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Author: Dr. Chantal Cappelletti
G.A.U.S.S. Srl, Italy, chantal.cappelletti@gmail.com

Prof. Filippo Graziani
Sapienza University of Rome, Italy, filippo.graziani@gaussteam.com

THERMAL CONTROL SYSTEM DESIGN FOR A UNIVERSITY LOW COST BIOMEDICAL PAYLOAD

Abstract

The design of a space system able to board a biomedical payload is characterized by different constraint. First of all the environment that host the biomedical payload need to be controlled in order to keep alive the experiment on all the mission phases. One of the main constraints for the biological sample survival is to maintain a particular temperature range. An increasing or a decreasing of the due temperature can easily kill the samples. For this reason normally at ground the biologists keep the samples inside the incubator where the temperature is fixed. The objective of a thermal control system for a space biomedical project is guarantee the needed temperature during all the missions phases. Normally this temperature is fixed at 37C with a tolerance of 0,1C. In particular the aim of this work is the design and the development of a thermal control system for GlioLab mission. The aim of GlioLab is to study on orbit the effects of ionizing radiations combined with microgravity conditions can increase, decrease or not have any effects on Glioblastoma multiforme cancer cells survival rate. So the sample used are ANGM Glioblastoma cells and normal neuronal astrocyte cells (NHA) that are very fragile. The platform used to perform this tests is a 2U Cubelab that will be board inside International Space Station using Nanoracks. This project started in 2009 by GAUSS (Group of Astrodynamics of University of Roma La Sapienza) at the School of Aerospace Engineering in Roma, involves also the Space Science Center and the biological department in Morehead State University (MSU) in Kentucky and the Genetic department of IRCCS-Hospital CSS San Giovanni Rotondo in Italy. The project is a joint university mission that has a very small volume available to perform the in orbit experiment; the 2U Cubelab dimensions are only 100x100x223.5 mm. This paper deals with the thermal control system used on GlioLab biomedical mission and the solution adopted to maintain the temperature range. In particular different launchers has been considered on the thermal environment model in order to design a system more flexible and easily adaptable to different launch opportunities.