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A comparative study of gamma-ray spectrometers with $LaBr_3(Ce^{3+})$ and $CeBr_3$ scintillation crystals for planetary remote sensing applications.

Alexander Kozyrev (1), Igor Mitrofanov (1), Alan Owens (2), Francesco Quarati (3), Johannes Benkhoff (2), Maxim Litvak (1), Alexey Malakhov (1), Maxim Mokrousov (1), Andrey Vostrukhin (1), Dmitry Golovin (1), Vladislav Tretyakov (1), Anton Sanin (1), Boris Bakhtin (1), Gennady Timoshenko (4), Valery Shvetsov (4), Carlos Granja (5), Tomáš Slavicek (5), and Stanislav Pospisil (5)

(1) Space Research Institute, Russian Federation (kozyrev@iki.rssi.ru), (2) SRE-PA, ESA/ESTEC, Keplerlaan, 2200AG Noordwijk,The Netherlands, (3) AP, RST, FAME, Delft University of Technology, Mekelweg 15, 2629JB Delft, The Netherlands., (4) Join Institute of Nuclear Research, Joliot-Curie 6, Dubna, Moscow region, Russia, 141980., (5) 6Institute of Experimental and Applied Physics, Czech Technical University in Prague, Horska 3a/22, 12800 Prague 2, Czech Republic.

The Russian Space Research Institute has developed and manufactured the gamma-ray spectrometer MGNS for remote sensing observations of the Mercury from the Mercury Polar Orbiter (MPO), which is the part of ESA's BepiColombo mission. The Flight Model (FM) of MGNS is based on a 3-inch single crystal of $LaBr_3(Ce^{3+})$, which was produced in the crystal development programme specifically for this mission. During the instrument development and verification, the crystals of $CeBr_3(Ce^{3+})$ became available with the similar sizes in a subsequent phase of the same crystal development programme. Consequently, the Flight Spare Model (FSM) of MGNS was produced with the 3-inch $CeBr_3$ crystal and qualified for space flight. Except for the crystals, the two units FM and FSM are essentially identical.

We report the results on a comparative assessment of the two units in terms of their respective spectroscopic capabilities, well as for their suitability for interplanetary spacecraft with respect to radiation tolerance and redundancy for activation. We also compare their performance with that of the Ge detector, as one used on the Messenger mission. Based on the tests results, the decision was taken to use FSM onboard the MPO on the BepiColombo mission. Thus, the MGNS with $CeBr_3$ is the central gamma-ray detection element on the MPO spacecraft.