THE NEW PLANETARY SIMULATION FACILITY OF DLR - CONSTRUCTION, OPERATION, APPLICATION; H.Kochan[1] , W. Feibig[1], M. Kretschmer[1], R. Willnecker[1], M.V. Gerasimov[2], B. Speth, U. Köhler, S. Weckesser[3]. [1]DLR, Institute for Space Simulation, 51140 Köln, FRG, [2]Space Research Institute, Moscow, 117810, Russia, [3]PINK GmbH Vakuumtechnik, 97865 Wertheim, FRG.

A promising way to study physical phenomena on planets, moons, and comets is the experimental simulation in a laboratory on Earth. This statement is based on the successful experiments, during the comet simulation program KOSI (1986-1993) [1], performed with the Space Simulator of DLR Köln as central experimental facility. KOSI stands for the German word "Kometen-Simulation".

This program, financially supported by the Deutsche Forschungsgemeinschaft, originated partly as consequence to the successful space missions to Comet P/Halley in 1986. Facing the upcoming space missions to Mars in 1996 and in 1998 as well as the ESA´s cornerstone mission to Comet P/Wirtanen in 2003, analogous activities can be foreseen in the new chamber. In the former, meanwhile disassembled DLR Space Simulator, experiments only could be performed under vacuum conditions. This was requested with respect to physical phenomena on cometary surfaces. The constructional design of the Space Simulator excluded experiments under cooling and insolation conditions with an additional gaseous atmosphere. Above an internal gas pressure of $\geq 10^{-2}$ Torr, thermal convection would have caused a complete external freezing of the chamber by the humidity of air.

To avoid this, the new simulation chamber is constructed as a Dewar vessel with two walls and an isolating vacuum between. In addition the liquid nitrogen (LN_2) operated cooling system will not only support experiments at around 77K. The cooling system is split into three parts: bottom, cylinder, and cover which are separately provided with LN_2. In addition after the cooling-down phase with full power, the cooling system is operated in an intermittent (pulsed) mode, opening experimental conditions over a wide temperature regime.

The new chamber with an internal cold compartment of 1.5m in diameter and 1.8m in height consists of a double walled outer shell with an isolating vacuum in between as main constructural characteristic.

This and the variable cooling system allow e.g. Mars-simulation experiments with a CO_2-atmosphere, as well as the realization of cometary vacuum conditions.

The dimension of the internal cold shroud is big enough for even tests of the ROSETTA lander RoLand on a simulated cometary surface. This could be the unprocessed Cometary Analogous Material (CAM), mixtures of ice(s) and minerals, as well as insolated material consisting of a dust mantle and a hardened ice-/mineral-matrix beneath. As it came out from the KOSI experiments, the originally fluffy ice-/mineral-mixture is hardened by sintering and re deposition of water vapor during the impact of a thermal wave.

As already done in the KOSI-program also the performance of experimental hardware under simulated cometary conditions can be tested. These tests can demonstrate the functional operation as well as answering the more fundamental question regarding the suited experimental design for getting the expected result, e.g. the temperature- or hardness-distribution in a simulated cometary surface. Even the operational performance of sampling-tools and the distribution of the sample material to the different experiments can be tested in the new Planetary Simulation Chamber.

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The "status of today" (Jan.1996) is the following: The manufacture of the chamber inclusive cold shroud system is completed. For the final tests at the manufacturers location, the chamber is aggregated with the vacuum system and a liquid nitrogen reservoir. The tests have been successful, in the second half of January 1996, the chamber will be build up in the DLR, Institute for Space Simulation, Köln.
The figure shows the new chamber at the manufacturers location.

[1] Kochan, H. *et al.*, Laboratory Comet Simulation Experiments, *Geophys. Res.*, **18.2**, 243-291, 1991