Subject: Re: Thermal effects LARES-2
Date: Friday, March 23, 2018 at 8:03 PM Eastern Daylight Time
From: David Arnold
To: Antonio Paolozzi
Cc: ErricosUmbc Pavlis; Ignazio Ciufolini
Attachments: Case16,17.docx,Case16,17.pdf

Dear Antonio,

Reinhart has checked the attached files. They agree with his calculations within the expected accuracy of the models. The results of these calculations would not be acceptable for LARES-2.

Investigating the possible use of a high emissivity material will be complicated as discussed in the email below dated 3/23/18, 9:11 AM. This is a new approach that has not been studied before. I have tried to explain the basic principles.

Best,

David Arnold

On 3/23/18, 9:11 AM, "David Arnold" <david-arnold2006@earthlink.net> wrote:

Dear Reinhart,

I am in the process of getting the software running again. I made a number of changes to my programs last summer in the process of doing the analysis of the temperature fields computed in Italy. I need to make sure that I am using the correct versions of the programs and that my current analyses agree with previous calculations and with your simulations.

I agree with Antonio that the satellite should be kept as cool as possible. There has always been agreement on this. The satellite surface should have a low a/e (solar absorptivity/thermal emissivity). Antonio has given the emissivity e = .29 but I do not have the absorptivity. The temperature of the plastic rings will depend on both the temperature of the core and the a/e of the upper metallic retaining rings that hold the plastic rings in place. I don't have this information.

The cube corners have a high emissivity (e=.9). This results in a large flux of radiation from the front face proportional to e x T^4. This heat flow results in thermal gradients within the cubes that distort the diffraction pattern. The cubes should be as cold as possible to minimize the thermal gradients.

The shape of the temperature distribution within the cube is also a factor. This is determined by the ratio of the thermal radiation from the cavity to the thermal radiation from the rings. It was recognized in the early thermal analyses of cube corners that it is desirable to balance the radial and vertical temperature gradients. The ideal temperature distribution is one where the temperature is a quadratic function of the distance from the center of the front face of the cube corner (spherical temperature distribution). I discovered this by accident. It is consistent with the principle of balancing radial and vertical temperature gradients.

It is possible for the phase front due to thermal gradients to be either concave or convex. This interacts with whether the dihedral angle offsets are positive or negative.

Since the thermal conditions change during the orbit the range correction also changes with time. Minimizing thermal effects is essential to achieving high range accuracy.

The optimum values of the physical constants can be determined by parametric analysis. This is a multi-dimensional problem.

Best,

David Arnold

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On 3/23/18, 6:24 AM, "Reinhart" <reinhart.neubert@web.de> wrote:

Dear David,

I shall not enter the discussion on optimal emissivity because I have no

background experience in the field.

But I wonder, did you get similar phase changes for the italien simulations 16 and 17 ?

with best regards

Reinhart

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