

Development and observation of a miniature automated torsion balance ("torsind")

Report

Attachments :

- 1-Doc. BONP 1026r2 « Definition file of a TORSIND ».
- 2- Doc. BON1021r3 « Read-out software-phase 2 ».
- 3- Doc. BON Physics"Operation Manual Torsind").
- 4- J.B. DELOLY- 04/07/2016 « Torsinds » developped by Bon Physics- State of the situation.
- 5- H.Munera,19/02/2018 « Torsind data collected at Chicago (Illinois, USA) during and after the 21 August 2017 solar eclipse - Preliminary analysis » Letter of Héctor A. Múnera to Victor O. de Haan.
- 6- J.B.Deloly, 22/10/2018 « Torsind observations in the Cacica mine ».

Appendices :

- Bibliography.
- Annex 1- Eclipses observations 2016 (Puttershoek)
- Annex 2- Removing of the connection to earth of the inner aluminium sheet
- Annex 3 - Chicago observation.
- Annex 4- Alexander Pugach's observations in Cacica mine.

Abstract :

In 2015 a contract was signed with the Dutch laboratory BonPhysics by the Fondation Maurice Allais to develop a device similar as the one designed by Dr Alexander Pugach, main astronomer at the Ukrainian Academy of Sciences. Very simple of design (we observe the rotation of a disc suspended from a wire, in a glass cylinder 25 cm high and 18 cm in diameter), fully automated, compact and simple to implement, inexpensive, this device, called "torsind", had made it possible, in particular, to highlight marked anomalies during eclipses.

▪ 4 units were built at the end of 2015. They were identical to Alexander Pugach's torsind in what is likely to act on the disc. It appeared that, contrary to what one could think from the results of the tests carried out by Alexander Pugach, the device was very sensitive to temperature variations of the room in which it was located. The mechanism of this sensitivity has not been identified, but it seems very unlikely that it involves unconventional phenomena. The observation of torsinds (continuous observations over the year 2016, then more episodic observations thereafter) did not reveal any significant eclipse effect, nor any phenomenon which does not appear to be able to be explained in a conventional framework. Long-term observations undisturbed by technical problems remained to be made in the disused salt mine of Cacica, Romania, where environmental conditions, and in particular temperature, are particularly stable. The death of Thomas Goodey, who locally had taken charge of organizing these observations, led to the abandonment of this operation.

▪ The above does not invalidate the conclusions of the two observations made by Alexander Pugach in the Cacica mine during the solar eclipses of June 1, 2011 and May 10, 2013 (see annex 4):

- Each time there has been a remarkable concordance between the eclipse and obviously abnormal deviations.

- These deviations do not seem to be able to be explained by known phenomena, given the stability of the local environment. In addition, tests carried out by BonPhysics have shown that the torsind is insensitive to large variations in the Earth's magnetic field, which is the only geophysical factor of variations of which the environment of the Cacica mine does not protect.

▪ Alexander Pugach highlighted a similarity between the evolution from 2009 to 2013 of an "activity index" of the torsind and a solar activity index (sunspots). Would the fact that torsind deviations mainly result from temperature variations mean that there is a link between these and solar activity.

1- Origin of this operation.

1.1 History.

Russian astrophysicist N.A. Kozyrev (1908-1983) is internationally known for having been the first, in 1958, to provide convincing evidence of volcanic activity on the Moon. He also carried out unconventional theoretical and experimental research concluding in the existence of a "5th force", which would activate "torsion fields". He had indicated, but without providing any experimental justification, that miniature torsion balances should react to astronomical events, and in particular to eclipses.

1.2 The works of Alexander Pugach.

This is at the origin of the work started in the early 2000s by Dr Alexander Pugach, main astronomer at the Ukrainian Academy of Sciences. He observed marked deviations strongly concomitant with the phenomenon considered during solar eclipses, a lunar eclipse and a transit of Venus (ref. 1,2,3,4,5). In two of the observations, those made during the solar eclipses of June 1, 2011 and May 10, 2013 (annex 4, ref. 3 and 5), a device was installed in the disused salt mine of Cacica, in Romania, where the temperature and the hygrometry are particularly stable, and which is protected from electrostatic phenomena.

The device used has evolved over the years, the final version, called "torsind", fully automated, is described in detail in ref.6. In a cylindrical quartz chamber hermetically closed 240 mm in high, an aluminum disk of 120 mm diameter and 100 μg (or a paper disk of 400 μg ¹), which is suspended by a silk thread of 20 μ of diameter. The inside of the chamber is covered by a grounded aluminum sheet. The position of the disc is read 1 times per minute by a camera connected to a computer. This device allows continuous observations over long durations.

¹ The paper disc was used by A.Pugach, together with the aluminium one, from 2013.

• The document in ref. 6 indicates the conclusions of the study by Alexander Pugach of the influence of the following perturbing factors:

- convective air flow inside the torsind housing;
- changes in outdoor weather parameters (temperature, humidity, barometer);
- tidal effects of the Moon and Sun ;
- change in the degree of excitation of the ionosphere over the place of observation (see Fig.7, right lower panel) ;
- Coriolis acceleration;
- floor vibration;
- local mobile phone interference;
- static electricity (the grounded aluminium screen excludes any action).

The conclusion is that they have no detectable influence. Graphs reproduced in ref.6 further show that the degree of excitation of the ionosphere and the addition of microcharges to the disk had no detectable effect on the rotation. With regard to the Earth's magnetic field, it is specified that the aluminium screen could only reduce very little a possible effect of its variations: μ -metal shielding would have been necessary to ensure truly effective protection. Pressure and external humidity have no effect, the housing being sealed. As regards temperature, two graphs compare the records of internal temperature and deviations, one over 4 days, the other being a zoom over 10 hours. There is no significant correlation, whether there are large temperature variations or micro variations.

It emerged from all this that the observed deviations (which were from a few degrees to several tens of degrees) could not apparently be explained by known phenomena.

• The document in ref. 6 explains the choice of silk thread:

- It specifies that the purpose is absolutely not of using it to measure torques: the restoring torque exerted by the silk thread depends on the speed of the rotation imposed (the faster the rotation, the more it is important). In addition, it may vary with temperature, humidity, wire load ... But in all cases it remains very low, that is the essential point.
- what is required of the thread is in fact only to oppose as little as possible to external torques which might be exercised: it is not to have stable characteristics. From this point of view, the use of silk does indeed seem quite justified.

• Three types of phenomena were highlighted by Alexander Pugach.

His torsinds were located in Kiev, in a room of the Observatory of the Ukrainian Academy of Sciences. This room was located in a very quiet location and was well sheltered, but the temperature was not regulated. He highlighted:

a) Diurnal rotations, the amplitude of which are generally limited (from some degrees to dozens of degrees). This amplitude is very variable, but is clearly correlated with sunrise and sunset (see ref.6).

b) Rotations distinguishing themselves clearly from the previous ones by their greatest amplitude, and clearly correlated with exceptional astronomical events (eclipses, syzygies...).

c) Rotations of an exceptional amplitude (possibly several tours), what A.Pugach named “spikes”. They could not until now be correlated with identified phenomena (except in the case of the May 10, 2013 eclipse in the Cacica mine: ref.5).

- Link with solar activity?

In the article in ref. 7, Alexander Pugach defines a daily index of activity of a torsind (“SD index”, which is the standard deviation of the recorded deviations). He analyzes its evolution for a torsind observed over 4 years (2009-2013). This index increased considerably from 2009 to 2013. He observes that the same was generally true for an “SN index” of solar activity deduced from the number of sunspots.

From this, and from the connection of daily variations with sunrise and sunset, he hypothesizes that the torsind deviations result from energy of an unknown nature coming from the sun.

- Links with variations of the Earth magnetic field?

Antonio Iovane (ref.8) highlighted striking concordances between the deviations of a torsind of Alexander Pugach from January 1 to 17, 2014 and the recording of the Earth's magnetic field by a magnetometer on board the GOES13 satellite of NOAA.

It is well known (this phenomenon was observed as early as the 19th century) that solar eclipses act on the Earth's magnetic field, the explanation being that they deflect the solar wind. The recordings collected by Antonio Iovane found again this phenomenon.

Therefore he proposed the disturbances of the Earth's magnetic field resulting from the influence of the solar wind as being the cause of the "eclipse effect". It would also make it possible to fully explain the unsystematic nature of this effect, as well as the fact that, when it occurs, it is never exactly the same.

The problem is that a calculation of the influence of variations of the Earth's magnetic field on the torsind apparently cannot explain the order of magnitude of the observed angular accelerations².

If there is a link, then it can only be by some mechanism other than a direct influence of variations of the magnetic field on the torsind. But then, what might this mechanism be?

2- Contract signed with Bonphysics in 2015.

- Considering the above, the total automation of the device, its simplicity and that of its implementation, it appeared very interesting to have it taken over by a professional laboratory as well as, possibly, by other experimenters.

The idea was to set up a device as close as possible to that of Alexander Pugach, at least initially, knowing that it would eventually be quite easy to change the type of wire or type of disc.

- It was established:

- In collaboration with Alexander Pugach, a "definition file" of his device, or more exactly of a device which is equivalent on the points a priori likely to influence its behavior, but which may differ on the others (those concerning the dismantling and transportability, the marking of the discs for the observation of their movements, the software for reading these movements, the computer used...). In its latest version (attachment 1: doc. BONP 1026 r2

² this has also been confirmed experimentally: see below §4.1.2

“Definition file of a TORSIND”), this definition file includes the results of sensitivity tests to temperature, pressure, humidity, movement of people nearby, shock, vibration, application of magnetic fields, grounding of the internal aluminum shield.

- A software file. In its latest version (attachment 2: doc. BON1021r3 "Read-out software-phase 2 ”), it incorporates the tests carried out by placing the tested torsind on a turntable.
- An user manual (attachment 3: "Operation Manual Torsind").

