The preliminary measurements from the bolometer oscillation system (BOS) on board PICARD

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INTRODUCTION

The PICARD mission is a CNES micro-satellite was successfully launched on June 15, 2010. The goal of the mission is to improve the understanding of Sun and the effect of its activity on Earth climate. Three kinds of sensors were simultaneously operated to measure the total and spectral irradiance, diameter, shape and oscillations. SOVAP/BOS (SOlar Variability for PICARD - Bolometer Oscillation System) is one of the key instruments in the PICARD payload. It's main goal is consisting in measuring the variation of Total Solar Irradiance (TSI) with very high precision. SOVAP is a modified version of the DIARAD absolute solar radiometer, which has been successfully operated on several previous missions. The BOS is a complementary pioneering experiment. It consists of a solar bolometer that are measuring the incident electromagnetic radiation power by converting this radiation energy in a thermal signal. The flux is measured using a differential thermometer placed in a thermal shunt.

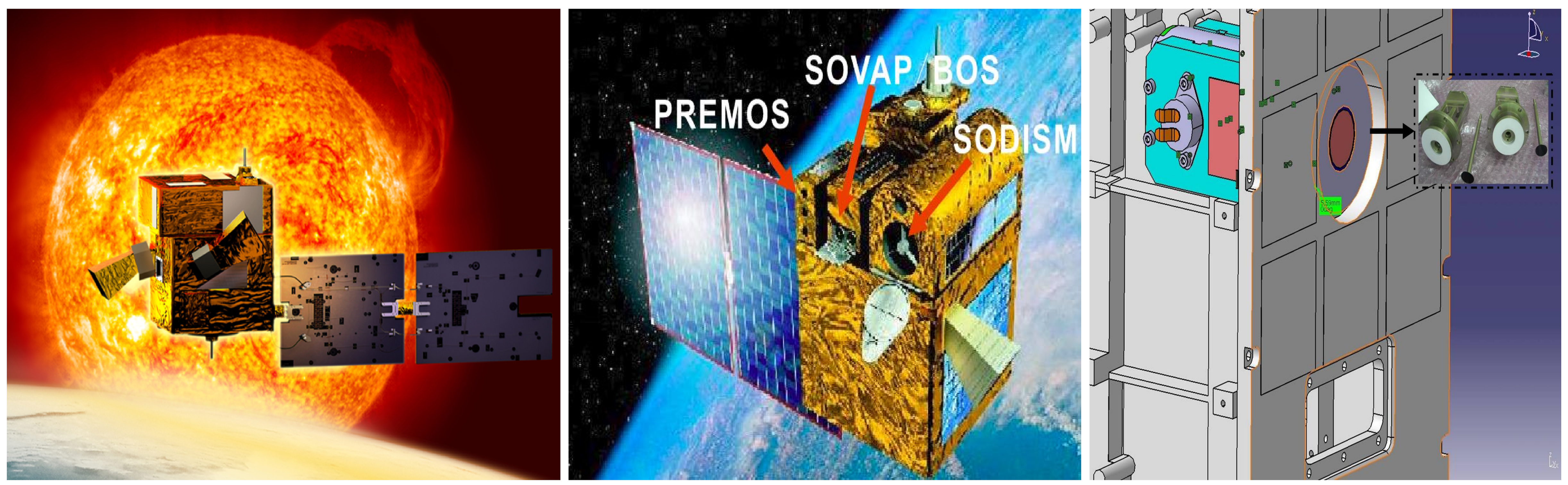
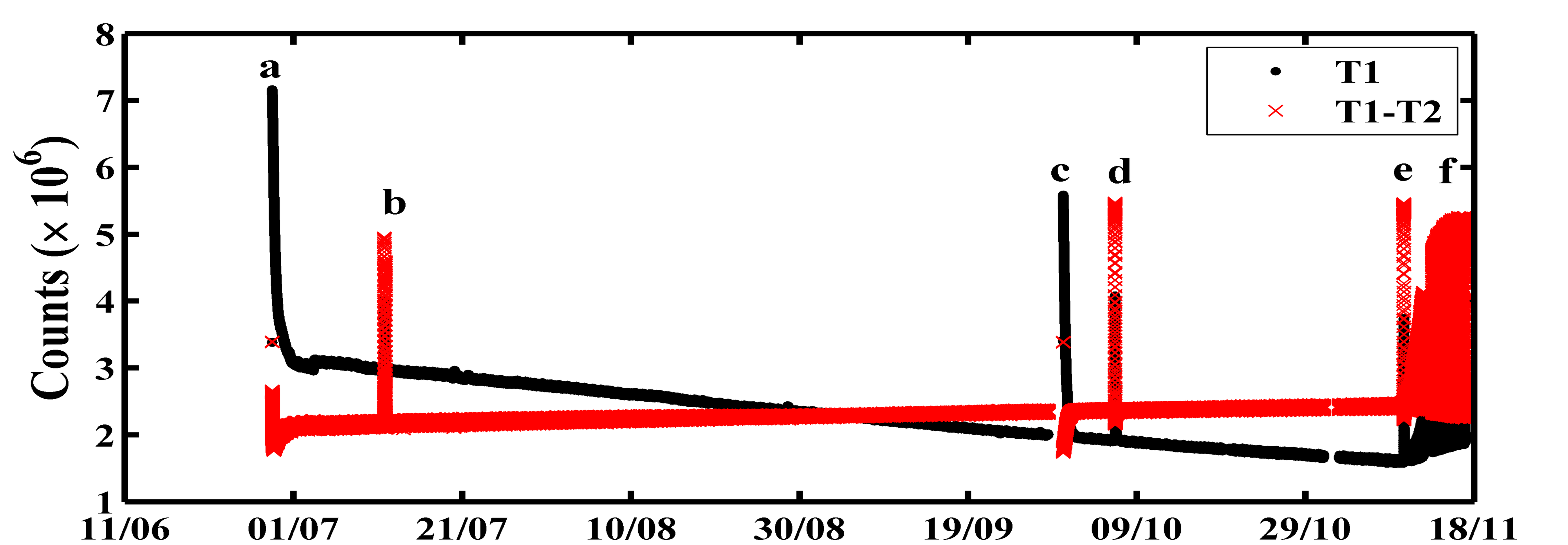


