

R009-P03

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Development Status of the TRITON: Triple-Reflection Compact Time-Of-Flight Neutral Mass Spectrometer for Lunar Polar Exploration

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For the purpose of investigating the presence (and amount) of the water (ice) molecules in the regolith 1 to 1.5 m below the lunar surface, a compact neutral particle mass spectrometer is under development. This neutral particle mass spectrometer TRITON (Triple-reflection Reflectron) is designed to be installed on the LUPEX (Lunar Polar Exploration) Moon rover as part of an onboard instrument REIWA (Resource Investigation Water Analyzer). TRITON will perform mass analysis of the neutral gas generated by LTGA (Lunar Thermogravimetric Analyzer) that is also a part of REIWA.

TRITON not only aims to measure the amount of water molecules included in the lunar regolith but also identify the atoms, molecules and their isotopes up to mass number 200 with mass resolution as high as 120. TRITON is a reflectron that is a Time-Of-Flight mass spectrometer. In order to increase the mass resolution as much as possible within the allocated volume, we have decided to modify the standard reflectron by adding a second reflector that enables triple reflections and doubles the flight length. This newly designed triple-reflection TOF mass spectrometer also has an additional function to select the mass range of the measured particles by changing the temporal pattern of the pulsed high voltage applied to the first and second reflectors. This function is useful, for example, to measure minor target gas by reducing the interference from the major gas. The triple-reflection TOF mass spectrometer can be operated also as a standard reflectron by changing the voltage applied to the analyzer. Triple-reflection mode is suitable for high mass resolution measurement and standard single reflection mode is suitable for high sensitivity measurement.

Based on the test results of the Test Model (TM) analyzer, designing Engineering Model (EM) has been mostly completed and fabrication of EM is underway. The testing of EM is scheduled for later this year.