▪ The differences with the Alexander Pugach device are as follows:

- a) Borosilicate glass housing, not quartz.
- b) The airtight cover was removable, not sealed.
- c) The connection to the earth of the internal aluminum foil was not systematic.
- d) Addition of a removable external thermal protection consisting of a 50mm thick styrofoam cylinder surrounded by a 1mm thick aluminum cylinder.
- e) The reading system of the position of the disc was fully redone:
 - USB camera reading of the 3-point position of the disc illuminate by a LED (and not of position of a single point).
 - Exploitation of camera data by a mini-computer Raspberry Pi, not a PC. This operation provides, in addition to the azimuth of a line segment attached to the disc, the position of the center of the disc.
 - The mini computer (which operates independently) also collects data from several sensors:
 - . temperature;
 - . magnetic field components;
 - . components of acceleration.
 - All these data (1 set per minute) is stored on an SD card. Successive sets can be read along the way with an internet connection.
 - Two modifications of the mini-computer were introduced early 2017 on all copies, to solve problems encountered after sending two torsinds Romania (see §3):
 - . implantation of an LED to check functioning of the reading system,
 - . supply by a battery of the clock of the mini-computer, so that a failure of the external supply does not reset the clock.

▪ 4 copies of the device were built, 2 with a paper disk and 2 with an aluminum disk. They were available in the beginning of December 2015.

3- Exploitation of torsinds

▪ They were installed in a room adjoining Victor De Haan’s home in Puttershoek, Holland. This room was simply equipped with thermostatically controlled heating. They remained there until August 2016, when 2 of them, one equipped with an aluminum disc and the other with a paper disc, were sent to Thomas Goodey, in Romania, in Comanesti, to be put in Cacica salt mine, which is few kilometers apart of Comanesti. The location in the mine posed some particular problems, as the power supply is not permanent there, and there is obviously no possibility of direct reading via the internet.

The two remaining devices continued to operate in Puttershoek.

▪ On the occasion of the eclipse which crossed North America on August 21, 2017 they were sent to Hector Munera, honorary professor of physics at the University of Bogota, one to be implanted in Chicago (in an air-conditioned house), the other in Bogota. Only the first (equipped with a paper disc) reached its destination, and operated from August 20 to September 22, before being returned to Victor De Haan. The second (equipped with an

aluminum disc), which had remained stuck at Colombian customs, was returned to him unused.

- As regards the two devices sent to Romania, for different reasons, only one was able to operate in the Cacica mine, from February 2018 to August 2018, the one equipped with the paper disc. However, failures of the emergency power supply severely affected its operation. Obviously, the goal of finally making the two torsinds work properly for several months in the Cacica had nothing really inaccessible, and it had been decided to maintain it. However, it could not be achieved in 2019 due to the priority given to carrying out in August a continuous observation of 1 month of the two pendulums of the Horodnic “pendularium”, and to prepare it very seriously. In this operation Thomas Goodey was very strongly involved. His illness, and afterward his death, led to give up the operations in Cacica mine.

4- Results

4-1 Sensitivity to disturbances.

The following conclusions result from both the specific tests carried out and the exploitation of the azimuth values of the disc and the data provided by the local sensors (minicomputer sensors or local sensors).

4-1-1 Shocks, vibrations.

While it was indeed insensitive to trampling on the concrete floor of the room, the torsind was found to be sensitive to shocks and vibrations, this sensitivity being very variable from one torsind to another. It is clearly due to the defects of disc centering and disc balancing, which are inevitable due to their design. This sensitivity was confirmed in Chicago (annex3 , attachment 5).

4-1-2 Variations in the Earth magnetic field.

Static magnetic field changes were applied of the order of 50-200 μT perpendicular and parallel to the disc. The changes did not induce a noticeable added rotation to the discs, whatever it is an aluminium disk or a paper disk.

It is reminded that the value of the earth magnetic field in the concerned areas is about 50 μT and that its possible daily variations remain largely under 200 nT. All that excludes absolutely any action of the magnetic field.

4-1-3 Removing of the earth connection of the inner conducting aluminium shield.

The internal shielding by an aluminum sheet alone is already an effective protection against external electrostatic actions. Its connection to earth only reinforces this protection. It was verified, on March 30, 2016, that its disconnection had no impact on the 4 torsinds (see annex 2).

4-1-4 Temperature.

- It quickly appeared (attachment 4) a very high sensitivity of the torsinds not to the temperature itself, but to the temperature variations in the room in which the torsind is located. This sensitivity is also considerably increased by the removal of the external thermal protection in styrofoam (with this protection the amplitude of deviations, very variable from one torsind to another, is from a few degrees to a few tens of degrees; without protection, it can go up to 80 degrees).

▪ In fact, in mid-2016, of the three phenomena observed by A. Pugach (diurnal variations, abnormal deviations during eclipses, "spikes"), only diurnal variations were found again, and the main cause of deviation appeared to be variations in temperature of the Puttershoek room, whatever they are natural (that is to say due to variations in the external temperature), or caused by increasing the heating.

This did not exclude the existence of other factors, but obviously their identification required a stabilized temperature in the room in which the torsind was located. Hence the decision to install 2 torsinds in the Cacica mine, where the temperature is very stable, and where Alexander Pugach had recorded significant deviations during eclipses.

5- Observed phenomena

5-1 Diurnal deviations.

5-1-1 Puttershoek.

As we have just seen, they were very clear, and mainly due to variations in the temperature of the room, whether the disc is made of paper or aluminum. In February 2016, a sunshine sensor was installed on the roof of the room, in order to try to separate what came from the internal temperature and what came from the sun (as we saw before, Alexander Pugach's hypothesis was that an unknown energy comes from the sun). They did not allow this to be done, as the correlation between the two data was too high.

5-1-2 Chicago (paper disk).

The room being air-conditioned, they were of low amplitude (see annex 3 and attachment 5). As far as we can judge, over the periods when the air conditioning is efficient, which is the case most of the time, they do not seem to be linked to variations in the temperature of the room and nevertheless have visually some diurnal character, which confirms the spectral analysis (the period of the main component is 24.6 h).

5-1-3 Cacica (paper disk)

No diurnal variations (see attachment 6)

5-2 Eclipses :

5-2-1 Puttershoek : 2016 eclipses

4 eclipses took place in 2016 :

- 9/03/2016 : Sun

-23/03/2016 : Moon

-1/09/2016 : Sun

-16/09/2016 : Moon

No significant particular effect that can be attributed to these eclipses has been identified: cf annex 1.

5-2-2 Chicago : eclipse of 08/21/2017.

There are anomalies of small amplitude (0,5 degrees) during the eclipse , but it is impossible to assert that they were caused by the eclipse (see annex 3 and attachment 5).

5-2-3 Cacica mine.

3 eclipses occurred: solar eclipse on february 15th (18h55m51s-22h47m08s) ; lunar eclipse on july 27th (18h 24m to 22h 19m), solar eclipse on august 11th (8h 2m 5s-11h 30m 40s) .

Assuredly the observations were disturbed by power outages, but nevertheless it does not seem that something really particular happened : see attachment 6, §1.1.

5-3 Spikes.

5-3-1 Puttershoek.

No spike that cannot be explained by identified physical actions was recorded.

5-3-2 Chicago

Same conclusion : see annex 3 and attachment 5.

5-3-3 Cacica mine (see attachment 6, § 1.2).

There are 5 spikes the amplitudes of which is > 2 degrees and which seem actually result from short impulsions. The more important is the 23 june one (36 degrees).

We cannot exclude neither a local seismic action (natural or from human activity), nor an unknown phenomenon.

6- Analysis of deviations caused by variations in the temperature of the room.

- They cannot have as main cause a torque exerted by the silk thread itself due to variations in the internal temperature of the housing.

We should then note systematically significantly greater deviations for the aluminum disc, which is 4 times heavier than the paper disc. But it is exactly the opposite that happened from 5/12/2015 to 4/1/2016, as shown in the table below.

One might then think that the higher tension of the wire increases the torque of torsion in the case of paper disks. But this is not at all what happens from 12/04/2016 to 22/04/2016.

| | Standard deviation of the azimuth (degree) | | |
|------------------------------|--|-----------------------|-------------|
| | 5/12/2015-4/1/2016 | 12/04/2016-22/04/2016 | |
| External thermal protection | yes | yes | no |
| torsind 2 (aluminium) | 1,1 | | 76,8 |
| torsind 3 (aluminium) | 1,3 | 3,9 | |
| torsind 4 (paper) | 9,6 | | 40,7 |
| torsind5 (paper) | 14,3 | 3,7 | |
| ratio paper/aluminium | 9,93 | 0,95 | 0,53 |

- They can therefore only result from actions applied on the disk itself ; but what kind of action ?

- The behaviour of a torsind (amplitude of deviations, deviations in the opposite direction or not to that of temperature variations) is stable in normal times. It can vary if the torsind is rotated by 90°, or if, for one reason or another (physical manipulation, strong heating, ...), there is a very significant rotation. The direction of the deviations from that of the temperature variations can be reversed, and the magnitude of the deviations can be changed considerably.

- Hence the perturbing action cannot be an action with symmetry of revolution: it is a directional action. This therefore eliminates an explanation by an action with circular symmetry (which very few known phenomena could explain).

There can be directional action only if the symmetry of the device is not perfectly of revolution. It is absolutely certain that the circular symmetry defects of the disc play a very important role: they alone can explain the considerable differences in behavior between

torsinds equipped with the same type of disc. Given the design of the disc, these defects in symmetry are inevitable, and can be very significant.

- In the end, the mechanism from which these deviations result has not yet been elucidated:
- They also seem totally impossible to be explained by electrostatic or electromagnetic phenomena: as we have seen, this is the result of both calculations and experiments.
- The hypothesis of internal electrostatic actions resulting from the penetration of cosmic rays into the housing was examined. They do not seem to be able to quantitatively explain the deviations observed.

