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Abstract. Gamma-ray spectroscopy is a well-known technique used in measuring planetary elemental compositions, and provides key information for understanding planet formation and evolution. Orbital gamma-ray measurements have been collected previously from Mercury, the Moon, asteroids, and Mars. The development of a new high-purity germanium (HPGe) gamma-ray spectrometer (GRS), called the GeMini-Plus, is currently underway and will allow for high-resolution (3 keV @ 1332 keV), laboratory quality measurements to be made in both orbital and landed missions. GeMini-Plus, seen in Figure 1, is a high-heritage design (TRL-6) based on the successful MESSENGER GRS. This same type of gamma-ray detector is part of a proposed NASA Discovery mission to fly to the asteroid 16-Psyche. Asteroid 16-Psyche's high albedo and bulk density suggests that it is a metal world, primarily made up of iron. Non-destructive elemental analysis of iron IV meteorite samples by neutron activation analysis (NAA) are currently being performed at LLNL, using GeMini-Plus, in order to further characterize the capabilities of HPGe sensors with respect to the 16-Psyche mission. Analysis and testing of other meteorite samples (stony, stony-iron, etc.), as well as planetary regolith or soil simulant, are being considered. This work contributes to confidence in the GeMini-Plus to collect quality data, emphasizing it for use in future extraterrestrial missions.

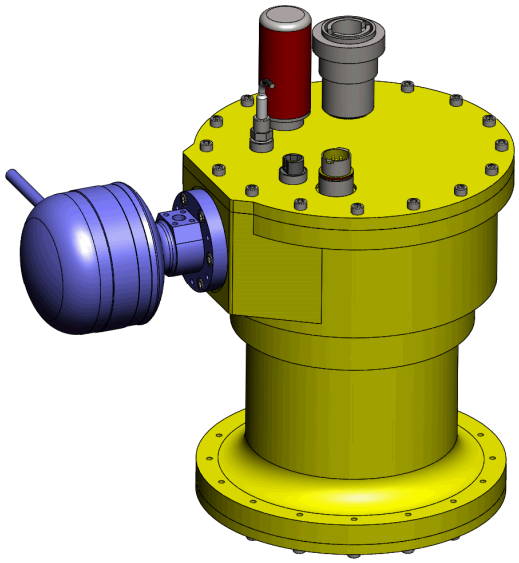

Figure 1: Cryostat design of the GeMini-Plus HPGe GRS.

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