Diagram of PICARD Satellite in Space. (Left) The orbit of PICARD is heliocentric; (Middle) The three systems are always pointing to the Sun; (Right) The location of the BOS sensor. The superposed photo shows the prototype of the sensors, one of them is now on boarding PICARD satellite and the other one is kept at the Royal Observatory of Belgium for the ground based simulations. *(Satellite photos credit CNES©).*

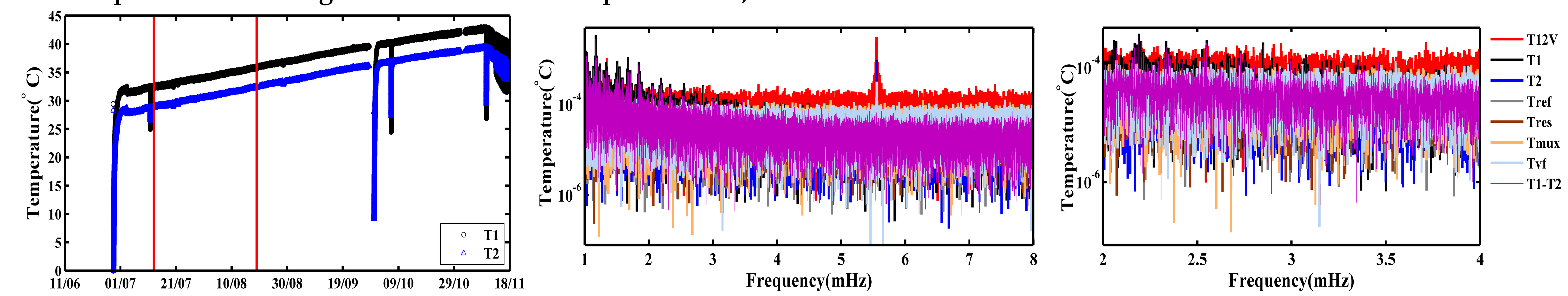
THE ORIGINAL SIGNAL OF BOLOMETER OSCILLATION SYSTEM (BOS)



The original recording of the BOS just after the launch. We high lighted six sets of events: (a) Temperature stabilization just after the launch; (b) Solar eclipse on July 11, 2010; (c) Thermic test by power off the SOVAP units; (d) and (e) Stellar pointing; (f) Occultation produced by the 'eclipses'.