- Taking into account all the available data, we cannot rule out an explanation by air convection movements internal to the torsind: temperature differences settling on the internal wall of the torsind, convection currents appear inside the housing, and evolve with the temperature differences. Note that LED lighting inside the housing might contribute to these convection currents.

Obviously, taking into account the design of the torsind, these temperature differences can only be very small, and therefore it is the same for convection currents. But the torsind equipped with a silk thread is an extremely sensitive device (the angular accelerations observed are commonly $< 10^{-6}$ degrees/s², which corresponds, in the case of paper disk (moment of inertia $\sim 1,75 \cdot 10^{-7}$ MKSA) to torques $< 2 \cdot 10^{-14}$ N.m.

7- Conclusion

- No convincing eclipse effect was observed during the 8 observed eclipses (2 solar eclipses and 2 lunar eclipses in Puttershoek, 1 solar eclipse in Chicago, 2 solar eclipses and 1 lunar eclipse in the mine of Cacica). If one of these eclipses had resulted in deviations of at least 10 degrees strongly correlated with the eclipse itself, as is the case in most of the positive observations reported by Alexander Pugach, this would have been put in evidence despite the existence of significant deviations associated with temperature variations. However, as far as we can tell today, this eclipse effect, if it appear to exist truly in some solar eclipses, is by no means systematic. Maybe we just weren't lucky ...

- As regards spikes, there were never any where the torsind did several laps, unlike Alexander Pugach. Among the few spikes observed, the only that might not have a conventional explanation are several spikes recorded in the Cacica mine. The amplitude of the larger one is 36 degrees.

- As regards diurnal deviations, it appeared in Puttershoek that they resulted mainly from variations in the temperature of the room in which the torsind is located. In the Cacica mine, where the temperature is very stable, there was no deviation. However, this was not the case in Chicago, where there was an air conditioner, even during the period when the air conditioner was fully operational. There were small deviations (standard deviation 0.6 degrees) showing a diurnal character. These deviations might not result from variations in the temperature of the room.

- The mechanism by which variations in the temperature of the room rotate the disk has not been elucidated, but it seems very unlikely that it results from unconventional phenomena. It was further established that this could not be a circular symmetry action, that the circular symmetry defects of the disc played a very important role, and that it could not result from the silk thread itself.

- Very probably, the deviations noted by Alexander Pugach at the Kiev Observatory, where the temperature was not regulated, were mainly due to variations in the external temperature. This would mean that the links with solar activity and the Earth's magnetic field that were observed were in fact links between these two quantities and temperature.

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- 8 - Antonio Iovane, “The Lunar wake as cause of the Allais effect” (2014)
<https://vixra.org/pdf/1411.0483v1.pdf>
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http://www.fondationmauriceallais.org/wp-content/uploads/2016/05/situation_allais_2015-trad_2-.pdf

ANNEX 1

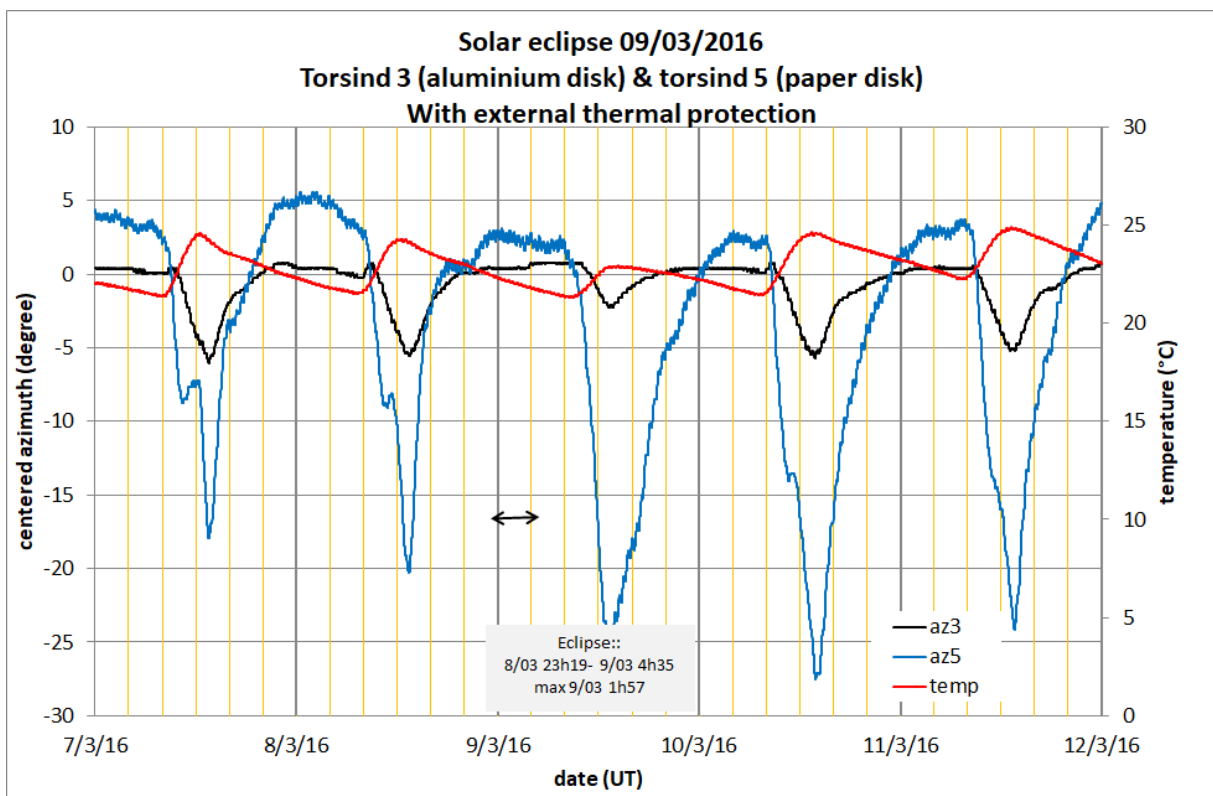
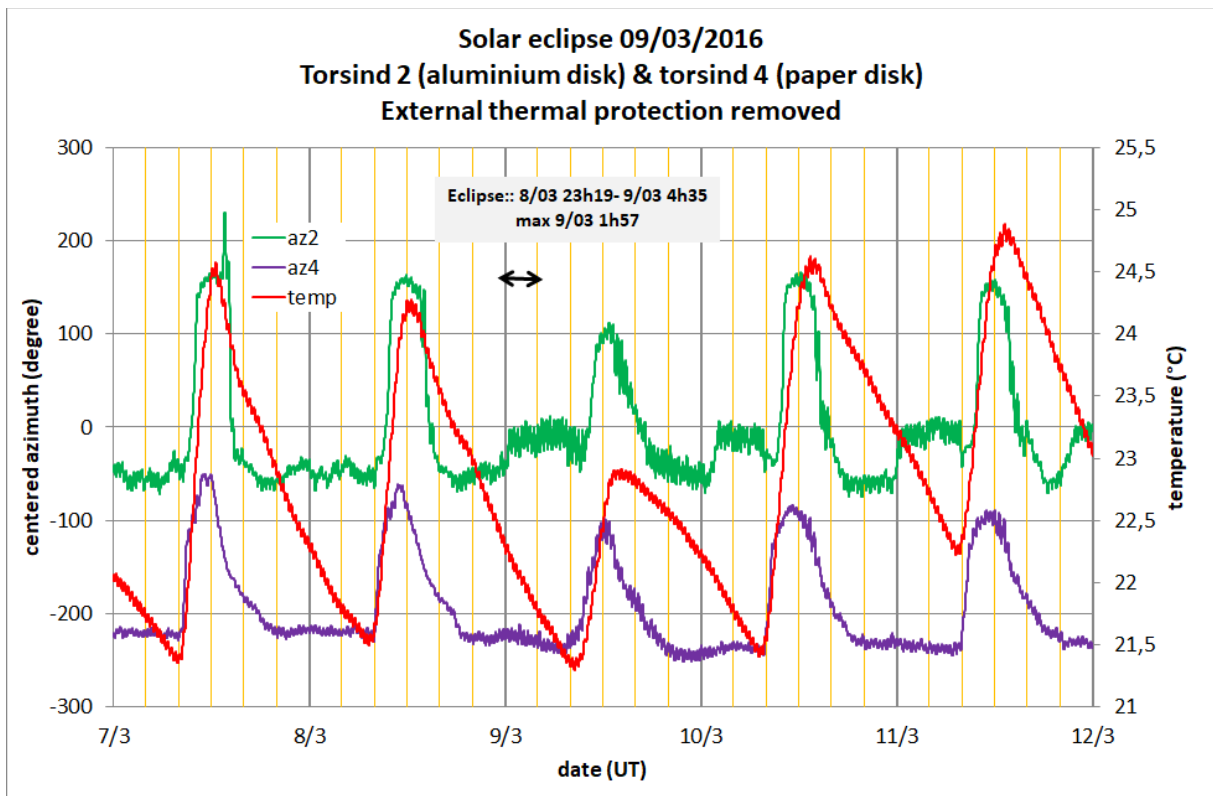
Eclipses observations 2016 (Puttershoek)

4 eclipses took place in 2016:

