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Development of Single sided Si Strip Detector system in High-energy particle instruments for BepiColombo-MMO

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Three decades ago, the only one spacecraft mission, Mariner 10, has explored Mercury through three fly-by observations. Results of observations by Mariner 10 clearly provided the interesting results showing that the high-energy particles are generated in the Mercury magnetosphere and the burst events are sequentially observed with short time intervals (about 6 second). These remarkable observations strongly suggest the existence and active phenomena (like a substorm) of the Mercury's magnetosphere. It is also crucial to investigate the relation of the high-energy particle acceleration and transport with the Mercury substorm through the comparison with the terrestrial substorm. A new insight will be attained by the comparison researches. On the basis of the high-energy particle measurements with high-performance instruments on MMO, comprehensive particle observations will surely shed a light to the studies concerning the existence and distribution of complete/partial ring current particles in the Mercury magnetosphere. The key observation is to measure the maximum energy of accelerated particles correctly. It is important to reduce the pile-up events, in order to measure the correct maximum energy in the period of electron burst events. Now we plan to use Single-sided Si Strip Detector (SSSD) as energy analyzer parts in MMO-HEP instruments for the following reasons: 1. To reduce the electric noise of a preamplifier, that is associated with a large detector capacitance. The detector capacitance of the SSD type is about a few ten times larger than that of the SSSD and it is difficult to measure in the less than 100keV energy. 2.To reduce detector noise associated with the leakage current of the Si detector. The leakage current of the SSD type is larger than a few

10 nA, while that of the SSSD type is less than 10 nA. 3.To measure directions of incident particles and to reduce energy-pileup events in burst events around Mercury. We have finalized the detailed design for the measurement of an energy part using the SSSDs. The characteristics of the proto-type SSSD system are now being investigated in our laboratory. This paper presents the performance result of SSSD system and the recent status of our high-energy particle instruments for MMO.