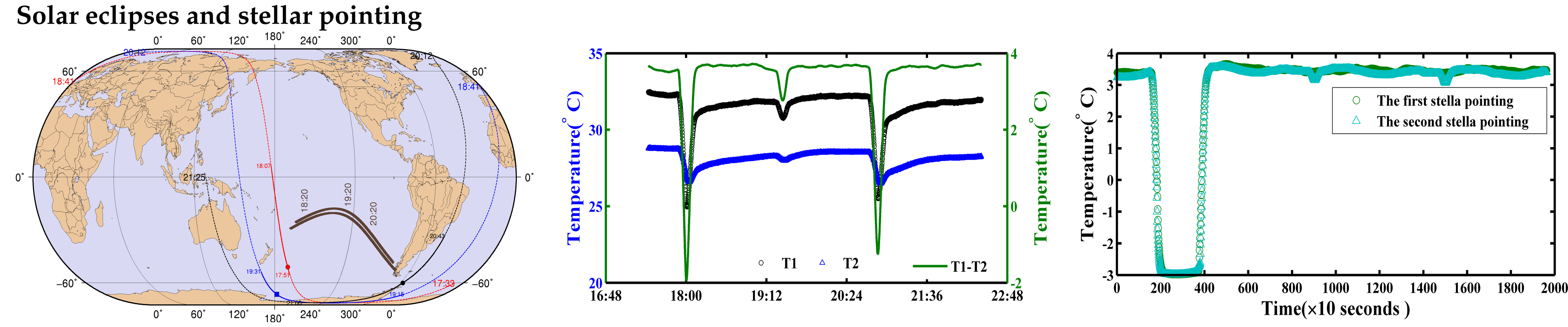
THE PRELIMINARY OBSERVATIONS

The temperature recording of T1 and T2 and the spectra of T1, T2 and other thermistors



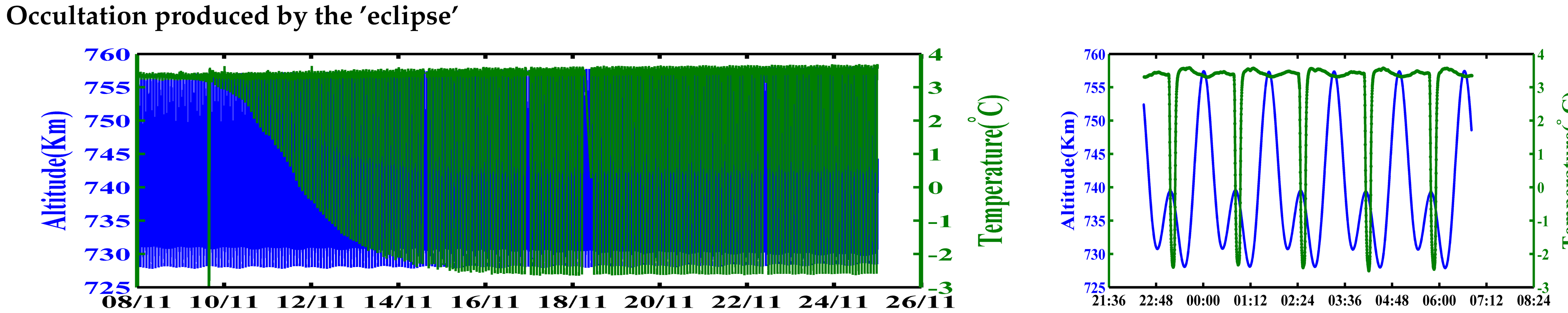
(Left), the calibrated signal was transformed into temperature; (Middle)We computed the amplitude Fourier spectrum using the data marked by the red line; There are several thermistors installed near by our sensor. The spectra of theirs were also computed (*legend see the right figure*); (Right) The T1-T2 shows the lowest signal-to-noise level.

Solar eclipses and stellar pointing



BOS is the first PICARD instrument started to work on 28 June and the only one who recorded the solar eclipse on 11 July, 2010. (Left) The projection of PICARD satellite orbit. Here, we plotted the position of PICARD from 17:33 to 21:25 on July 11. This period is overlap with the solar eclipse. Red dashed line is from 17:33 to 18:41; Blue dashed line is from 18:41 to 20:12; Black dashed line is from 20:12 to 21:15. Two dark brown lines mark the north and south limit of the greatest eclipse from *NASA 2010 Eclipse Bulletin, Espenak* & *Anderson*. (Middle)The first temperature drops were measurements made near the position marked by the red dot on the left map; the second temperature decrease were around the position marked by blue square and the last one was measured nearby the position marked by the black dot on the left map. (Right) The two repeated stellar pointing events confirm the common mode rejection.

Occultation produced by the 'eclipse'



The occultation produced by the 'eclipses', the altitude of the PICARD satellite was computed from WGS84 reference (`http://picard.busoc.be/sitools/index.jsp`). Here we plotted the difference temperature between T1 and T2.

SUMMARY

The signal coming from the BOS sensors integrates the Solar, the Earth and the satellite radiative energy in addition the conductive flux through the thermic shunt, absorption and emission of radiation of the black and white front faces. However the each identified event we showed here, proofs that the sensors are stable and working at very high dynamics range. We will deduce the total solar irradiance (TSI) by comparing with other sensors when a longer series are cumulated.

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