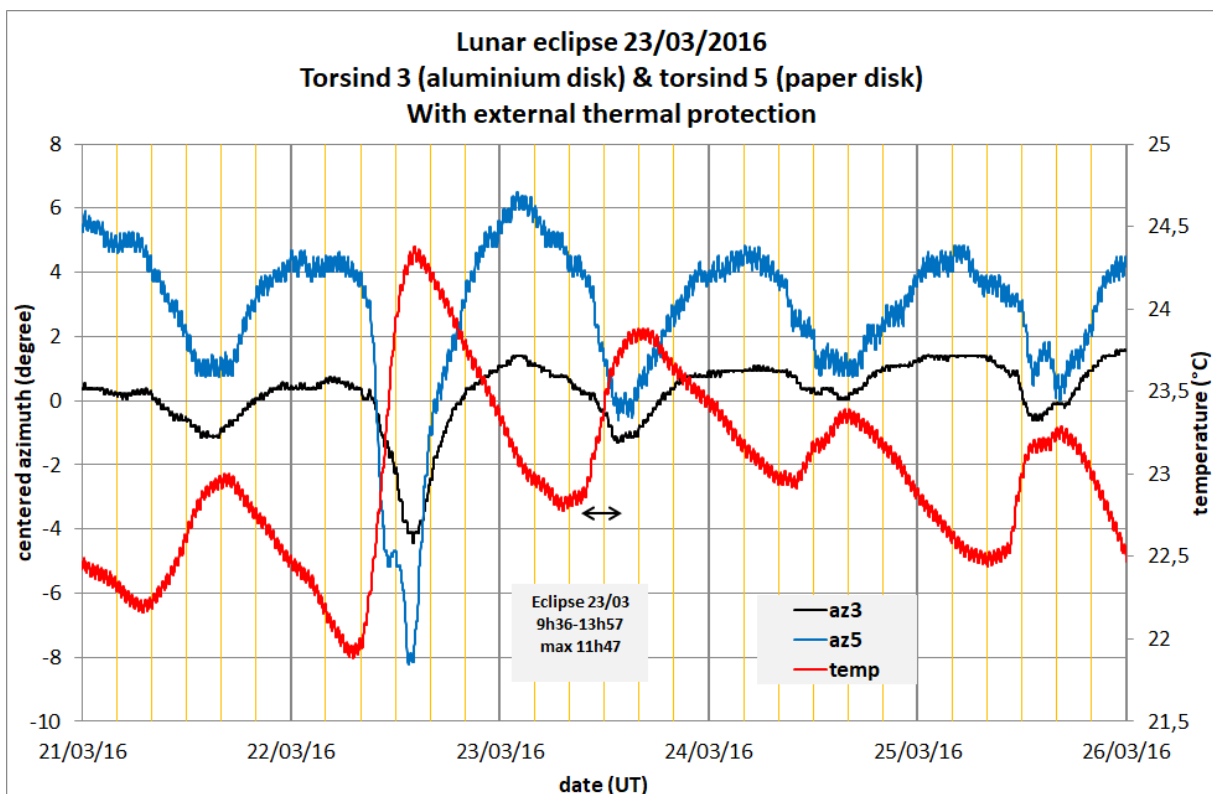
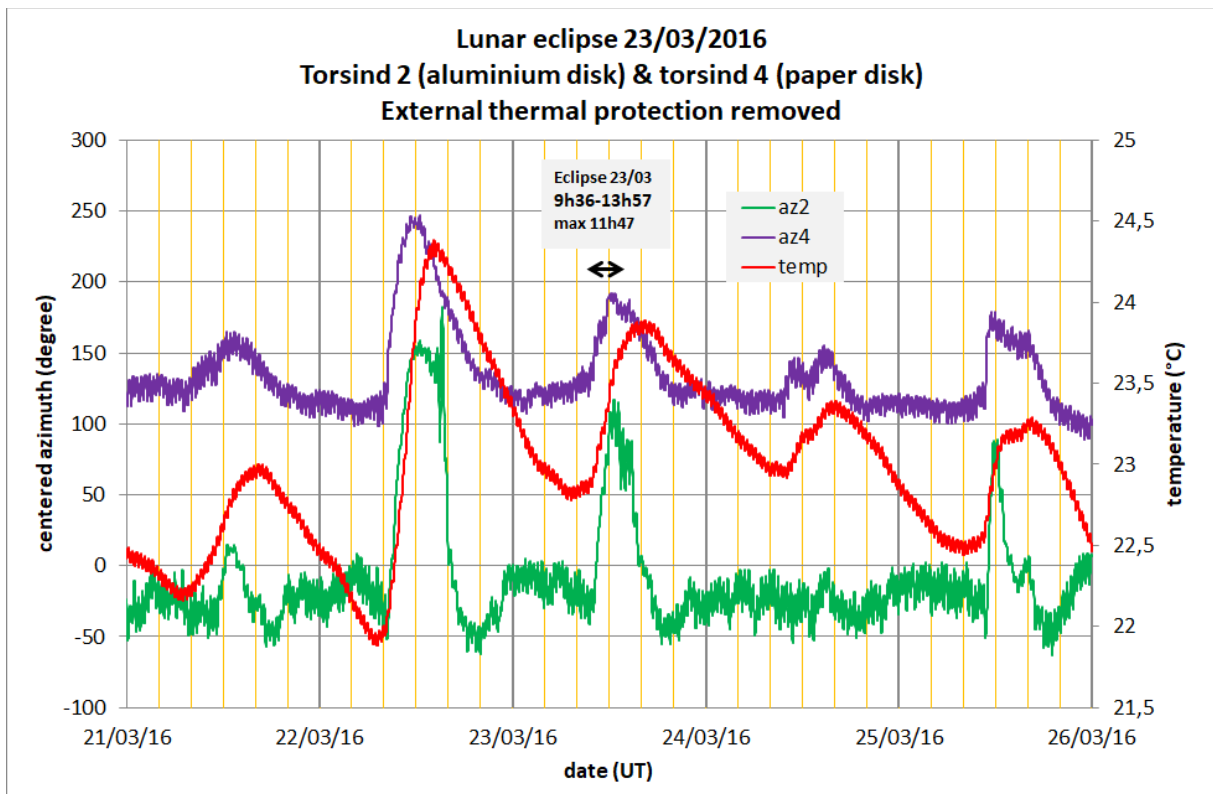
- 9/03/2016 : Sun (observation by the 4 torsinds)
- 23/03/2016 : Moon (observation by the 4 torsinds)
- 1/09/2016 : Sun (observation by torsinds 3 et 5)
- 16/09/2016 : Moon (observation by torsinds 3 et 5)

The following graphs do not show any significant particular effect during these eclipses which cannot be explained by temperature variations.

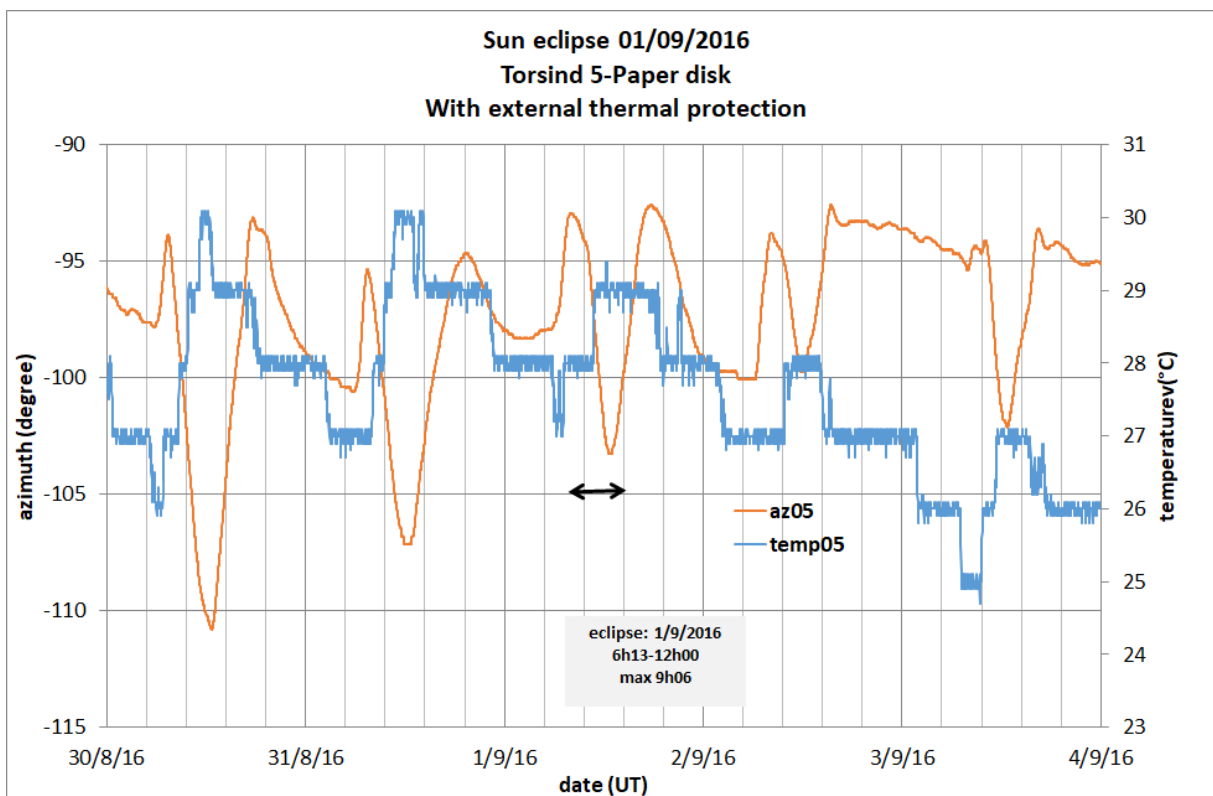
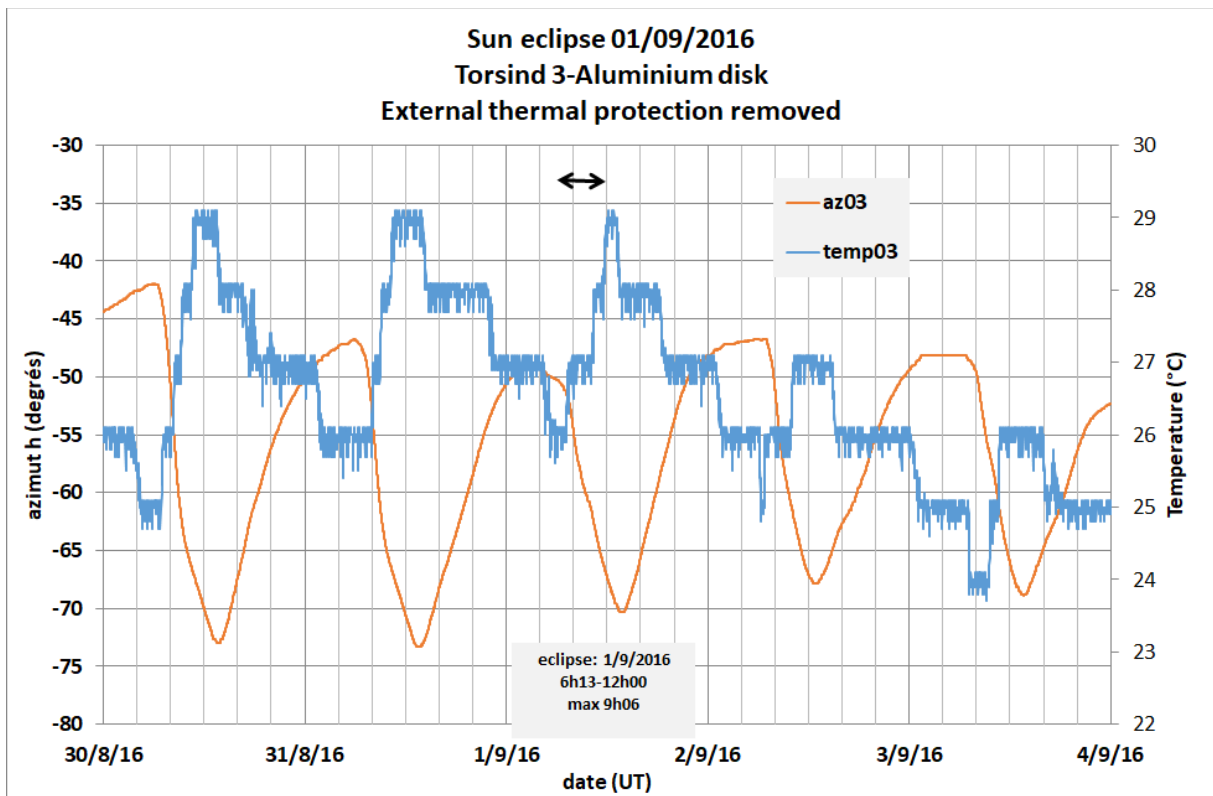
Solar eclipse 9/03/2016



