | 0.135  | 0.433 | -1.843 | -0.839 | 27.872 | 894.300 | 99  | 1 |
| 59 | 05:38:15 | 156 | 2008 980647604.799 | 5.085  | 0.508 | 0.508 | -56.536  | -0.504 | 0.152  | 0.433 | -1.843 | -0.839 | 27.864 | 894.355 | 100 | 0 |
| 60 | 06:38:09 | 156 | 2008 980647605.147 | 4.870  | 0.492 | 0.492 | -12.683  | 0.115  | 0.178  | 0.433 | -1.843 | -0.834 | 27.862 | 894.444 | 98  | 2 |
| 61 | 07:38:13 | 156 | 2008 980647604.931 | 4.466  | 0.449 | 0.449 | 39.895   | 0.731  | 0.146  | 0.433 | -1.843 | -0.848 | 28.012 | 894.337 | 99  | 1 |
| 62 | 08:38:15 | 156 | 2008 980647604.299 | 4.585  | 0.458 | 0.458 | 93.052   | 1.179  | 0.120  | 0.433 | -1.843 | -0.829 | 28.308 | 894.250 | 100 | 0 |
| 63 | 09:38:15 | 156 | 2008 980647605.556 | 4.438  | 0.446 | 0.446 | 137.706  | 1.336  | 0.086  | 0.433 | -1.843 | -0.829 | 28.459 | 894.136 | 99  | 1 |
| 64 | 10:38:15 | 156 | 2008 980647604.717 | 4.582  | 0.458 | 0.458 | 165.812  | 1.153  | 0.024  | 0.433 | -1.843 | -0.815 | 28.441 | 893.929 | 100 | 0 |
| 65 | 11:38:20 | 156 | 2008 980647604.976 | 3.917  | 0.394 | 0.394 | 172.115  | 0.665  | -0.028 | 0.433 | -1.843 | -0.817 | 28.413 | 893.756 | 99  | 1 |
| 66 | 12:38:16 | 156 | 2008 980647604.050 | 4.382  | 0.443 | 0.443 | 155.494  | -0.012 | -0.071 | 0.433 | -1.843 | -0.822 | 28.519 | 893.612 | 98  | 2 |
| 67 | 13:38:15 | 156 | 2008 980647603.973 | 4.633  | 0.463 | 0.463 | 119.197  | -0.718 | -0.142 | 0.433 | -1.843 | -0.806 | 28.573 | 893.377 | 100 | 0 |
| 68 | 14:38:15 | 156 | 2008 980647604.068 | 4.181  | 0.420 | 0.420 | 70.013   | -1.280 | -0.210 | 0.433 | -1.843 | -0.811 | 28.400 | 893.149 | 99  | 1 |
| 69 | 15:38:17 | 156 | 2008 980647604.327 | 4.474  | 0.450 | 0.450 | 16.687   | -1.561 | -0.206 | 0.433 | -1.843 | -0.842 | 28.304 | 893.163 | 99  | 1 |
| 70 | 16:38:11 | 156 | 2008 980647605.861 | 3.803  | 0.386 | 0.386 | -31.933  | -1.490 | -0.194 | 0.433 | -1.843 | -0.840 | 28.182 | 893.202 | 97  | 3 |
| 71 | 17:38:11 | 156 | 2008 980647606.115 | 4.945  | 0.499 | 0.499 | -69.329  | -1.086 | -0.197 | 0.433 | -1.843 | -0.813 | 28.210 | 893.194 | 98  | 2 |
| 72 | 18:38:15 | 156 | 2008 980647606.164 | 4.651  | 0.465 | 0.465 | -91.990  | -0.444 | -0.191 | 0.433 | -1.843 | -0.818 | 28.112 | 893.212 | 100 | 0 |
| 73 | 19:38:11 | 156 | 2008 980647606.169 | 4.445  | 0.447 | 0.447 | -100.137 | 0.276  | -0.057 | 0.433 | -1.843 | -0.813 | 28.083 | 893.661 | 99  | 1 |



|    |          |     |                   |       |       |       |          |        |        |       |        |        |        |         |     |   |
|----|----------|-----|-------------------|-------|-------|-------|----------|--------|--------|-------|--------|--------|--------|---------|-----|---|
| 74 | 20:38:19 | 156 | 2008980647605.470 | 4.126 | 0.415 | 0.415 | -97.266  | 0.905  | -0.060 | 0.433 | -1.843 | -0.831 | 28.066 | 893.650 | 99  | 1 |
| 75 | 21:38:15 | 156 | 2008980647607.216 | 4.477 | 0.448 | 0.448 | -88.797  | 1.290  | -0.073 | 0.433 | -1.843 | -0.809 | 28.020 | 893.606 | 100 | 0 |
| 76 | 22:38:15 | 156 | 2008980647607.620 | 4.521 | 0.452 | 0.452 | -80.399  | 1.347  | -0.151 | 0.433 | -1.843 | -0.820 | 28.036 | 893.348 | 100 | 0 |
| 77 | 23:38:15 | 156 | 2008980647606.717 | 4.673 | 0.467 | 0.467 | -76.444  | 1.072  | -0.204 | 0.433 | -1.843 | -0.820 | 28.017 | 893.169 | 100 | 0 |
| 78 | 00:38:15 | 157 | 2008980647605.829 | 4.187 | 0.419 | 0.419 | -78.802  | 0.545  | -0.274 | 0.433 | -1.843 | -0.821 | 28.020 | 892.937 | 100 | 0 |
| 79 | 01:38:15 | 157 | 2008980647605.558 | 4.508 | 0.451 | 0.451 | -86.373  | -0.092 | -0.343 | 0.433 | -1.843 | -0.828 | 27.995 | 892.708 | 100 | 0 |
| 80 | 02:38:11 | 157 | 2008980647605.184 | 4.752 | 0.478 | 0.478 | -95.417  | -0.668 | -0.369 | 0.433 | -1.843 | -0.823 | 27.965 | 892.620 | 99  | 1 |
| 81 | 03:38:15 | 157 | 2008980647605.761 | 6.670 | 0.667 | 0.667 | -100.633 | -1.035 | -0.395 | 0.433 | -1.843 | -0.812 | 27.985 | 892.532 | 100 | 0 |
| 82 | 04:38:15 | 157 | 2008980647604.962 | 4.725 | 0.472 | 0.472 | -96.578  | -1.096 | -0.351 | 0.433 | -1.843 | -0.814 | 27.989 | 892.679 | 100 | 0 |

