JUICE/GALA-J (6) : JUICE 搭載ガニメデレーザー高度計 (GALA) における受光部の光学/構造/熱設計

JUICE/GALA-J (6): Optical/thermal/structural design for the receiver part of the Ganymede Laser Altimeter (GALA) for the JUICE mission

*塩谷 圭吾[1]、小林 正規[2]、石橋 高[2]、鹿島 伸悟[3]、宇都宮 真[1]、岩村 哲[4]、飯田 光人 [5]、松本 吉昭 [5]、藤井 雅之 [6]、藤代 尚文 [7]、山室 智康 [8]、尾崎 正伸 [1]、水野 貴秀 [1]、斎藤 義文[1]、東原 和行[1]、並木 則行[3]、荒木 博志[3]、野田 寛大[3]、押上 祥子[3]、木村 淳[9]、Althaus, Christian[10]、DelTogno, Simone[10]、Lingenauber, Kay[10]、Hussmann, Hauke[10]
*Keigo Enya[1], Masanori Kobayashi[2], Ko Ishibashi[2], Shingo Kashima[3], Shin Utsunomiya[1], Satoru Iwamura[4], Teruhito Iida[5], Yoshiaki Matsumoto[5], Masanori Fujii[6], Naofumi Fujishiro[7], Tomoyasu Yamamuro[8], Masanobu Ozaki[1], Takahide Mizuno[1], Yoshifumi Saito[1], Kazuyuki Touhara[1], Noriyuki Namiki[3], Hiroshi Araki[3], Hirotomo Noda[3], Shoko Oshigami[3], Jun Kimura[9], Christian Althaus[10], Simone DelTogno[10], Kay Lingenauber[10], Hauke Hussmann[10]

1.宇宙航空研究開発機構・宇宙科学研究所、2.千葉工大 、3.国立天文台 、4.MRJ、5.プラネット、6.ファムサイエンス 、7.アストロオプト 、8.オプトクラフト 、9.東京工業大学 地球生命研究所 、10.ドイツ航空宇宙センター
1.Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, 2.CIT, 3.NAOJ, 4.MRJ, 5.PLANET, 6.FAM Science, 7.Astro-Opt, 8.OptCraft, 9.Earth-Life Science Institute, Tokyo Institute of Technology, 10.DLR

We present Optical/Structural/thermal design for the receiver part of the Ganymede Laser Altimeter (GALA) for the Jupiter Icy Moon Explorer (JUICE) mission. JUICE is a mission of ESA to be launched in 2022, and GALA is one of the payloads of JUICE. For the laser altimetry, GALA emits and receives laser pulses at about 500 km altitude above Ganymede. Wavelength, energy, and repetition frequency of the laser plus are 1064 nm, 17 mJ, and 30 Hz, respectively. Reflected beam from the Ganymede surface is received by the receiver telescope with 25 cm diameter aperture, re-focused by the BEO including a narrow band-pass filter, and then detected by the APD detector. In the international collaboration, GALA-Japan will develop the Backend Optics (BEO), the Focal Plane assembly (FPA) including an avalanche photo-diode (APD) detector, and the Analog Electronics module (AEM) in the receiver chain.
Thermal environment of GALA is unique: The Receiver telescope and some parts are cooled to intermediately cryogenic temperature by radiation to the cold surface of Ganymede and deep space while the APD detector has to be kept at 25 degree in its operation time. Many parts of GALA are warmed by self-heating. Furthermore, GALA repeats observation time of 16 hours and data downlink time of 8 (power of observation part is off) hours. So the thermal environment is dynamic.
On the other hand, GALA have to keep stability of optical performance, especially absolute agreement of the optical axis of the emitter and the receiver and to the spacecraft coordinate system. Radiation shield also has to be mandatory. Considering these conditions, we are carrying out design of optics, structure and thermal design for the BEO, FPA, and AEM. The current baseline design, the BEO is simply consisting of a collimator lens, a narrow band-pass filter, a focusing lens supported without adhesive. The material used for the structural material of both BEO and FPA must have small thermal expansion and good radiation shielding. Iterative studies of thermal analysis of whole GALA and the optical/thermal/structural design is ongoing.

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