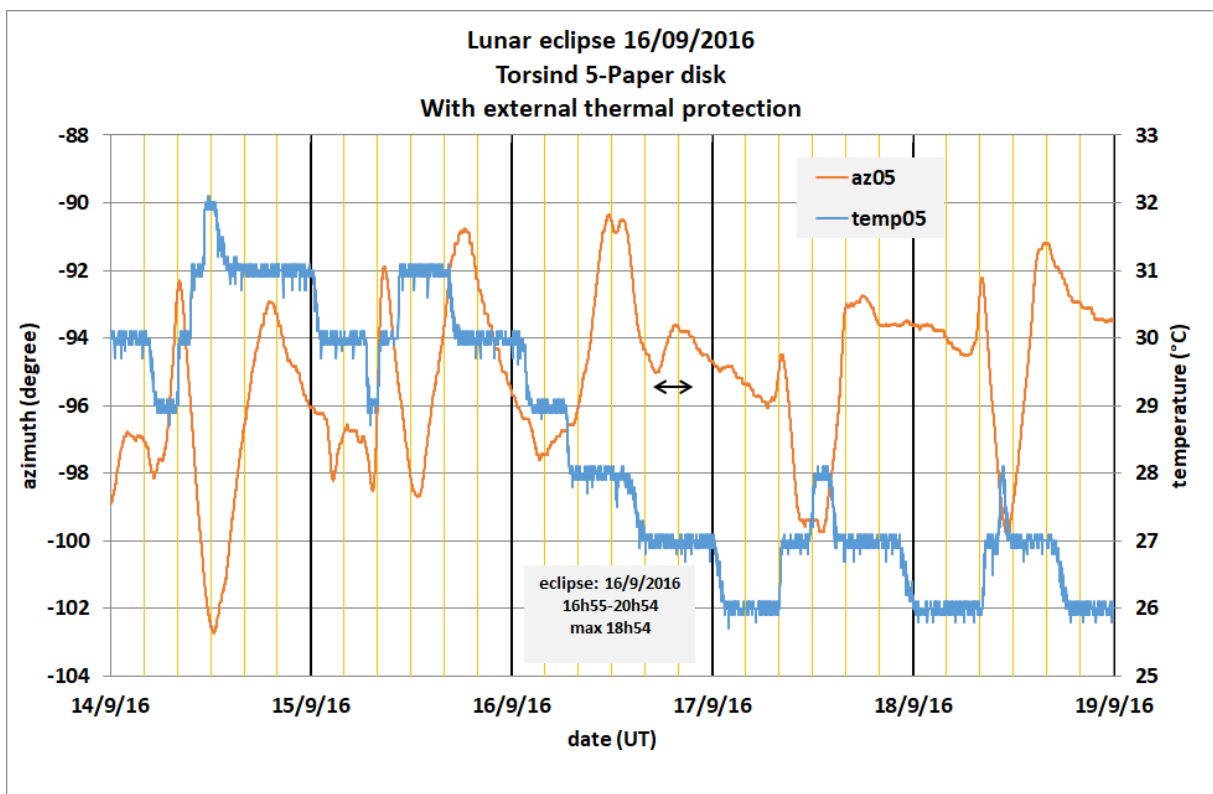
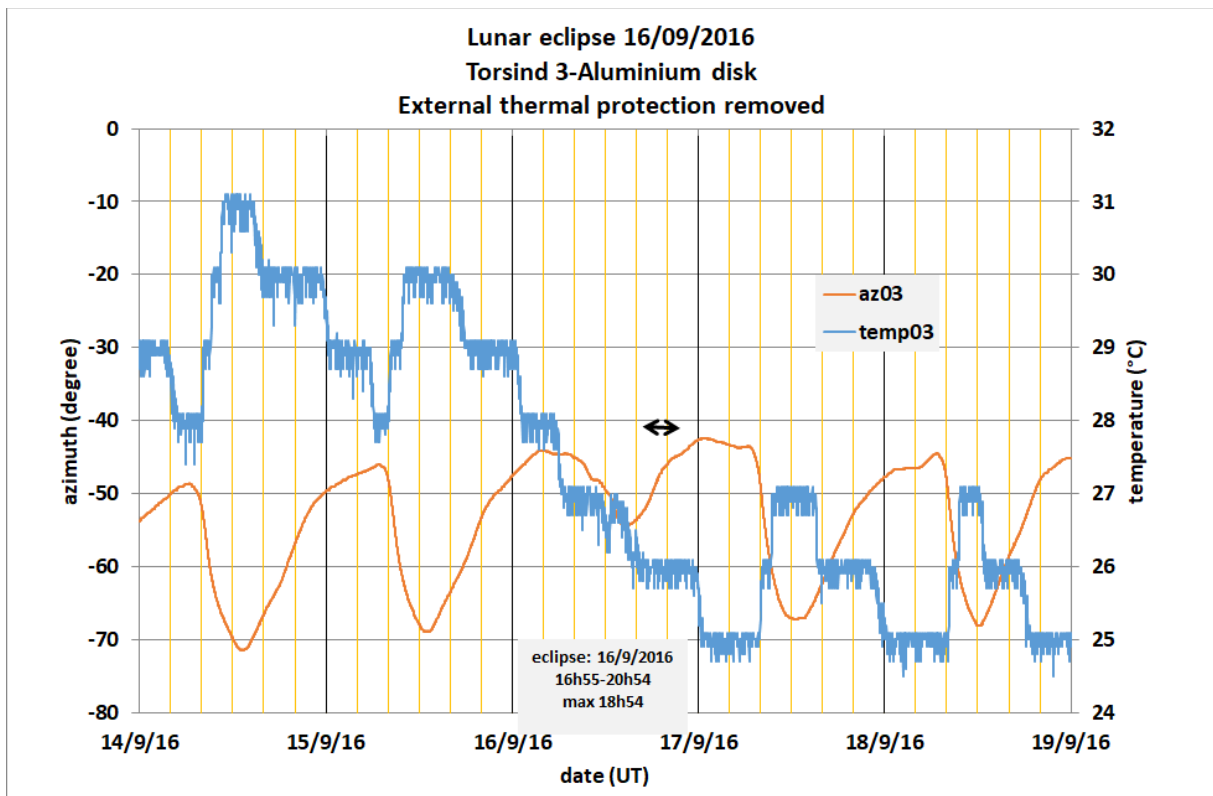
Lunar eclipse 23/03/2016



Solar eclipse 1/09/2016



Lunar eclipse 16/09/2016



ANNEX 2

Removing of the connection to earth of the inner aluminium sheet

The disconnection was made on 03/30/2016 at 4.30 p.m. exactly, i.e. minute 37875. Fig. 1 shows that there was no effect on the 4 torsinds. As regards the short inflection of the curve observed at minute 37875 for torsinds 3 and 5, it started at minute 37874 for torsind 5.

Torsinds 2 (aluminum disk) and 4 (paper disk) did not have external thermal protection, unlike torsinds 3 (aluminum disk) and 5 (paper disk), which explains why the deviations observed are much greater.

Fig .2, where the temperature was introduced, also shows very clearly the link between temperature variations and torsind deviations.

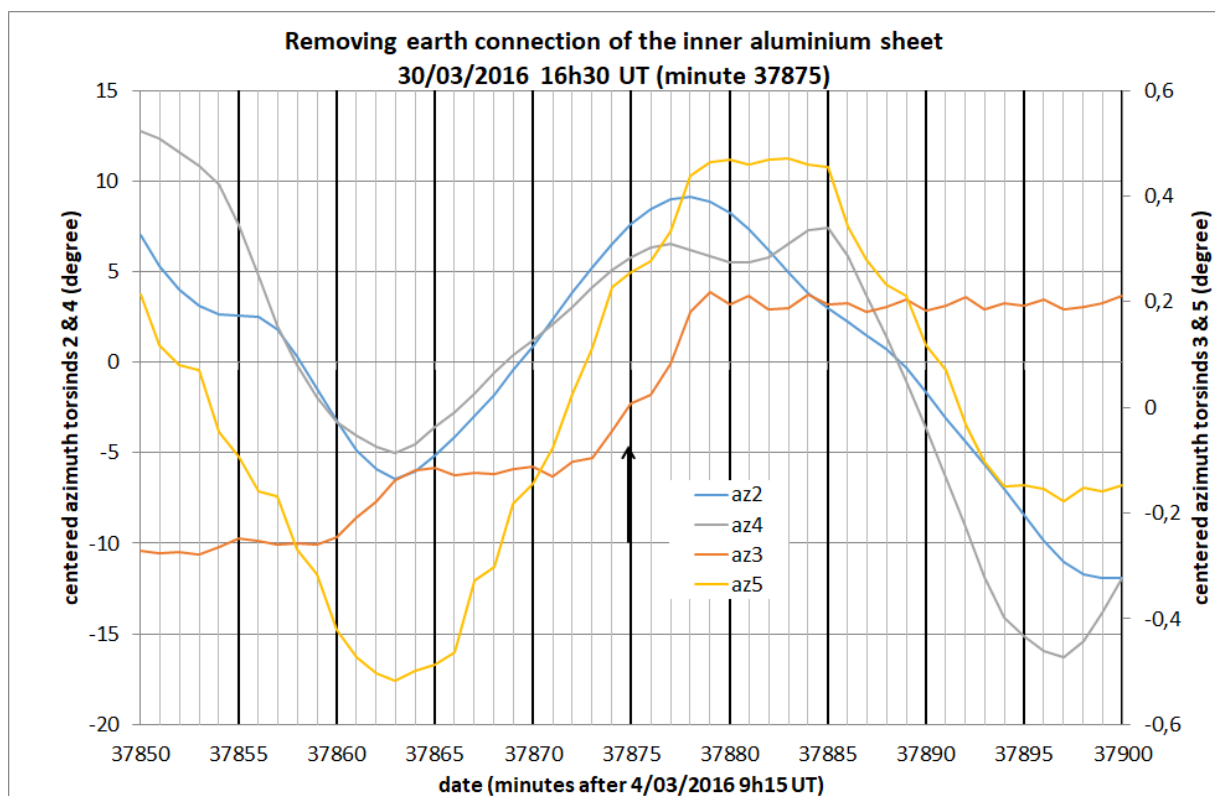


Fig.1

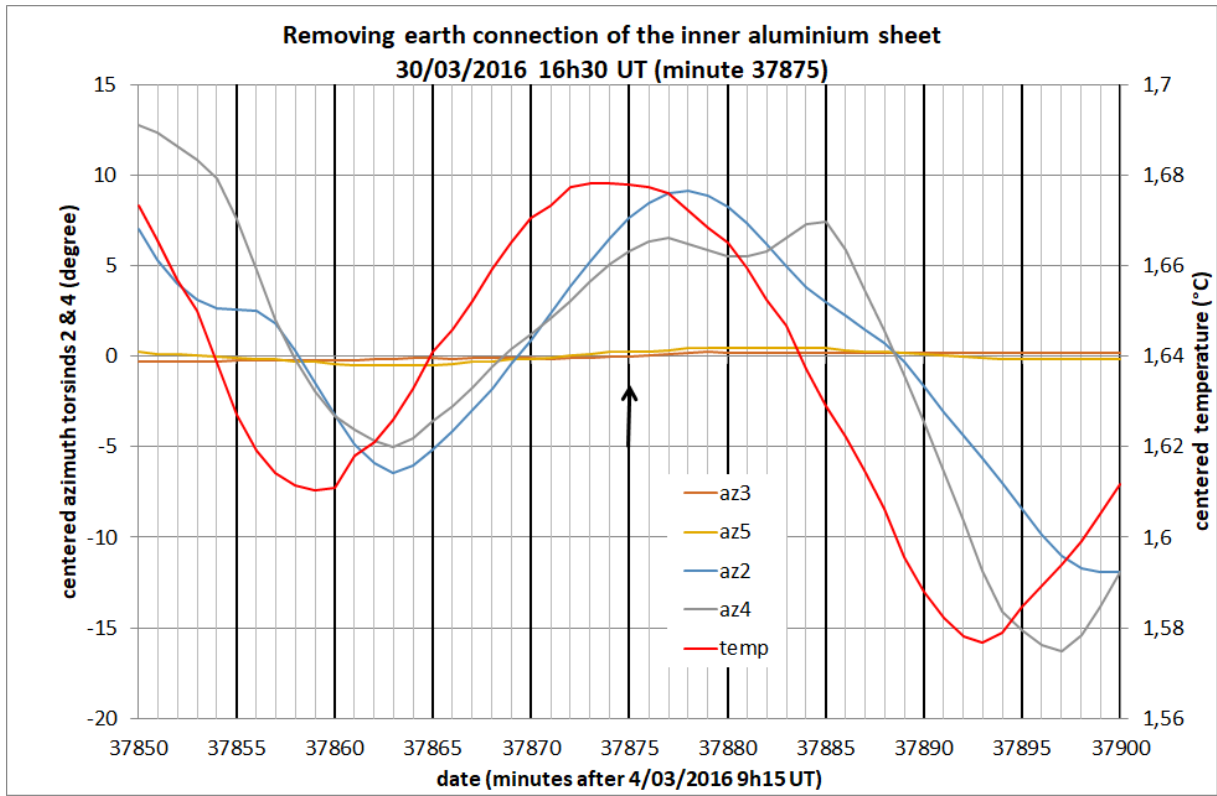


Fig.2

ANNEX 3 : Chicago observations (20/08/2017-22/09/2017)

- A very detailed report of these observations was provided by Prof. Hector Munera (attachment 4).

It is recalled that, on the occasion of the eclipse that crossed North America on August 21, 2017, torsind No. 5 was installed in Chicago, in an air-conditioned basement room. It was equipped with a paper disc. External thermal protection (aluminum + styrofoam) had been put in place. This annex provides some additional analysis and graphs.

- Fig. 1 shows a drift, which could be adjusted quite remarkably by a logarithmic curve, as Pr Munera noticed it.

Possibly this drift results from the wire itself, after a load has been attached to it. A similar phenomenon was observed at the beginning of observations in the Cacica mine (attachment 6). But it is shorter (about 2 weeks), and, above all, of very much lesser amplitude (0,6 degrees).

Pr Munera suggests this drift could be the result of a particular torsion field, that could explain the very remarkable logarithmic curve (annex 2 of attachment4).

Fig. 2 represents the residual oscillations. The spike of September 10 in the morning results from the operation of a washing machine.

There is visually a certain influence of temperature variations. However, it remains important areas where the air conditioning has worked well, where nevertheless there are oscillations which remain of comparable amplitude, and which have a certain diurnal character. They have no identified cause.

- Fig.3 provides a zoom on the four first days, where the eclipse took place. There are anomalies of small amplitude (0,5 degrees) during the eclipse, but there are also variations of temperature. It is impossible to assert that they were caused by the eclipse.

- Fig.4 shows the spectral analysis of the residual oscillations, from 21/08/2017 0h 0mn to 22/09/17 2h47mn.

This analysis was performed by scanning with a bandpass filter the period range 10h-30h in 2 minute steps. The period corresponding to the maximum amplitude is 24,567h, which clearly indicates that there is a diurnal influence.

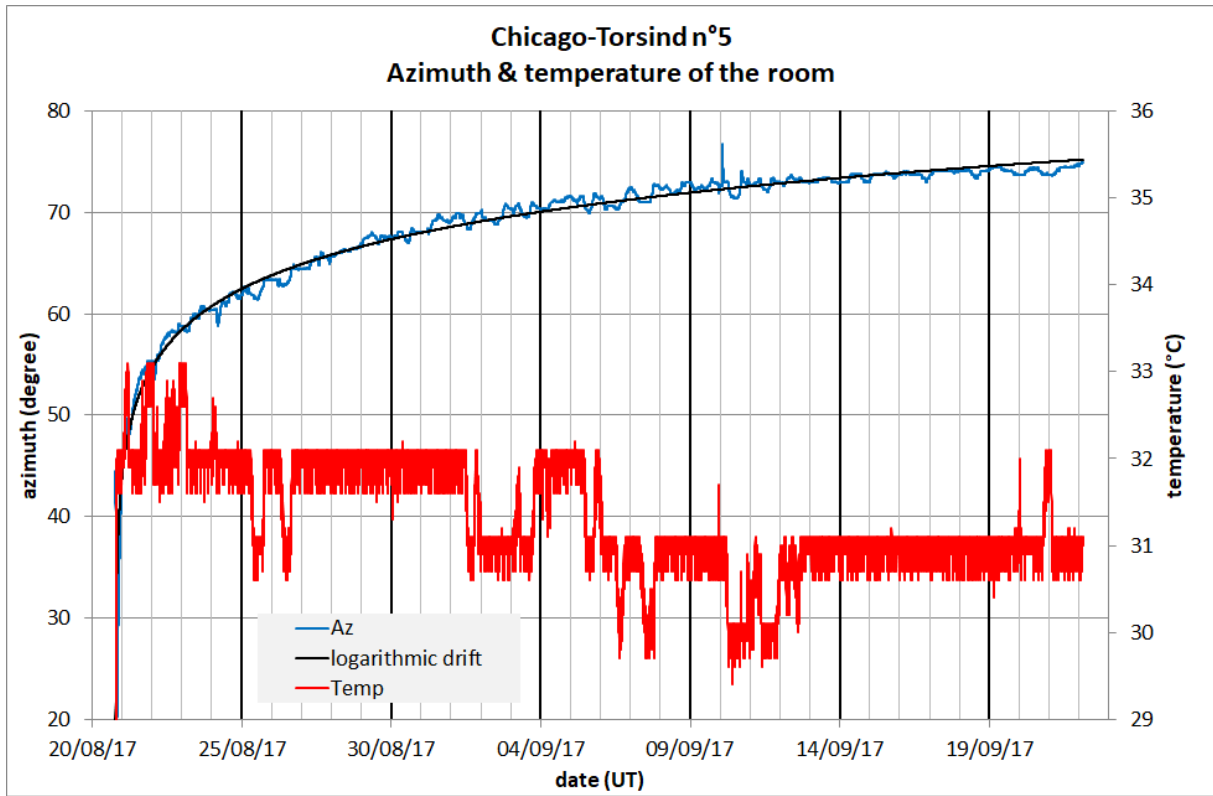


Fig.1

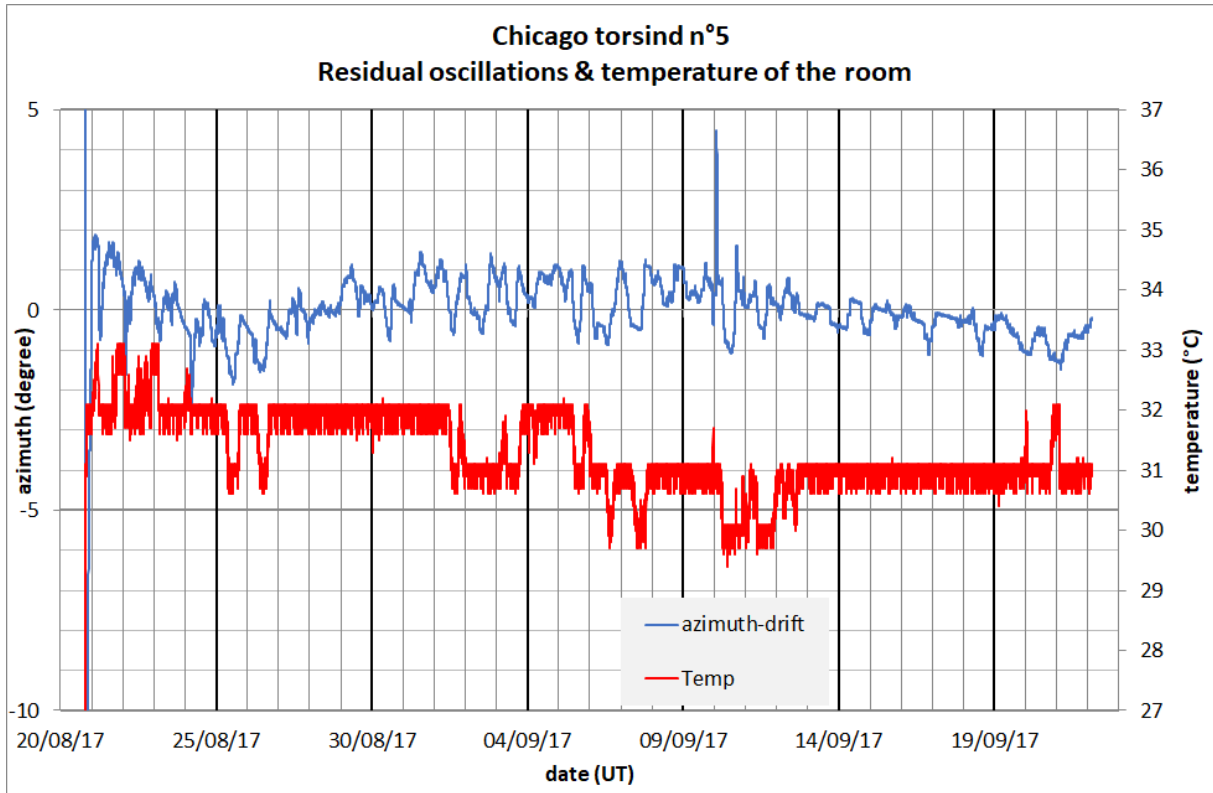


Fig.2

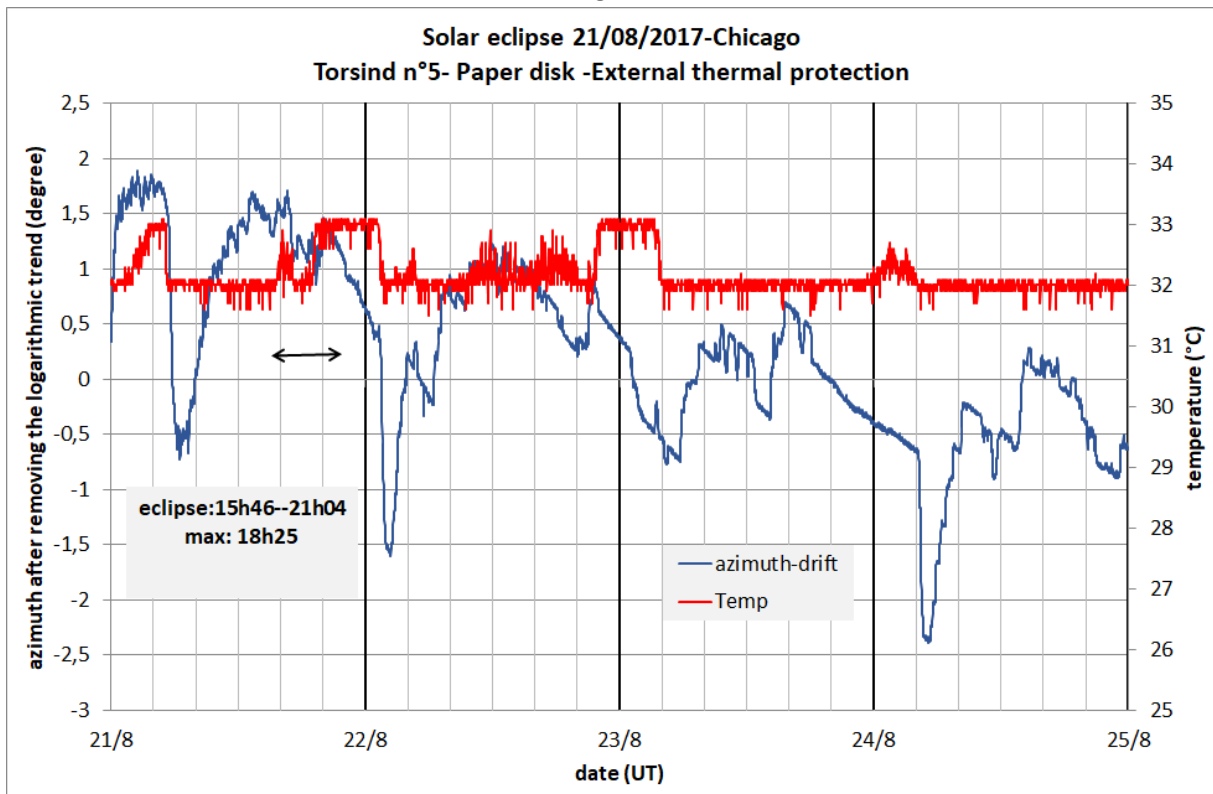


Fig.3

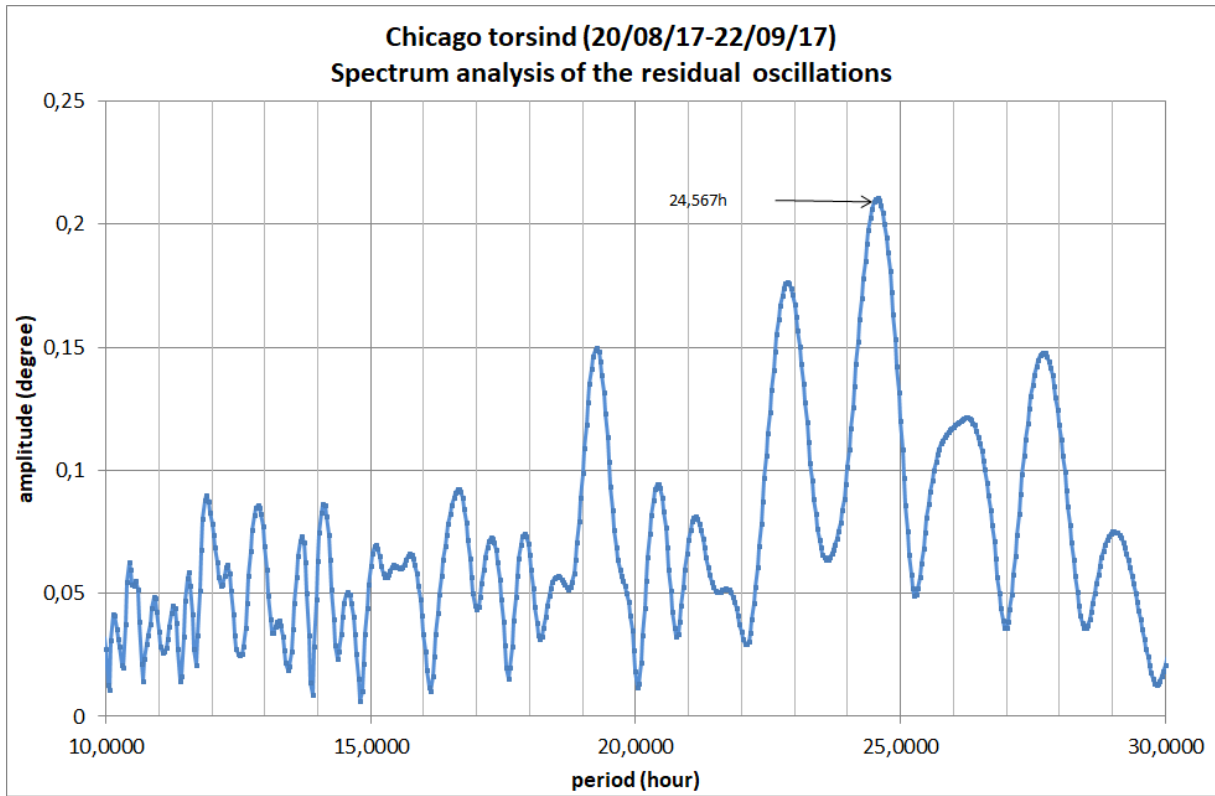


Fig.4

ANNEX 4

Alexander Pugach's observations in Cacica mine.

Alexander Pugach organized two eclipse observations in the disused Cacica salt mine, which he had been able to access through Dimitrie Olenici. These observations were published (ref.3, ref.5).

a) 01/06/2011 solar eclipse (ref.3).

- The device was noticeably different of the torsind (see next picture): parallelepipedal housing, instead of a cylindric one, and no protection at all. The disk was an aluminium disk.

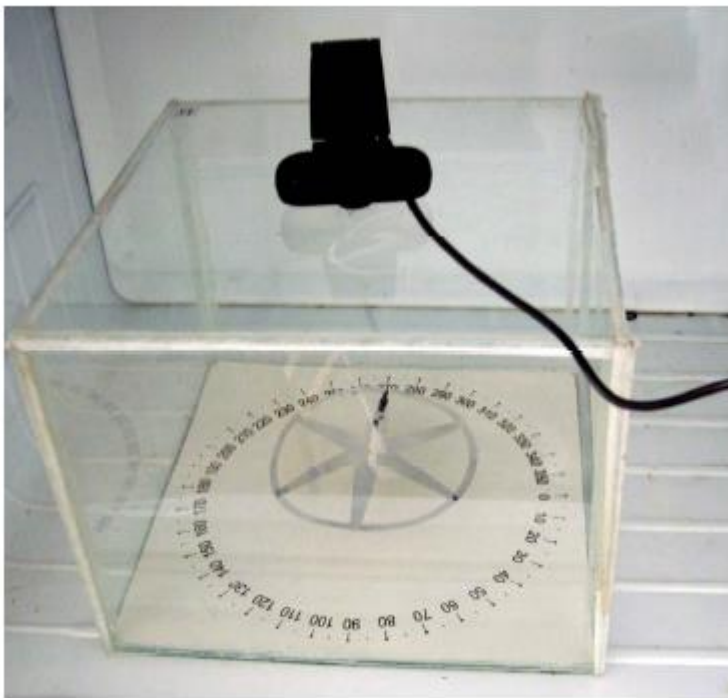


Figure 1. A demonstration model of a disk torsion balance.

- As the following figure shows, the correlation between the eclipse and the observed anomalies is absolutely remarkable. It seems indisputable that something special happened during the eclipse

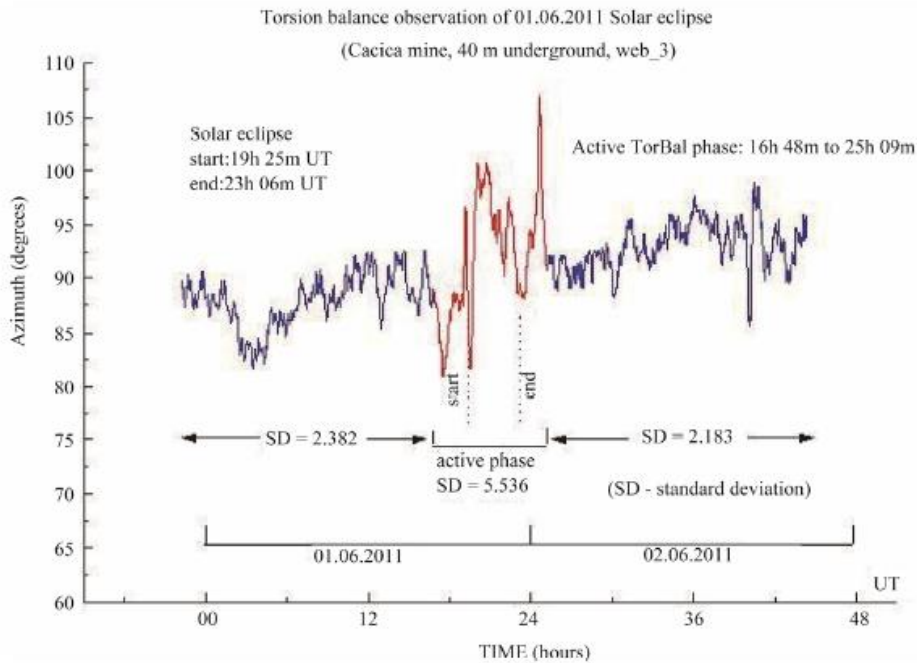


Figure 3. Results of torsion balance observations of 1st June, 2009 solar eclipse.

- In addition, this does not seem to be able to be explained by a known phenomenon:
 - Taking into account the implantation of the device in the mine, these anomalies cannot result from variations in temperature, hygrometry, pressure, electrostatic actions, or human activities (which moreover should have lasted, in local time, from 5 p.m. to 3 a.m...).
 - With regard to variations in the Earth's magnetic field:
 - . calculations have shown that variations in the magnetic field of the order of the earth's magnetic field cannot rotate the disc by several tens of degrees.
 - . the tests carried out on the torsind developed by De Haan (see § 4.1.2) showed that it was insensitive to such variations. Assuredly the housings are different, but in both cases they provide no protection against variations in the magnetic field .

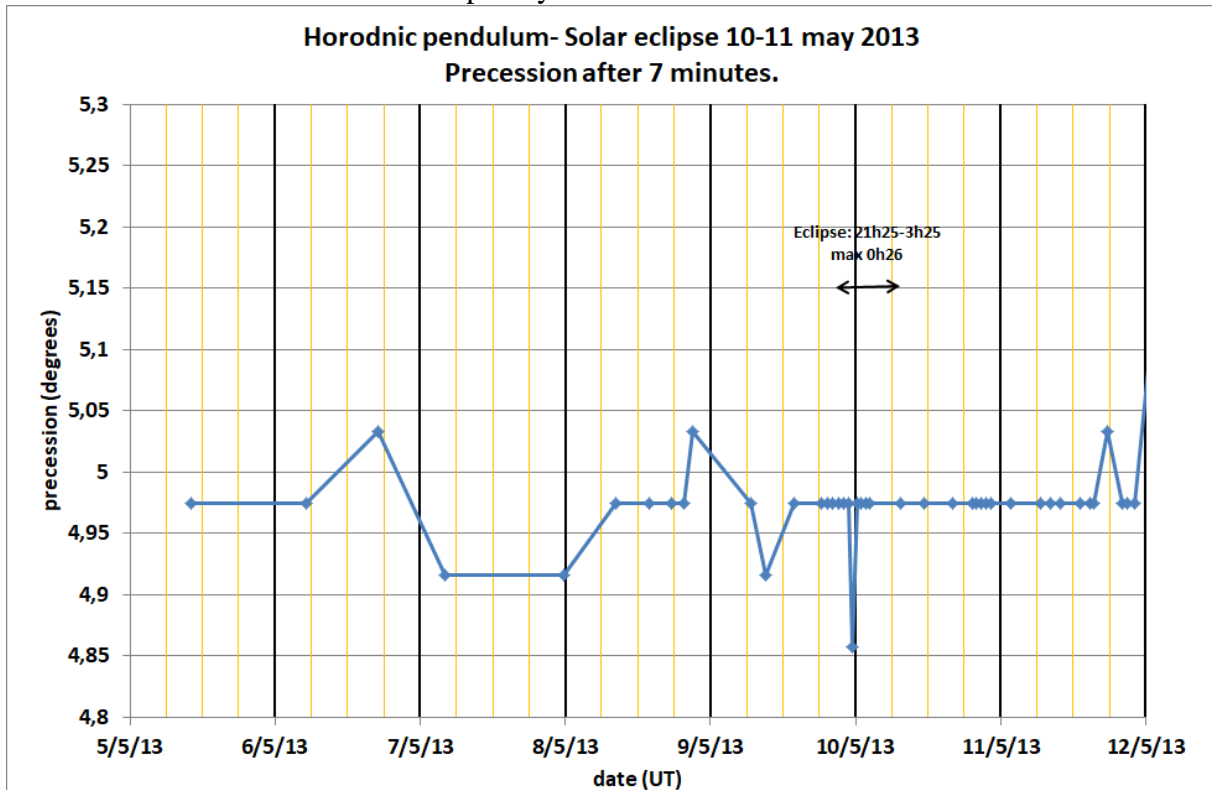
b) 13/05/2013 solar eclipse (cf ref.5, 9).

- The device used was a torsind of Alexander Pugach torsind equipped with an aluminum disc.

Following picture provides an external view of this device.

- As for the eclipse of 1/6/2009, known phenomena do not seem to be able to explain what was observed. Even if the spike was the result of a mechanical action (a nearby explosion, which no one would have heard, or a seism that no one would have felt ...), this could not explain the anomalies that had started 3 hours earlier.

- It should also be noted (see also ref.9 appendix 4) that, around 11.30 pm, a pendulum located in Horodnic recorded a completely abnormal deviation.



- Remark: Note that, outside the disturbed period, unlike what happens for the other two torsinds, the curve is reduced to a straight line, with rapid oscillations resembling “noise”, the amplitude of which (about 5 degrees peak to peak) is the same as for the other torsinds. This noise is very clearly greater than the “noise” recorded in the Cacica mine (cf. attachment 5) by the torsind built by De Haan (approximately 0.2 degrees peak to peak). It is possible that this difference results from the fact that the devices are different with regard to the system for reading the movements of the disc. But that cannot explain the anomalies observed during the eclipse...